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Air Cleaner LH

Air Cleaner RH

Air Cleaner Element

Air Cleaner Outlet Pipe

Charge Air Cooler

Supercharger

## Supercharger Outlet Pipe

### **303-13A:** Evaporative Emissions - V6 3.0L Petrol

Specification

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Evaporative Emissions

Removal and Installation

Evaporative Emission Canister (17.15.13)

Evaporative Emission Canister Purge Valve (17.15.30)

Evaporative Emission Canister Vent Solenoid (17.15.45)

### **303-13B:** Evaporative Emissions - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Specification

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Evaporative Emissions

Removal and Installation

Evaporative Emission Canister (17.15.13)

Evaporative Emission Canister Purge Valve (17.15.30) - 4.2L NA V8 - AJV8

Evaporative Emission Canister Purge Valve - 4.2L SC V8 - AJV8

### **303-14A:** Electronic Engine Controls - TDV6 2.7L Diesel

Specification

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Electronic Engine Controls

Removal and Installation

Camshaft Position (CMP) Sensor (18.30.63)  
Crankshaft Position (CKP) Sensor (18.30.12)  
Crankshaft Position (CKP) Sensor Ring  
Engine Control Module (ECM) (18.30.01)  
Engine Coolant Temperature (ECT) Sensor (18.30.10)  
Engine Oil Pressure (EOP) Sensor  
Fuel Rail Pressure (FRP) Sensor (18.30.98)  
Fuel Temperature Sensor (18.30.99)  
Knock Sensor (KS) LH (18.30.92)  
Knock Sensor (KS) RH (18.30.93)  
Intake Air Temperature (IAT) Sensor  
Manifold Absolute Pressure (MAP) Sensor (18.30.86)  
Mass Air Flow (MAF) Sensor (18.30.15)  
Oil Temperature Sensor (18.31.01)

### **303-14B:** Electronic Engine Controls - V6 3.0L Petrol

Specification

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Electronic Engine Controls

Removal and Installation

Camshaft Position (CMP) Sensor LH (18.31.12)

Camshaft Position (CMP) Sensor RH (18.31.11)

Catalyst Monitor Sensor (18.30.66)

Crankshaft Position (CKP) Sensor (18.30.12)

Engine Control Module (ECM) (18.30.01)

Engine Coolant Temperature (ECT) Sensor

Fuel Temperature Sensor

Heated Oxygen Sensor (HO2S)

Intake Manifold Tuning (IMT) Valve LH (19.70.30)

Knock Sensor (KS) LH (18.30.92)

Knock Sensor (KS) RH (18.30.93)

Manifold Absolute Pressure (MAP) Sensor (18.30.86)



Mass Air Flow (MAF) Sensor (18.30.15)

Oil Temperature Sensor (18.31.01)

Variable Camshaft Timing (VCT) Oil Control Solenoid (18.30.90)

### **303-14C: Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8**

Specification

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Electronic Engine Controls

General Procedures

Powertrain Control Module (PCM) Long Drive Cycle Self-Test

Powertrain Control Module (PCM) Short Drive Cycle Self-Test

Removal and Installation

Camshaft Position (CMP) Sensor LH (18.31.12)

Camshaft Position (CMP) Sensor RH (18.31.11)

Catalyst Monitor Sensor (18.30.66)

Crankshaft Position (CKP) Sensor (18.30.12) - 4.2L NA V8 - AJV8

Engine Control Module (ECM) (18.30.01)

Engine Coolant Temperature (ECT) Sensor (18.30.10)

Fuel Temperature Sensor (18.30.99)

Heated Oxygen Sensor (HO2S)

Intake Air Temperature (IAT) Sensor (18.30.52)

Knock Sensor (KS) (18.30.69)

Manifold Absolute Pressure (MAP) Sensor (18.30.86)

Mass Air Flow (MAF) Sensor (18.30.15)

Oil Temperature Sensor (18.31.01)

Variable Camshaft Timing (VCT) Oil Control Solenoid (18.30.90)

### **307: Automatic Transmission/Transaxle**

#### **307-01: Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8**

Specification

Description and Operation

Component Location - Vehicles With: ZF 6HP26

Overview - Vehicles With: ZF 6HP26

System Operation and Component Description - Vehicles With: ZF 6HP26

Component Location - Vehicles With: ZF 6HP26

Overview - Vehicles With: ZF 6HP26

System Operation and Component Description - Vehicles With: ZF 6HP26

## Diagnosis and Testing

Diagnostic Strategy

## General Procedures

Transmission Fluid Drain and Refill (44.24.02)

Transmission Fluid Level Check

## In-Vehicle Repair

Extension Housing Seal (44.20.18)

Transmission Fluid Pan, Gasket and Filter (44.24.07)

Transmission Control Module (TCM) and Main Control Valve Body

## Removal

Transmission (44.20.01) - TDV6 2.7L Diesel

Transmission (44.20.01) - V6 3.0L Petrol

Transmission (44.20.01) - V8 4.2L Petrol/V8 S/C 4.2L Petrol

## Installation

Transmission (44.20.01) - TDV6 2.7L Diesel

Transmission (44.20.01) - V6 3.0L Petrol

Transmission (44.20.01) - V8 4.2L Petrol/V8 S/C 4.2L Petrol

**307-02:** Transmission/Transaxle Cooling - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8  
- AJV8/4.2L SC V8 - AJV8

## Description and Operation

Component Location - Vehicles With: ZF 6HP26

Overview - Vehicles With: ZF 6HP26

System Operation and Component Description - Vehicles With: ZF 6HP26

## Diagnosis and Testing

Transmission Cooling

## Removal and Installation

Transmission Fluid Cooler (44.24.10) - TDV6 2.7L Diesel

Transmission Fluid Cooler Tubes (44.24.19) - TDV6 2.7L Diesel

## **307-05: Automatic Transmission/Transaxle External Controls**

Specification

Description and Operation

Component Location - Vehicles With: ZF 6HP26

Overview - Vehicles With: ZF 6HP26

System Operation and Component Description - Vehicles With: ZF 6HP26

Diagnosis and Testing

External Controls

Removal and Installation

Transmission Control Switch (TCS)

Transmission Control Switch (TCS) Knob

Emergency Park Position Release Lever

Upshift Paddle Switch

Downshift Paddle Switch

## **309: Exhaust System**

309-00A: Exhaust System - TDV6 2.7L Diesel

Specification

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Exhaust System

Removal and Installation

Catalytic Converter (17.50.05)

Exhaust System

Diesel Particulate Filter (DPF)

Diesel Particulate Filter (DPF) Differential Pressure Sensor

Front Muffler (30.10.18)

Rear Muffler

**309-00B: Exhaust System - V6 3.0L Petrol**

Specification

Description and Operation

Component Location

- Overview
- System Operation and Component Description
- Diagnosis and Testing
  - Exhaust System
- Removal and Installation
  - Catalytic Converter (17.50.05)
  - Exhaust System
  - Front Muffler (30.10.18)
  - Rear Muffler

### **309-00C: Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8**

- Specification
- Description and Operation
  - Component Location
  - Overview
  - System Operation and Component Description
- Diagnosis and Testing
  - Exhaust System
- Removal and Installation
  - Catalytic Converter (17.50.05)
  - Exhaust System
  - Front Muffler (30.10.18)
  - Rear Muffler

### **310: Fuel System - General Information**

#### **310-00: Fuel System - General Information**

- Specification
- General Procedures
  - Fuel System Pressure Check - 3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 – AJV8
  - Fuel System Pressure Release (19.50.02) - 3.0L NA V6 - AJ27/4.2L NA V8 – AJV8/4.2L SC V8 - AJV8
  - Fuel Tank Draining
  - Low-Pressure Fuel System Bleeding - TDV6 2.7L Diesel
  - Spring Lock Couplings
  - Quick Release Coupling

## Quick Release Coupling - Push Connect

### 310-01A: Fuel Tank and Lines - TDV6 2.7L Diesel

Specification

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Fuel Tank and Lines

Removal and Installation

Fuel Cooler

Fuel Filter

Fuel Tank

Fuel Pump Module (19.45.08)

Fuel Transfer Unit

### **310-01B:** Fuel Tank and Lines - V6 3.0L Petrol

Specification

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Fuel Tank and Lines

Removal and Installation

Fuel Filter

Fuel Level Sender LH

Fuel Level Sender RH

Fuel Pump Module (19.45.08)

Fuel Tank

Fuel Tank Filler Pipe (19.55.33)

Fuel Transfer Unit

### **310-01C:** Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Specification

Description and Operation

- Component Location
- Overview
- System Operation and Component Description
- Diagnosis and Testing
  - Fuel Tank and Lines
- Removal and Installation
  - Fuel Filter
  - Fuel Level Sender LH
  - Fuel Level Sender RH
  - Fuel Pump Module (19.45.08)
  - Fuel Tank
  - Fuel Tank Filler Pipe (19.55.33)
  - Fuel Transfer Unit

### **310-02: Acceleration Control**

- Specification
- Diagnosis and Testing
  - Acceleration Control
- Removal and Installation
  - Accelerator Pedal

### **310-03A: Speed Control - TDV6 2.7L Diesel**

- Specification
- Description and Operation
  - Component Location
  - Overview
  - System Operation and Component Description
- Diagnosis and Testing
  - Speed Control
- General Procedures
  - Speed Control Sensor Adjustment
- Removal and Installation
  - Speed Control Deactivator Switch
  - Speed Control Module
  - Speed Control Sensor
  - Speed Control Switch

**310-03B: Speed Control - V6 3.0L Petrol**

Specification

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Speed Control

General Procedures

Speed Control Sensor Adjustment

Removal and Installation

Speed Control Deactivator Switch

Speed Control Module

Speed Control Sensor

Speed Control Switch

**310-03C: Speed Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8**

Specification

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Speed Control

General Procedures

Speed Control Sensor Adjustment

Removal and Installation

Speed Control Deactivator Switch

Speed Control Module

Speed Control Sensor

Speed Control Switch

## 4: Electrical

### 412: Climate Control System

#### 412-00: Climate Control System - General Information

Specification

Diagnosis and Testing

Climate Control System

General Procedures

Air Conditioning (A/C) System Recovery, Evacuation and Charging (82.30.30)

Air Conditioning (A/C) System Flushing

Contaminated Refrigerant Handling

Electronic Leak Detection

Fluorescent Dye Leak Detection

Inspection and Assembly Requirements

Manifold Gauge Set Connection

Refrigerant Oil Adding

Refrigerant System Tests

#### 412-01: Climate Control

Specification

Description and Operation

Air Distribution and Filtering

Component Location

Overview

System Operation and Component Description

Heating and Ventilation

Component Location

Overview

System Operation and Component Description

Air Conditioning

Component Location

Overview

System Operation and Component Description

Control Components

Component Location

Overview



## System Operation and Component Description

### Removal and Installation

- Ambient Air Temperature Sensor
- Blower Motor
- Blower Motor Control Module
- Center Registers
- Climate Control Assembly
- Climate Control Module
- Defrost Vent/Register Blend Door Actuator
- Driver Side Register
- Evaporator
- Floor Console Register
- Footwell Vent/Duct Blend Door Actuator
- Heater Core
- Heater Core and Evaporator Core Housing
- Instrument Panel Register Trim Panel
- In-Vehicle Temperature Sensor
- Passenger Side Register
- Pollen Filter
- Recirculation Blend Door Actuator
- Sunload Sensor
- Thermostatic Expansion Valve

### **412-03:** Air Conditioning

#### Specification

#### Diagnosis and Testing

#### Air Conditioning

#### Removal and Installation

- Air Conditioning (A/C) Compressor (82.10.20) - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8
- Condenser Core - 4.2L NA V8 - AJV8
- Condenser Core - 4.2L SC V8 - AJV8
- Pressure Cutoff Switch (82.10.32)

### **413: Instrumentation and Warning Systems**

#### **413-01:** Instrument Cluster

#### Specification

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Instrument Cluster

Removal and Installation

Instrument Cluster

**413-06: Horn**

Specification

Removal and Installation

Horn

Horn Switch

**413-08: Information and Message Center**

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Information and Message Center

**413-09: Warning Devices**

Description and Operation

Diagnosis and Testing

Warning Devices

**413-13: Parking Aid**

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Parking Aid

Removal and Installation

Front Inner Parking Aid Sensor

- Front Outer Parking Aid Sensor
- Parking Aid Camera
- Parking Aid Module
- Rear Parking Aid Sensor

## **414: Battery and Charging System**

### **414-00: Charging System - General Information**

- Diagnosis and Testing
- Charging System

### **414-01: Battery, Mounting and Cables**

- Description and Operation
  - Component Location
  - Overview
  - System Operation and Component Description
- Diagnosis and Testing
  - Battery
- General Procedures
  - Battery Disconnect and Connect
- Removal and Installation
  - Battery

### **414-02C: Generator and Regulator - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8**

- Specification
- Description and Operation
  - Component Location
  - Overview
  - System Operation and Component Description
- Diagnosis and Testing
  - Generator
- Removal and Installation
  - Generator (86.10.02) - 4.2L NA V8 - AJV8
  - Generator (86.10.02) - 4.2L SC V8 - AJV8

## **415: Information and Entertainment Systems**

## **415-00: Information and Entertainment System - General Information**

### Diagnosis and Testing

Information and Entertainment System

Cellular Phone

Navigation System

## **415-01: Information and Entertainment System**

### Specification

### Description and Operation

#### Audio System

Component Location

Overview

System Operation and Component Description

#### Speakers

Component Location

Overview

System Operation and Component Description

#### Cellular Phone

Component Location

Overview

System Operation and Component Description

#### Navigation System

Component Location

Overview

System Operation and Component Description

#### Video System

Component Location

Overview

System Operation and Component Description

### Diagnosis and Testing

Information and Entertainment System

### Removal and Installation

Audio Unit

Audio Unit Antenna Amplifier

Audio and Climate Control Assembly

Front Door Speaker

Information and Entertainment Display

- Information and Entertainment Module
- Instrument Panel Speaker
- Rear Door Speaker
- Steering Wheel Audio Controls
- Subwoofer Amplifier
- Subwoofer Speaker

## **417: Lighting**

### **417-01: Exterior Lighting**

- Specification
- Description and Operation
  - Component Location
  - Overview
  - System Operation and Component Description
- Diagnosis and Testing
  - Headlamps
- Removal and Installation
  - Approach Lamp
  - Headlamp Assembly
  - Headlamp Leveling Front Sensor
  - Headlamp Leveling Rear Sensor
  - High Mounted Stoplamp
  - Rear Fog Lamp
  - Rear Lamp Assembly
  - Side Turn Signal Lamp

### **417-02: Interior Lighting**

- Description and Operation
  - Component Location
  - Overview
  - System Operation and Component Description
- Diagnosis and Testing
  - Interior Lighting

### **417-04: Daytime Running Lamps (DRL)**

- Description and Operation

Overview

System Operation and Component Description

## **418: Electrical Distribution**

### **418-00: Module Communications Network**

Description and Operation

Overview

System Operation and Component Description

Diagnosis and Testing

Communications Network

Removal and Installation

Central Junction Box (CJB)

### **418-02: Wiring Harnesses**

Description and Operation

Wiring Harness

General Procedures

Wiring Harness Repair

Removal and Installation

Engine Wiring Harness - TDV6 2.7L Diesel

Luggage Compartment Lid Wiring Harness

## **419: Electronic Feature Group**

### **419-01A: Anti-Theft - Active**

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Anti-Theft - Active

Removal and Installation

Anti-Theft Alarm Horn (86.52.03)

### **419-01B: Anti-Theft - Passive**

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Anti-Theft – Passive

#### **419-07: Navigation System**

Removal and Installation

Navigation System Antenna (86.62.06)

Navigation System Module (86.62.05)

#### **419-08: Cellular Phone**

Removal and Installation

Bluetooth Module

#### **419-10: Multifunction Electronic Modules**

Specification

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Driver Door Module (DDM)

Remote Keyless Entry (RKE) Module

Passenger Door Module (PDM)

Removal and Installation

Driver Door Module (DDM)

Driver Seat Module (DSM)

Passenger Door Module (PDM)

Rear Door Module (RDM)

### **501: Body and Paint**

#### **501-02: Front End Body Panels**

Specification

Removal and Installation

Air Deflector

Cowl Vent Screen (76.10.01)

Engine Rear Undershield

Fender Splash Shield

Radiator Splash Shield

Secondary Bulkhead Center Panel

Secondary Bulkhead Panel LH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 –  
AJV8/4.2L SC V8 - AJV8

Secondary Bulkhead Panel RH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 –  
AJV8/4.2L SC V8 - AJV8

### **501-03: Body Closures**

Removal and Installation

Front Door

Fuel Filler Door

Fuel Filler Door Assembly

Luggage Compartment Lid (76.19.01)

Rear Door

### **501-05: Interior Trim and Ornamentation**

Specification

Removal and Installation

A-Pillar Trim Panel

B-Pillar Lower Trim Panel

B-Pillar Upper Trim Panel

C-Pillar Lower Trim Panel

C-Pillar Trim Panel

Cowl Side Trim Panel

Engine Cover (76.11.35) - 4.2L NA V8 - AJV8

Engine Cover (76.11.35) - TDV6 2.7L Diesel

Engine Cover - 4.2L SC V8 - AJV8

Front Door Trim Panel (76.34.01)

Front Scuff Plate Trim Panel

Instrument Panel Speaker Grille

Headliner

Loadspace Scuff Plate Trim Panel

Loadspace Trim Panel

Loadspace Trim Panel LH

Loadspace Trim Panel RH



- Luggage Compartment Lid Trim Panel
- Parcel Shelf
- Rear Door Trim Panel
- Rear Scuff Plate Trim Panel
- Sun Visor (76.10.48)

### **501-08: Exterior Trim and Ornamentation**

- Specification
- Removal and Installation
  - Radiator Grille
  - Luggage Compartment Lid Moulding

### **501-09: Rear View Mirrors**

- Specification
- Description and Operation
  - Component Location
  - Overview
  - System Operation and Component Description
- Diagnosis and Testing
  - Rear View Mirrors
- Removal and Installation
  - Exterior Mirror
  - Exterior Mirror Cover
  - Exterior Mirror Glass
  - Exterior Mirror Motor
  - Interior Rear View Mirror

### **501-10: Seating**

- Specification
- Description and Operation
  - Component Location
  - Overview
  - System Operation and Component Description
- Diagnosis and Testing
  - Seats
- Removal and Installation
  - Front Seat (76.70.01)

- Front Seat Backrest (76.70.06)
- Front Seat Backrest Cover (76.70.15)
- Front Seat Cushion Cover
- Front Seat Track Motor
- Memory Seat Position Switch
- Seat Base
- Rear Seat Backrest Cover (76.70.48) (78.90.12)
- Rear Seat Cushion (76.70.37)
- Front Seat Height Adjustment Motor
- Front Seat Control Switch
- Rear Seat Bolster

## **501-11: Glass, Frames and Mechanisms**

- Specification

- Description and Operation

  - Component Location

  - Overview

  - System Operation and Component Description

- Diagnosis and Testing

  - Glass, Frames and Mechanisms

- General Procedures

  - Door Window Motor Initialization

- Removal and Installation

  - Door Window Regulator Motor (86.25.04)

  - Driver Door Window Control Switch (86.25.03) (86.25.08)

  - Front Door Window Glass

  - Front Door Window Regulator and Motor (76.31.45)

  - Passenger Door Window Control Switch

  - Rear Door Fixed Window Glass

  - Rear Door Window Glass

  - Rear Door Window Regulator and Motor

  - Rear Window Glass

  - Windshield Glass

## **501-12: Instrument Panel and Console**

- Specification

## Description and Operation

- Component Location

- Overview

- System Operation and Component Description

## Removal and Installation

- Floor Console

- Floor Console Cup Holder

- Floor Console Double Cup Holder

- Floor Console Side Trim Panel

- Glove Compartment

- Instrument Panel Console

- Instrument Panel Lower Trim Panel

- Overhead Console

## **501-14:** Handles, Locks, Latches and Entry Systems

### Specification

### Description and Operation

- Component Location

- Overview

- System Operation and Component Description

### Diagnosis and Testing

- Locks, Latches and Entry Systems

### Removal and Installation

- Exterior Front Door Handle

- Exterior Luggage Compartment Lid Release Switch

- Exterior Rear Door Handle

- Front Door Latch

- Front Door Lock Cylinder

- Interior Front Door Handle

- Luggage Compartment Lid Latch Actuator

- Luggage Compartment Lid Lock Cylinder

- Rear Door Latch

## **501-16:** Wipers and Washers

### Specification

### Description and Operation

- Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Wipers and Washers

Removal and Installation

Headlamp Washer Jet

Headlamp Washer Pump

Rain Sensor

Windshield Washer Reservoir

Windshield Wiper Motor

Windshield Washer Pump

## **501-17: Roof Opening Panel**

Specification

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Roof Opening Panel

General Procedures

Roof Opening Panel Alignment

Motor Synchronization (76.82.48)

Removal and Installation

Roof Opening Panel Front Drain Hose

Roof Opening Panel Frame

Roof Opening Panel Glass

Roof Opening Panel Motor

Roof Opening Panel Rear Drain Hose

Roof Opening Panel Weatherstrip

## **501-19: Bumpers**

Specification

Removal and Installation

Front Bumper Cover

Front Bumper Cover Insert

Rear Bumper Cover

Rear Bumper

**501-20A: Safety Belt System**

Specification

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Safety Belt System

Removal and Installation

Front Safety Belt Buckle

Front Safety Belt Retractor

Rear Center Safety Belt Retractor

Rear Safety Belt Buckle

Rear Safety Belt Retractor

Safety Belt Shoulder Height Adjuster

**501-20B: Supplemental Restraint System**

Specification

Description and Operation

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

General Procedures

Air Bag Disposal

Removal and Installation

B-Pillar Side Impact Sensor

Clockspring

C-Pillar Side Impact Sensor

Crash Sensor

Driver Air Bag Module

Front Door Side Impact Sensor

Occupant Classification Sensor

Passenger Air Bag Module

Restraints Control Module (RCM)

## **501-20C: Pedestrian Protection System**

Description and Operation

Pedestrian Protection System

Component Location

Overview

System Operation and Component Description

Diagnosis and Testing

Pedestrian Protection System

Removal and Installation

Pedestrian Impact Sensor

Pedestrian Protection Hood Actuator LH

Pedestrian Protection Hood Actuator RH

Pedestrian Protection Module

## **501-25A: Body Repairs - General Information**

Description and Operation

Body Repairs

## **501-25B: Body Repairs - Corrosion Protection**

Description and Operation

Corrosion Protection

## **501-25C: Body Repairs - Water Leaks**

Description and Operation

Water Leaks

## **501-26: Body Repairs - Vehicle Specific Information and Tolerance Checks**

Description and Operation

Body and Frame

## **501-27: Front End Sheet Metal Repairs**

Description and Operation

Front End Sheet Metal

Removal and Installation

Fender Apron Closing Panel Front Section

Fender Apron Panel

Fender Apron Panel Closing Panel

Fender Apron Panel Front Extension

Fender Apron Panel Front Section

Front Bumper Mounting

Front Fender

Front Fender Support Bracket

Front Side Member

Front Side Member and Suspension Top Mount Assembly

Front Side Member Closing Panel

Front Side Member Closing Panel Section

Front Side Member Section

Front Wheelhouse Section

Hood Latch Panel

Hood Latch Panel Mounting Bracket

### **501-28: Roof Sheet Metal Repairs**

Description and Operation

Roof

Removal and Installation

Roof Panel - Vehicles With: Sliding Roof Opening Panel

Roof Panel - Vehicles Without: Sliding Roof Opening Panel

### **501-29: Side Panel Sheet Metal Repairs**

Description and Operation

Side Panel Sheet Metal

Removal and Installation

A-Pillar Outer Panel

A-Pillar Reinforcement

B-Pillar Inner Panel

B-Pillar Reinforcement

Front Door Skin Panel

Rear Door Skin Panel

Rocker Panel

Rocker Panel and B-Pillar Outer Panel

Rocker Panel Front Section

Rocker Panel Inner Reinforcement

Rocker Panel Rear Section

### **501-30: Rear End Sheet Metal Repairs**

Removal and Installation

Back Panel

Quarter Panel

Quarter Panel Lower Extension

Rear Bumper Mounting

### **502: Frame and Mounting**

#### **502-00: Uni-Body, Subframe and Mounting System**

Specification

Removal and Installation

Front Subframe (76.10.05) - TDV6 2.7L Diesel

Front Subframe (76.10.05) - V6 3.0L Petrol

Front Subframe (76.10.05) - 4.2L NA V8 - AJV8

Front Subframe (76.10.05) - 4.2L SC V8 - AJV8

Rear Subframe (64.25.01)

Rear Subframe Rear Bushing (64.25.36)



## General Information - About This Manual

Description and Operation

### Introduction

This manual covers diagnosis and testing and repair procedures.

It is structured into groups and sections, with specific system sections collected together under their relevant group.

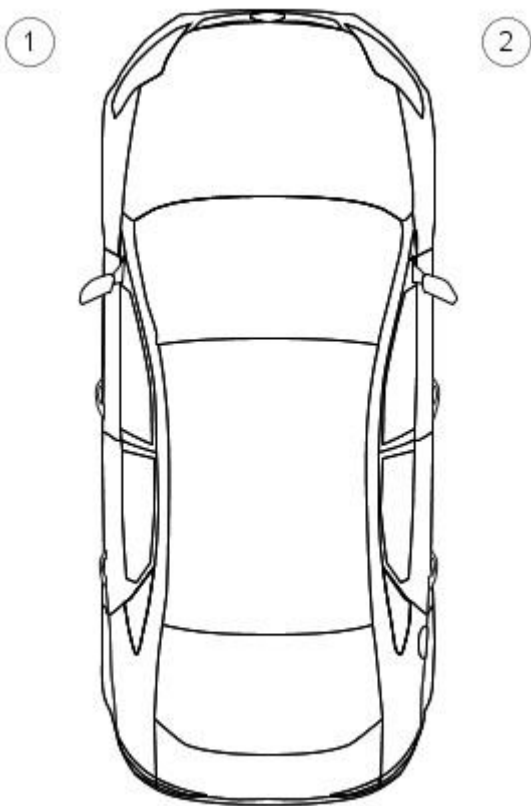
A group covers a specific portion of the vehicle. The manual is divided into five groups, General Information, Chassis, Powertrain, Electrical and Body and Paint. The number of the group is the first number of a section number.

Within Etis, the navigation tree will list the groups. After selecting a group the navigation tree will then list the sections within that group. Each section has a contents list detailing Specifications, Description and Operation, Diagnosis and Testing, General Procedures, Disassembly and Assembly, Removal and Installation.

### References to LH (left-hand) and RH (right-hand)

All [LH](#) and [RH](#) references to the vehicle are taken from a position sitting in the driver seat looking forward.

Vehicle [LH](#) and [RH](#) definition

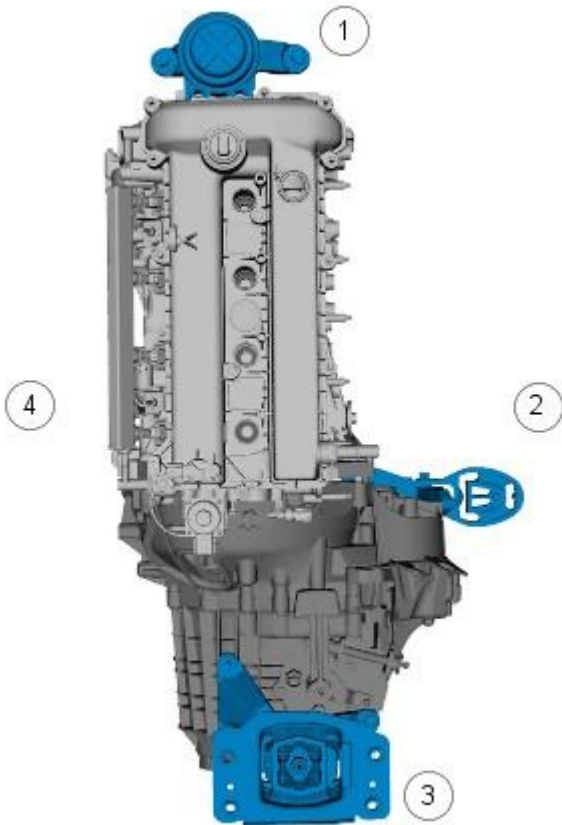


E126780

Item	Part Number	Description
1	-	LH
2	-	RH

All [LH](#) and [RH](#) references to the engine are taken from a position at the flywheel looking towards the crankshaft front pulley.

Powertrain [LH](#) and [RH](#) definition



E126781

Item	Part Number	Description
1	-	front
2	-	right
3	-	rear
4	-	left

## How to use Repair Procedures

This manual has been written in a format that is designed to meet the needs of technicians worldwide. It provides general descriptions for accomplishing repair work with tested and effective techniques.

## Important Safety Instructions

Appropriate service methods and correct repair procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual carrying out the work.

Anyone who departs from the instructions provided in this manual must first establish that personal safety or vehicle integrity is not compromised by the choice of method, tools or components.

## Warnings, Cautions and Notes in This Manual



**WARNING:** Warnings are used to indicate that failure to follow a procedure correctly may result in personal injury.



**CAUTION:** Cautions are used to indicate that failure to follow a procedure correctly may result in damage to the vehicle or equipment being used.

• **NOTE:** Notes are used to provide additional essential information required to carry out a complete and satisfactory repair.

Generic warnings or cautions are in their relevant description and operation procedure within section 100-00. If the generic warnings or cautions are required for a procedure, there will be a referral to the appropriate description and operation procedure.

If a warning, caution or note only applies to one step, it is placed at the beginning of the specific step.

## Trustmark Authoring Standards (TAS) Repair Procedures

• **NOTE:** TAS style procedures can be identified by steps that have no accompanying step text and the magenta color of the electrical connectors and fasteners such as nuts, bolts, clamps or clips.

A TAS removal and installation procedure uses a sequence of color illustrations to indicate the order to be followed when removing/disassembling or installing/assembling a component.

Many of the TAS procedures will have the installation information within the removal steps. These procedures will have the following note at the beginning of the procedure:

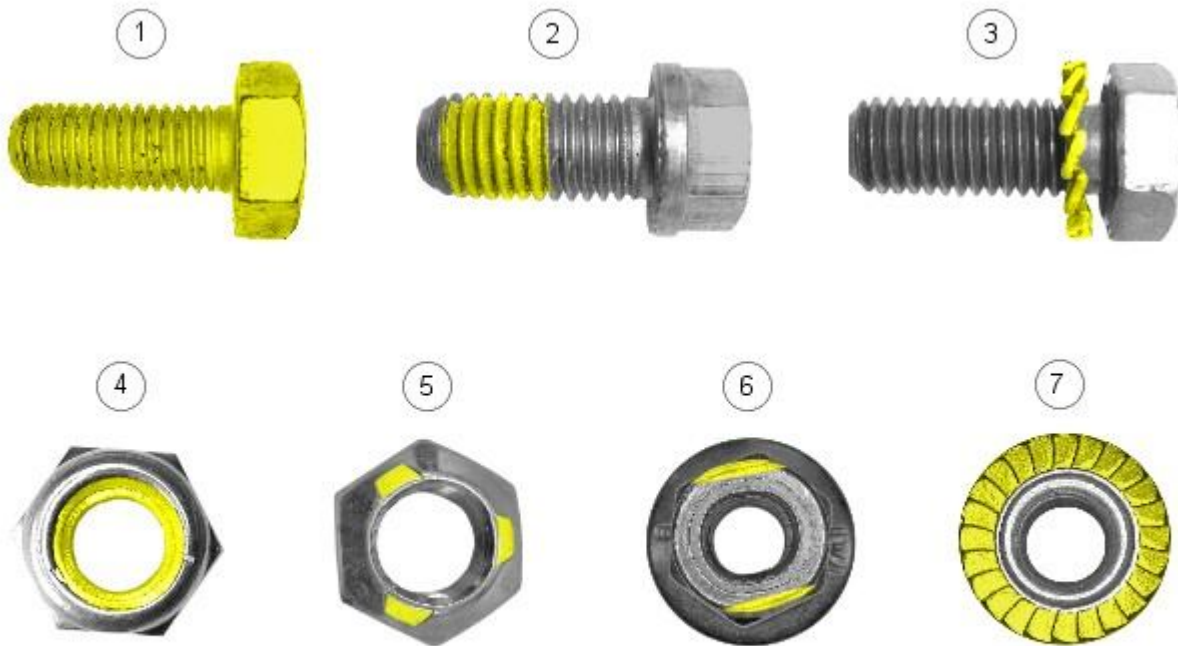
• NOTE: Removal steps in this procedure may contain installation details.

Reuse of fasteners and seals and gaskets

The following list details the general policy for the reuse of fasteners and seals and gaskets.

Types of self-locking nuts and bolts

• NOTE: There are more types of self-locking fasteners available than shown in following illustration.



E126782

Item	Part Number	Description
1	-	Completely coated self-locking bolt
2	-	Partially coated self-locking bolt
3	-	Self-locking bolt with a locking washer
4	-	Self-locking nut with a plastic locking insert
5	-	Self-locking nut with thread deformation (3 dents)
6	-	Self-locking nut with thread deformation (squeeze of thread to oval shape)
7	-	Self-locking nut with integrated locking ring

- All types of seals and gaskets must be discarded and new seals and gaskets installed unless otherwise stated within the procedure.
- Nuts and bolts with a chemical coating for locking and/or sealing and/or antiseize must be discarded unless the procedure advises to reapply the coating with a specified material.
- Nuts and bolts with a mechanical locking such as thread inserts, thread deformation or locking washers must be discarded and new nuts and bolts installed unless otherwise stated within the procedure.
- Torque to yield bolts must be discarded and new torque to yield bolts installed unless otherwise stated within the procedure, recognizable by a tightening torque with more than one stage together with a torque angle.

Specification data

Specification procedures will only contain technical data that is not already part of a repair procedure.

Sequence of tasks

If components must be removed or installed in a specific sequence, the sequence will be identified numerically in a graphic and the corresponding text will be numbered accordingly.

Special Tools, Equipment, Materials and Torque Figures

Special tools will be shown with the tool numbers in the illustration. The special tool numbers, general equipment, materials and torque figures used for the procedure step will be shown in the text column.

TAS Graphics

Colors used in the graphic are as follows:

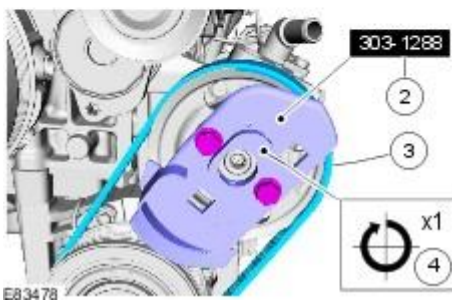
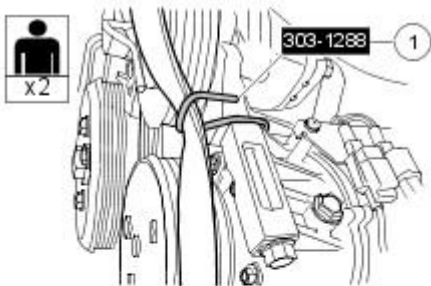
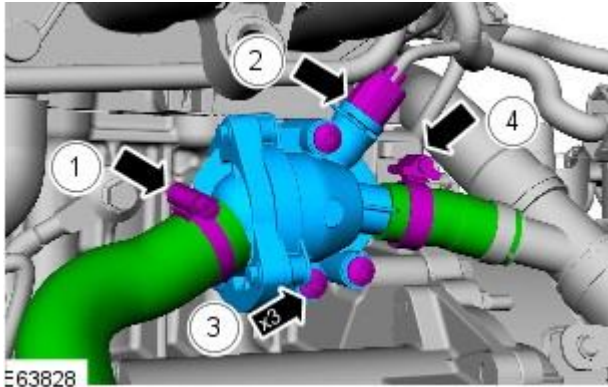
- Blue - Component to be removed/installed or disassembled/assembled.
- Green and Brown - Additional components that need to be removed/installed or disassembled/assembled prior to

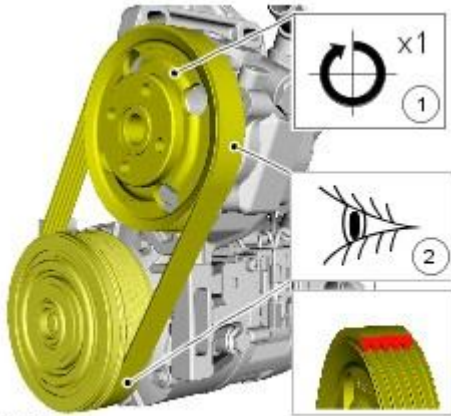
- the target component.
- Yellow - Component that is touched or affected in a way but remains in the vehicle. It may be detached, attached, moved, modified, checked, adjusted etc.
- Magenta - Electrical connectors and fasteners such as nuts, bolts, clamps and clips.
- Pale Blue - Special tool(s) and general equipment.

One illustration may have multiple steps assigned to it.

Numbered pointers are used to indicate the number of electrical connectors and fasteners such as nuts, bolts, clamps and clips.

Items in the illustration can be transparent or use cutouts to show hidden details.





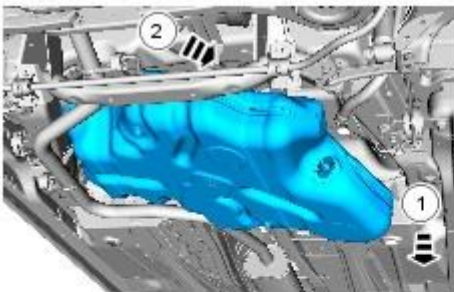
E92595

TAS Symbols

Symbols are used inside the graphics and in the text area to enhance the information display. The following paragraphs describe the various types and categories of symbols.

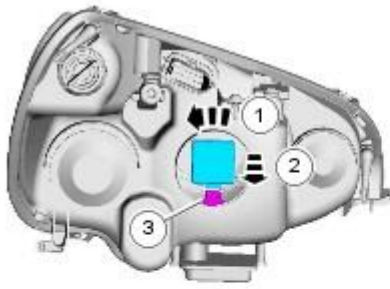
For additional information, refer to: [Symbols Glossary](#) (100-00 General Information, Description and Operation).

Prohibition symbols advise on prohibited actions to either avoid damage or health and safety related risks. These symbols are



E85026

Health and Safety symbols recommend the use of particular protection equipment to avoid or at least reduce the risk or severity of possible injuries.

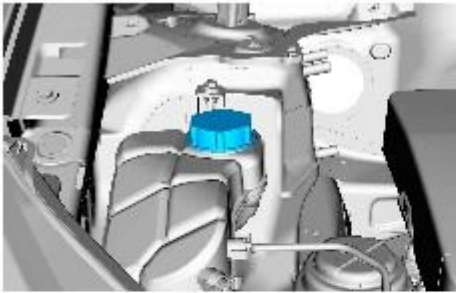


2.  



E85027

Warning symbols are used to indicate potential risks resulting from a certain component or area.



3. 



E85028

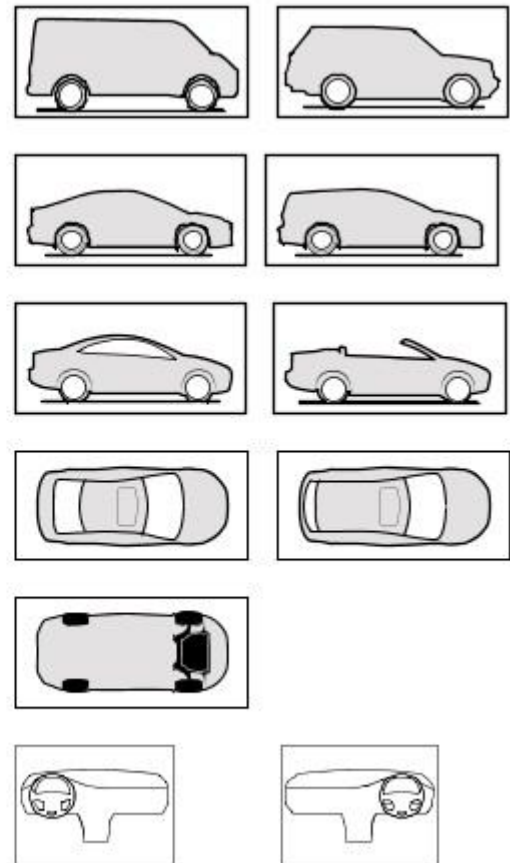
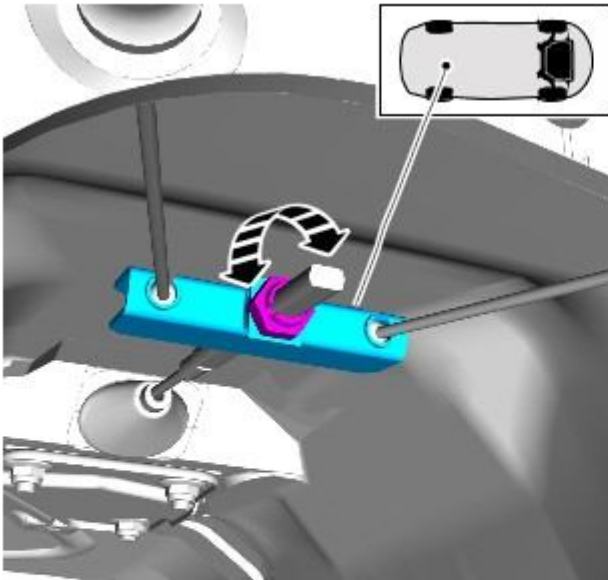
Instruction symbols are used to apply sealer, lubricant, weight, tape or cleaning detergent to a component.





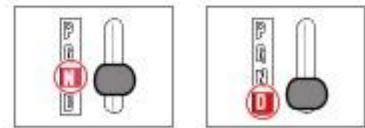
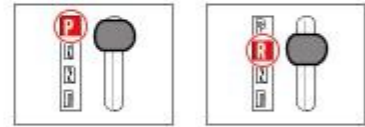
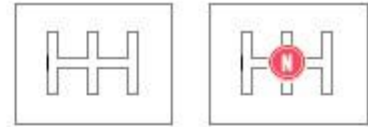
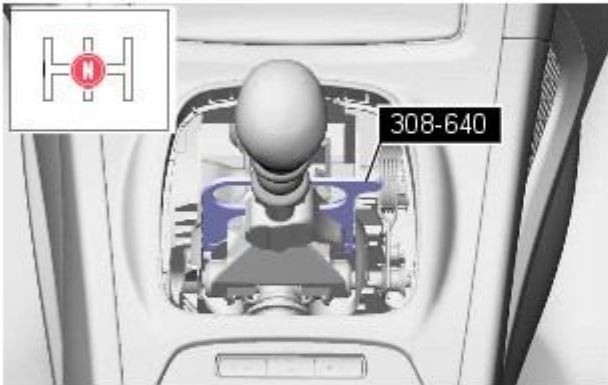
E84834

Location symbols are used to show the location of a component or system within the vehicle.



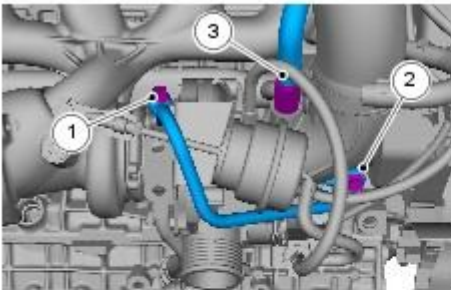
E84835

Gearshift lever or selector lever position symbols are used to show which gearshift lever or selector lever position is to be set.

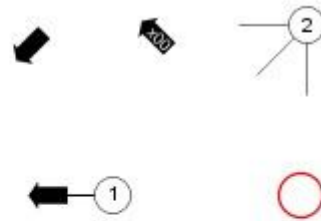


E84836

Pointer symbols are used to draw attention to components and give special instructions such as a required sequence or number of components. The number of components is reflected by the value inside the luty arrow. A sequence number is located inside the circle. Numbers inside circles are also used to allocate special information such as tightening torques or chemicals to a particular component.

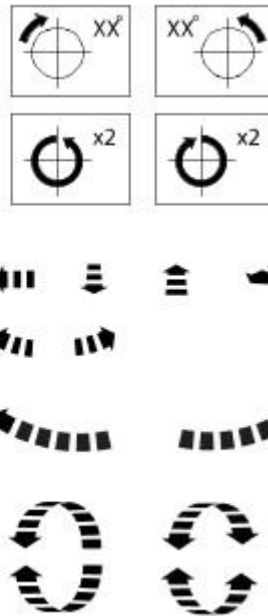
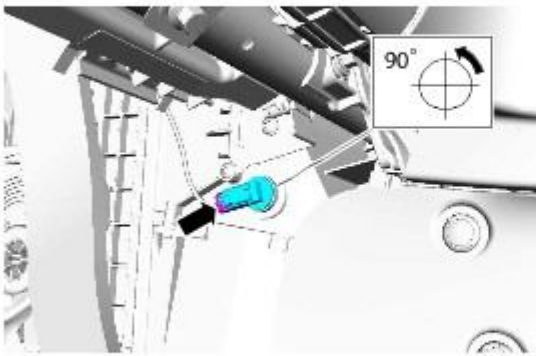


E84837



Movement arrows are used to show three dimensional or rotational movements. These movements can include specific values inside the symbol if required.





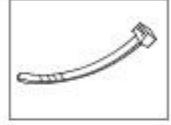
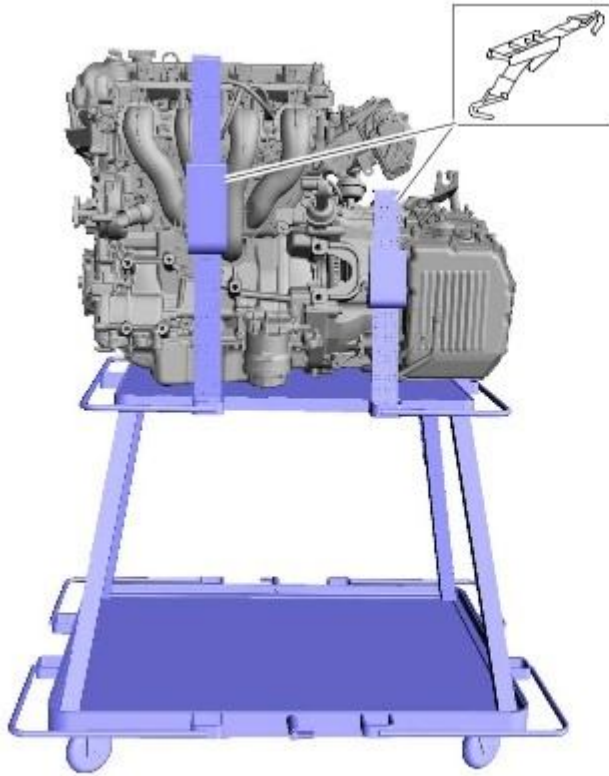
E84838

Standard tool symbols recommend the use of certain standard tools. These tools can include dimension values if required.



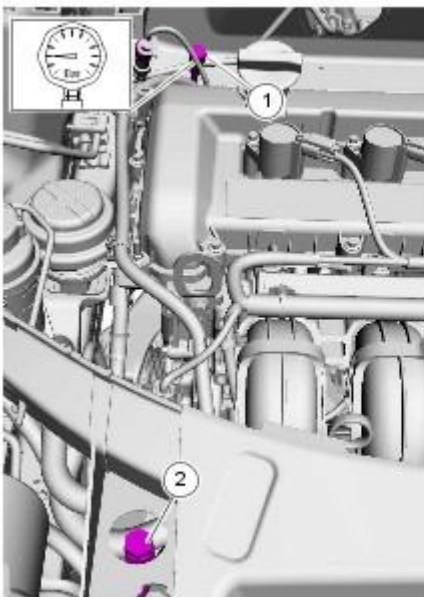
E84839

The following graphic illustrates a set of symbols that are used to provide detailed information on where to apply a material.



E84840

Measurement symbols provide detailed information on where to carry out a specific measurement. These symbols can include specific values if required.



E84841

## How to use Diagnosis and Testing procedures

### Inspection and Verification

Visual Inspection Charts, Symptom Charts and other information charts (such as diagnostic routines) or supplement test procedures with technical specifications will navigate the user to a specific test procedure.

### Symptom Chart

The symptom chart indicates symptoms, sources and actions to address a condition.

### Pinpoint Tests

For electrical systems, pinpoint test steps are used to identify the source of a concern in a logical, step-by-step manner. Pinpoint tests have two columns: CONDITIONS and DETAILS/RESULTS/ACTIONS.

The CONDITIONS column is used exclusively for graphics and icons (with or without captions) and the DETAILS/RESULTS /ACTIONS column provides direction to another test step or specific corrective actions.

The boxed numbers indicate the order in which the described action is to be carried out.

#### Component Tests

A component test is used when a component is tested in multiple pinpoint tests, or if a procedure is too complicated to be formatted within a single page of the pinpoint test.

#### Graphics

Test graphics show the measurement or test to be carried out in a test step.

A representative tester graphic is used for voltmeters and ohmmeters.

If multiple measurements are made in a single graphic, the test leads are drawn with a solid line until the test lead splits to indicate the multiple measurements, at which point dashed lines are used.

Breakout box type testers are represented by a double circle test pin. Test pins are labeled with the pin number.

## **General Information - Application and Use of Specifications**

Description and Operation

### **Torque Specifications**

Torque specifications are shown in the torque specifications chart located at the front of the relevant section.

## General Information - Battery and Battery Charging Health and Safety

### Precautions

#### Description and Operation

- WARNINGS:



Batteries contain sulphuric acid, avoid contact with skin, eyes or clothing. Wear safety goggles when working near the battery to protect against possible splashing of the acid solution.



**EYE CONTACT:** If acid comes into contact with the eyes, flush immediately with plenty of running water for a minimum of 15 minutes. Seek immediate medical attention.



**SKIN CONTACT:** If acid comes into contact with the skin, flush immediately with plenty of running water for a minimum of 15 minutes. Seek immediate medical attention.



**SWALLOWED:** If acid is swallowed, rinse the mouth with plenty of water and then drink plenty of water or milk. Do not induce vomiting. Seek immediate medical attention.



Batteries normally produce explosive gases. Do not allow naked flames, sparks or lighted substances to come near the battery.



When charging the battery shield your face and wear safety goggles. Provide adequate ventilation.



**CAUTION:** Boost charging with excessive current or voltage above 16 volts will damage the battery.

## General Information - Brake System Health and Safety Precautions

### Description and Operation

- WARNINGS:



**EYE CONTACT:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with the eyes. Wash hands thoroughly after handling. If brake fluid comes into contact with the eyes, flush the eyes with plenty of cold running water for 15 minutes. Seek medical attention for any persistent eye irritation or abnormality.



**SWALLOWED:** Brake fluid contains polyglycol ethers and polyglycols. If swallowed, drink plenty of water. Seek immediate medical attention.



**INHALED:** Dust from friction materials can be harmful if inhaled.



Only use new specified brake fluid from airtight containers.



**CAUTION:** If brake fluid is spilled on the paintwork, the affected area must be immediately washed down with cold water.

## General Information - General Service Information

Description and Operation

### Repairs and Replacements

When service parts are required, it is essential that only genuine Jaguar/Daimler replacements are used.

Attention is drawn to the following points concerning repairs and the installation of replacement parts and accessories:

- Safety features embodied in the vehicle may be impaired if other than genuine parts are installed. In certain territories, legislation prohibits the installation of parts which are not produced to the vehicle manufacturer's specification.
- Torque wrench setting figures given in this manual must be strictly adhered to. Locking devices, where specified, must be installed. If the efficiency of a locking device is impaired during removal it must be renewed.
- Owners purchasing accessories while travelling abroad should make sure that the accessory and its installed location on the vehicle conform to mandatory requirements existing in their country of origin.
- The vehicle warranty may be invalidated by the installation of other than genuine Jaguar/Daimler parts. All Jaguar/Daimler replacements have the full backing of the factory warranty.
- Jaguar/Daimler dealers are obliged to supply only genuine service parts.

### Vehicle Specifications

Purchasers are advised that the specification details set out in this manual apply to a range of vehicles and not to any specific one. For the specification of a particular vehicle, purchasers should consult their dealer.

The Manufacturer reserves the right to vary the specifications, with or without notice, and at such times and in such manner as the Manufacturer thinks fit. Major as well as minor changes may be involved, in accordance with the Manufacturer's policy of continuous improvement.

Whilst every effort is made to make sure the accuracy of the particulars contained in this manual, neither the Manufacturer nor the Dealer, by whom the manual is supplied, shall in any circumstances be held liable for any inaccuracy or the consequences thereof.

### Service Repair Operation Numbering

A master index of numbered operations has been compiled for universal application to all vehicles manufactured by Jaguar Cars Ltd.

Each operation is allocated a number from the master index and cross-refers with an identical number in the Repair Operation Times schedule. The number consists of six digits arranged in three pairs.

Each maintenance procedure in this manual is described in the sequence necessary to complete the operation in the minimum time, as specified in the Repair Operation Times schedule.

### References to Bank-1 and Bank-2

References to Bank-1 and Bank-2 are made with regard to the engine. When viewed from the flywheel the right-hand bank will be Bank-1 and the left-hand bank will be Bank-2.

### Special Tools

Any special tools and equipment required to perform a maintenance procedure, are shown at the beginning of each procedure. When possible, illustrations are given to assist in identifying the tool needed.

### Disconnecting/Connecting the Battery

Always stop the engine before disconnecting the battery negative lead and make sure the battery positive lead is isolated i.e. wrapped in a suitable cloth.



**WARNING:** Radio code saving devices must not be used when conducting work on Air Bag or Fuel systems. It must be noted that, when using these devices, the vehicle electrical system is still live albeit with a reduced current flow.

• **NOTE:** Before disconnecting the battery make sure that the radio receiver/cassette player/mini disc player and compact disc player keycodes are known and, that no data is required from the Engine Control Module (ECM) as battery disconnection will erase any fault codes and idle/drive values held in the Keep Alive Memory (KAM).

Always disconnect the battery before commencing repair operations which require:

- The vehicle to be jacked up
- Work on the engine
- Work underneath the vehicle
- Arc welding

Alternatively a Radio Code Saver may be used, when not working on the Air Bag or Fuel systems. With the battery disconnected, a Radio Code Saver will allow sufficient current to pass to maintain the radio receiver/cassette player/mini disc player and compact disc player memory, operate the clock and supply the door operated interior lights while isolating the battery in the event of a short circuit.

### Reconnecting the Battery



**WARNING:** If the battery has been on bench charge the cells may be giving off explosive hydrogen gas. Avoid creating sparks, and if in doubt cover the vent plugs or covers with a damp cloth.

Always make sure that all electrical systems are switched OFF before reconnecting the battery to avoid causing sparks or damage to sensitive electrical equipment.

Always reconnect the battery positive lead first and the negative last, ensuring that there is a good electrical contact and the battery terminals are secure.

Restart the clock (where installed) and set it to the correct time.

Enter the radio receiver/cassette player/mini disc player and compact disc player keycodes and preset frequencies, if known.

Following reconnection of the battery, the engine should be allowed to idle until it has reached normal operating temperature as the stored idle and drive values contained within the ECM have been lost. Allow the vehicle to idle for a further three minutes. Drive the vehicle at constant speeds of approximately 48 km/h (30 mph), 64 km/h (40 mph), 80 km/h (50 mph), 96 km/h (60 mph) and 112 km/h (70 mph) for three minutes each. This will allow the ECM to relearn idle and drive values, and may cause driveability concerns if the procedure is not carried out.

## Connecting a Slave Battery Using Jump Leads



**WARNING:** If the slave battery has recently been charged and is gassing, cover the vent plugs or covers with a damp cloth to reduce the risk of explosion should arcing occur when connecting the jump leads.

### • CAUTIONS:

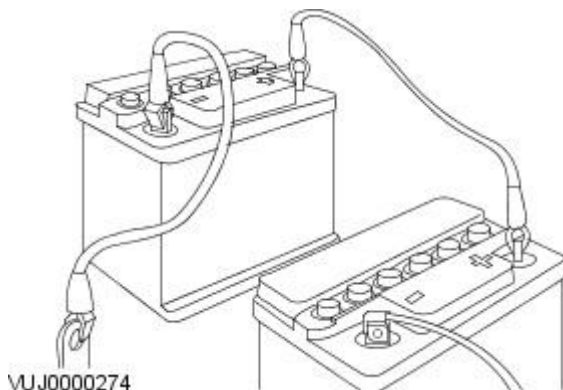


A discharged battery condition may have been caused by an electrical short circuit. If this condition exists there will be an apparently live circuit on the vehicle even when all circuits are switched off. This can cause arcing when the jump leads are connected.



Whilst it is not recommended that the vehicle is jump started, it is recognized that this may occasionally be the only practical way to mobilize a vehicle. In such an instance the discharged battery must be recharged immediately after jump starting to avoid permanent damage.

- Always make sure that the jump leads are adequate for the task. Heavy duty cables must be used.
- Always make sure that the slave battery is of the same voltage as the vehicle battery. The batteries must be connected in parallel.
- Always make sure that switchable electric circuits are switched off before connecting jump leads. This reduces the risk of sparks occurring when the final connection is made.



**WARNING:** Make sure that the ends of the jump leads do not touch each other or ground against the vehicle body at any time while the leads are attached to the battery. A fully charged battery, if shorted through jump leads, can discharge at a rate well above 1000 amps causing violent arcing and very rapid heating of the jump leads and terminals, and can even cause the battery to explode.

Always connect the jump leads in the following sequence.

- Slave battery positive first then vehicle battery positive.
- Slave battery negative next and then vehicle ground at least, 300 mm (12 in) from the battery terminal e.g. engine lifting bracket.

Always reduce the engine speed to idle before disconnecting the jump leads.

Before removing the jump leads, switch on the heater blower (high) or the heated rear screen, to reduce the voltage peak when the leads are removed.

Always disconnect the jump leads in the reverse order to the connecting sequence and take great care not to short the ends of the leads.

Do not rely on the generator to restore a discharged battery. For a generator to recharge a battery, it would take in excess of 8 hours continuous driving with no additional loads placed on the battery.



## Component Cleaning

To prevent ingress of dirt, accumulations of loose dirt and greasy deposits should be removed before disconnecting or dismantling components or assemblies.

Components should be thoroughly cleaned before inspection prior to reassembly.

Cleaning Methods:

- Dry Cleaning
- Removal of loose dirt with soft or wire brushes
- Scraping dirt off with a piece of metal or wood
- Wiping off with a rag



**CAUTION:** Compressed air is sometimes wet so use with caution, especially on hydraulic systems.

- Blowing dirt off with compressed air (Eye protection should be worn when using this method)
- Removal of dry dust using vacuum equipment. This method should always be used to remove friction lining material dust (asbestos particles)
- Steam Cleaning

## Calibration of Essential Measuring Equipment



**WARNING:** Failure to comply may result in personal injury or damage to components.

It is of fundamental importance that certain essential equipment e.g. torque wrenches, multimeters, exhaust gas analysers, rolling roads etc., are regularly calibrated in accordance with the manufacturers instructions.

## Use of Control Modules

Control modules may only be used on the vehicle to which they were originally installed. Do not attempt to use or test a control module on any other vehicle.

## Functional Test

On completion of a maintenance procedure, a thorough test should be carried out, to ensure the relevant vehicle systems are working correctly.

## Preparation

Before disassembly, clean the surrounding area as thoroughly as possible. When components have been removed, blank off any exposed openings using grease-proof paper and masking tape. Immediately seal fuel, oil and hydraulic lines when separated, using plastic caps or plugs, to prevent loss of fluid and the entry of dirt. Close the open ends of oil ways, exposed by component removal, with tapered hardwood plugs or readily visible plastic plugs. Immediately a component is removed, place it in a suitable container; use a separate container for each component and its associated parts. Before dismantling a component, clean it thoroughly with a recommended cleaning agent; check that the agent will not damage any of the materials within the component. Clean the bench and obtain marking materials, labels, containers and locking wire before dismantling a component.

## Dismantling

Observe scrupulous cleanliness when dismantling components, particularly when parts of the brake, fuel or hydraulic systems are being worked on. A particle of dirt or a fragment of cloth could cause a dangerous malfunction if trapped in these systems. Clean all tapped holes, crevices, oil ways and fluid passages with compressed air.



**WARNING:** Do not permit compressed air to enter an open wound. Always use eye protection when using compressed air.

Make sure that any O-rings used for sealing are correctly reinstalled or renewed if disturbed. Mark mating parts to make sure that they are replaced as dismantled. Whenever possible use marking materials which avoid the possibilities of causing distortion or the initiation of cracks, which could occur if a center punch or scriber were used. Wire together mating parts where necessary to prevent accidental interchange (e.g. roller bearing components). Tie labels on to all parts to be renewed and to parts requiring further inspection before being passed for reassembly. Place labelled parts and other parts for rebuild in separate containers. Do not discard a part which is due for renewal until it has been compared with the new part, to make sure that the correct part has been obtained.

## Inspection

Before inspecting a component for wear or performing a dimensional check, make sure that it is absolutely clean; a slight smear of grease can conceal an incipient failure. When a component is to be checked dimensionally against figures quoted for it, use the correct equipment (surface plates, micrometers, dial gauges etc.) in serviceable condition. The use of makeshift equipment can be dangerous. Reject a component if its dimensions are outside the limits quoted, or if damage is apparent. A component may be reinstalled if its critical dimension is exactly to the limit size and it is otherwise satisfactory. Use Plastigauge 12 Type PG-1 for checking bearing surface clearance, e.g. big end bearing shell to crank journal. Instructions for the use of Plastigauge and a scale giving bearing clearances in steps of 0,0025 mm (0.0001 in) are supplied with the package.

## On-Board Diagnostics (OBD)

This vehicle uses programmed electronic control systems to provide engine management and emission regulation, automatic transmission operation and anti-lock braking control. These control systems are integral with the On-Board Diagnostics (OBD) facility that is used in conjunction with either the Jaguar approved diagnostic system or the more restricted scan tools.

The OBD information in this manual provides diagnostic and rectification procedures for emission related electrical and mechanical systems. The information is intended to facilitate fault diagnosis and the subsequent rectification of the vehicle without recourse to the Jaguar approved diagnostic system.

The diagnosis and testing sections within the manual cover:

- System principles of operation with links to the relevant Description and Operation sections
- Self tests (where appropriate)
- Inspection and Verification - manual checks, symptom and Diagnostic Trouble Code (DTC) driven diagnostic charts with actions required to rectify concerns
- Component tests (where appropriate)

## Circuit Diagrams

To understand the relationship between the vehicle electrical system and the system circuit diagrams, Refer to the Electrical Guide.

In the interest of clarity, single lines may represent multiple wires. Refer to the color code (1st alpha) followed by the wire reference (numeric/alpha/numeric) to trace origin and destination.

e.g. BW 647B002. BW (black with white trace) 647 (wire reference) B002 (stage from origin).

## Glossary of Terms

This glossary of terms is intended to cover mainly emissions-related (to SAE J 1930) terminology, and other abbreviations that may be used in this manual.

The required term may be looked-up in the left-hand column, and subsequent columns give the standard acronym, unit or abbreviation, and definition.

Term(s)	Acronym/Unit /Abbreviation	Definition
Air Conditioning	A/C	
Accelerator Pedal Position	APP	Is a multitrack sensor which inputs the drivers demand into the engine control module (ECM)
After Bottom Dead Center	ABDC	Event occurring after bottom dead center
After Top Dead Center	ATDC	Event occurring after top dead center
Anti-lock Brake System	ABS	System which prevents wheel lock-up under braking by sensing lack of rotation of a wheel(s) and diverting fluid pressure away from it (them)
Alternating Current	ac	
Amplitude Modulation	AM	
Automatic Temperature Control	ATC	
Automatic Transmission Fluid	ATF	
Ampere	A	SI unit of current
Ampere hour	Ah	
Barometric Pressure	BARO	Pressure of surrounding air at any given temperature and altitude
Battery positive voltage	B+	The positive voltage from a battery or any circuit connected directly to it
Before Bottom Dead Center	BBDC	Event occurring before bottom dead center
Before Top Dead Center	BTDC	Event occurring before top dead center
Bottom Dead Center	BDC	Lowest point of piston travel in a reciprocating engine
Battery Junction Box	BJB	
Brake Pedal Position	BPP	
Brake Horsepower	BHP	Effective horsepower developed by an engine or motor, as measured by a brake applied to its output shaft
British Standard	BS	Standard specification issued by the British Standards Institution
Brake Traction Control System	BTCS	
Bus	Topology of a communication network	
Coast Clutch Solenoid	CCS	
Camshaft Position	CMP	Indicates camshaft position
Carbon dioxide	CO <sup>2</sup>	Colorless gas with a density of approximately 1.5 times that of air
Carbon monoxide	CO	Poisonous gas produced as the result of incomplete combustion
Chlorofluorocarbon	CFC	
Catalytic converter		In-line exhaust system device used to reduce the level of engine exhaust emissions
Celsius	C	SI term for the Centigrade scale, with freezing point at zero and boiling point at 100 degrees
Compact Disc	CD	
Cylinder Head Temperature Sensor	CHT Sensor	A sensor for measuring the temperature of the cylinder head
Central Junction Box	CJB	
Crankshaft Position	CKP	Indicates crankshaft position
Clutch Pedal Position	CPP	Indicates clutch pedal position

Term(s)	Acronym/Unit /Abbreviation	Definition
Controller Area Network	CAN	A communication system which allows control modules to be linked together
Constant Velocity	CV	
Cubic centimeter	cm <sup>3</sup>	
Central Security Module	CSM	Electronic module to support security system functionality
Data Link Connector	DLC	Connector providing access and/or control of the vehicle information, operating conditions, and diagnostic information
Driver Door Module	DDM	Electronic module to support driver door functionality
Driver Seat Module	DSM	Electronic module to support driver seat functionality
Daytime Running Lamps	DRL	
Deutsche Institut fur Normung	DIN	German standards regulation body
Diagnostic Trouble Code	DTC	An alpha/numeric identifier for a fault condition identified by the On-Board Diagnostic (OBD) system
Direct current	dc	Current which flows in one direction only, though it may have appreciable pulsations in its magnitude
Domestic Data Bus	D2B	
Digital Versatile Disc	DVD	
Electronic Automatic Temperature Control	EATC	
Exhaust Gas Recirculation	EGR	
Exhaust Gas Recirculation Temperature Sensor	EGRT	Sensing EGR function based on temperature change
Electronic Brake Force Distribution	EBD	
Engine Control Module	ECM	Electronic module to support engine functionality
Electronic Crash Sensor	ECS	Sensor to measure severity of impact
Engine Coolant Temperature	ECT	
Engine Oil Pressure	EOP	
European On-Board Diagnostic	EOBD	
Electronic Pressure Control	EPC	
Electrically Erasable Programmable Read-Only Memory	EEPROM	
Erasable Programmable Read-Only Memory	EPROM	
Evaporative Emission	EVAP	System designed to prevent fuel vapor from escaping into the atmosphere. Typically includes a charcoal filled canister to absorb fuel vapor
Flash Electrically Erasable Programmable Read-Only Memory	FEEPROM	
Front Electronic Module	FEM	
Flash Erasable Programmable Read-Only Memory	FEPRM	
Frequency Modulation	FM	
Fuel Pump Driver Module	FPDM	
Fuel Rail Pressure	FRP	
Generic Electronic Module	GEM	
Ground	GND	Electrical conductor used as a common return for an electrical circuit or circuits, and with a relative zero potential
Global Positioning System	GPS	
Global System for Mobile Communication	GSM	
Gross Vehicle Weight	GVW	
Heated Oxygen Sensor	HO2S	Electrically heated oxygen sensor which induces fuelling corrections
Hydrofluorocarbon	HFC	
High tension	HT	
Hydrocarbon	HC	
Idle Air Control	IAC	Stepper motor driven device which varies the volume of air by-passing the throttle to maintain the programmed idle speed
Intake Air Temperature	IAT	Temperature of intake air
Inertia Fuel Shut-off	IFS	An inertia system that shuts off the fuel supply when activated by pre-determined force limits brought about by (e.g.) collision
Input Shaft Speed	ISS	Indicates input shaft speed
Key On, Engine Off	KOEO	
Key On, Engine Running	KOER	
Kilogram (mass)	kg	
Kilogram (force)	kgf	
Kilogram force per square centimeter	kgf/cm <sup>2</sup>	
Kilometer	km	
Kilometer per hour	km/h	
Kilopascal	kPa	
Kilovolt	kV	
Knock Sensor	KS	Sensor which detects the onset of detonation, and signals the ECM to retard the ignition

Term(s)	Acronym/Unit /Abbreviation	Definition
Liquid Crystal Display	LCD	Optical digital display system, to which applied voltage varies the way the crystals reflect light, thereby modifying the display
Lighting Control Module	LCM	
Light Emitting Diode	LED	
Low Tension	LT	Primary circuit of the ignition system, linking the battery to the primary winding in the ignition coil
Left-Hand	LH	
Left-Hand Drive	LHD	
Mass Air Flow	MAF	System which provides information on the mass flow rate of the intake air to the engine
Manifold Absolute Pressure	MAP	Absolute pressure of the intake manifold air
Manifold Absolute Pressure and Temperature	MAPT	
Malfunction Indicator Lamp	MIL	A required on-board indicator to alert the driver of an emission related malfunction
Meter (measurement)	m	
Metric (screw thread, e.g. M8)	M	
Farad	F	Unit of electrical capacitance
Millimeter	mm	
Millimeter of mercury	mmHg	
Millisecond	ms	
Model year	MY	
Newton	N	SI unit of force. 1 N = 0.2248 pounds force
Newton Meter	Nm	SI unit of torque. Must not be confused with nm (nanometer)
Negative Temperature Coefficient	NTC	
Naturally aspirated	N/A	Fuelling system using intake air at atmospheric pressure; not supercharged or turbocharged
Noise, Vibration and Harshness	NVH	
North American Specification	NAS	Vehicles for sale in the USA and Canadian markets
On-Board Diagnostic	OBD	A system that monitors some or all computer input and output control signals. Signal(s) outside the pre-determined limits imply a fault in the system or a related system
Oxides of Nitrogen	Nox	
Oxygen Sensor	O2S	A sensor which detects oxygen content in the exhaust gases
On-board Refuelling Vapour Recovery	ORVR	
Output State Control	OSC	
Output Shaft Speed	OSS	
Passenger Air Bag Deactivation	PAD	
Pulsed Secondary Air Injection	PAIR	
Passive Anti-Theft System	PATS	
Positive Crankcase Ventilation	PCV	
Parameter Identification	PID	An index number referring to a parameter within a module without knowledge of its storage location
Park/Neutral Position	PNP	
Pulse Width Modulation	PWM	
Programmable Electronic Control Units System	PECUS	Process whereby a common ECM is programmed on the production line to suit the market requirements of a particular vehicle
Programmable Read-only Memory	PROM	ROM with some provision for setting the stored data after manufacture
Portable Support Electronics	PSE	
Power Steering Pressure	PSP	
Polytetrafluoroethylene	PTFE	
Random Access Memory	RAM	Fast access memory store which is accessible for entry or extraction of data
Read Only Memory	ROM	Fast access memory in which data is fixed and may not be changed
Restraints Control Module	RCM	Electronic module to support functionality of the Supplemental Restraints System
Radio Data System	RDS	
Rear Electronic Module	REM	
Remote Keyless Entry	RKE	
Right-hand	RH	
Right-hand drive	RHD	
Research Octane Number	RON	
Rear Seat Module	RSM	Electronic module to support functionality of rear seats
Supercharger	SC	An intake system which utilizes a supercharger (mechanically driven device that pressurizes intake air, thereby increasing density of charge air and the consequent power output from a given displacement)
Serial Communications Link	SCL	
Standard Corporate Protocol	SCP	A high-speed, serial communications system linking all body system control modules. Control messages and data are passed between modules at up to 786 messages per second
Supplemental Restraints System	SRS	
Shift Solenoid	SS	Controls shifting in an automatic transmission

<b>Term(s)</b>	<b>Acronym/Unit /Abbreviation</b>	<b>Definition</b>
Seat Control Module	SCM	Module controlling the seat motor systems (not electric raise/lower-only seats)
Secondary Air Injection	AIR	System used for a period of time each time the engine is started, unless certain temperature criteria are met. Pumps air directly into the exhaust system which generates extra heat and reduces the time taken for the catalytic converters to reach operating temperature
Service Repair Operation (number)	SRO	Number generated by Jaguar Methods & Techniques system which relates to the time allowed to complete a repair operation. Further information on the system can be found in the separate Jaguar Publications (for each model range) entitled 'Repair Operation Times'
Society of Automotive Engineers	SAE	
Timing/Coast Clutch Solenoid	T/CCS	
Torque Converter Clutch	TCC	
Transmission Control Indicator Lamp	TCIL	
Throttle Position	TP	
Top Dead Center	TDC	
Transmission Control Module	TCM	Controls the shifting pattern of the (automatic) transmission
Transmission Control Switch	TCS	Modifies the operation of electronically controlled transmissions
Transmission Fluid Temperature	TFT	Indicates temperature of transmission fluid
Transmission Range	TR	The range in which the transmission is operating
Turbine Shaft Speed	TSS	Indicates rotational speed of transmission output shaft or turbine shaft
Variable Assist Power Steering	VAPS	
Variable Camshaft Timing	VCT	A system by which the relationship of the crankshaft and camshaft may be altered during engine running
Vehicle Identification Number	VIN	Number assigned to the vehicle by the manufacturer, primarily for licensing and identification purposes
Vehicle Speed Sensor	VSS	Sensor which provides vehicle speed information
Worldwide Diagnostic System	WDS	Jaguar approved diagnostic system
Wide Open Throttle	WOT	Full throttle position

## General Information - Health and Safety Precautions

### Description and Operation

The Health and Safety Precautions subsection refers to some commonly used chemicals and materials, hazards associated with their use, and safety measures to be taken. Some of these chemicals may be included in the following list either in their own right or as an ingredient in a sealer or adhesive.

### Acids and Alkalis

See also Battery Acids.

e.g. caustic soda, sulphuric acid.

Used in batteries and cleaning materials.

Irritant and corrosive to the skin, eyes, nose and throat. Cause burns. Can destroy ordinary protective clothing.

Avoid splashes to the skin, eyes and clothing. Wear suitable protective impervious apron, gloves and goggles. Do not breath mists.

Ensure access to eye wash bottles, shower and soap are readily available for splashing accidents.

Display Eye Hazard sign.

### Air Bags

See also Fire, Chemical Materials - General

Highly flammable, explosive – observe No Smoking policy.

Used as a part of the Supplemental Restraint System (SRS), mounted in various positions around the vehicle.

The inflator contains a high-energetic propellant which, when ignited, produces a VERY HOT GAS (2500° C).

The gas generant used in air bags is Sodium Azide. This material is hermetically sealed in the module and is completely consumed during deployment. No attempt should be made to open an air bag inflator as this will lead to the risk of exposure to Sodium Azide. If a gas generator is ruptured, full protective clothing should be worn when dealing with the spillage.

After normal deployment, gloves and safety goggles should be worn during the handling process.

Deployed air bags should be disposed of in a plastic bag in accordance with local regulations at an approved chemical waste site.

Following any direct contact with gas generant.

- Wash affected areas thoroughly with water
- Seek medical assistance if necessary



**WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any SRS components. To deplete the backup power supply energy, disconnect the battery negative cable and wait for one minute. Failure to follow this instruction may result in personal injury.

• **NOTE:** The storage, transportation, disposal and/or recycling of air bag modules must be carried out in accordance with all applicable federal, state and local regulations including, but not limited to, those governing building and fire codes, environmental protection, occupational health and safety and transportation.

#### Air Bags - Do's

- Do store in an air bag safe when not installed to the vehicle.
- Do store modules in an upright position
- Do keep modules dry
- Do carry modules with the cover side pointing away from the body
- Do place modules with their cover side upwards
- Do carefully inspect modules for damage
- Do stand to one side when connecting modules
- Do make sure all test equipment is properly calibrated and maintained
- Do wash you hands after handling deployed air bags
- Do wear safety glasses when carrying out repairs to the SRS or when handling an air bag module
- Only carry out a system test with the air bag modules fully installed
- Do inspect the condition of the impact sensor mounting bracket and sensor flylead if the vehicle has been involved in an impact. Replace if damaged, even if there has been no deployment.

#### Air Bags - Do Nots

- Do not store highly flammable material together with modules or gas generators
- Do not store gas generators at temperatures exceeding 80° C
- Do not store modules upside down
- Do not attempt to open a gas generator housing
- Do not expose gas generators to open flame or sources of heat
- Do not place anything on top of a module cover
- Do not use damaged modules
- Do not handle a deployed device or gas generator for at least 20 minutes

- Do not probe air bag module electrical connectors or any other SRS component

## **Air Conditioning Refrigerant**

See also Chlorofluorocarbon, Chemical Materials

Highly flammable, combustible – observe No Smoking policy.

Skin contact may result in frostbite.

Instructions given by the manufacturer must be followed. Avoid naked lights, wear suitable protective gloves and goggles.

If refrigerant comes into contact with the skin or eyes, rinse the affected areas with water immediately. Eyes should also be rinsed with an appropriate irrigation solution and should not be rubbed. SEEK MEDICAL ASSISTANCE IF NECESSARY.

Air Conditioning Refrigerant - Do Not

- Do not expose refrigerant bottles to sunlight or heat
- Do not expose refrigerant bottles to frost
- Do not drop refrigerant bottles
- Do not vent refrigerant to atmosphere under any circumstance
- Do not mix refrigerants i.e. R12 (Freon) and R134a

## **Antifreeze**

See also Fire, Solvents.

e.g. isopropanol, ethylene glycol, methanol.

Highly flammable, flammable, combustible.

Used in vehicle coolant systems, brake air pressure systems, screenwash solutions.

Vapors may be given off from coolant antifreeze (glycol) when heated. Avoid breathing these vapors.

Antifreeze may be absorbed through the skin in toxic or harmful quantities. Antifreeze, if swallowed can be fatal and medical attention should be sought immediately.

These products must not be used in any cooling or industrial water system which is connected or linked to general, food preparation or drinking water supplies.

## **Asbestos**

Used in brake and clutch linings, transmission brake bands and gaskets. Jaguar original production and replacement items are asbestos free.

See also Warning Symbols on Vehicles at the end of this subsection.

Breathing asbestos dust may cause lung damage or, in some cases, cancer.

The use of drum cleaning units, vacuum cleaning or damp wiping is preferred.

Asbestos dust waste should be dampened, placed in a sealed container and marked to make sure safe disposal. If any cutting or drilling is attempted on materials containing asbestos the item should be dampened and only hand tools or low speed power tools used.

## **Battery Acids**

See also Acids and Alkalis.

Gases released during charging are explosive. Never use naked flames or allow sparks near charging or recently charged batteries.

Ensure adequate ventilation.

## **Brake and Clutch Linings and Pads**

See Asbestos.

## **Brake Fluids (Polyalkylene Glycols)**

See also Fire.

Splashes to the skin and eyes may cause irritation. Avoid skin and eye contact as far as possible. Vapor inhalation hazards do not arise at ambient temperatures because of the very low vapor pressure.

## **Brazing**

See Welding.

## **Chemical Materials**

See also Legal Aspects.

Chemical materials such as solvents, sealers, adhesives, paints, resin foams, battery acids, antifreeze, brake fluids, fuels, oils and grease should always be used with caution and stored and handled with care. They may be toxic, harmful, corrosive, irritant or highly flammable and give rise to hazardous fumes and dusts.

The effects of excessive exposure to chemicals may be immediate or delayed; briefly experienced or permanent; cumulative; superficial; life threatening; or may reduce life-expectancy.

#### Chemical Materials - Do's

- Do carefully read and observe hazard and precaution warnings given on material containers (labels) and in any accompanying leaflets, posters or other instructions. Material health and safety data sheets can be obtained from manufacturers
- Do remove chemical materials from the skin and clothing as soon as practical after soiling. Change heavily soiled clothing and have it cleaned
- Do organise work practices and protective clothing to avoid soiling of the skin and eyes, and the breathing in of vapors, aerosols, dusts or fumes
- Do wash before breaks, before eating, smoking, drinking or using toilet facilities when handling chemical materials
- Do keep work areas clean, uncluttered and free from spills
- Do store chemical materials according to national and local regulations
- Do keep chemical materials out of the reach of children

#### Chemical Materials - Do Not's

- Do not mix chemical materials except under the manufacturer's instructions; some chemicals can form other toxic or harmful chemicals, give off toxic or harmful fumes or become explosive when mixed together
- Do not spray chemical materials, particularly those based on solvents, in confined spaces e.g. when people are inside a vehicle
- Do not apply heat or flame to chemical materials except under the manufacturer's instructions. Some are highly flammable and some may release toxic or harmful fumes
- Do not leave containers open. Fumes given off can build up to toxic, harmful or explosive concentrations. Some fumes are heavier than air and will accumulate in confined areas, pits etc.
- Do not transfer chemical materials to unlabeled containers
- Do not clean hands or clothing with chemicals. Chemicals, particularly solvents and fuels, will dry skin and may cause irritation leading to dermatitis or be absorbed through the skin in toxic or harmful quantities
- Do not use emptied containers for other materials except when they have been cleaned under supervised conditions
- Do not sniff or smell chemical materials. Brief exposure to high concentrations of fumes can be toxic or harmful

### Chlorofluorocarbons (CFC)

There is concern in the scientific community that CFCs and Halons are depleting the upper ozone layer which filters out harmful ultraviolet radiation. Decreased filtration of ultraviolet radiation may result in increases in skin cancer, cataracts and immune system suppression in humans, as well as decreased productivity of crops and aquatic systems.

CFCs are used primarily as refrigerants in vehicle air conditioning systems and as aerosol propellants. Halons are used as fire extinguishants.

Jaguar supports worldwide elimination of CFC usage and it is recommended that Company subsidiaries and affiliates should phase out CFC usage as soon as acceptable substitutes are commercially available.

### Clutch Fluids

See Brake fluids.

### Clutch Linings and Pads

See Asbestos.

### Corrosion Protection Materials

See also Solvents, Fire.

Highly flammable, flammable – observe No Smoking policy.

These materials are varied and the manufacturer's instructions should be followed. They may contain solvents, resins, petroleum products etc. Skin and eye contact should be avoided. They should only be sprayed in conditions of adequate ventilation and not in confined spaces.

### Cutting

See Welding.

### Dewaxing

See Solvents and Fuels (Kerosene).

### Dusts

Powder, dusts or clouds may be irritant, harmful or toxic. Avoid breathing dusts from powdery chemical materials or those arising from dry abrasion operations. Wear respiratory protection if ventilation is inadequate.

Fine dusts of combustible material can present an explosion hazard. Avoid explosive limits and/or sources of ignition.

### Electric Shock



Electric shock can result from the use of faulty electrical equipment or from the misuse of equipment in good condition.

Ensure that electrical equipment is maintained in good condition and frequently tested. Faulty equipment should be labelled and preferably removed from the work station.

Ensure that flexes, cables, plugs and sockets are not frayed, kinked, cut, cracked or otherwise damaged.

Ensure that electrical equipment and flexes do not come into contact with water.

Ensure that electrical equipment is protected by the correct rated fuse.

Never misuse electrical equipment and never use equipment which is in any way faulty. The results could be fatal.

Ensure that the cables of mobile electrical equipment cannot get trapped and damaged, such as in a vehicle hoist.

Ensure that the designated electrical workers are trained in basic First Aid.

In cases of electrocution:

- Switch off the power supply before approaching the victim
- If this is not possible push or drag the victim from the source of electricity using dry non-conductive material
- Commence resuscitation if trained to do so
- SUMMON MEDICAL ASSISTANCE

## **Engine Oils**

See Lubricants and Grease.

## **Exhaust Fumes**

These contain asphyxiating, harmful and toxic chemicals and particles such as carbon oxides, nitrogen oxides, aldehydes, lead and aromatic hydrocarbons. Engines should be run only under conditions of adequate exhaust extraction or general ventilation and not in confined spaces.

## **Gasolene (petrol) engine**

There may not be adequate warning of odour or of irritation before toxic or harmful effects arise. These may be immediate or delayed.

## **Fibre Insulation**

See also Dusts.

Used in noise and sound insulation.

The fibrous nature of surfaces and cut edges can cause skin irritation. This is usually a physical and not a chemical effect.

Precautions should be taken to avoid excessive skin contact through careful organization of work practices and the use of gloves.

## **Fire**

See also Welding, Foams, Legal Aspects.

Many of the materials found on or associated with the repair of vehicles are highly flammable. Some give off toxic or harmful fumes if burnt.

Observe strict fire safety when storing and handling flammable materials or solvents, particularly near electrical equipment or welding processes.

Ensure, before using electrical or welding equipment, that there is no fire hazard present.

Have a suitable fire extinguisher available when using welding or heating equipment.

## **First Aid**

Apart from meeting any legal requirements it is desirable for someone in the workshop to be trained in First Aid procedures.

Splashes in the eye should be flushed carefully with clean water for at least ten minutes.

Soiled skin should be washed with soap and water.

Individuals affected by inhalation of gases, fumes etc. should be removed to fresh air immediately. If effects persist, consult a doctor.

If liquids are swallowed inadvertently, consult a doctor giving the information on the container or label. Do not induce vomiting unless this action is indicated on the label.

## **Fluoroelastomer**

See Viton.

## **Foams - Polyurethane**

See also Fire.

Used in sound and noise insulation. Cured foams used in seat and trim cushioning.

Follow manufacturer's instructions.

Unreacted components are irritating and may be harmful to the skin and eyes. Wear gloves and goggles.

Individuals with chronic respiratory diseases, asthma, bronchial medical problems, or histories of allergic diseases should not work in or near uncured materials.

The components, vapors or spray mists can cause direct irritation, sensitivity reactions and may be toxic or harmful.

Vapors and spray mists must not be inhaled. These materials must be applied with adequate ventilation and respiratory protection. Do not remove the respirator immediately after spraying, wait until the vapor/mists have cleared.

Burning of the uncured components and the cured foams can generate toxic and harmful fumes. Smoking, naked flames or the use of electrical equipment during foaming operations and until vapors/mists have cleared should not be allowed. Any heat cutting of cured foams or partially cured foams should be conducted with extraction ventilation.

## **Freon**

See Air Conditioning Refrigerant.

## **Fuels**

See also, Fire, Legal Aspects, Chemicals and Solvents.

Avoid skin contact with fuel where possible. Should contact occur, wash the affected skin with soap and water.

### **Gasoline (Petrol)**

Highly flammable - observe No Smoking policy.

Swallowing can result in mouth and throat irritation and absorption from the stomach can result in drowsiness and unconsciousness. Small amounts can be fatal to children. Aspiration of liquid into the lungs e.g. through vomiting, is a very serious hazard.

Gasoline dries the skin and can cause irritation and dermatitis on prolonged or repeated contact. Liquid in the eye causes severe pain.

Motor gasoline may contain appreciable quantities of benzene, which is toxic upon inhalation, and the concentration of gasoline vapors must be kept very low. High concentrations will cause eye, nose and throat irritation, nausea, headache, depression and symptoms of drunkenness. Very high concentrations will result in rapid loss of consciousness.

Ensure there is adequate ventilation when handling and using gasoline. Great care must be taken to avoid the serious consequences of inhalation in the event of vapor build up arising from spillages in confined spaces.

Special precautions apply to cleaning and maintenance operations on gasoline storage tanks.

Gasoline should not be used as a cleaning agent. It must not be siphoned by mouth. See First Aid.

### **Gas - oil (Diesel Fuel)**

See warnings and cautions in relevant manual sections.

Combustible.

Gross or prolonged skin contact with high boiling point gas oils may also cause serious skin disorders including skin cancer.

### **Kerosene (Paraffin)**

Used also as heating fuel, solvent and cleaning agent.

Flammable - observe No Smoking policy.

Irritation of the mouth and throat may result from swallowing. The main hazard from swallowing arises if liquid aspiration into the lungs occurs.

Liquid contact dries the skin and can cause irritation or dermatitis. Splashes in the eye may be slightly irritating.

In normal circumstances the low volatility does not give rise to harmful vapors. Exposure to mists and vapors from kerosene at elevated temperature should be avoided (mists may arise in dewaxing). Avoid skin and eye contact and make sure there is adequate ventilation.

## **Gas Cylinders**

See also Fire.

Gases such as oxygen, acetylene, argon and propane are normally stored in cylinders at pressures of up to 13.790 kPa, (2000 lb/in<sup>2</sup>) and great care should be taken in handling these cylinders to avoid mechanical damage to them or to the valve gear attached. The contents of each cylinder should be clearly identified by appropriate markings.

Cylinders should be stored in well ventilated enclosures, and protected from ice and snow, or direct sunlight. Fuel gases (e.g. acetylene and propane) should not be stored in close proximity to oxygen cylinders.

Care should be exercised to prevent leaks from gas cylinders and lines, and to avoid sources of ignition.

Only trained personnel should undertake work involving gas cylinders.

## **Gases**

See Gas Cylinders.

## **Gaskets (Fluoroelastomer)**

See Viton.

## **General Workshop Tools and Equipment**

It is essential that all tools and equipment are maintained in good condition and the correct safety equipment is used where required.

Never use tools or equipment for any purpose other than that for which they were designed. Never over – load equipment such as hoists, jacks, axle and chassis stands or lifting slings. Damage caused by overloading is not always immediately apparent and may result in a fatal failure the next time that the equipment is used.

Do not use damaged or defective tools or equipment, particularly high speed equipment such as grinding wheels. A damaged grinding wheel can disintegrate without warning and cause serious injury.

Wear suitable eye protection when using grinding, chiselling or sand blasting equipment.

Wear a suitable breathing mask when using abrasive blasting equipment, working with asbestos-based materials or using spraying equipment.

Ensure adequate ventilation to control dusts, mists and fumes.

## **High Pressure Air, Lubrication and Oil Test Equipment**

See also Lubricants and Greases.

Always keep high pressure equipment in good condition, and regularly maintained, particularly at joints and unions.

Never direct a high pressure nozzle, e.g. diesel injector, at the skin as the fluid may penetrate to the under - lying tissue etc., and cause serious injury.

## **Halon**

See CFCs.

## **Legal Aspects**

Many laws and regulations make requirements relating to health and safety in the use and disposal of materials and equipment in workshops. Some of these laws which apply in the UK are listed. Similar laws exist for other territories:

- The Factories Act (1961)
- The Asbestos Regulations (1969)
- Highly Flammable Liquids and Liquefied Petroleum Gases Regulations (1972)
- Control of Pollution Act (1974)
- Health and Safety at Work Act (1974)
- The Classification, Packaging and Labelling of Dangerous Substances Regulations (1978, 1981, 1983, 1984)
- Control of Lead at Work Regulations (1980)
- Control of Substances Hazardous to Health (COSHH) Regulations (1989)
- Abrasive Wheels Regulations (1970)
- Reporting of injuries, diseases and dangerous occurrences regulations 1985 (RIDDOR)

Workshops should be familiar, in detail, with these and associated laws and regulations.

Consult the local factory inspectorate if in any doubt.

## **Lubricants and Greases**

Avoid all prolonged and repeated contact with mineral oils. All lubricants and greases may be irritating to the eyes and skin.

## **Used Engine Oil**

Prolonged and repeated contact with mineral oil will result in the removal of natural oils from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities must be provided.

Do not employ used engine oils as lubricants or for any application where appreciable skin contact is likely to occur.

There are publications describing the problems and advising on precautionary measures. For the UK a typical Health and Safety Executive publication is: SHW 397: Cautionary Notice: Effects of mineral oil on the skin.

Health Protection Precautions

- Avoid prolonged and repeated contact with oils, particularly used engine oils
- Wear protective clothing, including impervious gloves where practicable

- Do not put oily rags into pockets
- Avoid contaminating clothing with oil
- Heavily soiled clothing and oil-impregnated footwear should not be worn. Overalls must be cleaned regularly
- First Aid treatment should be obtained immediately for open cuts and wounds.
- Use barrier creams, applying them before each work period, to enable easier removal of dirty oil and grease from the skin
- Wash with soap and water to make sure all oil is removed (skin cleansers and nail brushes will help). Preparations containing lanolin replace the natural skin oils which have been removed
- Do not use gasoline (petrol), kerosene (paraffin), diesel fuel (gas oil), thinners or solvents for cleaning skin.
- If skin disorders develop, obtain medical advice without delay
- Where practical, degrease components prior to handling
- Where there is a risk of eye contact, eye protection should be worn, for example, goggles or face shields; in addition an eye wash facility should be provided

#### Environmental Precautions

Burning used engine oil in small space heaters or boilers can be recommended only for units of approved design. In the UK the heating system must meet the requirements of HM Inspectorate of Pollution for small burners of less than 0.4 MW. If in doubt check with the appropriate local authority and/or manufacturer of approved appliances.

Dispose of used oil and used oil filters through authorized waste disposal contractors or licensed waste disposal sites, or to the waste oil reclamation trade, batteries should also be disposed off under similar arrangements. If in doubt, contact the relevant local authority for advice on disposal facilities.

It is illegal to pour used oil, antifreeze and automatic transmission fluid on to the ground, down sewers, drains, or into water courses.

### Noise

Some operations may produce high noise levels which could, in time, damage hearing. In these cases, suitable ear protection must be worn.

### Noise Insulation Materials

See Foams, Fibre Insulation.

### O-Rings (Fluoroelastomer)

See Viton.

### Paints

See also body and paint manual.

See also Solvents, Chemical Materials.

Highly flammable, flammable - observe No Smoking policy

### Pressurized Equipment

See High Pressure Air, Lubrication and Oil Test Equipment.

### Solder

Solders are a mixture of metals such that the melting point of the mixture is below that of the constituent metals (normally lead and tin). Solder application does not normally give rise to toxic lead fumes, provided a gas/air flame is used. Oxy-acetylene flames should not be used, as they are much hotter and will cause lead fumes to be produced.

Some fumes may be produced by the application of any flame to surfaces coated with grease etc. and inhalation of these should be avoided.

Removal of excess solder should be undertaken with care, to make sure that fine lead dust is not produced, which can give toxic effects if inhaled. Respiratory protection may be necessary.

Solder spillage and filings should be collected and removed promptly to prevent general air contamination by lead.

High standards of personal hygiene are necessary in order to avoid ingestion of lead or inhalation of solder dust from clothing.

### Solvents

See also Chemical Materials, Fuels (Kerosene), Fire.

e.g. acetone, white spirit, toluene, xylene, trichloroethane.

Used in cleaning and de-waxing materials, paints, plastics, resins, thinners etc.

Some may be highly flammable or flammable.

Skin contact will degrease the skin and may result in irritation and dermatitis following repeated or prolonged contact. Some can be absorbed through the skin in toxic or harmful quantities.

Splashes in the eye may cause severe irritation and could lead to loss of vision.

Brief exposure to high concentrations of vapors or mists will cause eye and throat irritation, drowsiness, dizziness, headaches and, in the worst circumstances, unconsciousness.

Repeated or prolonged exposure to excessive but lower concentrations of vapors or mists, for which there might not be adequate warning indications, can cause more serious toxic or harmful effects.

Aspiration into the lungs (e.g. through vomiting) is the most serious consequence of swallowing.

Avoid splashes to the skin, eyes and clothing. Wear protective gloves, goggles and clothing if necessary.

Ensure good ventilation when in use, avoid breathing fumes, vapors and spray mists and keep containers tightly sealed. Do not use in confined spaces.

When spraying materials containing solvents, e.g. paints, adhesive, coatings, use extraction ventilation or personal respiratory protection in the absence of adequate general ventilation.

Do not apply heat or flame except under specific and detailed manufacturer's instructions.

## Sound Insulation

See Fibre Insulation, Foams.

## Suspended Loads



**CAUTION:** Never improvise lifting tackle.

There is always a danger when loads are lifted or suspended. Never work under an unsupported, suspended or raised load e.g. suspended engine, etc.

Always make sure that lifting equipment such as jacks, hoists, axle stands, slings, etc., are adequate and suitable for the job, in good condition and regularly maintained.

## Transmission Brake Bands

See Asbestos.

## Underseal

See Corrosion Protection.

## Viton

In common with many other manufacturers' vehicles, some components installed to the Jaguar range have 'O' rings, seals or gaskets which contain a material known as 'Viton'.

Viton is a fluoroelastomer, that is a synthetic rubber type which contains Fluorine. It is commonly used for 'O' rings, gaskets and seals of all types. Although Viton is the most well known fluoroelastomer, there are others, including Fluorel and Tecnoflon.

When used under design conditions fluoroelastomers are perfectly safe. If, however, they are exposed to temperatures in excess of 400° C, the material will not burn, but will decompose, and one of the products formed is hydrofluoric acid.

This acid is extremely corrosive and may be absorbed directly, through contact, into the body.

'O' rings, seals or gaskets which have been exposed to very high temperatures will appear charred or as a black sticky substance.

DO NOT, under any circumstances touch them or the attached components.

Enquiries should be made to determine whether Viton or any other fluoroelastomer has been used in the affected 'O' ring, seal or gasket. If they are of natural rubber or nitrile there is no hazard. If in doubt, be cautious and assume that the material may be Viton or any fluoroelastomer.

If Viton or any other fluoroelastomers have been used, the affected area should be decontaminated before the commencement of work.

Disposable heavy duty plastic gloves should be worn at all times, and the affected area washed down using wire wool and a limewater (calcium hydroxide) solution to neutralize the acid before disposing of the decomposed Viton residue and final cleaning of the area. After use, the plastic gloves should be discarded carefully and safely.

## Welding

See also Fire, Electric Shock, Gas Cylinders.

Welding processes include Resistance Welding (Spot Welding), Arc Welding and Gas Welding (and cutting).

Resistance Welding (Spot Welding)

This process may cause particles of molten metal to be emitted at a high velocity, and the eyes and skin must be protected.

Arc Welding

This process emits a high level of ultraviolet radiation which may cause arc-eye and skin burns to the operator and to

other persons nearby. Gas-shielded welding processes are particularly hazardous in this respect. Personal protection must be worn, and screens used to shield other people.

CONTACT LENS WEARERS ARE ADVISED TO REVERT TO ORDINARY SPECTACLES WHEN ARC WELDING as the arc spectrum is believed to emit microwaves which dry out the fluid between the lens and the eye. This may result in blindness when the lens is removed from the eye.

Metal spatter will also occur, and appropriate eye and skin protection is necessary.

The heat of the welding arc will produce fumes and gases from the metals being welded, the rods and from any applied coatings or contamination on the surfaces being worked on. These gases and fumes may be toxic and inhalation of these should be avoided. The use of extraction ventilation to remove the fumes from the working area may be necessary particularly in cases where the general ventilation is poor, or where considerable welding work is anticipated. In extreme cases or confined spaces where adequate ventilation cannot be provided, air-fed respirators may be necessary.

#### Gas Welding (and Cutting)

Oxy-acetylene torches may be used for welding and cutting, and special care must be taken to prevent leakage of these gases, with consequent risk of fire and explosion.

The process will produce metal spatter and eye and skin protection is necessary.

The flame is bright, and eye protection should be used, but the ultraviolet emission is much less than that from arc welding, and lighter filters may be used.

The process itself produces few toxic fumes, but such fumes and gases may be produced from coatings on the work, particularly during cutting away of damaged body parts, and inhalation of the fumes should be avoided.

In brazing, toxic fumes may be produced from the metals in the brazing rod, and a severe hazard may arise if brazing rods containing cadmium are used. In this event particular care must be taken to avoid inhalation of fumes and expert advice may be required.

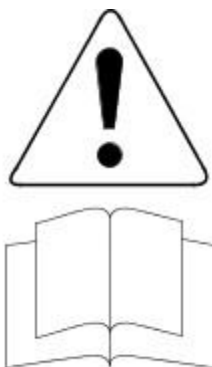
SPECIAL PRECAUTIONS MUST BE TAKEN BEFORE ANY WELDING OR CUTTING TAKES PLACE ON VESSELS WHICH HAVE CONTAINED COMBUSTIBLE MATERIALS, E.G. BOILING OR STEAMING OUT OF FUEL TANKS.

### Warning Symbols on Vehicles

Decals showing warning symbols will be found on various vehicle components.

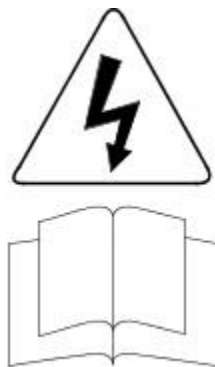
These decals must not be removed. The warnings are for the attention of owners/operators and persons carrying out service or repair operations on the vehicle.

The most commonly found decals are reproduced below together with an explanation of the warnings.



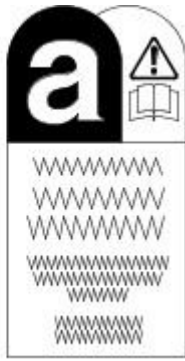
VUJ0000269

1. Components or assemblies displaying the warning triangle and open book symbol advise consultation of the relevant section of the owners handbook before touching or attempting adjustments of any kind.



VUJ0000270

2. Components or assemblies displaying the warning triangle with the electrified arrow and open book symbol give warning of inherent high voltages. Never touch these with the engine running or the ignition switched on. See Electric Shock in this subsection.



VUJ0000271

3. 3. Jaguar vehicles and replacement parts which contain asbestos are identified by this symbol. See Asbestos in this subsection.



VUJ0000272

4. 4. Components or assemblies displaying this symbol give warning that the component contains a corrosive substance. See Acids and Alkalis in this subsection.



VUJ0000273

5. 5. Vehicles displaying the caution circle with a deleted lighted match symbol, caution against the use of naked lights or flames within the immediate vicinity due to the presence of highly flammable or explosive liquids or vapors. See Fire in this subsection.



VUJ0002037

6. 6. All vehicles with the passenger air bag installed from the factory have a warning sticker attached to the instrument panel, prohibiting the use of rear facing child seats in the front seating position. Failure to follow this instruction may result in personal injury.

## White Spirit

See Solvents.

## Safety Precautions

- WARNINGS:



Working on the fuel system results in fuel and fuel vapor being present in the atmosphere. Fuel vapor is extremely flammable, hence great care must be taken whilst working on the fuel system. Adhere strictly to the following precautions:

- Do not smoke in the work area
- Display 'no smoking' signs around the area
- Disconnect the battery before working on the fuel system
- Do not connect/disconnect electrical circuits, use electrical equipment or other tools or engage in working practices which in any way may result in the production of sparks
- Ensure that a CO<sup>2</sup> fire extinguisher is close at hand
- Ensure that dry sand is available to soak up any fuel spillage
- Empty fuel using suitable fire proof equipment into an authorized explosion proof container
- Do not empty fuel while working in a workshop or a pit
- Ensure that working area is well ventilated
- Ensure that any work on the fuel system is only carried out by experienced and well qualified maintenance personnel
- Ensure that fume extraction equipment is used where appropriate



Fume extraction equipment must be in operation when solvents are used e.g. Trichloroethane, white spirit, sbp3, methylene chloride, perchlorethylene. Do not smoke in the vicinity of volatile degreasing agents.

Whenever possible, use a ramp or pit whilst working beneath a vehicle, in preference to jacking. Position chocks at the wheels as well as applying the parking brake. Never rely on a jack alone to support a vehicle. Use axle stands, or blocks carefully placed at the jacking points, to provide a rigid location. Check that any lifting equipment used has adequate capacity and is fully serviceable. Ensure that a suitable form of fire extinguisher is conveniently located. When using electrical tools and equipment, inspect the power lead for damage and check that it is properly earthed. Disconnect the earth (grounded) terminal of the vehicle battery. Do not disconnect any pipes of the air conditioning refrigeration system unless you are trained and instructed to do so. A refrigerant is used which can cause blindness if allowed to come into contact with the eyes. Ensure that adequate ventilation is provided when volatile degreasing agents are being used.

Adhere strictly to handling and safety instructions given on containers and labels. Keep oils and solvents away from naked flames and other sources of ignition. Do not apply heat in an attempt to free seized nuts or fittings; as well as causing damage to protective coatings, there is a risk of damage from stray heat to electronic equipment and brake lines. Do not leave tools, equipment, spilt oil etc. around the work area. Wear protective overalls and use barrier cream when necessary.

## Environmental Protection

In some countries it is illegal to pour used oil onto the ground, down sewers or drains, or into water courses. The burning of used engine oil in small space heaters or boilers is not recommended unless emission control equipment is installed. Dispose of used oil through authorized waste disposal contractors, to licensed waste disposal sites or to the waste oil reclamation trade. If in doubt, contact the Local Authority for advice on disposal facilities.



# General Information - How To Use This Manual

Description and Operation

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## Workshop Manual Organization

This manual covers descriptive, diagnostic (including OBD), and repair aspects to service the vehicle effectively.

The manual is arranged in sections, each section dealing with a specific part of a vehicle system. For example, Section 412-03 [Air Conditioning] covers air conditioning, which is part of the climate control system.

The first digit of the section number indicates the group (in the above example this being Electrical). There are five groups:

- General Information.
- Chassis.
- Powertrain.
- Electrical.
- Body and Paint.

The second and third digits of the section number indicate the vehicle system (12 in the above example being Climate Control).

The last two digits of the section number indicate the part of the system covered by the section (03 in the example denotes Air Conditioning).

# **General Information - Important Safety Instructions**

Description and Operation

## Safety Notice

Appropriate service methods and correct repair procedures are essential for the safe, reliable operation of all motor vehicles, as well as the safety of the person doing the work. This manual provides general directions for accomplishing service and repair work with tested effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the person doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in the manual must first establish that neither personal safety or vehicle integrity is compromised from choices of methods, tools or parts.

# General Information - Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions

## Description and Operation

### • WARNINGS:



Fuel may not give adequate warning before toxic or harmful effects arise.



Exposure to fuel can be harmful and can cause severe health damage or death.



Extreme care must be exercised when handling hot fluids. Always wash off spilled fluids from affected areas of skin immediately.



Highly flammable mixtures are always present and may ignite when working on fuel systems. Do not allow naked flames, sparks or lighted substances to come near fuel related components.



Fuel must not be used as a cleaning agent.



Keep fuel containers tightly closed, out of direct sunlight and in a cool area. Keep away from heat sources, ignition sources and oxidizing agents.



**SKIN CONTACT:** Excessive or prolonged skin contact with diesel fuel may cause serious skin disorders including skin cancer.



**SKIN CONTACT:** Fuel is mildly irritating to the skin and may cause dermatitis due to defatting effect. Remove contaminated clothing. Wash affected areas of skin with soap and water. Seek medical attention for any persistent skin irritation or abnormality. Wash contaminated clothing before reuse.



**EYE CONTACT:** Fuel is mildly irritating to the eyes. Flush with plenty of running water, blinking as often as possible. Do not force the eyelid open. Seek medical attention for any persistent eye irritation or abnormality.



**SWALLOWED:** Fuel is moderately toxic and tends to foam on vomiting. If drawn into the lungs, inflammation may develop. Do not induce vomiting. If spontaneous vomiting occurs place the victim in a forward position to reduce the risk of fuel being drawn into the lungs. Give nothing by mouth. If breathing but unconscious, place in the recovery position. If breathing has stopped, apply artificial respiration. Seek immediate medical attention.



**INHALED:** Fuel is toxic to the respiratory and other body systems. Exposure may result in various symptoms including drowsiness, unconsciousness or severe health damage. Move a victim to fresh air. Keep a victim warm and at rest. If unconscious, place in the recovery position. If not breathing, apply artificial respiration. Give cardiac massage if necessary. Seek immediate medical attention.

### • CAUTIONS:



Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components.



Make sure that the workshop area in which the vehicle is being worked on is as clean and as dust free as possible.

## General Information - Solvents, Sealants and Adhesives

Description and Operation



**WARNING:** Always handle all solvents, sealers and adhesives with extreme care. Some contain chemicals or give off fumes which can be dangerous to health. Always follow the manufacturers instructions. If in doubt about any substance, particularly a solvent, DO NOT use it.



**CAUTION:** If in doubt about the suitability of any proprietary solvent or sealer for a particular application, contact the manufacturer of the product for information regarding storage, handling and application.

The Solvents, Sealers and Adhesives subsection refers to some commonly used chemicals and materials, hazards associated with their use, and safety measures to be taken.

### Adhesives and Sealers

Highly flammable, flammable, combustible – observe No Smoking policy.

Generally should be stored in 'No Smoking' areas. Cleanliness and tidiness in use should be observed e.g. disposable paper covering benches; should be dispensed from applicators where possible; containers, including secondary containers, should be labelled appropriately.

### Solvent - based Adhesives/Sealers - See Solvents

Follow manufacturer's instructions.

### Water - based Adhesives/Sealers

Those based on polymer emulsions and rubber latexes may contain small amounts of volatile toxic and harmful chemicals. Skin and eye contact should be avoided and adequate ventilation provided during use.

### Hot Melt Adhesives

In the solid state, they are safe. In the molten state they may cause burns and health hazards may arise from the inhalation of toxic fumes.

Use appropriate protective clothing and a thermostatically controlled heater with a thermal cut - out and adequate extraction.

### Resin - based Adhesives/Sealers e.g. Epoxide and Formaldehyde Resin - based

Mixing should be carried out in well ventilated areas, as harmful or toxic volatile chemicals may be released.

Skin contact with uncured resins and hardeners can result in irritation, dermatitis, and absorption of toxic or harmful chemicals through the skin. Splashes can damage the eyes.

Provide adequate ventilation and avoid skin and eye contact.

### Anaerobic, Cyanoacrylate (Super - glues) and other Acrylic Adhesives

Many are irritant, sensitizing or harmful to the skin and/or respiratory tract. Some are eye irritants.

Skin and eye contact should be avoided and the manufacturer's instructions followed.

Cyanoacrylate adhesives (super-glues) MUST NOT contact the skin or eyes. If skin or eye tissue is bonded, cover with a clean moist pad and seek immediate medical attention. Do not attempt to pull tissue apart. Use in well ventilated areas as vapors can cause irritation to the nose and eyes.

For two - pack systems see Resin - based and Isocyanate Adhesives/Sealers.

### Isocyanate (Polyurethane) Adhesives/Sealers

See also Resin - based Adhesives

Individuals suffering from asthma or respiratory allergies should not work with or near these materials as sensitivity reactions can occur.

Over exposure is irritating to the eyes and respiratory system. Excessive concentrations may produce effects on the nervous system including drowsiness. In extreme cases, loss of consciousness may result. Long term exposure to vapor concentrations may result in adverse health effects.

Prolonged contact with the skin may lead to skin irritation and, in some cases, dermatitis.

Splashes entering the eye will cause discomfort and possible damage.

Any spraying should preferably be carried out in exhaust ventilated booths removing vapors and spray droplets from the breathing zone.

Wear appropriate gloves, eye and respiratory protection.

# General Information - Standard Workshop Practices

Description and Operation

## Protecting the Vehicle

Always install covers to protect the fenders before commencing work in the engine compartment. Always install the interior protection kit, wear clean overalls and wash hands or wear gloves before working inside the vehicle. Avoid spilling hydraulic fluid, antifreeze or battery acid on the paintwork. In the event of spillage, wash off with water immediately. Use polythene sheets in the luggage compartment to protect carpets. Always use the recommended service tool, or a satisfactory equivalent, where specified. Protect temporarily exposed screw threads by replacing nuts or installing caps.

## Vehicle in Workshop

When working on a vehicle in the workshop always make sure that:

- The parking brake is applied or the wheels are securely chocked to prevent the vehicle moving forwards or backwards
- If the engine is to be run, there is adequate ventilation, or an extraction hose to remove exhaust fumes is installed
- There is adequate room to jack up the vehicle and remove the wheels, if necessary
- Fender covers are always installed if any work is to be carried out in the engine compartment
- The battery is disconnected if working on the engine, underneath the vehicle, or if the vehicle is jacked up



**CAUTION:** When electric arc welding on a vehicle, always disconnect the generator wiring to prevent the possibility of a surge of current causing damage to the internal components of the generator.

- If using welding equipment on the vehicle, ensure a suitable fire extinguisher is readily available.

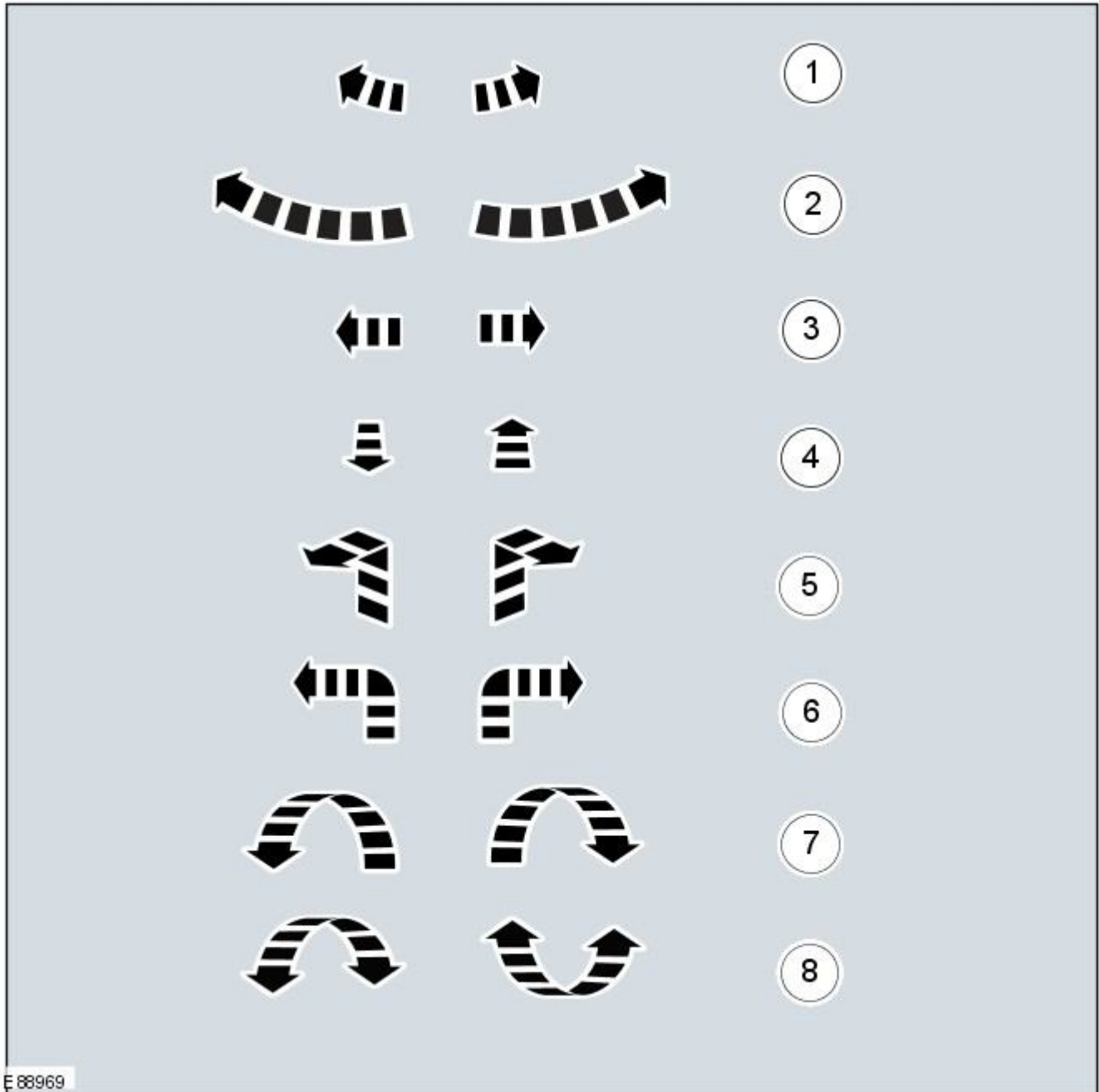
## General Information - Symbols Glossary

### Description and Operation

Symbols are used inside the graphics and in the text area to enhance the information display.

#### Movement Symbols

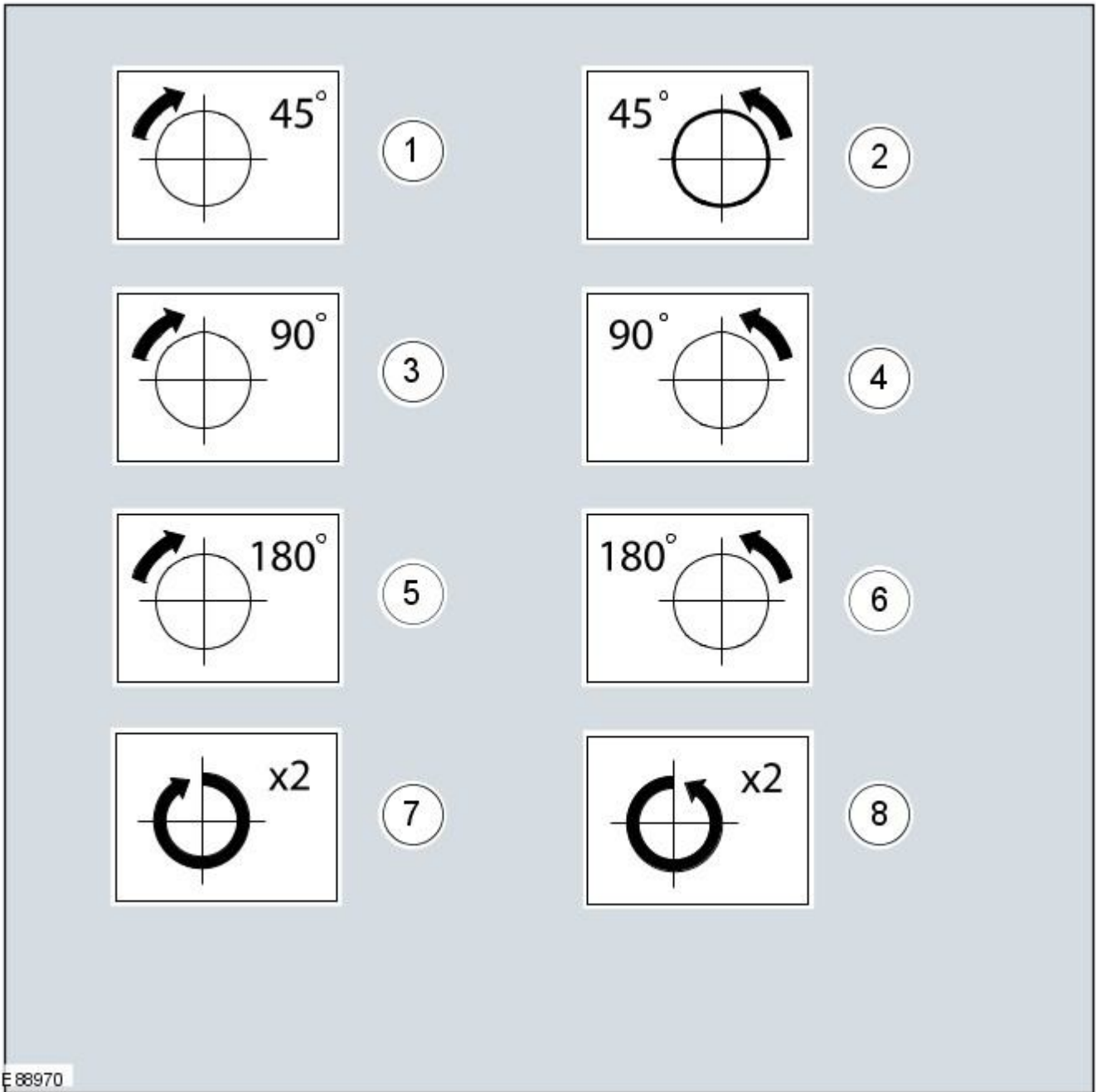
Movement symbols provide detailed information to a required component movement. These component movements can be rotational or 1-3 dimensional movements.



Item	Part Number	Description
1	-	Minor component movement clockwise/counterclockwise
2	-	Major component movement clockwise/counterclockwise
3	-	Component movement to the left/right/up/down
4	-	Component movement towards/away
5	-	3 dimensional component movement
6	-	2 dimensional component movement
7	-	3 dimensional component rotation
8	-	3 dimensional component cycling

#### Turn Symbols

Turn symbols are used to provide further information on the direction or angle of component turns.



E 88970

Item	Part Number	Description
1	-	Turn the component clockwise through 45°
2	-	Turn the component counterclockwise through 45°
3	-	Turn the component clockwise through 90°
4	-	Turn the component counterclockwise through 90°
5	-	Turn the component clockwise through 180°
6	-	Turn the component counterclockwise through 180°
7	-	Turn the component clockwise through 2 complete turns
8	-	Turn the component counterclockwise through 2 complete turns

**Steering Wheel Symbols**

Steering wheel symbols are used to provide further information to a required steering wheel position or steering column lock status.



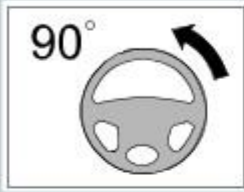
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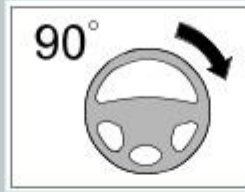
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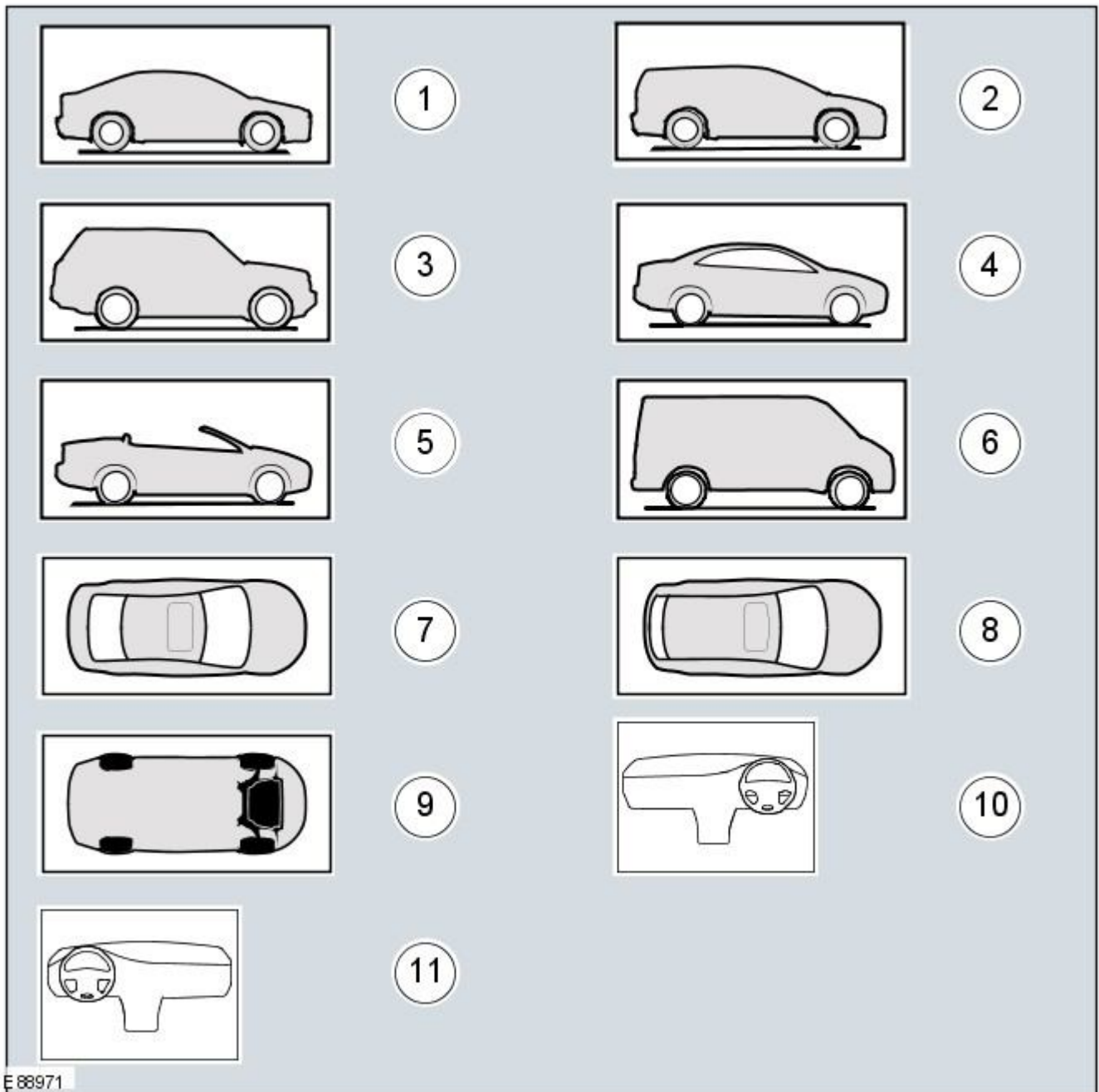


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E 123751

Item	Part Number	Description
1	-	Steering wheel in straight ahead position
2	-	Steering column lock locked
3	-	Steering column lock unlocked
4	-	Turn the steering wheel to the 90° left position
5	-	Turn the steering wheel to the 90° right position
6	-	Turn the steering wheel to the left-hand end position
7	-	Turn the steering wheel to the right-hand end position



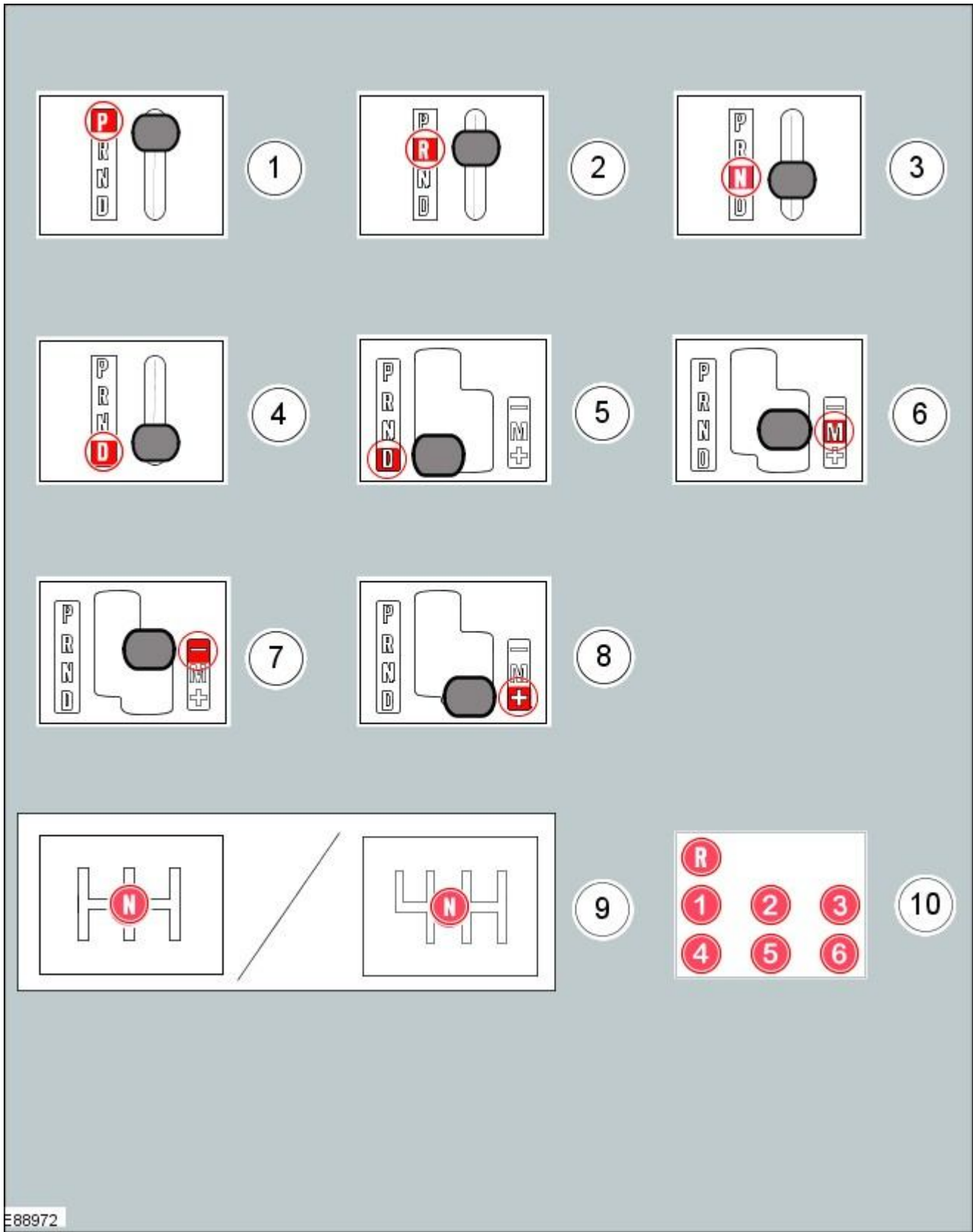


E 88971

Item	Part Number	Description
1	-	3, 4, 5-door body style
2	-	Wagon body style
3	-	Sports utility vehicle body style
4	-	Coupe body style
5	-	Convertible body style
6	-	Van body style
7	-	3, 4, 5-door body style - Top View
8	-	Wagon body style - Top View
9	-	Underview
10	-	Right-hand drive (RHD) vehicle
11	-	Left-hand drive (LHD) vehicle

Gearshift lever and selector lever position symbols

Gearshift lever and selector lever position symbols are used to show the lever position that is required to be selected to carry out a procedure step.



E88972

Item	Part Number	Description
1	-	Set the selector lever to the park (P) position
2	-	Set the selector lever to the reverse (R) position
3	-	Set the selector lever to the neutral (N) position
4	-	Set the selector lever to the drive (D) position
5	-	Set the selector lever with manual shift pattern to the park (D) position
6	-	Set the selector lever with manual shift pattern to the manual (M) position
7	-	Set the selector lever with manual shift pattern to the shift down (-) position
8	-	Set the selector lever with manual shift pattern to the shift up (+) position
9	-	Set the gearshift lever to the neutral (N) position
10	-	Further gearshift lever positions that may appear in illustrations

Screwdriver symbols

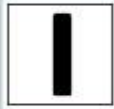
The screwdriver symbols are used to show which screwdriver bit is recommended to carry out a procedure step.



1



2



3



4



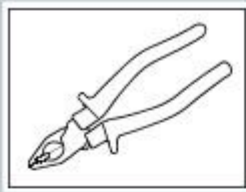
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E88973

Item	Part Number	Description
1	-	Screwdriver
2	-	Cross bladed screwdriver
3	-	Flat bladed screwdriver
4	-	Hexagonal screwdriver
5	-	TORX screwdriver

Pliers symbols

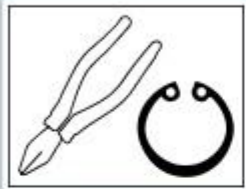
The pliers symbols are used to show which pliers is recommended to carry out a procedure step.



1



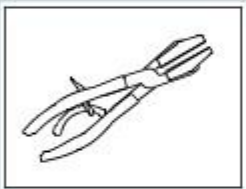
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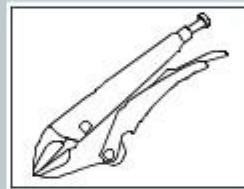
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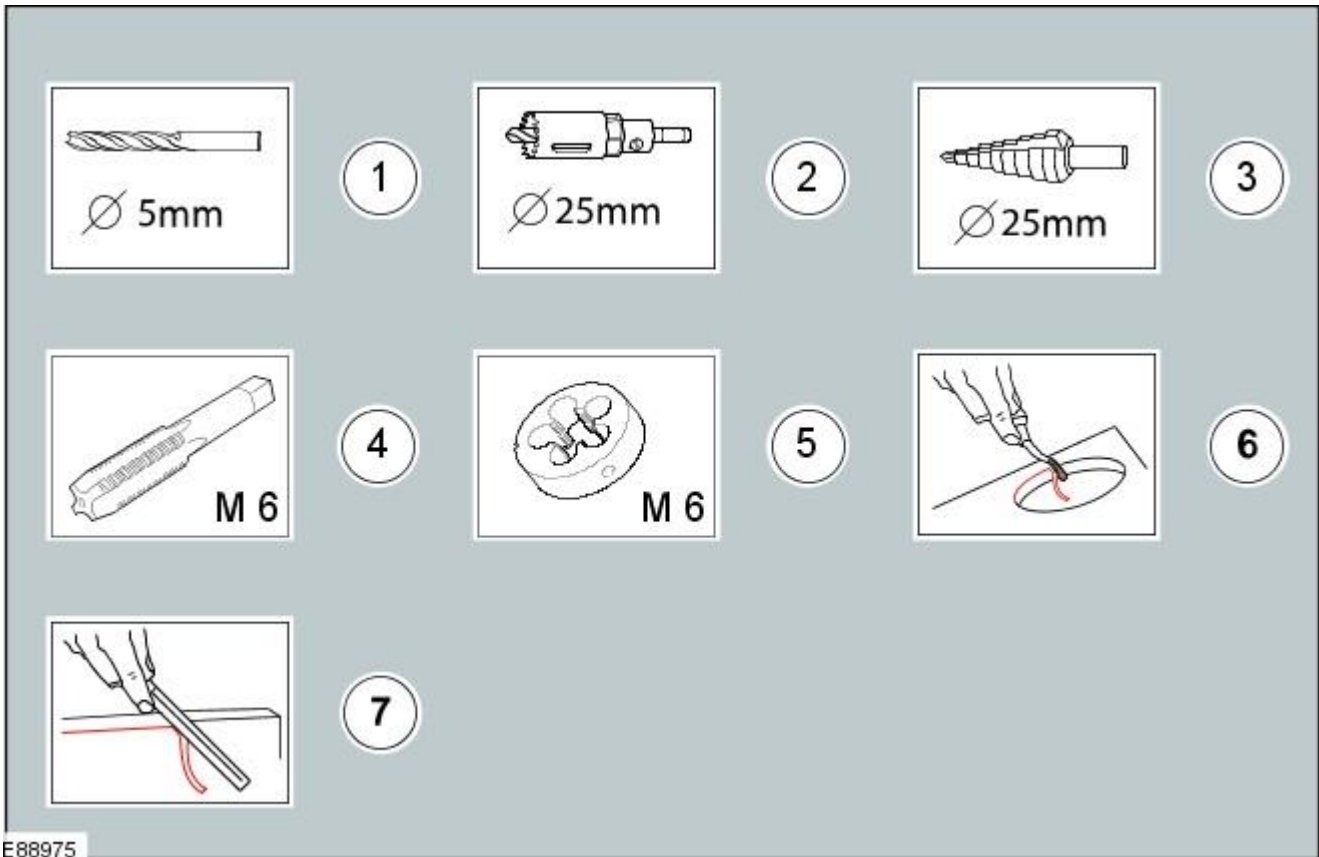
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E88974

Item	Part Number	Description
1	-	Combination pliers
2	-	Side cutter pliers
3	-	Securing ring pliers - inner
4	-	Securing ring pliers - outer
5	-	Hose clamp pliers
6	-	Locking pliers
7	-	Long nose pliers

Drill symbols

The drill symbols are used to show which type and size of drill bit is recommended to carry out a procedure step.

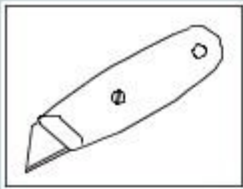


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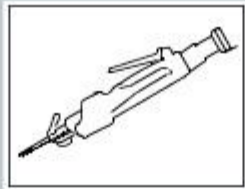
Item	Part Number	Description
1	-	Drill bit with a specified diameter
2	-	Hole saw with a specified diameter
3	-	Stepped drill bit with a specified diameter
4	-	Tap with a specified diameter
5	-	Die with a specified diameter
6	-	Scraper for circular holes
7	-	Scraper for straight edges

Cutting tool symbols

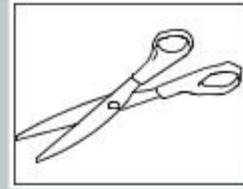
The cutting tool symbols are used to show which type of cutting tool is recommended to carry out a procedure step.



1



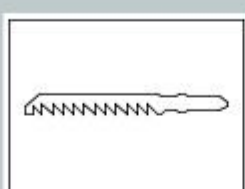
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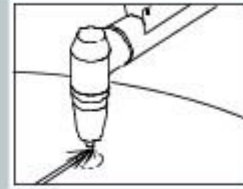
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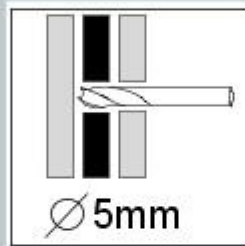
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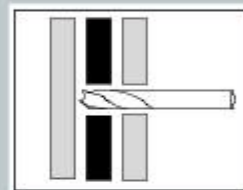
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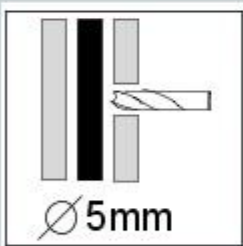
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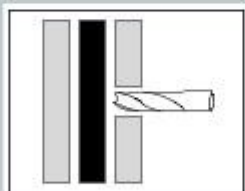
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10



11



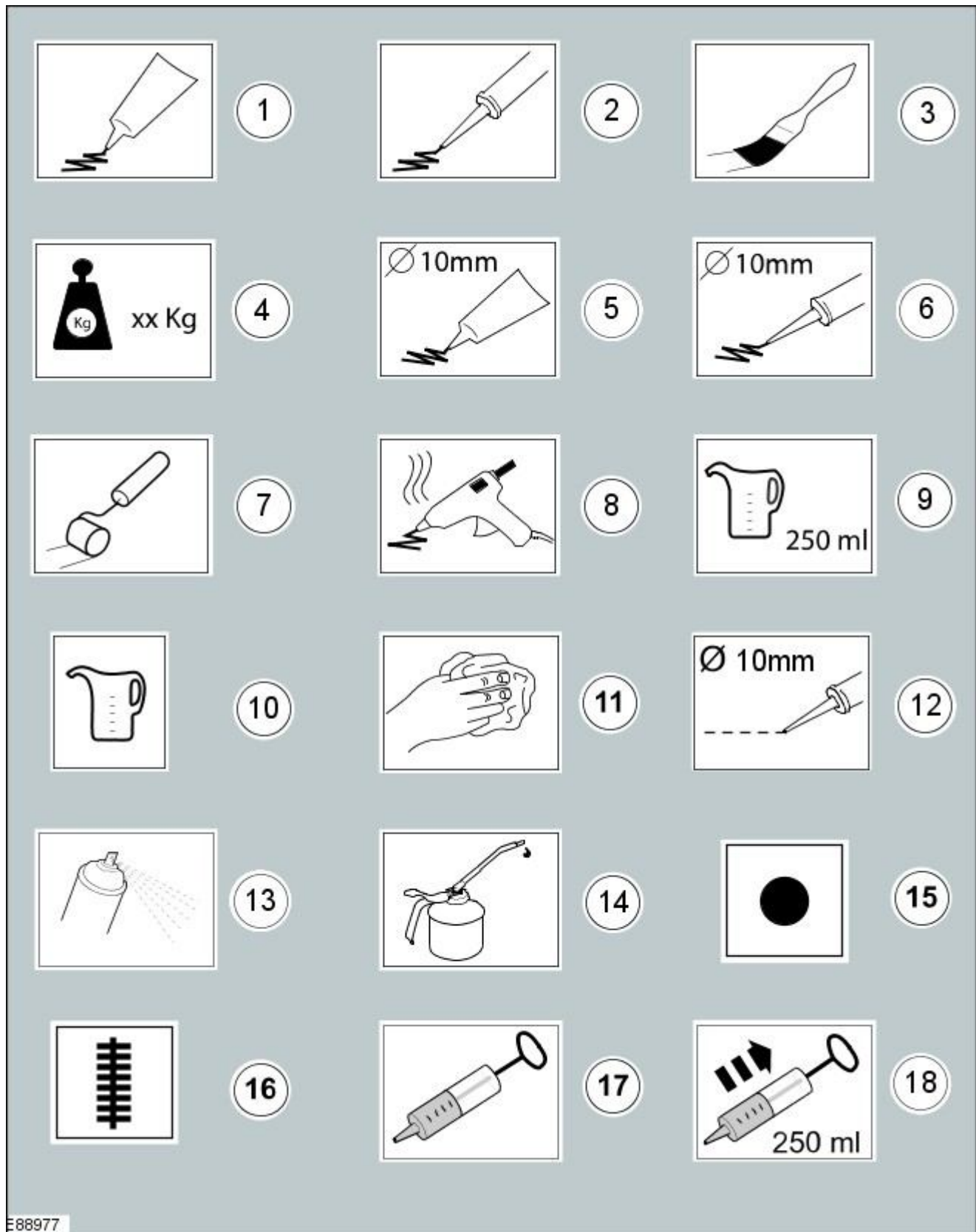
12

E88976

Item	Part Number	Description
1	-	Cutting knife
2	-	Air body saw
3	-	Scissors
4	-	Grinder
5	-	Jig saw
6	-	Plasma cutter
7	-	Sanding Paper
8	-	Drill through the shown number of body panel layers with a specified diameter
9	-	Drill through the shown number of body panel layers with a suitable diameter
10	-	Drill through 1 body panel layer with a specified diameter
11	-	Drill through 1 body panel layer with a suitable diameter
12	-	Wire brush

Apply Chemical or load symbols

The apply chemical or load symbols are used to show where to apply which type of chemical or load to carry out a procedure step.



E88977

Item	Part Number	Description
1	-	Apply a bead from the specified tube
2	-	Apply a bead from the specified cartridge
3	-	Apply the specified chemical with a brush
4	-	Apply the specified load to the specified component
5	-	Apply a bead with a specific diameter from the specified tube
6	-	Apply a bead with a specific diameter from the specified cartridge
7	-	Apply the specified chemical with a roller
8	-	Apply hot glue to the specified component



9	-	Apply the specified amount of fluid from the fluid can
10	-	Apply fluid from the fluid can
11	-	Clean the specified component with the specified material
12	-	Apply a broken bead from the specified tube
13	-	Apply the specified chemical from a spray can
14	-	Apply the specified lubricant to the specified component
15	-	Apply spot welds to the specified component
16	-	Apply a continuous weld to the specified component
17	-	Handle the fluid using a syringe
18	-	Extract the specified amount of fluid using a syringe

Measurement symbols

The measurement symbols are used to show where to measure which type of measurement to carry out a procedure step.

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Item	Part Number	Description
1	-	Measure the current using a digital multimeter
2	-	Measure the voltage using a digital multimeter
3	-	Measure the resistance using a digital multimeter
4	-	Measure the length/distance
5	-	Check that the specified pressure is available using a suitable pressure gauge
6	-	Measure the pressure at the specified port using a suitable pressure gauge
7	-	Measure the time using a suitable stopwatch
8	-	Wait for the specified period of time
9	-	The specified task requires the specified minimum temperature
10	-	The specified task requires the specified maximum temperature not to be exceeded
11	-	The specified task requires the specified temperature range
12	-	The specified task requires the specified temperature
13	-	Measure and check for the specified value using a dial indicator gauge
14	-	Measure and check for the specified MAX value using a dial indicator gauge
15	-	Measure and check for the specified MIN value using a dial indicator gauge

#### General equipment symbols

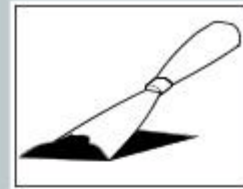
The general equipment symbols are used to show where to use which type of general equipment to carry out a procedure step.



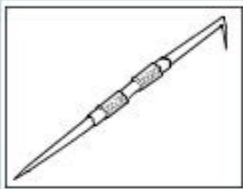
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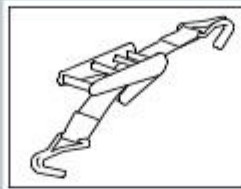
2



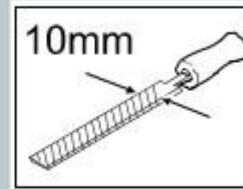
3



4



5



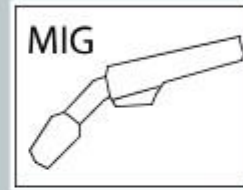
6



7



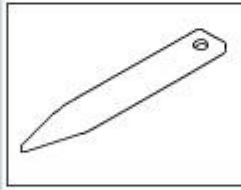
8



9



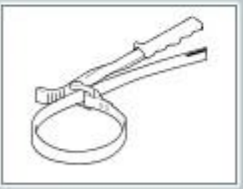
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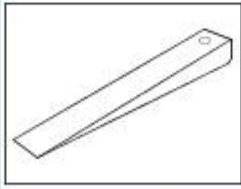
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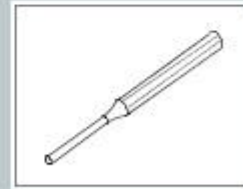
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13



14



15

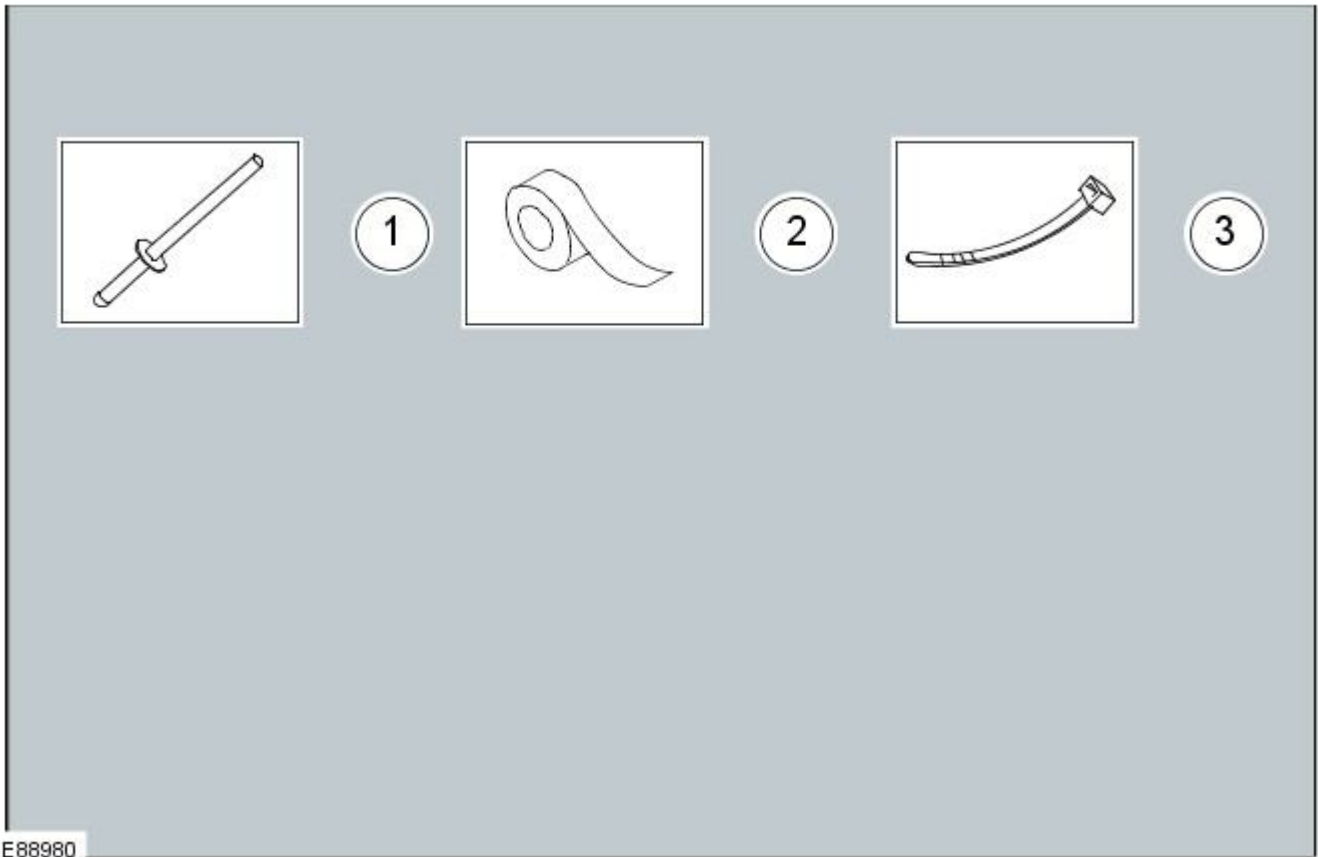
E88979

Item	Part Number	Description
1	-	Hot air gun
2	-	Soldering iron
3	-	Scrapper
4	-	Scriber
5	-	Securing strap
6	-	File with a specified size
7	-	Center punch
8	-	Marker
9	-	Metal inert gas (MIG) welding equipment
10	-	Hose clamp
11	-	Interior trim remover
12	-	Vacuum cleaner

13	-	Strap wrench
14	-	Wedge
15	-	Pin Punch

Material symbols

The material symbols are used to show where to use which type of material to carry out a procedure step.

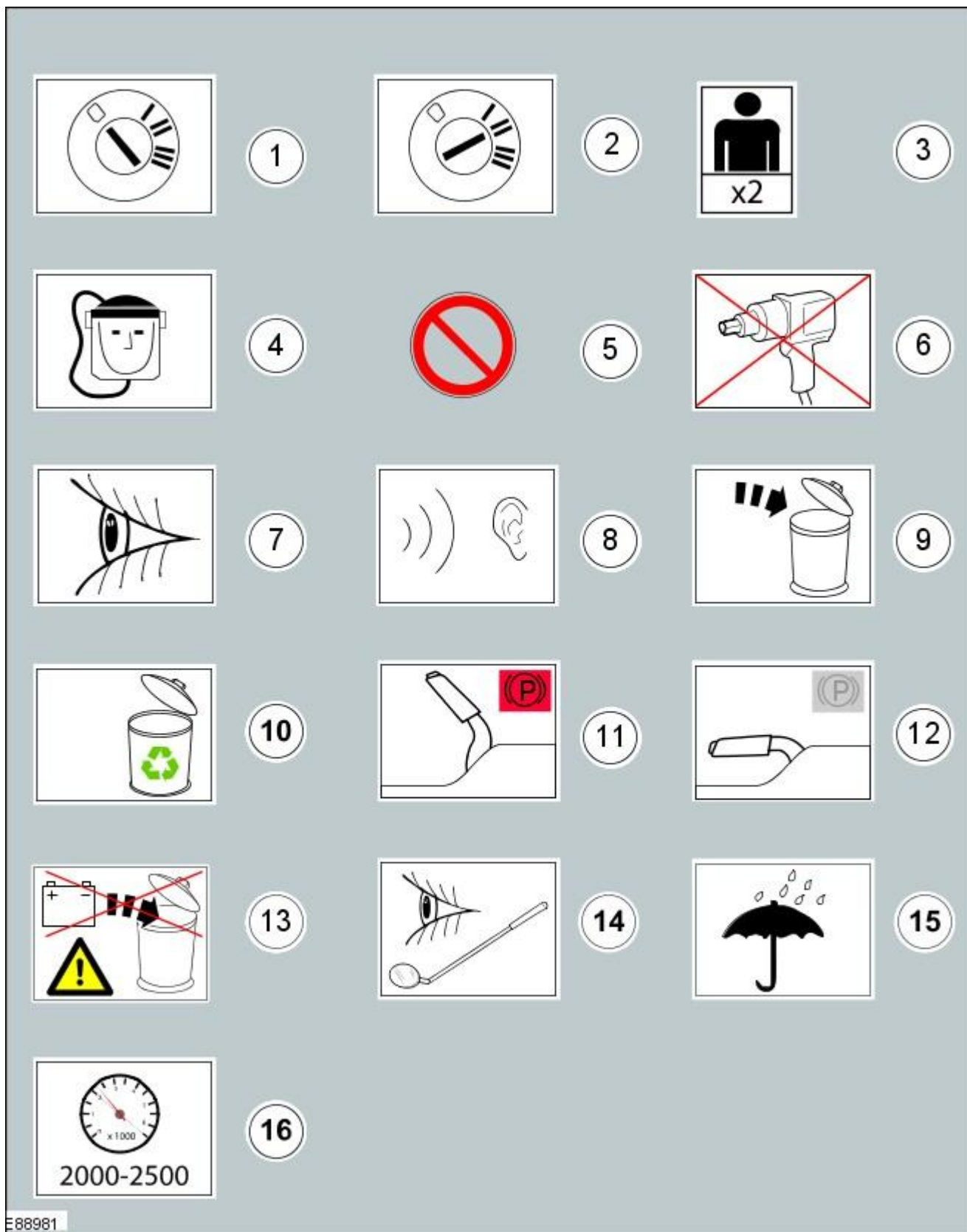


E88980

Item	Part Number	Description
1	-	Remove/Install the specified blind rivet
2	-	Apply tape to the specified component/area
3	-	Remove/Install the specified cable tie

Miscellaneous symbols

These symbols provide further information that is required to carry out a procedure step.



E88981

Item	Part Number	Description
1	-	Set the ignition switch to the 0 position
2	-	Set the ignition switch to the II position
3	-	The procedure step requires the aid of the specified number of supporting technicians
4	-	Self contained breathing apparatus
5	-	General prohibition used in combination with another symbol
6	-	Do not use power tools
7	-	Visual check
8	-	Noise check
9	-	Dispose the specified component
10	-	Replaced by item 9 (Dispose the specified component)
11	-	Set the engine speed to the specified value
12	-	Fully apply the parking brake lever

13	-	Fully release the parking brake lever
14	-	Do not dispose of batteries into the waste bin
15	-	Visual check using a mirror
16	-	Area/component must be dry

Mandatory Protective equipment - Health and safety symbols

The protective equipment symbols advise to use a mandatory protective equipment to avoid or at least reduce possible health and safety risks.

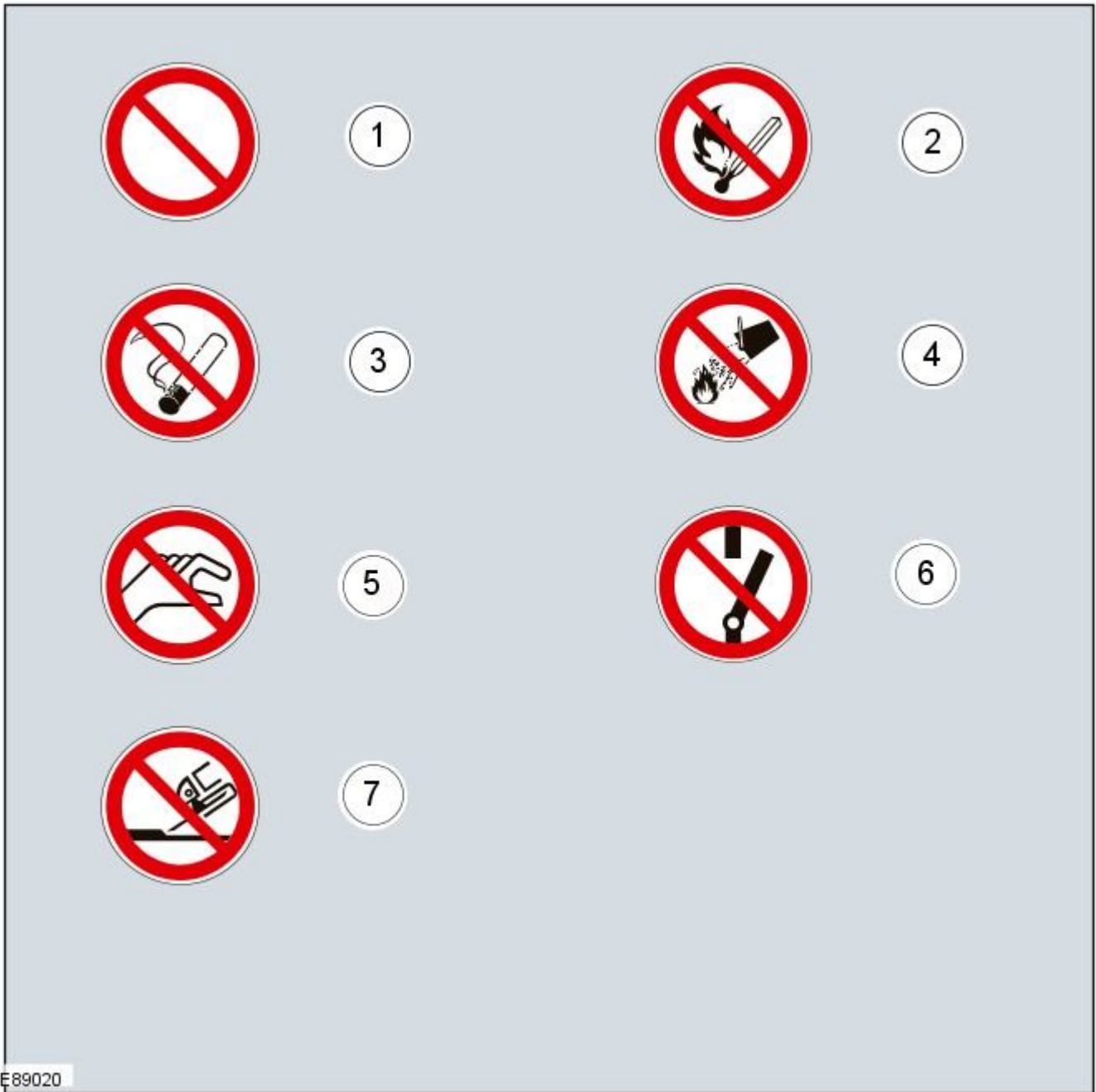


E 89019

Item	Part Number	Description
1	-	Wear protective gloves
2	-	Wear face guard
3	-	Wear safety goggles
4	-	Wear ear protectors
5	-	Wear safety goggles and ear protectors
6	-	Wear a respirator

Prohibition - Health and safety symbols and component damage

The prohibition symbols are used to prohibit the specified actions to avoid or at least reduce possible component damage and health and safety risks.

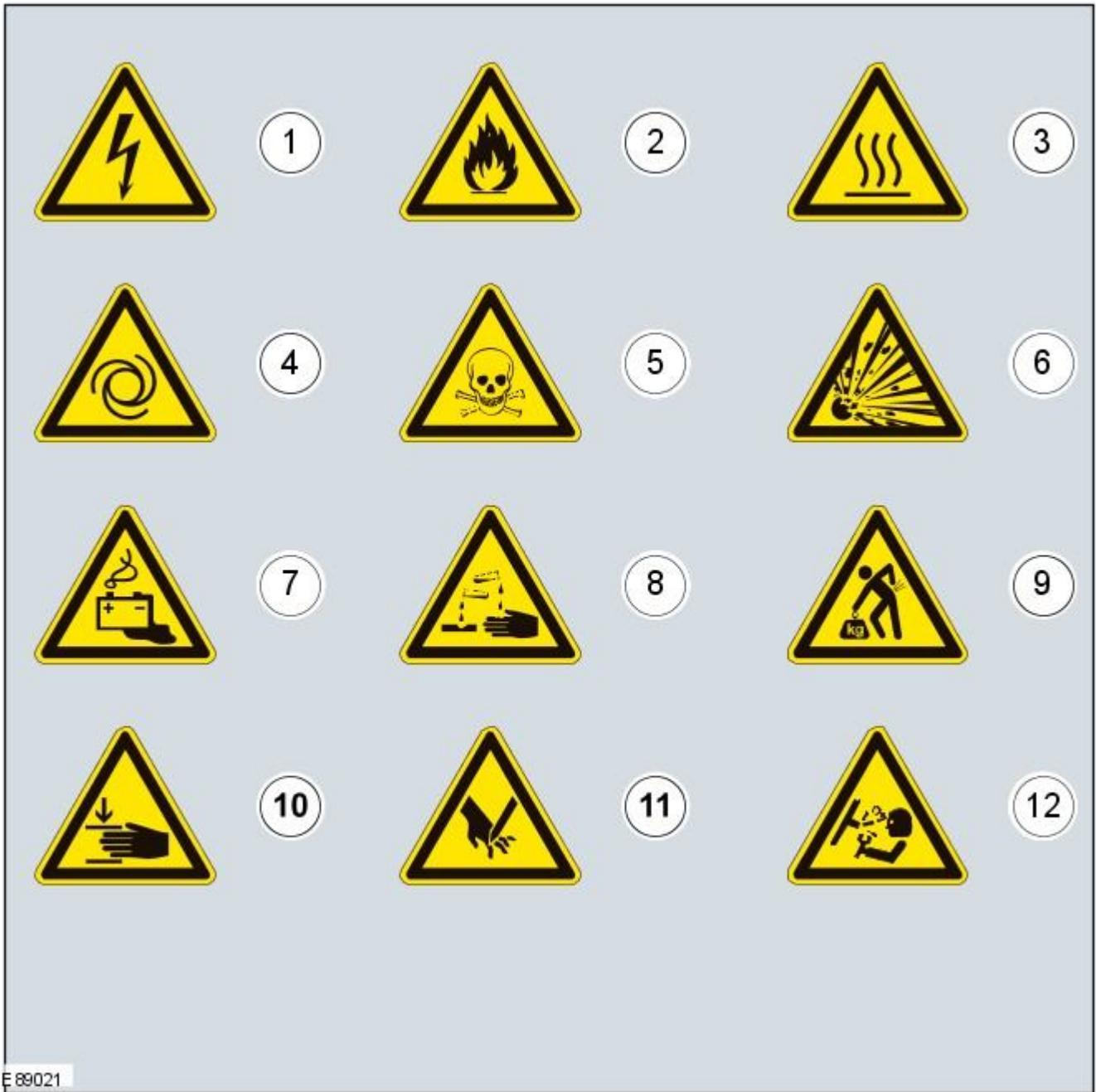


E89020

Item	Part Number	Description
1	-	General prohibition symbol
2	-	No naked flames
3	-	No smoking
4	-	No water
5	-	Do not touch
6	-	Do not switch
7	-	No grinding

Warning symbols - Health and safety and component damage

The warning symbols are used to advise on hazardous conditions to avoid or at least reduce possible component damage and health and safety risks.

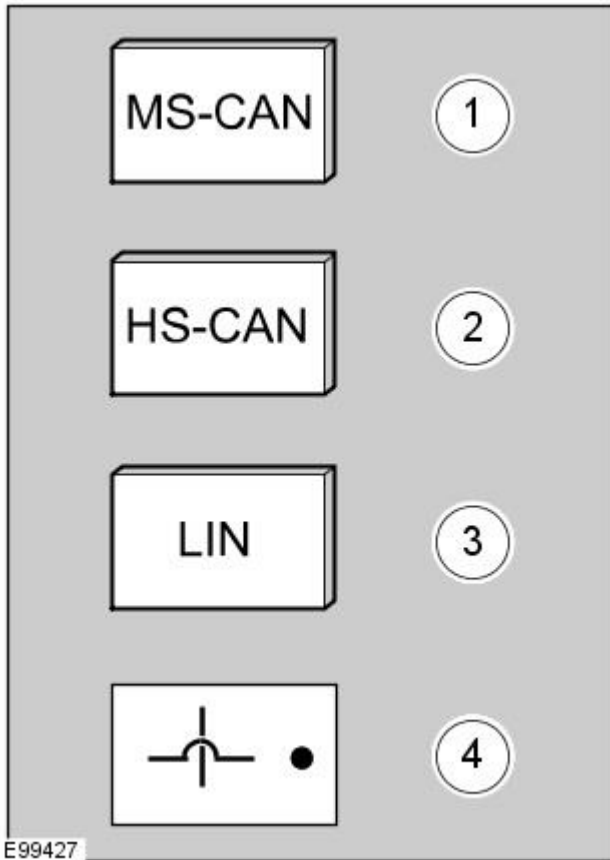


E 89021

Item	Part Number	Description
1	-	Hazardous voltage/Electrical shock/Electrocution
2	-	Fire Hazard/Highly flammable
3	-	Burn hazard/Hot surface
4	-	Automatic start-up
5	-	Toxic
6	-	Explosive material
7	-	Battery hazard
8	-	Corrosive material
9	-	Lifting hazard
10	-	Hand crush/Force from above
11	-	Cutting of fingers or hand
12	-	Pressure hazard

Control Diagram symbols - Description and Operation procedures

These symbols provide further information on the type of connectivity, direction of flow or type of data bus of a system.



E99427

Item	Part Number	Description
1	-	Mid-speed Controller Area Network (CAN)
2	-	High-speed Controller Area Network (CAN)
3	-	Local Interconnect Network (LIN)
4	-	Wires crossing not connected



# General Information - Supplemental Restraint System (SRS) Health and Safety Precautions

## Description and Operation

### • WARNINGS:



Only qualified technicians are allowed to work on pyrotechnic components.



**INHALED:** Exposure to pyrotechnic residue may cause low blood pressure, severe headache, irritation of mucous membranes, fainting, shortness of breath or rapid pulse. Move a victim to fresh air. Seek immediate medical attention.



**EYE CONTACT:** Exposure to unburned pyrotechnic residue may cause irritation, burning and etching of the eyes. Flush immediately with plenty of cold running water for at least 15 minutes. Seek immediate medical attention.



**EYE CONTACT:** Exposure to burned pyrotechnic residue may cause irritation, burning and etching of the eyes. Flush immediately with diluted boric acid solution. Seek immediate medical attention.



**SKIN CONTACT:** Unburned pyrotechnic residue may be rapidly absorbed through the skin in toxic quantities. Wash immediately with plenty of soap and water. Seek medical attention.



**SKIN CONTACT:** Burned pyrotechnic residue may be rapidly absorbed through the skin in toxic quantities. Wash with plenty of water. Do not use soap. Seek medical attention.



**SWALLOWED:** Unburned pyrotechnic residue is extremely toxic. If conscious drink plenty of water then induce vomiting. Seek immediate medical attention. If unconscious, or in convulsions do not attempt to induce vomiting or give anything by mouth. Seek immediate medical attention.



**SWALLOWED:** Burned pyrotechnic residue is extremely toxic. Drink plenty of water and seek immediate medical attention.



The deployment key must only be accessible to authorized personnel.



Make sure that the deployment key remains removed from the deployment equipment except during deployment.



If permanently disabling or enabling the passenger air bag a new seat belt for vehicles without or with a passenger air bag must be installed.



Undeployed pyrotechnic components must not be deployed in the vehicle.



Pyrotechnic components must be deployed following local regulations.



Check thoroughly that no loose objects can be spread during the deployment of pyrotechnic components.



Pyrotechnic components must be transported following local regulations.



Never carry out any electrical measurement on disconnected, undeployed pyrotechnic components.



Pyrotechnic components must not be disassembled.



Pyrotechnic components are not interchangeable between vehicles.



Always carry a live air bag module away from the body with the air bag or trim cover pointing upwards.



Live air bag modules must be placed in a suitable cage when removed from the vehicle. The air bag or trim cover must be facing upwards.



Do not install a rearward facing child safety seat to the passenger seat with an activated passenger air bag.

### • CAUTIONS:



Pyrotechnic components must not be subjected to temperatures higher than 110°C.



Never install aftermarket accessories to the vehicle on or adjacent to the supplemental restraint system module.

## General Information - Road/Roller Testing

### Description and Operation

Road or roller testing may be carried out for various reasons and a procedure detailing pre-test checks, through engine starting and stopping, pre-driving checks, on-test checks to final checks on completion of the test is given in this section.

Unless complete vehicle performance is being checked, the full road test procedure need not be carried out. Instead, those items particularly relevant to the system/s being checked can be extracted.

### Pre - Test Checks



**WARNING:** If the brake system hydraulic fluid level is low, pedal travel is excessive or a hydraulic leak is found, do not attempt to road test the vehicle until the reason for the low fluid level, excessive pedal travel or hydraulic leak is found and rectified.

It is suggested that pre-test checks, and functional tests of those systems/circuits which affect the safe and legal operations of the vehicle, such as brakes, lights and steering, should always be carried out before the road or roller test.

- Engine oil level
- Engine coolant level
- Tires, for correct pressure, compatible types and tread patterns, and wear within limits
- There is sufficient fuel in the tank to complete the test
- All around the engine, transmission and under the vehicle for oil, coolant, hydraulic and fuel leaks. Make a note of any apparent leaks and wipe off the surrounding areas to make it easier to identify the extent of the leak on completion of the test

### Starting the Engine



**CAUTION:** On initial drive away from cold and within the first 1.5 km (1 mile), do not depress accelerator pedal beyond half travel until the vehicle has attained a minimum speed of 25 km/h (15 miles/h). Never operate at high engine speed or with the accelerator pedal at full travel whilst the engine is cold.

With the ignition switched off, check:

- The parking brake is applied
- The transmission selector lever is in Park
- All instrument gauges (except fuel gauge) read zero

With the ignition switched on, check:

- Ignition controlled warning lamps come on
- Engine coolant temperature gauge registers a reading compatible with the engine coolant temperature
- Fuel gauge registers a reading appropriate to the fuel level in the tank
- The operation of the parking brake and brake fluid level warning lamps

### On Road or Roller Test Check:



**CAUTION:** If road testing, check the brake operation while still travelling at low speed before continuing with the test. If the brakes pull to one side, or appear to be otherwise faulty, do not continue with the road test until the fault has been found and rectified.

- Initial gear engagement is smooth
- Parking brake control operates smoothly and the parking brake releases quickly and completely
- Transmission takes up the drive smoothly, without judder
- The engine power output is satisfactory, full power is achieved, acceleration is smooth and pedal operation not stiff or heavy, and engine speed returns to idle correctly
- There is no excessive or abnormally colored smoke from the engine under normal driving, heavy load or overrun conditions
- Steering operation, including power steering, is smooth, accurate, not excessively heavy or with excessive free play or vibration. Does not pull to one side and self centres smoothly after cornering
- Speedometer, oil pressure warning lamp, coolant temperature gauge and tachometer register the correct readings or operate correctly
- Switches and controls operate smoothly and positively, warning lamps operate correctly and the direction indicator control self cancels when the steering is returned to the straight ahead position
- Heating and ventilation systems work correctly and effectively
- Brake operation and efficiency

### Brake Testing



**WARNING:** When brake testing, avoid breathing the smoke or fumes from hot brakes, this may contain asbestos dust which is hazardous to health, see Health and Safety Precautions.

Avoid brake testing on busy roads where it can cause inconvenience or danger to other road users.



**CAUTION:** Brake testing which includes heavy brake applications should not be carried out with new brake pads/discs or linings/drums until the components have bedded-in. New brake friction components will not reach full efficiency until the

bedding-in process is complete.

Test the brakes at several speeds within the normal operating range using both light and heavy pedal pressure. Note any tendency to snatch, pull or drag, and any undue delay in application or release.

Allow the vehicle to coast and note any tendency to pull to one side, or evidence that the brakes are binding.

After stopping the vehicle (not immediately after a period of heavy braking), carefully check the brake temperature. A disc which feels hot, or appreciably hotter than the others, indicates that the brake is binding.

After completion of the test, check for:

- Oil, coolant, hydraulic, air and fuel leaks
- Abnormal temperature of any moving components or assemblies, e.g. wheel hubs, transmission, axle etc., which might indicate over tightness or lack of lubrication

## Identification Codes - Identification Codes

Description and Operation

### Vehicle Identification Number (VIN)

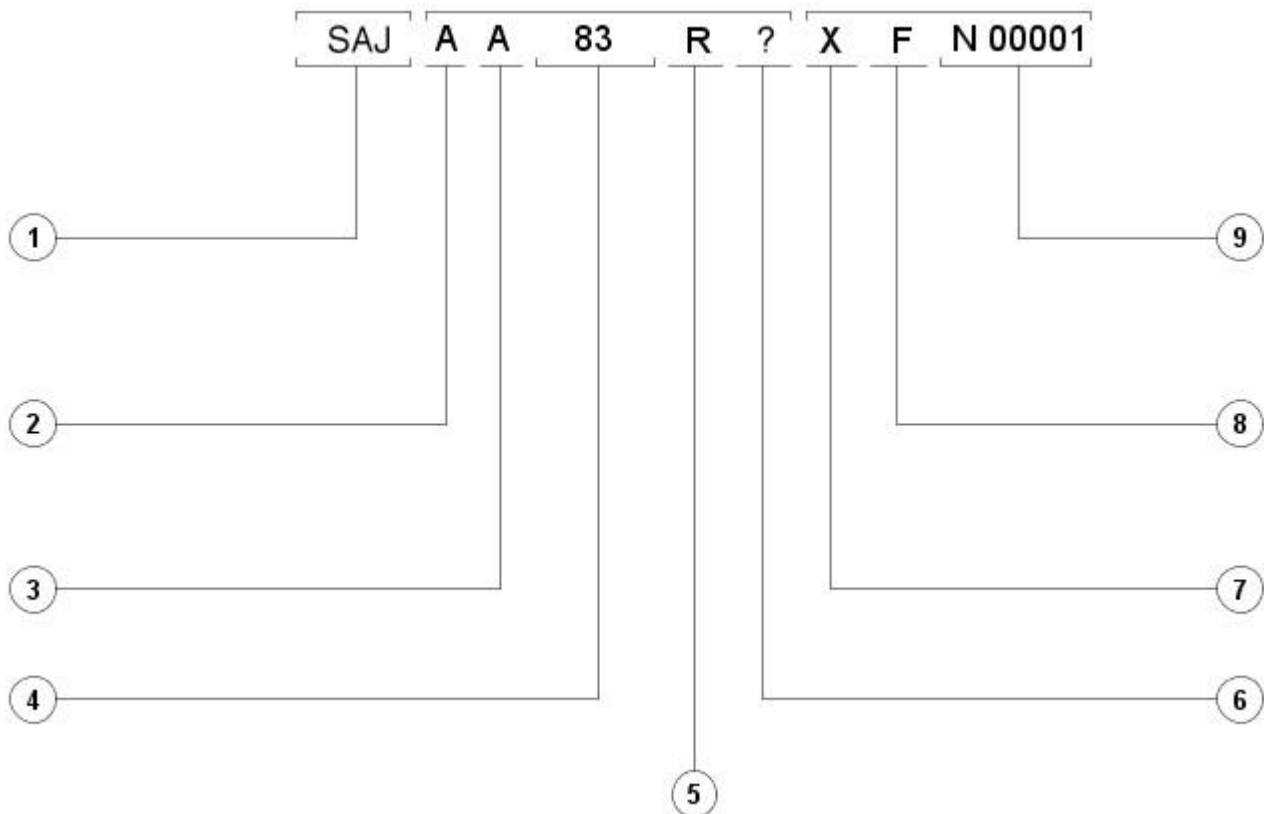
The official Vehicle Identification Number (VIN) for title and registration purposes is stamped on a metal plate and fastened to the instrument panel. It is positioned close on the left-hand side of the vehicle and is visible from the outside.

The VIN is also located on the vehicle certification label.



Item	Part Number	Description
1	—	VIN (stamped)
2	—	Bar code label (USA)
3	—	VIN label (Europe/Rest of World shown)
4	—	VIN plate

### Vehicle Identification Number (Typical)



E63050

Item	Part Number	Description
1	—	World manufacturer identifier
2	—	Market, air bag specification
3	—	Transmission and steering code
4	—	Body code
5	—	Emission control system
6	—	Check digit
7	—	Model year
8	—	Assembly plant, model line
9	—	Production sequence number

### World Manufacturer Identifier

#### VIN Positions 1

Codes	Manufacturer	Make	Type
SAJ	Jaguar Cars Limited, England	Jaguar	Passenger Car

### Market, Air Bag Specification

#### VIN position 2

VIN code	Description
A	Rest of World with twin air bags, side air bags and curtain air bags
K	Japan with twin air bags, side air bags and curtain air bags
W	USA with twin air bags, side air bags and curtain air bags
X	Canada with twin air bags, side air bags and curtain air bags
Y	Mexico with twin air bags, side air bags and curtain air bags

### Transmission, Steering Code

#### VIN Position 3

VIN Code	Description
A	Automatic LHS
C	Automatic RHS

### Body Code - All except USA and Canada 2010 model year

#### VIN Position 4

VIN Code	Description
05	Luxury
06	Premium luxury
07	Sport luxury/Portfolio/SV8
08	'R'

### Body Code (USA and Canada) - 2010 model year

**VIN Position 4**

VIN Code	Description
OF	Luxury
OG	Premium luxury
OH	Portfolio/SV8
OJ	'R'

**Engine Emission System - 2009 model year**
**VIN Position 5**

- NOTE: \*1 EU. Includes the following markets; Austria, Belgium, Bulgaria, Cyprus, Czech Rep, Denmark, Eire, Estonia, Finland, France, Germany, Greece, Holland, Hungary, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Romania, Slovenia, Slovakia, Spain (incl. Canary Islands), Sweden and UK.
- NOTE: \*2 East Europe. Includes the following markets; Albania, Bosnia, Croatia, Former Yugoslav Republic of Macedonia, Kosovo, Montenegro and Serbia.
- NOTE: \*3 Russia. Includes the following markets; Belarus, Kazakhstan, Ukraine and Uzbekistan.
- NOTE: \*4 Middle East. Includes the following markets; Abu Dhabi, Bahrain, Dubai, Jordan, Kuwait, Lebanon, Oman, Qatar and Saudi Arabia.
- NOTE: \*5 Caribbean. Includes the following markets; Bahamas, Barbados, Grand Cayman, Grenada and Trinidad and Tobago.

VIN Code	Engine	Market
D	3.0L	*5 Caribbean, Chile, Dominican Rep, Guatemala, Indonesia, Malaysia, *4 Middle East, Morocco, Panama, Phillipines, Singapore, Sri Lanka and Uruguay
F	4.2L	
G	4.2L Supercharged	
N/A	2.7L Diesel	
M	3.0L	China
N/A	4.2L	
N/A	4.2L Supercharged	
N/A	2.7L Diesel	
M	3.0L	*2 East Europe, *1 EU, Israel, Norway, *3 Russia, Switzerland and Turkey
P	4.2L	
R	4.2L Supercharged	
1	2.7L Diesel	
W	3.0L	Brazil
X	4.2L	
Y	4.2L Supercharged	
N/A	2.7L Diesel	
S	3.0L	Egypt and Syria
U	4.2L	
V	4.2L Supercharged	
N/A	2.7L Diesel	
H	3.0L	Japan
K	4.2L	
L	4.2L Supercharged	
N/A	2.7L Diesel	
N/A	3.0L	USA
B	4.2L	
C	4.2L Supercharged	
N/A	2.7L Diesel	
N/A	3.0L	Canada
B	4.2L	
C	4.2L Supercharged	
N/A	2.7L Diesel	
N/A	3.0L	Mexico
K	4.2L	
L	4.2L Supercharged	
N/A	2.7L Diesel	
N/A	3.0L	South Korea
B	4.2L	
C	4.2L Supercharged	
1	2.7L Diesel	
D	3.0L	South Africa
F	4.2L	

VIN Code	Engine	Market
G	4.2L Supercharged	Argentina, Australia, Cyprus, Hong Kong, Malta, New Zealand, Taiwan, Thailand and UK (and Eire)
1	2.7L Diesel	
M	3.0L	
P	4.2L	
R	4.2L Supercharged	
1	2.7L Diesel	

## Engine Emission System - 2010 model year

### VIN Position 5

- NOTE: \*1 EU. Includes the following markets; Austria, Belgium, Bulgaria, Cyprus, Czech Rep, Denmark, Eire, Estonia, Finland, France, Germany, Greece, Holland, Hungary, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Romania, Slovenia, Slovakia, Spain (incl. Canary Islands), Sweden and UK.
- NOTE: \*2 East Europe. Includes the following markets; Albania, Bosnia, Croatia, Former Yugoslav Republic of Macedonia, Kosovo, Montenegro and Serbia.
- NOTE: \*3 Russia. Includes the following markets; Belarus, Kazakhstan, Ukraine and Uzbekistan.
- NOTE: \*4 Middle East. Includes the following markets; Abu Dhabi, Bahrain, Dubai, Jordan, Kuwait, Lebanon, Oman, Qatar and Saudi Arabia.
- NOTE: \*5 Caribbean. Includes the following markets; Bahamas, Barbados, Grand Cayman, Grenada and Trinidad and Tobago.

VIN Code	Engine	Market
D	3.0L	Algeria, Brunei, *5 Caribbean, Dominican Rep, Guatemala, Indonesia, Libya, *4 Middle East, Morocco, Pakistan, Panama, Phillipines, Sri Lanka, Tunisia and Uruguay
F	5.0L	
G	5.0L Supercharged	
H	3.0L	China
P	5.0L	
R	5.0L Supercharged	
H	3.0L	Chile
P	5.0L	
R	5.0L Supercharged	
H	3.0L	Argentina
P	5.0L	
R	5.0L Supercharged	
H	3.0L	*1 EU, *2 East Europe, Israel, Norway, Switzerland and Turkey
P	5.0L	
R	5.0L Supercharged	
2	3.0L Diesel	
W	3.0L	Brazil
X	5.0L	
Y	5.0L Supercharged	
S	3.0L - <b>Egypt only</b>	Egypt and Syria
F	5.0L	
G	5.0L Supercharged	
H	3.0L	Japan
P	5.0L	
R	5.0L Supercharged	
A	4.2L	USA
B	5.0L	
C	5.0L Supercharged	
A	4.2L	Canada
B	5.0L	
C	5.0L Supercharged	
A	4.2L	Mexico
B	5.0L	
C	5.0L Supercharged	
B	5.0L	South Korea
C	5.0L Supercharged	



VIN Code	Engine	Market
2	3.0L Diesel	Malaysia
H	3.0L	
P	5.0L	
R	5.0L Supercharged	
D	3.0L	South Africa
F	5.0L	
G	5.0L Supercharged	
2	3.0L Diesel	
H	3.0L	Taiwan
P	5.0L	
R	5.0L Supercharged	
2	3.0L Diesel	
D	3.0L	Thailand
F	5.0L	
G	5.0L Supercharged	
D	3.0L	
F	5.0L	Singapore
G	5.0L Supercharged	
H	3.0L	
P	5.0L	
R	5.0L Supercharged	Australia, Cyprus, Hong Kong, Malta, New Zealand and UK (and Eire)
2	3.0L Diesel	

## Check Digit

### VIN Position 6

VIN Code	Description
0 - 9 or X	Calculated in accordance with American standard CFR part 565

## Model Year

### VIN Position 7

VIN Code	Description
9	2009 model year
A	2010 model year

## Assembly Plant and Model Line

### VIN Position 8

VIN Code	Description
F	Castle Bromwich 3.0L
H	Castle Bromwich 4.2L Normally aspirated
1	Castle Bromwich 4.2L Supercharged
7	Castle Bromwich 2.7L Diesel
K	Castle Bromwich 3.0L Diesel (low power)
L	Castle Bromwich 5.0L Normally aspirated
M	Castle Bromwich 5.0L Supercharged
N	Castle Bromwich 3.0L Diesel
P	Castle Bromwich 5.0L Supercharged (low power)

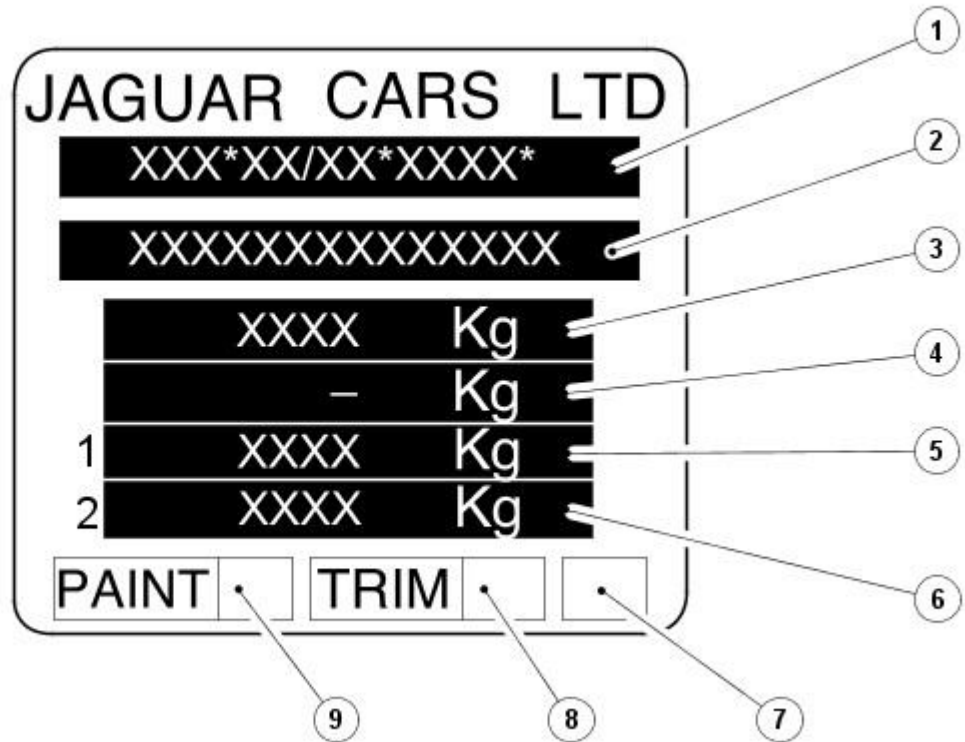
## Production Sequence Number

### VIN Position 9

Sequence Number
R00001 - R99999

## VIN Label

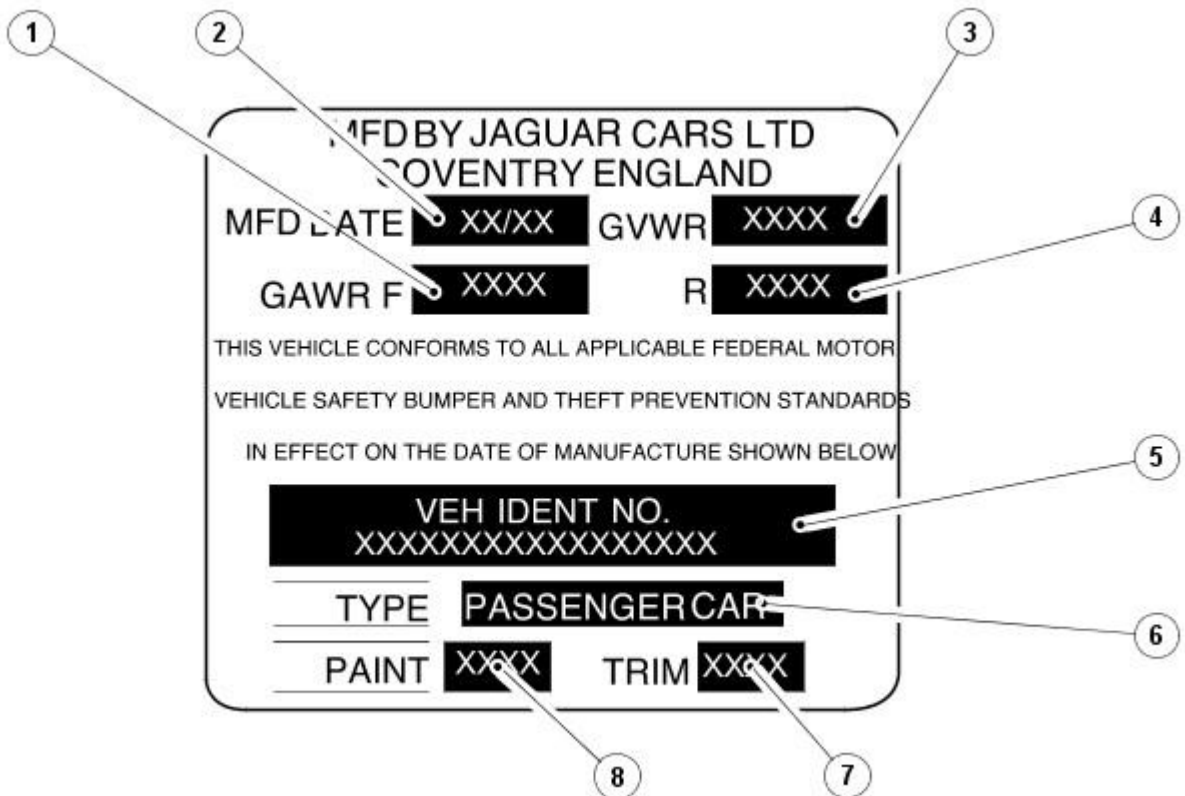
VIN Label (Europe and Rest of world)



E36533

Item	Part Number	Description
1	—	Whole Vehicle Type Approval (WVTA) - Only shown for certain markets
2	—	VIN
3	—	Gross vehicle weight
4	—	Gross train weight
5	—	Maximum permitted front axle loading
6	—	Maximum permitted rear axle loading
7	—	Date of manufacture
8	—	Interior trim code
9	—	Paint code

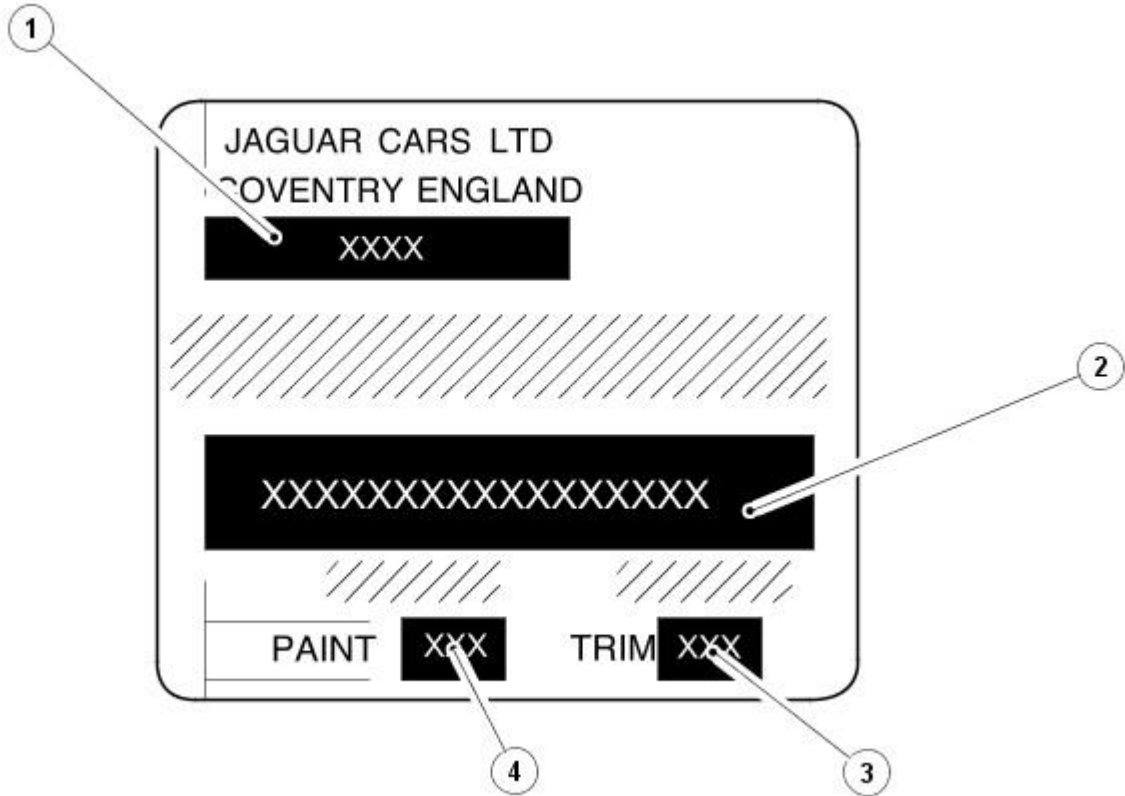
VIN Label (North America)



E36534

Item	Part Number	Description
1	—	Maximum permitted front axle loading
2	—	Date of manufacture
3	—	Gross vehicle weight
4	—	Maximum permitted rear axle loading
5	—	VIN
6	—	Type
7	—	Interior trim code
8	—	Paint code

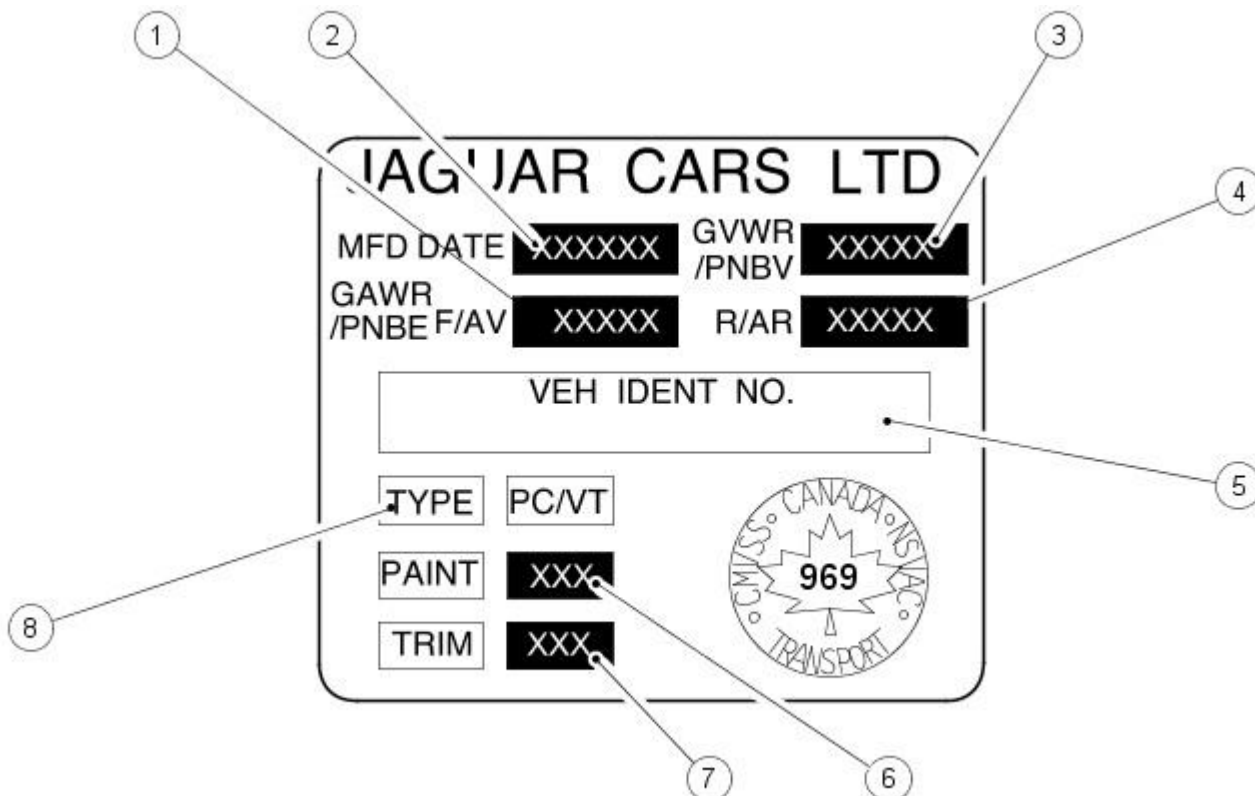
VIN Label (Saudi Arabia and Gulf States)



E36535

Item	Part Number	Description
1	—	Date of manufacture
2	—	VIN
3	—	Interior trim code
4	—	Paint code

VIN Label (Canada)



E36536

Item	Part Number	Description
1	—	Maximum permitted front axle loading
2	—	Date of manufacture
3	—	Gross vehicle weight
4	—	Maximum permitted rear axle loading
5	—	VIN
6	—	Paint code
7	—	Interior trim code
8	—	Type

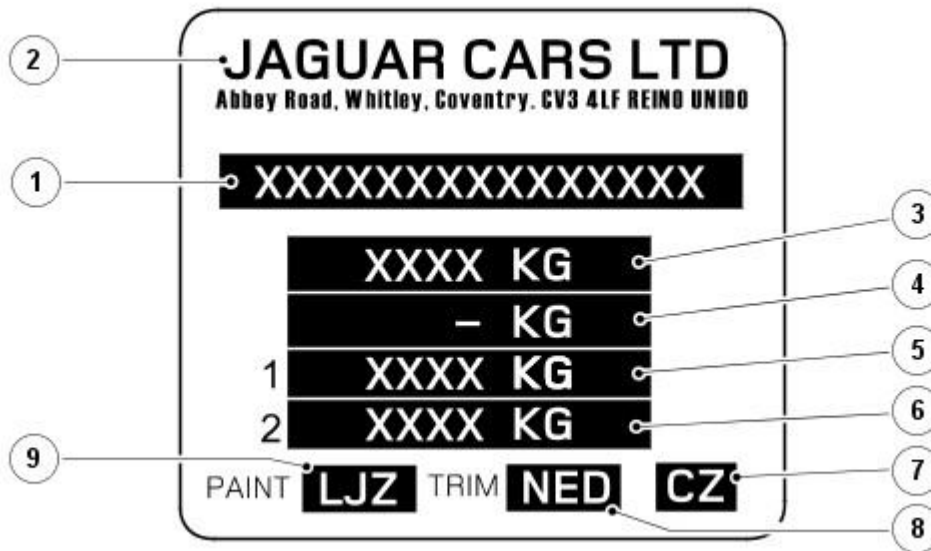
VIN Label (China)



E99220

Item	Part Number	Description
1	—	Occupant number
2	—	Engine specification (Type/Capacity/Power)
3	—	VIN
4	—	Trade mark
5	—	Vehicle type
6	—	Gross vehicle weight
7	—	Date of manufacture
8	—	Manufacturer name

VIN Label (Argentina)



E99221

Item	Part Number	Description
1	—	VIN
2	—	Trade mark and manufacturer adress (in Spanish)
3	—	Gross vehicle weight
4	—	Gross train weight
5	—	Maximum permitted front axle loading
6	—	Maximum permitted rear axle loading
7	—	Date of manufacture
8	—	Interior trim code
9	—	Paint code

### Automatic Transmission Number

The serial number of the transmission unit is displayed on a metal label or bar code (if equipped) attached to the transmission casing.

### Engine Number(s)

#### Engine Number - 2.7L Diesel

The serial number is stamped on an engine web on the right-hand side of the cylinder block behind the engine mounting.

#### Engine Number - 3.0L Diesel

The serial number is stamped on an engine web on the right-hand side of the cylinder block behind the engine mounting.

#### Engine Number - 3.0L

The engine number is contained on a bar code label on the front cover and is also stamped in the cylinder block casting on the left-hand side of the engine below the engine mounting.

#### Engine Number - 4.2L and 4.2L Supercharged

The serial number is stamped on an engine web on the left-hand side of the cylinder block behind the engine mounting. The emission code is also located here, on the transmission flange.

#### Engine Number - 5.0L and 5.0L Supercharged

The serial number is stamped on an engine web on the left-hand side of the cylinder block behind the engine mounting.

## Jacking and Lifting - Jacking

Description and Operation

### Safety Precautions



**WARNING:** The jack provided with the vehicle is intended to be used in an emergency for changing a deflated tire. To avoid damage to the vehicle, never use the jack to raise the vehicle for any other purpose. Refer to the Driver Handbook when using the jack supplied with the vehicle. Failure to follow these instructions may result in personal injury.

The following safety precautions must be observed when raising the vehicle to carry out service operations:

- Never rely on a jack alone to support a vehicle. Always use suitable vehicle stands to provide rigid support.
- When working beneath a vehicle, whenever possible use a vehicle hoist instead of a jack and vehicle stands.
- Make sure that the vehicle is standing on firm, level ground before using a jack.
- Do not rely on the parking brake alone; chock the wheels and put the automatic transmission into Park if possible.
- Check that any lifting equipment used has adequate capacity for the load being lifted and is in correct working order.

## Jacking and Lifting - Lifting

Description and Operation

### Lifting Points—Twin-Post Hoist and Floor Jack

• CAUTIONS:



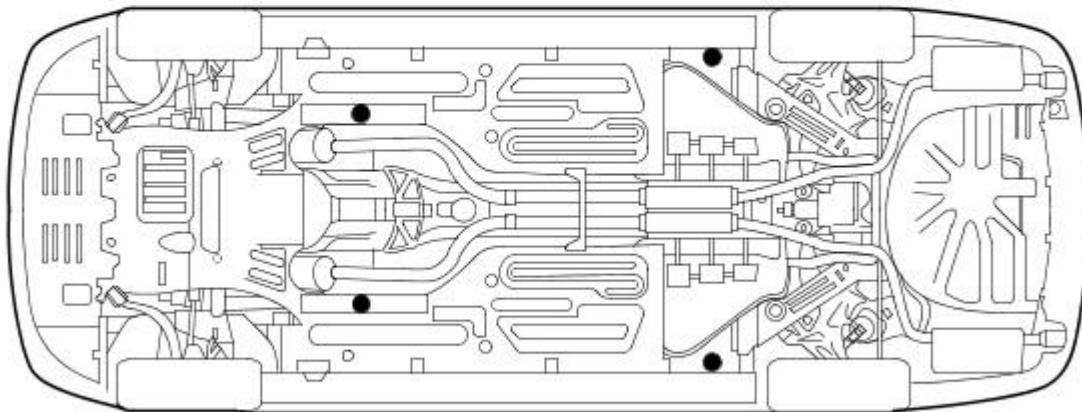
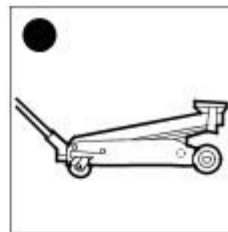
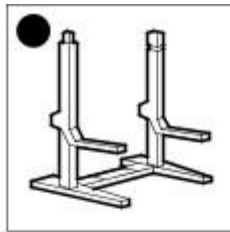
Do not allow the hoist adapters to contact the steering linkage, suspension arms, stabilizer bar, rear subframe stabilizer brackets or to compress the lower suspension arm stabilizer bar insulator. Damage to the suspension, exhaust and steering linkage components may occur if care is not exercised when positioning the hoist adapters of two-post hoists prior to lifting the vehicle.



Never use the differential housing as a lift point. Damage to the differential housing and cover may occur.

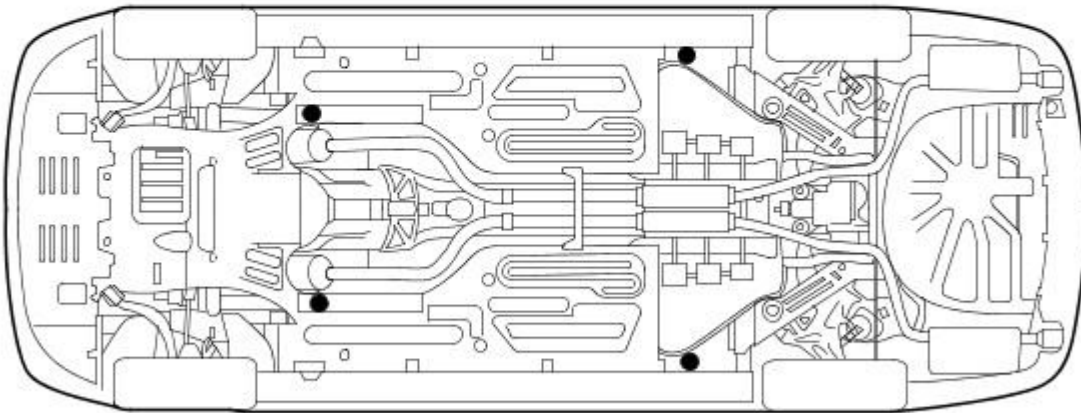
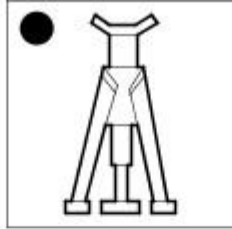


When using a floor jack, a cushioned pad must be utilized to avoid body damage.



E30331

### Vehicle Support Points



E30332

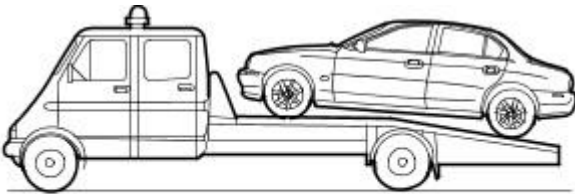
## Vehicle Recovery

- NOTE: Prior to vehicle recovery, make sure the vehicle keys are available and the security system is disarmed.

Vehicle recovery methods are:

- By flat-bed transporter.
- By rear suspended tow.
- By rear suspended tow.

## Transporter or Trailer Recovery

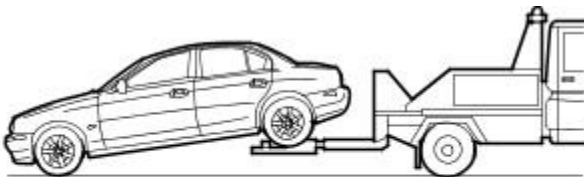


VJJ0001116

When the vehicle is being recovered by transporter or trailer:

- The parking brake must be applied and the wheels chocked.
- The gear selector lever must be in Neutral. Do not select Park on automatic transmission vehicles, as the parking lock mechanism may be damaged by the forward and backward rocking motion of the vehicle.
- The vehicle must be securely tied down to the transporter or trailer.

## Rear Suspended Tow



VJJ0001117

When the vehicle is being recovered by rear suspended tow:

- The ignition key must be removed from the ignition switch to lock the steering.
- The rear wheels must be correctly positioned in the lifting cradle and securely tied down.



## Emergency Towing



**WARNING:** If the engine is not running, the steering will become heavy and the force necessary to effectively apply the brakes will be greatly increased.



**CAUTION:** A vehicle with a defective transmission must be towed by rear suspended tow.

When the vehicle is being towed on its own wheels:

- Local regulations for the towing of vehicles must be followed. In some countries the registration number of the towing vehicle and an 'On Tow' sign or warning triangle must be displayed at the rear of the towed vehicle.
- The gear selector lever must be in Neutral.
- The ignition switch must be in position II to release the steering lock and make the direction indicators, horn and stop lamps operate.
- A distance of 0,8 km (0.5 mile) must not be exceeded.
- A speed of 48 km/h (30 mph) must not be exceeded.
- The tow rope must be attached to the front towing eye.

# Noise, Vibration and Harshness - Noise, Vibration and Harshness (NVH)

## Description and Operation

Noise, vibration and harshness (NVH) is becoming more important as vehicles become more sophisticated and passenger comfort levels increase. This section is designed to aid in the diagnosis, testing and repair of NVH concerns.

- Noise is defined as sounds not associated with the operation of passenger compartment equipment that interface with customer satisfaction.
- Vibration is defined as impulses felt by the customer that are not caused by road surface changes.
- Harshness is a ride quality issue where the customer feels that the vehicle response to the road surface is sharply transmitted to the customer.

## Diagnostic Theory

Diagnosis is more than just following a series of interrelated steps in order to find the solution to the specific condition. It is a way of looking at systems that are not functioning the way they should and finding out why. Also it is knowing how the system should work and whether it is working correctly.

There are basic rules for diagnosis. If these rules are followed, the cause of the condition is usually found the first time through the system.

## Know the System

- Know how the parts go together.
- Know how the system operates as well as its limits and what happens when the system goes wrong.
- Sometimes this means checking the system against one that is known to be working correctly.

## Know the History of the System

A clue in any one of these areas may save time:

- How old or new is the system?
- What kind of treatment has it had?
- Has it been repaired in the past in such a manner that might relate to the present condition?
- What is the repair history?

## Know the History of the Condition

- Did it start suddenly or appear gradually?
- Was it related to some other occurrence such as a collision or previous part renewal?
- Know how the condition made itself known; it may be an important clue to the cause.

## Know the Probability of Certain Conditions Developing

- Look for the simple rather than the complex.
- For example:
  - Electrical conditions usually occur at connections rather than components.
  - An engine no-start is more likely to be caused by a loose wire or small adjustment rather than a sheared-off camshaft.
- Know the difference between impossible and improbable. Certain failures in a system can be improbable but still happen.
- New parts are just that, new. It does not mean they are always good functioning parts.

## Do Not Cure the Symptom and Leave the Cause

Lowering the pressure in a front tire may correct the condition of a vehicle leaning to one side, but it does not correct the original condition.

## Be Positive the Cause is Found

- Double check the findings.
- What caused a worn component?
- A loose transmission or engine mount could indicate that other mounts are also loose.

## Diagnostic Charts

Charts are a simple way of expressing the relationship between basic logic and a physical system of components. They help discover the cause of a condition in the least time. Diagnostic charts combine many areas of diagnosis into one visual display:

- probability of certain things occurring in a system
- speed of checking certain components or functions before others
- simplicity of carrying out certain tests before others
- elimination of checking huge portions of a system by carrying out simple tests
- certainty of narrowing down the search to a small portion before carrying out in-depth testing

The fastest way to find a condition is to work with the tools that are available. This means working with proven diagnostic charts and the correct special equipment for the system.

# Noise, Vibration and Harshness - Noise, Vibration and Harshness (NVH)

Diagnosis and Testing

## Principle of Operation

For a detailed description of Noise, Vibration and Harshness issues, refer to the Description and Operation section of the workshop manual.

REFER to: [Noise, Vibration and Harshness \(NVH\)](#) (100-04 Noise, Vibration and Harshness, Description and Operation).

## Inspection and Verification

1. **1.** Verify the customer's concerns by operating the vehicle to duplicate the condition.
2. **2.** Visually inspect the vehicle to determine any obvious cause(s) of the concern(s).
3. **3.** If the inspection reveals obvious causes that can be readily identified, repair as necessary.
4. **4.** If the concern(s) remains after the inspection, determine the symptom(s) and refer to the Symptom Chart.

## How To Use This Diagnostic Procedure Section

- Noise, vibration and harshness (NVH) concerns have become more important as vehicles have become more sensitive to these vibrations. This section is designed as an aid to identifying these situations
- The section provides diagnostic procedures based on symptoms. If the condition occurs at high speed, for instance, the most likely place to start is under High Speed Shake
- The road test procedure will tell how to sort the conditions into categories and how to tell a vibration from a shake
- A series of Road Test Quick Checks is provided to make sure that a cause is either pinpointed or eliminated
- Name the condition, proceed to the appropriate section and locate the correct diagnosis. When the condition is identified, the job is partly done
- Follow the diagnostic procedure as outlined
- Quick Checks are described within the step, while more involved tests and adjustments are outlined in General Procedures
- Always follow each step exactly and make notes to recall important findings later

## Customer Interview

The road test and customer interview (if available) provide information that will help identify the concerns and will provide direction to the correct starting point for diagnosis.

## Identify the Condition

NVH problems usually occur in a number of areas:

- tires
- engine accessories
- suspension
- driveline
- air leakage (wind noise)
- squeaks and rattles
- heating ventilation and air conditioning (HVAC)
- electrical (e.g. motor noise)
- transmission
- engine

It is important, therefore, that an NVH concern be isolated into its specific area(s) as soon as possible. The easiest and quickest way to do this is to carry out the Road Test as outlined.

## Noise Diagnostic Procedure

### Non-Axle Noise

The five most important sources of non-axle noise are exhaust, tires, roof racks, trim and mouldings, and transmission.

Therefore, make sure that none of the following conditions are the cause of the noise before proceeding with a driveline tear down and diagnosis.

- Under certain conditions, the pitch of the exhaust may sound very much like gear noise. At other times, it can be mistaken for a wheel bearing rumble
- Tires, especially snow tires, can have a high pitched tread whine or roar, similar to gear noise. Radial tires, to some degree, have this characteristic. Also, any non-standard tire with an unusual tread construction may emit a roar or whine type noise
- Trim and mouldings can also cause whistling or a whining noise
- Clunk may be a metallic noise heard when the automatic transmission is engaged in reverse or drive, or it may occur when the throttle is applied or released. It is caused by backlash somewhere in the driveline
- Bearing rumble sounds like marbles being tumbled. This condition is usually caused by a damaged wheel bearing

### Noise Conditions

- Gear noise is typically a howling or whining due to gear damage or incorrect bearing preload. It can occur at various speeds and driving conditions, or it can be continuous
- Chuckle is a particular rattling noise that sounds like a stick against the spokes of a spinning bicycle wheel. It

occurs while decelerating from approximately 64 km/h (40 miles/h) and can usually be heard all the way to a stop. The frequency varies with vehicle speed

- Knock is very similar to chuckle, though it may be louder and occurs on acceleration or deceleration. The tear down will disclose what has to be corrected

Check and rule out tires, exhaust and trim items before disassembling the transmission to diagnose and correct gear noise.

The noises described under Road Test usually have specific causes that can be diagnosed by observation as the unit is disassembled. The initial clues are the type of noise heard on the road test and the driving conditions.

## Vibration Conditions

• **NOTE: New Constant Velocity (CV) joints should not be installed unless disassembly and inspection revealed unusual wear.**

Clicking, popping or grinding noises may be caused by the following:

- Cut or damaged CV joint boots resulting in inadequate or contaminated lubricant in the outboard or inboard CV joint bearing housings
- Loose CV joint boot clamps
- Another component contacting the rear drive half shaft
- Worn, damaged or incorrectly installed wheel bearing, suspension or brake component

Vibration at highway speeds may be caused by the following:

- Out-of-balance front or rear wheels
- Out-of-round tires
- Driveline imbalance
- Driveline run-out (alignment)

• **NOTE: Rear drive half shafts are not balanced and are not likely to contribute to rotational vibration disturbance.**

Shudder or vibration during acceleration (including from rest) may be caused by the following:

- Driveline alignment
- Excessively worn or damaged outboard or inboard CV joint bearing housing
- Excessively high CV joint operating angles caused by incorrect ride height. Check ride height, verify correct spring rate and check items under Inoperative Conditions
- Excessively worn driveshaft components

## Leakage Conditions

1. **1.** Inspect the CV joint boots for evidence of cracks, tears or splits.
2. **2.** Inspect the underbody for any indication of grease splatter in the vicinity of the rear drive half shaft, outboard and inboard CV joint boot locations, which is an indication of CV joint boot or CV joint boot clamp damage.
3. **3.** Inspect the inboard CV joint bearing housing seal for leakage.

## Inoperative Conditions

If a CV joint or rear drive half shaft pull-out occurs, check the following:

- suspension components for correct location, damage or wear
- bushings for wear
- subframe for damage
- bent or worn components
  - Stabilizer bar link
  - Left-hand rear suspension lower arm and bushing
  - Right-hand rear suspension lower arm and bushing
  - Rear wheel hub and rear drive half shaft

## Road Test

A gear-driven unit will produce a certain amount of noise. Some noise is acceptable and may be audible at certain speeds or under various driving conditions as on a newly paved blacktop road. The slight noise is in no way detrimental and must be considered normal.

The road test and customer interview (if available) provide information needed to identify the condition and give direction to the correct starting point for diagnosis.

1. **1.** Make notes throughout the diagnosis routine. Make sure to write down even the smallest piece of information, because it may turn out to be the most important.
2. **2.** Do not touch anything until a road test and a thorough visual inspection of the vehicle have been carried out. Leave the tire pressures and vehicle load just where they were when the condition was first observed. Adjusting tire pressures, vehicle load or making other adjustments may reduce the conditions intensity to a point where it cannot be identified clearly. It may also inject something new into the system, preventing correct diagnosis.
3. **3.** Make a visual inspection as part of the preliminary diagnosis routine, writing down anything that does not look right. Note tire pressures, but do not adjust them yet. Note leaking fluids, loose nuts and bolts, or bright spots where components may be rubbing against each other. Check the luggage compartment for unusual loads.
4. **4.** Road test the vehicle and define the condition by reproducing it several times during the road test.

5. Carry out the Road Test Quick Checks as soon as the condition is reproduced. This will identify the correct diagnostic procedure. Carry out the Road Test Quick Checks more than once to verify they are providing a valid result. Remember, the Road Test Quick Checks may not tell where the concern is, but they will tell where it is not.

## Road Test Quick Checks

1. 24-80 km/h (15-50 miles/h): With light acceleration, a moaning noise is heard and possibly a vibration is felt in the front floor pan. It is usually worse at a particular engine speed and at a particular throttle setting during acceleration at that speed. It may also produce a moaning sound, depending on what component is causing it. Refer to Tip-In Moan in the Symptom Chart.
2. Acceleration/deceleration: With slow acceleration and deceleration, a shake is sometimes noticed in the steering wheel/column, seats, front floor pan, front door trim panel or front end sheet metal. It is a low frequency vibration (around 9-15 cycles per second). It may or may not be increased by applying brakes lightly. Refer to Idle Boom/Shake/Vibration in the Symptom Chart.
3. High speed: A vibration is felt in the front floor pan or seats with no visible shake, but with an accompanying sound or rumble, buzz, hum, drone or booming noise. Coast with the clutch pedal depressed or shift control selector lever in neutral and engine idling. If vibration is still evident, it may be related to wheels, tires, front brake discs, wheel hubs or front wheel bearings. Refer to High Speed Shake in the Symptom Chart.
4. Engine rpm sensitive: A vibration is felt whenever the engine reaches a particular rpm. It will disappear in neutral coasts. The vibration can be duplicated by operating the engine at the problem rpm while the vehicle is stationary. It can be caused by any component, from the accessory drive belt to the torque converter which turns at engine speed when the vehicle is stopped. Refer to High Speed Shake in the Symptom Chart.
5. Noise/vibration while turning: Clicking, popping, or grinding noises may be due to a worn, damaged, or incorrectly installed front wheel bearing, rear drive half shaft or CV joint.
6. Noise/vibration that is road speed relative: This noise/vibration can be diagnosed independent of engine speed or gear selected (engine speed varies but torque and road speed remain constant). The cause may be a rear drive axle/differential whine.

## Road Conditions

An experienced technician will always establish a route that will be used for all NVH diagnosis road tests. The road selected should be reasonably smooth, level and free of undulations (unless a particular condition needs to be identified). A smooth asphalt road that allows driving over a range of speeds is best. Gravel or bumpy roads are unsuitable because of the additional road noise produced. Once the route is established and consistently used, the road noise variable is eliminated from the test results.

- NOTE: Some concerns may be apparent only on smooth asphalt roads.

If a customer complains of a noise or vibration on a particular road and only on a particular road, the source of the concern may be the road surface. If possible, try to test the vehicle on the same type of road.

## Vehicle Preparation

Carry out a thorough visual inspection of the vehicle before carrying out the road test. Note anything which is unusual. Do not repair or adjust any condition until the road test is carried out, unless the vehicle is inoperative or the condition could pose a hazard to the technician.

After verifying the condition has been corrected, make sure all components removed have been installed.

## Lift Test

After a road test, it is sometimes useful to do a similar test on a lift.

When carrying out the high-speed shake diagnosis or engine accessory vibration diagnosis on a lift, observe the following precautions:



**WARNING:** If only one drive wheel is allowed to rotate, speed must be limited to 55 km/h (35 miles/h) indicated on the speedometer since actual wheel speed will be twice that indicated on the speedometer. Speed exceeding 55 km/h (35 miles/h) or allowing the drive wheel to hang unsupported could result in tire disintegration, differential failure, constant velocity joint and drive half shaft failure, which could cause serious personal injury and extensive vehicle damage. Failure to follow these instructions may result in personal injury.



**CAUTION:** The suspension should not be allowed to hang free. When the CV joint is run at a very high angle, extra vibration as well as damage to the seals and joints can occur.

The rear suspension lower arm should be supported as far outboard as possible. To bring the vehicle to its correct ride height, the full weight of the vehicle should be supported in the rear by floor jacks. REFER to: (100-02 Jacking and Lifting)

[Jacking](#) (Description and Operation),  
[Lifting](#) (Description and Operation).

1. Raise and support the vehicle. REFER to: (100-02 Jacking and Lifting)

[Jacking](#) (Description and Operation),  
[Lifting](#) (Description and Operation).

2. Explore the speed range of interest using the Road Test Quick Checks as previously described.

3. **3.** Carry out a coast down in neutral. If the vehicle is free of vibration when operating at a steady indicated speed and behaves very differently in drive and coast, a transmission concern is likely.

Note, however, that a test on the lift may produce different vibrations and noises than a road test because of the effect of the lift. It is not unusual to find vibrations on the lift that were not found in the road test. If the condition found on the road can be duplicated on the lift, carrying out experiments on the lift may save a great deal of time.

### Exhaust Neutralization Procedure

1. **1.** Raise vehicle on lift and slacken all exhaust fixings.
2. **2.** With all fixings loose, neutralize the exhaust system.
3. **3.** Tighten all fixings to correct torque, starting at the rear-most point working towards the front of the vehicle.

### Symptom Chart

Symptom	Possible Cause	Action
High-speed shake	<ul style="list-style-type: none"> <li>● Wheel end vibration</li> <li>● Engine/transmission</li> <li>● Driveline</li> </ul>	GO to Pinpoint Test <a href="#">A</a> .
Tip-in moan	<ul style="list-style-type: none"> <li>● Air cleaner</li> <li>● Power steering</li> <li>● Powertrain</li> <li>● Engine mounts</li> <li>● Exhaust system</li> </ul>	GO to Pinpoint Test <a href="#">B</a> .
Idle boom/shake/vibration, or shudder	<ul style="list-style-type: none"> <li>● Cable(s)/hoses(s)</li> <li>● Intake air distribution and filtering system</li> <li>● Engine mounts</li> <li>● Exhaust system</li> <li>● Belt/pulleys</li> </ul>	GO to Pinpoint Test <a href="#">C</a> .
Wheel end vibration analysis	<ul style="list-style-type: none"> <li>● Suspension/rear drive halfshaft and CV joints</li> <li>● Tires/wheels</li> <li>● Wheel bearings</li> <li>● CV joint boots</li> </ul>	GO to Pinpoint Test <a href="#">D</a> .
Non-axle noise	<ul style="list-style-type: none"> <li>● Trim/mouldings</li> <li>● A/C system</li> <li>● Accessories</li> </ul>	GO to Pinpoint Test <a href="#">E</a> .

### Pinpoint Tests

• **NOTE:** These Pinpoint Tests are designed to take the technician through a step-by-step diagnosis procedure to determine the cause of a condition. It may not always be necessary to follow the chart to its conclusion. Carry out only the Pinpoint Test steps necessary to correct the condition. Then check operation of the system to make sure the condition is corrected.

After verifying that the condition has been corrected, make sure all components removed have been installed.

PINPOINT TEST A : HIGH-SPEED SHAKE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>A1: NEUTRAL COAST</b>	
	<b>1</b> Carry out the neutral coast test.
	Does the vibration disappear during the neutral coast test? <b>Yes</b> Check and install/re-balance wheels and tires and driveshaft. Check and install new engine/transmission mounts as necessary. Repeat Road Test as outlined. <b>No</b> <a href="#">GO to D1.</a>

PINPOINT TEST B : TIP-IN MOAN	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>B1: CHECK THE AIR CLEANER</b>	
	<b>1</b> Check the air cleaner. <ul style="list-style-type: none"> <li>● Check the air cleaner, inlet tube, outlet tube, resonators and all other components associated with the air induction system for correct installation and tightness of all connections.</li> </ul>
	Are the components OK? <b>Yes</b> <a href="#">GO to B2.</a> <b>No</b> Correct the condition. Repeat the Road Test as outlined.
<b>B2: CHECK THE EXHAUST SYSTEM</b>	
	<b>1</b> Carry out the exhaust system neutralizing procedure in this section.

	Is the exhaust system OK? Yes <a href="#">GO to B3.</a> No Repair as necessary. Restore vehicle. Repeat the Road Test as outlined.
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**B3: CHECK THE POWER STEERING**

	<b>1</b> Remove the auxiliary drive belt and test for tip-in moan.
	Is the tip-in moan OK? Yes Repair the power steering as necessary. For additional information, refer to Section 211-00. No Check and install new engine/transmission mounts as necessary. Repeat Road Test as outlined.

**PINPOINT TEST C : IDLE BOOM/SHAKE/VIBRATION/SHUDDER**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
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**C1: CHECK CABLE/HOSES**

	<b>1</b> Check the engine compartment for any component that may be grounding between the engine and body or chassis. Example: air conditioning (A/C) hoses.
	Are the components OK? Yes <a href="#">GO to C2.</a> No Correct the condition. Repeat the Road Test as outlined.

**C2: CHECK THE COOLING RADIATOR**

	<b>1</b> Check the engine cooling radiator mountings and bushings for security and condition. Check the radiator installation for any component that may have a touch condition.
	Are the installation and bushings OK? Yes <a href="#">GO to C3.</a> No Correct the condition. Repeat the Road Test as outlined.

**C3: CHECK THE EXHAUST SYSTEM**

	<b>1</b> Carry out the exhaust system neutralizing procedure in this section.
	Is the exhaust system OK? Yes Check and install new engine/transmission mounts as necessary. Repeat Road Test as outlined. No Repair as necessary. Repeat Road Test.

**PINPOINT TEST D : WHEEL END VIBRATION ANALYSIS**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
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**D1: INSPECT THE TIRES**

	<b>1</b> Inspect the tires. <ul style="list-style-type: none"> <li>● Raise and support the vehicle. REFER to: (100-02 Jacking and Lifting) <a href="#">Jacking</a> (Description and Operation), <a href="#">Lifting</a> (Description and Operation).</li> <li>● Inspect the tires for: <ul style="list-style-type: none"> <li>● Correct tire size</li> <li>● Tire/wheel compatibility</li> <li>● Wear or damage</li> <li>● Tire beads correctly seated</li> </ul> </li> </ul>
	Are the tires OK? Yes <a href="#">GO to D2.</a> No Inspect the wheels. For additional information, refer to Section 204-00.

**D2: INSPECT WHEEL BEARINGS**

	<b>1</b> Inspect the wheel bearings. For additional information, refer to Section 204-00.
	Are the wheel bearings OK? Yes <a href="#">GO to D3.</a> No Repair as necessary. Repeat the Road Test as outlined.

**D3: INSPECT THE CONSTANT VELOCITY (CV) JOINT BOOTS**

	<b>1</b> Inspect the CV joint boots. <ul style="list-style-type: none"> <li>● Spin the rear tire by hand</li> <li>● Inspect for evidence of cracks, tears, splits or splattered grease</li> </ul>
	Are the CV joint boots OK? Yes <a href="#">GO to D4.</a> No

	Repair as necessary. Repeat the Road Test as outlined.
<b>D4: INSPECT WHEEL AND TIRE RUNOUT</b>	
	<p><b>1</b> Inspect the wheel and tire runout.</p> <ul style="list-style-type: none"> <li>Carry out the Wheel and Tire Check procedure. REFER to: <a href="#">Wheels and Tires</a> (204-04 Wheels and Tires, Diagnosis and Testing).</li> </ul>
	<p>Is the wheel and tire runout OK?</p> <p><b>Yes</b> Balance the wheels and tires. Refer to the wheel balance equipment manufacturers instructions.</p> <p><b>No</b> Repair as necessary. REFER to: <a href="#">Wheels and Tires</a> (204-04 Wheels and Tires, Diagnosis and Testing). Repeat the Road Test as outlined.</p>

<b>PINPOINT TEST E : NON-AXLE NOISE</b>	
<b>TEST CONDITIONS</b>	<b>DETAILS/RESULTS/ACTIONS</b>
<b>E1: INSPECT VEHICLE TRIM</b>	
	<p><b>1</b> Check the grille and trim mouldings to see if they are the source of the noise.</p>
	<p>Are the vehicle trim components causing the noise?</p> <p><b>Yes</b> Install new trim or repair as necessary. For additional information, refer to Section 501-08.</p> <p><b>No</b> <a href="#">GO to E2.</a></p>
<b>E2: CHECK THE A/C SYSTEM FOR NOISE</b>	
	<p><b>1</b> Check the A/C system components for noise by turning the A/C system on and off.</p>
	<p>Is the A/C system causing the noise?</p> <p><b>Yes</b> Diagnose the A/C system. REFER to: <a href="#">Climate Control System</a> (412-00 Climate Control System - General Information, Diagnosis and Testing).</p> <p><b>No</b> <a href="#">GO to E3.</a></p>
<b>E3: CHECK NON-FACTORY ACCESSORIES</b>	
	<p><b>1</b> Inspect any accessories for being the source of the noise. Example: grounding body-to-frame, antennas, visors, bug deflectors and fog lights?</p>
	<p>Are the accessories the cause of the noise?</p> <p><b>Yes</b> Adjust, repair or install new accessories or fasteners as required.</p> <p><b>No</b> Verify the customer concern.</p>



## **Noise, Vibration and Harshness - Exhaust System Neutralizing**

### General Procedures

1. Loosen the muffler inlet pipe and resonator pipe to exhaust manifold fasteners at the flanges and the muffler inlet connection.
2. Place a stand to support the muffler parallel to the vehicle frame with the muffler pipe bracket free of stress.
3. Tighten the muffler connection.
4. Position the exhaust pipes to the manifolds and tighten. Make sure that the catalytic converter and heat shield do not contact the frame rails.
5. With the complete exhaust system tight (and cooled) the rear hanger insulator should be angled forward, to allow the system to expand rearward when heated during normal running

## Suspension System - General Information -

### Vehicle Ride Height

Description		Measurement	
Description	Front/Rear	Kerb mm (inch)	Tolerance mm (inch)
Vehicles without supercharger	Front	387 (15.23)	±15 (0.6)
	Rear	392 (15.11)	±15 (0.6)
Vehicles with supercharger	Front	386 (15.19)	±15 (0.6)
	Rear	387 (15.23)	±15 (0.6)

- Ride height is measured from the centre of the wheel to the apex of the wheel arch, through the wheel centre line.
- Kerb - with all fluids at full and a full tank of fuel, no occupants/luggage.

### Wheel Alignment - Front Camber

Description		Left-hand		Right-hand		Balance*1	
Markets	Degrees/Minutes	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
All right-hand drive and Japan	Degrees/Minutes	-0° 36'	±45'	-0° 12'	±45'	-0° 24'	±45'
	Decimal Degrees	-0.6°	±0.75°	-0.2°	±0.75°	-0.4°	±0.75°
USA, Canada, Mexico and Dominican Republic (Federal)	Degrees/Minutes	-0° 12'	±45'	-0° 33'	±45'	0° 21'	±45'
	Decimal Degrees	-0.2°	±0.75°	-0.55°	±0.75°	0.35°	±0.75°
Rest of world	Degrees/Minutes	-0° 12'	±45'	-0° 24'	±45'	0° 12'	±45'
	Decimal Degrees	-0.2°	±0.75°	-0.4°	±0.75°	0.2°	±0.75°

- All above figures are at "Kerb" height - For additional information, refer to Vehicle Ride Height.
- Tires must be inflated to normal pressure - For additional information, refer to: Specifications (204-04, Specifications).

### Wheel Alignment - Front Caster

Description		Left-hand		Right-hand		Balance*2	
Markets	Degrees/Minutes	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
All right-hand drive and Japan	Degrees/Minutes	6° 53'	±45'	6° 20'	±45'	0° 33'	±45'
	Decimal Degrees	6.88°	±0.75°	6.33°	±0.75°	0.55°	±0.75°
USA, Canada, Mexico and Dominican Republic (Federal)	Degrees/Minutes	6° 36'	±45'	6° 45'	±45'	-0° 8'	±45'
	Decimal Degrees	6.61°	±0.75°	6.74°	±0.75°	-0.14°	±0.75°
Rest of world	Degrees/Minutes	6° 36'	±45'	6° 36'	±45'	0° 0'	±45'
	Decimal Degrees	6.61°	±0.75°	6.61°	±0.75°	0°	±0.75°

- All above figures are at "Kerb" height - For additional information, refer to Vehicle Ride Height.
- Tires must be inflated to normal pressure - For additional information, refer to: Specifications (204-04, Specifications).

### Wheel Alignment - Front Toe

Description		Total Toe	
Markets	Degrees/Minutes	Nominal	Tolerance
All right-hand drive and Japan	Degrees/Minutes	0° 13'	±12'
	Decimal Degrees	0.22°	±0.20°
USA, Canada, Mexico and Dominican Republic (Federal)	Degrees/Minutes	0° 13'	±12'
	Decimal Degrees	0.22°	±0.20°
Rest of world	Degrees/Minutes	0° 13'	±12'
	Decimal Degrees	0.22°	±0.20°

- All above figures are at "Kerb" height - For additional information, refer to Vehicle Ride Height.
- Tires must be inflated to normal pressure - For additional information, refer to: Specifications (204-04, Specifications).

### Wheel Alignment - Rear Camber

Description		Left-hand		Right-hand	
Markets	Degrees/Minutes	Nominal	Tolerance	Nominal	Tolerance
All Markets	Degrees/Minutes	-0° 41'	±45'	-0° 41'	±45'
	Decimal Degrees	-0.69°	±0.75°	-0.69°	±0.75°

- All above figures are at "Kerb" height - For additional information, refer to Vehicle Ride Height.
- Tires must be inflated to normal pressure - For additional information, refer to: Specifications (204-04, Specifications).

### Wheel Alignment - Rear Toe

Description		Left-hand		Right-hand		Thrust Angle*5		Total Toe	
Markets	Degrees/Minutes	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
All Markets	Degrees/Minutes	0° 5'	±8'	0° 5'	±8'	0° 0'	±8'	0° 10'	±12'
	Decimal Degrees	0.09°	±0.14°	0.09°	±0.14°	0°	±0.14°	0.17°	±0.20°

- \*1 Camber balance = LH camber - RH camber
- \*2 Caster balance = LH caster - RH caster
- \*5 Thrust angle = Crab angle = (LH rear toe - RH rear toe)÷2
- All above figures are at "Kerb" height - For additional information, refer to Vehicle Ride Height.
- Tires must be inflated to normal pressure - For additional information, refer to: Specifications (204-04, Specifications).

### General Specifications

Item	Specification
------	---------------

Item	Specification
<b>Clear Vision</b>	
Clear vision (negative value is counterclockwise)	$0^\circ \pm 3^\circ$
<b>Ball Joint Radial Play</b>	
Lower ball joint — maximum	0.8 mm (1/32 in)
Upper ball joint — maximum	0.8 mm (1/32 in)

# Suspension System - General Information - Suspension System

Diagnosis and Testing

## Principle of Operation

For a detailed description of the suspension system, refer to the relevant Description and Operation section of the workshop manual. REFER to:

[Front Suspension](#) (204-01 Front Suspension, Description and Operation),  
[Front Suspension](#) (204-01 Front Suspension, Description and Operation),  
[Front Suspension](#) (204-01 Front Suspension, Description and Operation),  
[Rear Suspension](#) (204-02 Rear Suspension, Description and Operation),  
[Rear Suspension](#) (204-02 Rear Suspension, Description and Operation),  
[Rear Suspension](#) (204-02 Rear Suspension, Description and Operation).

## Inspection and Verification

1. Verify the customer concern by carrying out a road test on a smooth road. If any vibrations are apparent, refer to section 100-04 Noise, Vibration and Harshness.
2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection Chart

Mechanical
<ul style="list-style-type: none"> <li>● Damaged tires</li> <li>● Wheel bearing(s)</li> <li>● Loose or damaged front or rear suspension components</li> <li>● Loose, damaged or missing suspension fastener(s)</li> <li>● Incorrect spring usage</li> <li>● Damaged or sagging spring(s)</li> <li>● Damaged or leaking shock absorber(s)</li> <li>● Damaged or leaking strut(s)</li> <li>● Worn or damaged suspension bushing(s)</li> <li>● Loose, worn or damaged steering system components</li> <li>● Damaged axle components</li> </ul>

3. If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the next step.
4. If the fault is not visually evident, verify the symptom and refer to the following Symptom Chart.

## Symptom Chart

Symptom	Possible Sources	Action
Crabbing	* Incorrect rear thrust angle.	* Check the rear toe adjustment. REFER to: <a href="#">Rear Toe Adjustment</a> (204-00 Suspension System - General Information, General Procedures).
	* Front or rear suspension components.	* Inspect the front and rear suspension systems. Repair or install new suspension components as necessary.
	* Drive axle damaged.	* Install a new rear drive axle/differential. REFER to: <a href="#">Axle Assembly - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Vehicles Without: Differential Drain Plug</a> (205-02 Rear Drive Axle/Differential, Removal and Installation).
Drift/Pull	* Unequal tire pressure.	* Check and adjust the tire pressures. Inspect the tire for excessive wear. REFER to: <a href="#">Specifications</a> (204-04 Wheels and Tires, Specifications).
	* Incorrect wheel alignment.	* Check and adjust the wheel alignment. REFER to: (204-00 Suspension System - General Information) <a href="#">Front Toe Adjustment</a> (General Procedures), <a href="#">Rear Toe Adjustment</a> (General Procedures), <a href="#">Camber and Caster Adjustment</a> (General Procedures).
	* Tires.	* Check and adjust the tire pressures. Inspect the tire for excessive wear. REFER to: <a href="#">Specifications</a> (204-04 Wheels and Tires, Specifications).
	* Unevenly loaded or overloaded vehicle.	* Notify the customer of incorrect vehicle loading.
	* Damaged steering components.	* Check the steering system.
	* Brake drag.	* Check the brakes. REFER to: <a href="#">Brake System</a> (206-00 Brake System - General Information, Diagnosis and Testing).
Front Bottoming or Riding Low	* Coil springs.	* Check the ride height. Install new springs as necessary. REFER to: <a href="#">Front Shock Absorber</a> (204-01 Front Suspension, Removal and Installation), <a href="#">Shock Absorber and Spring Assembly</a> (204-02 Rear Suspension, Removal and Installation).

Incorrect Tire Wear	* Incorrect tire pressure (rapid center rib or inner and outer edge wear).	* Check and adjust the tire pressure. Inspect the tire for excessive wear. REFER to: <a href="#">Specifications</a> (204-04 Wheels and Tires, Specifications).
	* Excessive front or rear toe (rapid inner or outer edge wear).	* Check and adjust the wheel alignment. REFER to: (204-00 Suspension System - General Information) <a href="#">Front Toe Adjustment</a> (General Procedures), <a href="#">Rear Toe Adjustment</a> (General Procedures), <a href="#">Camber and Caster Adjustment</a> (General Procedures).
	* Excessive negative or positive camber (rapid inner or outer edge wear).	* Check and adjust the wheel alignment. REFER to: (204-00 Suspension System - General Information) <a href="#">Front Toe Adjustment</a> (General Procedures), <a href="#">Rear Toe Adjustment</a> (General Procedures), <a href="#">Camber and Caster Adjustment</a> (General Procedures).
	* Tires out of balance (tires cupped or dished).	* Balance the tires.
Rough ride	* Spring(s)	* Check and install new spring(s) as necessary. REFER to: <a href="#">Front Shock Absorber</a> (204-01 Front Suspension, Removal and Installation), <a href="#">Shock Absorber and Spring Assembly</a> (204-02 Rear Suspension, Removal and Installation).
Shimmy or Wheel Tramp	* Loose wheel nut(s).	* Check and tighten the wheel nuts to specification. REFER to: <a href="#">Specifications</a> (204-04 Wheels and Tires, Specifications).
	* Loose front suspension fasteners.	* Check and tighten the suspension fasteners to specification. REFER to: <a href="#">Specifications</a> (204-00 Suspension System - General Information, Specifications).
	* Front wheel bearing(s).	* Check the wheel bearings.
	* Worn or damaged suspension component bushing.	* Check and install new components as necessary.
	* Wheel/tires.	* Check the wheels/tires. Balance or install new wheel/tires as necessary. REFER to: <a href="#">Wheels and Tires</a> (204-04 Wheels and Tires, Diagnosis and Testing).
	* Loose, worn or damaged ball joint(s).	* Check the Ball Joint(s).
	* Loose, worn or damaged steering components.	* Check and install new components as necessary.
	* Front wheel alignment.	* Check and adjust the wheel alignment. REFER to: (204-00 Suspension System - General Information) <a href="#">Front Toe Adjustment</a> (General Procedures), <a href="#">Rear Toe Adjustment</a> (General Procedures), <a href="#">Camber and Caster Adjustment</a> (General Procedures).
	* Shock absorber(s).	* Check and install new shock absorber(s) as necessary. REFER to: <a href="#">Front Shock Absorber</a> (204-01 Front Suspension, Removal and Installation), <a href="#">Shock Absorber and Spring Assembly</a> (204-02 Rear Suspension, Removal and Installation).
	* Spring(s).	* Check and install new springs as necessary. REFER to: <a href="#">Front Shock Absorber</a> (204-01 Front Suspension, Removal and Installation), <a href="#">Shock Absorber and Spring Assembly</a> (204-02 Rear Suspension, Removal and Installation).
Poor self center action of the steering	* Ball joints.	* Check the Ball Joints.
	* Steering components.	* Check and install new components as necessary.
Steering wheel off-center	* Unequal front or rear toe settings.	* Check and adjust the wheel alignment. REFER to: (204-00 Suspension System - General Information) <a href="#">Front Toe Adjustment</a> (General Procedures), <a href="#">Rear Toe Adjustment</a> (General Procedures), <a href="#">Camber and Caster Adjustment</a> (General Procedures).
	* Steering components.	* Check and install new components as necessary.
Sway or roll	* Overloaded, unevenly or incorrectly loaded vehicle.	* Notify the customer of incorrect vehicle loading.
	* Loose wheel nut(s).	* Check and tighten the wheel nut(s) to specification. REFER to: <a href="#">Specifications</a> (204-04 Wheels and Tires, Specifications).
	* Coil spring(s).	* Check and install new coil springs as necessary. REFER to: <a href="#">Front Shock Absorber</a> (204-01 Front Suspension, Removal and Installation), <a href="#">Shock Absorber and Spring Assembly</a> (204-02 Rear Suspension, Removal and Installation).
	* Loose front stabilizer bar or rear stabilizer bar.	* Check and tighten the stabilizer bar to specification. REFER to: <a href="#">Specifications</a> (204-01 Front Suspension, Specifications), <a href="#">Specifications</a> (204-02 Rear Suspension, Specifications).
	* Worn lower suspension arm stabilizer bar insulators.	* Install new lower suspension arm stabilizer bar as necessary. REFER to: Front Stabilizer Bar - 2.7L Diesel (204-01, Removal and Installation), Front Stabilizer Bar - 3.0L (204-01, Removal and Installation), <a href="#">Front Stabilizer Bar - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8</a> (204-01 Front Suspension, Removal and Installation), <a href="#">Rear Stabilizer Bar</a> (204-02 Rear Suspension, Removal and Installation).

	* Shock absorber(s).	* Check and install new shock absorber(s) as necessary. REFER to: <a href="#">Front Shock Absorber</a> (204-01 Front Suspension, Removal and Installation), <a href="#">Shock Absorber and Spring Assembly</a> (204-02 Rear Suspension, Removal and Installation).
Vehicle Leans to One Side	* Unevenly loaded or overloaded vehicle.	* Notify the customer of incorrect vehicle loading.
	* Front or rear suspension components.	* Inspect the front and rear suspension systems. Repair or install new suspension components as necessary.
	* Shock absorber(s).	* Check and install new shock absorber(s) as necessary. REFER to: <a href="#">Front Shock Absorber</a> (204-01 Front Suspension, Removal and Installation), <a href="#">Shock Absorber and Spring Assembly</a> (204-02 Rear Suspension, Removal and Installation).
	* Coil spring(s).	* Check and install new spring(s) as necessary. REFER to: <a href="#">Front Shock Absorber</a> (204-01 Front Suspension, Removal and Installation), <a href="#">Shock Absorber and Spring Assembly</a> (204-02 Rear Suspension, Removal and Installation).
	* Incorrect ride height. Lateral tilt out of specification.	* Check the ride height. Install new spring(s) as necessary. REFER to: <a href="#">Front Shock Absorber</a> (204-01 Front Suspension, Removal and Installation), <a href="#">Shock Absorber and Spring Assembly</a> (204-02 Rear Suspension, Removal and Installation).
Vibration/Noise	* Tires/wheels. * Wheel bearings. * Wheel hubs. * Brake components. * Suspension components. * Steering components.	* Check and install new components as necessary.
Wander	* Unevenly loaded or overloaded vehicle.	* Notify the customer of incorrect vehicle loading.
	* Ball joint(s).	* Check the Ball Joint(s).
	* Front wheel bearing(s).	* Check the wheel bearings.
	* Loose, worn or damaged suspension components.	* Check and install new suspension components as necessary.
	* Loose suspension fasteners.	* Check and tighten the suspension fasteners to specification. REFER to: <a href="#">Specifications</a> (204-00 Suspension System - General Information, Specifications).
	* Steering components.	* Check and install new steering components.
	* Wheel alignment (excessive total front toe-out).	* Check and adjust the wheel alignment. REFER to: (204-00 Suspension System - General Information) <a href="#">Front Toe Adjustment</a> (General Procedures), <a href="#">Rear Toe Adjustment</a> (General Procedures), <a href="#">Camber and Caster Adjustment</a> (General Procedures).

## Component Tests

### Ball Joint Inspection

• NOTE: The front suspension is shown in the following procedures. The inspection of the rear suspension upper ball joint is similar.

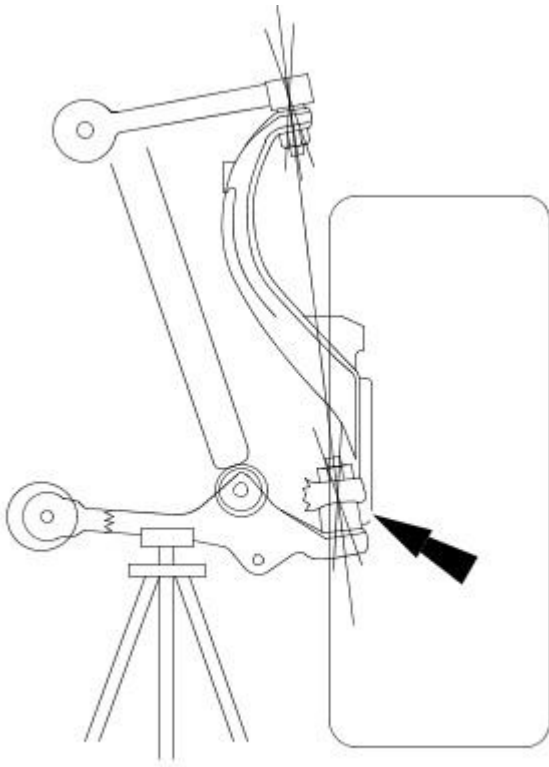
1. Raise and support the vehicle. REFER to: (100-02 Jacking and Lifting)

[Jacking](#) (Description and Operation),  
[Lifting](#) (Description and Operation).

2. Prior to carrying out any inspection of the ball joints, inspect the front wheel bearings.

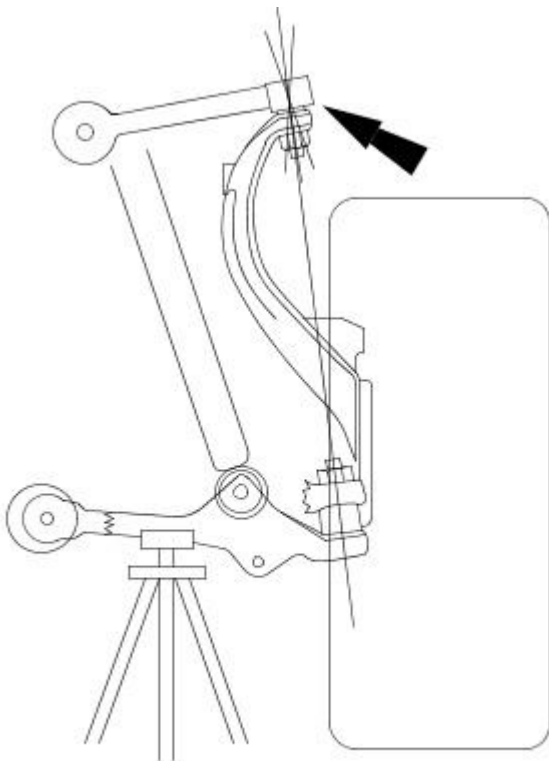
3.  CAUTION: The safety stand beneath the suspension lower arm must only support the weight of the suspension and not the full weight of the vehicle. Failure to follow this instruction may result in damage to the components.

3. Position a safety stand beneath the front suspension lower arm or rear suspension lower arm to be tested.



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4. 4. While an assistant pulls and pushes the top and bottom of the tire, observe the relative movement between the ball joint and the front suspension lower arm. Any movement at or exceeding the specification indicates a worn or damaged ball joint. Install a new wheel knuckle as necessary. REFER to: [Wheel Knuckle](#) (204-01 Front Suspension, Removal and Installation).



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5. 5. While an assistant pulls and pushes the top and bottom of the tire, observe the relative movement between the ball joint and the front suspension upper arm or rear suspension upper arm. Any movement at or exceeding the specification indicates a worn or damaged ball joint. Install a new upper arm as necessary. REFER to: (204-01 Front Suspension)

[Upper Arm LH](#) (Removal and Installation),  
[Upper Arm RH](#) (Removal and Installation).

6. **6.** Remove the safety stand.

7. **7.** Lower the vehicle.



# Suspension System - General Information - Camber and Caster Adjustment

## General Procedures

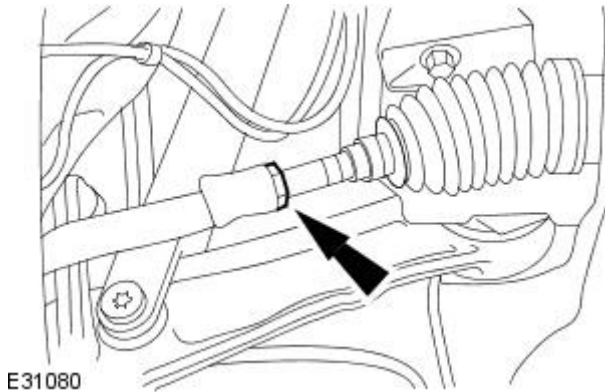
- NOTE: The camber and caster adjustment for the left-hand side is shown, the procedure for adjusting the right-hand side is similar.
- NOTE: This procedure must be carried out using a 4-post ramp.
- NOTE: Adjustments to the camber will affect the toe settings. Therefore, the camber and toe may need to be adjusted at the same time to achieve the correct settings.
- NOTE: Adjustments to the camber may affect the caster settings. Therefore, the caster will need to be checked, and adjusted as necessary.

### All vehicles

1. Check the rear toe adjustment.  
For additional information, refer to: [Rear Toe Adjustment](#) (204-00 Suspension System - General Information, General Procedures).  
Adjust as necessary.
2. Check the front toe adjustment.  
For additional information, refer to: [Front Toe Adjustment](#) (204-00 Suspension System - General Information, General Procedures).  
Adjust as necessary.
3. Check the camber and caster settings. Follow the equipment manufacturer's instructions.
4. NOTE: Left-hand shown, right-hand similar.

Loosen the tie-rod end lock nut.

- Clean and lubricate the lock nut and tie-rod threads.

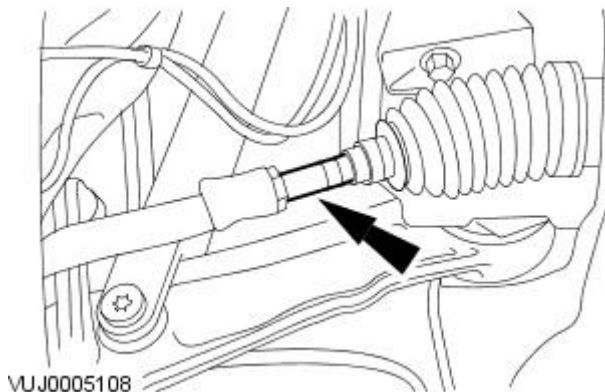


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5. NOTE: Do not allow the tie-rod end or steering gear boot to twist when the tie-rod is rotated.

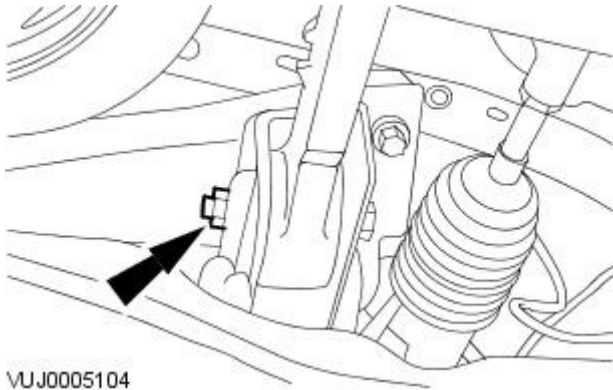
- NOTE: Left-hand, shown right-hand similar.

Rotate the tie-rod to adjust the toe.



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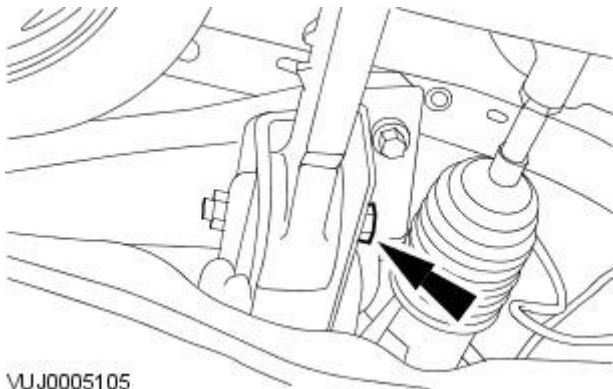
### Vehicles requiring camber adjustment



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6. NOTE: Left-hand shown, right-hand similar.

Loosen the rear lower arm lock nut.



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7. NOTE: Left-hand shown, right-hand similar.

Rotate the camber adjustment cam bolt to adjust the camber.

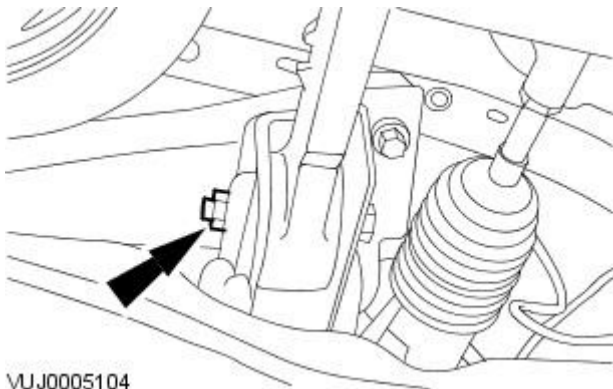
8. Check the camber and toe settings. Follow the equipment manufacturer's instructions. Adjust as necessary.

9. NOTE: Make sure the camber adjustment cam bolt does not rotate.

• NOTE: Left-hand shown, right-hand similar.

Tighten the rear lower arm lock nut.

- Tighten to 175 Nm.

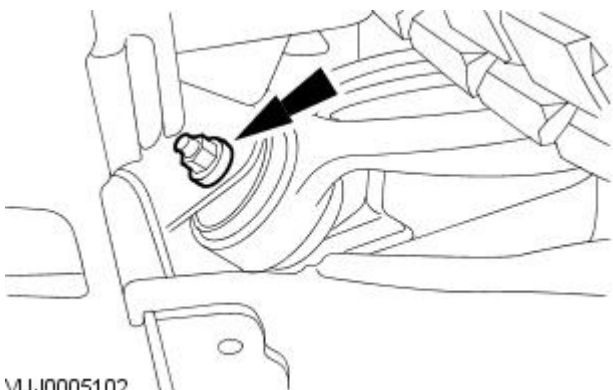


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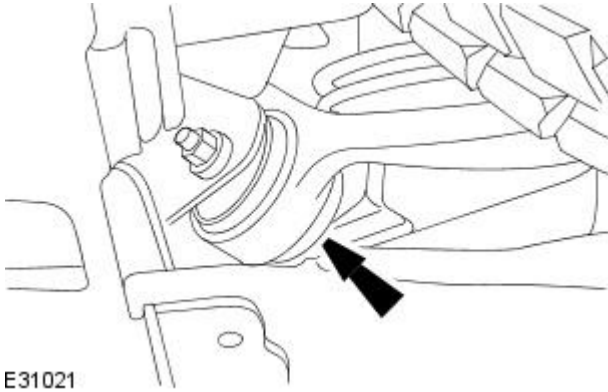
#### Vehicles requiring caster adjustment

10. NOTE: Left-hand shown, right-hand similar.

Loosen the front lower arm lock nut.



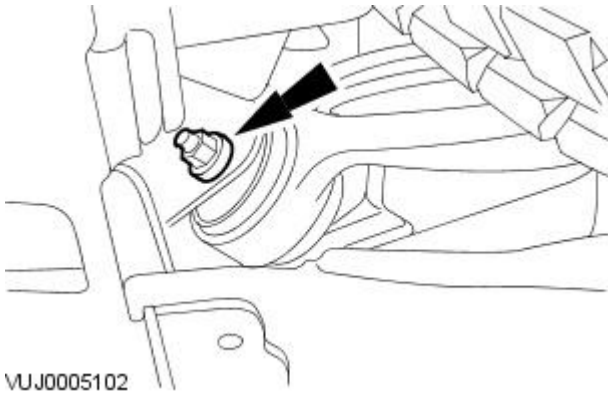
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**11. NOTE:** Adjustments to the caster will affect the toe settings. Therefore, the caster and toe may need to be adjusted at the same time to achieve the correct settings.

- NOTE: Left-hand shown, right-hand similar.

Rotate the caster adjustment cam bolt to adjust the caster.

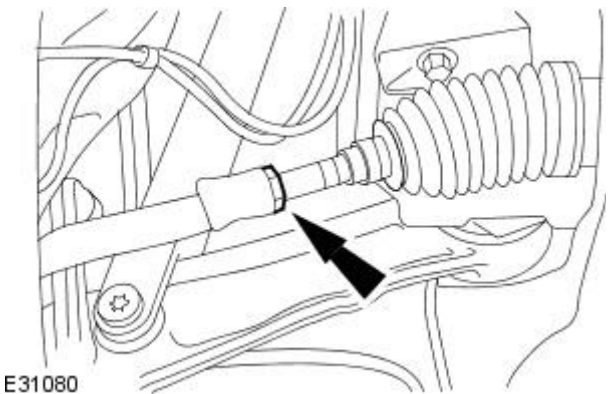


**12. NOTE:** Make sure the caster adjustment cam bolt does not rotate.

- NOTE: Left-hand shown, right-hand similar.

Tighten the caster adjustment cam bolt lock nut.

- Tighten to 175 Nm.



**13. NOTE:** Make sure the tie-rod or tie-rod end does not rotate.

- NOTE: Left-hand shown, right-hand similar.

Tighten the tie-rod end lock nut

- Tighten to 55 Nm.

**14. NOTE:** Make sure that all fixings are torqued to the correct specification.

Check the caster and toe settings. Follow the equipment manufacturer's instructions. Adjust as necessary.

# Suspension System - General Information - Four-Wheel Alignment

## General Procedures

### • CAUTIONS:



Make sure the vehicle is on a flat level surface.



Make sure the tire pressures are within specification.



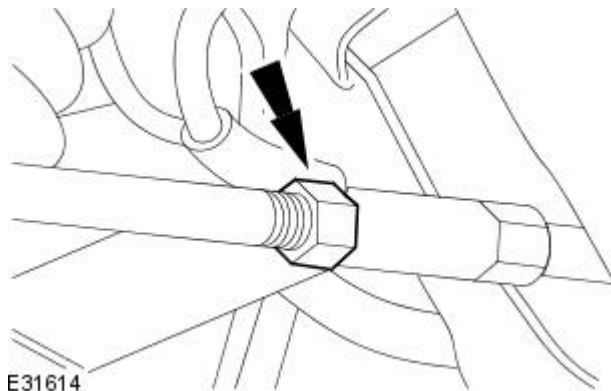
Make sure that only the manufacturers' recommended four wheel alignment equipment is used.



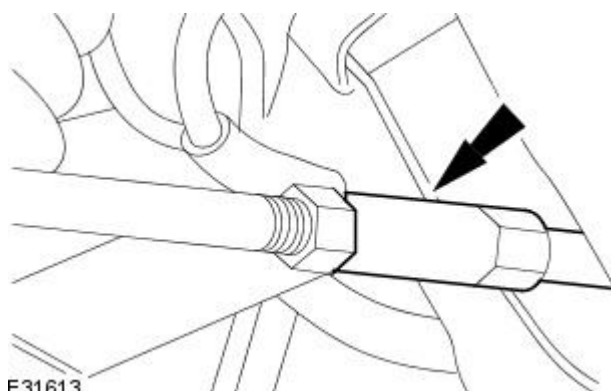
Make sure the steering is in the straight ahead position.

1. For wheel alignment information, refer to the suspension specification section.  
For additional information, refer to: [Specifications](#) (204-00 Suspension System - General Information, Specifications).
2. Check the tie rod ends, suspension joints, wheel bearings and wheels and tires for damage, wear and free play.
  - Adjust or repair any worn, damaged or incorrectly adjusted components.
3. Check and adjust tire pressures.
4. Position the vehicle on a calibrated, level, vehicle lift.
5. Release the vehicle parking brake.
6. Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment.
7. **NOTE:** LH illustration shown, RH is similar.

To adjust, loosen the toe link locknuts.



E31614

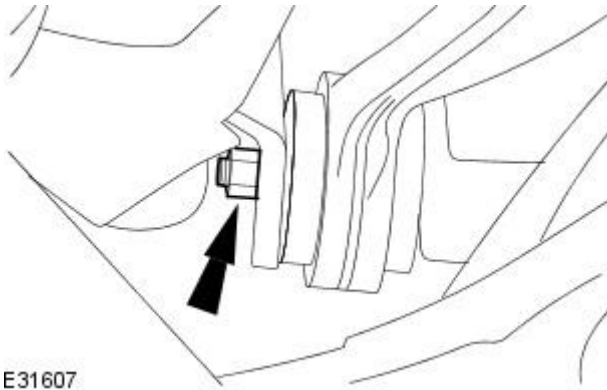


E31613

8. **CAUTION:** Do not allow the gaiter to twist.
  - **NOTE:** Both tie rods must be rotated by an equal amount.
  - **NOTE:** LH illustration shown, RH is similar.

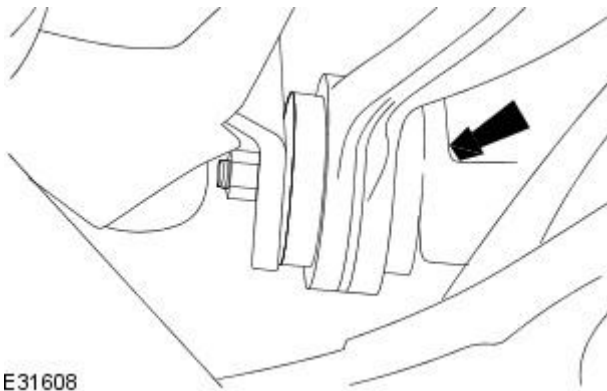
Adjust the rear toe.

9. Tighten the toe link locknuts to 55 Nm (40 lb.ft).




10. NOTE: LH illustration shown, RH is similar.

To adjust the caster, loosen the front lower arm lock nuts.



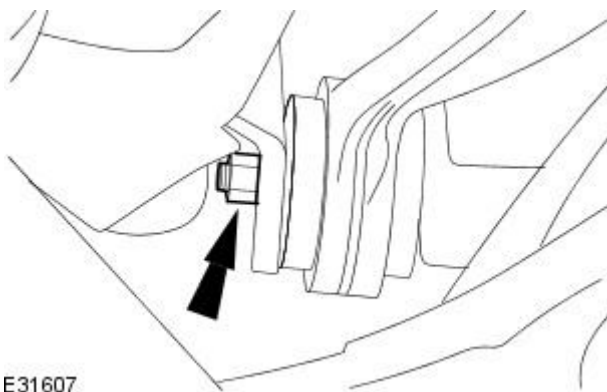
11. NOTE: LH illustration shown, RH is similar.


Rotate the caster adjustment cam bolt.

12.  CAUTION: Make sure the caster adjustment bolt does not rotate while the lock nut is being tightened.

Tighten the caster adjustment cam bolt nut.

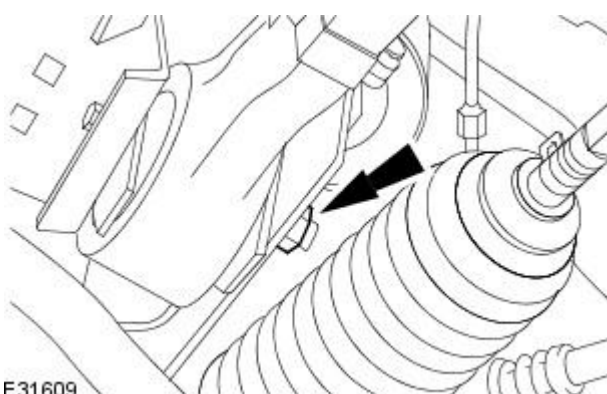
- Tighten the nut and bolt to 175 Nm (129 lb.ft).



13.  CAUTION: Adjustments made to the camber setting will affect the front toe setting. Therefore, the camber and toe may need to be adjusted at the same time.

• NOTE: LH illustration shown, RH is similar.

To adjust the camber, loosen the rear lower arm lock nuts.



14. NOTE: LH illustration shown, RH is similar.

Rotate the camber adjustment cam bolt.

15.  CAUTION: Make sure the camber adjustment bolt does

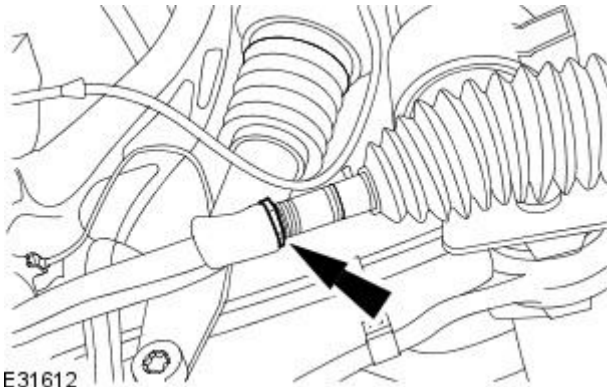
not rotate while the lock nut is being tightened.

Tighten the camber adjustment cam bolt nut.

- Tighten the nut and bolt to 175 Nm (129 lb.ft).

**16. NOTE:** LH illustration shown, RH is similar.

To adjust, loosen the tie rod end lock nuts.

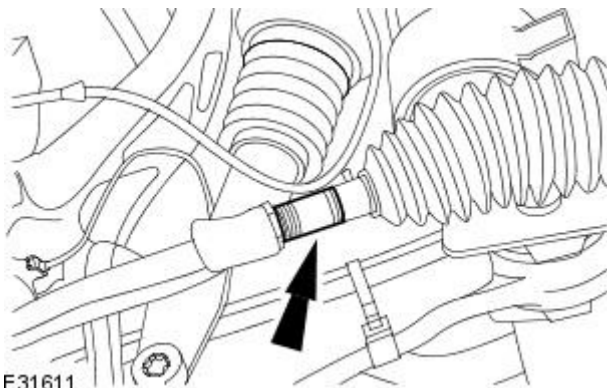


E31612

**17. ⚠ CAUTION:** Do not allow the gaiter to twist.

- NOTE: Both tie rods must be rotated by an equal amount.
- NOTE: LH illustration shown, RH is similar.

Adjust the front toe.



E31611

**18.** Tighten the tie rod end lock nuts to 55 Nm (40 lb.ft).

**19.** Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment.



# Suspension System - General Information - Front Toe Adjustment

## General Procedures

### • CAUTIONS:



Make sure the vehicle is on a flat level surface.



Make sure the tire pressures are within specification.



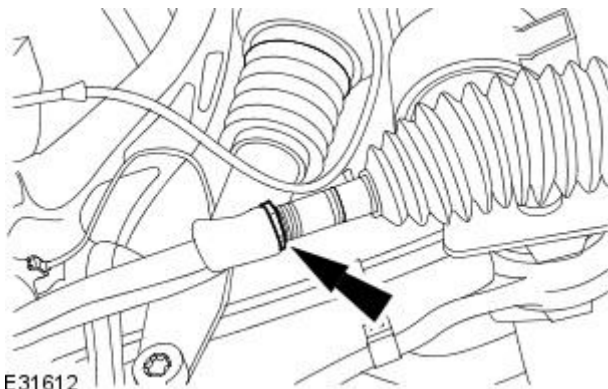
Make sure that only the manufacturers' recommended four wheel alignment equipment is used.



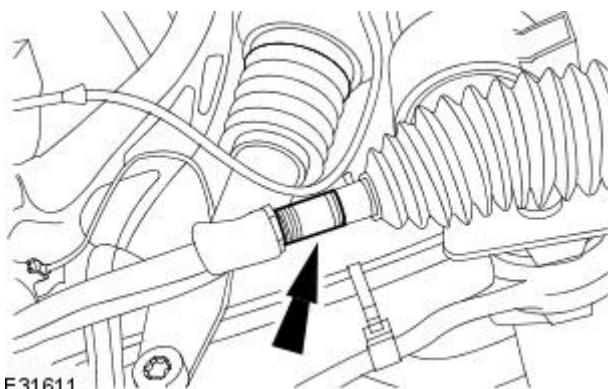
Make sure the steering is in the straight ahead position.

1. For wheel alignment information, refer to the suspension specification section.  
For additional information, refer to: [Specifications](#) (204-00 Suspension System - General Information, Specifications).
2. Check the tie rod ends, suspension joints, wheel bearings and wheels and tires for damage, wear and free play.
  - Adjust or repair any worn, damaged or incorrectly adjusted components.
3. Check and adjust tire pressures.
4. Position the vehicle on a 4 post lift.
5. Release the vehicle parking brake.
6. Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment.
7. **NOTE:** LH illustration shown, RH is similar.

To adjust, loosen the tie rod end lock nuts.



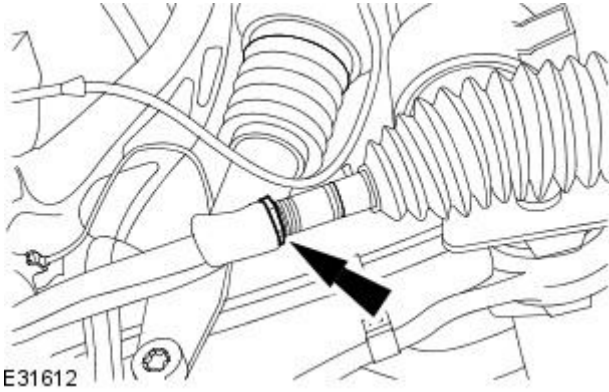
E31612



E31611

8. **CAUTION:** Do not allow the gaiter to twist.
- **NOTE:** Both tie rods must be rotated by an equal amount.
- **NOTE:** LH illustration shown, RH is similar.

Adjust the front toe.



**9. NOTE:** LH illustration shown, RH is similar.

Tighten the tie rod end lock nuts to 55 Nm.

**10.** Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment.



## Suspension System - General Information - Rear Toe Adjustment

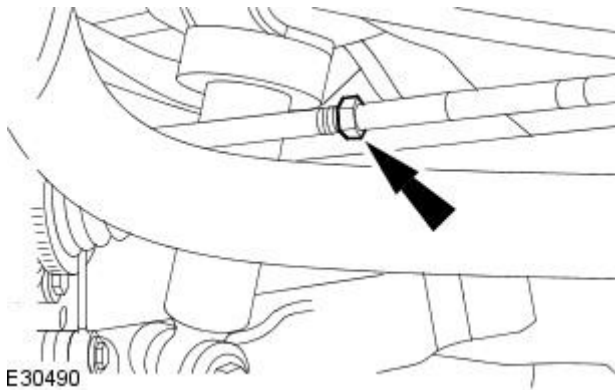
General Procedures

1. Check the toe settings. Follow the equipment manufacturer's instructions.

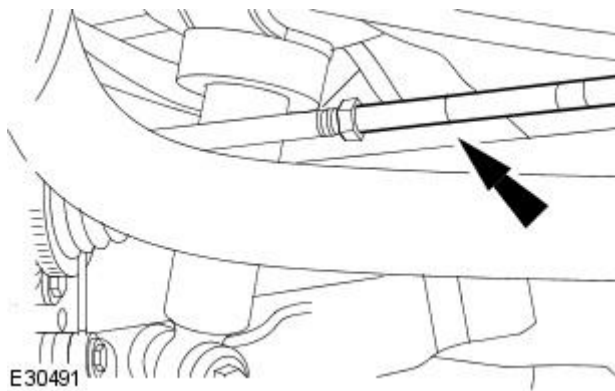
2. **NOTE:** Left-hand, shown right-hand similar.

Loosen the lock nut.

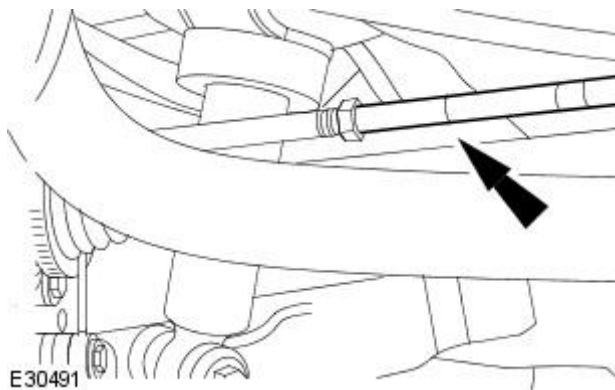
- Clean and lubricate the lock nut and toe link threads.



3. Rotate the toe link to adjust the toe settings.



4. Tighten the lock nut.



5. Check the toe settings. Follow the equipment manufacturer's instructions.

## Front Suspension -

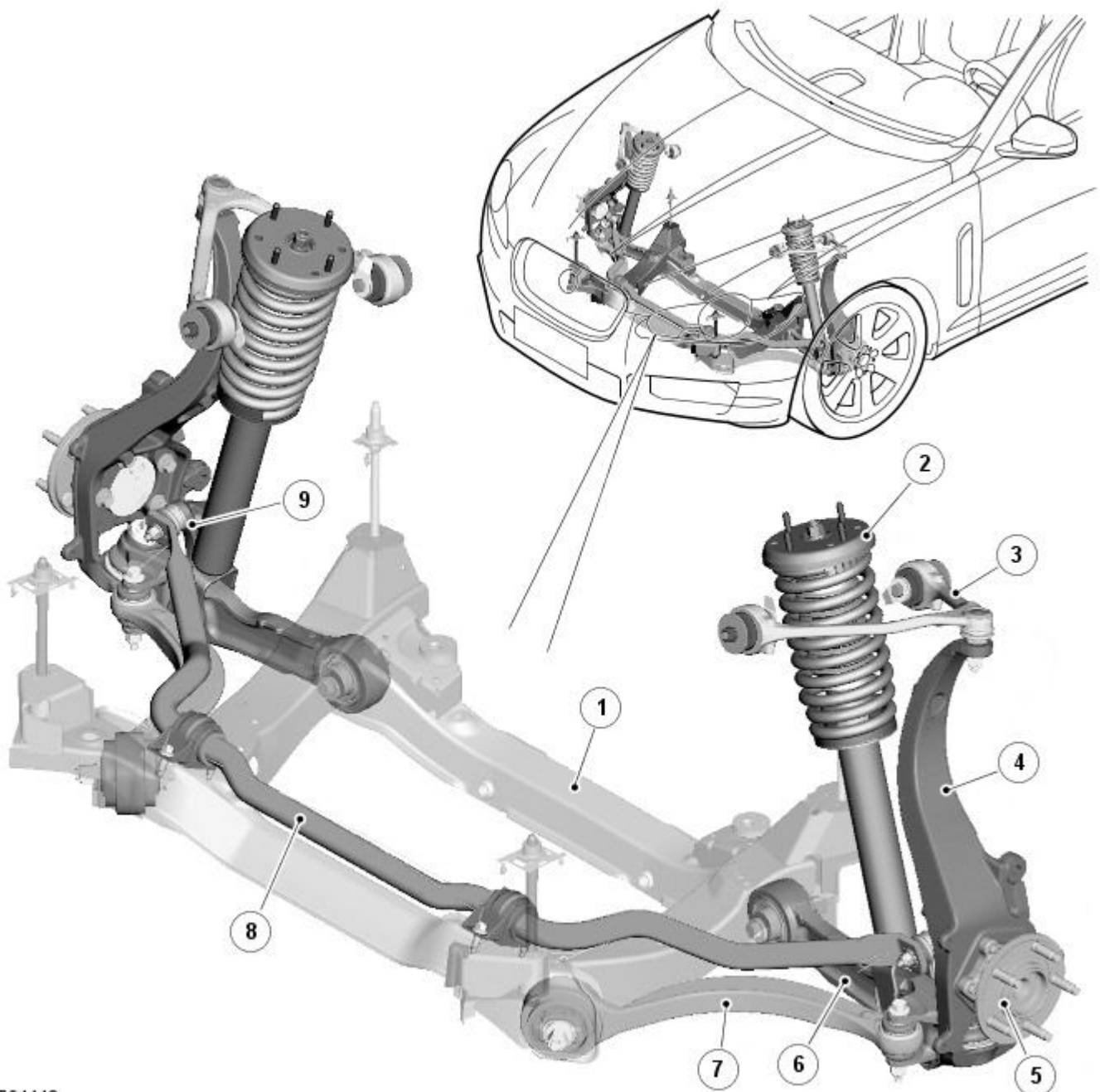
### Torque Specification

Description	Nm	lb-ft	lb-in
Steering gear to subframe retaining bolts	100	74	-
Toe link ball joint to wheel knuckle retaining nut	133	98	-
Stabilizer bar link to stabilizer bar retaining nut	43	32	-
Stabilizer bar link to lower arm retaining nut and bolt	70	52	-
Stabilizer bar clamp to subframe retaining bolts	55	41	-
Rear lower arm to wheel knuckle ball joint retaining nut	75	55	-
Rear lower arm to subframe retaining nut and bolt	175	129	-
Front lower arm to subframe retaining nut and bolt	175	129	-
Front lower arm to rear lower arm retaining nut and bolt	Stage 1 - 60 Stage 2 - 135 degrees	Stage 1 - 44 Stage 2 - 135 degrees	-
Upper arm ball joint to wheel knuckle retaining nut	90	66	-
Upper arm to body retaining nuts and bolts	47	35	-
Shock absorber and spring assembly upper mounting to body retaining nuts	28	20	-
Shock absorber and spring assembly to lower arm retaining nut and bolt	175	129	-
Shock absorber and spring assembly upper mounting retaining nut (without adaptive damping)	50	37	-
Shock absorber and spring assembly upper mounting retaining nut (with adaptive damping)	27	20	-
Wheel hub and bearing assembly to wheel knuckle retaining bolt	90	66	-
Wheel and tire to wheel hub retaining nuts	125	92	-

# Front Suspension - Front Suspension - Component Location

Description and Operation

COMPONENT LOCATION



E94448

## ItemDescription

1	Subframe
2	Spring and damper assembly
3	Upper control arm
4	Wheel knuckle
5	Wheel hub and bearing assembly
6	Lower lateral control arm
7	Lower forward control arm
8	Stabilizer bar
9	Stabilizer bar link

# Front Suspension - Front Suspension - Overview

Description and Operation

## OVERVIEW

The front suspension is a fully independent design assembled on a non-isolated subframe. The wheel knuckle attaches to the wishbone type upper and lower control arms.

The stabilizer bar attaches to the front of the subframe and varies in shape depending on the engine variant.

The spring and damper assemblies are located between the lower control arm and the front suspension housing in the inner wing. Dependant on vehicle model there are three types of coil spring and damper available:

- a standard oil passive damper (All models except supercharged),
- an adaptive damper, also known as Computer Active Technology Suspension (CATS) on 4.2L supercharged vehicles up to 2010MY,  
Refer to: [Vehicle Dynamic Suspension - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (204-05 Vehicle Dynamic Suspension, Description and Operation).
- a continuously variable adaptive damper, also known as Adaptive Dynamics System on 5.0L supercharged vehicles from 2010MY.  
Refer to: [Vehicle Dynamic Suspension - 5.0L](#) (204-05 Vehicle Dynamic Suspension, Description and Operation).

# Front Suspension - Front Suspension - System Operation and Component Description

Description and Operation

## System Operation

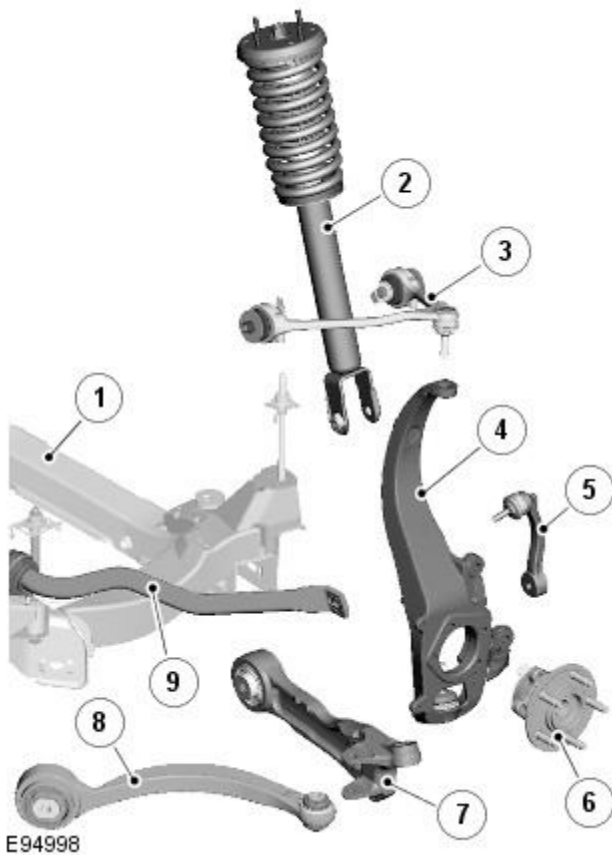
The front suspension is a fully independent design assembled on a non-isolated subframe mounted by four bolts to the vehicle body. This rigid mounting arrangement provides the driver with optimum steering feel and facilitates towards the vehicle's sporty dynamic suspension.

The suspension arrangement is a double-wishbone type with the length ratio between the upper and lower wish-bone control arms calculated to minimize track and camber changes.

An adaptive damping system is available on specified models. For additional information refer to Vehicle Dynamic Suspension 4.2L or 5.0L.

## Component Description

### COMPONENTS



#### ItemDescription

1	Subframe
2	Spring and damper assembly
3	Upper control arm
4	Wheel knuckle
5	Stabilizer bar link
6	Wheel hub and bearing assembly
7	Lower lateral control arm
8	Lower forward control arm
9	Stabilizer bar

### Upper Control Arm

The forged-aluminum upper control arm is a wishbone design and connects to the vehicle body through two plain bushes, and links to the swan neck wheel knuckle by an integral ball joint. The upper control arm is inclined to provide anti-dive characteristics under heavy braking, while also controlling geometry for vehicle straight-line stability.

### Lower Control Arm

The forged aluminum lower control arms are of the wishbone design; the arms separate to allow for optimum bush tuning:

- The rear lateral control arm is fitted with a bush at its inner end which locates between brackets on the subframe. The arm is secured with an eccentric bolt which provides the adjustment of the suspension camber geometry. The outer end of the control arm has a tapered hole which locates on a ball joint fitted to the wheel knuckle. An integral clevis bracket on the forward face of the lateral control arm allows for the attachment of the forward control arm. A bush is fitted below the clevis bracket to provide for the attachment of the stabilizer bar link. A cross-axis joint is fitted to a cross-hole in the control arm to provide the location for the clevis attachment of the spring and damper assembly.
- The forward control arm is fitted with a fluid-block rubber bush at its inner end which locates between brackets on the subframe. The arm is secured with an eccentric bolt which provides adjustment of the castor and camber geometry. The outer end of the control arm is fitted with a cross-axis joint and locates in the integral clevis bracket on the lateral control arm.

## Wheel Knuckle

The cast aluminum wheel knuckle is a swan neck design and attaches to the upper control arm and lower lateral control arm. The lower lateral control arm locates on a non serviceable ball-joint integral with the wheel knuckle. The lower boss on the rear of the knuckle provides for the attachment of the steering gear tie-rod ball joint.

The wheel knuckle also provides the mounting locations for the:

- wheel hub and bearing assembly
- the wheel speed sensor (integral to the wheel hub and bearing assembly)
- brake caliper and disc shield.

## Stabilizer Bar

The stabilizer bar is attached to the front of the subframe with bushes and mounting brackets. The pressed steel mounting brackets locate over the bushes and are attached to the cross member with bolts screwed into threaded locations in the subframe. The stabilizer bar has crimped, 'anti-shuffle' collars pressed in position on the inside edges of the bushes. The collars prevent sideways movement of the stabilizer bar.

The stabilizer bar is manufactured from 32mm diameter tubular steel on supercharged models and 31mm diameter tubular steel on diesel and normally aspirated models and has been designed to provide particular characteristics in maintaining roll rates, specifically in primary ride comfort.

Each end of the stabilizer bar curves rearwards to attach to a ball joint on a stabilizer link. Each stabilizer link is secured to a bush in the lower lateral arm with a bolt and locknut. The links allow the stabilizer bar to move with the wheel travel providing maximum effectiveness.

The only difference between the front stabilizer bars, in addition to the diameter, is in the shape to accommodate engine variant:

- a slightly curved bar, between bush centers, for V6 diesel (31 mm dia) and V8 gasoline supercharged (32 mm dia),
- a straight bar, between bush centers, for V6 and V8 normally aspirated gasoline engines (31 mm dia).

## Spring and Damper Assembly

The spring and damper assemblies are located between the lower lateral arm and the front suspension housing in the inner wing. Dependant on vehicle model there are three types of coil spring and damper available:

- a standard oil passive damper (All models except supercharged),
- an adaptive damper, also known as Computer Active Technology Suspension (CATS) on 4.2L supercharged vehicles up to 2010MY, For additional information refer to Vehicle Dynamic Suspension 4.2L.
- a continuously variable adaptive damper, also known as Adaptive Dynamics System on 5.0L supercharged vehicles from 2010MY. For additional information refer to Vehicle Dynamic Suspension 5.0L.

The dampers are a monotube design with a spring seat secured by a circlip onto the damper tube. The damper's lower spherical joint is an integral part of the lateral lower control-arm, and the damper takes the form of a clevis-end, which straddles the spherical joint.

The damper piston is connected to a damper rod which is sealed at its exit point from the damper body. The threaded outer end of the damper rod locates through a hole in the top mount. A self locking nut secures the top mount to the damper rod. The damper rod on the adaptive damper has an electrical connector on the outer end of the damper rod.

Supercharged 4.2L vehicles up to 2010MY: The adaptive damper functions by restricting the flow of hydraulic fluid through internal galleries in the damper's piston. The adaptive damper has a solenoid operated valve, which when switched allows a greater flow of hydraulic fluid through the damper's piston. This provides a softer damping characteristic from the damper. The adaptive damper defaults to a firmer setting when not activated. The solenoid is computer controlled and can switch between soft and hard damping settings depending on road wheel inputs and vehicle speed.

Supercharged 5.0L vehicles from 2010MY: The variable damper functions by adjustment of a solenoid operated variable orifice, which opens up an alternative path for oil flow within the damper. When de-energized the bypass is closed and all the oil flows through the main (firm) piston. When energized the solenoid moves an armature and control blade, which work against a spring. The control blade incorporates an orifice which slides inside a sintered housing to open up the bypass as required. In compression, oil flows from the lower portion of the damper through a hollow piston rod, a separate soft (comfort) valve, the slider housing and orifice and into the upper portion of the damper, thereby bypassing the main (firm) valve. In rebound the oil flows in the opposite direction

The damper rod is fitted with a spring aid which prevents the top mount making contact with the top of the damper body during full suspension compression and also assists with the suspension tune.

The spring rate of the coil springs can differ between models and are color coded for identification. The coil spring locates on a spring packer and a lower spring seat which is located on the damper body. The spring locates in an upper spring seat which is located on the underside of the top mount. The majority of the roll stiffness is provided by the springs rather than the stabilizer bar as this arrangement allows for a natural frequency of roll and consequently a consistent suspension ride.

## **Front Suspension - Front Suspension**

Diagnosis and Testing

For Diagnosis and Testing information.

REFER to: [Suspension System](#) (204-00 Suspension System - General Information, Diagnosis and Testing).


## Front Suspension - Front Shock Absorber

Removal and Installation

### Removal

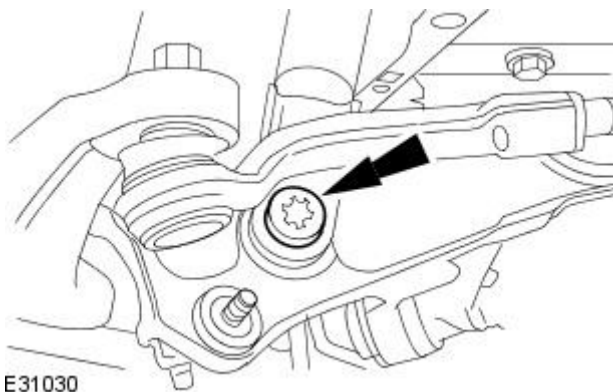
- NOTE: Fuse box release only required on removal of the RH front shock absorber.
- NOTE: Expansion tank release only required for supercharged variant removal of the LH front shock absorber.

All vehicles


1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the front wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
3. Remove the front stabilizer bar link.  
For additional information, refer to: [Front Stabilizer Bar Link](#) (204-01 Front Suspension, Removal and Installation).
4. Release the front shock absorber from the lower arm.

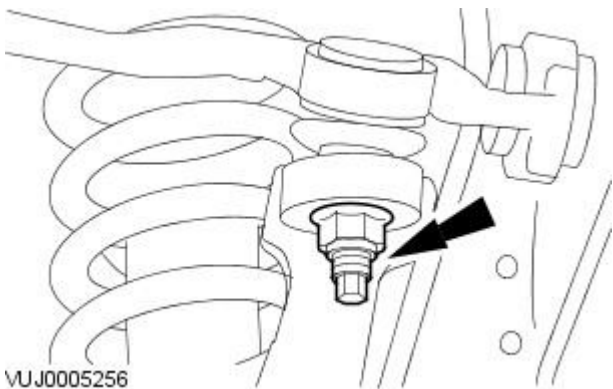


### 5. CAUTIONS:

 Make sure the wheel knuckle is supported. Failure to follow these instructions may result in damage to the vehicle.

 Use an Allen key to prevent the ball joint rotating whilst removing the nut.

Disconnect the upper arm from the wheel knuckle.

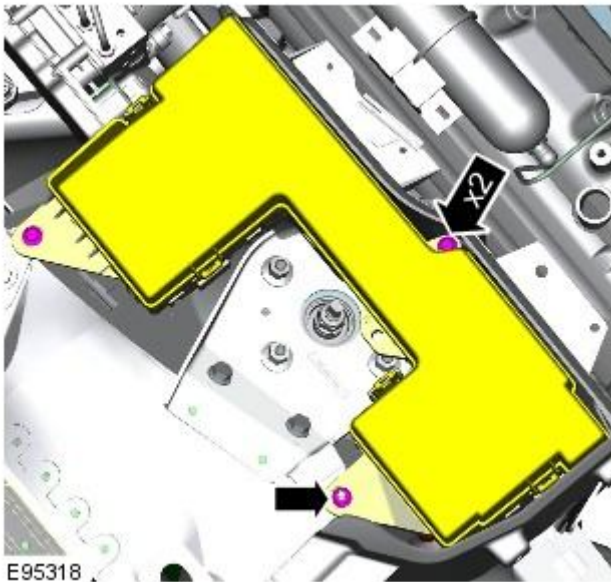


6. Lower the vehicle.



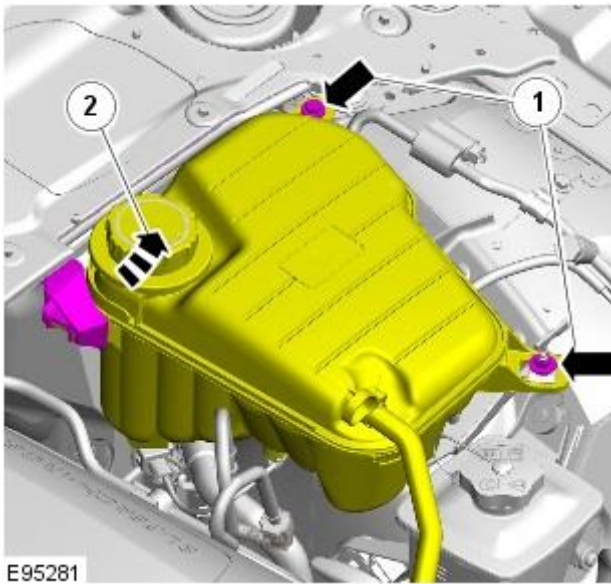
7. Release the fuse box.

- Remove the 2 bolts and 1 nut.
- Position the fuse box aside for access to the inboard retaining nut.



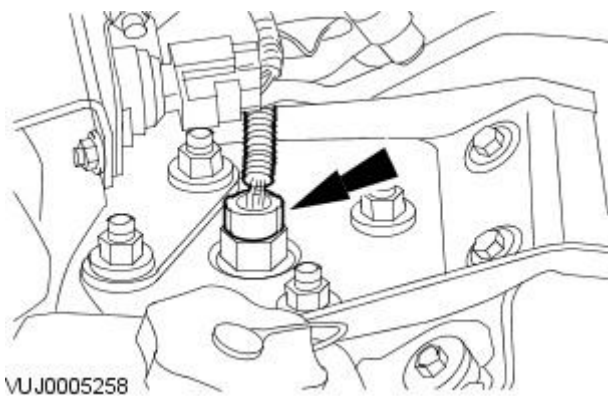
Vehicles with supercharger

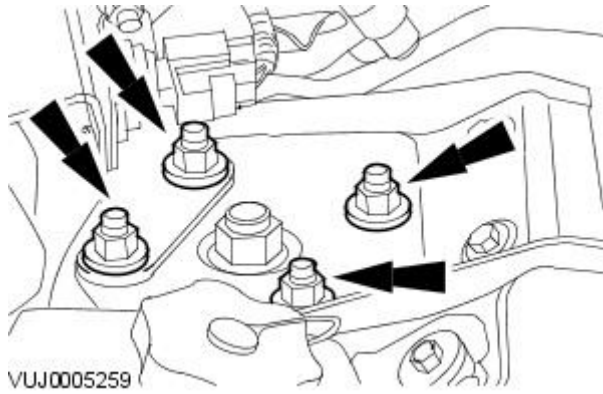
8. Release the coolant expansion tank for access.



All vehicles

9. Disconnect the front shock absorber electrical connector.





**10. NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

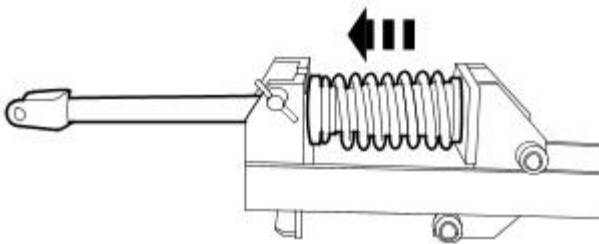
Remove the front shock absorber and spring assembly.

**11. NOTE:** Do not disassemble further if the component is removed for access only.

Install the front shock absorber and spring assembly in the spring compressor.

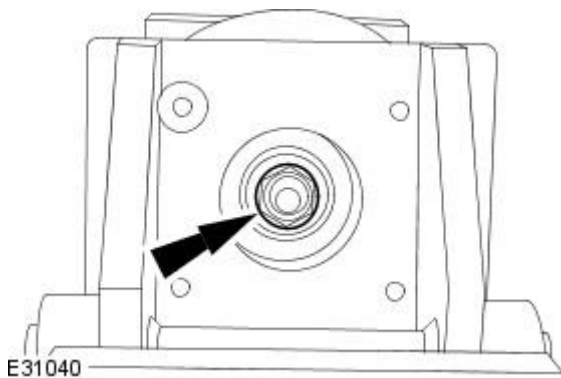
**12. ⚠ WARNING:** The spring is under extreme tension, care must be taken at all times. Failure to follow these instructions may result in personal injury.

Compress the spring.

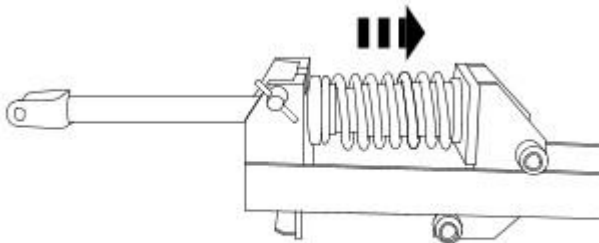


E31041

**13.** Remove the front shock absorber retaining nut

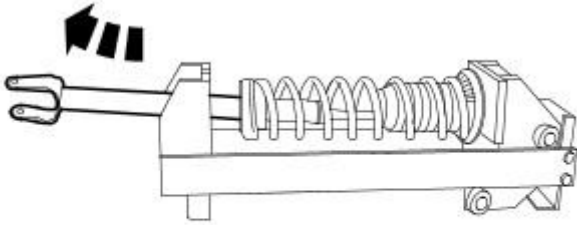


**14.** Carefully release the spring tension.



E31039

15. Remove the front shock absorber.

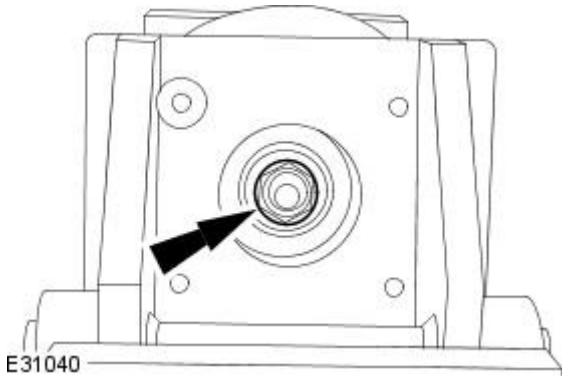


E31042

## Installation

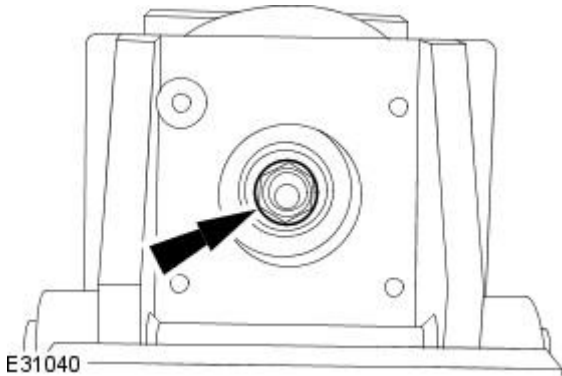
All vehicles

1. Vehicles without adaptive damping: Tighten the nut to 50 Nm.



E31040

2. Vehicles with adaptive damping: Tighten the nut to 27 Nm.

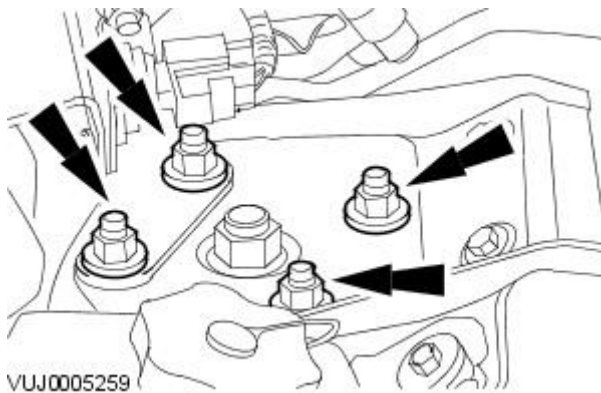


E31040

3. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

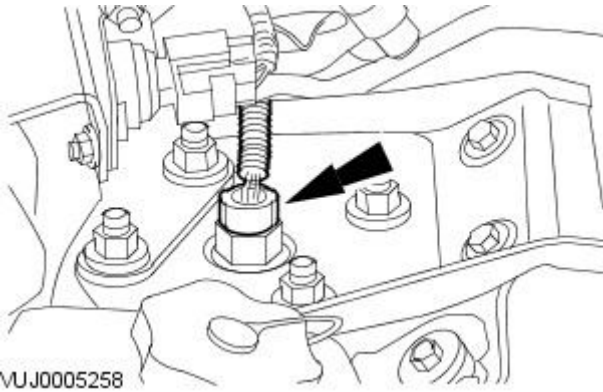
Install the front shock absorber and spring assembly.

- Tighten the nuts to 27 Nm.



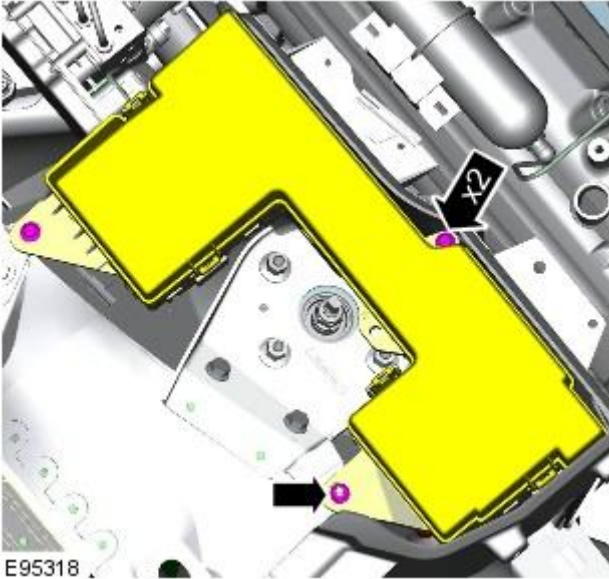
VUJ0005259

4. Connect the front shock absorber electrical connector.



VUJ0005258

5. Secure the fuse box.

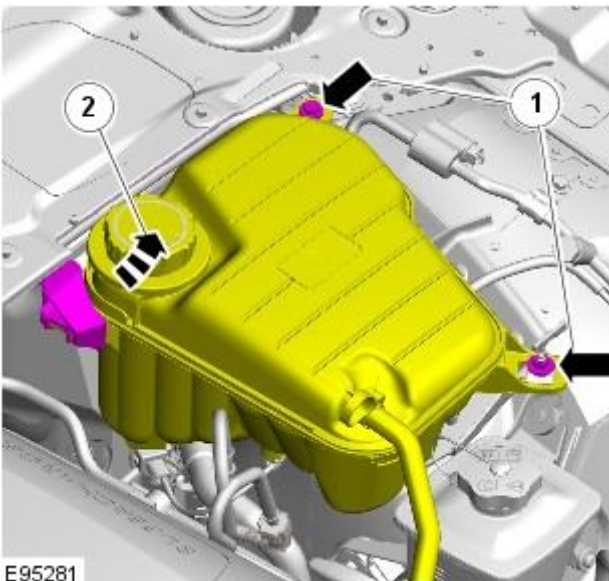


E95318

Vehicles with supercharger

6. Secure the coolant expansion tank.

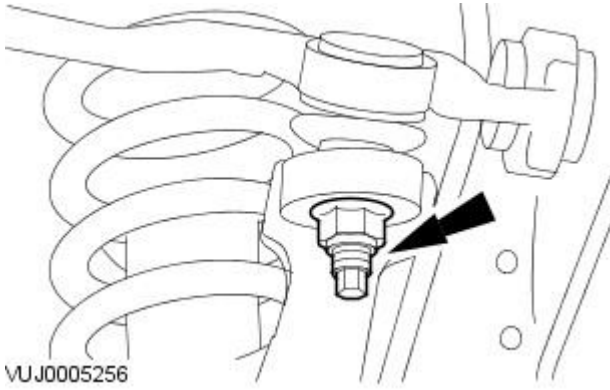
- Tighten to 10 Nm.



E95281


All vehicles

7. Raise the vehicle.



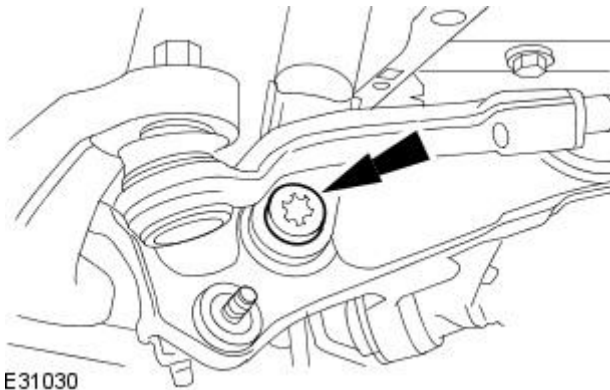
#### 8. CAUTIONS:

 Use an Allen key to prevent the ball joint rotating whilst installing the nut.

 Make sure the wheel knuckle is supported. Failure to follow these instructions may result in damage to the vehicle.

Secure the upper arm to the wheel knuckle.

- Tighten the nut to 90 Nm.



9. Connect the front shock absorber and spring assembly to the lower arm.

- Tighten the bolt to 175 Nm.

10. Install the front stabilizer bar link.

For additional information, refer to: [Front Stabilizer Bar Link](#) (204-01 Front Suspension, Removal and Installation).

11. Install the front wheel and tire.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).


12. Lower the vehicle.



## Front Suspension - Front Lower Arm

Removal and Installation

### Removal

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

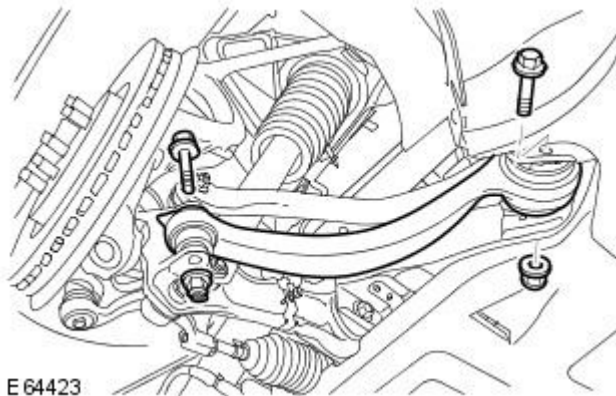
Raise and support the vehicle.

- Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).
- Remove the front wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
- NOTE:** Note the fitted position.

• **NOTE:** RH illustration shown, LH is similar

Release the front lower arm.

- Remove the 2 bolts and discard the nuts.



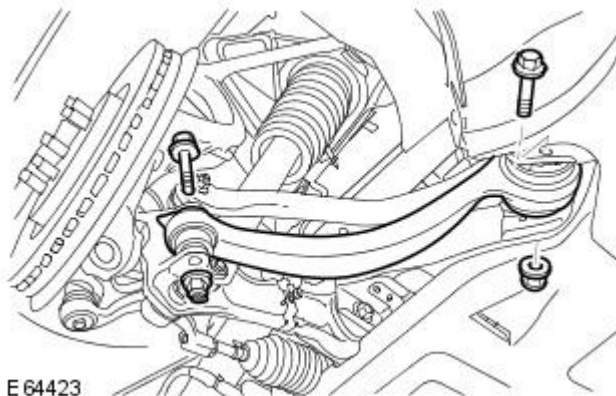
E64423

### Installation

- NOTE:** RH illustration shown, LH is similar

Install the front lower arm.

- Install the bolt and tighten the new nut to 60 Nm + 135 degrees.
- Install the front lower arm inner retaining nut and bolt, but do not fully tighten at this stage.

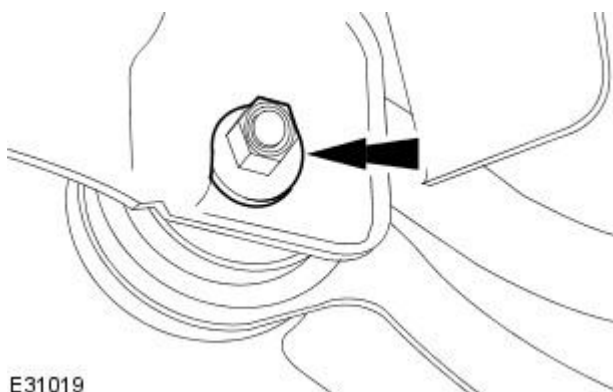


E64423

- Install the front wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
- Lower the vehicle.

-  **CAUTION:** The final tightening of the front lower arm inner retaining nut and bolt must be carried out with the vehicle on its wheels

Tighten the 14mm bolt to 175 Nm.



E31019


- 5.** Install the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).
- 6.** Lower the vehicle.
- 7.** Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment, and adjust if required.

## Front Suspension - Rear Lower Arm

Removal and Installation


Special Tool(s)	
 <p>204-327</p> <p>E63732</p>	Ball joint splitter 204-327

### Removal

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

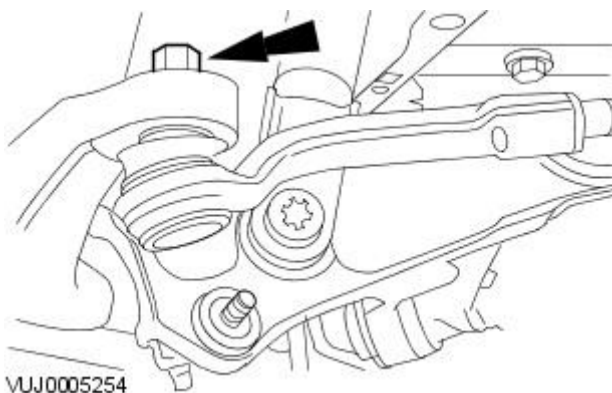
Raise the vehicle on a 4 post lift.

- Remove the engine undertray.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

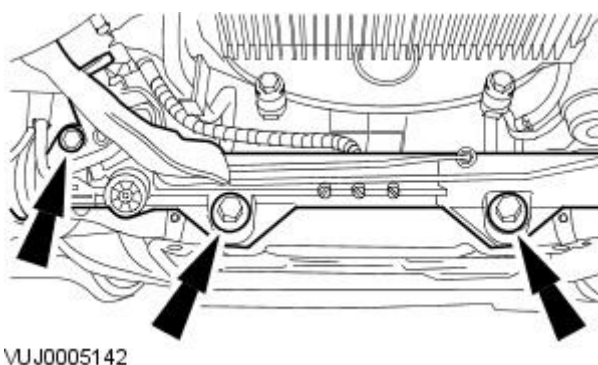
-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the body.

- Remove the wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
- Remove the stabilizer bar link.  
For additional information, refer to: [Front Stabilizer Bar Link](#) (204-01 Front Suspension, Removal and Installation).
- Release the tie rod.

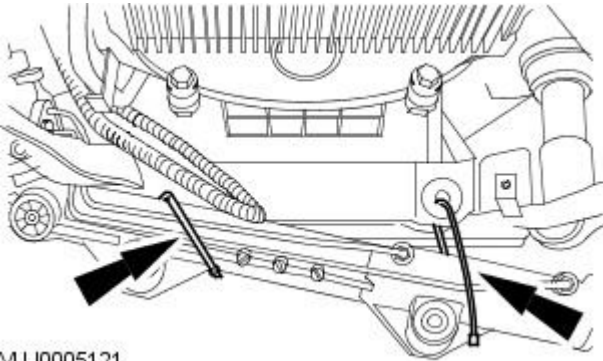


- Release the steering gear.



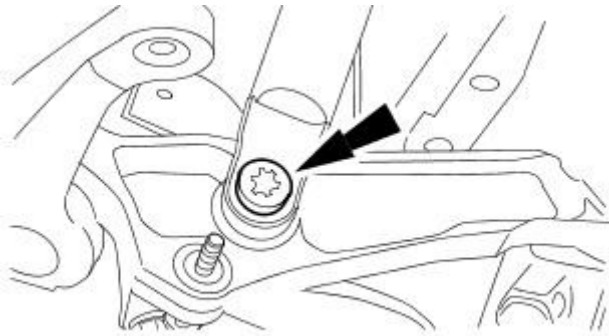


8. Secure the steering gear.



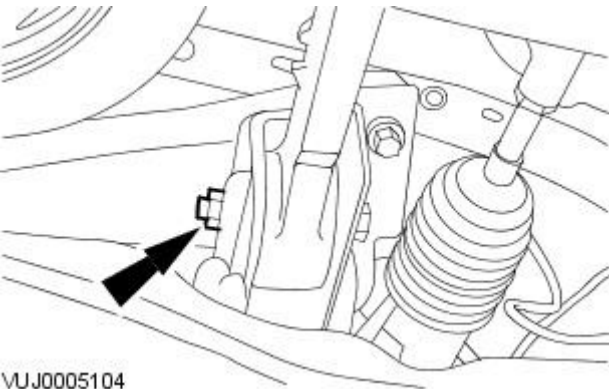
VUJ0005121

9. Release the shock absorber and spring assembly.



VUJ0005255

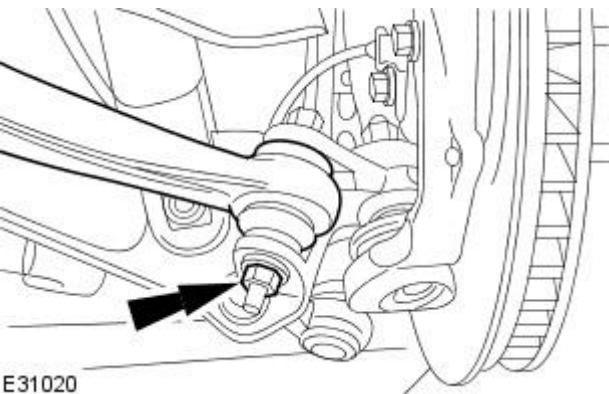
10. Remove the rear lower arm inner bolt.



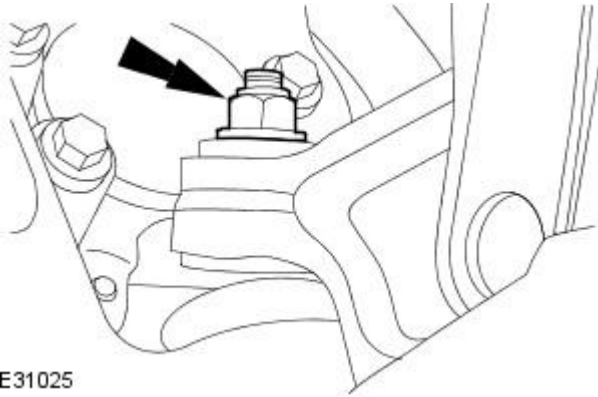
VUJ0005104


11. Release the front lower arm.

- Remove and discard the nut and bolt.



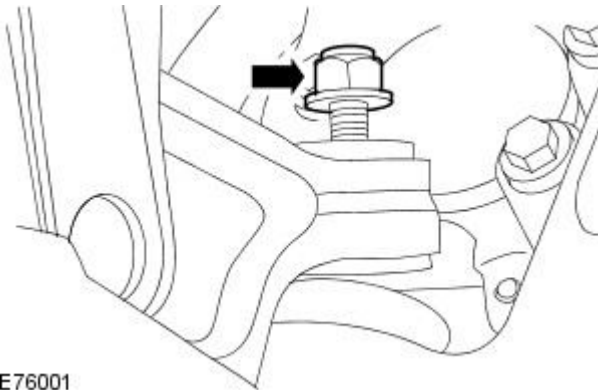
E31020




12.  CAUTION: Prevent the rear lower arm ball joint ball pin hexagon from rotating. Failure to follow this instruction may result in damage to the lower ball joint boot.

Loosen the rear lower arm ball joint retaining nut.

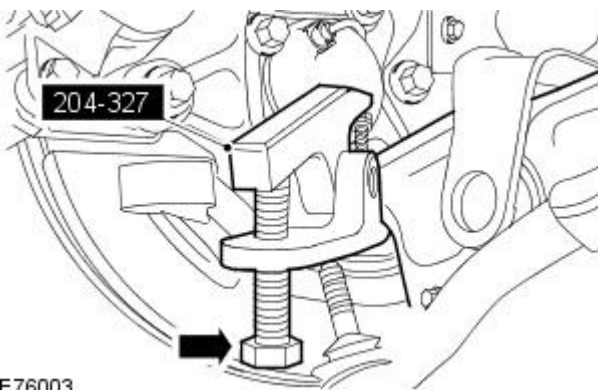
E31025




13.  CAUTION: Prevent the rear lower arm ball joint ball pin hexagon from rotating. Failure to follow this instruction may result in damage to the lower ball joint boot.

Adjust the rear lower arm ball joint retaining nut until the ball joint thread cannot be seen.


E76001



14.  WARNING: Make sure the special tool is supported while carrying out the operation. Failure to follow this instruction may result in personal injury.

• CAUTIONS:

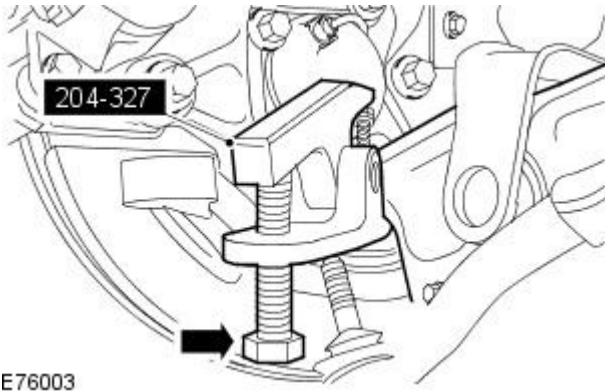
 Make sure the special tool is supported while carrying out the operation. Failure to follow this instruction may result in damage to the special tool.

 Make sure the special tool is correctly located and the lower ball joint boot is not damaged while carrying out the operation. Failure to follow this instruction may result in damage to the component.


E76003

Using the special tool, release the rear lower arm ball joint from the wheel knuckle lower pivot.

- Tighten the special tool adjusting bolt to a maximum of 60 Nm.
- If the rear lower arm ball joint releases from the wheel knuckle lower pivot, using no more than 60 Nm on the special tool adjusting bolt, proceed to step 13.
- If the rear lower arm ball joint does not release from the wheel knuckle lower pivot, using no more than 60 Nm on the special tool adjusting bolt, proceed to step 12.




E76003

**15.**  **WARNING:** Make sure the special tool is supported while carrying out the operation. Failure to follow this instruction may result in personal injury.

• **CAUTIONS:**

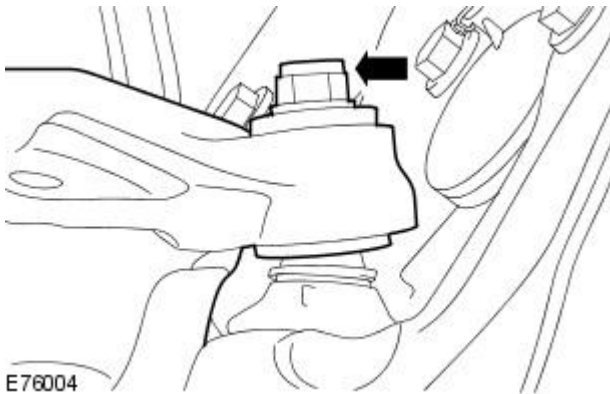
 Make sure the special tool is supported while carrying out the operation. Failure to follow this instruction may result in damage to the special tool.

 Make sure the special tool is correctly located and the lower ball joint boot is not damaged while carrying out the operation. Failure to follow this instruction may result in damage to the component.


• **NOTE:** Do not carry out this step if the rear lower arm ball joint released from the wheel knuckle lower pivot in step 12.

Using the special tool, release the rear lower arm ball joint from the wheel knuckle lower pivot.

- Tighten the special tool adjusting bolt to a maximum of 60 Nm.
- Strike the top surface of the special tool directly above the rear lower arm ball joint at the point indicated using a copper mallet.



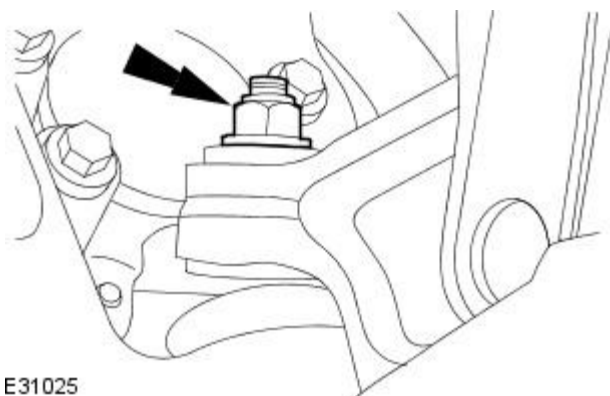
E76004

**16.**  **CAUTION:** Prevent the rear lower arm ball joint ball pin hexagon from rotating. Failure to follow this instruction may result in damage to the lower ball joint boot.


Remove the rear lower arm.


- Remove and discard the retaining nut.

## Installation



E31025

**1.**  **WARNING:** Make sure that a new lower arm ball joint nut is installed.

 **CAUTION:** Prevent the rear lower arm ball joint ball pin hexagon from rotating. Failure to follow this instruction may result in damage to the lower ball joint boot.

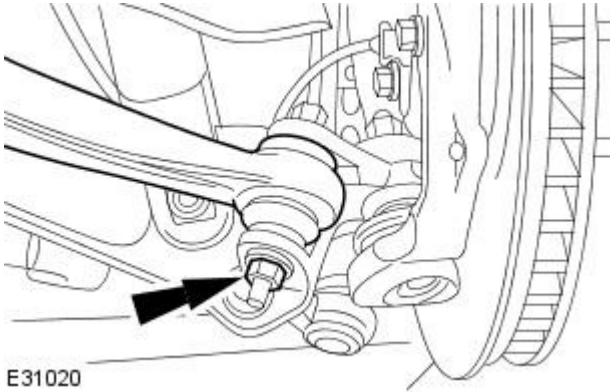
Install the rear lower arm.

- Tighten the nut to 92 Nm.

**2. NOTE:** Install a new retaining nut and bolt.

Secure the front lower arm.

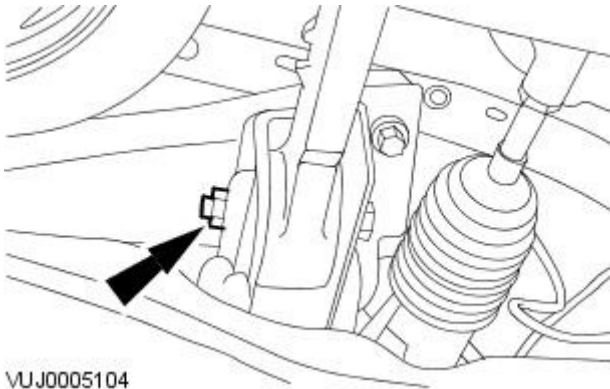
- Stage 1: Tighten to 60 Nm.
- Stage 2: Tighten to a further 135 degrees.



E31020

**3. Secure the rear lower arm.**

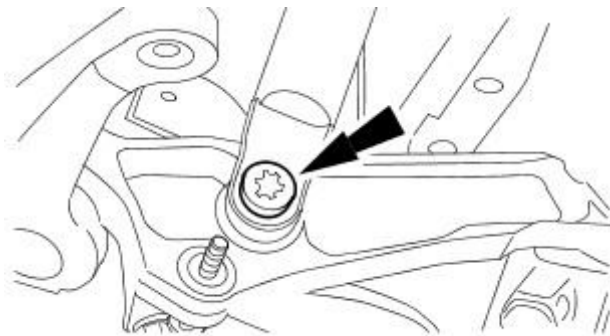
- Install the rear lower arm inner retaining nut, but do not tighten fully at this stage.



VUJ0005104

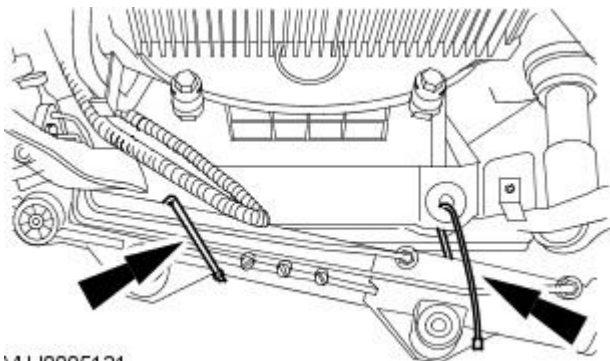
**4. Install the shock absorber and spring assembly.**

- Tighten the bolt to 175 Nm.

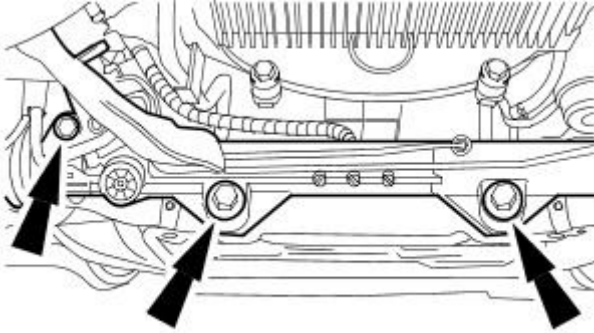


VUJ0005255

**5. Remove and discard the retaining straps.**



VUJ0005121



VUJ0005142

6. Install the steering gear.

- Tighten the bolts to 100 Nm.

7. Secure the tie rod end.

- Tighten the nut to 55 Nm.


8. Install the stabilizer bar link.

For additional information, refer to: [Front Stabilizer Bar Link](#) (204-01 Front Suspension, Removal and Installation).

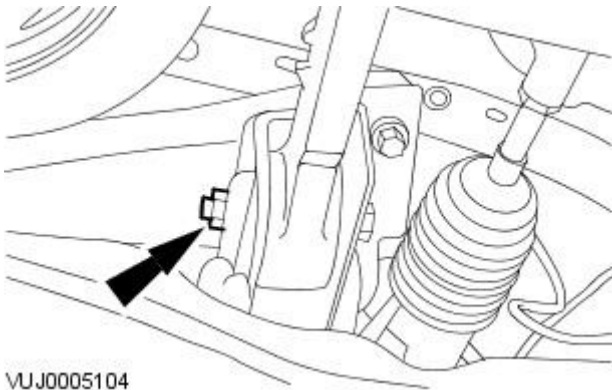
9. Install the wheel and tire.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

10. Lower the body.

11.  **CAUTION:** The final tightening of the upper arm must be carried out with the vehicle on it's wheels.

Tighten to 175 Nm.



VUJ0005104

12. Install the engine undertray.



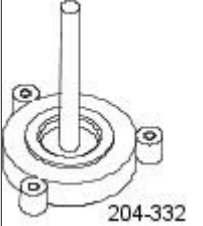
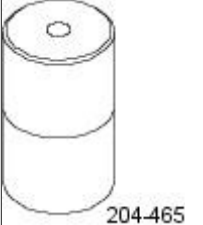

For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

13. Using only four-wheel alignment equipment approved by Jaguar, check and adjust the wheel alignment.

For additional information, refer to: [Camber and Caster Adjustment](#) (204-00 Suspension System - General Information, General Procedures).

## Front Suspension - Rear Lower Arm Bushing

Removal and Installation

Special Tool(s)	
	Rear lower arm bushing remover and installer 204-464
	Rear lower arm bushing remover 204-333
	Rear lower arm bushing installer 204-332
	Rear lower arm bushing installer 204-465
	Rear lower arm bushing installer 204-334

### Removal



**CAUTION:** Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

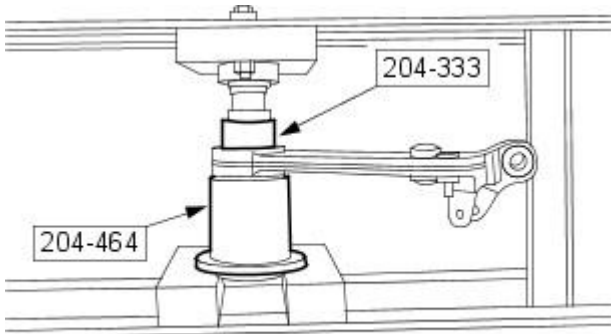


**1. WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

**2.** Remove the rear lower arm.  
For additional information, refer to: [Rear Lower Arm](#) (204-01 Front Suspension, Removal and Installation).



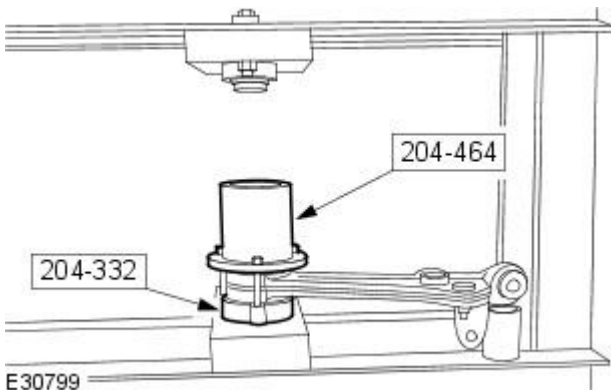


E30798

3. NOTE: Note the fitted position.

Using the special tools, remove and discard the lower arm rear bushings.

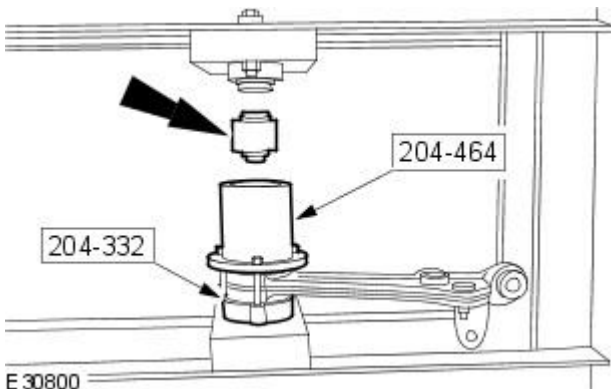
### Installation



E30799

1. Install the special tools to the rear lower arm.

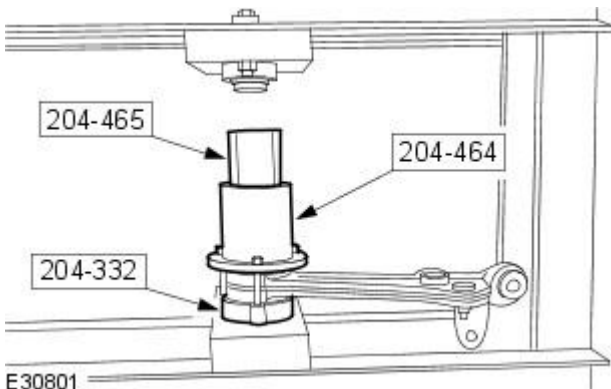
- Tighten the bolts.



E 30800

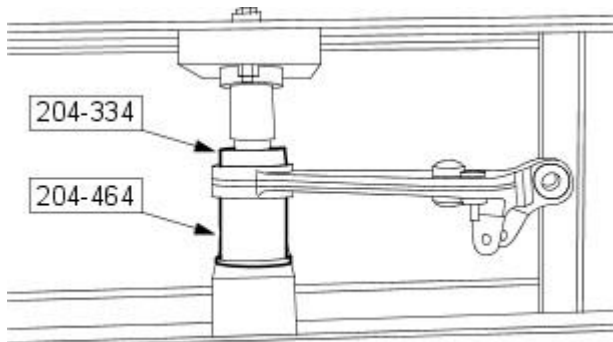
2. NOTE: Align to the position noted on removal.

Position the bushing in the special tool.



E30801

3. Using the special tools, partially install the lower arm bushing.



E30802

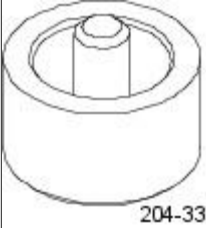
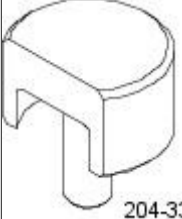

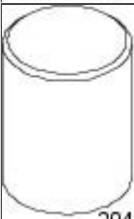
4. Change the special tools, then complete installation of the bushing.

5. Install the rear lower arm.  
For additional information, refer to: [Rear Lower Arm](#) (204-01 Front Suspension, Removal and Installation).



## Front Suspension - Shock Absorber Bushing


Removal and Installation

Special Tool(s)	
	Replacer support-bush 204-337
	Replacer-bush 204-338
	Remover-bush 204-336
	Remover support-bush 204-335

### Removal



**CAUTION:** Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

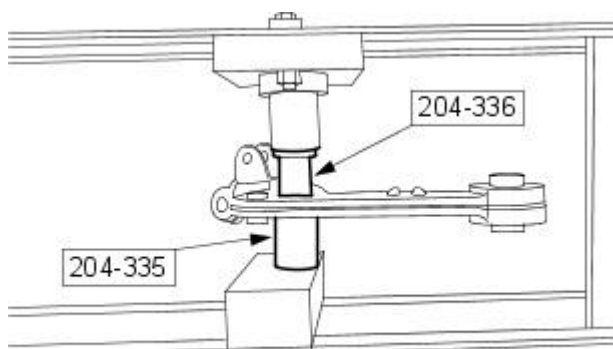
-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise the vehicle on a 4 post lift.

- Remove the rear lower arm.  
For additional information, refer to: [Rear Lower Arm](#) (204-01 Front Suspension, Removal and Installation).

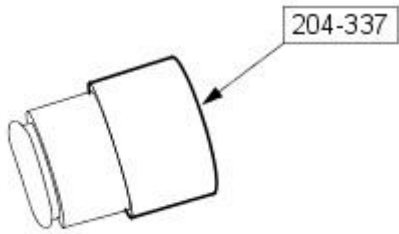
- NOTE:** Take note of the fitted position of the bush.

Using the special tools, remove the shock absorber bushing.



E30779

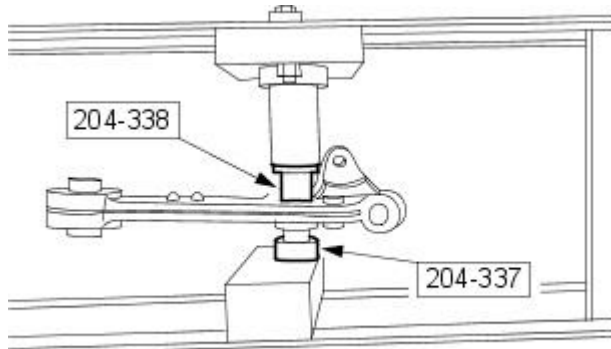
### Installation



**1. NOTE:** Make sure the shock absorber bushing boot is correctly located into the special tool.

Install the bushing into the special tool.

E30781



**2. NOTE:** Align to the position noted on removal.

Using the special tools, install the shock absorber bushing.

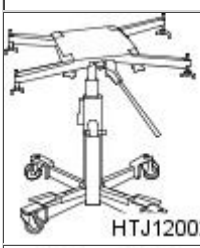
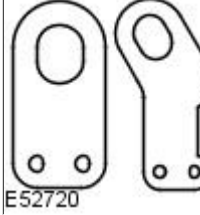

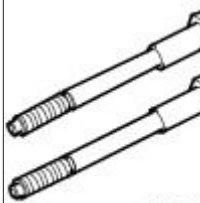
E30782

**3.** Install the rear lower arm.

For additional information, refer to: [Rear Lower Arm](#) (204-01 Front Suspension, Removal and Installation).

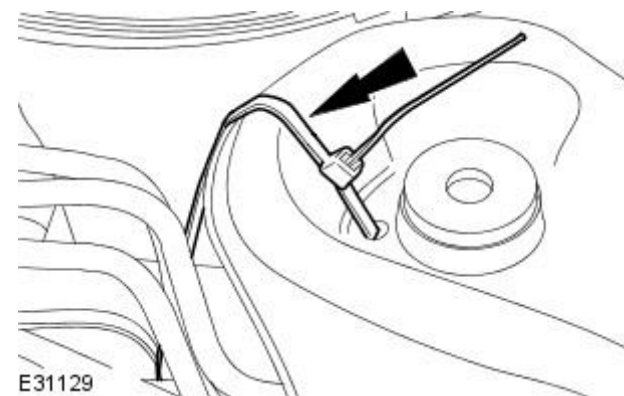
# Front Suspension - Front Stabilizer BarTDV6 2.7L Diesel

Removal and Installation

Special Tool(s)	
 <p>HTJ1200-2</p>	<p>Powertrain Assembly Jack HTJ1200-2</p>
 <p>E52720</p>	<p>Engine Lifting Brackets 303-1129</p>
 <p>303-021</p>	<p>Engine Support Bracket 303-021</p>
 <p>502-005</p>	<p>Subframe Alignment Bolt 502-005</p>

## Removal

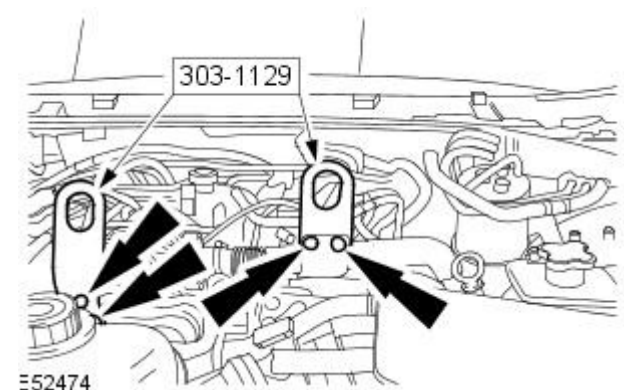
1. Disconnect the battery ground cable.  
For additional information, refer to: Battery Disconnect and Connect (414-01, General Procedures).
2. Using suitable [tie straps](#), secure the radiator.



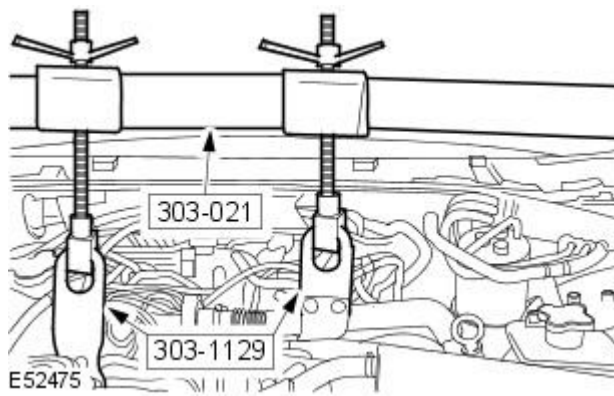
3. Remove the intake air shutoff throttle.  
For additional information, refer to: Intake Air Shutoff Throttle (303-04A, Removal and Installation).


4.  **CAUTION:** Protect the paintwork during this operation.

Install the special tool.



5. Install the special tool.



6.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

7. Remove both the front wheel and tires.

For additional information, refer to: Wheel and Tire (204-04, Removal and Installation).

8. Remove the air deflector.

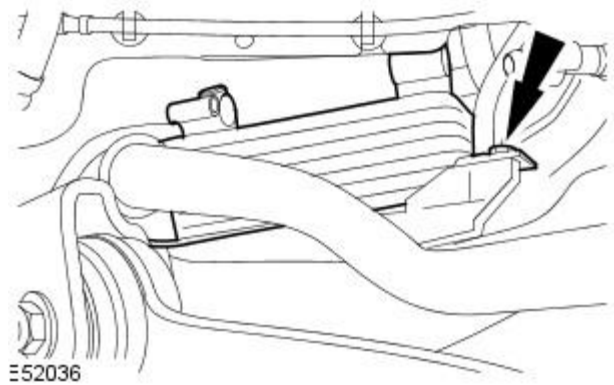
For additional information, refer to: Air Deflector (501-02, Removal and Installation).

9. Remove the radiator splash shield.

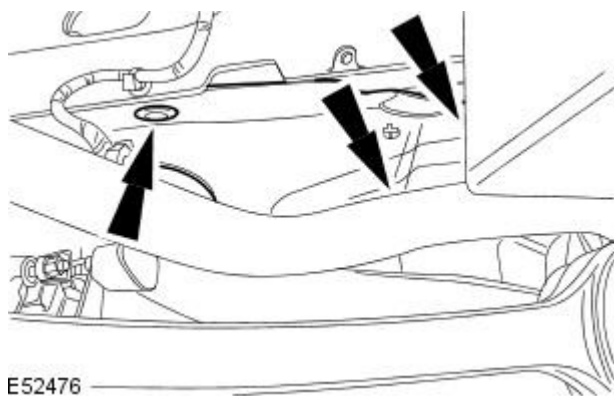
For additional information, refer to: Radiator Splash Shield (501-02, Removal and Installation).

10. Detach the transmission fluid cooler.

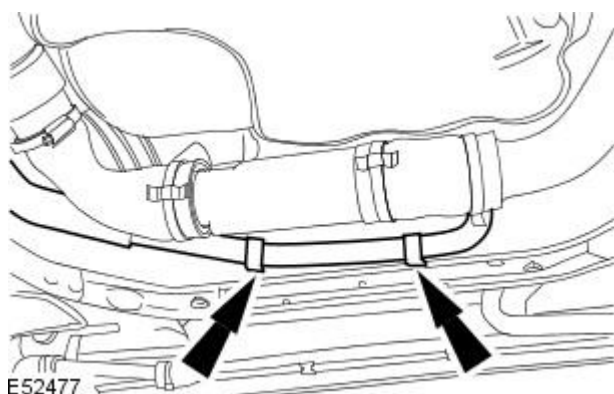
- Tie aside.



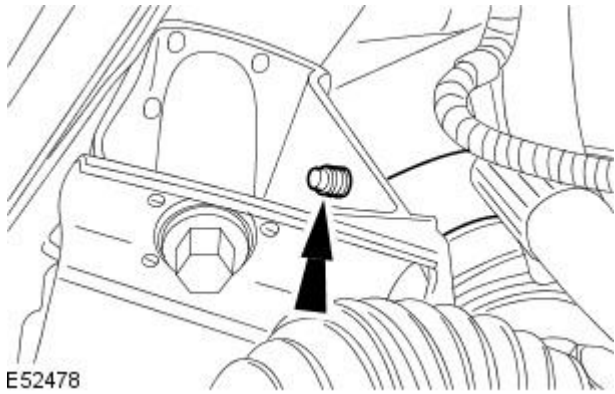
11. Remove the right-hand splash shield.



12. Detach the engine coolant inlet pipe from the front subframe.



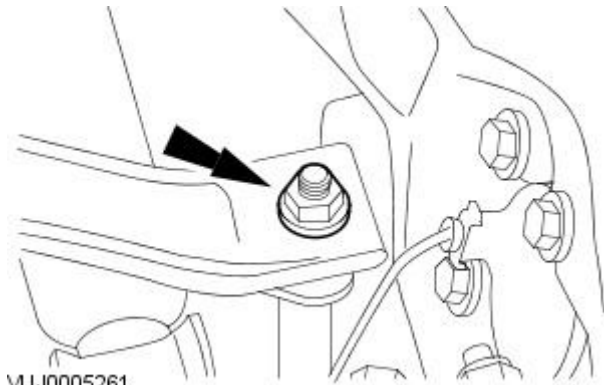
13. Detach the power steering hose retaining clip from the front subframe.



E52478

14. NOTE: Left-hand shown, right-hand similar.

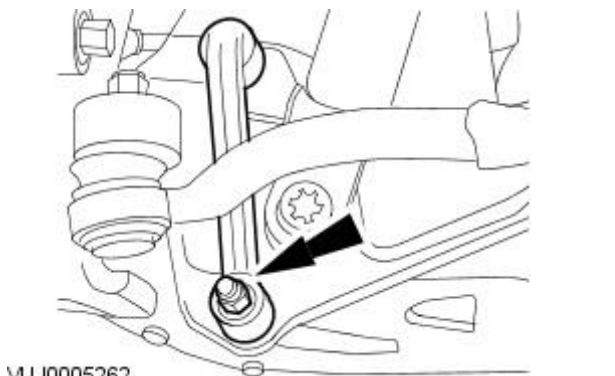
Remove the front stabilizer bar link upper retaining nut.



VUJ0005261

15. NOTE: Left-hand shown, right-hand similar.

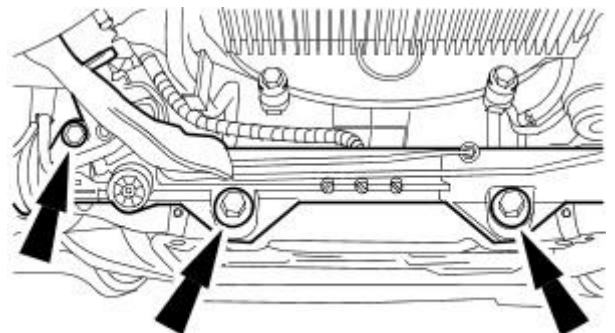
Remove the front stabilizer bar link lower retaining bolt and nut and remove the front stabilizer bar link.



VUJ0005262

16. Detach the steering gear.

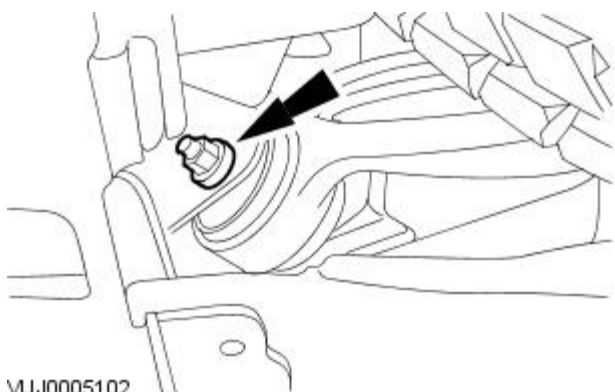
- Secure the steering gear.



VUJ0005142

17. NOTE: Left-hand shown, right-hand similar.

Release the front lower arm and position it to one side.

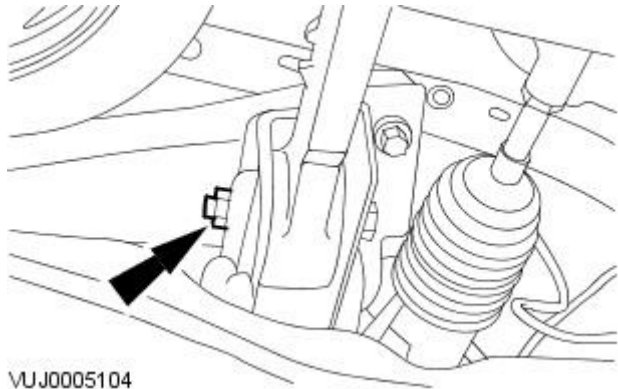


VUJ0005102



18. NOTE: Left-hand shown, right-hand similar.

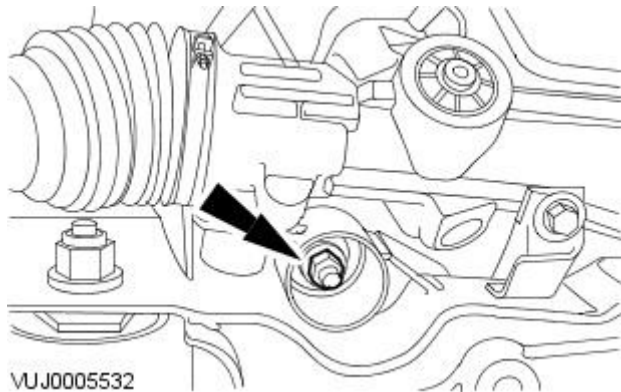
Release the rear lower arm and position it to one side.



VUJ0005104

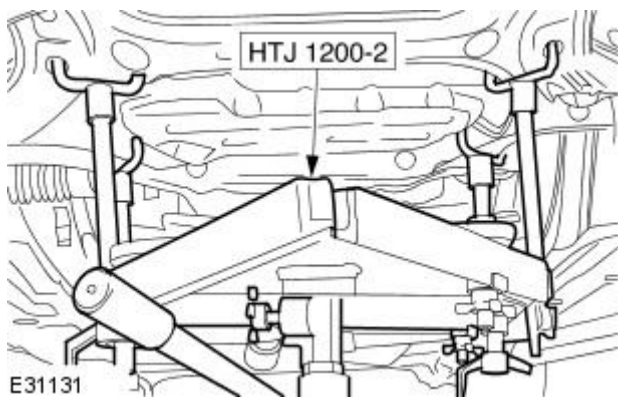
19. NOTE: Left-hand shown, right-hand similar.

Remove the engine mount retaining nut.



VUJ0005532

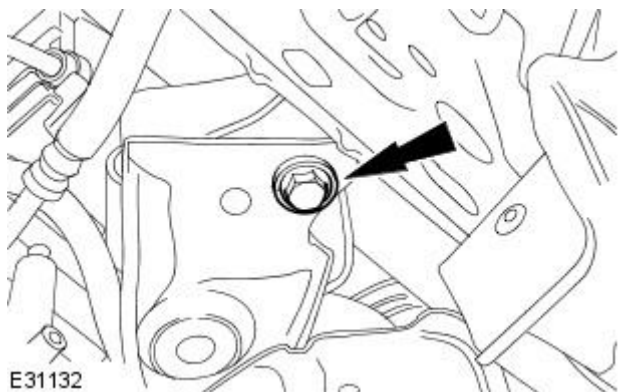
20. Install the special tool to the front subframe.



E31131

21. NOTE: Left-hand shown, right-hand similar.

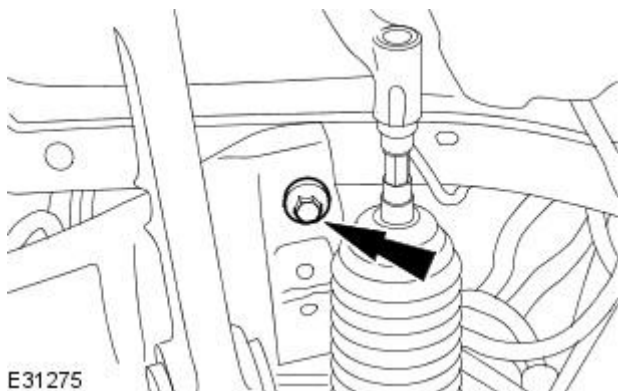
Remove the front subframe front retaining bolt.




E31132

22. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe rear retaining bolt.



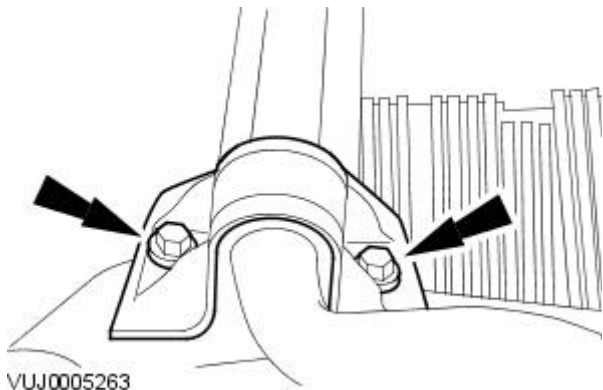
E31275

23.  CAUTION: When lowering the special tool care must be taken to manoeuvre the special tool so that the front subframe does not touch the air conditioning (A/C) pipes. Failure to follow this instruction may result in damage to the A/C pipes.

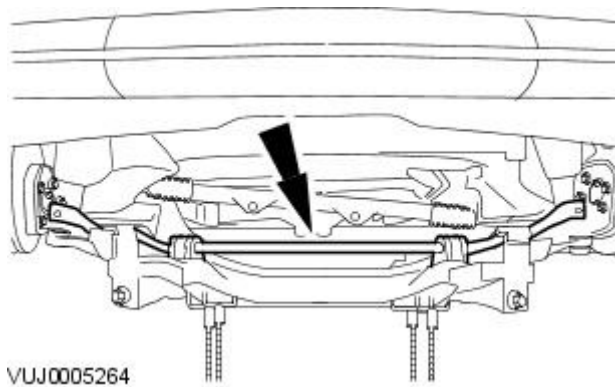
Lower the special tool by approximately 200 mm (7.9 in).

24. NOTE: Left-hand shown, right-hand similar.

Remove the front stabilizer bar clamp.

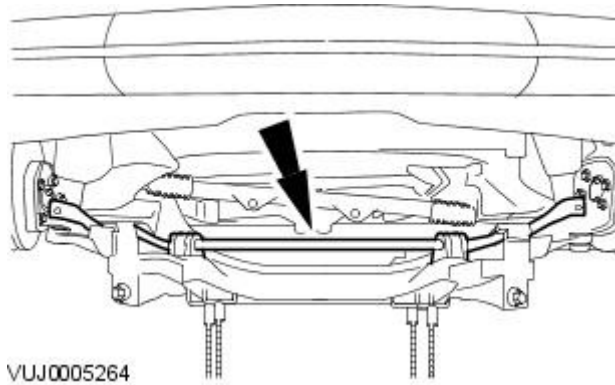


25. Remove the front stabilizer bar.



## Installation

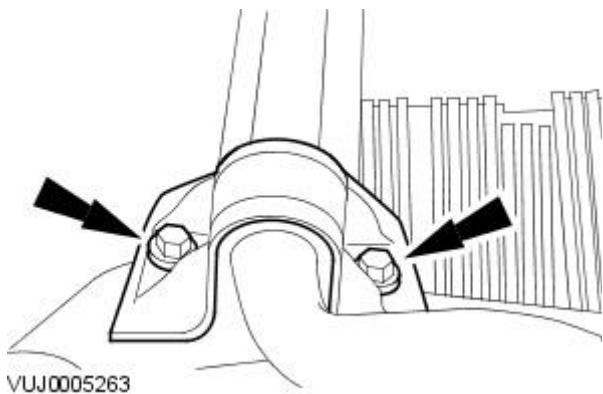
1. Install the front stabilizer bar.

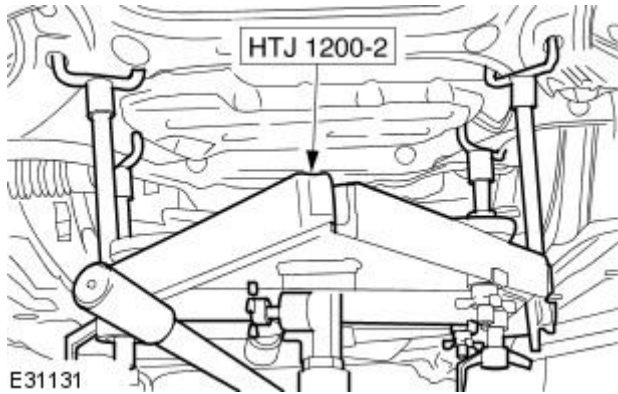



2. NOTE: Left-hand shown, right-hand similar.

Install the front stabilizer bar clamp.

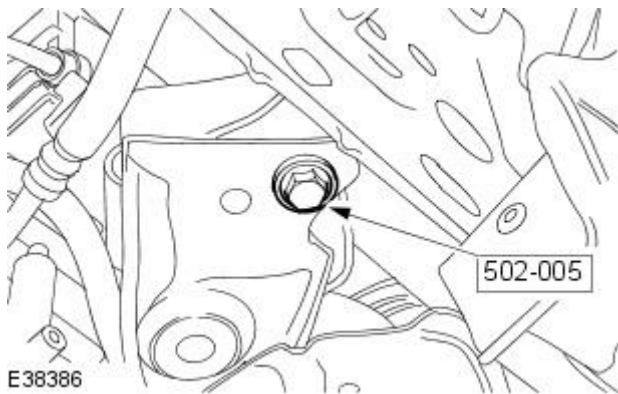
- Tighten to 55 Nm.





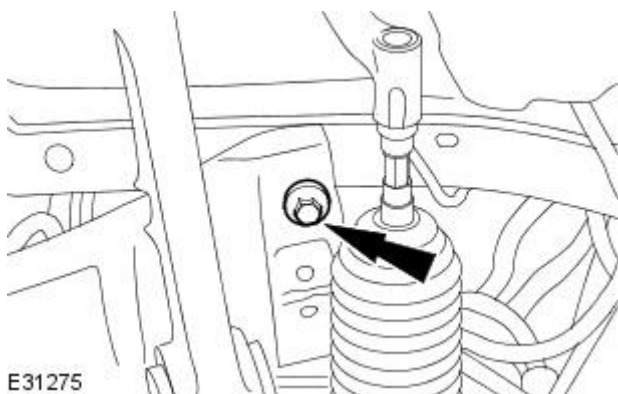
3.  CAUTION: When raising the special tool care must be taken to manoeuvre the special tool so that the front subframe does not touch the air conditioning (A/C) pipes. Failure to follow this instruction may result in damage to the A/C pipes.

Install the front subframe.



4. NOTE: Left-hand shown, right-hand similar.

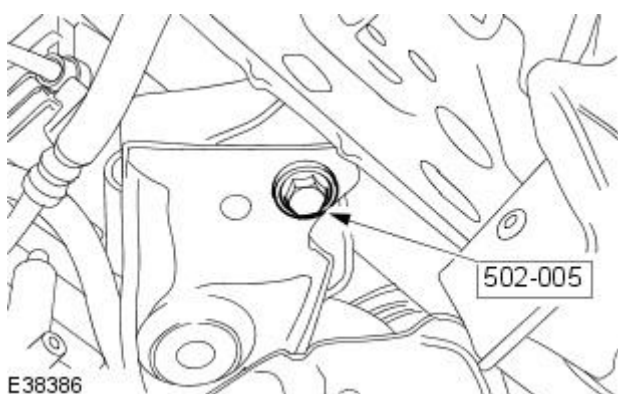
Install the special tool.



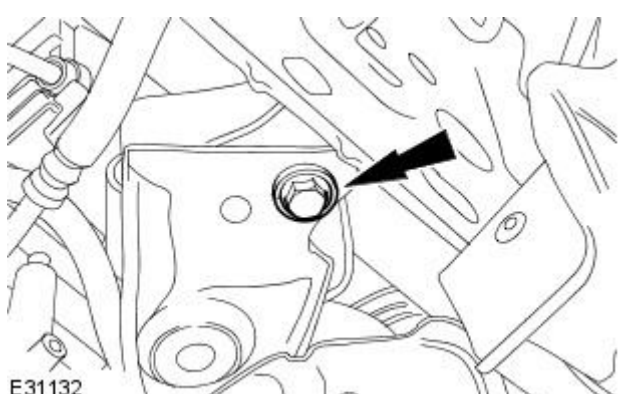
5. NOTE: Left-hand shown, right-hand similar.

Install the front subframe rear retaining bolt.

- Tighten to 150 Nm + 240°.



6. Remove the special tool.

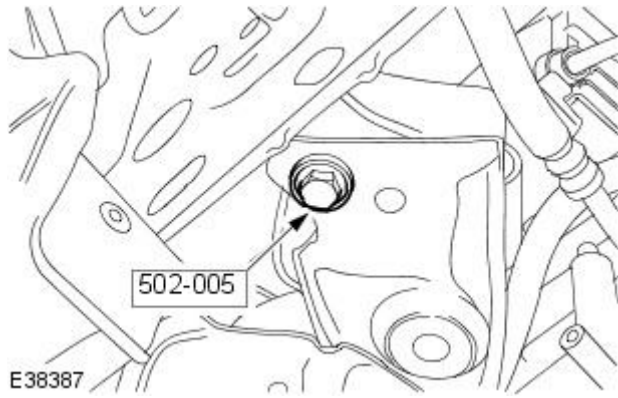


7. Install the front subframe front retaining bolt.

- Tighten to 150 Nm + 240°.

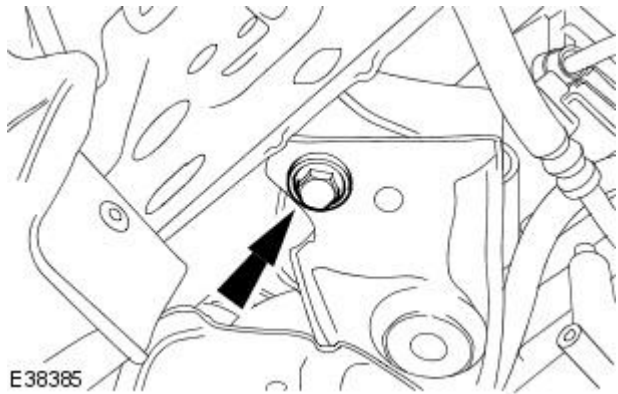


8. Remove the special tool.

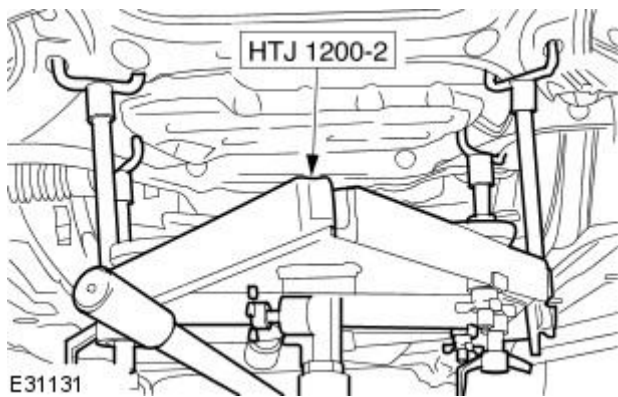


9. Install the front subframe front retaining bolt.

- Tighten to 150 Nm + 240°.



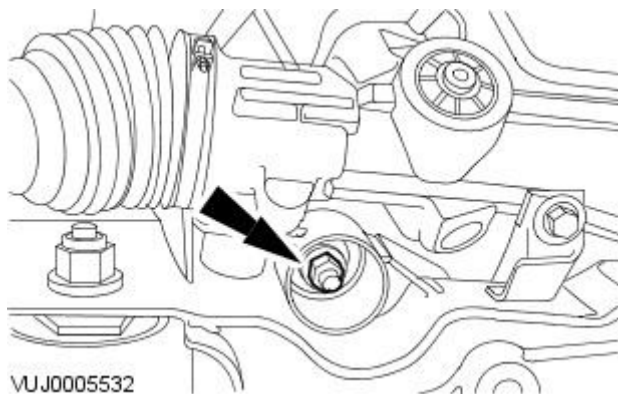
10. Remove the special tool.



11. NOTE: Left-hand shown, right-hand similar.

Install the engine mount retaining nut.

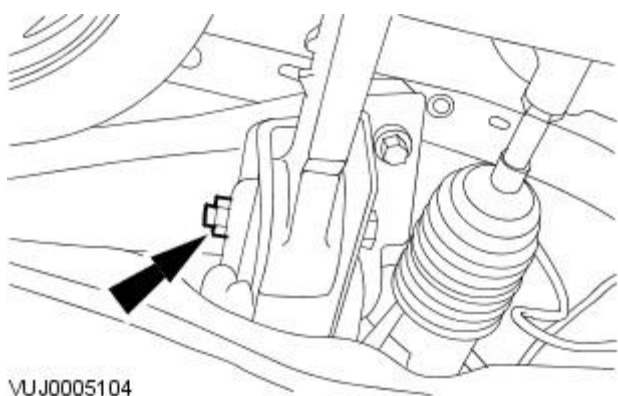
- Tighten to 63 Nm.

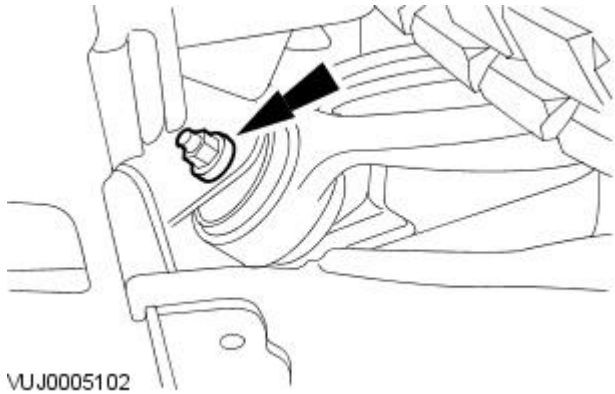


12.  CAUTION: The final tightening of the rear lower arm inner retaining nut and bolt must be carried out with the vehicle on its wheels.

• NOTE: Left-hand shown, right-hand similar.

Install the rear lower arm.

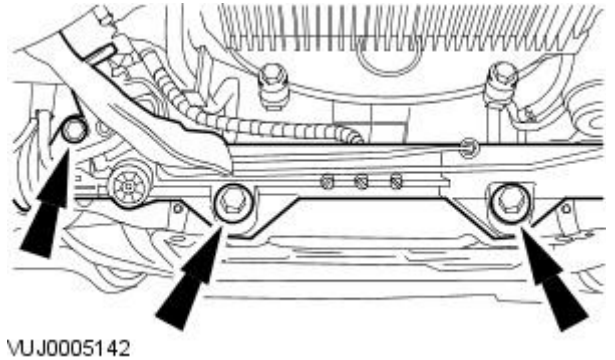




13.  CAUTION: The final tightening of the front lower arm inner retaining nut and bolt must be carried out with the vehicle on its wheels.

• NOTE: Left-hand shown, right-hand similar.

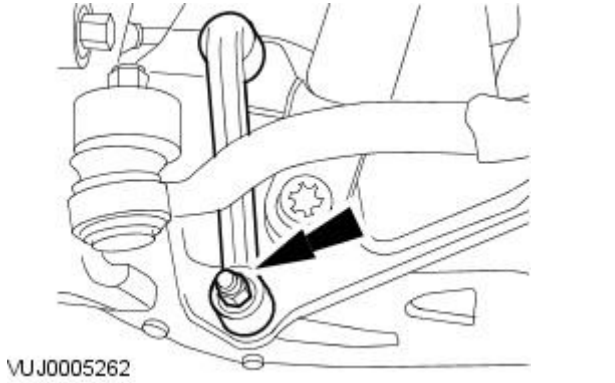
Install the front lower arm.



14. NOTE: Left-hand shown, right-hand similar.

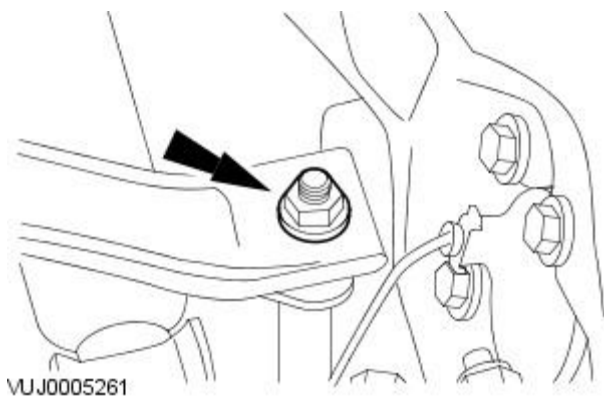
Install the steering gear.

- Tighten to 100 Nm.



15. NOTE: Left-hand shown, right-hand similar.

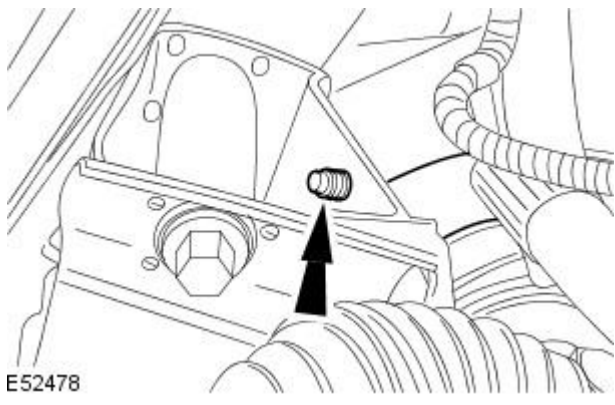
Install the front stabilizer bar link.



16. NOTE: Left-hand shown, right-hand similar.

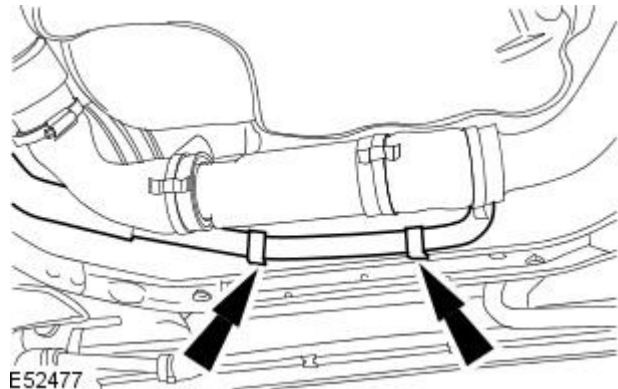
Attach the front stabilizer bar link and install the front stabilizer bar link retaining nut.

- Tighten to 43 Nm.

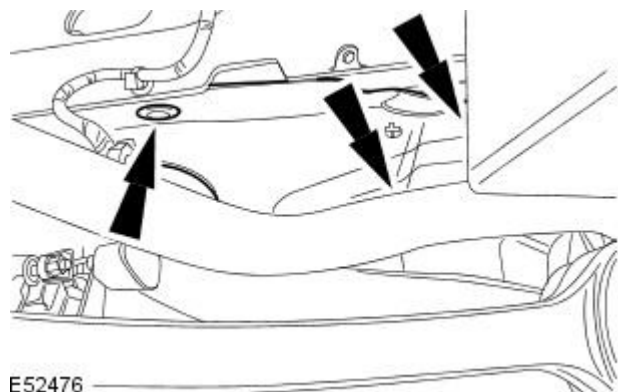


17. Attach the power steering hose retaining clip to the front subframe.

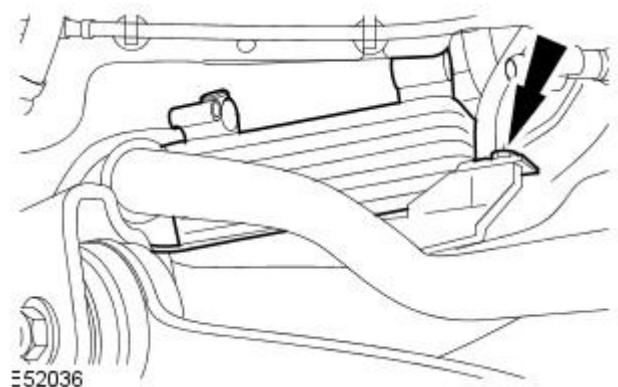
18. Attach the engine coolant inlet pipe to the front subframe.



19. Install the right-hand splash shield.



20. Attach the transmission fluid cooler.



21. Install the radiator splash shield.

For additional information, refer to: Radiator Splash Shield (501-02, Removal and Installation).

22. Install the air deflector.

For additional information, refer to: Air Deflector (501-02, Removal and Installation).

23. Install both the front wheel and tires.

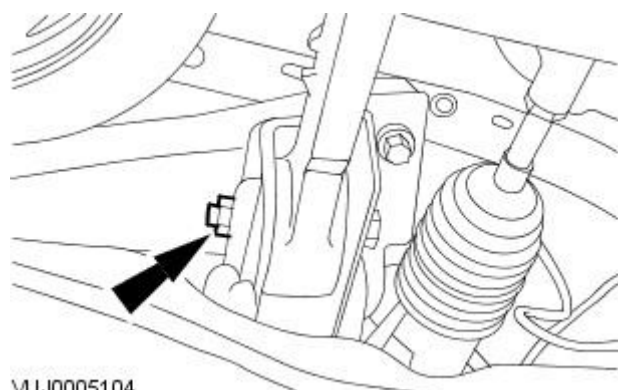
For additional information, refer to: Wheel and Tire (204-04, Removal and Installation).

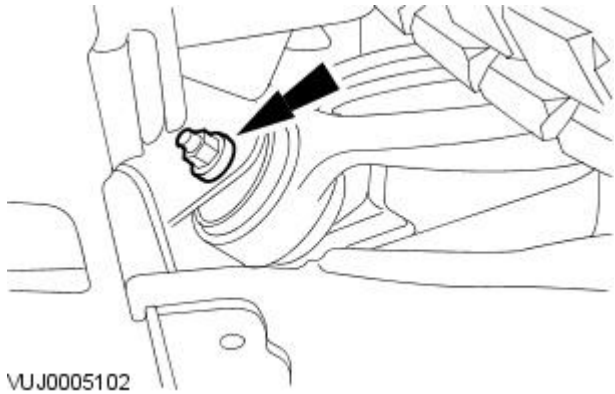
24. Lower the vehicle.

25.  **CAUTION:** The final tightening of the rear lower arm inner retaining nut and bolt must be carried out with the vehicle on its wheels.

• **NOTE:** Left-hand shown, right-hand similar.

Tighten to 175 Nm.

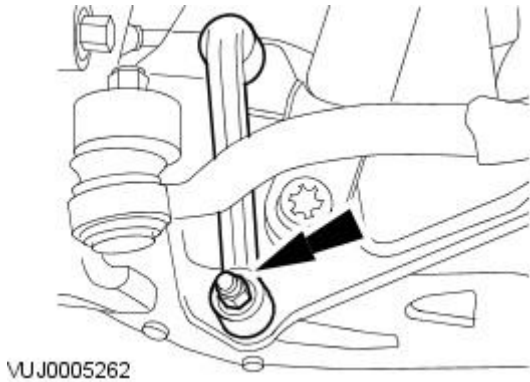




26.  CAUTION: The final tightening of the front lower arm inner retaining nut and bolt must be carried out with the vehicle on its wheels.

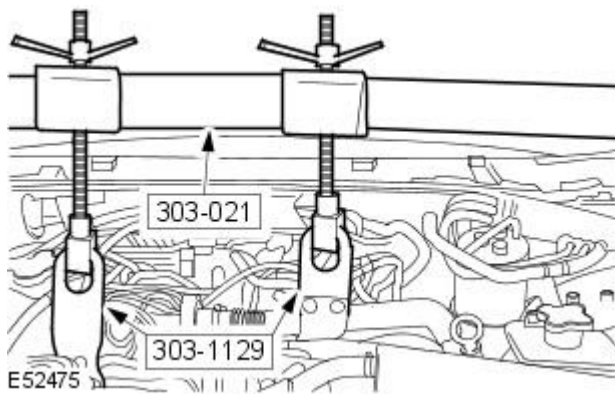
• NOTE: Left-hand shown, right-hand similar.

Tighten to 175 Nm.



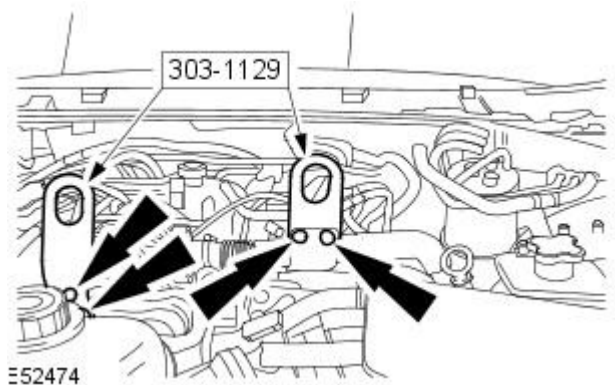
27. NOTE: Left-hand shown, right-hand similar.

Tighten to 70 Nm.



28.  CAUTION: Protect the paintwork during this operation.

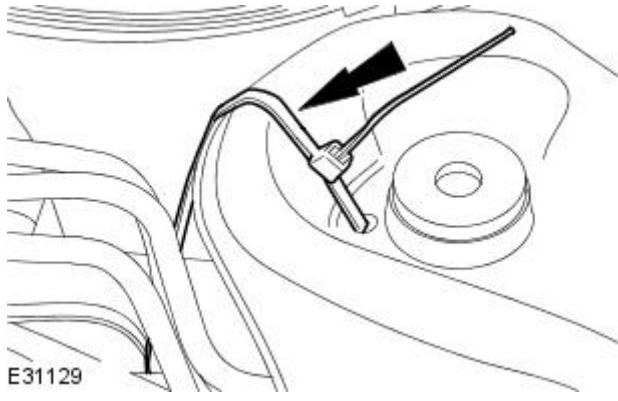
Remove the special tool.



29. Remove the special tool.

30. Install the intake air shutoff throttle.  
For additional information, refer to: Intake Air Shutoff Throttle (303-04A, Removal and Installation).

31. Remove the radiator support.

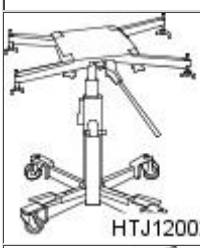
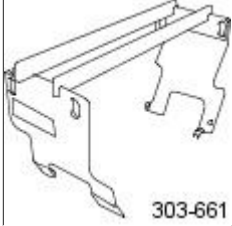




32. Using only four-wheel alignment equipment approved by Jaguar, check and adjust the wheel alignment.  
For additional information, refer to: Four-Wheel Alignment (204-00, General Procedures).



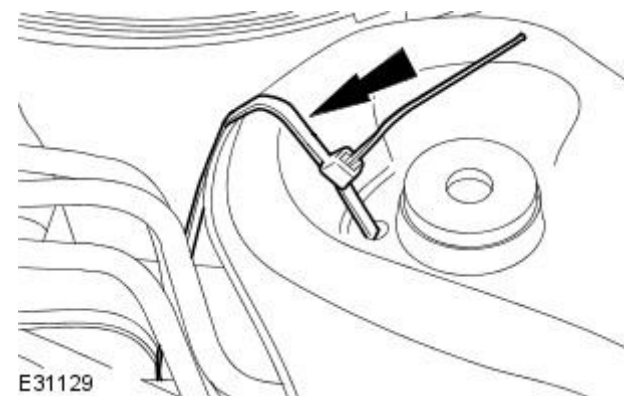
# Front Suspension - Front Stabilizer BarV6 3.0L Petrol

## Removal and Installation

Special Tool(s)	
 <p>HTJ1200-2</p>	Power train assembly jack HTJ1200-2
 <p>303-661</p>	Engine lifting bracket 303-661
 <p>303-021</p>	Engine support bracket 303-021
 <p>502-005</p>	Subframe Alignment Bolt 502-005

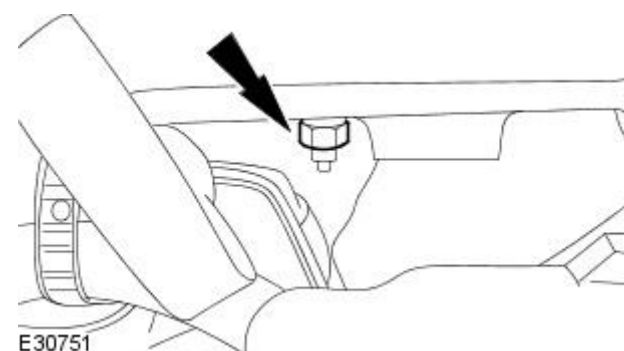
### Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Using suitable [tie straps](#), secure the radiator.



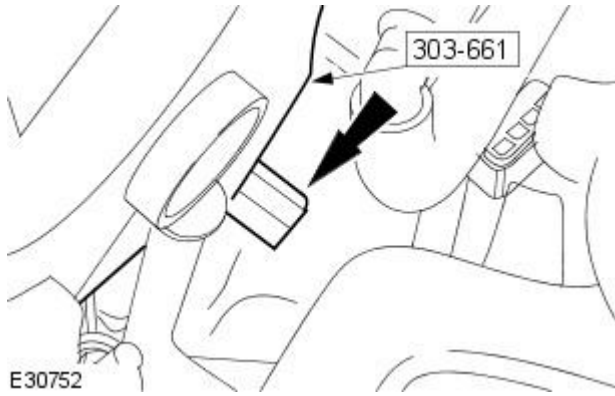
3. **NOTE:** Left-hand shown, right-hand similar.

Loosen the exhaust manifold retaining nut.



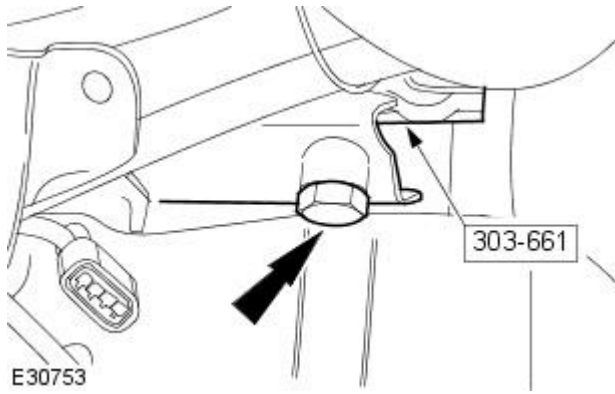
4. Install the special tool to the exhaust manifold.

- Install the retaining bolt.

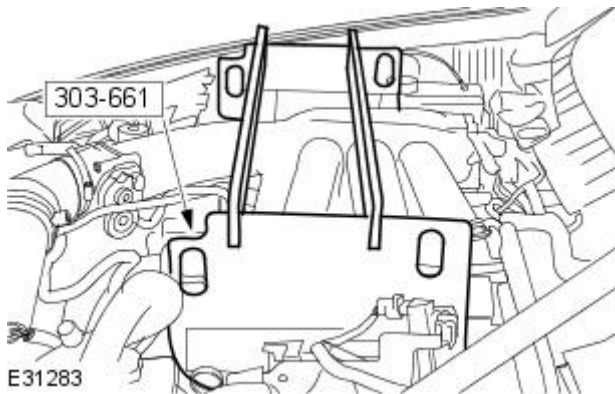


5. NOTE: Left-hand shown, right-hand similar.

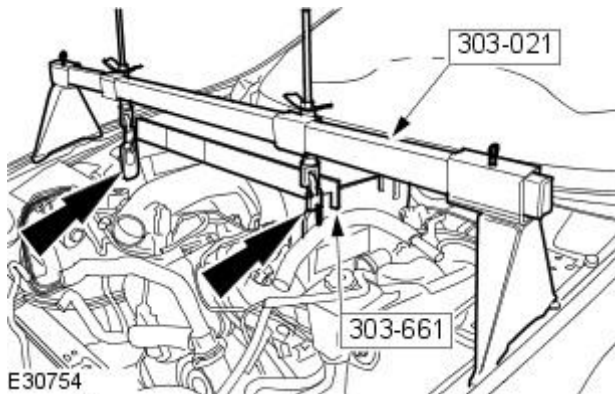
Install the retaining bolt.



6. Install the special tool support bars to the special tool.



7. Install the special tool.



**8. ⚠ WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

9. Remove both the front wheel and tires.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

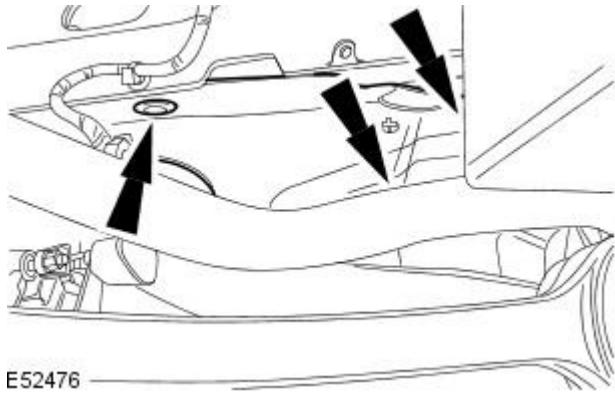
10. Remove the air deflector.

For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

11. Remove the radiator splash shield.

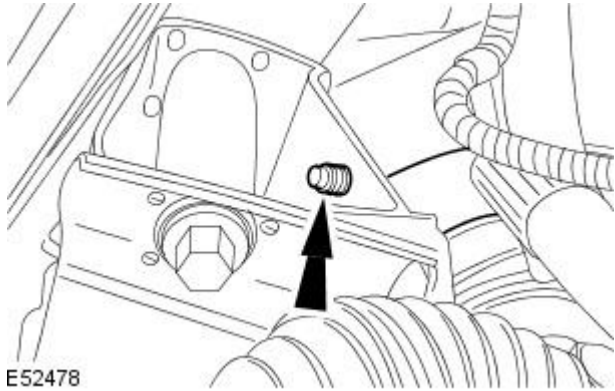
For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

12. Remove the right-hand splash shield.



E52476

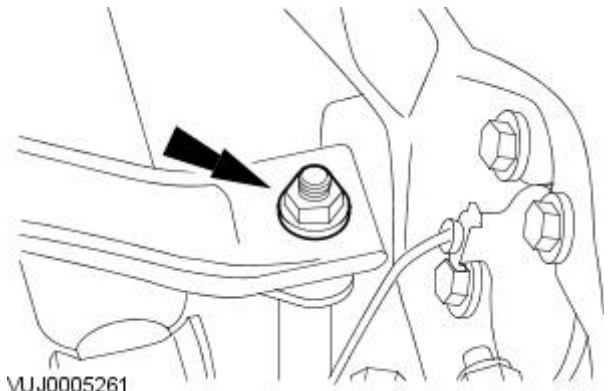
13. Detach the power steering hose retaining clip from the front subframe.



E52478

14. NOTE: Left-hand shown, right-hand similar.

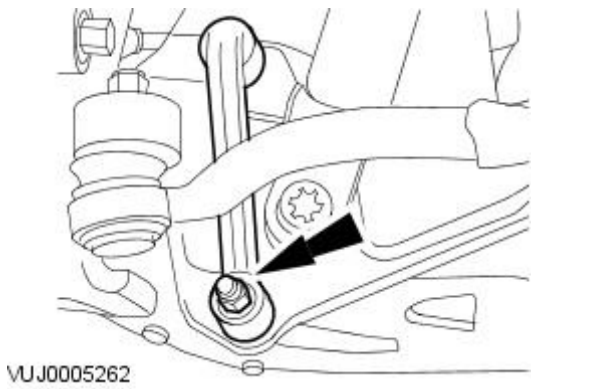
Remove the front stabilizer bar link upper retaining nut.



VUJ0005261

15. NOTE: Left-hand shown, right-hand similar.

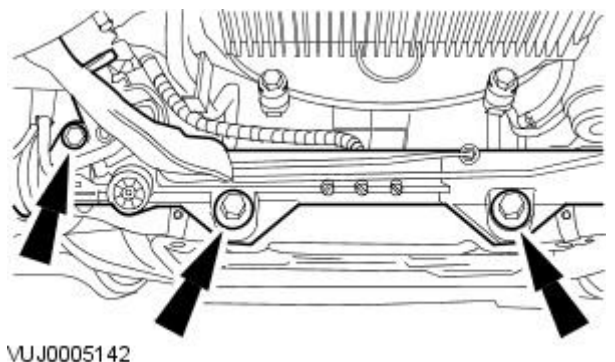
Remove the front stabilizer bar link lower retaining bolt and nut and remove the front stabilizer bar link.



VUJ0005262

16. Detach the steering gear.

- Secure the steering gear.



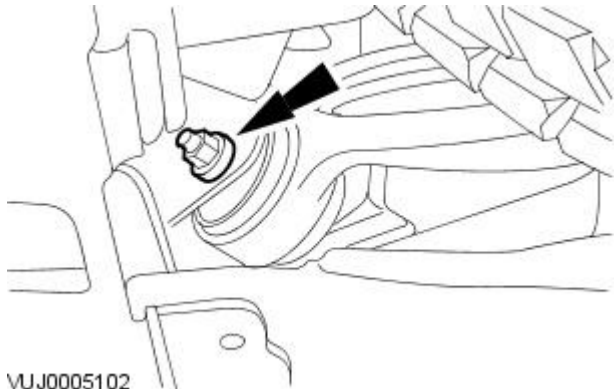
VUJ0005142



**17. NOTE:** Left-hand shown, right-hand similar.

Release the front lower arm and position it to one side.

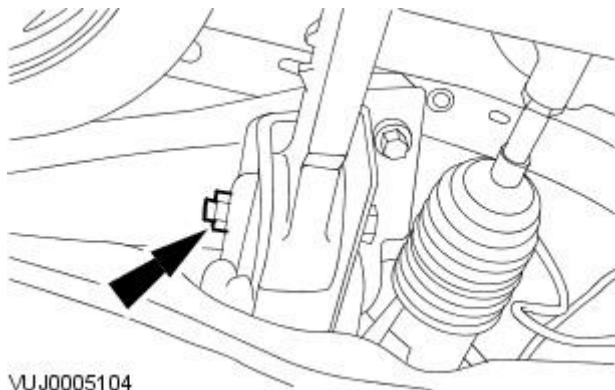
- Mark the position of the bolt.



VUJ0005102

**18. NOTE:** Left-hand shown, right-hand similar.

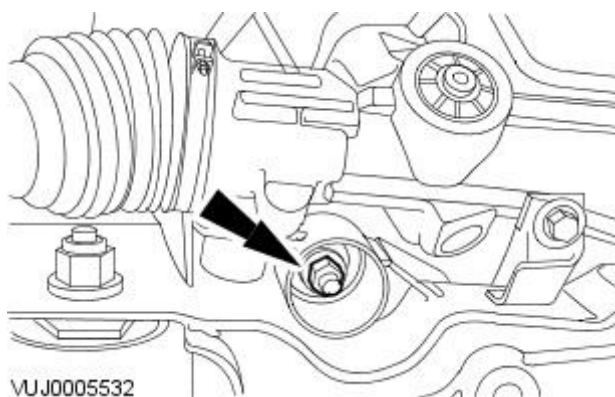
Release the rear lower arm and position it to one side.



VUJ0005104

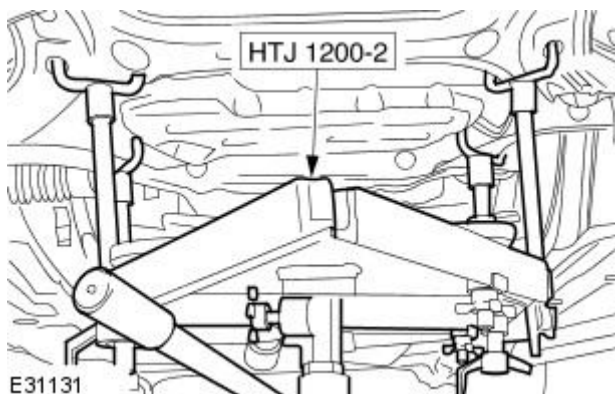
**19. NOTE:** Left-hand shown, right-hand similar.

Remove the engine mount retaining nut.



VUJ0005532

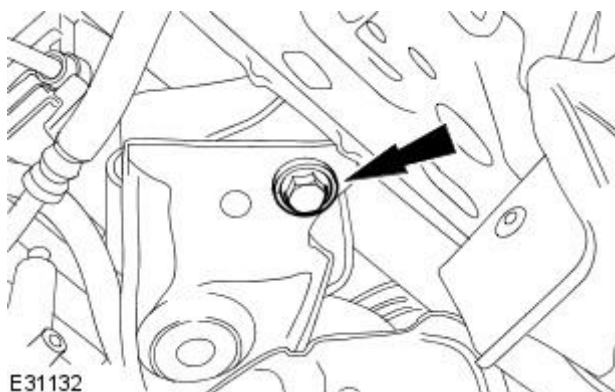
**20.** Install the special tool to the front subframe.



E31131

**21. NOTE:** Left-hand shown, right-hand similar.

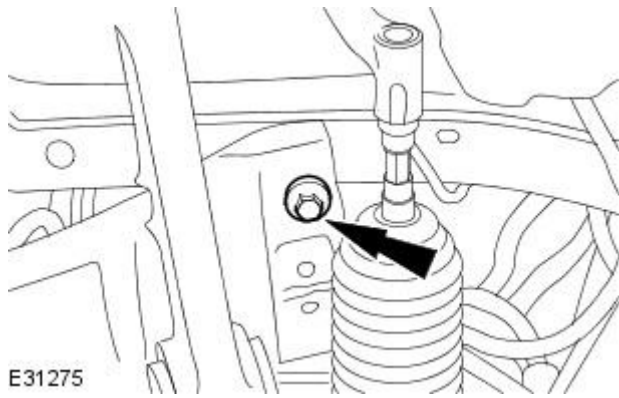
Remove the front subframe front retaining bolt.




E31132

22. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe rear retaining bolt.



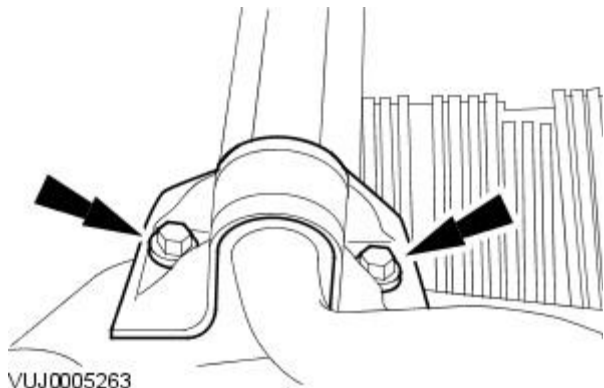
E31275

23.  CAUTION: When lowering the special tool care must be taken to manoeuvre the special tool so that the front subframe does not touch the air conditioning (A/C) pipes. Failure to follow this instruction may result in damage to the A/C pipes.

Lower the special tool by approximately 200 mm (7.9 in).

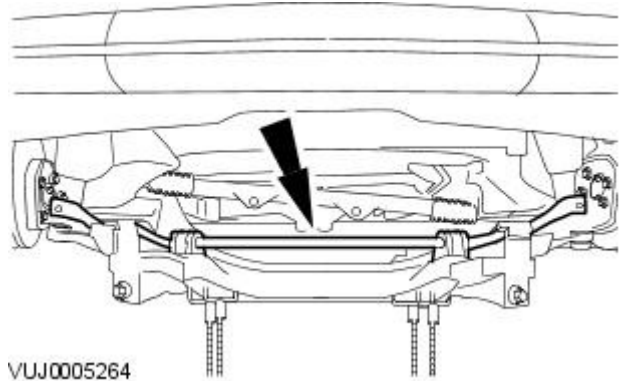
24. NOTE: Left-hand shown, right-hand similar.

Remove the front stabilizer bar clamp.



VUJ0005263

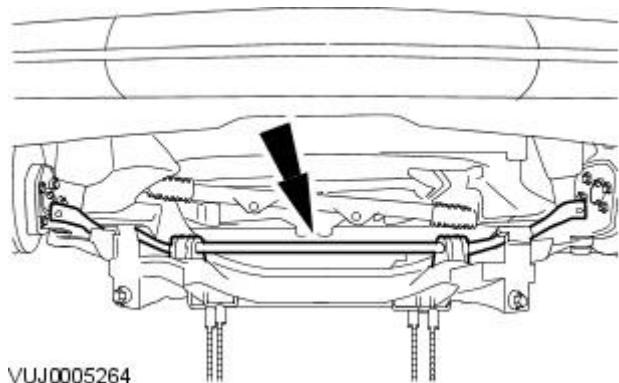
25. Remove the front stabilizer bar.



VUJ0005264

## Installation

1. Install the front stabilizer bar.

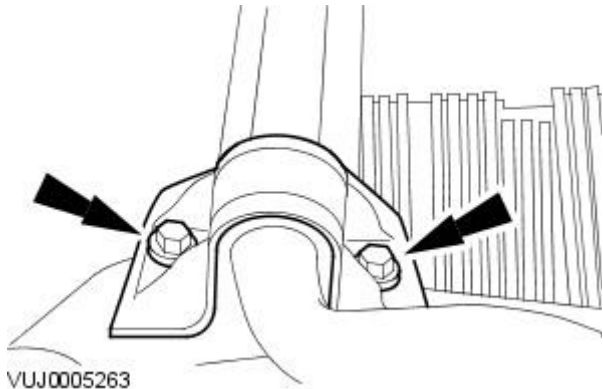



VUJ0005264

2. NOTE: Left-hand shown, right-hand similar.

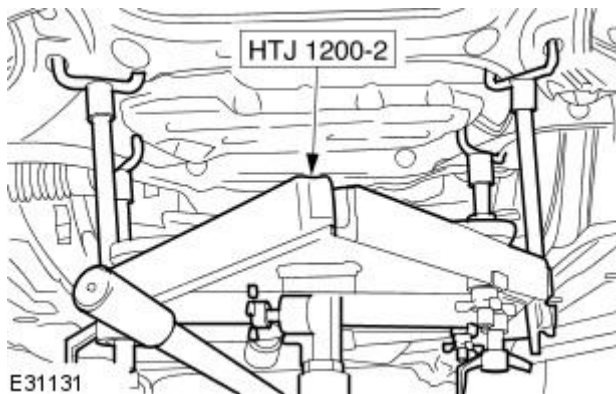
Install the front stabilizer bar clamp.

- Tighten to 55 Nm.



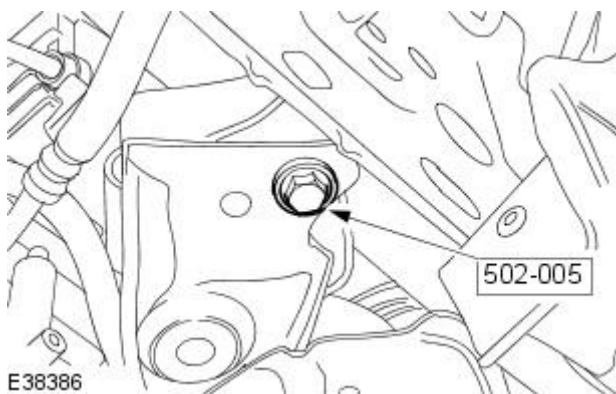
3.  CAUTION: When raising the special tool care must be taken to manoeuvre the special tool so that the front subframe does not touch the air conditioning (A/C) pipes. Failure to follow this instruction may result in damage to the A/C pipes.

Install the front subframe.



4. NOTE: Left-hand shown, right-hand similar.

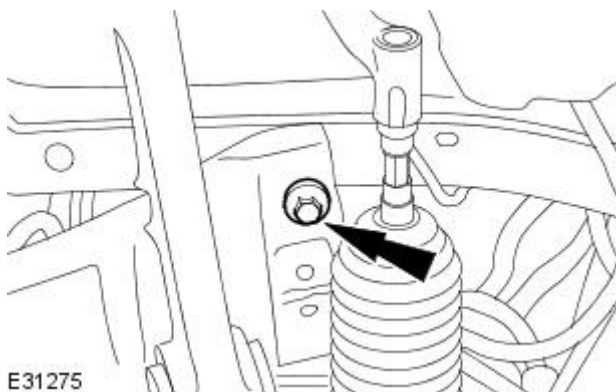
Install the special tool.



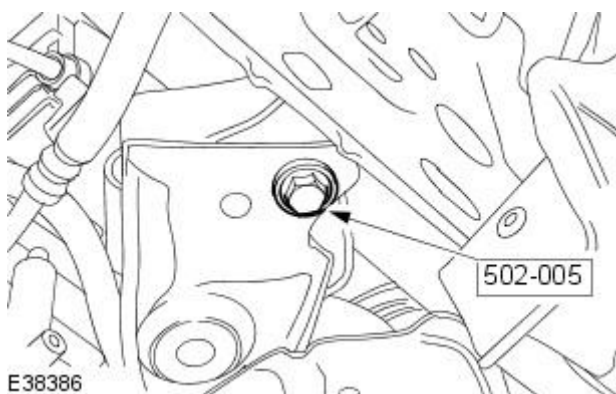
5. NOTE: Left-hand shown, right-hand similar.

Install the front subframe rear retaining bolt.

- Tighten to 150 Nm + 240°.



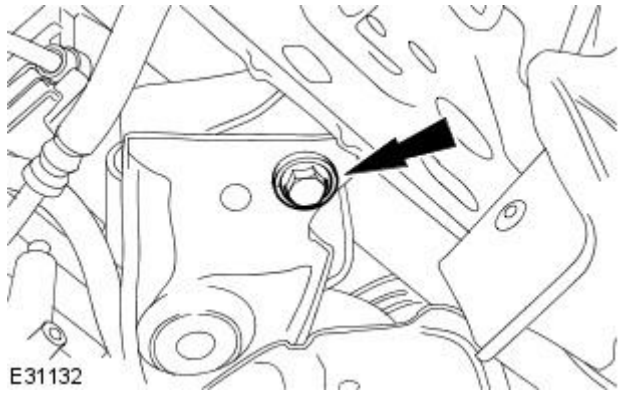
6. Remove the special tool.



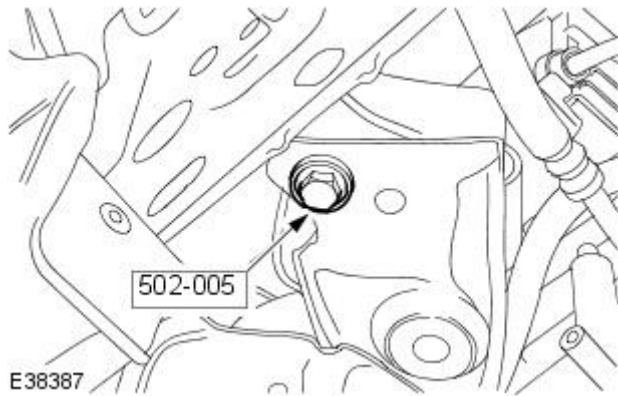


7. Install the front subframe front retaining bolt.

- Tighten to 150 Nm + 240°.

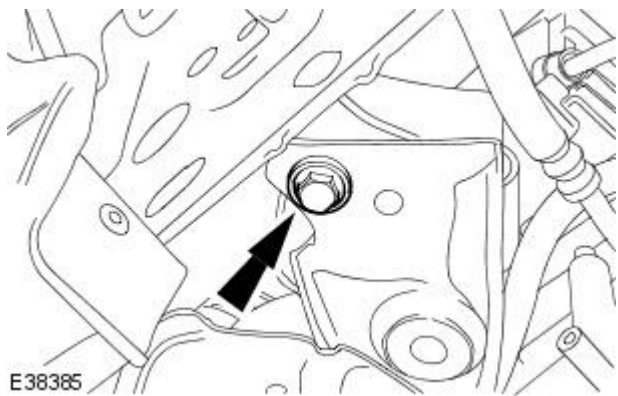


8. Remove the special tool.

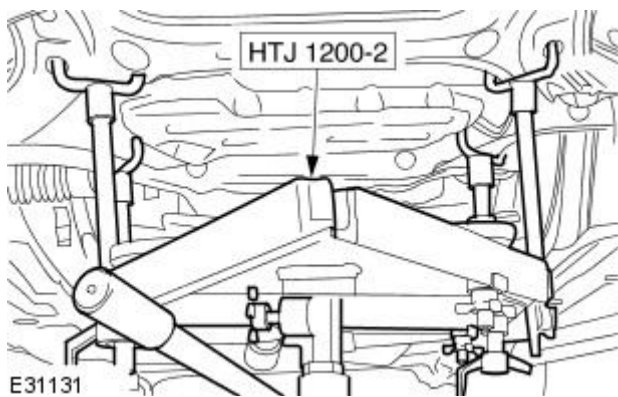


9. Install the front subframe front retaining bolt.

- Tighten to 150 Nm + 240°.



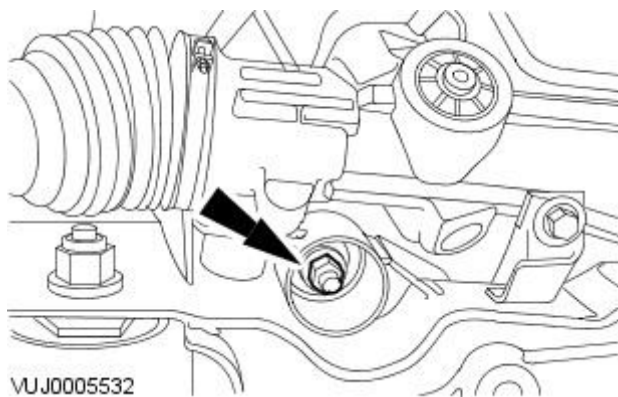
10. Remove the special tool.

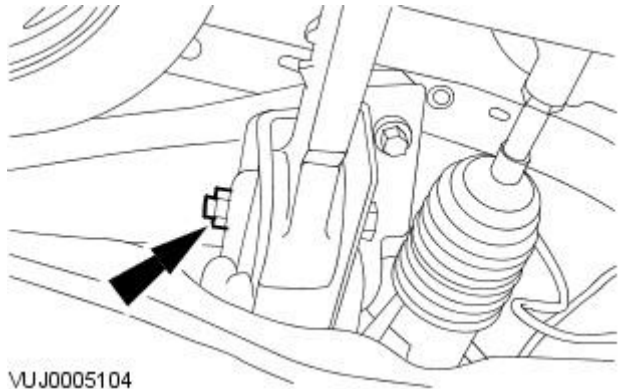


11. NOTE: Left-hand shown, right-hand similar.

Install the engine mount retaining nut.

- Tighten to 63 Nm.



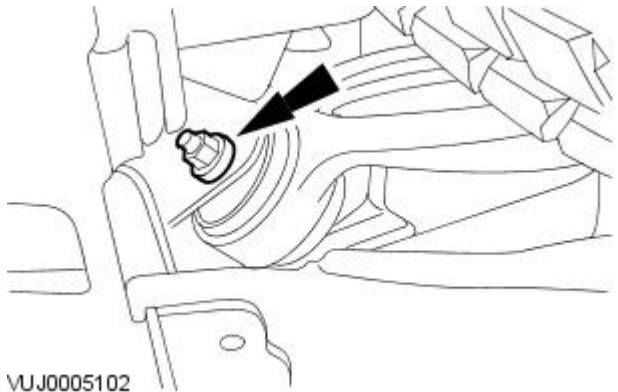


VUJ0005104

12.  CAUTION: The final tightening of the rear lower arm inner retaining nut and bolt must be carried out with the vehicle on its wheels.

• NOTE: Left-hand shown, right-hand similar.

Install the rear lower arm.

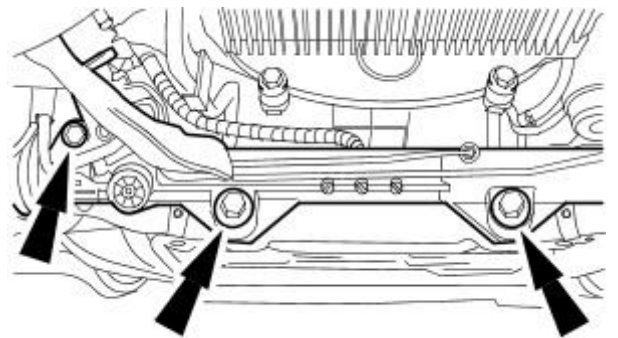


VUJ0005102

13.  CAUTION: The final tightening of the front lower arm inner retaining nut and bolt must be carried out with the vehicle on its wheels.

• NOTE: Left-hand shown, right-hand similar.

Install the front lower arm.

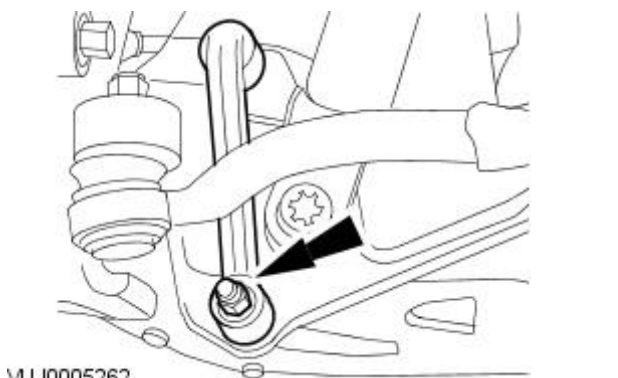


VUJ0005142

14. NOTE: Left-hand shown, right-hand similar.

Install the steering gear.

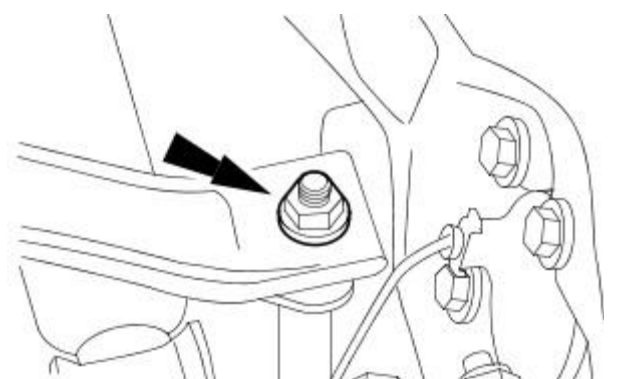
- Tighten to 100 Nm.



VUJ0005262

15. NOTE: Left-hand shown, right-hand similar.

Install the front stabilizer bar link.



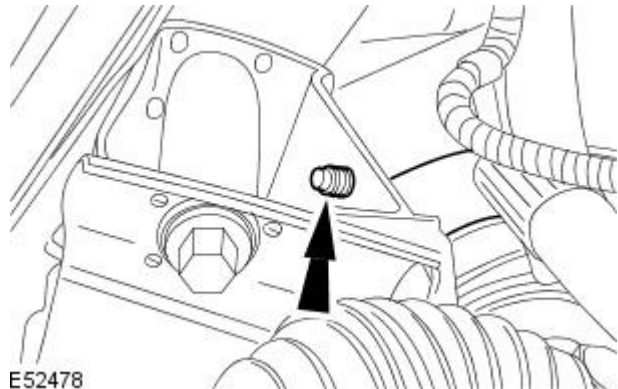
VUJ0005261

16. NOTE: Left-hand shown, right-hand similar.

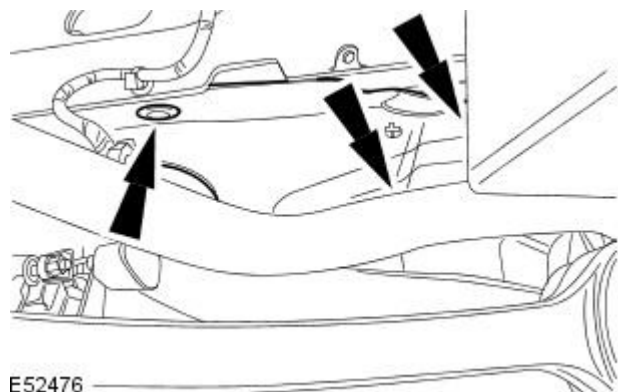
Attach the front stabilizer bar link and install the front stabilizer bar link retaining nut.

- Tighten to 43 Nm.

17. Attach the power steering hose retaining clip to the front subframe.



18. Install the right-hand splash shield.



19. Install the radiator splash shield.

For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

20. Install the air deflector.

For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

21. Install both the front wheel and tires.

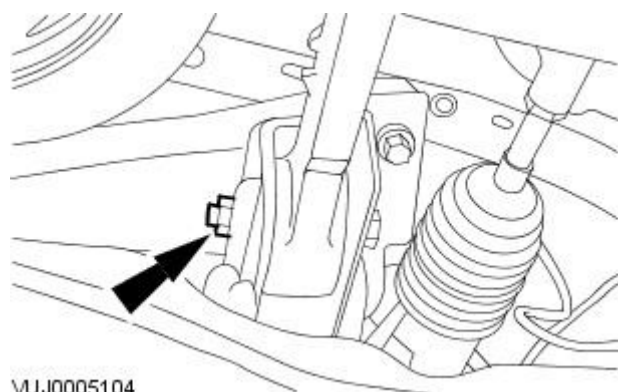
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

22. Lower the vehicle.

23.  CAUTION: The final tightening of the rear lower arm inner retaining nut and bolt must be carried out with the vehicle on its wheels.

• NOTE: Left-hand shown, right-hand similar.

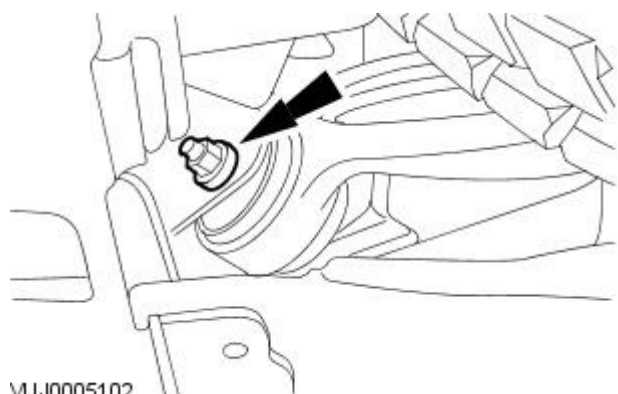
Tighten to 175 Nm.



24.  CAUTION: The final tightening of the front lower arm inner retaining nut and bolt must be carried out with the vehicle on its wheels.

• NOTE: Left-hand shown, right-hand similar.

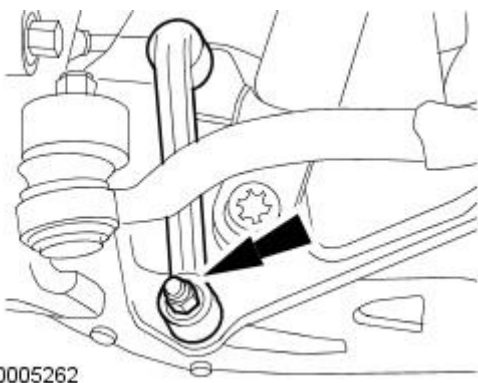
Tighten to 175 Nm.



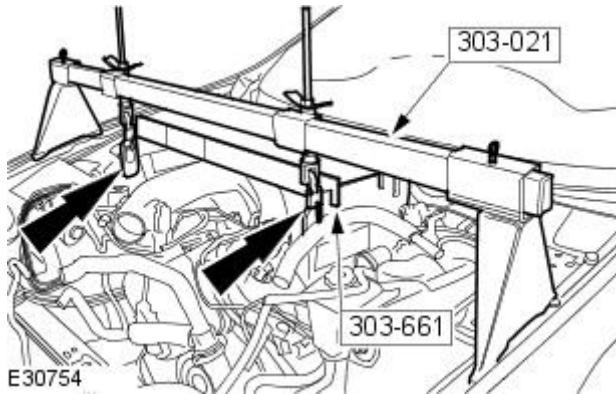


25. NOTE: Left-hand shown, right-hand similar.

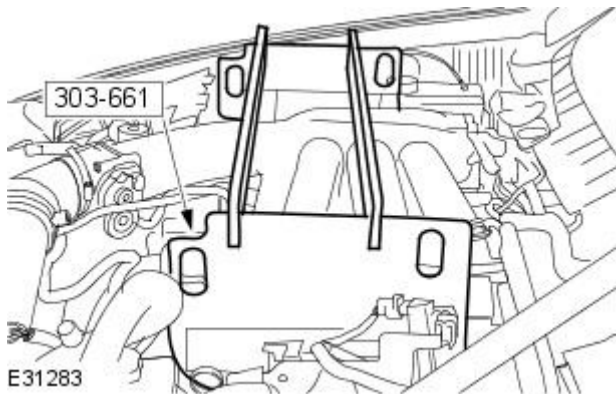
Tighten to 70 Nm.



26. Remove the special tool.

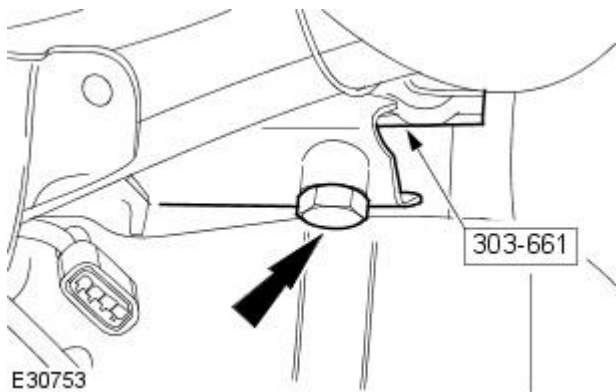


27. Remove the special tool support bars from the special tool.



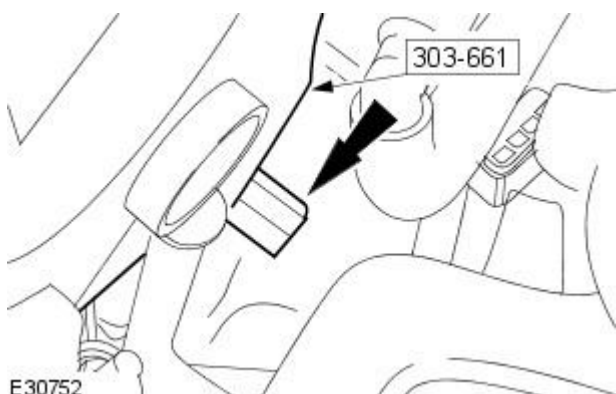
28. NOTE: Left-hand shown, right-hand similar.

Remove the retaining bolt.



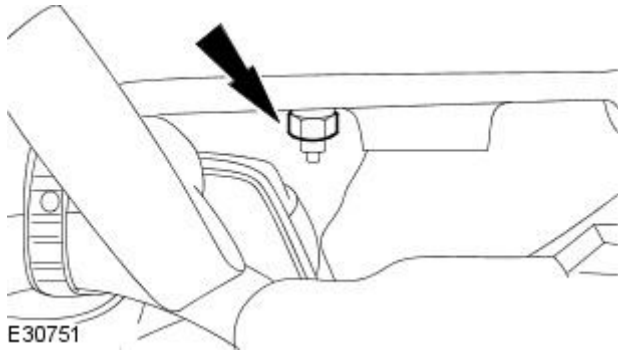
29. Remove the special tool from the exhaust manifold.

- Install the retaining bolt.

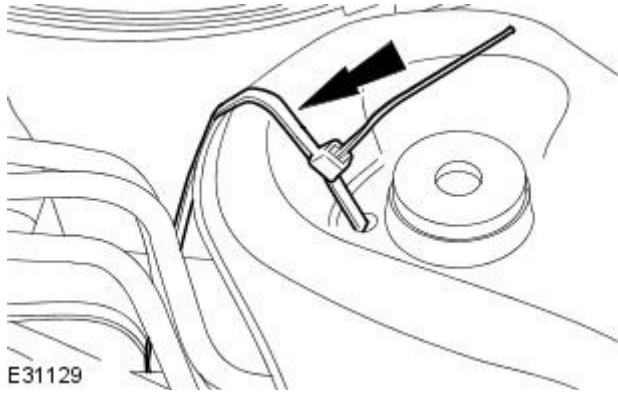


**30. NOTE:** Left-hand shown, right-hand similar.

Tighten the exhaust manifold retaining nut.



**31.** Remove the radiator support.



**32.** Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).




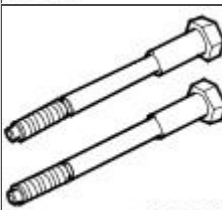
**33.** Using only four-wheel alignment equipment approved by Jaguar, check and adjust the wheel alignment.

For additional information, refer to: [Four-Wheel Alignment](#) (204-00 Suspension System - General Information, General Procedures).



# Front Suspension - Front Stabilizer Bar 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

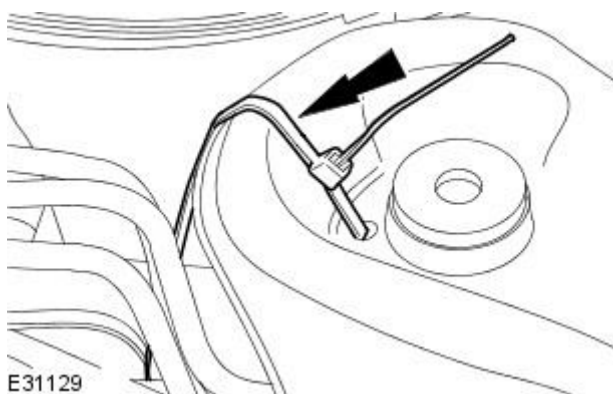
## Removal and Installation

Special Tool(s)	
 <p>HTJ12002</p>	Powertrain Assembly Jack, HTJ 1200-2
 <p>303-749</p>	Engine lifting brackets 303-749
 <p>303-021</p>	Engine support bracket 303-021
 <p>502-005</p>	Subframe Alignment Bolt 502-005

## Removal

All vehicles

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Using suitable [tie straps](#), secure the radiator.



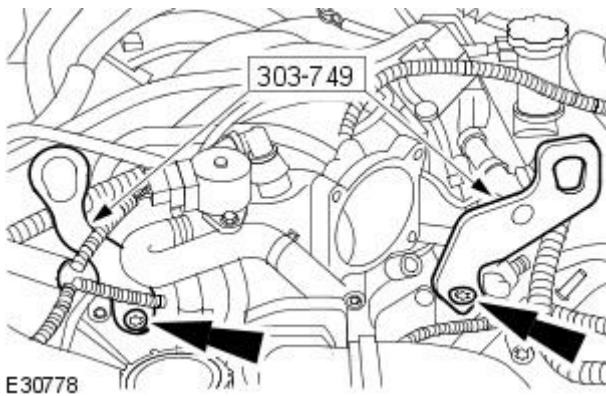
Vehicles without supercharger


3. Remove the throttle body.  
For additional information, refer to: [Throttle Body](#) (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Removal and Installation).

Vehicles with supercharger

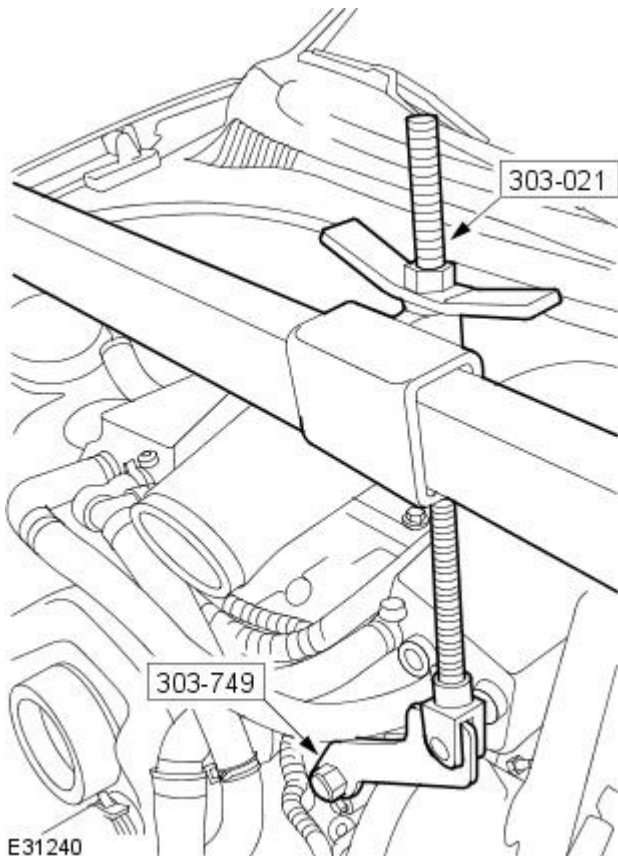
4. Remove the air cleaner outlet pipe.  
For additional information, refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).

All vehicles



5.  CAUTION: Protect the paintwork during this operation.
- NOTE: Vehicles without supercharger shown, vehicles with supercharger similar.

Install the special tools.




6. NOTE: Vehicles with supercharger shown, vehicles without supercharger similar.

- NOTE: Right-hand shown, left-hand similar.

- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

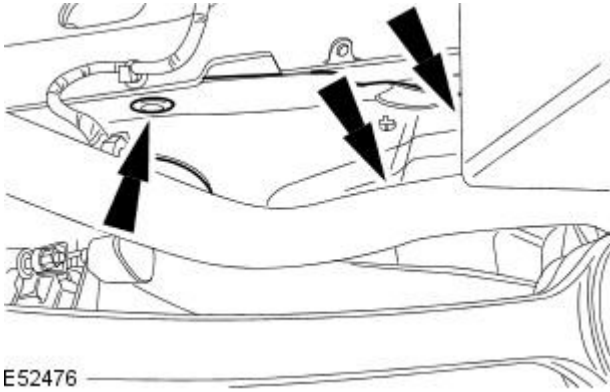
Install the special tool.

7.  WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

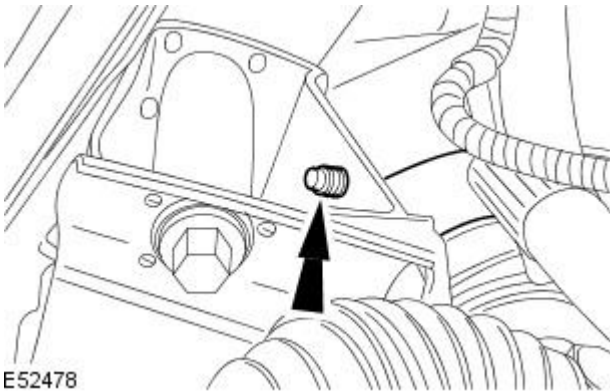
Raise and support the vehicle.

8. Remove both the front wheel and tires.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
9. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).
10. Remove the radiator splash shield.  
For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

11. Remove the right-hand splash shield.

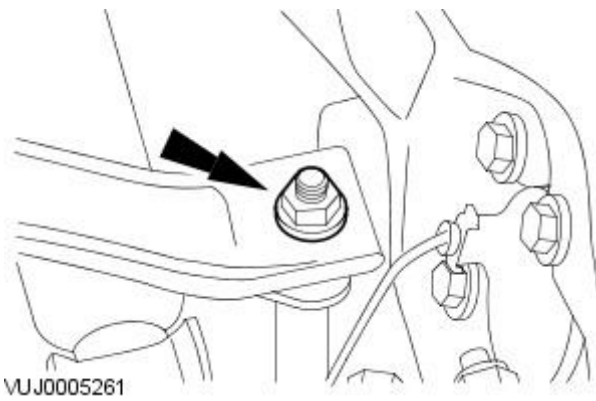


12. Detach the power steering hose retaining clip from the front subframe.



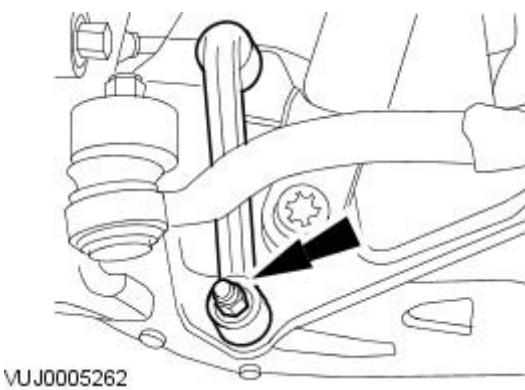
13. NOTE: Left-hand shown, right-hand similar.

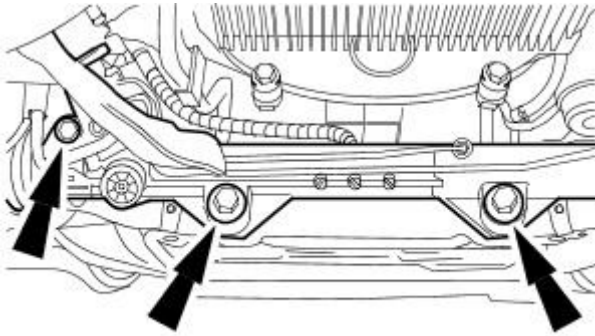
Remove the front stabilizer bar link upper retaining nut.



14. NOTE: Left-hand shown, right-hand similar.

Remove the front stabilizer bar link lower retaining bolt and nut and remove the front stabilizer bar link.

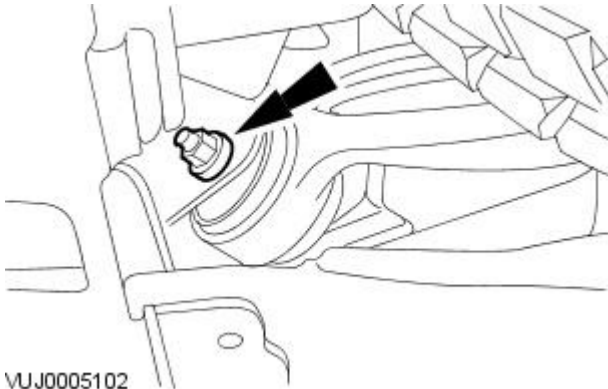




VUJ0005142

15. Detach the steering gear.

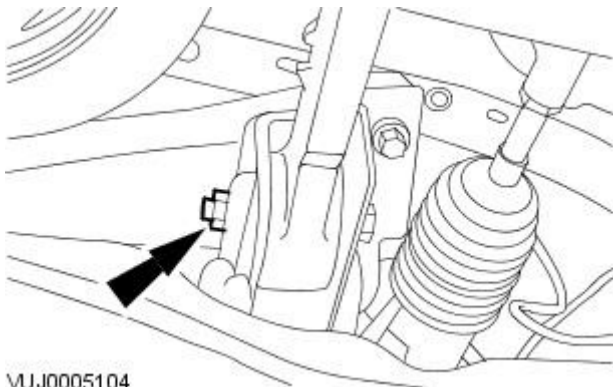
- Secure the steering gear.



VUJ0005102

16. NOTE: Left-hand shown, right-hand similar.

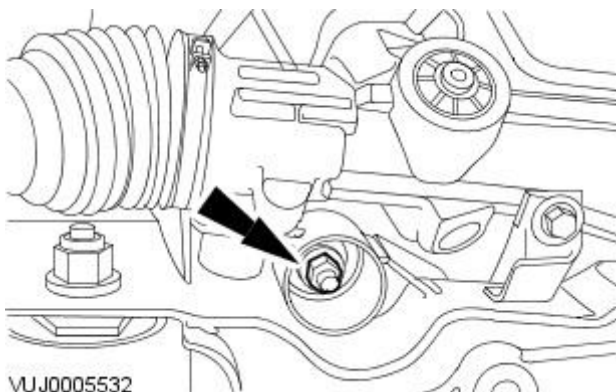
Release the front lower arm and position it to one side.



VUJ0005104

17. NOTE: Left-hand shown, right-hand similar.

Release the rear lower arm and position it to one side.

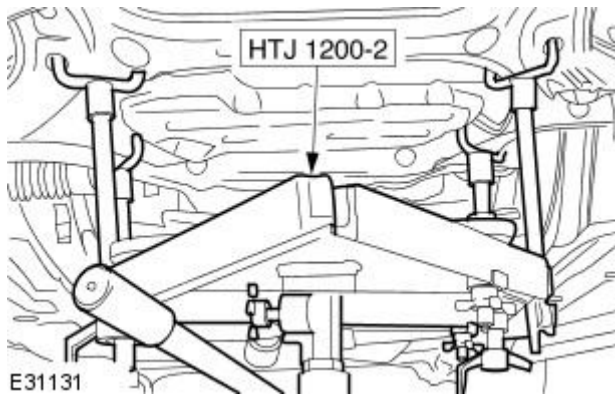


VUJ0005532

18. NOTE: Left-hand shown, right-hand similar.

Remove the engine mount retaining nut.

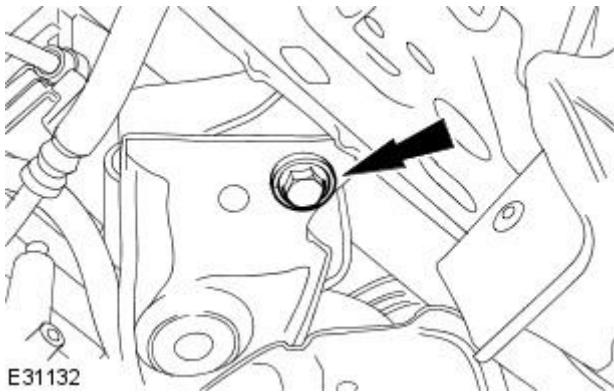
19. Install the special tool to the front subframe.



E31131

20. NOTE: Left-hand shown, right-hand similar.

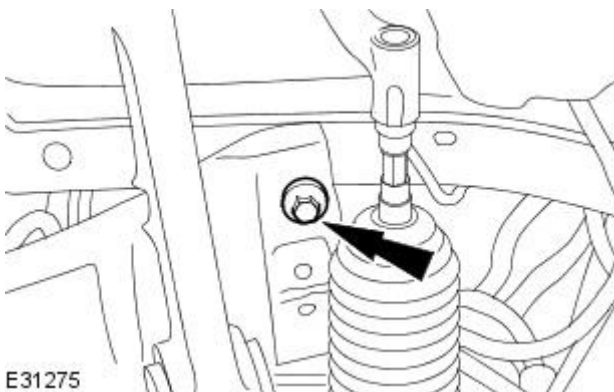
Remove the front subframe front retaining bolt.




E31132

21. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe rear retaining bolt.



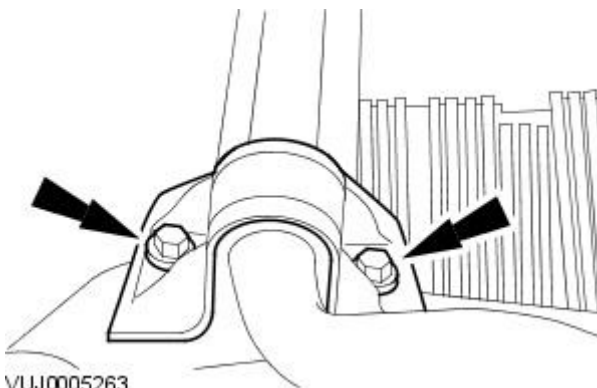
E31275

22.  CAUTION: When lowering the special tool care must be taken to manoeuvre the special tool so that the front subframe does not touch the air conditioning (A/C) pipes. Failure to follow this instruction may result in damage to the A/C pipes.

Lower the special tool by approximately 200 mm (7.9 in).

23. NOTE: Left-hand shown, right-hand similar.

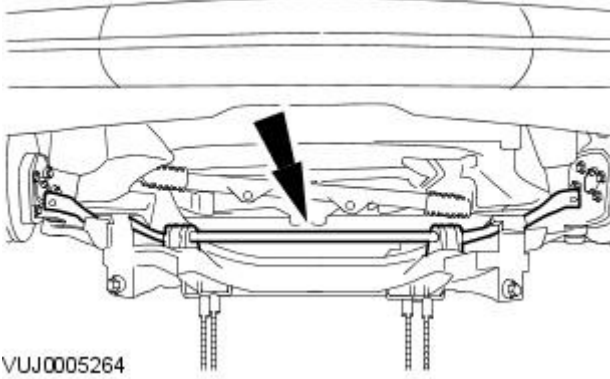
Remove the front stabilizer bar clamp.



VUJ0005263



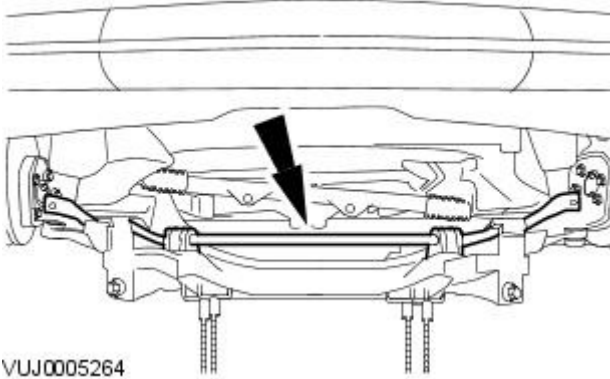
24. Remove the front stabilizer bar.



## Installation

All vehicles

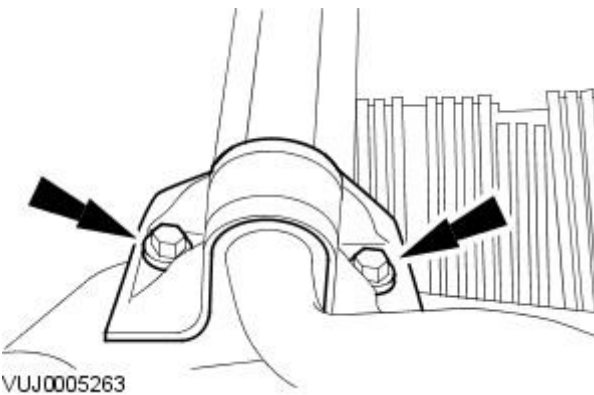
1. Install the front stabilizer bar.




2. NOTE: Left-hand shown, right-hand similar.

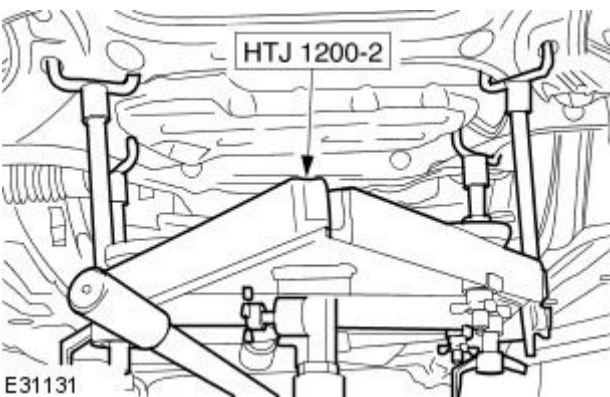
Install the front stabilizer bar clamp.

- Tighten to 55 Nm.



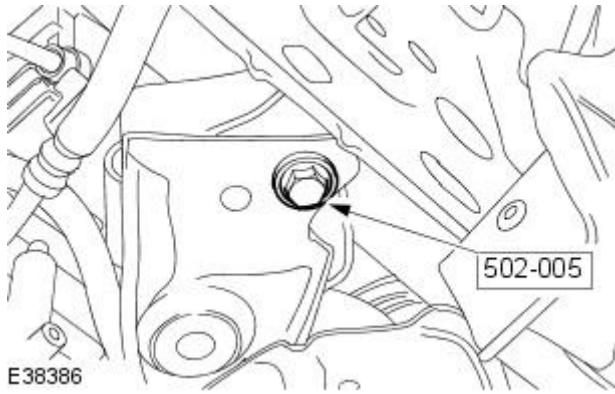
3.  CAUTION: When raising the special tool care must be taken to manoeuvre the special tool so that the front subframe does not touch the air conditioning (A/C) pipes. Failure to follow this instruction may result in damage to the A/C pipes.

Install the front subframe.



4. NOTE: Left-hand shown, right-hand similar.

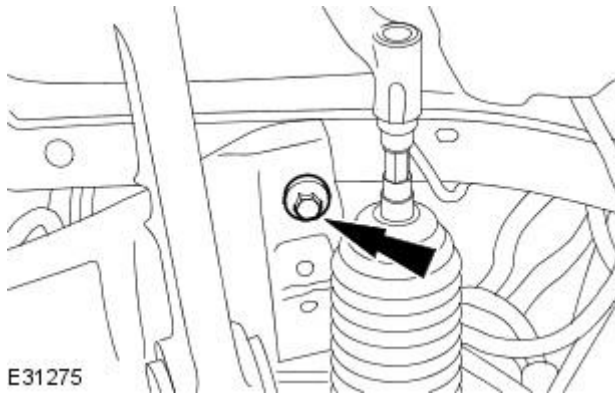
Install the special tool.



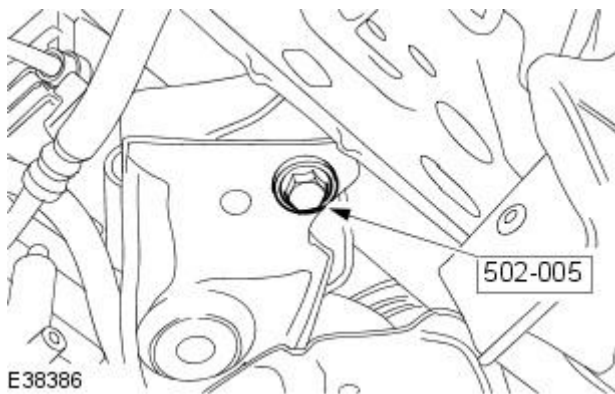
5. NOTE: Left-hand shown, right-hand similar.

Install the front subframe rear retaining bolt.

- Tighten to 150 Nm + 240°.

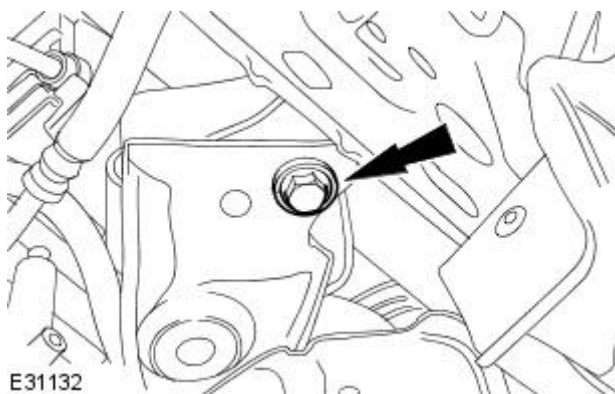


6. Remove the special tool.

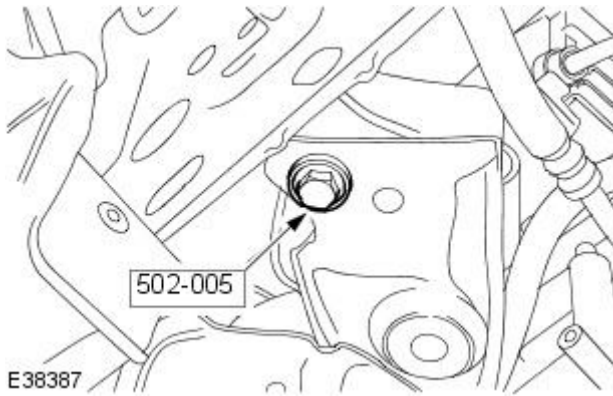


7. Install the front subframe front retaining bolt.

- Tighten to 150 Nm + 240°.

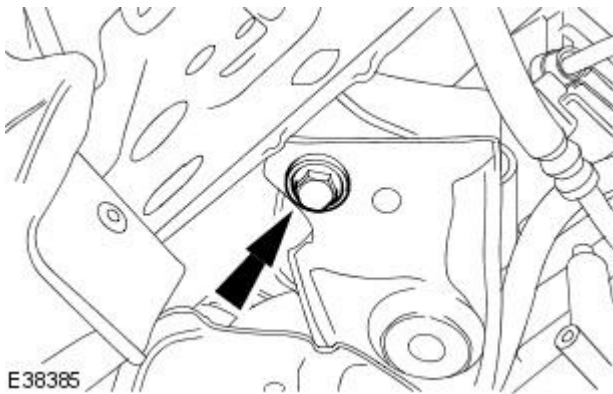


8. Remove the special tool.

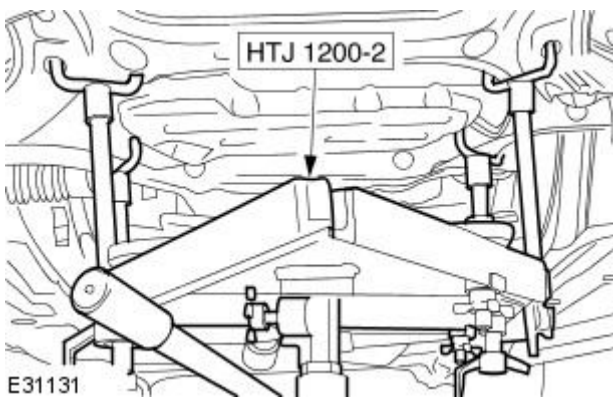


9. Install the front subframe front retaining bolt.

- Tighten to 150 Nm + 240°.



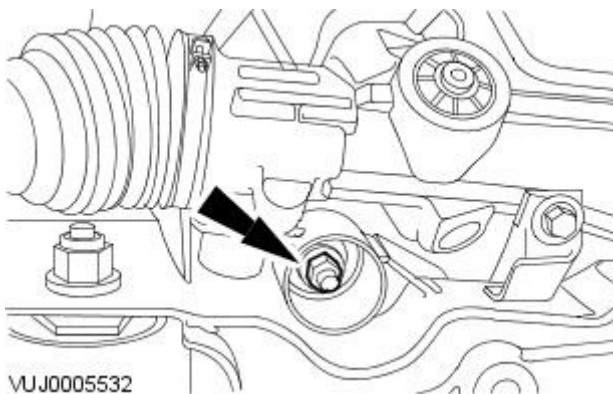
10. Remove the special tool.



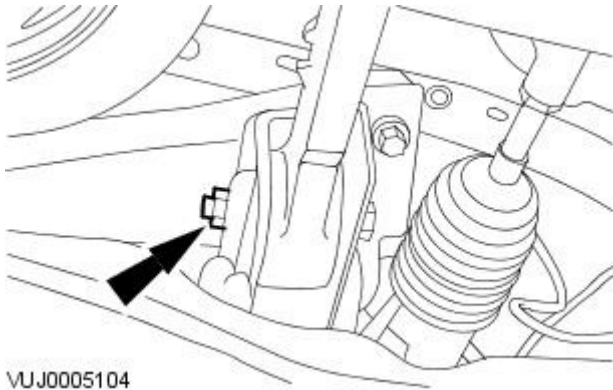
11. NOTE: Left-hand shown, right-hand similar.

Install the engine mount retaining nut.


- Tighten to 63 Nm.





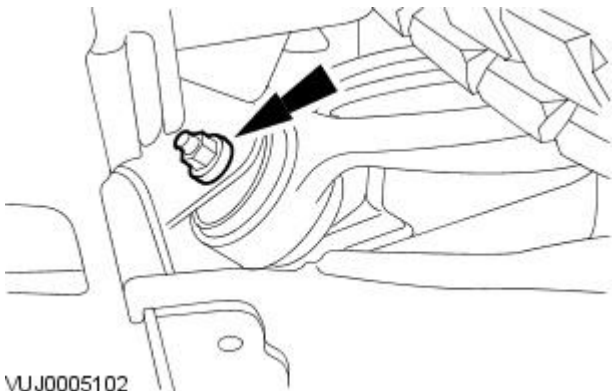


VUJ0005104


12.  CAUTION: The final tightening of the rear lower arm inner retaining nut and bolt must be carried out with the vehicle on its wheels.

• NOTE: Left-hand shown, right-hand similar.

Install the rear lower arm.

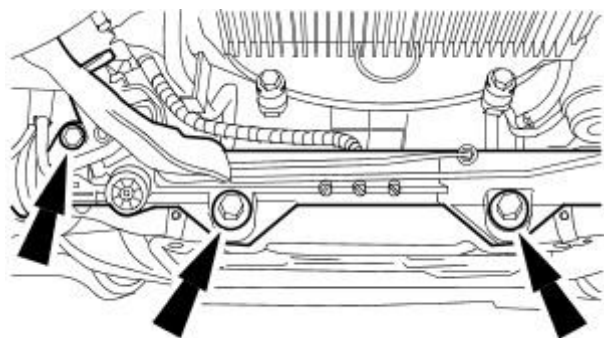


VUJ0005102

13.  CAUTION: The final tightening of the front lower arm inner retaining nut and bolt must be carried out with the vehicle on its wheels.

• NOTE: Left-hand shown, right-hand similar.

Install the front lower arm.

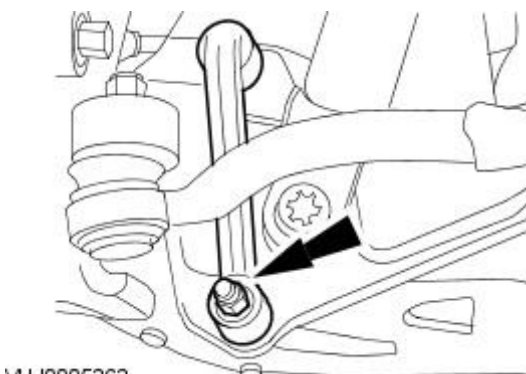


VUJ0005142

14. NOTE: Left-hand shown, right-hand similar.

Install the steering gear.

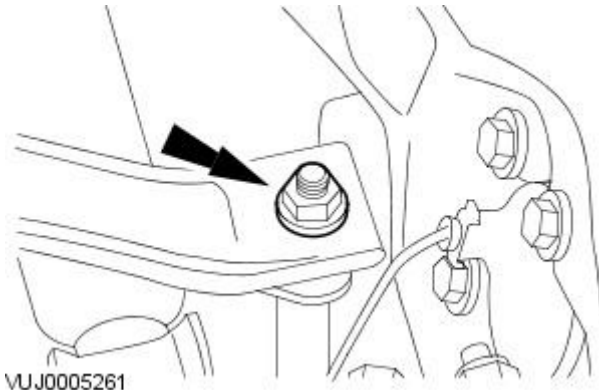
- Tighten to 100 Nm.



VUJ0005262

15. NOTE: Left-hand shown, right-hand similar.

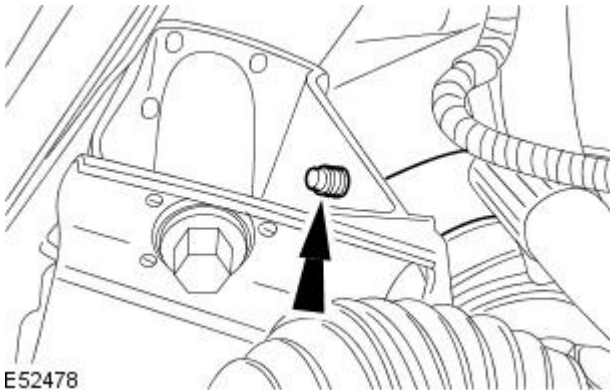
Install the front stabilizer bar link.



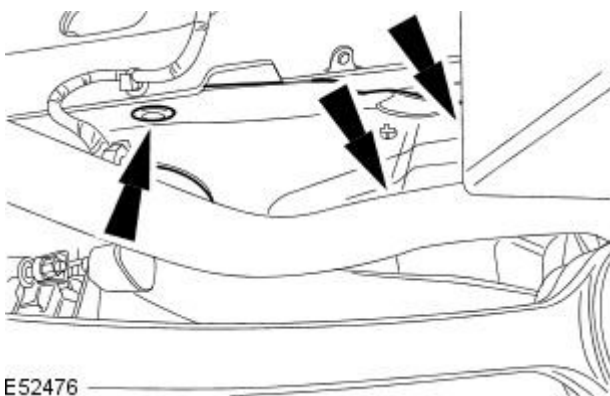
**16. NOTE:** Left-hand shown, right-hand similar.

Attach the front stabilizer bar link and install the front stabilizer bar link retaining nut.

- Tighten to 43 Nm.



**17.** Attach the power steering hose retaining clip to the front subframe.



**18.** Install the right-hand splash shield.

**19.** Install the radiator splash shield.

For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).


**20.** Install the air deflector.

For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

**21.** Install both the front wheel and tires.

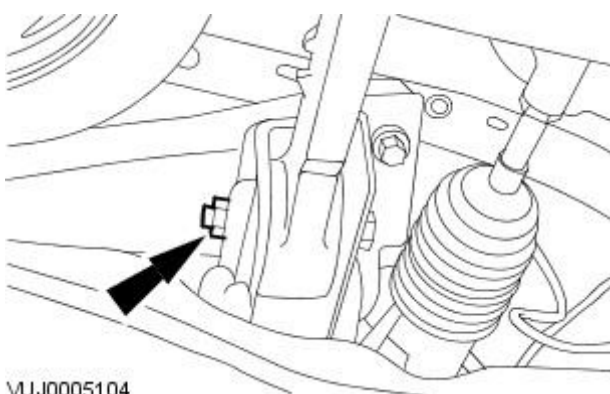
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

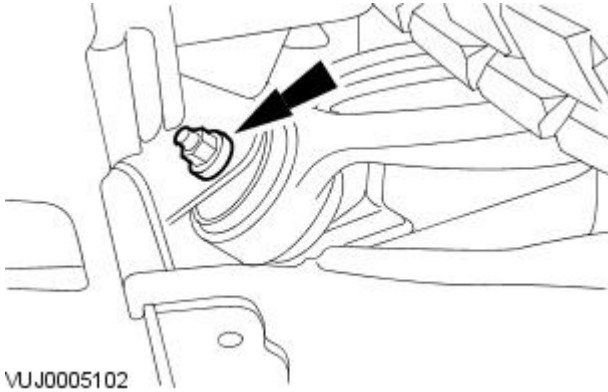
**22.** Lower the vehicle.


**23.**  **CAUTION:** The final tightening of the rear lower arm inner retaining nut and bolt must be carried out with the vehicle on its wheels.

- **NOTE:** Left-hand shown, right-hand similar.

Tighten to 175 Nm.

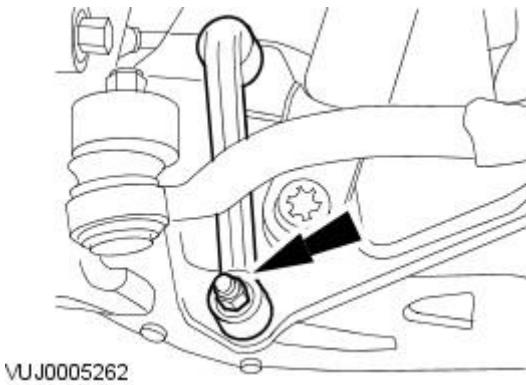




24.  CAUTION: The final tightening of the front lower arm inner retaining nut and bolt must be carried out with the vehicle on its wheels.

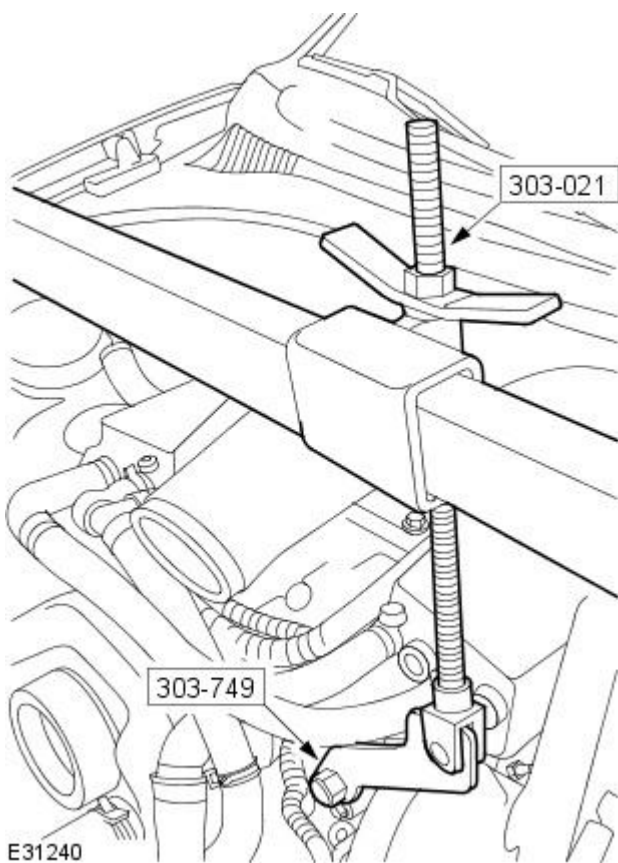
• NOTE: Left-hand shown, right-hand similar.


Tighten to 175 Nm.



25. NOTE: Left-hand shown, right-hand similar.

Tighten to 70 Nm.



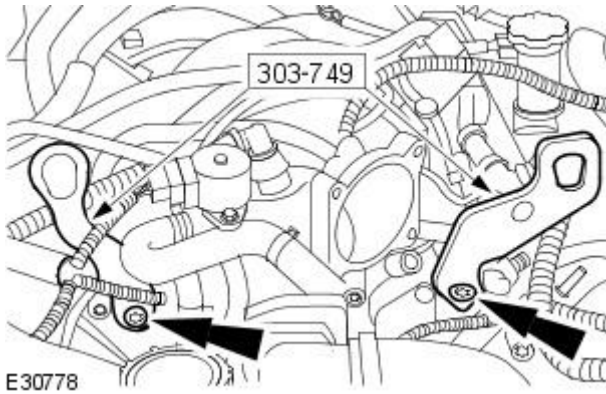
26.  CAUTION: Protect the paintwork during this operation.

• NOTE: Vehicles with supercharger shown, vehicles without supercharger similar.

• NOTE: Right-hand shown, left-hand similar.

Remove the special tool.

- Loosen the special tool adjustment bolts.



**27. NOTE:** Vehicles without supercharger shown, vehicles with supercharger similar.

Remove the special tools.

#### Vehicles with supercharger

**28.** Install the air cleaner outlet pipe.

For additional information, refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).

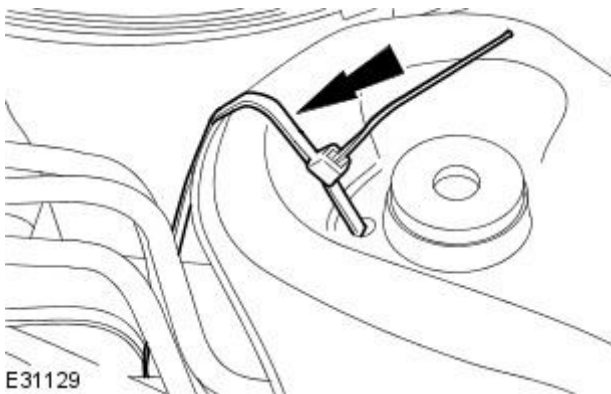
#### Vehicles without supercharger

**29.** Install the throttle body.

For additional information, refer to: [Throttle Body](#) (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Removal and Installation).

#### All vehicles

**30.** Remove the radiator support.



**31.** Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).


**32.** Using only four-wheel alignment equipment approved by Jaguar, check and adjust the wheel alignment.

For additional information, refer to: [Four-Wheel Alignment](#) (204-00 Suspension System - General Information, General Procedures).

## Front Suspension - Front Stabilizer Bar Link

Removal and Installation

### Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

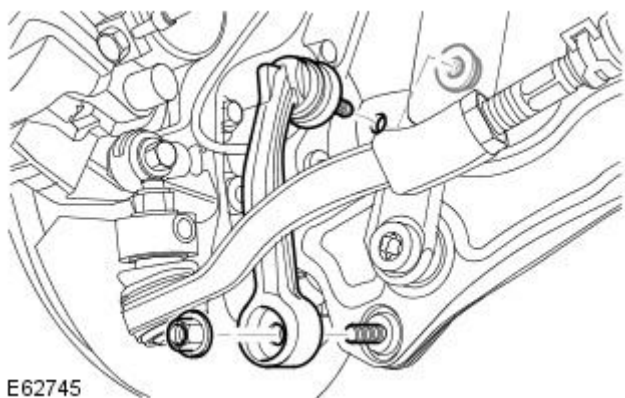
Raise and support the vehicle.

2. Remove the front wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

3. **NOTE:** Use an additional wrench to prevent the ball joint rotating.

Remove the front stabilizer bar link.

- Remove and discard the 2 nuts.

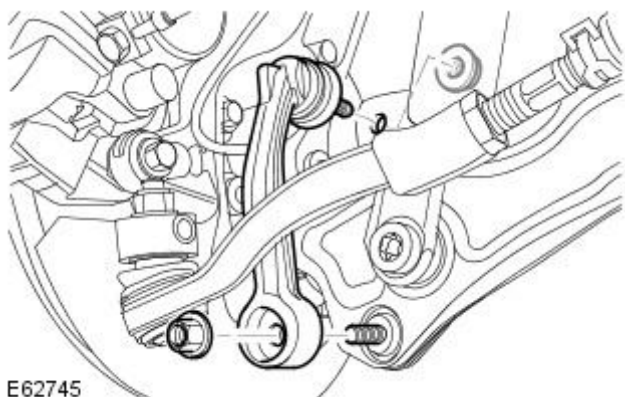


### Installation

1. **NOTE:** Use an additional wrench to prevent the ball joint rotating.

Install the front stabilizer bar link.

- Tighten the upper nut to 47 Nm.
- Tighten the lower nut to 70 Nm.



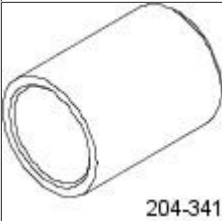
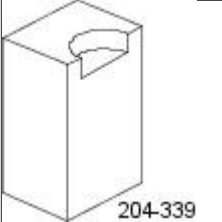


2. Install the wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).



## Front Suspension - Stabilizer Bar Link Bushing

Removal and Installation

Special Tool(s)	
 204-340	Bush installer 204-340
 204-342	Bush remove 204-342
 204-341	Support 204-341
 204-339	Support 204-339

### Removal



**CAUTION:** The final tightening of the suspension components must be carried out with the vehicle on its wheels.

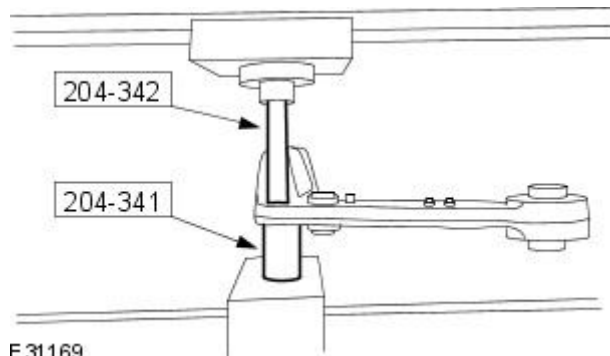


**1. WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise the vehicle on a 4 post lift.

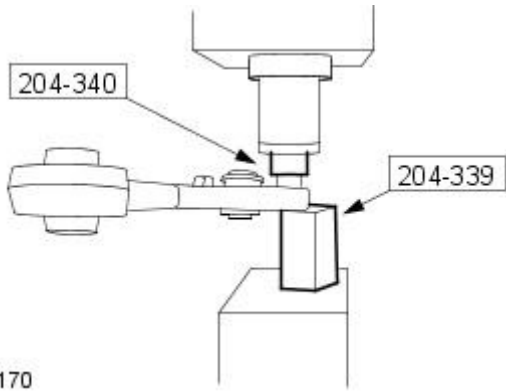
**2.** Remove the rear lower arm.  
For additional information, refer to: [Rear Lower Arm](#) (204-01 Front Suspension, Removal and Installation).

**3.** Using the special tools, remove and discard the stabilizer bar link bushing.



E31169

### Installation



E31170

1. NOTE: Apply water to lubricate the bushing.

Using the special tools, install the stabilizer bar link bushing.


2. Install the rear lower arm.

For additional information, refer to: [Rear Lower Arm](#) (204-01 Front Suspension, Removal and Installation).

## Front Suspension - Upper Arm LH

Removal and Installation

### Removal

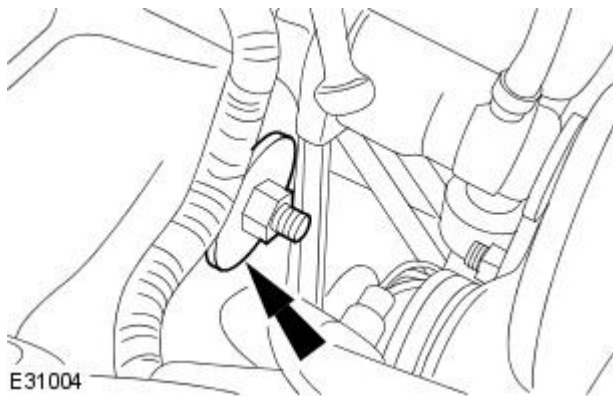
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the front shock absorber.  
For additional information, refer to: [Front Shock Absorber](#) (204-01 Front Suspension, Removal and Installation).
3. Remove the secondary bulkhead panel LH.  
For additional information, refer to: [Secondary Bulkhead Panel LH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).
4. Remove the air cleaner.  
For additional information, refer to: Air Cleaner (303-12A, Removal and Installation) / Air Cleaner (303-12B, Removal and Installation) / [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8, Removal and Installation) / Air Cleaner LH (303-12D, Removal and Installation).

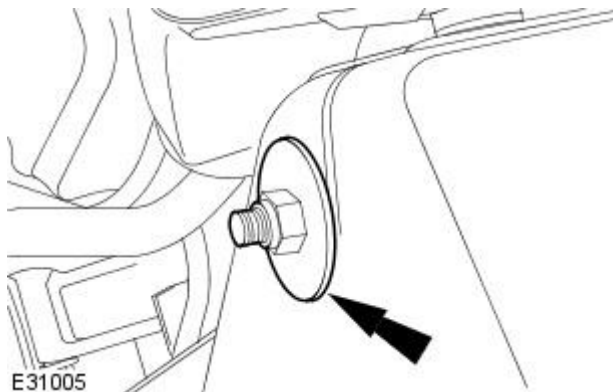
5. **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Remove the upper arm retaining nut.

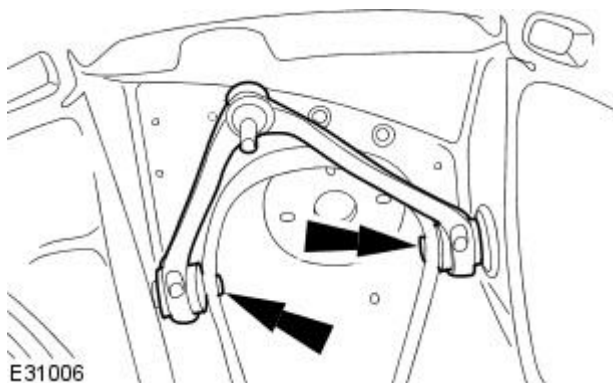


6. **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Remove the upper arm retaining nut.



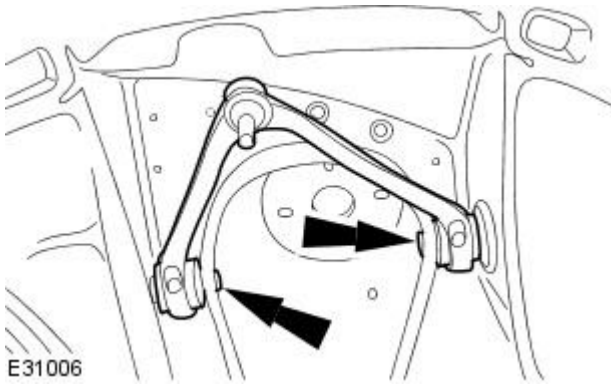
7. Remove the upper arm.





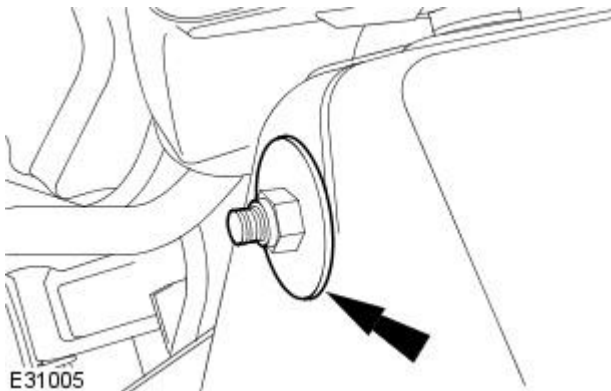
## Installation

1. Install the upper arm.



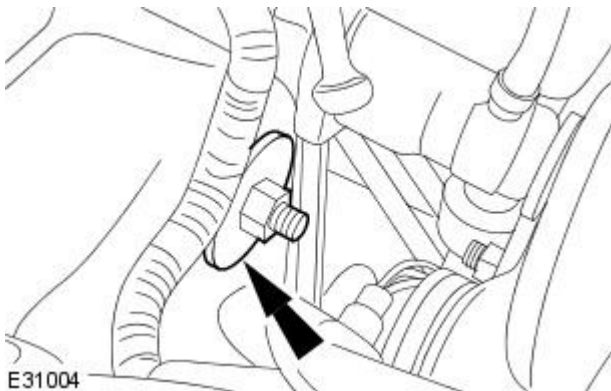
2. **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Install the upper arm retaining nut, but do not tighten fully at this stage.



3. **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Install the upper arm retaining nut, but do not tighten fully at this stage.



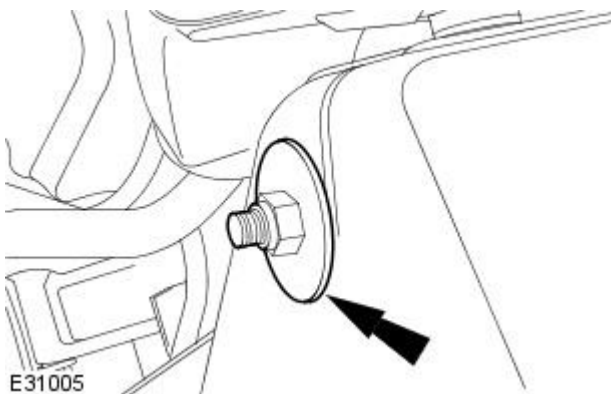
4. Install the front shock absorber.

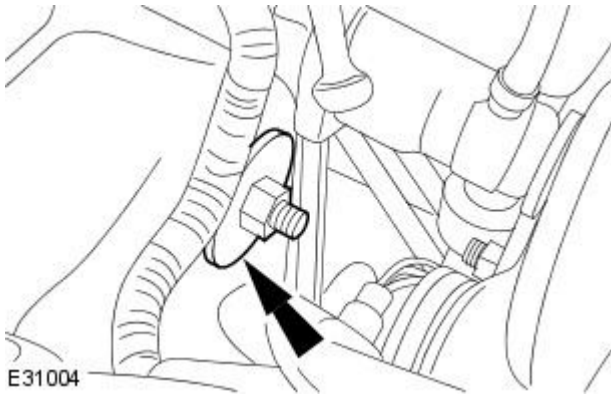
For additional information, refer to: [Front Shock Absorber](#) (204-01 Front Suspension, Removal and Installation).

5.  **CAUTION:** The final tightening of the suspension components must be carried out with the vehicle on its wheels.

• **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Tighten to 47 Nm.





6.  **CAUTION:** The final tightening of the suspension components must be carried out with the vehicle on its wheels.

• **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Tighten to 47 Nm.

7. Install the air cleaner.

For additional information, refer to: Air Cleaner (303-12A, Removal and Installation) /

Air Cleaner (303-12B, Removal and Installation) /

[Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8, Removal and Installation) /

Air Cleaner LH (303-12D, Removal and Installation).

8. Install the secondary bulkhead panel LH.

For additional information, refer to: [Secondary Bulkhead Panel](#)


[LH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L](#)

[SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).

## Front Suspension - Upper Arm RH

Removal and Installation

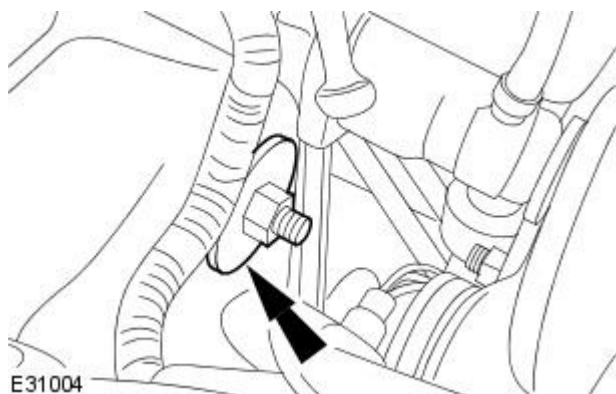
### Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

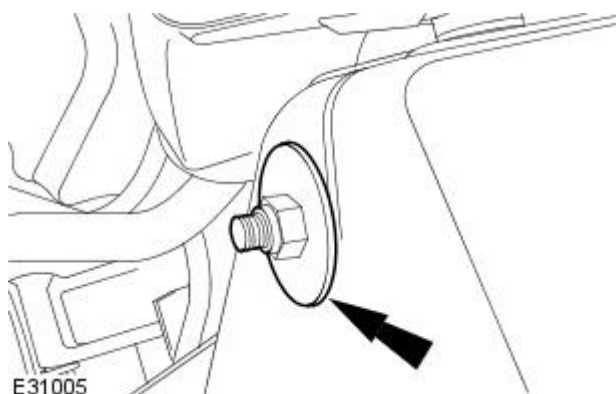
2. Remove the front shock absorber.  
For additional information, refer to: [Front Shock Absorber](#) (204-01 Front Suspension, Removal and Installation).
3. Remove the secondary bulkhead panel RH.  
For additional information, refer to: [Secondary Bulkhead Panel RH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).
4. **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Remove the upper arm retaining nut.

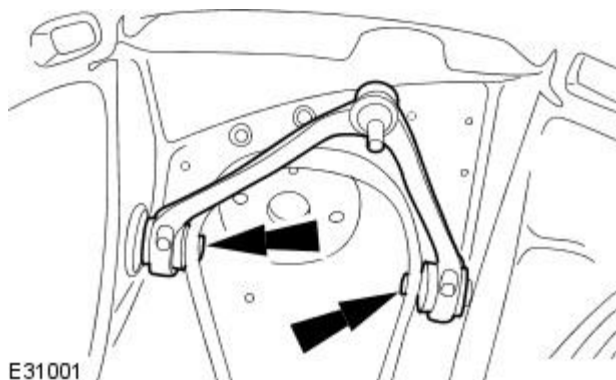


5. **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Remove the upper arm retaining nut.

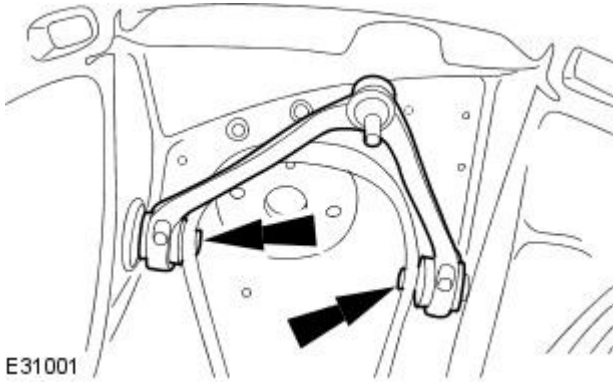


6. Remove the upper arm.



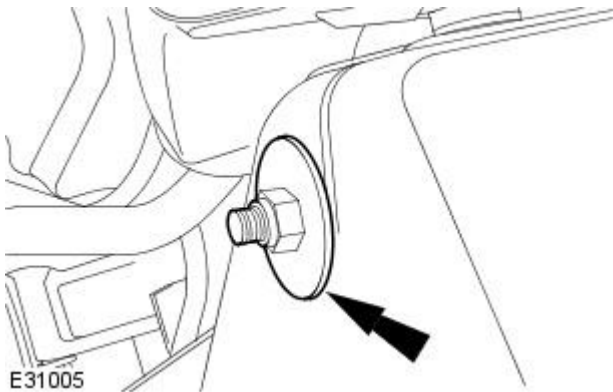
### Installation

1. Install the upper arm.



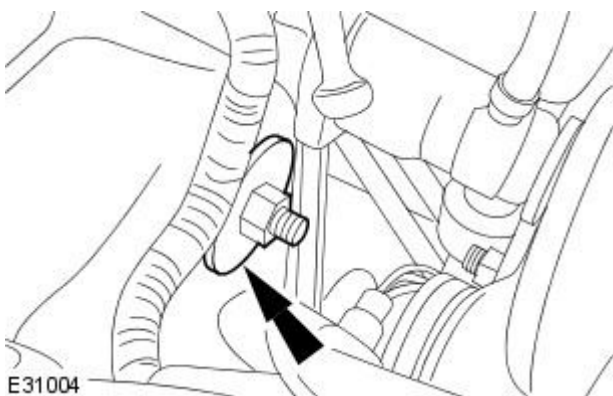
2. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Install the upper arm retaining nut, but do not tighten fully at this stage.



3. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Install the upper arm retaining nut, but do not tighten fully at this stage.



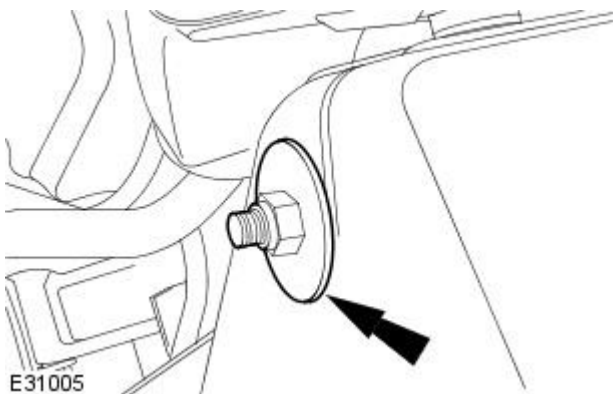
4. Install the front shock absorber.

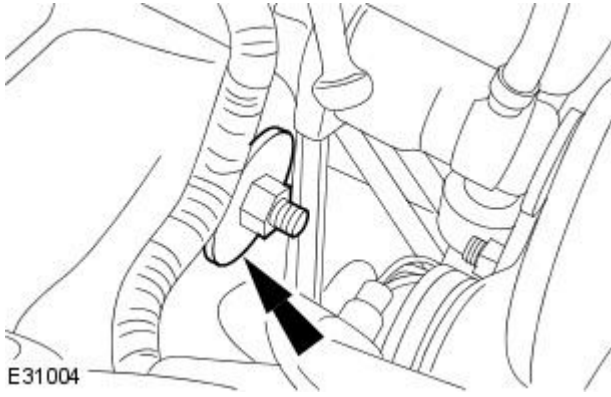
For additional information, refer to: [Front Shock Absorber](#) (204-01 Front Suspension, Removal and Installation).

5.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.

• NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Tighten to 47 Nm.





6.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.

• NOTE: Some variation in the illustrations may occur, but the essential information is always correct.


Tighten to 47 Nm.

7. Install the secondary bulkhead panel RH.  
For additional information, refer to: [Secondary Bulkhead Panel RH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).

# Front Suspension - Front Wheel Bearing and Wheel Hub

## Removal and Installation

### Removal

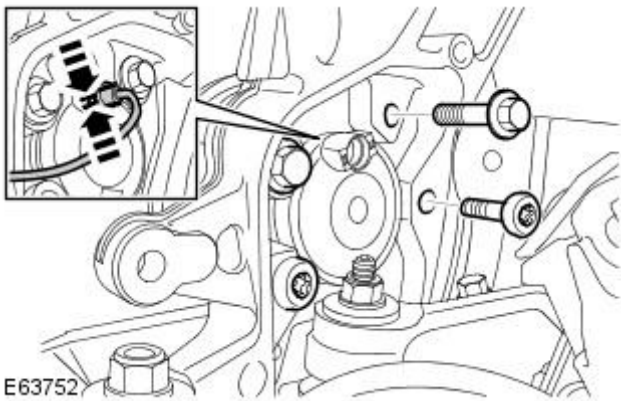
-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.


Raise and support the body.

- Remove the brake disc.  
For additional information, refer to: [Brake Disc - Vehicles With: Standard Brakes](#) (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
- NOTE:** LH illustration shown, RH is similar.

Release the wheel speed sensor.

- Release the clip.
- Tie aside.



-  **CAUTION:** Do not attempt to release the wheel hub by hitting it with a hammer directly, loosen the wheel hub retaining bolts partially before applying an even amount of force to the head of each bolts to release the wheel hub from the wheel knuckle. Failure to follow this instruction may cause damage to the component.

- **NOTE:** Note the fitted position.
- **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.
- **NOTE:** LH illustration shown, RH is similar.

Remove the hub assembly.

- Remove and discard the 4 bolts.

### Installation

- NOTE:** Align to the position noted on removal.  
  
• **NOTE:** Make sure that all the component mating faces are clean.

Install the hub assembly.

- Clean the component mating faces.
- Tighten the bolts to 90 Nm (66 lb.ft).

- Install the wheel speed sensor.

- Secure the clip.


- Install the brake disc.  
For additional information, refer to: [Brake Disc - Vehicles With: Standard Brakes](#) (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

# Front Suspension - Wheel Knuckle

Removal and Installation

Special Tool(s)	
 <p>204-327</p> <p>E63732</p>	<p>Ball joint splitter</p> <p>204-327</p>

## Removal

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

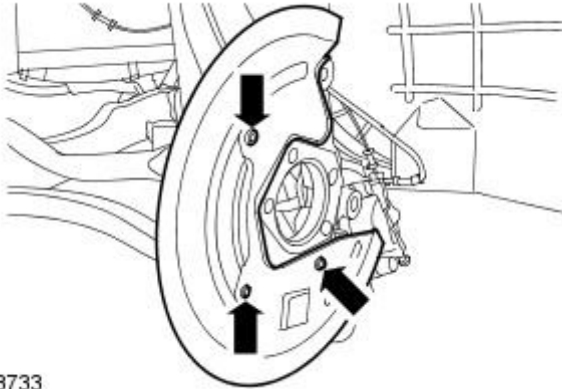
Raise and support the vehicle.

- Remove the hub assembly.  
For additional information, refer to: [Front Wheel Bearing and Wheel Hub](#) (204-01 Front Suspension, Removal and Installation).

- NOTE:** LH illustration shown, RH is similar.

Remove the brake disc shield.

- Remove the 3 rivets.



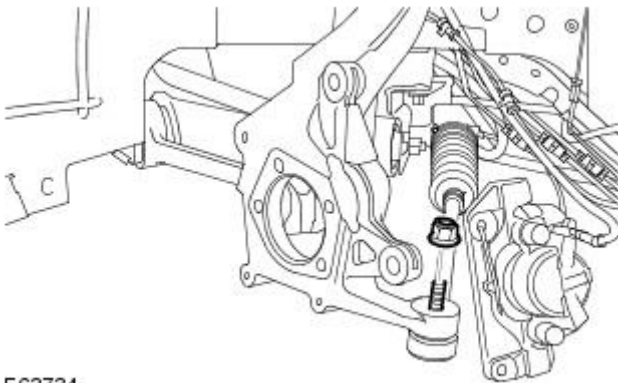
E63733

- NOTE:** LH illustration shown, RH is similar.

- NOTE:** Use an additional wrench to prevent the ball joint rotating.

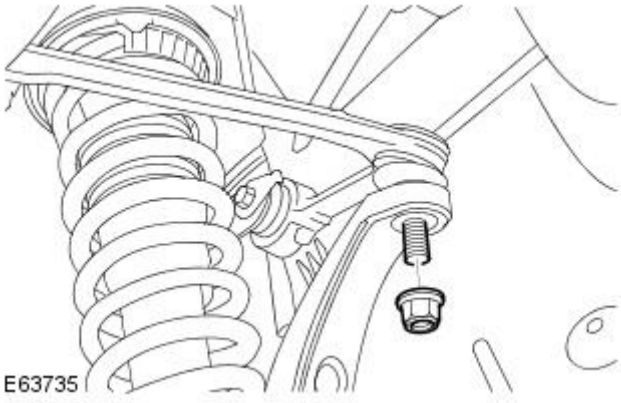
Disconnect the steering gear tie rod end ball joint.

- Remove and discard the tie rod end retaining nut.



E63734



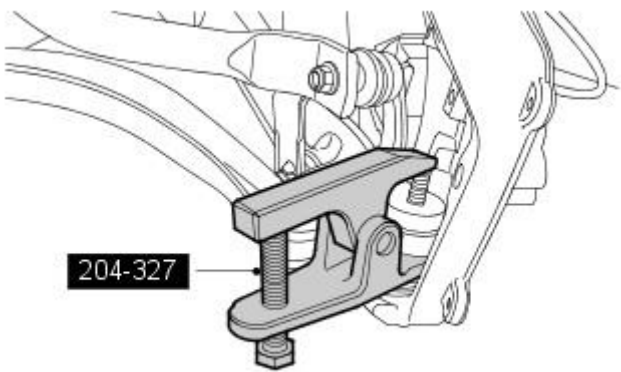



5. NOTE: Use an additional wrench to prevent the ball joint rotating.

- NOTE: LH illustration shown, RH is similar.

Disconnect the upper arm from the wheel knuckle.

- Remove and discard the nut.



6.  CAUTION: Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.

- NOTE: Use an additional wrench to prevent the ball joint rotating.

- NOTE: LH illustration shown, RH is similar.

Remove the wheel knuckle.

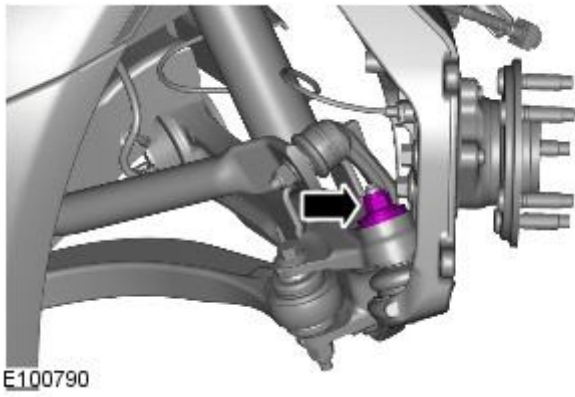
- Remove and discard the nut.
- Using the special tool, release the ball joint from the lower suspension arm.

## Installation

1. NOTE: Use an additional wrench to prevent the ball joint rotating.

Install the wheel knuckle.

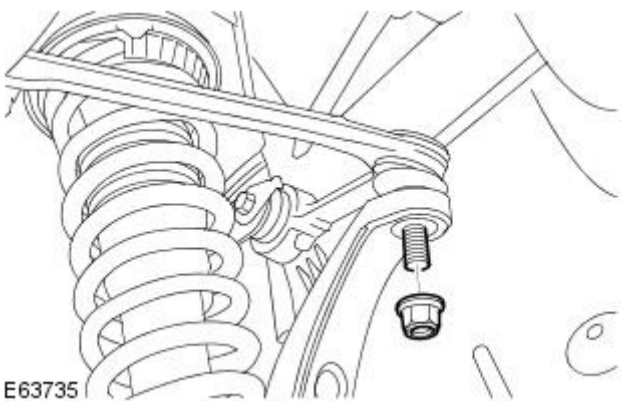
- Clean the component mating faces.
- Tighten the nut to 92 Nm.



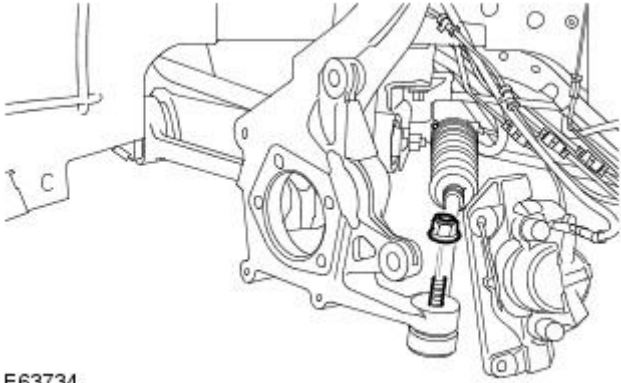
2. NOTE: Use an additional wrench to prevent the ball joint rotating.

Connect the upper arm and wheel knuckle.

- Tighten the nut to 90 Nm.





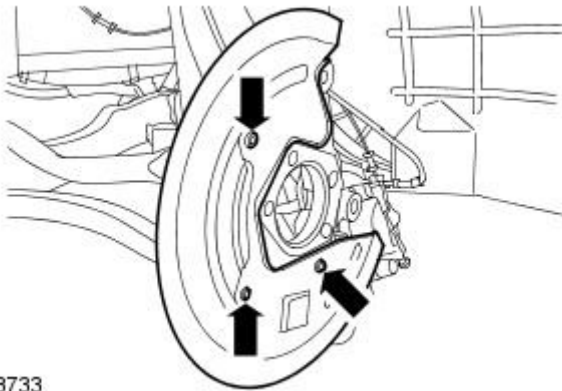


3. NOTE: Use an additional wrench to prevent the component from rotating.

Connect the tie-rod end ball joint.

- Tighten the nut to 133 Nm.

E63734



4. Install the brake disc shield.

- Install the rivets.

E63733

5. Install the hub assembly.

For additional information, refer to: [Front Wheel Bearing and Wheel Hub](#) (204-01 Front Suspension, Removal and Installation).

## Rear Suspension -

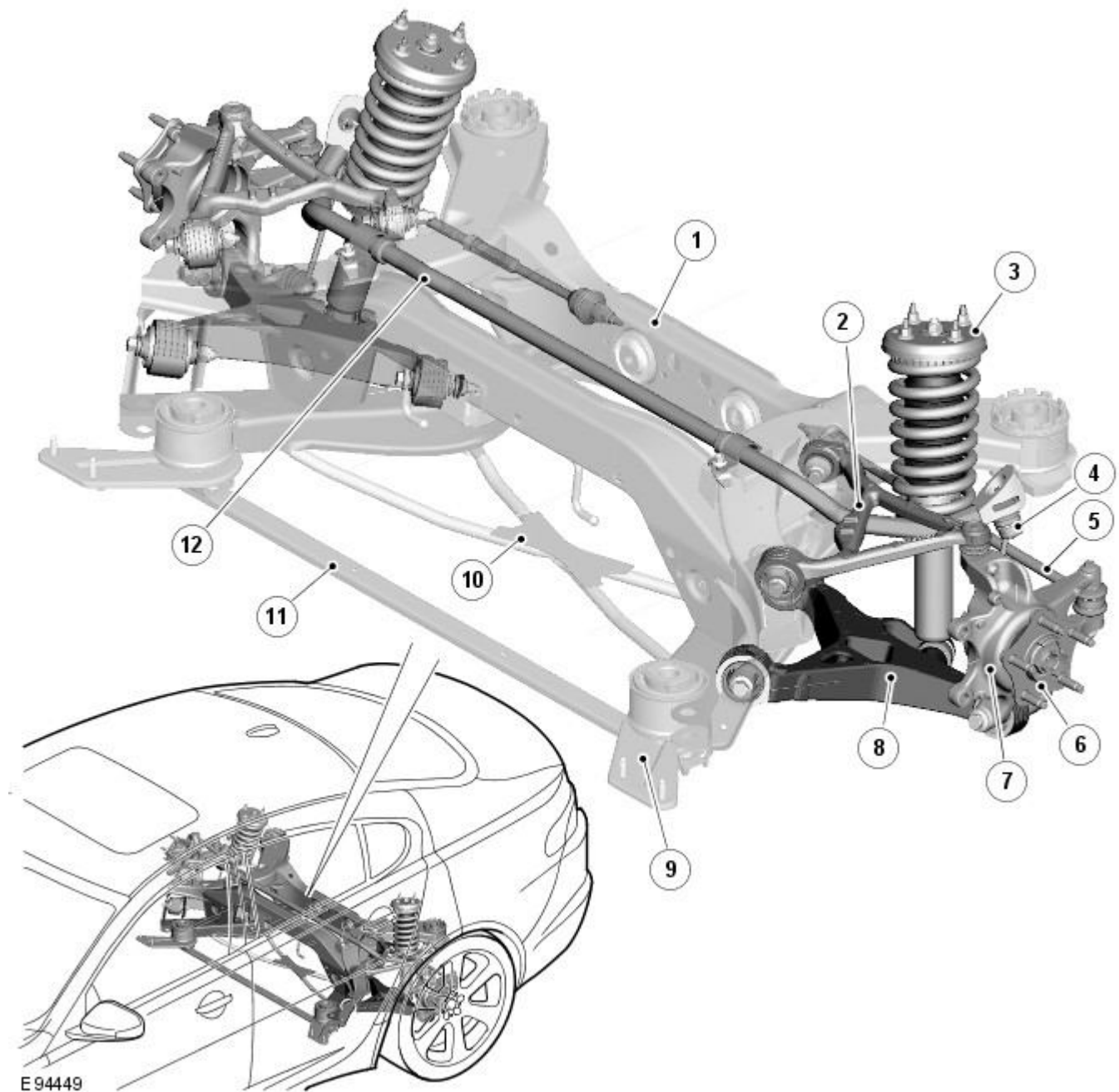
### Torque Specifications

Description	Nm	lb-ft	lb-in
Halfshaft outer constant velocity joint retaining nut	300	221	-
Lower arm to wheel knuckle retaining nut and bolt	190	140	-
Lower arm to subframe retaining nut and bolt	192	142	-
Lower arm to subframe retaining bolt	192	142	-
Upper arm ball joint to wheel knuckle retaining nut	96	71	-
Upper arm to subframe retaining nut and bolt	115	85	-
Toe link to subframe ball joint retaining nut	90	66	-
Toe link to wheel knuckle retaining nut and bolt	63	46	-
Toe link setting nut	55	41	-
Shock absorber and spring assembly upper mounting to body retaining nuts	28	21	-
Shock absorber and spring assembly upper mounting retaining nut (without adaptive damping)	50	37	-
Shock absorber and spring assembly upper mounting retaining nut (with adaptive damping)	27	20	-
Shock absorber to lower arm retaining bolt	133	98	-
Stabilizer bar link to stabilizer bar retaining nut	48	35	-
Stabilizer bar clamp to subframe retaining bolt	55	41	-
Stabilizer bar link to lower arm retaining nut	48	35	-
Wheel and tire to wheel hub retaining nuts	125	92	-

# Rear Suspension - Rear Suspension - Component Location

Description and Operation

## COMPONENT LOCATION



E94449

### ItemDescription

1	Subframe
2	Upper control arm
3	Spring and damper assembly
4	Stabilizer bar link
5	Toe link
6	Wheel hub and bearing assembly
7	Wheel knuckle
8	Lower control arm
9	Shear bracket
10	Cross brace
11	Single brace
12	Stabilizer bar

# Rear Suspension - Rear Suspension - Overview

Description and Operation

## OVERVIEW

The double wishbone type rear-suspension is a fully independent design assembled on a steel subframe; large diameter bushes isolate the subframe from the vehicle's body.

A toe-link located between the wheel knuckle and the subframe is used to adjust the toe angle of the rear wheels.

The wheel knuckle attaches to the upper and lower control arms, and the coil spring and damper assembly is located between the lower control arm and the vehicle body.

Dependant on vehicle model there are three types of coil spring and damper available:

- a standard oil passive damper (All models except supercharged),
- an adaptive damper, also known as Computer Active Technology Suspension (CATS) on 4.2L supercharged vehicles up to 2010MY, For additional information refer to Vehicle Dynamic Suspension 4.2L.
- a continuously variable adaptive damper, also known as Adaptive Dynamics System on 5.0L supercharged vehicles from 2010MY. For additional information refer to Vehicle Dynamic Suspension 5.0L.

# Rear Suspension - Rear Suspension - System Operation and Component Description

Description and Operation

## System Operation

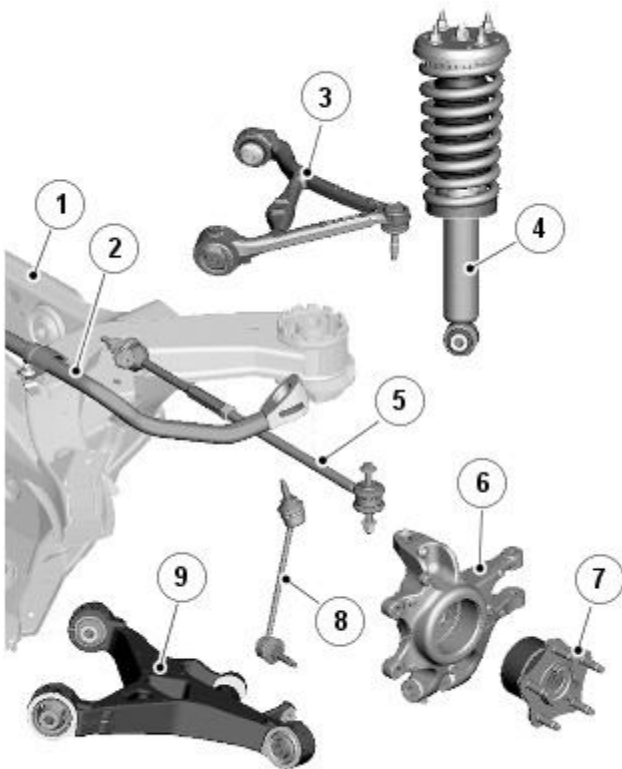
The double wishbone type rear-suspension is assembled on a fabricated high-grade steel subframe. Large diameter mounting bushes are used to isolate the subframe from the vehicle's body; the front bushes are hydrabushes, the rear are voided rubber.

To achieve optimum suspension refinement a cross-brace is used to increase the torsional stiffness of the subframe. The single brace attached to the shear brackets helps to reduce the transmission of road noise.

An adaptive damping system is available on specified models. For additional information refer to Vehicle Dynamic Suspension 4.2L or 5.0L.

## Component Description

### COMPONENTS



E94999

#### ItemDescription

1	Subframe
2	Stabilizer bar
3	Upper control arm
4	Spring and damper assembly
5	Toe link
6	Wheel knuckle
7	Wheel hub and bearing assembly
8	Stabilizer bar link
9	Lower control arm

### Upper Control Arm

The cast aluminum upper control arm locates to the subframe via one cross-axis joint and one plain rubber bush, and links to the aluminum wheel knuckle via an integral ball-joint.

### Lower Control Arm

The aluminum lower arm locates to the subframe via one cross-axis joint and one plain rubber bush, and to the wheel

knuckle via a second plain rubber bush.

The rear of the control arm has mounting points for the damper and the stabilizer link.

## Toe-Link

The toe-link is located between the wheel knuckle and brackets on the subframe.

The toe-link comprises an inner rod with integral axial ball joint. The inner ball joint has a threaded spigot which locates in a bracket on the subframe and is secured with a locknut. The rod has an internal thread which accepts the outer rod.

The outer rod has a cross-axis joint at its outer end which is located in a clevis on the wheel knuckle, and is secured with a bolt and locknut.

The length of the toe-link can be adjusted by rotating the inner rod. This allows for adjustment of the toe angle for the rear wheel. Once set the inner rod can be locked in position by tightening a locknut on the outer rod against the inner rod.

## Wheel Knuckle

The cast aluminum wheel knuckle attaches to:

- the upper control arm via a ball-joint located in the arm,
- the lower control arm via a plain rubber bush located in the arm,
- the toe-link via a cross-axis joint located in the toe link.

The wheel knuckle also provides the mounting locations for the:

- wheel hub assembly,
- wheel bearing,
- wheel speed sensor,
- brake caliper,
- and disc shield.

## Stabilizer Bar

The solid construction stabilizer bar and bushes have been designed to provide particular characteristics in maintaining roll rates, specifically in primary ride comfort. There are four derivatives of rear stabilizer bar, with different diameters, to support the various powertrains:

- V6 gasoline - 12.7 mm solid bar
- V8 4.2L and 5.0L gasoline - 13.6 mm solid bar
- V6 2.7L diesel - 14.5 mm solid bar
- V6 3.0L diesel - 14.5 mm solid bar
- V8 4.2L gasoline supercharged – 16mm tubular
- V8 5.0L gasoline supercharged - 18 mm tubular

The stabilizer bar is attached to the top of the subframe with two bushes and mounting brackets. The stabilizer bar has crimped, 'anti-shuffle' collars pressed in position on the inside edges of the bushes. The collars prevent sideways movement of the stabilizer bar.

Each end of the stabilizer bar curves rearward to attach to a ball joint on each stabilizer link. Each link is attached via a second ball joint to a cast bracket on the lower control arm. The links allow the stabilizer bar to move with the wheel travel providing maximum effectiveness.

## Spring and Damper Assembly

The spring and damper assembly are attached to cast brackets on the lower control arms and to the vehicle body by four studs secured by locking nuts. Depending on vehicle model there are three types of coil spring and damper available:

- a standard oil passive damper (All models except supercharged),
- an adaptive damper, also known as Computer Active Technology Suspension (CATS) on 4.2L supercharged vehicles up to 2010MY. For additional information refer to Vehicle Dynamic Suspension 4.2L.
- a continuously variable adaptive damper, also known as Adaptive Dynamics System on 5.0L supercharged vehicles from 2010MY. For additional information refer to Vehicle Dynamic Suspension 5.0L.

The dampers are a monotube design with a spring located by a circlip onto the damper tube. The lower end of the damper has a spherical joint which locates in the lower control arm and is secured with a bolt.

The damper piston is connected to a damper rod which is sealed at its exit point from the damper body. The threaded outer end of the damper rod locates through a hole in the top mount. A self locking nut secures the top mount to the damper rod. The damper rod on the adaptive damper has an electrical connector on the outer end of the damper rod.

Supercharged 4.2L vehicles up to 2010MY: The damper functions by restricting the flow of hydraulic fluid through internal galleries in the damper's piston. The adaptive damper has a solenoid operated valve, which when switched allows a greater flow of hydraulic fluid through the damper's piston. This provides a softer damping characteristic from the damper. The adaptive damper defaults to a firmer setting when not activated. The solenoid is computer controlled and can switch between soft and hard damping settings depending on road wheel inputs and vehicle speed.

Supercharged 5.0L vehicles from 2010MY: The variable damper functions by adjustment of a solenoid operated variable orifice, which opens up an alternative path for oil flow within the damper. When de-energized the bypass is closed and all the oil flows through the main (firm) piston. When energized the solenoid moves an armature and control blade, which work against a spring. The control blade incorporates an orifice which slides inside a sintered housing to open up the bypass as required. In compression, oil flows from the lower portion of the damper through a hollow piston rod, a separate soft (comfort) valve, the slider housing and orifice and into the upper portion of the damper, thereby bypassing the main (firm) valve. In rebound the oil flows in the opposite direction

The damper rod is fitted with a spring aid which prevents the top mount making contact with the top of the damper body during full suspension compression and also assists with the suspension tune.

The spring rate of the coil springs can differ between models and are color coded for identification. The coil spring locates on a spring packer and a lower spring seat which is located on the damper body. The spring locates in an upper spring seat which is located on the underside of the top mount. The majority of the roll stiffness is provided by the springs rather than the stabilizer bar as this arrangement allows for a natural frequency of roll, providing a consistent suspension ride.

## **Rear Suspension - Rear Suspension**

Diagnosis and Testing

For Diagnosis and Testing information.

REFER to: [Suspension System](#) (204-00 Suspension System - General Information, Diagnosis and Testing).




## Rear Suspension - Upper Arm

Removal and Installation

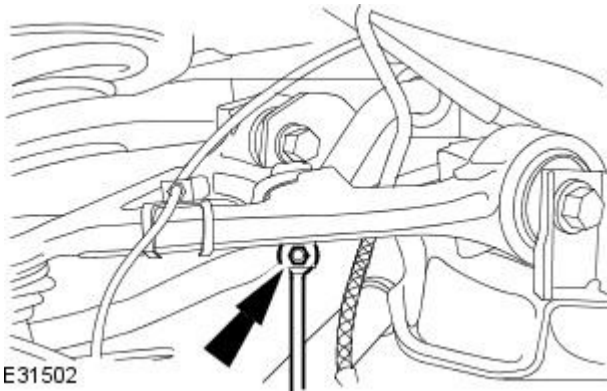
### Removal

- NOTE: Removal steps in this procedure may contain installation details.

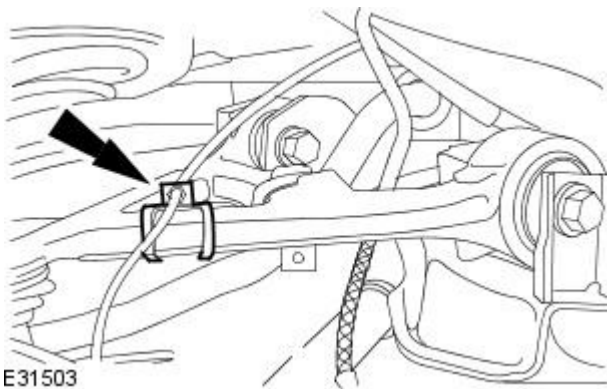
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise the vehicle.

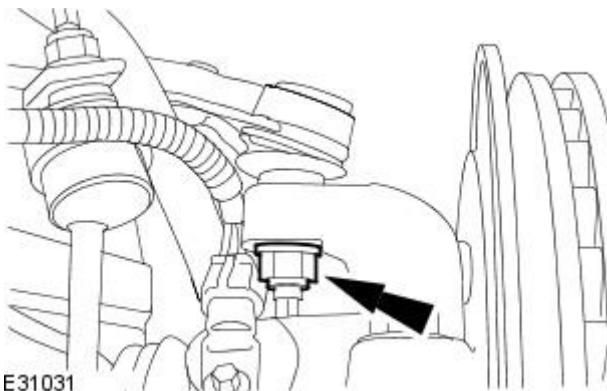
2. Remove the wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
3. Release the high intensity discharge (HID) sensor link rod.



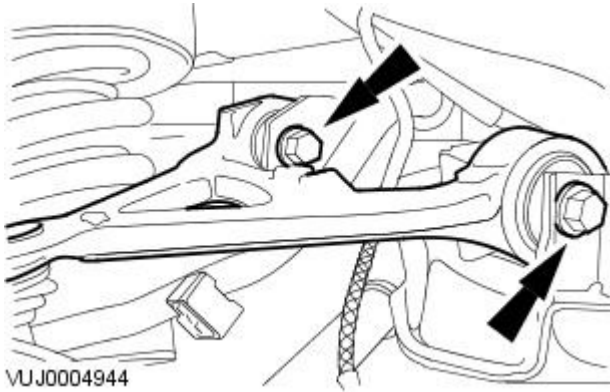
4. Release the anti-lock brake system (ABS) sensor wiring harness.



5. Release the upper arm from the wheel knuckle.

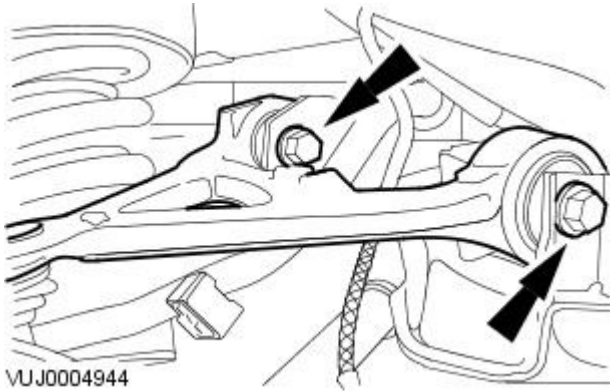


6. Remove the upper arm.

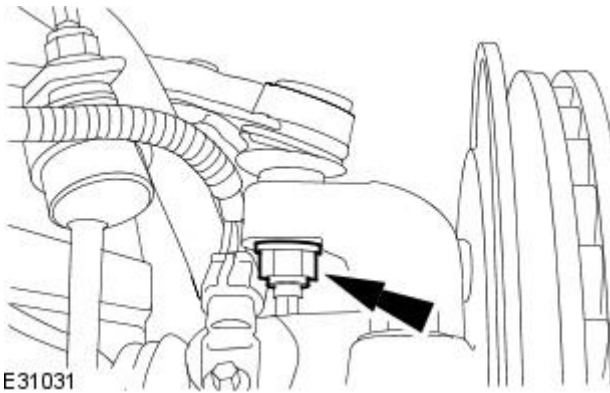


### Installation

1. To install, reverse the removal procedure.
2. Tighten to 98 Nm.



3. Tighten to 96 Nm.




## Rear Suspension - Lower Arm

Removal and Installation

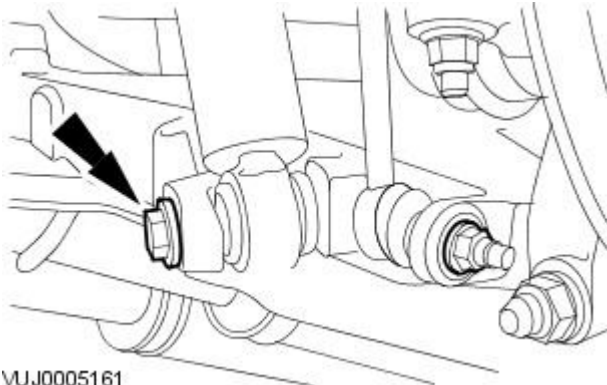
### Removal

- NOTE: Before commencing work on the vehicle ensure the park brake is in the off position.
- NOTE: LH shown RH similar.

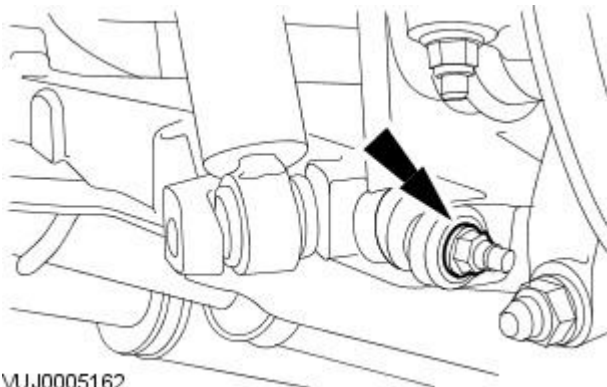
1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise the vehicle.

2. Remove the wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
3. Release the shock absorber and spring assembly from the lower arm.



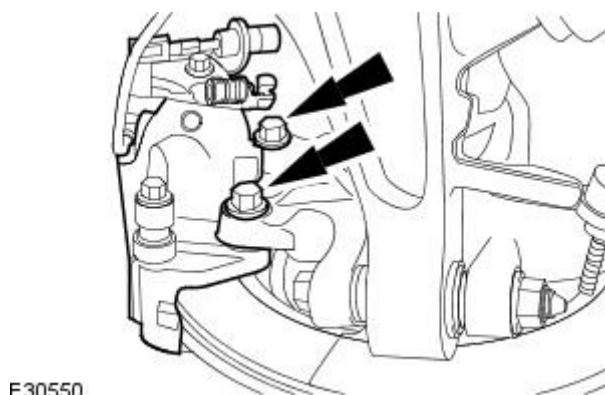
4. Release the rear stabilizer bar link.



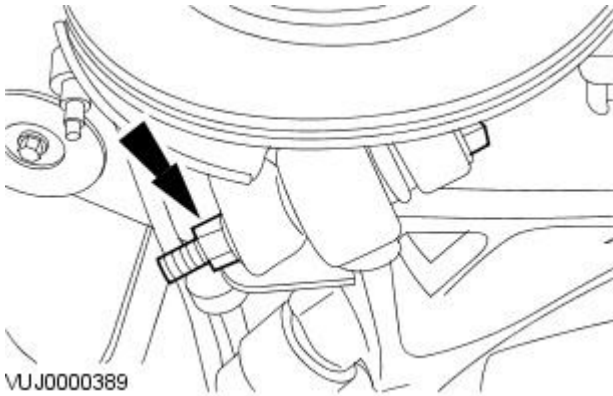
5.  **CAUTION:** Do not allow the brake caliper to hang on the brake hose.

- NOTE: Make sure that new bolts are installed.

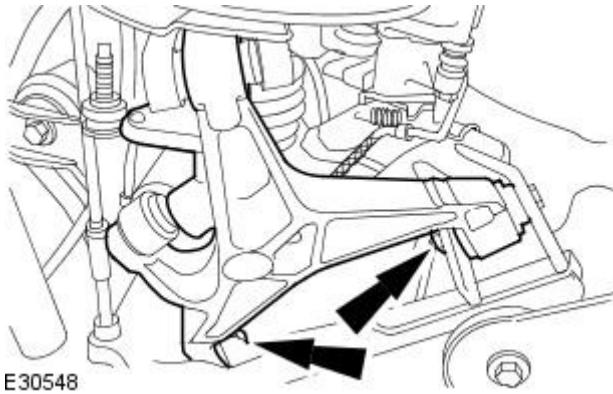
Release the rear brake caliper and tie aside.



6. Release the lower arm from the wheel hub assembly.



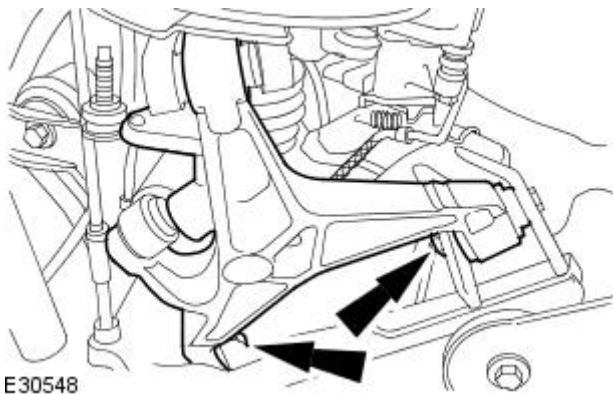
7. Remove the lower arm.



## Installation

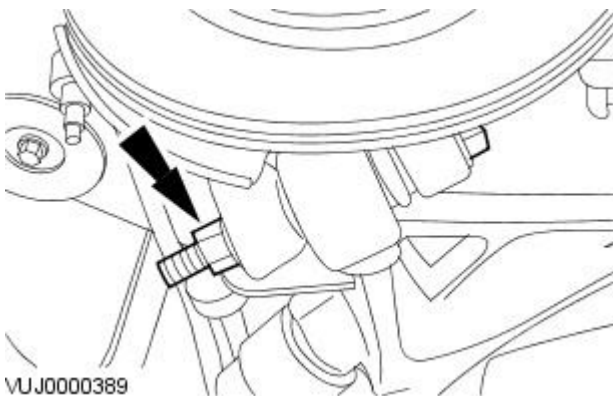
1.  CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

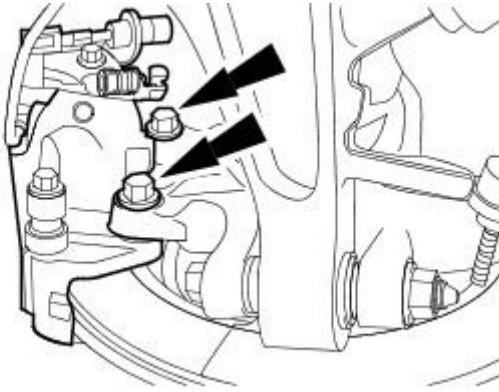
Install the lower arm.



2.  CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

Secure the lower arm to the wheel hub assembly.





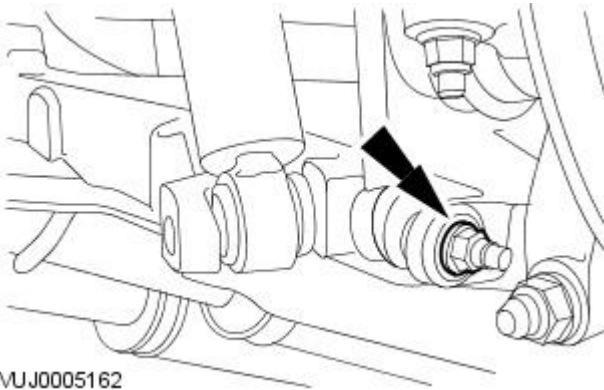
E30550

3.  CAUTION: Do not allow the brake caliper to hang on the brake hose.

• NOTE: Make sure that new bolts are installed.

Secure the rear brake caliper.

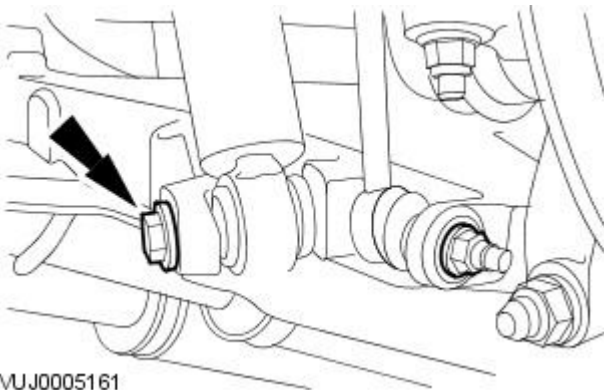
- Tighten the bolts to 103 Nm.



VUJ0005162

4. Secure the rear stabilizer bar link.

- Tighten the nut to 48 Nm.



VUJ0005161

5.  CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

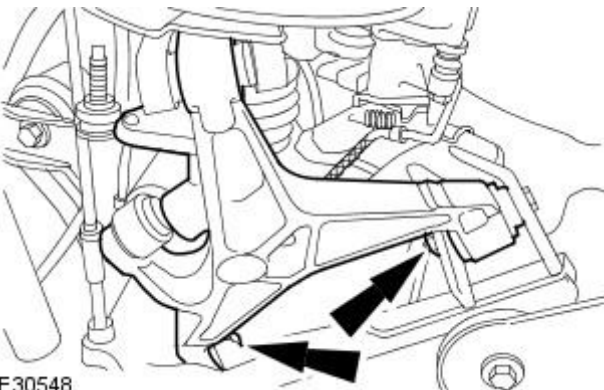
Secure the shock absorber and spring assembly to the lower arm.

6. Install the wheel and tire.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

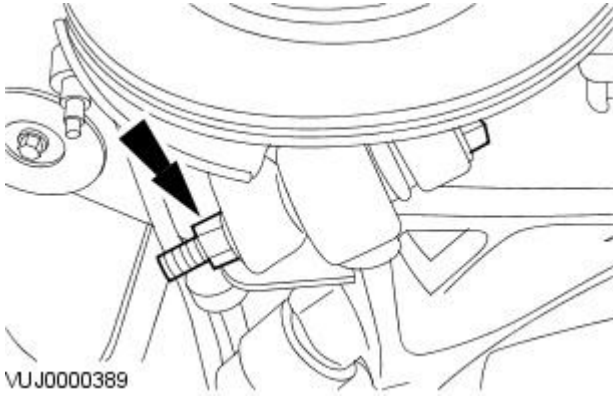
7. Lower the vehicle.

8. Tighten to 175 Nm.

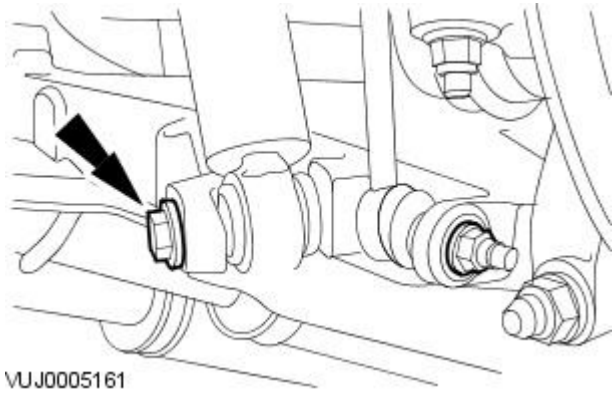


E30548

9. Tighten to 190 Nm.



10. Tighten to 133 Nm.





## Rear Suspension - Shock Absorber and Spring Assembly

Removal and Installation

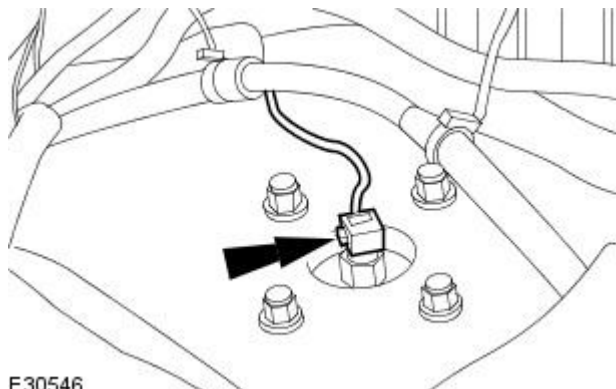
### Removal

All vehicles

1. Remove the luggage compartment side trim panel.  
For additional information, refer to: [Loadspace Trim Panel LH](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

Vehicles with active damping

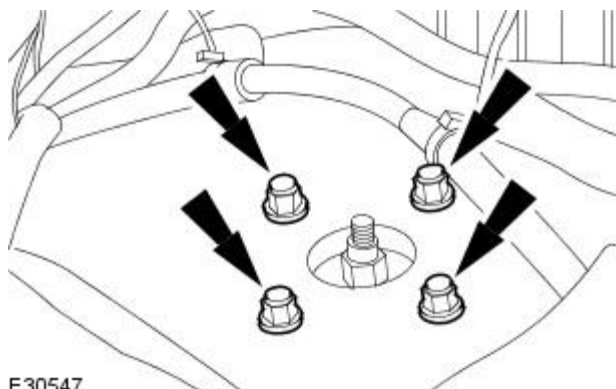
2. Disconnect the active suspension damper electrical connector.



E30546

All vehicles

3. Remove the shock absorber and spring assembly top mount nuts. TORQUE: 28 Nm



E30547

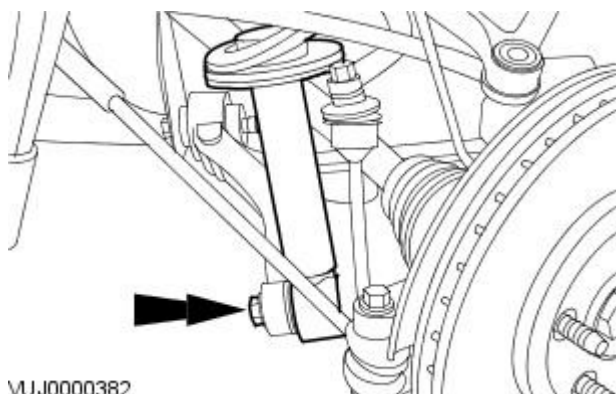
4.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise the vehicle.

5. Remove the wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

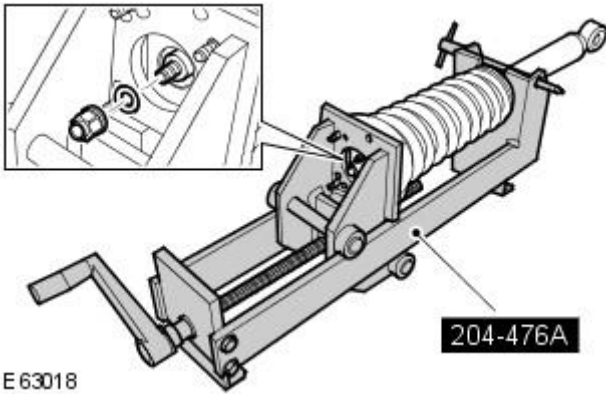
6. **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the shock absorber and spring assembly. TORQUE: 133 Nm




VUJ0000382


### Vehicles with active damping



#### 7. WARNINGS:

 Make sure the shock absorber is secured by fully inserting the locking pin in to the special tool. Failure to follow these instructions may result in personal injury.

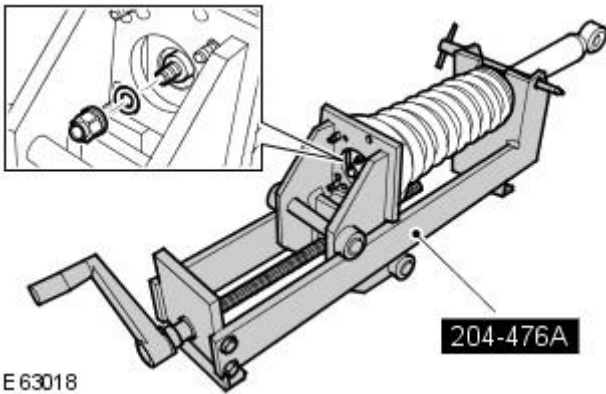
 As the spring is under extreme tension care must be taken at all times. Failure to follow these instructions may result in personal injury.

 Make sure that a new nut is installed.


Using the special tool, compress the suspension spring to remove the shock absorber.

- Compress the spring.
- Remove the nut. TORQUE: 27 Nm

### Vehicles without active damping



#### 8. WARNINGS:

 Make sure the shock absorber is secured by fully inserting the locking pin in to the special tool. Failure to follow these instructions may result in personal injury.

 As the spring is under extreme tension care must be taken at all times. Failure to follow these instructions may result in personal injury.

 Make sure that a new nut is installed.

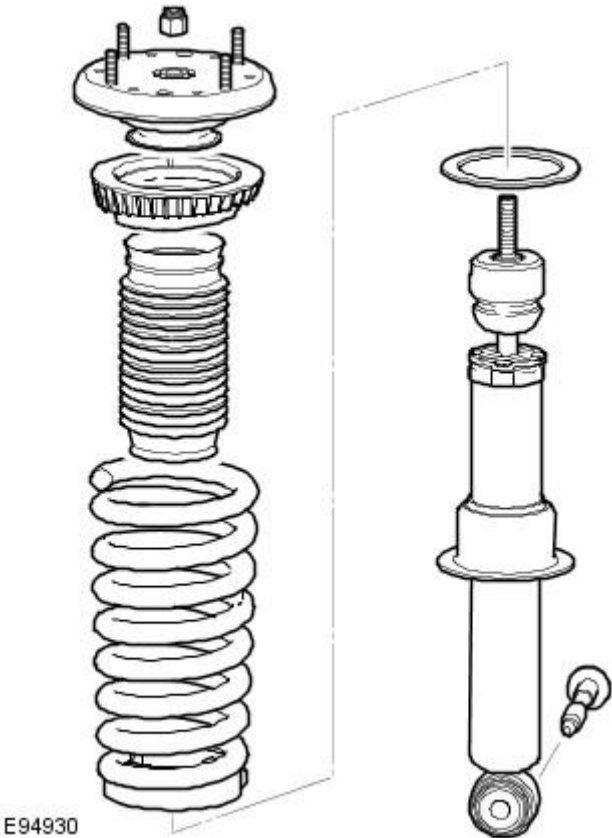
Using the special tool, compress the suspension spring to remove the shock absorber.

- Compress the spring.
- Remove the nut. TORQUE: 50 Nm

### All vehicles



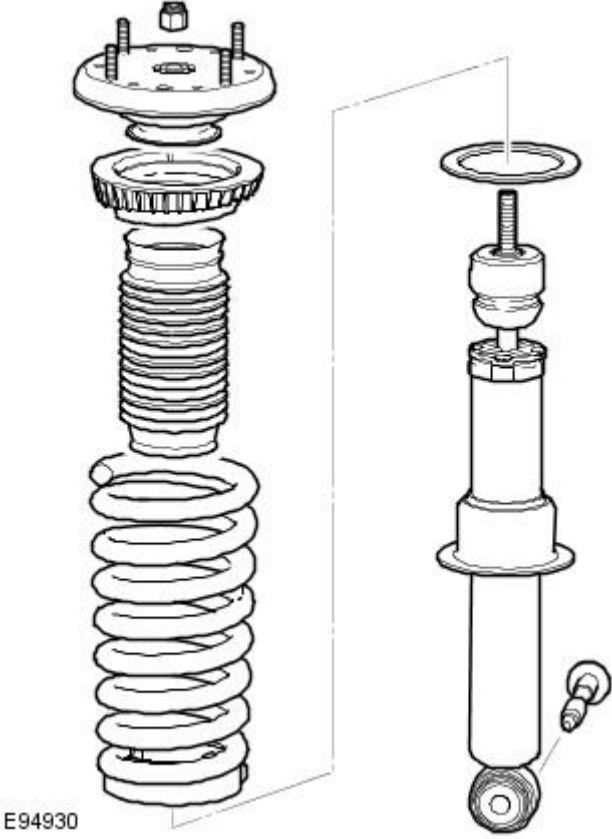
9. Remove the shock absorber rod components.



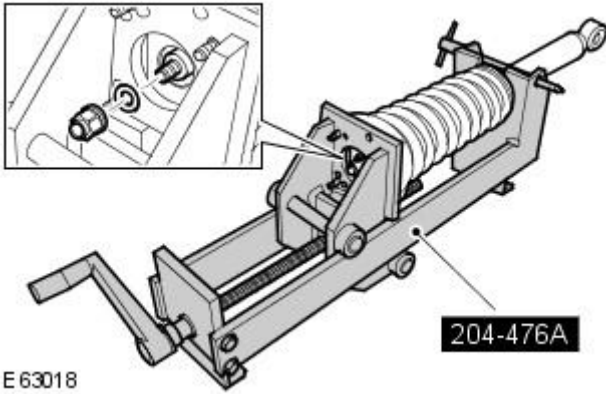
**Installation**

All vehicles


- 1. Install the shock absorber rod components.




Vehicles with active damping



## 2. WARNINGS:

 Make sure the shock absorber is secured by fully inserting the locking pin in to the special tool. Failure to follow these instructions may result in personal injury.

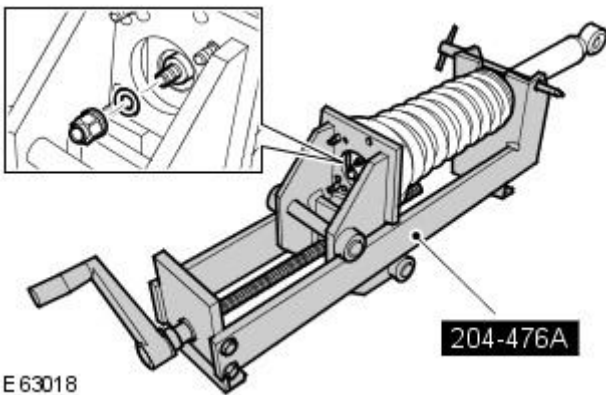
 As the spring is under extreme tension care must be taken at all times. Failure to follow these instructions may result in personal injury.

 Make sure that a new nut is installed.


Using the special tool, compress the suspension spring to install the shock absorber.

- Compress the spring.
- Tighten the nut to 27 Nm.

## Vehicles without active damping



## 3. WARNINGS:

 Make sure the shock absorber is secured by fully inserting the locking pin in to the special tool. Failure to follow these instructions may result in personal injury.

 As the spring is under extreme tension care must be taken at all times. Failure to follow these instructions may result in personal injury.

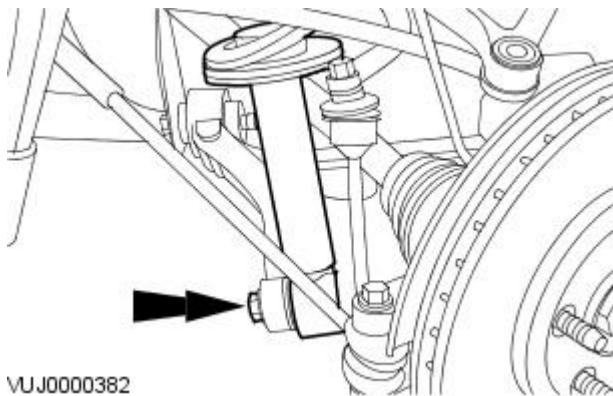
 Make sure that a new nut is installed.

Using the special tool, compress the suspension spring to install the shock absorber.

- Compress the spring.
- Tighten the nut to 50 Nm.

## 4. Install the shock absorber and spring assembly.

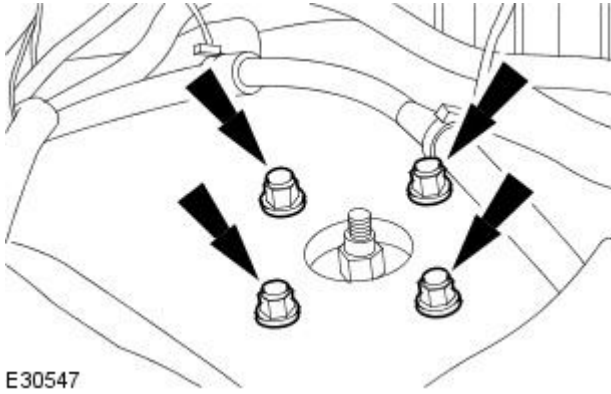
- Tighten to 133 Nm.



## 5. Install the wheel and tire.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

## All vehicles

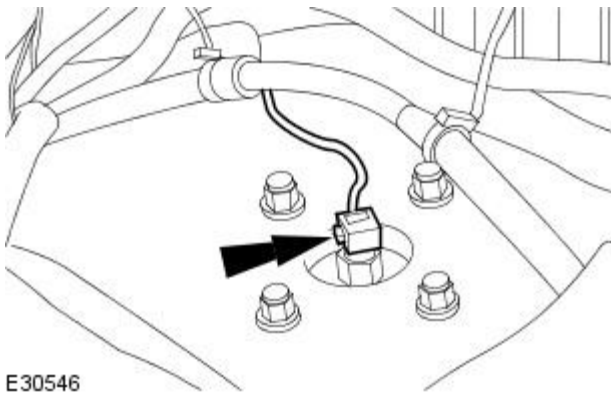


E30547

6. Install the shock absorber and spring assembly top mount nuts.

- Tighten to 28 Nm.

#### Vehicles with active damping



E30546


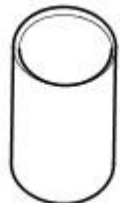

7. Connect the active suspension damper electrical connector.

#### All vehicles

8. Install the luggage compartment side trim panel.  
For additional information, refer to: [Loadspace Trim Panel LH](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

## Rear Suspension - Shock Absorber Lower Bushing

Removal and Installation

Special Tool(s)	
 E52622	Bushing Remover / Installer 204-335
 E52621	Bushing remover 204-533
 E52620	Bushing installer 204-534

### Removal

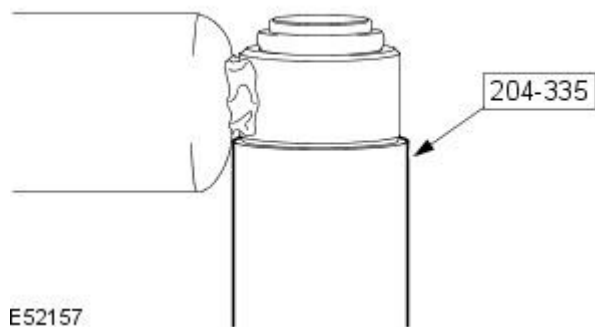
-  **WARNING:** Failure to follow this instruction may cause damage to the vehicle.

Mark the orientation of the shock absorber in relation to the lower suspension arm.

- Remove the shock absorber and spring assembly.  
For additional information, refer to: [Shock Absorber and Spring Assembly](#) (204-02 Rear Suspension, Removal and Installation).
- NOTE:** Place the shock absorber with the recessed side facing upwards.

- NOTE:** With assistance make sure the special tool is aligned.

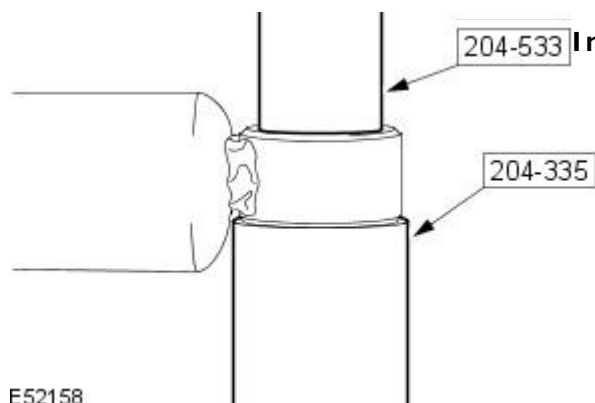
Using the special tool, support the shock absorber.



- NOTE:** Position the special tool onto the recessed side of the shock absorber.
- Using the special tools, carefully remove the bushing from the shock absorber.

- NOTE:** With assistance make sure the special tool is aligned.

Position and align the special tool to the shock absorber bushing.



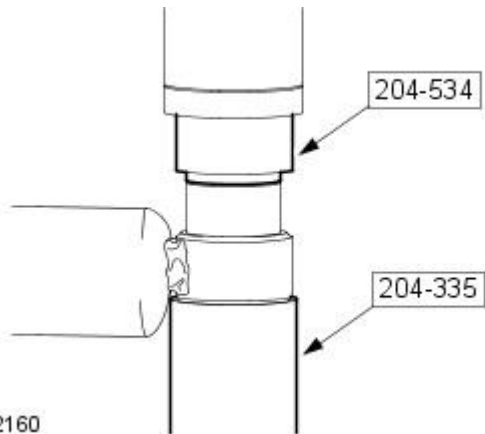
1. NOTE: Make sure the bush is clean and free from oil or grease.

• NOTE: Use a suitable lubricant to allow the bush to locate into the special tool.

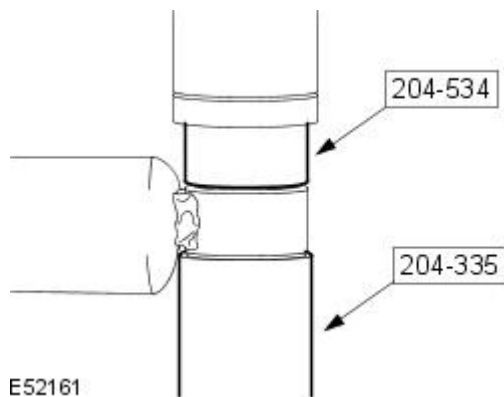
Locate the new bushing in the special tool.



E52159



E52160



E52161

2.  WARNING: Failure to follow this instruction may cause damage to the vehicle.

• NOTE: Make sure the shock absorber is clean and free from oil or grease and is not damaged prior to pushing in the new bush.

• NOTE: Make sure the bush is installed following the same direction as removal.

• NOTE: Make sure correct alignment is maintained.

Using the special tools, align the bushing to the shock absorber.

3. NOTE: Make sure correct alignment is maintained.

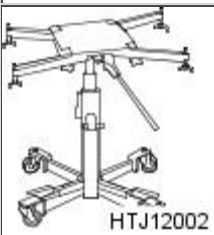
Slowly push the bush into the shock absorber until the tool reaches the stop.

4. Install the shock absorber and spring assembly.


For additional information, refer to: [Shock Absorber and Spring Assembly](#) (204-02 Rear Suspension, Removal and Installation).

## Rear Suspension - Rear Stabilizer Bar

Removal and Installation

Special Tool(s)	
 <p>HTJ12002</p>	Powertrain Assembly Jack, HTJ
	1200-2

### Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Make sure to support the vehicle with axle stands.  
  
Raise and support the vehicle.
3. Remove both rear wheels and tires.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
4. Drain the fuel tank.  
For additional information, refer to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).
5. Remove the exhaust system.  
For additional information, refer to: Front Muffler (309-00 Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

6.  **CAUTION:** Always plug any open connections to prevent contamination.

• **NOTE:** To prevent the loss of brake fluid, using the special tool apply the brake pedal and set to 40mm ( 1.6 in ) below the rest position.

• **NOTE:** RH illustration shown, LH is similar.

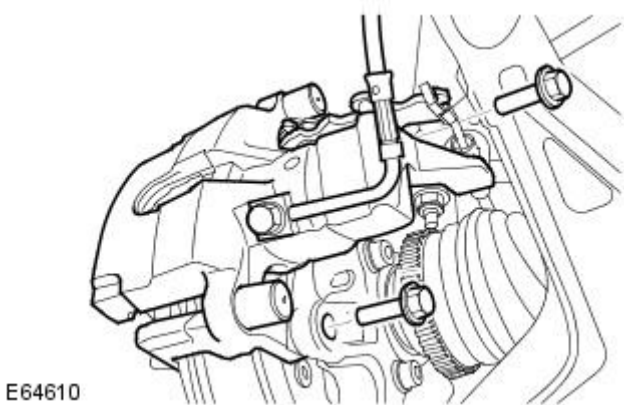
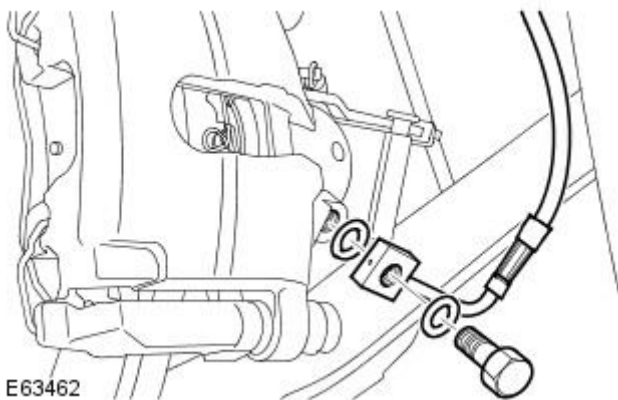
Disconnect the brake hose from the brake caliper.

- Using the special tool, press and hold the brake pedal.
- Remove and discard the two sealing washers.

7. **NOTE:** Left-hand shown, right-hand similar.

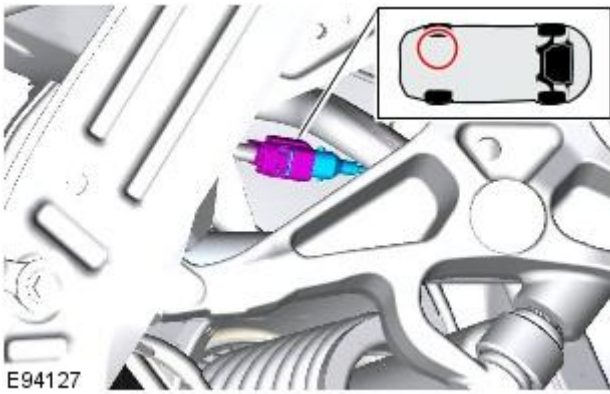
Release the brake caliper.

- Remove and discard the 2 bolts.
- Tie the brake caliper aside.

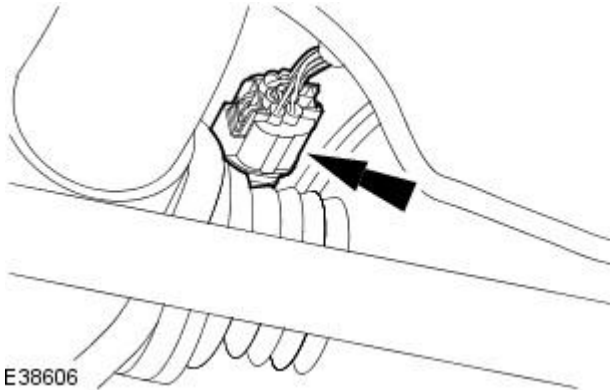


**8. NOTE:** Left-hand shown, right-hand similar.

Disconnect the rear wheel speed sensor.

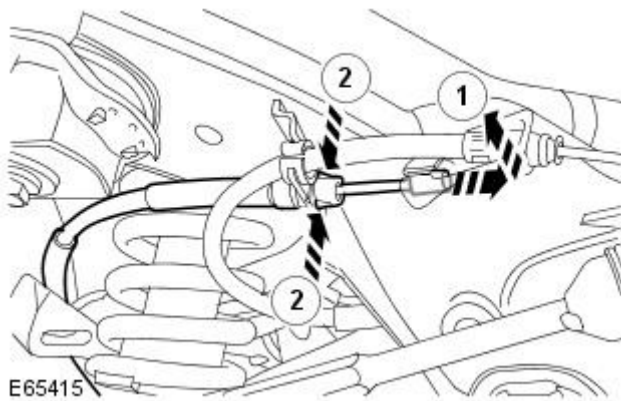


**9.** Disconnect the electronic parking brake actuator electrical connector.



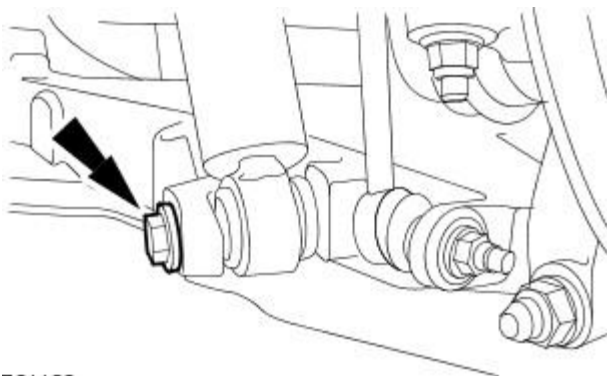
**10. NOTE:** Left-hand shown, right-hand similar.

Disconnect both parking brake cables from the rear brake calipers.



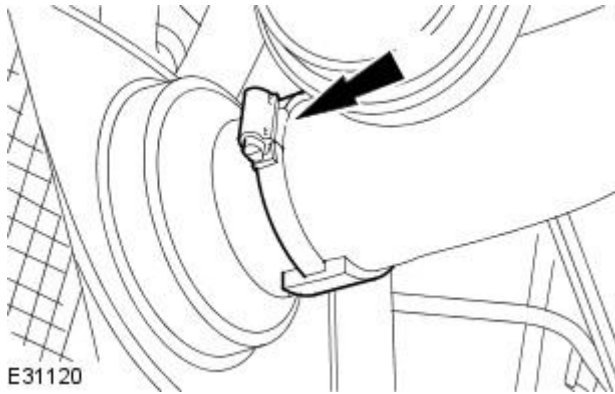
**11. NOTE:** Left-hand shown, right-hand similar.


Detach the shock absorber.





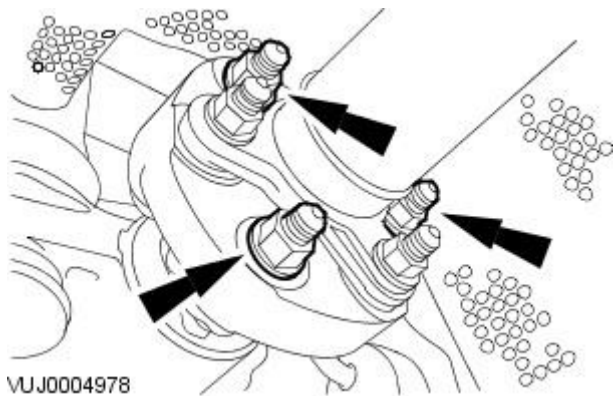
12. Detach the fuel filler hose.



13.  CAUTION: Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the driveshaft.

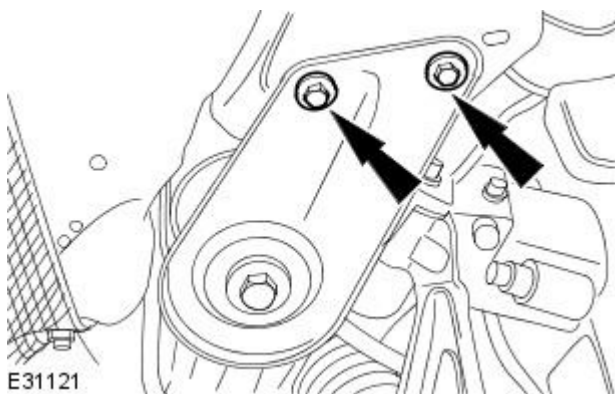
Detach the driveshaft from the rear drive axle flange.

- Mark the position of the driveshaft in relation to the rear drive axle flange.
- Mark the position of the balance nut in relation to the rear drive axle flange. (if fitted).
- Mark the position of each nut and bolt in relation to the driveshaft flexible joint.

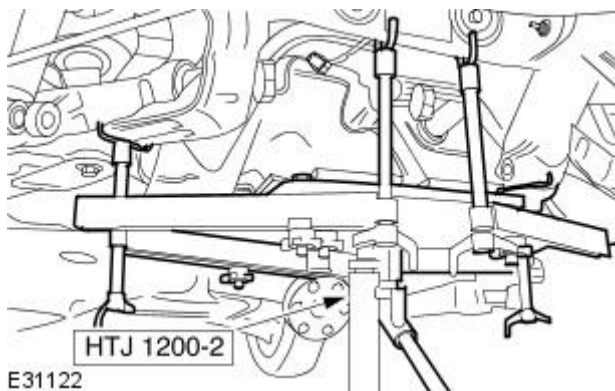


14. NOTE: Left-hand shown, right-hand similar.

Remove the rear subframe reinforcement plate retaining bolts.



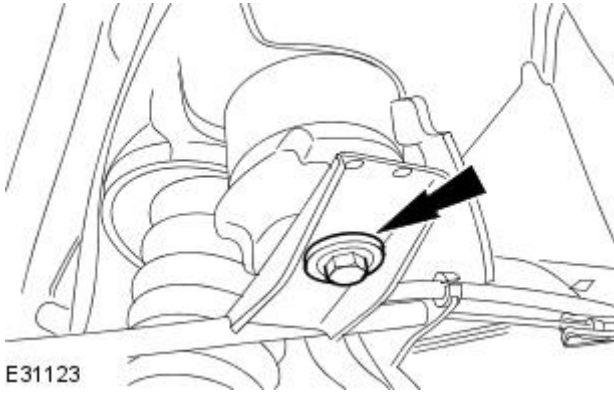
15. Install the special tool to support the rear subframe.





16. NOTE: Left-hand shown, right-hand similar.

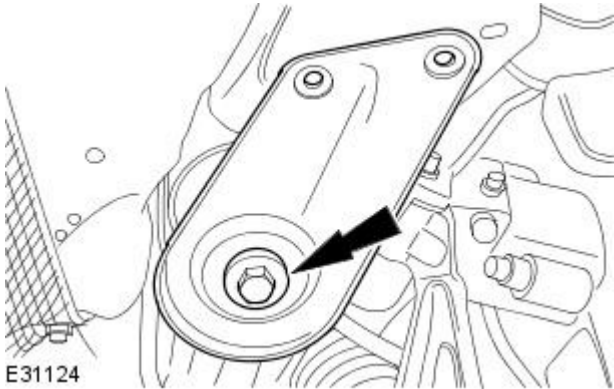
Remove the rear subframe rear retaining bolt.



E31123

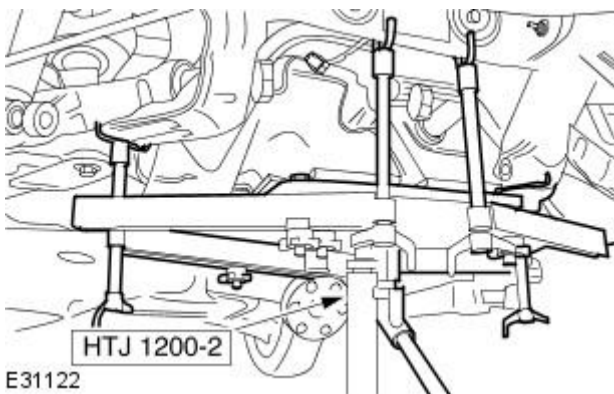
17. NOTE: Left-hand shown, right-hand similar.

Remove the rear subframe front retaining bolt.



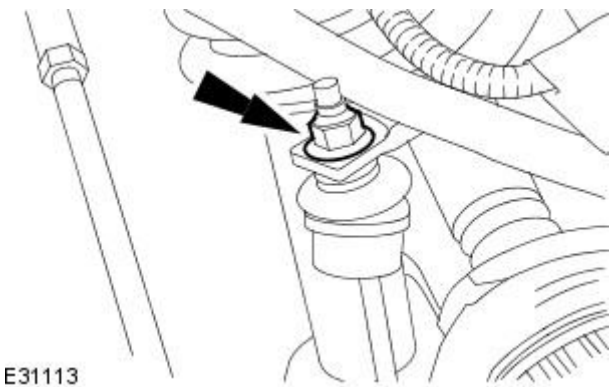
E31124

18. Remove the rear subframe.



E31122

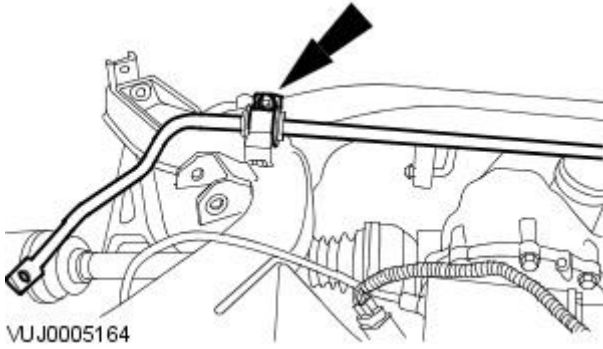
19. Remove the stabilizer bar link nuts.



E31113

20. Remove the rear stabilizer bar.

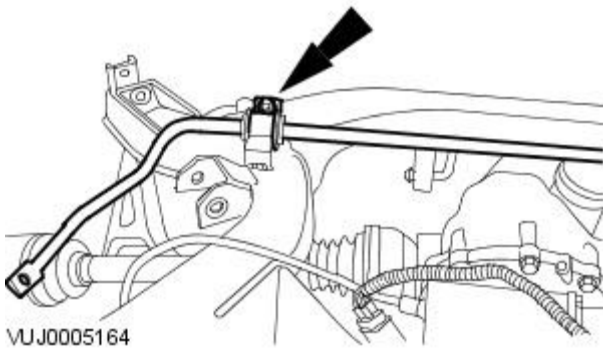
- Remove the stabilizer bar bushings.



## Installation

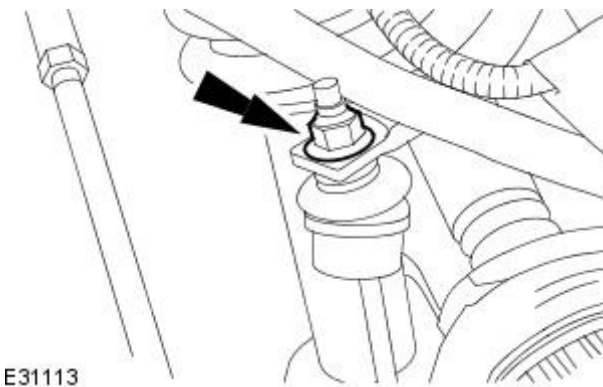
1. Install the stabilizer bar.

- Install the stabilizer bar bushings.
- Tighten to 55 Nm.

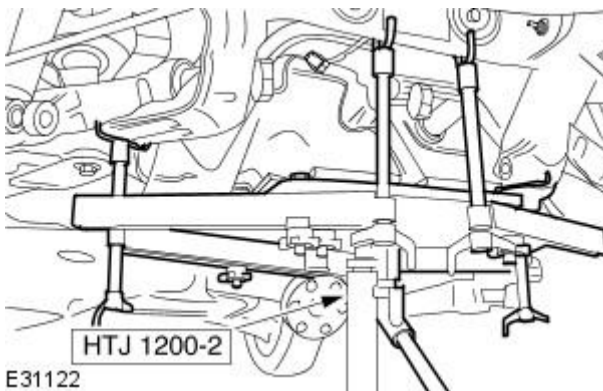


2. Install new nuts to the stabilizer bar links.

- Tighten to 48 Nm.

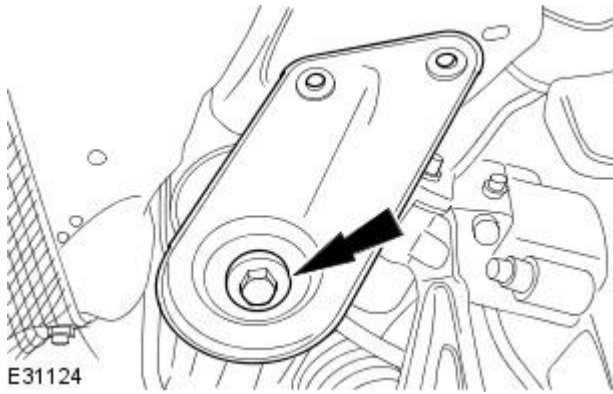


3. Install the rear subframe.

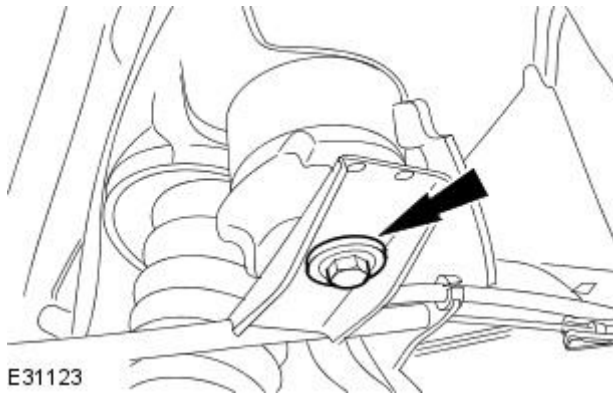


4. NOTE: Left-hand shown, right-hand similar.

Loosely install the rear subframe front bolt.

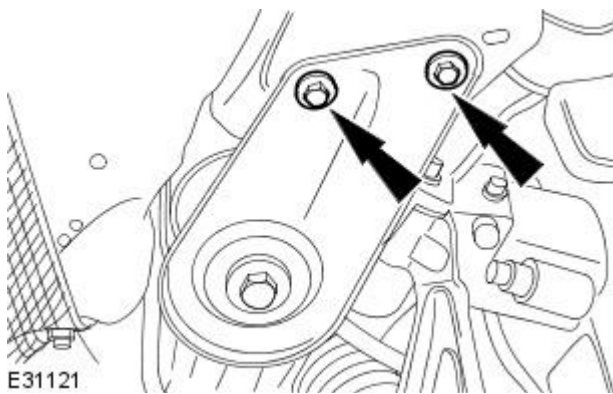


5. Loosely install the rear subframe rear bolt.



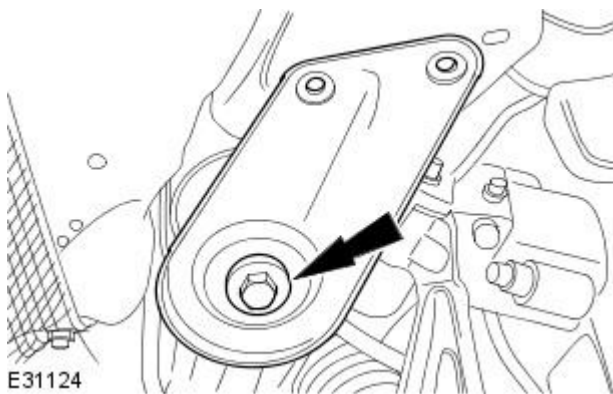
6. NOTE: Left-hand shown, right-hand similar.

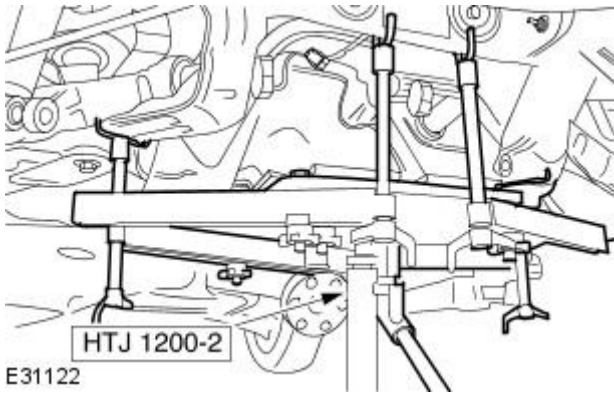
Loosely install the rear subframe reinforcement plate bolts.



7. Tighten the subframe bolts.

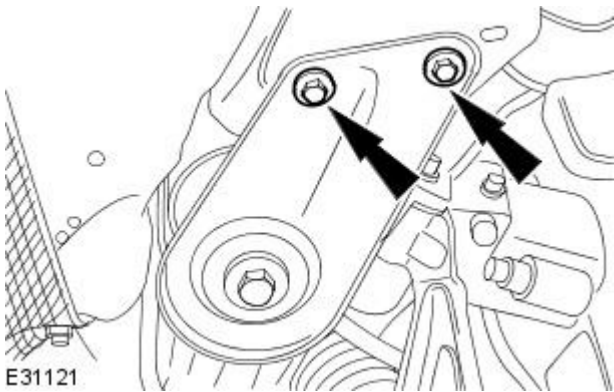
- Tighten to 80 Nm + 240°.





E31122

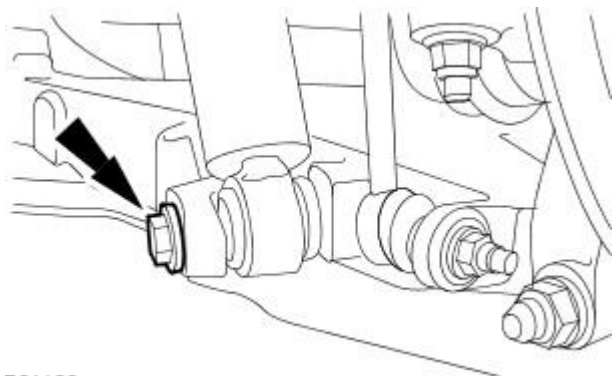
8. Remove the special tool.



E31121

9. Tighten the rear subframe reinforcement plate retaining bolts.

- Tighten to 47 Nm.

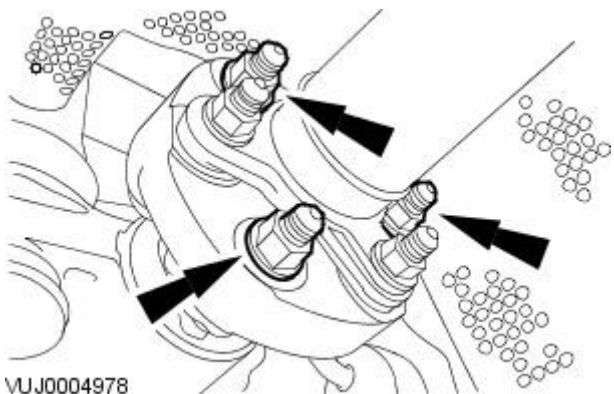


E31128

10. NOTE: Left-hand shown, right-hand similar.

Install the shock absorber.

- Tighten to 133 Nm.

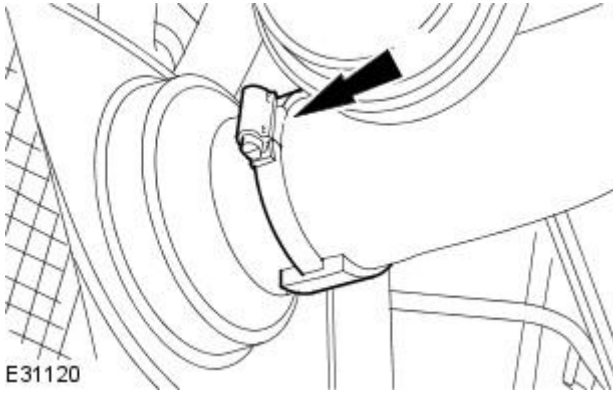


VUJ0004978

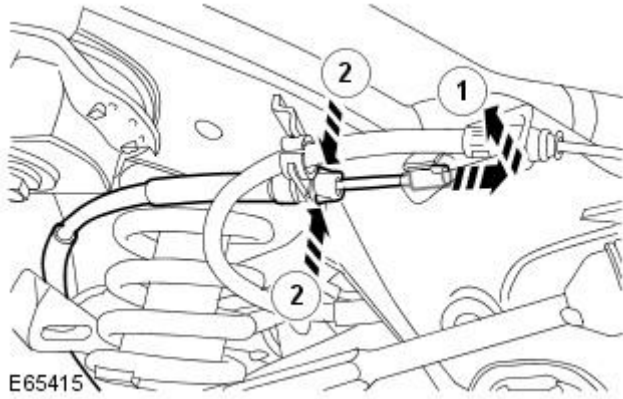
11. NOTE: Install the components to their original fitted positions.

Attach the driveshaft to the rear drive axle flange.

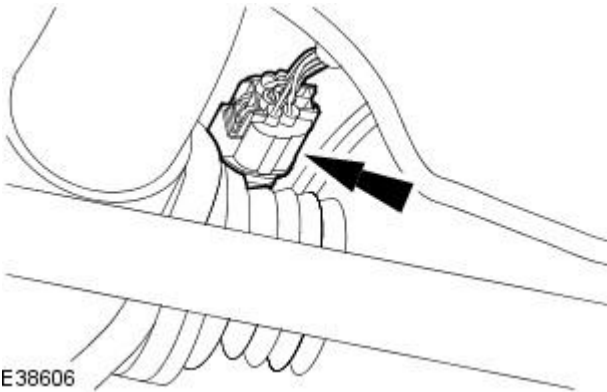
12. Attach the fuel filler hose to the fuel tank.



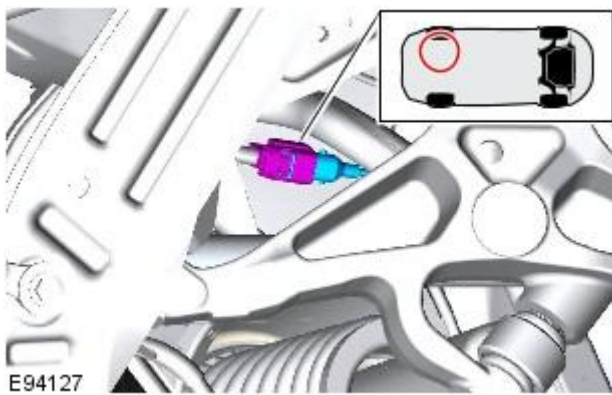
13. Connect both park brake cables to the rear brake calipers.



14. Connect the parking brake actuator electrical connector.



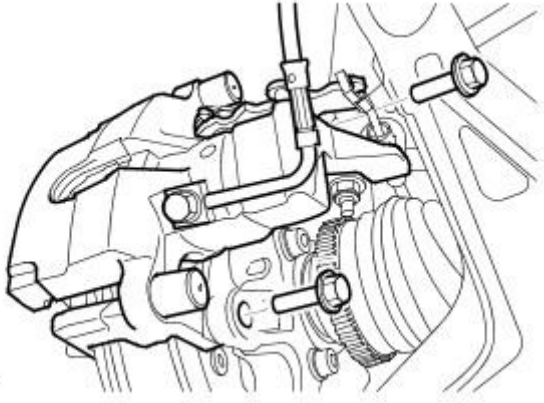
15. Connect the wheel speed sensor electrical connector.





**16. Install the brake caliper.**

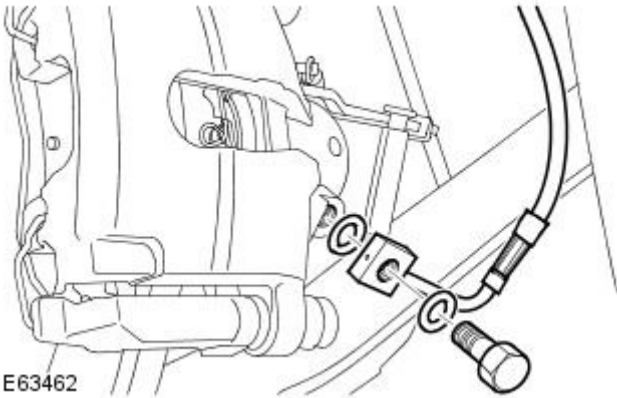
- Tighten the bolts to 103 Nm.



E64610

**17. Connect the brake hose to the brake caliper.**

- Install new sealing washers.
- Tighten the union to 38 Nm.



E63462

**18. Install the exhaust system.**

For additional information, refer to: Front Muffler (309-00 Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

**19. Refill the fuel tank.**

For additional information, refer to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).

**20. Bleed the brake system.**

For additional information, refer to: [Brake System Bleeding](#) (206-00 Brake System - General Information, General Procedures).

**21. Install the rear wheels and tires.**

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

**22. Connect the battery ground cable.**

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).


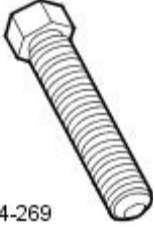


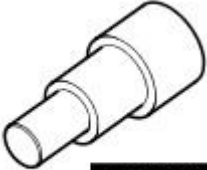


**23. Using only four-wheel alignment equipment approved by Jaguar, check and adjust the wheel alignment.**


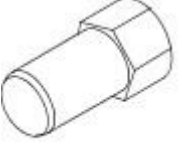
For additional information, refer to: [Camber and Caster Adjustment](#) (204-00 Suspension System - General Information, General Procedures).

## Rear Suspension - Rear Wheel Bearing


Removal and Installation

### Special Tool(s)

 <p>204-250</p>	<p>204-250 Wheel bearing install and removal tool</p>
 <p>204-269</p>	<p>204-269 Flange remover forcing screw</p>
 <p>E117832</p>	<p>204-305 Remover, Wheel Bearing</p>
 <p>E101989</p> <p>204-725</p>	<p>204-725 Wheel hub support tool</p>
 <p>E101990</p> <p>204-726</p>	<p>204-726 Wheel bearing install and removal tool</p>
 <p>E117751</p>	<p>204-727A Installer, Wheel Bearing</p>
 <p>E117752</p>	<p>204-791 Installer, Wheel Bearing</p>

 <p>205-491</p>	<p>205-491 Hub puller</p>
 <p>20549101</p>	<p>205-491-1 Adapter nuts</p>

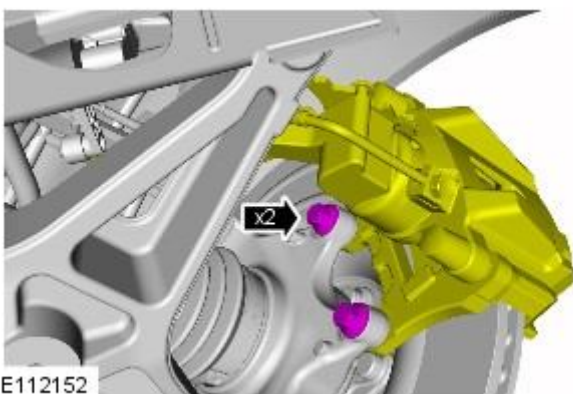
## Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.  
Raise and support the vehicle.
2. Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

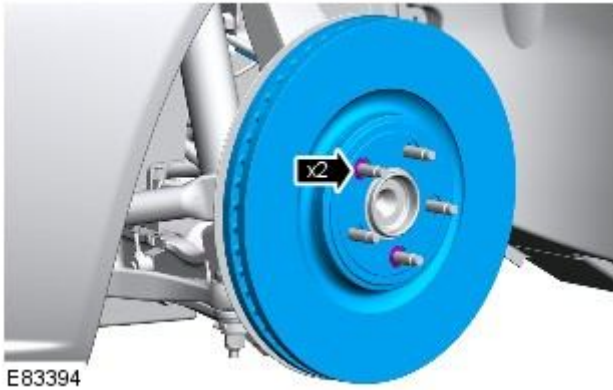
3.



4.

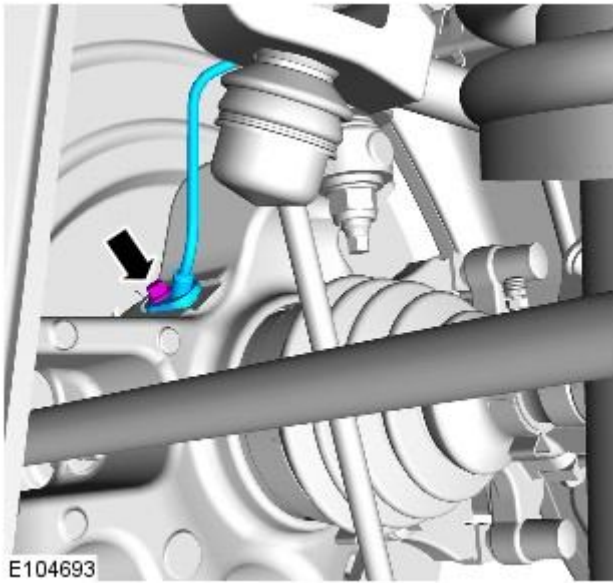






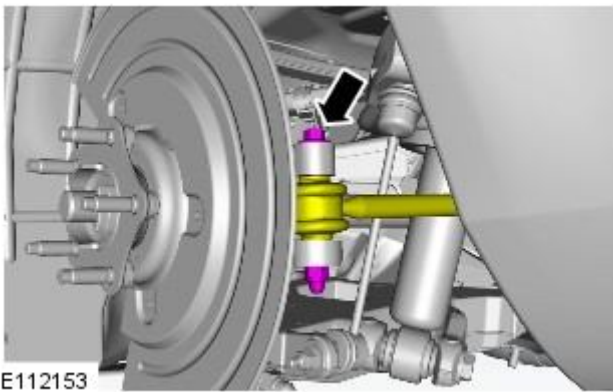
E83394

5.



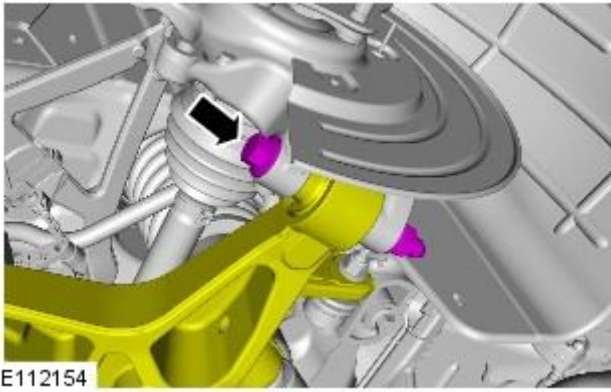
E104693

6.

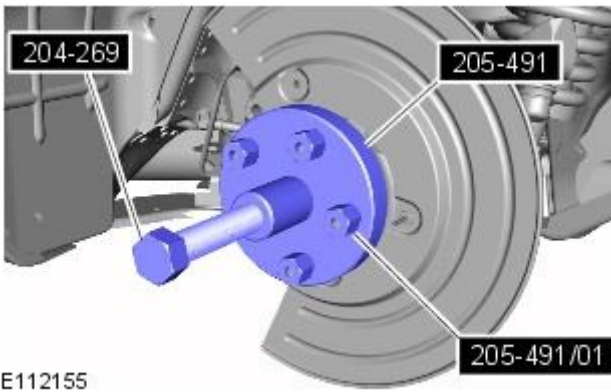


E112153

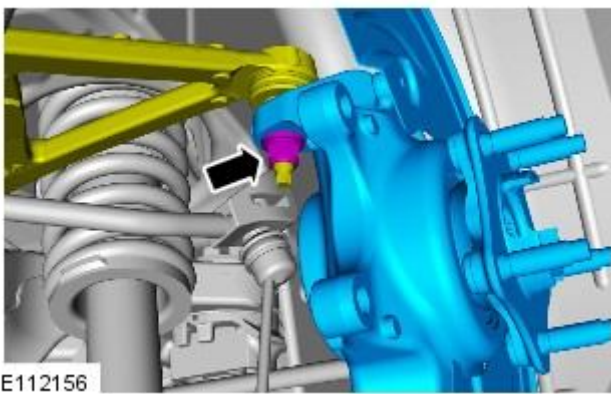
7.



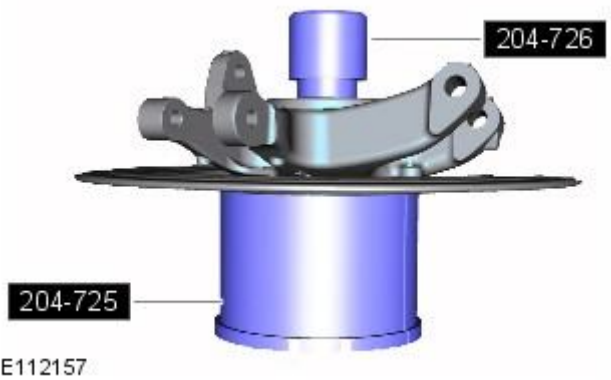
8.



9. *Special Tool(s):* [205-491](#), [205-491-1](#), [204-269](#)

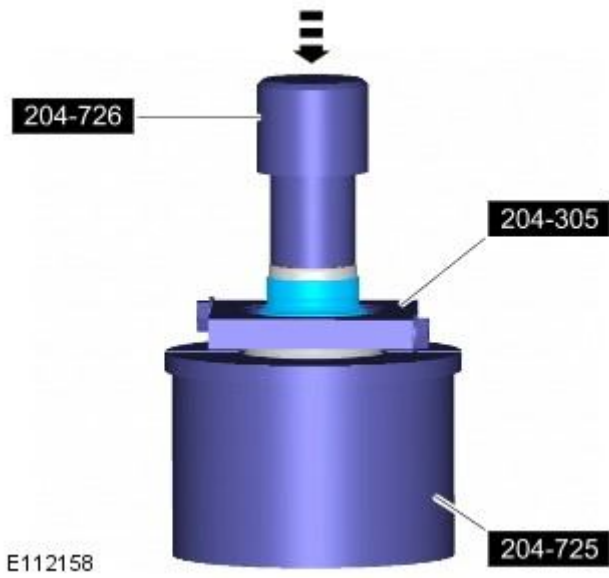


10. **10. NOTE:** Use an additional wrench to prevent the component from rotating.

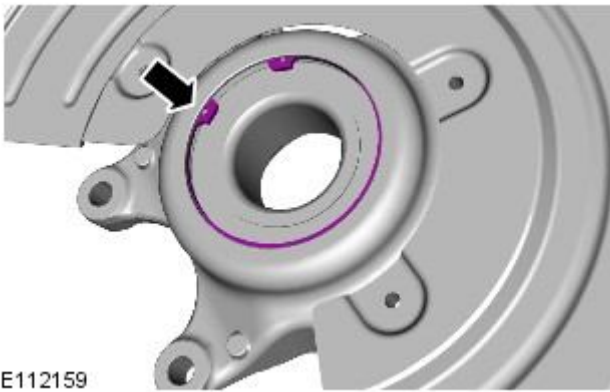


11. *Special Tool(s):* [204-726](#), [204-725](#)

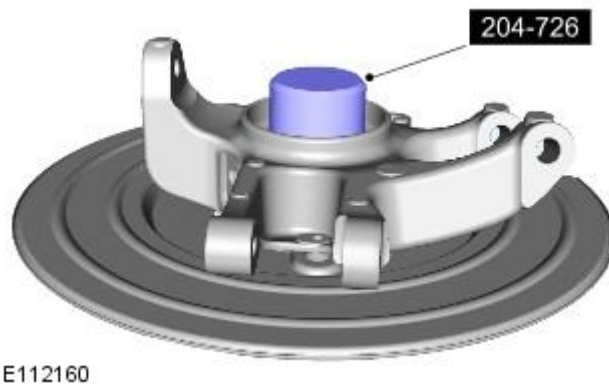
12. *Special Tool(s):* [204-305](#), [204-726](#), [204-725](#)



13.



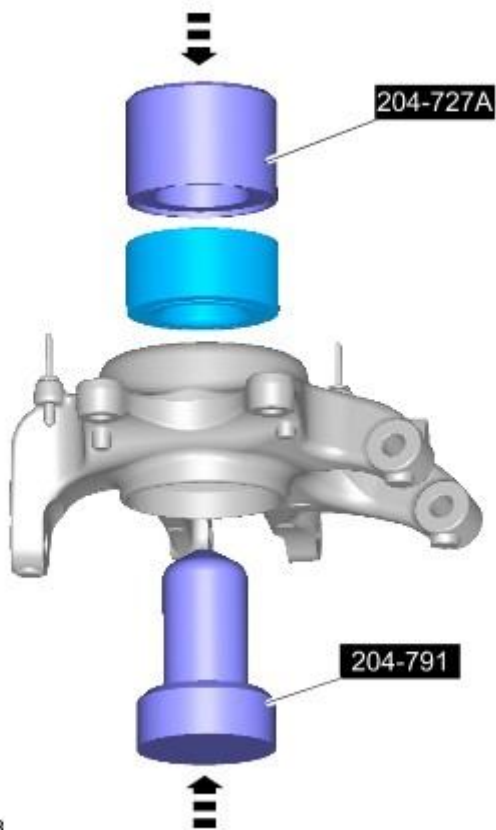
14. *Special Tool(s):* [204-726](#)



## Installation

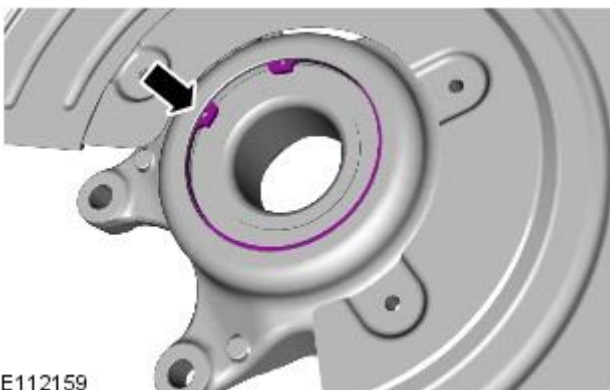
1. **NOTE:** Make sure correct alignment of the bearing is maintained when installing into the hub carrier.

*Special Tool(s):* [204-727A](#), [204-791](#)



E117753

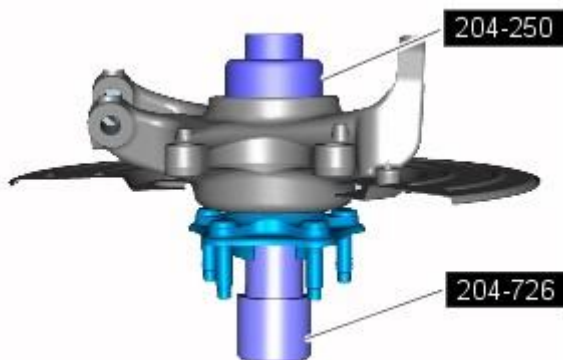
- 2.



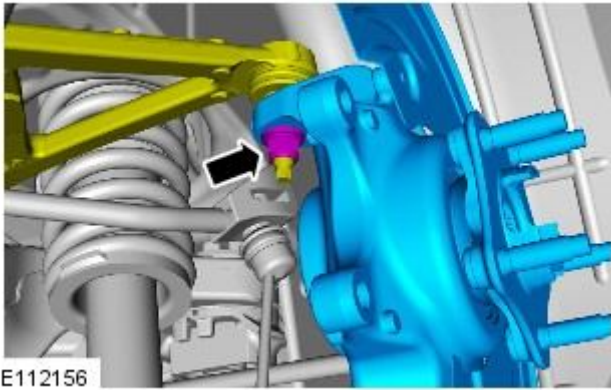
E112159


3. **NOTE:** Make sure the correct alignment of the drive flange is maintained when installing into the hub carrier and bearing assembly.

*Special Tool(s):* [204-726](#), [204-250](#)



E112162

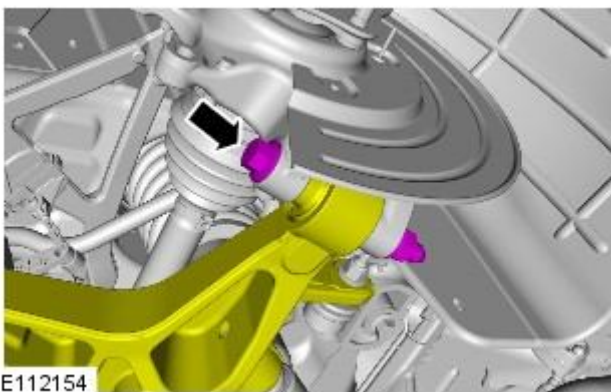



4.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.

*Torque:* 90 Nm

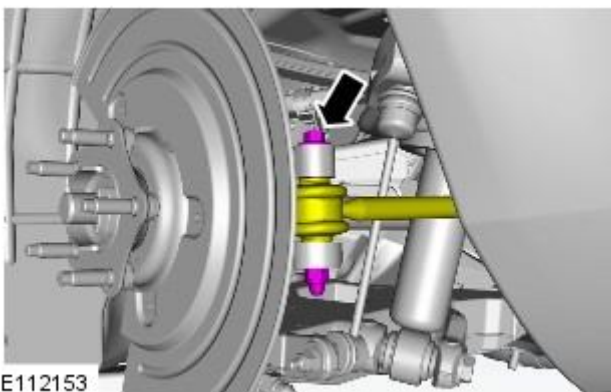



5. **NOTE:** The wheel hub nut is not tightened at this stage.



6.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.

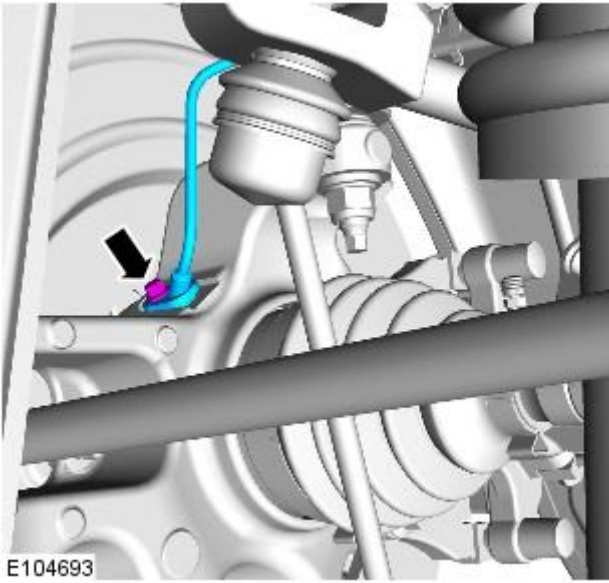
*Torque:* 150 Nm



7.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.

*Torque:* 55 Nm

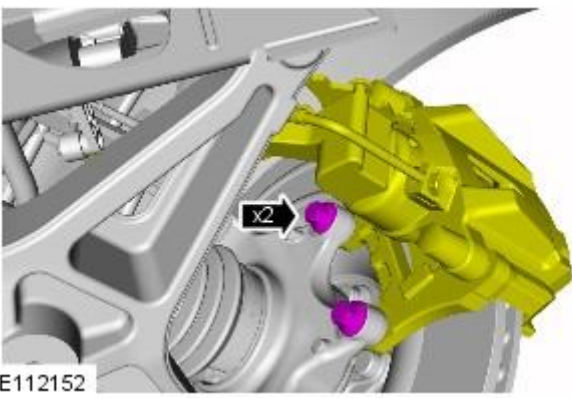




8. Torque: 6 Nm



9.



10. Torque: 103 Nm

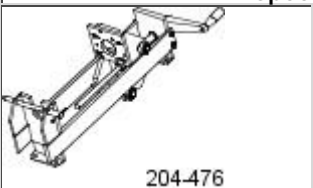


11. Torque: 300 Nm

12. Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

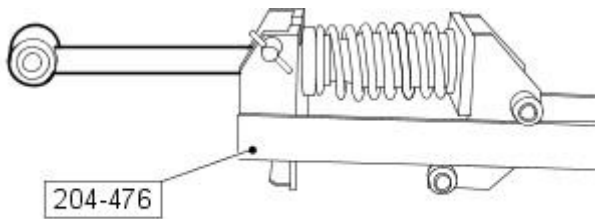
## Rear Suspension - Shock Absorber and Spring Assembly

Disassembly and Assembly


Special Tool(s)	
	Compressor, Coil Spring 204-476

### Disassembly

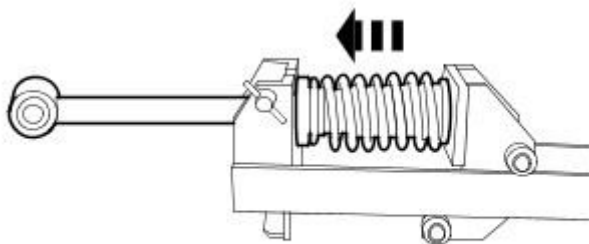
1. Remove the shock absorber and spring assembly.  
For additional information, refer to [Shock Absorber and Spring Assembly](#) in this section.



E31044

2.  **WARNING:** Make sure the shock absorber is secured by fully inserting the locking pin in to the special tool. Failure to follow these instructions may result in personal injury.

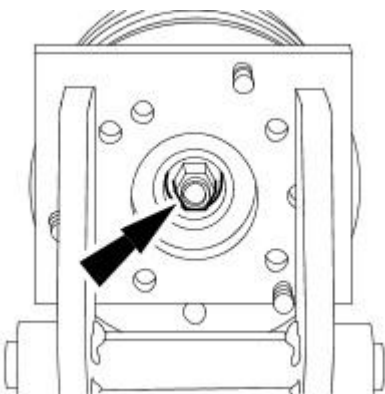
Install the shock absorber and spring assembly to the special tool as shown.



E31046

3.  **WARNING:** AS THE SPRING IS UNDER EXTREME TENSION CARE MUST BE TAKEN AT ALL TIMES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

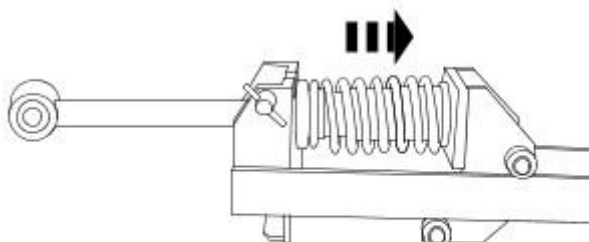
Clamp the road spring.



E43414

4. Remove the shock absorber retaining nut.

- Remove and discard the retaining nut.

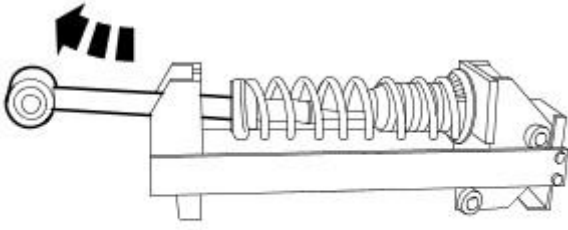


E31045

5. Release the road spring.

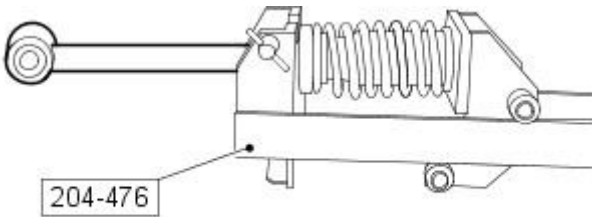



6. Remove the shock absorber.



E31047

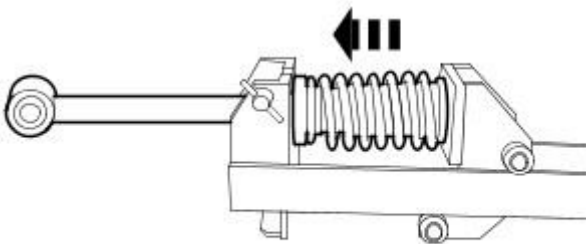
### Assembly




1.  CAUTION: Make sure the spring ends butt correctly against the spring seats.

Install the shock absorber and spring assembly to the special tool.

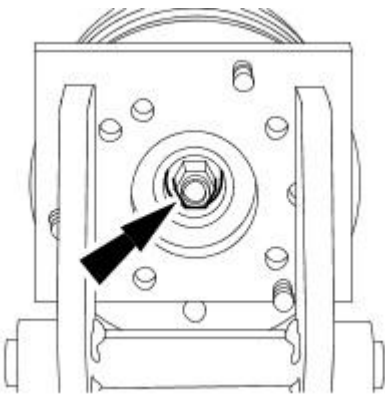
E31044



2.  WARNING: AS THE SPRING IS UNDER EXTREME TENSION CARE MUST BE TAKEN AT ALL TIMES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

Clamp the road spring.

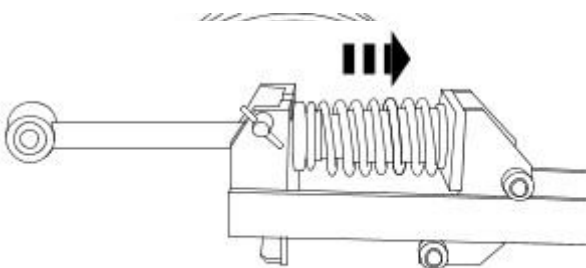
E31046



3. Vehicles without adaptive damping.

- Install a new retaining nut.
- Tighten to 50 Nm.

E43414



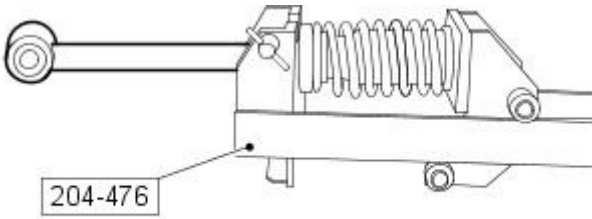
4. Vehicles with adaptive damping.

- Install a new retaining nut.
- Tighten to 27 Nm.

E31045

E43414





6. Remove the shock absorber and spring assembly from the special tool.

E31044

## Wheels and Tires - Wheels and Tires - Component Location

Description and Operation

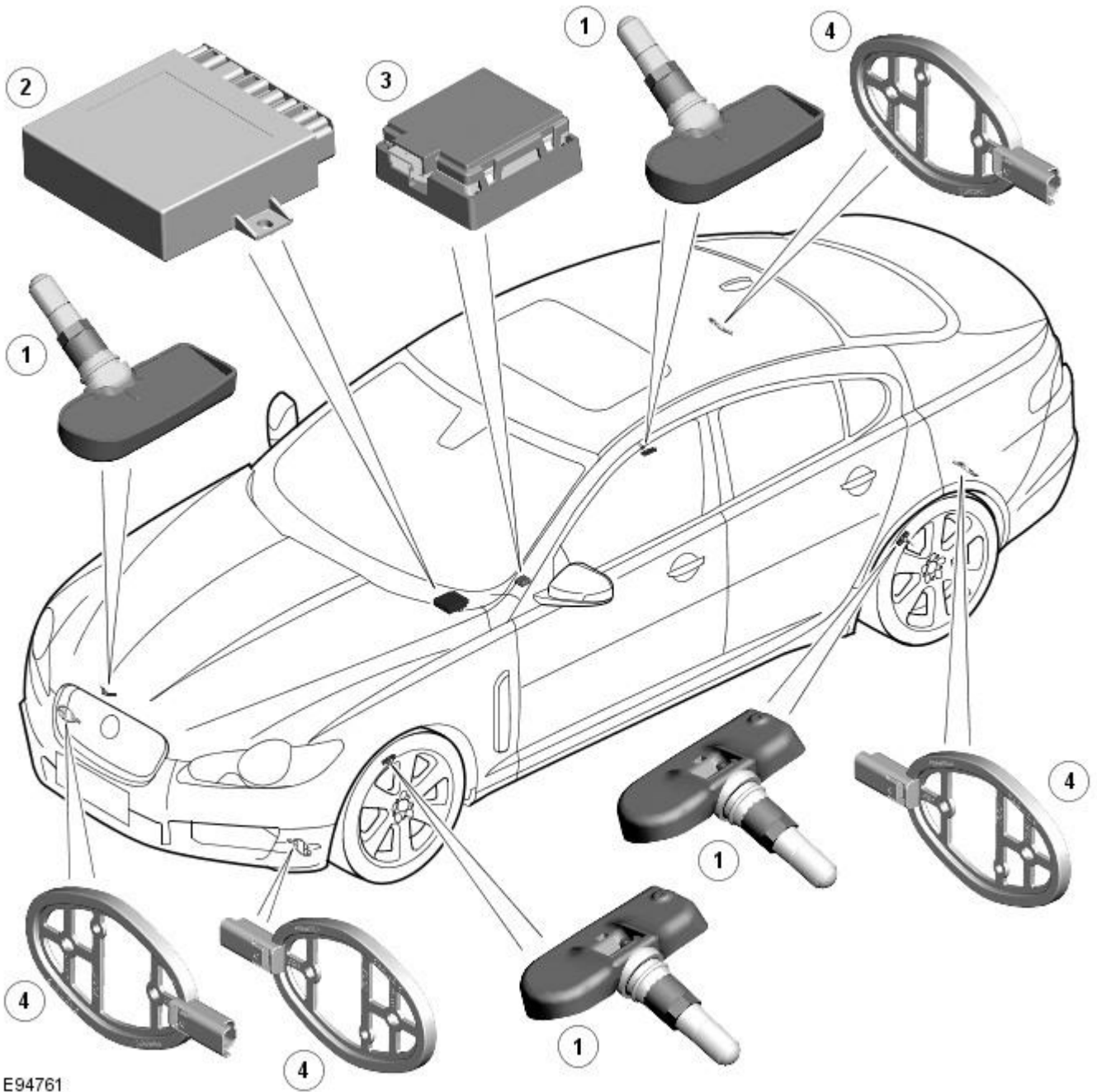


E94759

### ItemDescription

1	7.5J x 17 inch
2	8.5J x 18 inch (optional)
3	8.5J x 18 inch
4	8.5J x 19 inch (optional)
5	Front - 8.5J x 20 inch – Rear 9.5J x 20 inch

Tire Pressure Monitoring System



E94761

**ItemDescription**

1	Tire pressure sensor
2	Tire pressure monitoring system module
3	Tire pressure receiver
4	Tire pressure monitoring system initiator

## Wheels and Tires - Wheels and Tires - Overview

Description and Operation

### OVERVIEW

A number of alloy wheel designs are available ranging from 17 to 20 inch in diameter. A Tire Pressure Monitoring System (TPMS) is used to monitor the air pressure in each tire and inform the driver if the pressure falls below predetermined thresholds.

Refer to: [Wheels and Tires](#) (204-04 Wheels and Tires, Description and Operation).

All wheels are of cast construction in aluminum alloy with the choice of wheel design dependant on the vehicle trim level:

- The 17 inch wheel, not available in North America, is available on Luxury vehicles.
- The two variants of the 18 inch wheel are offered on the High Luxury vehicle.
- The 19 inch wheel is an optional fit for both Luxury and High Luxury models; it will also be available with run-flat tires.
- The 20 inch wheel is available on Super Charged vehicles only.

A 4J X 18 inch temporary spare wheel is supplied as standard, although in some major European markets an Instant Mobility System is offered as an alternative to the spare wheel. The Instant Mobility System is capable of providing a temporary repair and tire inflation to a puncture of up to 6mm in diameter in the tread area of the tire. A puncture in the tire wall cannot be repaired using the system.

The vehicle jack and accessories are stored in the spare wheel-well in the luggage compartment.

### Tire Changing

#### • WARNINGS:

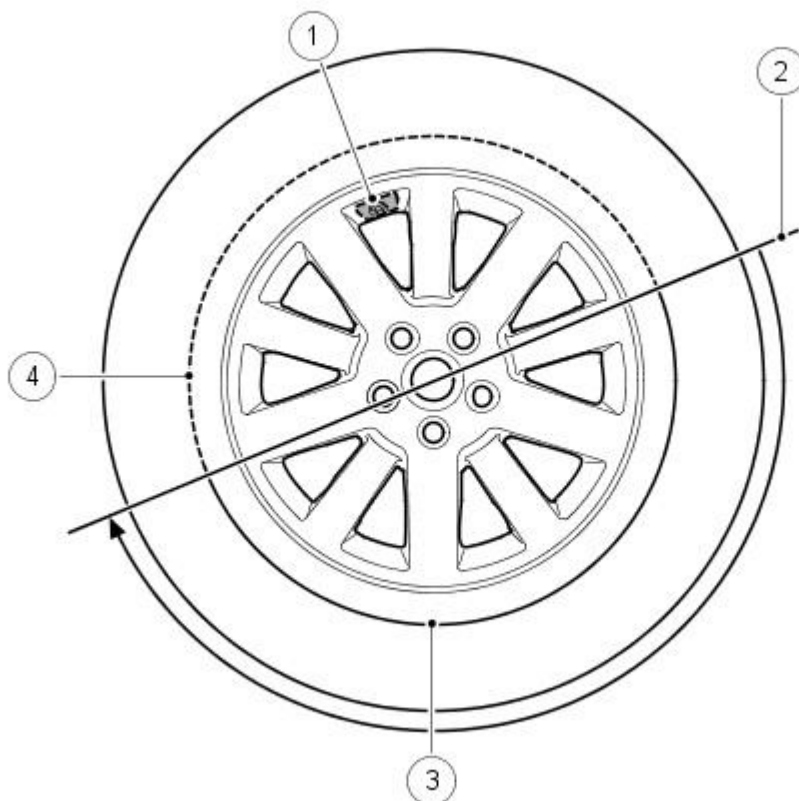


Tires must be inflated to the recommended pressures when the tires are cold (ambient temperature) only. Refer to label on the 'B' pillar for recommended tire pressures. If the tires have been subjected to use or exposed to direct sunlight, move the vehicle into a shaded position and allow the tires to cool before checking or adjusting the pressures.



Valve stem seal, washer nut, valve core and cap should be replaced at every tire change. Valve stem seal, washer and nut must be replaced if the valve retention nut is loosened. Sensor units and nuts must be fitted using correct torque figures and associated profile. Damage to the vehicle and consequently injury to the vehicle's occupants may result if these instructions are not adhered to.

Vehicles fitted with TPMS can be visually identified by an external metal locknut and valve of the tire pressure sensor on the road wheels. Vehicles without TPMS will have rubber tire valve.



E45549

ItemDescription

1	Tire valve and pressure sensor
2	Tire fitting/removal tool initial start position
3	High tire and bead tension area
4	Low tire and bead tension area

When removing the tire, the bead breaker must not be used within 90 degrees of the tire valve in each direction on each side of the tire.

When using the tire removal machine, the fitting arm start position must be positioned as shown in the tire changing illustration for each side of the tire. The wheel can then be rotated through 180 degrees in a counter-clockwise direction. This will relieve tension from the tire bead allowing the remaining 180 degrees of the tire to be manually pulled from the rim.

When refitting the tire, position the fitting arm as shown. Rotate the tire and take care that the bead on the low tension side of the tire does not damage the sensor.

## Run-Flat Tires

Run-flat tires can be handled, fitted and removed using the same principles as used for normal low profile and high-performance tires, with two exceptions:

- They are always fitted with tire pressure sensors.
- They have thicker bead cores and more rigid sidewalls which require special care when being mounted on the rims.

It is recommended that the tire fitting machine is fitted with plastic rollers for the upper and lower bead. This will ensure that the bead is removed gently, protecting the rims and the tire pressure sensors.

Adequate amounts of special fitting lubricant must be used to ensure that the sidewalls move with the minimum exertion and locate on the rim flange correctly.

Run-flat tires can be identified by the marking 'RSC' on the tire sidewall.

- **NOTE:** Vehicles fitted with run-flat tires are not supplied with a spare wheel, vehicle jack or wheel brace.

## TREAD Act - NAS Only

Vehicles supplied to the North American markets must comply with the legislation of the Transport Recall Enhancement, Accountability and Documentation (TREAD) act. Part of the requirement of the TREAD act is for the vehicle to display a label which defines the recommended tire inflation pressure, load limits and maximum load of passengers and luggage weight the vehicle can safely carry. This label will be specific to each individual vehicle and will be installed on the production line. The label is positioned on the driver's side 'B' pillar on NAS vehicles and the inside rear face of the LH door on Canadian specification vehicles.

This label must not be removed from the vehicle. The label information will only define the specification of the vehicle as it came off the production line. It will not include dealer or owner fitted accessory wheels and tires of differing size from the original fitment.

If the label is damaged or removed for body repair, it must be replaced with a new label specific to that vehicle. A new label is requested from Jaguar parts and will be printed specifically for the supplied VIN of the vehicle.

## Tire Pressure Monitoring System

The Tire Pressure Monitoring System (TPMS) is a driver assistance system which assists the driver to maintain the tire pressures at the optimum level. TPMS is standard fitment on NAS vehicles and an optional fitment in other markets. TPMS provides the following benefits:

- Maintain optimal fuel consumption.
- Maintain ride and handling characteristics.
- Reduce the risk of rapid tire deflation - which may be caused by under inflated tires.
- Comply with legislation requirements in relevant markets.



**CAUTION:** TPMS is not intended as a replacement for regular tire pressure and tire condition checks and should be considered as additional to good tire maintenance practices.

The TPMS measures the pressure in each of the vehicle's tires and issues warnings to the driver if any of the pressures deviate from defined tolerances. The space saver spare wheel is not monitored.

- **NOTE:** TPMS is not designed to warn the driver of a tire 'blow-out', as due to the short duration of a 'blow-out', it is not possible to give the driver sufficient warning that such an event is occurring. The design of the TPMS is to assist the driver in keeping the tires at the correct pressure, which will assist to reduce the likelihood of a tire 'blow-out' occurring.



## System Operation

### Tire Pressure Monitoring System

The controlling software for the Tire Pressure Monitoring System (TPMS) is located within a Tire Pressure Monitoring System Module. The software detects the following:

- When the tire pressure is below the recommended low pressure value - under inflated tire.
- The location of the tire on the vehicle that is below the recommended pressure.
- Malfunction warning.

The TPMS system comprises:

- Tire pressure monitoring system module located below the right-hand front seat.
- Tire pressure receiver located near the gear shifter within the floor console.
- Two front initiators positioned forward of the wheels and behind the fender splash shields.
- Two rear initiators positioned rearward of the wheels and assembled on dedicated brackets located behind the fender splash shields.
- Four sensors, each sensor is integral with a tire valve and located within the tire; the space saver spare wheel is not fitted with a sensor.

The four initiators are hard wired to the TPMS module. The initiators transmit 125 KHz Low Frequency (LF) signals to the tire pressure sensors which respond by modifying the mode status within the Radio Frequency (RF) transmission. The 315 or 433 MHz RF signals are detected by the tire pressure receiver which is connected directly to the TPMS module. The received RF signals from the tire pressure sensors are passed to the TPMS module and contain identification, pressure, temperature and acceleration information for each wheel and tire.

The TPMS module communicates with the instrument cluster via the medium speed CAN bus to provide the driver with appropriate warnings. The TPMS module also indicates status or failure of the TPMS or components.

#### Tire Location and Identification

The TPMS can identify the position of the wheels on the vehicle and assign a received tire pressure sensor identification to a specific position on the vehicle, for example front left, front right, rear left and rear right. This feature is required because of the different pressure targets and threshold that could exist between the front and rear tires.

The wheel location is performed automatically by the TPMS module using an 'auto-location' function. This function is fully automatic and requires no input from the driver. The TPMS module automatically re-learns the position of the wheels on the vehicle if the tire pressure sensors are replaced or the wheel positions on the vehicle are changed.

The TPMS software can automatically detect, under all operating conditions, the following:

- one or more new tire pressure sensors have been fitted
- one or more tire pressure sensors have stopped transmitting
- TPMS module can reject identifications from tire pressure sensors which do not belong to the vehicle
- two 'running' wheels on the vehicle have changed positions.

If a new tire pressure sensor is fitted on any 'running' wheel, the module can learn the new sensor identification automatically through the tire learn and location process.

The tire-learn and location process is ready to commence when the vehicle has been stationary or traveling at less than 12 mph (20 km/h) for 15 minutes. This is known as 'parking mode'. The learn/locate process requires the vehicle to be driven at speeds of more than 12 mph (20 km/h) for 15 minutes. If the vehicle speed reduces to below 12 mph (20 km/h), the learn process timer is suspended until the vehicle speed increases to more than 12 mph (20 km/h), after which time the timer is resumed. If the vehicle speed remains below 12 mph (20 km/h) for more than 15 minutes, the timer is set to zero and process starts again.

#### Low Pressure Monitoring

The tire low pressure sensor transmits by RF (315 MHz or 433 MHz depending on market) signal. These signals contain data which corresponds to tire low pressure sensor identification, tire pressure, tire temperature, acceleration and tire low pressure sensor mode.

Each time the vehicle is driven, the tire pressure monitoring system module activates each LF antenna in turn. The corresponding tire low pressure sensor detects the LF signal and responds by modifying the mode status within the RF transmission.

The system enters 'parking mode' after the vehicle speed has been less than 20 km/h (12.5 miles/h) for 12 minutes. In parking mode the tire low pressure sensors transmit a coded signal to the tire pressure monitoring system module once every 13 hours. If the tire pressure decreases by more than 0.06 bar (1 lbf/in<sup>2</sup>) the tire low pressure sensor will transmit more often as pressure is lost.

As each wheel responds to the LF signal from the tire pressure monitoring system module, it is assigned a position on the vehicle and is monitored for the remainder of that drive cycle in that position.

When the vehicle has been parked for more than 15 minutes and then driven at a speed of more than 20 km/h (12.5 miles/h), the antennas fire in turn for 6 seconds on all except North American specification vehicles or for 18 seconds on North American specification only vehicles in the following order:

- Front left
- Six second pause (for the tire pressure monitoring system module to detect a response from the tire low pressure sensor)
- Front right
- Six second pause
- Rear right
- Six second pause
- Rear left



- Six second pause

Each tire low pressure sensor responds in turn so the tire pressure monitoring system module can establish the tire low pressure sensor positions at the start of the drive cycle. This process is repeated up to three times but less if the tire low pressure sensor positions are already known in the tire pressure monitoring system module.

This process is known as 'Auto Location' and takes:

- three to five minutes on all except North American specification vehicles to complete, and
- seven to eight minutes on North American specification vehicles to complete.

During this period the tire low pressure sensors transmit at regular intervals:

- once every 5 seconds on all except North American specification vehicles, and
- once every 15 seconds on North American specification vehicles.

For the remainder of the drive cycle the tire low pressure sensors transmit once every 60 seconds or if a change in tire pressure is sensed until the vehicle stops and the tire pressure monitoring system returns to parking mode.

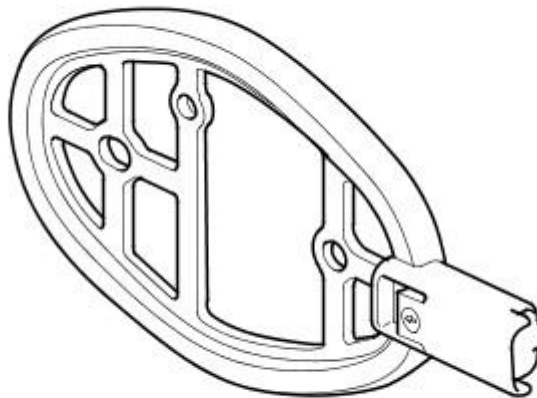
Once the wheel position is established, the antennas stop firing and do not fire again until the vehicle has been parked for more than 15 minutes. The signal transmissions from each tire low pressure sensor continue at one minute intervals whilst the vehicle is being driven. This transmission is to monitor the tire pressure. The warning occurs at 25% deflation and comprises the low tire pressure warning indicator and an appropriate message displayed in the instrument cluster message center. The message center will also display additional information about the position of the affected wheel(s).

### **Spare Tire Monitoring**

Tire pressure sensors are not fitted to the space saver spare wheel and therefore the spare wheel is not monitored.

## **Component Description**

### **Initiator**

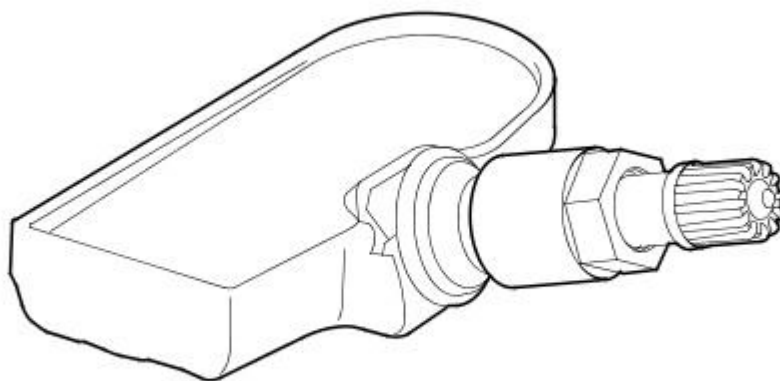


E45552

Each initiator has a connector which connects to the vehicle body harness. The initiator is a passive, LF transmitter. The initiators transmit their signals which are received by the tire pressure sensors, prompting them to modify their mode status.

The TPMS module energizes each initiator in turn using LF drivers. The corresponding tire pressure sensor detects the LF signal and responds by modifying the mode status within the RF transmission.

### **Tire Pressure Sensor**



E45553

The TPMS uses active tire pressure sensors which are located on each wheel, inside the tire cavity. The sensor incorporates the tire valve and is secured in the wheel by a nut on the outside of the wheel. The sensor contains a Printed Circuit Board which houses a **PTC (positive temperature coefficient)** sensor, a Piezo pressure sensor, a radio receiver and transmitter and a lithium battery.

The tire pressure sensors use the PTC sensor and the Piezo sensor to periodically measure the pressure and temperature of the air inside the tire. The data is transmitted by RF data signals at either 315 MHz or 433 MHz dependant on market requirements.

The RF transmission from the sensor contains a unique identification code in its transmission data. This allows the TPMS to identify the wheel on the vehicle. If the sensor is replaced on a wheel, the new sensor identification will be learnt through the learn and location process.

The tire pressure sensor can also detect when the wheel is rotating. In order to preserve battery power, the sensor uses different transmission rates when the wheel is stationary or moving.

• **NOTE:** For important information regarding the removal and fitting of tire pressure sensors and associated valves, see the **Tire Changing** section.  
Refer to: [Wheels and Tires](#) (204-04 Wheels and Tires, Description and Operation).

### Instrument Cluster Indications



E94763

#### ItemDescription

- |   |                                     |
|---|-------------------------------------|
| 1 | Low tire pressure warning indicator |
| 2 | Message center                      |

The warning indications to the driver are common on all vehicles fitted with TPMS. The driver is alerted to system warnings by a low tire pressure warning indicator in the instrument cluster and an applicable text message in the message centre.

The TPMS module passes system status information to the instrument cluster on the medium speed CAN bus. The instrument cluster converts this data into illumination of the warning indicator and the display of an appropriate message.

When the ignition is switched on, the warning indicator is illuminated for 3 seconds for a bulb check.

- NOTE: If the vehicle is not fitted with the TPMS, the warning indicator will not illuminate.

The instrument cluster checks, within the 3 second bulb check period, for a CAN bus message from the TPMS. During this time the TPMS performs internal tests and CAN bus initialization. The warning indicator will be extinguished if the TPMS module does not issue a fault message or tire pressure warning message.

If a TPMS fault warning message is detected by the instrument cluster at ignition on, the warning indicator will flash for 72 seconds after the 3 second bulb check period and then remain permanently illuminated.

If a tire pressure warning message is detected by the instrument cluster at ignition on, the warning indicator will extinguish briefly after the 3 second bulb check period, before re-illuminating to indicate a tire pressure warning.

The following table shows the warning indicator functionality for given events:

Event	Instrument Cluster Indications
Low pressure warning limit reached in one wheel	Warning indicator illuminated. 'CHECK TYRE PRESSURE' message displayed and applicable tire highlighted on display.
Low pressure warning limit reached in one or more wheels in low speed mode (only if programmed or learning)	Warning indicator illuminated. 'CHECK ALL TYRE PRESSURES' message displayed.
TPMS fault	Warning indicator flashes for 72 seconds and is then permanently illuminated. The flash sequence repeats after ignition on cycle. 'TYRE PRESSURE SYSTEM FAULT' message displayed.
No transmission from a specific tire pressure sensor or Specific tire pressure sensor fault	Warning indicator flashes for 72 seconds and is then permanently illuminated. The flash sequence repeats after ignition on cycle. 'TYRE NOT MONITORED' message displayed.
No transmission from more than one tire pressure sensor or more than one tire pressure sensor fault	Warning indicator flashes for 72 seconds and is then permanently illuminated. The flash sequence repeats after ignition on cycle. 'TYRE PRESSURE SYSTEM FAULT' message displayed.
CAN signals missing	Warning indicator flashes for 72 seconds and is then permanently illuminated. The flash sequence repeats after ignition on cycle. 'TYRE PRESSURE SYSTEM FAULT' message displayed.
Vehicle enters high speed mode (only available in certain markets)	Warning indicator illuminated. 'TYRE PRESSURE LOW FOR SPEED' message displayed.

# Wheels and Tires - Wheels and Tires

Diagnosis and Testing

## Principle of Operation

For a detailed description of the wheels and tires, refer to the relevant Description and Operation section in the workshop manual. REFER to: (204-04 Wheels and Tires)

[Wheels and Tires](#) (Description and Operation),  
[Wheels and Tires](#) (Description and Operation),  
[Wheels and Tires](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer complaint. As much information as possible should be gathered from the driver to assist in diagnosing the cause(s). Confirm which of the following two warning types exist for the TPMS
  - **Check tyre pressure warnings.** A low tire pressure warning will continuously illuminate the low tire pressure warning lamp. This warning will generate a text message CHECK TYRE PRESSURE. No Diagnostic Trouble Codes (DTCs) are generated with this type of warning.
    - **NOTE:** Tire pressure adjustments are part of routine owner maintenance. Tire pressure adjustments that are required due to a lack of owner maintenance are not to be claimed under vehicle warranty. To extinguish this warning it is essential that, with the ignition 'ON', all vehicle tires are to be set to the correct pressure as stated in the vehicle handbook or as indicated on the placard label in the passenger/driver door aperture
  - **System fault warnings.** When a system fault is detected, the low tire pressure warning lamp will flash for approximately 75 seconds prior to being continuously illuminated. This indicates the presence of a system fault.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Tire pressures</li> <li>● Tire/Wheel damage. Refer to component tests in this section</li> <li>● Tire low pressure sensor installation/damage (metal valve stems as opposed to rubber)</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.
5. 5. If the tester fails to communicate with the TPMS module, it is recommended that the TPMS power supply fuse is removed from the Rear Junction Box (RJB) for approximately 10 seconds and re-installed.

### Drive Cycle

The vehicle must remain stationary for 15 minutes. Carry out a road test, for a minimum of 15 minutes at a speed greater than 12.5 mph (20 kph) for at least 75% of the road test.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• **NOTE:** If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• **NOTE:** Generic scan tools may not read the codes listed, or may read only five digit codes. If this is the case, match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• **NOTE:** When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• **NOTE:** If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
C1A5631	Left Front Tire Pressure Sensor and	<ul style="list-style-type: none"> <li>● No signal</li> <li>● Missing, incompatible or</li> </ul>	GO to Pinpoint Test <a href="#">E</a> .

DTC	Description	Possible Cause	Action
	Transmitter Assembly	defective tire pressure monitoring system low pressure sensor or receiver	
C1A5668	Left Front Tire Pressure Sensor and Transmitter Assembly	<ul style="list-style-type: none"> <li>Event information</li> <li>Vehicle exposed to extreme temperature environment</li> <li>Tire low pressure sensor low battery event</li> </ul>	No action required, event information only DTC
C1A5691	Left Front Tire Pressure Sensor and Transmitter Assembly	<ul style="list-style-type: none"> <li>Data out of range</li> <li>Tire low pressure sensor has reported out of range information for pressure, temperature or acceleration</li> </ul>	Suspect the left front tire low pressure sensor, check and install a new sensor as required. REFER to: Tire Low Pressure Sensor (204-04 Wheels and Tires, Removal and Installation).
C1A5693	Left Front Tire Pressure Sensor and Transmitter Assembly	<ul style="list-style-type: none"> <li>No sensor can be found at this location</li> <li>Tire pressure monitoring system initiator failure</li> <li>Tire low pressure sensor failure</li> </ul>	GO to Pinpoint Test <a href="#">G.</a>
C1A5711	Left Front Initiator	<ul style="list-style-type: none"> <li>Left front initiator or circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system, alternatively GO to Pinpoint Test <a href="#">B.</a> . Refer to the electrical circuit diagrams and check front left initiator and circuits for short to ground. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification
C1A5712	Left Front Initiator	<ul style="list-style-type: none"> <li>Left front initiator or circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system, alternatively GO to Pinpoint Test <a href="#">B.</a> . Refer to the electrical circuit diagrams and check front left initiator and circuits for short to power. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification
C1A5713	Left Front Initiator	<ul style="list-style-type: none"> <li>Left front initiator or circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system, alternatively GO to Pinpoint Test <a href="#">B.</a> . Refer to the electrical circuit diagrams and check front left initiator and circuits for open circuit. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification
C1A5831	Right Front Tire Pressure Sensor and Transmitter Assembly	<ul style="list-style-type: none"> <li>No signal</li> <li>Missing, incompatible or defective tire pressure monitoring system low pressure sensor or receiver</li> </ul>	GO to Pinpoint Test <a href="#">E.</a>
C1A5868	Right Front Tire Pressure Sensor and Transmitter Assembly	<ul style="list-style-type: none"> <li>Event information</li> <li>Vehicle exposed to extreme temperature environment</li> <li>Tire low pressure sensor low battery event</li> </ul>	No action required, event information only DTC
C1A5891	Right Front Tire Pressure Sensor and Transmitter Assembly	<ul style="list-style-type: none"> <li>Data out of range</li> <li>Tire low pressure sensor has reported out of range information for pressure, temperature or acceleration</li> </ul>	Suspect the right front tire low pressure sensor, check and install a new sensor as required. REFER to: Tire Low Pressure Sensor (204-04 Wheels and Tires, Removal and Installation).
C1A5893	Right Front Tire Pressure Sensor and Transmitter Assembly	<ul style="list-style-type: none"> <li>No sensor can be found at this location</li> <li>Tire pressure monitoring system initiator failure</li> <li>Tire low pressure sensor failure</li> </ul>	GO to Pinpoint Test <a href="#">G.</a>
C1A5911	Right Front Initiator	<ul style="list-style-type: none"> <li>Right front initiator or circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system, alternatively GO to Pinpoint Test <a href="#">C.</a> . Refer to the electrical circuit diagrams and check front right initiator and circuits for short to ground. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification

DTC	Description	Possible Cause	Action
C1A5912	Right Front Initiator	<ul style="list-style-type: none"> <li>Right front initiator or circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system, alternatively GO to Pinpoint Test <a href="#">C.</a> Refer to the electrical circuit diagrams and check front right initiator and circuits for short to power. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification
C1A5913	Right Front Initiator	<ul style="list-style-type: none"> <li>Right front initiator or circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system, alternatively GO to Pinpoint Test <a href="#">C.</a> Refer to the electrical circuit diagrams and check front right initiator and circuits for open circuit. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification
C1A6031	Left Rear Tire Pressure Sensor and Transmitter Assembly	<ul style="list-style-type: none"> <li>No signal</li> <li>Missing, incompatible or defective tire pressure monitoring system low pressure sensor or receiver</li> </ul>	GO to Pinpoint Test <a href="#">E.</a>
C1A6068	Left Rear Tire Pressure Sensor and Transmitter Assembly	<ul style="list-style-type: none"> <li>Event information</li> <li>Vehicle exposed to extreme temperature environment</li> <li>Tire low pressure sensor low battery event</li> </ul>	No action required, event information only DTC
C1A6091	Left Rear Tire Pressure Sensor and Transmitter Assembly	<ul style="list-style-type: none"> <li>Data out of range</li> <li>Tire low pressure sensor has reported out of range information for pressure, temperature or acceleration</li> </ul>	Suspect the left rear tire low pressure sensor, check and install a new sensor as required. REFER to: Tire Low Pressure Sensor (204-04 Wheels and Tires, Removal and Installation).
C1A6093	Left Rear Tire Pressure Sensor and Transmitter Assembly	<ul style="list-style-type: none"> <li>No sensor can be found at this location</li> <li>Tire pressure monitoring system initiator failure</li> <li>Tire low pressure sensor failure</li> </ul>	GO to Pinpoint Test <a href="#">G.</a>
C1A6111	Left Rear Initiator	<ul style="list-style-type: none"> <li>Left rear initiator or circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system, alternatively GO to Pinpoint Test <a href="#">D.</a> Refer to the electrical circuit diagrams and check left rear initiator and circuits for short to ground. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification
C1A6112	Left Rear Initiator	<ul style="list-style-type: none"> <li>Left rear initiator or circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system, alternatively GO to Pinpoint Test <a href="#">D.</a> Refer to the electrical circuit diagrams and check left rear initiator and circuits for short to power. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification
C1A6113	Left Rear Initiator	<ul style="list-style-type: none"> <li>Left rear initiator or circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system, alternatively GO to Pinpoint Test <a href="#">D.</a> Refer to the electrical circuit diagrams and check left rear initiator and circuits for open circuit. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification
C1A6231	Right Rear Tire Pressure Sensor and Transmitter Assembly	<ul style="list-style-type: none"> <li>No signal</li> <li>Missing, incompatible or defective tire pressure monitoring system low pressure sensor or receiver</li> </ul>	GO to Pinpoint Test <a href="#">E.</a>
C1A6268	Right Rear Tire Pressure Sensor and Transmitter Assembly	<ul style="list-style-type: none"> <li>Event information</li> <li>Vehicle exposed to extreme temperature environment</li> <li>Tire low pressure sensor low battery event</li> </ul>	No action required, event information only DTC
C1A6291	Right Rear Tire Pressure Sensor and Transmitter Assembly	<ul style="list-style-type: none"> <li>Data out of range</li> <li>Tire low pressure sensor has reported out of range information for pressure, temperature or acceleration</li> </ul>	Suspect the right rear tire low pressure sensor, check and install a new sensor as required. REFER to: Tire Low Pressure Sensor (204-04 Wheels and Tires, Removal and Installation).
<p><b>Component Tests</b></p> <p><b>Wheels and Tires</b></p> <p>For wheel and tire specification information (pressures, torques, etc), refer to the specification section in 204-04.</p>			

When replacing wheels or tires, local legislation regarding health and safety must be complied with.

If the vehicle has TPMS installed, only Jaguar approved wheels and tires should be used. If the wheel and tire size is changed (for example from R18 to R20) the TPMS module should be updated with the correct pressure information appropriate to the new wheel and tire set. Update the Car Configuration File using the manufacturer approved diagnostic system.

As a general guideline, only replace tires in pairs or as a set, and only with tires of equivalent size and specification.

Confirm the symptoms of the customer complaint.

As much information as possible should be gathered from the driver to assist in diagnosing the cause(s).

1. Before a road test, carry out a basic inspection to make sure the vehicle is safe and legal to drive.

#### Basic inspection

- Correct tire inflation
- Legal tire tread depth
- Cuts/Bulges in tire sidewall(s)
- Tire ply separation
- Embedded objects
- Wheel rim damage
- Correct tire installation (specification, direction of rotation, etc)
- Any obvious distortion of the tire (flat/high spots)
- Worn/Damaged steering or suspension components.

REFER to: [Suspension System](#) (204-00 Suspension System - General Information, Diagnosis and Testing).

#### Road test

If the results of the basic inspection are acceptable, carry out a road test to confirm the symptoms.

To reproduce the symptoms, test the vehicle on similar roads to those on which the fault occurs and at similar speeds (provided it is legal to do so).

If the vibration or noise can be reproduced, note the speed at which it occurs and see if it is possible to drive through the symptom, meaning, is it possible to alter the fault by driving faster or slower than the speed at which it occurs?

If it is possible, it is likely that the fault is caused by an imbalance in the wheel or tire.

If the vibration or noise gets worse as the vehicle speed increases, it is likely that the fault is caused by distortion in the wheel or tire, or worn or damaged components.

#### Distortion checks

Check for distortion by raising the vehicle so that the wheels are free and placing an axle stand or similar fixed object next to each wheel in turn.

If the stand is placed at the tread of the tire, the tire can be checked for ovality by turning the wheel by hand and checking for high or low spots where the gap between the tread and the stand increases or reduces.

If the stand is placed next to the wheel rim or tire sidewall, the wheel and tire can be checked for run-out in a similar way.

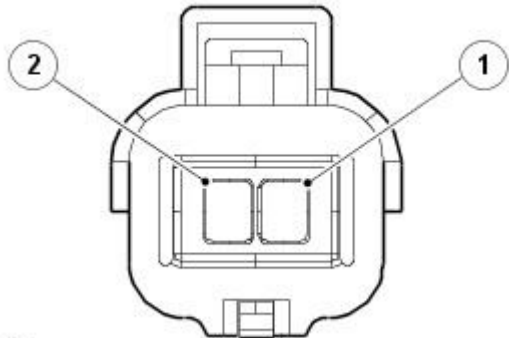
#### Pinpoint Tests

PINPOINT TEST A : TPMS EXTERNAL RECEIVER DATA LINE CIRCUIT	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>A1: CHECK THE EXTERNAL RECEIVER DATA LINE CIRCUIT FOR SHORT CIRCUIT TO GROUND</b>	
	<b>1</b> Key off.
	<b>2</b> Disconnect the TPMS external receiver electrical connector, C3MC45.
	<b>3</b> Measure the resistance between:
	<b>C3MC45, harness side</b>
	<b>Battery</b>
	Pin 1 Negative terminal
	Is the resistance less than 10,000 ohms? <b>Yes</b> <a href="#">GO to A3.</a> <b>No</b> <a href="#">GO to A2.</a>
<b>A2: CHECK THE EXTERNAL RECEIVER DATA LINE CIRCUIT FOR SHORT CIRCUIT TO POWER</b>	
	<b>1</b> Measure the resistance between:
	<b>C3MC45, harness side</b>
	<b>Battery</b>
	Pin 1 Positive terminal
	Is the resistance less than 10,000 ohms? <b>Yes</b> <a href="#">GO to A4.</a> <b>No</b> <a href="#">GO to A5.</a>
<b>A3: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE</b>	
	<b>1</b> Disconnect the TPMS module connector, C3MC39B.
	<b>2</b> Measure the resistance between:
	<b>C3MC45, harness side</b>
	<b>Battery</b>
	Pin 1 Negative terminal



	<p>Is the resistance less than 10,000 ohms?</p> <p><b>Yes</b> REPAIR the short circuit. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.</p> <p><b>No</b> INSTALL a new TPMS module. REFER to: <a href="#">Tire Pressure Monitoring System (TPMS) Module</a> (204-04 Wheels and Tires, Removal and Installation).</p>				
<b>A4: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE</b>					
	<p><b>1</b> Disconnect the TPMS module connector, C3MC39B.</p> <p><b>2</b> Measure the resistance between:</p> <table border="1"> <tr> <td><b>C3MC45, harness side</b></td> <td><b>Battery</b></td> </tr> <tr> <td>Pin 1</td> <td>Positive terminal</td> </tr> </table>	<b>C3MC45, harness side</b>	<b>Battery</b>	Pin 1	Positive terminal
<b>C3MC45, harness side</b>	<b>Battery</b>				
Pin 1	Positive terminal				
	<p>Is the resistance less than 10,000 ohms?</p> <p><b>Yes</b> REPAIR the short circuit. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.</p> <p><b>No</b> INSTALL a new TPMS module. REFER to: <a href="#">Tire Pressure Monitoring System (TPMS) Module</a> (204-04 Wheels and Tires, Removal and Installation).</p>				
<b>A5: CHECK THE EXTERNAL RECEIVER DATA LINE CIRCUIT FOR HIGH RESISTANCE</b>					
	<p><b>1</b> Measure the resistance between:</p> <table border="1"> <tr> <td><b>C3MC39B, harness side</b></td> <td><b>C3MC45, harness side</b></td> </tr> <tr> <td>Pin 4</td> <td>Pin 1</td> </tr> </table>	<b>C3MC39B, harness side</b>	<b>C3MC45, harness side</b>	Pin 4	Pin 1
<b>C3MC39B, harness side</b>	<b>C3MC45, harness side</b>				
Pin 4	Pin 1				
	<p>Is the resistance greater than 5 ohms?</p> <p><b>Yes</b> REPAIR the high resistance. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.</p> <p><b>No</b> INSTALL a new external receiver. REFER to: <a href="#">Tire Pressure Monitoring System (TPMS) Receiver</a> (204-04 Wheels and Tires, Removal and Installation).</p>				

**PINPOINT TEST B : FRONT LEFT LOW-FREQUENCY INITIATOR CIRCUIT**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS				
<b>B1: CHECK THE INITIATOR RETURN CIRCUIT FOR SHORT CIRCUIT TO GROUND</b>					
	<p><b>1</b> Key off.</p> <p><b>2</b> Disconnect the left hand front low-frequency initiator electrical connector, C1MC40.</p>				
 <p>E63657</p>					
	<p><b>3</b> Measure the resistance between:</p> <table border="1"> <tr> <td><b>C1MC40, harness side</b></td> <td><b>Battery</b></td> </tr> <tr> <td>Pin 2</td> <td>Negative terminal</td> </tr> </table>	<b>C1MC40, harness side</b>	<b>Battery</b>	Pin 2	Negative terminal
<b>C1MC40, harness side</b>	<b>Battery</b>				
Pin 2	Negative terminal				
	<p>Is the resistance less than 10,000 ohms?</p> <p><b>Yes</b> <a href="#">GO to B5.</a></p> <p><b>No</b> <a href="#">GO to B2.</a></p>				
<b>B2: CHECK THE INITIATOR NEGATIVE CIRCUIT FOR SHORT CIRCUIT TO POWER</b>					
	<p><b>1</b> Measure the resistance between:</p> <table border="1"> <tr> <td><b>C1MC40, harness side</b></td> <td><b>Battery</b></td> </tr> <tr> <td>Pin 2</td> <td>Positive terminal</td> </tr> </table>	<b>C1MC40, harness side</b>	<b>Battery</b>	Pin 2	Positive terminal
<b>C1MC40, harness side</b>	<b>Battery</b>				
Pin 2	Positive terminal				
	<p>Is the resistance less than 10,000 ohms?</p> <p><b>Yes</b> <a href="#">GO to B6.</a></p> <p><b>No</b> <a href="#">GO to B3.</a></p>				
<b>B3: CHECK THE INITIATOR POWER CIRCUIT FOR SHORT CIRCUIT TO GROUND</b>					
	<p><b>1</b> Measure the resistance between:</p> <table border="1"> <tr> <td><b>C1MC40, harness side</b></td> <td><b>Battery</b></td> </tr> <tr> <td>Pin 1</td> <td>Negative terminal</td> </tr> </table>	<b>C1MC40, harness side</b>	<b>Battery</b>	Pin 1	Negative terminal
<b>C1MC40, harness side</b>	<b>Battery</b>				
Pin 1	Negative terminal				



Is the resistance less than 10,000 ohms?  
**Yes**  
[GO to B7.](#)  
**No**  
[GO to B4.](#)

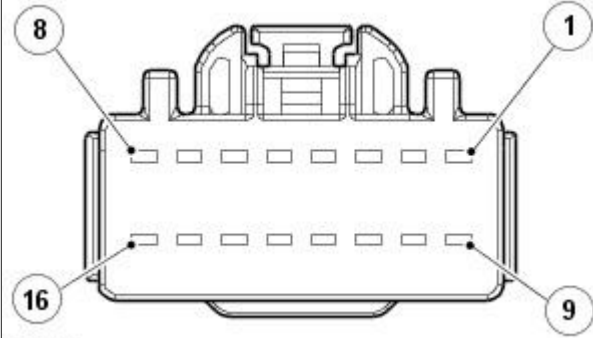
**B4: CHECK THE INITIATOR POWER CIRCUIT FOR SHORT CIRCUIT TO POWER**

<b>1</b>	Measure the resistance between:	
	<b>C1MC40, harness side</b>	<b>Battery</b>
	Pin 1	Positive terminal

Is the resistance less than 10,000 ohms?  
**Yes**  
[GO to B8.](#)  
**No**  
[GO to B9.](#)

**B5: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE**

**1** Disconnect the TPMS module connector, C3MC39A.



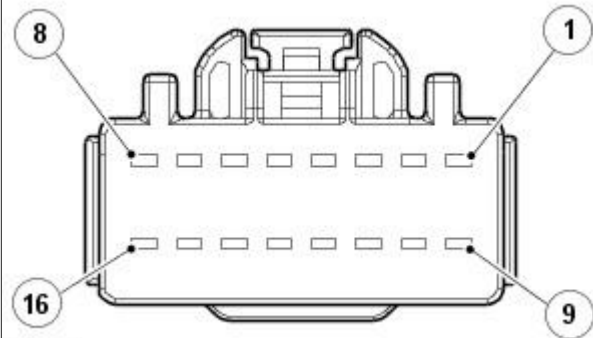
E63655

<b>2</b>	Measure the resistance between:	
	<b>C1MC40, harness side</b>	<b>Battery</b>
	Pin 2	Negative terminal

Is the resistance less than 10,000 ohms?  
**Yes**  
 REPAIR the short circuit. This circuit contains intermediate connector, C13-B. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
 INSTALL a new TPMS module.  
 REFER to: [Tire Pressure Monitoring System \(TPMS\) Module \(204-04 Wheels and Tires, Removal and Installation\)](#).

**B6: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE**

**1** Disconnect the TPMS module connector, C3MC39A.



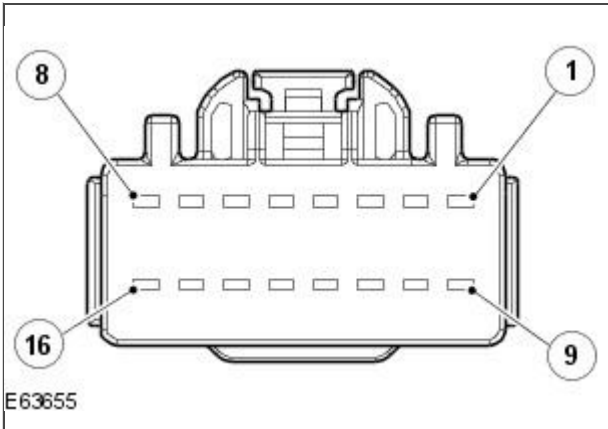
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<b>2</b>	Measure the resistance between:	
	<b>C1MC40, harness side</b>	<b>Battery</b>
	Pin 2	Positive terminal

Is the resistance less than 10,000 ohms?  
**Yes**  
 REPAIR the short circuit. This circuit contains intermediate connector, C13-B. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
 INSTALL a new TPMS module.  
 REFER to: [Tire Pressure Monitoring System \(TPMS\) Module \(204-04 Wheels and Tires, Removal and Installation\)](#).

**B7: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE**

**1** Disconnect the TPMS module connector, C3MC39A.

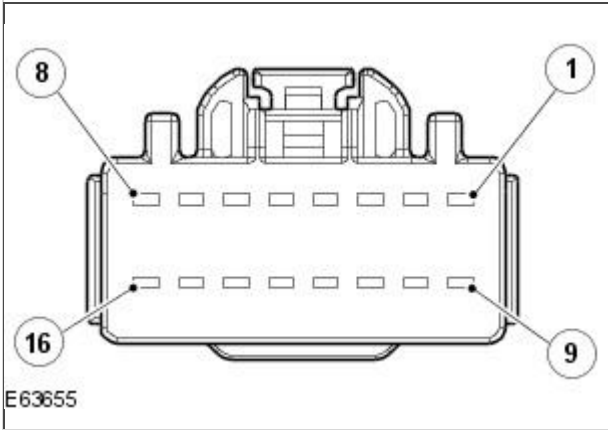


<b>2</b>	Measure the resistance between:	
	<b>C1MC40, harness side</b>	<b>Battery</b>
	Pin 1	Negative terminal

Is the resistance less than 10,000 ohms?  
**Yes**  
 REPAIR the short circuit. This circuit contains intermediate connector, C13-B. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
 INSTALL a new TPMS module.  
 REFER to: [Tire Pressure Monitoring System \(TPMS\) Module \(204-04 Wheels and Tires, Removal and Installation\)](#).

**B8: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE**

<b>1</b>	Disconnect the TPMS module connector, C3MC39A.
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<b>2</b>	Measure the resistance between:	
	<b>C1MC40, harness side</b>	<b>Battery</b>
	Pin 1	Positive terminal

Is the resistance less than 10,000 ohms?  
**Yes**  
 REPAIR the short circuit. This circuit contains intermediate connector, C13-B. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
 INSTALL a new TPMS module.  
 REFER to: [Tire Pressure Monitoring System \(TPMS\) Module \(204-04 Wheels and Tires, Removal and Installation\)](#).

**B9: CHECK THE INITIATOR RETURN CIRCUIT FOR HIGH RESISTANCE**

<b>1</b>	Measure the resistance between:	
	<b>C3MC39A, harness side</b>	<b>C1MC40, harness side</b>
	Pin 14	Pin 2

Is the resistance greater than 5 ohms?  
**Yes**  
 REPAIR the high resistance circuit. This circuit contains intermediate connector, C13-B. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
[GO to B10.](#)

**B10: CHECK THE INITIATOR POWER CIRCUIT FOR HIGH RESISTANCE**

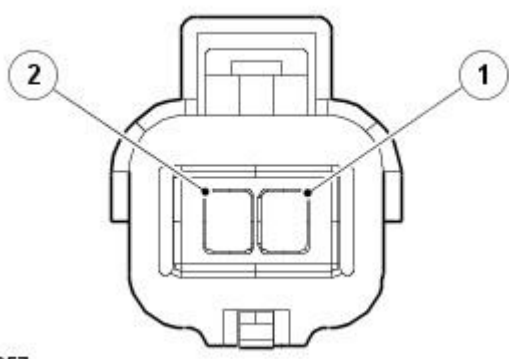
<b>1</b>	Measure the resistance between:	
	<b>C3MC39A, harness side</b>	<b>C1MC40, harness side</b>
	Pin 13	Pin 1

	<p>Is the resistance greater than 5 ohms?</p> <p><b>Yes</b> REPAIR the high resistance circuit. This circuit contains intermediate connector, C13-B. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.</p> <p><b>No</b> INSTALL a new left hand front low-frequency initiator. REFER to: Tire Pressure Monitoring System Front Antenna (204-04 Wheels and Tires, Removal and Installation).</p>
--	--

**PINPOINT TEST C : FRONT RIGHT LOW FREQUENCY INITIATOR CIRCUIT**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
-----------------	-------------------------

**C1: CHECK THE INITIATOR RETURN CIRCUIT FOR SHORT CIRCUIT TO GROUND**

	<p><b>1</b> Key off.</p> <p><b>2</b> Disconnect the right hand front low-frequency initiator electrical connector, C1MC41.</p>				
 <p>E63657</p>	<p><b>3</b> Measure the resistance between:</p> <table border="1"> <thead> <tr> <th>C1MC41, harness side</th> <th>Battery</th> </tr> </thead> <tbody> <tr> <td>Pin 2</td> <td>Negative terminal</td> </tr> </tbody> </table>	C1MC41, harness side	Battery	Pin 2	Negative terminal
	C1MC41, harness side	Battery			
	Pin 2	Negative terminal			
<p>Is the resistance less than 10,000 ohms?</p> <p><b>Yes</b> <a href="#">GO to C5.</a></p> <p><b>No</b> <a href="#">GO to C2.</a></p>					

	<p>Is the resistance less than 10,000 ohms?</p> <p><b>Yes</b> <a href="#">GO to C5.</a></p> <p><b>No</b> <a href="#">GO to C2.</a></p>
--	--

**C2: CHECK THE INITIATOR RETURN CIRCUIT FOR SHORT CIRCUIT TO POWER**

	<p><b>1</b> Measure the resistance between:</p> <table border="1"> <thead> <tr> <th>C1MC41, harness side</th> <th>Battery</th> </tr> </thead> <tbody> <tr> <td>Pin 2</td> <td>Positive terminal</td> </tr> </tbody> </table>	C1MC41, harness side	Battery	Pin 2	Positive terminal
C1MC41, harness side	Battery				
Pin 2	Positive terminal				
	<p>Is the resistance less than 10,000 ohms?</p> <p><b>Yes</b> <a href="#">GO to C6.</a></p> <p><b>No</b> <a href="#">GO to C3.</a></p>				

**C3: CHECK THE INITIATOR POWER CIRCUIT FOR SHORT CIRCUIT TO GROUND**

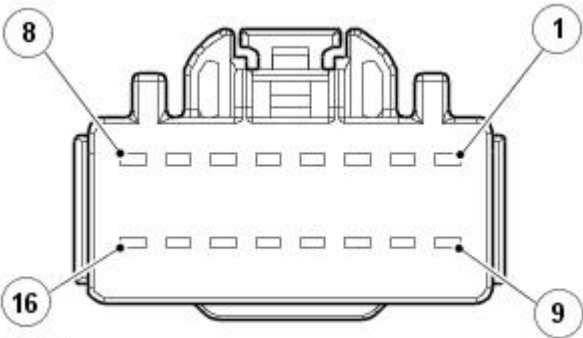
	<p><b>1</b> Measure the resistance between:</p> <table border="1"> <thead> <tr> <th>C1MC41, harness side</th> <th>Battery</th> </tr> </thead> <tbody> <tr> <td>Pin 1</td> <td>Negative terminal</td> </tr> </tbody> </table>	C1MC41, harness side	Battery	Pin 1	Negative terminal
C1MC41, harness side	Battery				
Pin 1	Negative terminal				
	<p>Is the resistance less than 10,000 ohms?</p> <p><b>Yes</b> <a href="#">GO to C7.</a></p> <p><b>No</b> <a href="#">GO to C4.</a></p>				

**C4: CHECK THE INITIATOR POWER CIRCUIT FOR SHORT CIRCUIT TO POWER**

	<p><b>1</b> Measure the resistance between:</p> <table border="1"> <thead> <tr> <th>C1MC41, harness side</th> <th>Battery</th> </tr> </thead> <tbody> <tr> <td>Pin 1</td> <td>Positive terminal</td> </tr> </tbody> </table>	C1MC41, harness side	Battery	Pin 1	Positive terminal
C1MC41, harness side	Battery				
Pin 1	Positive terminal				
	<p>Is the resistance less than 10,000 ohms?</p> <p><b>Yes</b> <a href="#">GO to C8.</a></p> <p><b>No</b> <a href="#">GO to C9.</a></p>				

**C5: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE**

	<p><b>1</b> Disconnect the TPMS module connector, C3MC39A.</p>
--	--

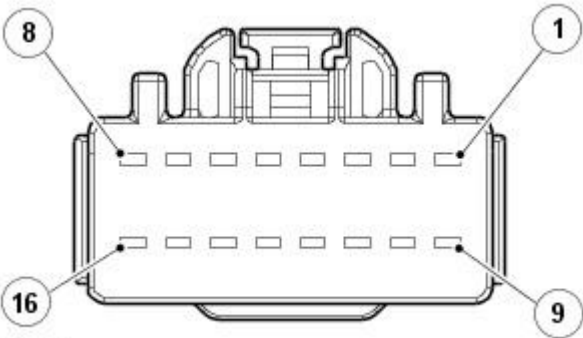


E63655

<b>2</b> Measure the resistance between:	
<b>C1MC41, harness side</b>	<b>Battery</b>
Pin 2	Negative terminal

Is the resistance less than 10,000 ohms?  
**Yes**  
 REPAIR the short circuit. This circuit contains intermediate connector, C13-B. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
 INSTALL a new TPMS module.  
 REFER to: [Tire Pressure Monitoring System \(TPMS\) Module \(204-04 Wheels and Tires, Removal and Installation\)](#).

**C6: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE**

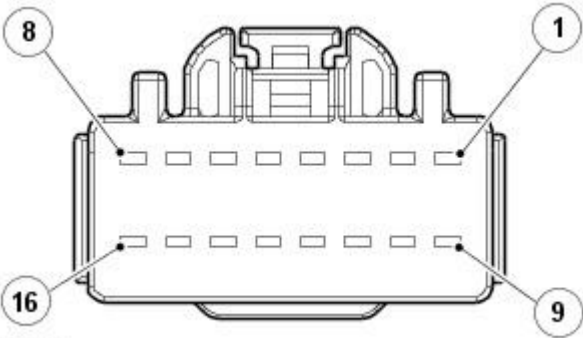


E63655

<b>1</b> Disconnect the TPMS module connector, C3MC39A.	
<b>2</b> Measure the resistance between:	
<b>C1MC41, harness side</b>	<b>Battery</b>
Pin 2	Positive terminal

Is the resistance less than 10,000 ohms?  
**Yes**  
 REPAIR the short circuit. This circuit contains intermediate connector, C13-B. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
 INSTALL a new TPMS module.  
 REFER to: [Tire Pressure Monitoring System \(TPMS\) Module \(204-04 Wheels and Tires, Removal and Installation\)](#).

**C7: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE**



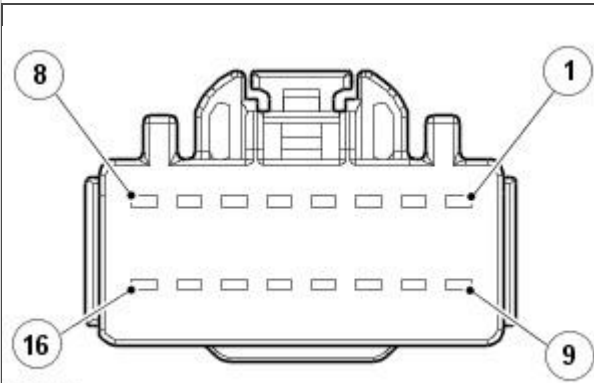
E63655

<b>1</b> Disconnect the TPMS module connector, C3MC39A.	
<b>2</b> Measure the resistance between:	
<b>C1MC41, harness side</b>	<b>Battery</b>
Pin 1	Negative terminal

Is the resistance less than 10,000 ohms?  
**Yes**  
 REPAIR the short circuit. This circuit contains intermediate connector, C13-B. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.

**No**  
 INSTALL a new TPMS module.  
 REFER to: [Tire Pressure Monitoring System \(TPMS\) Module](#)  
 (204-04 Wheels and Tires, Removal and Installation).

**C8: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE**



E63655

- 1 Disconnect the TPMS module connector, C3MC39A.
- 2 Measure the resistance between:
 

C1MC41, harness side	Battery
Pin 1	Positive terminal

Is the resistance less than 10,000 ohms?  
**Yes**  
 REPAIR the short circuit. This circuit contains intermediate connector, C13-B. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
 INSTALL a new TPMS module.  
 REFER to: [Tire Pressure Monitoring System \(TPMS\) Module](#)  
 (204-04 Wheels and Tires, Removal and Installation).

**C9: CHECK THE INITIATOR RETURN CIRCUIT FOR HIGH RESISTANCE**

- 1 Measure the resistance between:
 

C3MC39A, harness side	C1MC41, harness side
Pin 16	Pin 2

Is the resistance greater than 5 ohms?  
**Yes**  
 REPAIR the high resistance circuit. This circuit contains intermediate connector, C13-B. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
[GO to C10.](#)

**C10: CHECK THE INITIATOR POWER CIRCUIT FOR HIGH RESISTANCE**

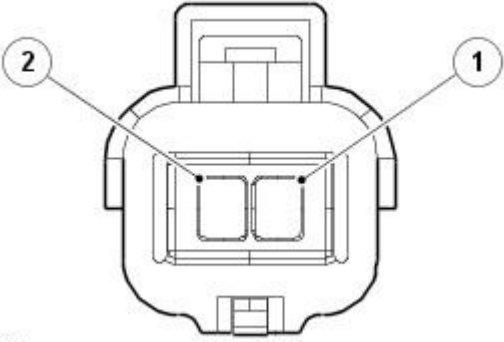
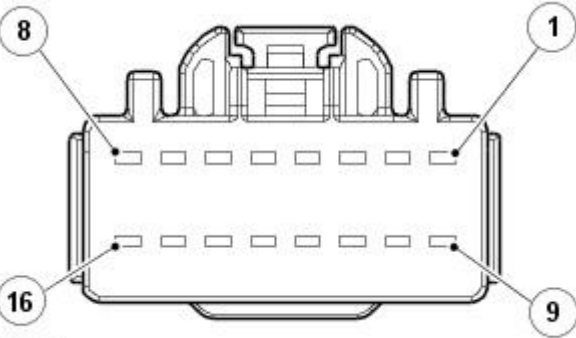
- 1 Measure the resistance between:
 

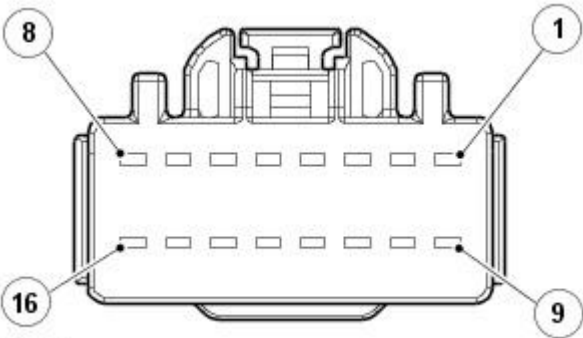
C3MC39A, harness side	C1MC41, harness side
Pin 15	Pin 1

Is the resistance greater than 5 ohms?  
**Yes**  
 REPAIR the high resistance circuit. This circuit contains intermediate connector, C13-B. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
 INSTALL a new right hand front low-frequency initiator.  
 REFER to: [Tire Pressure Monitoring System Front Antenna](#)  
 (204-04 Wheels and Tires, Removal and Installation).

**PINPOINT TEST D : REAR LEFT LOW-FREQUENCY INITIATOR CIRCUIT**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>D1: CHECK THE INITIATOR RETURN CIRCUIT FOR SHORT CIRCUIT TO GROUND</b>	
	<ol style="list-style-type: none"> <li>1 Key off.</li> <li>2 Disconnect the left hand rear low-frequency initiator electrical connector, C4MC42.</li> </ol>

 <p>E63657</p>	<b>3</b> Measure the resistance between:					
	<table border="1"> <thead> <tr> <th>C4MC42, harness side</th> <th>Battery</th> </tr> </thead> <tbody> <tr> <td>Pin 2</td> <td>Negative terminal</td> </tr> </tbody> </table>	C4MC42, harness side	Battery	Pin 2	Negative terminal	
C4MC42, harness side	Battery					
Pin 2	Negative terminal					
Is the resistance less than 10,000 ohms? <b>Yes</b> <a href="#">GO to D5.</a> <b>No</b> <a href="#">GO to D2.</a>						
<b>D2: CHECK THE INITIATOR RETURN CIRCUIT FOR SHORT CIRCUIT TO POWER</b>						
	<b>1</b> Measure the resistance between:					
	<table border="1"> <thead> <tr> <th>C4MC42, harness side</th> <th>Battery</th> </tr> </thead> <tbody> <tr> <td>Pin 2</td> <td>Positive terminal</td> </tr> </tbody> </table>	C4MC42, harness side	Battery	Pin 2	Positive terminal	
C4MC42, harness side	Battery					
Pin 2	Positive terminal					
Is the resistance less than 10,000 ohms? <b>Yes</b> <a href="#">GO to D6.</a> <b>No</b> <a href="#">GO to D3.</a>						
<b>D3: CHECK THE INITIATOR POWER CIRCUIT FOR SHORT CIRCUIT TO GROUND</b>						
	<b>1</b> Measure the resistance between:					
	<table border="1"> <thead> <tr> <th>C4MC42, harness side</th> <th>Battery</th> </tr> </thead> <tbody> <tr> <td>Pin 1</td> <td>Negative terminal</td> </tr> </tbody> </table>	C4MC42, harness side	Battery	Pin 1	Negative terminal	
C4MC42, harness side	Battery					
Pin 1	Negative terminal					
Is the resistance less than 10,000 ohms? <b>Yes</b> <a href="#">GO to D7.</a> <b>No</b> <a href="#">GO to D4.</a>						
<b>D4: CHECK THE INITIATOR POWER CIRCUIT FOR SHORT CIRCUIT TO POWER</b>						
	<b>1</b> Measure the resistance between:					
	<table border="1"> <thead> <tr> <th>C4MC42, harness side</th> <th>Battery</th> </tr> </thead> <tbody> <tr> <td>Pin 1</td> <td>Positive terminal</td> </tr> </tbody> </table>	C4MC42, harness side	Battery	Pin 1	Positive terminal	
C4MC42, harness side	Battery					
Pin 1	Positive terminal					
Is the resistance less than 10,000 ohms? <b>Yes</b> <a href="#">GO to D8.</a> <b>No</b> <a href="#">GO to D9.</a>						
<b>D5: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE</b>						
 <p>E63655</p>	<b>1</b> Disconnect the TPMS module connector, C3MC39A.					
	<b>2</b> Measure the resistance between:					
	<table border="1"> <thead> <tr> <th>C4MC42, harness side</th> <th>Battery</th> </tr> </thead> <tbody> <tr> <td>Pin 2</td> <td>Negative terminal</td> </tr> </tbody> </table>	C4MC42, harness side	Battery	Pin 2	Negative terminal	
C4MC42, harness side	Battery					
Pin 2	Negative terminal					
Is the resistance less than 10,000 ohms? <b>Yes</b> REPAIR the short circuit. This circuit contains intermediate connector, C44-K. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation. <b>No</b> INSTALL a new TPMS module. REFER to: <a href="#">Tire Pressure Monitoring System (TPMS) Module (204-04 Wheels and Tires, Removal and Installation)</a> .						
<b>D6: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE</b>						
	<b>1</b> Disconnect the TPMS module connector, C3MC39A.					

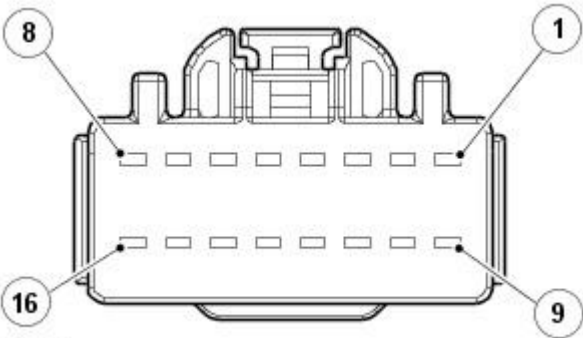


E63655

<b>2</b> Measure the resistance between:	
<b>C4MC42, harness side</b>	<b>Battery</b>
Pin 2	Positive terminal

Is the resistance less than 10,000 ohms?  
**Yes**  
 REPAIR the short circuit. This circuit contains intermediate connector, C44-K. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
 INSTALL a new TPMS module.  
 REFER to: [Tire Pressure Monitoring System \(TPMS\) Module \(204-04 Wheels and Tires, Removal and Installation\)](#).

**D7: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE**

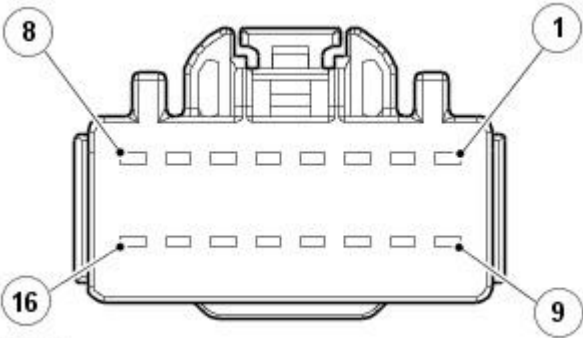


E63655

<b>1</b> Disconnect the TPMS module connector, C3MC39A.	
<b>2</b> Measure the resistance between:	
<b>C4MC42, harness side</b>	<b>Battery</b>
Pin 1	Negative terminal

Is the resistance less than 10,000 ohms?  
**Yes**  
 REPAIR the short circuit. This circuit contains intermediate connector, C44-K. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
 INSTALL a new TPMS module.  
 REFER to: [Tire Pressure Monitoring System \(TPMS\) Module \(204-04 Wheels and Tires, Removal and Installation\)](#).

**D8: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE**



E63655

<b>1</b> Disconnect the TPMS module connector, C3MC39A.	
<b>2</b> Measure the resistance between:	
<b>C4MC42, harness side</b>	<b>Battery</b>
Pin 1	Positive terminal

Is the resistance less than 10,000 ohms?  
**Yes**  
 REPAIR the short circuit. This circuit contains intermediate connector, C44-K. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.

	<p><b>No</b></p> <p>INSTALL a new TPMS module.  REFER to: <a href="#">Tire Pressure Monitoring System (TPMS) Module (204-04 Wheels and Tires, Removal and Installation)</a>.</p>
--	--

**D9: CHECK THE INITIATOR RETURN CIRCUIT FOR HIGH RESISTANCE**

	<p><b>1</b> Measure the resistance between:</p> <table border="1"> <tr> <td><b>C3MC39A, harness side</b></td> <td><b>C4MC42, harness side</b></td> </tr> <tr> <td>Pin 6</td> <td>Pin 2</td> </tr> </table>	<b>C3MC39A, harness side</b>	<b>C4MC42, harness side</b>	Pin 6	Pin 2
<b>C3MC39A, harness side</b>	<b>C4MC42, harness side</b>				
Pin 6	Pin 2				
	<p>Is the resistance greater than 5 ohms?</p> <p><b>Yes</b></p> <p>REPAIR the high resistance circuit. This circuit contains intermediate connector, C44-K. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.</p> <p><b>No</b></p> <p><a href="#">GO to D10.</a></p>				

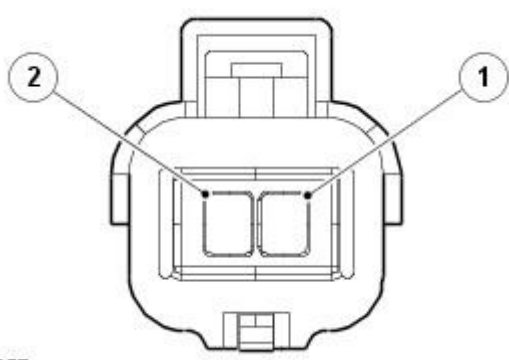
**D10: CHECK THE INITIATOR POWER CIRCUIT FOR HIGH RESISTANCE**

	<p><b>1</b> Measure the resistance between:</p> <table border="1"> <tr> <td><b>C3MC39A, harness side</b></td> <td><b>C4MC42, harness side</b></td> </tr> <tr> <td>Pin 5</td> <td>Pin 1</td> </tr> </table>	<b>C3MC39A, harness side</b>	<b>C4MC42, harness side</b>	Pin 5	Pin 1
<b>C3MC39A, harness side</b>	<b>C4MC42, harness side</b>				
Pin 5	Pin 1				
	<p>Is the resistance greater than 5 ohms?</p> <p><b>Yes</b></p> <p>REPAIR the high resistance circuit. This circuit contains intermediate connector, C44-K. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.</p> <p><b>No</b></p> <p>INSTALL a new rear left hand low-frequency initiator.  REFER to: Tire Pressure Monitoring System Rear Antenna (204-04 Wheels and Tires, Removal and Installation).</p>				

**PINPOINT TEST E : REAR RIGHT LOW-FREQUENCY INITIATOR CIRCUIT**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
-----------------	-------------------------

**E1: CHECK THE INITIATOR RETURN CIRCUIT FOR SHORT CIRCUIT TO GROUND**

	<p><b>1</b> Key off.</p> <p><b>2</b> Disconnect the right hand rear low-frequency initiator electrical connector, C4MC43.</p>				
 <p>E63657</p>	<p><b>3</b> Measure the resistance between:</p> <table border="1"> <tr> <td><b>C4MC43, harness side</b></td> <td><b>Battery</b></td> </tr> <tr> <td>Pin 2</td> <td>Negative terminal</td> </tr> </table>	<b>C4MC43, harness side</b>	<b>Battery</b>	Pin 2	Negative terminal
	<b>C4MC43, harness side</b>	<b>Battery</b>			
Pin 2	Negative terminal				
	<p>Is the resistance less than 10,000 ohms?</p> <p><b>Yes</b></p> <p><a href="#">GO to E5.</a></p> <p><b>No</b></p> <p><a href="#">GO to E2.</a></p>				

**E2: CHECK THE INITIATOR RETURN CIRCUIT FOR SHORT CIRCUIT TO POWER**

	<p><b>1</b> Measure the resistance between:</p> <table border="1"> <tr> <td><b>C4MC43, harness side</b></td> <td><b>Battery</b></td> </tr> <tr> <td>Pin 2</td> <td>Positive terminal</td> </tr> </table>	<b>C4MC43, harness side</b>	<b>Battery</b>	Pin 2	Positive terminal
<b>C4MC43, harness side</b>	<b>Battery</b>				
Pin 2	Positive terminal				
	<p>Is the resistance less than 10,000 ohms?</p> <p><b>Yes</b></p> <p><a href="#">GO to E6.</a></p> <p><b>No</b></p> <p><a href="#">GO to E3.</a></p>				

**E3: CHECK THE INITIATOR POWER CIRCUIT FOR SHORT CIRCUIT TO GROUND**

	<p><b>1</b> Measure the resistance between:</p> <table border="1"> <tr> <td><b>C4MC43, harness side</b></td> <td><b>Battery</b></td> </tr> <tr> <td>Pin 1</td> <td>Negative terminal</td> </tr> </table>	<b>C4MC43, harness side</b>	<b>Battery</b>	Pin 1	Negative terminal
<b>C4MC43, harness side</b>	<b>Battery</b>				
Pin 1	Negative terminal				
	<p>Is the resistance less than 10,000 ohms?</p> <p><b>Yes</b></p> <p><a href="#">GO to E7.</a></p> <p><b>No</b></p> <p><a href="#">GO to E4.</a></p>				

**E4: CHECK THE INITIATOR POWER CIRCUIT FOR SHORT CIRCUIT TO POWER**



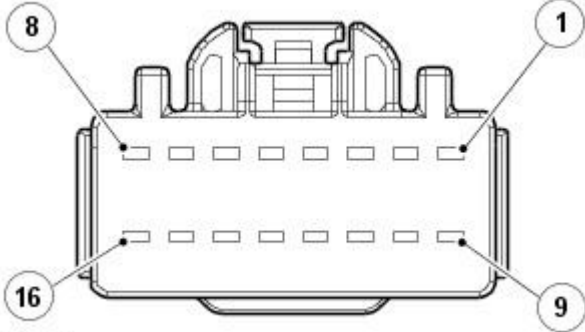
<b>1</b> Measure the resistance between:	
<b>C4MC43, harness side</b>	<b>Battery</b>
Pin 1	Positive terminal

Is the resistance less than 10,000 ohms?  
**Yes**  
[GO to E8.](#)  
**No**  
[GO to E9.](#)

**E5: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE**

**1** Disconnect the TPMS module connector, C3MC39A.

<b>2</b> Measure the resistance between:	
<b>C4MC43, harness side</b>	<b>Battery</b>
Pin 2	Negative terminal



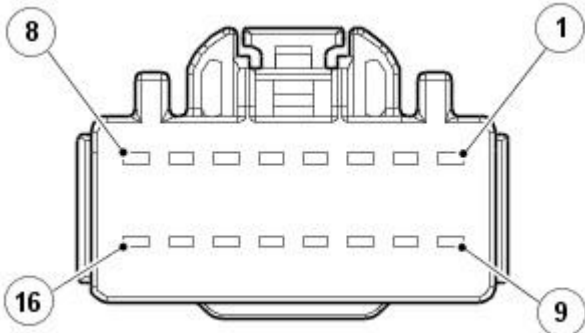
E63655

Is the resistance less than 10,000 ohms?  
**Yes**  
 REPAIR the short circuit. This circuit contains intermediate connector, C44-L. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
 INSTALL a new TPMS module.  
 REFER to: [Tire Pressure Monitoring System \(TPMS\) Module](#) (204-04 Wheels and Tires, Removal and Installation).

**E6: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE**

**1** Disconnect the TPMS module connector, C3MC39A.

<b>2</b> Measure the resistance between:	
<b>C4MC43, harness side</b>	<b>Battery</b>
Pin 2	Positive terminal

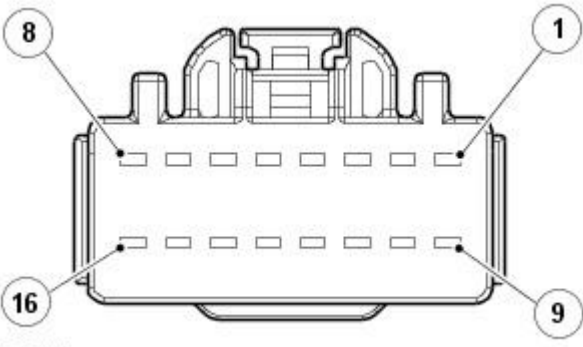


E63655

Is the resistance less than 10,000 ohms?  
**Yes**  
 REPAIR the short circuit. This circuit contains intermediate connector, C44-L. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
 INSTALL a new TPMS module.  
 REFER to: [Tire Pressure Monitoring System \(TPMS\) Module](#) (204-04 Wheels and Tires, Removal and Installation).

**E7: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE**

**1** Disconnect the TPMS module connector, C3MC39A.

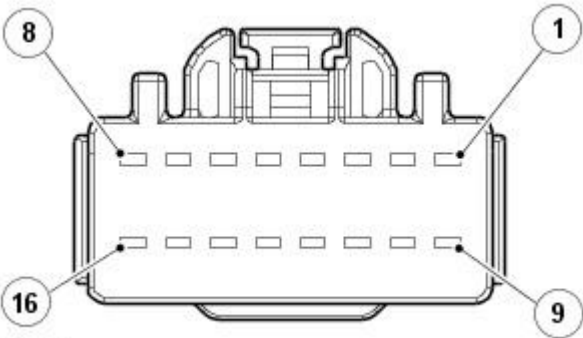


E63655

<b>2</b> Measure the resistance between:	
<b>C4MC43, harness side</b>	<b>Battery</b>
Pin 1	Negative terminal

Is the resistance less than 10,000 ohms?  
**Yes**  
 REPAIR the short circuit. This circuit contains intermediate connector, C44-L. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
 INSTALL a new TPMS module.  
 REFER to: [Tire Pressure Monitoring System \(TPMS\) Module \(204-04 Wheels and Tires, Removal and Installation\)](#).

**E8: CHECK WHETHER THE SHORT CIRCUIT IS IN THE HARNESS OR THE MODULE**



E63655

<b>1</b> Disconnect the TPMS module connector, C3MC39A.	
<b>2</b> Measure the resistance between:	
<b>C4MC43, harness side</b>	<b>Battery</b>
Pin 1	Positive terminal

Is the resistance less than 10,000 ohms?  
**Yes**  
 REPAIR the short circuit. This circuit contains intermediate connector, C44-L. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
 INSTALL a new TPMS module.  
 REFER to: [Tire Pressure Monitoring System \(TPMS\) Module \(204-04 Wheels and Tires, Removal and Installation\)](#).

**E9: CHECK THE INITIATOR RETURN CIRCUIT FOR HIGH RESISTANCE**

<b>1</b> Measure the resistance between:	
<b>C3MC39A, harness side</b>	<b>C4MC43, harness side</b>
Pin 8	Pin 2

Is the resistance greater than 5 ohms?  
**Yes**  
 REPAIR the high resistance circuit. This circuit contains intermediate connector, C44-L. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
[GO to E10.](#)

**E10: CHECK THE INITIATOR POWER CIRCUIT FOR HIGH RESISTANCE**

<b>1</b> Measure the resistance between:	
<b>C3MC39A, harness side</b>	<b>C4MC43, harness side</b>
Pin 7	Pin 1

Is the resistance greater than 5 ohms?  
**Yes**  
 REPAIR the high resistance circuit. This circuit contains intermediate connector, C44-L. For additional information, refer to the wiring diagram. Clear the DTC and test the system for normal operation.  
**No**  
 INSTALL a new rear right hand low-frequency initiator.  
 REFER to: [Tire Pressure Monitoring System Rear Antenna](#)

**PINPOINT TEST F : MISSING, INCOMPATIBLE OR DEFECTIVE RUNNING TIRE LOW PRESSURE SENSOR OR RECEIVER**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>F1: CHECK FOR CORRECT WHEEL AND TIRE ASSEMBLY AND TIRE LOW PRESSURE SENSOR</b>	
	<ul style="list-style-type: none"> <li>NOTE: One way of identifying if a tire low pressure sensor is installed to a wheel and tire assembly is by a metal valve stem rather than rubber. A tire low pressure sensor cannot be installed to a space saver spare wheel.</li> </ul>
	<p>1 Check that the wheel and tire assembly installed to the applicable position on the vehicle is a full size wheel and tire with a tire low pressure sensor installed.</p>
	<p>Is a full size wheel and tire assembly with tire low pressure sensor installed?</p> <p><b>Yes</b> <a href="#">GO to F2.</a></p> <p><b>No</b> Install the correct wheel and tire assembly or tire low pressure sensor, of correct frequency, in accordance with that defined in the manufacturer approved diagnostic system new tire low pressure sensor application.</p>
<b>F2: CHECK FOR ADDITIONAL DTCS</b>	
	<p>1 Check for additional DTCS C1A5631, C1A5831, C1A6031, C1A6231.</p>
	<p>Have all four DTCS logged in the tire pressure monitoring system module?</p> <p><b>Yes</b> Suspect the tire pressure monitoring system receiver. Check and install a new receiver as required. REFER to: <a href="#">Tire Pressure Monitoring System (TPMS) Receiver</a> (204-04 Wheels and Tires, Removal and Installation).</p> <p><b>No</b> <a href="#">GO to F3.</a></p>
<b>F3: VERIFY THE POSITION OF THE DEFECTIVE TIRE LOW PRESSURE SENSOR</b>	
	<p>1 Clear DTCS and carry out Drive Cycle as outlined in Inspection and Verification section above.</p>
	<p>2 Check tire pressure monitoring system DTCS.</p>
	<p>Are any C1AXX31 DTCS logged?</p> <p><b>Yes</b> Install the correct tire low pressure sensor, of correct frequency, in accordance with that defined in the manufacturer approved diagnostic system new tire low pressure sensor application, to the position identified by the logged DTC. REFER to: Tire Low Pressure Sensor (204-04 Wheels and Tires, Removal and Installation).</p> <p><b>No</b> No further action is required.</p>

**PINPOINT TEST G : LOCALIZATION FAILURE**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>G1: CHECK FOR ADDITIONAL DTCS</b>	
	<p>1 Check for additional DTCS: Left Front - C1A5711, C1A5712, C1A5713. Right Front - C1A5911, C1A5912, C1A5913. Left Rear - C1A6111, C1A6112, C1A6113. Right Rear - C1A6311, C1A6312, C1A6313.</p>
	<p>Are any of the DTCS listed above also logged?</p> <p><b>Yes</b> Refer to the DTC Index and remedial actions. If a fault has been rectified, run On Demand Self Test routine to confirm.</p> <p><b>No</b> <a href="#">GO to G2.</a></p>
<b>G2: CHECK FOR ADDITIONAL DTCS</b>	
	<p>1 Check for additional DTCS: C1AXX31.</p>
	<p>Is a C1AXX31 DTC also logged?</p> <p><b>Yes</b> Refer to the DTC Index and remedial actions.</p> <p><b>No</b> <a href="#">GO to G3.</a></p>
<b>G3: CHECK INITIATOR INSTALLATION</b>	
	<p>1 Check for correct installation of Initiator. REFER to: (204-04 Wheels and Tires) Tire Pressure Monitoring System Front Antenna (Removal and Installation), Tire Pressure Monitoring System Rear Antenna (Removal and Installation).</p>
	<p>Is the Initiator correctly installed?</p> <p><b>Yes</b> <a href="#">GO to G4.</a></p> <p><b>No</b> Rectify as required. REFER to: (204-04 Wheels and Tires) Tire Pressure Monitoring System Front Antenna (Removal and Installation), Tire Pressure Monitoring System Rear Antenna (Removal and Installation).</p>
<b>G4: CHECK FOR SHORT CIRCUIT IN INITIATOR HARNESS</b>	
	<p>1 Check for short circuit between Initiator power and return circuits.</p>
	<p>Has a short circuit been identified?</p> <p><b>Yes</b> Rectify the short circuit as required.</p> <p><b>No</b> Install the correct tire low pressure sensor, of correct frequency, in accordance with that defined in the manufacturer approved diagnostic system new tire low pressure sensor application, to the position identified by the logged DTC.</p>


<b>PINPOINT TEST H : MISSING MESSAGE FROM RECEIVER</b>	
<b>TEST CONDITIONS</b>	<b>DETAILS/RESULTS/ACTIONS</b>
<b>H1: CHECK TIRE PRESSURE MONITORING SYSTEM RECEIVER OR DATALINE CIRCUITS FOR OPEN CIRCUIT</b>	
	<p>1 Check tire pressure monitoring system receiver or dataline circuits for open circuit.</p> <p>Has an open circuit fault been identified?</p> <p><b>Yes</b> Rectify the open circuit as required, run On Demand Self Test routine to confirm.</p> <p><b>No</b> <a href="#">GO to H2.</a></p>
<b>H2: CHECK FOR CORRECT WHEEL AND TIRE ASSEMBLY AND TIRE LOW PRESSURE SENSOR</b>	
	<p>• NOTE: One way of identifying if a tire low pressure sensor is installed to a wheel and tire assembly is by a metal valve stem rather than rubber. A tire low pressure sensor cannot be installed to a space saver spare wheel.</p> <p>1 Check that the wheel and tire assemblies installed to all four running wheel positions are full size wheel and tires with tire low pressure sensors installed.</p> <p>Are full size wheel and tire assemblies with tire low pressure sensors installed?</p> <p><b>Yes</b> Drive the vehicle for an accumulative period of at least 19 minutes at a speed greater than 28 mph (45kph), then check for DTCs. If DTC remains install a new tire pressure monitoring system receiver. REFER to: <a href="#">Tire Pressure Monitoring System (TPMS) Receiver</a> (204-04 Wheels and Tires, Removal and Installation). If no DTC, suspect RF blocking event, no further action is required.</p> <p><b>No</b> Install the correct wheel and tire assembly or tire low pressure sensor, of correct frequency, in accordance with that defined in the manufacturer approved diagnostic system new tire low pressure sensor application.</p>

# Wheels and Tires - Tire Low Pressure Sensor

Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

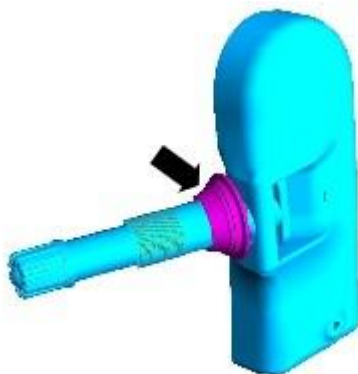
1.  **WARNING:** Make sure to support the vehicle with axle stands.  
Raise and support the vehicle.
2. Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
3. Remove the tire from the wheel, release the tire bead from the rim 180 degrees from the valve.



4.

5.

- Discard the tire valve and retaining nut.



## Installation

1. **CAUTIONS:**

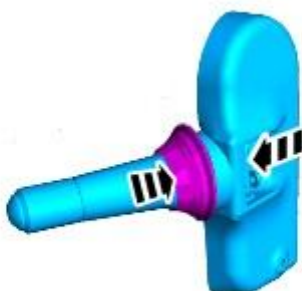


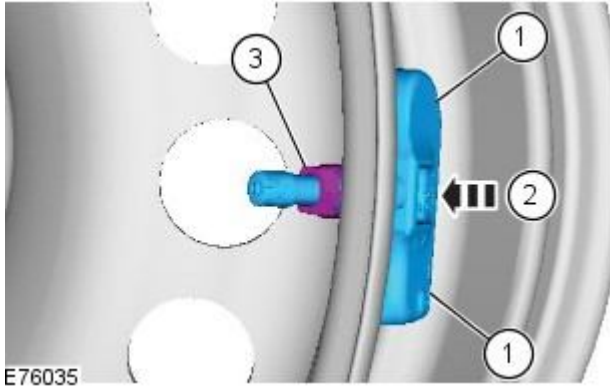
Make sure that the seal is correctly located.



Make sure that new components are installed.

Install the washer and seal, making sure the valve remains pressed fully onto its seat.





2. **2. WARNINGS:**

 Make sure that any corrosion or dirt is removed from the mating surfaces.

 Make sure that a new tire valve, valve core, seal, washer, cap and retaining nut is installed.

• **CAUTIONS:**

 Use lint free cloth.

 Only use moderate force when installing the sensor.

• **NOTE:** Only tighten the nut finger tight at this stage.

- Install the tire low pressure sensor and support the sensor body in position.
- Support the back of the valve stem in order to prevent rotation to the tire low pressure sensor body.
- Gently push the nut towards the center of the wheel. Tighten the nut.

*Torque: 8 Nm*

3. Install the tire and balance the wheel.

4. Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

5.  **WARNING:** Make sure to support the vehicle with axle stands.


Lower the vehicle.

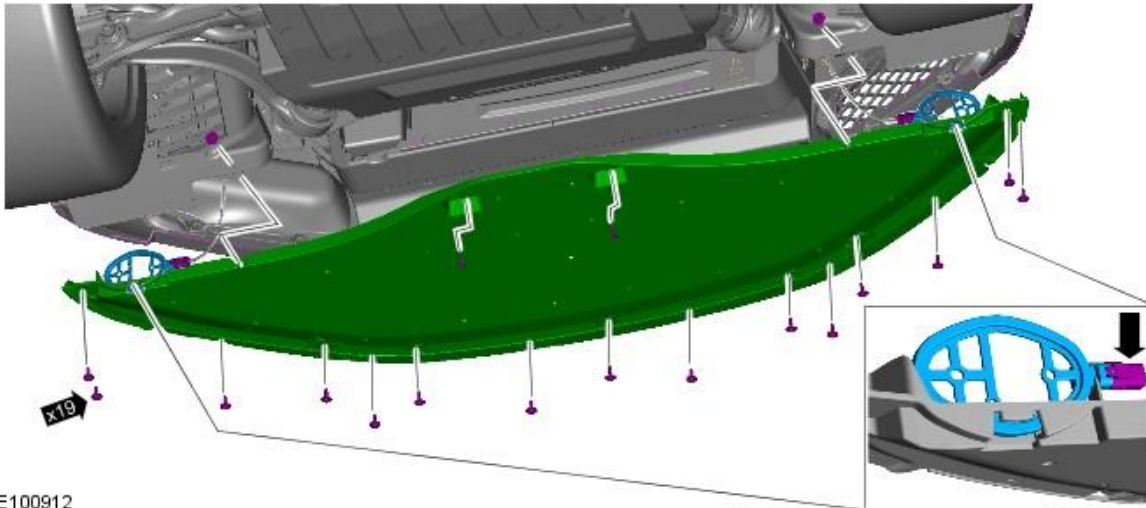
# Wheels and Tires - Tire Pressure Monitoring System (TPMS) Front Antenna

Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.  
Raise and support the vehicle.




E100912

2. **NOTE:** This step requires the aid of another technician.

- NOTE: Lower the radiator splash shield enough to access the tire pressure monitoring system front antenna.

- NOTE: Note the position of the component before removal.

## Installation

1.  **CAUTION:** Make sure that the component is secured in the retainer.  
  - NOTE: Make sure that the component is installed to the noted removal position.
 To install, reverse the removal procedure.

# Wheels and Tires - Tire Pressure Monitoring System (TPMS) Rear Antenna

## Removal and Installation

### Removal

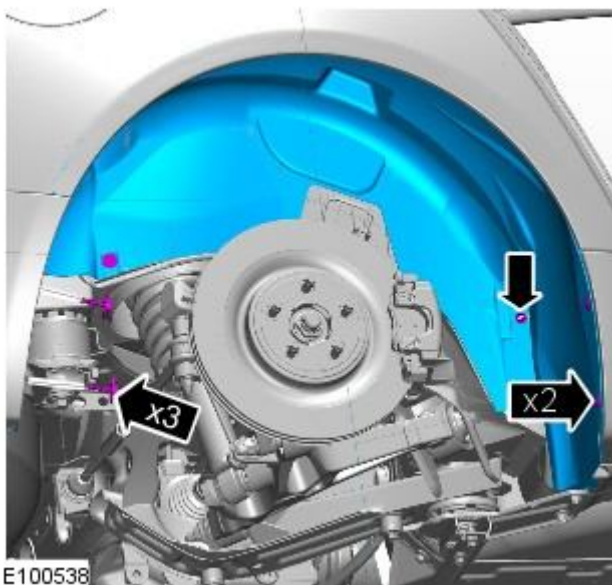
- NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

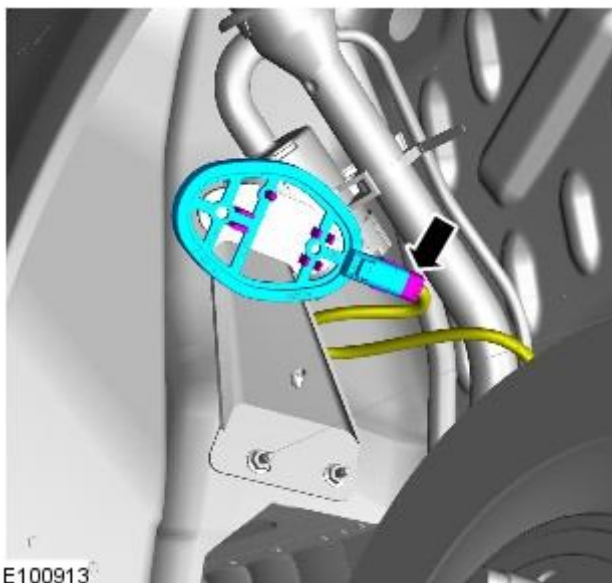
Raise and support the vehicle.

2. Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).


3.



4. **NOTE:** Note the position of the component before removal.



### Installation

1.  **CAUTION:** Make sure that the component is secured in the retainer.

- NOTE: Make sure that the component is installed to the noted removal position.

To install, reverse the removal procedure.



# Wheels and Tires - Tire Pressure Monitoring System (TPMS) Module

Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

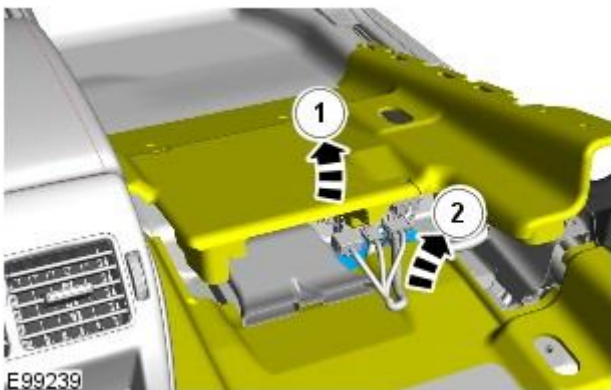
1. Switch the ignition off.

2. Remove the right-hand front seat.

Refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).

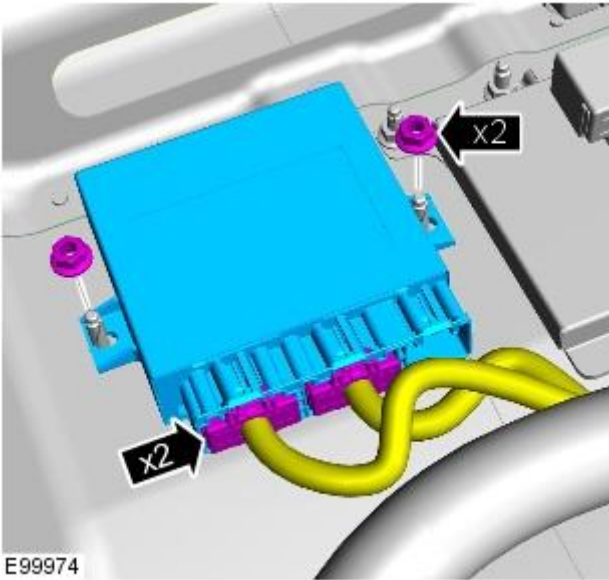
3. Refer to: [B-Pillar Lower Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

4. Detach and reposition the floor covering.



5.





6.

## Installation

1. To install, reverse the removal procedure.

# Wheels and Tires - Tire Pressure Monitoring System (TPMS) Receiver

Removal and Installation

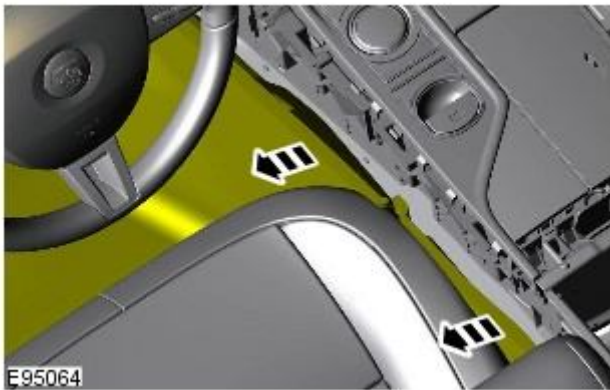
## Removal

- NOTE: Removal steps in this procedure may contain installation details.
- NOTE: The tire pressure monitoring system receiver is installed in the same location on both LHD and RHD vehicles.

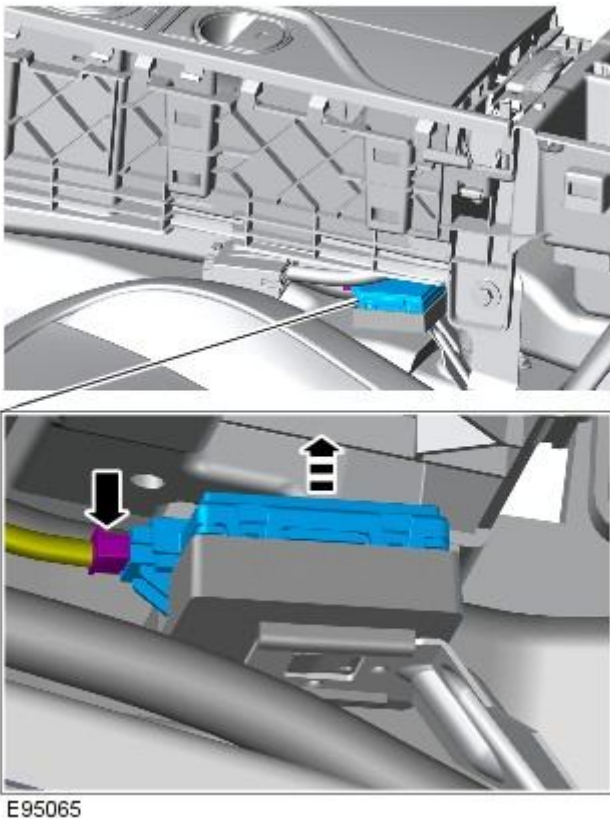
1. Switch the ignition off.
2. Remove the left-hand floor console side trim panel.

Refer to: [Floor Console Side Trim Panel](#) (501-12 Instrument Panel and Console, Removal and Installation).

3.



4.



## Installation

1. To install, reverse the removal procedure.
2. Configure the tire pressure monitoring system using the diagnostic tool.

## Wheels and Tires - Wheel and Tire

Removal and Installation

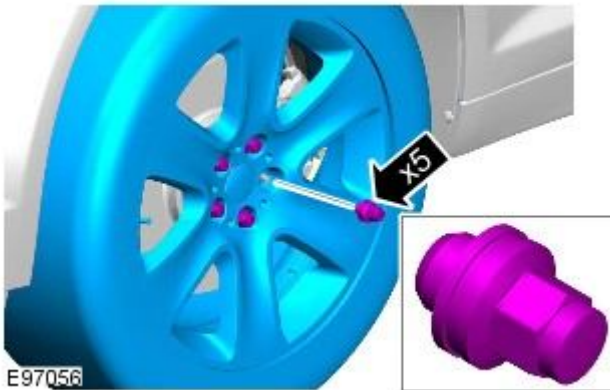
### Removal

- NOTE: Removal steps in this procedure may contain installation details.


1.  WARNING: Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Torque: 125 Nm



### Installation

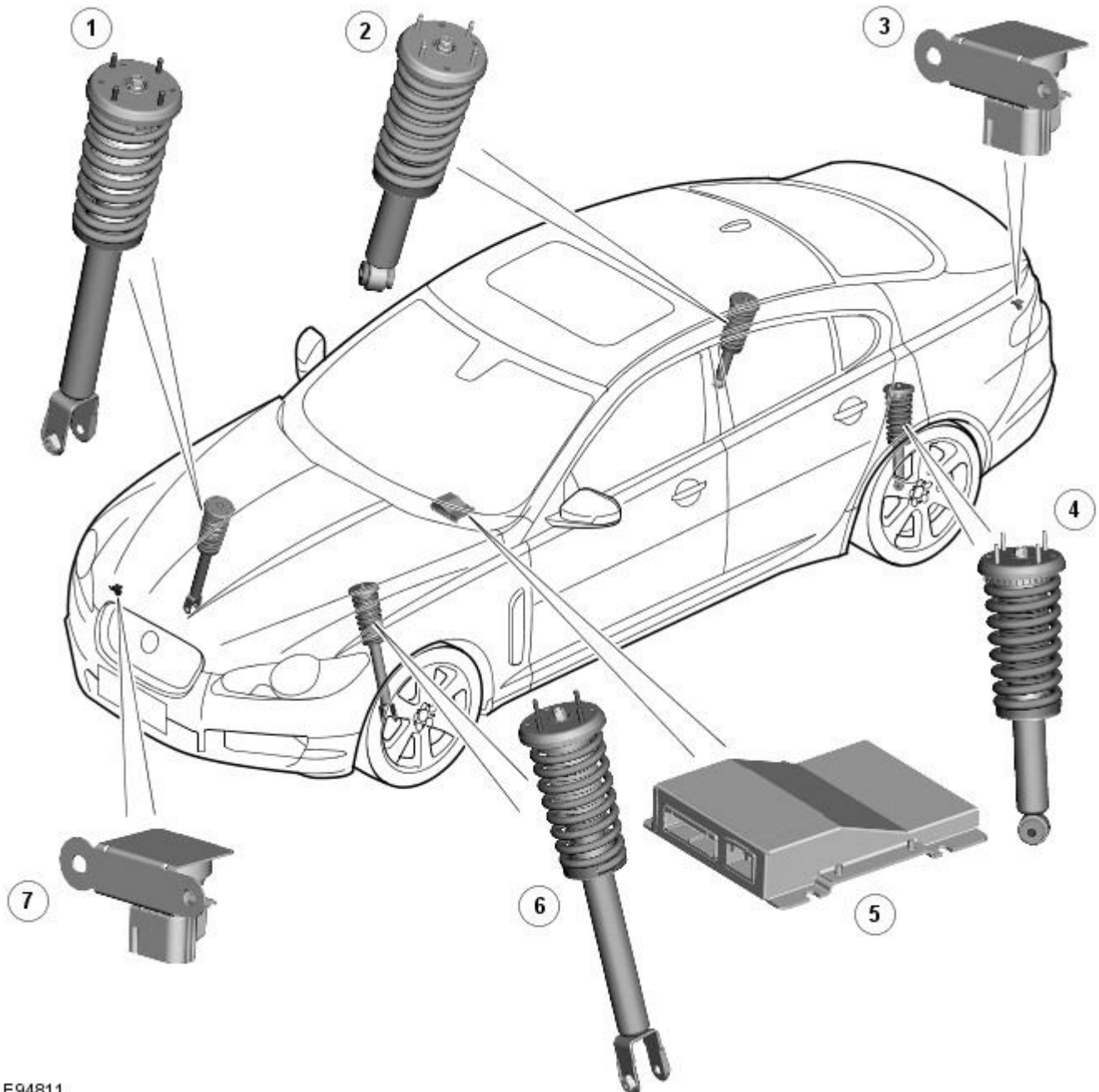
1.  CAUTION: Apply a small amount of grease to the hub and wheel mating surfaces before installation. Make sure the grease does not come into contact with the vehicles braking components and the wheel stud threads. Failure to follow these instructions may result in personal injury.

To install, reverse the removal procedure.

# Vehicle Dynamic Suspension - Vehicle Dynamic Suspension 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Component Location

Description and Operation

Adaptive Damping System Components



E94811

## Item Description

1	Right-hand front-spring and damper assembly
2	Right-hand rear-spring and damper assembly
3	Rear vertical accelerometer
4	Left-hand rear-spring and damper assembly
5	Adaptive damping module
6	Left-hand front-spring and damper assembly
7	Front vertical accelerometer

# **Vehicle Dynamic Suspension - Vehicle Dynamic Suspension4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Overview**

Description and Operation

## **Adaptive Damping System**

The adaptive damping system, also known as Computer Active Technology Suspension (CATS), is an electronically controlled suspension system which constantly adjusts the damping characteristics of the suspension dampers in reaction to the existing driving conditions. The adaptive damping system is available on specified models.

The system is controlled by an adaptive damping module, located beneath the right-hand front seat; the module receives signals from two dedicated vertical accelerometers; one at the front of the vehicle and one at the rear.

In addition to these inputs, further signals from other vehicle electronic system components are monitored by the adaptive damping module to determine vehicle body motion and driver inputs. These combined signals are used by the adaptive damping module to control the damping characteristics of each damper and switch them to either 'soft' or 'firm' to give the optimum vehicle ride for the prevailing driving conditions.

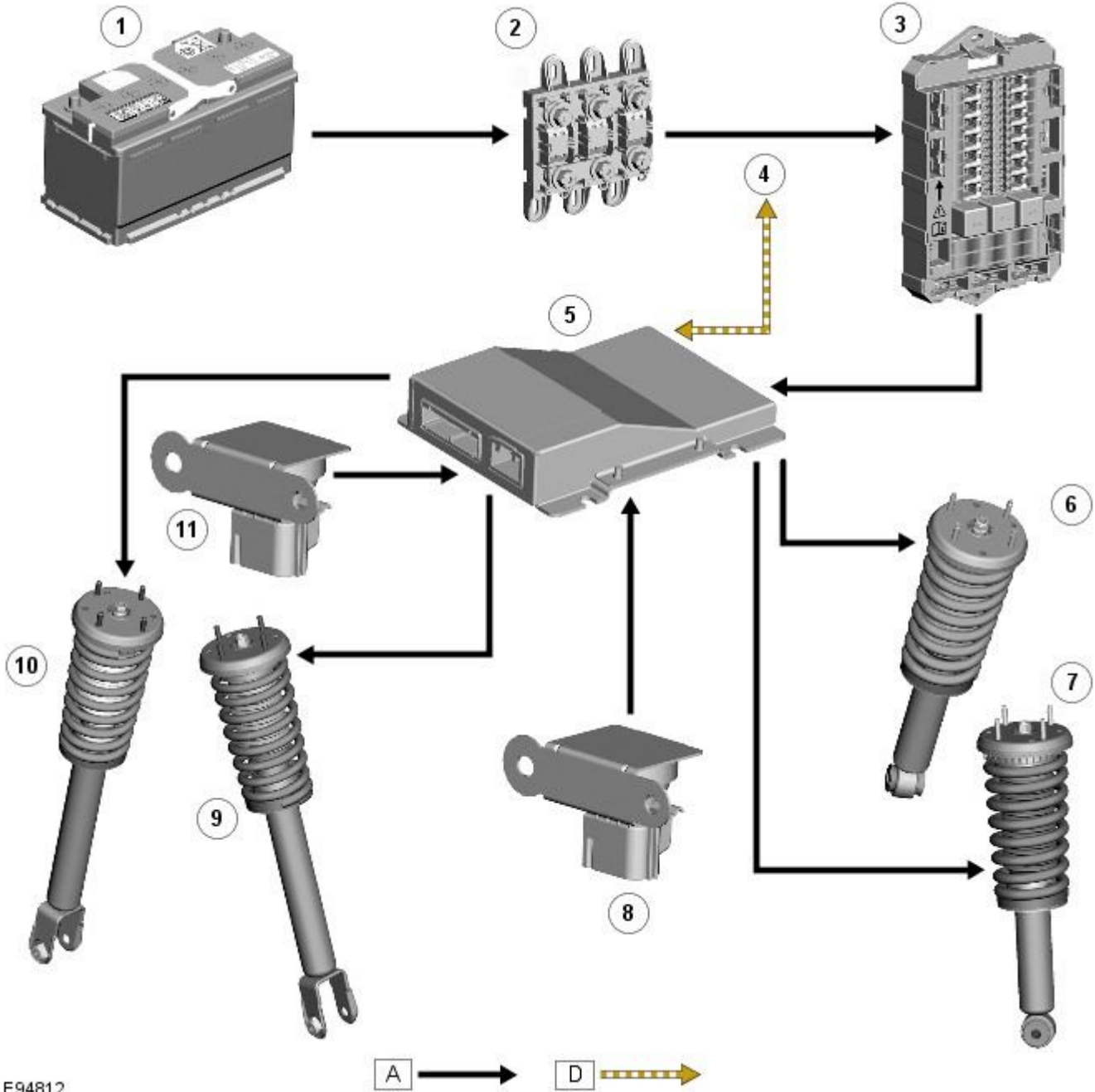
# Vehicle Dynamic Suspension - Vehicle Dynamic Suspension4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired **D** = High speed CAN bus

Adaptive Damping System



E94812

### ItemDescription

1	Battery
2	Megafuse (250 A)
3	CJB (central junction box)
4	High Speed CAN (controller area network) connection to other vehicle systems
5	Adaptive damping module
6	Right-hand rear active damper
7	Left-hand rear active damper
8	Rear vertical accelerometer
9	Left-hand front active damper
10	Right-hand front active damper



## System Operation

### Adaptive Damping System

The adaptive damping module uses a combination of information from other system modules and data from the accelerometer to measure the vehicle motion and driver inputs. Using this information, the module applies algorithms to control the dampers for the existing driving conditions.

The adaptive damping module receives signals on the high speed [CAN](#) bus from the following system components:

- Vehicle speed - [ABS \(anti-lock brake system\)](#) module
- Brake switch status - [ECM \(engine control module\)](#)
- Brake pressure - ABS module
- Gear position - [TCM \(transmission control module\)](#)
- Lateral acceleration - ABS module
- Throttle pedal position - ECM
- Power mode - [CJB](#) via the instrument cluster gateway
- Steering wheel angle - Steering angle sensor via ABS module
- Steering wheel speed - Steering angle sensor via ABS module
- Engine speed - ECM
- Engine running status - ECM
- Car Configuration File Data - auxiliary junction box via instrument cluster gateway
- Master configuration identification - auxiliary junction box via instrument cluster gateway
- Vehicle information parameters - auxiliary junction box via instrument cluster gateway.

The adaptive damping module also outputs information for use by other systems as follows:

- Computer Active Technology Suspension (CATS) fault - instrument cluster
- Front left damper status - ECM
- Front right damper status - ECM
- Rear left damper status - ECM
- Rear right damper status - ECM.

When the vehicle is stationary with the engine running, the dampers are set to the soft setting. With the vehicle in motion the adaptive damping module monitors the input signals and operates the damper solenoids appropriately. The input signals are compared against algorithms within the adaptive damping module and preset speed thresholds. The gear position signal is also used to determine longitudinal detection and, along with the speed signal, is compared against algorithms to select the appropriate 'soft' or 'firm' damper setting.

The adaptive damping module receives its power supply via a relay in the [CJB](#). The relay remains energized for a period of time after the ignition is off. This allows the adaptive damping module to record and store any fault codes relating to the adaptive damping system faults.

#### Adaptive Damping System Fault Message

The adaptive damping has a CAN connection to the instrument cluster. If a fault is detected by the adaptive damping module, a message is sent to the instrument cluster and a message 'CATS SYSTEM FAULT' is displayed.

When this message is displayed a fault has been detected and an appropriate [DTC \(diagnostic trouble code\)](#) will be logged in the module. The faults can be interrogated using the recommended Jaguar Diagnostic System.

When a fault is detected, the module stops outputs to the active dampers and the dampers operate continually on their default 'hard' setting until the fault is corrected.

## Component Description

### Adaptive Damping System

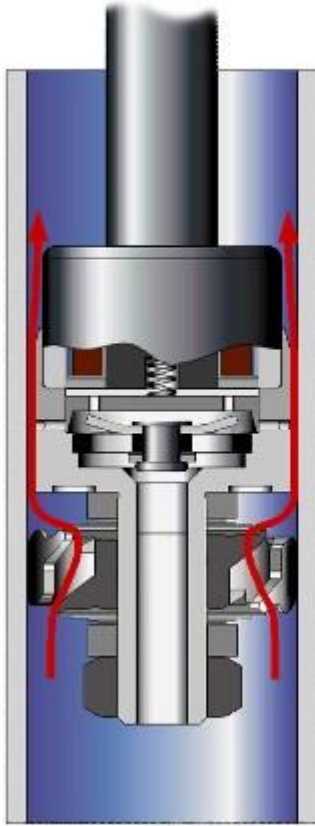
#### Dampers

The adaptive dampers are nitrogen-gas and oil-filled monotube units. The dampers have a two-stage adjustment which allows the damping force to be electrically adjusted when the vehicle is being driven. The two-stage dampers provide the optimum compromise between performance handling and ride comfort.

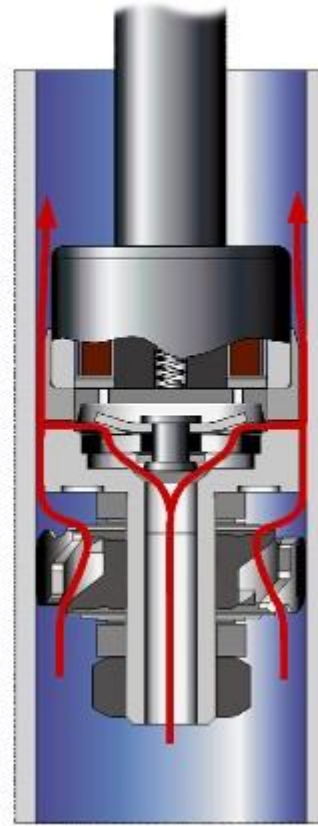
The adaptive dampers can be easily identified by an electrical connector on the end of the piston rod, in the center of the top mount.

The two-stage adjustment is achieved by a solenoid controlled valve. When the solenoid valve is de-energized, the damper is on its firm setting and oil flow is restricted to a controlled rate through orifices in the damper piston. The restricted oil flow stiffens the damper action improving the handling when braking, accelerating and cornering.

A



B



E72756

#### ItemDescription

A Firm setting

B Soft setting

The solenoid is connected to a by-pass valve which allows additional oil flow through the damper. When the solenoid is energized, the valve is lifted from its seat, allowing oil to flow through a hollow piston rod in the center of the damper piston and out through additional orifices. The increased oil flow softens the damper action providing a more comfortable ride quality.

The solenoid is operated by a 400 Hz [PWM \(pulse width modulation\)](#) signal from the adaptive damping module. When energized, the module applies a 1.3 ampere push current for 75 milliseconds to move the valve and then applies a 0.5 ampere hold current to operate the damper in the 'soft' setting.

#### Vertical Accelerometer

Two accelerometers are used by the adaptive damping system:

- a front accelerometer attached to the bracket of the right-hand engine oil cooler,
- a rear accelerometer mounted in the luggage compartment, in the rear left-hand corner next to the rear lamp assembly.

The accelerometers measure acceleration in the vertical plane and output a corresponding analogue signal to the adaptive damping module. Each accelerometer is connected to the adaptive damping module via three wires which supply: ground, 5 volt supply and signal return.

The accelerometers are of the capacitive type. The sensing element comprises two parallel plate capacitors. The capacitors alter the peak voltage which is generated by an internal oscillator when the accelerometer is subjected to acceleration. Detection circuits within the accelerometer measure the peak voltage and pass an analogue output signal to the adaptive damping module. The accelerometers output a signal voltage of approximately  $1 \text{ V/g} \pm 0.05 \text{ V/g}$ .

# Vehicle Dynamic Suspension - Vehicle Dynamic Suspension

Diagnosis and Testing

## Principle of Operation

For a detailed description of the adaptive damping system operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: (204-05 Vehicle Dynamic Suspension)

[Vehicle Dynamic Suspension - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (Description and Operation),  
[Vehicle Dynamic Suspension - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (Description and Operation),  
[Vehicle Dynamic Suspension - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (Description and Operation).

## Inspection and Verification

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Coil spring(s)</li> <li>● Shock absorber(s)</li> <li>● Accelerometer(s) installation</li> <li>● Height sensor(s) installation</li> </ul>	<ul style="list-style-type: none"> <li>● Fuse(s)</li> <li>● Wiring harness/electrical connectors</li> <li>● Accelerometer(s)</li> <li>● Adaptive Damping Control Module</li> <li>● Height sensor(s)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check the system for any logged Diagnostic Trouble Codes (DTCs) and refer to the DTC index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

- NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
- NOTE: Generic scan tools may not read the codes listed, or may read only five-digit codes. Match the five-digits from the scan tool to the first five-digits of the seven-digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).
- NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.
- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.
- NOTE: If DTCs are logged and, after carrying out the pinpoint tests, a fault is not identified, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
C101D-12	Left Front vertical acceleration sensor - short to power	<ul style="list-style-type: none"> <li>● Left Front vertical acceleration sensor circuit short to power</li> </ul>	Refer to the electrical circuit diagrams and check left front vertical acceleration sensor circuit for short to power or another circuit. Repair circuit, clear the DTC and retest the system
C101D-14	Left Front vertical acceleration sensor - short to ground, open circuit	<ul style="list-style-type: none"> <li>● Left Front vertical acceleration sensor circuit short to ground, open circuit</li> <li>● Vertical acceleration sensor fault</li> </ul>	Refer to the electrical circuit diagrams and check front vertical acceleration sensor circuit for short to ground, open circuit. If no fault found on wiring suspect sensor. Replace sensor, clear DTC and retest the system
C101D-22	Left Front vertical acceleration sensor - signal amplitude > maximum	<ul style="list-style-type: none"> <li>● Left front vertical acceleration sensor insecurely mounted</li> <li>● Left front vertical acceleration sensor signal circuit short to another circuit</li> <li>● Left front vertical acceleration sensor internal fault</li> </ul>	With vehicle parked on a level surface, read Left Front Vertical Accelerometer voltage and check it lies in range 1.9 to 2.1 volts. If not OK then check electrical wiring for shorts, loose connections and repair as required. If wiring OK then suspect faulty sensor/incorrectly fitted sensor. Check the sensor is correctly mounted, secure or replace sensor as required. Refer to the new module/component installation note at the top of the DTC Index, clear DTC and retest system

DTC	Description	Possible Cause	Action
C101D-26	Left Front vertical acceleration sensor - signal rate of change below threshold	<ul style="list-style-type: none"> <li>Left front vertical acceleration sensor signal circuit short to another circuit</li> <li>Left front vertical acceleration sensor internal fault</li> </ul>	Refer to the electrical circuit diagrams and check Left Front Vertical Accelerometer signal circuit for faults, if circuit is correct suspect faulty sensor, refer to the new module/component installation note at the top of the DTC Index. Replace the sensor, clear the DTC and retest the system
C101D-78	Left Front vertical acceleration sensor - alignment or adjustment incorrect	<ul style="list-style-type: none"> <li>Left front vertical acceleration sensor bracket bent</li> <li>Left front vertical acceleration sensor damaged</li> </ul>	Check Left Front Vertical Accelerometer for location and security, if correct suspect faulty Accelerometer, refer to the new module installation note at the top of the DTC Index. Replace the sensor/bracket as required, clear the DTC and retest the system
C101E-12	Right Front vertical acceleration sensor - short to power	<ul style="list-style-type: none"> <li>Right Front vertical acceleration sensor circuit short to power</li> </ul>	Refer to the electrical circuit diagrams and check right front vertical acceleration sensor circuit for short to power or another circuit. Repair circuit, clear the DTC and retest the system
C101E-14	Right Front vertical acceleration sensor - short to ground, open circuit	<ul style="list-style-type: none"> <li>Right Front vertical acceleration sensor circuit short to ground, open circuit</li> <li>Vertical acceleration sensor fault</li> </ul>	Refer to the electrical circuit diagrams and check right front vertical acceleration sensor circuit for short to ground, open circuit. If no fault found on wiring suspect sensor. Replace sensor, clear DTC and retest the system
C101E-22	Right Front vertical acceleration sensor - signal amplitude > maximum	<ul style="list-style-type: none"> <li>Right front vertical acceleration sensor insecurely mounted</li> <li>Right front vertical acceleration sensor signal circuit short to another circuit</li> <li>Right front vertical acceleration sensor internal fault</li> </ul>	With vehicle parked on a level surface, read Right Front Vertical Accelerometer voltage and check it lies in range 1.9 to 2.1 volts. If not OK then check electrical wiring for shorts, loose connections and repair as required. If wiring OK then suspect faulty sensor/incorrectly fitted sensor. Check the sensor is correctly mounted, secure or replace sensor as required. Refer to the new module/component installation note at the top of the DTC Index, clear DTC and retest system
C101E-26	Right Front vertical acceleration sensor - signal rate of change below threshold	<ul style="list-style-type: none"> <li>Right front vertical acceleration sensor signal circuit short to another circuit</li> <li>Right front vertical acceleration sensor internal fault</li> </ul>	Refer to the electrical circuit diagrams and check Right Front Vertical Accelerometer signal circuit for faults, if circuit is correct suspect faulty sensor, refer to the new module/component installation note at the top of the DTC Index. Replace the sensor, clear the DTC and retest the system
C101E-78	Right Front vertical acceleration sensor - alignment or adjustment incorrect	<ul style="list-style-type: none"> <li>Right front vertical acceleration sensor bracket bent</li> <li>Right front vertical acceleration sensor damaged</li> </ul>	Check Right Front Vertical Accelerometer for location and security, if correct suspect faulty Accelerometer, refer to the new module installation note at the top of the DTC Index. Replace the sensor/bracket as required, clear the DTC and retest the system
C1024-00	System Temporarily Disabled Due To Power Interruption During Driving - no sub type information	<ul style="list-style-type: none"> <li>Loss of power to control module whilst driving</li> </ul>	Refer to the electrical circuit diagrams and check power and ground circuits to Adaptive Damping Control Module for intermittent or poor connection. Repair wiring circuits as required, clear DTC and retest the system
C1030-12	Left Rear vertical acceleration sensor - short to power	<ul style="list-style-type: none"> <li>Left Rear vertical acceleration sensor circuit short to power</li> </ul>	Refer to the electrical circuit diagrams and check left Rear vertical acceleration sensor circuit for short to power or another circuit. Repair circuit, clear the DTC and retest the system
C1030-14	Left Rear vertical acceleration sensor - short to ground, open circuit	<ul style="list-style-type: none"> <li>Left rear vertical acceleration sensor circuit short to ground, open circuit</li> <li>Vertical acceleration sensor fault</li> </ul>	Refer to the electrical circuit diagrams and check left Rear vertical acceleration sensor circuit for short to ground, open circuit. If no fault found on wiring suspect sensor. Replace sensor, clear DTC and retest the system
C1030-22	Left Rear vertical acceleration sensor - signal amplitude > maximum	<ul style="list-style-type: none"> <li>Left Rear vertical acceleration sensor insecurely mounted</li> <li>Left Rear vertical acceleration sensor signal circuit short to another circuit</li> <li>Left Rear vertical acceleration sensor internal fault</li> </ul>	With vehicle parked on a level surface, read Left Rear Vertical Accelerometer voltage and check it lies in range 1.9 to 2.1 volts. If not OK then check electrical wiring for shorts, loose connections and repair as required. If wiring OK then suspect faulty sensor/incorrectly fitted sensor. Check the sensor is correctly mounted, secure or replace sensor as required. Refer to the new module/component installation note at the top of the DTC Index, clear DTC and retest system

# Vehicle Dynamic Suspension - Adaptive Damping Module

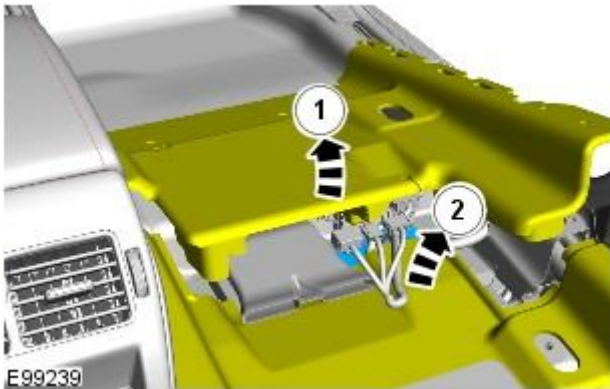
Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).
2. Refer to: [B-Pillar Lower Trim Panel](#) (501-05 Interior Trim and Ornementation, Removal and Installation).

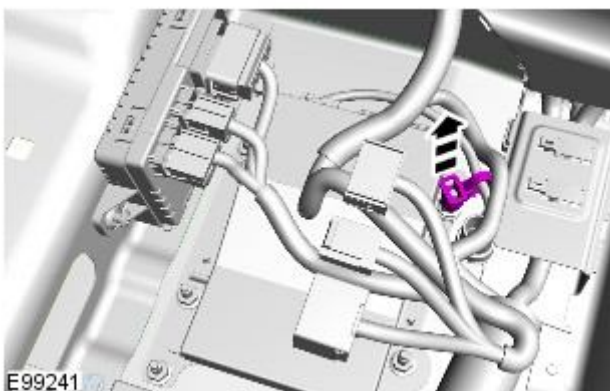
3. Detach and reposition the floor covering.

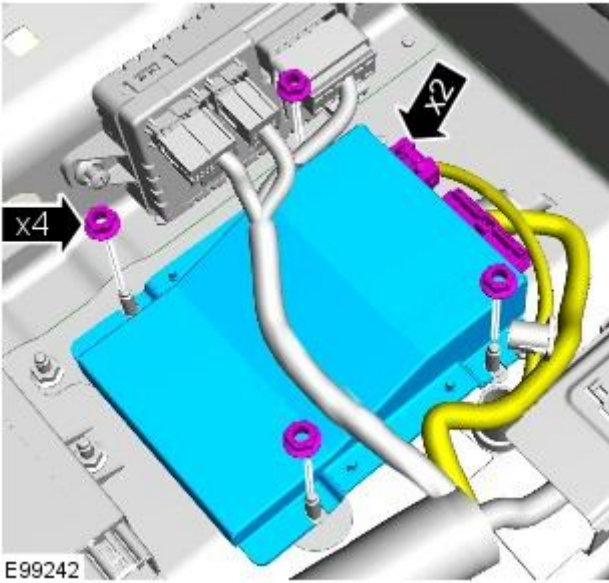


4.



5.





6.
  - Torque: 5 Nm

## Installation

1. To install, reverse the removal procedure.

# Vehicle Dynamic Suspension - Front Suspension Vertical Accelerometer

Removal and Installation

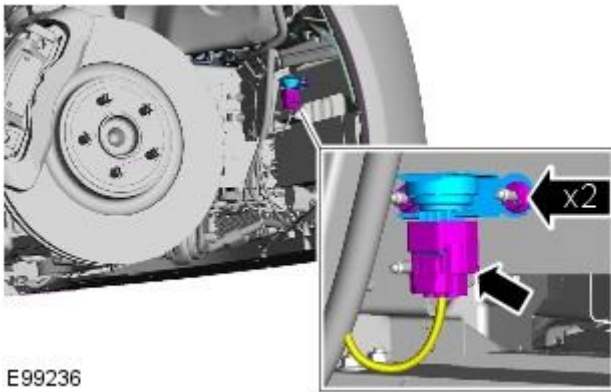
## Removal


- NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.


2. Refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).



3.  **CAUTION:** The accelerometer is an extremely delicate component and can easily be rendered unserviceable. Never use an accelerometer which has been dropped or subjected to mistreatment of any type.

- Torque: 5 Nm

## Installation

1.  **CAUTION:** The accelerometer is an extremely delicate component and can easily be rendered unserviceable. Never use an accelerometer which has been dropped or subjected to mistreatment of any type.

To install, reverse the removal procedure.

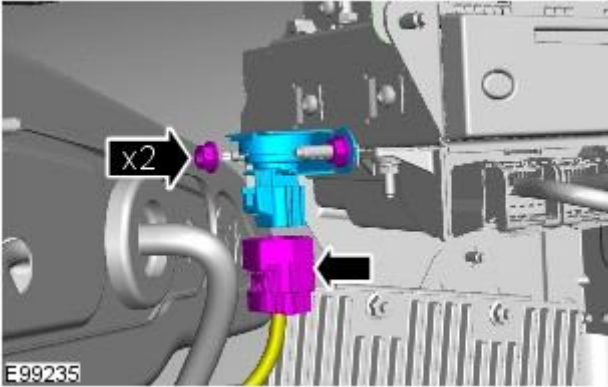
# Vehicle Dynamic Suspension - Rear Suspension Vertical Accelerometer


Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.


1. Refer to: [Loadspace Trim Panel LH](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).



2.  CAUTION: The accelerometer is an extremely delicate component and can easily be rendered unserviceable. Never use an accelerometer which has been dropped or subjected to mistreatment of any type.

- Torque: 5 Nm

## Installation

1.  CAUTION: The accelerometer is an extremely delicate component and can easily be rendered unserviceable. Never use an accelerometer which has been dropped or subjected to mistreatment of any type.

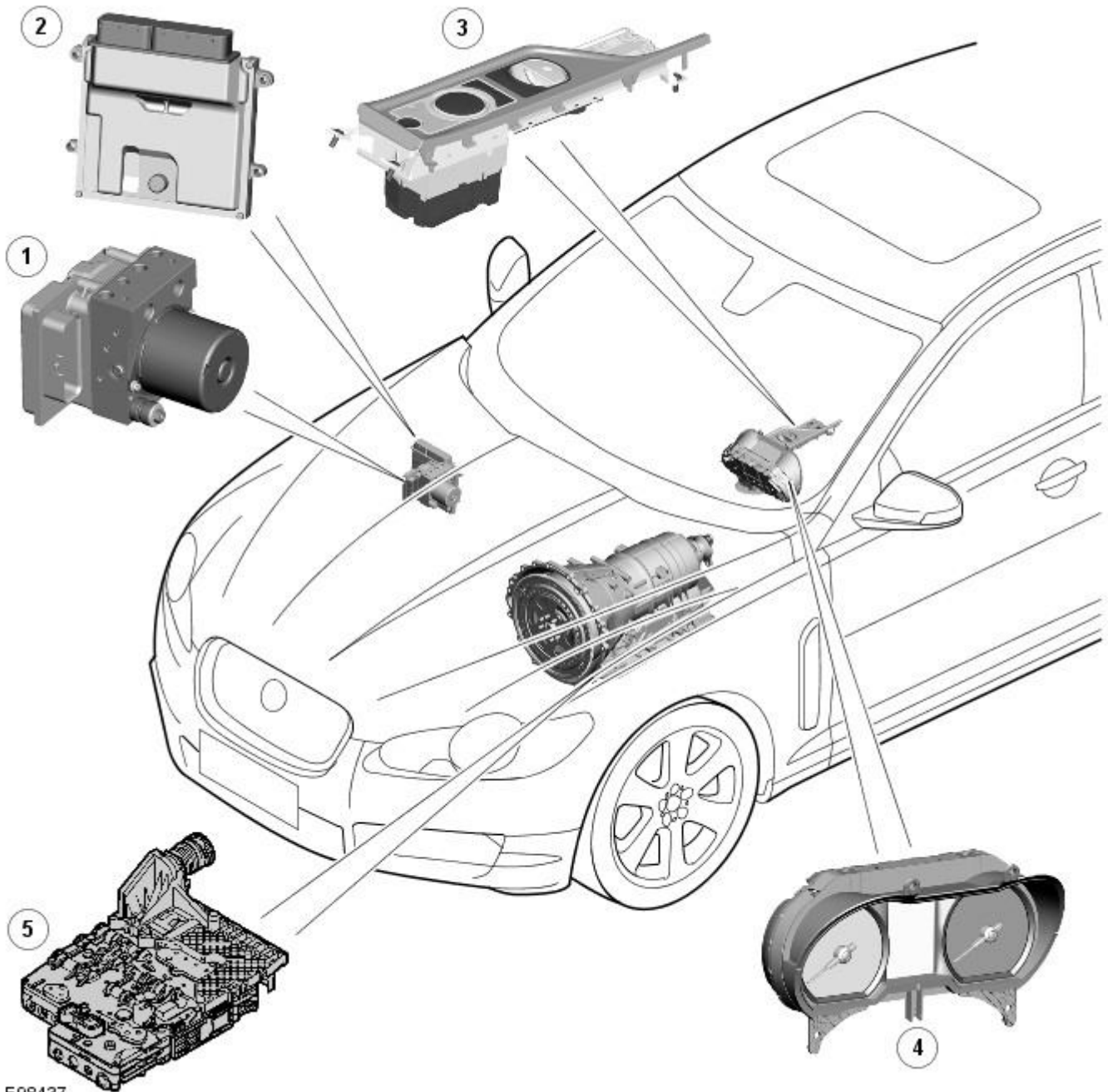
To install, reverse the removal procedure.



# Ride and Handling Optimization - Ride and Handling Optimization - Component Location

Description and Operation

## COMPONENT LOCATION



E98437

### ItemDescription

1	ABS (anti-lock brake system) module
2	ECM (engine control module)
3	JaguarDrive Control selection buttons
4	Instrument cluster
5	TCM (transmission control module)

# Ride and Handling Optimization - Ride and Handling Optimization -

## Overview

Description and Operation

### OVERVIEW

JaguarDrive Control is a selectable vehicle optimisation system, designed to fine-tune the driving characteristics of the vehicle by accommodating different driving conditions or driving styles. The system allows the performance envelope of the vehicle to be stretched and prevents the necessity for a single, compromised configuration for all conditions. JaguarDrive Control increases the vehicle's abilities by changing the characteristics of engine mapping, transmission shifts and stability and traction interventions. The software for the JaguarDrive control is incorporated in the JaguarDrive selector module.

- **NOTE:** The JaguarDrive Control system is a co-ordinating system only. It **CANNOT** generate a fault in one of the participating sub-systems. All participating subsystems should be **FULLY** diagnosed before assuming a fault with JaguarDrive Control. Replacing the JaguarDrive selector module should not be done until all other options have been exhausted.

# Ride and Handling Optimization - Ride and Handling Optimization - System Operation and Component Description

Description and Operation

## System Operation

### JAGUARDRIVE CONTROL OPERATION

#### Engine Management System

The Engine Management System (EMS) varies the accelerator pedal maps to change the amount of torque per percentage of pedal travel. The EMS can also change the accelerator pedal response to control the allowed torque change relative to the speed of pedal travel.

Each driving mode uses a combination of operating parameters for each sub-system. Changing between driving modes initiates a different set of operating characteristics, which will be noticeable to the driver. The driver will notice differences in engine response when, for example, the accelerator pedal is held in a constant position and the driving mode is changed from Winter to Dynamic, the driver will notice the torque and engine speed increase. Similarly, if the mode is changed from Normal or Dynamic to Winter the driver will notice a reduction in torque and engine speed.

• **NOTE:** The change in torque and engine speed can take approximately 30 seconds and care must be taken not to confuse the JaguarDrive Control system operation with an EMS fault.

#### Transmission Control

The TCM (transmission control module) changes the shift maps for the JaguarDrive Control mode selected. This changes the shift points providing early or late upshifts and downshifts. For example, on slippery surfaces in Winter mode the transmission will select 2nd gear for starting from a standstill on a flat surface to minimize wheel slip.

#### Anti-lock Braking System Control

The ABS (anti-lock brake system) module controls several vehicle functions and adjusts the operating parameters of these functions to optimize the selected JaguarDrive Control mode. Traction control uses different slip/acceleration thresholds to improve traction and vehicle composure. For example, the system sensitivity is increased on slippery surfaces to reduce wheel spin.

If TracDSC is selected or DSC is switched off, then subsequently the JaguarDrive Control mode is changed, DSC is automatically switched back on (or to TracDSC for Dynamic mode).

The stability control uses different threshold values for the selected mode, reducing the requirement for the driver to change the DSC system mode for optimum performance in various driving scenarios.

#### Incorrect Mode Usage

Selection of an inappropriate mode is discouraged in the following ways:

- The active mode icon is continually displayed in the instrument cluster message center
- In any special mode, when the ignition has been in the off position continuously for more than 6 hours, the JaguarDrive Control system defaults to the special modes off (DSC on).

Selection of an inappropriate mode for the conditions will not endanger the driver or immediately cause damage to the vehicle. Continued use of an inappropriate mode may reduce the life of some components. The driver may notice a different vehicle response, with the engine and transmission responses being different than in the special modes off.

#### Driver Information

The instrument cluster contains a message center, which displays vehicle information to the driver. The message center contains the JaguarDrive Control mode icons, which display the currently selected mode. If no symbol is displayed, no special mode is selected and the system is in special modes off.

Any required changes to the subsystems are also passed to the driver in the form of warning illumination in the instrument cluster or appropriate messages in the message center, DSC off for example.

In Dynamic mode when the transmission is in manual mode, the gear information is displayed in amber when the appropriate engine speed is reached for optimum sporty change point.

### DIAGNOSTICS

JaguarDrive Control relies on the correct functionality of the sub-systems. If one of the sub-systems develops a fault, the JaguarDrive Control system will not function, even though the fault is not in the JaguarDrive Control system.

The JaguarDrive Selector module and rotary control should only be investigated if there are no apparent faults in any of the sub-systems. If a fault in a sub-system is subsequently corrected, the JaguarDrive Control system will function normally after an ignition on and off cycle.

#### JaguarDrive Control Sub-System Faults

If a fault occurs in a sub-system, the driver is alerted by the illumination of a warning indicator and/or an appropriate message for that sub-system in the instrument cluster message center. No JaguarDrive Control message will be shown when a failed sub-system displays its own message.

When a sub-system fault is present and the driver attempts to select a different JaguarDrive Control mode or at the next ignition on cycle, a message 'WINTER MODE FAULT' or 'DYNAMIC MODE FAULT' will appear in the message center. This

generally implies that the JaguarDrive Control system has a fault, but only because a sub-system fault is preventing its operation. This message will be displayed once per ignition cycle, but is repeated if a further selection is made by the driver using the JaguarDrive Control buttons or at the next ignition on cycle.

• **NOTE:** The message 'WINTER MODE FAULT' or 'DYNAMIC MODE FAULT' can also in very rare circumstances be generated by a fault in the JaguarDrive Control module.

It is not possible for the JaguarDrive Control module to cause any fault behavior (warning indicator illumination or message generation) in any of the sub-systems. Illumination of a sub-system warning indicator and/or a sub-system related message will never be associated with a JaguarDrive Control module or JaguarDrive Control system fault.

The sub-system control modules can detect a fault with the [CAN \(controller area network\)](#) bus signal from the transmission selector module. If a fault in the JaguarDrive Control system is detected, the sub-system control modules will operate in the 'special modes off' setting. The sub-system control modules will record a fault code for a failure of the JaguarDrive Control [CAN](#) signal. These faults can be retrieved using the Jaguar approved diagnostic tool and will provide useful information to indicate investigation of the JaguarDrive Selector module or the [CAN](#) bus network.

#### JaguarDrive Control System or Control Module Fault

If a fault occurs in the JaguarDrive Control system, all button icon [LED \(light emitting diode\)](#)'s will be turned off (background illumination will remain on) and pressing of the JaguarDrive Control buttons is ignored. The instrument cluster message center will display a message 'WINTER MODE FAULT' or 'DYNAMIC MODE FAULT' when the fault occurs, if the fault is present and the driver attempts to select a special mode (if the control module is able to do this) or at the next ignition on cycle.

The JaguarDrive Control buttons and control module (JaguarDrive Selector module) are an integral unit. If a fault occurs in either component, the whole unit will require replacement, however, this is extremely unlikely.

#### CAN Bus Faults

If a [CAN](#) bus fault exists and prevents JaguarDrive Control system operation, all of the JaguarDrive Control button icon [LED](#)'s will be illuminated and rotation pressing of the JaguarDrive Control buttons is ignored.

If the instrument cluster does not receive a JaguarDrive Control system [CAN](#) bus message from the JaguarDrive Control module, the message 'SPECIAL MODE UNAVAILABLE' will be displayed when the fault occurs and will be repeated at every ignition on cycle.

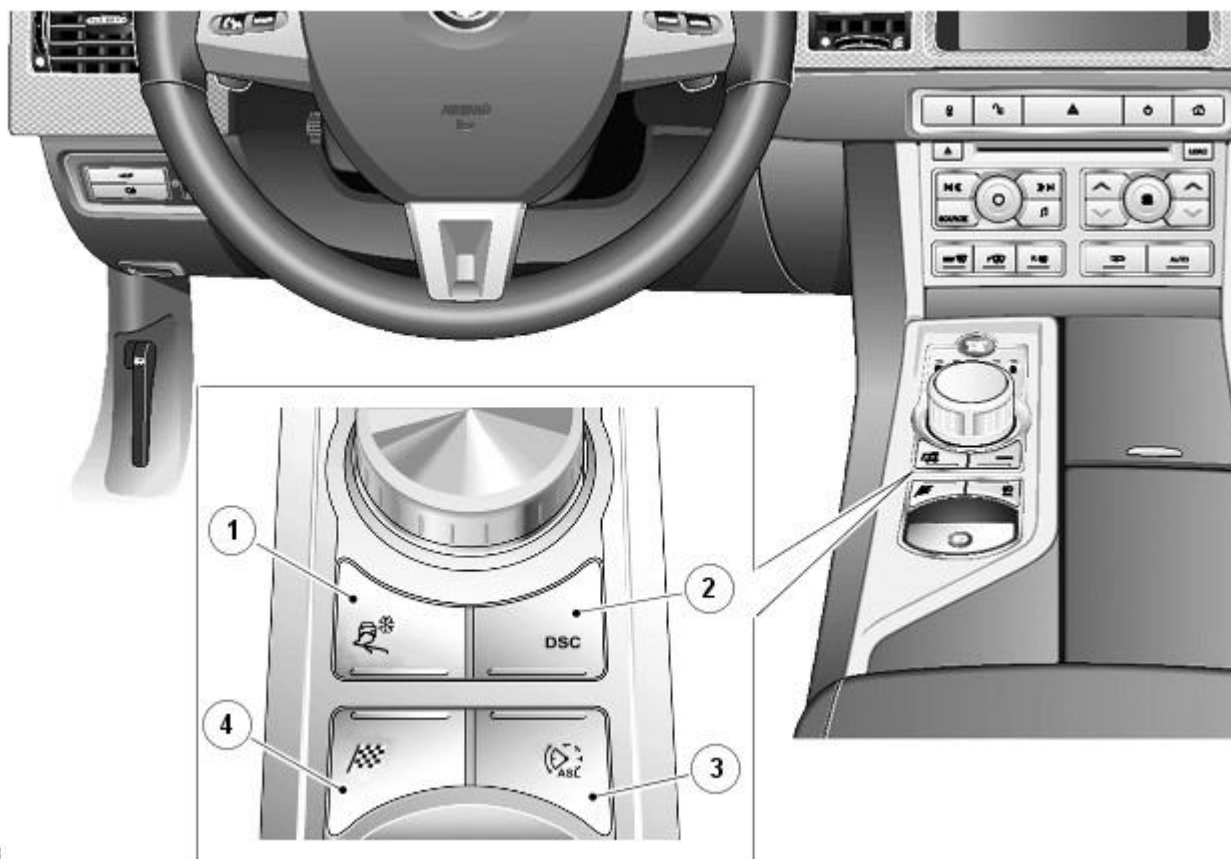
#### User Error

A special mode change while DSC or [ABS](#) is active (this includes [ABS](#) cycling) may be misinterpreted as a system fault.

### Component Description

#### JAGUARDRIVE CONTROL DESCRIPTION

##### JAGUARDRIVE CONTROLS



E98438

#### ItemDescription

1	Winter mode button
2	DSC/TracDSC mode button
3	ASL (automatic speed limiter) - Reference only, not part of JaguarDrive system
4	Dynamic mode (Supercharged models only)

The system is controlled by buttons adjacent to the JaguarDrive Selector located on the floor console. The buttons allow the selection of one of the following 3 modes:

- Special modes off
- Winter mode
- Dynamic mode (Supercharged models only).

The instrument cluster will display the selected JaguarDrive Control mode in the message center.

The JaguarDrive Control system uses a combination of a number of vehicle sub-systems to achieve the required vehicle characteristics for the mode selected. The following sub-systems make up the JaguarDrive Control system:

- The Engine Management System (EMS)
- Automatic transmission
- Brake system.

The JaguarDrive Control software is stored in the JaguarDrive Selector module located below the JaguarDrive selector. The module detects the selection made using the buttons and transmits a signal on the high speed [CAN](#) bus, which is received by each of the sub-system control modules.

Each of the affected sub-system control modules contain software, which applies the correct operating parameters to their controlled system for the JaguarDrive Control mode selection made.

Each sub-system control module also provides a feedback for the selected mode so that the JaguarDrive Control software can check that all systems have changed to the correct operating parameters.

• **NOTE:** The JaguarDrive Control system is a co-ordinating system only. It CANNOT generate a fault in one of the participating sub-systems. All participating sub-systems should be FULLY diagnosed before assuming a fault with JaguarDrive Control. Replacing the JaguarDrive Selector module should not be done until all other options have been exhausted.

#### Winter Mode



To activate winter mode, press the winter mode button briefly (not less than 300 ms) to activate or de-activate the mode.

• **NOTE:** Winter mode cannot be active at the same time as dynamic mode (Supercharged models only).

When active the winter mode icon and message appear in the instrument cluster message center to confirm the activation.

#### Dynamic Stability Control (DSC)



Press the DSC mode button briefly (not less than 300 ms) to switch between DSC and TracDSC. The instrument cluster message center will display either 'DSC ON' or 'TRAC DSC' depending on which selection is made. When TracDSC is selected, the DSC warning lamp in the instrument cluster is illuminated and the DSC button is illuminated.

DSC can be manually switched off by pressing the DSC mode button for more than 10 seconds. Confirmation is given by a chime from the instrument cluster, 'DSC OFF' is displayed in the instrument cluster message center and the DSC warning lamp in the instrument cluster is illuminated.

• **NOTE:** DSC is operational at all times when the engine is running unless manually switched off.

#### Dynamic Mode (Supercharged models only)



To activate Dynamic mode, press the button briefly. The dynamic mode and DSC buttons are illuminated. 'Dynamic Mode Confirmed' message is displayed in the instrument cluster message center and the DSC off warning lamp in the instrument cluster is illuminated (due to automatic selection of TracDSC in Dynamic mode).

• **NOTE:** Dynamic mode cannot be active at the same time as winter mode.

Once activated, TracDSC is automatically selected. In gearbox Sport mode, the driver has full control over the transmission shift points and the [TCM](#) will not intervene to prevent engine overspeed (for example; upshifts are inhibited in gearbox sport mode when Dynamic mode is selected). In this setting, the gear indicator in the instrument cluster will turn amber at high rev's to indicate an appropriate manual upshift point.

# Driveline System - General Information - Driveline System

Diagnosis and Testing

## Principle of Operation

For a detailed description of driveline operation, refer to the relevant Description and Operation section in the workshop manual. REFER to:

[Driveshaft](#) (205-01 Driveshaft, Description and Operation),  
[Driveshaft](#) (205-01 Driveshaft, Description and Operation),  
[Driveshaft](#) (205-01 Driveshaft, Description and Operation),  
[Rear Drive Axle and Differential - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (205-02 Rear Drive Axle/Differential, Description and Operation),  
[Rear Drive Axle and Differential - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (205-02 Rear Drive Axle/Differential, Description and Operation),  
[Rear Drive Axle and Differential - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (205-02 Rear Drive Axle/Differential, Description and Operation),  
[Rear Drive Halfshafts](#) (205-05 Rear Drive Halfshafts, Description and Operation),  
[Rear Drive Halfshafts](#) (205-05 Rear Drive Halfshafts, Description and Operation),  
[Rear Drive Halfshafts](#) (205-05 Rear Drive Halfshafts, Description and Operation).

## Inspection and Verification



**CAUTION:** Only serviceable items can be renewed or adjusted. Failure to follow this instruction may result in the warranty of the component being rejected.

Certain driveline trouble symptoms are also common to the engine, transmission, wheel bearings, tires, and other parts of the vehicle. For this reason, make sure that the cause of the trouble is in the driveline before adjusting, repairing, or installing any new components. For additional information, refer to Workshop Manual section 100-04 Noise, Vibration and Harshness.

1. 1. Verify the customer concern by carrying out a road test of the vehicle.
2. 2. Visually inspect for obvious signs of mechanical damage and system integrity.
3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

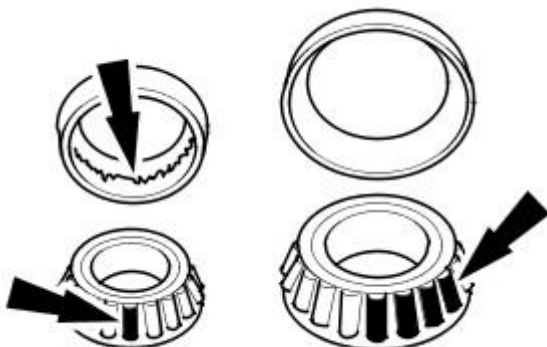
## Identify the Condition

### Gear Howl and Whine

Howling or whining of the ring gear and pinion is due to an incorrect gear pattern, gear damage or incorrect bearing preload.

### Bearing Whine

Bearing whine is a high-pitched sound similar to a whistle. It is usually caused by worn/damaged pinion bearings, which are operating at driveshaft speed. Bearing noise occurs at all driving speeds. This distinguishes it from gear whine which is speed dependent.



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As noted, pinion bearings make a high-pitched, whistling noise, usually at all speeds. If however there is only one pinion bearing that is worn/damaged, the noise may vary in different driving phases.

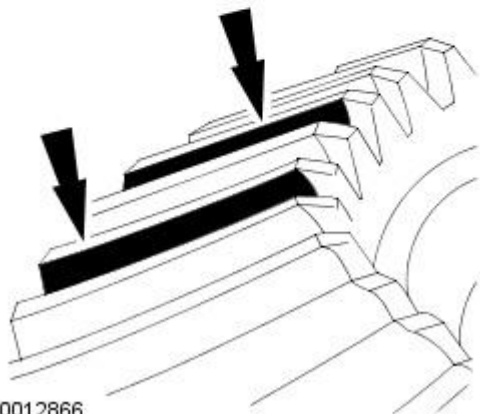
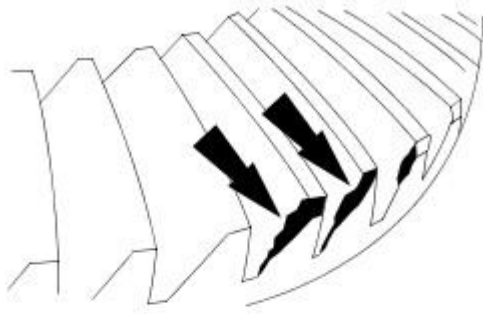
A wheel bearing noise can be mistaken for a pinion bearing noise.

### Chuckle

Chuckle that occurs on the coast driving phase is usually caused by excessive clearance between the differential gear hub and the differential case bore.



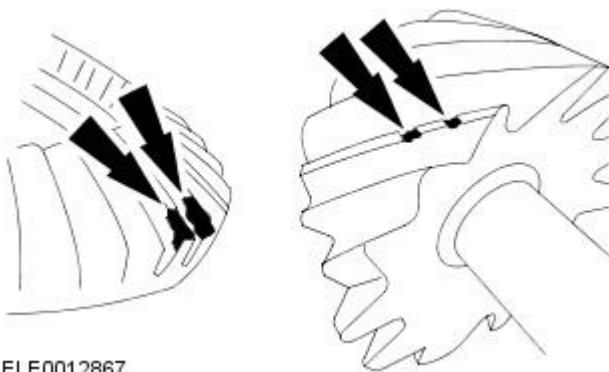
Damage to a gear tooth on the coast side can cause a noise identical to a chuckle. A very small tooth nick or ridge on the edge of a tooth can cause the noise.



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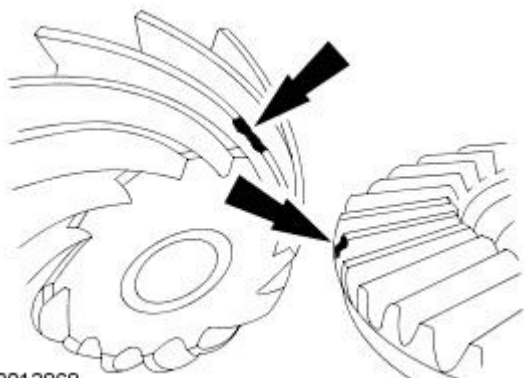
### Knock

Knock, which can occur on all driving phases, has several causes including damaged teeth or gearset.



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A gear tooth damaged on the drive side is a common cause of the knock.



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### Clunk

Clunk is a metallic noise heard when the automatic transmission is engaged in REVERSE or DRIVE. The noise may also

occur when the throttle is applied or released. Clunk is caused by transmission calibration, backlash in the driveline or loose suspension components and is felt or heard in the vicinity of the rear drive axle.

## Bearing Rumble

Bearing rumble sounds like marbles being tumbled. This condition is usually caused by a worn/damaged wheel bearing. The lower pitch is because the wheel bearing turns at only about one-third of the driveshaft speed. Wheel bearing noise also may be high-pitched, similar to gear noise, but will be evident in all four driving modes.

## Symptom Chart

Symptom	Possible Cause	Action
Noise is at constant tone over a narrow vehicle speed range. Usually heard on light drive and coast conditions	<ul style="list-style-type: none"> <li>Rear drive axle</li> </ul>	<ul style="list-style-type: none"> <li>For additional information, GO to Pinpoint Test <a href="#">A</a>.</li> </ul>
Noise is the same on drive or coast	<ul style="list-style-type: none"> <li>Road</li> <li>Worn or damaged driveshaft joint</li> <li>Driveshaft center bearing</li> <li>Wheel bearing</li> </ul>	<ul style="list-style-type: none"> <li>No action required for road noise</li> <li>Install new components as required</li> </ul>
Noise is produced with the vehicle standing and driving	<ul style="list-style-type: none"> <li>Engine</li> <li>Transmission</li> </ul>	<ul style="list-style-type: none"> <li>For additional information, REFER to: <a href="#">Engine - 3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8</a> (303-00 Engine System - General Information, Diagnosis and Testing), <a href="#">Engine - 2.7L Diesel</a> (303-00, Diagnosis and Testing), <a href="#">Diagnostic Strategy</a> (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> </ul>
Loud clunk in the driveline when shifting from reverse to forward	<ul style="list-style-type: none"> <li>Transmission calibration</li> <li>Transmission Mount</li> <li>Transmission</li> <li>Suspension components</li> <li>Backlash in the driveline</li> <li>Engine idle speed set too high</li> <li>Engine mount</li> </ul>	<ul style="list-style-type: none"> <li>Using the Manufacturer approved diagnostic system, re-configure the Transmission Control Module (TCM) with the latest available calibration</li> <li>Inspect and install new transmission mounts as required</li> <li>For additional transmission information, REFER to: <a href="#">Diagnostic Strategy</a> (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>Inspect and install new suspension components as required</li> <li>Inspect and install new driveline components as required</li> <li>Check and adjust the idle speed as required</li> <li>Inspect and install new engine mounts as required</li> </ul>
Clicking, popping, or grinding noises	<ul style="list-style-type: none"> <li>Inadequate or contaminated lubrication in the rear drive halfshaft constant velocity (CV) joint</li> <li>Another component contacting the rear drive halfshaft</li> <li>Wheel bearings, brakes or suspension components</li> </ul>	<ul style="list-style-type: none"> <li>Inspect, clean and lubricate with new grease as required</li> <li>Inspect and repair as required</li> <li>Inspect and install new components as required</li> </ul>
Vibration at highway speeds	<ul style="list-style-type: none"> <li>Out-of-balance wheel(s) or tire(s)</li> <li>Driveline out of balance/misalignment</li> <li>Driveshaft center bearing touching body mounting point</li> </ul>	<ul style="list-style-type: none"> <li>Balance and install new wheel(s) and tire(s) as required REFER to: <a href="#">Wheel and Tire</a> (204-04 Wheels and Tires, Removal and Installation).</li> <li>For additional information, REFER to: <a href="#">Driveline Angle Inspection</a> (205-00 Driveline System - General Information, General Procedures). Refer to the Manufacturer approved diagnostic system for driveshaft balancing application</li> <li>Check for correct spacer washer thickness. Inspect and install new washers as required</li> </ul>
Shudder, Vibration During Pinpoint Tests	<ul style="list-style-type: none"> <li>Powertrain/driveline misalignment</li> <li>High constant velocity (CV) joint operating angles caused by incorrect ride height</li> </ul>	<ul style="list-style-type: none"> <li>Check for misalignment. Install new components as required. For driveshaft alignment, REFER to: <a href="#">Driveline Angle Inspection</a> (205-00 Driveline System - General Information, General Procedures).</li> <li>Check the ride height and verify the correct spring rate. Install new components as required</li> </ul>
<b>PINPOINT TEST A : EXCESSIVE DRIVELINE NOISE</b>		
<b>TEST CONDITIONS</b>	<b>DETAILS/RESULTS/ACTIONS</b>	<b>ACTIONS</b>



**A1: CHECK NOISE FROM VEHICLE ON ROAD TEST**


	<b>1</b>	Road test vehicle to determine load and speed conditions when noise occurs.
	<b>2</b>	Assess the noise with different gears selected.
		Does the noise occur in different gears at the same vehicle speed?
		<b>Yes</b> Install a new rear drive axle/differential assembly. REFER to: <a href="#">Axle Assembly - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Vehicles Without: Differential Drain Plug</a> (205-02 Rear Drive Axle/Differential, Removal and Installation). Re-test the system for normal operation.
		<b>No</b> Suspect the engine or transmission. For additional information, REFER to: <a href="#">Engine - 3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8</a> (303-00 Engine System - General Information, Diagnosis and Testing), <a href="#">Engine - 2.7L Diesel</a> (303-00, Diagnosis and Testing), <a href="#">Diagnostic Strategy</a> (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).

# Driveline System - General Information - Driveline Angle Inspection

General Procedures

Special Tool(s)	
 <p>205-535</p> <p>E98972</p>	<p>Alignment Tool</p> <p>205-535</p>

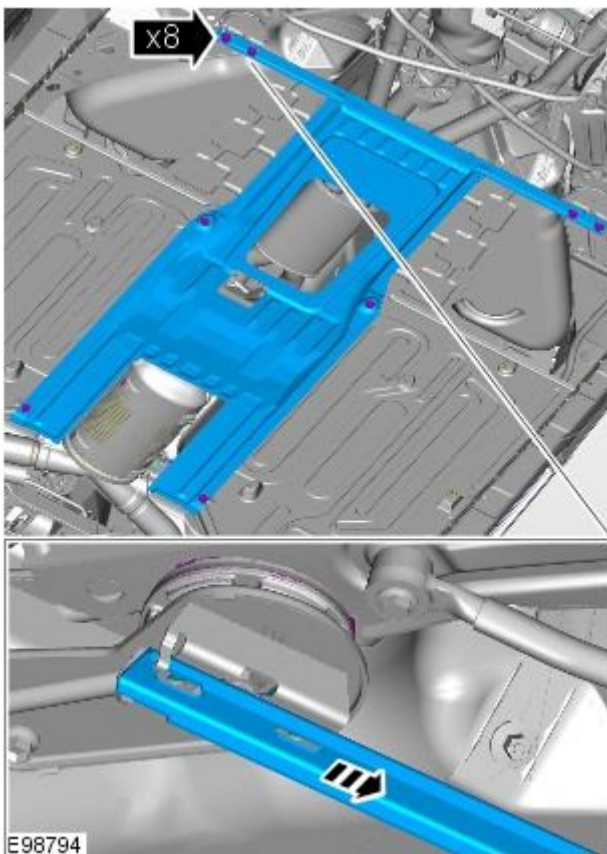
All vehicles

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

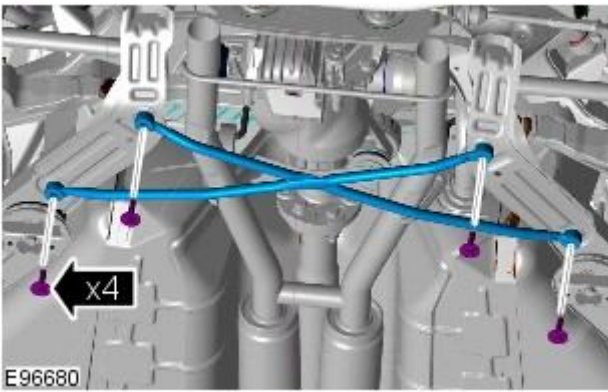
Raise and support the vehicle.

All vehicles

- Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).
- Remove the engine rear undershield.

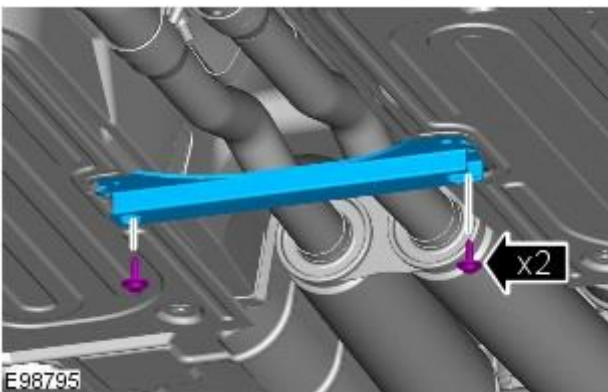


4. Remove the rear subframe crossbrace.

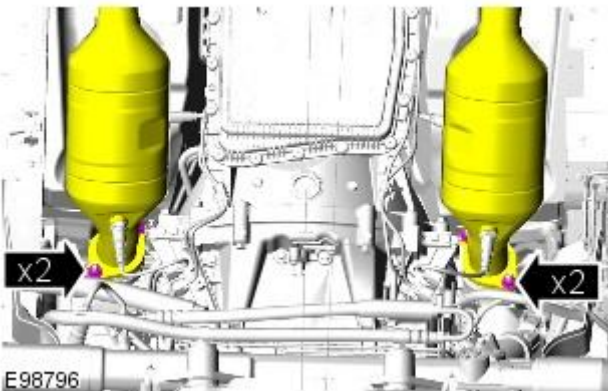


All except vehicles with diesel engine

5. Remove the support bracket.



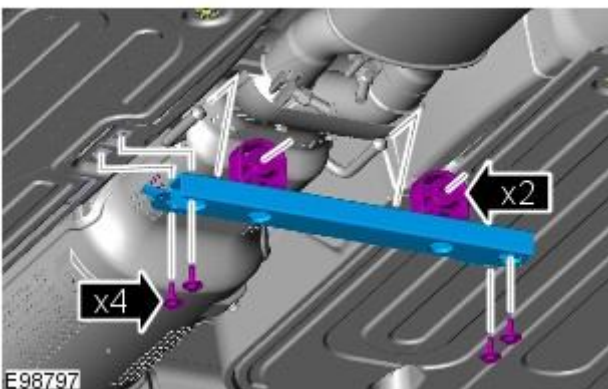
6. Loosen the retaining nuts.



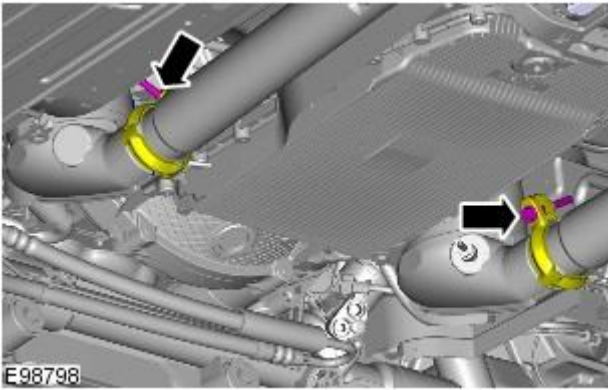
Vehicles with diesel engine

7. Remove the support bracket.

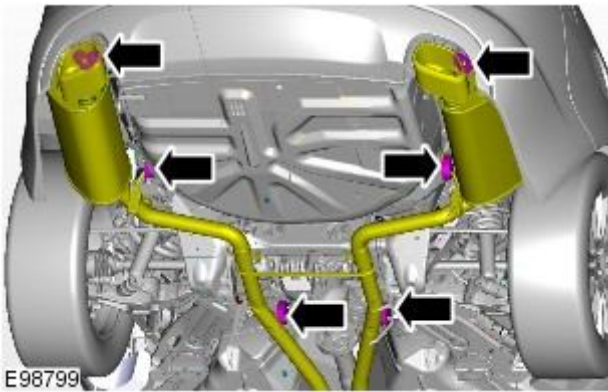
- Remove the bolts.
- Detach the intermediate muffler exhaust hanger insulators.




8. Loosen the catalytic converter to diesel particulate filter (DPF) retaining clamps.



All vehicles

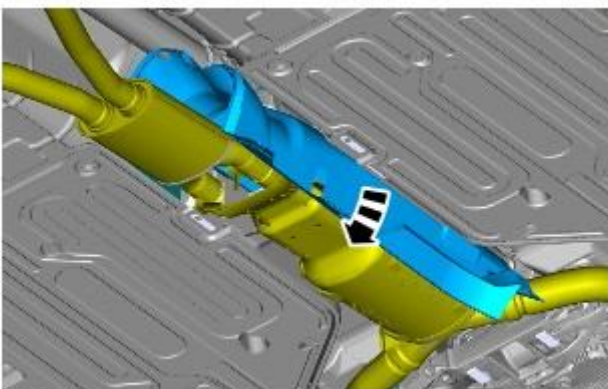
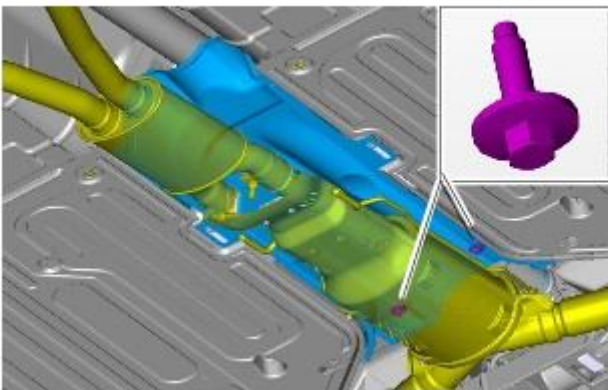


9.  CAUTION: Make sure that the exhaust system is supported with a suitable transmission stand.

Lower the exhaust assembly sufficiently to gain access to the driveshaft heat shield.

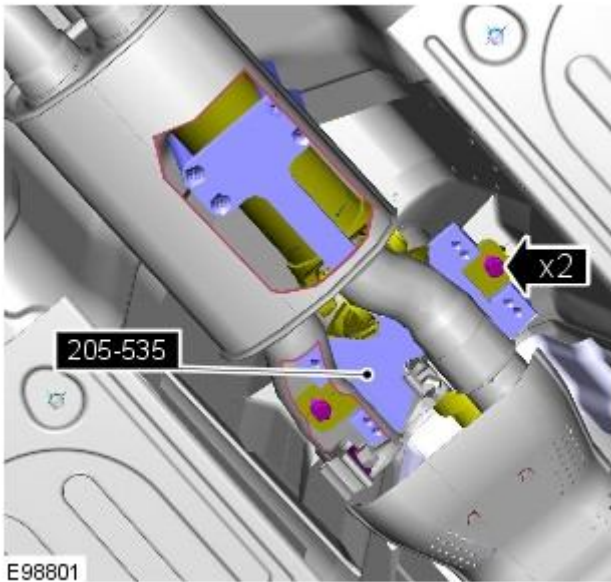
- Release the 6 exhaust hangers.


10. Remove the driveshaft heat shield.



All vehicles





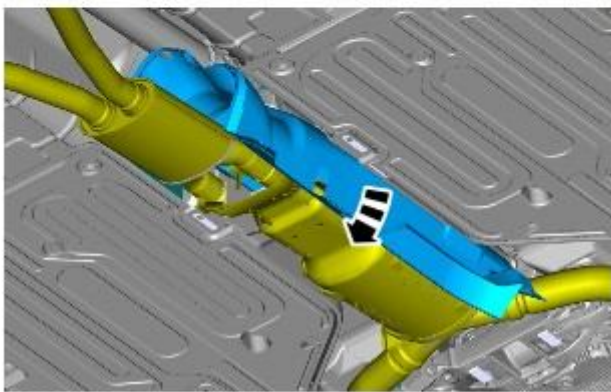
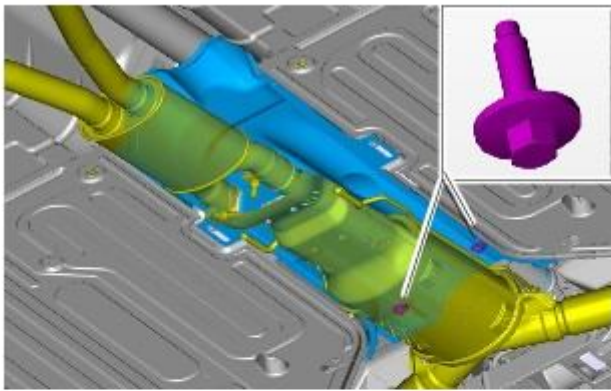
11.  CAUTION: Make sure that the special tool is correctly located.

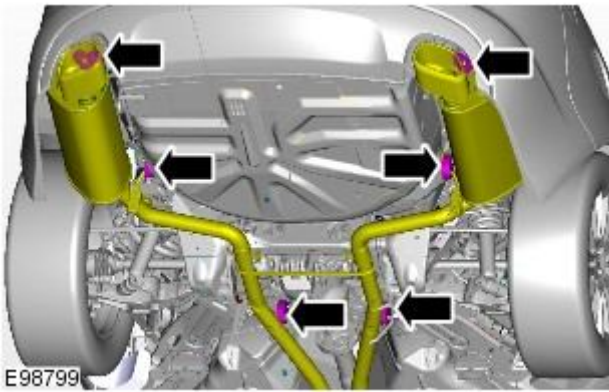
Using the special tool, align the driveshaft center bearing.


- Tighten to 40 Nm.

12. Install the driveshaft heat shield.

- Tighten to 10 Nm.





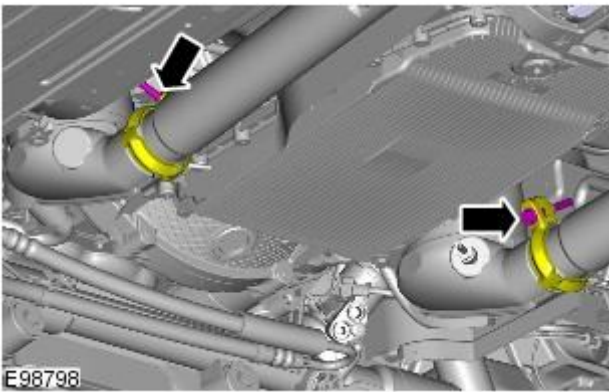
13.  CAUTION: Make sure that the exhaust system is supported with a suitable transmission stand.

Attach the exhaust hangers.

Vehicles with diesel engine

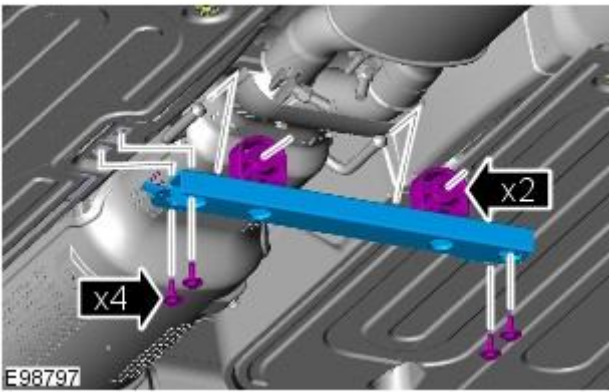
14. Tighten the catalytic converter to DPF retaining clamps.

- Tighten to 11 Nm.



15. Install the support bracket.

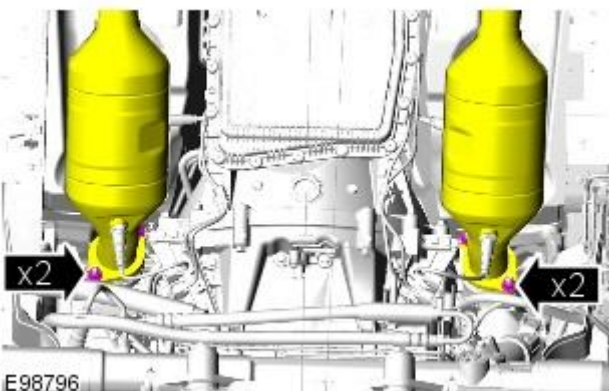
- Attach the intermediate muffler exhaust hanger insulators.
- Tighten to 10 Nm.



All except vehicles with diesel engine

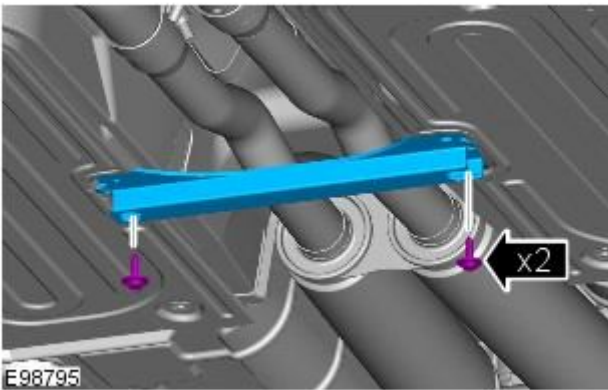
16. Tighten the retaining nuts.

- Tighten to 45 Nm.



17. Install the support bracket.

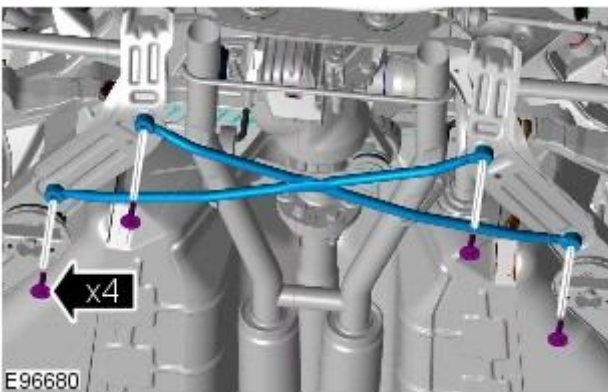
- Tighten to 10 Nm.



All vehicles

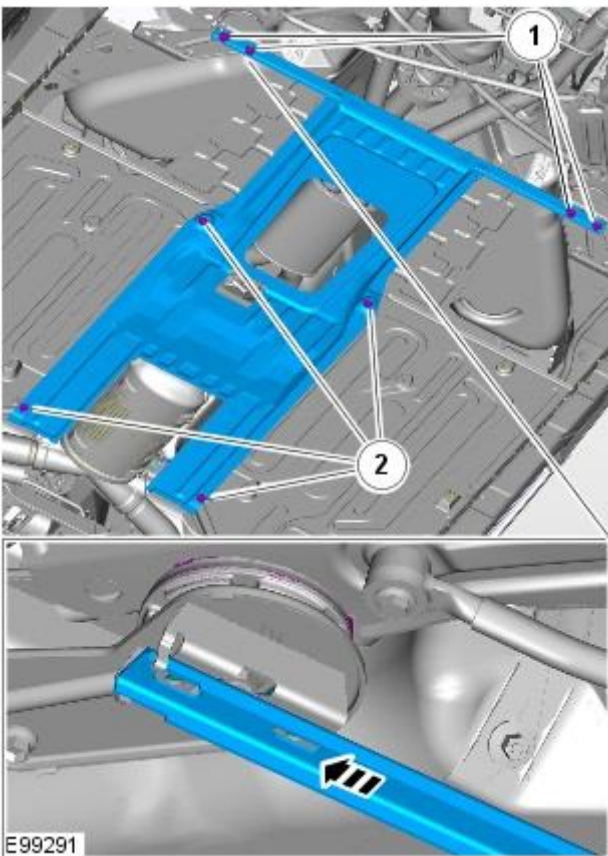
18. Install the rear subframe cross brace.

- Tighten to 62 Nm.



19. Install the engine rear undershield.

1. Tighten to 30 Nm.
2. Tighten to 10 Nm.



20. Install the air deflector.

For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

## Driveshaft -

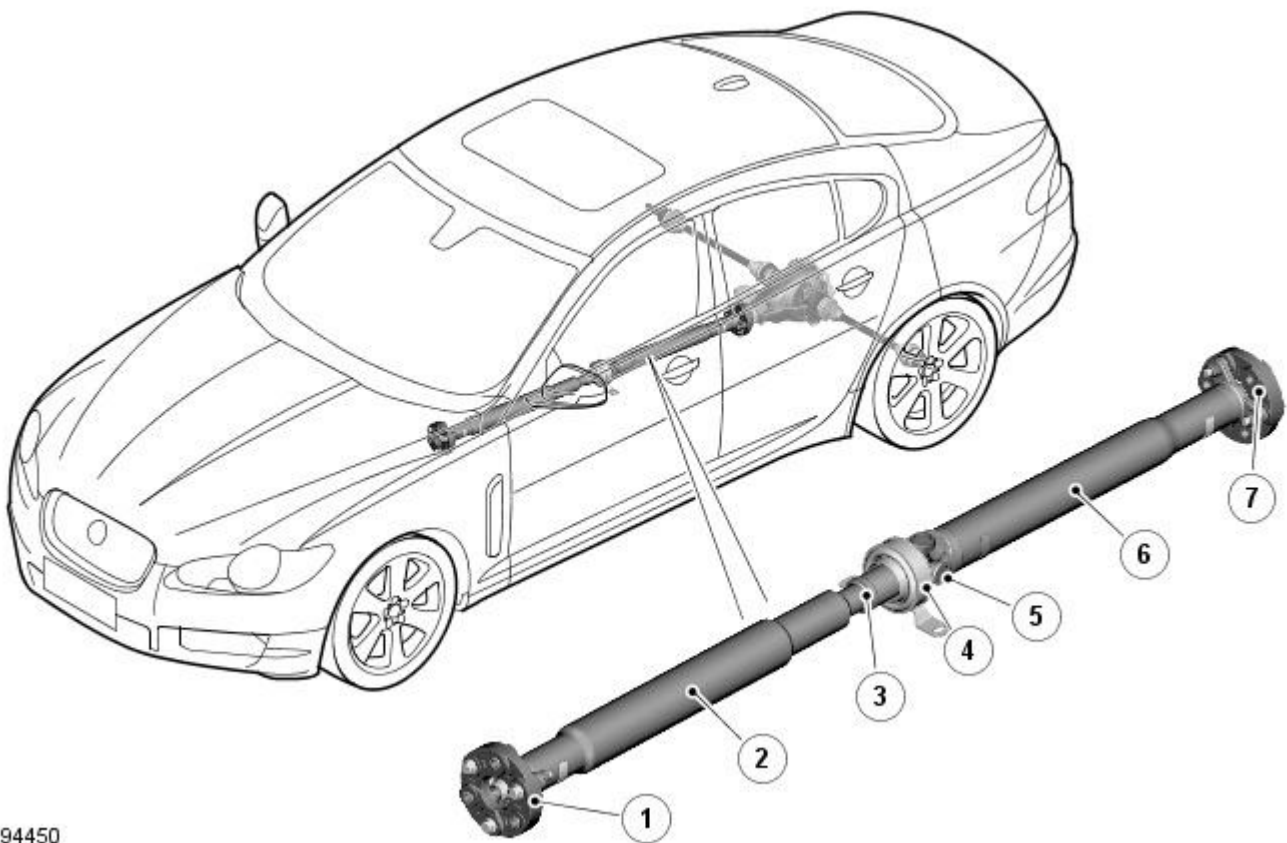
### Torque Specifications

Description	Nm	lb-ft	lb-in
Centre bearing retaining bolts	48	36	-
Transmission flexible joint retaining bolts	127	94	-
Rear drive axle CV joint retaining bolts	73	54	-
Driveshaft heat shield retaining bolts	7	-	62



## Driveshaft - Driveshaft - Component Location

Description and Operation



E94450

### ItemDescription

1	Transmission flexible joint
2	Collapsible front driveshaft tube
3	Splined slip joint
4	Center bearing
5	Universal joint
6	Rear driveshaft tube
7	Differential flexible joint

## **Driveshaft - Driveshaft - Overview**

Description and Operation

### **Driveshaft Overview**

The two-piece driveshaft, manufactured from lightweight tubular steel, transmits drive from the engine, via the transmission, to the differential. The driveshaft aligns with the centerline of the vehicle's body and is supported by a center bearing.

# Driveshaft - Driveshaft - System Operation and Component Description

Description and Operation

## System Operation

### Driveshaft

The two-piece driveshaft, manufactured from lightweight tubular steel, transmits drive from the engine, via the transmission, to the differential. The driveshaft aligns with the centerline of the vehicle's body and is supported by a center bearing.

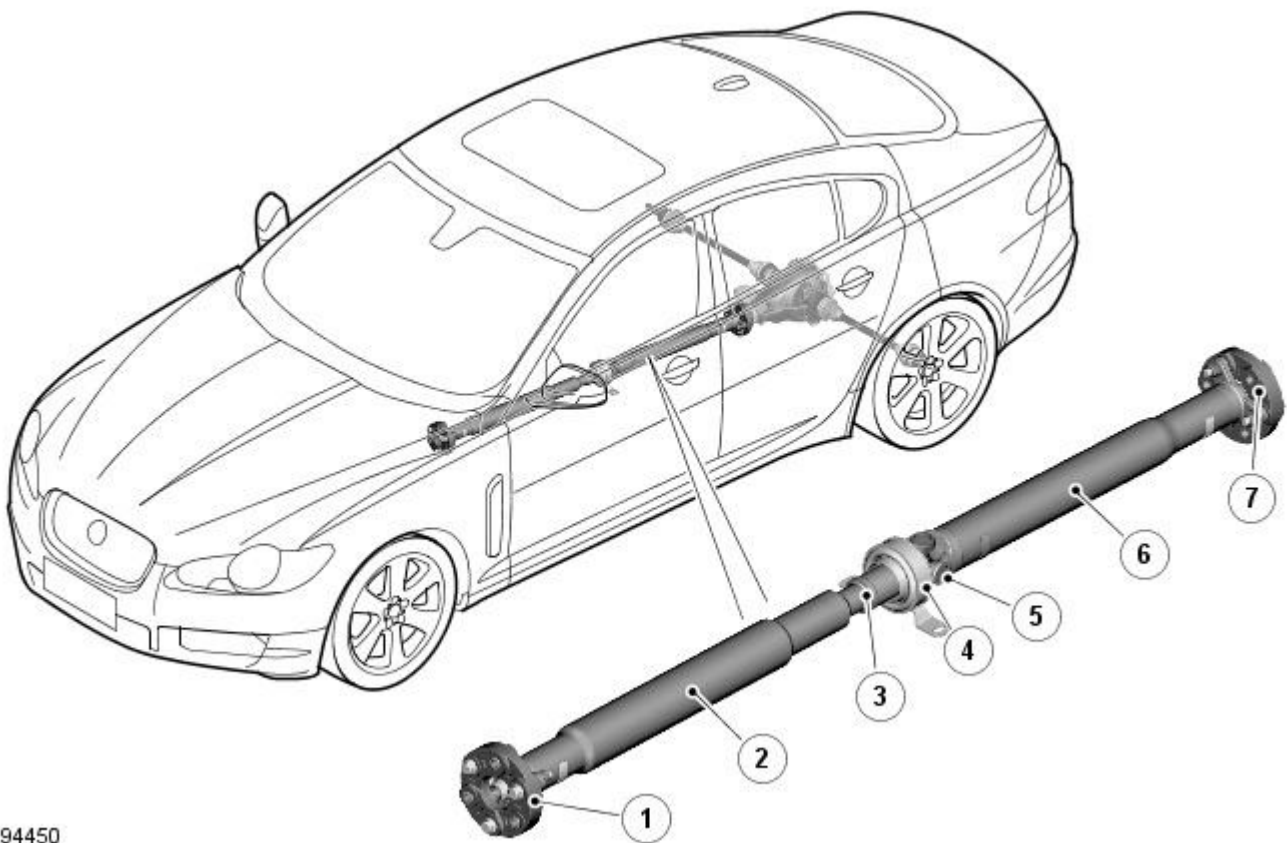
The driveshaft's front tube is of swaged construction, which is a crash energy management feature, designed to collapse progressively and predictably in the event of a severe frontal impact. A low-friction splined slip-joint at the center of the driveshaft provide the driveshaft's plunge capability.

Flexible couplings connecting the driveshaft to both the transmission and the differential counteract the angular movement of the driveshaft caused by the driveline's acceleration and braking forces.

The center universal joint is positioned at a specified angle using shims between the center bearing and the vehicle's body. The driveline angles have been carefully configured to balance minimum power losses with excellent vibration and wear characteristics. The universal joint is lubricated during manufacture and sealed for life.

## Driveshaft - Universal Joints - Component Location

Description and Operation



E94450

### ItemDescription

1	Transmission flexible joint
2	Collapsible front driveshaft tube
3	Splined slip joint
4	Center bearing
5	Universal joint
6	Rear driveshaft tube
7	Differential flexible joint

## **Driveshaft - Universal Joints - Overview**

Description and Operation

Refer to: [Driveshaft](#) (205-01 Driveshaft, Description and Operation).

# Driveshaft - Universal Joints - System Operation and Component

## Description

Description and Operation

## System Operation

Refer to: [Driveshaft](#) (205-01 Driveshaft, Description and Operation).

## **Driveshaft - Driveshaft**

Diagnosis and Testing

For additional information.

REFER to: [Driveline System](#) (205-00 Driveline System - General Information, Diagnosis and Testing).

# Driveshaft - Driveshaft Runout and Balancing

General Procedures

1. For additional information, refer to the Jaguar Approved Diagnostic System.



## Driveshaft - Driveshaft

Removal and Installation

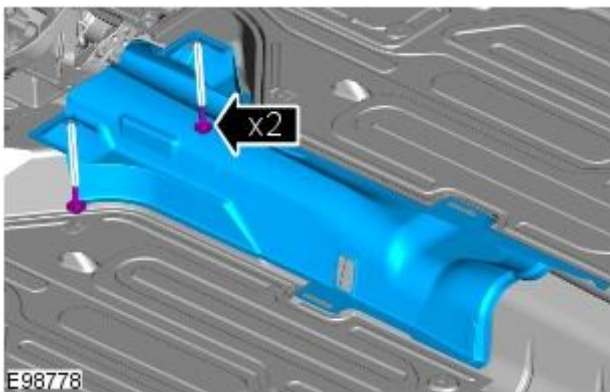
### Removal

- NOTE: Removal steps in this procedure may contain installation details.

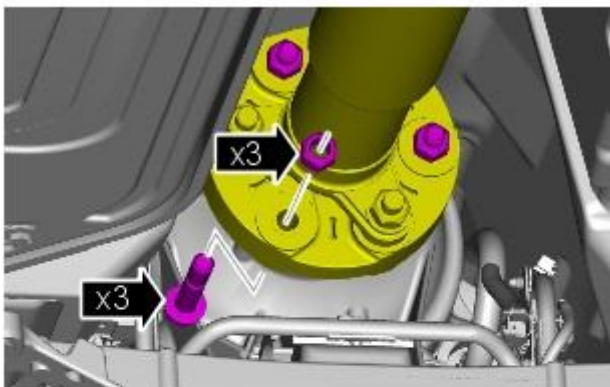
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.


2. Refer to: Exhaust System (309-00A, Removal and Installation).




3.
  - Torque: 9 Nm

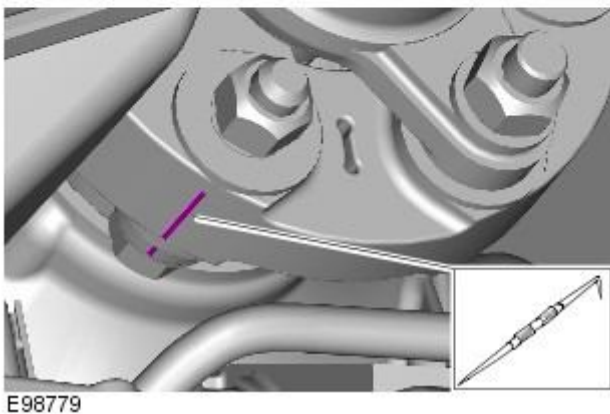


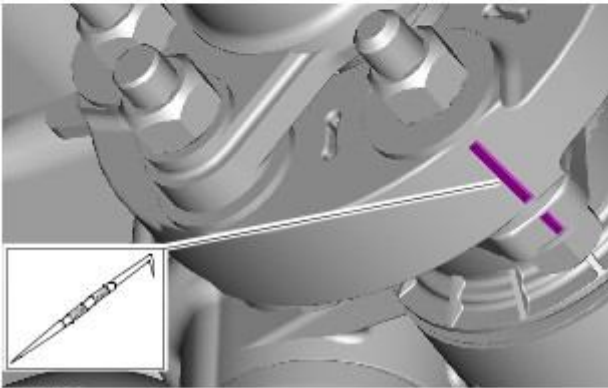
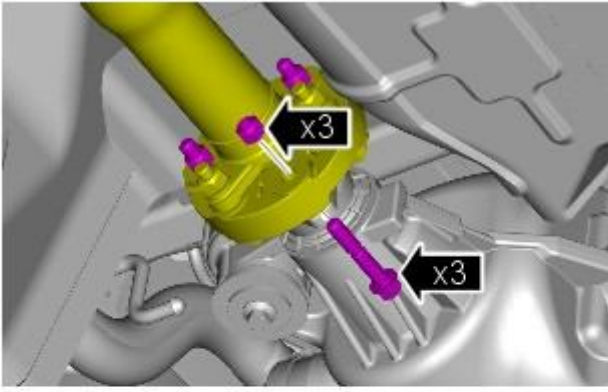
4. **CAUTIONS:**

 Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the driveshaft.

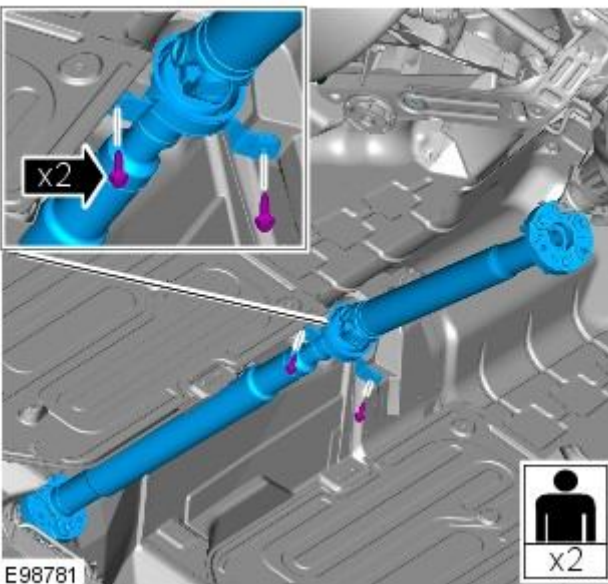
 Make sure that the driveshaft is supported with suitable retaining straps.

- Mark the position of the driveshaft flange in relation to the output flange.
- Torque: 127 Nm






E98780



E98781

5. 5. CAUTIONS:

 Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the driveshaft.

 Make sure that the driveshaft is supported with suitable retaining straps.

- Mark the position of the driveshaft in relation to the rear drive axle flange.
- Mark the position of the balance nut (if fitted) in relation to the flexible coupling.
- *Torque:* 108 Nm

6.  **WARNING:** This step requires the aid of another technician.

• **NOTE:** Note the fitted position of the spacers.

- *Torque:* 88 Nm

**Installation**

1. **1. NOTE:** Make sure that these components are installed to the noted removal position.

To install, reverse the removal procedure.

## Rear Drive Axle/Differential -

### General Specifications

Item	Specification
Differential fluid type	M2C192A synthetic
Differential fluid capacity	1.25 liters

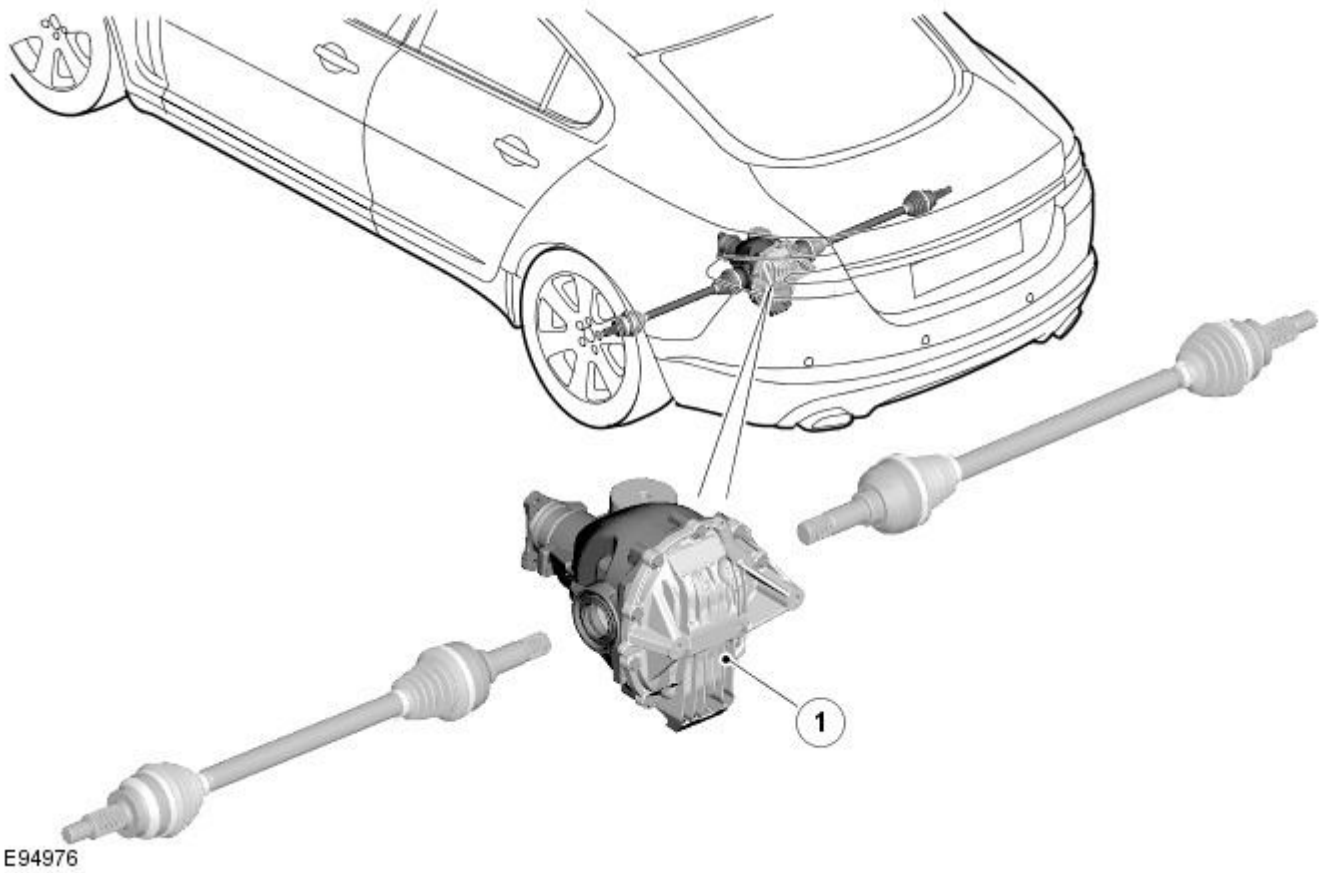
### Torque Specifications

Description	Nm	lb-ft	lb-in
Axle assembly front retaining bolt	90	66	-
Axle assembly rear retaining bolts	200	148	-
Driveshaft flexible joint	88	65	-

# Rear Drive Axle/Differential - Rear Drive Axle and Differential 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Component Location

Description and Operation

Component Location



## ItemDescription

1	Differential
---	--------------

## **Rear Drive Axle/Differential - Rear Drive Axle and Differential 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Overview**

Description and Operation

### **Differential**

The differential's purpose is to compensate for discrepancies in the rotation rates of the vehicle's drive wheels during cornering.

# Rear Drive Axle/Differential - Rear Drive Axle and Differential 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - System Operation and Component Description

Description and Operation

## System Operation

### Differential

The differential's pinion shaft aligns with the centerline of the vehicle's body and is supported by two taper-roller bearings.

The pinion shaft receives power from the engine through the transmission and driveshaft. The pinion shaft gear rotates the differential ring gear, which is bolted to the differential housing outer flange. Inside the differential housing, two differential pinion gears are mounted on a differential shaft, which is pinned to the differential housing. These pinion gears are engaged with the differential side gears to which the halfshafts are splined. As the differential side gears turn, they rotate the halfshafts and rear wheels.

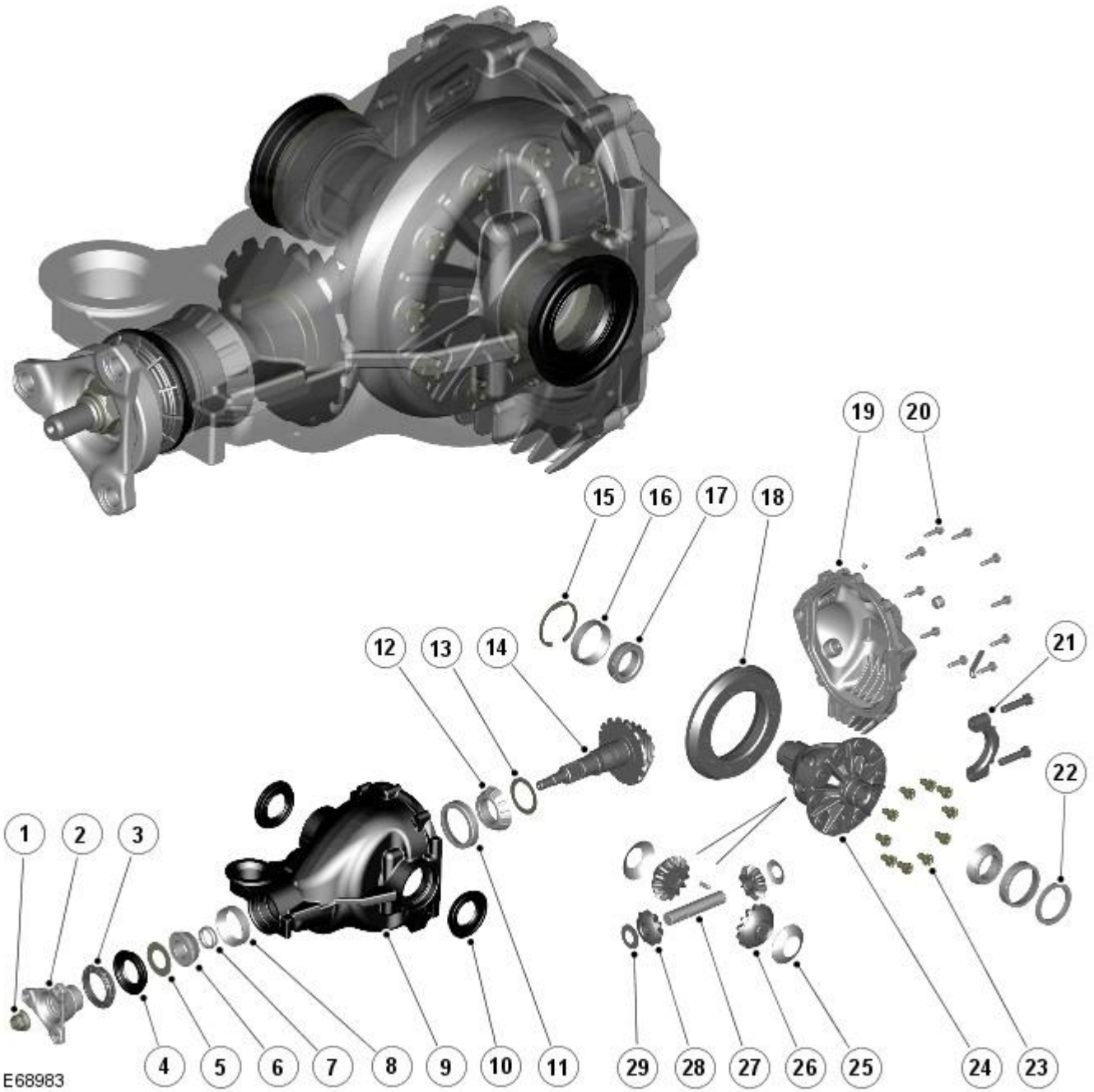
When it is necessary for one wheel and halfshaft to rotate faster than the other, the faster turning differential side gear causes the differential pinion gears to roll on the slower turning differential side gear. This allows differential action between the two halfshafts.

## Component Description

### Differential

The differential is supported at three mounting points, one at the front of the unit, and two at the rear, through rubber bushes to the vehicle's rear subframe. This mounting arrangement plus the subframe to vehicle-body mounting arrangement provides the rear driveline with double isolation from the vehicle's body.

The main casing of the differential is constructed of lightweight cast-iron with an aluminum rear cover. The rear cover incorporates fins to aid air cooling of the differential unit.



E68983

**ItemDescription**

1	Pinion nut
2	Pinion flange
3	Dust shield
4	Pinion oil seal
5	Pinion shaft oil slinger
6	Pinion bearing
7	Collapsible spacer
8	Pinion bearing cup
9	Differential housing
10	Halfshaft oil seal
11	Differential pinion bearing cup
12	Pinion bearing
13	Drive pinion bearing adjustment shim
14	Pinion
15	Circlip
16	Differential bearing cup
17	Differential pilot bearing
18	Differential ring gear

19	Differential rear cover
20	Rear cover bolt (10 off)
21	Differential bearing cap
22	Differential bearing adjustment shim
23	Ring gear bolt (10 off)
24	Differential
25	Dished plate
26	Differential side gear
27	Shaft
28	Differential pinion gear
29	Thrust washer



## **Rear Drive Axle/Differential - Rear Drive Axle and Differential**

Diagnosis and Testing

For additional information.

REFER to: [Driveline System](#) (205-00 Driveline System - General Information, Diagnosis and Testing).

# Rear Drive Axle/Differential - Axle Assembly 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Vehicles Without: Differential Drain Plug

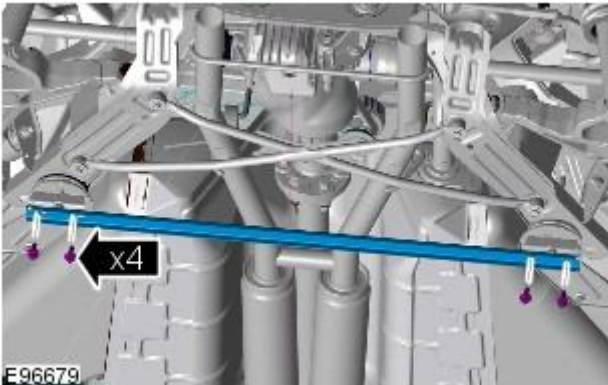
Removal and Installation

## Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

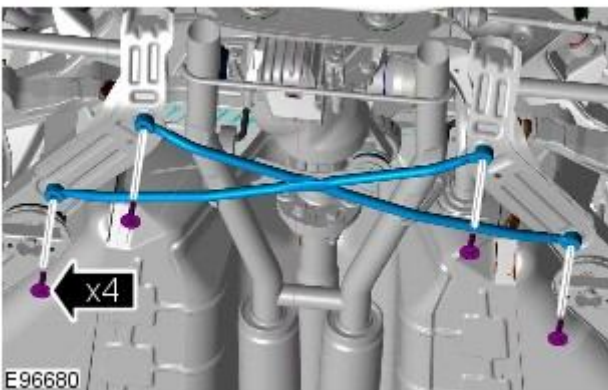
Raise the vehicle.

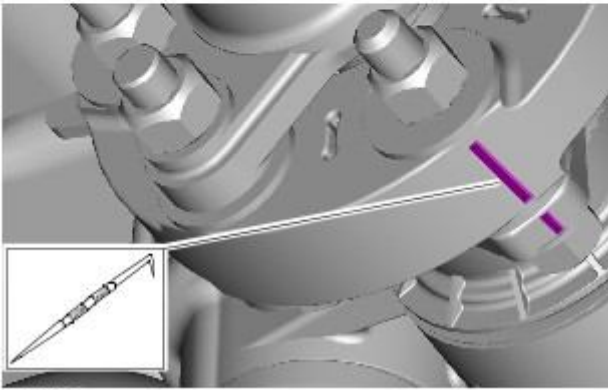
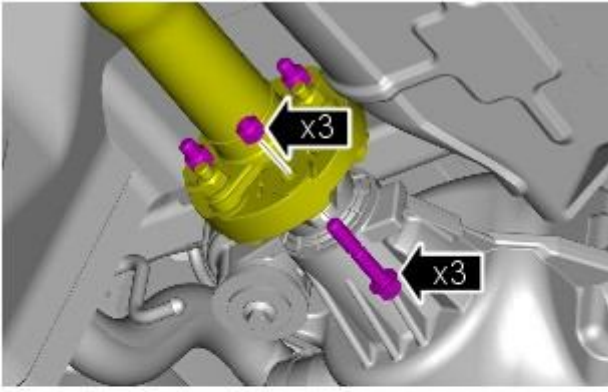
2. Remove both halfshafts.  
For additional information, refer to: [Rear Halfshaft](#) (205-05 Rear Drive Halfshafts, Removal and Installation).
3. Remove the rear crossmember.




4. Remove the rear subframe crossbrace.

- Remove the rear subframe crossbrace.





E98780

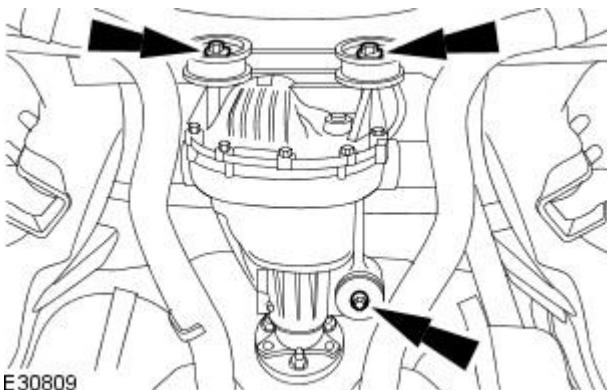
5.  **CAUTION:** Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the driveshaft.

Detach the driveshaft from the rear drive axle flange.

- Mark the position of the driveshaft in relation to the rear drive axle flange.
- Mark the position of the balance nut in relation to the rear drive axle flange. (if fitted).
- Mark the position of each nut and bolt in relation to the driveshaft flexible joint.

6. Using the special tool, support the axle assembly.

7. Remove the axle assembly.

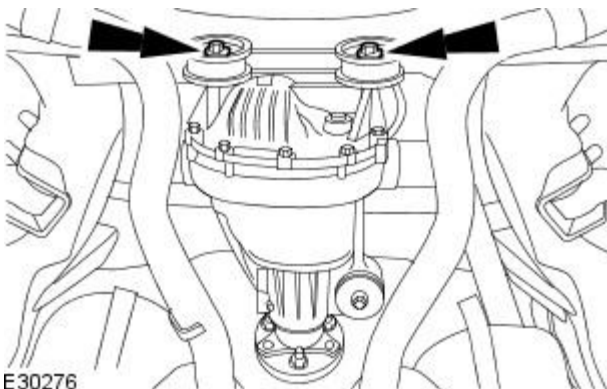


E30809

## Installation

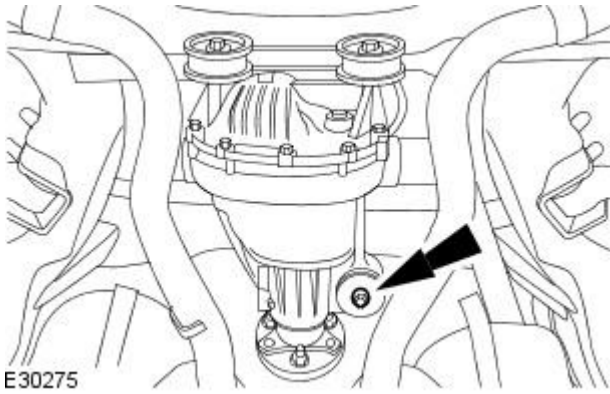
1. To install, reverse the removal procedure.

- Tighten to 190 Nm.



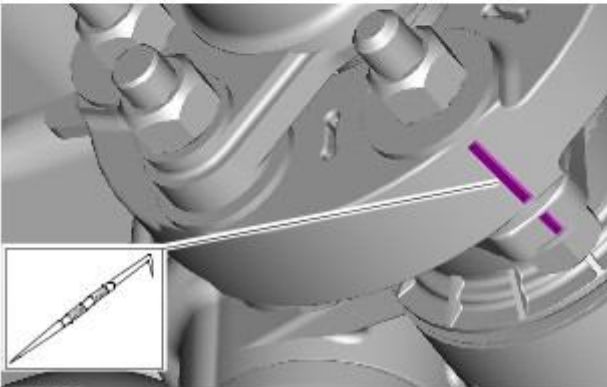
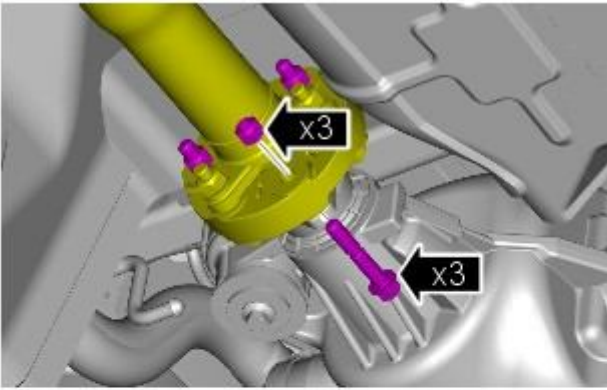
E30276

2. Tighten to 90 Nm.



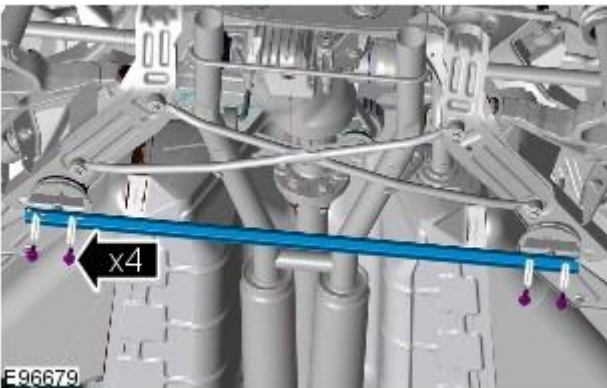
E30275

3. Tighten to 108 Nm.



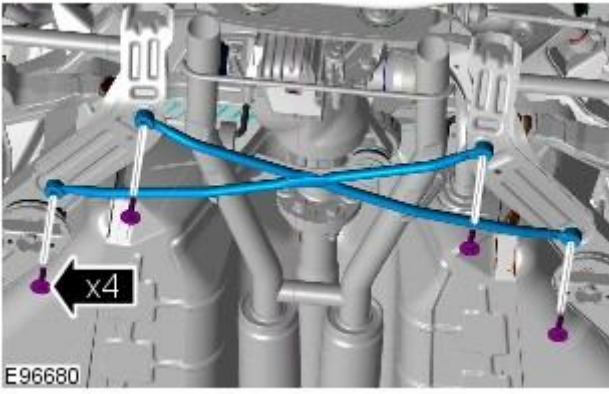
E98780

4. Tighten to 62 Nm.






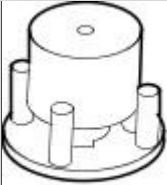
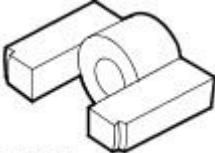

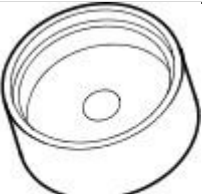
E96679

5. Tighten to 30 Nm.




# Rear Drive Axle/Differential - Axle Housing Bushing 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

## Removal and Installation

Special Tool(s)	
 204-275	Forcing screw 204-275
 204-274	Forcing screw nut 204-274
 JAG-061	Bearing kit JAG-061
 205-534	Receiving cup and mount plate 205-534
 205-533	Remover front mount bush 205-533
 204-245	Installer front mount bush 204-245
 204-243	Installer front mount bush 204-243

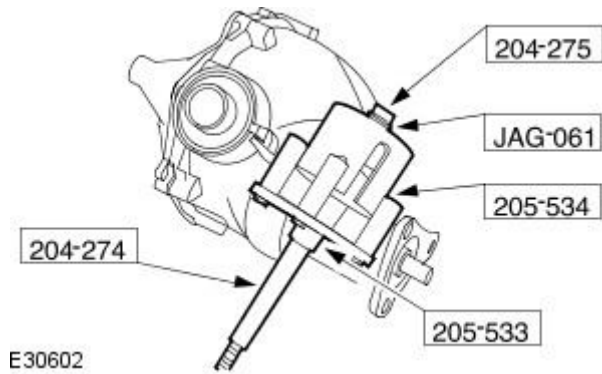
## Removal

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

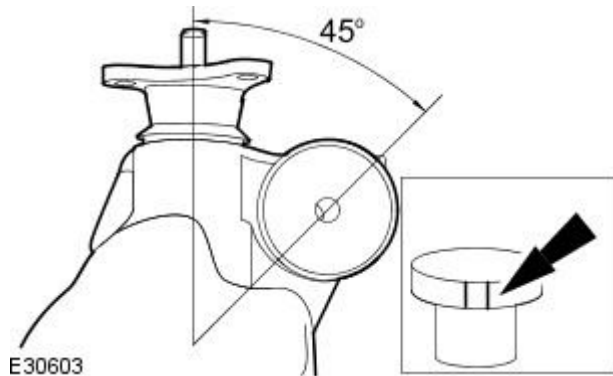
- Remove the axle assembly.  
 For additional information, refer to: [Axle Assembly - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Vehicles Without: Differential Drain Plug](#) (205-02 Rear Drive Axle/Differential, Removal and Installation).

3. Using the special tools, remove the differential bushing.

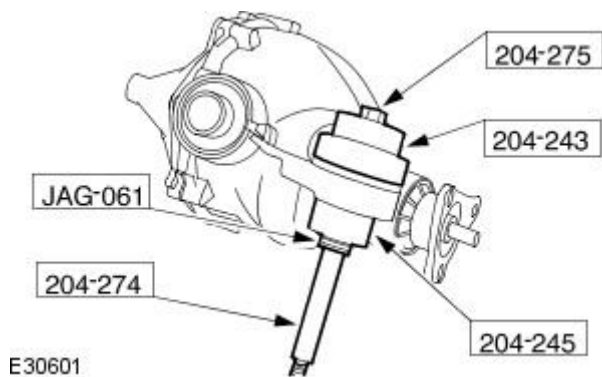


## Installation

1. The raised mouldings on the bushing, should be set at 45 degrees to the center line of the pinion shaft.



2. Using the special tools, install the bushing.



3. Install the axle assembly.

For additional information, refer to: [Axle Assembly - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Vehicles Without: Differential Drain Plug](#) (205-02 Rear Drive Axle/Differential, Removal and Installation).

## Rear Drive Halfshafts -

### Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Constant velocity (CV) grease	Optimal LN 584 LO

### Fill Capacities

Description	Grams
Grease for inner CV joint - all vehicles	140
Grease for outer CV joint - all vehicles	125

### Torque Specifications

- NOTE: Make sure that a new nut is installed.

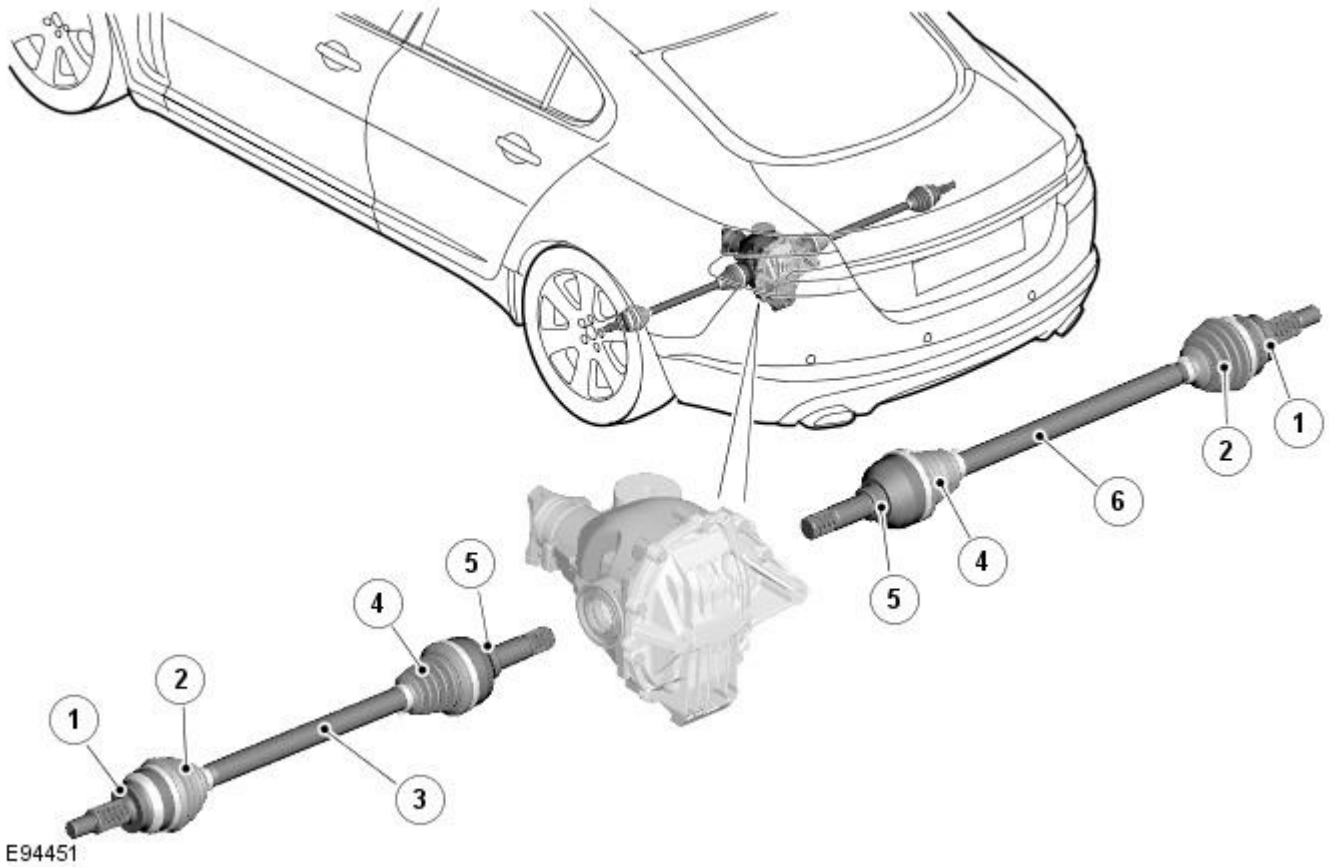
Item	Nm	lb-ft	lb-in
Halfshaft outer constant velocity joint retaining nut	300	221	-



# Rear Drive Halfshafts - Rear Drive Halfshafts - Component Location

Description and Operation

Component Location



## ItemDescription

1	Outer constant velocity joint
2	Outer constant velocity joint gaiter
3	Left hand halfshaft
4	Inner constant velocity joint gaiter
5	Inner constant velocity joint
6	Right hand halfshaft

# Rear Drive Halfshafts - Rear Drive Halfshafts - Overview

Description and Operation

## Overview

The CV (constant velocity) joint at each end of the halfshafts meets the angle change requirements due to suspension deflection. The plunge capability of the CV joint accommodates the length change.

# Rear Drive Halfshafts - Rear Drive Halfshafts - System Operation and Component Description

Description and Operation

## System Operation

## Component Description

### Rear Drive Halfshafts

The solid-steel halfshafts are of unequal length, with each halfshaft comprising inner and outer CV (constant velocity) joints. The CV joints are the 'ball and socket' type packed with grease and protected by gaiters.

The outer CV joint is an interference fit into the wheel hub and secured by a locking nut. The inner CV joint is a slide fit and is retained in the differential with a spring clip.

## **Rear Drive Halfshafts - Rear Drive Halfshafts**

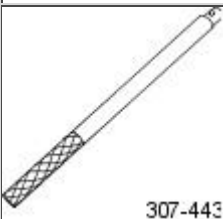



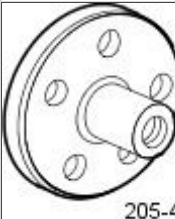

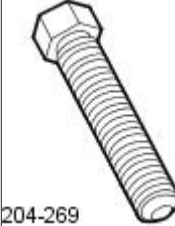
Diagnosis and Testing

For additional information.

REFER to: [Driveline System](#) (205-00 Driveline System - General Information, Diagnosis and Testing).

## Rear Drive Halfshafts - Rear Halfshaft

Removal and Installation

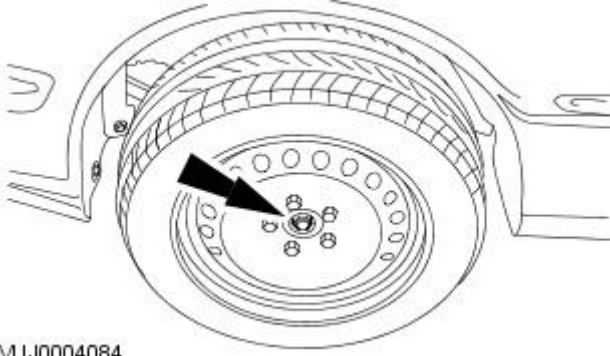
Special Tool(s)	
 <p>307-443</p>	Halfshaft splitter handle 307-443
 <p>307-442</p>	Halfshaft splitter 307-442
 <p>205-532</p>	Halfshaft oil seal installer 205-532
 <p>205-461</p>	Halfshaft seal protector 205-461
 <p>205-491</p>	Hub puller 205-491
 <p>20549101</p>	Adaptor nuts 205-491-01
 <p>204-269</p>	Flange remover forcing screw 204-269

### Removal

- 
**WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Loosen the wheel hub nut.



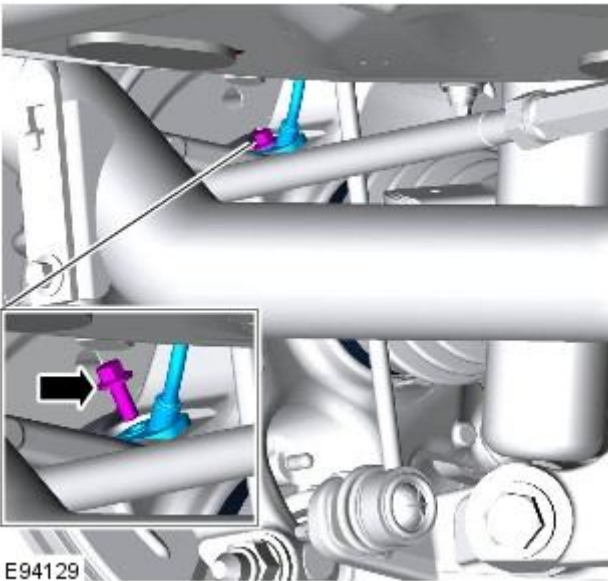
VUJ0004084

3. Remove the brake disc.

For additional information, refer to: [Brake Disc](#) (206-04 Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

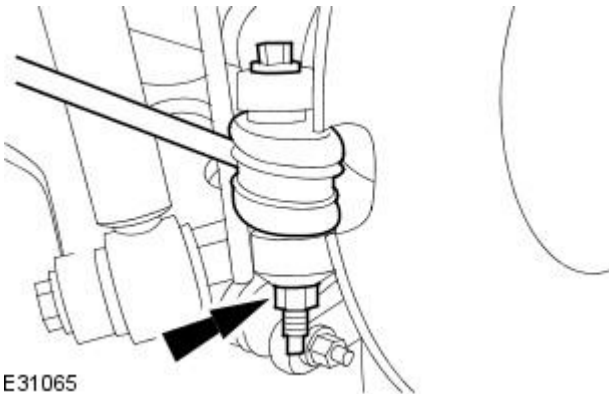
4.  **CAUTION:** Note the fitted position of the component prior to removal.

Detach the anti-lock brake system (ABS) sensor.



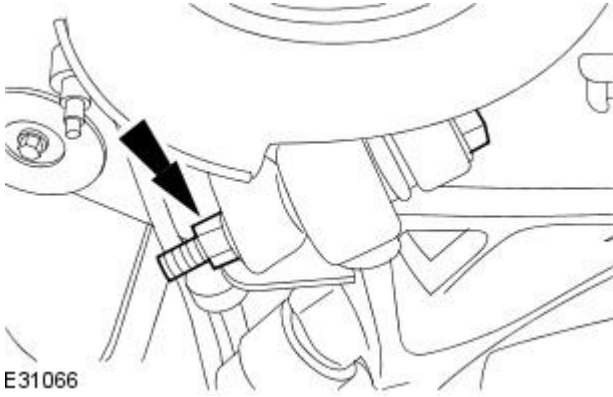
E94129

5. Detach the outer tie rod.



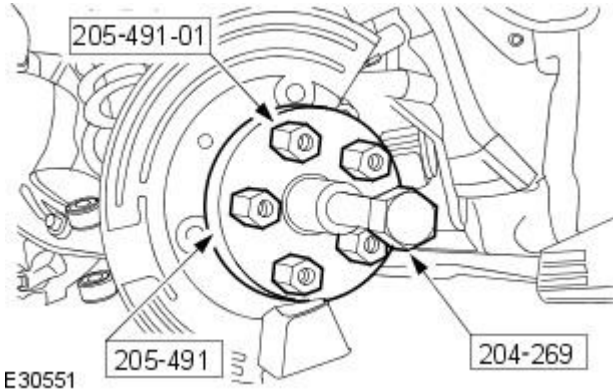
E31065

6. Detach the lower arm from the wheel knuckle.



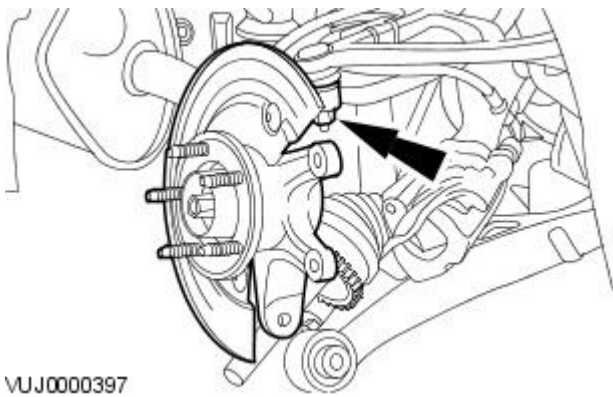
7. Remove the wheel hub nut.

8. Using the special tools, detach the rear halfshaft.



9. **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Remove the wheel knuckle assembly.

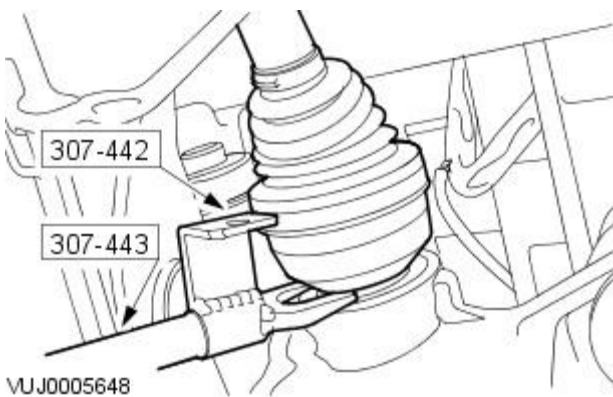


10. **⚠ CAUTION:** To avoid damage to the halfshaft constant velocity (CV) joints and boots, do not allow the CV joints to exceed 18 degrees of travel.

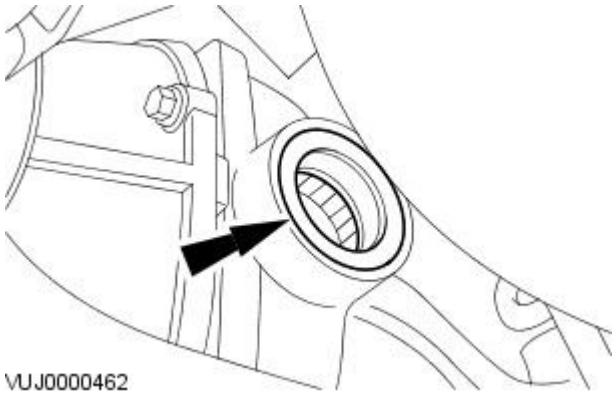
• **NOTE:** The halfshaft is retained in the axle assembly by a retaining clip.

Using the special tools, remove the rear halfshaft.

- Remove and discard the retaining clip.



11. Remove the halfshaft seal.

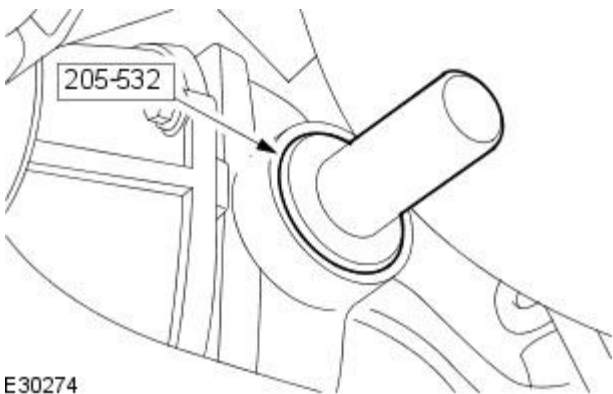


VUJ0000462

## Installation

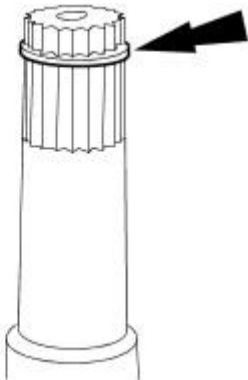
1.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.

Using the special tool, install the halfshaft seal.




E30274

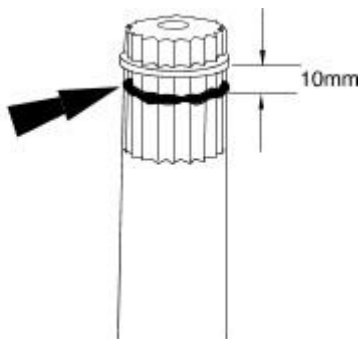
2. Install a new retaining clip.



A0000438

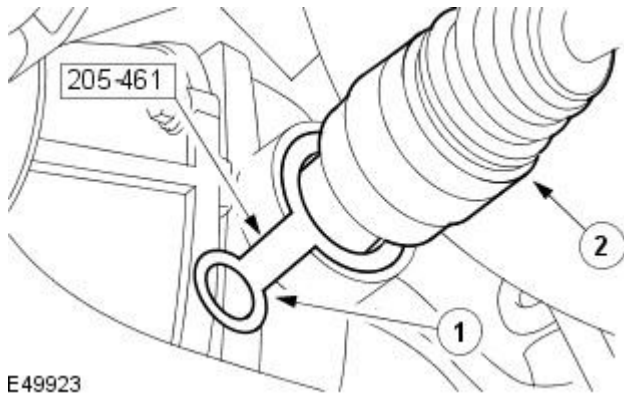
3.  CAUTION: The next four steps must be carried out within 5 minutes of applying the sealant.

Apply a 3mm diameter bead of Loctite 648 or equivalent meeting Jaguar specification to the halfshaft.




E38645





E49923

4. CAUTIONS:

 To avoid damage to the halfshaft constant velocity (CV) joints and boots, do not allow the CV joints to exceed 18 degrees of travel.

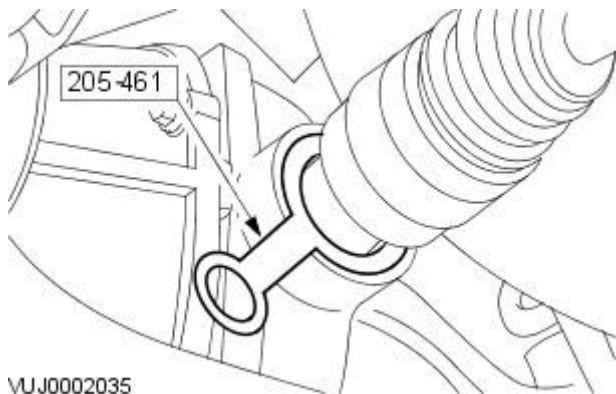
 Make sure no damage occurs to the halfshaft seal when installing the halfshaft.

• NOTE: Do not fully engage the halfshaft into the axle assembly.

Install the halfshaft.


- Install the special tool to the rear halfshaft seal.
- Install the halfshaft.

5. Remove the special tool.



VUJ0002035

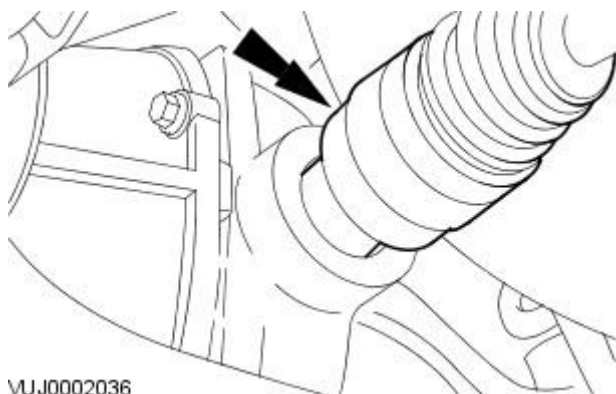
6. CAUTIONS:

 To avoid damage to the halfshaft constant velocity (CV) joints and boots, do not allow the CV joints to exceed 18 degrees of travel.


 Make sure no damage occurs to the halfshaft seal when installing the halfshaft.

• NOTE: Make sure the retaining clip is correctly seated.

Attach the rear halfshaft.



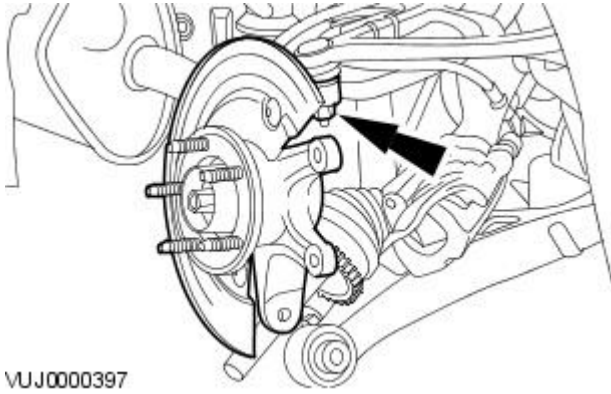
VUJ0002036

7.  CAUTION: Axle fluid should flow from the filler plug threaded hole when full. Failure to follow this instruction may result in damage to the axle.

• NOTE: Install a new fluid level filler plug.

Check and top up the axle assembly fluid level as required.

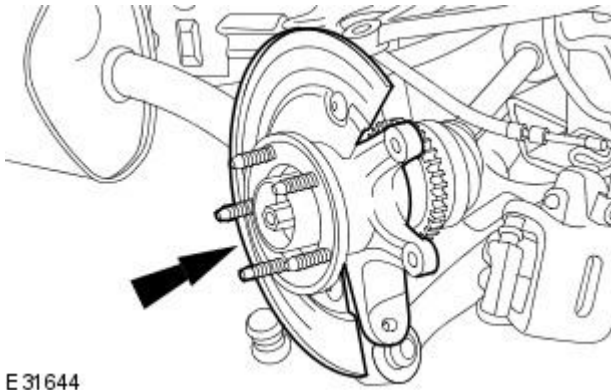
- Tighten to 34 Nm.



VUJ0000397

**8. NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Install the wheel knuckle assembly.

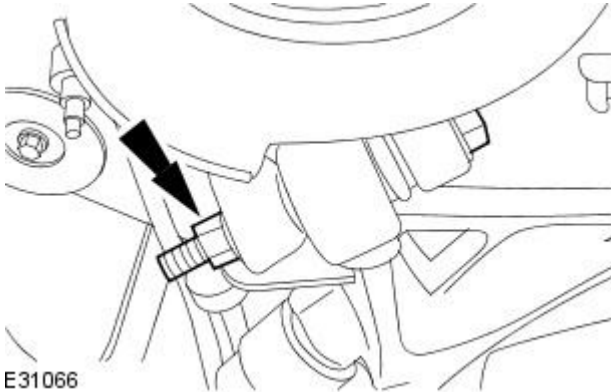


E 31644

**9. NOTE:** Using the old wheel hub nut, tighten to 150 Nm.

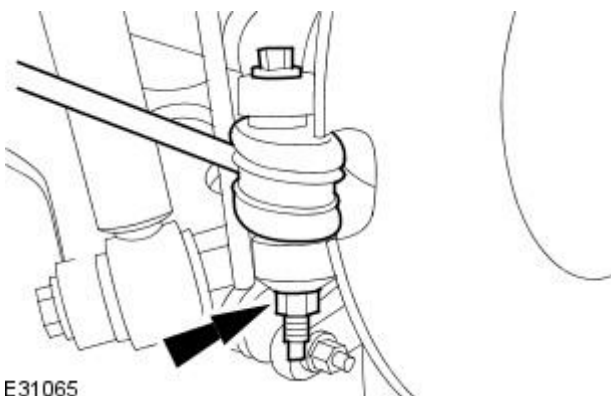
• **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Attach the wheel knuckle to the rear halfshaft.



E31066

**10.** Install the lower arm to the wheel knuckle.

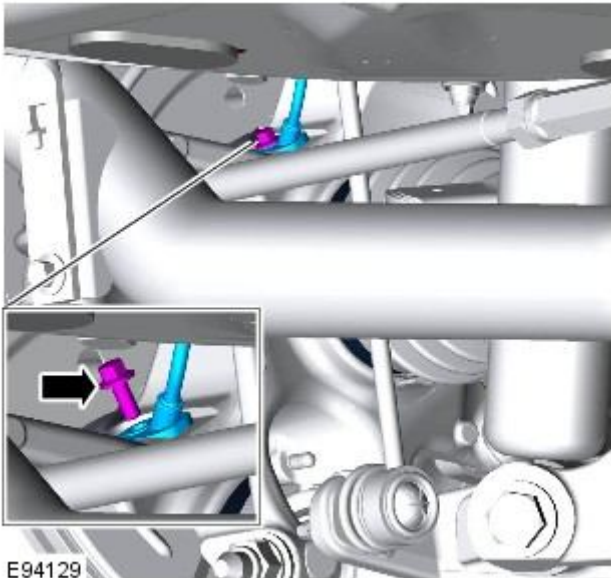


E31065

**11.** Install the outer tie rod retaining nut.

12. Install the ABS sensor.

- Tighten to 6 Nm.



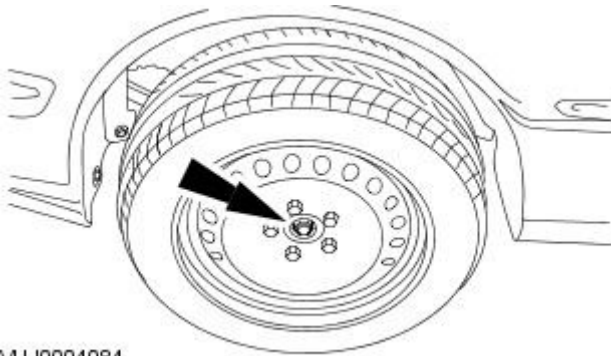
E94129

13. Install the brake disc.

For additional information, refer to: [Brake Disc](#) (206-04 Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

14. Remove and discard the old wheel hub nut, install a new wheel hub nut.

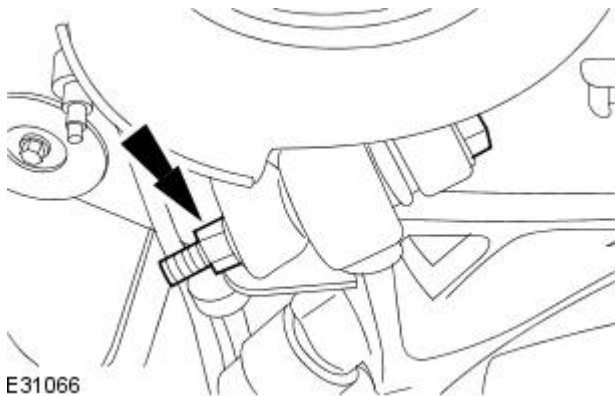
- Tighten to 300 Nm.



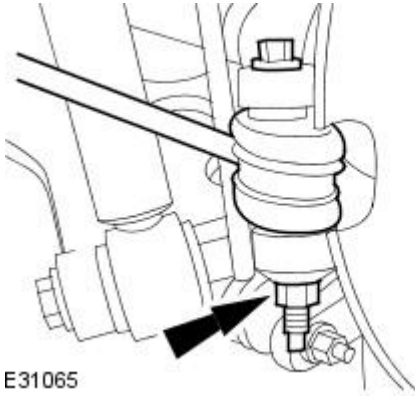
VUJ0004084


15.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.

Tighten to 150 Nm.



E31066




16.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.

Tighten to 55 Nm.

# Rear Drive Halfshafts - Inner Constant Velocity (CV) Joint Boot

Removal and Installation

## Removal


1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

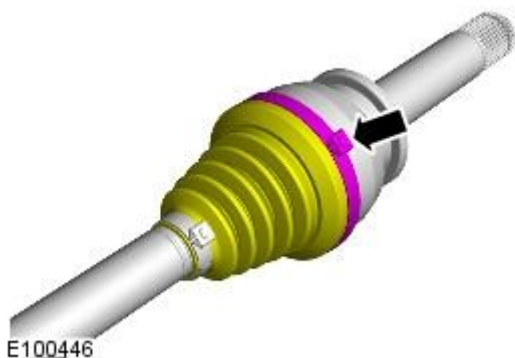
2. Remove the rear halfshaft.  
For additional information, refer to: Rear Halfshaft - 5.0L/3.0L Diesel (205-05, Removal and Installation).

3.  **CAUTION:** Use suitable protective covers to protect the halfshaft.

Using a suitable clamp, secure the rear halfshaft.

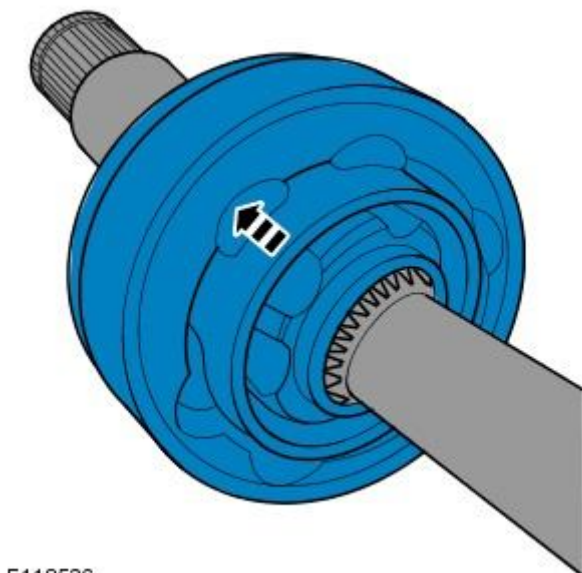
4.  **CAUTION:** Make sure the inner constant velocity (CV) joint is not separated from the halfshaft.

Remove and discard the inner CV joint boot retaining clip.



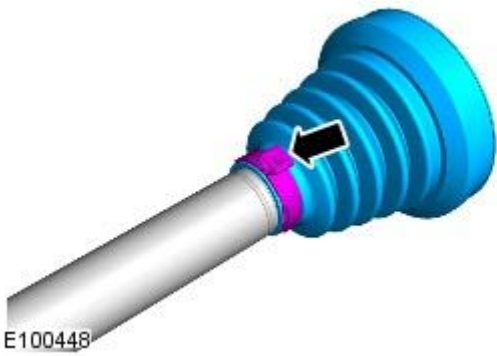
5.  **CAUTION:** Make sure the CV joint ball bearings do not drop out of the CV joint.

Using a suitable tool, remove the inner CV joint.



6. Remove the inner CV joint boot.

- Remove and discard the retaining clip.

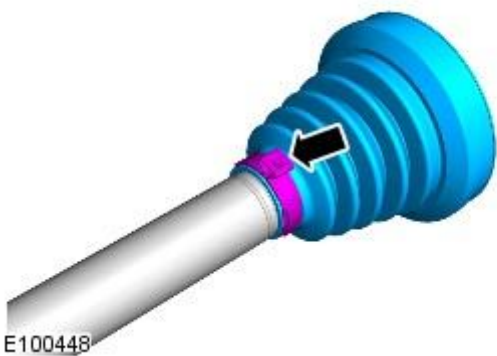


## Installation

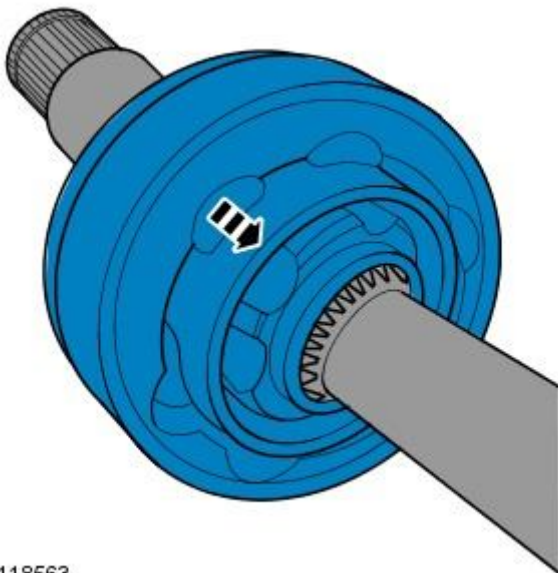
1. NOTE: Make sure that the protective sleeve is correctly installed, prior to installing the CV joint boot.



2. NOTE: Install a new retaining clip.







E118563

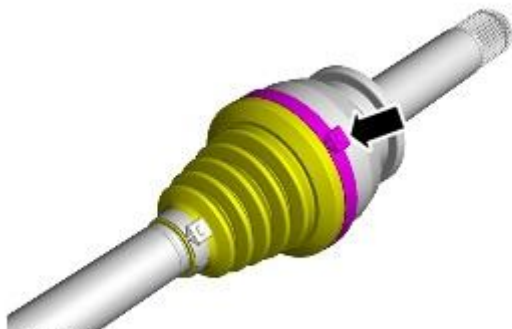
**3. CAUTIONS:**

- ⚠ Only use lubricants meeting the Jaguar specification.
- ⚠ Make sure the CV joint ball bearings do not drop out of the CV joint.

• NOTE: Clean the constant velocity (CV) joint, removing as much of the old grease as possible.

Install the inner CV joint.

- Fill the CV joint with 40 grams of grease.
- Fill the CV joint boot with 100 grams of grease.



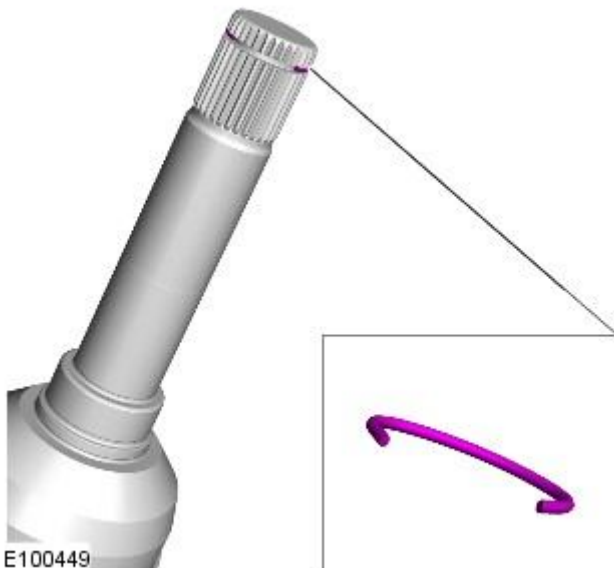
E100446

**4. CAUTIONS:**

- ⚠ Make sure the CV joint is not separated from the halfshaft.
- ⚠ Make sure enough air is present in the CV boot.

Install a new retaining clip.

5. Install a new retaining clip.



E100449

6. Remove the rear halfshaft from the clamp.


7. Install the rear halfshaft.

For additional information, refer to: Rear Halfshaft - 5.0L/3.0L Diesel (205-05, Removal and Installation).

# Rear Drive Halfshafts - Outer Constant Velocity (CV) Joint Boot

Removal and Installation

## Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- 2.
3. For additional information, refer to: [Inner Constant Velocity \(CV\) Joint Boot](#) (205-05 Rear Drive Halfshafts, Removal and Installation).
- 4.



E118528

- 5.



E118524

6.  **CAUTION:** Make sure the CV joint ball bearings do not drop out of the CV joint.

• **NOTE:** Clean the constant velocity (CV) joint, removing as much of the old grease as possible.

## Installation




1.  CAUTION: Only use lubricants meeting the Jaguar specification.

• NOTE: Make sure that the protective sleeve is correctly installed, prior to installing the CV joint boot.

- Fill the CV joint with 50 grams of grease.
- Fill the CV joint boot with 85 grams of grease.



E118459

2.  CAUTION: Make sure enough air is present in the CV boot.

• NOTE: Install new retaining clips.



E118528

## Brake System - General Information -

### Lubricants, Fluids, Sealers and Adhesives



**CAUTION:** Do not use brake fluid ITT Super Dot 4 on 2006my vehicles onwards. Failure to follow this instruction may result in damage to the vehicle.

• **NOTE:** Brake fluid ITT Super Dot 4 has now been superseded by Shell ESL Super Dot 4 which is the Jaguar recommended brake fluid. Shell ESL Super Dot 4 can be used on all model years.

Item	Specification
Brake fluid	Shell ESL Dot 4

### Brake Lining and Disc Specifications

Item	Specification
Brake pad material nominal thickness - front - Vehicles with 2.7L Diesel, 3.0L or 4.2L engine	13 mm (0.51 in)
Brake pad material minimum thickness - front - Vehicles with 2.7L Diesel, 3.0L or 4.2L engine	2 mm (0.08 in)
Brake pad material nominal thickness - front - Vehicles with high performance brakes	13 mm (0.51 in)
Brake pad material minimum thickness - front - Vehicles with high performance brakes	2 mm (0.08 in)
Brake pad material nominal thickness - rear - Vehicles with 2.7L Diesel, 3.0L or 4.2L engine	11 mm (0.43 in)
Brake pad material minimum thickness - rear - Vehicles with 2.7L Diesel, 3.0L or 4.2L engine	2 mm (0.08 in)
Brake pad material nominal thickness - rear - Vehicles with high performance brakes	11 mm (0.43 in)
Brake pad material minimum thickness - rear - Vehicles with high performance brakes	2 mm (0.08 in)
Front brake disc diameter - Vehicles with 2.7L Diesel, 3.0L, 4.2L engine	326 mm (12 in)
Front brake disc diameter - Vehicles with high performance brakes	355 mm (14 in)
New front Brake disc nominal thickness - Vehicles with 2.7L Diesel, 3.0L or 4.2L engine	30 mm (1.2 in)
New front brake disc nominal thickness - Vehicles with high performance brakes	32 mm (1.28 in)
Worn brake disc discard thickness - Vehicles with 2.7L Diesel, 3.0L, 4.2L engine	28 mm (1.10 in)
Worn front brake disc discard thickness - Vehicles with high performance brakes	30 mm (1.2 in)
Rear brake disc diameter - Vehicles with 2.5L, 2.7L Diesel, 3.0L or 4.2L engine	288 mm (11.52 in)
Rear brake disc diameter - All Vehicles	326 mm (13 in)
New rear brake disc nominal thickness - All Vehicles	20 mm (0.8 in)
Worn rear brake disc minimum thickness - All Vehicles	18 mm (0.71 in)
Maximum front brake disc runout (installed) - All Vehicles	0.09 mm ( 0.003 in)
Maximum rear brake disc runout (installed) - All Vehicles	0.075 mm ( 0.003 in)
Maximum front hub face runout (installed)	0.015 mm ( 0.006 in)
Maximum rear hub face runout (installed)	0.05 mm ( 0.02 in)
Front brake caliper piston diameter - All Vehicles	60 mm (2.36 in)
Rear brake caliper piston diameter - All Vehicles	45 mm (1.77 in)

# Brake System - General Information - Brake System

Diagnosis and Testing

## Principle of Operation

For a detailed description of the brake system, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

[Front Disc Brake](#) (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation),  
[Front Disc Brake](#) (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation),  
 Front Disc Brake (206-03, Description and Operation),  
[Rear Disc Brake](#) (206-04 Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation),  
[Rear Disc Brake](#) (206-04 Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation),  
 Rear Disc Brake (206-04, Description and Operation),  
[Parking Brake](#) (206-05 Parking Brake and Actuation, Description and Operation),  
[Parking Brake](#) (206-05 Parking Brake and Actuation, Description and Operation),  
[Parking Brake](#) (206-05 Parking Brake and Actuation, Description and Operation),  
[Hydraulic Brake Actuation](#) (206-06 Hydraulic Brake Actuation, Description and Operation),  
[Hydraulic Brake Actuation](#) (206-06 Hydraulic Brake Actuation, Description and Operation),  
[Hydraulic Brake Actuation](#) (206-06 Hydraulic Brake Actuation, Description and Operation),  
[Brake Booster](#) (206-07 Power Brake Actuation, Description and Operation),  
[Brake Booster](#) (206-07 Power Brake Actuation, Description and Operation),  
 Brake Booster (206-07, Description and Operation).

## Inspection and Verification

Visually examine the front and rear wheel and tire assemblies for damage such as uneven wear patterns, tread worn out or sidewall damage. Verify the tires are the same size, type and, where possible, same manufacturer. Replace the damaged wheel or excessively worn tire.

Wheels and tires must be cleared of any foreign matter and tire pressures adjusted to the correct specification.

If the tires exhibit uneven wear or feathering, the cause must be corrected. Check the steering and suspension components for damage or wear and, if necessary, check and adjust front wheel alignment. REFER to: (204-00 Suspension System - General Information)

[Specifications](#) (Specifications),  
[Front Toe Adjustment](#) (General Procedures).

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Brake master cylinder</li> <li>● Brake caliper piston(s)</li> <li>● Brake discs</li> <li>● Wheel bearings</li> <li>● Brake pads</li> <li>● Power brake booster</li> <li>● Brake pedal linkage</li> <li>● Brake booster vacuum hose</li> <li>● Tires</li> <li>● Debris</li> </ul>	<ul style="list-style-type: none"> <li>● Parking brake actuator</li> <li>● Parking brake module</li> <li>● Parking brake switch</li> <li>● Damaged or corroded wiring harness</li> <li>● Brake master cylinder fluid level switch</li> </ul>

### Road Test

Carry out a road test to compare actual vehicle braking performance with the performance standards expected by the driver. The ability of the test driver to make valid comparisons and detect performance deficiencies will depend on experience.

The driver should have a thorough knowledge of brake system operation and accepted general performance guidelines to make good comparisons and detect performance concerns.

An experienced brake technician will always establish a route that will be used for all brake diagnosis road tests. The roads selected will be reasonably smooth and level. Gravel or bumpy roads are not suitable because the surface does not allow the tires to grip the road equally. Crowned roads should be avoided because of the large amount of weight shifted to the low set of wheels on this type of road. Once the route is established and consistently used, the road surface variable can be eliminated from the test results.

Before a road test, obtain a complete description of the customer concerns or suspected condition. From the description, the technician's experience will allow the technician to match possible causes with symptoms. Certain components will be tagged as possible suspects while others will be eliminated by the evidence. More importantly, the customer description can reveal unsafe conditions which should be checked or corrected before the road test. The description will also help form the basic approach to the road test by narrowing the concern to specific components, vehicle speed or conditions.

Begin the road test with a general brake performance check. Keeping the description of the concern in mind, test the brakes at different vehicle speeds using both light and heavy pedal pressure. To determine if the concern is in the front or rear braking system, use the brake pedal and then use the parking brake control. If the condition (pull, vibration, pulsation) occurs only with the parking brake, the concern is in the rear brake system.

If the concern becomes evident during this check, verify it fits the description given before the road test. If the concern is

not evident, attempt to duplicate the condition using the information from the description.

If a concern exists, use the Symptom Chart in order to isolate it to a specific sub-system and condition description. From this description, a list of possible sources can be used to further narrow the cause to a specific component or condition.

## Symptom Chart

Symptom	Possible Cause	Action
Brakes noisy	<ul style="list-style-type: none"> <li>● Brake pads</li> <li>● Brake discs</li> </ul>	GO to Pinpoint Test <a href="#">A.</a>
Vibration when brakes are applied	<ul style="list-style-type: none"> <li>● Wheels/tires out of balance</li> <li>● Wheel hub nuts loose</li> <li>● Brake caliper mounting bolts loose</li> <li>● Brake pads</li> <li>● Foreign material/scratches/corrosion on brake disc contact surfaces</li> <li>● Excessive brake disc thickness variation</li> <li>● Excessive brake disc runout</li> <li>● Wheel bearing wear or failure</li> <li>● Suspension bushing wear or failure</li> <li>● Steering bushing wear or failure</li> </ul>	GO to Pinpoint Test <a href="#">B.</a>
The brakes pull or drift	<ul style="list-style-type: none"> <li>● Tire pressures/wear</li> <li>● Brake calipers</li> <li>● Brake pads</li> <li>● Brake discs</li> <li>● Wheel alignment adjustment</li> <li>● Wheel bearing</li> <li>● Suspension bushings and ball joints</li> </ul>	GO to Pinpoint Test <a href="#">C.</a>
The pedal feels spongy	<ul style="list-style-type: none"> <li>● Air in brake hydraulic system</li> <li>● Leak in hydraulic system</li> <li>● Brake booster/master cylinder</li> <li>● Brake pads</li> </ul>	GO to Pinpoint Test <a href="#">D.</a>
The pedal goes down fast	<ul style="list-style-type: none"> <li>● Air in brake hydraulic system</li> <li>● Leak in hydraulic system</li> <li>● Brake booster/master cylinder</li> <li>● Brake pads</li> </ul>	GO to Pinpoint Test <a href="#">E.</a>
The pedal goes down slowly	<ul style="list-style-type: none"> <li>● Air in brake hydraulic system</li> <li>● Brake booster/master cylinder</li> </ul>	GO to Pinpoint Test <a href="#">F.</a>
Excessive brake pedal effort required	<ul style="list-style-type: none"> <li>● Brake pads</li> <li>● Brake booster</li> </ul>	GO to Pinpoint Test <a href="#">G.</a>
Brake lockup during light brake pedal force	<ul style="list-style-type: none"> <li>● Brake pads</li> <li>● Brake calipers</li> </ul>	GO to Pinpoint Test <a href="#">H.</a>
Brakes drag	<ul style="list-style-type: none"> <li>● Parking brake control applied/malfunction</li> <li>● Seized parking brake cables</li> <li>● Seized brake caliper slide pins</li> <li>● Seized brake caliper</li> <li>● Brake booster</li> <li>● Pedal gear</li> </ul>	GO to Pinpoint Test <a href="#">I.</a>
Excessive/Erratic brake pedal travel	<ul style="list-style-type: none"> <li>● Hydraulic system</li> <li>● Brake pads</li> <li>● Brake discs</li> <li>● Hub and bearing assembly</li> </ul>	GO to Pinpoint Test <a href="#">J.</a>
The red brake warning indicator is always on	<ul style="list-style-type: none"> <li>● Fluid level</li> <li>● Brake master cylinder fluid level sensor</li> <li>● Parking brake control</li> <li>● Electrical circuit</li> </ul>	Fill the system to specification. Check for leaks. Install a new brake master cylinder fluid reservoir as required. REFER to: <a href="#">Brake Fluid Reservoir</a> (206-06 Hydraulic Brake Actuation, Removal and Installation). For parking brake control and circuit tests. REFER to: <a href="#">Parking Brake</a> (206-05 Parking Brake and Actuation, Diagnosis and Testing).
Slow or incomplete brake pedal return	<ul style="list-style-type: none"> <li>● Brake pedal binding</li> <li>● Brake booster/master cylinder</li> </ul>	GO to Pinpoint Test <a href="#">K.</a>

## Pinpoint Tests

PINPOINT TEST A : BRAKES NOISY	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>A1: INSPECT BRAKE PADS</b>	
<b>1</b>	Inspect the condition of the front and rear brake pads. Check for damage to any anti-squeal shims.

	<p>Are the brake pads OK?</p> <p><b>Yes</b> <a href="#">GO to A2.</a></p> <p><b>No</b> Clean/install new front and rear brake pads as required. REFER to:  <a href="#">Brake Pads - Vehicles With: Standard Brakes</a> (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation),  <a href="#">Brake Pads - Vehicles With: High Performance Brakes</a> (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation),  <a href="#">Brake Pads</a> (206-04 Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation),            Brake Pads - Vehicles With: High Performance Brakes (206-04, Removal and Installation).            Re-test vehicle for brake noise.</p>
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**A2: INSPECT BRAKE DISCS**

	<p><b>1</b> Inspect the brake discs for excessive corrosion, wear or disc thickness variation.</p>
	<p>Does excessive corrosion, wear or disc thickness variation exist?</p> <p><b>Yes</b> Install new front and rear brake discs and brake pads as required. REFER to:  <a href="#">Brake Pads - Vehicles With: Standard Brakes</a> (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation),  <a href="#">Brake Pads - Vehicles With: High Performance Brakes</a> (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation),  <a href="#">Brake Pads</a> (206-04 Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation),            Brake Pads - Vehicles With: High Performance Brakes (206-04, Removal and Installation),  <a href="#">Brake Disc - Vehicles With: Standard Brakes</a> (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation),  <a href="#">Brake Disc - Vehicles With: High Performance Brakes</a> (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation),            Brake Disc - Vehicles With: High Performance Brakes (206-04, Removal and Installation).            Re-test vehicle for brake noise.</p> <p><b>No</b> No action required, vehicle is OK.</p>

**PINPOINT TEST B : VIBRATION WHEN BRAKES ARE APPLIED**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>B1: ROAD TEST VEHICLE</b>	
	<p><b>1</b> Road test the vehicle between 40-80 km/h (25-50 mph) without applying brakes.</p>
	<p>Is the vibration present?</p> <p><b>Yes</b> For noise vibration and harshness tests. REFER to: <a href="#">Noise, Vibration and Harshness (NVH)</a> (100-04 Noise, Vibration and Harshness, Diagnosis and Testing).</p> <p><b>No</b> <a href="#">GO to B2.</a></p>
<b>B2: CHECK FOR BRAKE VIBRATION</b>	
	<p><b>1</b> Road test the vehicle between 40-80 km/h (25-50 mph) with light and medium application on the brake pedal.</p>
	<p>Is a vibration present?</p> <p><b>Yes</b> Check the brake caliper mounting bolts and wheel hub nuts and tighten to specification as required. Check the balance of all road wheels and tires and repair as required. Check the brake discs for excessive wear, runout, thickness variation or cracks. Install new brake discs and brake pads as required. <a href="#">GO to B3.</a></p> <p><b>No</b> No action required, vehicle is OK.</p>
<b>B3: IS VIBRATION STILL PRESENT UNDER BRAKE APPLICATION?</b>	
	<p><b>1</b> Road test the vehicle between 40-80 km/h (25-50 mph) with light and medium application on the brake pedal.</p>
	<p>Is a vibration present?</p> <p><b>Yes</b> Check for wear or failure of steering gear bushings. Check for wear or failure of steering gear ball joints. Check for wear or failure of front wheel bearings, suspension bushings and ball joints. Check for wear or failure of rear wheel bearings, suspension bushings and ball joints. Refer to relevant section in workshop manual and install new components as required.</p> <p><b>No</b> No action required, vehicle is OK.</p>

**PINPOINT TEST C : THE BRAKES PULL OR DRIFT**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>C1: ROAD TEST VEHICLE</b>	
	<p><b>1</b> Road test the vehicle and apply the brake pedal.</p>
	<p>Does the vehicle pull or drift?</p> <p><b>Yes</b> <a href="#">GO to C2.</a></p> <p><b>No</b> No action required, vehicle is OK.</p>
<b>C2: INSPECT TIRE CONDITION/PRESSURE</b>	

	<b>1</b> Check for excessive tire wear or incorrect pressures.
Are the tires at the correct pressure and in good condition?	
<b>Yes</b>	<a href="#">GO to C3.</a>
<b>No</b>	Adjust the tire pressures or install new tires if excessively worn. Re-test the system for normal operation.

### C3: CHECK CALIPERS

	<b>1</b> Check the disc brake caliper pistons and pins for binding, leaking or sticking.
Do the disc brake caliper pistons and pins bind, leak or stick?	
<b>Yes</b>	Rectify sticking pins and install new brake calipers as required. REFER to: <a href="#">Brake Caliper - Vehicles With: Standard Brakes</a> (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation), <a href="#">Brake Caliper - Vehicles With: High Performance Brakes</a> (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation), <a href="#">Brake Caliper</a> (206-04 Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation), <a href="#">Brake Caliper - Vehicles With: High Performance Brakes</a> (206-04, Removal and Installation). Re-test the system for normal operation.
<b>No</b>	<a href="#">GO to C4.</a>

### C4: INSPECT BRAKE DISCS

	<b>1</b> Check the brake discs for excessive damage, thickness variation or runout. REFER to: <a href="#">Brake Disc Runout Check</a> (206-00 Brake System - General Information, General Procedures).
Does excessive damage or runout exist?	
<b>Yes</b>	Install new brake discs and brake pads as required. Re-test the system for normal operation.
<b>No</b>	<a href="#">GO to C5.</a>

### C5: INSPECT THE FRONT HUB AND WHEEL BEARING ASSEMBLY

	<b>1</b> Check the front hub and wheel bearing assembly.
Are the wheel bearings OK?	
<b>Yes</b>	<a href="#">GO to C6.</a>
<b>No</b>	Install new wheel bearings as required. REFER to: <a href="#">Front Wheel Bearing and Wheel Hub</a> (204-01 Front Suspension, Removal and Installation). Re-test the system for normal operation.

### C6: CHECK SUSPENSION BUSHINGS AND BALL JOINTS.

	<b>1</b> Check all suspension bushings and ball joints.
Are the suspension bushings and ball joints OK?	
<b>Yes</b>	<a href="#">GO to C7.</a>
<b>No</b>	Install new front suspension bushings and ball joints as required. Install new rear suspension bushings and ball joints as required. Refer to the relevant section in the workshop manual.

### C7: CHECK VEHICLE ALIGNMENT

	<b>1</b> Check the vehicle alignment. REFER to: Front Subframe - 2.7L Diesel (502-00, Removal and Installation), Front Subframe - 3.0L (502-00, Removal and Installation), <a href="#">Front Subframe - 4.2L SC V8 - AJV8</a> (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
Is the alignment within specification?	
<b>Yes</b>	No action is required, vehicle is OK.
<b>No</b>	Adjust the alignment as required. REFER to: Front Subframe - 2.7L Diesel (502-00, Removal and Installation), Front Subframe - 3.0L (502-00, Removal and Installation), <a href="#">Front Subframe - 4.2L SC V8 - AJV8</a> (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

## PINPOINT TEST D : THE PEDAL FEELS SPONGY

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>D1: CHECK FOR SPONGY PEDAL (ENGINE OFF)</b>	
	<b>1</b> Check for a firm brake pedal.
Is the brake pedal effort and brake pedal travel normal?	
<b>Yes</b>	No action is required, vehicle is OK.
<b>No</b>	<a href="#">GO to D2.</a>
<b>D2: CHECK BRAKE PEDAL RESERVE (ENGINE OFF)</b>	
	<b>1</b> Pump the brake pedal 10 times and hold on the final application.
Does the brake pedal feel firm on final application?	
<b>Yes</b>	<a href="#">GO to D3.</a>
<b>No</b>	Bleed the brake system.

	REFER to: <a href="#">Brake System Bleeding</a> (206-00 Brake System - General Information, General Procedures).
<b>D3: CHECK BRAKE PEDAL RESERVE (ENGINE ON)</b>	
	<b>1</b> With engine running at idle speed.
	<b>2</b> Apply the brake pedal lightly three or four times.
	<b>3</b> Wait 15 seconds for the vacuum to recover.
	<b>4</b> Push down on the brake pedal until it stops moving downward or an increased resistance to the brake pedal travel occurs.
	<b>5</b> Hold the brake pedal in the applied position while increasing the engine speed to 2000 revs/min.
	<b>6</b> Release the accelerator pedal.
	Does the brake pedal move downward as the engine speed returns to idle? <b>Yes</b> <a href="#">GO to D4.</a> <b>No</b> Check the vacuum to brake booster.
<b>D4: CHECK BRAKE FLUID LEVEL</b>	
	<b>1</b> Check the brake master cylinder reservoir fluid level.
	Is the fluid level OK? <b>Yes</b> Bleed the brake system. REFER to: <a href="#">Brake System Bleeding</a> (206-00 Brake System - General Information, General Procedures). Re-test the system for normal operation. <b>No</b> Check for leaking brake system and rectify as required. Add fluid and bleed the brake system. REFER to: <a href="#">Brake System Bleeding</a> (206-00 Brake System - General Information, General Procedures). Re-test the system for normal operation.

### PINPOINT TEST E : THE PEDAL GOES DOWN FAST

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>E1: ROAD TEST VEHICLE</b>	
	<b>1</b> Road test the vehicle and apply the brake pedal.
	Is the brake pedal effort and brake pedal travel normal? <b>Yes</b> No action required, vehicle is OK. <b>No</b> <a href="#">GO to E2.</a>
<b>E2: CHECK BRAKE PEDAL TRAVEL-PRESSURIZE SYSTEM</b>	
	<b>1</b> Pump the brake pedal rapidly (five times).
	Does the brake pedal travel build up and then hold? <b>Yes</b> Bleed the brake system. REFER to: <a href="#">Brake System Bleeding</a> (206-00 Brake System - General Information, General Procedures). Re-test the system for normal operation. <b>No</b> <a href="#">GO to E3.</a>
<b>E3: CHECK FOR BRAKE SYSTEM LEAKS</b>	
	<b>1</b> Check for external brake system leaks. For additional information, refer to brake master cylinder component test in this section.
	Is there a leak present? <b>Yes</b> Repair as necessary, add fluid and bleed brake system. REFER to: <a href="#">Brake System Bleeding</a> (206-00 Brake System - General Information, General Procedures). Re-test the system for normal operation. <b>No</b> No action required, system is OK.

### PINPOINT TEST F : THE PEDAL GOES DOWN SLOWLY

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>F1: ROAD TEST VEHICLE - CHECK BRAKE PEDAL OPERATION</b>	
	<b>1</b> Check if the condition occurs during actual stopping application by applying the brake pedal while the vehicle is moving.
	Does the condition occur when the vehicle is moving? <b>Yes</b> <a href="#">GO to F2.</a> <b>No</b> <a href="#">GO to F3.</a>
<b>F2: CHECK FOR BRAKE SYSTEM LEAKS</b>	
	<b>1</b> Check for external brake system leaks. For additional information, refer to brake master cylinder component test in this section.
	Are there any external brake system leaks? <b>Yes</b> Rectify as necessary. Add fluid and bleed the brake system. REFER to: <a href="#">Brake System Bleeding</a> (206-00 Brake System - General Information, General Procedures).



	<p>Re-test the system for normal operation.</p> <p><b>No</b> <a href="#">GO to F3.</a></p>
<b>F3: CARRY OUT A BRAKE MASTER CYLINDER BYPASS TEST</b>	
	<p><b>1</b> Test for brake master cylinder bypass condition. Refer to Brake master cylinder component test in this section.</p>
	<p>Has a concern been identified?</p> <p><b>Yes</b> Install a new brake master cylinder, add fluid and bleed the brake system. REFER to: <a href="#">Brake System Bleeding</a> (206-00 Brake System - General Information, General Procedures). Re-test the system for normal operation.</p> <p><b>No</b> No action required, system is OK.</p>

### PINPOINT TEST G : EXCESSIVE BRAKE PEDAL EFFORT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>G1: CHECK BRAKE PADS</b>	
	<p><b>1</b> Check the brake pads for wear, contamination, correct installation, damage and type.</p>
	<p>Has a concern been identified?</p> <p><b>Yes</b> Correctly install or install new brake pads as required. REFER to: <a href="#">Brake Pads - Vehicles With: Standard Brakes</a> (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation), <a href="#">Brake Pads - Vehicles With: High Performance Brakes</a> (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation), <a href="#">Brake Pads</a> (206-04 Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation), Brake Pads - Vehicles With: High Performance Brakes (206-04, Removal and Installation). Re-test the system for normal operation.</p> <p><b>No</b> <a href="#">GO to G2.</a></p>

### G2: CHECK VACUUM

	<p><b>1</b> Disconnect the vacuum hose from the brake booster.</p> <p><b>2</b> Connect a vacuum/pressure tester to the vacuum hose.</p> <p><b>3</b> Run the engine at normal operating temperature.</p> <p><b>4</b> Record the vacuum reading.</p>
	<p>Is the reading 40.5 kPa (12 in-Hg) or greater?</p> <p><b>Yes</b> <a href="#">GO to G3.</a></p> <p><b>No</b> Locate and rectify the source of low vacuum. Re-test the system for normal operation.</p>

### G3: INSPECT SYSTEM

	<p><b>1</b> Switch the engine off.</p> <p><b>2</b> Reconnect the vacuum hose.</p> <p><b>3</b> Inspect the brake booster, rubber grommet, and all vacuum plumbing for cracks, holes, damaged connections, or missing clamps.</p> <p><b>4</b> Pump the brake pedal several times to exhaust the vacuum. Push down on the brake pedal and hold.</p>
	<p>Does the brake pedal move down when the engine is started?</p> <p><b>Yes</b> Vacuum system is OK.</p> <p><b>No</b> <a href="#">GO to G4.</a></p>

### G4: CHECK POWER BRAKE BOOSTER VALVE

	<p><b>1</b> Check the brake booster valve. For additional information, refer to Brake Booster component test in this section.</p>
	<p>Is the power brake booster valve OK?</p> <p><b>Yes</b> Check the brake booster. For additional information, refer to Brake Booster component test in this section. Install a new brake booster as required. REFER to: <a href="#">Brake Booster</a> (206-07 Power Brake Actuation, Removal and Installation), Brake Booster - RHD (206-07, Removal and Installation). Re-test the system for normal operation.</p> <p><b>No</b> Install a new brake booster valve. Re-test the system for normal operation.</p>

### PINPOINT TEST H : BRAKE LOCKUP DURING LIGHT BRAKE PEDAL FORCE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>H1: TEST BRAKE LOCKUP</b>	
	<p><b>1</b> Road test the vehicle and apply the brake pedal lightly.</p>
	<p>Do the brakes lockup?</p> <p><b>Yes</b> <a href="#">GO to H2.</a></p> <p><b>No</b> No action required, vehicle is OK.</p>
<b>H2: INSPECT BRAKE PADS</b>	
	<p><b>1</b> Inspect brake pads for contamination, correct installation, damage and type.</p>



	<p>Has a concern been identified?</p> <p><b>Yes</b></p> <p>Correctly install or install new brake pads as required. REFER to:  <a href="#">Brake Pads - Vehicles With: Standard Brakes</a> (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation),  <a href="#">Brake Pads - Vehicles With: High Performance Brakes</a> (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation),  <a href="#">Brake Pads</a> (206-04 Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation),            Brake Pads - Vehicles With: High Performance Brakes (206-04, Removal and Installation).</p> <p>Re-test the system for normal operation.</p> <p><b>No</b></p> <p><a href="#">GO to H3.</a></p>
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**H3: INSPECT BRAKE CALIPERS**

	<p><b>1</b> Inspect brake calipers for binding, leaking or sticking.</p>
	<p>Has a concern been identified?</p> <p><b>Yes</b></p> <p>Correctly install or install new brake calipers as required. REFER to:  <a href="#">Brake Caliper - Vehicles With: Standard Brakes</a> (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation),  <a href="#">Brake Caliper - Vehicles With: High Performance Brakes</a> (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation),  <a href="#">Brake Caliper</a> (206-04 Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation),            Brake Caliper - Vehicles With: High Performance Brakes (206-04, Removal and Installation).</p> <p>Re-test the system for normal operation.</p> <p><b>No</b></p> <p>No action required, vehicle is OK.</p>

**PINPOINT TEST I : BRAKES DRAG**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>I1: ROAD TEST VEHICLE</b>	
	<p><b>1</b> Road test the vehicle and apply the brakes.</p>
	<p>Are the brakes functioning correctly?</p> <p><b>Yes</b></p> <p>No action required, vehicle is OK.</p> <p><b>No</b></p> <p><a href="#">GO to I2.</a></p>
<b>I2: CHECK BRAKE CALIPERS</b>	
	<p><b>1</b> Check the front and rear calipers pistons and pins for binding, leaking or sticking.</p>
	<p>Do the disc brake caliper pistons and pins bind, leak or stick?</p> <p><b>Yes</b></p> <p>Inspect the brake calipers and parking brake cables. Install new components as required. Re-test the system for normal operation.</p> <p><b>No</b></p> <p><a href="#">GO to I3.</a></p>
<b>I3: CHECK BRAKE BOOSTER</b>	
	<p><b>1</b> Check the brake booster connecting rod alignment and travel.</p>
	<p>Is the connecting rod OK?</p> <p><b>Yes</b></p> <p>Vehicle is OK.</p> <p><b>No</b></p> <p>Install a new brake booster as required. REFER to:  <a href="#">Brake Booster</a> (206-07 Power Brake Actuation, Removal and Installation),            Brake Booster - RHD (206-07, Removal and Installation).</p> <p>Re-test the system for normal operation.</p>

**PINPOINT TEST J : EXCESSIVE/ERRATIC BRAKE PEDAL TRAVEL**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>J1: TEST ON ROUGH ROAD</b>	
	<p><b>1</b> Road test the vehicle on rough road conditions.</p> <p><b>2</b> Apply the brakes slowly.</p>
	<p>Is the brake pedal effort and brake pedal travel normal?</p> <p><b>Yes</b></p> <p>No action required, vehicle is OK.</p> <p><b>No</b></p> <p><a href="#">GO to J2.</a></p>
<b>J2: CHECK BRAKE FLUID LEVEL</b>	
	<p><b>1</b> Check the brake master cylinder reservoir fluid level.</p>
	<p>Is the fluid level OK?</p> <p><b>Yes</b></p> <p><a href="#">GO to J3.</a></p> <p><b>No</b></p> <p>Check brake master cylinder reservoir sealing points. For additional information, refer to Brake master cylinder component test in this section. Add brake fluid and bleed the brake system. REFER to: <a href="#">Brake System Bleeding</a> (206-00 Brake System - General Information, General Procedures). Re-test the system for normal operation.</p>
<b>J3: CHECK BRAKE PEDAL RESERVE</b>	
	<p><b>1</b> Run engine at idle speed.</p>

	<b>2</b> Apply the brake pedal lightly three or four times.
	<b>3</b> Wait 15 seconds for the vacuum to replenish.
	<b>4</b> Push down on the brake pedal until it stops moving downward or an increased resistance to the brake pedal travel occurs.
	<b>5</b> Hold the brake pedal in the applied position while increasing the engine speed to 2000 revs/min.
	<b>6</b> Release the accelerator pedal.
	Does the brake pedal move downward as the engine speed returns to idle? <b>Yes</b> <a href="#">GO to J4.</a> <b>No</b> Check the vacuum to the brake booster.
<b>J4: CHECK THE FRONT WHEEL BEARING ASSEMBLY</b>	
	<b>1</b> Check the front wheel bearing assembly.
	Are the front wheel bearings loose/damaged? <b>Yes</b> Tighten to specification or install a new front wheel bearing as required. REFER to: <a href="#">Front Wheel Bearing and Wheel Hub</a> (204-01 Front Suspension, Removal and Installation). Re-test the system for normal operation. <b>No</b> Check the front brake discs for thickness variances.

### PINPOINT TEST K : SLOW OR INCOMPLETE BRAKE PEDAL RETURN

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>K1: CHECK FOR BRAKE PEDAL RETURN</b>	
	<b>1</b> Run the engine at idle while making several brake applications.
	<b>2</b> Pull the brake pedal rearward with approximately 44.5 N (10lb) force.
	<b>3</b> Release the brake pedal and measure the distance to the toe board.
	<b>4</b> Make a hard brake application.
	<b>5</b> Release the brake pedal and measure the brake pedal to toe board distance. The brake pedal should return to its original position.
	Does the brake pedal return to its original position? <b>Yes</b> No action required, vehicle is OK. <b>No</b> <a href="#">GO to K2.</a>
<b>K2: CHECK FOR BRAKE PEDAL BINDING</b>	
	<b>1</b> Disconnect the brake booster from the brake pedal. Check the brake pedal to ensure free operation.
	Is the brake pedal operating freely? <b>Yes</b> Install a new brake booster as required. REFER to: <a href="#">Brake Booster</a> (206-07 Power Brake Actuation, Removal and Installation), <a href="#">Brake Booster - RHD</a> (206-07, Removal and Installation). Re-test the system for normal operation. <b>No</b> Repair or install new brake pedal. Re-test the system for normal operation.

## Component Tests

### Brake Booster

- 1.** Check all hoses and connections. All unused vacuum connectors should be capped. Hoses and their connections should be correctly secured and in good condition with no holes and no collapsed areas. Inspect the valve on the brake booster for damage.
- 2.** Check the hydraulic brake system for leaks or low fluid.
- 3.** With the automatic transmission in PARK, stop the engine and apply the parking brake. Pump the brake pedal several times to exhaust all vacuum in the system. With the engine switched off and all vacuum in the system exhausted, apply the brake pedal and hold it down. Start the engine. If the vacuum system is operating, the brake pedal will tend to move downward under constant foot pressure. If no motion is felt, the vacuum booster system is not functioning.
- 4.** Remove the vacuum hose from the brake booster. Manifold vacuum should be available at the brake booster end of the hose with the engine at idle speed and the automatic transmission in PARK. Make sure that all unused vacuum outlets are correctly capped, hose connectors are correctly secured and vacuum hoses are in good condition. When it is established that manifold vacuum is available to the brake booster, connect the vacuum hose to the brake booster and repeat Step 3. If no downward movement of the brake pedal is felt, install a new brake booster.
- 5.** Operate the engine for a minimum of 10 seconds at a fast idle. Stop the engine and allow the vehicle to stand for 10 minutes. Then, apply the brake pedal with approximately 89 N (20lb) of force. The pedal feel (brake application) should be the same as that noted with the engine running. If the brake pedal feels hard (no power assist), install a new valve and then repeat the test. If the brake pedal still feels hard, install a new brake booster. If the brake pedal movement feels spongy, bleed the brake system.  
REFER to: [Brake System Bleeding](#) (206-00 Brake System - General Information, General Procedures).

### Brake Master Cylinder

Usually, the first and strongest indicator of anything wrong in the brake system is a feeling through the brake pedal. In diagnosing the condition of the brake master cylinder, check pedal feel as evidence of a brake concern. Check for brake warning lamp illumination and the brake fluid level in the brake master cylinder reservoir.

#### Normal Conditions

The following conditions are considered normal and are not indications that the brake master cylinder is in need of repair.

- Modern brake systems are designed to produce a pedal effort that is not as hard as in the past. Complaints of light pedal efforts should be compared to the pedal efforts of another vehicle of the same model and year.
- The fluid level will fall with brake pad wear.

#### Abnormal Conditions

Changes in the brake pedal feel or brake pedal travel are indicators that something could be wrong in the brake system. The diagnostic procedure and techniques use brake pedal feel, warning indicator illumination and low brake fluid level as indicators to diagnosing brake system concerns. The following conditions are considered abnormal and indicate that the brake master cylinder is in need of repair:

- **NOTE:** Prior to carrying out any diagnosis, make sure the brake system warning indicator is functional.
- Brake pedal goes down fast. This could be caused by an external or internal leak.
- Brake pedal goes down slowly. This could be caused by an internal or external leak.
- Brake pedal is low or feels spongy. This condition may be caused by no fluid in the brake master cylinder, reservoir cap vent holes clogged or air in the hydraulic system.
- Brake pedal effort is excessive. This may be caused by a bind or obstruction in the pedal/linkage, a faulty non-return valve, booster or insufficient booster vacuum.
- Rear brakes lock up during light pedal force. This may be caused by damaged brake pads, a partially applied parking brake, a damaged ABS sensor or bearing failure.
- Brake pedal effort erratic. This condition could be caused by the brake booster or incorrectly installed brake pads.
- Brake warning indicator is on. This may be caused by low fluid level or float assembly damaged.

#### Non Pressure Leaks

Any reduced fluid volume in the brake master cylinder reservoir may be caused by two types of none pressure external leaks.

Type 1: An external leak may occur at the brake master cylinder reservoir cap because of incorrect positioning of the gasket and cap. Reposition cap and gasket.

Type 2: An external leak may occur at the brake master cylinder reservoir mounting seals. Repair such a leak by installing new seals and make sure that the brake master cylinder reservoir retaining bolt is correctly installed.

# Brake System - General Information - Brake Disc Runout Check

General Procedures

## Check

1. Remove the wheel and tire.  
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
2. Install all wheel nuts and tighten equally to 20 Nm (15 lb.ft).
  - Make sure that the brake disc is fully seated against the hub face.
3. Install a dial test indicator gauge and holding fixture to a suitable mounting point.
4. **NOTE:** If the runout is outside specification, check the hub face runout.

Using the dial test indicator, measure the inner and outer faces of the brake disc.

For additional information, refer to: Specifications (206-03, Specifications) / Specifications (206-04, Specifications).

1. Position the gauge so that it contacts the disc 10 mm (0.4 in) from the outer edge.
  2. Slowly rotate the hub/disc assembly. Note the reading.
5. If a front hub runout check is required, remove the front brake disc.  
For additional information, refer to: Brake Disc - Vehicles With: Standard Brakes (206-03 Front Disc Brake, Removal and Installation).
  6. If a rear hub runout check is required, remove the rear brake disc.  
For additional information, refer to: Brake Disc - Vehicles With: Standard Brakes (206-04 Rear Disc Brake, Removal and Installation).
7. **NOTE:** The hub surface should be free from dirt and corrosion. Do not use abrasive cloths to clean hub faces.

Using the dial test indicator, measure the hub face runout.

1. Position the gauge so that it contacts the mounting tube between the stud and the chamfer.
  2. Slowly rotate the hub and note the runout. For additional information, refer to the specification chart.
- If the front hub runout exceeds the specifications, install a new hub, brake disc and recheck.  
For additional information, refer to: Wheel Bearing and Wheel Hub (204-01 Front Suspension, Removal and Installation).  
If the rear hub runout exceeds the specifications, install a new hub, brake disc and recheck.  
For additional information, refer to: Rear Wheel Bearing (204-02 Rear Suspension, Removal and Installation).
8. If the front hub face is within specification, install a new brake disc.  
For additional information, refer to: Brake Disc - Vehicles With: Standard Brakes (206-03 Front Disc Brake, Removal and Installation).  
If the rear hub face is within specification, install a new disc.  
For additional information, refer to: Brake Disc - Vehicles With: Standard Brakes (206-04 Rear Disc Brake, Removal and Installation).
  9. Install the wheel and tire.  
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

# Brake System - General Information - Brake System Bleeding

General Procedures

• CAUTIONS:



The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.



Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

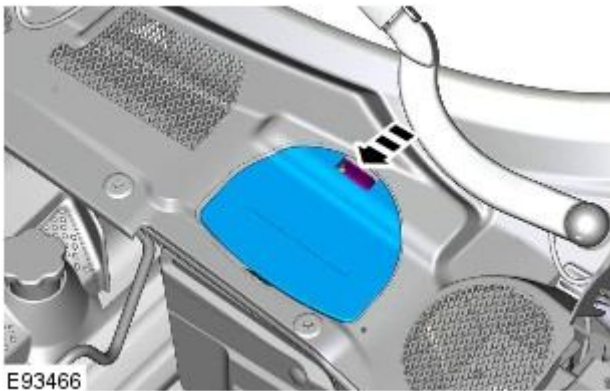
• NOTE:

All vehicles

- WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- Check that the brake fluid lines are secure and that there are no signs of a brake fluid leak. If a brake fluid leak is detected, investigate and rectify the cause of the leak before bleeding the brakes.
- Remove the brake master cylinder cover.
  - Carefully release the clip.

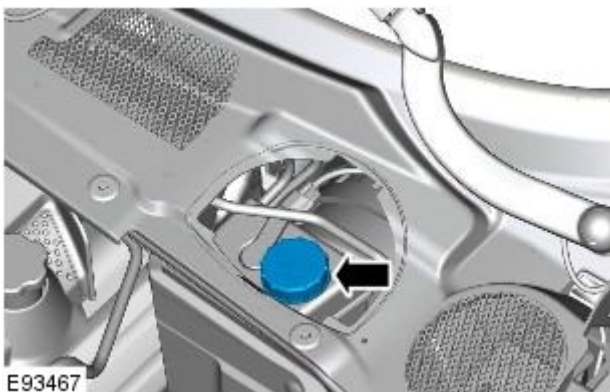


- WARNING:** Do not allow dirt or foreign liquids to enter the reservoir. Use only new brake fluid of the correct specification from airtight containers. Do not mix brands of brake fluid as they may not be compatible.

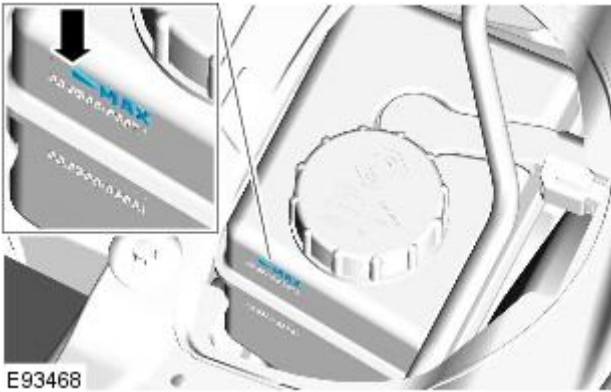


**CAUTION:** Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

Remove the brake fluid reservoir cap.



5. Fill the brake fluid reservoir to the MAX mark.

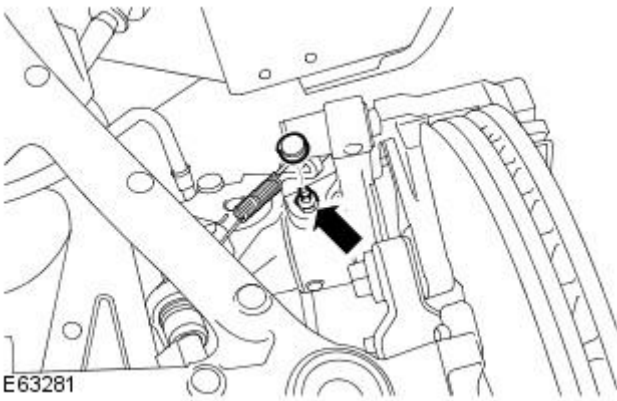



All vehicles

6. Install the bleed tube to the right hand rear brake caliper bleed screw and immerse the free end of the bleed tube in a bleed jar, containing a small quantity of approved brake fluid.

- Remove the bleed screw caps.


7. Loosen the bleed screw by one-half to three-quarters of a turn.



8.  CAUTION: The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.

• NOTE: If the bleed tube used, does not have a one way valve the bleed screw will need to be closed before the brake pedal is returned to the rest position. Then opened again and the procedure repeated for each pedal application.

With assistance, depress the brake pedal steadily through its full stroke and allow it to return to the rest position. Repeat the procedure until brake fluid, clean and air-free flows into the bleed jar.

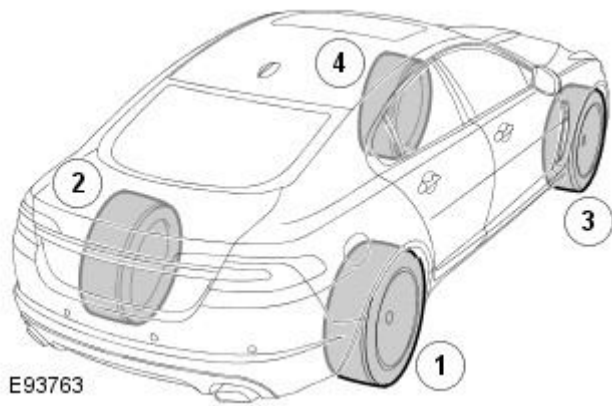
9.  CAUTION: Make sure the bleed screw cap is installed after bleeding. This will prevent corrosion to the bleed screw.

With the brake pedal fully depressed, tighten the bleed screw.

- Vehicles with standard brakes: Tighten the front caliper bleed screw to 8 Nm.
- Vehicles with high performance brakes: Tighten the front caliper bleed screw to 14 Nm.
- Tighten the rear bleed screw to 14 Nm.

10. Fill the brake fluid reservoir to the MAX mark.

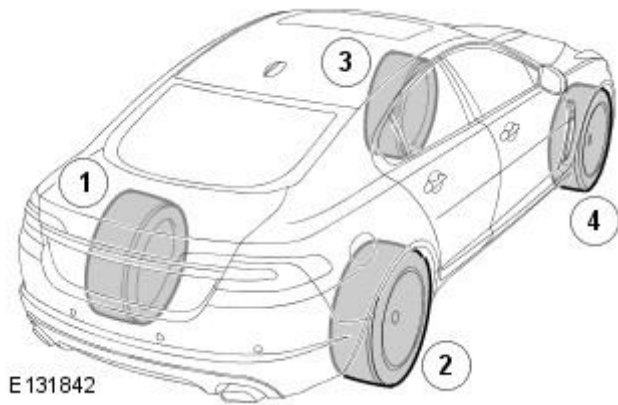
Left-hand drive vehicles



**11.**  **WARNING:** Braking efficiency may be seriously impaired if an incorrect bleed sequence is used.

Repeat the brake bleeding procedure for each brake caliper, following the above sequence.

#### Right-hand drive vehicles



**12.**  **WARNING:** Braking efficiency may be seriously impaired if an incorrect bleed sequence is used.

Repeat the brake bleeding procedure for each brake caliper, following the above sequence.

#### All vehicles

13. Fill the brake fluid reservoir to the MAX mark.
14. Apply the brakes and check for leaks.
15. Install the brake fluid reservoir cap.
16. Install the brake master cylinder cover.
  - Carefully secure the clip.

## Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 -

### Lubricants, Fluids, Sealers and Adhesives



**CAUTION:** Do not use brake fluid ITT Super Dot 4 on 2006my vehicles onwards. Failure to follow this instruction may result in damage to the vehicle.

• **NOTE:** Brake fluid ITT Super Dot 4 has now been superseded by Shell ESL Super Dot 4 which is the Jaguar recommended brake fluid. Shell ESL Super Dot 4 can be used on all model years.

Item	Specification
Brake fluid	Shell ESL Dot 4

### Torque Specifications

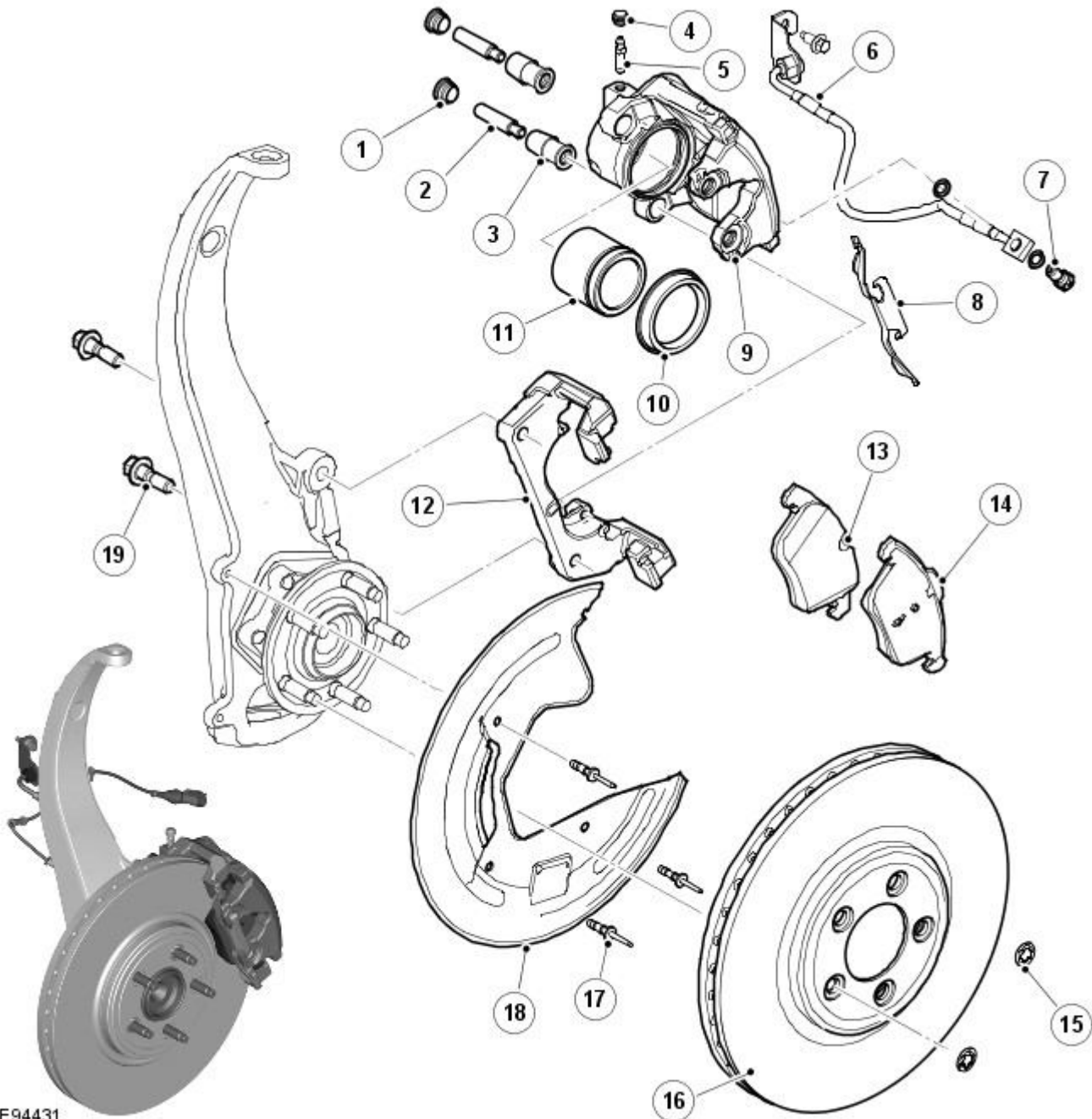
Description	Nm	lb-ft	lb-in
Brake caliper anchor plate retaining bolts	115	85	-
Brake caliper retaining bolts - Vehicles with high performance brakes	58	43	-
Brake caliper retaining bolts - Vehicles with standard brakes	28	21	-
Brake hose retaining bolt	38	28	-



# Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Front Disc Brake - Component Location

Description and Operation

Component Location - Standard Brakes



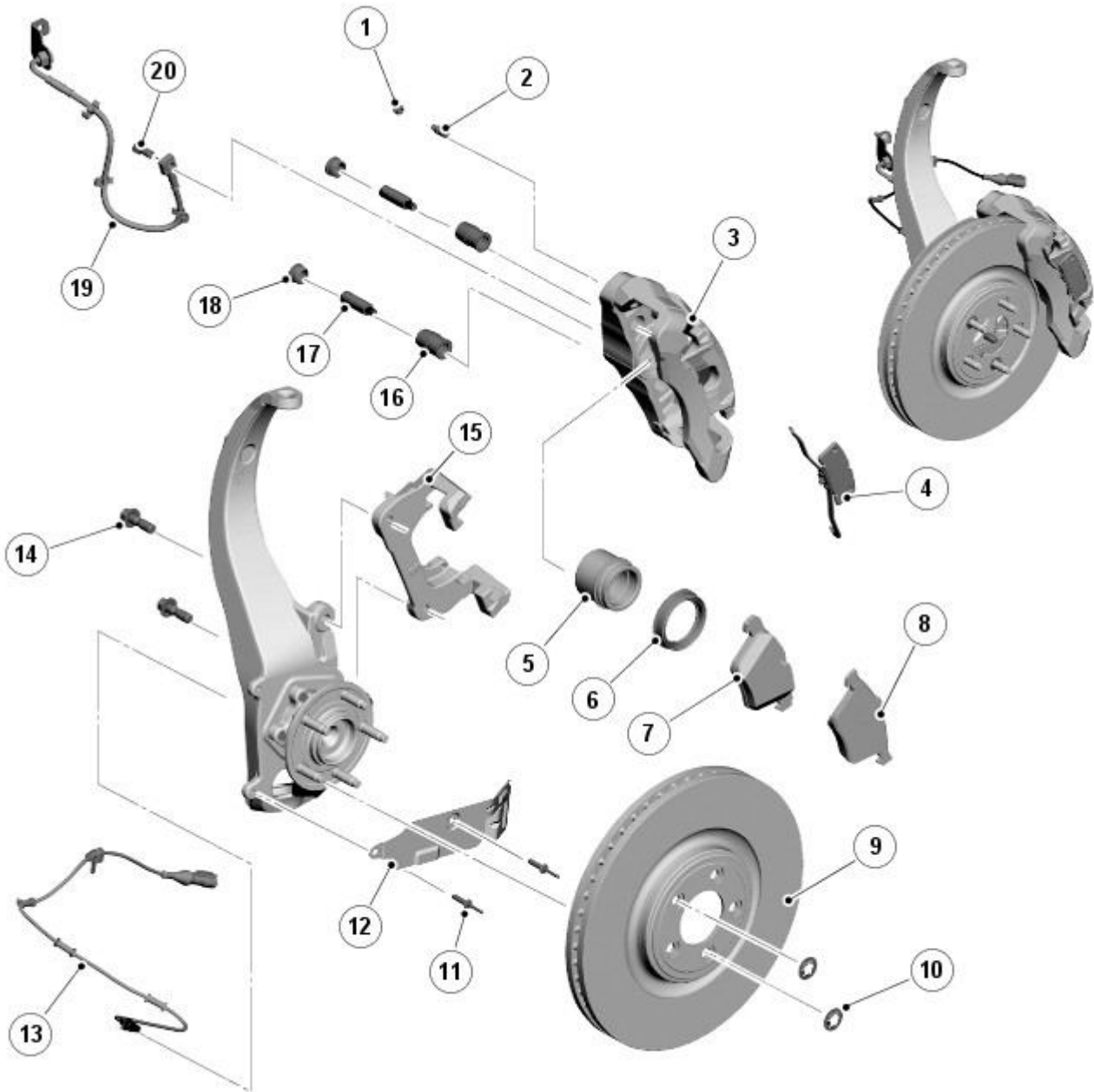
E94431

## ItemDescription

1	Guide pin dust cover (2 off)
2	Guide pin (2 off)
3	Guide pin bush (2 off)
4	Bleed screw dust cap
5	Bleed screw
6	Brake hose
7	Bolt - brake hose to caliper
8	Anti-rattle spring
9	Brake caliper housing
10	Piston dust cover
11	Piston
12	Caliper carrier

13	Inboard brake pad
14	Outboard brake pad
15	Retaining washers (2 off)
16	Brake disc
17	Rivets (3 off)
18	Brake dust shield
19	Caliper carrier bolts (2 off)

Component Location - Performance Brakes



E94432

Item	Description
1	Bleed screw dust cap
2	Bleed screw
3	Brake caliper housing
4	Anti-rattle spring
5	Piston
6	Piston dust cover
7	Inboard brake pad
8	Outboard brake pad
9	Brake disc
10	Retaining washers (2 off)

11	Rivets (2 off)
12	Brake heat shield
13	ABS (anti-lock brake system) sensor cable
14	Caliper carrier bolts (2 off)
15	Caliper carrier
16	Guide pin bush (2 off)
17	Guide pin (2 off)
18	Guide pin dust cover (2 off)
19	Brake hose
20	Bolt - brake hose to caliper

# Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Front Disc Brake - Overview

Description and Operation

## Overview

### Standard Brakes

The standard front braking system used on naturally aspirated vehicles features 326 mm (12.83 in.) diameter x 30 mm (1.18 in.) thick ventilated brake discs and cast iron, single piston, sliding calipers. The brake disc is also manufactured from cast iron. The brake disc is retained on the wheel hub by two washers and the wheel nuts.

The caliper is mounted within a fixed carrier that is secured to the front wheel knuckle with two bolts. When hydraulic pressure is supplied to the caliper, the piston extends to force the inner pad against the brake disc. The caliper reacts and slides along two guide pins to bring the outer pad into contact with the brake disc.

Each inboard brake pad is installed with a pressed steel anti-rattle spring. There is no wear indicator installed in the brake pads.

### Performance Brakes

The performance front braking system used on vehicles with supercharger features 355 mm (13.98 in.) diameter x 32 mm (1.26 in.) thick ventilated brake discs and composite aluminum and cast iron, single piston and sliding calipers. The brake disc is manufactured from cast iron. The brake disc is retained on the wheel hub by two washers and the wheel nuts.

The caliper is mounted within a fixed carrier that is secured to the front wheel knuckle with two bolts. When hydraulic pressure is supplied to the caliper, the piston extends to force the inner pad against the brake disc. The caliper reacts and slides along two guide pins to bring the outer pad into contact with the brake disc.

Each inboard brake pad is installed with a pressed steel anti-rattle spring. There is no wear indicator installed in the brake pads.

## **Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Front Disc Brake**

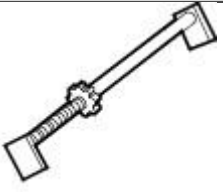
Diagnosis and Testing

For additional information.

REFER to: [Brake System](#) (206-00 Brake System - General Information, Diagnosis and Testing).

# Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Brake Caliper Vehicles With: Standard Brakes

Removal and Installation

Special Tool(s)	
 JDS9013	Brake pedal hold down tool
	JDS9013

## Removal

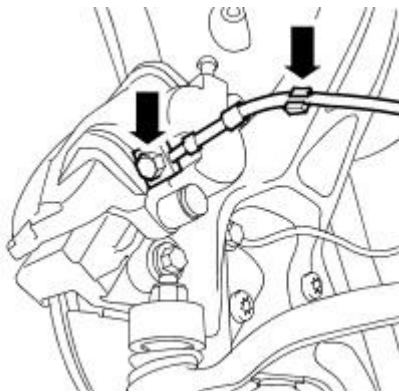


**CAUTION:** Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

- WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- Remove the LH front wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).



E60620

- CAUTION:** Always plug any open connections to prevent contamination.

• **NOTE:** To prevent the loss of brake fluid, using the special tool apply the brake pedal and set to 40mm ( 1.6 in ) below the rest position.

• **NOTE:** Left-hand shown, right-hand similar.

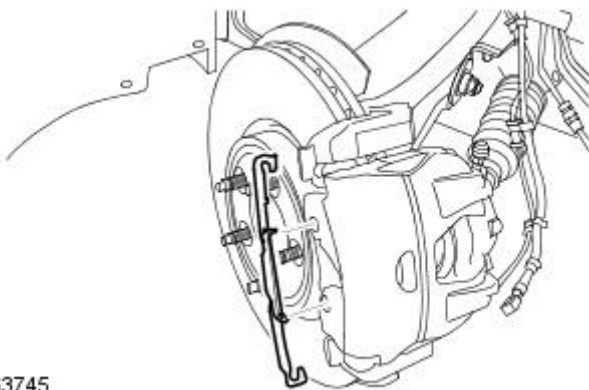
Disconnect the brake hose from the brake caliper.

- Using the special tool, press and hold the brake pedal.
- Remove and discard the two sealing washers.

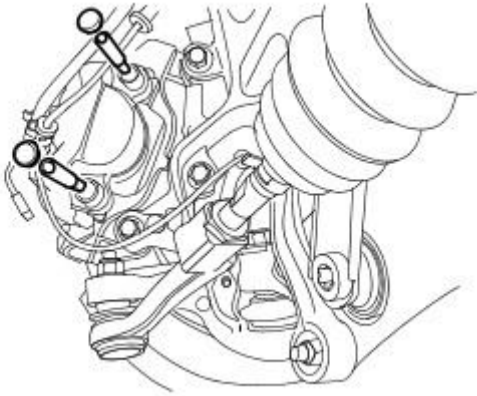
- NOTE:** Left-hand shown, right-hand similar.

Remove the LH anti-rattle spring.

- Release the 2 clips.



E63745



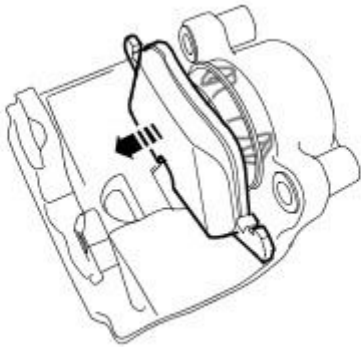
E63746

5.  **CAUTION:** Do not allow the brake caliper to hang on the brake hose.

• **NOTE:** Left-hand shown, right-hand similar.

Remove the LH brake caliper.

- Remove the 2 access plugs.
- Release the 2 brake caliper guide pins.
- Tie the brake caliper aside.

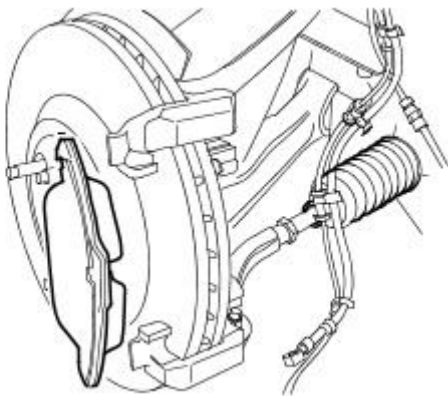


E63747

6. **NOTE:** Left-hand shown, right-hand similar.

Release the inboard brake pad from the caliper.

- Release the clip.



E63748

7. **NOTE:** Left-hand shown, right-hand similar.

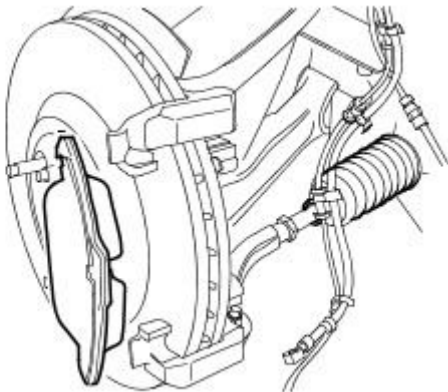
Remove the outboard brake pad.

## Installation

1. **NOTE:** Left-hand shown, right-hand similar.

Install the outboard brake pad.

- Using a suitable tool, fully retract the brake caliper piston.
- Clean the component mating faces.

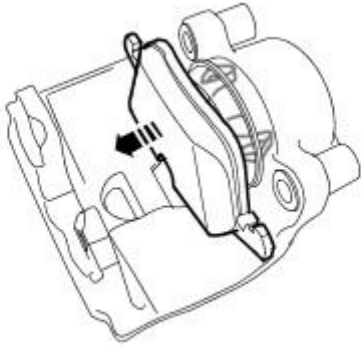


E63748

**2. NOTE: Left-hand shown, right-hand similar.**

Install the inboard brake pad.

- Clean the component mating faces.

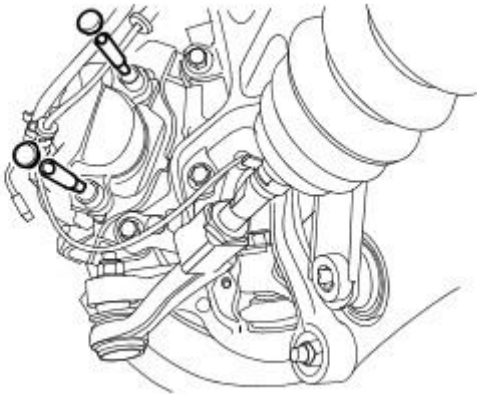


E63747

**3. NOTE: Left-hand shown, right-hand similar.**

Install the brake caliper.

- Tighten the guide pins to 28 Nm.
- Install the access plugs.

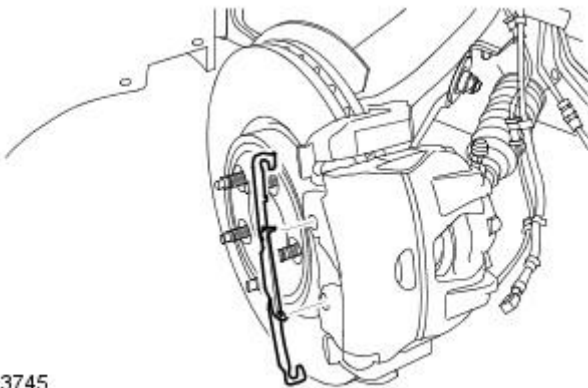


E63746

**4. NOTE: Left-hand shown, right-hand similar.**

Install the anti-rattle spring.

- Carefully secure the clips.

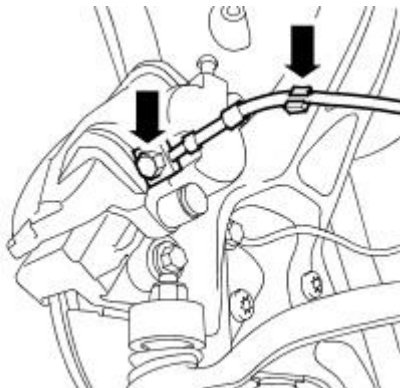


E63745

**5. NOTE: Left-hand shown, right-hand similar.**

Connect the brake hose to the brake caliper.

- Install new sealing washers.
- Tighten the union to 38 Nm.



E60620

**6. Bleed the brake system.**

For additional information, refer to: [Brake System Bleeding](#) (206-00 Brake System - General Information, General Procedures).

**7. Install the front wheels and tires.**

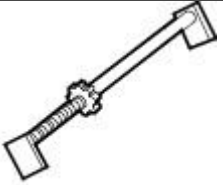
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).





# Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Brake Caliper Vehicles With: High Performance Brakes

Removal and Installation

Special Tool(s)	
 JDS9013	Brake pedal hold down tool
	JDS9013

## Removal



**CAUTION:** Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

- WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- Remove the front wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

- CAUTION:** Always plug any open connections to prevent contamination.

- NOTE:** To prevent the loss of brake fluid, using the special tool apply the brake pedal and set to 40mm ( 1.6 in ) below the rest position.

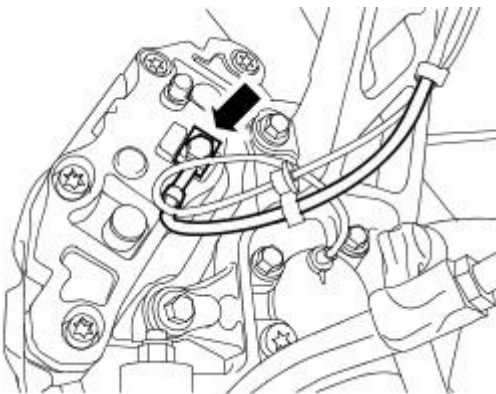
- NOTE:** Left-hand shown, right-hand similar.

Disconnect the brake hose from the brake caliper.

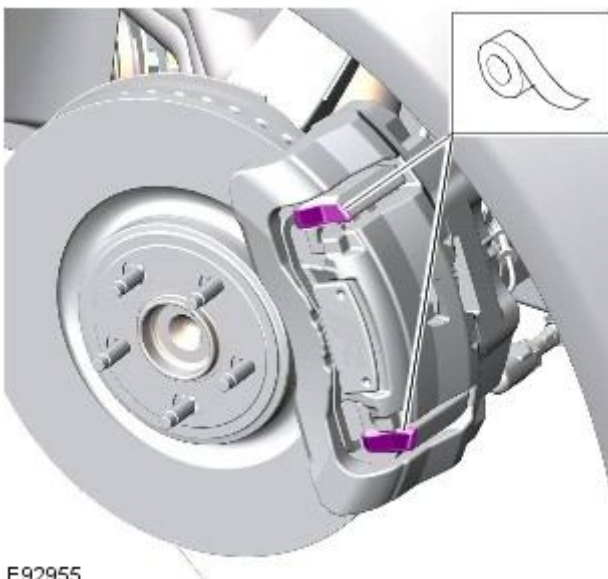
- Using the special tool, press and hold the brake pedal.
- Remove and discard the two sealing washers.

- NOTE:** Left-hand shown, right-hand similar.

Apply protective tape to the caliper.

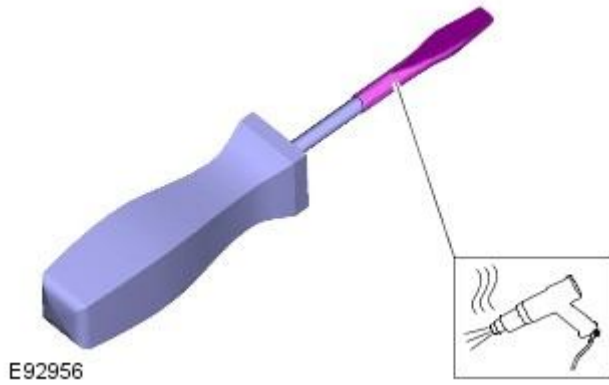



60661



E92955

5. Apply heatshrink or protective tape to the end of the screwdriver.

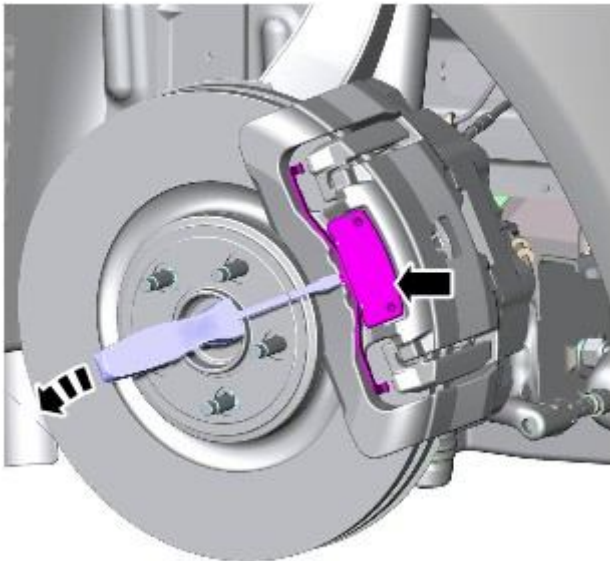


6.  CAUTION: Removal of the clips is a delicate procedure, damage will occur if any force is used.

- NOTE: Left-hand shown, right-hand similar.

Remove the anti-rattle spring.

- Lever the anti-rattle spring in the center of the spring until either side is released.

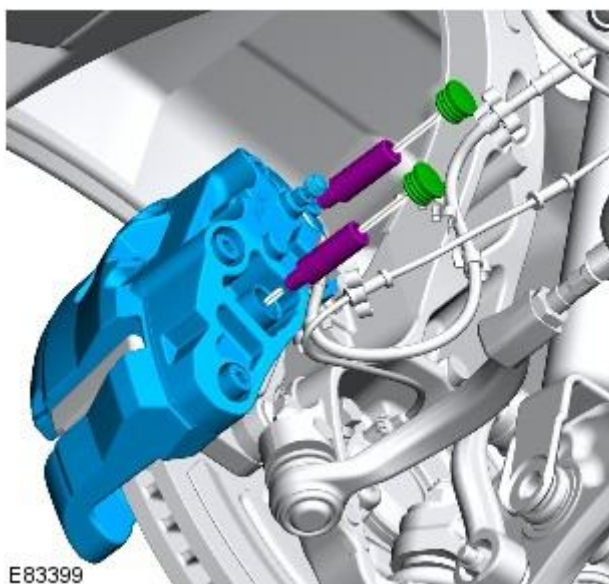


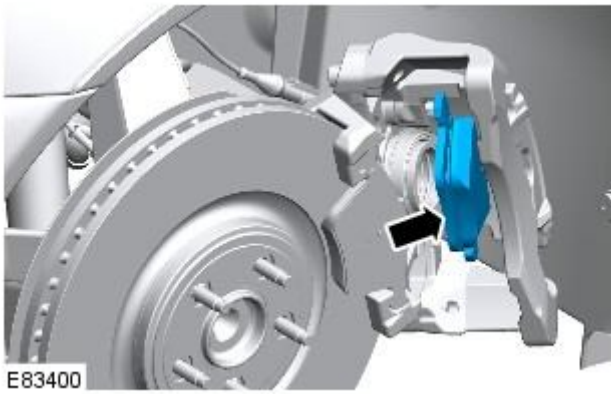
7.  CAUTION: Do not allow the brake caliper to hang on the brake hose.

- NOTE: Left-hand shown, right-hand similar.

Remove the brake caliper.

- Remove the 2 access plugs.
- Remove the 2 caliper guide pins.
- Tie the brake caliper aside.

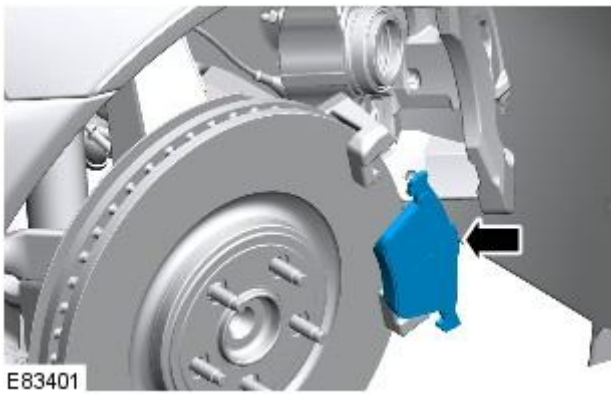




8. NOTE: Left-hand shown, right-hand similar.

Release the inboard brake pad from the caliper.

- Release the clip.



9. NOTE: Left-hand shown, right-hand similar.

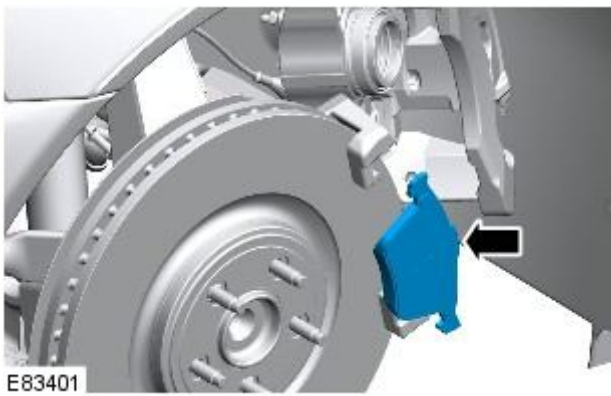
Remove the outboard brake pad.

## Installation

1. NOTE: Left-hand shown, right-hand similar.

Install the outboard brake pad.

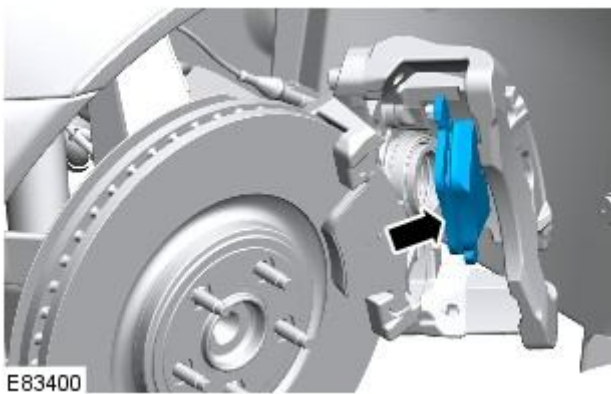
- Using a suitable tool, fully retract the brake caliper pistons.
- Clean the component mating faces.

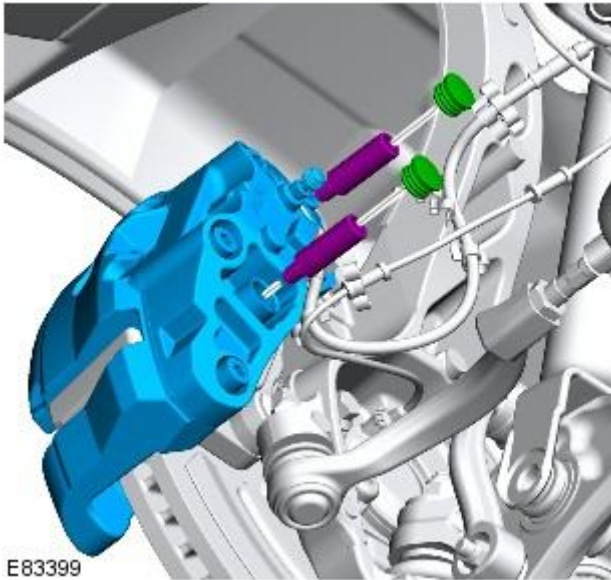


2. NOTE: Left-hand shown, right-hand similar.

Install the inboard brake pad.

- Clean the component mating faces.



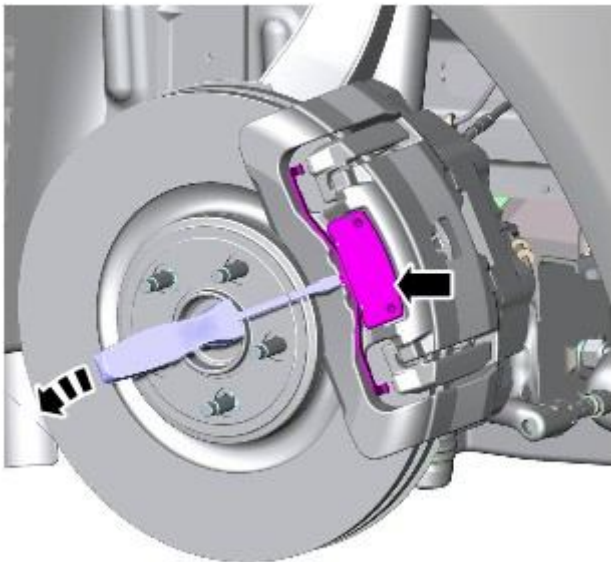


E83399

**3. NOTE: Left-hand shown, right-hand similar.**

Install the brake caliper.

- Tighten the guide pins to 58 Nm (43 lb.ft).
- Install the access plugs.

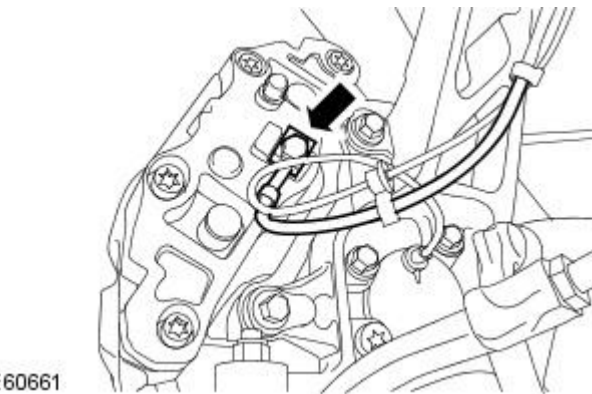


E92957

**4. NOTE: Left-hand shown, right-hand similar.**

Install the anti-rattle spring.

- Secure the bottom arm of the anti-rattle spring under the bottom anchor bracket of the caliper.
- Compress the upper spring arm into the correct position, under the upper anchor bracket, whilst retaining the logo plate.
- Using the screw-driver, tap the central locating tag into the locked position.



E60661

**5. NOTE: Left-hand shown, right-hand similar.**

Connect the brake hose to the brake caliper.

- Install new sealing washers.
- Tighten the union to 38 Nm (28 lb.ft).

**6. Bleed the brake system.**

For additional information, refer to: [Brake System Bleeding](#) (206-00 Brake System - General Information, General Procedures).

**7. Install the front wheels and tires.**

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).



# Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Brake Disc Vehicles With: Standard Brakes

Removal and Installation

## Removal



**CAUTION:** Brake discs must be renewed in pairs, unless one disc requires changing before 1000 miles (1600 kilometers) from new.



**1. WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

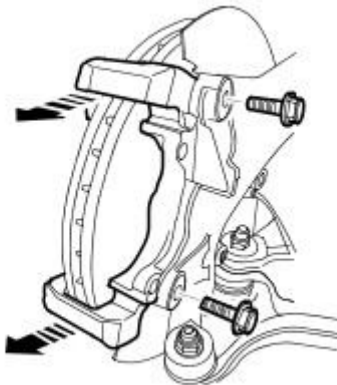
Raise and support the vehicle.

**2.** Remove the front brake pads.  
For additional information, refer to: [Brake Pads - Vehicles With: Standard Brakes](#) (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

**3. NOTE:** LH illustration shown, RH is similar.

Remove the brake caliper anchor bracket.

- Remove and discard the 2 bolts.

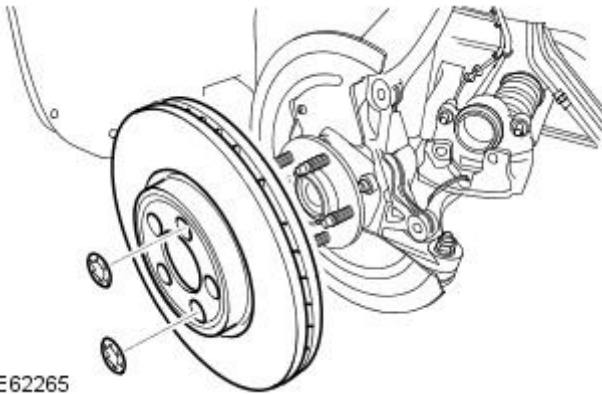


E62264

**4. NOTE:** LH illustration shown, RH is similar.

Remove the brake disc.

- Remove the 2 clips.



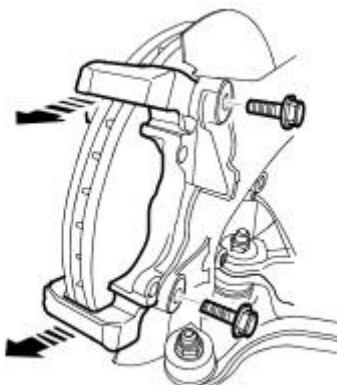
E62265

## Installation

**3.** Install the brake pads.  
For additional information, refer to: [Brake Pads - Vehicles With: Standard Brakes](#) (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).  
Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

Install the brake caliper anchor bracket.

- Clean the component mating faces.
- Tighten the component mating faces.
- Secure the clips.



E62264


# Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Brake Disc Vehicles With: High Performance Brakes

Removal and Installation

## Removal

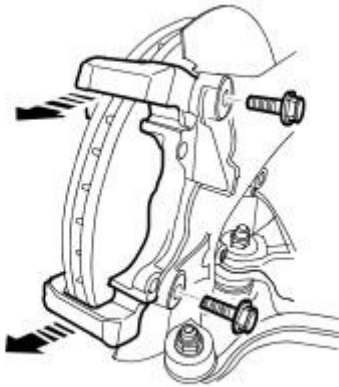


**CAUTION:** Brake discs must be renewed in pairs, unless one disc requires changing before 1000 miles (1600 kilometers) from new.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

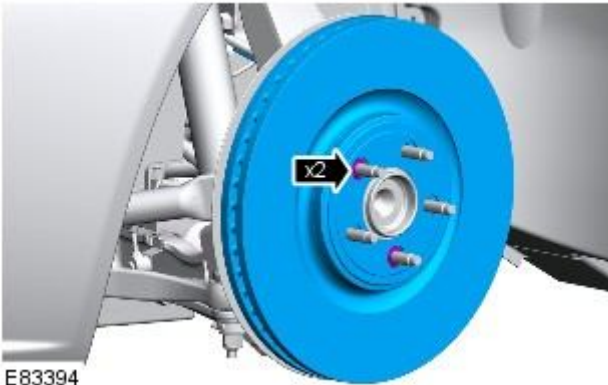
Raise and support the vehicle.

2. Remove the front brake pads.  
For additional information, refer to: [Brake Pads - Vehicles With: High Performance Brakes](#) (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
3. Remove the brake caliper anchor bracket.
  - Remove and discard the 2 bolts.

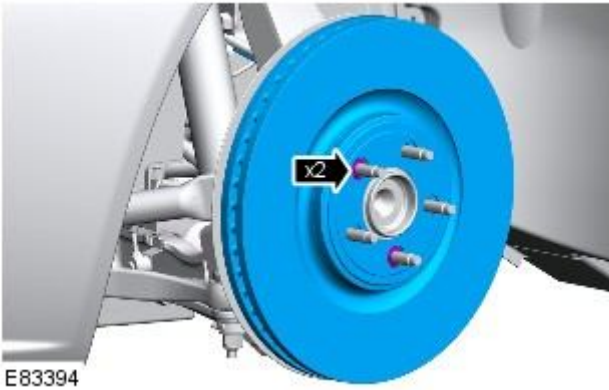


4. Remove the brake disc.


- Remove the 2 clips.



## Installation

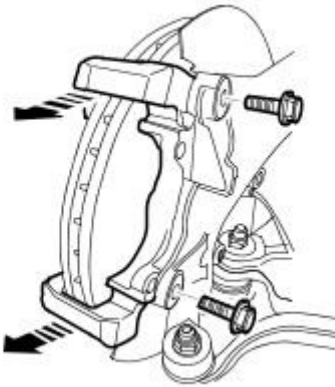


E83394


1.  **WARNING:** Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

Install the brake disc.

- Clean the component mating faces.
- Secure the clips.



E62264

2.  **CAUTION:** Make sure that new bolts are installed.

Install the brake caliper anchor bracket.

- Clean the component mating faces.
- Tighten the bolts to 115 Nm.

3. Install the brake pads.

For additional information, refer to: [Brake Pads - Vehicles With: High Performance Brakes](#) (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).



# Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Brake Disc Shield Vehicles With: Standard Brakes

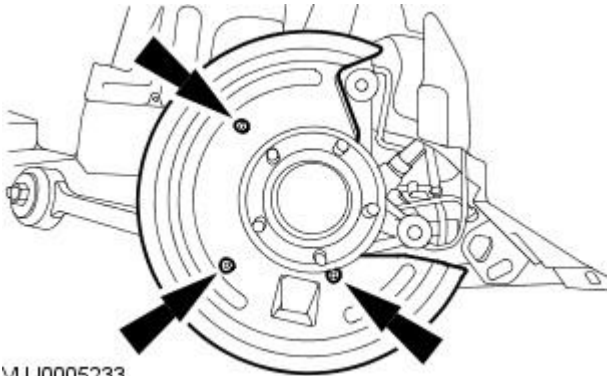
Removal and Installation

## Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the brake disc.  
For additional information, refer to: [Brake Disc - Vehicles With: Standard Brakes](#) (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
3. Remove the brake disc shield.
  - Remove the 3 rivets.



## Installation

1. To install, reverse the removal procedure.
  - Install the rivets.

# Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Brake Disc Shield Vehicles With: High Performance Brakes

Removal and Installation

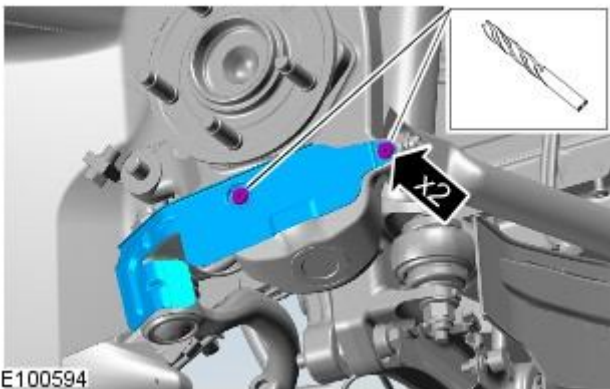
## Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the front brake disc.  
For additional information, refer to: [Brake Disc - Vehicles With: High Performance Brakes](#) (206-03 Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
3. Remove the brake disc shield.

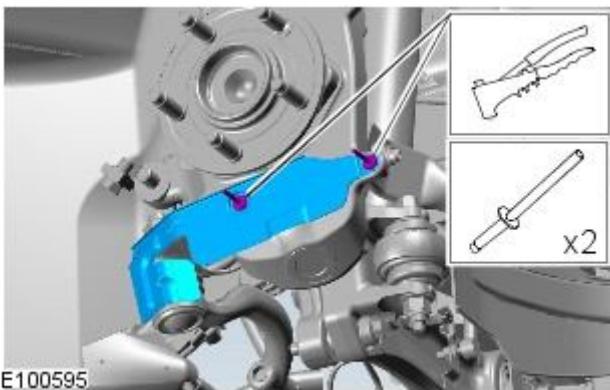
- Remove the 2 rivets.



## Installation

1. To install, reverse the removal procedure.

- Install the rivets.



# Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Brake Pads Vehicles With: Standard Brakes

Removal and Installation

## Removal

### • WARNINGS:



Brake pads must be renewed in axle sets only. Failure to follow this instruction may result in braking efficiency being impaired.



Do not allow dirt or foreign liquids to enter the reservoir. Use only new brake fluid of the correct specification from airtight containers. Do not mix brands of brake fluid as they may not be compatible.



**CAUTION:** Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used.

- WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

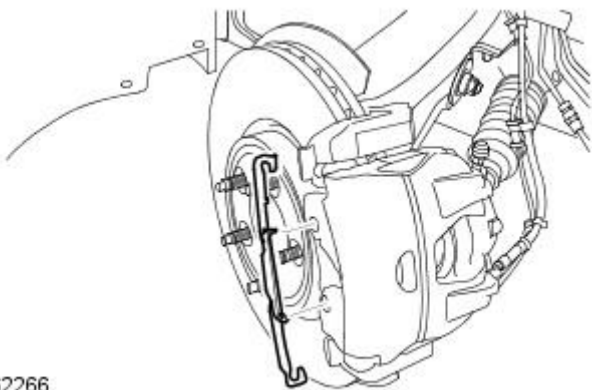
Raise and support the vehicle.

- Remove the front wheels and tires.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

- NOTE:** Left-hand shown, right-hand similar.

Remove the anti-rattle spring.

- Release the 2 clips.



E62266

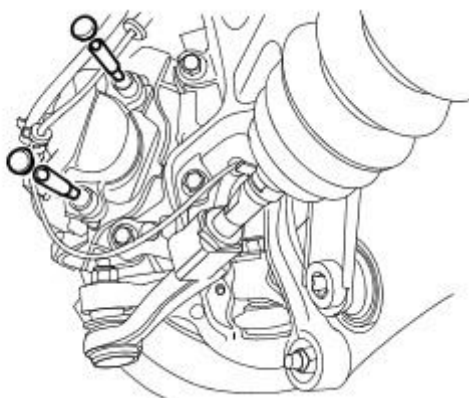


- CAUTION:** Do not allow the brake caliper to hang on the brake hose.

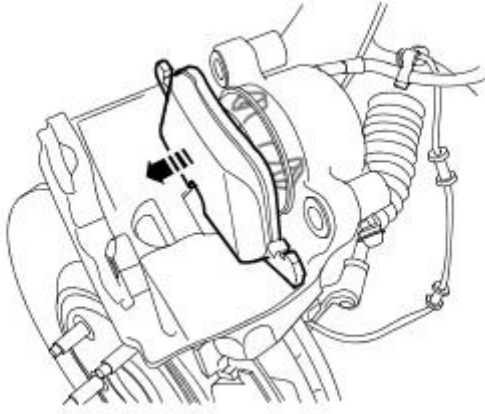
- **NOTE:** Left-hand shown, right-hand similar.

Remove the brake caliper.

- Remove the 2 access plugs.
- Remove the 2 caliper guide pins.
- Tie the brake caliper aside.



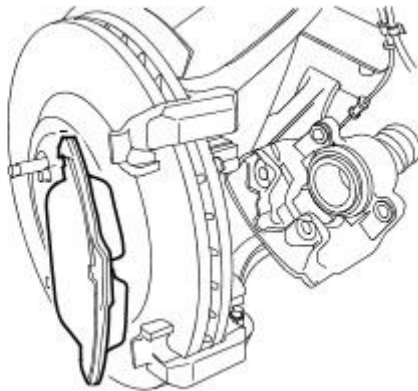
E62267



5. NOTE: Left-hand shown, right-hand similar.

Release the inboard brake pad from the caliper.

- Release the clip.




6. NOTE: Left-hand shown, right-hand similar.

Remove the outboard brake pad.

7. NOTE: Left-hand shown, right-hand similar.


Repeat the above procedure for the RH brake pads.


## Installation

1.  **WARNING:** Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

Clean the brake caliper housings and anchor plates, using brake cleaning fluid.

2. CAUTIONS:

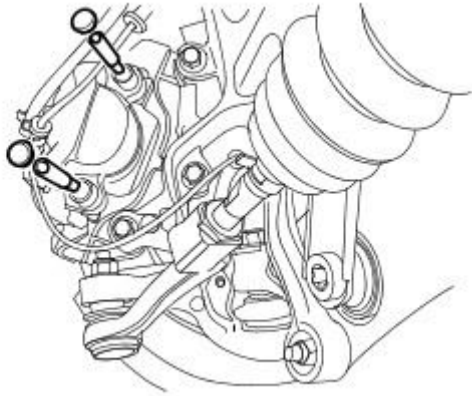
 As the piston is pushed back into the caliper housing, the brake fluid level in the reservoir will rise. Do not allow the reservoir to overflow.

 Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

Press the pistons into the caliper housing.

3. Install the brake pads.

- Secure the inboard brake pad in the clip.
- Position the outboard brake pad.

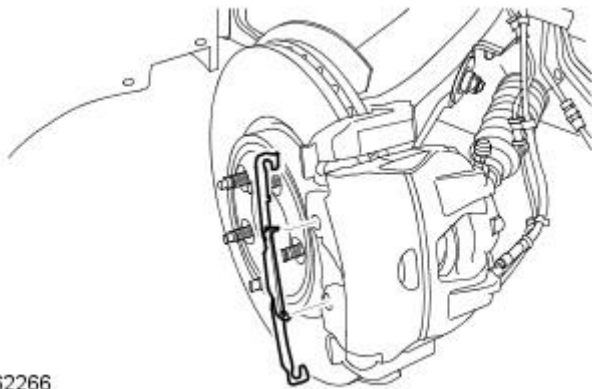


E62267

**4. NOTE: Left-hand shown, right-hand similar.**

Install the brake caliper.

- Tighten the guide pins to 28 Nm.
- Install the access plugs.



E62266

**5. NOTE: Left-hand shown, right-hand similar.**

Install the anti-rattle spring.

- Carefully secure the clips.

**6.** Repeat the above procedure for the RH brake pads.

**7.** Install the front wheels and tires.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

# Front Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Brake Pads Vehicles With: High Performance Brakes

Removal and Installation

## Removal

### • WARNINGS:



Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.



Brake pads must be renewed in axle sets only. Failure to follow this instruction may result in braking efficiency being impaired.



Do not allow dirt or foreign liquids to enter the reservoir. Use only new brake fluid of the correct specification from airtight containers. Do not mix brands of brake fluid as they may not be compatible.

### • CAUTIONS:



Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used.



The High performance brake caliper is aligned to the brake disc when it is first installed to the vehicle, therefore, care must be taken not to disturb this alignment. When removing the caliper, remove the bolts that secure the anchor bracket to the vertical link and/or the guide pin bolts only. DO NOT loosen any other caliper bolts.

• NOTE: Open engine compartment and fit paint work protection covers to fenders.



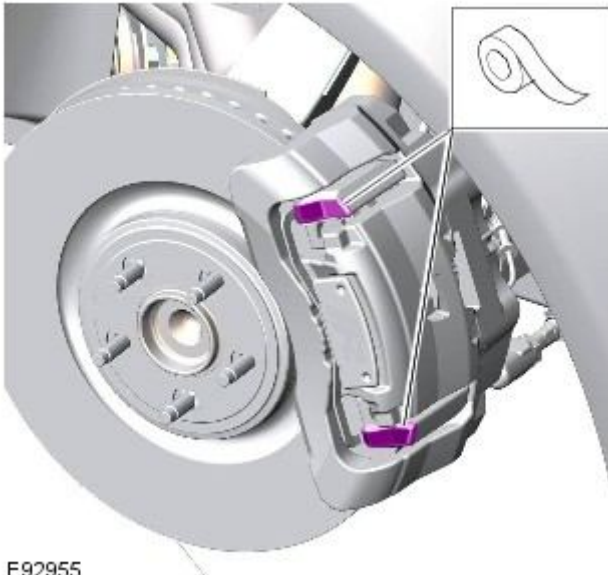
**1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

**2.** Remove the front road wheels and tires.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

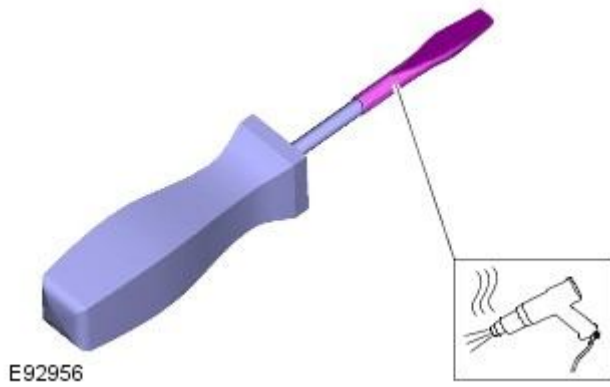
**3.** NOTE: Left-hand shown, right-hand similar.

Apply protective tape to the caliper.




E92955

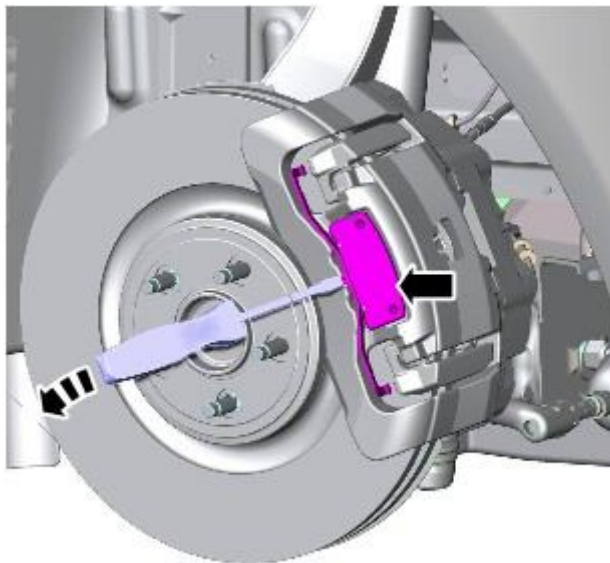





E92956

4.  CAUTION: Removal of the clips is a delicate procedure, damage will occur if any force is used.

Apply heatshrink or protective tape to the end of the screwdriver.



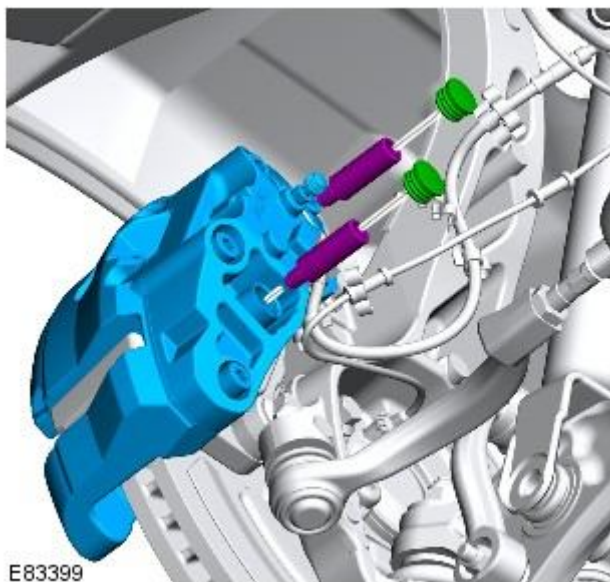
E92957

5.  CAUTION: Removal of the clips is a delicate procedure, damage will occur if any force is used.

• NOTE: Left-hand shown, right-hand similar.

Remove the anti-rattle spring.

- Lever the anti-rattle spring in the center of the spring until either side is released.



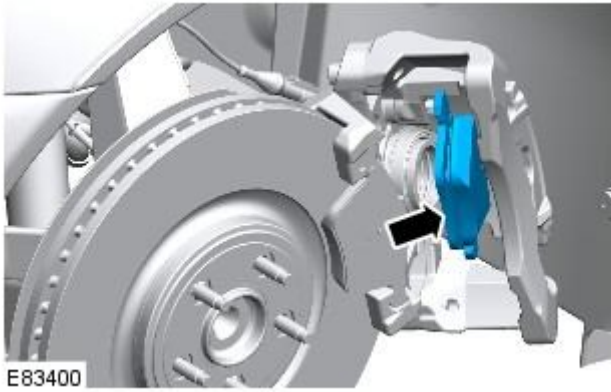
E83399

6.  CAUTION: Do not allow the brake caliper to hang on the brake hose.

• NOTE: Left-hand shown, right-hand similar.

Remove the brake caliper.

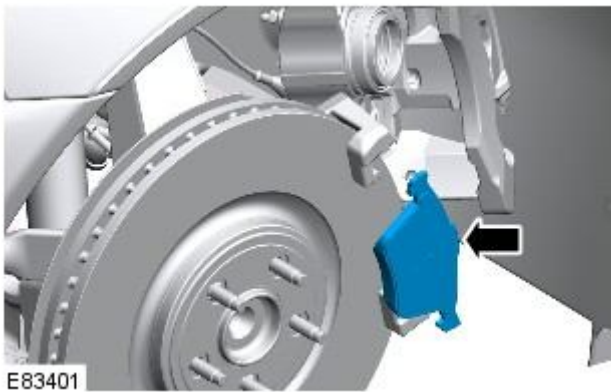
- Remove the 2 access plugs.
- Remove the 2 caliper guide pins.
- Tie the brake caliper aside.



7. NOTE: Left-hand shown, right-hand similar.

Release the inboard brake pad from the caliper.

- Release the clip.




8. NOTE: Left-hand shown, right-hand similar.

Remove the outboard brake pad.


9. Repeat the above procedure on the opposite side.


## Installation

1.  **WARNING:** Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

Clean the brake caliper housings and anchor plates, using brake cleaning fluid.

2. CAUTIONS:

 As the piston is pushed back into the caliper housing, the brake fluid level in the reservoir will rise. Do not allow the reservoir to overflow.

 Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

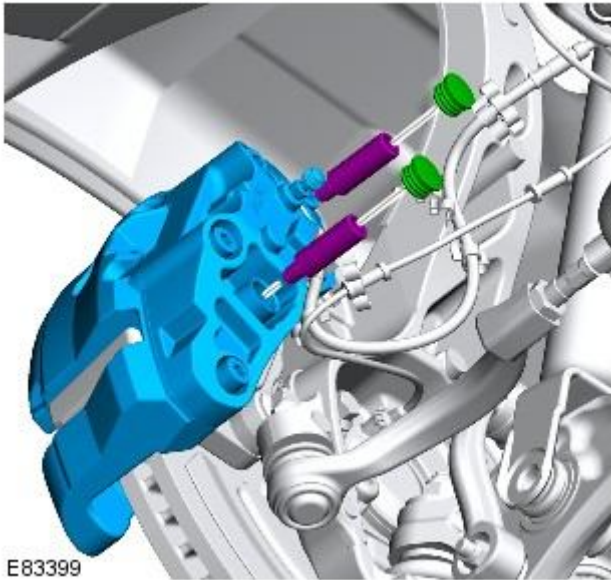
Press the piston into the caliper housing.

3. Install the brake pads.

- Secure the inboard brake pad in the clip.
- Position the outboard brake pad.



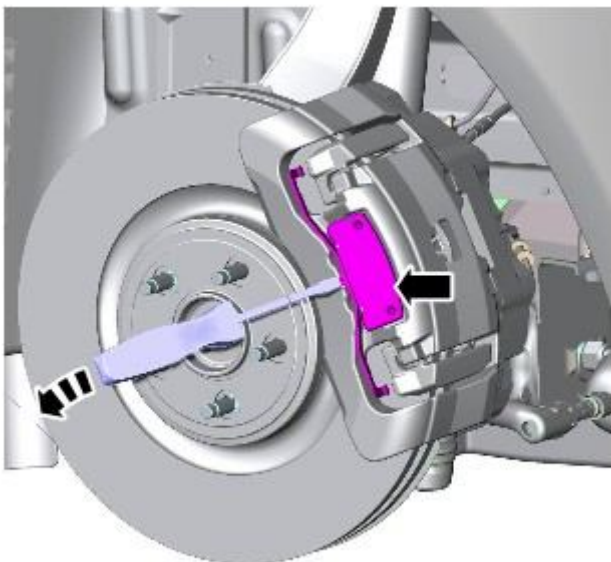
**4. NOTE: Left-hand shown, right-hand similar.**



Install the brake caliper.

- Tighten the guide pins to 58 Nm.
- Install the access plugs.

**5. NOTE: Left-hand shown, right-hand similar.**



Install the anti-rattle spring.

- Secure the bottom arm of the anti-rattle spring under the bottom anchor bracket of the caliper.
- Compress the upper spring arm into the correct position, under the upper anchor bracket, whilst retaining the logo plate.
- Using the screw-driver, tap the central locating tag into the locked position.

**6.** Repeat the above procedure on the opposite side.

**7.** Install both wheels and tires.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

## Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 -

### Lubricants, Fluids, Sealers and Adhesives



**CAUTION:** Do not use brake fluid ITT Super Dot 4 on 2006my vehicles onwards. Failure to follow this instruction may result in damage to the vehicle.

• **NOTE:** Brake fluid ITT Super Dot 4 has now been superseded by Shell ESL Super Dot 4 which is the Jaguar recommended brake fluid. Shell ESL Super Dot 4 can be used on all model years.

Item	Specification
Brake fluid	Shell ESL Dot 4

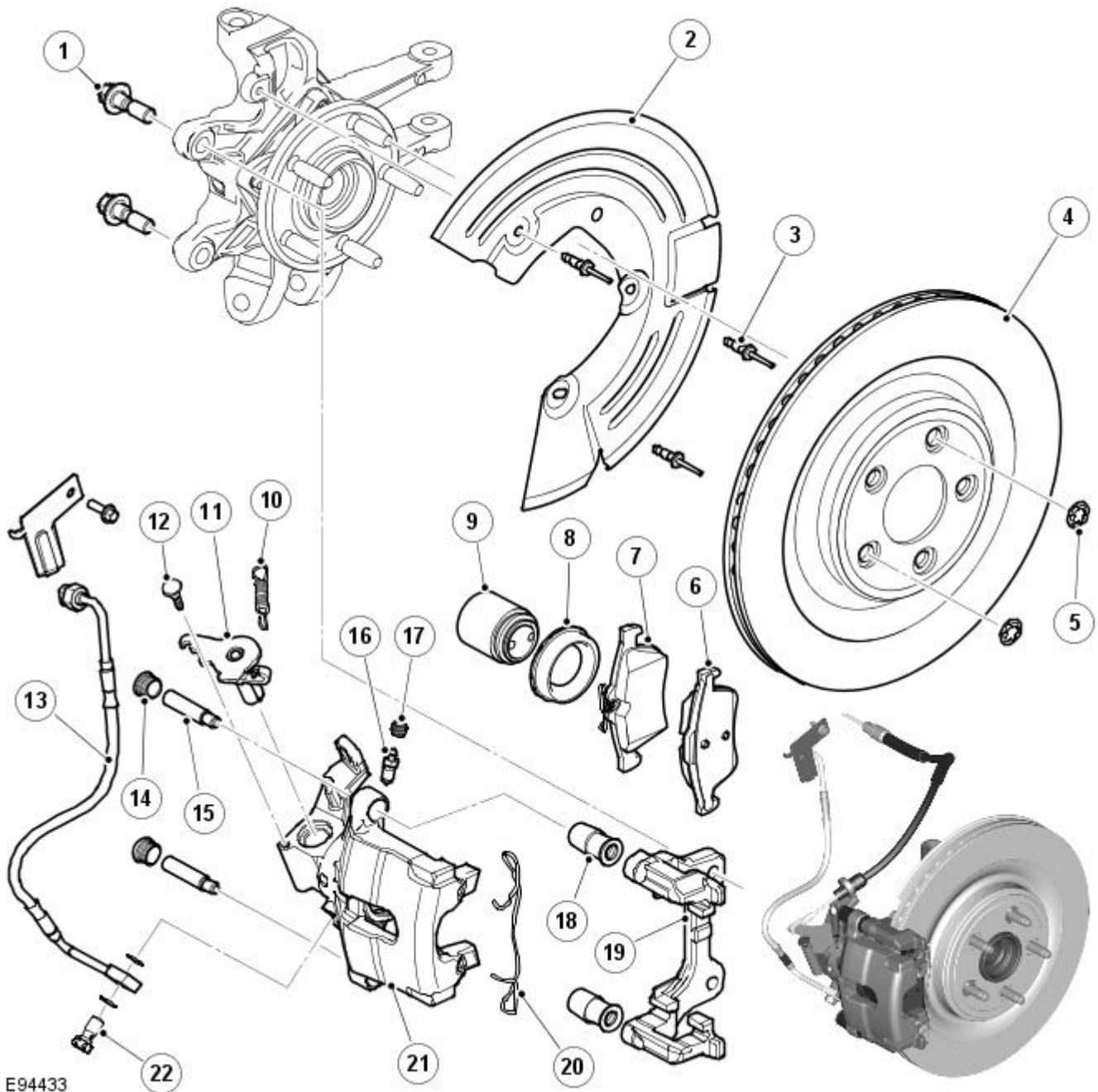
### Torque Specifications

Description	Nm	lb-ft	lb-in
Brake hose to brake caliper	38	28	-
Brake caliper anchor plate	103	76	-
Brake caliper retaining bolts	28	21	-
Brake caliper logo badge retaining screws - Vehicles with high performance brakes	5	4	-

# Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Rear Disc Brake - Component Location

Description and Operation

Component Location



E94433

## ItemDescription

1	Caliper carrier bolts (2 off)
2	Brake dust shield
3	Rivets (3 off)
4	Brake disc
5	Retaining washers (2 off)
6	Outboard brake pad
7	Inboard brake pad
8	Piston dust cover
9	Piston
10	Parking brake return spring
11	Parking brake lever
12	Parking brake lever stop

13	Brake hose
14	Guide pin dust cover (2 off)
15	Guide pins (2 off)
16	Bleed screw dust cap
17	Bleed screw dust cap
18	Guide pin bush (2 off)
19	Caliper carrier
20	Anti-rattle spring
21	Brake caliper housing
22	Brake hose to caliper bolt

## **Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Rear Disc Brake - Overview**

Description and Operation

### **Overview**

The rear braking system on all vehicles features 326 mm (12.83 in.) diameter x 20 mm (0.79 in.) thick ventilated brake discs with aluminum, single acting piston, sliding calipers. The brake disc is manufactured from cast iron. The disc is retained on the wheel hub by two washers and the wheel nuts.

The caliper is mounted within a fixed carrier that is secured to the rear wheel knuckle with two bolts. When hydraulic pressure is supplied to the caliper, the piston extends to force the inner pad against the brake disc. The caliper reacts and slides along two guide pins to bring the outer pad into contact with the brake disc. The brake calipers on the supercharged vehicle are painted and also include a logo badge, which must be removed in order to renew the brake pads.

Each inboard brake pad is installed with a wire type anti-rattle spring. There is no wear indicator installed in the brake pads.

Also incorporated into each rear brake caliper carrier is the parking brake mechanism.

Refer to: [Parking Brake](#) (206-05 Parking Brake and Actuation, Description and Operation).

After any work on the rear brakes, the parking brake must be re-calibrated.

Refer to: [Parking Brake](#) (206-05 Parking Brake and Actuation, Diagnosis and Testing).

## **Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Rear Disc Brake**

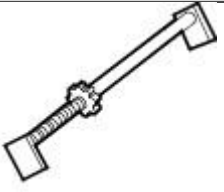
Diagnosis and Testing

For additional information.


REFER to: [Brake System](#) (206-00 Brake System - General Information, Diagnosis and Testing).


## Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Brake Caliper

Removal and Installation


Special Tool(s)	
 JDS9013	Brake pedal hold down tool
	JDS9013

### Removal

 **WARNING:** Failure to release the tension and calibrate the electric parking brake during rear parking brake related service procedures, could cause the parking brake to function incorrectly or become inoperative.

 **CAUTION:** Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

All vehicles

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

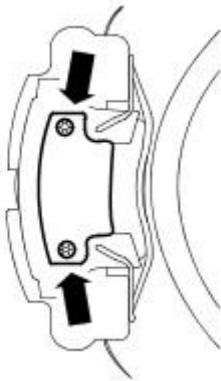
- Remove the rear wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
- Release the parking brake cable tension.  
For additional information, refer to: [Parking Brake Cable Tension Release](#) (206-05 Parking Brake and Actuation, General Procedures).

Vehicles with high performance brakes

- NOTE:** Left-hand shown, right-hand similar.

Remove the logo badge.

- Remove the two retaining screws.



E61746

All vehicles

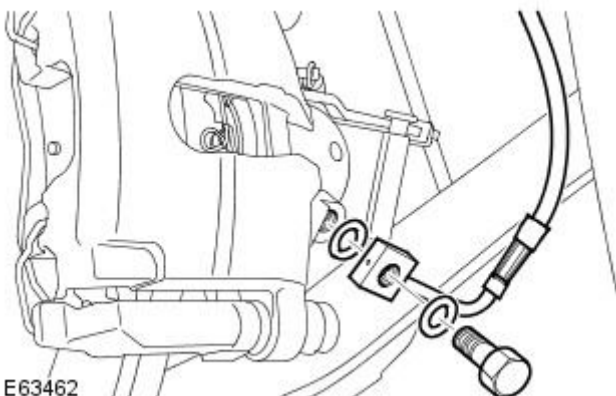
-  **CAUTION:** Always plug any open connections to prevent contamination.

• **NOTE:** To prevent the loss of brake fluid, using the special tool apply the brake pedal and set to 40mm ( 1.6 in ) below the rest position.

• **NOTE:** RH illustration shown, LH is similar.

Disconnect the brake hose from the brake caliper.

- Using the special tool, press and hold the brake pedal.
- Remove and discard the two sealing washers.

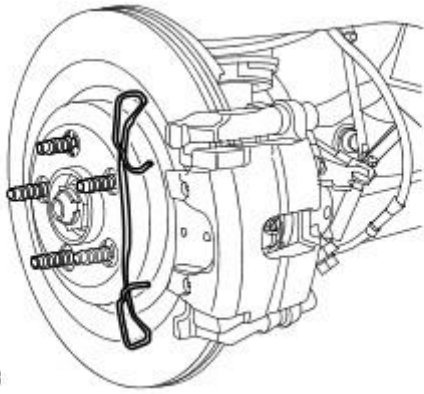


E63462

6. NOTE: RH illustration shown, LH is similar.

Remove the anti-rattle spring.

- Release the 2 clips.



E62738

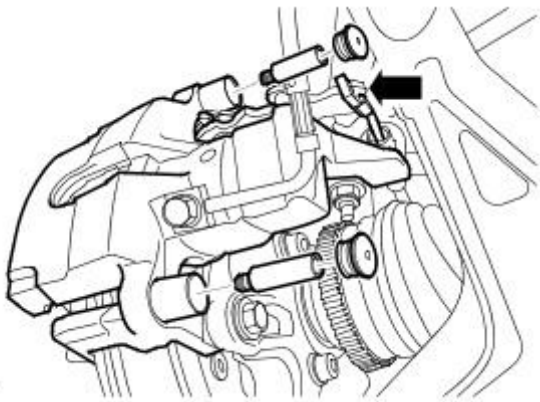
7. Disconnect and release the parking brake cable from the caliper.

- Release the clip.

8. NOTE: RH illustration shown, LH is similar.

Remove the brake caliper.

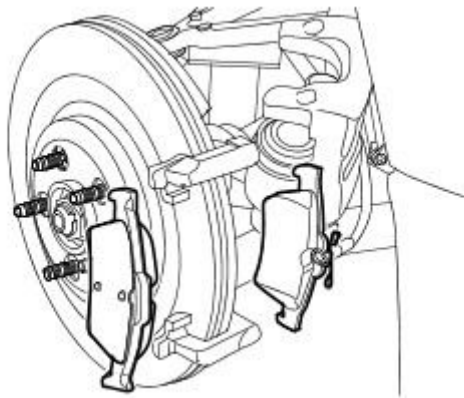
- Remove the 2 access plugs.
- Release the 2 brake caliper guide pins.



E66773

9. NOTE: RH illustration shown, LH is similar.

Remove the brake pads.



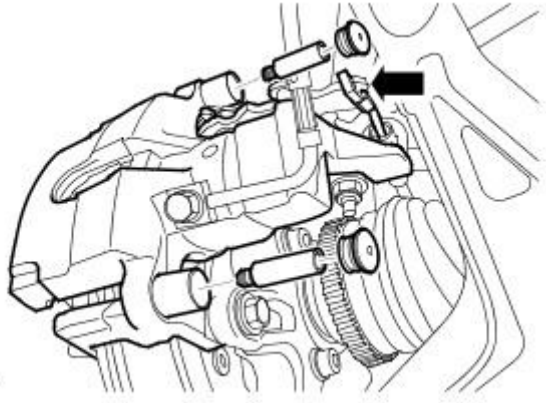
E62740

## Installation

All vehicles

1. Install the brake pads.

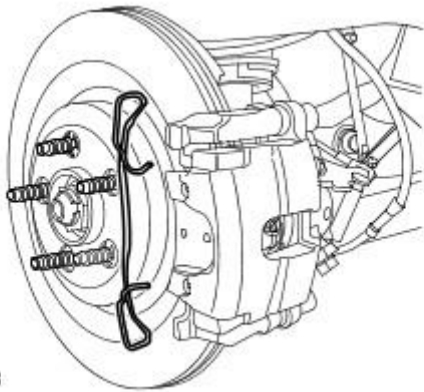




E66773

2. Install the brake caliper.

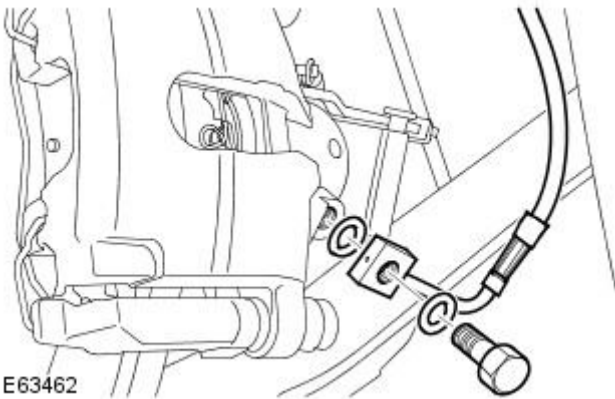
- Tighten the guide pins to 28 Nm.
- Install the access plugs.



E62738

3. Install the anti-rattle spring.

- Carefully secure the clips.



E63462

4. Connect the brake hose to the brake caliper.

- Install new sealing washers.
- Tighten the union to 38 Nm.

5. Connect the parking brake cable.

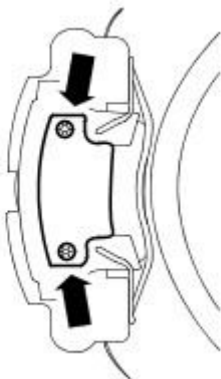
- Carefully secure the clips.

Vehicles with high performance brakes

6. NOTE: Left-hand shown, right-hand similar.

Install the logo badge.

- Install the two retaining screws.



E61746

## All vehicles

**7.** Bleed the brake system.

For additional information, refer to: [Brake System Bleeding](#) (206-00 Brake System - General Information, General Procedures).

**8.** Install the wheel and tire.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

**9.** Re-calibrate the electric park brake.

For additional information, refer to: [Parking Brake Cable Tension Release](#) (206-05 Parking Brake and Actuation, General Procedures).

# Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Brake Disc

Removal and Installation

## Removal



**CAUTION:** Brake discs must be renewed in pairs, unless one disc requires changing before 1000 miles (1600 kilometers) from new.



**1. WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

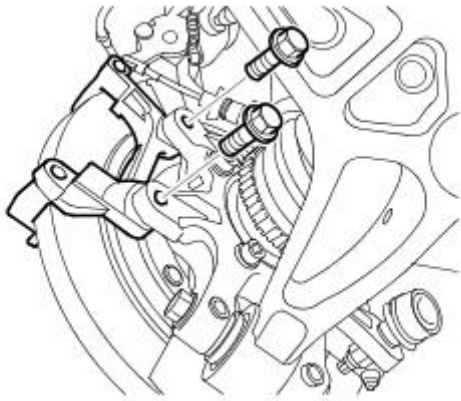
Raise and support the vehicle.

**2.** Remove the rear brake pads.

For additional information, refer to: [Brake Pads](#) (206-04 Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

**3.** Remove the brake caliper anchor bracket.

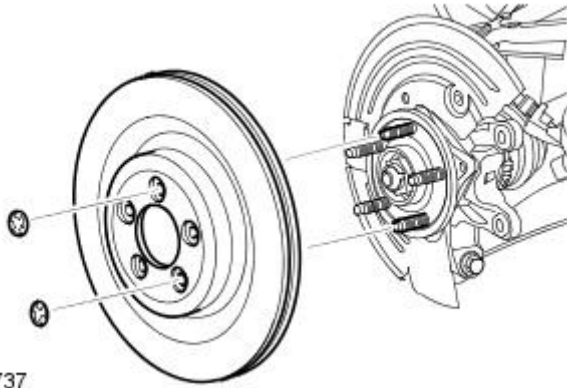
- Remove and discard the 2 bolts.



E62736

**4.** Remove the brake disc.

- Remove the 2 clips.



E62737

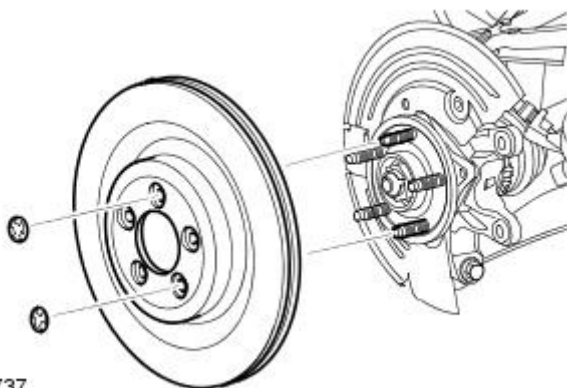
## Installation



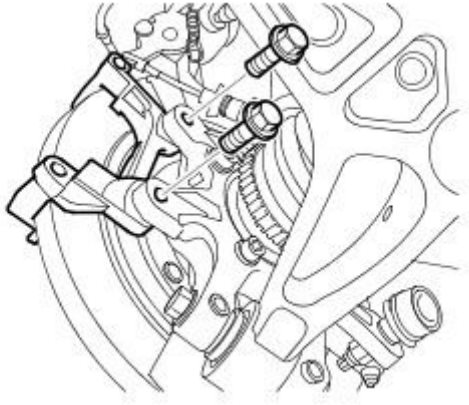
**1. WARNING:** Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

Install the brake disc.


- Clean the component mating faces.
- Secure the clips.



E62737



E62736

2.  CAUTION: Make sure that new bolts are installed.

Install the brake caliper anchor bracket.

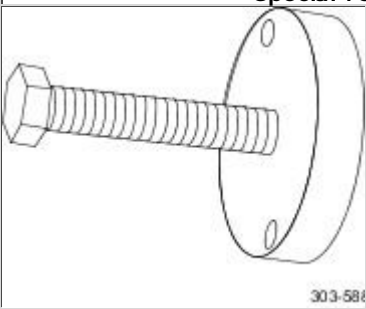
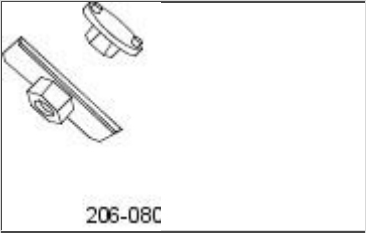
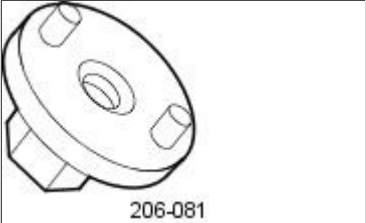
- Clean the component mating faces.
- Tighten the bolts to 103 Nm.

3. Install the brake pads.

For additional information, refer to: [Brake Pads](#) (206-04 Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

## Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Brake Pads

Removal and Installation

Special Tool(s)	
	Crankshaft pulley/damper remover 303-588
	Brake caliper piston retractor tool 206-080
	Brake caliper piston retractor tool 206-081

### Removal

- WARNINGS:



Brake pads must be renewed in axle sets only, otherwise braking efficiency may be impaired.



Do not allow dirt or foreign liquids to enter the reservoir. Use only new brake fluid of the correct specification from airtight containers. Do not mix brands of brake fluid as they may not be compatible.



Failure to release the tension and calibrate the electric parking brake during rear parking brake related service procedures, could cause the parking brake to function incorrectly or become inoperative.

- NOTE: Only extraction bolt from special tool 303-588 is used.

All vehicles



**1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

**2.** Release the parking brake cable tension.  
For additional information, refer to: [Parking Brake Cable Tension Release](#) (206-05 Parking Brake and Actuation, General Procedures).

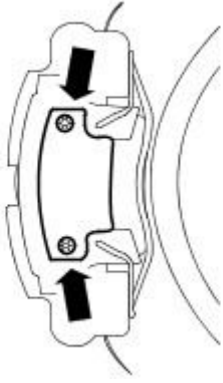
**3.** Remove the rear wheels and tires.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

Vehicles with high performance brakes

4. NOTE: Left-hand shown, right-hand similar.

Remove the logo badge.

- Remove the two retaining screws.



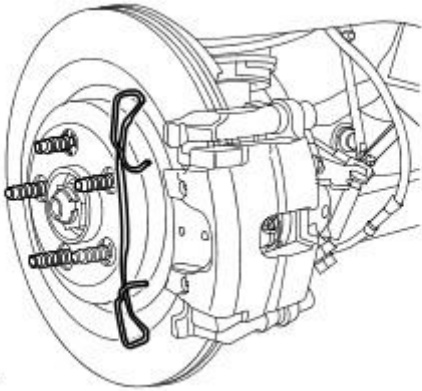
E61746

All vehicles

5. NOTE: Right-hand shown, left-hand similar.

Remove the anti-rattle spring.

- Release the 2 clips.



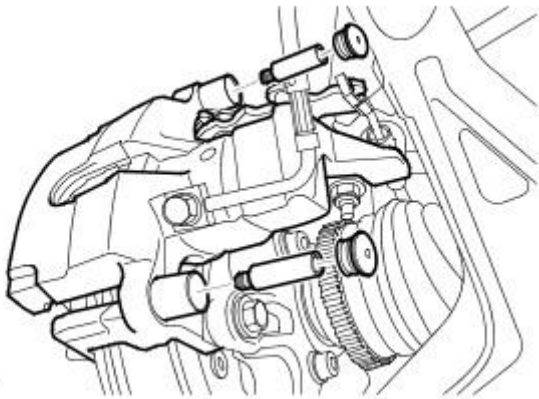
E62738

6.  CAUTION: Do not allow the brake caliper to hang on the brake hose.

• NOTE: Right-hand shown, left-hand similar.

Remove the brake caliper.

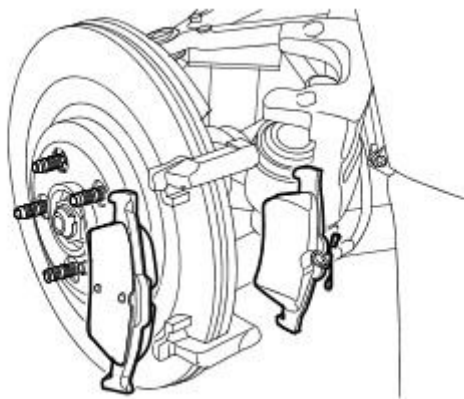
- Remove the 2 access plugs.
- Release the 2 brake caliper guide pins.
- Tie the brake caliper aside.



E62739

7. NOTE: Right-hand shown, left-hand similar.

Remove the brake pads.




E62740

8. Repeat the above procedure for the other side.

## Installation

All vehicles


1.  **WARNING:** Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

Clean the brake caliper housings and anchor plates, using brake cleaning fluid.

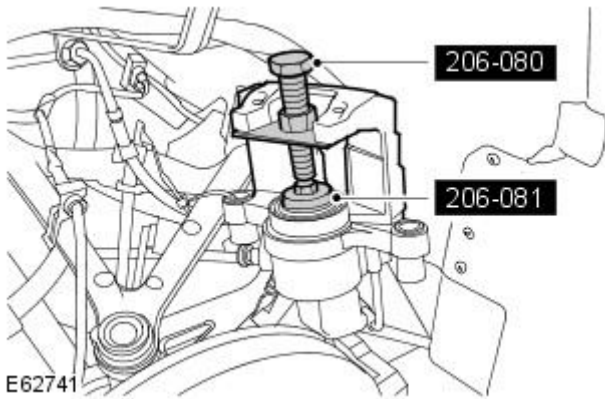
- Repeat the above procedure for the other side.

2. CAUTIONS:

 As the piston is pushed back into the caliper housing, the brake fluid level in the reservoir will rise. Do not allow the reservoir to overflow.

 Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

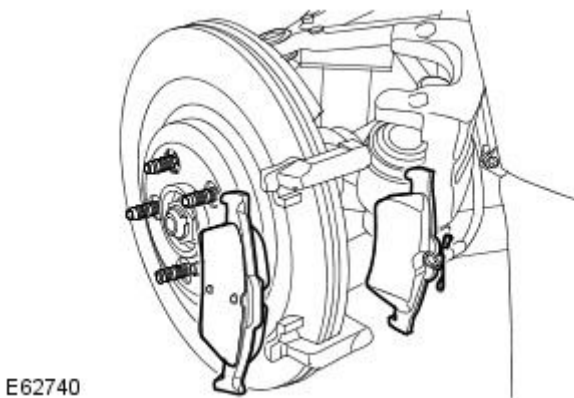
Using the special tools, fully retract the brake caliper piston.



3. NOTE: Right-hand shown, left-hand similar.

Install the brake pads.

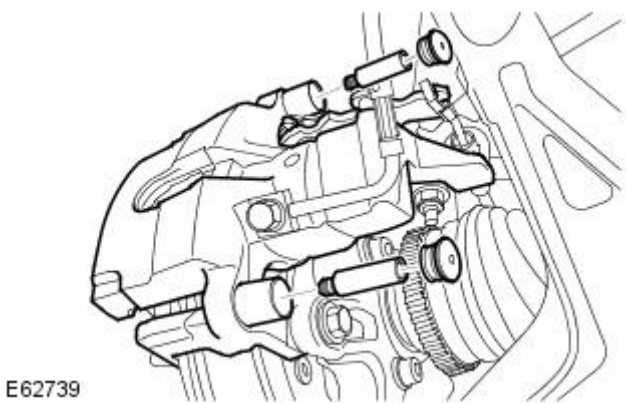
- Position the inboard brake pad.
- Position the outboard brake pad.



4. NOTE: Right-hand shown, left-hand similar.

Install the brake caliper.

- Tighten the guide pins to 28 Nm.

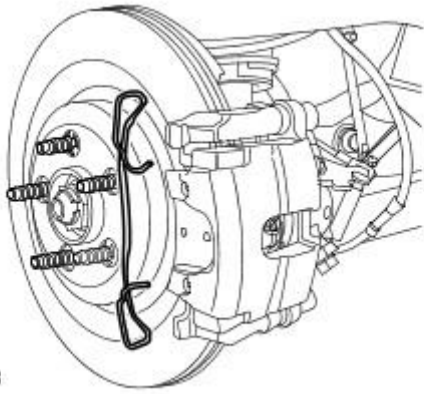




5. NOTE: Right-hand shown, left-hand similar.

Install the anti-rattle spring.

- Carefully secure the clips.



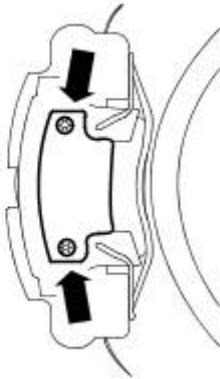
E62738

Vehicles with high performance brakes

6. NOTE: Left-hand shown, right-hand similar.

Install the logo badge.

- Install the two retaining screws.




E61746

All vehicles

7. Repeat the above procedure for the other side.

8. Install the wheels and tires.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

9.  **WARNING:** Calibrate the electric park brake using Jaguar approved diagnostic equipment. If Jaguar approved diagnostic equipment is not available disconnect the battery for approximately 30 seconds, the vehicle will then prompt the driver to carry out the calibration procedure as per the vehicle hand book on re-connection.

Re-calibrate the electric park brake.

For additional information, refer to: [Parking Brake Cable Tension Release](#) (206-05 Parking Brake and Actuation, General Procedures).



# Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Brake Disc Shield

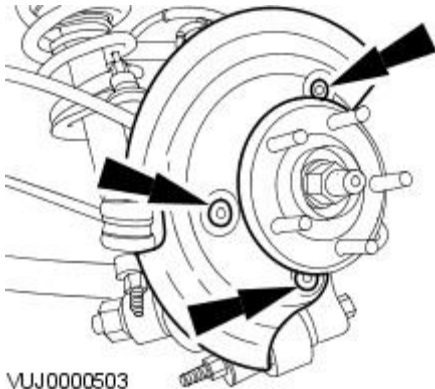
Removal and Installation

## Removal



**WARNING:** Make sure to support the vehicle with axle stands.

1. Raise and support the body.
2. Remove the brake disc.  
For additional information, refer to: [Brake Disc](#) (206-04 Rear Disc Brake - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
3. Remove the brake disc shield.
  - Drill out the 3 rivets



VUJ0000503

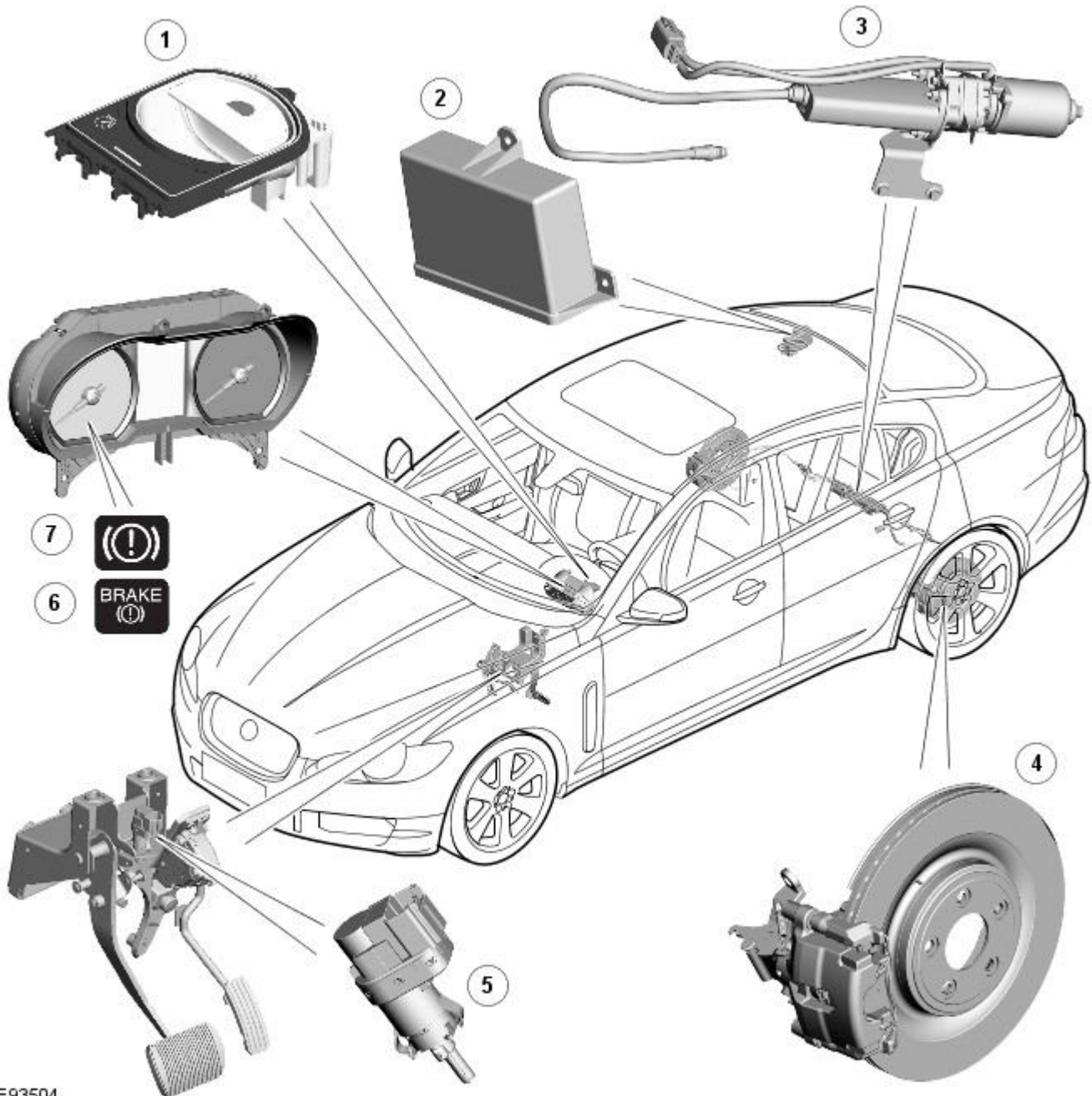
## Installation

1. To install, reverse the removal procedure.

# Parking Brake and Actuation - Parking Brake - Component Location

Description and Operation

Component Location



E93504

## ItemDescription

1	Parking brake switch
2	EPB (electronic parking brake) module
3	Parking brake actuator
4	Caliper and disc assemblies (2 off)
5	Stoplamp switch
6	Brake warning indicator - NAS vehicles
7	Brake warning indicator (all except NAS (North American Specification) vehicles)

# Parking Brake and Actuation - Parking Brake - Overview

Description and Operation

## Overview

The parking brake is an electrically actuated system that operates on the rear brake calipers. Two cables are connected to the rear brake calipers, and act directly on the same pistons used for normal, hydraulic rear brake actuation. Refer to: Rear Disc Brake (206-04, Description and Operation).

The parking brake is controlled by the EPB (electronic parking brake) module. In response to commands from the driver through the parking brake switch, the EPB module controls operation of the parking brake actuator. The actuator adjusts the tension of the brake cables to apply and release the rear brake calipers. Features of the parking brake include:

- Manual apply.
- Manual release.
- Automatic release.

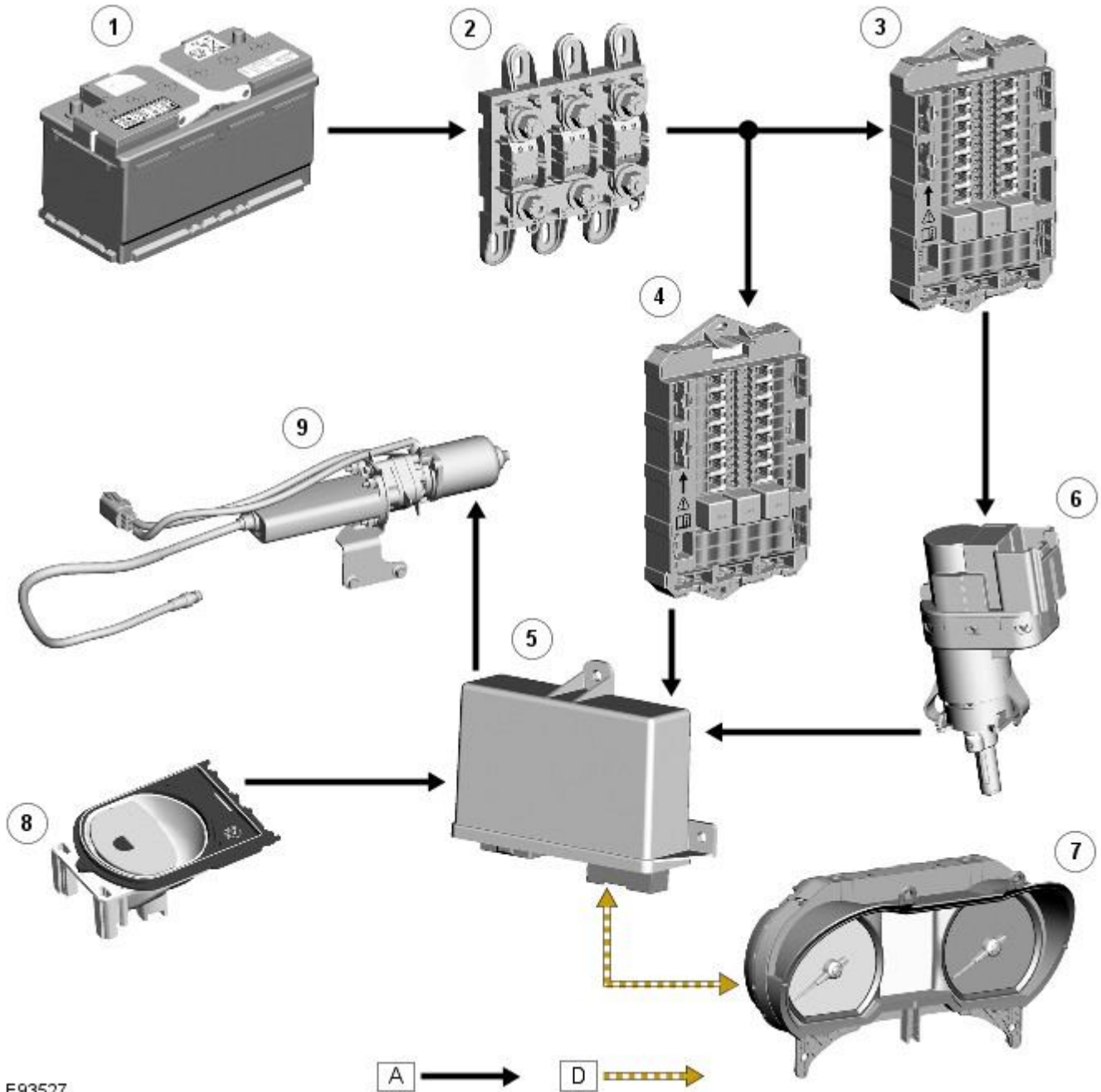
A service mode is also available and must be activated using the Jaguar approved diagnostic system. This allows the decoupling of the components and prevention of damage to the actuator. When in service mode all switch functions will be inhibited.

# Parking Brake and Actuation - Parking Brake - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **D** = High speed CAN (controller area network) bus.



E93527

### ItemDescription

1	Battery
2	BJB (battery junction box)
3	CJB (central junction box)
4	RJB (rear junction box)
5	EPB module
6	Stoplamp switch
7	Instrument cluster
8	Parking brake switch
9	Parking brake actuator

## System Operation

## Static Apply

The EPB module receives a vehicle speed signal from the [ABS \(anti-lock brake system\)](#) module on the high speed [CAN](#) bus. If the parking brake switch is pulled to the 'Apply' position and vehicle speed is less than 2 mph (3 km/h), the EPB module will instigate its 'Static Apply' mode and drive the actuator to apply full parking brake force to the rear wheels.

The EPB module monitors the current drawn by the actuator and compares this to information held within its configuration software to determine when full braking force has been applied.

## Dynamic Apply

There are two 'Dynamic Apply' modes; low speed dynamic and high speed dynamic. The low speed dynamic mode operates at speeds between 2 mph (3 km/h) and 20 mph (32 km/h). The high speed dynamic mode operates at speeds above 20 mph (32 km/h).

If the parking brake switch is pulled up to the 'Apply' position and vehicle speed is within the low speed dynamic range, the EPB module drives the actuator to apply full parking brake force to the rear wheels.

If the parking brake switch is pulled up to the 'Apply' position and vehicle speed is within the high speed dynamic range, the EPB module will apply braking force to the rear wheels at a slower rate until full braking load is reached or the switch is released. The rate with which braking force is applied is controlled by the EPB module, which monitors both current drawn by the actuator and positional information from the actuator hall sensor and compares this to information held within its configuration software.

## Drive Away Release

The EPB module will initiate its 'Drive Away Release' function and automatically release the parking brake if the following conditions are detected:

- The engine is running.
- Drive , or reverse is selected.
- Positive throttle movement is detected.

The EPB module receives messages of gear selector position and throttle angle over the high speed [CAN](#) bus from the [TCM \(transmission control module\)](#) and the [ECM \(engine control module\)](#) respectively.

## Release from Park

The EPB module will initiate its 'Release from Park' function and automatically release the parking brake if the gear selector is moved from Park to any position except Neutral.

## Repairs

Before carrying out any work on the parking brake system, the Jaguar approved diagnostic system must be connected and the 'parking brake unjam' routine run. The routine can be found in the 'Vehicle Configuration' area, under the 'Set-up and Configuration' menu. After any work has been carried out on the parking brake, the system will require resetting.



**CAUTION:** Do not use the 'Emergency Release' tool to allow work to be carried out on the parking brake. Work can only be carried out on the parking brake system after the 'parking brake unjam' routine has been run.

## Resetting

If the electrical supply is disconnected from the EPB module, the actuator will lose its position memory. On battery re-connection and ignition on, 'APPLY FOOT AND PARK BRAKE' will be displayed in the instrument cluster message center indicating the parking brake requires resetting.

Refer to: [Parking Brake](#) (206-05 Parking Brake and Actuation, Diagnosis and Testing).

## Operating Voltages

The EPB module will only operate the actuator if the power supply from the battery is between 9 V and 16 V. At any voltage within this range, the actuator is able to fully tighten and release the brake cables. If the power supply falls outside of the range, a fault code is stored in the EPB module and can be retrieved using the Jaguar approved diagnostic system.

## Component Description

### Parking Brake Switch



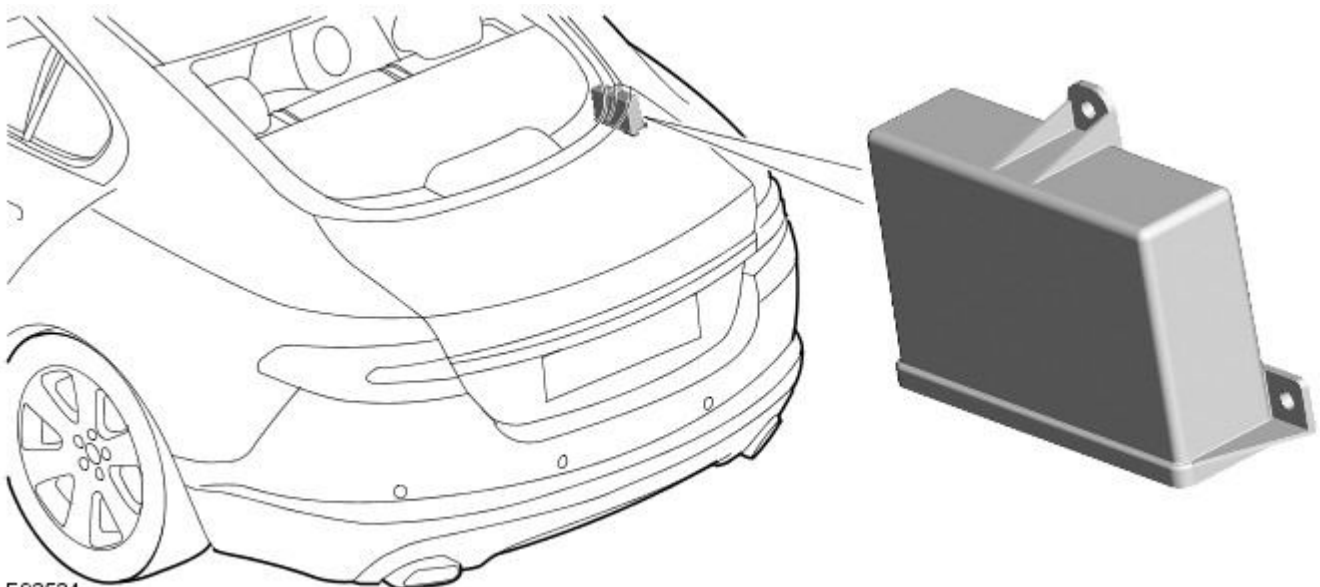
E93523

The parking brake switch is mounted in the floor console, rearward of the rotary gear selector. The switch has 3 states:

- Apply: When the switch is pulled up to apply the parking brake.
- Release: When the switch is pushed down to release the parking brake.
- Neutral: The central default position. The switch returns to this position regardless of parking brake status.

The parking brake switch contains a pair of micro-switches for both the apply and release actions. The EPB module provides an individual hardwired electrical feed to each of the four micro-switches plus a single ground connection, allowing it to constantly monitor switch status.

### EPB Module



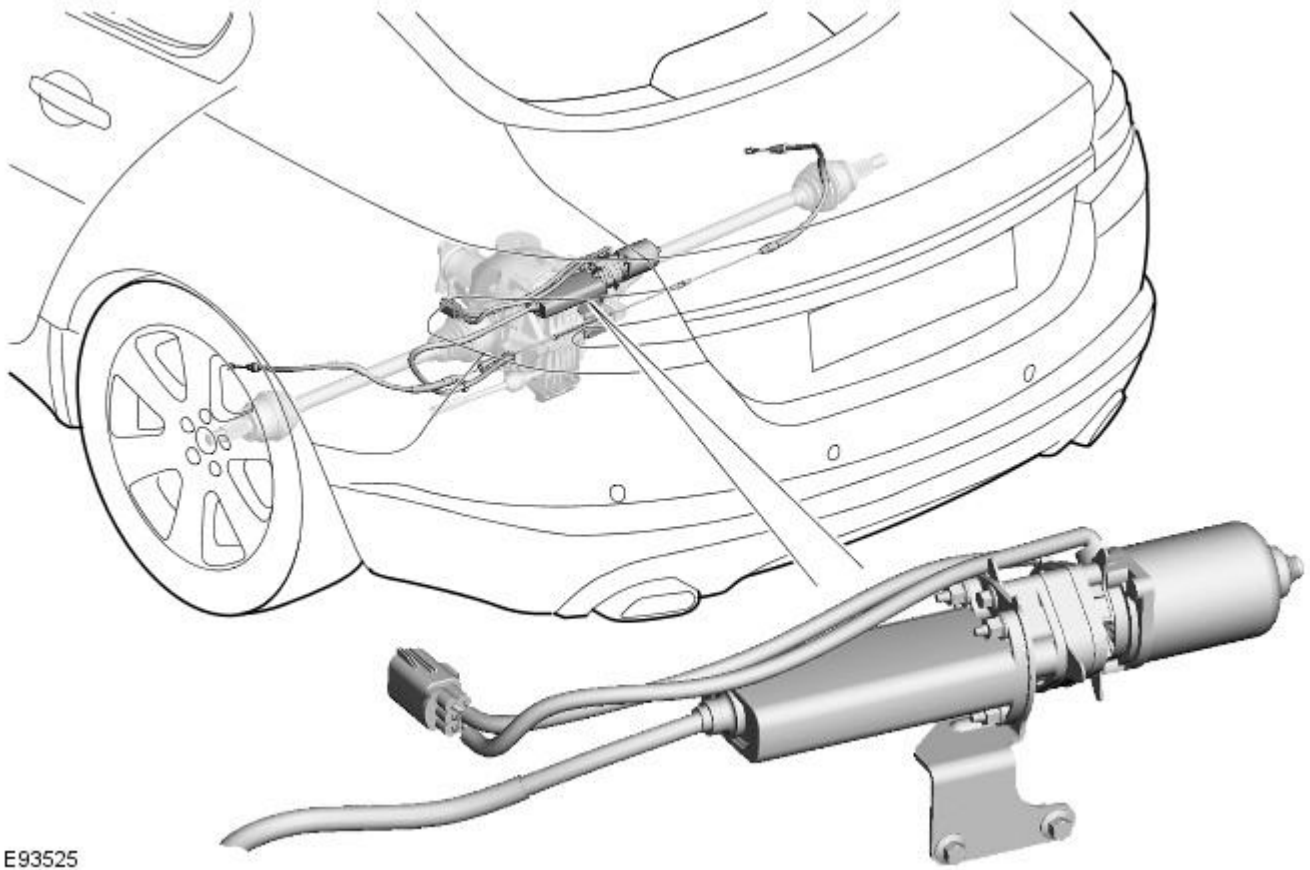
E93524

The EPB module is mounted in the luggage compartment on the **RH (right-hand)** side quarter panel and is connected to the vehicles electrical wiring by two multiplugs. The EPB module is also connected to the high speed [CAN](#) bus, allowing it to communicate with other vehicle systems.

The EPB module monitors the condition of the parking brake switch through a series of hardwired electrical connections and controls operation of the parking brake actuator accordingly.

### Parking Brake Actuator



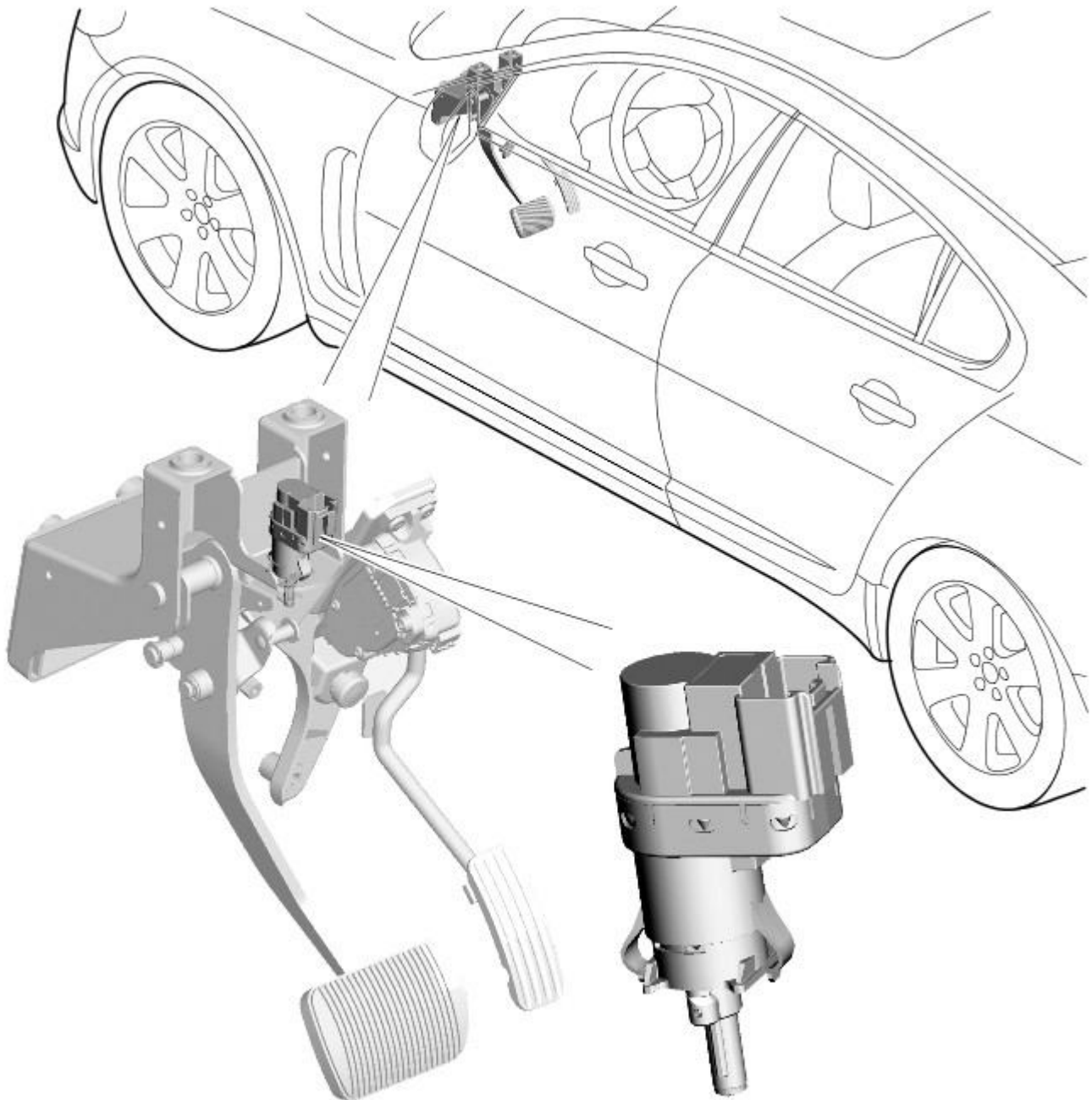


E93525

The parking brake actuator is mounted on the rear cross beam, underneath the vehicle. Operation of the actuator is controlled by the EPB module in response to parking brake switch requests from the driver.

A Hall sensor is located within the actuator and provides positional information back to the EPB module. The principle function of the Hall sensor is to ensure the actuator fully releases the parking brake when a static release request is made. The signal provided by the Hall sensor is compared to configuration information contained within the EPB module software to determine when a full release has been carried out.

### **Stoplamp Switch**



E93526

The stoplamp switch is mounted on the brake pedal box. One of the prerequisites for releasing the parking brake is that the foot brake is applied. The EPB module is able to determine the position of the footbrake by monitoring the status of the stoplamp switch via a hardwired electrical connection.

The stoplamp switch also forms part of:

- The [ABS](#).  
Refer to: [Anti-Lock Control - Stability Assist](#) (206-09 Anti-Lock Control - Stability Assist, Description and Operation).
- The speed control system. For additional information, refer to:  
Speed Control (310-03A, Description and Operation),  
Speed Control (310-03B, Description and Operation),  
[Speed Control](#) (310-03 Speed Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

## Instrument Cluster

Depending on market specification, the instrument cluster may contain a red and an amber brake warning indicator, or only a red brake warning indicator. The functionality of the warning indicators is shown in the table below.

Indicator	Status	Details
Red	Illuminated	Parking brake applied
Red	Flashing	Parking brake electrical failure
Amber	Illuminated	Parking brake electrical failure

If a parking brake failure warning indicator is active, the message 'CANNOT APPLY PARK BRAKE' or 'PARK BRAKE FAULT' will also appear in the instrument cluster message center. If the vehicle is moving with the parking brake applied, the message 'PARK BRAKE ON' will appear in the message center accompanied by a chime from the instrument cluster.

Refer to: [Information and Message Center](#) (413-08 Information and Message Center, Description and Operation).



# Parking Brake and Actuation - Parking Brake

Diagnosis and Testing

## Principle of Operation

For a detailed description of the Parking Brake system, refer to the relevant Description and Operation sections of the workshop manual. REFER to: (206-05 Parking Brake and Actuation)

[Parking Brake](#) (Description and Operation),  
[Parking Brake](#) (Description and Operation),  
[Parking Brake](#) (Description and Operation).

## Parking Brake Calibration

The parking brake system must be calibrated whenever the battery has been disconnected or has been in a state of discharge, or repairs have been carried out to the rear service or parking brake system.

• **NOTE:** If new rear brake pads have been installed, pressure must be applied to the brake pedal a minimum of five times prior to calibration of the parking brake system.

To calibrate the parking brake system:

1. **1.** Place gear selector lever in 'P' Park position.
2. **2.** Release parking brake cable tension to service position.  
REFER to: [Parking Brake Cable Tension Release](#) (206-05 Parking Brake and Actuation, General Procedures).
3. **3.** Set the ignition status to 'ON'.
4. **4.** Apply and hold the footbrake then pull up the parking brake switch.
5. **5.** To release the parking brake, apply and hold the footbrake then press down the parking brake switch.

## Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Parking brake cable</li> <li>● Parking brake actuator</li> <li>● Brake caliper</li> <li>● Brake pads</li> <li>● Stabilizer bar drop link rubber cable deflector block</li> </ul>	<ul style="list-style-type: none"> <li>● Fuse(s)</li> <li>● Wiring harness/electrical connectors</li> <li>● Check for bent/corroded pins</li> <li>● Parking brake switch</li> <li>● Parking brake module</li> </ul>

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident check the system for any logged Diagnostic Trouble Codes (DTCs) and proceed to the DTC Index , alternatively, verify the customer concern and refer to the Symptom Chart.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• **NOTE:** If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• **NOTE:** Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• **NOTE:** When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• **NOTE:** Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• **NOTE:** If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B114264	Ignition Status 1	<ul style="list-style-type: none"> <li>● Signal plausibility failure - Ignition power supply is</li> </ul>	Refer to electrical circuit diagrams and check parking brake module ignition power supply for short to

DTC	Description	Possible Cause	Action
		detected open circuit when ignition status is set to 'ON'	ground, open circuit
B131700	Parking Brake Module Voltage High	<ul style="list-style-type: none"> <li>Battery voltage is high (above 18 volts)</li> </ul>	Check for charging system failure, refer to section 303-04
B131800	Parking Brake Module Voltage Low	<ul style="list-style-type: none"> <li>Battery voltage is low (below 8 volts) (not logged on battery disconnect)</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Check vehicle battery is in fully charged and serviceable condition. Check for charging system failure, refer to section 303-04. Refer to the electrical circuit diagrams and check parking brake module logic power circuit for high resistance
B134200	Parking Brake Module Is Defective	<ul style="list-style-type: none"> <li>Internal module fault</li> </ul>	Install new Parking Brake module as required, refer to the new module installation note at the top of the DTC Index
C109400	Primary Parking Brake Apply Switch Circuit Failure	<ul style="list-style-type: none"> <li>Connector fault - bent, loose or corroded pin(s)</li> <li>Harness fault - high resistance, open circuit</li> <li>Switch fault</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check primary parking brake apply switch circuit for high resistance, open circuit. Check and install a new switch as required
C140800	Primary Parking Brake Release Switch Circuit Voltage Out Of Range	<ul style="list-style-type: none"> <li>Connector fault - bent, loose or corroded pin(s)</li> <li>Harness fault - low resistance to ground</li> <li>Switch fault</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check primary parking brake release switch circuit for low resistance to ground. Check and install a new switch as required
C140900	Primary Parking Brake Apply Switch Circuit Voltage Out Of Range	<ul style="list-style-type: none"> <li>Connector fault - bent, loose or corroded pin(s)</li> <li>Harness fault - low resistance to ground</li> <li>Switch fault</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check primary parking brake apply switch circuit for low resistance to ground. Check and install a new switch as required
C176900	Primary Parking Brake Apply Switch Circuit Short To Ground	<ul style="list-style-type: none"> <li>Connector fault - bent, loose or corroded pin(s)</li> <li>Harness fault - short to ground</li> <li>Switch fault</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check primary parking brake apply switch circuit for short to ground. Check and install a new switch as required
C178200	Primary Parking Brake Release Switch Circuit Failure	<ul style="list-style-type: none"> <li>Connector fault - bent, loose or corroded pin(s)</li> <li>Harness fault - high resistance, open circuit</li> <li>Switch fault</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check primary parking brake release switch circuit for high resistance, open circuit. Check and install a new switch as required
C178300	Primary Parking Brake Release Switch Circuit Short To Ground	<ul style="list-style-type: none"> <li>Connector fault - bent, loose or corroded pin(s)</li> <li>Harness fault - short to ground</li> <li>Switch fault</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check primary parking brake release switch circuit for short to ground. Check and install a new switch as required
C178400	Parking Brake Motor Output Circuit Short To Ground	<ul style="list-style-type: none"> <li>Connector fault - bent, loose or corroded pin(s)</li> <li>Harness fault - short to ground</li> <li>Actuator fault</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check parking brake motor output circuit for short to ground. Check and install a new actuator as required
C178500	Parking Brake Motor Output Circuit Open Circuit	<ul style="list-style-type: none"> <li>Connector fault - bent, loose or corroded pin(s)</li> <li>Harness fault - open circuit</li> <li>Actuator fault</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check parking brake motor output circuit for open circuit. Check and install a new actuator as required
C178600	Parking Brake Motor Output Circuit Short To Power	<ul style="list-style-type: none"> <li>Connector fault - bent, loose or corroded pin(s)</li> <li>Harness fault - short to power</li> <li>Actuator fault</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check parking brake motor output circuit for short to power. Check and install a new actuator as required
C179900	Hall Effect Circuit Failure	<ul style="list-style-type: none"> <li>Connector fault - bent, loose or corroded pin(s)</li> <li>Parking brake motor Hall effect position sensor power circuit fault</li> <li>Parking brake motor Hall effect position sensor ground circuit fault</li> <li>Parking brake motor Hall effect position sensor signal circuit fault</li> <li>Mechanical fault with sensor/actuator</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check parking brake motor hall effect position sensor circuits for short, open circuit. Check and install a new sensor/actuator as required

DTC	Description	Possible Cause	Action
C180100	Motor Engage Current Reached Before Full Apply Travel Distance	<ul style="list-style-type: none"> <li>● Service brake not correctly adjusted following lining replacement</li> <li>● Parking brake not calibrated after lining replacement</li> <li>● Cables fouled, trapped or damaged</li> <li>● Cables incorrectly routed or fixed</li> <li>● Caliper malfunction</li> <li>● Actuator malfunction</li> </ul>	Carry out parking brake calibration procedure. Check for mechanical failure of parking brake system
C180200	Motor Engage Current Not Reached or Travelled Too Far Upon Apply	<ul style="list-style-type: none"> <li>● Service brake not correctly adjusted following lining replacement</li> <li>● Parking brake not calibrated after lining replacement</li> <li>● Cables broken</li> <li>● Cables incorrectly routed or fixed</li> <li>● Caliper malfunction</li> <li>● Actuator malfunction</li> </ul>	Carry out parking brake calibration procedure. Check for mechanical failure of parking brake system
C180300	Motor Disengage Full Travel Distance Not Reached Upon Release	<ul style="list-style-type: none"> <li>● Intermittent motor or circuit - open circuit</li> <li>● Actuator malfunction (excessive noise may be heard during release)</li> </ul>	Check for additional motor and circuit DTCs and refer to DTC Index. Check for mechanical failure of parking brake system
C198900	Parking Brake Apply And Release Switches Are Active At The Same Time	<ul style="list-style-type: none"> <li>● Connector fault - bent, loose or corroded pin(s)</li> <li>● Harness fault - apply and release circuits - short to each other</li> <li>● Switch fault</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check parking brake apply/release switch circuits for short to each other. Check and install a new switch as required
C1D0062	Apply Switch Active Then Release Switch Active	<ul style="list-style-type: none"> <li>● Connector fault - bent, loose or corroded pin(s)</li> <li>● Switch fault</li> </ul>	Refer to electrical circuit diagrams and check apply/release switch circuits. Check and install a new switch as required
C1D0064	Erroneous Apply Switch Active	<ul style="list-style-type: none"> <li>● Connector fault - bent, loose or corroded pin(s)</li> <li>● Harness fault - primary or secondary apply circuit</li> <li>● Switch fault</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check apply/release switch circuits. Check and install a new switch as required
C1D0066	Parking Brake Apply/Release Switch Signal Has Too Many Transitions/Events	<ul style="list-style-type: none"> <li>● High amount of apply/release applications in short space of time (switch locked out due to abuse)</li> </ul>	Clear DTC and cycle ignition to re-enable switch functionality
C1D0711	Secondary Parking Brake Apply Switch Circuit Short To Ground	<ul style="list-style-type: none"> <li>● Connector fault - bent, loose or corroded pin(s)</li> <li>● Harness fault - short to ground</li> <li>● Switch fault</li> </ul>	Refer to electrical circuit diagrams and check secondary parking brake apply switch circuit for short to ground. Check and install a new switch as required
C1D0715	Secondary Parking Brake Apply Switch Circuit Failure	<ul style="list-style-type: none"> <li>● Connector fault - bent, loose or corroded pin(s)</li> <li>● Harness fault - high resistance, open circuit</li> <li>● Switch fault</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check secondary parking brake apply switch circuit for high resistance, open circuit. Check and install a new switch as required
C1D071C	Secondary Parking Brake Apply Switch Circuit Voltage Out Of Range	<ul style="list-style-type: none"> <li>● Connector fault - bent, loose or corroded pin(s)</li> <li>● Harness fault - low resistance to ground</li> <li>● Switch fault</li> </ul>	Refer to electrical circuit diagrams and check secondary parking brake apply switch circuit for low resistance to ground. Check and install a new switch as required
C1D0811	Secondary Parking Brake Release Switch Circuit Short To Ground	<ul style="list-style-type: none"> <li>● Connector fault - bent, loose or corroded pin(s)</li> <li>● Harness fault - short to ground</li> <li>● Switch fault</li> </ul>	Refer to electrical circuit diagrams and check secondary parking brake release switch circuit for short to ground. Check and install a new switch as required
C1D0815	Secondary Parking Brake Release Switch Circuit Failure	<ul style="list-style-type: none"> <li>● Connector fault - bent, loose or corroded pin(s)</li> <li>● Harness fault - high resistance, open circuit</li> <li>● Switch fault</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check secondary parking brake release switch circuit for high resistance, open circuit. Check and install a new switch as required

DTC	Description	Possible Cause	Action
C1D081C	Secondary Parking Brake Release Switch Circuit Voltage Out Of Range	<ul style="list-style-type: none"> <li>● Connector fault - bent, loose or corroded pin(s)</li> <li>● Harness fault - low resistance to ground</li> <li>● Switch fault</li> </ul>	Refer to electrical circuit diagrams and check secondary parking brake release switch circuit for low resistance to ground. Check and install a new switch as required
C1D1000	Field Effect Transistor Circuit Over Current/Over Temperature	<ul style="list-style-type: none"> <li>● Internal module fault</li> </ul>	Install a new parking brake module, refer to the new module/component installation note at the top of the DTC Index
C1D1162	Release Switch Active Then Apply Switch Active	<ul style="list-style-type: none"> <li>● Connector fault - bent, loose or corroded pin(s)</li> <li>● Switch fault</li> </ul>	Refer to electrical circuit diagrams and check release switch circuit for short, open circuit. Check and install a new switch as required
C1D1164	Erroneous Release Switch Active	<ul style="list-style-type: none"> <li>● Connector fault - bent, loose or corroded pin(s)</li> <li>● Harness fault - primary or secondary apply circuit</li> <li>● Switch fault</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check release switch circuit for short, open circuit. Check and install a new switch as required
C1D1564	Brake Switch Status	<ul style="list-style-type: none"> <li>● ECM off Bus (ECM off Bus DTC may also be logged)</li> <li>● Harness fault - brake switch circuit open circuit to parking brake module</li> <li>● Harness fault - brake switch circuit open circuit to ECM</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check brake switch circuits for open circuit
C1D1614	High Power Battery Feed Circuit Failure	<ul style="list-style-type: none"> <li>● Fuse</li> <li>● Harness fault - high resistance, open circuit</li> <li>● Connector fault - bent, loose or corroded pin(s)</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check battery power supply circuits to parking brake module for high resistance and open circuit
C1D2092	Vehicle Deceleration, Performance Or Incorrect Operation	<ul style="list-style-type: none"> <li>● Implausible vehicle speed message sent from ABS</li> </ul>	Cycle the ignition. Check ABS for DTCs and refer to DTC Index
U000187	High Speed CAN Communication Bus	<ul style="list-style-type: none"> <li>● All CAN messages are detected missing at Ignition ON</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U000188	High Speed CAN Communication Bus - Bus Off	<ul style="list-style-type: none"> <li>● CAN Bus circuit fault</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U010000	Lost Communication With ECM	<ul style="list-style-type: none"> <li>● ECM off Bus</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Check ECM for related DTCs and refer to the relevant DTC Index
U010300	Lost Communication With The Gear Shift Control Module A	<ul style="list-style-type: none"> <li>● Transmission Shift Module off Bus</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Check the transmission shift module for related DTCs and refer to the relevant DTC Index
U010400	Lost Communication With Speed Control Front Distance Range Sensor	<ul style="list-style-type: none"> <li>● Speed control module off Bus</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Check the speed control module for related DTCs and refer to the relevant DTC Index
U012100	Lost Communication With Anti-Lock Brake System	<ul style="list-style-type: none"> <li>● ABS module off Bus</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Check the ABS module for related DTCs and refer to the relevant DTC Index
U015500	Lost Communication With Instrument Cluster	<ul style="list-style-type: none"> <li>● Instrument cluster off Bus</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Check the instrument cluster for related DTCs and refer to the relevant DTC Index
U030000	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>● Invalid configuration message is received</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the Parking Brake module, refer to the new module installation note at the top of the DTC Index
U040100	Invalid Data Received From ECM	<ul style="list-style-type: none"> <li>● Invalid message from the ECM</li> </ul>	No fault with parking brake system if this DTC is logged. Check ECM for DTCs and refer to the relevant DTC Index
U040400	Invalid Data Received From Gear Shift Control Module A	<ul style="list-style-type: none"> <li>● Invalid message from the transmission shift module</li> </ul>	No fault with parking brake system if this DTC is logged. Check transmission shift module for related DTCs and refer to the relevant DTC Index
U041500	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module	<ul style="list-style-type: none"> <li>● Invalid message from the anti-lock brake system module</li> </ul>	No fault with parking brake system if this DTC is logged. Check anti-lock control - stability assist module for DTCs and refer to the relevant DTC Index
U042200	Invalid Data Received From Body Control Module	<ul style="list-style-type: none"> <li>● Invalid message from the CJB</li> </ul>	No fault with parking brake system if this DTC is logged. Check CJB for DTCs and refer to the relevant DTC Index


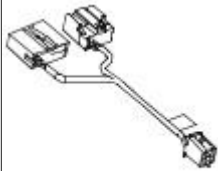
DTC	Description	Possible Cause	Action
U042300	Invalid Data Received From Instrument Panel Control Module	<ul style="list-style-type: none"> <li>Invalid message from the instrument cluster</li> </ul>	No fault with parking brake system if this DTC is logged. Check the instrument cluster for DTCs and refer to relevant DTC Index
U043364	Invalid Data Received From Cruise Control Front Distance Range Sensor	<ul style="list-style-type: none"> <li>Incorrect parking brake apply request from the speed control when the conditions were not correct</li> </ul>	No fault with parking brake system if this DTC is logged. Check the speed control module for DTCs and refer to relevant DTC Index
U200168	Reduced System Function	<ul style="list-style-type: none"> <li>Invalid or missing message from ABS with ignition OFF and vehicle speed &gt; 3Kph</li> </ul>	No fault with parking brake system if this DTC is logged. Check the anti-lock control - stability assist module for DTCs and refer to the relevant DTC Index
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> <li>Vehicle/component VIN mis-match between RJB and parking brake module, module installed from donor vehicle</li> </ul>	Install original module, check for parking brake related DTCs and refer to DTC Index. If DTC remains suspect parking brake module, refer to new module/component installation note at top of DTC Index
U300362	Battery Voltage	<ul style="list-style-type: none"> <li>Mis-match in battery voltage, of 2 volts or more, between parking brake module and RJB</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system


## Symptom Chart


Symptom	Possible Cause	Action
The parking brake will not engage or release (with no parking brake warning message)	<ul style="list-style-type: none"> <li>Cables fouled, trapped or damaged</li> <li>Cables incorrectly routed or installed</li> <li>Rear lining wear</li> <li>Service brake incorrectly adjusted following lining change</li> <li>Caliper malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Check parking brake system for DTCs and refer to DTC Index</li> <li>Check the rear and primary cables for correct installation and damage.</li> <li>Inspect the rear brake linings for wear</li> <li>Carry out parking brake calibration procedure</li> <li>Check the rear service brake for correct installation and operation</li> </ul>
The parking brake will not engage or release (with parking brake warning message)	<ul style="list-style-type: none"> <li>Cables fouled, trapped or damaged</li> <li>Cables incorrectly routed or installed</li> <li>Rear lining wear</li> <li>Actuator malfunction</li> <li>Caliper malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Check parking brake system for DTCs and refer to DTC Index</li> <li>Check the rear and primary cables for correct installation and damage.</li> <li>Inspect the rear brake linings for wear</li> <li>Carry out parking brake calibration procedure</li> <li>Check the rear service brake for correct installation and operation</li> </ul>
No communication with the parking brake module	<ul style="list-style-type: none"> <li>Fuse</li> <li>Module off Bus</li> <li>CAN network error</li> <li>Parking brake module fault</li> </ul>	<ul style="list-style-type: none"> <li>Check fuses</li> <li>Ensure battery is fully charged and in serviceable condition. Check battery voltage at parking brake module</li> <li>Check CAN network using manufacturer approved diagnostic system</li> </ul>
'Park brake Fault' displayed on message center with associated warning lamps	<ul style="list-style-type: none"> <li>Parking brake system fault</li> </ul>	<ul style="list-style-type: none"> <li>Check the parking brake module for DTCs and refer to DTC Index</li> </ul>
Brakes drag	<ul style="list-style-type: none"> <li>Parking brake not re-calibrated after battery has been disconnected or has been in a state of discharge, or repairs have been carried out to the rear service or parking brake system</li> <li>Service brake system fault</li> </ul>	<ul style="list-style-type: none"> <li>Check parking brake levers are fully returned to the hard stops when the parking brake is released. If the levers are fully returned, check service brake for correct operation. If not, carry out the parking brake calibration procedure</li> </ul>

## Parking Brake and Actuation - Parking Brake Cable Tension Release

General Procedures


Special Tool(s)	
 <p>206-082</p>	<p>Electric parking brake release tool 206-082. Only to be used for EMERGENCY brake release</p>
 <p>E69907</p>	<p>Electric parking brake release tool link lead 206-082-01. Only to be used for EMERGENCY brake release</p>

 **WARNING:** Failure to release the tension and calibrate the electric parking brake during rear parking brake related service procedures, could cause the parking brake to function incorrectly or become inoperative.

-  **WARNING:** Always use Jaguar approved diagnostic equipment to release the cable tension, when carrying out repair operations on the electric park brake which require cable tension release.

Connect the Jaguar approved diagnostic equipment to release the electric parking brake cable tension.

- Follow the on-screen instructions.

-  **WARNING:** The procedure below should only be used in emergency situations, to release the electric park brake. All calibration of the parking brake system will be lost, and the parking brake will need to be re-calibrated to function correctly.

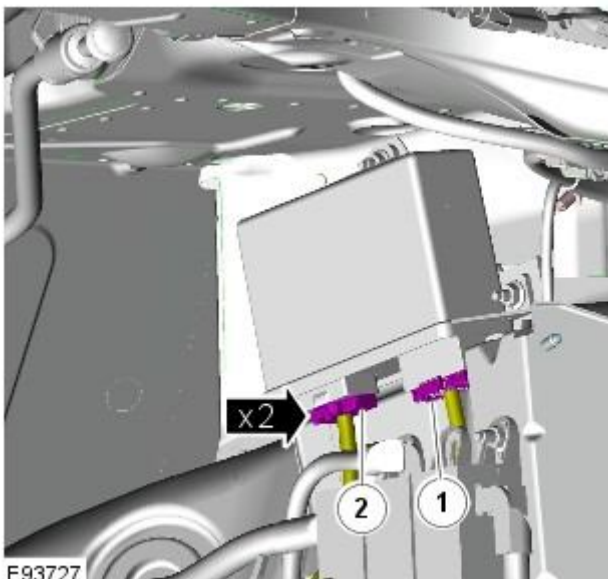
- **NOTE:** The tools shown must only be used in the event of an emergency.

Remove the RH loadspace trim panel.

For additional information, refer to: [Loadspace Trim Panel RH](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

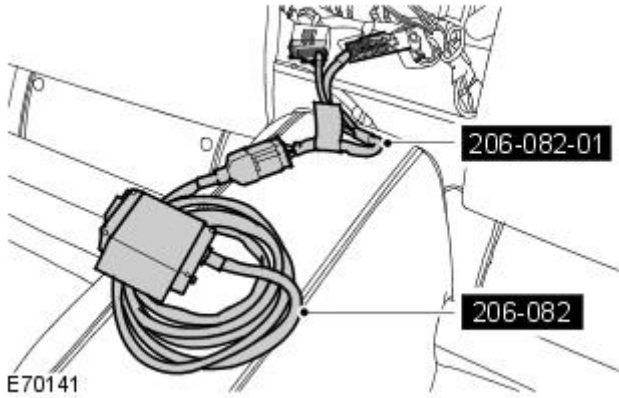
-  **WARNING:** Failure to follow this instruction may result in a diagnostic trouble code (DTC) being generated.

Disconnect the 2 electrical connectors from the parking brake module, in the sequence illustrated.



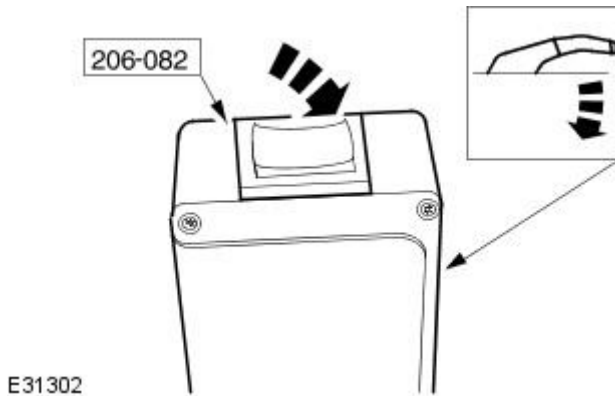
4. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Connect the special tool to the parking brake module.



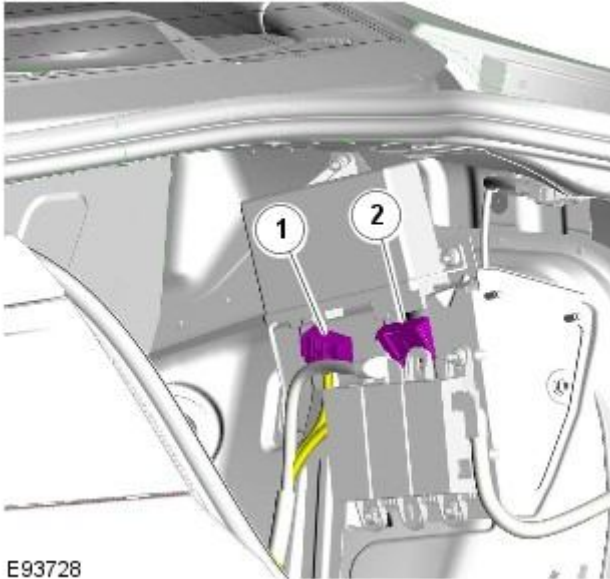
5. Release the parking brake cable tension.

- An audible 'click', signals complete parking brake cable tension release.




6. Remove the special tool and carry out any necessary repairs on the system.

7. Connect the electrical connectors in the sequence shown.



8. Install the RH loadspace trim panel.

For additional information, refer to: [Loadspace Trim Panel RH](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

9.  **WARNING:** Calibrate the electric park brake using Jaguar approved diagnostic equipment. If Jaguar approved diagnostic equipment is not available disconnect the battery for approximately 30 seconds, the vehicle will then prompt the driver to carry out the calibration procedure as per the vehicle hand book on re-connection.

Calibrate the electric park brake.

# Parking Brake and Actuation - Parking Brake Cable LH2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Removal and Installation

## Removal



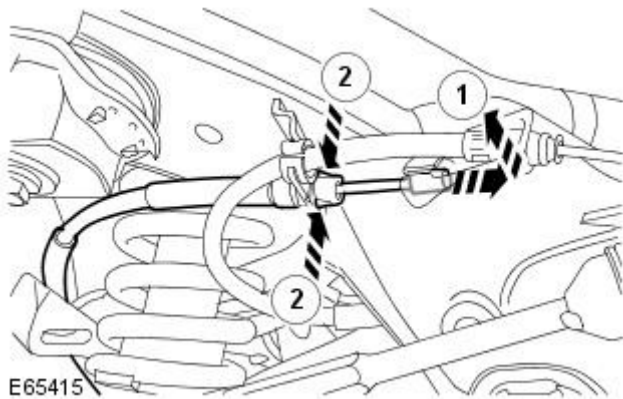
**WARNING:** Failure to release the tension and calibrate the electric parking brake during rear parking brake related service procedures, could cause the parking brake to function incorrectly or become inoperative.



**1. WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

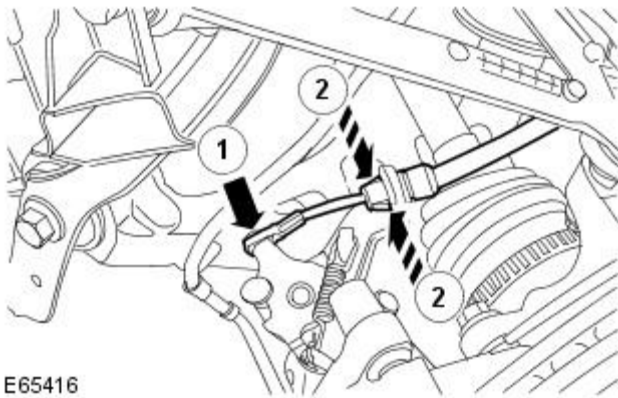
2. Remove the LH rear wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
3. Release the parking brake cable tension.  
For additional information, refer to: [Parking Brake Cable Tension Release](#) (206-05 Parking Brake and Actuation, General Procedures).
4. Detach the LH parking brake cable.



1. Detach the LH parking brake cable from the retaining tang.
2. Release the 2 clips.

**5. NOTE:** Note the fitted position.

Detach and remove the LH parking brake cable from the caliper.



1. Detach the LH parking brake cable.
2. Release the 2 clips.

## Installation

**1. NOTE:** Align to the position noted on removal.

Install the LH parking brake cable.

- Carefully secure the clips.
- Attach the LH parking brake cable.

**2. NOTE:** Make sure that the RH parking brake cable is correctly set in the retaining tang.  
**3.** Install the wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).  
Attach the LH parking brake cable.

- Carefully secure the clips.
- Attach the LH parking brake cable to the retaining tang.



# Parking Brake and Actuation - Parking Brake Cable RH2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Removal and Installation

## Removal



**WARNING:** Failure to release the tension and calibrate the electric parking brake during rear parking brake related service procedures, could cause the parking brake to function incorrectly or become inoperative.



**1. WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

**2.** Remove the RH rear wheel and tire.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

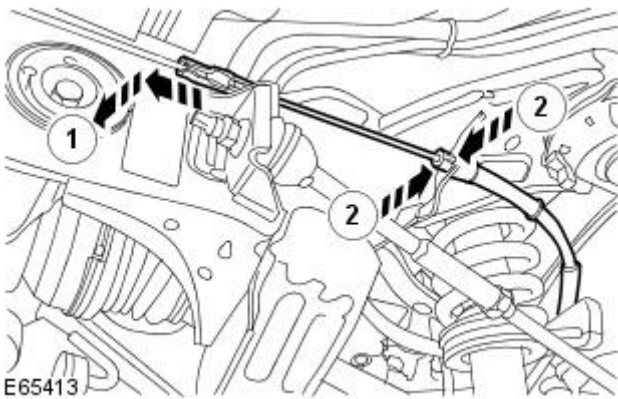
**3.** Release the parking brake cable tension.

For additional information, refer to: [Parking Brake Cable Tension Release](#) (206-05 Parking Brake and Actuation, General Procedures).

**4.** Detach the RH parking brake cable.

**1.** Detach the RH parking brake cable from the retaining tang.

**2.** Release the 2 clips.



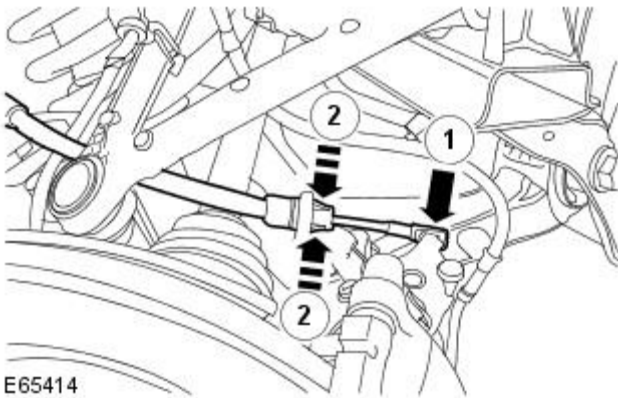
E65413

**5. NOTE:** Note the fitted position.

Detach and remove the RH parking brake cable from the caliper.

**1.** Detach the RH parking brake cable.

**2.** Release the 2 clips.



E65414

## Installation

**1. NOTE:** Align to the position noted on removal.

Install the RH parking brake cable.

- Carefully secure the clips.
- Attach the RH parking brake cable.

**2. NOTE:** Make sure that the RH parking brake cable is correctly

**3.** Install the wheel and tire. For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation). Attach the RH parking brake cable.

- Carefully secure the clips.
- Attach the RH parking brake cable to the retaining tang.

## Parking Brake and Actuation - Parking Brake Module

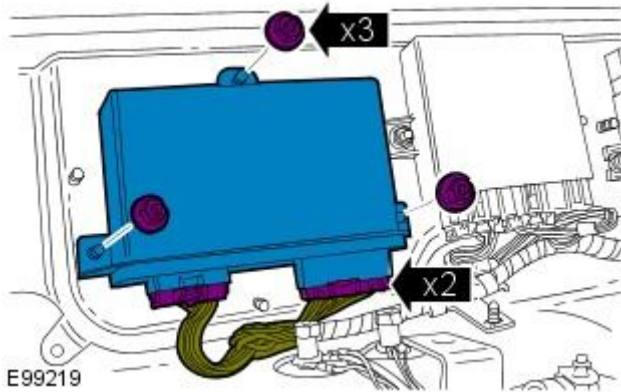
Removal and Installation

### Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Loadspace Trim Panel RH](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Torque: 4 Nm



### Installation

1. To install, reverse the removal position
2. Configure the electronic parking brake (EPB) using the diagnostic tool.

# Parking Brake and Actuation - Parking Brake Switch


Removal and Installation

## Removal

- NOTE: The parking brake switch is part of the transmission control switch (TCS) assembly and therefore can not be serviced separately.
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Transmission Control Switch \(TCS\)](#) (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation).

## Installation

1.  CAUTION: Make sure that all diagnostic trouble codes (DTCs) have been removed after the road test.


To install, reverse the removal procedure.

# Parking Brake and Actuation - Parking Brake Release Actuator 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Removal and Installation

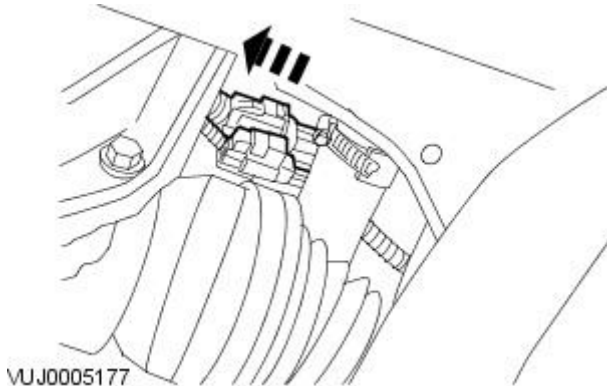
## Removal

1. Carry out the parking brake cable tension release.  
For additional information, refer to: [Parking Brake Cable Tension Release](#) (206-05 Parking Brake and Actuation, General Procedures).

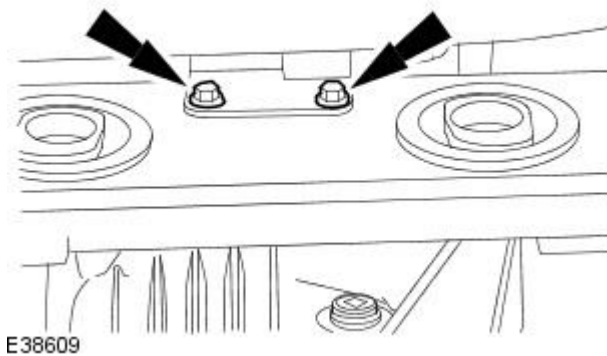
2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Disconnect the parking brake release actuator electrical connector.



4. Remove the parking brake release actuator retaining bolts.

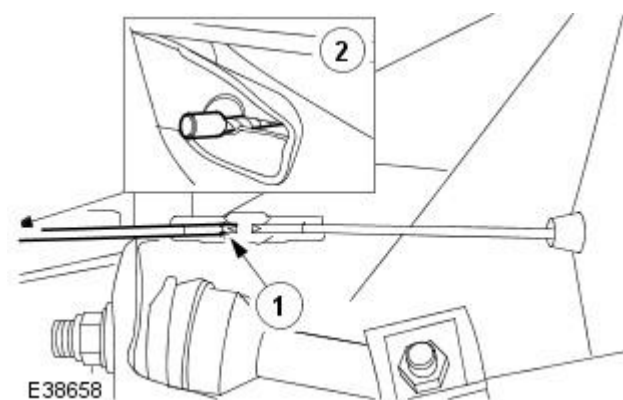


5. Detach the parking brake release actuator cable.

1. For right-hand side connector bracket:
  1. Reposition the retaining tang.

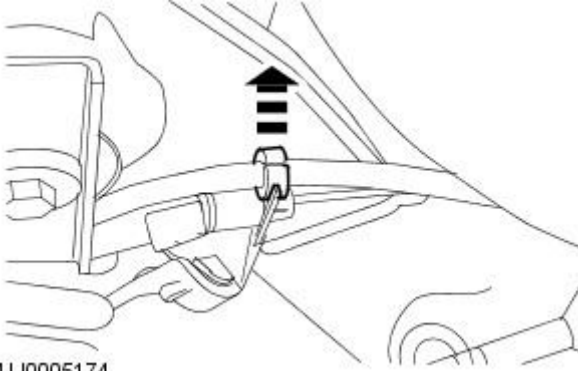
2. Detach the parking brake cable.

2. For left-hand side reaction bracket, detach the parking brake cable.



**6. NOTE:** Note the fitted position.

Detach the parking brake release actuator cable.

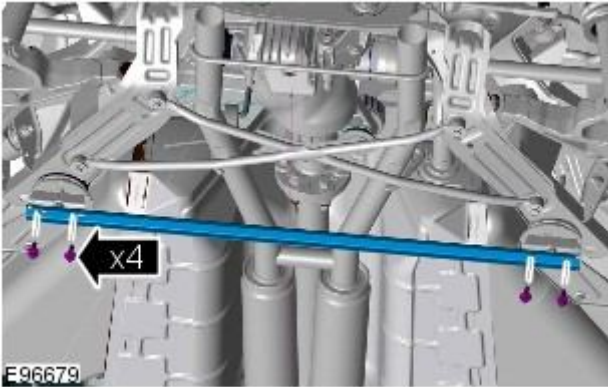


VUJ0005174

**7.** Remove the engine rear undershield.

For additional information, refer to: [Engine Rear Undershield](#) (501-02 Front End Body Panels, Removal and Installation).

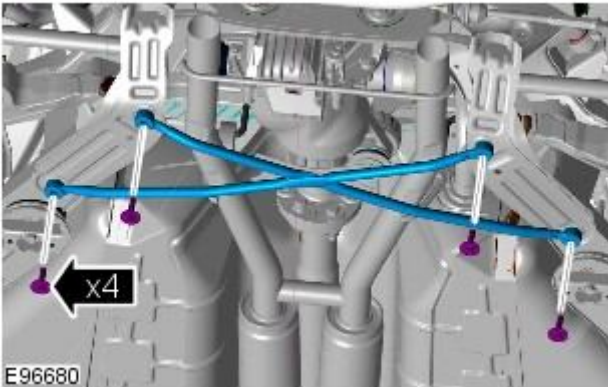
**8.** Remove the rear crossmember.



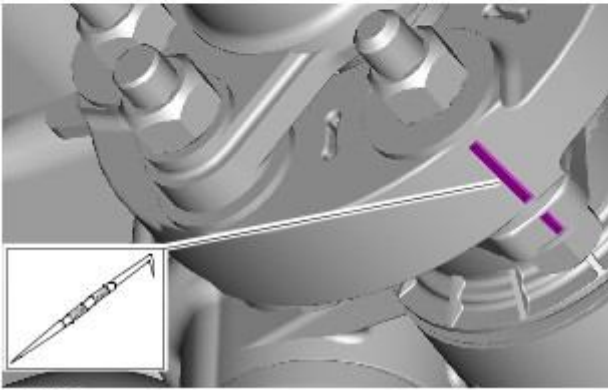
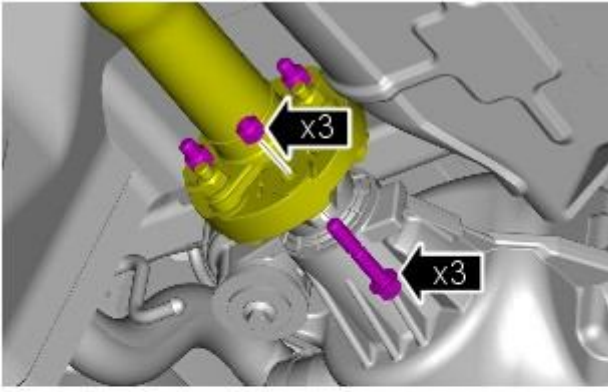
E96679

**9.** Remove the rear subframe crossbrace.


- Remove the rear subframe crossbrace.



E96680



E98780

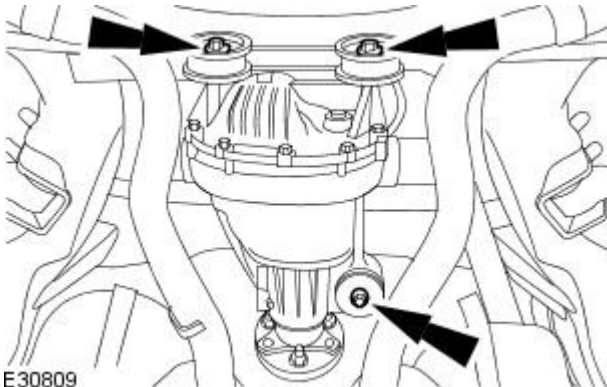
**10.**  **CAUTION:** Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the driveshaft.

Detach the driveshaft from the rear drive axle flange.

- Mark the position of the driveshaft in relation to the rear drive axle flange.
- Mark the position of the balance nut in relation to the rear drive axle flange. (if fitted).
- Mark the position of each nut and bolt in relation to the driveshaft flexible joint.

**11.** Using the special tool, support the axle assembly.

**12.** Remove the axle assembly retaining bolts.

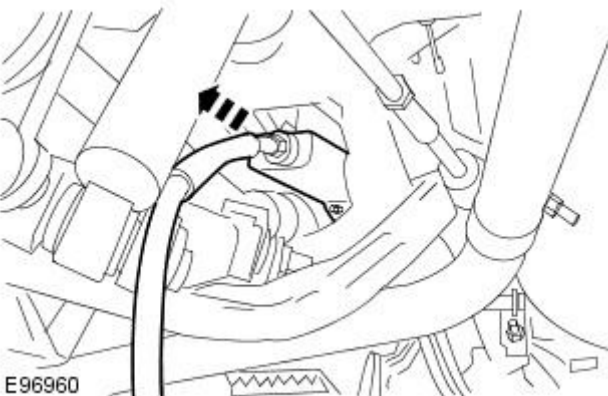


E30809

**13.**  **CAUTION:** Make sure the halfshafts remain clear of the rear suspension/subframe.

Lower the rear axle assembly.

**14.** Remove the parking brake actuator.



E96960



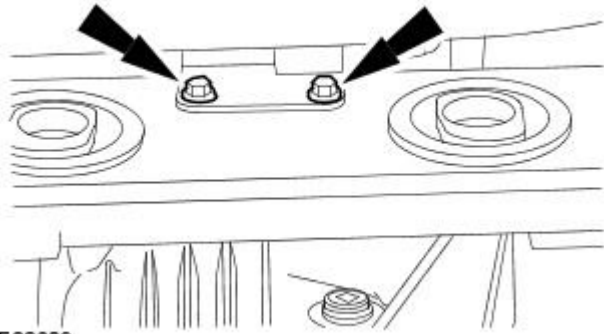
## Installation

1. NOTE: Make sure the parking brake cable is correctly routed.

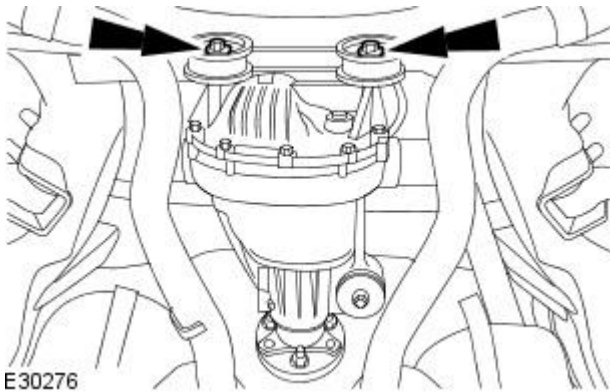
• NOTE: Make sure that the parking brake cables are correctly seated in the retaining tangs.

To install, reverse the removal procedure.

- Tighten to 20 Nm.

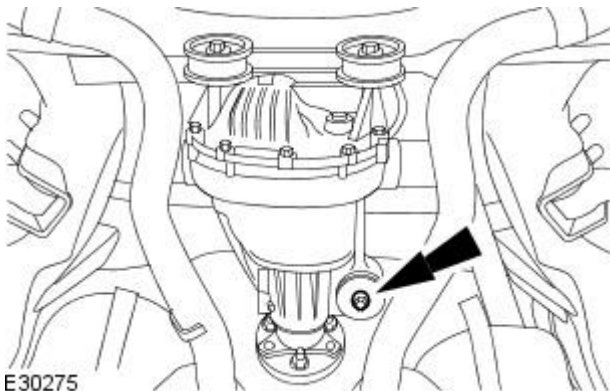


E38609



E30276

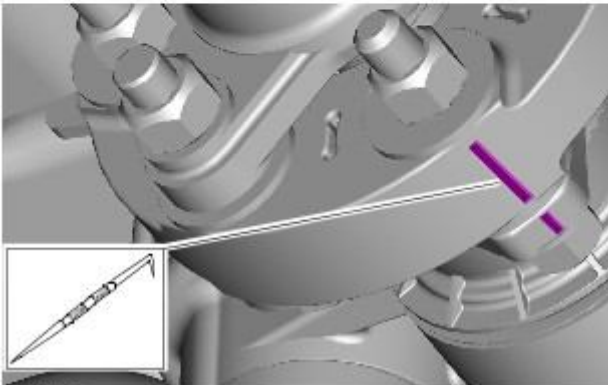
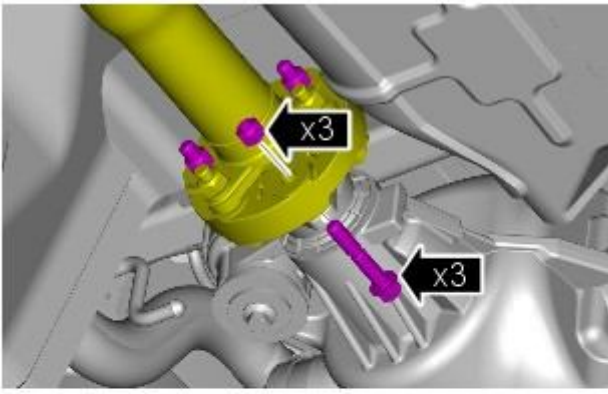
2. Tighten to 190 Nm.



E30275

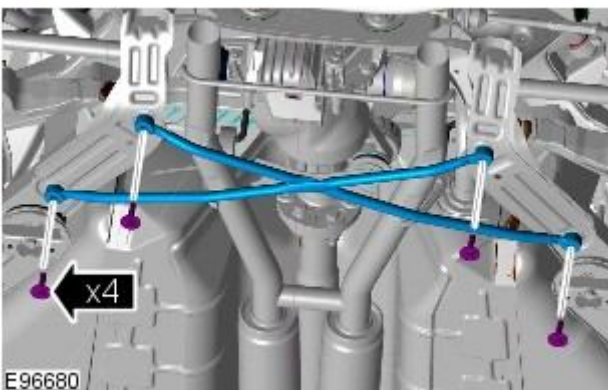
3. Tighten to 90 Nm.

4. Tighten to 108 Nm.



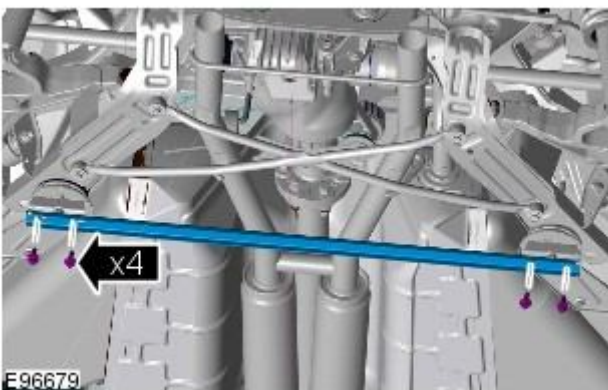
E98780

5. Tighten to 30 Nm.



E96680

6. Tighten to 62 Nm.



E96679

7. Install the engine rear undershield.  
For additional information, refer to: [Engine Rear Undershield](#)  
(501-02 Front End Body Panels, Removal and Installation).

8.  CAUTION: Calibrate the electric park brake using Jaguar



approved diagnostic system. If the Jaguar approved diagnostic system is not available disconnect the battery for approximately 30 seconds, the vehicle will then prompt the driver to carry out the calibration procedure as per the vehicle hand book on re-connection.

Calibrate the electric parking brake (EPB) using the diagnostic tool.

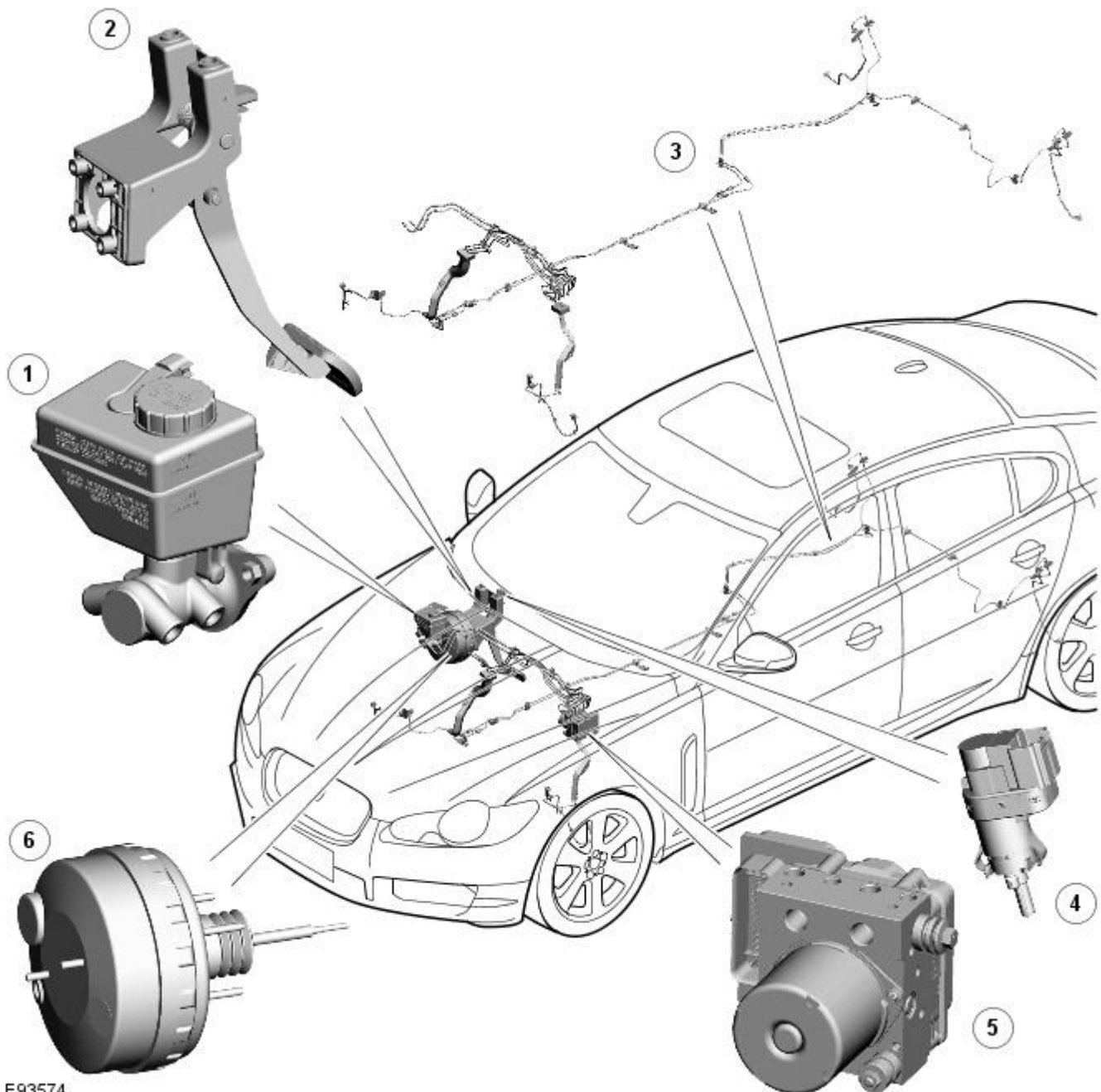
# Hydraulic Brake Actuation - Hydraulic Brake Actuation - Component

## Location

Description and Operation

- NOTE: RHD (right-hand drive) installation shown, LHD (left-hand drive) installation similar.

Component Location



E93574

### ItemDescription

1	Brake master cylinder and fluid reservoir
2	Brake pedal
3	Brake pipes
4	Stoplamp switch
5	ABS (anti-lock brake system) module/ HCU (hydraulic control unit)
6	Brake booster

# Hydraulic Brake Actuation - Hydraulic Brake Actuation - Overview

Description and Operation

## Overview

The hydraulic brake system is a diagonally split dual line system. The system consists of a brake pedal, vacuum brake booster, brake master cylinder assembly, [HCU \(hydraulic control unit\)](#), hydraulic pipes and brake hoses.

Brake pipes from the master cylinder supply pressure to the brake calipers at the four corners of the vehicle via the [HCU](#). Braided steel hoses are used to connect the brake pipes to the front and rear brake calipers.

# Hydraulic Brake Actuation - Hydraulic Brake Actuation - System Operation and Component Description

Description and Operation

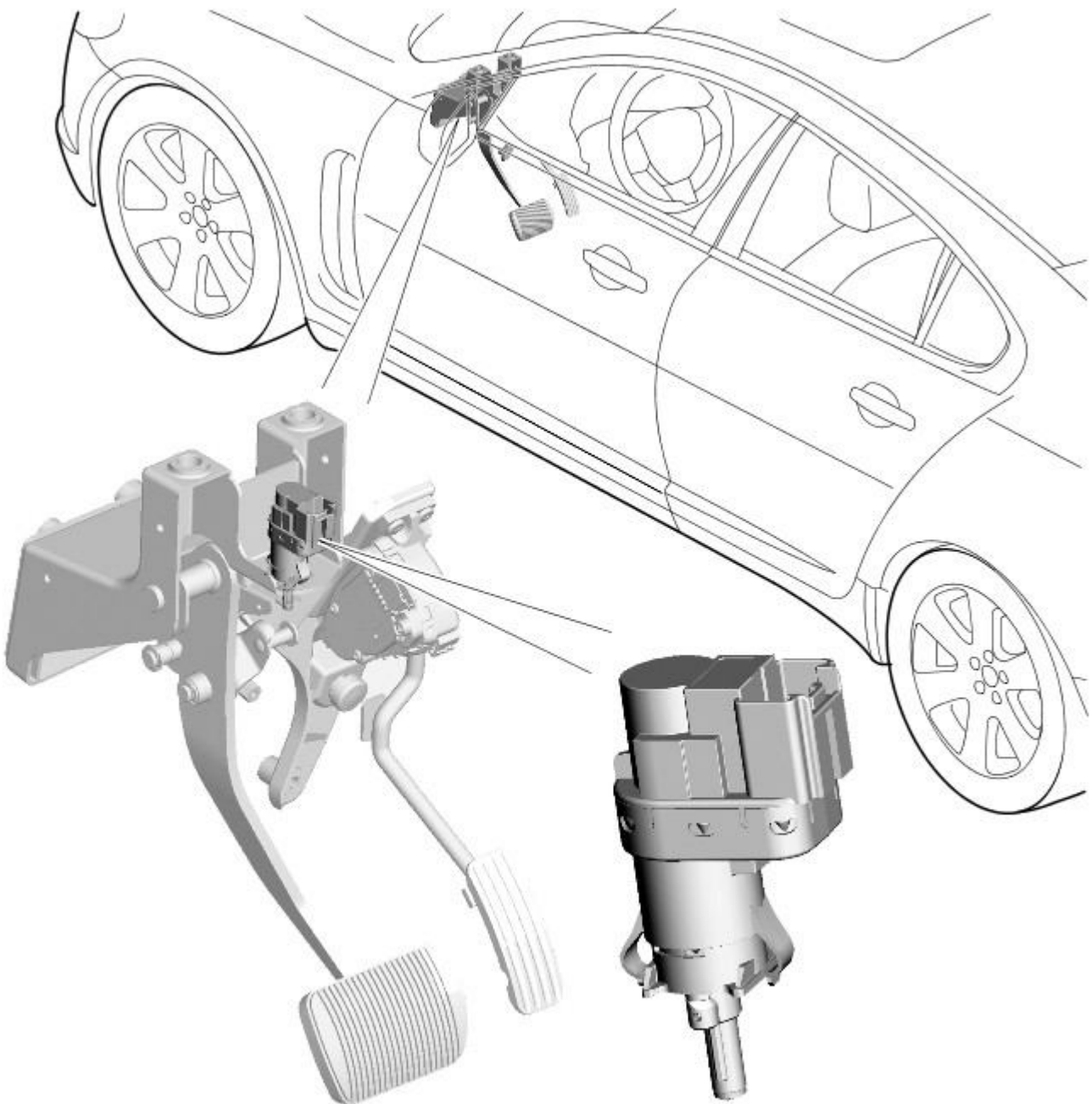
## System Operation

When the brake pedal is pressed, the front push rod in the brake booster pushes the master cylinder primary piston along the bore of the housing. This produces pressure in the primary pressure chamber which, in conjunction with the primary spring, overcomes the secondary spring and simultaneously moves the secondary piston along the bore. The initial movement of the pistons away from the piston stops closes the primary and secondary center valves in the master cylinder. Further movement of the pistons then pressurizes the fluid in the primary and secondary chambers and thus the brake circuits. The fluid in the chambers behind the pistons is unaffected by the movement of the pistons and can flow unrestricted through the inlet ports between the chambers and the reservoir.

Pressurized fluid enters the [HCU \(hydraulic control unit\)](#), which is mounted on the front of the [ABS \(anti-lock brake system\)](#) module. The [HCU](#) modulates the supply of pressurized fluid to the brakes under control of the [ABS](#) module. Refer to: [Anti-Lock Control - Stability Assist](#) (206-09 Anti-Lock Control - Stability Assist, Description and Operation).

## Component Description

### Brake Pedal

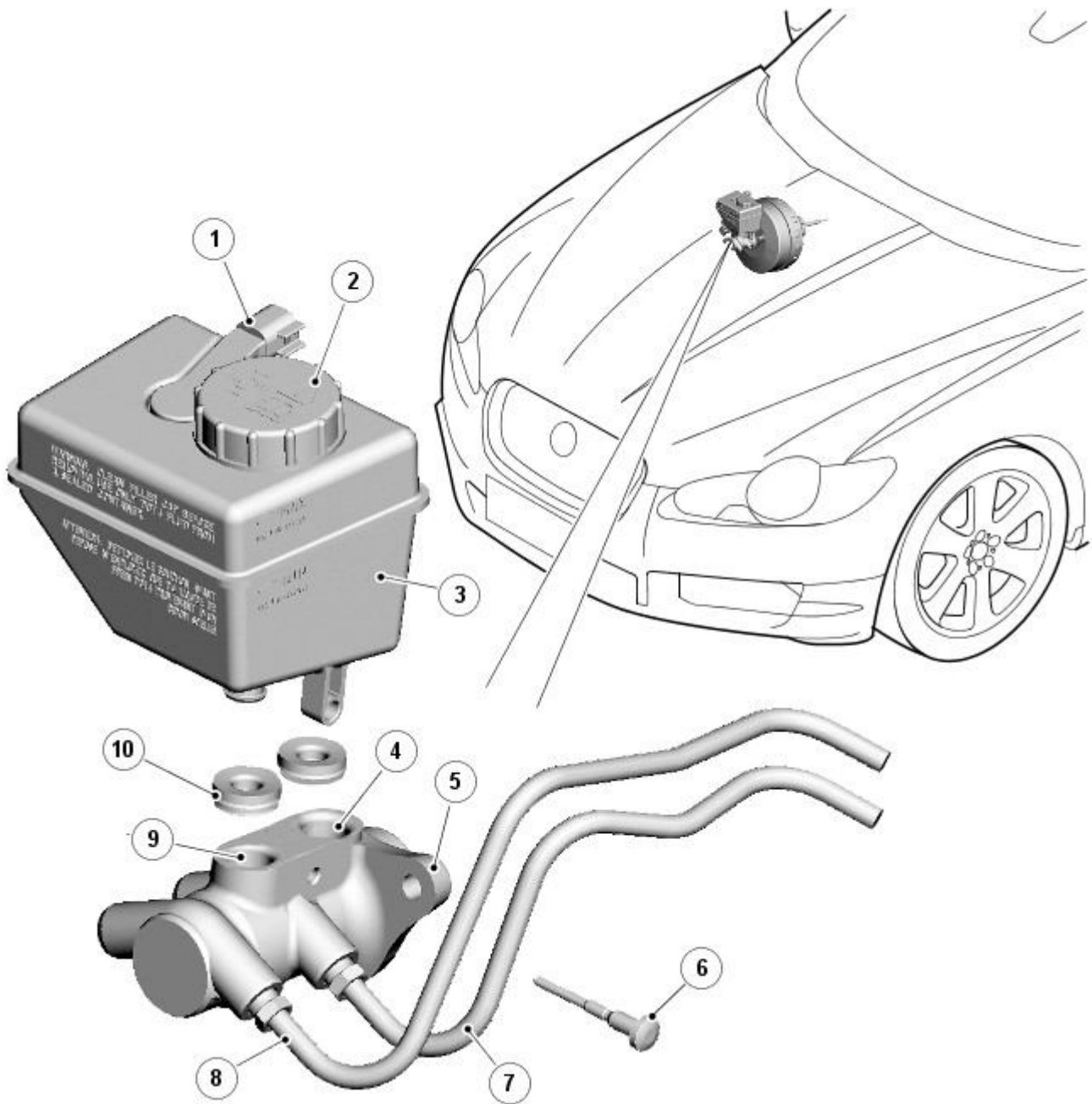


E93526

The brake pedal is mounted to a bracket attached to the rear side of the engine bulkhead. The bracket also contains the accelerator pedal. A clevis pin connects the brake pedal to the input push rod of the brake booster and master cylinder assembly.

The stoplamp switch is mounted in the brake pedal bracket and is operated by the brake pedal.

## Brake Master Cylinder and Fluid Reservoir



E93575

### ItemDescription

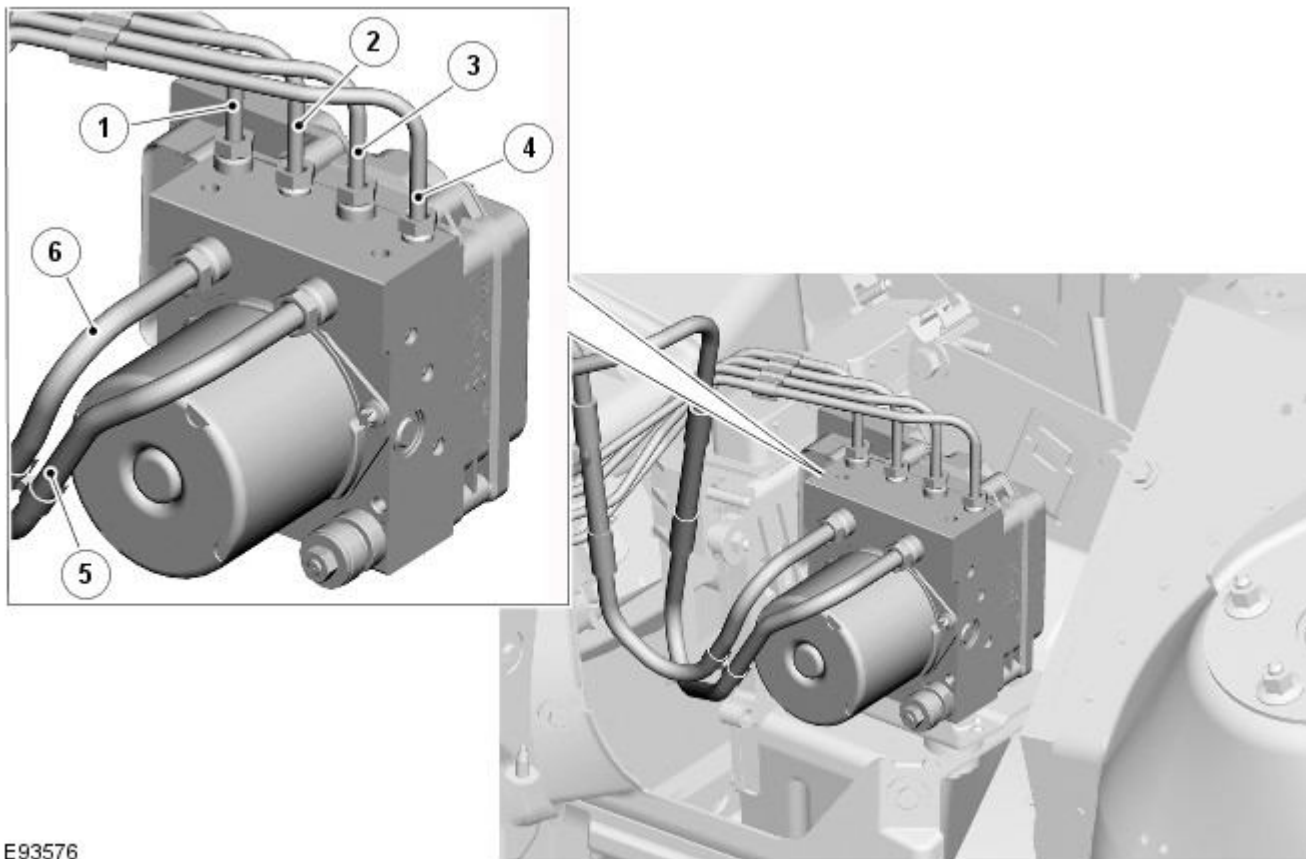
1	Brake fluid level switch electrical connector
2	Brake fluid reservoir cap
3	Brake fluid reservoir
4	Primary circuit inlet port
5	Brake master cylinder
6	Torx bolt
7	Primary circuit outlet
8	Secondary circuit outlet
9	Secondary circuit inlet port
10	Reservoir to master cylinder seal (2 off)

The brake booster and master cylinder assembly is fitted in the engine compartment. The brake master cylinder housing consists of two hydraulic chambers containing two pistons in tandem. The primary piston (adjacent to the brake booster) produces pressure for the primary braking circuit and this pressure acts on the secondary piston and hence creates pressure in the secondary circuit. A brake fluid reservoir is mounted on top of the master cylinder to provide a supply of brake fluid to the brake system. The reservoir cap is fitted with a brake fluid level switch.

## Brake Fluid Level Switch

The brake fluid level switch is located in the fluid reservoir and is hardwired to the instrument cluster. When the level of fluid in the reservoir reaches a predetermined low level, the switch contacts close and provide a signal feed back to the instrument cluster. On receipt of the signal, the brake fluid red warning indicator will illuminate and 'BRAKE FLUID LOW' will be displayed in the message center.

### ABS Module



E93576

#### ItemDescription

1	LH (left-hand) front brake
2	RH (right-hand) rear brake
3	LH rear brake
4	RH front brake
5	Primary circuit inlet port
6	Secondary circuit inlet port

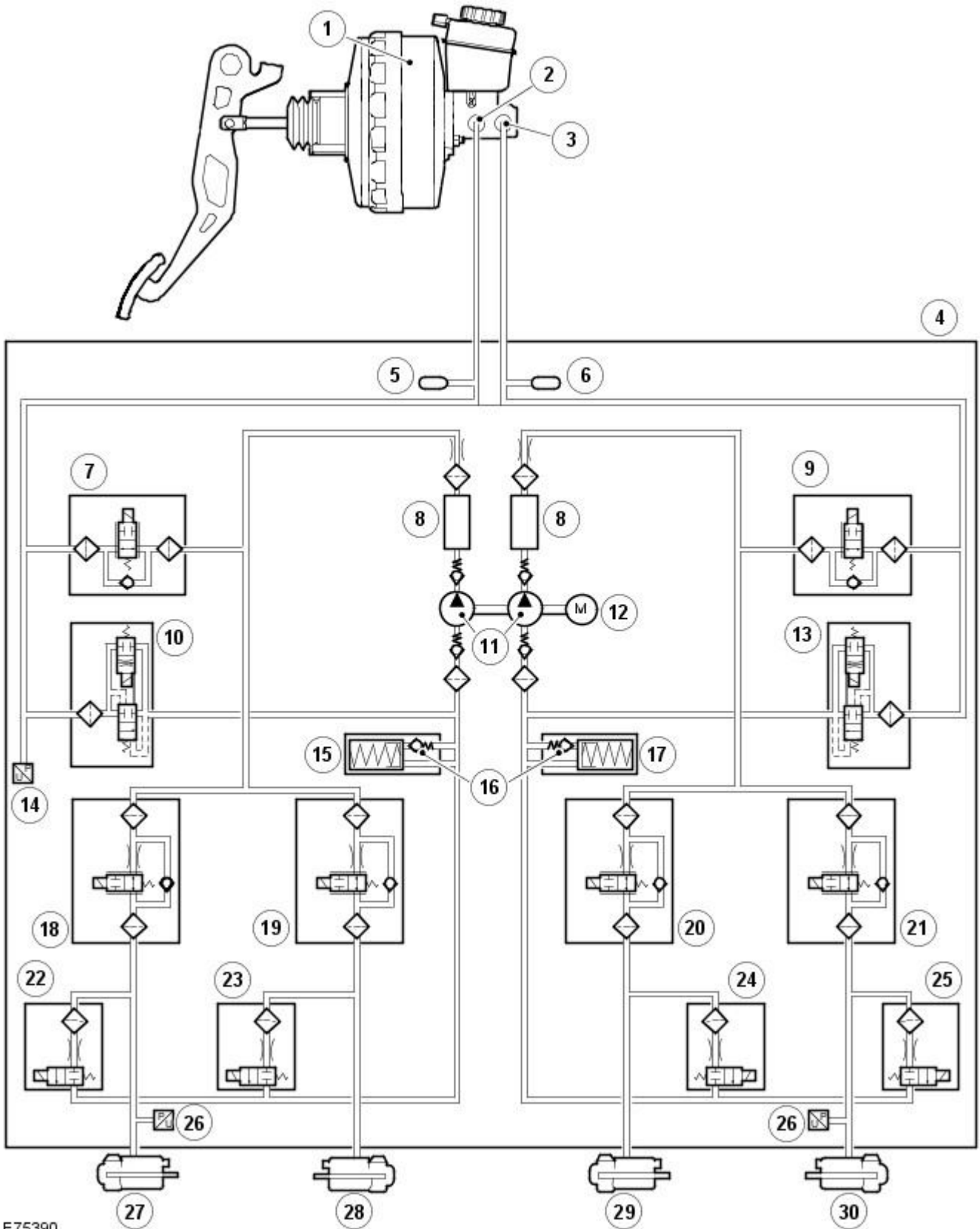
The [ABS](#) module is located in the passenger side, rear engine bay and incorporates the [HCU](#). The [HCU](#) is a four channel unit that modulates the supply of hydraulic pressure to the brakes under control of the [ABS](#) module.

The primary and secondary outlets of the master cylinder are connected to the primary and secondary circuits within the [HCU](#). The primary circuit in the [HCU](#) has separate outlet ports to the [RH](#) front and [LH](#) rear brakes. The secondary circuit in the [HCU](#) has separate outlet ports to the [LH](#) front and [RH](#) rear brakes.



**CAUTION:** The [ABS](#) module and the [HCU](#) are a single unit and must not be separated.

HCU Schematic Diagram



E75390

**ItemDescription**

1	Brake booster
2	Primary circuit
3	Secondary circuit
4	<a href="#">HCU</a>
5	Pulsation damper
6	Pulsation damper
7	Separation valve
8	Damping chambers



9	Separation valve
10	Shuttle valve
11	Hydraulic pumps
12	Motor
13	Shuttle valve
14	Pressure sensor - all vehicles
15	Low pressure accumulator
16	Check valve
17	Low pressure accumulator
18	Inlet valve
19	Inlet valve
20	Inlet valve
21	Inlet valve
22	Outlet valve
23	Outlet valve
24	Outlet valve
25	Outlet valve
26	Pressure sensors - vehicles fitted with adaptive speed control only
27	<a href="#">RH</a> front brake
28	<a href="#">LH</a> rear brake
29	<a href="#">RH</a> rear brake
30	<a href="#">LH</a> front brake



## Hydraulic Brake Actuation - Hydraulic Brake Actuation

Diagnosis and Testing

For additional information.

REFER to: [Brake System](#) (206-00 Brake System - General Information, Diagnosis and Testing).

# Hydraulic Brake Actuation - Brake Fluid Reservoir

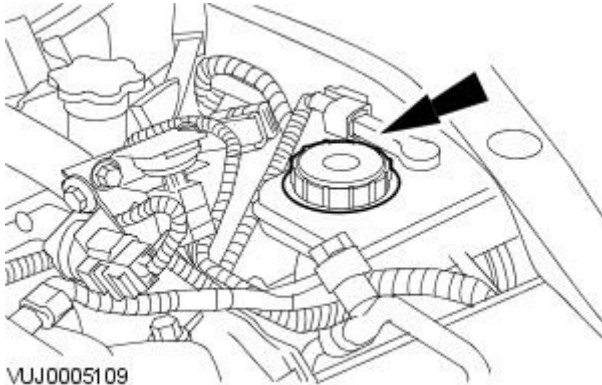
Removal and Installation

## Removal

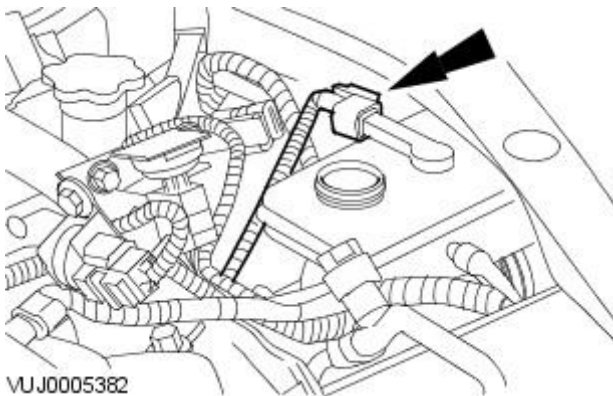


**CAUTION:** If brake fluid is spilled on the paintwork, the affected area must be immediately washed down with cold water.

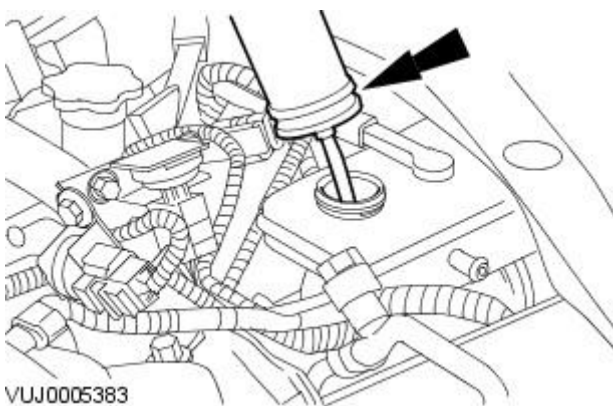
1. Remove the brake fluid reservoir cap.



2. Disconnect the brake fluid level electrical connector.



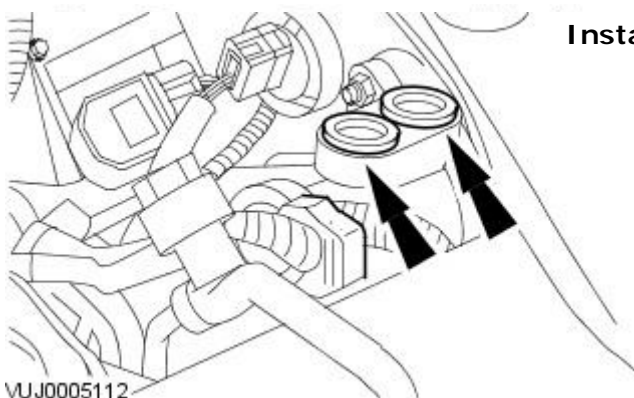
3. Using a suitable suction device drain the brake fluid reservoir.

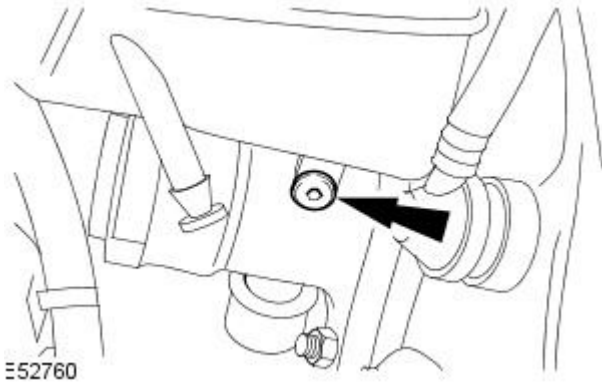


4. Remove the brake fluid reservoir seals.

## Installation

5. Remove and discard the O-ring seals.





E52760


1. To install, reverse the removal procedure.

- Tighten to 8 Nm.
- Fill the brake fluid reservoir to the MAX mark.

# Hydraulic Brake Actuation - Brake Master Cylinder


Removal and Installation

## Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

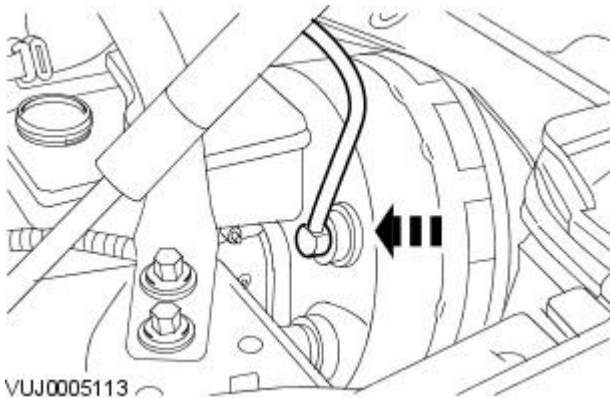
2. Remove the cowl vent screen.  
For additional information, refer to: [Cowl Vent Screen](#) (501-02 Front End Body Panels, Removal and Installation).


3.  **CAUTION:** Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

Remove the brake fluid reservoir.

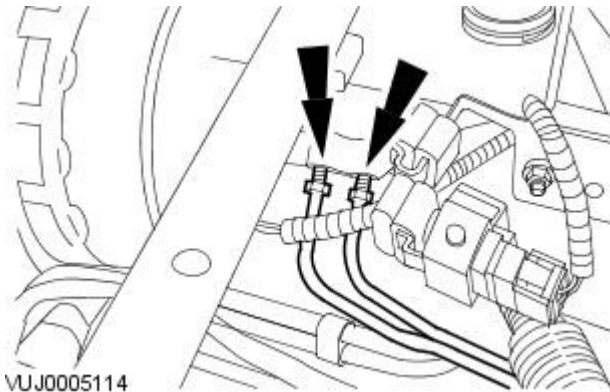
For additional information, refer to: [Brake Fluid Reservoir](#) (206-06 Hydraulic Brake Actuation, Removal and Installation).

4. Remove the brake booster vacuum line from the brake vacuum pump.

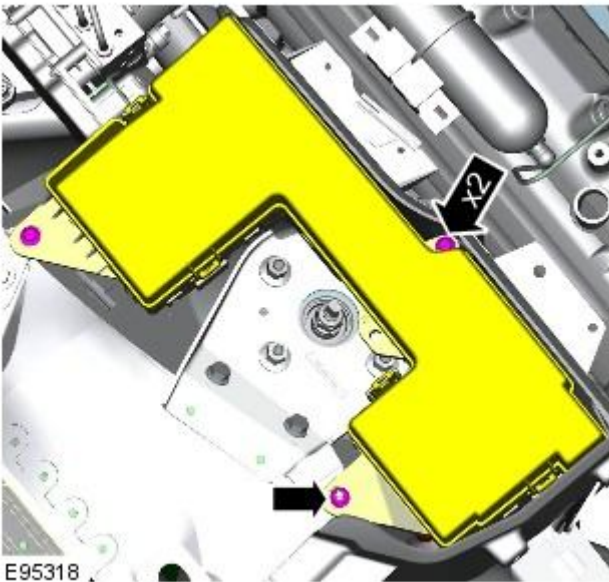


5.  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.

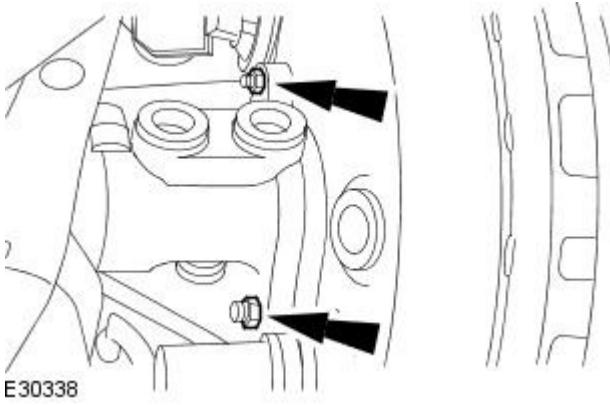
Disconnect the master cylinder brake pipes.



6. Release the fuse box.



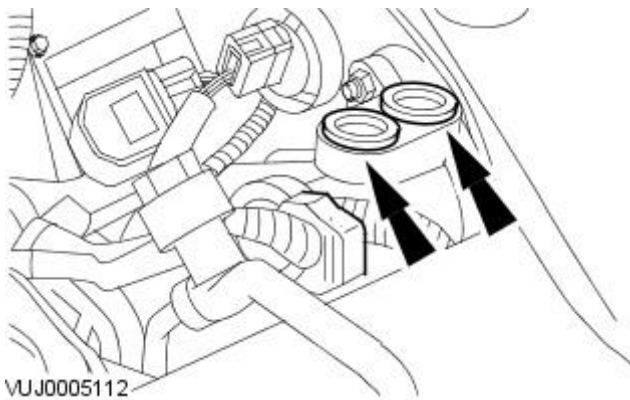
7. Remove the brake master cylinder.



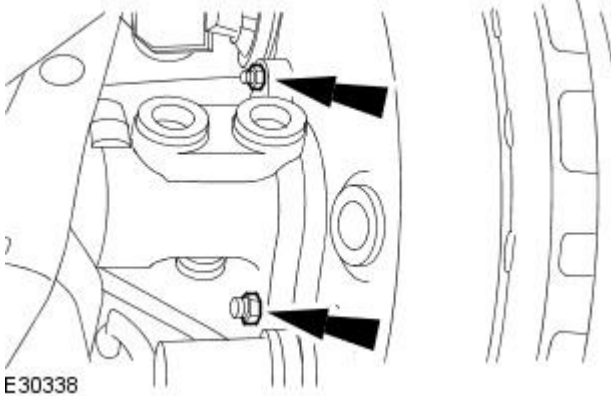
### Installation

1. To install, reverse the removal procedure.

- Install new O-ring seals.

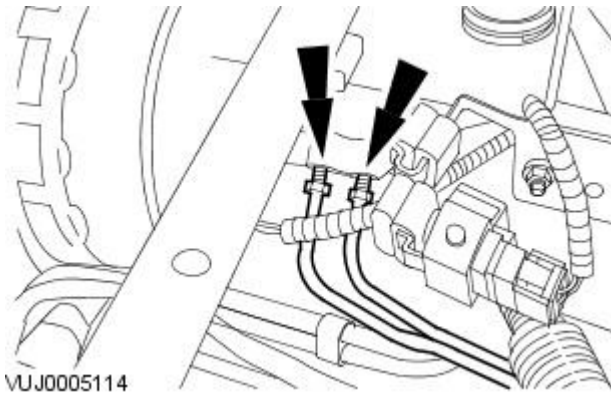


2. Tighten to 25 Nm.



E30338

3. Tighten to 17 Nm.



VUJ0005114

4. Bleed the brake system.

For additional information, refer to: [Brake System Bleeding](#) (206-00 Brake System - General Information, General Procedures).

## Power Brake Actuation -

### Torque Specifications

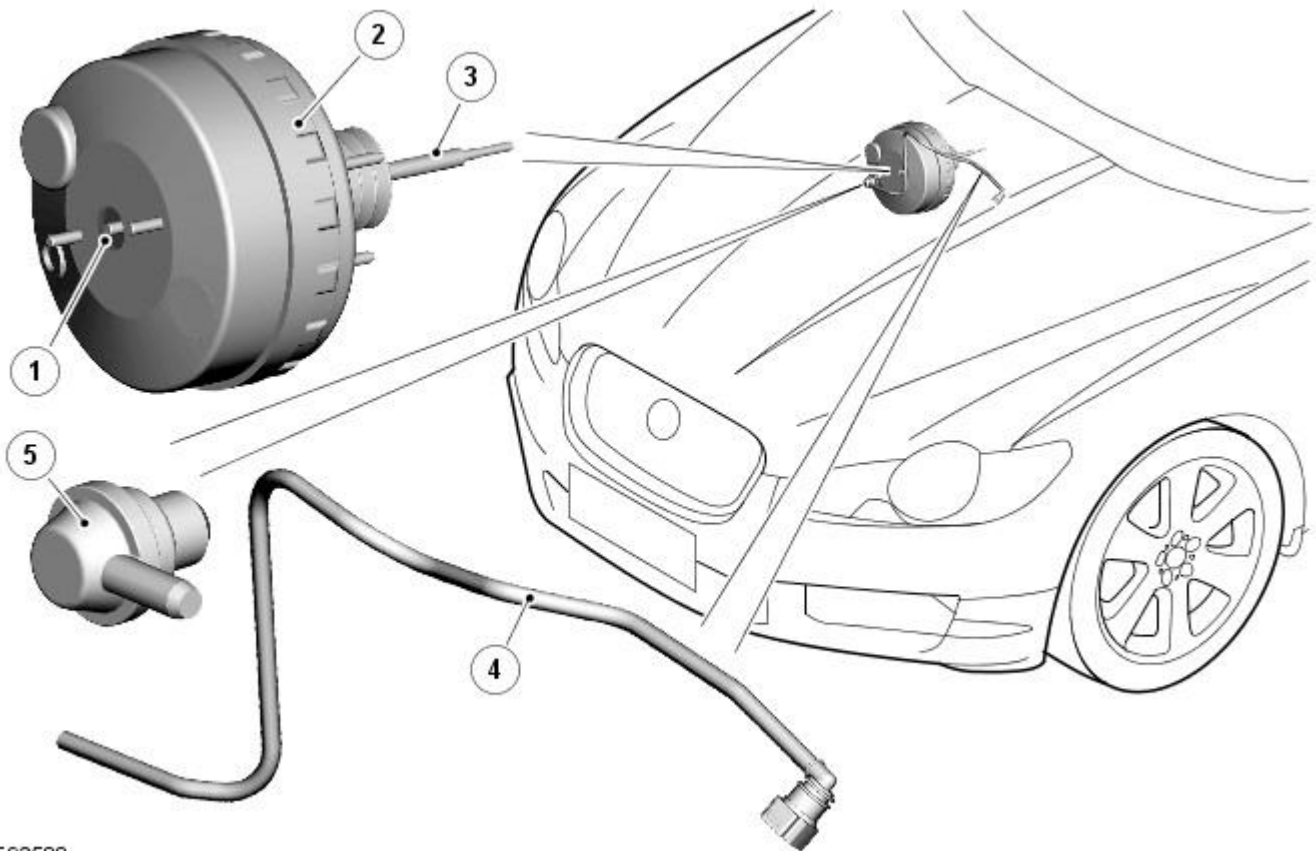
Description	Nm	lb-ft	lb-in
Brake booster retaining nuts - all vehicles	25	18	-
Exhaust gas recirculation valve coolant pipe - vehicles with 3.0L Diesel	9	-	80
Brake vacuum pump nut - vehicles with 3.0L Diesel	23	17	-
Brake vacuum pump threaded stud - vehicles with 3.0L Diesel	13	10	-
Brake vacuum pump bolts - vehicles with 3.0L Diesel	23	17	-
Brake vacuum pump bolts - vehicles with 5.0L	12	9	-

## Power Brake Actuation - Brake Booster - Component Location

Description and Operation

- NOTE: RHD (right-hand drive) installation shown, LHD (left-hand drive) installation similar.

Component Location



E93588

### ItemDescription

1	Output pushrod
2	Brake booster
3	Input pushrod
4	Vacuum pipe
5	Non return valve



# Power Brake Actuation - Brake Booster - Overview

Description and Operation

## Overview

Power assistance for the braking system is provided by a vacuum brake booster. The unit increases the input load by a ratio of 6.2 : 1 and is secured to the driver's side of the engine compartment bulkhead by four studs and nuts.

The booster and master cylinder assembly is fitted in the engine compartment. A two piece plastic vacuum pipe connects the brake booster to the inlet manifold to provide the necessary vacuum to the booster. The connection into the brake booster has a non return valve to maintain the vacuum level in the booster and also prevent fuel vapor from entering the brake booster.

The input push rod within the brake booster is connected to the brake pedal lever. Initially, any effort applied by the driver is increased by pedal ratio which is transferred to the input push rod. This load is further increased by the booster. The increased load is applied to the primary piston of the master cylinder via the output pushrod of the booster. Hydraulic pressure in the master cylinder is then applied to the brakes.

Refer to: [Hydraulic Brake Actuation](#) (206-06 Hydraulic Brake Actuation, Description and Operation).

## **Power Brake Actuation - Power Brake System**

Diagnosis and Testing

For additional information.

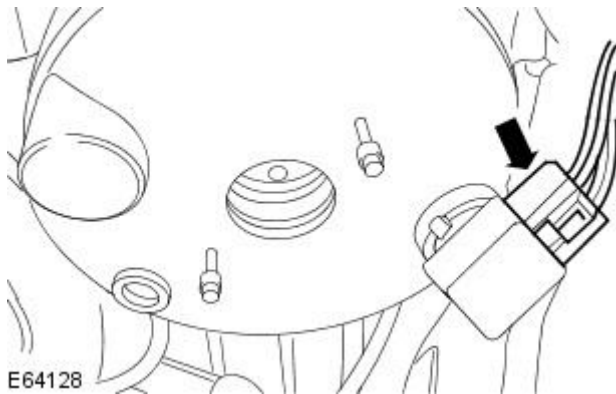
REFER to: [Brake System](#) (206-00 Brake System - General Information, Diagnosis and Testing).

## Power Brake Actuation - Brake Booster

Removal and Installation

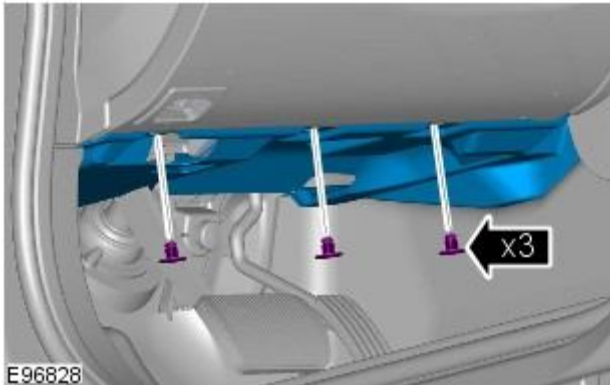
### Removal

1. Remove the brake master cylinder.
2. Disconnect the brake booster vacuum electrical connector.



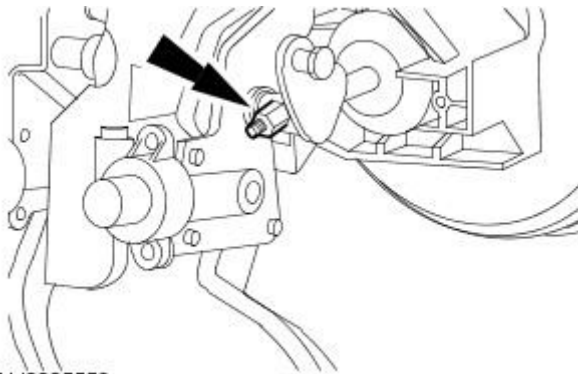
E64128

3. Remove the lower trim panel.



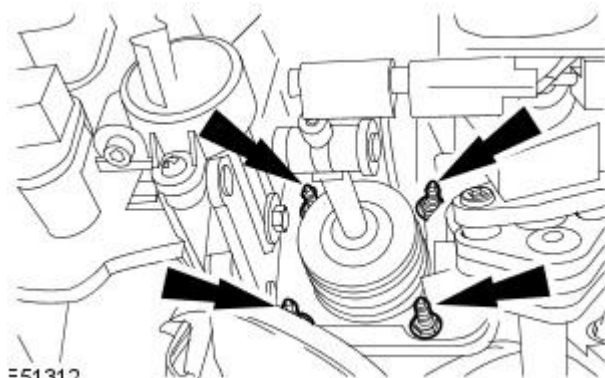
E96828

4. Remove the retaining nut.



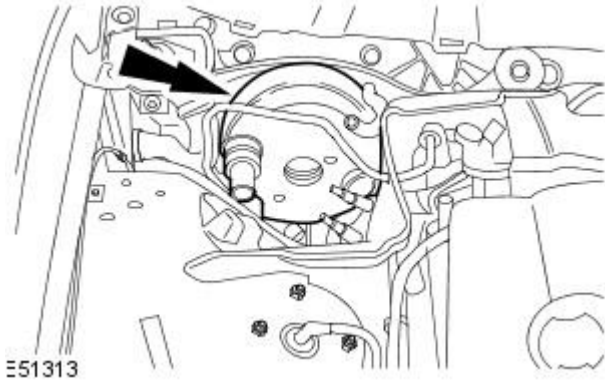
VUJ0005552

5. Remove the brake booster retaining nuts.



E51312

6. Remove the brake booster.

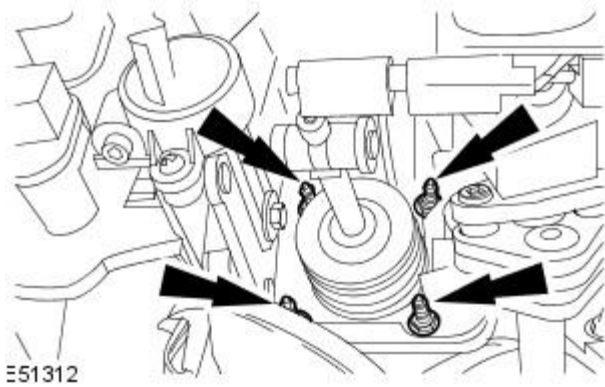


## Installation

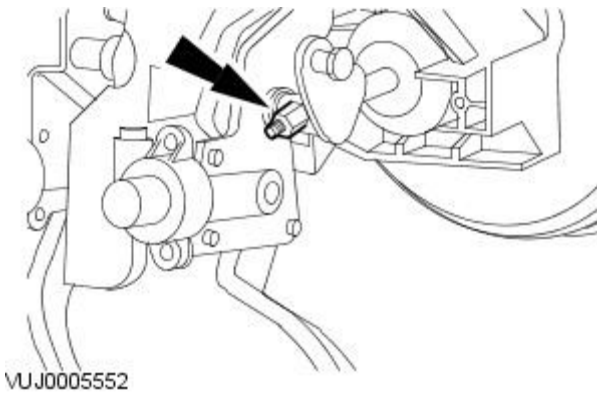
1. NOTE: Replace the brake booster/pedal box gasket.

To install, reverse the removal procedure.

- Tighten to 25 Nm.



2. Tighten to 3 Nm.

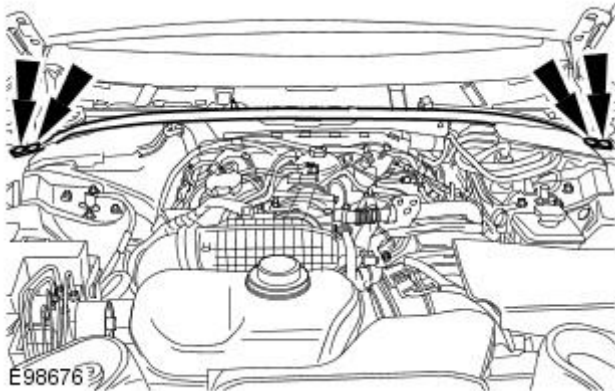


# Power Brake Actuation - Brake Vacuum Pump 2.7L V6 - TdV6

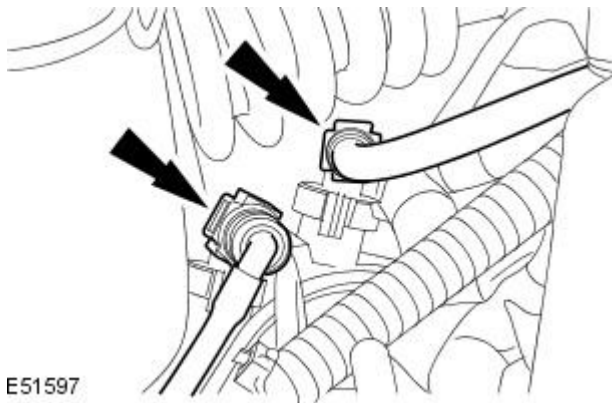
Removal and Installation

## Removal

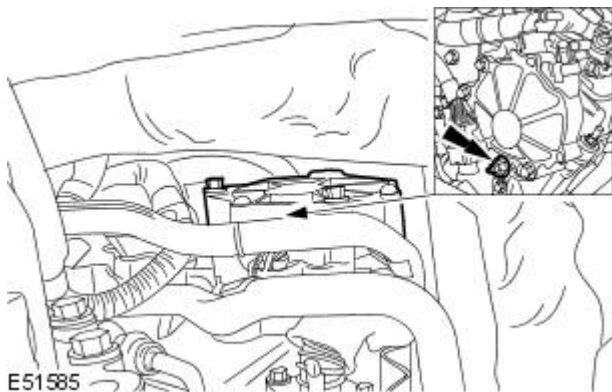
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the engine cover.  
For additional information, refer to: [Engine Cover - 2.7L Diesel](#) (501-05, Removal and Installation).
3. Remove the secondary bulkhead center panel.  
For additional information, refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).
4. Remove the engine compartment brace.



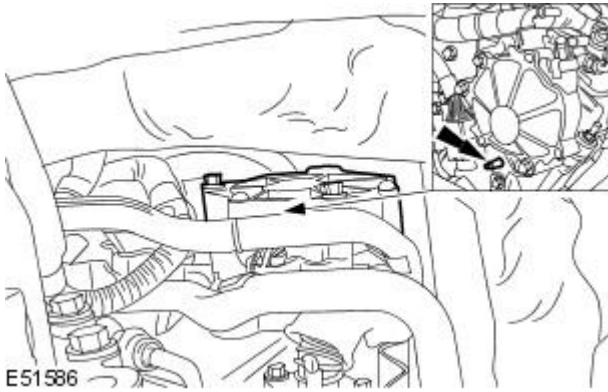
5. Disconnect both vacuum lines from the brake vacuum pump.



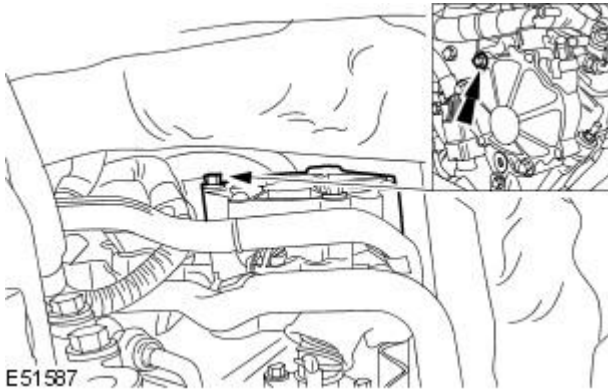
6. Remove the crankcase breather pipe bracket retaining nut.



7. Remove the brake vacuum pump retaining stud.



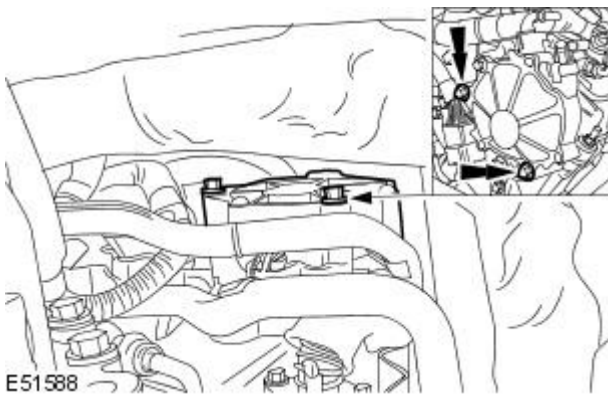
8. Remove the high pressure fuel pipe bracket retaining bolt.



9. NOTE: Remove and discard the O-ring seal.

Remove the brake vacuum pump.

- Remove the gasket.

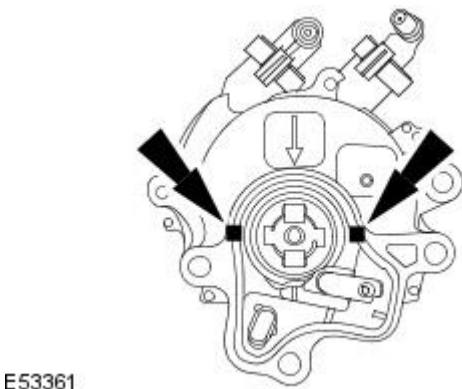


## Installation

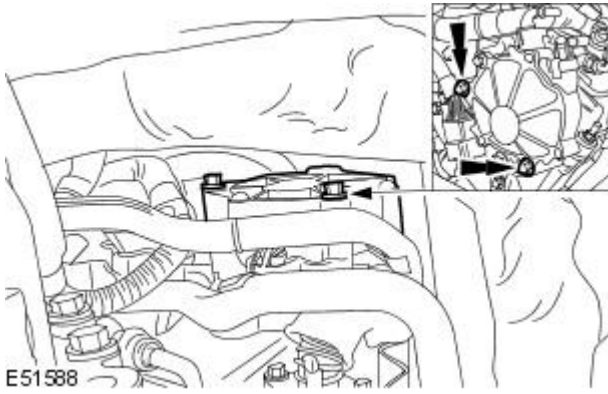
1. NOTE: Install a new O-ring seal.

To install, reverse the removal procedure.

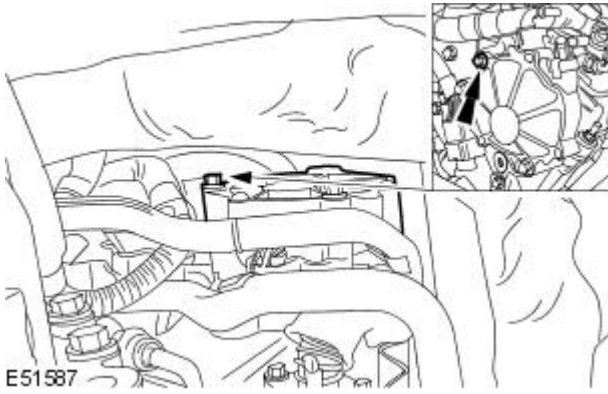
- Install a new gasket.
- Apply silicone gasket sealant or equivalent meeting Jaguar specification.
- The application of sealant must be 10 mm square in two places. Install the brake vacuum pump immediately after applying the sealant.
- The brake vacuum pump should be fitted directly to the engine without smearing the sealant.
- Make sure that the drive coupling is aligned with camshaft coupling.



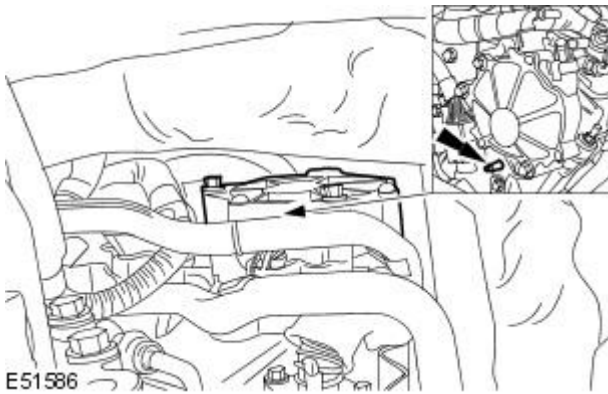
2. Tighten to 23 Nm.



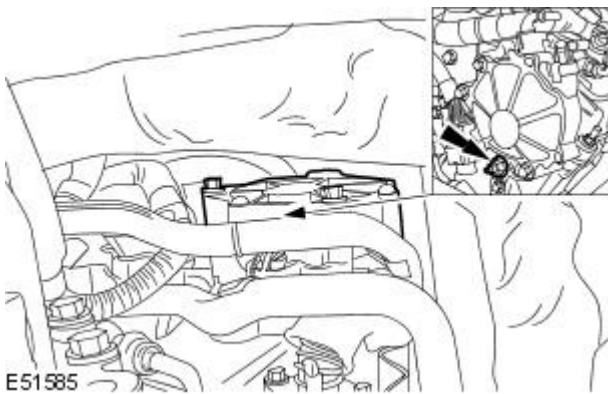
3. Tighten to 10 Nm.



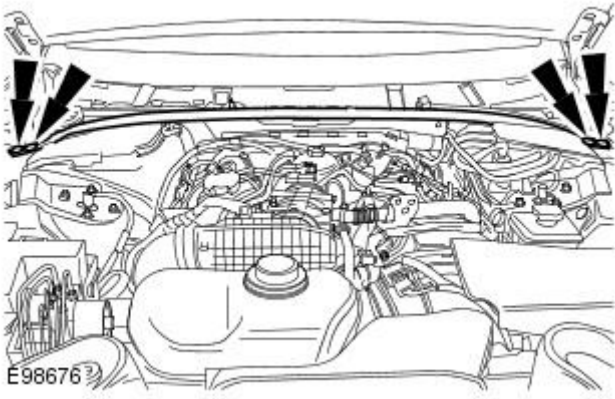
4. Tighten to 13 Nm.



5. Tighten to 13 Nm.



6. Tighten to 25 Nm.





**Anti-Lock Control - Stability Assist -****Lubricants, Fluids, Sealers and Adhesives**

<b>Item</b>	<b>Specification</b>
Brake fluid	Shell ESL Dot 4

**Torque Specifications**

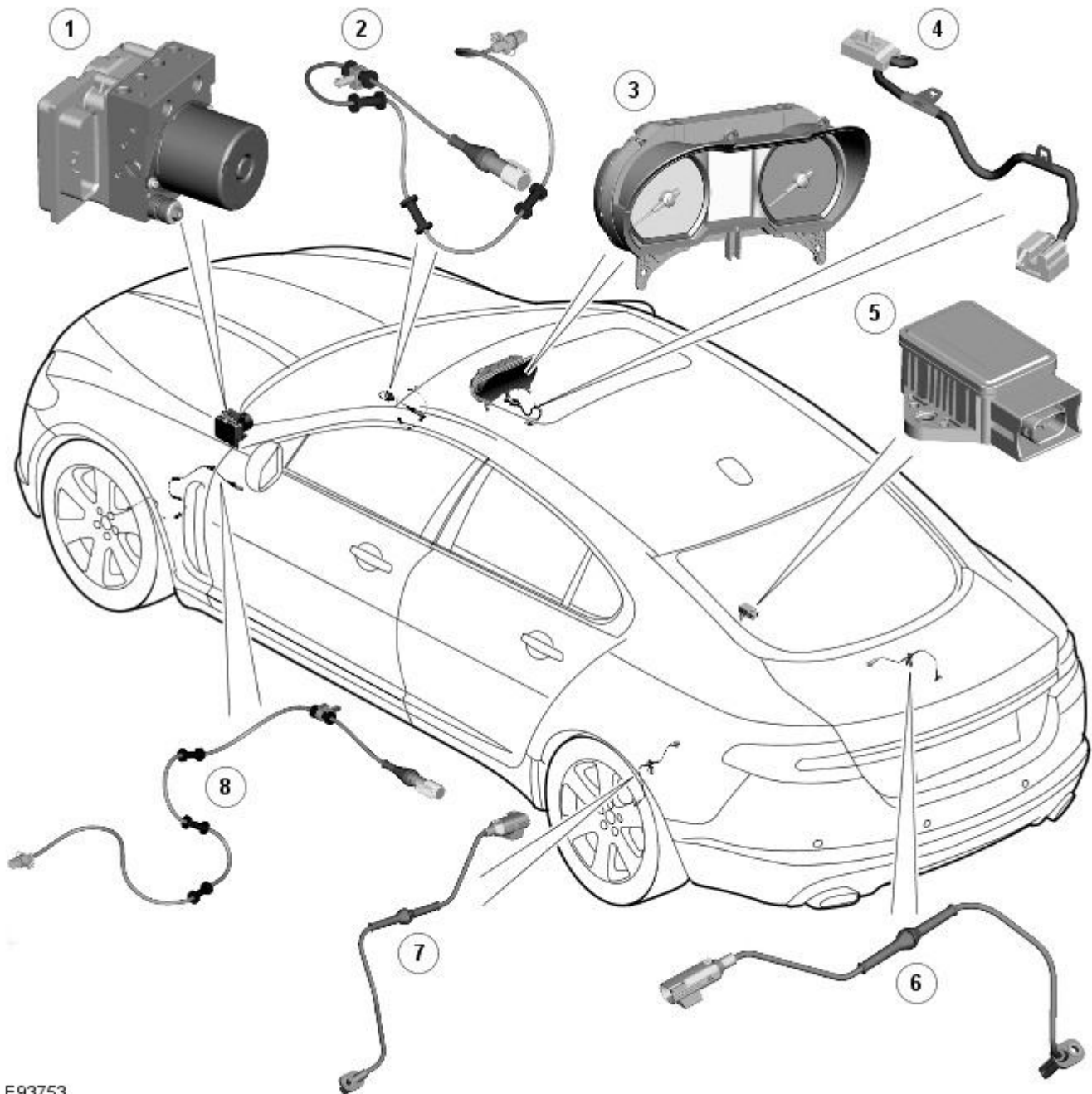
<b>Description</b>	<b>Nm</b>	<b>lb-ft</b>	<b>lb-in</b>
Brake master cylinder primary pressure transducer	30	22	–
Brake tubes to hydraulic control unit (HCU)	17	13	–
Rear wheel speed sensor retaining bolt	6	–	53
Yaw rate sensor and accelerometer retaining nuts	7	–	62
Hydraulic control unit (HCU) retaining bolts	8	–	71
Steering wheel rotation sensor retaining screws	4	–	35
Steering column to lower shroud retaining screws	3	–	27

# Anti-Lock Control - Stability Assist - Anti-Lock Control - Stability Assist - Component Location

Description and Operation

- NOTE: RHD (right-hand drive) installation shown, LHD (left-hand drive) installation similar.

Component Location



E93753

## ItemDescription

1	ABS (anti-lock brake system) module
2	RH (right-hand) front wheel speed sensor
3	Instrument cluster
4	Steering angle sensor
5	Yaw rate and lateral acceleration sensor
6	RH rear wheel speed sensor
7	LH (left-hand) rear wheel speed sensor
8	LH front wheel speed sensor

# Anti-Lock Control - Stability Assist - Anti-Lock Control - Stability Assist - Overview

Description and Operation

## Overview

The [ABS \(anti-lock brake system\)](#) and DSC (dynamic stability control) system features a Bosch modulator, which is an integrated four-channel [HCU \(hydraulic control unit\)](#) and [ABS](#) module. The unit is located in the rear of the engine compartment on the passenger side, and is installed in the brake hydraulic circuit between the brake master cylinder and the four brake calipers.

The [ABS](#) module is connected to the high speed [CAN \(controller area network\)](#) bus, and actively interacts with other vehicle system control modules and associated sensors to receive and transmit current vehicle operating information.

When required, the [ABS](#) module will actively intervene and operate the [HCU](#) during braking or vehicle maneuvers to correct the vehicle attitude, stability, traction or speed. During incidents of vehicle correction, the [ABS](#) module may also request the [ECM \(engine control module\)](#) to control engine power in order to further stabilize and correct the vehicle.

To provide full system functionality, the [ABS](#) and DSC system comprise the following components:

- DSC switch.
- Four wheel speed sensors.
- Steering angle sensor.
- Yaw rate and lateral acceleration sensor.
- Stoplamp switch.
- Instrument cluster indicator lamps.
- Integrated [ABS](#) module and [HCU](#).
- Brake booster vacuum sensor (3.0L vehicles only).

Two variants of [ABS](#) module are available, Bosch ESP®8.1 and Bosch ESP®plus8.1. The Bosch ESP®plus8.1 system is fitted to vehicles with ACC (adaptive cruise control) and incorporates a new feature to Jaguar known as 'electronic brake prefill'.

Electronic brake prefill, senses any rapid throttle lift off, activating a small brake hydraulic pressure build-up of approximately 3 to 5 bar (43.5 to 72.5 lbf/in<sup>2</sup>) in anticipation of the brakes being applied. This application produces a quicker brake pedal response and consequently slightly shorter stopping distances. When the [ECM](#) detects rapid throttle lift off it signals the [ABS](#) module which controls the [HCU](#) to apply a low brake pressure to assist in a quicker brake application.

- **NOTE: All vehicles with ACC are supported by the Bosch ESP®plus8.1 system.**

The [ABS](#) provides the following brake functions that are designed to assist the vehicle or aid the driver:

- [ABS](#).
- DSC, including Trac DSC.
- CBC (corner brake control).
- [EBD \(electronic brake force distribution\)](#).
- ETC (electronic traction control).
- [EBA \(emergency brake assist\)](#).
- EDC (engine drag-torque control).
- Understeer control.
- Electronic brake prefill (vehicles with ACC only).
- Brake vacuum assist (3.0L vehicles only).

All the brake functions listed are automatically active when the ignition is in power mode and the engine is running. The DSC system can be selected to off using the DSC switch.



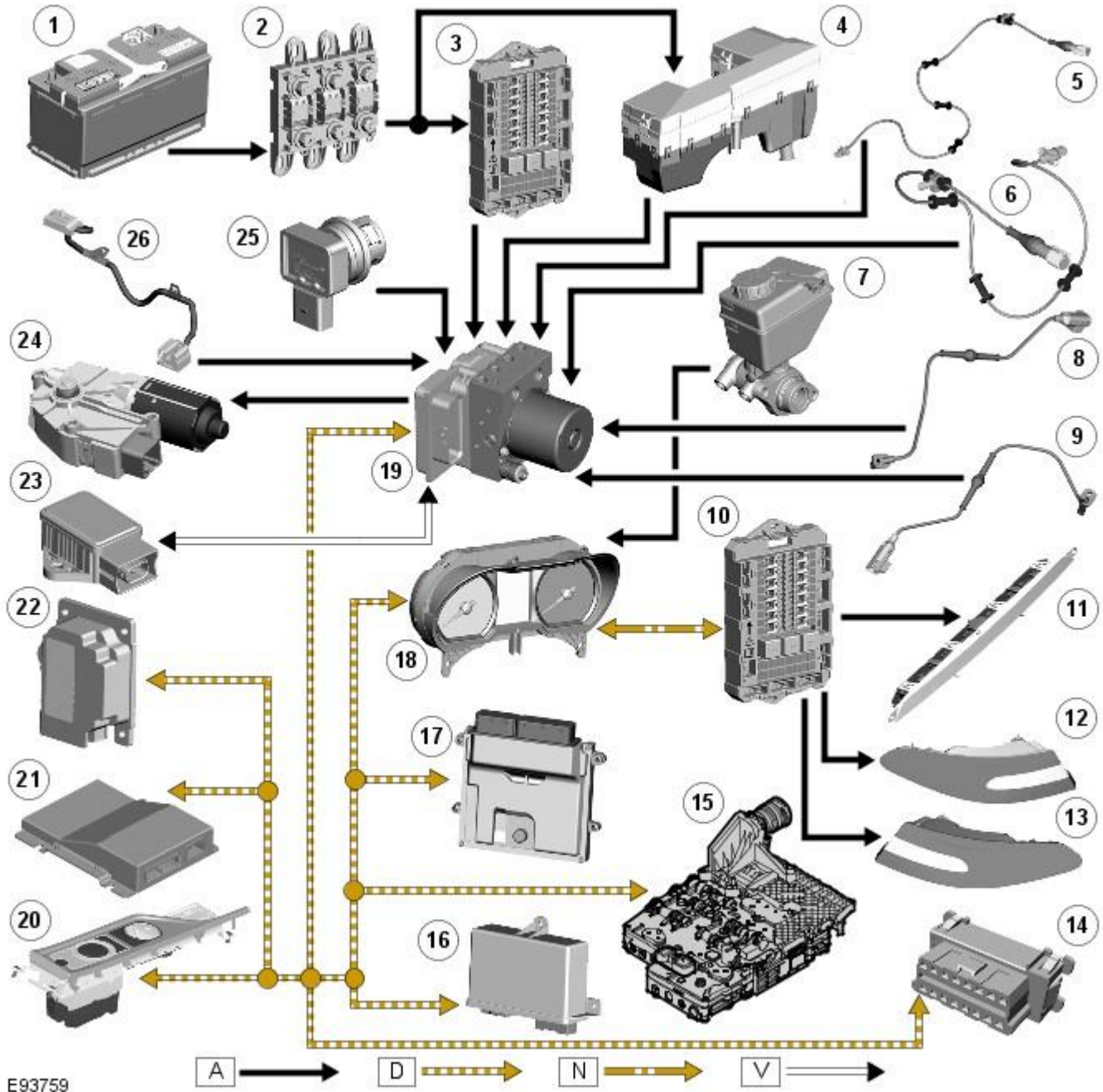
**WARNING:** Although the vehicle is fitted with DSC, it remains the drivers responsibility to drive safely according to the prevailing conditions.

# Anti-Lock Control - Stability Assist - Anti-Lock Control - Stability Assist - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **D** = High speed CAN (controller area network) bus; **N** = Medium speed CAN bus; **V** = Private CAN bus.



### ItemDescription

1	Battery
2	BJB (battery junction box) (250 A megafuse)
3	CJB (central junction box)
4	EJB (engine junction box)
5	LH (left-hand) front wheel speed sensor
6	RH (right-hand) front wheel speed sensor
7	Brake fluid level switch
8	LH rear wheel speed sensor
9	RH rear wheel speed sensor
10	RJB (rear junction box)

11	High mounted stop lamp
12	<a href="#">LH</a> stop lamp
13	<a href="#">RH</a> stop lamp
14	Diagnostic socket
15	<a href="#">TCM (transmission control module)</a>
16	Electronic parking brake module
17	<a href="#">ECM (engine control module)</a>
18	Instrument cluster
19	<a href="#">ABS (anti-lock brake system)</a> module
20	JaguarDrive selector module
21	Adaptive damping control module
22	Adaptive speed control module
23	Yaw rate and lateral acceleration sensor
24	Roof opening panel motor/module
25	Brake booster vacuum sensor (3.0L vehicles only)
26	Steering angle sensor

## System Operation

### Anti-Lock Brake System

[ABS](#) controls the speed of all road wheels to ensure optimum wheel slip when braking at the adhesion limit. The wheels are prevented from locking to retain effective steering control of the vehicle.

The brake pressures are modulated separately for each wheel. Rear brake pressures are controlled to maintain rear stability on split friction surfaces.

### Dynamic Stability Control

DSC (dynamic stability control) uses brakes and powertrain torque control to assist in maintaining the yaw stability of the vehicle. While the ignition is energized the DSC function is permanently enabled, unless selected off using the DSC switch.

DSC enhances driving safety in abrupt maneuvers and in under-steer or over-steer situations that may occur in a bend. The [ABS](#) module monitors the yaw rate and lateral acceleration of the vehicle, steering input and individual wheel speeds, then selectively applies individual brakes and signals for powertrain torque adjustments to reduce under-steer or over-steer conditions.

In general:

- In an under-steer situation the inner wheels are braked to counteract the yaw movement towards the outer edge of the bend.
- In an over-steer situation the outer wheels are braked to prevent the rear end of the vehicle from pushing towards the outer edge of the bend.

The [ABS](#) module monitors the tracking stability of the vehicle using inputs from the wheel speed sensors, the steering angle sensor, and the yaw rate and lateral acceleration sensor. The tracking stability is compared with stored target data. Whenever the tracking stability deviates from the target data, the [ABS](#) module intervenes by applying the appropriate control strategy.

The following interactions occur in an intervention situation:

- High speed [CAN](#) signal to the [ECM](#), to reduce engine torque.
- Application of braking to the appropriate corner of the vehicle.

### Trac DSC

TracDSC is an alternative setting of DSC with reduced system interventions. With TracDSC engaged, traction may be somewhat increased, although stability may be reduced compared to normal DSC. TracDSC is intended for use only on dry tarmac, by suitably experienced drivers and should not be selected for other surfaces or by drivers with insufficient skill and training to operate the vehicle safely with the TracDSC function engaged.

The less restrictive TracDSC setting may be preferred, for example, by expert drivers engaged in high performance driving on dry Tarmac surfaces such as tracks and circuits.

Switching between DSC and Trac DSC:

- Press and hold the DSC switch for less than 10 seconds.
  - The message center will temporarily display either **Trac DSC** or **DSC ON**.
  - The warning indicator in the instrument panel will illuminate while Trac DSC is selected.
  - The warning indicator will flash when DSC or Trac DSC is active.
- **NOTE:** If cruise control is engaged, it will automatically disengage if DSC activates.

Refer to: Speed Control (310-03 Speed Control - 2.7L V6 - TdV6, Description and Operation).

### Corner Brake Control

CBC (corner brake control) influences the brake pressures, below and within DSC and [ABS](#) thresholds, to counteract the yawing moment produced when braking in a corner. CBC produces a correction torque by limiting the brake pressure on one side of the vehicle.

## Electronic Brake Force Distribution

[EBD \(electronic brake force distribution\)](#) limits the brake pressure applied to the rear wheels. When the brakes are applied, the weight of the vehicle transfers forwards, reducing the ability of the rear wheels to transfer braking effort to the road surface. This may cause the rear wheels to slip and make the vehicle unstable.

[EBD](#) uses the [ABS](#) braking hardware to automatically optimize the pressure to the rear brakes, below the point where [ABS](#) is normally invoked.

- **NOTE:** Only the rear brakes are controlled by the [EBD](#) function.

## Electronic Traction Control

ETC (electronic traction control) attempts to optimize forward traction by reducing engine torque, or by applying the brake of a spinning wheel until traction is regained.

ETC is activated if an individual wheel speed is above that of the vehicle reference speed (positive slip) and the brake pedal is not pressed. The brake is applied to the spinning wheel, allowing the excess torque to be transmitted to the non-spinning wheel through the drive line. If necessary, the [ABS](#) module also sends a high speed [CAN](#) bus message to the [ECM](#) to request a reduction in engine torque.

When the DSC function is selected off using the DSC switch, the braking and engine torque reduction features are both disabled, except when the JaguarDrive control is in winter mode. When the JaguarDrive control is in winter mode, selecting the DSC function off retains the braking and engine torque reduction features, but reduces intervention levels compared to DSC and Trac DSC modes.

## Emergency Brake Assist

[EBA \(emergency brake assist\)](#) assists the driver in emergency braking situations by automatically increasing the applied braking effort. The [ABS](#) module invokes [EBA](#) when:

- The brake pedal is rapidly pressed.
- The brake pedal is pressed hard enough to bring the front brakes into [ABS](#) operation.

When the brake pedal is rapidly pressed, the [ABS](#) module increases the hydraulic pressure to all of the brakes until the threshold for [ABS](#) operation is reached. This action applies the maximum braking effort for the available traction. The [ABS](#) module monitors for the sudden application of the brakes, using inputs from the brake pedal switch and from the pressure sensor within the [HCU \(hydraulic control unit\)](#). With the brake pedal pressed, if the rate of increase of hydraulic pressure exceeds the predetermined limit, the [ABS](#) module invokes emergency braking.

When the brake pedal is pressed hard enough to bring the front brakes into [ABS](#) operation, the [ABS](#) module increases the hydraulic pressure to the rear brakes up to the [ABS](#) threshold.

[EBA](#) operation continues until the driver releases the brake pedal, sufficiently for the hydraulic pressure in the [HCU](#) to drop below a threshold value stored in the [ABS](#) module.

## Engine Drag-Torque Control

EDC (engine drag-torque control) prevents wheel slip caused by any of the following:

- A sudden decrease in engine torque when the accelerator is suddenly released.
- A downshift using the Jaguar sequential shift function on automatic transmission vehicles.

When the [ABS](#) module detects the onset of wheel slip without the brakes being applied, the [ABS](#) module signals the [ECM](#) via the high speed [CAN](#) bus to request a momentary increase in engine torque.

## Understeer Control

Understeer Logic Control is a proactive system which monitors the vehicle for understeer by comparing signals from the yaw rate and lateral acceleration sensor with signals from the steering angle sensor and wheel speed sensors.

When the [ABS](#) module detects the onset of understeer, the [ABS](#) module signals the [ECM](#) via the high speed [CAN](#) bus to request a decrease in engine torque. At the same time the [ABS](#) module will control the [HCU](#) to apply brake pressure to the relevant wheels to correct the understeer.

## Electronic Brake Prefill (Vehicles With ACC Only)

Electronic brake prefill (Bosch ESP®plus8.1), senses any rapid throttle lift off, activating a small brake hydraulic pressure build-up of approximately 3 to 5 bar (43.5 to 72.5 lbf/in<sup>2</sup>) in anticipation of the brakes being applied.

This application produces a quicker brake pedal response and consequently slightly shorter stopping distances. The system supports vehicles with ACC (adaptive cruise control).

When the [ABS](#) module detects rapid throttle lift off (from the signals received from the [ECM](#) over the high speed [CAN](#) bus), it controls the [HCU](#) to apply a low brake pressure to assist in a quicker brake application.

## Brake Vacuum Assist (3.0L Vehicles Only)

Operation of Brake Vacuum Assist generally occurs at the beginning of an ignition cycle when brake booster vacuum levels are low; refer to Brake Booster Vacuum sensor, below.



Brake vacuum assist operation will be recognized by the driver experiencing a vibrating brake pedal and slight modulator noise. This will be similar to that experienced when [ABS](#) system is operating.

As the engine warms up, Brake Vacuum Assist operation will become less frequent. However, it can become more active when vacuum levels are low due to driving at high-altitudes, or during frequent heavy-braking.

Noise levels during Brake Vacuum Assist may vary with initial system activity being the loudest observed. In some circumstances initial activity may be interpreted as a 'thump' noise, particularly if there is no immediate and significant Brake Vacuum Assist functionality.

In this circumstance system behavior is normal and should not be a cause for fault investigation.

## Component Description

### Dynamic Stability Control Switch



#### ItemDescription

1 DSC switch

The DSC switch is mounted in the floor console adjacent to the JaguarDrive selector.

DSC becomes active whenever the engine is running. A momentary press of the switch allows the driver to toggle between the standard DSC settings and the optimized 'Trac DSC' settings. The message 'Trac DSC' or 'DSC on' will temporarily be displayed in the instrument cluster message center. The amber DSC warning indicator in the instrument cluster remains illuminated while 'Trac DSC' is selected.

The DSC can be switched off by pressing and holding the switch for more than 10 seconds.

In each case the message 'DSC OFF' will be displayed in the instrument cluster message center to confirm DSC has been switched off. The amber DSC warning indicator in the instrument cluster will remain illuminated. The system can be switched back on again by simply pressing and releasing the switch. The message 'DSC ON' will then temporarily appear in the instrument cluster message center to confirm the system is on.

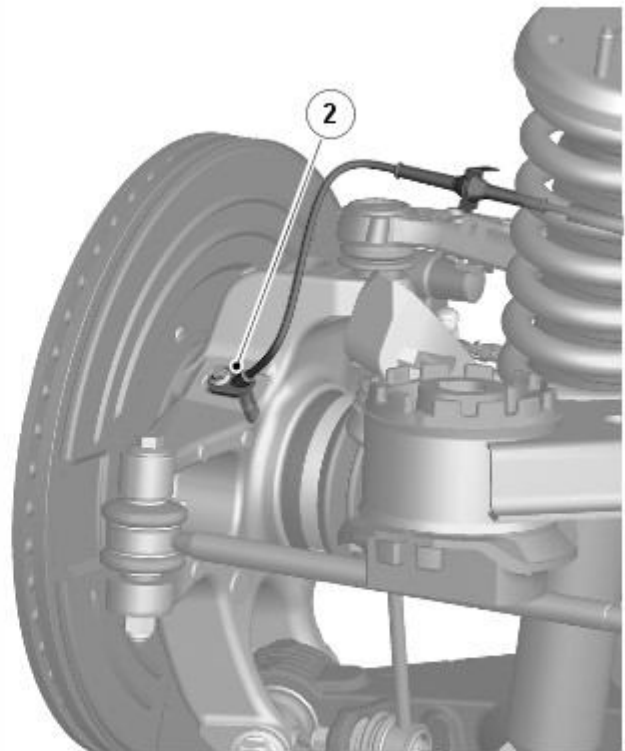
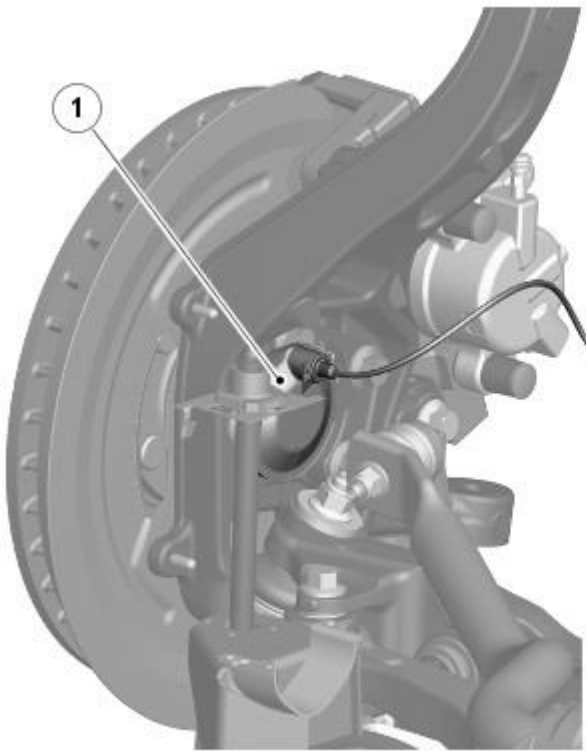
• **NOTE:** Switch requests may be delayed if the switch is pressed while a DSC operation is taking place. The switch request will be displayed in the instrument cluster but the [ABS](#) module will not initiate any stability changes until it is safe to do so.

If a fault is detected with the DSC switch, the [ABS](#) module defaults to the 'DSC ON' setting and any switch requests are ignored.



**WARNING:** It is recommended that when using snow chains, Trac DSC is switched off and JaguarDrive control winter mode is selected.

### Wheel Speed Sensors



E93755

**ItemDescription**

1	Front wheel speed sensor
2	Rear wheel speed sensor

An active wheel speed sensor is installed in each wheel hub to provide the [ABS](#) module with a rotational speed signal from each road wheel. The head of each front wheel speed sensor is positioned close to a magnetic encoder ring incorporated into the inboard seal of the wheel bearing. The head of each rear wheel speed sensor is positioned close to a magnetic encoder ring incorporated into the rear wheel bearing assembly. Each encoder ring contains 46 north and south poles. A fly lead connects each sensor to the vehicle harness.

The wheel speed sensors each have a signal and a return connection with the [ABS](#) module. When the ignition is ON the [ABS](#) module supplies a signal feed to the wheel speed sensors and monitors the return signals. Any rotation of the road wheels induces current fluctuations in the return signals, which are converted into individual wheel speeds and overall vehicle speed by the [ABS](#) module.

The [ABS](#) module broadcasts the individual wheel speeds and the vehicle speed on the high speed [CAN](#) bus for use by other systems, although vehicle speed information to the roof opening panel motor/module is a hardwired connection.

If a wheel speed sensor fault is detected by the [ABS](#) module, 'ABS FAULT' will be displayed in the instrument cluster message center and an amber warning indicator will illuminate.  
 Refer to: [Information and Message Center](#) (413-08 Information and Message Center, Description and Operation).

As the wheel speed sensors are active devices, a return signal is available when the road wheels are not rotating. This enables the [ABS](#) module to check the condition of the speed sensors while the vehicle is stationary.

**Steering Angle Sensor**





The steering angle sensor measures the steering wheel angle and the rate of change of the steering wheel angle. These measurements are received by the [ABS](#) module and broadcast on the high speed [CAN](#) bus for use by other systems.

The steering angle sensor is mounted on the steering column upper shroud mounting bracket, immediately behind the multifunction switches, and is secured by 2 screws. A fly lead connects the sensor to the passenger compartment wiring harness via a 4 pin multiplug.

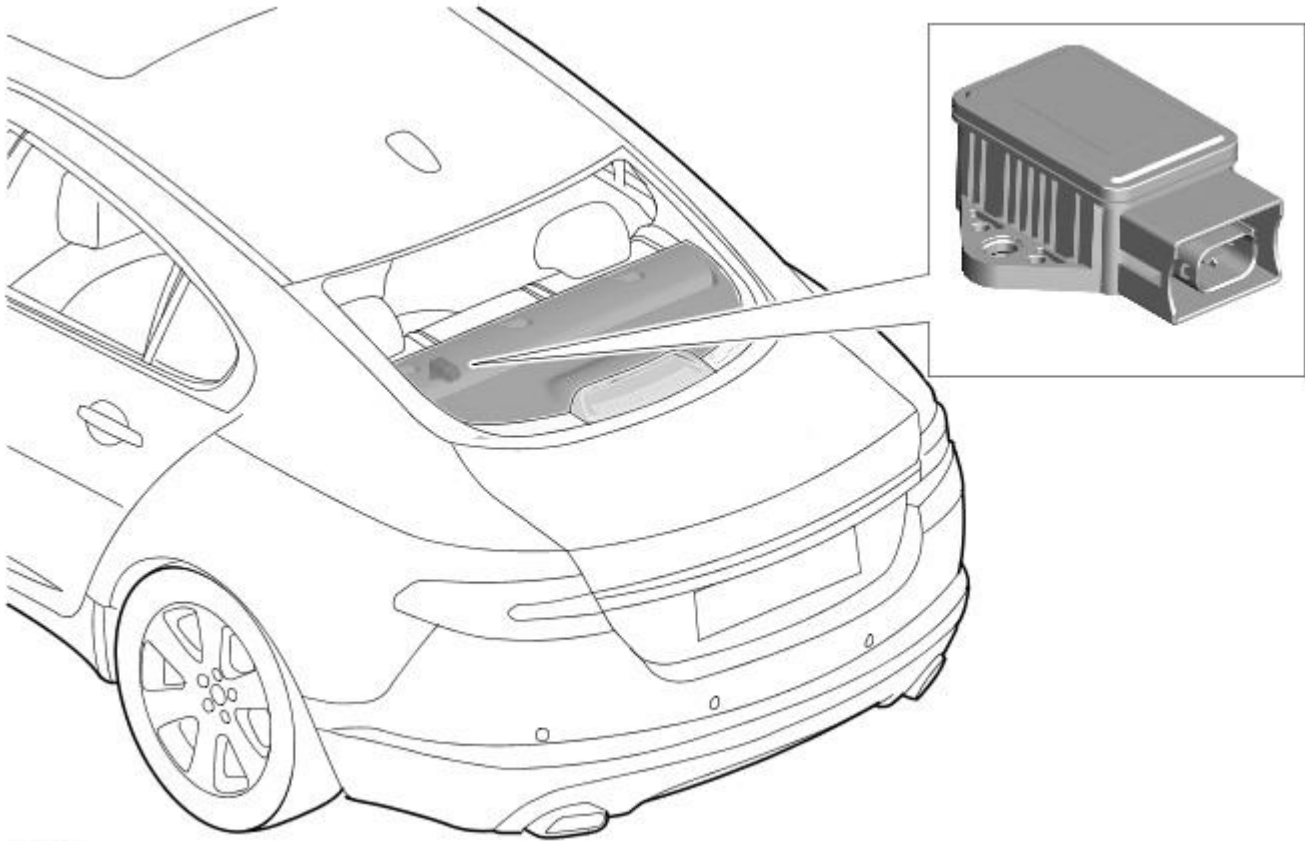
The sensor is housed in a 'U' shaped plastic casing and contains two offset [LED \(light emitting diode\)](#)s facing two detectors.

An encoder ring is mounted on the inner steering column shaft and intersects the [LEDs](#) and detectors. The encoder ring contains 60 slots which break and restore the light beams between the [LEDs](#) and the detectors as the steering wheel is rotated. The [ABS](#) module is able to determine the direction of rotation of the steering wheel by monitoring when the light beams change state. The [LEDs](#) and detectors are mounted in such a way that only one beam will change state, either to broken or restored, at any one time.

The center (straight ahead) position of the steering wheel has to be learned by the [ABS](#) module every time the ignition is switched ON. The steering angle sensor is unable to determine the center position so inputs from the yaw rate and lateral acceleration sensor and wheel speed signals are also used by the [ABS](#) module to help it perform this process. If extreme weather conditions are present, for example ice causing extreme wheel spin or understeer/oversteer, the [ABS](#) module may not be able to determine the center position of the steering wheel. In this situation 'DSC NOT AVAILABLE' will be displayed in the instrument cluster message center and the amber warning indicator will illuminate. Refer to: [Information and Message Center](#) (413-08 Information and Message Center, Description and Operation).

'DSC NOT AVAILABLE' will also be displayed if the [ABS](#) module detects a steering angle sensor fault. The amber warning indicator will illuminate until the fault is rectified.

## Yaw Rate and Lateral Acceleration Sensor



E93757

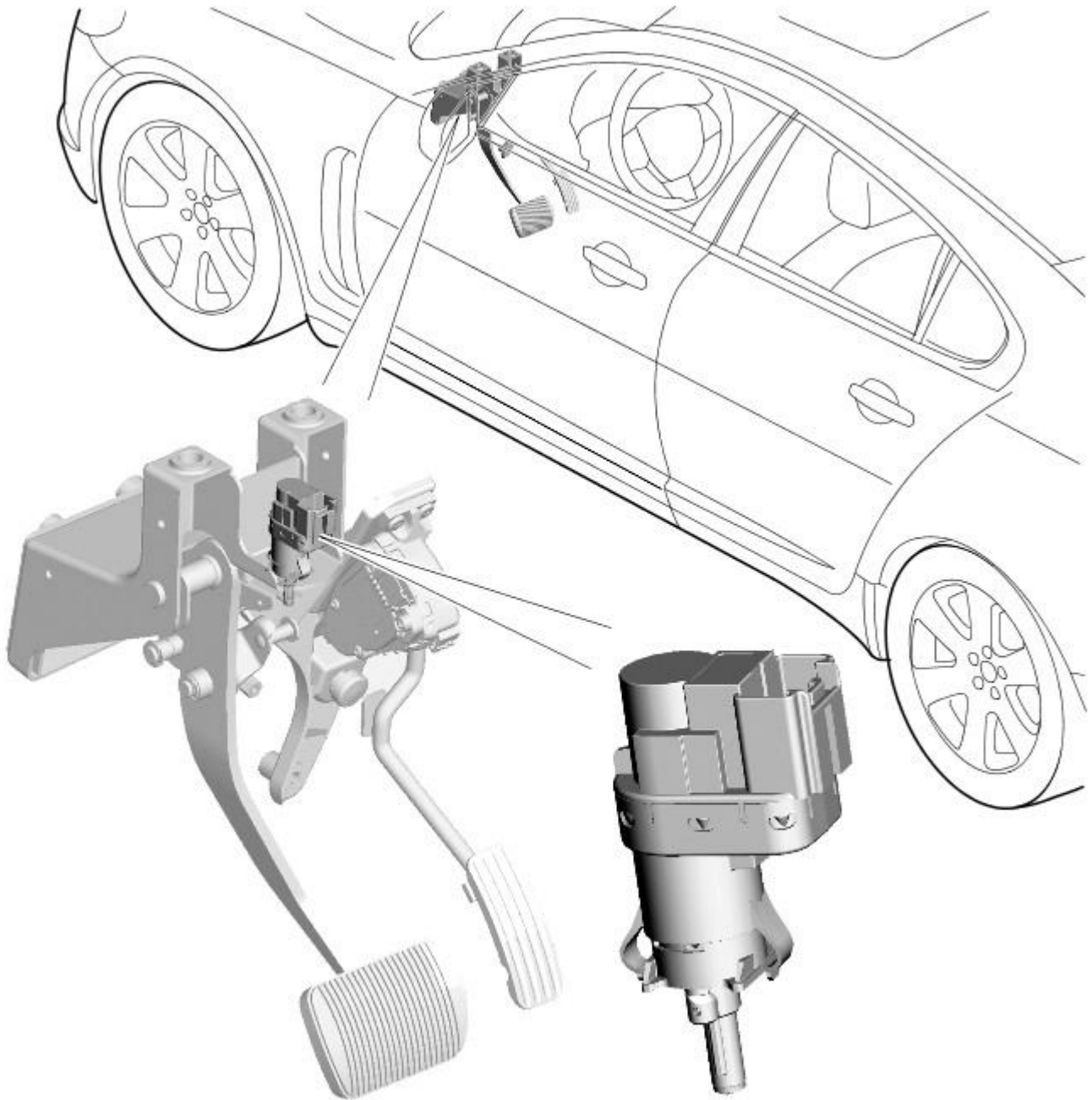
The yaw rate and lateral acceleration sensor is mounted on the rear parcel shelf. The sensor is secured by two screws and connects to the vehicle wiring via a four pin multiplug.

When the ignition is ON, the sensor receives a power feed from the [CJB](#). The ground path for the sensor is located behind the left hand rear seat back. The sensor measures the yaw rate and lateral acceleration of the vehicle, providing values to the [ABS](#) module via a dedicated, private high speed [CAN](#) bus connection. The [ABS](#) module broadcasts these values on the high speed [CAN](#) bus for use by other systems.

If a sensor fault is detected by the [ABS](#) module, 'DSC NOT AVAILABLE' will be displayed in the instrument cluster message center and the amber warning indicator will illuminate.

Refer to: [Information and Message Center](#) (413-08 Information and Message Center, Description and Operation).

## Stoplamp Switch



E93526

The stoplamp switch is mounted on the brake pedal box and is connected to the vehicle harness via a four pin multiplug.

When the brake pedal is pressed, the switch contacts close. This allows a hard wired signal feed to be sent to the [ECM](#). A stoplamp switch status message is then sent from the [ECM](#) to the [ABS](#) module on the high speed [CAN](#) bus. The [ABS](#) module is then able to control braking force accordingly in conjunction with the [HCU](#).

- **NOTE:** The stoplamp switch also forms part of the speed control system.

For additional information, refer to:

Speed Control (310-03 Speed Control - 2.7L V6 - TdV6, Description and Operation),  
Speed Control (310-03 Speed Control - 3.0L NA V6 - AJ27, Description and Operation),  
[Speed Control](#) (310-03 Speed Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

## Instrument Cluster Warning Indicators



E93782

**ItemDescription**

1	<a href="#">ABS</a> warning indicator (USA only)
2	<a href="#">ABS</a> warning indicator (Canada and Mexico only)
3	<a href="#">ABS</a> warning indicator (all except USA, Canada and Mexico)
4	DSC warning indicator
5	Brake warning indicator (USA only)
6	Brake warning indicator (all except USA)

The instrument cluster and message center contains warning indicators and warning messages to display the operating status of the anti-lock control - stability assist functions. The warning indicators and messages provide a visual notification of either a system warning or information indication to the driver. There are three warning indicators on the instrument cluster, which vary dependant on market, and several types of message relating to the anti-lock control - stability assist functions. The DSC OFF message is accompanied by an audible warning.

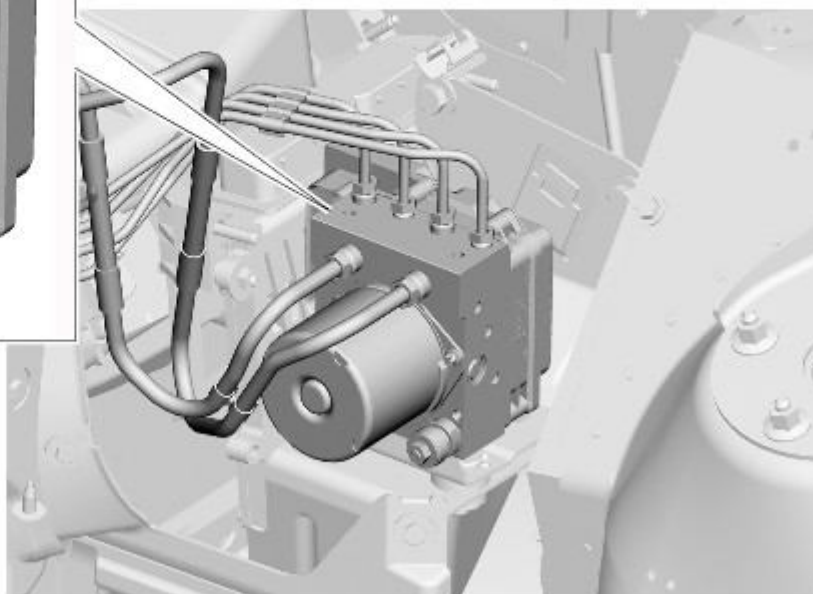
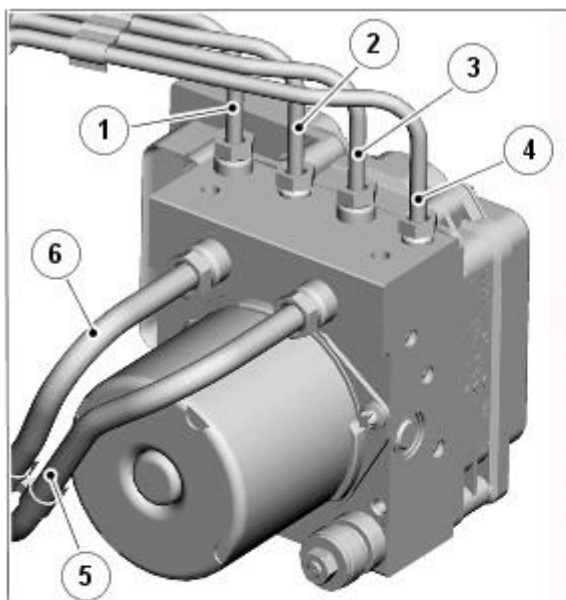
The following anti-lock control - stability assist warning indicators are installed in the instrument cluster:

- An amber [ABS](#) warning indicator.
- A red brake warning indicator.
- An amber DSC warning indicator.

Refer to: [Instrument Cluster](#) (413-01 Instrument Cluster, Description and Operation) / [Information and Message Center](#) (413-08 Information and Message Center, Description and Operation).

**ABS Module**





E93576

#### ItemDescription

1	<a href="#">LH</a> front brake
2	<a href="#">RH</a> rear brake
3	<a href="#">LH</a> rear brake
4	<a href="#">RH</a> front brake
5	Primary inlet
6	Secondary inlet

The [ABS](#) module is located in the passenger side, rear engine bay and incorporates the [HCU](#). The module is mounted on the rear face of the [HCU](#), which it uses to control all braking and stability functions by modulating hydraulic pressure to the individual wheel brakes.

Two types of [ABS](#) modules are available; one for vehicles with standard Speed Control, one for vehicles fitted with Adaptive Speed Control.

If an [ABS](#) modulator fault is detected, 'ABS FAULT' will be displayed in the instrument cluster message center and the amber warning indicator will illuminate.

Refer to: [Information and Message Center](#) (413-08 Information and Message Center, Description and Operation).



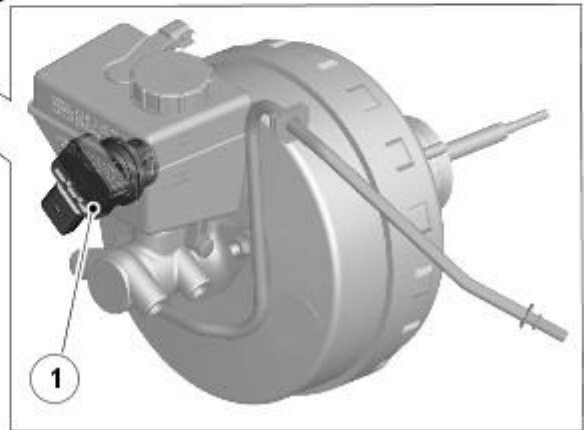
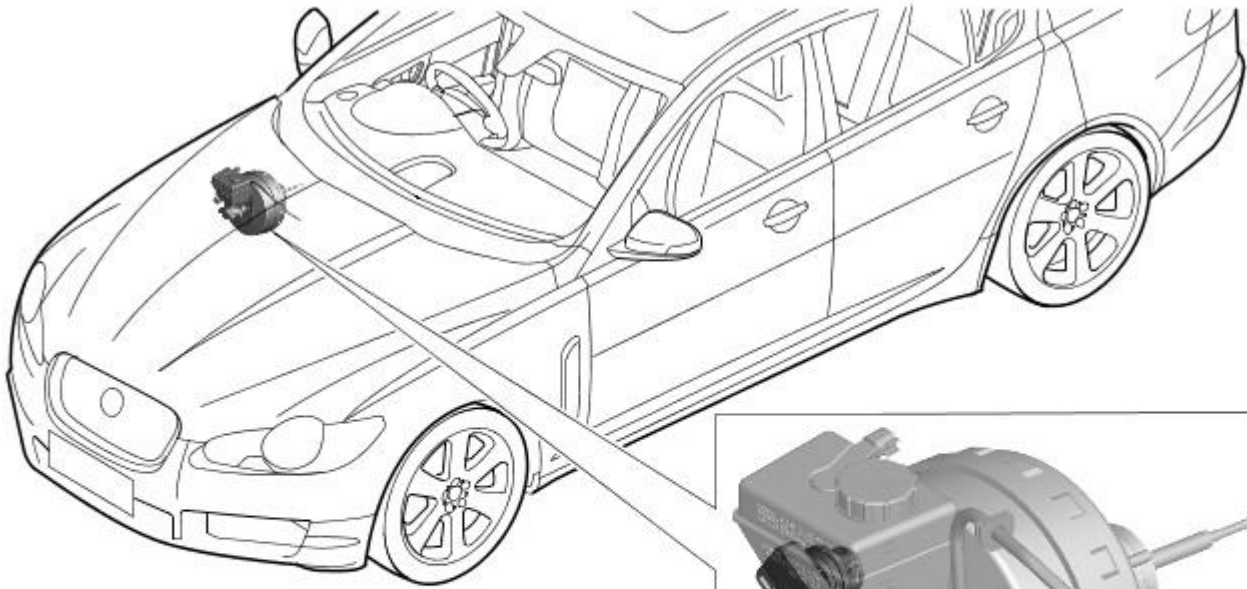
**CAUTION:** The [ABS](#) module and the [HCU](#) comprise a single unit and must not be separated.

### Hydraulic Control Unit

The [HCU](#) is a four channel unit, secured to a mounting bracket located in the passenger side, rear engine bay. The [HCU](#) modulates the supply of hydraulic pressure to the brakes under the control of the [ABS](#) module.

Refer to: [Hydraulic Brake Actuation](#) (206-06 Hydraulic Brake Actuation, Description and Operation).

### Brake Booster Vacuum Sensor (3.0L Vehicles Only)



E93758

**ItemDescription**

- 1 Brake booster vacuum sensor

When the brake booster vacuum is low the [ABS](#) control module will raise the braking system's hydraulic pressure to compensate for the brake booster's vacuum deficiency. This function will operate until the brake booster's vacuum has been replenished. See Brake Vacuum Assist above.

The brake booster vacuum sensor, mounted on the brake booster, provides vacuum pressure information to the [ABS](#) module. The sensor monitors the vacuum pressure in both chambers of the brake booster, providing vacuum pressure values to the [ABS](#) module via hard wired connections.

The brake booster vacuum sensor receives a power feed from the [ABS](#) module, which also provides a ground path for the sensor.

# Anti-Lock Control - Stability Assist - Anti-Lock Control - Stability Assist

Diagnosis and Testing

## Principle of Operation

For a detailed description of the Anti-Lock Control - Stability Assist system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (206-09 Anti-Lock Control - Stability Assist)

[Anti-Lock Control - Stability Assist](#) (Description and Operation),  
[Anti-Lock Control - Stability Assist](#) (Description and Operation),  
[Anti-Lock Control - Stability Assist](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Confirm if the Anti-Lock Brake System (ABS) warning light was illuminated, or still is.

• **NOTE:** An intermittent fault may allow the warning light to go off. This does not necessarily mean the fault is not present. Some warnings will appear to clear when the ignition is cycled. This is often because the warning has flagged as a result of one of the vehicle's on-board diagnostic routines having run to detect the fault. If the same routine is not run when the ignition status is set to **ON**, the warning will not re-flag until the routine does run.

3. 3. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Brake fluid level</li> <li>● Vacuum system</li> <li>● Wheel speed sensor installation</li> <li>● Wheel speed sensor air gap</li> <li>● Magnetic pulse wheel(s) (damaged/contaminated)</li> <li>● Steering angle sensor</li> <li>● Yaw rate sensor and accelerometer cluster installation</li> <li>● Incorrect wheel or tire size</li> </ul>	<ul style="list-style-type: none"> <li>● Warning light operation</li> <li>● Fuses</li> <li>● Wheel speed sensors</li> <li>● Connectors/Pins</li> <li>● Harnesses</li> <li>● Steering wheel rotation sensor</li> <li>● Yaw rate sensor and accelerometer cluster</li> <li>● Booster pressure sensor</li> <li>● Hydraulic Control Unit (HCU)</li> </ul>

4. 4. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
5. 5. If the cause is not visually evident check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• **NOTE:** If the Hydraulic Control Unit (HCU) is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new HCU.

• **NOTE:** Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).

• **NOTE:** When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• **NOTE:** If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
C0021-09	Brake Booster Performance	<ul style="list-style-type: none"> <li>● No vacuum available from engine due to split/leaking hose etc</li> <li>● Brake booster servo has failed due to lack of vacuum</li> </ul>	<ul style="list-style-type: none"> <li>● Check integrity of brake booster vacuum hose. Check and install a new brake booster as required</li> </ul>
C0030-38	Left Front Tone Wheel - signal frequency incorrect	<ul style="list-style-type: none"> <li>● Left front magnetic pulse ring damaged/contaminated</li> <li>● Incorrect component installed</li> </ul>	<ul style="list-style-type: none"> <li>● Check the left front magnetic pulse ring for damage or contamination. Clean or replace as required. If no damage/contamination found, suspect wheel speed sensor. Refer to the</li> </ul>

DTC	Description	Possible Cause	Action
		<ul style="list-style-type: none"> <li>* Sensor internal fault</li> </ul>	Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph for more than 10 seconds
C0031-12	Left Front Wheel Speed Sensor - short to battery	<ul style="list-style-type: none"> <li>Electrical wiring harness fault</li> <li>Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for short to power. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>
C0031-14	Left Front Wheel Speed Sensor - circuit short to ground or open	<ul style="list-style-type: none"> <li>Electrical wiring harness fault</li> <li>Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for short to ground or open circuit. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>
C0031-25	Left Front Wheel Speed Sensor - signal shape/waveform failure	<ul style="list-style-type: none"> <li>Electrical wiring harness fault</li> <li>Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for partial or intermittently grounded signal circuit. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph</li> </ul>
C0031-2F	Left Front Wheel Speed Sensor -signal erratic	<ul style="list-style-type: none"> <li>Electrical wiring harness fault</li> <li>Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for intermittent short to power, ground or open circuit. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph</li> </ul>
C0031-31	Left Front Wheel Speed Sensor - no signal	<ul style="list-style-type: none"> <li>Electrical wiring harness fault</li> <li>Magnetic pulse ring de-magnetised or damaged</li> <li>Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for open circuit or high resistance. Check connectors for damage or corrosion. Check the wheel speed sensor for correct location and contamination. Check the magnetic pulse wheel for contamination, damage or de-magnetisation. Clean or replace the sensor or wheel bearing as required. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph</li> </ul>
C0031-62	Left Front Wheel Speed Sensor - signal compare failure	<ul style="list-style-type: none"> <li>Electrical wiring harness fault</li> <li>Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for intermittent short to power, ground or open circuit. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph</li> </ul>
C0031-64	Left Front Wheel Speed Sensor - signal plausibility failure	<ul style="list-style-type: none"> <li>Incorrect wheels/tyres installed</li> <li>Electrical wiring harness fault</li> <li>EMC influences on left front wheel speed sensor and supply line</li> <li>Magnetic pulse wheel damaged/contaminated, de-magnetised</li> <li>Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>Check the correct wheels and tyres are installed. Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for intermittent short to power, or ground. Check for EMC influences on the speed sensor and circuits. Check magnetic pulse wheel for damage/contamination and de-magnetisation. Repair Wiring harness, install a new sensor or wheel bearing as required. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>
C0032-11	Left Front wheel Speed Sensor Supply - circuit short to ground	<ul style="list-style-type: none"> <li>Electrical wiring harness fault</li> <li>Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for short to ground. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>



DTC	Description	Possible Cause	Action
C0033-38	Right Front Tone Wheel - signal frequency incorrect	<ul style="list-style-type: none"> <li>● Right front magnetic pulse ring damaged/contaminated</li> <li>● Incorrect component installed</li> <li>● * Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Check the right front magnetic pulse ring for damage or contamination. Clean or replace as required. If no damage/contamination found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph for more than 10 seconds</li> </ul>
C0034-12	Right Front Wheel Speed Sensor - short to battery	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for short to power. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>
C0034-14	Right Front Wheel Speed Sensor - circuit short to ground or open	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for short to ground or open circuit. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>
C0034-25	Right Front Wheel Speed Sensor - signal shape/waveform failure	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for partial or intermittently grounded signal circuit. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph</li> </ul>
C0034-2F	Right Front Wheel Speed Sensor -signal erratic	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for intermittent short to power, ground or open circuit. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph</li> </ul>
C0034-31	Right Front Wheel Speed Sensor - no signal	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Magnetic pulse ring de-magnetised or damaged</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for open circuit or high resistance. Check connectors for damage or corrosion. Check the wheel speed sensor for correct location and contamination. Check the magnetic pulse wheel for contamination, damage or de-magnetisation. Clean or replace the sensor or wheel bearing as required. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph</li> </ul>
C0034-62	Right Front Wheel Speed Sensor - signal compare failure	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for intermittent short to power, ground or open circuit. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph</li> </ul>
C0034-64	Right Front Wheel Speed Sensor - signal plausibility failure	<ul style="list-style-type: none"> <li>● Incorrect wheels/tyres installed</li> <li>● Electrical wiring harness fault</li> <li>● EMC influences on right front wheel speed sensor and supply line</li> <li>● Magnetic pulse wheel damaged/contaminated, de-magnetised</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Check the correct wheels and tyres are installed. Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for intermittent short to power, or ground. Check for EMC influences on the speed sensor and circuits. Check magnetic pulse wheel for damage/contamination and de-magnetisation. Repair wiring harness, install a new sensor or wheel bearing as required. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>

DTC	Description	Possible Cause	Action
C0035-11	Right Front Wheel Speed Sensor Supply - circuit short to ground	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for short to ground. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>
C0036-38	Left Rear Wheel - signal frequency incorrect	<ul style="list-style-type: none"> <li>● Left rear magnetic pulse ring damaged/contaminated</li> <li>● Incorrect component installed</li> <li>● * Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Check the left rear magnetic pulse ring for damage or contamination. Clean or replace as required. If no damage/contamination found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph for more than 10 seconds</li> </ul>
C0037-12	Left Rear Wheel Speed Sensor - short to battery	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for short to power. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>
C0037-14	Left Rear Wheel Speed Sensor - circuit short to ground or open	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for short to ground or open circuit. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>
C0037-25	Left Rear Wheel Speed Sensor - signal shape/waveform failure	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for partial or intermittently grounded signal circuit. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph</li> </ul>
C0037-2F	Left Rear Wheel Speed Sensor -signal erratic	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for intermittent short to power, ground or open circuit. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph</li> </ul>
C0037-31	Left Rear Wheel Speed Sensor - no signal	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Magnetic pulse ring de-magnetised or damaged</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for open circuit or high resistance. Check connectors for damage or corrosion. Check the wheel speed sensor for correct location and contamination. Check the magnetic pulse wheel for contamination, damage or de-magnetisation. Clean or replace the sensor or wheel bearing as required. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph</li> </ul>
C0037-62	Left Rear Wheel Speed Sensor - signal compare failure	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for intermittent short to power, ground or open circuit. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph</li> </ul>
C0037-64	Left Rear Wheel Speed Sensor - signal plausibility failure	<ul style="list-style-type: none"> <li>● Incorrect wheels/tyres installed</li> <li>● Electrical wiring harness fault</li> <li>● EMC influences on left rear wheel speed sensor and supply line</li> <li>● Magnetic pulse wheel</li> </ul>	<ul style="list-style-type: none"> <li>● Check the correct wheels and tyres are installed. Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for intermittent short to power, or ground. Check for EMC influences on the speed sensor and circuits. Check magnetic pulse wheel for damage/contamination and de-magnetisation. Repair Wiring harness, install a new sensor or</li> </ul>

DTC	Description	Possible Cause	Action
		<p>damaged/contaminated, de-magnetised</p> <ul style="list-style-type: none"> <li>● Sensor internal fault</li> </ul>	<p>wheel bearing as required. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</p>
C0038-11	Left Rear Wheel Speed Sensor Supply - circuit short to ground	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for short to ground. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>
C0039-38	Right Rear Tone Wheel - signal frequency incorrect	<ul style="list-style-type: none"> <li>● Right rear magnetic pulse ring damaged/contaminated</li> <li>● Incorrect component installed</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Check the right rear magnetic pulse ring for damage or contamination. Clean or replace as required. . If no damage/contamination found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph for more than 10 seconds</li> </ul>
C003A-12	Right Rear Wheel Speed Sensor - short to battery	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for short to power. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>
C003A-14	Right Rear Wheel Speed Sensor - circuit short to ground or open	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for short to ground or open circuit. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>
C003A-25	Right Rear Wheel Speed Sensor - signal shape/waveform failure	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for partial or intermittently grounded signal circuit. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph</li> </ul>
C003A-2F	Right Rear Wheel Speed Sensor -signal erratic	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for intermittent short to power, ground or open circuit. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph</li> </ul>
C003A-31	Right Rear Wheel Speed Sensor - no signal	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Magnetic pulse ring de-magnetised or damaged</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for open circuit or high resistance. Check connectors for damage or corrosion. Check the wheel speed sensor for correct location and contamination. Check the magnetic pulse wheel for contamination, damage or de-magnetisation. Clean or replace the sensor or wheel bearing as required. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph</li> </ul>
C003A-62	Right Rear Wheel Speed Sensor - signal compare failure	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for intermittent short to power, ground or open circuit. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair and extinguish the lamps, the vehicle needs to be driven above 9mph/15kph</li> </ul>

DTC	Description	Possible Cause	Action
C003A-64	Right Rear Wheel Speed Sensor - signal plausibility failure	<ul style="list-style-type: none"> <li>● Incorrect wheels/tyres installed</li> <li>● Electrical wiring harness fault</li> <li>● EMC influences on left rear wheel speed sensor and supply line</li> <li>● Magnetic pulse wheel damaged/contaminated, de-magnetised</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Check the correct wheels and tyres are installed. Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for intermittent short to power, or ground. Check for EMC influences on the speed sensor and circuits. Check magnetic pulse wheel for damage/contamination and de-magnetisation. Repair Wiring harness, install a new sensor or wheel bearing as required. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>
C003B-11	Right Rear Wheel Speed Sensor Supply - circuit short to ground	<ul style="list-style-type: none"> <li>● Electrical wiring harness fault</li> <li>● Sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to the electrical circuit diagrams and check the wheel speed sensor circuit for short to ground. Repair harness as required. If no harness fault found, suspect wheel speed sensor. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>
C0047-16	Brake Booster Pressure Sensor - circuit voltage below threshold	<ul style="list-style-type: none"> <li>● Brake booster pressure sensor supply circuit - voltage below threshold</li> <li>● HCU failure</li> </ul>	<ul style="list-style-type: none"> <li>● Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check brake booster pressure sensor power supply for short to ground. Check and install a new HCU as required, refer to the new module/component installation note at the top of the DTC Index</li> </ul>
C0047-1C	Brake Booster Pressure Sensor - circuit voltage out of range	<ul style="list-style-type: none"> <li>● Brake booster pressure sensor supply circuit - voltage out of range 4.5v-5.3v</li> <li>● Brake booster pressure sensor failure</li> <li>● HCU failure</li> </ul>	<ul style="list-style-type: none"> <li>● Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check brake booster pressure sensor power supply for short, high resistance. Establish if sensor or HCU is at fault. Check and install a new brake booster pressure sensor or HCU as required, refer to the new module/component installation note at the top of the DTC Index</li> </ul>
C0047-29	Brake Booster Pressure Sensor - signal invalid	<ul style="list-style-type: none"> <li>● Brake booster pressure sensor signal 1 circuit - short to ground, power, open circuit</li> <li>● Brake booster pressure sensor signal 2 circuit - short to ground, power, open circuit</li> <li>● Brake booster pressure sensor failure</li> </ul>	<ul style="list-style-type: none"> <li>● Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check brake booster signal 1 and 2 circuits for short to ground, power, open circuit. Clear DTC and re-test. If DTC remains, suspect the brake booster pressure sensor, check and install a new sensor as required, refer to the new module/component installation note at the top of the DTC Index. To validate the repair and extinguish the lamps, start the engine and apply the foot brake</li> </ul>
C0047-62	Brake Booster Pressure Sensor - signal compare failure	<ul style="list-style-type: none"> <li>● NOTE: Fault detected during braking event</li> <li>● Brake booster pressure sensor signal circuits 1 and 2 - shorted together</li> </ul>	<ul style="list-style-type: none"> <li>● Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check brake booster pressure sensor signal circuits 1 and 2 for shorting together. Repair any harness faults found and retest. To validate the repair and extinguish the lamps, start the engine and apply the foot brake</li> </ul>
C0047-64	Brake Booster Pressure Sensor - signal plausibility failure	<ul style="list-style-type: none"> <li>● NOTE: Fault detected during non-braking event</li> <li>● Signal plausibility failure</li> <li>● Electrical wiring harness fault</li> <li>● Brake booster pressure sensor failure</li> </ul>	<ul style="list-style-type: none"> <li>● Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check brake booster signal 1 and 2 circuits for short to ground, power, open circuit or high resistance. Check connectors for damage or corrosion. Repair any harness faults found and retest. If DTC remains, suspect the brake booster pressure sensor, check and install a new sensor as required, refer to the new module/component installation note at the top of the DTC Index. To validate the repair and extinguish the lamps, start the engine and apply and release the foot brake</li> </ul>
C0062-28	Longitudinal Acceleration Sensor - signal bias level out of range/zero adjustment failure	<ul style="list-style-type: none"> <li>● Yaw sensor insecurely mounted</li> <li>● Yaw sensor fault</li> </ul>	<ul style="list-style-type: none"> <li>● Check the yaw sensor is securely mounted. If the mounting is secure suspect the yaw sensor, Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>

DTC	Description	Possible Cause	Action
C0062-54	Longitudinal Acceleration Sensor - missing calibration	<ul style="list-style-type: none"> <li>The longitudinal acceleration sensor has not been calibrated</li> <li>Mounting bracket bent/misaligned</li> </ul>	<ul style="list-style-type: none"> <li>Check the longitudinal acceleration sensor has been calibrated</li> <li>If it has been calibrated check that the sensor is aligned correctly, check for bent mounting bracket</li> <li>To validate the calibration/repair, ignition on and wait 10 seconds. Check lamps remain extinguished</li> </ul>
C0063-08	Yaw Rate Sensor - bus signal /message failures	<ul style="list-style-type: none"> <li>Wiring harness fault</li> <li>Yaw sensor fault</li> </ul>	<ul style="list-style-type: none"> <li>Refer to the electrical wiring diagrams and check the integrity of the power and ground supplies to the yaw sensor. Check the integrity of the bus connections. Repair any harness faults found and retest. If no harness faults are found suspect the yaw sensor, Refer to the Warranty Policy and Procedures manual if a module/component is suspect. To validate the repair, ignition on and wait 10 seconds. Check lamps remain extinguished.</li> </ul>
C0063-14	Yaw Rate Sensor - circuit short to ground or open	<ul style="list-style-type: none"> <li>Wiring harness fault</li> <li>Sensor fault</li> </ul>	<ul style="list-style-type: none"> <li>Refer to the electrical wiring diagrams and check the high speed CAN circuit between the yaw sensor and the Anti-Lock Braking System Hydraulic Control Unit for short to ground or open circuit. Repair any harness faults found and retest. If no harness faults are found suspect the yaw sensor, Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>
C0063-1C	Yaw Rate Sensor - circuit voltage out of range	<ul style="list-style-type: none"> <li>Yaw rate sensor power distribution fault</li> <li>Wiring harness fault</li> <li>Yaw sensor internal fault</li> </ul>	<ul style="list-style-type: none"> <li>Refer to the electrical wiring diagrams and check the power and ground supplies to the yaw sensor. Check power circuit for short to ground or open circuit. Check ground circuit for short to power or open circuit. Repair any harness faults found and retest. If no harness faults are found suspect the yaw sensor, Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> <li>To confirm the repair and extinguish the warning lamps, clear the DTC, cycle the ignition state to off, then return the ignition state to on and wait up to 10 seconds</li> </ul>
C0063-27	Yaw Rate Sensor - signal rate of change	<ul style="list-style-type: none"> <li>Yaw sensor insecurely mounted</li> <li>Yaw sensor connector insecure</li> <li>Wiring harness fault</li> <li>Yaw sensor fault</li> <li>Anti-Lock Braking System Hydraulic Control Unit fault</li> </ul>	<ul style="list-style-type: none"> <li>Check the yaw sensor is securely mounted. Check the yaw sensor harness connector is securely located. Refer to the electrical wiring diagrams and check the power and ground supplies to the yaw sensor. Check circuits for intermittent open circuit or high resistance. Repair any harness faults found and retest. If no harness faults are found suspect the yaw sensor or Anti-Lock Braking System Hydraulic Control Unit, Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>
C0063-28	Yaw Rate Sensor - signal bias level out of range/zero adjustment failure	<ul style="list-style-type: none"> <li>Yaw sensor insecurely mounted</li> <li>Yaw sensor fault</li> </ul>	<ul style="list-style-type: none"> <li>Check the yaw sensor is securely mounted. If the mounting is secure suspect the yaw sensor, Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> </ul>
C0063-41	Yaw Rate Sensor - checksum error	<ul style="list-style-type: none"> <li>Yaw sensor fault</li> <li>Anti-Lock Braking System Hydraulic Control Unit fault</li> </ul>	<ul style="list-style-type: none"> <li>Replace the yaw sensor, clear the DTC and retest the system. If the DTC remains install a new Anti-Lock Braking System Hydraulic Control Unit. Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> <li>To confirm the repair and extinguish the warning lamps, clear the DTC, cycle the ignition state to off, then return the ignition state to on and wait up to 10 seconds</li> </ul>
C0063-49	Yaw Rate Sensor - internal electronic failure	<ul style="list-style-type: none"> <li>Yaw rate sensor internal electronic failure</li> <li>Wiring harness fault</li> </ul>	<ul style="list-style-type: none"> <li>Refer to the electrical wiring diagrams and check the power and ground supplies to the yaw sensor. Repair any harness faults found and retest. If no harness faults are found suspect the yaw sensor, Refer to the Warranty Policy and Procedures manual if a module/component is suspect</li> <li>To confirm the repair and extinguish the warning lamps, clear the DTC, cycle the ignition state to off, then return the ignition state to on and wait up to 10 seconds</li> </ul>

# Anti-Lock Control - Stability Assist - Anti-Lock Brake System (ABS) Module

Removal and Installation

## Removal

**1. NOTE:** The anti-lock braking system (ABS) module mounted to the hydraulic control unit (HCU) cannot be serviced separately. If the ABS module requires replacement, the unit must be replaced as a complete assembly.

Remove the HCU.

For additional information, refer to: Hydraulic Control Unit (HCU) (206-09, Removal and Installation).

## Installation

**1.** Install the HCU.

For additional information, refer to: Hydraulic Control Unit (HCU) (206-09, Removal and Installation).

# Anti-Lock Control - Stability Assist - Front Wheel Speed Sensor

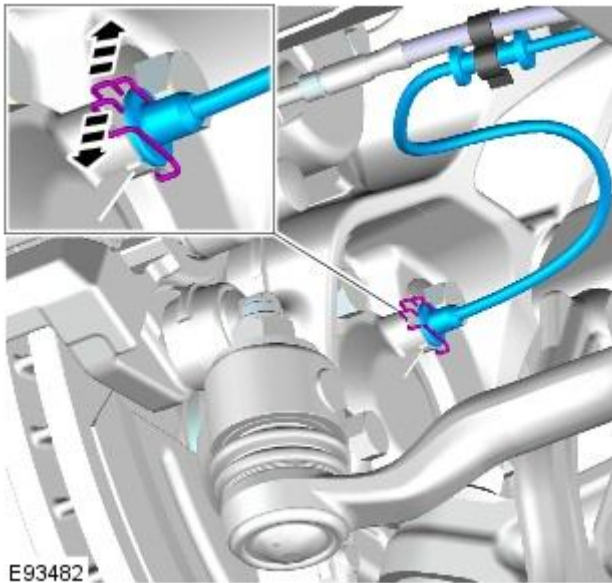
Removal and Installation

## Removal

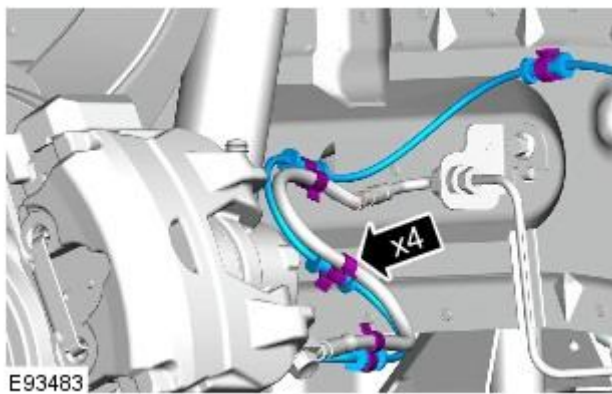
1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

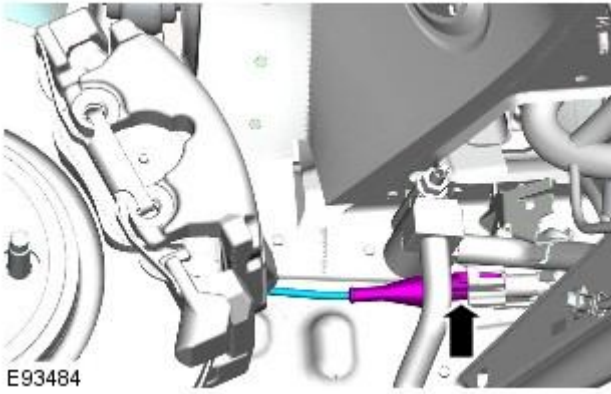
2. Refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).




3. **3.** NOTE: LH illustration shown, RH is similar.

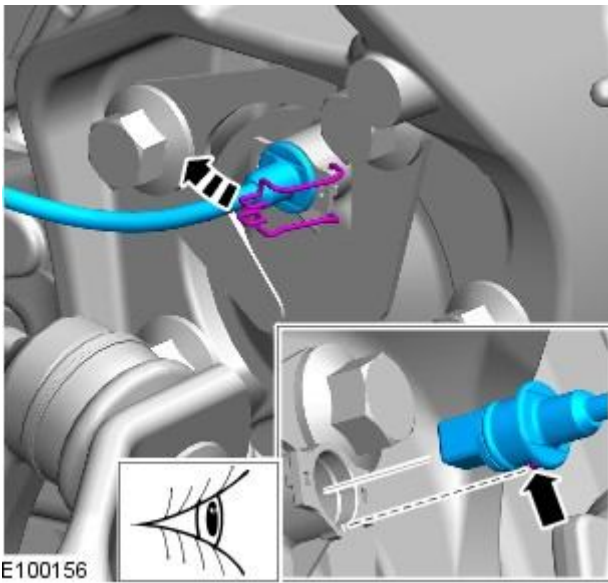


4. **4.** NOTE: LH illustration shown, RH is similar.

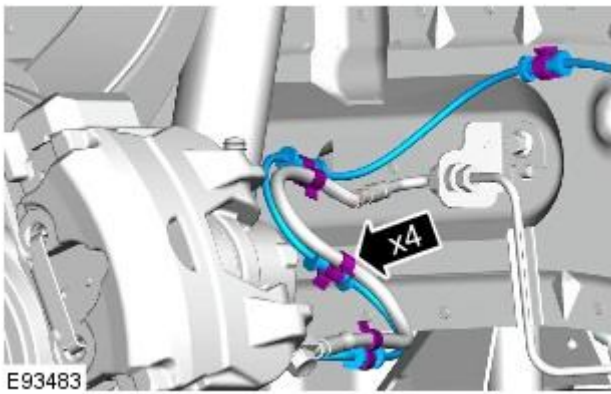


5.  CAUTION: Note the fitted position of the component prior to removal.
  - NOTE: LH illustration shown, RH is similar.

## Installation

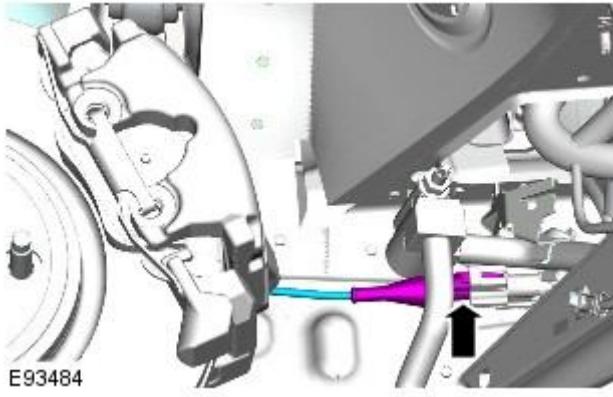


1. 1. NOTE: LH illustration shown, RH is similar.



2. 2. NOTE: LH illustration shown, RH is similar.






3. **3.** NOTE: LH illustration shown, RH is similar.

# Anti-Lock Control - Stability Assist - Rear Wheel Speed Sensor

Removal and Installation

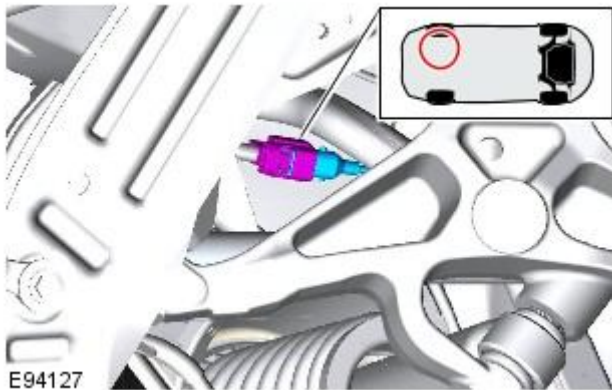
## Removal


- NOTE: Removal steps in this procedure may contain installation details.
- NOTE: The ignition must be switched off.
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

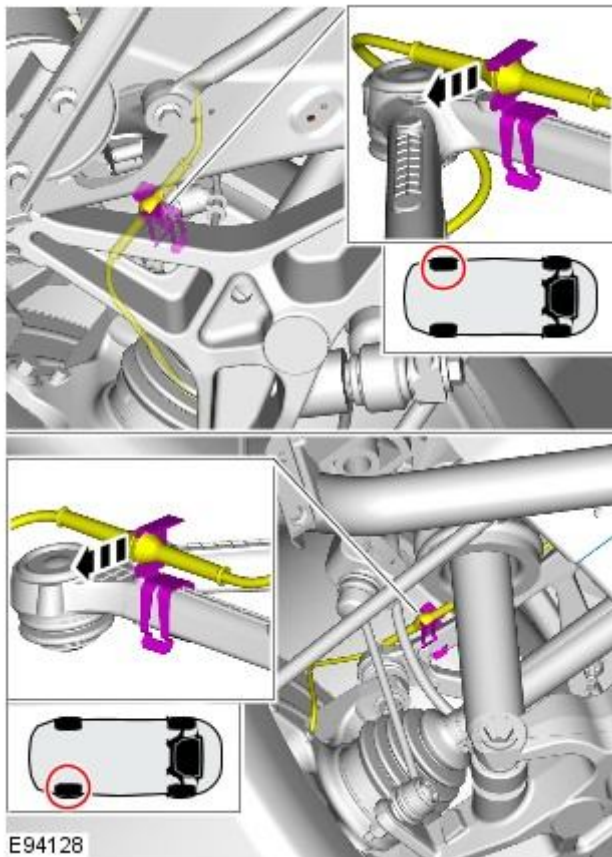
2. Disconnect the wheel speed sensor electrical connector.

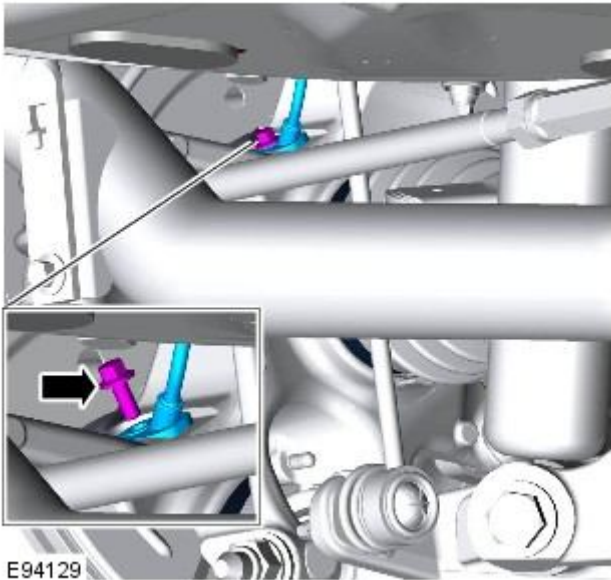


3.  **CAUTION:** Make sure that the harness retaining bracket is not removed. Failure to follow this instruction may result in damage to the harness.

- NOTE: Note the orientation of the clip.

Release the wiring harness grommet.





4.  CAUTION: Note the fitted position of the component prior to removal.

Remove the wheel speed sensor.

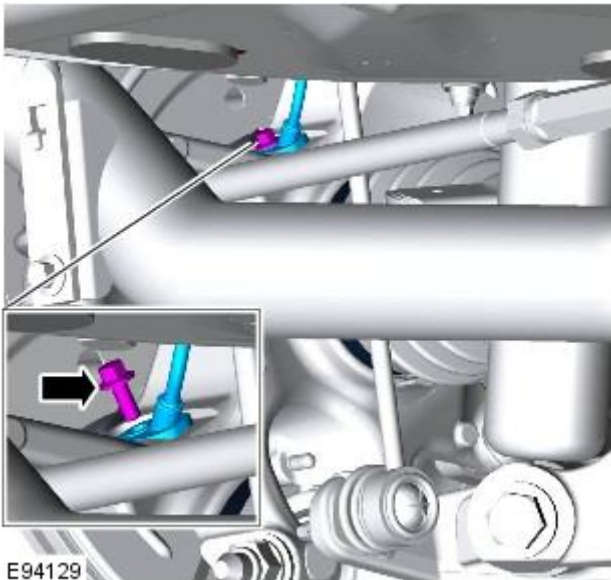
- Remove the retaining bolt.
- Release the wheel speed sensor.

### Installation

1. NOTE: Make sure that the component is installed to the position noted on removal.

To install, reverse the removal procedure.

- Tighten to 6 Nm.



# Anti-Lock Control - Stability Assist - Steering Wheel Rotation Sensor

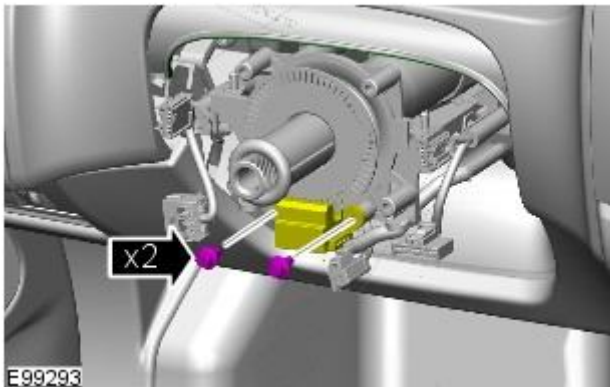
## Removal and Installation

### Removal

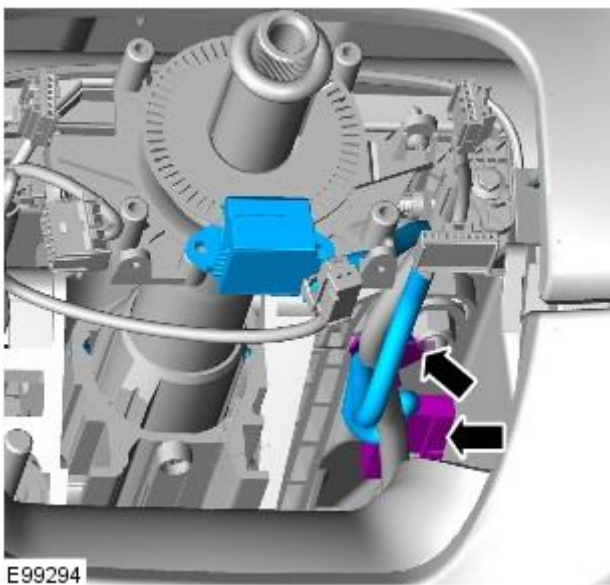
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Clockspring](#) (501-20B Supplemental Restraint System, Removal and Installation).

3.



4.



### Installation

1. To install, reverse the removal procedure.

# Anti-Lock Control - Stability Assist - Yaw Rate Sensor and Accelerometer

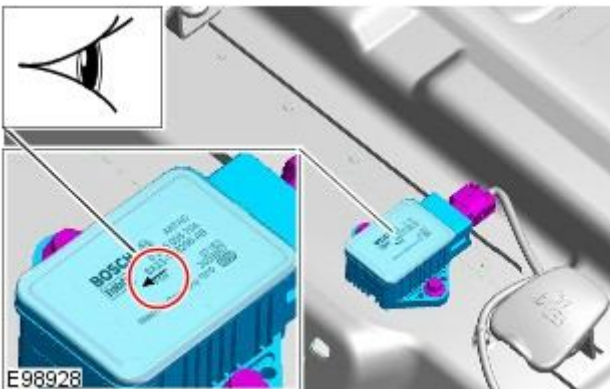
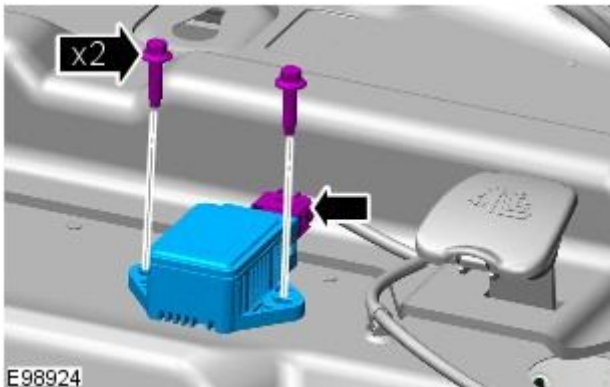
Removal and Installation


## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Parcel Shelf](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Torque: 6 Nm



4.  CAUTION: Make sure that all diagnostic trouble codes (DTCs) have been removed after the road test.  
• NOTE: Make sure that this component is installed to the noted removal position.

## Installation

1. To install, reverse the removal procedure.

## Steering System - General Information -

### Steering Linkage Specifications

<b>Steering Linkage Free Play</b>	<b>Measurement (mm)</b>	<b>Measurement (in)</b>
Free play (measured at the steering wheel rim)	0-6	0-0.24

### Power Steering Pump Specifications

<b>Item</b>	<b>Specification</b>
Power steering pump relief pressure	106-114 bar

### Lubricants, Fluids, Sealers and Adhesives

<b>Item</b>	<b>Specification</b>
Power steering fluid	Dextron 3

# Steering System - General Information - Steering System

Diagnosis and Testing

## Principle of Operation

For a detailed description of the steering system operation, refer to the relevant Description and Operation sections of the workshop manual. REFER to:

[Power Steering](#) (211-02 Power Steering, Description and Operation),  
[Power Steering](#) (211-02 Power Steering, Description and Operation),  
[Power Steering](#) (211-02 Power Steering, Description and Operation),  
[Steering Linkage](#) (211-03 Steering Linkage, Description and Operation),  
[Steering Linkage](#) (211-03 Steering Linkage, Description and Operation),  
[Steering Linkage](#) (211-03 Steering Linkage, Description and Operation),  
[Steering Column](#) (211-04 Steering Column, Description and Operation),  
[Steering Column](#) (211-04 Steering Column, Description and Operation),  
[Steering Column](#) (211-04 Steering Column, Description and Operation),  
[Steering Column Switches](#) (211-05 Steering Column Switches, Description and Operation),  
[Steering Column Switches](#) (211-05 Steering Column Switches, Description and Operation),  
[Steering Column Switches](#) (211-05 Steering Column Switches, Description and Operation).

## Inspection and Verification

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Tire condition/pressure</li> <li>● Fluid level</li> <li>● Leaks</li> <li>● Security, condition and correct installation of suspension components</li> <li>● Security, condition and correct installation of steering system components</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Harnesses for damage/corrosion</li> <li>● Electrical connector(s)</li> <li>● Damaged/corroded pins</li> </ul>



**CAUTION:** If a steering gear assembly is returned under warranty with leaking output shaft seals, but there is also damage to the steering gear boot/boots the steering gear warranty will be invalid. This is due to the steering gear output shaft seals being damaged due to foreign materials entering the steering gear boot and damaging the steering gear output shaft seals thereafter.

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the concern is not visually evident, verify the symptom and refer to the symptom chart.

## Symptom Charts



**WARNING:** It is not possible to CHECK the torque of a patchlock bolt, if the torque is suspected to be low, the bolt must be REMOVED/DISCARDED and a new bolt MUST be INSTALLED and torque to the correct value.

• NOTE: If the module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

### Fluid Leakage



• NOTE: Confirm the location of the fluid leak. CLEAN the area of the leak, inspect the area and confirm the exact position. Ensure the fluid is not from another system on the vehicle.

Symptom	Possible Causes	Action
● Power steering fluid leakage	● Overfilled system	● Correct the fluid level as required
	● Steering gear	● Check and install new steering gear as required, refer to the new module/component installation note at the top of the Symptom Charts
	● Damaged fluid cap/reservoir	● Check and install a new fluid cap/reservoir as required
	<ul style="list-style-type: none"> <li>● Loose or damaged hoses and fittings</li> <li>● O-ring or Dowty seals</li> </ul>	<ul style="list-style-type: none"> <li>● Tighten the hose connection or latch plate fixing to the recommended torque.</li> </ul> REFER to: <a href="#">Specifications</a> (211-00 Steering System - General Information, Specifications). <ul style="list-style-type: none"> <li>● Check and install new components as required</li> <li>● Install new O-ring or Dowty seals as required</li> </ul>




Symptom	Possible Causes	Action
	<ul style="list-style-type: none"> <li>Fluid cooler</li> </ul>	<ul style="list-style-type: none"> <li>Check and install a new fluid cooler as required, refer to the new module/component installation note at the top of the Symptom Charts</li> </ul>
	<ul style="list-style-type: none"> <li>Power steering pump</li> </ul>	<ul style="list-style-type: none"> <li>Check and install a new power steering pump as required, refer to the new module/component installation note at the top of the Symptom Charts</li> </ul>

**Functional**

Symptom	Possible Causes	Action
<ul style="list-style-type: none"> <li>Steering wheel misalignment</li> </ul>	<ul style="list-style-type: none"> <li>Steering not correctly centred</li> </ul>	<ul style="list-style-type: none"> <li>Check the steering alignment. REFER to: <a href="#">Specifications</a> (204-00 Suspension System - General Information, Specifications).</li> </ul>
<ul style="list-style-type: none"> <li>Excessive free play at steering wheel (refer to the Steering Linkage Inspection and Backlash (Free play) Check in this section)</li> </ul>	<ul style="list-style-type: none"> <li>Steering wheel loose</li> </ul>	<ul style="list-style-type: none"> <li>Check and tighten the steering wheel retaining bolt as required. REFER to: <a href="#">Specifications</a> (211-00 Steering System - General Information, Specifications).</li> </ul>
	<ul style="list-style-type: none"> <li>Excess play in the steering linkage</li> </ul>	<ul style="list-style-type: none"> <li>Check and install new components as required</li> </ul>
	<ul style="list-style-type: none"> <li>Steering gear not correctly adjusted (causing excessive backlash)</li> </ul>	<p> <b>CAUTION: DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will invalidate the steering gear warranty</b></p> <ul style="list-style-type: none"> <li>Check and install a new steering gear as required, refer to the new module/component installation note at the top of the Symptom Charts</li> </ul>
	<ul style="list-style-type: none"> <li>Lower steering column universal joint pinch bolts loose</li> </ul>	<ul style="list-style-type: none"> <li>Check and tighten the lower steering column pinch bolts as required. REFER to: <a href="#">Specifications</a> (211-00 Steering System - General Information, Specifications).</li> </ul>
	<ul style="list-style-type: none"> <li>Excessive wear in steering column universal joints</li> </ul>	<ul style="list-style-type: none"> <li>Check and install a new steering column or steering column lower shaft as required, refer to the new module/component installation note at the top of the Symptom Charts</li> </ul>
	<ul style="list-style-type: none"> <li>Steering gear mounting bolts loose or damaged</li> </ul>	<ul style="list-style-type: none"> <li>Check/tighten and install new steering gear mounting bolts as required. REFER to: <a href="#">Specifications</a> (211-00 Steering System - General Information, Specifications).</li> </ul>
	<ul style="list-style-type: none"> <li>Wear in steering gear tie-rod end ball joints</li> </ul>	<ul style="list-style-type: none"> <li>Check and install new tie-rod ends as required, refer to the new module/component installation note at the top of the Symptom Charts</li> </ul>
	<p>• NOTE: Inner ball joint wear is rare. The steering gear installed to all Jaguar vehicles has a spring loaded pinion to ensure the correct level of engagement between the rack and pinion. This play is optimized with the steering gear in the central position and should not be confused with inner ball joint wear. Check for vertical motion in the inner ball joint with the steering gear in the central position.</p> <ul style="list-style-type: none"> <li>Wear in steering gear inner ball joints</li> </ul>	<ul style="list-style-type: none"> <li>Check and install new steering gear as required, refer to the new module/component installation note at the top of the Symptom Charts</li> </ul>
	<ul style="list-style-type: none"> <li>Wear in suspension ball joints/bushings</li> </ul>	<ul style="list-style-type: none"> <li>Check and install new components as required</li> </ul>
<ul style="list-style-type: none"> <li>Veer under braking</li> </ul>	<ul style="list-style-type: none"> <li>Steering gear not correctly adjusted</li> </ul>	<p> <b>CAUTION: DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will invalidate the</b></p>




Symptom	Possible Causes	Action
		<p><a href="#">steering gear warranty</a></p> <ul style="list-style-type: none"> <li>● Check and install a new steering gear as required, refer to the new module/component installation note at the top of the Symptom Charts</li> </ul>
	<ul style="list-style-type: none"> <li>● Contamination of brake pads and discs</li> </ul>	<ul style="list-style-type: none"> <li>● Check and rectify the source of the contamination and install new brake pads and discs as required, refer to the new module/component installation note at the top of the Symptom Charts</li> </ul>
	<ul style="list-style-type: none"> <li>● Seized front brake caliper slide pins or piston <ul style="list-style-type: none"> <li>● Damaged brake discs</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● Check and rectify sticking slide pins and install new calipers as required, refer to the new module/component installation note at the top of the Symptom Charts</li> <li>● Check and install new brake discs as required, refer to the new module/component installation note at the top of the Symptom Charts</li> </ul>
<ul style="list-style-type: none"> <li>● Vehicle pulls to one side when driving on a level surface</li> </ul>	<ul style="list-style-type: none"> <li>● Uneven tire wear</li> <li>● Incorrect tire pressure</li> </ul>	<ul style="list-style-type: none"> <li>● For information on diagnosis of uneven tire wear. REFER to: <a href="#">Suspension System</a> (204-00 Suspension System - General Information, Diagnosis and Testing).</li> <li>● Check and adjust tire pressures as required. REFER to: <a href="#">Specifications</a> (204-04 Wheels and Tires, Specifications).</li> </ul>
	<ul style="list-style-type: none"> <li>● Incorrect geometry settings</li> </ul>	<ul style="list-style-type: none"> <li>● NOTE: Dealerships must keep a copy of the BEFORE and AFTER geometry figures with job card for future reference</li> <li>● Check and adjust geometry as required. REFER to: (204-00 Suspension System - General Information) <a href="#">Camber and Caster Adjustment</a> (General Procedures), <a href="#">Front Toe Adjustment</a> (General Procedures), <a href="#">Rear Toe Adjustment</a> (General Procedures).</li> </ul>
	<ul style="list-style-type: none"> <li>● Vehicle is unevenly loaded or overloaded</li> </ul>	<ul style="list-style-type: none"> <li>● Notify the customer of incorrect vehicle loading</li> </ul>
	<ul style="list-style-type: none"> <li>● Steering gear is not correctly adjusted</li> </ul>	<p> CAUTION: DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will invalidate the steering gear warranty</p> <ul style="list-style-type: none"> <li>● Check and install a new steering gear as required, refer to the new module/component installation note at the top of the Symptom Charts</li> </ul>
	<ul style="list-style-type: none"> <li>● Loose, damaged or worn front suspension components</li> </ul>	<ul style="list-style-type: none"> <li>● Check/tighten and install new front suspension components as required. REFER to: <a href="#">Specifications</a> (204-00 Suspension System - General Information, Specifications).</li> </ul>
	<ul style="list-style-type: none"> <li>● Loose, damaged or worn rear suspension components</li> </ul>	<ul style="list-style-type: none"> <li>● Check/tighten and install new rear suspension components as required. REFER to: <a href="#">Specifications</a> (204-00 Suspension System - General Information, Specifications).</li> </ul>

## Noise

Symptom	Possible Causes	Action
<ul style="list-style-type: none"> <li>Continuous noise</li> </ul>	<ul style="list-style-type: none"> <li>Low power steering fluid level</li> </ul>	<ul style="list-style-type: none"> <li>Check for leaks and rectify as required. For further information refer to the symptom charts for leakage in this section. Fill power steering fluid reservoir to correct level</li> </ul>
	<ul style="list-style-type: none"> <li><b>NOTE:</b> Look for small air bubbles visible in the fluid, air may also get trapped in the hydraulic system</li> <li>Air in hydraulic system</li> </ul>	<ul style="list-style-type: none"> <li>Bleed the power steering system. REFER to: <a href="#">Power Steering System Bleeding</a> (211-00 Steering System - General Information, General Procedures).</li> </ul>
	<ul style="list-style-type: none"> <li>Power steering pipe/hose in contact with the vehicle body</li> </ul>	<ul style="list-style-type: none"> <li>Check and reposition, or install new IF damaged/deformed, power steering pipe/hose</li> </ul>
	<ul style="list-style-type: none"> <li>Power steering pipe/hose restricted or twisted</li> </ul>	<ul style="list-style-type: none"> <li>Check and clear restriction to pipe/hose</li> <li>Reposition power steering pipe/hose. Install new pipe/hose IF permanently damaged/deformed</li> </ul>
	<ul style="list-style-type: none"> <li>Power steering pump mounting bolts loose</li> </ul>	<ul style="list-style-type: none"> <li>Tighten the power steering pump mounting bolts to the correct torque. REFER to: <a href="#">Specifications</a> (211-00 Steering System - General Information, Specifications).</li> </ul>
<ul style="list-style-type: none"> <li>Noise gets worse when system is loaded</li> </ul>	<ul style="list-style-type: none"> <li><b>NOTE:</b> Refer to the power steering pressure check in this section</li> <li>Low power steering fluid level                             <ul style="list-style-type: none"> <li>Aerated fluid</li> </ul> </li> <li>Low power steering pump pressure</li> </ul>	<ul style="list-style-type: none"> <li>Check and fill power steering fluid reservoir to correct level                             <ul style="list-style-type: none"> <li>Bleed the power steering system. REFER to: <a href="#">Power Steering System Bleeding</a> (211-00 Steering System - General Information, General Procedures).</li> </ul> </li> <li>Check power steering pump pressure. If the pump pressure is low, install a new power steering pump</li> </ul>
<ul style="list-style-type: none"> <li>Front End Accessory Drive (FEAD) belt squeal</li> </ul>	<ul style="list-style-type: none"> <li>FEAD belt incorrectly tensioned or glazed</li> </ul>	<ul style="list-style-type: none"> <li>Check FEAD belt tension</li> <li>Check FEAD belt condition and install a new belt as required</li> </ul>
<ul style="list-style-type: none"> <li>Chirp noise from the steering pump when a load is applied</li> </ul>	<ul style="list-style-type: none"> <li>Loose or worn FEAD belt</li> </ul>	<ul style="list-style-type: none"> <li>Check FEAD belt tension</li> <li>Check FEAD belt condition and install a new belt as required</li> </ul>
<ul style="list-style-type: none"> <li>Scrape/grind noise from behind steering wheel while steering</li> </ul>	<ul style="list-style-type: none"> <li>Steering column shroud foul condition or clockspring</li> </ul>	<ul style="list-style-type: none"> <li>Correctly install the steering column shroud to eliminate the foul condition</li> <li>Install a new clockspring as required</li> </ul>
	<ul style="list-style-type: none"> <li>Foreign objects</li> </ul>	<ul style="list-style-type: none"> <li>Remove foreign objects from between steering column shroud and steering wheel/steering column rotating components</li> </ul>
<ul style="list-style-type: none"> <li>Click</li> </ul>	<ul style="list-style-type: none"> <li>Clockspring or steering column multifunction switch LH</li> </ul>	<ul style="list-style-type: none"> <li>Correctly install and install new components as required</li> </ul>
	<ul style="list-style-type: none"> <li>Loose universal joint pinch bolt</li> </ul>	<ul style="list-style-type: none"> <li>Install a new universal joint pinch bolt and tighten to correct specification. REFER to: <a href="#">Specifications</a> (211-00 Steering System - General Information, Specifications).</li> </ul>
<ul style="list-style-type: none"> <li>Squeak</li> </ul>	<ul style="list-style-type: none"> <li>Steering column shroud joints</li> </ul>	<ul style="list-style-type: none"> <li>Apply Krytox spray to steering column shroud joints</li> </ul>
	<ul style="list-style-type: none"> <li>Clockspring</li> </ul>	<ul style="list-style-type: none"> <li>Install new clockspring as required</li> </ul>
<ul style="list-style-type: none"> <li>Knock</li> </ul>	<ul style="list-style-type: none"> <li>Loose fixings (universal joint pinch bolt and steering column fixings)</li> </ul>	<ul style="list-style-type: none"> <li>Tighten fixings to correct specification. REFER to: <a href="#">Specifications</a> (211-00 Steering System - General Information, Specifications).</li> </ul>
<ul style="list-style-type: none"> <li>Rattle</li> </ul>	<ul style="list-style-type: none"> <li>Foreign objects</li> </ul>	<ul style="list-style-type: none"> <li>Remove foreign objects from between steering column shroud and steering wheel/steering column rotating components</li> </ul>
	<ul style="list-style-type: none"> <li>Loose fixings</li> </ul>	<ul style="list-style-type: none"> <li>Tighten steering column fixings to correct specification. REFER to: <a href="#">Specifications</a> (211-00 Steering System - General Information, Specifications).</li> </ul>
<ul style="list-style-type: none"> <li>Noise while adjusting column</li> </ul>	<ul style="list-style-type: none"> <li>Electric motor/solenoid</li> </ul>	<ul style="list-style-type: none"> <li><b>NOTE:</b> Before carrying out repairs/replacement, assess column adjustment noise levels against other vehicles of the same model</li> <li>Install new components as required</li> </ul>

Symptom	Possible Causes	Action
	<ul style="list-style-type: none"> <li>● Motor spindle/lead screw</li> </ul>	<ul style="list-style-type: none"> <li>● Lubricate lead screw</li> </ul>

## Vibration

Symptom	Possible Causes	Action
<ul style="list-style-type: none"> <li>● Wheel Fight (Kick Back) - condition where roughness is felt in the steering wheel by the driver when the vehicle is driven over rough surfaces</li> </ul>	<ul style="list-style-type: none"> <li>● Loose or worn steering components/bushings</li> </ul>	 <b>CAUTION: DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will invalidate the steering gear warranty.</b> <ul style="list-style-type: none"> <li>● Tighten and install new steering components/bushings as required</li> </ul>
	<ul style="list-style-type: none"> <li>● Loose or worn suspension components/bushings</li> </ul>	<ul style="list-style-type: none"> <li>● Tighten and install new suspension components/bushings as required</li> </ul>
<ul style="list-style-type: none"> <li>● Nibble (Shimmy) - condition where oscillation of the steering wheel occurs (not vertical which is Shake). This is driven by road wheel imbalance</li> </ul>	<ul style="list-style-type: none"> <li>● Road wheel and tire condition</li> </ul>	<ul style="list-style-type: none"> <li>● Check for wheel and tire damage. Install new components as required</li> <li>● Check for tire uniformity. Install new tire(s) as required</li> </ul>
	<ul style="list-style-type: none"> <li>● Road wheel imbalance</li> </ul>	<ul style="list-style-type: none"> <li>● Check and adjust road wheel balance as required</li> </ul>
<ul style="list-style-type: none"> <li>● Shake - condition where vertical vibration of the steering wheel/column occurs (not oscillation which is Nibble)</li> </ul>	<ul style="list-style-type: none"> <li>● <b>NOTE: Vibration smooths out after several miles of driving</b></li> <li>● Road wheel imbalance due to tire flat-spotting</li> </ul>	<ul style="list-style-type: none"> <li>● Ensure tires installed are to Jaguar specification. Install new tires as required</li> <li>● Check and adjust tire pressures to correct specification</li> </ul>

## Component Tests


### Steering Linkage Inspection and Backlash (Free play) Check

 **CAUTION: Steering gear boots must be handled carefully to avoid damage. Use new clamps when installing steering gear boots.**

Inspect the boots for cuts, deterioration, twisting or distortion. Check the steering gear boots to make sure they are tight. Install new boots or clamps as required.

• **NOTE: The following steps must be carried out with assistance.**

1. With the wheels in the straight ahead position, gently turn the steering wheel to the left and the right to check for free play.
2. Free play should be between 0 and 6 mm (0 and 0.24 in) at the steering wheel rim. If the free play exceeds this limit, either the ball joints are worn, the lower steering column joints are worn or the backlash of the steering gear is excessive.

 **CAUTION: DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will invalidate the steering gear warranty.**

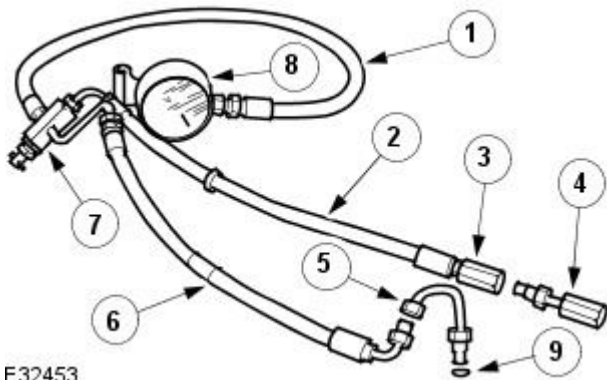
3. The backlash of the steering gear cannot be adjusted, install a new steering gear if excessive backlash is diagnosed.
4. Grasp the steering wheel firmly and move it up and down and to the left and right without turning the wheel to check for column bearing wear, steering wheel or steering column.

### Power Steering Fluid Condition Check

1. Run the engine for 2 minutes.
2. Check the power steering fluid system level.
3. Observe the color and the odor. The color under normal circumstances should be dark reddish, not brown or black.
4. Using a suitable clean syringe extract a suitable amount of fluid from the reservoir.
5. Allow the fluid to drip onto a facial tissue and examine the stain.
6. If evidence of solid material is found, the power steering fluid system should be drained for further inspection.
7. If fluid contamination or steering component failure is confirmed by the sediment in the power steering fluid system, refer to Steering Fault Diagnosis by Symptom Charts in this section.

### Power Steering Pressure Test

Test Equipment



E32453

Item	Part Number	Description
1	211-011	Pressure Gauge Hose
2	211-011-08	Pump Return Hose
3	211-011-07	Pump Return Hose Connector
4	211-011-03/2	Test Equipment to High Pressure Hose Adaptor
5	211-011-03/1	Pump High Pressure Outlet to Hose Adaptor
6	211-011-02	Pump Adaptor to Control Valve Hose
7	211-011-01	Control Valve
8	211-011	Pressure Gauge
9	-	'O' Ring Seal

The measurement of the maximum system pressure, (which is governed by the pressure relief valve) is achieved by inserting the Service Tool (pressure gauge and adaptors) into the fluid circuit of the power steering system. Run the engine at idle speed, turn the steering from lock to lock and read the maximum pressure recorded on the gauge.

### Installing Test Equipment

To install the pressure test equipment:

- Place a suitable drain tray below the power steering pump.
- Install a hose clamp on the reservoir to pump hose prior to disconnecting any hoses, to avoid unnecessary loss of fluid.
- Disconnect the hose from the power steering pump high pressure outlet.
- Install the pump outlet to hose adaptor (5). Do not omit the 'O' ring seal (9).
- Connect the power steering pump adaptor to control valve hose (6) of the test equipment.
- Install the adaptor (4) in the high pressure hose previously removed from the power steering pump outlet.
- Connect the connector (3) of the test equipment hose (2) to the adaptor (4).
- Remove the hose clamp from the reservoir hose.
- Start the engine to check the system pressure.

With the control valve (7) OPEN and the engine idling, the following system pressures may be checked:

- During turning when static (dry parking pressure).
- When the steering is held on full lock (maximum system pressure or pressure relief).
- With the steering at rest (idle pressure or back pressure).

#### • CAUTIONS:



To avoid excessive heating of the power steering pump when checking the pressure, do not close the valve for more than 5 seconds maximum.



When checking the pump pressure DO NOT drive the vehicle with the test equipment installed.

With the control valve (7) CLOSED the power steering pump maximum output pressure can be checked.

### Removing Test Equipment

To remove the test equipment:

- Install a hose clamp on the reservoir to power steering pump hose.
- Removing the test equipment is a reversal of the installation instructions.
- Install a new 'O' ring seal (9) to the power steering pump high pressure outlet to hose connection.
- Install the original hose to the power steering pump.
- Remove the clamp from the reservoir to the power steering pump hose.
- Top-up the reservoir fluid.
- Bleed the power steering system.  
REFER to: [Power Steering System Bleeding](#) (211-00 Steering System - General Information, General Procedures).

### Description of Terms

#### General Steering System Noises

##### Boom

Rhythmic sound like a drum roll or distant thunder. May cause pressure on the ear drum.

**Buzz**

Low-pitched sound, like a bee. Usually associated with vibrations.

**Chatter**

Rapidly repeating metallic sound.

**Chuckle**

Rapid noise that sounds like a stick against the spokes of a spinning bicycle wheel.

**Chirp**

High pitched rapidly repeating sound, like chirping birds.

**Click**

Light sound, like a ball point pen being clicked.

**Click/Thump**

Heavy metal-to-metal sound, like a hammer striking steel.

**Grind**

Abrasive sound, like a grinding wheel or sandpaper rubbing against wood.

**Groan/Moan**

Continuous, low-pitched humming sound.

**Groan/Howl**

Low, guttural sound, like an angry dog.

**Hiss**

Continuous sound like air escaping from a tire valve.

**Hum**

Continuous sound of varying frequencies, like a wire humming in the wind.

**Knock**

Heavy, loud repeating sound like a knock on a door.

**Ping**

Similar to knock, except at higher frequency.

**Rattle**

A sound suggesting looseness, such as marbles rolling around in a can.

**Roar**

Deep, long, prolonged sound like an animal, or winds and ocean waves.

**Rumble**

Low, heavy continuous sound like that made by wagons or thunder.

**Scrape**

Grating noise like one hard plastic part rubbing against another.

**Squeak**

High-pitched sound like rubbing a clean window.

**Squeal**

Continuous, high-pitched sound like running finger nails across a chalkboard.

**Tap**

Light, hammering sound like tapping pencil on edge of table. May be rhythmic or intermittent.

**Whirr/Whine**

High-pitched buzzing sound, like an electric motor or drill.

## Whistle

Sharp, shrill sound, like wind passing a small opening.

## Specific Steering System Noise Types

### Belt Squeal

Belt squeal is a high frequency air-borne noise generated by slippage of the ribbed Vee belt on the power steering pump pulley. Squeal increases with system loading and at full lock.

### Clonk

Clonk is a structure-borne noise heard as a loose-sounding rattle or vibration coming from the steering column. Clonk can be identified by driving and turning over cobblestones, rough roads, or high frequency bumps such as 25-50 mm tall tar strips. Clonk requires a tie-rod load impact.

### Column Knock

Column knock is a loose-sounding rattle or vibration generated by the steering column shaft contacting other portions of the column assembly. The noise is both audible and tactile. Column knock is generated by driving over cobblestones or rough pavement. It is not necessary to turn the steering wheel to create this noise.

### Column Rattle

Column rattle is a metallic sounding noise created when applying a highly impulsive force to the steering wheel. Column rattle is often used to combine the more general group of column noises including clonk and column knock. Column rattle noises can be caused by clonk, knock, loose column components, bonus parts etc. A series of parked, straight-line driving, and cornering tests should be carried out to isolate the source/sources.

### Grinding/Scrape

Grinding is a low frequency noise in the column when the steering wheel is turned. It is generally caused by interference between moving components such as the steering wheel to steering column shroud.

### Grunt (Squawk/Whoop)

Grunt is a 'honking' sound elicited when coming off one of the steering stops. Grunt is generally excited during parking manoeuvres with a low to medium speed steering input.

### Hiss (Swish)

Hiss or Valve Hiss is a high-frequency sound coming from the steering gear when the system is loaded. It is a rushing or 'swish' noise that doesn't change frequency with RPM. Hiss is the general noise generated by the flow of hydraulic fluid through restrictions in the steering system. Restrictions include the rotary steering valve, power steering tubes, connectors, tuning orifices, etc. Hiss can be air-borne and structure-borne, but the structure-borne path through the steering intermediate shaft is usually dominant.

### Moan (Groan)

Moan is the general structure-borne noise of the steering system. Moan is primarily transmitted to the driver via the body structure through the pump mount, engine mounts, power steering lines and power steering brackets. On some vehicles, moan is a loud humming noise, often present when the wheel is turned and the system is loaded. It may change frequency with engine RPM and if the system is loaded or unloaded.

### Steering Gear Knock (Steering Gear Slap)



**CAUTION:** DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will invalidate the steering gear warranty.

Steering gear knock is a rattle sound and steering wheel vibration caused by separation of the steering gear and pinion while driving over bumps. It is a structure-borne noise transmitted through the intermediate shaft and column. Steering gear knock can also be heard as a 'thump' or impact noise that occurs with the vehicle stationary when the steering wheel is released from a loaded position and allowed to return to rest. Noise occurs with the engine on or off.

### Rattles

Rattles are noises caused by knocking or hitting of components in the steering system. Steering rattles can occur in the engine compartment, the suspension, or the passenger compartment. Rattles can be caused by loose components, movable and flexible components, and improper clearances.

### Squeaks/Scrapes

Squeaks/Scrapes are noises due to friction or component rubbing anywhere in the steering system. Squeaks/Scrapes have appeared in steering linkages and joints, in column components and in column and steering wheel trim.

### Weep

Weep is an air-borne noise, occasionally generated when turning the steering across lock at a constant rate. When present on a vehicle the noise, once initiated can often be maintained across a large proportion of the available steering movement.

## **Whistle**

Whistle is similar to hiss but is louder and of a higher frequency. It is also more of a pure tone noise than hiss. Whistle is air-borne and is generated by a high flow rate of hydraulic fluid through a small restriction.

## **Zip**

Zip noise is the air-borne noise generated by power steering pump cavitation when power steering fluid does not flow freely through the suction hose from the reservoir to the pump. Zip primarily occurs during cold weather at start-up.

## **Steering System Vibrations and Harshness**

### **Buzz**

Buzz is a tactile rotary vibration felt in the steering wheel when steering inputs are slow. Buzz can also be called a grinding feel and it is closely related to grunt and is caused by high system gain with low damping. Buzz is generally excited during parking manoeuvres with low to medium speed steering input.

### **Buzz (Electrical)**

A different steering buzz can be caused by pulse width modulated (PWM) electric actuators used in variable assist steering systems. This buzz is felt by turning the ignition key to run without starting the engine and holding onto the steering wheel. In extreme cases, the buzz can be felt with the engine running also.

### **Column/Steering Wheel Shake**

Column shake is a low frequency vertical vibration excited by primary engine vibrations.

### **Nibble (Shimmy)**

Steering nibble is a rotary oscillation or vibration of the steering wheel, which can be excited at a specific vehicle speed. Nibble is driven by wheel and tire imbalance exciting a suspension recession mode, which then translates into steering gear travel and finally steering wheel nibble.

### **Shudder (Judder)**

Shudder is a low frequency oscillation of the entire steering system (tire, wheels, steering gear and linkage, etc.) when the vehicle is steered during static-park or at low speeds. Shudder is very dependent on road surface.

### **Torque/Velocity Variation (Phasing/Effort Cycling)**

Steering wheel torque variation occurring twice in one revolution is normally as a result of problems with the lower steering column (intermediate shaft), but foul conditions generally result in either constant stiffness or single point stiffness. Depending upon the orientation of the joints, the steering can feel asymmetric (torque falling off in one direction and rising in the other) or else it can simply have pronounced peaks and troughs as the steering moves from lock to lock.

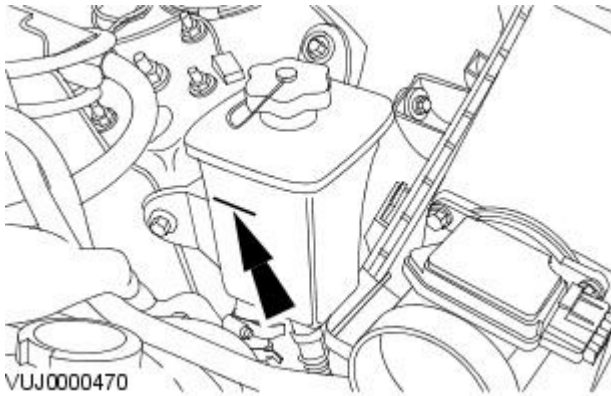
### **Wheel Fight (Kick Back)**

Wheel fight is excess feedback of sudden road forces through the steering system and back to the driver. It is evaluated at all vehicle speeds over cobblestones, rough roads, and potholes. The tires, wheels, and suspension generate forces into the steering systems. Steering friction, hydraulic damping, hydraulic compliance, mechanical compliance, steering ratio, and assist gain all affect how much is transmitted to the driver.

# Steering System - General Information - Power Steering System Bleeding

General Procedures

1. Clean power steering fluid reservoir around the filler cap and fluid indicator.
  - Check the power steering fluid, if aerated, wait until fluid is free from bubbles then top-up reservoir to UPPER level mark with recommended fluid.



2.  **CAUTION:** Fluid must always be present in the reservoir during bleeding.

Remove the filler cap and fill to the MAX level mark.

- Install the reservoir filler cap.

3. Start the engine and allow to run for 10 seconds, stop the engine.
  - Check the power steering fluid, if aerated, wait until fluid is free from bubbles then top-up reservoir to UPPER level mark with recommended fluid.

4.  **CAUTION:** Do not hold steering on full lock for longer than 10 seconds.

Start the engine and turn steering fully lock to lock, stop the engine.

- Check and top-up power steering fluid level.

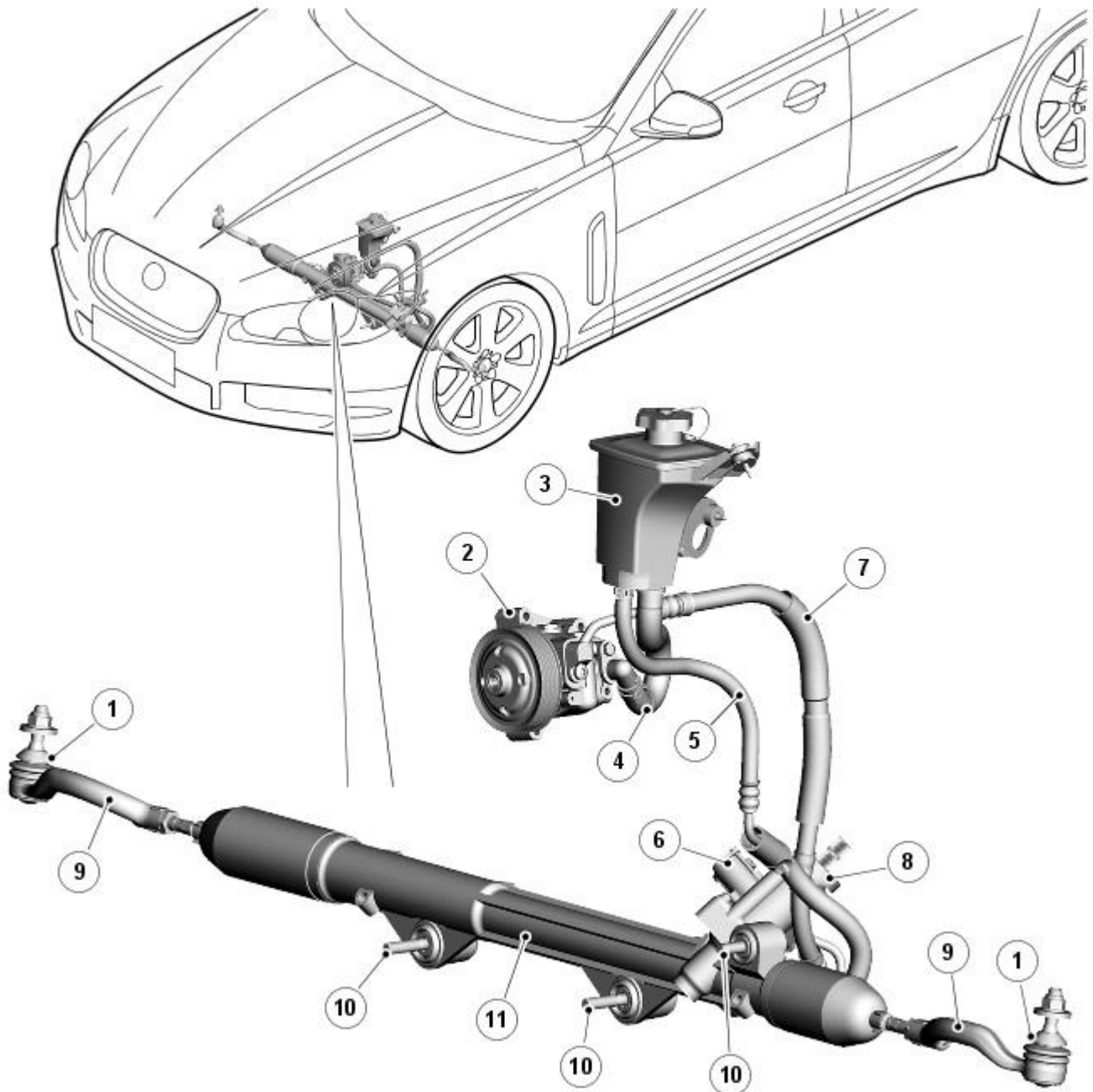
5. Start and run the engine for 2 minutes, turn the steering fully lock to lock.
  - Check and top-up power steering fluid level.



## Power Steering - Power Steering - Component Location

Description and Operation

POWER STEERING - COMPONENT LOCATION 2.7L TdV6

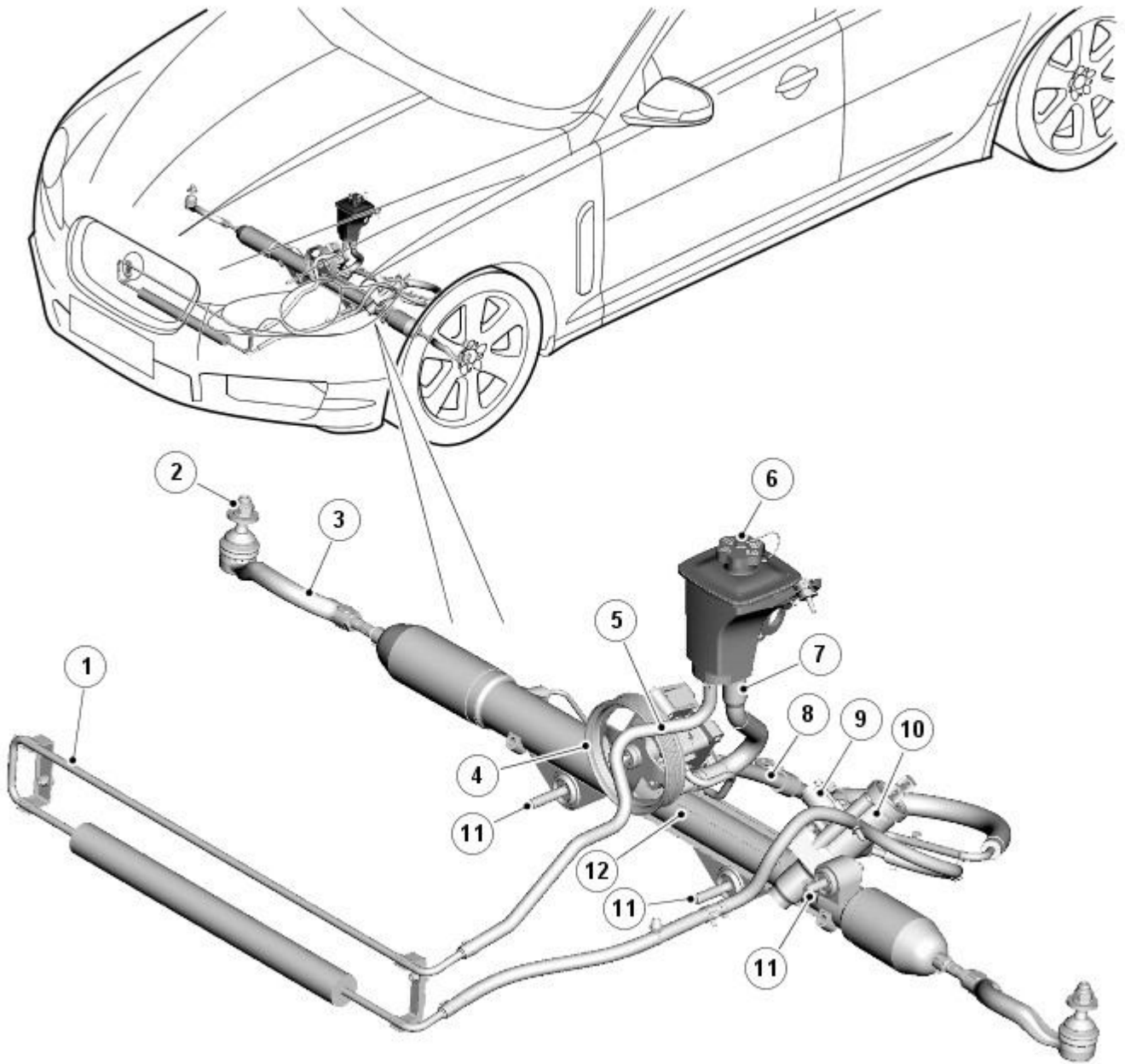


E93501

### ItemDescription

1	Tie-rod end (2 off)
2	Power steering pump
3	Power steering fluid reservoir
4	Feed pipe to pump
5	Low pressure fluid return hose
6	Servotronic transducer valve
7	High pressure feed pipe to steering gear
8	Valve unit
9	Tie-rod (2 off)
10	Mounting bolt (3 off)
11	Steering gear

POWER STEERING - COMPONENT LOCATION 3.0L V6

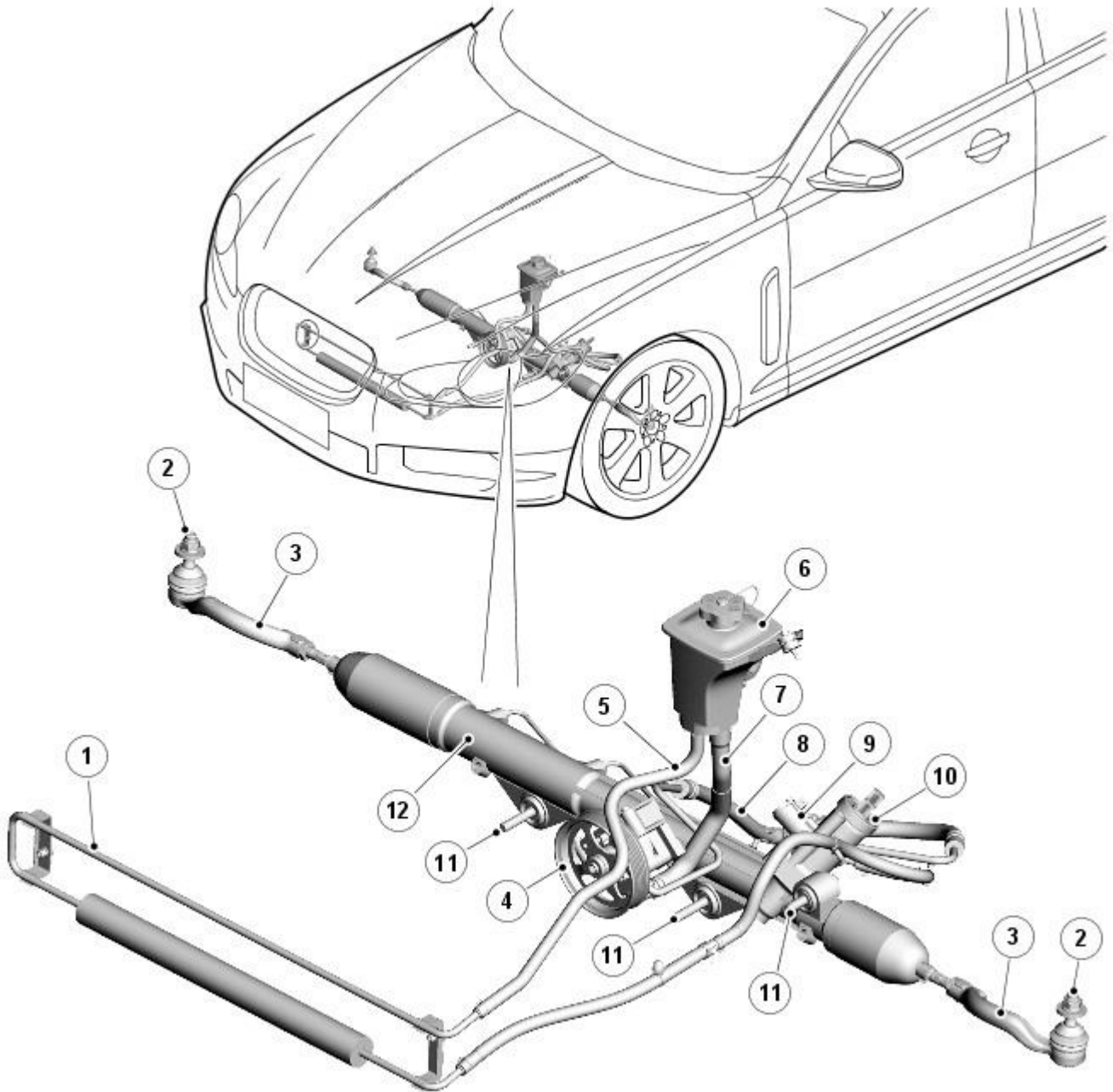


E93502

**ItemDescription**

1	Power steering fluid cooler
2	Tie-rod end (2 off)
3	Tie-rod (2 off)
4	Power steering pump
5	Low pressure fluid return hose
6	Power steering fluid reservoir
7	Feed pipe to pump
8	High pressure feed pipe to steering gear
9	Servotronic transducer valve
10	Valve unit
11	Mounting bolt (3 off)
12	Steering gear

POWER STEERING - COMPONENT LOCATION 4.2L V8



E93503

**ItemDescription**

NOTE: Naturally aspirated 4.2L V8 shown, Supercharged 4.2L V8 similar

1	Power steering fluid cooler
2	Tie-rod end (2 off)
3	Tie-rod (2 off)
4	Power steering pump
5	Low pressure fluid return hose
6	Power steering fluid reservoir
7	Feed pipe to pump
8	High pressure feed pipe to steering gear
9	Servotronic transducer valve
10	Valve unit
11	Mounting bolt (3 off)
12	Steering gear

# Power Steering - Power Steering - Overview

Description and Operation

## OVERVIEW

The steering system comprises a ZF manufactured rack and pinion Servotronic 2 steering gear, a power steering pump, a fluid reservoir, a fluid cooler (if fitted) and fluid hoses. The steering gear is an end take-off rack and pinion power assisted unit with the addition of road speed proportional ZF Servotronic 2 assistance.

The steering rack is connected to the front wheel knuckles by adjustable tie-rods. The tie-rods allow for adjustment to centralize the steering wheel and also adjust the toe setting of the front wheel geometry.

The steering gear has a variable ratio rack. This provides conventional response when the steering is in the centre, straight ahead position, but provides more direct and faster steering as the turning angle increases. The variable ratio provides precise and rapid steering response at high speeds and provides optimized steering of the vehicle when manoeuvring into parking spaces, turning in tight areas and when cornering in extreme conditions.

Fluid is supplied to the steering gear by a fixed displacement vane pump on petrol models and a variable displacement pump on diesel models. The pump is driven by a belt from the crankshaft pulley. The pump is mounted on the [LH \(left-hand\)](#) side of the engine, above the [A/C \(air conditioning\)](#) compressor. A fluid reservoir is positioned at the front [LH](#) side of the engine compartment, forward of the front suspension housing.

On petrol engine vehicles, a fluid cooler is located in front of the engine cooling radiator. Diesel models do not have a fluid cooler.

Servotronic 2 adds electronic control and speed sensitive steering to the steering gear. The Servotronic 2 feature provides easy and comfortable steering operation when parking, improved 'road feel' at increased road speeds and adds an integrated, positive center feel feature which optimises steering wheel torque during high speed driving. The Servotronic 2 system is controlled by software which is incorporated into the instrument cluster. The software responds to road speed signals and controls the power assistance via a transducer valve located on the steering gear valve housing.

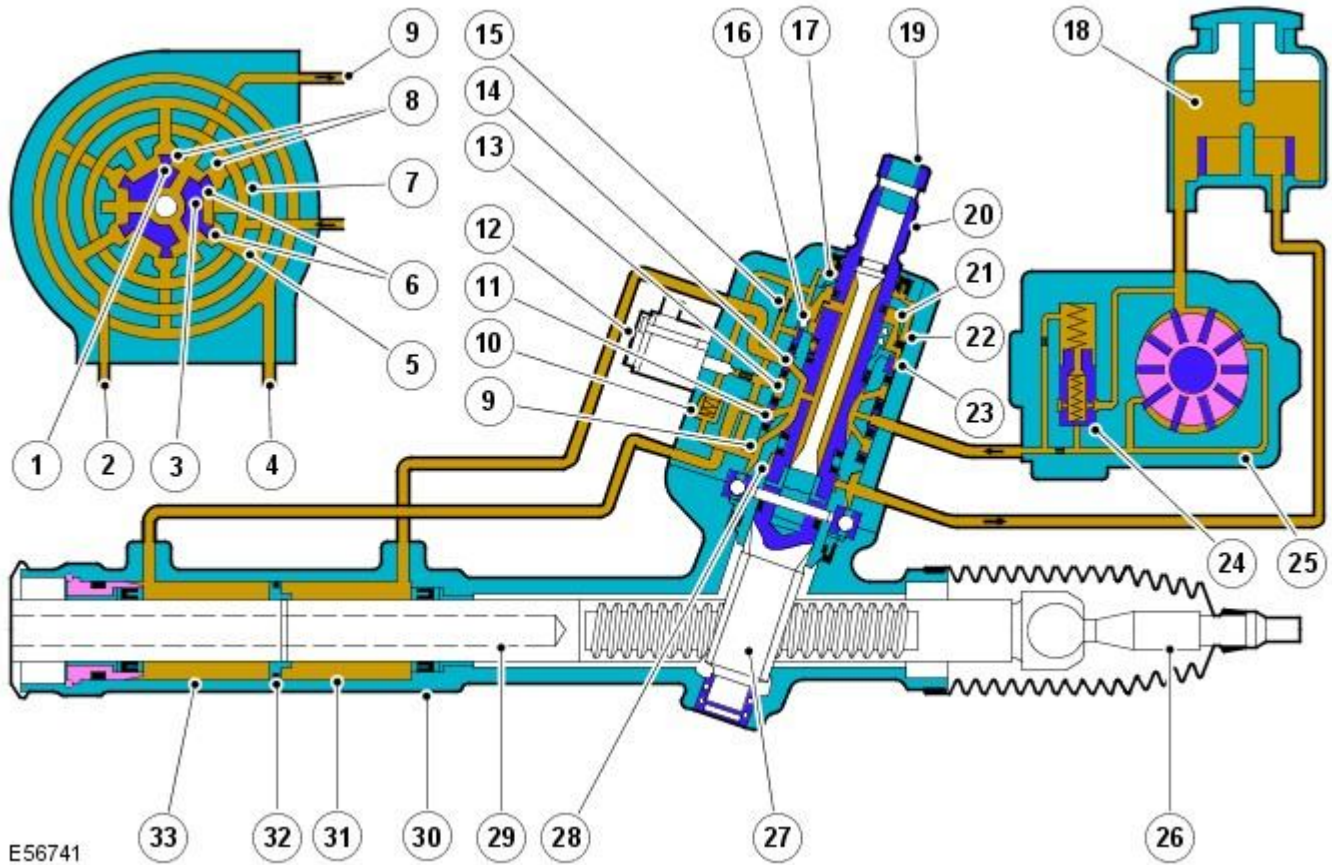
# Power Steering - Power Steering - System Operation and Component Description

Description and Operation

## System Operation

The following hydraulic circuits show power steering operation and fluid flow for the steering in a straight ahead, neutral position and when turning right. The circuit diagram for turning left is similar to that shown for turning right.

### Power Steering in Neutral Position



#### ItemDescription

1	Return fluid control groove
2	Radial groove
3	Feed fluid control groove
4	Radial groove
5	Axial groove
6	Feed fluid control edge
7	Feed fluid radial groove
8	Return fluid control edge
9	Return fluid chamber
10	Cut-off valve
11	Radial groove
12	Servotronic transducer valve
13	Feed fluid radial groove
14	Radial groove
15	Orifice
16	Balls
17	Compression spring
18	Torsion bar
19	Power steering fluid reservoir
20	Valve rotor
21	Reaction piston

22	Reaction chamber
23	Centering piece
24	Pressure relief/flow limiting valve
25	Power steering pump
26	Inner tie-rod
27	Pinion
28	Valve sleeve
29	Steering gear rack
30	Steering gear housing
31	Power assist cylinder - right
32	Piston
33	Power assist cylinder - left

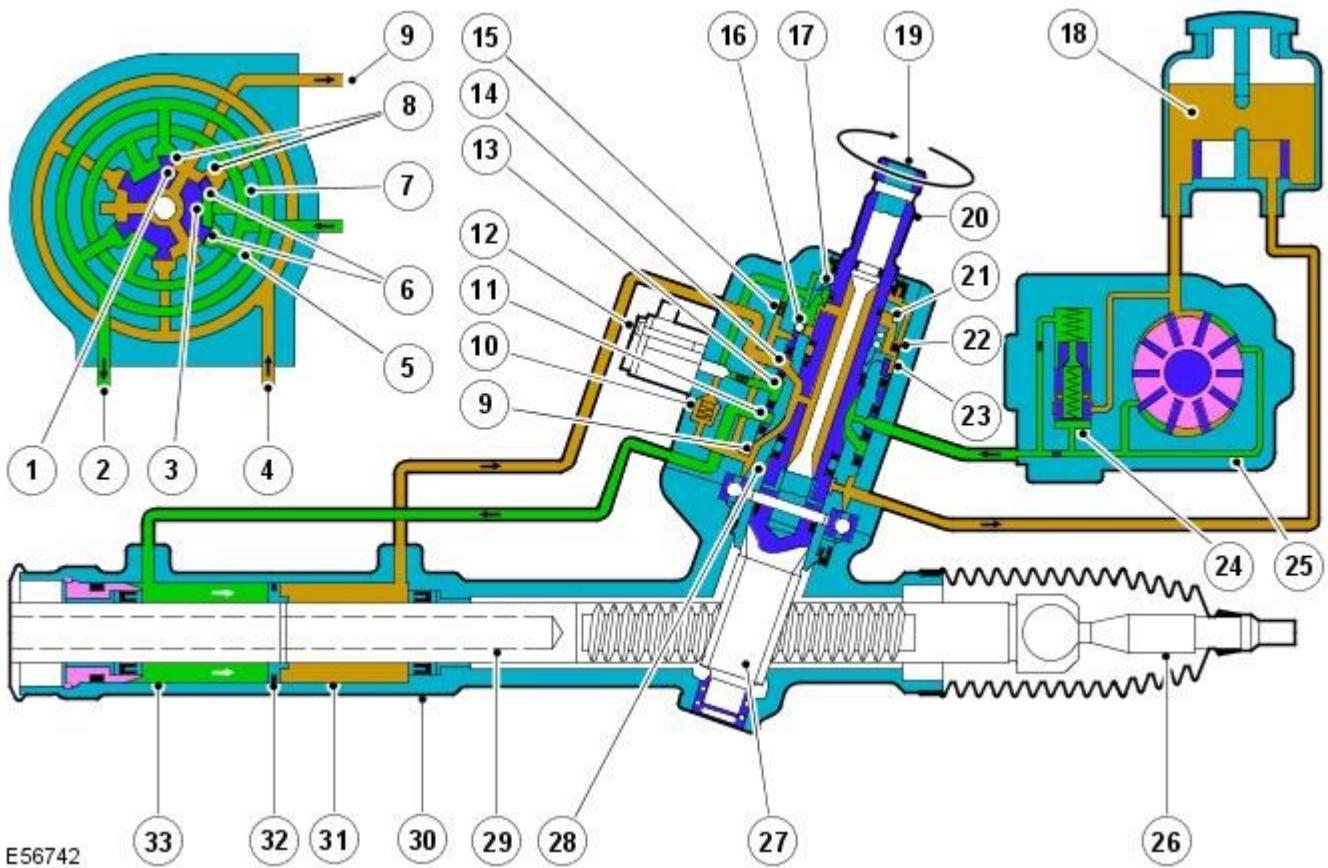
When the engine is started, the power steering pump draws fluid from the reservoir down the low pressure suction line. The fluid passes through the pump and is delivered at pressure, via a hose, to the steering rack valve unit.

The pressurized fluid flows through a connecting bore in the valve and, via the feed fluid radial groove and the transverse bores in the valve sleeve, passes to the feed fluid control groove of the valve rotor.

In the neutral (straight ahead) position, the fluid passes over the open feed fluid control edges to all valve sleeve axial grooves. The fluid then passes through return fluid control edges and the return fluid grooves of the valve rotor, back to the reservoir passes via the fluid cooler.

Simultaneously, the radial grooves of the valve and their associated pipes provide a connection the left and right power assist cylinders.

### Power Steering in Right Turn Position



Item	Description
1	Return fluid control groove
2	Radial groove
3	Feed fluid control groove
4	Radial groove
5	Axial groove
6	Feed fluid control edge
7	Feed fluid radial groove
8	Return fluid control edge
9	Return fluid chamber



10	Cut-off valve
11	Radial groove
12	Servotronic transducer valve
13	Feed fluid radial groove
14	Radial groove
15	Orifice
16	Balls
17	Compression spring
18	Torsion bar
19	Power steering fluid reservoir
20	Valve rotor
21	Reaction piston
22	Reaction chamber
23	Centering piece
24	Pressure relief/flow limiting valve
25	Power steering pump
26	Inner tie-rod
27	Pinion
28	Valve sleeve
29	Steering gear rack
30	Steering gear housing
31	Power assist cylinder - right
32	Piston
33	Power assist cylinder - left

When the steering wheel is turned to the right, the steering rack and piston moves to the left in the piston bore. The valve rotor is rotated to the right (clockwise) and pressurized fluid is directed over the further opened feed fluid control edges and to the associated axial grooves, the radial groove and via an external pipe to the left power assist cylinder chamber. The pressure applied to the piston from the left power assist cylinder chamber provides the hydraulic assistance.

An adaptable pressure build-up is achieved by the partially or fully closed feed fluid control edges restricting or preventing a connection between the fluid pressure inlet and the other axial grooves connected to the radial groove.

Simultaneously, the fluid pressure outlet to the pressurized axial grooves are restricted or partially restricted by the closing return fluid control edges. The fluid displaced by the piston from the right power assist cylinder chamber, flows through an external pipe to the radial grooves. From there the fluid passes to the associated axial grooves and on to the return fluid control grooves, via the further opened return fluid control edges.

The return flow of fluid to the reservoir passes via interconnecting bores which lead to the return fluid chamber. When the steering wheel is turned to the left the operating sequence is as above but the pressure is applied to the opposite side of the piston.

## Servotronic Operation

The Servotronic software contains a number of steering maps which are selected via the car configuration file depending on the vehicle mode and tire fitment.

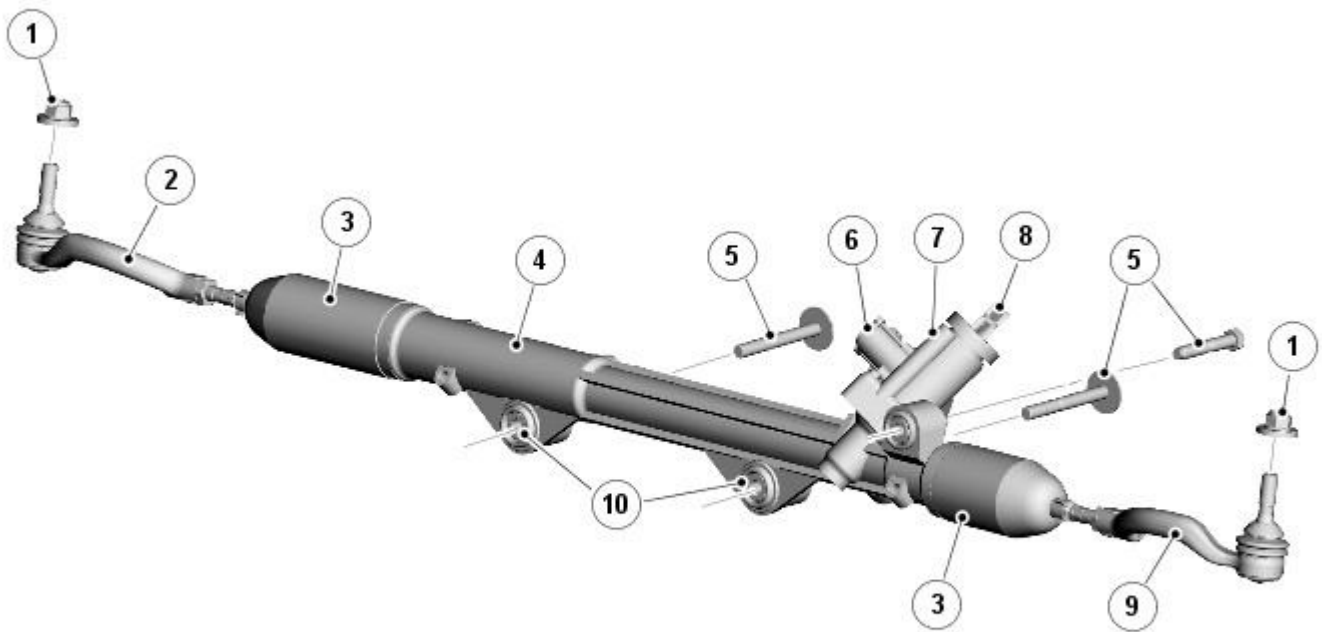
If a failure of the Servotronic valve or software occurs, the system will suspend Servotronic assistance and only normal power steering wheel be available. Fault codes relating to the fault are stored, but no warning lamps are illuminated and the driver may be aware of the steering being 'heavier' than usual.

When the vehicle is manoeuvred into and out of a parking space (or other similar manoeuvre), the Servotronic software uses road speed data from the ABS module to determine the vehicle speed, which in this case will be slow or stationary. The Servotronic software analyses the signals and outputs an appropriate control current to the Servotronic transducer valve. The Servotronic valve closes and prevents fluid flowing from the feed fluid radial groove to the reaction chamber. An orifice also ensures that there is return pressure in the reaction chamber. This condition eliminates any 'reaction' ensuring that the steering is very light to operate, reducing the effort required to turn the steering wheel.

As the vehicle is driven and the road speed increases, the Servotronic software analyses the road speed signals from the [ABS \(anti-lock brake system\)](#) module and reduces the amount of control current supplied to the Servotronic valve which increases the reaction pressure. This modifies the input torque applied through the steering wheel and provides the driver with an improved 'road feel' allowing precise steering and directional stability.

## Component Description

### Steering Gear



E97211

**ItemDescription**

1	Locknut ( 2 off)
2	RH (right-hand) tie-rod
3	Steering gear boot (2 off)
4	Steering gear
5	Bolt and washer (3 off)
6	Servotronic valve
7	Valve unit
8	Input shaft
9	LH (left-hand) tie-rod
10	Steering gear mounting bushes

The steering gear is located at the rear of the engine and attached to the front sub-frame. The gear is secured to the sub-frame with 3 bolts and washers which screw into threaded tubes in bushes which are integral with the sub-frame.

The steering gear comprises an aluminum, cast, valve housing which contains the hydraulic valve unit and Servotronic valve. The mechanical steering rack and the hydraulic actuator are located in a steel cylinder which is attached to the cast valve housing.

The steering gear uses a rack with an integrated piston which is guided on plain bearings within the cylinder and the valve housing. The pinion, which is attached to the valve unit, runs in bearings and meshes with the rack teeth. The rack is pressed against the pinion by a spring loaded yoke which ensures that the teeth mesh with the minimum of play. The pinion is connected to the valve unit via a torsion bar. The rotary motion of the steering wheel is converted into linear movement of the rack by the rack and pinion mechanism and is initiated by the valve unit. This movement is transferred into movement of the road wheels by adjustable tie-rods.

The rack teeth angles vary from 20 degrees in the centre position to 40 degrees at the end sections of the rack. It is this variation in teeth angles which provides the variable ratio.

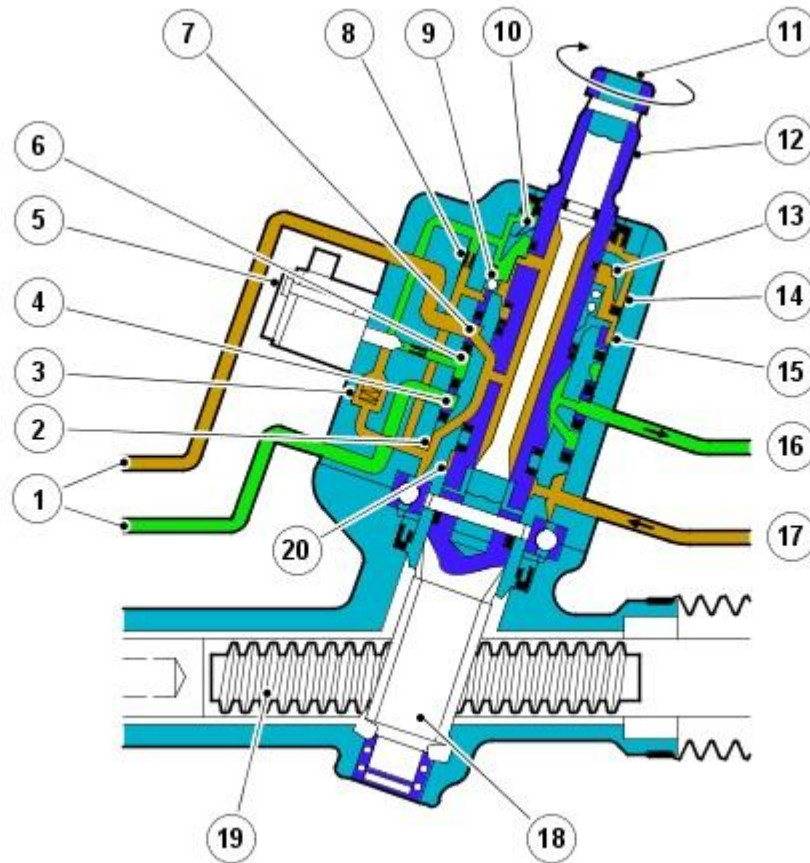
The piston of the hydraulic actuator is located on the rack bar. Each side of the piston is connected to fluid pressure or fluid return via external metal pipes which are connected to the valve unit.

Each end of the rack bar has a threaded hole which provides for the fitment of the tie-rod. The external ends of the gear are sealed with boots which prevent the ingress of dirt and moisture. The tie-rod has a long threaded area which allows for the fitment of the tie-rod end. The thread allows for the adjustment of the steering toe. When the correct toe setting is achieved, a locknut is tightened against the tie-rod end preventing inadvertent movement.

The gear has a central hole machined along most of its length. The hole allows the air in the boots to be balanced when the steering is turned. The boots are serviceable items and are retained on the gear housing and the tie-rod with clips.

**Valve Unit**





E56740

**ItemDescription**

1	Pressure/return to/from steering gear
2	Return fluid chamber
3	Cut-off valve
4	Radial groove
5	Servotronic transducer valve
6	Fluid feed radial groove
7	Radial groove
8	Orifice
9	Balls
10	Compression spring
11	Torsion bar
12	Valve rotor
13	Reaction piston
14	Reaction chamber
15	Centering piece
16	Return to reservoir
17	Pressure supply from pump
18	Pinion
19	Steering gear rack bar
20	Valve sleeve

The valve unit is an integral part of the steering gear. The principle function of the valve unit is to provide power assistance (i.e. when parking) to optimize the effort required to turn the steering wheel.

The pinion housing of the valve is an integral part of the main steering gear casting. The pinion housing has four machined ports which provide connections for pressure feed from the power steering pump, return fluid to the reservoir and pressure feeds to each side of the cylinder piston.

The valve unit comprises an outer sleeve, an input shaft, a torsion bar and a pinion shaft. The valve unit is co-axial with the pinion shaft which is connected to the steering column via the input shaft. The valve unit components are located in the steering gear pinion housing which is sealed with a cap.

The outer sleeve is located in the main bore of the pinion housing. Three annular grooves are machined on its outer diameter. PTFE (polytetrafluoroethylene) rings are located between the grooves and seal against the bore of the pinion housing. Holes are drilled radially in each annular groove through the wall of the sleeve. The bore of the outer sleeve is machined to accept the input shaft. Six equally spaced slots are machined in the bore of the sleeve. The ends of the slots are closed and do not continue to the end of the outer sleeve. The radial holes in the outer sleeve are drilled into each slot.

The input shaft has two machined flats at its outer end which allow for the attachment of the steering column intermediate shaft yoke. The flats ensure that the intermediate shaft is fitted in the correct position. The inner end of the input shaft forms a dog-tooth which mates with a slot in the pinion shaft. The fit of the dog-tooth in the slot allows a small amount of relative rotation between the input shaft and the pinion shaft before the dog-tooth contacts the wall of the slot. This ensures that, if the power assistance fails, the steering can be operated manually without over stressing the torsion bar. The central portion of the input shaft has equally spaced longitudinal slots machined in its circumference. The slots are arranged alternately around the input shaft.

The torsion bar is fitted inside the input shaft and is an interference fit in the pinion shaft. The torsion bar is connected to the input shaft by a drive pin. The torsion bar is machined to a smaller diameter in its central section. The smaller diameter allows the torsion bar to twist in response to torque applied from the steering wheel in relation to the grip of the tyres on the road surface.

The pinion shaft has machined teeth on its central diameter which mate with teeth on the steering gear rack. A slot, machined in the upper end of the pinion shaft mates with the dog-tooth on the input shaft. The pinion shaft locates in the pinion housing and rotates on ball and roller bearings.

## Servotronic Valve

The Servotronic transducer valve is located in a port in the side of the steering gear valve housing. The valve is sealed in the housing with an O-ring seal and is secured with two long screws into threaded holes in the housing. The Servotronic valve is a transducer controlled valve which responds to control signals supplied from Servotronic software in the instrument cluster.

The Servotronic valve determines the hydraulic reaction at the steering gear rotary valve and controls the input torque required to turn the steering wheel. The Servotronic system allows the steering to be turned with the optimum effort when the vehicle is stationary or manoeuvred at slow speed. The hydraulic reaction changes proportional to the vehicle speed, with the required steering effort increasing as the vehicle moves faster. At high speeds, the Servotronic system provides the driver with a good feedback through the steering providing precise steering and improved stability.

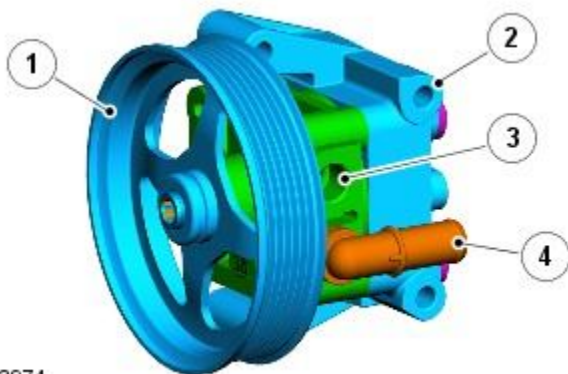
The instrument cluster receives road speed signals from the [ABS](#) module and calculates the correct controlling signal for the Servotronic valve. The Servotronic software within the instrument cluster has a diagnostic capability which allows a Jaguar approved diagnostic system to check the tune of the steering and retrieve fault codes relating to the Servotronic valve. Two fault codes are stored relating to the valve for positive connection short to ground or battery and negative connection short to ground or battery.

The Servotronic software within the instrument cluster also contains a number of steering maps which are selected via the car configuration file depending on the vehicle model and tire fitment.

If a failure of the Servotronic valve or software occurs, the system will suspend Servotronic assistance and only a default level of assistance will be available. Fault codes relating to the fault are stored in the instrument cluster. No warning lamps are illuminated and the driver may be aware of the steering being 'heavier' than usual.

## Power Steering Pump - V6 and V8 Petrol Models

- NOTE: V8 pump shown



E83974

The power steering pumps used on the different petrol engine variants are basically the same pump with different flow control valve mechanisms. The pump is a positive displacement, vane type pump which supplies a constant fluid flow to the steering gear valve unit. The pump is driven by a Poly Vee belt from the crankshaft pulley. A self-adjusting tensioner is fitted to maintain the correct tension on the belt.

The pump has an internal pressure relief valve and a flow control valve. The pressure relief valve limits the maximum pressure supplied to the steering gear to 110 bar (1595 lbf in<sup>2</sup>)  $\pm$  4 bar (58 lbf in<sup>2</sup>). The flow control valve limits the maximum flow to 7.5 l/min (1.64 gal/min)  $\pm$  0.75 l/min (0.16 gal/min) regardless of engine speed. The pump has a displacement of 10.5 cm<sup>3</sup>/rev (0.64 in<sup>3</sup>/rev).

A shaft runs longitudinally through the pump. One end of the shaft is fitted with a pressed-on drive pulley, the opposite end of the shaft is closed by a cover. The shaft runs in bearings located in the body and oil seals at each end of the shaft prevent leakage of hydraulic fluid. The pump contains ten vanes which rotate within a cam ring and are driven by the shaft. As the vanes rotate, the cam ring causes the space between the vanes to increase. This causes a depression between the vanes and fluid is drawn from the reservoir via the suction hose into the space between the vanes.

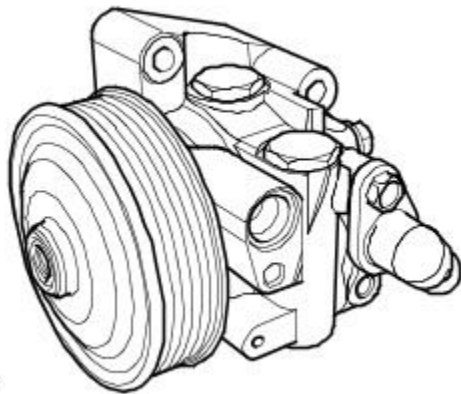
As the shaft rotates, the inlet port is closed to the vanes which have drawn in fluid, trapping the fluid between the vanes. The cam ring causes the space between the vanes to reduce and consequentially compresses and pressurises the hydraulic fluid trapped between them.

Further rotation of the shaft moves the vanes to the outlet port. As the vanes pass the port plate the pressurized fluid passes from the pump outlet port into the pressure hose to the steering gear.

The pressurized fluid is subject to control by the flow control and pressure relief valve. The flow control valve maintains a constant flow of fluid supplied to the steering gear irrespective of engine speed variations. The pressure relief valve limits the maximum pressure on the output side of the pump. A metering orifice is included in the discharge port of the pump. If the pressure in the orifice reaches a predetermined level, a spring loaded ball in the centre of the flow control valve is lifted from its seat and allows pressurized fluid to recirculate within the pump.

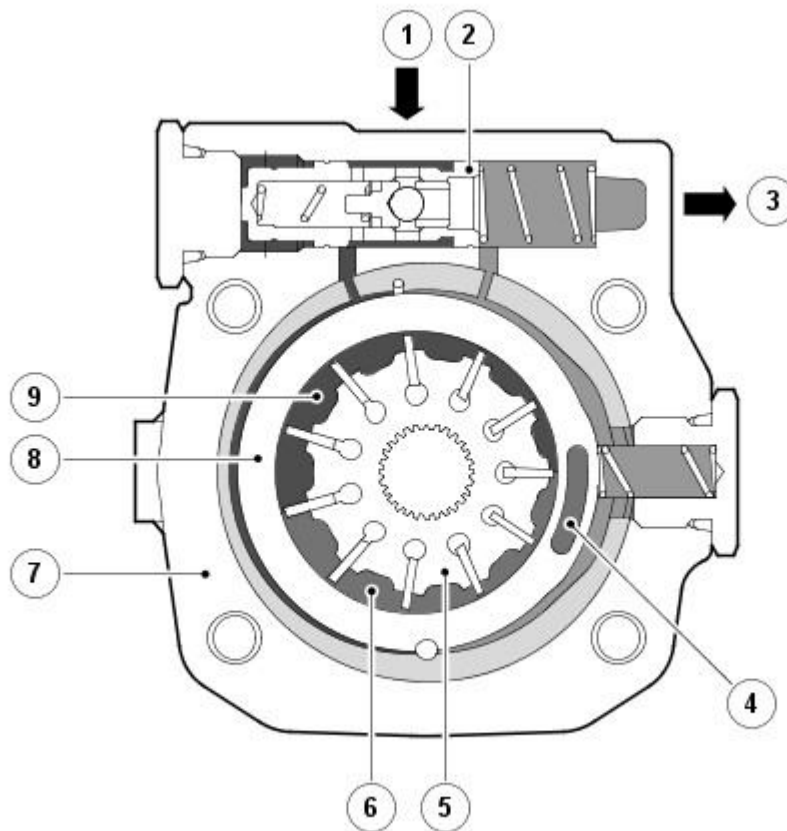
The pressure relief valve will operate if the discharge from the pump is restricted, i.e.; steering held on full lock. If the output from the pump is blocked, all output is recirculated through the pump. In this condition, as no fresh fluid is drawn into the pump from the reservoir, the fluid temperature inside the pump will increase rapidly. Consequentially, periods of operation of the steering gear on full lock should be kept to a minimum to prevent overheating of the pump and the fluid within it.

### Power Steering Pump - 2.7L V6 Diesel Models



E62199

A variable displacement power steering pump is used on the diesel engine variants. The variable displacement, vane type pump supplies the required hydraulic pressure to the steering gear valve unit. The pump is located at the front of the engine and is driven by the **FEAD (front end accessory drive)** Poly Vee belt which is directly driven from the crankshaft. The output from the pump increases proportionally with the load applied to the steering valve unit.



E62615

**ItemDescription**

1	Power steering fluid inlet port
2	Flow control valve
3	Power steering fluid outlet port
4	Variable Orifice

5	Pump rotor
6	High pressure
7	Adapter ring
8	Cam Ring
9	Low pressure

The pump consists of a shaft containing a number of slots into which vanes are inserted and these vanes run within a cam ring in the pump body. The centerline of the shaft is not concentric with that of the bore of the body and this creates the expanding and contracting cavities that form the pumping action.

The vanes rotate within the cam ring and are driven by the shaft. As the vanes rotate, the cam ring causes the space between the vanes to increase. This causes a depression between the vanes and fluid is drawn from the reservoir via the suction hose into the space between the vanes. As the shaft rotates, the inlet port is closed to the vanes which have drawn in fluid, trapping the fluid between the vanes. The cam ring causes the space between the vanes to reduce and consequently compresses and pressurizes the hydraulic fluid trapped between them. Further rotation of the shaft moves the vanes to the outlet port. As the vanes pass the port plate the pressurized fluid passes from the pump outlet port into the pressure hose to the steering gear.

The cam ring in the pump body can move within the valve body. By moving the cam ring it is possible to vary the eccentricity of the shaft and the vanes in relation to the cam ring. As the eccentricity is decreased, the volume of hydraulic fluid trapped between the vanes decreases, maintaining the flow in response to pump speed. This reduces the load required to turn the pump and therefore improves engine output and economy. This allows the flow rate to be matched to the system demands and increased flow rate is only required when the steering wheel is turned.

The pump has an internal regulating valve which controls the eccentricity of the cam ring and therefore varies the flow rate according to demand. The regulating relief valve limits the maximum pressure supplied to the steering gear to 110 bar (1595 lbf in<sup>2</sup>) ± 4 bar (58 lbf in<sup>2</sup>) and also limits the maximum flow to 8.5 l/min (1.86 gal/min) ± 0.5 l/min (0.1 gal/min) regardless of engine speed.

## Fluid Reservoir



E97212

### ItemDescription

1	Bolt and washer (2 off)
2	Rubber mounting (2 off)
3	Cap
4	Reservoir body
5	Return connection
6	Suction hose connection
7	Max/Min level
8	Lanyard

The reservoir is located in the engine compartment, on the [LH](#) suspension housing. The reservoir is attached to a bracket via 2 rubber mounts, and the bracket is attached to the suspension housing.

The reservoir is a plastic moulding with an integral 80 micron, non-serviceable filter. Two moulded ports at the base of the reservoir provide for attachment of the fluid supply hose to the power steering pump and fluid return hose from the fluid cooler. The reservoir is fitted with a removable cap which is screwed 1/4 turn to lock into the reservoir body.

The reservoir has upper and minimum marks moulded on its outside of the body.

### Fluid Cooler

A



B



E97213

#### ItemDescription

A	V8 naturally aspirated and 3.0 V6
B	V8 supercharged
1	Fluid cooler
2	Hose - return to fluid reservoir
3	Hose - Return from steering gear valve unit

The fluid cooler is located in the return circuit from the steering gear to the reservoir. The cooler is an aluminum fin and tube design. Cool air entering the front of the vehicle passes over the cooler and flows through the fins. The fins act as heat exchangers, conducting heat from the fluid as it passes through the tube.

## **Power Steering - Power Steering**

Diagnosis and Testing

For additional information.

REFER to: [Specifications](#) (211-00 Steering System - General Information, Specifications).

# Power Steering - Steering Gear

Removal and Installation

## Removal

• CAUTIONS:



Make sure that only the manufacturers' recommended four wheel alignment equipment is used.



Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

• NOTE: Make sure the steering is in the straight ahead position.



**1. WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

**2.** Center the steering wheel.

- Lock in position and remove the ignition key.

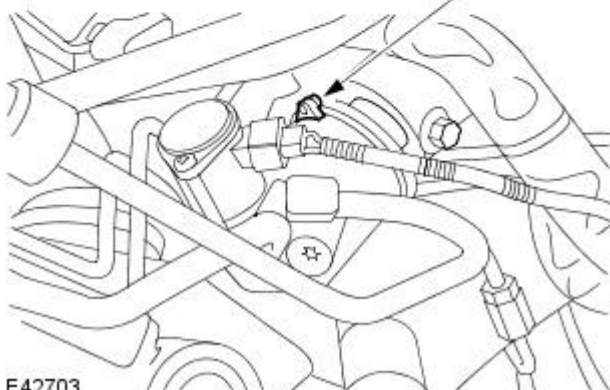
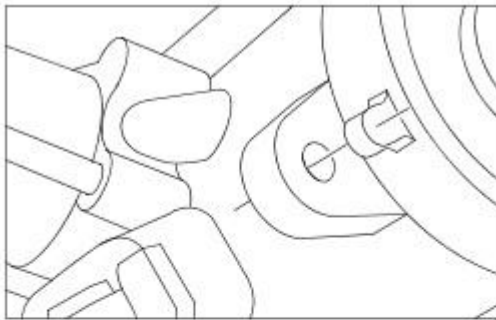
**3.** Remove the front wheels and tires.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

**4.** Remove the air deflector.

For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

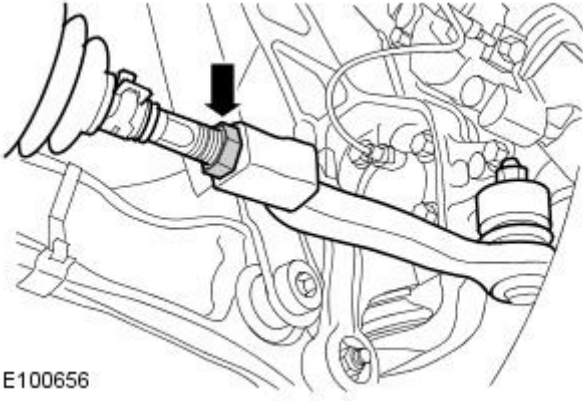
**5.** Make sure the alignment mark, on the steering gear pinion seal protection cover, is central to the steering gear pinion casting.



E42703



6. Release both track rods from tie rod ends, note the number of turns for installation.



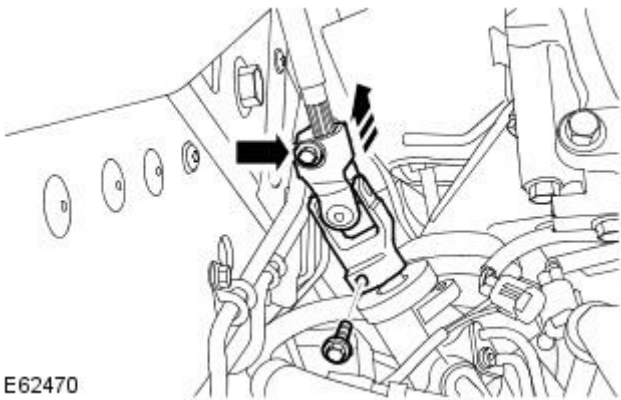
7. Disconnect the power steering control valve actuator electrical connector.



8.  CAUTION: Air tools MUST NOT be used on steering column bolts.


Disconnect the lower steering column from the steering gear.

- Remove and discard the bolt.




9. Release the power steering line support bracket.

10. CAUTIONS:

 Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean and dry. Plug open connections to prevent contamination.

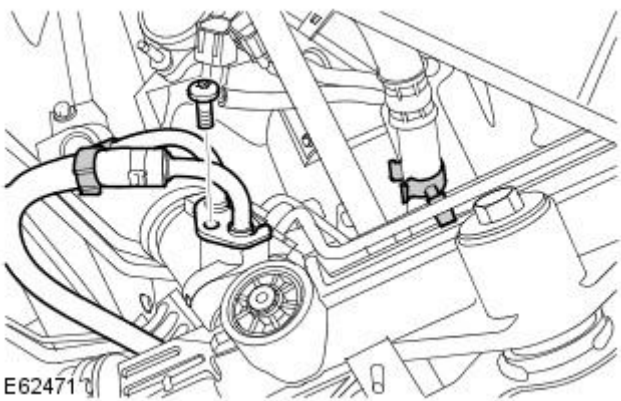
 Cap the power steering line to prevent losses of fluid and dirt ingress.

 If power steering fluid is spilt on the paintwork, the effected area must be immediately washed down with cold water. Failure to follow this instruction may result in damage to the vehicle.

- NOTE: Some fluid spillage is inevitable during this operation.

Disconnect the power steering feed and return fluid lines from the steering gear.

- Remove the bolt.

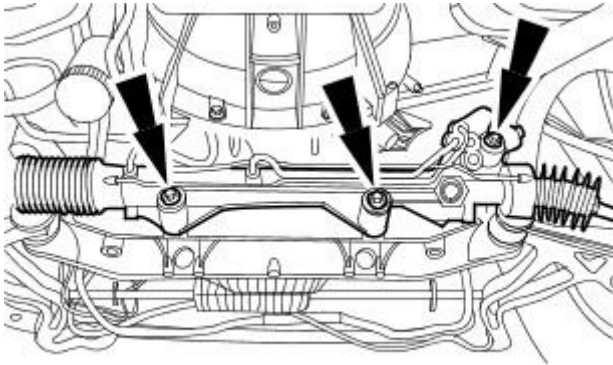





- Position a container to collect spillage.
- Remove and discard both O-ring seals.

11. Remove the steering gear.

- Remove the 3 bolts.



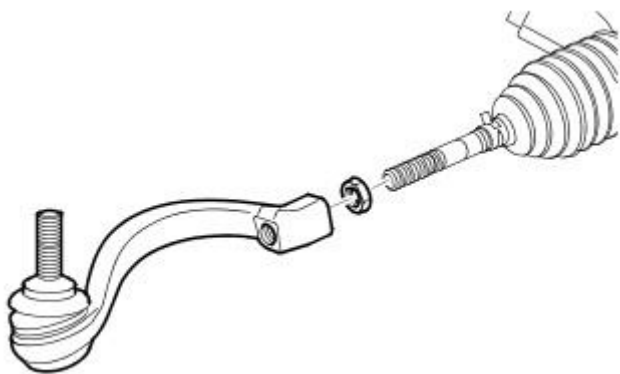
VUJ0002963

12.  CAUTION: Do not allow the gaiter to twist.

- NOTE: Do not disassemble further if the component is removed for access only.

Remove the outer tie-rod end, note the number of turns for installation.

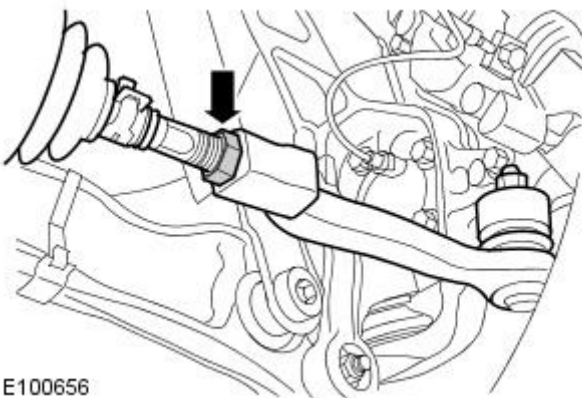
- Loosen the tie-rod end lock nut.
- Repeat the above procedure for the other side.



E62473

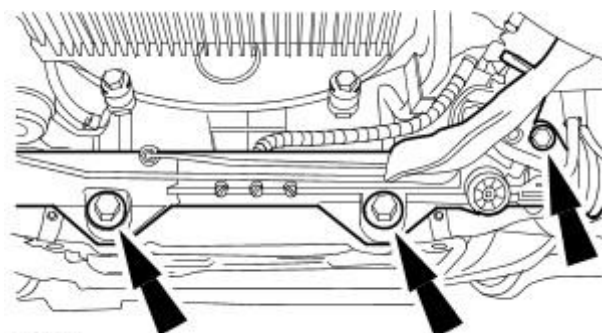
### Installation

1. To install, reverse the removal procedure.
2. Install the tie rod end, note the number of turns until adjacent to the locknut.
  - Repeat the above procedure for the other side.

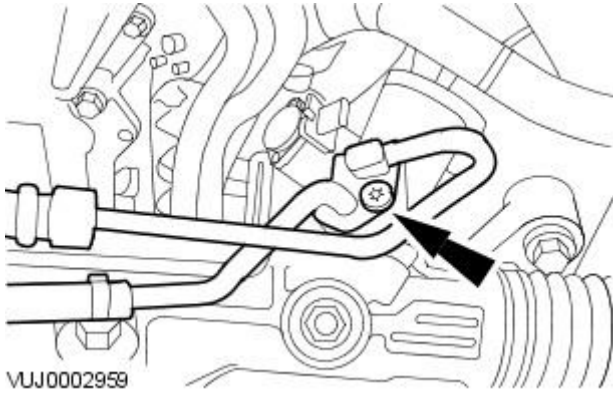


E100656

3. Tighten the bolts to 100 Nm.



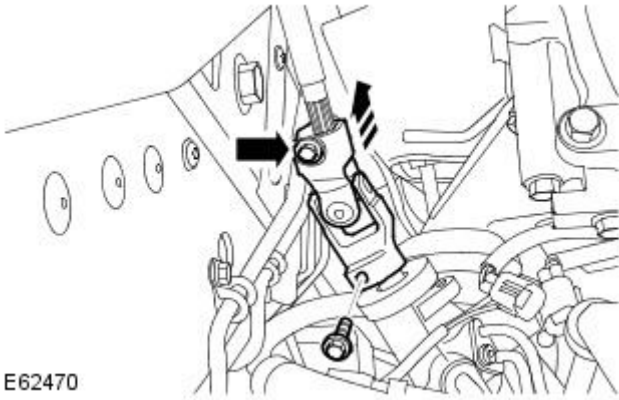
E31036



4. NOTE: Make sure that all the component mating faces are clean.

Tighten to 24 Nm.

- Install the new O-ring seals.



5. Tighten to 35 Nm.

- Install a new retaining bolt.

6. Fill and bleed the power steering system.

For additional information, refer to: [Power Steering System Bleeding](#) (211-00 Steering System - General Information, General Procedures).

7. Using only four-wheel alignment equipment approved by Jaguar, check and adjust the wheel alignment.

For additional information, refer to: [Four-Wheel Alignment](#) (204-00 Suspension System - General Information, General Procedures).


# Power Steering - Power Steering Fluid Cooler3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. For additional information, refer to: [Power Steering System Bleeding](#) (211-00 Steering System - General Information, General Procedures).
2. For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

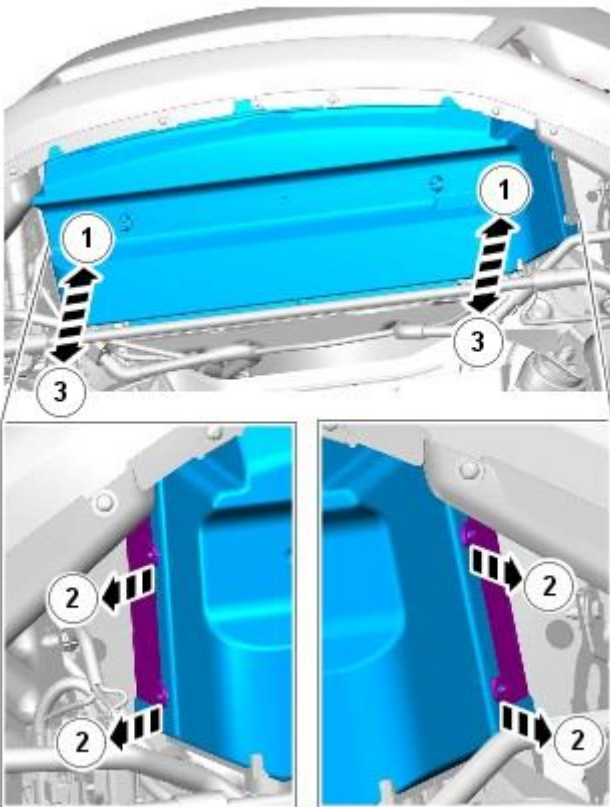
3.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

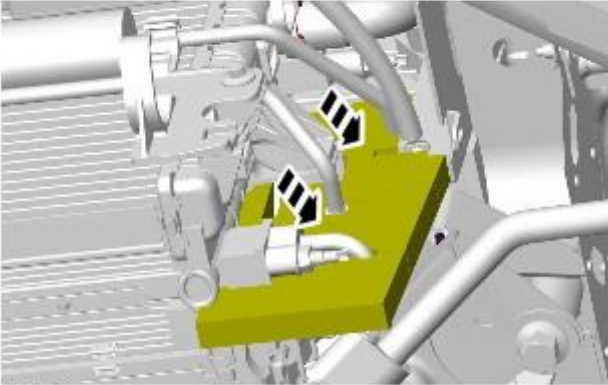
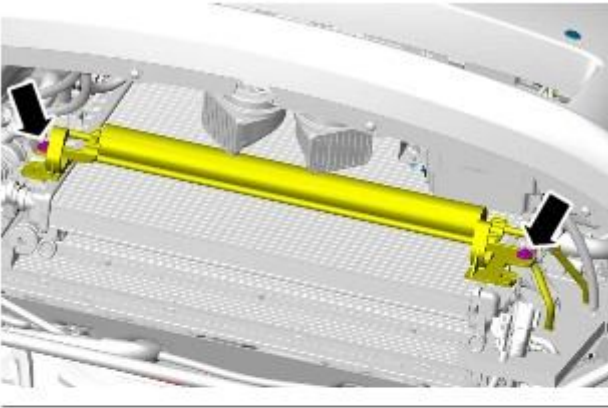
4.



5.

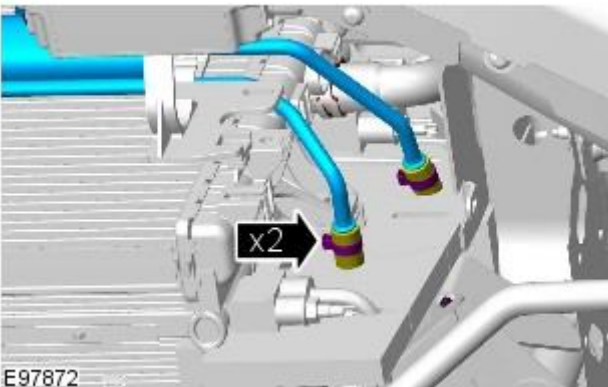


6. TORQUE: 10 Nm



E97871

7.



E97872

## Installation

1. To install, reverse the removal procedure.

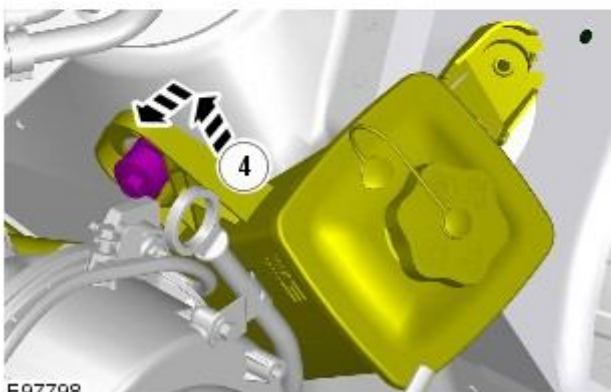
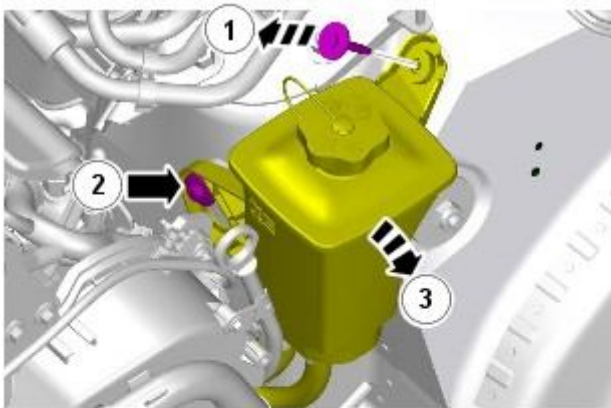
## Power Steering - Power Steering Fluid Reservoir

Removal and Installation

### Removal

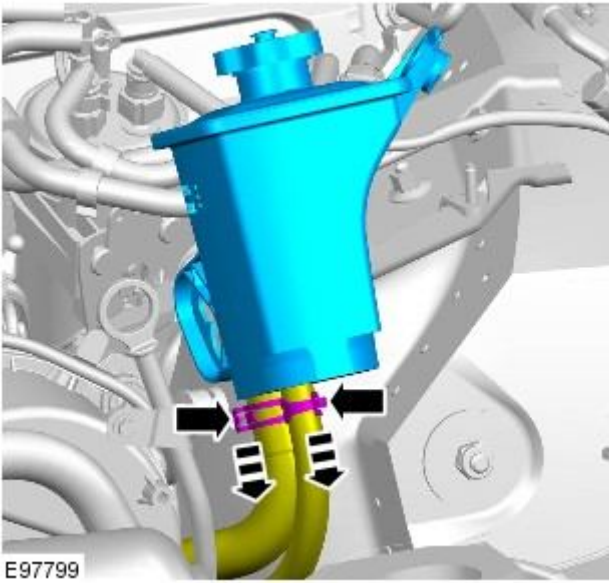
• NOTE: Removal steps in this procedure may contain installation details.

1. For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. For additional information, refer to: [Air Cleaner \(303-12 Intake Air Distribution and Filtering - 2.7L Diesel, Removal and Installation\)](#).
3. For additional information, refer to: [Power Steering System Bleeding](#) (211-00 Steering System - General Information, General Procedures).
4. Torque: 8 Nm



E97798

5.



### Installation


1. To install, reverse the removal procedure.



# Power Steering - Power Steering PumpTDV6 2.7L Diesel

Removal and Installation

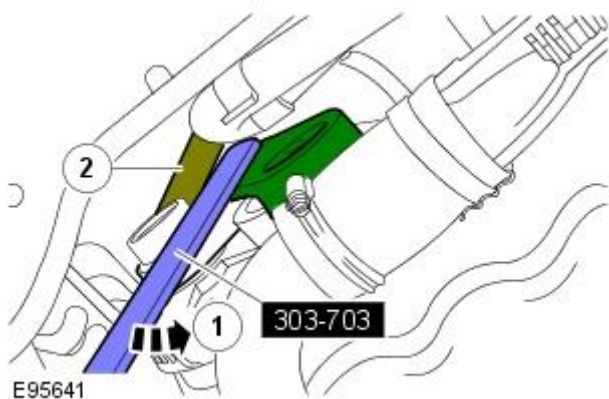
## Special Tool(s)

 <p>303-703 E95037</p>	<p>303-703 Wrench, Accessory Belt Tensioner</p>
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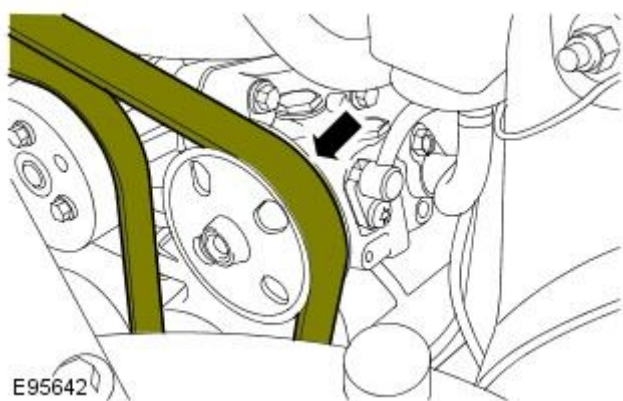
## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Battery Disconnect and Connect (414-01, General Procedures).
2. Raise and support the vehicle.
3. Refer to: Engine Cover - 2.7L Diesel (501-05, Removal and Installation).
4. Refer to: Air Cleaner (303-12, Removal and Installation).
5. Refer to: Air Deflector (501-02, Removal and Installation).



6.
  - Using the special tool , rotate the accessory drive belt tensioner counter-clockwise.
  - *Special Tool(s):* [303-703](#)
  - Detach the accessory drive belt.




- 7.



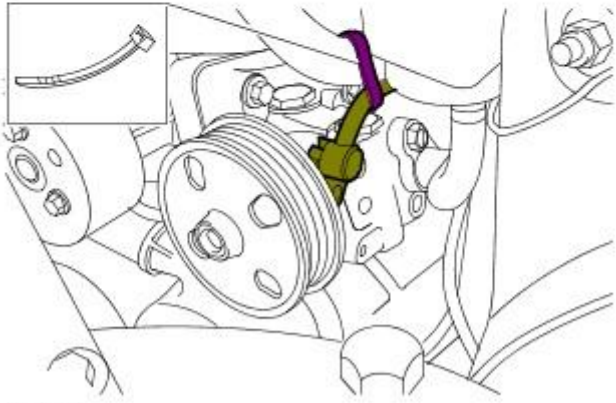
8. **8. CAUTIONS:**

 Ensure any open connections are plugged to prevent contamination.

 If power steering fluid comes into contact with the paintwork, the affected area must be immediately washed down with cold water.

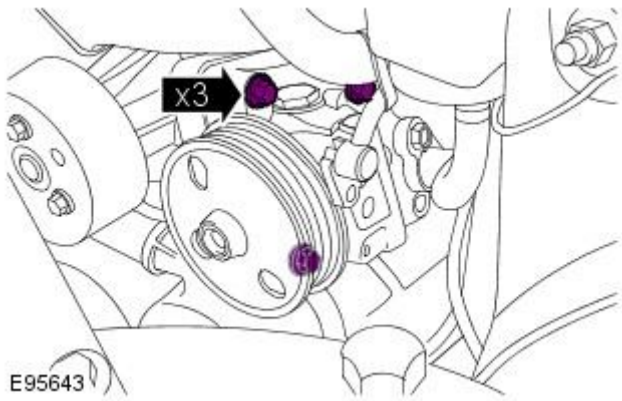
• NOTE: Remove and discard the O-ring seal.

Torque: 22 Nm



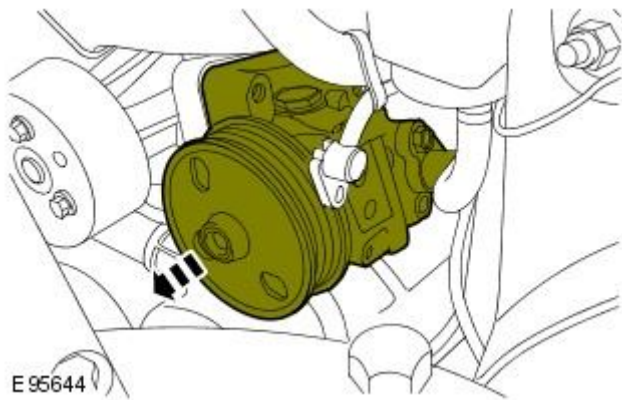
E94946

9. Torque: 25 Nm



E95643

10.



E 95644



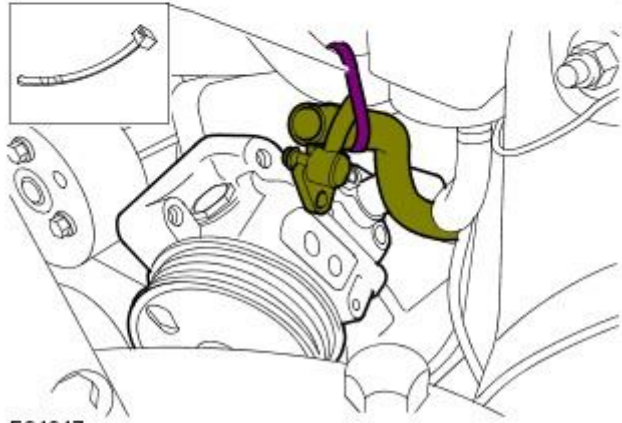
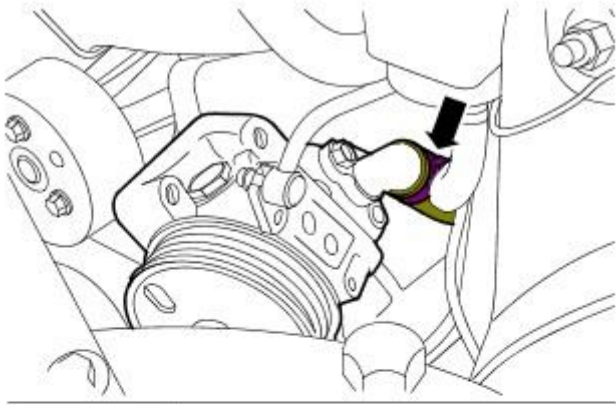
11. 11. CAUTIONS:



Ensure any open connections are plugged to prevent contamination.




If power steering fluid comes into contact with the paintwork, the affected area must be immediately washed down with cold water.



E94947


## Installation

1.  CAUTION: A new O-ring seal is to be installed.
  - NOTE: Lubricate the O-ring seal.To install, reverse the removal procedure.
2. Refer to: Power Steering System Bleeding (211-00, General Procedures).

# Power Steering - Power Steering Pump V6 3.0L Petrol

Removal and Installation

## Special Tool(s)

 <p>303-703 E95037</p>	<p>303-703 Wrench, Accessory Belt Tensioner</p>
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## Removal

• NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Air Cleaner](#) (303-12B Intake Air Distribution and Filtering - V6 3.0L Petrol, Removal and Installation).

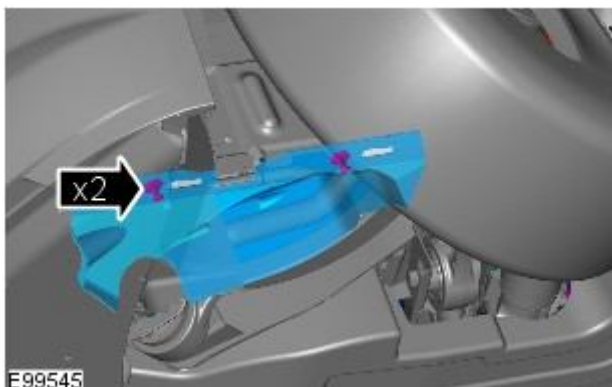


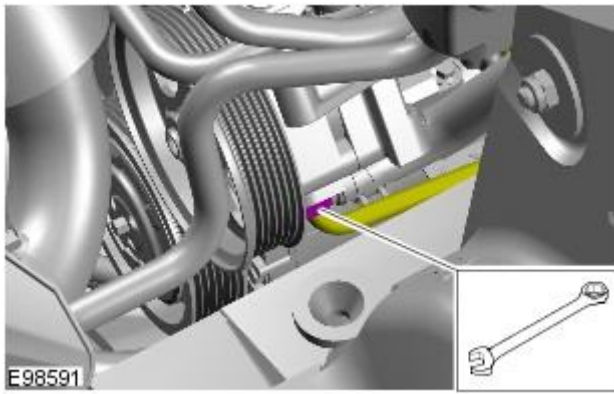
3. *Special Tool(s):* [303-703](#)

4.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

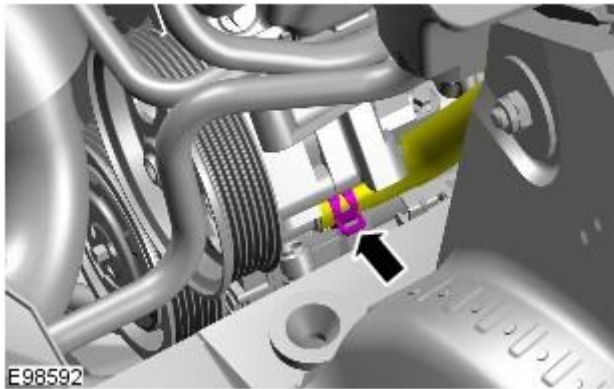
Raise and support the vehicle.

- 5.





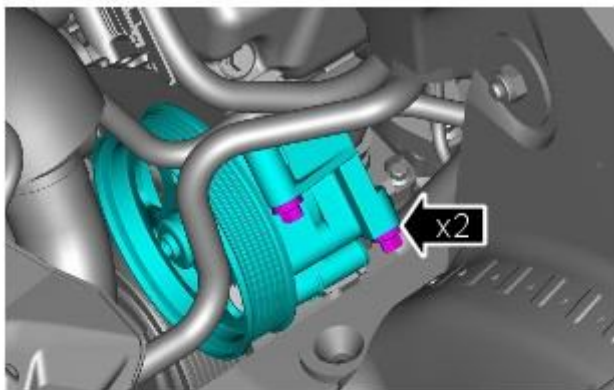
6.  CAUTION: Always plug any open connections to prevent contamination.



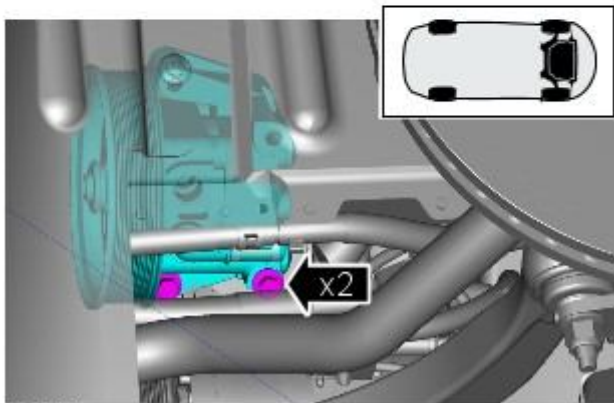
7.  WARNING: Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.

 CAUTION: Always plug any open connections to prevent contamination.

Torque: 25 Nm



8. Torque: 25 Nm



## Installation

1. To install, reverse the removal procedure.
2. Refer to: [Power Steering System Bleeding](#) (211-00 Steering System - General Information, General Procedures).

# Power Steering - Power Steering Pump 4.2L NA V8 - AJV8

Removal and Installation


Special Tool(s)	
 303-703 E95037	Accessory belt tensioner 303-703

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the air cleaner assembly.  
For additional information, refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8, Removal and Installation).
3. Release the accessory drive belt.

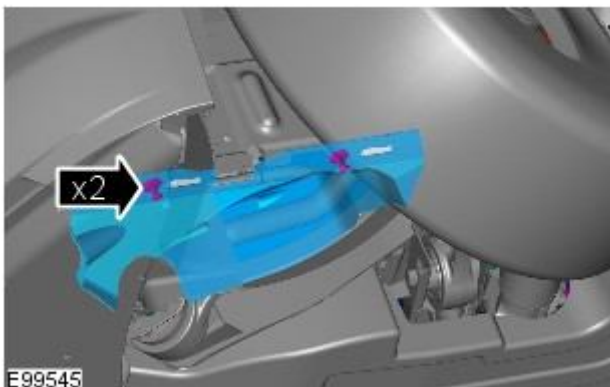


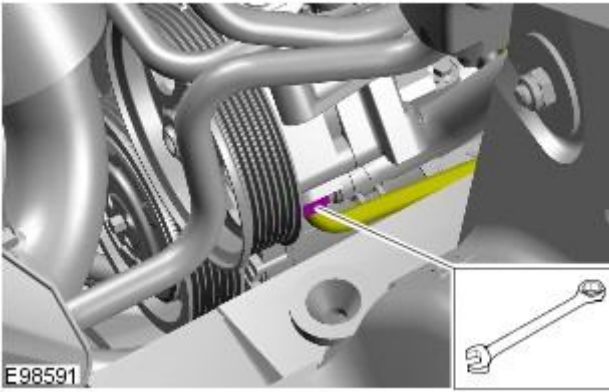
- Using the special tool 303-703, rotate the accessory drive belt tensioner counter-clockwise.

4.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

5. Remove the splash shield.

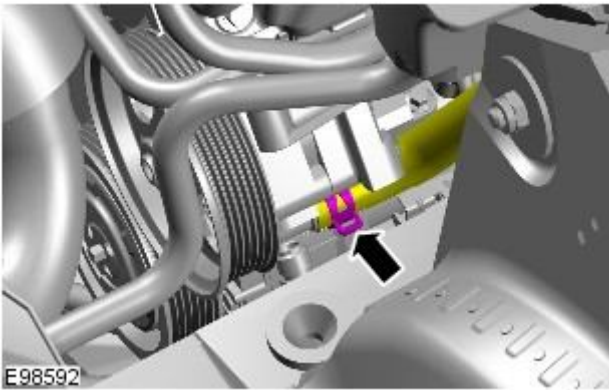





6.  CAUTION: Always plug any open connections to prevent contamination.

Disconnect the high pressure line from the power steering pump.

- Remove and discard the O-ring seal.



7.  WARNING: Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.

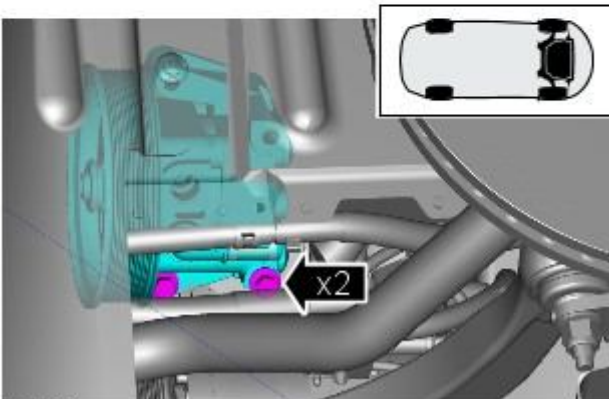
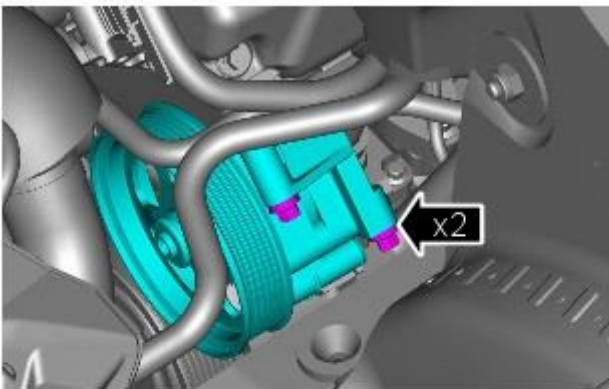
 CAUTION: Always plug any open connections to prevent contamination.

Disconnect the low pressure line from the power steering pump.

- Release the clip.

8. Remove the power steering pump.

- Remove the 4 bolts.



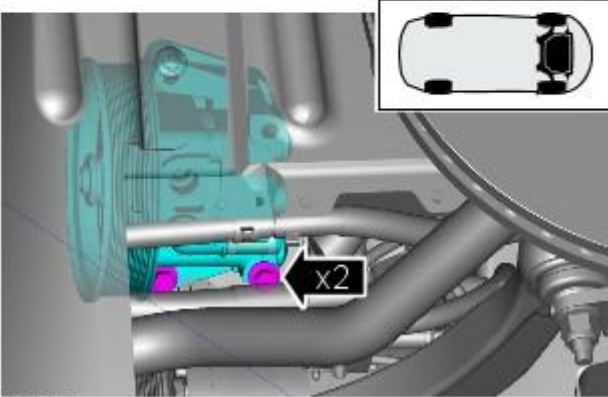
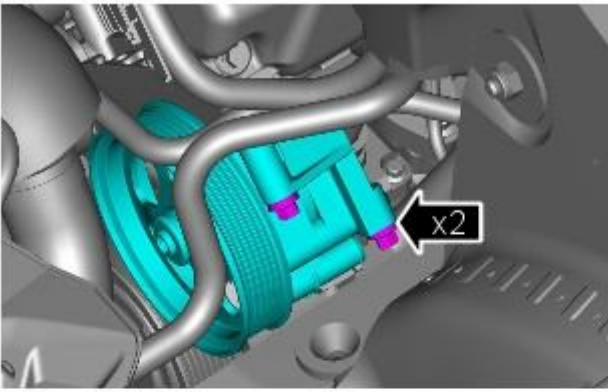
E98594

## Installation



1. Install the power steering pump.

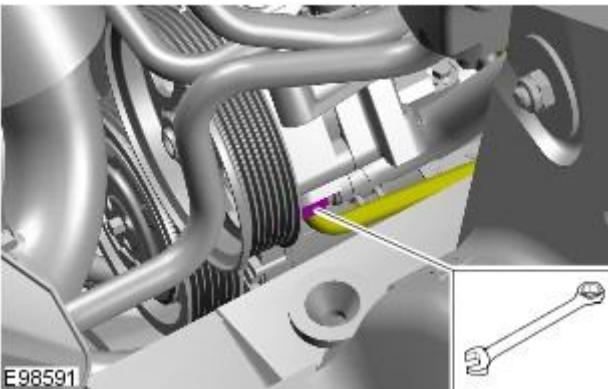
- Tighten to 25 Nm.



E98594

2. Connect the high pressure line.

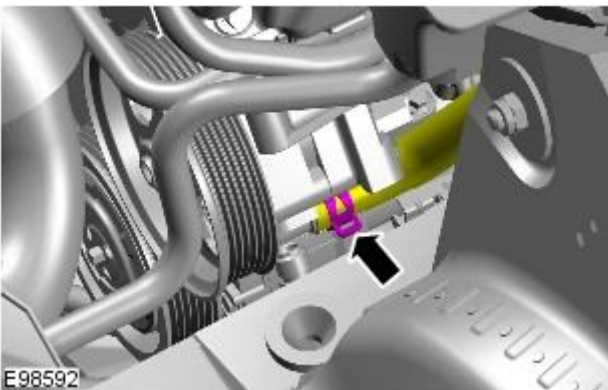
- Clean the component mating faces.
- Install a new O-ring seal.
- Tighten the union to 25 Nm.



E98591

3. Connect the low pressure line.

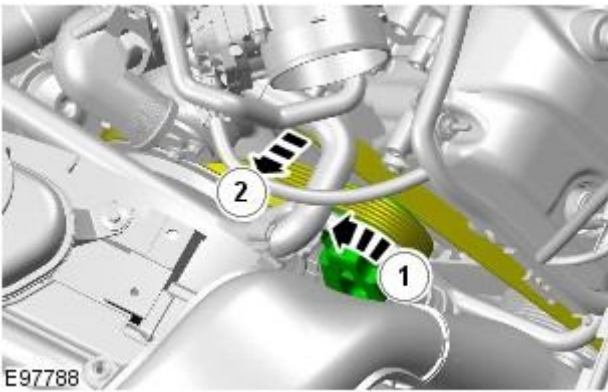
- Clean the component mating faces.
- Secure with the clip.



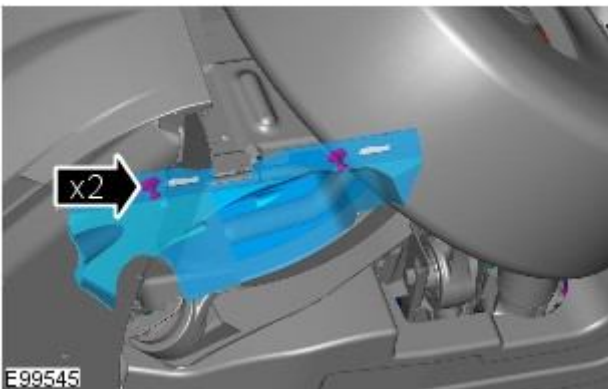
E98592

4. Install the accessory drive belt.

- Using the special tool 303-703, rotate the accessory drive belt tensioner counter-clockwise.



5. Install the splash shield.



6. Install the air cleaner assembly.

For additional information, refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8, Removal and Installation).

7. Check and top-up power steering fluid level.

For additional information, refer to: [Power Steering System Bleeding](#) (211-00 Steering System - General Information, General Procedures).

8. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

## Steering Linkage -

### Torque Specifications

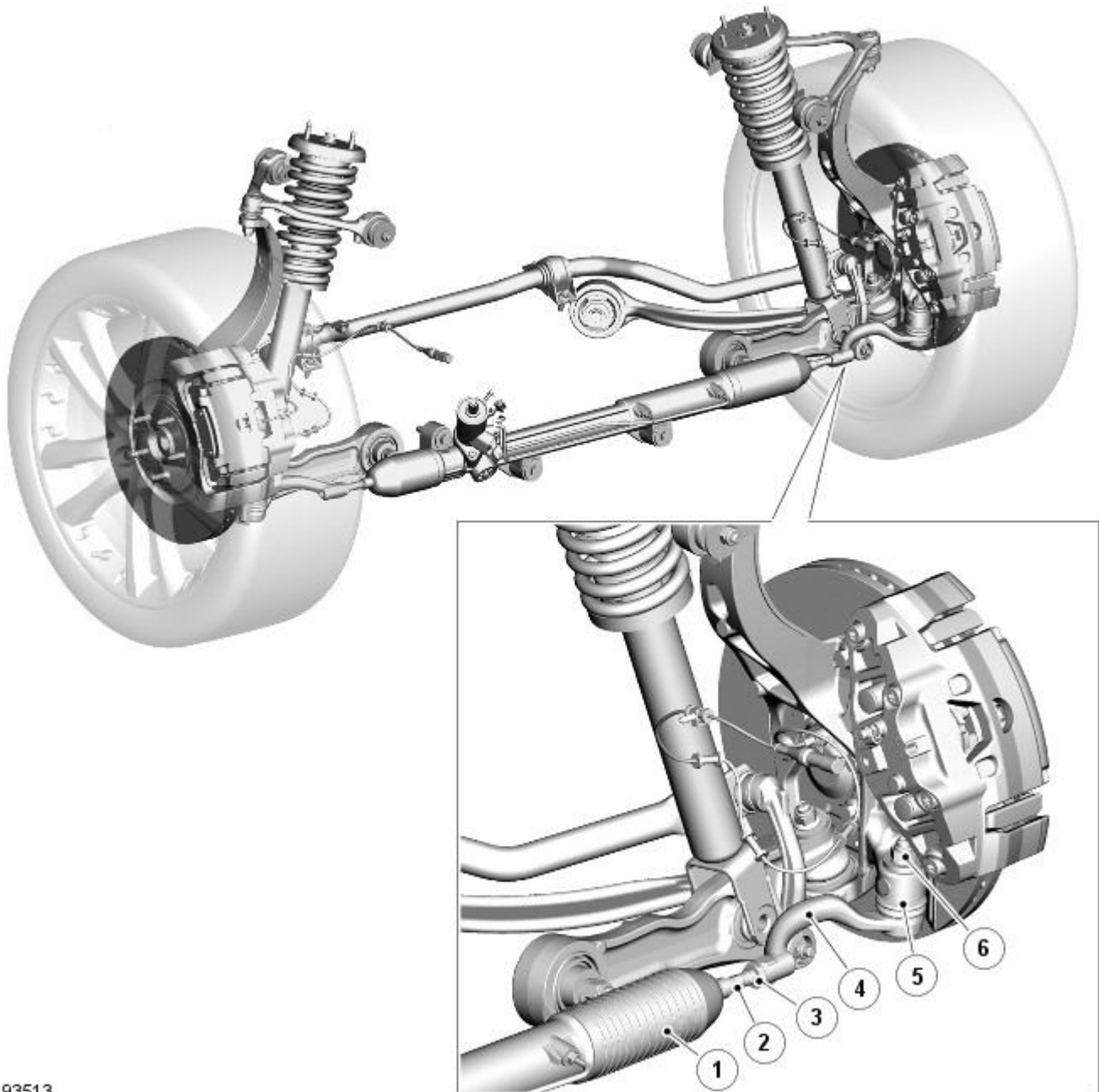
Description	Nm	lb-ft	lb-in
Tie-rod end retaining nut	133	98	-
Tie-rod end lock nut	55	41	-



# Steering Linkage - Steering Linkage - Component Location

Description and Operation

## STEERING LINKAGE COMPONENT LOCATION



E93513

### ItemDescription

1	Steering gear boot
2	Inner tie-rod arm
3	Locknut
4	Outer tie-rod arm
5	Taper ball joint
6	Locknut

# Steering Linkage - Steering Linkage - Overview

Description and Operation

## OVERVIEW

The steering linkage comprises the tie rod which provides the connection between the steering gear and the front wheel knuckle. Each end of the steering gear has a threaded hole which provides for the fitment of the inner tie rods. The external ends of the inner tie rods are sealed with boots to prevent the ingress of dirt and moisture into the steering gear.

# Steering Linkage - Steering Linkage - System Operation and Component Description

Description and Operation

## System Operation

### TIE-ROD

The threads on the tie rods allow the position of the outer tie rod to be adjusted in order to set the correct toe angle for each front wheel.

## Component Description

### TIE-ROD

Each tie rod comprises two parts; an inner and outer tie rod. The inner and outer tie rods are screwed into each other and locked with a locknut to prevent inadvertent movement.

The outer tie rod incorporates a non-serviceable tapered ball joint which locates in a tapered hole in the front wheel knuckle and is secured with a self-locking nut. The ball joint has an internal hexagonal drive which enables the joint to be held stationary when the self-locking nut is tightened.

## **Steering Linkage - Steering Linkage**

Diagnosis and Testing


For additional information.

REFER to: [Steering System](#) (211-00 Steering System - General Information, Diagnosis and Testing).

## Steering Linkage - Tie Rod End

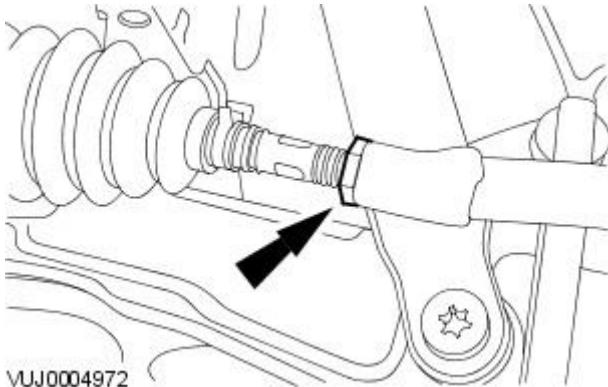
Removal and Installation


### Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

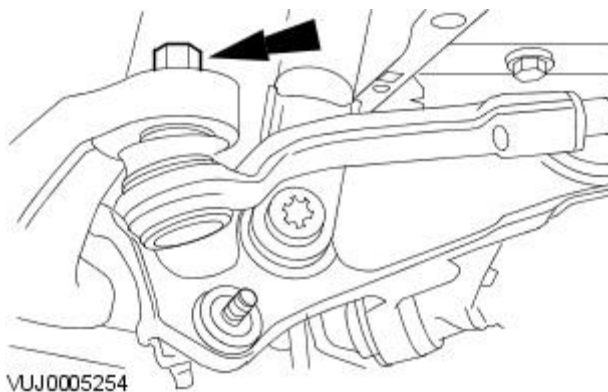
Raise and support the vehicle.

2. Remove the front wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
3. Loosen the tie-rod end lock nut.

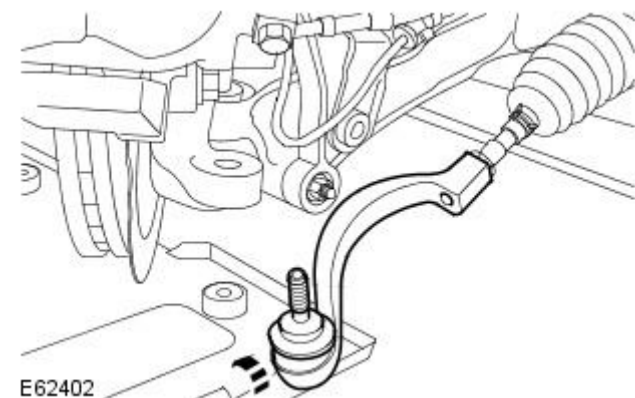


4.  **CAUTION:** Make sure that the ball joint ball does not rotate.

Remove and discard the tie rod end retaining nut.




5. Remove the tie-rod end, note the number of turns for installation.



### Installation

1. Install the tie rod end, note the number of turns until adjacent to the locknut.

2.  **CAUTION:** Make sure that the ball joint ball does not rotate.

Connect the tie-rod end ball joint.

- Clean the component mating faces.
- Install a new nut and tighten to 133 Nm.

**3.** Tighten the tie-rod locking nut.

- Clean the component mating faces.
- Tighten the nut to 55 Nm.

**4.** Install the front wheel.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

**5.** Using only four-wheel alignment equipment approved by Jaguar, check and adjust the wheel alignment.

For additional information, refer to: [Four-Wheel Alignment](#) (204-00 Suspension System - General Information, General Procedures).

## Steering Column -

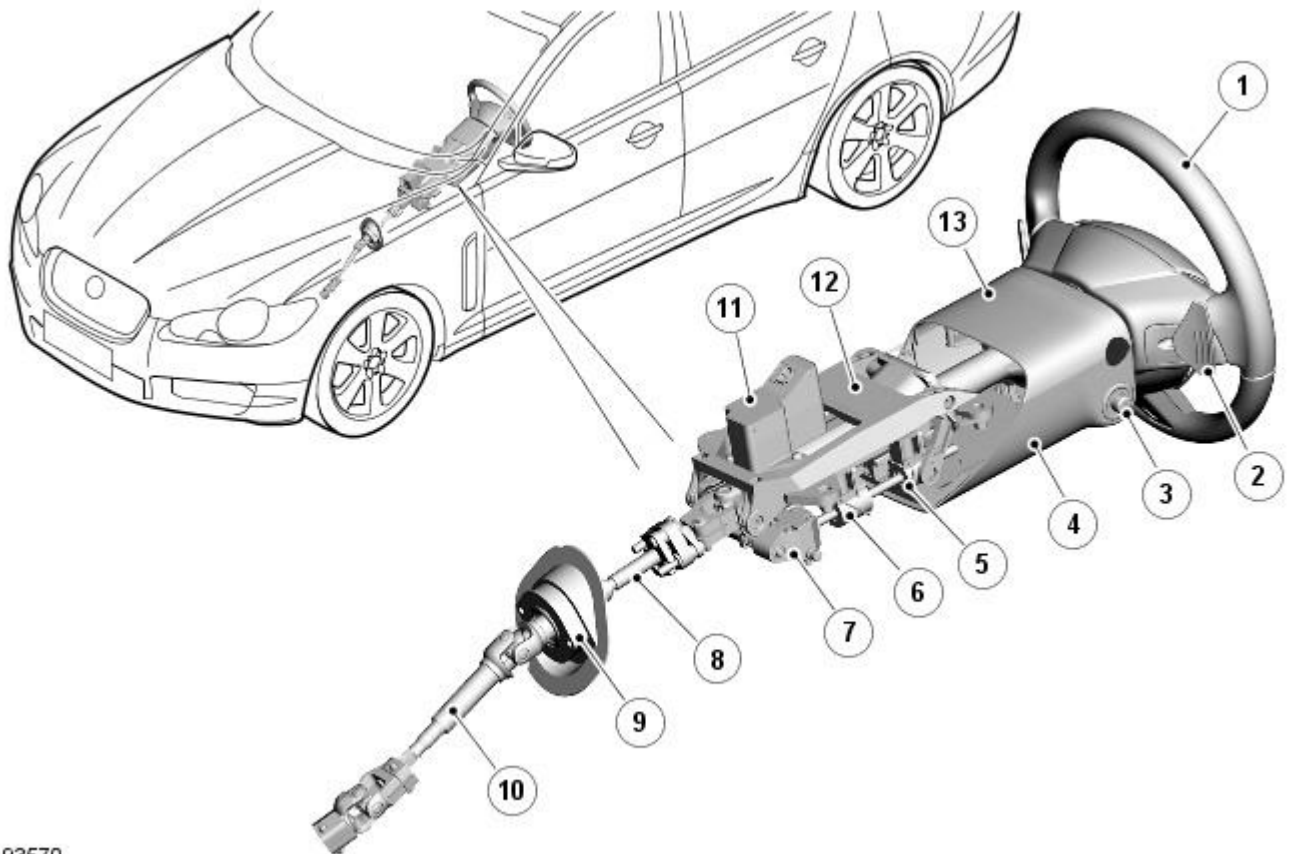
### Torque Specifications

Description	Nm	lb-ft	lb-in
Steering wheel retaining bolt	65	48	-
Steering column pinch bolt	35	26	-
Steering column retaining nuts	30*	22	-
Tilt solenoid retaining bolts	1	-	9
Telescopic solenoid retaining bolts	1	-	9
Telescopic housing retaining bolts	8	-	71

If you are re-using this fixing on a vehicle built prior to VIN N83337, then tighten to 25 Nm. If you are replacing a fixing, then you must tighten to 30 Nm.

# Steering Column - Steering Column - Component Location

Description and Operation



E93570

## ItemDescription

1	Steering wheel
2	Gear change paddle switch
3	Column adjust switch
4	Lower shroud
5	Rake adjustment housing
6	Reach adjustment housing
7	Column adjustment motor
8	Lower column - Upper collapse shaft
9	Bulkhead bearing and seal assembly
10	Lower column - Lower collapse shaft
11	Electric steering lock mechanism
12	Column mounting plate
13	Upper shroud



# Steering Column - Steering Column - Overview

Description and Operation

## OVERVIEW

The steering column comprises the upper column assembly, the lower column assembly and the steering wheel. The 3 components are positively connected together to pass driver rotary input from the steering wheel to a linear output of the steering rack.

The upper column assembly contains electrical adjustment for steering wheel reach and rake, the electric steering lock mechanism and the steering angle sensor. Steering adjustment memory positions are stored in the driver's seat module.

The electric steering column is a standard fitment on all models. The upper column assembly contains electrical adjustment for steering wheel reach and rake, the electric column lock mechanism and the steering angle sensor. Steering adjustment memory positions are stored in the driver's seat module. The column also features a 'tilt away' function which moves the steering column away from the driver allowing easier exit and entry to the vehicle.

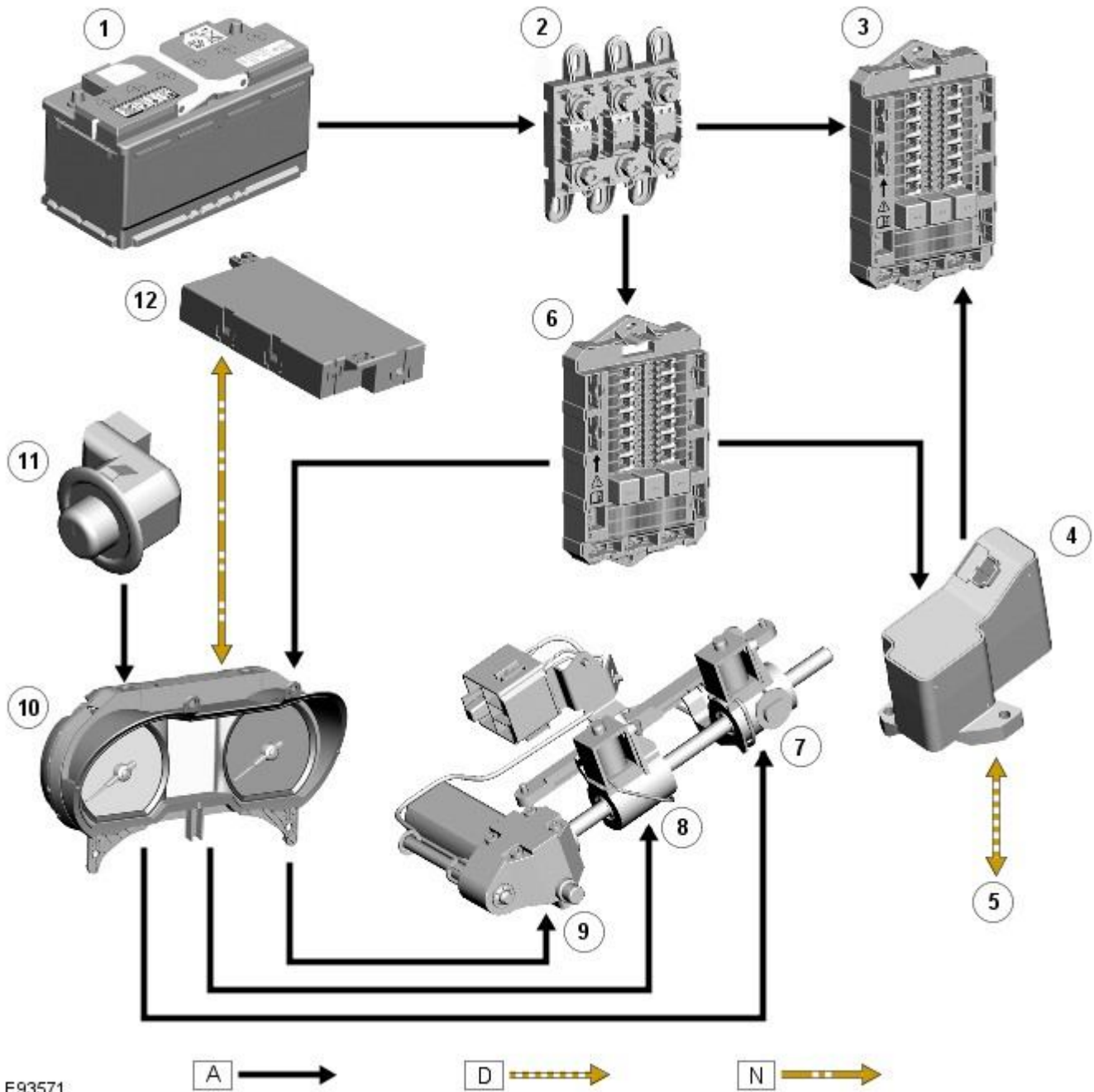
Column adjustment is provided by a single motor for both reach and rake adjustment. Operation of the column adjustment is controlled by a four way joystick type switch located in the column lower shroud. Column adjustment is an integral part of the driver position memory system.

# Steering Column - Steering Column - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **D** = High speed CAN bus; **N** = Medium speed CAN bus



E93571

### ItemDescription

1	Battery
2	BJB (battery junction box) - Megafuse (175A)
3	RJB (rear junction box)
4	Electric steering column lock
5	High Speed CAN (controller area network) bus to other vehicle systems
6	CJB (central junction box)
7	Rake adjustment solenoid and potentiometer
8	Reach adjustment solenoid and potentiometer
9	Column adjustment motor
10	Instrument cluster
11	Steering column adjust switch

## System Operation

### STEERING COLUMN ADJUSTMENT

Power for the column adjustment motor is supplied via a megafuse in the [BJB](#) to the [CJB](#). A fused supply from the [CJB](#) is passed to the instrument cluster which controls the power application to the motor.

The column adjust switch is hardwired to the instrument cluster. Up/down and in/out selections on the switch are each passed through a resistor of differing values to the instrument cluster. The cluster monitors the output value from the switch and operates the motor in the required direction and simultaneously energizes the required solenoid for rake or reach adjustment. When the applicable solenoid is energized, a clutch is engaged and locates on a lead screw. The motor rotates the lead screw and the rotational drive of the screw is transferred into linear movement of the applicable clutch to move either the rake or reach adjustment. For reach adjustment, the lead screw drives the outer housing in or out as required. For rake adjustment the lead screw drives a rake lever which moves the column up or down as required.

The position of the column is monitored by potentiometers which are connected to the instrument cluster. The cluster monitors the output signal from the potentiometers to precisely control the positioning of the column in each plane.

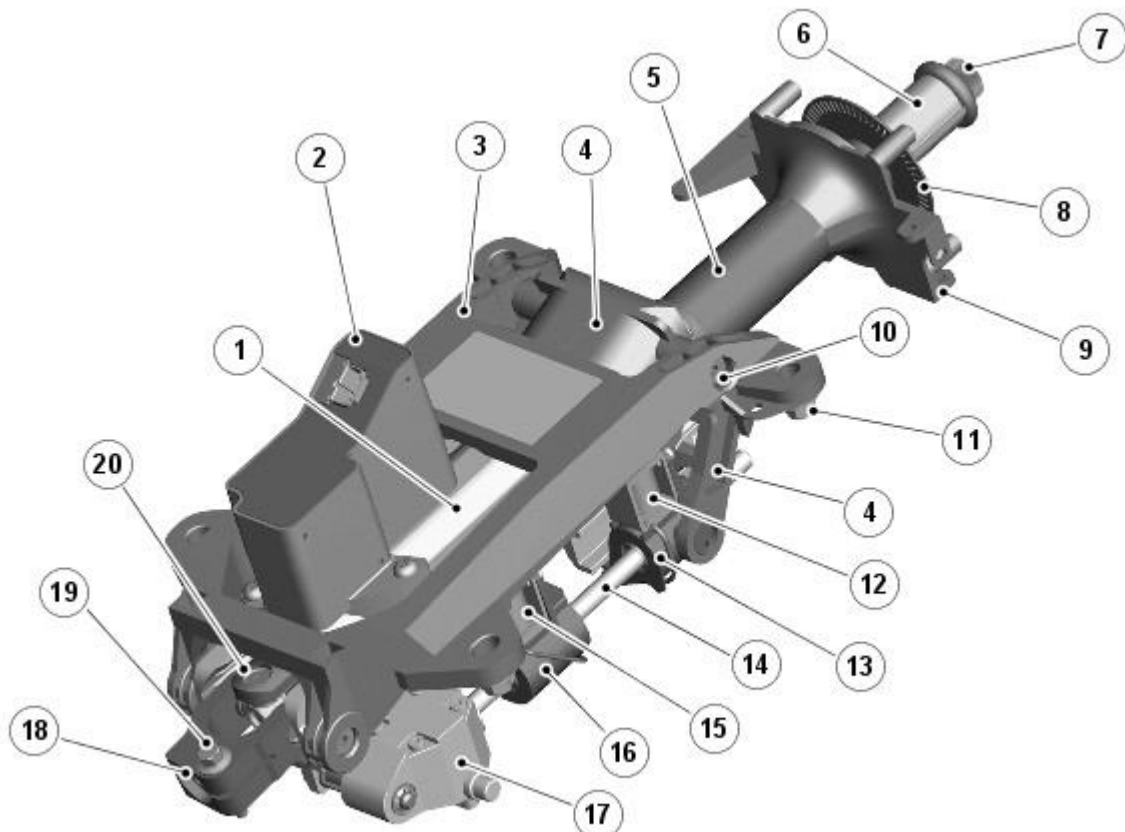
The instrument cluster controls the memory positioning of the column via a medium speed [CAN](#) bus connection to the driver's seat module. The driver's seat module receives information regarding the particular remote handset used to enter the vehicle and outputs positional information relative to that stored for the handset. This information is passed to the instrument cluster via the medium speed [CAN](#) bus which moves the column to the memorized positions.

The column logic in the instrument cluster also incorporates an entry/exit mode. When the vehicle is unlocked or the ignition is switched off, the instrument cluster lifts the column upwards to its maximum rake position to allow the driver more room below the steering wheel and improve access/egress of the vehicle. When the ignition is next switched on the column will adjust to its previous position.

The electric steering column lock is controlled by the [CJB](#) and is an integral function of the passive start system. Refer to: [Anti-Theft - Passive](#) (419-01B Anti-Theft - Passive, Description and Operation).

### Component Description

#### STEERING COLUMN



E97704

#### ItemDescription

1	Rake housing
2	Electric steering column lock
3	Mounting plate
4	Rake lever
5	Crash tube

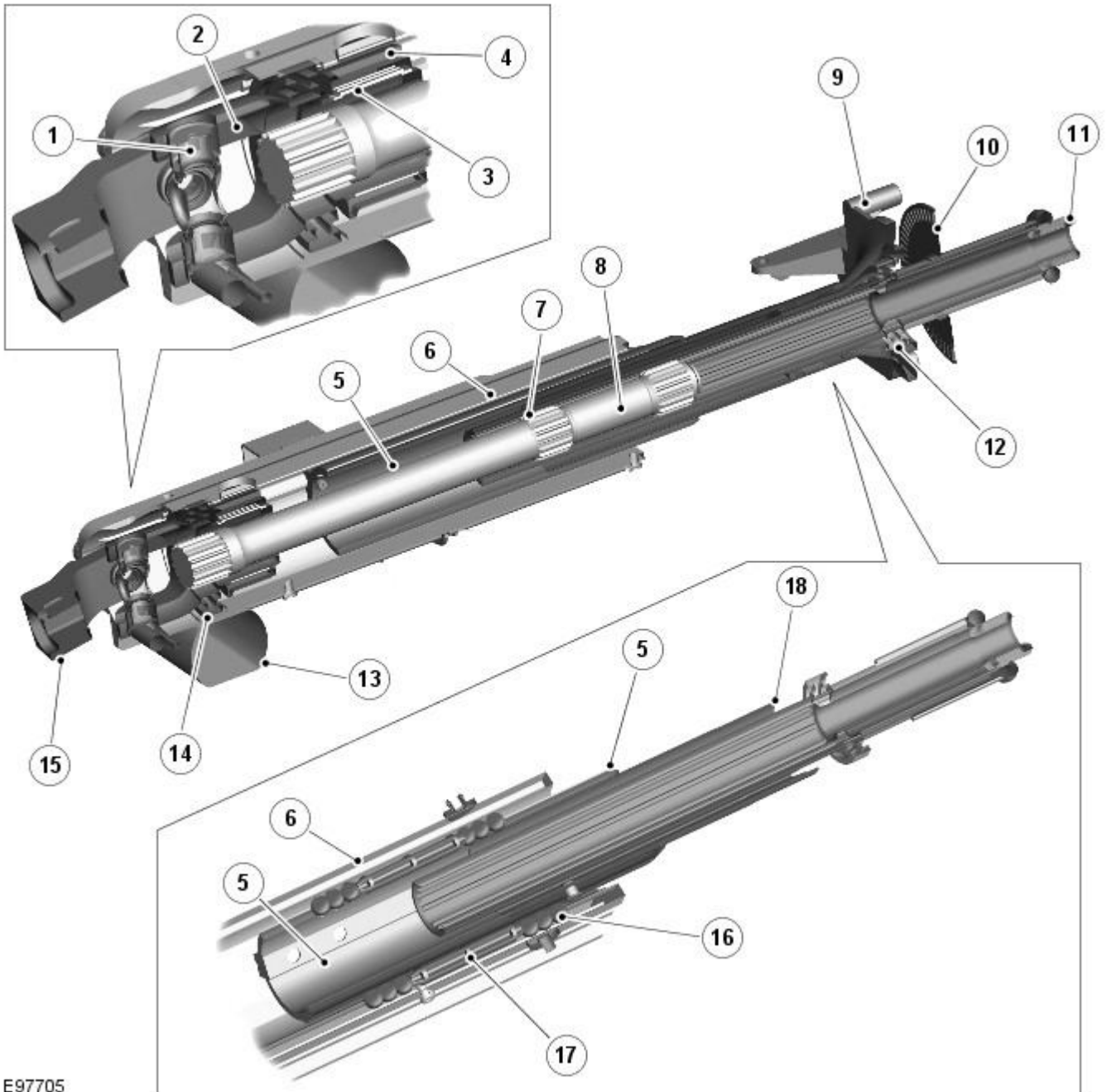
6	Distance keeper
7	Steering wheel mounting splines
8	Steering angle sensor ring
9	Crash adaptor
10	Rake lever pivot bearing (2 off)
11	Flanged locknut (4 off) - mounting to cross-beam
12	Rake solenoid
13	Rake clutch
14	Spindle
15	Reach solenoid
16	Reach clutch
17	Column adjustment motor
18	Outer clamping yoke
19	Clamp bolt
20	Inner tube yoke



**WARNING:** Do not attempt to dismantle the steering column. The crash safety of the unit will be compromised.

The steering column is attached to the in-vehicle cross-beam and secured with 4 flanged lock nuts onto 4 studs integral with the cross-beam.

Steering Column - Sectional View



E97705

**ItemDescription**

1	Tube and clamping yoke pivot bearing
2	Tube yoke
3	Tolerance ring
4	Locking ring
5	Axial housing
6	Rake housing
7	Tube
8	Splined shaft
9	Crash adaptor
10	Steering angle sensor ring
11	Steering wheel mounting splines
12	Upper bearing
13	Column adjustment motor
14	Lower bearing
15	Outer clamping yoke
16	Ball (12 off)
17	Distance keeper
18	Crash tube

The column comprises a cast magnesium mounting bracket which provides the attachment to the cross-beam. Attached to the mounting bracket is a rake lever which is attached to the mounting bracket at the lower end with two pivot bearings. The bearings allow the rake lever to rotate upwards or downward to adjust the column rake.

The rake lever also provides for the attachment of the rake housing which can slide within the lever to provide the reach adjustment. Within the rake housing is the axial housing which is supported on each side with 6 ball bearings which allow the rake housing to move forward or backwards. The bearings on each side are arranged in groups of 3 bearings and are separated by a distance keeper which allows the housing to be supported on bearings along its length. Within the axial housing is a tube which is supported at the upper end of the column on the upper bearing. The tube has a central splined hole which provides for the fitment of the splined shaft. The splined shaft can slide within the tube on the splines when the column reach is adjusted or the column collapses in a crash condition. The splined shaft also passes rotary motion from the steering wheel through the length of the column to the outer clamping yoke which is supported on the lower bearing.

The electric steering column lock is attached to the top of the rake lever. A lock bolt within the steering column lock engages in one of 8 slots in the locking sleeve located at the lower end of the column preventing rotation of the steering wheel. The locking sleeve is retained by a tolerance ring which in turn is located on the outer diameter of the tube yoke. The tolerance ring allows a specified amount of torque to be applied to the splined shaft before it slips, preventing damage to the column lock due to excessive force being applied to the steering wheel when the lock is engaged. The tolerance ring is designed to slip on the splined shaft when the applied torque exceeds the fitted slip load of 200 Nm minimum. Repeated rotation of the lock collar will reduce its slipping torque to 100 Nm minimum. The lock is controlled by the [CJB](#) and is an integral function of the passive start system.

A steering angle sensor is located at the upper end of the steering column and is attached to the crash adaptor. The sensor measures steering rotation via a toothed wheel located on the splined tube at the upper end of the column. The sensor receives a power supply from the [CJB](#) and supplies 2 signals (A and B) relating to the steering rotation to the [ABS \(anti-lock brake system\)](#) module. The module transmits this data on the high speed [CAN](#) bus for use by other vehicle systems.

Refer to: [Anti-Lock Control - Stability Assist](#) (206-09 Anti-Lock Control - Stability Assist, Description and Operation).

The steering column is adjustable electrically, for reach and rake. The adjustment mechanism comprises an electric adjustment motor, a lead screw, a rake solenoid, a reach solenoid, a reach clutch and a rake clutch. The column adjustment is controlled manually using a joystick switch located on the [LH \(left-hand\)](#) side of the column lower cowl. The joystick can be moved forward and backward to adjust the column reach in and out and moved up and down to adjust the rake. The switch selection energizes the adjustment motor in the applicable direction and also engages the applicable solenoid and clutch.

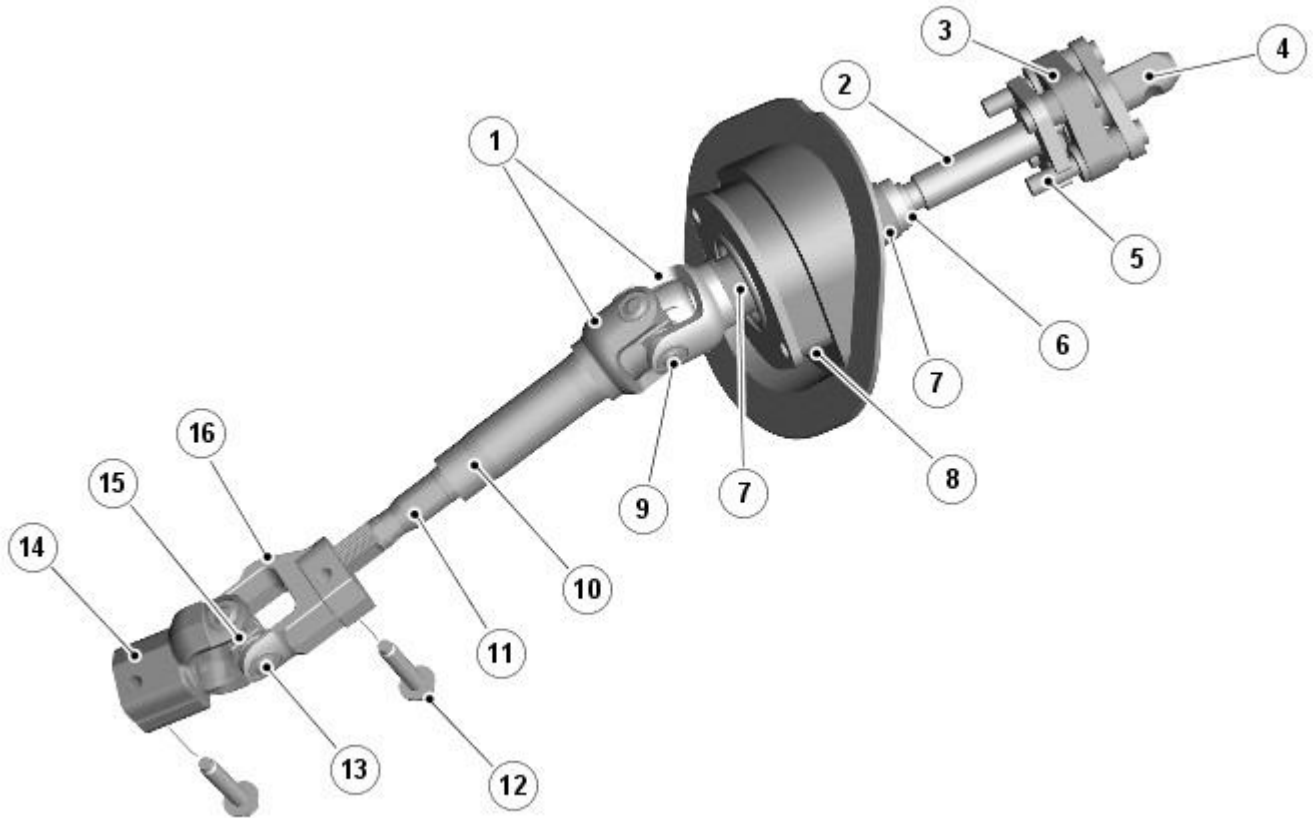
When the joystick switch is rotated to the 'auto' position, the steering column will adjust to the uppermost rake position when the ignition is switched off. It will re-adjust to the position corresponding to the memory position for the remote handset when the ignition is switched on.

The memory function of the electric column is linked to and controlled by the driver's seat module. The module provides for the storage of three separate memory positions which are stored against 3 individual remote handsets. Refer to: [Seats](#) (501-10 Seating, Description and Operation).

The steering wheel locates on a splined shaft in the upper column assembly and is secured with a bolt. The steering wheel houses the driver's airbag and switches for the audio system, gear change and speed control. A clockspring is used to connect the steering wheel electrical components to the vehicle harness.

Two plastic shrouds are fitted to the upper column assembly. The lower shroud is fitted with an energy absorbing foam pad to minimize leg injury in the event of an accident.

## **LOWER SHAFT ASSEMBLY**



E97706

**ItemDescription**

1	Yoke
2	Upper collapse shaft
3	Flexible coupling
4	Shaft plate
5	Rivet (4 off)
6	Upper tube
7	Plastic sleeve
8	Boot
9	Bearing (4 off)
10	Teeth tube
11	Lower shaft
12	Yoke clamp bolt (2 off)
13	Bearing (4 off)
14	Lower yoke
15	Spider
16	Upper yoke

The lower shaft assembly comprises 2 splined shafts connected by a universal joint in the center.

The upper collapse shaft has a flexible couple at its upper end. The flexible coupling controls axial and torsional movements and also assists with noise and vibration damping. The flexible coupling is fitted with a shaft plate which has a boss with machined flats on it. The flats provide positive location on the upper column outer clamping yoke. A cut-out in the boss allows for the fitment of a clamping bolt to secure the upper column outer clamping yoke. The cut-out ensures that the lower shaft assembly can only be fitted in one orientation.

The upper collapse shaft is connected to the stopper plate of the flexible coupling with splines. The stopper plate is connected to the shaft plate via the flexible coupling and is secured with rivets. The upper collapse shaft has a series of splines which engage with the upper tube. The splines allow the upper collapse shaft to slide into the upper tube in the event of an accident.

The upper tube is positively connected to the upper half of the yoke of the universal joint. A plastic tube is located around the upper tube and provides for the attachment of a boot which seals the lower shaft assembly where it passes through the vehicle bulkhead.

The yoke is attached to the teeth tube which in turn is located over the lower shaft on splines. The teeth tube is fitted with a tolerance ring which provides resistance to movement of the splines on the lower shaft. The splines of the lower shaft allow it to slide into the teeth tube with the tolerance ring controlling the collapse.

The lower shaft is fitted with a yoke which provides the attachment to the torsion bar of the steering valve unit.

## **Steering Column - Steering Column**

Diagnosis and Testing

For additional information.

REFER to: [Steering System](#) (211-00 Steering System - General Information, Diagnosis and Testing).



# Steering Column - Steering Column

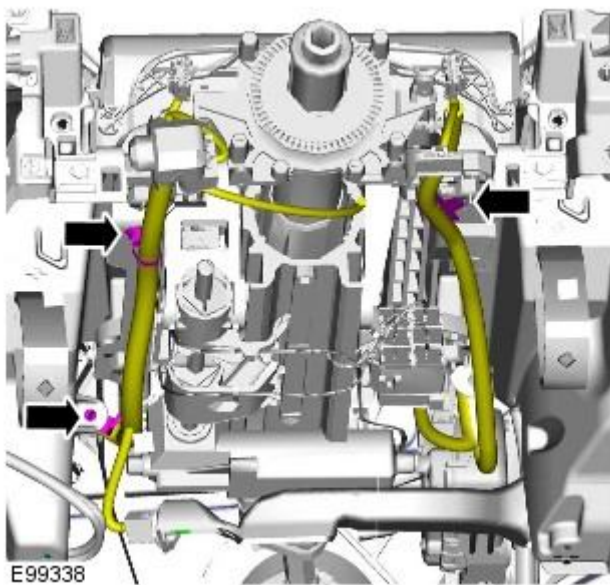
Removal and Installation

## Removal

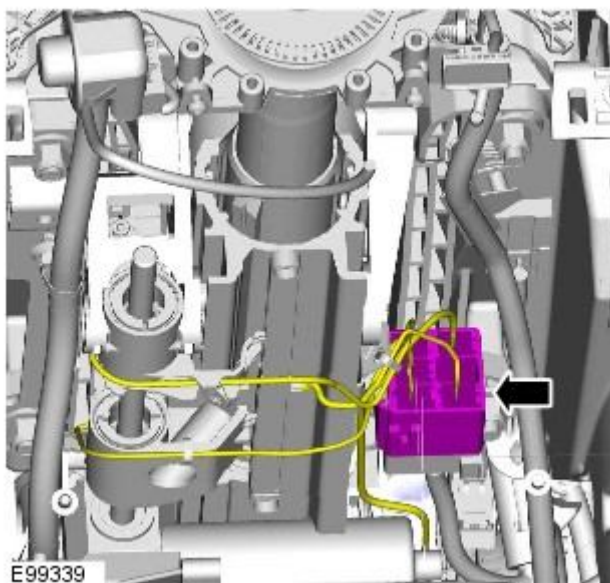
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Instrument Panel Lower Trim Panel](#) (501-12 Instrument Panel and Console, Removal and Installation).
3. Refer to: [Steering Wheel Rotation Sensor](#) (206-09 Anti-Lock Control - Stability Assist, Removal and Installation).

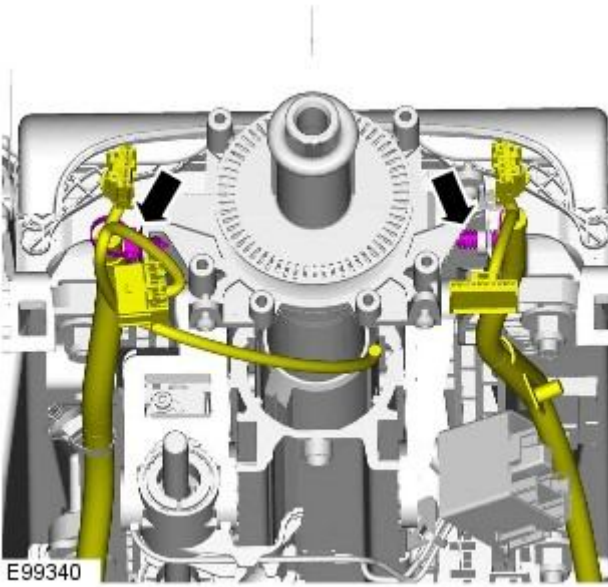
4.



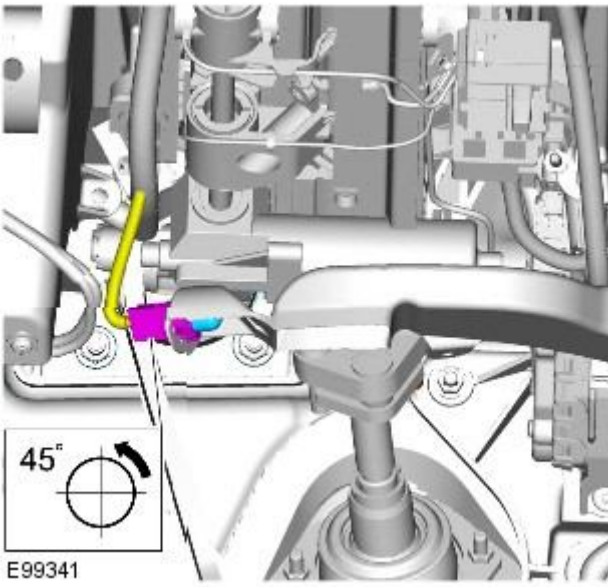
5.



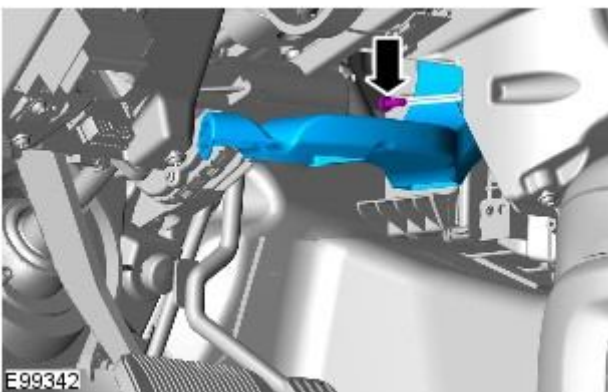
6.

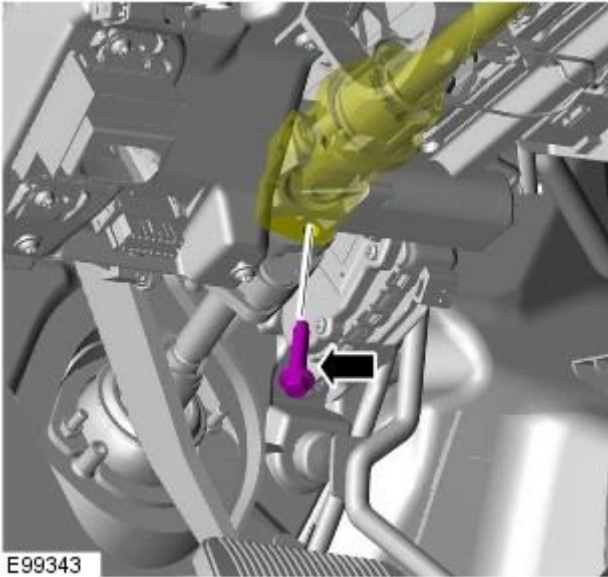


7.

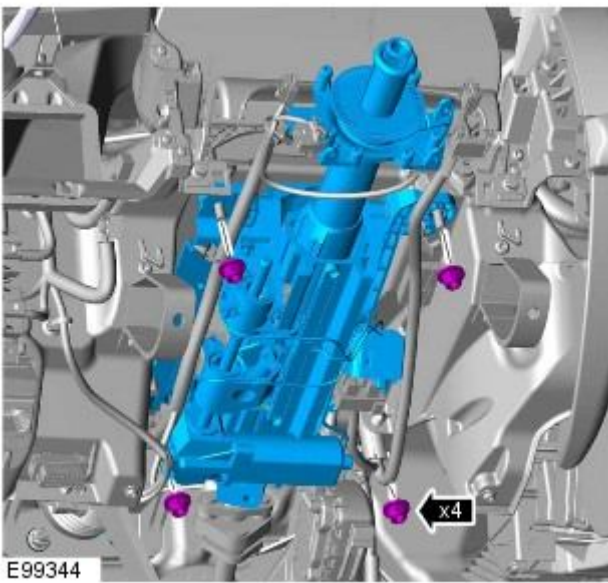


8.





9. Torque: 30 Nm



10. Torque: 25 Nm

## Installation

1. To install, reverse the removal procedure.

# Steering Column - Steering Column Flexible Coupling

Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

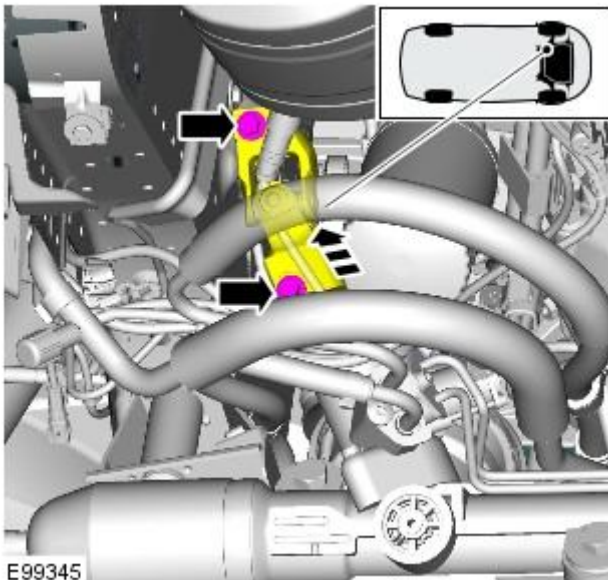
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).


2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

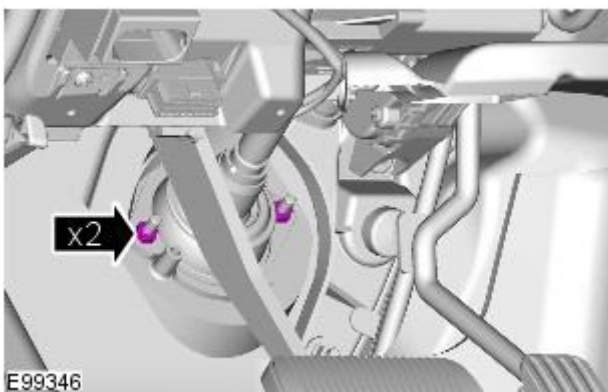
3. Refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

4. Refer to: [Instrument Panel Lower Trim Panel](#) (501-12 Instrument Panel and Console, Removal and Installation).

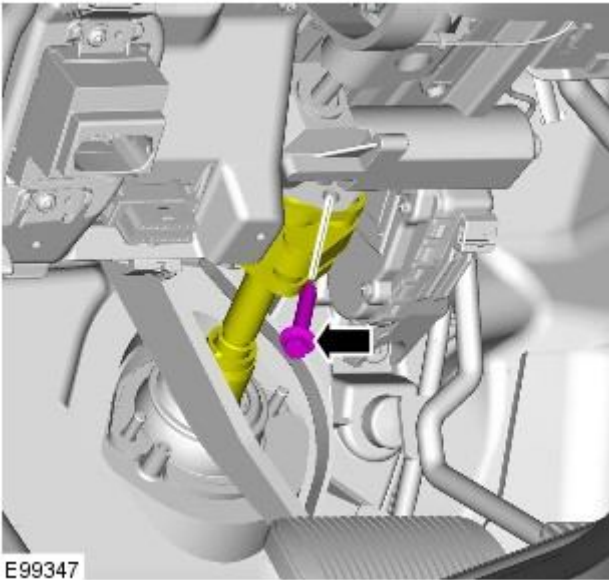



5.  **WARNING:** Make sure that a new steering column flexible coupling bolt is installed.

*Torque:* 30 Nm

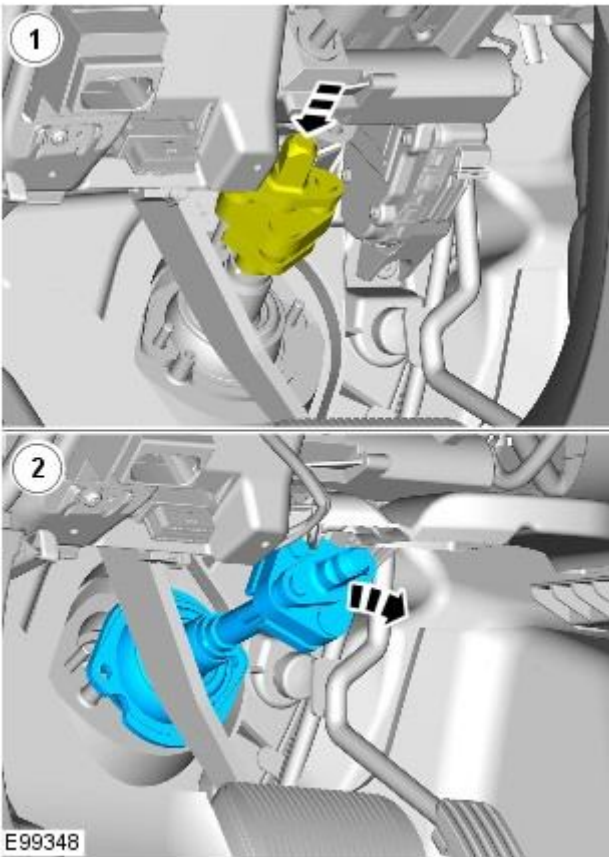


6. *Torque:* 10 Nm



7.  **WARNING:** Make sure that a new steering column flexible coupling bolt is installed.

*Torque:* 30 Nm



- 8.


## Installation

1. To install, reverse the removal procedure.



# Steering Column - Steering Wheel

Removal and Installation

Special Tool(s)	
	Clockspring locking tool
	211-326

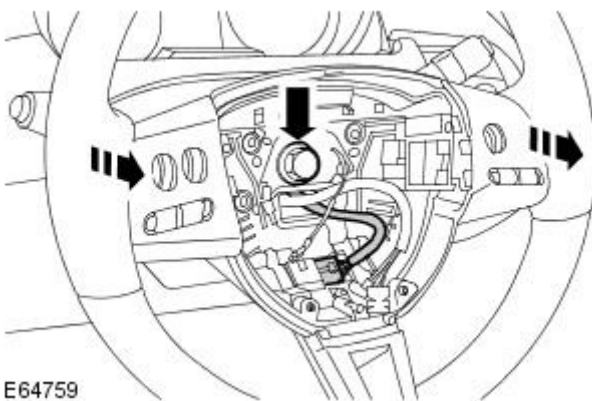
E43628

## Removal

1. Make the SRS system safe.  
For additional information, refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).
2. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
3. Remove the driver air bag module.  
For additional information, refer to: [Driver Air Bag Module](#) (501-20B Supplemental Restraint System, Removal and Installation).
4. **NOTE:** Note the fitted position.


Remove the steering wheel.

- Disconnect the electrical connector.
- Loosen, but do not fully remove the bolt.
- Release the steering wheel from the spline.
- Remove the bolt.
- Release the electrical harness.



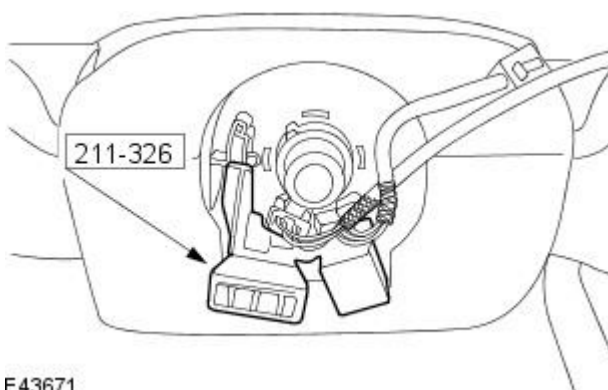
## 5. CAUTIONS:

 Failing to install the clockspring special tool, may result in damage to vehicle.

 Do not dismantle the clockspring, it has no serviceable parts and must be replaced as a complete assembly.

 Do not allow the clockspring to unwind.

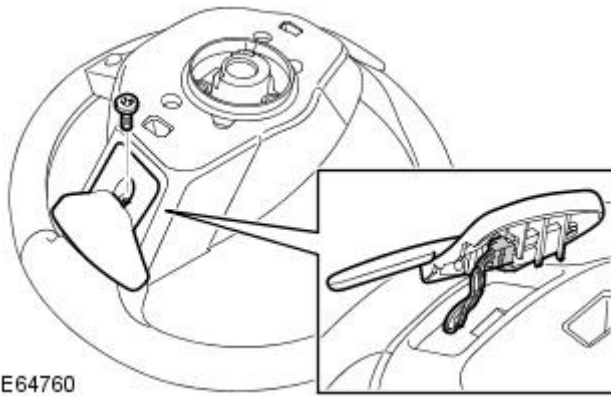
Install the special tool to the clockspring.



**6. NOTE:** Do not disassemble further if the component is removed for access only.

Remove the upshift and downshift paddle switches.

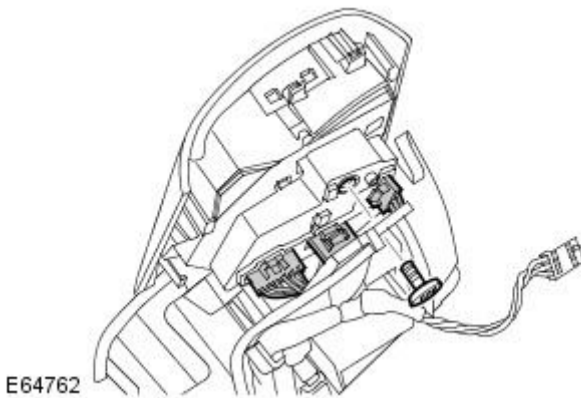
- Remove the Torx bolt.
- Release the assembly.
- Disconnect the electrical connector.
- Repeat the procedure and remove the opposite hand.



**7. NOTE:** The steering wheel is shown removed for clarity.

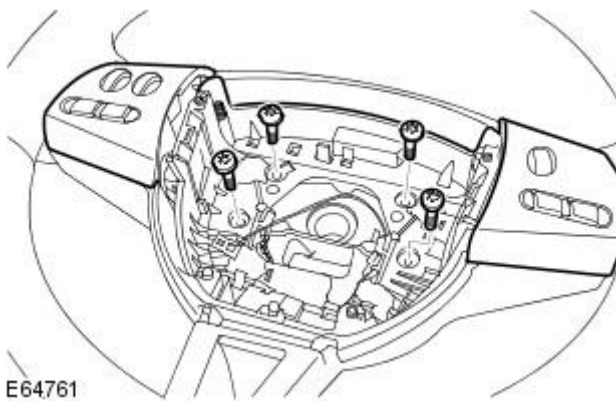
Release the steering wheel switch assembly.

- Remove the Torx bolt.
- Repeat the procedure and remove the opposite hand.



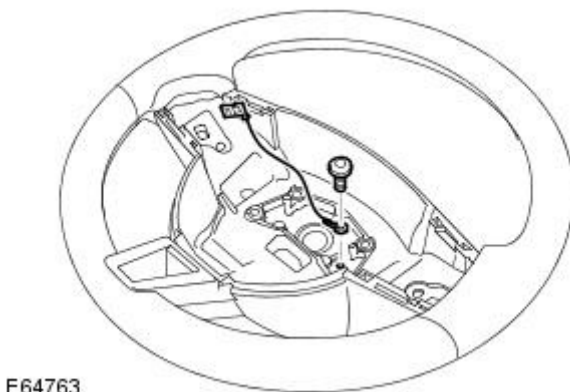
**8.** Remove the air bag housing.

- Remove the 4 Torx bolts.
- Release the electrical harness.



**9.** Remove the air bag ground cable.

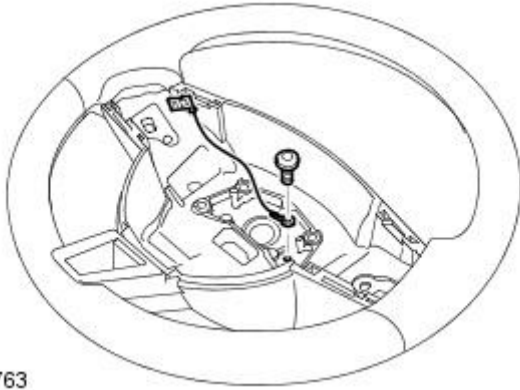
- Remove the Torx screw.



## Installation

1. Install the air bag ground cable.

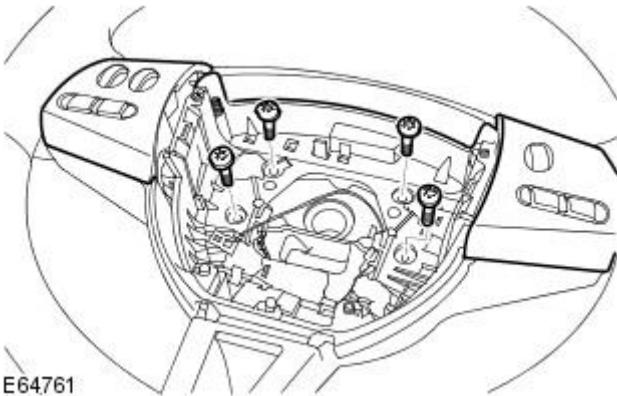
- Install the Torx screw.



E64763

2. Install the air bag housing.

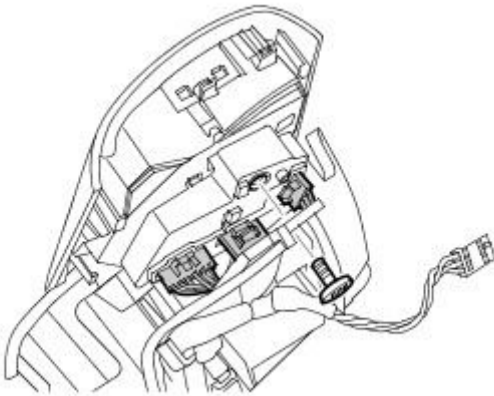
- Secure the electrical harness.
- Tighten to 6 Nm.



E64761

3. Secure the steering wheel switch assembly.

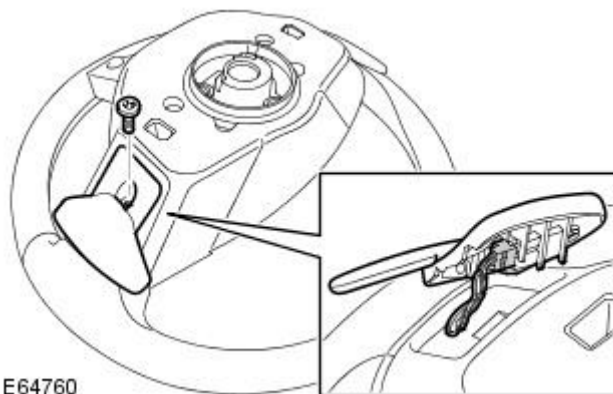
- Connect and secure the electrical connectors.
- Tighten to 3 Nm.
- Repeat the above procedure on the opposite hand.



E64762

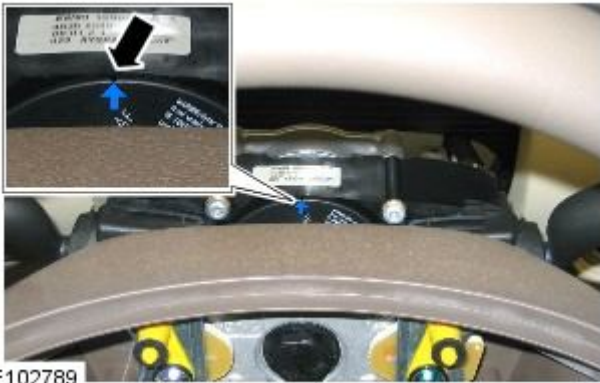
4. Install the upshift and downshift paddle switches.


- Connect and secure the electrical connector.
- Tighten to 3 Nm.
- Repeat the above procedure on the opposite hand.



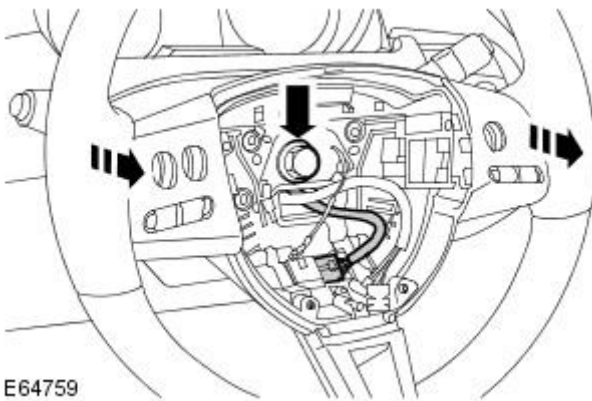
E64760






5.  CAUTION: Make sure that the arrow on the cassette is centered and pointing vertically prior to the steering wheel installation. On removal of the special tool keep the clockspring cables taught to prevent the cassette moving from the set position. Do not allow the clockspring to unwind. Failure to follow this instruction may result in damage to the component.

Remove the special tool.



6.  CAUTION: Check the alignment arrow is still in the vertical position with the wheels straight ahead to make sure that the directional indicator cancellation is central.

Install the steering wheel.

- Check the clockspring is aligned.
- Position the electrical harness.
- Connect the electrical connector.
- Tighten to 40 Nm.

7. Install the driver air bag module.

For additional information, refer to: [Driver Air Bag Module](#) (501-20B Supplemental Restraint System, Removal and Installation).

8. Connect the battery ground cable.

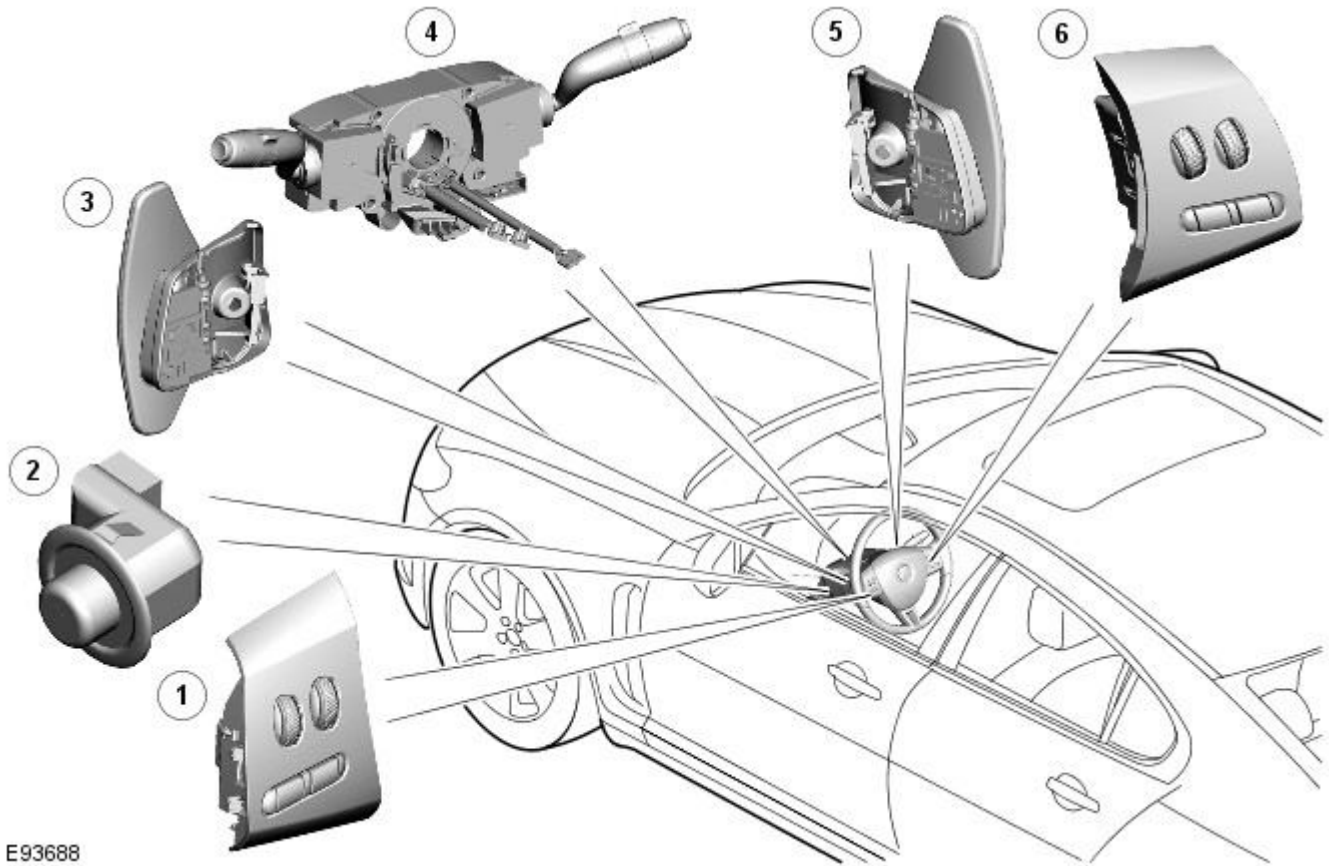
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Steering Column Switches - Steering Column Switches - Component

## Location

Description and Operation

### STEERING COLUMN SWITCHES COMPONENT LOCATION



E93688

#### ItemDescription

1	Audio and telephone switches
2	Steering column adjustment switch
3	LH (left-hand) (-) gear change paddle switch
4	Steering column multifunction switches and clockspring
5	RH (right-hand) (+) gear change paddle switch
6	Speed control switches (Adaptive Speed Control switch pack shown, non adaptive speed control switch pack similar)

# Steering Column Switches - Steering Column Switches - Overview

Description and Operation

## OVERVIEW

The steering column multifunction switch is situated on the steering column and consists of the wiper switch, the turn signal indicator/lighting switch and the trip computer switch.

The **RH (right-hand)** multifunction switch controls the following windshield wiper functions:

- Flick wipe
- Intermittent wipe
- Slow speed wipe
- High speed wipe
- Wash/Wipe
- Headlamp powerwash
- Rain sensing / variable wipe selection.

The **LH (left-hand)** multifunction switch controls the following functions:

- Turn signal indicators
- Side lamps
- Headlamps
- Auto lamps
- High/low beam
- Headlamp flash
- Headlamp timer
- Trip computer.

The steering column adjustment switch is located in the steering column lower shroud on the **LH** side. The switch is a 4 position 'joystick' which controls reach and rake adjustment.

The trip button allows the driver to cycle through an option menu and also reset trip cycle mileage calculations. The trip computer information is displayed in the instrument cluster message centre.

Steering wheel mounted switches on the **LH** side of the driver's airbag, control the audio and telephone functions. Switches on the **RH** side of the driver's airbag, control the speed control functions.

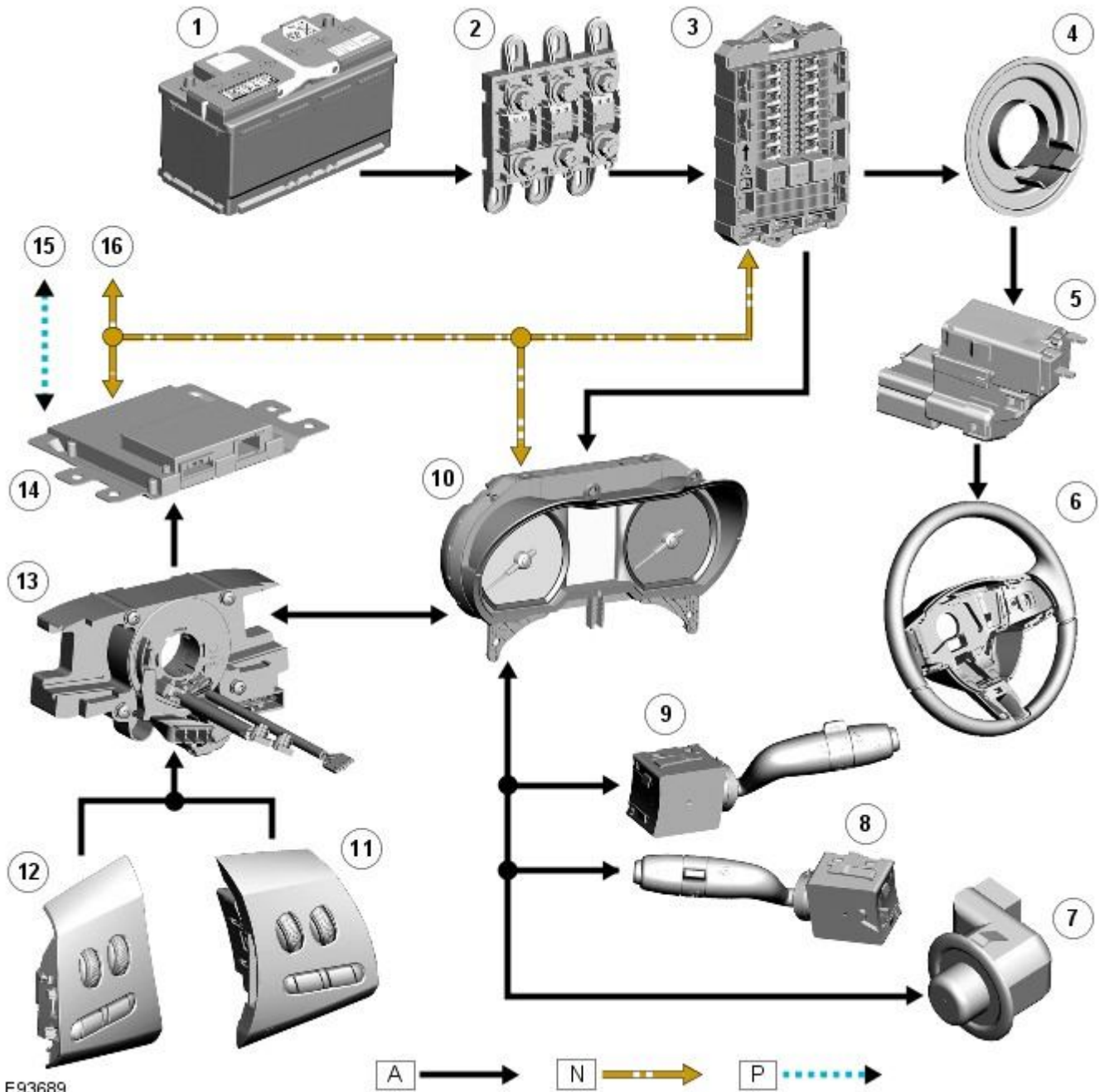
The steering wheel has an internal heating element. This is controlled by the driver via the Touch Screen Display (TSD).

# Steering Column Switches - Steering Column Switches - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **N** = Medium speed CAN bus; **P** = Fibre Optic MOST ring



E93689

### ItemDescription

1	Battery
2	BJB (battery junction box)
3	CJB (central junction box)
4	Heated steering wheel slip rings
5	Heated steering wheel control module
6	Steering wheel heater element
7	Steering column adjustment switch
8	Steering column LH (left-hand) multifunction switch
9	Steering column RH (right-hand) multifunction switch
10	Instrument cluster
11	Speed control switches

12	Audio/telephone switches
13	Clockspring
14	Information and entertainment module
15	Media Oriented System Transport (MOST) ring connection to other vehicle systems
16	Medium speed <a href="#">CAN (controller area network)</a> bus to other vehicle systems

## System Operation

### LEFT HAND MULTIFUNCTION SWITCH

#### Turn Signal Indicators

The instrument cluster outputs a reference voltage to the turn signal indicator switch. When the switch is in the central off position, the voltage flows through 3 resistors which are connected in series and back to the instrument cluster which monitors the signal and determines the turn signal indicators are off. This information is broadcast on the medium speed [CAN](#) bus to the [CJB](#).

When the switch is operated in the [LH](#) turn signal indicator position, the reference voltage from the instrument cluster is routed via 1 of the resistors. The returned signal voltage is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#). The [CJB](#) activates the applicable turn signal indicators until it receives an off message from the instrument cluster.

When the switch is operated in the [RH](#) turn signal indicator position, the reference voltage from the instrument cluster is routed via 2 of the resistors. The returned signal voltage is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#). The [CJB](#) activates the applicable turn signal indicators until it receives an off message from the instrument cluster.

#### Lighting Control Switch

The instrument cluster outputs 2 reference voltages to the rotary lighting control switch; one feed being supplied to the light selection function of the switch and the second feed being supplied to the autolamp exit delay function. The switch position is determined by instrument cluster by the change in returned signal voltage which is routed through up to 4 resistors in series depending on the selection made.

When the lighting control switch is in the off position, the reference voltage flows through 1 of the resistors. The returned signal voltage is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) that no lighting selection is made. The reference voltage to the autolamp exit delay switch is routed through 4 resistors which is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) that autolamp or exit delay has not been selected.

When the lighting control switch is in the sidelamp position, the reference voltage flows through 2 of the resistors. The returned signal voltage is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) to activate the sidelamps. The reference voltage to the autolamp exit delay switch is routed through 4 resistors which is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) that autolamp or exit delay has not been selected.

When the lighting control switch is in the headlamp position, the reference voltage flows through 3 of the resistors. The returned signal voltage is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) to activate the headlamps. The reference voltage to the autolamp exit delay switch is routed through 4 resistors which is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) that autolamp or exit delay has not been selected.

When the lighting control switch is in the autolamp position, the reference voltage flows through 4 of the resistors. The returned signal voltage is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) to activate the autolamp function. The reference voltage to the autolamp exit delay switch is routed through 4 resistors which is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) that autolamp has been selected.

#### Autolamp Exit Delay

When the lighting control switch is in any of the autolamp exit delay position, the lighting control switch reference voltage flows through 4 of the resistors. The returned signal voltage is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) that autolamps has been selected.

Depending on the selected position, the reference voltage to the autolamp exit delay switch is routed through 3, 2 or 1 resistors which is detected by the instrument cluster. The cluster outputs a message on the medium speed [CAN](#) bus to the [CJB](#) that autolamp exit delay period has been selected at 30, 60 or 120 seconds respectively.

#### Trip Function Button

The instrument cluster outputs a reference voltage to the trip function button. When the function button is pressed a ground path is completed and a signal voltage is returned to the instrument cluster via a resistor. The returned reference voltage is detected by the instrument cluster and performs the requested trip function.

### RIGHT HAND MULTIFUNCTION SWITCH

The instrument cluster outputs 4 separate reference voltages to the following switch functions:

- Wash/wipe switch
- Intermittent wipe switch
- Master wiper switch
- Flick wipe switch.

## Wash/Wipe Switch

The reference voltage is supplied to one of two resistors connected in parallel. When the switch is not being operated the current flows through one resistor and the returned signal voltage is monitored by the instrument cluster. When the wash/wipe switch is operated, a connection is made and the current flows through the second resistor. The change in signal voltage is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) to activate the wash/wipe function.

## Intermittent Delay/Auto Wipe Switch

The reference voltage is supplied to the switch and can pass through up to 7 resistors, connected in series, for intermittent delay selections and the auto wipe function.

When the rotary switch is in the auto position the reference voltage flows through 1 resistor. The returned signal voltage is detected by the instrument cluster which determines auto wipe is selected. The instrument cluster outputs a message on the medium speed [CAN](#) bus to the [CJB](#) to activate the auto wipe function.

With the rotary switch in one of the intermittent positions, the reference voltage is routed through up to 7 of the resistors depending on the delay period selected. The returned signal voltage is detected by the instrument cluster which determines selected delay period. The instrument cluster outputs a message on the medium speed [CAN](#) bus to the [CJB](#) to activate the selected intermittent wipe function.

- **NOTE:** The delay period for the intermittent selections can vary according to vehicle speed.

## Master Wiper Switch

The reference voltage supplied from the instrument cluster to the master wiper switch. The voltage can pass through up to 4 resistors connected in series.

When the switch is in the off position, the reference voltage passes through 4 resistors and the returned voltage is monitored by the instrument cluster. The instrument cluster outputs a message on the medium speed [CAN](#) bus to the [CJB](#) that no wiper selections have been requested.

With the switch in the intermittent, slow wipe or fast wipe position, the reference voltage passes through 3, 2 or 1 resistors respectively. The returned signal voltage is detected by the instrument cluster which determines selected delay period. The instrument cluster outputs a message on the medium speed [CAN](#) bus to the [CJB](#) to activate the selected wipe function.

## Flick Wipe Switch

The reference voltage is supplied to one of two resistors connected in parallel. When the switch is not being operated the current flows through one resistor and the returned signal voltage is monitored by the instrument cluster. When the flick wipe switch is operated, a connection is made and the current flows through the second resistor. The change in signal voltage is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) to activate the flick wipe function.

## STEERING COLUMN ADJUSTMENT SWITCH

The instrument cluster supplies 2 reference voltages to the column adjustment switch.

The first reference voltage is supplied to the joystick switch. When the switch is moved to one of its 4 positions, the switch contact is completed and the reference voltage is passed through one of 4 different resistors with different values. The returned signal voltage is measured by the instrument cluster which determines the selected column adjust request. The instrument cluster outputs a supply to the steering column adjustment motor and energizes the applicable clutch solenoid to move the column to the desired position.

The second reference voltage is supplied to the auto/manual selection of the switch. When the switch is in the auto position, the reference voltage passes directly through the switch contacts and is measured by the instrument cluster. The instrument cluster outputs a message on the medium speed [CAN](#) bus to the driver seat module which responds with the recorded memory position setting. The instrument cluster then activates the column adjustment motor and clutch solenoids to move the column to the memorized position. When the switch is in the manual position the reference circuit is broken. The instrument cluster detects the broken circuit and allows manual operation of the column adjustment switch to move the column.

## HEATED STEERING WHEEL

The heated steering wheel receives a battery power supply via the [CJB](#). The heated steering wheel is controlled by the driver using a selection on the TSD. When the driver selects the heated steering wheel to be active, the request is passed from the TSD on the MOST ring to the information and entertainment module. The information and entertainment module converts the message into a medium speed [CAN](#) bus message which is passed to the [CJB](#). The [CJB](#) processes the request and allows the battery power supply to be passed via the slip ring assembly in the steering wheel to the heated steering wheel control module. The steering wheel module supplies power to the steering wheel heater element and also monitors the temperature via a [NTC \(negative temperature coefficient\)](#) temperature sensor incorporated into the heater element. The control module varies the power supply to the element to maintain the steering wheel rim at the optimum temperature.

## Component Description

### STEERING COLUMN MULTIFUNCTION SWITCHES

The steering column multifunction switches are situated on the steering column and consists of the wiper switch, the turn signal indicator/lighting switch and the trip computer switch.

The steering column adjustment switch is located in the steering column lower shroud on the [LH](#) side. The switch is a 4 position 'joystick' which controls reach and rake adjustment.

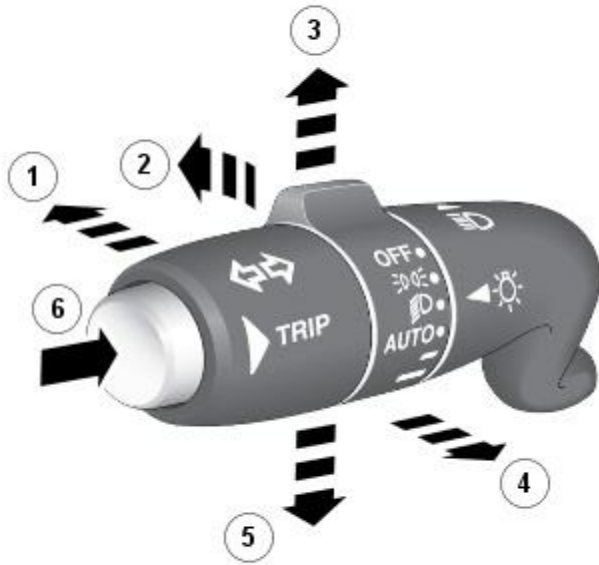


Steering wheel mounted switches on the [LH](#) side of the driver's airbag, control the audio and telephone functions. Switches on the [RH](#) side of the driver's airbag, control the speed control functions. For additional information, refer to:

- [Audio System](#) (415-01 Information and Entertainment System, Description and Operation),
- [Speed Control](#) (310-03A, Description and Operation),
- [Speed Control](#) (310-03B, Description and Operation),
- [Speed Control](#) (310-03 Speed Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

Two transmission paddle switches are located at the rear of the steering wheel. Refer to: [External Controls - Vehicles With: ZF 6HP26](#) (307-05 Automatic Transmission/Transaxle External Controls, Description and Operation).

**LH Multifunction Switch**



E97751

**ItemDescription**

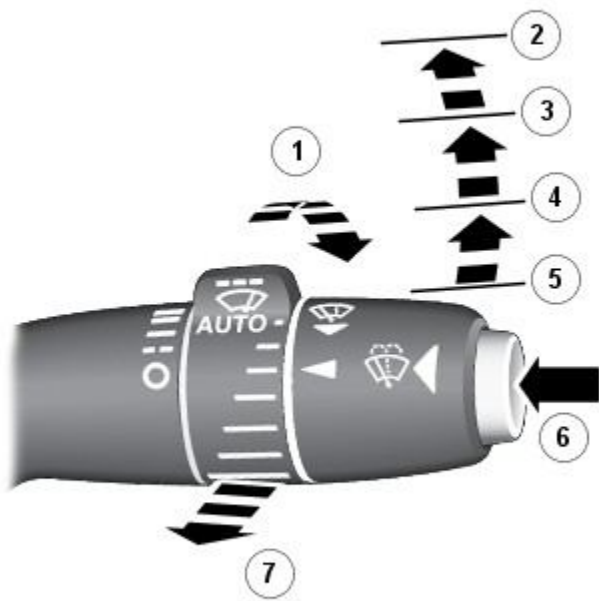
1	High beam
2	Lighting control rotary switch
3	<a href="#">RH</a> turn signal indicator
4	Headlamp flash
5	<a href="#">LH</a> turn signal indicator
6	Trip computer function button

The [LH](#) multifunction switch controls the following windshield wiper functions:

- Turn signal indicators
- Side lamps
- Headlamps
- Auto lamps
- High/low beam
- Headlamp flash
- Headlamp timer
- Trip computer.

The switch is located in a slot in the clockspring and secured with 2 plastic clips.

**RH Multifunction Switch**



E97752

**ItemDescription**

1	Auto/intermittent rotary switch
2	Fast wipe
3	Slow wipe
4	Intermittent wipe
5	Off position
6	Wash/wipe
7	Flick wipe

The RH multifunction switch controls the following windshield wiper functions:

- Flick wipe
- Intermittent wipe
- Slow speed wipe
- High speed wipe
- Wash/Wipe
- Headlamp powerwash
- Rain sensing / variable wipe selection.

The switch is located in a slot in the clockspring and secured with 2 plastic clips.

**STEERING COLUMN ADJUSTMENT SWITCH**

The column adjustment switch is located in the steering column lower shroud and held in place with a spring clip. The switch allows the adjustment of the steering column for both reach and rake angle. The switch has an auto position which allows the desired position of the column to be set by the driver using the driver's seat memory buttons. The column position is automatically reset once the applicable remote handset has been detected by the vehicle security systems.

**STEERING WHEEL HEATER**

On certain models the rim of the steering wheel contains a heater element. Operation of the heater is selected using the Touch Screen Display (TSD).

The heater temperature is controlled by a heated steering wheel control module located within the steering wheel. Power for the heater element is supplied to the steering wheel via 2 contacts on the clockspring and a slip ring mounted on the steering wheel.



# Steering Column Switches - Steering Column Switches

Diagnosis and Testing

## Principle of Operation

For a detailed description of the steering column lock and switches, refer to the relevant Description and Operation section in the workshop manual. REFER to: (211-05 Steering Column Switches)

[Steering Column Switches](#) (Description and Operation),  
[Steering Column Switches](#) (Description and Operation),  
[Steering Column Switches](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Switches</li> <li>● Steering column lock</li> </ul>	<ul style="list-style-type: none"> <li>● Fuse(s)</li> <li>● Electrical connector(s)</li> <li>● Wiring Harness</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for DTCs and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

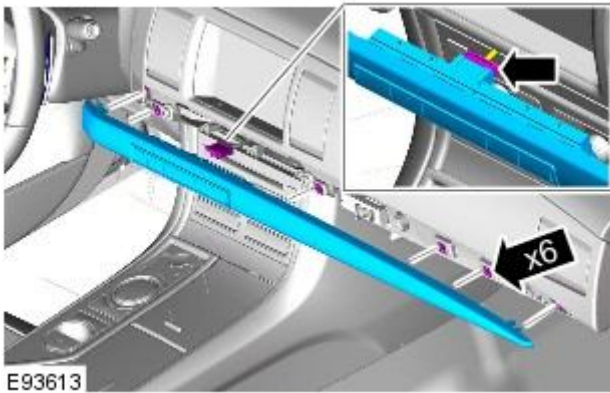
DTC	Description	Possible Cause	Action
B100D51	Column lock authorisation	<ul style="list-style-type: none"> <li>● Not programmed</li> </ul>	Check ignition, power and ground supplies to steering column lock and instrument cluster. Re-synchronise ID by re-configuring the steering column lock as a new module
B100D62	Column lock authorisation - signal compare failure	<ul style="list-style-type: none"> <li>● CAN fault</li> <li>● Steering column lock fault</li> <li>● Instrument cluster fault</li> <li>● Incorrect module installed (Steering column lock/Instrument cluster)</li> <li>● Target ID synchronisation error following re-programming</li> <li>● Noise/EMC related error</li> </ul>	Check CAN network between steering column lock and instrument cluster. Check power and ground supplies to steering column lock and instrument cluster. Confirm the correct modules are installed. Re-synchronize ID by re-configuring the steering column lock as new. Check CAN network for interference/EMC related issues
B100D64	Column lock authorisation - signal plausibility failure	<ul style="list-style-type: none"> <li>● CAN fault</li> <li>● Steering column lock fault</li> <li>● Instrument cluster fault</li> </ul>	Check CAN network to steering column lock. Check power and ground supplies to steering column lock and instrument cluster
B100D87	Column lock authorisation - missing message	<ul style="list-style-type: none"> <li>● CAN fault</li> <li>● Steering column lock fault</li> <li>● Instrument cluster fault</li> <li>● Low voltage at steering column lock &lt; 8V</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check CAN network between steering column lock and instrument cluster. Check power and ground supplies to steering column lock and instrument cluster

# Steering Column Switches - Hazard Flasher Switch

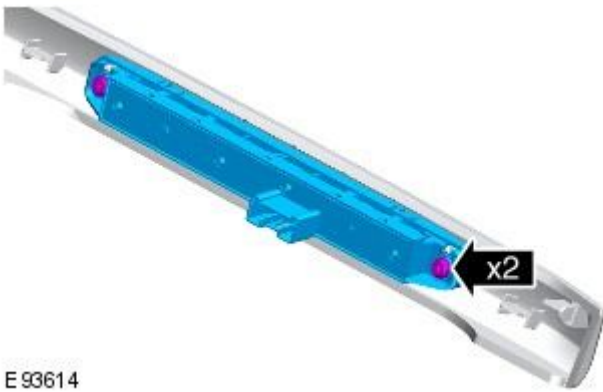
Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.



1. NOTE: When removing the component, some of the clips may remain attached. These clips should be removed and returned to their original positions in the instrument panel.



- 2.

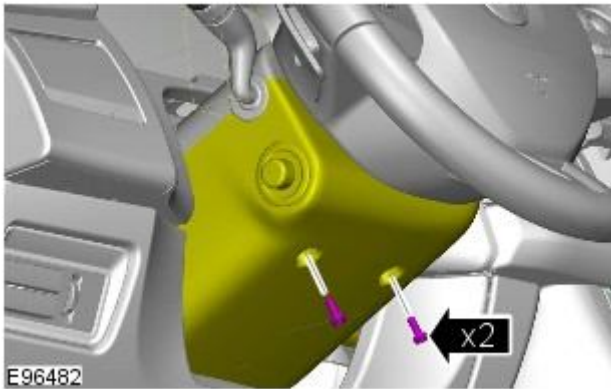
## Installation

1. To install, reverse the removal procedure.

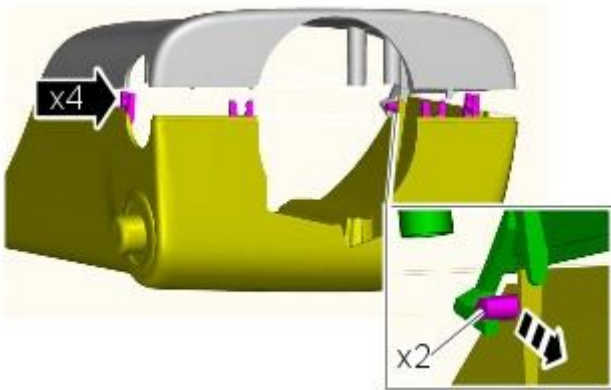
# Steering Column Switches - Steering Column Multifunction Switch LH

Removal and Installation

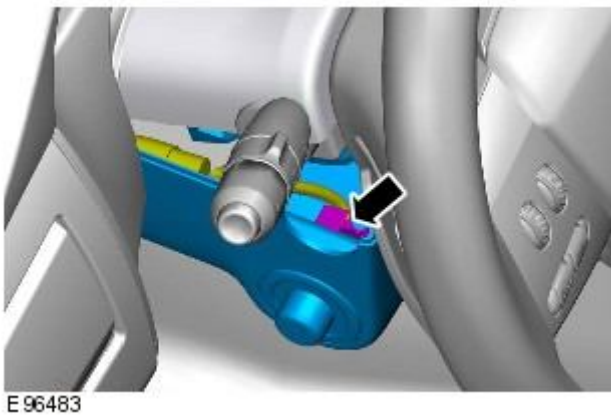
## Removal



1.

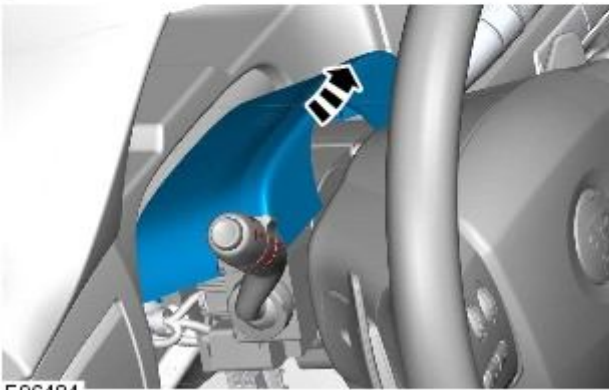
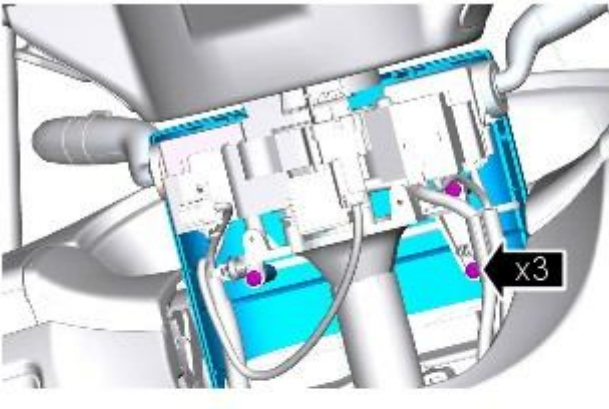


2.



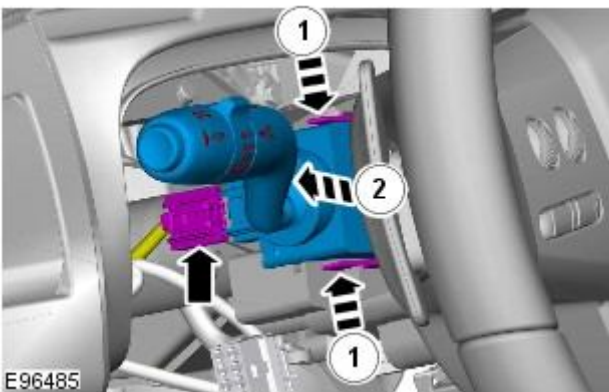
E 96483

3.



E96484

4.



E96485

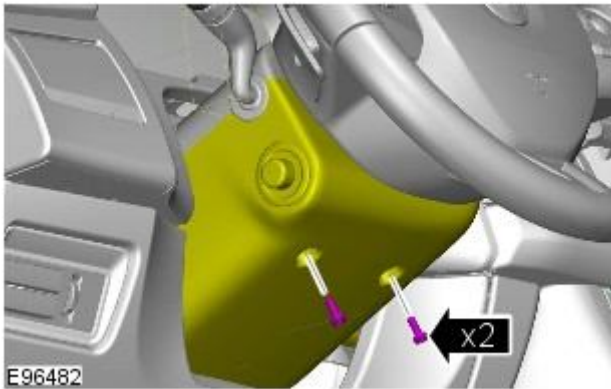
## Installation

1. To install, reverse the removal procedure.

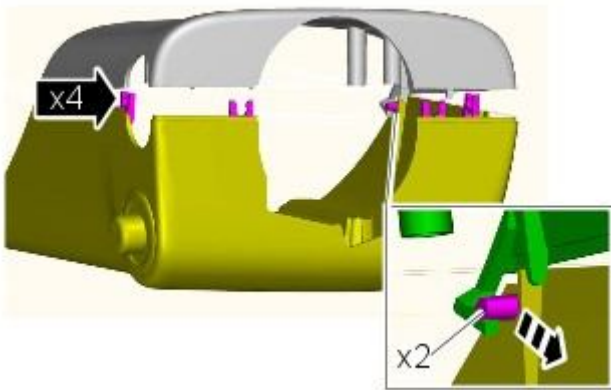
# Steering Column Switches - Steering Column Multifunction Switch RH

Removal and Installation

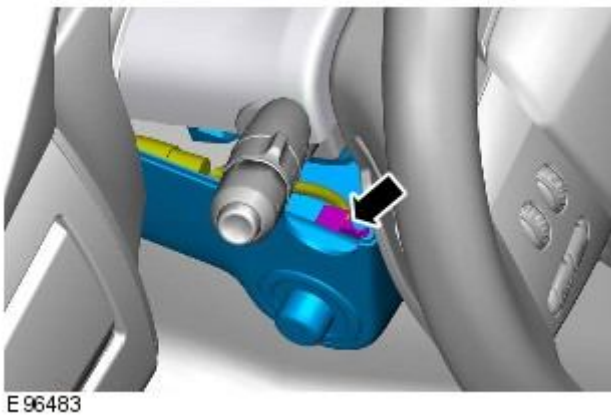
## Removal



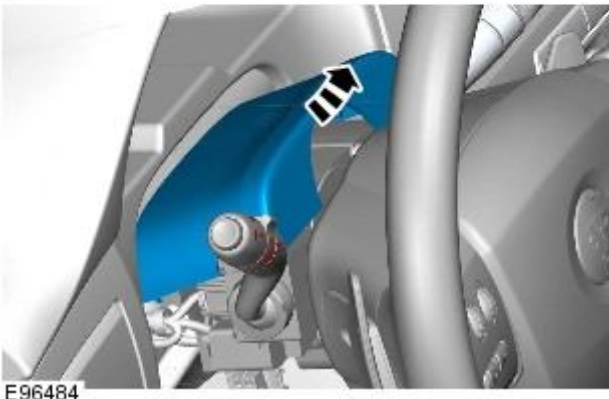
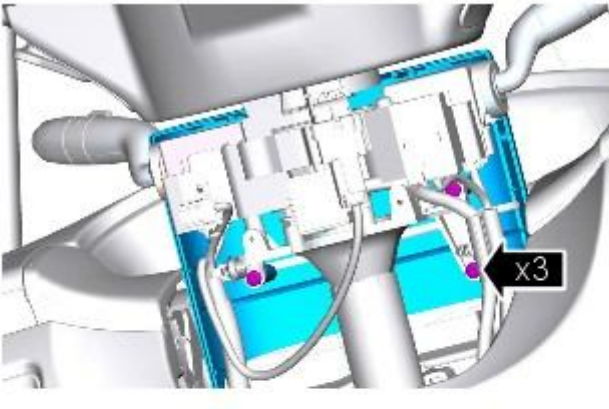
1.



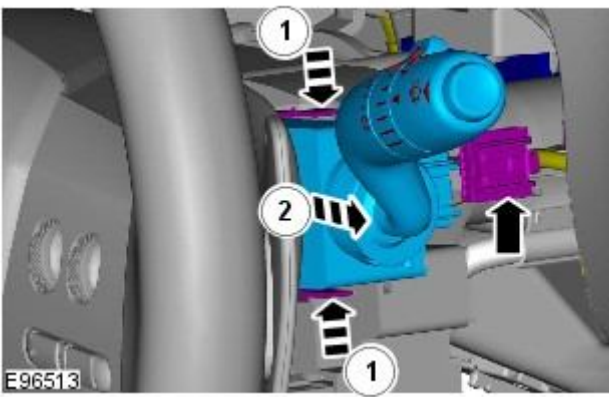
2.



3.



4.



## Installation

1. To install, reverse the removal procedure.

# Steering Column Switches - Steering Column Lock Actuator

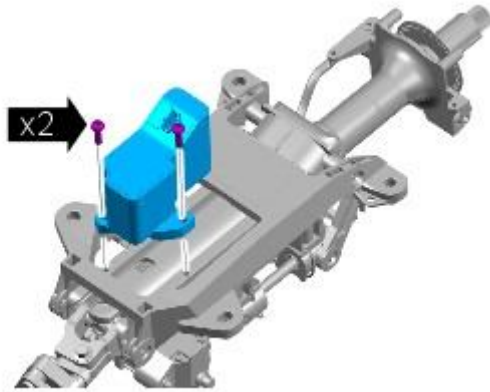
Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Steering Column](#) (211-04 Steering Column, Removal and Installation).

3. Torque: 12 Nm



E100063

## Installation

1. To install, reverse the removal procedure.



# Engine System - General Information - Engine3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Diagnosis and Testing

## Principle of Operation

For a detailed description of the 4.2L/3.0L engines, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

[Engine](#) (303-01A Engine - 4.2L NA V8 - AJV8, Description and Operation),  
[Engine](#) (303-01A Engine - 4.2L NA V8 - AJV8, Description and Operation),  
[Engine](#) (303-01A Engine - 4.2L NA V8 - AJV8, Description and Operation),  
[Engine](#) (303-01B Engine - 4.2L SC V8 - AJV8, Description and Operation),  
[Engine](#) (303-01B Engine - 4.2L SC V8 - AJV8, Description and Operation),  
[Engine](#) (303-01B Engine - 4.2L SC V8 - AJV8, Description and Operation).

## Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>○ Coolant leaks</li> <li>○ Oil leaks</li> <li>○ Leaks in the fuel system</li> <li>○ Visibly damaged or worn parts</li> <li>○ Loose or missing fixings</li> </ul>	<ul style="list-style-type: none"> <li>○ Fuses</li> <li>○ Loose or corroded electrical connectors</li> <li>○ Harnesses</li> <li>○ Sensors</li> </ul>

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

## Symptom Chart

• NOTE: If an engine is suspect, and the vehicle remains under the Manufacturers warranty refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new engine.

• NOTE: Due to the possibility of loose carbon, that has become trapped between the valve face and seat, effecting the pressure readings, when carrying out a compression test and some cylinders are found to have low pressures, install the spark plugs, road test the vehicle and re-test the suspect cylinders. If the correct pressures are restored, no further action is required.

Symptom	Action
All engine related issues	<ul style="list-style-type: none"> <li>● Check ECM for Diagnostic Trouble Codes (DTCs) and refer to DTC Index. REFER to: <a href="#">Electronic Engine Controls</a> (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> </ul>
Difficult to start hot and cold	<ul style="list-style-type: none"> <li>● Carry out general engine checks: <ul style="list-style-type: none"> <li>- Compression test. Refer to component tests in this section.</li> <li>- Valve clearances</li> <li>- Spark plug condition and color</li> </ul> </li> </ul>
Poor idle	<ul style="list-style-type: none"> <li>● Ensure the air intake system is free from leaks</li> <li>● Carry out general engine checks: <ul style="list-style-type: none"> <li>- Compression test. Refer to component tests in this section.</li> <li>- Valve clearances</li> <li>- Spark plug condition and color</li> </ul> </li> <li>● Check for collapsed catalytic converter/blocked exhaust system</li> <li>● Check long and short term fuel trim datalogger signals <ul style="list-style-type: none"> <li>- Readings up to 10%: may be considered as acceptable if the readings are equal bank to bank</li> <li>- Positive readings of between 10-20%: check for air leaks in air intake system</li> <li>- Negative readings of between 10-20%: check for over fuelling e.g. leaking injectors, high fuel pressure</li> <li>- Readings above 20%: check for DTCs and refer to DTC Index. REFER to: <a href="#">Electronic Engine Controls</a> (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> </ul> </li> <li>● Carry out a vacuum gauge check. Refer to component tests in this section</li> </ul>
Insufficient power/Insufficient compression	<ul style="list-style-type: none"> <li>● Ensure the air intake system is free from leaks</li> <li>● Carry out general engine checks: <ul style="list-style-type: none"> <li>- Compression test. Refer to component tests in this section.</li> <li>- Valve clearances</li> <li>- Spark plug condition and color</li> </ul> </li> <li>● Check for collapsed catalytic converter/blocked exhaust system</li> <li>● Check long and short term fuel trim datalogger signals <ul style="list-style-type: none"> <li>- Readings up to 10%: may be considered as acceptable if the readings are equal</li> </ul> </li> </ul>



Symptom	Action
	bank to bank - Positive readings of between 10-20%: check for air leaks in air intake system - Negative readings of between 10-20%: check for over fuelling e.g. leaking injectors, high fuel pressure - Readings above 20%: check for DTCs and refer to DTC Index. REFER to: <a href="#">Electronic Engine Controls</a> (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing). ● Carry out a vacuum gauge check. Refer to component tests in this section
Oil consumption	● Carry out oil leak check followed by an oil consumption test. Refer to the component tests in this section ● If oil consumption is excessive: ● Check the integrity of the engine breather system ● Carry out general engine checks: - Compression test. Refer to component tests in this section. - Valve clearances - Spark plug condition and color
Noise	● Refer to the Special Service Messages on the Electronic Product Quality Report (EPQR) system for sound files. If the symptom does NOT compare to any of the sound files, contact Dealer Technical Support (DTS)

## Component Tests

### Engine Oil Leaks

- NOTE: Before installing new gaskets or oil seals, make sure that the fault is clearly established.

If the oil leak cannot be identified clearly by a visual inspection, carry out an Ultraviolet test:

#### Fluorescent Oil Additive Method

1. Clean the engine with a suitable cleaning fluid (brake cleaner).
2. Drain the engine oil and refill with recommended oil, premixed with Diesel Engine Oil Dye or equivalent. Use a minimum 14.8 ml (0.5 ounce) to a maximum 29.6 ml (1 ounce) of fluorescent additive to all engines. If oil is not premixed, fluorescent additive must first be added to the crankcase.
3. Run engine for 15 minutes. Stop the engine and inspect all seal and gasket areas for leaks using a 12 Volt Master UV Diagnostic Inspection Kit or equivalent. A clear bright yellow or orange area will identify leak. For extremely small leaks, several hours may be required for the leak to appear.
4. As necessary, pressurize the main oil gallery system to locate leaks due to incorrectly sealed, loose or cocked plugs. If the flywheel bolts leak oil, look for sealer on the threads.
5. Repair all leaks as necessary.

### Compression Test

#### General Remarks

• NOTE: Removing fuses and disconnecting electrical components may cause the Engine Control Module (ECM) to log Diagnostic Trouble Codes (DTCs). After the measurements have been carried out, DTCs should be cleared from memory by connecting to the Manufacturer Approved Diagnostic System.

- NOTE: Only check the compression pressure with the valves set to the prescribed clearance (if this can be adjusted).

The compression pressure should be checked with the engine at normal operating temperature.

#### Check the Compression Pressure



**WARNING:** Move gear selector lever to 'P' position. Failure to follow this instruction may result in personal injury.

1. Remove the fuel pump relay.
2. Start the engine - the engine will start, run for a few seconds then stall.
3. Remove the spark plugs.
4. Install the compression tester.
5. Install an auxiliary starter switch in the starting circuit. With the ignition switch OFF, using the auxiliary starter switch, crank the engine a minimum of five compression strokes and record the highest reading. Note the approximate number of compression strokes required to obtain the highest reading.
6. Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.
7. Install the removed components in reverse order, observing the specified tightening torques.
8. Clear all DTCs from the ECM.

### Interpretation of the Results

• **NOTE:** Due to the possibility of loose carbon that has become trapped between the valve face and seat effecting the pressure readings, when carrying out a compression test and cylinders are found to have low pressures, install the spark plugs, road test the vehicle and re-test the suspect cylinders. If the correct pressures are restored, no further action is required.

The indicated compression pressures are considered within specification if the lowest reading cylinder is within 75% of the highest reading.

If the cylinder pressures are found to be low, carry out a leakdown test to determine the location of the fault (if any leakback can be heard through the engine breather system suspect the piston rings, if any leakback can be heard through the inlet system suspect the inlet valve or seat, if any leakback can be heard through the exhaust manifold suspect the exhaust valve or seat. If the measurements for two cylinders next to each other are both too low then it is very likely that the cylinder head gasket between them is burnt through. This can also be recognized by traces of engine oil in the coolant and/or coolant in the engine oil).

## Oil Consumption Test

The amount of oil an engine uses will vary with the way the vehicle is driven in addition to normal engine-to-engine variation. This is especially true during the first 16,100 km (10,000 miles) when a new engine is being broken in or until certain internal components become conditioned. Vehicles used in heavy-duty operation may use more oil. The following are examples of heavy-duty operation:

- Trailer towing applications
- Severe loading applications
- Sustained high speed operation

Engines need oil to lubricate the following internal components:

- Cylinder block cylinder walls
- Pistons and piston rings
- Intake and exhaust valve stems
- Intake and exhaust valve guides
- All internal engine components

When the pistons move downward, a thin film of oil is left on the cylinder walls. As the vehicle is operated, some oil is also drawn into the combustion chambers past the intake and exhaust valve stem seals and burned.

The following are examples of conditions that can affect oil consumption rates:

- Engine size
- Operator driving habits
- Ambient temperatures
- Quality and viscosity of oil
- Engine is being run in an overfilled condition (check the oil level at least five minutes after a hot shutdown with the vehicle parked on a level surface. The oil level should not be above the top of the cross-hatched area and the letter "F" in FULL).

Operation under varying conditions can frequently be misleading. A vehicle that has been run for several thousand miles on short trips or in below-freezing ambient temperatures may have consumed a "normal" amount of oil. However, when checking the engine oil level, it may measure up to the full mark on the oil level indicator due to dilution (condensation and fuel) in the engine crankcase. The vehicle then might be driven at high speeds on the highway where the condensation and fuel boil off. The next time the engine oil is checked it may appear that a liter of oil was used in about 160 km (100 miles). Oil consumption rate is about one liter per 2,400 km (1,500 miles).

Make sure the selected engine oil meets Jaguar specification and the recommended API performance category "SG" and SAE viscosity grade as shown in the vehicle Owner's Guide. It is also important that the engine oil is changed at the intervals specified for the typical operating conditions.

The following diagnostic procedure is used to determine the source of excessive oil consumption.

• **NOTE:** Oil use is normally greater during the first 16,100 km (10,000 miles) of service. As mileage increases, oil use decreases. High speed driving, towing, high ambient temperature and other factors may result in greater oil use.

1. Define excessive consumption, such as the number of miles driven per liter of oil used. Also determine customers driving habits, such as sustained high speed operation, towing, extended idle and other considerations.
2. Verify that the engine has no external oil leaks as described under Engine Oil Leaks in this section.
3. Carry out an oil consumption test:
  - Run the engine to normal operating temperature. Switch engine OFF and allow oil to drain back for at least five minutes .
  - With vehicle parked on level surface, check the engine oil level.
  - If required, add engine oil to set level exactly to the FULL mark.
  - Record the vehicle mileage.
  - Instruct the customer to return for a level check after driving the vehicle as usual for 1,610 km (1000 miles).
  - Check the oil level under the same conditions and at the same location as the initial check.

• **NOTE:** If the oil consumption rate is unacceptable go to Step 4.

4. Check the Positive Crankcase Ventilation (PCV) system. Make sure the system is not plugged.
5. Check for plugged oil drain-back holes in the cylinder head and cylinder block.
6. If the condition still exists after carrying out the above tests go to step 9.
7. Carry out a cylinder compression test. Refer to the Compression Test procedure in this section. This can help

determine the source of oil consumption such as valves, piston rings or other areas.

8. Check valve guides for excessive guide clearance. Install new valve stem seals after verifying valve guide clearance.
9. Worn or damaged internal engine components can cause excessive oil consumption. Small deposits of oil on the tips of the spark plugs can be a clue to internal oil consumption.

### Intake Manifold Vacuum Test

Bring the engine to normal operating temperature. Connect a vacuum gauge or equivalent to the intake manifold. Run the engine at the specified idle speed.

The vacuum gauge should read between 51-74 kPa (15-22 in-Hg) depending upon the engine condition and the altitude at which the test is performed. Subtract 4.0193 kPa (1 in-Hg) from the specified reading for every 304.8 m (1,000 feet) of elevation above sea level.

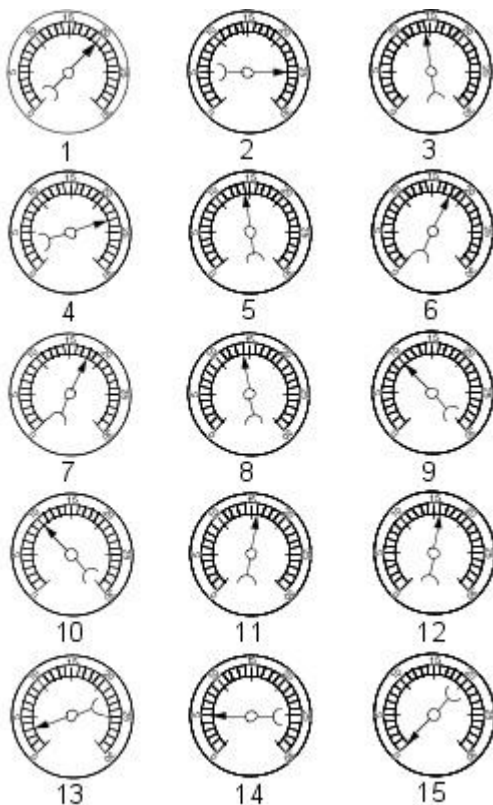
The reading should be steady. As necessary, adjust the gauge damper control (where used) if the needle is fluttering rapidly. Adjust damper until needle moves easily without excessive flutter.

### Interpreting Vacuum Gauge Readings

A careful study of the vacuum gauge reading while the engine is idling will help pinpoint trouble areas. Always conduct other appropriate tests before arriving at a final diagnostic decision. Vacuum gauge readings, although helpful, must be interpreted carefully.

Most vacuum gauges have a normal band indicated on the gauge face.

The following are potential gauge readings. Some are normal; others should be investigated further.



VUJ0001694

1. **NORMAL READING:** Needle between 51-74 kPa (15-22 in-Hg) and holding steady.
2. **NORMAL READING DURING RAPID ACCELERATION:** When the engine is rapidly accelerated, the needle will drop to a low (not to zero) reading. When the throttle is suddenly released, the needle will snap back up to a higher than normal figure.
3. **NORMAL FOR HIGH-LIFT CAMSHAFT WITH LARGE OVERLAP:** The needle will register as low as 51 kPa (15 in-Hg) but will be relatively steady. Some oscillation is normal.
4. **WORN RINGS OR DILUTED OIL:** When the engine is accelerated, the needle drops to 0 kPa (0 in-Hg). Upon deceleration, the needle runs slightly above 74 kPa (22 in-Hg).
5. **STICKING VALVES:** When the needle remains steady at a normal vacuum but occasionally flicks (sharp, fast movement) down and back about 13 kPa (4 in-Hg), one or more valves may be sticking.
6. **BURNED OR BENT VALVES:** A regular, evenly-spaced, downscale flicking of the needle indicates one or more burned or damaged valves. Insufficient hydraulic valve tappet or hydraulic lash adjuster clearance will also cause this reaction.
7. **POOR VALVE SEATING:** A small but regular downscale flicking can mean one or more valves are not seating

correctly.

8. **8. WORN VALVE GUIDES:** When the needle oscillates over about a 13 kPa (4 in-Hg) range at idle speed, the valve guides could be worn. As engine speed increases, the needle will become steady if guides are responsible.
9. **9. WEAK VALVE SPRINGS:** When the needle oscillation becomes more violent as engine RPM is increased, weak valve springs are indicated. The reading at idle could be relatively steady.
10. **10. LATE VALVE TIMING:** A steady but low reading could be caused by late valve timing.
11. **11. IGNITION TIMING RETARDED:** Retarded ignition timing will produce a steady but somewhat low reading.
12. **12. INSUFFICIENT SPARK PLUG GAP:** When spark plugs are gapped too close, a regular, small pulsation of the needle can occur.
13. **13. INTAKE LEAK:** A low, steady reading can be caused by an intake manifold or throttle body gasket leak.
14. **14. BLOWN HEAD GASKET:** A regular drop of fair magnitude can be caused by a blown head gasket or warped cylinder head to cylinder block surface.
15. **15. RESTRICTED EXHAUST SYSTEM:** When the engine is first started and is idled, the reading may be normal, but as the engine RPM is increased, the back pressure caused by a clogged muffler, kinked tail pipe or other concerns will cause the needle to slowly drop to 0 kPa (0 in-Hg). The needle then may slowly rise. Excessive exhaust clogging will cause the needle to drop to a low point even if the engine is only idling.

When vacuum leaks are indicated, search out and correct the cause. Excess air leaking into the system will upset the fuel mixture and cause concerns such as rough idle, missing on acceleration or burned valves. If the leak exists in an accessory such as the power brake booster, the unit will not function correctly. Always repair vacuum leaks.

# Engine System - General Information - EngineTDV6 2.7L Diesel

Diagnosis and Testing

## Principle of Operation

For a detailed description of the 2.7L Diesel engine, refer to the relevant Description and Operation section in the workshop manual. REFER to: (303-14A Electronic Engine Controls - TDV6 2.7L Diesel)

[Electronic Engine Controls](#) (Description and Operation),  
[Electronic Engine Controls](#) (Description and Operation),  
[Electronic Engine Controls](#) (Description and Operation).

## Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>○ Coolant level</li> <li>○ Coolant leaks</li> <li>○ Oil level</li> <li>○ Oil leaks</li> <li>○ Visibly damaged or worn parts</li> <li>○ Loose or missing nuts or bolts</li> </ul>	<ul style="list-style-type: none"> <li>○ Wiring harness</li> <li>○ Electrical connector(s)</li> <li>○ Injectors</li> <li>○ Glow plugs</li> <li>○ 5 volt sensor supply</li> <li>○ Sensor(s)</li> <li>○ Cooling fan control module and motor</li> <li>○ Engine Control Module (ECM)</li> </ul>

2. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
3. If the concern is not visually evident, verify the symptom and refer to the relevant Symptom Chart. Symptom Charts have been separated into **Leaks** and **Noise Vibration and Harshness (NVH)** for ease of use.

## Symptom Charts

### Symptom Chart, Leaks

Symptom	Possible Cause	Action
External coolant leaks	<ul style="list-style-type: none"> <li>● Damaged hose(s)</li> <li>● Damaged expansion tank</li> <li>● Damaged radiator</li> <li>● Leaking seals/gaskets</li> <li>● Cracked/damaged casings</li> </ul>	For cooling system checks, REFER to: <a href="#">Engine Cooling</a> (303-03A Engine Cooling - TDV6 2.7L Diesel, Diagnosis and Testing).
Internal coolant leaks Note: This may be indicated by the production of white smoke from the exhaust	<ul style="list-style-type: none"> <li>● Leaking seals/gaskets</li> <li>● Cracked/damaged casings</li> </ul>	For cooling system checks, REFER to: <a href="#">Engine Cooling</a> (303-03A Engine Cooling - TDV6 2.7L Diesel, Diagnosis and Testing).
Engine overheats	<ul style="list-style-type: none"> <li>● Insufficient coolant</li> <li>● Insufficient oil</li> <li>● Pressure cap fault</li> <li>● Thermostat not opening</li> <li>● Coolant pump failure</li> <li>● Cooling fan failure</li> </ul>	For cooling system checks, REFER to: <a href="#">Engine Cooling</a> (303-03A Engine Cooling - TDV6 2.7L Diesel, Diagnosis and Testing).
Engine takes too long to reach operating temperature	<ul style="list-style-type: none"> <li>● Thermostat stuck open</li> </ul>	For cooling system checks, REFER to: <a href="#">Engine Cooling</a> (303-03A Engine Cooling - TDV6 2.7L Diesel, Diagnosis and Testing).
External oil leaks	<ul style="list-style-type: none"> <li>● Gaskets</li> <li>● Seals</li> <li>● Oil pipes</li> <li>● Oil filter</li> <li>● Oil cooler</li> <li>● Damaged/cracked casings</li> <li>● Crankcase ventilation system</li> <li>● Piston ring blow-by</li> </ul>	Clean and confirm the area of the leak. Check the visual condition of oil carrying components. Check the crankcase ventilation system, REFER to: <a href="#">Engine Emission Control</a> (303-08A Engine Emission Control - TDV6 2.7L Diesel, Diagnosis and Testing). Carry out a compression test, GO to Pinpoint Test <a href="#">A</a> .
Internal oil leaks (leaks into coolant or combustion chamber) Note: This may be indicated by the production of blue smoke from the exhaust	<ul style="list-style-type: none"> <li>● Gaskets</li> <li>● Seals</li> <li>● Damaged/cracked casings</li> <li>● Worn valve guides</li> <li>● Worn cylinder bores/pistons</li> <li>● Broken piston rings</li> </ul>	Check for traces of oil in the coolant. Check for evidence of oil in the combustion chambers (deposits on the glow plugs, etc). Confirm oil consumption and vehicle usage with the owner/driver. Carry out an oil consumption test, GO to Pinpoint Test <a href="#">B</a> .

### Symptom Chart, NVH

• NOTE: As the checks suggested here are open to interpretation, they should be used as a guide only. Descriptions of noises, etc, are in general terms, so depend on a degree of experience on the part of the technician.


Symptom	Possible Cause	Action
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Symptom	Possible Cause	Action
Rattle/ticking from top of engine	<ul style="list-style-type: none"> <li>● Valve gear noise</li> <li>● Camshaft bearing noise</li> <li>● Camshaft chain noise</li> <li>● Tensioner noise</li> <li>● Vacuum pump noise</li> <li>● High pressure fuel pump noise</li> </ul>	Check the engine oil pressure, GO to Pinpoint Test <a href="#">C...</a> . Check the function of the hydraulic tappets and the camshaft condition. Check the camshaft bearings, chains and tensioners. Check the vacuum pump, and high pressure fuel pump
Growl from top of engine	<ul style="list-style-type: none"> <li>● High pressure fuel pump belt noise</li> <li>● High pressure fuel pump belt tensioner noise</li> </ul>	Check the high pressure fuel pump belt and tensioner
Squeaking/Creaking/Squeal from front of engine	<ul style="list-style-type: none"> <li>● Front End Accessory Drive (FEAD) belt</li> <li>● FEAD belt tensioner</li> <li>● Driven components on FEAD belt</li> </ul>	Check the FEAD belt and driven components, REFER to: <a href="#">Accessory Drive</a> (303-05A Accessory Drive - TDV6 2.7L Diesel, Diagnosis and Testing).
Whine/Slap/Growl from front of engine	<ul style="list-style-type: none"> <li>● Front End Accessory Drive (FEAD) belt</li> <li>● FEAD belt tensioner</li> <li>● Driven components on FEAD belt</li> <li>● Timing belt noise</li> <li>● Timing belt tensioner noise</li> </ul>	Check the FEAD belt and driven components. Check the timing belt and tensioners
Knock from lower half of engine (often worse with a cold engine)	<ul style="list-style-type: none"> <li>● Piston slap</li> <li>● Piston pin noise</li> <li>● Connecting rod bearing noise</li> </ul>	Check the engine oil pressure, GO to Pinpoint Test <a href="#">C...</a> . Check piston, cylinder bore, piston pin and connecting rod bearing for excess wear
Knock/Rumble from lower half of engine (often worse on overrun)	<ul style="list-style-type: none"> <li>● Main bearing noise</li> </ul>	Check the engine oil pressure, GO to Pinpoint Test <a href="#">C...</a> . Check connecting rod bearing for excess wear
Misfire/Rough running	<ul style="list-style-type: none"> <li>● Engine management system</li> <li>● Fuel charging and controls</li> <li>● Exhaust gas recirculation (EGR) system</li> <li>● Burnt/sticking valves</li> <li>● Worn valve guides</li> <li>● Worn cylinder bores/pistons</li> <li>● Broken piston rings</li> <li>● Damaged/cracked casings</li> </ul>	For engine management system tests, REFER to: Electronic Engine Controls - 2.7L Diesel (303-14A, Diagnosis and Testing). For fuel charging and controls systems tests, REFER to: <a href="#">Fuel Charging and Controls</a> (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Diagnosis and Testing), <a href="#">Turbocharger</a> (303-04B Fuel Charging and Controls - Turbocharger - TDV6 2.7L Diesel, Diagnosis and Testing). For EGR system tests, REFER to: <a href="#">Engine Emission Control</a> (303-08A Engine Emission Control - TDV6 2.7L Diesel, Diagnosis and Testing). Carry out a compression test, GO to Pinpoint Test <a href="#">A...</a> Check for excess wear in engine components

## Pinpoint Tests

• NOTE: Where reference is made to 'suitable equipment', this refers to standard workshop equipment. Refer to the operating instructions for your own equipment when performing any tests.

### PINPOINT TEST A : CHECK THE CYLINDER COMPRESSIONS

 **WARNING:** Only compression testers able to read the higher compression pressures found in diesel engines should be used. Failure to follow this instruction may result in personal injury.

• NOTE: Where possible, compression testing should be carried out on an engine at operating temperature.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>A1: CARRY OUT A DRY CYLINDER COMPRESSION TEST</b>	
<b>1</b>	Make sure the parking brake is applied and that the selector lever is in park.
<b>2</b>	Set the ignition status to <b>OFF</b> .
<b>3</b>	Remove the starter relay.
<b>4</b>	Disconnect the starter motor solenoid connector.
<b>5</b>	Connect a suitable remote starter device to the starter motor solenoid.
<b>6</b>	Remove the glow plugs, REFER to: <a href="#">Glow Plugs - 2.7L V6 - TdV6</a> (303-07C Glow Plug System, Removal and Installation).
<b>7</b>	Install adaptor 303-1131 in place of the glow plug in the first cylinder to be tested.
<b>8</b>	Connect a suitable compression tester to the adaptor. See warning above.
<b>9</b>	Using the remote starter device, crank the engine a minimum of five revolutions.
<b>10</b>	Record the compression figure and the number of revolutions taken to reach it.
<b>11</b>	Repeat steps 7 - 10 above for the remaining cylinders, cranking the engine for a similar number of revolutions each time.
<b>12</b>	Compare the compression figures across all the cylinders.
	Are the compression figures within 10% of each other?
<b>Yes</b>	Unless the compression figures are universally very low (experience will indicate this), check for other causes for the customer complaint.
<b>No</b>	<a href="#">GO to A2.</a>
<b>A2: CARRY OUT A WET CYLINDER COMPRESSION TEST</b>	



**CAUTION:** If engine oil is introduced into the cylinders, run the engine at 2,000 rpm for a minimum of ten minutes after completing testing to prevent damage to the catalytic converters. Failure to follow this instruction may result in damage to the vehicle.

• **NOTE:** There is a combustion chamber in the top of each piston. Make sure that the oil is not allowed to run into this chamber.

<b>1</b>	Using a suitable oil can with a flexible spout, introduce a small amount of clean engine oil into the cylinder just before testing, such that the oil is able to run between the piston and the cylinder bore.
<b>2</b>	Repeat steps 7 - 10 from the test above, introducing oil into each cylinder just before testing.
<b>3</b>	Compare the compression figures across all the cylinders.
Is the compression figure higher than the dry test?	
<b>Yes</b> A higher figure following the introduction of oil may indicate a worn or damaged cylinder bore, piston and/or piston rings. Disassembly would be required to confirm this.	
<b>No</b> If the compression figure is unaffected by the introduction of oil, but the figure is still less than 90% of the other cylinders, this may indicate a burnt and/or sticking valve, leaking head gasket, etc. Disassembly would be required to confirm this. Clear any DTCs which may have been induced by the test.	

**PINPOINT TEST B : OIL CONSUMPTION TEST**

• **NOTE:** Oil consumption will vary, depending on a number of factors. New engines will normally use more oil than 'run-in' engines, although a guideline would be to expect 16,000 Km (10,000 miles) per liter.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>B1: CHECK FOR EXCESSIVE OIL CONSUMPTION</b>	
<b>1</b>	Start the engine and allow it to run until it reaches normal operating temperature.
<b>2</b>	Make sure the vehicle is parked on a level surface and set ignition status to <b>OFF</b> .
<b>3</b>	Allow to settle for at least five minutes.
<b>4</b>	Check the oil level.
<b>5</b>	Correct the level, if necessary, and record the reading and mileage in the vehicle history.
<b>6</b>	Make sure that the owner/driver is aware that a test is being carried out, and that they should not top-up their oil level for the duration of the test, but should check the level every 160-240 Km (100-150 miles).
<b>7</b>	When the oil level reaches the <b>ADD</b> mark, the customer should bring the vehicle in to be checked.
<b>8</b>	Top-up the oil to the level at the beginning of the test and record the amount of oil needed to do so, and the mileage covered in the course of the test.
<b>9</b>	From this, the consumption can be calculated, and a decision made as to whether or not the consumption is considered excessive.
Is the consumption excessive for the mileage and/or use?	
<b>Yes</b> Disassembly will be required to check the components indicated in the symptom chart.	
<b>No</b> No further action is required.	

**PINPOINT TEST C : CHECK THE ENGINE OIL PRESSURE**

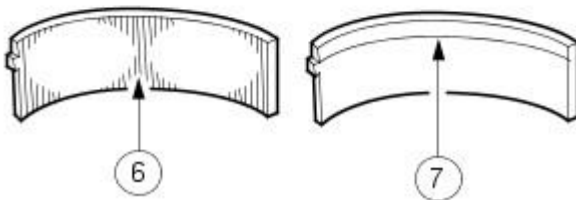
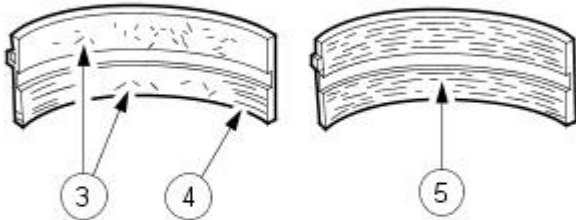
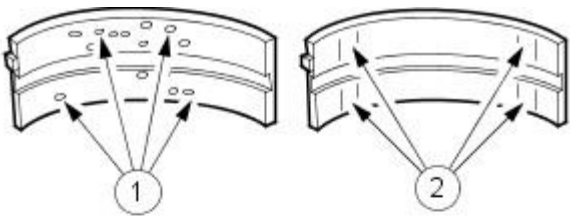
• **NOTE:** Check and, if necessary, top-up the engine oil level before beginning this test.

• **NOTE:** Where reference is made to 'suitable equipment', this refers to standard workshop equipment. Refer to the operating instructions for your own equipment when performing any tests.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>C1: CHECK FOR LOW ENGINE OIL PRESSURE</b>	
<b>1</b>	Remove the oil pressure sensor, REFER to: <a href="#">Engine Oil Pressure (EOP) Sensor</a> (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Removal and Installation).
<b>2</b>	Connect a suitable oil pressure gauge in place of the oil pressure sensor.
<b>3</b>	Start the engine and check for leaks at the gauge connection.
<b>4</b>	Allow the engine to idle and monitor the oil pressure.
<b>5</b>	Raise the engine speed to 2,500 rpm and monitor the oil pressure.
Is the oil pressure less than 0.50 bar (7.25 psi) between idle and 2,500 rpm?	
<b>Yes</b> <a href="#">GO to C2.</a>	
<b>No</b> <a href="#">GO to C3.</a>	
<b>C2: CHECK FOR LOW ENGINE OIL PRESSURE AT ENGINE SPEEDS GREATER THAN 2,500 RPM</b>	
<b>1</b>	Raise the engine speed to above 2,500 rpm and monitor the oil pressure.
Is the oil pressure less than 1.0 bar (14.5 psi) at engine speeds greater than 2,500 rpm?	
<b>Yes</b> Pressure this low may indicate a problem with: oil pump, filtering, clearances within the engine. Check if there are any other indications of engine faults (noise, etc), refer to the symptom chart above.	
<b>No</b> <a href="#">GO to C3.</a>	
<b>C3: CHECK FOR HIGH ENGINE OIL PRESSURE</b>	
<b>1</b>	Monitor the engine oil pressure at varying engine speeds.
Does the oil pressure reach 4.0 bar (58 psi)?	
<b>Yes</b> Pressure this high may indicate a blockage in the lubrication system. If this is not resolved, high oil pressure will lead to engine oil leaks and other failures.	
<b>No</b> If the oil pressure stays in the band between 0.50 bar (7.25 psi) and 1.0 bar (14.5 psi) this would be considered normal.	

# Engine System - General Information - Bearing Inspection

General Procedures



1. Inspect bearings for the following defects.

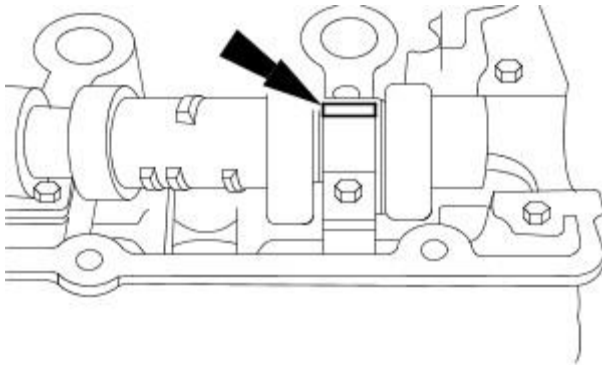
1. Cratering - fatigue failure
2. Spot polishing - incorrect seating.
3. Imbedded dirt engine oil.
4. Scratching - dirty engine oil.
5. Base exposed - poor lubrication.
6. Both edges worn - journal damaged.
7. One edge worn - journal tapered or bearing not seated.

VUJ0002219



# Engine System - General Information - Camshaft Bearing Journal Clearance

General Procedures



VUJ0001696

**1. NOTE:** Make sure that the following stages are followed exactly. The tappets or followers must be removed to carry out this measurement.

- **NOTE:** Make sure that the camshaft is to specification.
- **NOTE:** The bearing caps and journals should be free from engine oil and dirt.

Position on a length of plastigage on the bearing cap.

- Insert the camshaft, without lubrication, into the cylinder head.
- Position a plastigage strip, which should be equal to the width of the bearing cap, on the bearing journal.

**2.** Install the camshaft bearing caps.

- Follow the relevant tightening sequence.

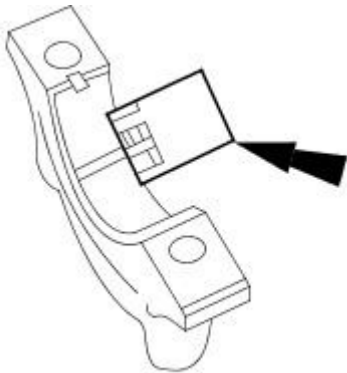
**3. NOTE:** Do not strike the bearing caps.

Remove the camshaft bearing caps.

- Follow the relevant loosening sequence.

**4.** Using the special tool, read off the measurement.

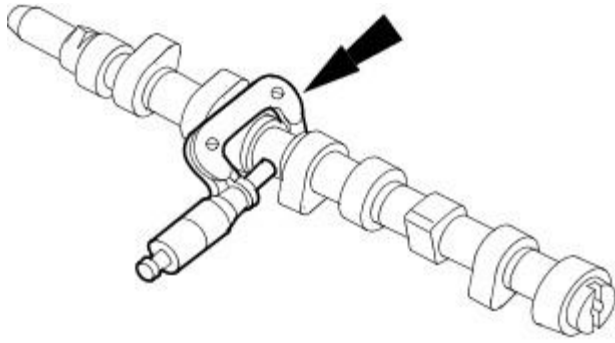
- Compare the width of plastigage with the plastigage scale.
- The value that is read off is the bearing clearance.
- If the values are not to specification install a new camshaft.



VUJ0001697

## Engine System - General Information - Camshaft Bearing Journal Diameter

General Procedures



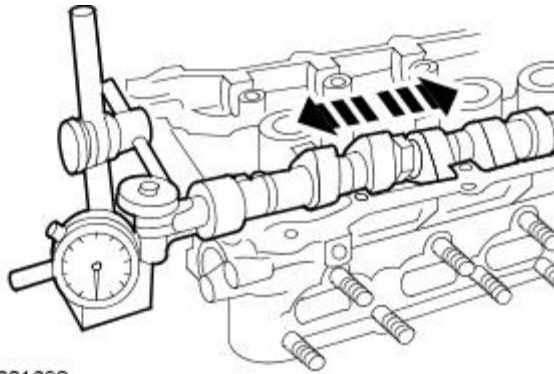
### 1. Determine the diameter of the camshaft journals.

- Using a micrometer measure the diameter at 90 degree intervals to determine if the journals are out-of-round.
- Measure at two different points on the journal to determine if there is any tapering.
- If the measurements are out of the specified range, install a new camshaft.

VUJ0001695

## Engine System - General Information - Camshaft End Play

General Procedures



VUJ0001698

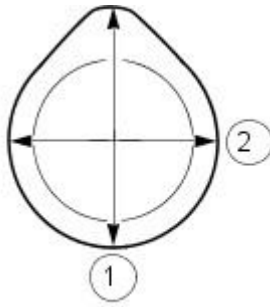
### 1. NOTE: Make sure that the camshaft is to specification.

Using the special tool, measure the end play.

- Slide the camshaft in both directions. Read and note the maximum and minimum values on the dial indicator gauge.
  1. End play = maximum value minus minimum value.
- If the measurement is out of specification, install new components.

## Engine System - General Information - Camshaft Lobe Lift

General Procedures

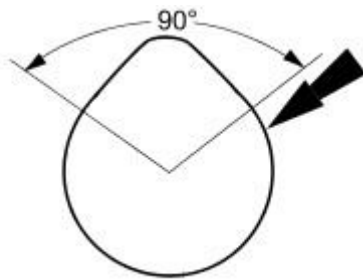


1. Measure the diameter (1) and diameter (2) with a vernier caliper. The difference in measurements is the lobe lift.

VUJ0001699

# Engine System - General Information - Camshaft Surface Inspection

General Procedures

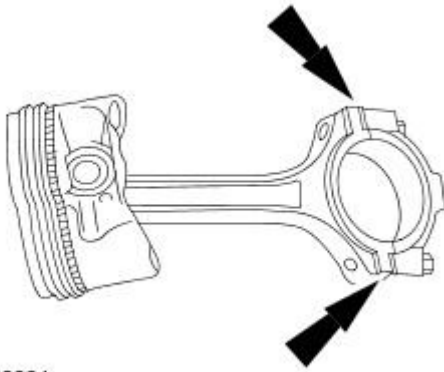


1. Inspect camshaft lobes for pitting or damage in the active area. Minor pitting is acceptable outside the active area.


VUJ0001700

## Engine System - General Information - Connecting Rod Cleaning

General Procedures



VUJ0002224

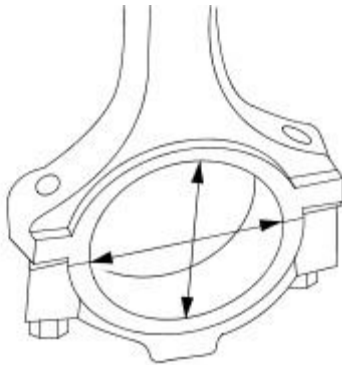
1.  CAUTION: Do not use a caustic cleaning solution or damage to connecting rods may occur.

Mark and separate the parts and clean with solvent. Clean the oil passages.

# Engine System - General Information - Connecting Rod Large End Bore

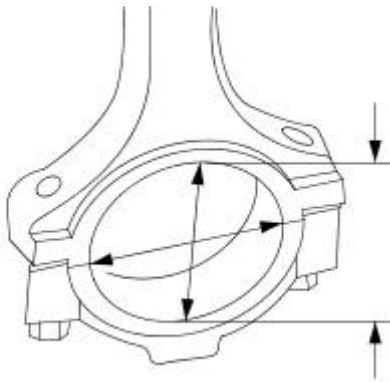
General Procedures

1. Measure the bearing bore in two directions. The difference is the connecting rod bore out-of-round. Verify the out-of-round is within specification.



VUJ0002223

2. Measure the bearing bore diameter in two directions. Verify the bearing bore is within specification.



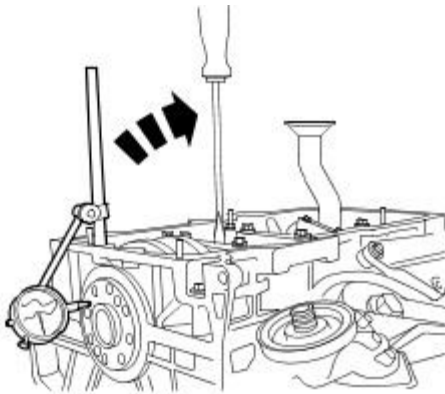
VUJ0002222

## Engine System - General Information - Crankshaft End Play

General Procedures

1. Using the Dial Indicator Gauge with Brackets, measure the end play.

- Measure the end play by lifting the crankshaft using a lever.
- If the value is out of the specification, install new thrust half rings to take up the end float and repeat the measurement.



VUJ0002235

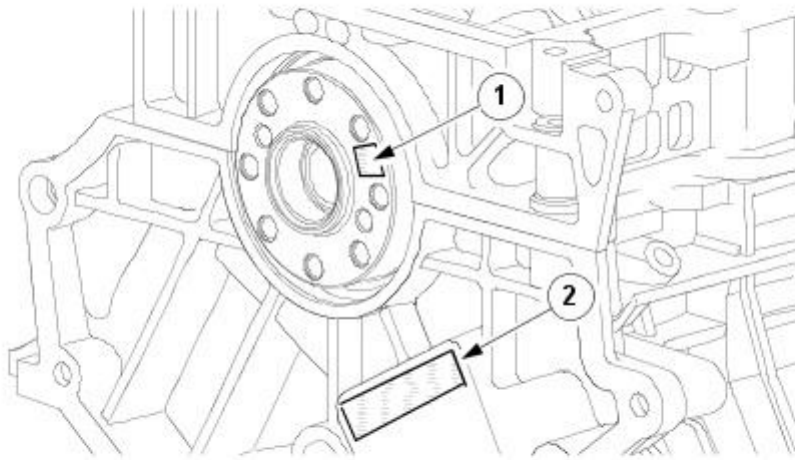


# Engine System - General Information - Crankshaft Main Bearing Journal ClearanceV6

## 3.0L Petrol

General Procedures

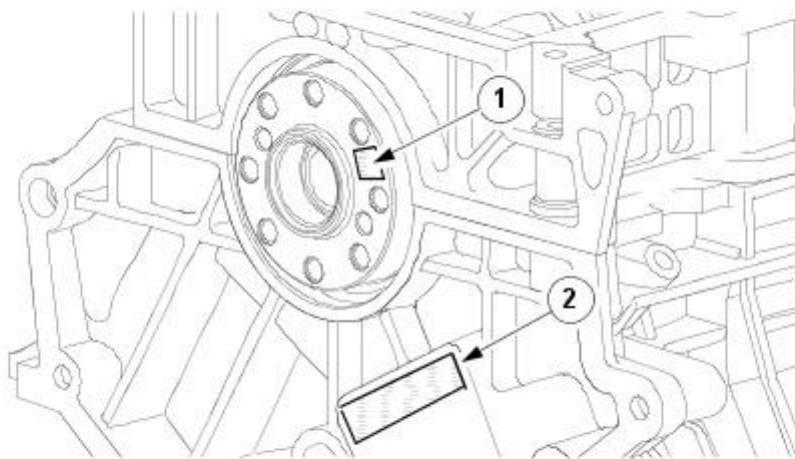
1. The main bearing machine codes are displayed on the crankshaft (1) and the cylinder block (2)



E53234

2. **NOTE:** Main bearing number 1 relates to the front of the engine.

Read the identification numbers from the crankshaft (1).

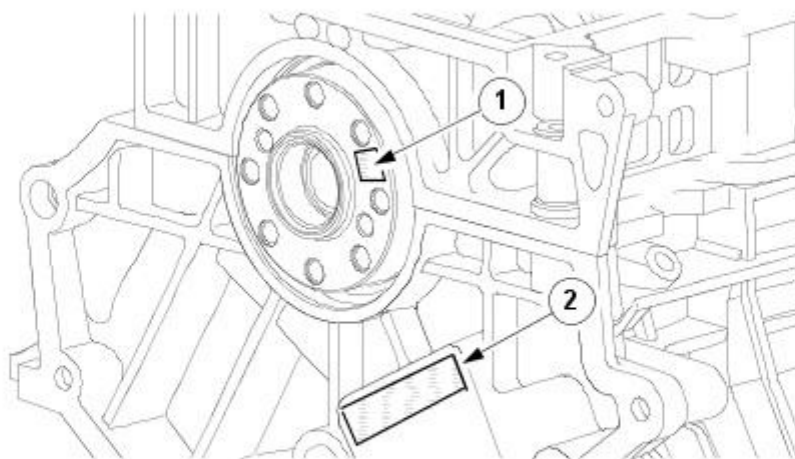


- The first two numbers represent the code for main bearing number 1.
- The second pair of numbers represents the code for main bearing number 2.
- The third pair of numbers represents the code for main bearing number 3.
- The last pair of numbers represents the code for main bearing number 4.

E53234

3. NOTE: Main bearing number 1 relates to the front of the engine.

Read the identification numbers on the cylinder block (2).



- The first two numbers represent the code for main bearing number 1.
- The second pair of numbers represents the code for main bearing number 2.
- The third pair of numbers represents the code for main bearing number 3.
- The last pair of numbers represents the code for main bearing number 4.

E53234

4. Using the select fit chart, for each main bearing match the crankshaft code (1) and the block code (2) with it's corresponding column or row. By reading across the crankshaft code row (1) and down the block code column (2) select the correct grade bearing for each main.

- 1 Crankshaft code.
- 2 Block code.

**2**

	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22
92	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
91	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
90	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2
89	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2
88	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
87	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
86	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
85	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
84	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3
83	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3
82	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
81	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3
80	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3
79	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3
78	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3
77	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3
76	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3
75	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
74	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3
73	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3
72	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
71	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
70	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
69	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
68	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

**1**

E53233

5. E.g. if the crankshaft code is \*8580\*8082\* and the Block code is \*0609\*0711\*, main bearing 1 should be assembled with a grade 1 bearing, as determined by the intersection of the number 06 block column (2) and the number 85 crankshaft row (1).

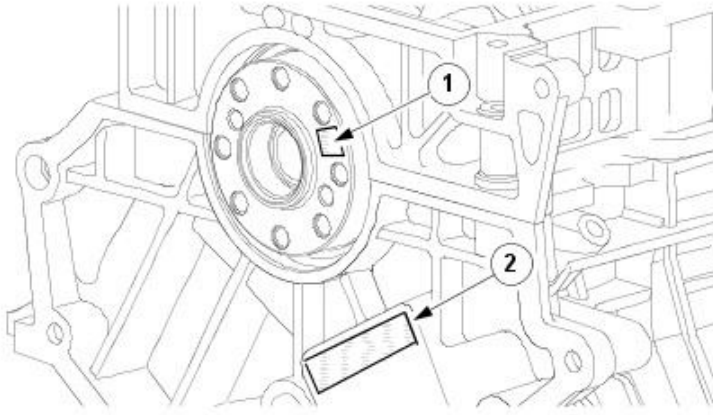
- Main bearing 2, 3 and 4 would all be assemble with a grade 2.

# Engine System - General Information - Crankshaft Main Bearing Journal Clearance

## 3.0L NA V6 - AJ27

General Procedures

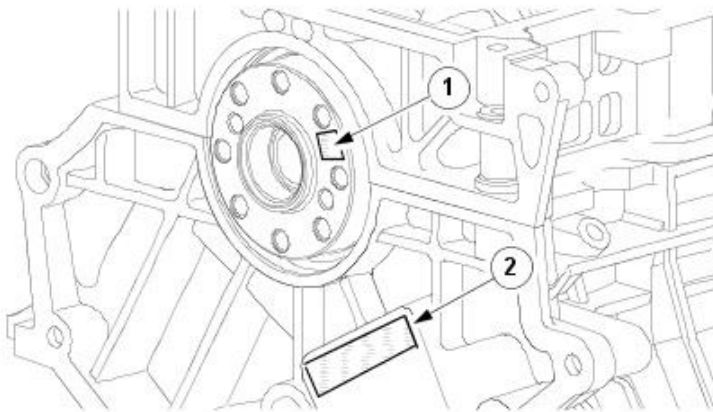
1. The main bearing machine codes are displayed on the crankshaft (1) and the cylinder block (2)



E53234

2. NOTE: Main bearing number 1 relates to the front of the engine.

Read the identification numbers from the crankshaft (1).

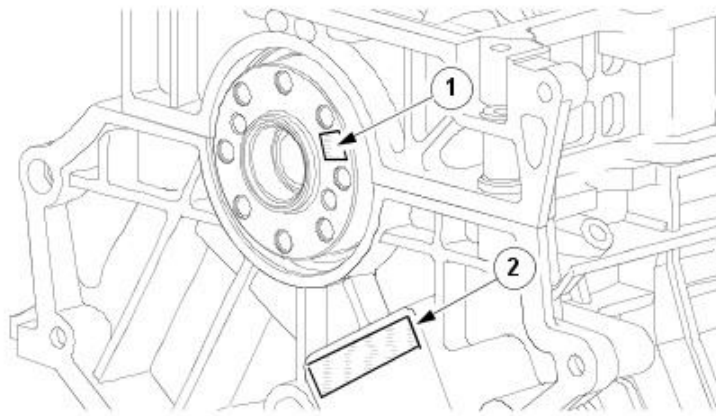


E53234

- The first two numbers represent the code for main bearing number 1.
- The second pair of numbers represents the code for main bearing number 2.
- The third pair of numbers represents the code for main bearing number 3.
- The last pair of numbers represents the code for main bearing number 4.

3. NOTE: Main bearing number 1 relates to the front of the engine.

Read the identification numbers on the cylinder block (2).



- The first two numbers represent the code for main bearing number 1.
- The second pair of numbers represents the code for main bearing number 2.
- The third pair of numbers represents the code for main bearing number 3.
- The last pair of numbers represents the code for main bearing number 4.

E53234

4. Using the select fit chart, for each main bearing match the crankshaft code (1) and the block code (2) with it's corresponding column or row. By reading across the crankshaft code row (1) and down the block code column (2) select the correct grade bearing for each main.

- 1 Crankshaft code.
- 2 Block code.

**2**

	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22
92	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
91	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
90	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
89	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
88	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
87	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
86	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
85	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
84	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3
83	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3
82	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3
81	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3
80	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3
79	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3
78	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3
77	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3
76	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3
75	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3
74	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3
73	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3
72	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3
71	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3
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69	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3
68	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3

**1**

E53233

5. E.g. if the crankshaft code is \*8580\*8082\* and the Block code is

\*0609\*0711\*, main bearing 1 should be assembled with a grade 1 bearing, as determined by the intersection of the number 06 block column (2) and the number 85 crankshaft row (1).

- Main bearing 2, 3 and 4 would all be assemble with a grade 2.



# Engine System - General Information - Crankshaft Main Bearing Journal Clearance

## 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

General Procedures

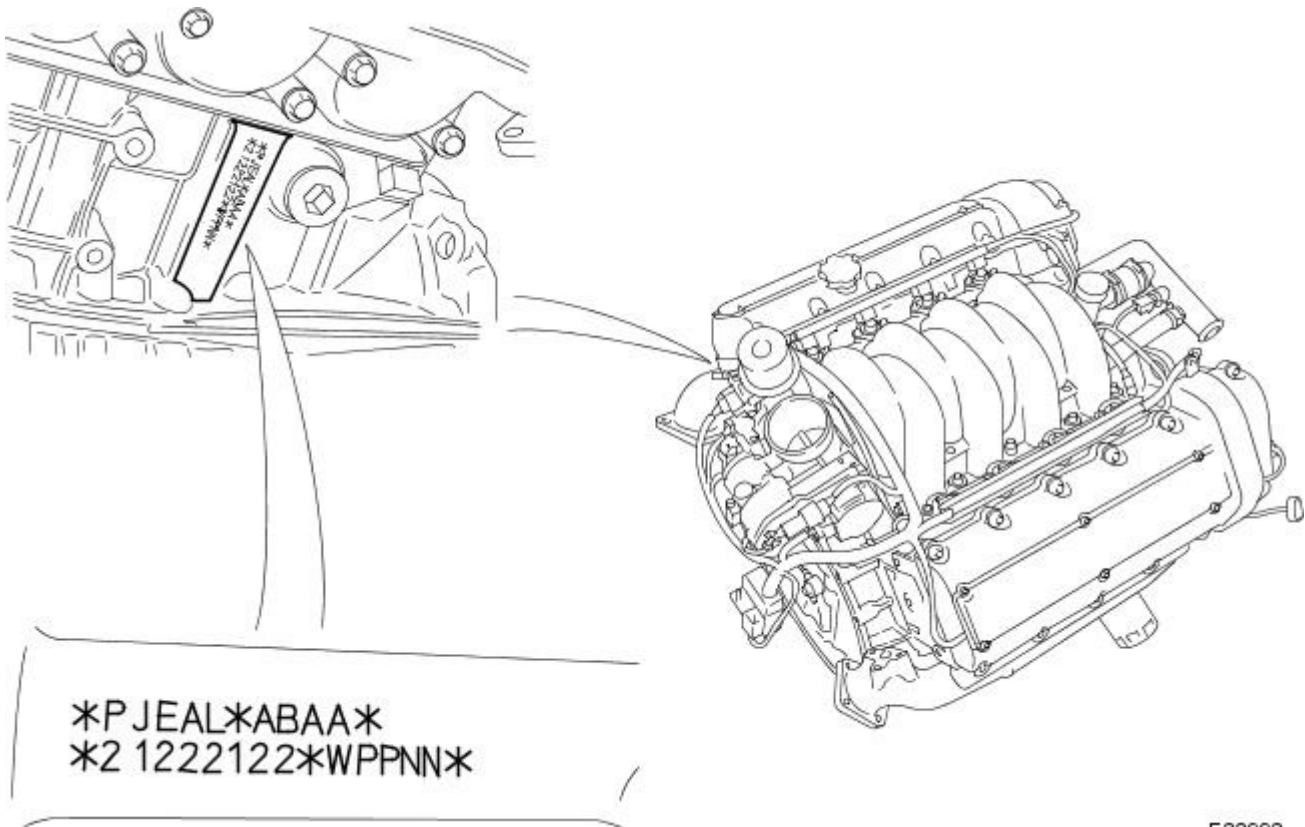


**CAUTION: THESE PROCEDURES SHOULD NOT BE CARRIED OUT DURING THE MANUFACTURERS WARRANTY PERIOD.**

### 1. NOTE: Example - \*PJEAL\* - Crankshaft Main Journal Diameter.

Read the grade letters from LEFT to RIGHT = FRONT to REAR of engine eg. for this example engine, the crank journal at the front of the engine is grade P, and at the rear is grade L.

- The selection of main bearing shells is described in the following chart.



E33992

### 2. NOTE: Example - \*ABAA\* - Crankshaft (Big End Bearing) Crankpin Diameter

- NOTE: For vehicles built up to 2002 MY.
- NOTE: If the crankshaft main bearing carrier retaining bolts have been marked with a center punch dot, they must be discarded and new bolts installed.

Read the grade letters from LEFT to RIGHT = FRONT to REAR of engine eg. for this example engine, the crankpin at the front of the engine is grade A and at the rear is also grade A.

- Grade A = 56,000 to 55,994 mm (Bearing Shell Color Code - Blue).
- Grade B = 55,994 to 55,988 mm (Bearing Shell Color Code - Green).
- Grade C = 55,988 to 55,982 mm (Bearing Shell Color Code - Yellow).

### 3. NOTE: Example - \*ABAA\* - Crankshaft (Big End Bearing) Crankpin Diameter

- NOTE: For vehicles built from 2002 MY.

- **NOTE: If the crankshaft main bearing carrier retaining bolts have been marked with a center punch dot, they must be discarded and new bolts installed.**

Read the grade letters from LEFT to RIGHT = FRONT to REAR of engine eg. for this example engine, the crankpin at the front of the engine is grade A and at the rear is also grade A.

- Grade A = 53,000 to 52,994 mm (Bearing Shell Color Code - Blue).
- Grade B = 52,994 to 52,988 mm (Bearing Shell Color Code - Green).
- Grade C = 52,988 to 52,982 mm (Bearing Shell Color Code - Yellow).

#### **4. NOTE: Example - \*21222122\* - Cylinder Bore and Piston**

The cylinder bore grades read from LEFT to RIGHT as follows:

- Bank 2 - Cylinder 1, Bank 2 - Cylinder 2, Bank 2 - Cylinder 3, Bank 2 - Cylinder 4, Bank 1 - Cylinder 4,
- Bank 1 - Cylinder 3, Bank 1 - Cylinder 2, Bank 1 - Cylinder 1.
- **(Note, in earlier publications Bank 1 was described as A-Bank and Bank 2 as B-Bank)**
- Grade 1 Bore = 85,990 to 86,000 mm.
- Grade 2 Bore = 86,000 to 86,010 mm.
- Grade 3 Bore = 86,010 to 86,020 mm.

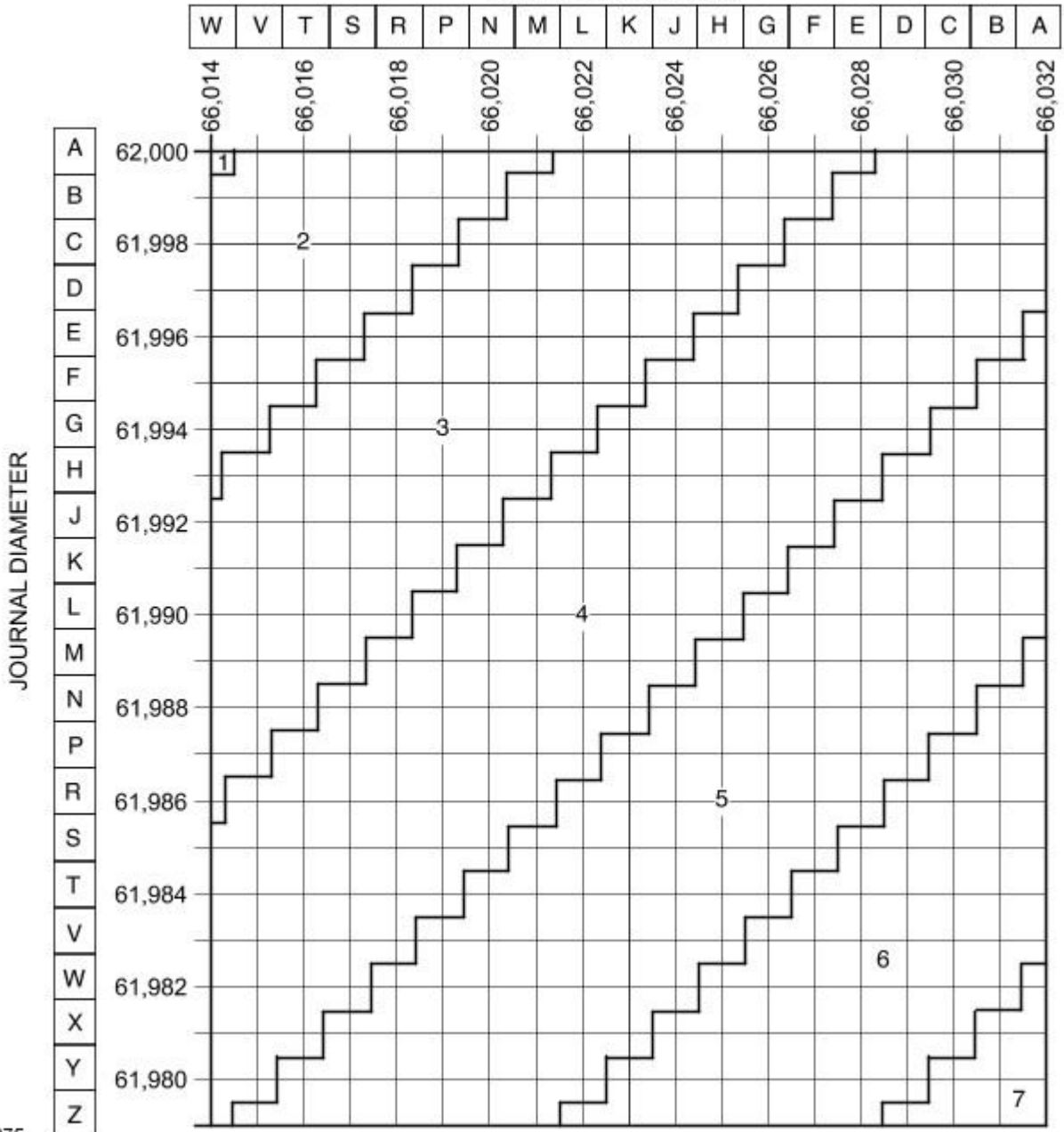
#### **5. NOTE: Example - \*WPPNN\* - Crankshaft Main Bearing Bore in Cylinder Block**

Read the grade letters from LEFT to RIGHT = FRONT to REAR of engine eg. for this example engine, the crank journal bore at the front of the engine is grade W, and at the rear is grade N.

- The selection of main bearing shells is described in the following **JOURNAL DIAMETER AND MAIN BEARING BORE CHART**.

#### **6. JOURNAL DIAMETER AND MAIN BEARING BORE CHART**

MAIN BEARING BORE



E94075

**7. NOTE: THIS PROCEDURE SHOULD ONLY BE CARRIED OUT WHEN REPLACING MAIN BEARING SHELLS.**

• NOTE: Refer to the **JOURNAL DIAMETER AND MAIN BEARING BORE CHART** in step 6 for tolerance and bearing information.

The number in each diagonal band represents a PAIR of color coded main bearing shells which must be used with a specific journal, depending on the combination of journal diameter and crankshaft bore diameter. The color codes for each band are as follows:

1. Blue / Green and Blue / Green
2. Blue / Green and Blue
3. Blue and Blue
4. Blue and Green
5. Green and Green
6. Green and Yellow
7. Yellow and Yellow

- Consider crankshaft journal 5 (from the example grade markings on the cylinder block) - the cylinder block bore is Grade N and the crankshaft journal diameter is Grade L.



From the chart, it will be seen that the point of intersection is in Band 4 which equates to one Blue shell and one Green shell.

- When the appropriate pair of color codes have been selected for a journal, either color may be installed to the cylinder block or to the bedplate, but, the shell which is to be installed to the cylinder block must have an oil groove and the shell which is to be installed to the bedplate must be plain.

**8. NOTE: THIS PROCEDURE SHOULD ONLY BE CARRIED OUT WHEN A REPLACEMENT CRANKSHAFT OR CYLINDER BLOCK HAS BEEN FITTED.**

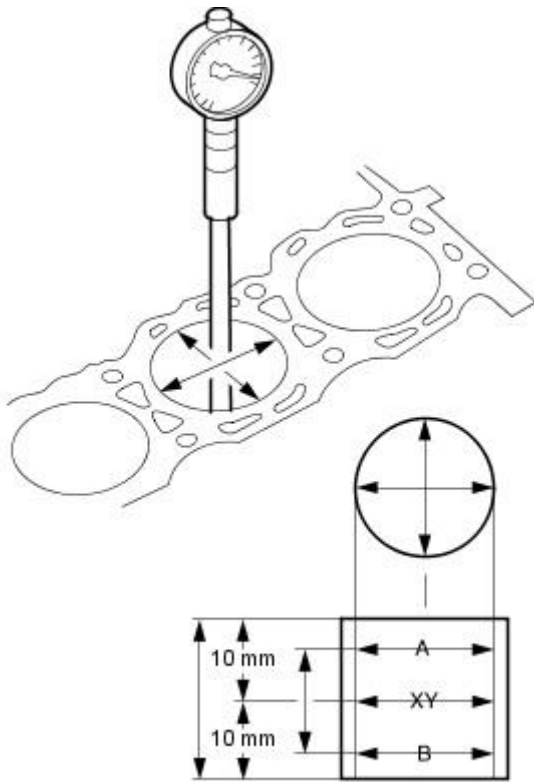
- NOTE: Refer to the **JOURNAL DIAMETER AND MAIN BEARING BORE CHART** in step 6 for tolerance and bearing information.

The thickness grade of all main bearing shells are to be selected to give a total running clearance of not less than 0.022 mm or greater than 0.040 mm.

- Each bearing bore in the block/bedplate assembly should be measured at two mutually perpendicular diameters 45° to the vertical in the middle of the bearing.
- The minimum diameter of the two is to be used.
- Each crankshaft main bearing journal should be measured dynamically at a point in line with the middle of each bearing.
- When the appropriate pair of color codes have been selected for a journal, either color may be installed to the cylinder block or to the bedplate, but, the shell which is to be installed to the cylinder block must have an oil groove and the shell which is to be installed to the bedplate must be plain.

## Engine System - General Information - Cylinder Bore Out-of-Round

General Procedures



**1. NOTE:** The main bearing caps or lower crankcase must be in place and tightened to the specified torque; however, the bearing shells should not be installed.

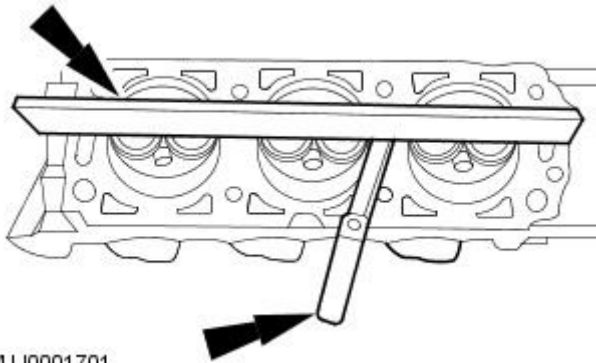
Measure the cylinder bore with an internal micrometer.

- Carry out the measurements in different directions and at different heights to determine if there is any out-of-roundness or tapering.
- If the measurement is out of the specified range, hone out the cylinder block or install a new block.

VUJ0002234

## Engine System - General Information - Cylinder Head Distortion

General Procedures



VUJ0001701

1. Measure the cylinder block/cylinder head distortion.

- Using the special tool, measure the mating face distortion.
- If the value is not to specification rework the mating face.

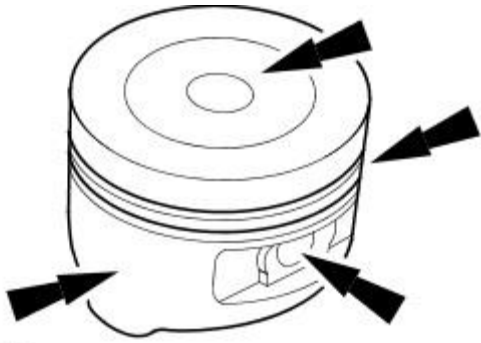
# Engine System - General Information - Exhaust Manifold Cleaning and Inspection

## General Procedures


1. Inspect the cylinder head joining flanges of the exhaust manifold for evidence of exhaust gas leaks.
2. Inspect the exhaust manifold for cracks, damaged gasket surfaces, or other damage that would make it unfit for further use.

## Engine System - General Information - Piston Inspection

General Procedures



VUJ0002233

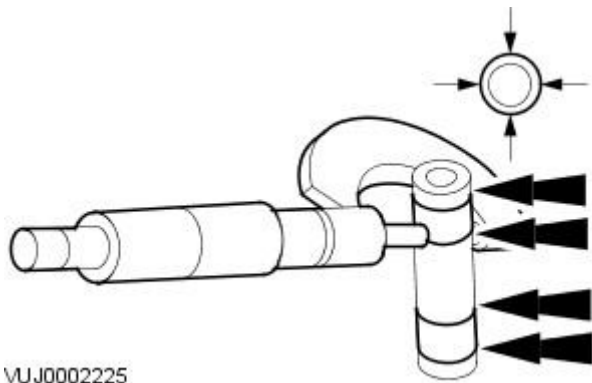
1.  **CAUTION:** Do not use any aggressive cleaning fluid or a wire brush to clean the piston.

Carry out a visual inspection.

- Clean the piston skirt, pin bush, ring grooves and crown and check for wear or cracks.
- If there are signs of wear on the piston skirt, check whether the connecting rod is twisted or bent.

## Engine System - General Information - Piston Pin Diameter

General Procedures



VUJ0002225

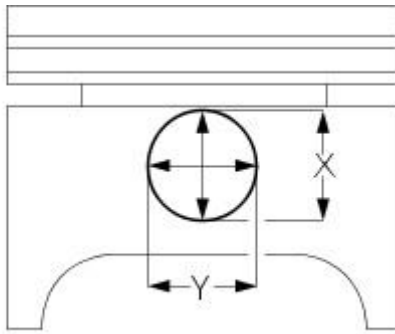
1. NOTE: The piston and piston pin are a matched pair. Do not mix up the components.

Measure the piston pin diameter.

- Measure the diameter in two directions.
- If the values are not to specification, install a new piston and a new piston pin.

## Engine System - General Information - Piston Pin to Bore Diameter

General Procedures



VUJ0002232

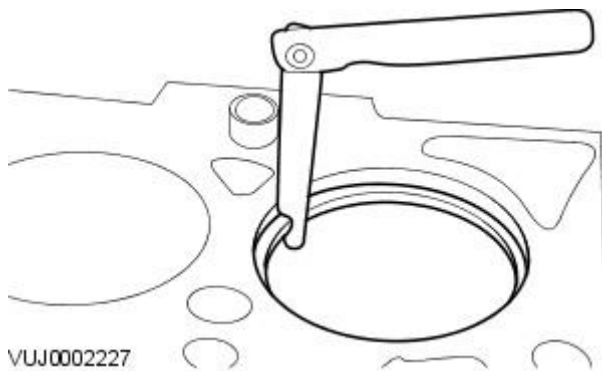
1. NOTE: The piston and piston pin form a matched pair. Do not mix up the components.

Measure the diameter of the piston pin bore.


- Measure the diameter in two directions.
- If the values are not to specification, install both a new piston and a new piston pin.

## Engine System - General Information - Piston Ring End Gap

General Procedures



VUJ0002227

1.  CAUTION: Do not mix up the piston rings. Install the piston rings in the same position and location.

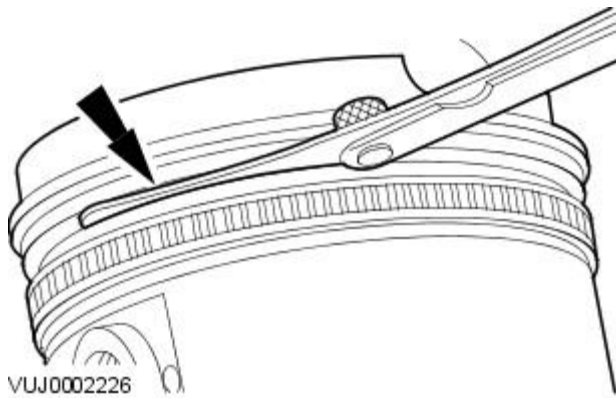
Using the Feeler Gauge, measure the piston ring gap.

- The values given in the specification refer to a gauge ring used during production.



## Engine System - General Information - Piston Ring-to-Groove Clearance

General Procedures



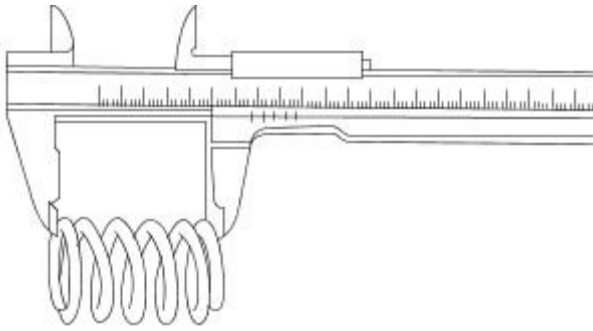
1. NOTE: The piston ring must protrude from the piston groove. To determine the piston ring clearance, insert the Feeler Gauge right to the back of the groove, behind the wear ridge.

Using the Feeler Gauge, measure the piston ring clearance.

## Engine System - General Information - Valve Spring Free Length

General Procedures

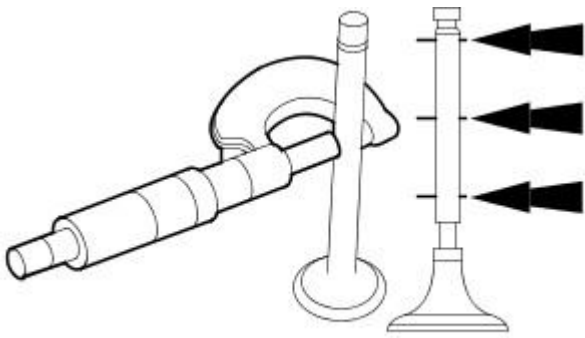
1. Using a vernier gauge, measure the free length of each valve spring. Verify the length is within specification.



VUJ0002221

## Engine System - General Information - Valve Stem Diameter

General Procedures



1. Using a micrometer measure the diameter of the valve stems.

- If the measurements are not to specification, install a new valve.

VUJ0002220

**Engine - TDV6 2.7L Diesel -****Lubricants, Fluids, Sealers and Adhesives**

Description	Specification
Engine oil, SAE 5W-30	WSS-M2C-913B A1
Sealant	WSE M4G323-A4 (Loctite 5910)
Sealant (camshaft caps)	ESK M4G269-A (Loctite 518)
Hose assembly surfactant	WSE N99C45-A2

**Capacities**

Description	Liters
Engine oil, initial fill	7.7
Engine oil, service fill with oil filter change	6.6

**General Specifications**

Maximum permissible cylinder head warp	
Total flame face	0.1 mm
150 mm x 150 mm square on flame face	0.05 mm
25 mm x 25 mm square on flame face	0.025 mm

**Torque Specifications**

Description	Nm	lb-ft	lb-in
Accessory drive belt idler pulley retaining bolt	47	35	-
Accessory drive belt idler pulley mount bracket retaining bolts	80	59	-
Accessory drivebelt tensioner retaining bolt	47	35	-
Air conditioning compressor retaining bolts	25	18	-
Air conditioning compressor mounting bracket retaining bolts	25	18	-
A/C manifold retaining bolt	9	-	80
Camshaft bearing caps retaining bolts	A	-	-
Camshaft position sensor retaining bolt	10	-	89
Camshaft hub retaining bolts	A	-	-
Camshaft pulley retaining bolts	23	17	-
Crankshaft pulley retaining bolt	A	-	-
Crankshaft position sensor retaining bolt	5	-	44
Coolant inlet housing	10	-	89
Cylinder head retaining bolts	A	-	-
Engine mount retaining nuts to crossmember	63	46	-
Engine mount bracket to engine mount retaining nut	48	35	-
Engine mount bracket to engine block retaining bolts	90	66	-
Engine wiring harness retaining bracket	4	-	35
Exhaust manifold heat shield retaining bolts	10	-	89
Exhaust manifold retaining nuts	23	17	-
Flexplate retaining bolts	A	-	-
Fuel injection pump	23	17	-
Fuel injection pump pulley retaining nut	50	37	-
Fuel injector retaining bolts	10	-	89
Generator retaining bolts	47	35	-
Generator mount bracket retaining bolts	23	17	-
Glow plugs	10	-	89
Knock sensor retaining nuts	20	15	-
Oil cooler to cylinder block retaining bolt	10	-	89
Oil level indicator tube retaining bolt	10	-	89
Oil pan retaining bolts	10	-	89
Oil pump to engine block retaining bolts	22	16	-
Oil pan drain plug	25	18	-
Oil separator pipe retaining bolts	10	-	89
Oil filter	25	18	-
Piston cooling jet retaining bolt	10	-	89
Power steering bracket retaining bolts	23	17	-
Power steering pump retaining bolts	22	16	-
Primary timing chain tensioner retaining bolts	10	-	89
Starter motor retaining bolts	48	35	-
Timing belt tensioner retaining bolt	24	18	-
Timing belt idler pulley retaining bolt	45	33	-
Water pump retaining bolts	10	-	89
Water pump pulley retaining bolts	24	18	-
Water pump outlet pipe retaining bolts	10	-	89
Valve cover retaining bolts	10	-	89
Vacuum pump retaining bolts	23	17	-
Vacuum pump retaining nuts	13	10	-

# Engine - TDV6 2.7L Diesel - Engine - Component Location

Description and Operation

External View



E93304

# Engine - TDV6 2.7L Diesel - Engine - Overview

Description and Operation

## Overview

The 2.7 liter diesel engine is a V6 configuration unit with 2 banks of 3 cylinders arranged at 60 degrees to each other. There are 4 valves per cylinder, which are operated by 2 overhead camshafts per cylinder bank.

The cylinder block is cast in compacted graphite iron, which uses less material to produce compared to a conventional cast iron block. This provides reduced weight and length with superior structural capabilities. A separate aluminum ladder frame, bolted to the underside of the cylinder block, provides a lightweight, compact and very stiff bottom end of the engine.

The cylinder heads are cast aluminum with a moulded plastic camshaft cover. The single-piece oil pan is formed from stamped steel. The cast iron exhaust manifolds are unique for each cylinder bank. A moulded plastic acoustic cover is fitted over the upper engine to absorb engine-generated noise.

A low, by diesel standards, compression ratio of 17.3:1 contributes to improved emissions quality, quieter combustion and compatibility with the engine's unique forced induction system.

Refer to: [Intake Air Distribution and Filtering](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Description and Operation).

The low compression ratio also means less heat build-up in the piston bowl and more efficient fuel burn, resulting in the production of lower levels of pollutants.

# Engine - TDV6 2.7L Diesel - Engine - System Operation and Component Description

Description and Operation

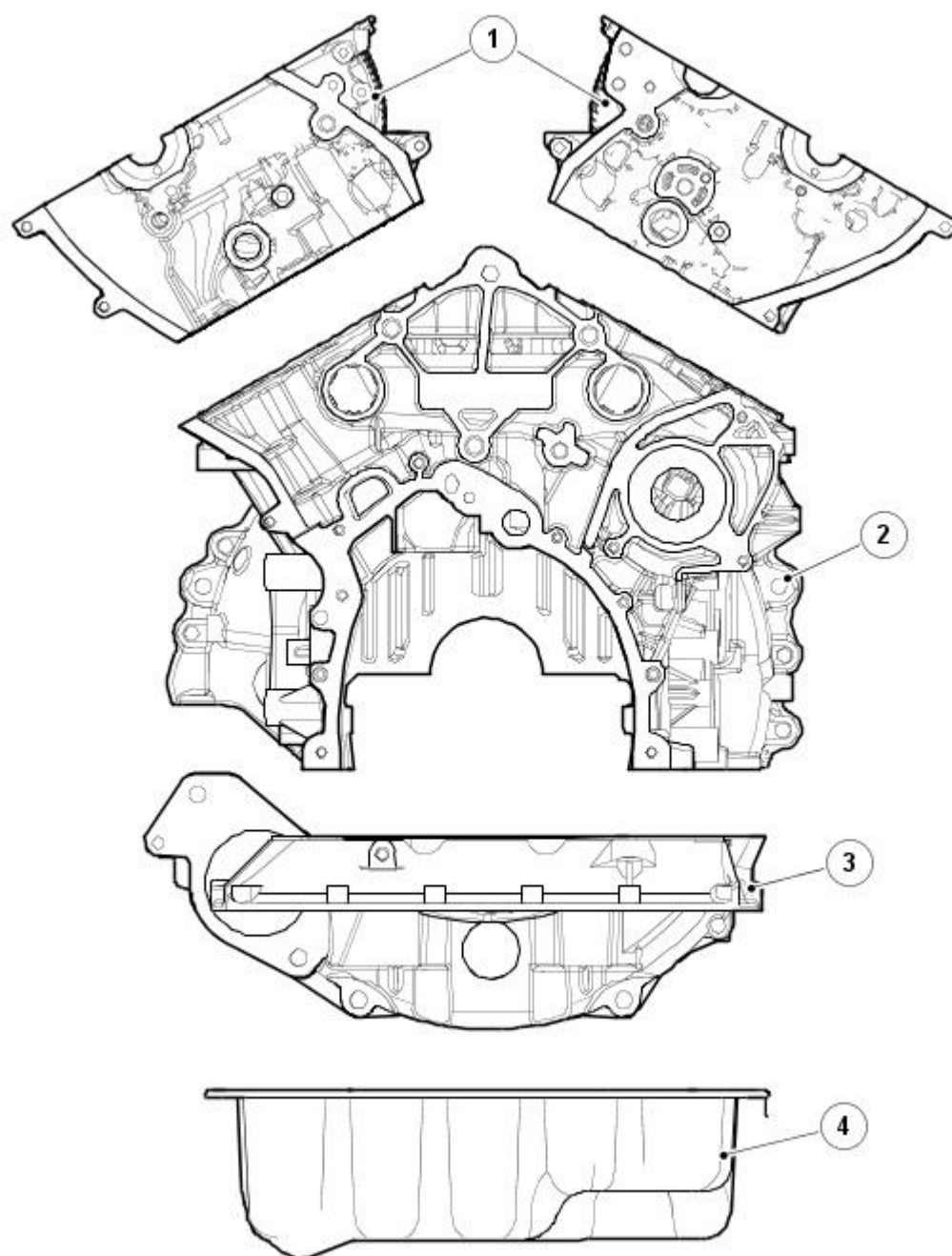
## System Operation

Operation of the engine is controlled by the [ECM \(engine control module\)](#).

Refer to: [Electronic Engine Controls](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Description and Operation).

## Component Description

### Engine Structure



E94880

#### ItemDescription

1	Cylinder heads
2	Cylinder block
3	Ladder frame
4	Oil pan

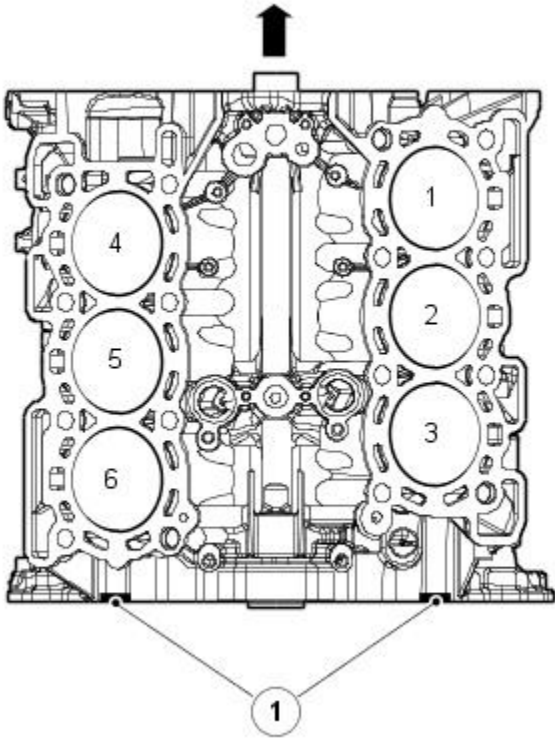
### Cylinder Block Components

The cylinder block is of a single cast compacted graphite iron construction with a hollow beam structure. This type of construction provides outstanding strength and durability and uses less material than a conventional cast iron block, therefore, reducing engine weight and length.

As the benefits of compacted graphite iron derive from its strength, this enables lightweight and thin-wall designs to be created for high-compression diesel applications.

- **NOTE:** Arrow indicates front of engine.

Engine Data



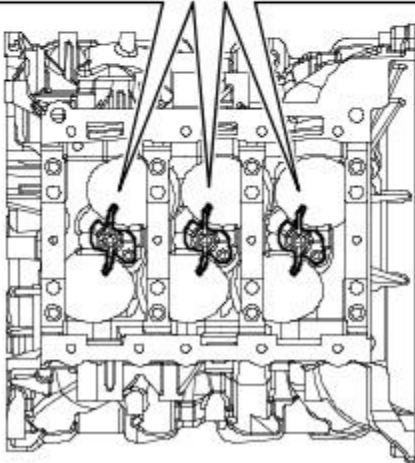
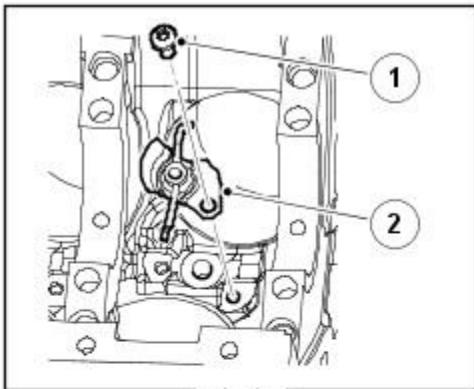
E44217

**ItemDescription**

- 1 Engine data locations

Engine data is marked at 2 locations at the back of the cylinder block. Component diameters are represented by alphabetical and numerical codes; keys to the codes are in the removal and installation section of this manual.

**Piston Cooling Jets**



E44219

**ItemDescription**

- 1 Bolt
- 2 Piston cooling jet

Jets located in the cylinder block provide piston and piston pin lubrication and cooling. These jets spray oil on to the inside of the piston, the oil then flows through 2 internal wave shaped channels to help cool each piston crown.

Lubrication oil is distributed through the cylinder block, via the main oil gallery and channels bored in the block, to all critical moving parts. These channels divert oil to the main and connecting rod bearings via holes machined into the crankshaft.



A tapping at the front of the cylinder block, below the **RH (right-hand)** cylinder head, connects a pipe to the turbochargers by means of a banjo connection. Oil is supplied, under pressure via this tapping, from the oil pump to provide lubrication for the turbochargers bearings.

Cylinder cooling is achieved by coolant circulating through chambers in the cylinder block casting.

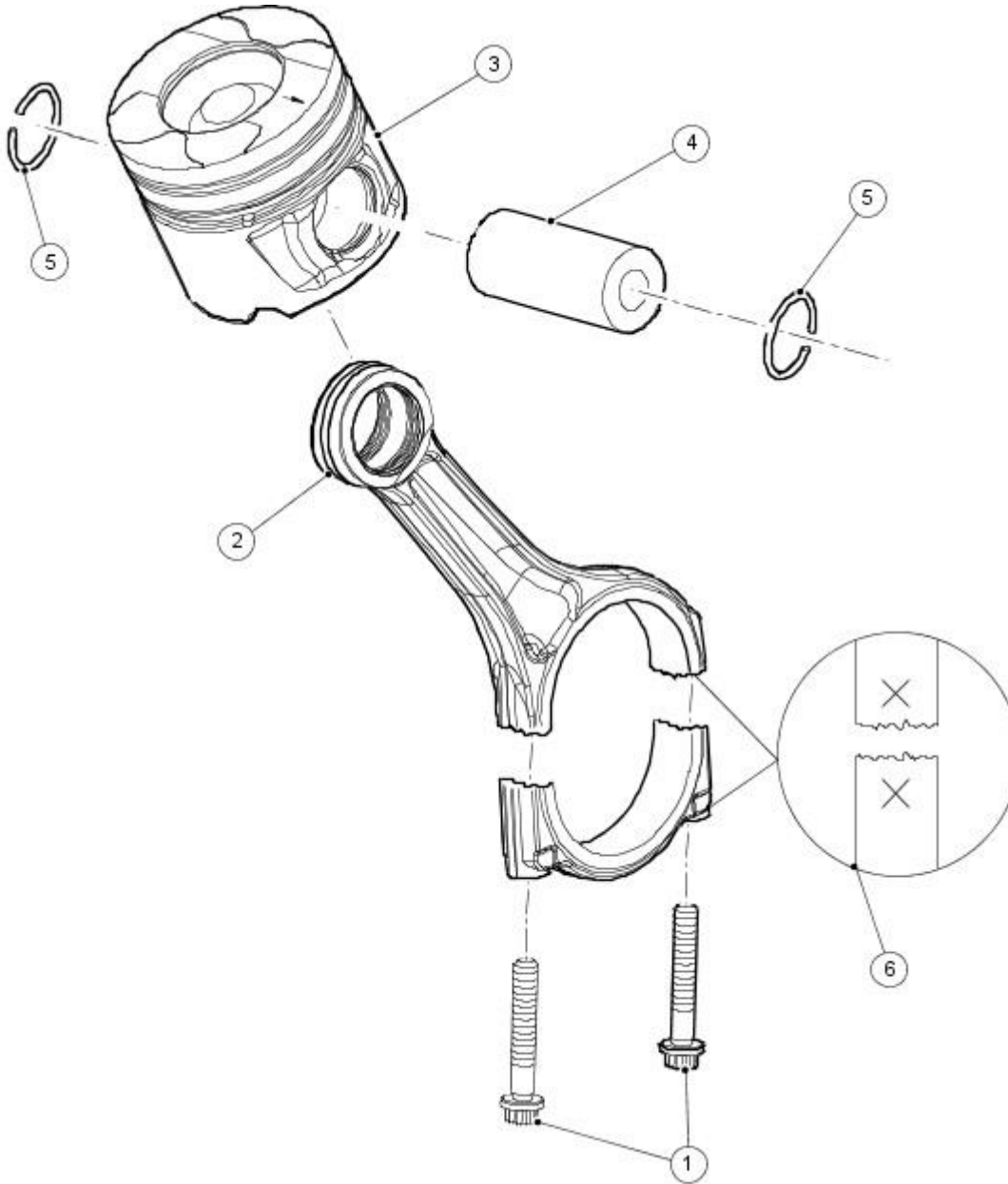
Two hollow metal dowels are used to locate the cylinder heads to the cylinder block, 1 on each side at the rear of the unit.

A port is included at the **RH** and **LH (left-hand)** side of the cylinder block, below each of the turbochargers, to connect the turbochargers oil return pipe to the oil pan.

Two coolant drain plugs are installed in the cylinder block, 1 is fitted in the rear **RH** side, and the other is fitted in the middle of the cylinder block on the **LH** side.

On vehicles destined for cold climates, a cylinder block heater replaces a core plug in the middle of the cylinder block on the **LH** side.

#### Piston and Connecting Rod Assembly



E52134

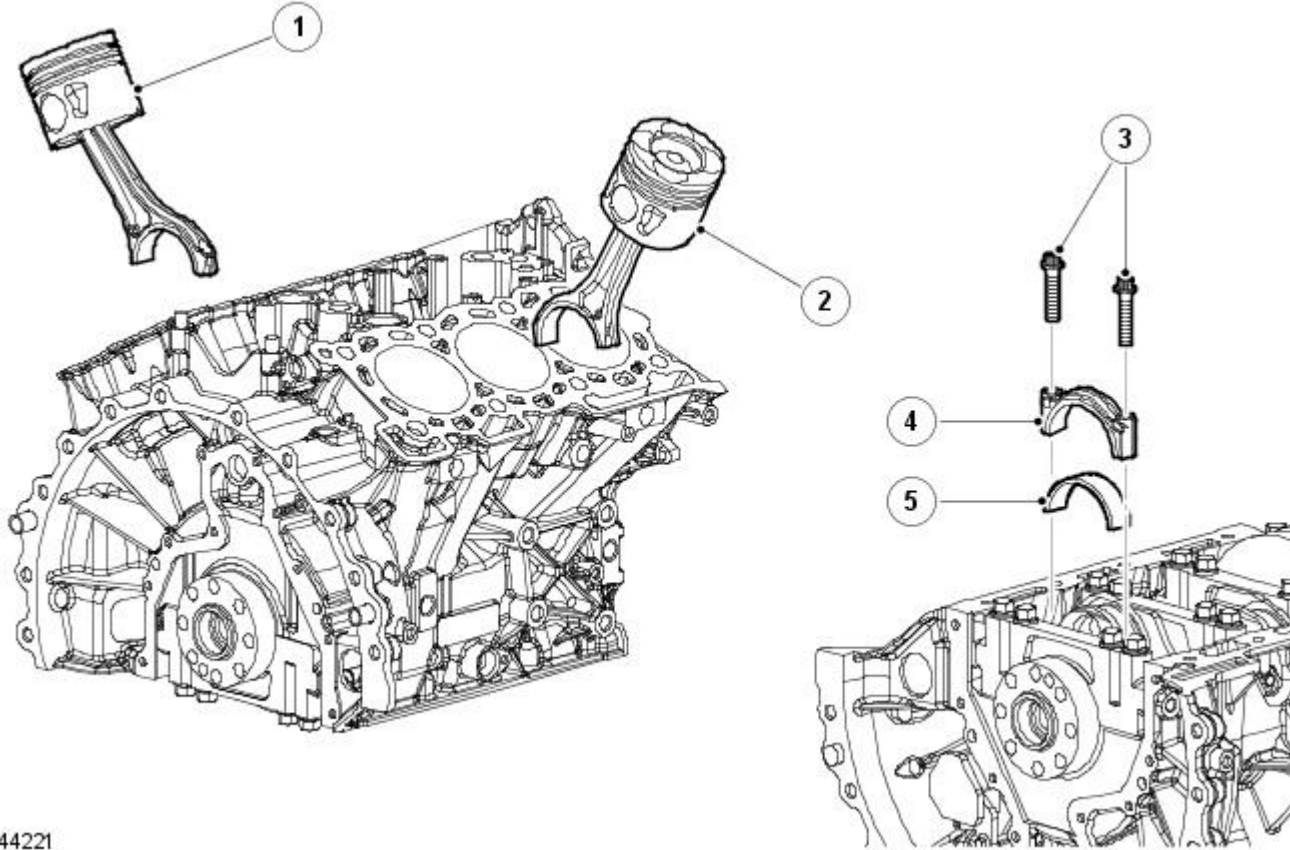
#### ItemDescription

1	Connecting rod bolts (2 off)
2	Connecting rod
3	Piston
4	Piston pin
5	Circlips
6	Connecting rod identification

The connecting rods are manufactured from sinter-forged steel and have fracture-split bearing caps. The bearing caps are produced by fracturing the opposing sides of the connecting rod at the bearing horizontal centre-line. As well as being easier to manufacture, when reassembled the fractured surfaces interlock to form a strong seamless joint. The cylinder position is etched on adjoining sides of the joint to identify matching connecting rods and bearing caps. The selective connecting rod bearings are aluminum/tin split plain bearings. The connecting rod bearing is 'sputter coated', which is a manufacturing process that layers the bearing material to produce a higher load capacity for improved durability.

• **NOTE:** The connecting rods are not selective.

#### Piston and Connecting Rod Orientation



E44221

**ItemDescription**

1	Piston and connecting rod assembly, cylinders 4-6
2	Piston and connecting rod assembly, cylinders 1-3
3	Bolts (12 off)
4	Connecting rod bearing cap (6 off)
5	Connecting rod lower bearing (6 off)

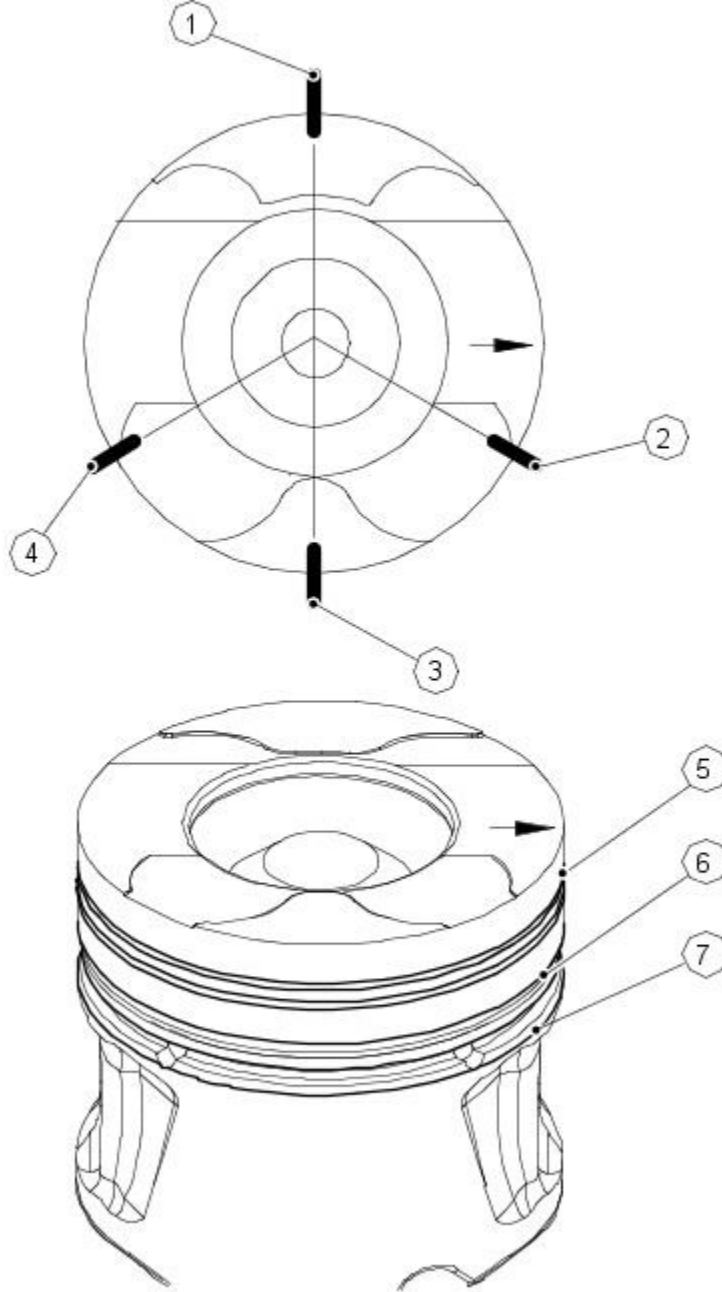
When installing a connecting rod, ensure the back of the connecting rod faces the center of the 'vee'.

The pistons are made from aluminum alloy and are fitted with 3 rings. The piston crown incorporates a pronounced bowl; this forms the combustion chamber, which promotes swirl and turbulence necessary for good combustion and improved emissions. In addition, the piston skirt has a molybdenum-coated surface, which counteracts scoring of the cylinder bore and piston.

The piston also incorporates a double wave gallery within the piston crown to enhance piston cooling. The pistons are supplied oil by means of spray jets located in the cylinder block oil gallery. These jets ensure optimum piston cooling to counteract the high temperatures generated by the combustion process.

Each piston is installed on a piston pin located in a aluminum/tin bushing in the connecting rod.

**Piston Ring Orientation**



E52133

**ItemDescription**

1	Ring gap oil control
2	Ring gap upper compression
3	Spiral joint oil control
4	Ring gap lower compression
5	Upper compression ring
6	Lower compression ring
7	Oil control ring

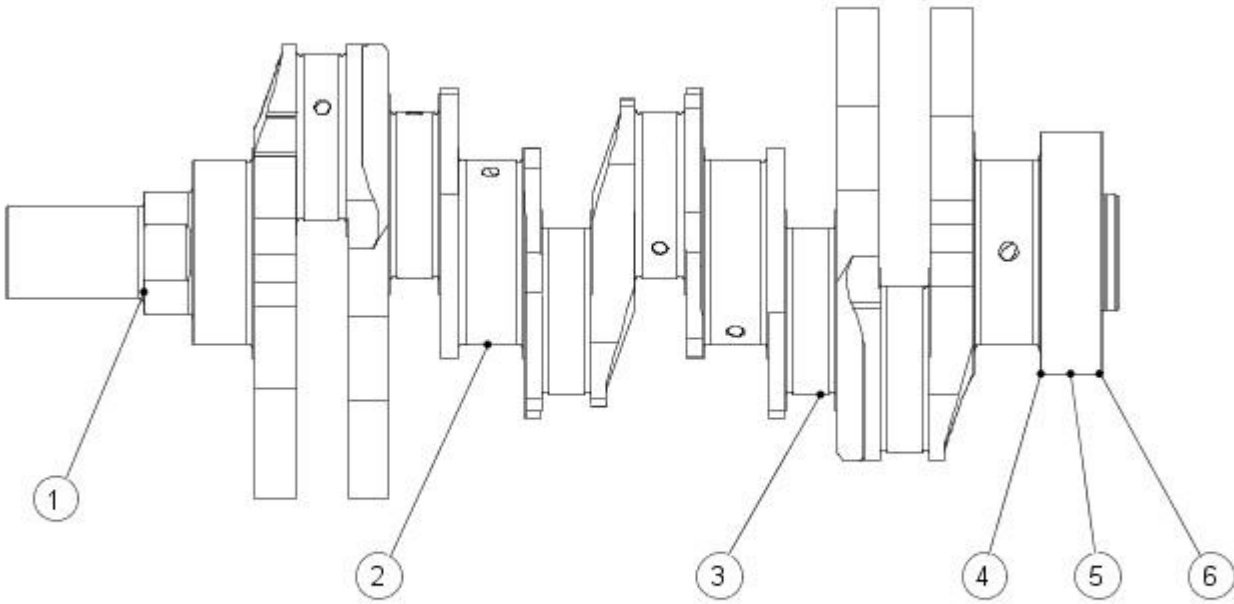
When installing pistons ensure the arrows on the piston crowns all point to the front of the engine and the pistons are located in the correct cylinder banks, i.e. cylinders 1, 2, 3 or cylinders 4, 5, 6.

All pistons are common single grade/single part number for all engines.

The piston top ring is a taper type and is fitted with the taper to the top of the piston. All rings marked 'top' are assembled with 'top' uppermost. All rings must be spaced evenly around the piston before installing. The circumference gap of the double bevelled oil control ring must be opposite the spiral control joint.

**Crankshaft and Oil Pan Components**

Crankshaft



E52135

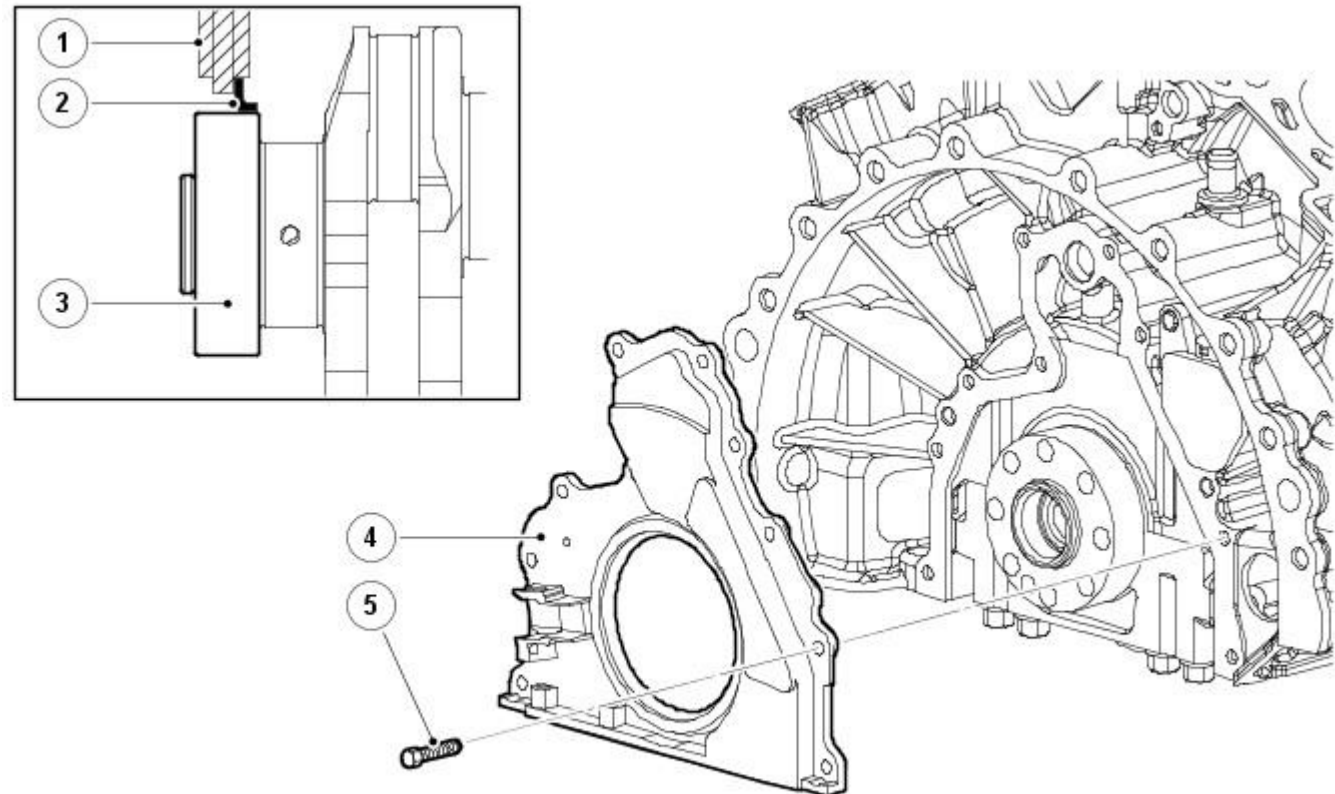
**ItemDescription**

1	Oil pump drive
2	Main bearing journal
3	Connecting rod bearing journal
4	Rear drive flange
5	Rear oil seal location
6	Trigger wheel location

The crankshaft is forged steel and fillet rolled with induction hardened journals, which run in 4 bearings with clamped 2 layer bearing shells. The upper and lower shells of bearing number 4 are flanged, which limits the end float of the crankshaft. The main bearing caps are double bolted and cross bolted to increase the strength and rigidity of the engine block.

The main bearings are aluminum/tin split plain selective bearings. An oil groove in the top half of each bearing transfers oil into the crankshaft for lubrication of the connecting rod bearings. The upper and lower shells of bearing number 4 contain integral thrust washers, which limits the end float of the crankshaft.

**Rear Main Oil Seal and Retainer**



E44227

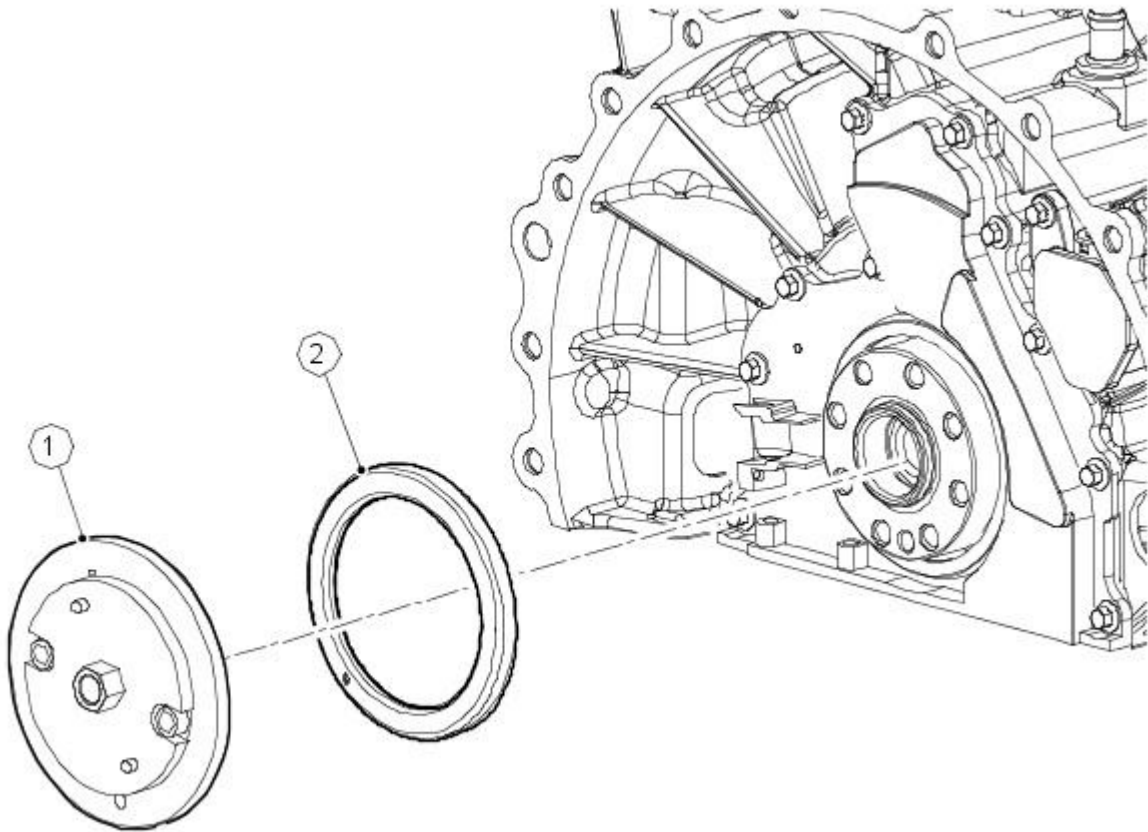
**ItemDescription**

- |   |                        |
|---|------------------------|
| 1 | Housing                |
| 2 | Seal                   |
| 3 | Crankshaft             |
| 4 | Rear oil seal retainer |
| 5 | Bolt (10 off)          |

The rear main oil seal and retainer assembly is a one-piece unit and is supplied with its own plastic fitting sleeve. The seal and retainer have 2 locating dowels, 10 fixing bolts and a rubber seal. In addition the retainer has a location for the crankshaft position sensor. Refer to: [Electronic Engine Controls](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Description and Operation).

A torsional vibration crankshaft damper pulley is bolted to the front of the crankshaft.

Trigger Wheel



E52137

**ItemDescription**

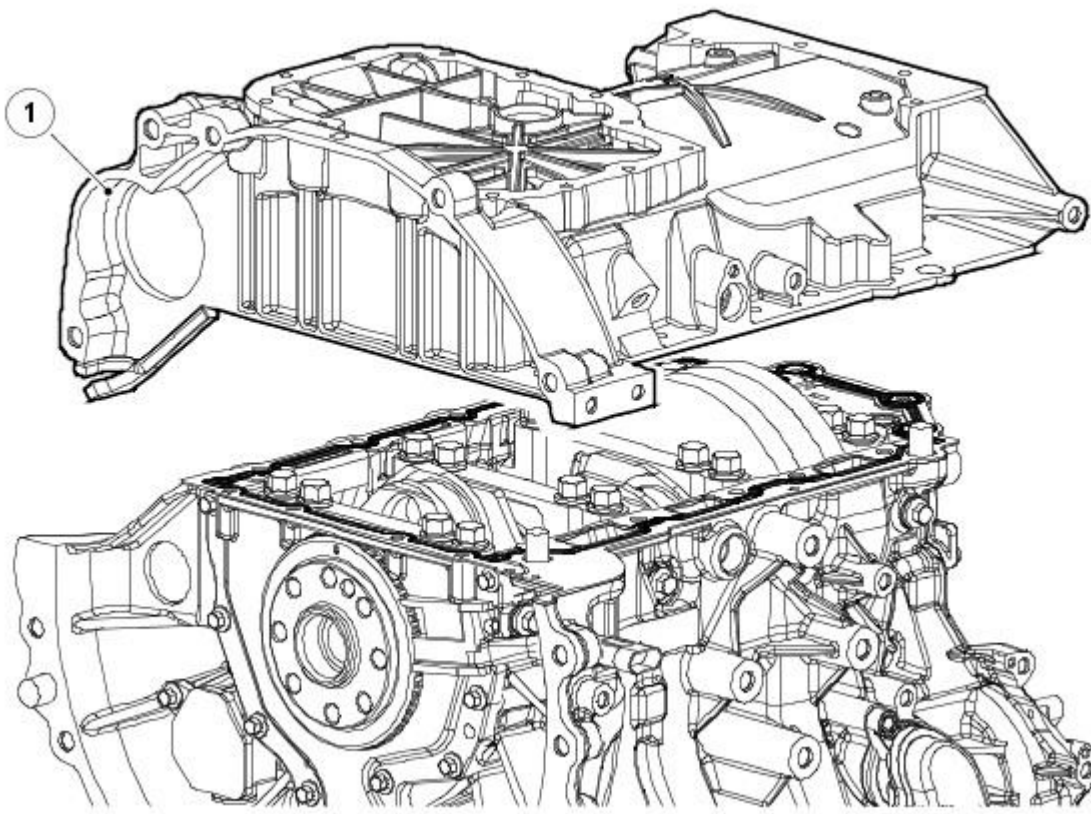
- |   |               |
|---|---------------|
| 1 | Special tool  |
| 2 | Trigger wheel |

The crankshaft trigger wheel is located on the rear of the crankshaft. It is pressed onto the crank using a special tool, which also precisely aligns the trigger wheel for crankshaft position and timing. The trigger wheel consists of 60 magnets minus 2 for [ECM](#) crankshaft position reference and synchronisation. The magnets cannot be seen on the trigger wheel, which therefore can only be positioned using a special tool.

Refer to: [Electronic Engine Controls](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Description and Operation).

If the trigger is removed for any reason, then a new trigger wheel must be fitted.

Ladder Frame



E44229

#### ItemDescription

1 Ladder frame

The ladder frame is fitted to the lower cylinder block to stiffen the base structure of the engine thus helping to reduce Noise, vibration and harshness. The frame is made of high-pressure die cast aluminum and also incorporates an oil baffle plate to reduce oil foaming and splash.

The ladder frame is secured to the cylinder block with 2 dowels, 2 locator pins for the gasket and 18 retaining bolts; 3 different lengths of bolts are used:

- M6 x 20 (6 off).
- M8 x 75 (4 off).
- M6 x 105 (8 off).

Iron inserts, cast into the main bearing supports of the ladder frame, minimize main bearing clearance changes due to heat expansion.

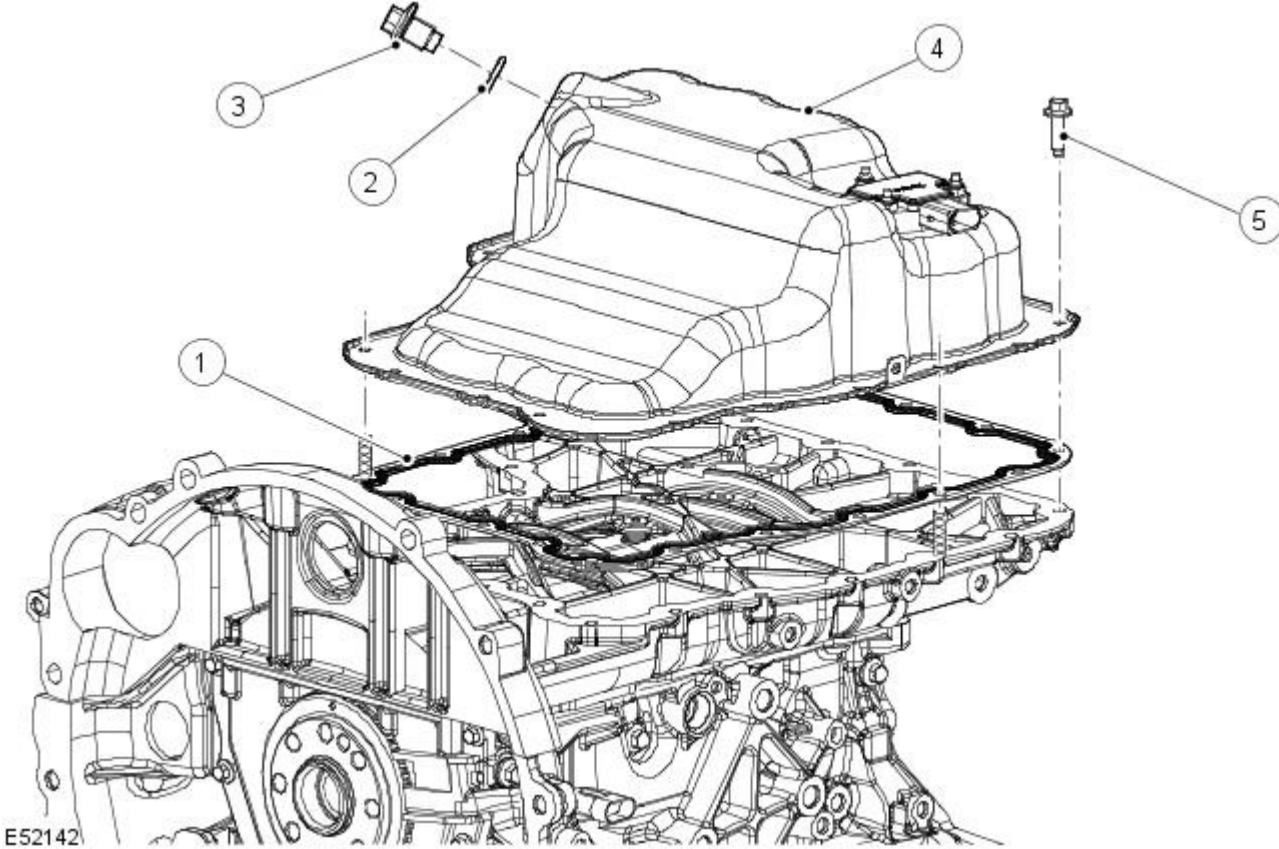
A gasket seals the joint between the ladder frame and the cylinder block.

A port for the oil level gage tube is included in the casting on the [LH](#) side of the ladder frame.

An oil pick-up pipe with integral strainer locates in the front of the ladder frame to provide oil to the crankshaft driven oil pump.

Oil Pan





E52142

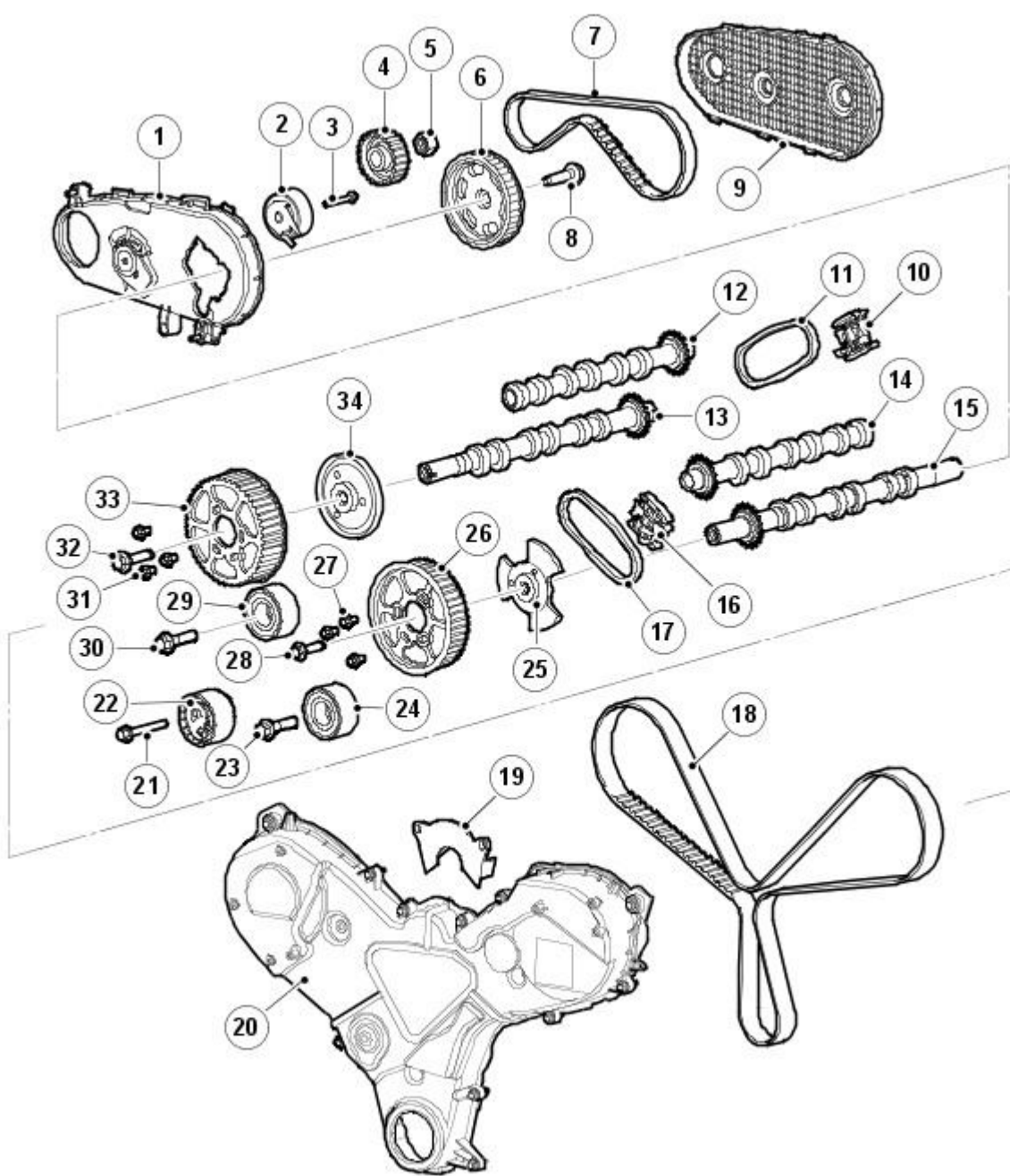
**ItemDescription**

1	Gasket
2	Draining bolt seal
3	Draining bolt
4	Sump pan
5	Retaining bolts

The pressed steel oil pan is bolted to the ladder frame with 14 M6 x 16 bolts and is sealed with a reusable gasket. The engine oil drain plug and the oil temperature sensor are located towards the front of the oil pan.

Refer to: [Electronic Engine Controls](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Description and Operation).

**Camshaft Timing Components**



E94884

**ItemDescription**

1	Rear engine accessory drive rear cover
2	Rear engine accessory drive tensioner
3	Bolt
4	Fuel pump pulley
5	Nut
6	Rear engine accessory drive camshaft pulley
7	Rear engine accessory drive belt
8	Bolt
9	Rear engine accessory drive front cover
10	<a href="#">RH</a> chain tensioner
11	<a href="#">RH</a> timing chain
12	<a href="#">RH</a> intake camshaft
13	<a href="#">RH</a> exhaust camshaft
14	<a href="#">LH</a> intake camshaft
15	<a href="#">LH</a> exhaust camshaft
16	<a href="#">LH</a> chain tensioner
17	<a href="#">LH</a> timing chain
18	Timing belt
19	Front cover bridge
20	Primary drive cover
21	Bolt
22	Tensioner
23	Bolt

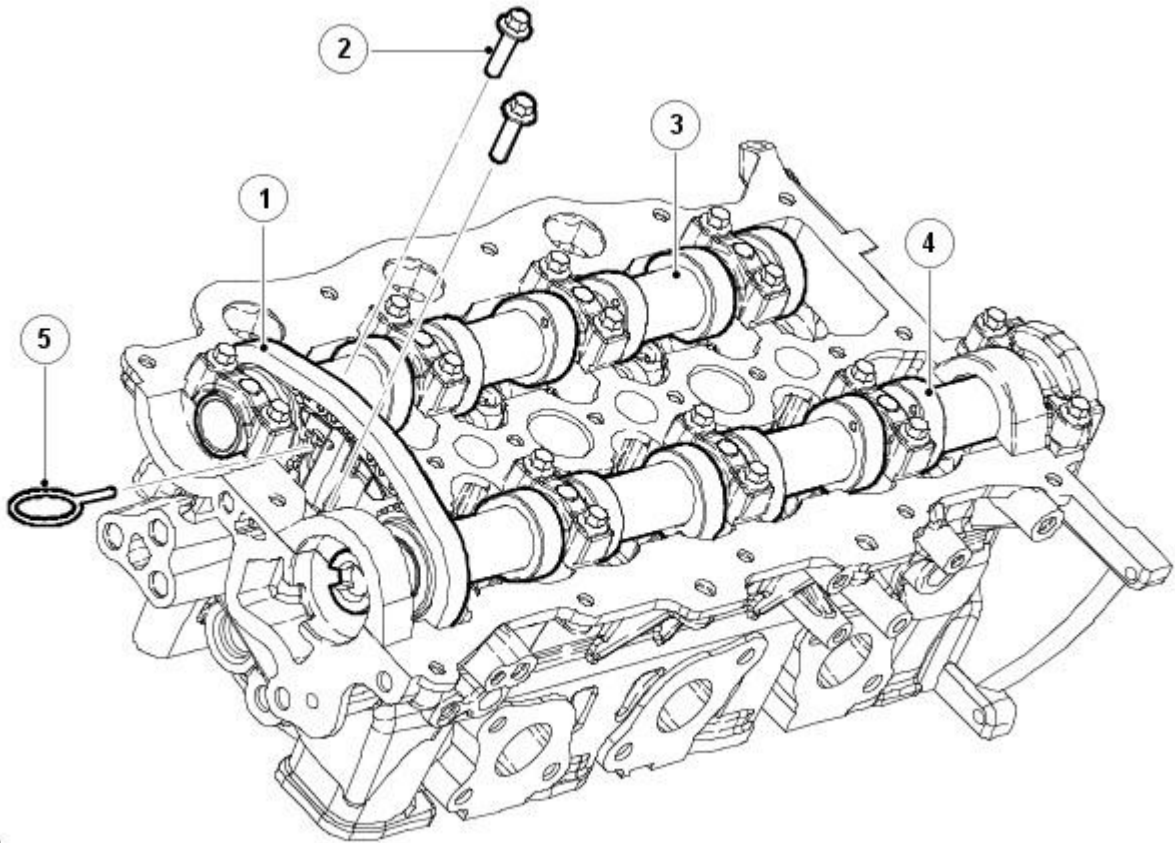


24	Idler
25	Camshaft hub
26	<a href="#">LH</a> camshaft timing pulley
27	Bolt (3 off)
28	Bolt
29	Idler
30	Bolt
31	Bolt (3 off)
32	Bolt
33	<a href="#">RH</a> camshaft timing pulley
34	Camshaft hub

Primary drive is provided by a single toothed belt from the crankshaft to the exhaust camshaft gears of each cylinder bank via 2 idler pulleys and a tensioner.

Timing belt adjustment is carried out by an eccentric type tensioner mounted on the [RH](#) front face of the cylinder block.

Secondary Drive



E44233

**ItemDescription**

1	Timing chain
2	Bolts
3	Intake camshaft
4	Exhaust camshaft
5	Tensioner firing pin

Secondary drive is provided by 2 short crossover chains, which transfer drive from the exhaust camshaft gears to the intake camshaft gears. The crossover drives are located at the rear of the [RH](#) cylinder bank and the front of the [LH](#) cylinder bank. This allows for a much shorter and simpler run for the main camshaft drive belt at the front of the engine.

Each crossover chain is tensioned via an automatic chain tensioner, which acts directly on the chains via a guide rail. The tensioners are located between the exhaust and intake camshafts at the front or rear of the cylinder head, depending on the cylinder bank.

The tensioner firing pin holds the automatic chain tensioner in a compressed state to aid installation.

Timing Cover

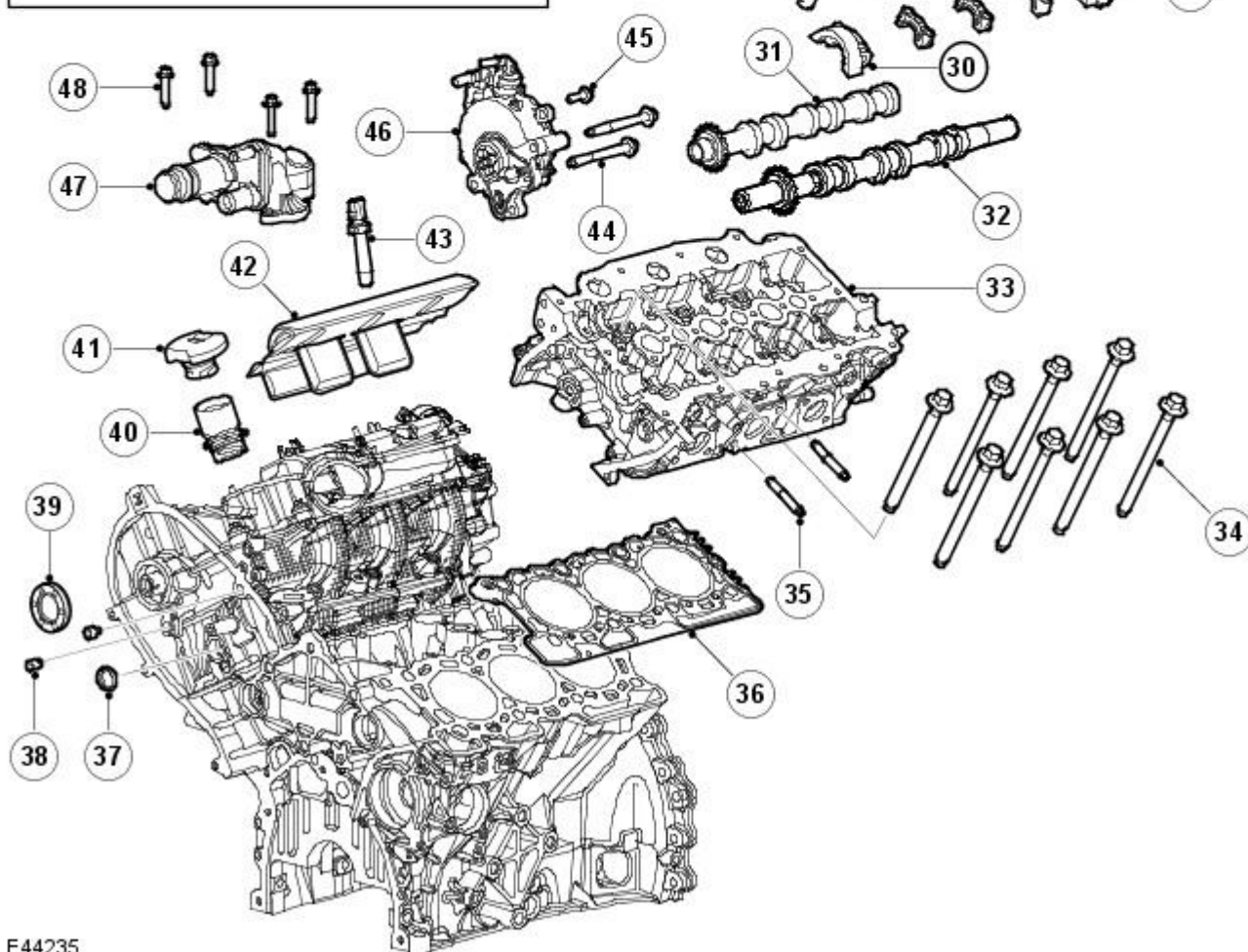
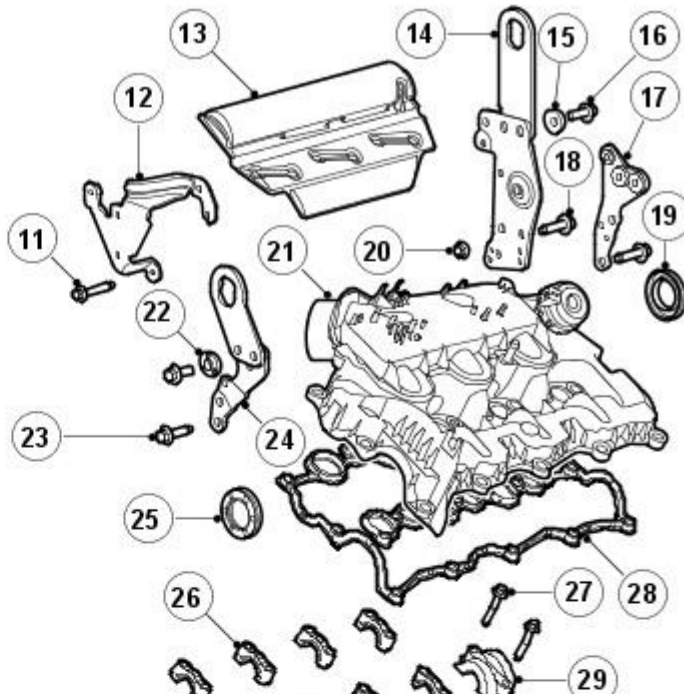
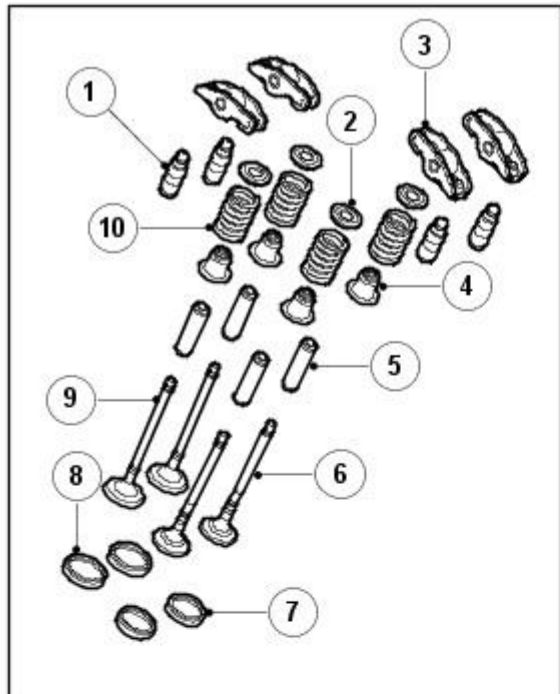


E94882

The plastic timing cover is bolted to the front of the cylinder block and cylinder heads with 16 bolts and sealed with a rubber seal.

### Cylinder Head Components

- NOTE: [LH](#) cylinder head shown; [RH](#) cylinder head similar.



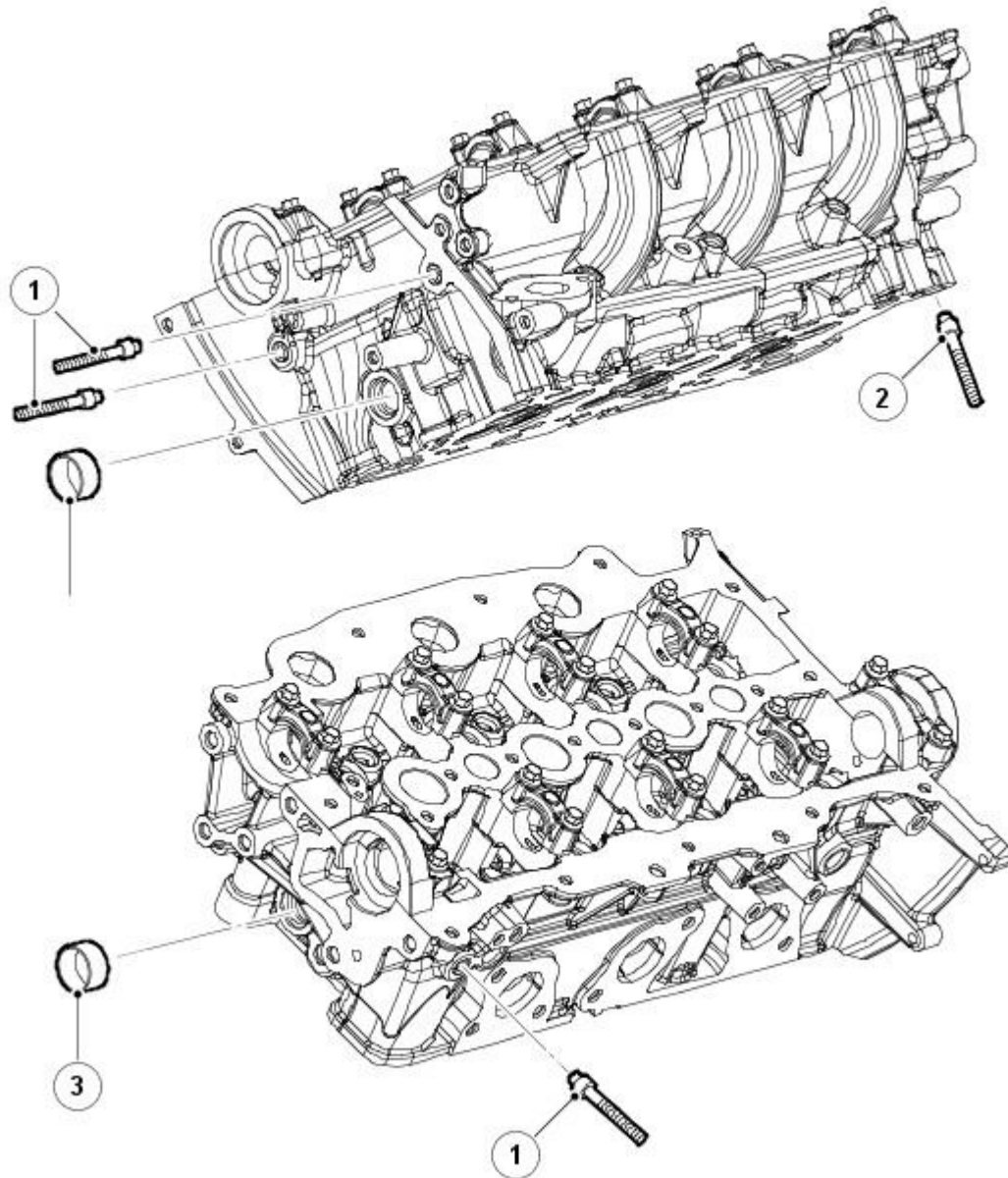
E44235

**ItemDescription**

1	Hydraulic lash adjusters (12 off)
2	Valve spring retainers (12 off)
3	Roller rockers (12 off)
4	Valve stem seals (12 off)
5	Valve guides (12 off)
6	Exhaust valves (6 off)
7	Intake valve seats (6 off)
8	Exhaust valve seats (6 off)
9	Intake valves (6 off)
10	Valve springs (12 off)
11	Bolt
12	Bracket
13	Cover

14	Lifting eye
15	Washer
16	Bolt
17	Bracket
18	Bolt
19	Seal
20	Cap
21	Intake manifold cover assembly
22	Washer
23	Bolt
24	Lifting eye
25	Seal
26	Camshaft bearing caps (7 off)
27	Bolts (18 off)
28	Gasket
29	Camshaft bearing cap and seal housing
30	Camshaft bearing cap and seal housing
31	Intake camshaft
32	Exhaust camshaft
33	Cylinder head
34	Cylinder head bolts (8 off)
35	Exhaust manifold studs (6 off)
36	Cylinder head gasket
37	Core plug
38	Plug
39	Seal
40	Oil filler tube
41	Oil filler cap
42	Cover
43	Injectors (3 off)
44	Bolt (2 off)
45	Bolt
46	Vacuum pump
47	Water outlet assembly
48	Bolt (4 off)

Cylinder Heads



E44236

**ItemDescription**

1	Studs
2	Bolts
3	Blanking plug

The aluminum gravity die cast cylinder heads are unique to each cylinder bank. Eight deep-seated bolts help reduce distortion and secure each cylinder head to the cylinder block. The cylinder head bolts are located beneath the camshafts, 4 under the intake camshaft and 4 under the exhaust camshaft. Two hollow dowels align each cylinder head with the cylinder block.

• **NOTE:** The cylinder heads cannot be reworked.

The cylinder head gasket is a 3-layer, laminated steel type and is available in 5 different thickness. The choice of gasket thickness is dependent on the maximum piston protrusion. Gasket thickness is identified by serrations cut into the front end of the gasket.

The cylinder head has 4 ports machined at each cylinder location, 2 exhaust ports and 2 intake ports. One of the intake ports is helical and functions as a swirl port, the other is arranged laterally as a tangential port and functions as a charge port.

The camshafts are of a hollow steel tube construction, with pressed on sintered lobes. Each camshaft is retained by aluminum alloy caps, 5 for the exhaust camshafts and 4 for the intake camshafts. Location letters, A to I for the intake camshaft and R to Z for the exhaust camshaft, are marked on the outer faces of the caps for each cylinder head.

The LH cylinder bank exhaust camshaft is machined to accept a rear camshaft gear. The rear camshaft gear provides drive for the high-pressure fuel pump.  
Refer to: [Fuel Charging and Controls](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Description and Operation).

The exhaust camshaft gear of the LH cylinder head also incorporates a trigger wheel, which is used in conjunction with the camshaft sensor to measure engine position.  
Refer to: [Electronic Engine Controls](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Description and Operation).

The RH cylinder head exhaust camshaft is machined at the rear end to provide a drive connection for the vacuum pump.

The fuel injection nozzles are centrally mounted above each cylinder.  
Refer to: [Fuel Charging and Controls](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Description and Operation).

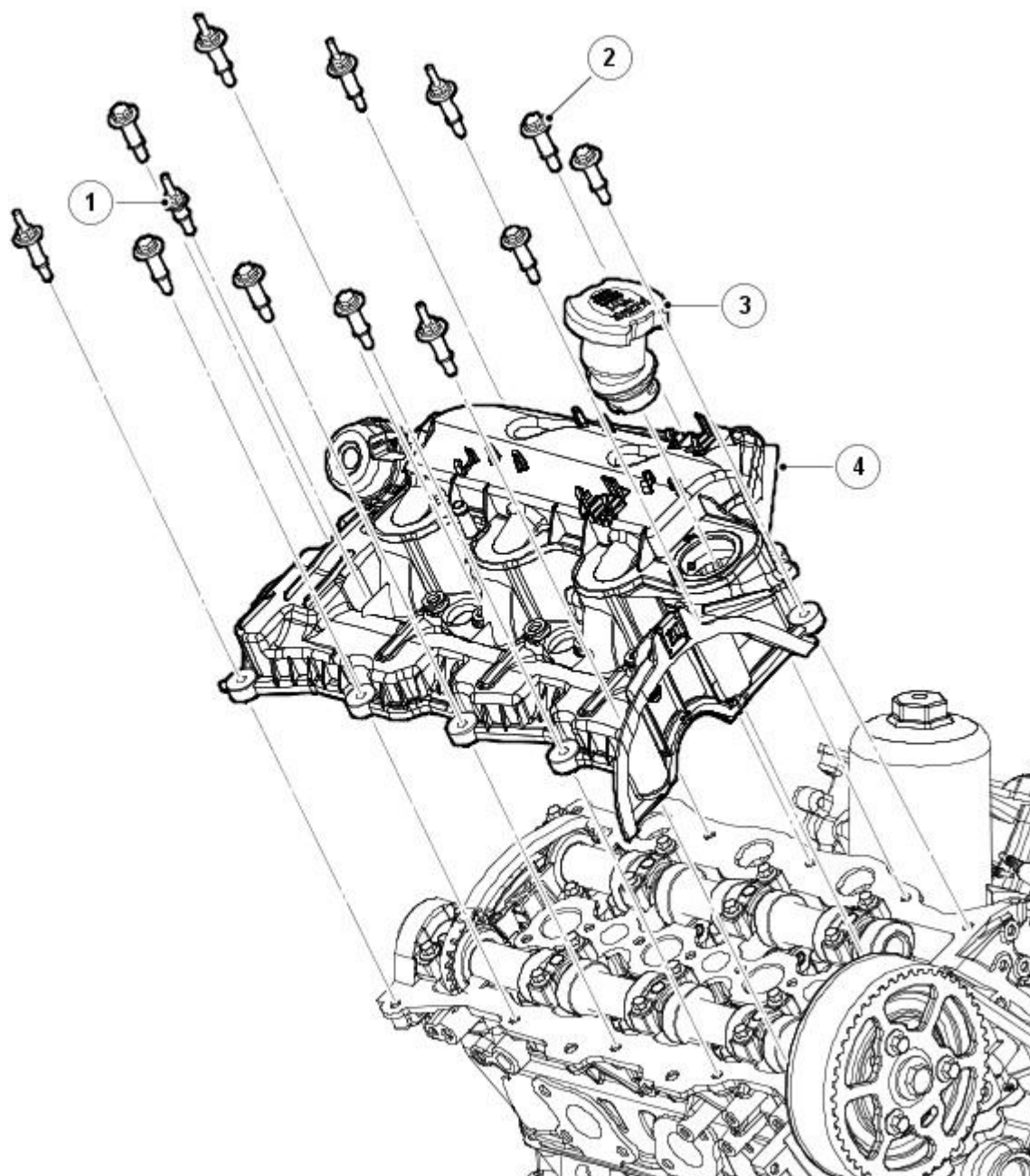
The glow plugs are arranged centrally on the intake side of the cylinder heads, between the 2 intake ports of each cylinder.



Refer to: [Glow Plug System](#) (303-07C Glow Plug System, Description and Operation).

The engine lifting eyes are bolted to the cylinder head, 1 at the front and 2 at the rear, 1 per cylinder head.

### Camshaft Covers



E44237

#### Item Description

- |   |  |
|---|--|
| 1 | Stud bolt M6 x 40 (6 off)                  |
| 2 | Bolt M6 x 40 (7 off)                       |
| 3 | Oil filler aperture                        |
| 4 | <a href="#">RH</a> camshaft cover assembly |

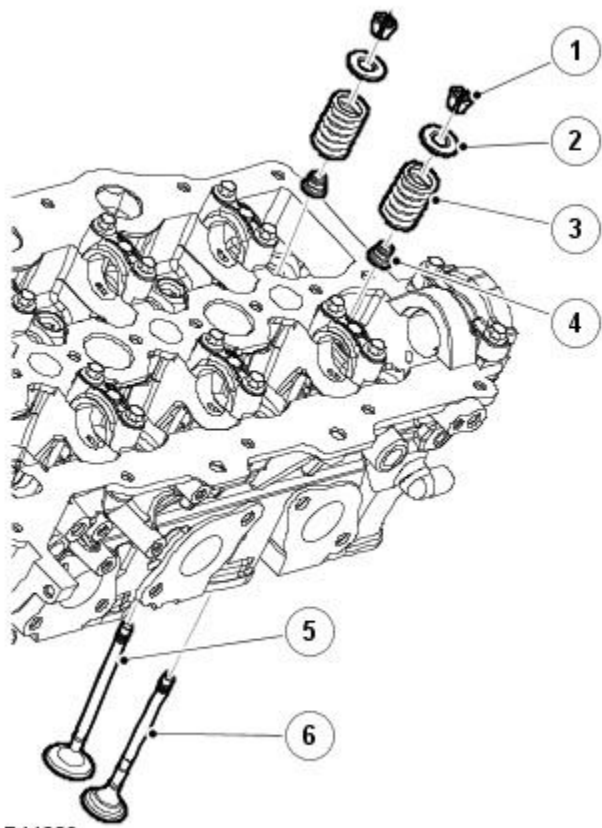
The camshaft covers are manufactured from vinyl ester composite. The [RH](#) bank camshaft cover incorporates an outlet for the full load engine breather and the engine oil filler cap. The [LH](#) bank camshaft cover incorporates an outlet for the part load engine breather. Refer to: [Engine Emission Control](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Description and Operation).

Silicon rubber in-groove gaskets seal the joints between the camshaft covers and the cylinder heads. Together with spacers and seals on the camshaft cover fasteners, they also isolate the covers from direct contact with the cylinder heads, to reduce noise.

#### Camshaft Timing

Valve	Position
Intake valve opens	8.5° BTDC (before top dead center)
Intake valve closes	35.5° ABDC (after bottom dead center)
Exhaust valve opens	64° BBDC (before bottom dead center)
Exhaust valve closes	12° ATDC (after top dead center)

Intake and Exhaust Valves



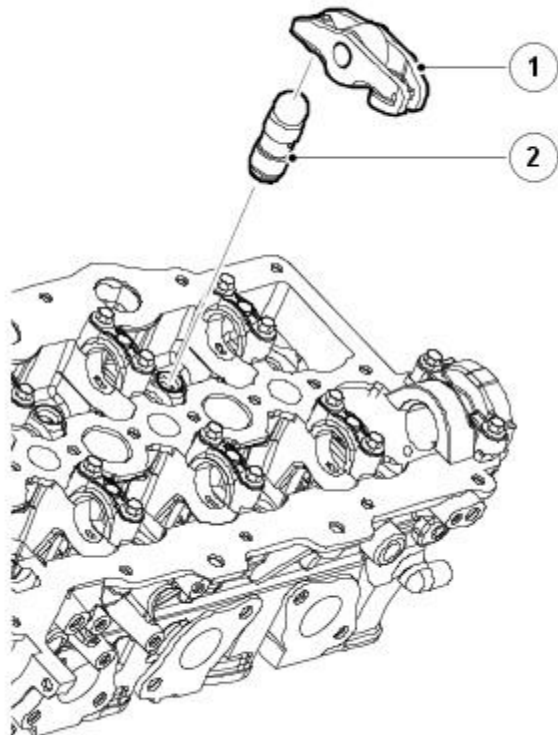
E44239

**ItemDescription**

1	Valve spring collet (24 off, 12 per cylinder head)
2	Valve spring retainer (24 off, 12 per cylinder head)
3	Valve spring (24 off, 12 per cylinder head)
4	Valve stem seal (24 off, 12 per cylinder head)
5	Intake valve (12 off, 6 per cylinder head)
6	Exhaust valve (12 off, 6 per cylinder head)

Each cylinder head incorporates 2 overhead camshafts operating 4 valves per cylinder via steel roller rockers with hydraulic lash adjusters.

Roller Rockers with Hydraulic Lash Adjusters



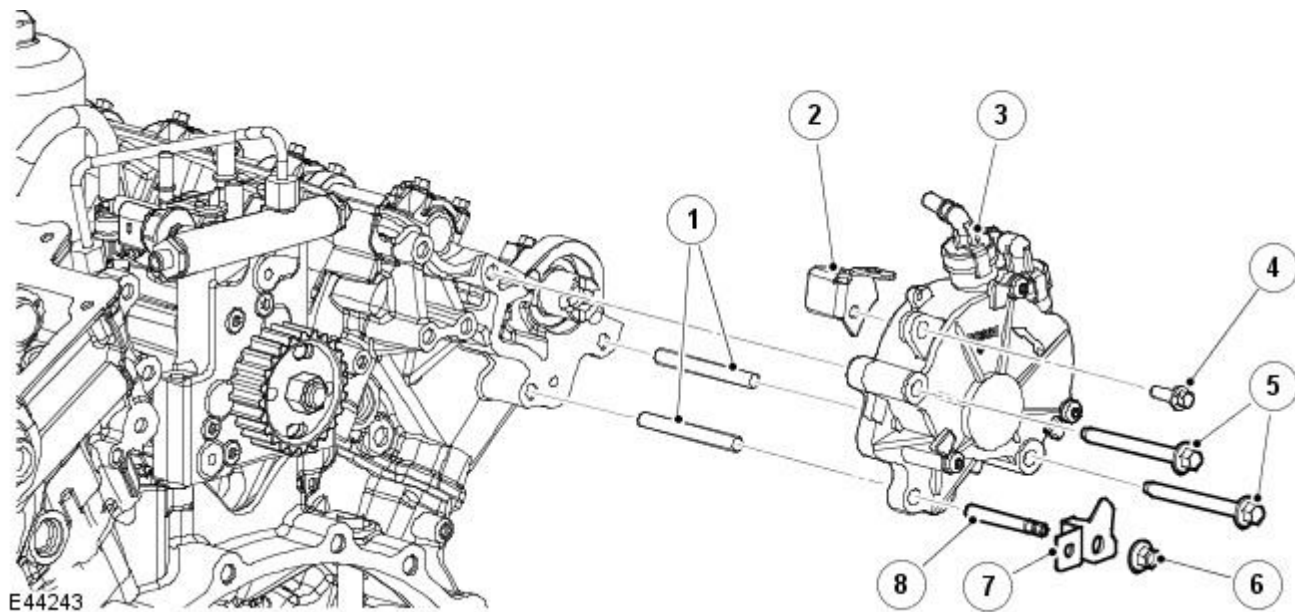
E44238

**ItemDescription**

1	Roller rocker (24 off, 12 per cylinder head)
2	Hydraulic lash adjuster (24 off, 12 per cylinder head)

The lightweight valve gear provides good economy and noise levels. Valve head diameters are 31 mm (1.220 in) for the exhaust and 35 mm (1.378 in) for the intake. All valves have 5 mm (0.197 in) diameter stems supported in sintered metal seats and guide inserts. Collets, valve collars and spring seats locate single valve springs on both intake and exhaust valves. Valve stem seals are integrated into the spring seats.

#### Vacuum Pump



E44243

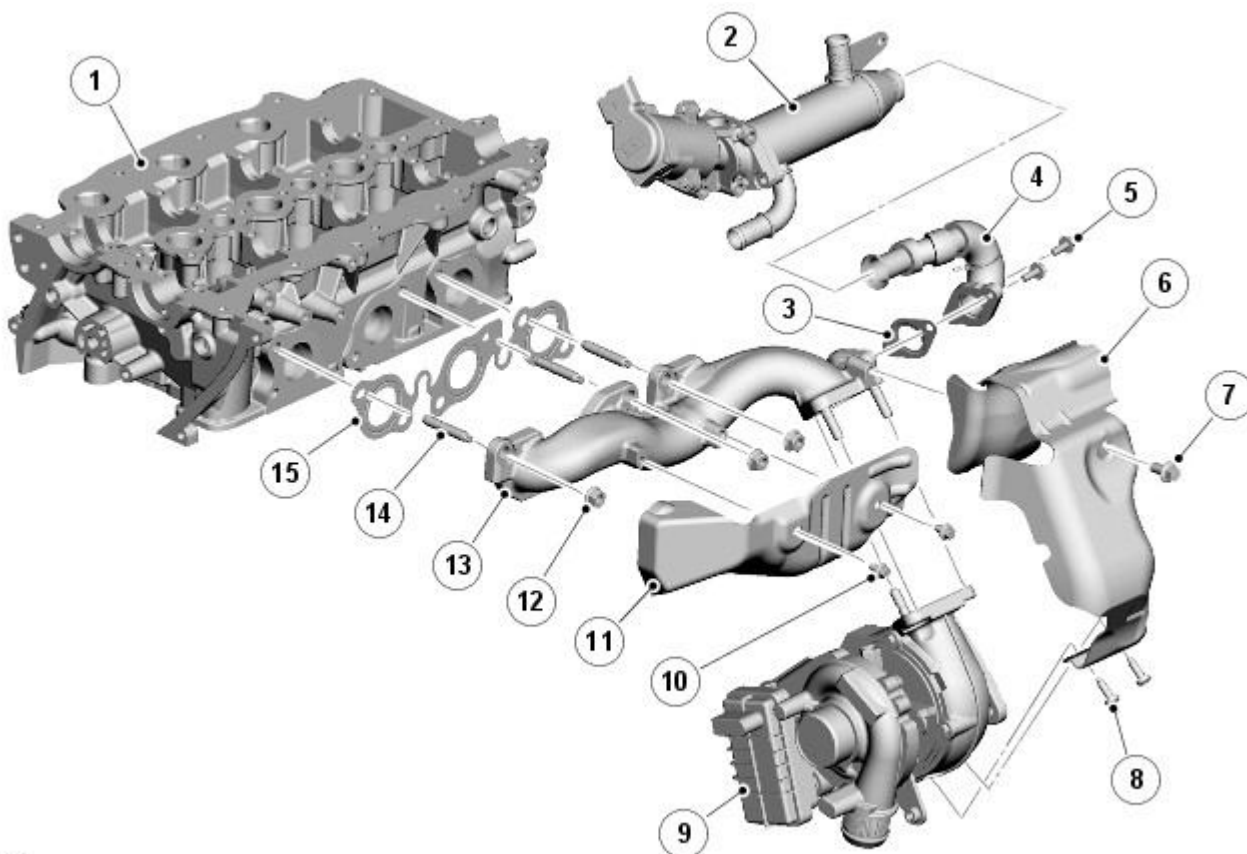
#### ItemDescription

1	Location dowel (2 off)
2	Bracket
3	Vacuum pump
4	Bolt
5	Bolt (2 off)
6	Nut
7	Bracket (transmission breather hose)
8	Stud

The vacuum pump is located at the rear of the [RH](#) side cylinder head and is driven from the exhaust camshaft.

• NOTE: [LH](#) exhaust manifold shown; [undefined \(undefined\)](#) exhaust manifold similar.

#### Exhaust Manifolds



E94908

#### ItemDescription

1	Cylinder head
---	---------------



2 [EGR \(exhaust gas recirculation\)](#) valve and cooler assembly

3 Gasket

4 [EGR](#) coolant inlet tube

5 Bolt (2 off)

6 Exhaust manifold heat shield

7 Bolt

8 Bolt (2 off)

9 Turbocharger assembly

10 Bolt (2 off)

11 Turbocharger heat shield

12 Nut (6 off)

13 Exhaust manifold

14 Stud (6 off)

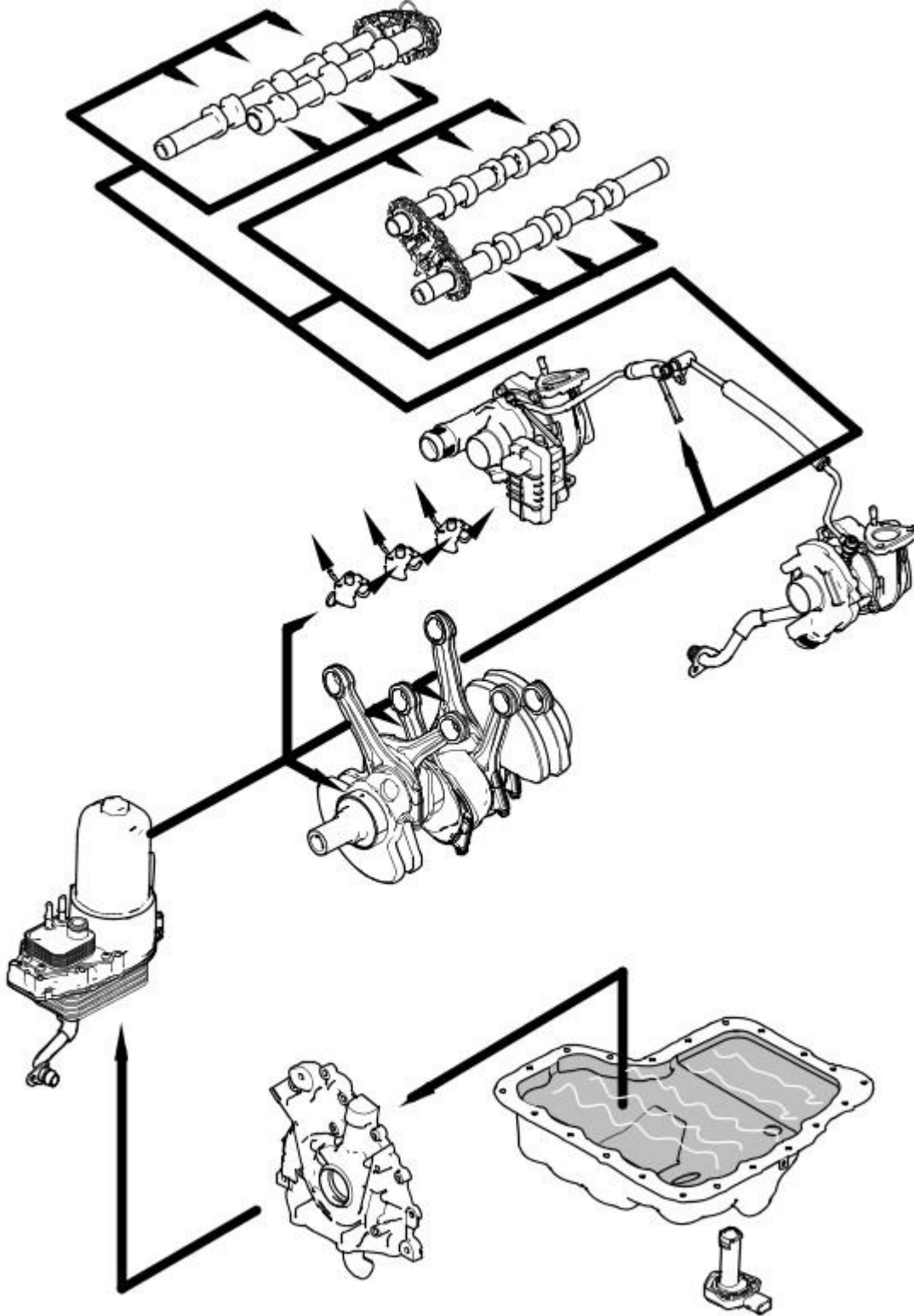
15 Gasket

The exhaust manifolds are cast from steel alloy and are unique for each cylinder bank. They are sealed to the cylinder head by means of a steel gasket. Sacrificial plastic sleeves are used to align the manifolds. These sleeves must be changed when refitting the manifolds. Spacers on the securing bolts allow the manifolds to expand and retract with changes of temperature while maintaining the clamping loads.

Each manifold has a connection for the [EGR](#) transfer pipe.

The engine is fitted with twin variable geometry turbochargers, which fix to the exhaust manifolds by a 3-hole flange with a steel gasket.

## Lubrication System

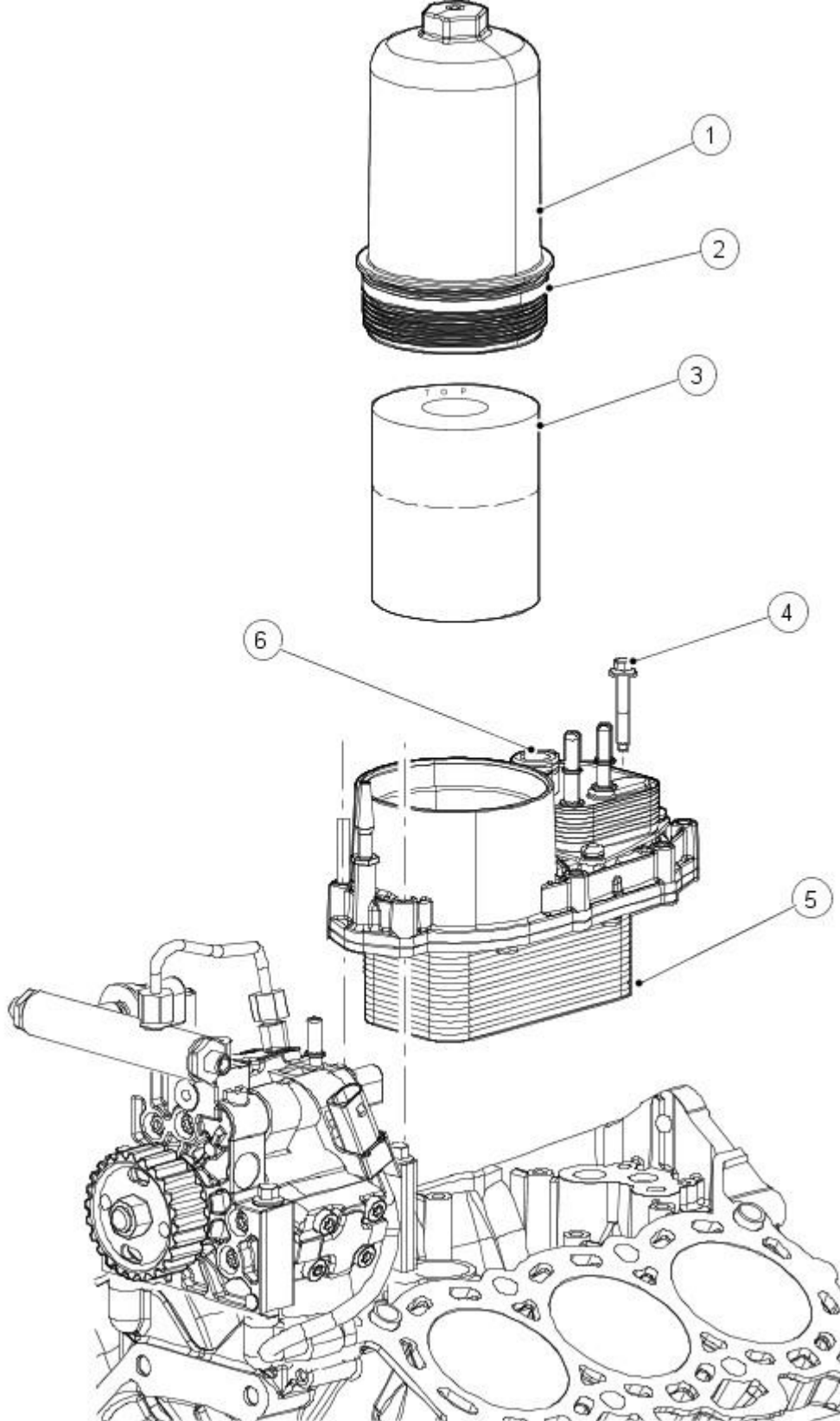


E52138

Oil is drawn from the reservoir in the oil pan and pressurized by the oil pump. The output from the oil pump is then filtered and distributed through internal oil passageways.

All moving parts are lubricated by pressure or splash oil. Pressurized oil is also provided for operation of the hydraulic adjusters and the timing gear chain tensioners.

Oil/Fuel Cooler and Filter Assembly



E52140

**ItemDescription**

1	Filter housing
2	'O' ring seal
3	Paper element
4	Retaining bolt (8 off)
5	Cooler assembly
6	Coolant outlet connection

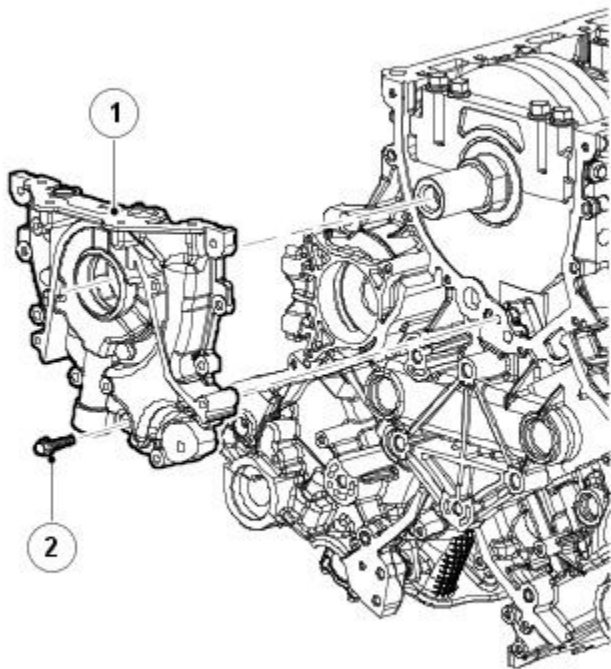
The engine is lubricated by a force-feed oil circulation system with a full flow oil filter. The oil cooler forms a unit with the oil filter and fuel cooler, which is mounted centrally in the middle of the cylinder block between the 2 banks of cylinders. The engine oil is cooled using the engine cooling system. This eliminates the need for an additional engine oil cooler remotely mounted.

The fuel cooler, which forms part of the oil filter body, is also cooled by engine coolant. In addition there is a further fuel cooler in the return line to the fuel tank.

Oil returns to the oil pan under gravity. Large drain holes through the cylinder heads and cylinder block ensure the quick return of the oil, reducing the volume of oil required and enabling an accurate check of the contents soon after the engine stops.

System replenishment is through the oil filler cap on the [RH](#) camshaft cover.

The moulded composite oil pick-up is immersed in the oil reservoir to provide a supply to the oil pump during all normal vehicle attitudes. A mesh screen in the inlet prevents debris from entering the oil system.



E44230

**ItemDescription**

1	Oil pump
2	Bolt (10 off)

The oil pump is a gear type pump and is bolted and dowelled to the front of the cylinder block. It is sealed by means of a rubber gasket, which is recessed into the oil pump housing. The pump inlet and outlet ports align with oil passages in the ladder frame.

The pumping element is an eccentric rotor, which is directly driven by flats on the crankshaft. An integral pressure relief valve regulates pump outlet pressure at 4.5 bar (65.25 psi).

The front crankshaft oil seal is housed in the oil pump casing and is fitted such that its front face is 1 mm (0.04 in) under flush with the machined front face of the oil pump.

• **NOTE:** The seal is not to be pushed all the way into the bore as this will block the seal drains.

The oil pressure switch, located in the 'vee' at the front of the [LH](#) cylinder head, connects a ground input to the instrument cluster when oil pressure is present. The switch operates at a pressure of 0.15 to 0.41 bar (2.2 to 5.9 psi).

The oil level gage locates midway along the [LH](#) side of the oil pan, supported in a tube installed in the ladder frame. There is a difference of approximately 1 liter (1 US quart) between the upper and lower oil levels.

## Engine - TDV6 2.7L Diesel - Engine

Diagnosis and Testing


For additional information.

REFER to: [Engine - TDV6 2.7L Diesel](#) (303-00 Engine System - General Information, Diagnosis and Testing).

# Engine - TDV6 2.7L Diesel - Engine Oil Draining and Filling

General Procedures

 **WARNING:** The spilling of hot engine oil is unavoidable during this procedure, care must be taken to prevent scalding.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

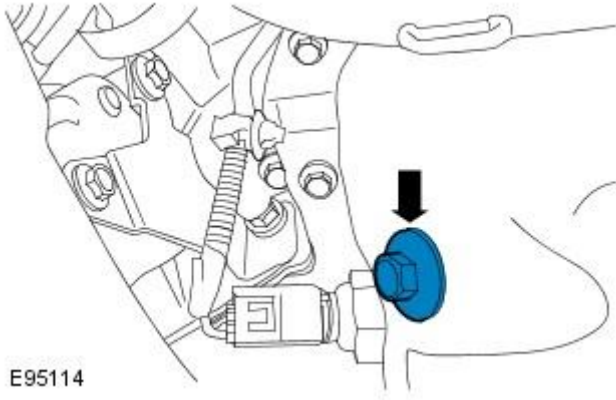
2. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).

3.  **WARNING:** Observe due care when draining engine oil as the oil can be very hot.

• **NOTE:** Remove and discard the seal.

Drain the engine oil.

- Allow the fluid to drain into a container.
- Remove the drain plug and drain the engine oil.



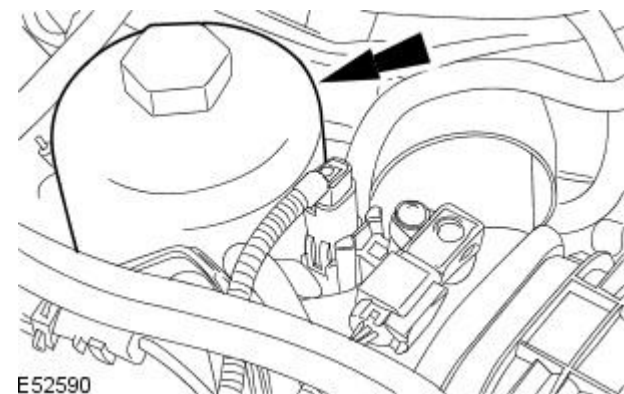
E95114

4. Remove the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

5. **NOTE:** Remove and discard the O-ring seal.

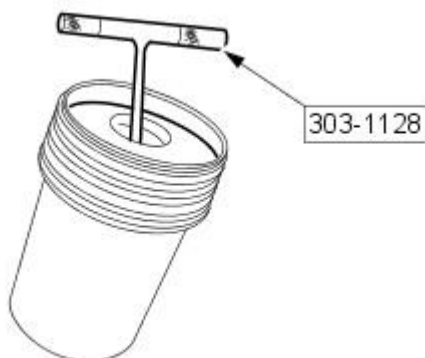
Remove the oil filter element housing.

- Rotate the oil filter element housing five complete turns counter-clockwise.
- Allow the engine oil to drain from the oil filter element housing for two minutes.
- Remove the oil filter element housing.



E52590

6. Using the special tool, remove and discard the oil filter element.



E50865

7. Install a new oil filter element.

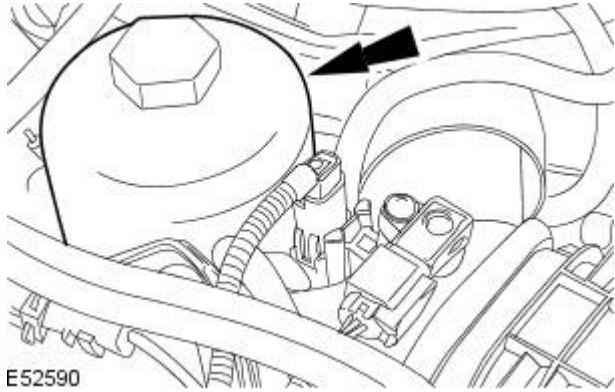


E56283

8. NOTE: Install a new O-ring seal.

Install the oil filter element housing.

- Tighten to 25 Nm.

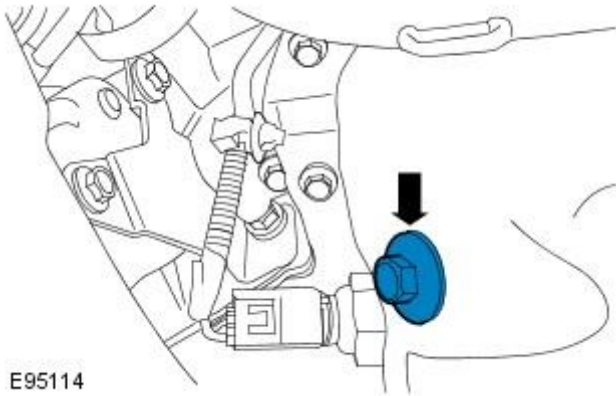


E52590

9. NOTE: Install a new seal.

Install the drain plug.

- Tighten to 25 Nm.



E95114

10. Install the air deflector.

For additional information, refer to: Air Deflector (501-02, Removal and Installation).

11. Fill the engine with oil.

12. Start engine and run at idle speed until the oil pressure warning light extinguishes.

- Stop the engine.
- Check for leaks.

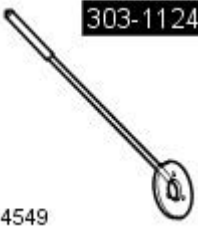



13. Check and top-up the engine oil if required.

14. Install the engine cover.

For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).


# Engine - TDV6 2.7L Diesel - Camshaft Front Seal

Removal and Installation

Special Tool(s)	
 <p>303-1124</p> <p>E54549</p>	<p>Holder - Camshaft Pulleys Front</p> <p>303-1124</p>
 <p>303-1119</p> <p>E54542</p>	<p>Installer - Camshaft Oil Seal</p> <p>303-1119</p>
 <p>303-1118</p> <p>E54541</p>	<p>Remover - Camshaft Oil Seal</p> <p>303-1118</p>
 <p>303-1126</p> <p>E54551</p>	<p>Timing Pin - Camshaft Pulleys</p> <p>303-1126</p>


## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

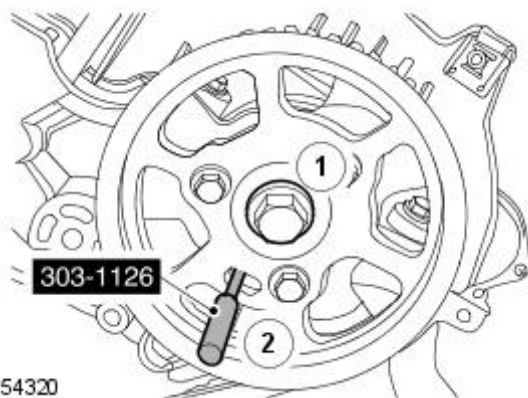
Raise and support the vehicle.

3. Remove the timing belt.  
For additional information, refer to: [Timing Belt](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).

4.  **CAUTION:** Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.

Remove the special tool.

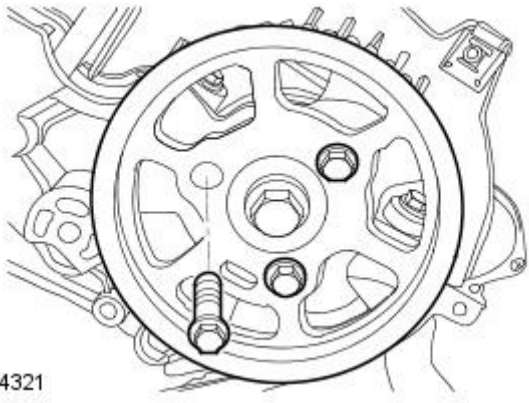
- Stage one: Retain the camshaft pulley.
- Stage two: Remove the special tool.





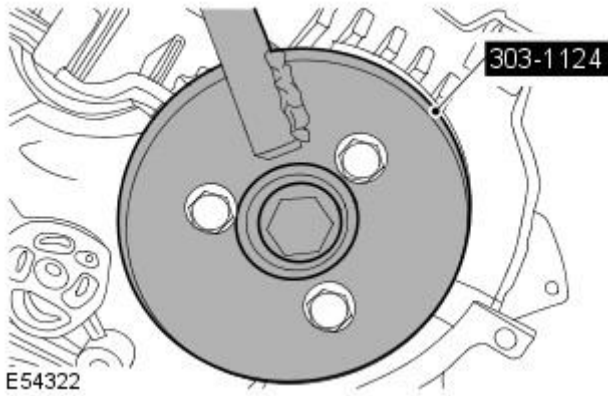
5. Remove the camshaft pulley.

- Remove the three retaining bolts.

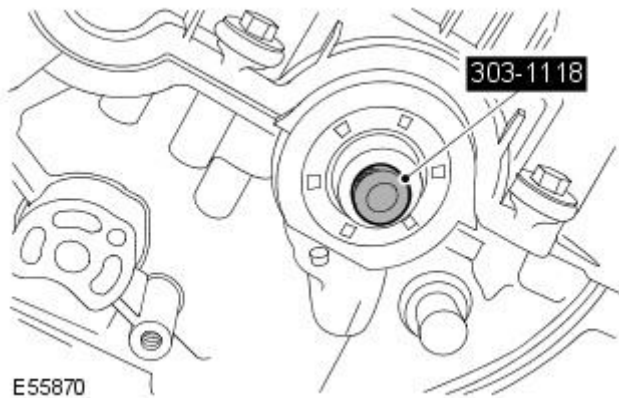



6. Using the special tool, remove the camshaft position (CMP) sensor timing plate.

- Remove and discard the retaining bolt.

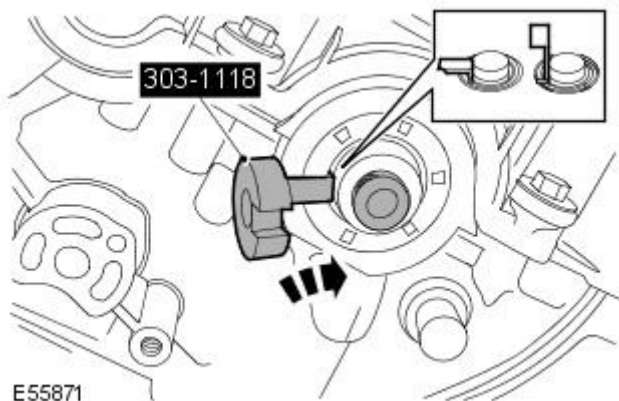


7. Install the special tool to the camshaft.

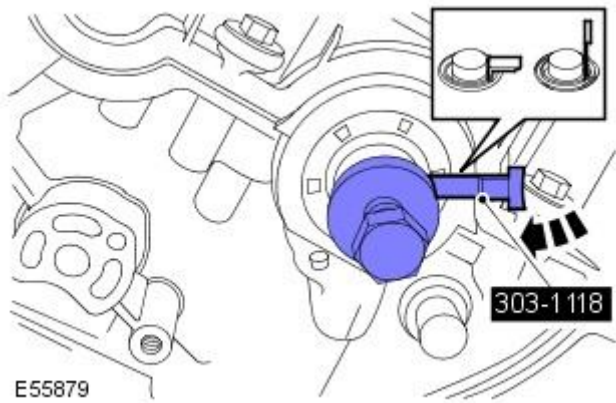


8.  CAUTION: Make sure the special tool is correctly seated behind the camshaft seal. Failure to follow this instruction may result in damage to the special tool.

Install the special tool into the camshaft front seal.

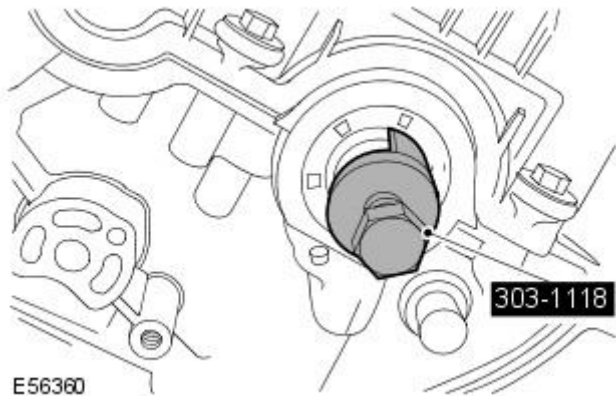


9. Install the special tool into the camshaft front seal.



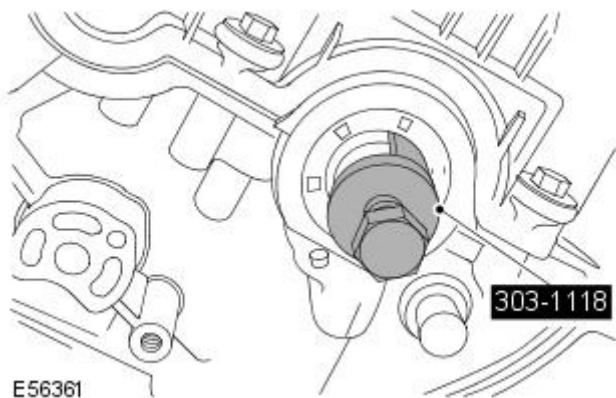
E55879

10. Install the special tool extracting bolt.



E56360

11. Using the special tool, remove the camshaft front seal.




E56361

## Installation

### 1. CAUTIONS:

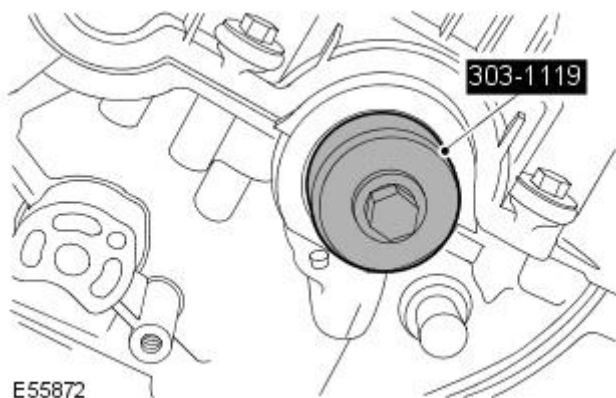
 Make sure the seal is installed correctly.

 Do not use any lubricant on the camshaft front seal or the camshaft. Failure to follow this instruction may result in damage to the vehicle.

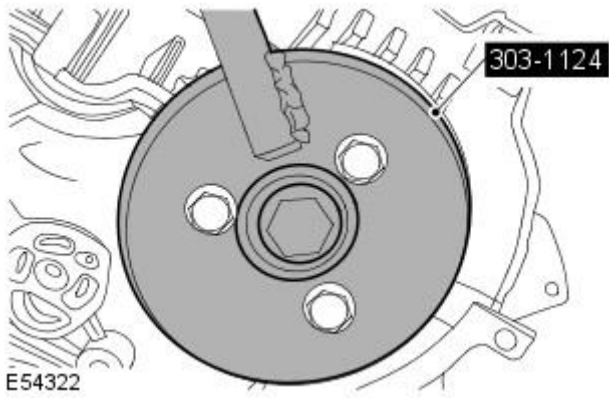
• NOTE: Make sure that the seal is 1mm below the face of the cylinder head.

Using the special tool, install the camshaft front seal.

- Clean the component mating faces.
- Use the discarded camshaft pulley hub retaining bolt with the special tool.



E55872

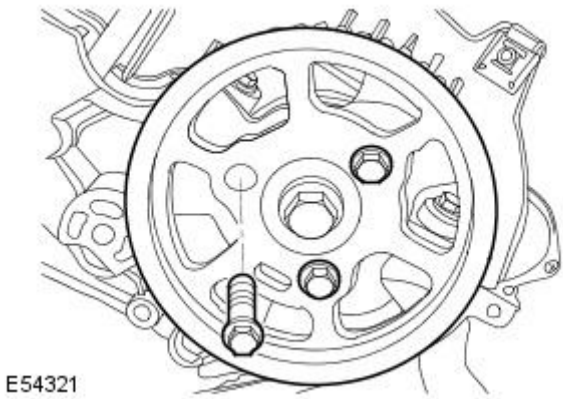



2. Using the special tool, install the CMP sensor timing plate.

- Install a new retaining bolt.
- Tighten the retaining bolt in two stages:
- Stage one: Tighten to 80 Nm.
- Stage two: Tighten a further 80 degrees.

3. Install the camshaft pulley.

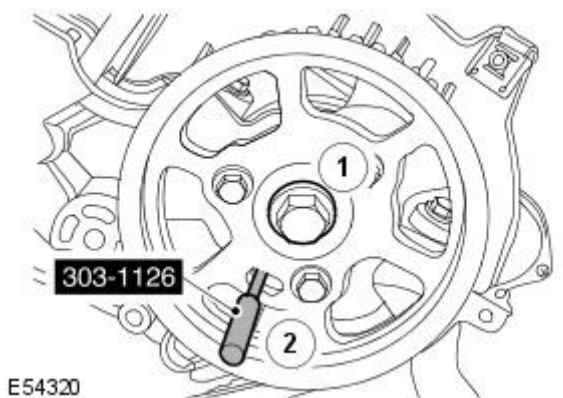
- Install the bolts, but do not tighten fully at this stage.



4.  **CAUTION:** Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.

Install the special tool.

- Stage one: Retain the camshaft pulley.
- Stage two: Install the special tool.



5. Install the timing belt.


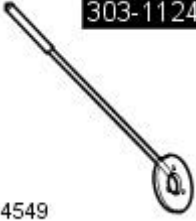


For additional information, refer to: [Timing Belt](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).

6. Connect the battery ground cable.


For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).


**Engine - TDV6 2.7L Diesel - Camshaft LH**


Removal and Installation


Special Tool(s)	
 <p>303-1126</p> <p>E54551</p>	<p>Timing Pin - Camshaft Pulleys</p> <p>303-1126</p>
 <p>303-1124</p> <p>E54549</p>	<p>Holder - Camshaft Pulleys Front</p> <p>303-1124</p>
 <p>E54550</p>	<p>Holder - Camshaft Pulley - Rear</p> <p>303-1125</p>
 <p>303-1119</p> <p>E54542</p>	<p>Installer - Camshaft Oil Seal</p> <p>303-1119</p>

**Removal****1. WARNINGS:**


 Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.


 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

 Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.

**• CAUTIONS:**

 Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

 Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

 Diesel fuel injection equipment is manufactured to very precise



tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Disconnect the battery ground cable.


For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2. Remove the intake air shutoff throttle.

For additional information, refer to: [Intake Air Shutoff Throttle](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

3. Remove the fuel injector.

For additional information, refer to: [Fuel Injector](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

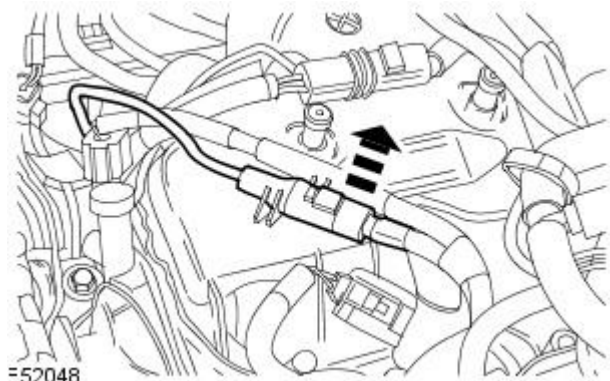
4.  **CAUTION:** Make sure the high-pressure fuel supply line remains in contact with both the fuel injector and the fuel injection supply manifold until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Remove the 2 remaining fuel injectors.

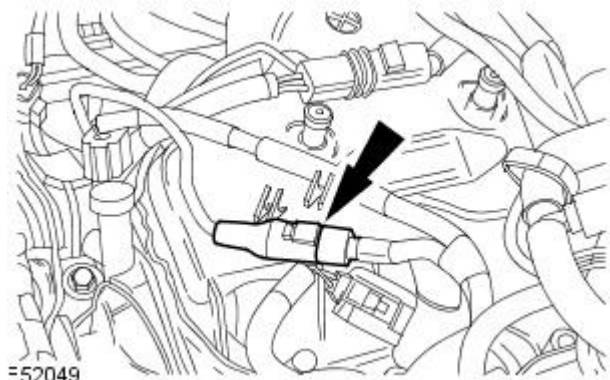
5. Remove the fuel injection pump belt.

For additional information, refer to: [Fuel Injection Pump Belt](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).

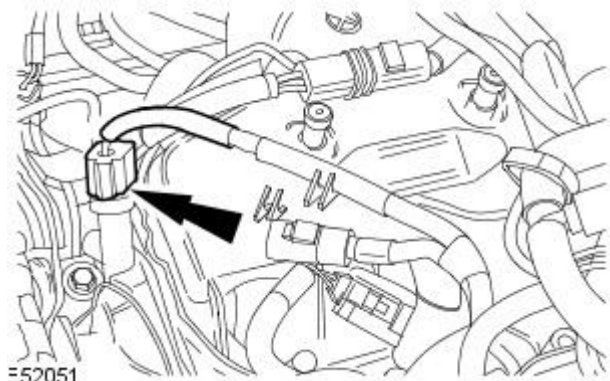
6. Detach the electrical connector from the left-hand valve cover.



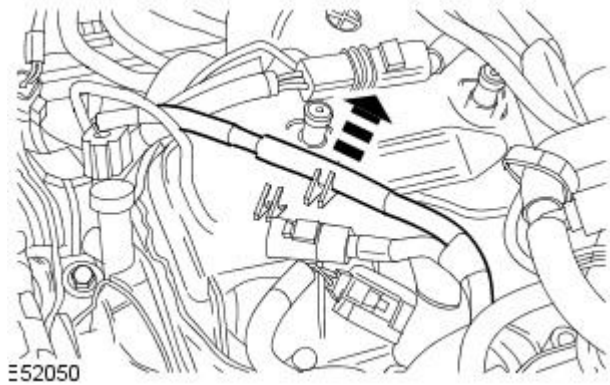
7. Disconnect the electrical sensor.



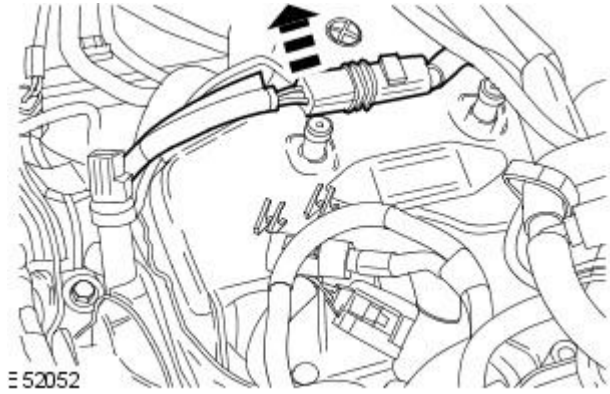
8. Disconnect the electrical sensor.



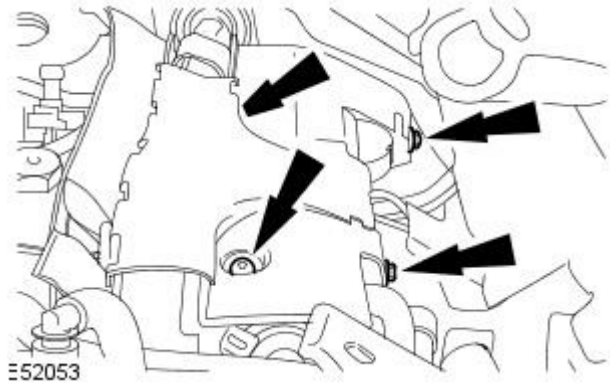
9. Detach the engine harness.



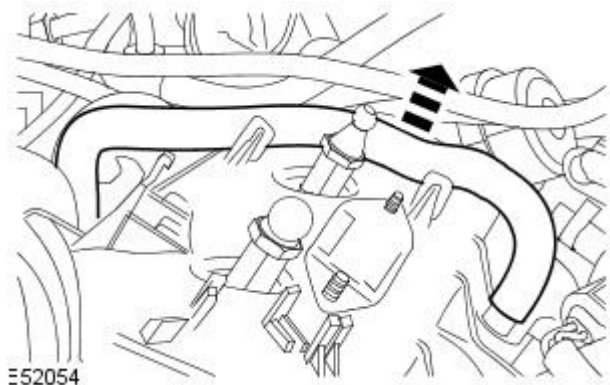
10. Detach the engine harness.



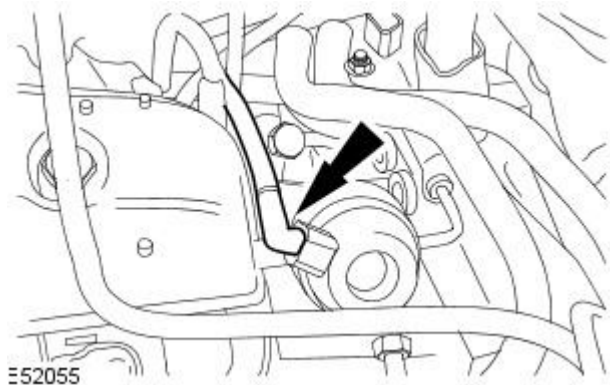
11. Remove the engine harness retaining bolts.



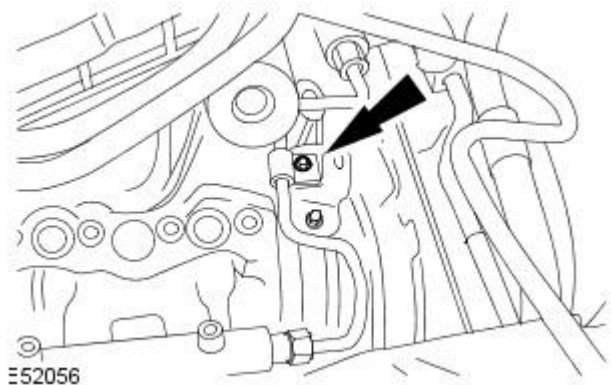
12. Detach the engine breather tube.



13. Disconnect the vacuum pipe.





14. Remove the fuel injection pump supply line retaining bolt.



15. Clean the fuel pump, high pressure fuel supply line and surrounding areas.  
For additional information, refer to: [Fuel Injection Component Cleaning](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, General Procedures).

16. CAUTIONS:

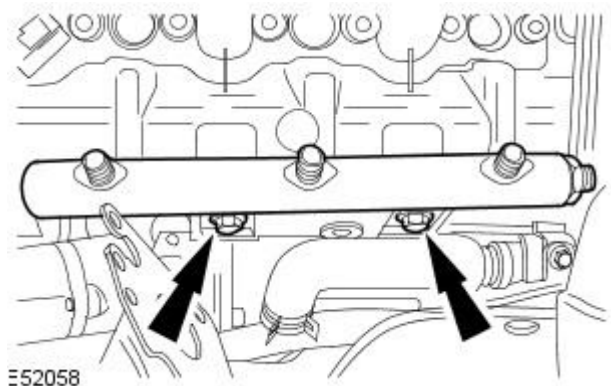
 Make sure the high-pressure fuel supply line remains in contact with both the fuel injector and the fuel injection supply manifold until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

 Make sure that the fuel injector adaptor union does not move when loosening the high-pressure fuel supply lines. Failure to follow this instruction may result in damage to the fuel injector or the fuel injector adaptor union.

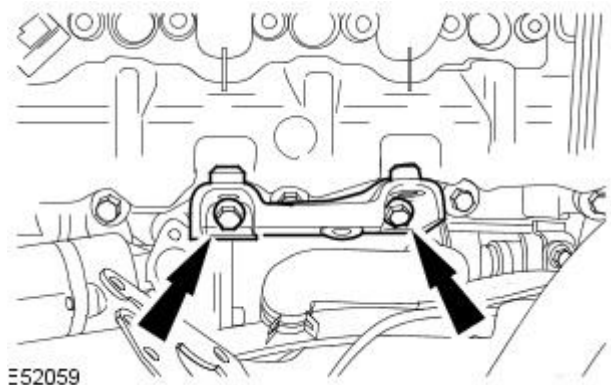
Remove and discard the high-pressure fuel supply line.

- Loosen the high-pressure fuel supply line from the fuel injector and the fuel injection supply manifold.
- Install blanking caps to the exposed ports.

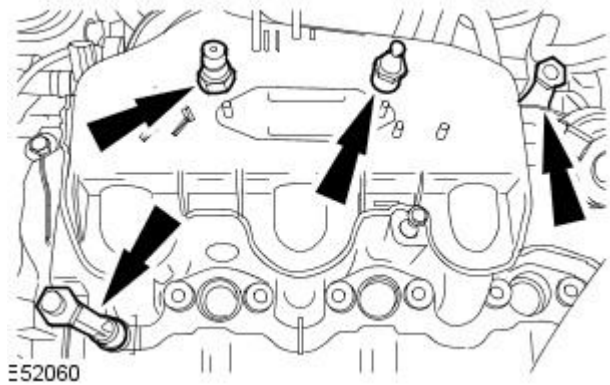
17. Remove the fuel injection supply manifold.



18. Remove the fuel injection supply manifold securing bracket.

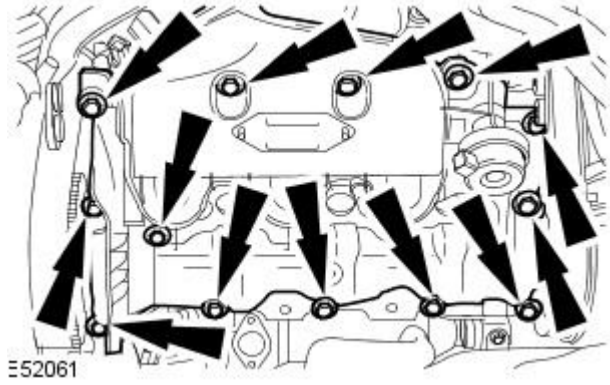


19. Remove the engine cover locating studs.



20. Remove the LH valve cover.

- Remove and discard the valve cover gasket.

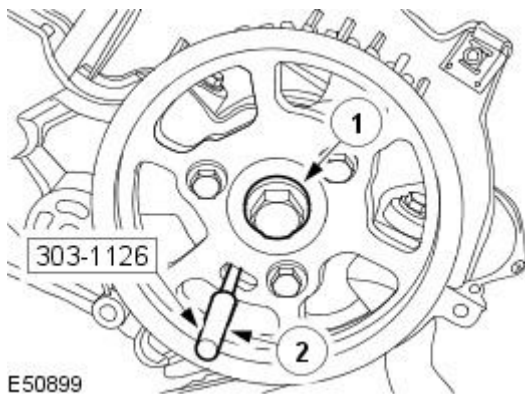



21. Remove the timing belt.

For additional information, refer to: [Timing Belt](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).

22. Remove the special tool.

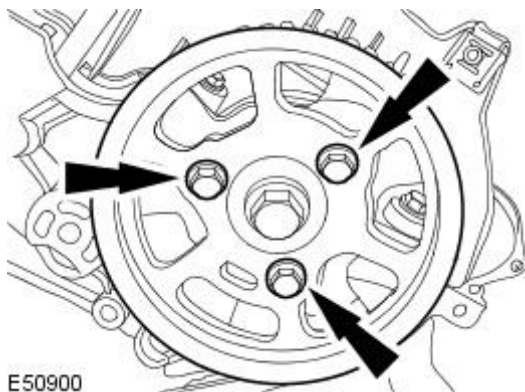
1. Retain the camshaft sprocket.
2. Remove the special tool.



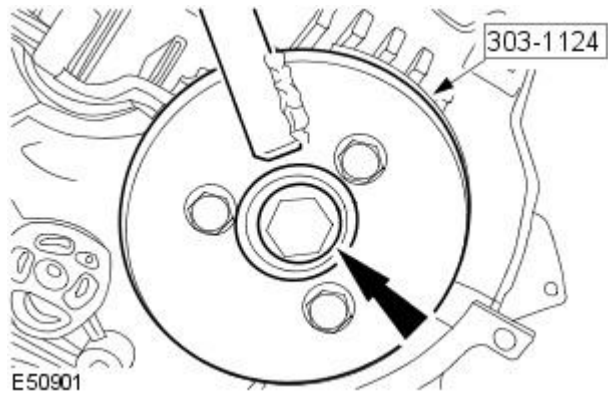
23.  **CAUTION:** Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.

Remove the camshaft sprocket.

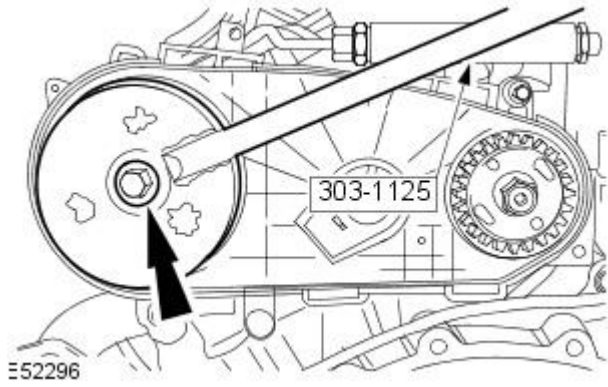
- Remove the camshaft sprocket retaining bolts.



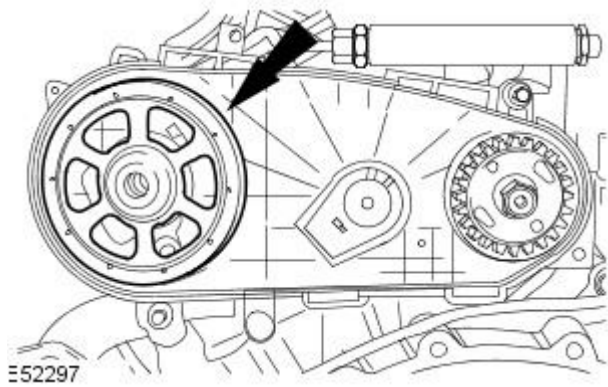




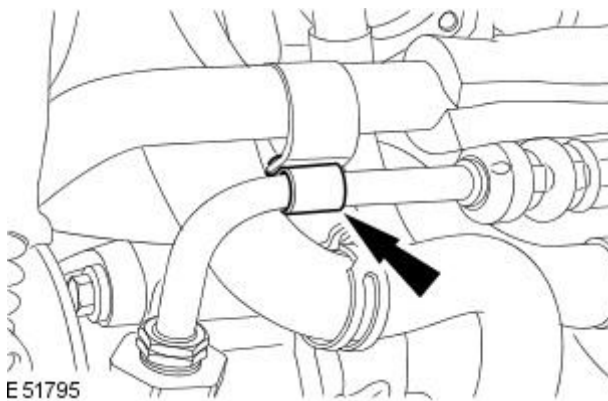
24. Using special tool, remove the camshaft sprocket hub.
- Remove the camshaft sprocket hub retaining bolt.



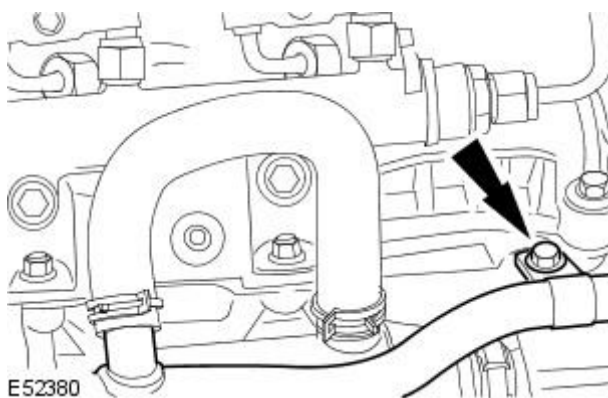
25. Remove the camshaft rear pulley retaining bolt.
- Using special tool, retain the camshaft rear pulley.
  - Remove the special tool.



26. Remove the camshaft rear pulley.



27. Detach the EGR coolant inlet tube.



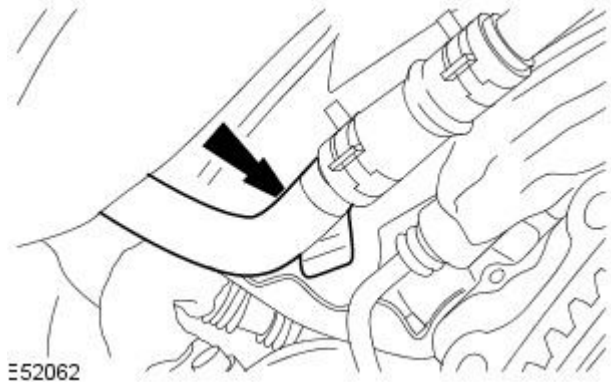
28. Detach the EGR coolant inlet tube.

29. Raise the vehicle.

30. Remove the LH catalytic converter.

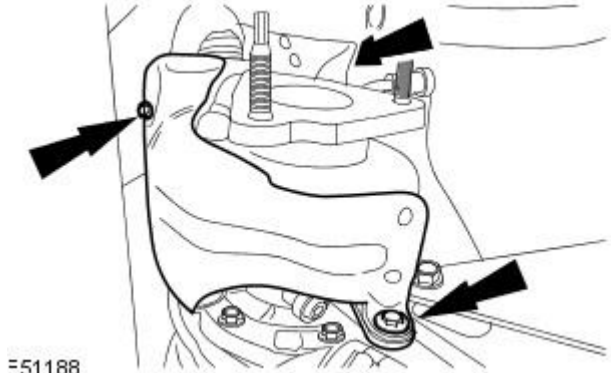
For additional information, refer to: [Catalytic Converter](#) (309-00A Exhaust System - TDV6 2.7L Diesel, Removal and Installation).

31. Detach the EGR coolant inlet tube.



E52062

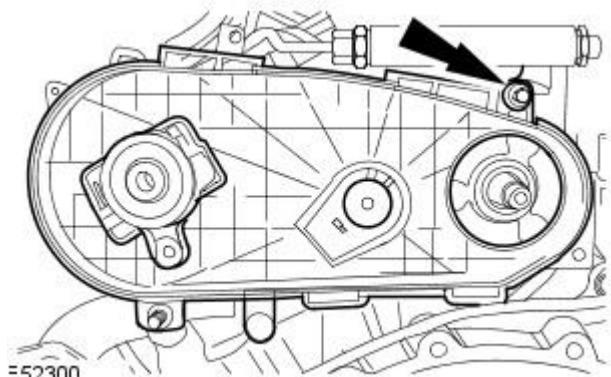
32. Remove the turbocharger heat shield.



E51188

33. Lower the vehicle.

34. Remove the fuel injection pump belt rear cover.

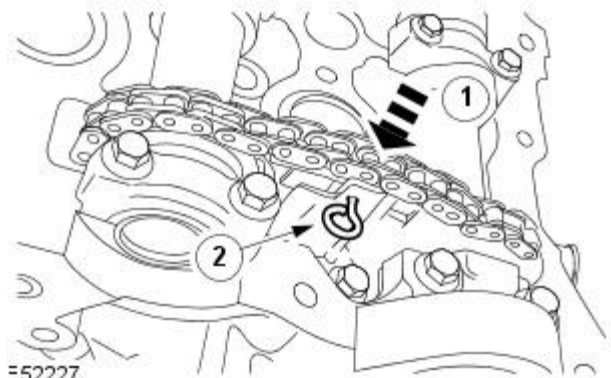


E52300

35. Retain the secondary timing chain tensioner plunger.

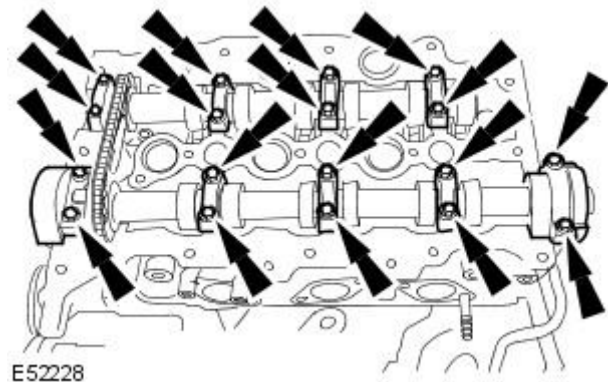
1. Reposition the secondary timing chain tensioner.

2. Retain the secondary timing chain tensioner plunger.

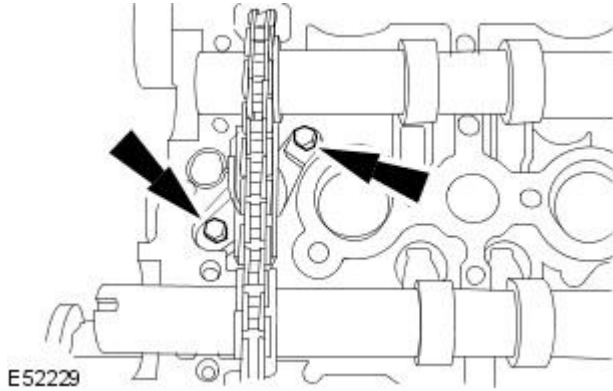


E52227

36. Remove the camshaft bearing caps evenly.

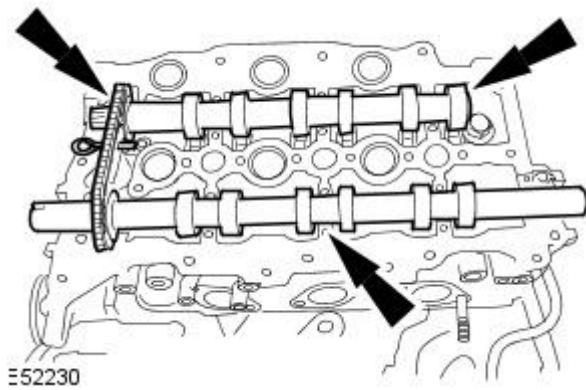


37. Remove the secondary timing chain tensioner retaining bolts.

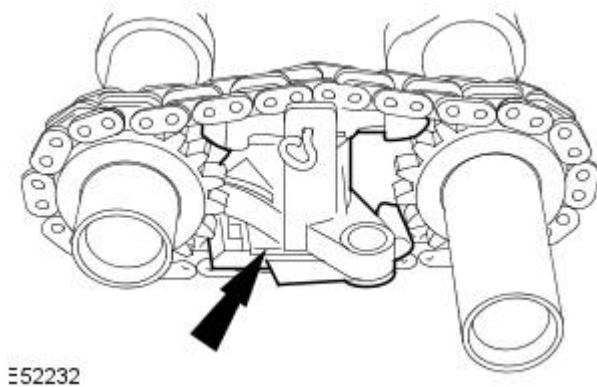


38. Remove the LH bank camshafts and secondary timing chain tensioner assembly.

- Discard the LH exhaust camshaft seals.

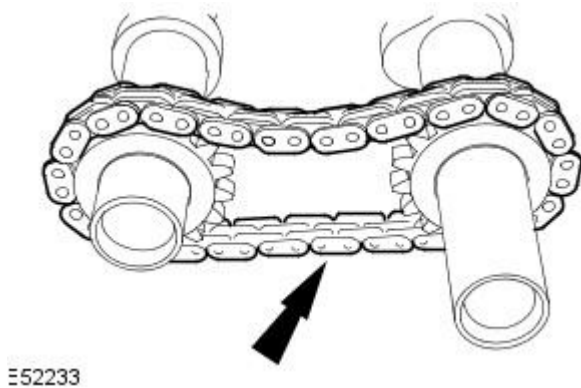


39. Remove the secondary timing chain tensioner assembly.




40. Remove the camshafts.


- Remove the secondary timing chain from the camshafts.





# Installation

## 1. WARNINGS:


 Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.


 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.


 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.


 Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.

## • CAUTIONS:

 Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

 Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.


 Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

 Make sure that the colored links on the secondary timing chain align with the dots and scribed line on the sprocket shoulder. Failure to follow this instruction may result in damage to the engine.

Install the camshafts.

- Install the secondary timing chain onto the camshafts.

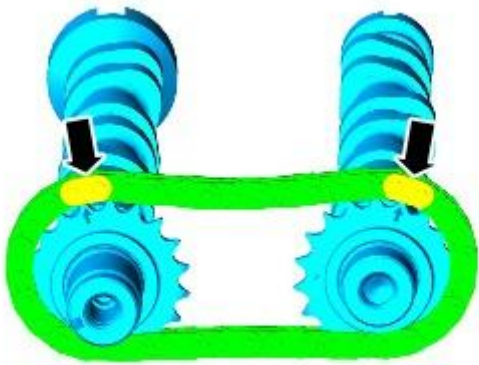
2. Install the secondary timing chain tensioner assembly.

3.  CAUTION: Make sure that the dots on the camshafts are aligned at the 12 o'clock position. Failure to follow this instruction may result in damage to the engine.

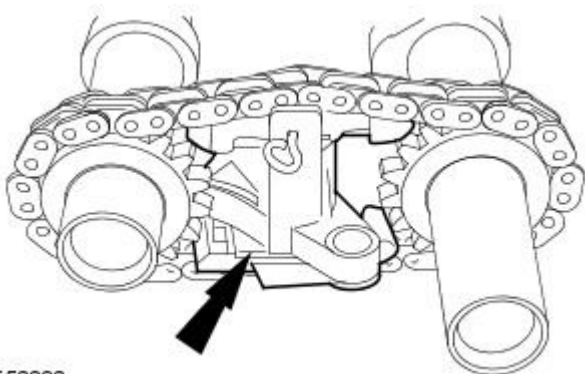
• NOTE: Lubricate the camshafts and the camshaft bearing caps with oil meeting Jaguar specification prior to installation.

Install the camshafts.

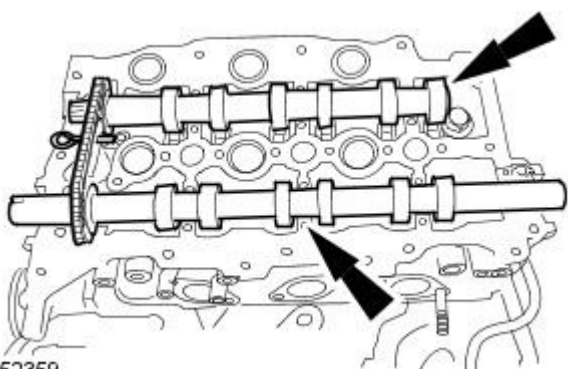
- Use Hypoid oil to lubricate the camshafts.



E86461



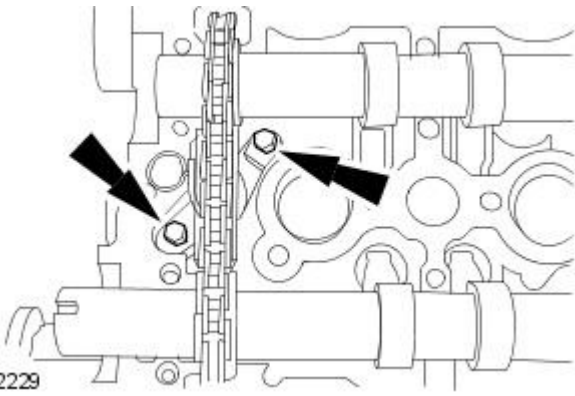
E52232



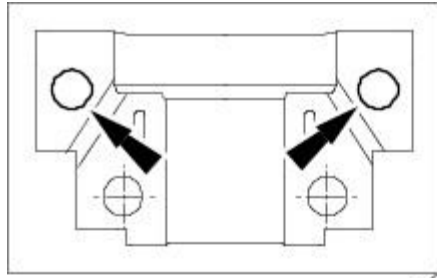
E52359

4. Install the secondary timing chain tensioner retaining bolts.

- Tighten to 10 Nm.



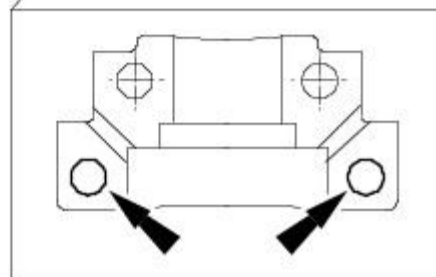
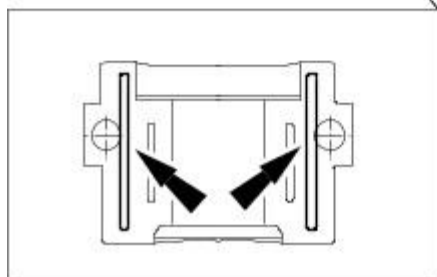
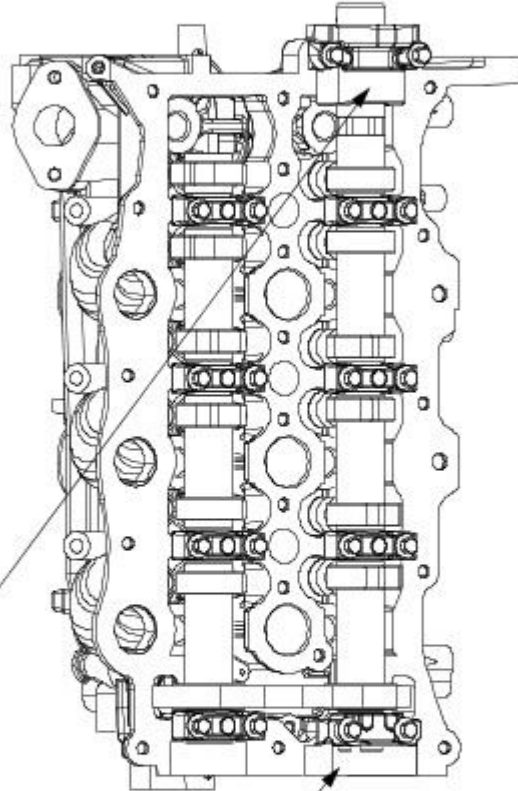
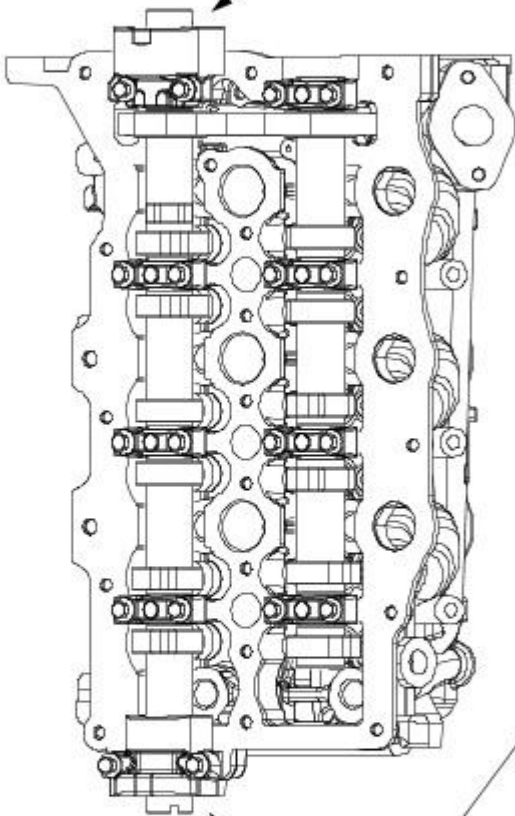
E52229



5. Apply Loctite 518 sealant to the exhaust camshaft seal bearing caps.

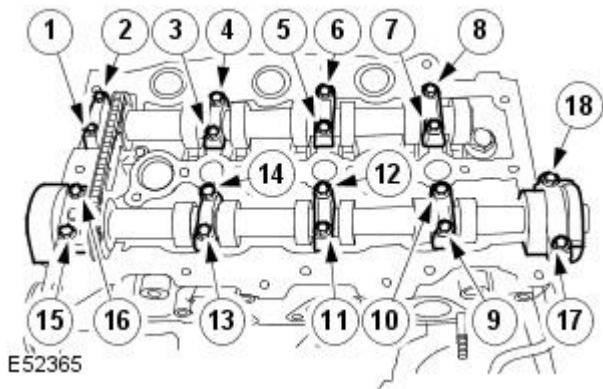
- Apply Loctite 518 sealant, 2 mm wide, to the LH rear and RH front camshaft bearing caps.

- Apply Loctite 518 sealant, 7 mm diameter, to the LH front and RH rear camshaft bearing caps.



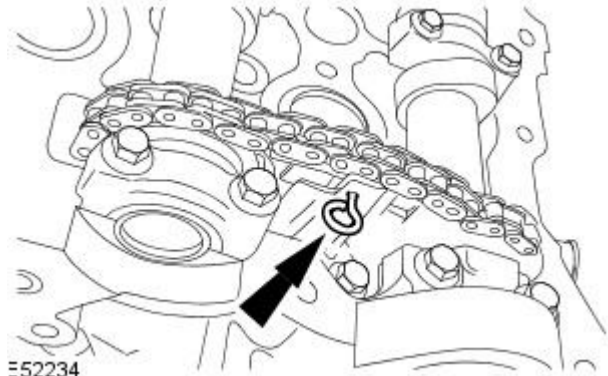
E53719





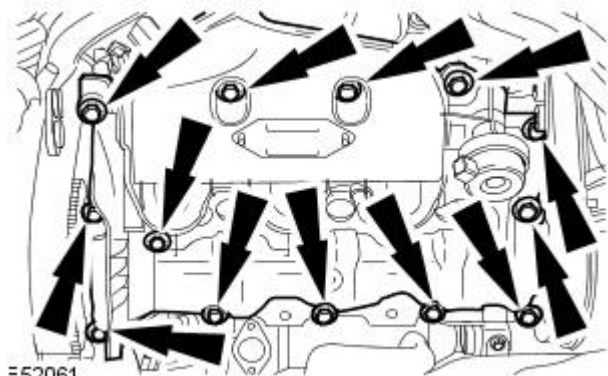
E52365

6. Install the camshaft bearing caps in their original positions.
- Tighten the retaining bolts in the sequence shown.
  - Stage 1: Bolts 1 to 14, 1 Nm.
  - Stage 2: Bolts 1 to 14, 5 Nm.
  - Stage 3: Bolts 1 to 14, 10 Nm.
  - Stage 4: Bolts 15 to 18, 1 Nm.
  - Stage 5: Bolts 15 to 18, 5 Nm.
  - Stage 6: Bolts 15 to 18, 10 Nm.



E52234

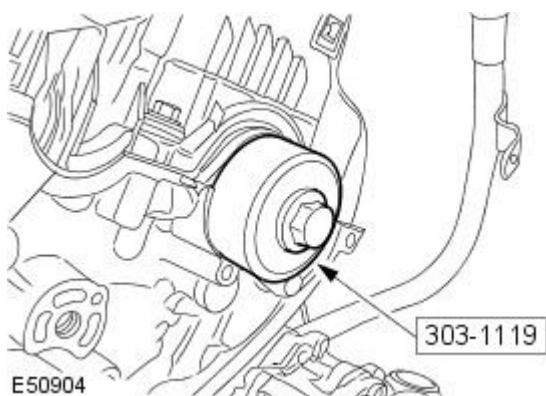
7. Remove the secondary timing chain tensioner retaining pin.



E52061


8. Install the LH valve cover.


- Install a new valve cover gasket.
- Tighten to 10 Nm.



E50904

9. CAUTIONS:

 A new camshaft front seal is supplied with a transit sleeve that must not be removed until the camshaft front seal is fully installed. Failure to follow this instruction may result in damage to the vehicle.

 Do not use any lubricant on the camshaft front seal, transit sleeve or the camshaft. Failure to follow this instruction may result in damage to the vehicle.

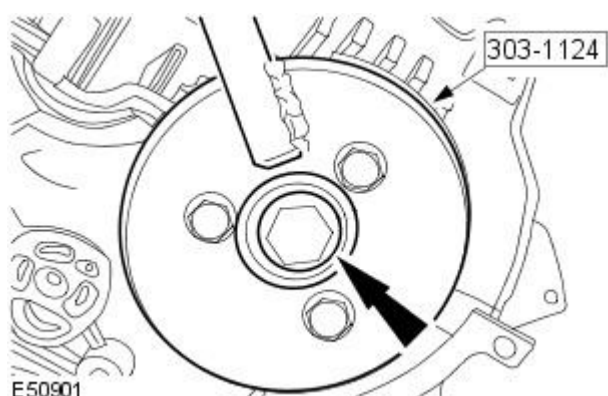
- NOTE: Make sure all components are clean.

Using the special tool, install the camshaft front seal.

- Remove and discard the transit sleeve.

10. Using special tool, install the camshaft sprocket hub.

- Install the camshaft sprocket hub retaining bolt.
- Tighten the bolt in the sequence shown.
- Stage one: Tighten to 80 Nm.
- Stage two: Tighten a further 80 degrees.

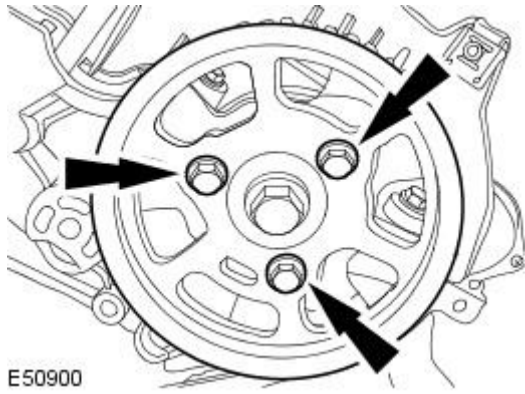


E50901

**11. NOTE:** Loosely install all retaining bolts.

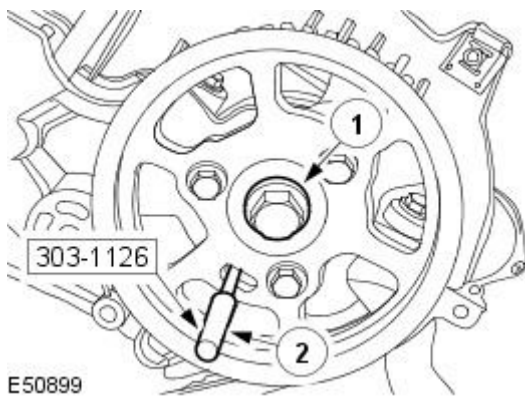
Install the camshaft sprocket.

- Install the camshaft sprocket retaining bolts.



E50900

**12.** Install the special tool.



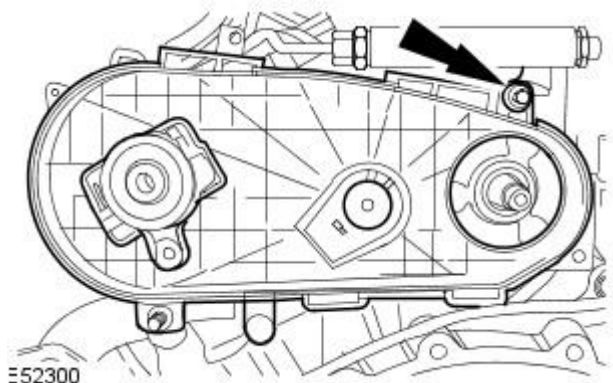
E50899

**13.** Install the timing belt.

For additional information, refer to: [Timing Belt](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).

**14.** Install the fuel injection pump belt rear cover.

- Tighten to 10 Nm.

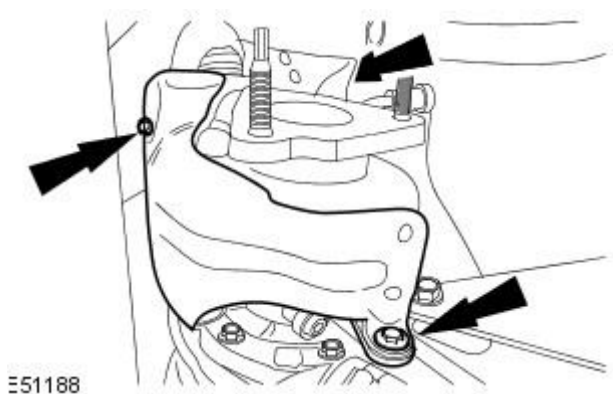


E52300

**15.** Raise the vehicle.

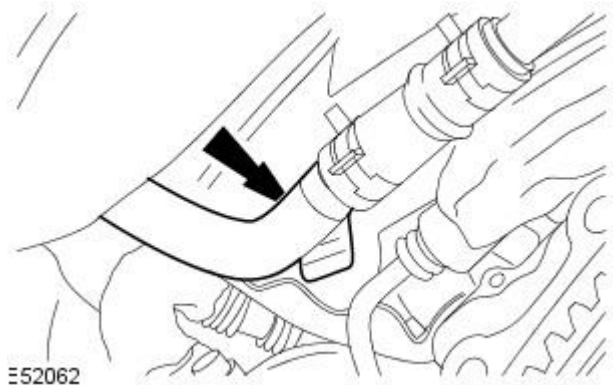
**16.** Install the turbocharger heat shield.

- Tighten to 9 Nm.



E51188

17. Attach the EGR coolant inlet tube.



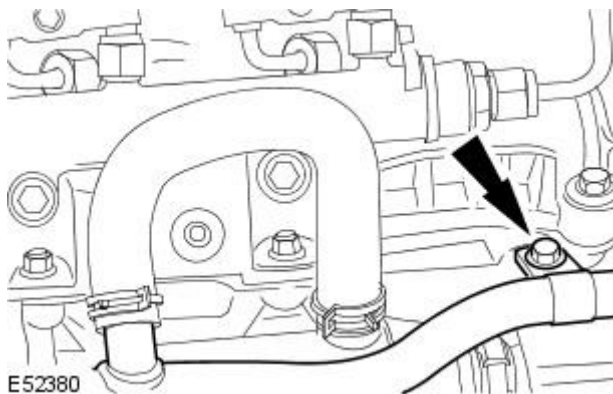
18. Install the LH catalytic converter.

For additional information, refer to: [Catalytic Converter](#) (309-00A Exhaust System - TDV6 2.7L Diesel, Removal and Installation).

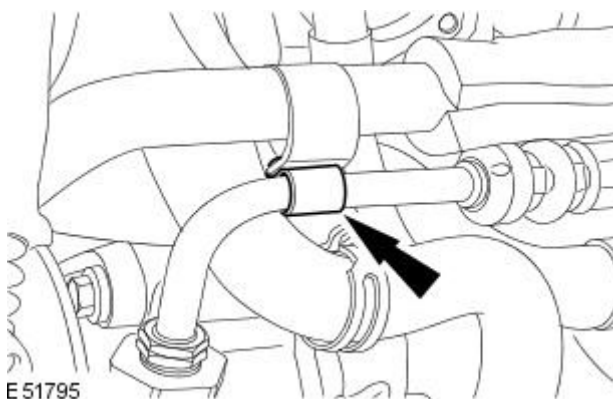
19. Lower the vehicle.

20. Attach the EGR coolant inlet tube.


- Tighten to 10 Nm.




21. Attach the EGR coolant inlet tube.



22. CAUTIONS:

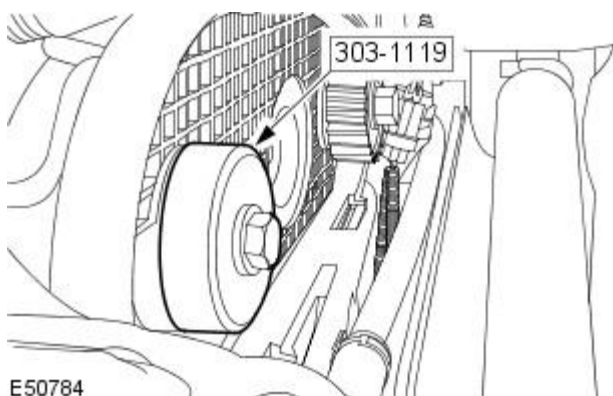
 A new camshaft front seal is supplied with a transit sleeve that must not be removed until the camshaft front seal is fully installed. Failure to follow this instruction may result in damage to the vehicle.

 Do not use any lubricant on the camshaft front seal, transit sleeve or the camshaft. Failure to follow this instruction may result in damage to the vehicle.

- NOTE: Make sure all components are clean.

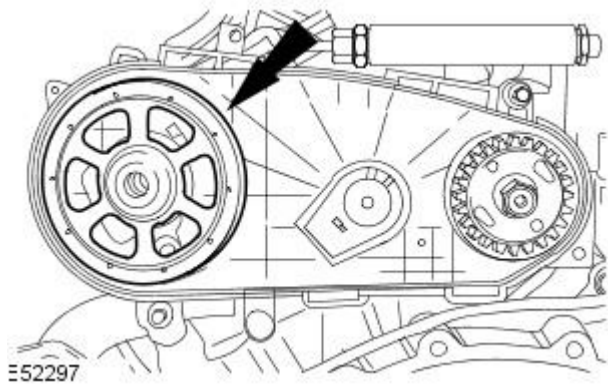
Using the special tool, install the new camshaft rear seal.

- Remove and discard the transit sleeve.



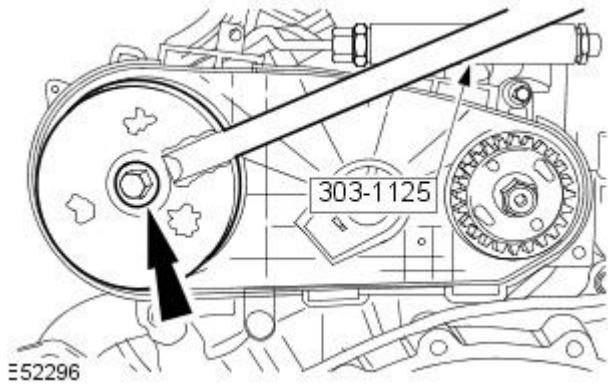


23. Install the camshaft rear pulley.



24. Install the camshaft rear pulley retaining bolt.

- Install a new retaining bolt.
- Using special tool, retain the camshaft rear pulley.
- Tighten the bolt in the sequence shown.
- Stage one: Tighten to 80 Nm.
- Stage two: Tighten a further 80 degrees.
- Remove the special tool.

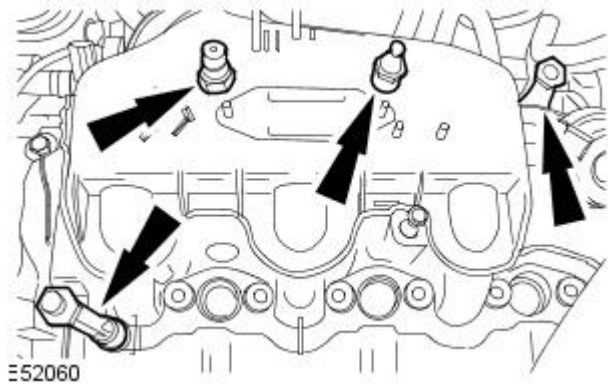


25. Install the fuel injection pump belt.

For additional information, refer to: [Fuel Injection Pump Belt](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).

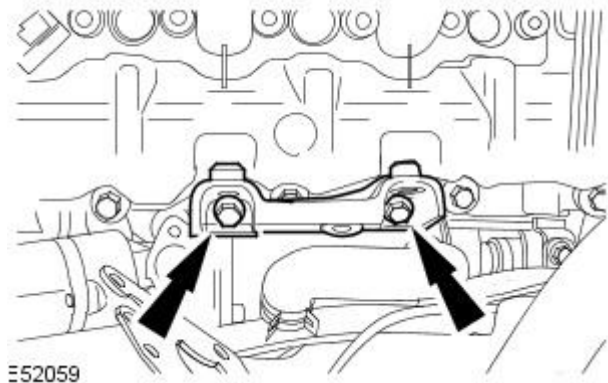
26. Install the engine cover locating studs.

- Tighten to 10 Nm.



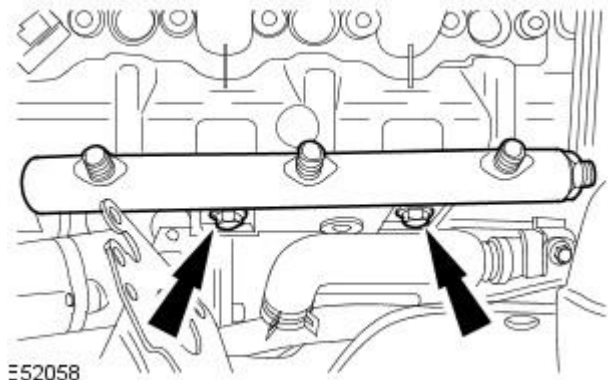
27. Install the fuel injection supply manifold securing bracket.

- Tighten to 24 Nm.



**28. NOTE:** Loosely install all retaining bolts.

Install the fuel injection supply manifold.



**29.** Install the fuel injector.

For additional information, refer to: [Fuel Injector](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

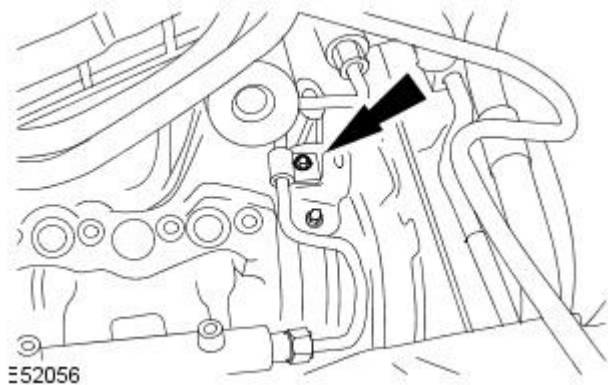
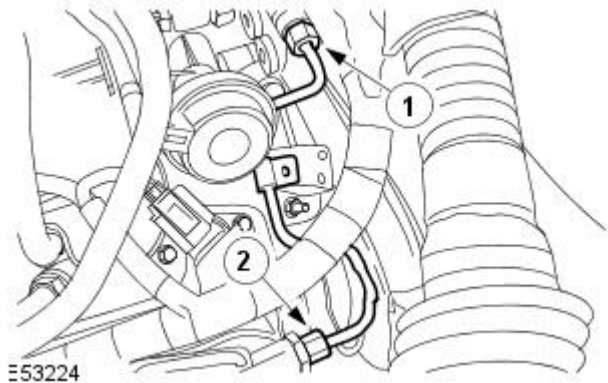
**30.** Install the 2 remaining fuel injectors.

**31.** Install the new high-pressure fuel supply lines.

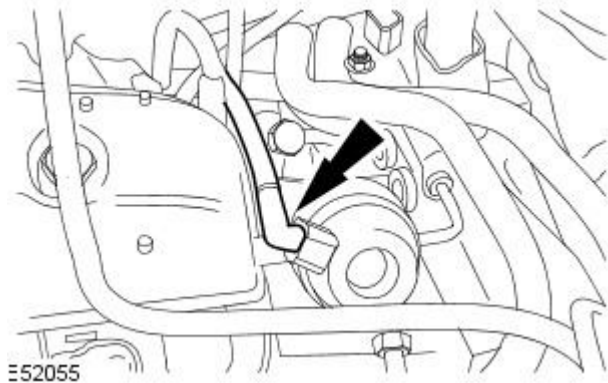
- Remove and discard the blanking caps.
- Install the new high pressure fuel supply line, but do not fully tighten at this stage.
- Tighten the fuel injection supply manifold retaining bolts to 23 Nm.
- Tighten the high-pressure fuel supply line in the sequence shown in four stages.
- Stage 1: Tighten the high-pressure fuel supply line union 1 to 15 Nm.
- Stage 2: Tighten the high-pressure fuel supply line union 2 to 15 Nm.
- Stage 3: Tighten the high-pressure fuel supply line union 1 to 30 Nm.
- Stage 4: Tighten the high-pressure fuel supply line union 2 to 30 Nm.

**32.** Install the fuel injection pump supply line retaining bolt.

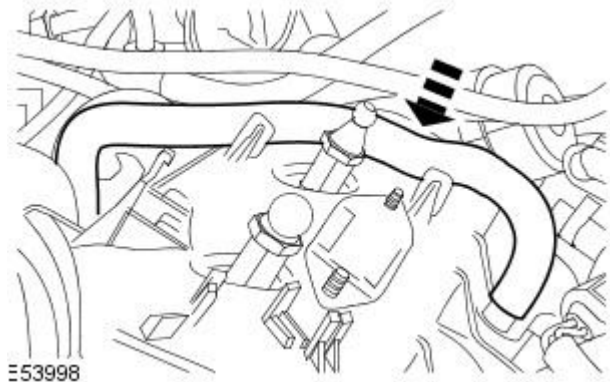
- Tighten to 10 Nm.



**33.** Connect the vacuum pipe.



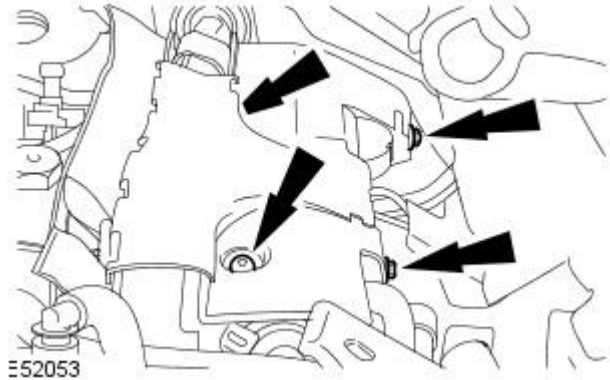
34. Attach the engine breather pipe.



E53998

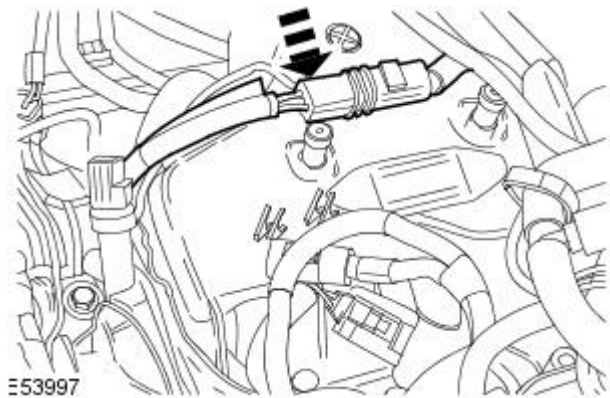
35. Install the engine harness retaining bolts.

- Tighten to 4 Nm.



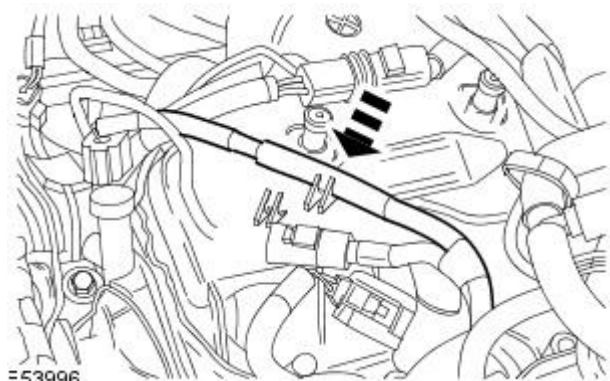
E52053

36. Attach the engine wiring harness.



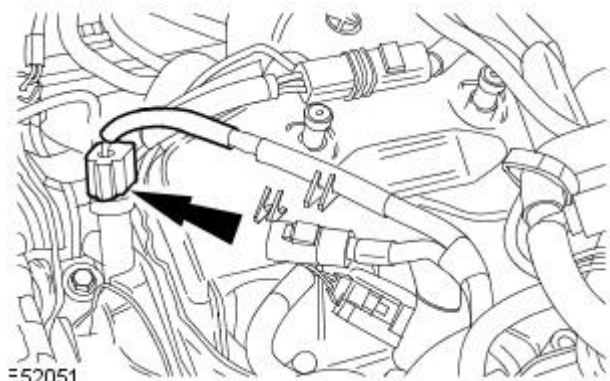
E53997

37. Attach the engine wiring harness.



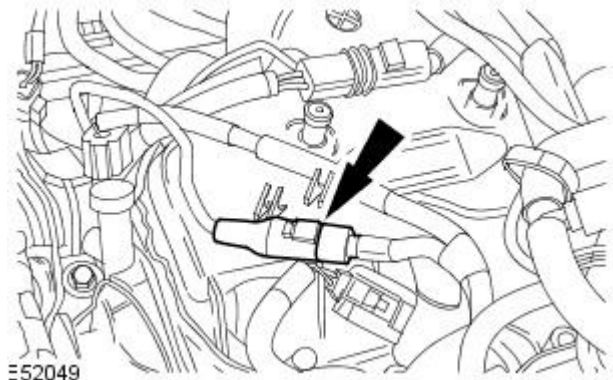
E53996

38. Connect the electrical connector.

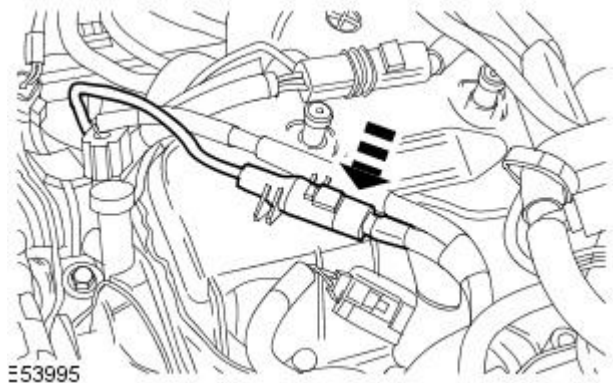


E52051

39. Connect the electrical connector.



40. Attach the electrical connector onto the valve cover.



41. Install the intake air shutoff throttle.

For additional information, refer to: [Intake Air Shutoff Throttle](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).


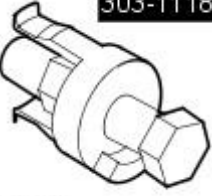

42. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).



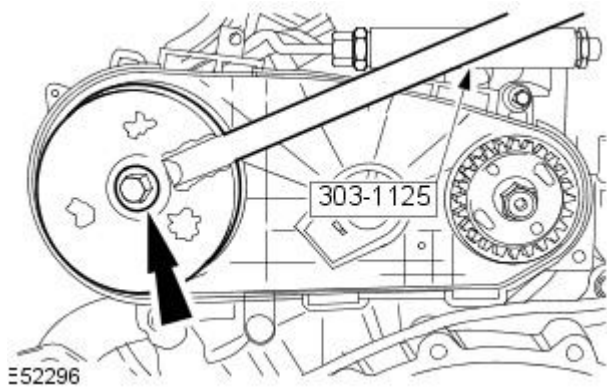
# Engine - TDV6 2.7L Diesel - Camshaft Rear Seal

Removal and Installation

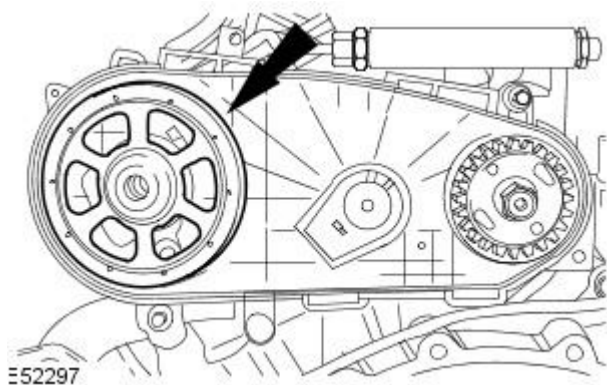
Special Tool(s)	
 <p>E54550</p>	Holder - Camshaft Pulley - Rear 303-1125
 <p>303-1118 E54541</p>	Remover - Camshaft Oil Seal 303-1118
 <p>303-1119 E54542</p>	Installer - Camshaft Oil Seal 303-1119

## Removal

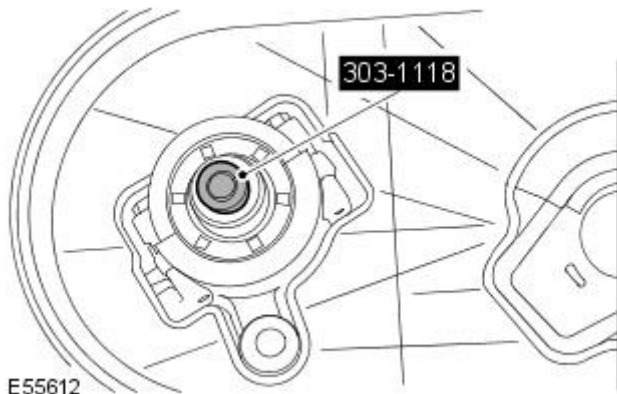
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the fuel injection pump belt.  
For additional information, refer to: [Fuel Injection Pump Belt](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).
3. Using special tool, retain the camshaft rear pulley.
  - Remove and discard the retaining bolt.



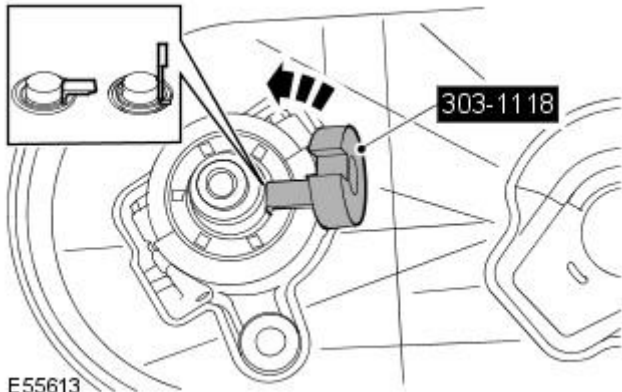
4. Remove the camshaft rear pulley.




5. Install the special tool to the camshaft.



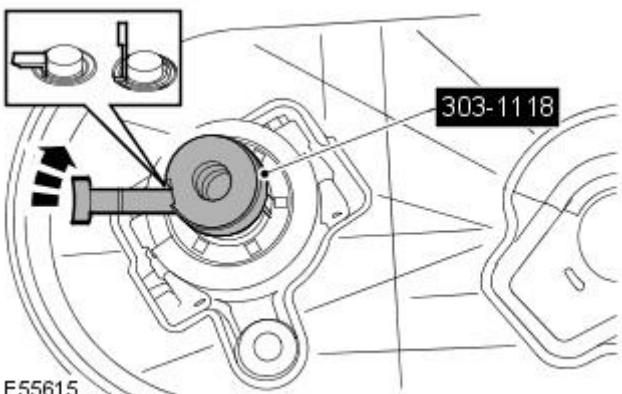
E55612




E55613

6.  CAUTION: Make sure the special tool is correctly seated behind the camshaft seal. Failure to follow this instruction may result in damage to the special tool.

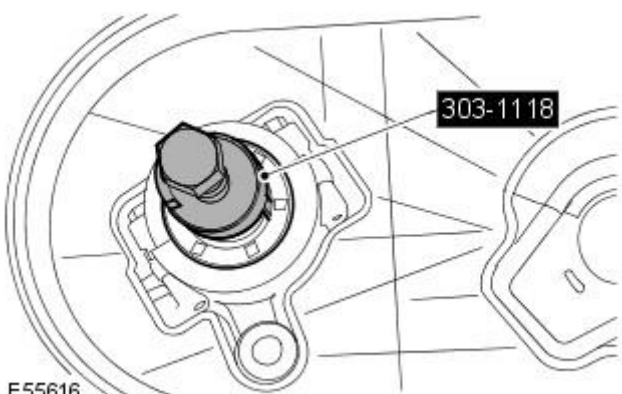
Install the special tool into the camshaft rear seal.



E55615

7.  CAUTION: Make sure the special tool is correctly seated behind the camshaft seal. Failure to follow this instruction may result in damage to the special tool.

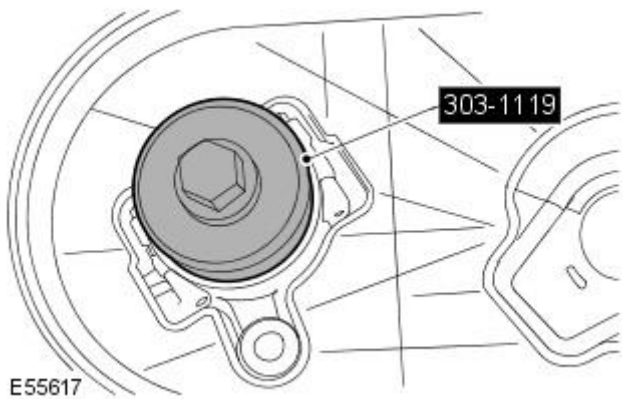
Install the special tool into the camshaft rear seal.



E55616

8. Using the special tool, remove and discard the camshaft rear seal.

## Installation



#### 1. CAUTIONS:



Make sure the seal is installed correctly.



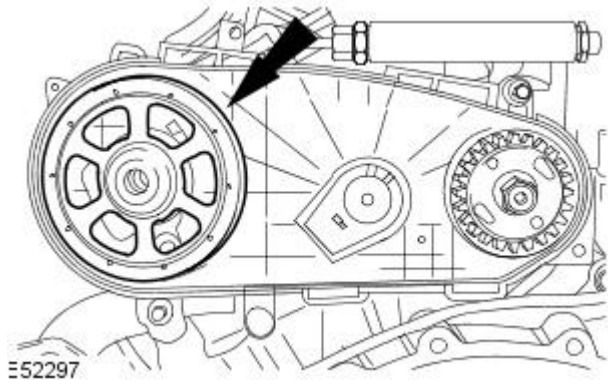
Do not use any lubricant on the camshaft rear seal or the camshaft. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Make sure that the seal is 1mm below the face of the cylinder head.

Using the special tool, install the camshaft rear seal.

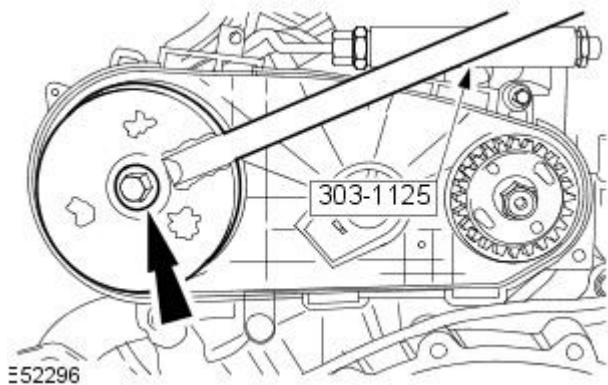
- Clean the component mating faces.
- Use the discarded camshaft pulley hub retaining bolt with the special tool.

#### 2. Install the camshaft rear pulley.



#### 3. Using the special tool, install the camshaft rear pulley retaining bolt.

1. Stage one: Tighten to 80 Nm.
2. Stage two: Tighten a further 80 degrees.



#### 4. Install the fuel injection pump belt.


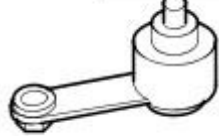




For additional information, refer to: [Fuel Injection Pump Belt](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).

#### 5. Connect the battery ground cable.


For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Engine - TDV6 2.7L Diesel - Crankshaft Front Seal

Removal and Installation

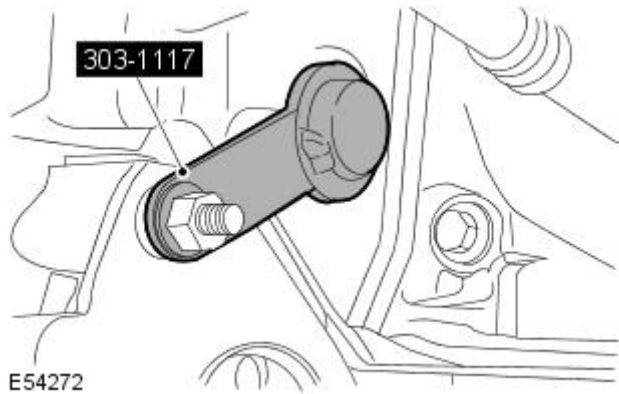
Special Tool(s)	
 <p><b>303-1123</b> E 54546</p>	Locking Tool - Flywheel 303-1123
 <p><b>303-1117</b> E54540</p>	Timing Pin - Automatic Transmission 303-1117
 <p><b>303-1120</b> E54543</p>	Crankshaft Front Seal Remover 303-1120
 <p><b>303-1122</b> E54545</p>	Crankshaft Front Seal Sleeve 303-1122
 <p><b>303-1121</b> E54544</p>	Crankshaft Front Seal Installer 303-1121
 <p><b>303-D121</b> E64849</p>	General purpose puller 303-D121

## Removal

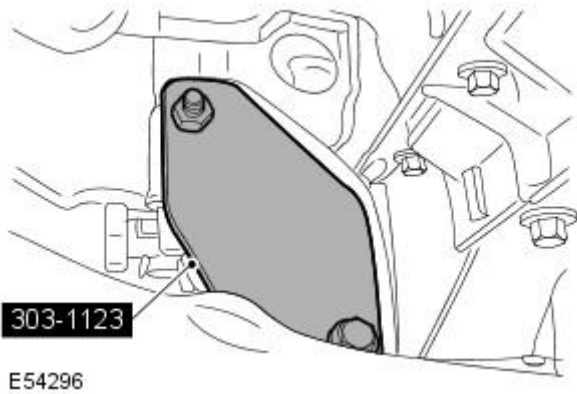
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the timing belt.  
For additional information, refer to: [Timing Belt](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).



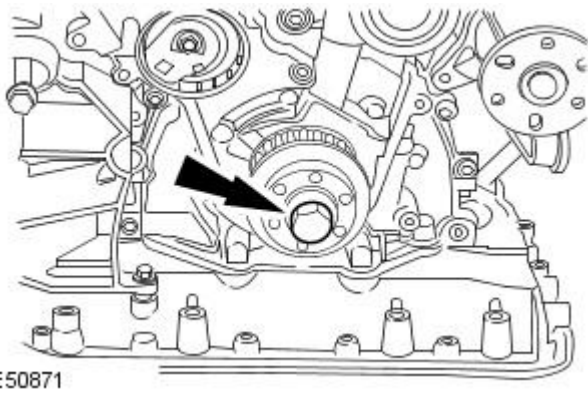
4. Remove the special tool.



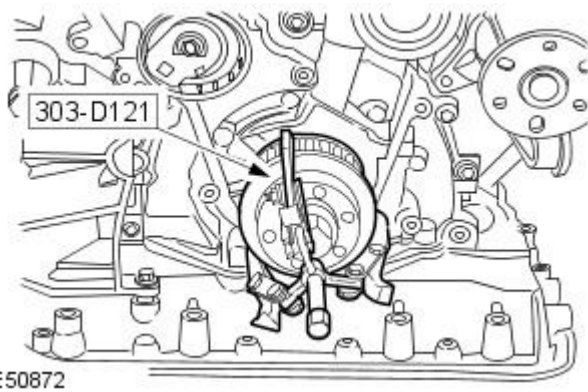
5. Install the special tool.

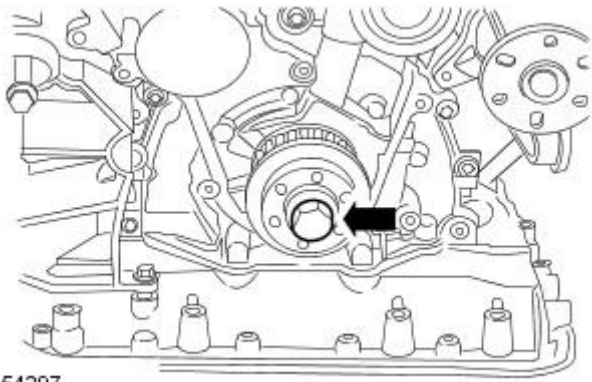


6. Loosen the crankshaft pulley retaining bolt.



7. Using the special tool, release the crankshaft pulley.

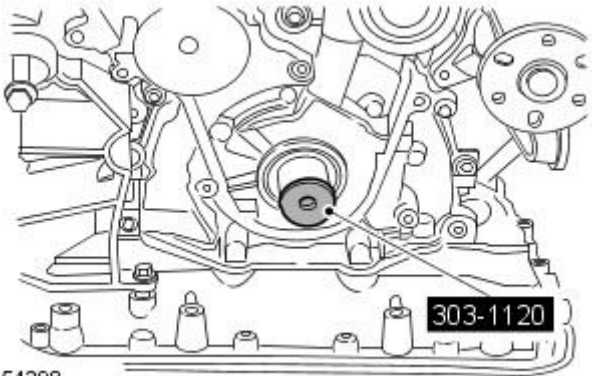




E54297

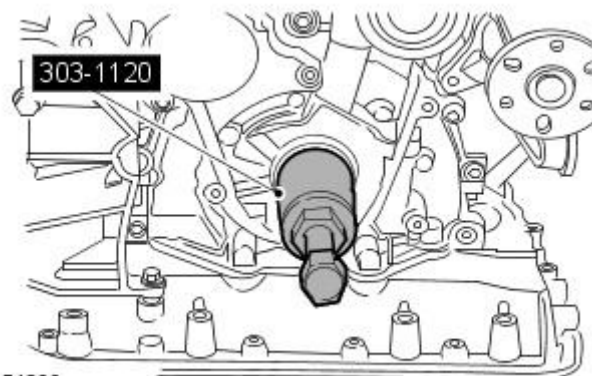
8. Remove the crankshaft pulley.

- Remove the crankshaft pulley retaining bolt.
- Discard the bolt.



E54298

9. Install the special tool to the crankshaft.

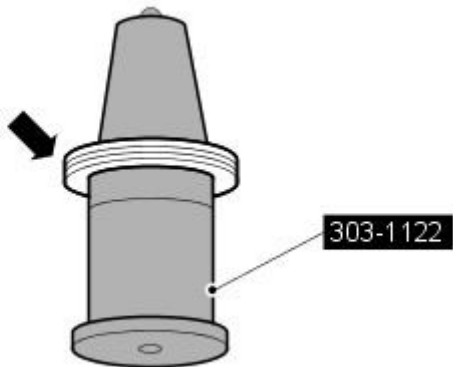


E54299


10. Using the special tool, remove the crankshaft front seal.

- Remove the special tool.
- Remove and discard the seal from the special tool.

## Installation



E54300

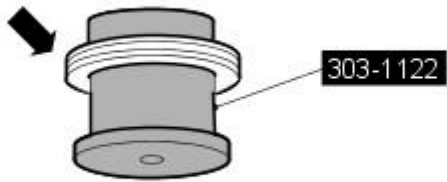
1.  CAUTION: Do not use any lubricant on the crankshaft front seal, special tools or the crankshaft. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Make sure that all the component mating faces are clean.

Install a new crankshaft front seal to the special tool.

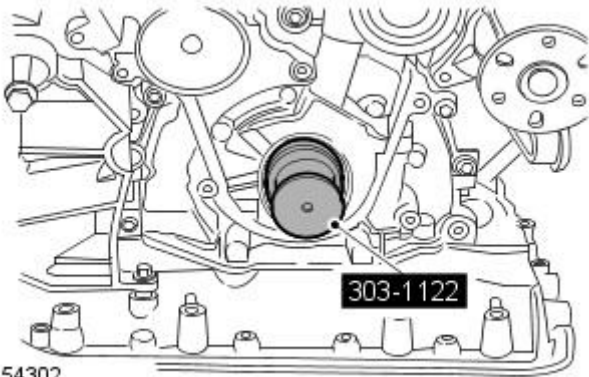
2. Reposition the crankshaft front seal along the special tool.

- Remove the sleeve from the special tool.



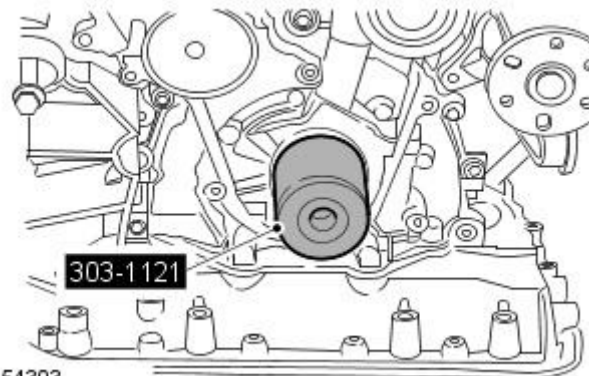
E54301

3. Install the special tool to the crankshaft.



E54302

4. Install the special tool to the crankshaft.



E54303

5. CAUTIONS:



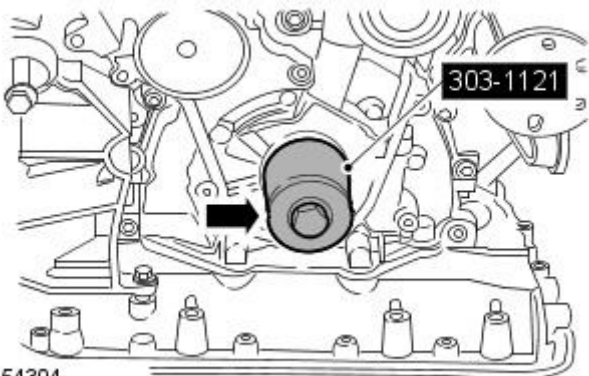
Make sure the seal is installed correctly.



Make sure that the seal is seated 1mm under flush.

Using the special tool, install the crankshaft front seal.

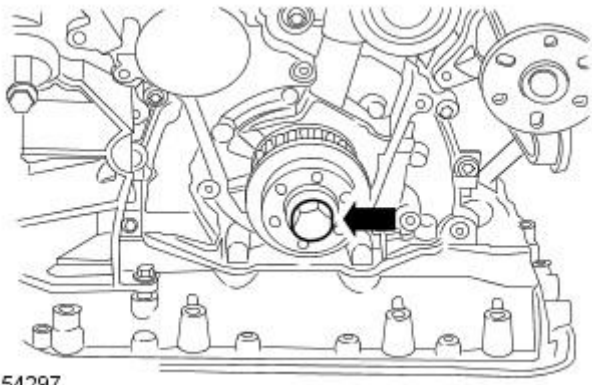
- Use the discarded crankshaft bolt with the service tool.



E54304

6. Remove the special tool.

- Remove and discard the crankshaft pulley retaining bolt.



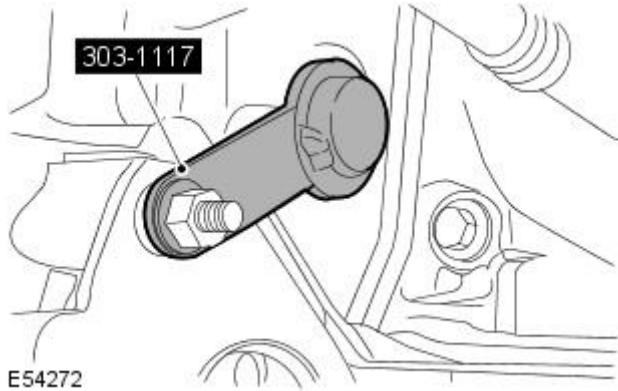
E54297

7. Install the crankshaft pulley.

- Install a new crankshaft pulley retaining bolt.
- Tighten the retaining bolt in two stages:
- Stage one: Tighten to 100 Nm.
- Stage two: Tighten a further 90 degrees.

8. Remove the special tool.

9. Install the special tool.



E54272

10. Install the timing belt.


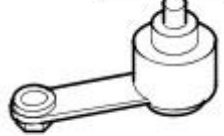

For additional information, refer to: [Timing Belt](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).

11. Connect the battery ground cable.


For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

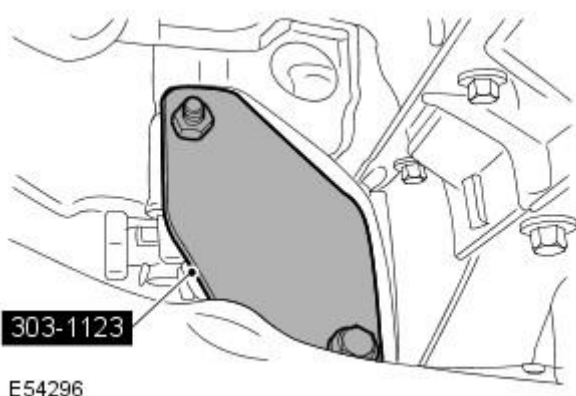
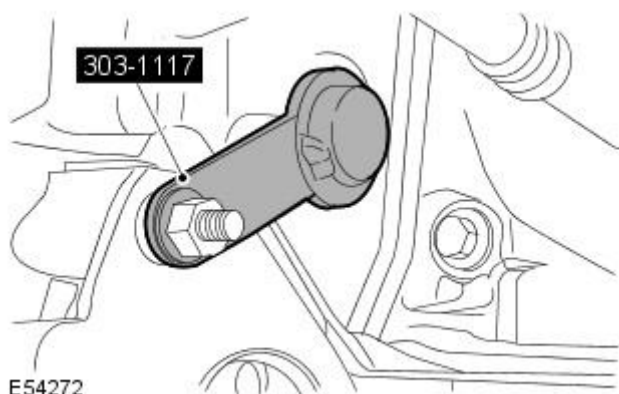
# Engine - TDV6 2.7L Diesel - Crankshaft Pulley

Removal and Installation

Special Tool(s)	
 <p><b>303-1123</b></p> <p>E 54546</p>	<p>Locking Tool - Flywheel</p> <p>303-1123</p>
 <p><b>303-1117</b></p> <p>E54540</p>	<p>Timing Pin - Automatic Transmission</p> <p>303-1117</p>
 <p><b>303-D121</b></p> <p>E64849</p>	<p>General purpose puller</p> <p>303-D121</p>

## Removal

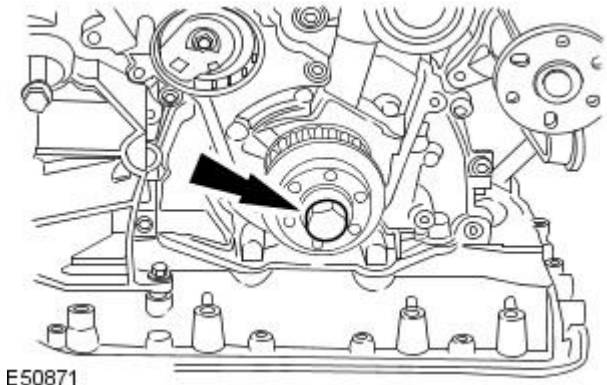
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove and discard the timing belt.  
For additional information, refer to: [Timing Belt](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).
4. Remove the special tool.



5. Using the special tool, lock the flexplate.

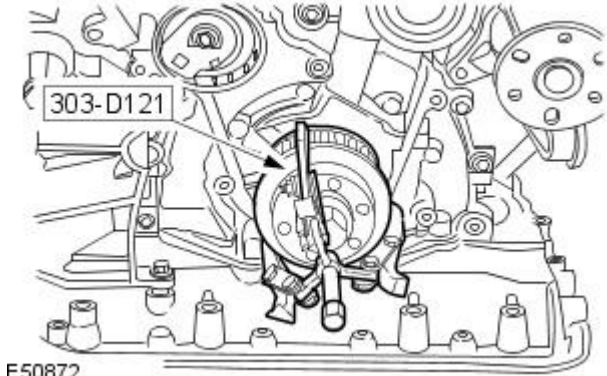


6. Loosen the crankshaft pulley retaining bolt.



E50871

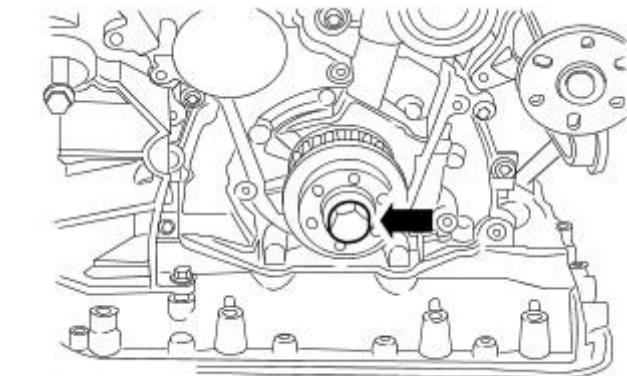
7. Using the special tool, release the crankshaft pulley.



E50872

8. Remove the crankshaft pulley.

- Remove the crankshaft pulley retaining bolt.
- Discard the bolt.



E54297

## Installation

1. CAUTIONS:



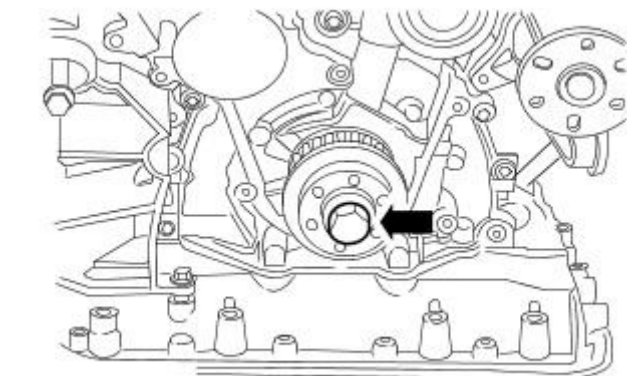
Make sure that the pulley washer is correctly seated before installing the pulley.



Do not lubricate the components.

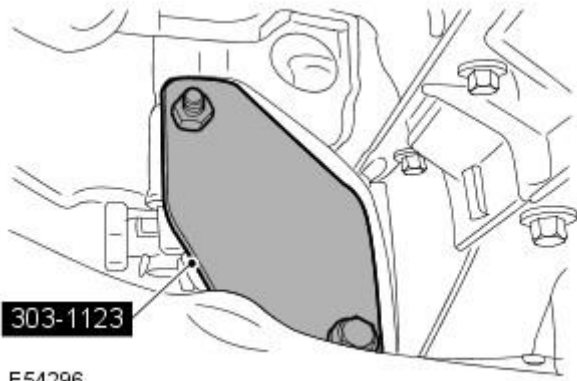
Install the crankshaft pulley.

- Install a new crankshaft pulley retaining bolt.
- Tighten the retaining bolt in two stages:
- Stage one: Tighten to 100 Nm.
- Stage two: Tighten a further 90 degrees.



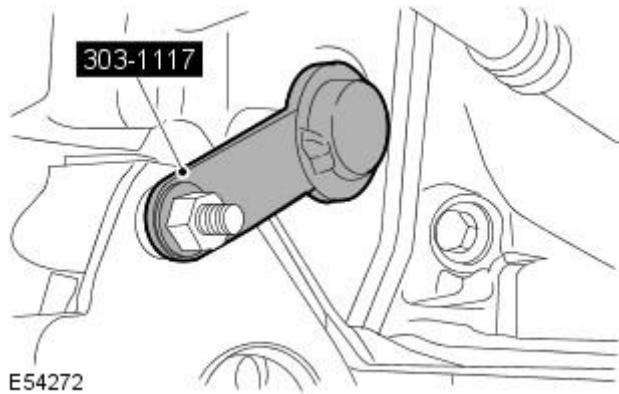
E54297

2. Remove the special tool.



E54296

3. Install the special tool.



E54272

4. Install the timing belt.

For additional information, refer to: [Timing Belt](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).

5. Connect the battery ground cable.


For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

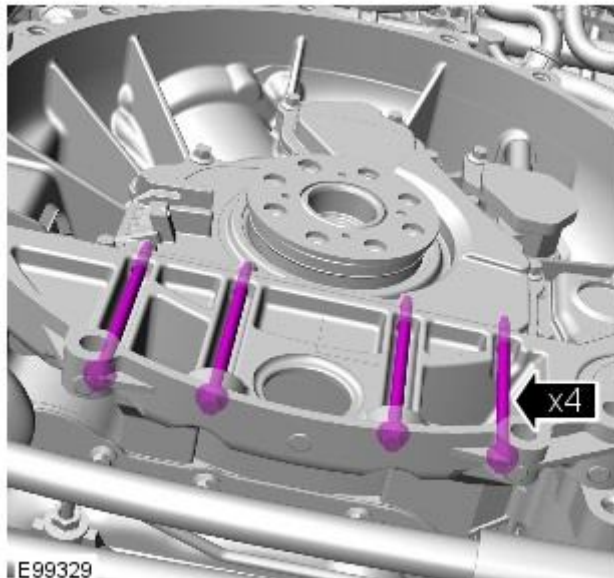


# Engine - TDV6 2.7L Diesel - Crankshaft Rear Seal

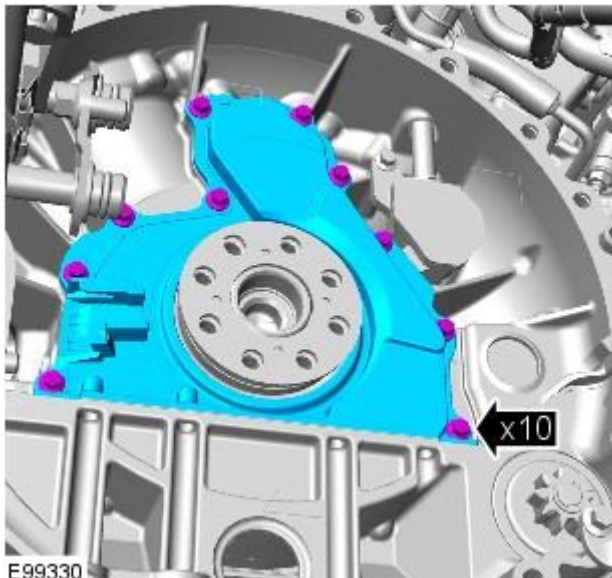
Removal and Installation

## Removal

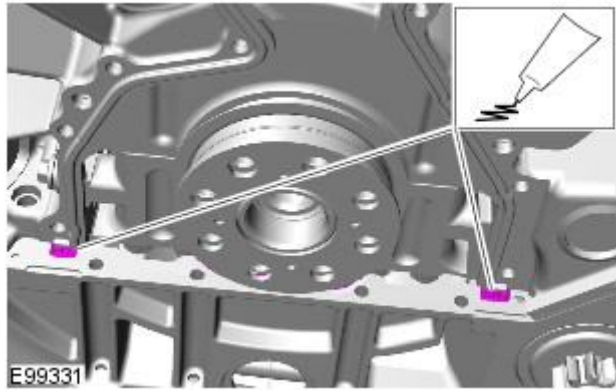
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the crankshaft position (CKP) sensor ring.  
For additional information, refer to: [Crankshaft Position \(CKP\) Sensor Ring](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Removal and Installation).
4. Remove the crankshaft rear seal retaining bolts.



5. Remove the crankshaft rear oil seal carrier.
  - Remove the retaining bolts.
  - Remove and discard the rear crankshaft oil seal.



## Installation

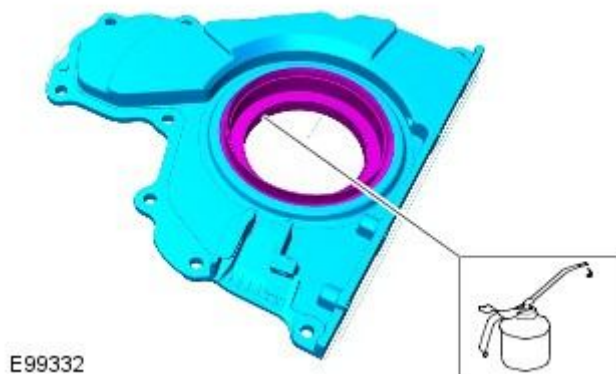


1. CAUTIONS:

 Make sure that the crankshaft rear oil seal is correctly located.

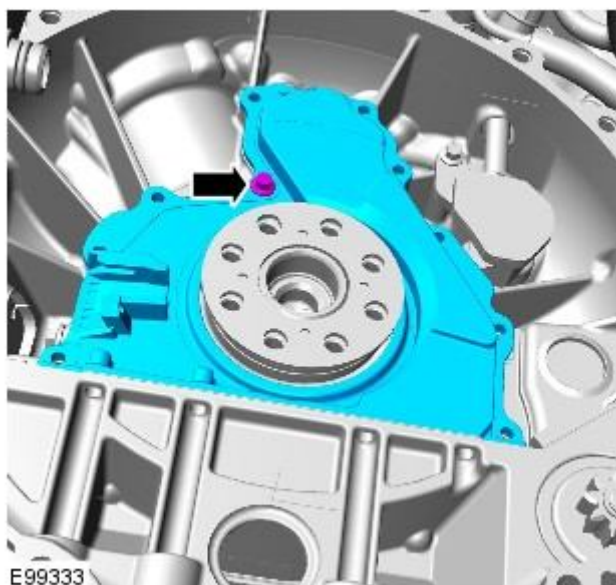
 Make sure the crankshaft seal mating faces are clean and dry.

Apply an 8 mm bead of sealant to the cylinder block in the areas shown.



2. Install the crankshaft rear oil seal carrier.

- Lubricate the oil seal.

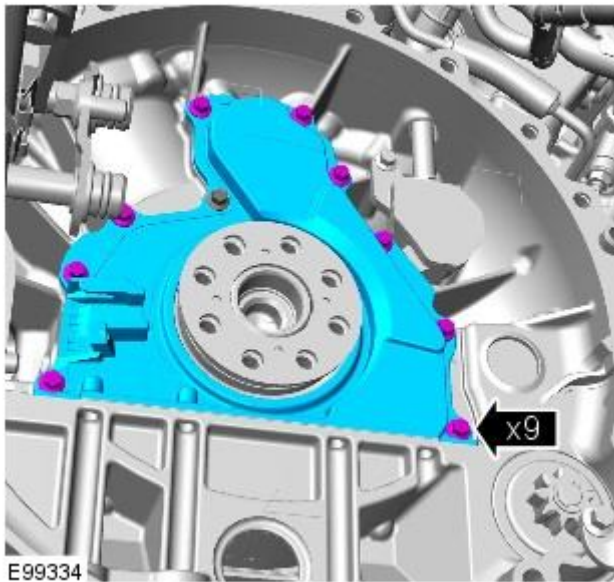


3. Install the retaining bolt.

- Tighten to 10 Nm.

4. Install the remaining retaining bolts.

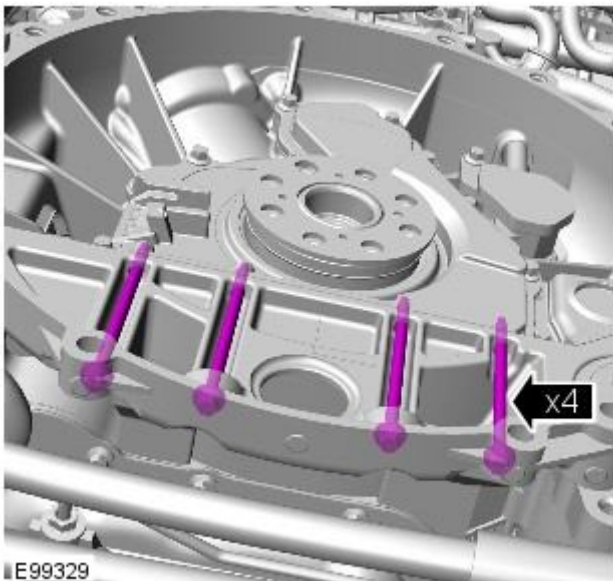
- Tighten to 10 Nm.



E99334

5. Install the crankshaft rear seal retaining bolts.

- Tighten to 10 Nm.



E99329

6. Install the CKP sensor ring.

For additional information, refer to: [Crankshaft Position \(CKP\) Sensor Ring](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Removal and Installation).

7. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Engine - TDV6 2.7L Diesel - Crankshaft Vibration Damper

Removal and Installation

## Special Tool(s)

303-703



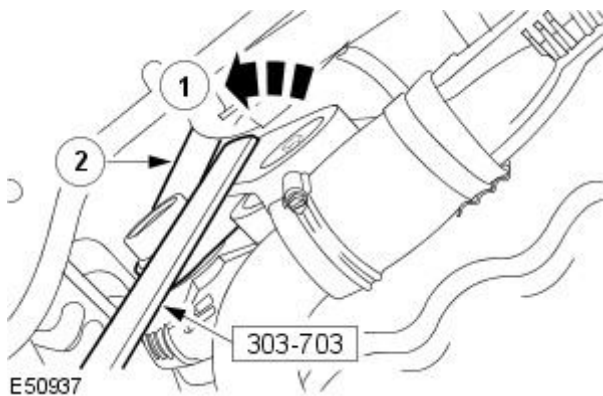
E95037

Accessory belt tensioner

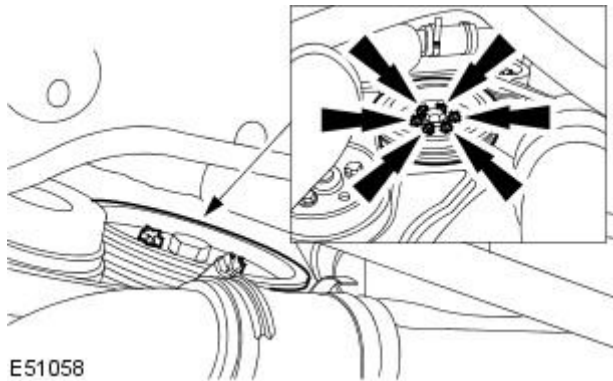
303-703

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Raise and support the vehicle.
3. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
4. Release the accessory drive belt.
  1. Using the special tool, rotate the accessory drive belt tensioner counter clockwise.
  2. Release the accessory drive belt.

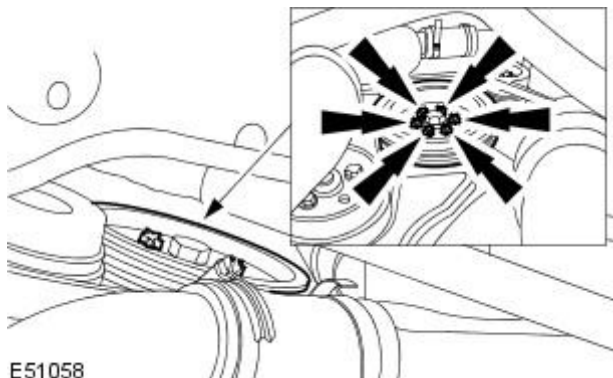


5. Remove the crankshaft damper.
  1. Remove the 6 bolts.

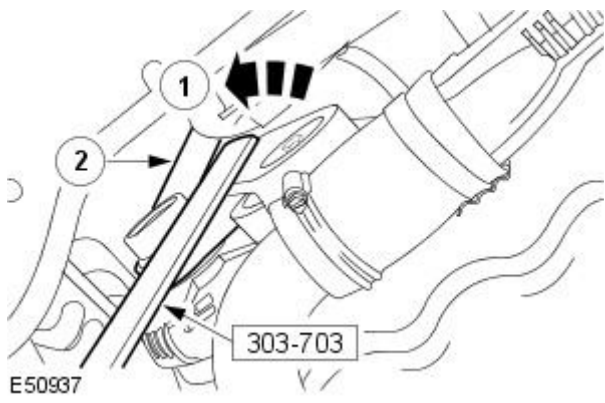


## Installation

1. Install the crankshaft damper.
  - Clean the components.
  - Tighten to 25 Nm.



2. Attach the accessory drive belt.



3. Install the air deflector.

For additional information, refer to: Air Deflector (501-02, Removal and Installation).

4. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

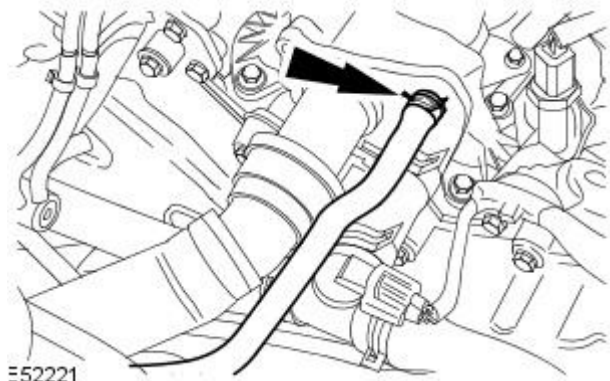


# Engine - TDV6 2.7L Diesel - Cylinder Head LH

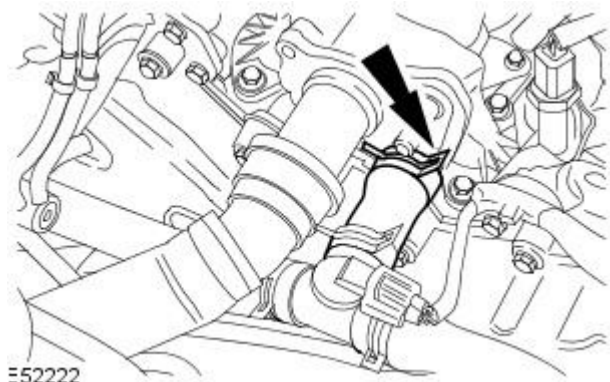
## Removal and Installation

### Removal

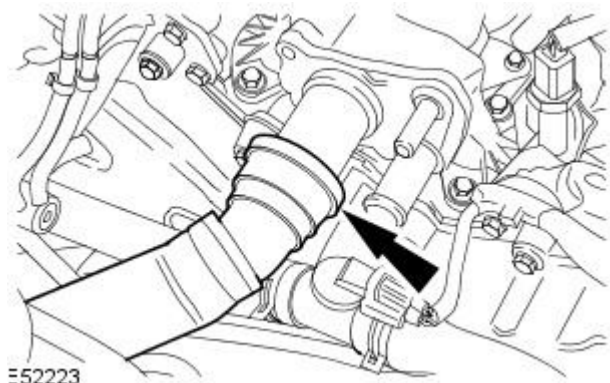
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Drain the cooling system.  
For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).
3. Remove the left-hand camshafts.  
For additional information, refer to: [Camshaft LH](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).
4. Remove the LH exhaust manifold.  
For additional information, refer to: [Exhaust Manifold](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).
5. Detach the coolant expansion tank hose from the cylinder head coolant outlet assembly.



6. Detach the engine coolant hose from the cylinder head coolant outlet assembly.

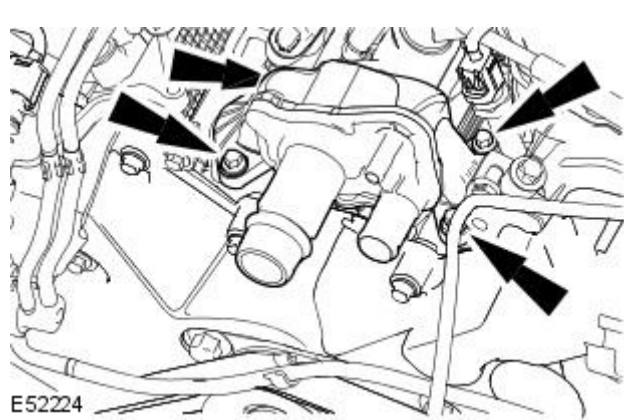


7. Detach the radiator upper hose from the cylinder head coolant outlet assembly.



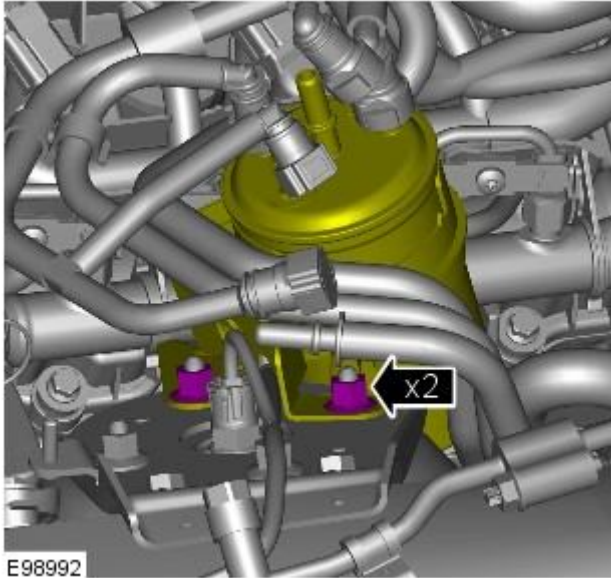
8. Remove the cylinder head coolant outlet assembly.

- Remove and discard the O-ring seals.



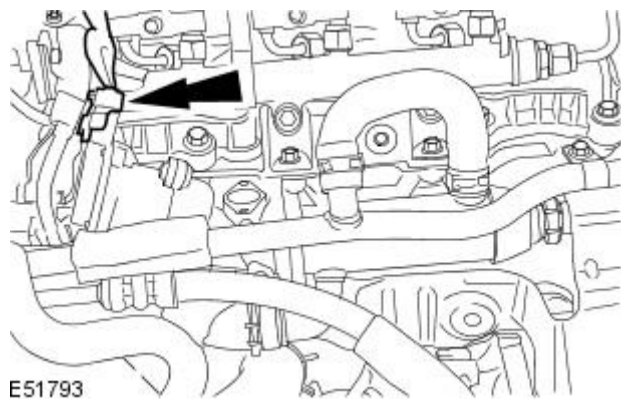
E52224

9. Reposition the fuel filter and support bracket.



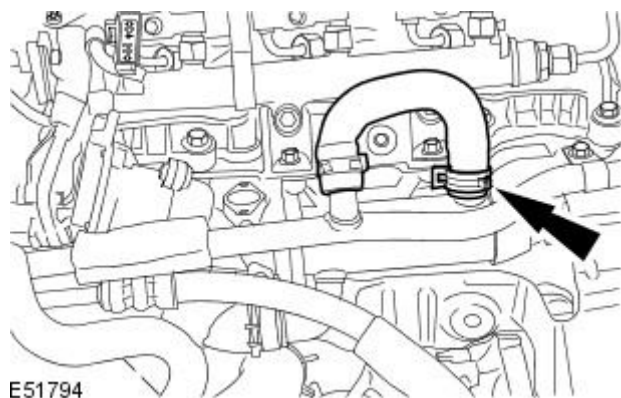
E98992

10. Disconnect the EGR valve electrical connector.



E51793

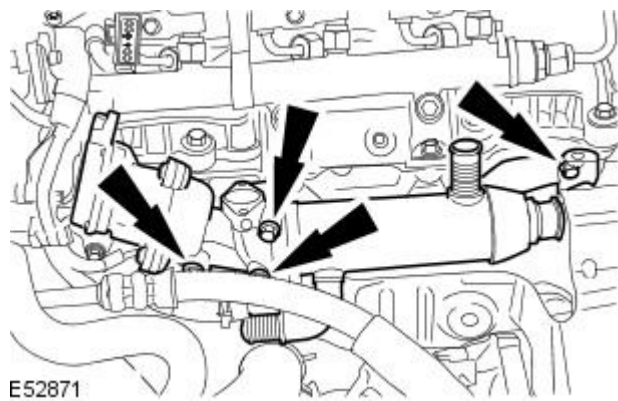
11. Disconnect the coolant hose from the EGR valve.



E51794

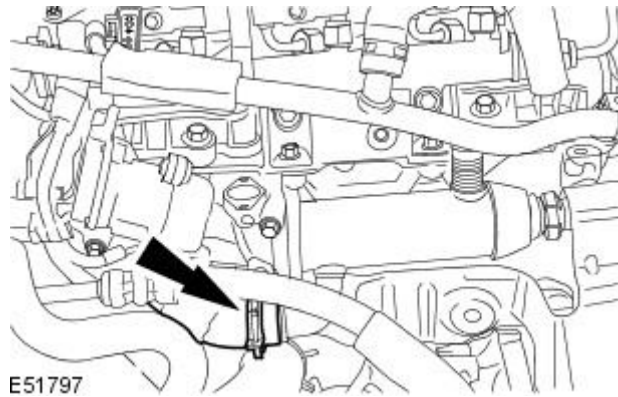


12. Release the EGR valve.



13. Remove the EGR valve.

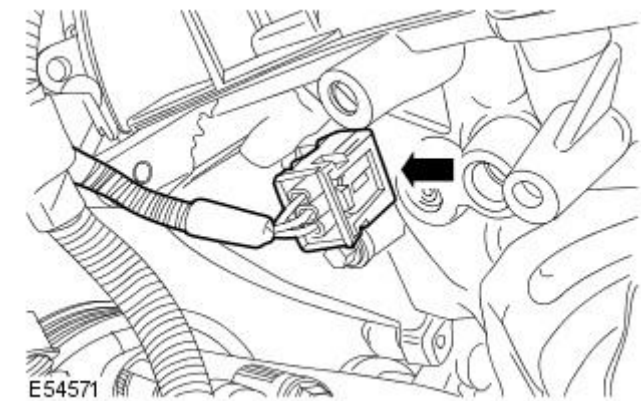
- Disconnect the coolant hose.



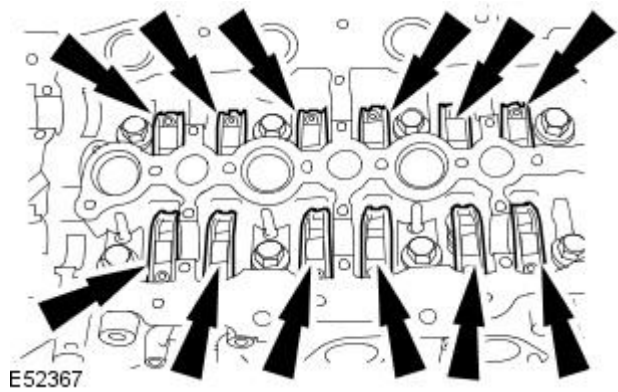
14. Remove the glow plugs.

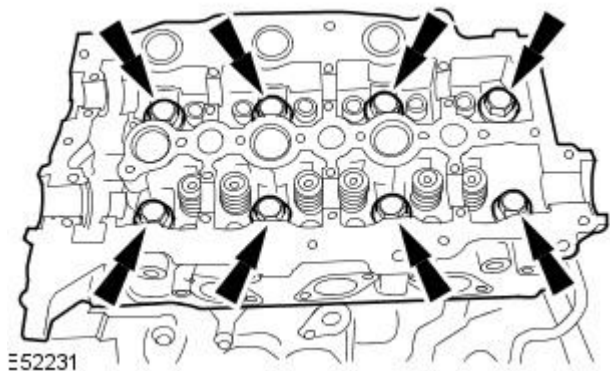
For additional information, refer to: [Glow Plugs - 2.7L V6 - TdV6](#) (303-07C Glow Plug System, Removal and Installation).

15. Disconnect the camshaft position (CMP) sensor electrical connector.



16. Remove the hydraulic adjuster and rocker assemblies.



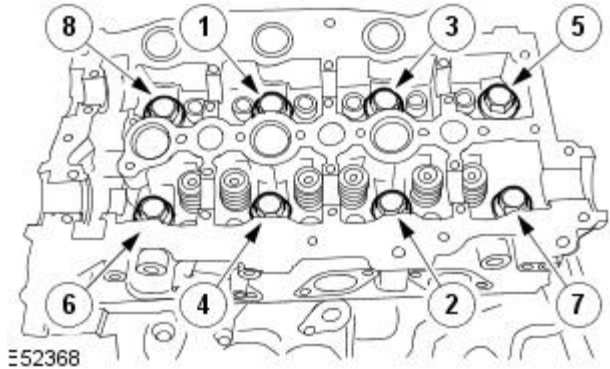


17.  CAUTION: Only use a plastic scraper to clean off the old gasket.


Remove the LH cylinder head assembly.

- Remove and discard the eight cylinder head bolts.
- Remove and discard the cylinder head gasket.

## Installation



1. CAUTIONS:

 Use care when installing the cylinder head. Damage to the cylinder block, cylinder head or cylinder head gasket may result.

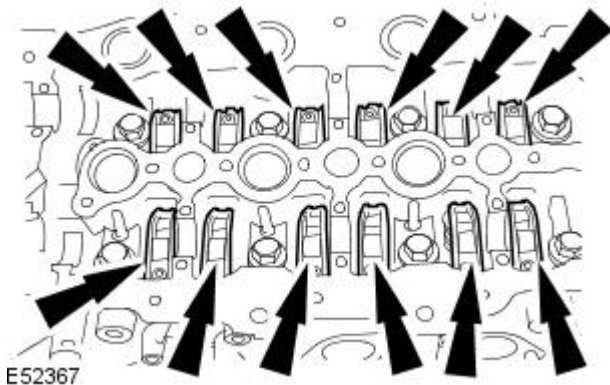
 The head gasket must be installed over the cylinder block dowels.

- NOTE: Install a new cylinder head gasket.
- NOTE: Tighten the retaining bolts in the indicated sequence in four stages.
- NOTE: No additional lubrication to the cylinder head bolts is required.

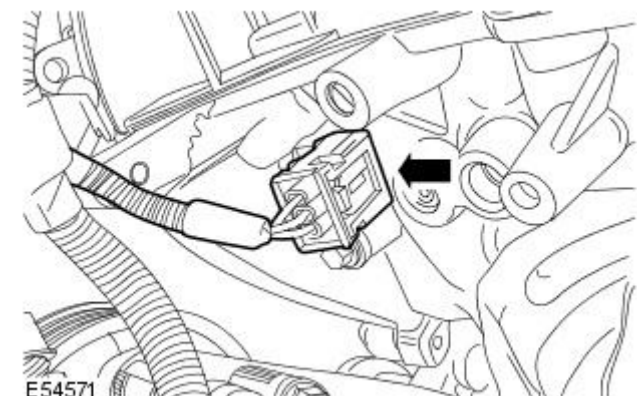
Install the LH cylinder head assembly and install new cylinder head retaining bolts.

- Stage 1: Tighten to 20 Nm.
- Stage 2: Tighten to 40 Nm.
- Stage 3: Tighten to 80 Nm.
- Stage 4: Tighten a further 180 degrees.

2. Install the hydraulic adjuster and rocker assemblies.



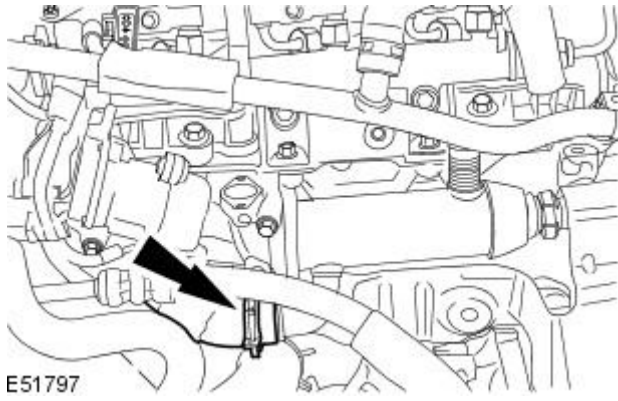
3. Connect the camshaft position (CMP) sensor electrical connector.



4. Install the glow plugs.  
For additional information, refer to: [Glow Plugs - 2.7L V6 - TdV6 \(303-07C Glow Plug System, Removal and Installation\)](#).

5. Install the EGR valve.

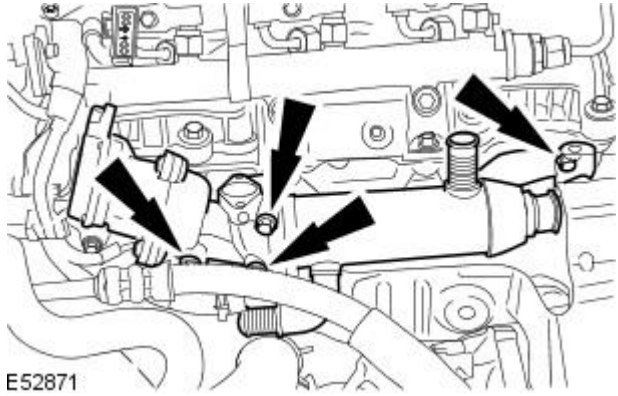
- Connect the coolant hose.



E51797

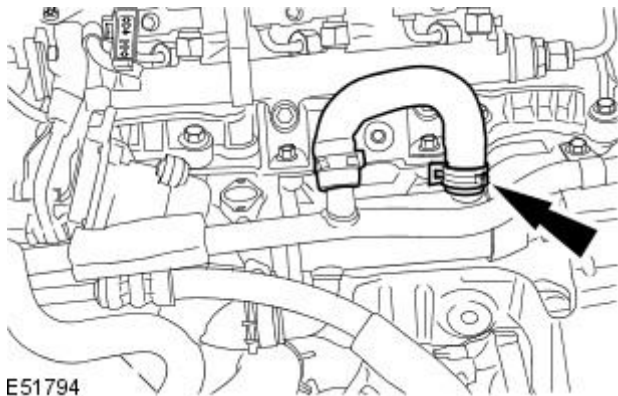
6. Secure the EGR valve.

- Tighten to 10 Nm.



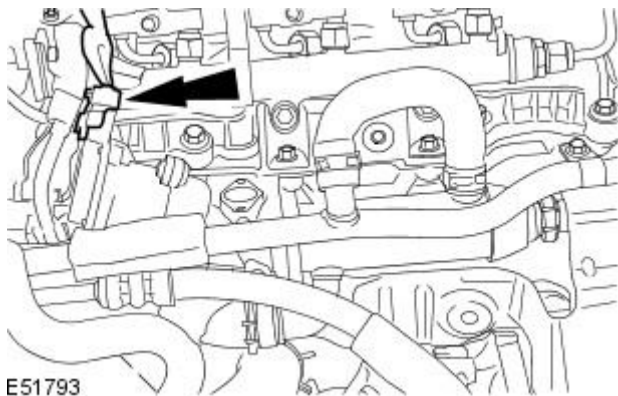
E52871

7. Connect the coolant hose to the EGR valve.



E51794

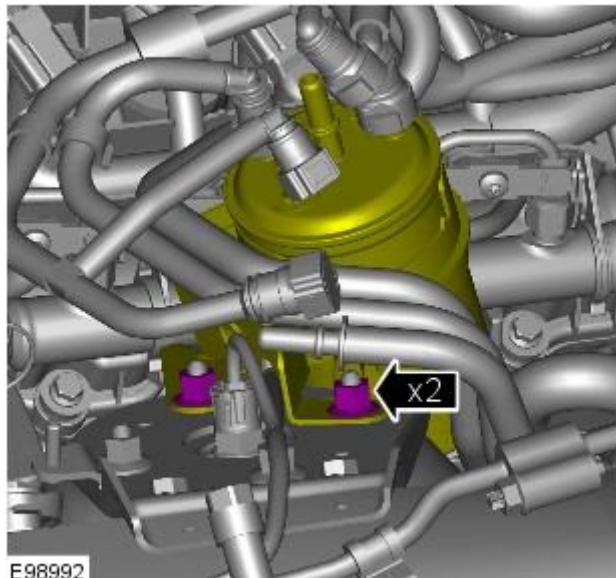
8. Connect the EGR valve electrical connector.



E51793

9. Secure the fuel filter and support bracket.

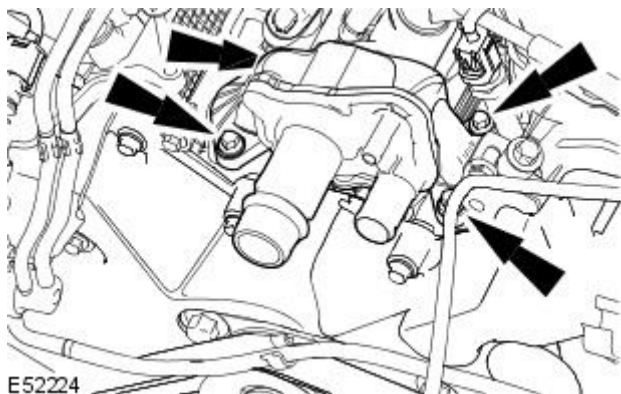
- Tighten to 27 Nm.



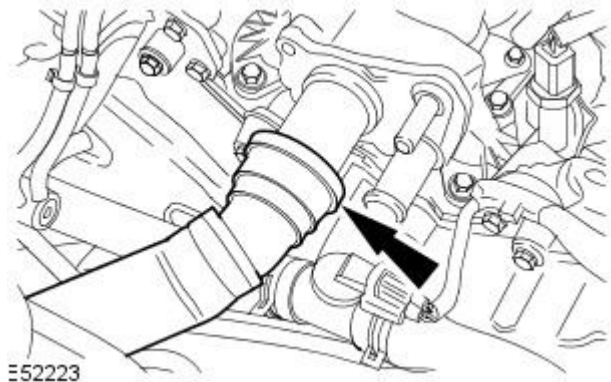
10. **NOTE:** Install new O-ring seals.

Install the cylinder head coolant outlet assembly.

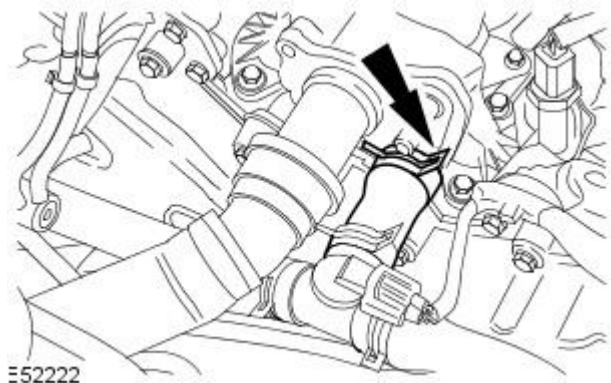
- Tighten to 10 Nm.



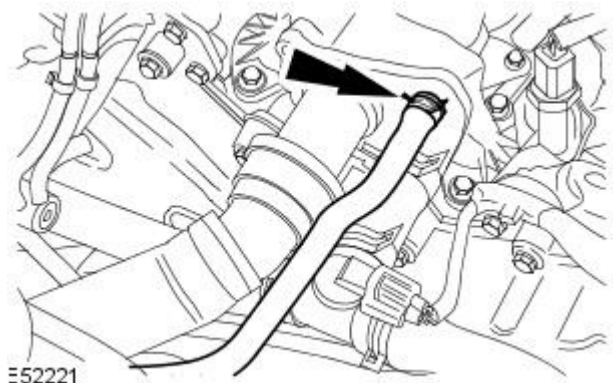
11. Attach the radiator upper hose onto the cylinder head coolant outlet assembly.



12. Attach the engine coolant hose onto the cylinder head coolant outlet assembly.







**13.** Attach the coolant expansion tank hose onto cylinder head coolant outlet assembly.

**14.** Install the exhaust manifold.

For additional information, refer to: [Exhaust Manifold](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).

**15.** Install the LH camshafts.

For additional information, refer to: [Camshaft LH](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).

**16.** Fill and bleed the cooling system.

For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).

**17.** Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Engine - TDV6 2.7L Diesel - Engine Mount LH

Removal and Installation

## Special Tool(s)

Power train assembly jack


HTJ1200-2



## Removal

All vehicles

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

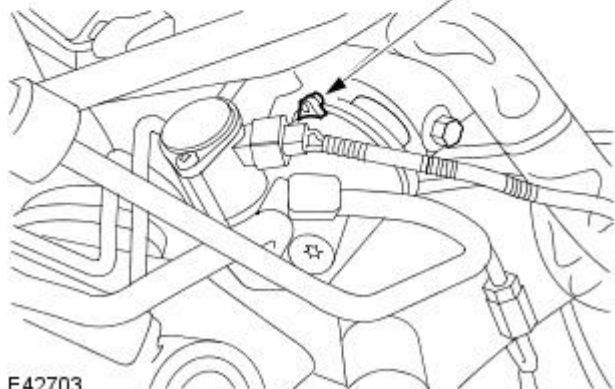
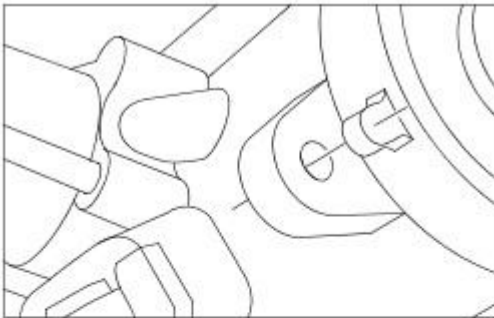
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

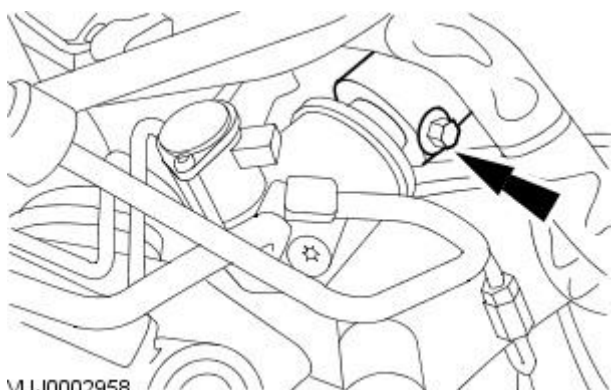
3. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

Left-hand drive vehicles


4. Make sure the alignment mark, on the steering gear pinion seal protection cover, is central to the steering gear pinion casting.



E42703

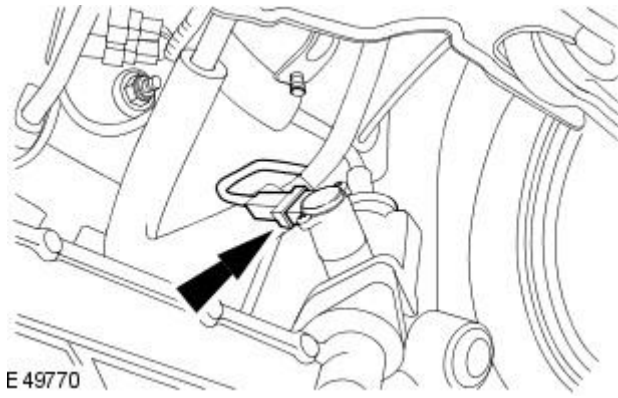


VUJ0002958

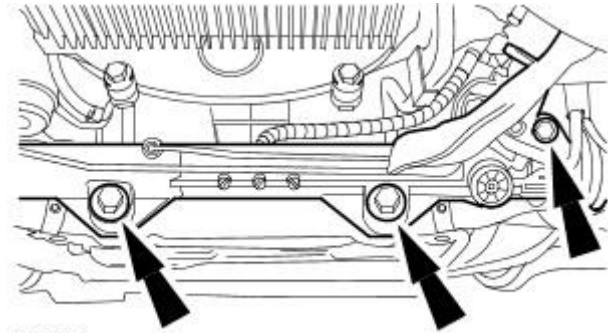
5.  **CAUTION:** Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

Remove the steering gear shaft pinch bolt.

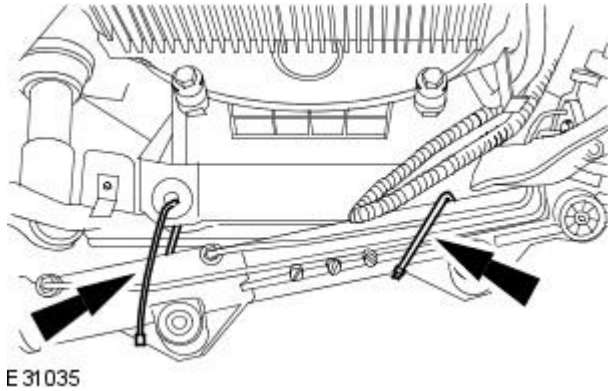
6. Disconnect the power steering control valve actuator electrical connector.



7. Detach the steering gear.

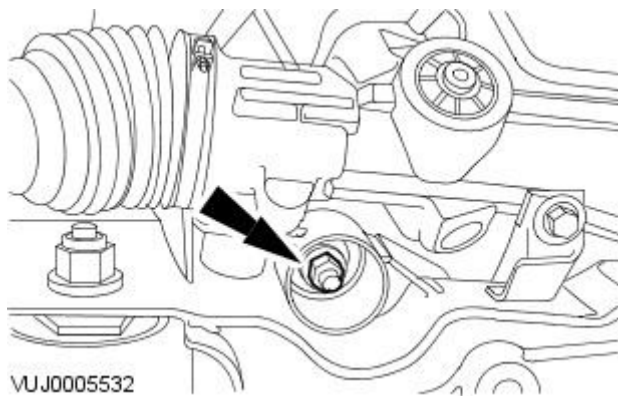


8. Support the steering gear.



All vehicles

9. Remove the engine mounts lower retaining nuts.

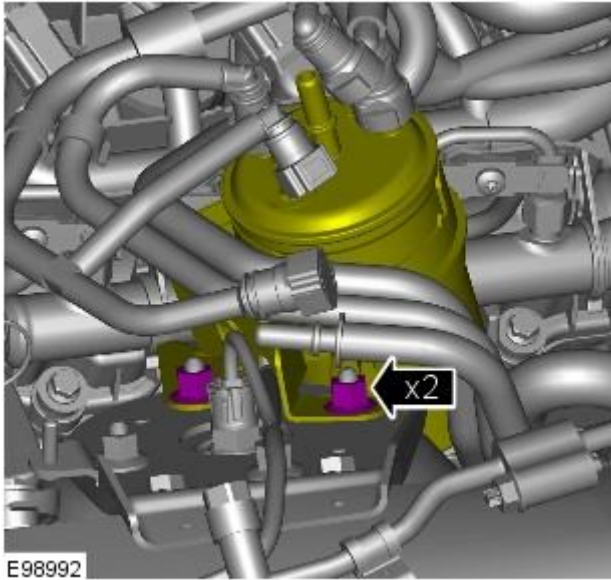


10. Release the LH turbocharger intake tube.

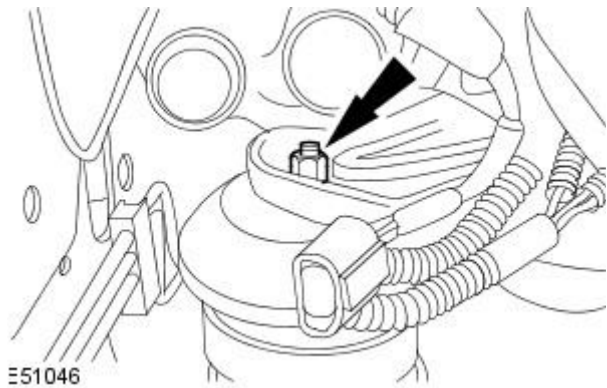




11. Lower the vehicle.
12. Reposition the fuel filter and support bracket.



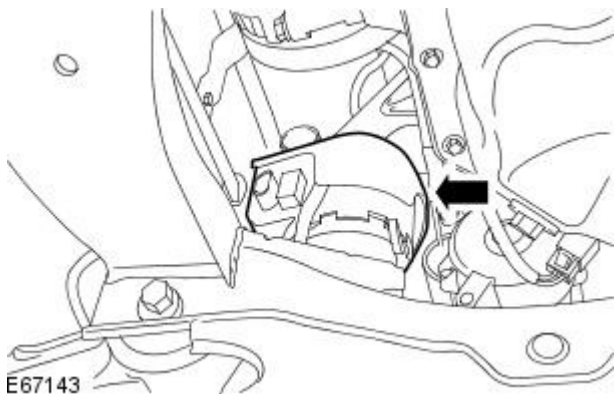
13. Using snap-on tool FRDHM15, remove the nut.



14. Raise the vehicle.
15. Using the special tool, raise and support the engine.
  - Raise the LH side of the engine.



16. NOTE: Right-hand shown, left-hand similar.  
Remove the LH engine mount.

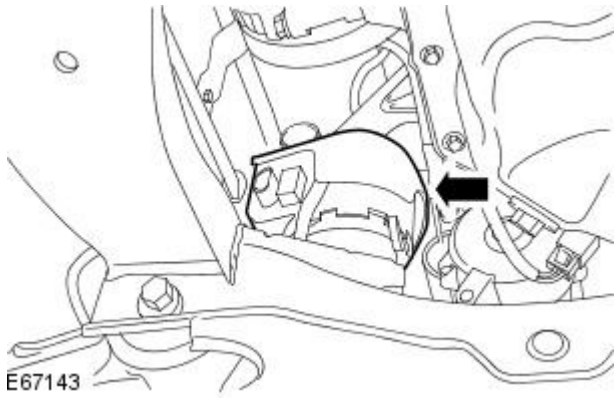


## Installation

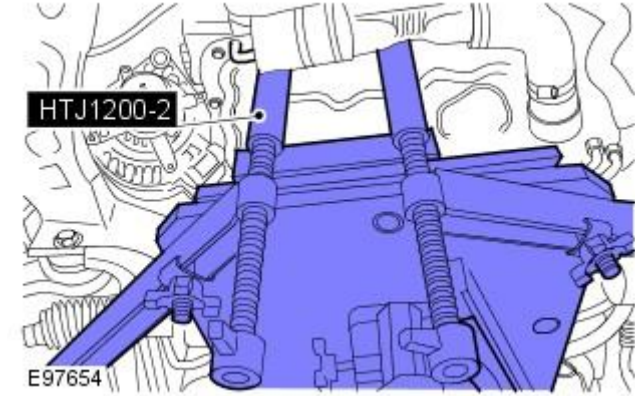
All vehicles

1. NOTE: Right-hand shown, left-hand similar.

Install the LH engine mount.



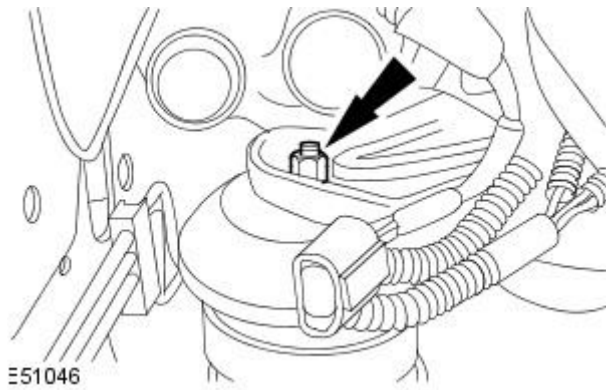
2. Using the special tools, lower the engine.



3. Lower the vehicle.

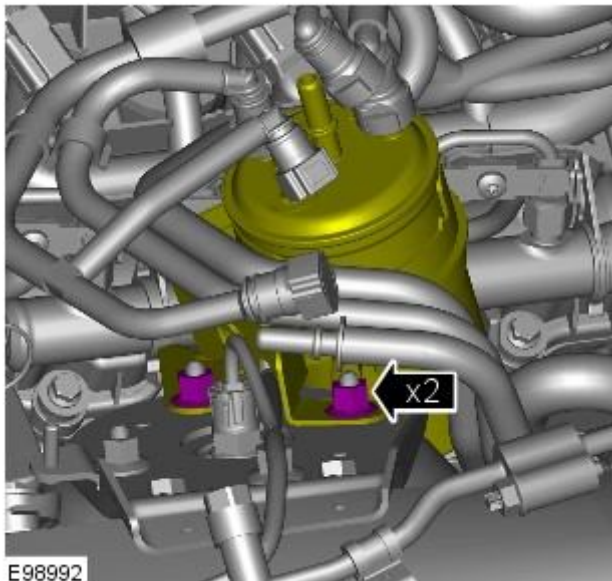
4. Using snap-on tool FRDHM15, install the nut.

- Tighten to 47 Nm.



5. Secure the fuel filter and support bracket.

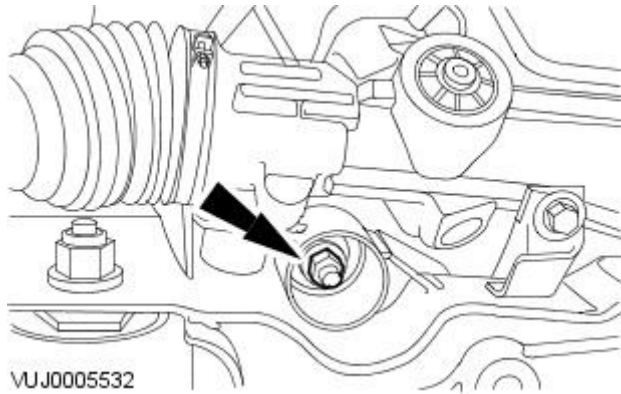
- Tighten to 27 Nm.



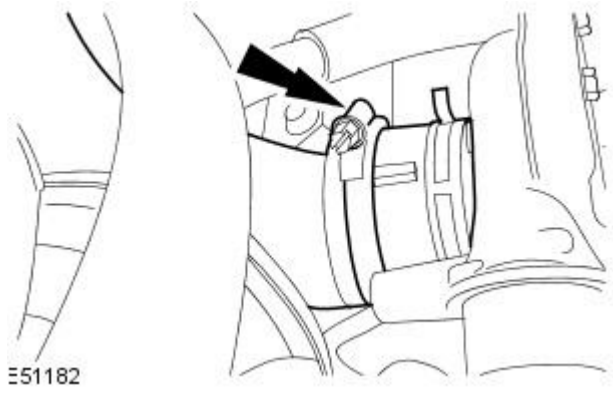
6. Raise the vehicle.

7. Install the engine mount lower retaining nut.

- Tighten to 63 Nm.



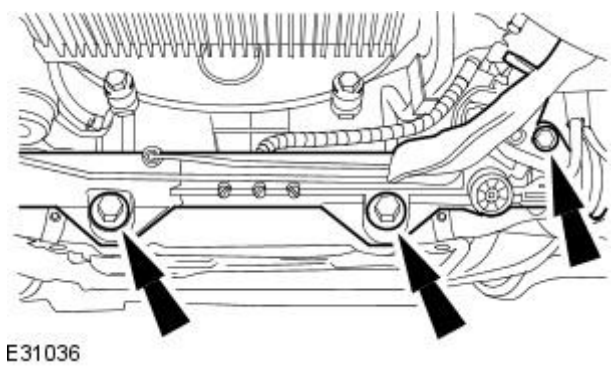
8. Secure the LH turbocharger inlet tube.



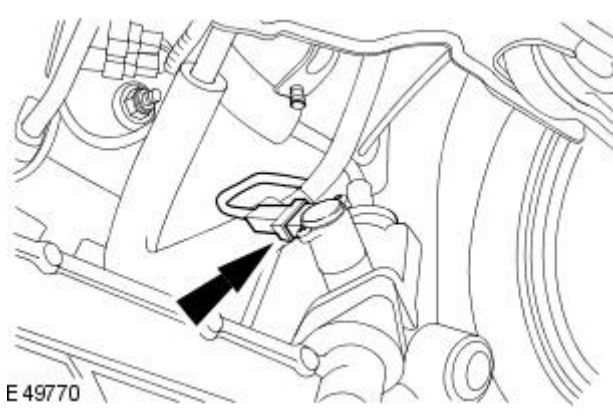
#### Left-hand drive vehicles

9. Attach the steering gear.

- Tighten to 100 Nm.

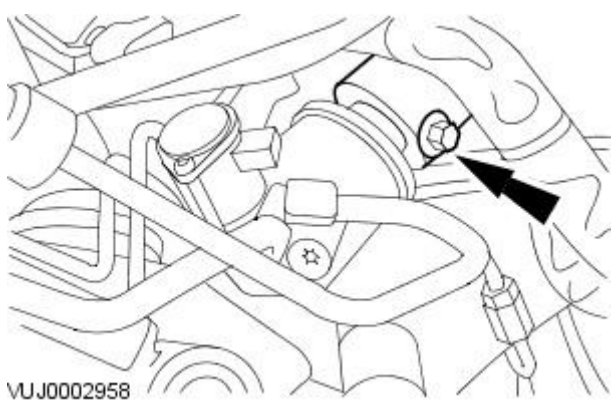


10. Connect the power steering control valve actuator electrical connector.



11. Install the steering gear shaft pinch bolt.

- Tighten to 35 Nm.



All vehicles

**12.** Install the air deflector.


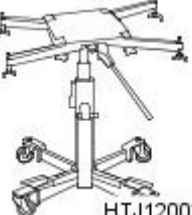
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

**13.** Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

**Engine - TDV6 2.7L Diesel - Engine Mount RH**


Removal and Installation

Special Tool(s)	
 <p>303-703</p> <p>E95037</p>	<p>Accessory belt tensioner</p> <p>303-703</p>
 <p>HTJ1200-2</p>	<p>Power train assembly jack</p> <p>HTJ1200-2</p>

**Removal**

All vehicles

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

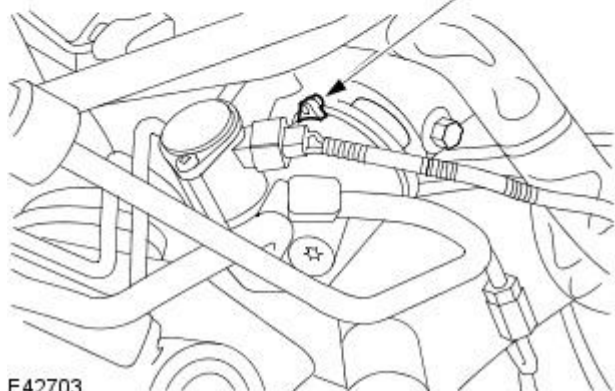
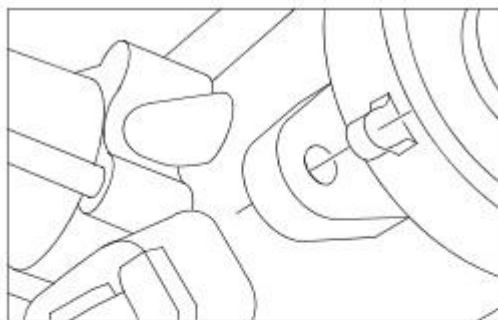
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).


Right-hand drive vehicles

4. Make sure the alignment mark, on the steering gear pinion seal protection cover, is central to the steering gear pinion casting.

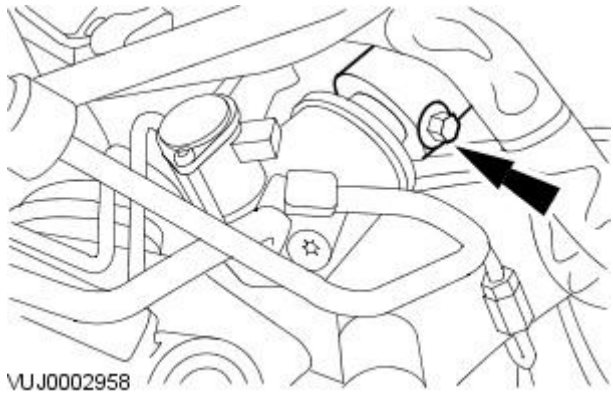


E42703



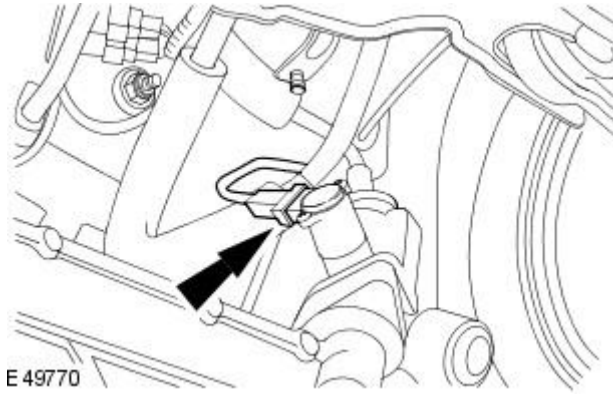
5.  CAUTION: Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

Remove the steering gear shaft pinch bolt.



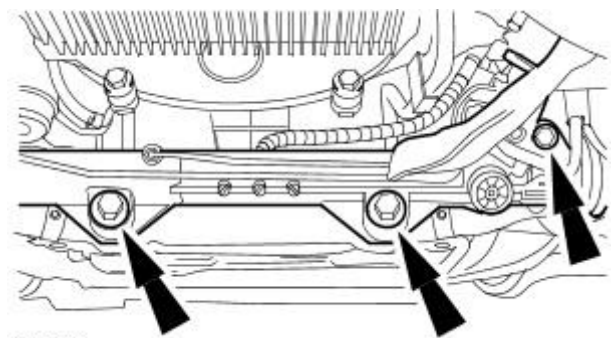
VUJ0002958

6. Disconnect the power steering control valve actuator electrical connector.



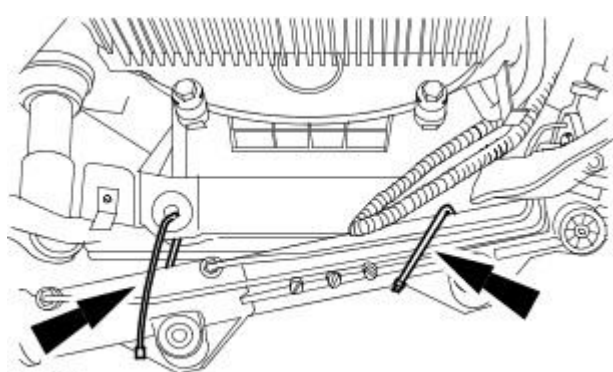
E 49770

7. Detach the steering gear.



E31036

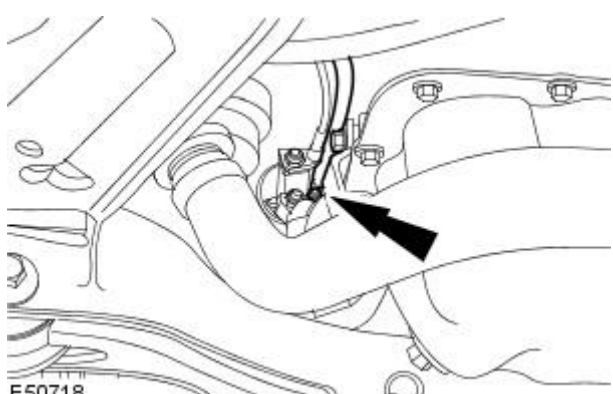
8. Support the steering gear.



E 31035

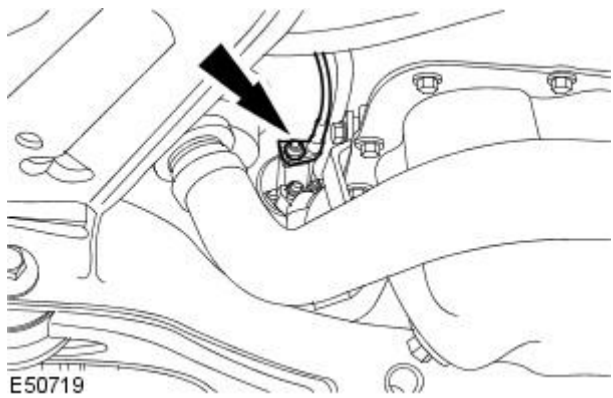
All vehicles

9. Detach the starter motor solenoid harness.



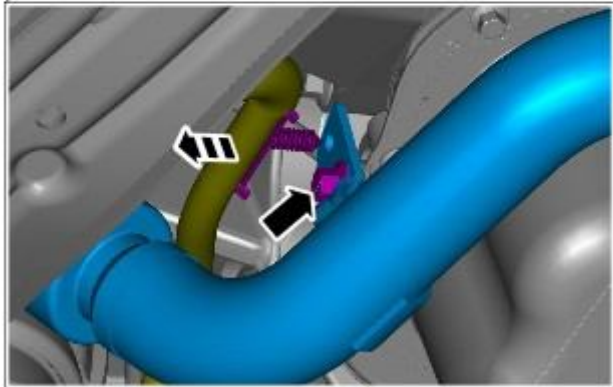
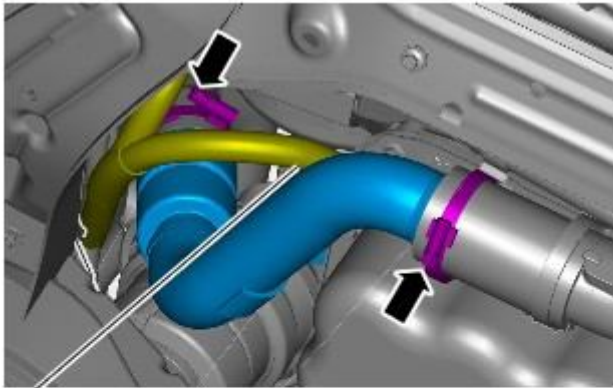
E50718

10. Detach the starter motor cable.



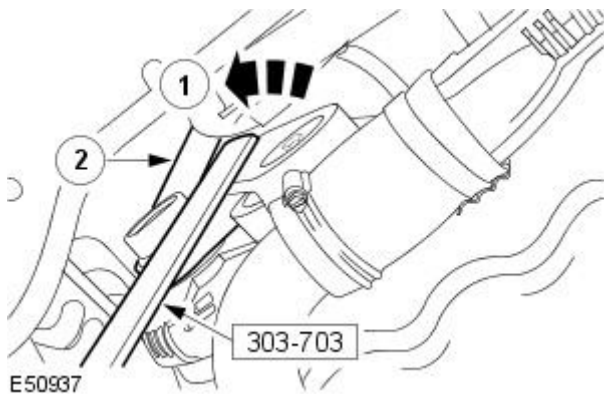
11. Remove the right-hand turbocharger outlet pipe.

- Remove the bolt.
- Release the turbocharger outlet pipe clip.
- Detach the wiring harness clip.



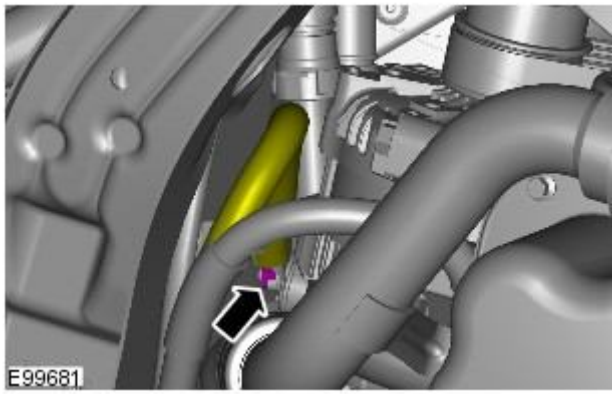
E98753

12. Release the accessory drive belt.

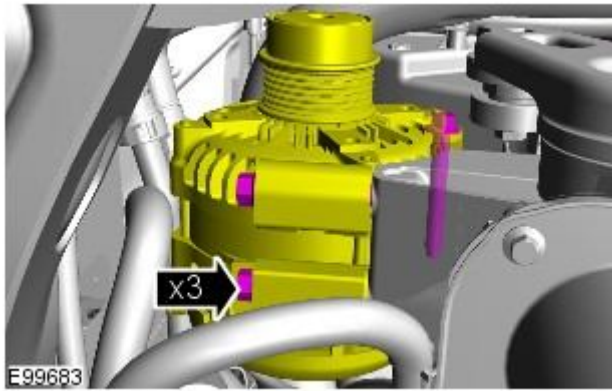




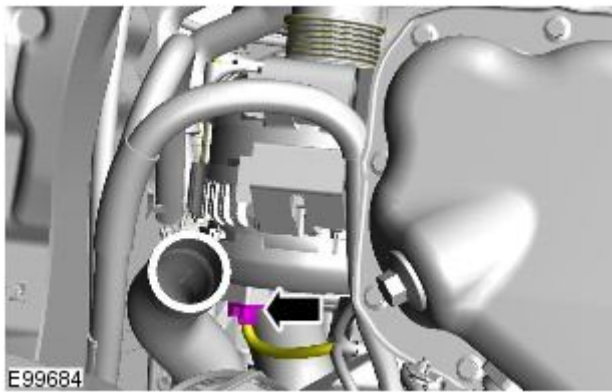
13. Disconnect the battery positive cable from the generator.



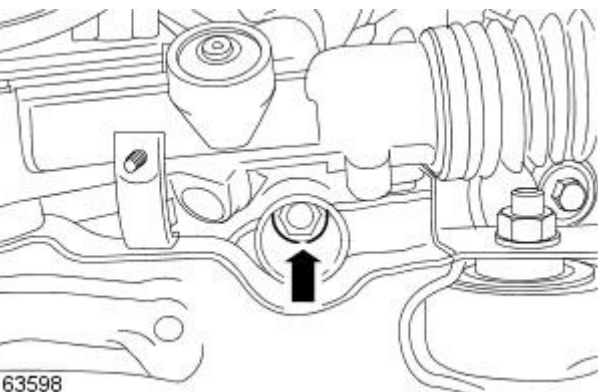
14. Release and reposition the generator.



15. Disconnect the generator electrical connector.



16. Detach the engine mount.

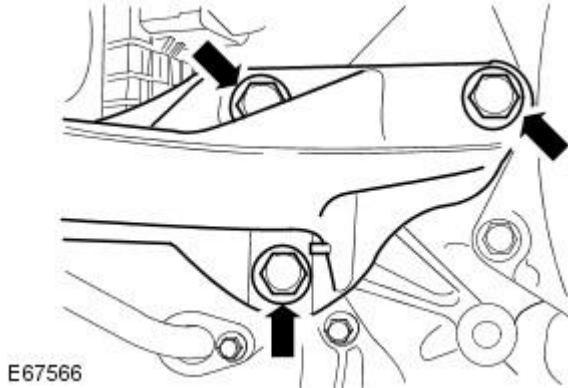


17. Using the special tool, raise and support the engine.

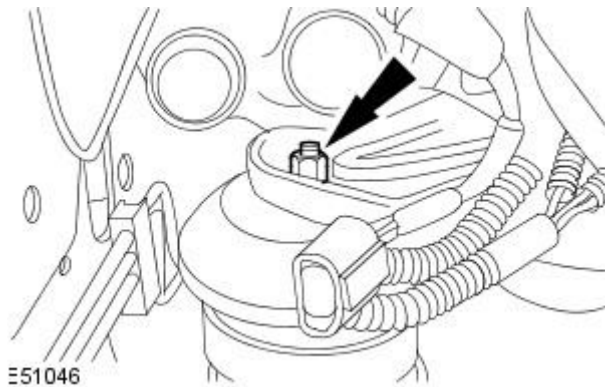
- Raise the RH side of the engine by approximately 15 mm.



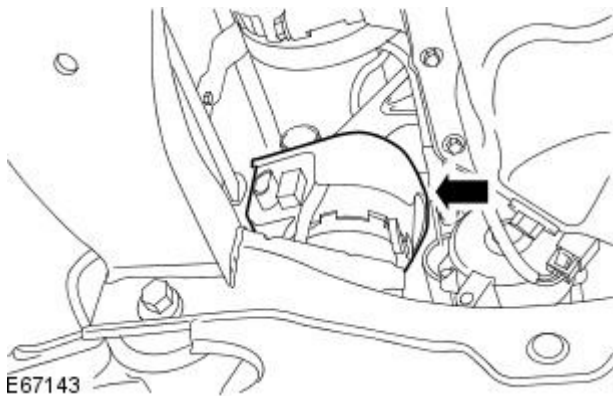
18. Release the engine mount bracket.



19. Detach the engine mounting bracket.



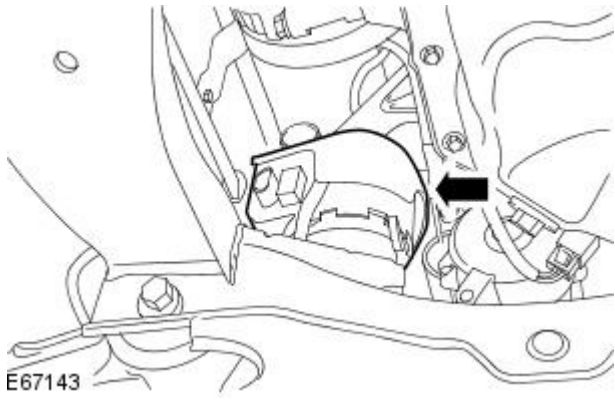
20. Remove the RH engine mount.



## Installation

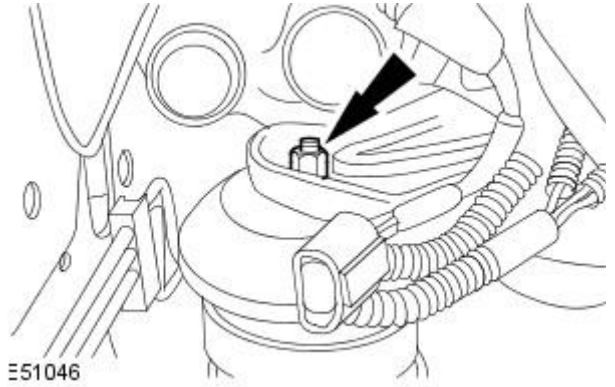
All vehicles

1. Install the RH engine mount.



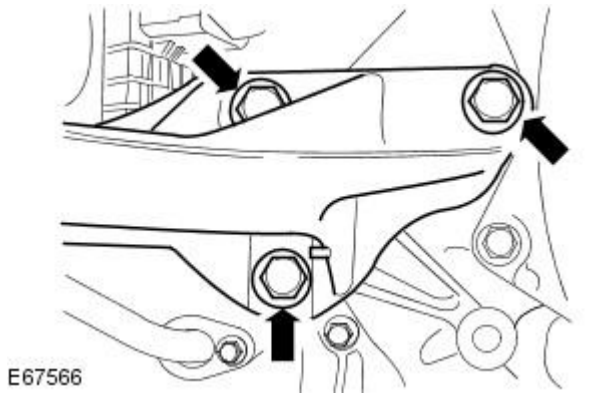
2. Attach the RH engine mount bracket.

- Tighten to 47 Nm.



3. Secure the engine mount bracket.

- Tighten to 90 Nm.

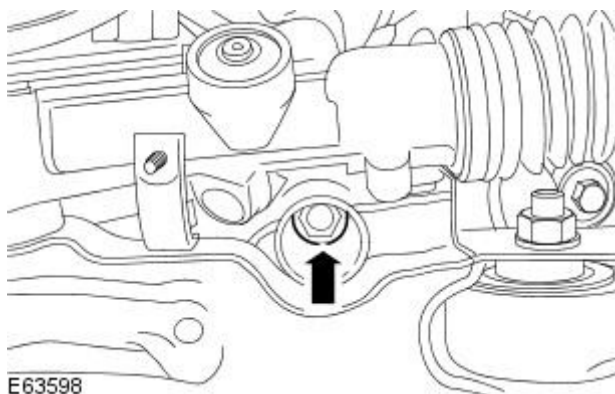


4. Using the special tools, lower the engine.

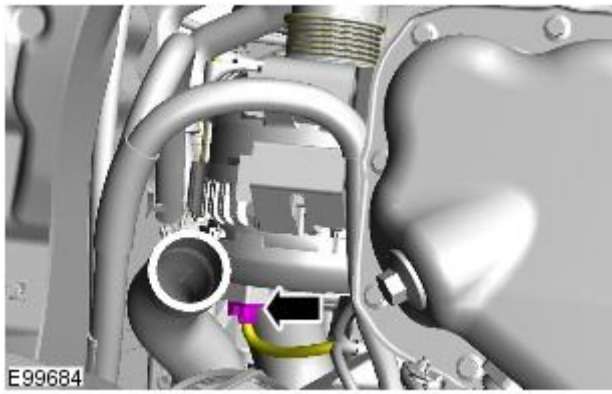


5. Attach the engine mount.

- Tighten to 63 Nm.

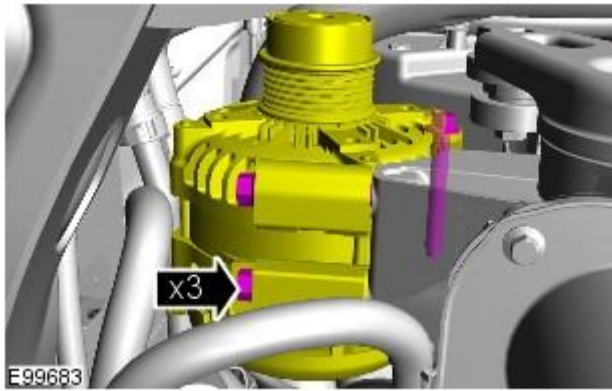


6. Connect the generator electrical connector.



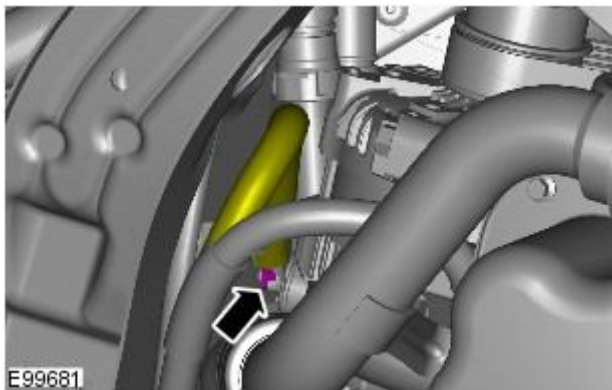
7. Secure the generator.

- Tighten to 47 Nm.

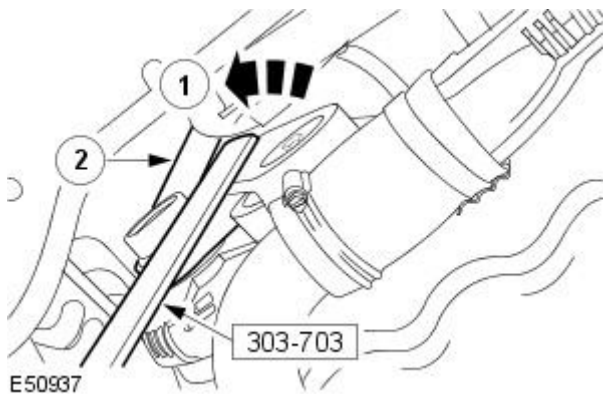


8. Connect the battery positive cable to the generator.

- Tighten to 20 Nm.



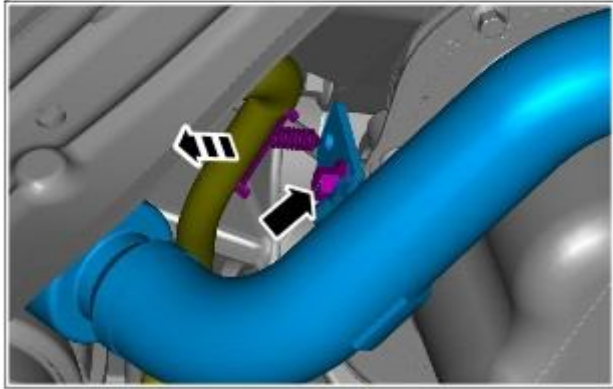
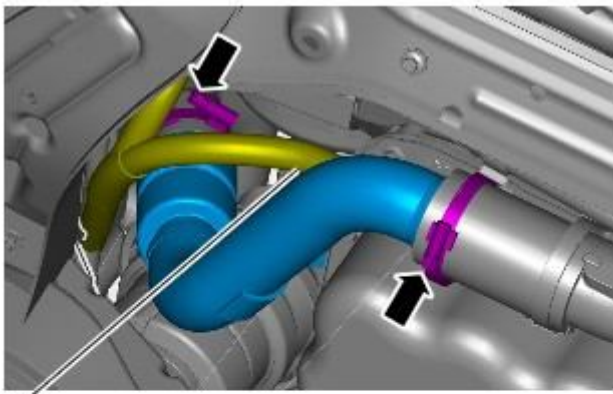
9. Attach the accessory drive belt.





**10.** Install the right-hand turbocharger outlet pipe.

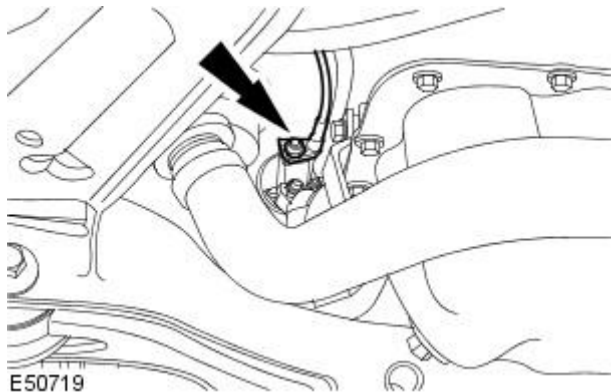
- Install the retaining bolt.
- Secure the turbocharger outlet pipe clip.
- Attach the wiring harness clip.



E98753

**11.** Attach the starter motor cable.

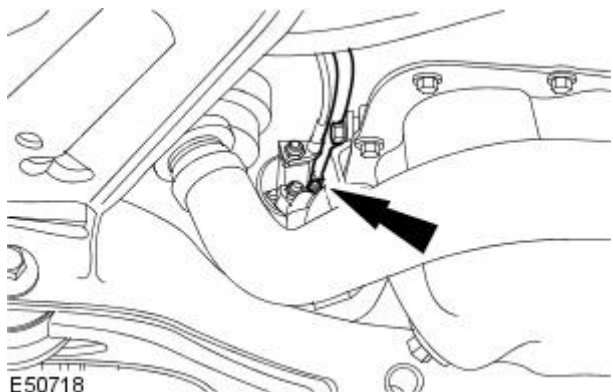
- Tighten to 10 Nm.



E50719

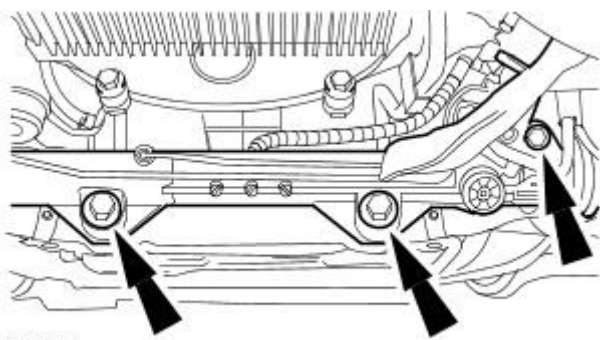
**12.** Attach the starter motor solenoid harness.

- Tighten to 7 Nm.



E50718

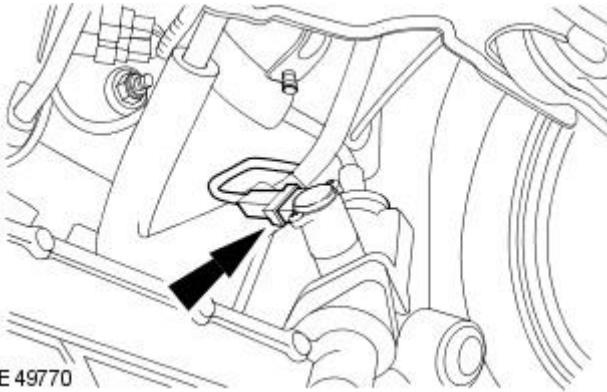
Right-hand drive vehicles



E31036

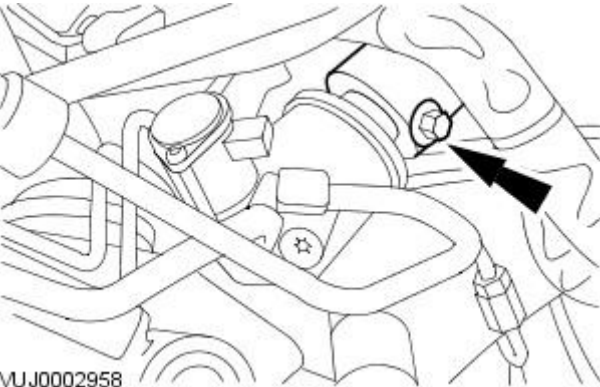
13. Attach the steering gear.

- Tighten to 100 Nm.



E49770

14. Connect the power steering control valve actuator electrical connector.



VUJ0002958

15. Install the steering gear shaft pinch bolt.

- Tighten to 35 Nm.

16. Install the air deflector.

For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

17. Connect the battery ground cable.


For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Engine - TDV6 2.7L Diesel - Exhaust Manifold

Removal and Installation

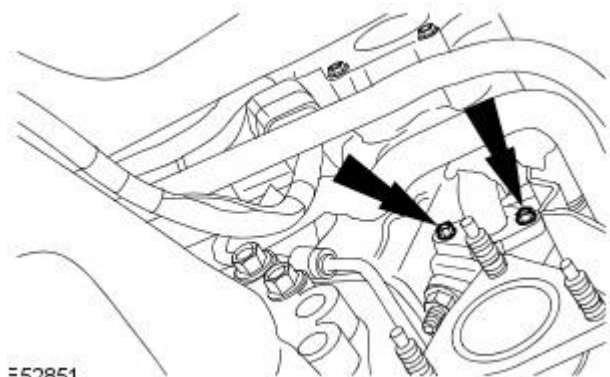
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

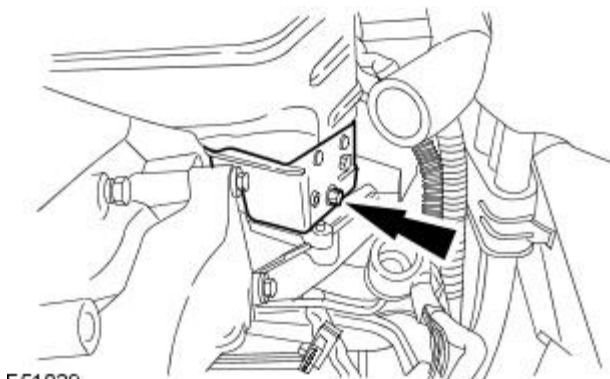
Raise and support the vehicle.

3. Remove the RH turbocharger.  
For additional information, refer to: [Turbocharger RH](#) (303-04B Fuel Charging and Controls - Turbocharger - TDV6 2.7L Diesel, Removal and Installation).
4. Disconnect the EGR valve inlet tube.
  - Discard the gasket.



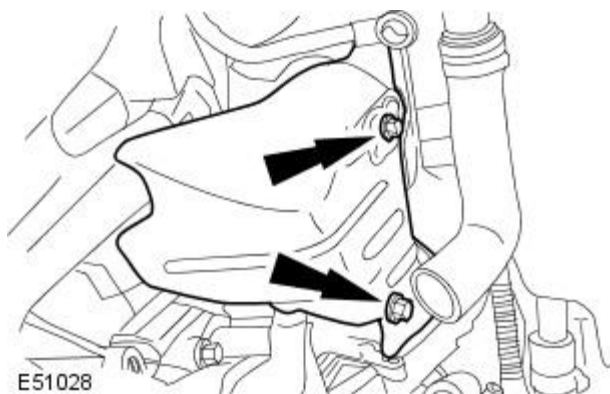
E52851

5. Remove the exhaust manifold front heat shield.



E51029

6. Remove the exhaust manifold heat shield.



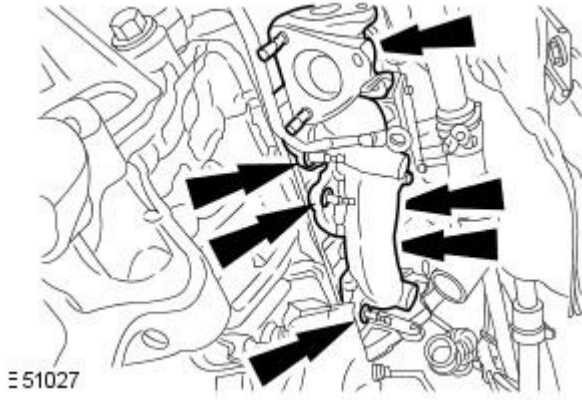
E51028



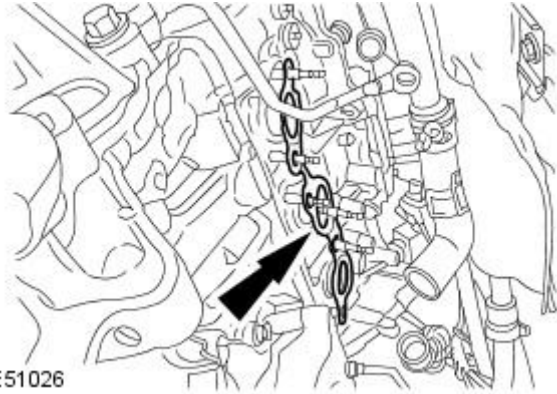
7. NOTE: New exhaust manifold retaining studs must be fitted if the old studs are removed.

Remove the exhaust manifold.

- Remove and discard the retaining nuts.



8. Remove and discard the exhaust manifold gasket.

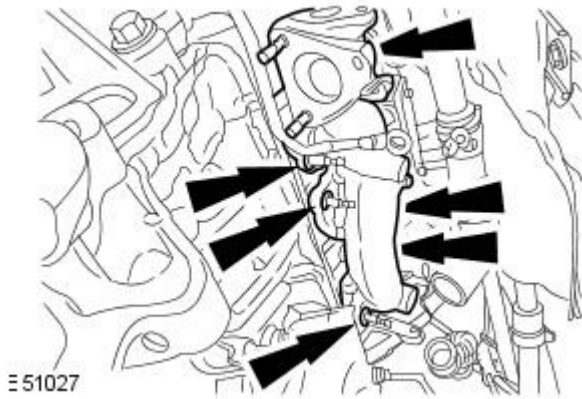


## Installation

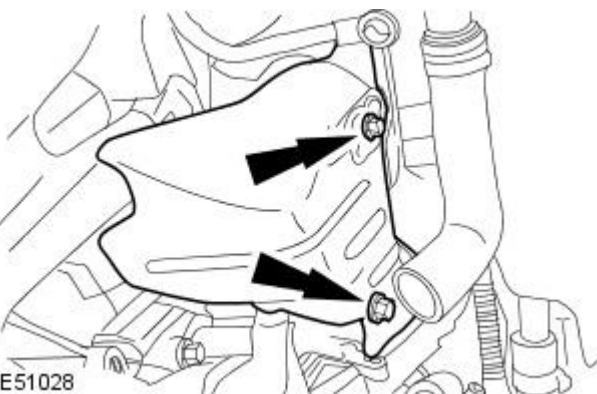
1. NOTE: New exhaust manifold retaining studs must be fitted if the old studs are removed.

To install, reverse the removal procedure.

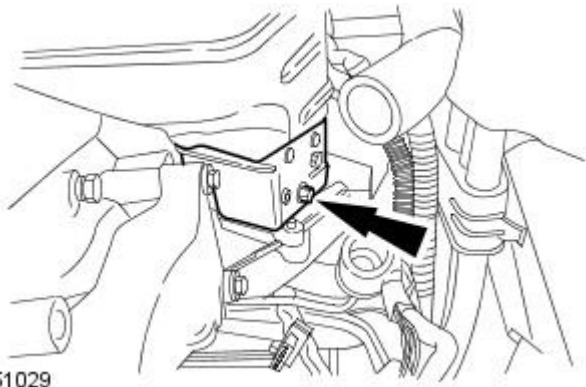
- Install a new exhaust manifold gasket.
- Install new retaining nuts.
- Tighten to 23 Nm.



2. Tighten to 10 Nm.

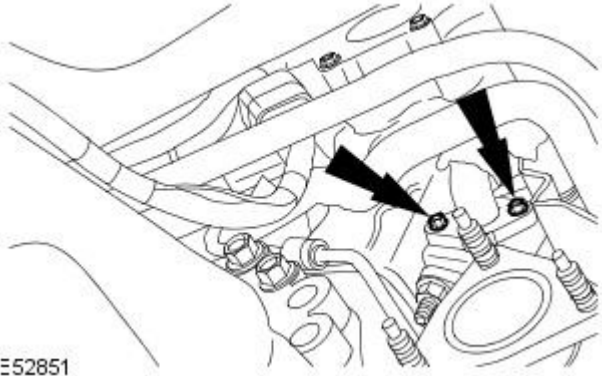


3. Tighten to 10 Nm.



E51029


4. Tighten to 10 Nm.



E52851

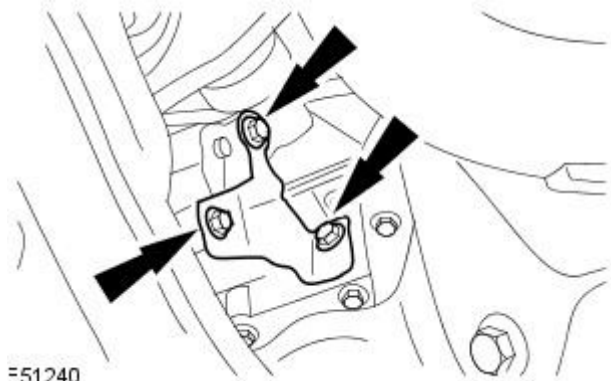
**Engine - TDV6 2.7L Diesel - Flexplate**

Removal and Installation

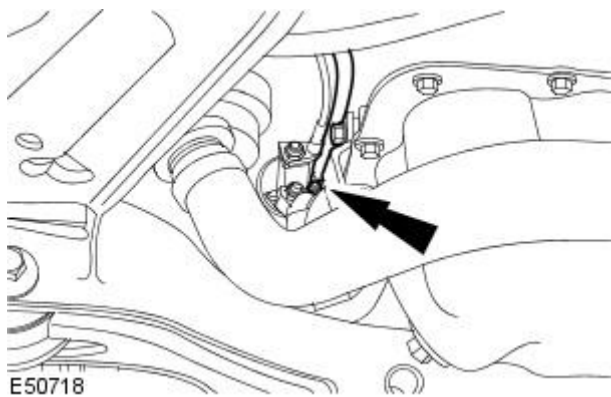
Special Tool(s)	
 <p>303-1123</p> <p>E 54546</p>	Locking Tool - Flywheel 303-1123

**Removal**

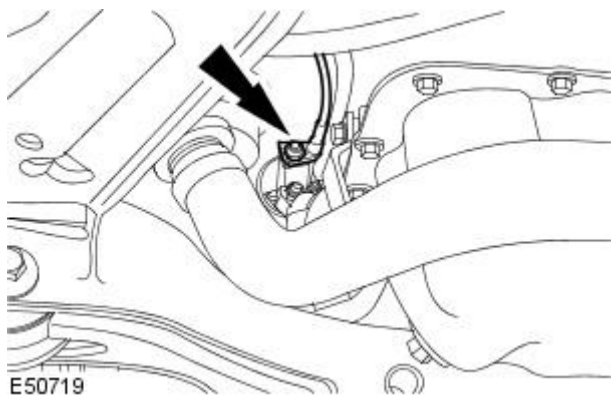
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Raise and support the vehicle.
3. Remove the automatic transmission.
4. Remove the starter motor retaining bracket.



5. Detach the starter motor solenoid harness.

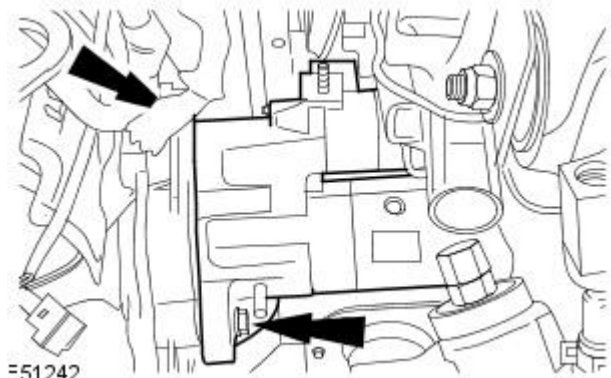


6. Detach the starter motor cable.



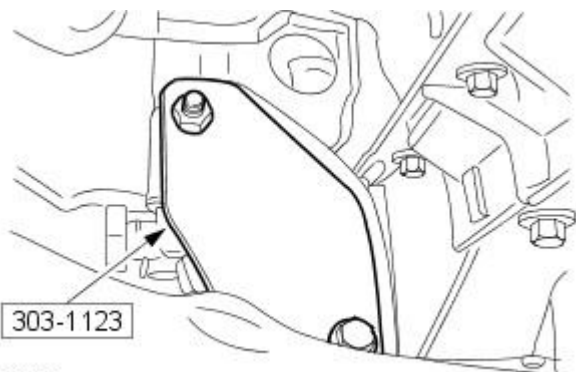
7. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Remove the starter motor.



E51242

8. Install the special tool.



E50870

9. NOTE: Prevent the flexplate from rotating.

Remove the flexplate.

- Remove and discard the bolts.



E51659

## Installation

1. NOTE: Make sure that all the component mating faces are clean.

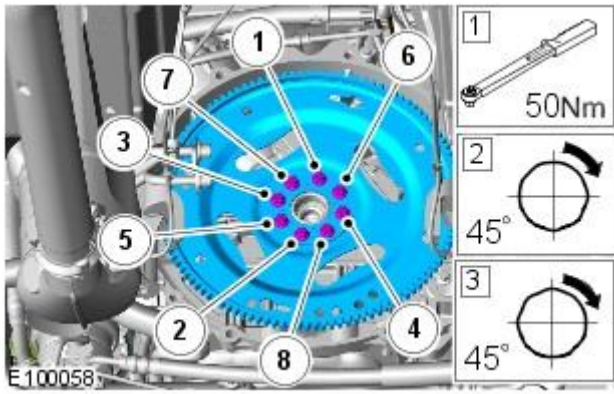
- NOTE: Loosely install all retaining bolts.

Install the flexplate.

- Prevent the flexplate from rotating.
- Install new retaining bolts.



E51659

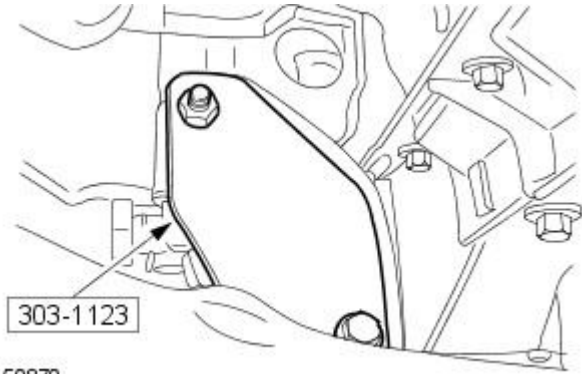


2. CAUTION: Tighten the bolts evenly in the stages shown.

Tighten the flexplate securing bolts.

- Stage 1: Tighten to 50 Nm.
- Stage 2: Tighten to 45 degrees.
- Stage 3: Tighten to 45 degrees.

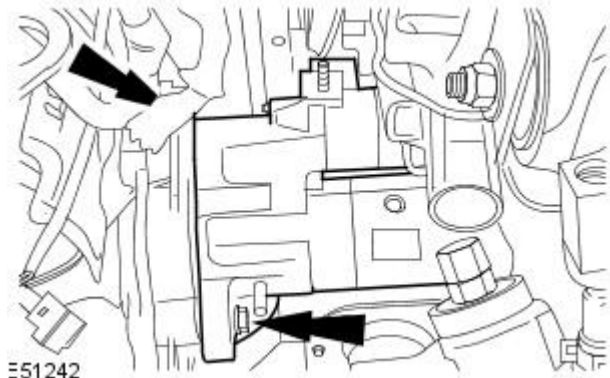
3. Remove the special tool.



E50870

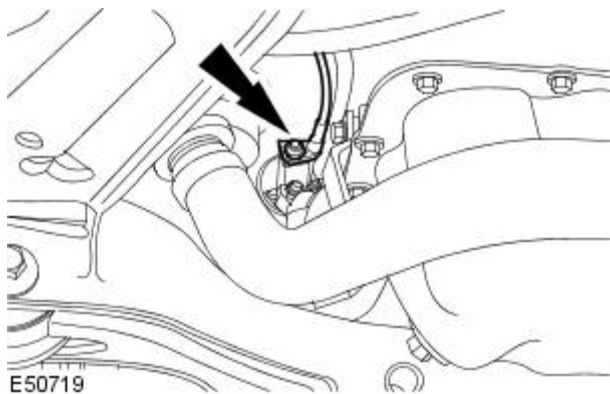
4. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Install the starter motor.



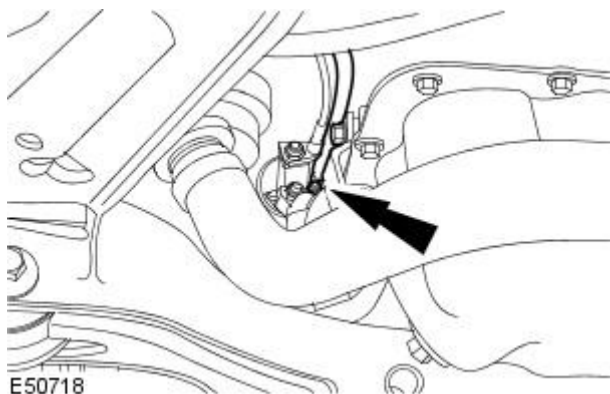
E51242

5. Tighten to 10 Nm.



E50719

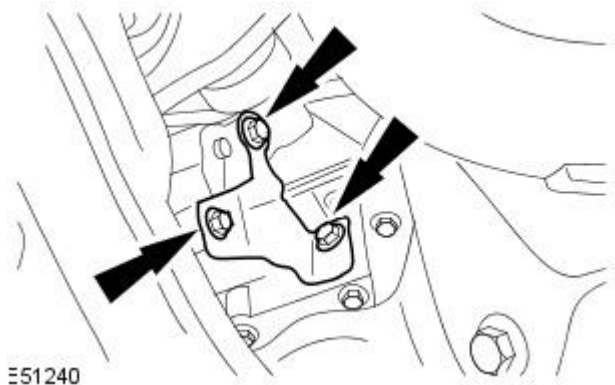
6. Tighten to 7 Nm.



E50718



7. Tighten to 23 Nm.



E51240


8. Install the automatic transmission.

9. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Engine - TDV6 2.7L Diesel - Oil Filter Element

Removal and Installation

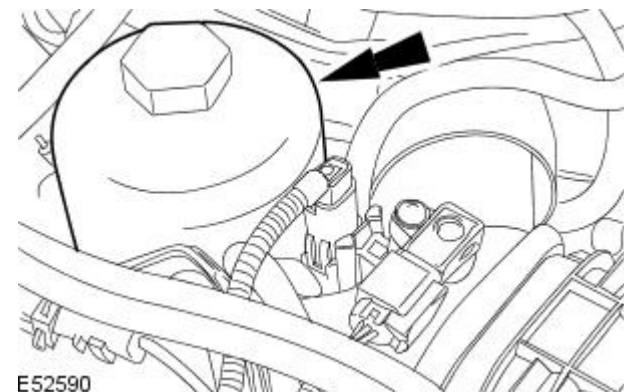
Special Tool(s)	
 <p>303-1128</p> <p>E54553</p>	<p>Remover - Oil Filter Element</p> <p>303-1128</p>

## Removal

1. Remove the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. Remove the oil filter element housing.

- Rotate the oil filter element housing five complete turns counter-clockwise.
- Allow the engine oil to drain from the oil filter element housing for two minutes.
- Remove the oil filter element housing.



3. **NOTE:** Remove and discard the O-ring seal.

Using the special tool, remove the oil filter element.



## Installation

1. **NOTE:** Install a new O-ring seal.

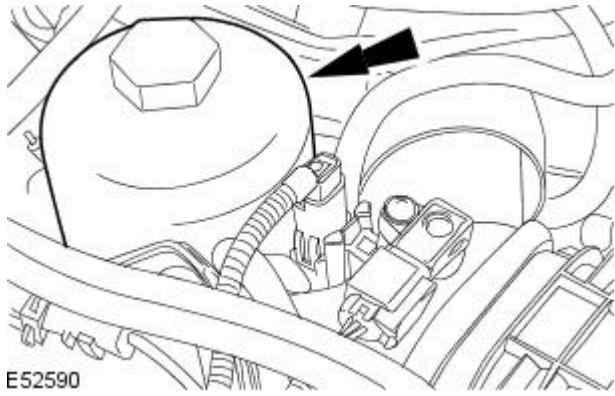
Install the oil filter element.





2. Install the oil filter element housing.

- Tighten to 25 Nm.



3. Install the engine cover.

For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

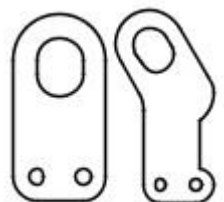

4. Check and top-up the engine oil.

5. Start and run the engine.


6. Check and if necessary top up the engine oil.

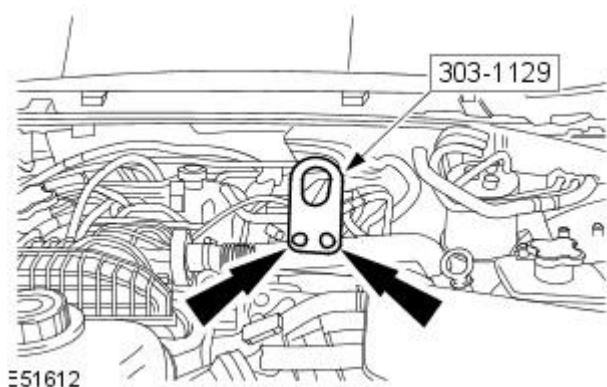
# Engine - TDV6 2.7L Diesel - Oil Pan

Removal and Installation

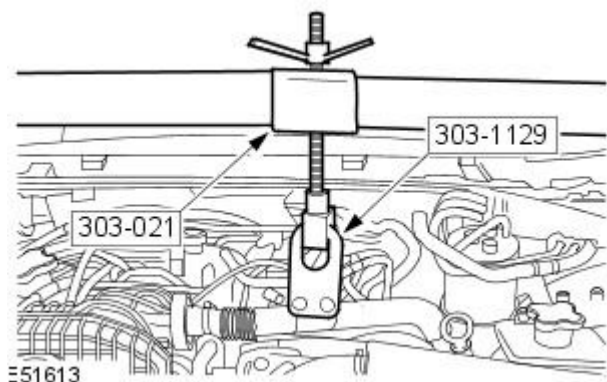
Special Tool(s)	
 <p>E54554</p>	<p>Lifting Brackets - Engine 303-1129</p>
 <p>303-021</p>	<p>Engine support bracket 303-021</p>

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
4. Install the special tool.

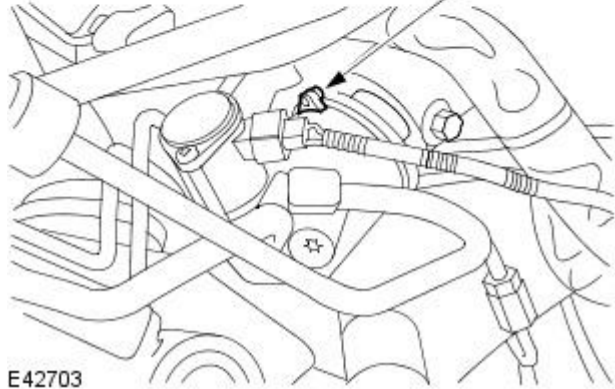
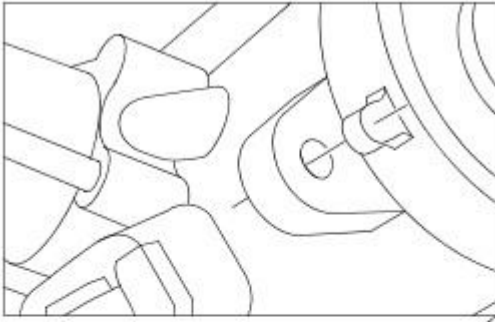



5. Install the special tool.



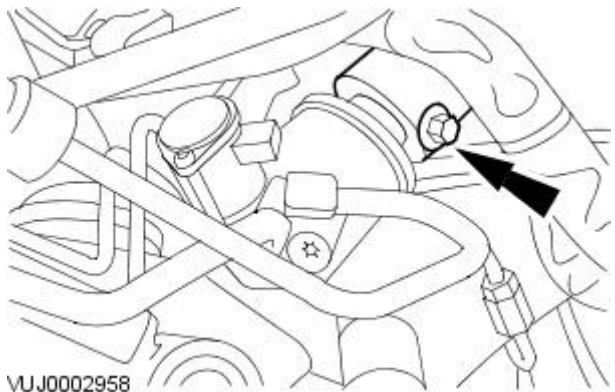
6. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).
7. Drain the engine oil.  
For additional information, refer to: [Engine Oil Draining and Filling](#) (303-01A Engine - TDV6 2.7L Diesel, General Procedures).

8. Make sure the alignment mark, on the steering gear pinion seal protection cover, is central to the steering gear pinion casting.

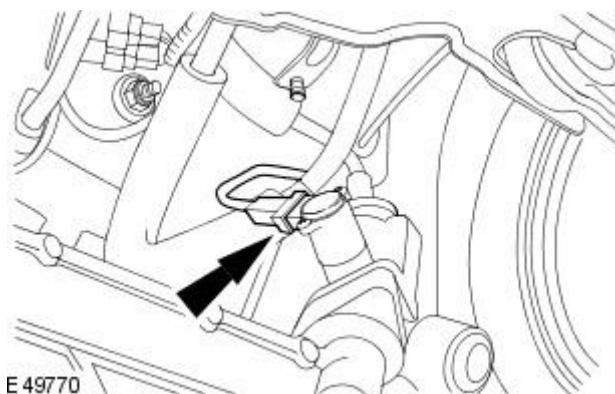


9.  CAUTION: Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

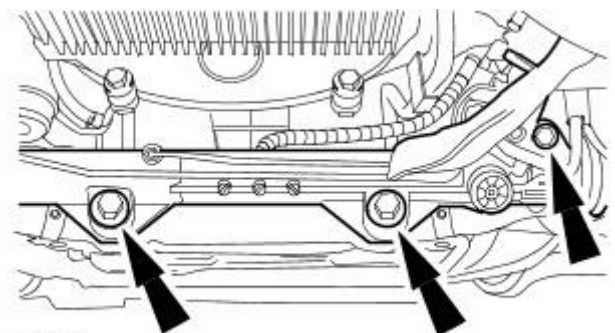
Remove the steering gear shaft pinch bolt.



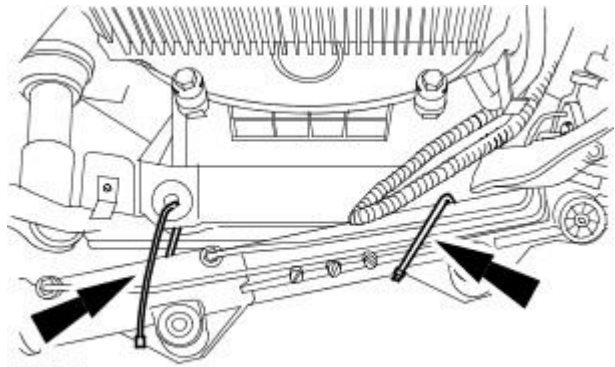
10. Disconnect the power steering control valve actuator electrical connector.



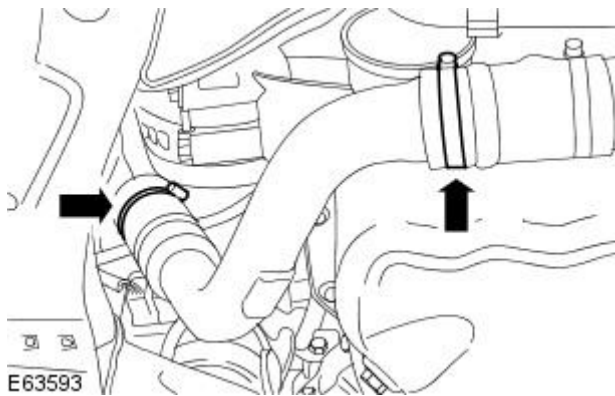
11. Detach the steering gear.



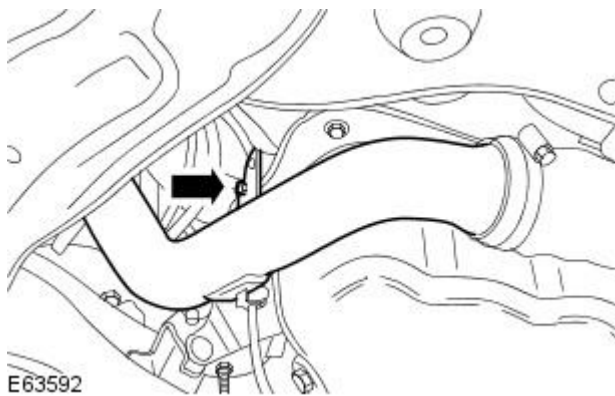
12. Support the steering gear.



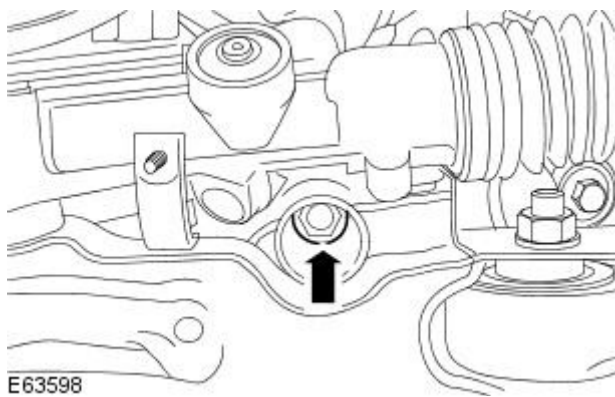
13. Loosen the RH turbocharger outlet tube securing clips.



14. Remove the RH turbocharger outlet tube.

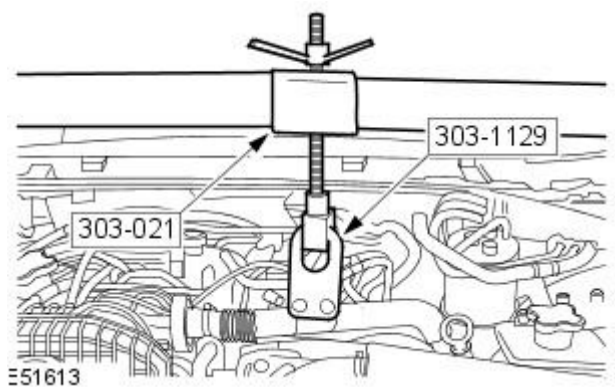


15. Remove the LH engine mount retaining nut.

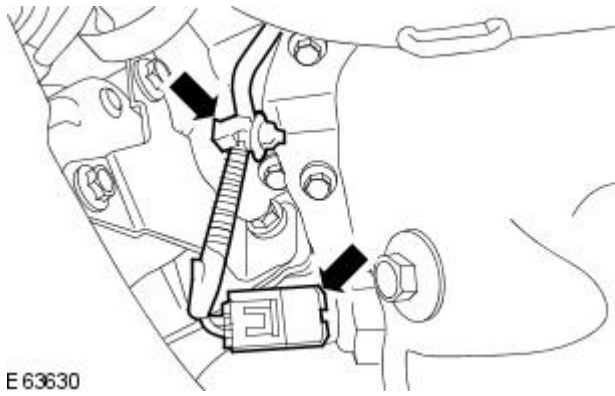


16. Lower the vehicle.

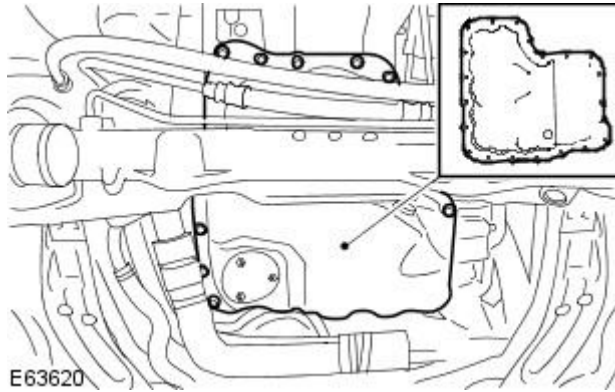
17. Raise the LH side of the engine.



18. Raise the vehicle.
19. Disconnect the engine oil temperature sensor electrical connector.

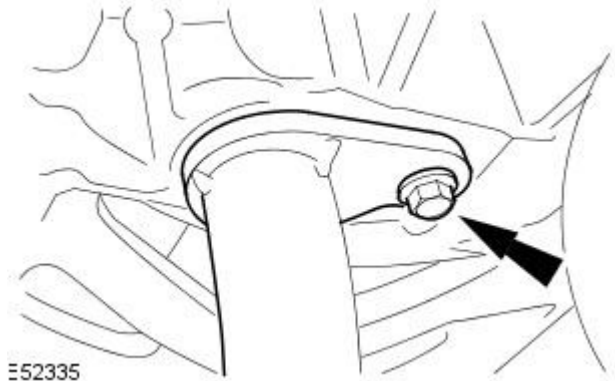


E 63630



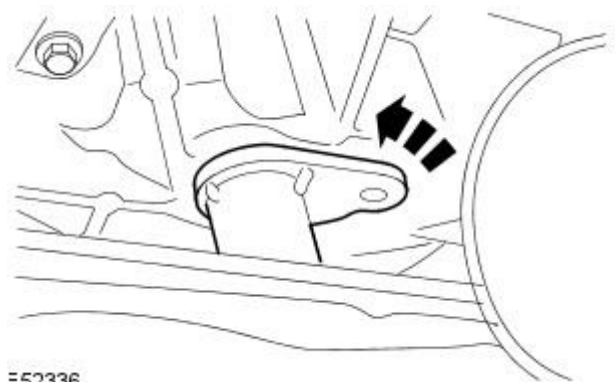
E63620

20. Reposition the oil pan.
  - Remove the 21 bolts.



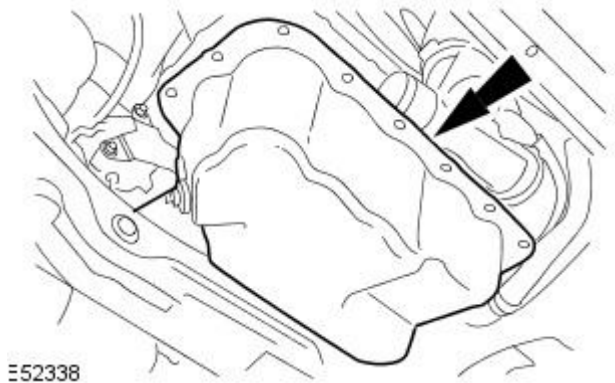
E52335

21. Remove the oil strainer bolt.



E52336

22. Reposition the oil strainer.



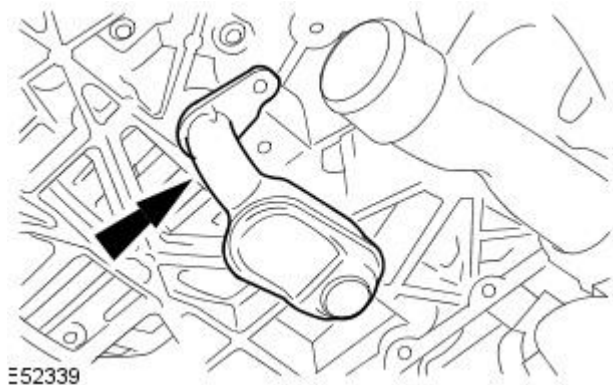
E52338

23. **NOTE:** Discard the gasket.  
Remove the oil pan.



24. NOTE: Remove and discard the O-ring seal.

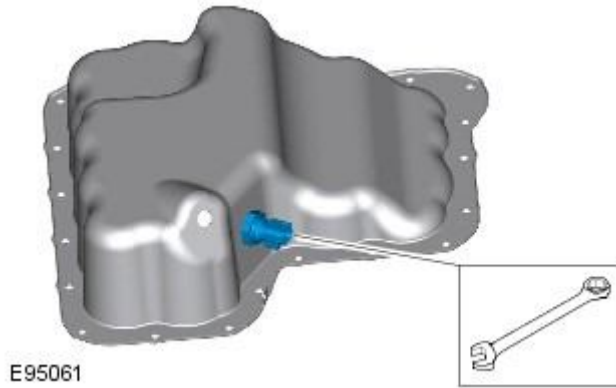
Remove the oil strainer pick-up assembly.



25. NOTE: Do not disassemble further if the component is removed for access only.

• NOTE: Remove and discard the O-ring seal.

Remove the engine oil temperature sensor.



## Installation

1. CAUTIONS:



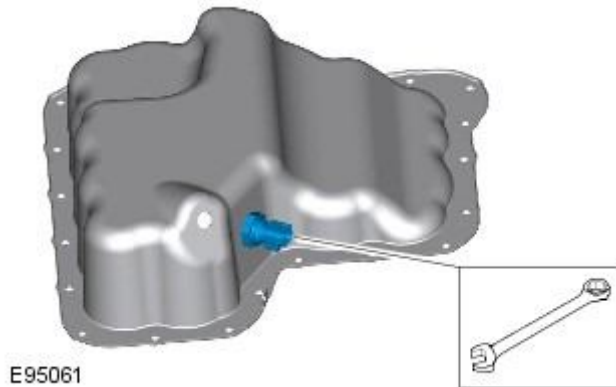
Make sure that the mating faces are clean and free of foreign material.



Install a new seal.

Install the oil temperature sensor.

- Tighten to 24 Nm.



2.  CAUTION: Install a new seal.

• NOTE: Make sure that all the components are clean.

• NOTE: Do not fully install the component at this stage.

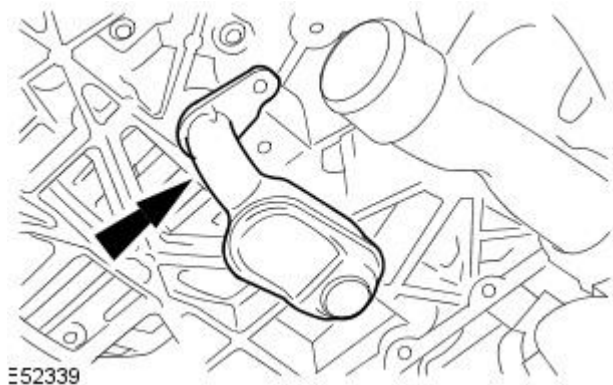
Position the oil strainer pick-up assembly.

3. NOTE: Make sure that all the component mating faces are clean.

• NOTE: Install a new gasket.

• NOTE: Do not fully install the component at this stage.

Position the oil pan.

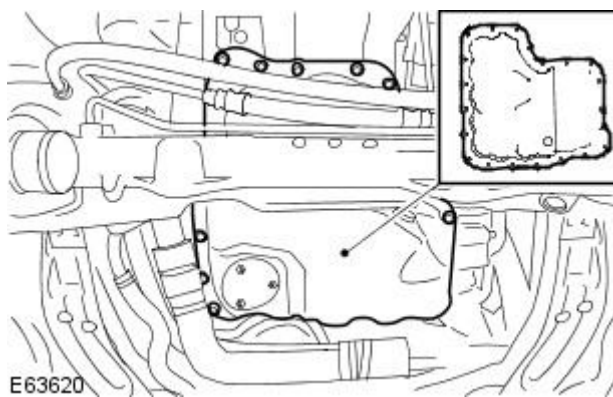


4. Install the oil strainer pick-up assembly.

- Tighten to 10 Nm.



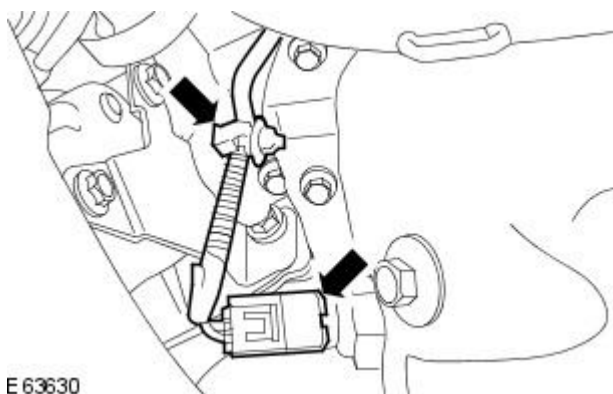
5. Install the oil pan.



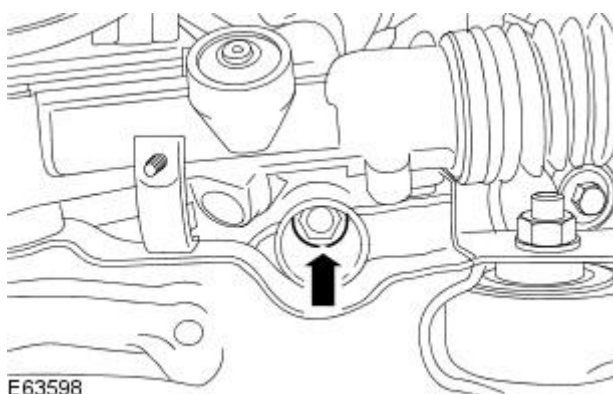
6.  **CAUTION:** Make sure the gasket is installed correctly.

Install the 21 bolts.

- Tighten to 10 Nm.



7. Connect the engine oil temperature sensor electrical connector.



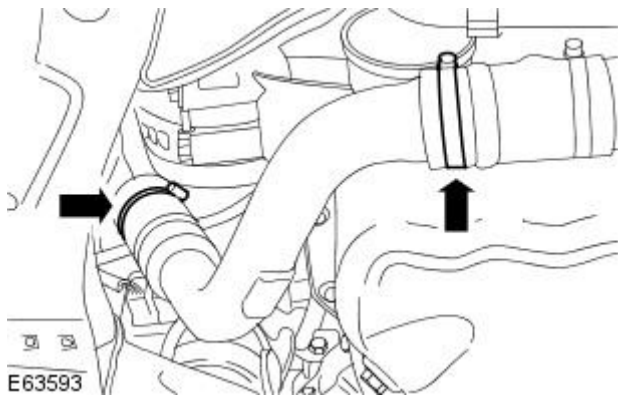
8. Lower the engine onto the engine mount.

9. Install the LH engine mount retaining nut.

- Tighten to 63 Nm.

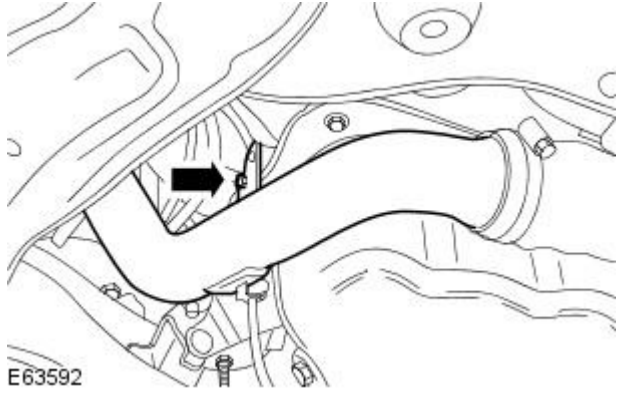


10. Install the RH turbocharger outlet tube.



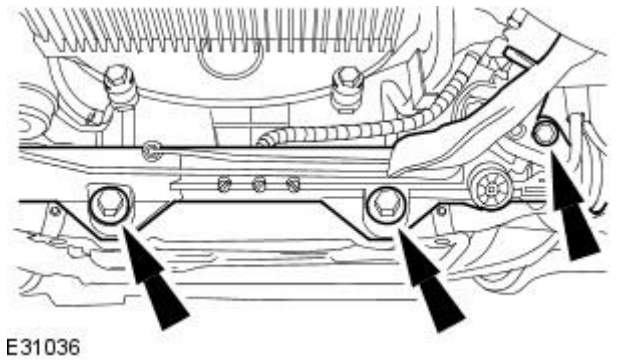
11. Install the RH turbocharger outlet tube retaining bolt.

- Tighten to 10 Nm.



12. Install the steering gear.

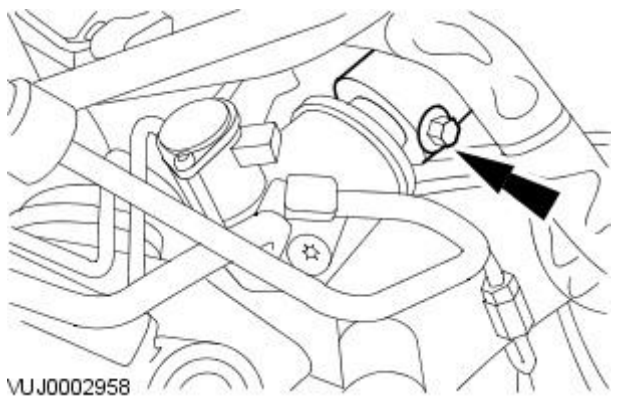
- Tighten to 100 Nm.



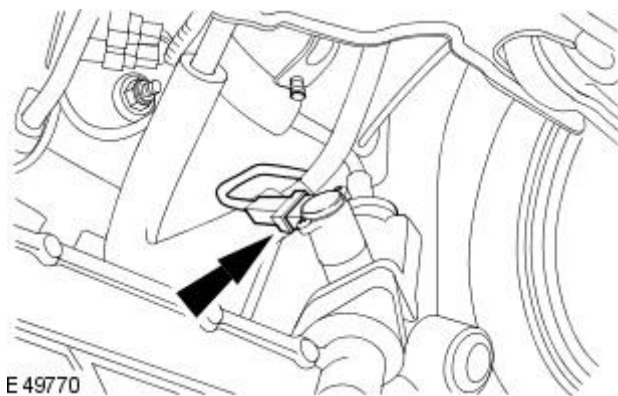
13. NOTE: Align to the position noted on removal.

Connect the steering column lower shaft.

- Tighten to 35 Nm.



14. Connect the steering gear control valve actuator electrical connector.



15. Install the air deflector.

For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

**16.** Remove the engine support.

**17.** Install the engine cover.

For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

**18.** Fill the engine with the recommended oil to the correct level.

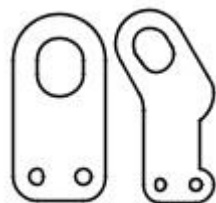

For additional information, refer to: [Engine Oil Draining and Filling](#) (303-01A Engine - TDV6 2.7L Diesel, General Procedures).

**19.** Connect the battery ground cable.


For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

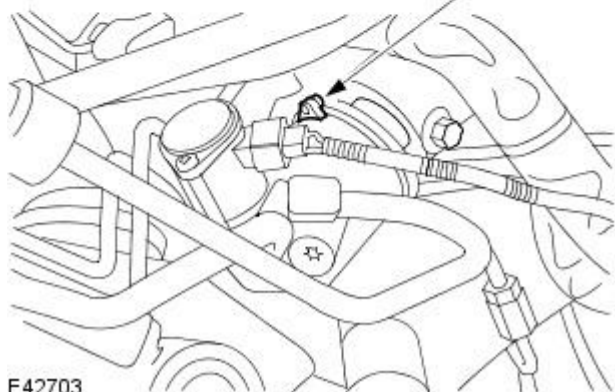
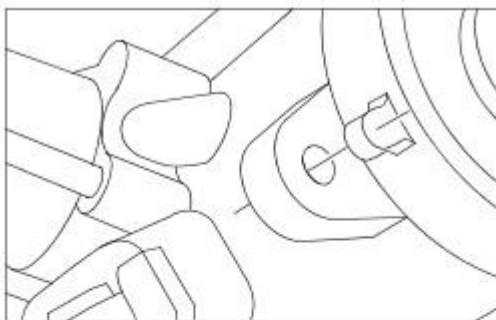
# Engine - TDV6 2.7L Diesel - Oil Pan Extension

Removal and Installation


Special Tool(s)	
 <p>E54554</p>	<p>Lifting Brackets - Engine 303-1129</p>
 <p>303-021</p>	<p>Engine support bracket 303-021</p>

## Removal

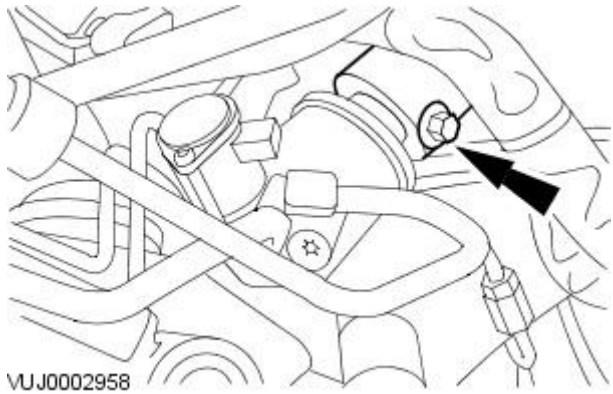
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the transmission assembly.  
For additional information, refer to: [Transmission - TDV6 2.7L Diesel](#) (307-01 Automatic Transmission/Transaxle - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel, Removal).
4. Drain the engine oil.  
For additional information, refer to: [Engine Oil Draining and Filling](#) (303-01A Engine - TDV6 2.7L Diesel, General Procedures).
5. Make sure the alignment mark, on the steering gear pinion seal protection cover, is central to the steering gear pinion casting.



E42703

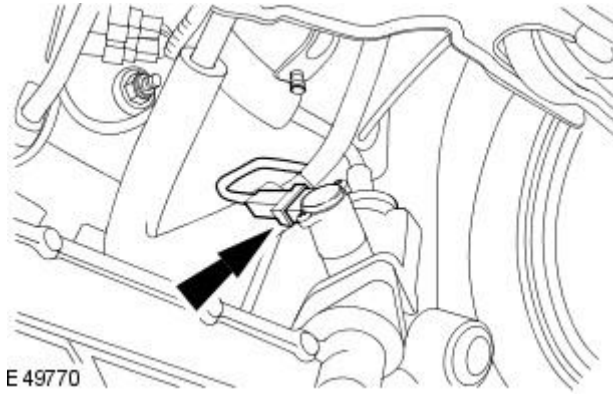
6.  CAUTION: Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

Remove the steering gear shaft pinch bolt.



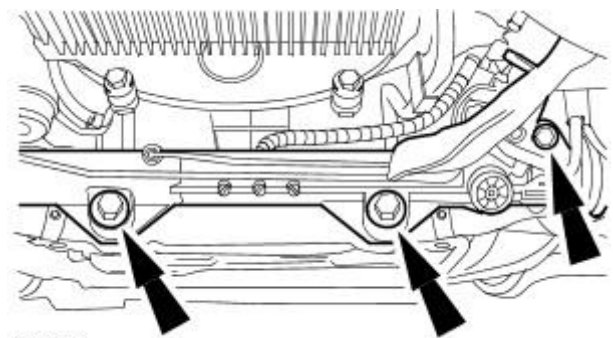
VUJ0002958

7. Disconnect the power steering control valve actuator electrical connector.



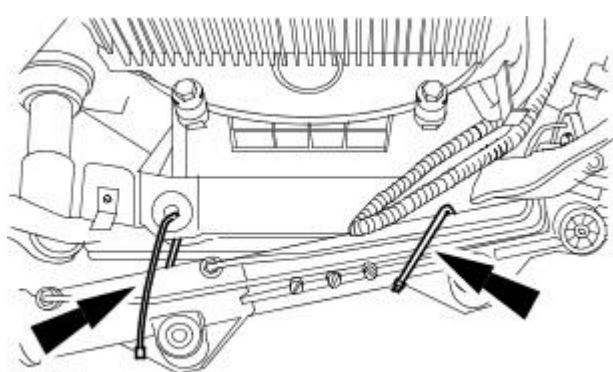
E 49770

8. Detach the steering gear.



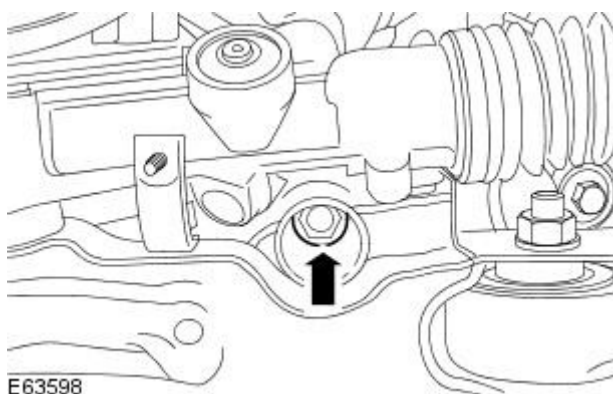
E31036

9. Support the steering gear.



E 31035

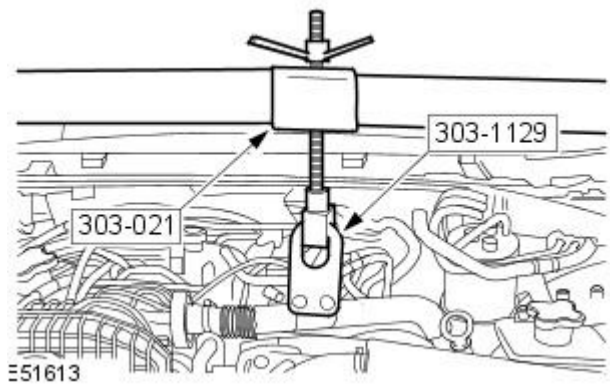
10. Remove the LH engine mount retaining nut.



E63598

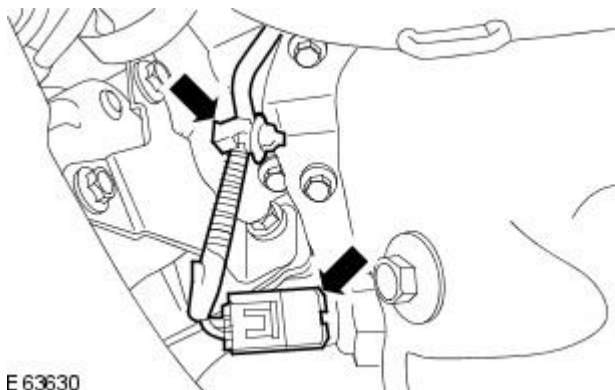
11. Lower the vehicle.

12. Raise the LH side of the engine.



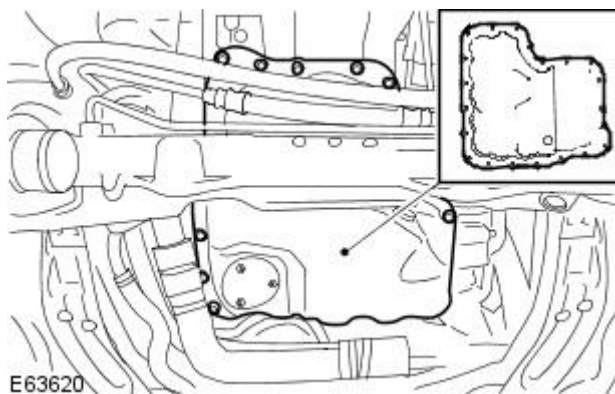
13. Raise the vehicle.

14. Disconnect the engine oil temperature sensor electrical connector.

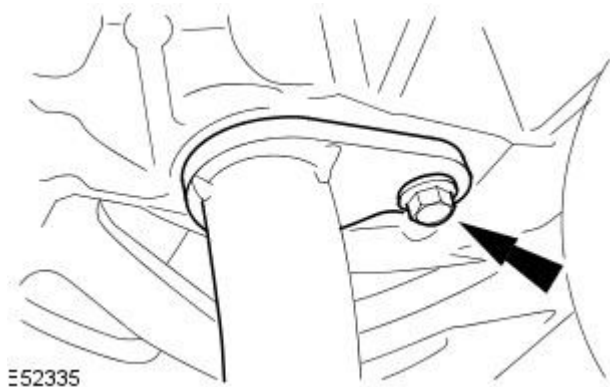


15. Reposition the oil pan.

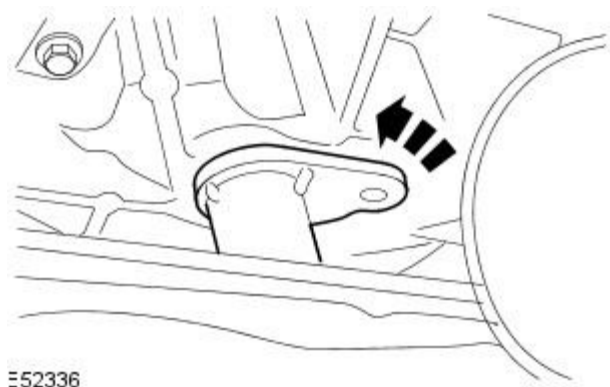
- Remove the 21 bolts.



16. Remove the oil strainer bolt.



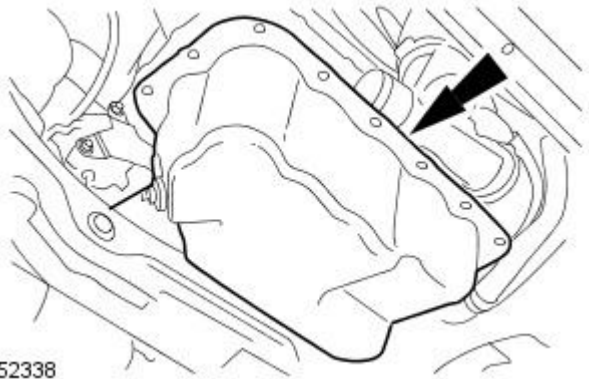
17. Reposition the oil strainer.





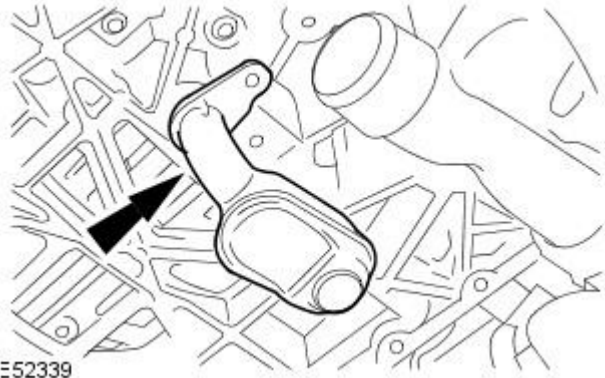
18. NOTE: Discard the gasket.

Remove the oil pan.

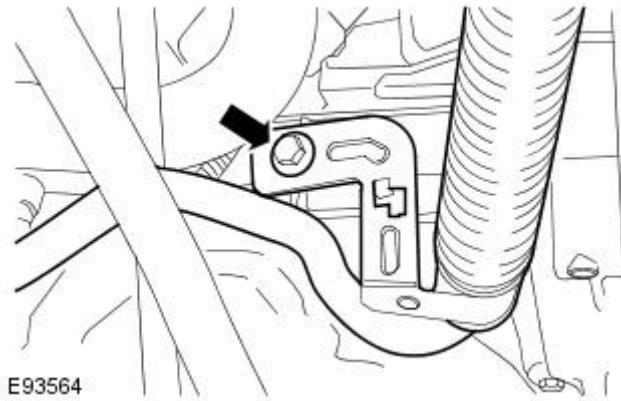


19. NOTE: Remove and discard the O-ring seal.

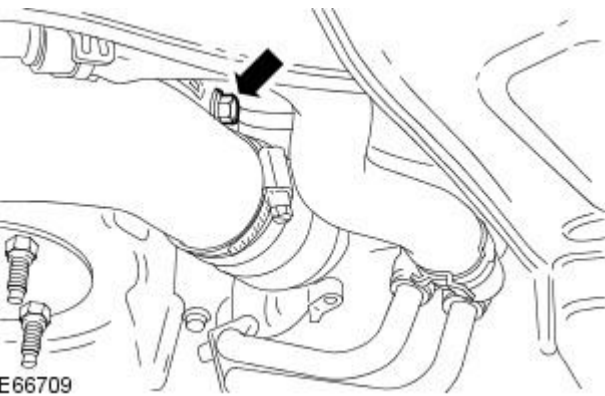
Remove the oil strainer pick-up assembly.



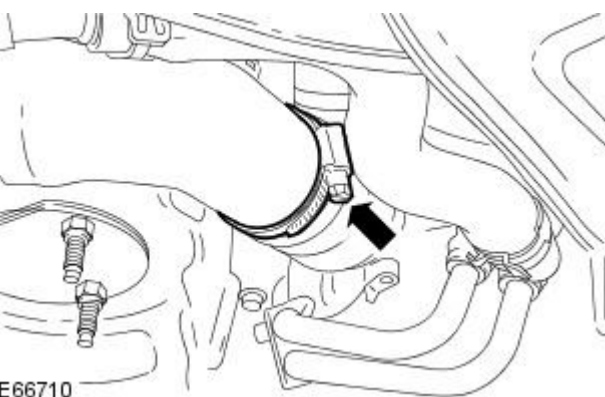
20. Remove the air conditioning (A/C) pipe retaining bolt.



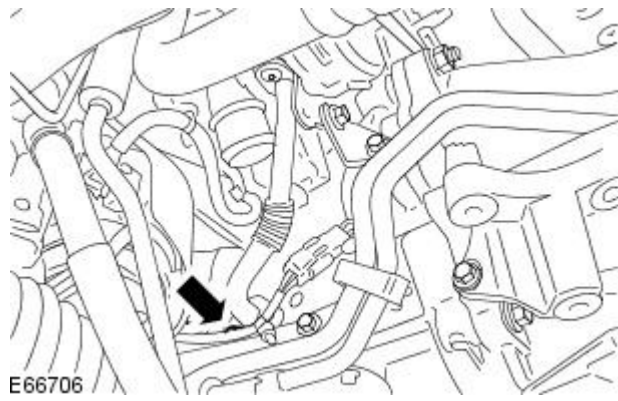
21. Remove the turbocharger outlet pipe retaining bolt.



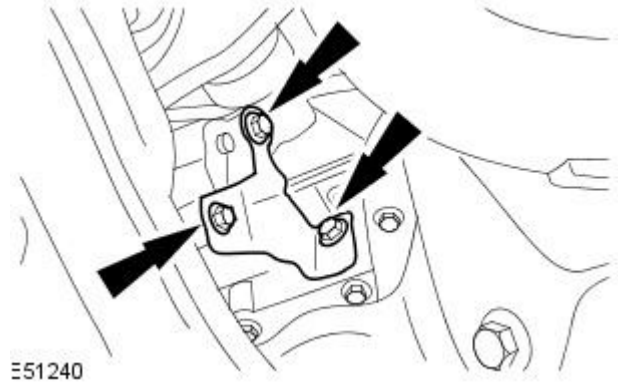
22. Disconnect the LH turbocharger outlet pipe.



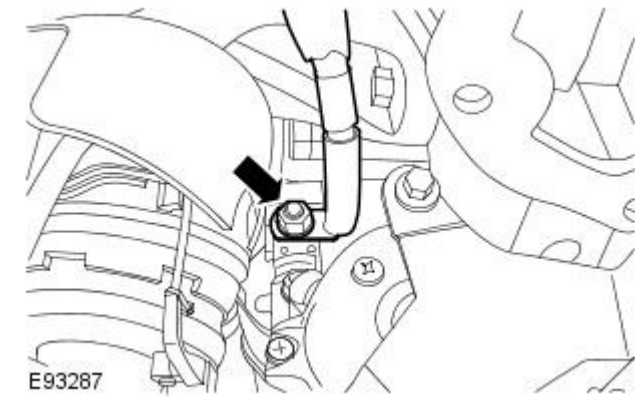
23. Remove the LH turbocharger outlet pipe.



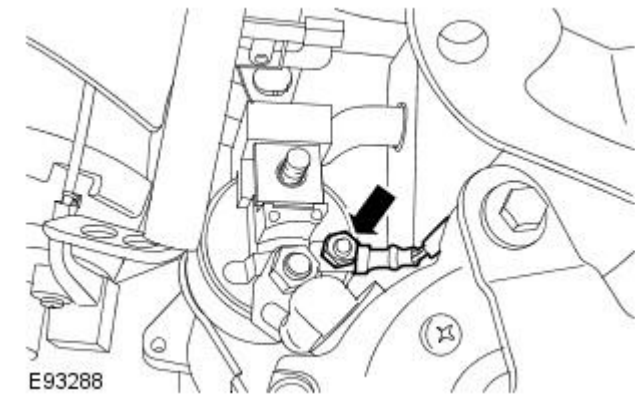
24. Remove the starter motor retaining bracket.



25. Disconnect the battery positive cable from the starter motor solenoid.

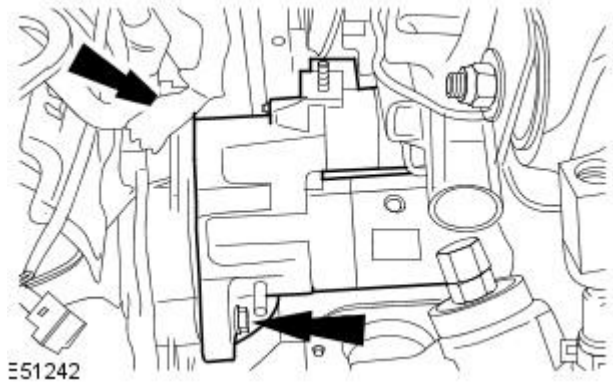


26. Disconnect the switch lead from the starter motor solenoid.

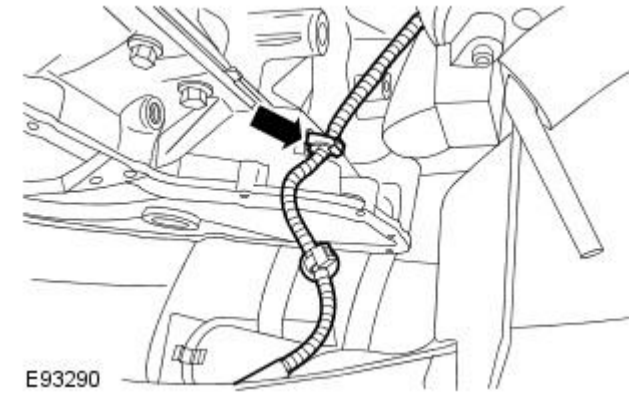




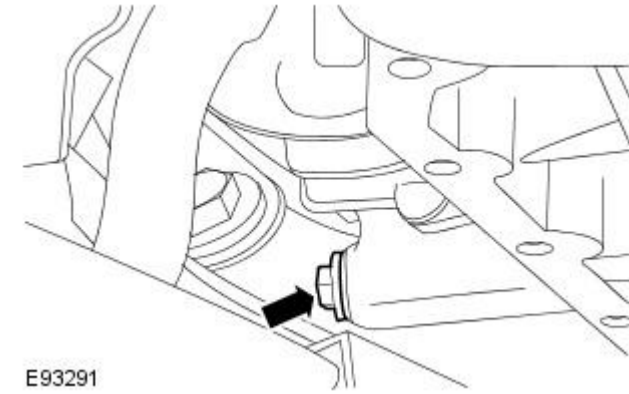
27. Remove the starter motor.



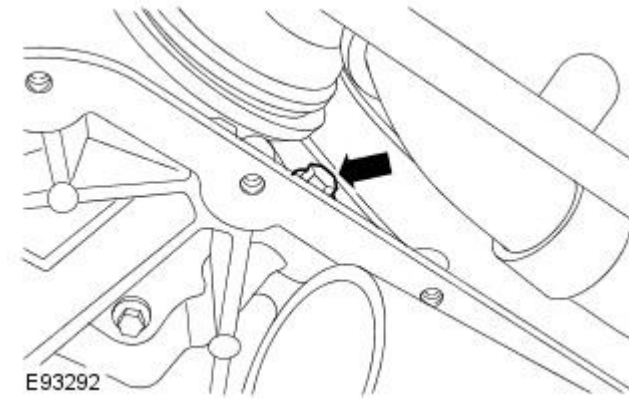
28. Release the oil temperature sensor harness.



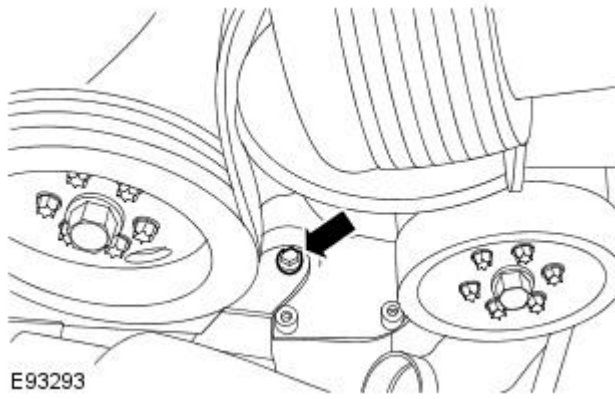
29. Remove the A/C compressor lower retaining bolt.



30. Remove the bolt from the accessory drive belt tensioner bracket.

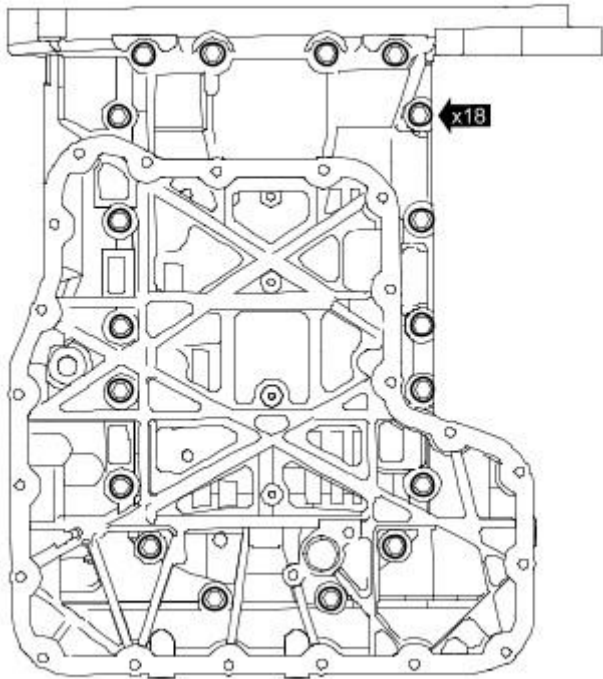


31. Remove the charge air cooler pipe retaining bolt.



32. NOTE: Discard the gasket.

Remove the oil pan extension.

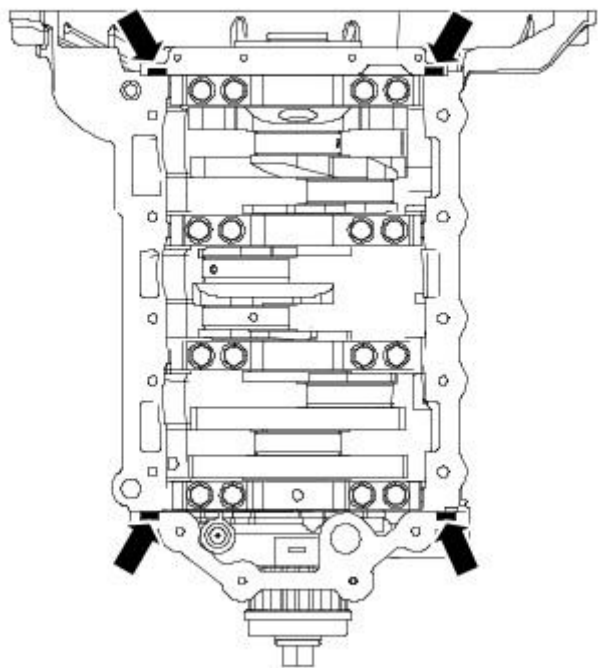


E93419

## Installation

1. Clean the component mating faces.

2. Apply an 8 mm bead of sealant to the cylinder block in the areas shown. For additional information, refer to: [Specifications](#) (303-01A Engine - TDV6 2.7L Diesel, Specifications).



E93678

3. NOTE: Install a new gasket.

- NOTE: Loosely install all retaining bolts.

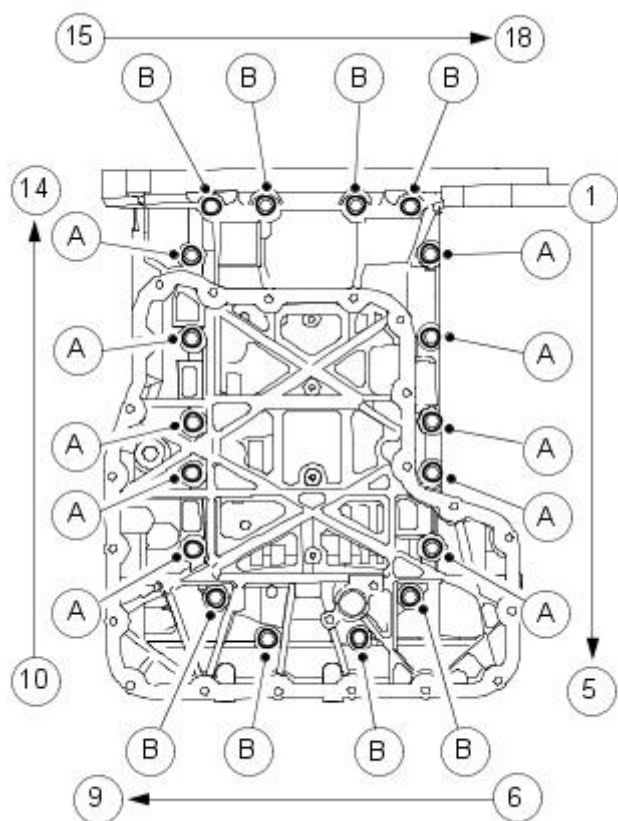
Install the oil pan extension.

4.  CAUTION: Tighten the bolts in the sequence shown.

- NOTE: The retaining bolts must be tightened within twenty minutes of applying the sealant.

Tighten the oil pan extension retaining bolts in the sequence shown.

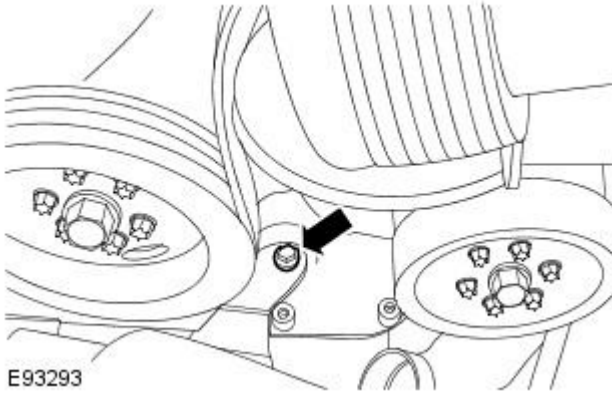
1. Tighten bolts A to 10 Nm.
2. Tighten bolts B to 4 Nm.
3. Tighten bolts A to 24 Nm.
4. Tighten bolts B to 10 Nm.



E93676

5. Tighten the charge air cooler retaining bolt.

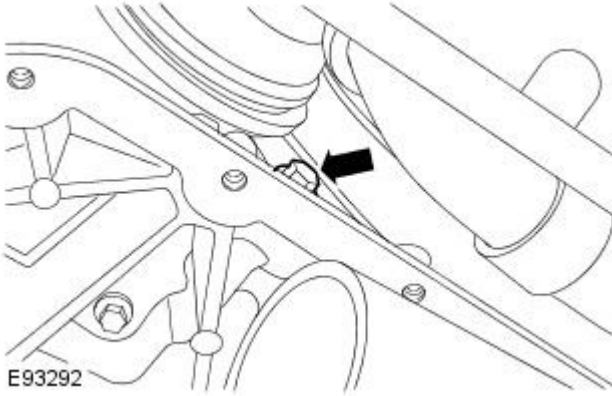
- Tighten to 10 Nm.



E93293

6. Install the accessory drive belt tensioner bracket bolt.

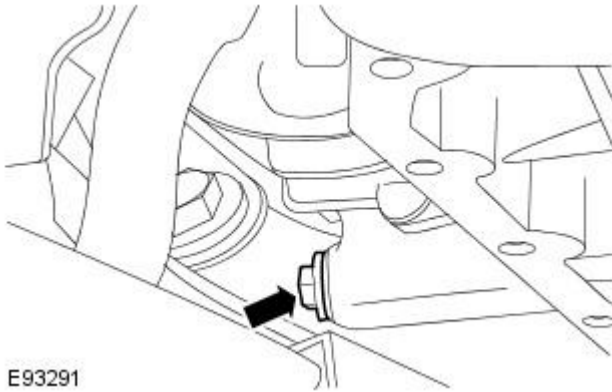
- Tighten to 24 Nm.



E93292

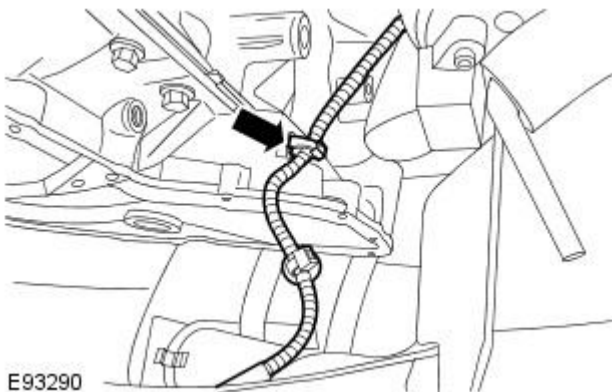
7. Install the A/C compressor lower bolt.

- Tighten to 24 Nm.



E93291

8. Secure the oil temperature sensor harness clip.

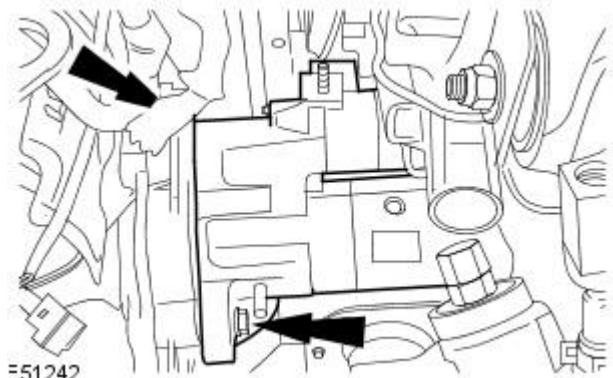


E93290

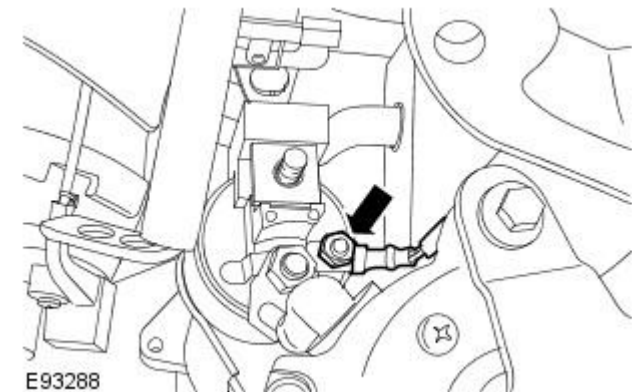
9. NOTE: Make sure that all the component mating faces are clean.

Install the starter motor.

- Tighten to 48 Nm.

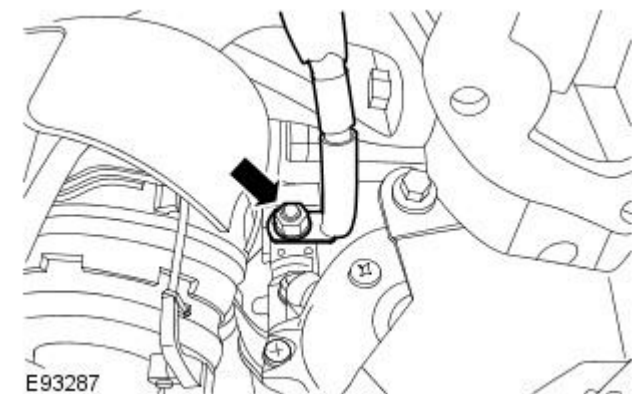


10. Connect the starter motor solenoid electrical connector.



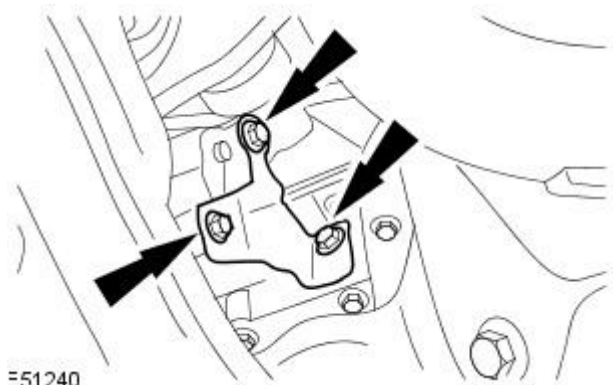
11. Connect the battery positive cable to the starter motor solenoid.

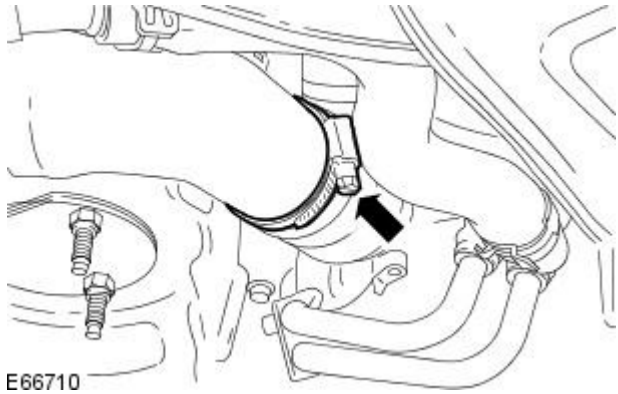
- Tighten to 10 Nm.



12. Install the starter motor support bracket.

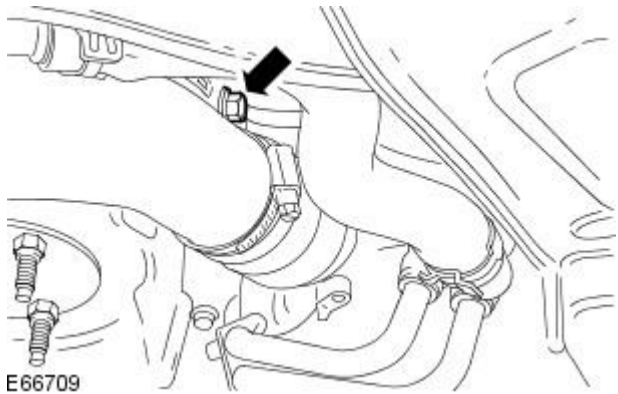
- Tighten to 23 Nm.





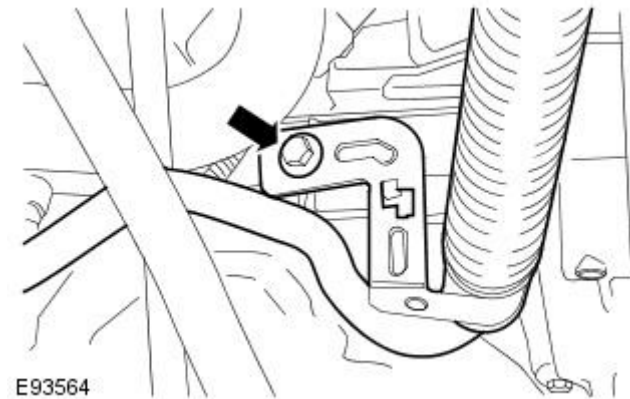
13. Install the LH turbocharger outlet pipe and secure with the clips.

- Tighten to 5 Nm.



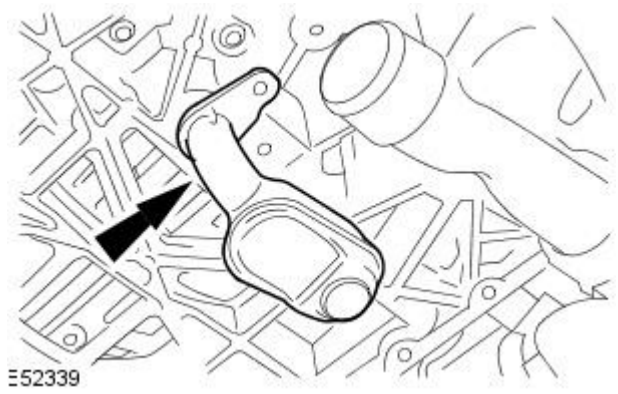
14. Install the LH turbocharger outlet pipe bolt.

- Tighten to 24 Nm.



15. Install the A/C pipe retaining bolt.

- Tighten to 24 Nm.



16.  CAUTION: Install a new seal.

- NOTE: Make sure that all the components are clean.
- NOTE: Do not fully install the component at this stage.

Position the oil strainer pick-up assembly.

17. NOTE: Make sure that all the component mating faces are clean.

- NOTE: Install a new gasket.
- NOTE: Do not fully install the component at this stage.

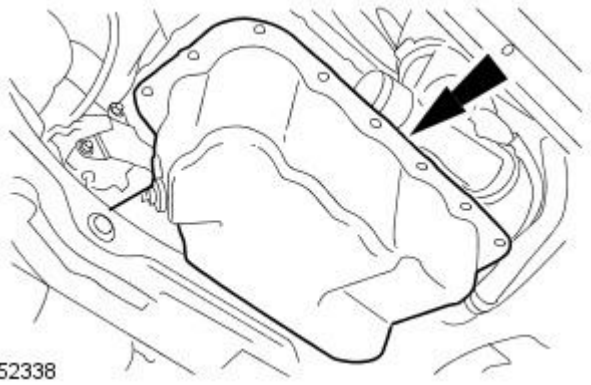
Position the oil pan.

18. Install the oil strainer pick-up assembly.

- Tighten to 10 Nm.



19. Install the oil pan.

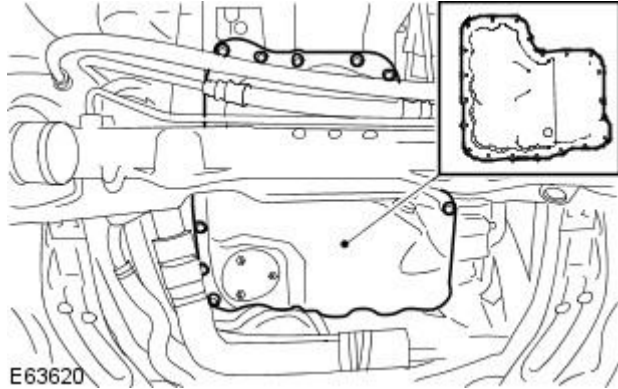


E52338

20.  CAUTION: Make sure the gasket is installed correctly.

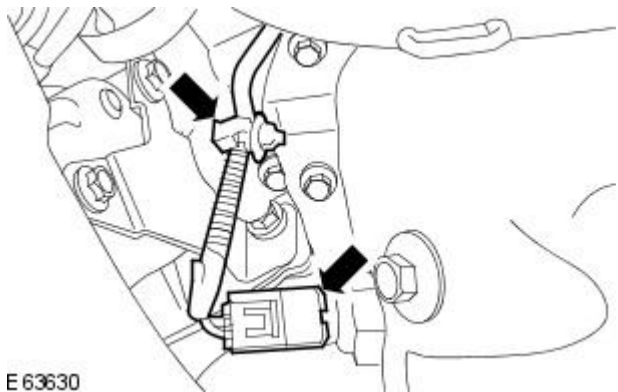
Install the 21 bolts.

- Tighten to 10 Nm.



E63620

21. Connect the engine oil temperature sensor electrical connector.

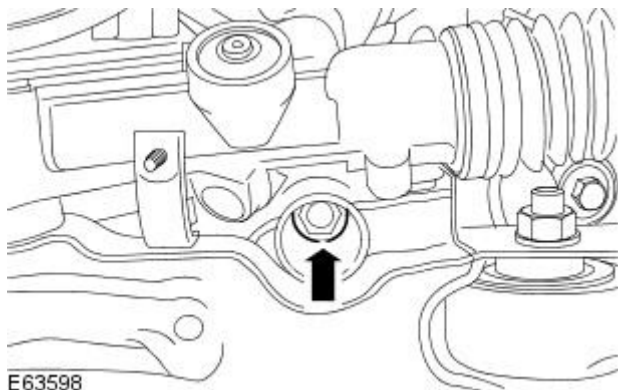


E63630

22. Lower the engine onto the engine mount.

23. Install the LH engine mount retaining nut.

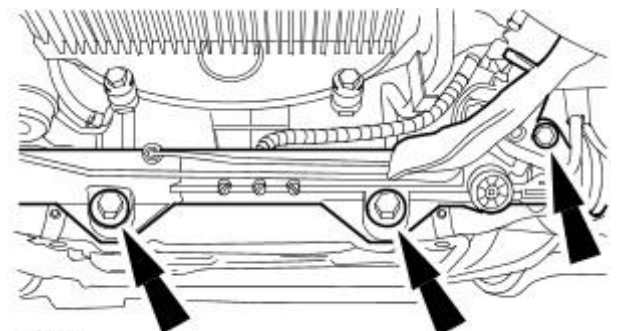
- Tighten to 63 Nm.



E63598

24. Install the steering gear.

- Tighten to 100 Nm.



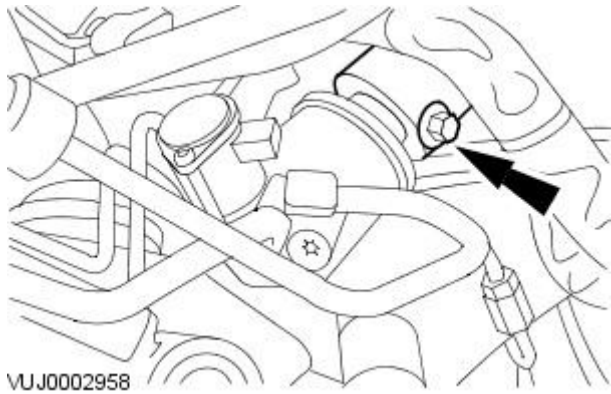
E31036



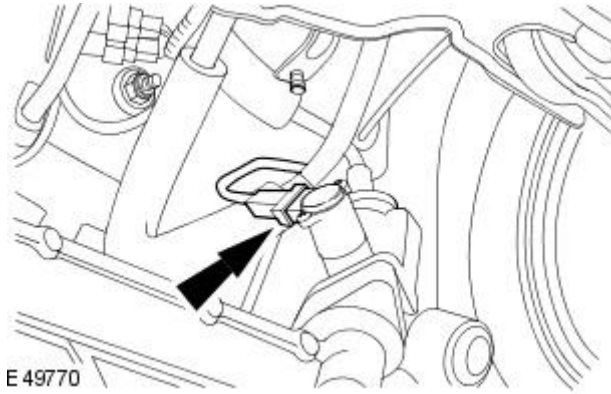
**25. NOTE:** Align to the position noted on removal.

Connect the steering column lower shaft.

- Tighten to 35 Nm.



**26.** Connect the steering gear control valve actuator electrical connector.



**27.** Fill the engine with the recommended oil to the correct level.

For additional information, refer to: [Engine Oil Draining and Filling](#) (303-01A Engine - TDV6 2.7L Diesel, General Procedures).

**28.** Install the transmission assembly.

For additional information, refer to: [Transmission - TDV6 2.7L Diesel](#) (307-01 Automatic Transmission/Transaxle - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel, Removal).

**29.** Connect the battery ground cable.


For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Engine - TDV6 2.7L Diesel - Oil Pump

Removal and Installation

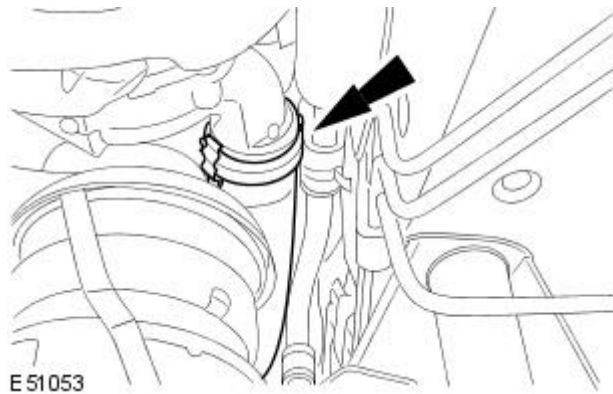
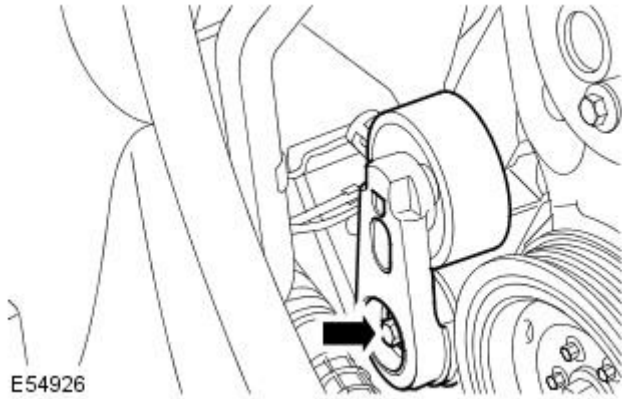
## Removal

1. Disconnect the battery ground cable. For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the crankshaft front oil seal.  
For additional information, refer to: [Crankshaft Front Seal](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).

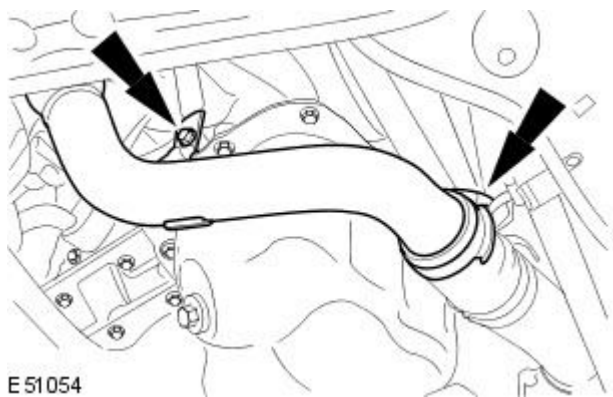
3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

4. Remove the oil pan extension.  
For additional information, refer to: [Oil Pan Extension](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).
5. Release the accessory drive belt tensioner.
  - Remove the bolt.

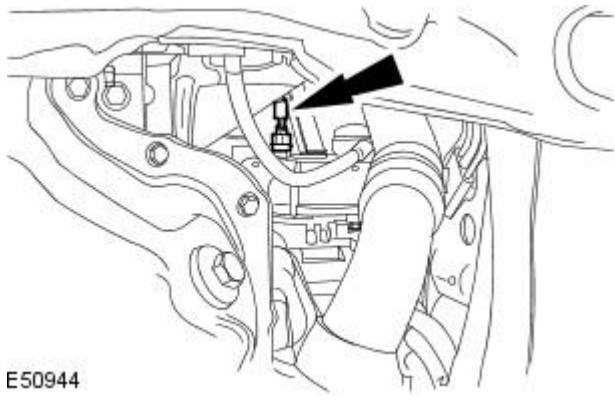


6. Release the RH turbocharger outlet pipe clip.



7. Remove the RH turbocharger outlet pipe.
  - Remove the bolt.
  - Release the clip.

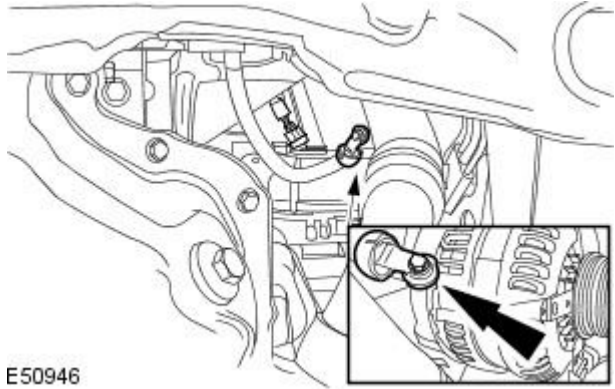
8. Disconnect the generator electrical connector.



E50944

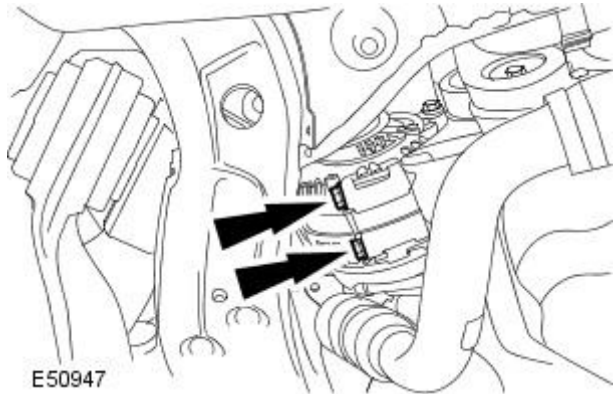
9. Disconnect the battery positive cable from the generator.

- Reposition the battery positive cable connector cover.
- Remove the nut.



E50946

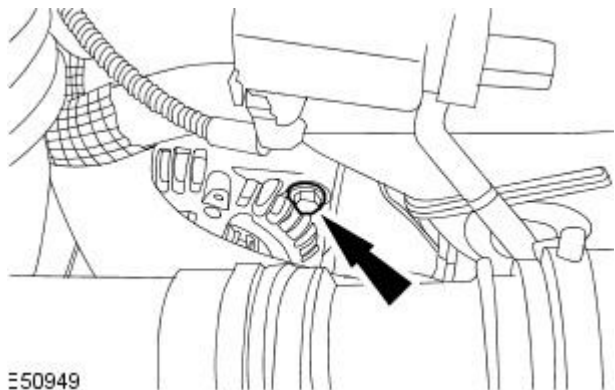
10. Remove the 2 lower bolts from the generator.



E50947

11. Release the generator.

- Remove the generator upper bolt.
- Reposition the generator.
- Using a suitable tie strap, secure the generator to the front subframe.

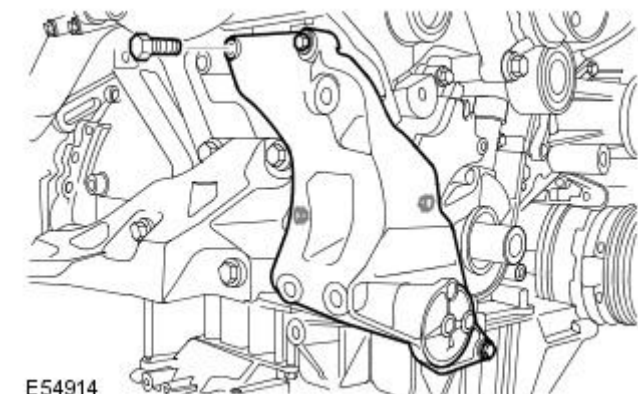


E50949

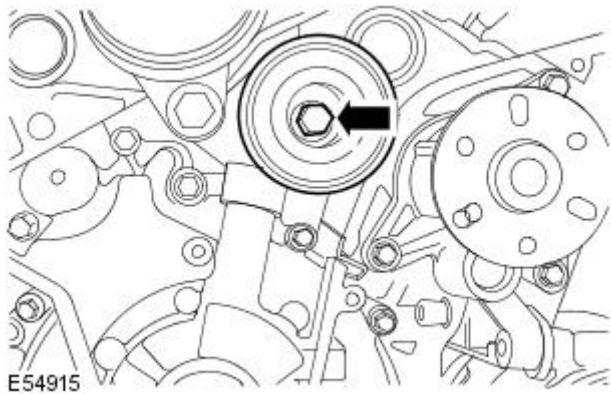
12. NOTE: The generator mounting bracket upper rear bolt cannot be fully removed until the generator mounting bracket has been detached from the engine.

Remove the generator mounting bracket.

- Remove the 4 bolts.



E54914



13. Remove the timing belt idler pulley.

- Remove the bolt.



14. Remove the timing belt cover sealing strips.



15. Remove the oil pump.

- Remove the 10 bolts.
- Remove and discard the gasket.

## Installation

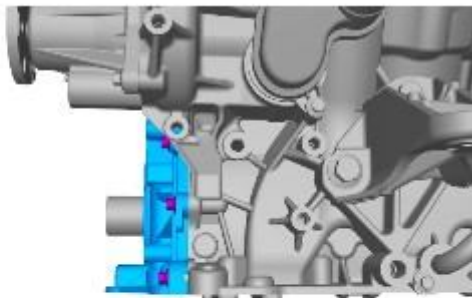
1. Prime the oil pump.

1. Fill the orifice shown with 20 ml of engine oil. For additional information, refer to: [Specifications](#) (303-01A Engine - TDV6 2.7L Diesel, Specifications).
2. Rotate the oil pump drive 2 complete turns.

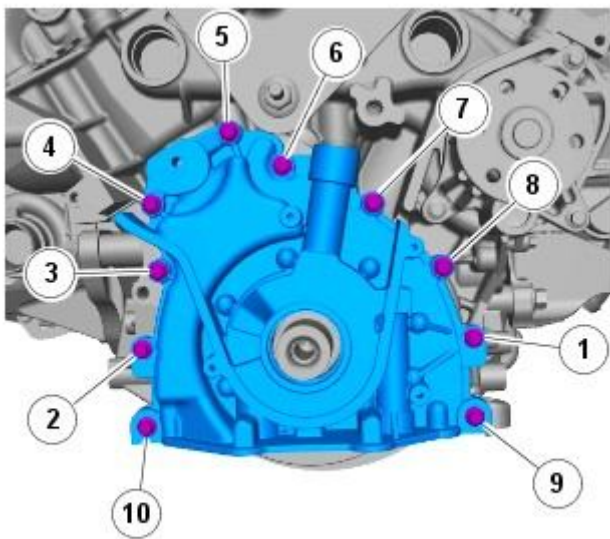




E123911




E123913



E123912


2. CAUTIONS:

 Make sure that the mating faces are clean and free of foreign material.

 Make sure the gasket is installed correctly.

Install the oil pump.

- Clean the component mating faces.
- Install a new gasket.
- Lightly tighten the bolts in the position shown.

3.  CAUTION: Make sure the base of the oil pump is aligned within 0.2 mm of the base of the engine block. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Vehicles fitted with oil pumps without dowels.

Check the oil pump to engine block alignment.

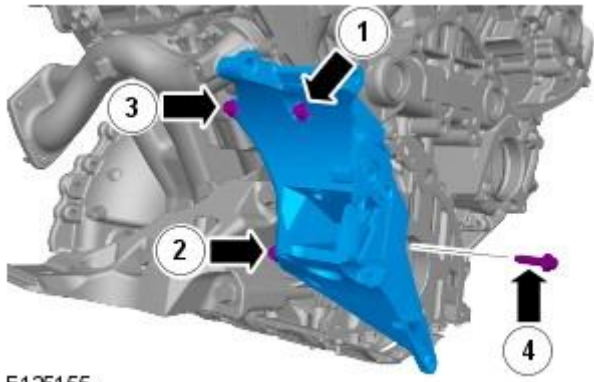
4. Secure the oil pump.

- Tighten the bolts in the sequence shown to 10 Nm .

5. Install timing belt cover sealing strips.

6. Install the timing belt idler pulley.

- Tighten the bolt to 45 Nm.



E125155

**7. Install the generator mounting bracket.**

- Loosely install the 4 bolts.
- Tighten the 4 bolts in the sequence shown to 23 Nm.

**8. Install the generator.**

- Tighten the bolts to 47 Nm (35 lb.ft).

**9. Connect the generator electrical connectors.**

- Tighten the nut to 12 Nm.
- Connect the generator electrical connection.

**10. Install the RH turbocharger outlet tube.**

- Secure the 2 clips.

**11. Install the accessory drive belt tensioner.**

- Tighten the bolt to 47 Nm (35 lb.ft).

**12. Install the oil pan extension.**

For additional information, refer to: [Oil Pan Extension](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).

**13. Install the crankshaft front oil seal.**



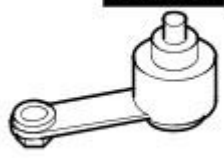
For additional information, refer to: [Crankshaft Front Seal](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).

**14. Connect the battery ground cable.**


For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

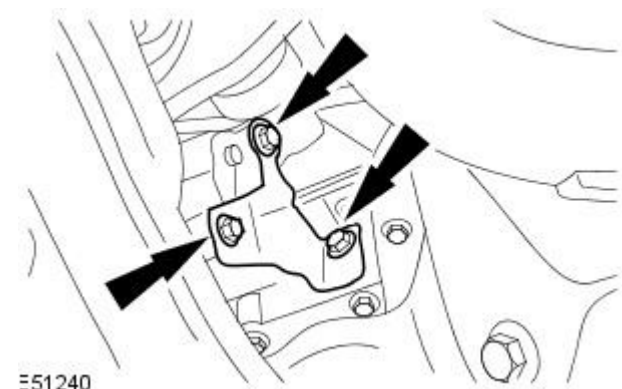
# Engine - TDV6 2.7L Diesel - Timing Belt

Removal and Installation

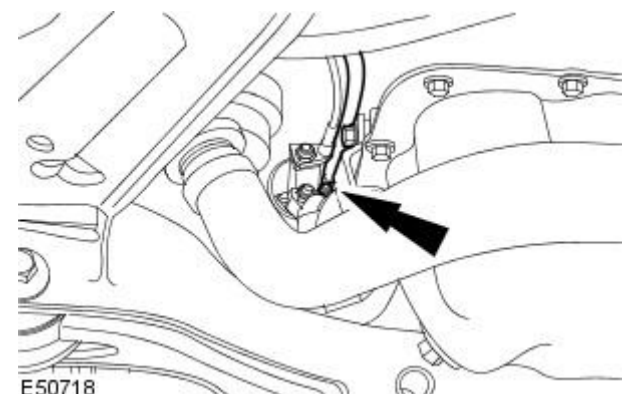
Special Tool(s)	
 <p><b>303-1132</b></p> <p>E54557</p>	<p>Check Pin - Camshaft Pulleys</p> <p>303-1132</p>
 <p><b>303-1126</b></p> <p>E54551</p>	<p>Timing Pin - Camshaft Pulleys</p> <p>303-1126</p>
 <p><b>303-1117</b></p> <p>E54540</p>	<p>Timing Pin - Automatic Transmission</p> <p>303-1117</p>

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the timing cover.  
For additional information, refer to: [Timing Cover](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).
3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
4. Remove the starter motor retaining bracket.

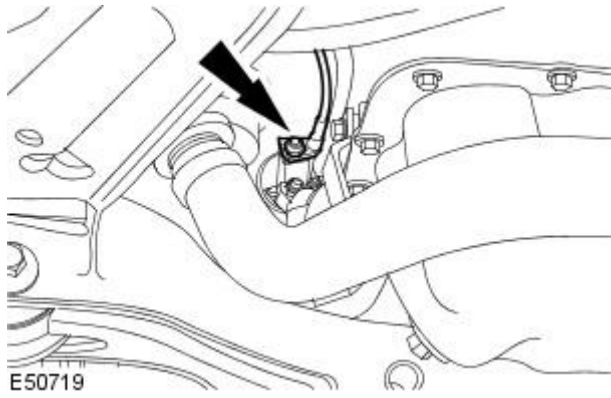


5. Release the starter motor solenoid harness.

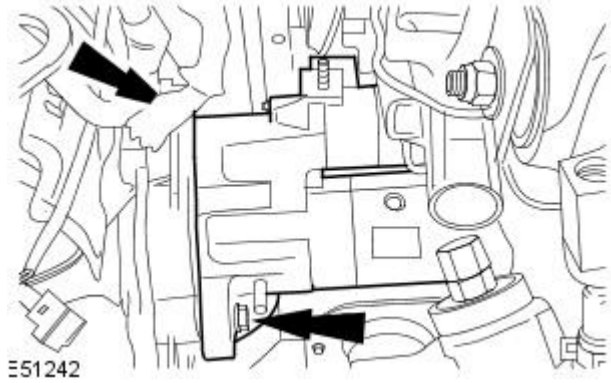




6. Release the starter motor cable.



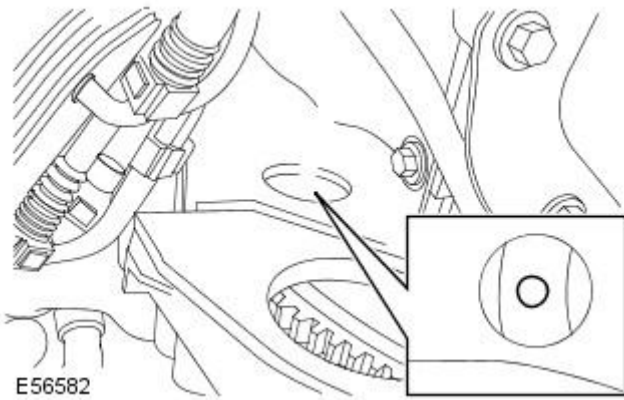
7. Release the starter motor.



8. Remove the crankshaft timing alignment grommet from the engine block.

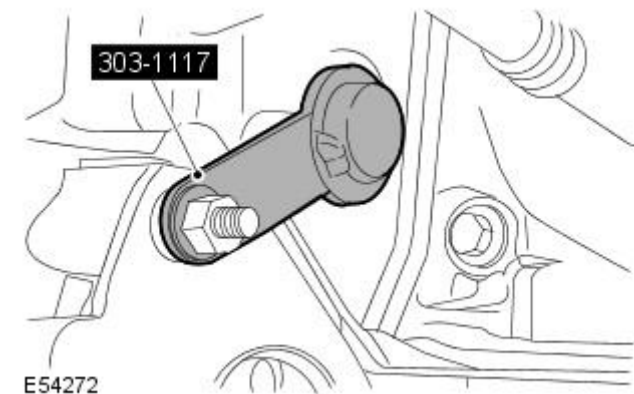
9. Rotate the crankshaft clockwise to align the crankshaft alignment hole in the flywheel or flexplate with the block aperture.

10. Check the camshaft pulley alignment holes are correctly aligned. If the alignment holes are not aligned, rotate the crankshaft one full turn clockwise.



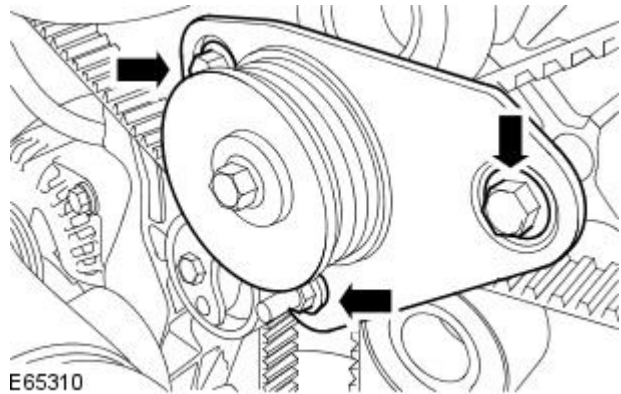
11. Using the special tool, lock the flexplate.

- Install a starter motor bolt to retain the special tool.

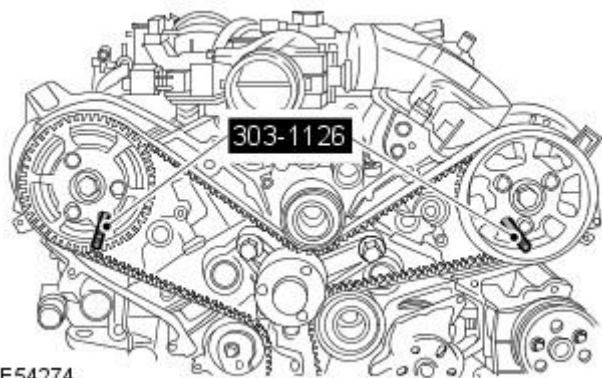



12. Remove the accessory drive belt pulley and bracket assembly.

- Remove the 3 retaining bolts.



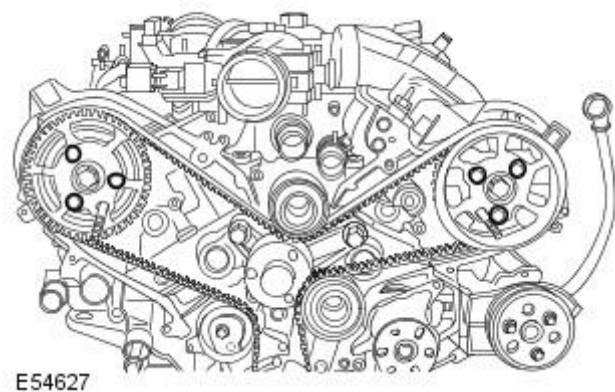
13. Install the special tools to the exhaust camshaft pulleys.



14.  **CAUTION:** Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.

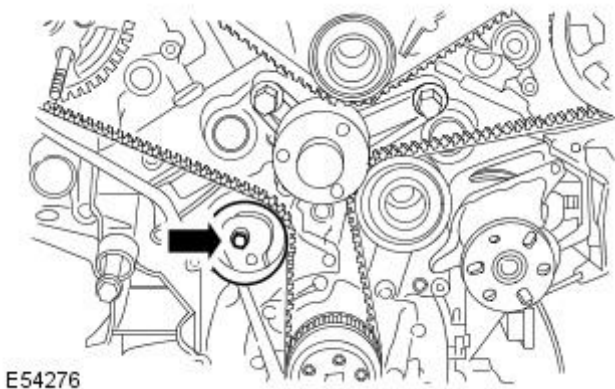
Loosen the six exhaust camshaft pulley damper retaining bolts.

- Using a suitable tool, counterhold the camshaft pulley center retaining bolts.

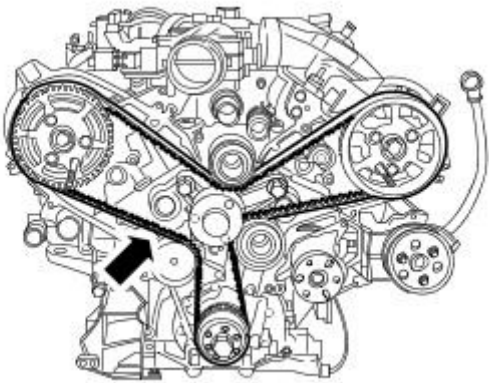


15. Remove and discard the timing belt tensioner.

- Remove and discard the bolt.



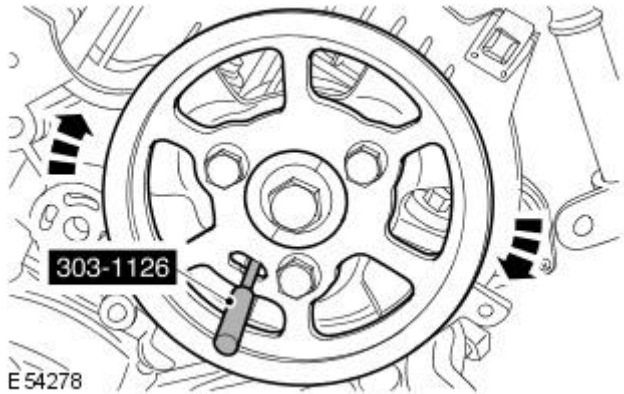
16. Remove and discard the timing belt.



E 54277

## Installation

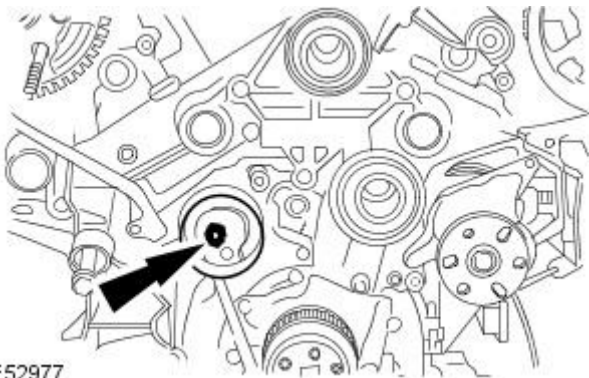
1. Rotate both camshaft pulleys clockwise.



E 54278

2. Install a new timing belt tensioner.

- Install a new bolt, but do not fully tighten at this stage.

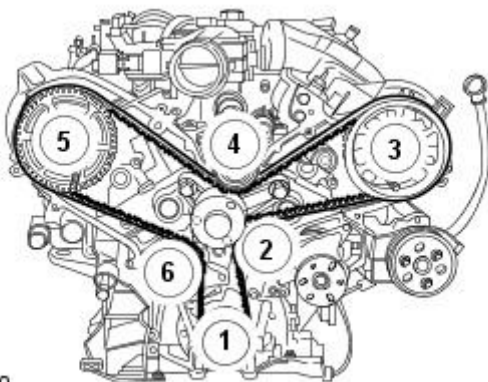


E52977

3.  **CAUTION:** Make sure the camshaft pulleys remain in the clockwise position.

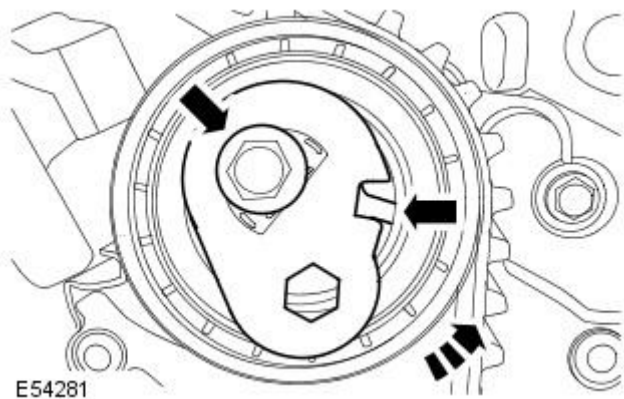
Install the new timing belt.

- Starting at the crankshaft pulley, install the timing belt in a counter-clockwise direction, in the sequence shown.
- Stage one: Attach the timing belt to the crankshaft pulley.
- Stage two: Attach the timing belt to the idler pulley.
- Stage three: Attach the timing belt to the left-hand camshaft pulley.
- Stage four: Attach the timing belt to the idler pulley.
- Stage five: Attach the timing belt to the RH camshaft pulley.
- Stage six: Attach the timing belt to the timing belt tensioner.



E54280



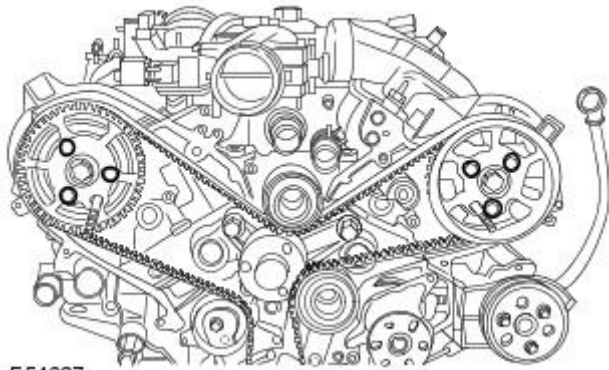


E54281


4.  CAUTION: Make sure the timing belt tensioner window is aligned with the groove.

Tension the timing belt.

- Rotate the tensioner assembly counter-clockwise.
- Tighten to 24 Nm.

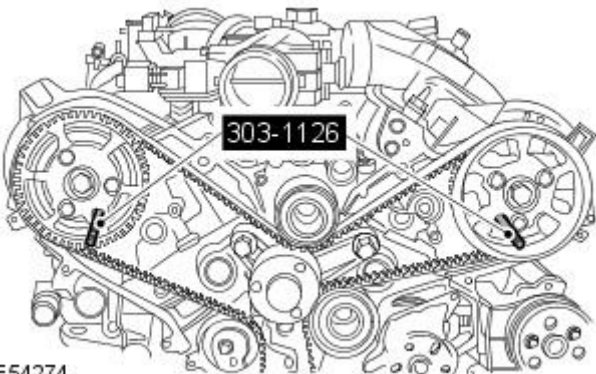


E54627

5.  CAUTION: Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.

Using a suitable tool, counterhold the camshaft pulley center retaining bolts.

- Tighten the six exhaust camshaft pulley damper retaining bolts.
- Tighten to 23 Nm.



E54274

6. Remove the special tools from the camshaft pulleys.

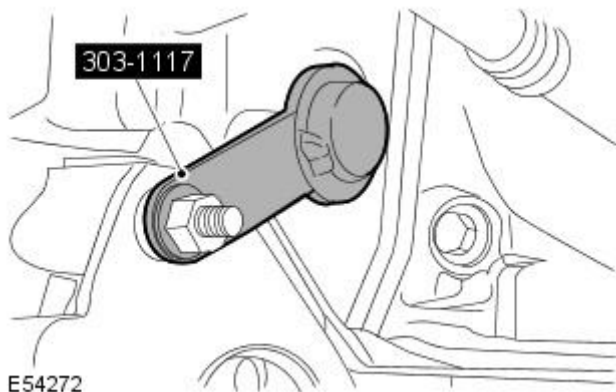
7. Remove the special tool from the flexplate.

8.  CAUTION: Only rotate the crankshaft clockwise.

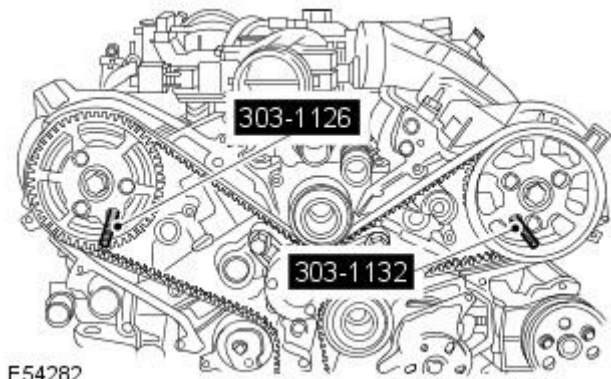
Rotate the engine two complete turns clockwise.

9. Using the special tool, lock the flexplate.

- Install a starter motor bolt to retain the special tool.



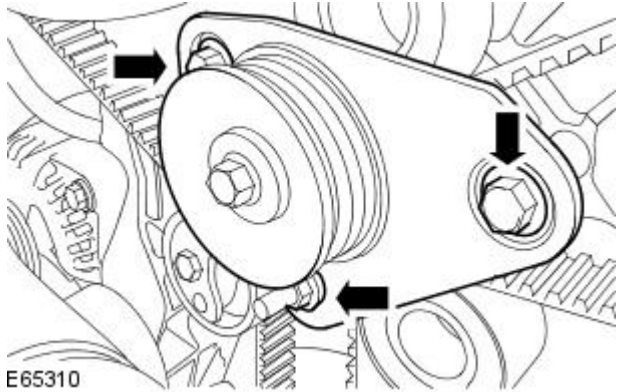
E54272



E54282

10. Install the special tools to the exhaust camshaft pulleys.

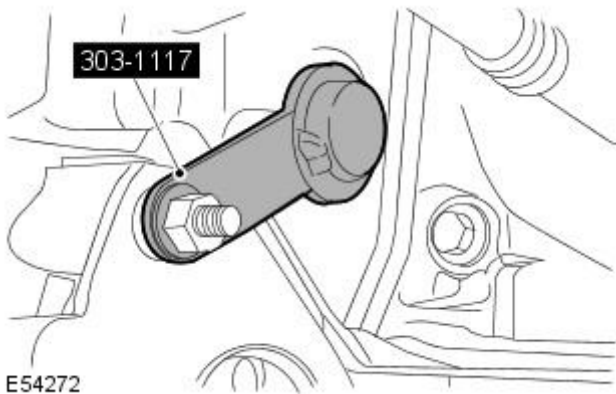
- If the special tool does not fit correctly, repeat the timing belt installation procedure.
- Remove the special tools from the camshaft pulleys.



E65310

11. Install the accessory drive belt pulley and bracket assembly.

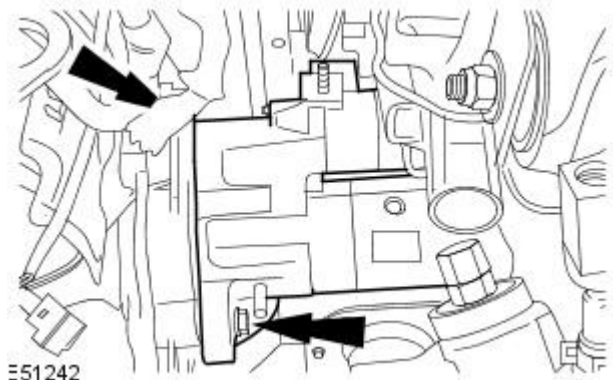
- Tighten to 80 Nm.



E54272

12. Remove the special tool from the flexplate.

- Install the grommet.



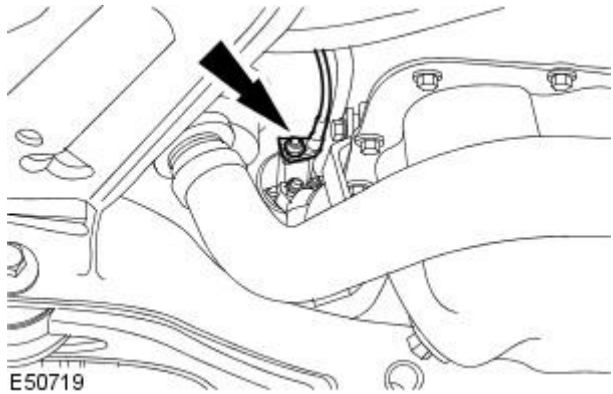
E51242

13. Install the starter motor.

- Tighten to 48 Nm.

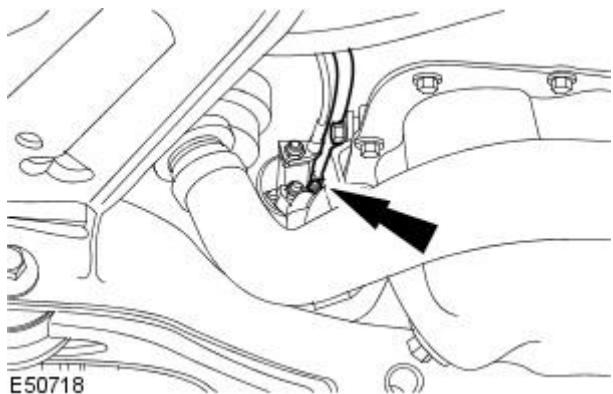
14. Connect the starter motor cable.

- Tighten to 10 Nm.



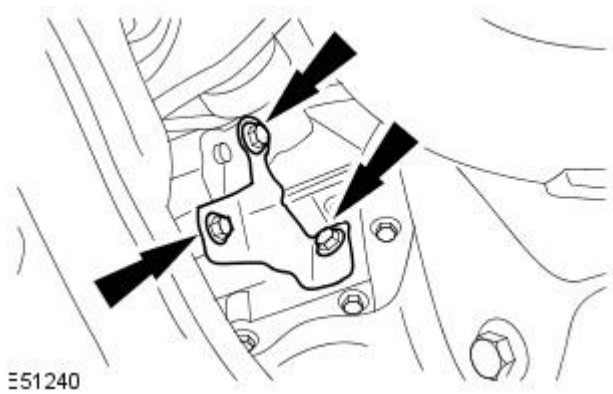
15. Connect the starter motor solenoid electrical connector.

- Tighten to 7 Nm.



16. Install the starter motor retaining bracket.

- Tighten to 23 Nm.



17. Install the timing cover.

For additional information, refer to: [Timing Cover](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).

18. Connect the battery ground cable.


For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Engine - TDV6 2.7L Diesel - Timing Cover

Removal and Installation

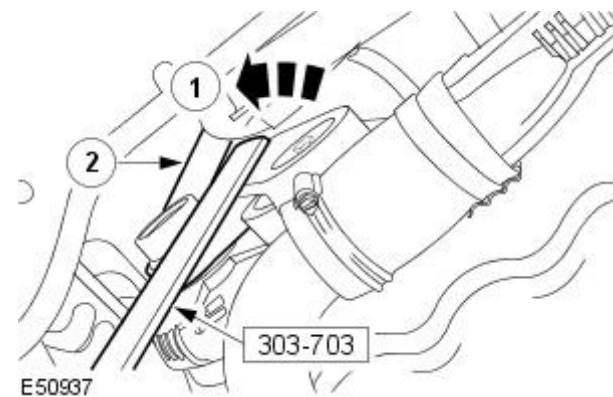
Special Tool(s)	
 <p>303-703</p> <p>E95037</p>	<p>Accessory belt tensioner</p> <p>303-703</p>

## Removal

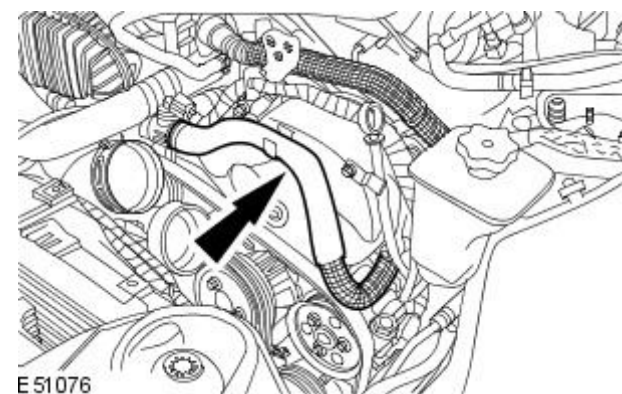
-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

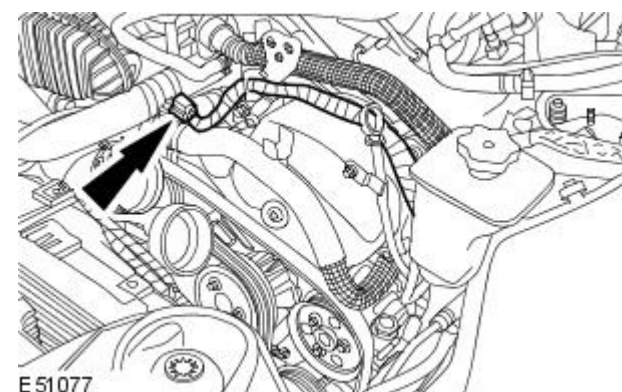
- Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
- Remove the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Remove the air cleaner.  
For additional information, refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Removal and Installation).
- Remove the accessory drive belt.  
For additional information, refer to: [Accessory Drive Belt](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).



- Release the coolant hose.

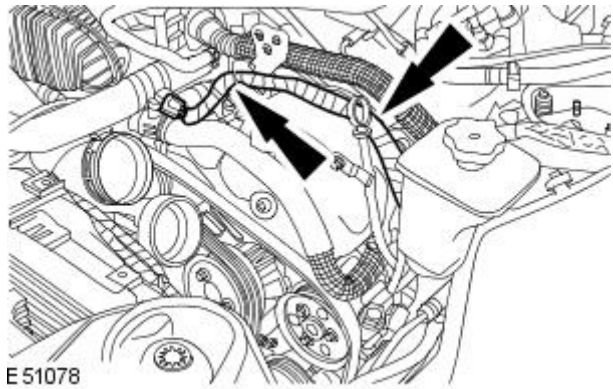


- Disconnect the engine coolant temperature (ECT) sensor electrical connector.



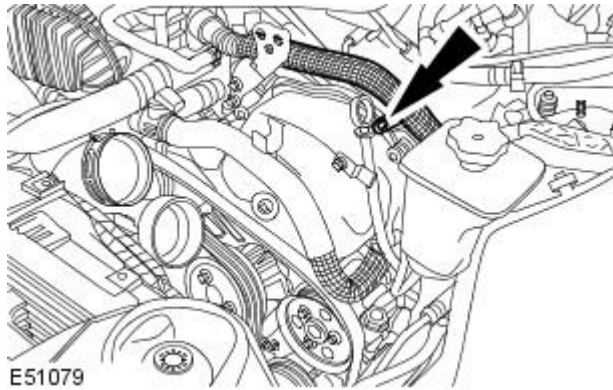


8. Detach the ECT sensor wiring harness.



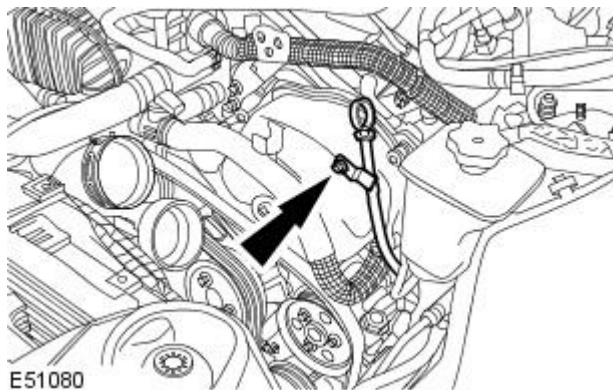
9. Release the exhaust gas recirculation (EGR) valve outlet tube from the timing cover.

- Remove the retaining bolt.



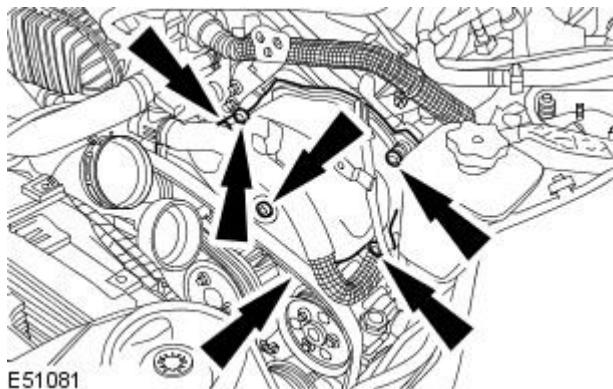
10. Reposition the oil level indicator tube.

- Remove the retaining bolt.

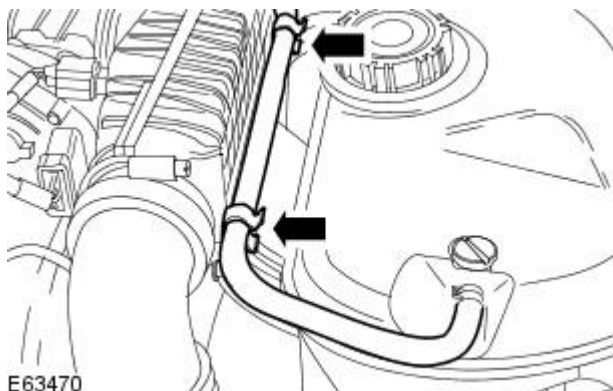


11. Remove the LH timing cover.

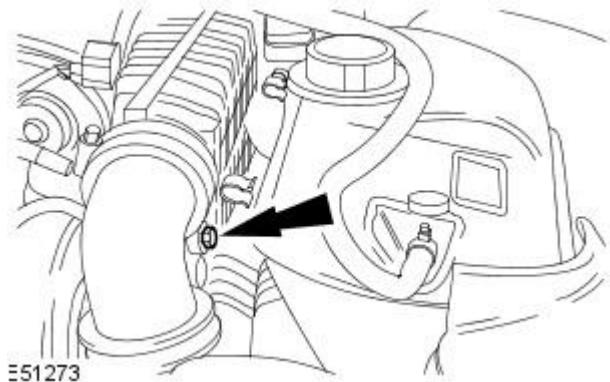
- Remove and discard the gasket.



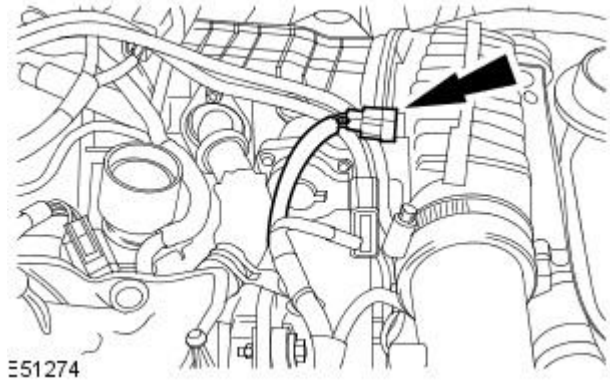
12. Release the coolant expansion tank hose from the clips.



13. Remove the retaining bolt.

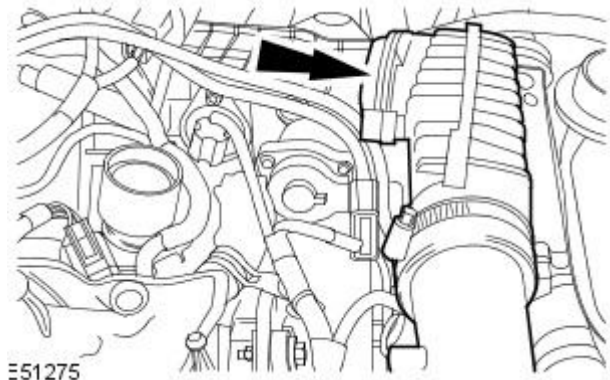


14. Disconnect the electrical connector.

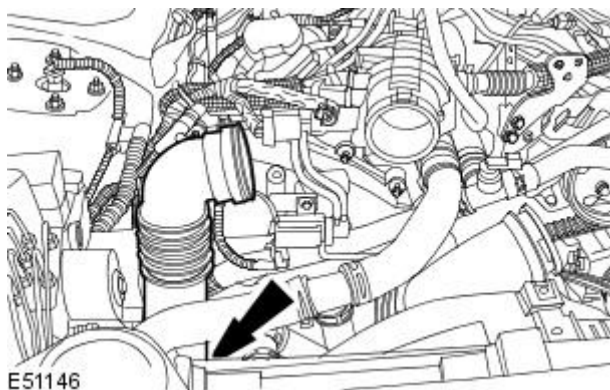


15. Release the intake air shutoff throttle elbow.

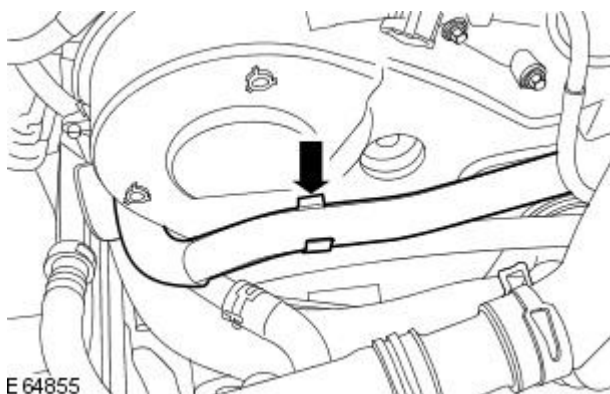
- Release the retaining clip.



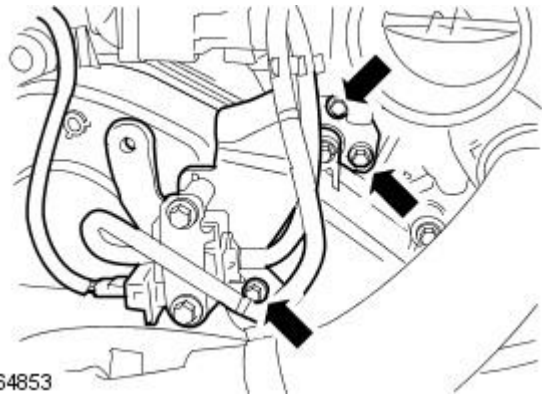
16. Remove the charge air cooler inlet hose.



17. Release the coolant hose.

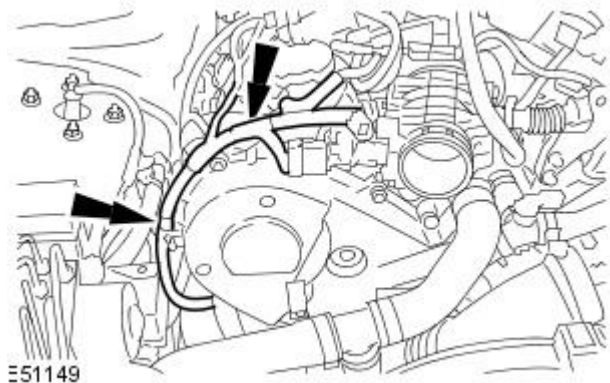


18. Release the port deactivation valve retaining bracket.



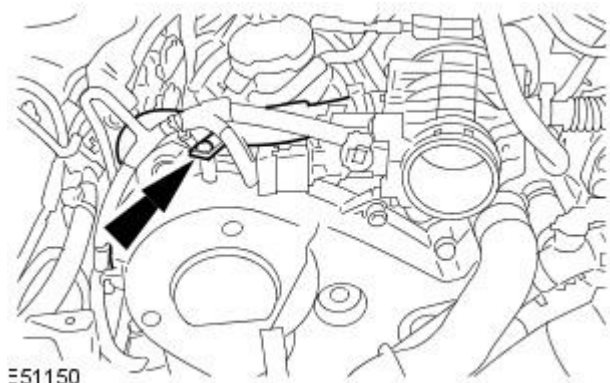
19. Release the air temperature sensor wiring harness.

- Release the 2 wiring harness clips.



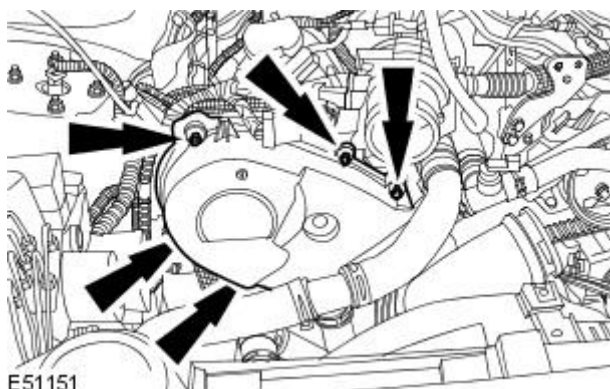
20. Release the EGR valve outlet tube from the timing cover

- Remove the retaining bolt.

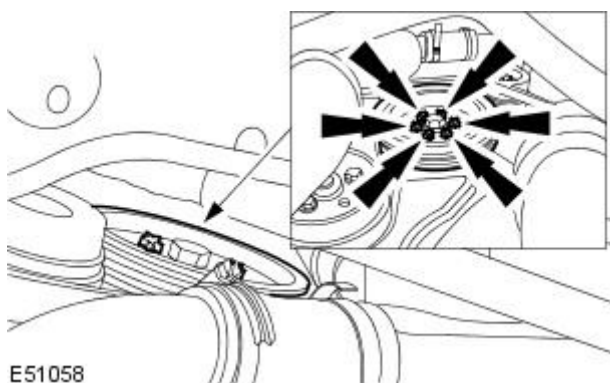


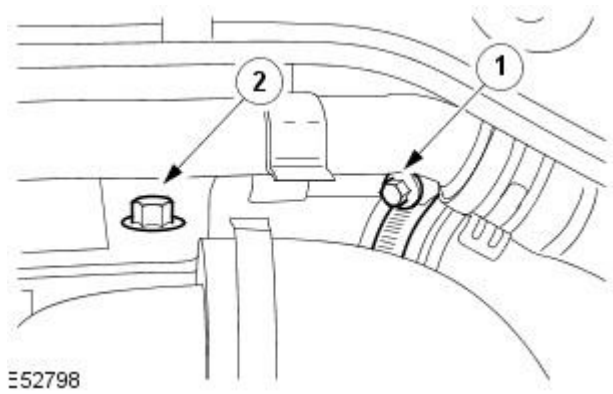
21. Remove the RH timing cover.

- Remove and discard the gasket.



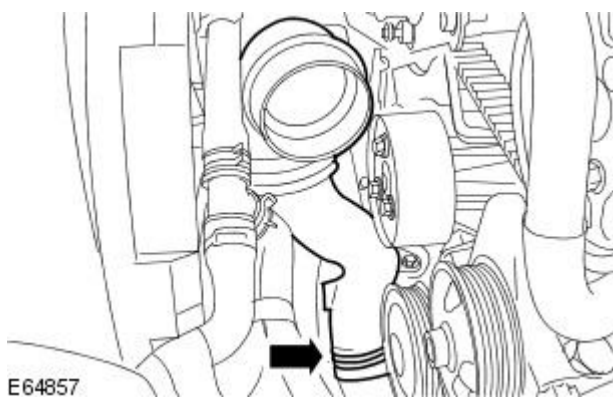
22. Remove the crankshaft damper.



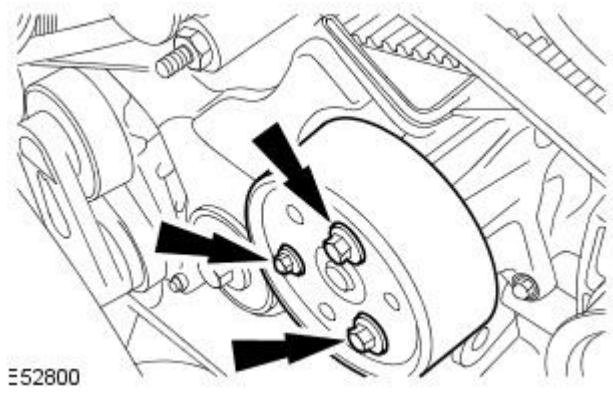


23. Release the charge air cooler hose.

1. Remove the hose clamp.
2. Remove the retaining bolt.



24. Remove the charge air hose.

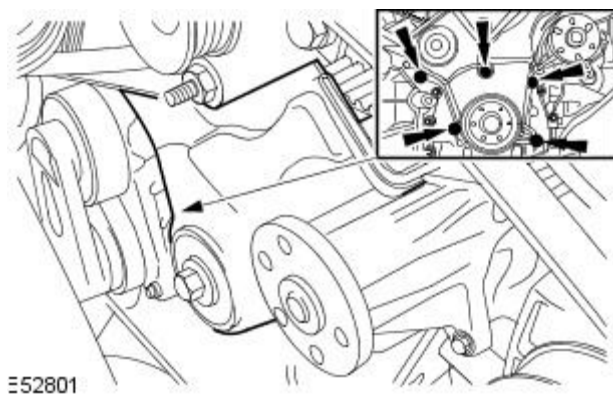


25.  CAUTION: Discard the bolts.

• NOTE: Using a suitable bar lock the coolant pump pulley.

Remove the coolant pump pulley.

- Remove the 3 coolant pump pulley retaining bolts.

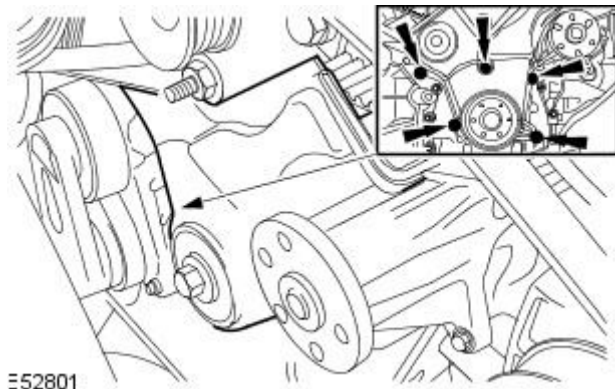


26. Remove the lower timing cover.

- Remove and discard the gasket.

## Installation



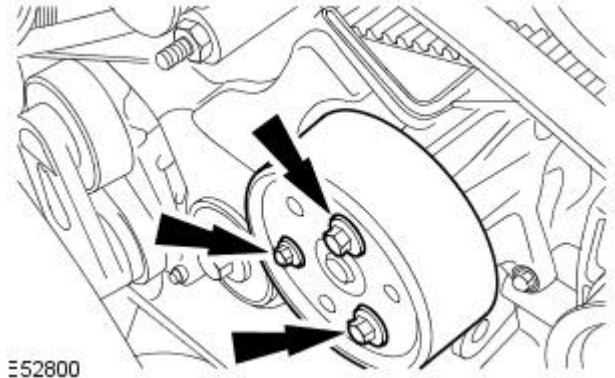


E52801

**1. NOTE: Install a new gasket.**

Install the lower timing cover.

- Tighten to 10 Nm.

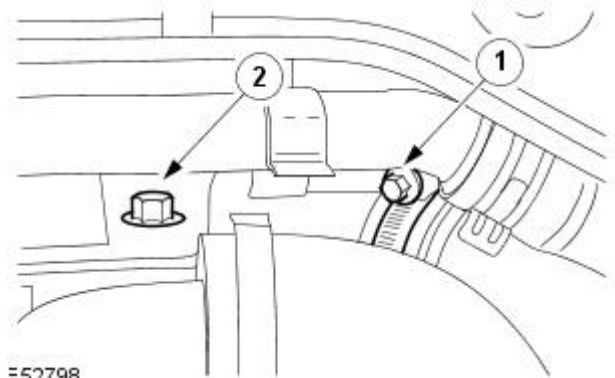


E52800

**2. NOTE: Make sure that new bolts are installed.**

Install the coolant pump pulley.

- Tighten to 24 Nm.

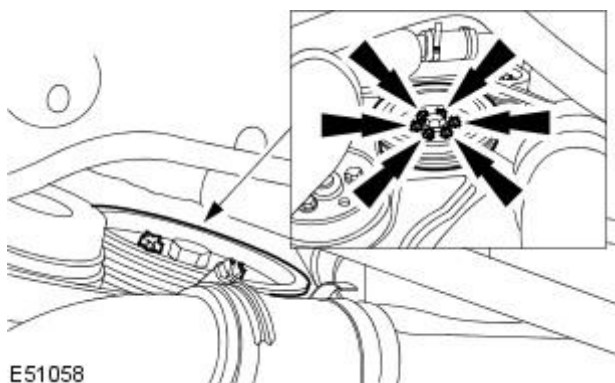


E52798

**3. Install the charge air cooler hose.**

1. Tighten to 4 Nm.

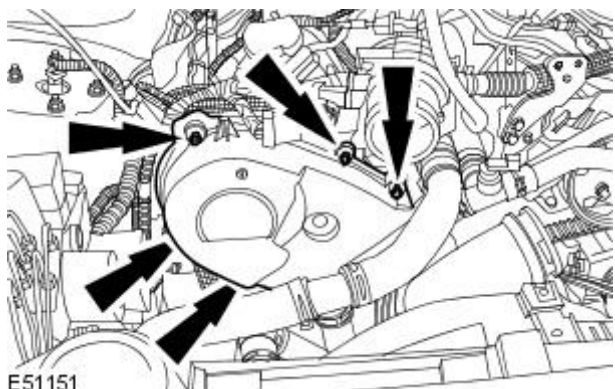
2. Tighten to 8 Nm.



E51058

**4. Install the crankshaft damper.**

- Tighten to 14 Nm.

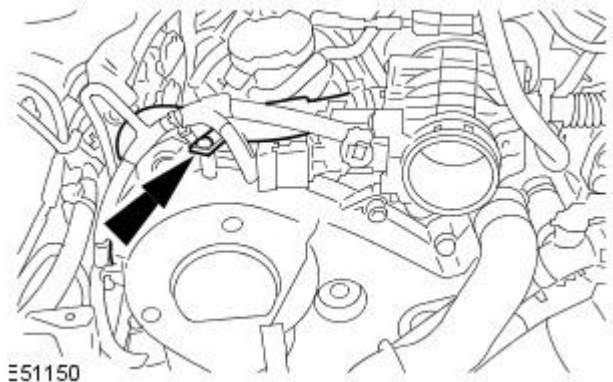


E51151

**5. NOTE: Install a new gasket.**

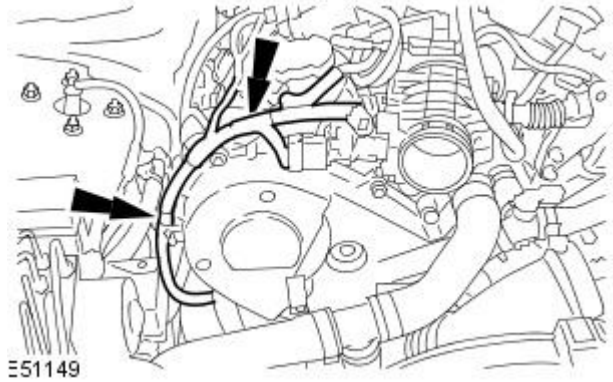
Install the RH timing cover.

- Tighten to 10 Nm.

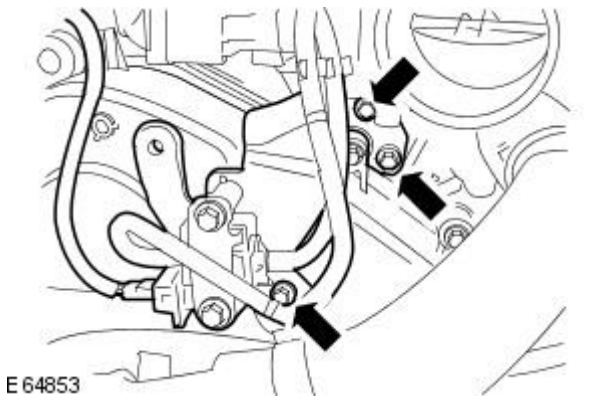


6. Secure the EGR valve outlet tube to the timing cover.

- Tighten to 4 Nm.

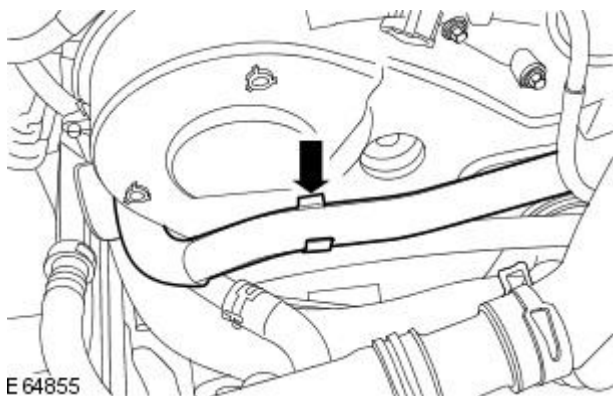


7. Attach the air temperature sensor wiring harness.

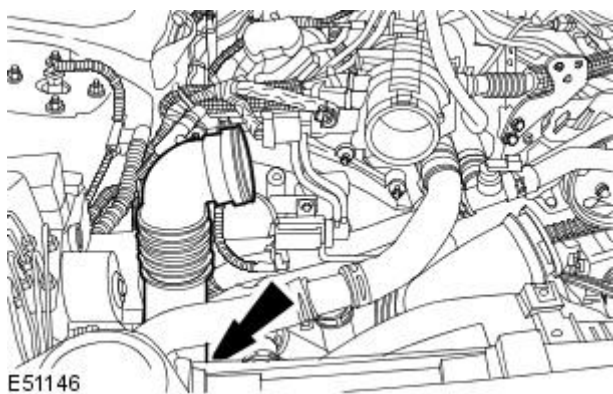


8. Secure the port deactivation valve retaining bracket.

- Tighten to 8 Nm.



9. Secure the coolant hose.

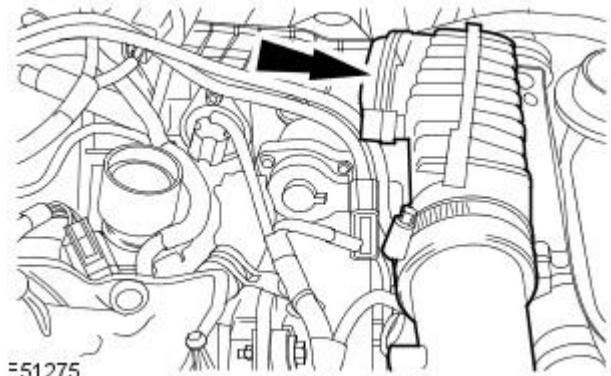


10. Install the charge air cooler hose.

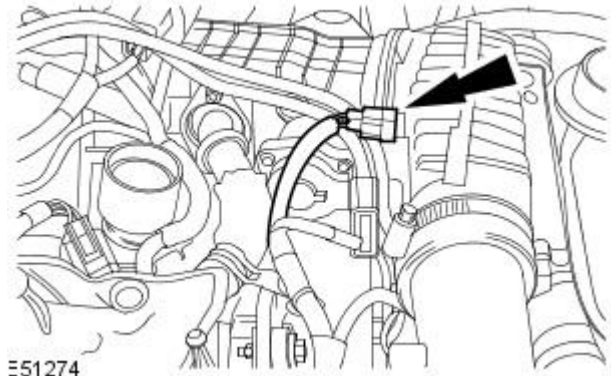
- Tighten to 8 Nm.

11. Secure the intake air shutoff throttle elbow.

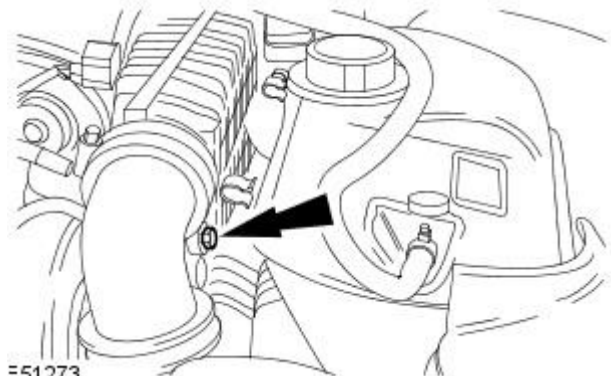
- Install the retaining clip.



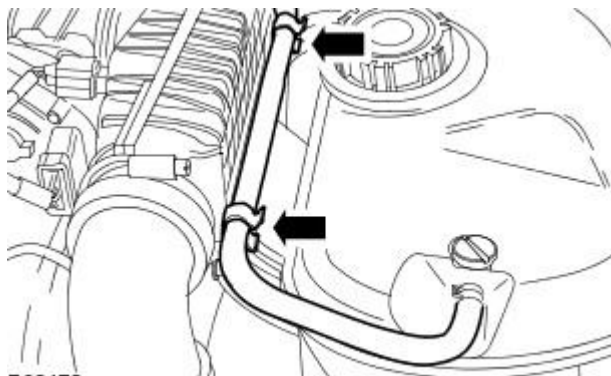
12. Connect the electrical connector.



13. Install the retaining bolt.



14. Secure the coolant expansion tank hose.



15. NOTE: Install a new gasket.

Install the LH timing cover.

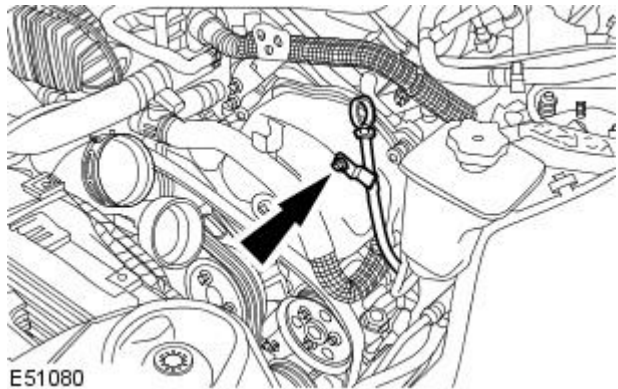
- Tighten to 10 Nm.





16. Install the oil level indicator tube.

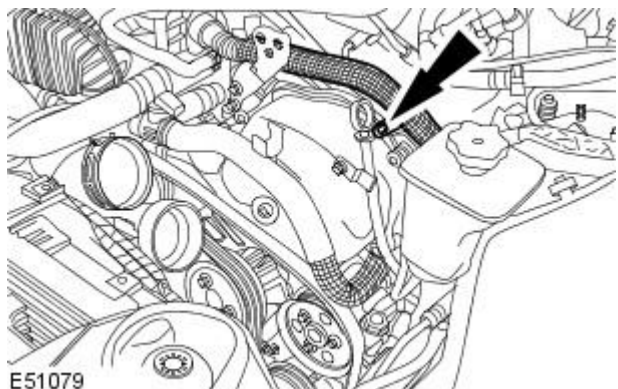
- Tighten to 3 Nm.



E51080

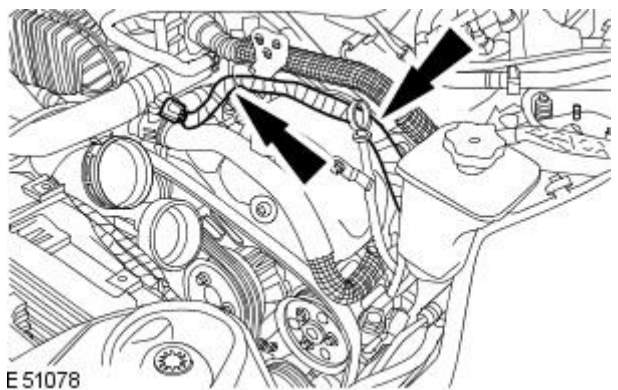
17. Install the EGR valve outlet tube to the timing cover.

- Tighten to 3 Nm.



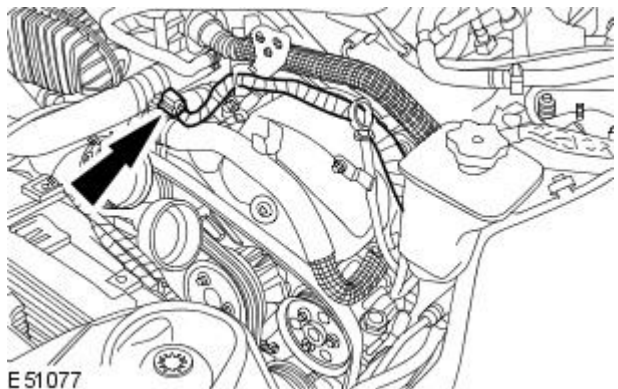
E51079

18. Secure the ECT sensor wiring harness.



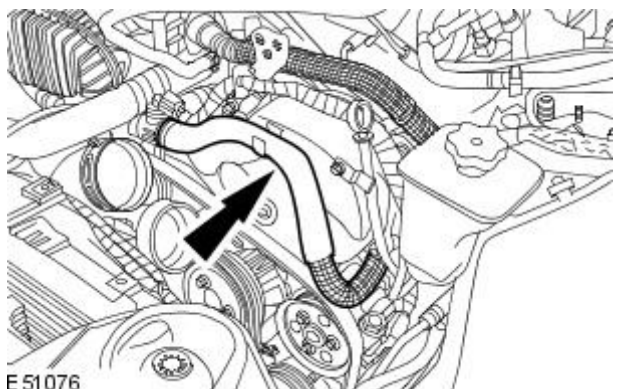
E51078

19. Connect the ECT sensor electrical connector.



E51077

20. Secure the coolant hose.



E51076

**21.** Install the accessory drive belt.

For additional information, refer to: [Accessory Drive Belt](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).

**22.** Install the air cleaner.

For additional information, refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Removal and Installation).

**23.** Install the engine cover.


For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

**24.** Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).


# Engine - TDV6 2.7L Diesel - Valve Cover


Removal and Installation


Special Tool(s)	
 <p>303-703</p> <p>E95037</p>	<p>Accessory belt tensioner</p> <p>303-703</p>


## Removal

### 1. WARNINGS:


 Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.


 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.


 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

 Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.

### • CAUTIONS:


 Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

 Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

 Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Disconnect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

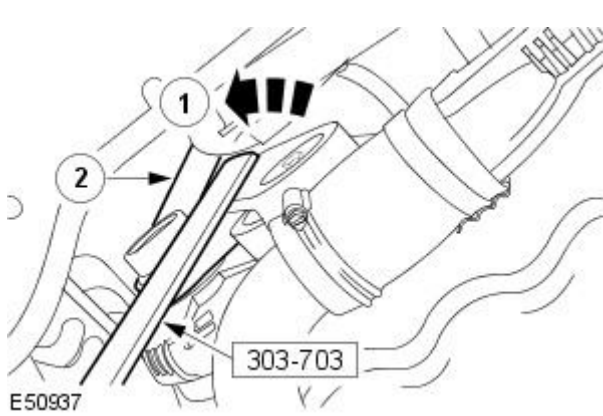
**2.  WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

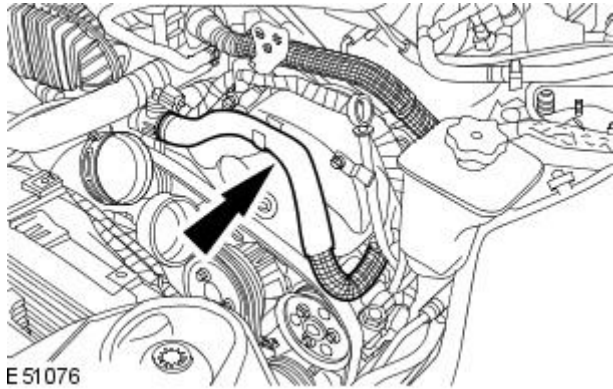
3. Remove the secondary bulkhead center panel.  
For additional information, refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).
4. Remove the intake air shutoff throttle.  
For additional information, refer to: [Intake Air Shutoff Throttle](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).
5. Remove the air cleaner assembly.  
For additional information, refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Removal and Installation).
6. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

7. Release the accessory drive belt.

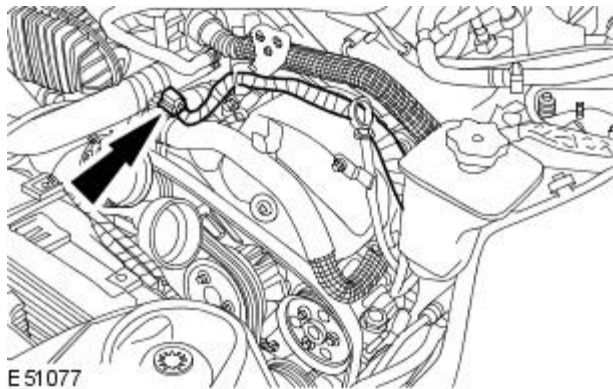
1. Using the special tool, rotate the accessory drive belt tensioner counter-clockwise.



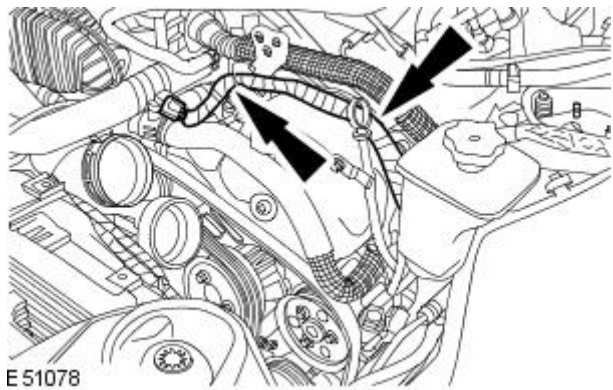
8. Release the coolant hose retaining clip.



9. Disconnect the engine coolant temperature (ECT) sensor electrical connector.

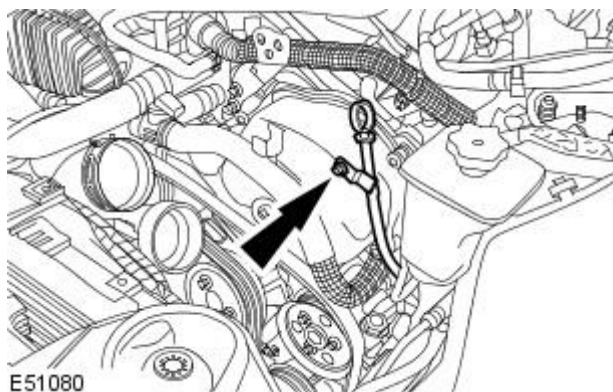


10. Detach the coolant temperature sensor wiring harness.



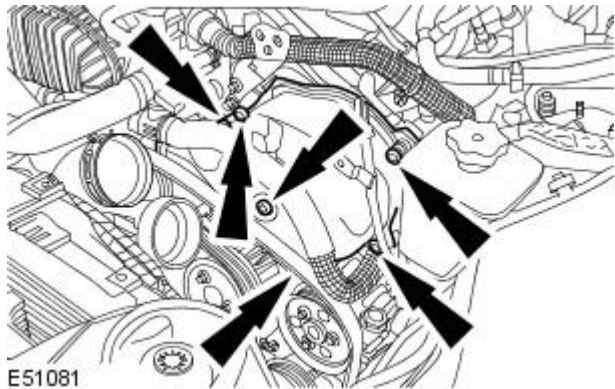
11. Remove the oil level indicator tube retaining bolt.

- Reposition the oil level indicator tube.

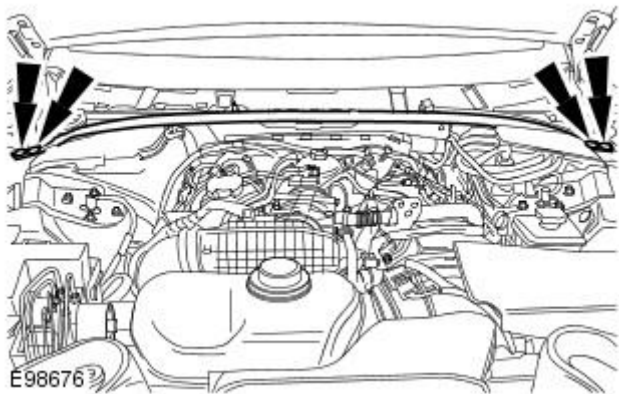


12. Remove the LH timing cover.

- Remove and discard the gasket.



13. Remove the engine compartment brace.

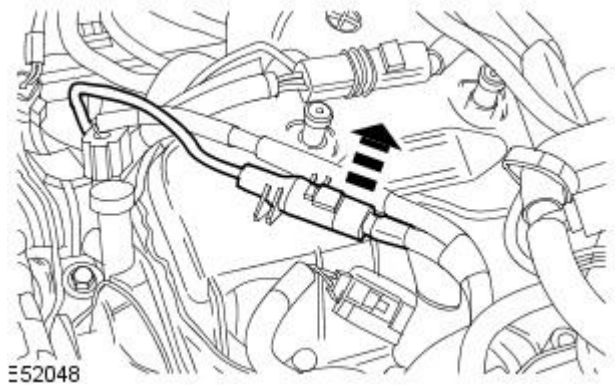


14. Remove the fuel injector.

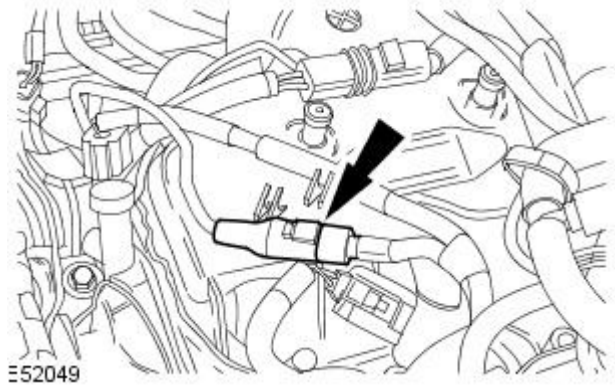
For additional information, refer to: [Fuel Injector](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

15. Remove the 2 remaining fuel injectors.

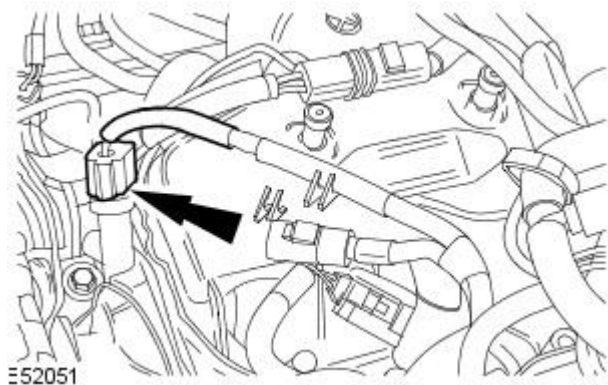
16. Detach the electrical connector from the left-hand valve cover.



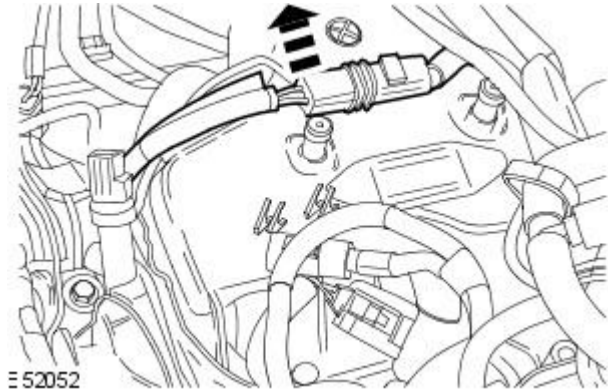
17. Disconnect the electrical connector.



18. Disconnect the electrical connector.

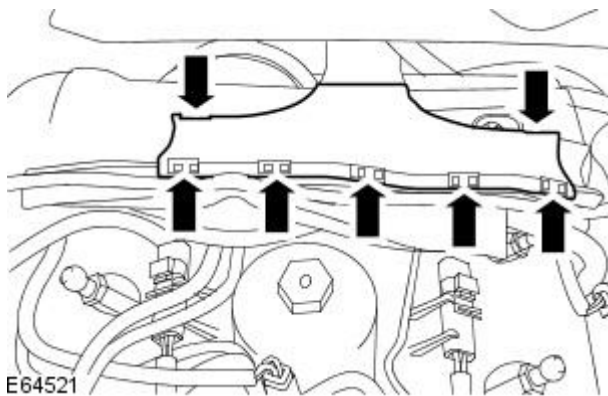


19. Detach the engine harness.



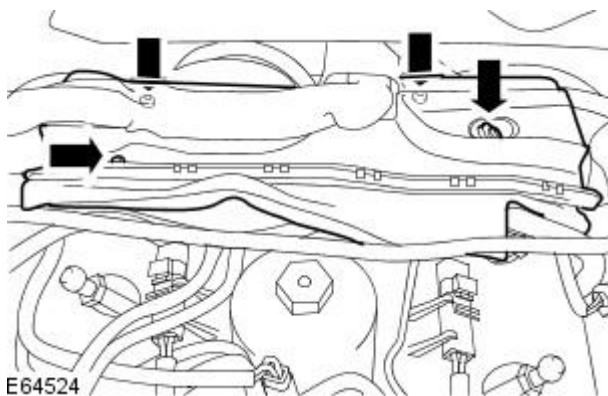
20. Remove the cover from the engine wiring harness casing.

- Release the 7 retaining clips.

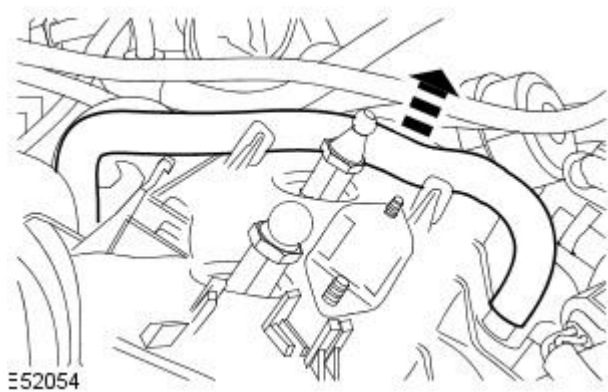


21. Remove the engine wiring harness casing.

- Remove the 4 retaining bolts.

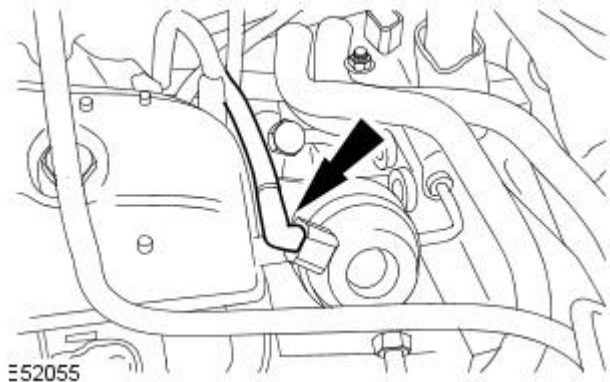


22. Remove the engine breather hose.

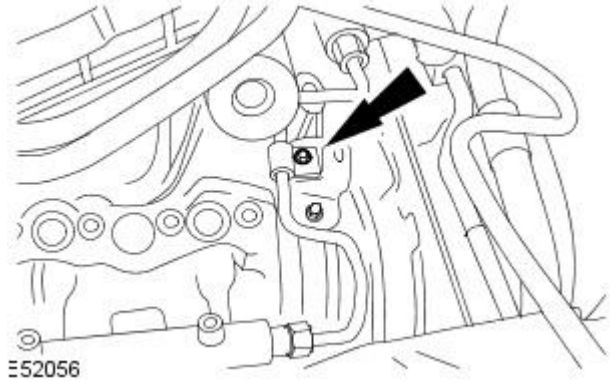





23. Disconnect the vacuum pipe.



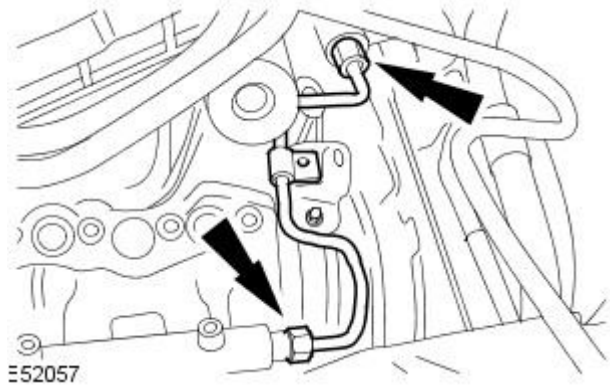
24. Remove the fuel injection pump supply line retaining bolt.



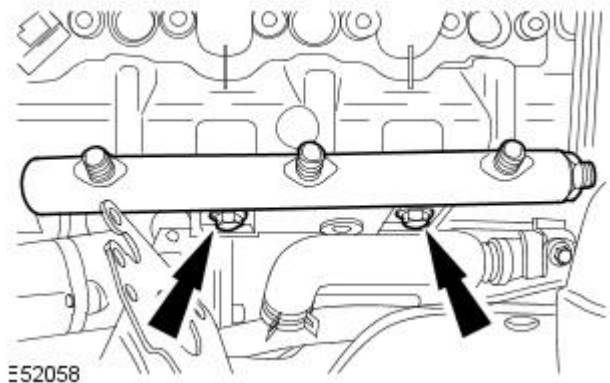
25.  CAUTION: Make sure that the high-pressure fuel supply line remains in contact with the fuel injection supply manifold and the fuel injection diverter rail until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Remove and discard the high-pressure fuel supply line.

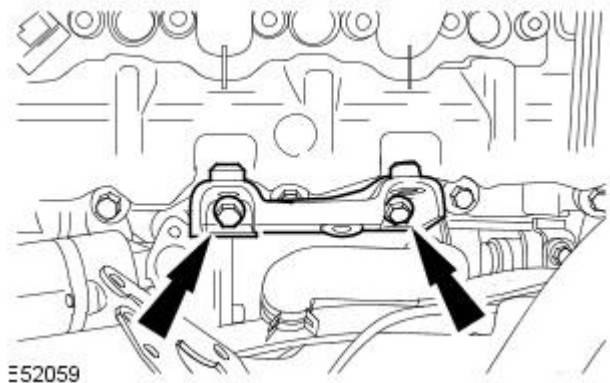
- Install blanking caps to the exposed ports.



26. Remove the LH fuel injection supply manifold.

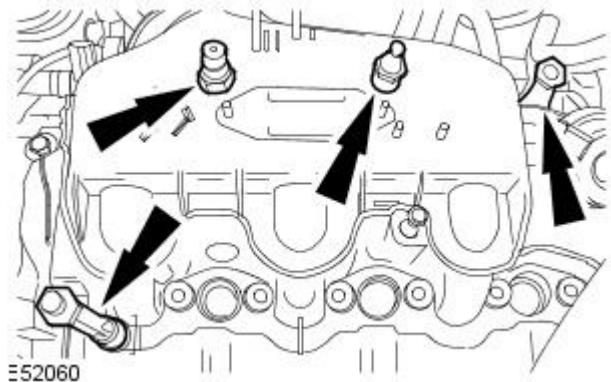


27. Remove the fuel injection supply manifold securing bracket.



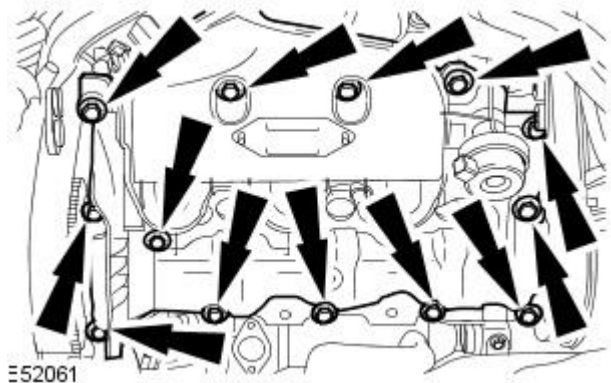


28. Remove the engine cover locating studs.




29. Remove the LH valve cover.


- Remove and discard the gasket.





## Installation

### 1. WARNINGS:


 Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.


 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.


 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

 Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.

### • CAUTIONS:

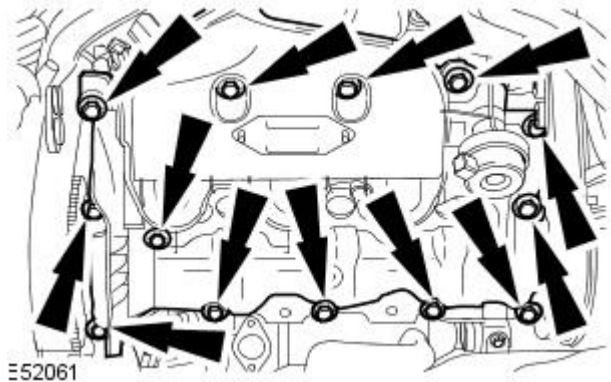
 Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

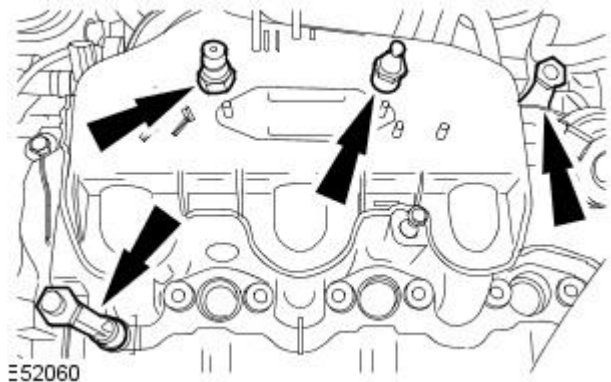
 Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

 Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Install the LH valve cover.

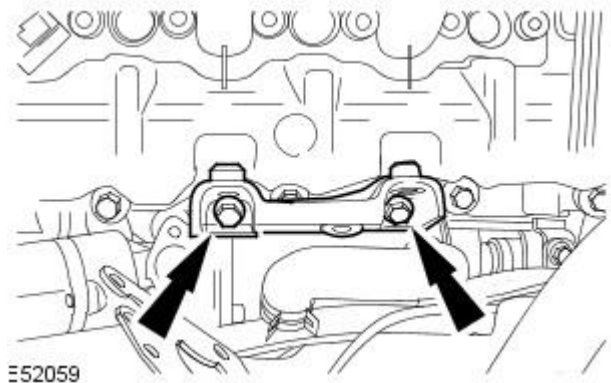
- Install a new gasket.
- Tighten to 10 Nm.





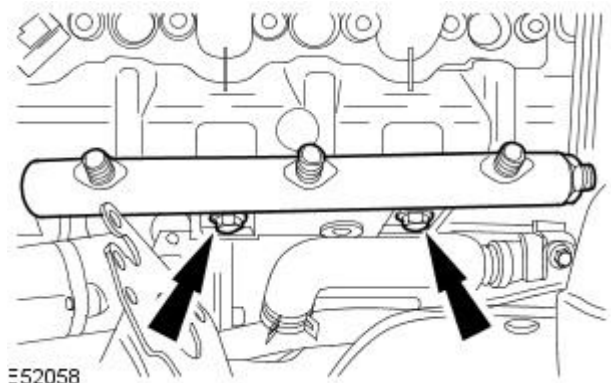
2. Install the engine cover locating studs.

- Tighten to 10 Nm.



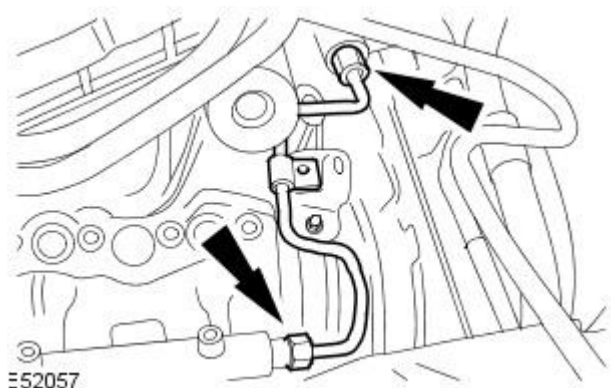
3. Install the fuel injection supply manifold securing bracket.

- Tighten to 24 Nm.



4. NOTE: Loosely install all retaining bolts.

Install the LH fuel injection supply manifold.



5. Install the fuel injector.

For additional information, refer to: [Fuel Injector](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

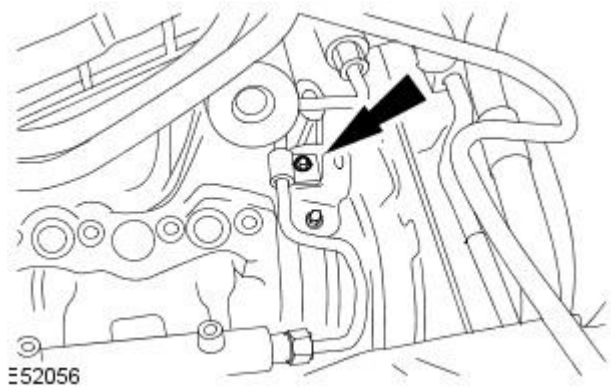
6. Install the 2 remaining fuel injectors.

7. Install a new high-pressure fuel supply line.

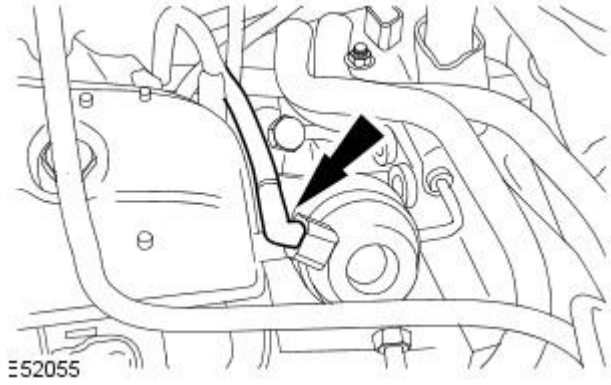
- Remove the blanking caps from the ports.
- Loosely install the new high-pressure fuel supply line.
- Tighten the fuel injection supply manifold retaining bolts to 23 Nm (17 lb.ft).
- Tighten the fuel injection supply line unions in the sequence shown in four stages:
  - Stage 1: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 15 Nm (11 lb.ft).
  - Stage 2: Tighten the high-pressure fuel supply line union at the fuel injection supply manifold to 15 Nm (11 lb.ft).
  - Stage 3: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 30 Nm (22 lb.ft).
  - Stage 4: Tighten the high-pressure fuel supply line union at the fuel injection supply manifold to 30 Nm (22 lb.ft).

8. Install the fuel injection pump supply line retaining bolt.

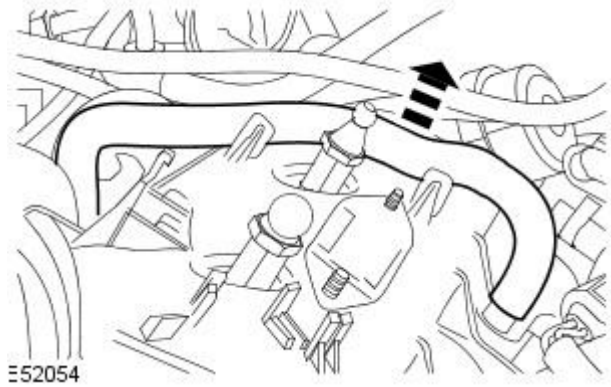
- Tighten to 10 Nm.



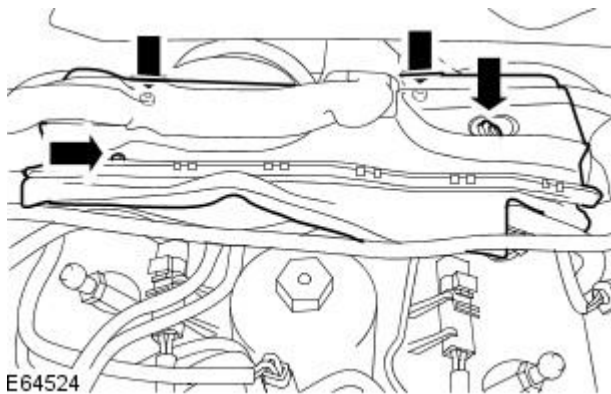
9. Connect the vacuum pipe.



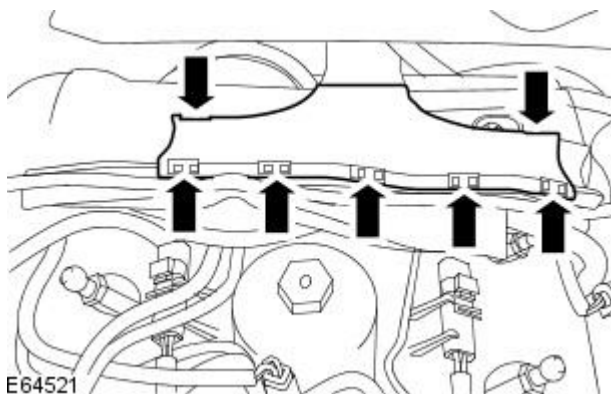
10. Install the engine breather hose.



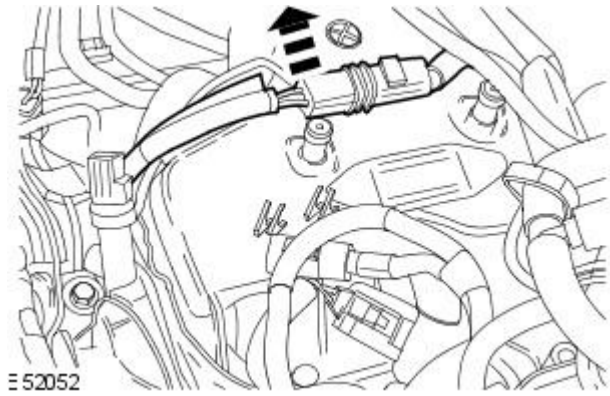
11. Install the engine wiring harness casing.



12. Install the engine wiring harness cover.

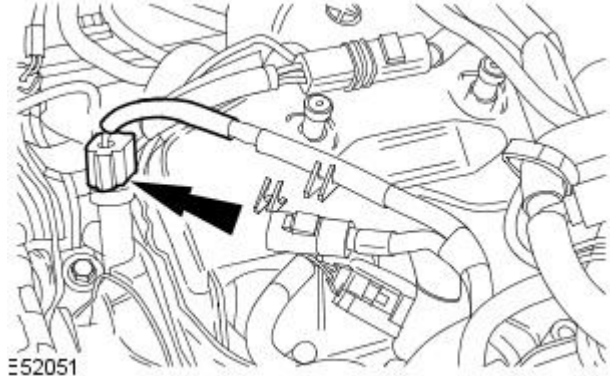


13. Attach the engine wiring harness.



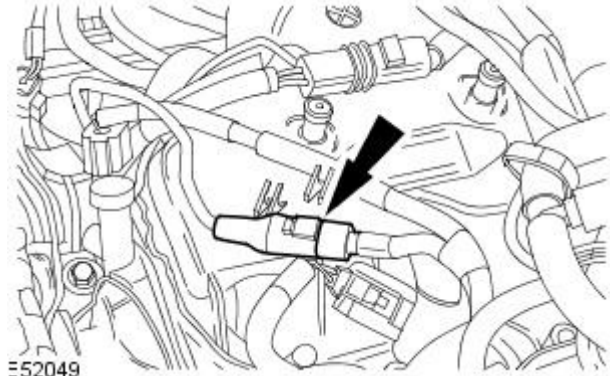
E52052

14. Connect the electrical connector.



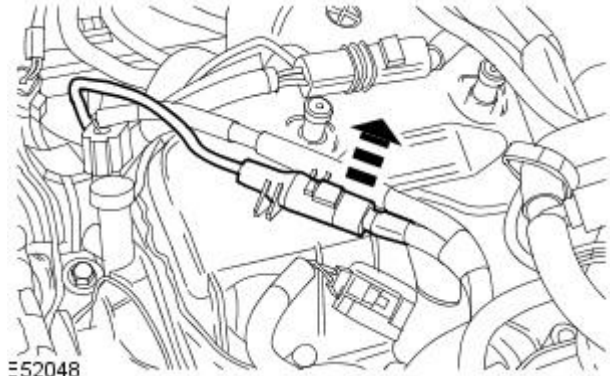
E52051

15. Connect the electrical connector.



E52049

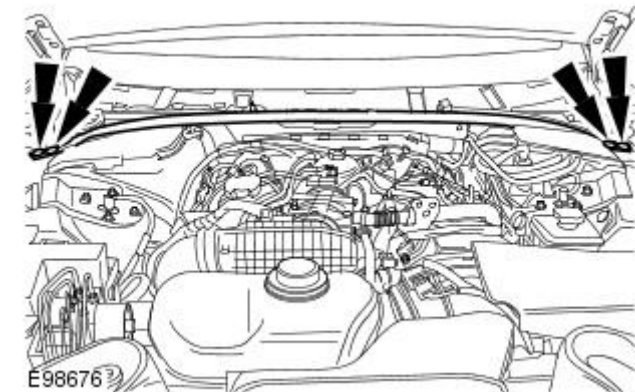
16. Attach the electrical connector onto the valve cover.



E52048

17. Install the engine compartment brace.

- Tighten to 25 Nm.



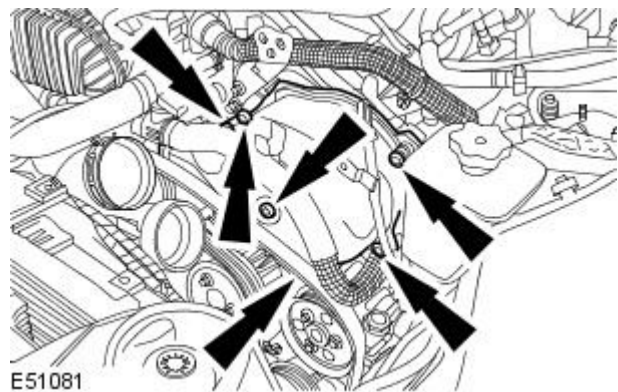
E98676



**18. NOTE:** Install a new gasket.

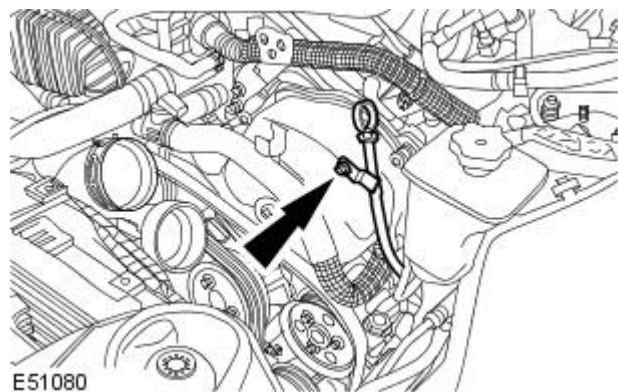
Install the LH timing cover.

- Tighten to 10 Nm.

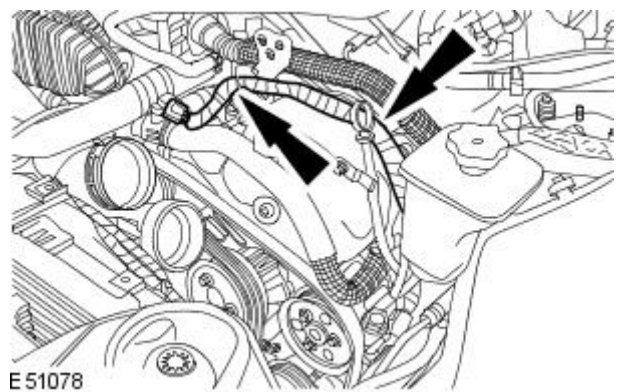


**19.** Install the oil level indicator tube.

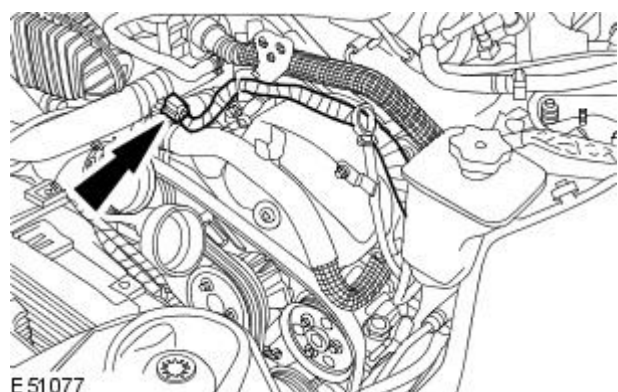
- Tighten the bolt to 3 Nm (2.2 lb.ft).



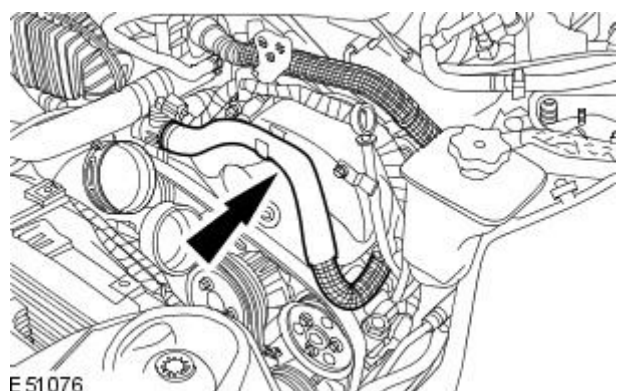
**20.** Refit the engine coolant temperature sensor wiring harness.

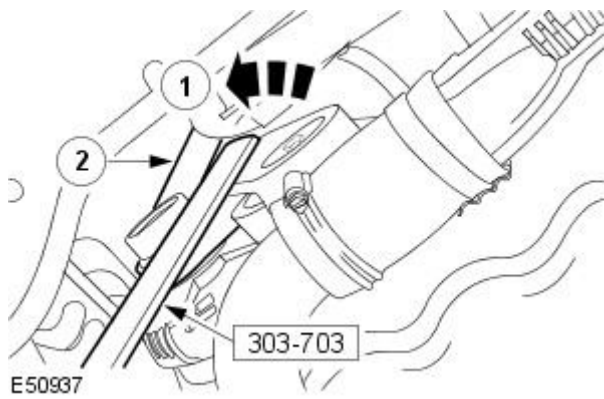


**21.** Connect the engine coolant temperature (ECT) sensor electrical connector.



**22.** Install the coolant hose retaining clip.





23. Raise the vehicle.

24. Attach the accessory drive belt.

- Using the special tool, rotate the accessory drive belt tensioner counter-clockwise.

25. Install the air deflector.

For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

26. Install the air cleaner assembly.

For additional information, refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Removal and Installation).

27. Install the intake air shutoff throttle.

For additional information, refer to: [Intake Air Shutoff Throttle](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

28. Install the secondary bulkhead center panel.

For additional information, refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).

29. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Engine - TDV6 2.7L Diesel - Valve Cover LH

Removal and Installation

## Removal

### 1. WARNINGS:



Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.



Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.

### • CAUTIONS:



Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.



Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.



Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Disconnect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

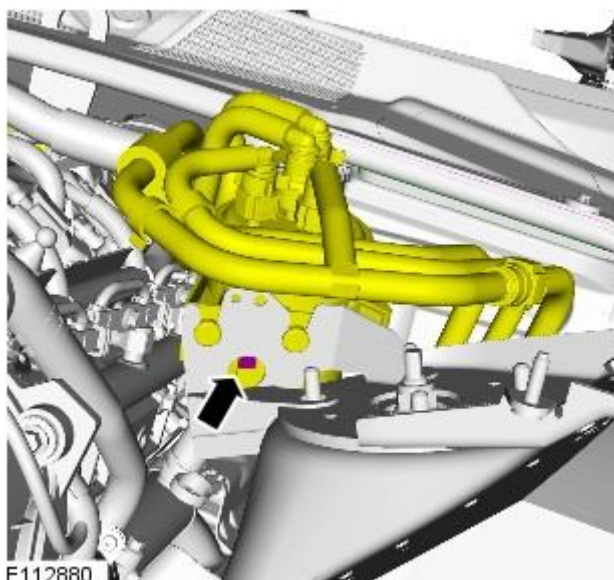
2. Remove the secondary bulkhead center panel.

For additional information, refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).

3. Remove the air cleaner assembly.

For additional information, refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Removal and Installation).

4. Release the fuel filter assembly and position aside.

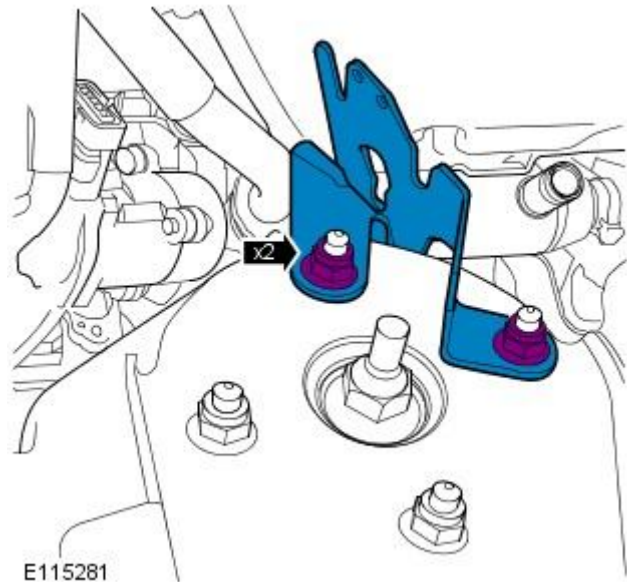


E112880



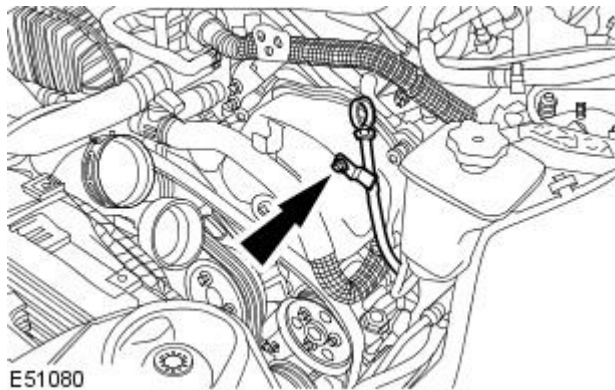
5. Remove the fuel filter bracket.

- Remove the 2 nuts.



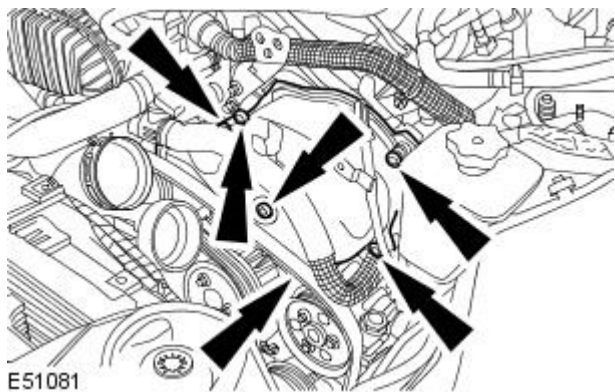
6. Remove the oil level indicator tube retaining bolt.

- Reposition the oil level indicator tube.

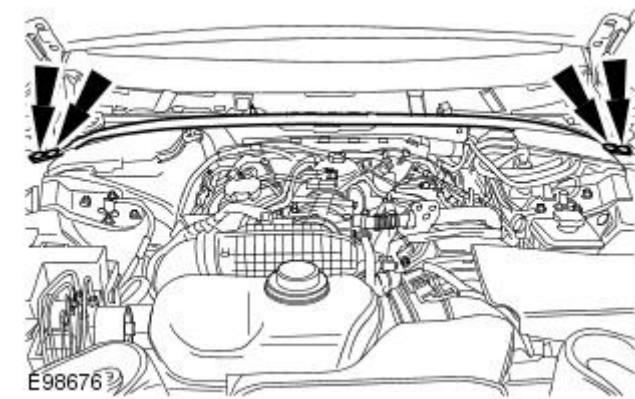


7. Release the Left hand timing cover.

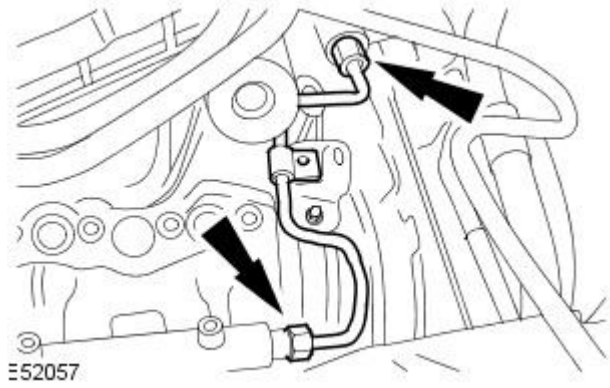
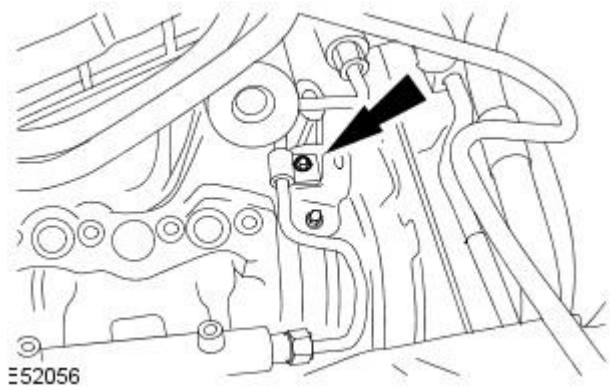
- Remove the 6 bolts.
- Release from the cylinder head.




8. Remove the engine compartment brace.



9. Remove the fuel injection pump supply line retaining bolt.



10.  CAUTION: Make sure that the high-pressure fuel supply line remains in contact with the fuel injection supply manifold and the fuel injection diverter rail until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Remove and discard the high-pressure fuel supply line.

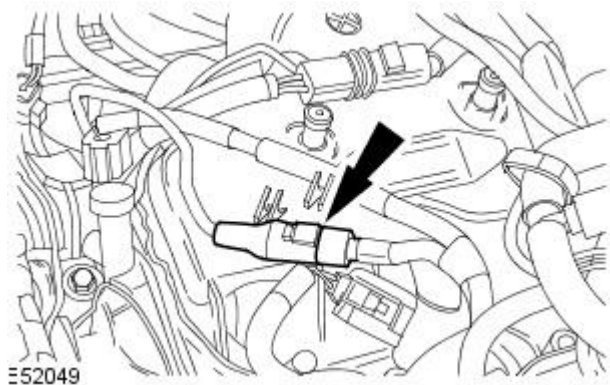
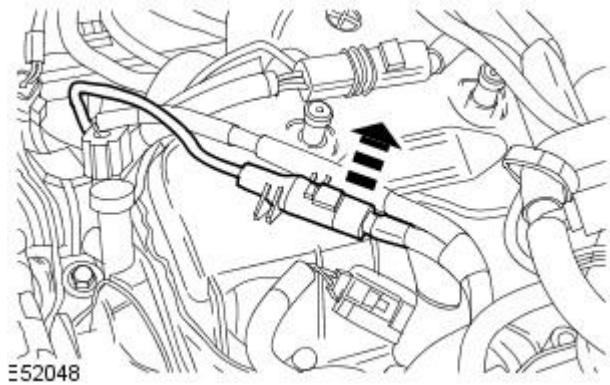
- Install blanking caps to the exposed ports.

11. Remove the fuel injector.

For additional information, refer to: [Fuel Injector](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

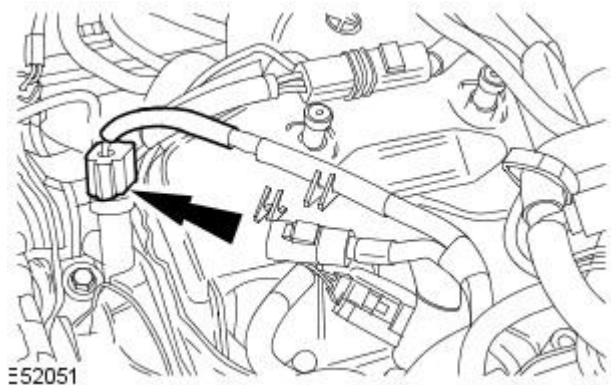
12. Remove the 2 remaining fuel injectors.

13. Detach the electrical connector from the valve cover.



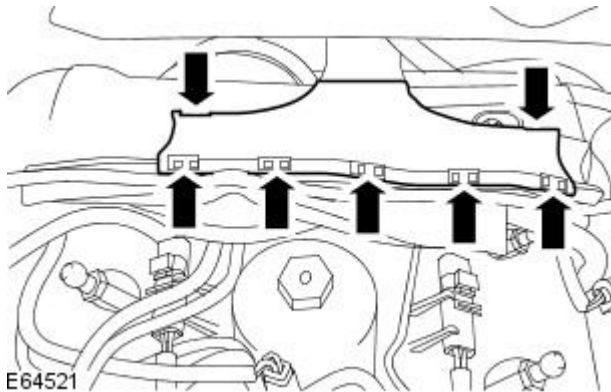
14. Release the left hand knock sensor (KS) electrical connector.

15. Disconnect the left hand KS electrical connector.



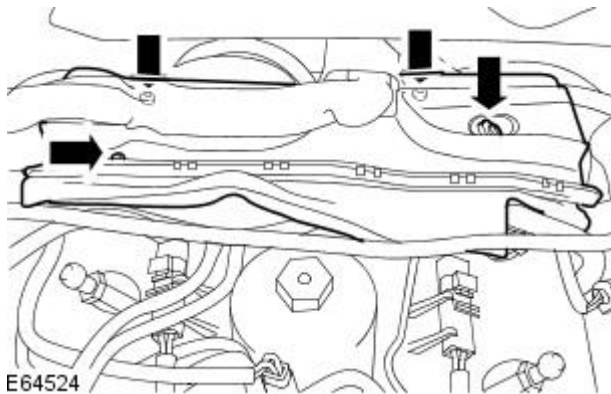
16. Remove the cover from the engine wiring harness casing.

- Release the 7 retaining clips.

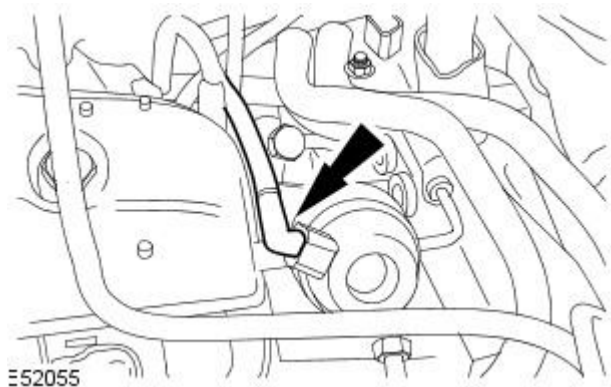


17. Remove the engine wiring harness casing.

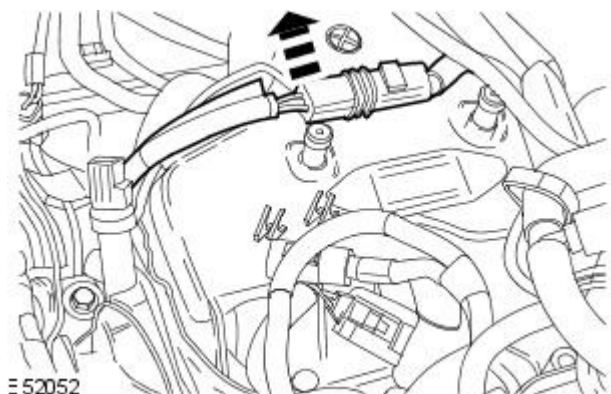
- Remove the 4 retaining bolts.



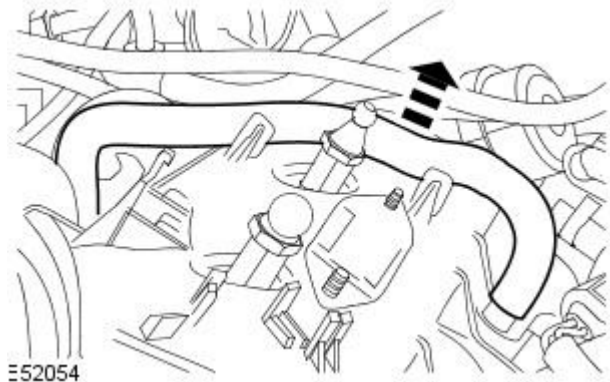
18. Disconnect the swirl plate actuator vacuum hose.



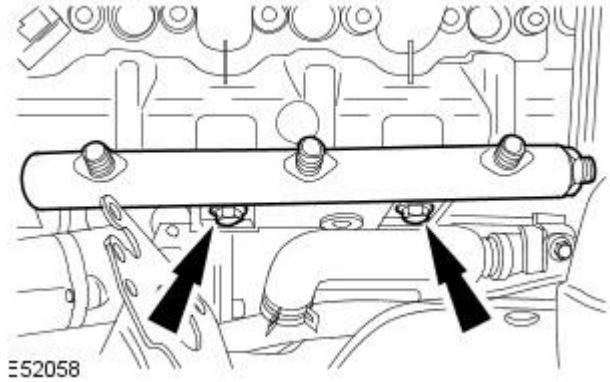
19. Detach the engine harness.



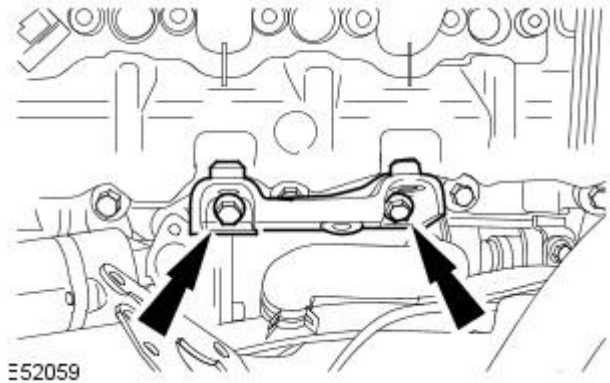
20. Remove the engine breather hose.



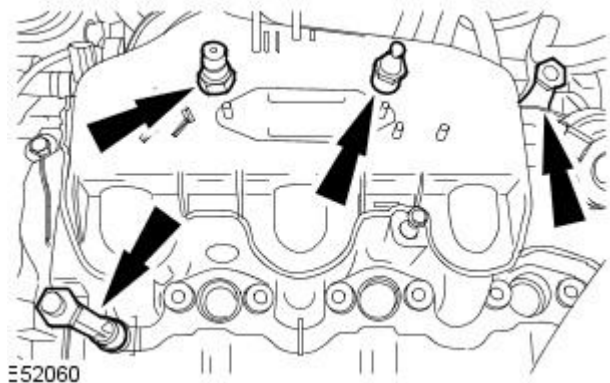
21. Remove the left hand fuel injection supply manifold.



22. Remove the fuel injection supply manifold securing bracket.

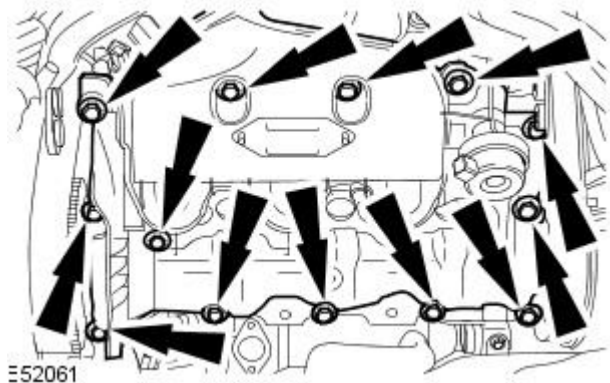


23. Remove the engine cover locating studs.



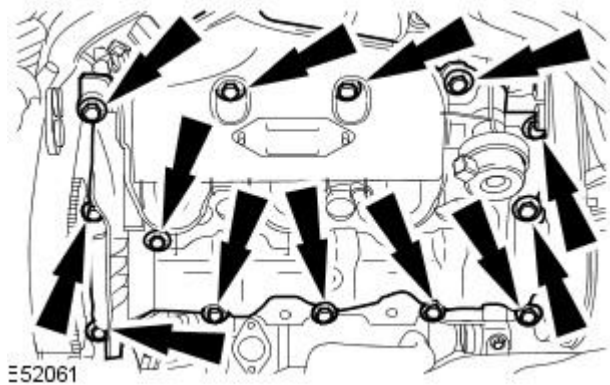
24. Remove the left hand valve cover.

- Remove and discard the gasket.












# Installation



## 1. WARNINGS:

-  Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.
-  Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.
-  This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.
-  Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.

## • CAUTIONS:

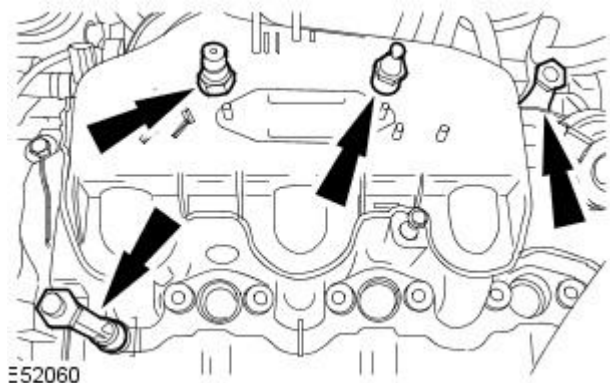
-  Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.
-  Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.
-  Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Install the left hand valve cover.

- Install a new gasket.
- Tighten to 10 Nm.

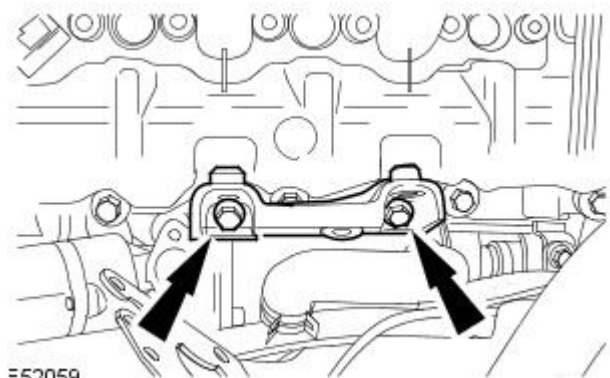
2. Install the engine cover locating studs.

- Tighten to 10 Nm.



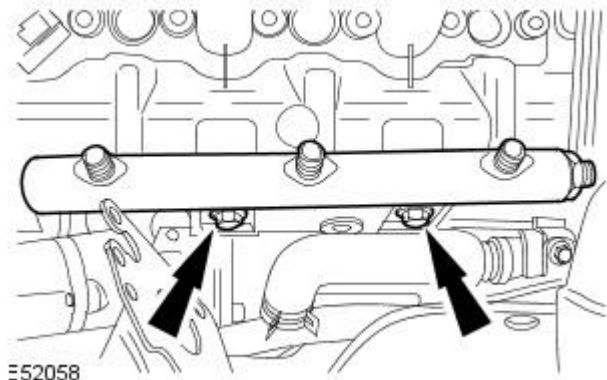
3. Install the fuel injection supply manifold securing bracket.

- Tighten to 24 Nm.



**4. NOTE: Loosely install all retaining bolts.**

Install the left hand fuel injection supply manifold.



**5. Install the fuel injector.**

For additional information, refer to: [Fuel Injector](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

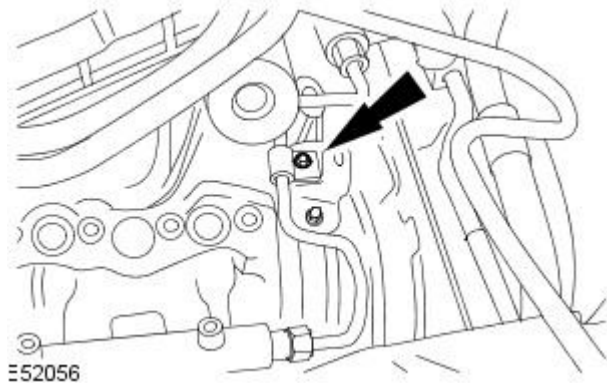
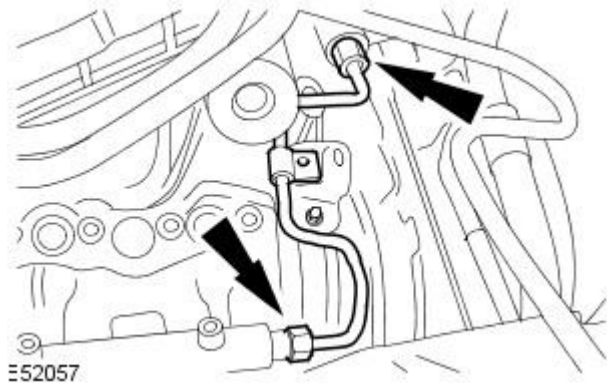
**6. Install the 2 remaining fuel injectors.**

**7. Install a new high-pressure fuel supply line.**

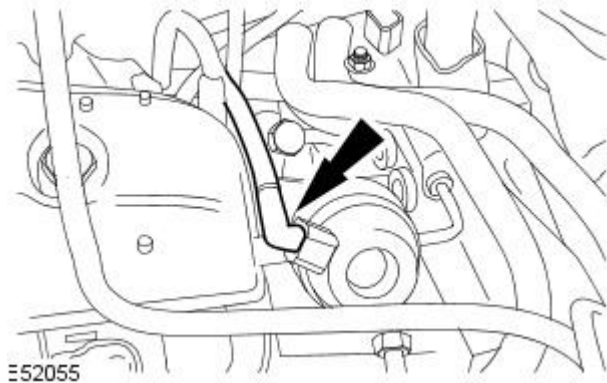
- Remove the blanking caps from the ports.
- Loosely install the new high-pressure fuel supply line.
- Tighten the fuel injection supply manifold retaining bolts to 23 Nm (17 lb.ft).
- Tighten the fuel injection supply line unions in the sequence shown in four stages:
  - Stage 1: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 15 Nm (11 lb.ft).
  - Stage 2: Tighten the high-pressure fuel supply line union at the fuel injection supply manifold to 15 Nm (11 lb.ft).
  - Stage 3: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 30 Nm (22 lb.ft).
  - Stage 4: Tighten the high-pressure fuel supply line union at the fuel injection supply manifold to 30 Nm (22 lb.ft).

**8. Install the fuel injection pump supply line retaining bolt.**

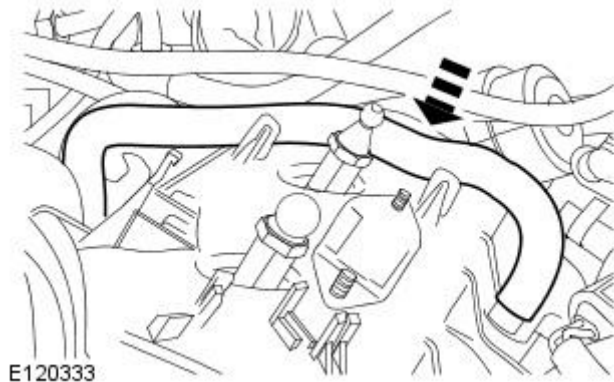
- Tighten to 10 Nm.



**9. Connect the swirl plate actuator vacuum hose.**

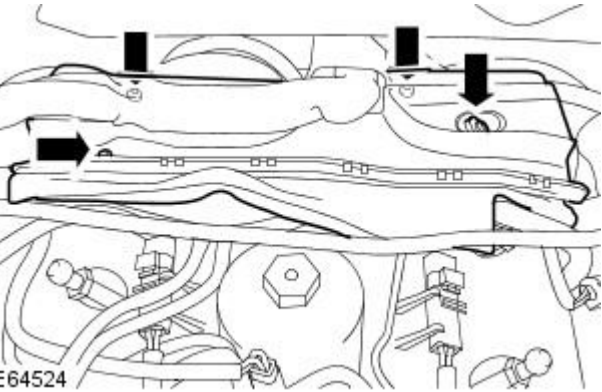


10. Install the engine breather hose.



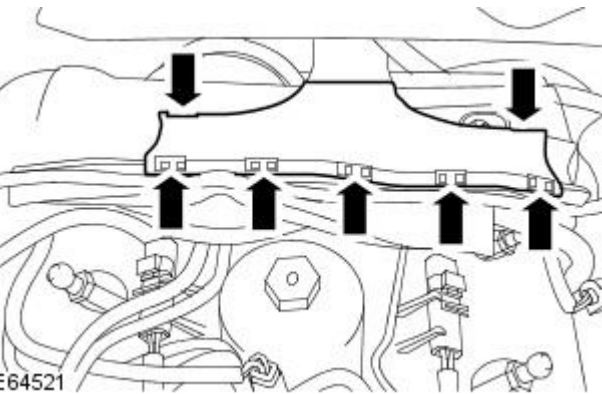
E120333

11. Install the engine wiring harness casing.



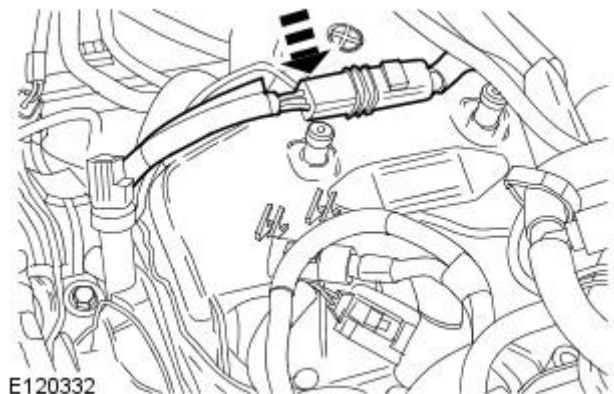
E64524

12. Install the engine wiring harness cover.



E64521

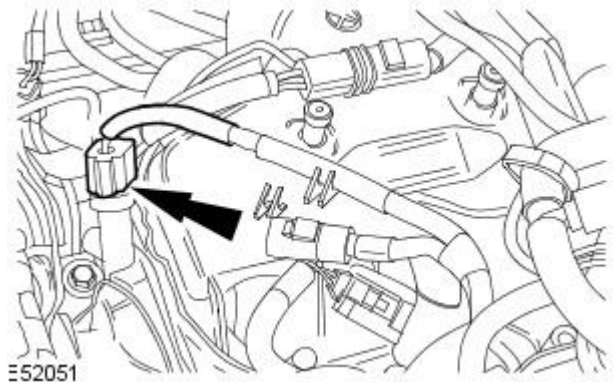
13. Attach the engine wiring harness.



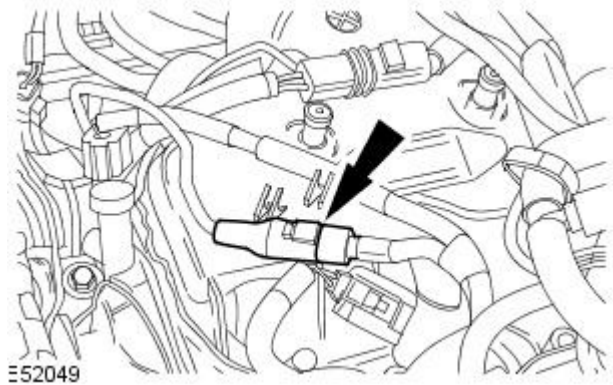
E120332



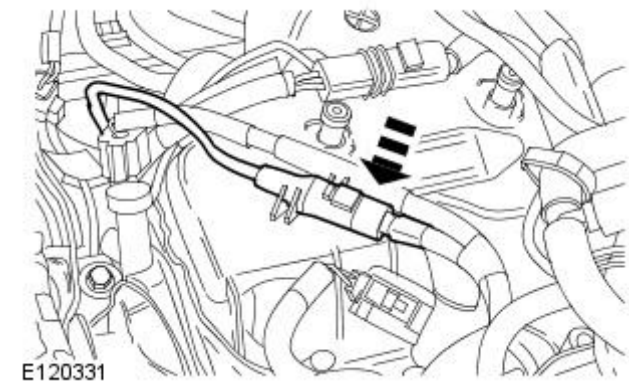
14. Connect the left hand KS electrical connector.



15. Secure the left hand KS electrical connector.

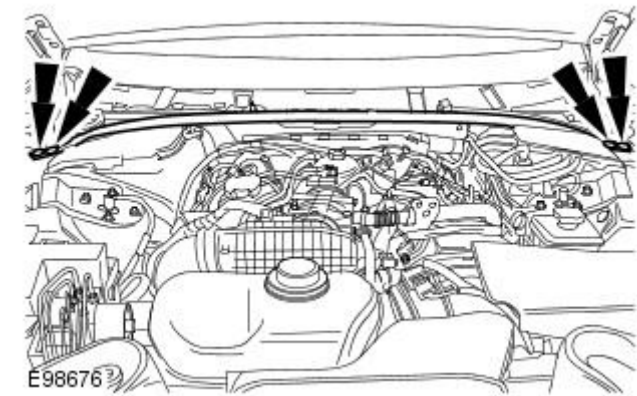


16. Attach the electrical connector onto the valve cover.



17. Install the engine compartment brace.

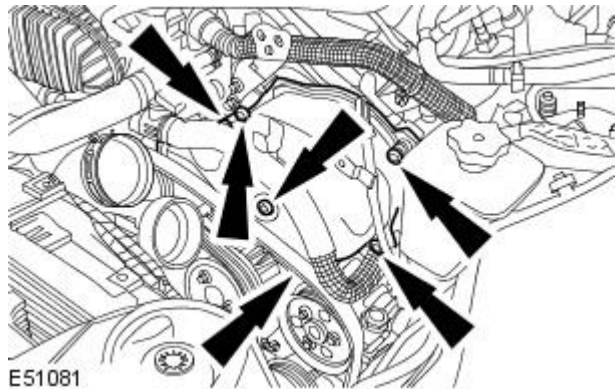
- Tighten to 25 Nm.



**18. NOTE: Install a new gasket.**

Attach the left hand timing cover.

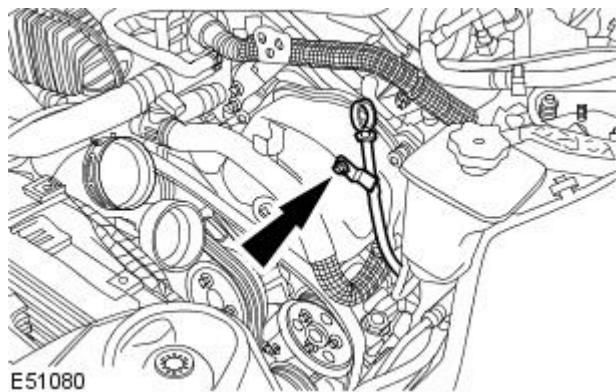
- Tighten to 10 Nm.



E51081

**19. Install the oil level indicator tube.**

- Tighten the bolt to 3 Nm (2.2 lb.ft).

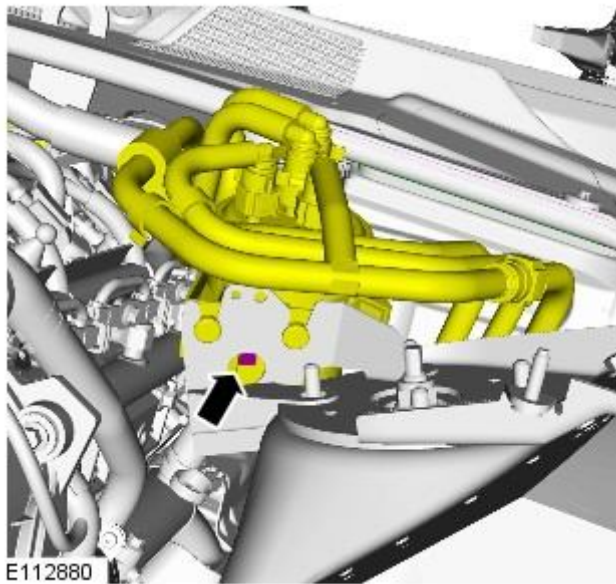


E51080

**20. Install the fuel filter bracket.**

- Tighten to 25 Nm.

**21. Secure the fuel filter assembly.**



E112880

**22. Install the air cleaner assembly.**

For additional information, refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Removal and Installation).

**23. Install the secondary bulkhead center panel.**

For additional information, refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).

**24. Connect the battery ground cable.**

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Engine - TDV6 2.7L Diesel - Valve Cover RH

Removal and Installation

## Removal

### 1. WARNINGS:



Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.



Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.

### • CAUTIONS:



Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.



Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.



Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

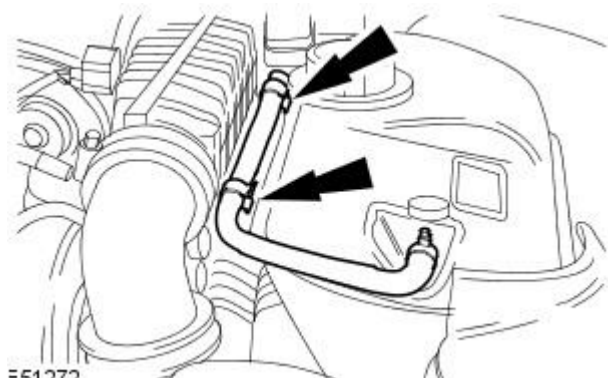
Disconnect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

### 2. Remove the secondary bulkhead center panel.

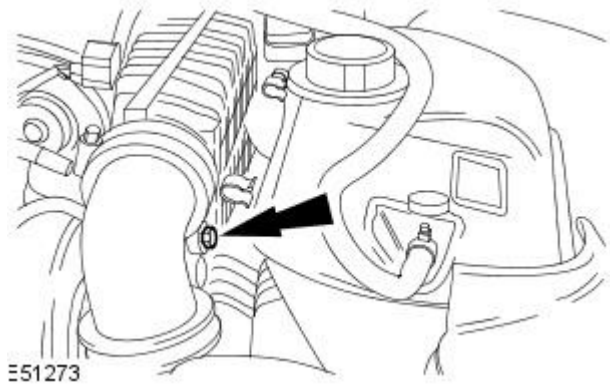
For additional information, refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).

### 3. Detach the coolant hose.



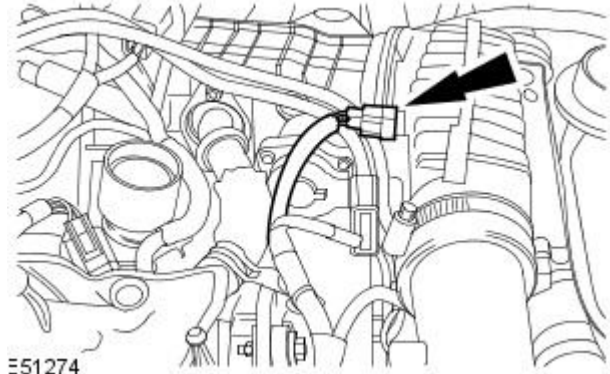
E51272

4. Remove the intake air shut off throttle elbow bolt.



E51273

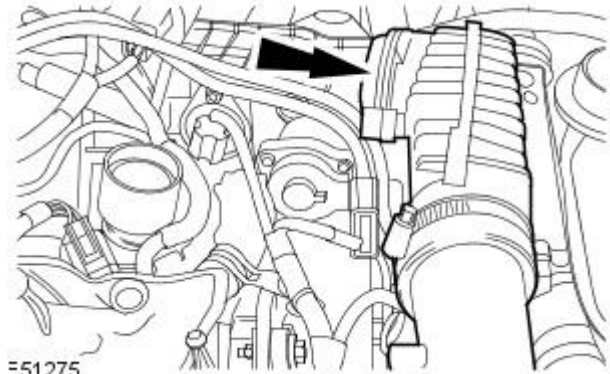
5. Disconnect the air charge temperature sensor electrical connector.



E51274

6. Detach the intake air shut off throttle elbow.

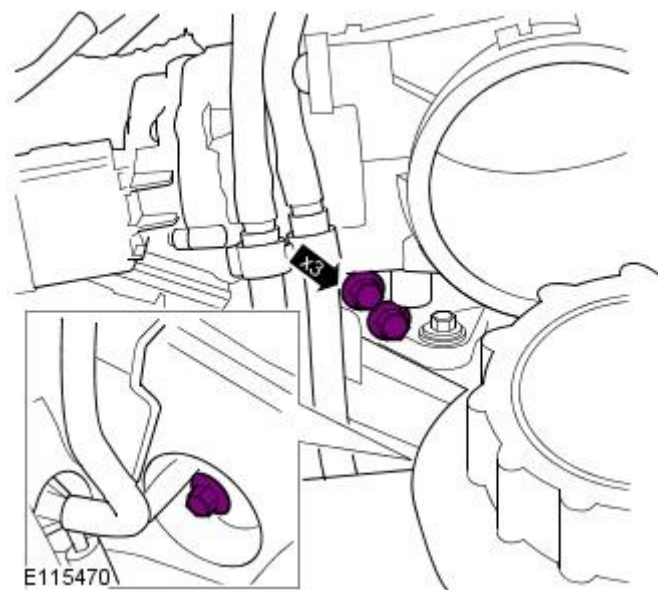
- Release the clip.
- Position aside.



E51275

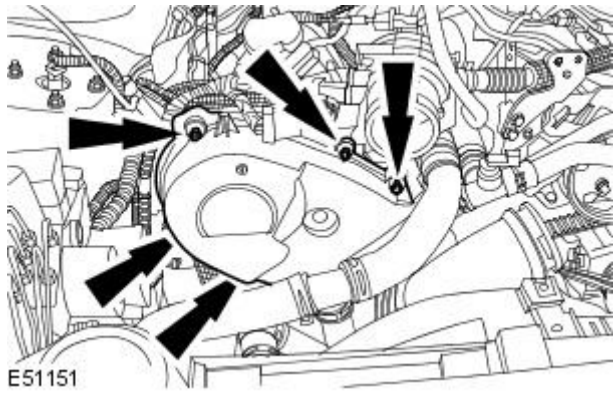
7. Release the port deactivation solenoid and bracket assembly.

- Remove the 3 bolts.
- Position aside.



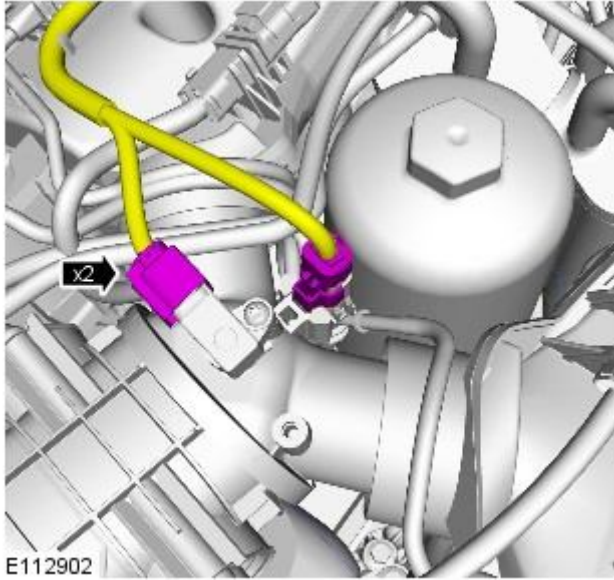
E115470



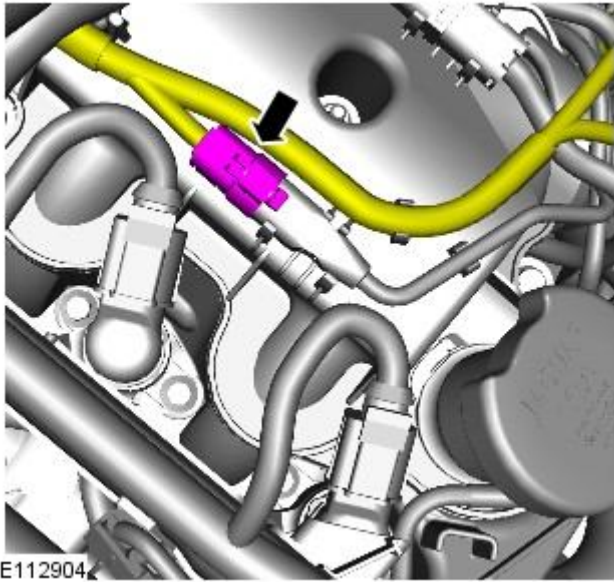


8. Release the right hand timing cover.

- Remove the 5 bolts.
- Release from the cylinder head.

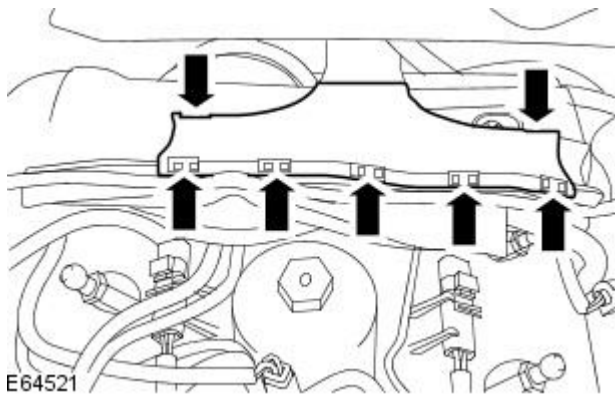


9. Disconnect the manifold absolute pressure (MAP) sensor and the fuel pressure sensor electrical connectors.



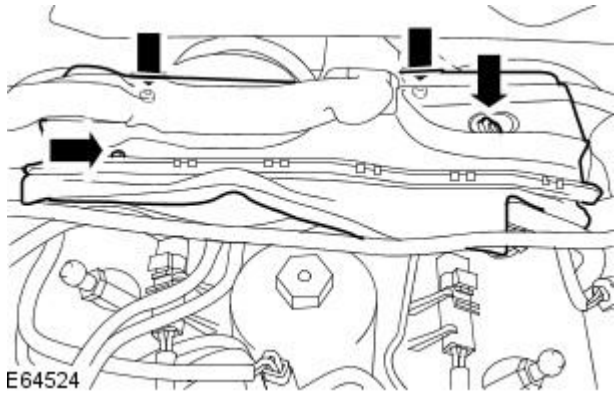
10. Disconnect the right hand knock sensor (KS) electrical connector.

- Release from the valve cover.
- Disconnect the electrical connector.



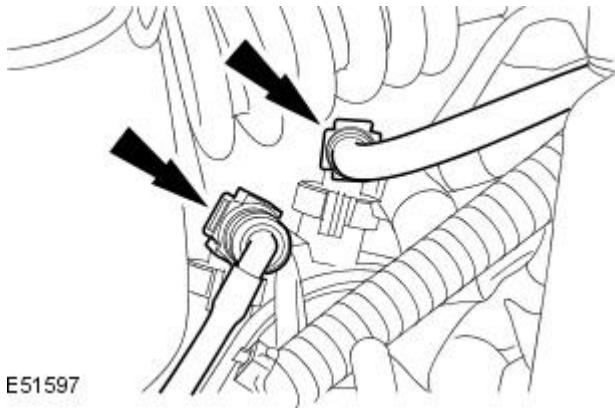
11. Remove the cover from the engine wiring harness casing.

- Release the 7 retaining clips.



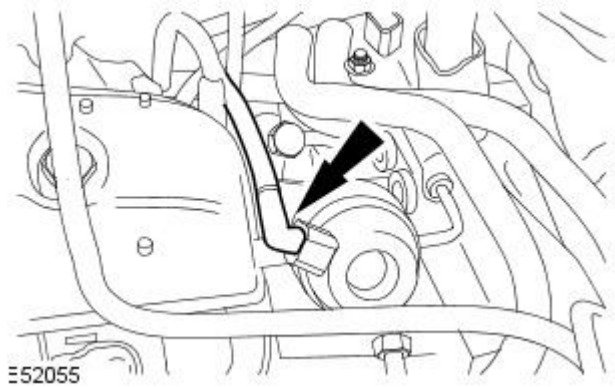
12. Remove the engine wiring harness casing.

- Remove the 4 retaining bolts.

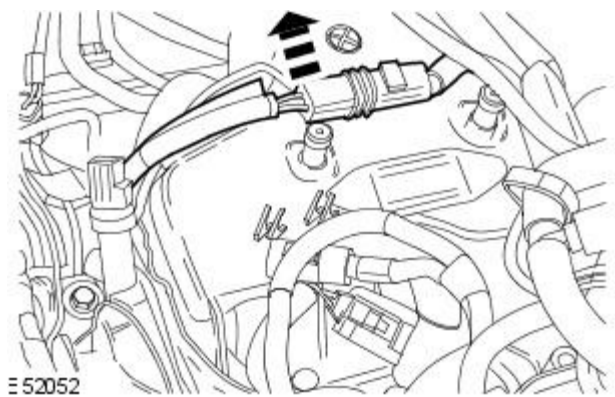


13. Disconnect the 2 vacuum lines from the brake vacuum pump.

- Position aside.

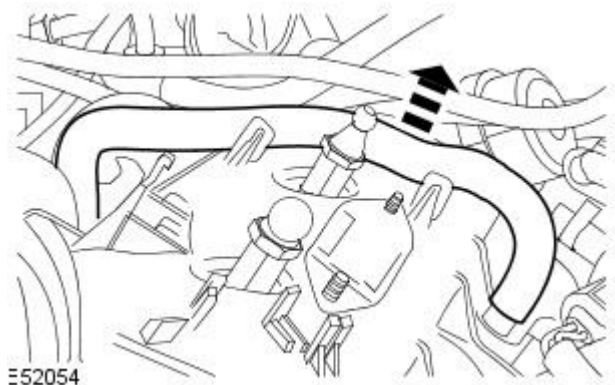


14. Disconnect the swirl plate actuator vacuum hose.



15. NOTE: LH illustration shown, RH is similar.

Detach the engine harness.

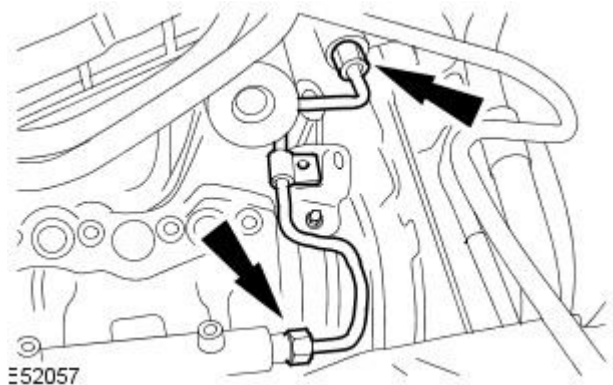
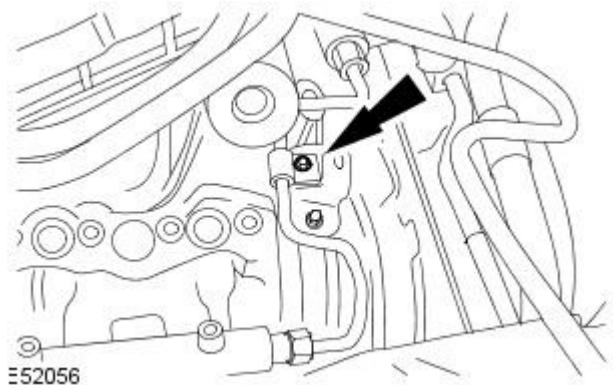



16. NOTE: LH illustration shown, RH is similar.

Remove the engine breather hose.

17. NOTE: LH illustration shown, RH is similar.

Remove the fuel injection pump supply line retaining bolt.



18.  CAUTION: Make sure that the high-pressure fuel supply line remains in contact with the fuel injection supply manifold and the fuel injection diverter rail until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

• NOTE: LH illustration shown, RH is similar.

Remove and discard the high-pressure fuel supply line.

- Install blanking caps to the exposed ports.

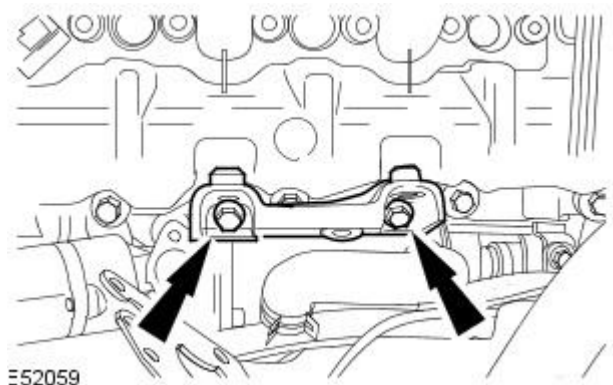
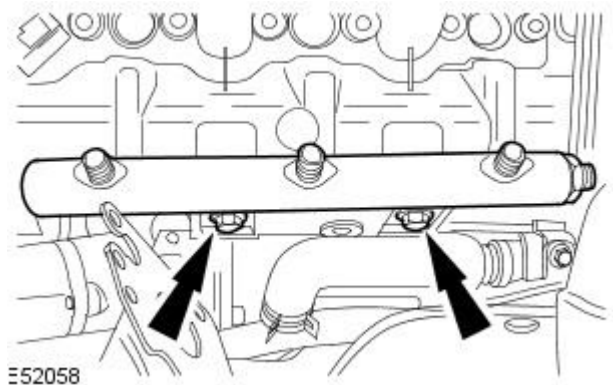
19. Remove the fuel injector.

For additional information, refer to: [Fuel Injector](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

20. Remove the 2 remaining fuel injectors.

21. NOTE: LH illustration shown, RH is similar.

Remove the right hand fuel injection supply manifold.



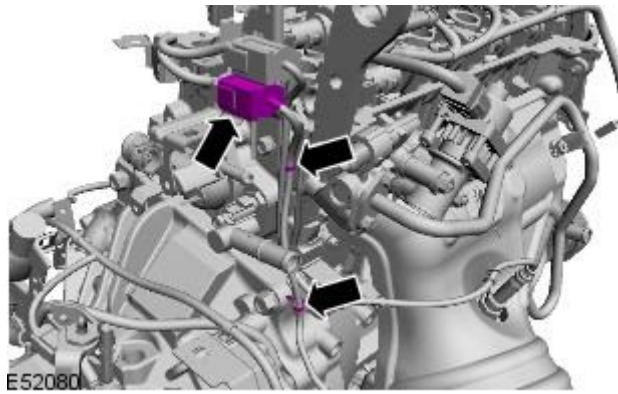
22. NOTE: LH illustration shown, RH is similar.

Remove the fuel injection supply manifold securing bracket.



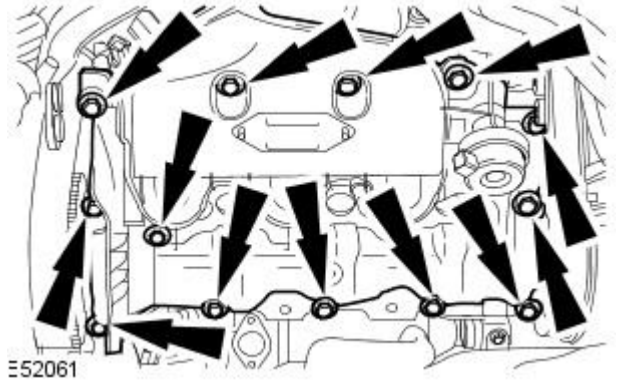
23. NOTE: LH illustration shown, RH is similar.

Remove the engine cover locating studs.

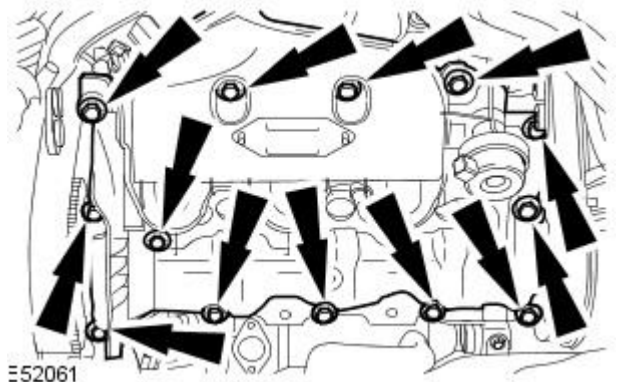


24. Remove the right hand valve cover.


- Remove and discard the gasket.





## Installation




### 1. WARNINGS:


 Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.


 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.


 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

 Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.

### • CAUTIONS:

 Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

 Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

 Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Install the right hand valve cover.

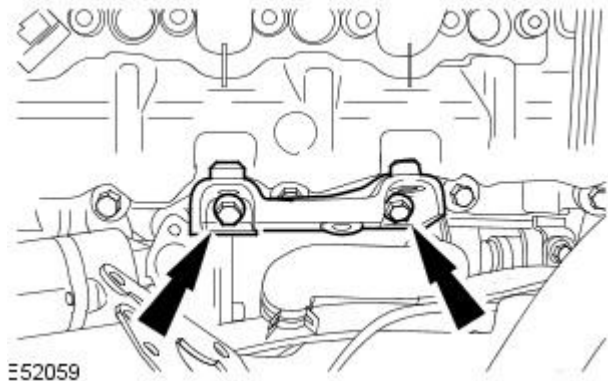
- Install a new gasket.
- Tighten to 10 Nm.

2. Install the engine cover locating studs.

- Tighten to 10 Nm.

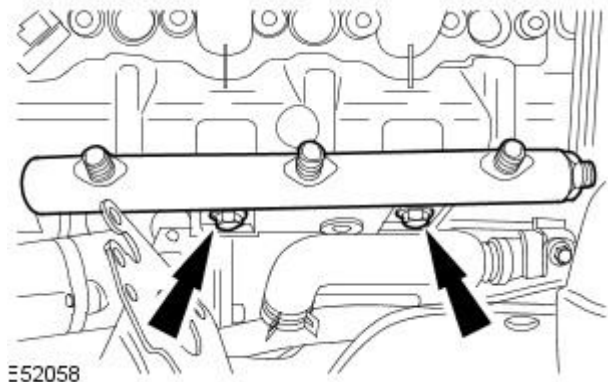
3. Install the fuel injection supply manifold securing bracket.

- Tighten to 24 Nm.



4. NOTE: Loosely install all retaining bolts.

Install the right-hand fuel injection supply manifold.



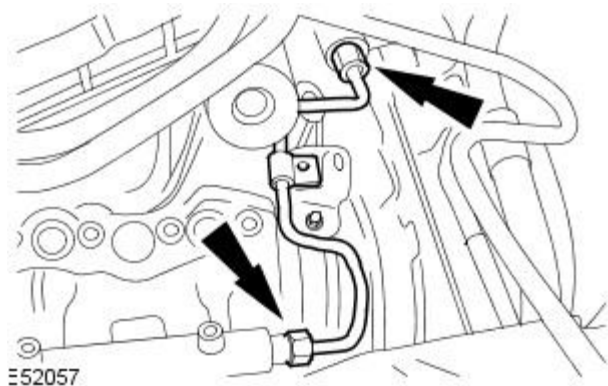
5. Install the fuel injector.

For additional information, refer to: [Fuel Injector](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

6. Install the 2 remaining fuel injectors.

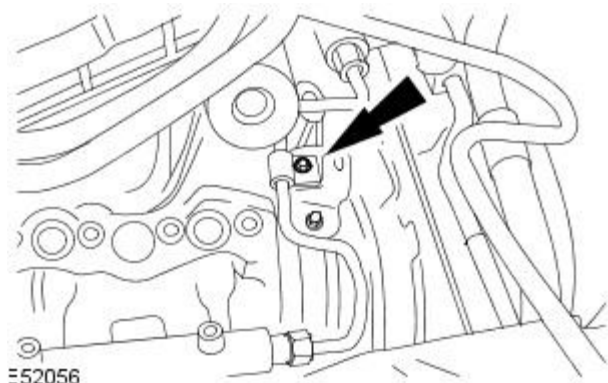
7. Install a new high-pressure fuel supply line.

- Remove the blanking caps from the ports.
- Loosely install the new high-pressure fuel supply line.
- Tighten the fuel injection supply manifold retaining bolts to 23 Nm (17 lb.ft).
- Tighten the fuel injection supply line unions in the sequence shown in four stages:
  - Stage 1: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 15 Nm (11 lb.ft).
  - Stage 2: Tighten the high-pressure fuel supply line union at the fuel injection supply manifold to 15 Nm (11 lb.ft).
  - Stage 3: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 30 Nm (22 lb.ft).
  - Stage 4: Tighten the high-pressure fuel supply line union at the fuel injection supply manifold to 30 Nm (22 lb.ft).

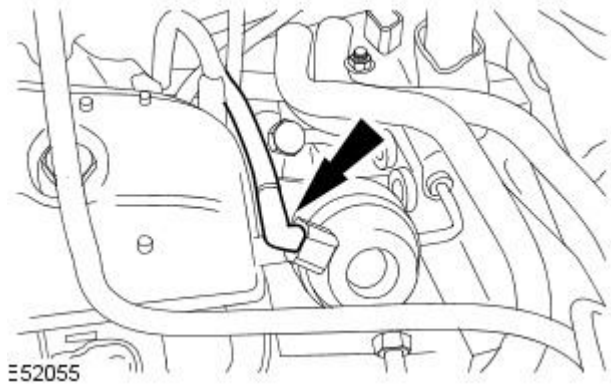


8. Install the fuel injection pump supply line retaining bolt.

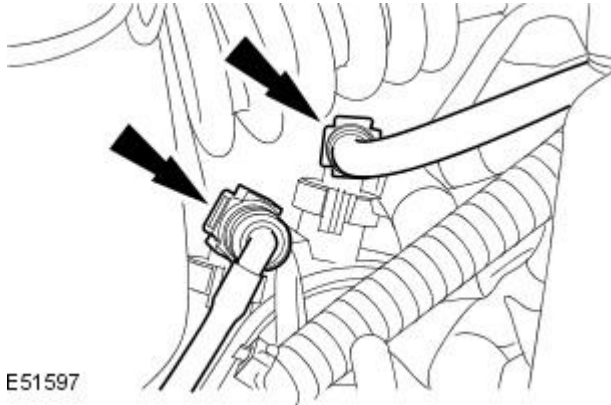
- Tighten to 10 Nm.



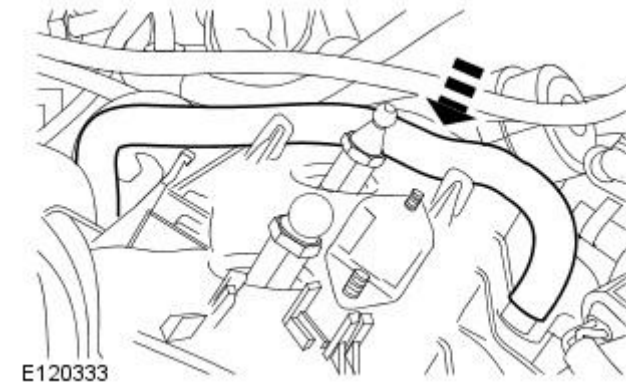
9. Connect the swirl plate actuator vacuum hose.



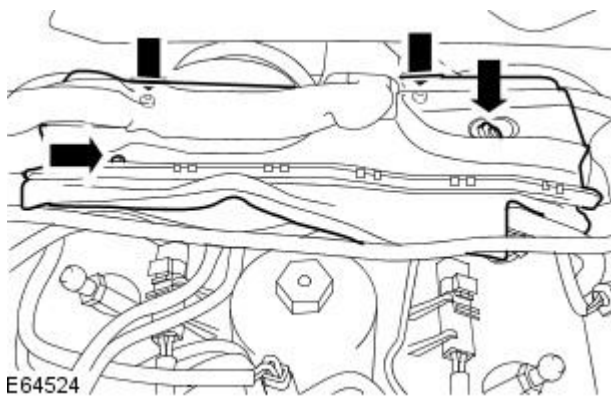
10. Connect the brake booster vacuum line to the brake vacuum pump.



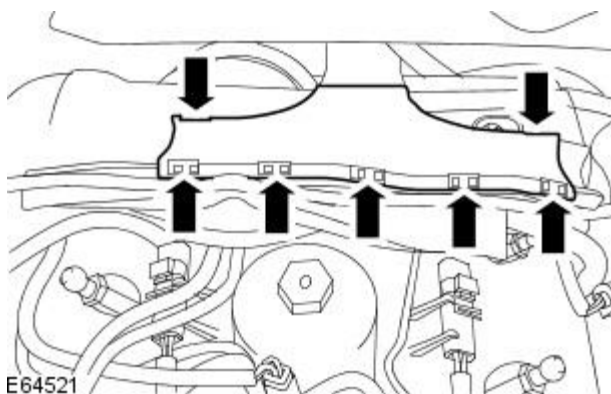
11. Install the engine breather hose.



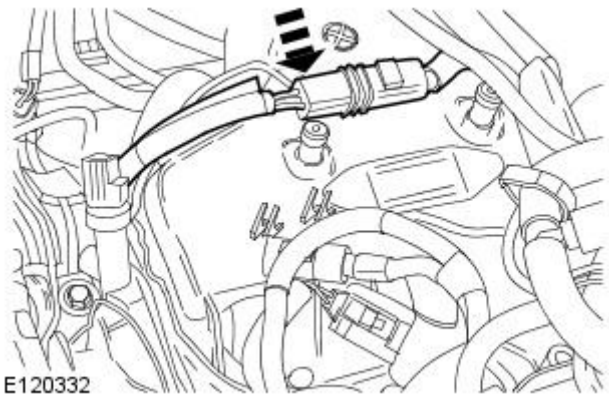
12. Install the engine wiring harness casing.



13. Install the engine wiring harness cover.

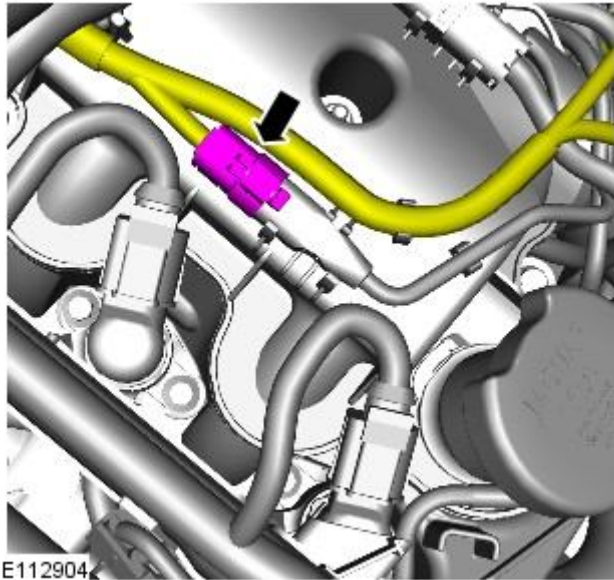


14. Attach the engine wiring harness.



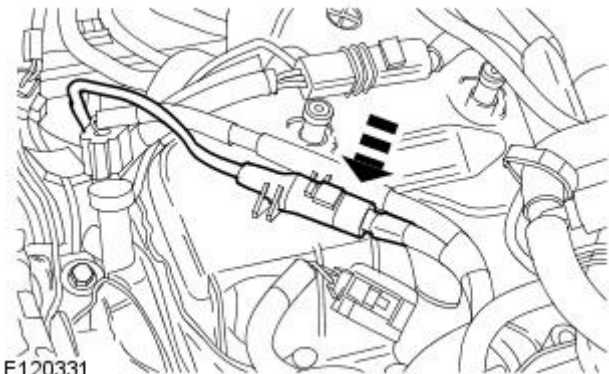
E120332

15. Connect the right-hand KS electrical connector.



E112904

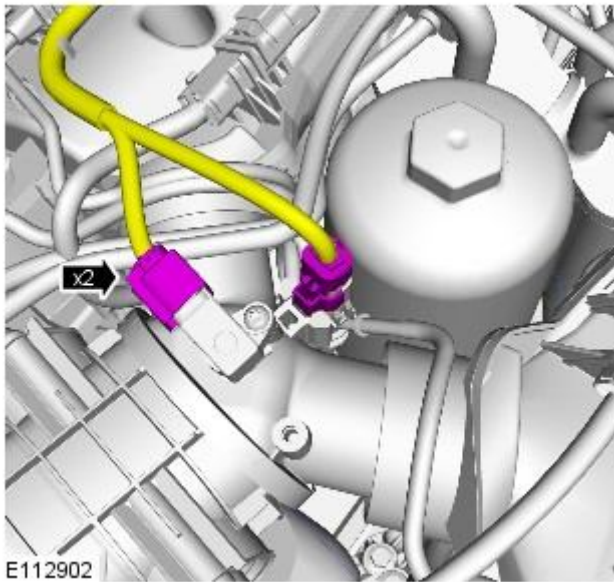
16. Attach the KS electrical connector to the valve cover.



E120331



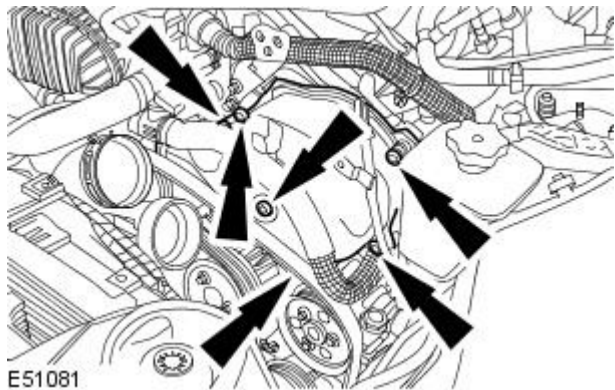
17. Connect the MAP sensor and the fuel pressure sensor electrical connectors.



18. **NOTE:** Install a new gasket.

Attach the right hand timing cover.

- Tighten to 10 Nm.

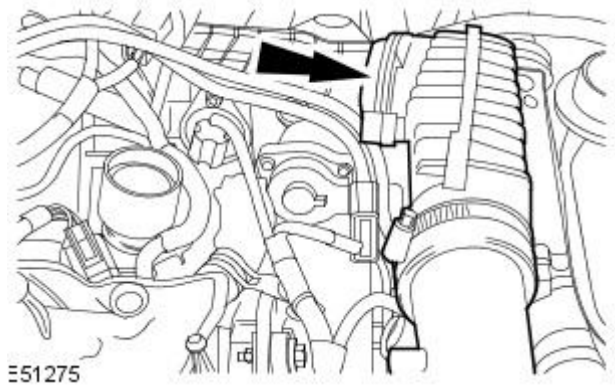


19. Install the port deactivation solenoid and bracket assembly.

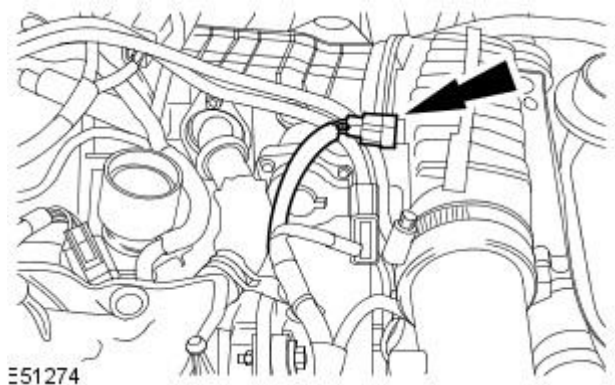
- Tighten the bolts to 10 Nm.

20. Attach the intake air shutoff throttle elbow.

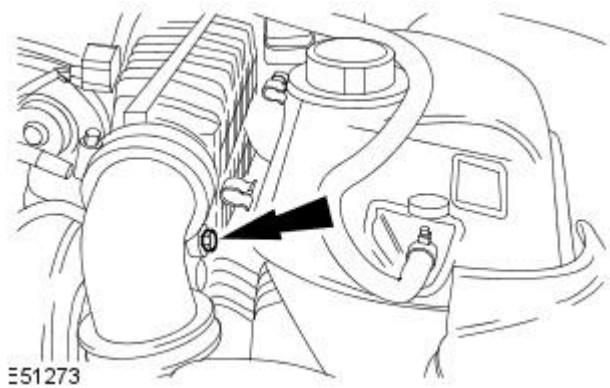
- Secure with the clip.



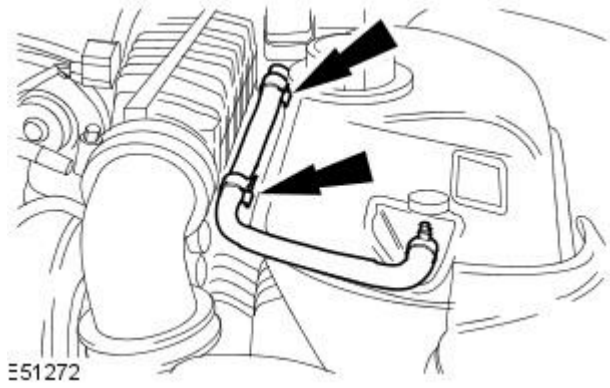
21. Connect the air charge temperature sensor electrical connector.



22. Install the intake air shutoff throttle elbow retaining bolt.



23. Attach the coolant hose.


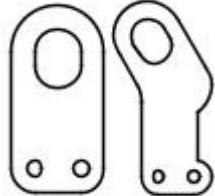



24. Install the secondary bulkhead center panel.  
For additional information, refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).

25. Connect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).


# Engine - TDV6 2.7L Diesel - Engine

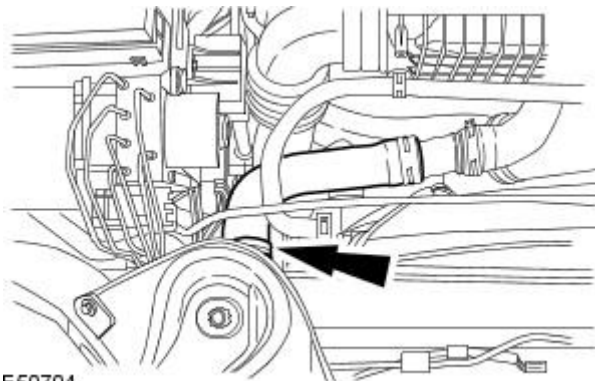
Removal

Special Tool(s)	
 <p>303-703</p> <p>E95037</p>	Accessory belt tensioner 303-703
 <p>E54554</p>	Lifting Brackets - Engine 303-1129
 <p>303-021</p>	Engine support bracket 303-021

## Removal

All vehicles

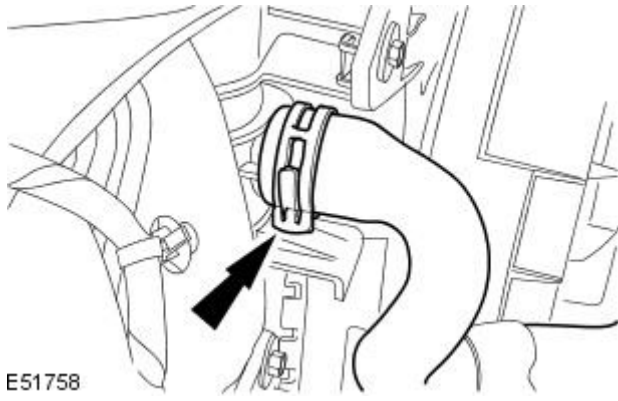
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Make sure to support the vehicle with axle stands.  
Raise and support the vehicle.
3. Drain the cooling system.  
For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).
4. Recover the air conditioning (A/C) refrigerant.
5. Remove the cooling fan motor and shroud.  
For additional information, refer to: [Cooling Fan Motor and Shroud](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation).
6. Remove the transmission.  
For additional information, refer to: [Transmission - TDV6 2.7L Diesel](#) (307-01 Automatic Transmission/Transaxle - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel, Removal).
7. Remove the injector sound proofing.
8. Remove the radiator top hose.



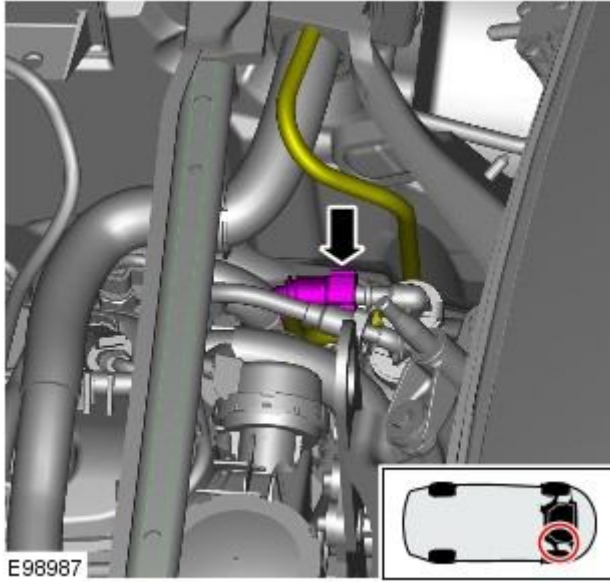
E50704



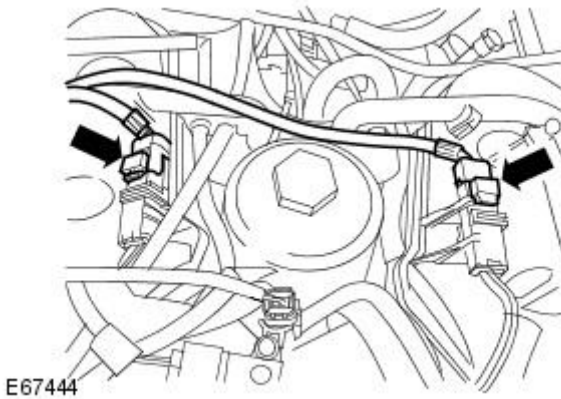
9. Disconnect the hose from the radiator.



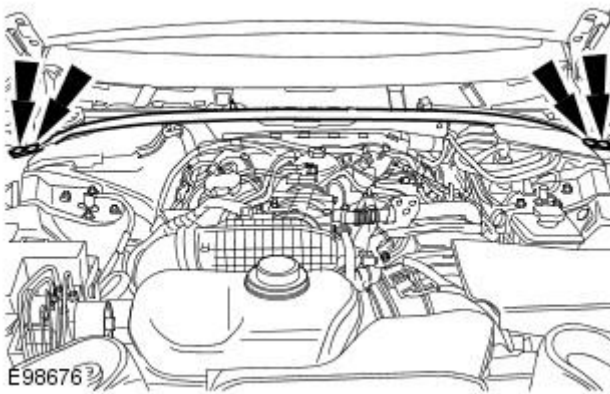
10. Disconnect the brake booster vacuum pipe.



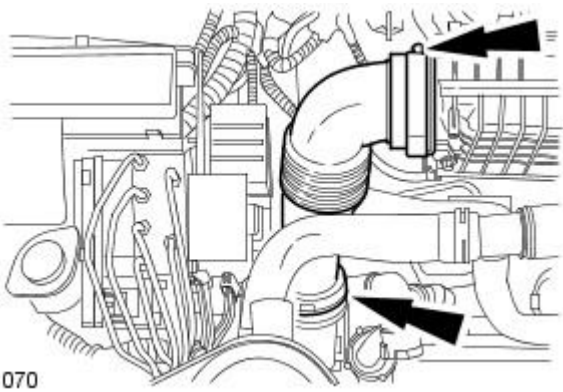
11. Disconnect the glow plug harness electrical connectors.



12. Remove the engine compartment brace.

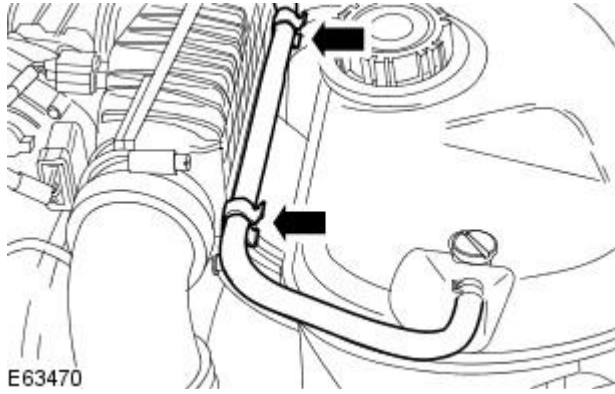


13. Disconnect the air intake hose.



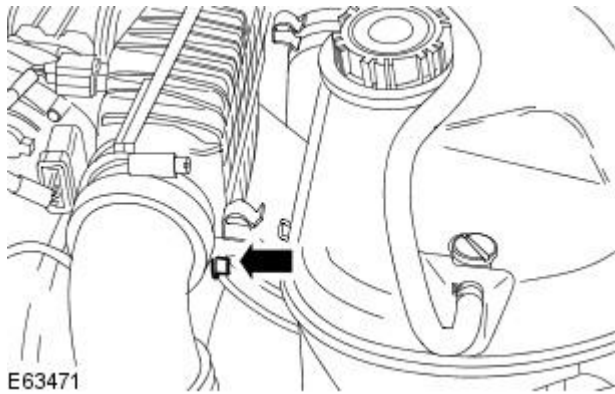
E51070

14. Detach the coolant expansion tank coolant hose from the intake air shutoff throttle elbow.



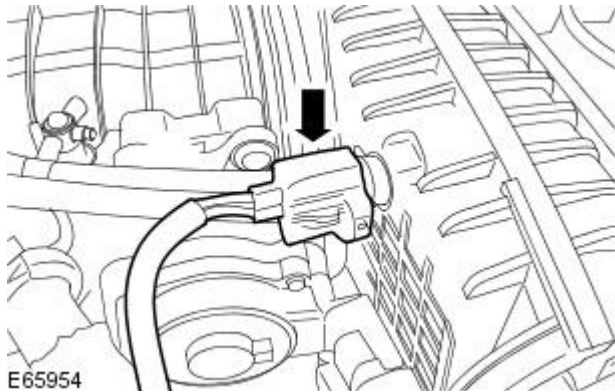
E63470

15. Remove the intake air shutoff throttle elbow retaining bolt.



E63471

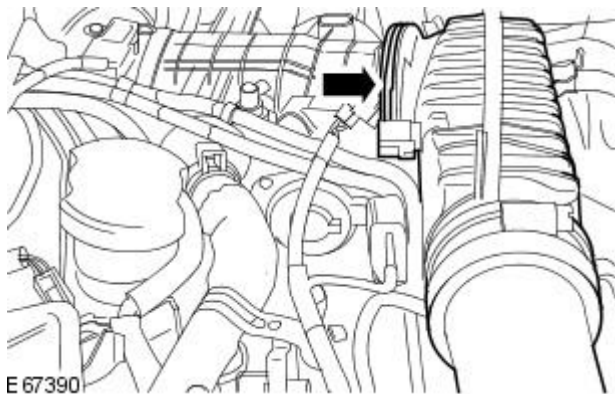
16. Disconnect the intake air temperature (IAT) sensor electrical connector.



E65954

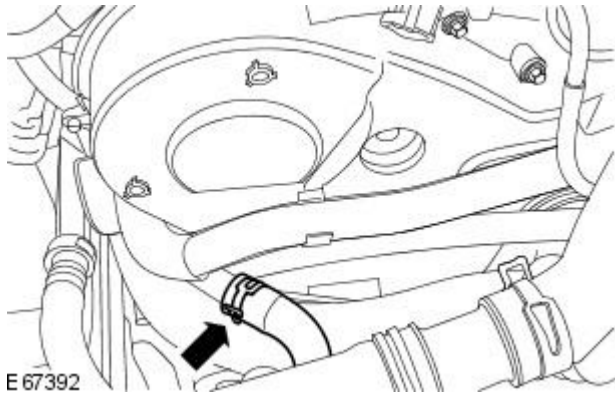
17. Remove the intake air shutoff throttle elbow.

- Remove and discard the O-ring seal.

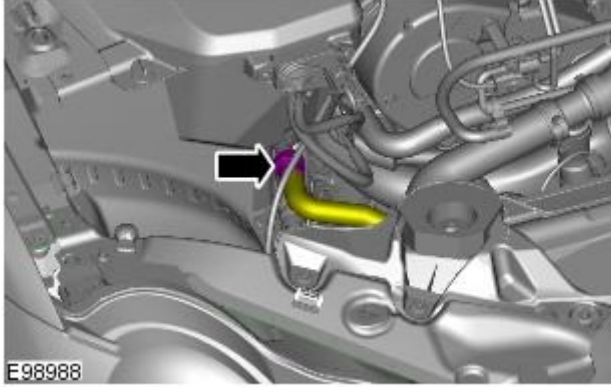


E67390

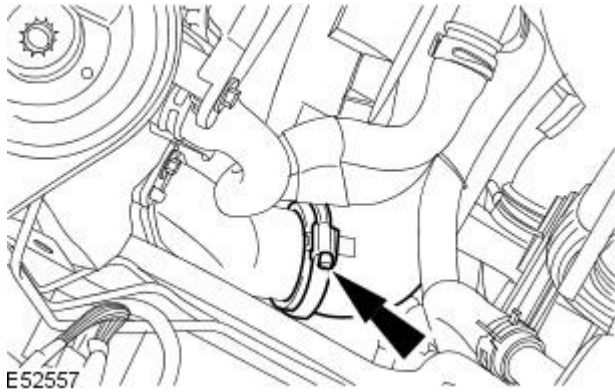
18. Disconnect the exhaust gas recirculation (EGR) coolant hose.



19. Disconnect the coolant hose.



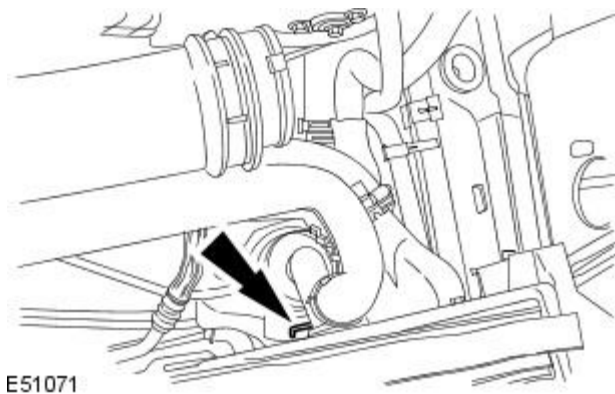
20. Disconnect the charge air cooler inlet hose.



21.  CAUTION: Be prepared to collect escaping coolant.

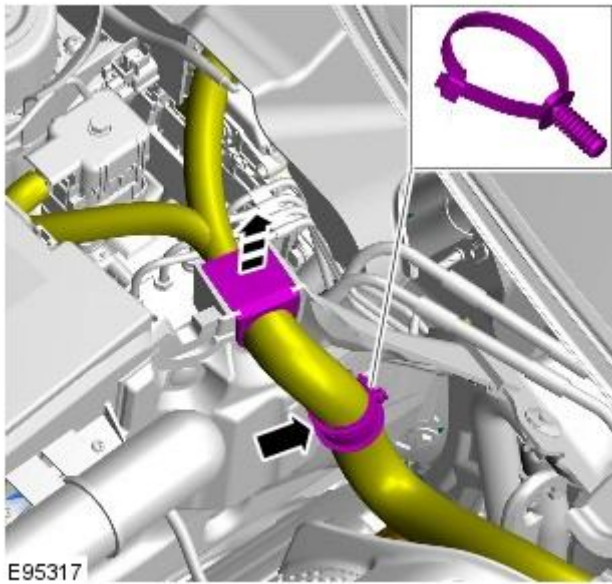
Disconnect the thermostat housing lower radiator hose.

- Release the retaining clip.



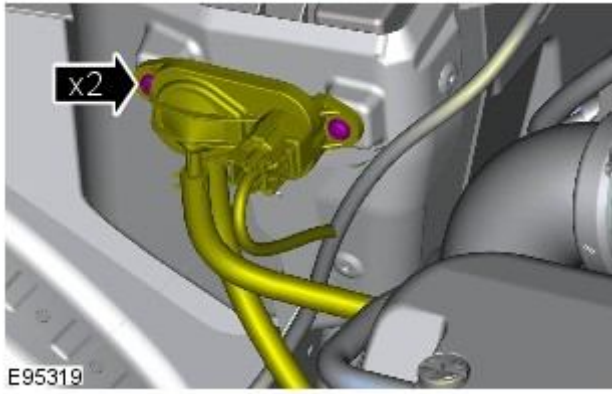
Left-hand drive vehicles

22. Release and reposition the wiring harness.

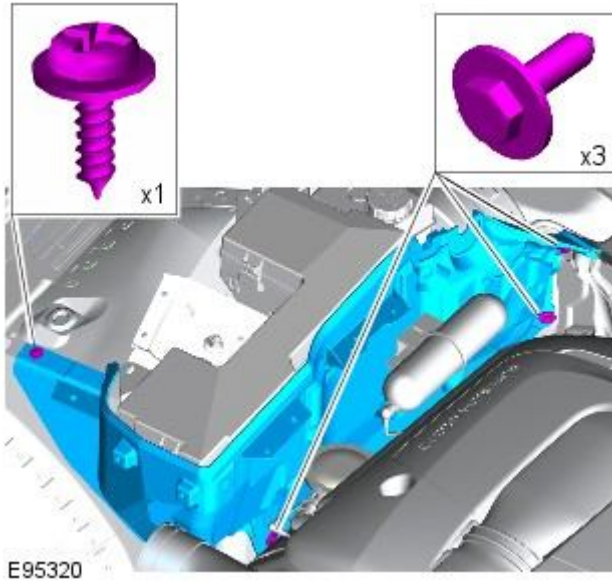


All vehicles

23. Release the diesel particulate filter (DPF) differential pressure sensor.

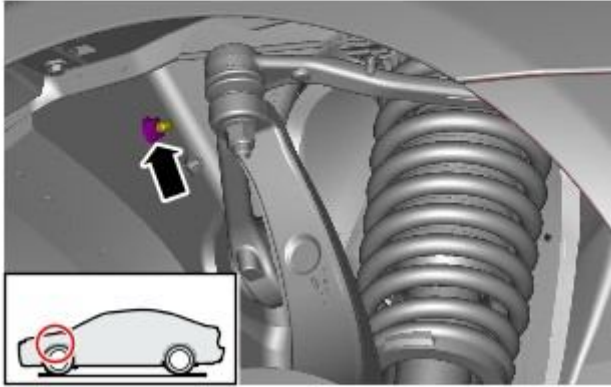
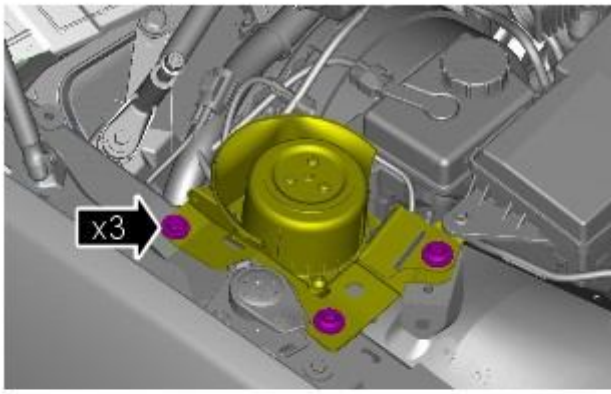


24. Remove the RH secondary bulkhead panel.



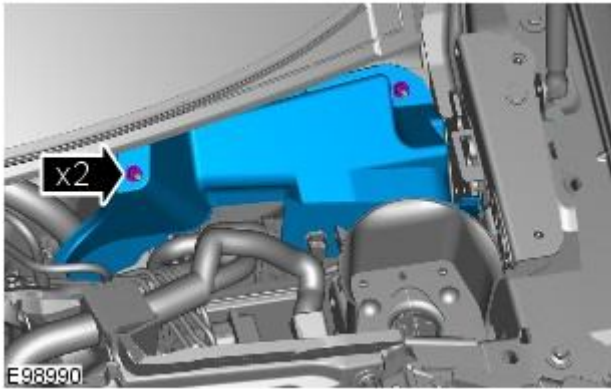


25. Remove the RH pedestrian protection actuator and bracket.



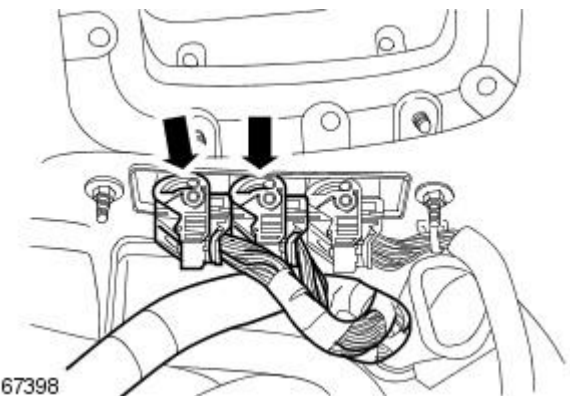
E98989

26. Remove the engine control module (ECM) cover.



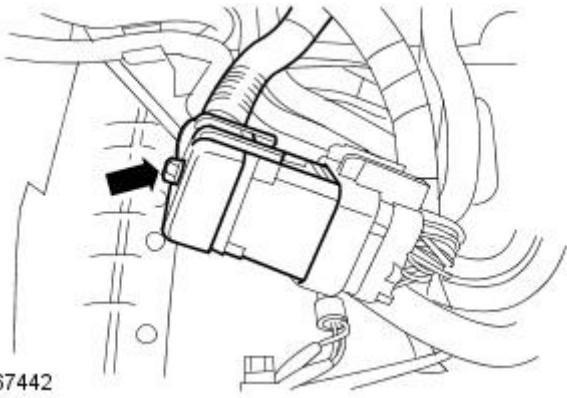
E98990

27. Disconnect the ECM electrical connectors.



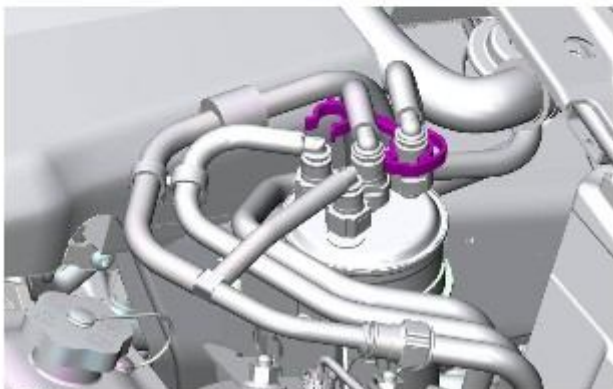
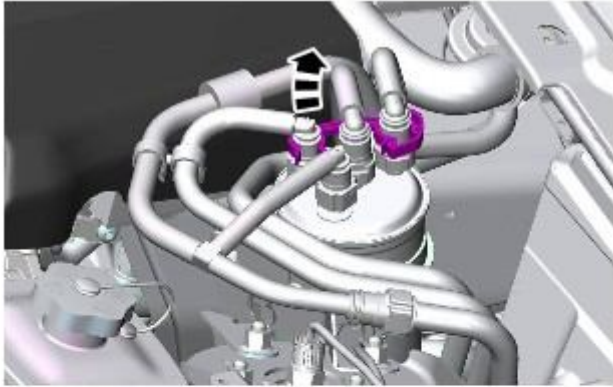
E 67398

28. Disconnect the engine wiring harness electrical connector.




E67442

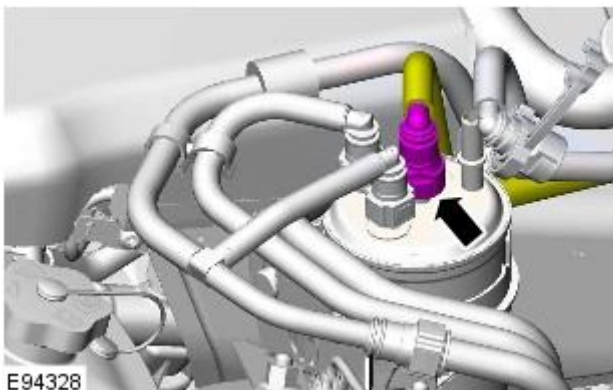
29. Release the fuel line safety clip.



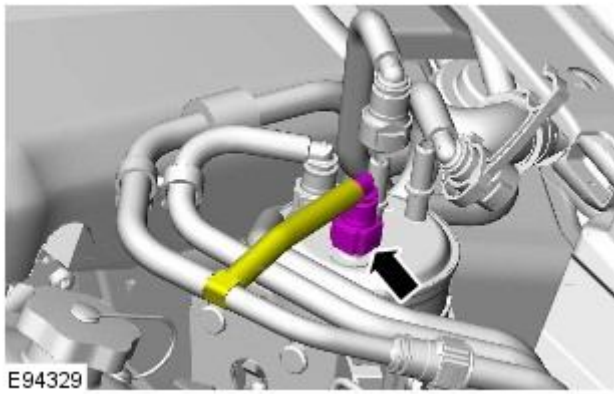
E94326


30.  CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Disconnect the high pressure fuel pump supply line from the fuel filter.

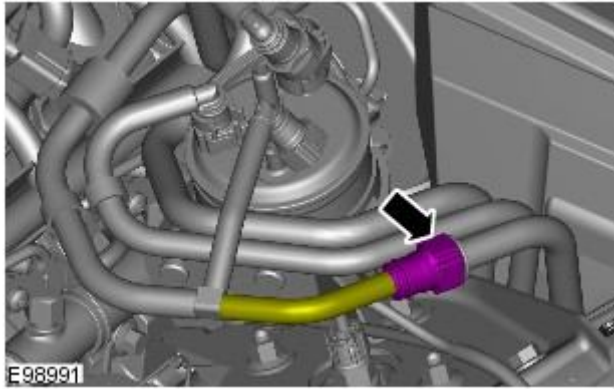



E94328



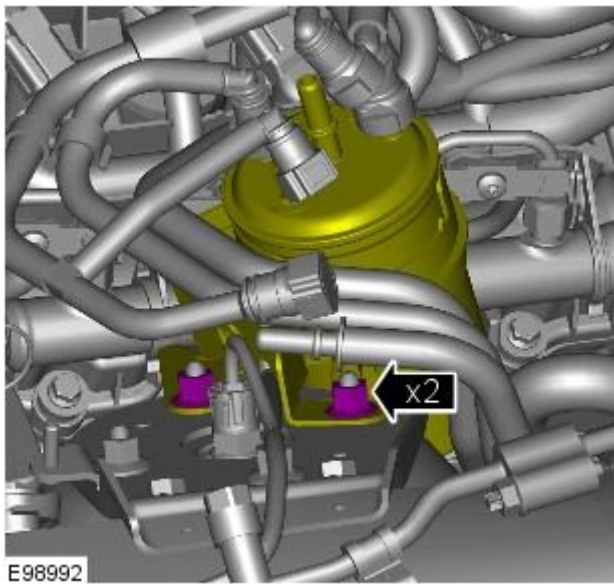
31.  CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Disconnect the high-pressure fuel pump return line from the fuel filter.

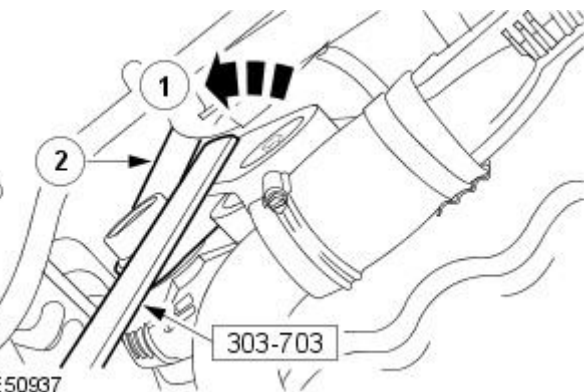


32.  CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Disconnect the fuel line.



33. Reposition the fuel filter and support bracket.



34. Release the accessory drive belt.

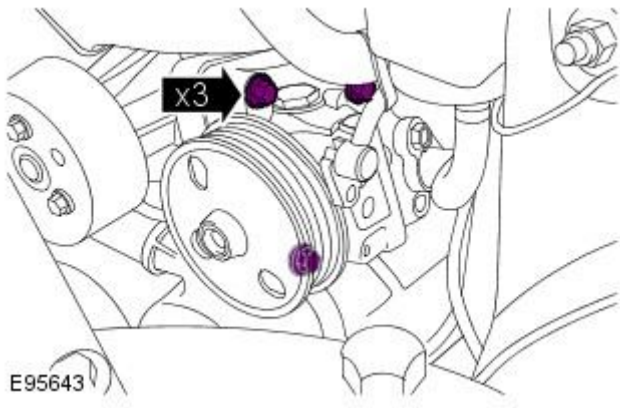
1. Using the special tool, rotate the accessory drive belt tensioner counter-clockwise.



**35. NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Release and reposition the power steering pump.

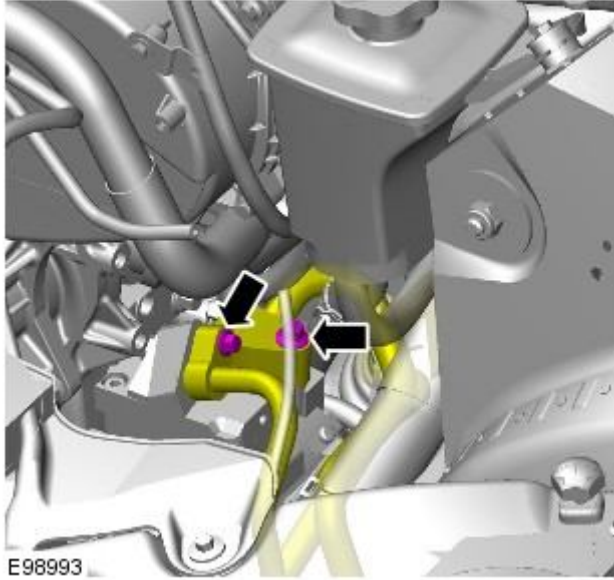
- Tie aside.



E95643

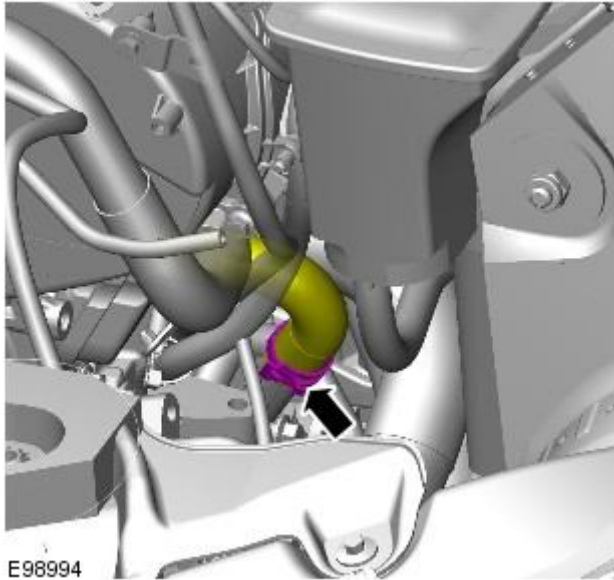
**36.** Disconnect the air conditioning (A/C) compressor supply and return lines.

- Remove and discard the O-ring seals.
- Install blanking caps to the exposed ports.



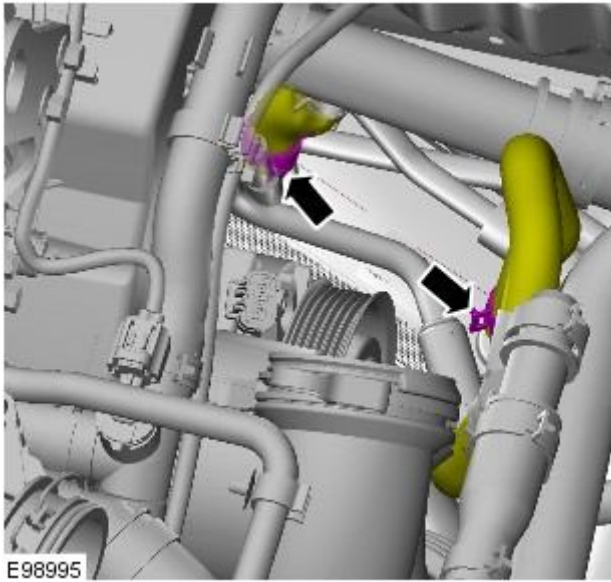
E98993

**37.** Disconnect the coolant hose.



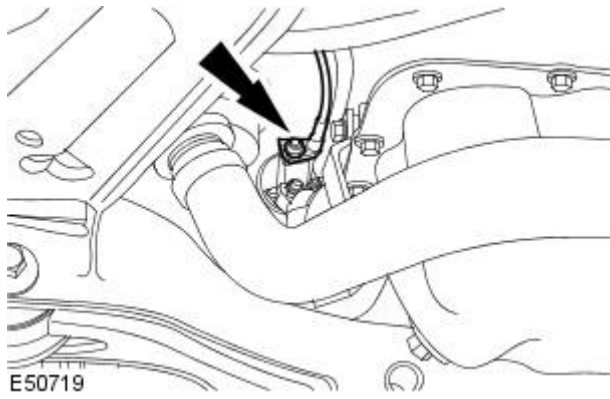
E98994

38. Disconnect the 2 transmission fluid cooler hoses.

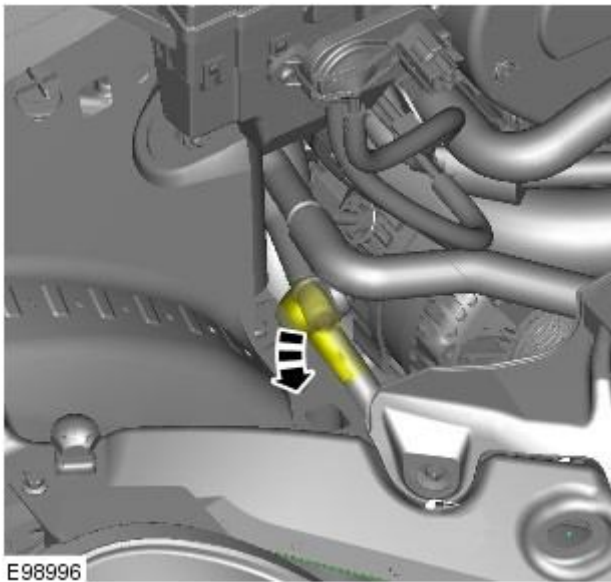


39. Raise the vehicle.

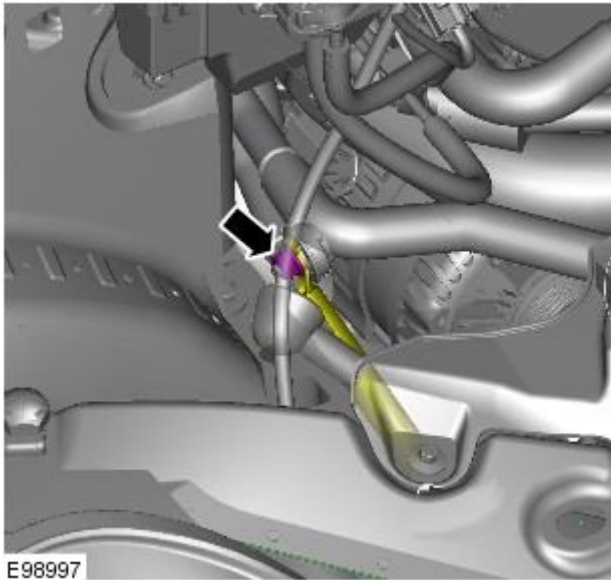
40. Detach the starter motor cable.



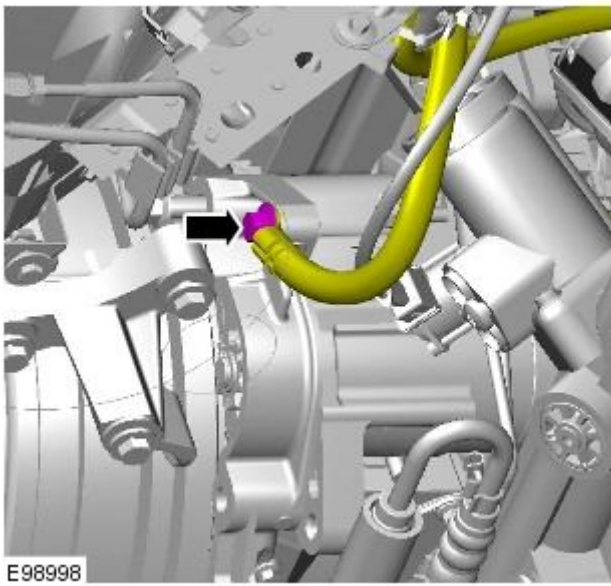
41. Release the battery positive cable protective cover.



42. Disconnect the battery positive cable from the generator.

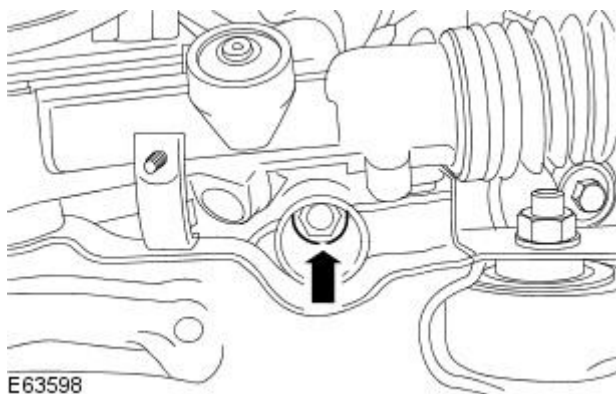


43. Disconnect the engine earth strap.



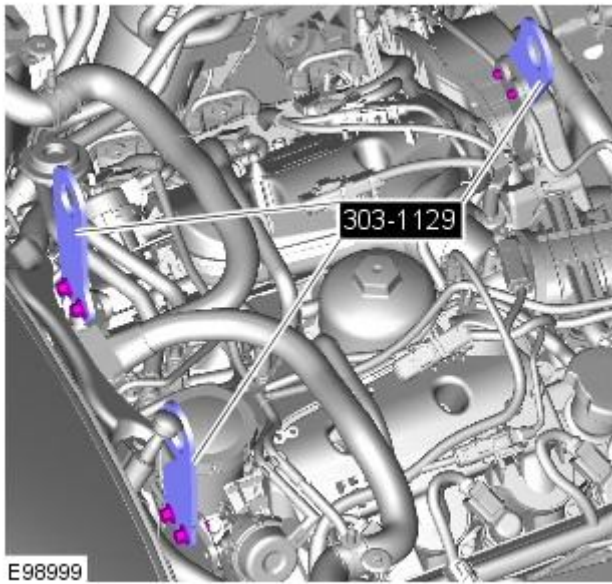
44. NOTE: Right-hand shown, left-hand similar.

Remove the engine mounts lower retaining nuts.

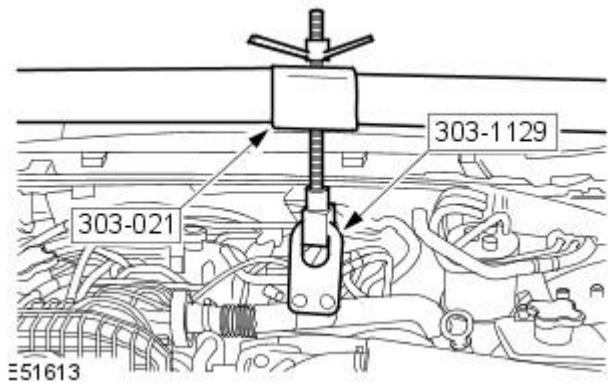


45. Lower the vehicle.

46. Install the special tool.



47. Remove the special tool.

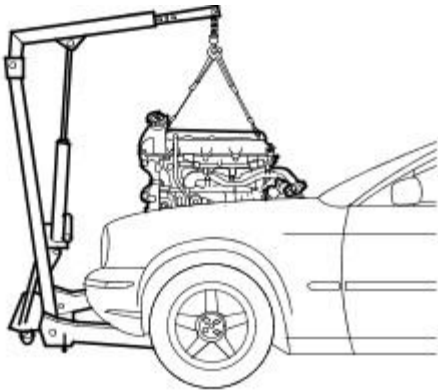


48. Install the lifting equipment to the vehicle.

- Install the lifting chains.


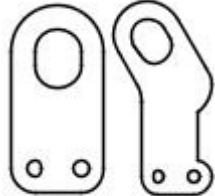
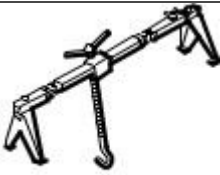
49. Remove the engine.

- With assistance, carefully remove the engine.



# Engine - TDV6 2.7L Diesel - Engine

## Installation

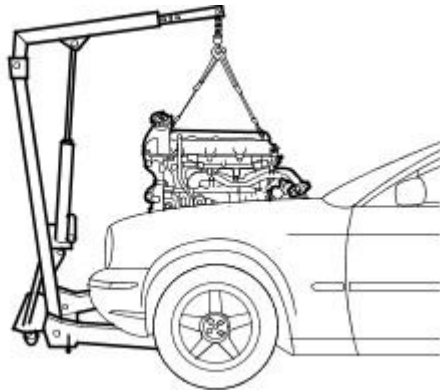
Special Tool(s)	
 <p>303-703</p> <p>E95037</p>	<p>Accessory belt tensioner</p> <p>303-703</p>
 <p>E54554</p>	<p>Lifting Brackets - Engine</p> <p>303-1129</p>
 <p>303-021</p>	<p>Engine support bracket</p> <p>303-021</p>

## Installation

All vehicles

1. Install the engine.

- With assistance, carefully install the engine.



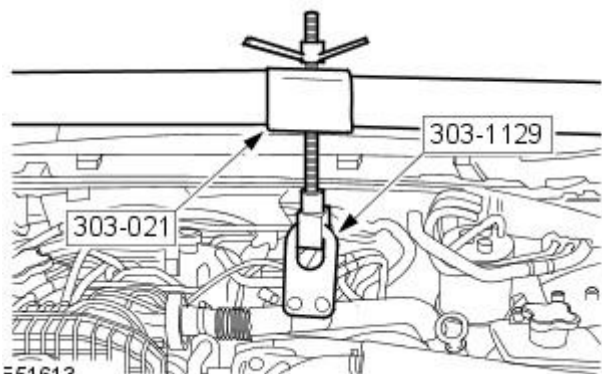
E31824

2. Remove the engine lifting equipment.

- Remove the lifting chains.

3. Install the special tool.

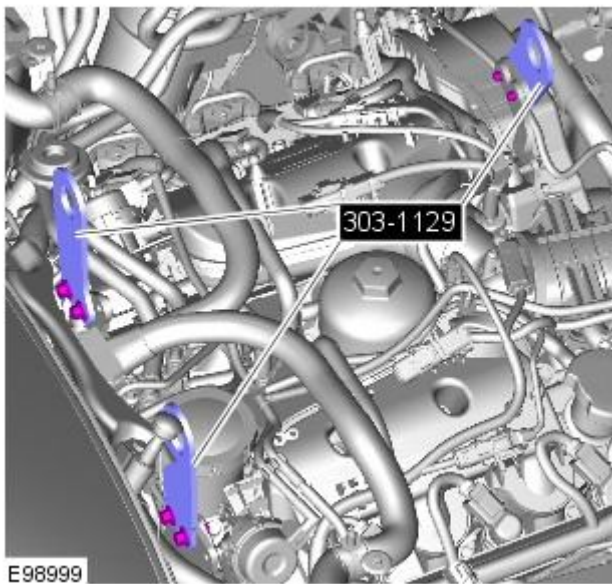
- Rotate the special tool adjustment bolt a suitable amount of turns to support the engine.



E51613



4. Remove the special tool.

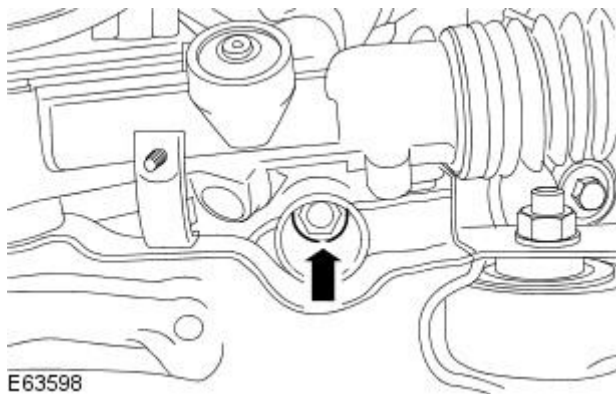


5. Raise the vehicle.

6. NOTE: Right-hand shown, left-hand similar.

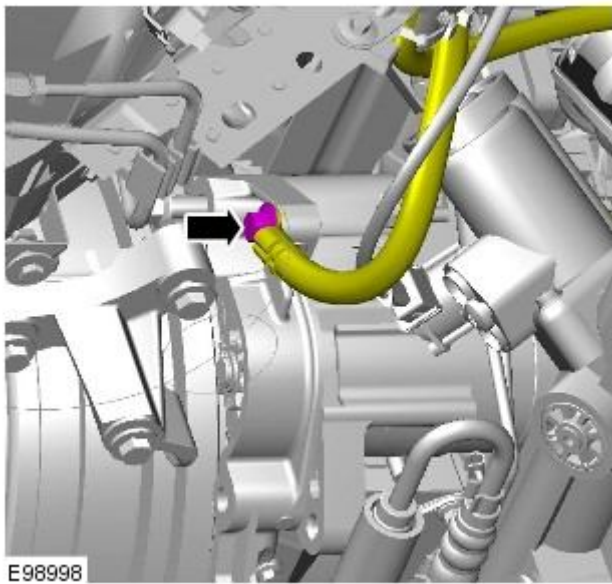
Install the engine mounts lower retaining nuts.

- Tighten to 63 Nm.



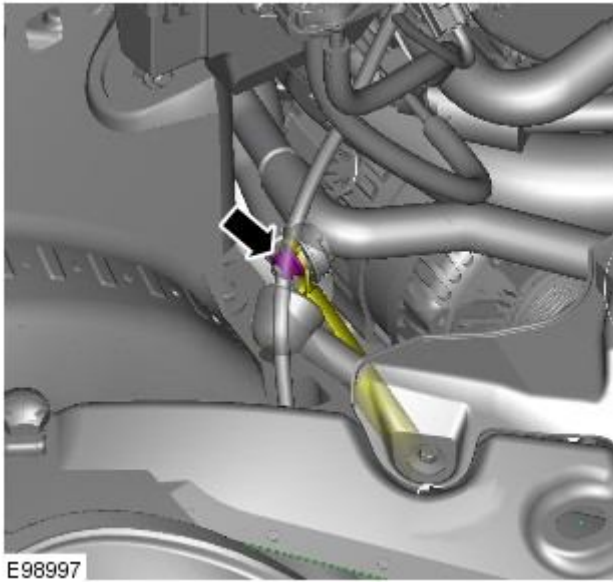
7. Connect the engine earth strap.

- Tighten to 25 Nm.

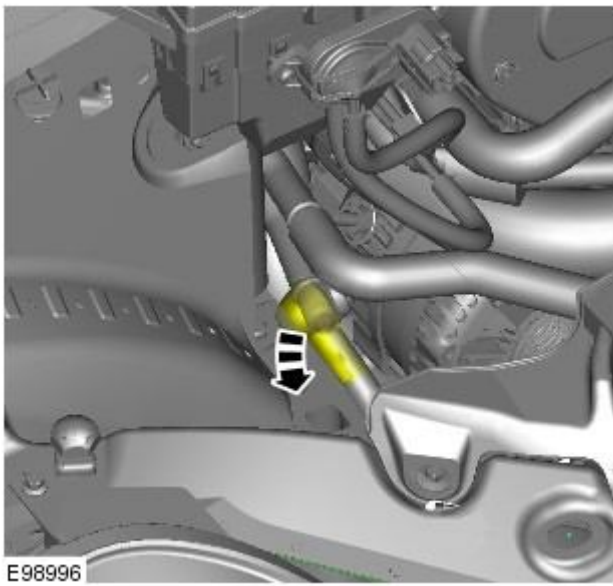


8. Connect the battery positive cable to the generator.

- Tighten to 15 Nm.

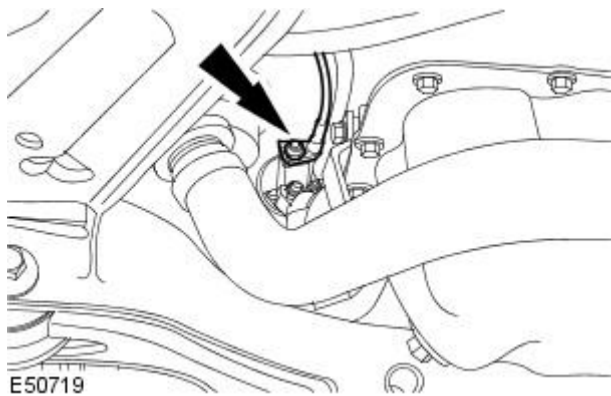


9. Attach the battery positive cable protective cover.



10. Attach the starter motor cable.

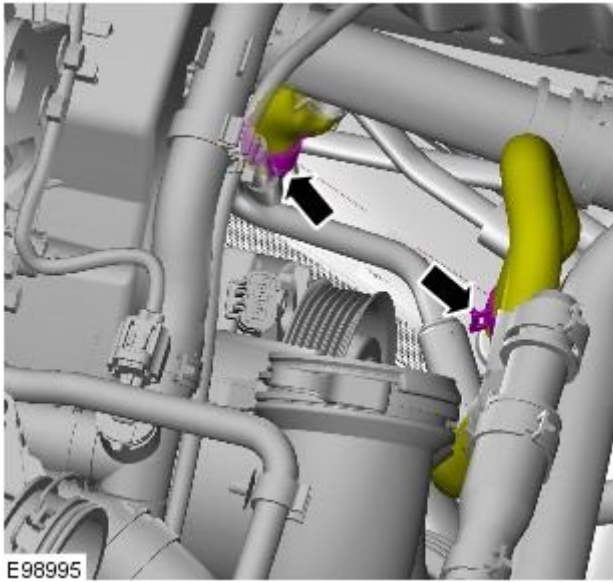
- Tighten to 10 Nm.



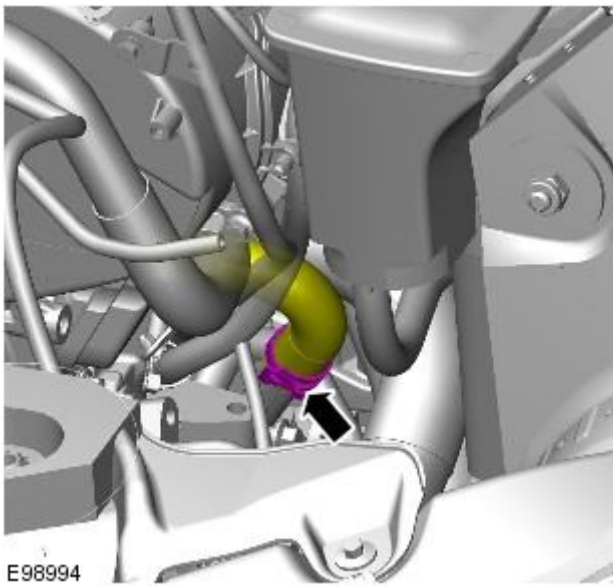
11. Lower the vehicle.



12. Connect the 2 coolant hoses to the transmission fluid cooler.

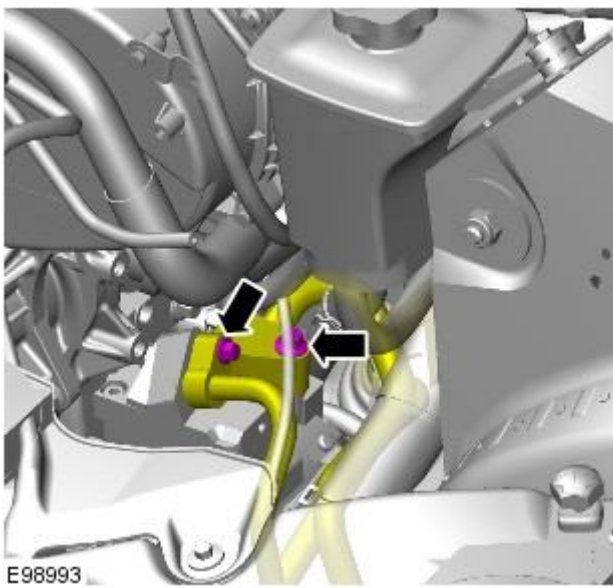


13. Connect the coolant hose.



14. Connect the A/C lines.

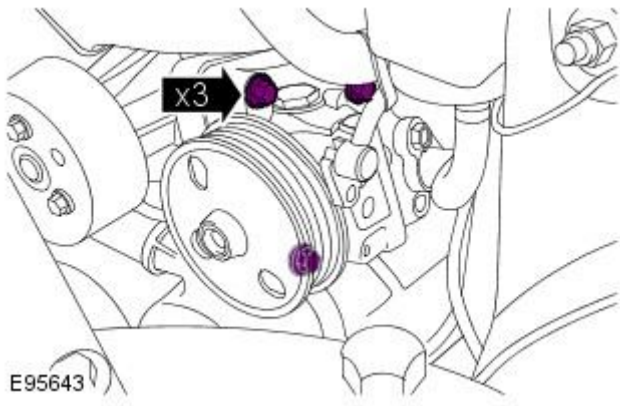
- Remove the blanking plugs.
- Install new O-ring seals.
- Tighten to 10 Nm.



**15. NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

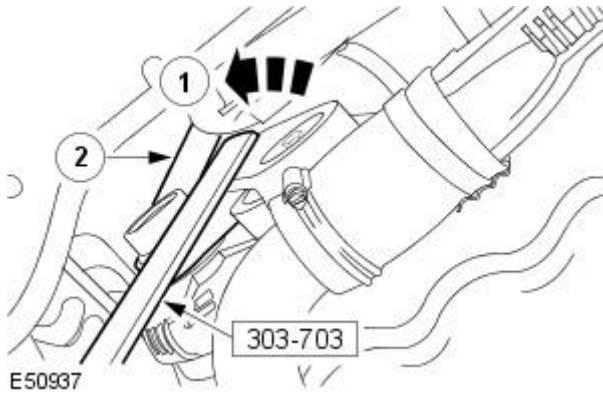
Attach the power steering pump.

- Tighten to 25 Nm.



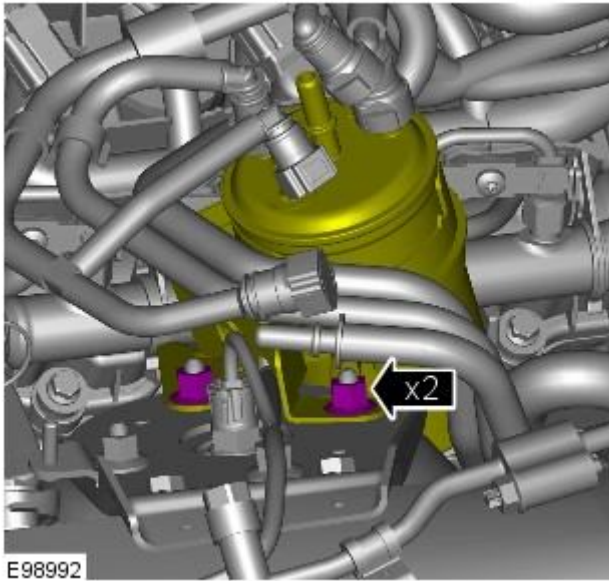
**16.** Attach the accessory drive belt.

- Using the special tool, rotate the accessory drive belt tensioner counter-clockwise.



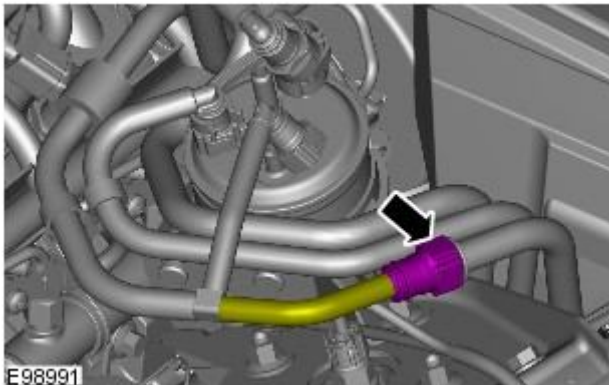
**17.** Install the fuel filter support bracket.

- Tighten to 25 Nm.



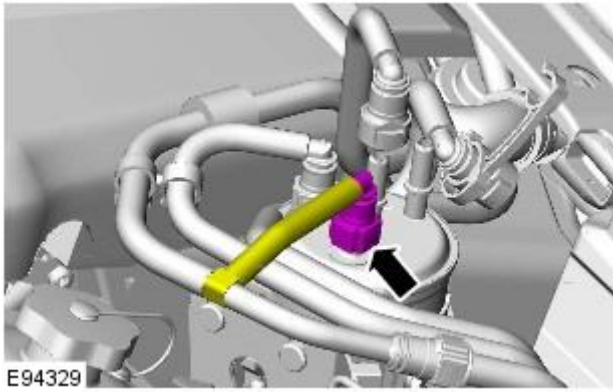
**18. NOTE:** Remove and discard the blanking caps.

Connect the fuel line.



**19. NOTE:** Remove and discard the blanking caps.

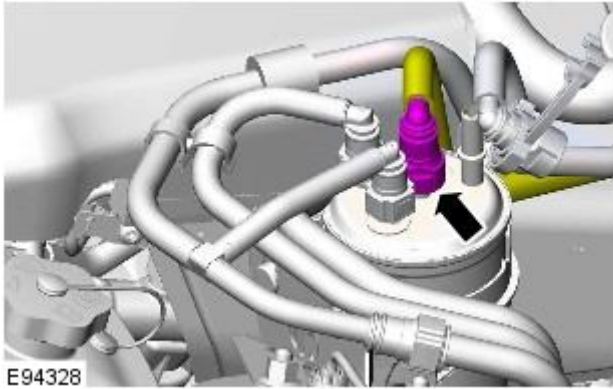
Connect the high-pressure fuel pump return line to the fuel filter.



E94329

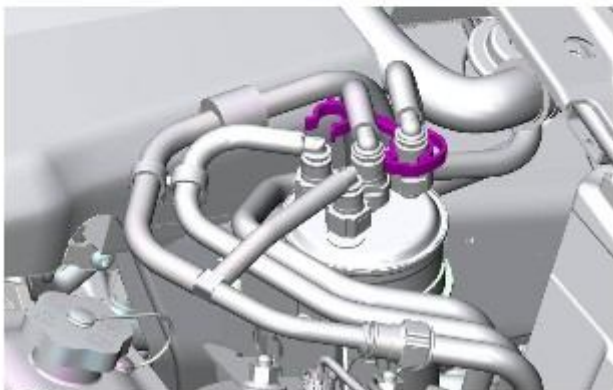
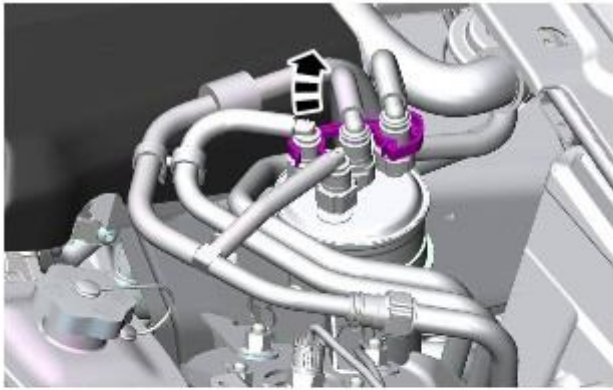
**20. NOTE:** Remove and discard the blanking caps.

Connect the high pressure fuel pump supply line to the fuel filter.



E94328

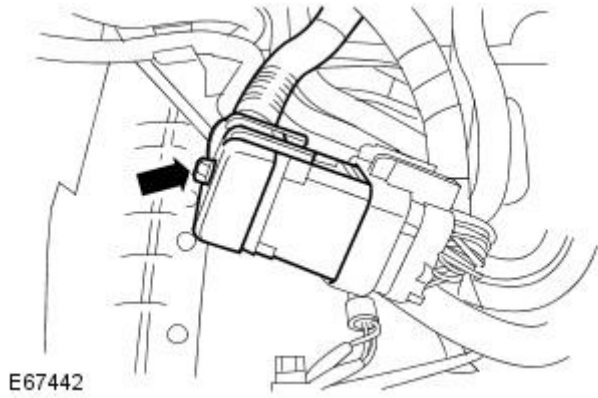
**21.** Attach the fuel line safety clip.



E94326

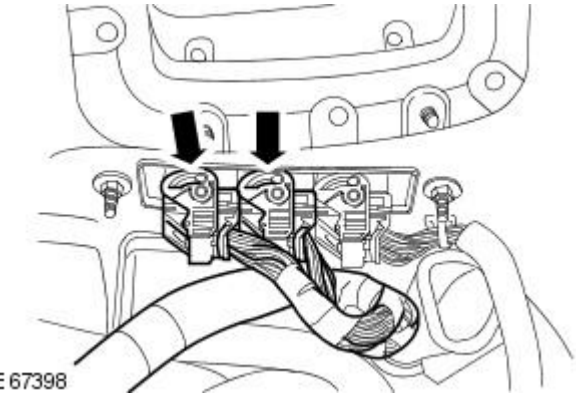
22. Connect the engine wiring harness electrical connector.

- Tighten to 10 Nm.



E67442

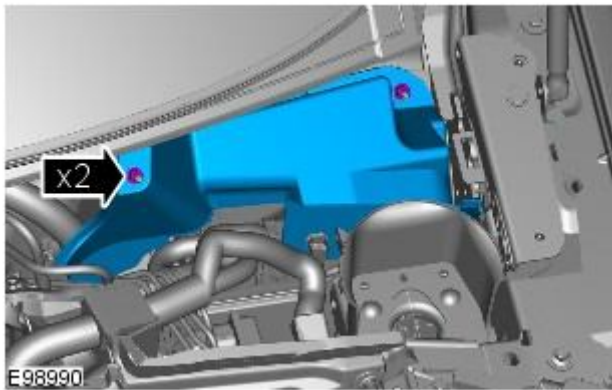
23. Connect the ECM electrical connectors.



E 67398

24. Install the ECM cover.

- Tighten to 10 Nm.

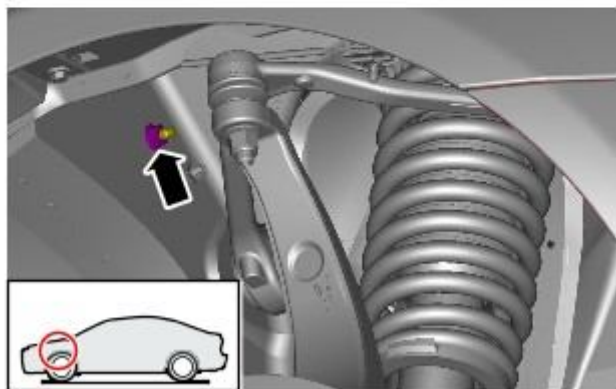
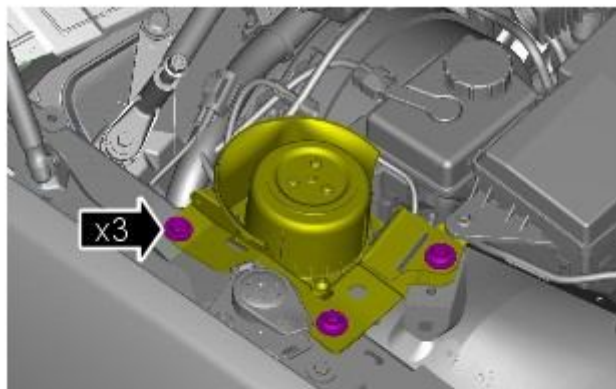


E98990



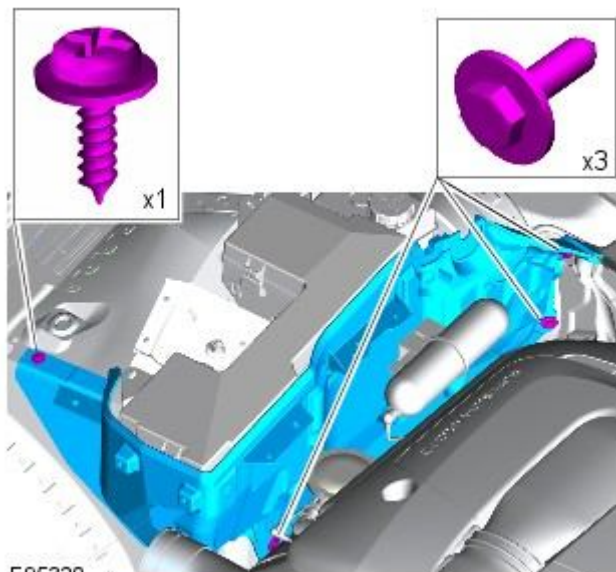
25. Install the RH pedestrian protection actuator and bracket.

- Tighten to 25 Nm.



E98989

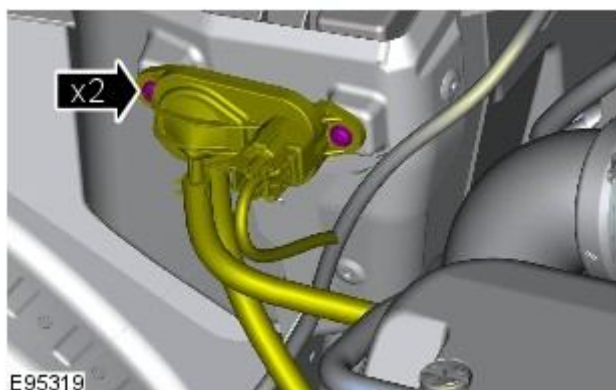
26. Install the RH secondary bulkhead panel.



E95320

27. Attach the DPF differential pressure sensor.

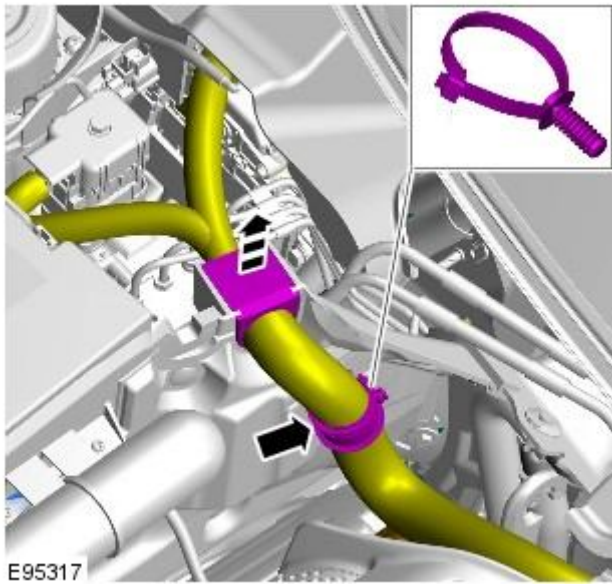
- Tighten to 2 Nm.



E95319

Left-hand drive vehicles

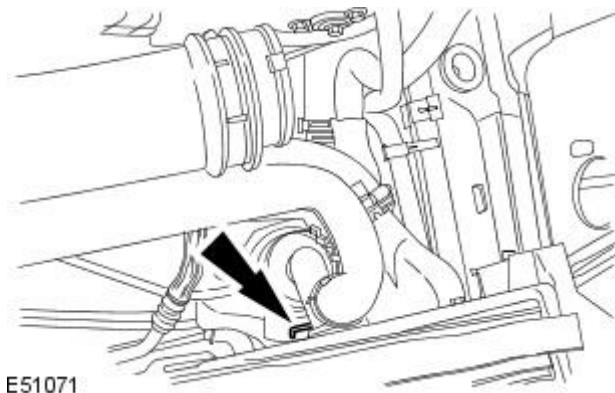
28. Attach the wiring harness.



All vehicles

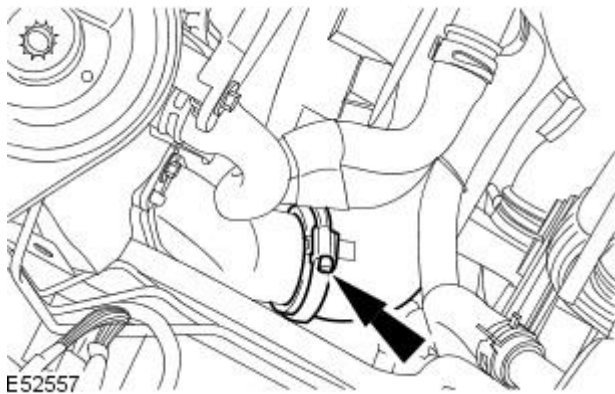
29. Connect the thermostat housing to the radiator.

- Attach the retaining clip.

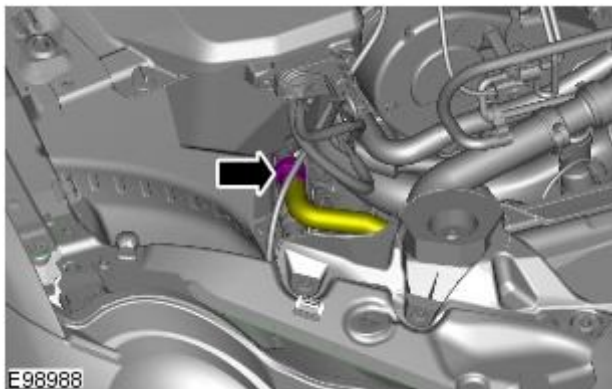


30. Connect the charge air cooler inlet hose.

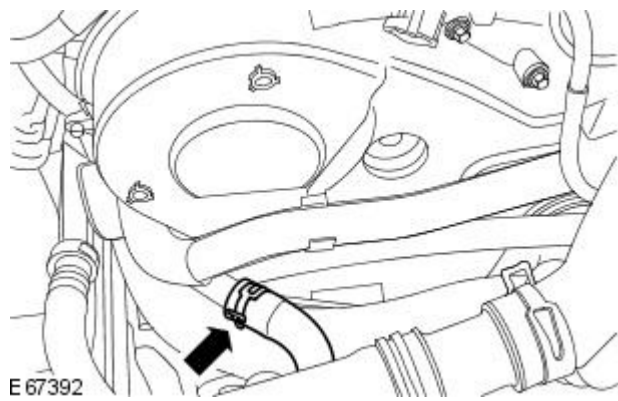
- Tighten to 5 Nm.



31. Connect the coolant hose.

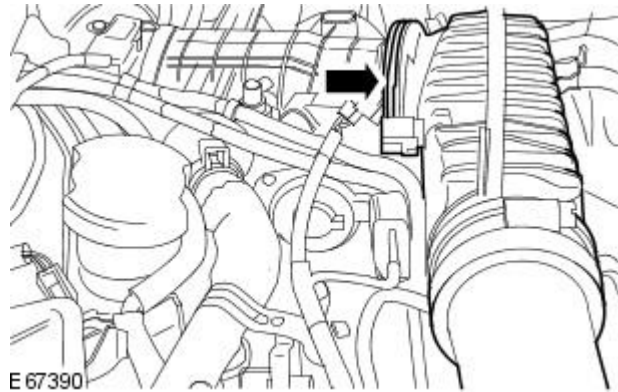


32. Connect the RH EGR coolant hose.

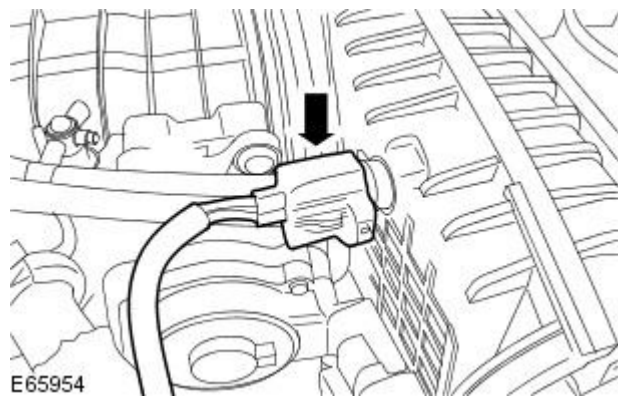


33. Install the intake air shutoff throttle elbow.

- Install a new O-ring seal.

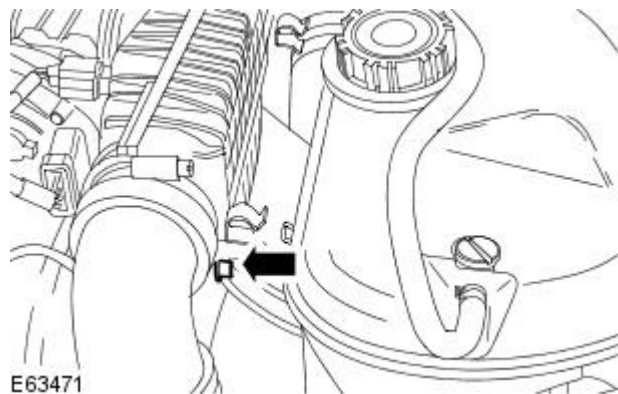


34. Connect the intake air temperature (IAT) sensor electrical connector.

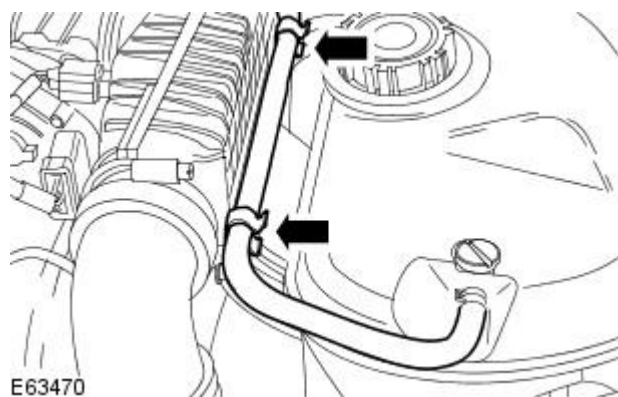


35. Install the intake air shutoff throttle elbow retaining bolt.

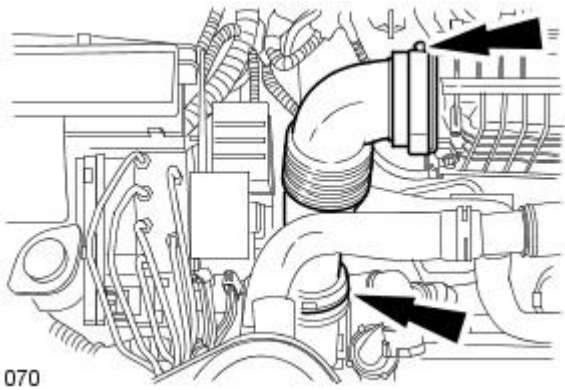
- Tighten to 10 Nm.



36. Attach the coolant expansion tank coolant hose to the intake air shutoff throttle elbow.



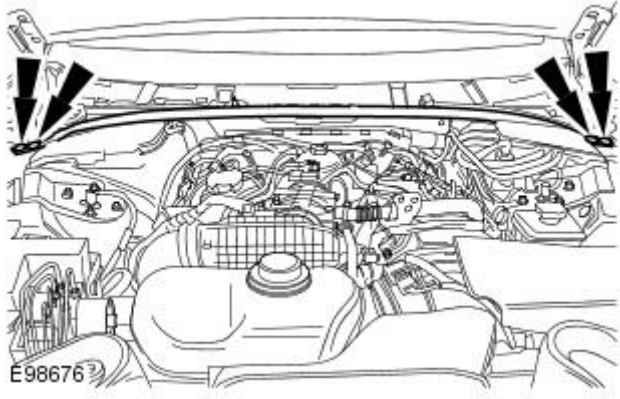




37. Connect the air intake hose.

- Tighten to 5 Nm.

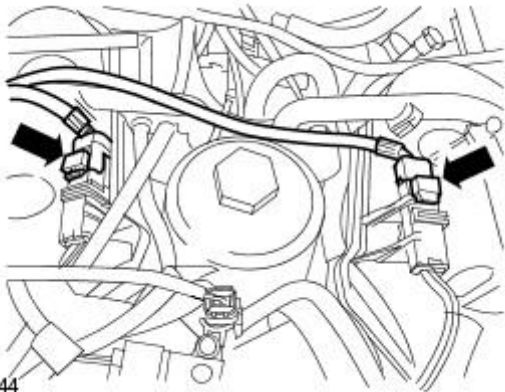
E51070



38. Install the engine compartment brace.

- Tighten to 25 Nm.

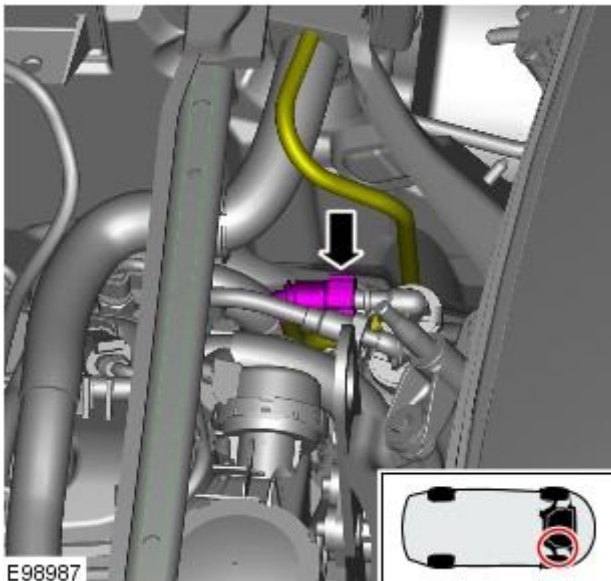
E98676



39. Connect the glow plug harness electrical connectors.

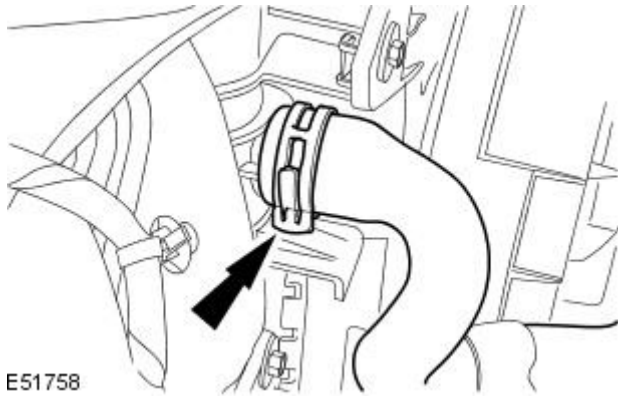
E67444

40. Connect the brake booster vacuum pipe.

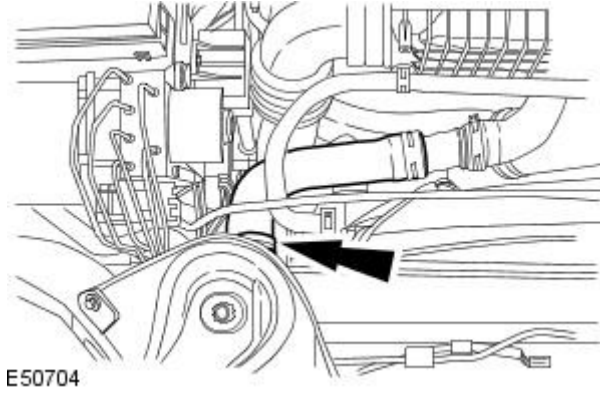


E98987

41. Connect the coolant hose to the radiator.



42. Connect the coolant top hose.



43. Install the injector sound proofing.

44. Install the transmission.

For additional information, refer to: [Transmission - TDV6 2.7L Diesel](#) (307-01 Automatic Transmission/Transaxle - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel, Removal).

45. Install the cooling fan motor and shroud.

For additional information, refer to: [Cooling Fan Motor and Shroud](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation).

46. Charge the A/C refrigerant.

47. Refill and bleed the cooling system.

For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).

48. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

49. Check and top-up the engine oil.

**Engine - V6 3.0L Petrol -****Lubricants, Fluids, Sealers and Adhesives**

Description	Specification
Engine oil, SAE 5W-30 (ROW)	API SJ / EC and ACEA A1 or A3 Jaguar WSS-M2C913-B preferred
Engine oil, SAE 5W-30 (NAS)	API SL and ILSAC GF-4
Engine assembly lubricant	WSP-M2C197-A
Sealant	WSS-M4G320-A4
Hose assembly surfactant	ESE-M99 B144-B

**Engine Firing Order**

Firing Order
1:2:3:4:5:6

**Engine Valve Clearance (cold)**

Intake Valve	Exhaust Valve
0.200 mm ± 0.025	0.350 mm ± 0.025

**Capacities**

Description	Liters
Engine oil, initial fill	7.0
Engine oil, service fill with oil filter change	6.5

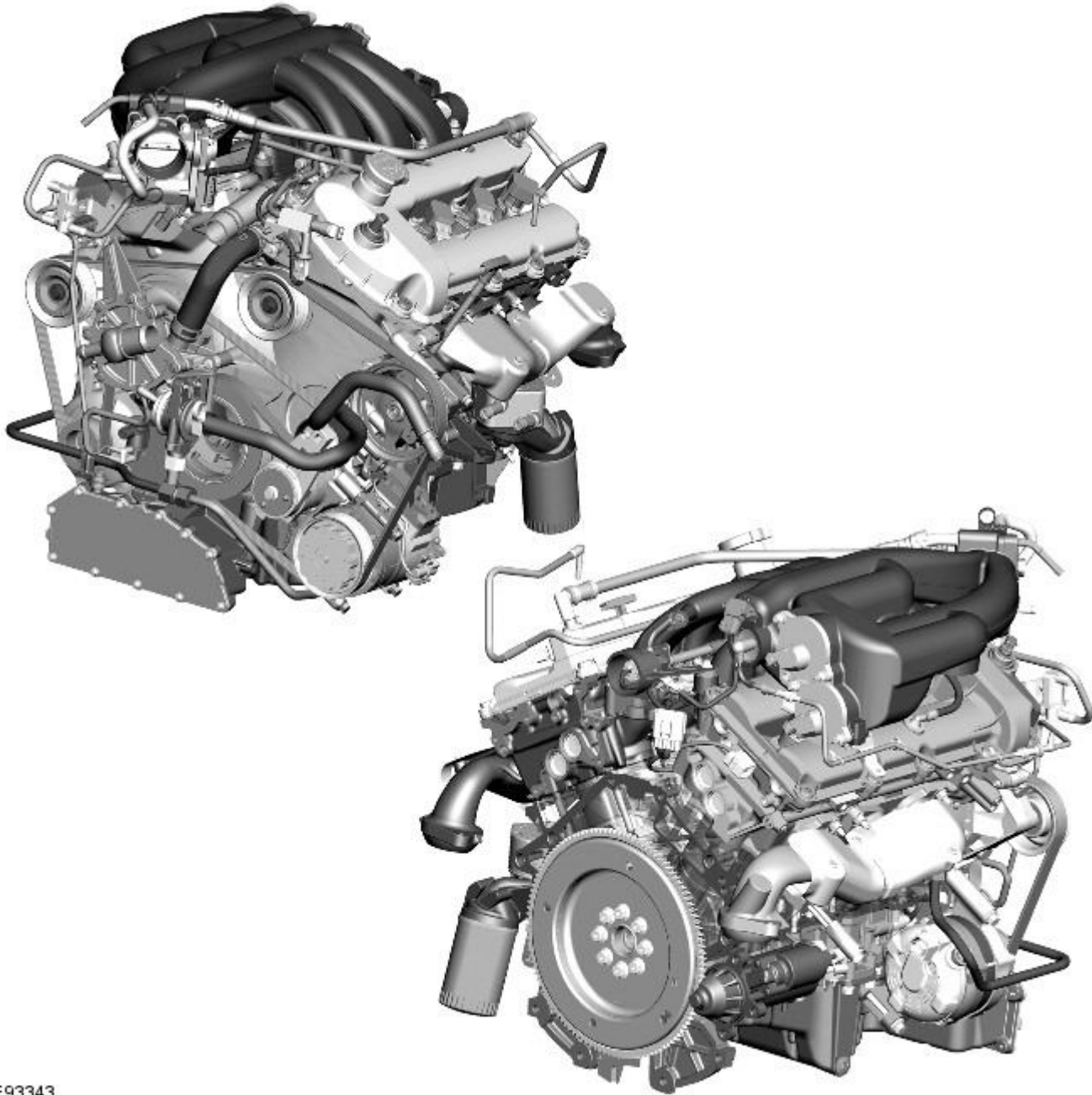
**Torque Specifications**

Description	Nm	lb-ft	lb-in
Accessory drive belt idler pulley retaining bolt	25	18	-
Accessory drive belt tensioner retaining bolt	48	35	-
A/C compressor retaining bolts	25	18	-
A/C compressor mounting bracket retaining bolts	25	18	-
A/C manifold retaining bolt	9	-	80
Camshaft bearing caps retaining bolts	A	-	-
Camshaft position sensor retaining bolt	7	-	62
Connecting rod cap retaining bolts	<ul style="list-style-type: none"> <li>● Stage 1: 23</li> <li>● Stage 2: 43</li> <li>● Stage 3: 100°</li> </ul>	-	-
Coolant by-pass tube to cylinder head retaining bolts	10	7	-
Crankshaft position sensor retaining bolt	10	7	-
Crankshaft pulley retaining bolt	A	-	-
Cylinder head retaining bolts	A	-	-
Engine ground strap retaining bolt	10	7	-
Engine front cover retaining bolts	A	-	-
Engine mounting bracket retaining bolts	90	66	-
Engine mount bracket to engine mount retaining nuts	48	35	-
Engine mount retaining bolts to crossmember retaining nuts	63	46	-
Engine mount/oil filter housing retaining bolts	A	-	-
Engine wiring harness retaining bracket	7	-	62
Exhaust manifold heat shield retaining bolts	10	7	-
Exhaust manifold retaining studs	9	-	80
Exhaust manifold retaining nuts	A	-	-
Flexplate retaining bolts	80	59	-
Generator retaining bolts	48	35	-
Ignition coils retaining bolts	7	-	62
Knock sensor retaining bolts	25	18	-
Lower cylinder block retaining bolts	A	-	-
Lower intake manifold retaining bolts	A	-	-
Oil level indicator tube retaining bolt	10	7	-
Oil pan retaining bolts	A	-	-
Oil pan drain plug	24	18	-
Oil pressure sensor	16	12	-
Oil pump to engine block retaining bolts	10	7	-
Oil separator blanking plate	10	7	-
Oil temperature sensor	14	10	-
Power steering pump retaining bolts	25	18	-
Spark plugs	15	11	-
Timing chain guide retaining bolts	A	-	-
Timing chain tensioner retaining bolts	25	18	-
Upper intake manifold retaining bolts	A	-	-
Upper intake manifold support retaining bolts	10	7	-
Variable camshaft timing oil control unit retaining bolt	40 + 90°	30 + 90°	-
Valve cover studs and retaining bolts	A	-	-
Water pump retaining bolts	25	18	-
Wiring harness to valve cover retaining nuts	10	7	-
A = refer to the procedure for correct torque sequence	-	-	-

# Engine - V6 3.0L Petrol - Engine - Component Location

Description and Operation

External View



E93343

# Engine - V6 3.0L Petrol - Engine - Overview

Description and Operation

## Overview

The 3.0 V6 engine is a liquid cooled 6 cylinder unit, arranged in 2 planes having a 60 degree 'V' configuration. It features a strong, forged steel crankshaft having 3 throws and 4 main bearings.

The lightweight aluminum cylinder block is equipped with steel dry liners and provides 4 main bearings. These are supported by an aluminum structural bedplate with cast iron inserts. This design increases the torsional stiffness of the crankcase/bed-plate assembly and minimizes vibration levels. A die-cast aluminum oil pan is bolted to the bed-plate and adds further stiffness.

The 4 cast iron camshafts, 2 per cylinder head, are chain-driven and operate a total of 24 valves (4 valves per cylinder). All valves are directly activated via mechanical bucket tappets and the inlet camshaft features continuously [VCT \(variable camshaft timing\)](#).

The continuously [VCT](#) adjusts the timing of the inlet camshafts. This ensures maximum performance throughout the speed range and for all engine demands. The system is controlled by the engine management system.

# Engine - V6 3.0L Petrol - Engine - System Operation and Component Description

Description and Operation

## System Operation

Operation of the engine is controlled by the [ECM \(engine control module\)](#).

Refer to: [Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 3.0L Petrol, Description and Operation).

## Component Description

### General

The engine includes the following features:

- 10.5 : 1 compression ratio.
- Lightweight valve gear.
- Unique camshaft lift and duration.

The engine has an aluminum cylinder block with dry steel liners. A forged steel, three-throw crankshaft is carried in four main bearings supported by an aluminum structural bedplate with cast iron inserts. This design increases the engine's torsional stiffness and minimizes vibration levels. Torsional stiffness is further increased by a die-cast aluminum oil pan bolted to the bedplate.

Four chain-driven cast iron camshafts, two per cylinder head, operate four valves per cylinder. All valves are directly activated via mechanical bucket tappets, and the intake camshafts feature [VCT \(variable camshaft timing\)](#). The [RH \(right-hand\)](#) cylinder bank (bank 1) contains the odd numbered cylinders, with cylinder No. 1 towards the front of the vehicle. The [LH \(left-hand\)](#) cylinder bank (bank 2) contains the even numbered cylinders, with cylinder No. 2 towards the front of the vehicle.

### Variable Camshaft Timing

Oil is supplied to the front of each [VCT](#) actuator via the spider bracket assembly, which contains the [VCT](#) actuator solenoid, supply oil galleries and timing chain guide. Oil pressure advances and retards the camshaft timing which is controlled by the engine management system via a solenoid valve mounted on top of the oil feed spider assembly. Camshaft timing, dependant on engine speed, load and oil temperature can be optimised over the adjustment range of 30 degrees.

### Engine Lubrication System

The engine lubrication system is of the force-feed type in which oil is supplied under pressure to the:

- Crankshaft main bearings.
- Crankshaft thrust main bearing.
- Connecting rod bearings.
- Valve shims.
- Camshaft bearings.
- [VCT](#).

All other parts are lubricated by splashed oil.

The oil is pressurized by a rotary pump installed at the front of the engine block and driven by the crankshaft.

A full flow oil filter is externally mounted on the oil filter housing. If the filter element should become blocked, a spring-loaded bypass valve will open and allow an uninterrupted flow of oil to the engine.

## Engine - V6 3.0L Petrol - Engine

Diagnosis and Testing


For additional information.


REFER to: [Engine - V8 4.2L Petrol/V8 S/C 4.2L Petrol/3.0L NA V6 - AJ27](#) (303-00 Engine System - General Information, Diagnosis and Testing).




# Engine - V6 3.0L Petrol - Engine Oil Draining and Filling


General Procedures

Special Tool(s)	
 <p>303-752</p> <p>E75849</p>	<p>Wrench, Oil filter</p> <p>303-752</p>

 **WARNING:** The spilling of hot engine oil is unavoidable during this procedure, care must be taken to prevent scalding.

 **CAUTION:** Correct installation of the oil filler cap can be obtained by tightening the cap until an audible click is heard.

• **NOTE:** Clean the components general area prior to dismantling.

 **1. WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

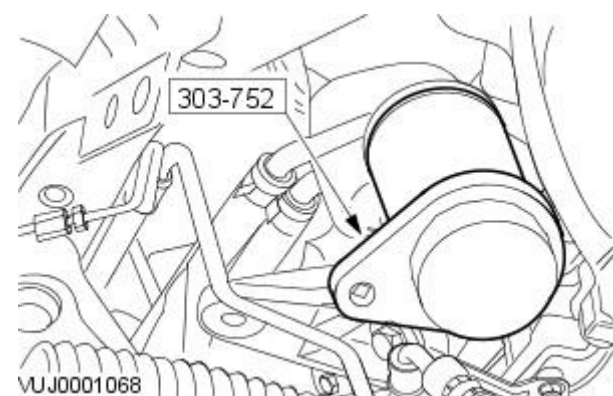
**2.** Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).

**3.** Remove the oil pan drain plug.

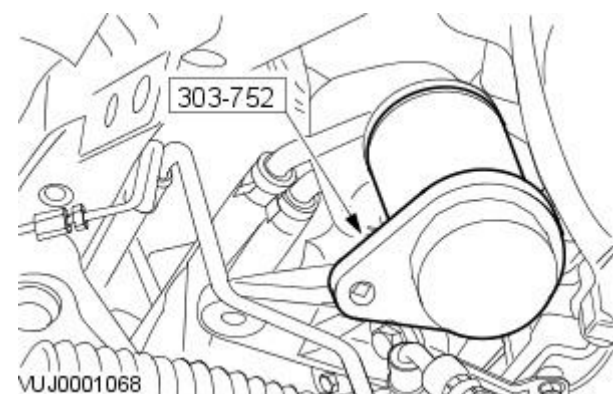
- Position a container to collect the fluid.
- Discard the oil pan drain plug seal.

**4.** Using the special tool, remove the oil filter.

- Position a container to collect the fluid.
- Discard the oil filter.



**5.** Using the special tool, install the oil filter.



**6.** Tighten the drain plug to 25 Nm.

- Install a new seal.

**7.** Fill the engine with oil.

**8.** Start engine and run at idle speed until the oil pressure warning light extinguishes.

- Stop the engine.
- Check for leaks.

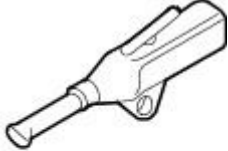

**9.** Install the air deflector.

For additional information, refer to: Air Deflector (501-02, Removal and Installation).

**10.** Check and top-up the engine oil.


# Engine - V6 3.0L Petrol - Valve Clearance Adjustment


General Procedures

Special Tool(s)	
 <p>DWST074</p>	<p>Fan nozzle - air gun</p> <p>303-590</p>
 <p>E99146</p>	<p>Tappet hold-down tool</p> <p>303-717</p>

- Remove the LH valve cover.  
For additional information, refer to: [Valve Cover LH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).
- Remove the RH valve cover.  
For additional information, refer to: [Valve Cover RH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).

### 3. CAUTIONS:

 Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.

 Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

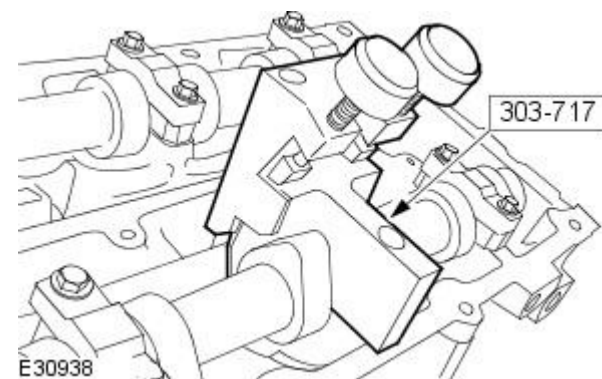
Rotate the engine clockwise to position the camshaft lobe away from the shim surface.


- Using the feeler gauge set, measure the clearance between the camshaft and the shim surface. Record and check the readings.
- Repeat the above procedure for the remaining valves.


- Remove the camshaft bearing cap.


- Install the special tool.


- Make sure the legs of the tool are in contact with the edge of the valve bucket, compress the bucket.



- Use the following formula to calculate the required shim thickness.  
**6.  WARNING: The following operations require the use of compressed air. ~~Original shim thickness~~ + measured clearance - desired clearance = required shim thickness.**

 **CAUTION:** Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.

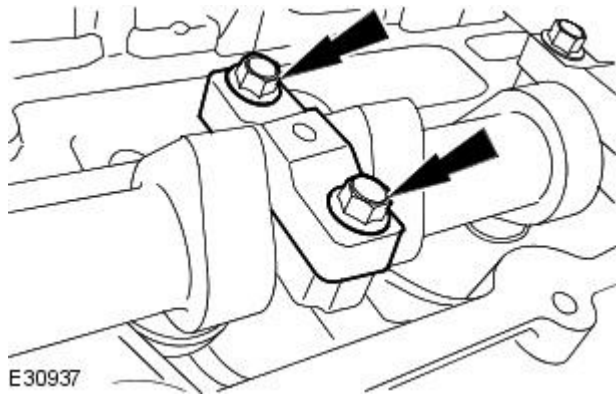
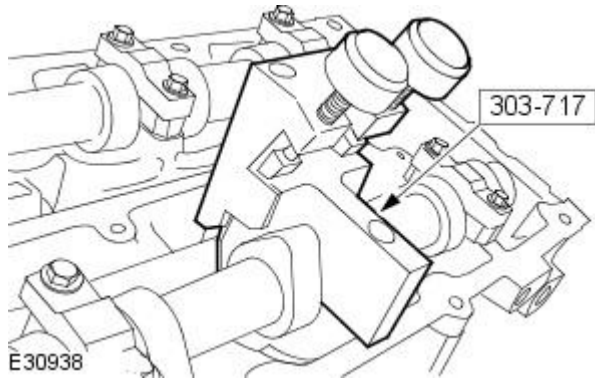
 compressed air to remove the shims that require replacing. Shims must be fitted with the size markings facing the tappet, not the camshaft. Surround the immediate working area with a cloth, to retain any loose shims displaced by the compressed air.

 Do not use the special tool 303-590 aimed at the edge of the shim, to lift it from the tappet. Note the position of each one. Instructions may result in damage to the vehicle.

- Remove the old shim and measure the shim.

- Apply a light coat of clean engine oil to the replacement valve shims.

9. Remove the special tool.



10. Install the camshaft bearing caps in their original position.


- Lubricate the journals and camshaft lobes with clean engine oil.
- Install the cap.
- Install the camshaft bearing cap retaining bolts evenly.
- Tighten to 10 Nm.


11. If necessary, repeat the above adjustment procedure.


- Check the valve tappet clearances are correct.
- Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.
- Adjust the clearances as necessary.

12.  **WARNING:** The following operations require the use of compressed air. Always wear suitable eye protection.

• CAUTIONS:

 Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.

 Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

 Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.

Repeat the above procedure for the remaining valves.

13. Install the right-hand valve cover.

For additional information, refer to: [Valve Cover RH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).

14. Install the left-hand valve cover.


For additional information, refer to: [Valve Cover LH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).


# Engine - V6 3.0L Petrol - Valve Clearance Check

General Procedures

1. Remove the LH valve cover.  
For additional information, refer to: [Valve Cover LH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).
2. Remove the RH valve cover.  
For additional information, refer to: [Valve Cover RH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).

### 3. CAUTIONS:

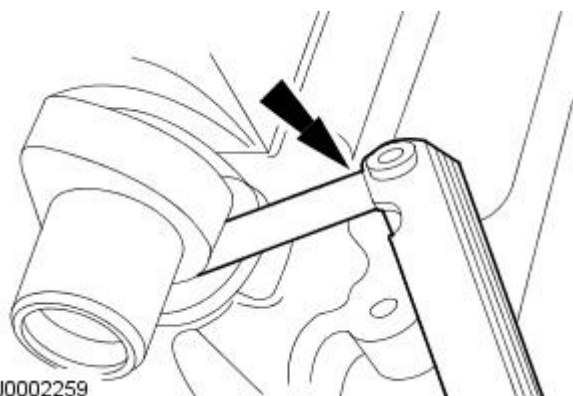
 Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.

 Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

Rotate the engine clockwise to position the camshaft lobe away from the shim surface.

- Using the feeler gauge set, measure the clearance between the camshaft and the shim surface. Record and check the readings.
- Repeat the above procedure for the remaining valves.

4. Adjust the clearances as necessary.  
For additional information, refer to: [Valve Clearance Adjustment](#) (303-01B Engine - V6 3.0L Petrol, General Procedures).
5. Install the right-hand valve cover.  
For additional information, refer to: [Valve Cover RH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).
6. Install the left-hand valve cover.  
For additional information, refer to: [Valve Cover LH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).




VUJ0002259

# Engine - V6 3.0L Petrol - Camshafts LH

In-vehicle Repair

## Removal

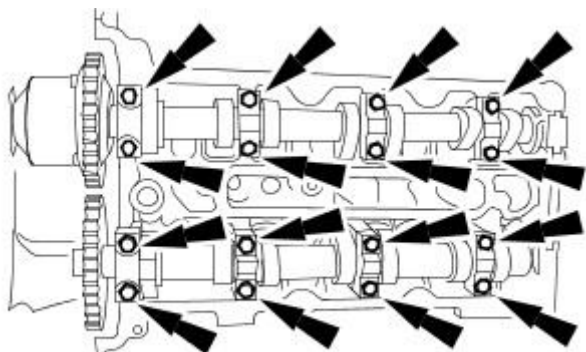
-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

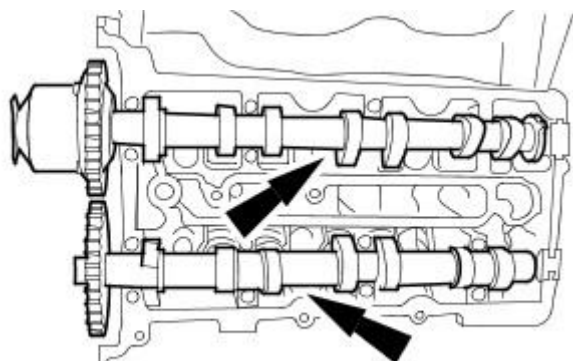
- Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
- Remove the timing drive components.  
For additional information, refer to: [Timing Drive Components](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).

-  **CAUTION:** Note the fitted position of the component prior to removal.

Remove the camshaft bearing caps evenly.



VUJ0003766




VUJ0003767

-  **CAUTION:** Note the fitted position of the component prior to removal.

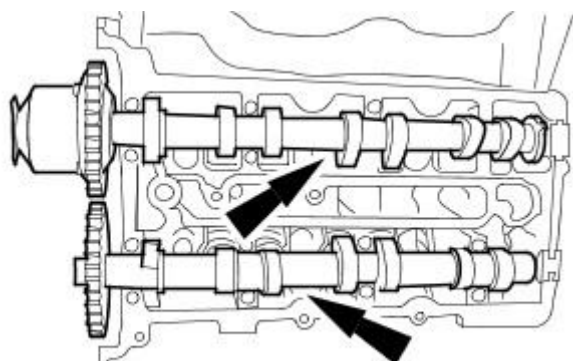
Remove the camshafts.

## Installation

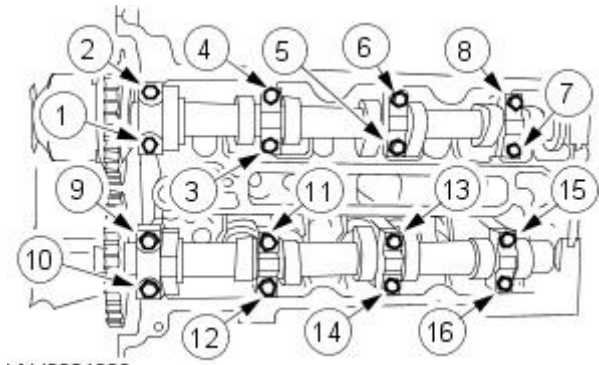
-  **CAUTION:** Make sure that these components are installed to the noted removal position.

- NOTE:** Lubricate the camshafts and the camshaft bearing caps with oil meeting Jaguar specification prior to installation.

Install the camshafts.



VUJ0003767



VUJ0004303

## 2. CAUTIONS:



Do not install the cylinder head camshaft journal thrust caps until the camshaft journal caps are installed or damage to the thrust caps may occur.



Make sure that these components are installed to the noted removal position.

Install the camshaft bearing caps in their original position.

- Install the camshaft bearing cap retaining bolts evenly.
- Tighten the retaining bolts in the sequence shown to 10 Nm.

### 3. Carry out a valve clearance check.

For additional information, refer to: [Valve Clearance Check](#) (303-01B Engine - V6 3.0L Petrol, General Procedures).

### 4. Install the timing drive components.

For additional information, refer to: [Timing Drive Components](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).

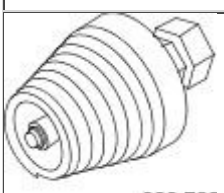
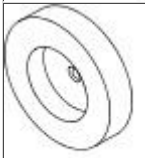
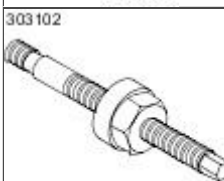
### 5. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).



# Engine - V6 3.0L Petrol - Crankshaft Front Seal

In-vehicle Repair

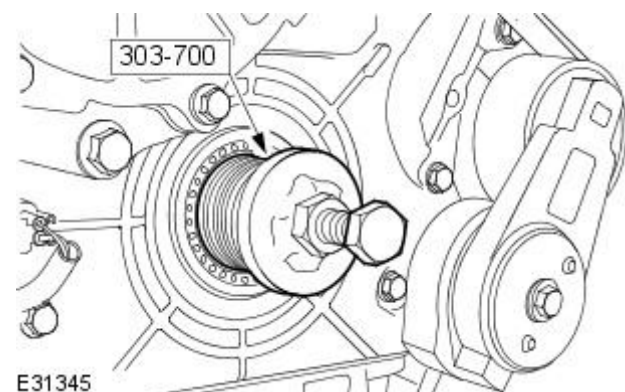
Special Tool(s)	
 303-700	Crankshaft Front Seal Remover 303-700
 303-542	Crankshaft Front Seal Installer 303-542
 303102	Crankshaft Pulley Installer 303-102

## Removal

1. Raise and support the vehicle.
2. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
3. Remove the crankshaft pulley.  
For additional information, refer to: [Crankshaft Pulley](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).

4.  **CAUTION:** Avoid scratching or damaging the oil seal sealing surfaces on the crankshaft and cylinder block.

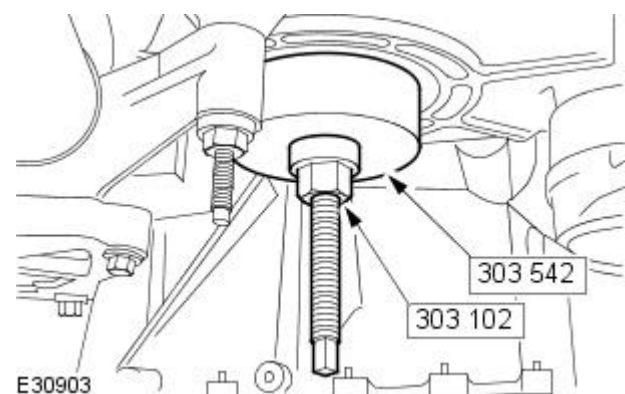
Using the special tool, remove and discard the crankshaft front seal.



## Installation

1. Using the special tools, install the crankshaft front seal.

- Lubricate the seal with clean engine oil.
- Install the crankshaft front oil seal between flush and 1.0 mm underflush with the cylinder block.

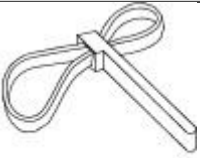

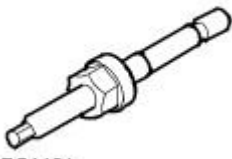
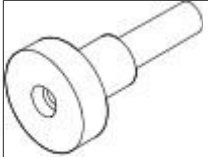



2. Install the crankshaft pulley.  
For additional information, refer to: [Crankshaft Pulley](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).
3. Connect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).




**Engine - V6 3.0L Petrol - Crankshaft Pulley**

In-vehicle Repair

<b>Special Tool(s)</b>	
 303D055	Wrench strap-universal 303-D055
 E64849	General purpose puller 303-D121
 E54431	Installer - crankshaft damper pulley 303-102
 303D12101	Thrust Pad 303-D121-01
 303-335/2	Crankshaft Pulley Installer 303-335/2

**Removal**

All vehicles

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.


- Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
- Drain the cooling system.  
For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 3.0L Petrol, General Procedures).

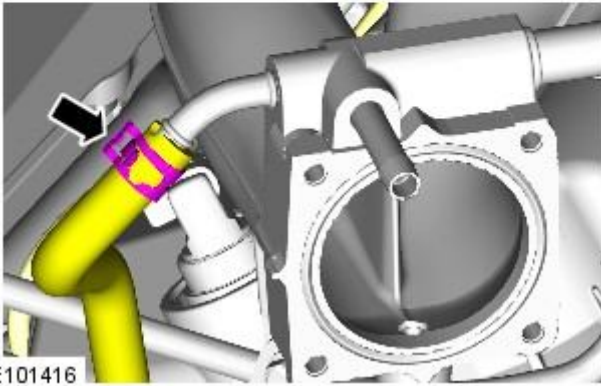
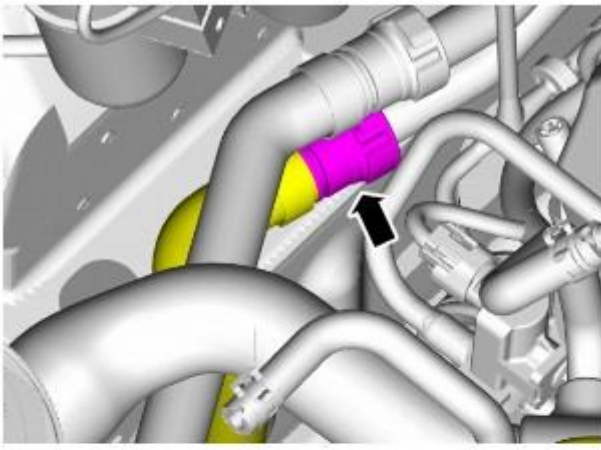
Vehicles with secondary air injection (AIR)

- Remove the secondary air injection (AIR) control valve.  
For additional information, refer to: [Secondary Air Injection \(AIR\) Control Valve](#) (303-08B Engine Emission Control - V6 3.0L Petrol, Removal and Installation).

All vehicles

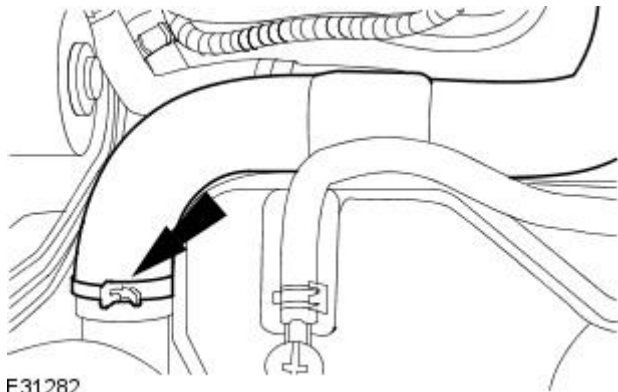
- Remove the throttle body.  
For additional information, refer to: [Throttle Body](#) (303-04C Fuel Charging and Controls - V6 3.0L Petrol, Removal and Installation).

6.  CAUTION: Be prepared to collect escaping coolant.  
Disconnect the coolant hoses.



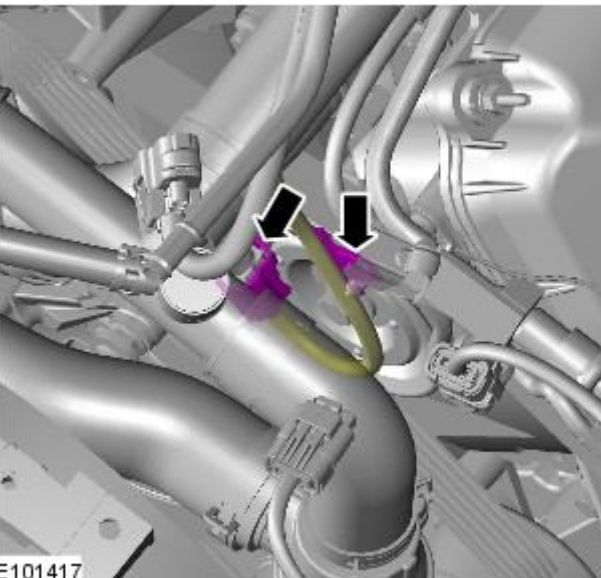
E101416

7. Disconnect the radiator upper hose.



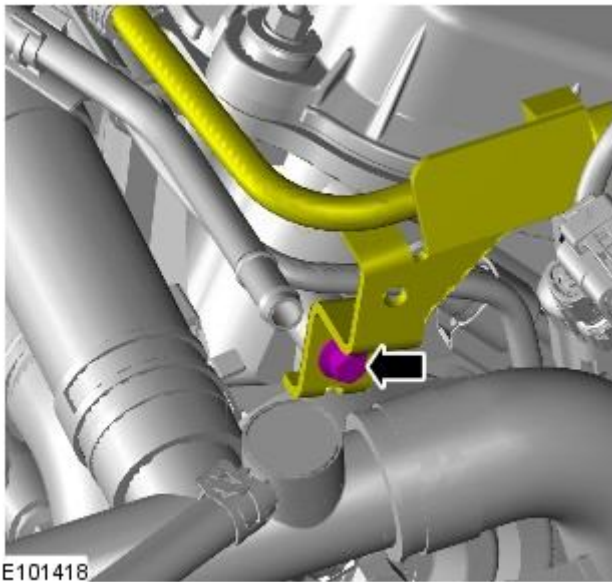
E31282


8. Disconnect the ECT sensor electrical connector.
- Release the retaining clip.

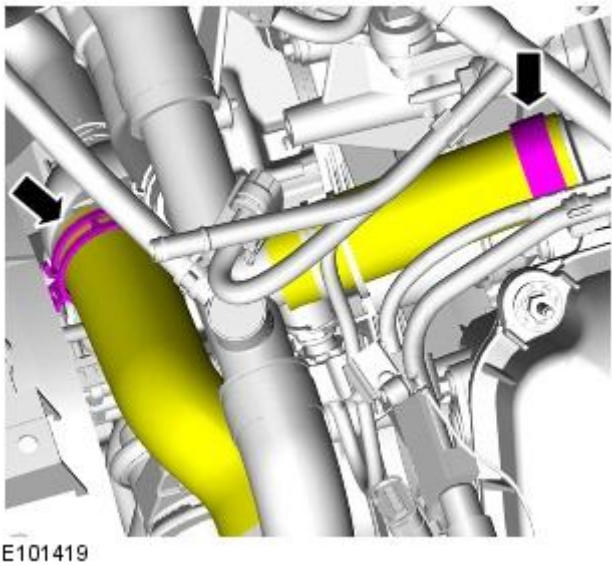



E101417

9. Remove the fuel line securing bracket retaining bolt.

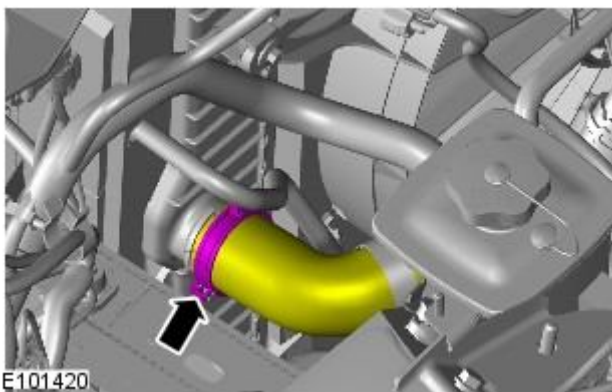


10.  CAUTION: Be prepared to collect escaping coolant.  
Disconnect the 2 coolant hoses.

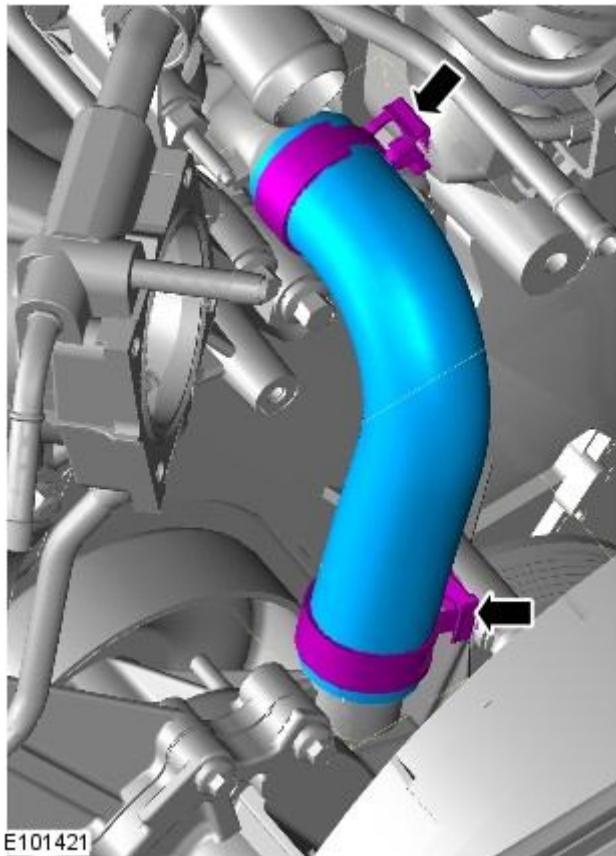


11.  CAUTION: Be prepared to collect escaping coolant.  
Disconnect the radiator lower hose.


- Position the coolant hoses aside for access.

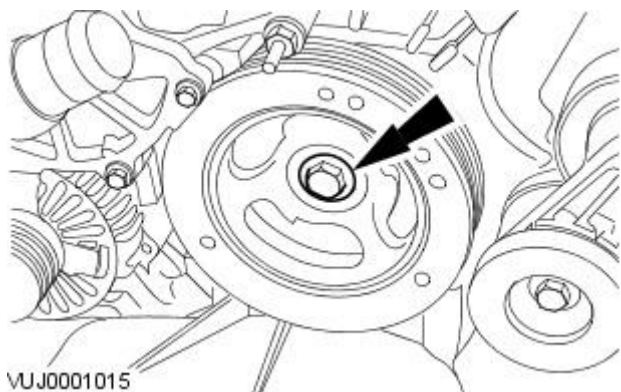


12. Remove the accessory drive pulley.  
For additional information, refer to: [Accessory Drive Belt Idler Pulley](#)  
(303-05B Accessory Drive - V6 3.0L Petrol, Removal and Installation).



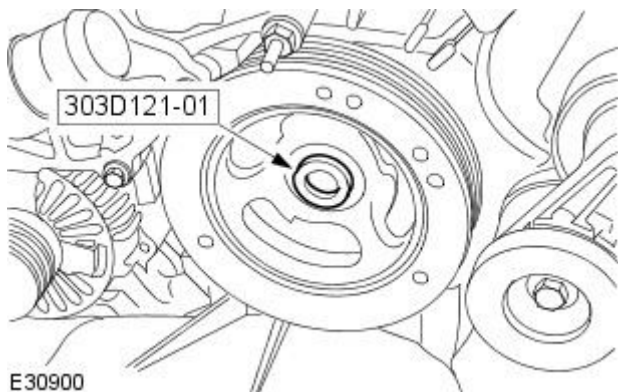
E101421

13.  CAUTION: Be prepared to collect escaping coolant.  
Disconnect and remove the coolant hose.



VUJ0001015

14. Install the special tool.  
15. NOTE: This step requires the aid of another technician.  
Remove the crankshaft pulley retaining bolt.

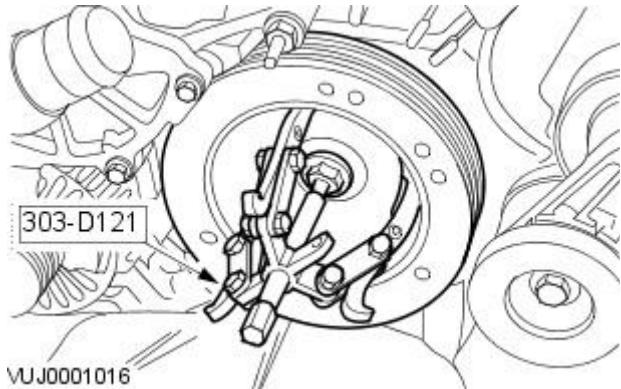


E30900

16. Install the special tool.



17. Using the special tools, remove the crankshaft pulley.

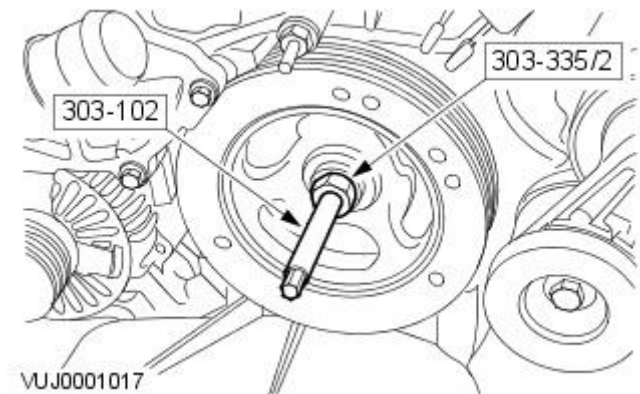


## Installation

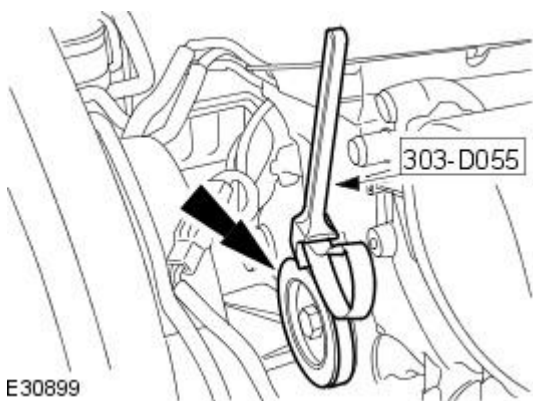
All vehicles

1. Using the special tools, install the crankshaft pulley.

- Coat the crankshaft pulley keyway with silicone gasket sealant meeting Jaguar specification.



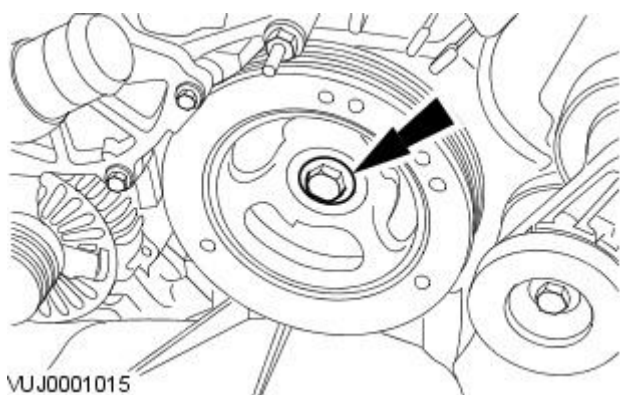
2. Install the special tool.



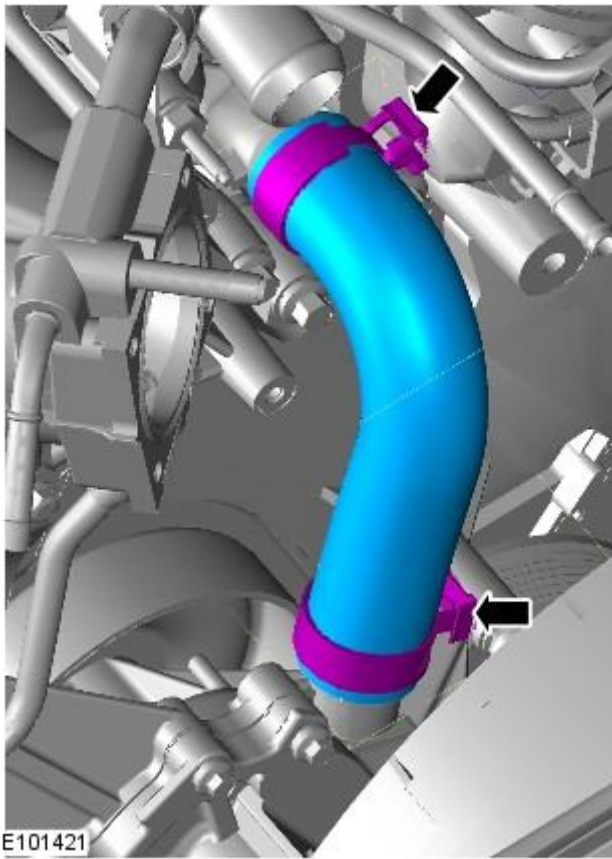
3. NOTE: This step requires the aid of another technician.

Install the crankshaft pulley bolt.

- Tighten to 120 Nm.
- Loosen the bolt (minimum 1 turn).
- Tighten to 50 Nm.
- Angle torque to 90 degrees.

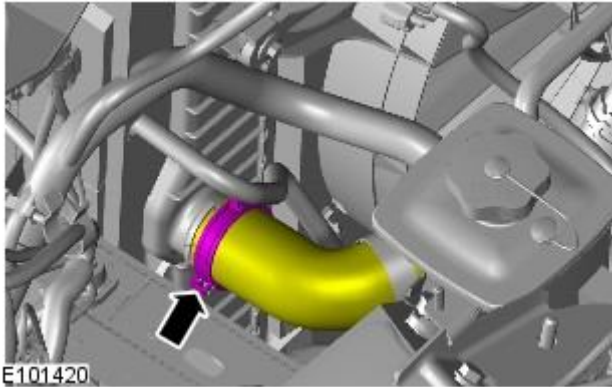


4. Install the coolant hose.



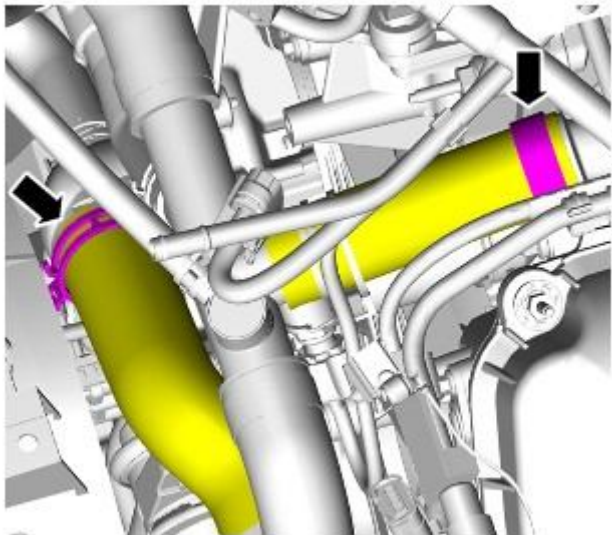
E101421

5. Install the accessory drive pulley.  
For additional information, refer to: [Accessory Drive Belt Idler Pulley](#)  
(303-05B Accessory Drive - V6 3.0L Petrol, Removal and Installation).
6. Connect the radiator lower hose.



E101420

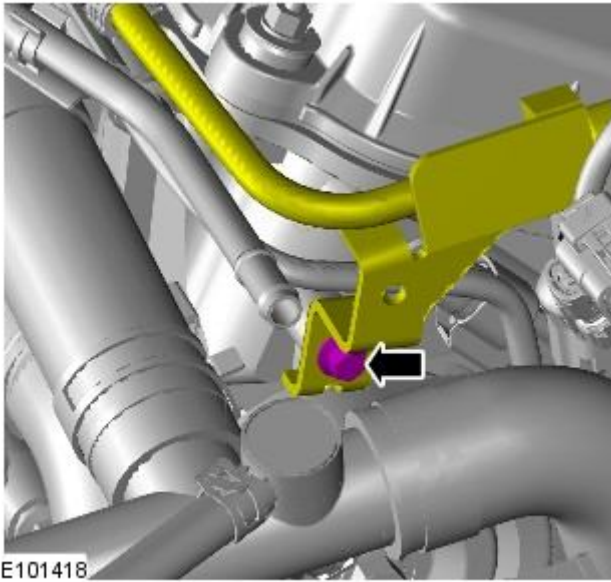
7. Connect the 2 coolant hoses.



E101419

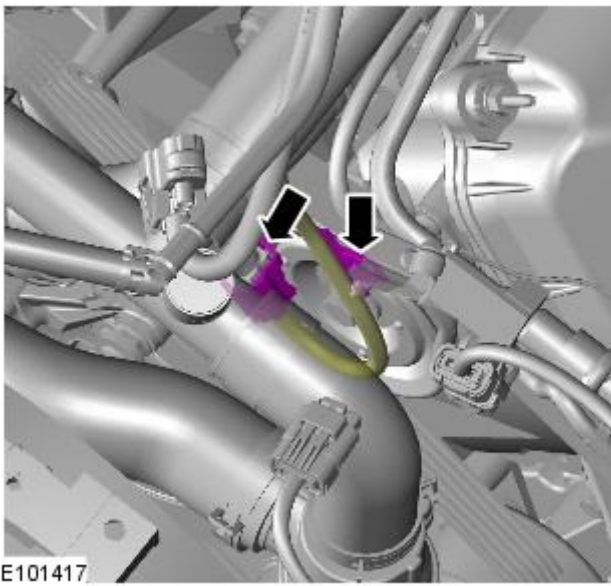
8. Install the fuel line retaining bracket.

- Install the bolt and tighten to 10 Nm

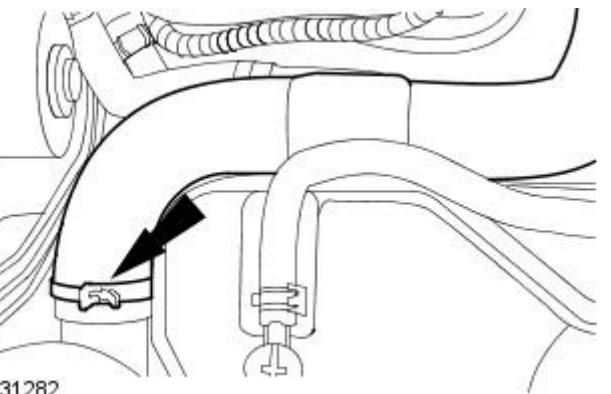


9. Connect the ECT sensor electrical connector.

- Attach the retaining clip.

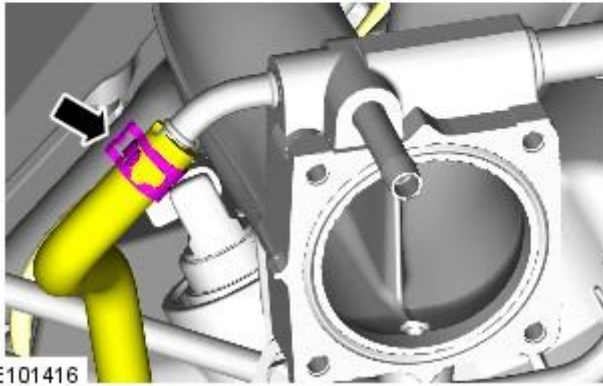
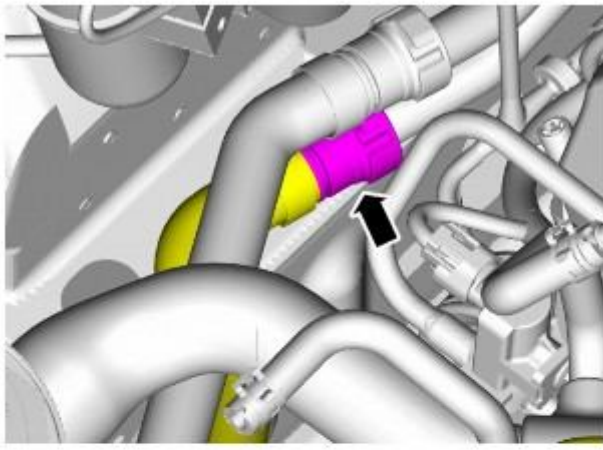


10. Connect the radiator upper hose.





11. Connect the coolant hoses.



E101416

12. Install the throttle body.

For additional information, refer to: [Throttle Body](#) (303-04C Fuel Charging and Controls - V6 3.0L Petrol, Removal and Installation).

Vehicles with secondary air injection (AIR)

13. Install the AIR control valve.

For additional information, refer to: [Secondary Air Injection \(AIR\) Control Valve](#) (303-08B Engine Emission Control - V6 3.0L Petrol, Removal and Installation).

All vehicles

14. Carry out the cooling system filling and bleeding procedure.

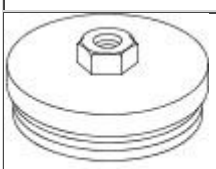
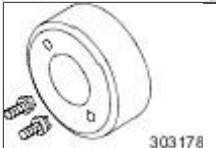
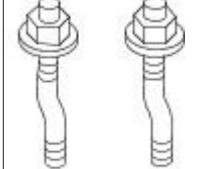

For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 3.0L Petrol, General Procedures).

15. Connect the battery ground cable.


For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Engine - V6 3.0L Petrol - Crankshaft Rear Seal

In-vehicle Repair


Special Tool(s)	
 <p>303566</p>	Crankshaft Rear Seal Remover 303-566
 <p>303178</p>	Crankshaft Rear Seal Installer 303-178
 <p>303384</p>	Crankshaft Rear Seal Installer 303-384
 <p>303102</p>	Crankshaft Rear Seal Installer Draw 303-102

## Removal

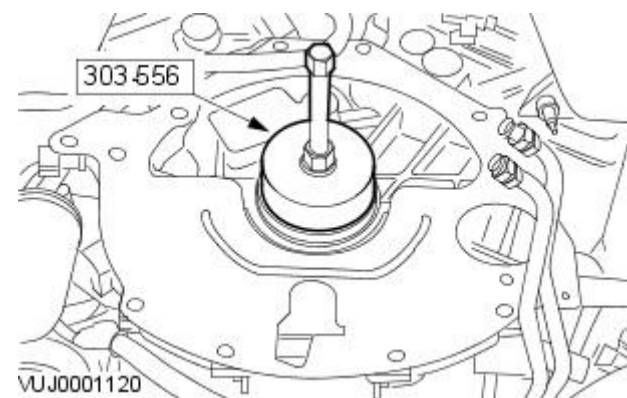
-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
- Remove the flexplate.  
For additional information, refer to: [Flexplate](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).

-  **CAUTION:** Avoid scratching or damaging the oil seal sealing surfaces on the crankshaft and cylinder block.

Using the special tools, remove the crankshaft rear seal.



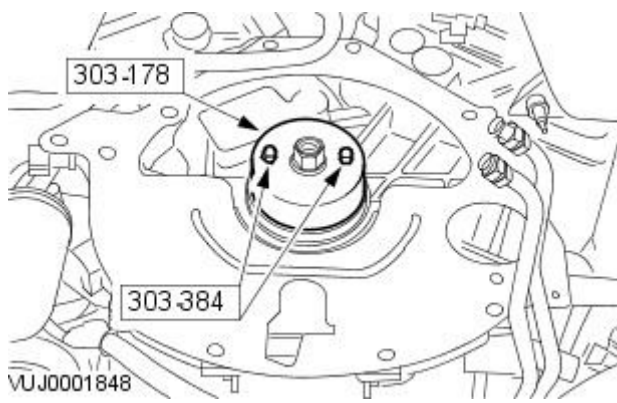
## Installation

- Clean and inspect the crankshaft rear seal sealing surfaces.
- Lubricate the crankshaft flange, the crankshaft rear seal, and the seal lip.
  - Use engine assembly lubricant or equivalent meeting Jaguar specification ESR-M99C80-A.

3. NOTE: Alternate bolt tightening to correctly seat the crankshaft rear oil seal until it is flush with the cylinder block.

Using the special tools, install the crankshaft rear seal.

- Install the crankshaft rear oil seal between flush and 2.0 mm underflush with the engine block.



4. Install the flexplate.

For additional information, refer to: [Flexplate](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).


5. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Engine - V6 3.0L Petrol - Cylinder Head

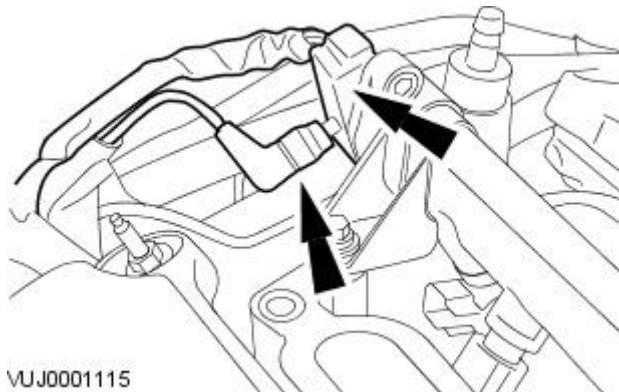
In-vehicle Repair

## Removal

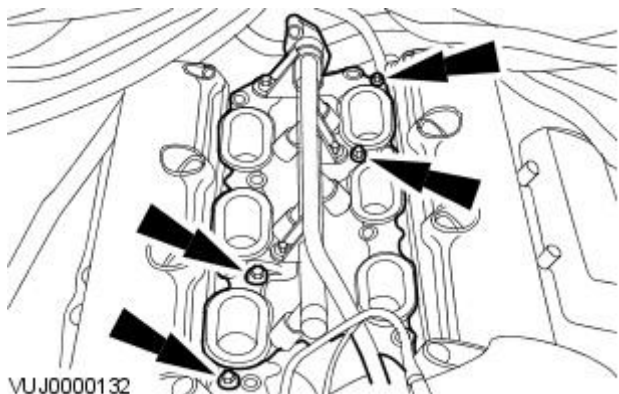
-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

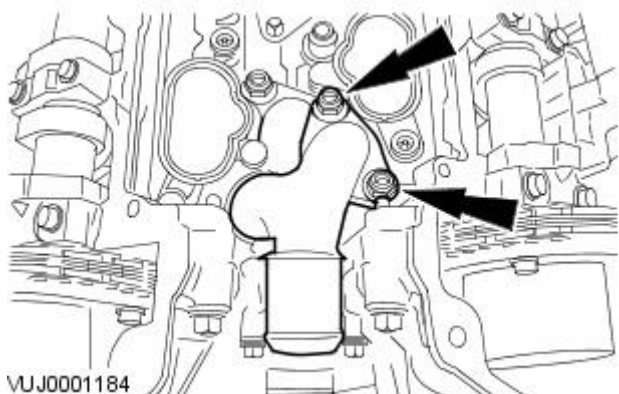
- Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
- Remove the camshafts.  
For additional information, refer to: [Camshafts LH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).
- Disconnect the fuel pressure regulator electrical connector and vacuum hose.



- Remove the fuel supply manifold and lower intake manifold.
  - Remove and discard the lower intake manifold gaskets.



- Remove the coolant crossover tube.
  - Discard the O-ring seals.

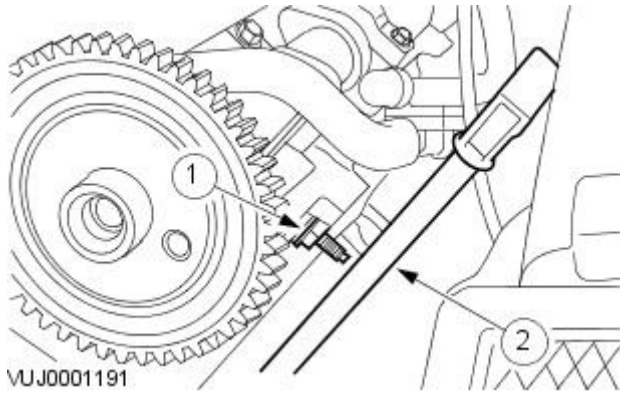


- Remove the catalytic converter.  
For additional information, refer to: [Catalytic Converter](#) (309-00B Exhaust System - V6 3.0L Petrol, Removal and Installation).

**8. NOTE: LH cylinder head only.**

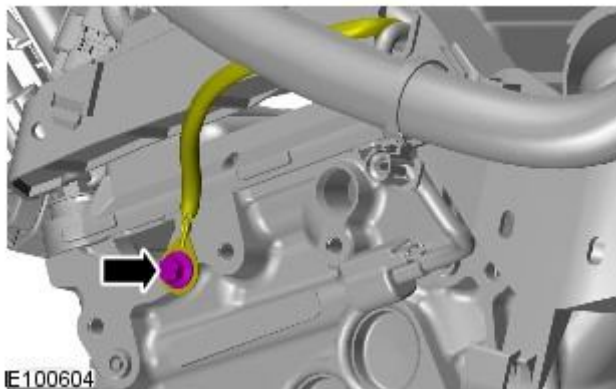
Remove the oil level indicator and tube.

- Remove the retaining bolt.
- Remove the oil level indicator and tube.



**9. NOTE: LH cylinder head only.**

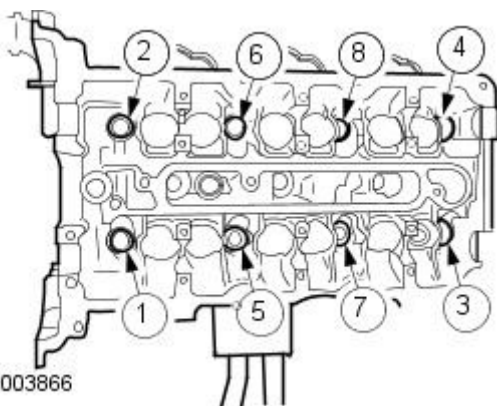
Detach the engine harness earth strap from the rear of the left-hand cylinder head.



**10. NOTE: Remove the retaining bolts in the indicated sequence.**

Remove the cylinder head.

- Remove the retaining bolts in the indicated sequence.
- Remove and discard the cylinder head gasket.



**11. NOTE: Make sure that all the component mating faces are clean.**

Clean and inspect the cylinder head and cylinder block.

## Installation

**1. NOTE: The cylinder head gasket must be installed over the cylinder head to cylinder block dowels.**

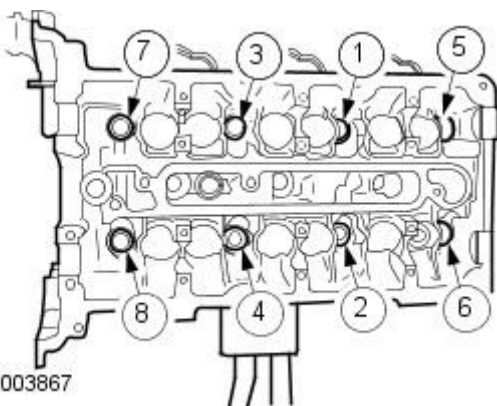
Install a new cylinder head gasket.

**2. CAUTION:** Use care when installing the cylinder head. Damage to the cylinder block, cylinder head or cylinder head gasket may result.

- NOTE: Make sure the cylinder head is installed in its original position.
- NOTE: Make sure the cylinder head is installed in its original position.
- NOTE: Tighten the retaining bolts in the indicated sequence in six stages.

Install the cylinder head and install new cylinder head retaining bolts and washers.

- Stage 1: Tighten to 30 Nm.
- Stage 2: Tighten the bolts a further 90 degrees.
- Stage 3: Loosen 360 degrees.
- Stage 4: Tighten to 30 Nm.
- Stage 5: Tighten the bolts a further 90 degrees.
- Stage 6: Tighten the bolts a further 90 degrees.

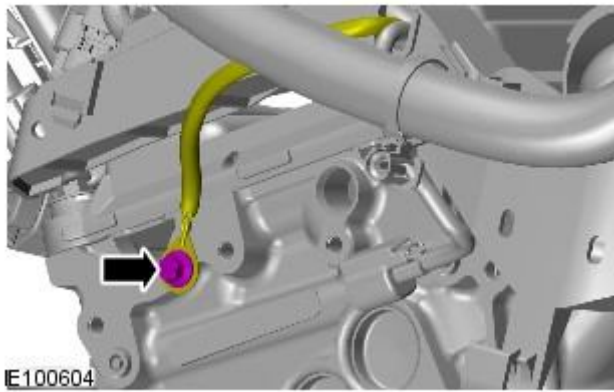




**3. NOTE: LH cylinder head only.**

Attach the engine harness earth strap to the rear of the left-hand cylinder head.

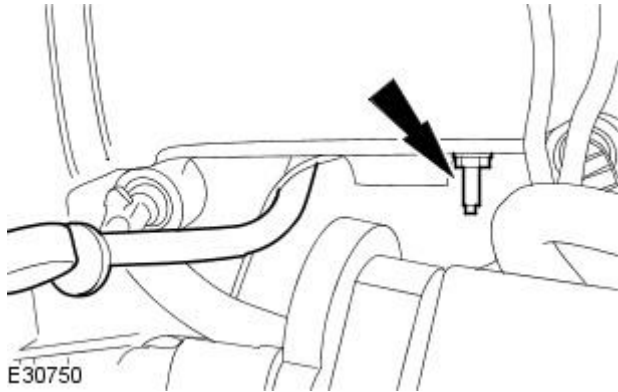
- Tighten to 10 Nm.



**4. NOTE: LH cylinder head only.**

Install the oil level indicator and tube.

- Install the retaining bolt.
- Tighten to 10 Nm.



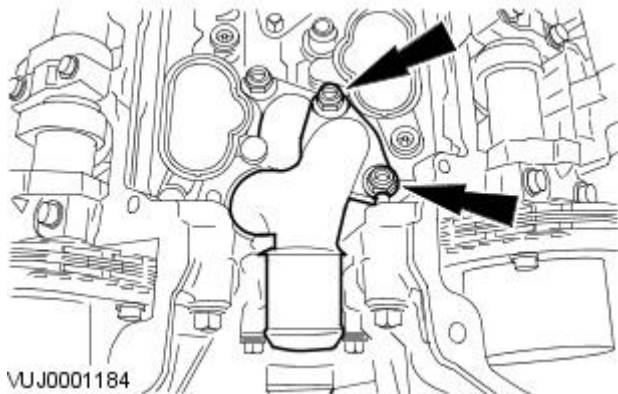
**5. Install the catalytic converter.**

For additional information, refer to: [Catalytic Converter](#) (309-00B Exhaust System - V6 3.0L Petrol, Removal and Installation).

**6. NOTE: Install new O-ring seals.**

Install the coolant crossover tube.

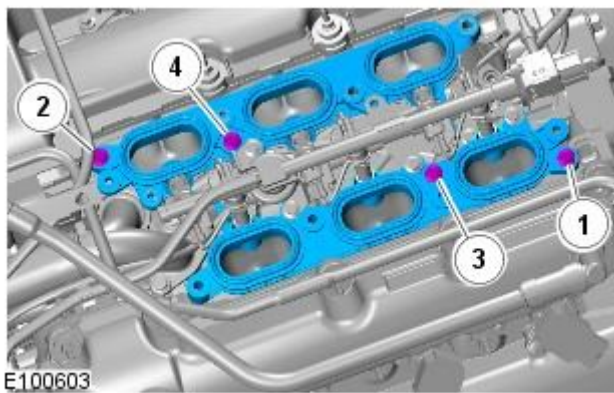
- Tighten to 10 Nm.



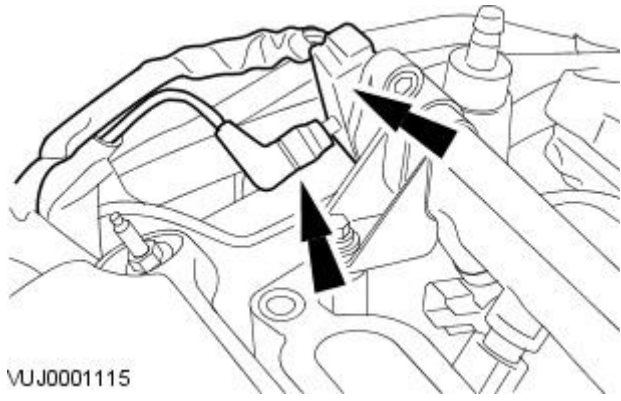
**7. NOTE: Install new lower intake manifold gaskets.**

Install the fuel injection supply manifold and lower intake manifold.

- Install the fuel supply manifold and lower intake manifold gaskets.
- Tighten the bolts to the sequence shown.
- Tighten to 10 Nm.



- 8.** Connect the fuel pressure regulator electrical connector and vacuum hose.



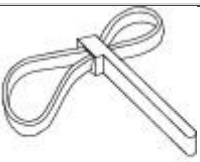
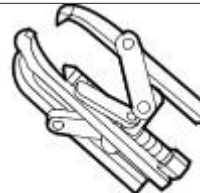

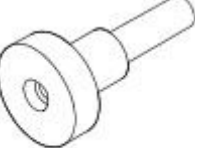
VUJ0001115

- 9.** Install the camshafts.  
For additional information, refer to: [Camshafts LH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).
- 10.** Connect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).




# Engine - V6 3.0L Petrol - Engine Front Cover

In-vehicle Repair

Special Tool(s)	
 303D055	Wrench strap-universal 303-D055
 303D121	Crankshaft front oil seal remover 303-D121
 303102	Crankshaft Pulley Installer 303-102
 303D12101	Thrust Pad 303-D121-01

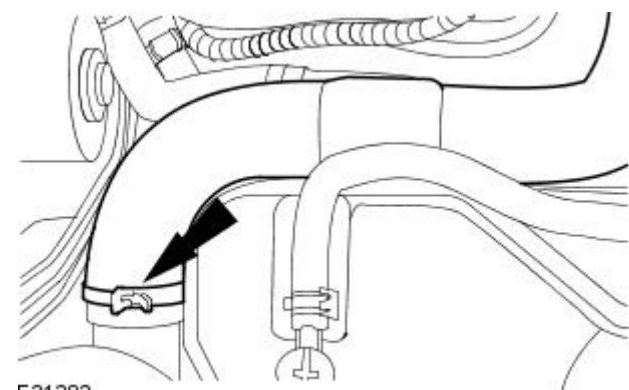
## Removal

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle. For additional information, refer to: (100-02 Jacking and Lifting)

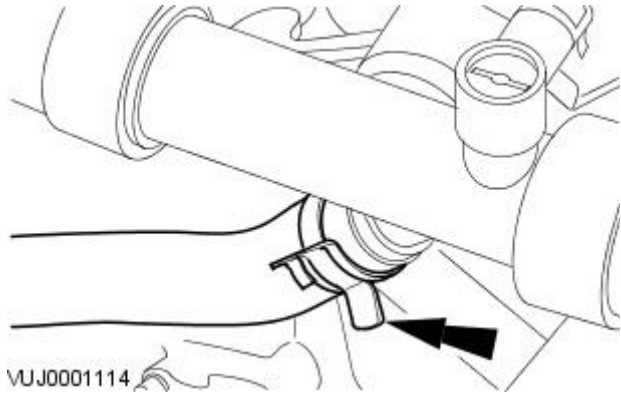
[Jacking](#) (Description and Operation),  
[Lifting](#) (Description and Operation).

- Remove the LH valve cover.  
For additional information, refer to: [Valve Cover LH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).
- Remove the RH valve cover.  
For additional information, refer to: [Valve Cover RH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).
- Remove the oil pan.  
For additional information, refer to: [Oil Pan](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).
- Drain the cooling system.  
For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 3.0L Petrol, General Procedures).
- Remove the accessory drive belt.  
For additional information, refer to: [Accessory Drive Belt](#) (303-05B Accessory Drive - V6 3.0L Petrol, Removal and Installation).
- Lower the vehicle.
- Disconnect the radiator upper hose.

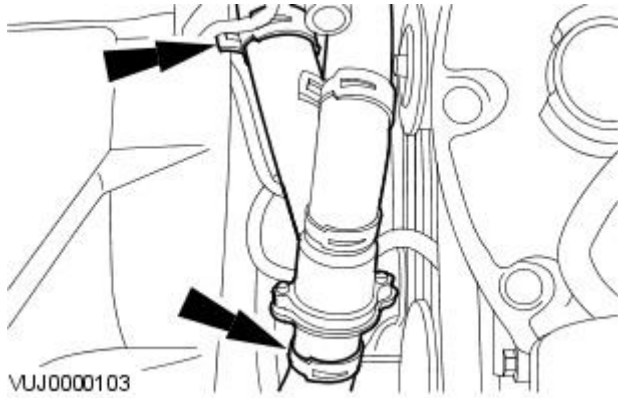


E31282

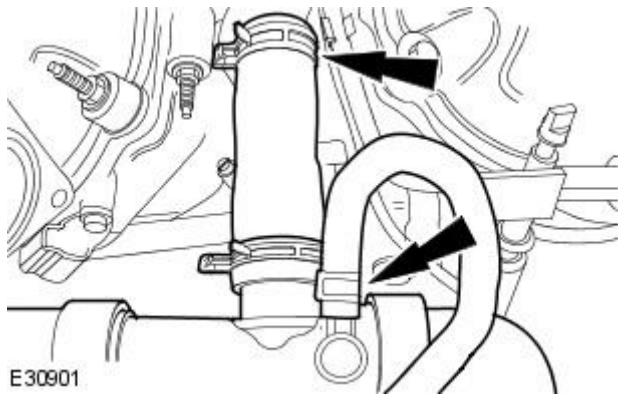
9. Disconnect the coolant hose from the radiator upper hose assembly.



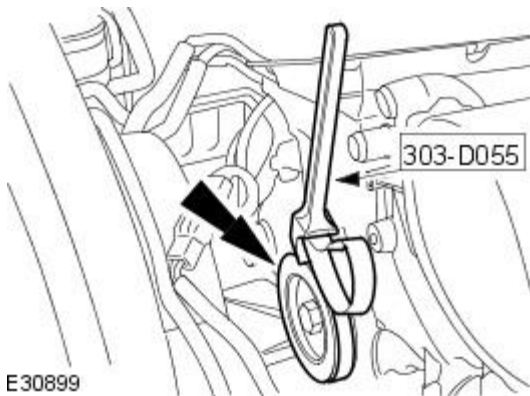
10. Disconnect the coolant hose assembly from the coolant pump and lower hose.



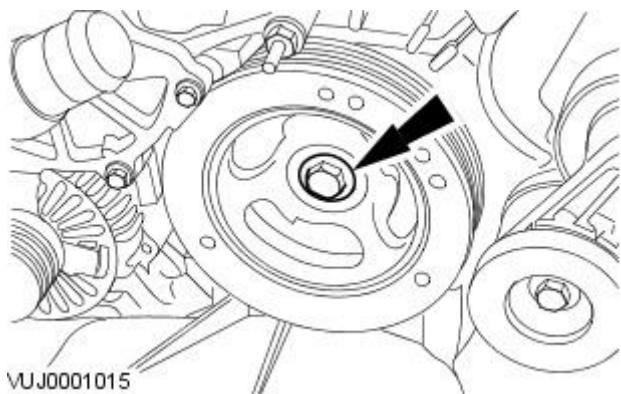
11. Remove the hose assembly.



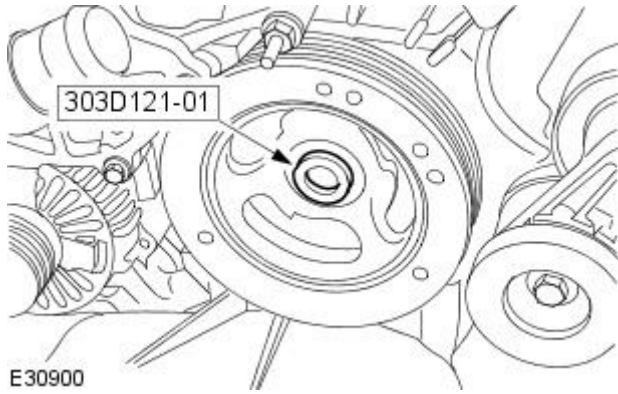
12. Install the special tool.



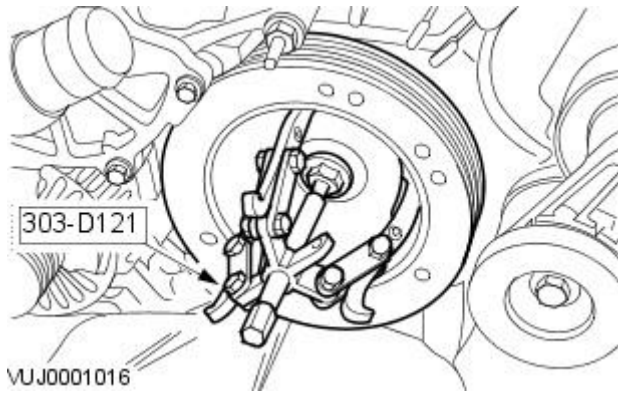
13. Remove the crankshaft pulley retaining bolt.



14. Install the special tool.

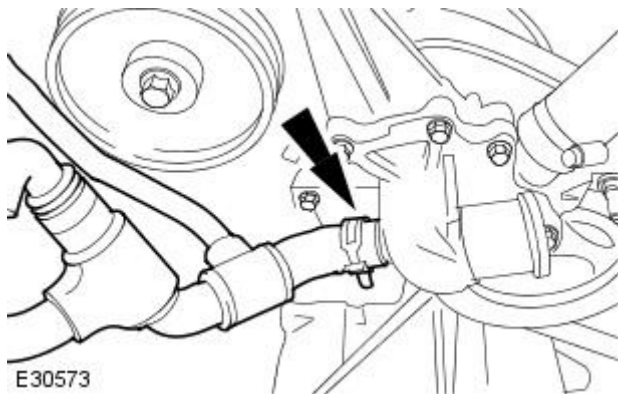


15. Using the special tools, remove the crankshaft pulley.

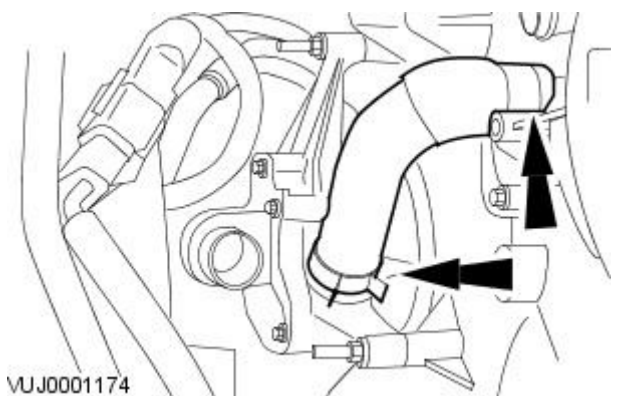


16. Remove the crankshaft front oil seal.

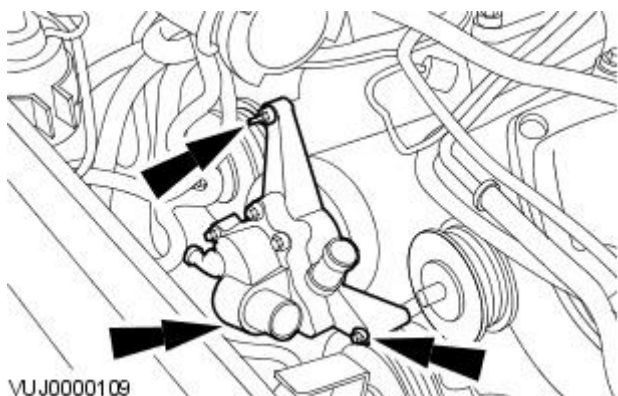
17. Detach the coolant hose.



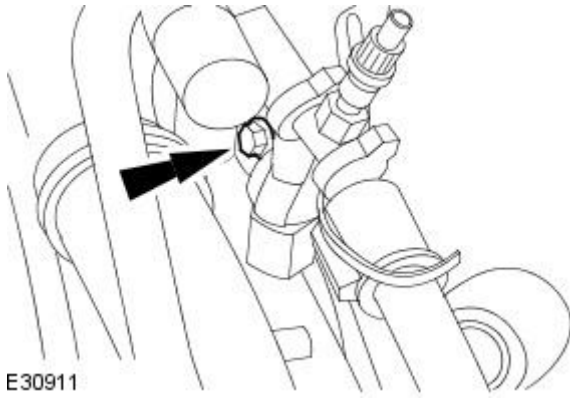
18. Remove the coolant hose.



19. Remove the coolant pump.

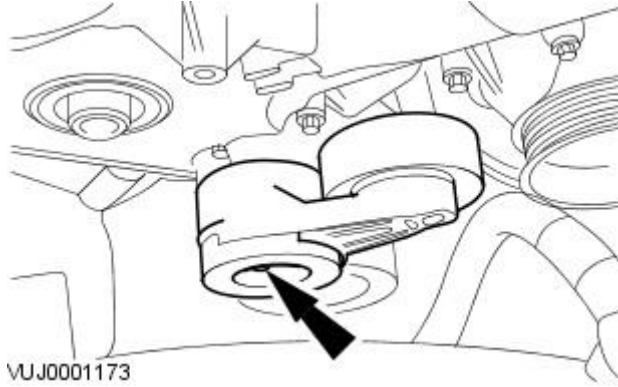


20. Detach the fuel supply manifold retaining bolt.



E30911

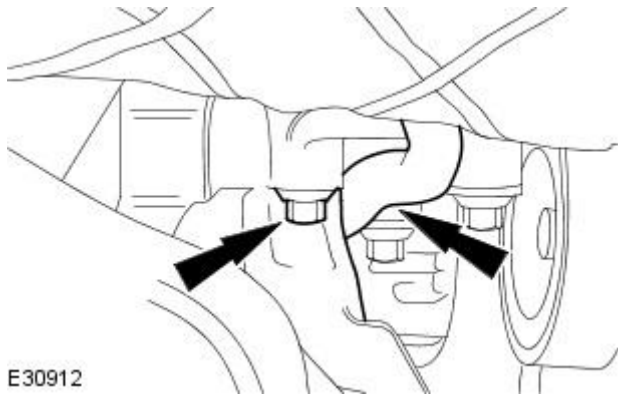
21. Remove the accessory drive belt tensioner.



VUJ0001173

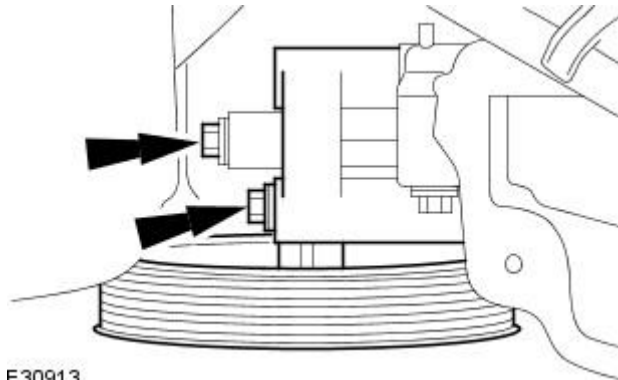
22. Detach the engine harness from the right-hand idler pulley.

- Detach the splash shield.
- Detach the engine harness.



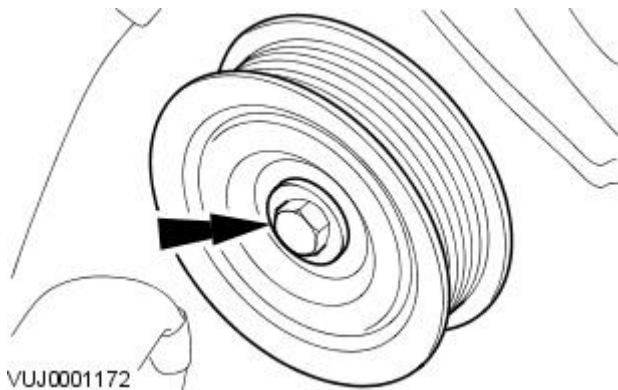
E30912

23. Remove the right-hand idler pulley.



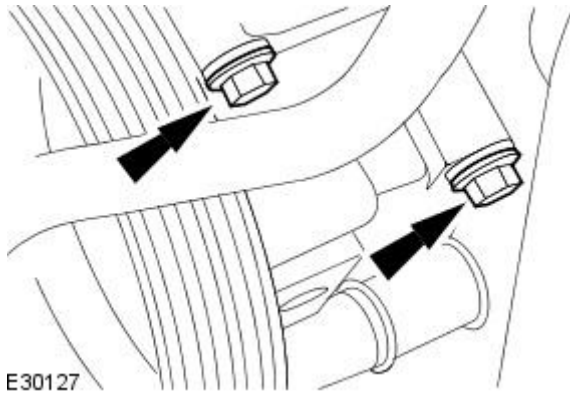
E30913

24. Remove the left-hand idler pulley.



VUJ0001172

25. Remove the power steering pump upper retaining bolts.

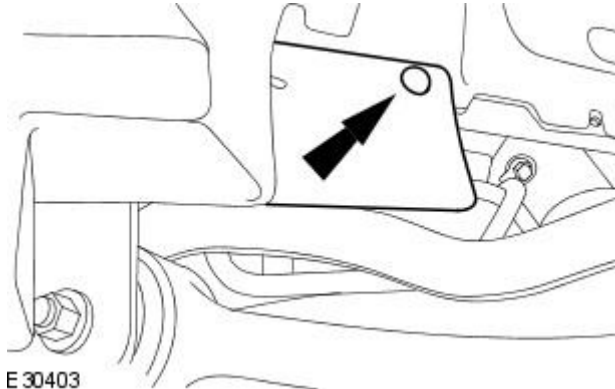


E30127

26. Raise the vehicle.

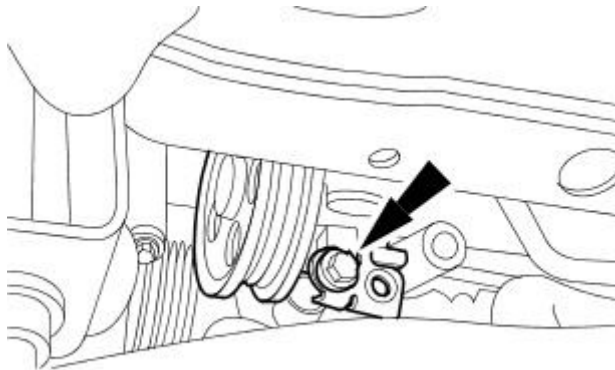
27. Reposition the splash shield.

- Remove the splash shield retaining clip.



E 30403

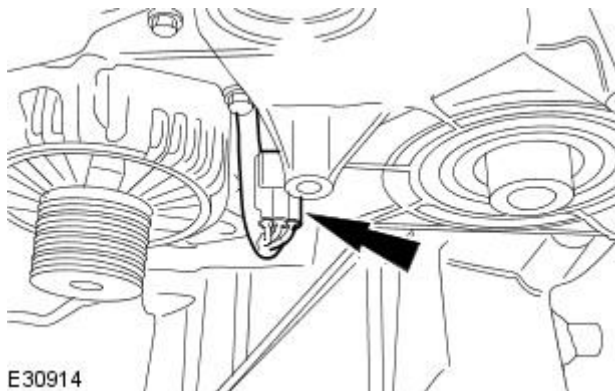
28. Detach the power steering pump.



VJJ0001803

29. Lower the vehicle.

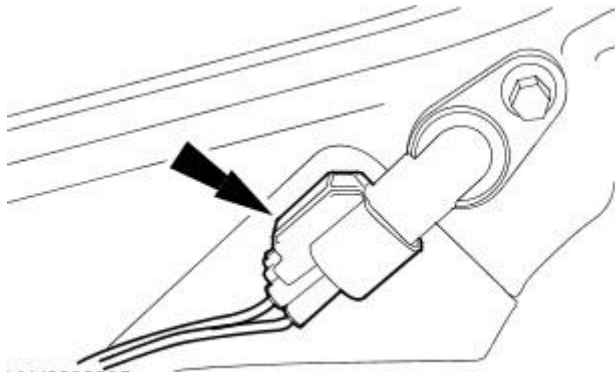
30. Disconnect the crankshaft position (CKP) sensor electrical connector.



E30914

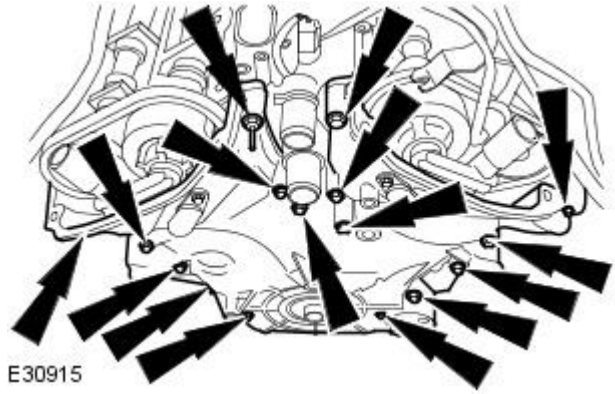
31. NOTE: Right-hand camshaft position sensor shown, left-hand similar.

Disconnect the 2 camshaft position (CMP) sensor electrical connectors.



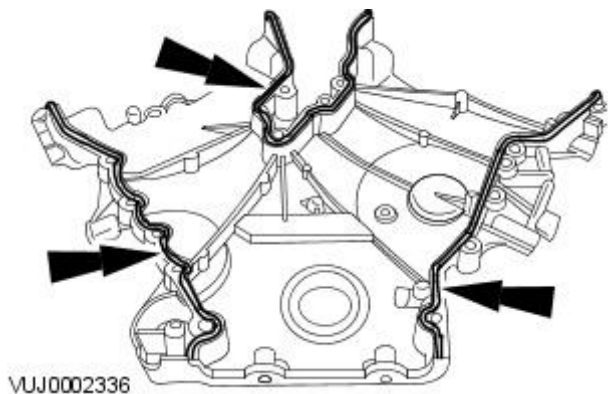
VUJ0003995

32. Remove the engine front cover.



E30915

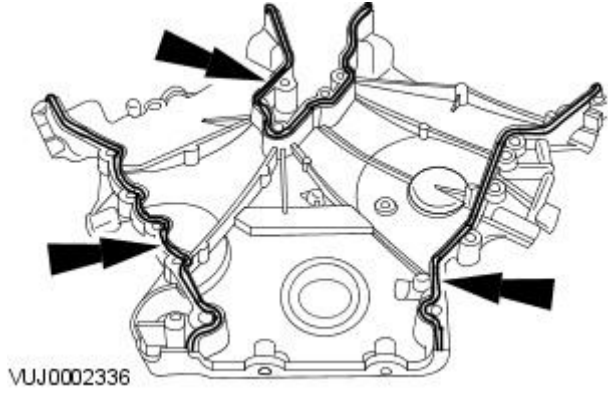
33. Remove and discard the engine front cover gaskets.



VUJ0002336

### Installation

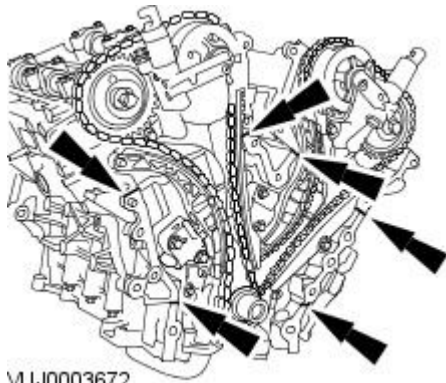
1. Install new engine front cover gaskets.



VUJ0002336



2. Apply a 6 mm diameter dot of silicone sealant meeting Jaguar specification to the indicated locations.

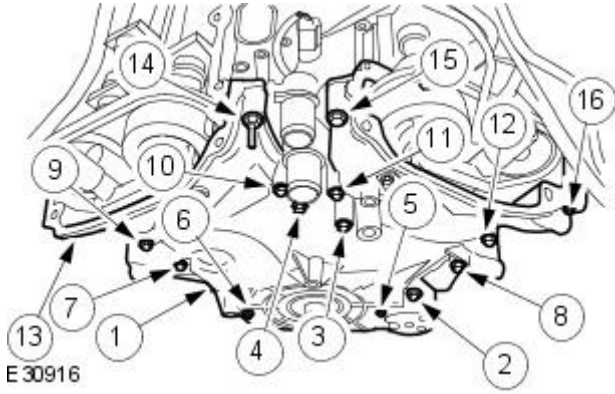


VUJ0003672

3. NOTE: The engine front cover retaining bolts numbered 3,4,10 and 11 are longer than the retaining bolts numbered 1,2,5,6,7,8,9,12,13,15 and 16. The retaining bolt numbered 14 is a retaining bolt with a stud head.

Install the engine front cover.

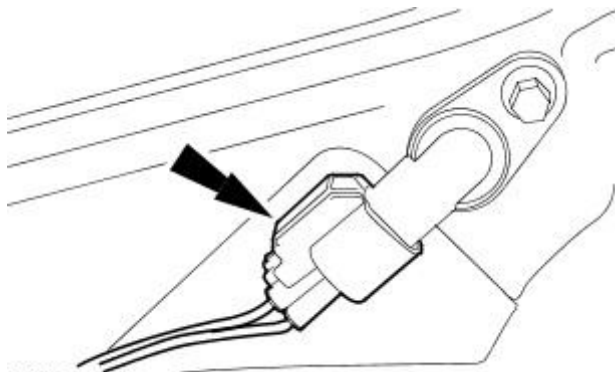
- Tighten to 25 Nm.



E 30916

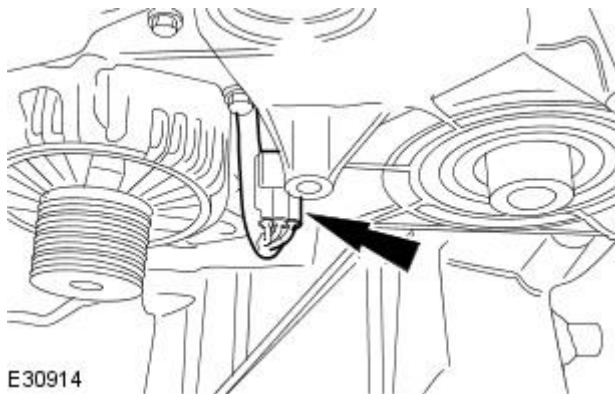
4. NOTE: Right-hand camshaft position sensor shown, left-hand similar.

Connect and secure the CMP sensor electrical connectors.



VUJ0003995

5. Connect the CKP sensor electrical connector.

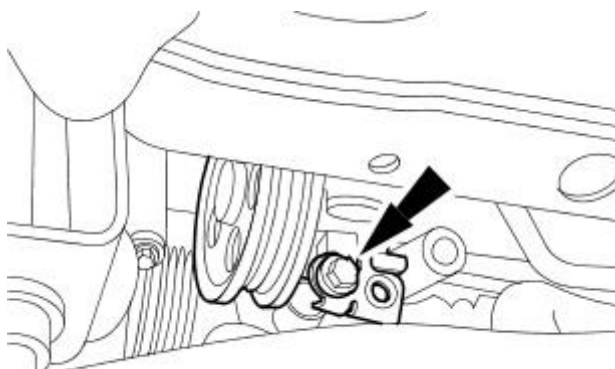


E 30914

6. Raise the vehicle.

7. Attach the power steering pump.

- Tighten to 25 Nm.

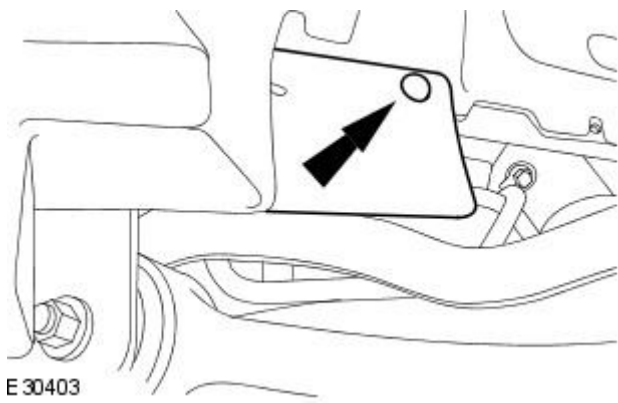


VUJ0001803



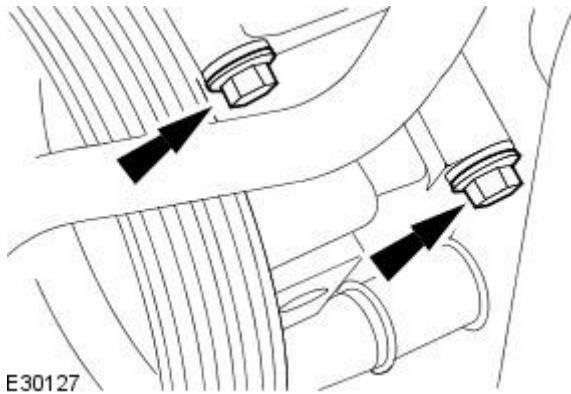
8. Install the splash shield.

- Install the splash shield retaining clip.



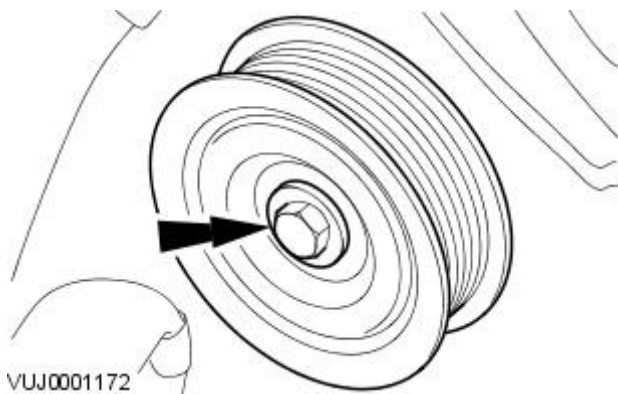
9. Install the power steering pump upper retaining bolts.

- Tighten to 25 Nm.



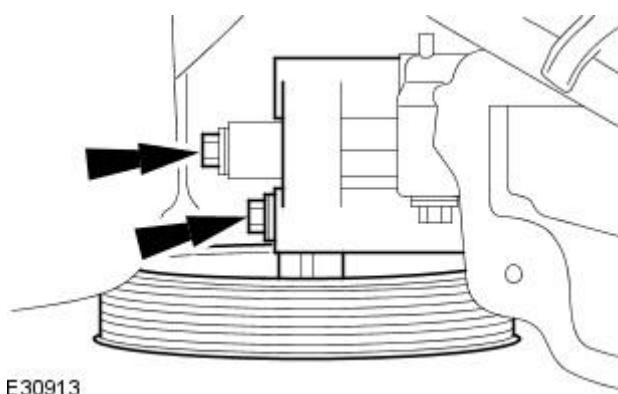
10. Install the left-hand idler pulley.

- Tighten to 25 Nm.



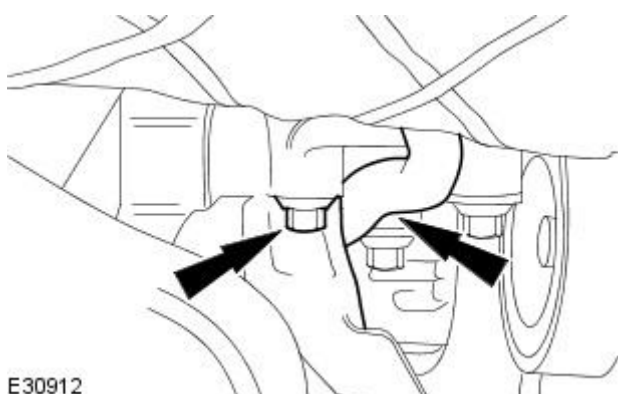
11. Install the right-hand idler pulley.

- Tighten to 25 Nm.



12. Attach the engine splash shield.

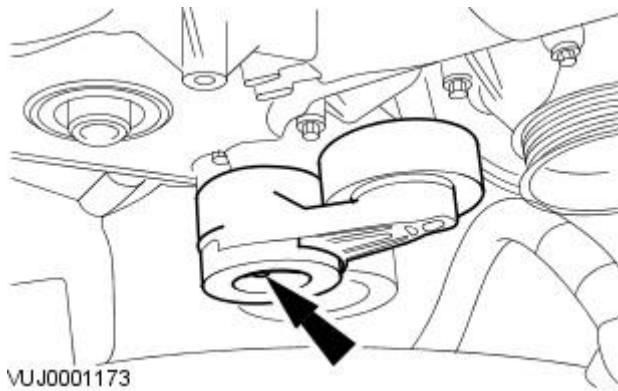
- Attach the engine harness to the right-hand idler pulley.
- Attach the engine splash shield.
- Tighten to 25 Nm.



13. Lower the vehicle.

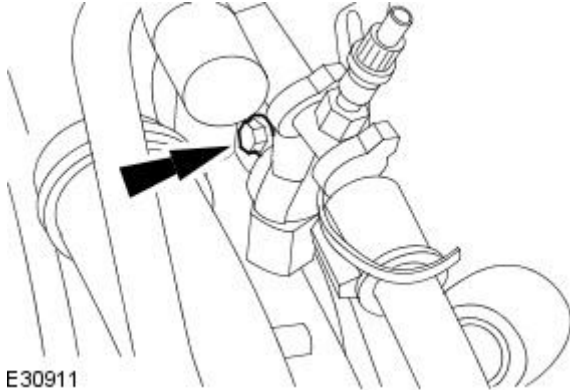
14. Install the accessory drive belt tensioner.

- Tighten to 45 Nm.



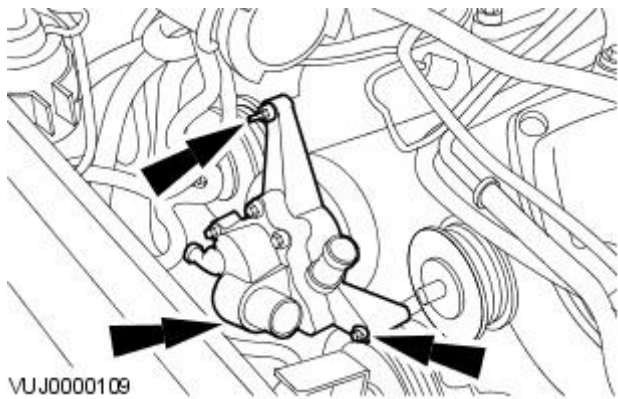
15. Attach the fuel supply manifold retaining bolt.

- Tighten to 10 Nm.

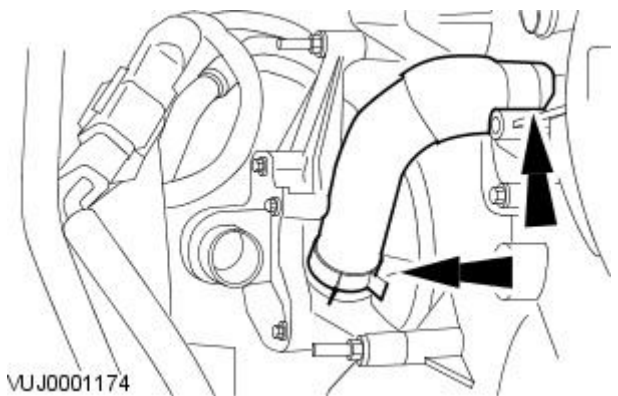


16. Install the coolant pump.

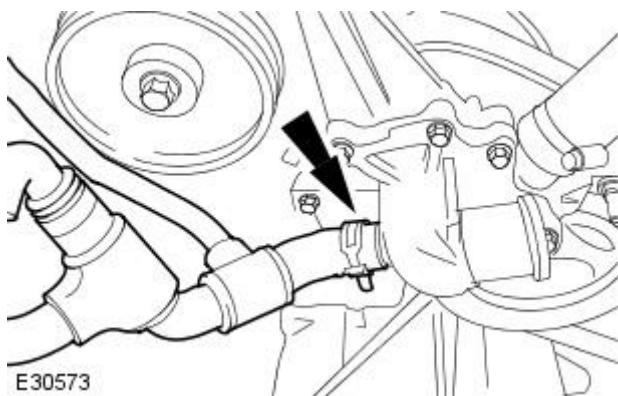
- Tighten to 25 Nm.



17. Install the coolant hose.



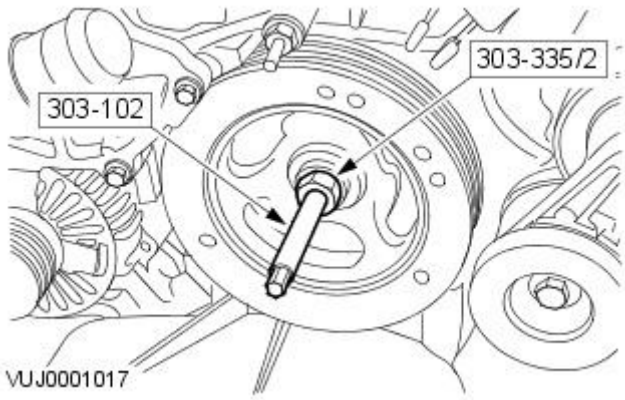
18. Attach the coolant hose.



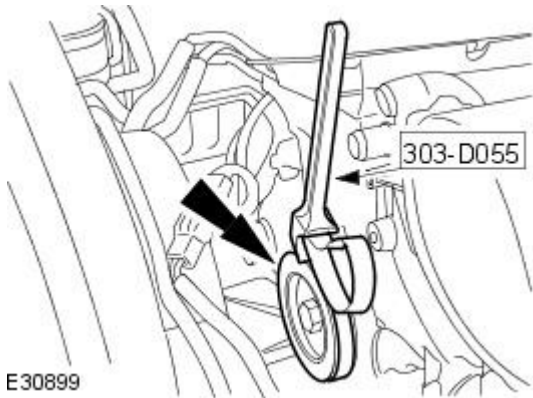
19. Install the crankshaft front oil seal.

20. Using the special tools, install the crankshaft pulley.

- Coat the crankshaft pulley keyway with silicone gasket sealant meeting Jaguar specification.
- Coat the sealing surfaces of the crankshaft pulley with silicone gasket sealant meeting Jaguar specification.

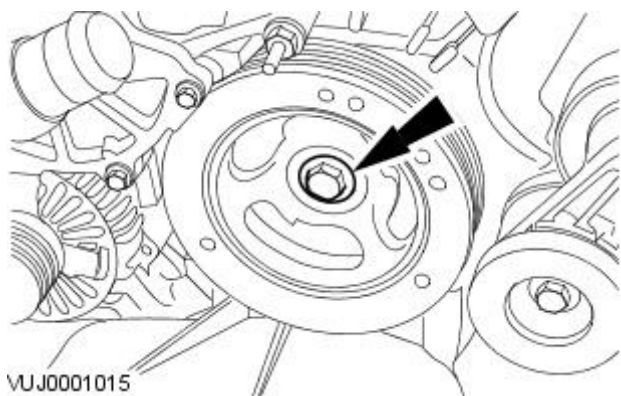


21. Install the special tool.

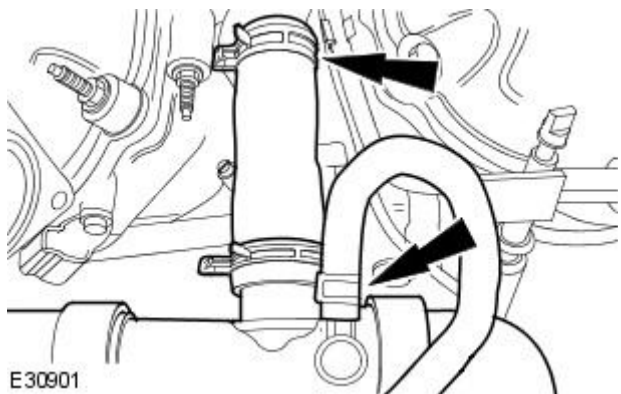


22. Install the crankshaft pulley bolt.

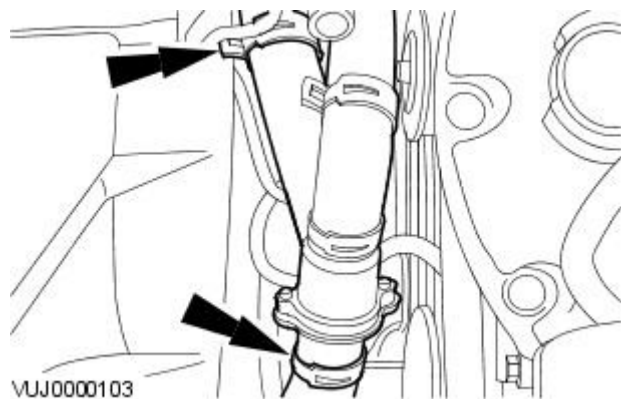
- Tighten to 120 Nm.
- Loosen the bolt (minimum 1 turn).
- Tighten to 50 Nm.
- Tighten a further 90 degrees.



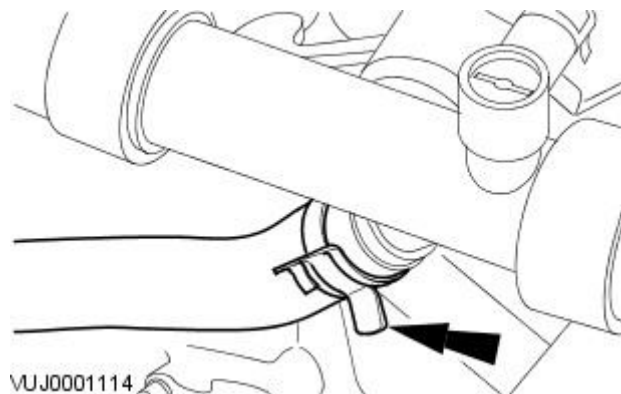
23. Install the coolant hose assembly.



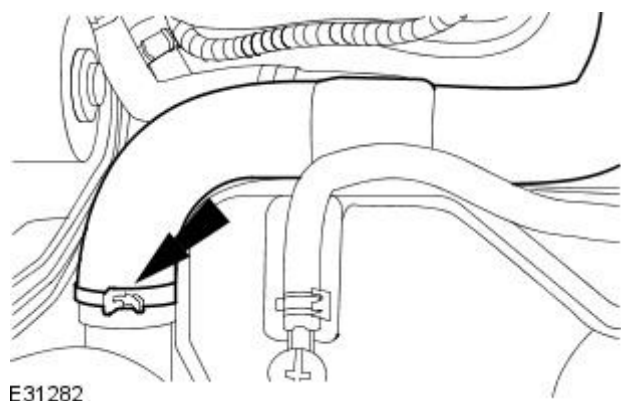
24. Connect the coolant hose assembly to the coolant pump and lower hose.



25. Connect the coolant hose to the radiator upper hose assembly.



26. Connect the radiator upper hose.



27. Install the accessory drive belt.

For additional information, refer to: [Accessory Drive Belt](#) (303-05B Accessory Drive - V6 3.0L Petrol, Removal and Installation).

28. Install the oil pan.

For additional information, refer to: [Oil Pan](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).

29. Install the LH valve cover.

For additional information, refer to: [Valve Cover LH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).

30. Install the RH valve cover.

For additional information, refer to: [Valve Cover RH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).

31. Refill and bleed the cooling system.

For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 3.0L Petrol, General Procedures).

32. Fill the engine with the recommended oil to the correct level.

# Engine - V6 3.0L Petrol - Engine Mount LH

In-vehicle Repair

## Special Tool(s)





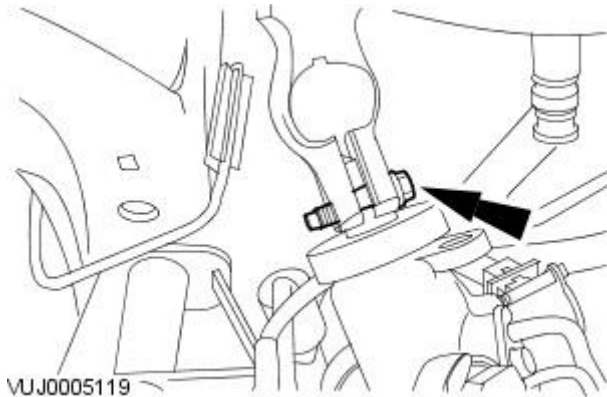
502-005

Subframe Alignment Bolt

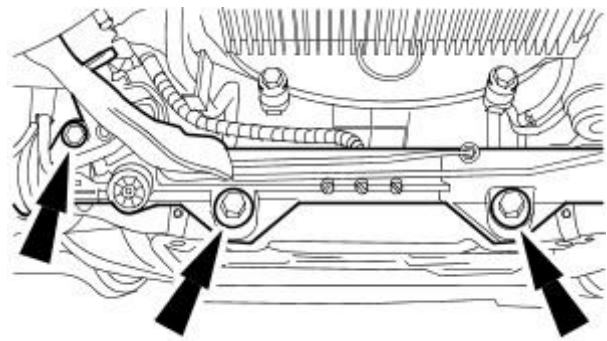
502-005

## Removal

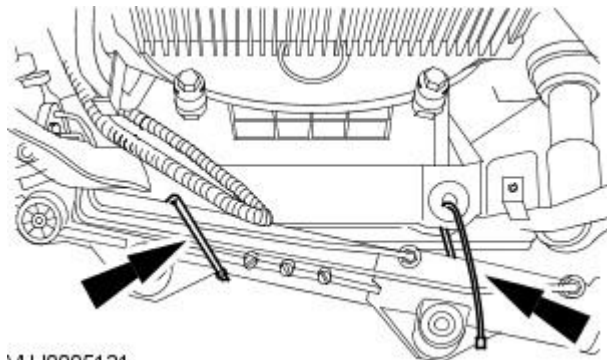
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Make sure to support the vehicle with axle stands.  
Raise and support the vehicle.
3. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).
4.  **CAUTION:** Discard the bolt.  
Remove the steering gear shaft pinch bolt.



VUJ0005119



VUJ0005142

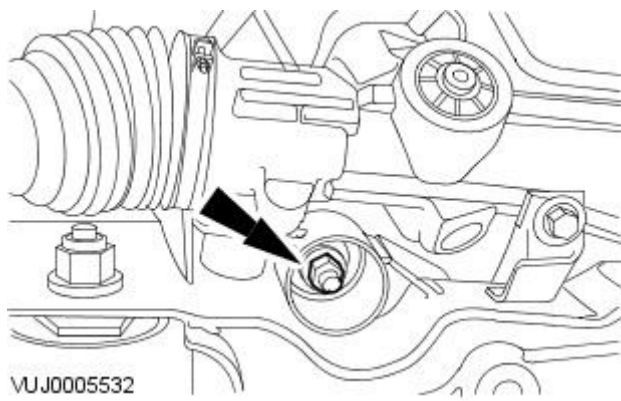


VUJ0005121


5. Detach the steering gear.
  - Remove the 3 bolts.
6. Secure the steering gear.

7. Remove the engine mount retaining nut.

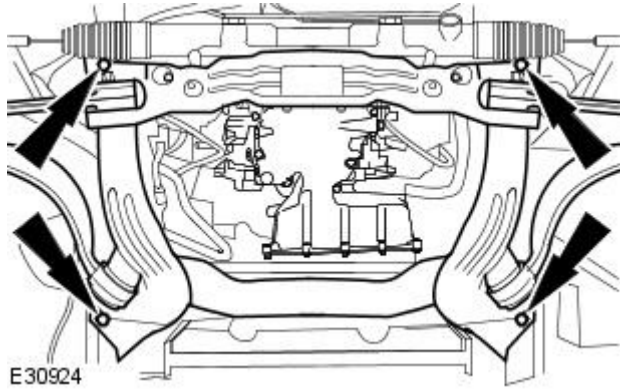
- Support the engine.



VUJ0005532

8.  **WARNING:** Do not remove the front subframe retaining bolts. Failure to follow this procedure may result in personal injury.

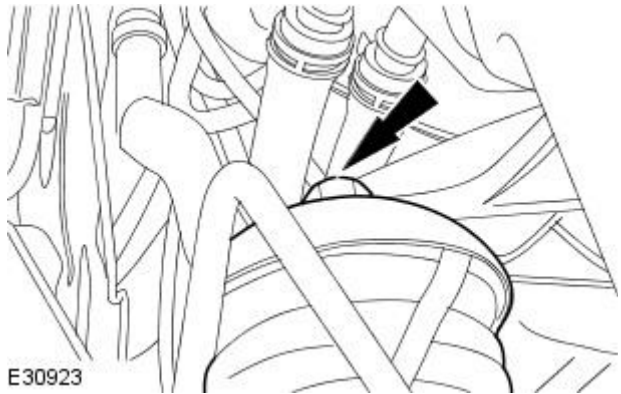
Loosen the front subframe retaining bolts to enable the engine mount to be removed.



E30924


9. Remove the engine mount.

- Raise the engine.



E30923

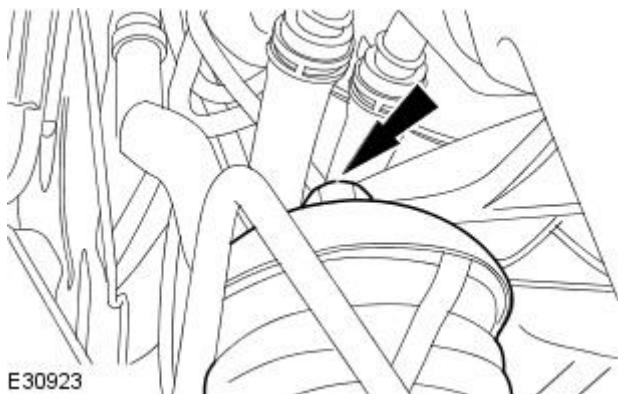
## Installation

1.  **CAUTION:** Make sure the engine mount locators are correctly aligned on installation. Failure to follow this procedure may result in damage to the vehicle.

- **NOTE:** Left-hand shown, right-hand similar.

Install the engine mount.

- Install a new nut and tighten to 48 Nm.

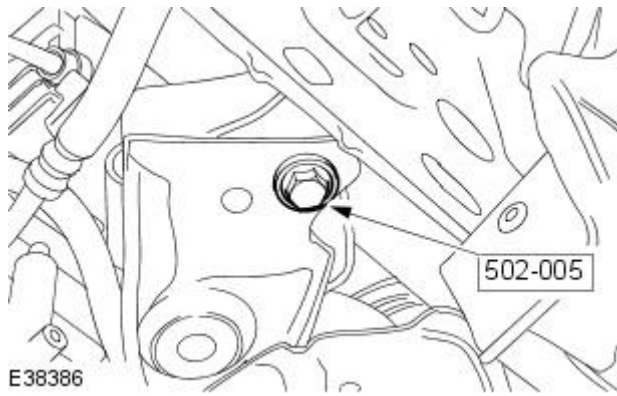


E30923



2. NOTE: Left-hand shown, right-hand similar.

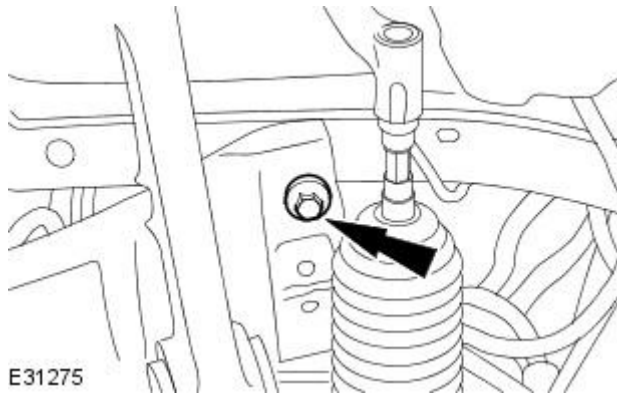
Install the special tool.



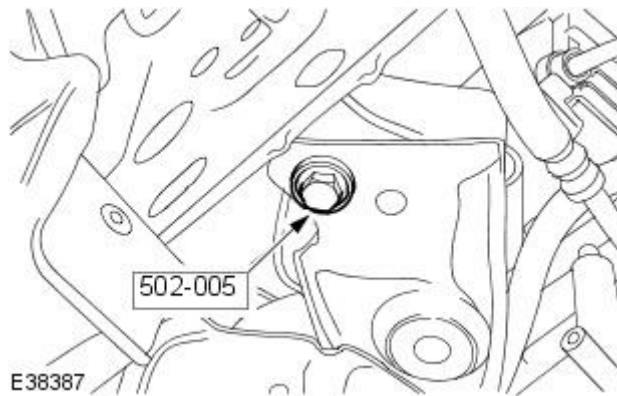
3. NOTE: Left-hand shown, right-hand similar.

Install the front subframe rear retaining bolt.

- Tighten to 150 Nm + 240°.

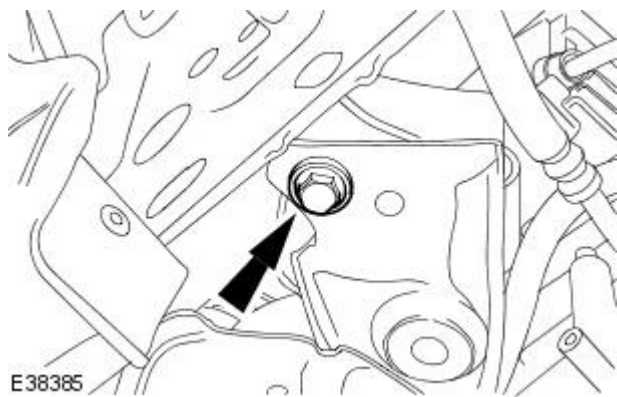


4. Remove the special tool.



5. Install the front subframe front retaining bolt.

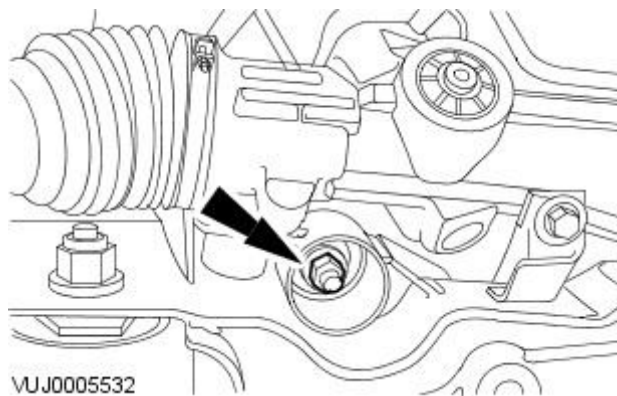
- Tighten to 150 Nm + 240°.



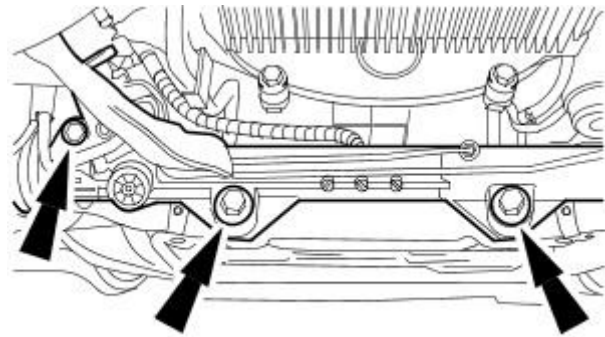
6. NOTE: Left-hand shown, right-hand similar.

Install the engine mounts retaining nut.

- Tighten to 63 Nm.



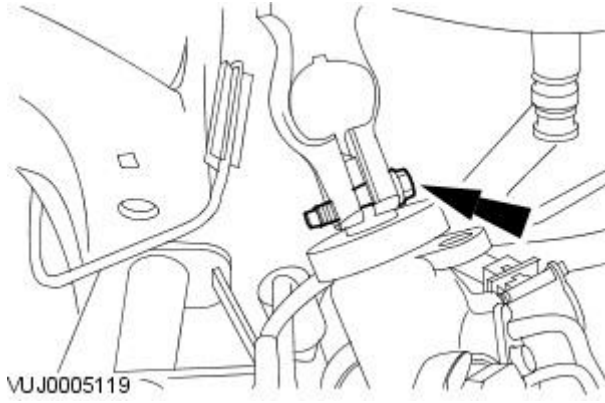





VUJ0005142

7. Attach the steering gear.

- Tighten to 100 Nm.



VUJ0005119

8.  CAUTION: Make sure that a new bolt is installed.

Install the steering gear shaft pinch bolt.

- Tighten to 35 Nm.

9. Install the air deflector.

For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

10. Lower the vehicle.

11. Connect the battery ground cable.


For additional information, refer to: [Specifications](#) (414-01 Battery, Mounting and Cables, Specifications).

# Engine - V6 3.0L Petrol - Exhaust Manifold LH

In-vehicle Repair

## Removal

All vehicles

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

All vehicles

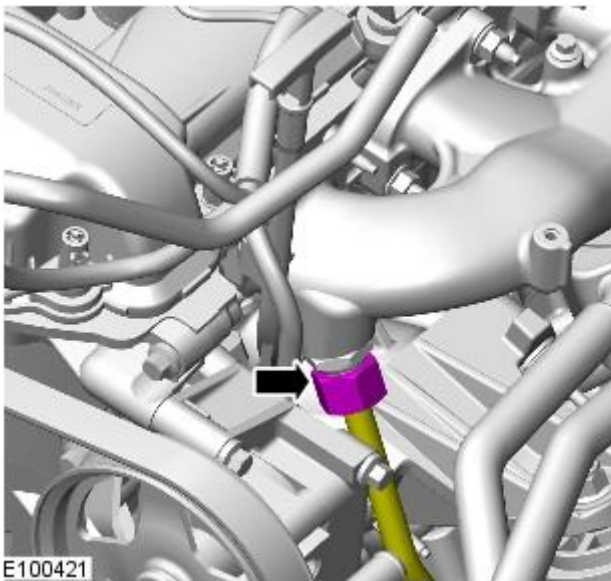
2. Remove the left-hand exhaust manifold heat shield.



E30942

Vehicles with secondary air injection (AIR)

3. Disconnect the secondary air injection (AIR) control valve to exhaust manifold left-hand tube.



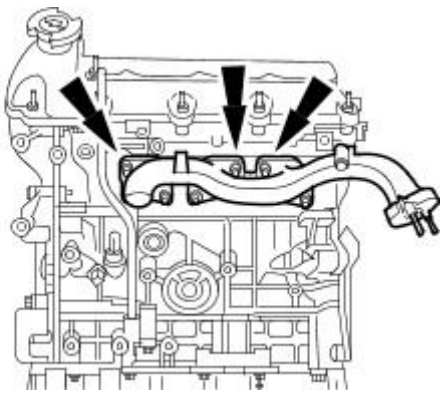
E100421

All vehicles

4. NOTE: Engine shown removed for clarity.

- NOTE: When an exhaust manifold retaining stud is removed, it must be replaced with a new retaining stud and nut.

Remove the left-hand exhaust manifold upper retaining nuts.

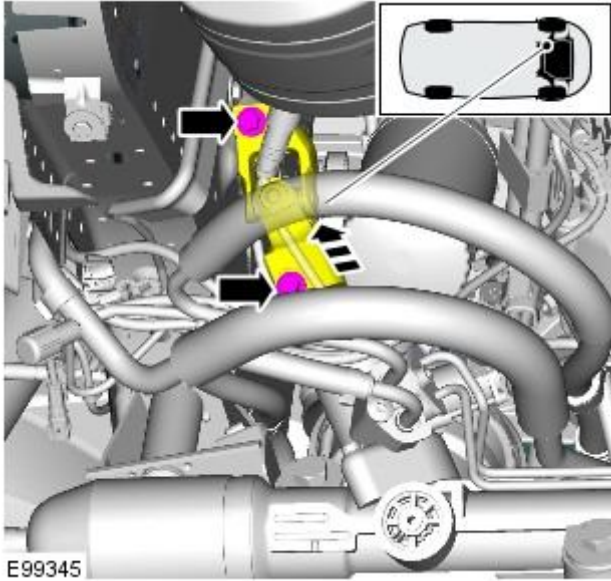


E30943

5. Raise the vehicle.

Left-hand drive vehicles

6. Detach the steering column lower shaft and tie aside.



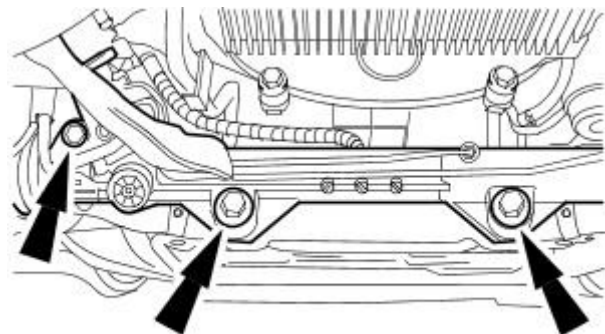
E99345

7. Disconnect the steering gear control valve actuator electrical connector.



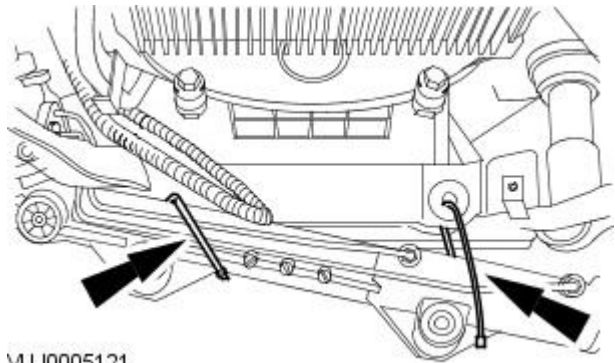
E62469

8. Detach the steering gear.



VUJ0005142

9. Using suitable tie strap(s), secure the steering gear.



All vehicles

10. Remove the left-hand catalytic converter.

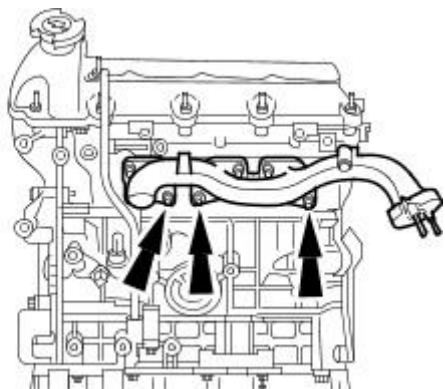
For additional information, refer to: [Catalytic Converter](#) (309-00B Exhaust System - V6 3.0L Petrol, Removal and Installation).

11. NOTE: Engine shown removed for clarity.

• NOTE: When an exhaust manifold retaining stud is removed, it must be replaced with a new retaining stud and nut.

Remove the left-hand exhaust manifold.

- Remove and discard the gasket.



## Installation

All vehicles

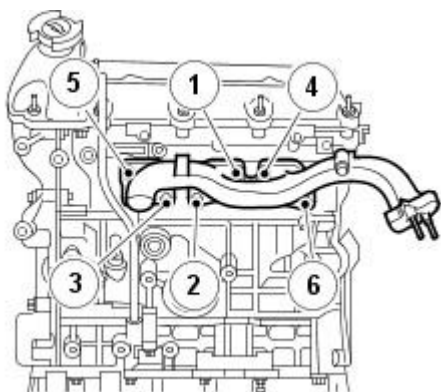
1. NOTE: Engine shown removed for clarity.

• NOTE: Tighten the exhaust manifold retaining nuts in the sequence shown.

• NOTE: When a new exhaust manifold retaining stud is installed, tighten to 9 Nm.

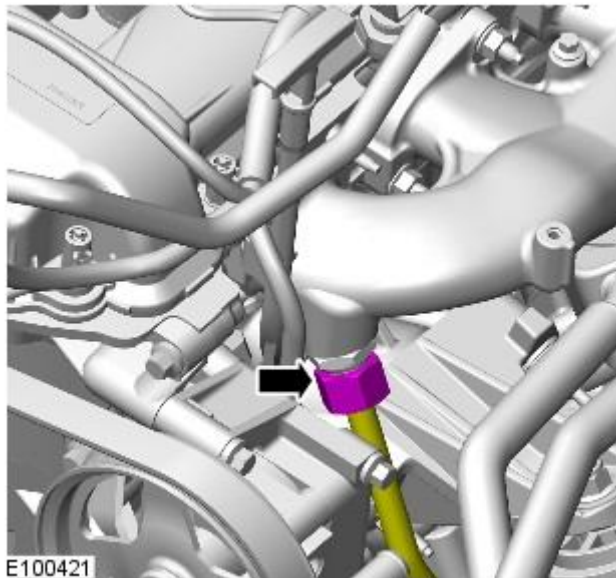
To install, reverse the removal procedure.

- Install a new gasket.
- Tighten to 20 Nm.



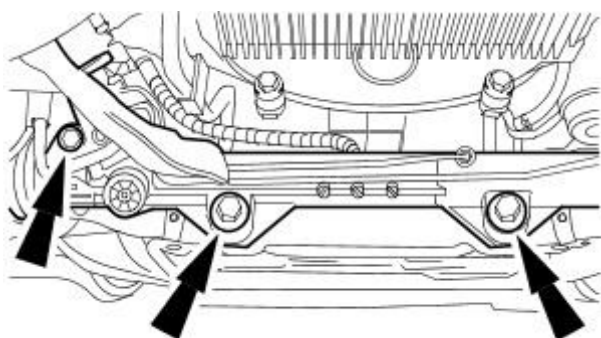
Vehicles with secondary air injection (AIR)

2. Tighten to 35 Nm.

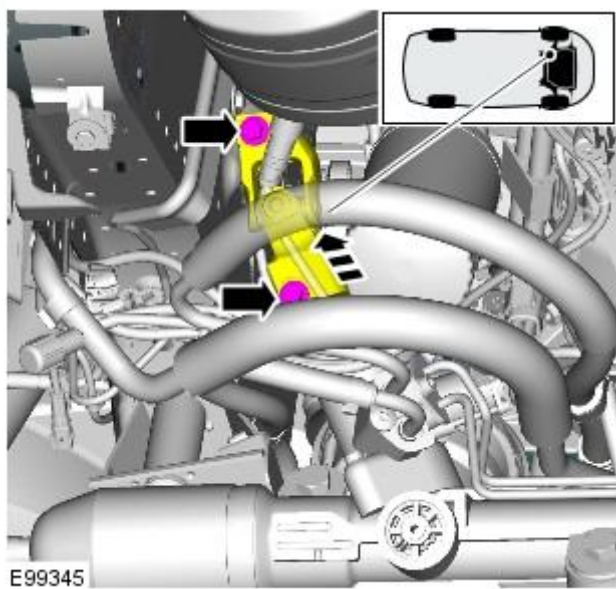


Left-hand drive vehicles

3. Tighten to 100 Nm.



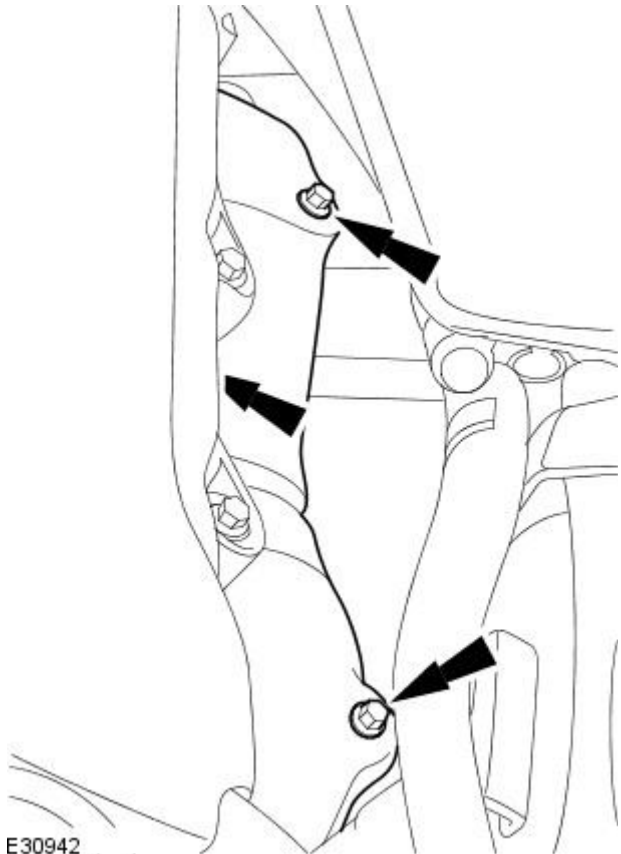
4. Tighten to 35 Nm.



All vehicles



5. Tighten to 10 Nm.




E30942

# Engine - V6 3.0L Petrol - Flexplate

In-vehicle Repair

## Removal

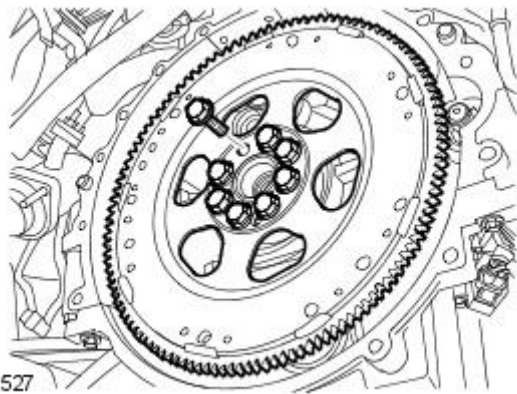
-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- Remove the automatic transmission.  
For additional information, refer to: [Transmission - V6 3.0L Petrol](#) (307-01 Automatic Transmission/Transaxle - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel, Removal).
- NOTE:** Prevent the flexplate from rotating.


Remove the flexplate.

- Remove the 8 bolts.



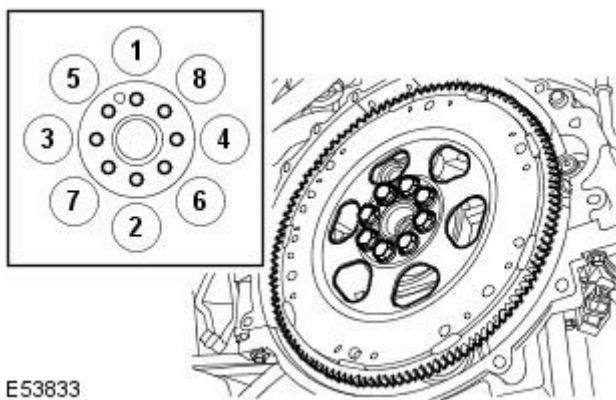
E46527

## Installation

-  **CAUTION:** Make sure that the locating pin on the crankshaft is aligned with the guide hole in the flexplate.

To install, reverse the removal procedure.

- Tighten the bolts in the sequence shown in two stages.
- Tighten to 15 Nm.
- Tighten to 80 Nm.



E53833

- Install the automatic transmission.  
For additional information, refer to: [Transmission - V6 3.0L Petrol](#) (307-01 Automatic Transmission/Transaxle - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel, Removal).



**Engine - V6 3.0L Petrol - Oil Cooler**

In-vehicle Repair

**Special Tool(s)**

Wrench, Oil filter

303-752

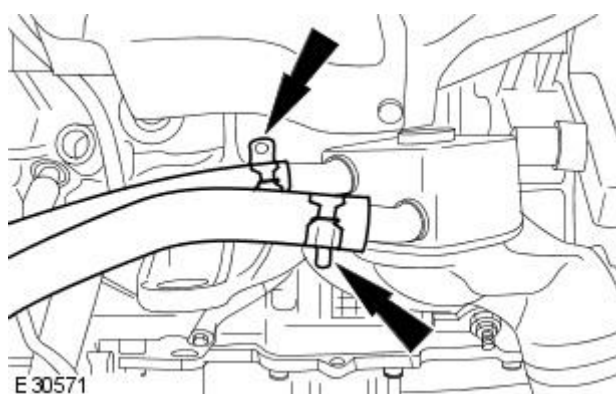
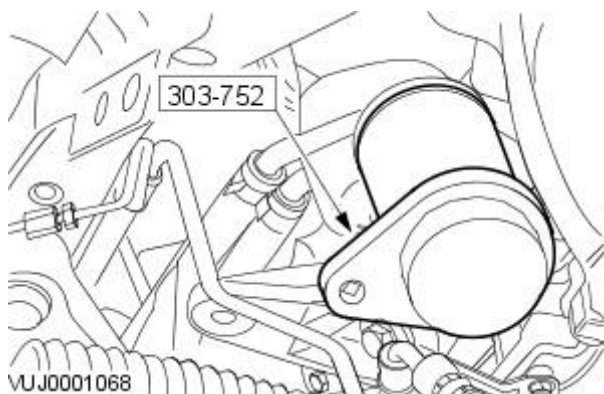
303-752



E75849

**Removal**

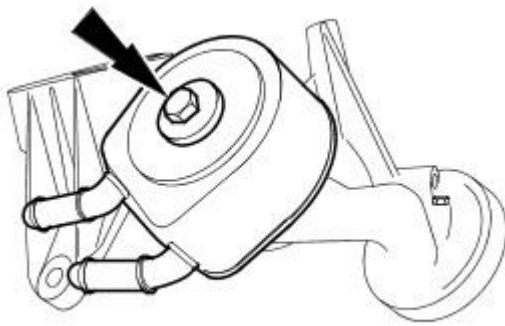
1. Raise and support the vehicle.
2. Carry out the cooling system draining procedure.  
For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 3.0L Petrol, General Procedures).
3. Remove the left-hand engine mount.  
For additional information, refer to: [Engine Mount LH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).
4. Drain the engine oil.
  - Place a suitable container under the vehicle.
  - Remove the drain plug and drain the engine oil.
5. Remove and discard the engine oil filter.



6. Disconnect the coolant hoses.



7. Remove the oil filter housing.
  - Remove the center oil filter housing retaining bolt.
  - Remove the oil filter housing.

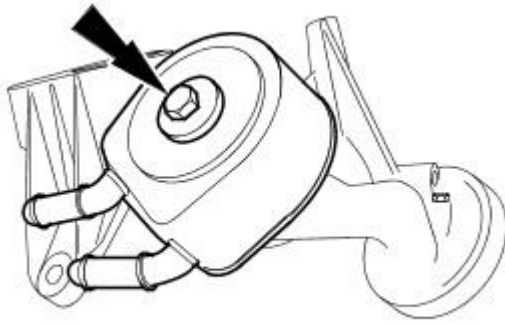


8. Remove the oil cooler.

- Remove and discard the oil cooler O-ring seal.

E30930

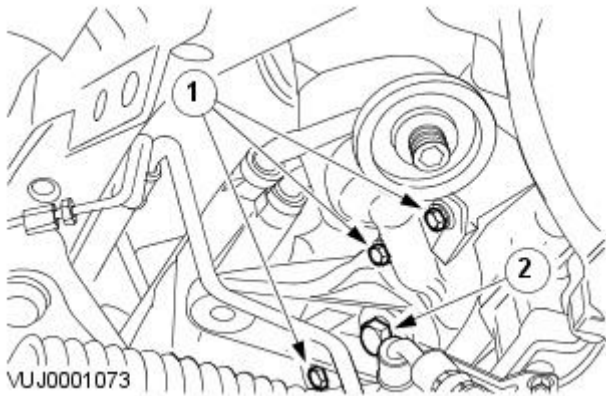
## Installation



1. Install the oil cooler.

- Install a new oil cooler O-ring seal.
- Tighten to 58 Nm.

E30930



2. Install the oil filter housing.

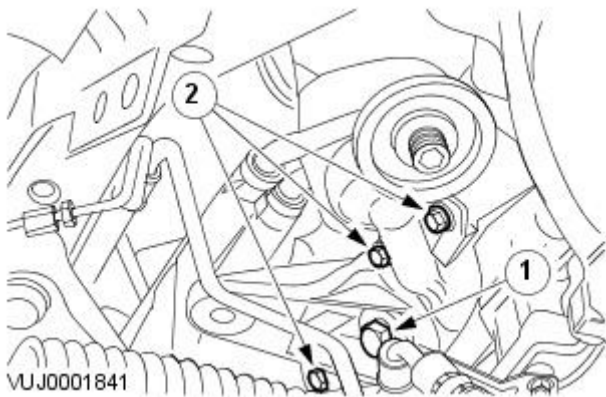
- Loosely install the oil filter housing retaining bolts.
- Loosely install the center oil filter housing retaining bolt.
- Install the oil filter housing.

VUJ0001073

3. NOTE: Tighten the bolts in the indicated sequence.

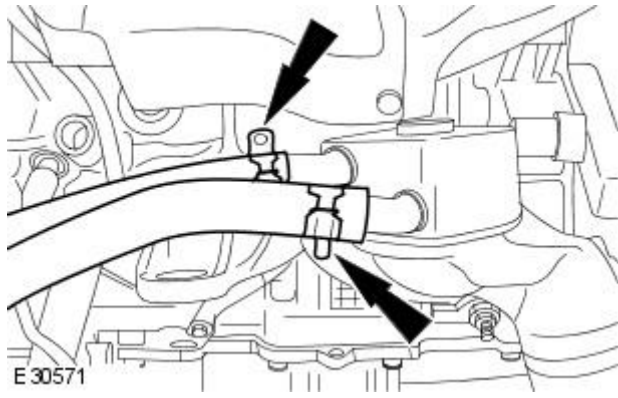
Tighten all bolts to 25 Nm.

- Tighten the M22 bolt to 155 Nm.
- Tighten the rest to 40 Nm + 90 degrees.

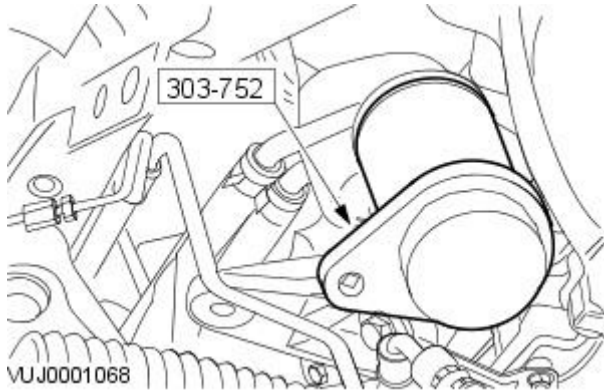


VUJ0001841

4. Connect the coolant hoses.



5. Install a new engine oil filter.



6. Install the left-hand engine mount.

For additional information, refer to: [Engine Mount LH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).

7. Install the oil pan drain plug

- Tighten to 24 Nm.

8. Lower the vehicle.

9. Refill the engine with oil.


10. Carry out the coolant fill and bleeding procedure.

For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 3.0L Petrol, General Procedures).

# Engine - V6 3.0L Petrol - Oil Pan

In-vehicle Repair

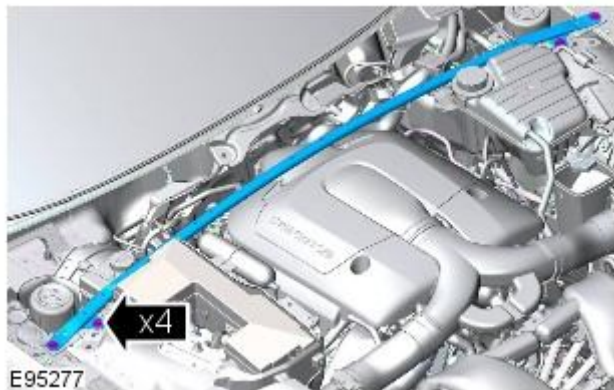
## Removal

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

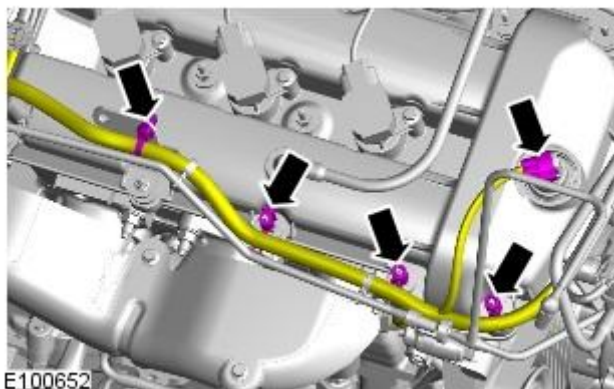
Raise and support the vehicle.

- Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
- Remove the cowl vent screen.  
For additional information, refer to: [Cowl Vent Screen](#) (501-02 Front End Body Panels, Removal and Installation).
- NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

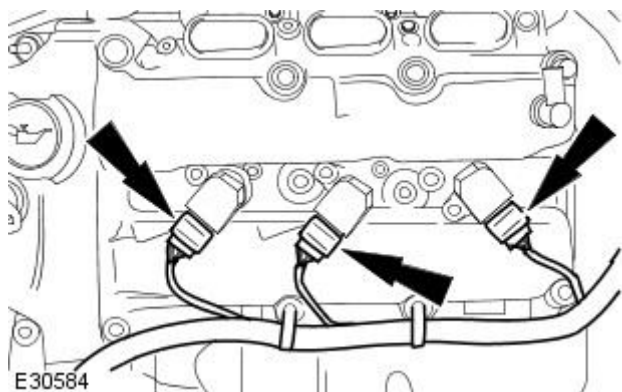
Remove the engine compartment support.



- Detach the right-hand valve cover wiring harness.

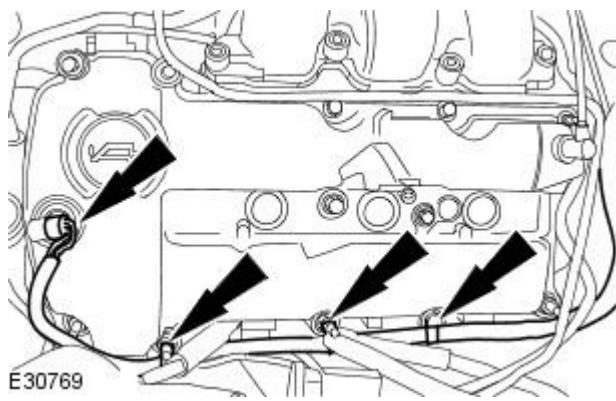


- Disconnect the left-hand ignition coil-on plug electrical connectors.



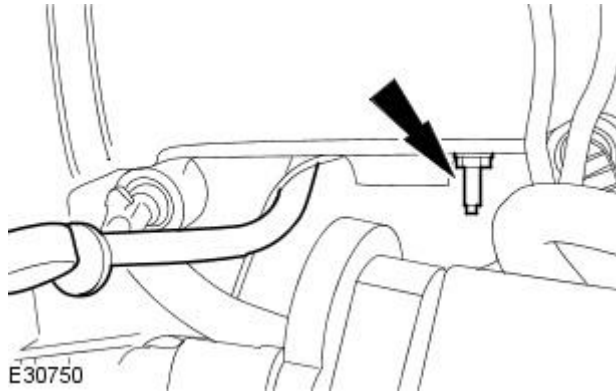


7. Detach the left-hand valve cover wiring harness.



8. Remove the oil level indicator tube retaining bolt.

- Reposition the oil level indicator tube.



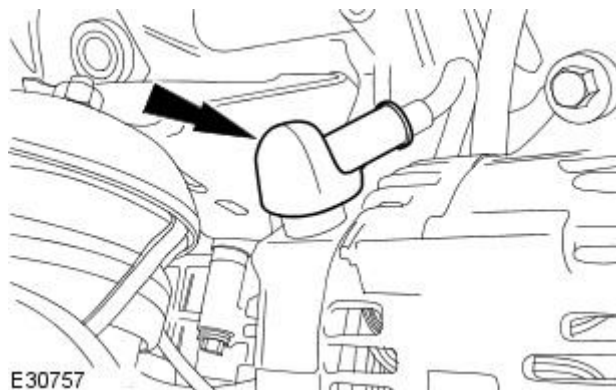
9. Remove the front subframe assembly.

For additional information, refer to: [Front Subframe - V6 3.0L Petrol](#) (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

10. Remove the air conditioning (A/C) compressor.

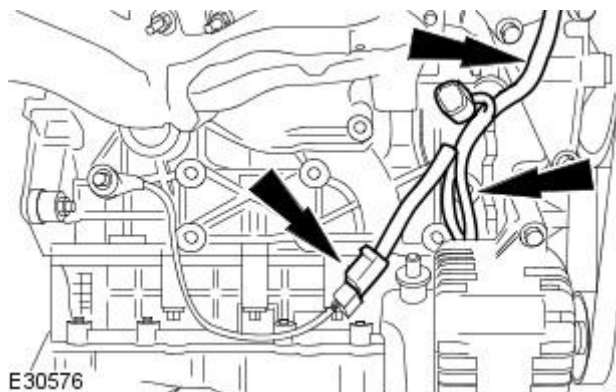
For additional information, refer to: [Air Conditioning \(A/C\) Compressor - V6 3.0L Petrol](#) (412-03 Air Conditioning, Removal and Installation).

11. Detach the generator battery positive cable protective cover.

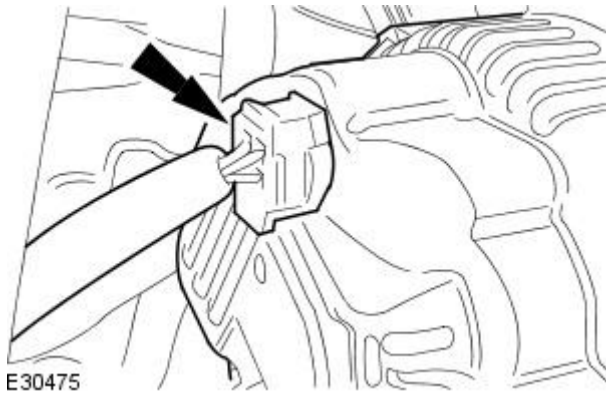


12. Disconnect the generator battery positive cable.

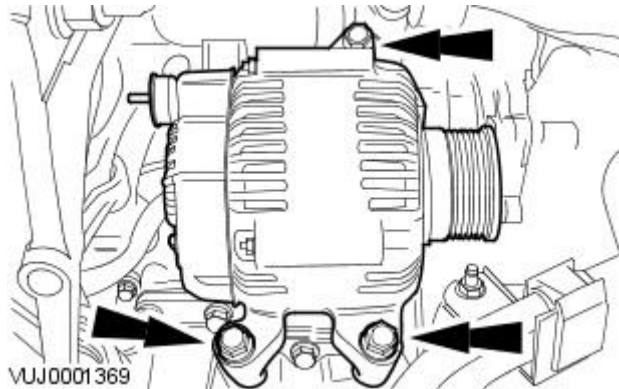
- Remove the battery positive cable retaining nut.



13. Disconnect the generator electrical connector.

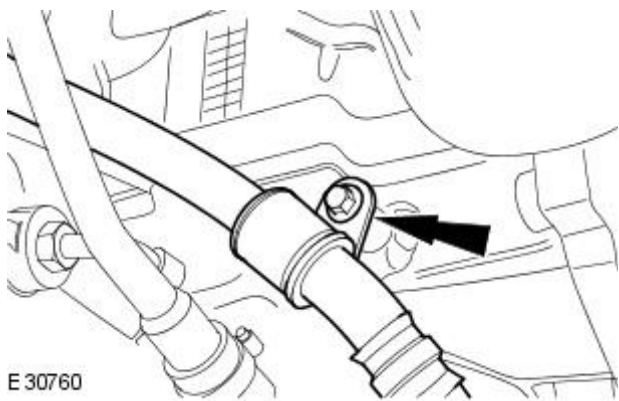


14. Remove the generator.

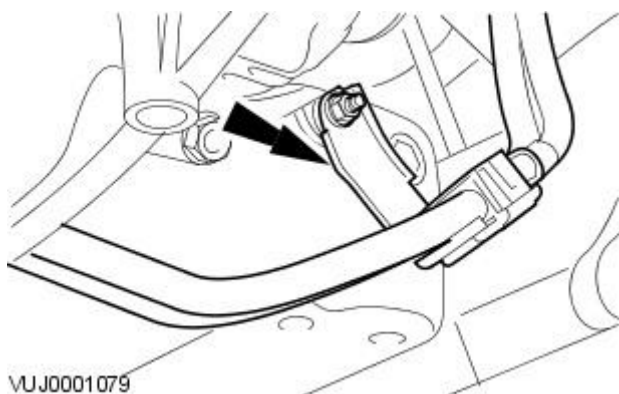


15. Drain the engine oil.

16. Detach the power steering hose.

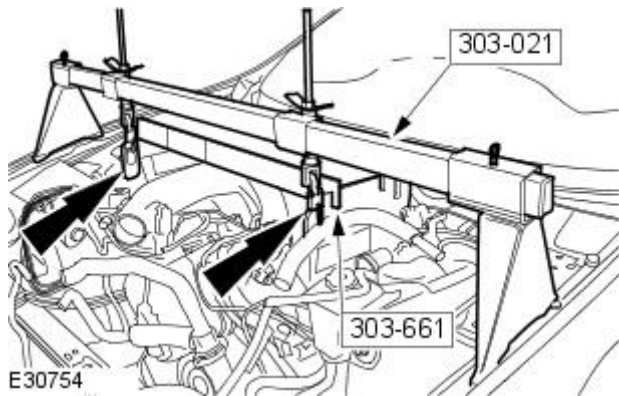


17. Detach the automatic transmission oil cooler tubes retaining bracket.



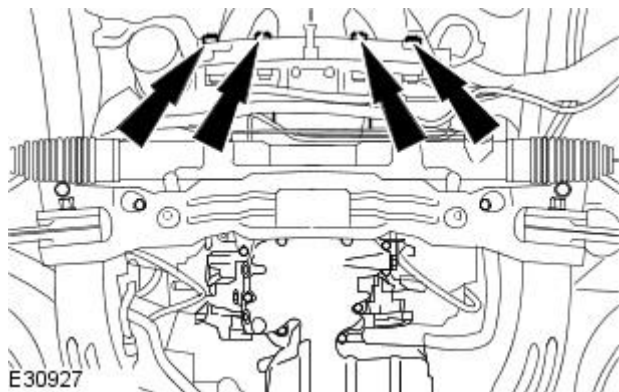
18. Lower the vehicle.

19. Using the special tools, raise the engine to a suitable height.



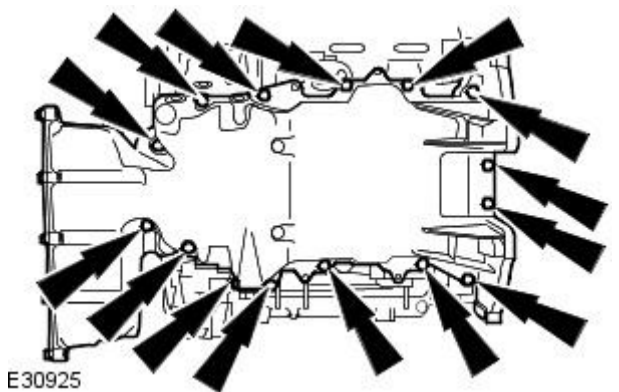
20. Raise the vehicle.

21. Remove the oil pan rear retaining bolts.



22. Remove the oil pan.

- Remove and discard the oil pan gasket.
- Clean and inspect the oil pan and cylinder block sealing surfaces using metal surface cleaner or equivalent meeting Jaguar specification.



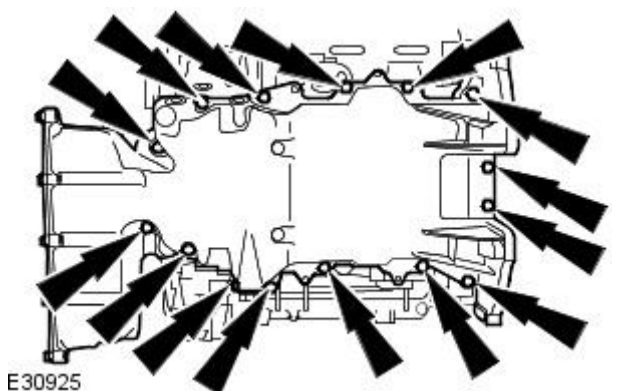
## Installation

1.  **CAUTION:** Install the oil pan within five minutes of applying the sealer. Failure to follow this instruction may cause damage to the vehicle.

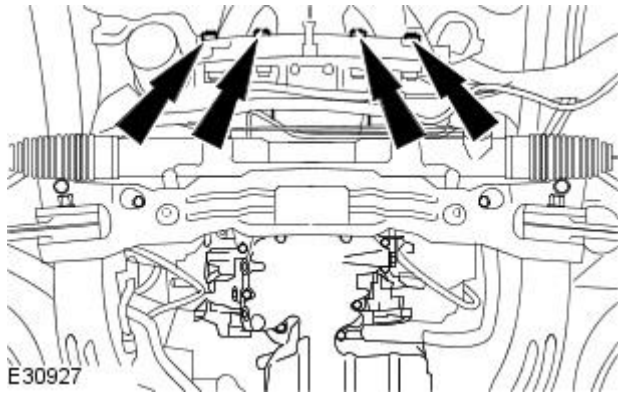
• **NOTE:** Apply a 10 mm dot of silicone gasket and sealant meeting Jaguar specification to the engine block and front cover mating surface.

Install the oil pan retaining bolts.

1. Install a new gasket.
2. Install the retaining bolts finger tight.

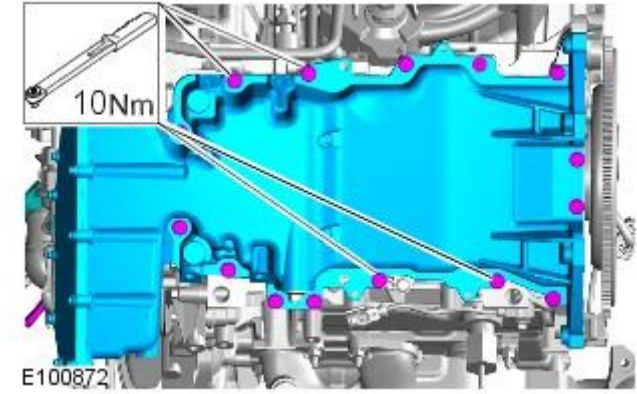






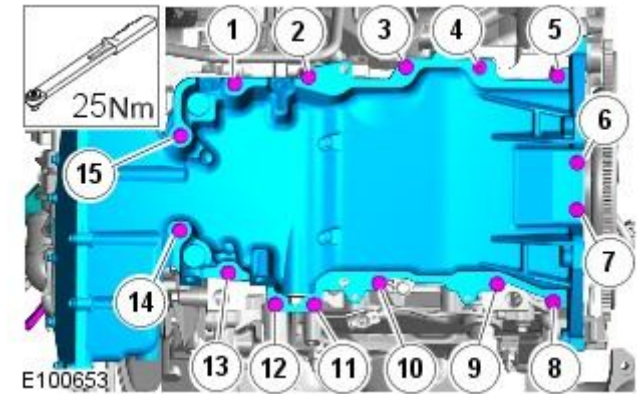
2. Install and tighten the bolts.

- Tighten to 10 Nm.



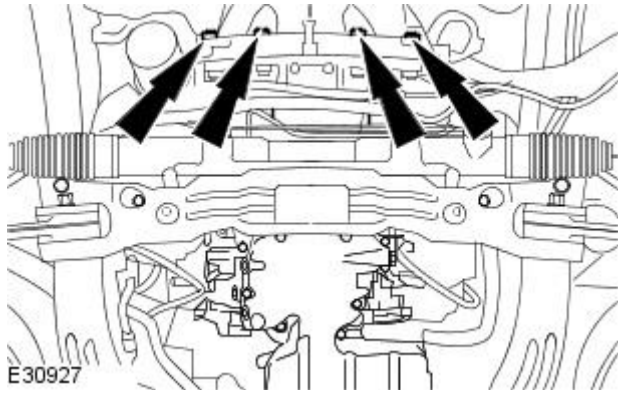
3. Tighten the oil pan retaining bolts.

- Tighten the 4 bolts to 10 Nm.



4. Tighten the oil pan retaining bolts.

- Complete the tightening sequence as illustrated.
- Tighten to 25 Nm.




5. Tighten the oil pan to transmission housing retaining bolts.

- Tighten to 48 Nm.

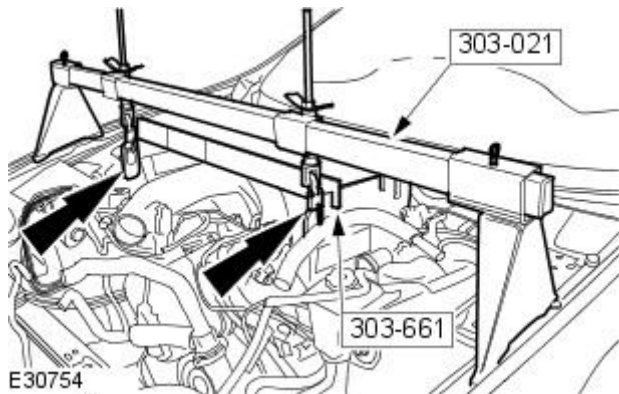
6. Install the front subframe.


For additional information, refer to: [Front Subframe - V6 3.0L Petrol \(502-00 Uni-Body, Subframe and Mounting System, Removal and Installation\)](#).

7. Lower the vehicle.

8.  CAUTION: Make sure the engine mounts locate into the correct position when the engine is repositioned.

Using the special tools, reposition the engine.

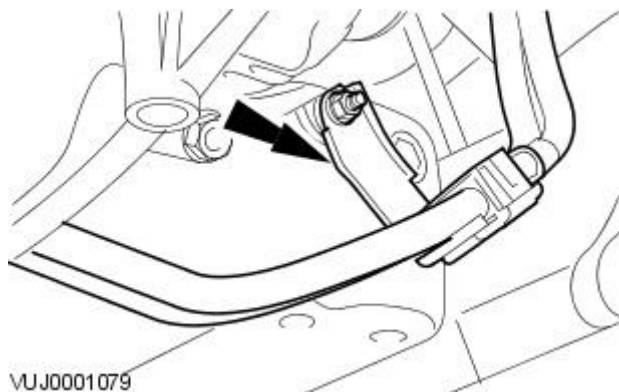


9.  WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise the vehicle.

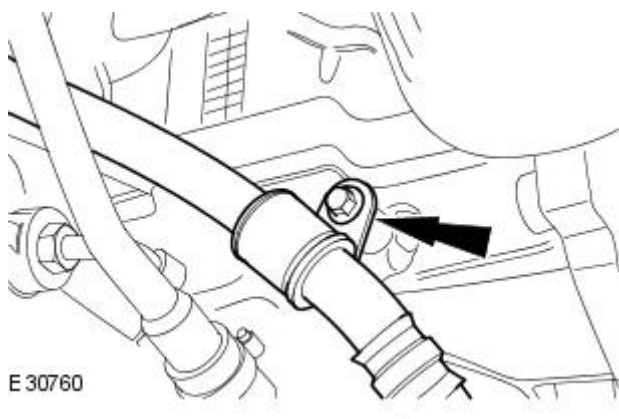
10. Attach the automatic transmission oil cooler tubes retaining bracket.

- Tighten to 10 Nm.



11. Attach the power steering hose.

- Tighten to 10 Nm.



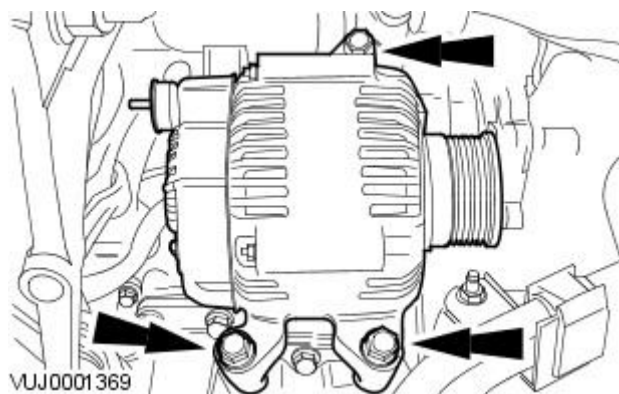
12. NOTE: Install a new sealing washer.

Install the oil pan drain plug.

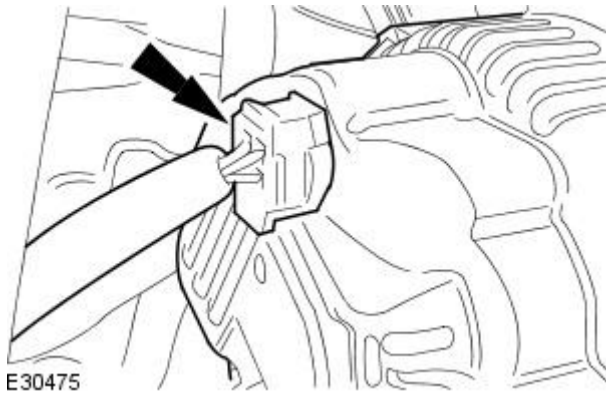
- Tighten to 24 Nm.

13. Install the generator.

- Tighten to 48 Nm.

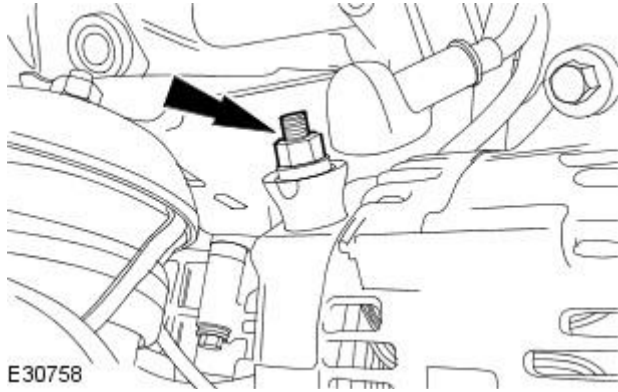


14. Connect the generator electrical connector.

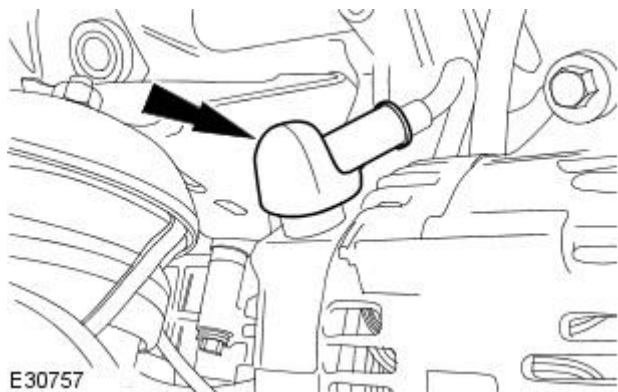


15. Install the battery positive cable retaining nut.

- Tighten to 12 Nm.



16. Attach the generator battery positive cable protective cover.

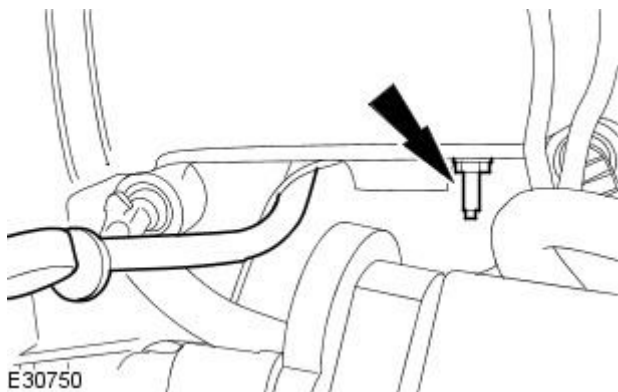


17. Install the air conditioning (AC) compressor.

For additional information, refer to: [Air Conditioning \(A/C\) Compressor - V6 3.0L Petrol](#) (412-03 Air Conditioning, Removal and Installation).

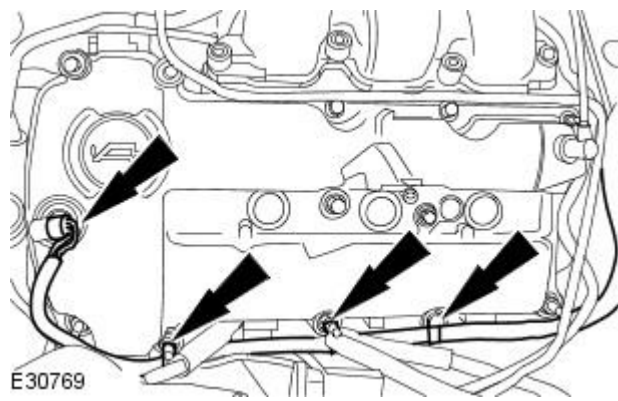
18. Install the oil level indicator and tube.

- Tighten to 10 Nm.

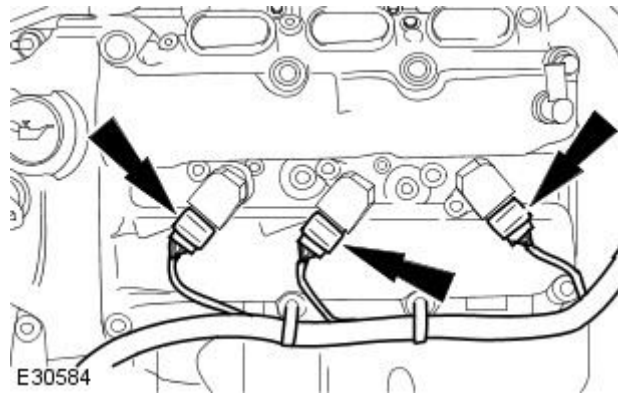




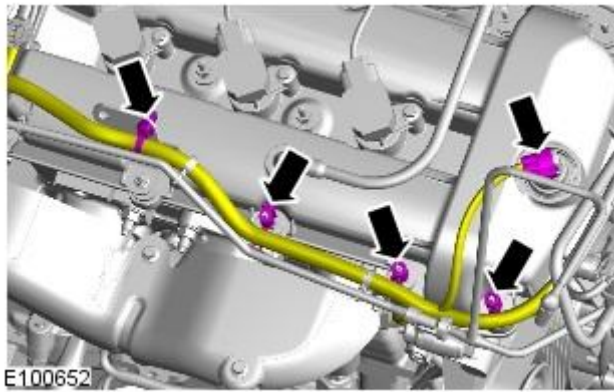
19. Attach the left-hand valve cover wiring harness.



20. Connect the left-hand ignition coils electrical connectors.



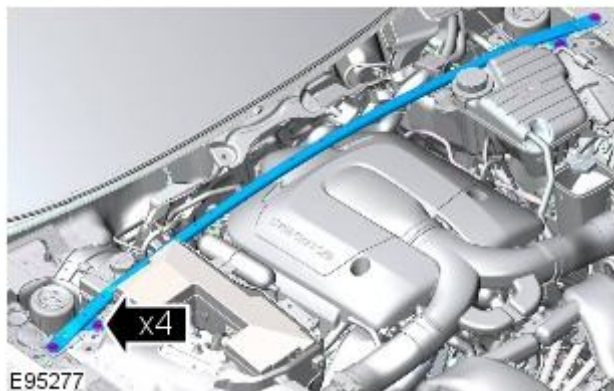
21. Attach the right-hand valve cover wiring harness.



22. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Install the engine compartment support.

- Tighten to 25 Nm.



23. Install the cowl vent screen.

For additional information, refer to: [Cowl Vent Screen](#) (501-02 Front End Body Panels, Removal and Installation).

24. Connect the battery ground cable.


For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

25. Refill the engine with oil.

# Engine - V6 3.0L Petrol - Oil Pump

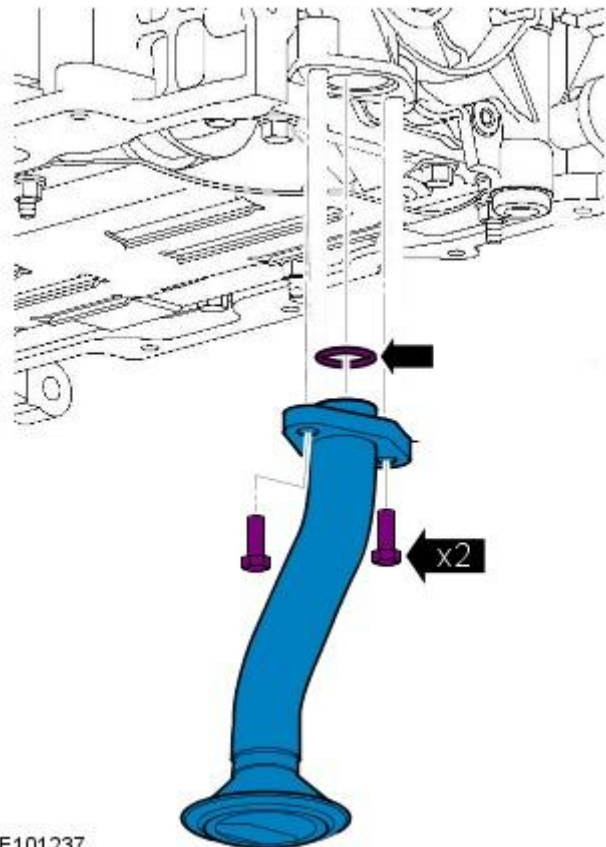
In-vehicle Repair

## Removal

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

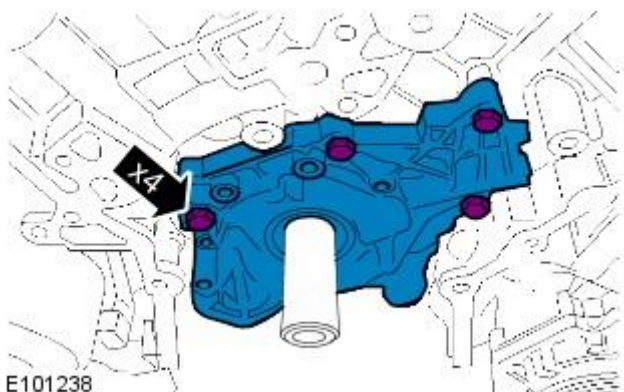
Raise and support the vehicle.

- Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
- Remove the timing drive components.  
For additional information, refer to: [Timing Drive Components](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).
- Remove the oil pump tube.
  - Remove the 2 retaining bolts.
  - Remove and discard the O-ring seal.



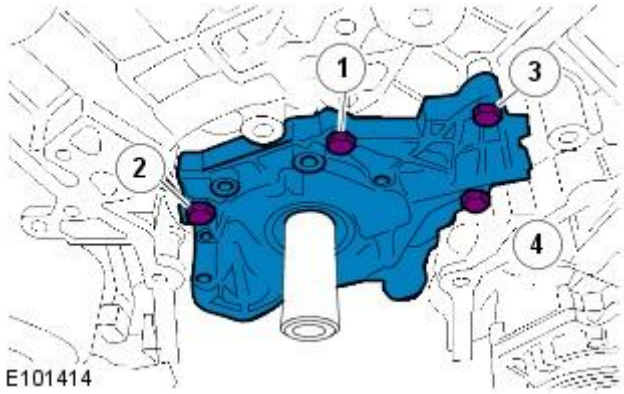
E101237

- Remove the oil pump.
  - Remove the 4 bolts.
  - Remove and discard the O-ring seal.



E101238

## Installation



E101414

### 1. CAUTIONS:



Install the oil pump flush to the cylinder block for correct sealing.



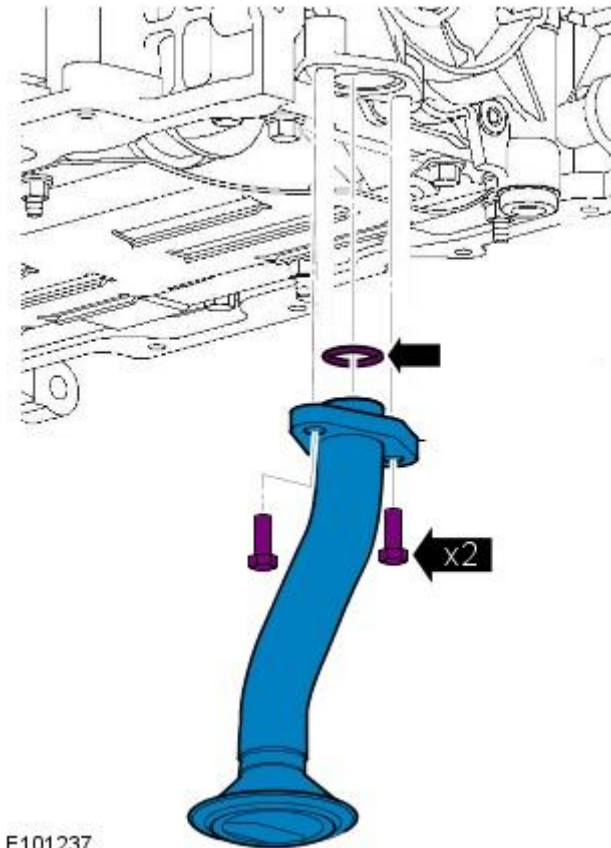
Rotate the inner rotor of the oil pump to align with the flats on the crankshaft before installation.

Install the oil pump.

- Install a new O-ring seal.
- Complete the tightening sequence.
- Tighten to 10 Nm.

### 2. Install the oil pump tube.

- Install a new O-ring seal.
- Tighten to 10 Nm.



E101237


### 3. Install the timing drive components.

For additional information, refer to: [Timing Drive Components](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).

# Engine - V6 3.0L Petrol - Timing Drive Components

In-vehicle Repair

## Removal

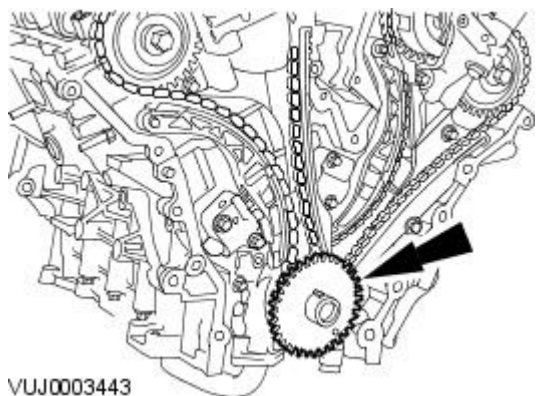
-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.


Raise and support the vehicle.

- Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
- Remove the engine front cover.  
For additional information, refer to: [Engine Front Cover](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).
- Remove the spark plugs.

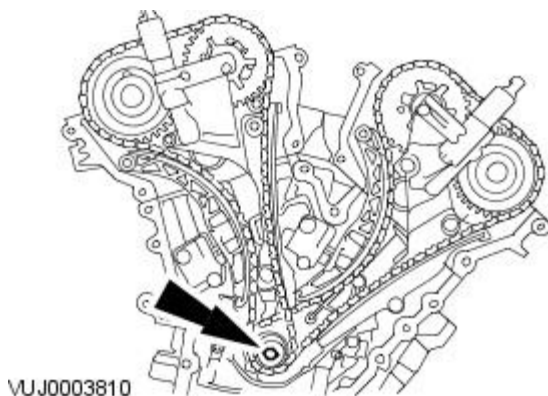
- NOTE:** Note the position of the crankshaft position (CKP) sensor pulse wheel during removal. It must be returned to its original position during installation.


Remove the crankshaft position (CKP) sensor pulse wheel.



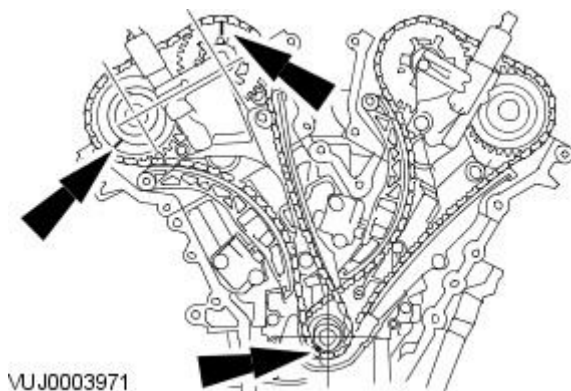
-  **CAUTION:** Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Install the crankshaft pulley retaining bolt and washer.



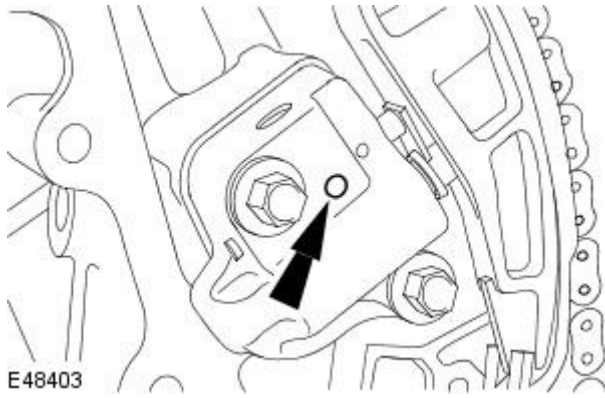
-  **CAUTION:** Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Rotate the crankshaft clockwise until the crankshaft keyway is at the 7 O'clock position, the alignment mark on the right-hand intake camshaft sprocket is at the 1 O'clock position and the alignment mark on the right-hand exhaust camshaft sprocket is at the 8 O'clock position.



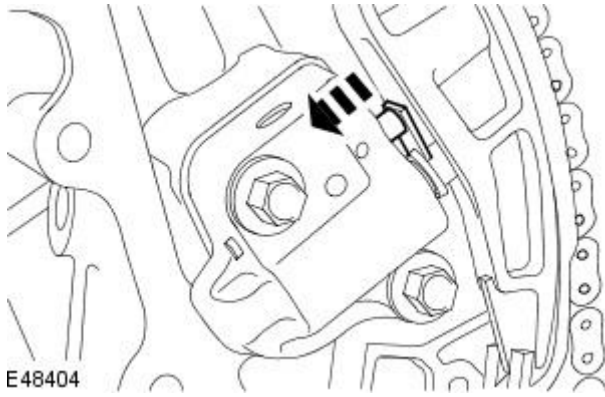


8. Release the timing chain tensioner ratchet.

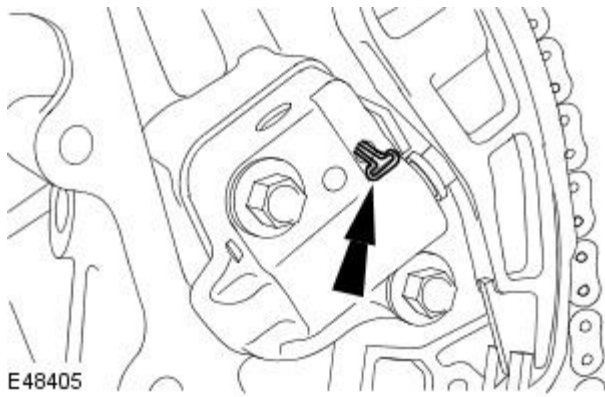


9. NOTE: Keep the timing chain tensioner ratchet released.

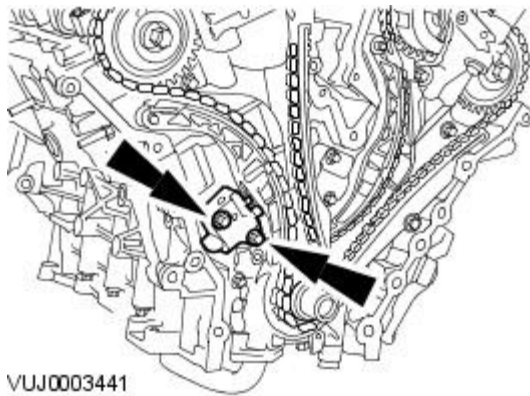
Reposition the timing chain tensioner plunger.



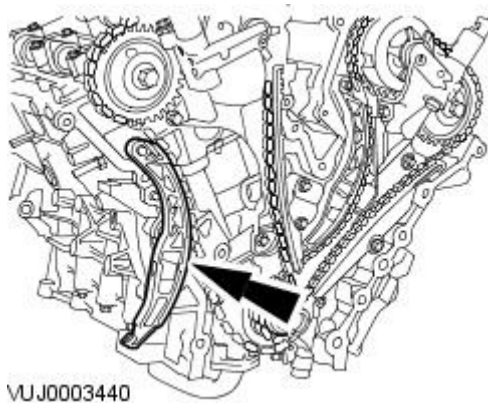
10. Retain the timing chain tensioner plunger.



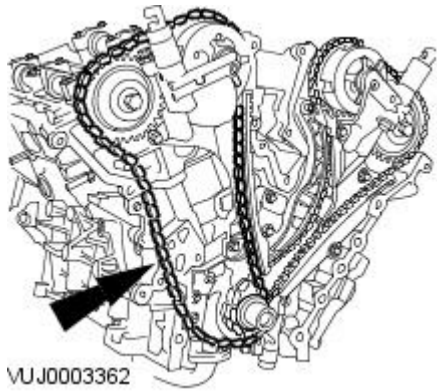
11. Remove the right-hand timing chain tensioner.



12. Remove the right-hand timing chain outer guide.

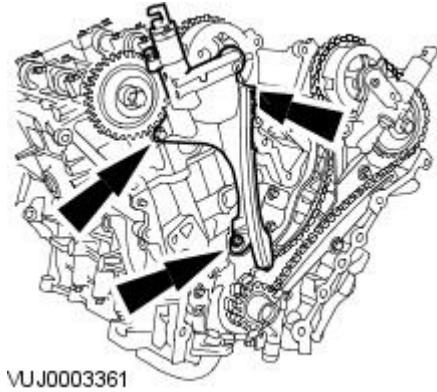



13. Remove the right-hand timing chain.



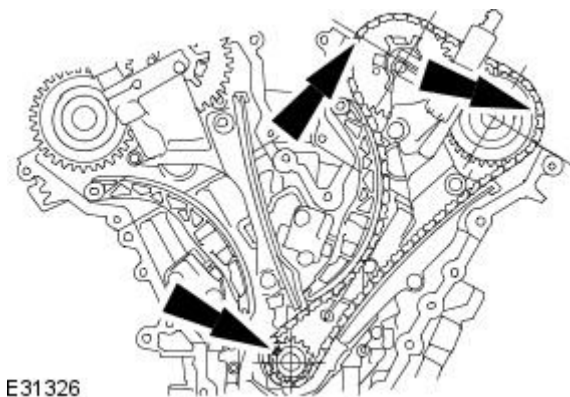
14.  CAUTION: Inspect and replace the O-ring if necessary.

Remove the right-hand timing chain inner guide.



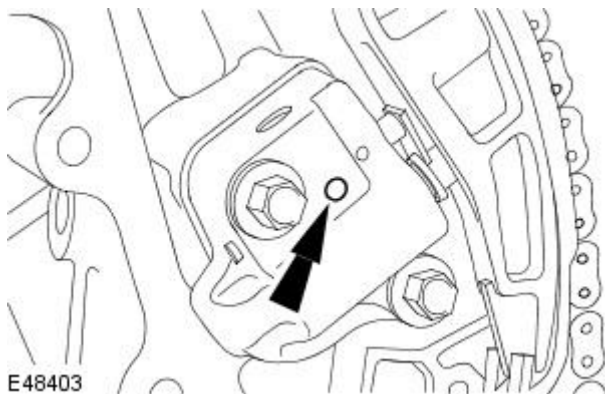
15.  CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Rotate the crankshaft clockwise until the crankshaft keyway is at the 11 O'clock position, the alignment mark on the left-hand intake camshaft sprocket is at the 9 O'clock position and the alignment mark on the left-hand exhaust camshaft sprocket is at the 2 O'clock position.



16. NOTE: Right-hand bank shown, left-hand bank similar.

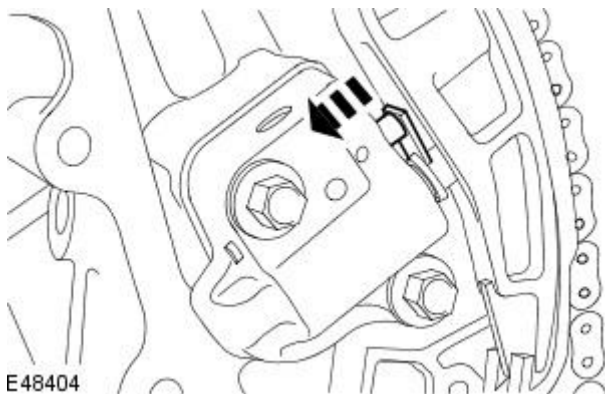
Release the timing chain tensioner ratchet.



17. NOTE: Keep the timing chain tensioner ratchet released.

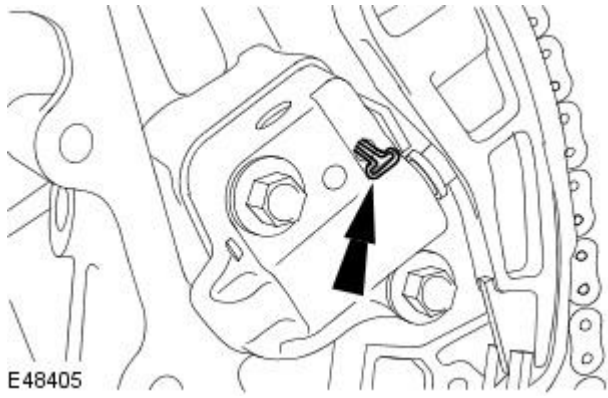
• NOTE: Right-hand bank shown, left-hand bank similar.

Reposition the timing chain tensioner plunger.

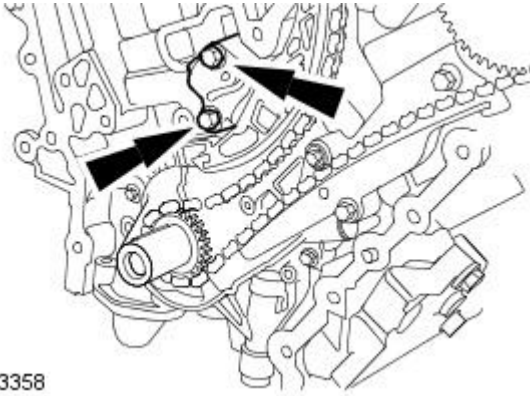


18. NOTE: Right-hand bank shown, left-hand bank similar.

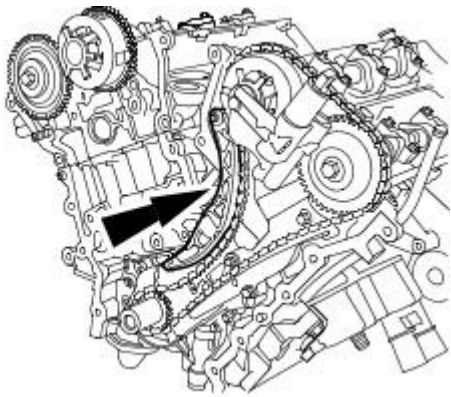
Retain the timing chain tensioner plunger.



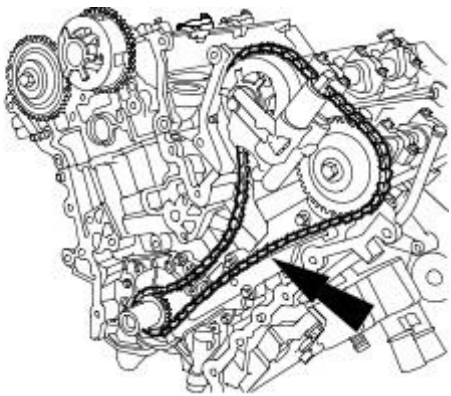
19. Remove the left-hand timing chain tensioner.



20. Remove the left-hand timing chain inner guide.

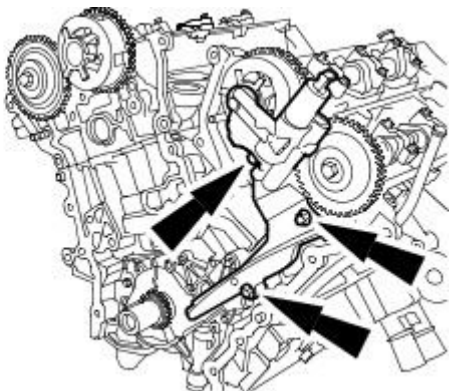


21. Remove the left-hand timing chain.

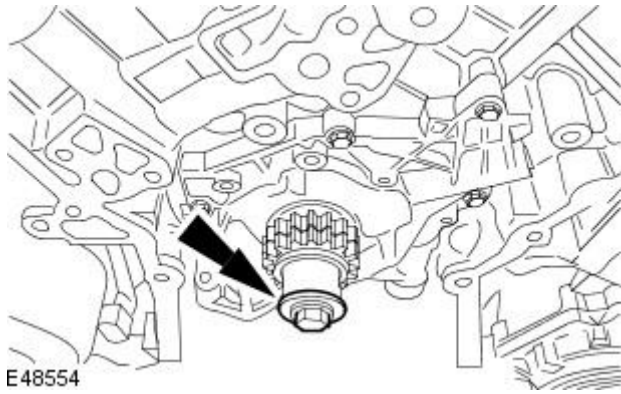



22.  CAUTION: Inspect and replace the O-ring if necessary.

Remove the left-hand timing chain outer guide.

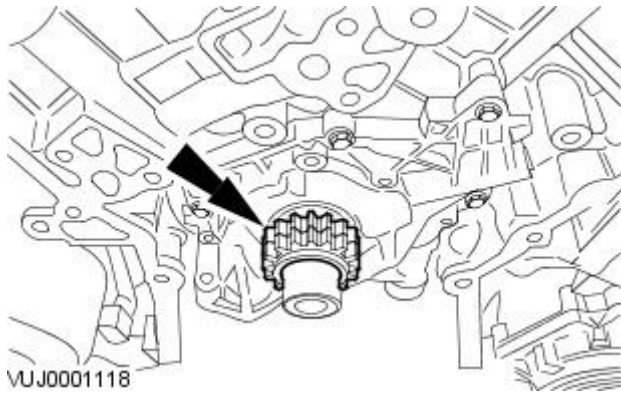






23.  CAUTION: Make sure the crankshaft keyway is at the 9 O'clock position before any further engine repairs are carried out.

Remove the crankshaft pulley retaining bolt and washer.



24. Remove the crankshaft sprocket.

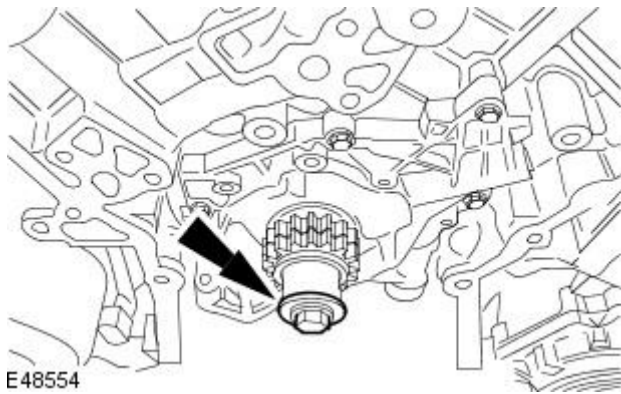
### Installation

1. NOTE: Make sure the crankshaft sprocket timing marks are facing outwards.

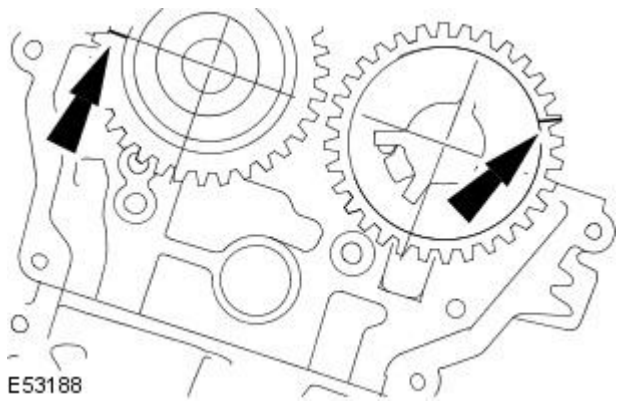
Install the crankshaft sprocket.

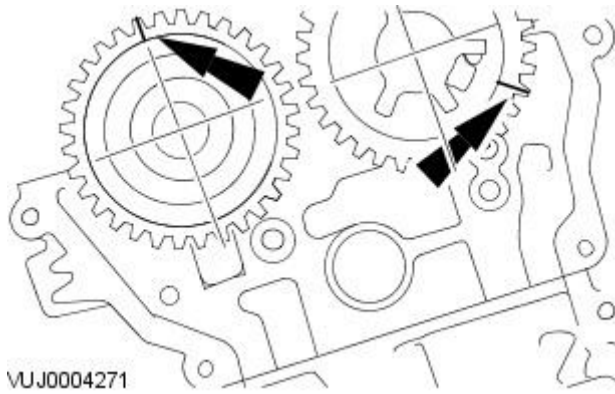
2.  CAUTION: Make sure the crankshaft keyway is at the 9 O'clock position before the camshaft positions are aligned.

Install the crankshaft pulley retaining bolt and washer.



3. Rotate the left-hand intake camshaft clockwise until the camshaft sprocket alignment mark is at the 9 O'clock position and rotate the left-hand exhaust camshaft sprocket clockwise until the camshaft sprocket alignment mark is at the 2 O'clock position.





4. Rotate the right-hand intake camshaft clockwise until the camshaft sprocket alignment mark is at the 5 O'clock position and rotate the right-hand exhaust camshaft clockwise until the camshaft sprocket alignment mark is at the 12 O'clock position.

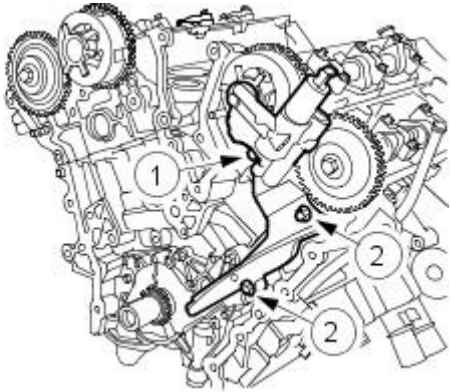
VUJ0004271

5. Rotate the crankshaft clockwise until the keyway is at the 11 O'clock position.

6.  **CAUTION:** Inspect and replace the O-ring if necessary.


Install the left-hand timing chain outer guide.

- Tighten the retaining bolts in the sequence shown.
- Stage 1: Tighten bolt 1 to 25 Nm.
- Stage 2: Tighten bolts 2 to 25 Nm.



VUJ0003807

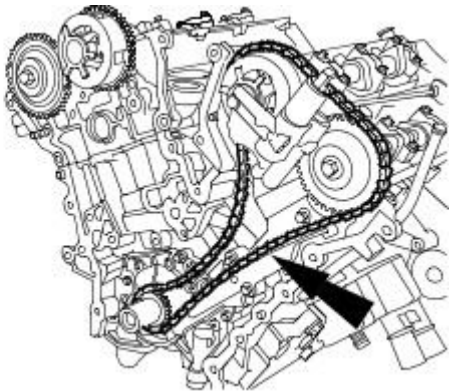
7. **CAUTIONS:**

 Make sure the crankshaft keyway is at the 11 O'clock position, the alignment mark on the left-hand intake camshaft sprocket is at the 9 O'clock position and the alignment mark on the left-hand exhaust camshaft sprocket is at the 2 O'clock position.

 Make sure the timing chain alignment marks are correctly positioned to the crankshaft sprocket and camshaft sprocket alignment marks.

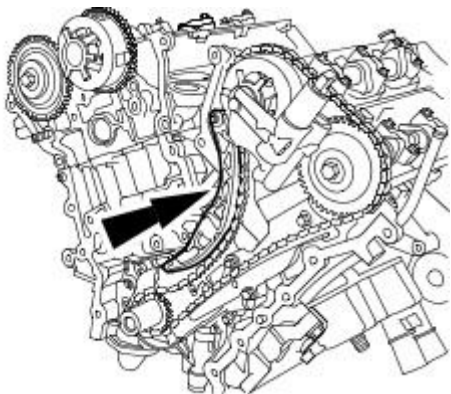
 Make sure the timing chain slack is on the tensioned side of the timing chain.

Install the left-hand timing chain.

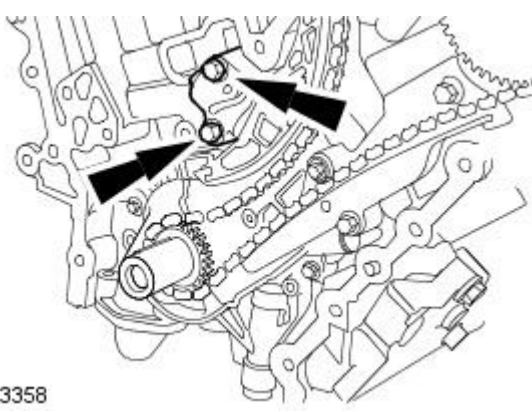


VUJ0003356

8. Install the left-hand timing chain inner guide.



VUJ0003357

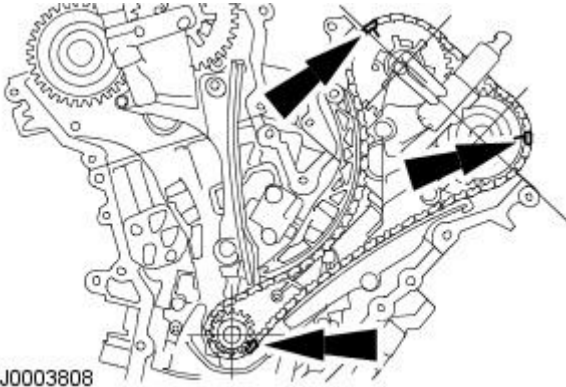


VUJ0003358

9. CAUTION: Do not manually adjust the timing chain tensioner.

Install the left-hand timing chain tensioner.

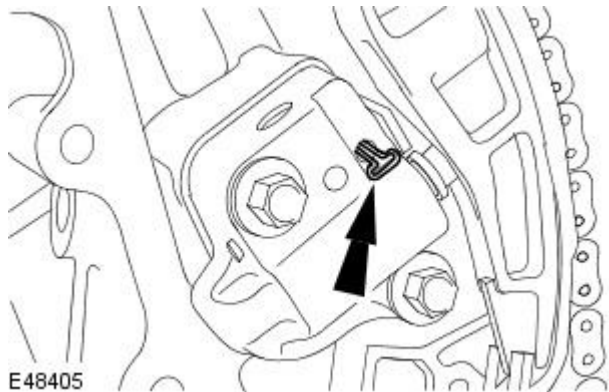
- Tighten to 25 Nm.



VUJ0003808

10. CAUTION: Do not manually adjust the timing chain tensioner.

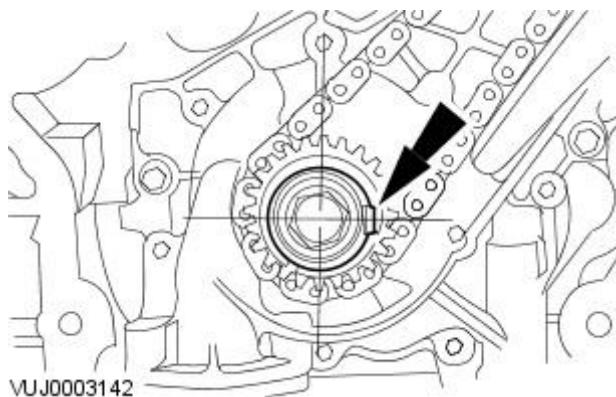
Make sure the left-hand timing chain alignment marks have remained correctly positioned to the camshaft sprocket and crankshaft sprocket alignment marks.



E48405

11. CAUTION: Do not manually adjust the timing chain tensioner.

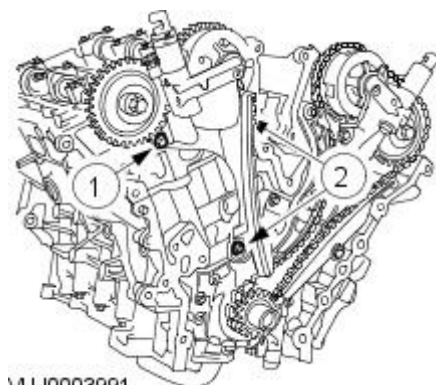
Remove the timing chain tensioner retaining pin.



VUJ0003142

12. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Rotate the crankshaft clockwise until the crankshaft keyway is at the 3 O'clock position.



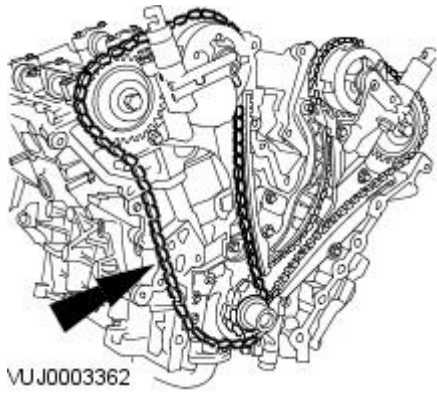
VUJ0003991

13. CAUTION: Inspect and replace the O-ring if necessary.

Install the right-hand timing chain inner guide.




- Tighten the retaining bolts in the sequence shown.
- Stage 1: Tighten bolt 1 to 25 Nm.
- Stage 2: Tighten bolts 2 to 25 Nm.





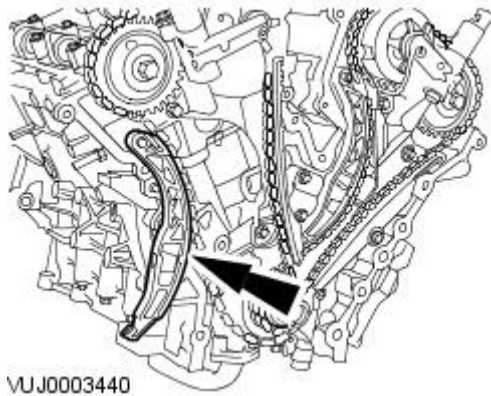
VUJ0003362

**14. CAUTIONS:**

-  Make sure the crankshaft keyway is at the 3 O'clock position, the alignment mark on the right-hand intake camshaft sprocket is at the 5 O'clock position and the alignment mark on the right-hand exhaust camshaft sprocket is at the 12 O'clock position.
-  Make sure the timing chain alignment marks are correctly positioned to the crankshaft sprocket and camshaft sprocket alignment marks.
-  Make sure the timing chain slack is on the tensioned side of the timing chain.

Install the right-hand timing chain.

**15. Install the right-hand timing chain outer guide.**

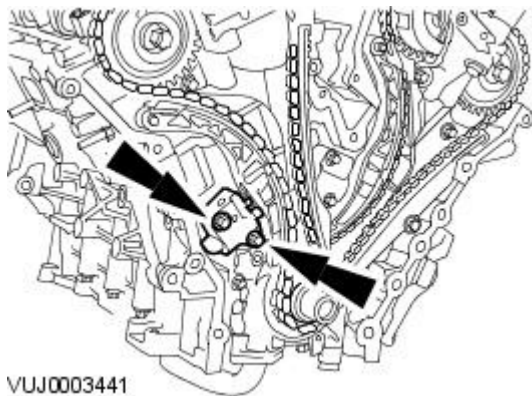


VUJ0003440

**16.  CAUTION: Do not manually adjust the timing chain tensioner.**

Install the right-hand timing chain tensioner.

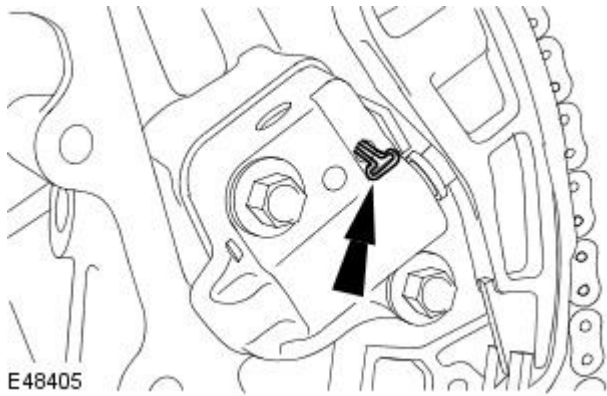
- Tighten to 25 Nm.



VUJ0003441


**17.  CAUTION: Do not manually adjust the timing chain tensioner.**

Remove the timing chain tensioner retaining pin.



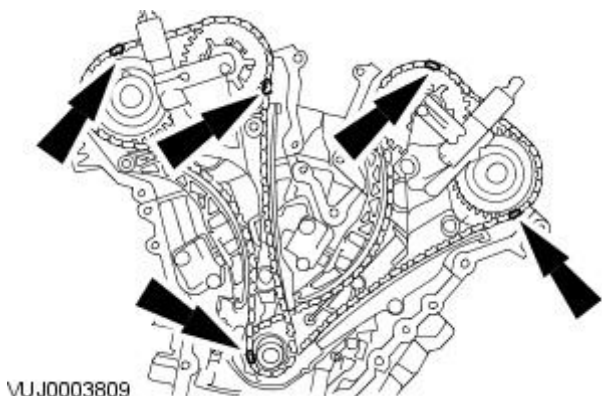
E48405

**18. CAUTIONS:**

-  Make sure the right-hand timing chain alignment marks have remained correctly positioned to the camshaft sprocket and crankshaft sprocket alignment marks.


-  Do not manually adjust the timing chain tensioner.

Make sure all the timing chain alignment marks are in the positions shown.




VUJ0003809



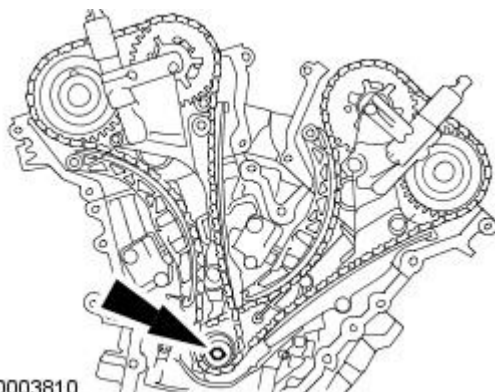
19.  CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

- NOTE: Rotate the crankshaft using hand tools only.

Rotate the crankshaft two complete turns clockwise to make sure the valves and pistons do not clash.


20.  CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Remove the crankshaft pulley retaining bolt and washer.



21. CAUTIONS:

 Make sure the crankshaft position (CKP) sensor wheel is correctly installed with the missing tooth aligned to the crankshaft keyway.

 Make sure the crankshaft position (CKP) sensor wheel is correctly installed with the teeth pointing outwards.

Install the crankshaft position (CKP) sensor pulse wheel.

22. Install the spark plugs.

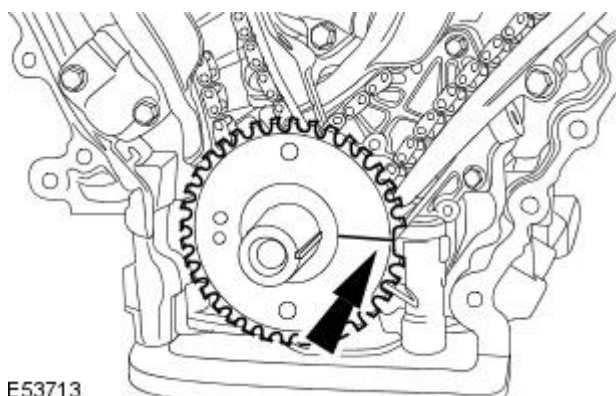
- Tighten to 15 Nm.

23. Install the engine front cover.

For additional information, refer to: [Engine Front Cover](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).

24. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

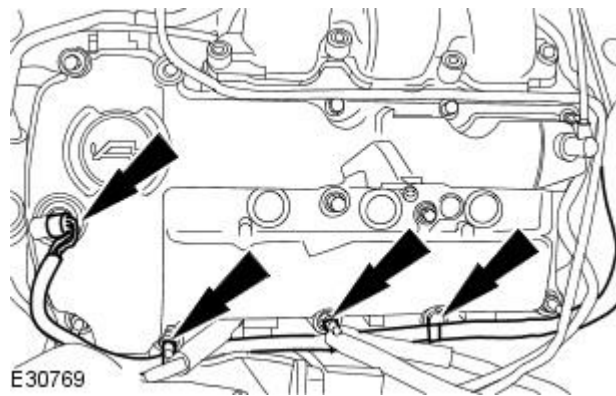


# Engine - V6 3.0L Petrol - Valve Cover LH

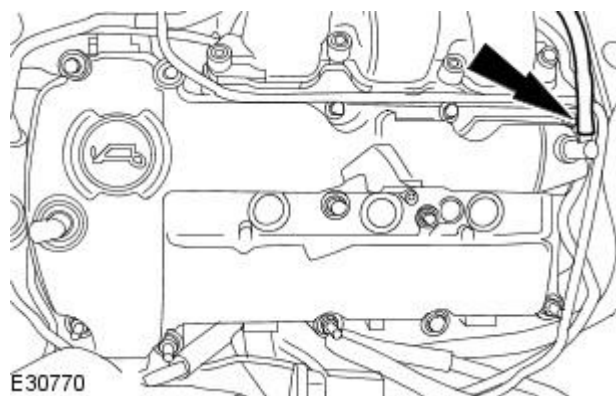
In-vehicle Repair

## Removal

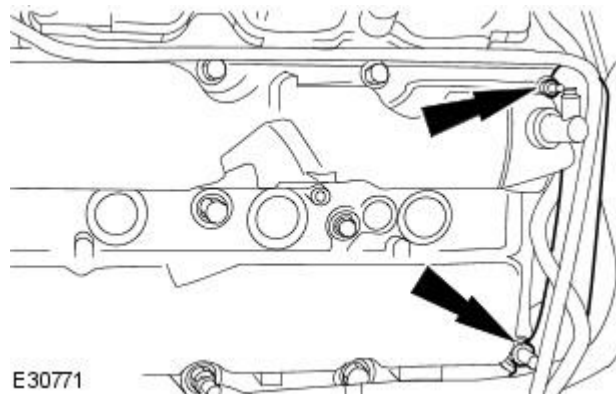
1. Remove the left-hand on-plug coils.  
For additional information, refer to: [Ignition Coil-On-Plug LH](#) (303-07A Engine Ignition - V6 3.0L Petrol, Removal and Installation).
2. Detach the left-hand valve cover wiring harness.



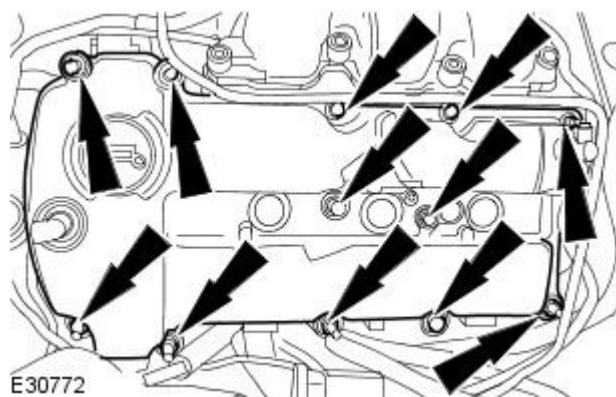
3. Detach the engine breather tube.



4. Detach the engine wiring harness retaining bracket.



5. Remove the valve cover.

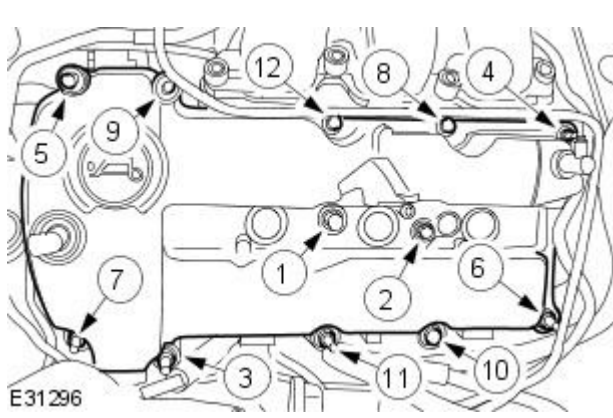


## Installation

**1.** NOTE: Apply a 5mm diameter bead of silicone gasket sealant or equivalent meeting Jaguar specification on the half round gaskets and apply an 8mm diameter on the two places where the cylinder head and front cover join.

To install, reverse the removal procedure.

- Install new valve cover gaskets.
- Complete the tightening sequence.
- Tighten to 10 Nm.

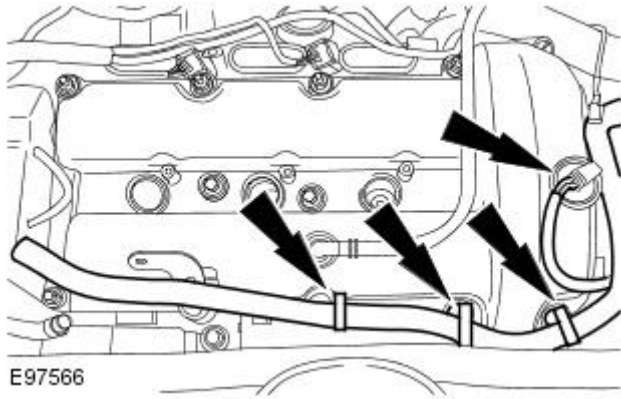


# Engine - V6 3.0L Petrol - Valve Cover RH

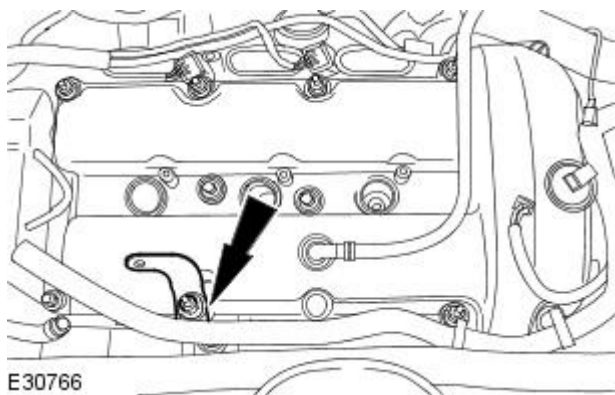
In-vehicle Repair

## Removal

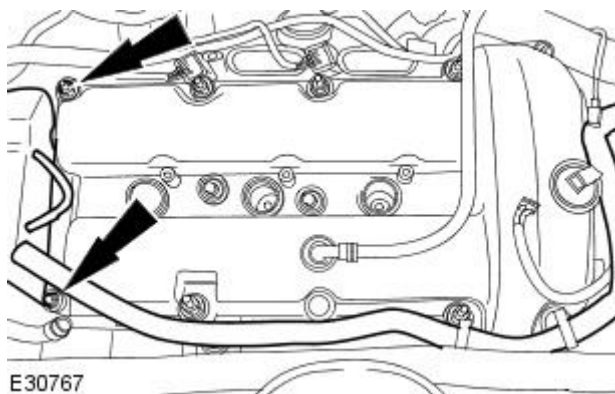
1. Remove the right-hand on-plug coils.  
For additional information, refer to: [Ignition Coil-On-Plug RH](#) (303-07A Engine Ignition - V6 3.0L Petrol, Removal and Installation).
2. Detach the right-hand valve cover wiring harness.



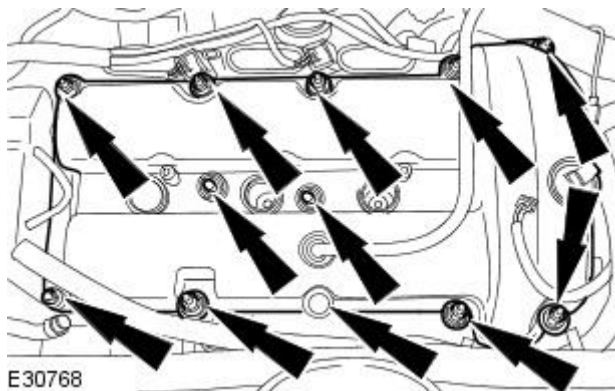
3. Detach the intake manifold rear retaining bracket.



4. Detach the engine wiring harness retaining bracket.



5. Remove the valve cover.

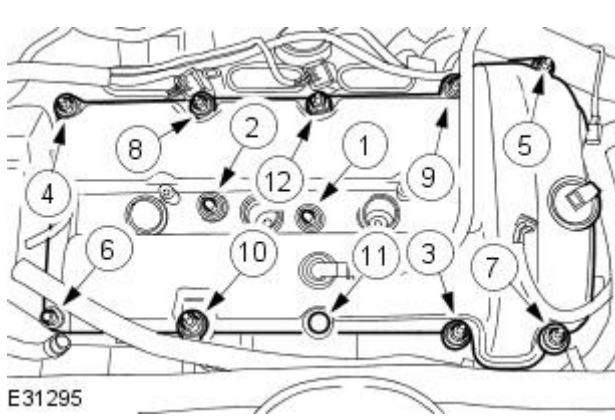


## Installation

**1. NOTE:** Apply a 5mm diameter bead of silicone gasket sealant or equivalent meeting Jaguar specification on the half round gaskets and apply an 8mm diameter on the two places where the cylinder head and front cover join.

To install, reverse the removal procedure.

- Install new valve cover gaskets.
- Complete the tightening sequence.
- Tighten to 10 Nm.



E31295



# Engine - V6 3.0L Petrol - Intake Manifold

Removal and Installation


## Removal


1. Remove the air cleaner outlet pipe.

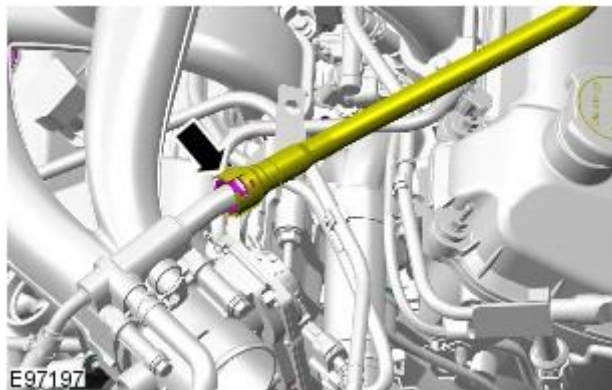
Refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - V6 3.0L Petrol, Removal and Installation).



2. **2. WARNINGS:**

 Never remove the coolant pressure cap under any circumstances while the engine is operating. Failure to follow this instruction may result in personal injury.

 To avoid having scalding hot coolant or steam blowing out of the cooling system, use extreme care when removing the coolant pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant pressure cap and turn it slowly until the pressure begins to release. Step back while the pressure is released from the system. When certain all the pressure has been released (still with a cloth) turn and remove the coolant pressure cap from the coolant expansion tank. Failure to follow these instructions may result in personal injury.



- 3.

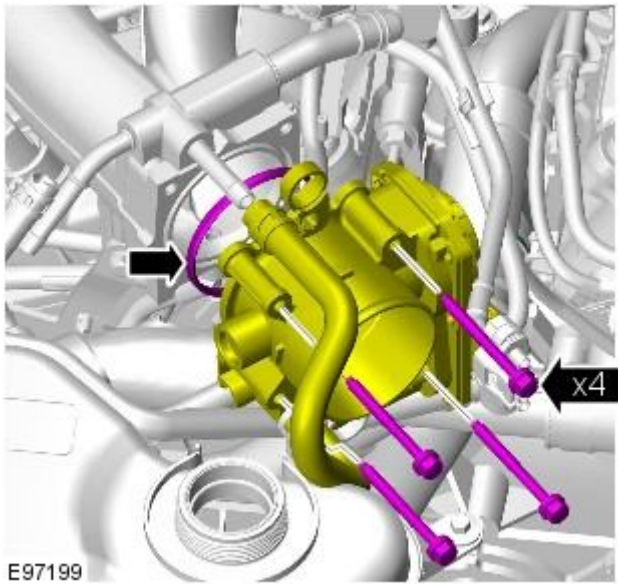


4. **4. NOTE:** Clamp the coolant hose to minimize coolant lose.



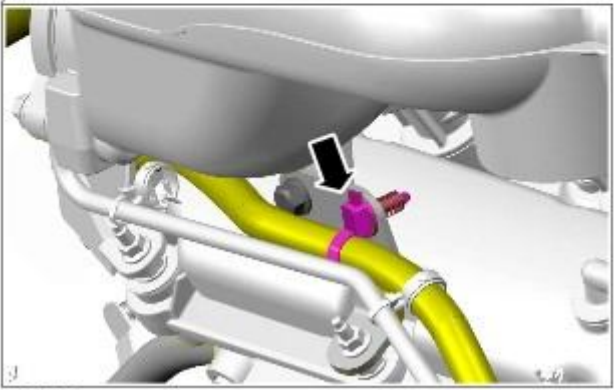
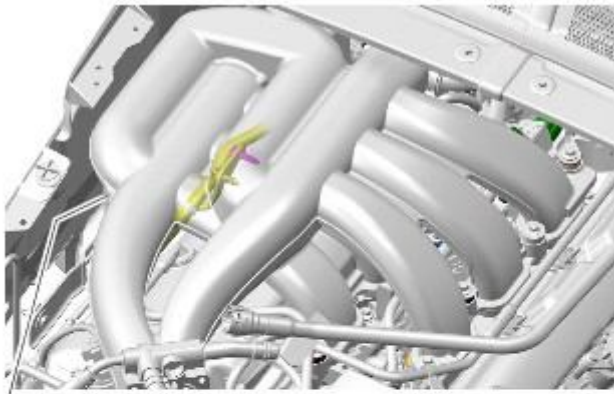
5. **5.** NOTE: Remove and discard the O-ring seal.

*Torque: 10 Nm*



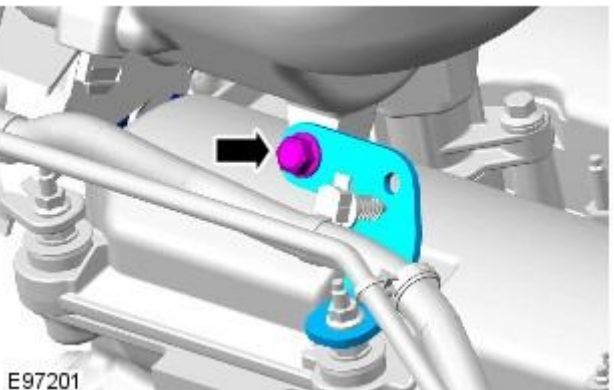
E97199

6.



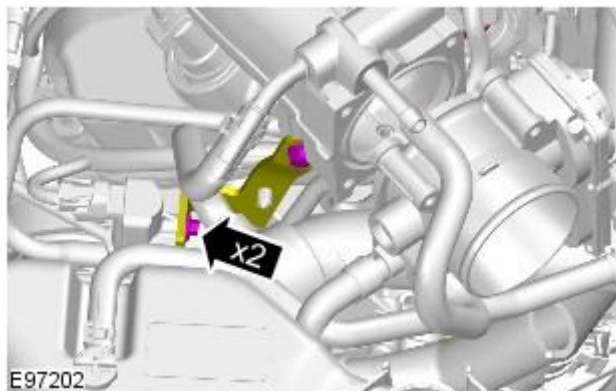
E97200

7. *Torque: 10 Nm*

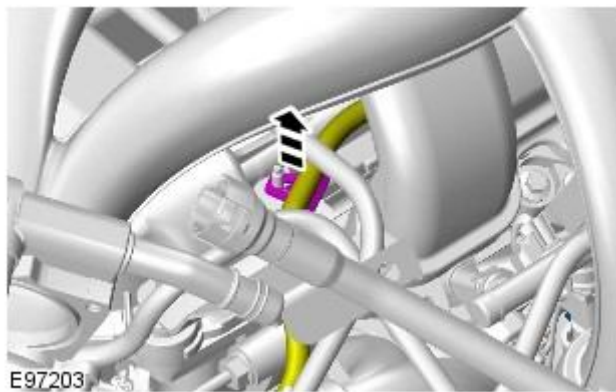


E97201

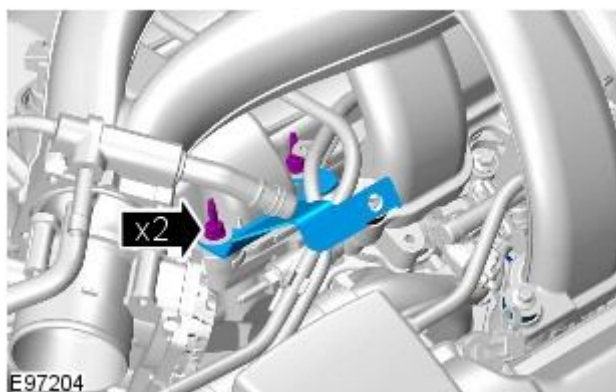
8. Torque: 10 Nm



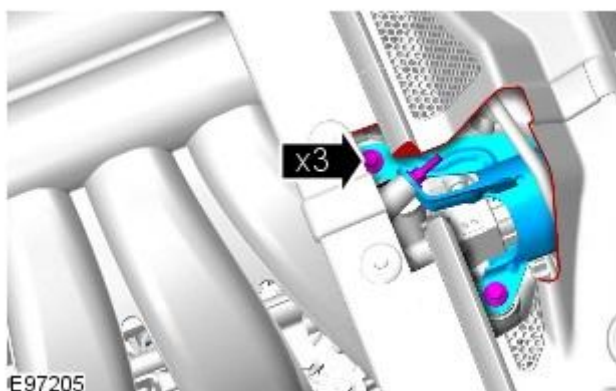
9.



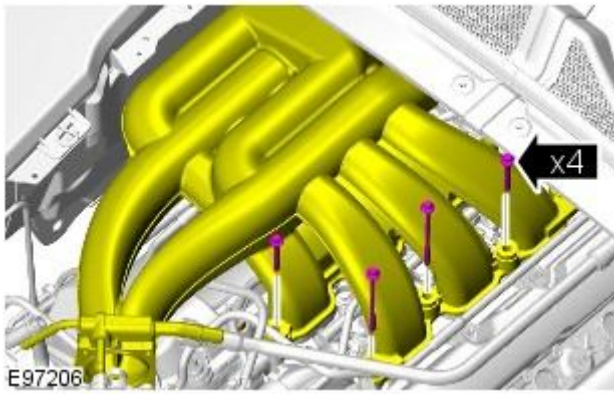
10. Torque: 10 Nm



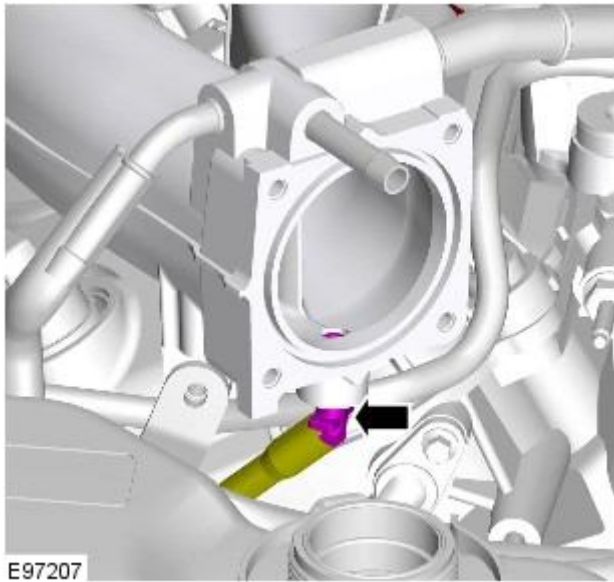
11. Torque:  
M5 6 Nm  
M6 10 Nm



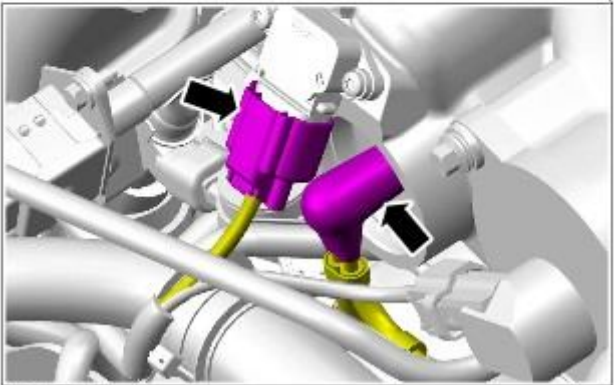
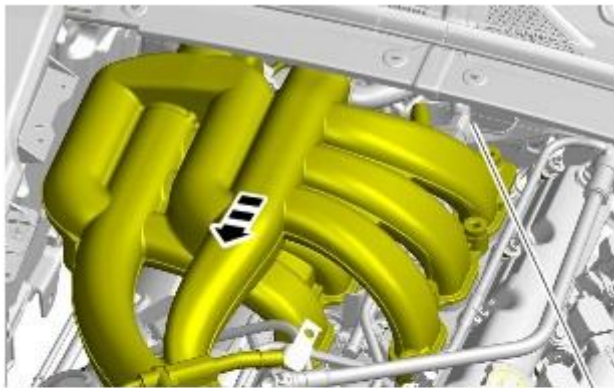
12. Torque: 10 Nm



13.

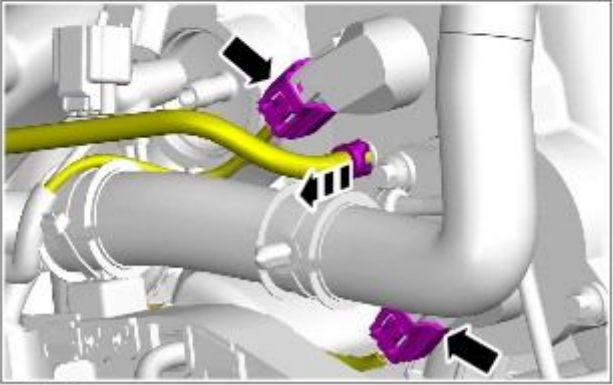
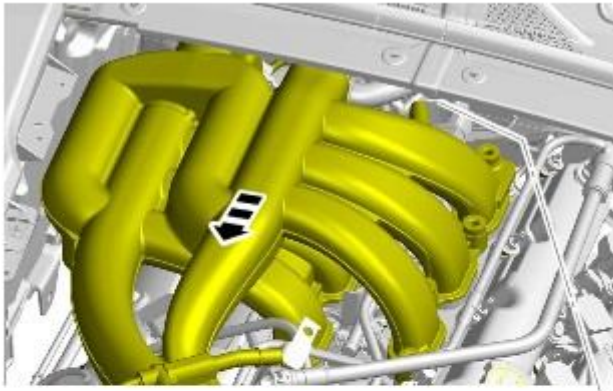


14.



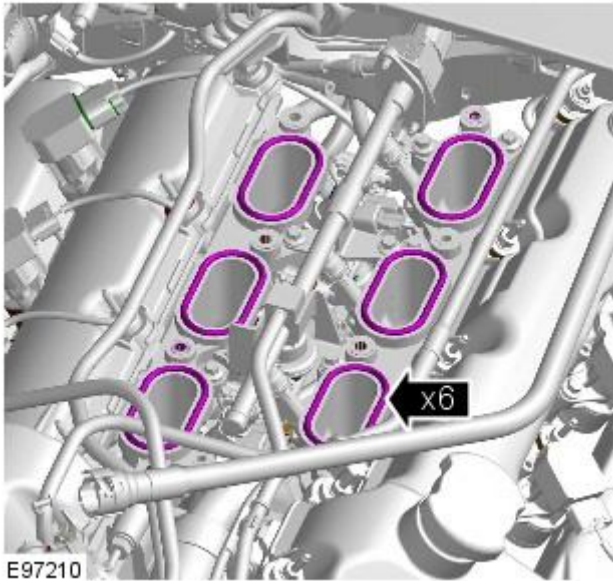


15.



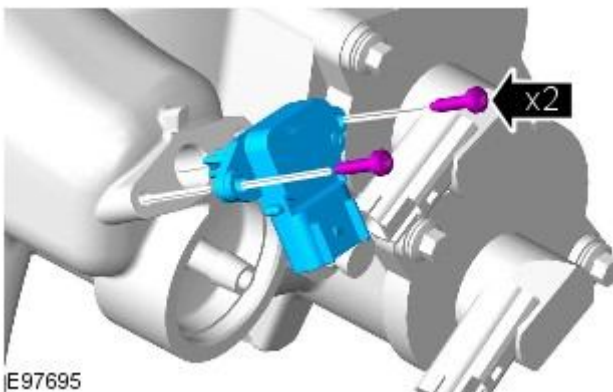
E97209

16. **16.** NOTE: Remove and discard the O-ring seals.



E97210

17. Torque: 7 Nm



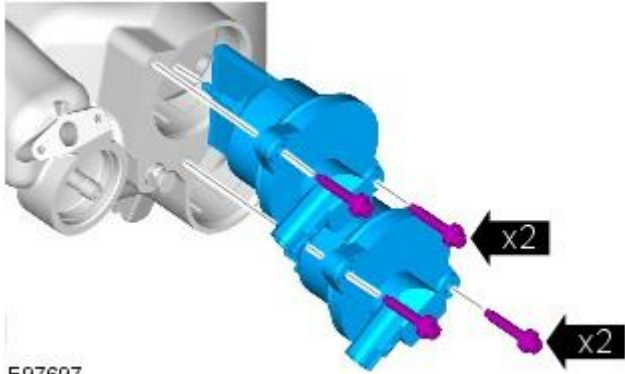
E97695

18.



E97696

19. Torque: 20 Nm



E97697

## Installation

1. To install, reverse the removal procedure.

# Engine - V6 3.0L Petrol - Lower Intake Manifold

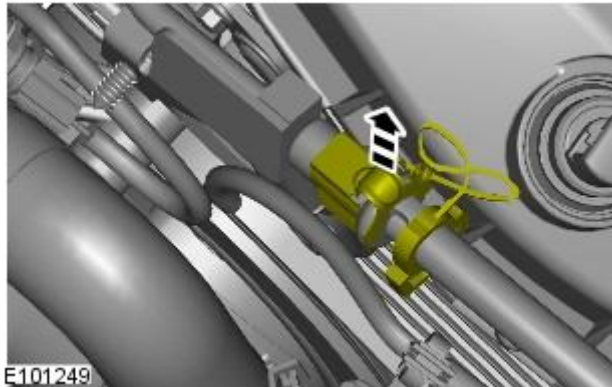
## Removal and Installation

### Removal

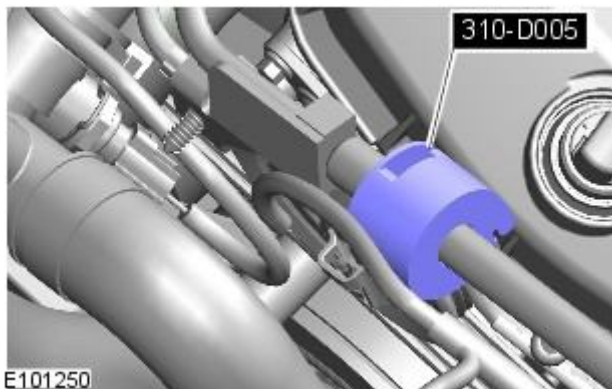
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Fuel Temperature Sensor](#) (303-14B Electronic Engine Controls - V6 3.0L Petrol, Removal and Installation).
3. Refer to: [Intake Manifold](#) (303-01B Engine - V6 3.0L Petrol, Removal and Installation).

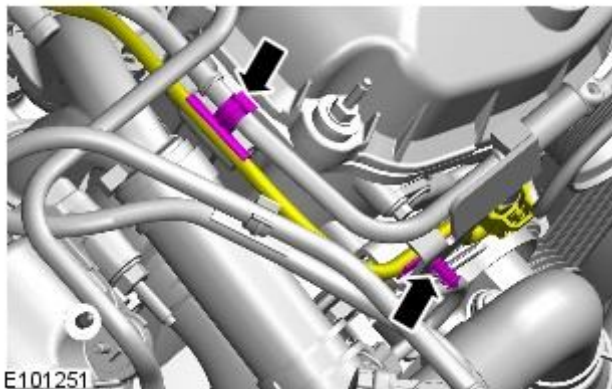
4.



5.

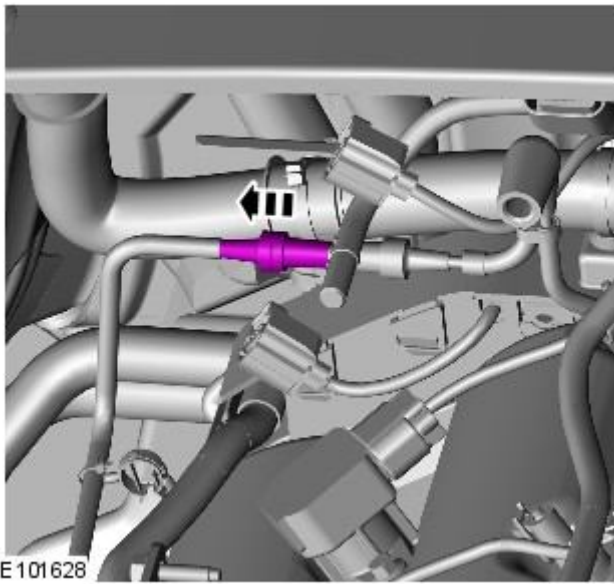


6.

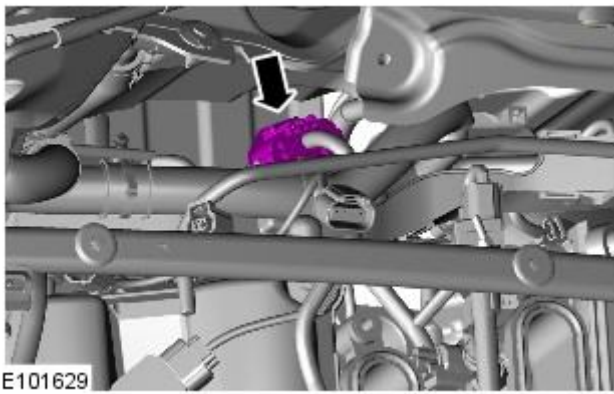




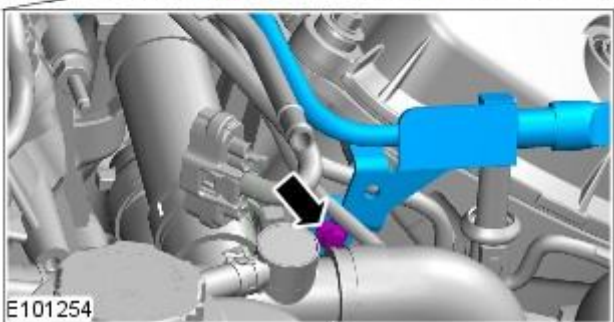
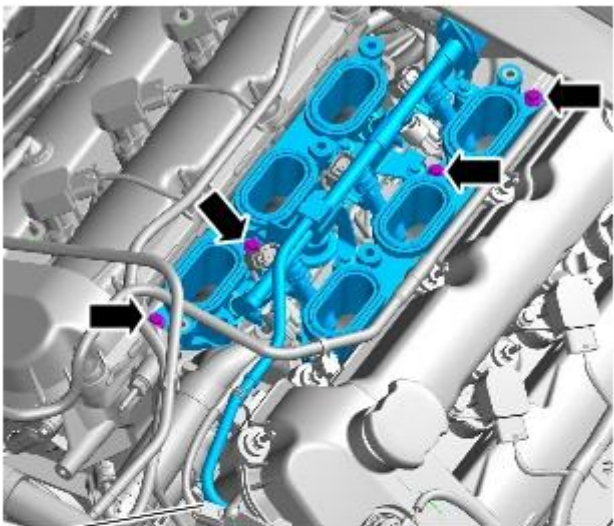
7.



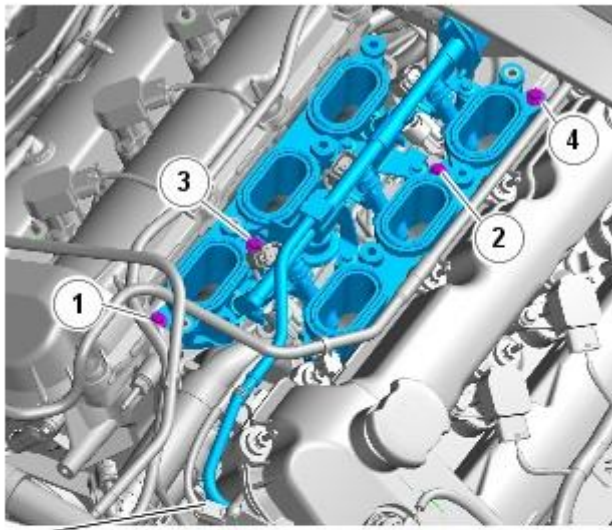
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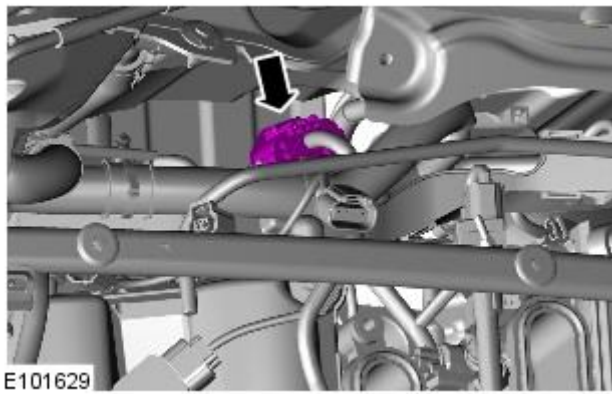
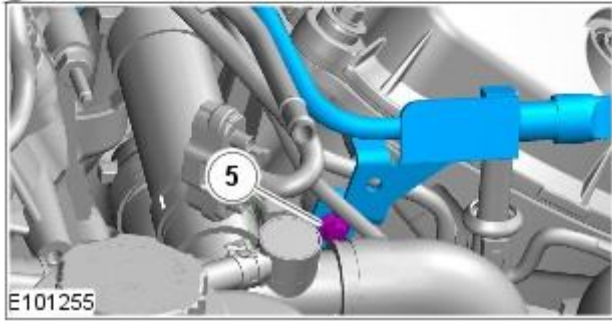
9. **9. NOTE:** Remove and discard the O-ring seals.



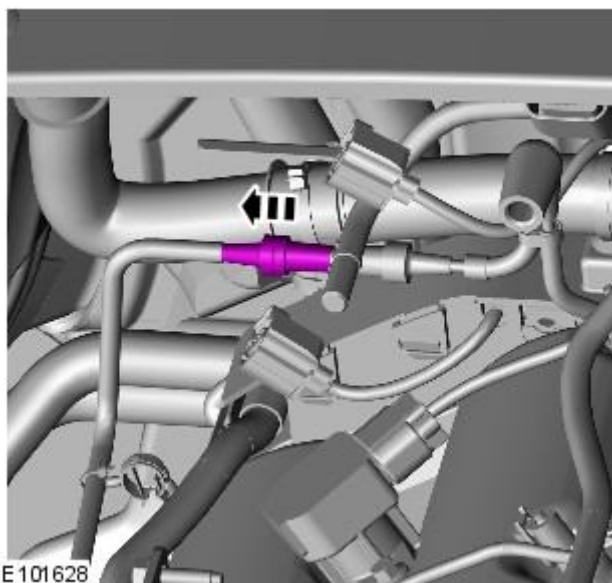
## Installation



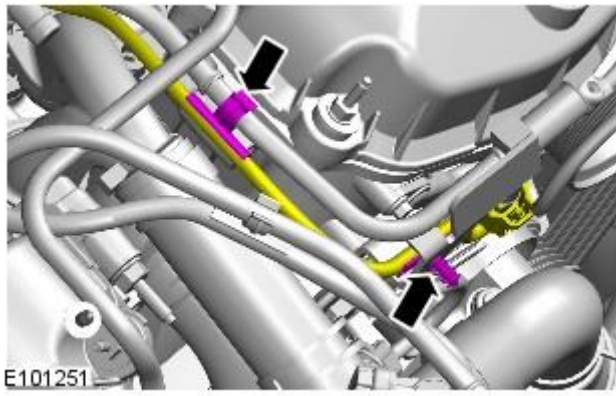
1. NOTE: Install new O-ring seals.
  - NOTE: Tighten the bolts in the indicated sequence.
    - Torque: 10 Nm



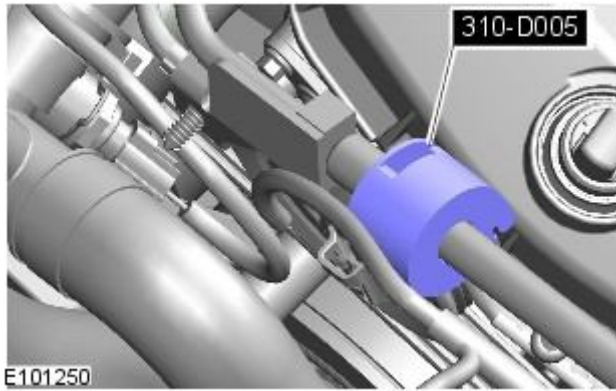
2.



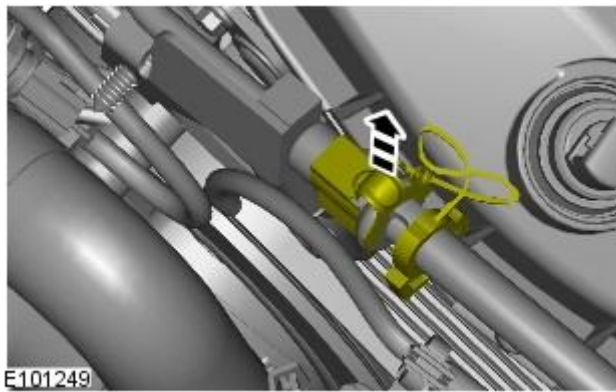
3.



4.



5.



6.

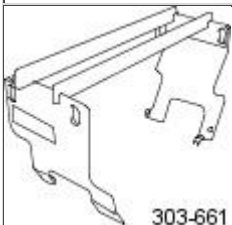

7. Refer to: [Intake Manifold](#) (303-01B Engine - V6 3.0L Petrol, Removal and Installation).

8. Refer to: [Fuel Temperature Sensor](#) (303-14B Electronic Engine Controls - V6 3.0L Petrol, Removal and Installation).

9. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Engine - V6 3.0L Petrol - Engine

Removal

Special Tool(s)	
	Engine Lifting Bracket 303-661
	Engine support bracket 303-021

## Removal

All vehicles

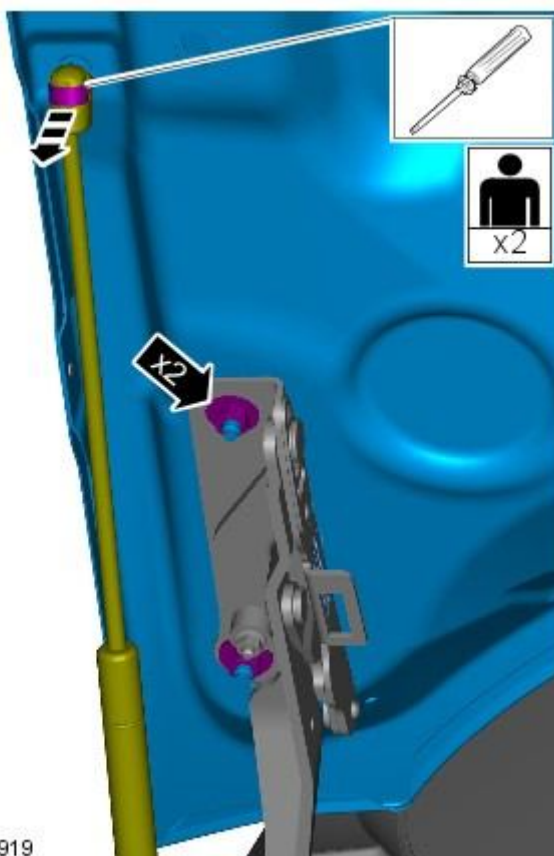
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the transmission.  
For additional information, refer to: [Transmission - V6 3.0L Petrol](#) (307-01 Automatic Transmission/Transaxle - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel, Removal).
3. Remove the cooling module.  
For additional information, refer to: [Cooling Module](#) (303-03B Engine Cooling - V6 3.0L Petrol, Removal and Installation).
4. Remove the front RH fender splash shield.  
For additional information, refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).
5. Lower the vehicle.
6. Evacuate the A/C system.

**7. ⚠ WARNING:** Make sure that the hood is sufficiently supported before the gas strut is disconnected.

- NOTE: Right-hand shown, left-hand similar.

With assistance, remove the hood.

- Release the hood support struts and secure the hood in an upright position.
- Remove the 2 nuts.

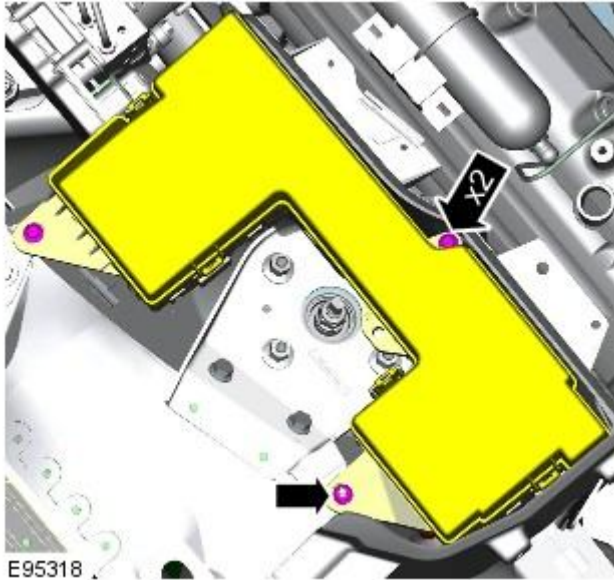


E100919

8. Depressurise the fuel system.  
For additional information, refer to: [Fuel System Pressure Release - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol](#) (310-00 Fuel System - General Information, General Procedures).
9. Remove the RH secondary bulkhead panel.



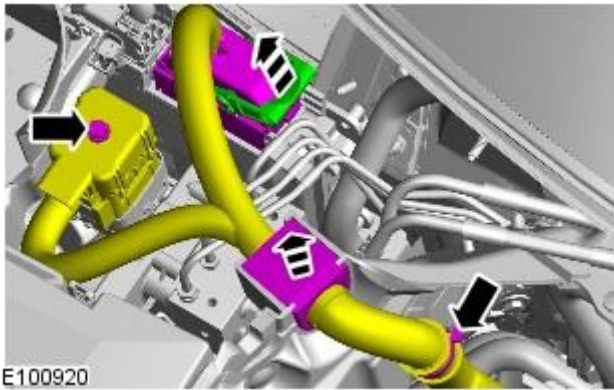
10. Release the engine junction box (EJB).




11. **NOTE:** The engine control module (ECM) electrical connector retaining bolt remains captive in the electrical connector.

Disconnect the 2 electrical connectors.

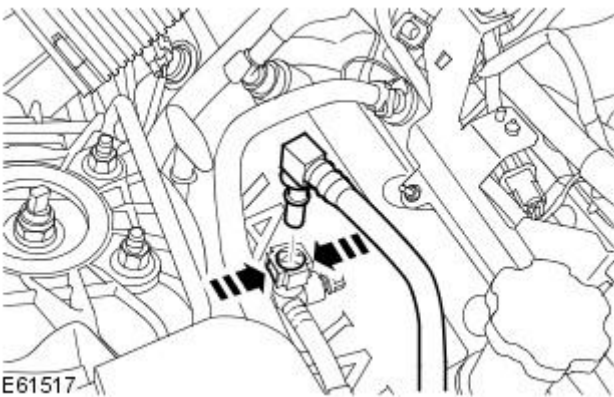
- Disconnect the ECM electrical connector.
- Disconnect the engine junction box (EJB).
- Detach the engine harness grommet from the RH secondary bulkhead.
- Cut the cable tie.



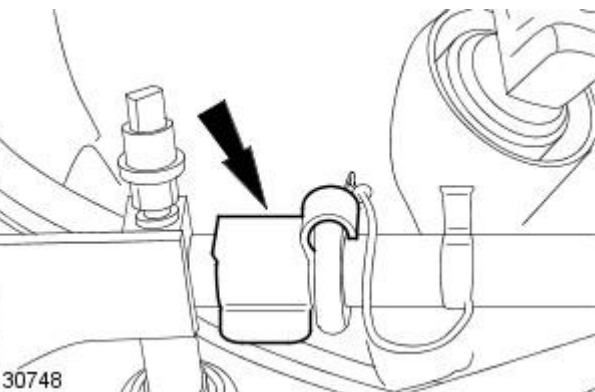
12.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

• **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

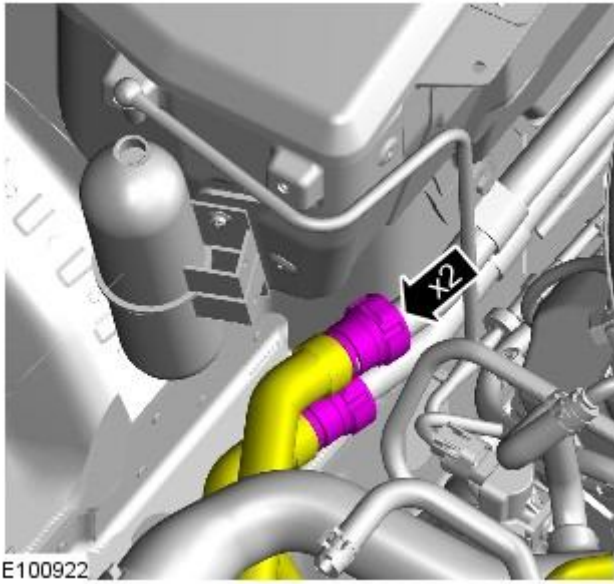
Release the clip and disconnect the purge inlet line.



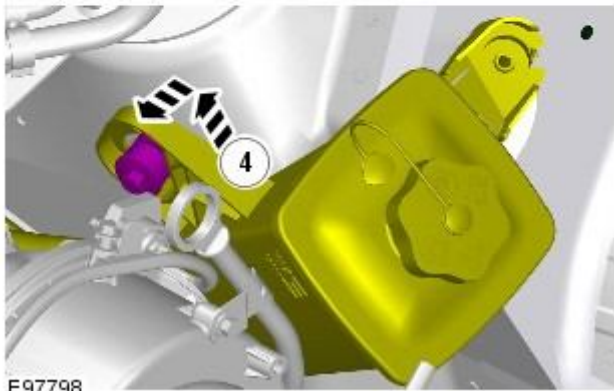
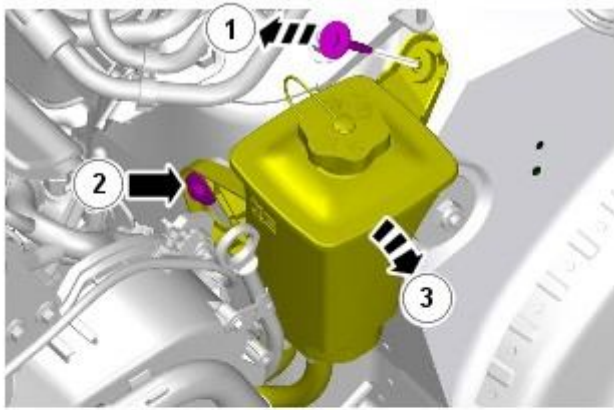
13. Disconnect the fuel supply manifold spring lock coupling.



14. Disconnect the coolant pipes.

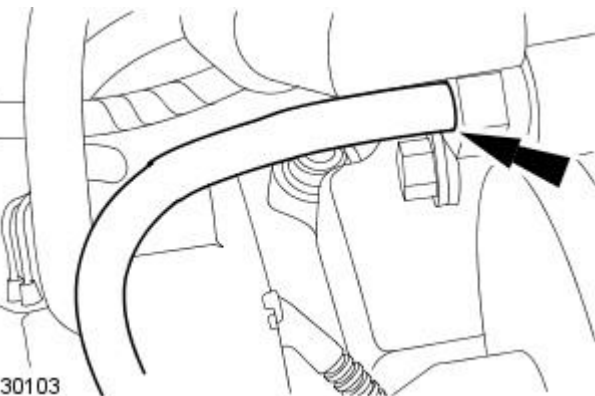


15. Release the power steering fluid reservoir.



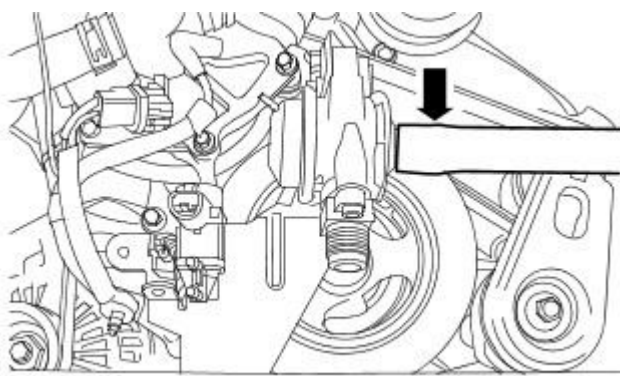
16. NOTE: The brake booster vacuum hose is attached to the induction manifold by a quick release coupling.

Detach the brake booster vacuum hose from the intake manifold.






17. Disconnect the secondary air injection (AIR) control valve supply hose.



E63560

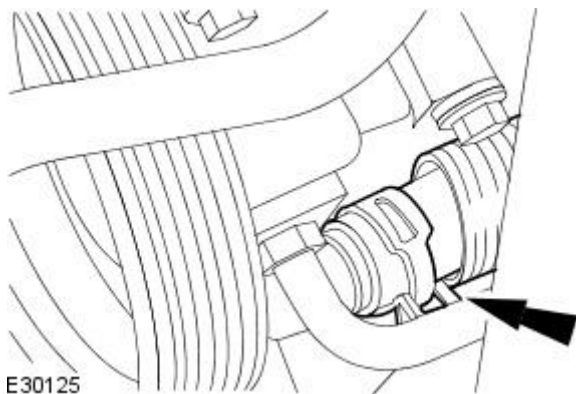
18. CAUTIONS:

 Cap the power steering line to prevent losses of fluid and dirt ingress.

 If power steering fluid comes into contact with the paintwork, the affected area must be immediately washed down with cold water.

• NOTE: Drain the fluid into a suitable container.


Disconnect the power steering reservoir to power steering pump supply line.



E30125

19. CAUTIONS:

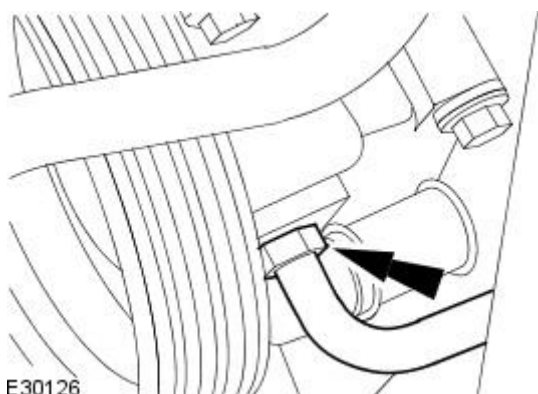
 Cap the power steering line to prevent losses of fluid and dirt ingress.

 If power steering fluid comes into contact with the paintwork, the affected area must be immediately washed down with cold water.

• NOTE: Drain the fluid into a suitable container.

Disconnect the power steering pump to steering gear supply line.

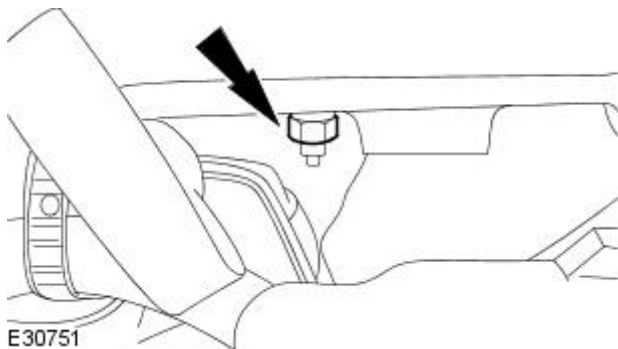
- Remove and discard the O-ring seal.



E30126

20. NOTE: Left-hand shown, right-hand similar.

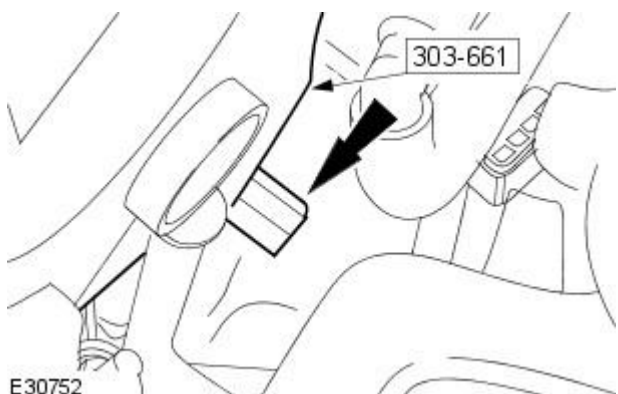
Loosen the exhaust manifold retaining nut.



E30751

21. Install the special tool to the exhaust manifold.

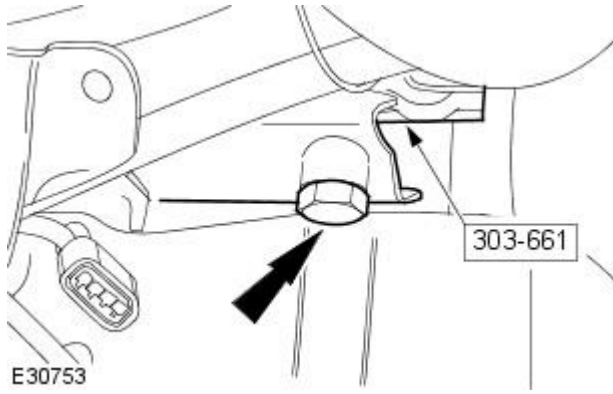
- Install the retaining bolt.



E30752

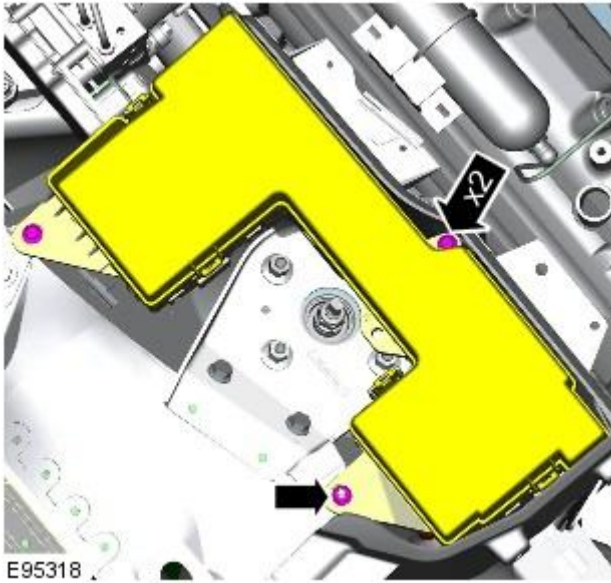
22. NOTE: Left-hand shown, right-hand similar.

Install the retaining bolt.

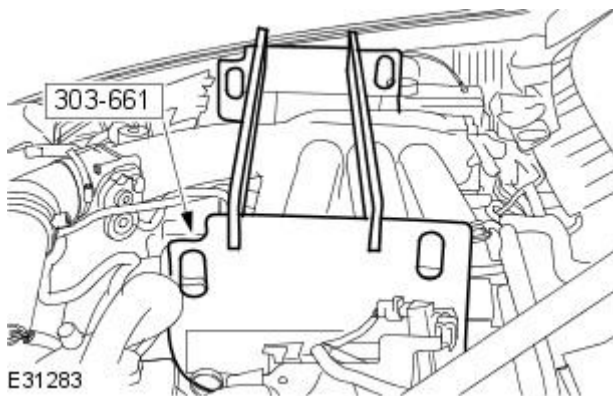


Right-hand drive vehicles

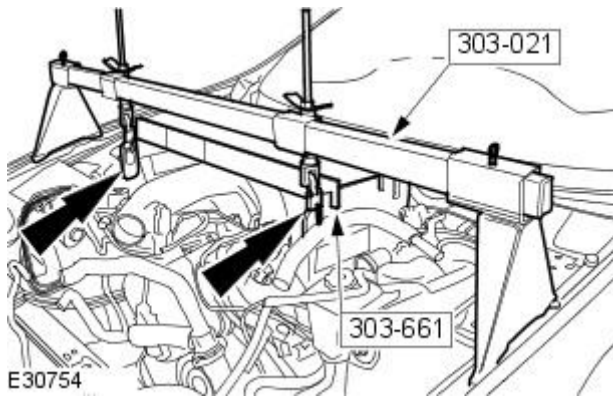
23. Replace the fuse box.



24. Install the special tool support bars to the special tool.

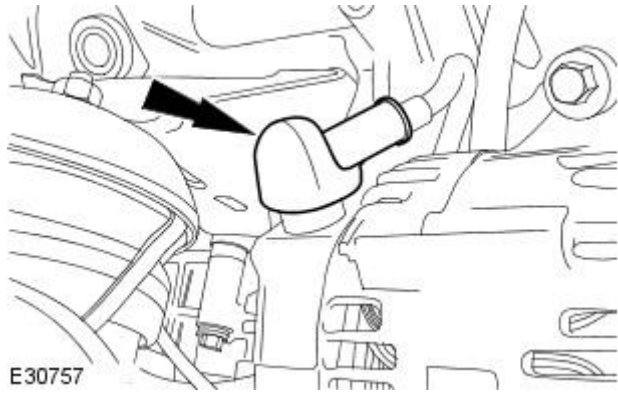


25. Install the special tool.



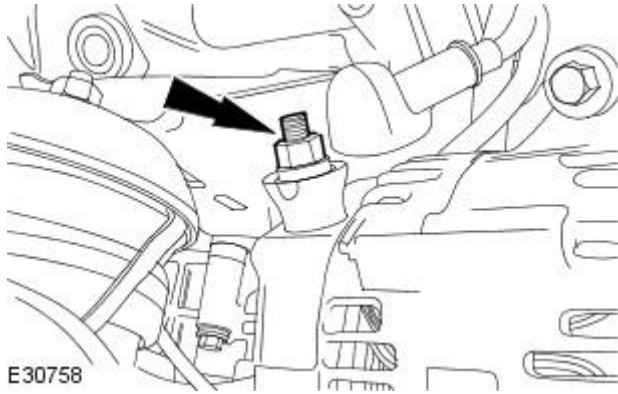
26. Raise the vehicle.

27. Detach the battery positive cable protective cover.



E30757

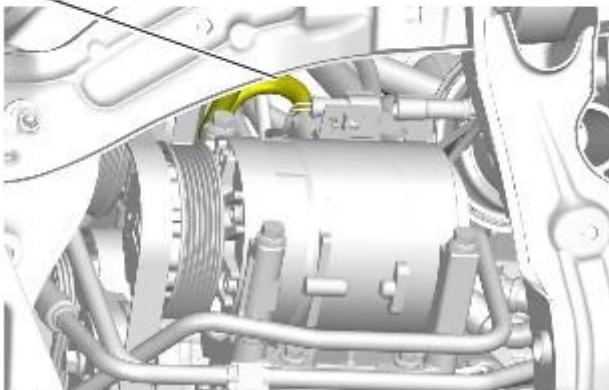
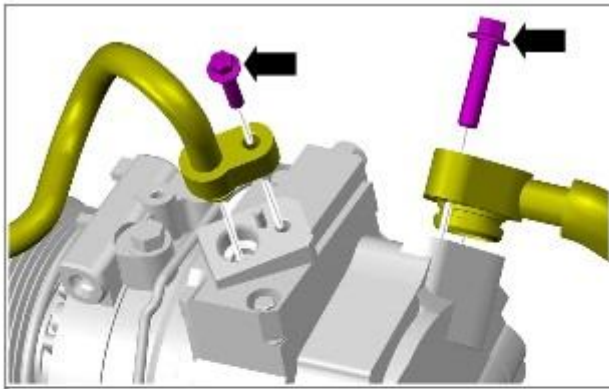
28. Remove the battery positive cable retaining nut.



E30758

29. Disconnect the air conditioning (A/C) compressor supply and return lines.

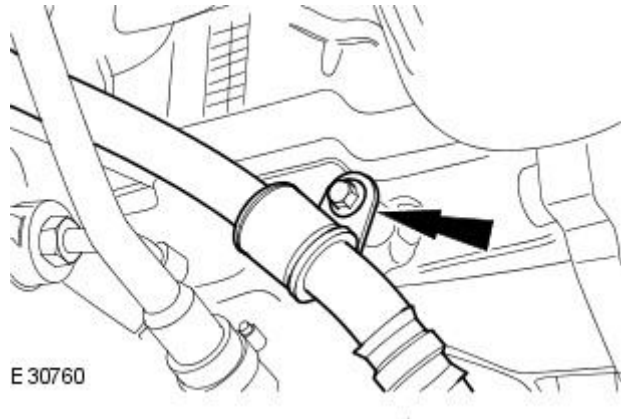
- Remove and discard the O-ring seals.
- Install blanking caps to the exposed ports.



E97758

30. Reposition the A/C compressor supply and return lines away from the engine.

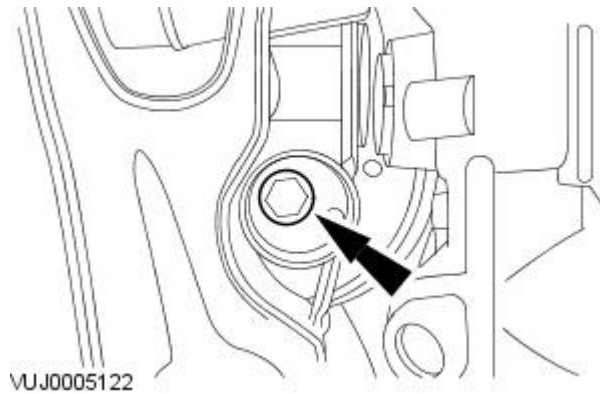
31. Detach the power steering hose.



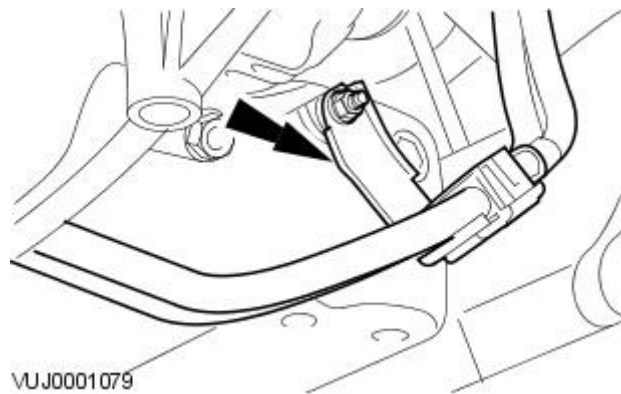
32. Reposition the power steering hose away from the engine.

33. NOTE: Left-hand shown, right-hand similar.

Remove the engine mounts lower retaining bolts.

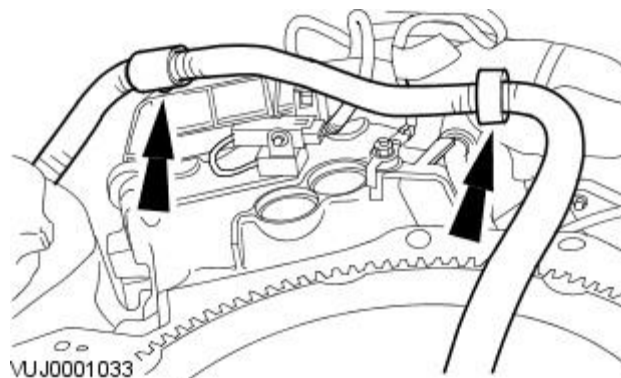


34. Detach the transmission fluid cooler tubes retaining bracket.



35. Reposition the transmission fluid cooler tubes away from the engine.

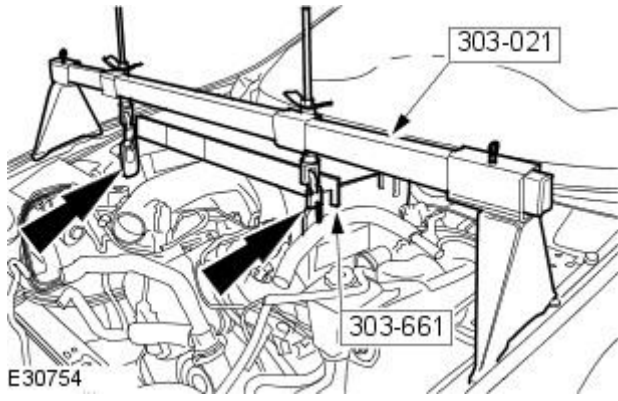
36. Detach the transmission wiring harness.



37. Lower the vehicle.

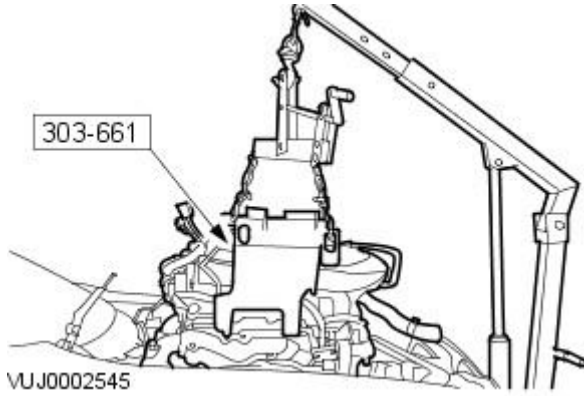


38. Remove the special tool.



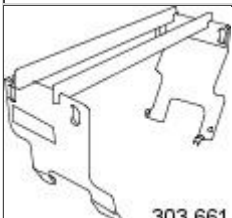

39. Remove the engine assembly.

- Using the special tools, install a suitable floor crane.



# Engine - V6 3.0L Petrol - Engine

## Installation

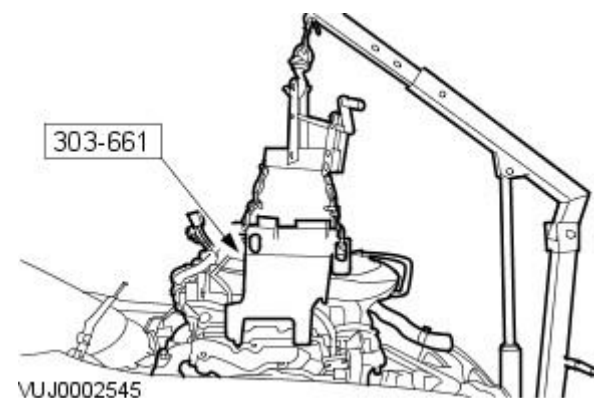
Special Tool(s)	
	Engine Lifting Bracket 303-661
	Engine support bracket 303-021

## Installation

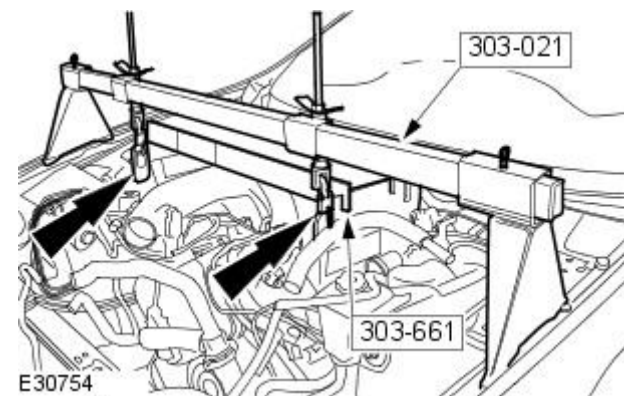
**1. NOTE:** Make sure all wiring harnesses and oil pipes are suitably positioned for engine installation.

Install the engine assembly.

- Make sure the engine mounts are correctly located.
- Remove the floor crane.



**2.** Install the special tool.

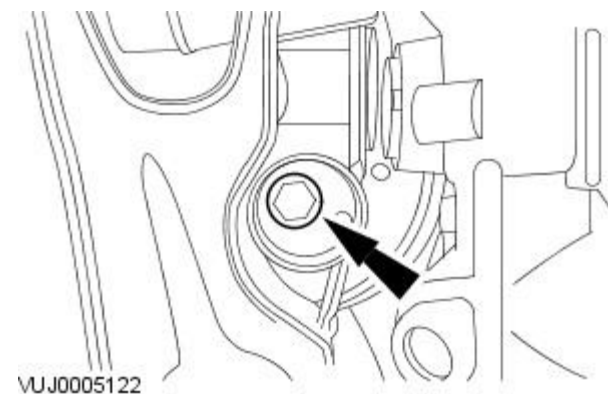


**3.** Raise the vehicle.

**4. NOTE:** Left-hand engine mount lower retaining bolt shown, right-hand similar.

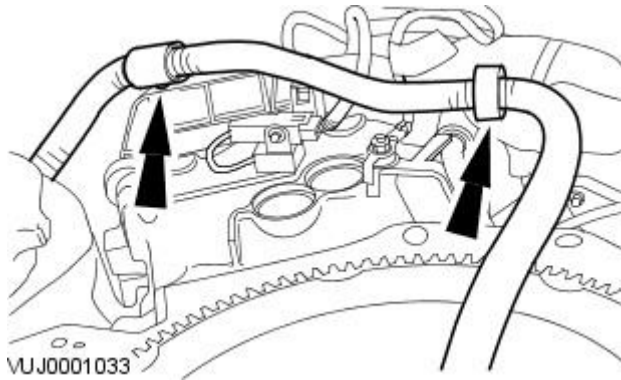
Install the engine mounts lower retaining bolts.

- Tighten to 63 Nm.



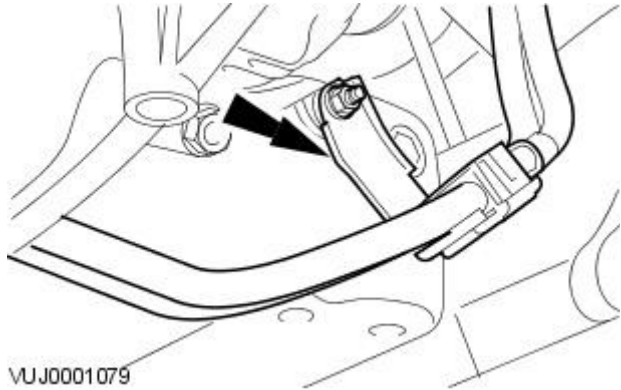


5. Attach the transmission wiring harness



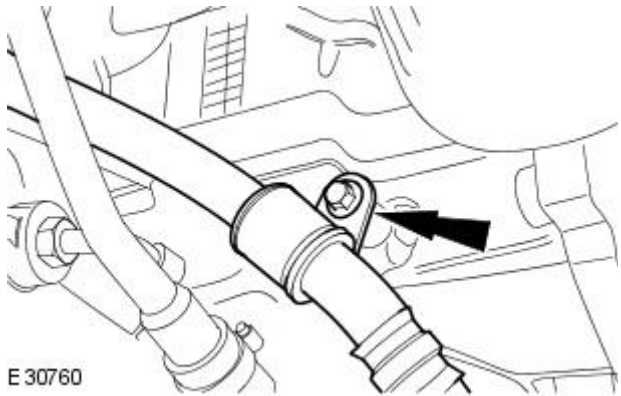
6. Attach the transmission fluid cooler tubes retaining bracket.

- Tighten to 10 Nm.



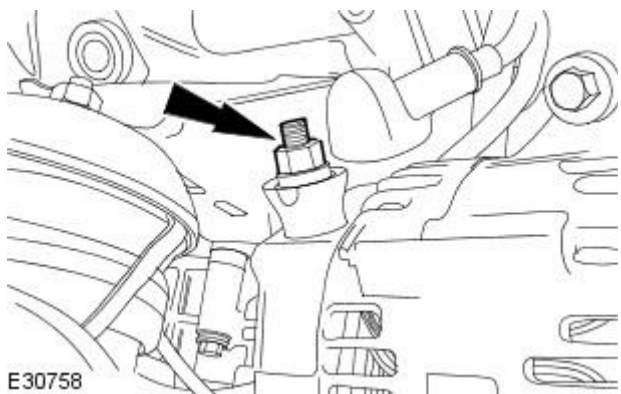
7. Attach the power steering hose.

- Tighten to 10 Nm.

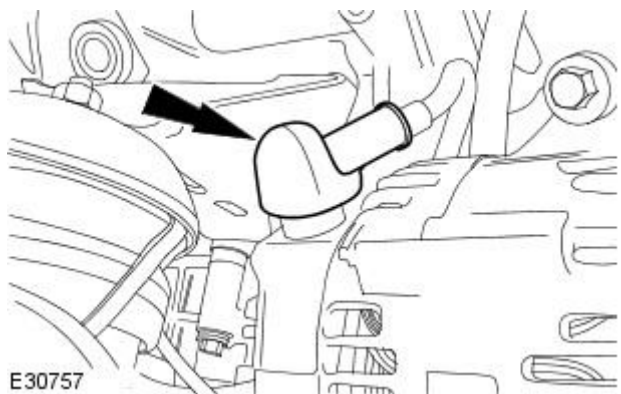


8. Install the battery positive cable retaining nut.

- Tighten to 12 Nm.

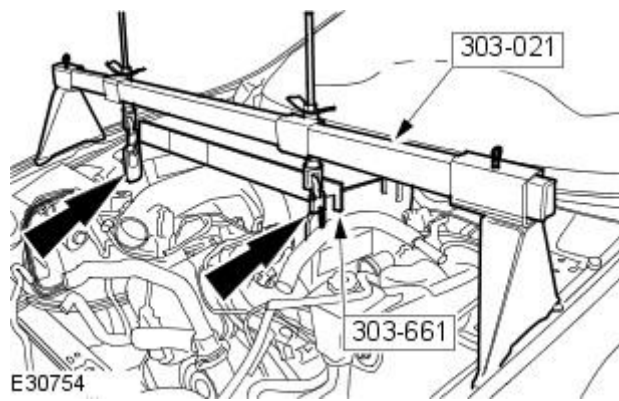


9. Attach the battery positive cable protective cover.

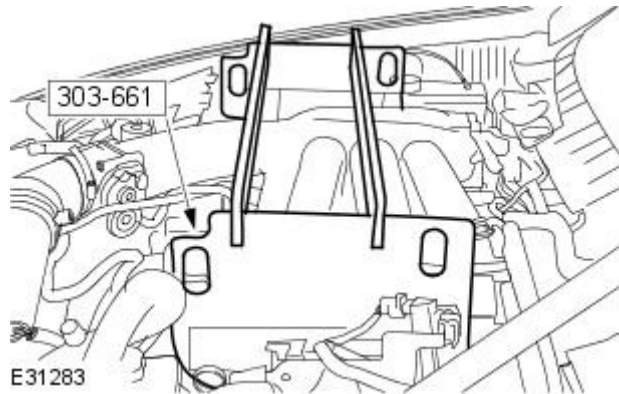


10. Lower the vehicle.

11. Remove the special tool.



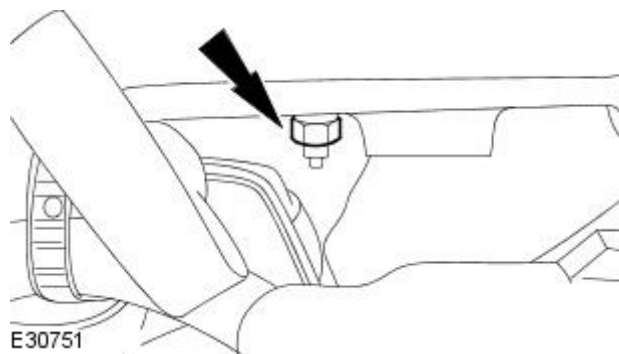
12. Remove the special tool.



13. NOTE: Left-hand shown, right-hand similar.

Install the exhaust manifold retaining nut.

- Tighten to 25 Nm.

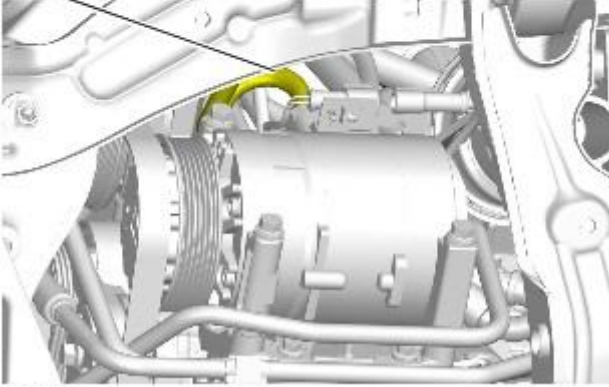
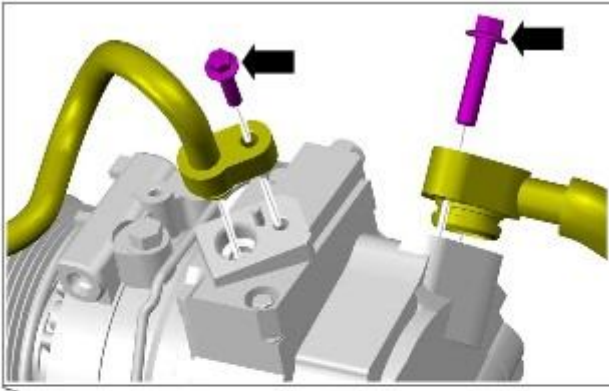


14. NOTE: Un-cap the exposed ports.

Install new A/C compressor O-ring seals.

- Lubricate the new O-rings with A/C refrigerant oil.


15. Connect the A/C compressor supply and return lines.



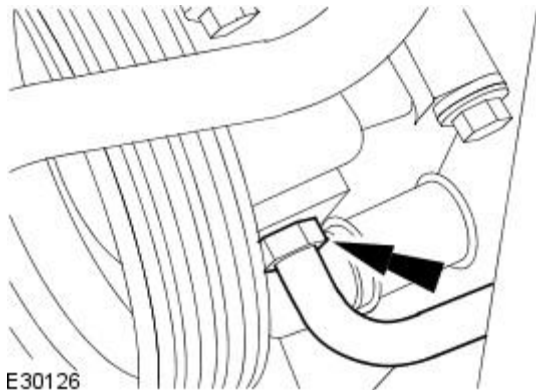
E97758

16. NOTE: Un-cap the power steering pump exposed ports.


Install new power steering pump supply line O-ring seal.

17.  CAUTION: If power steering fluid comes into contact with the paintwork, the affected area must be immediately washed down with cold water.

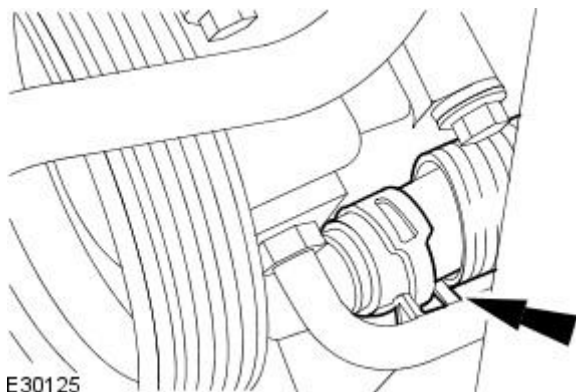
Connect the power steering pump to the steering gear supply line.



E30126

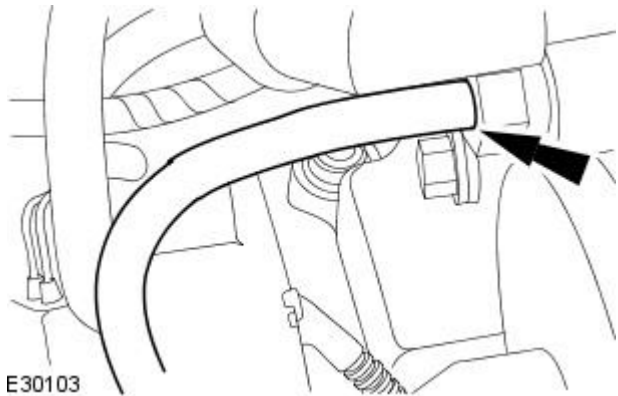
18.  CAUTION: If power steering fluid comes into contact with the paintwork, the affected area must be immediately washed down with cold water.

Connect the power steering reservoir to the power steering pump supply line.



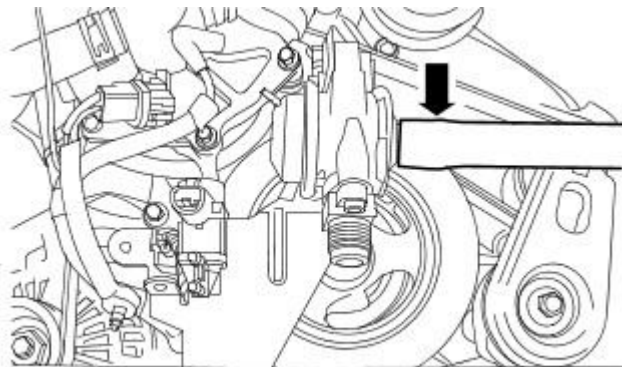
E30125

19. Attach the brake booster vacuum hose to the intake manifold.



E30103

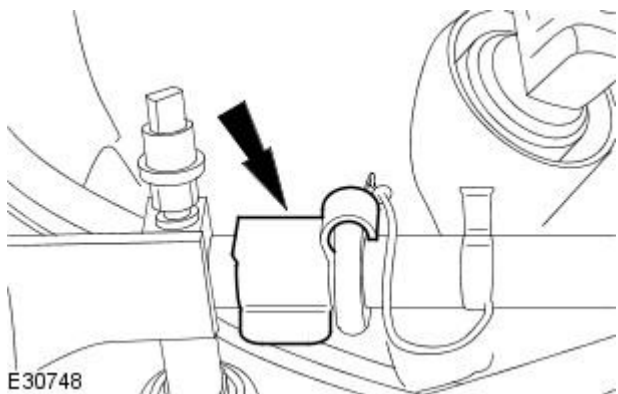
20. Connect the secondary air injection (AIR) control valve supply hose.



E63560

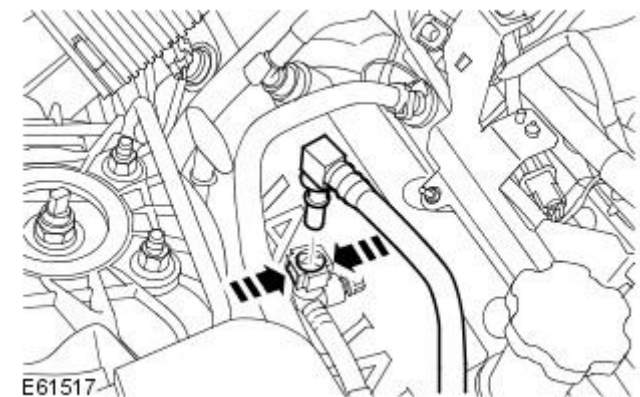
21. NOTE: Install new O-ring seals.

Connect the fuel supply manifold spring lock coupling.



E30748

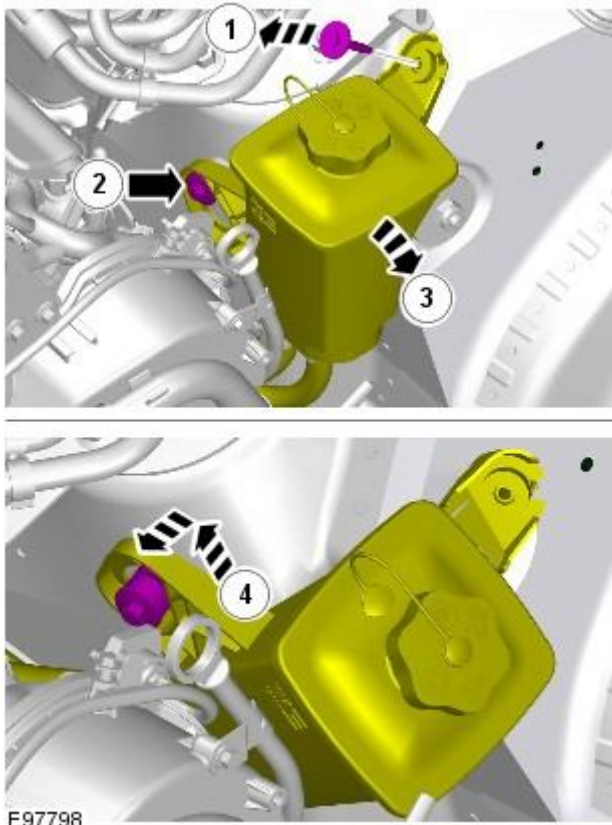
22. Connect the purge inlet line.



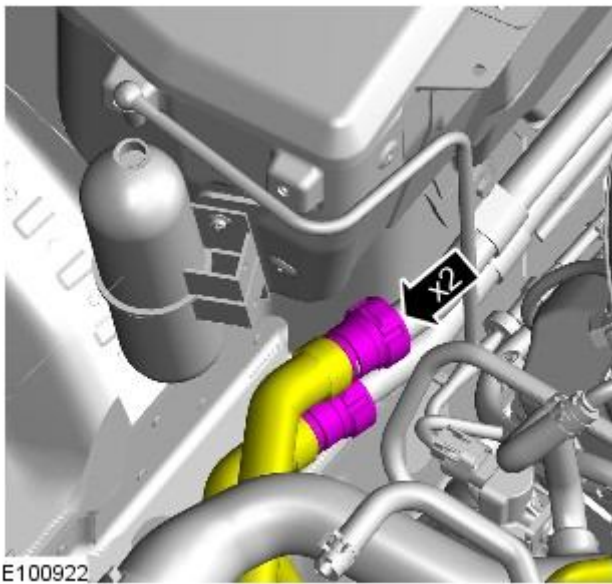
E61517



23. Secure the power steering fluid reservoir.

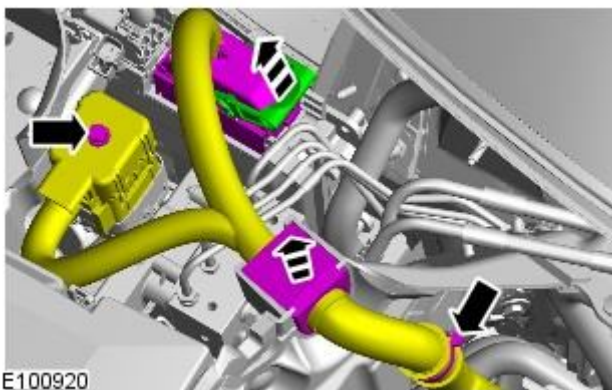


24. Connect the 2 hoses to the coolant pipes.



25. Connect the 2 electrical connectors.

- Connect the ECM electrical connector.
- Connect the EJB electrical connector.
- Attach the engine harness grommet to the RH secondary bulkhead.
- Secure the harness with a new cable tie.



26. Install the RH fender splash shield.

For additional information, refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

27. Install the cooling module.

For additional information, refer to: [Cooling Module](#) (303-03B Engine

Cooling - V6 3.0L Petrol, Removal and Installation).

**28. Install the transmission.**

For additional information, refer to: [Transmission - V6 3.0L Petrol](#) (307-01 Automatic Transmission/Transaxle - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel, Removal).

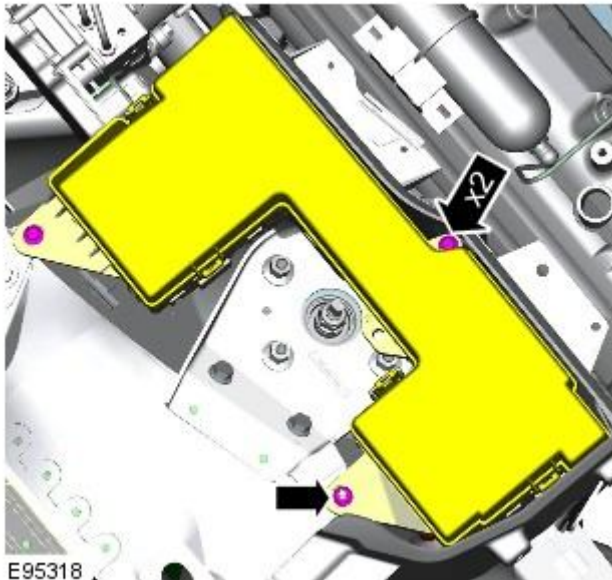
**29. Install the secondary bulkhead RH panel.**

For additional information, refer to: [Secondary Bulkhead Panel RH - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel](#) (501-02 Front End Body Panels, Removal and Installation).

**30. Recharge the A/C system.**

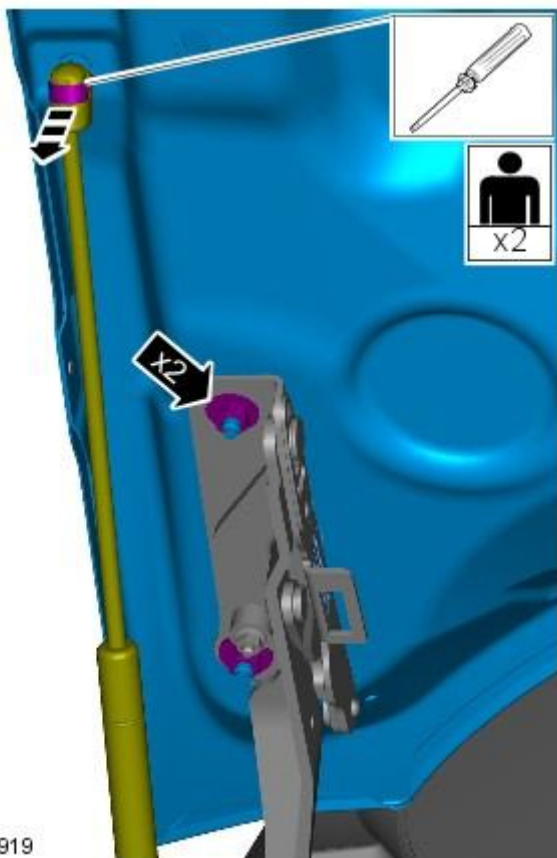
For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

**31. Secure the EJB.**



**32. Install the hood.**

- Tighten to 25 Nm





**Engine - 4.2L NA V8 - AJV8 -****Lubricants, Fluids, Sealers and Adhesives**

Description	Specification
Engine oil, SAE 5W-30	WSS-M2C-912A
Engine assembly lubricant	SQM-2C9003 AA EP90
Sealant	WSS M4G 320-A3
Hose assembly surfactant	ESE-M99 B144-B

**Capacities**

Description	Litres
Engine oil, initial fill	6.8
Engine oil, service fill with oil filter change	6.0

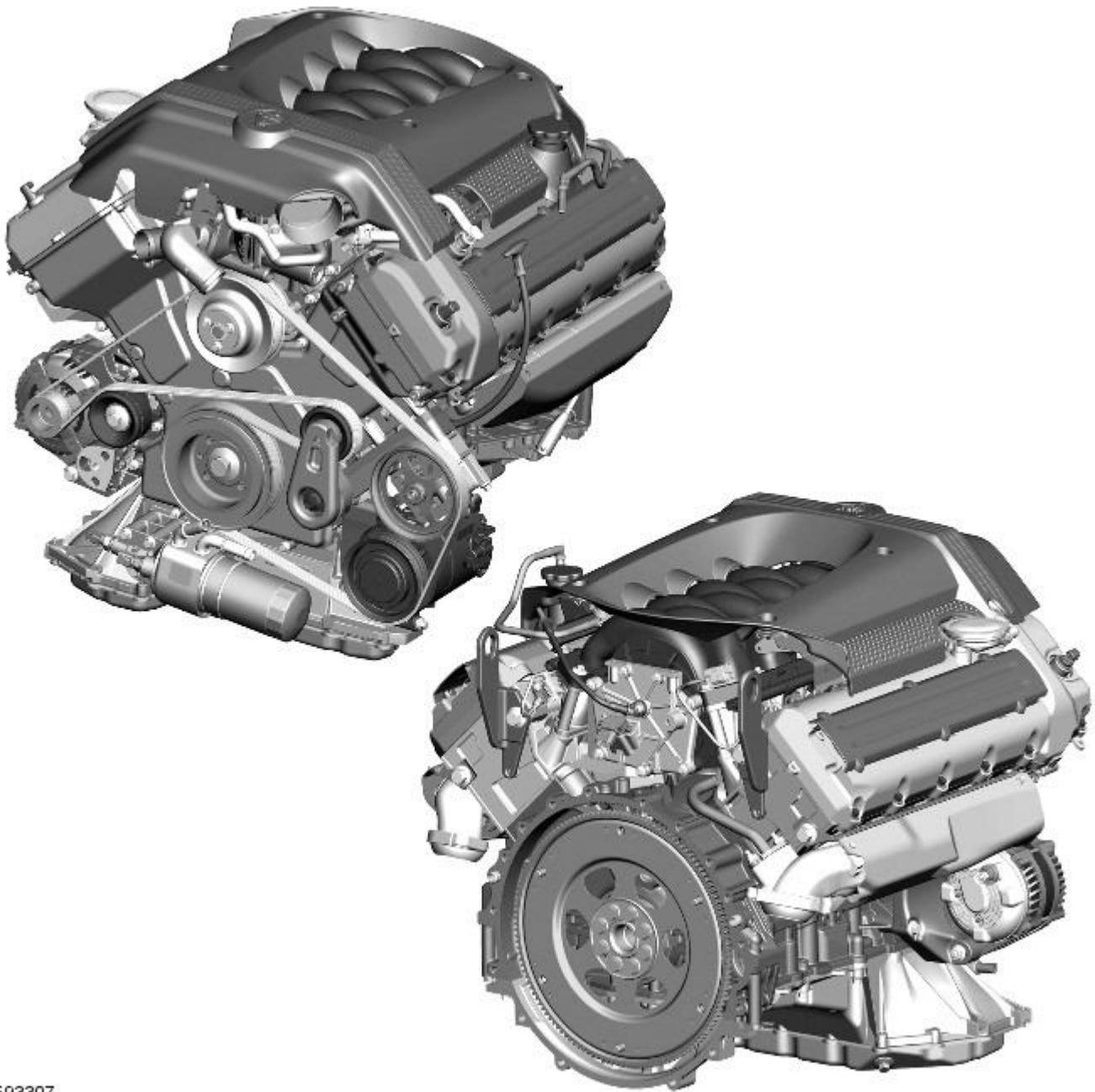
**Torque Specifications**

Description	Nm	lb-ft	lb-in
Accessory drive belt idler pulley retaining bolt	40	30	-
Accessory drivebelt tensioner retaining bolt	40	30	-
Air conditioning compressor retaining bolts	25	18	-
Air conditioning compressor mounting bracket retaining bolts	25	18	-
A/C manifold retaining bolt	9	-	80
Camshaft bearing caps retaining bolts	10	7	-
Camshaft position sensor retaining bolt	7	-	62
Connecting rod retaining bolts	A	-	-
Crankshaft pulley retaining bolt	320	236	-
Crankshaft position sensor retaining bolt	7	5	-
Cylinder head retaining bolts	A	-	-
Drive plate retaining bolts	A	-	-
Engine front cover retaining bolts	12	9	-
Engine mounting bracket retaining bolts	47 (+/- 7)	35 (+/- 5)	-
Engine mount retaining nuts to crossmember	62 (+/- 10)	46 (+/- 7)	-
Engine mount bracket to engine mount retaining nuts	47 (+/- 7)	35 (+/- 5)	-
Engine wiring harness retaining bracket	10	7	-
Exhaust manifold heat shield retaining bolts	3	-	27
Exhaust manifold heat shield retaining bolt to cylinder head	50	37	-
Exhaust manifold retaining bolts	24	18	-
Flexiplate retaining bolts	A	-	-
Generator lower retaining bolt	40	30	-
Generator upper retaining bolt	21	15	-
Generator mounting bracket retaining bolts	45	33	-
Ignition coil retaining bolts	5	-	-
Intake manifold assembly retaining bolts	22	16	-
<b>Intake camshaft sprocket retaining bolt</b>			
Stage 1	20	15	-
Stage 2	Further 90 degrees	Further 90 degrees	-
Knock sensor retaining nuts	20	15	-
Lower cylinder block to the upper cylinder block retaining bolts	A	-	-
Oil cooler to oil filter housing retaining bolt	21	15	-
Oil filter housing retaining bolts	21	15	-
Oil level indicator tube retaining nut	6	-	51
Oil pan retaining bolts	12	9	-
Oil pump to engine block retaining bolts	12	9	-
Oil pan drain plug	23	17	-
Oil separator retaining bolts (PVC Valve)	5	-	44
Oil filter	18	13	-
Piston cooling jet retaining bolt	9	-	80
Power steering bracket bracket retaining bolts	25	18	-
Power steering pump retaining bolts	25	18	-
Primary timing chain tensioner retaining bolts	12	9	-
Primary timing chain tensioner guide retaining bolts	12	9	-
Secondary timing chain tensioner retaining bolts	12	9	-
Spark plugs	27	20	-
Starter motor retaining bolts	45	33	-
Thermostat housing retaining bolts	10	7	-
Water pump retaining bolts	8	6	-
Water pump pulley retaining bolts	A	-	-
Upper oil pan retaining bolts	21	15	-
Valve cover retaining bolts	10	7	-
Variable camshaft timing (VCT) oil control unit housing retaining bolts	22	16	-
<b>VCT sprocket centre retaining bolt</b>			
Stage 1	20	15	-
Stage 2	Further 90 degrees	Further 90 degrees	-
A = refer to the procedure for the correct torque sequence	-	-	-

## Engine - 4.2L NA V8 - AJV8 - Engine - Component Location

Description and Operation

External View



E93307

## Engine - 4.2L NA V8 - AJV8 - Engine - Overview

Description and Operation

### Overview

The liquid cooled V8 engine is a 4.2 liter unit, arranged in a 90 degree 'V' configuration, with a 4-throw crankshaft supported by 5 main bearings.

The lightweight cylinder block is of cast aluminum alloy construction with cast iron liners.

The cylinder heads, which are also manufactured in cast aluminum alloy, are unique for each cylinder bank. Deep seated bolts reduce distortion and secure the cylinder heads to the cylinder block. Each cylinder head incorporates 2 overhead camshafts, operating 4 valves per cylinder via valve lifters. A [VVT \(variable valve timing\)](#) system gives improved low and high-speed engine performance and excellent idle quality. The lightweight valve gear provides good economy and noise levels and is chain driven, via the crankshaft, for durability.

The aluminum alloy bedplate is a casting bolted to the bottom of the cylinder block to retain the crankshaft and improve lower structure rigidity. The oil pan assembly consists of a pressed steel oil pan bolted to a structural aluminum alloy casting, which is then bolted to the bedplate.

# Engine - 4.2L NA V8 - AJV8 - Engine - System Operation and Component Description

Description and Operation

## System Operation

### General

Operation of the engine is controlled by the [ECM \(engine control module\)](#).

Refer to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.7L Diesel, Description and Operation).

### Variable Valve Timing

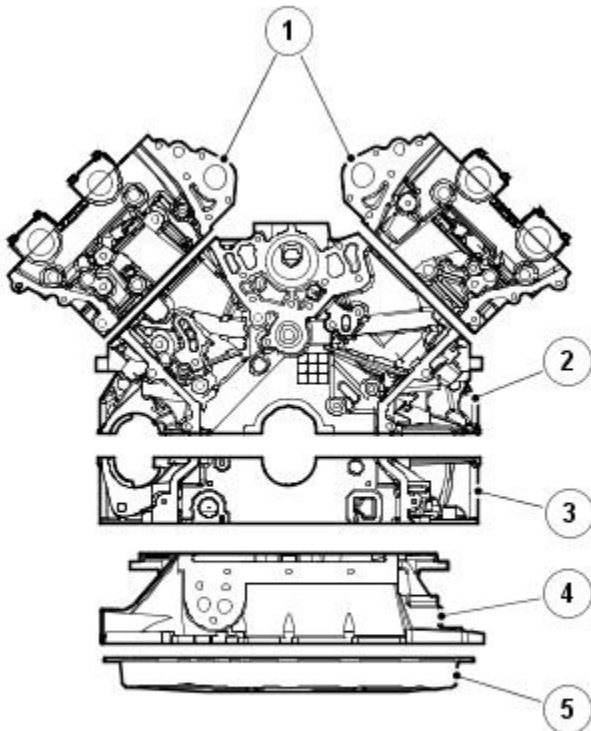
When directed by the [ECM](#), the [VVT \(variable valve timing\)](#) unit will be set to the optimum position between full advance and retard for a particular engine speed and load. This is achieved when the [ECM](#) sends the energizing signal to the oil control solenoid until the target position is met. At this point, the energizing signal is reduced to hold the solenoid position, and as a result the position of the shuttle valve. This function is under closed-loop control, where the [ECM](#) will alter the energizing signal, when required, to maintain the desired position.

Engine oil properties and temperature can affect the ability of the [VVT](#) mechanism to follow demand changes to the cam phase angle. At very low oil-temperatures, movement of the [VVT](#) mechanism is sluggish due to increased viscosity, and at high oil-temperatures the reduced viscosity may impair operation if the oil pressure is too low. To maintain satisfactory [VVT](#) performance, an increased capacity oil pump is installed, plus an engine oil temperature sensor to enable monitoring by the [ECM](#). The [VVT](#) system is normally under closed-loop control except in extreme temperature conditions, such as cold starts below 0 °C (32 °F). At extremely high oil-temperatures, the [ECM](#) may limit the amount of [VVT](#) advance to prevent the engine from stalling when returning to idle speed.

The [VVT](#) does not operate when engine oil-pressure is below 1.25 bar (18.1 lbf/in<sup>2</sup>), as there is insufficient pressure to release the [VVT](#) unit's internal stopper pin. This usually occurs when the engine is shutting-down and the [VVT](#) has returned to the retarded position. The stopper pin locks the camshaft to the [VVT](#) unit to ensure camshaft stability during the next engine start-up.

## Component Description

### Engine Structure



E71998

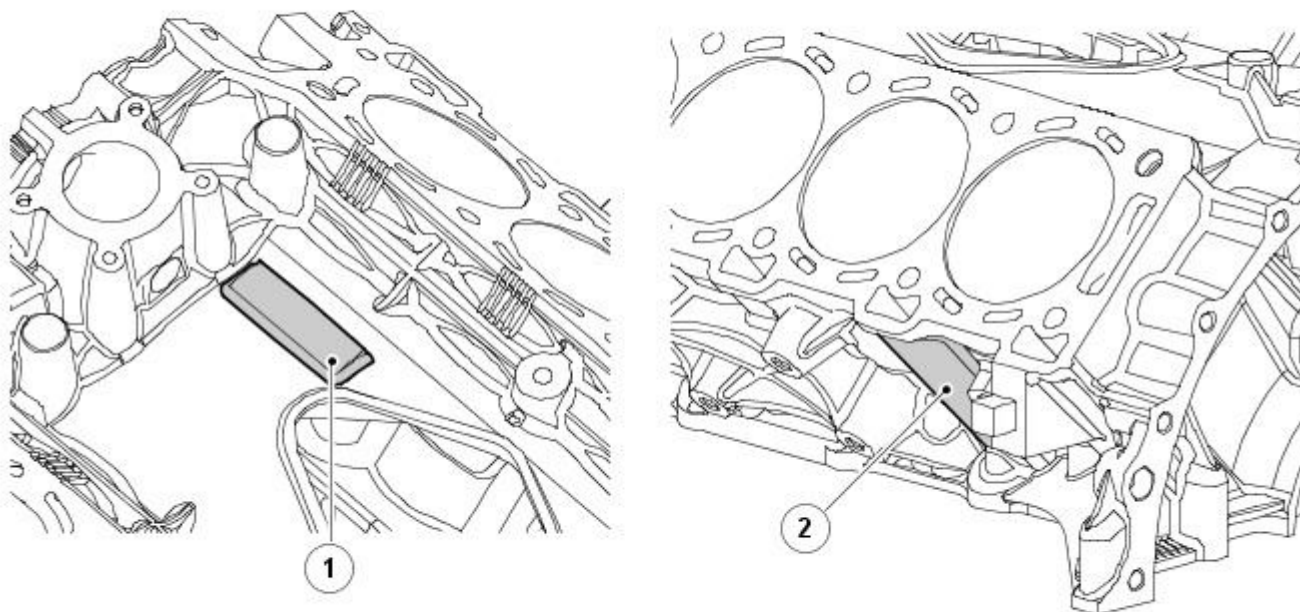
#### ItemDescription

1	Cylinder head (2 off)
2	Cylinder block
3	Bedplate
4	Structural sump

## Cylinder Block Components

The cylinder block is of a cast aluminum alloy construction with cast iron liners. The 90 degree 'V' configuration provides a rigid structure with good vibration levels. A low volume coolant jacket improves warm-up times and piston noise levels; the longitudinal flow design of the jacket, with a single cylinder head coolant transfer port in each bank, improves rigidity and head gasket sealing. The **RH (right-hand)** cylinder bank is designated as bank 1, and the **LH (left-hand)** as bank 2, viewed from the front of the engine.

Data Locations



E43426

### ItemDescription

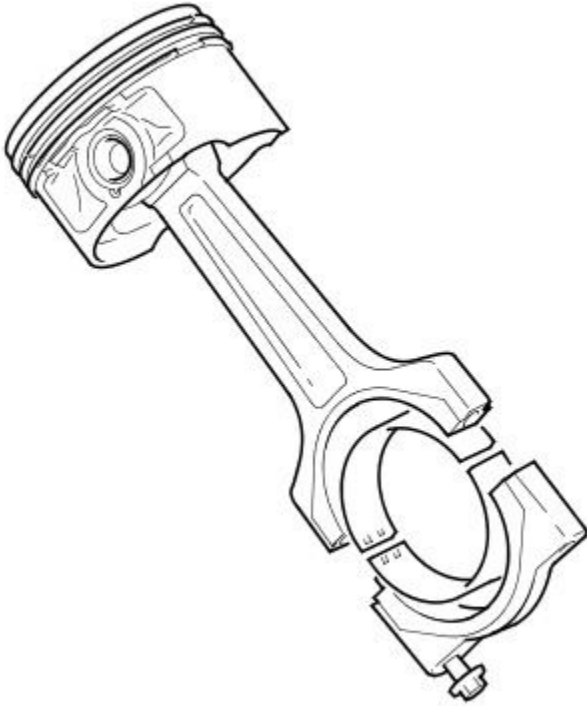
1 Engine part number

2 Engine data (main bearing diameters, cylinder bore diameters, etc), emissions code and engine number

Engine data is marked at 3 locations, 2 on the cylinder block (shown) and 1 on the engine front cover, which consists of a label displaying the engine number. Component diameters are represented by alpha and numeric codes.

Refer to: [Crankshaft Main Bearing Journal Clearance - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (303-00 Engine System - General Information, General Procedures).

Piston and Connecting Rod Assembly

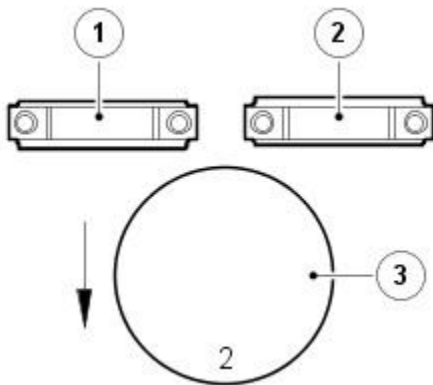


E43427

The connecting rods are manufactured from sinter-forged steel and have fracture-split bearing caps. The bearing caps are produced by fracturing the opposing sides of the connecting rod at the bearing horizontal centre line. As well as being easier to manufacture, when reassembled the fractured surfaces interlock to form a strong seamless joint. The cylinder position is marked on adjoining sides of the joint to identify matching connecting rods and bearing caps. The connecting rod bearings are aluminum/tin split plain bearings.

The pistons are of the open-ended skirt design with a dished crown. Three piston rings, 2 compression and one 3-piece oil control ring, are installed on each piston. Each piston is installed on a gudgeon pin located in a bronze bushing in the connecting rod.

#### Connecting Rod Orientation



E43428

#### ItemDescription

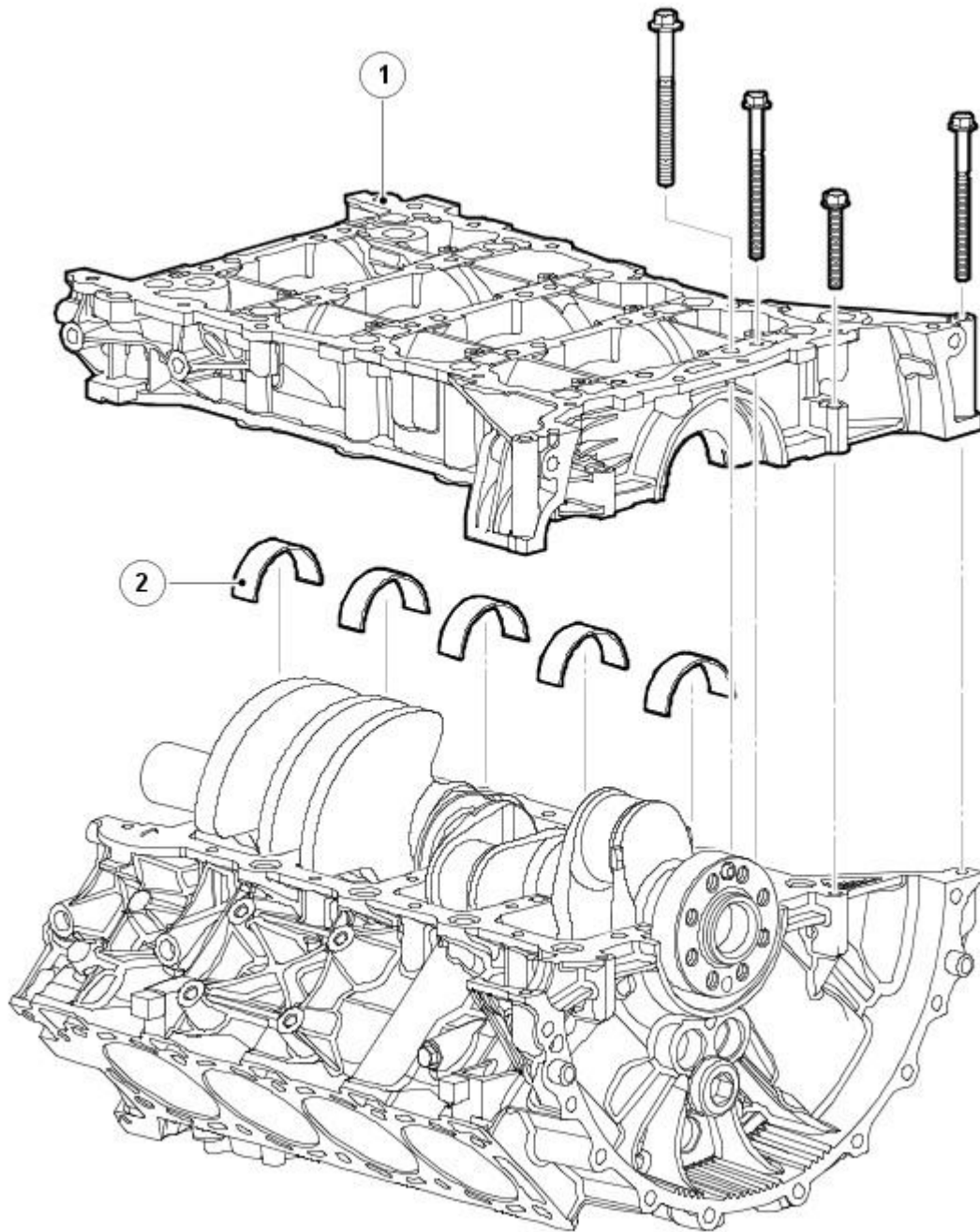
1	Bank 1
2	Bank 2
3	Piston

The piston grade number is stamped on the crown of the piston and must coincide with that for each cylinder bore. The piston must be assembled in the correct orientation for the designated cylinder bore:

- Bank 1 - piston grade number and the thick flange of the connecting rod must face the front of the engine.
- Bank 2 - piston grade number and the thin flange of the connecting rod must face the front of the engine.

#### Crankshaft and Structural Sump Components





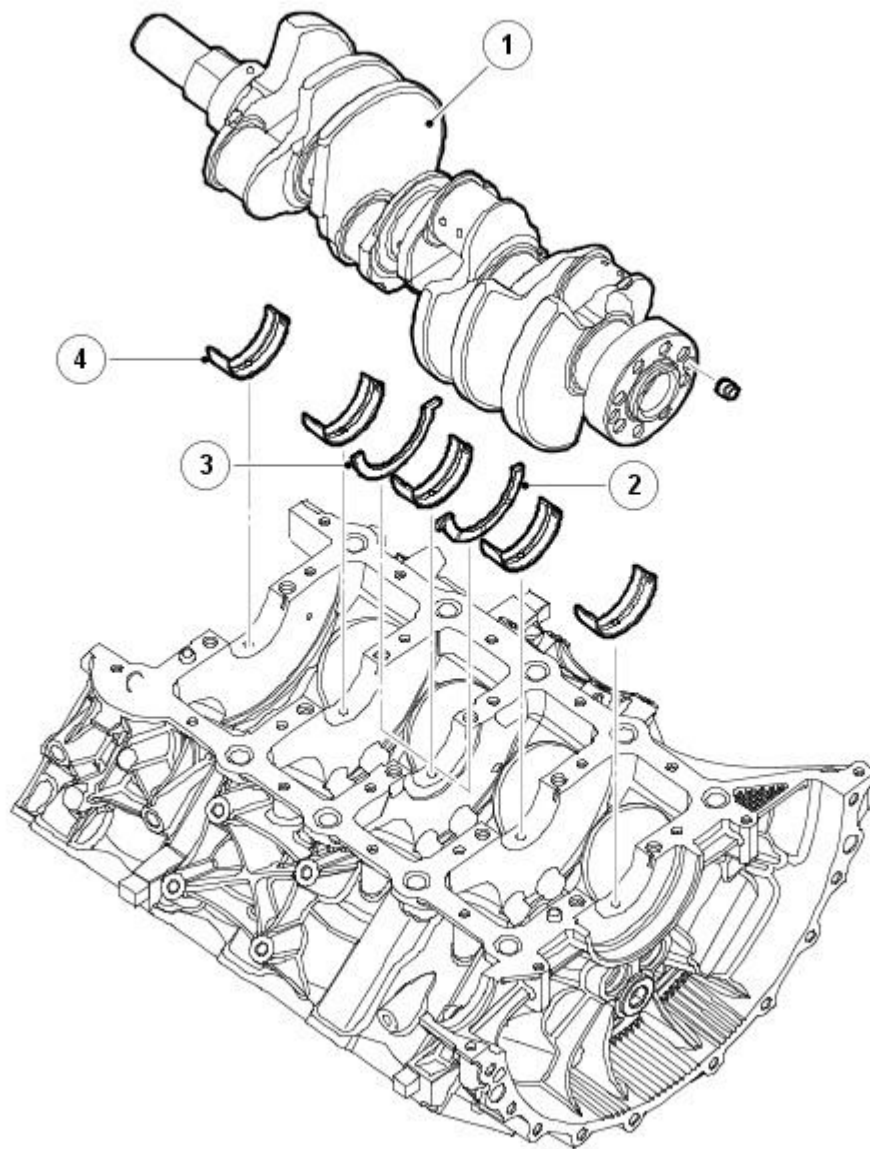
E43435

**ItemDescription**

1 Bedplate

2 Main bearings - lower (5 off)

Crankshaft and Main Bearings



E43436

**ItemDescription**

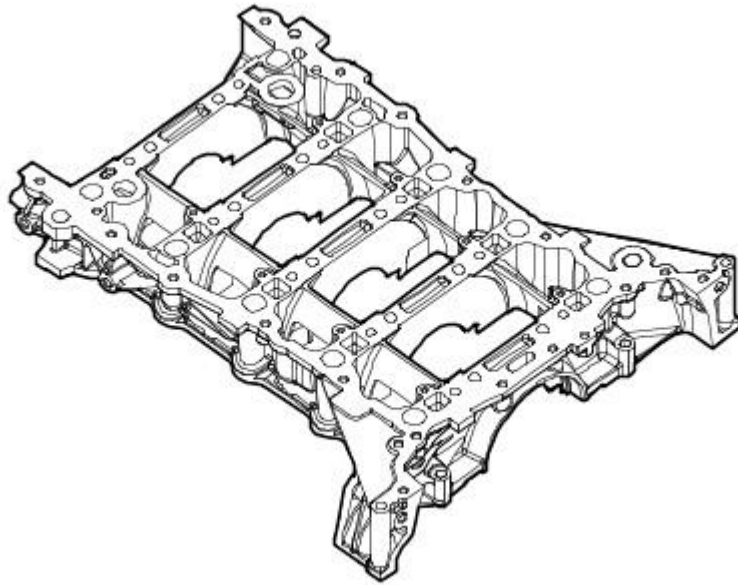
1	Crankshaft
2	Thrust washer
3	Thrust washer
4	Main bearings - upper (5 off)

Six counter-balance weights ensure good vibration levels from the 4 throw, 5 bearing crankshaft. Manufactured in cast iron, the crankshaft also has undercut and rolled fillets for improved strength.

The crankshaft rear oil seal is a press fit in the bedplate to cylinder block interface.

The main bearings are aluminum/tin split plain bearings. An oil groove in the upper half of each bearing transfers the oil into the crankshaft for lubrication of the connecting rod bearings. An aluminum/tin thrust washer is installed each side of the top half of the center main bearing.

Bedplate



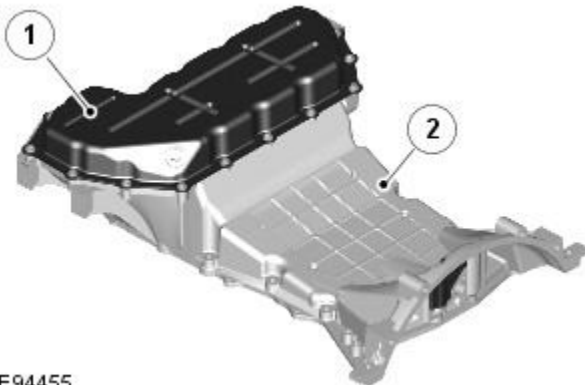
E43437

The bedplate is a structural casting bolted to the bottom of the cylinder block to retain the crankshaft. The use of a bedplate further improves rigidity. Iron inserts, cast into the main bearing supports of the bedplate, minimize main bearing clearance changes due to heat expansion.

Two hollow dowels align the bedplate with the cylinder block.

Beads of sealant seal the joint between the bedplate and the cylinder block.

Oil Pan



E94455

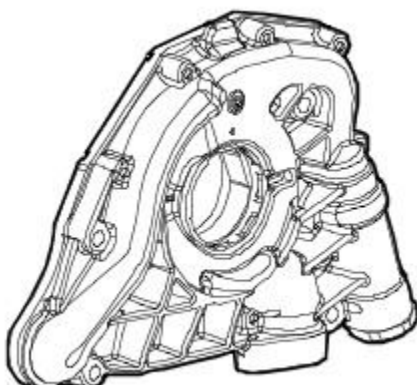
**ItemDescription**

1	Oil pan
2	Structural sump

The aluminum alloy structural sump is bolted to the bedplate. A windage tray attached to the underside of the bedplate isolates the oil pan from the disturbed air produced by the rotation of the crankshaft, to prevent oil aeration and improve oil drainage. A rubber plug at the rear of the structural sump seals the port that provides access to the torque converter securing bolts. The engine oil drain plug is located in the pressed steel oil pan, which attaches to the underside of the aluminum alloy structural sump.

A bead of sealant seals the joint between the structural sump and the bedplate.

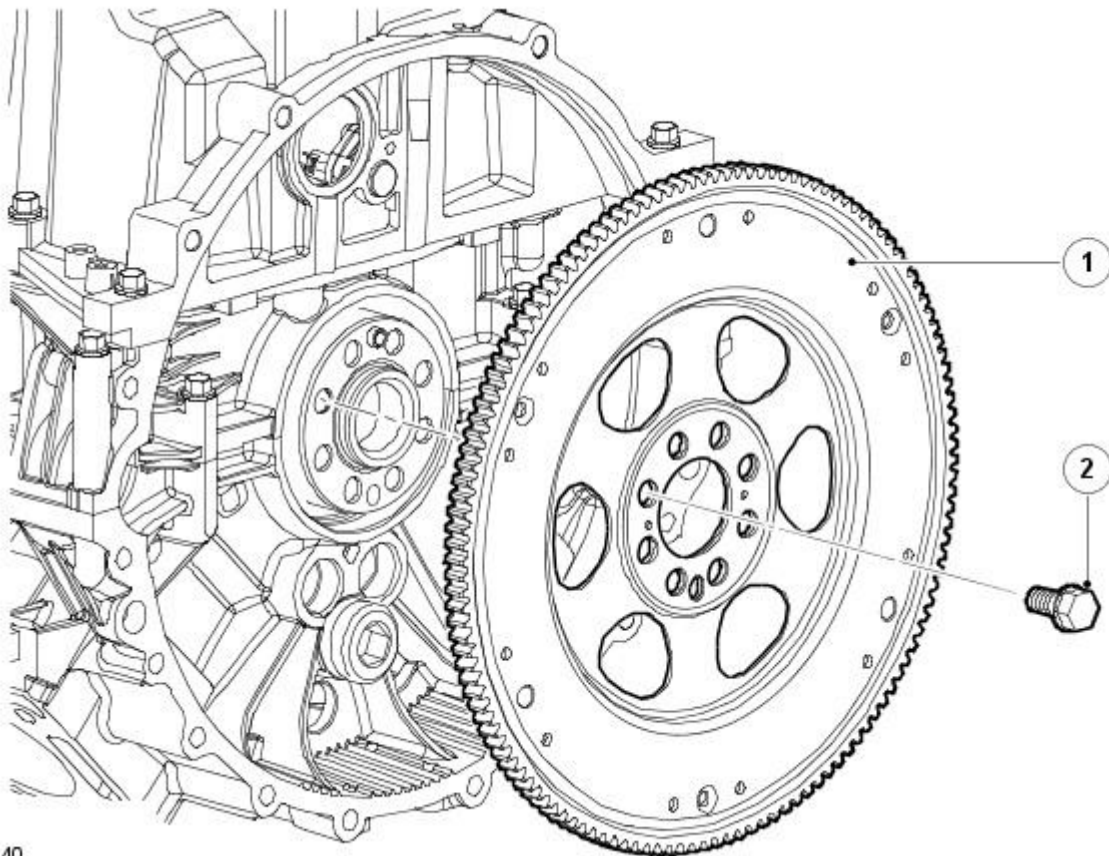
Oil Pump



E43439

The oil pump is installed on the crankshaft at the front of the engine. The pump outlet port aligns with oil passages in the bedplate (see Lubrication System for more information).

#### Starter Drive Plate



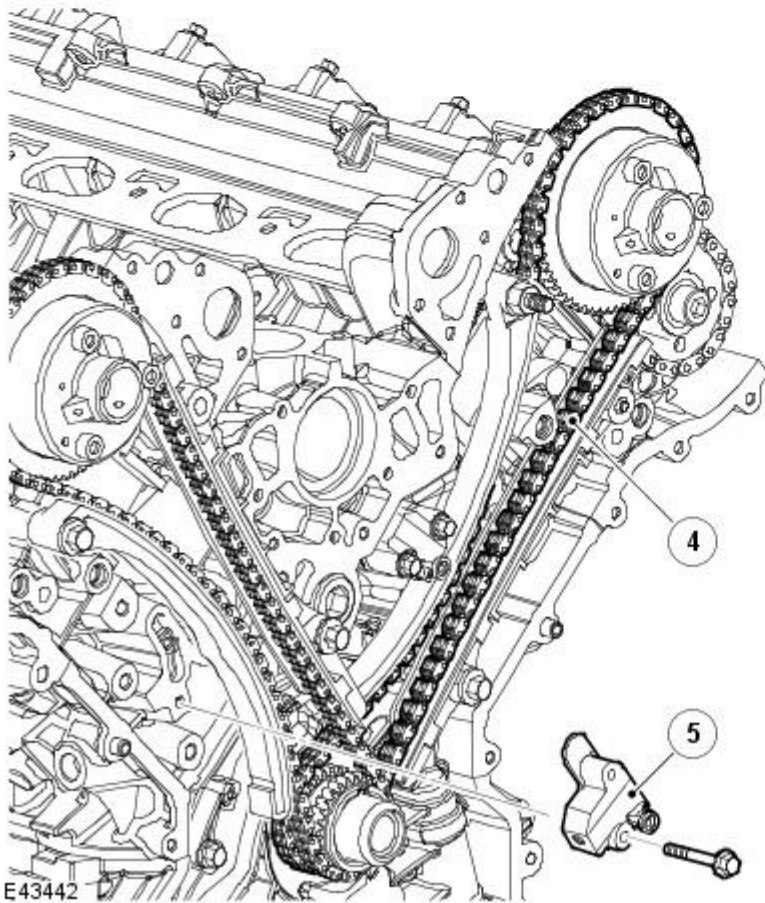
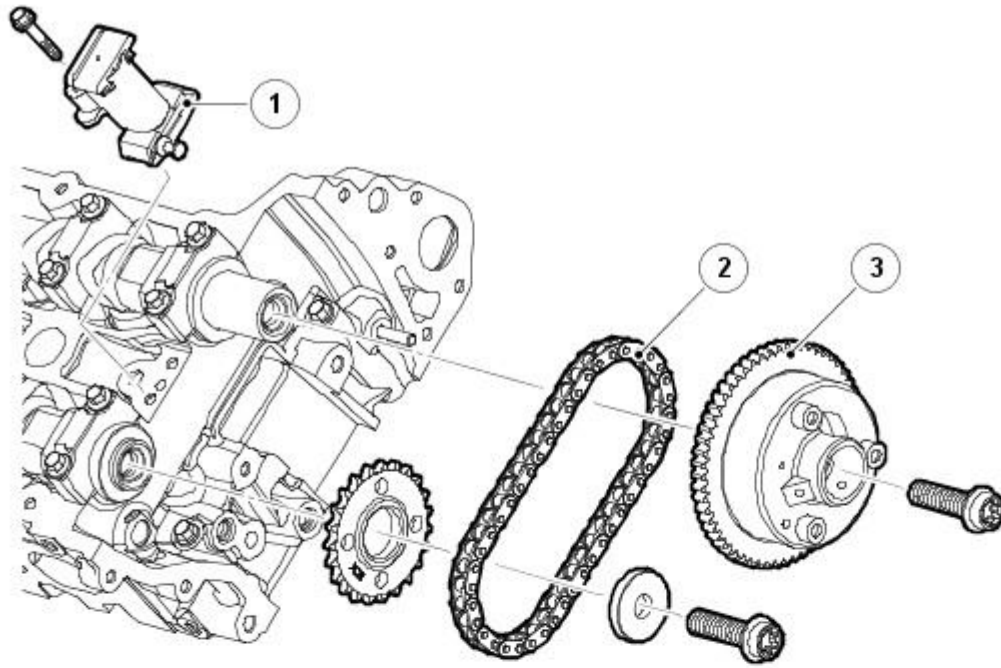
E43440

#### ItemDescription

- |   |                     |
|---|---------------------|
| 1 | Starter drive plate |
| 2 | Bolts (8 off)       |

The starter drive plate is attached to the rear of the crankshaft. A timing disc, for the [CKP \(crankshaft position\)](#) sensor, is spot welded to the front face of the drive plate.

#### Camshaft Timing Components



E43442

**ItemDescription**

1	Secondary chain tensioner
2	Secondary chain
3	<a href="#">VVT</a> unit
4	Primary chain
5	Primary chain tensioner

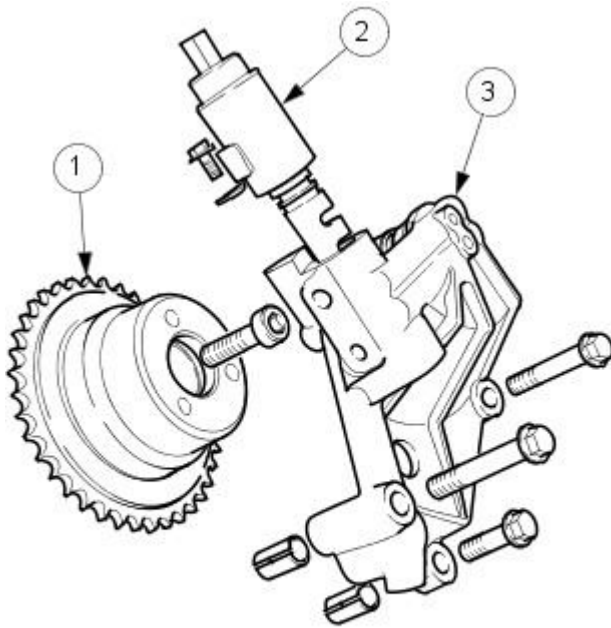
Multiple link primary and single row secondary chains drive the camshafts of each cylinder bank. The primary chains transmit the drive from 2 sprockets on the crankshaft to variable valve timing units on the intake camshafts. The secondary chains transmit the drive from the variable valve-timing units to sprockets on the exhaust camshafts.

A key locates the 2 drive sprockets on the crankshaft. The crankshaft's torsional vibration damper retains the sprockets in

position. The variable valve timing units and the exhaust camshaft sprockets are non-interference, non-keyed fits on their respective camshafts; the drive being transmitted by the face to face friction load produced by the valve timing unit/sprocket securing bolt.

Each chain has a hydraulic tensioner operated by engine oil. The primary chains are lubricated via oil squirt tubes located at the front of the engine block near the crankshaft drive sprockets. A jet of oil from the end of each secondary chain tensioner lubricates the secondary chains. The primary chain tensioners act on pivoting flexible tensioner blades. The secondary chain tensioners act directly on the chains. Guide rails are installed on the drive side of the primary chains.

#### Variable Valve Timing



E31298

#### ItemDescription

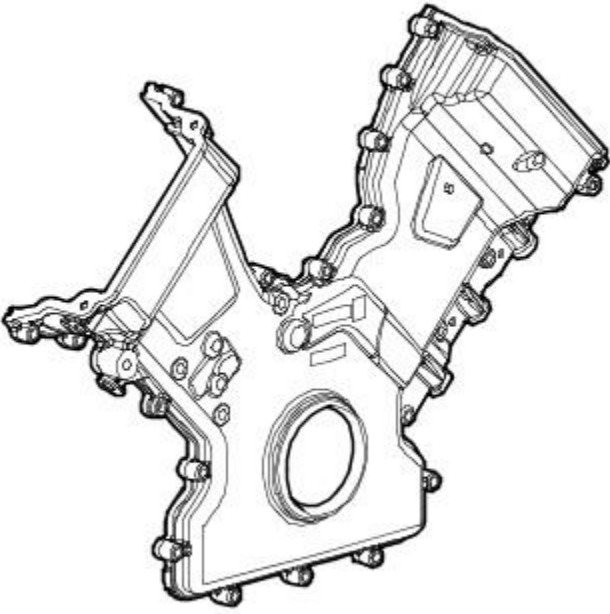
1	<a href="#">VVT</a> oil control unit
2	<a href="#">VVT</a> oil control solenoid
3	Bush carrier

The [VVT](#) unit is a hydraulic actuator mounted on the end of the intake camshaft, which advances or retards the intake camshaft timing and thereby alters the camshaft to crankshaft phasing. The oil control solenoid, controlled by the [ECM](#), routes oil pressure to either the advance or retard chambers located either side of the 3 vanes interspersed within the machined housing of the unit.

The [VVT](#) unit is driven by the primary chain and rotates relative to the exhaust camshaft sprocket. When the [ECM](#) requests the camshaft timing to advance, the oil control solenoid is energized moving the shuttle valve to the relevant position to allow engine oil pressure, via a filter, into the [VVT](#) unit's advance chambers. When the camshaft timing is requested to retard, the shuttle valve moves position to allow oil pressure to exit the advance chambers, while simultaneously routing the oil pressure into the retard chambers.

#### Timing Cover

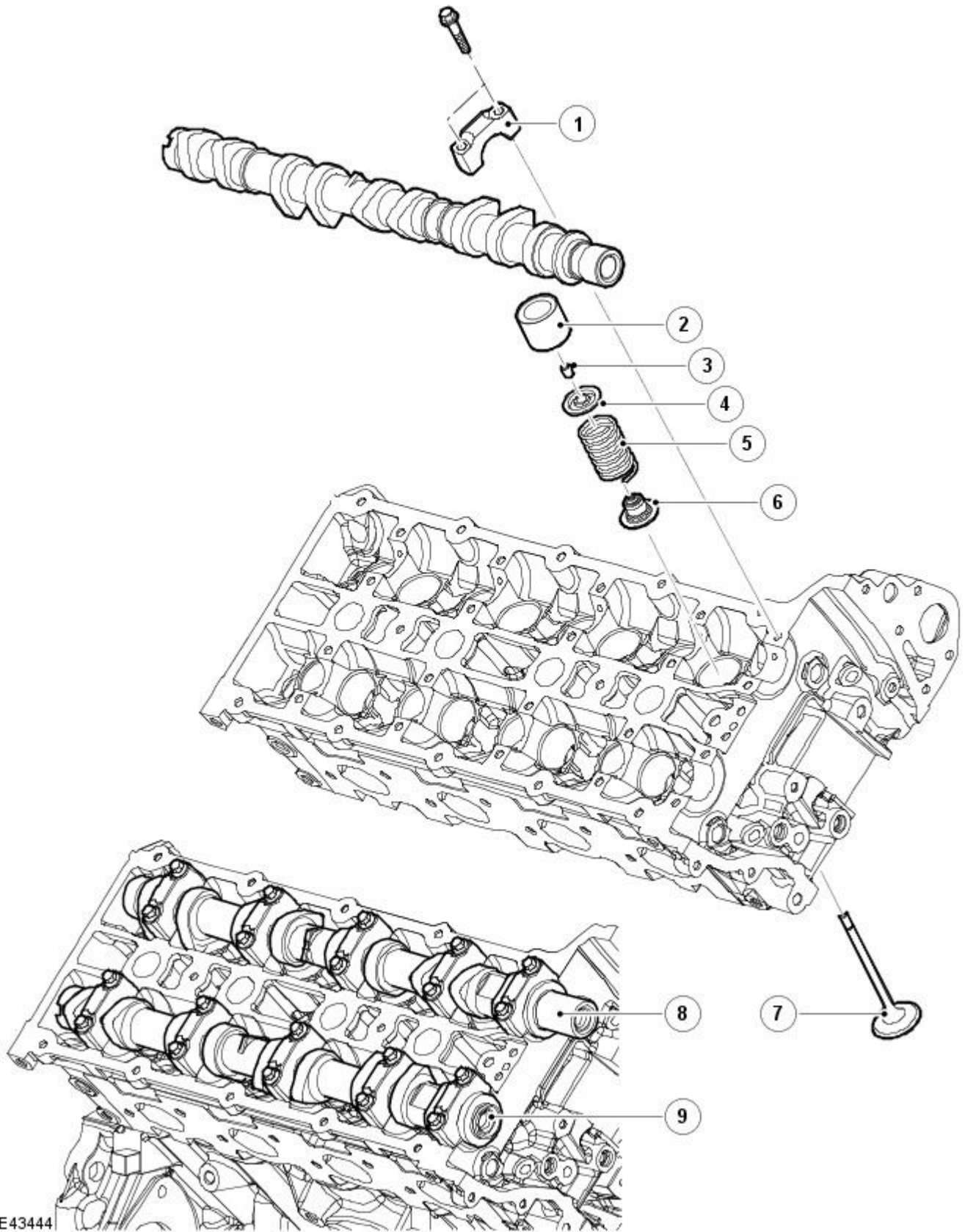




E43443

The aluminum alloy timing cover accommodates the crankshaft front oil seal (a [PTFE \(polytetrafluoroethylene\)](#) lip seal). Silicon rubber in-groove gaskets seal the joint between the timing cover and the front face of the engine.

## Cylinder Head Components



E43444

**ItemDescription**

1	Camshaft bearing cap
2	Tappet
3	Collet
4	Valve spring cap
5	Valve spring
6	Valve stem oil seal
7	Valve
8	intake camshaft

## 9 Exhaust camshaft

The cylinder heads are unique to each cylinder bank. Deep-seated bolts, to reduce distortion, secure the cylinder heads to the cylinder block. Two hollow dowels align each cylinder head with the cylinder block. The multi-layered steel cylinder head gasket has cylinder specific coolant flow cross-sections for uniform coolant flow.

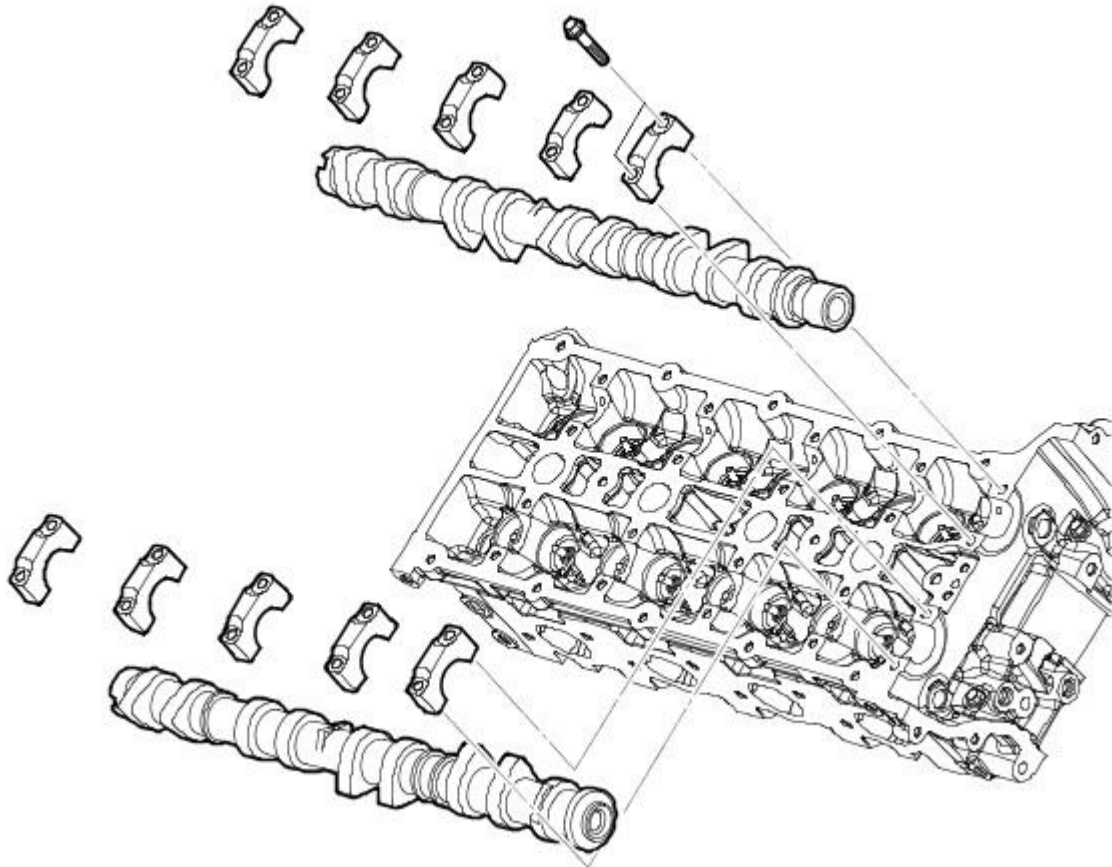
The 14 mm (0.55 in) spark plugs, 1 per cylinder, locate in recesses down the centre line of each cylinder head.

The engine-lifting eyes are bolted to the cylinder heads, 2 on the rear (1 per head) and 1 at the front.

Each cylinder head incorporates dual overhead camshafts operating 4 valves per cylinder via solid shim-less valve lifters.

The lightweight valve gear provides good fuel economy and noise levels. Valve head diameters are 31 mm (1.220 in) for the exhaust and 35 mm (1.378 in) for the intake. All valves have 5 mm (0.197 in) diameter stems supported in sintered metal seats and guide inserts. Collets, valve collars and spring seats locate single valve springs on both intake and exhaust valves. Valve stem seals are integrated into the spring seats.

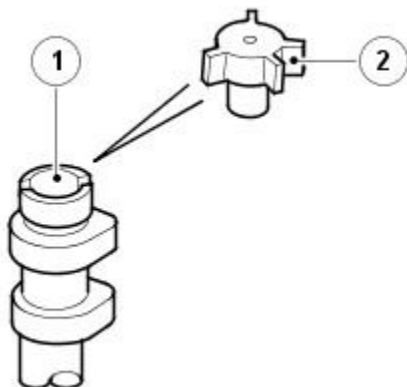
### Camshafts



E43446

The camshafts are manufactured in chilled cast iron. Five aluminum alloy caps retain each camshaft. Location numbers, 0 to 4 for the intake camshaft and 5 to 9 for the exhaust camshaft, are marked on the outer faces of the caps.

### Sensor Timing Ring



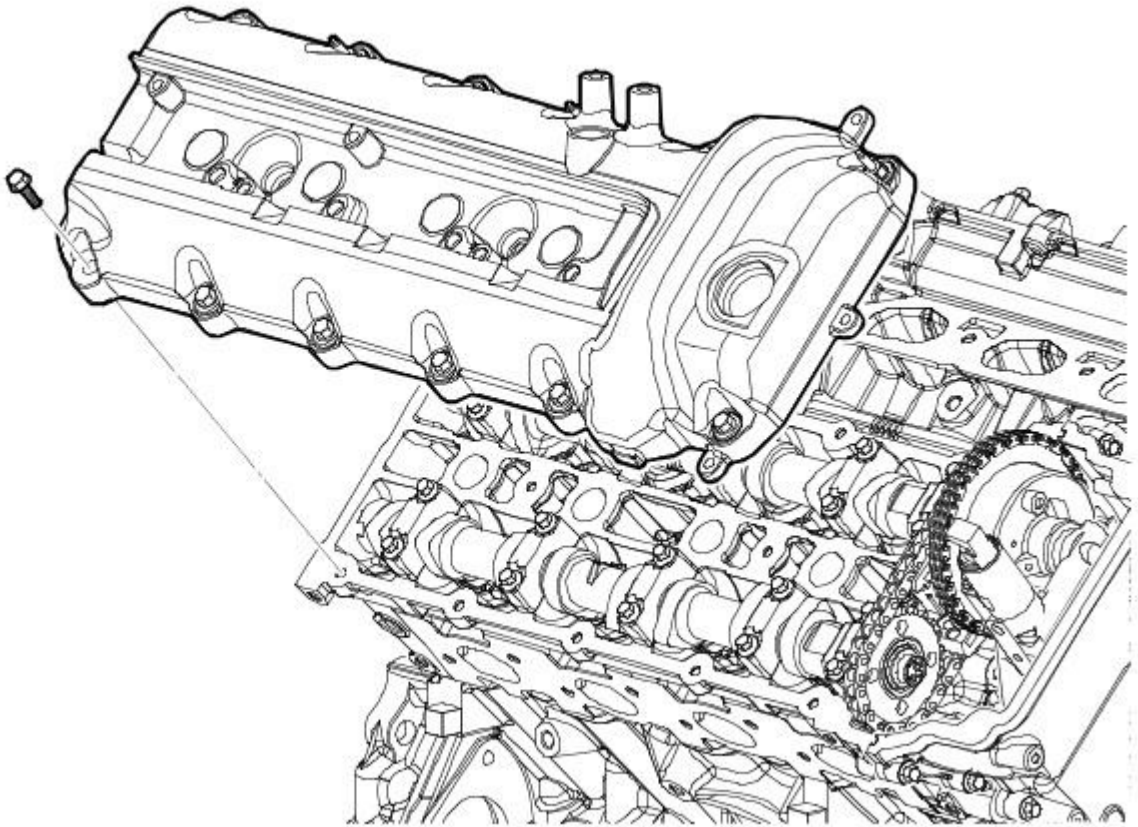
E43447

### ItemDescription

- |   |                 |
|---|-----------------|
| 1 | Intake camshaft |
| 2 | Timing ring     |

A camshaft position sensor timing ring is located at the rear of both intake camshafts. A flat, machined near the front of each camshaft, enables the camshafts to be locked during the valve timing procedure.

## Camshaft Covers

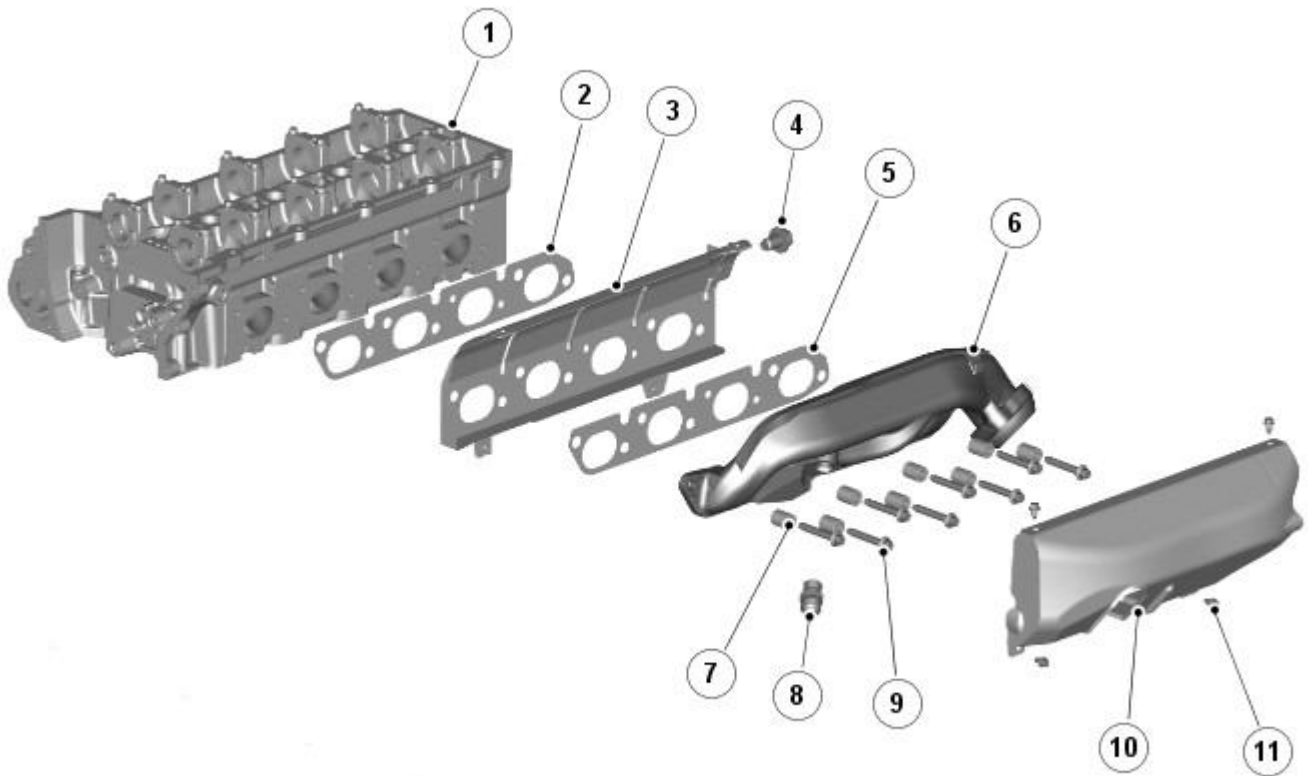


E43445

The camshaft covers are manufactured from thermoplastic. Bank 1 camshaft cover incorporates an outlet for the part load engine breather and the pressure control valve. Bank 2 camshaft cover incorporates an outlet for the full load engine breather and the engine oil filler cap. Identical oil separators are incorporated below the breather outlet in each cover. Refer to: [Engine Emission Control](#) (303-08 Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

- NOTE: [LH](#) exhaust manifold shown, [RH](#) exhaust manifold similar.

Exhaust Manifolds



E94456

**ItemDescription**

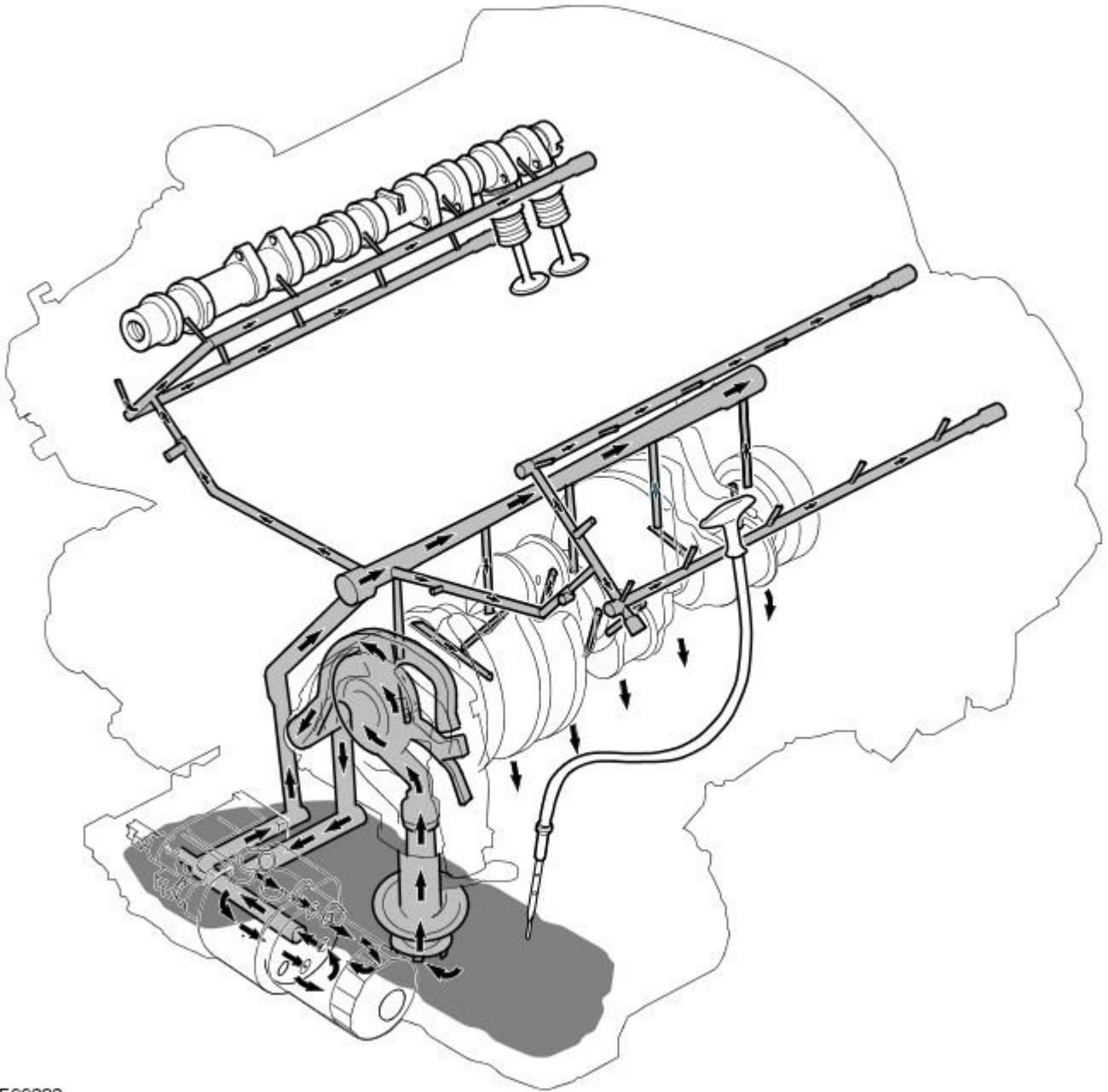
1	Cylinder head
2	Gasket
3	Heat shield
4	Bolt
5	Gasket
6	<a href="#">LH</a> exhaust manifold
7	Spacer (8 off)
8	Connector for <a href="#">AIR (secondary air injection)</a> system (where fitted)
9	Bolt (8 off)
10	Heat shield
11	Bolt (4 off)

The cast stainless steel exhaust manifolds are unique for each cylinder bank. Each exhaust manifold installation includes two metal gaskets and two heat shields. Spacers on the securing bolts allow the manifolds to expand and contract with changes of temperature while maintaining the clamping loads.

Each exhaust manifold incorporates a connector for the [AIR](#) system (where fitted). Where an [AIR](#) system is not fitted, each connector is sealed with a cap nut. The [RH](#) exhaust manifold incorporates a connection flange for the [EGR \(exhaust gas recirculation\)](#) system.

Refer to: [Engine Emission Control](#) (303-08 Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

**Lubrication System**



E99283

Oil is drawn from the reservoir in the oil pan and pressurized by the oil pump. The output from the oil pump is then filtered, cooled and distributed through internal oil passages.

All moving parts are lubricated by pressure or splash oil. Pressurized oil is also provided for operation of the variable valve timing units and the timing gear chain tensioners.

The oil returns to the oil pan under gravity. Large drain holes through the cylinder heads and cylinder block ensure the quick return of the oil, reducing the volume of oil required and enabling an accurate check of the contents soon after the engine stops.

System replenishment is through the oil filler cap on the [LH](#) camshaft cover.

With the exception of the pump, all oil system components are installed on the structural sump.

Oil Pick-up

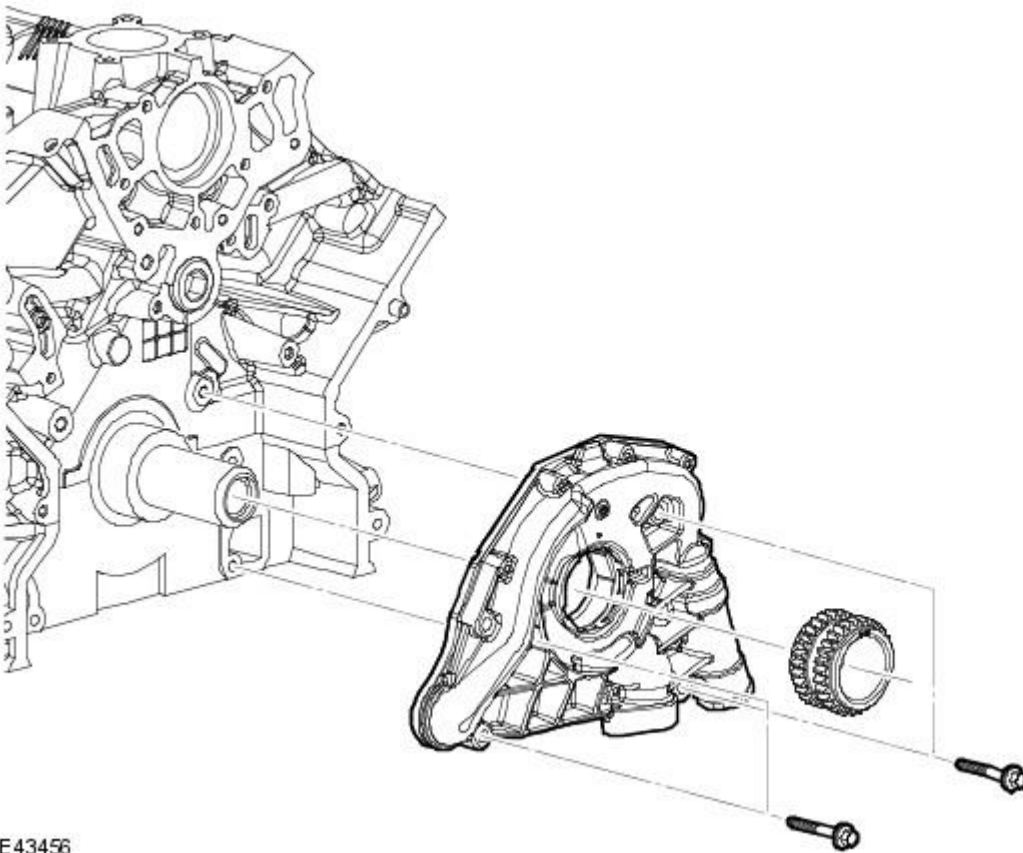




E72000

The fabricated steel oil pick-up is immersed in the oil reservoir to provide a supply to the oil pump during all normal vehicle attitudes. A mesh screen in the inlet prevents debris from entering the oil system.

#### Oil Pump

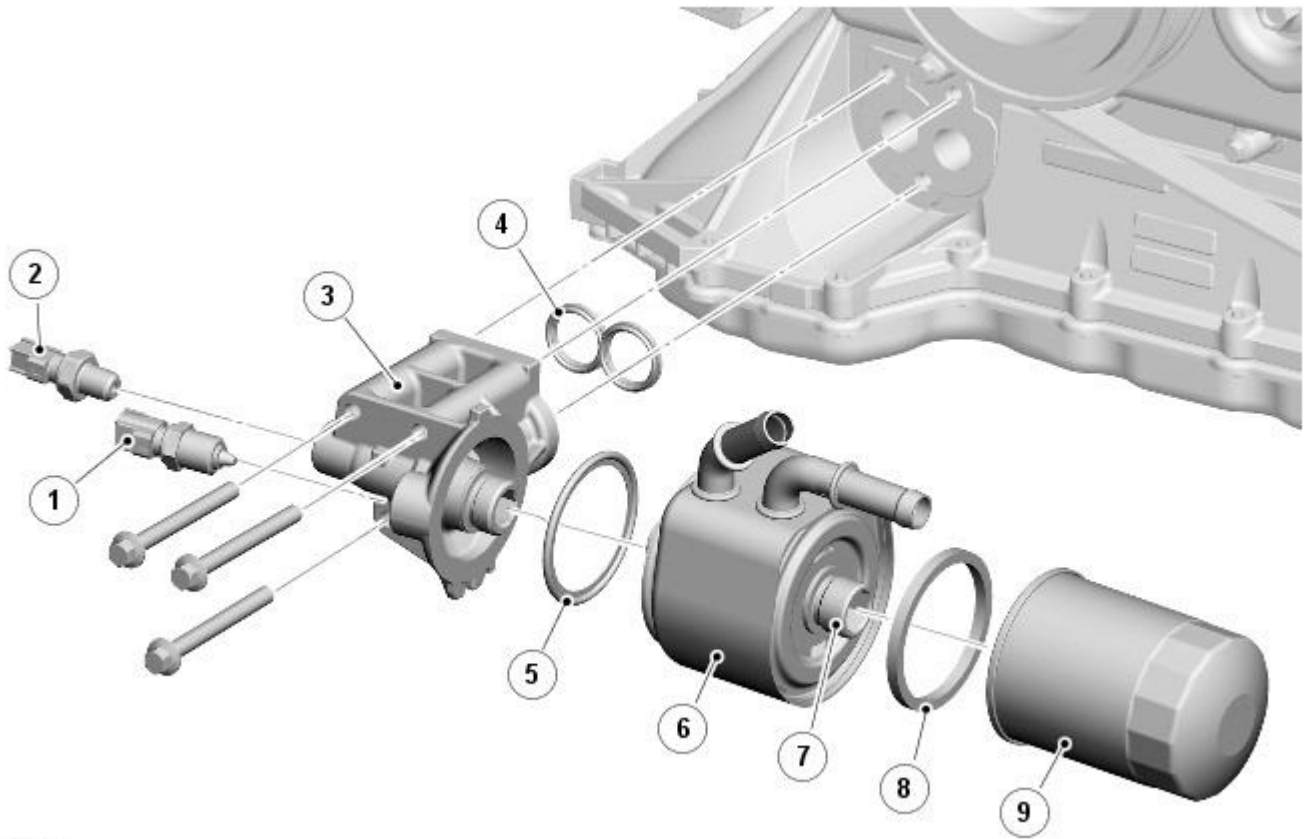


E43456

The oil pump is installed on the crankshaft at the front of the engine. The pump inlet and outlet ports align with oil passages in the bedplate.

The pumping element is an eccentric rotor, which is directly driven by flats on the crankshaft. An integral pressure relief valve regulates pump outlet pressure at 4.5 bar (65.25 lbf/in<sup>2</sup>).

#### Oil Filter Assembly



E99284

**ItemDescription**

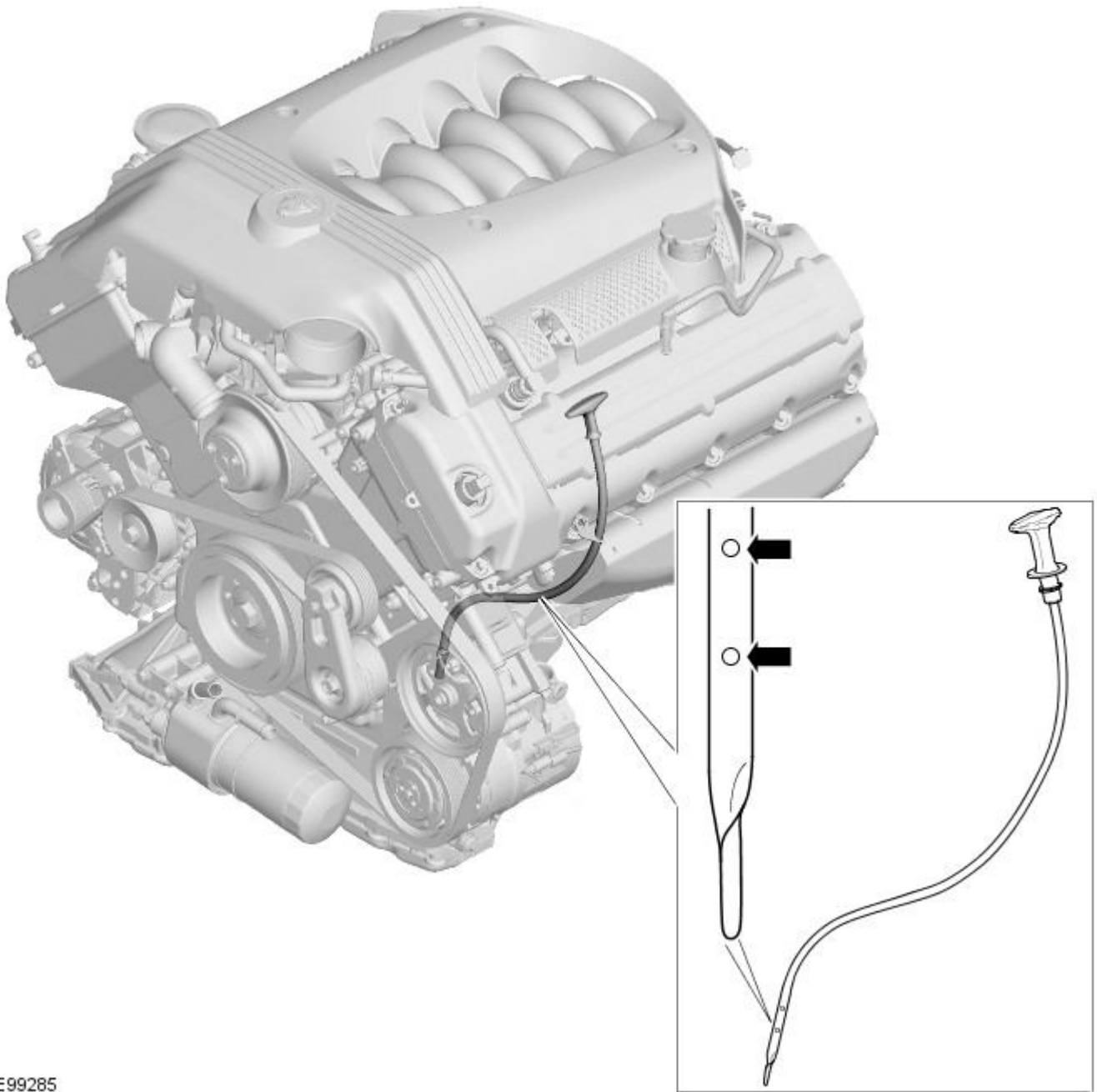
1	Oil temperature sensor
2	Oil pressure switch
3	Filter head
4	Seal
5	O-ring seal
6	Engine oil cooler
7	Mounting bolt
8	Gasket
9	Filter

The oil filter is a replaceable cartridge with an internal bypass facility that permits full flow bypass if the filter is blocked. The oil filter is attached to the engine oil cooler, which is attached to a filter head installed on the front of the structural sump. The filter head also incorporates:

- An oil pressure switch.  
Refer to: [Instrument Cluster](#) (413-01 Instrument Cluster, Description and Operation).
- An oil temperature sensor.  
Refer to: [Electronic Engine Controls](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

The engine oil cooler is a liquid-to-liquid heat exchanger cooled by engine coolant. The coolant feed and return hoses for the engine oil cooler are connected to the radiator lower hose.  
Refer to: [Engine Cooling](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

Oil Level Gage



E99285

The oil level gage locates along the left side of the oil pan, supported in a tube installed in the bedplate. Two holes in the end of the gage indicate the minimum and maximum oil levels. There is a difference of approximately 1.0 liter (1.0 US quart) between the two levels.

## **Engine - 4.2L NA V8 - AJV8 - Engine**


Diagnosis and Testing

For additional information.

REFER to: [Engine - 3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (303-00 Engine System - General Information, Diagnosis and Testing).

# Engine - 4.2L NA V8 - AJV8 - Engine Oil Draining and Filling

General Procedures

Special Tool(s)	
 <p>303-752</p> <p>E75849</p>	<p>Wrench, Oil filter</p> <p>303-752</p>

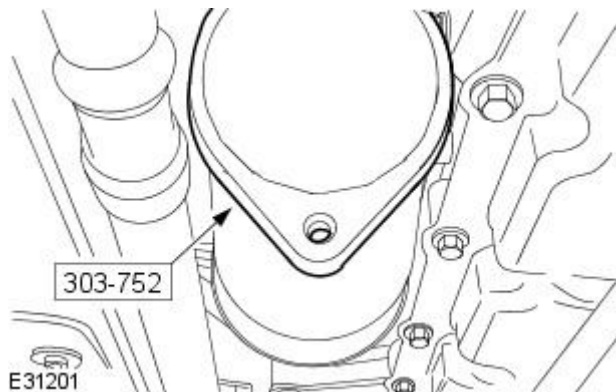
**WARNING:** The spilling of hot engine oil is unavoidable during this procedure, care must be taken to prevent scalding.

• NOTE: Clean the components general area prior to dismantling.

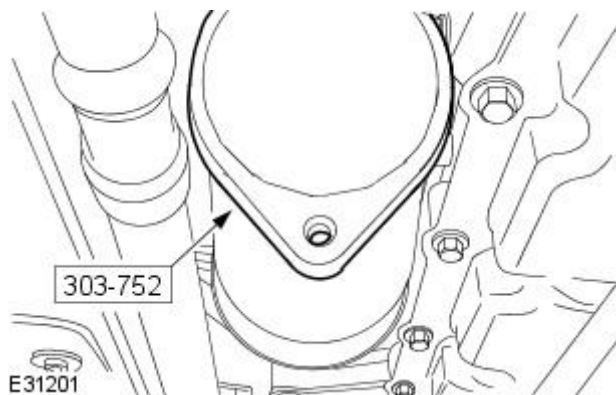
**WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
3. Remove the oil pan drain plug.
  - Position a container to collect the fluid.
  - Discard the oil pan drain plug seal.
4. Remove the oil filter.
  - Position a container to collect the fluid.
  - Discard the oil filter.



5. Using the special tool, install the oil filter.



6. Tighten the drain plug to 25 Nm.

- Install a new seal.

7. Fill the engine with oil.

8. Start engine and run at idle speed until the oil pressure warning light extinguishes.

- Stop the engine.

- Check for leaks.

**9.** Install the air deflector.



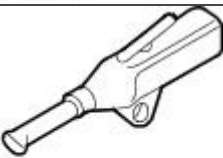
For additional information, refer to: Air Deflector (501-02, Removal and Installation).

**10.** Check and top-up the engine oil.



# Engine - 4.2L NA V8 - AJV8 - Valve Clearance Adjustment

General Procedures

Special Tool(s)	
 <p>303-540</p> <p>E65896</p>	<p>Tappet hold-down tool</p> <p>303-540</p>
 <p>303-540/02</p> <p>E65897</p>	<p>Tappet hold-down tool adaptor</p> <p>303-540/02</p>
 <p>DWST074</p>	<p>Fan nozzle - air gun</p> <p>303-590</p>

• CAUTIONS:

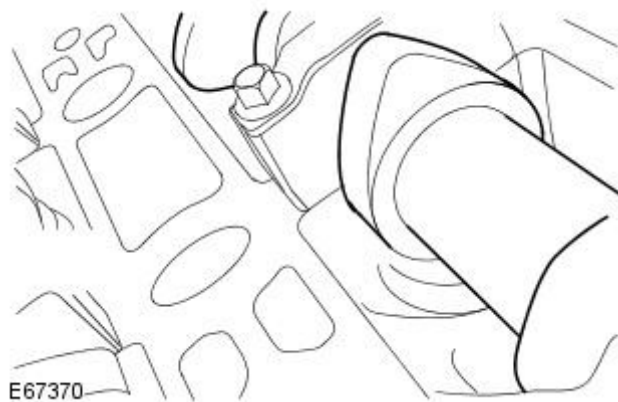


Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.



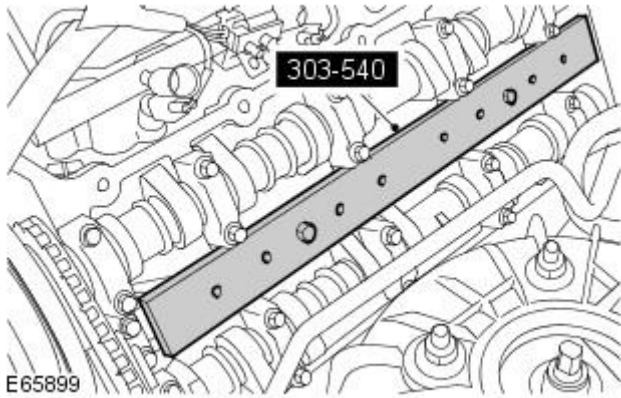
Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Check the valve clearances.  
For additional information, refer to: [Valve Clearance Check](#) (303-01A Engine - 4.2L NA V8 - AJV8, General Procedures).
3. Rotate the engine clockwise to position the camshaft lobe away from the valve tappet.



4. Install the special tool 303-540, to the cylinder head.

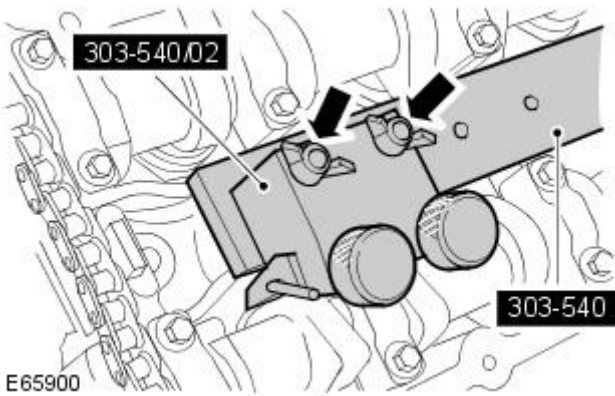
- Tighten the 2 bolts to 10 Nm



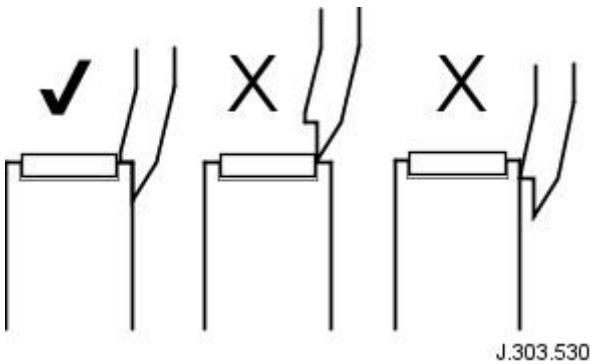
5.  CAUTION: Do not rotate the crankshaft while the special tool 303-540/02 is attached to 303-540.

Attach the special tool 303-540/02 to 303-540.

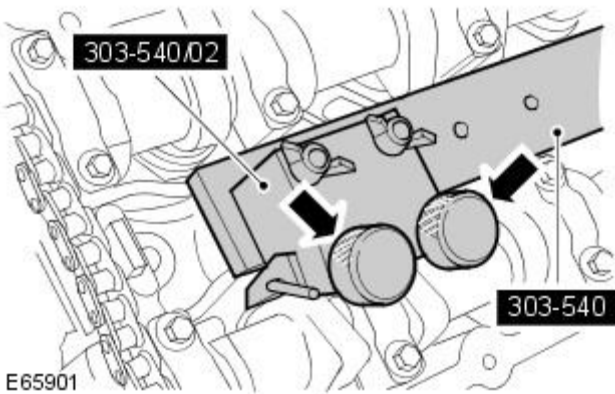
- Secure with the 2 wing nuts.

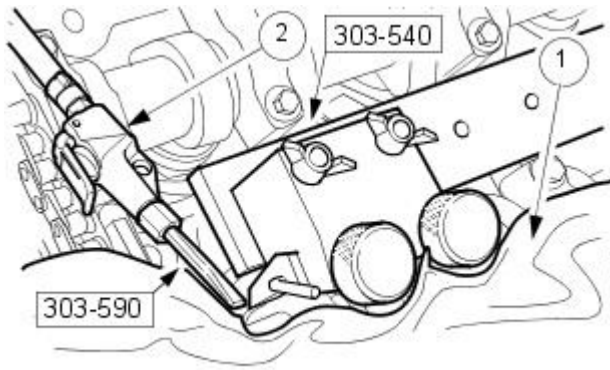


6. Position the special tool to the tappet as shown.




7. Using the special tool, compress the valve spring.





E31420

**8.**  **CAUTION:** Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.


• **NOTE:** Use the following formula to calculate the required shim thickness. Original shim thickness + measured shim clearance - desired clearance = required shim thickness.

Remove, clean and measure the shim.

- Surround the immediate working area with a cloth, to retain any loose shims displaced by the compressed air.
- Use the special tool 303-590, aimed at the edge of the shim, to lift it from the tappet. Note the position of each one.

**9. CAUTIONS:**

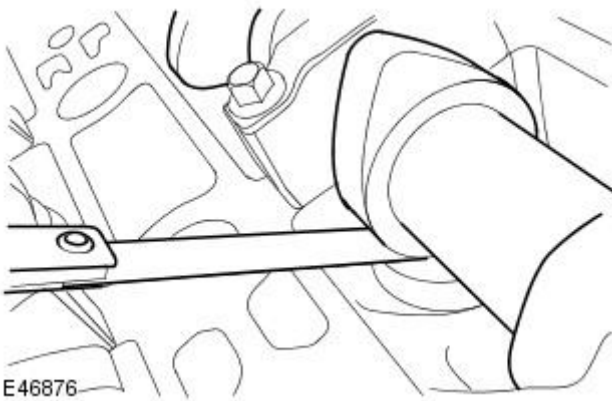
 Shims must be fitted with the size markings facing the tappet, not the camshaft.

 Do not use a magnet to install shims. Failure to follow these instructions may result in damage to the vehicle.

Install the new shim.

- Clean the components.
- Lubricate the shim with clean engine oil.
- Release and remove the special tools as required.

**10.** Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



E46876

**11.** Repeat the above procedure for the remaining valves.

## Engine - 4.2L NA V8 - AJV8 - Valve Clearance Check

General Procedures

• CAUTIONS:



Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.



Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the LH valve cover.  
For additional information, refer to: [Valve Cover LH](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).
3. Remove the RH valve cover.  
For additional information, refer to: [Valve Cover RH](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).

4. CAUTIONS:



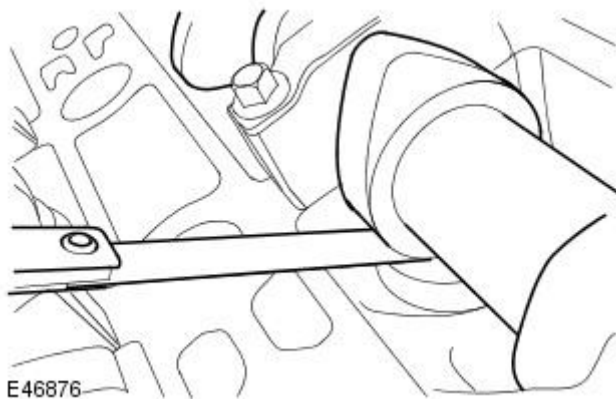
Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.



Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

Rotate the engine clockwise to position the camshaft lobe away from the valve tappet.

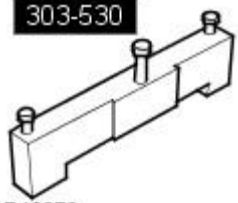




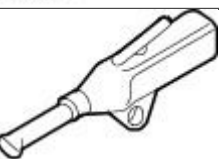
5. Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



6. Repeat the above procedure for the remaining 11 shims.
7. Adjust the clearance as necessary.
8. For cylinder head data, refer to specifications.  
For additional information, refer to: [Specifications](#) (303-01A Engine - 4.2L NA V8 - AJV8, Specifications).
9. Install the RH valve cover.  
For additional information, refer to: [Valve Cover RH](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).
10. Install the LH valve cover.  
For additional information, refer to: [Valve Cover LH](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).
11. Reconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).


**Engine - 4.2L NA V8 - AJV8 - Camshafts LH**

In-vehicle Repair

Special Tool(s)	
 <p>303-530 E46879</p>	Camshaft setting/locking tool 303-530
 <p>303-645 E46881</p>	Timing Setting tool 303-645
 <p>303-532 E46880</p>	Timing chain tensioning tool 303-532
 <p>303-540 E65896</p>	Tappet hold-down tool 303-540
 <p>303-540/02 E65897</p>	Tappet hold-down tool adaptor 303-540/02
 <p>DWST074</p>	Fan nozzle - air gun 303-590

**Removal**

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.


3. Remove the engine front cover.

For additional information, refer to: [Engine Front Cover](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).

4. Remove the crankshaft position (CKP) sensor.

For additional information, refer to: [Crankshaft Position \(CKP\) Sensor - 4.2L NA V8 - AJV8](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

5. CAUTIONS:

 Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.

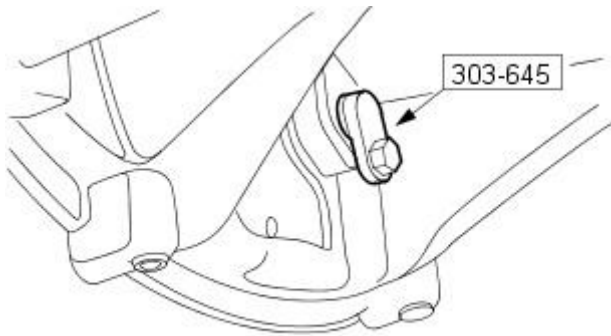
 Rotate the crankshaft clockwise to position the engine to top dead center (TDC) number 1 cylinder.

Lock the crankshaft.

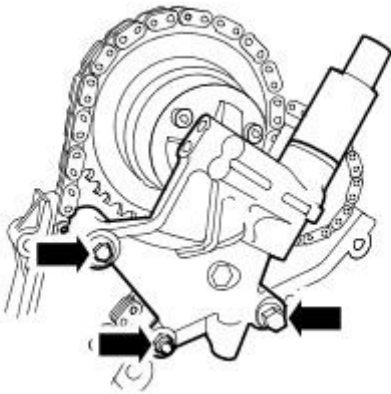
- Install the special tool.
- Install the screw.

6. Remove the LH variable camshaft timing (VCT) control solenoid housing.

- Remove the 2 bolts.
- Remove the nut.
- Remove and discard the O-ring seals.



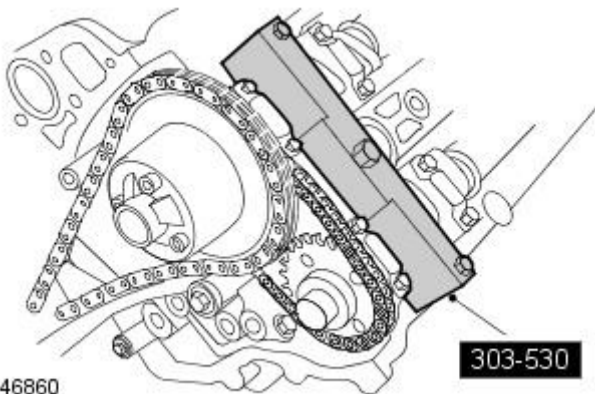
VUJ0002400



E48360

7. Install the special tool to the LH cylinder head.

- Install the 3 bolts.
- Rotate the crankshaft until the flats on the camshafts are parallel with the cylinder head joint faces.

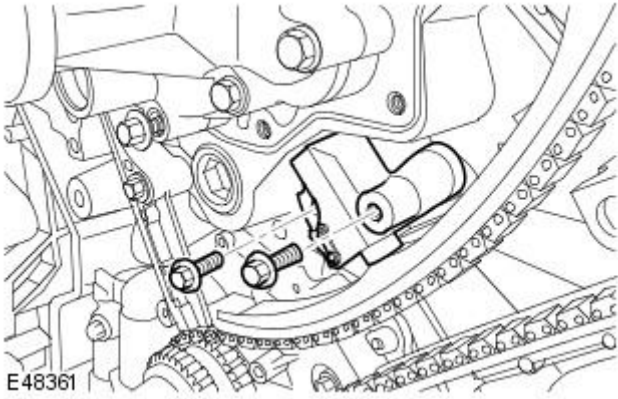


E46860



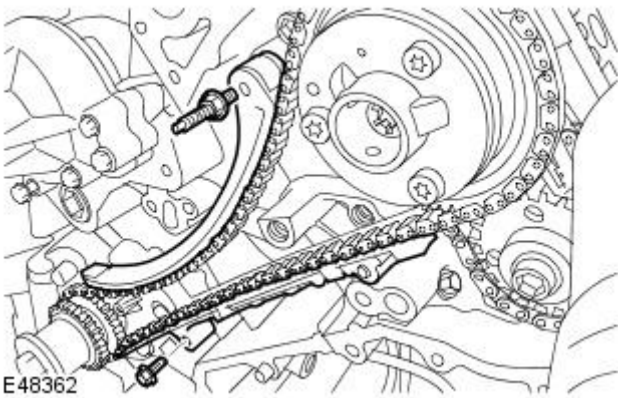
8. Remove the LH primary timing chain tensioner.

- Remove the 2 bolts.

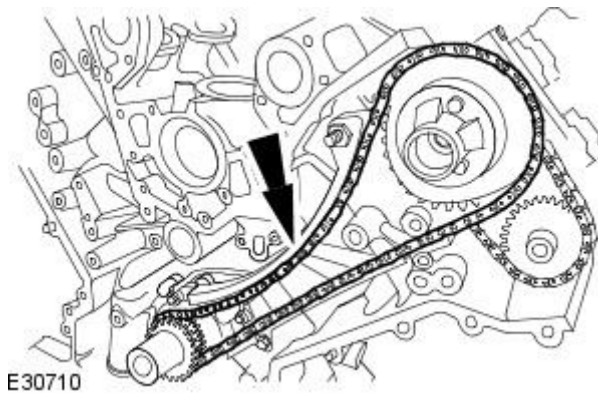


9. Remove the LH upper and lower primary timing chain tensioner guides.

- Remove the 2 bolts.

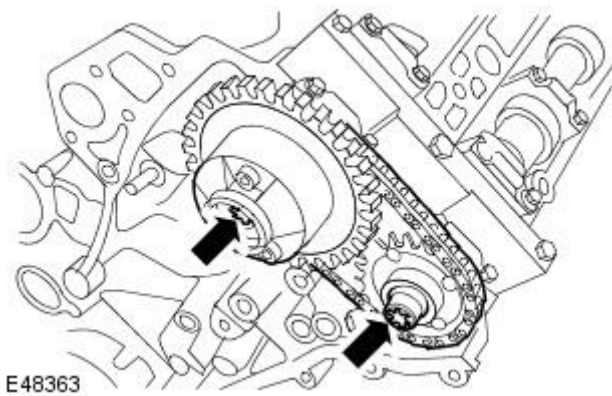


10. Remove the LH primary timing chain.



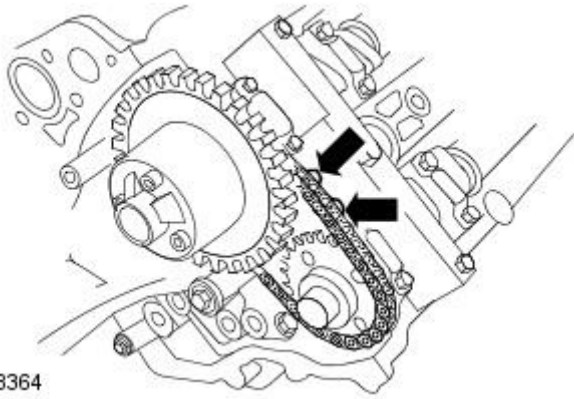
11. Release the LH camshaft sprocket assembly.

- Remove and discard the 2 Torx bolts.



12. Remove the LH secondary timing chain, tensioner and sprocket assembly.

- Remove the 2 bolts.



E48364

13. Remove the special tool from the LH cylinder head.

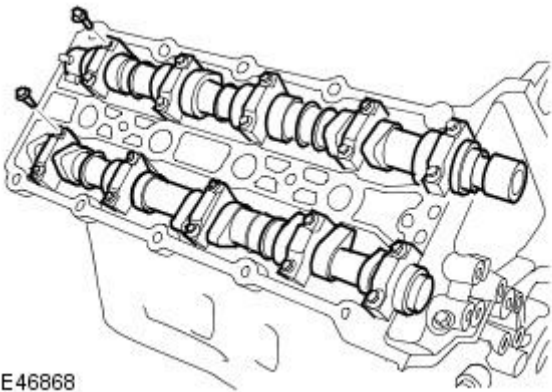
14.  CAUTION: Evenly and progressively, release the camshaft bearing caps.

• NOTE: Remove the camshaft bearing caps. Note: their position, orientation and markings. Each is marked with its position (number) and an orientation (arrow).

Remove the camshaft bearing caps.

- Remove the 20 bolts.

15. Remove the camshafts.



E46868

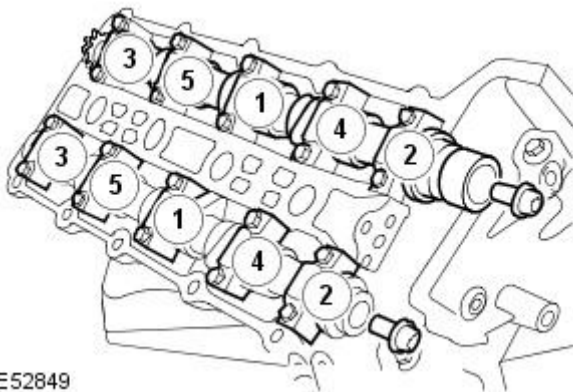
## Installation

1. Install the camshafts.

- Clean the component mating faces.
- Replace the valve shims, with the smallest shim available.
- Lubricate the journals and camshaft lobes.

2. Install the camshaft bearing caps.

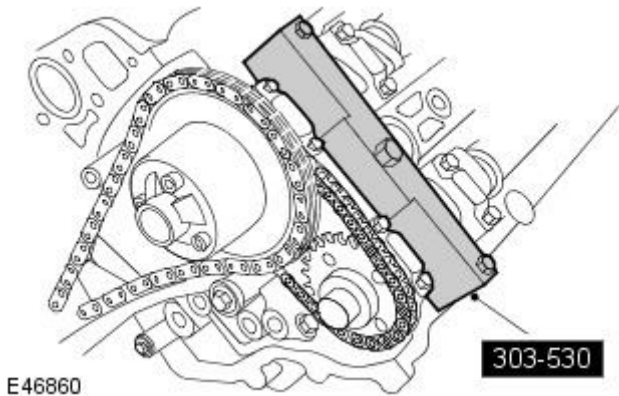
- Clean the component mating faces.
- Tighten the bolts to 10 Nm.



E52849

3. Install the special tool to the LH cylinder head.

- Install the 3 bolts.



4. Install the LH secondary timing chain tensioner retaining bolts.

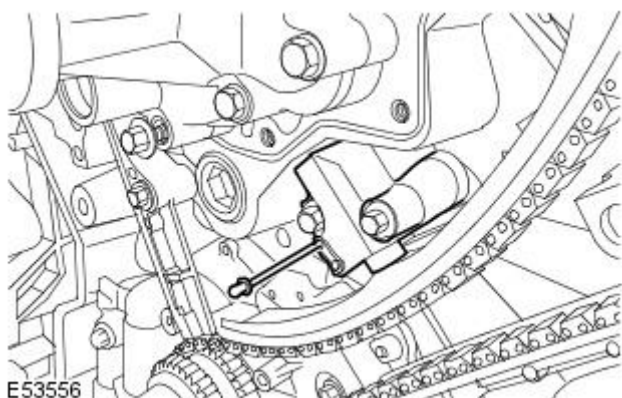
- Tighten to 12 Nm.

5. Install the LH primary timing chain.

- Clean the components.
- Make sure the timing chain slack is on the tensioner side of the timing chain.

6. Install the LH primary timing chain tensioner guides.

- Clean the components.
- Tighten to 12 Nm.



7. **CAUTION:** During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

- NOTE: LH illustration shown, RH is similar.

Install the LH primary timing chain tensioner.

- Clean the components.
- Using 3 mm diameter metal rod, retain the chain tensioner piston.
- Remove the retaining rod.
- Tighten to 12 Nm.

8. CAUTIONS:

**CAUTION:** Using the special tool, apply force to the tool in a counter-clockwise direction, to tension the primary timing chain on its drive side.

**CAUTION:** The intake camshaft sprocket retaining bolt **MUST** be tightened before the exhaust camshaft sprocket retaining bolt. Engine damage will occur if this procedure is not followed.

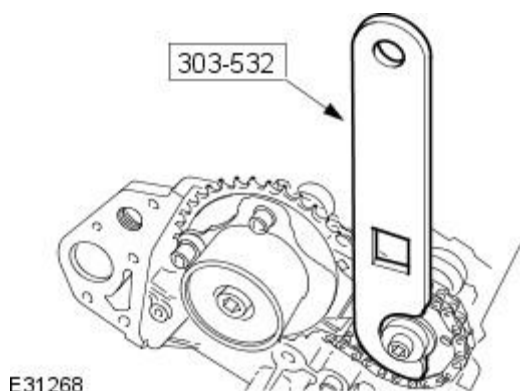
**CAUTION:** Make sure that new bolts are installed.

Install the special tool to the LH exhaust camshaft sprocket.

- Tighten the intake camshaft sprocket retaining bolt to 20 Nm + 90 deg.
- Tighten the exhaust camshaft sprocket retaining bolt to 20 Nm + 90 deg.

9. Install the LH VCT control solenoid housing.

- Clean the components.



- Install the new O-ring seals.
- Tighten the nut to 10 Nm.
- Tighten to 22 Nm.

10. Remove the special tool from the LH cylinder head.

11. Remove the crankshaft locking tool.

- Remove the screw.

12. Install the CKP sensor.

For additional information, refer to: [Crankshaft Position \(CKP\) Sensor - 4.2L NA V8 - AJV8](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

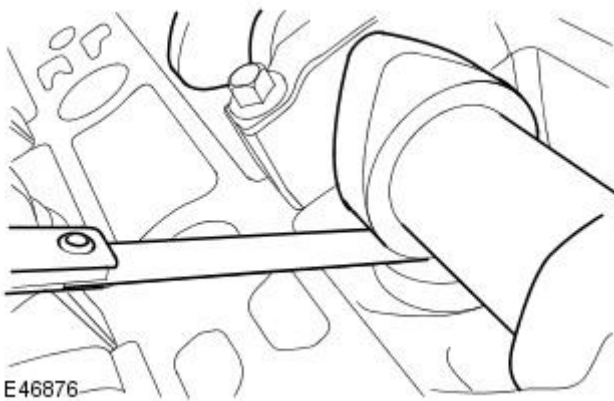
13. For cylinder head data, refer to specifications.

For additional information, refer to: [Specifications](#) (303-01A Engine - 4.2L NA V8 - AJV8, Specifications).

14. Rotate the engine clockwise to position the camshaft lobe away from the valve tappet.

15.  **CAUTION:** Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

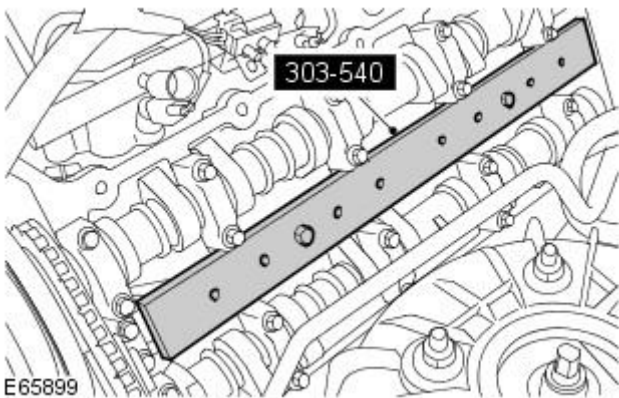
Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.




16. Repeat the above procedure for the remaining 15 shims.

17. Install the special tool 303-540, to the cylinder head.

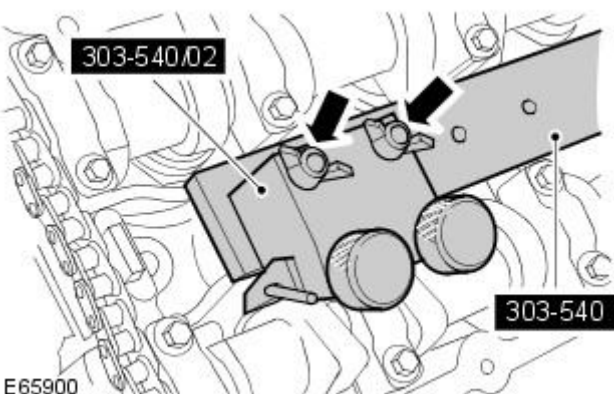
- Tighten the two bolts to 10 Nm.



18.  **CAUTION:** Do not rotate the crankshaft while the special tool 303-540/02 is attached to 303-540.

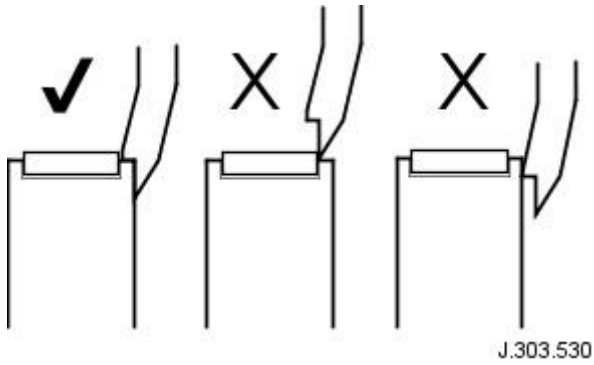
Attach the special tool 303-540/02 to 303-540.

- Secure with the 2 wing nuts.

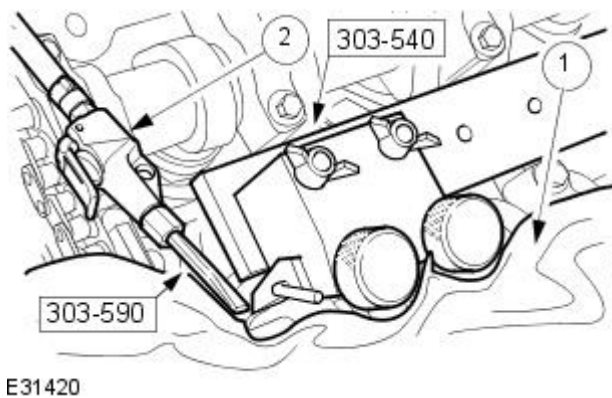
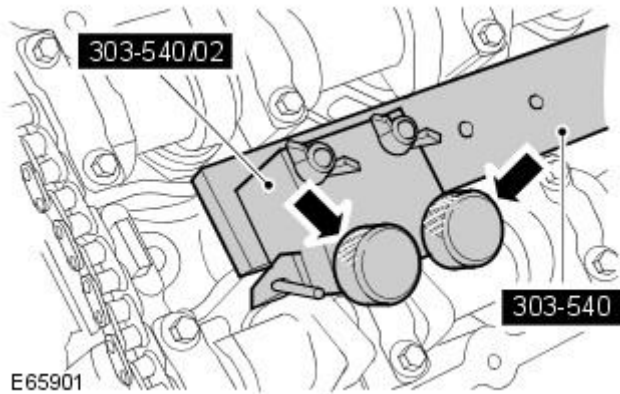





19. Position the special tool to the tappet as shown.



20. Using the special tool, compress the valve spring.



21.  **CAUTION:** Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.


• **NOTE:** Use the following formula to calculate the required shim thickness. Original shim thickness + measured shim clearance - desired clearance = required shim thickness.

Remove, clean and measure the shim.

- Surround the immediate working area with a cloth, to retain any loose shims displaced by the compressed air.
- Use the special tool 303-590, aimed at the edge of the shim, to lift it from the tappet. Note the position of each one.

22. **CAUTIONS:**

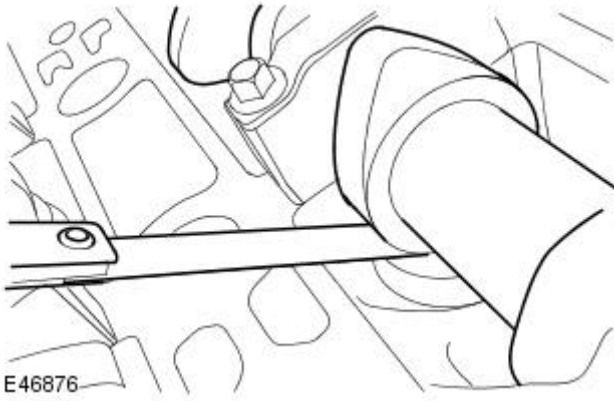
 Shims must be fitted with the size markings facing the tappet, not the camshaft.

 Do not use a magnet to install shims. Failure to follow these instructions may result in damage to the vehicle.

Install the new shim.

- Clean the components.
- Lubricate the shim with clean engine oil.
- Release and remove the special tools as required.

23. Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.

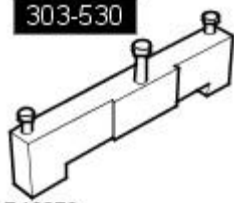




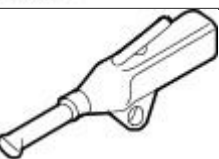


24. Repeat the above procedure for the remaining valves.
25. Install the engine front cover.  
For additional information, refer to: [Engine Front Cover](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).
26. Connect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).




**Engine - 4.2L NA V8 - AJV8 - Camshafts RH**

In-vehicle Repair

Special Tool(s)	
 <p>303-530 E46879</p>	Camshaft setting/locking tool 303-530
 <p>303-645 E46881</p>	Timing Setting tool 303-645
 <p>303-532 E46880</p>	Timing chain tensioning tool 303-532
 <p>303-540 E65896</p>	Tappet hold-down tool 303-540
 <p>303-540/02 E65897</p>	Tappet hold-down tool adaptor 303-540/02
 <p>DWST074</p>	Fan nozzle - air gun 303-590

**Removal**


1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3. Remove the engine front cover.  
For additional information, refer to: [Engine Front Cover](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).
4. Remove the crankshaft position (CKP) sensor.  
For additional information, refer to: [Crankshaft Position \(CKP\) Sensor - 4.2L NA V8 - AJV8](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

5. CAUTIONS:

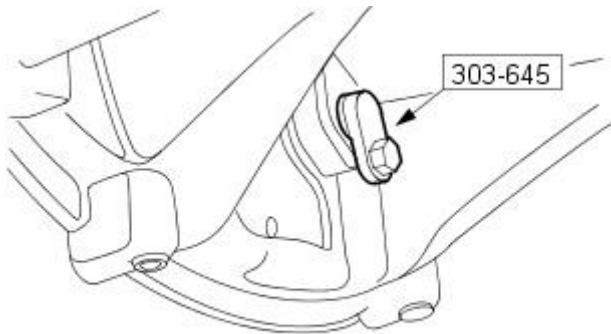
 Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.

 Rotate the crankshaft clockwise to position the engine to top dead center (TDC) number 1 cylinder.

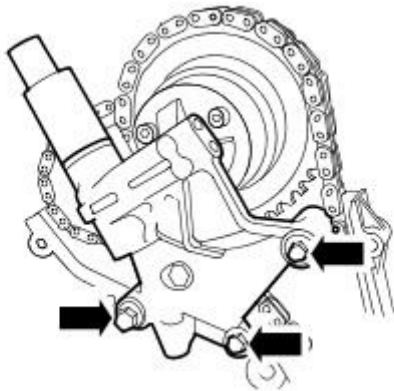
Lock the crankshaft.

- Install the special tool.
- Install the screw.

6. Remove the RH variable camshaft timing (VCT) control solenoid housing.
  - Remove the 3 bolts.
  - Remove and discard the O-ring seals.

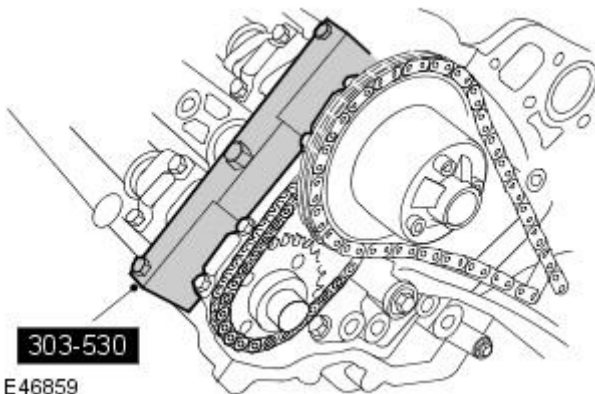


VUJ0002400



E46858

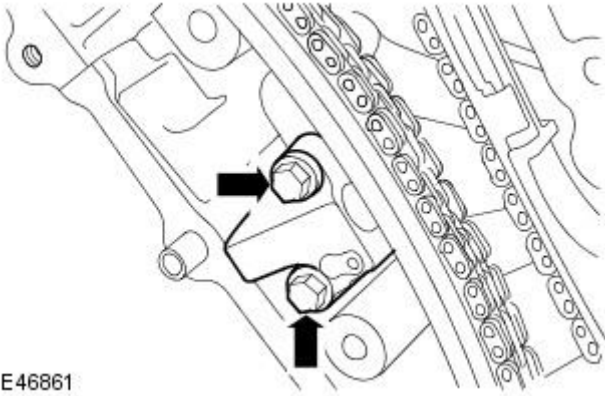
7. Install the special tool to the RH cylinder head.
  - Rotate the crankshaft until the flats on the camshafts are parallel with the cylinder head joint faces.
  - Install the 3 bolts.



E46859

8. Remove the RH primary timing chain tensioner.

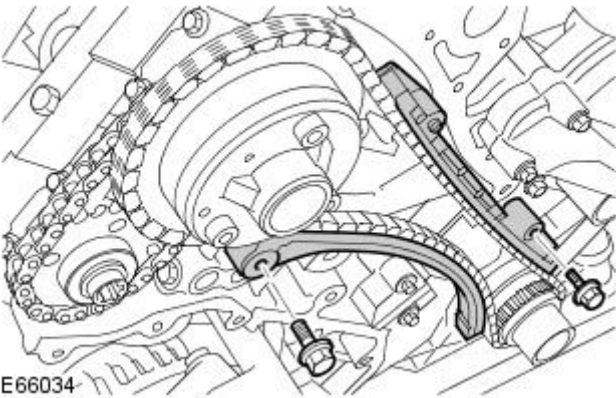
- Remove the 2 bolts.



E46861

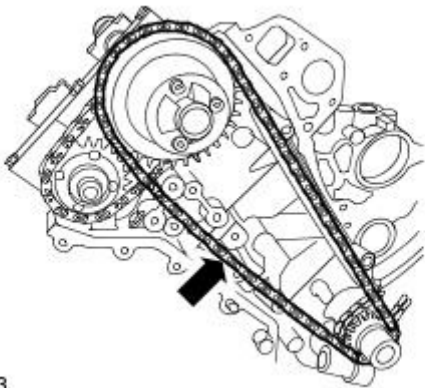
9. Remove the RH upper and lower primary timing chain tensioner guides.

- Remove the 2 bolts.



E66034

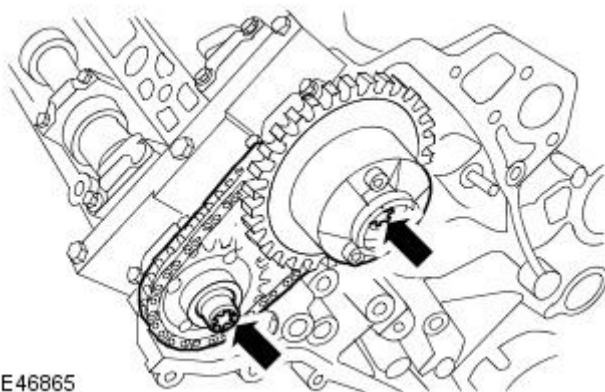
10. Remove the RH primary timing chain.



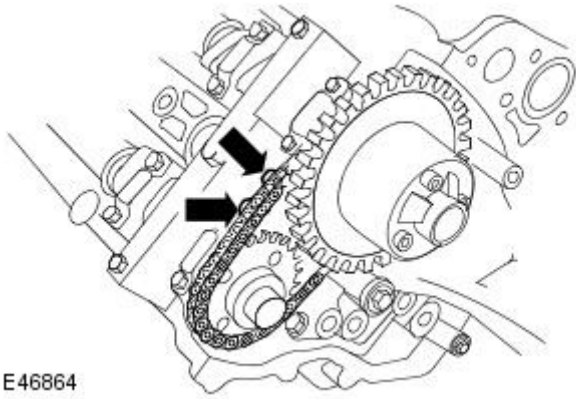
E46863

11. Release the RH camshaft sprocket assembly.

- Remove and discard the 2 Torx bolts.



E46865



12. Remove the RH secondary timing chain, tensioner and sprocket assembly.

- Remove the 2 retaining bolts.

13. Remove the special tool from the RH cylinder head.

- Remove the 3 bolts.

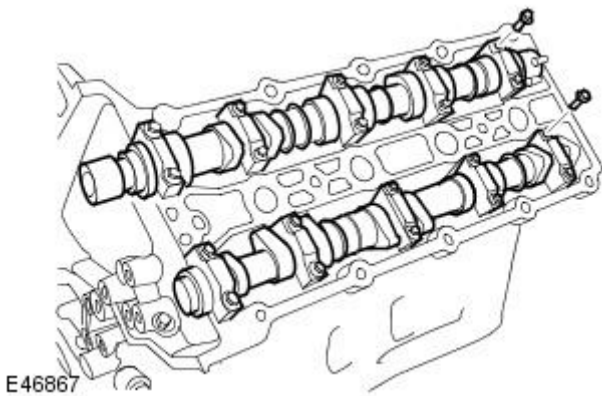
14.  CAUTION: Evenly and progressively, release the camshaft bearing caps.

• NOTE: Remove the camshaft bearing caps. Note: their position, orientation and markings. Each is marked with its position (number) and an orientation (arrow).

Remove the camshaft bearing caps.

- Remove the 20 bolts.

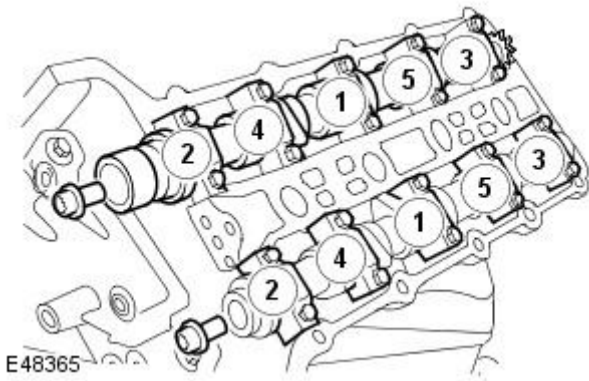
15. Remove the camshafts.



## Installation

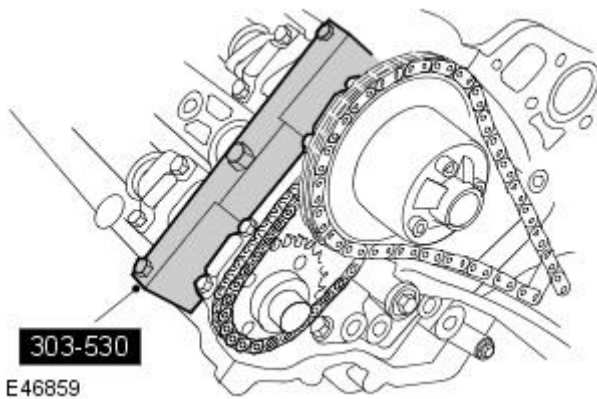
1. Install the camshafts.

- Clean the component mating faces.
- Replace the valve shims, with the smallest shim available.
- Lubricate the journals and camshaft lobes.




2. Install the camshaft bearing caps.

- Clean the component mating faces.
- Tighten to 10 Nm.



3. Install the special tool to the RH cylinder head.

- Rotate the crankshaft until the flats on the camshafts are parallel with the cylinder head joint faces.
- Install the 3 bolts.

4.  **CAUTION:** Make sure the secondary timing chain and camshaft sprockets are free to rotate.

Install the RH secondary timing chain, tensioner and sprocket assembly.

- Clean the components.
- Install the Torx bolts, but do not tighten fully at this stage.

5. Install the RH secondary timing chain tensioner retaining bolts.


- Tighten to 12 Nm.

6. Install the RH primary timing chain.

- Clean the components.
- Make sure the timing chain slack is on the tensioner side of the timing chain.

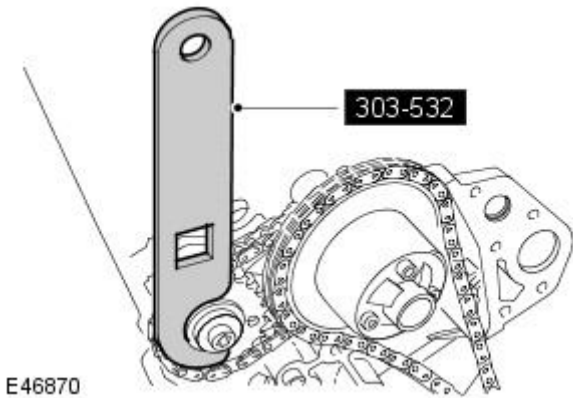
7. Install the RH primary timing chain tensioner guides.

- Tighten to 12 Nm.


8.  **CAUTION:** During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.


Install the RH primary timing chain tensioner.

- Clean the components.
- Using 3 mm diameter metal rod, retain the chain tensioner piston.
- Tighten to 12 Nm.
- Remove the retaining rod.



## 9. CAUTIONS:

 Using the special tool, apply force to the tool in a counter-clockwise direction, to tension the primary timing chain on its drive side.

 The intake camshaft sprocket retaining bolt **MUST** be tightened before the exhaust camshaft sprocket retaining bolt. Engine damage will occur if this procedure is not followed.

Install the special tool to the RH exhaust camshaft sprocket.

- Tighten the exhaust camshaft sprocket retaining bolt to 20 Nm + 90deg.
- Tighten the intake camshaft sprocket retaining bolt to 20 Nm + 90 deg.
- Install new retaining bolts.

## 10. Install the RH VCT control solenoid housing.

- Clean the components.
- Install the new O-ring seals.
- Tighten to 22 Nm.

## 11. Remove the special tool from the RH cylinder head.

- Remove the 3 bolts.

## 12. Remove the crankshaft locking tool.

- Remove the screw.

## 13. Install the CKP sensor.

For additional information, refer to: [Crankshaft Position \(CKP\) Sensor - 4.2L NA V8 - AJV8](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

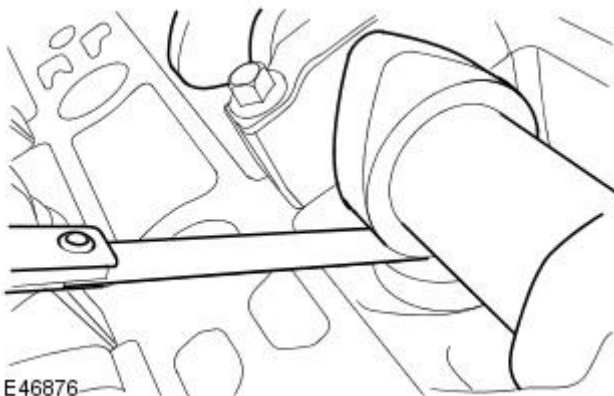
## 14. For cylinder head data, refer to specifications.

For additional information, refer to: [Specifications](#) (303-01A Engine - 4.2L NA V8 - AJV8, Specifications).

## 15. Rotate the engine clockwise to position the camshaft lobe away from the valve tappet.

 **CAUTION:** Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.

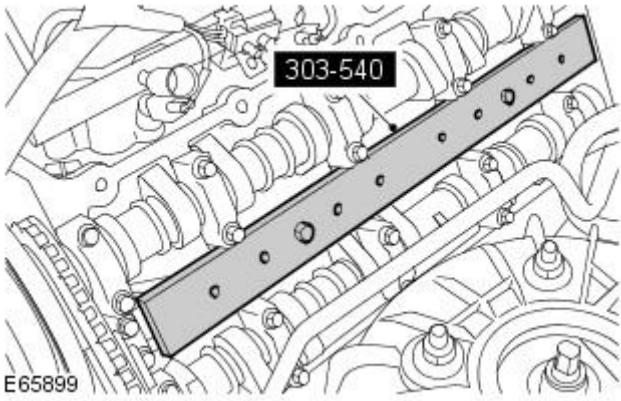


## 17. Repeat the above procedure for the remaining 15 shims.




18. Install the special tool 303-540, to the cylinder head.

- Tighten the two bolts to 10 Nm.

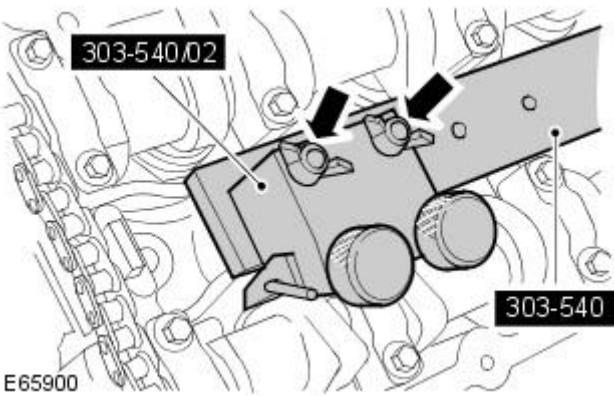


E65899

19.  CAUTION: Do not rotate the crankshaft while the special tool 303-540/02 is attached to 303-540.

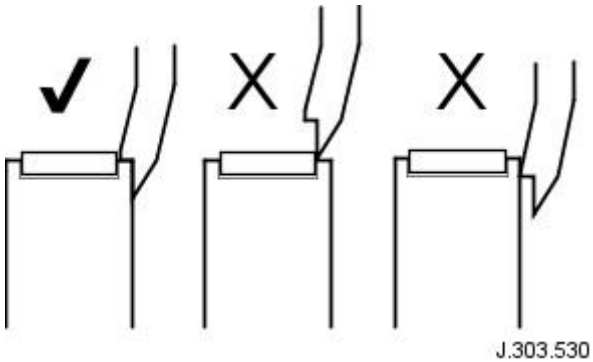
Attach the special tool 303-540/02 to 303-540.

- Secure with the 2 wing nuts.



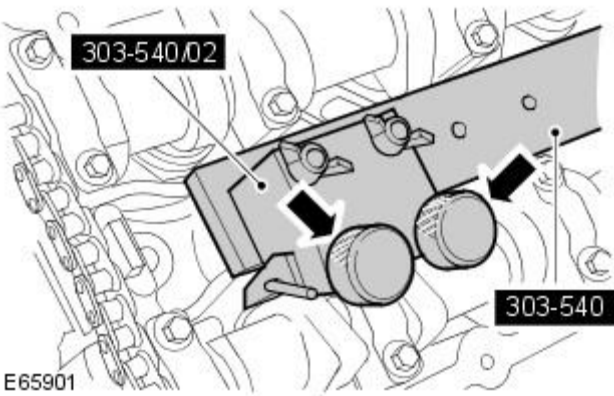
E65900

20. Position the special tool to the tappet as shown.

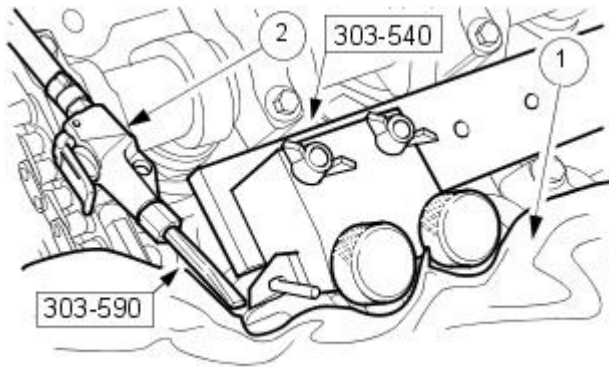


J.303.530


21. Using the special tool, compress the valve spring.



E65901



E31420

**22.**  **CAUTION:** Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.


• **NOTE:** Use the following formula to calculate the required shim thickness. Original shim thickness + measured shim clearance - desired clearance = required shim thickness.

Remove, clean and measure the shim.

- Surround the immediate working area with a cloth, to retain any loose shims displaced by the compressed air.
- Use the special tool 303-590, aimed at the edge of the shim, to lift it from the tappet. Note the position of each one.

**23. CAUTIONS:**

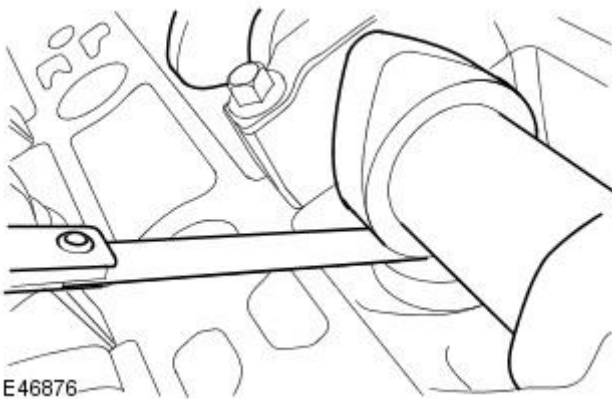
 Shims must be fitted with the size markings facing the tappet, not the camshaft.

 Do not use a magnet to install shims. Failure to follow these instructions may result in damage to the vehicle.

Install the new shim.

- Clean the components.
- Lubricate the shim with clean engine oil.
- Release and remove the special tools as required.

**24.** Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



E46876

**25.** Repeat the above procedure for the remaining valves.

**26.** Install the engine front cover.

For additional information, refer to: [Engine Front Cover](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).

**27.** Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

## Engine - 4.2L NA V8 - AJV8 - Crankshaft Front Seal

In-vehicle Repair

### Removal

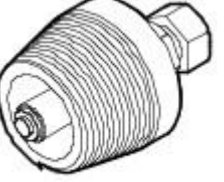

1. Remove the crankshaft pulley.  
For additional information, refer to: [Crankshaft Pulley](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).

### Installation

1. Install the crankshaft pulley.  
For additional information, refer to: [Crankshaft Pulley](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).


**Engine - 4.2L NA V8 - AJV8 - Crankshaft Pulley**

In-vehicle Repair

Special Tool(s)	
 303-191	Crankshaft pulley locking tool 303-191
 303-191-02	Crankshaft pulley locking tool adapter 303-191/02
 303-751	Seal extractor 303-751
 303-750	Seal installer 303-750
 303-588	Crankshaft pulley/damper remover 303-588

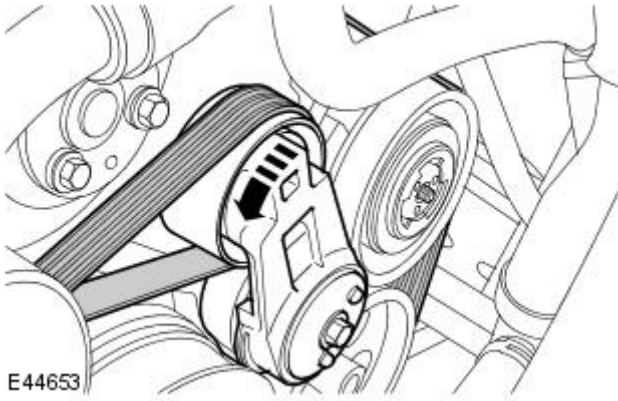
**Removal**

All vehicles

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the oil filter housing.  
For additional information, refer to: [Oil Filter Housing](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).

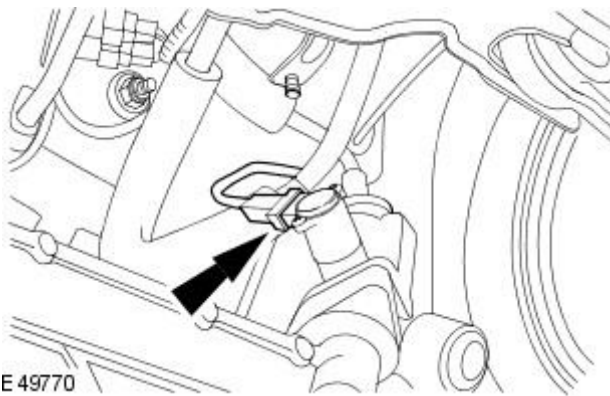
4. Release the accessory drive belt.

- Rotate the accessory drive belt tensioner counter-clockwise, using a 3/8 " drive wrench.



Left-hand drive vehicles

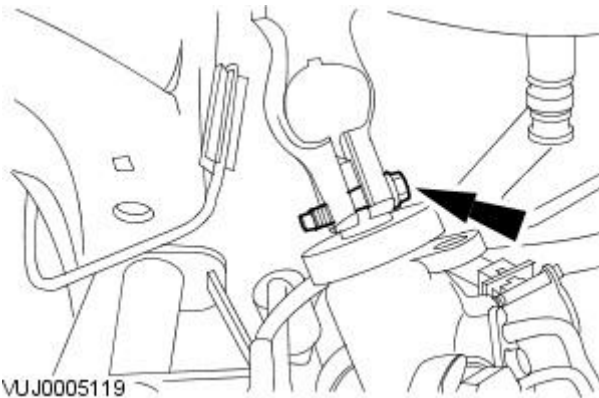
5. Disconnect the power steering control valve actuator electrical connector.



6. NOTE: Note the fitted position.

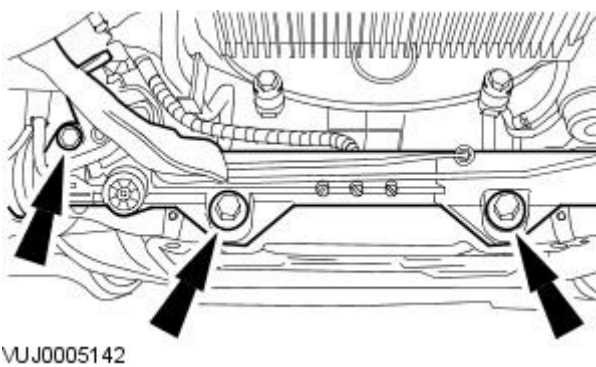
Disconnect the steering column lower shaft from the steering gear.

- Tie aside.



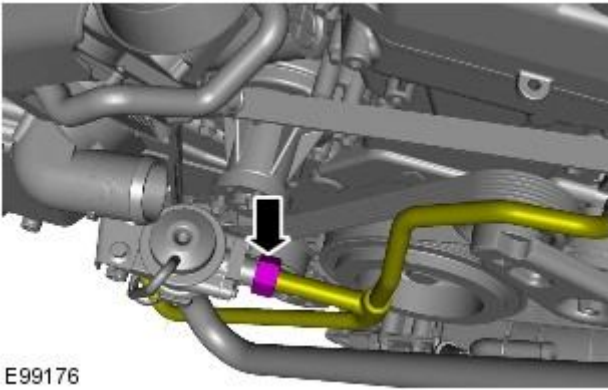
7. Detach the steering gear.

- Remove the 3 bolts.

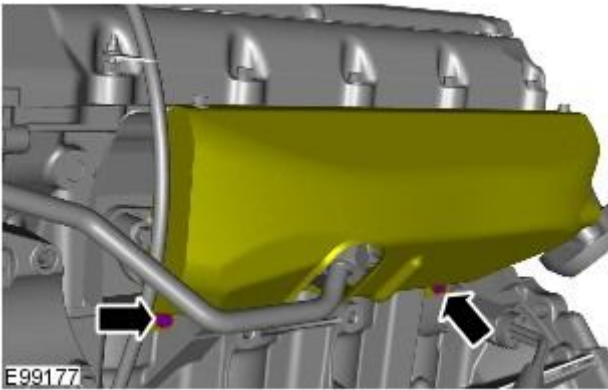


All vehicles

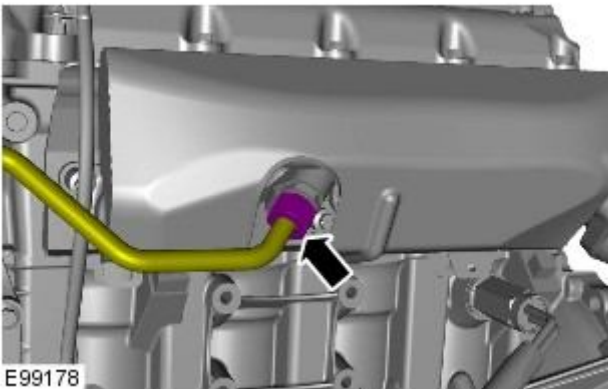
8. Disconnect the secondary air injection (AIR) control valve to exhaust manifold tube.



9. Release the LH exhaust manifold heat shield.

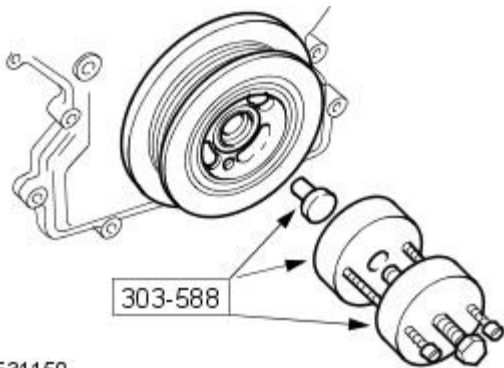


10. Disconnect the AIR control valve to exhaust manifold tube.



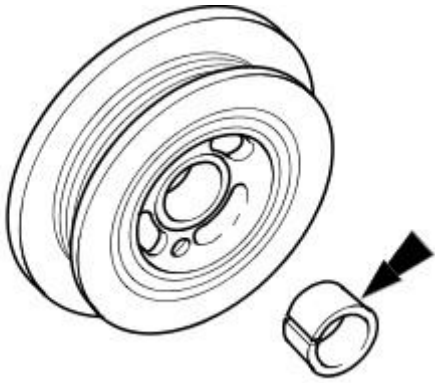
11. Remove the crankshaft pulley.

- Using a suitable tool, release the crankshaft pulley.
- Collect the locking ring.



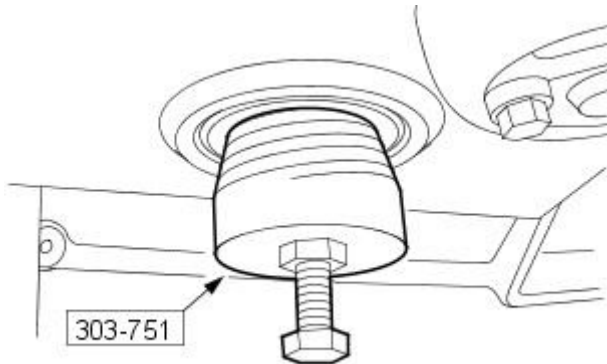


12. Check the crankshaft pulley and locking ring for damage.



E31151

13. Using the special tool, remove the crankshaft front seal.



E31171

## Installation

All vehicles

### 1. CAUTIONS:

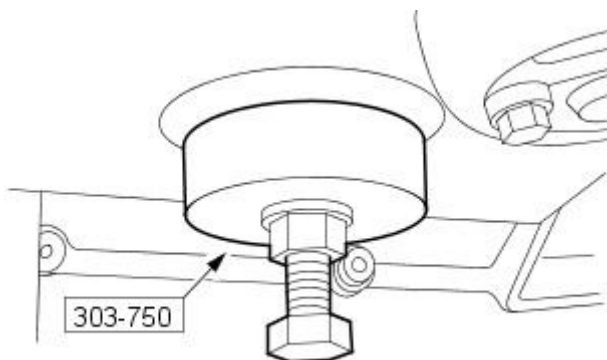
 Make sure the crankshaft seal mating faces are clean and dry.

 Do not remove the seal protector at this stage.

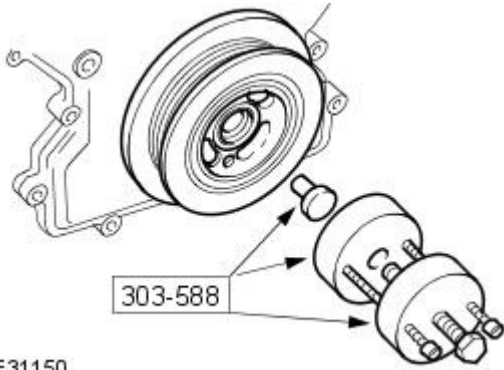
Using the special tool, install the crankshaft front seal.

- Clean the component mating faces.

2. Remove the seal protector.



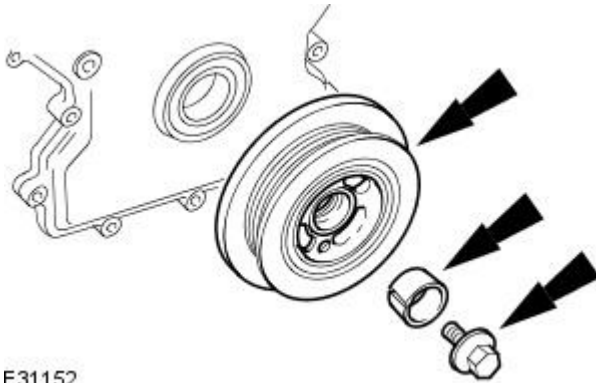
E31173



E31150

3. Install the crankshaft pulley.


- Lubricate the seal with clean engine oil.
- Install the locking ring.



E31152

4.  CAUTION: The screw thread in the crankshaft pulley must be cleaned out before installing a new crankshaft pulley bolt.

Install, but do not tighten, the new crankshaft pulley bolt.

5.  CAUTION: Under no circumstances should the crankshaft setting peg, 303-645, be used in the following operations, to restrain the crankshaft.

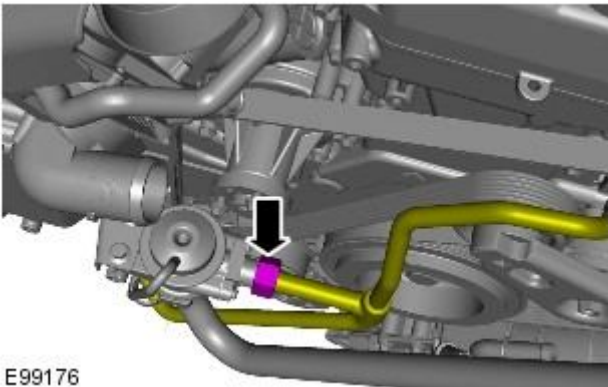
Using the special tools, retain the crankshaft pulley.

- Tighten the crankshaft pulley bolt to 380 Nm.
- Remove the special tools.

6. Attach the accessory drive belt.

7. Connect the AIR control valve to exhaust manifold tube.

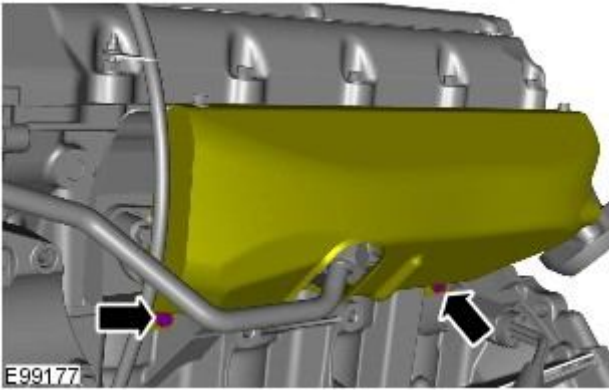
- Tighten to 35 Nm.



E99176

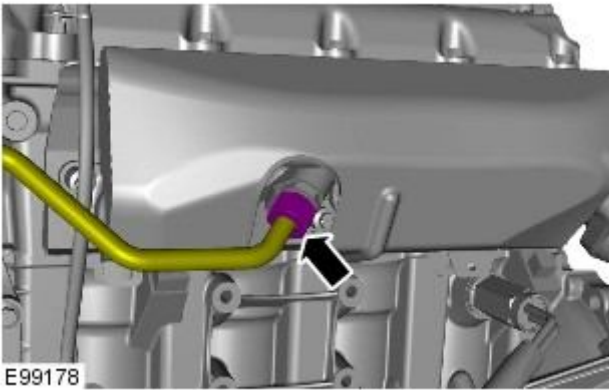
8. Secure the LH exhaust manifold heat shield.

- Tighten to 10 Nm.



9. Connect the AIR control valve to exhaust manifold tube.

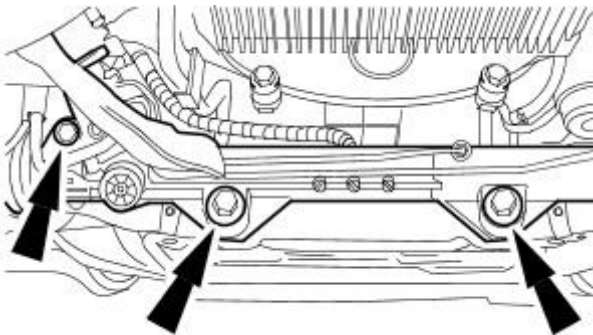
- Tighten to 35 Nm.



Left-hand drive vehicles

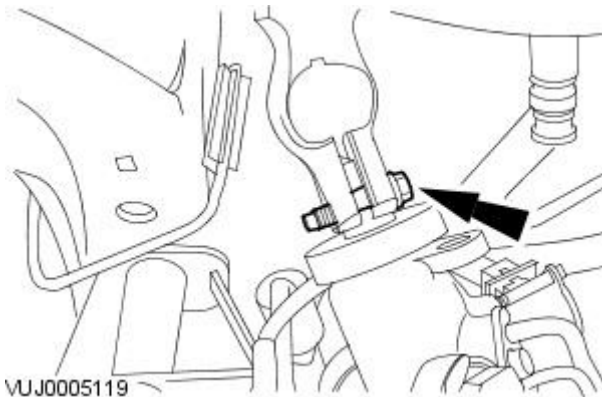
10. Secure the steering gear.

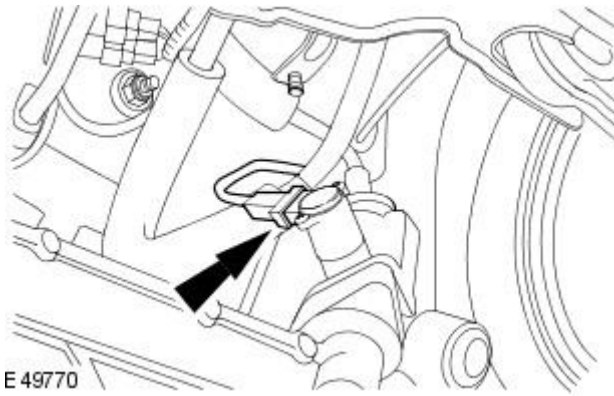
- Tighten to 100 Nm.



11. Connect the steering column lower shaft.

- Tighten to 35 Nm.





12. Connect the power steering control valve actuator electrical connector.

All vehicles


13. Install the oil filter housing.  
For additional information, refer to: [Oil Filter Housing](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).
14. Connect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Engine - 4.2L NA V8 - AJV8 - Crankshaft Rear Seal

In-vehicle Repair

Special Tool(s)	
 <p>303-538</p> <p>E46616</p>	<p>Crankshaft rear oil seal remover/installer</p> <p>303-538</p>

## Removal

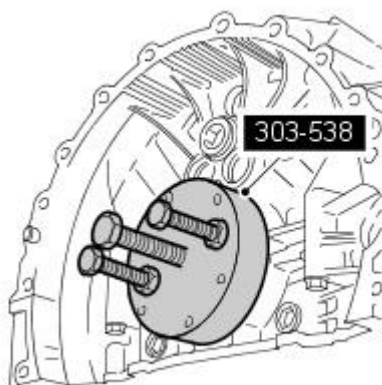
-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- Remove the flexplate.  
For additional information, refer to: [Flexplate](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).

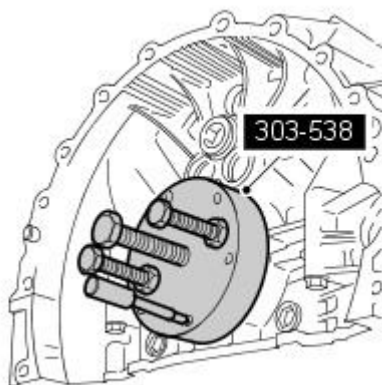
- Install the special tools.

- Install the 2 bolts.
- Tighten the 2 nuts to retain the special tool.



E46613

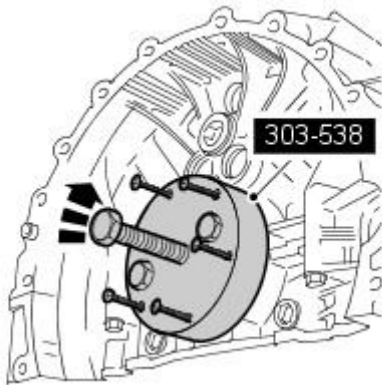
- Using the special tool, pierce the seal to create holes for the 6 self-tapping screws.



E46614


5. Using the special tools, remove and discard the crankshaft rear oil seal.

- Install the 6 self-tapping screws.
- Adjust the 2 nuts.
- Tighten the center bolt.



E46615

## Installation

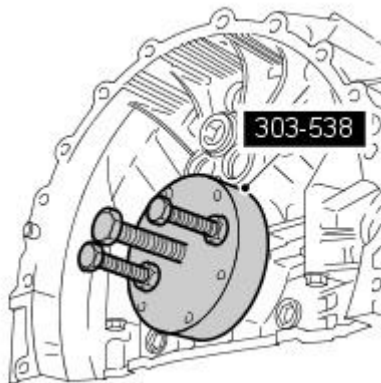
1.  **CAUTION:** Do not lubricate the components.

Partially install the crankshaft rear oil seal.

- Make sure the components are clean and dry.
- Carefully remove the transit sleeve, leaving the seal on the crankshaft.

2. Install the special tools.

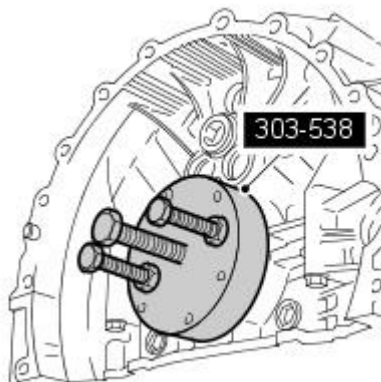
- Install the 2 bolts.
- Tighten the 2 nuts to retain the special tool.



E46613

3. Using the special tool, install the crankshaft rear oil seal.

- Tighten the special tool nuts evenly and progressively to fully install the seal.



E46613

4. Install the flexplate.

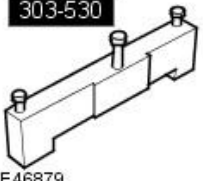
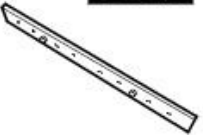

For additional information, refer to: [Flexplate](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).

5. Check and top-up the engine oil.




**Engine - 4.2L NA V8 - AJV8 - Cylinder Head LH**

In-vehicle Repair

Special Tool(s)	
 <p>303-530 E46879</p>	Camshaft setting/locking tool 303-530
 <p>303-540 E65896</p>	Tappet hold-down tool 303-540
 <p>303-540/02 E65897</p>	Tappet hold-down tool adaptor 303-540/02

**Removal**

• NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the intake manifold.  
For additional information, refer to: [Intake Manifold](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).
4. Remove the timing drive components.  
For additional information, refer to: [Timing Drive Components](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).

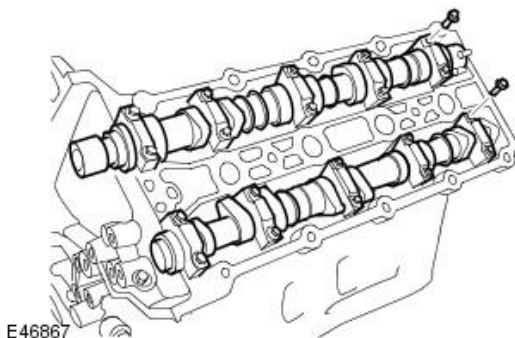
5.  **CAUTION:** Evenly and progressively, release the camshaft bearing caps.

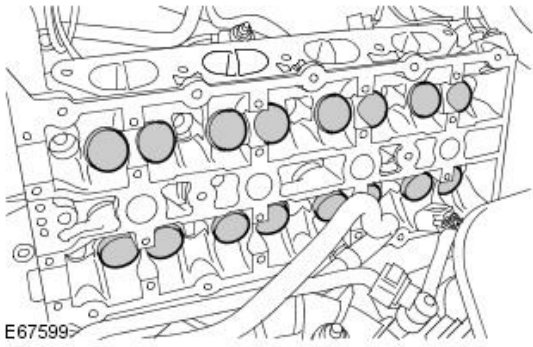
• NOTE: Remove the camshaft bearing caps. Note: their position, orientation and markings. Each is marked with its position (number) and an orientation (arrow).

Remove the camshaft bearing caps.

- Remove the 20 bolts.

6. Remove the camshafts.

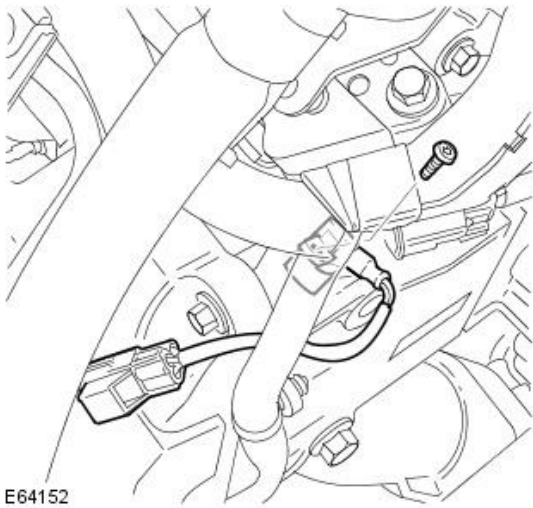




7. NOTE: Note the fitted position.

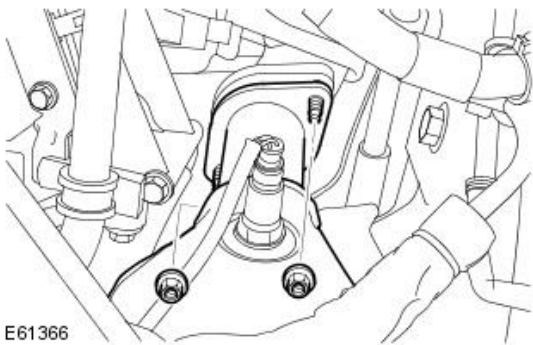
- NOTE: Make sure the shim remains with the tappet.

Remove the 16 tappets.



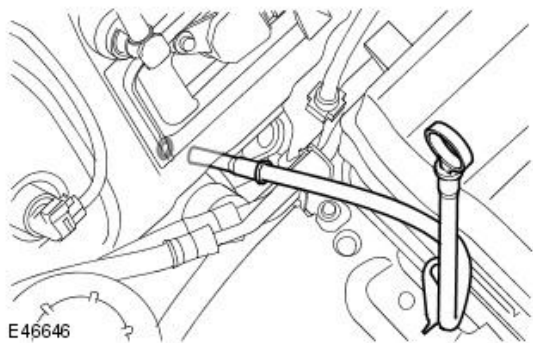
8. Remove the CMP sensor.

- Remove the Torx bolt.
- Remove and discard the O-ring seal.



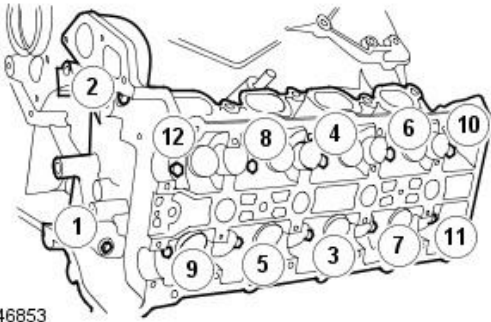
9. Release the LH catalytic converter.

- Remove and discard the 2 nuts.




10. Remove the oil level indicator and tube.


- Discard the O-ring seal.



E46853

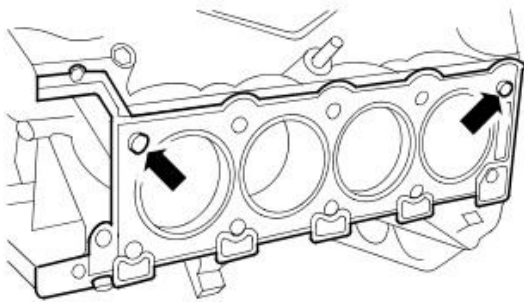
**11. CAUTIONS:**

 The bolts can only be used twice, mark the bolts with a center punch. If two punch marks are visible, discard the bolts.


 Vehicles fitted with Polydrive cylinder head bolts, the cylinder head bolts must be removed using a 10 mm Polydrive socket or a 10 mm Allen key. Failure to follow this instruction may result in damage to the component.

• **NOTE:** Remove the bolts in the indicated sequence.

Remove the 12 cylinder head bolts.



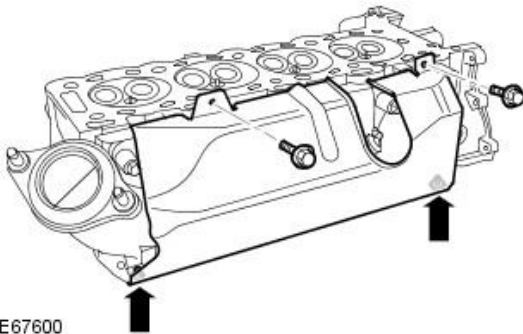
E46854

**12.**  **CAUTION:** The cylinder head must not be placed mating face down. Failure to follow this instruction may result in damage to the vehicle.

With assistance remove the cylinder head.

**13.** Remove and discard the cylinder head gasket.

- Clean the cylinder head locating dowels.
- Clean and inspect the cylinder head and cylinder block.

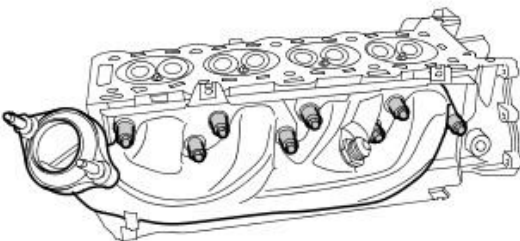


E67600

**14. NOTE:** Do not disassemble further if the component is removed for access only.

Remove the LH heat shield.

- Remove the 4 screws.



E67601

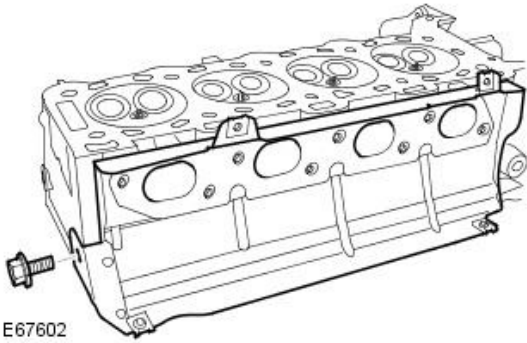
**15. NOTE:** Do not disassemble further if the component is removed for access only.

Remove the exhaust manifold.

- Remove and discard the 8 bolts.
- Remove the 8 spacers.

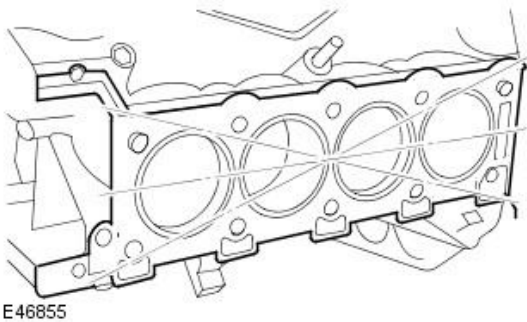
16. Remove and discard the exhaust manifold gasket.

- Remove the bolt.



### Installation

1. Clean the component mating faces.
2. Check cylinder head face for distortion, across the center and from corner to corner.

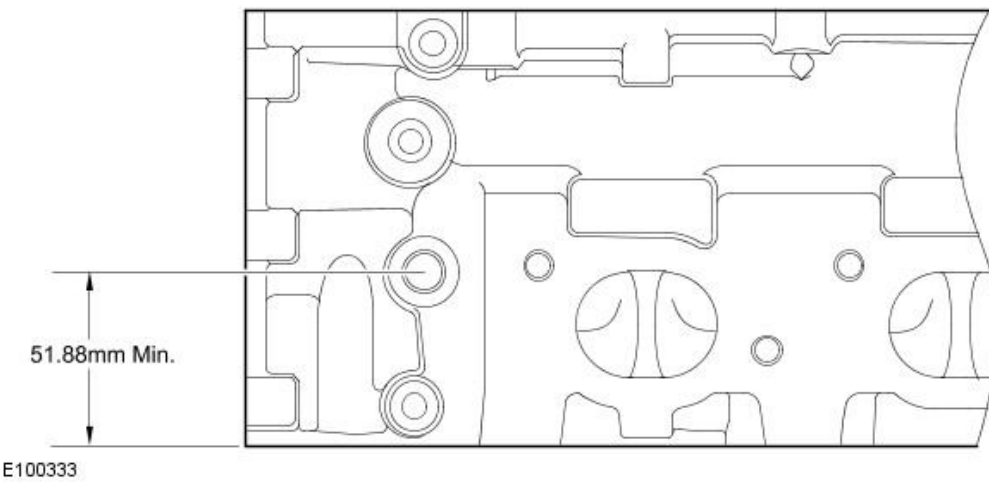


3. For cylinder head face distortion data, refer to specifications.  
For additional information, refer to: [Specifications](#) (303-01A Engine - 4.2L NA V8 - AJV8, Specifications).

4. NOTE: For cylinder head with distortion above the maximum allowance, the cylinder head material must be measured.

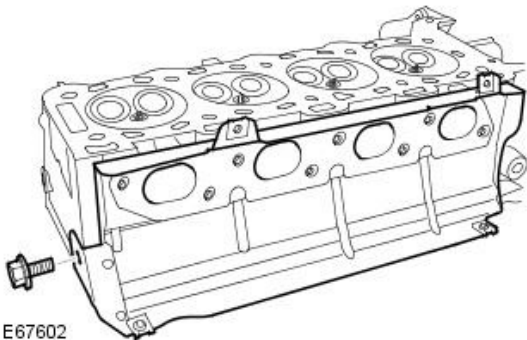
Measure the cylinder head material.

- Check measurement from the centre of the exhaust dowel to the cylinder head face as shown.
- If the measurement is less than 51.88 mm the cylinder head requires replacement.



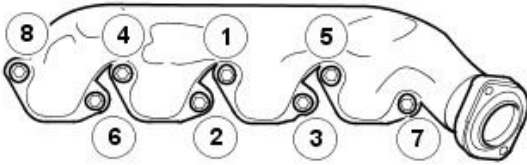
5. Tighten to 50 Nm.

- Clean the component mating faces.



6. Tighten the new bolts in the sequence shown, to 24 Nm.

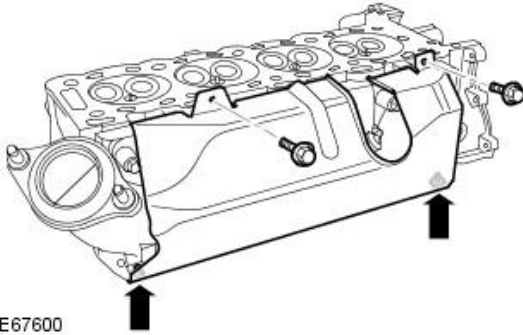
- Clean the component mating faces.
- Install the spacers.




E65731

7. Install the heat shield.

- Tighten the screws.



E67600

8.  **CAUTION:** The head gasket must be installed over the cylinder block dowels.

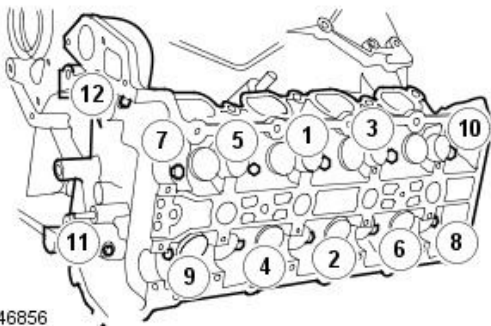
Install a new cylinder head gasket.

9. With assistance install the cylinder head.

10. **NOTE:** Tighten the bolts 1 to 10 in the sequence shown.

Install the cylinder head bolts.

- Lubricate the new cylinder head bolt threads with clean engine oil.
- Tighten the bolts 1 to 10 to 20 Nm.
- Tighten the bolts 1 to 10 to 35 Nm.
- Tighten the bolts 1 to 10, a further 90 degrees.
- Tighten the bolts 1 to 10, a further 90 degrees.
- Tighten the M8 bolts 11 and 12 to 25 Nm.



E46856

11. Install the oil level indicator and tube.

- Clean the components.
- Install a new O-ring seal.
- Lubricate the O-ring seal with clean engine oil.

12. Attach the catalytic converter.

- Tighten to 40 Nm.

13. Install the tappets.

- Clean the components.
- Lubricate the components with clean engine oil.

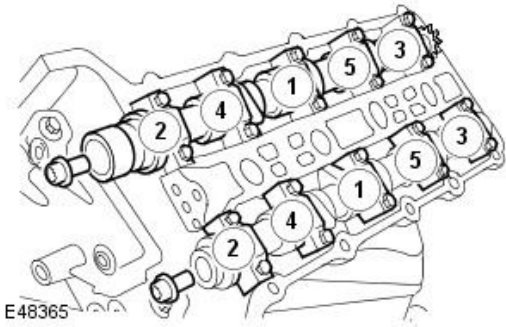
14. Install the camshafts.

- Clean the component mating faces.
- Lubricate the journals and camshaft lobes with clean engine oil.



15. Install the camshaft bearing caps.

- Clean the component mating faces.
- Tighten the bolts in the sequence shown to 10 Nm .

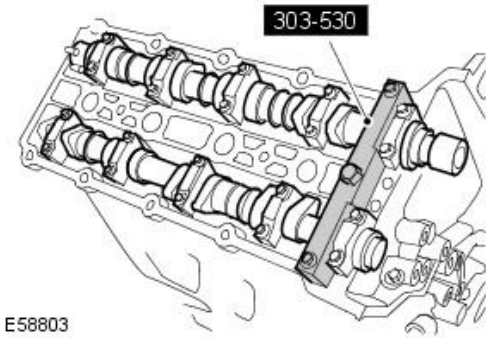


E48365

16. NOTE: RH illustration shown, LH is similar.

Install the special tool to the LH cylinder head.

- Install the 3 bolts.




E58803

17. NOTE: Do not install the LH valve cover until valve clearance adjustment has been completed.

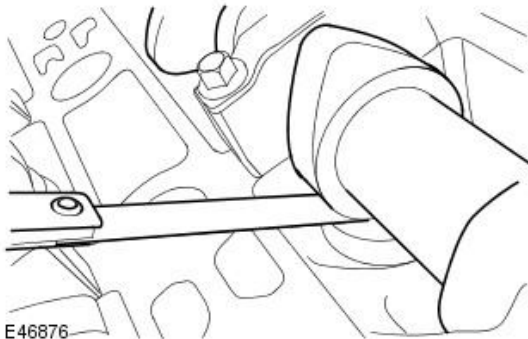
Install the timing drive components.

For additional information, refer to: [Timing Drive Components](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).

18. Rotate the engine clockwise to position the camshaft lobe away from the valve tappet.

19.  CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.

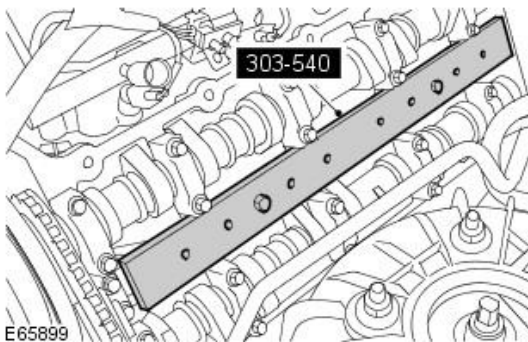


E46876

20. Repeat the above procedure for the remaining 15 shims.

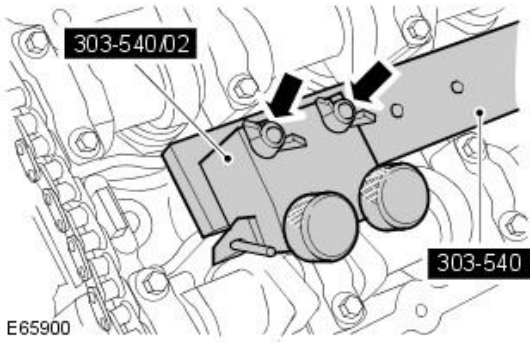
21. Install the special tool 303-540, to the cylinder head.


- Tighten the two bolts to 10 Nm.



E65899



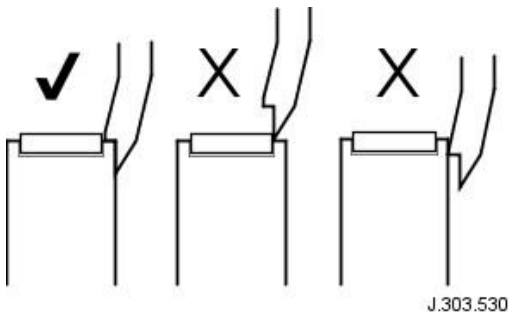


22.  CAUTION: Do not rotate the crankshaft while the special tool 303-540/02 is attached to 303-540.

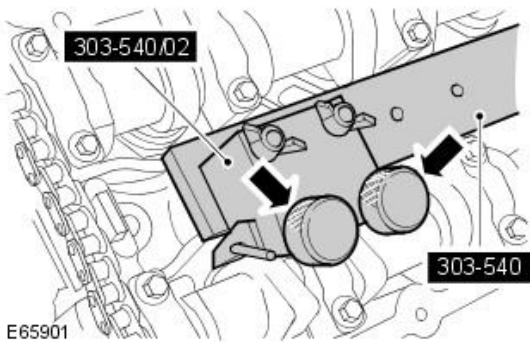
Attach the special tool 303-540/02 to 303-540.

- Secure with the 2 wing nuts.

23. Position the special tool to the tappet as shown.



24. Using the special tool, compress the valve spring.

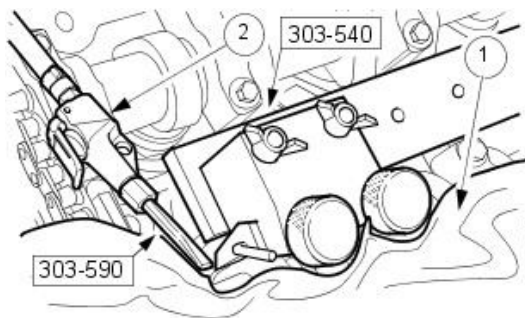


25.  CAUTION: Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.


• NOTE: Use the following formula to calculate the required shim thickness.  
 $\text{Original shim thickness} + \text{measured shim clearance} - \text{desired clearance} = \text{required shim thickness}$ .

Remove, clean and measure the shim.

- Surround the immediate working area with a cloth, to retain any loose shims displaced by the compressed air.
- Use the special tool 303-590, aimed at the edge of the shim, to lift it from the tappet. Note the position of each one.



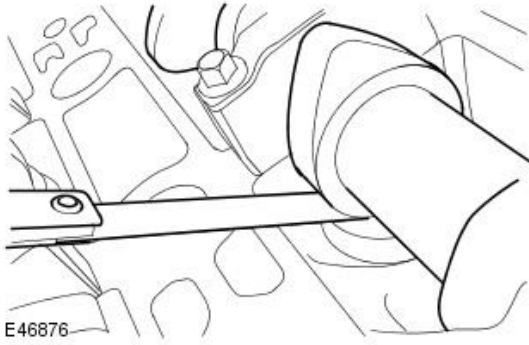
26. CAUTIONS:

 Shims must be fitted with the size markings facing the tappet, not the camshaft.

 Do not use a magnet to install shims. Failure to follow these instructions may result in damage to the vehicle.

Install the new shim.

- Clean the components.
- Lubricate the shim with clean engine oil.
- Release and remove the special tools as required.



27. Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.

28. Repeat the above procedure for the remaining valves.

29. Install the intake manifold.

For additional information, refer to: [Intake Manifold](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).


30. Connect the battery ground cable and install the cover.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Engine - 4.2L NA V8 - AJV8 - Engine Front Cover

In-vehicle Repair

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Recover the A/C refrigerant.
3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
4. Disconnect the engine oil temperature sensor electrical connector.



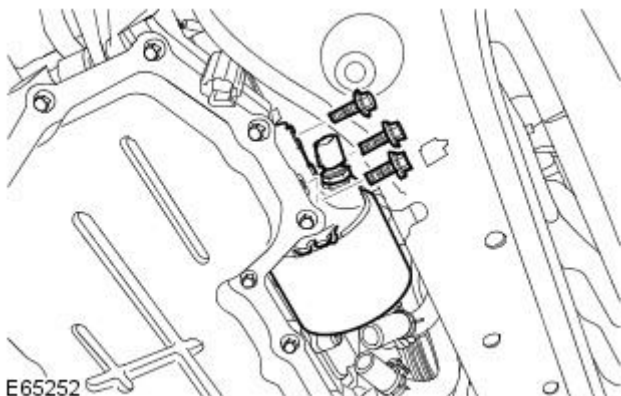
5. Disconnect the engine oil pressure (EOP) sensor electrical connector.



6. Remove the thermostat housing.  
For additional information, refer to: [Thermostat Housing - 4.2L NA V8 - AJV8](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

7. Detach the oil filter housing.

- Remove the 3 bolts.
- Remove and discard the O-ring seal.



8. Remove the power steering pump.  
For additional information, refer to: [Power Steering Pump -](#)

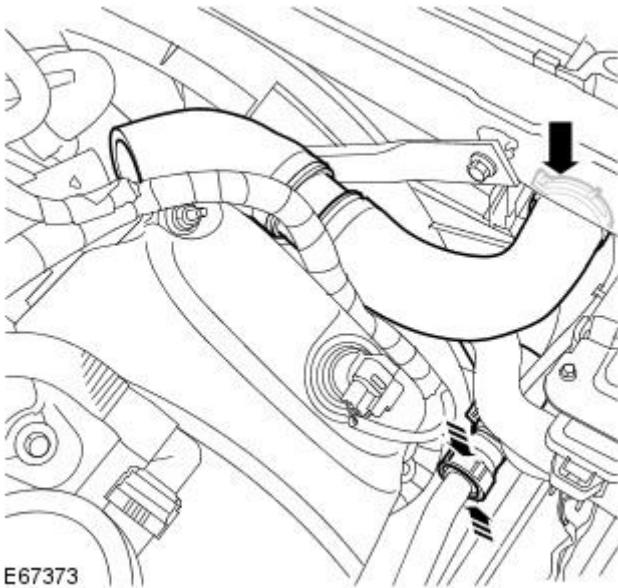
[4.2L NA V8 - AJV8](#) (211-02 Power Steering, Removal and Installation).

9. Remove the coolant expansion tank.

For additional information, refer to: [Coolant Expansion Tank](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

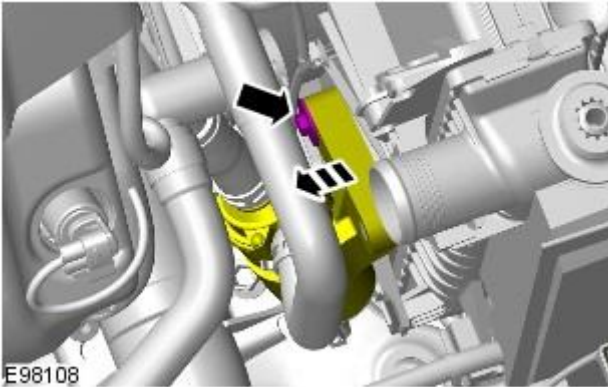
10. Disconnect the radiator upper hose.

- Release the clip.
- Disconnect the quick release connector.



E67373

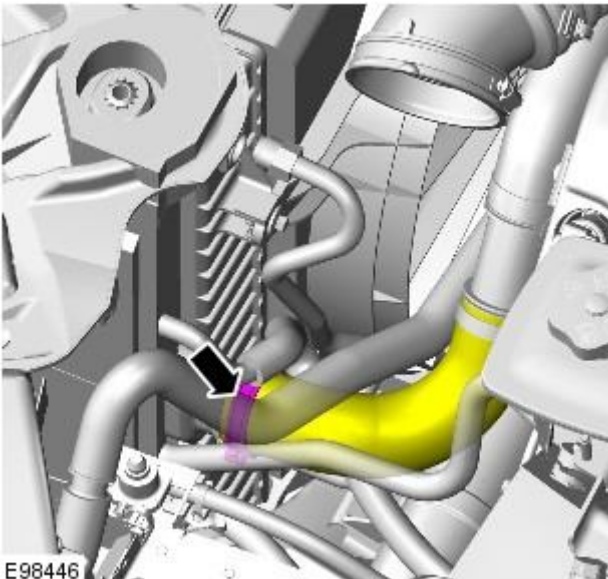
11. Release the auxiliary coolant pump.



E98108

12. Release the radiator lower hose.

- Release the clip.



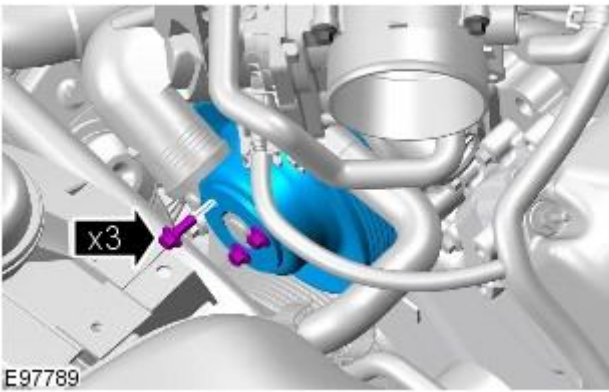
E98446



**13. NOTE:** Restrain the pulley to aid the removal of the bolts.

Remove the coolant pump pulley.

- Remove the 3 bolts.



**14.** Remove the LH valve cover.

For additional information, refer to: [Valve Cover LH](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).

**15.** Remove the RH valve cover.

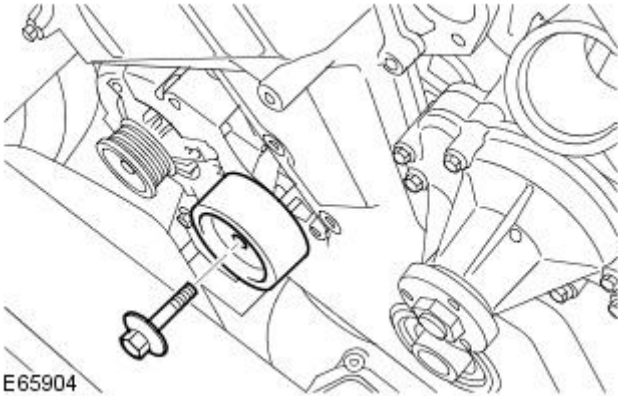
For additional information, refer to: [Valve Cover RH](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).

**16.** Remove the crankshaft pulley.

For additional information, refer to: [Crankshaft Pulley](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).

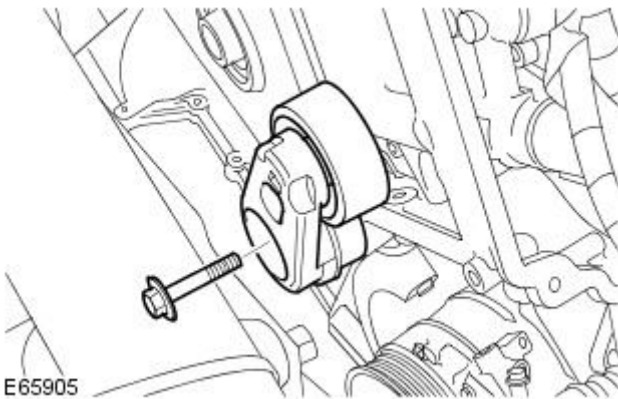
**17.** Remove the accessory drive belt idler pulley.

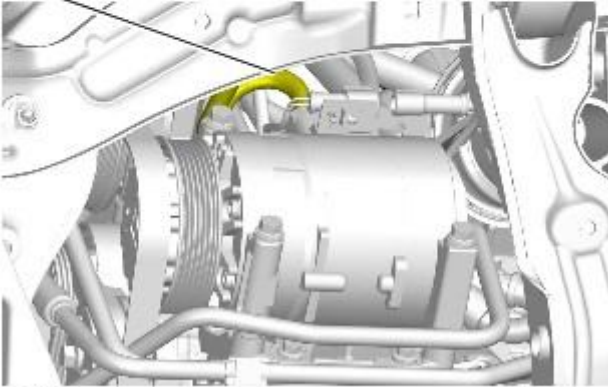
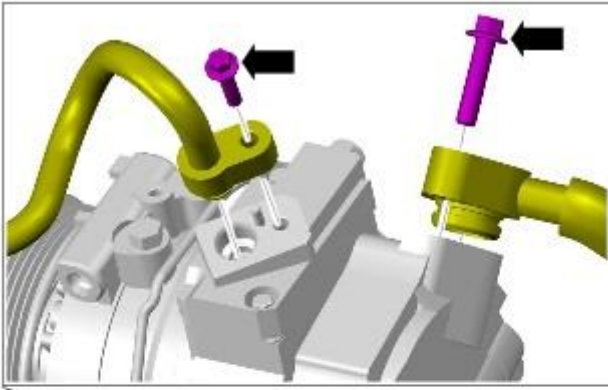
- Remove the bolt.



**18.** Remove the accessory drive belt tensioner.

- Remove the bolt.



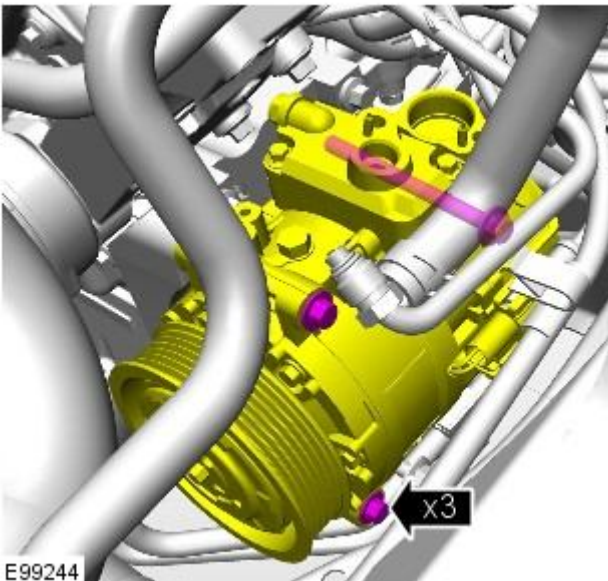


E97758

19.  **CAUTION:** Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

Disconnect the refrigerant lines from the A/C compressor.

- Remove the 2 bolts.
- Remove and discard the 2 O-ring seals.



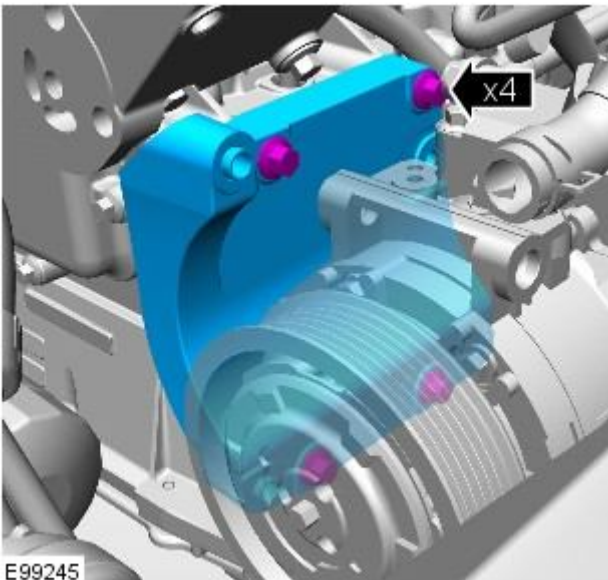
E99244

20. Position the A/C compressor aside to access the A/C compressor mounting bracket.



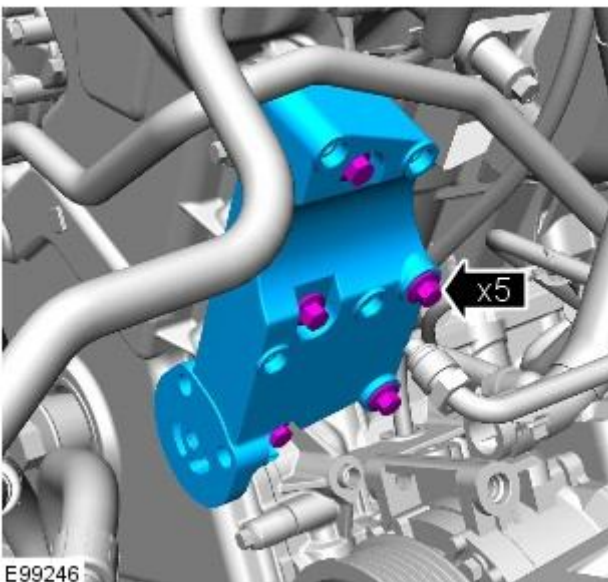
21. Remove the A/C compressor mounting bracket.

- Remove the 4 bolts.



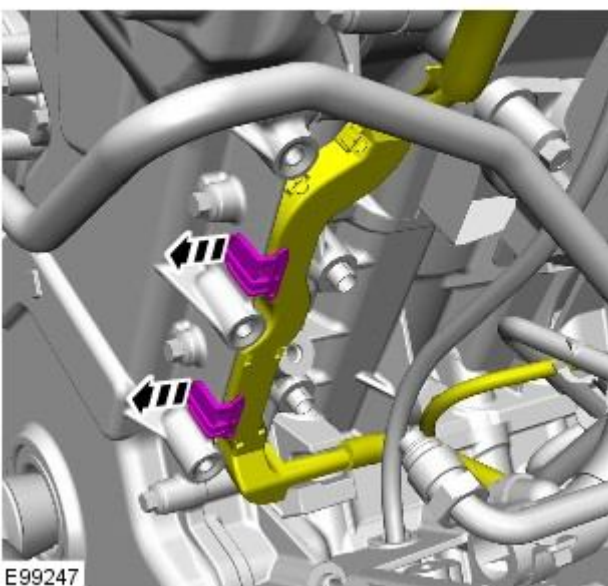
22. Remove the power steering pump mounting bracket.

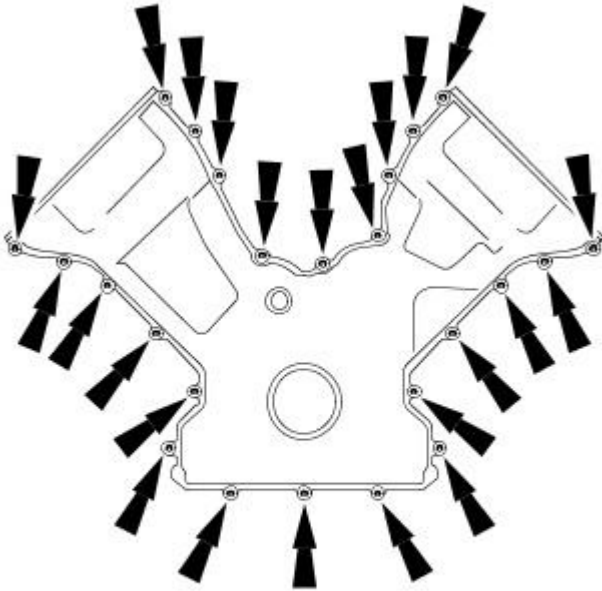
- Remove the 4 bolts.



23. LH side: Release the wiring harness.

- Release the 2 clips.





24. Remove the engine front cover.

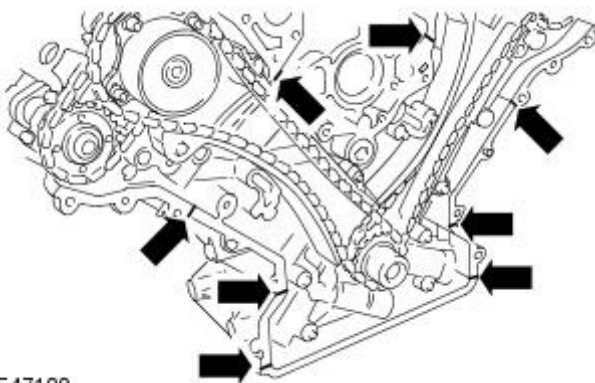
- Remove the 24 bolts.
- Remove and discard the 2 gaskets.
- Remove and discard the 3 O-ring seals.

VUJ0002018

### Installation

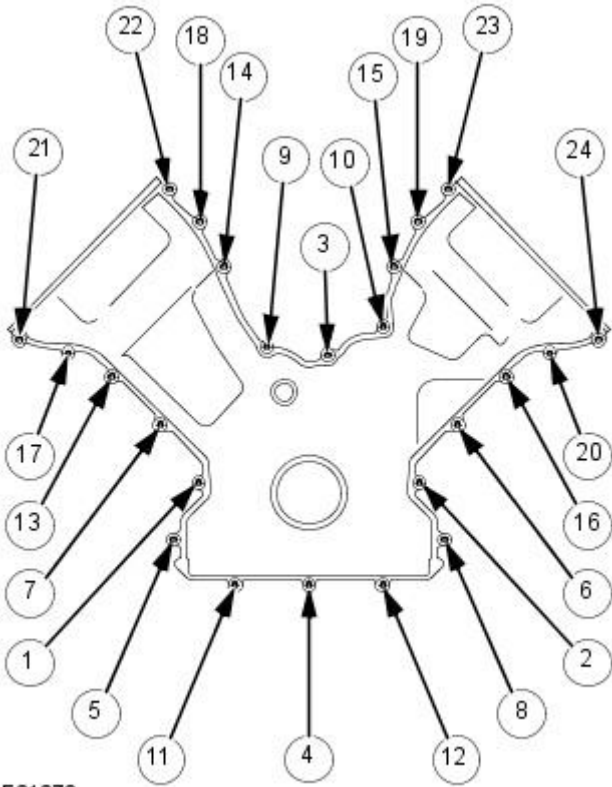
1. To install, reverse the removal procedure.

- Apply a bead of sealant 3 mm diameter, by 12 mm long, to the 8 places indicated.



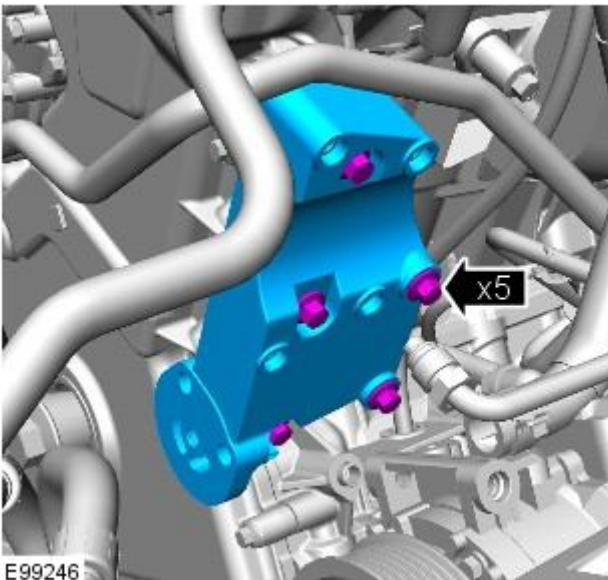
E47100

2. Tighten to 12 Nm.



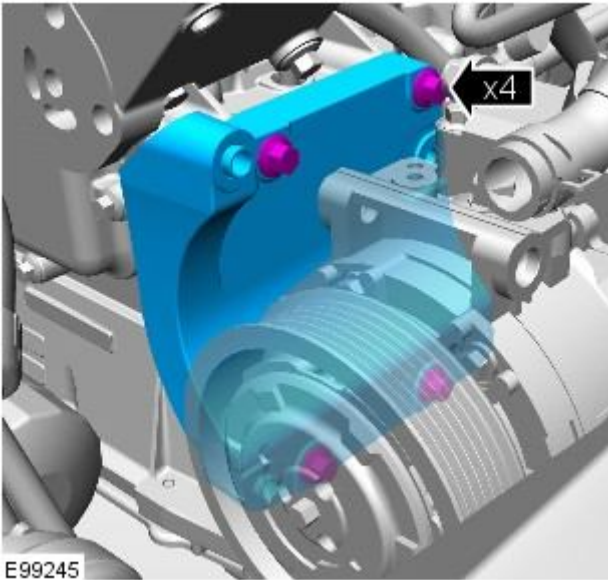
E31273

3. Tighten to 25 Nm

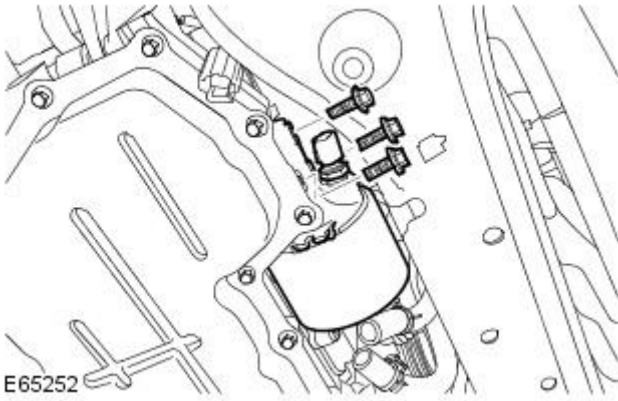


E99246

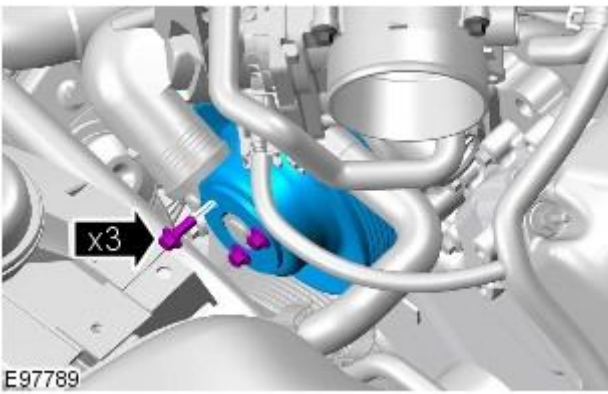
4. Tighten to 25 Nm



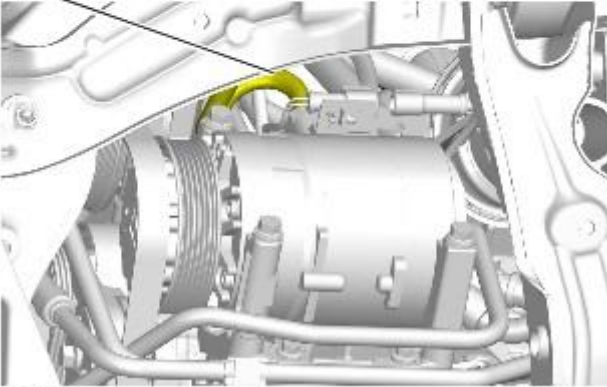
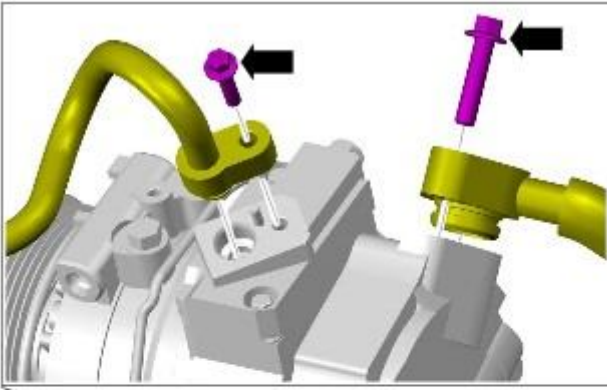
5. Tighten to 20 Nm.



6. Tighten to 10 Nm.

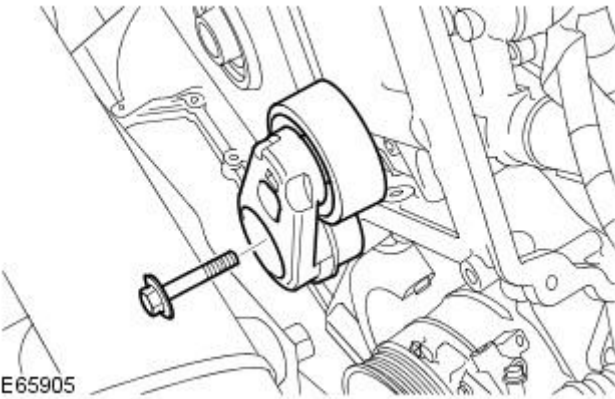


7. Tighten to 9 Nm.



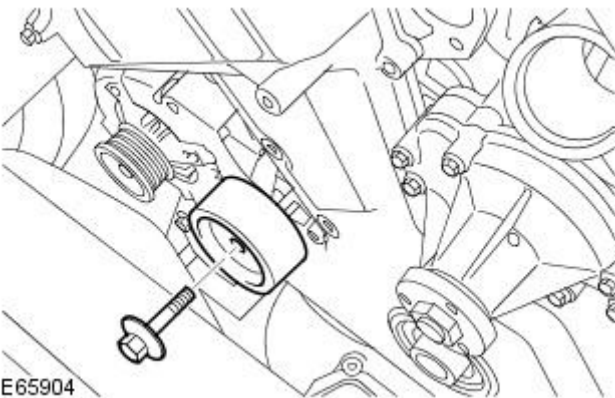
E97758

8. Tighten to 45 Nm.



E65905

9. Tighten to 45 Nm.



E65904




# Engine - 4.2L NA V8 - AJV8 - Engine Mount LH

In-vehicle Repair

## Removal

All vehicles

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

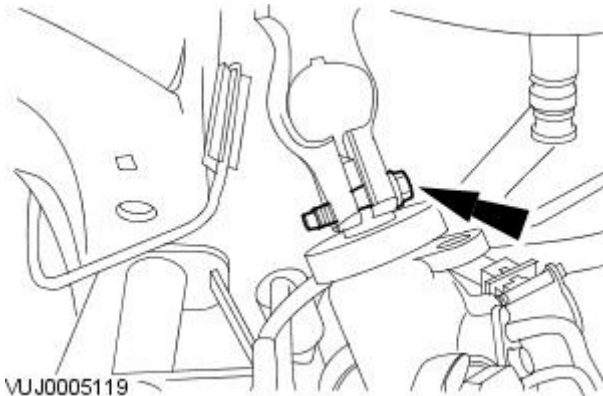
Raise and support the vehicle.

2. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

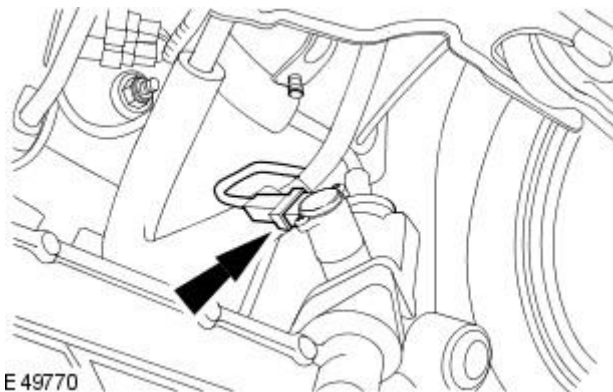
Left-hand drive vehicles

3. **NOTE:** Note the fitted position.

Detach the steering column lower shaft and tie aside.

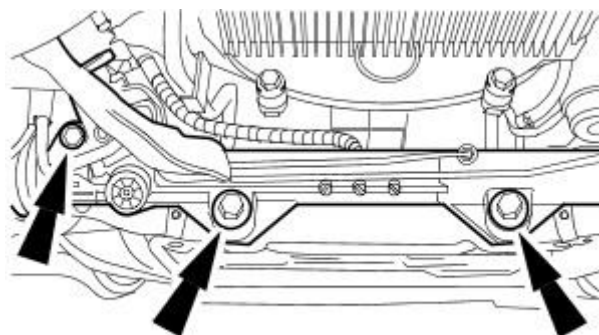


4. Disconnect the power steering control valve actuator electrical connector.



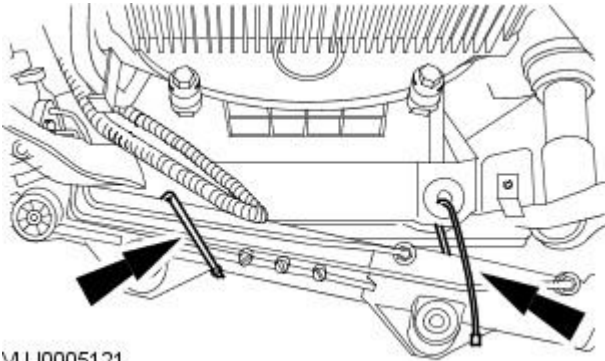
5. Detach the steering gear.

- Remove the 3 bolts.





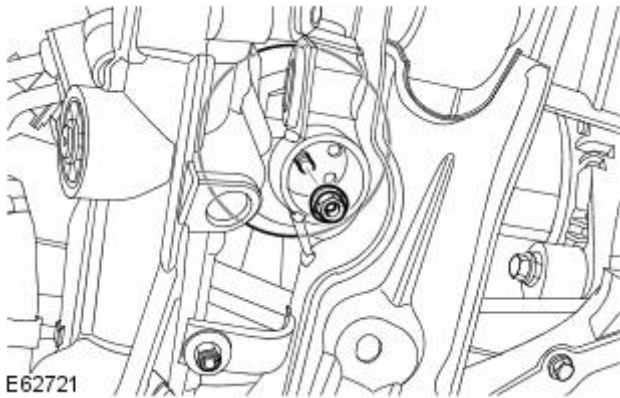
6. Secure the steering gear.



All vehicles

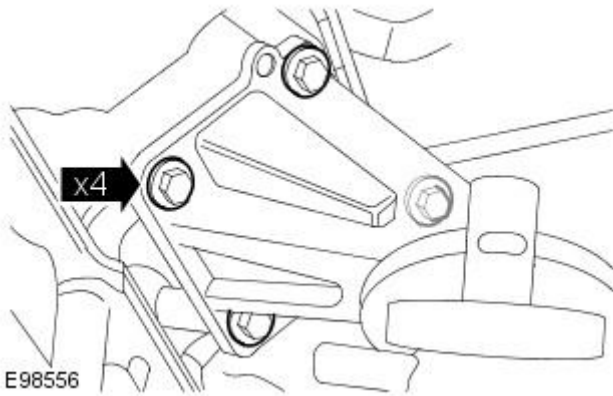
7. Release the engine mount.

- Support the engine.
- Remove and discard the nut.



8. Remove the engine mount and bracket.

- Raise the engine.
- Remove the 4 bolts.



9. NOTE: Do not disassemble further if the component is removed for access only.

Remove the engine mount.

- Remove and discard the nut.



## Installation

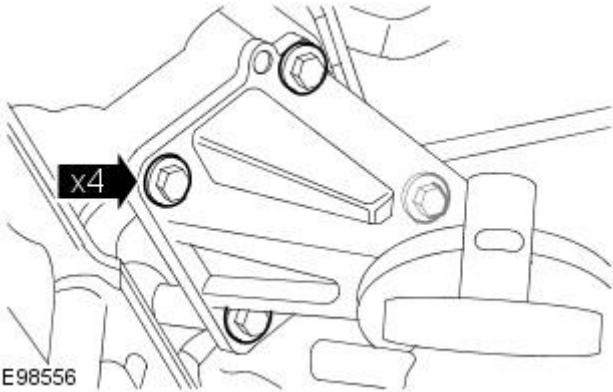
1. To install, reverse the removal procedure.

- Tighten to 48 Nm.



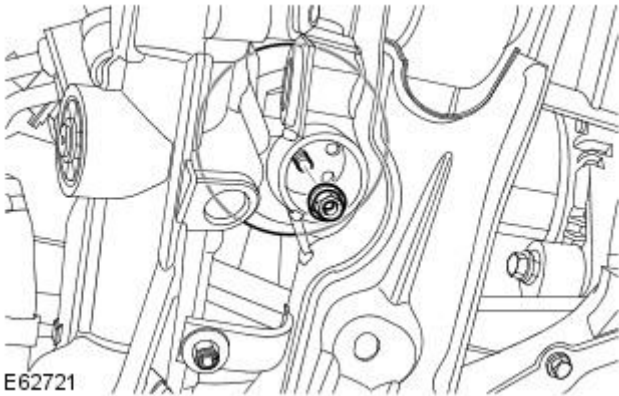
E31200

2. Tighten to 47 Nm.



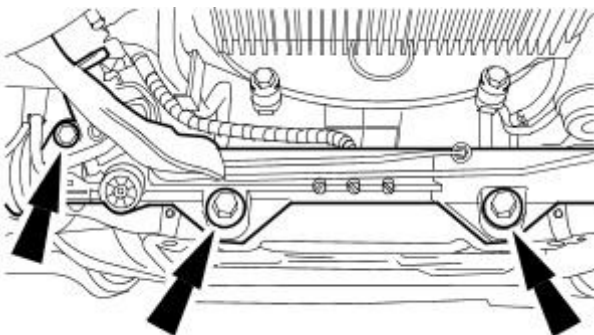
E98556

3. Tighten to 63 Nm.



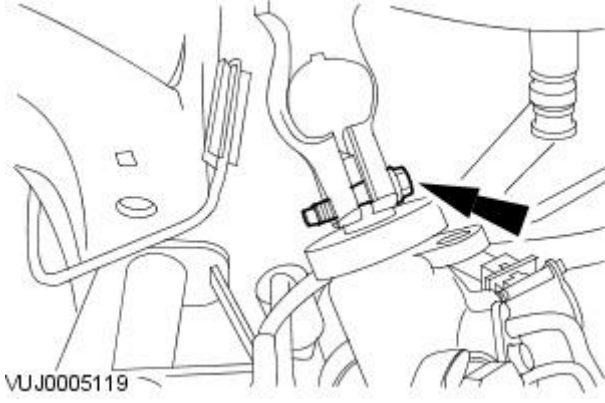
E62721

4. Tighten to 100 Nm.



VUJ0005142

5. Tighten to 35 Nm.



VUJ0005119


# Engine - 4.2L NA V8 - AJV8 - Engine Mount RH

In-vehicle Repair

## Removal

All vehicles

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

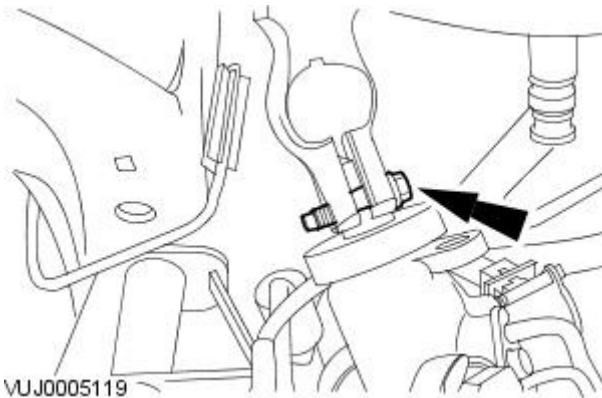
Raise and support the vehicle.

3. Remove the air deflector.

Right-hand drive vehicles

4. **NOTE:** Note the fitted position.

Release the universal joint from the steering gear.



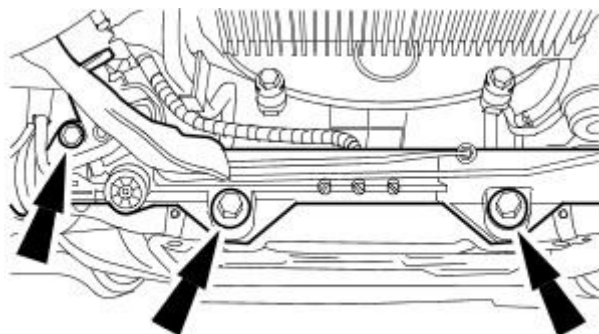
5. Disconnect the power steering control valve actuator electrical connector.



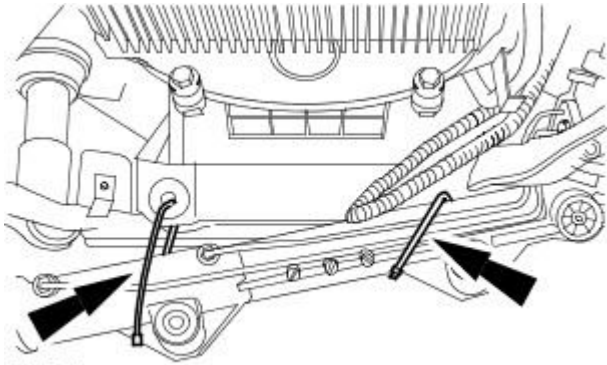
6. **NOTE:** Left-hand shown, right-hand similar.

Release the steering gear.

- Remove the 3 bolts.



7. Support the steering gear.

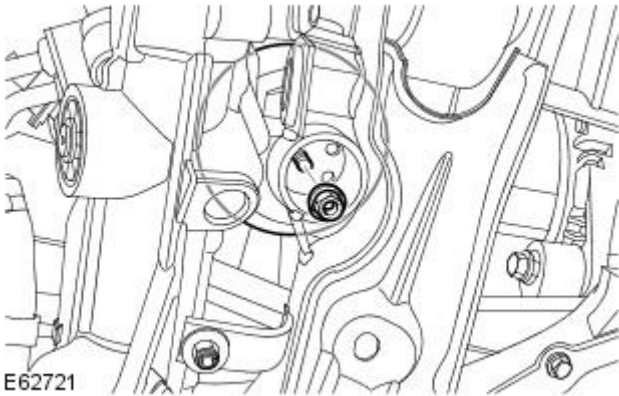


E 31035

All vehicles

8. Release the engine mount.

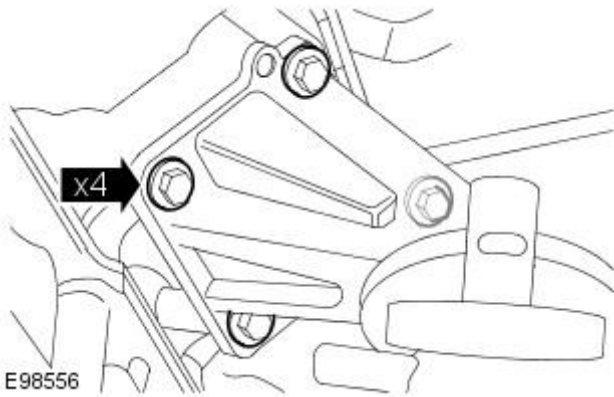
- Support the engine.
- Remove and discard the nut.



E62721

9. Remove the engine mount and bracket.

- Raise the engine.
- Remove the 4 bolts.



E98556

10. NOTE: Do not disassemble further if the component is removed for access only.

Remove the engine mount.

- Remove and discard the nut.



E62723

## Installation

All vehicles

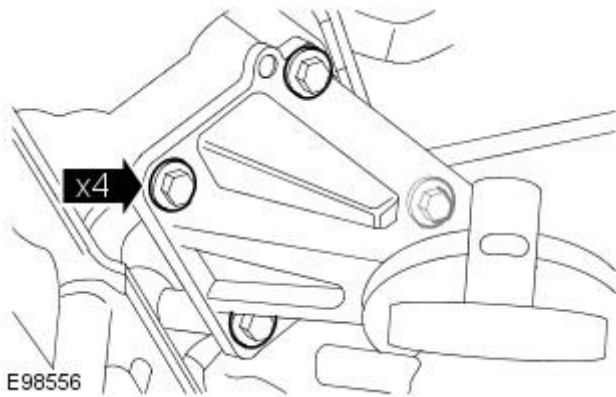
1. To install, reverse the removal procedure.

All vehicles

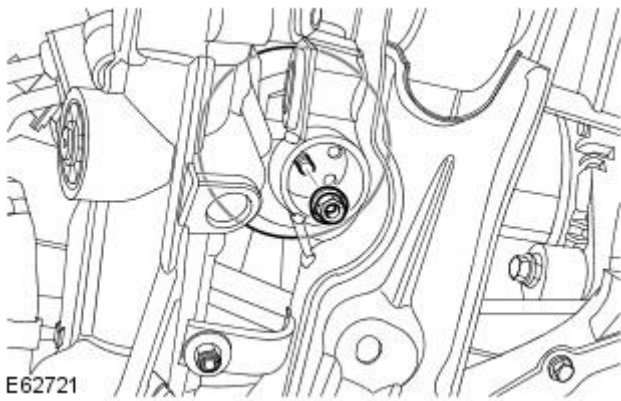
2. Tighten to 55 Nm.



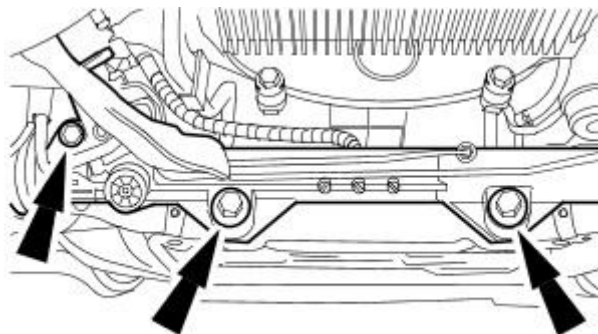
3. Tighten to 47 Nm.



4. Tighten to 63 Nm.

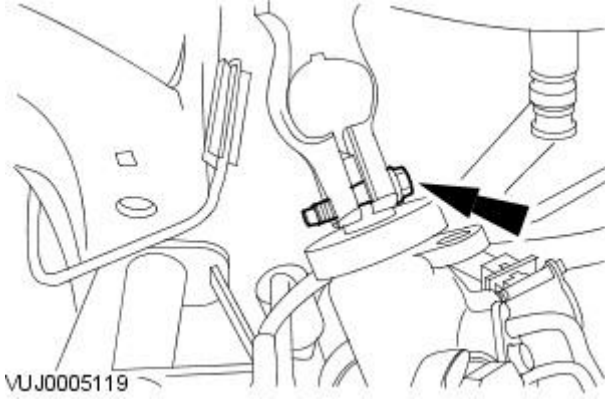


5. Tighten to 100 Nm.





6. Tighten to 35 Nm.




VUJ0005119

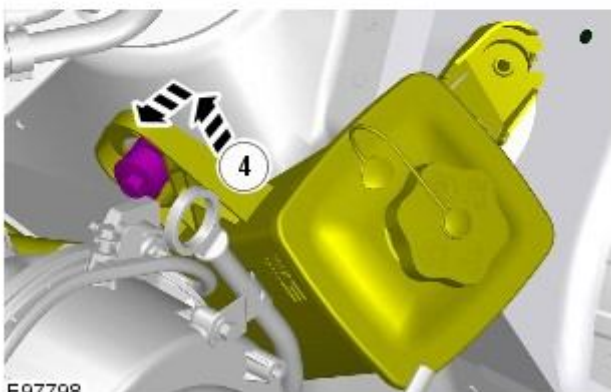
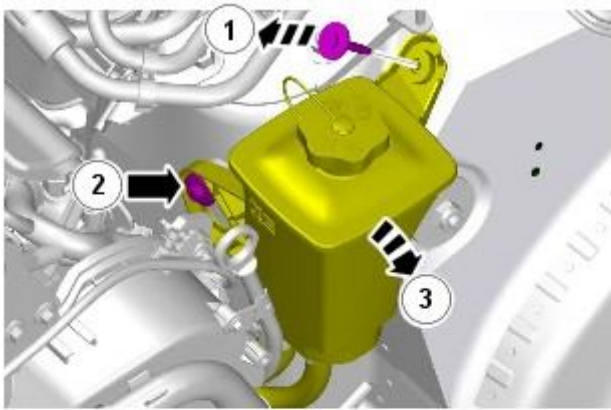
# Engine - 4.2L NA V8 - AJV8 - Exhaust Manifold LH

In-vehicle Repair

## Removal

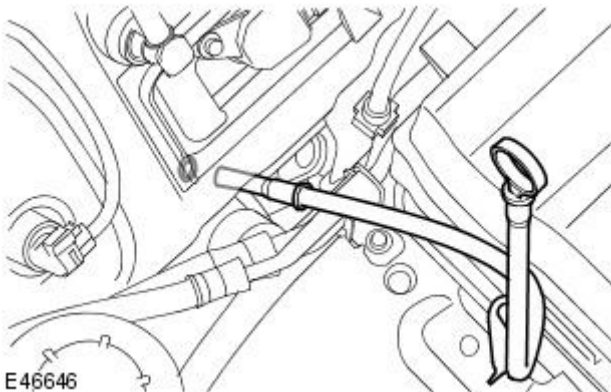
All vehicles

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Release and tie aside the power steering reservoir.



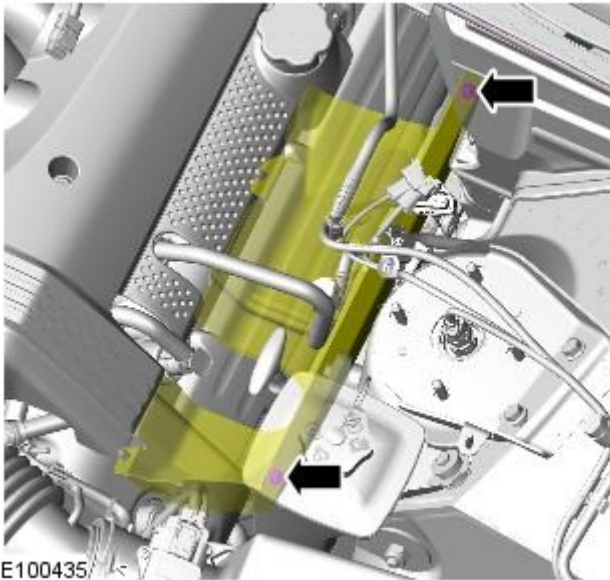
E97798


4. Remove the oil level indicator and tube.
  - Remove the nut.
  - Discard the O-ring seal.



E46646

5. Remove the LH exhaust manifold heat shield retaining bolts.



6.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

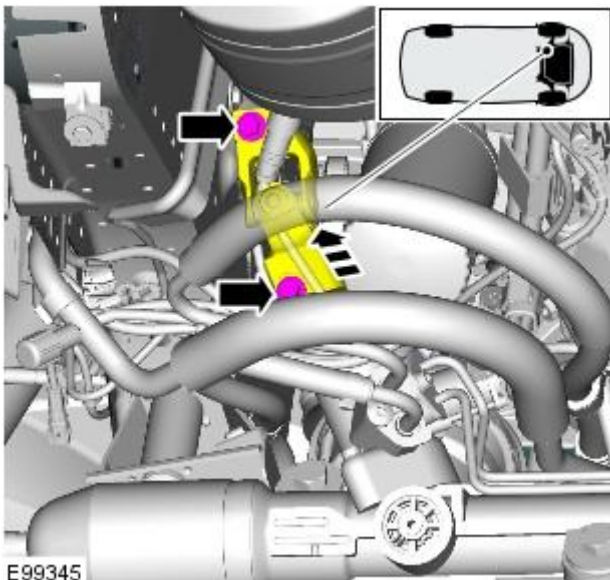
Raise the vehicle.

7. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).
8. Remove the LH catalytic converter.  
For additional information, refer to: [Catalytic Converter](#) (309-00, Removal and Installation).

#### Left-hand drive vehicles

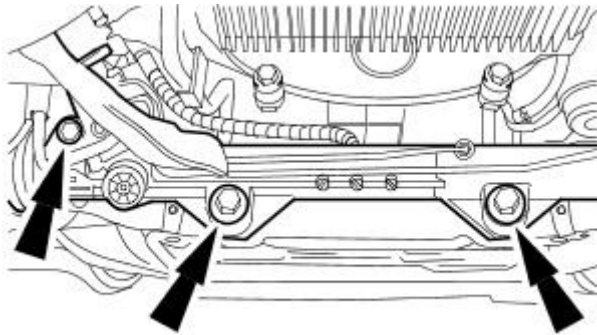
9. Disconnect the steering column lower shaft from the steering gear.

- Remove the steering column flexible coupling securing bolts.



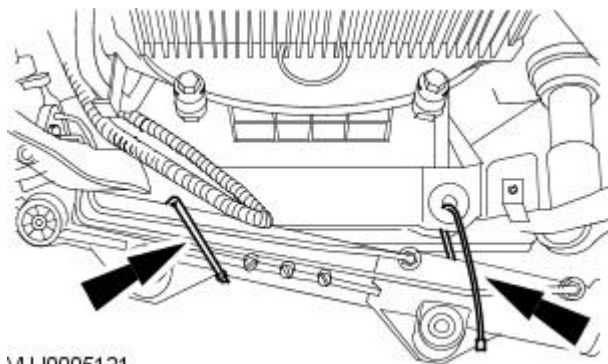


10. Disconnect the steering gear control valve actuator electrical connector.



11. Detach the steering gear.

- Remove the steering gear retaining bolts.

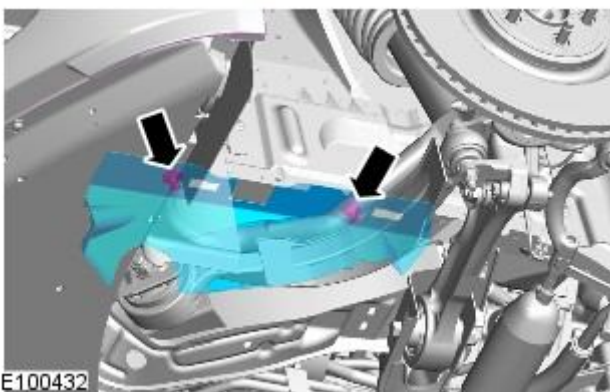


12. Using suitable tie strap(s), secure the steering gear.

All vehicles

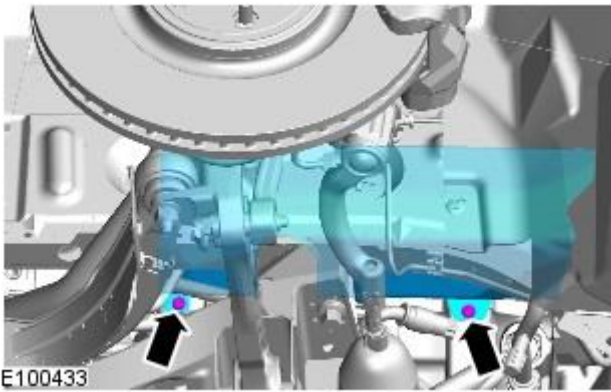
13. Remove the splash shield retaining clips.

- Position the splash shield to one side.



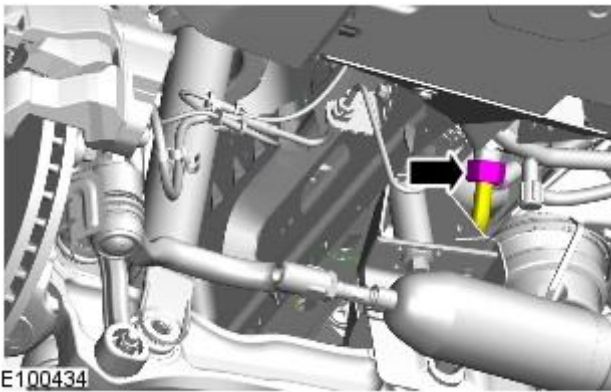
14. Remove the LH exhaust manifold heat shield retaining bolts.

- Remove the LH exhaust manifold heat shield.



Vehicles with secondary air injection (AIR)

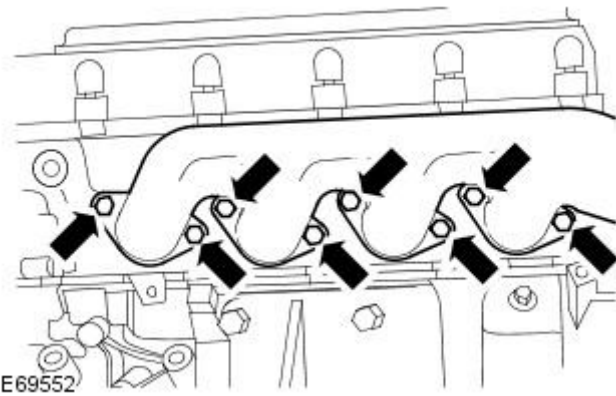
15. Detach the secondary air injection (AIR) control valve to exhaust manifold tube from the exhaust manifold.



All vehicles

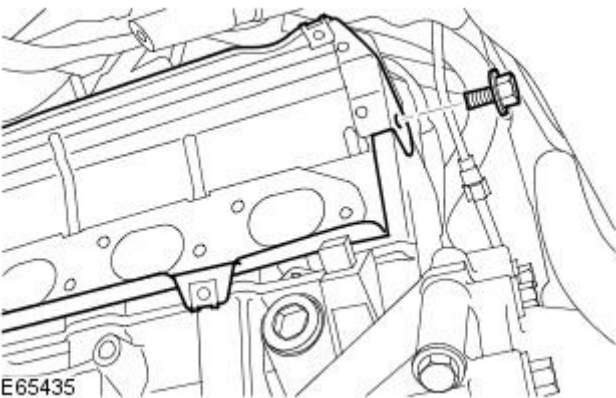
16. Remove the exhaust manifold.

- Remove and discard the 8 bolts.
- Remove the 8 spacers.



17. Remove and discard the LH exhaust manifold gasket.

- Remove the bolt.



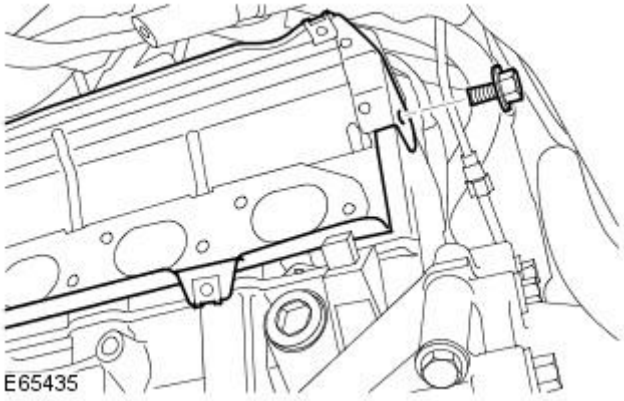


## Installation

All vehicles

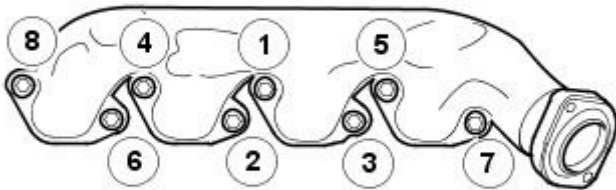
1. Install the LH exhaust manifold gasket.

- Clean the component mating faces.
- Tighten the bolt to 50 Nm.



2. Install the LH exhaust manifold.

- Clean the component mating faces.
- Install the spacers.
- Evenly and progressively, tighten the new bolts in the sequence shown, to 24 Nm.

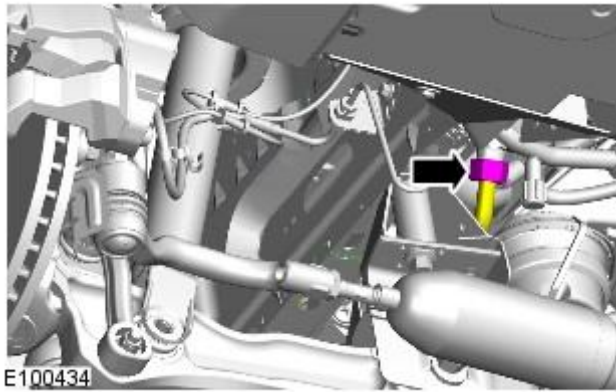


E65731

Vehicles with secondary air injection (AIR)

3. Attach the AIR control valve to exhaust manifold tube to the exhaust manifold.

- Tighten to 35 Nm.

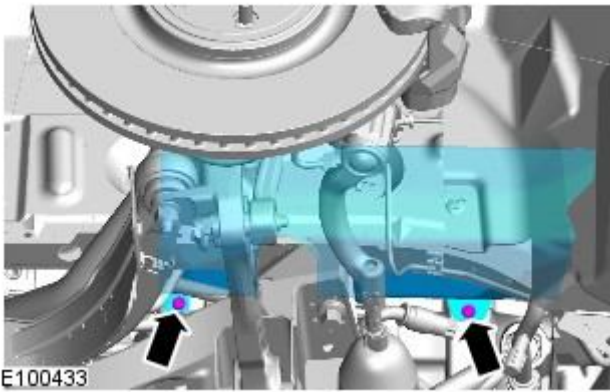


All vehicles



4. Install the LH exhaust manifold heat shield.

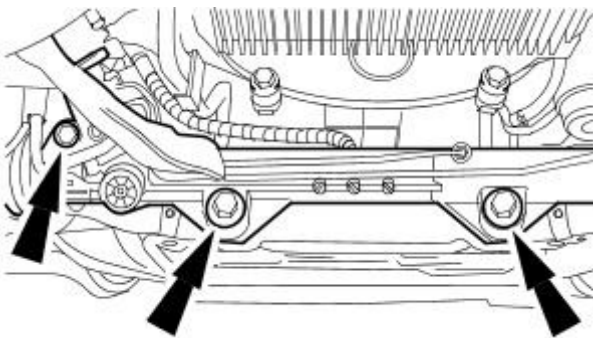
- Tighten the bolts to 8 Nm.



Left-hand drive vehicles

5. Install the steering gear.

- Tighten the bolts to 100 Nm.

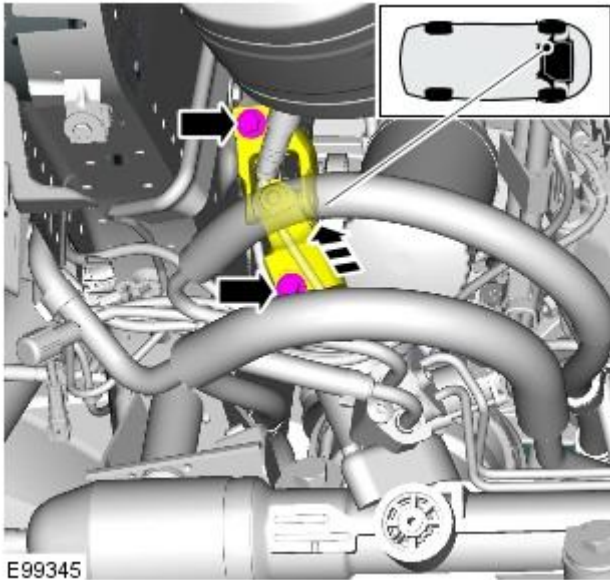


VUJ0005142

6. Connect the steering gear control valve actuator electrical connector.



E62469

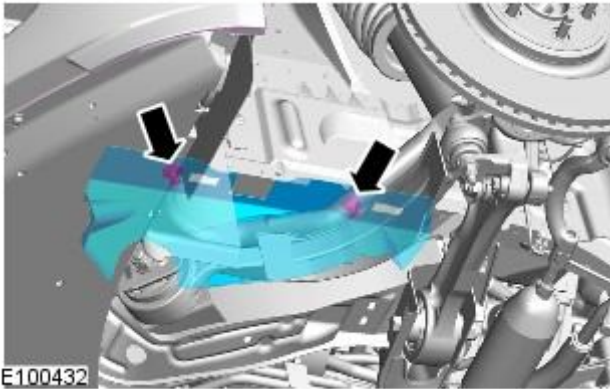


7. Connect the lower steering column shaft to the steering gear.

- Tighten the bolts to 35 Nm.

All vehicles

8. Install the splash shield.



- Install the 2 clips.

9. Install the LH catalytic converter.

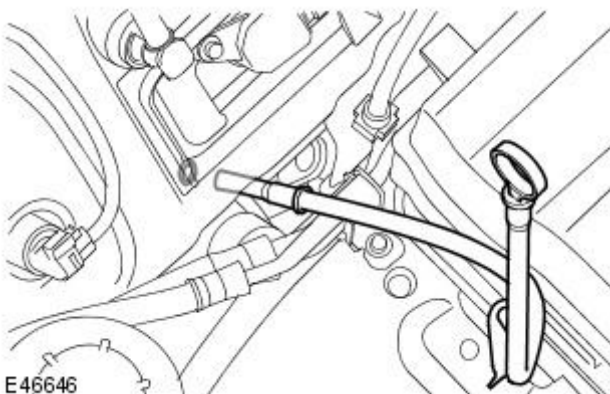
For additional information, refer to: Catalytic Converter (309-00, Removal and Installation).

10. Install the air deflector.

For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

11. Lower the vehicle.

13. With assistance, install the oil level indicator and tube.



- Tighten the bolts to 8 Nm.

Clear the components.

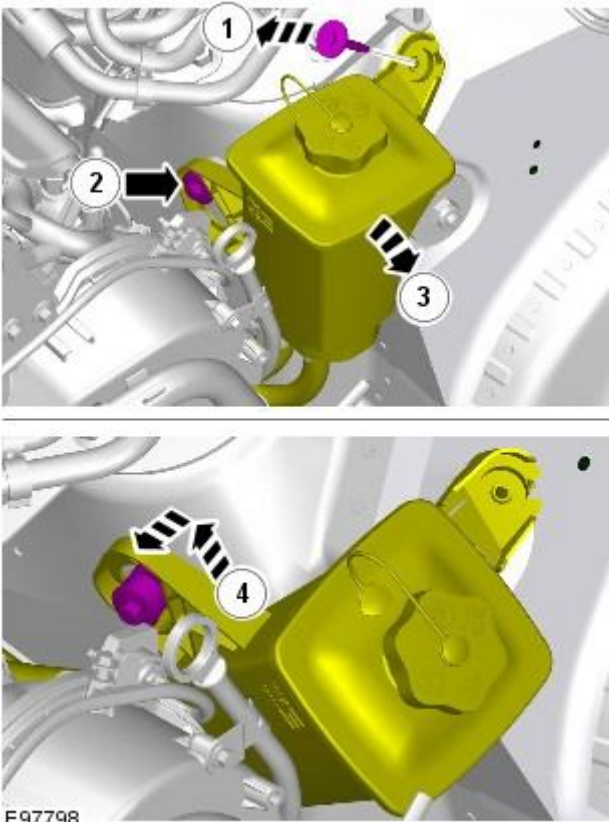
- Install a new O-ring seal.

- Lubricate the O-ring seal with clean engine oil.

- Tighten the nut to 6 Nm.



14. Install the power steering fluid reservoir.




15. Connect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

## Engine - 4.2L NA V8 - AJV8 - Flexplate

In-vehicle Repair

### Removal

1. Remove the transmission.  
For additional information, refer to: [Transmission - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal).

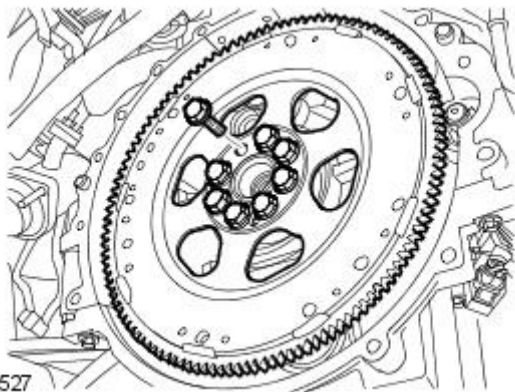
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3. **NOTE:** Prevent the flexplate from rotating.


Remove the flexplate.

- Remove the 8 bolts.



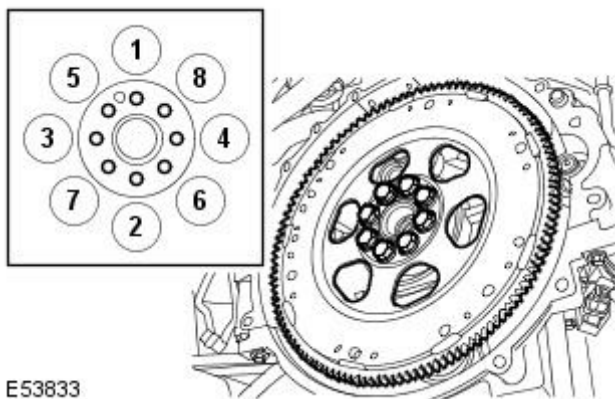
E46527

### Installation

1.  **CAUTION:** Make sure that the locating pin on the crankshaft is aligned with the guide hole in the flexplate.

To install, reverse the removal procedure.

- Tighten the bolts in the sequence shown in two stages.
- Tighten to 15 Nm.
- Tighten to 110 Nm.



E53833



## Engine - 4.2L NA V8 - AJV8 - Exhaust Manifold RH


In-vehicle Repair

### Removal

- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

All vehicles

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

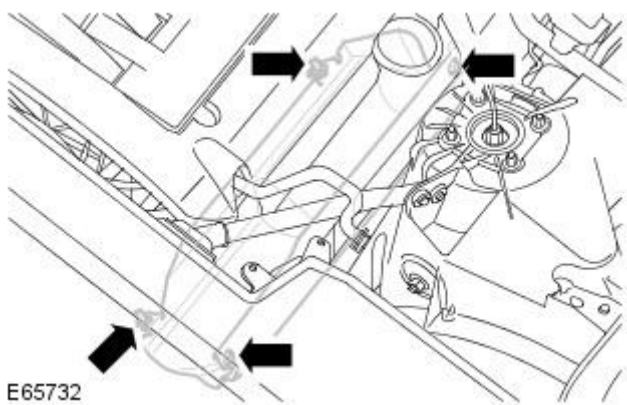
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

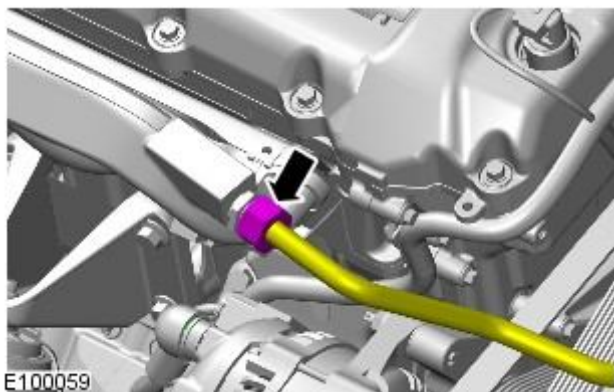
3. Remove the RH catalytic converter.  
For additional information, refer to: [Catalytic Converter \(309-00, Removal and Installation\)](#).

4. Release the exhaust heat shield for access.

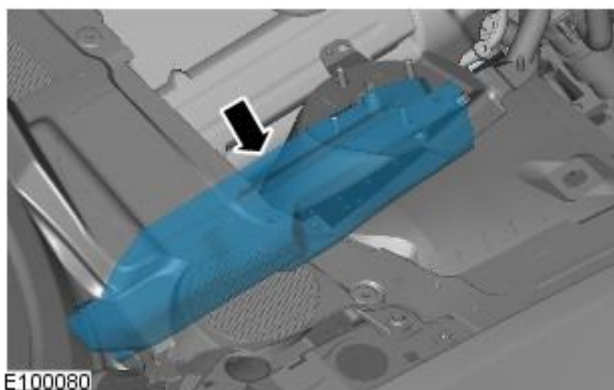
- Remove the 4 screws.

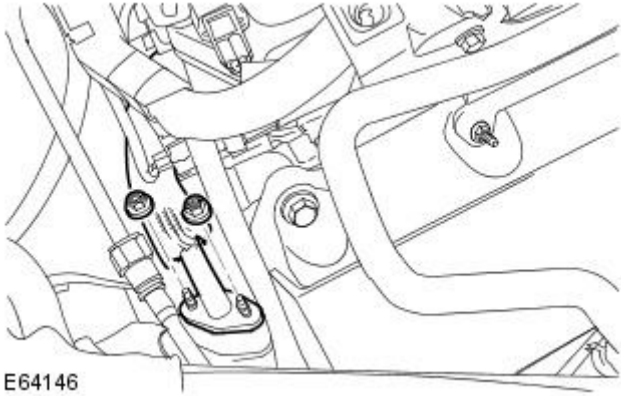


5. Disconnect the secondary air injection (AIR) control valve to exhaust manifold right-hand tube from the right-hand exhaust manifold.



6. Remove the RH exhaust manifold heat shield.





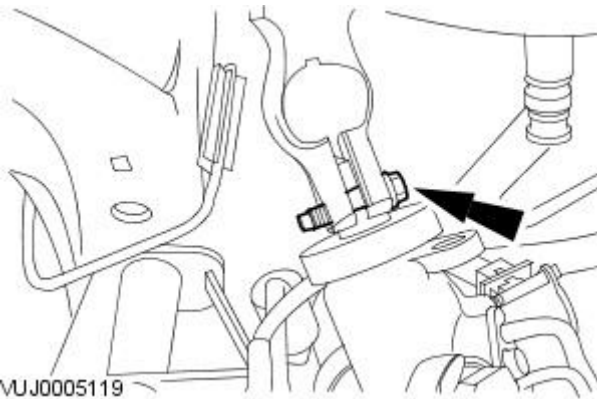
7. Release the EGR valve to exhaust manifold pipe.

- Remove the 2 nuts.
- Remove and discard the gasket.

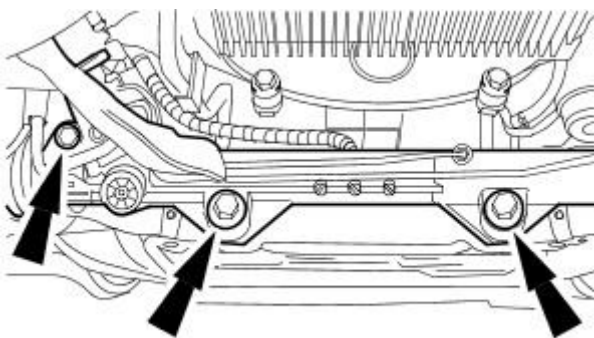
Right-hand drive vehicles

8. NOTE: Note the fitted position.

Release the universal joint from the steering gear.



9. Disconnect the power steering control valve actuator electrical connector.



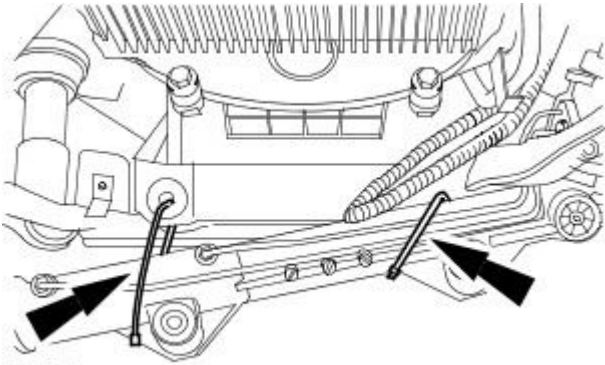
10. NOTE: LHD illustration shown, RHD is similar.

Release the steering gear.

- Remove the 3 bolts.

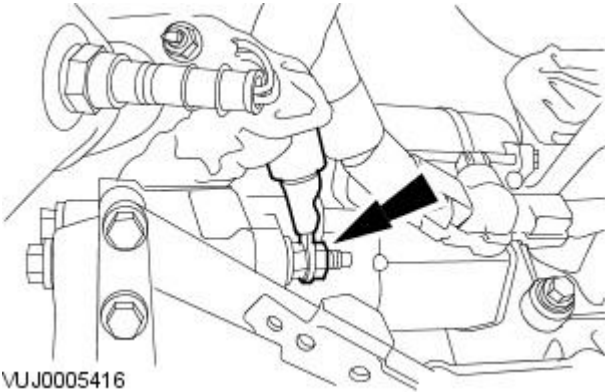


11. Support the steering gear.



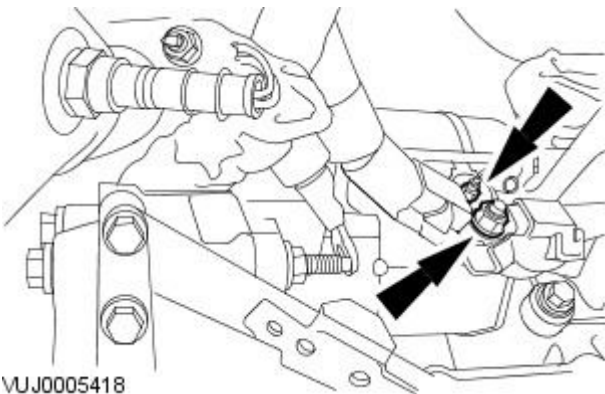
E 31035

12. Disconnect the engine ground cable.



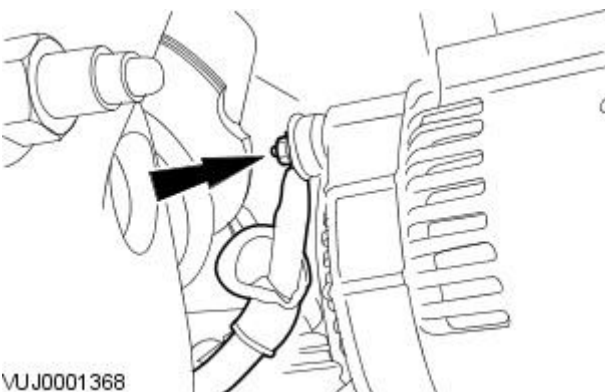
VUJ0005416

13. Release the starter motor positive cable.

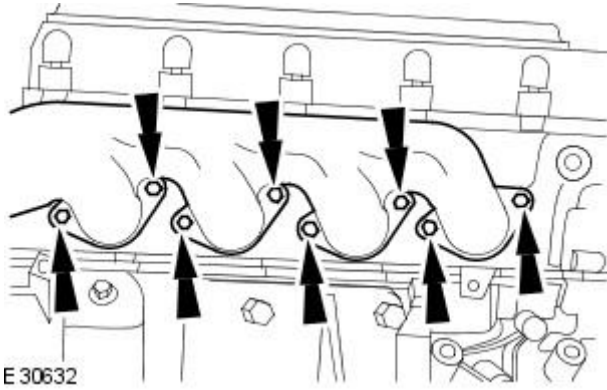


VUJ0005418

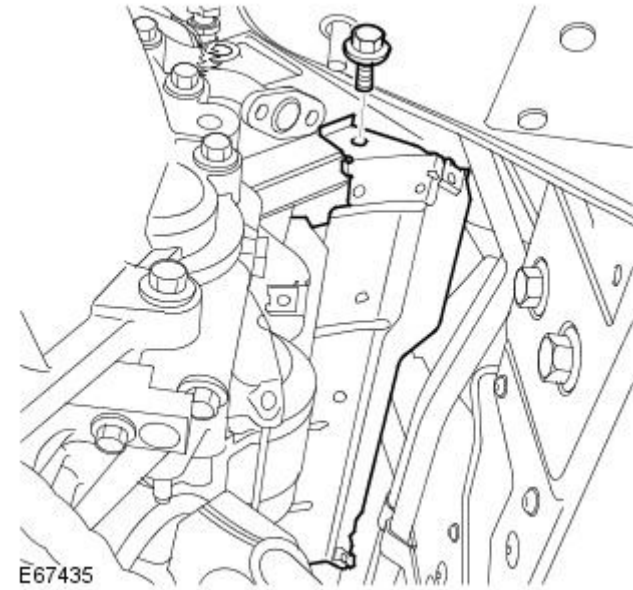
14. Disconnect the battery positive cable from the generator.



VUJ0001368



15. Remove the exhaust manifold.
- Remove and discard the 8 bolts.
  - Remove the 8 spacers.

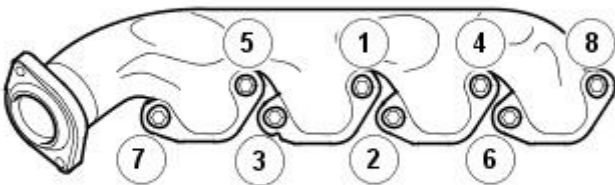


16. Remove and discard the exhaust manifold gasket.
- Remove the bolt.

## Installation

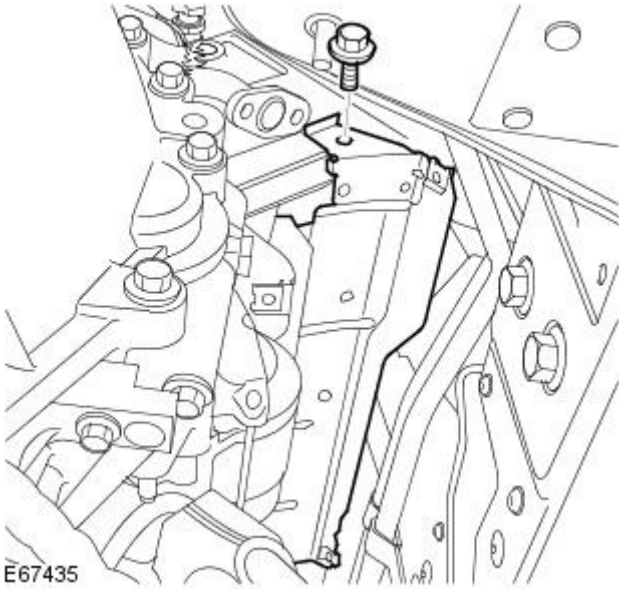
All vehicles

1. To install, reverse the removal procedure.
2. Tighten to 24 Nm.

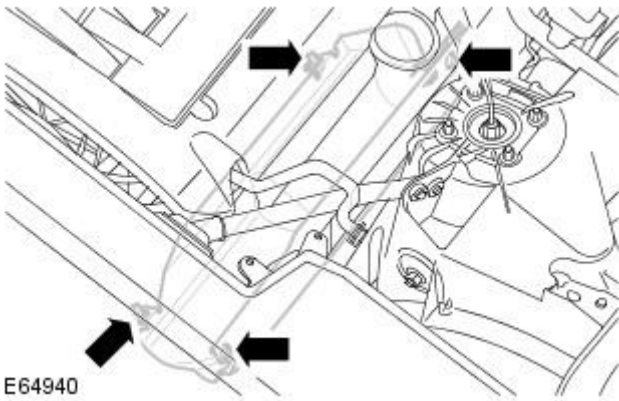


E65730

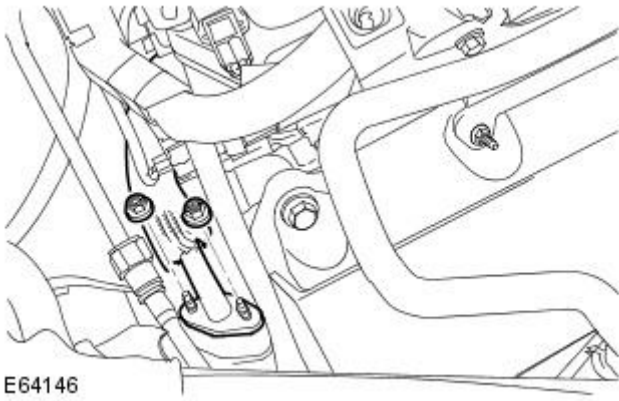
3. Tighten to 50 Nm.



4. Tighten to 35 Nm.

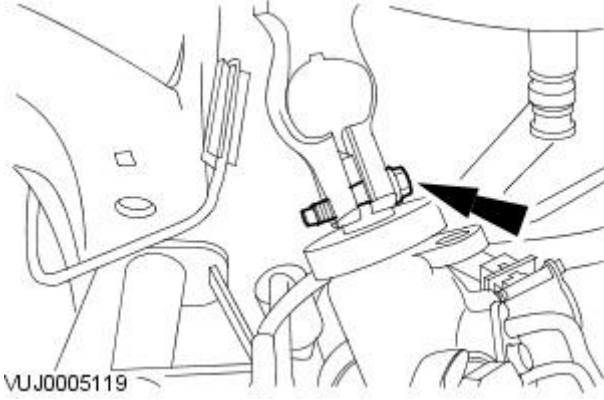


5. Tighten to 25 Nm.



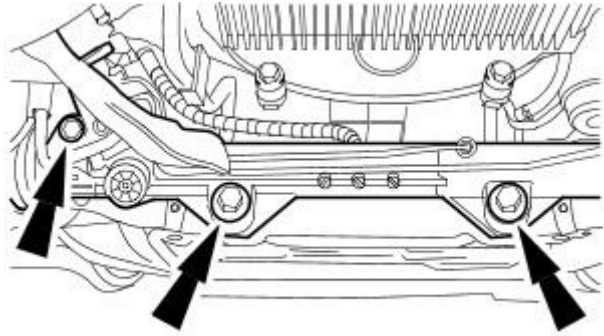
Right-hand drive vehicles

6. Tighten to 35 Nm.



VUJ0005119


7. Tighten to 100 Nm.



VUJ0005142

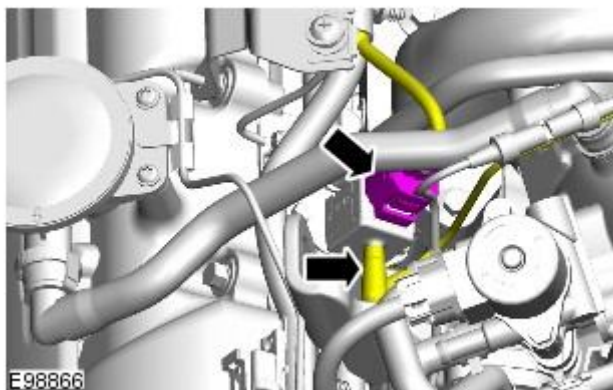
## Engine - 4.2L NA V8 - AJV8 - Intake Manifold

In-vehicle Repair

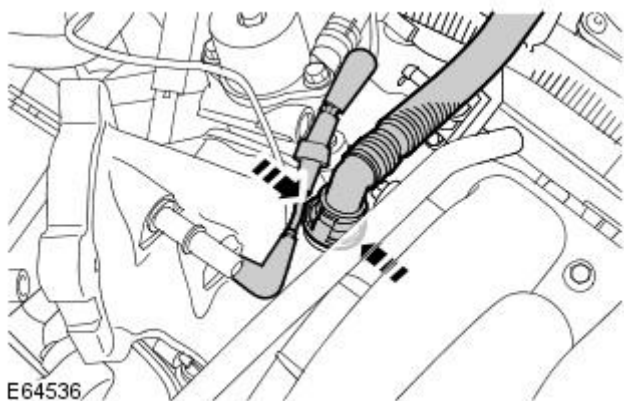
Special Tool(s)	
 <p>310-D005</p> <p>E45289</p>	Fuel spring lock decoupling tool
	310-D005

### Removal

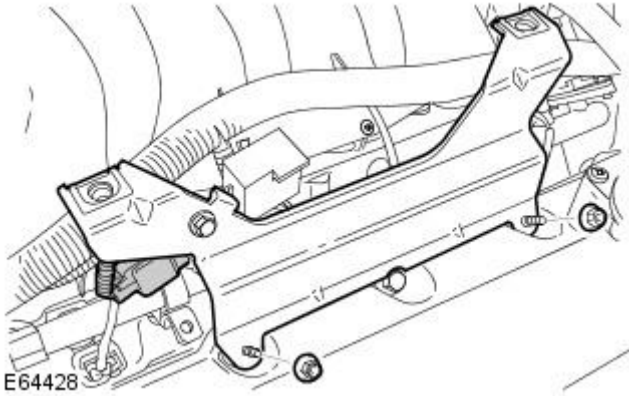
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the air cleaner outlet pipe.  
For additional information, refer to: [Air Cleaner Outlet Pipe](#) (303-12A Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8, Removal and Installation).
3. Remove the throttle body.  
For additional information, refer to: [Throttle Body](#) (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Removal and Installation).
4. Disconnect the fuel rail pressure (FRP) sensor electrical connector.
  - Disconnect the FRP sensor vacuum line.



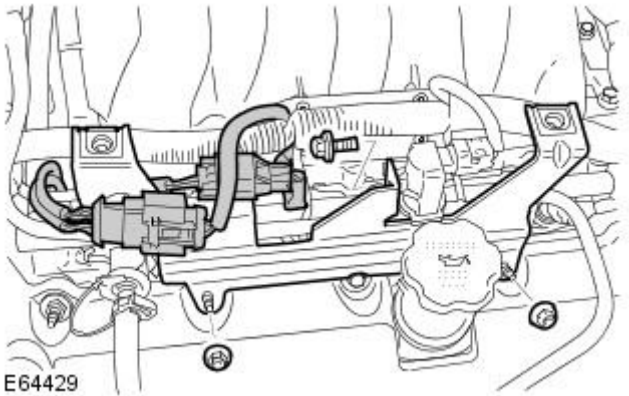
5. Disconnect the throttle body elbow vacuum line.
6. Disconnect the positive crankcase ventilation (PCV) line from the throttle body elbow.



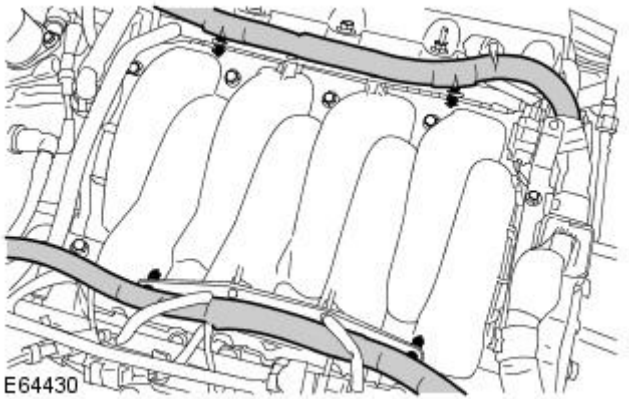
7. Remove the engine cover LH bracket.



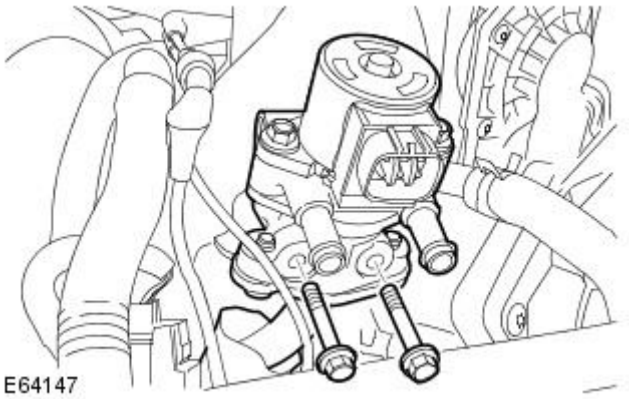
8. Remove the engine cover RH bracket.



9. Release the engine wiring harness from the intake manifold.

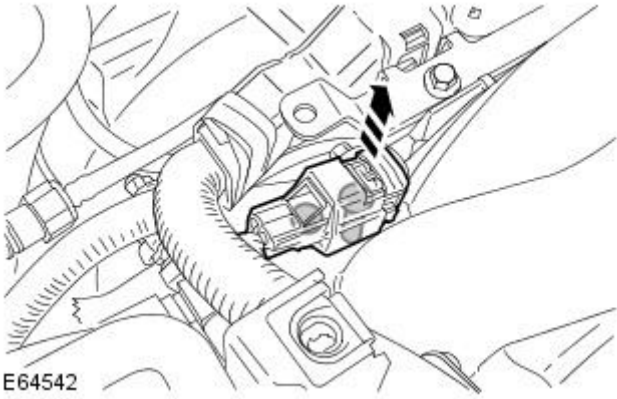


10. Release the exhaust gas recirculation (EGR) valve.



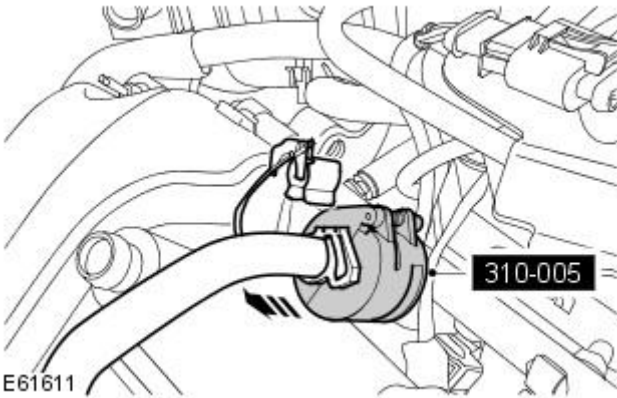


11. Release the RH camshaft position (CMP) sensor electrical connector.



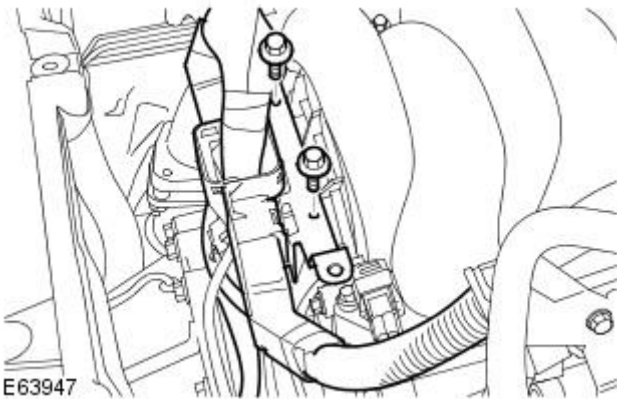
E64542

12. Disconnect the fuel line.



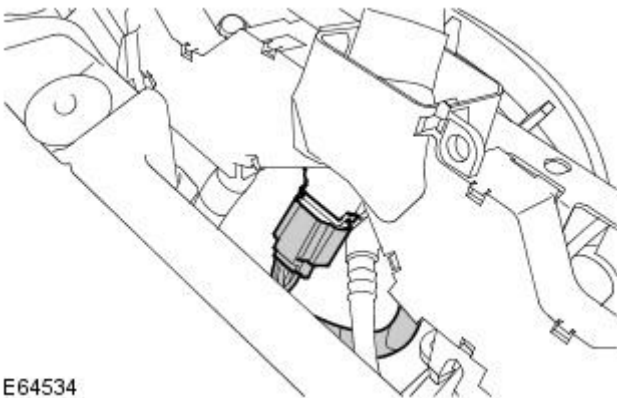
E61611

13. Release the wiring harness from the rear of the engine.



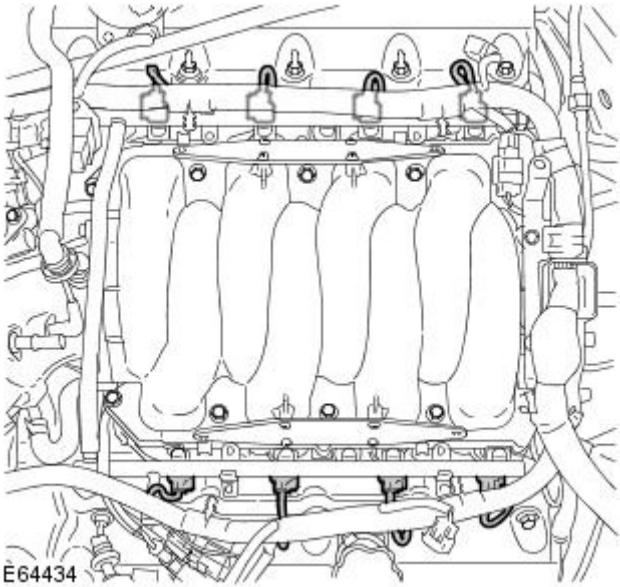
E63947

14. Disconnect the manifold absolute pressure (MAP) sensor electrical connector.

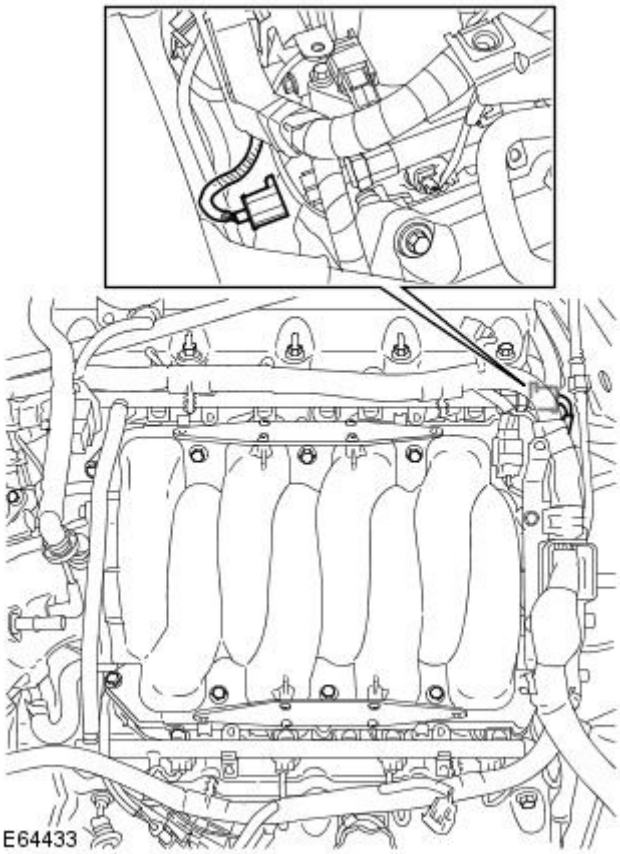


E64534

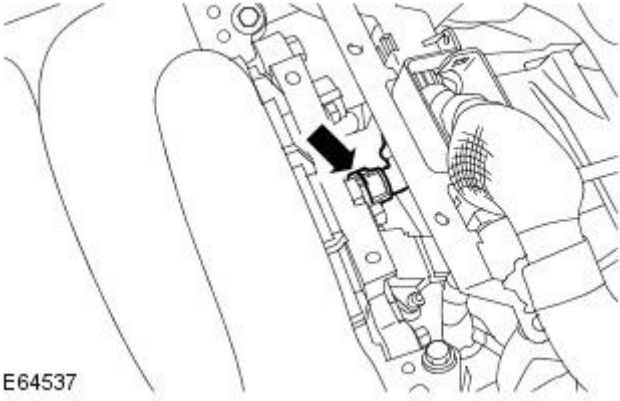
15. Disconnect the 8 fuel injector electrical connectors.



16. Disconnect the fuel temperature sensor electrical connector.



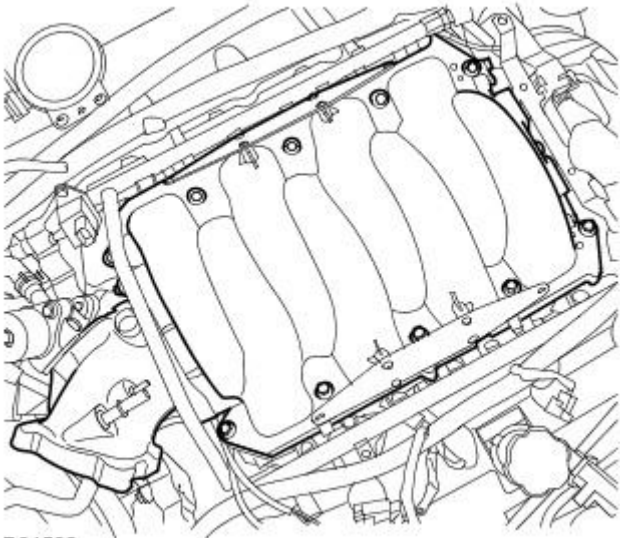
17. Disconnect the brake booster vacuum hose from the intake manifold.



E64537

18.  CAUTION: Always plug any open connections to prevent contamination.

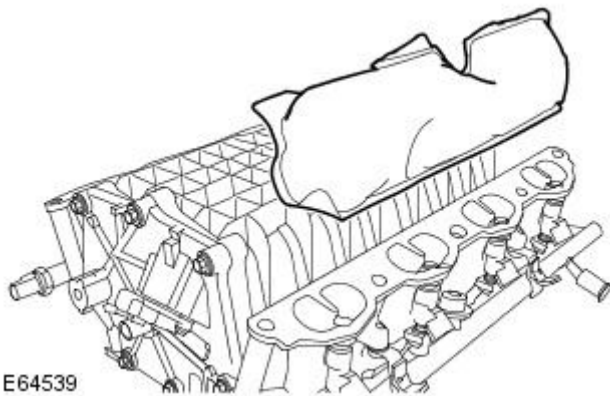
Remove the intake manifold.



E64538

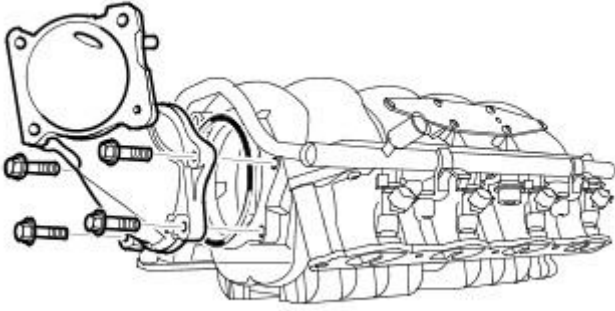
19. NOTE: Do not disassemble further if the component is removed for access only.

Remove the foam pad.



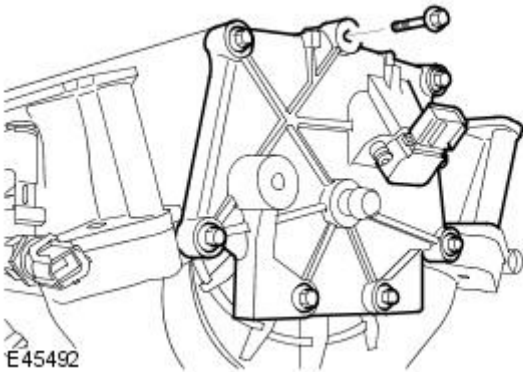
E64539

20. Remove the throttle body elbow.



E64540

21. Remove the intake manifold MAP sensor housing.



E45492

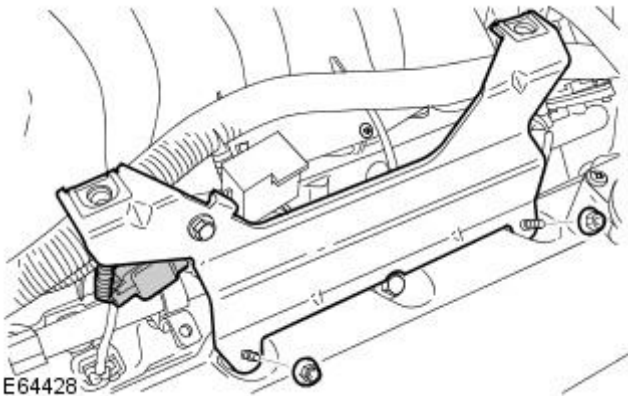
22. Remove the 2 intake manifold housings.



E45494

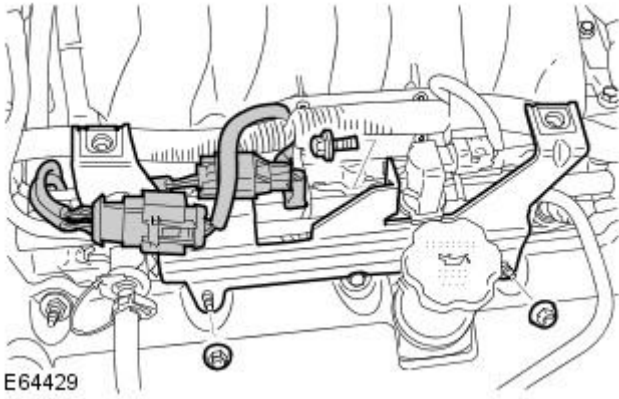
## Installation

1. To install, reverse the removal procedure.
2. Tighten to 10 Nm.



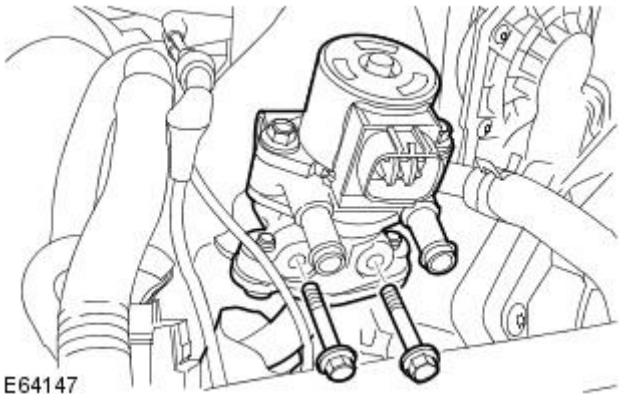
E64428

3. Tighten to 10 Nm.



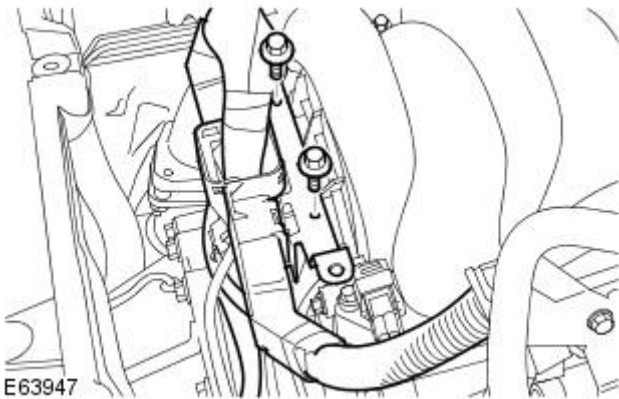
E64429

4. Tighten to 10 Nm.



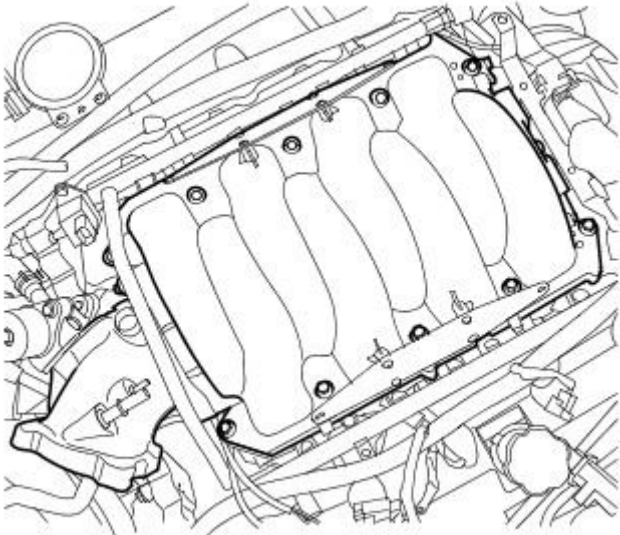
E64147

5. Tighten to 10 Nm.



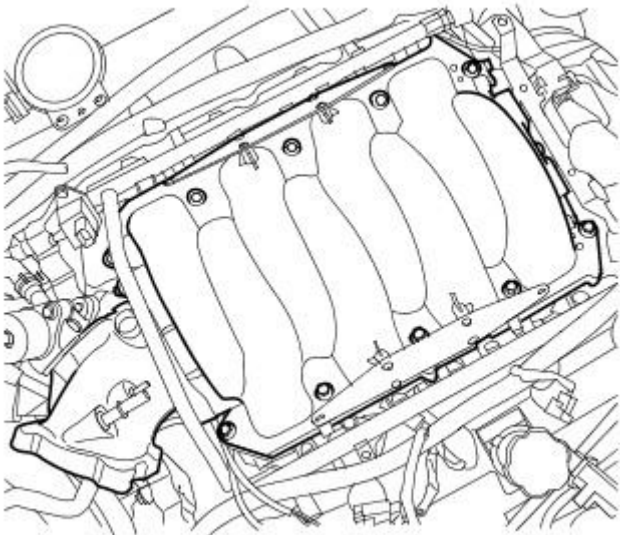
E63947

6. Tighten to 20 Nm.



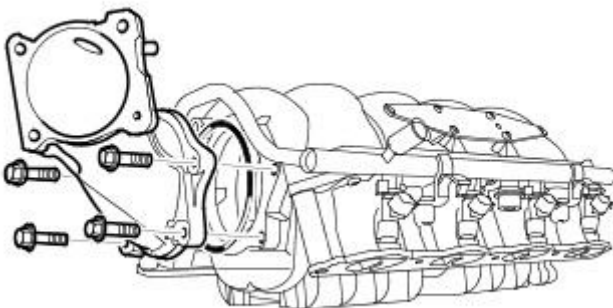
E64538

7. Tighten to 20 Nm.



E64538

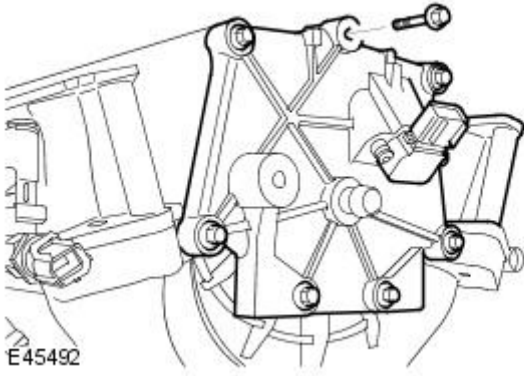
8. Tighten to 10 Nm.



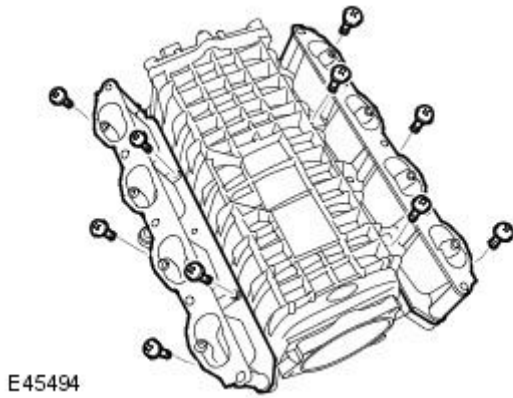
E64540



9. Tighten to 10 Nm.




10. Tighten to 4 Nm.



## Engine - 4.2L NA V8 - AJV8 - Oil Pan

In-vehicle Repair

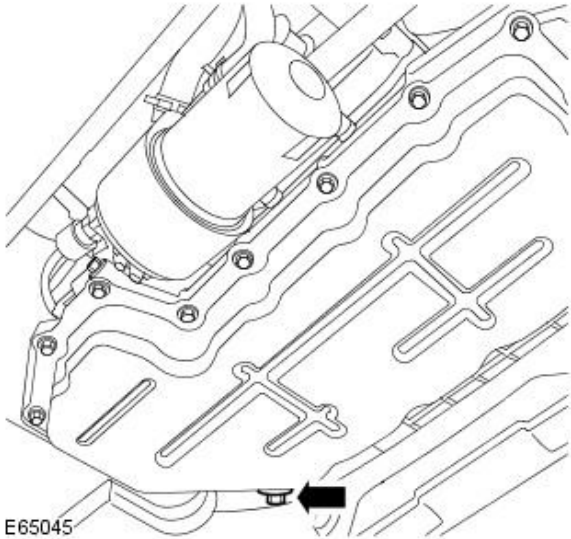
### Removal

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

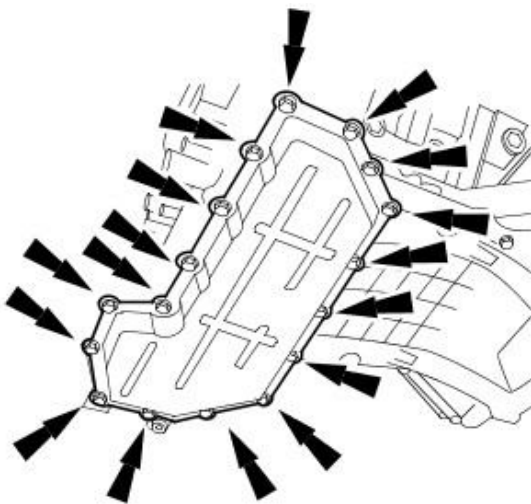
- Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
- Drain the engine oil.  
For additional information, refer to: [Engine Oil Draining and Filling](#) (303-01A Engine - 4.2L NA V8 - AJV8, General Procedures).

- Position a container to collect the fluid.
- Discard the oil pan drain plug seal.



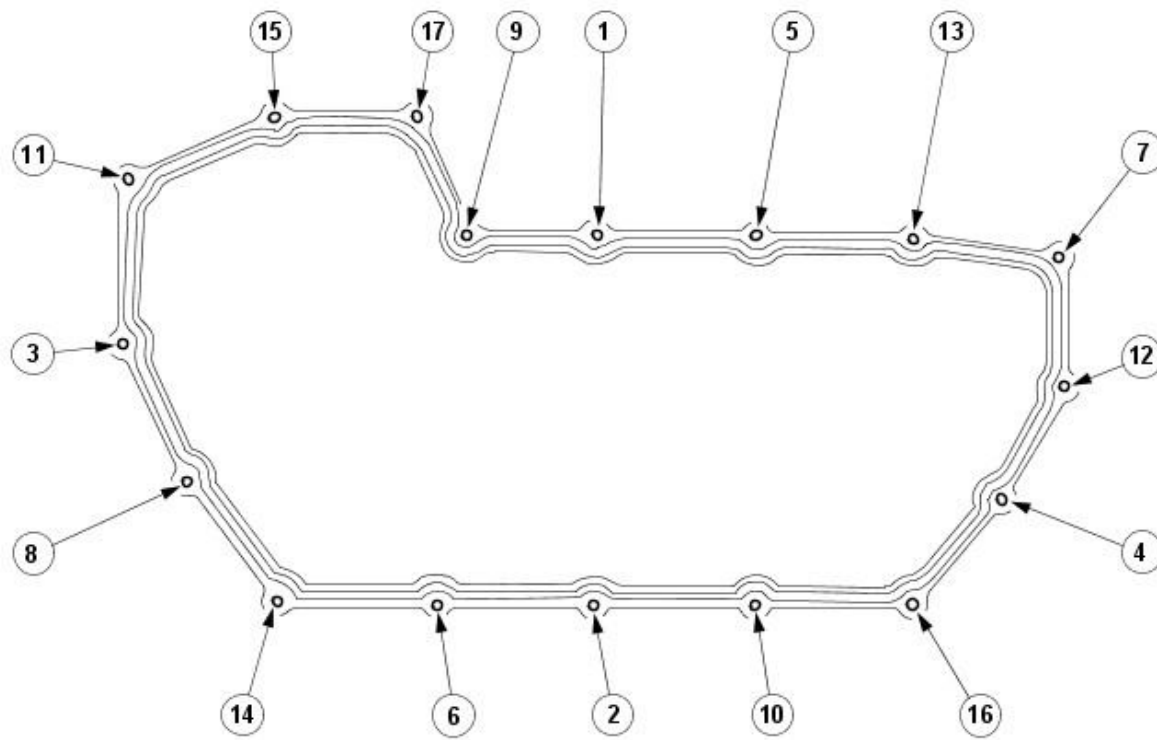
- Remove the oil pan.

- Remove the 17 bolts.
- Remove and discard the gasket.



E31186

### Installation



1. To install, reverse the removal procedure.
  - Tighten to 12 Nm.

E36705

## Engine - 4.2L NA V8 - AJV8 - Oil Pan Extension

In-vehicle Repair

### Removal

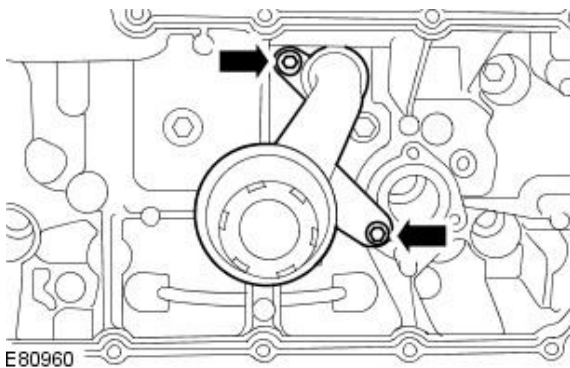
• NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

**2. ⚠ WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

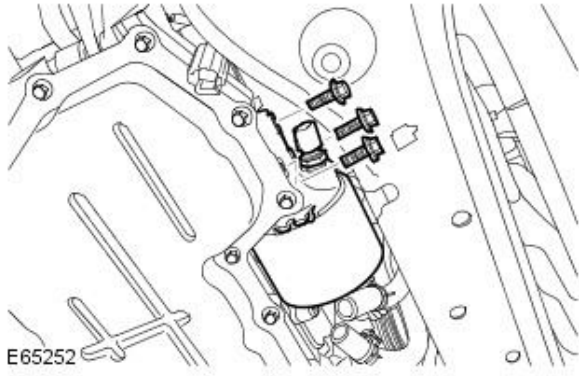
3. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).
4. Remove the transmission.  
For additional information, refer to: [Transmission - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Installation).
5. Remove the oil pan.  
For additional information, refer to: [Oil Pan](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).
6. Remove the oil strainer pick-up assembly.



7. Disconnect the engine oil temperature sensor electrical connector.

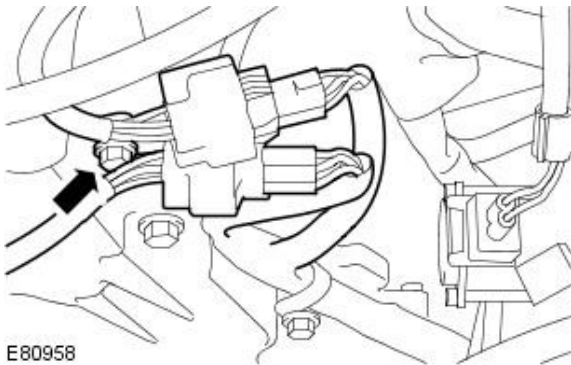


8. Disconnect the engine oil pressure (EOP) sensor electrical connector.

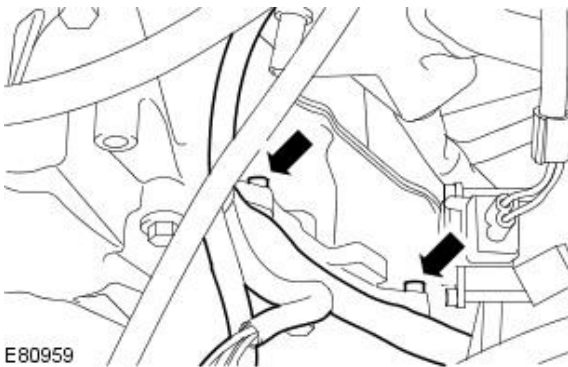


9. Remove the oil filter housing.

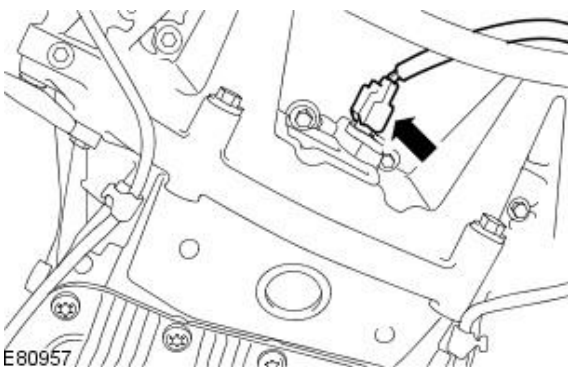
- Remove the 3 bolts.
- Remove and discard the O-ring seal.



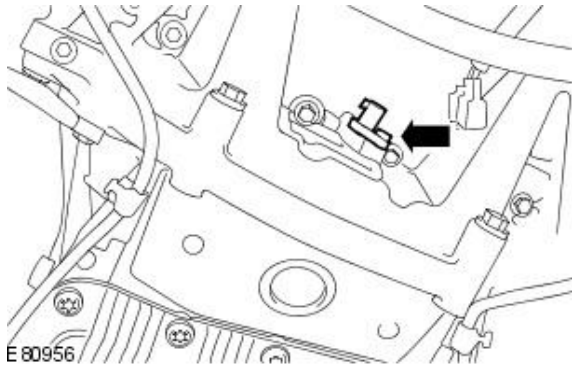
10. Detach the right-hand heated oxygen sensor (HO2S) electrical connector retaining bracket.



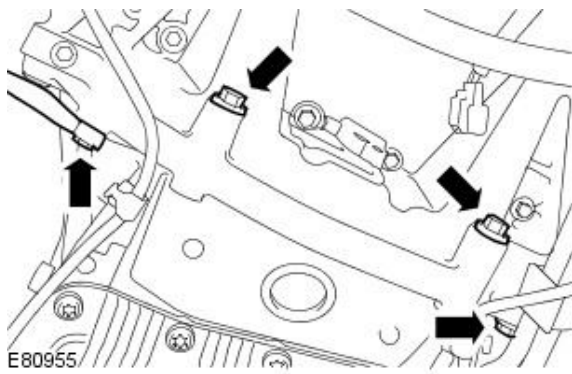
11. Detach the engine wiring harness from the oil pan extension.



12. Disconnect the crankshaft position (CKP) sensor electrical connector.

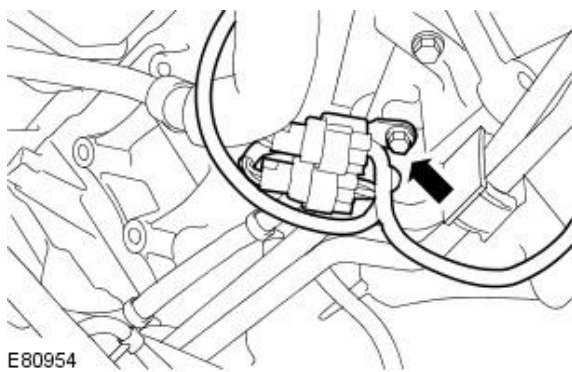


13. Remove the crankshaft position (CKP) sensor.



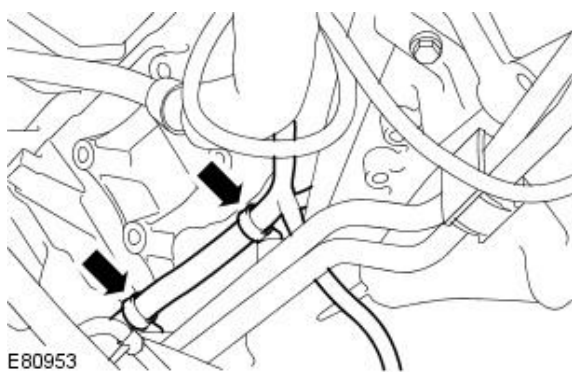
14. Remove the transmission bell housing to oil pan retaining bolts.

- Disconnect the engine ground cable.

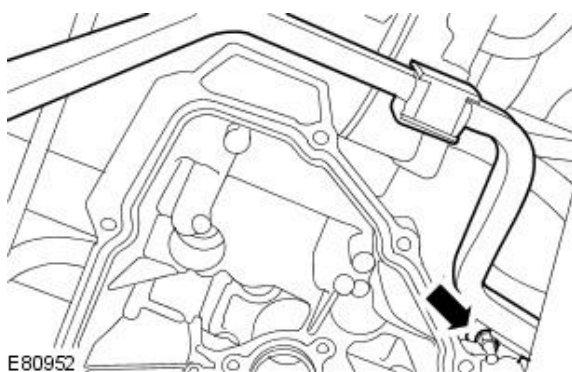


15. Detach the left-hand HO2S electrical connector retaining bracket.

- Remove the retaining bolt.



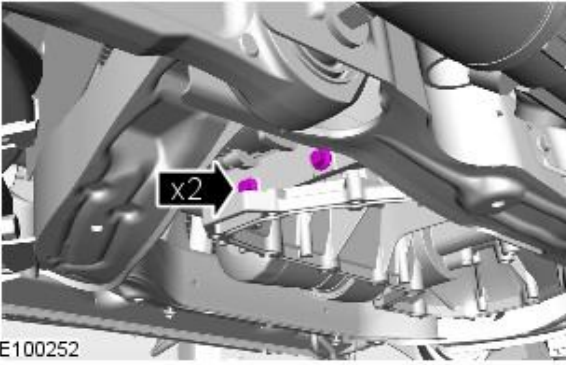
16. Detach the wiring harness from the oil pan.



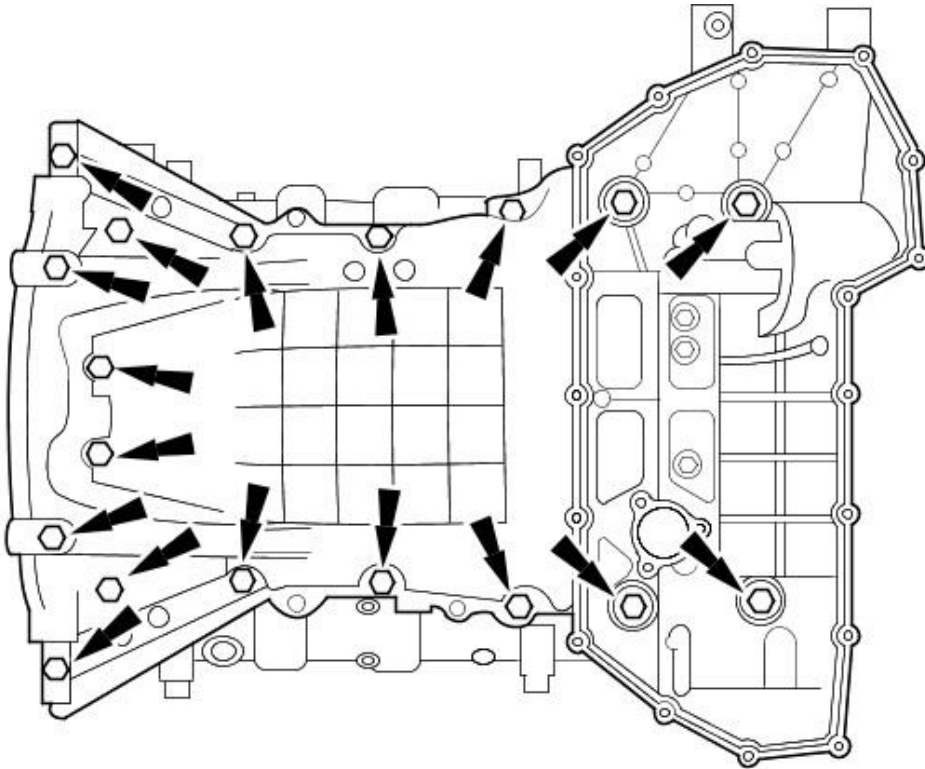
17. Detach the transmission fluid cooler tubes.



18. Remove the two lower bolts from the air conditioning (A/C) compressor bracket.



19. Remove the oil pan extension.

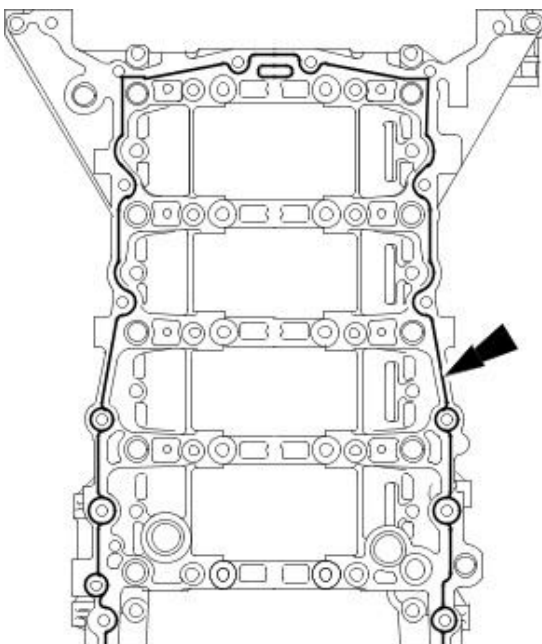


VUJ0002435

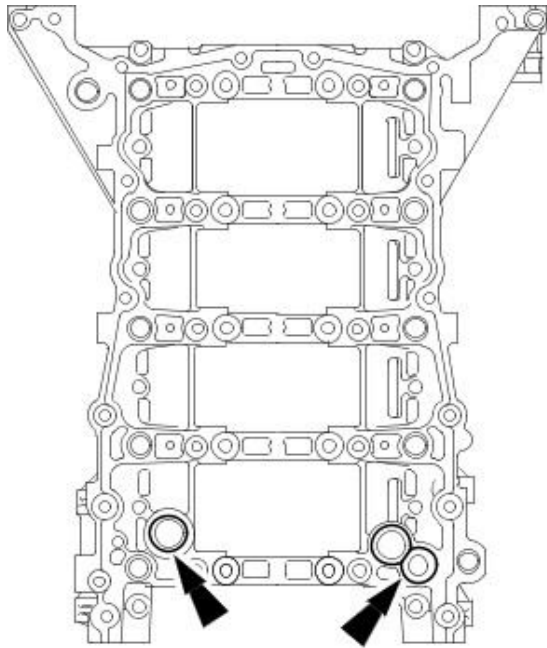
20. NOTE: Use only a plastic scraper when removing old gasket material.

• NOTE: Clean all the mating faces and reusable parts thoroughly and check for damage.

Apply a continuous bead of RTV sealant (Loctite 5699) 3 mm diameter, around the flange as indicated.



E32647



**21. NOTE:** It is important that the oil pan extension is bolted to the bedplate within 20 minutes of applying the RTV sealant.

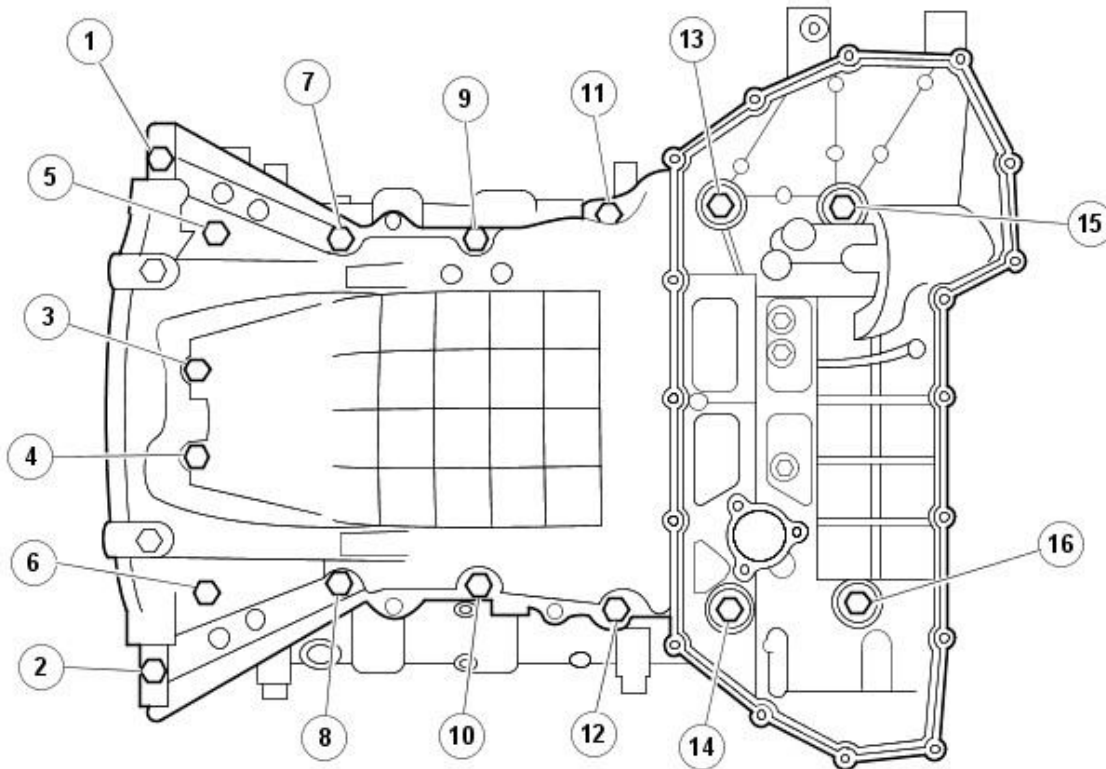
Apply a continuous bead of RTV sealant ( Loctite 5699 ) 2 mm diameter, around the diverter valve flange as indicated.

E32648

### Installation

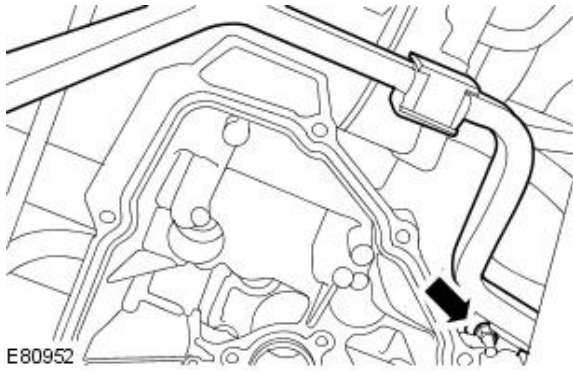
1. To install, reverse the removal procedure.

2. Tighten to 21 Nm.

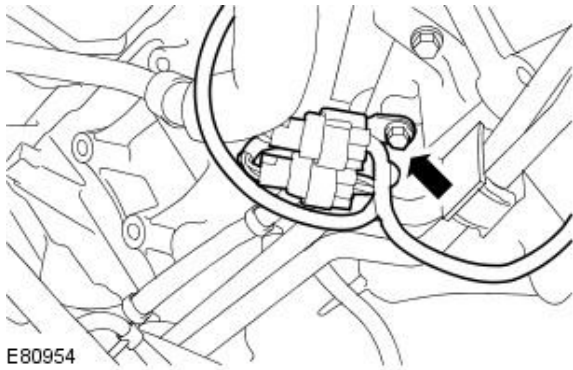


E81046

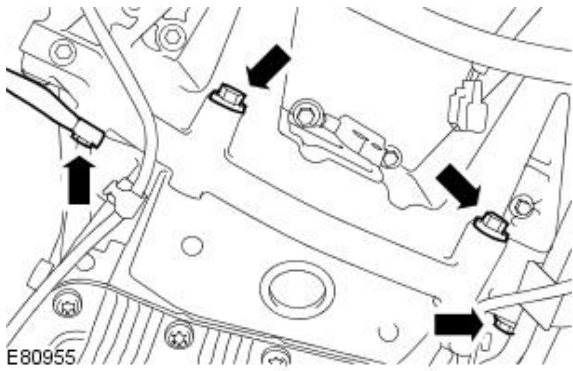
3. Tighten to 10 Nm.



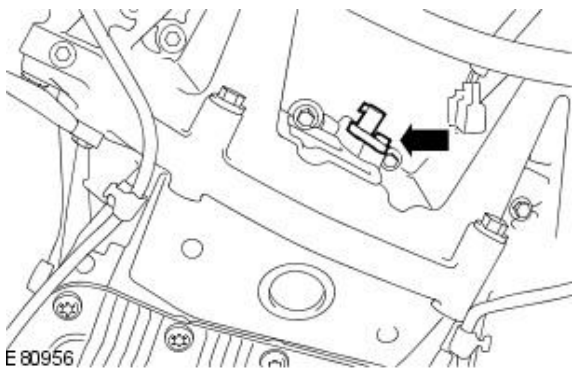
4. Tighten to 10 Nm.



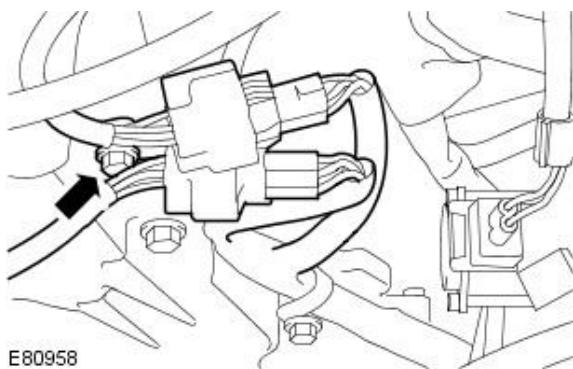
5. Tighten to 48 Nm.

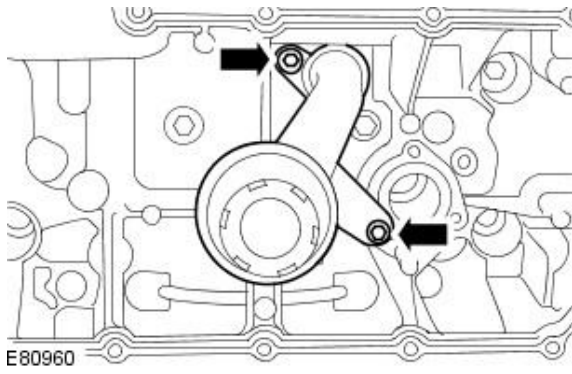


6. Tighten to 10 Nm.

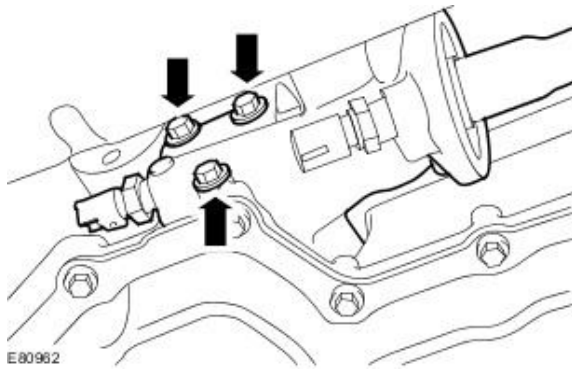


7. Tighten to 10 Nm.

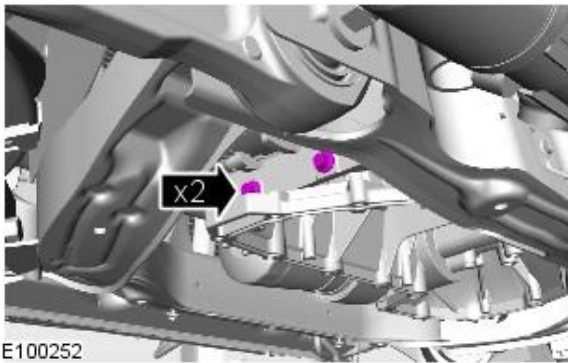




8. Tighten to 12 Nm.



9. Tighten to 21 Nm.




10. Tighten the bolts to 20 Nm.

# Engine - 4.2L NA V8 - AJV8 - Oil Pump

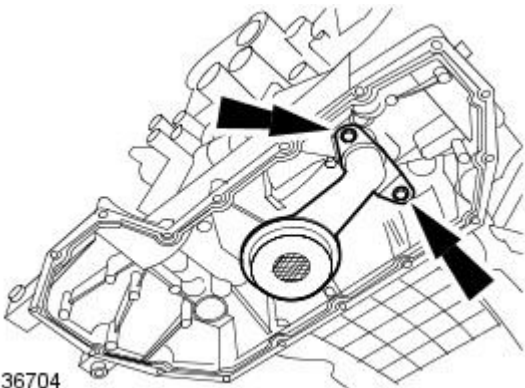
In-vehicle Repair

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the timing drive components.  
For additional information, refer to: [Timing Drive Components](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).
4. Remove the oil pan.  
For additional information, refer to: [Oil Pan](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).
5. **NOTE:** The bolts will remain captive.

Remove the oil strainer pick-up assembly.

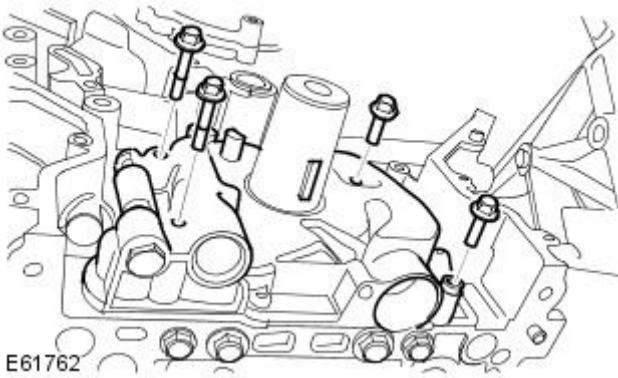
- Remove the 2 bolts.
- Remove and discard the O-ring seal.



E36704

6. Remove the oil pump assembly.

- Remove the 4 bolts.
- Remove and discard the O-ring seal.

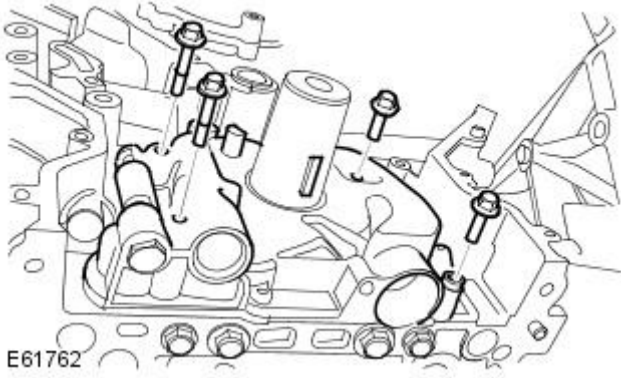


E61762

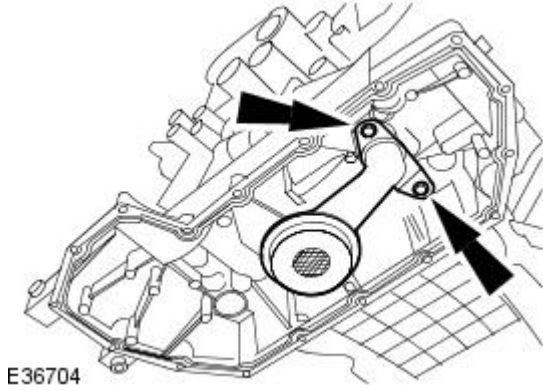
## Installation

1. To install, reverse the removal procedure.

2. Tighten to 12 Nm.



3. Tighten to 12 Nm.





## Engine - 4.2L NA V8 - AJV8 - Secondary Timing Chain Tensioner

In-vehicle Repair

### Removal

1. Remove the timing drive components.

For additional information, refer to: [Timing Drive Components](#)  
(303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).

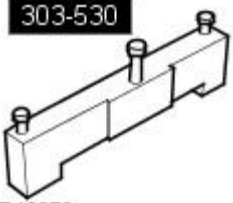


### Installation

1. Install the timing drive components.

For additional information, refer to: [Timing Drive Components](#)  
(303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).


# Engine - 4.2L NA V8 - AJV8 - Timing Drive Components

In-vehicle Repair


Special Tool(s)	
 <p>303-530 E46879</p>	<p>Camshaft setting/locking tool 303-530</p>
 <p>303-645 E46881</p>	<p>Timing Setting tool 303-645</p>
 <p>303-532 E46880</p>	<p>Timing chain tensioning tool 303-532</p>

## Removal

• NOTE: This procedure covers the removal and installation of the following components: timing chains, chain guides, tensioners and sprockets.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the engine front cover.  
For additional information, refer to: [Engine Front Cover](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).
4. Remove the crankshaft position (CKP) sensor.  
For additional information, refer to: [Crankshaft Position \(CKP\) Sensor - 4.2L NA V8 - AJV8](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

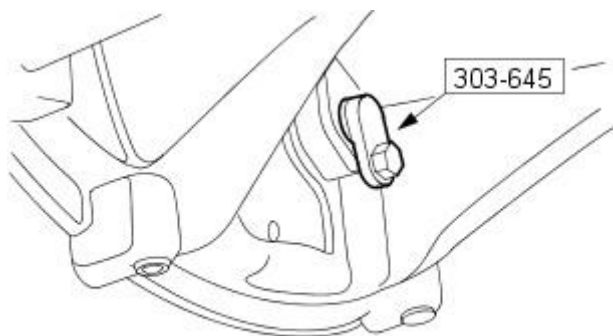
### 5. CAUTIONS:

 Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.

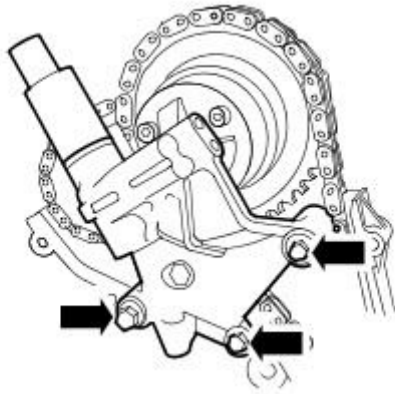
 Rotate the crankshaft clockwise to position the engine to top dead center (TDC) number 1 cylinder.

Lock the crankshaft.

- Install the special tool.
- Install the screw.



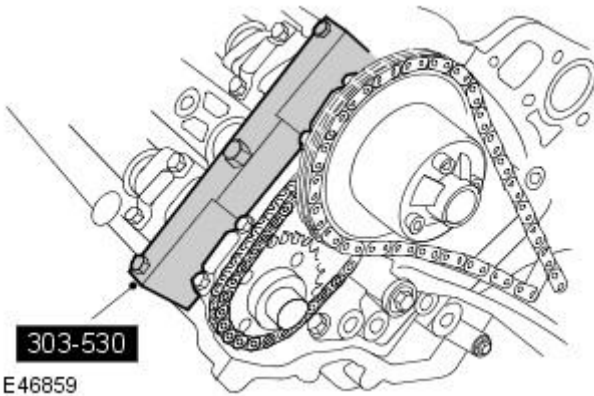
VUJ0002400



E46858

6. Remove the RH variable camshaft timing (VCT) control solenoid housing.

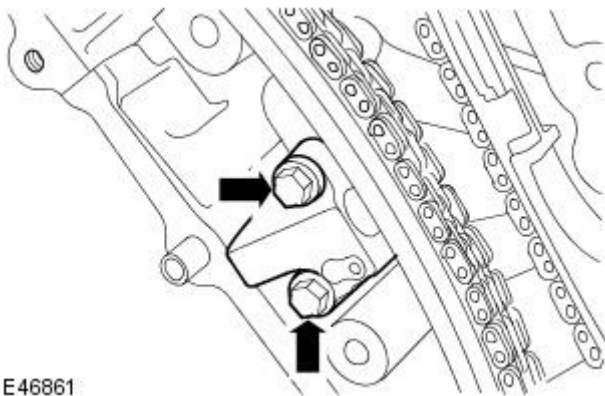
- Remove the 3 bolts.
- Remove and discard the O-ring seals.



E46859

7. Install the special tool to the RH cylinder head.

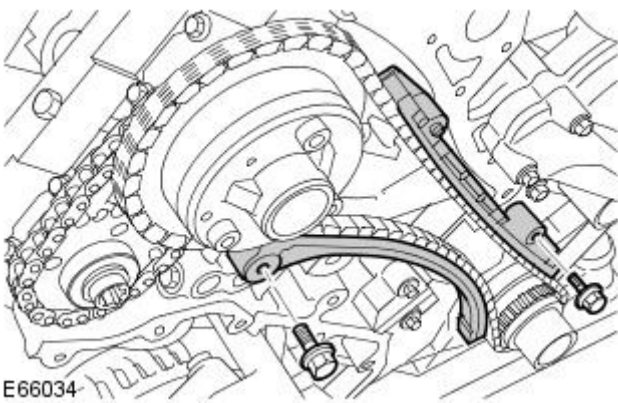
- Rotate the crankshaft until the flats on the camshafts are parallel with the cylinder head joint faces.
- Install the 3 bolts.



E46861

8. Remove the RH primary timing chain tensioner.

- Remove the 2 bolts.

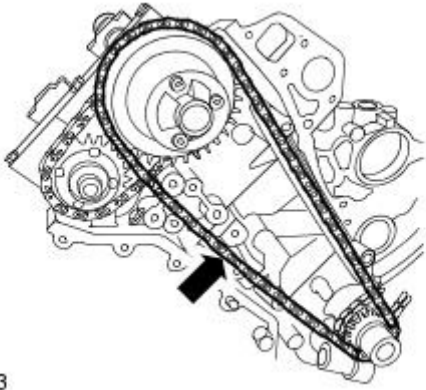


E66034

9. Remove the RH upper and lower primary timing chain tensioner guides.

- Remove the 2 bolts.

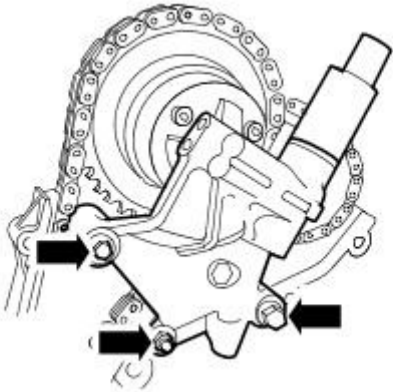
10. Remove the RH primary timing chain.



E46863

11. Remove the LH variable camshaft timing (VCT) control solenoid housing.

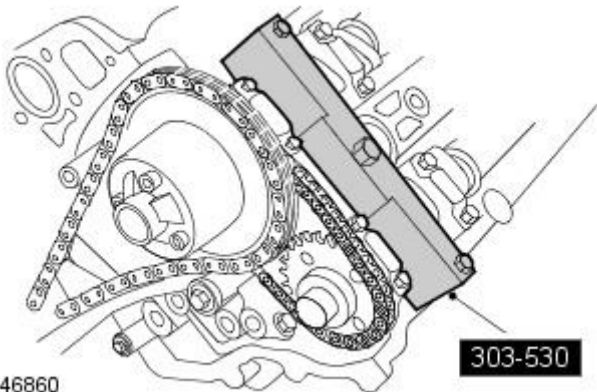
- Remove the 2 bolts.
- Remove the nut.
- Remove and discard the O-ring seals.



E48360

12. Install the special tool to the LH cylinder head.

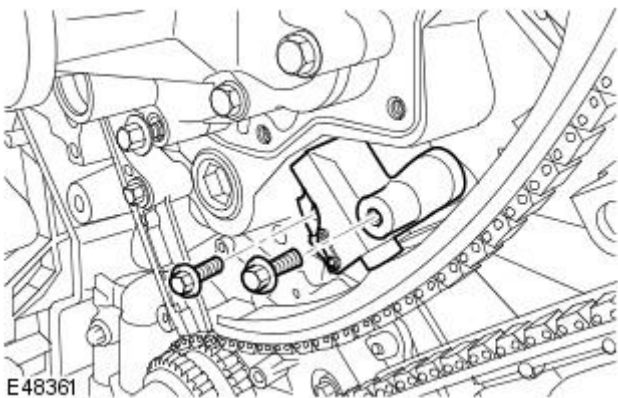
- Install the 3 bolts.



E46860

13. Remove the LH primary timing chain tensioner.

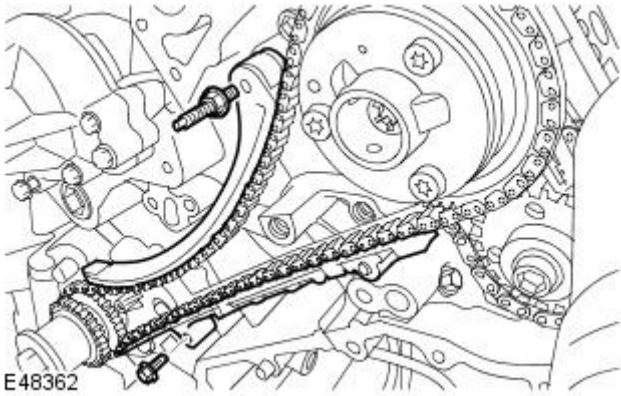
- Remove the 2 bolts.



E48361

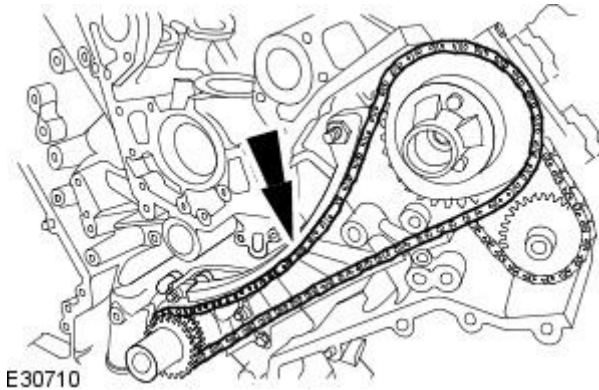
14. Remove the LH upper and lower primary timing chain tensioner guides.

- Remove the 2 bolts.



E48362

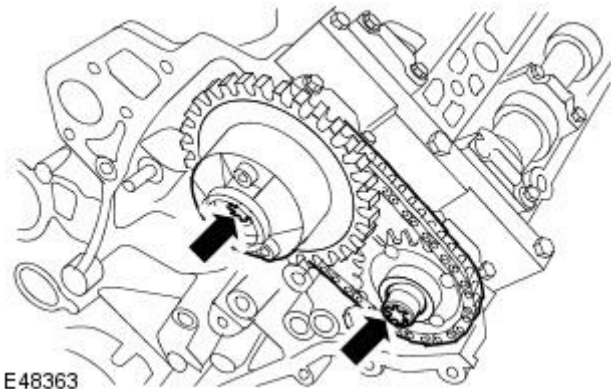
15. Remove the LH primary timing chain.



E30710

16. Release the LH camshaft sprocket assembly.

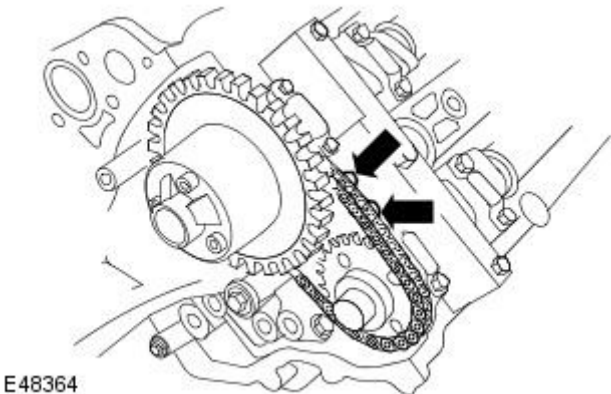
- Remove and discard the 2 Torx bolts.



E48363

17. Remove the LH secondary timing chain, tensioner and sprocket assembly.

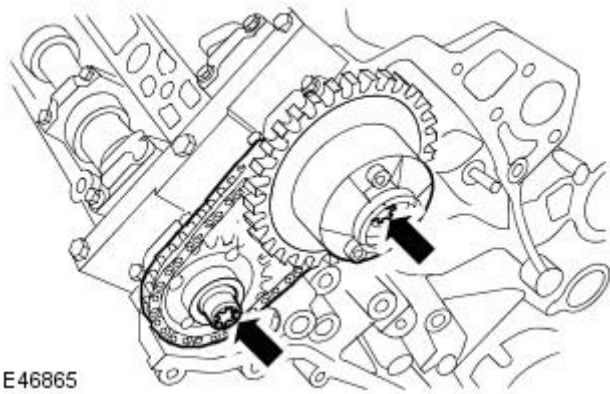
- Remove the 2 bolts.



E48364

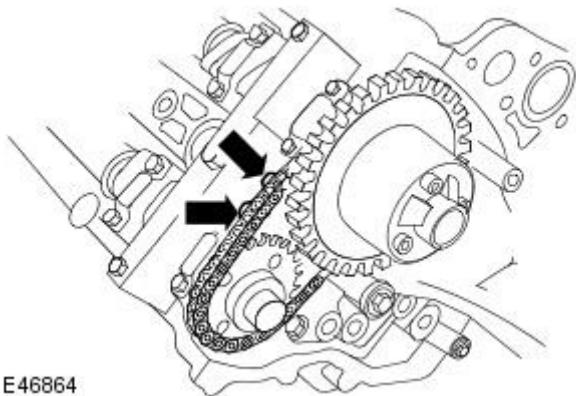
18. Release the RH camshaft sprocket assembly.

- Remove and discard the 2 Torx bolts.



19. Remove the RH secondary timing chain, tensioner and sprocket assembly.

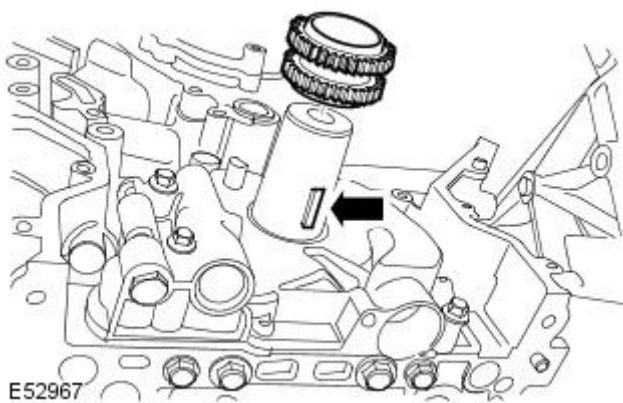
- Remove the 2 retaining bolts.



20. NOTE: Note the orientation of the crankshaft sprocket.

Remove the crankshaft sprocket.

- Remove the crankshaft sprocket key.

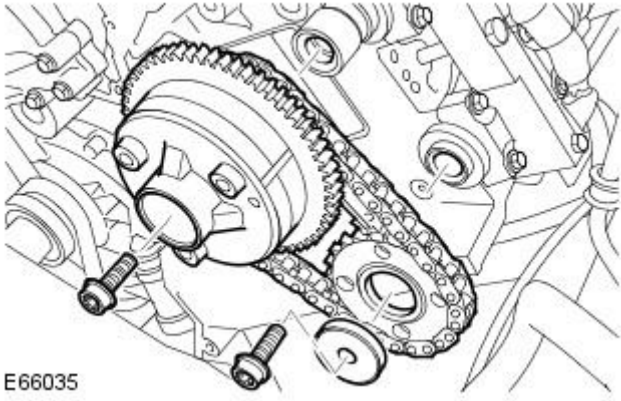


## Installation


1. Install the crankshaft sprocket.

- Clean the components.
- Install the crankshaft sprocket key.





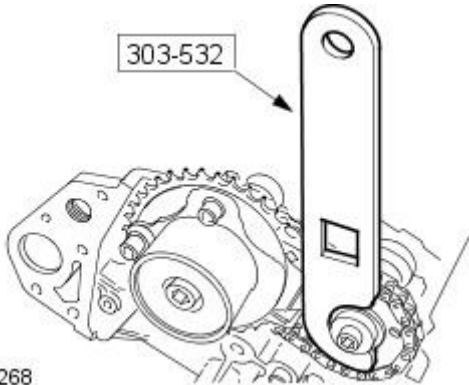
E66035

2.  **CAUTION:** Make sure the secondary timing chain and camshaft sprockets are free to rotate.

• **NOTE:** LH illustration shown, RH is similar.

Install the LH secondary timing chain, tensioner and sprocket assembly.

- Clean the components.
- Install the Torx bolts, but do not tighten fully at this stage.



E31268

3. Install the special tool to the exhaust camshaft sprocket.

- Reposition the camshaft sprockets for the most advantageous position for use of the special tool.

4. Install the LH secondary timing chain tensioner retaining bolts.


- Tighten to 12 Nm.

5. Install the LH primary timing chain.

- Clean the components.
- Make sure the timing chain slack is on the tensioner side of the timing chain.

6. Install the LH primary timing chain tensioner guides.

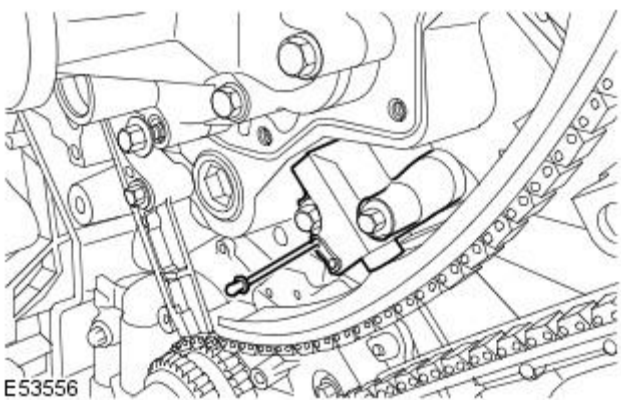
- Clean the components.
- Tighten to 12 Nm.

7.  **CAUTION:** During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

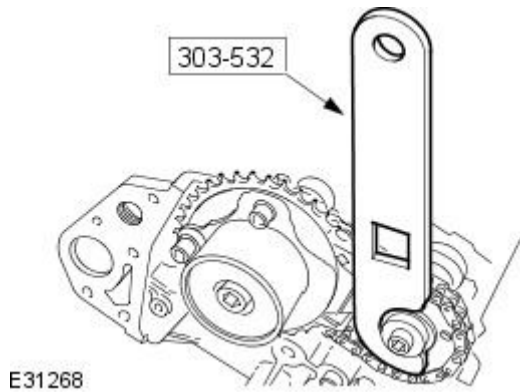
• **NOTE:** LH illustration shown, RH is similar.

Install the LH primary timing chain tensioner.




- Clean the components.
- Using 3 mm diameter metal rod, retain the chain tensioner piston.
- Remove the retaining rod.
- Tighten to 12 Nm.



E53556



#### 8. CAUTIONS:

-  Using the special tool, apply force to the tool in a counter-clockwise direction, to tension the primary timing chain on its drive side.
-  The intake camshaft sprocket retaining bolt **MUST** be tightened before the exhaust camshaft sprocket retaining bolt. Engine damage will occur if this procedure is not followed.
-  Make sure that new bolts are installed.

Install the special tool to the LH exhaust camshaft sprocket.

- Tighten the intake camshaft sprocket retaining bolt to 20 Nm + 90 deg.
- Tighten the exhaust camshaft sprocket retaining bolt to 20 Nm + 90 deg.

#### 9. Install the LH VCT control solenoid housing.

- Clean the components.
- Install the new O-ring seals.
- Tighten the nut to 10 Nm.
- Tighten to 22 Nm.

#### 10. CAUTION: Make sure the secondary timing chain and camshaft sprockets are free to rotate.

Install the RH secondary timing chain, tensioner and sprocket assembly.

- Clean the components.
- Install the Torx bolts, but do not tighten fully at this stage.

#### 11. Install the RH secondary timing chain tensioner retaining bolts.

- Tighten to 12 Nm.

#### 12. Install the RH primary timing chain.

- Clean the components.
- Make sure the timing chain slack is on the tensioner side of the timing chain.

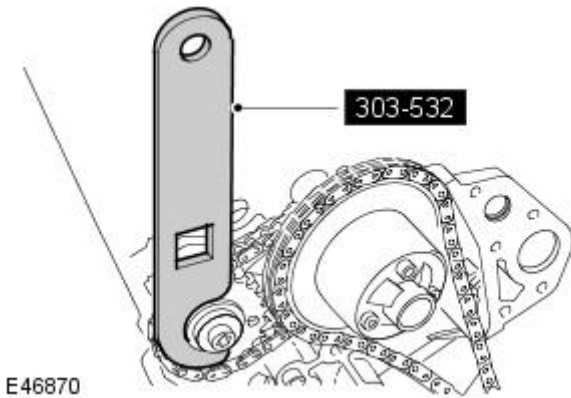
#### 13. Install the RH primary timing chain tensioner guides.

- Tighten to 12 Nm.

#### 14. CAUTION: During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

Install the RH primary timing chain tensioner.

- Clean the components.
- Using 3 mm diameter metal rod, retain the chain tensioner piston.
- Tighten to 12 Nm.
- Remove the retaining rod.



#### 15. CAUTIONS:

- ⚠ Using the special tool, apply force to the tool in a counter-clockwise direction, to tension the primary timing chain on its drive side.
- ⚠ The intake camshaft sprocket retaining bolt **MUST** be tightened before the exhaust camshaft sprocket retaining bolt. Engine damage will occur if this procedure is not followed.
- ⚠ Make sure that new bolts are installed.

Install the special tool to the RH exhaust camshaft sprocket.

- Tighten the intake camshaft sprocket retaining bolt to 20 Nm + 90 deg.
- Tighten the exhaust camshaft sprocket retaining bolt to 20 Nm + 90 deg.

#### 16. Install the RH VCT control solenoid housing.

- Clean the components.
- Install the new O-ring seals.
- Tighten to 22 Nm.

#### 17. Remove the special tool from the RH cylinder head.

- Remove the 3 bolts.

#### 18. Remove the special tool from the LH cylinder head.

- Remove the 3 bolts.

#### 19. Install the engine front cover.

For additional information, refer to: [Engine Front Cover](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).

#### 20. Remove the crankshaft locking tool.

- Remove the screw.

#### 21. Install the CKP sensor.


For additional information, refer to: [Crankshaft Position \(CKP\) Sensor - 4.2L NA V8 - AJV8](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

#### 22. Install the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

## Engine - 4.2L NA V8 - AJV8 - Valve Cover LH

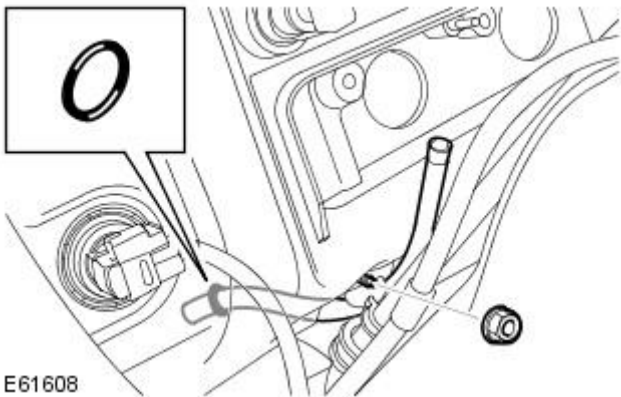
In-vehicle Repair

Special Tool(s)	
 <p>E45289</p>	Fuel spring lock decoupling tool
	310-D005

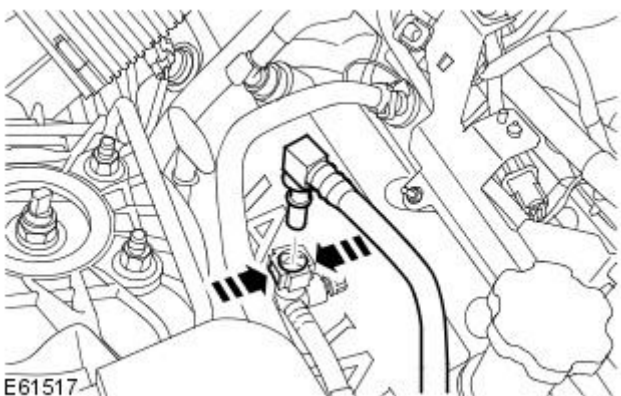
### Removal

- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the ignition coil-on-plug.  
For additional information, refer to: [Ignition Coil-On-Plug - 4.2L NA V8 - AJV8](#) (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
3. Remove the remaining ignition coil-on-plugs.
4. Remove the oil level indicator and tube.
  - Remove the nut.
  - Remove and discard the O-ring seal.



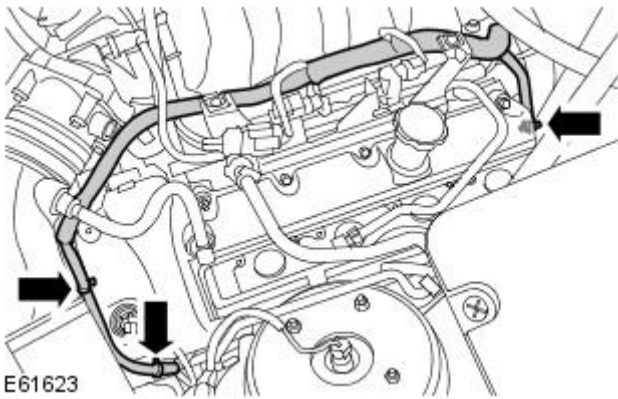
5. Release the clip and disconnect the purge inlet line.



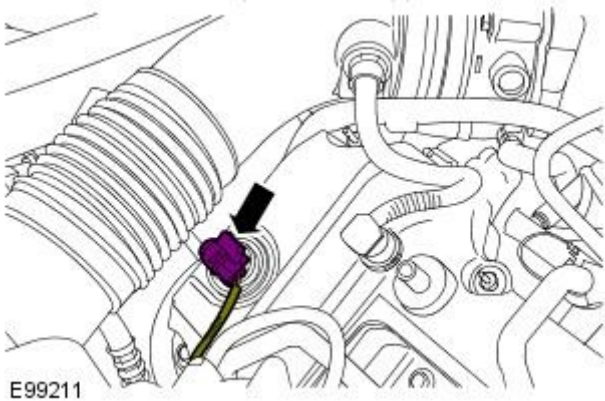


6. Remove the engine cover bracket.

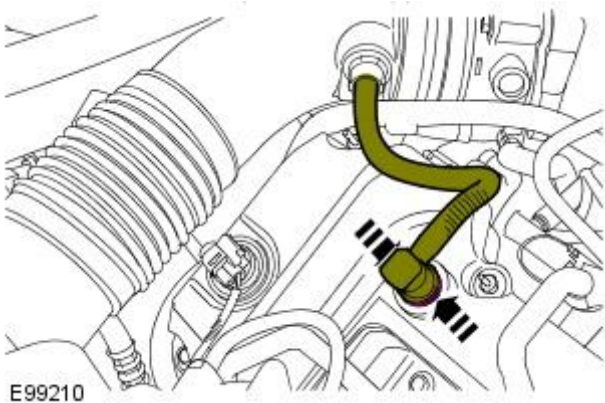
- Remove the 2 nuts.
- Position the bracket aside.



7. Release the 3 wiring harness clips.



8. Disconnect the variable camshaft timing (VCT) oil control solenoid electrical connector.

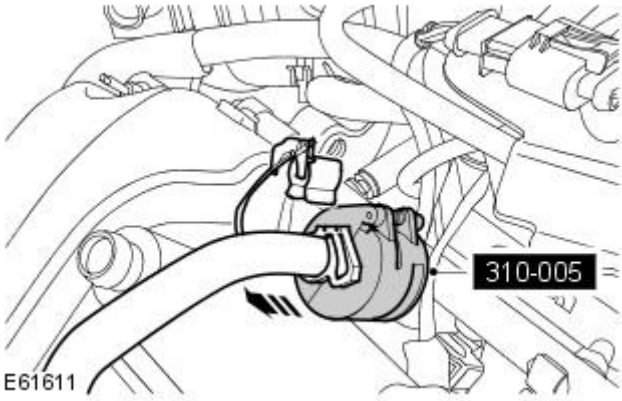


9. Disconnect the valve cover breather hose.



10. Using the special tool, disconnect the fuel line.

- Release the clip.
- Position an absorbent cloth to collect fluid spillage.



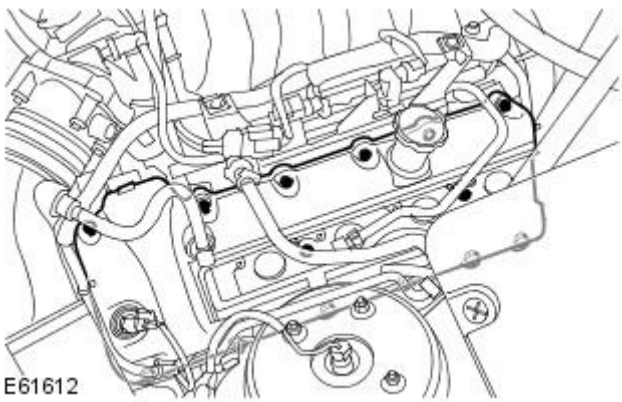
11. Remove the secondary bulkhead LH panel.

For additional information, refer to: [Secondary Bulkhead Panel LH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).

12. NOTE: Note the fitted position of the retaining bolts prior to removal.

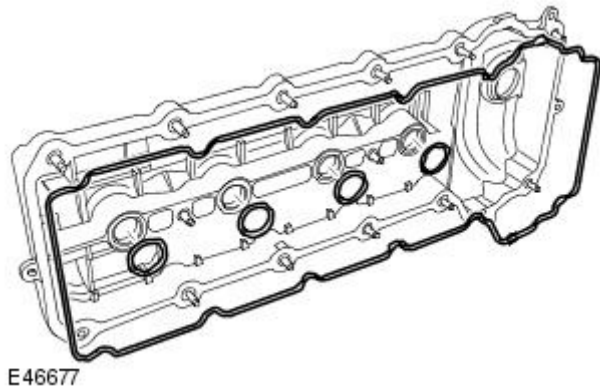
Remove the valve cover assembly.

- Remove the 14 valve cover retaining bolts.



13. Remove and discard the valve cover gasket.

- Carefully remove the sealant.

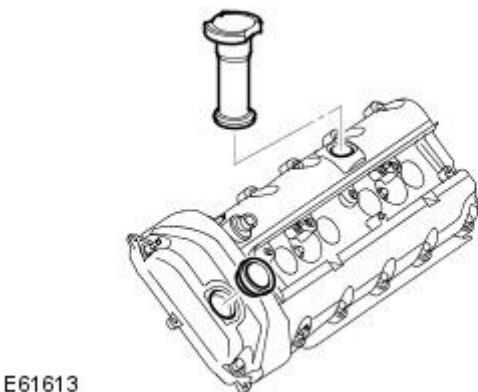


14. Remove the valve cover plug aperture seals.

15. Remove the VCT oil control solenoid seal.  
16. NOTE: Do not disassemble further if the component is removed for access only.

Remove the oil filler pipe.

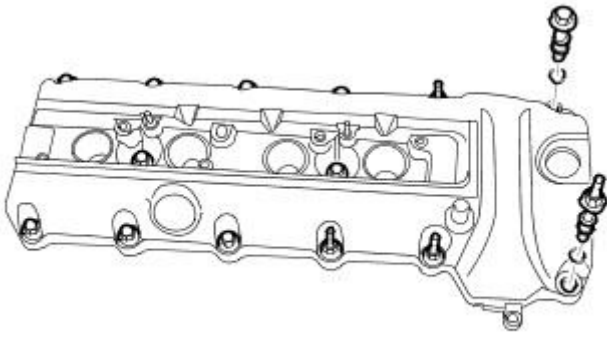
- Remove and discard the O-ring seal.





17. NOTE: Note the fitted position.

Remove the bolts, remove and discard the seals.



E61614

## Installation

1. NOTE: Install the components to their original fitted positions.

Install the seals and bolts.

2. Install the oil filler pipe.

- Install a new O-ring seal.

3. Install new valve cover plug aperture seals.

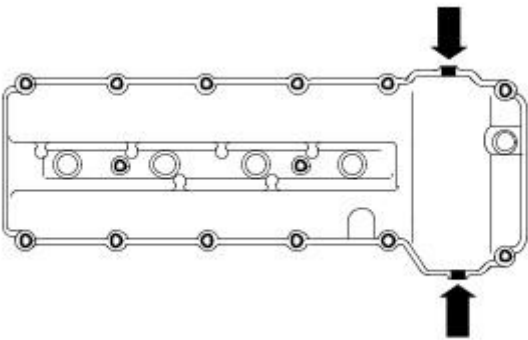
4. Install a new valve cover gasket.

5. Install the new VCT oil control solenoid seal.

6. NOTE: Apply two beads of silicone gasket sealant as shown on the illustration. The application of the sealant must be 3mm diameter 12mm long. Install the valve cover immediately after applying the sealant. The cover should be fitted directly to the head without smearing the sealant or the seals.

Install the valve cover.

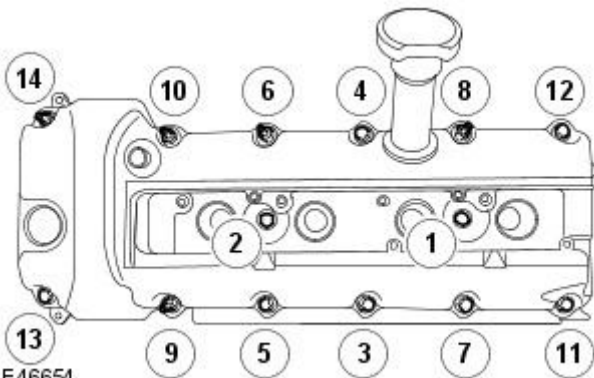
- Clean the component mating faces.



E49922

7. Install the valve cover retaining bolts.

- Complete the tightening sequence as illustrated.
- Tighten to 12 Nm.



E46654

8. Install the secondary bulkhead LH panel.

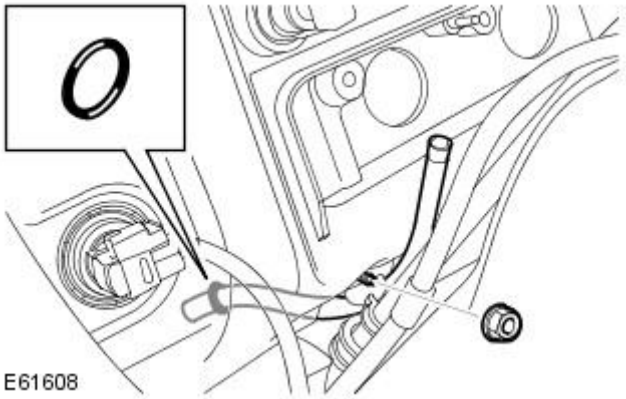
For additional information, refer to: [Secondary Bulkhead Panel LH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).



E61609

9. Install the engine cover mounting bracket.

- Tighten to 10 Nm.



E61608

10. Connect the purge line.

11. Install the oil level indicator and tube.

- Install a new O-ring seal.
- Tighten to 6 Nm.

12. Connect the fuel line.

- Secure the clip.

13. Connect the VCT oil solenoid electrical connector.

14. Install the ignition coil-on-plug.

For additional information, refer to: [Ignition Coil-On-Plug - 4.2L NA V8 - AJV8](#) (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

15. Install the remaining ignition coil-on-plugs.

16. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

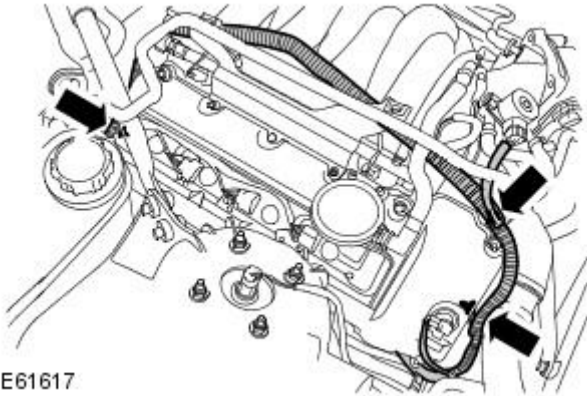
## Engine - 4.2L NA V8 - AJV8 - Valve Cover RH

In-vehicle Repair

### Removal

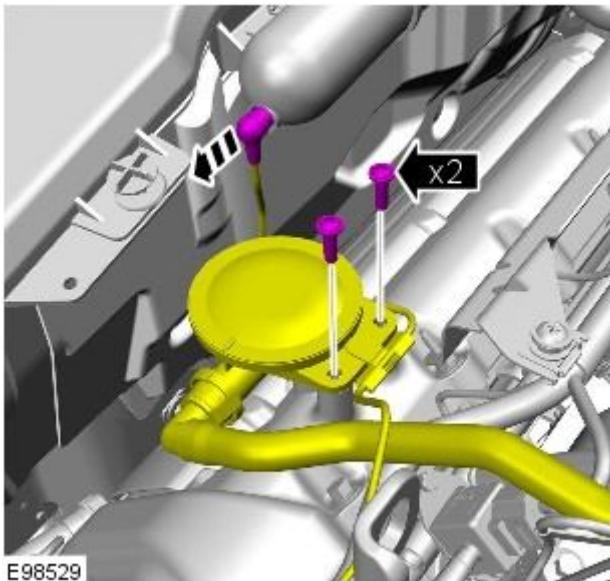
• NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the ignition coil-on-plug.  
For additional information, refer to: [Ignition Coil-On-Plug - 4.2L NA V8 - AJV8](#) (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
3. Remove the remaining ignition coil-on-plugs.
4. Release the 3 wiring harness clips.



E61617

5. Detach the positive crankcase ventilation (PCV) valve from the RH valve cover.
  - Disconnect the vacuum hose.



E98529



6. Remove the engine cover bracket.

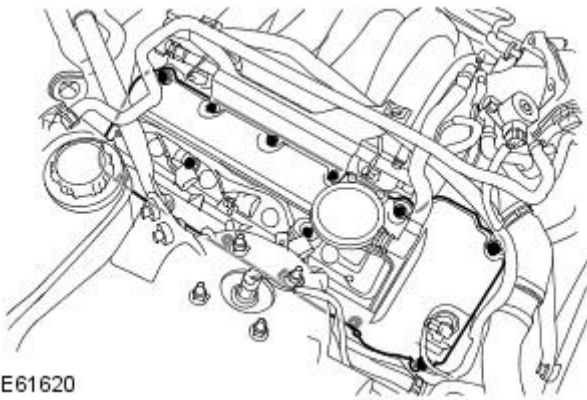
- Remove the 2 nuts.
- Position the bracket aside.

7. Remove the secondary bulkhead RH panel.

For additional information, refer to: [Secondary Bulkhead Panel RH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).

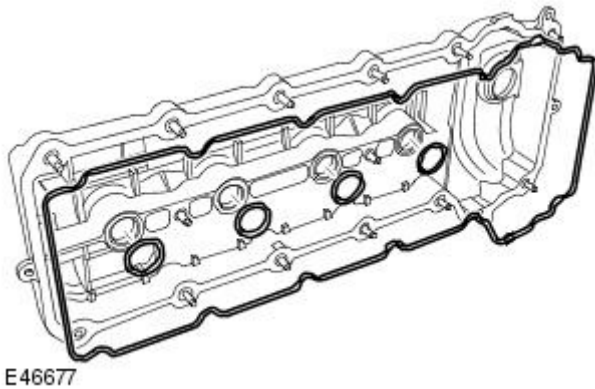
8. Remove the valve cover assembly.

- Remove the 14 valve cover retaining bolts.

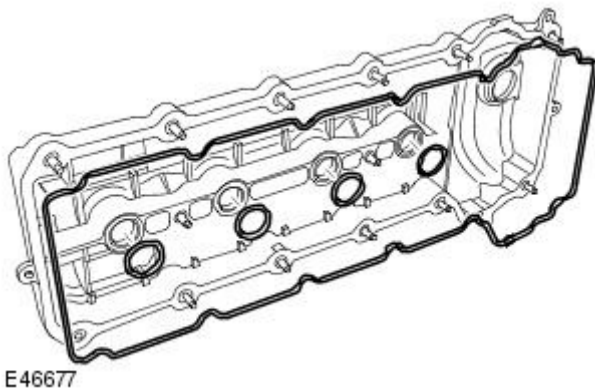


9. Remove and discard the valve cover gasket.

- Carefully remove the sealant.

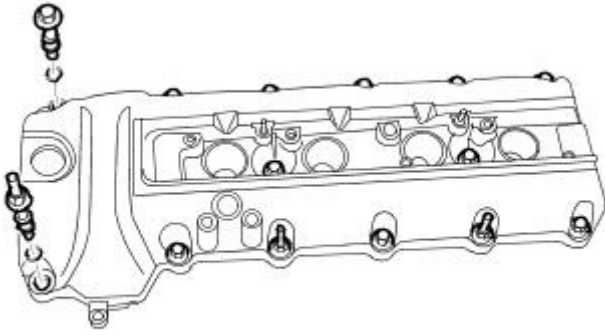


10. Remove the valve cover plug aperture seals.



11. NOTE: Note the fitted position.

Remove the bolts, remove and discard the seals.

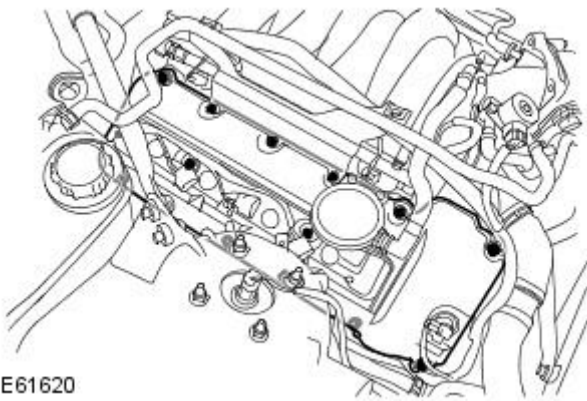


E61627

## Installation

1. To install, reverse the removal procedure.

- Tighten to 12 Nm.



E61620

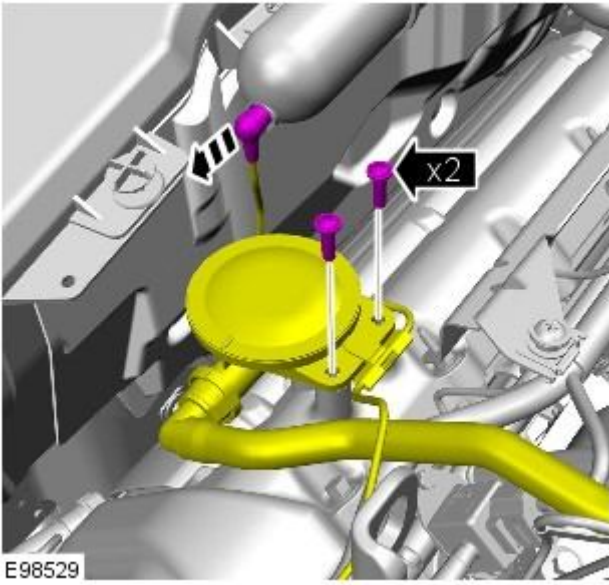
2. Tighten to 10 Nm.



E61619




3. Tighten to 4 Nm.






## Engine - 4.2L NA V8 - AJV8 - Oil Filter Housing

In-vehicle Repair

Special Tool(s)	
 <p>303-752</p> <p>E75849</p>	<p>Wrench, Oil filter</p> <p>303-752</p>

### Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02, Removal and Installation).
4. Disconnect the engine oil temperature sensor electrical connector.



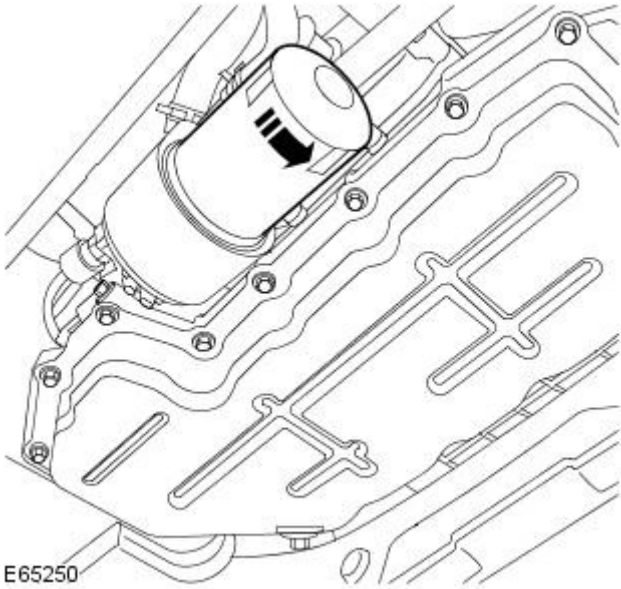
5. Disconnect the engine oil pressure (EOP) sensor electrical connector.

**6. NOTE:** Some oil spillage is inevitable during this operation.

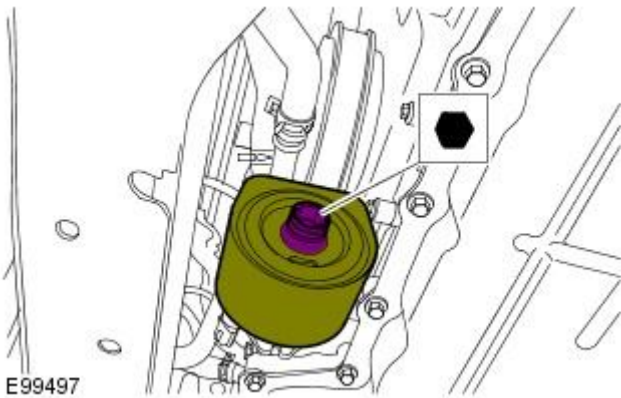
• **NOTE:** Clean the components general area prior to dismantling.

Remove the oil filter.

- Position a container to collect the fluid.
- Drain the engine oil.

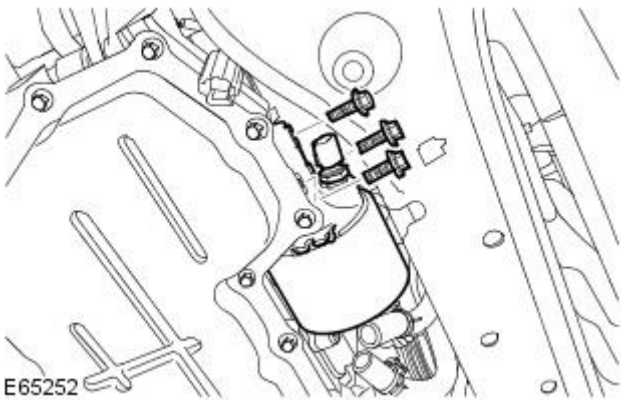


**7.** Detach the oil cooler housing from the oil filter housing.



**8.** Remove the oil filter housing.

- Remove the 3 bolts.
- Remove and discard the O-ring seal.



9. NOTE: Do not disassemble further if the component is removed for access only.

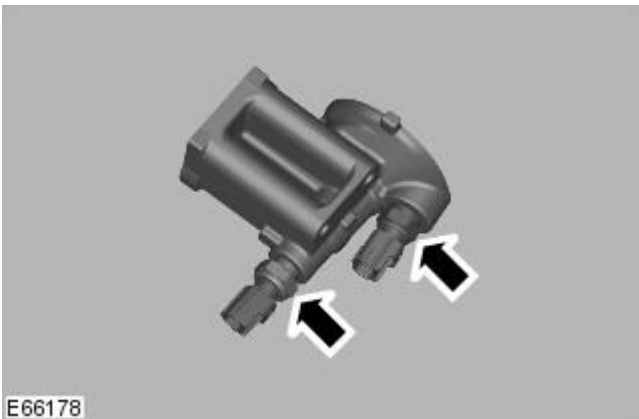
Remove the engine oil temperature and oil pressure sensors



## Installation

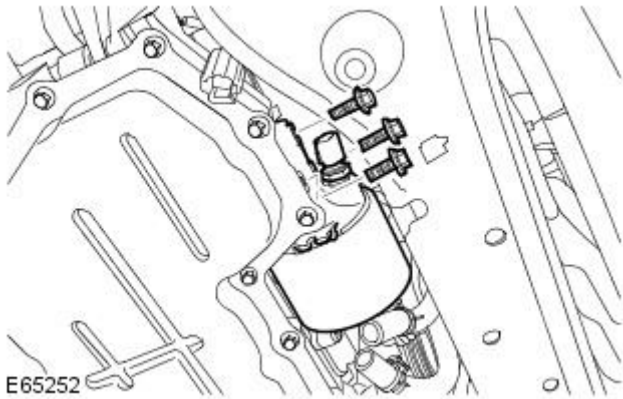
1. NOTE: Do not disassemble further if the component is removed for access only.

Install the engine oil temperature and oil pressure sensors



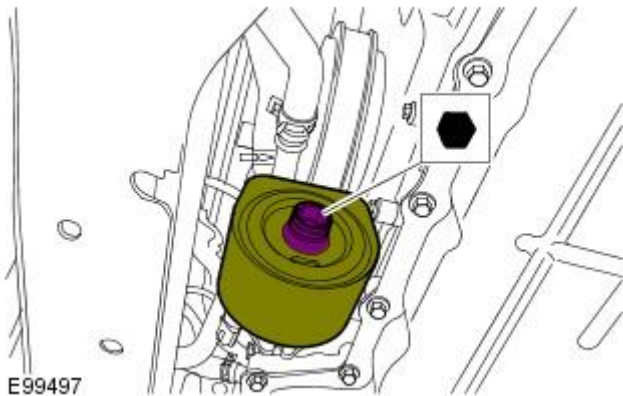
2. Install the oil filter housing.

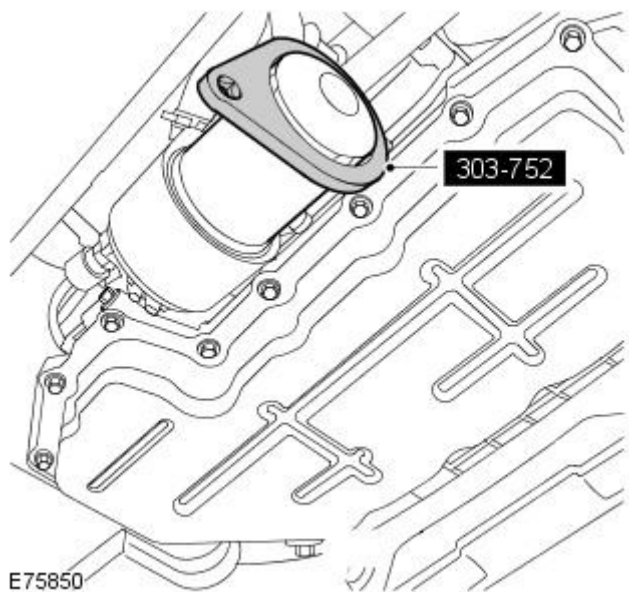
- Clean the component mating faces.
- Install a new O-ring seal.
- Tighten to 20 Nm.



3. Attach the oil cooler housing to the oil filter housing.

- Tighten to 58 Nm.





4. Using the special tool, install the oil filter.

- Lubricate the oil filter seal with clean engine oil and tighten to 18 Nm .

5. Connect the EOP sensor electrical connector.

6. Connect the engine oil temperature sensor electrical connector.

7. Install the air deflector.

For additional information, refer to: Air Deflector (501-02, Removal and Installation).


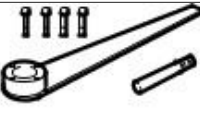


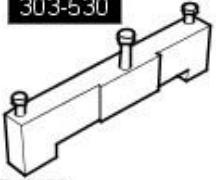
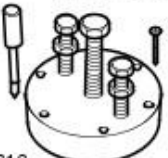


8. Connect the battery ground cable.

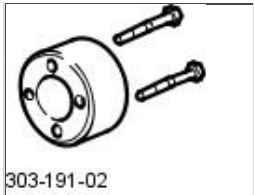
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

9. Check and top-up the engine oil.

**Engine - 4.2L NA V8 - AJV8 - Crankshaft Main Bearing Carrier**

Removal and Installation

<b>Special Tool(s)</b>	
 <p><b>303-191-04</b></p> <p>E59251</p>	Bolts and spacers 303-191-04
 <p>303-191</p>	Crankshaft pulley locking tool 303-191
 <p><b>303-D121</b></p> <p>E64849</p>	Remover, crankshaft seal 303-D121
 <p><b>303-645</b></p> <p>E46881</p>	Timing Setting tool 303-645
 <p><b>303-530</b></p> <p>E46879</p>	Camshaft setting/locking tool 303-530
 <p><b>303-538</b></p> <p>E46616</p>	Crankshaft rear oil seal remover/installer 303-538
 <p>303-750</p>	Seal installer 303-750
 <p>303-751</p>	Seal extractor 303-751




Crankshaft pulley locking tool adapter  
303-191/02

303-191-02

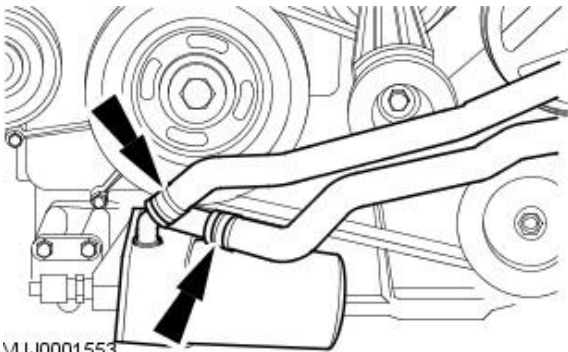
### Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

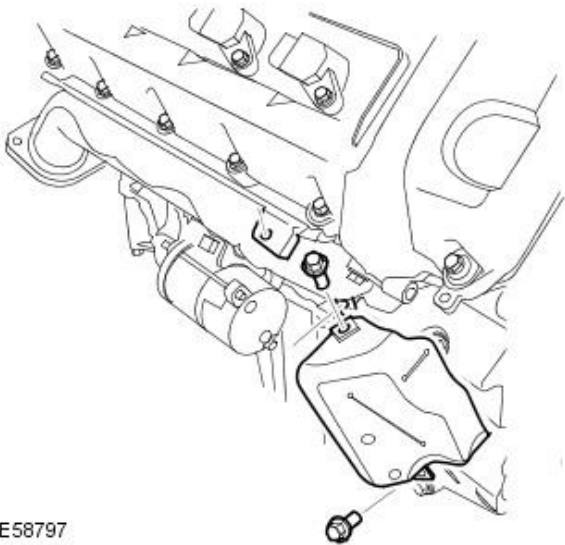
3. Remove the engine.  
For additional information, refer to: [Engine](#) (303-01A Engine - 4.2L NA V8 - AJV8, Removal).
4. Mount the engine to an engine stand.
5. Disconnect the 2 oil cooler hoses.



VUJ0001553

6. Remove the exhaust manifold heat shield.

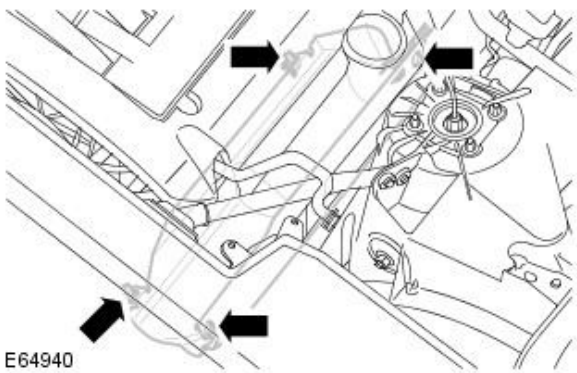
- Remove the 2 bolts.



E58797

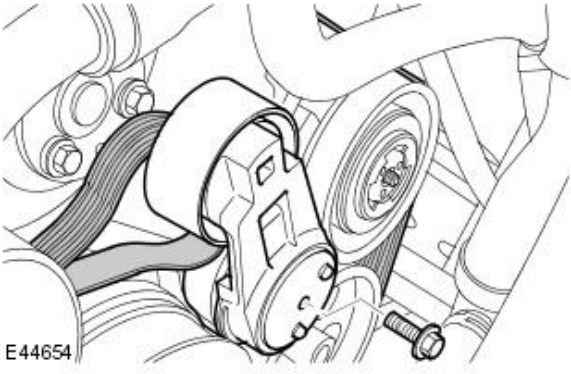
7. Release the accessory drive belt.

- Rotate the accessory drive belt tensioner counter-clockwise, using a 3/8 " drive wrench.



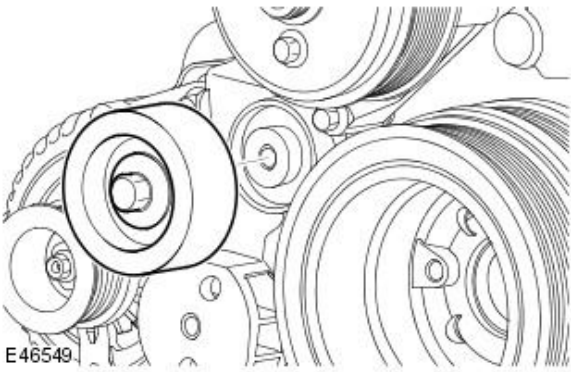
E64940





8. Remove the accessory drive belt tensioner.

- Remove the bolt.

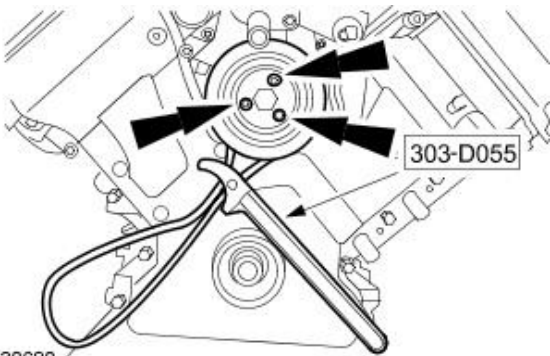


9. NOTE: Note the fitted position of the accessory drive belt.

Remove the accessory drive belt.

10. Remove the accessory drive belt idler pulley.

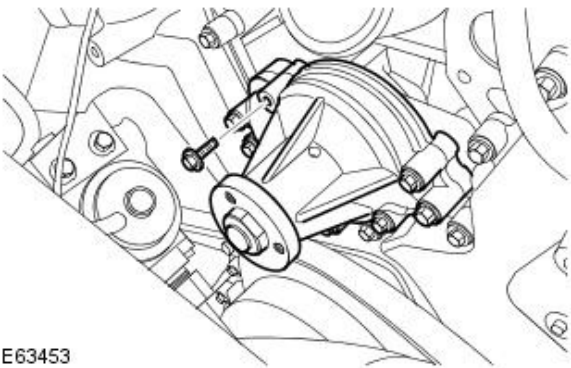
- Remove the bolt.



11. NOTE: Restrain the pulley to aid the removal of the bolts.

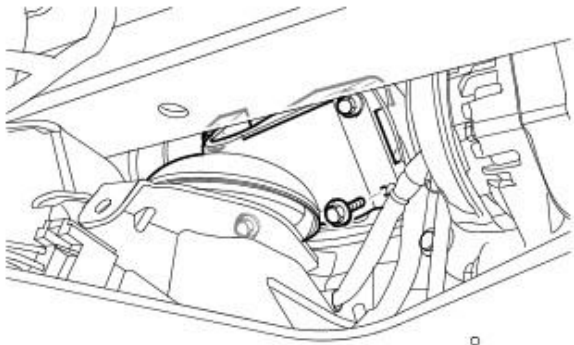
Using the special tool, remove the coolant pump pulley.

- Remove and discard the 3 bolts.



12. Remove the coolant pump.

- Remove the 5 bolts.
- Remove and discard the gasket.

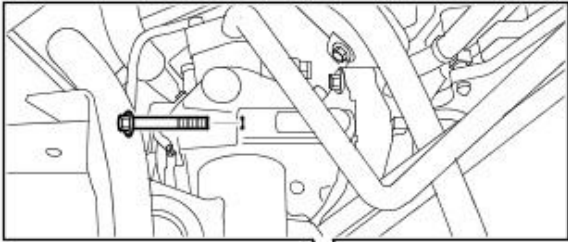


E62722

**13. NOTE: Right-hand shown, left-hand similar.**

Remove both the engine mounts and brackets.

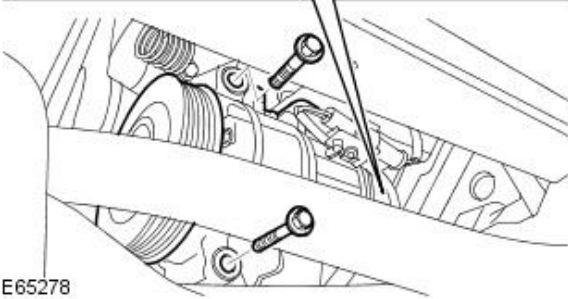
- Remove the 4 bolts.
- Repeat the above procedure for the other side.



E65278

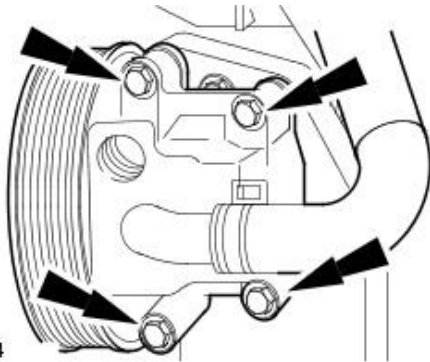
**14. Remove the air conditioning (A/C) compressor.**

- Remove the 3 bolts.
- Disconnect the electrical connector.



**15. Remove the power steering pump.**

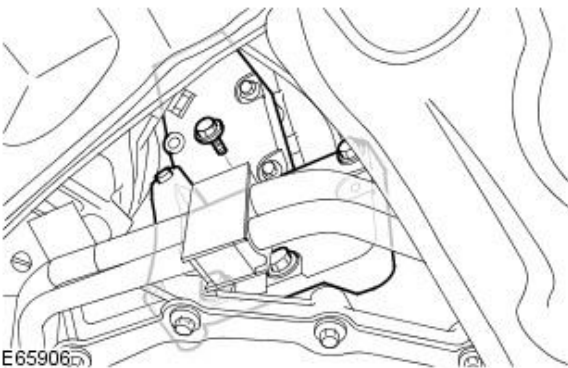
- Remove the 4 bolts.



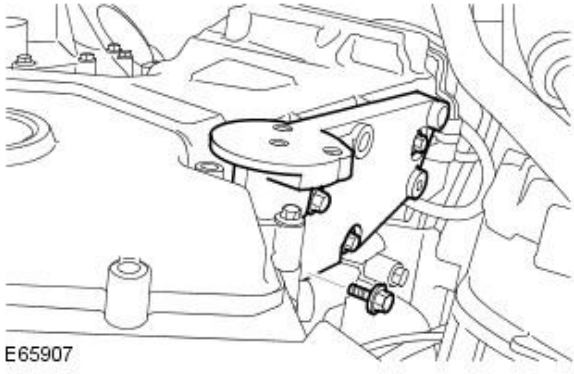
E30644

**16. Remove the A/C compressor mounting bracket.**

- Remove the 4 bolts.



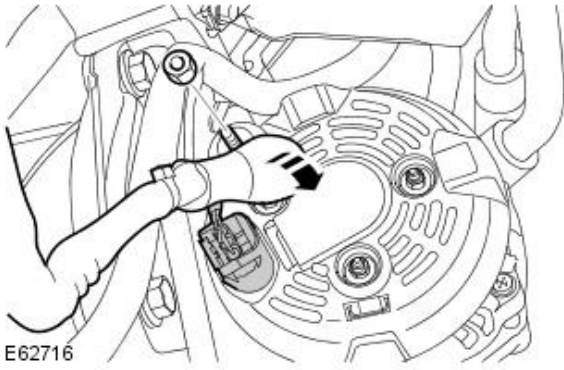
E65906



E65907

17. Remove the power steering pump mounting bracket.

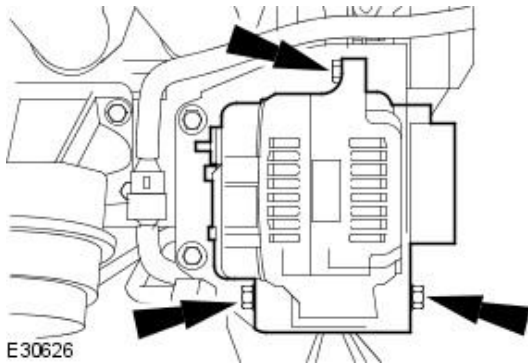
- Remove the 4 bolts.



E62716

18. Disconnect the battery positive cable and the generator electrical connector.

- Release the cover.
- Remove the nut.
- Disconnect the electrical connector.



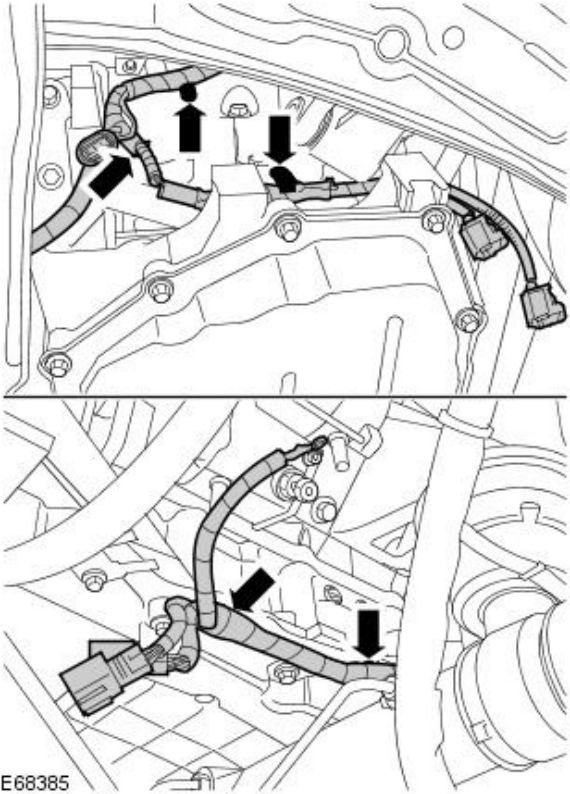
E30626

19. Remove the generator.

- Remove the nut.
- Remove the nut and bolt.

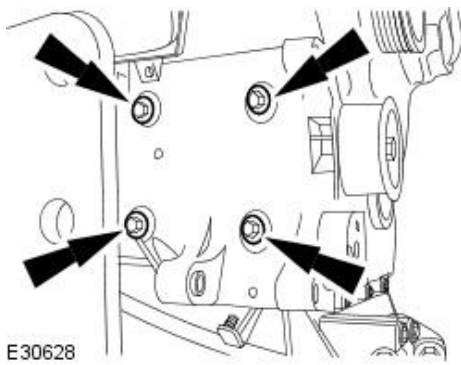
20. RH side: Release the engine wiring harness.

- Release the 5 clips.



21. Remove the generator mounting bracket.

- Remove the 4 bolts.

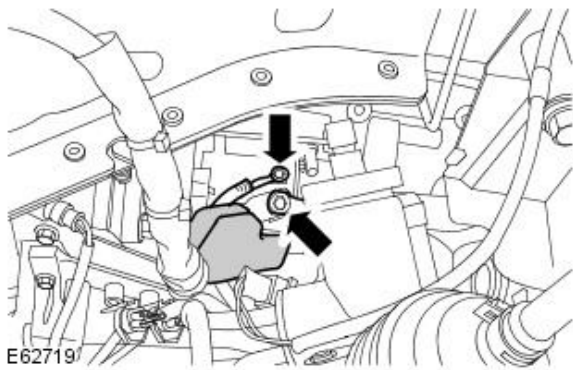


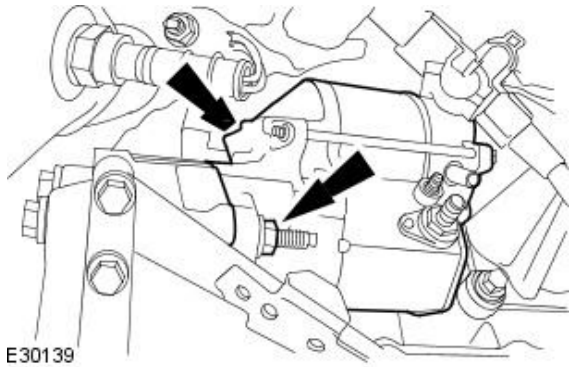
22. Disconnect the battery positive cable.

- Release the cover.
- Remove the nut.

23. Disconnect the starter motor solenoid electrical connector.

- Remove and discard the nut.

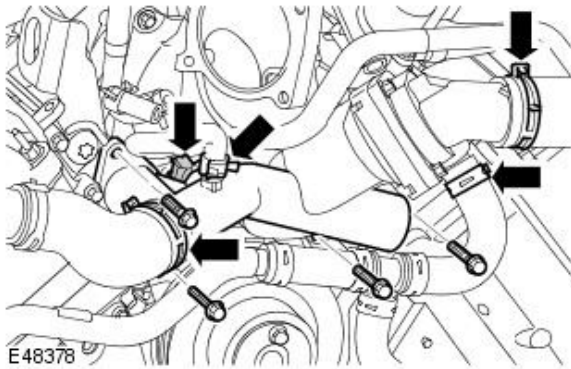




E30139

24. Remove the starter motor.

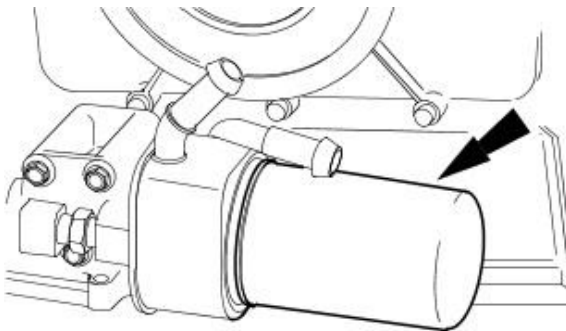
- Remove the 2 bolts.



E48378

25. Remove the coolant manifold.

- Release the clips and disconnect the 4 coolant hoses.
- Remove the 4 bolts.
- Disconnect the engine coolant temperature (ECT) sensor electrical connector.



VUJ0001576

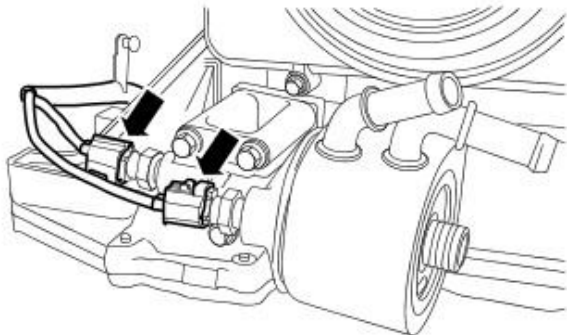
26. NOTE: Some oil spillage is inevitable during this operation.

- NOTE: Clean the components general area prior to dismantling.

Remove the oil filter.

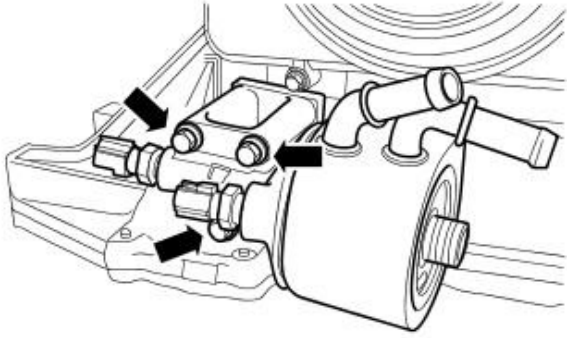
27. Disconnect the engine oil pressure (EOP) sensor electrical connector.

28. Disconnect the engine oil temperature sensor electrical connector.



E82652

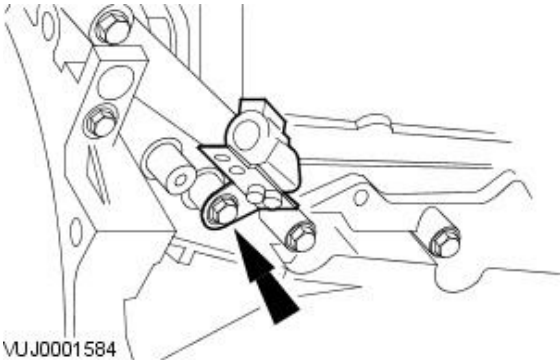




E82653

29. Remove the oil filter housing.

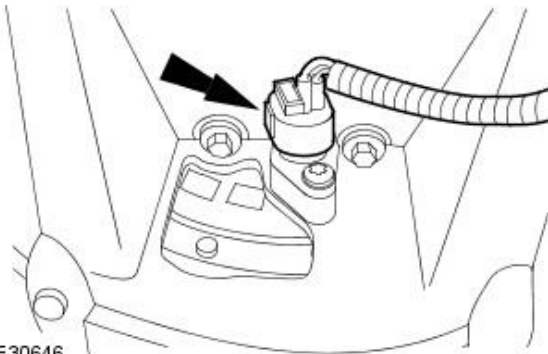
- Remove the 3 bolts.
- Remove and discard the O-ring seal.



VUJ0001584

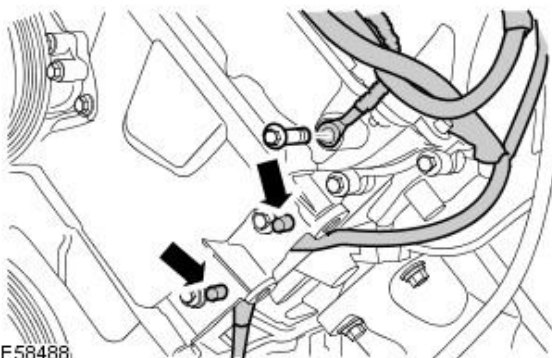
30. NOTE: Right-hand shown, left-hand similar.

Release the 2 heated oxygen sensor (HO2S) harness brackets.



E30646

31. Disconnect the crankshaft position (CKP) sensor electrical connector.

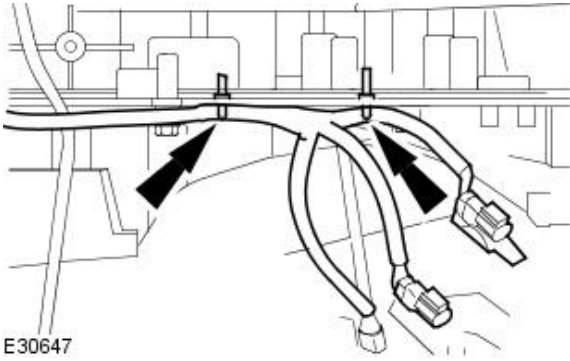


E58488

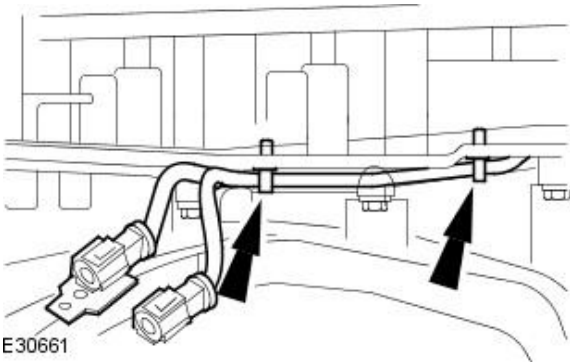
32. Release the engine wiring harness.

- Release the 2 clips.
- Remove the bolt.

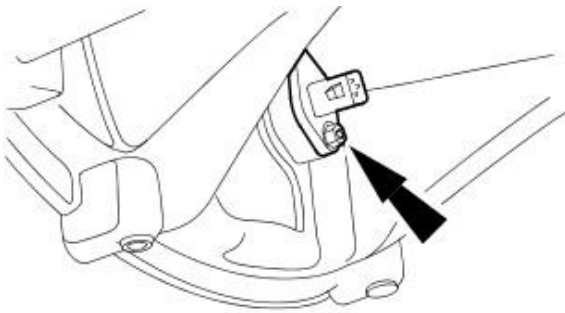




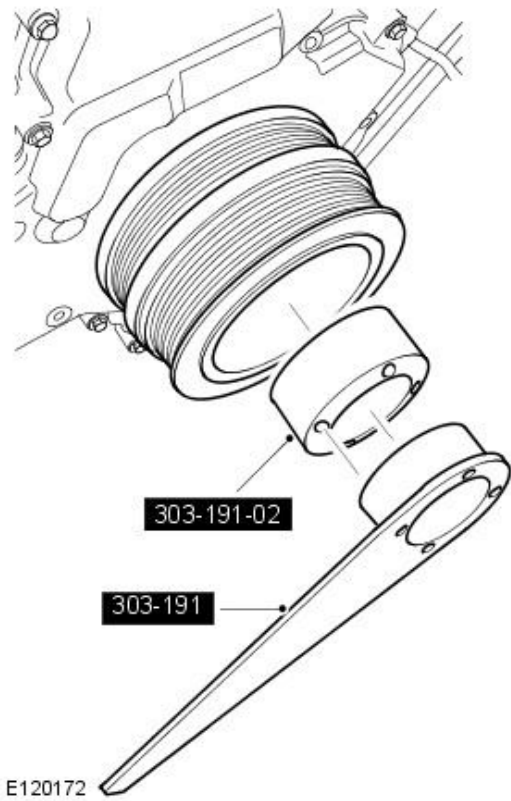
33. Release the wiring harness from the LH side of the engine.
- Release the clips.




34. Release the wiring harness from the RH side of the engine.
- Release the clips.



35. Remove the CKP sensor.
- Remove the bolt.



**36.**  **CAUTION:** Under no circumstances should the crankshaft setting peg, 303-645, be used in the following operations, to restrain the crankshaft.

Using the special tools, retain the crankshaft pulley.

**37. NOTE:** The crankshaft pulley retaining bolt will be very tight.

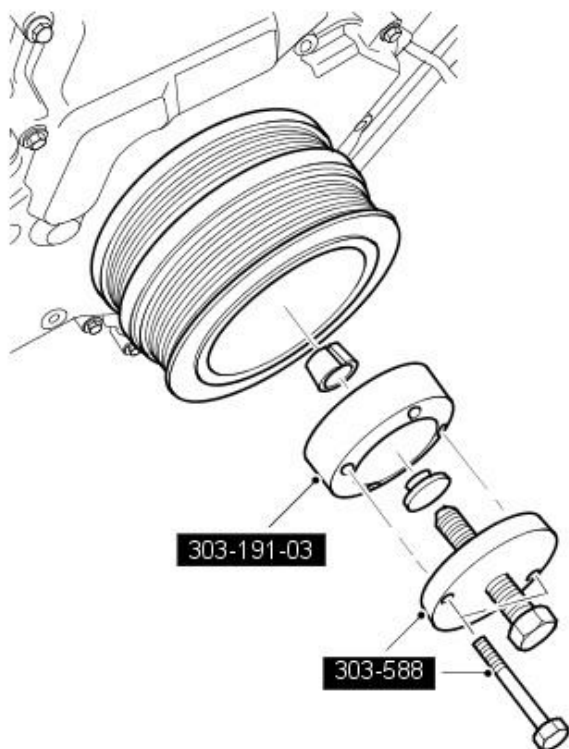
Using the special tools, remove the crankshaft pulley bolt.

- Discard the bolt.
- Remove the special tools.

**38. NOTE:** The crankshaft pulley will be very tight.

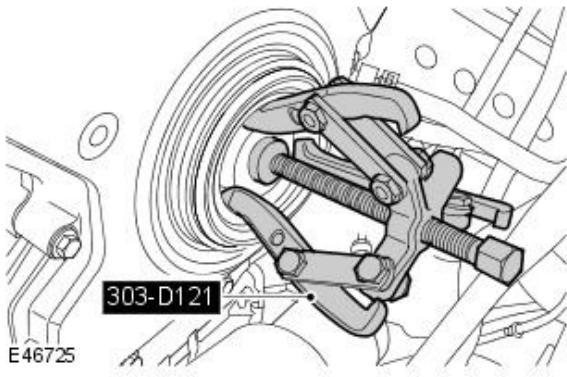
Using the special tools, remove the crankshaft pulley.

- Collect the locking ring.
- Remove the special tools.



E46724

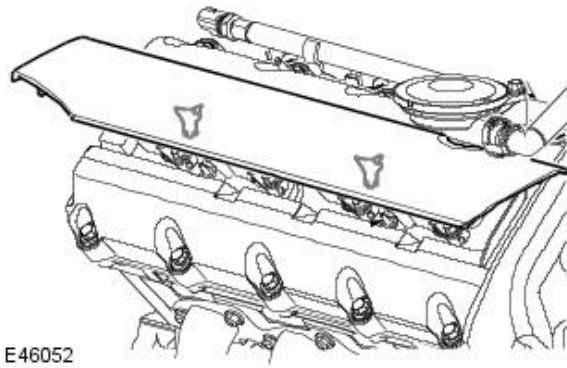
39. Using the special tool, remove and discard the crankshaft front seal.



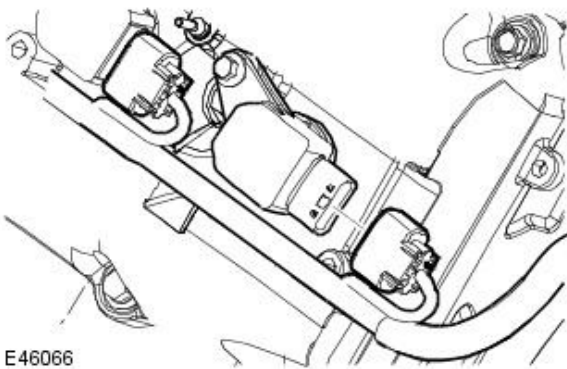
40. NOTE: Right-hand shown, left-hand similar.

Remove both the ignition coil-on-plug covers.

- Release from the 2 clips.

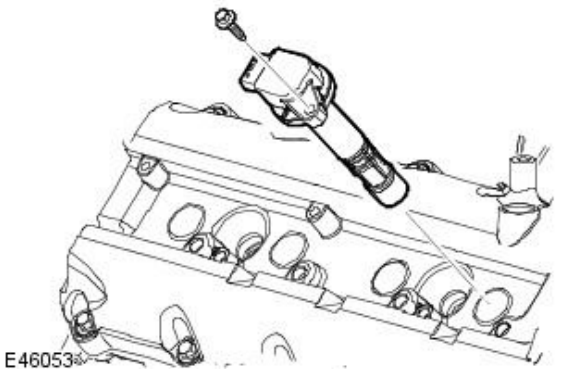


41. Disconnect the RH ignition coil-on-plug electrical connector.



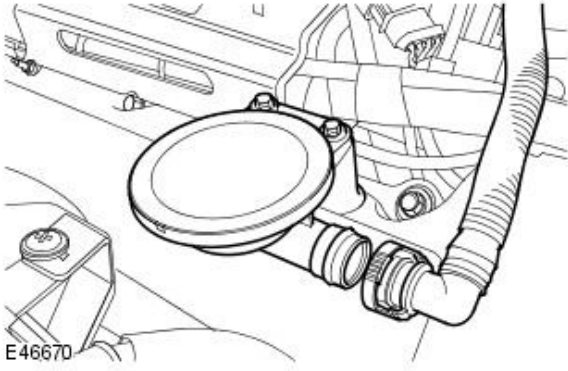
42. Remove the RH ignition coil-on-plug.

- Remove the bolt.
- Remove and discard the seal.



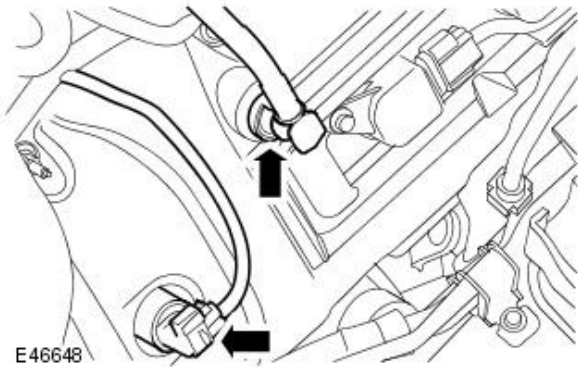
43. Remove the remaining RH ignition coil-on-plugs.

44. Disconnect the positive crankcase ventilation (PCV) line.

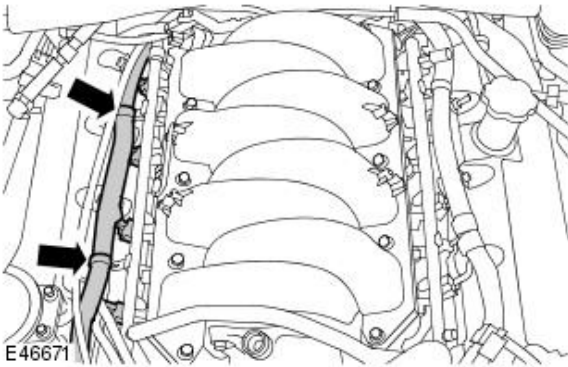


45. Disconnect the LH variable camshaft timing (VCT) oil solenoid electrical connector.

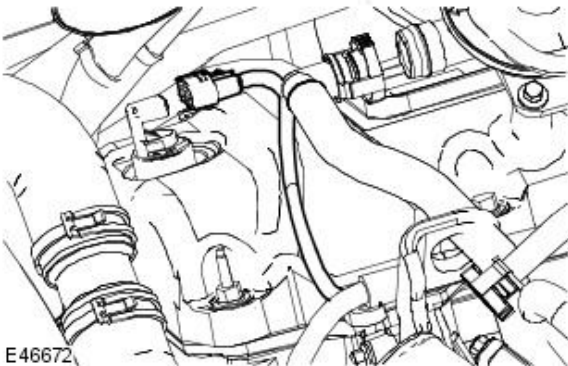
46. Disconnect the valve cover breather hose.

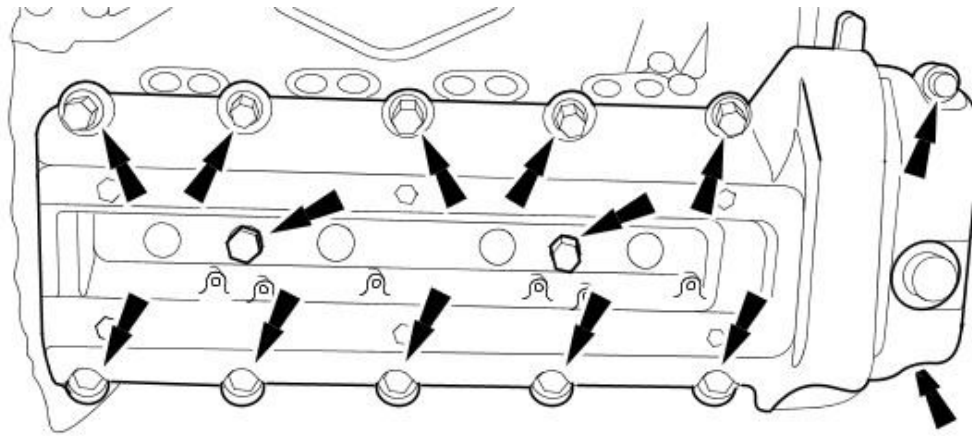


47. Release the engine wiring harness from the retaining bracket.



48. Disconnect the RH variable camshaft timing (VCT) oil solenoid electrical connector.





**49. NOTE:** Note the fitted position of the retaining bolts prior to removal.

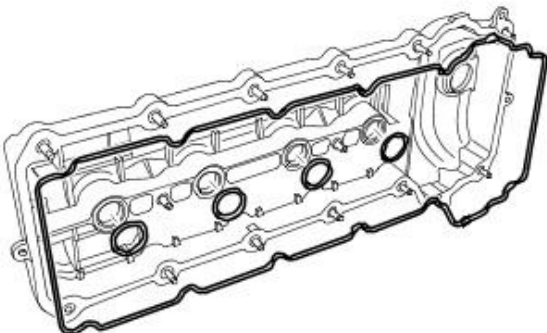
Remove the RH valve cover.

- Remove the 14 valve cover retaining bolts.
- Remove the engine cover bracket.

E30696

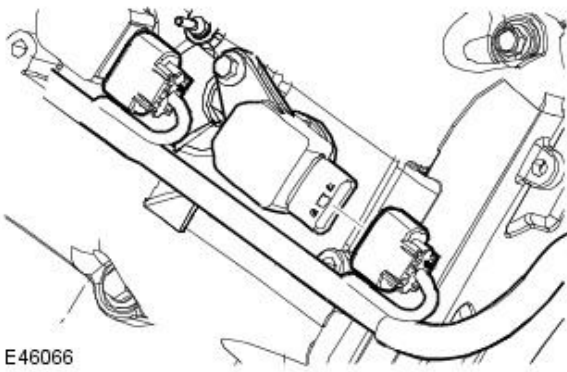
**50.** Remove and discard the RH valve cover gaskets.

- Remove and discard the seals.



E46677

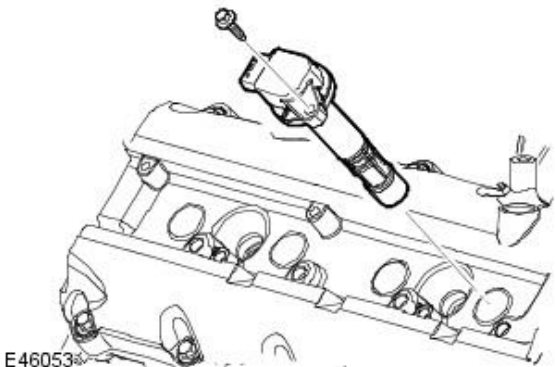
**51.** Disconnect the LH ignition coil-on-plug electrical connector.



E46066

**52.** Remove the LH ignition coil-on-plug.

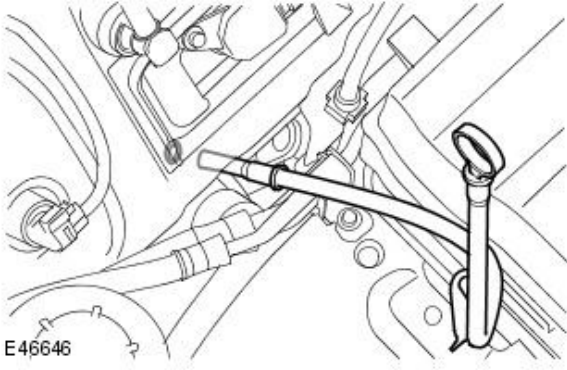
- Remove the bolt.
- Remove and discard the seal.



E46053

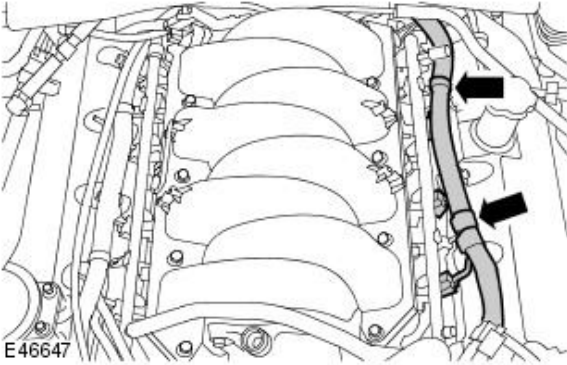
**53.** Remove the remaining LH ignition coil-on-plugs.



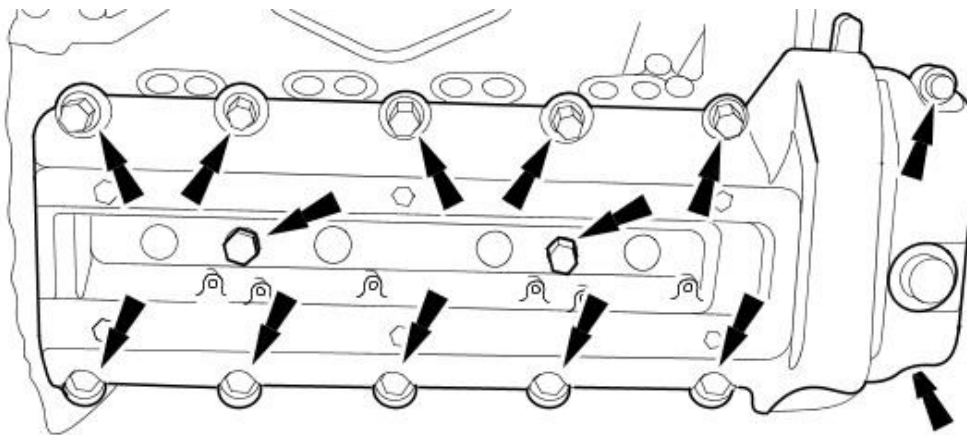


54. Remove the oil level indicator and tube.

- Remove the oil level indicator.
- Remove the nut.
- Remove the tube.
- Remove and discard the O-ring seal.



55. Release the engine wiring harness from the retaining bracket.



56. NOTE: Note the fitted position of the retaining bolts prior to removal.

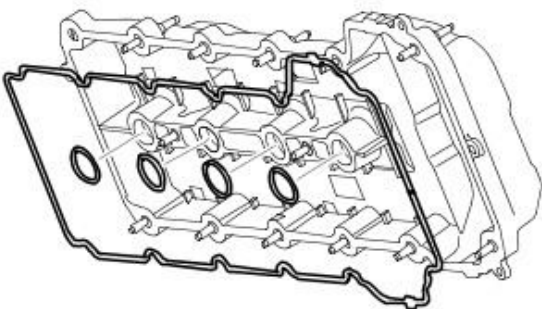
Remove the LH valve cover.

- Remove the 14 valve cover retaining bolts.

E30696

57. Remove and discard the LH valve cover gaskets.

- Remove and discard the seals.



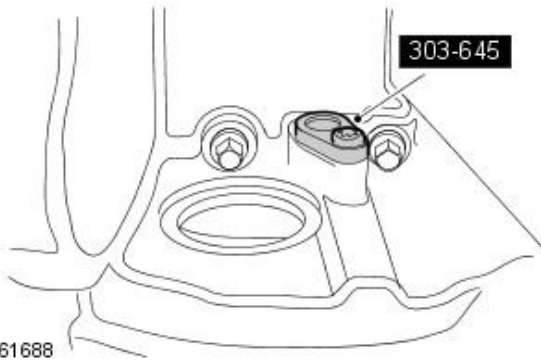
E46652



58. NOTE: Install the special tool to the crankshaft sensor aperture.

Lock the crankshaft.

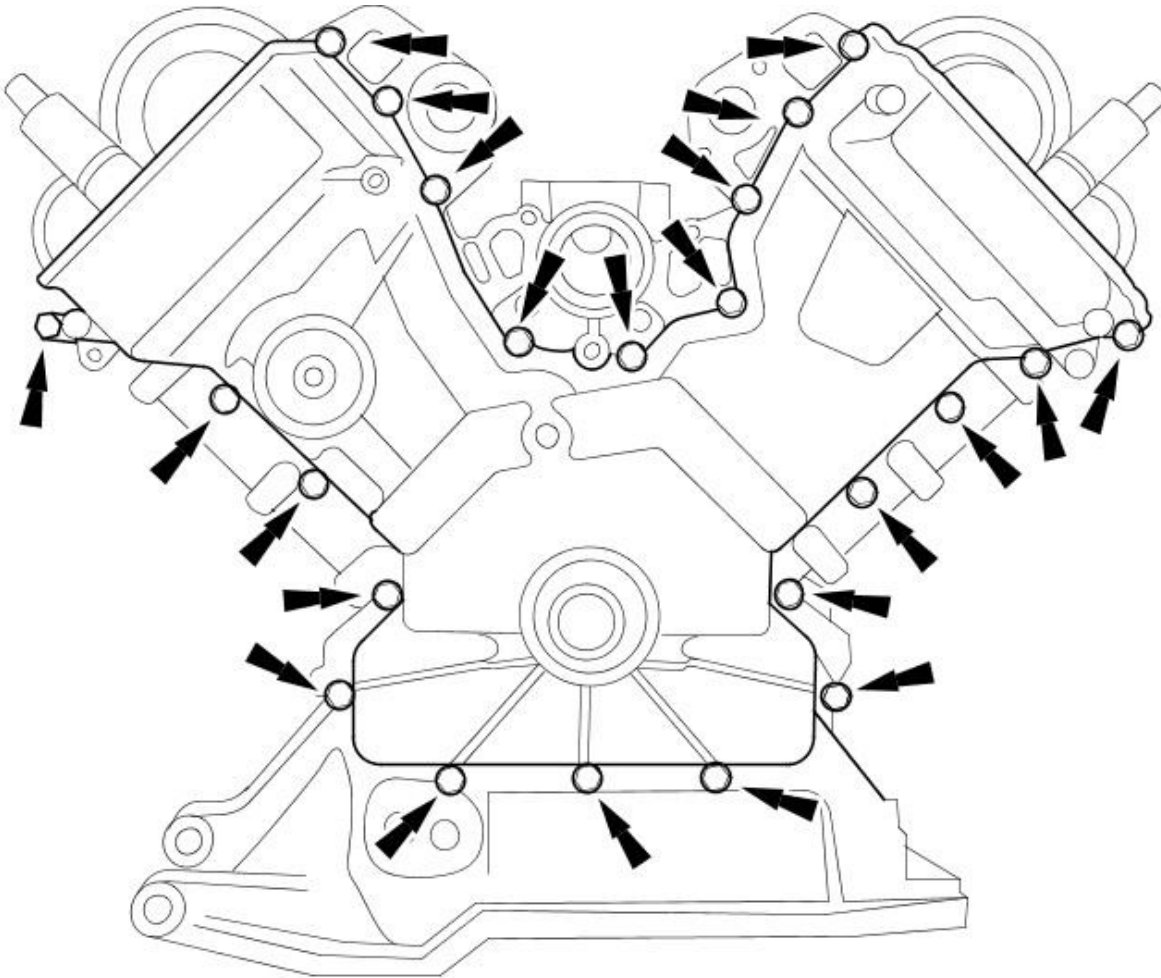
- Install the special tool.
- Install the bolt.



E61688

59. Remove the engine front cover.

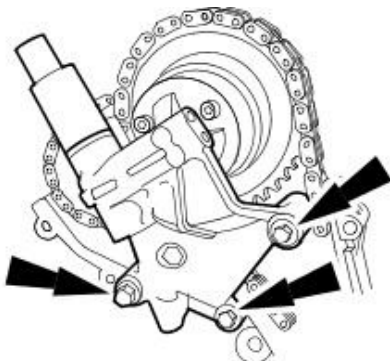
- Remove the 24 bolts.
- Remove and discard the gasket.
- Remove and discard the 3 O-ring seals.



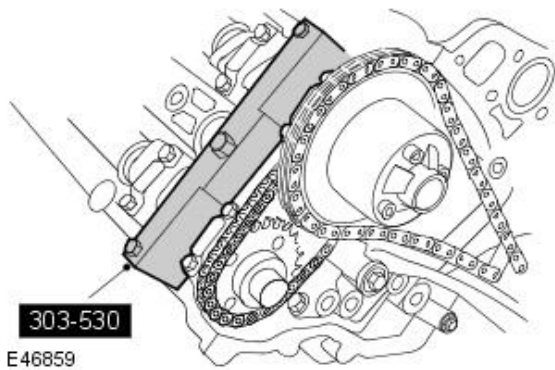
VUJ0002398

60. Remove the RH VCT housing.

- Remove the 3 bolts.
- Remove and discard the O-ring seals.

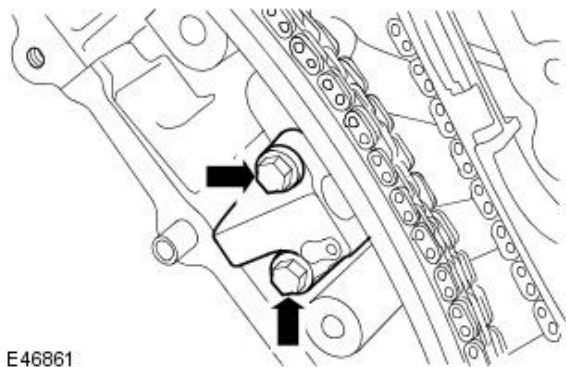


E30699



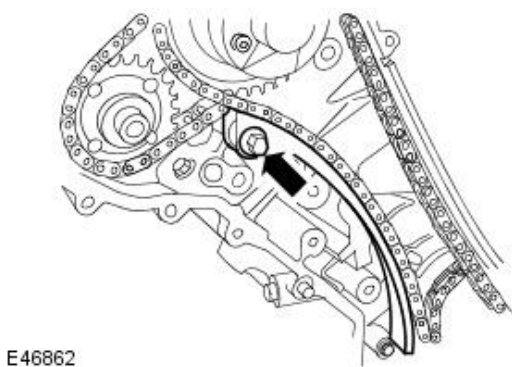
61. Install the special tool to the RH cylinder head.

- Install the 3 bolts.



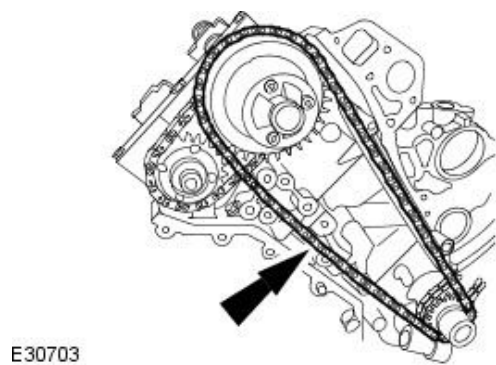
62. Remove the RH primary timing chain tensioner assembly.

- Remove the 2 bolts.

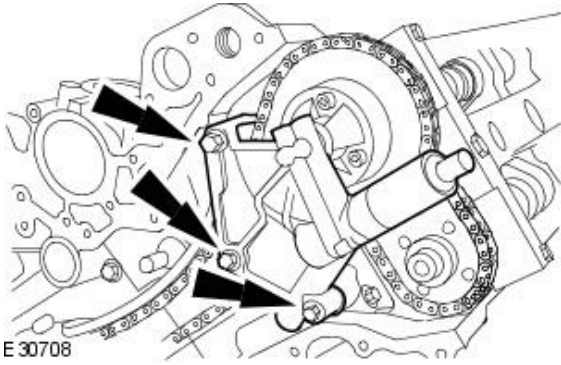


63. Remove the RH primary timing chain tensioner guide.

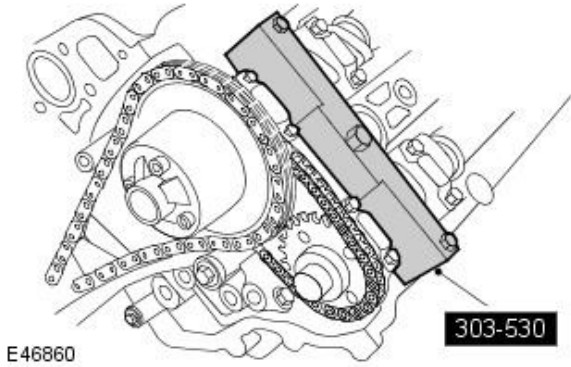
- Remove the bolt.



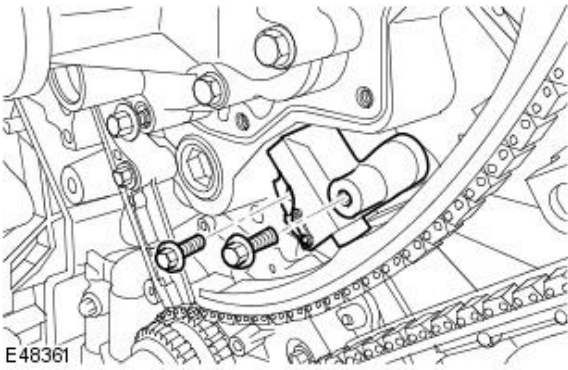
64. Remove the RH primary timing chain.



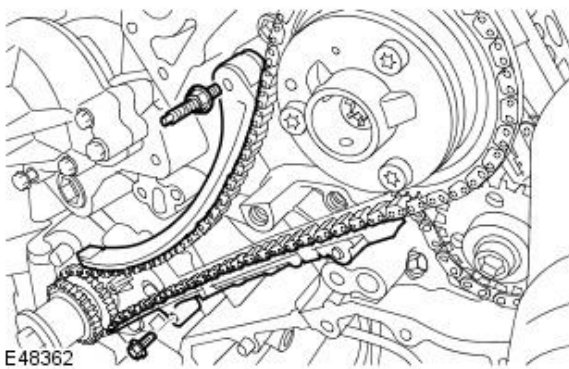
65. Remove the LH VCT housing.
- Remove the 3 bolts.
  - Remove and discard the O-ring seals.



66. Install the special tool to the LH cylinder head.
- Install the 3 bolts.

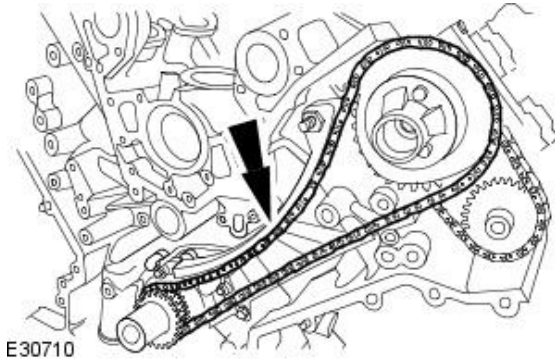


67. Remove the LH primary timing chain tensioner.
- Remove the 2 bolts.



68. Remove the LH upper and lower primary timing chain tensioner guides.
- Remove the 2 bolts.

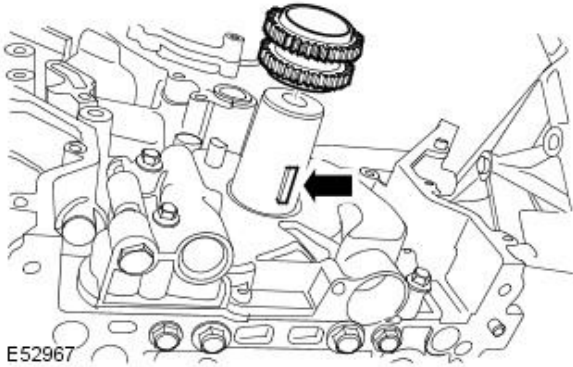
69. Remove the LH primary timing chain.



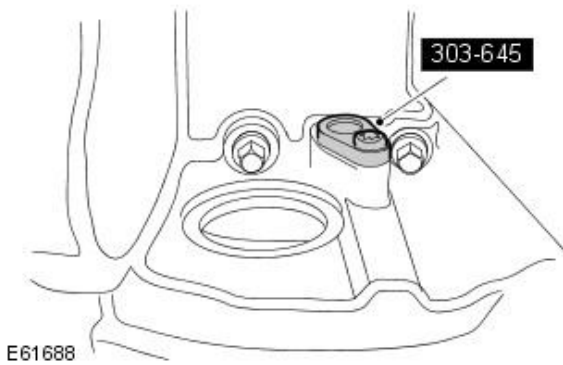
70. NOTE: Note the orientation of the crankshaft sprocket.

Remove the crankshaft sprocket.

- Remove the crankshaft sprocket key.

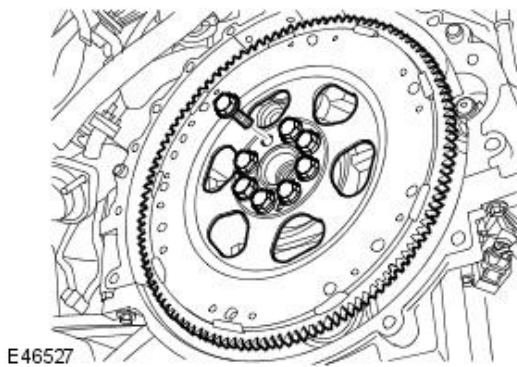


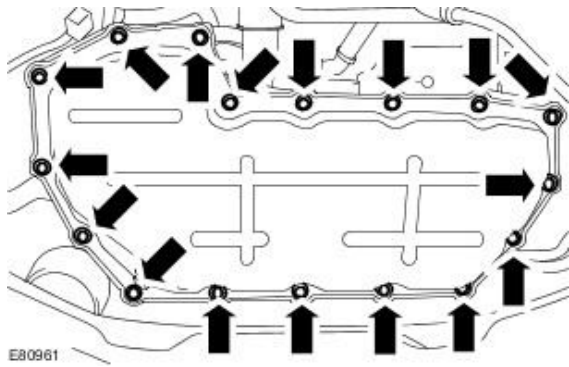
71. Remove the special tool.



72. Remove the torque converter flexplate.

- Remove and discard the 8 bolts.

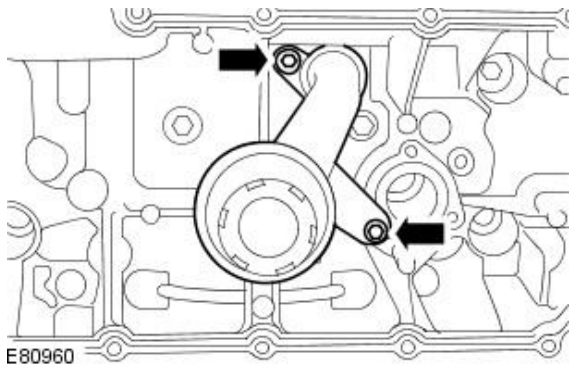




73.  CAUTION: Note the position of the bolts, prior to removal.

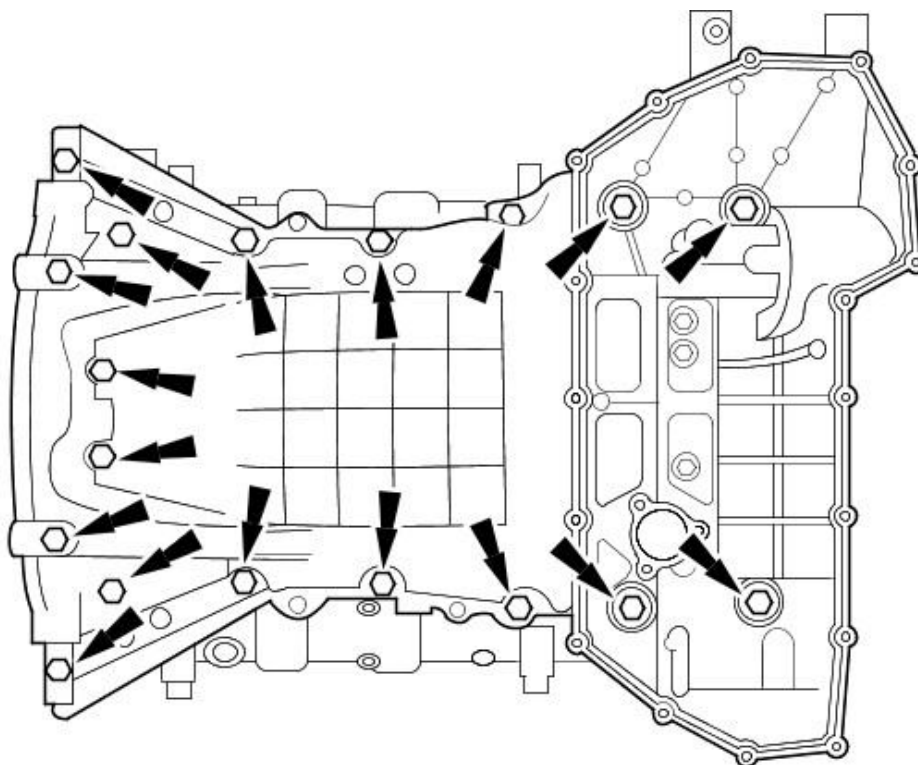
Remove the oil pan.

- Remove the 17 bolts.
- Remove and discard the gasket.



74. Remove the oil strainer pick-up assembly.

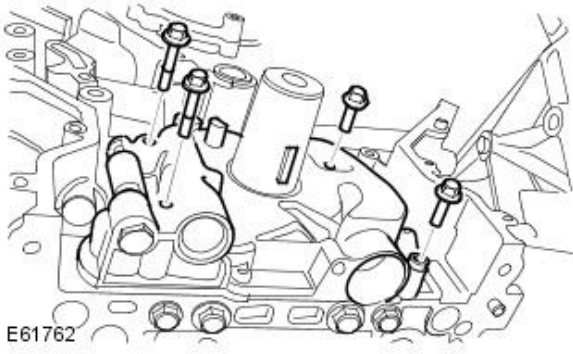
- Remove the 2 bolts.
- Remove and discard the O-ring seal.



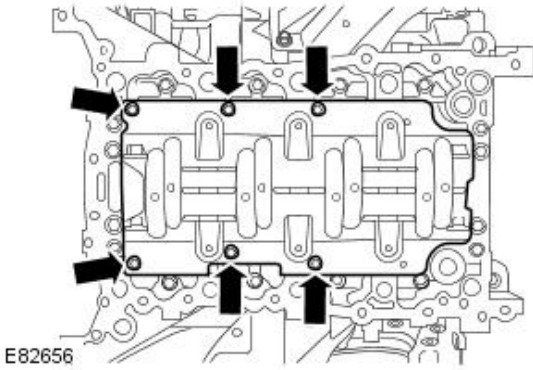
75. Remove the oil pan extension.

- Remove the 18 bolts.






76. Remove the oil pump assembly.
- Remove the 4 bolts.
  - Remove and discard the gasket.
  - Clean the component mating faces.



77. Remove the baffle plate.
- Remove the 6 bolts.

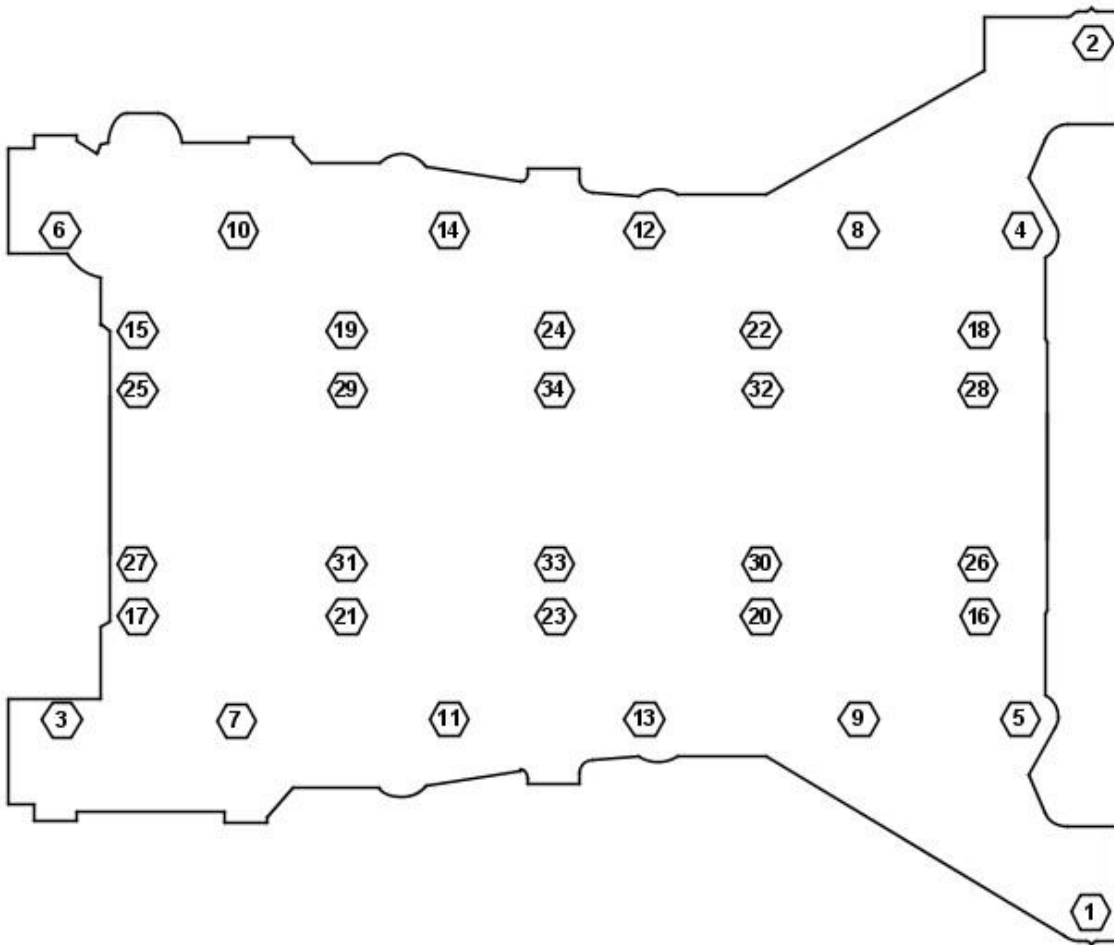
78.  **WARNING:** To make sure damage does not occur to the crankshaft and piston components, the engine must be inverted on the engine stand. Failure to follow this instruction may result in damage to the engine.

- **NOTE:** If the crankshaft main bearing carrier retaining bolts have been marked with a center punch dot, they must be discarded and new bolts installed.

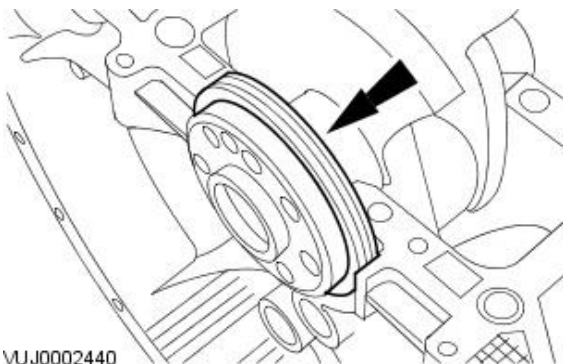
Remove the crankshaft main bearing carrier.

- Remove the crankshaft main bearing carrier retaining bolts in the indicated sequence.





VUJ0002439



VUJ0002440

79. Discard the crankshaft rear main oil seal.

### Installation

#### 1. CAUTIONS:

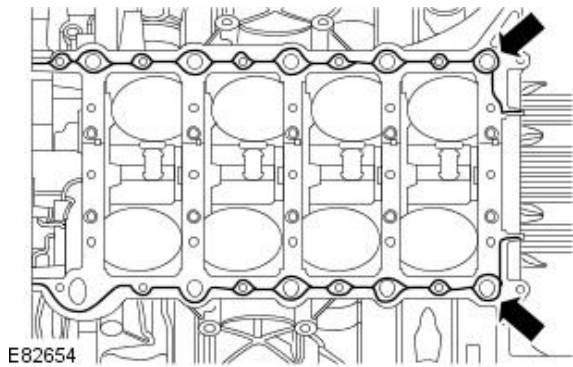


Use only a plastic scraper when removing the sealing material.



If any new bolts are to be installed to retain the crankshaft main bearing carrier, pre-stress the retaining bolts by installing the crankshaft main bearing carrier without any sealant and tightening the new retaining bolts to the specified torque. Remove the crankshaft main bearing carrier once the bolts have been pre-stressed. Failure to follow this instruction may result in damage to the vehicle.

Clean all the mating faces and reusable parts thoroughly and check

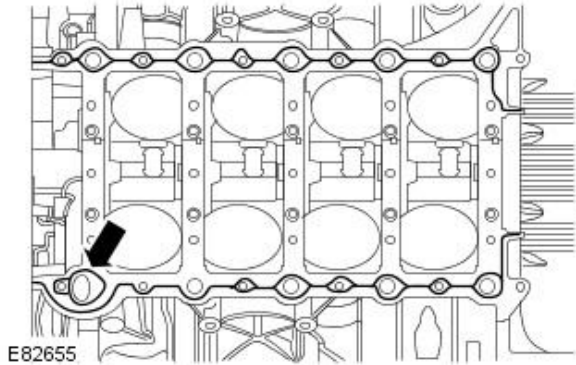


for damage.

2. NOTE: Install the crankshaft main bearing carrier and tighten bolts to specification within twenty minutes of applying the sealant.

Apply a 2 mm bead of sealant to the cylinder block in the area shown.

- Use WSS-M4G323-A4-RTV sealant.



3. NOTE: Install the crankshaft main bearing carrier and tighten bolts to specification within twenty minutes of applying the sealant.

Apply a 1 mm bead of sealant to the cylinder block in the area shown.

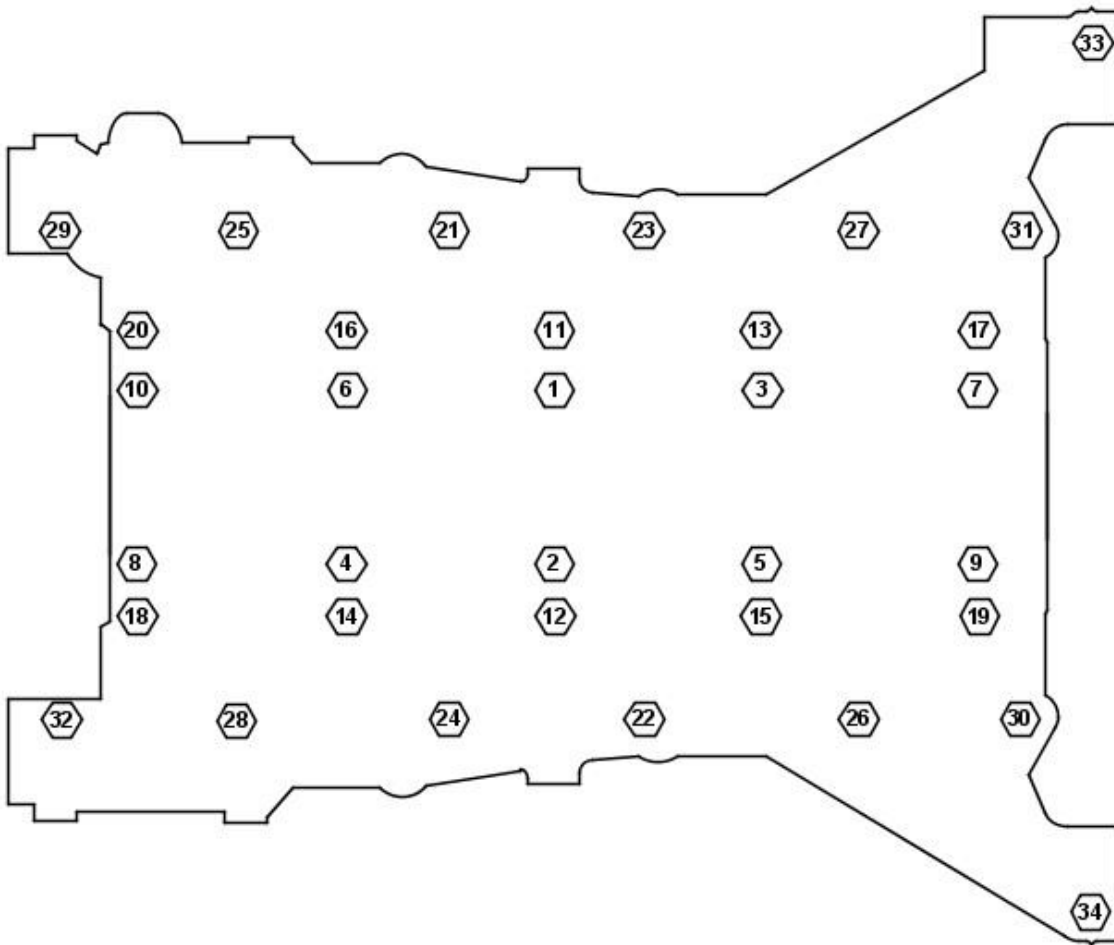
- Use WSS-M4G323-A4-RTV sealant.

4.  CAUTION: Make sure all dowels are fully seated into the crankshaft main bearing carrier prior to tightening the bolts.

- NOTE: Do not lubricate the crankshaft main bearing carrier retaining bolts.
- NOTE: Do not rotate the crankshaft until all the retaining bolts are tightened to specification.
- NOTE: The retaining bolts must be tightened within twenty minutes of applying the sealant.
- NOTE: Tighten the retaining bolts in the sequence shown.

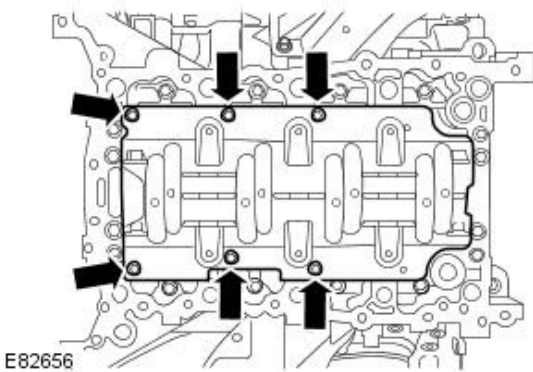
Install the crankshaft main bearing carrier to the cylinder block.

1. Stage 1: Bolts 21 to 32, tighten to 15 Nm.
2. Stage 2: Bolts 33 to 34, tighten to 15 Nm.
3. Stage 3: Bolts 1 to 10, tighten to 25 Nm.
4. Stage 4: Bolts 11 to 20, tighten to 15 Nm.
5. Stage 5: Bolts 1 to 10, tighten to 35 Nm, then a further 135 degrees.
6. Stage 6: Bolts 11 to 20, tighten to 20 Nm, then a further 150 degrees.
7. Stage 7: Bolts 21 to 32, tighten to 20 Nm, then a further 90 degrees.
8. Stage 8: Bolts 33 to 34, tighten to 20 Nm, then a further 150 degrees.
9. Stage 9: Center punch each of the bolt heads to indicate it has been reused.

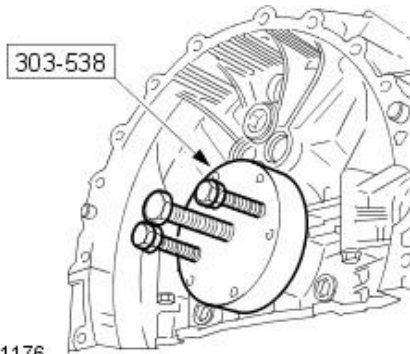


VUJ0002450

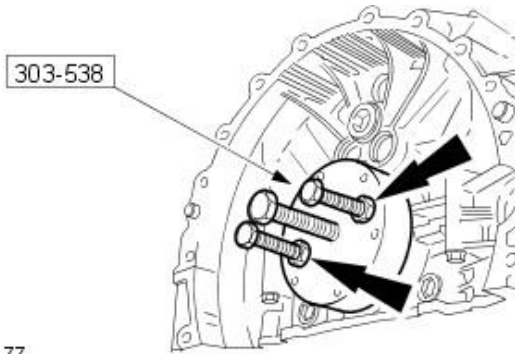
5. Rotate the crankshaft to check correct operation.
6. Remove excess sealant which may squeeze out at the front cover sealing surfaces.
7. Install the baffle plate.
  - Tighten the 6 bolts to 6 Nm.



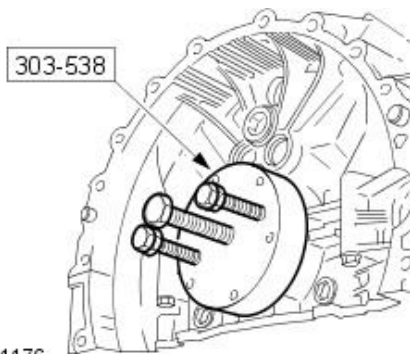
E82656



E31176



E31177



E31176



E61688

8. NOTE: Carefully remove the transit sleeve, leaving the seal in place.


• NOTE: Make sure that the transit sleeve is correctly positioned and install the new seal over the crankshaft. Do not use any lubricant on the seal, the transit sleeve or the crankshaft.

Using the special tool, position the crankshaft rear oil seal.

- Install the special tool to the crankshaft.

9.  CAUTION: Alternate the nut tightening to correctly seat the crankshaft rear oil seal.

Using the special tool, install the rear crankshaft oil seal.

10.  CAUTION: Make sure that the crankshaft rear oil seal is correctly located.

Remove the special tool.

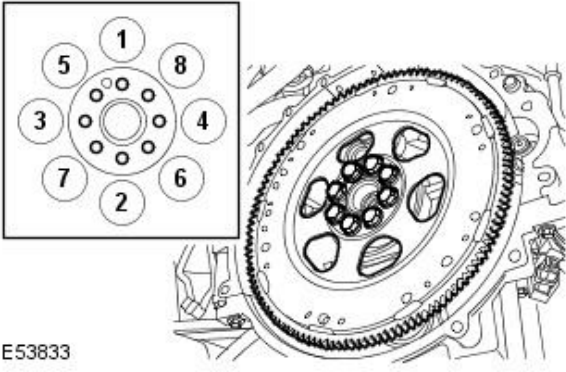
11. Install the special tool.

- Install the bolt.

12. NOTE: Install a new gasket.

Install the oil pump assembly.

- Clean the component mating faces.
- Install the gasket.
- Tighten the bolts to 10 Nm.



E53833

**13. NOTE:** Prevent the flexplate from rotating.

Install the torque converter flexplate.

- Clean the component mating faces.
- Tighten the bolts evenly in 2 stages to the sequence shown.
- Tighten the bolts to 15 Nm.
- Tighten the bolts to 110 Nm.

**14. NOTE:** Install a new O-ring seal.

Install the oil strainer pick-up assembly.

- Install the O-ring seal.
- Tighten the bolts to 12 Nm.

**15.** Install the crankshaft sprocket.

- Clean the component mating faces.
- Install the crankshaft sprocket key.

**16.** Install the LH primary timing chain.

- Make sure the timing chain slack is on the tensioner side of the timing chain.

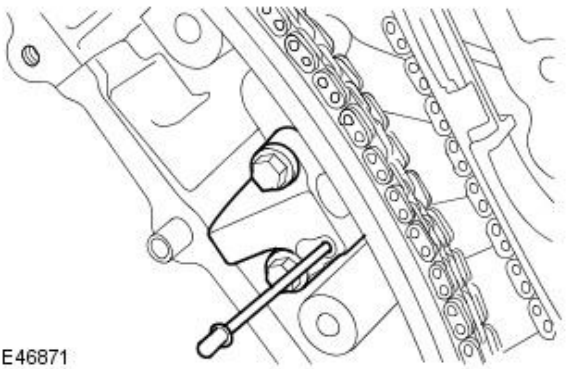
**17.** Install the LH primary timing chain tensioner guides.

- Tighten the bolts to 12 Nm.

**18. ⚠ CAUTION:** During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

Install the LH primary timing chain tensioner.

- Using a 3 mm diameter rod, retain the timing chain tensioner adjuster.
- Tighten the bolts to 12 Nm.
- Remove the retaining rod.



E46871

**19. ⚠ CAUTION:** Make sure that new bolts are installed.

• **NOTE:** Install new O-ring seals.

Install the LH VCT control solenoid housing.

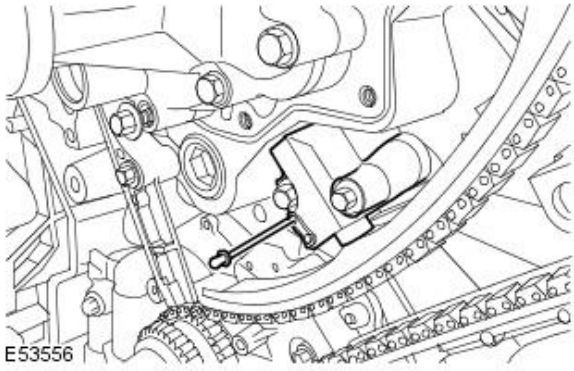
- Install the O-ring seals.
- Tighten the bolts to 22 Nm.
- Tighten the nut to 10 Nm.


**20.** Install the RH primary timing chain.

- Make sure the timing chain slack is on the tensioner side of the timing chain.

**21.** Install the RH primary timing chain tensioner guide.

- Tighten the bolts to 12 Nm.



**22.**  **CAUTION:** During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

Install the RH primary timing chain tensioner.

- Using a 3 mm diameter rod, retain the timing chain tensioner adjuster.
- Tighten the bolts to 12 Nm.
- Remove the retaining rod.

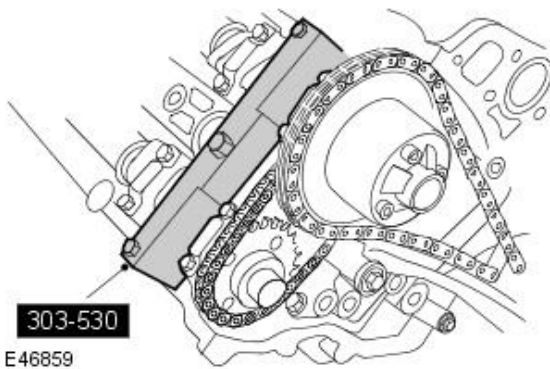
**23.** **NOTE:** Install new O-ring seals.

• **NOTE:** Make sure that new bolts are installed.

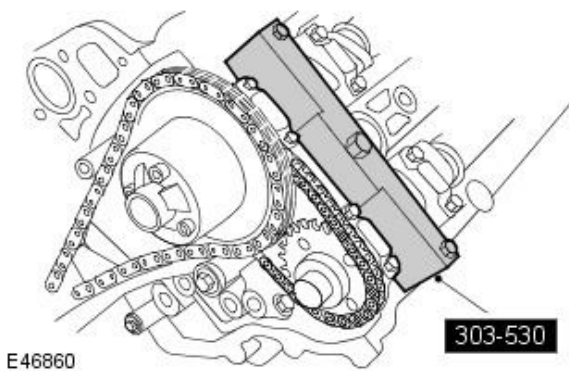
Install the RH VCT control solenoid housing.

- Install the O-ring seals.
- Tighten the bolts to 22 Nm.
- Tighten the nut to 10 Nm.

**24.** Remove the special tool from the RH cylinder head.

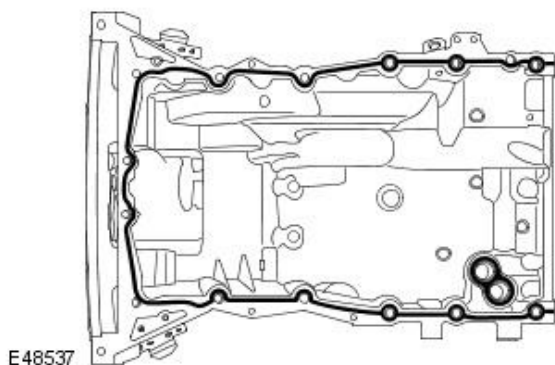


**25.** Remove the special tool from the LH cylinder head.



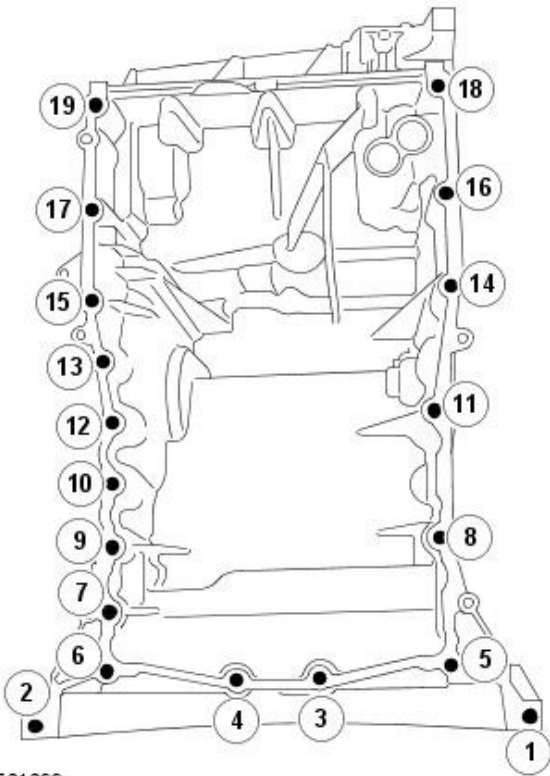
**26.** Install the oil pan extension.

- Clean the component mating faces.
- Apply a 3 mm diameter bead of sealant, to the area shown.
- Install the bolts, but do not tighten fully at this stage.





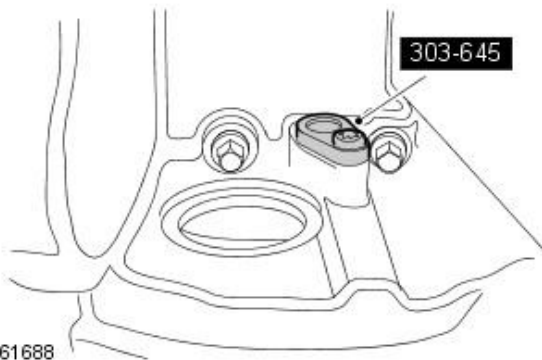
27. Tighten the oil pan bolts in the sequence shown to 20 Nm.



E61699

28. Remove the special tool.

- Remove the bolt.



E61688

29. Install the CKP sensor.

- Tighten the bolt to 8 Nm.

30. Attach the wiring harness to the LH side of the engine

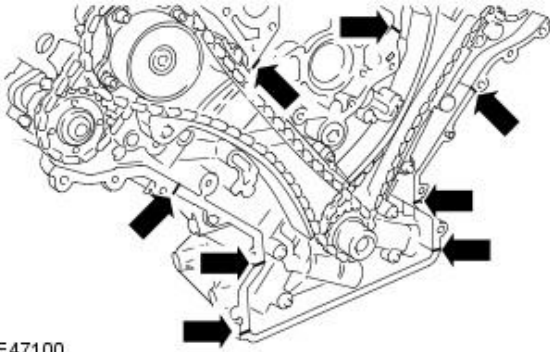
- Secure the clips.

31. Attach the wiring harness to the RH side of the engine.

- Secure the clips.

32. Install the power steering pump mounting bracket.

- Tighten the bolts to 25 Nm.



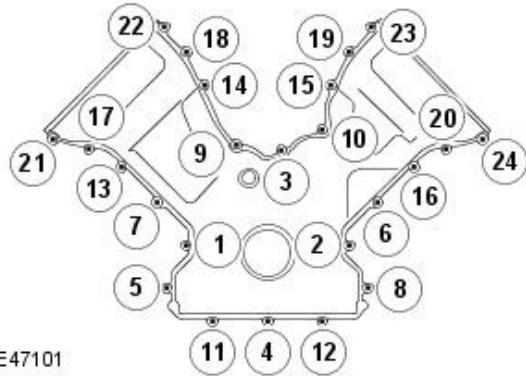
E47100

33. NOTE: Install a new gasket.

• NOTE: Install a new O-ring seal.

Install the engine front cover.

- Clean the component mating faces.
- Apply a 3 mm diameter bead of sealant 12mm long, to the 8 places shown.
- Install the gasket.
- Install the O-ring seal.



E47101

34. Tighten the bolts in the sequence shown to 12 Nm.

35. Attach the engine wiring harness.

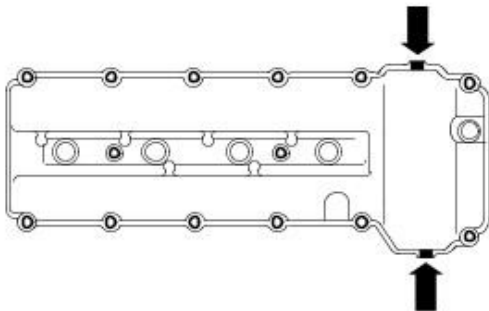
- Secure the clips.
- Tighten the bolt to 10 Nm.

36. NOTE: Install new seals.

Install the LH valve cover plug aperture seals.

37. NOTE: Install a new gasket.

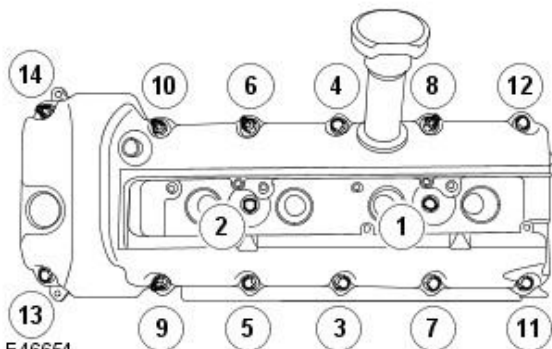
• NOTE: Apply two beads of silicone gasket sealant as shown on the illustration. The application of the sealant must be 3 mm (0.118 in) diameter 12 mm (0.47 in) long. Install the valve cover immediately after applying the sealant. The cover should be fitted directly to the head without smearing the sealant or the seals.



E49922

Install the LH valve cover.

- Clean the component mating faces.
- Install the valve cover gasket.



E46654

38. Install the LH valve cover bolts.

- Install the LH valve cover bolts to the positions previously noted.
- Tighten the bolts in the sequence shown to 12 Nm.

39. Connect the LH VCT oil solenoid electrical connector.

40. Attach the engine wiring harness to the retaining bracket.

**41. NOTE: Install a new O-ring seal.**

With assistance, install the oil level indicator and tube.

- Clean the component mating faces.
- Install the O-ring seal.
- Lubricate the O-ring seal with clean engine oil.
- Tighten the nut to 6 Nm.

**42. NOTE: Install new O-ring seals.**

Install the 4 LH ignition coil-on-plugs.

- Install the O-ring seals.
- Install the 4 ignition coil-on-plugs.
- Tighten the 6 bolts to 6 Nm.

**43. Connect the 4 electrical connectors.**

**44. Install the LH ignition coil-on-plug cover.**

**45. NOTE: Install new seals.**

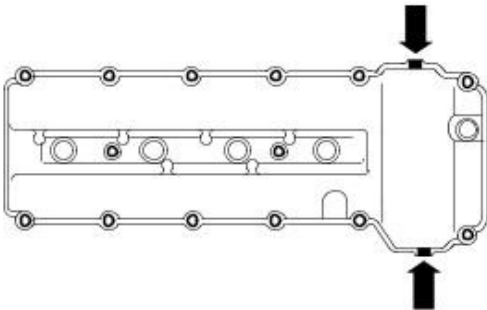
Install new RH valve cover plug aperture seals.

**46. NOTE: Install a new gasket.**

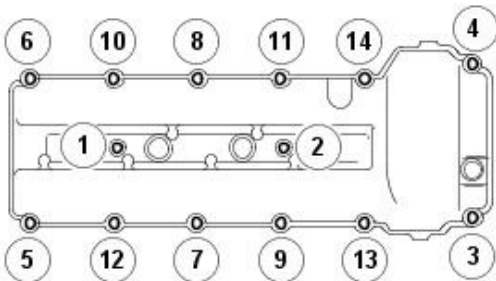
• NOTE: Apply two beads of silicone gasket sealant as shown on the illustration. The application of the sealant must be 3 mm (0.118 in) diameter 12 mm (0.47 in) long. Install the valve cover immediately after applying the sealant. The cover should be fitted directly to the head without smearing the sealant or the seals.

Install the RH valve cover.

- Clean the component mating faces.
- Install the gasket.



E49922



E46679

**47. Install the RH valve cover bolts.**

- Install the RH valve cover bolts to the positions previously noted.
- Tighten the bolts in the sequence shown to 12 Nm.

**48. NOTE: Install new O-ring seals.**

Install the 4 RH ignition coil-on-plugs.

- Install the O-ring seals.
- Install the 4 ignition coil-on-plugs.
- Tighten the bolts to 6 Nm.

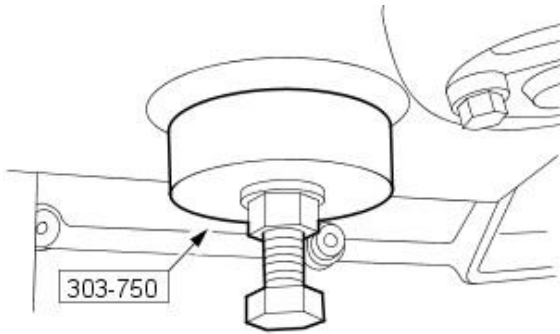
**49. Connect the 4 electrical connectors.**

**50. Connect the RH VCT oil solenoid electrical connector.**

**51. Attach the engine wiring harness to the retaining bracket.**

**52. Connect the PCV line to the RH valve cover.**

**53. Clean the crankshaft pulley mating faces.**



E31173

54. Using the special tool, install the crankshaft front seal.

- Lubricate the seal with clean engine oil.
- Use the discarded crankshaft bolt with the special tool.
- Remove the special tools.

55. Install the crankshaft pulley.

- Lubricate the seal with clean engine oil.

56. Install the crankshaft pulley locking ring.

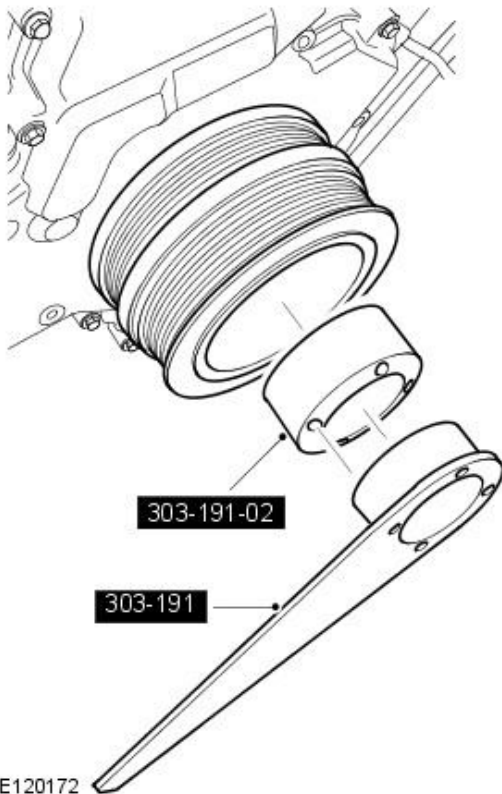
57. **CAUTION:** The screw thread in the crankshaft pulley must be cleaned out before installing a new crankshaft pulley bolt.

Install, but do not tighten, the new crankshaft pulley bolt.

58. **CAUTION:** Under no circumstances should the crankshaft setting peg, 303-645, be used in the following operations, to restrain the crankshaft.

Using the special tools, tighten the crankshaft pulley bolt.

- Remove the special tools.
- Tighten the crankshaft pulley bolt to 380 Nm.



E120172

59. **NOTE:** Install a new O-ring seal.

Install the oil filter housing.

- Clean the component mating faces.
- Install a new O-ring seal.
- Tighten the bolts to 20 Nm.

60. **NOTE:** Install a new engine oil filter.

Install the engine oil filter.

- Lubricate the oil filter seal with clean engine oil and tighten to 18 Nm .

61. Connect the EOP sensor electrical connector.

62. Connect the engine oil temperature sensor electrical connector.

63. Install the starter motor.

- Clean the component mating faces.
- Tighten the bolts to 45 Nm.

**64. NOTE: Install new O-ring seals.**

Install the coolant manifold.

- Clean the components.
- Install the O-ring seals.
- Connect the 4 coolant hoses and install the clips.
- Attach the wiring harness bracket.
- Tighten the bolts to 10 Nm.

**65. Connect the starter motor solenoid electrical connector.**

- Tighten the new nut to 7 Nm.

**66. Connect the battery positive cable to the starter motor.**

- Tighten the nut to 10 Nm.
- Secure the cover.

**67. Install the generator mounting bracket.**

- Tighten the bolts to 25 Nm.

**68. RH side: Attach the wiring harness.**

- Secure the clips.

**69. Install the generator.**

- Tighten the nut to 25 Nm.
- Tighten the nut and bolt to 40 Nm.

**70. Connect the battery positive cable and generator electrical connector.**

- Secure the cover.
- Tighten the nut to 12 Nm.

**71. Install the exhaust manifold heat shield.**

- Tighten the 2 bolts.

**72. Install the power steering pump mounting bracket.**

- Tighten the bolts to 25 Nm.

**73. Install the A/C compressor mounting bracket.**

- Tighten the bolts to 25 Nm.

**74. Install the power steering pump.**

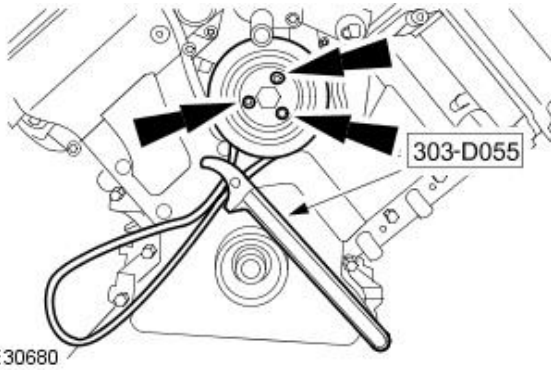
- Tighten the bolts to 25 Nm.

**75. Install the A/C compressor.**

- Tighten the bolts to 25 Nm.
- Connect the electrical connector.

**76. Install both engine mounts and brackets.**

- Clean the component mating faces.
- Tighten the bolts to 45 Nm.
- Repeat the above procedure for the other side.



E30680

**77. NOTE: Make sure that new bolts are installed.**

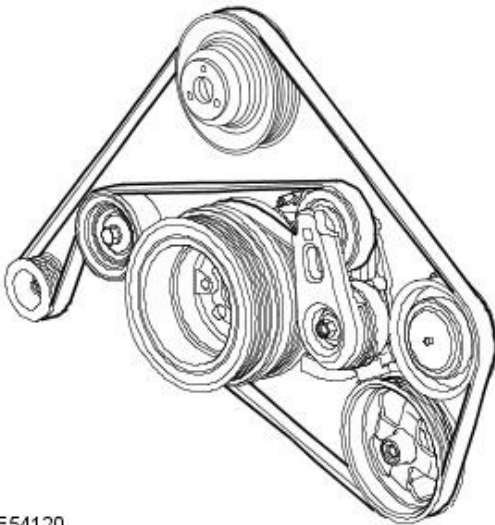
Using the special tool, install the coolant pump pulley.

- Tighten the 5 bolts to 10 Nm.
- Tighten the bolts to 25 Nm.

**78. Install the accessory drive belt idler pulley.**

- Tighten the bolts to 25 Nm.

**79. Install the accessory drive belt.**



E54120

**80. Install the accessory drive belt tensioner.**

- Clean and inspect the drive pulleys for damage.
- Tighten the accessory drive belt tensioner bolt to 40 Nm.

**81. Connect the oil cooler hoses.**

**82. Remove the engine from the engine stand.**

**83. Install the engine.**

For additional information, refer to: [Engine](#) (303-01A Engine - 4.2L NA V8 - AJV8, Removal).



**84. Connect the battery ground cable.**

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).




## Engine - 4.2L NA V8 - AJV8 - Engine

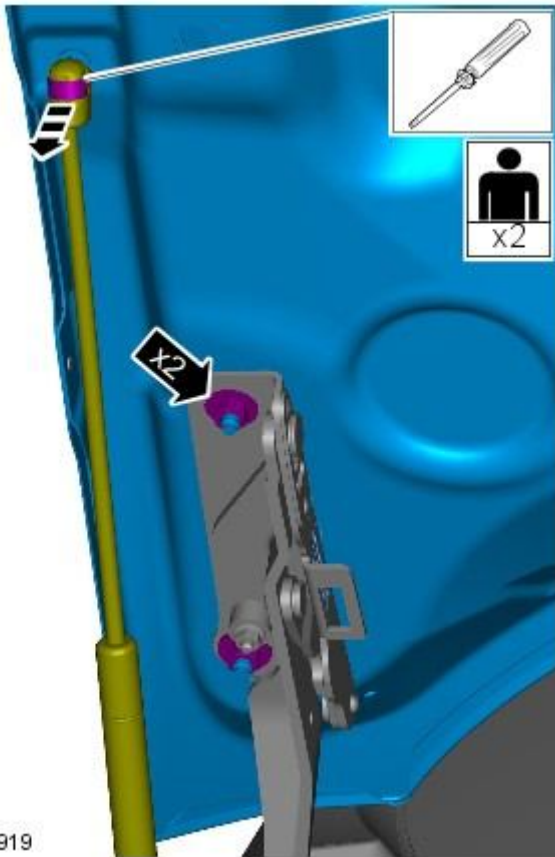
Removal

Special Tool(s)	
 303-536	Engine lifting brackets 303-536
 303-749	Engine lifting brackets 303-749

### Removal

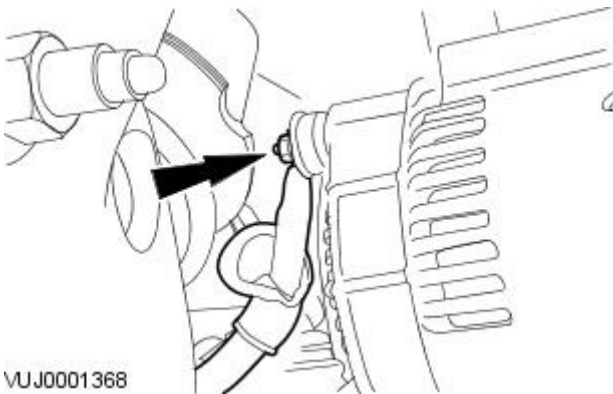
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Evacuate the A/C system.  
For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
4. Remove the transmission.  
For additional information, refer to: [Transmission - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal).
5. Install the torque converter retainer.
6. Remove the cooling module.  
For additional information, refer to: [Cooling Module - 4.2L NA V8 - AJV8](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

7. Remove the hood.



8. Remove the throttle body.  
For additional information, refer to: [Throttle Body](#) (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Removal and Installation).

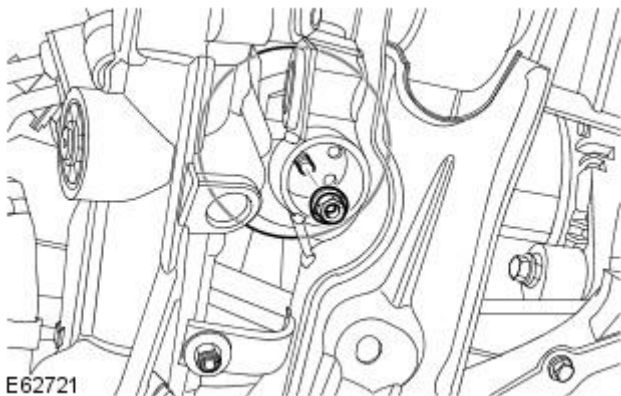
9. Disconnect the battery positive cable from the generator.



10. NOTE: RH illustration shown, LH is similar.

Release the engine mounts.

- Remove and discard the 2 nuts.

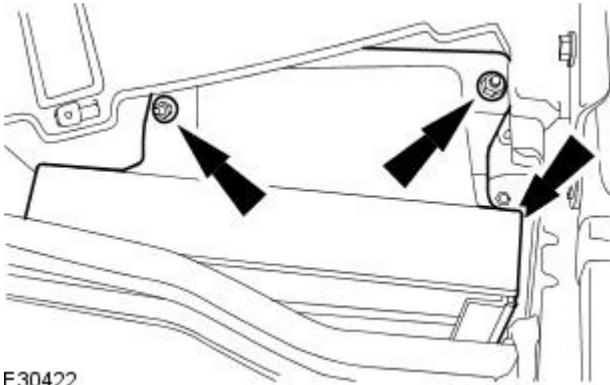


11. Lower the vehicle.

12. Remove the secondary bulkhead LH panel.

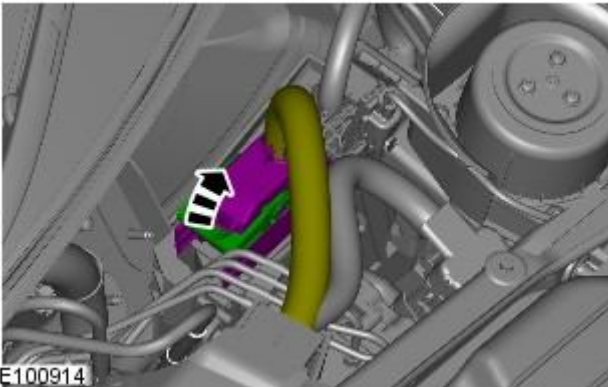
For additional information, refer to: [Secondary Bulkhead Panel LH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).

13. Remove the engine control module (ECM) cover.



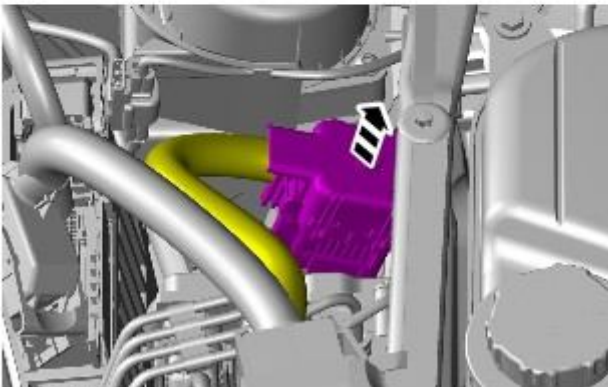
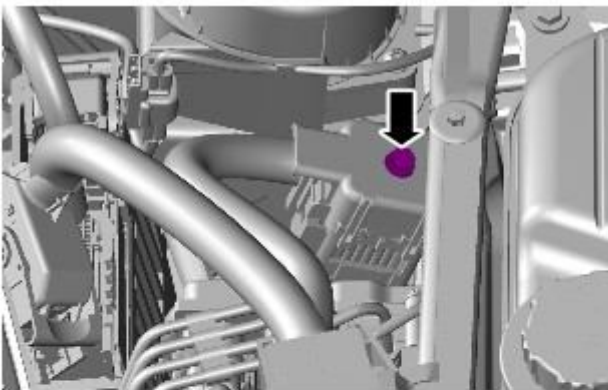
E30422

14. Release the ECM wiring harnesses and position aside.



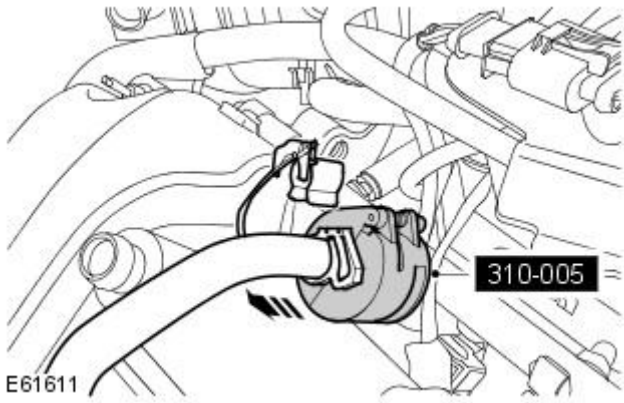
E100914


15. Disconnect the engine wiring harness.



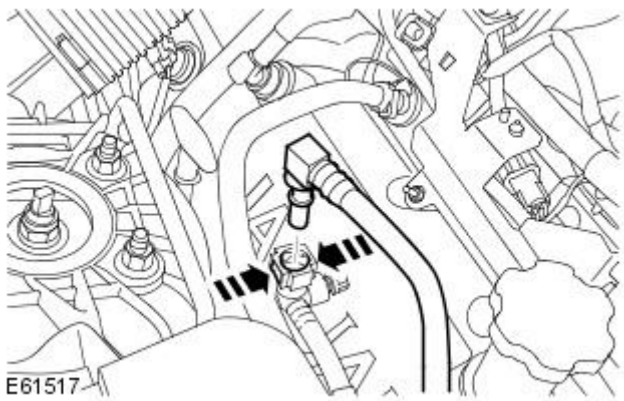
E100915

16. Disconnect the fuel line.

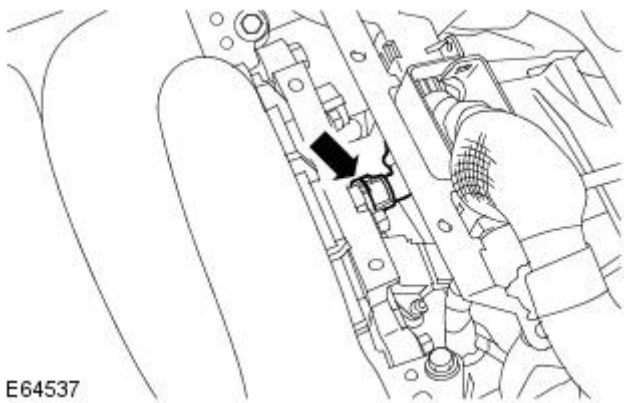


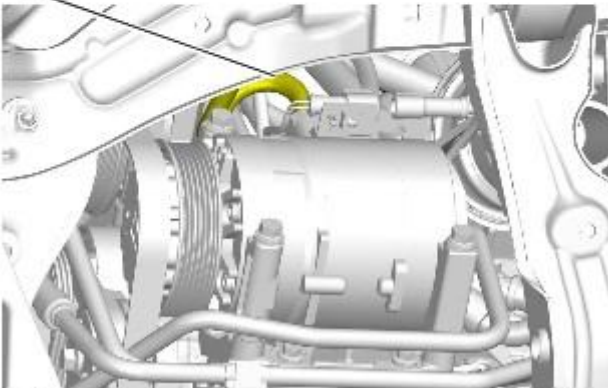
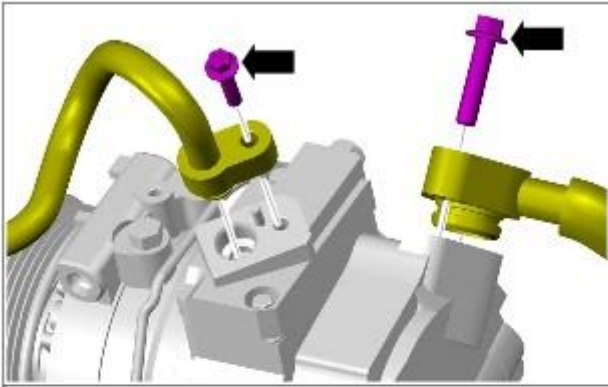
17.  CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Release the clip and disconnect the purge inlet line.



18. Disconnect the brake booster vacuum hose from the intake manifold.



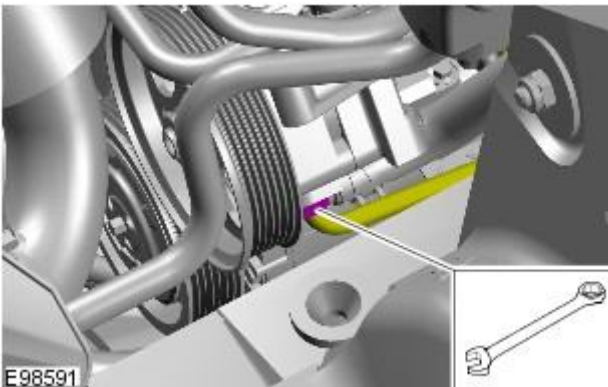


E97758

19.  **CAUTION:** Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

Disconnect the refrigerant lines from the A/C compressor.

- Remove the 2 bolts.
- Remove and discard the 2 O-ring seals.

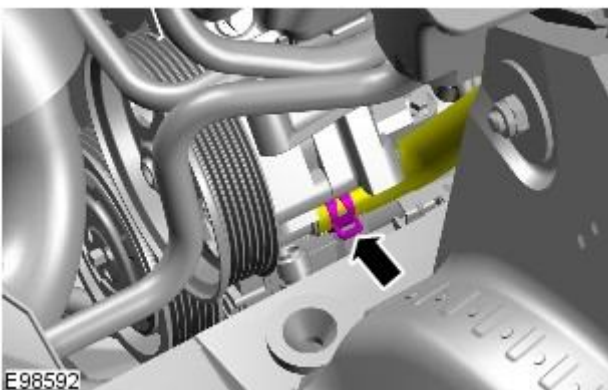


E98591


20.  **CAUTION:** Always plug any open connections to prevent contamination.


Disconnect the high pressure line from the power steering pump.

- Remove and discard the O-ring seal.



E98592

21.  **WARNING:** Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.

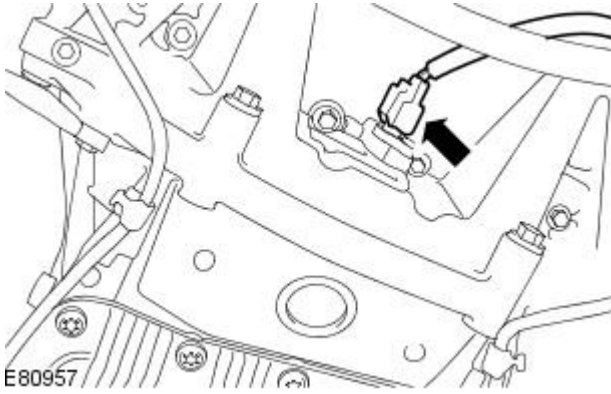
 **CAUTION:** Always plug any open connections to prevent contamination.

Disconnect the low pressure line from the power steering pump.

- Release the clip.

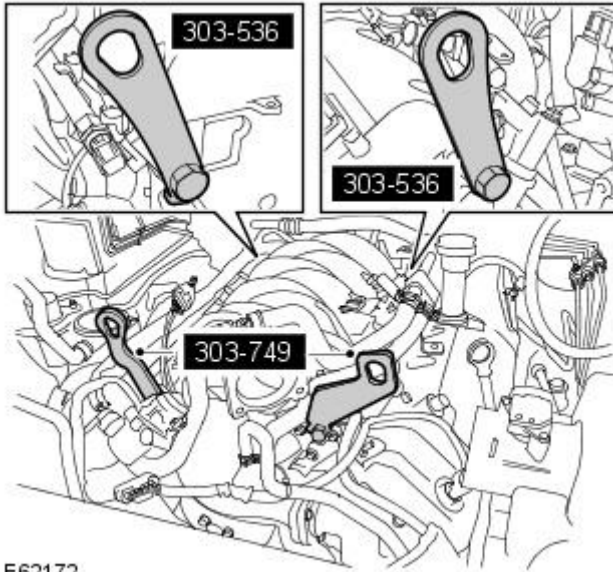


22. Disconnect the crankshaft position (CKP) sensor electrical connector.



23. Install the special tools to the engine.

- Support the engine.

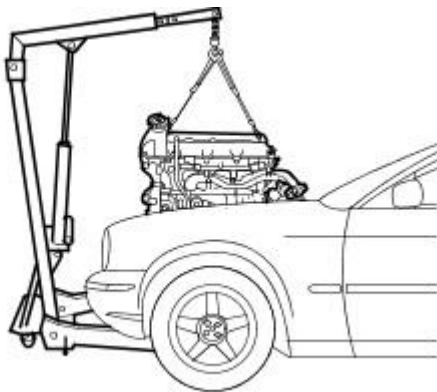


24. Install the lifting equipment to the vehicle.

- Install the lifting chains.

25. Remove the engine.



- With assistance, carefully remove the engine.





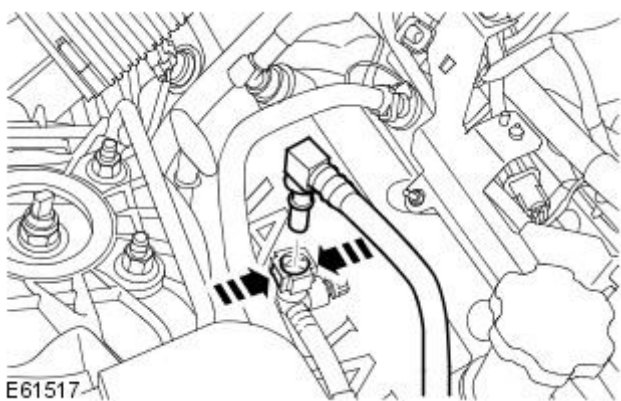
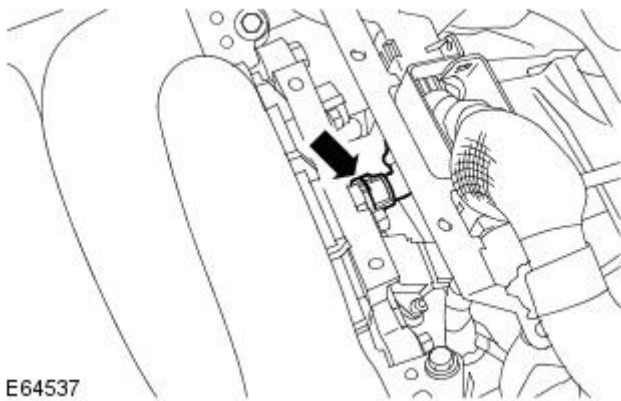
## Engine - 4.2L NA V8 - AJV8 - Engine


### Installation

Special Tool(s)	
 <p>303-536</p>	Engine lifting brackets 303-536
 <p>303-749</p>	Engine lifting brackets 303-749

### Installation

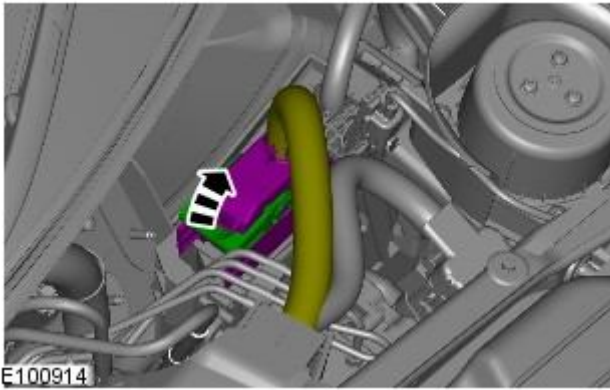
- Carefully lower the engine onto the engine mounts.
  - Clean the components.
- Remove the special tools.
- Connect the brake booster vacuum hose to the intake manifold.



-  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

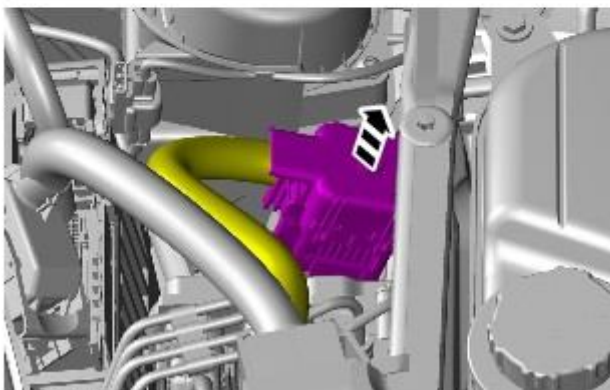
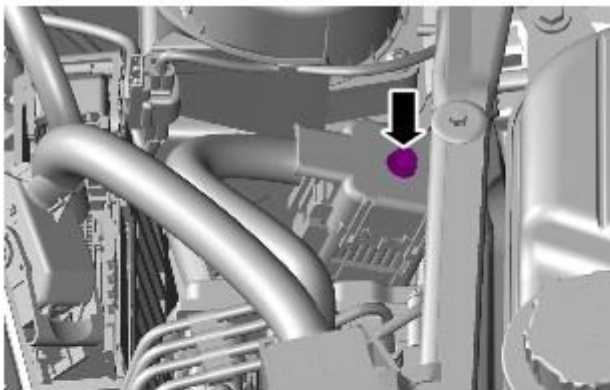
Connect the purge valve.

5. Connect the main engine wiring harness to the ECM.

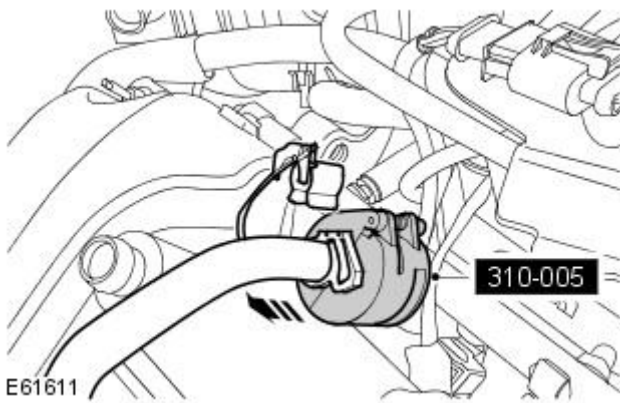


6. Connect the engine wiring harness.

- Tighten to 10 Nm.

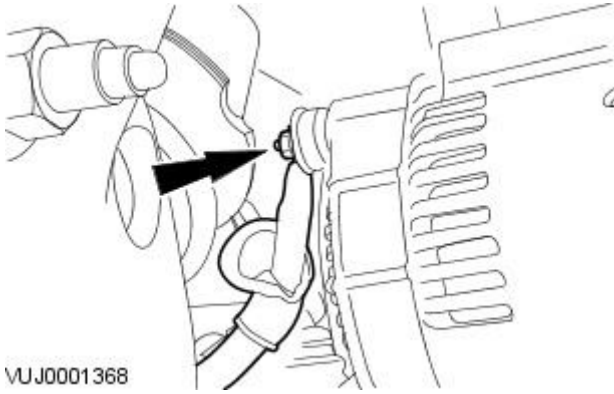


7. Connect the fuel line.

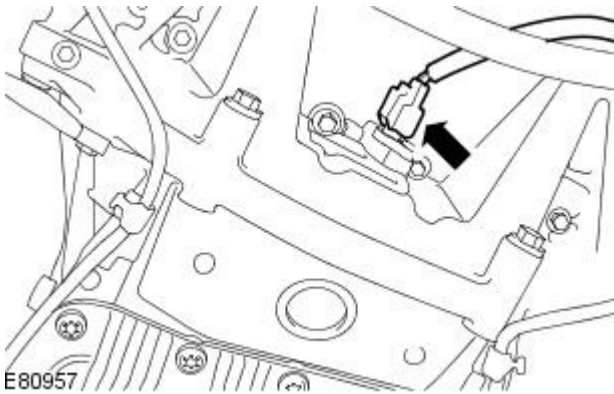



8. Raise the vehicle.

9. Connect the battery positive cable to the generator.



10. Connect the CKP sensor electrical connector.

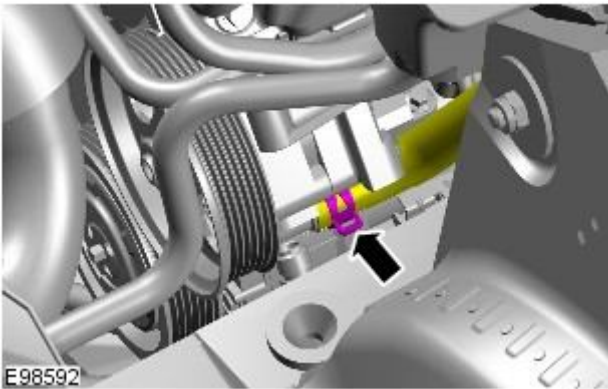


11.  **WARNING:** Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.

 **CAUTION:** Always plug any open connections to prevent contamination.

Connect the low pressure line to the power steering pump.

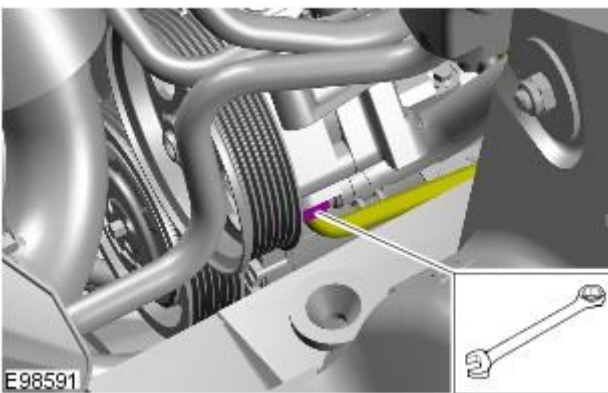
- Secure the clip.

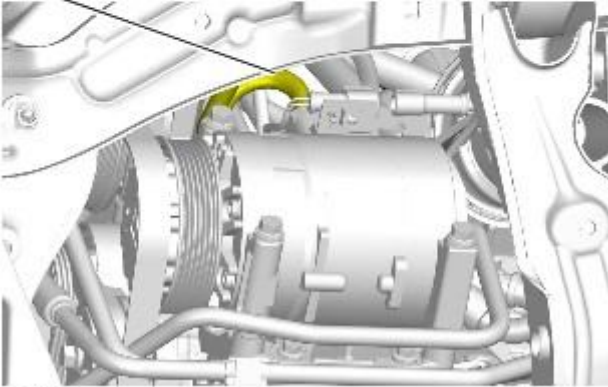
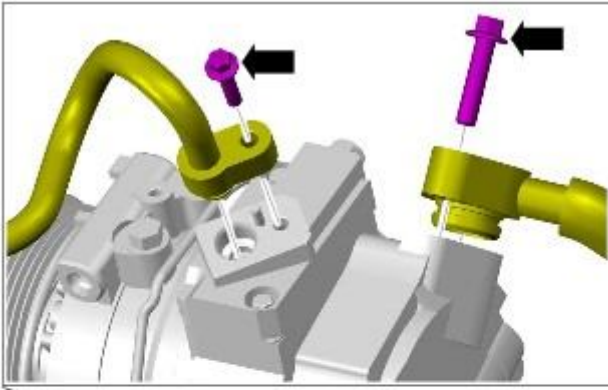


12.  **CAUTION:** Always plug any open connections to prevent contamination.

Connect the high-pressure power steering line to the power steering pump.

- Install a new O-ring seal.
- Tighten to 20 Nm.



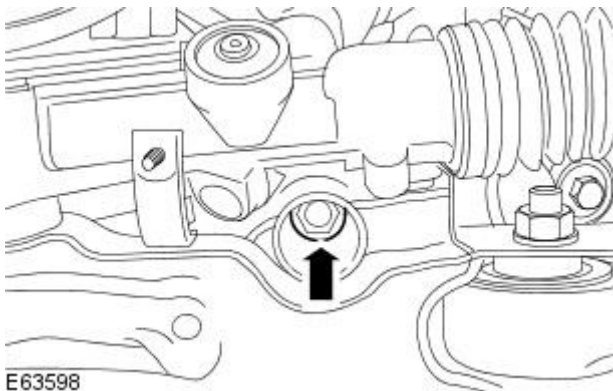


E97758

13.  **CAUTION:** Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

Connect the refrigerant lines to A/C compressor.

- Install the 2 bolts.
- Install new O-ring seals.



E63598

14. **NOTE:** Right-hand shown, left-hand similar.

Install the engine mounts lower retaining nuts.

- Tighten to 63 Nm.

15. Remove the torque converter retainer.

16. Install the transmission.

For additional information, refer to: [Transmission - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal).

17. Lower the vehicle.

18. Install the secondary bulkhead LH panel.

For additional information, refer to: [Secondary Bulkhead Panel LH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).

19. Install the cooling module.

For additional information, refer to: [Cooling Module - 4.2L NA V8 - AJV8](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

20. Install the throttle body.

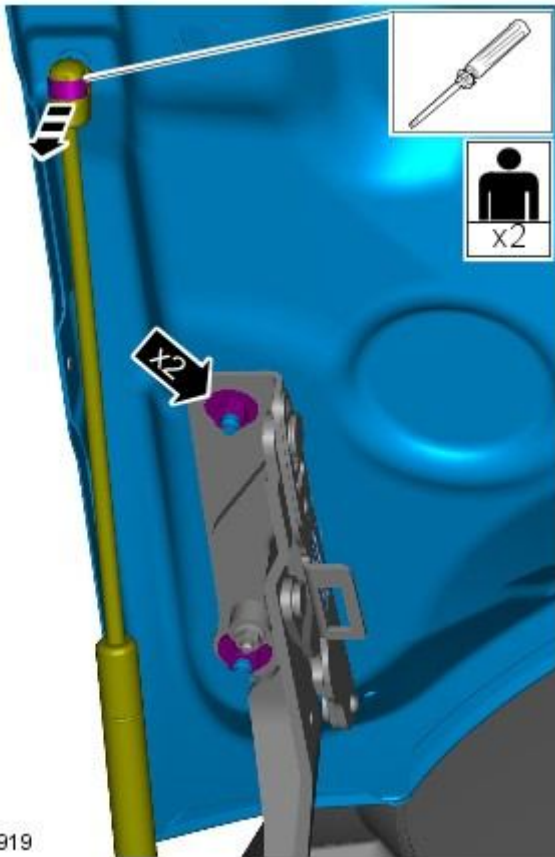
For additional information, refer to: [Throttle Body](#) (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Removal and Installation).

21. Recharge the A/C system.

For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

22. Install the hood.

- Tighten to 25 Nm



E100919

23. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

**Engine - 4.2L SC V8 - AJV8 -****Lubricants, Fluids, Sealers and Adhesives**

Description	Specification
Engine oil, SAE 5W-30	WSS-M2C-912B
Engine assembly lubricant	SQM-2C9003 AA EP90
Sealant	WSE M46323-A4
Hose assembly surfactant	ESE-M99 B144-B

**Capacities**

Description	Liters
Engine oil, initial fill	7.78
Engine oil, service fill with oil filter change	6.5

**Torque Specifications**

Description	Nm	lb-ft	lb-in
Accessory drive belt idler pulley retaining bolt	25	18	-
Accessory drivebelt tensioner retaining bolt	40	30	-
Air conditioning compressor retaining bolts	25	18	-
Air conditioning compressor mounting bracket retaining bolts	25	18	-
A/C manifold retaining bolt	9	-	80
Camshaft bearing caps retaining bolts	10	7	-
Camshaft position sensor retaining bolt	7	-	62
Connecting rod retaining bolts	A	-	-
Crankshaft pulley retaining bolt	377	278	-
Crankshaft position sensor retaining bolt	10	7	-
Cylinder head retaining bolts	A	-	-
Drive plate retaining bolts	A	-	-
Engine front cover retaining bolts	13	10	-
Engine mounting bracket retaining bolts	47 (+/- 7)	35 (+/- 5)	-
Engine mount retaining nuts to crossmember	62 (+/- 10)	46 (+/- 7)	-
Engine mount bracket to engine mount retaining nuts	47 (+/- 7)	35 (+/- 5)	-
Engine wiring harness retaining bracket	10	7	-
Exhaust manifold heat shield retaining bolts	3	-	27
Exhaust manifold heat shield retaining bolt to cylinder head	50	37	-
Exhaust manifold retaining bolts	20	15	-
Flexiplate retaining bolts	A	-	-
Front engine cover retaining bolts	12	9	-
Generator lower retaining bolt	40	30	-
Generator upper retaining bolt	21	15	-
Generator lower retaining bolt	40	30	-
Generator mounting bracket retaining bolts	45	33	-
Ignition coil retaining bolts	5	4	-
Intake manifold assembly retaining bolts	22	16	-
<b>Intake camshaft sprocket retaining bolt</b>			
Stage 1	20	15	-
Stage 2	Further 90 degrees	Further 90 degrees	-
Knock sensor retaining nuts	20	15	-
Lower cylinder block to the upper cylinder block retaining bolts	A	-	-
Oil cooler to oil filter housing retaining bolt	21	15	-
Oil filter housing retaining bolts	21	15	-
Oil level indicator tube retaining nut	6	-	51
Oil pan retaining bolts	12	9	-
Oil pump to engine block retaining bolts	12	9	-
Oil pan drain plug	25	18	-
Oil separator retaining bolts	5	-	44
Oil filter	18	13	-
Piston cooling jet retaining bolt	9	-	80
Power steering bracket retaining bolts	25	18	-
Power steering pump retaining bolts	25	18	-
Primary timing chain tensioner retaining bolts	12	9	-
Primary timing chain tensioner guide retaining bolts	12	9	-
Secondary timing chain tensioner retaining bolts	12	9	-
Spark plugs	27	20	-
Starter motor retaining bolts	45	33	-
Thermostat housing retaining bolts	10	7	-
Water pump retaining bolts	12	9	-
Water pump pulley retaining bolts	A	-	-
Upper oil pan retaining bolts	21	15	-
Valve cover retaining bolts	10	7	-
Variable camshaft timing (VCT) oil control unit housing retaining bolts	22	16	-
<b>VCT sprocket centre retaining bolt</b>			
Stage 1	20	15	-
Stage 2	Further 90 degrees	Further 90 degrees	-
A = refer to the procedure for the correct torque sequence	-	-	-



## Engine - 4.2L SC V8 - AJV8 - Engine - Component Location

Description and Operation

External View



E93327

## Engine - 4.2L SC V8 - AJV8 - Engine - Overview

Description and Operation

### Overview

The liquid cooled V8 supercharged engine is a 4.2 liter unit, arranged in a 90 degree 'V' configuration, with a 4-throw crankshaft supported by 5 main bearings.

The lightweight cylinder block is of cast aluminum alloy construction with cast iron liners.

The cylinder heads, which are also manufactured in cast aluminum alloy, are unique for each cylinder bank. Deep seated bolts reduce distortion and secure the cylinder heads to the cylinder block. Each cylinder head incorporates 2 overhead camshafts, operating 4 valves per cylinder via valve lifters. A [VVT \(variable valve timing\)](#) system gives improved low and high-speed engine performance and excellent idle quality. The lightweight valve gear provides good economy and noise levels and is chain driven, via the crankshaft, for durability.

The aluminum alloy bedplate is a casting bolted to the bottom of the cylinder block to retain the crankshaft and improve lower structure rigidity. The oil pan assembly consists of a pressed steel oil pan bolted to a structural aluminum alloy casting, which is then bolted to the bedplate.

# Engine - 4.2L SC V8 - AJV8 - Engine - System Operation and Component Description

Description and Operation

## System Operation

### General

Operation of the engine is controlled by the [ECM \(engine control module\)](#).

Refer to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.7L Diesel, Description and Operation).

### Variable Valve Timing

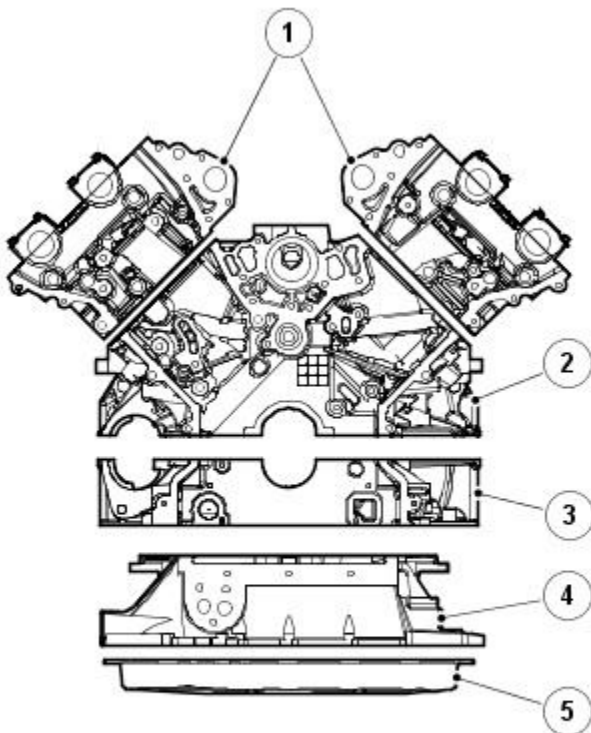
When directed by the [ECM](#), the [VVT \(variable valve timing\)](#) unit will be set to the optimum position between full advance and retard for a particular engine speed and load. This is achieved when the [ECM](#) sends the energizing signal to the oil control solenoid until the target position is met. At this point, the energizing signal is reduced to hold the solenoid position, and as a result the position of the shuttle valve. This function is under closed-loop control, where the [ECM](#) will alter the energizing signal, when required, to maintain the desired position.

Engine oil properties and temperature can affect the ability of the [VVT](#) mechanism to follow demand changes to the cam phase angle. At very low oil-temperatures, movement of the [VVT](#) mechanism is sluggish due to increased viscosity, and at high oil-temperatures the reduced viscosity may impair operation if the oil pressure is too low. To maintain satisfactory [VVT](#) performance, an increased capacity oil pump is installed, plus an engine oil temperature sensor to enable monitoring by the [ECM](#). The [VVT](#) system is normally under closed-loop control except in extreme temperature conditions, such as cold starts below 0 °C (32 °F). At extremely high oil-temperatures, the [ECM](#) may limit the amount of [VVT](#) advance to prevent the engine from stalling when returning to idle speed.

The [VVT](#) does not operate when engine oil-pressure is below 1.25 bar (18.1 lbf/in<sup>2</sup>), as there is insufficient pressure to release the [VVT](#) unit's internal stopper pin. This usually occurs when the engine is shutting-down and the [VVT](#) has returned to the retarded position. The stopper pin locks the camshaft to the [VVT](#) unit to ensure camshaft stability during the next engine start-up.

## Component Description

### Engine Structure



E71998

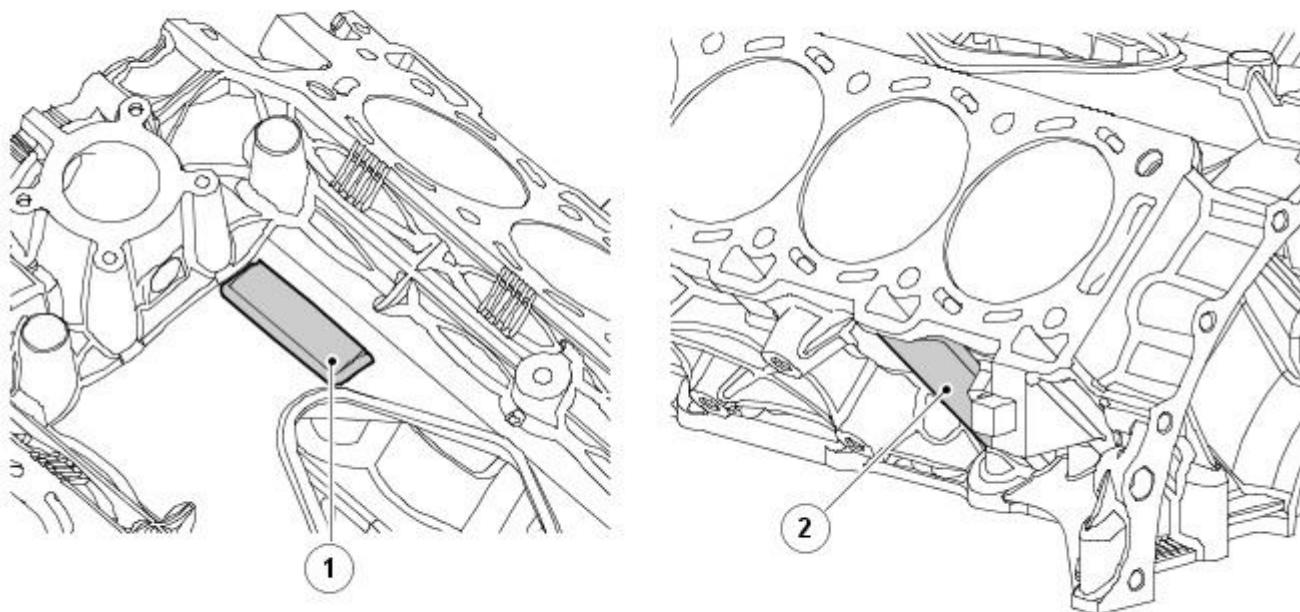
#### ItemDescription

1	Cylinder head (2 off)
2	Cylinder block
3	Bedplate
4	Structural sump

## Cylinder Block Components

The cylinder block is of a cast aluminum alloy construction with cast iron liners. The 90 degree 'V' configuration provides a rigid structure with good vibration levels. A low volume coolant jacket improves warm-up times and piston noise levels; the longitudinal flow design of the jacket, with a single cylinder head coolant transfer port in each bank, improves rigidity and head gasket sealing. The **RH (right-hand)** cylinder bank is designated as bank 1, and the **LH (left-hand)** as bank 2, viewed from the front of the engine.

Data Locations



E43426

### ItemDescription

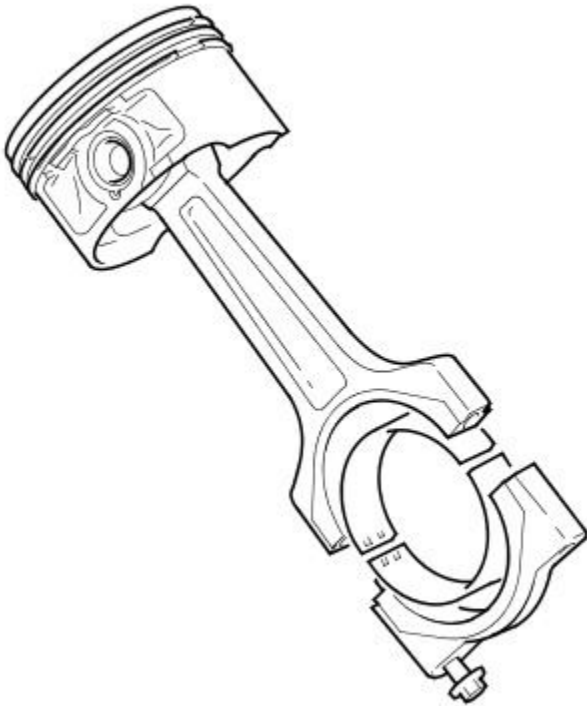
1 Engine part number

2 Engine data (main bearing diameters, cylinder bore diameters, etc), emissions code and engine number

Engine data is marked at 3 locations, 2 on the cylinder block (shown) and 1 on the engine front cover, which consists of a label displaying the engine number. Component diameters are represented by alpha and numeric codes.

Refer to: [Crankshaft Main Bearing Journal Clearance - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (303-00 Engine System - General Information, General Procedures).

Piston and Connecting Rod Assembly

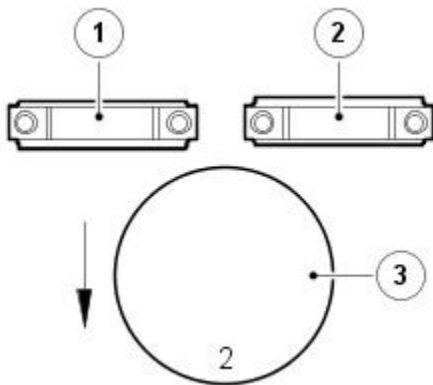


E43427

The connecting rods are manufactured from sinter-forged steel and have fracture-split bearing caps. The bearing caps are produced by fracturing the opposing sides of the connecting rod at the bearing horizontal center line. As well as being easier to manufacture, when reassembled the fractured surfaces interlock to form a strong seamless joint. The cylinder position is marked on adjoining sides of the joint to identify matching connecting rods and bearing caps. The connecting rod bearings are aluminum/tin split plain bearings.

The pistons are of the open-ended skirt design with a dished crown. Three piston rings, 2 compression and one 3-piece oil control ring, are installed on each piston. Each piston is installed on a piston pin located in a bronze bushing in the connecting rod.

#### Connecting Rod Orientation



E43428

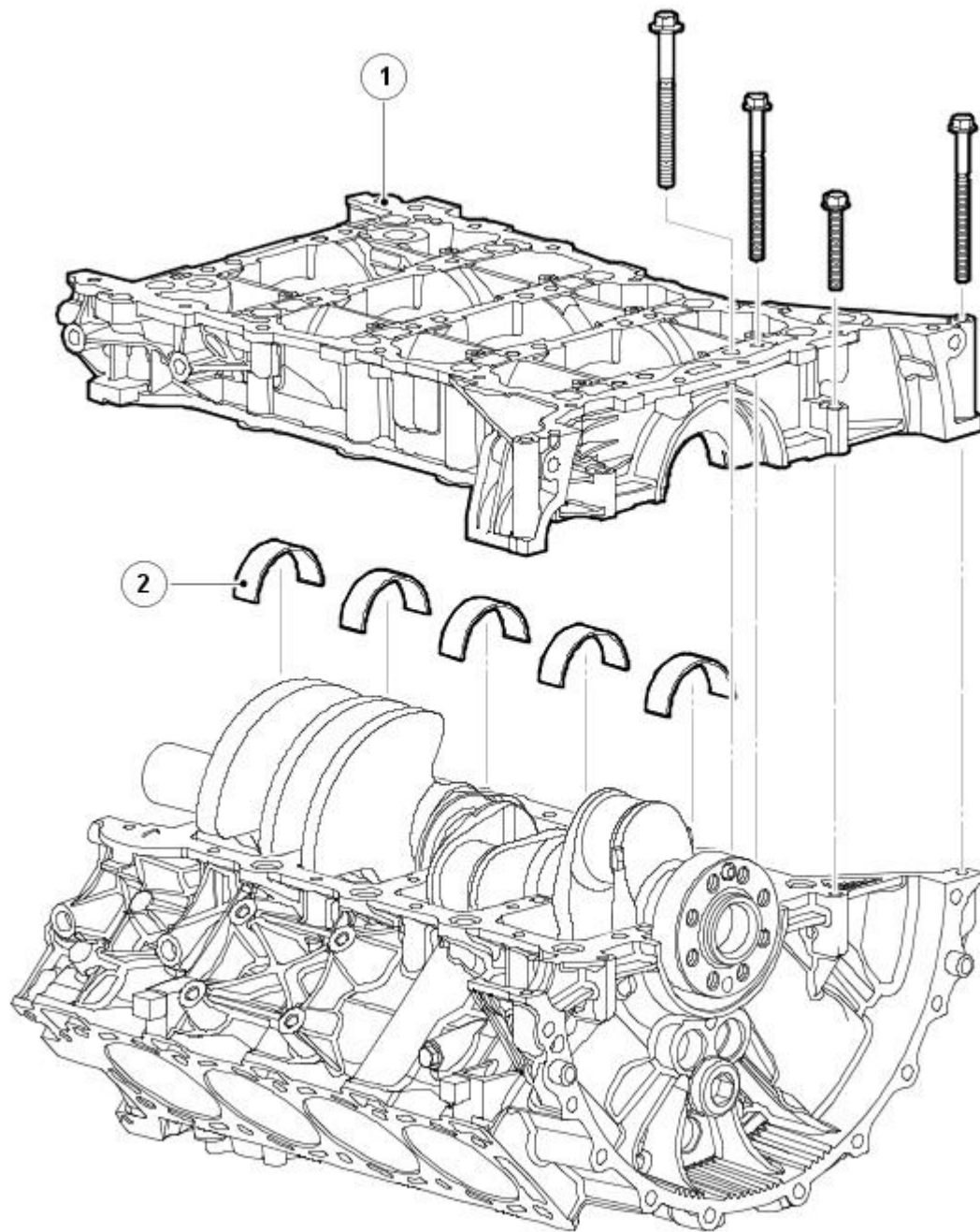
#### ItemDescription

1	Bank 1
2	Bank 2
3	Piston

The piston grade number is stamped on the crown of the piston and must coincide with that for each cylinder bore. The piston must be assembled in the correct orientation for the designated cylinder bore:

- Bank 1 - piston grade number and the thick flange of the connecting rod must face the front of the engine.
- Bank 2 - piston grade number and the thin flange of the connecting rod must face the front of the engine.

#### Crankshaft and Structural Sump Components



E43435

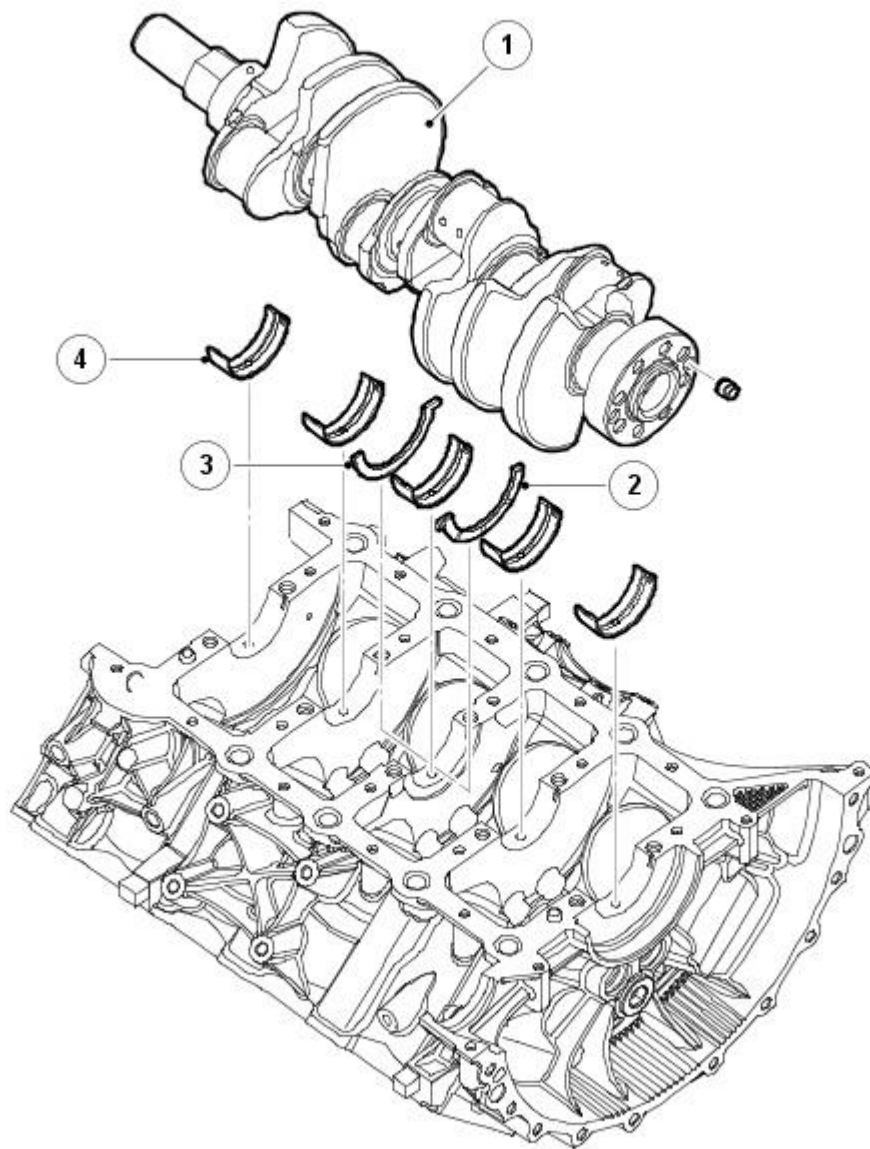
**ItemDescription**

1 Bedplate

2 Main bearings - lower

Crankshaft and Main Bearings





E43436

**ItemDescription**

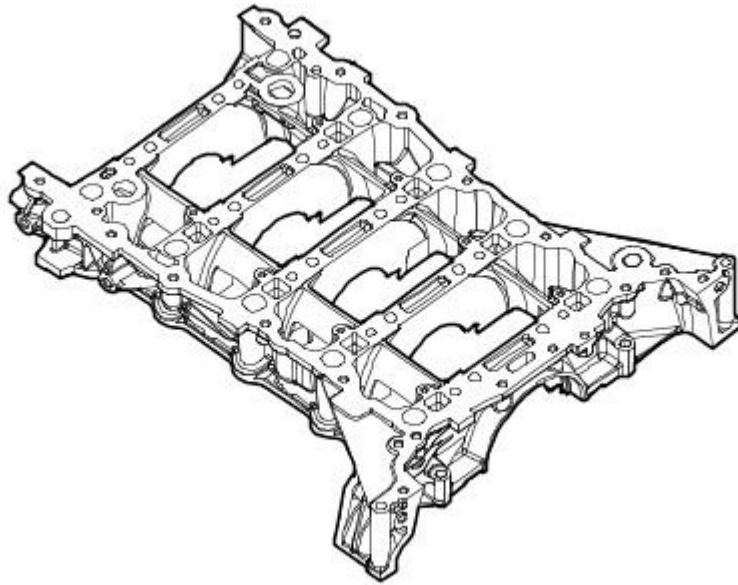
1	Crankshaft
2	Thrust washer
3	Thrust washer
4	Main bearings - upper (5 off)

Six counter-balance weights ensure low vibration levels from the 4 throw, 5 bearing crankshaft. Manufactured in cast iron, the crankshaft also has undercut and rolled fillets for improved strength.

The crankshaft rear oil seal is a press fit in the bedplate to cylinder block interface.

The main bearings are aluminum/tin split plain bearings. An oil groove in the upper half of each bearing transfers the oil into the crankshaft for lubrication of the connecting rod bearings. An aluminum/tin thrust washer is installed each side of the top half of the center main bearing.

Bedplate



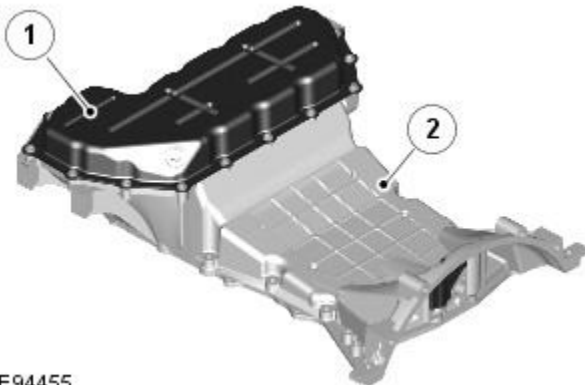
E43437

The bedplate is a structural casting bolted to the bottom of the cylinder block to retain the crankshaft. The use of a bedplate further improves rigidity. Iron inserts, cast into the main bearing supports of the bedplate, minimize main bearing clearance changes due to heat expansion.

Two hollow dowels align the bedplate with the cylinder block.

Beads of sealant seal the joint between the bedplate and the cylinder block.

Oil Pan



E94455

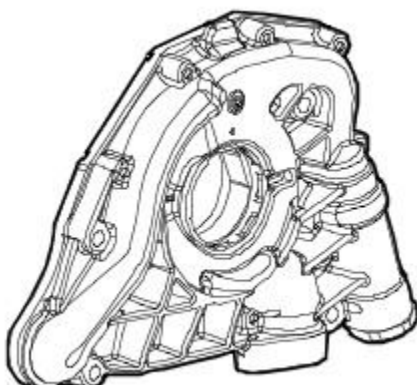
**ItemDescription**

1	Oil pan
2	Structural sump

The aluminum alloy structural sump is bolted to the bedplate. A windage tray attached to the underside of the bedplate isolates the oil pan from the disturbed air produced by the rotation of the crankshaft, to prevent oil aeration and improve oil drainage. A rubber plug at the rear of the structural sump seals the port that provides access to the torque converter securing bolts. The engine oil drain plug is located in the pressed steel oil pan, which attaches to the underside of the aluminum alloy structural sump.

A bead of sealant seals the joint between the structural sump and the bedplate.

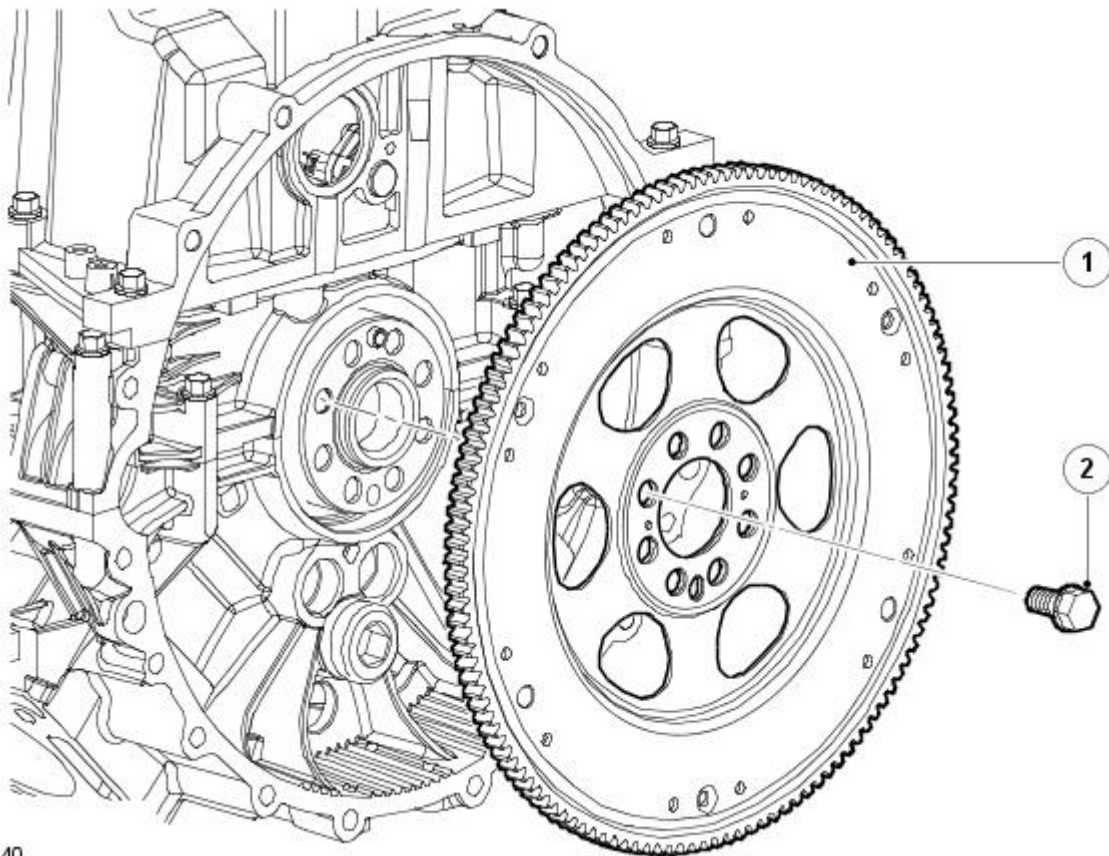
Oil Pump



E43439

The oil pump is installed on the crankshaft at the front of the engine. The pump outlet port aligns with oil passages in the bedplate (see lubrication section for more information).

#### Starter Drive Plate



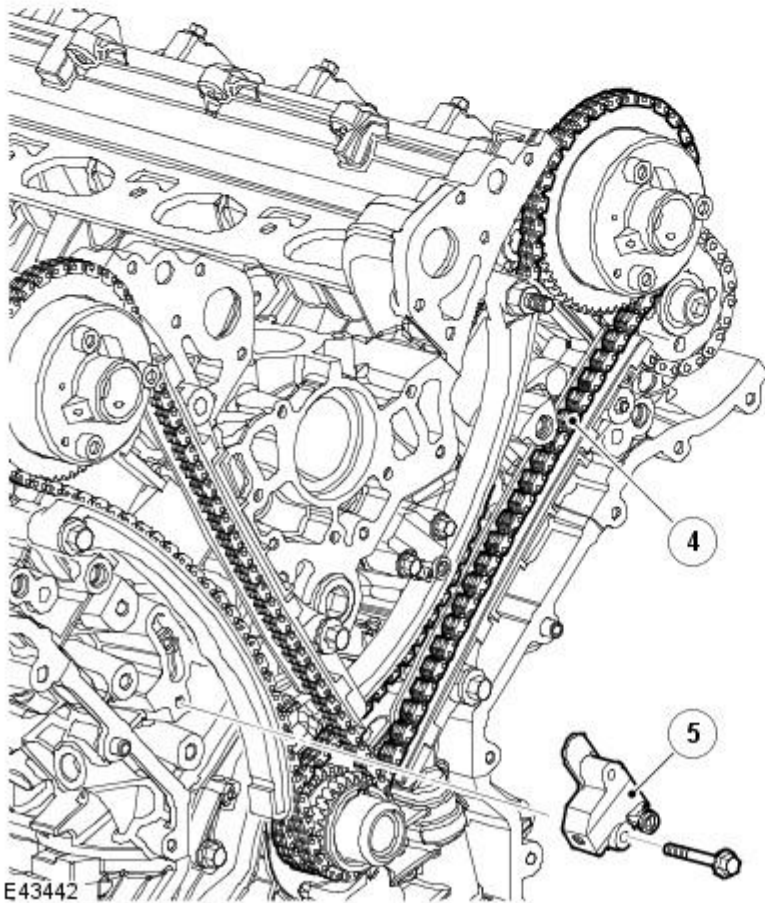
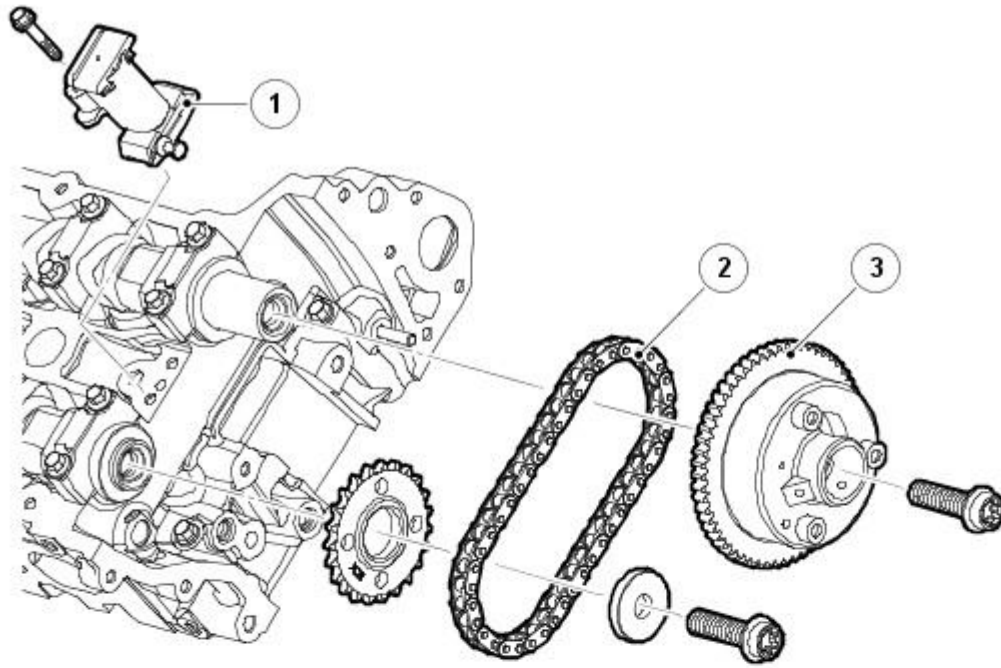
E43440

#### ItemDescription

- |   |                     |
|---|---------------------|
| 1 | Starter drive plate |
| 2 | Bolts (8 off)       |

The starter drive plate is attached to the rear of the crankshaft. A timing disc, for the [CKP \(crankshaft position\)](#) sensor, is spot welded to the front face of the drive plate.

#### Camshaft Timing Components



E43442

**ItemDescription**

1	Secondary chain tensioner
2	Secondary chain
3	<a href="#">VVT</a> unit
4	Primary chain
5	Primary chain tensioner

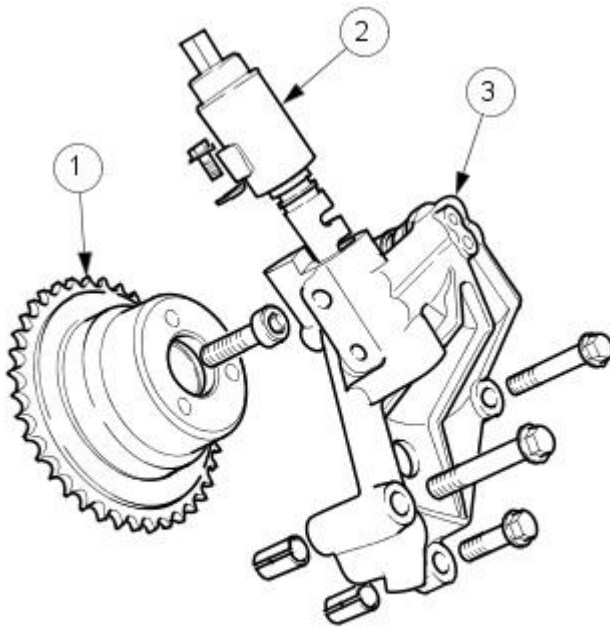
Multiple link primary and single row secondary chains drive the camshafts of each cylinder bank. The primary chains transmit the drive from 2 sprockets on the crankshaft to variable valve timing units on the intake camshafts. The secondary chains transmit the drive from the variable valve-timing units to sprockets on the exhaust camshafts.

A key locates the 2 drive sprockets on the crankshaft. The crankshaft's torsional vibration damper retains the sprockets in

position. The variable valve timing units and the exhaust camshaft sprockets are non-interference, non-keyed fits on their respective camshafts; the drive being transmitted by the face to face friction load produced by the valve timing unit/sprocket securing bolt.

Each chain has a hydraulic tensioner operated by engine oil. The primary chains are lubricated via oil squirt tubes located at the front of the engine block near the crankshaft drive sprockets. A jet of oil from the end of each secondary chain tensioner lubricates the secondary chains. The primary chain tensioners act on pivoting flexible tensioner blades. The secondary chain tensioners act directly on the chains. Guide rails are installed on the drive side of the primary chains.

#### Variable Valve Timing



E31298

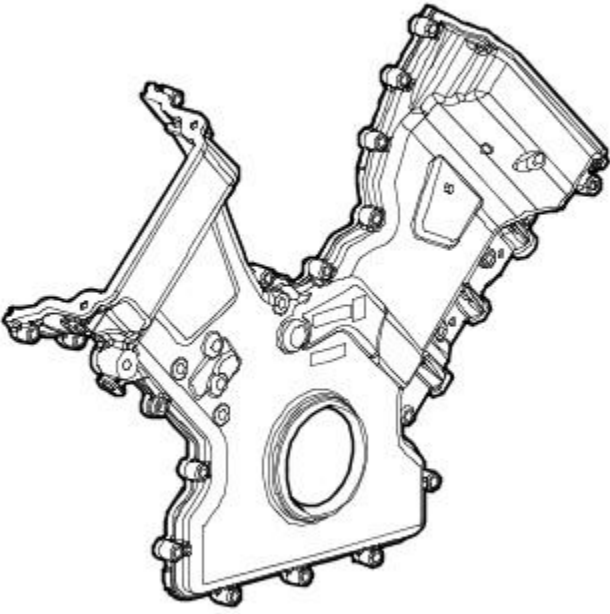
#### ItemDescription

1	<a href="#">VVT</a> oil control unit
2	<a href="#">VVT</a> oil control solenoid
3	Bush carrier

The [VVT](#) unit is a hydraulic actuator mounted on the end of the intake camshaft, which advances or retards the intake camshaft timing and thereby alters the camshaft to crankshaft phasing. The oil control solenoid, controlled by the [ECM](#), routes oil pressure to either the advance or retard chambers located either side of the 3 vanes interspersed within the machined housing of the unit.

The [VVT](#) unit is driven by the primary chain and rotates relative to the exhaust camshaft sprocket. When the [ECM](#) requests the camshaft timing to advance, the oil control solenoid is energized moving the shuttle valve to the relevant position to allow engine oil pressure, via a filter, into the [VVT](#) unit's advance chambers. When the camshaft timing is requested to retard, the shuttle valve moves position to allow oil pressure to exit the advance chambers, while simultaneously routing the oil pressure into the retard chambers.

#### Timing Cover

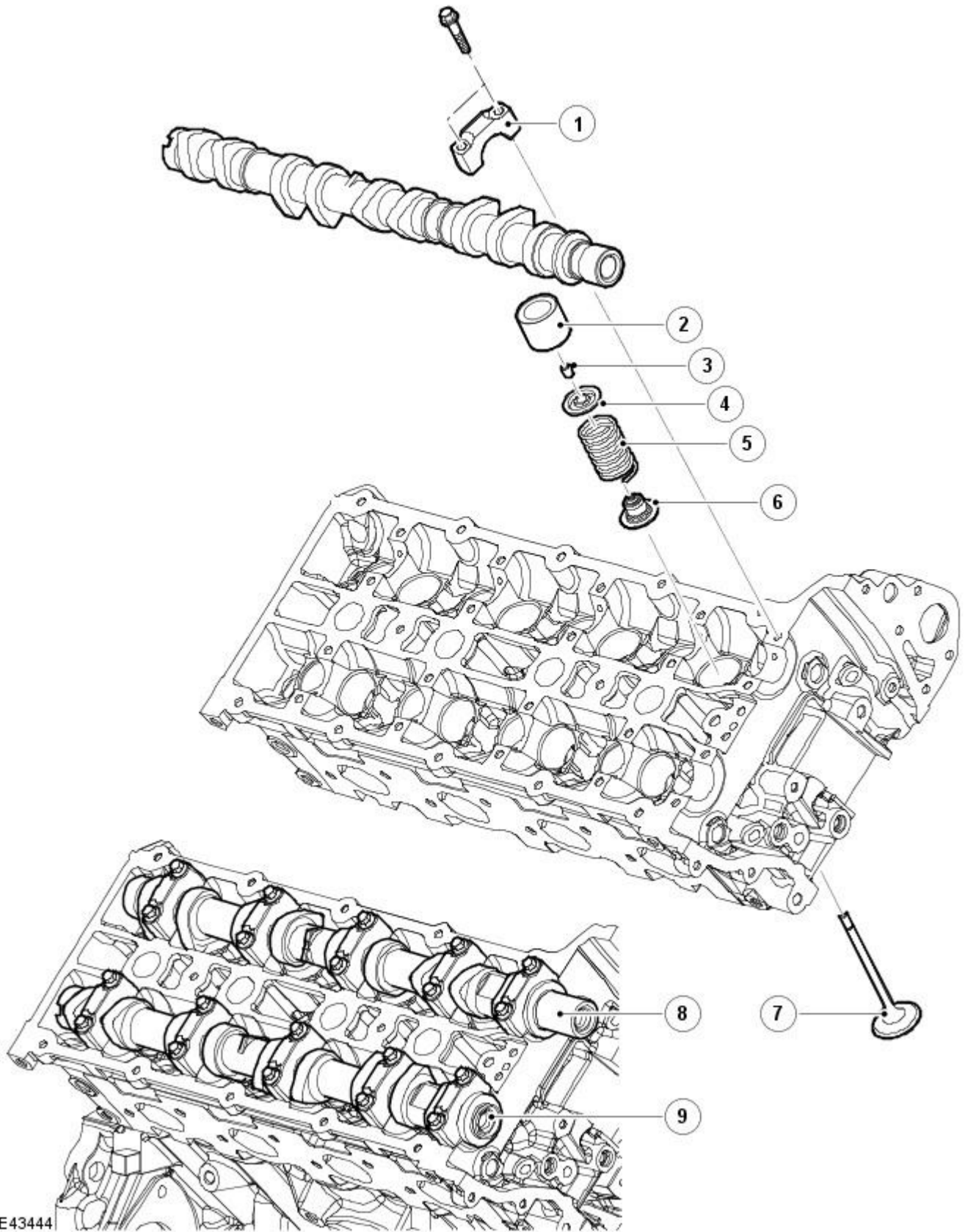


E43443

The aluminum alloy timing cover accommodates the crankshaft front oil seal (a [PTFE \(polytetrafluoroethylene\)](#) lip seal). Silicon rubber in-groove gaskets seal the joint between the timing cover and the front face of the engine.

## Cylinder Head Components





E43444

**ItemDescription**

1	Camshaft bearing cap
2	Tappet
3	Collet
4	Valve spring cap
5	Valve spring
6	Valve stem oil seal
7	Valve
8	intake camshaft

## 9 Exhaust camshaft

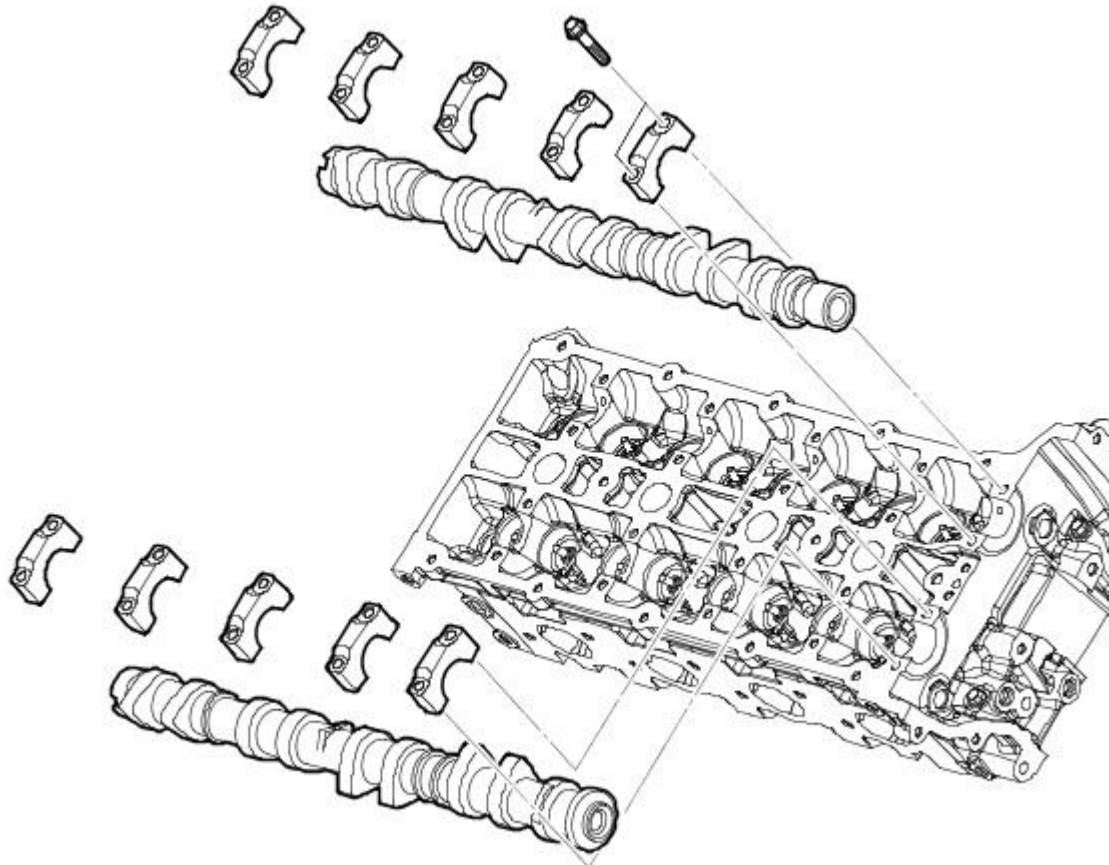
The cylinder heads are unique to each cylinder bank. Deep-seated bolts, to reduce distortion, secure the cylinder heads to the cylinder block. Two hollow dowels align each cylinder head with the cylinder block. The multi-layered steel cylinder head gasket has cylinder specific coolant flow cross-sections for uniform coolant flow.

The 14 mm (0.55 in) spark plugs, 1 per cylinder, locate in recesses down the center line of each cylinder head.

The engine-lifting eyes are bolted to the cylinder heads, 2 on the rear (1 per head) and 1 at the front.

The lightweight valve gear provides good fuel economy and noise levels. Valve head diameters are 31 mm (1.220 in) for the exhaust and 35 mm (1.378 in) for the intake. All valves have 5 mm (0.197 in) diameter stems supported in sintered metal seats and guide inserts. Collets, valve collars and spring seats locate single valve springs on both intake and exhaust valves. Valve stem seals are integrated into the spring seats.

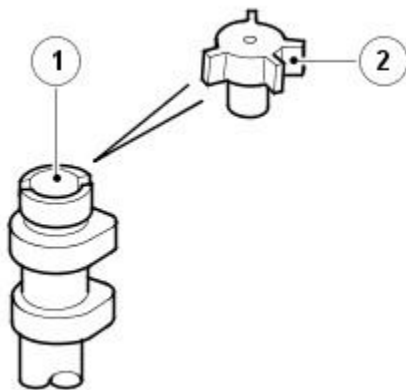
### Camshafts



E43446

The camshafts are manufactured in chilled cast iron. Five aluminum alloy caps retain each camshaft. Location numbers, 0 to 4 for the intake camshaft and 5 to 9 for the exhaust camshaft, are marked on the outer faces of the caps.

### Sensor Timing Ring



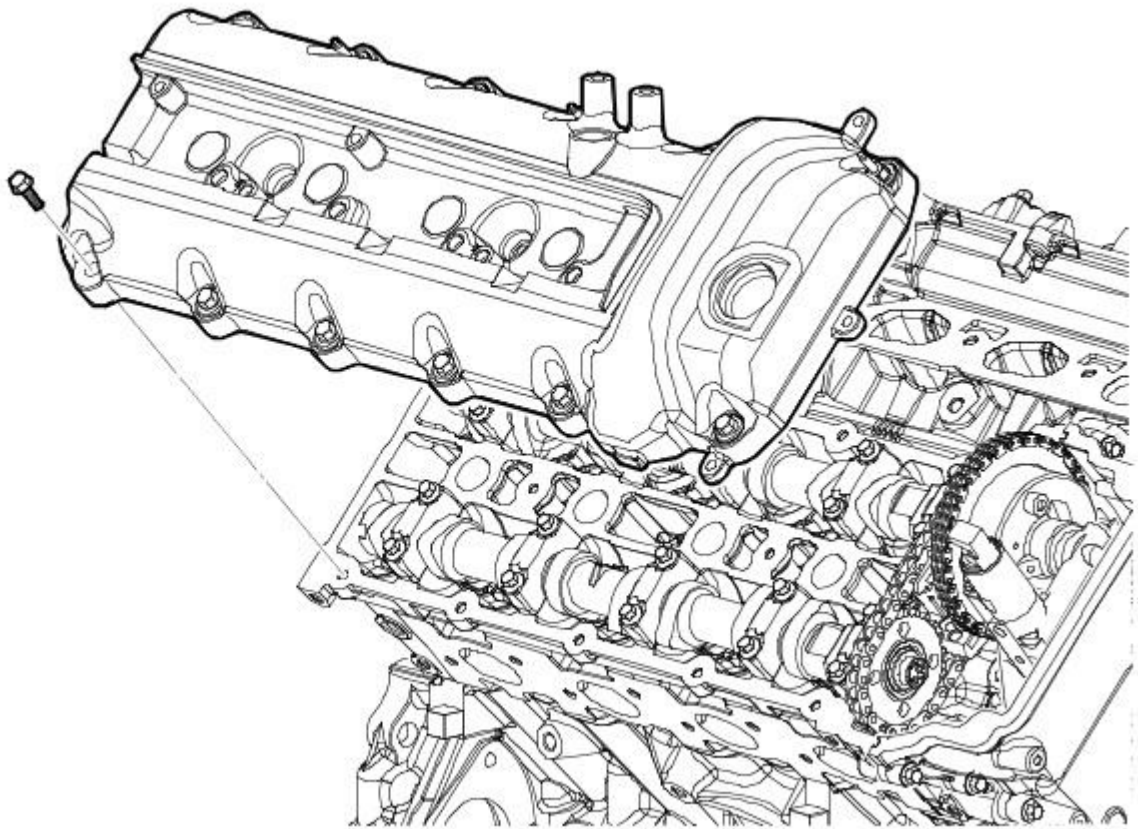
E43447

### ItemDescription

- |   |                 |
|---|-----------------|
| 1 | Intake camshaft |
| 2 | Timing ring     |

A camshaft position sensor timing ring is located at the rear of both intake camshafts. A flat, machined near the front of each camshaft, enables the camshafts to be locked during the valve timing procedure.

### Camshaft Cover

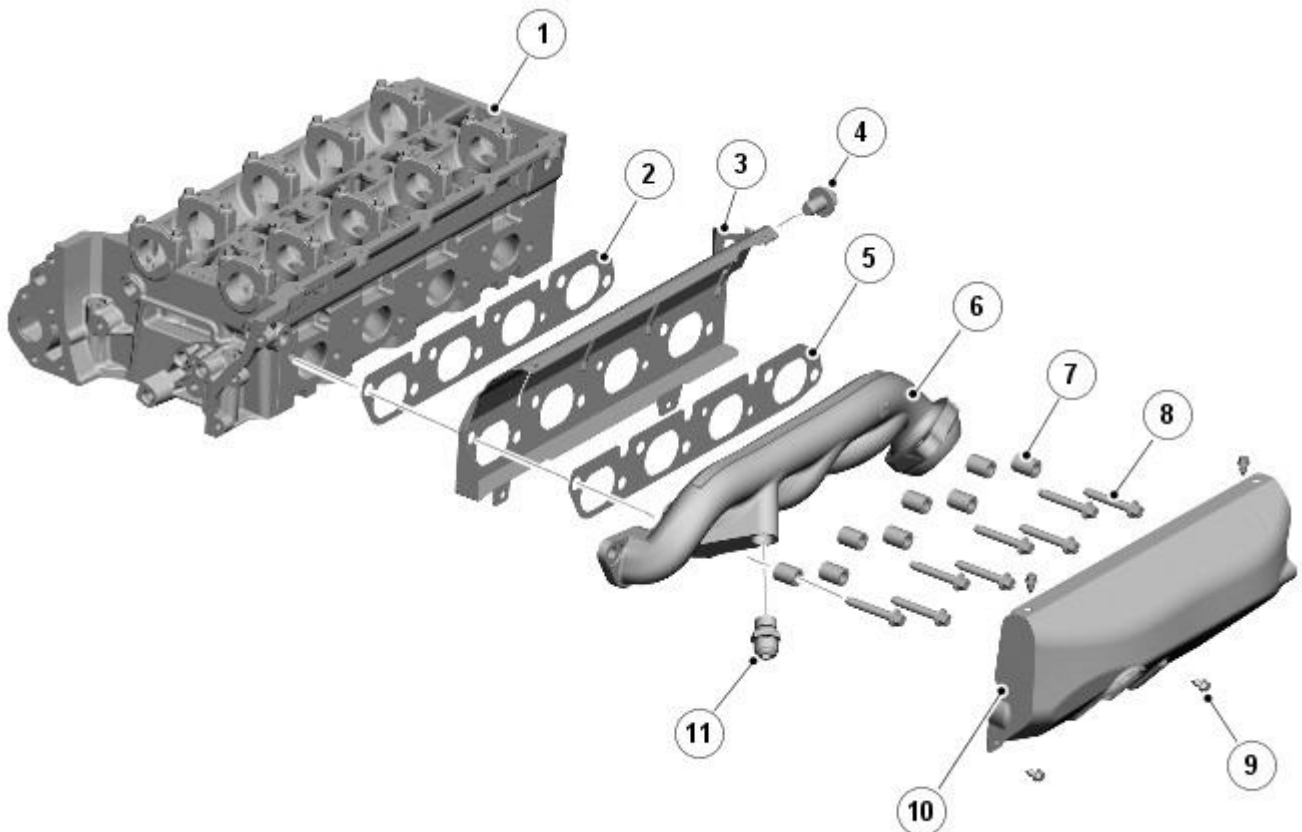


E43445

The camshaft covers are manufactured from thermoplastic. Bank 1 camshaft cover incorporates an outlet for the part load engine breather and the pressure control valve. Bank 2 camshaft cover incorporates an outlet for the full load engine breather and the engine oil filler cap. Identical oil separators are incorporated below the breather outlet in each cover. Refer to: [Engine Emission Control](#) (303-08 Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

• NOTE: [LH](#) exhaust manifold shown, [RH](#) exhaust manifold similar.

Exhaust Manifolds



E99693

**ItemDescription**

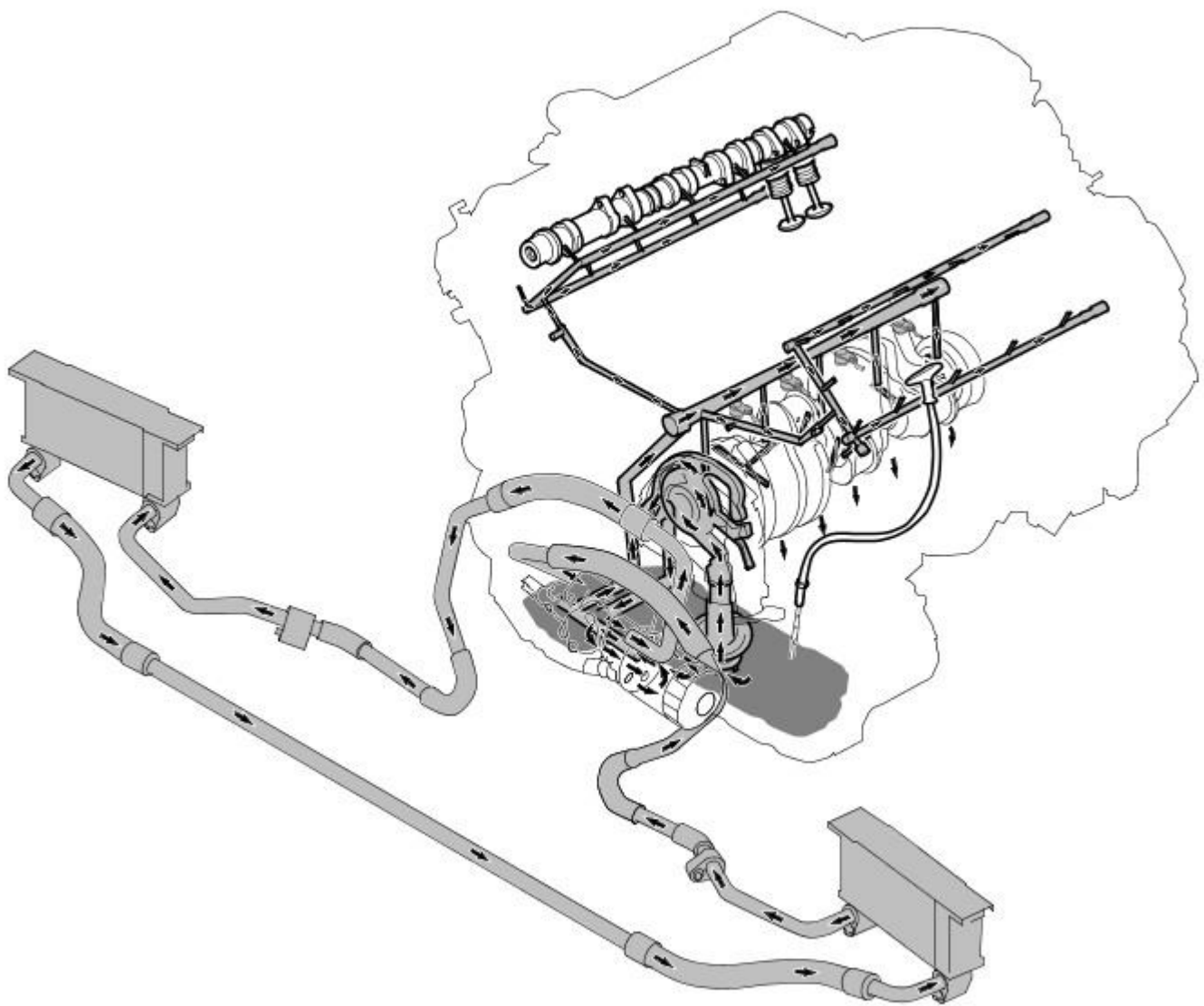
1	Cylinder head
2	Gasket
3	Heat shield
4	Bolt
5	Gasket
6	<a href="#">LH</a> exhaust manifold
7	Spacer (8 off)
8	Bolt (8 off)
9	Bolt (4 off)
10	Heat shield
11	Connector for <a href="#">AIR (secondary air injection)</a> system (where fitted)

The cast stainless steel exhaust manifolds are unique for each cylinder bank. Each exhaust manifold installation includes two metal gaskets and two heat shields. Spacers on the securing bolts allow the manifolds to expand and contract with changes of temperature while maintaining the clamping loads.

Each exhaust manifold incorporates a connector for the [AIR](#) system (where fitted). Where an [AIR](#) system is not fitted, each connector is sealed with a cap nut. The [RH](#) exhaust manifold incorporates a connection flange for the [EGR \(exhaust gas recirculation\)](#) system.

Refer to: [Engine Emission Control](#) (303-08 Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

**Lubrication System**



#### E 99289

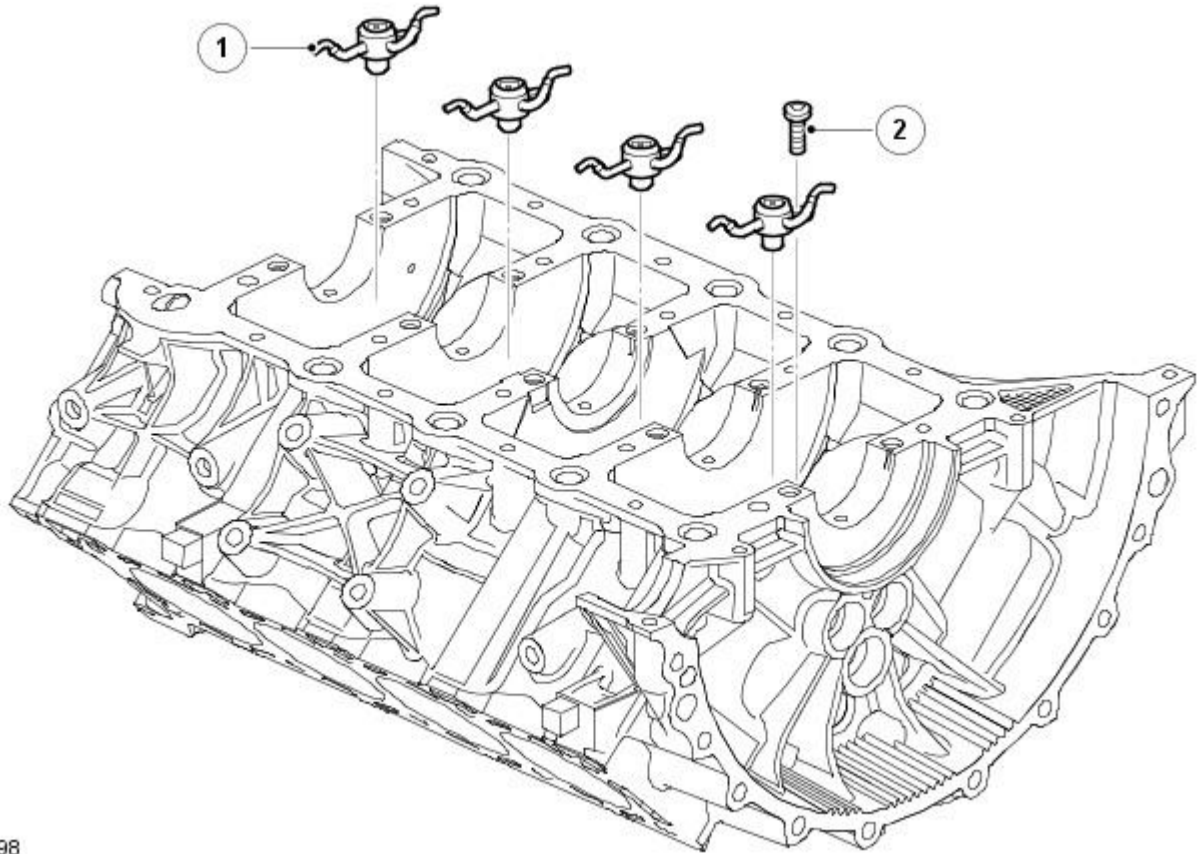
Oil is drawn from the reservoir in the oil pan and pressurized by the oil pump. The output from the oil pump is then filtered, cooled and distributed through internal oil passages.

All moving parts are lubricated by pressure or splash oil. Pressurized oil is also provided for the timing gear chain tensioners and the piston cooling jets.

The oil returns to the oil pan under gravity. Large drain holes through the cylinder heads and cylinder block ensure the quick return of the oil, reducing the volume of oil required and enabling an accurate check of the contents soon after the engine stops.

System replenishment is through the oil filler cap on bank 2 camshaft cover.

Piston Cooling Jets



E56198

**ItemDescription**

1	Piston cooling jet (4 off)
2	Bolt (4 off)

The piston cooling jets lubricate and cool the pistons and piston pins. The jets are located in the cylinder block, one between each adjacent pair of main bearings. Each jet sprays oil on the underside of two pistons.

Oil Pick-up

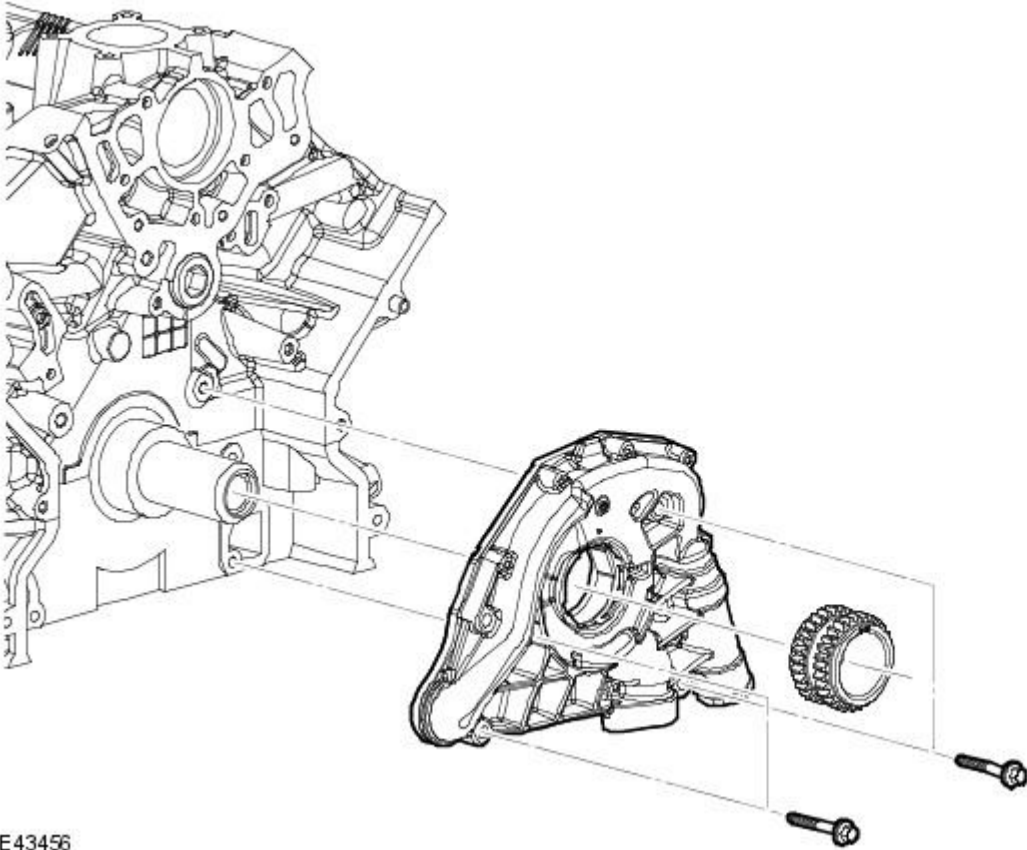


E72000

The fabricated steel oil pick-up is immersed in the oil reservoir to provide a supply to the oil pump during all normal vehicle attitudes. A mesh screen in the inlet prevents debris from entering the oil system.

Oil Pump



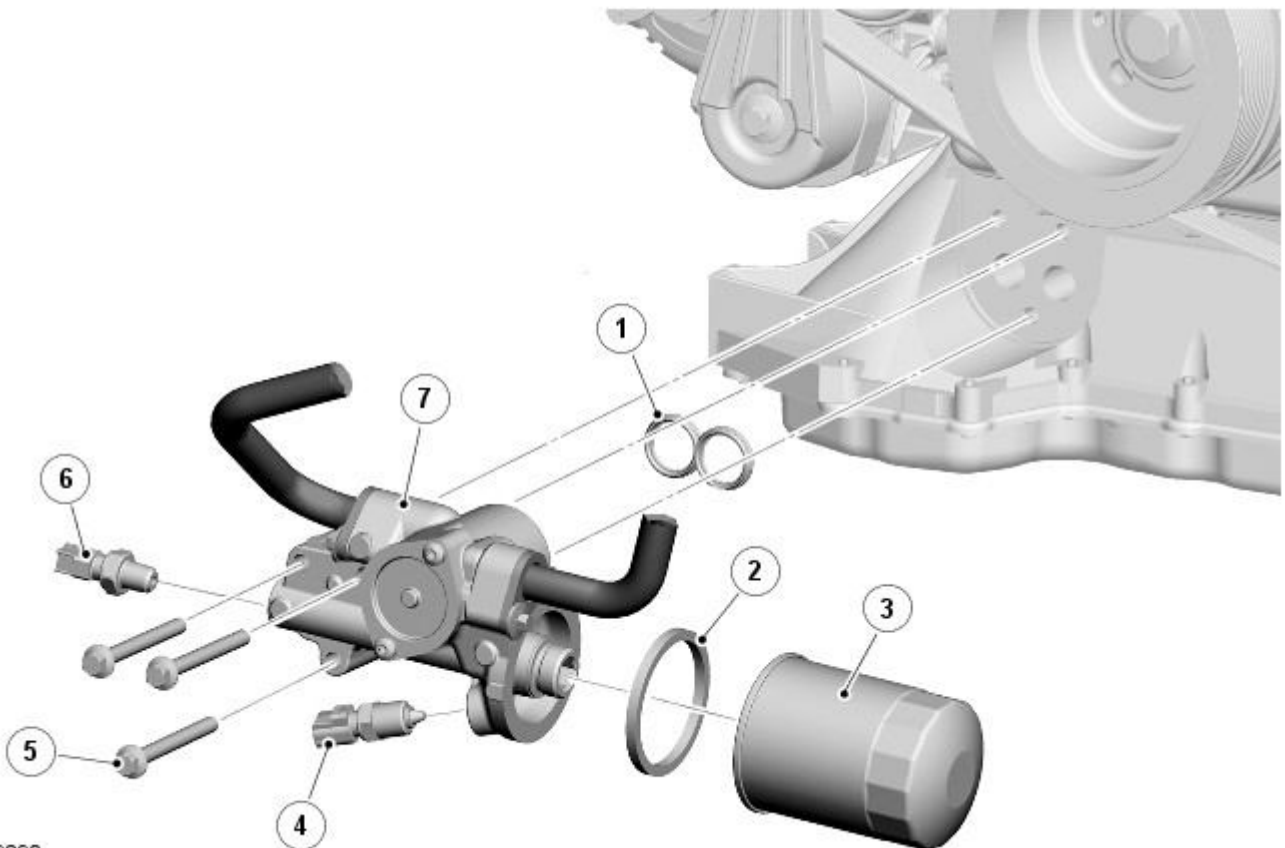


E43456

The oil pump is installed on the crankshaft at the front of the engine. The pump outlet port aligns with oil passages in the bedplate.

The pumping element is an eccentric rotor, which is directly driven by flats on the crankshaft. An integral pressure relief valve regulates pump outlet pressure at 4.5 bar (65.25 lbf/in<sup>2</sup>).

Oil Filter



E99290

ItemDescription

1	Seal
2	Gasket
3	Filter
4	Oil temperature sensor
5	Bolt (3 off)
6	Oil pressure switch
7	Filter head

The oil filter is a replaceable cartridge with an internal bypass facility that permits full flow bypass if the filter is blocked. The oil filter is installed on a filter head attached to the front of the structural sump. The oil cooler feed and return pipes are connected to the filter head. The filter head also incorporates:

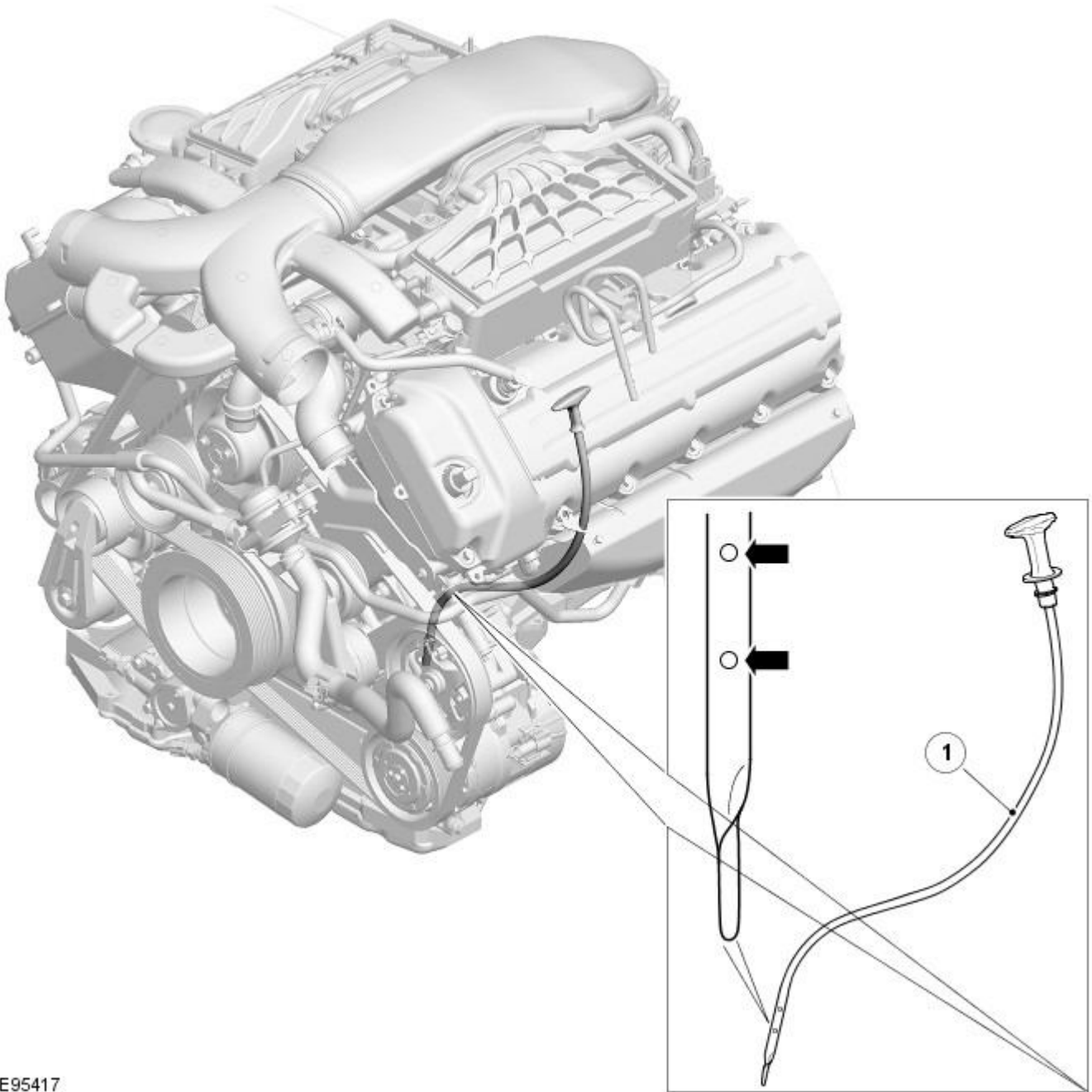
- An oil pressure switch.  
Refer to: [Instrument Cluster](#) (413-01 Instrument Cluster, Description and Operation).
- An oil temperature sensor.  
Refer to: [Electronic Engine Controls](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

The lubrication system has two engine oil coolers. The engine oil coolers are identical liquid-to-air heat exchangers installed immediately in front of each front wheel arch. Each engine oil cooler is attached to a mounting bracket with bonded rubber mountings.

Engine oil flows through the coolers in series. Pipes and hoses direct the engine oil from the filter head to the [RH](#) engine oil cooler, then to the [LH](#) oil cooler and then back to the filter head.

Cooling air for the oil coolers is taken in through mesh covered openings at the ends of the front bumper. Air ducts connect the openings to the oil coolers. Exhaust air from the oil coolers flows into the front wheel arches through slots in the wheel arch liners.

Oil Level Gage



E95417

**ItemDescription**

1 Oil level gage

The oil level gage locates along the left side of the oil pan, supported in a tube installed in the bedplate. Two holes in the end of the gage indicate the minimum and maximum oil levels. There is a difference of approximately 1.5 liters (1.58 US quarts) between the 2 levels.

## **Engine - 4.2L SC V8 - AJV8 - Engine**

Diagnosis and Testing

For additional information.

REFER to: [Engine - 3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (303-00 Engine System - General Information, Diagnosis and Testing).

# Engine - 4.2L SC V8 - AJV8 - Engine Oil Draining and Filling

General Procedures

Special Tool(s)	
 <p>303-752</p> <p>E75849</p>	<p>Wrench, Oil filter</p> <p>303-752</p>



**WARNING:** The spilling of hot engine oil is unavoidable during this procedure, care must be taken to prevent scalding.

• **NOTE:** Clean the components general area prior to dismantling.



**1. WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

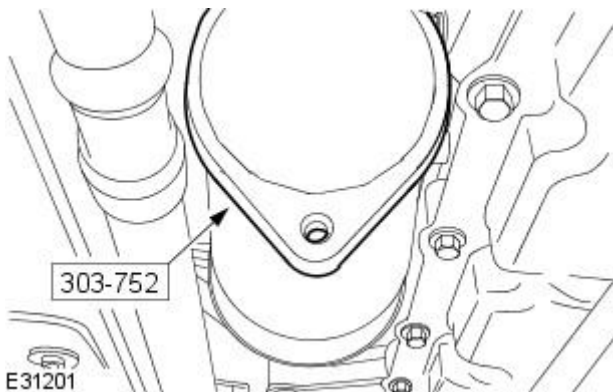
**2.** Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).

**3.** Remove the oil pan drain plug.

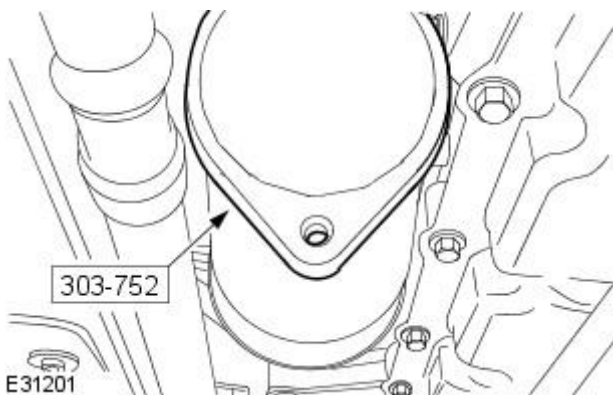
- Position a container to collect the fluid.
- Discard the oil pan drain plug seal.

**4.** Remove the oil filter.

- Position a container to collect the fluid.
- Discard the oil filter.



**5.** Using the special tool, install the oil filter.



**6.** Tighten the drain plug to 25 Nm.

- Install a new seal.

**7.** Fill the engine with oil.

**8.** Start engine and run at idle speed until the oil pressure warning light extinguishes.

- Stop the engine.
- Check for leaks.

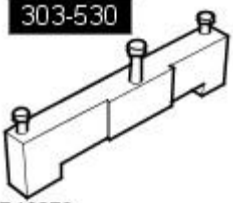




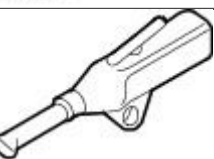
**9.** Install the air deflector.

For additional information, refer to: Air Deflector (501-02, Removal and Installation).

**10.** Check and top-up the engine oil.


**Engine - 4.2L SC V8 - AJV8 - Camshafts LH**

In-vehicle Repair

Special Tool(s)	
 <p>303-530 E46879</p>	<p>Camshaft setting/locking tool 303-530</p>
 <p>303-645 E46881</p>	<p>Timing Setting tool 303-645</p>
 <p>303-532 E46880</p>	<p>Timing chain tensioning tool 303-532</p>
 <p>303-540 E65896</p>	<p>Tappet hold-down tool 303-540</p>
 <p>303-540/02 E65897</p>	<p>Tappet hold-down tool adaptor 303-540/02</p>
 <p>DWST074</p>	<p>Fan nozzle - air gun 303-590</p>

**Removal**

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).


2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.



3. Remove the engine front cover.  
For additional information, refer to: [Engine Front Cover](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).
4. Remove the crankshaft position (CKP) sensor.  
For additional information, refer to: [Crankshaft Position \(CKP\) Sensor - Vehicles With: Supercharger](#) (303-14, Removal and Installation).
5. Remove the LH valve cover.  
For additional information, refer to: [Valve Cover LH](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).

**6. CAUTIONS:**

 Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.

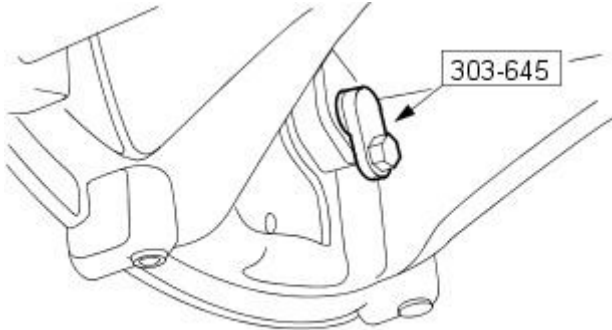
 Rotate the crankshaft clockwise to position the engine to top dead center (TDC) number 1 cylinder.

Lock the crankshaft.

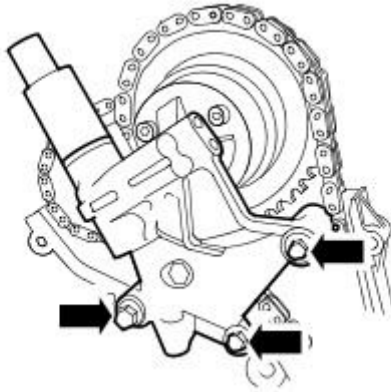
- Install the special tool.
- Install the screw.

7. Remove the RH variable camshaft timing (VCT) control solenoid housing.
  - Remove the 3 bolts.
  - Remove and discard the O-ring seals.

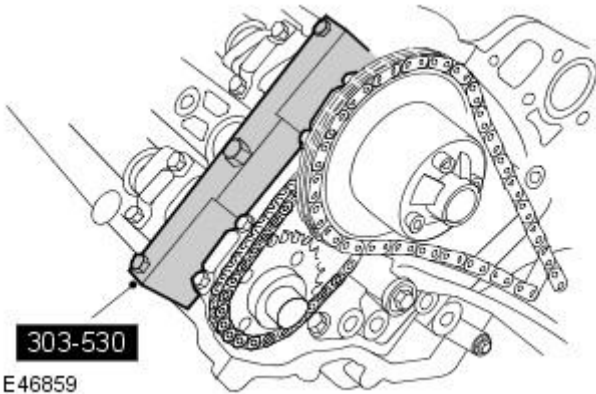
8. Install the special tool to the RH cylinder head.
  - Rotate the crankshaft until the flats on the camshafts are parallel with the cylinder head joint faces.
  - Install the 3 bolts.



VUJ0002400



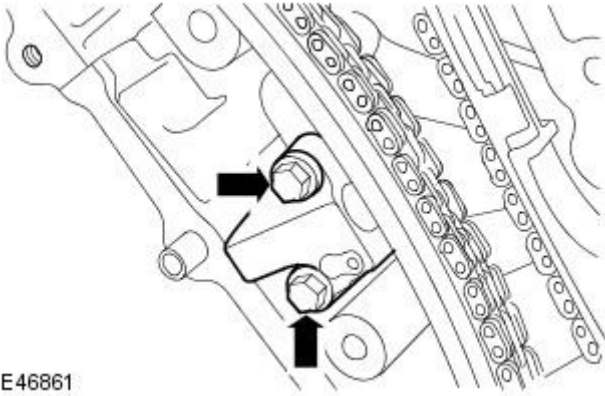
E46858



E46859

9. Remove the LH primary timing chain tensioner.

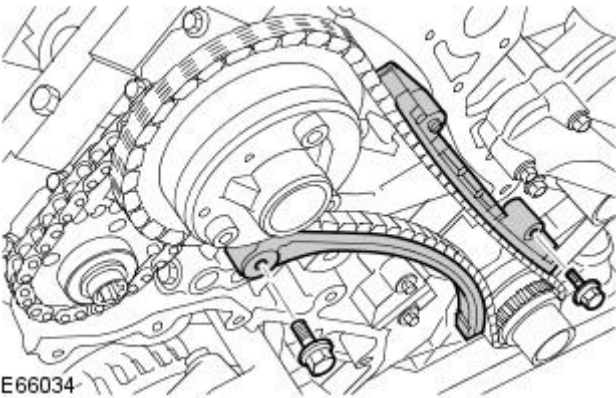
- Remove the 2 bolts.



E46861

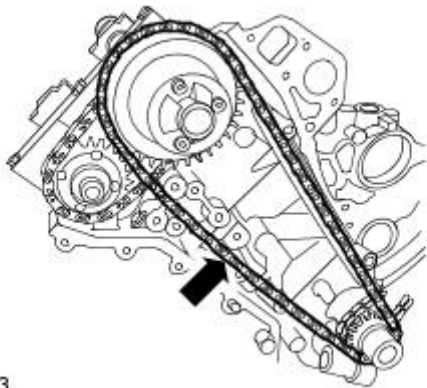
10. Remove the LH upper and lower primary timing chain tensioner guides.

- Remove the 2 bolts.



E66034

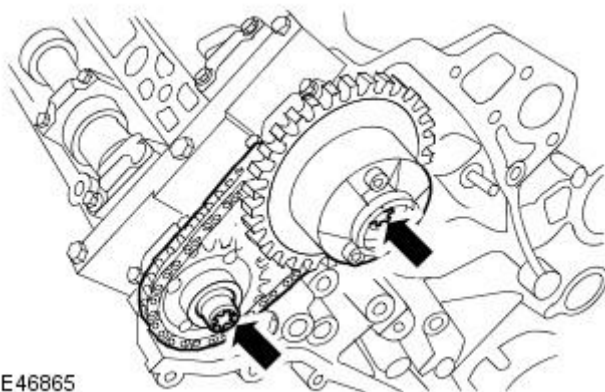
11. Remove the LH primary timing chain.



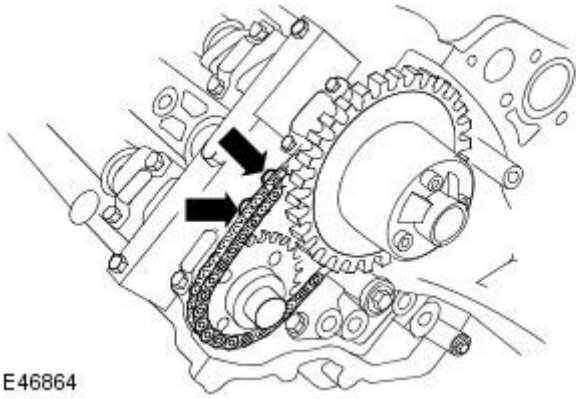
E46863

12. Release the LH camshaft sprocket assembly.

- Remove the 2 Torx bolts.



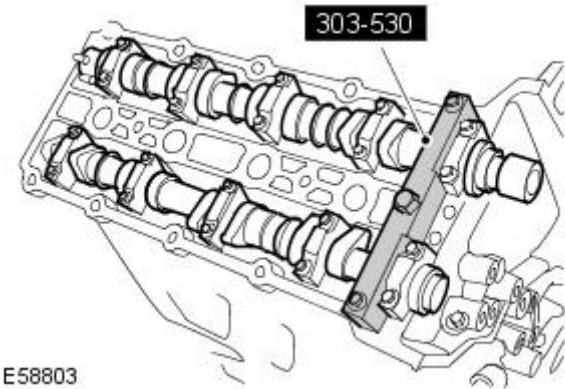
E46865



E46864

13. Remove the LH secondary timing chain, tensioner and sprocket assembly.

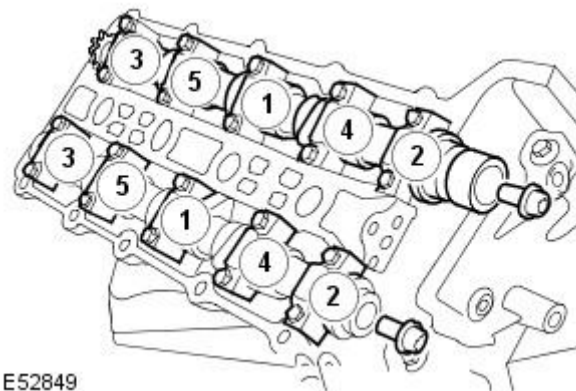
- Remove the 2 retaining bolts.



E58803

14. Remove the special tool from the LH cylinder head.

- Remove the 3 bolts.



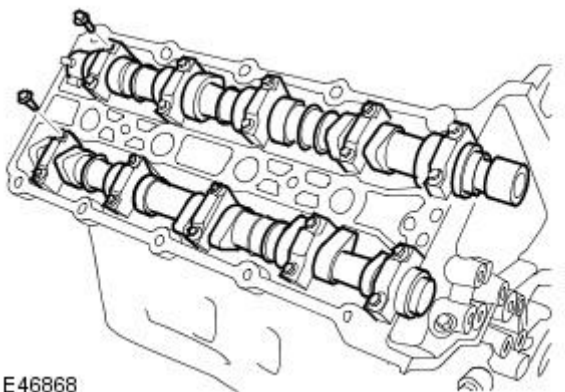
E52849

15.  CAUTION: Evenly and progressively, release the camshaft bearing caps.

- NOTE: Remove the camshaft bearing caps. Note: their position, orientation and markings. Each is marked with its position (number) and an orientation (arrow).

Remove the camshaft bearing caps.

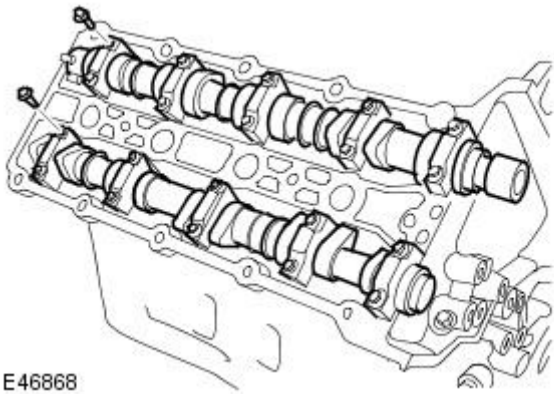
- Remove the 20 bolts.



E46868

16. Remove the camshafts.

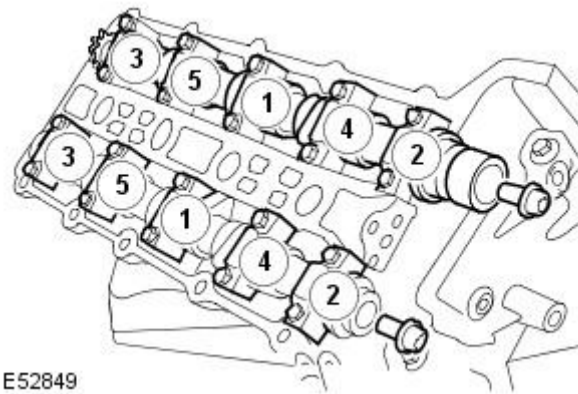
## Installation



E46868

1. Install the camshafts.

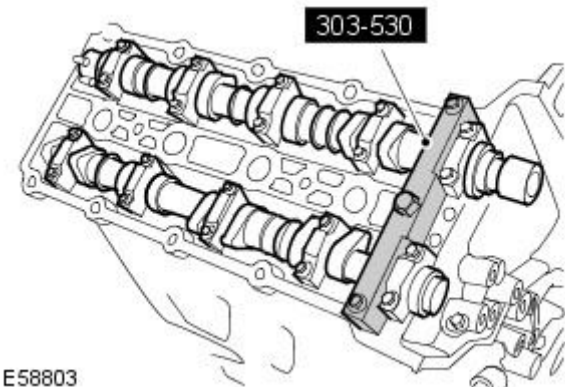
- Clean the component mating faces.
- Replace the valve shims, with the smallest shim available.
- Lubricate the journals and camshaft lobes.



E52849

2. Install the camshaft bearing caps.

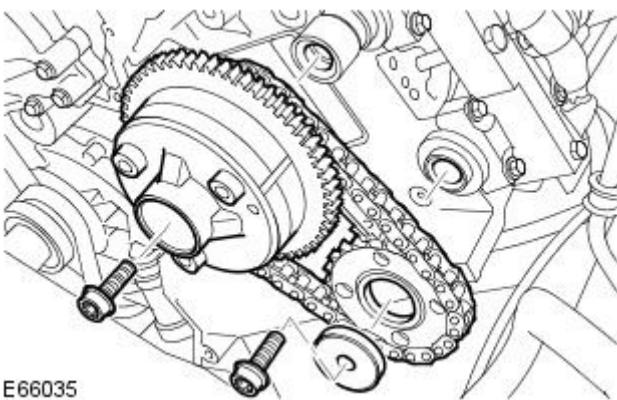
- Clean the component mating faces.
- Evenly and progressively tighten the bolts in the sequence shown to 10 Nm.




E58803

3. Install the special tool to the LH cylinder head.

- Install the 3 bolts.



E66035

4.  CAUTION: Make sure the secondary timing chain and camshaft sprockets are free to rotate.

- NOTE: LH illustration shown, RH is similar.

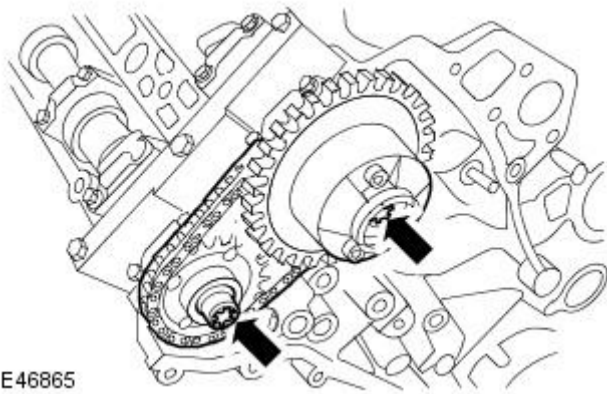
Install the LH secondary timing chain, tensioner and sprocket assembly.

- Clean the components.
- Install the Torx bolts, but do not tighten fully at this stage.



5. Install the LH secondary timing chain tensioner retaining bolts.

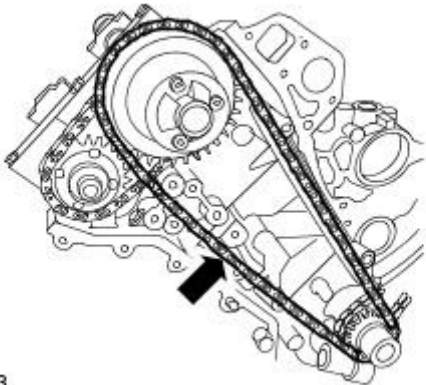
- Tighten the bolts to 12 Nm.



E46865

6. Install the LH primary timing chain.

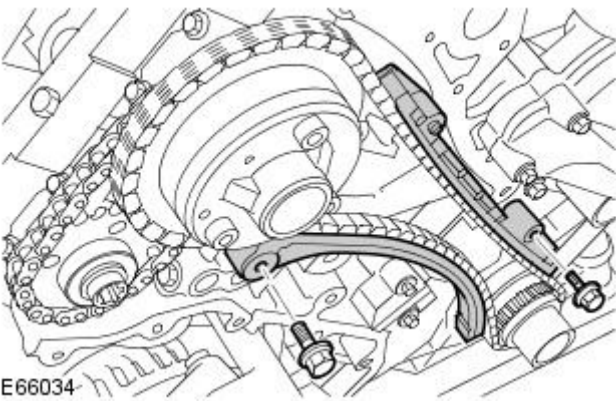
- Clean the components.
- Make sure the timing chain slack is on the tensioner side of the timing chain.




E46863

7. Install the LH primary timing chain tensioner guides.

- Tighten the bolts to 12 Nm.

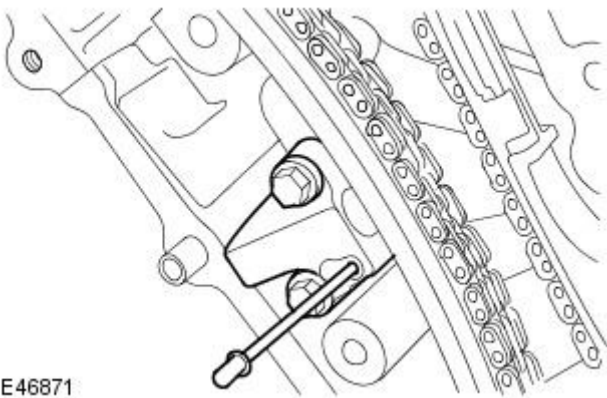


E66034

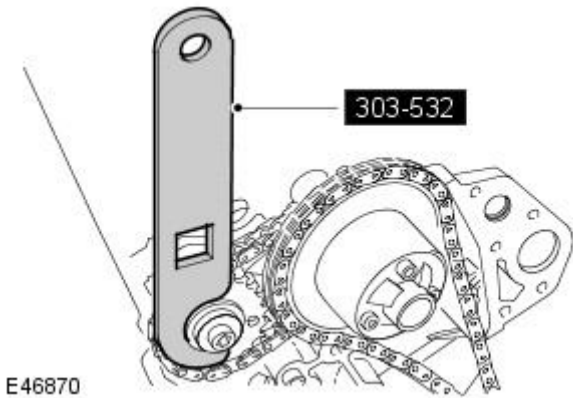
8.  CAUTION: During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

Install the LH primary timing chain tensioner.


- Clean the components.
- Using 3 mm diameter metal rod, retain the chain tensioner piston.
- Remove the retaining rod.
- Tighten the bolts to 12 Nm.




E46871



#### 9. CAUTIONS:

 Using the special tool, apply force to the tool in a counter-clockwise direction, to tension the primary timing chain on its drive side.

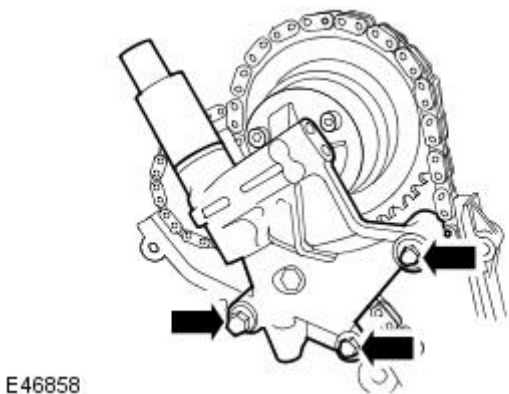
 The intake camshaft sprocket retaining bolt **MUST** be tightened before the exhaust camshaft sprocket retaining bolt. Engine damage will occur if this procedure is not followed.

Install the special tool to the RH exhaust camshaft sprocket.

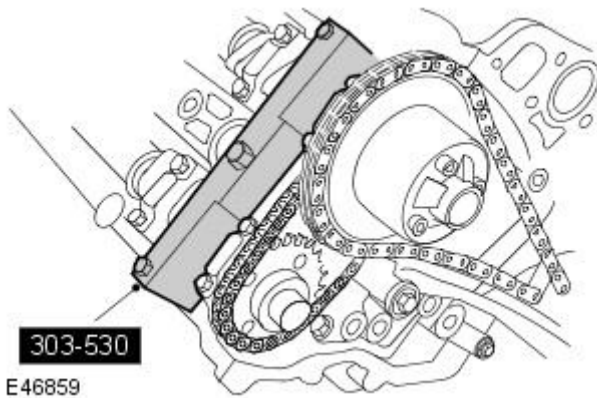
- Tighten the intake camshaft sprocket retaining bolt to 20 Nm + 90 degrees
- Tighten the exhaust camshaft retaining bolt to 20 Nm + 90 degrees.
- Install new retaining bolts.

#### 10. Install the LH VCT control solenoid housing.

- Clean the components.
- Install the new O-ring seals.
- Tighten the new bolts to 22 Nm.

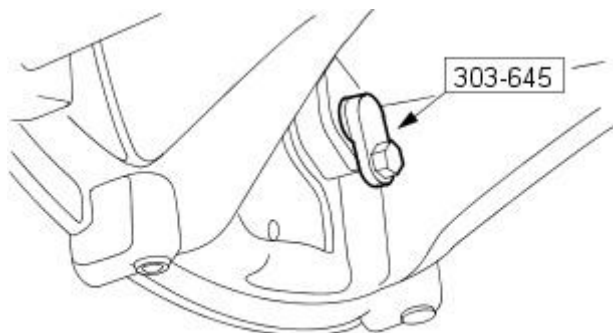


#### 11. Remove the special tool from the LH cylinder head.



#### 12. Remove the crankshaft locking tool.

- Remove the screw.




#### 13. Install the CKP sensor.

For additional information, refer to: Crankshaft Position (CKP) Sensor - Vehicles With: Supercharger (303-14, Removal and Installation).

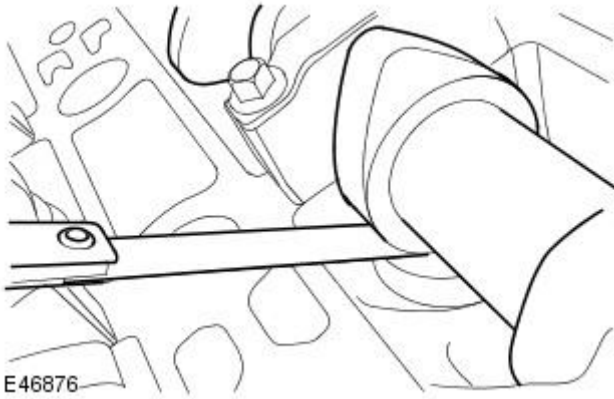


14. For cylinder head data, refer to specifications.

15. Rotate the engine clockwise to position the camshaft lobe away from the valve tappet.

16.  CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

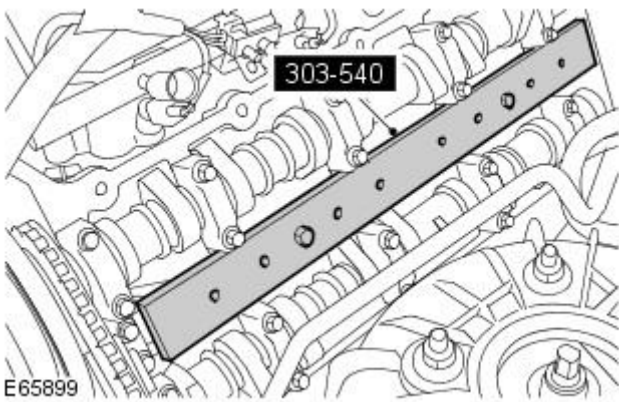
Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.




17. Repeat the above procedure for the remaining 15 shims.

18. Install the special tool 303-540, to the cylinder head.

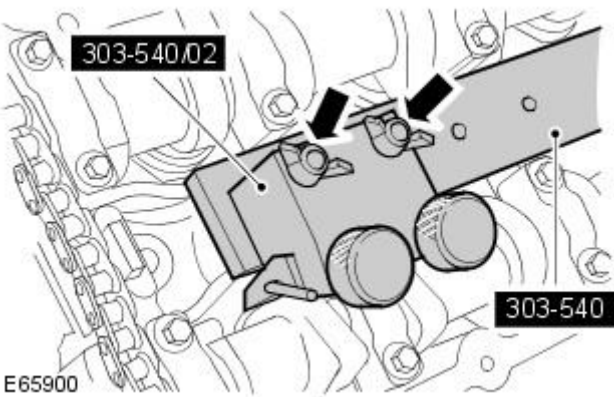
- Tighten the 2 bolts to 10 Nm



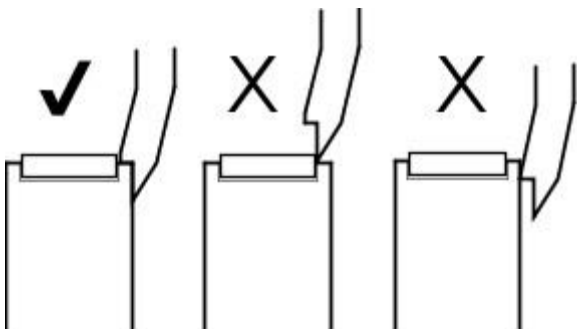
19.  CAUTION: Do not rotate the crankshaft while the special tool 303-540/02 is attached to 303-540.

Attach the special tool 303-540/02 to 303-540.

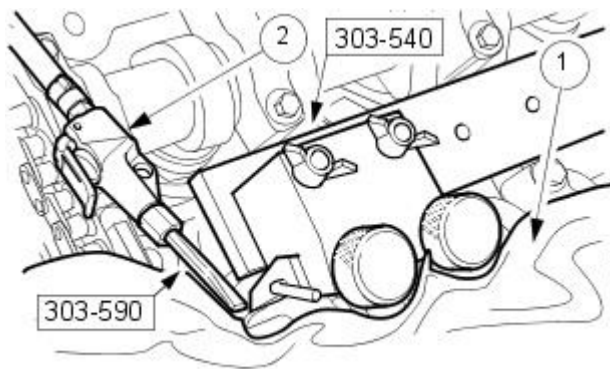
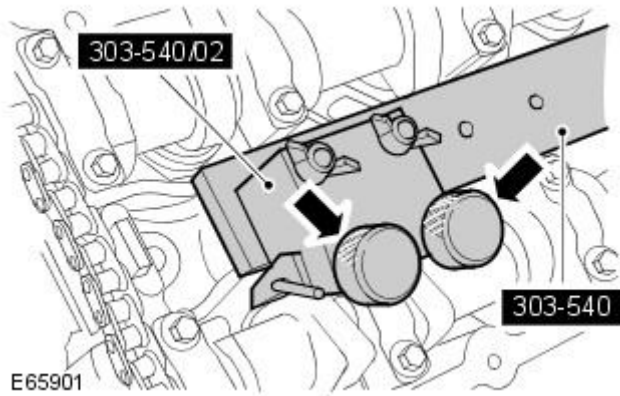
- Secure with the 2 wing nuts.



20. Position the special tool to the tappet as shown.



21. Using the special tool, compress the valve spring.



22. **⚠ CAUTION:** Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.

• **NOTE:** Use the following formula to calculate the required shim thickness. Original shim thickness + measured shim clearance - desired clearance = required shim thickness.

Remove, clean and measure the shim.

- Surround the immediate working area with a cloth, to retain any loose shims displaced by the compressed air.
- Use the special tool 303-590, aimed at the edge of the shim, to lift it from the tappet. Note the position of each one.

23. **CAUTIONS:**

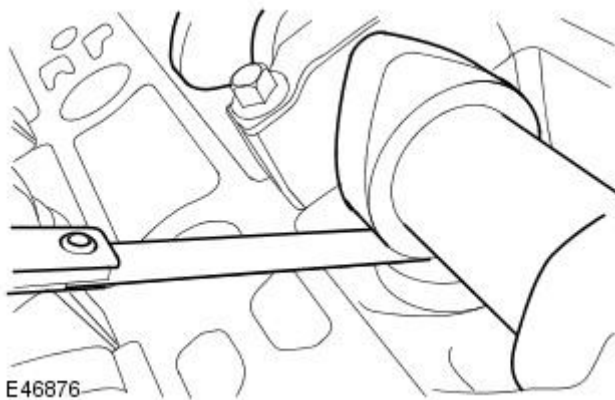
**⚠** Shims must be fitted with the size markings facing the tappet, not the camshaft.

**⚠** Do not use a magnet to install shims. Failure to follow these instructions may result in damage to the vehicle.

Install the new shim.

- Clean the components.
- Lubricate the shim with clean engine oil.
- Release and remove the special tools as required.

24. Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



25. Repeat the above procedure for the remaining valves.

26. Install the LH valve cover.

For additional information, refer to: [Valve Cover LH](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).

27. Install the engine front cover.

For additional information, refer to: [Engine Front Cover](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).

28. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

## Engine - 4.2L SC V8 - AJV8 - Crankshaft Front Seal

In-vehicle Repair

### Removal



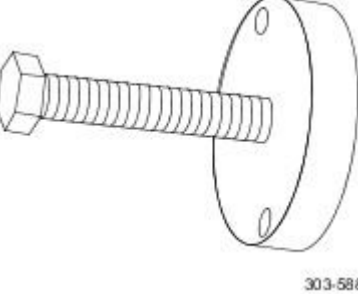
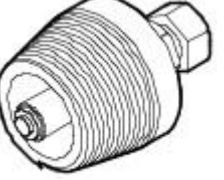

1. Remove the crankshaft pulley.  
For additional information, refer to: [Crankshaft Pulley](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).

### Installation


1. Install the crankshaft pulley.  
For additional information, refer to: [Crankshaft Pulley](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).

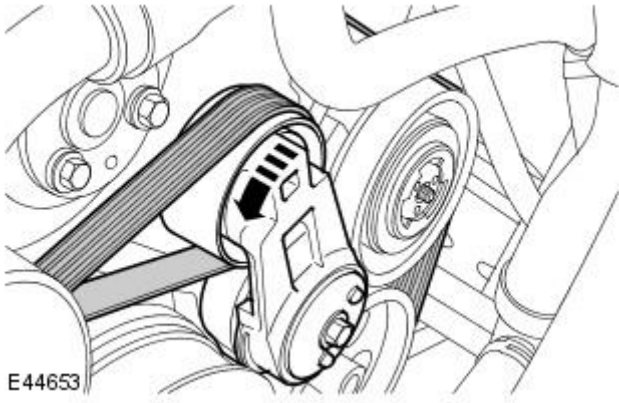
# Engine - 4.2L SC V8 - AJV8 - Crankshaft Pulley

In-vehicle Repair

Special Tool(s)	
 303-191	Crankshaft pulley locking tool 303-191
 303-191-02	Crankshaft pulley locking tool adapter 303-191/02
 303-588	Crankshaft pulley/damper remover 303-588
 303-751	Seal extractor 303-751
 303-750	Seal installer 303-750


## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the cooling fan motor and shroud.  
For additional information, refer to: [Cooling Fan Motor and Shroud - 4.2L SC V8 - AJV8](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
4. Remove the oil filter housing.  
For additional information, refer to: [Oil Filter Housing](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).



5. Release the accessory drive belt.

- Rotate the accessory drive belt tensioner counter-clockwise, using a 3/8 " drive wrench.

6.  CAUTION: Under no circumstances should the crankshaft setting peg, 303-645, be used in the following operations, to restrain the crankshaft.

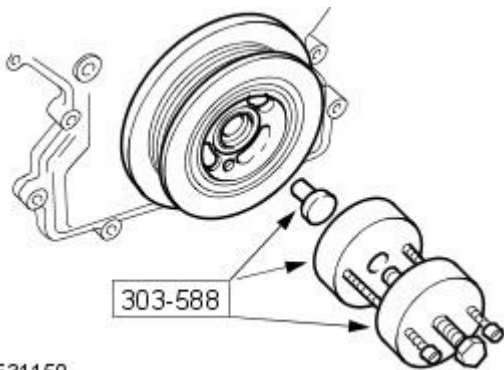
- NOTE: The crankshaft pulley retaining bolt will be very tight.

Using the special tool, retain the crankshaft front pulley.

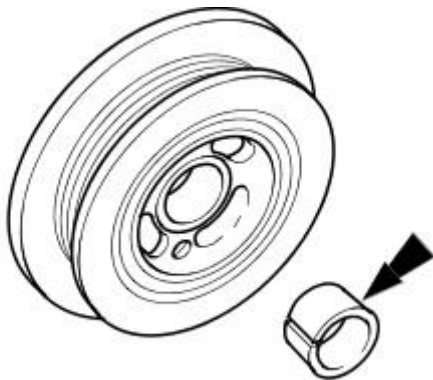
- Remove and discard the crankshaft pulley retaining bolt.
- Remove the special tools.

7. Using the special tools, remove the crankshaft pulley.

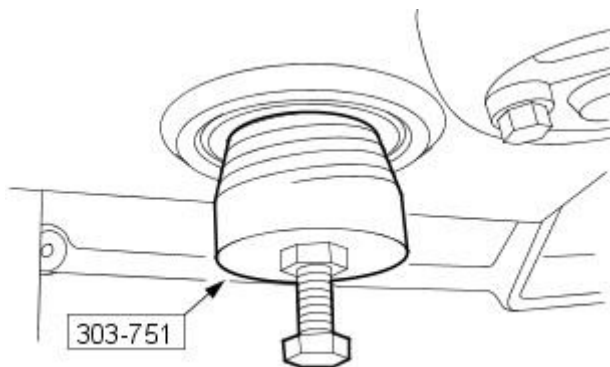
- Collect the locking ring.
- Remove the special tools.



8. Check the crankshaft pulley and locking ring for damage.



9. Using the special tool, remove the crankshaft front seal.



E31171

## Installation

### 1. CAUTIONS:



Make sure the crankshaft seal mating faces are clean and dry.

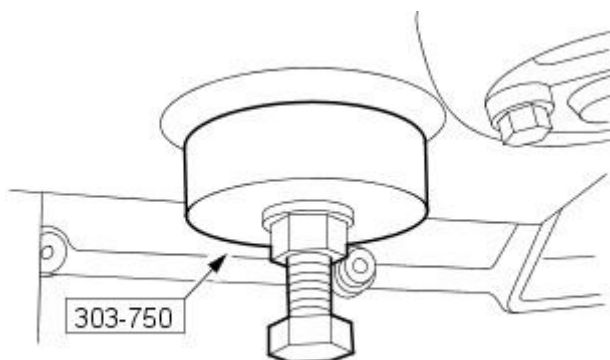


Do not remove the seal protector at this stage.

Using the special tool, install the crankshaft front seal.

- Clean the component mating faces.

### 2. Remove the seal protector.



E31173

### 3. Install the crankshaft pulley.

- Lubricate the seal with clean engine oil.
- Install the locking ring.

### 4. CAUTION: The screw thread in the crankshaft pulley must be cleaned out before installing a new crankshaft pulley bolt.

Install, but do not tighten, the new crankshaft pulley bolt.

### 5. CAUTION: Under no circumstances should the crankshaft setting peg, 303-645, be used in the following operations, to restrain the crankshaft.

Using the special tools, retain the crankshaft pulley.

- Tighten the crankshaft pulley bolt to 380 Nm.
- Remove the special tools.

### 6. Attach the accessory drive belt.

### 7. Install the oil filter housing.

For additional information, refer to: [Oil Filter Housing](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).

### 8. Install the cooling fan motor and shroud.

For additional information, refer to: [Cooling Fan Motor and Shroud - 4.2L SC V8 - AJV8](#) (303-03A Engine Cooling - 4.2L NA

V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

### 9. Connect the battery ground cable.

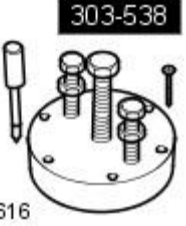
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).






# Engine - 4.2L SC V8 - AJV8 - Crankshaft Rear Seal

In-vehicle Repair

Special Tool(s)	
 <p>E46616</p>	<p>Crankshaft rear oil seal remover/installer</p>
	<p>303-538</p>

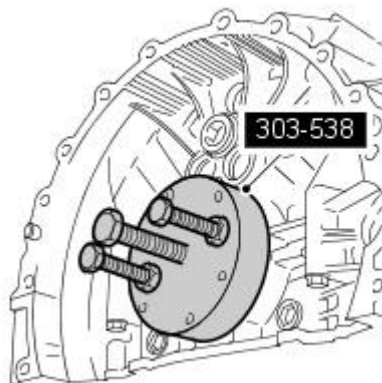
## Removal

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

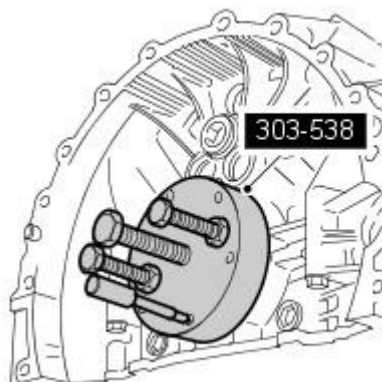
Raise and support the vehicle.

- Remove the flexplate.
- Install the special tools.

- Install the 2 bolts.
- Tighten the 2 nuts to retain the special tool.

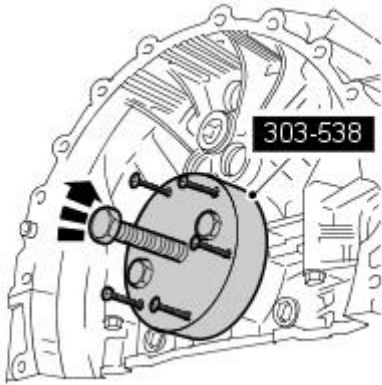


- Using the special tool, pierce the seal to create holes for the 6 self-tapping screws.




5. Using the special tools, remove and discard the crankshaft rear oil seal.

- Install the 6 self-tapping screws.
- Adjust the 2 nuts.
- Tighten the center bolt.



E46615

## Installation

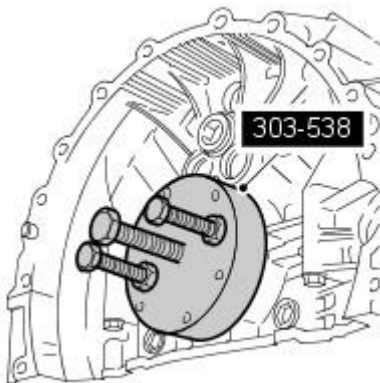
1.  **CAUTION:** Do not lubricate the components.

Partially install the crankshaft rear oil seal.

- Make sure the components are clean and dry.
- Carefully remove the transit sleeve, leaving the seal on the crankshaft.

2. Install the special tools.

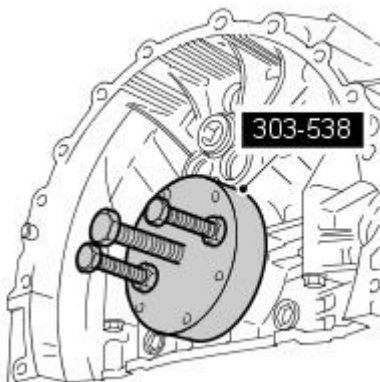
- Install the 2 bolts.
- Tighten the 2 nuts to retain the special tool.



E46613

3. Using the special tool, install the crankshaft rear oil seal.

- Tighten the special tool nuts evenly and progressively to fully install the seal.



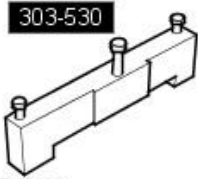
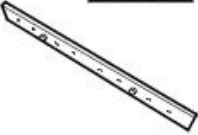

E46613

4. Install the flexplate.




5. Check and top-up the engine oil.

**Engine - 4.2L SC V8 - AJV8 - Cylinder Head LH**

In-vehicle Repair

Special Tool(s)	
 <p>303-530 E46879</p>	Camshaft setting/locking tool 303-530
 <p>303-540 E65896</p>	Tappet hold-down tool 303-540
 <p>303-540/02 E65897</p>	Tappet hold-down tool adaptor 303-540/02

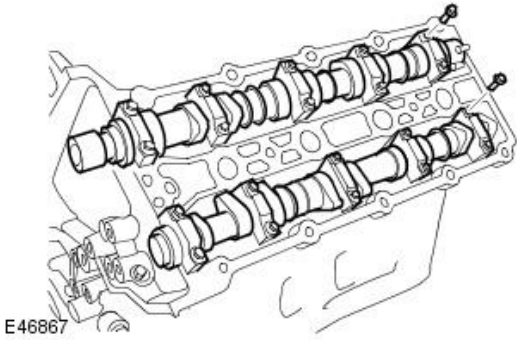
**Removal**

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the fuel injection supply manifold.  
For additional information, refer to: [Fuel Rail](#) (303-04B Fuel Charging and Controls - 4.2L SC V8 - AJV8, Removal and Installation).
4.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.  
  
Remove the LH charge air cooler adaptor assembly.
  - Remove the 5 bolts.
  - Discard the gasket.
5. Remove the timing drive components.  
For additional information, refer to: [Timing Drive Components](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).
6. Remove the special tool from the LH cylinder head.
7.  **CAUTION:** Evenly and progressively, release the camshaft bearing caps.
  - **NOTE:** Remove the camshaft bearing caps. Note: their position, orientation and markings. Each is marked with its position (number) and an orientation (arrow).

Remove the camshaft bearing caps.

- Remove the 20 bolts.

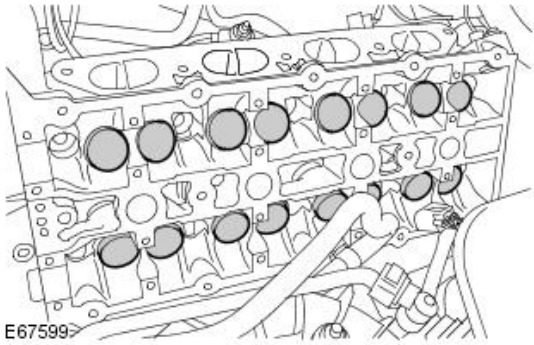
8. Remove the camshafts.



9. NOTE: Note the fitted position.

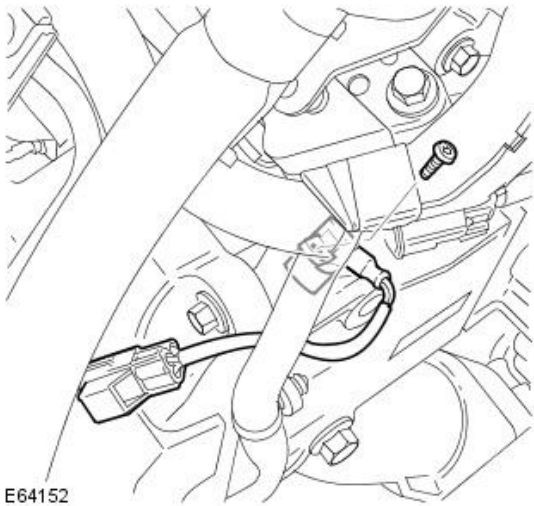
• NOTE: Make sure the shim remains with the tappet.

Remove the 16 tappets.



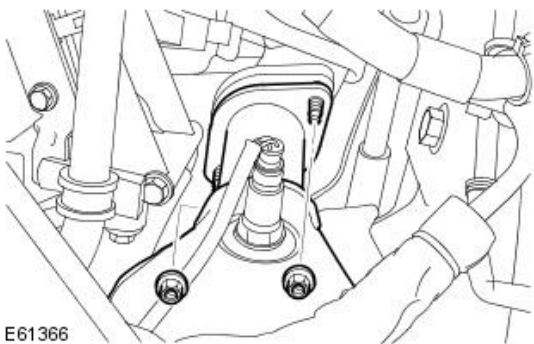
10. Remove the CMP sensor.

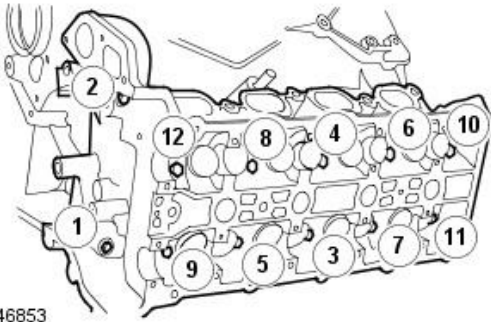
- Remove the Torx bolt.
- Remove and discard the O-ring seal.



11. Release the LH catalytic converter.


- Remove and discard the 2 nuts.






E46853

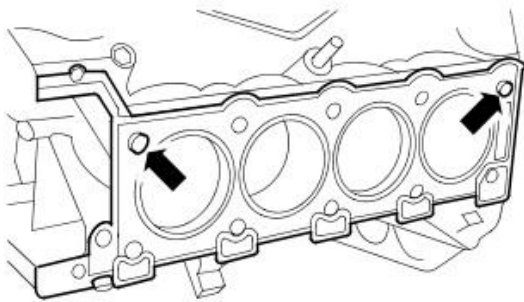
**12. CAUTIONS:**

 The bolts can only be used twice, mark the bolts with a center punch. If two punch marks are visible, discard the bolts.


 Vehicles fitted with Polydrive cylinder head bolts, the cylinder head bolts must be removed using a 10 mm Polydrive socket or a 10 mm Allen key. Failure to follow this instruction may result in damage to the component.

• **NOTE:** Remove the bolts in the indicated sequence.

Remove the 12 cylinder head bolts.



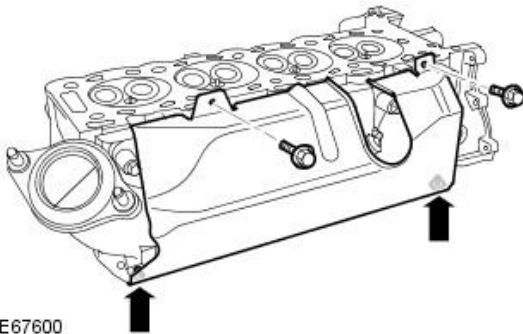
E46854

**13.  CAUTION:** The cylinder head must not be placed mating face down. Failure to follow this instruction may result in damage to the vehicle.

With assistance remove the cylinder head.

**14.** Remove and discard the cylinder head gasket.

- Clean the cylinder head locating dowels.
- Clean and inspect the cylinder head and cylinder block.

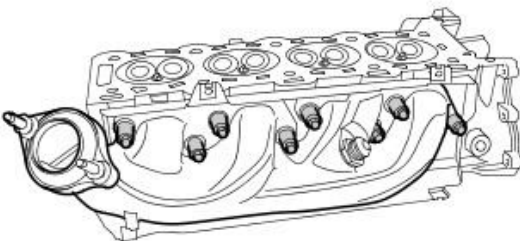


E67600

**15. NOTE:** Do not disassemble further if the component is removed for access only.

Remove the LH heat shield.

- Remove the 4 screws.



E67601

**16. NOTE:** Do not disassemble further if the component is removed for access only.

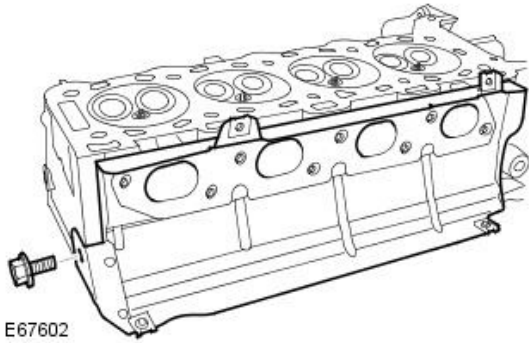
Remove the exhaust manifold.

- Remove and discard the 8 bolts.
- Remove the 8 spacers.



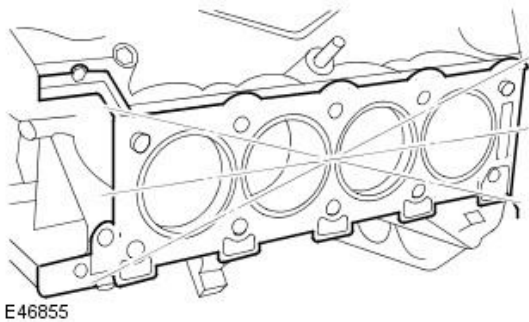
17. Remove and discard the exhaust manifold gasket.

- Remove the bolt.



### Installation

1. Clean the component mating faces.
2. Check cylinder head face for distortion, across the center and from corner to corner.

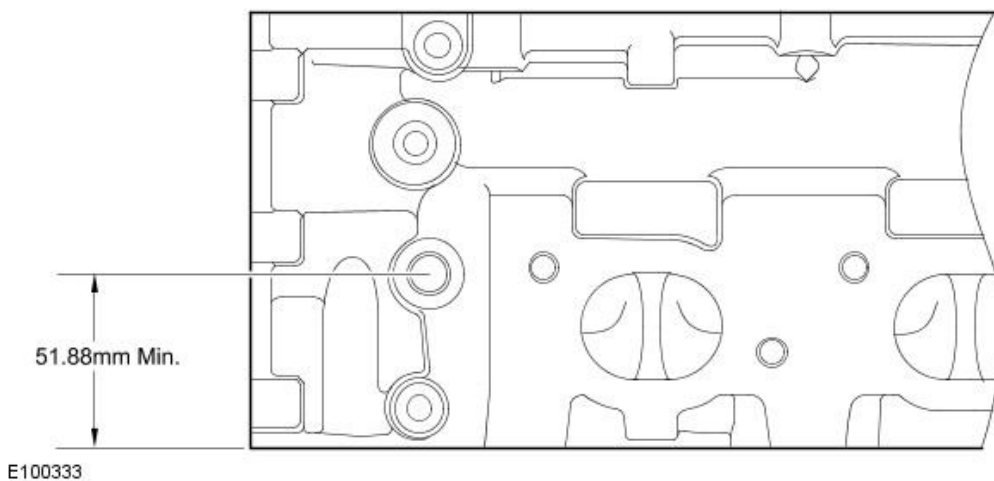


3. For cylinder head face distortion data, refer to specifications. For additional information, refer to: [Specifications](#) (303-01B Engine - 4.2L SC V8 - AJV8, Specifications).

4. NOTE: For cylinder head with distortion above the maximum allowance, the cylinder head material must be measured.

Measure the cylinder head material.

- Check measurement from the centre of the exhaust dowel to the cylinder head face as shown.
- If the measurement is less than 51.88 mm the cylinder head requires replacement.

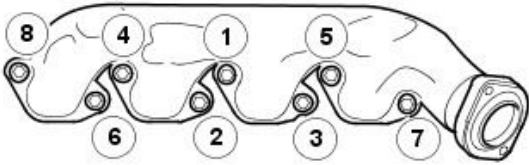


5. Install the exhaust manifold gasket.

- Clean the component mating faces.
- Tighten the bolt to 50 Nm (37 lb.ft).

6. Install the exhaust manifold.

- Clean the component mating faces.
- Install the spacers.
- Evenly and progressively, tighten the new bolts in the sequence shown, to 24 Nm (18 lb.ft).



E65731

7. Install the heat shield.

- Tighten the screws.

8.  CAUTION: The head gasket must be installed over the cylinder block dowels.

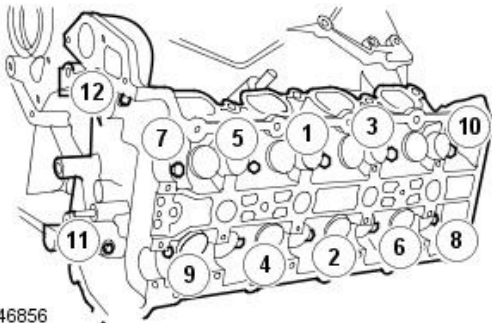
Install a new cylinder head gasket.

9. With assistance install the cylinder head.

10. NOTE: Tighten the bolts 1 to 10 in the sequence shown.

Install the cylinder head bolts.

- Lubricate the new cylinder head bolt threads with clean engine oil.
- Tighten the bolts 1 to 10 to 20 Nm (15 lb.ft).
- Tighten the bolts 1 to 10 to 35 Nm (26 lb.ft).
- Tighten the bolts 1 to 10, a further 90 degrees.
- Tighten the bolts 1 to 10, a further 90 degrees.
- Tighten the M8 bolts 11 and 12, to 25 Nm (18 lb.ft).



E46856

11. Attach the catalytic converter.

- Tighten the nuts to 40Nm (30 lb.ft).

12. Install the CMP sensor.

- Clean the components.
- Install a new O-ring seal.
- Tighten the Torx bolt to 7 Nm (5 lb.ft).

13. Install the tappets.

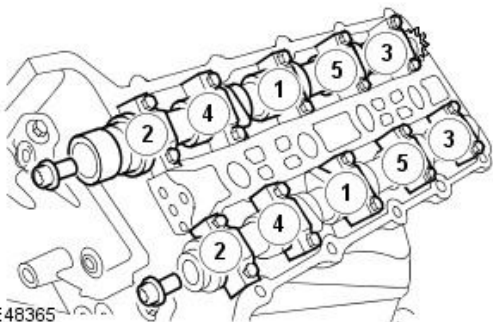
- Clean the components.
- Lubricate the components with clean engine oil.

14. Install the camshafts.

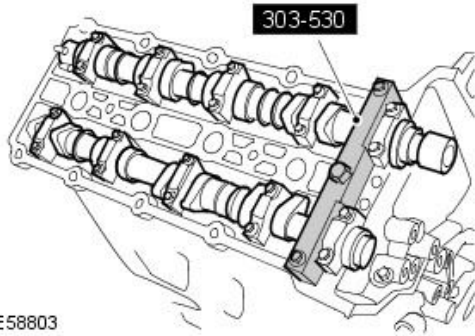
- Clean the component mating faces.
- Lubricate the journals and camshaft lobes with clean engine oil.

15. Install the camshaft bearing caps.

- Clean the component mating faces.
- Evenly and progressively tighten the bolts in the sequence shown to 10 Nm (7 lb.ft).



E48365



E58803

16. NOTE: RH illustration shown, LH is similar.

Install the special tool to the LH cylinder head.

- Install the 3 bolts.

17. NOTE: Do not install the LH valve cover until valve clearance adjustment has been completed.

Install the timing drive components.

For additional information, refer to: [Timing Drive Components](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).


18. Install the charge air cooler adaptor assembly.

- Clean the component mating faces.
- Install a new gasket.
- Tighten the bolts to 25 Nm (18 lb.ft).

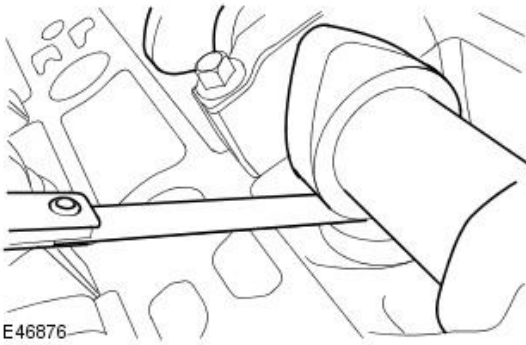
19. Install the fuel injection supply manifold.

For additional information, refer to: [Fuel Rail](#) (303-04B Fuel Charging and Controls - 4.2L SC V8 - AJV8, Removal and Installation).

20. Rotate the engine clockwise to position the camshaft lobe away from the valve tappet.

21.  CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.

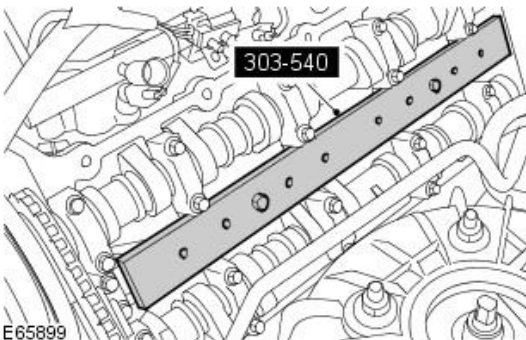


E46876

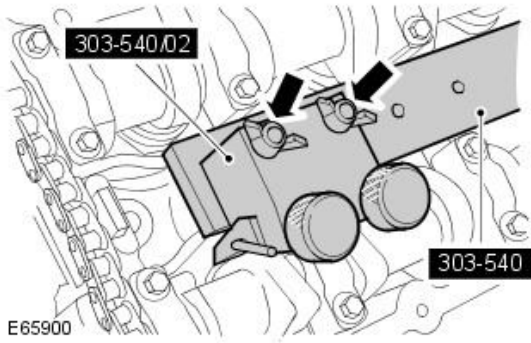
22. Repeat the above procedure for the remaining 15 shims.

23. Install the special tool 303-540, to the cylinder head.

- Tighten the 2 bolts to 10 Nm (7 lb.ft).



E65899

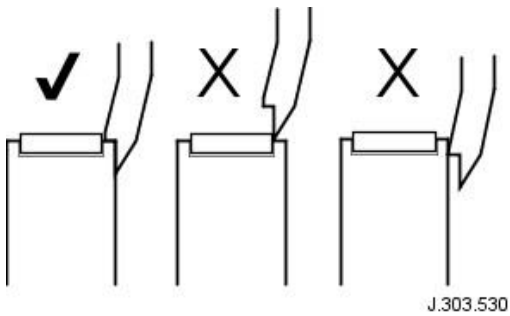


24. **⚠ CAUTION:** Do not rotate the crankshaft while the special tool 303-540/02 is attached to 303-540.

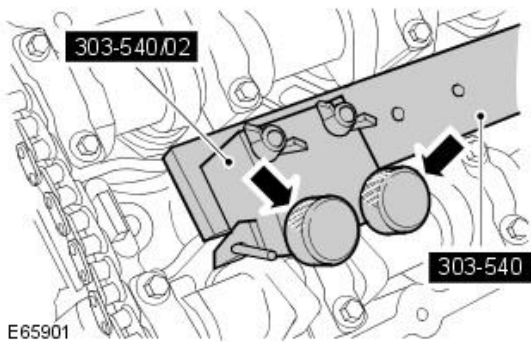
Attach the special tool 303-540/02 to 303-540.

- Secure with the 2 wing nuts.

25. Position the special tool to the tappet as shown.



26. Using the special tool, compress the valve spring.

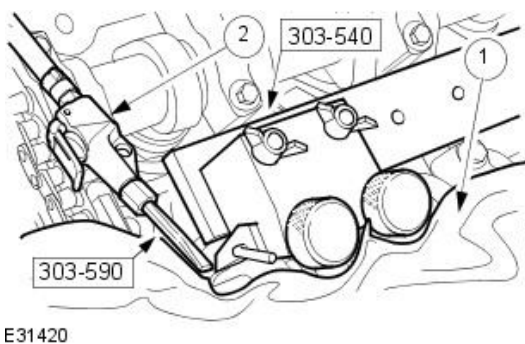


27. **⚠ CAUTION:** Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.

• NOTE: Use the following formula to calculate the required shim thickness.  
 $\text{Original shim thickness} + \text{measured shim clearance} - \text{desired clearance} = \text{required shim thickness}$ .

Remove, clean and measure the shim.

- Surround the immediate working area with a cloth, to retain any loose shims displaced by the compressed air.
- Use the special tool 303-590, aimed at the edge of the shim, to lift it from the tappet. Note the position of each one.



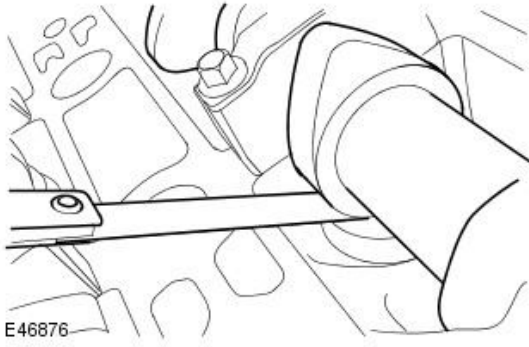
28. CAUTIONS:

**⚠** Shims must be fitted with the size markings facing the tappet, not the camshaft.

**⚠** Do not use a magnet to install shims. Failure to follow these instructions may result in damage to the vehicle.

Install the new shim.

- Clean the components.
- Lubricate the shim with clean engine oil.
- Release and remove the special tools as required.



29. Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.

30. Repeat the above procedure for the remaining valves.


31. Connect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).



# Engine - 4.2L SC V8 - AJV8 - Engine Front Cover

In-vehicle Repair

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Recover the A/C refrigerant.  
For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

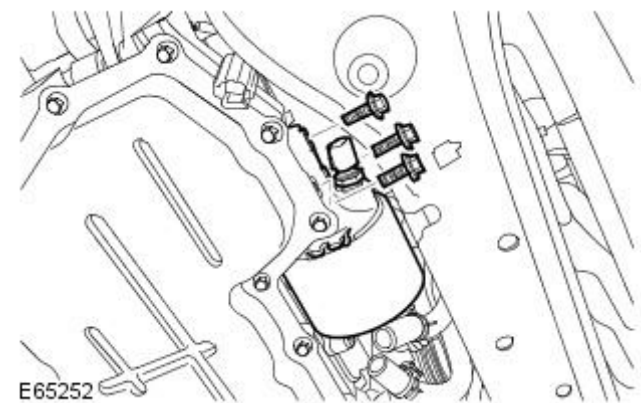
4. Disconnect the engine oil temperature sensor electrical connector.



5. Disconnect the engine oil pressure (EOP) sensor electrical connector.



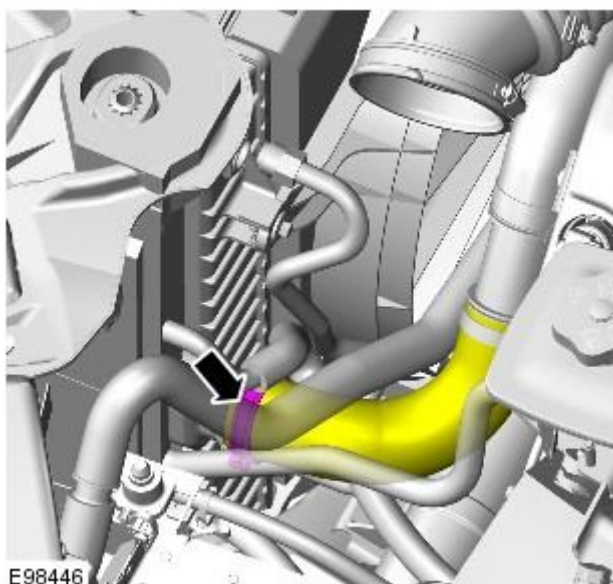
6. Detach the oil filter housing.
  - Remove the 3 bolts.
  - Remove and discard the O-ring seal.



7. Remove the cooling fan and shroud.  
For additional information, refer to: [Cooling Fan Motor and Shroud - 4.2L SC V8 - AJV8](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).



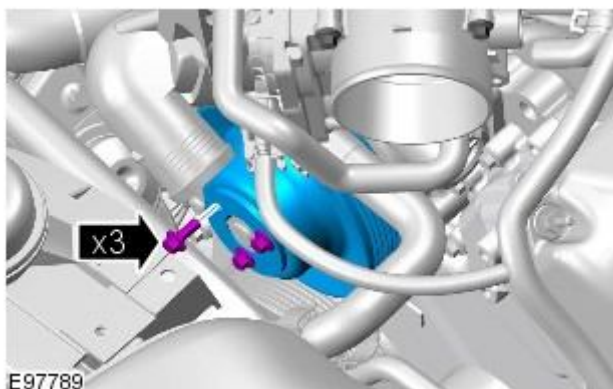
8. Remove the thermostat housing.  
For additional information, refer to: [Thermostat Housing - 4.2L SC V8 - AJV8](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
9. Remove the secondary air injection (AIR) tube.  
For additional information, refer to: [Secondary Air Injection \(AIR\) Control Valve to Exhaust Manifold Tube](#) (303-08 Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
10. Release the radiator lower hose.



- Release the clip.

11. **NOTE:** Restrain the pulley to aid the removal of the bolts.

Remove the coolant pump pulley.

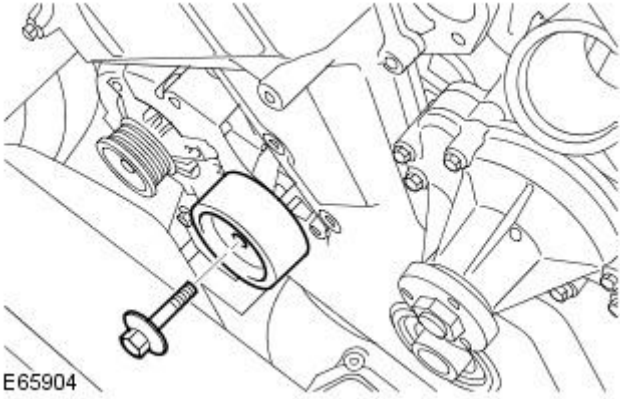


- Remove the 3 bolts.

12. Remove the power steering pump.  
For additional information, refer to: [Power Steering Pump - 4.2L NA V8 - AJV8](#) (211-02 Power Steering, Removal and Installation).
13. Remove the LH valve cover.  
For additional information, refer to: [Valve Cover LH](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).
14. Remove the RH valve cover.  
For additional information, refer to: [Valve Cover RH](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).
15. Remove the crankshaft pulley.  
For additional information, refer to: [Crankshaft Pulley](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).

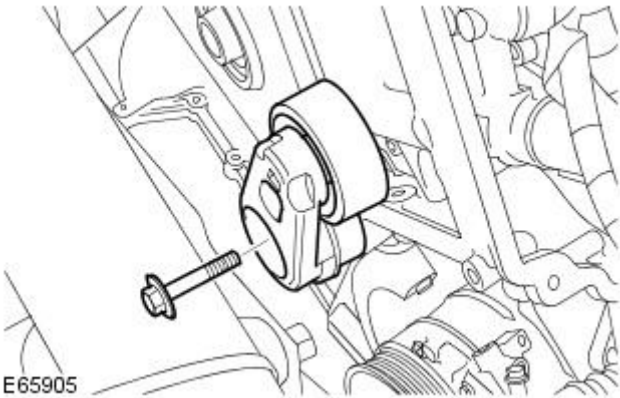
16. Remove the accessory drive belt idler pulley.

- Remove the bolt.



17. Remove the accessory drive belt tensioner.

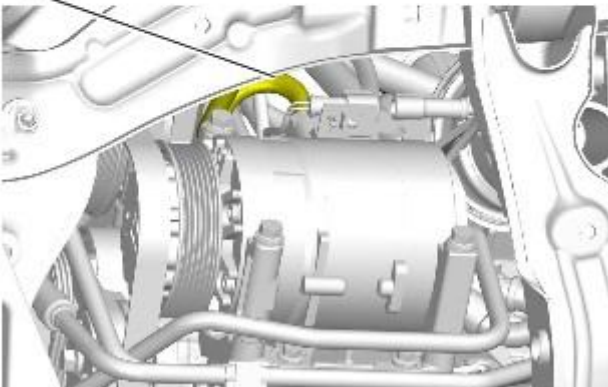
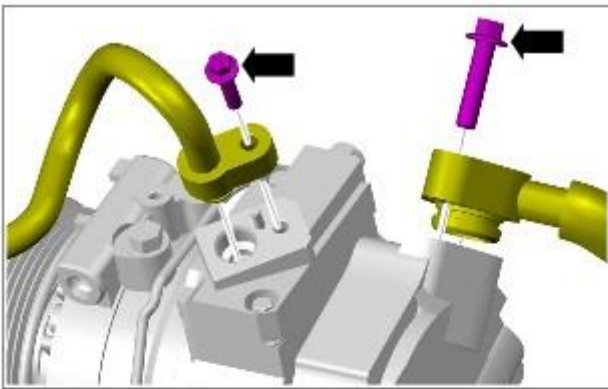
- Remove the bolt.



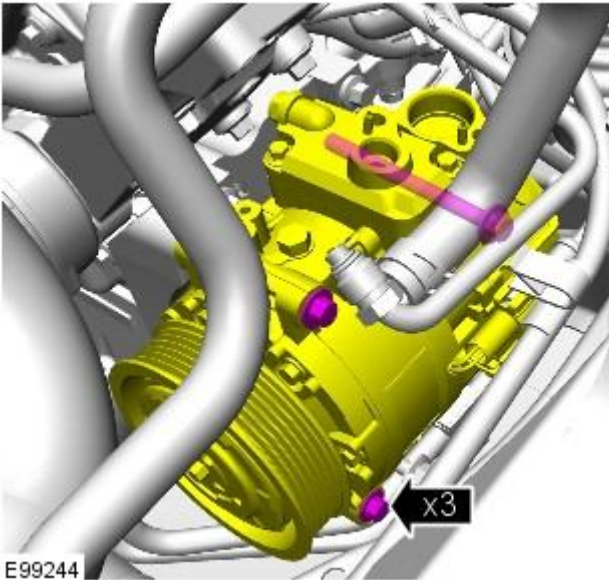
18.  **CAUTION:** Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

Disconnect the refrigerant lines from the A/C compressor.

- Remove the 2 bolts.
- Remove and discard the 2 O-ring seals.

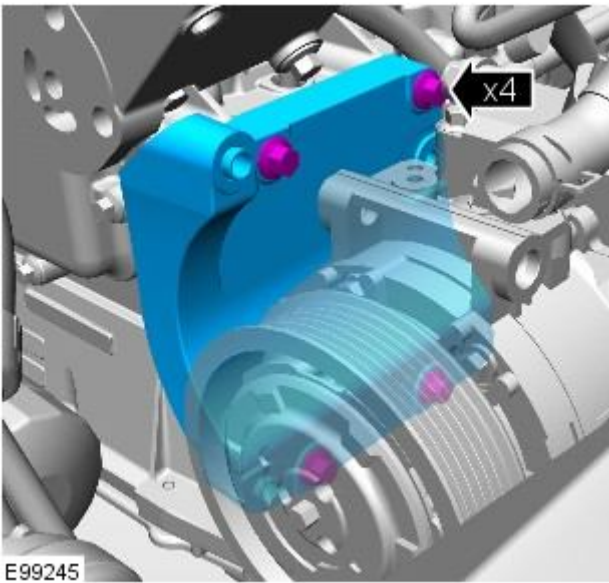


19. Position the A/C compressor aside to access the A/C compressor mounting bracket.



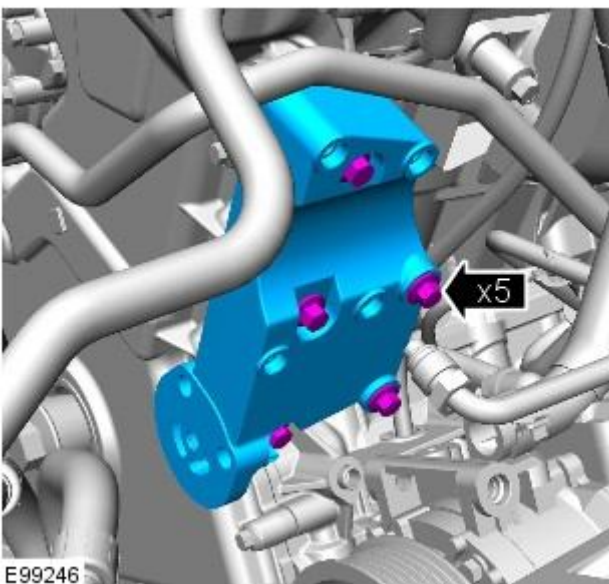
20. Remove the A/C compressor mounting bracket.

- Remove the 4 bolts.



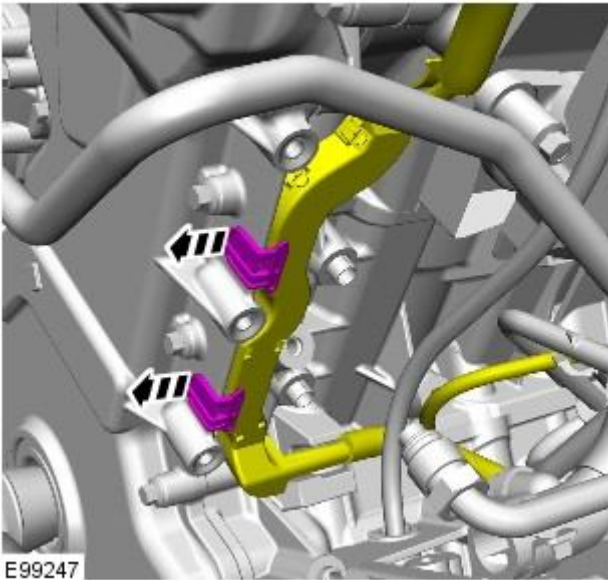
21. Remove the power steering pump mounting bracket.

- Remove the 4 bolts.



22. LH side: Release the wiring harness.

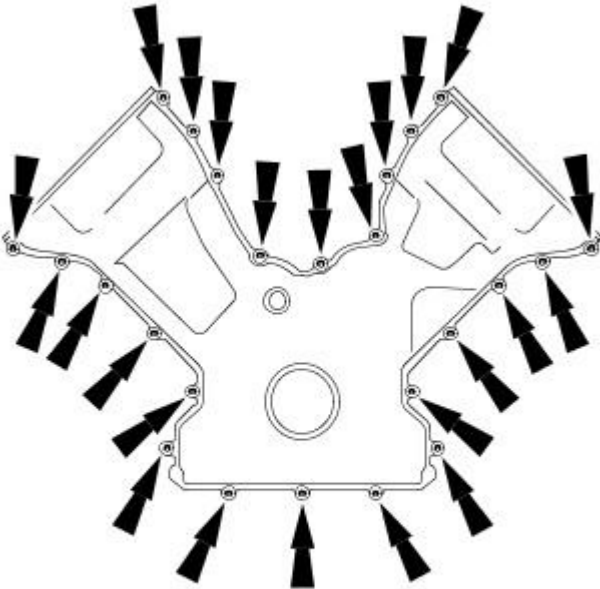
- Release the 2 clips.



E99247

23. Remove the engine front cover.

- Remove the 24 bolts.
- Remove and discard the 2 gaskets.
- Remove and discard the 3 O-ring seals.

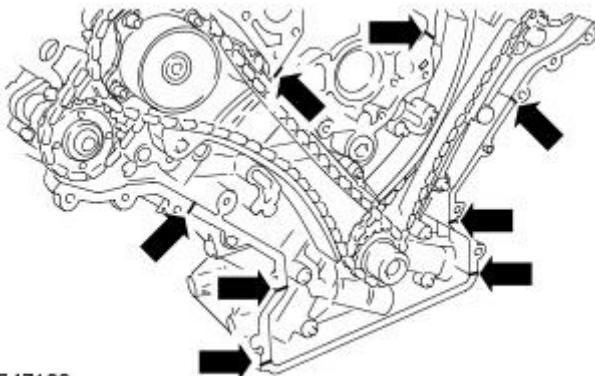


VUJ0002018

## Installation

1. To install, reverse the removal procedure.

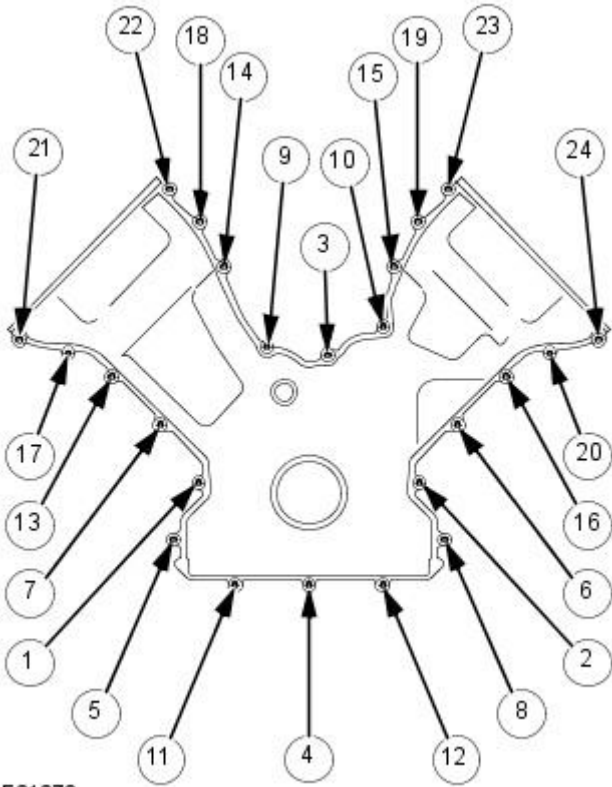
- Apply a bead of sealant 3 mm diameter, by 12 mm long, to the 8 places indicated.



E47100

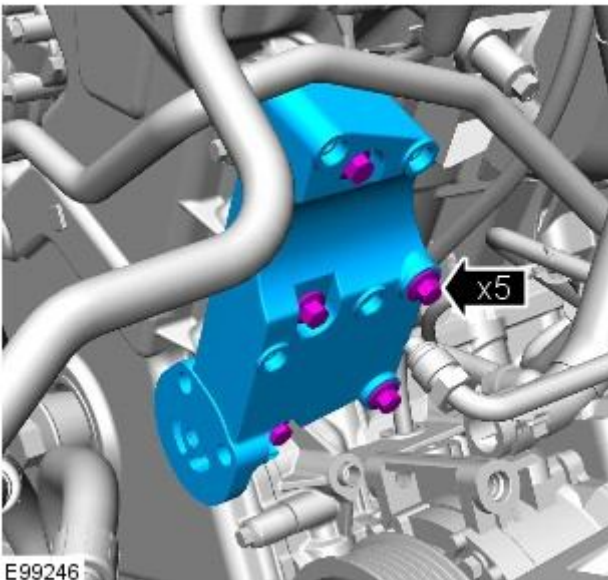


2. Tighten to 12 Nm.



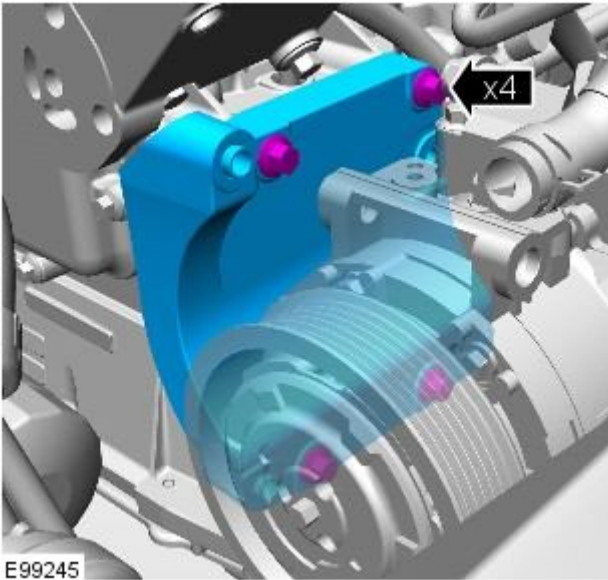
E31273

3. Tighten to 25 Nm

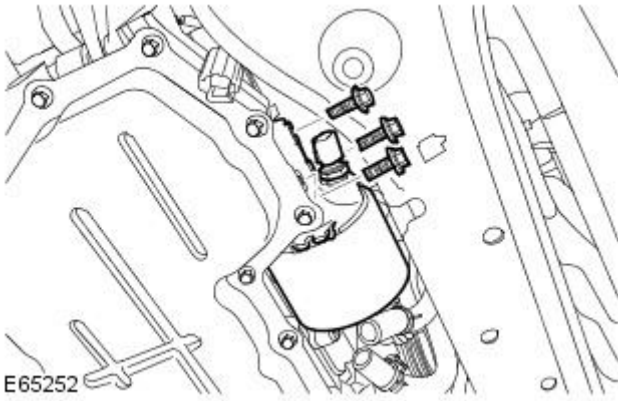


E99246

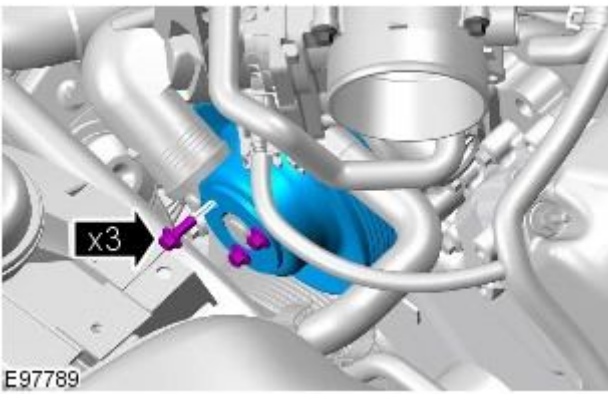
4. Tighten to 25 Nm



5. Tighten to 20 Nm.

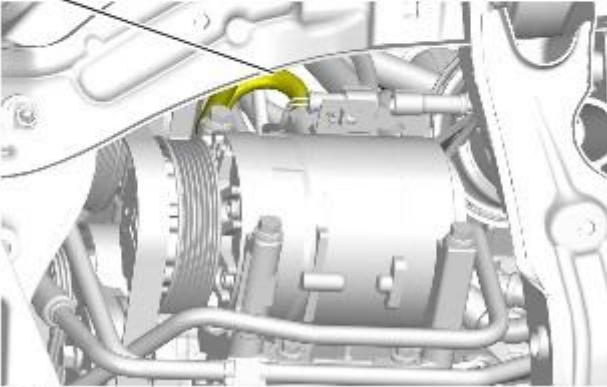
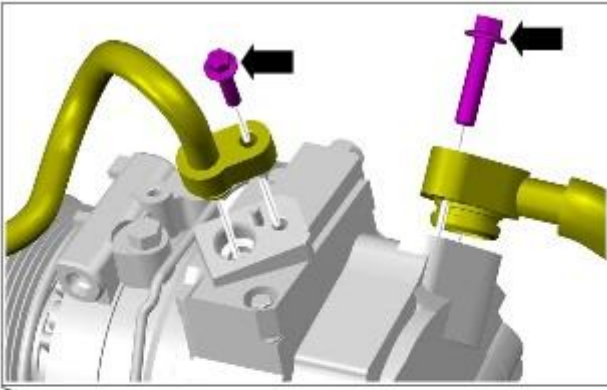


6. Tighten to 10 Nm.



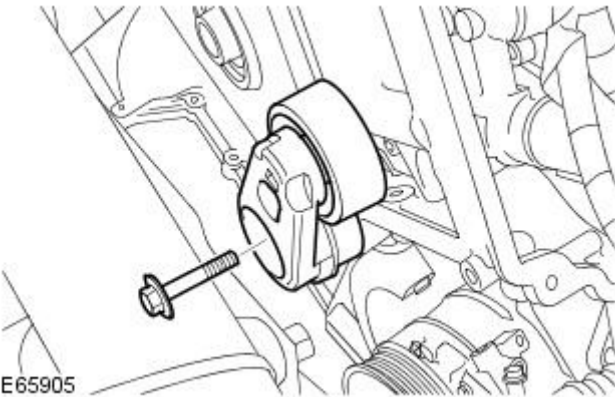


7. Tighten to 9 Nm.



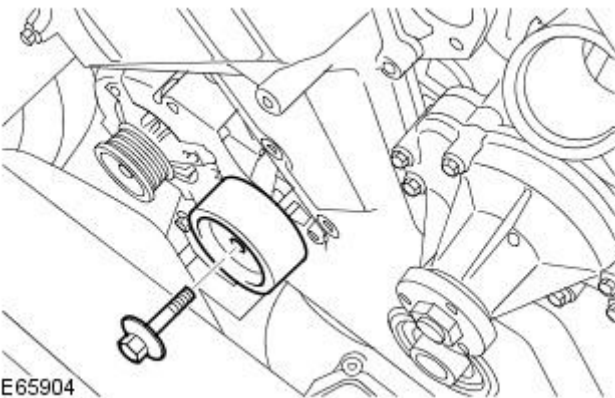
E97758

8. Tighten to 45 Nm.



E65905

9. Tighten to 45 Nm.



E65904


# Engine - 4.2L SC V8 - AJV8 - Engine Mount LH

In-vehicle Repair

## Removal

All vehicles

1. Remove the cover and disconnect the battery ground cable.  
For additional information, refer to: Specifications (414-01, Specifications).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

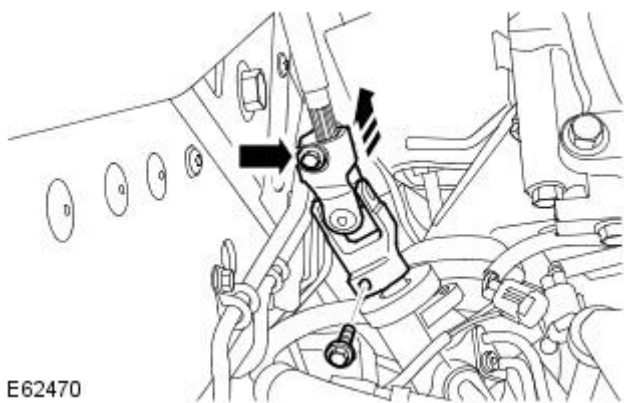
3. Remove the LH front wheel and tire.  
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
4. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02 Front End Body Panels, Removal and Installation).

Left-hand drive vehicles

5. **NOTE:** Note the fitted position.

Remove the steering gear flexible coupling.

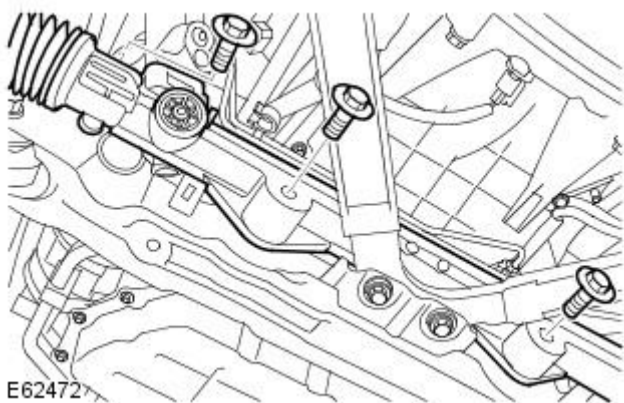
- Remove and discard the 2 bolts.



E62470

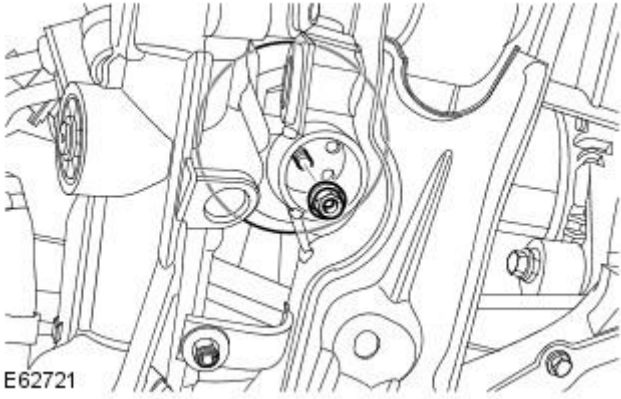
6. Release the steering gear.

- Remove the 3 bolts.



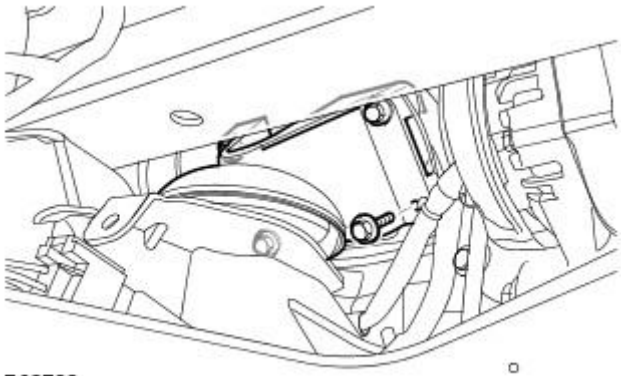
E62472

All vehicles



7. Release the engine mount.

- Support the engine.
- Remove and discard the nut.



8. Remove the engine mount and bracket.

- Raise the engine.
- Remove the 4 bolts.



9. NOTE: Do not disassemble further if the component is removed for access only.

Remove the engine mount.

- Remove and discard the nut.

## Installation

All vehicles

1. Install the engine mount.

- Tighten the new nut to 55 Nm (41 lb.ft).

2. Install the engine mount and bracket.

- Clean the component mating faces.
- Tighten the bolts to 45 Nm (33 lb.ft).
- Lower the engine.
- Tighten the new nut to 63 Nm (46 lb.ft).

Left-hand drive vehicles

3. Secure the steering gear.

- Tighten the bolts to 100 Nm ( 74 lb.ft).

4. Install the steering gear flexible coupling.

- Tighten the new bolts to 35 Nm (26lb.ft).

All vehicles

5. Install the air deflector.

For additional information, refer to: Air Deflector (501-02 Front End Body Panels, Removal and Installation).

6. Install the front wheel.

For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

7. Connect the battery ground cable and install the cover.

For additional information, refer to: Specifications (414-01, Specifications).


## Engine - 4.2L SC V8 - AJV8 - Engine Mount RH

In-vehicle Repair

### Removal

All vehicles

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

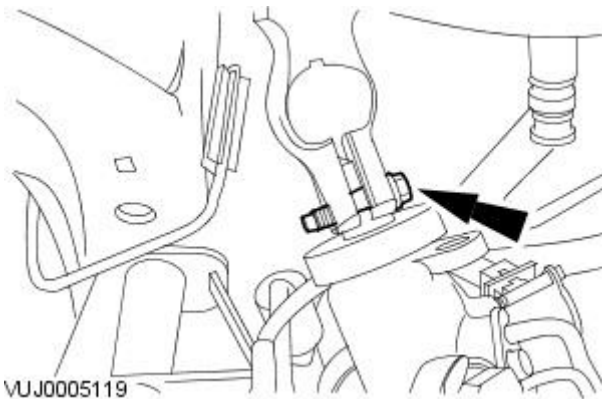
Raise and support the vehicle.

3. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

Right-hand drive vehicles

4. **NOTE:** Note the fitted position.

Release the universal joint from the steering gear.



VUJ0005119

5. Disconnect the power steering control valve actuator electrical connector.

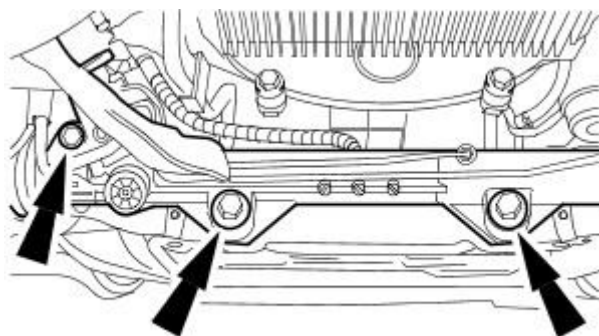


E62469

6. **NOTE:** Left-hand shown, right-hand similar.

Release the steering gear.

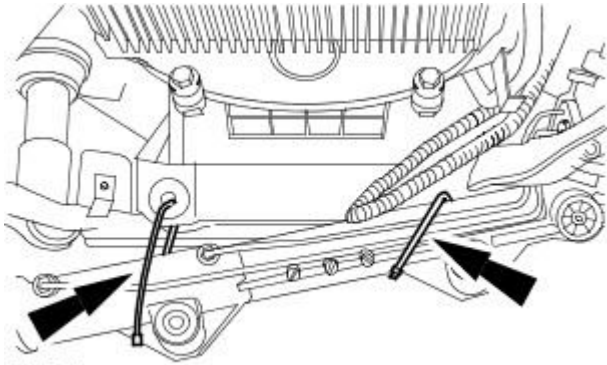
- Remove the 3 bolts.



VUJ0005142



7. Support the steering gear.

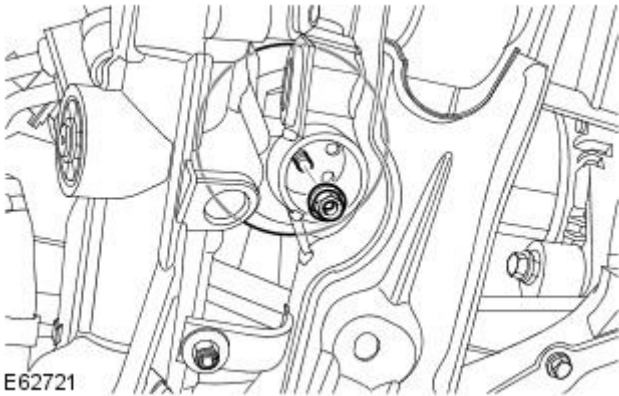


E 31035

All vehicles

8. Release the engine mount.

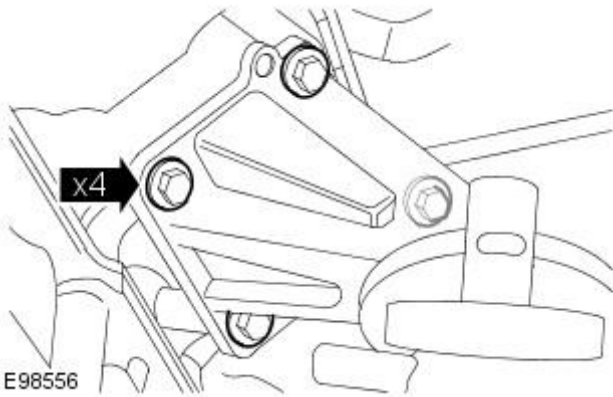
- Support the engine.
- Remove and discard the nut.



E62721

9. Remove the engine mount and bracket.

- Raise the engine.
- Remove the 4 bolts.



E98556

10. NOTE: Do not disassemble further if the component is removed for access only.

Remove the engine mount.

- Remove and discard the nut.



E62723

## Installation

All vehicles



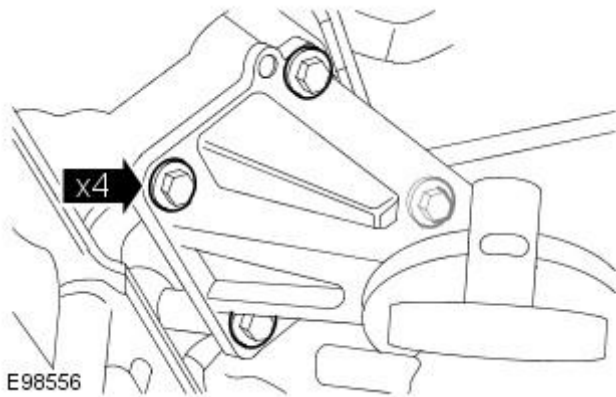
1. To install, reverse the removal procedure.

All vehicles

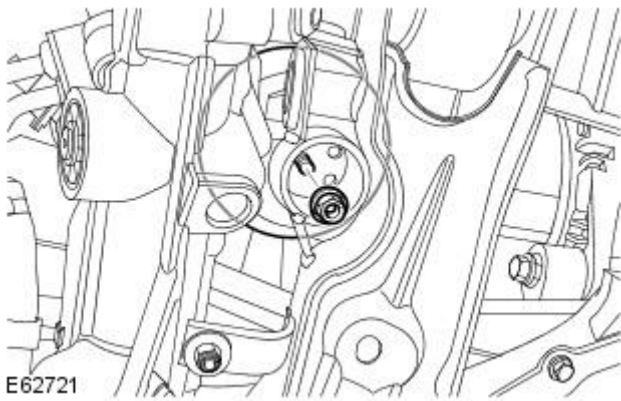
2. Tighten to 55 Nm.



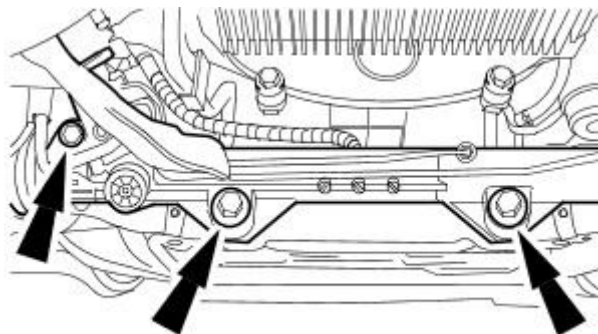
3. Tighten to 47 Nm.



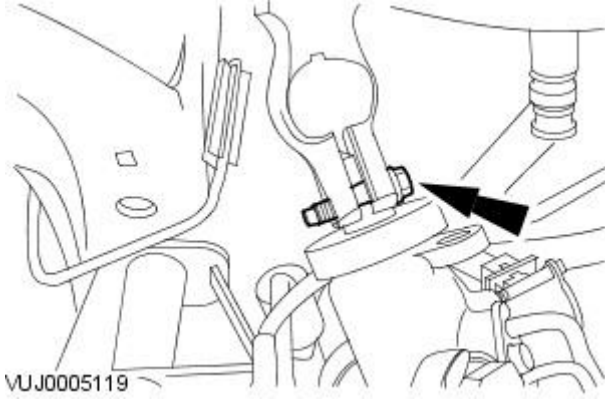
4. Tighten to 63 Nm.



5. Tighten to 100 Nm.



6. Tighten to 35 Nm.



VUJ0005119


# Engine - 4.2L SC V8 - AJV8 - Exhaust Manifold LH

In-vehicle Repair

## Removal

All vehicles

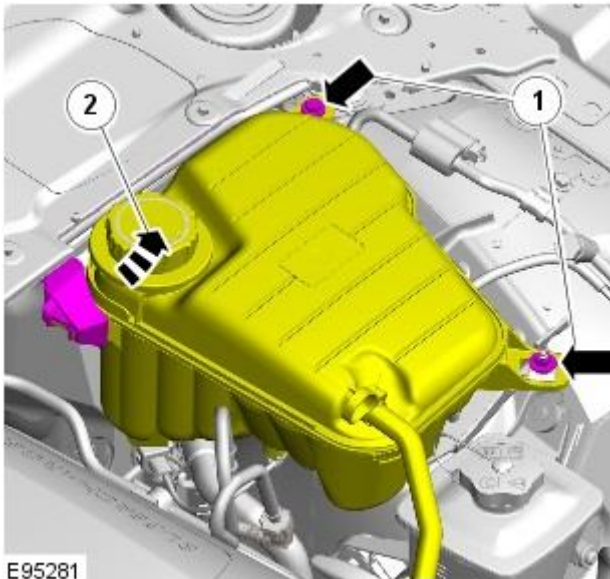
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

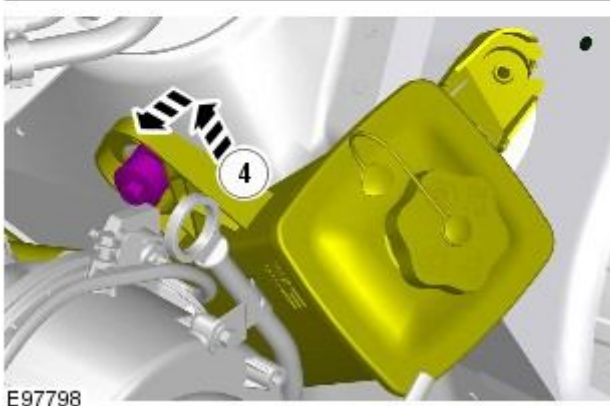
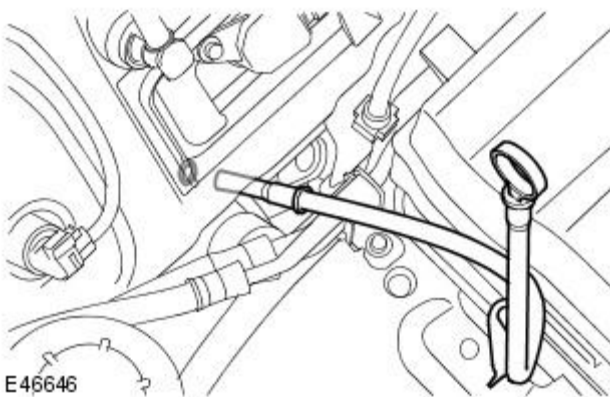
3. Release the coolant expansion tank for access.

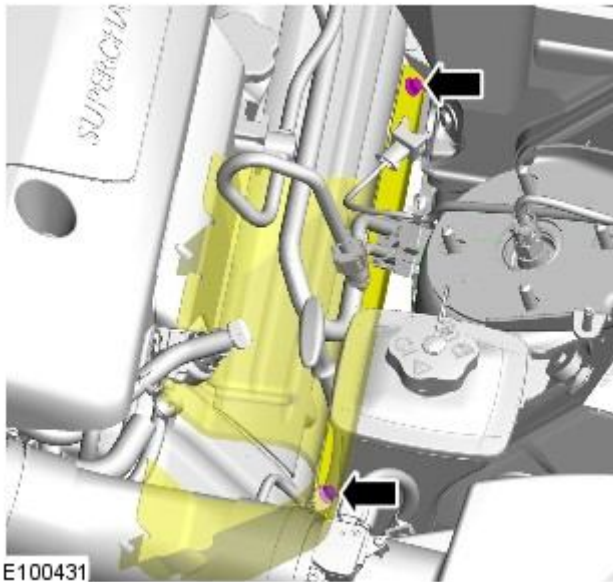
- Remove the retaining nut and bolt.
- Remove the clip.
- Position the coolant expansion tank aside.




4. Release and tip aside the power steering reservoir.

- Remove the nut.
- Discard the O-ring seal.





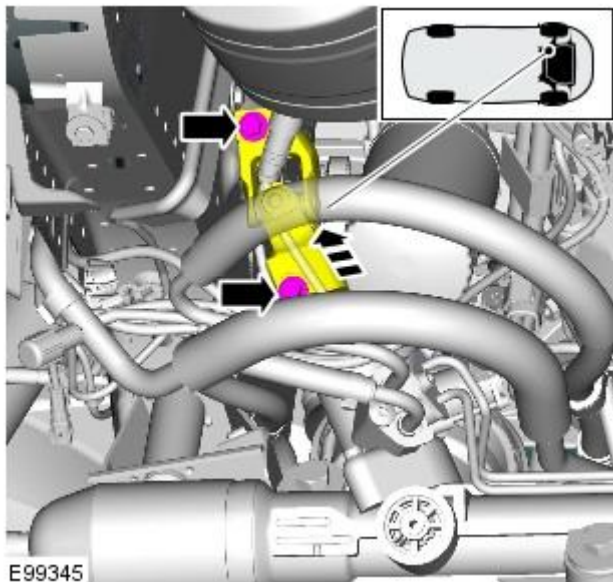
6. Remove the LH exhaust manifold heat shield retaining bolts.

7.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise the vehicle.

8. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).
9. Remove the LH catalytic converter.  
For additional information, refer to: [Catalytic Converter](#) (309-00, Removal and Installation).

#### Left-hand drive vehicles

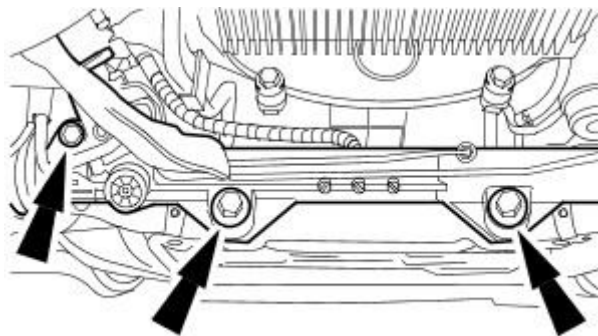


10. Disconnect the steering column lower shaft from the steering gear.

- Remove the steering column flexible coupling securing bolts.

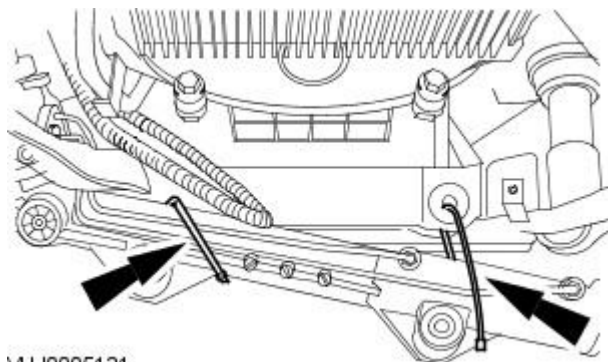


11. Disconnect the steering gear control valve actuator electrical connector.



12. Detach the steering gear.

- Remove the steering gear retaining bolts.

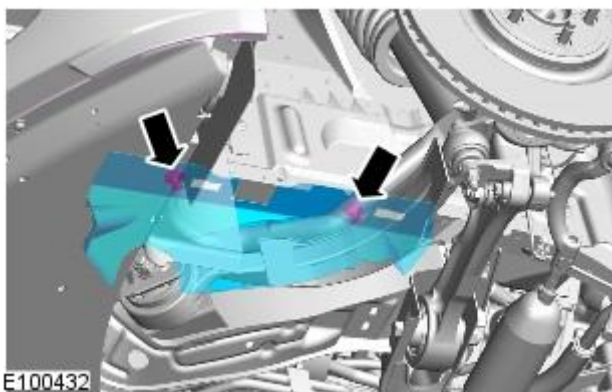


13. Using suitable tie strap(s), secure the steering gear.

All vehicles

14. Remove the splash shield retaining clips.

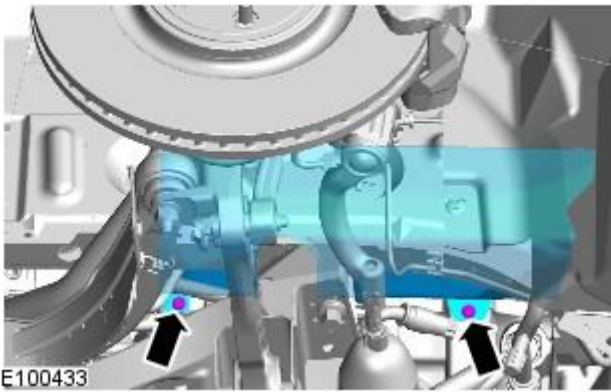
- Position the splash shield to one side.





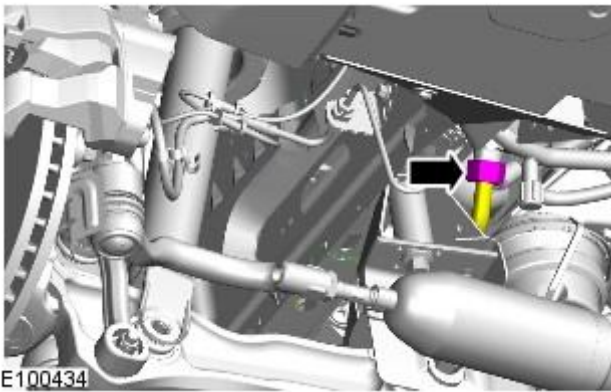
15. Remove the LH exhaust manifold heat shield retaining bolts.

- Remove the LH exhaust manifold heat shield.



Vehicles with secondary air injection (AIR)

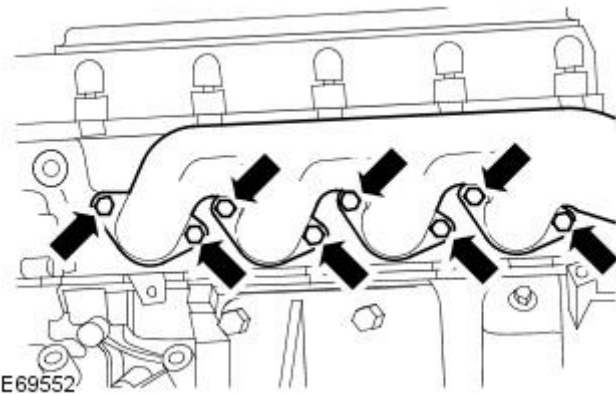
16. Detach the secondary air injection (AIR) control valve to exhaust manifold tube from the exhaust manifold.



All vehicles

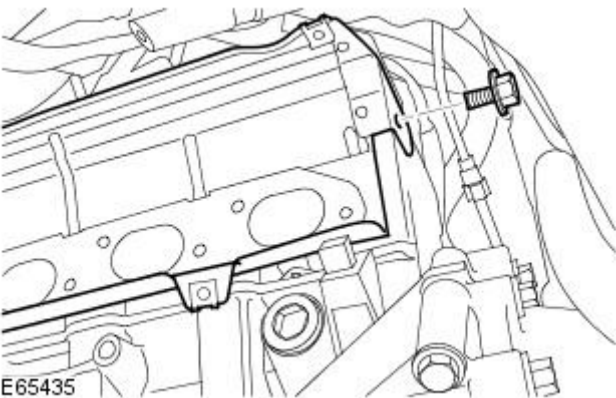
17. Remove the exhaust manifold.

- Remove and discard the 8 bolts.
- Remove the 8 spacers.



18. Remove and discard the LH exhaust manifold gasket.

- Remove the bolt.



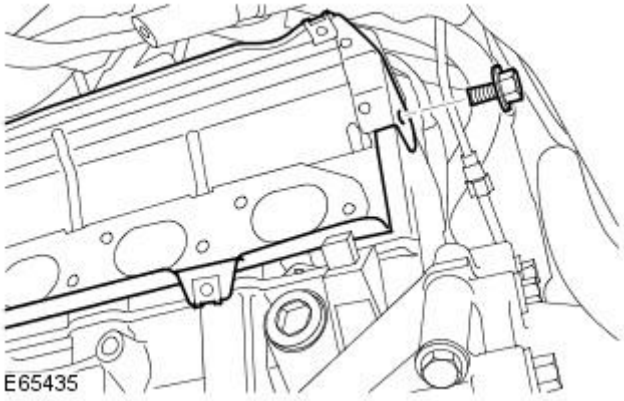


## Installation

All vehicles

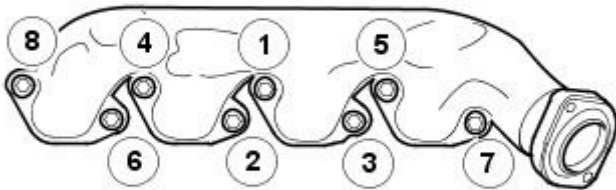
1. Install the LH exhaust manifold gasket.

- Clean the component mating faces.
- Tighten the bolt to 50 Nm.



2. Install the LH exhaust manifold.

- Clean the component mating faces.
- Install the spacers.
- Evenly and progressively, tighten the new bolts in the sequence shown, to 24 Nm.

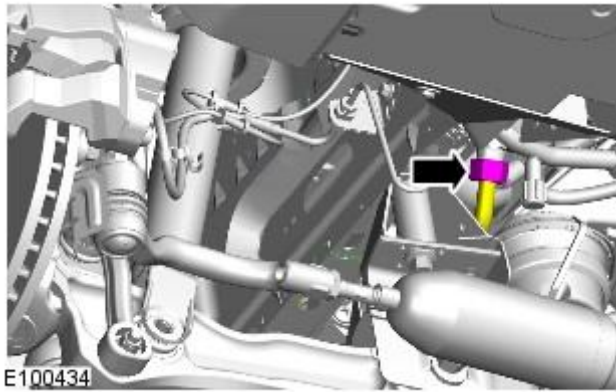


E65731

Vehicles with secondary air injection (AIR)

3. Attach the AIR control valve to exhaust manifold tube to the exhaust manifold.

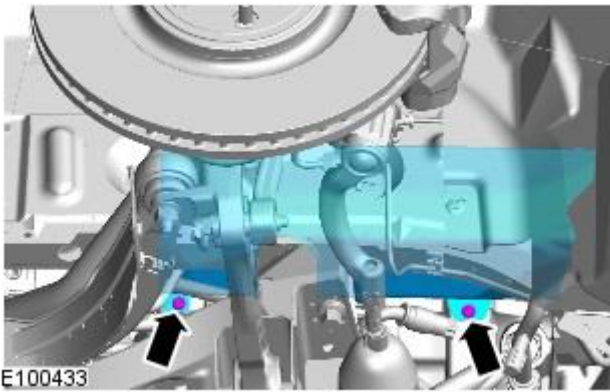
- Tighten to 35 Nm.



All vehicles

4. Install the LH exhaust manifold heat shield.

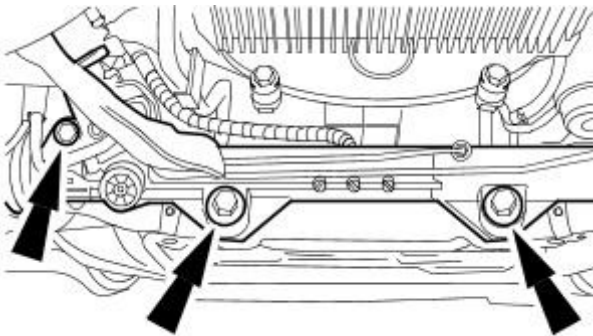
- Tighten the bolts to 8 Nm.



Left-hand drive vehicles

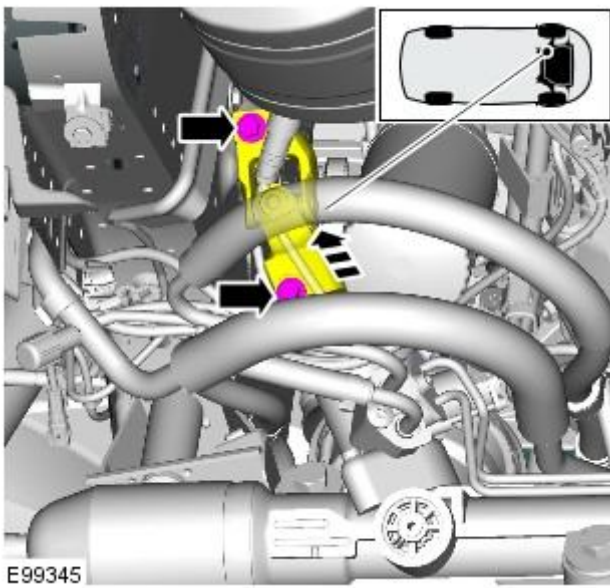
5. Install the steering gear.

- Tighten the bolts to 100 Nm.



6. Connect the lower steering column shaft to the steering gear.

- Tighten the bolts to 35 Nm.



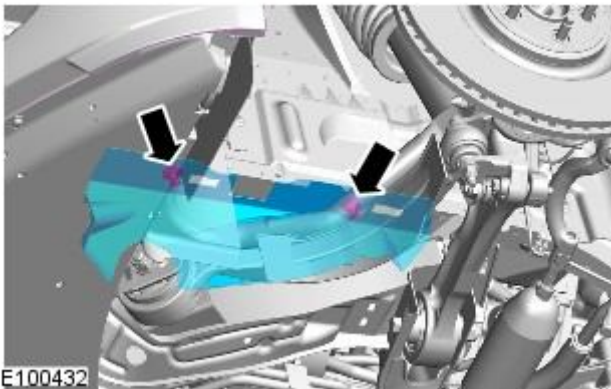


7. Connect the steering gear control valve actuator electrical connector.

All vehicles

8. Install the splash shield.

- Install the 2 clips.



9. Install the LH catalytic converter.

For additional information, refer to: Catalytic Converter (309-00, Removal and Installation).

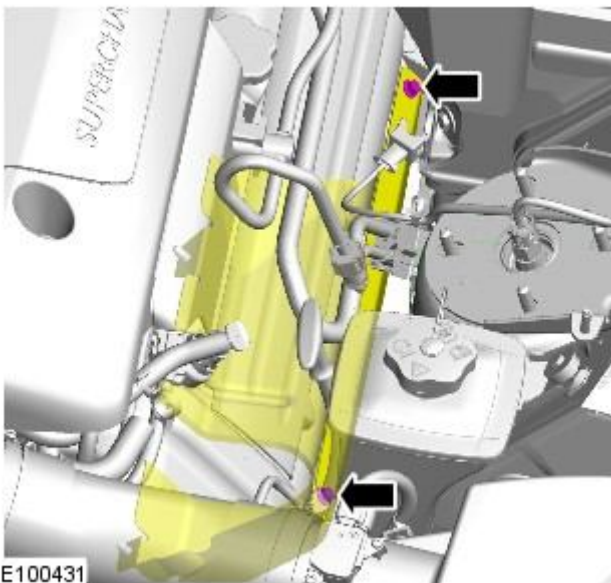
10. Install the air deflector.

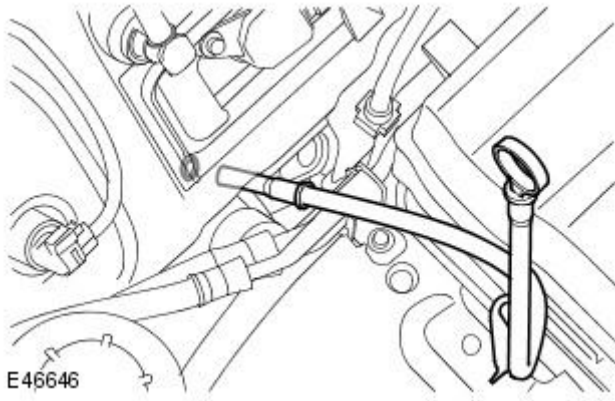
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

11. Lower the vehicle.

12. Install the LH exhaust manifold heat shield retaining bolts.

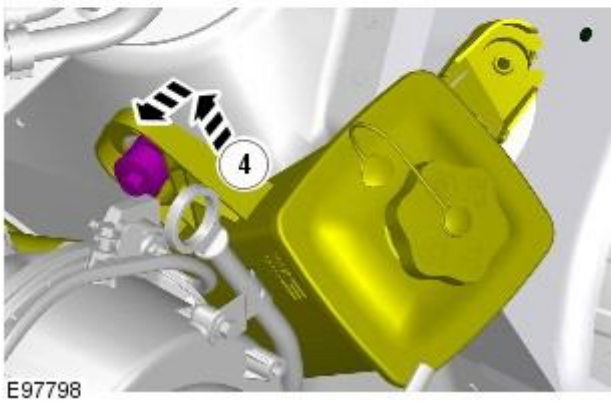
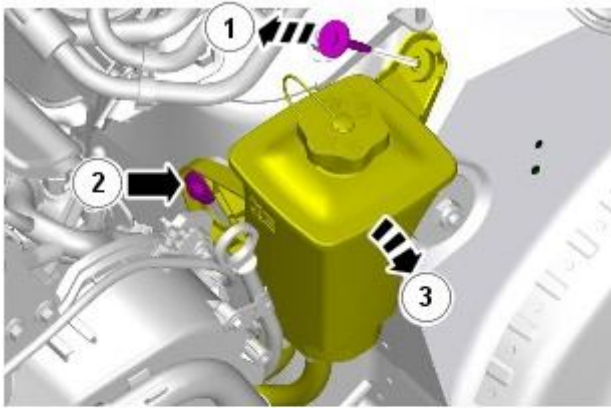
- Tighten the bolts to 8 Nm.





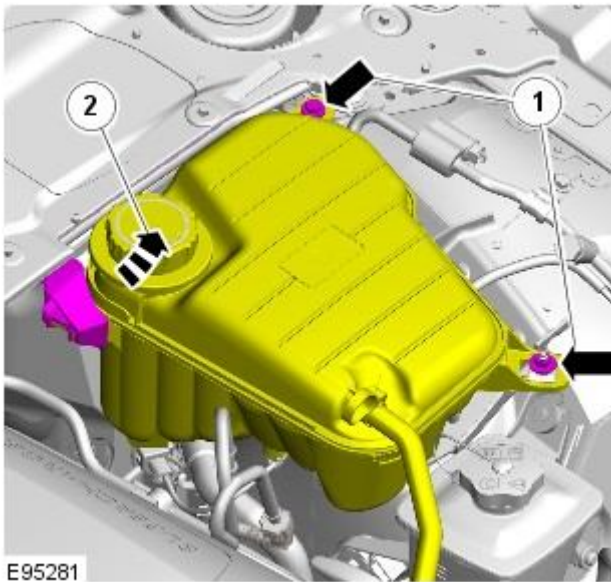
13. With assistance, install the oil level indicator and tube.

- Clean the components.
- Install a new O-ring seal.
- Lubricate the O-ring seal with clean engine oil.
- Tighten the nut to 6 Nm.



14. Install the power steering fluid reservoir.

E97798



**15.** Attach the coolant expansion tank.

- Reposition the coolant expansion tank.
- Tighten the nut and bolt to 10 Nm.
- Install the clip.

- 16.** Connect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).




## Engine - 4.2L SC V8 - AJV8 - Flexplate

In-vehicle Repair

### Removal

1. Remove the transmission.  
For additional information, refer to: [Transmission - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal).

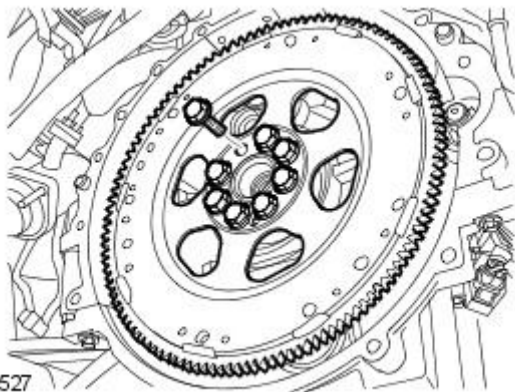
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3. **NOTE:** Prevent the flexplate from rotating.


Remove the flexplate.

- Remove the 8 bolts.



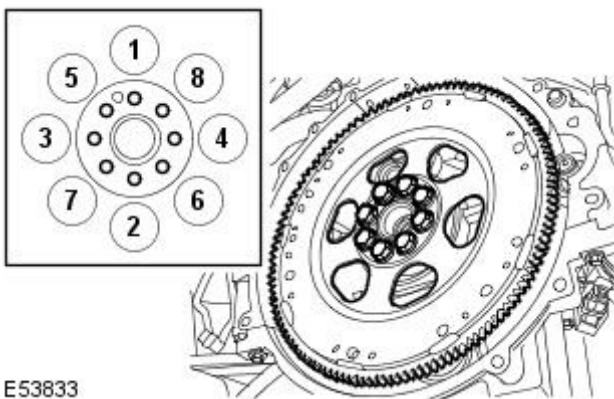
E46527

### Installation

1.  **CAUTION:** Make sure that the locating pin on the crankshaft is aligned with the guide hole in the flexplate.

To install, reverse the removal procedure.

- Tighten the bolts in the sequence shown in two stages.
- Tighten to 15 Nm.
- Tighten to 110 Nm.




E53833




# Engine - 4.2L SC V8 - AJV8 - Oil Filter Housing

In-vehicle Repair

Special Tool(s)	
 <p>303-752</p> <p>E75849</p>	<p>Wrench, Oil filter</p> <p>303-752</p>

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: Battery Disconnect and Connect (414-01, General Procedures).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
4. Disconnect the engine oil temperature sensor electrical connector.



5. Disconnect the engine oil pressure (EOP) sensor electrical connector.

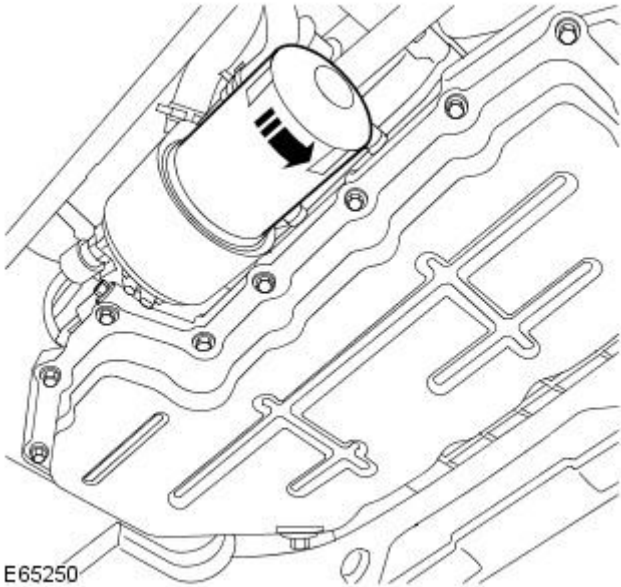


6. NOTE: Some oil spillage is inevitable during this operation.

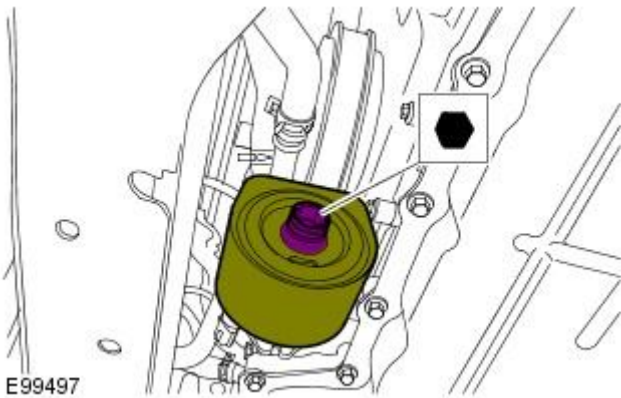
• NOTE: Clean the components general area prior to dismantling.

Remove the oil filter.

- Position a container to collect the fluid.

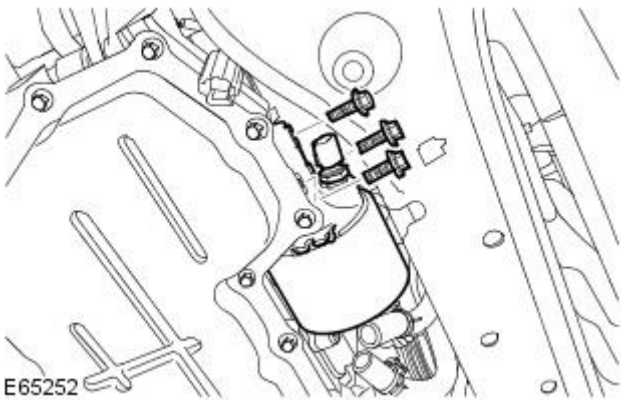


7. Detach the oil cooler housing from the oil filter housing.



8. Remove the oil filter housing.

- Remove the 3 bolts.
- Remove and discard the O-ring seal.



9. NOTE: Do not disassemble further if the component is removed for access only.

Remove the engine oil temperature sensor.

10. Remove the EOP sensor.



## Installation

1. Install the EOP sensor.

- Clean the components.
- Apply sealant of the correct specification to the sensor thread.
- Tighten to 15 Nm.

2. Install the engine oil temperature sensor.

- Clean the components.
- Apply sealant of the correct specification to the sensor thread.
- Tighten to 15 Nm.

3. Install the oil filter housing.

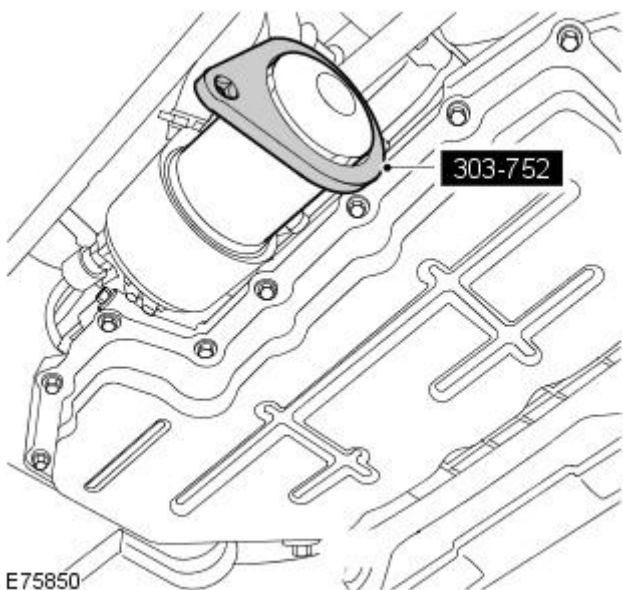
- Clean the component mating faces.
- Install a new O-ring seal.
- Tighten the bolts to 20 Nm.

4. Connect the engine oil cooler lines.

- Clean the component mating faces.
- Install new O-ring seals.
- Tighten to 7 Nm.

5. Using the special tool, install the oil filter.

- Lubricate the oil filter seal with clean engine oil and tighten to 18 Nm .




- 6.** Connect the EOP sensor electrical connector.
- 7.** Connect the engine oil temperature sensor electrical connector.
- 8.** Install the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
- 9.** Connect the battery ground cable.  
For additional information, refer to: Battery Disconnect and Connect (414-01, General Procedures).
- 10.** Check and top-up the engine oil.

## Engine - 4.2L SC V8 - AJV8 - Oil Pan

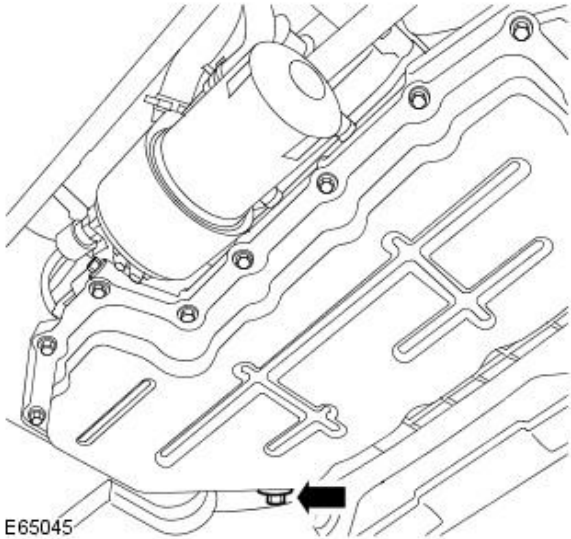
In-vehicle Repair

### Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

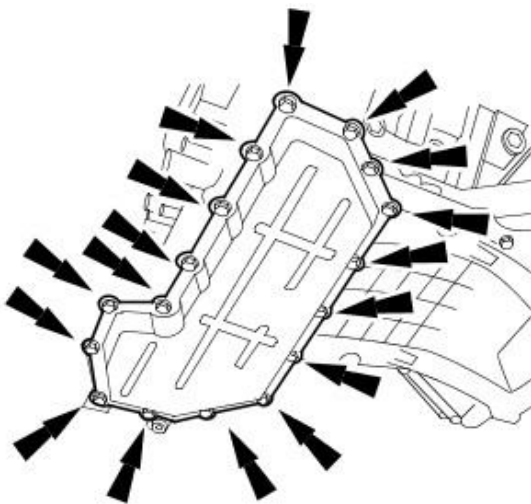
Raise and support the vehicle.

2. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).
3. Drain the engine oil.  
For additional information, refer to: [Engine Oil Draining and Filling](#) (303-01B Engine - 4.2L SC V8 - AJV8, General Procedures).



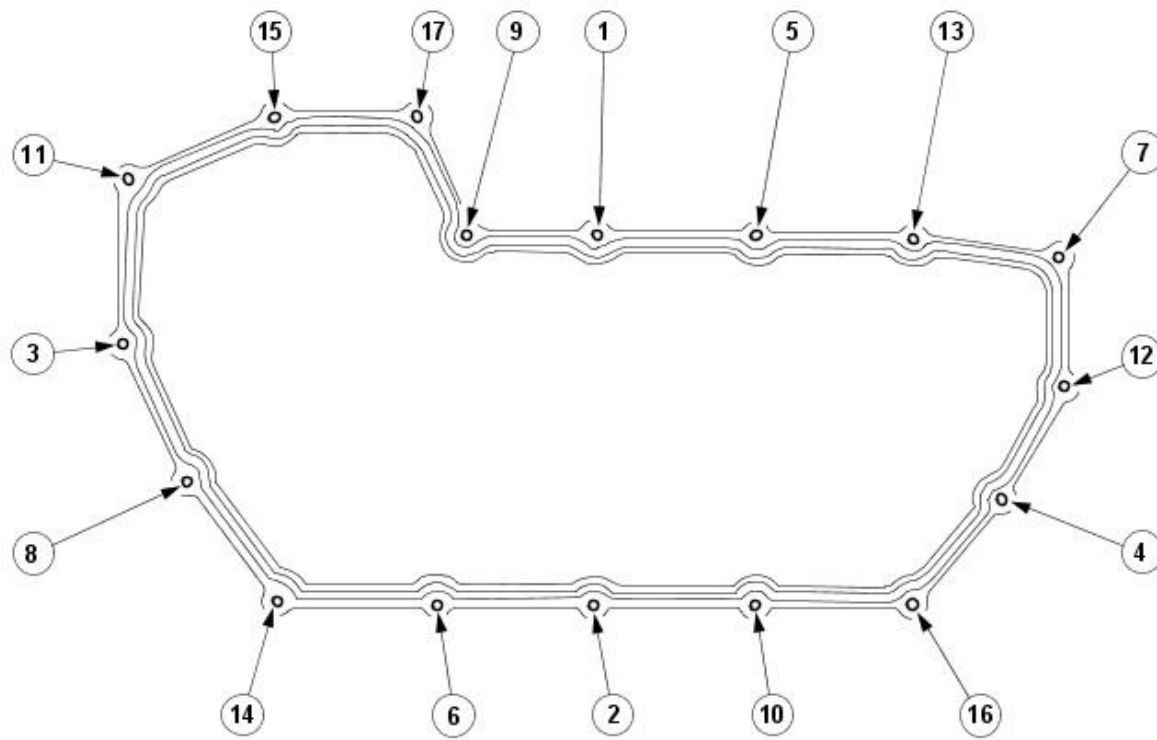
4. Remove the oil pan.

- Remove the 17 bolts.
- Remove and discard the gasket.



E31186

### Installation



1. To install, reverse the removal procedure.
- Tighten to 12 Nm.


E36705



# Engine - 4.2L SC V8 - AJV8 - Oil Pump

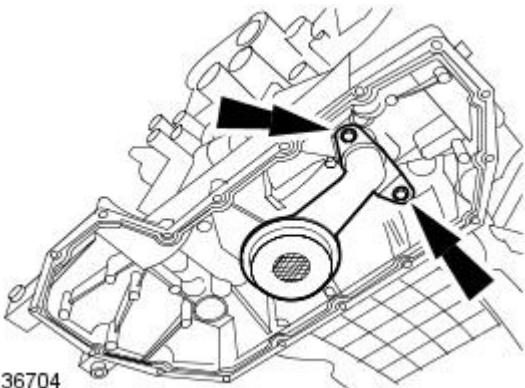
In-vehicle Repair

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the timing drive components.  
For additional information, refer to: [Timing Drive Components](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).
4. Remove the oil pan.  
For additional information, refer to: [Oil Pan](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).
5. **NOTE:** The bolts will remain captive.

Remove the oil strainer pick-up assembly.

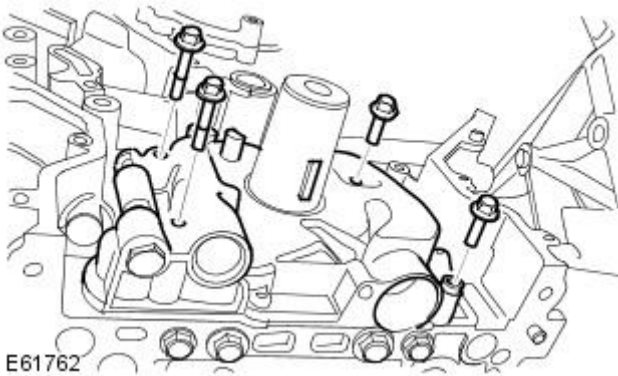
- Remove the 2 bolts.
- Remove and discard the O-ring seal.



E36704

6. Remove the oil pump assembly.

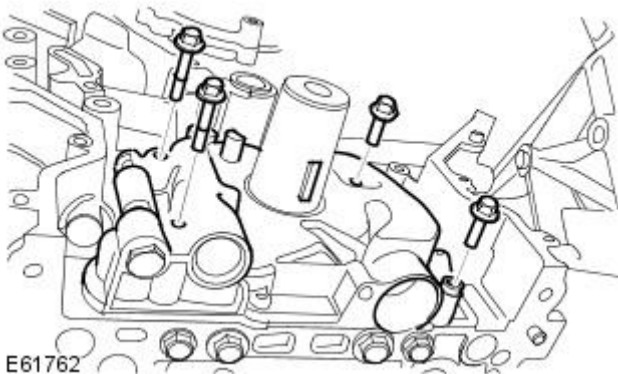
- Remove the 4 bolts.
- Remove and discard the O-ring seal.



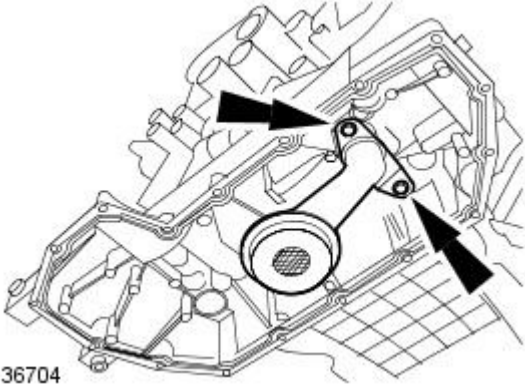
E61762

## Installation

1. Install the oil pump assembly.
  - Clean the components mating faces.
  - Install a new O-ring seal.
  - Tighten the bolts to 12 Nm.



E61762



E36704

2. Install the oil strainer pick-up assembly.

- Install a new O-ring seal.
- Tighten the bolts to 12 Nm.

3. Install the oil pan.

For additional information, refer to: [Oil Pan](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).

4. Install the timing drive components.

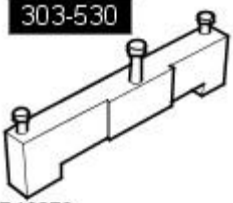


For additional information, refer to: [Timing Drive Components](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).

5. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).


# Engine - 4.2L SC V8 - AJV8 - Timing Drive Components

In-vehicle Repair


Special Tool(s)	
 <p>303-530 E46879</p>	<p>Camshaft setting/locking tool 303-530</p>
 <p>303-645 E46881</p>	<p>Timing Setting tool 303-645</p>
 <p>303-532 E46880</p>	<p>Timing chain tensioning tool 303-532</p>

## Removal

• NOTE: This procedure covers the removal and installation of the following components: timing chains, chain guides, tensioners and sprockets.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
  2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
- Raise and support the vehicle.
3. Remove the engine front cover.  
For additional information, refer to: [Engine Front Cover](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).
  4. Remove both the crankshaft position (CKP) sensors.  
For additional information, refer to: [Crankshaft Position \(CKP\) Sensor - 4.2L NA V8 - AJV8](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

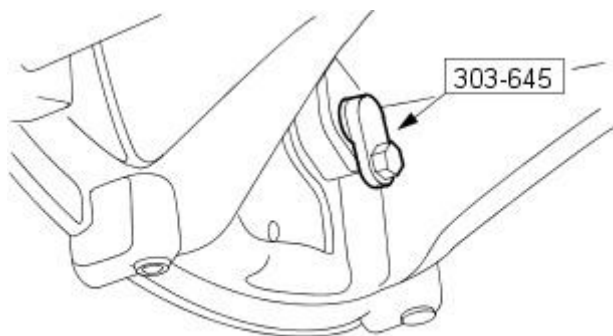
### 5. CAUTIONS:

 Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.

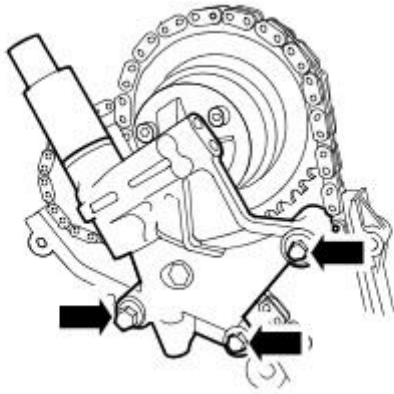
 Rotate the crankshaft clockwise to position the engine to top dead center (TDC) number 1 cylinder.

Lock the crankshaft.

- Install the special tool.
- Install the screw.



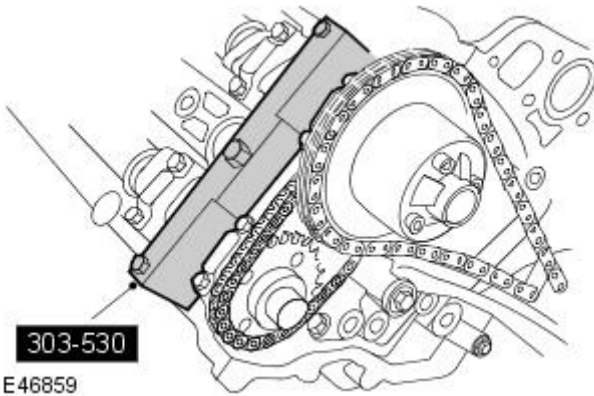
VUJ0002400



E46858

6. Remove the RH variable camshaft timing (VCT) control solenoid housing.

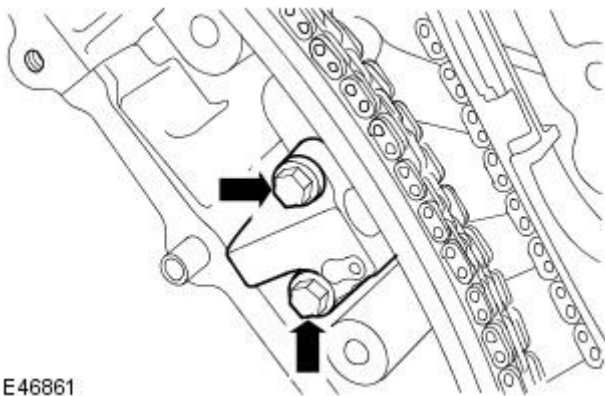
- Remove the 3 bolts.
- Remove and discard the O-ring seals.



E46859

7. Install the special tool to the RH cylinder head.

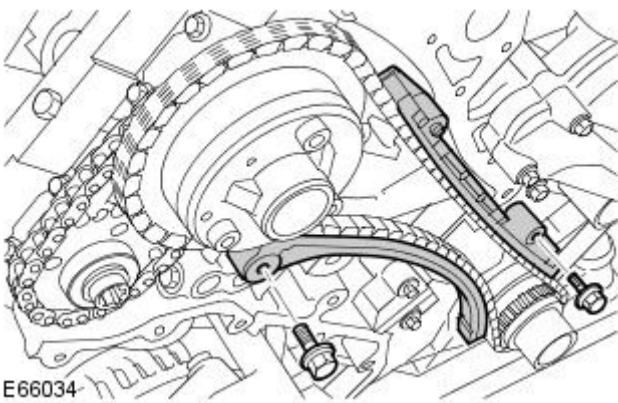
- Rotate the crankshaft until the flats on the camshafts are parallel with the cylinder head joint faces.
- Install the 3 bolts.



E46861

8. Remove the RH primary timing chain tensioner.

- Remove the 2 bolts.

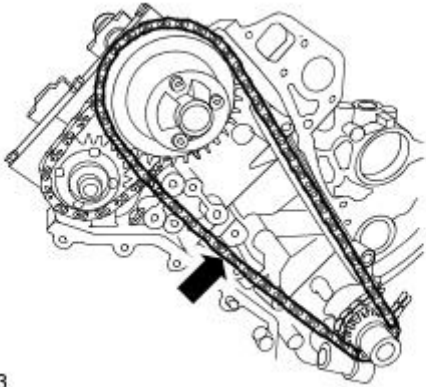


E66034

9. Remove the RH upper and lower primary timing chain tensioner guides.

- Remove the 2 bolts.

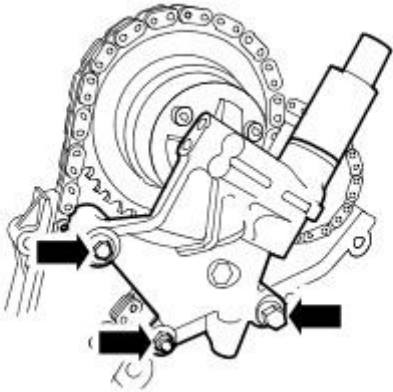
10. Remove the RH primary timing chain.



E46863

11. Remove the LH variable camshaft timing (VCT) control solenoid housing.

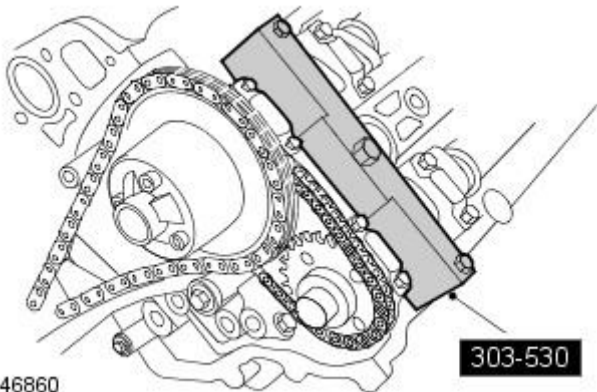
- Remove the 2 bolts.
- Remove the nut.
- Remove and discard the O-ring seals.



E48360

12. Install the special tool to the LH cylinder head.

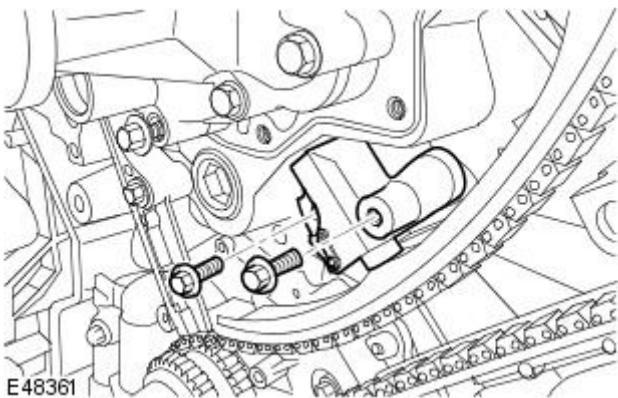
- Install the 3 bolts.



E46860

13. Remove the LH primary timing chain tensioner.

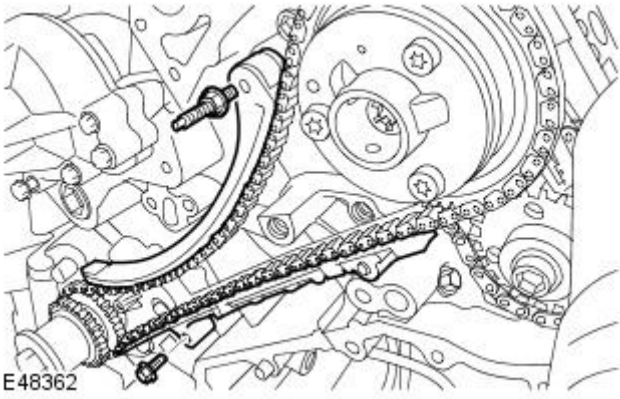
- Remove the 2 bolts.



E48361

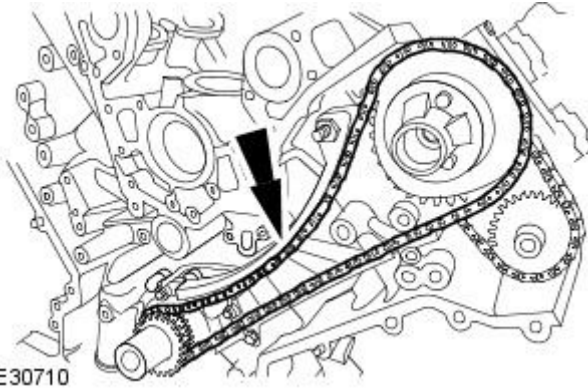
14. Remove the LH upper and lower primary timing chain tensioner guides.

- Remove the 2 bolts.



E48362

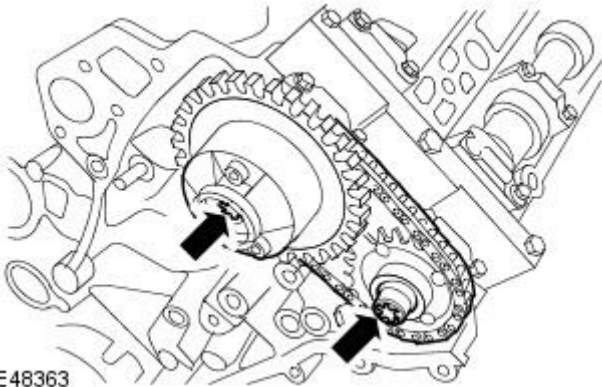
15. Remove the LH primary timing chain.



E30710

16. Release the LH camshaft sprocket assembly.

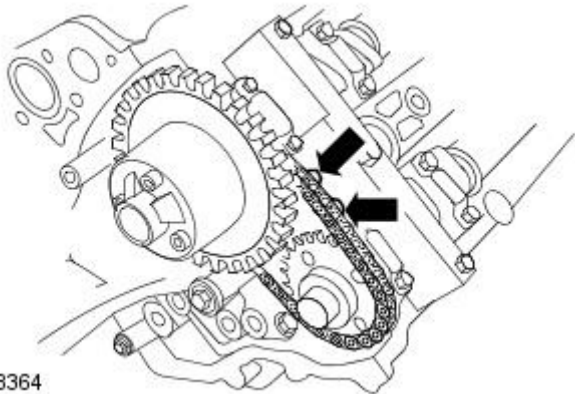
- Remove the 2 Torx bolts.



E48363

17. Remove the LH secondary timing chain, tensioner and sprocket assembly.

- Remove the 2 bolts.

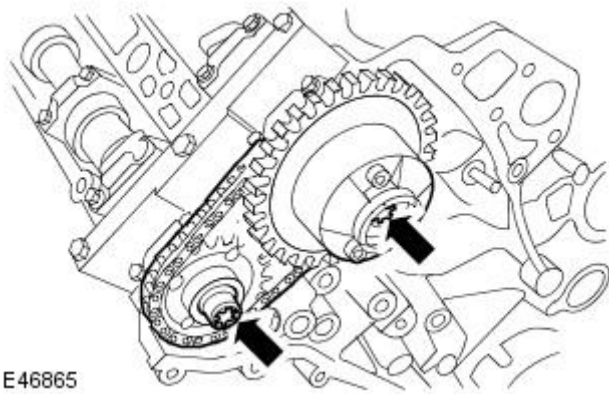


E48364



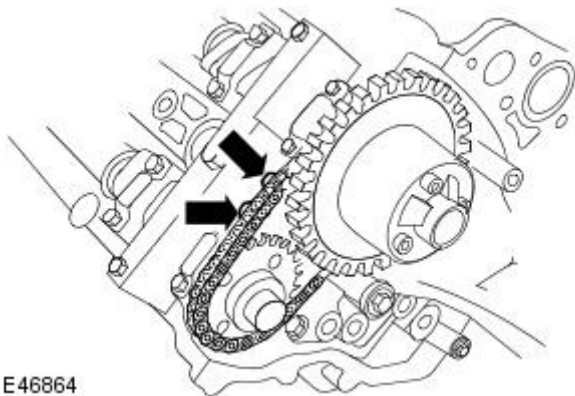
18. Release the RH camshaft sprocket assembly.

- Remove the 2 Torx bolts.



19. Remove the RH secondary timing chain, tensioner and sprocket assembly.

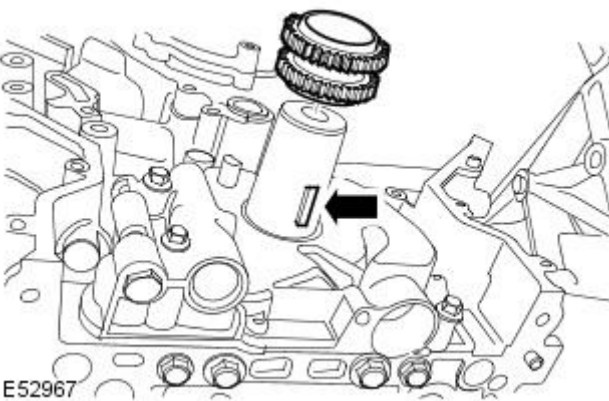
- Remove the 2 retaining bolts.



20. NOTE: Note the orientation of the crankshaft sprocket.

Remove the crankshaft sprocket.

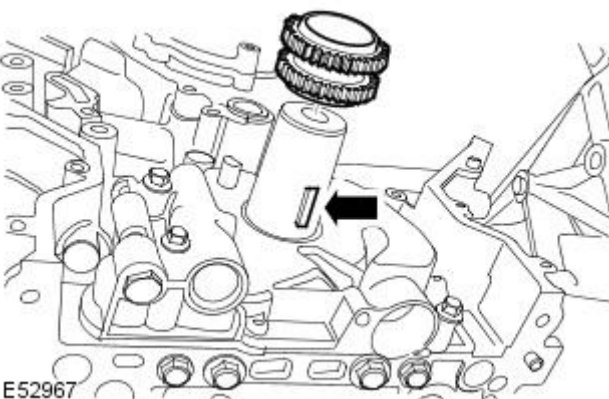
- Remove the crankshaft sprocket key.

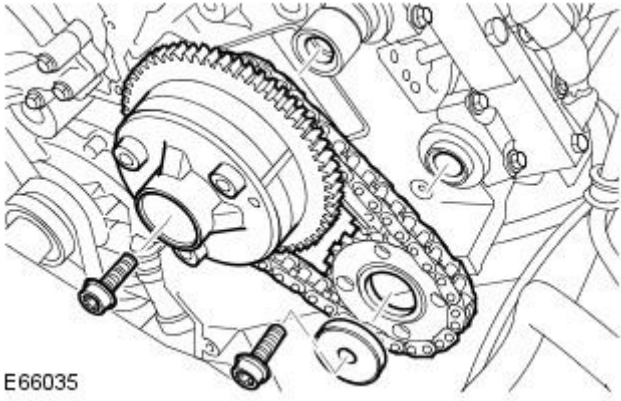


## Installation


1. Install the crankshaft sprocket.

- Clean the components.
- Install the crankshaft sprocket key.





E66035

2.  **CAUTION:** Make sure the secondary timing chain and camshaft sprockets are free to rotate.

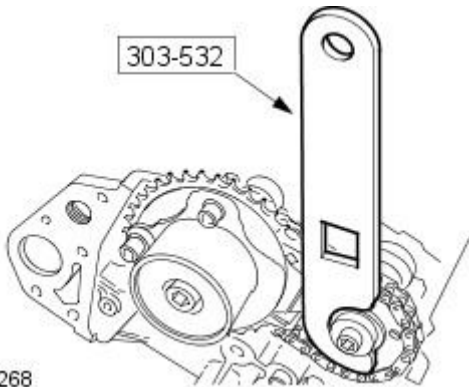
• **NOTE:** LH illustration shown, RH is similar.

Install the LH secondary timing chain, tensioner and sprocket assembly.

- Clean the components.
- Install the Torx bolts, but do not tighten fully at this stage.

3. Install the special tool to the exhaust camshaft sprocket.

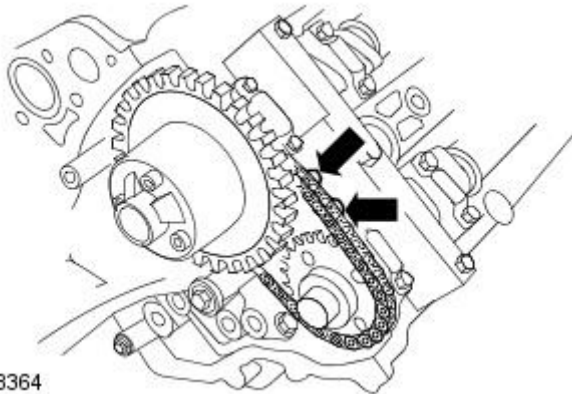
- Reposition the camshaft sprockets for the most advantageous position for use of the special tool.



E31268

4. Install the LH secondary timing chain tensioner retaining bolts.

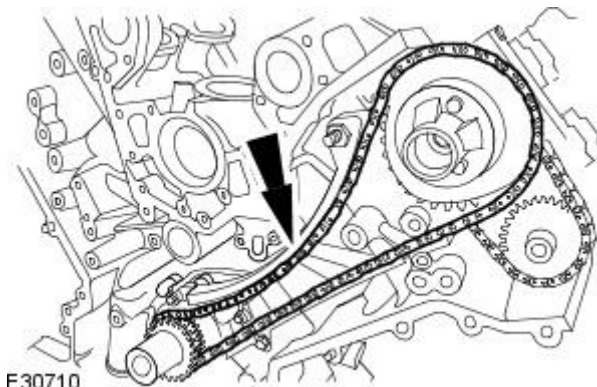
- Tighten to 12 Nm.



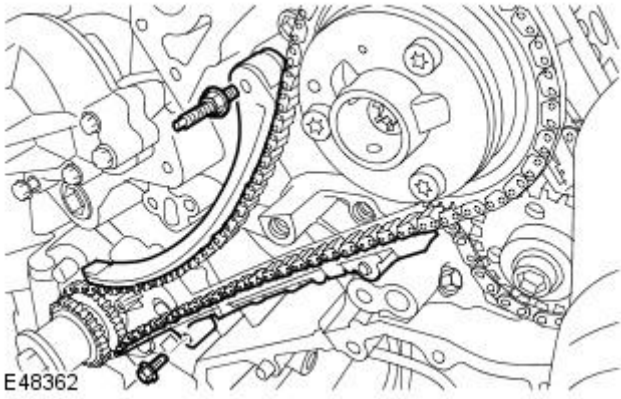
E48364

5. Install the LH primary timing chain.

- Clean the components.
- Make sure the timing chain slack is on the tensioner side of the timing chain.

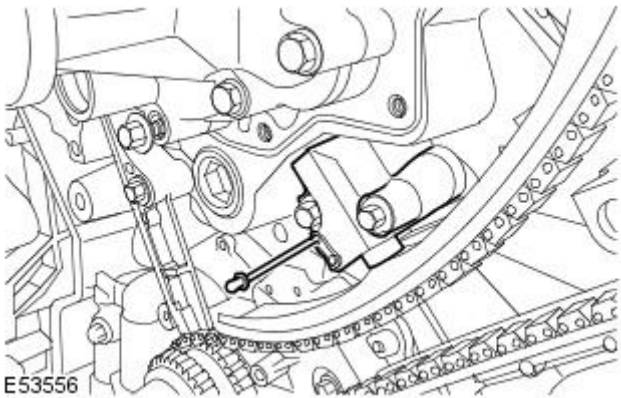


E30710



6. Install the LH primary timing chain tensioner guides.

- Clean the components.
- Tighten to 12 Nm.

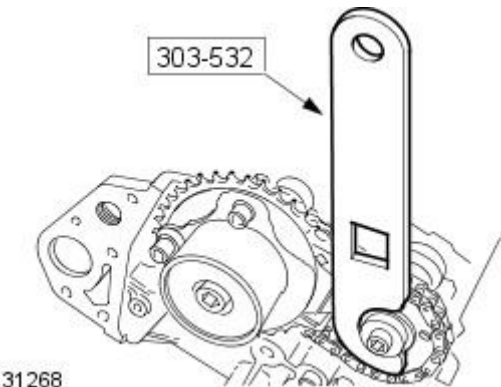


7. **!** CAUTION: During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

- NOTE: LH illustration shown, RH is similar.

Install the LH primary timing chain tensioner.

- Clean the components.
- Using 3 mm diameter metal rod, retain the chain tensioner piston.
- Remove the retaining rod.
- Tighten to 12 Nm.



8. CAUTIONS:

**!** Using the special tool, apply force to the tool in a counter-clockwise direction, to tension the primary timing chain on its drive side.

**!** The intake camshaft sprocket retaining bolt **MUST** be tightened before the exhaust camshaft sprocket retaining bolt. Engine damage will occur if this procedure is not followed.

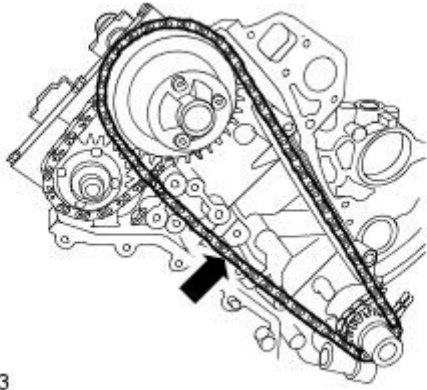
Install the special tool to the LH exhaust camshaft sprocket.

- Tighten the intake camshaft sprocket retaining bolt to 20 Nm + 90 degrees
- Tighten the exhaust camshaft retaining bolt to 20 Nm + 90 degrees.
- Install new retaining bolts.


9. Install the LH VCT control solenoid housing.

- Clean the components.
- Install the new O-ring seals.
- Tighten the new bolts to 22 Nm.
- Tighten the nut to 10 Nm.



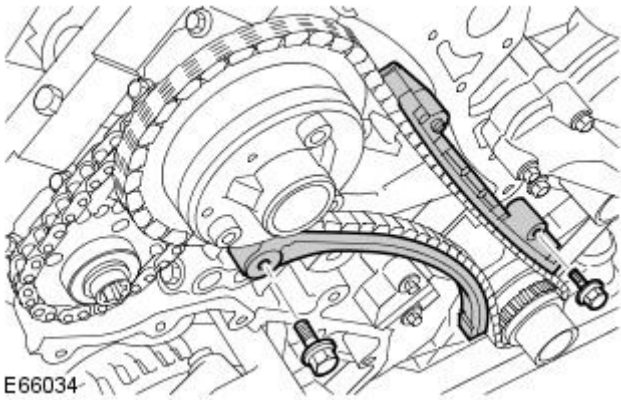


E46863

10.  **CAUTION:** Make sure the secondary timing chain and camshaft sprockets are free to rotate.

Install the RH secondary timing chain, tensioner and sprocket assembly.

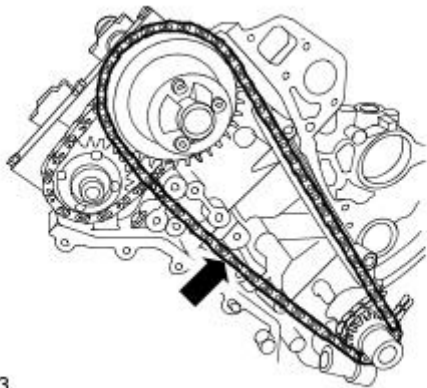
- Clean the components.
- Install the Torx bolts, but do not tighten fully at this stage.



E66034

11. Install the RH secondary timing chain tensioner retaining bolts.

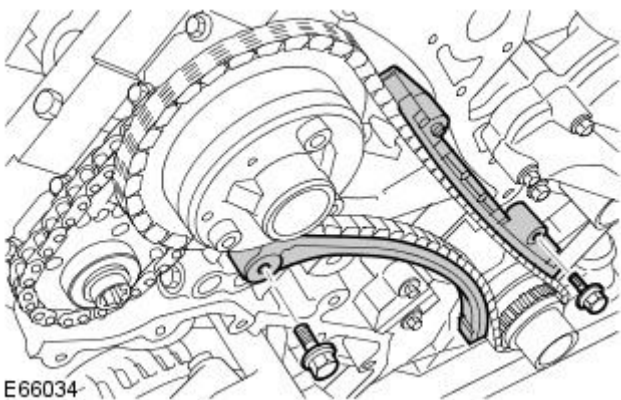
- Tighten the bolts to 12 Nm.



E46863

12. Install the RH primary timing chain.

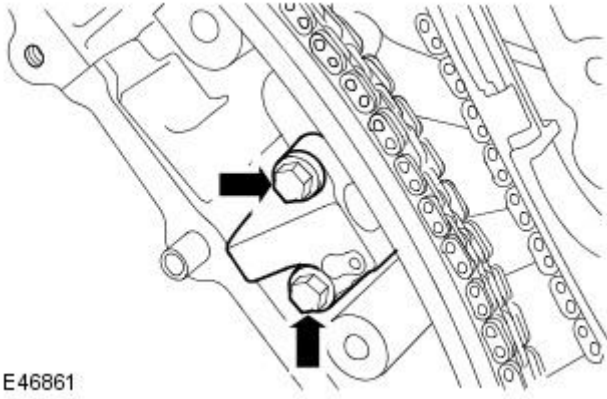
- Clean the components.
- Make sure the timing chain slack is on the tensioner side of the timing chain.




E66034

13. Install the RH primary timing chain tensioner guides.

- Tighten the bolts to 12 Nm.

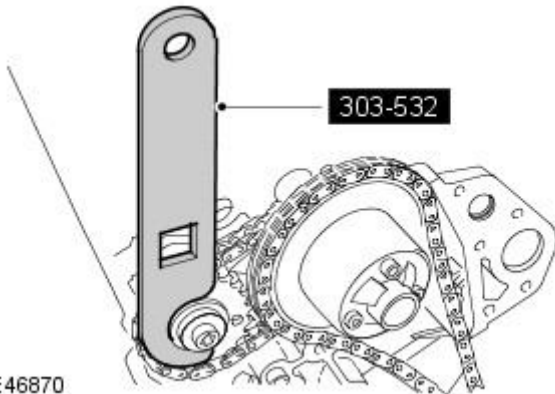


E46861

14.  **CAUTION:** During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.


Install the RH primary timing chain tensioner.


- Clean the components.
- Using 3 mm diameter metal rod, retain the chain tensioner piston.
- Remove the retaining rod.
- Tighten the bolts to 12 Nm.



E46870

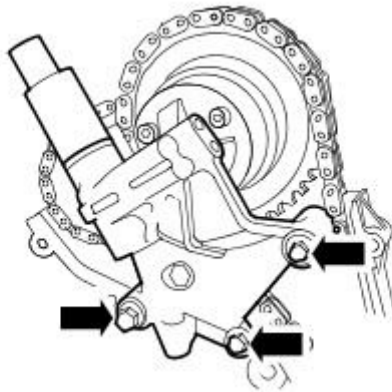
15. **CAUTIONS:**

 Using the special tool, apply force to the tool in a counter-clockwise direction, to tension the primary timing chain on its drive side.

 The intake camshaft sprocket retaining bolt **MUST** be tightened before the exhaust camshaft sprocket retaining bolt. Engine damage will occur if this procedure is not followed.

Install the special tool to the RH exhaust camshaft sprocket.

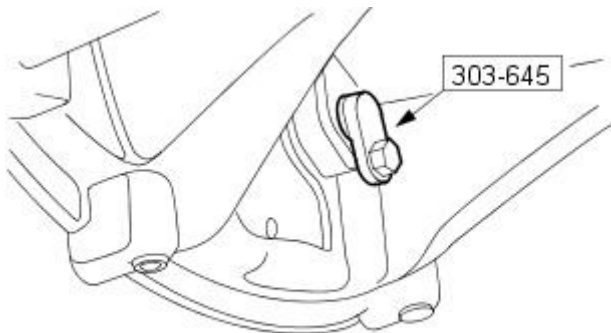
- Tighten the intake camshaft sprocket retaining bolt to 20 Nm + 90 degrees
- Tighten the exhaust camshaft retaining bolt to 20 Nm + 90 degrees.
- Install new retaining bolts.



E46858

16. Install the RH VCT control solenoid housing.

- Clean the components.
- Install the new O-ring seals.
- Tighten the new bolts to 22 Nm.



VUJ0002400

17. Remove the special tool from the RH cylinder head.

- Remove the 3 bolts.

18. Remove the special tool from the LH cylinder head.

- Remove the 3 bolts.

**19.** Install the engine front cover.

For additional information, refer to: [Engine Front Cover](#) (303-01B Engine - 4.2L SC V8 - AJV8, In-vehicle Repair).

**20.** Remove the crankshaft locking tool.

- Remove the screw.

**21.** Install both the CKP sensors.

For additional information, refer to: [Crankshaft Position \(CKP\) Sensor - 4.2L NA V8 - AJV8](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

**22.** Connect the battery ground cable.


For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).



## Engine - 4.2L SC V8 - AJV8 - Twin Oil Coolers


In-vehicle Repair

### Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

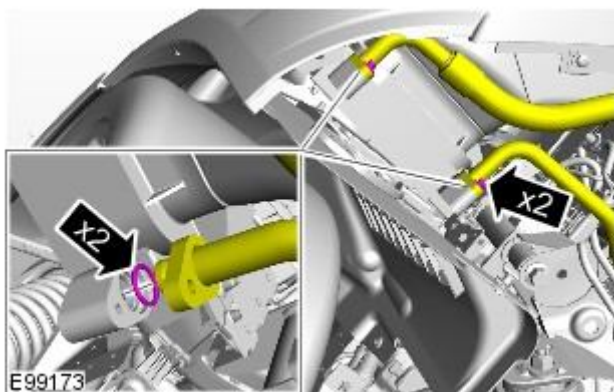
2. Remove the radiator splash shield.  
For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

3.  **CAUTION:** Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

- **NOTE:** Right-hand shown, left-hand similar.

Disconnect the 2 oil cooler lines.

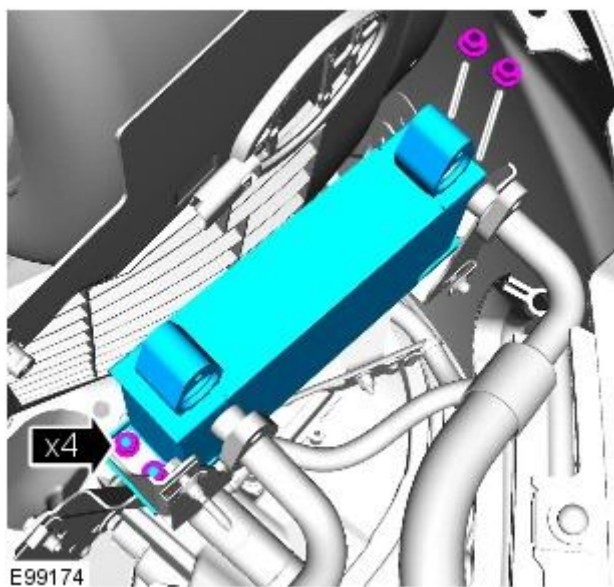
- Position a container to collect the engine oil.
- Remove the 2 nuts.
- Remove and discard the 2 O-ring seals.
- Remove the 2 brackets.



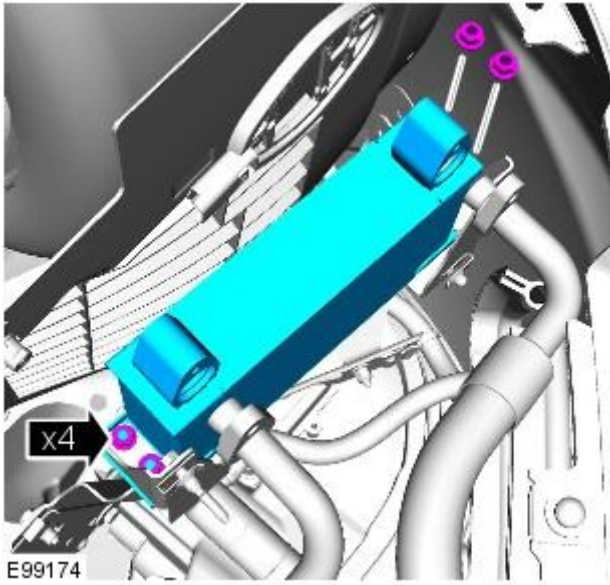
4. **NOTE:** Right-hand shown, left-hand similar.

Remove the oil cooler.

- Remove the 4 securing nuts.

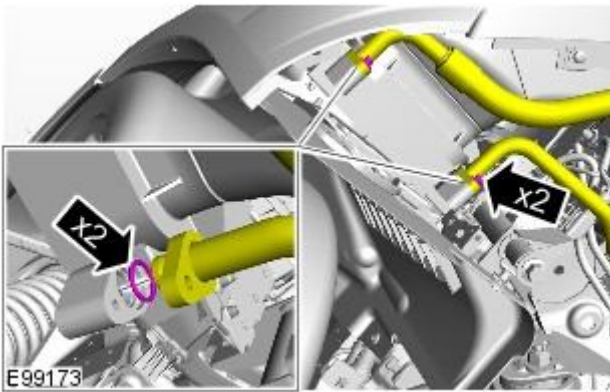


### Installation



1. Install the oil cooler.

- Install the support brackets.
- Install the retainer.
- Tighten to 5 Nm.



2. Connect the oil cooler lines.

- Clean the components.
- Install new O-ring seals.
- Tighten to 7 Nm.

3. Install the radiator splash shield.

For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

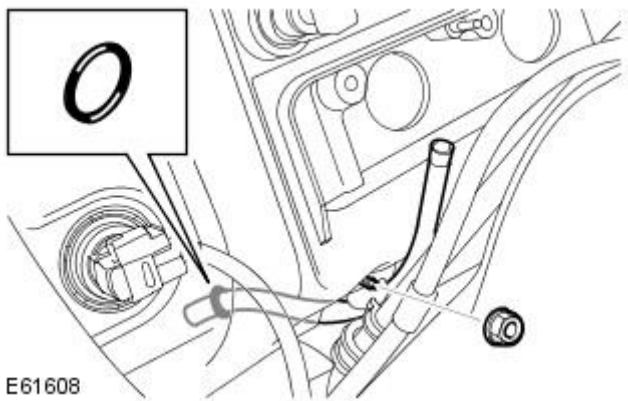
4. Check and top-up the engine oil.

# Engine - 4.2L SC V8 - AJV8 - Valve Cover LH

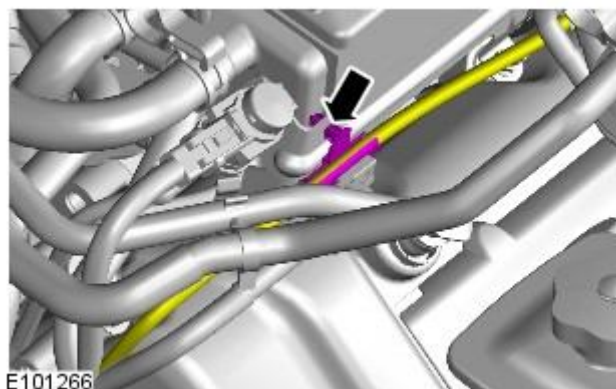
In-vehicle Repair

## Removal

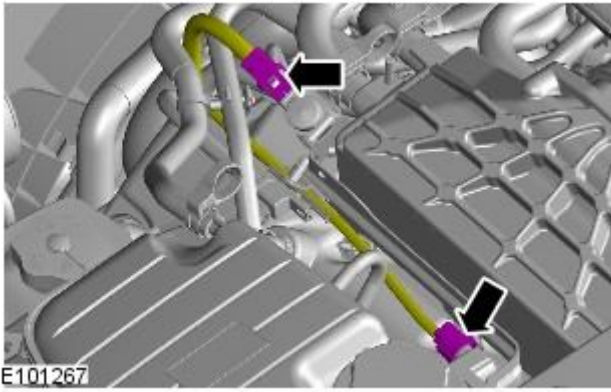
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the evaporative emission canister purge valve.  
For additional information, refer to: [Evaporative Emission Canister Purge Valve - 4.2L SC V8 - AJV8](#) (303-13 Evaporative Emissions - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
3. Remove the secondary bulkhead LH panel.  
For additional information, refer to: [Secondary Bulkhead Panel LH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).
4. Remove the ignition coil-on-plug.  
For additional information, refer to: [Ignition Coil-On-Plug - 4.2L SC V8 - AJV8](#) (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
5. Remove the remaining ignition coil-on-plugs.
6. Remove the oil level indicator and tube.
  - Remove the nut.
  - Remove and discard the O-ring seal.



7. Disconnect the variable camshaft timing (VCT) oil control solenoid electrical connector.
8. Disconnect fuel line from the fuel rail.  
For additional information, refer to: [Spring Lock Couplings](#) (310-00 Fuel System - General Information, General Procedures).
9. Release the wiring harness.

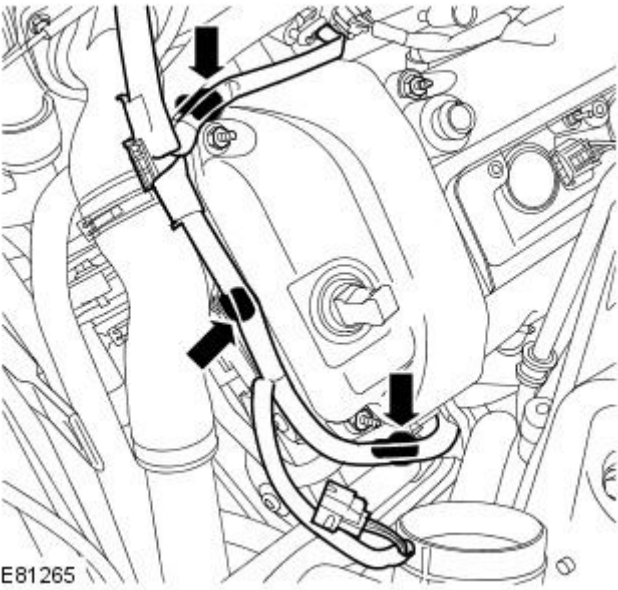


10. Disconnect the 2 electrical connectors.

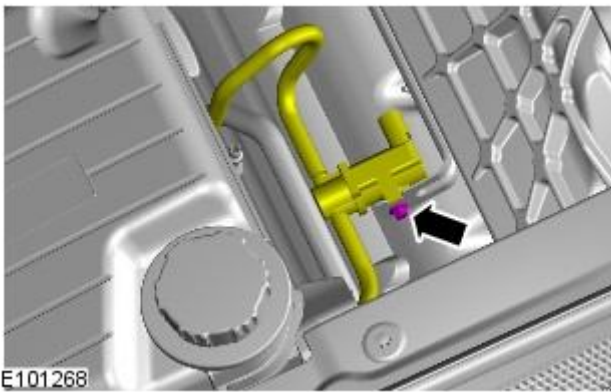


11. Release the engine wiring harness.

- Release the 3 clips.

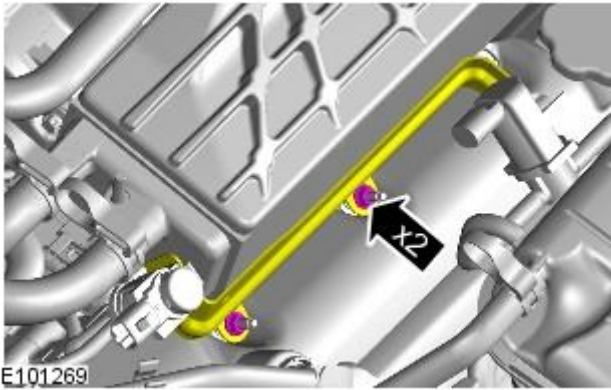


12. Detach the fuel vapour valve from the mounting bracket.





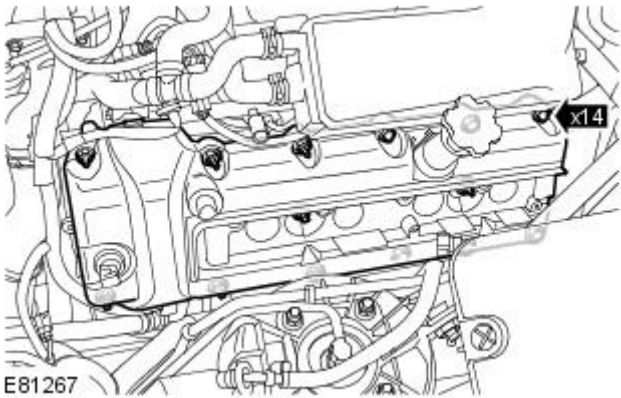
13. Detach the mounting bracket and position it to one side.



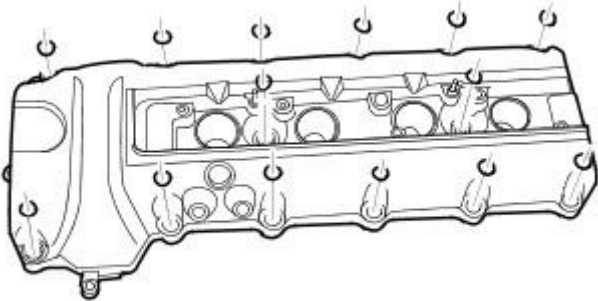
14. NOTE: Note the fitted position of the retaining bolts prior to removal.

Remove the valve cover.

- Remove the 14 valve cover retaining bolts.



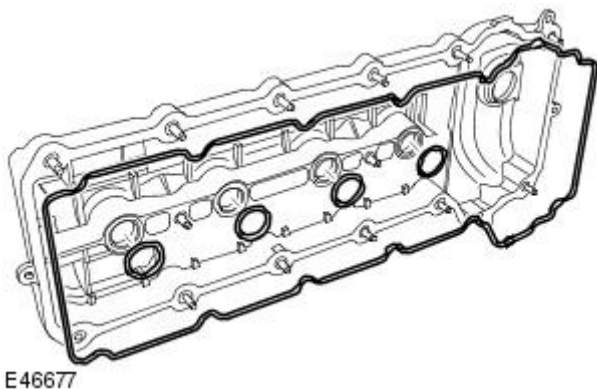
15. Remove and discard the valve cover retaining bolt O-ring seals.



16. Remove and discard the valve cover gasket.

- Carefully remove the sealant.

17. Remove and discard the valve cover plug aperture seals.

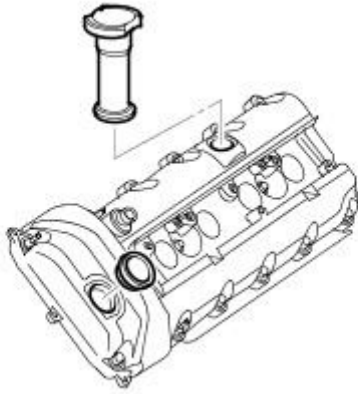


18. Remove and discard the VCT oil control solenoid seal.

**19. NOTE:** Do not disassemble further if the component is removed for access only.

Remove the oil filler pipe.

- Remove and discard the O-ring seal.

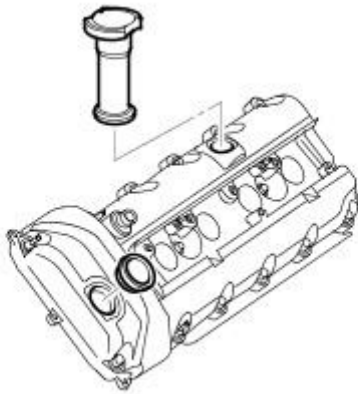


E61613

## Installation

1. Install the oil filler pipe.

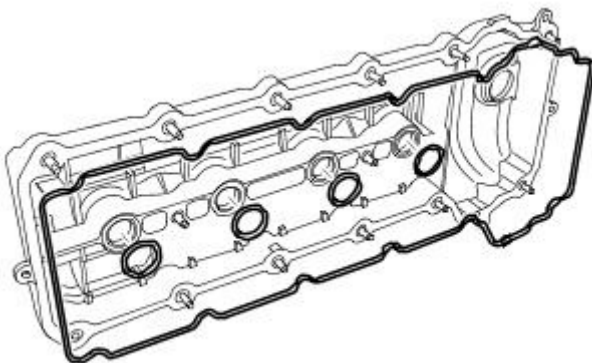
- Install a new O-ring seal.



E61613

2. Install the new VCT oil control solenoid seal.

3. Install the new valve cover plug aperture seals.



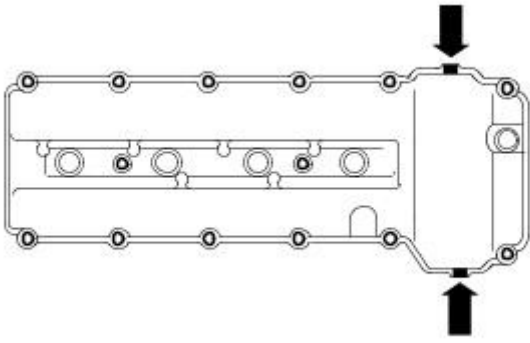
E46677

4. Install a new valve cover gasket.

- Clean the components.



5. NOTE: Apply two beads of silicone gasket sealant as shown on the illustration. The application of the sealant must be 3mm diameter 12mm long. Install the valve cover immediately after applying the sealant. The cover should be fitted directly to the head without smearing the sealant or the seals.

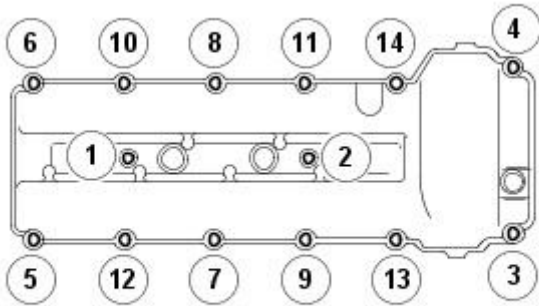


E49922

Install the valve cover.

- Clean the component mating faces.

6. Install valve cover retaining bolts to their position previously noted.

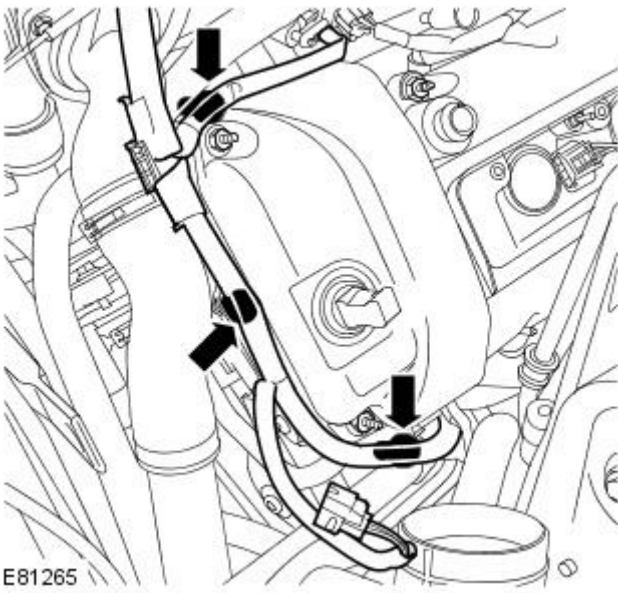


E46679

- Install new valve cover bolt O-ring seals.
- Complete the tightening sequence as illustrated.
- Tighten the bolts to 12 Nm.

7. Attach the engine wiring harness.

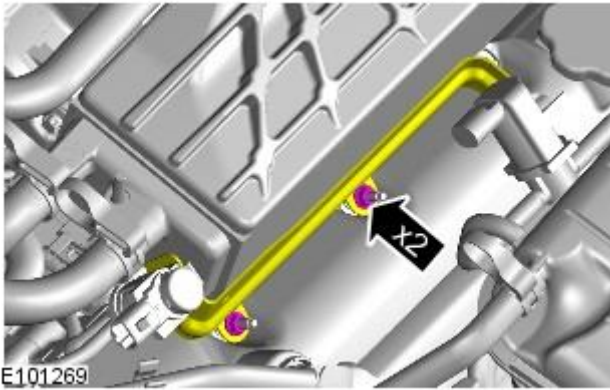
- Secure with the clips.



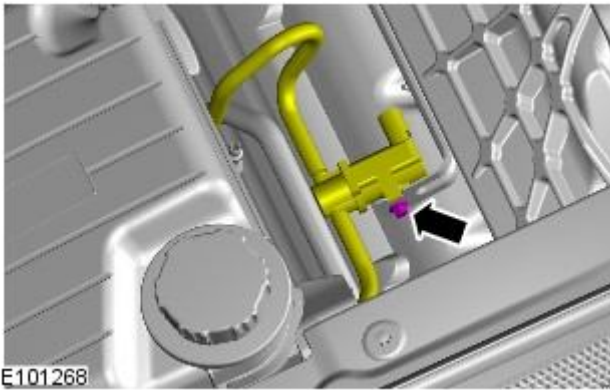
E81265

8. Connect the VCT oil control solenoid electrical connector.

9. Attach the mounting bracket.

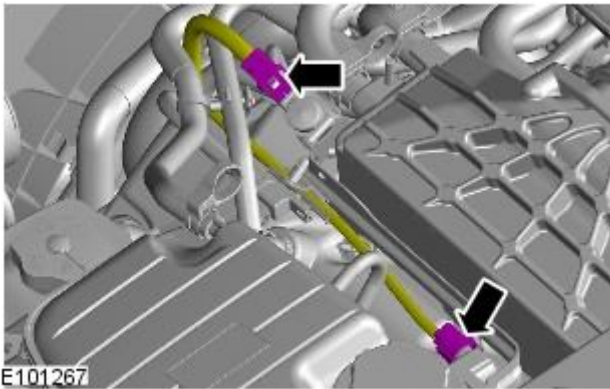


10. Attach the fuel vapour valve to the mounting bracket.



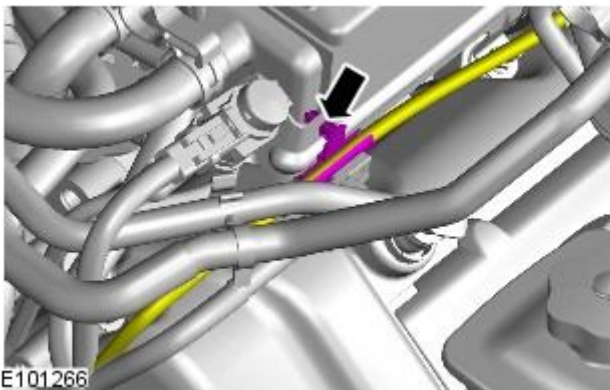
11. Attach the wiring harness.

12. Connect the two electrical connectors.



13. Connect the fuel line.

For additional information, refer to: [Spring Lock Couplings](#) (310-00 Fuel System - General Information, General Procedures).



14. Install the secondary bulkhead LH panel.

For additional information, refer to: [Secondary Bulkhead Panel LH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and

Installation).

**15.** Install the oil level indicator and tube.

- Install a new O-ring seal.
- Tighten the nut to 6 Nm.

**16.** Install the ignition coil-on-plug.

For additional information, refer to: [Ignition Coil-On-Plug - 4.2L SC V8 - AJV8](#) (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

**17.** Install the remaining ignition coil-on-plugs.

**18.** Install the evaporative emission canister purge valve.

For additional information, refer to: [Evaporative Emission Canister Purge Valve - 4.2L SC V8 - AJV8](#) (303-13 Evaporative Emissions - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

**19.** Connect the battery ground cable.

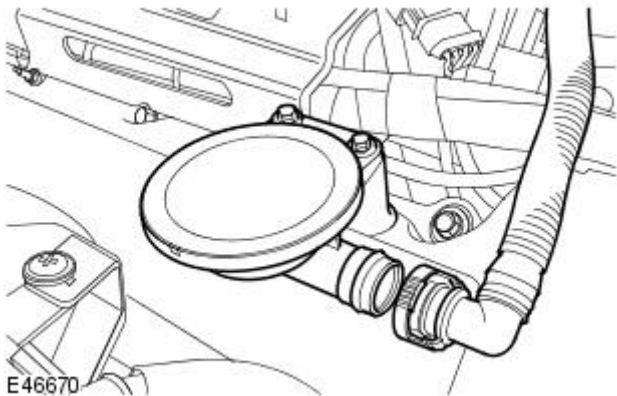
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

## Engine - 4.2L SC V8 - AJV8 - Valve Cover RH

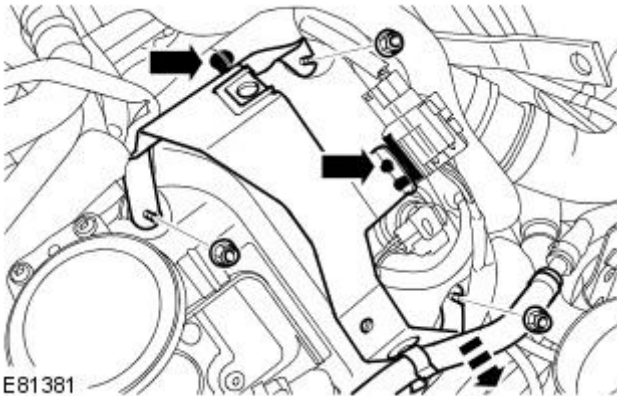
In-vehicle Repair

### Removal

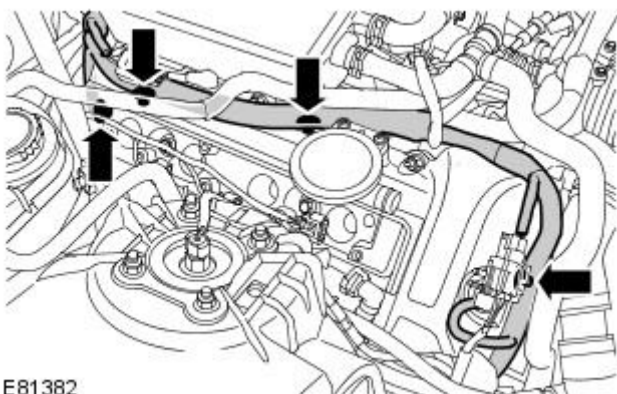
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the ignition coil-on-plug.  
For additional information, refer to: [Ignition Coil-On-Plug - 4.2L SC V8 - AJV8](#) (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
3. Remove the remaining ignition coil-on-plugs.
4. Remove the secondary bulkhead RH panel.  
For additional information, refer to: [Secondary Bulkhead Panel RH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).
5. Disconnect the positive crankcase ventilation (PCV) line.



6. Remove the engine cover bracket.
  - Remove the 3 nuts.
  - Release the 2 wiring harness clips.
  - Release the hose.



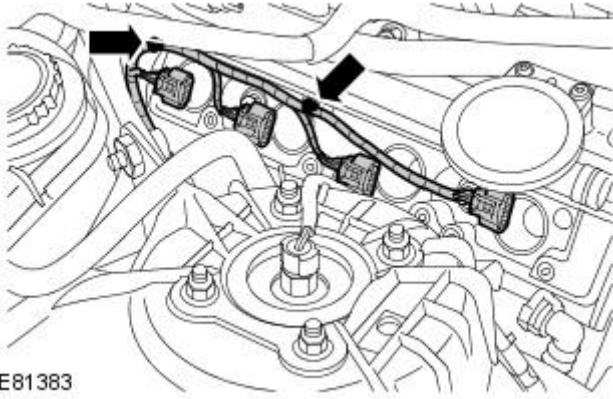
7. Release the engine wiring harness.
  - Release the 4 clips.



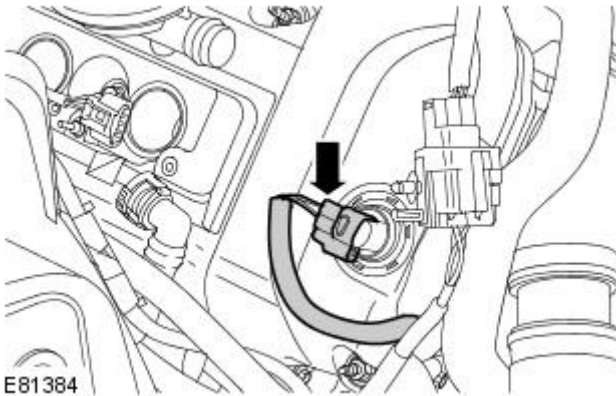


8. Release the coil-on-plug wiring harness.

- Release the 2 clips.



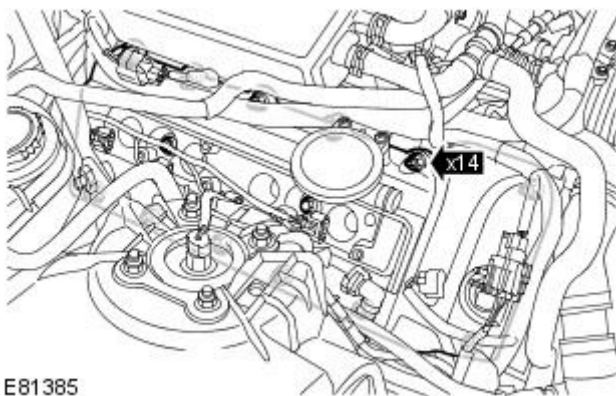
9. Disconnect the variable camshaft timing (VCT) oil control solenoid electrical connector.



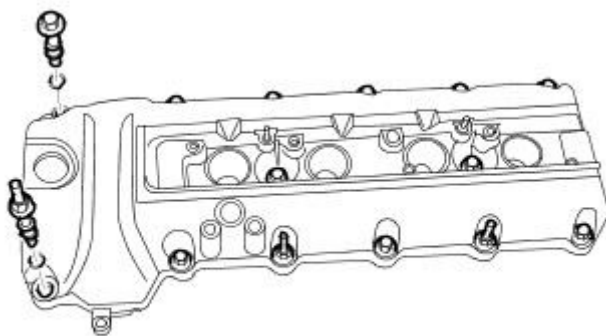
10. NOTE: Note the fitted position of the retaining bolts prior to removal.

Remove the valve cover.

- Remove the 14 valve cover retaining bolts.



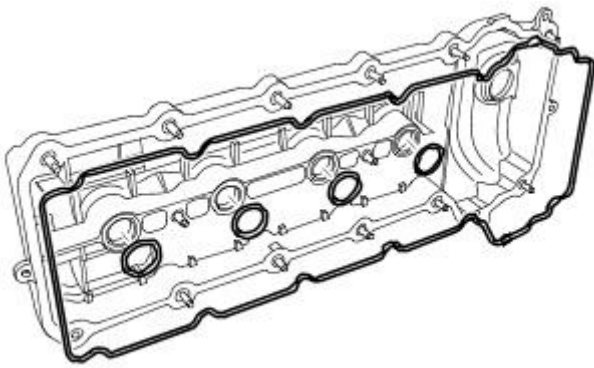
11. Remove and discard the valve cover retaining bolt O-ring seals.



12. Remove and discard the valve cover gasket.

- Carefully remove the sealant.

13. Remove and discard the valve cover plug aperture seals.



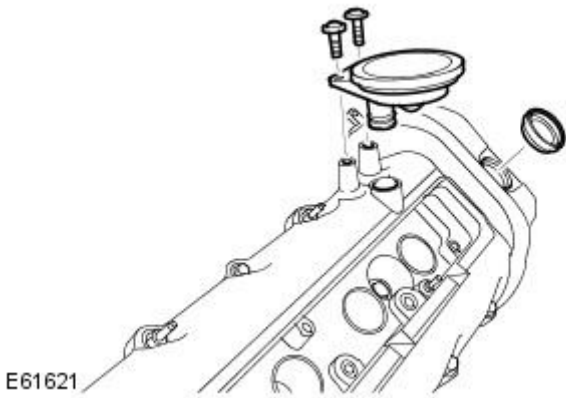
E46677

14. Remove and discard the VCT oil control solenoid seal.

15. NOTE: Do not disassemble further if the component is removed for access only.

Remove the PCV valve.

- Remove the 2 Torx screws.
- Remove and discard the O-ring seal.

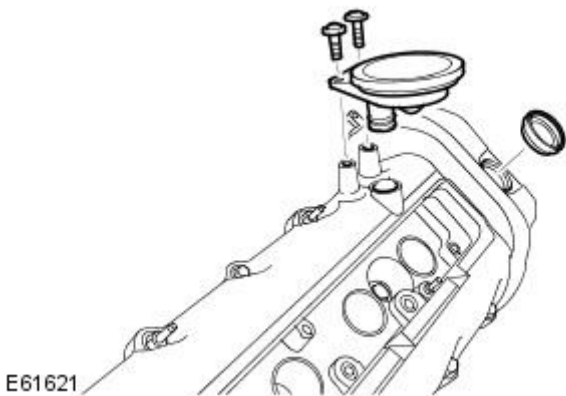


E61621

## Installation

1. Install the PCV valve.

- Clean the component mating faces.
- Install a new O-ring seal.
- Tighten the Torx screws.

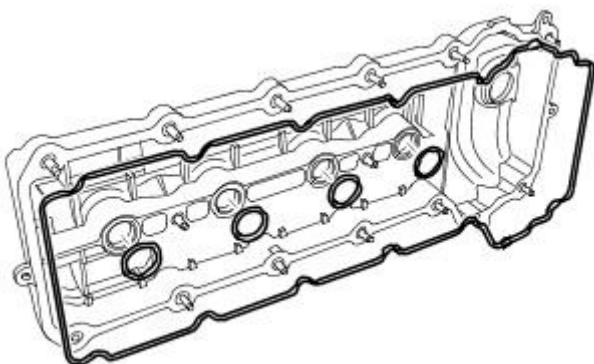


E61621

2. Install the new VCT oil control solenoid seal.

3. Install new valve cover plug aperture gaskets.

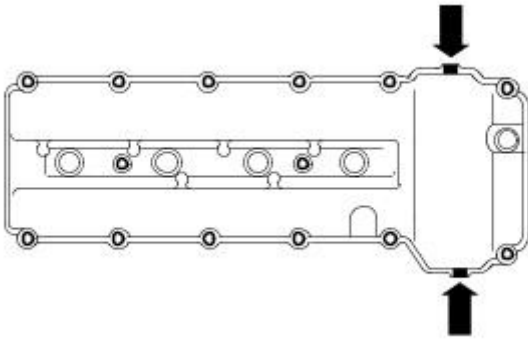
4. Install a new valve cover gasket.



E46677



5. NOTE: Apply two beads of silicone gasket sealant as shown on the illustration. The application of the sealant must be 3mm diameter 12mm long. Install the valve cover immediately after applying the sealant. The cover should be fitted directly to the head without smearing the sealant or the seals.

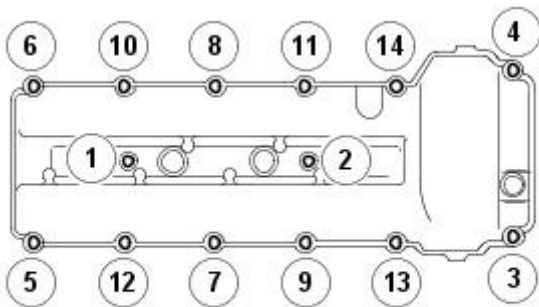


E49922

Install the valve cover.

- Clean the component mating faces.

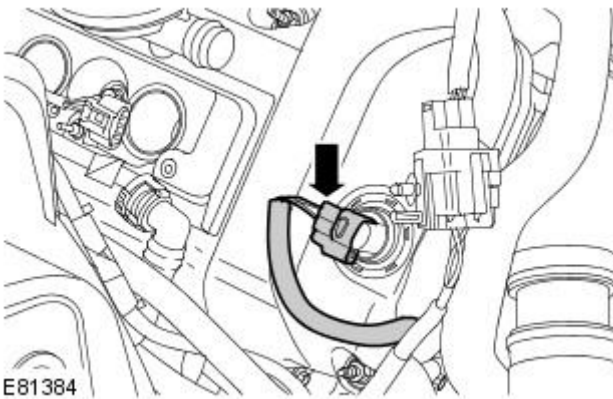
6. Install valve cover retaining bolts to their position previously noted.



E46679

- Install new valve cover bolt O-ring seals.
- Tighten the bolts to 12 Nm.
- Complete the tightening sequence as illustrated.

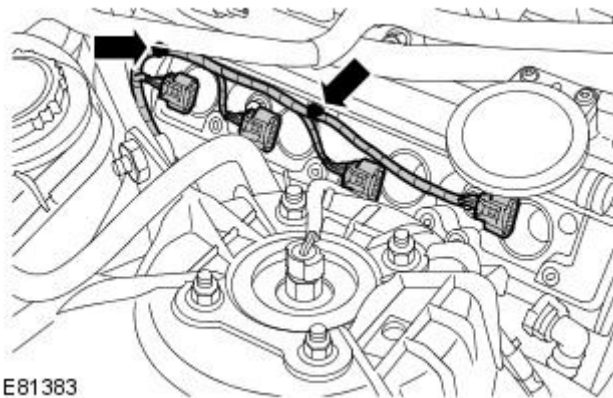
7. Connect the VCT oil control solenoid electrical connector.



E81384

8. Attach the coil-on-plug wiring harness.

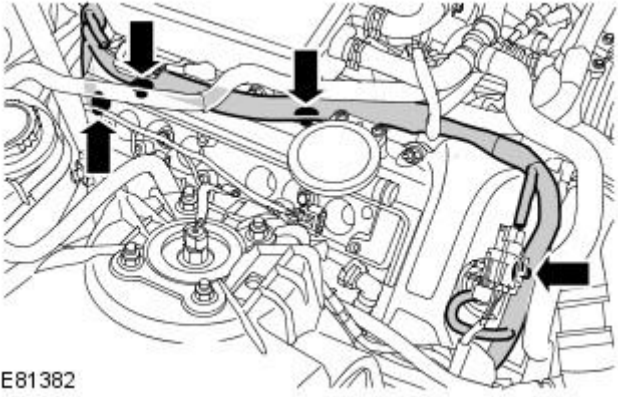
- Secure with the clips.



E81383

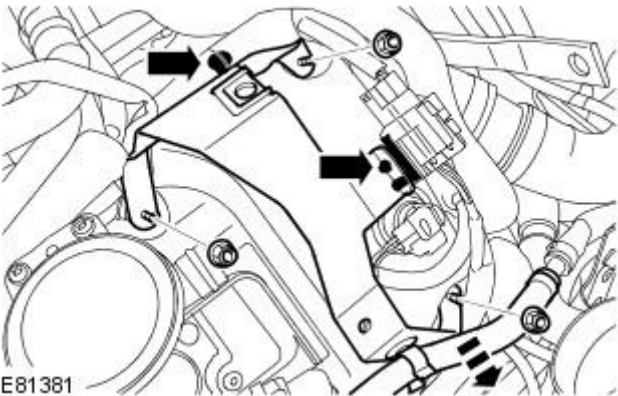
9. Attach the engine wiring harness.

- Secure with the clips.

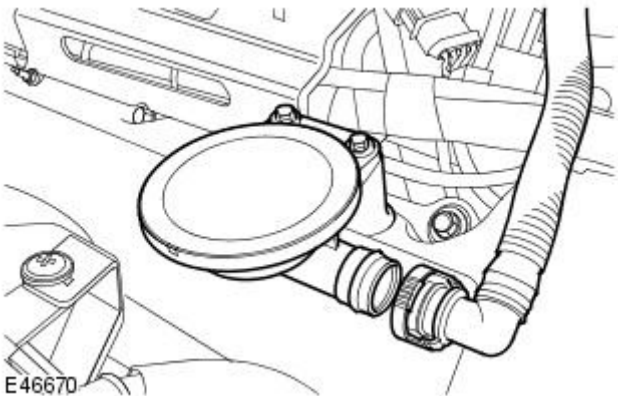


10. Install the engine cover bracket.

- Secure the wiring harness.
- Secure the hose.
- Tighten to 6 Nm.



11. Connect the PCV line.



12. Install the secondary bulkhead RH panel.

For additional information, refer to: [Secondary Bulkhead Panel RH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).

13. Install the ignition coil-on-plug.

For additional information, refer to: [Ignition Coil-On-Plug - 4.2L SC V8 - AJV8](#) (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).



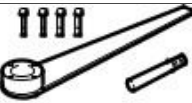


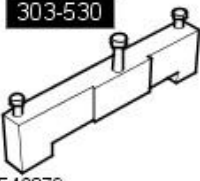
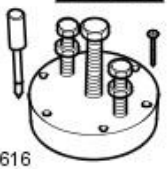

14. Install the remaining ignition coil-on-plugs.


15. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).


**Engine - 4.2L SC V8 - AJV8 - Crankshaft Main Bearing Carrier**

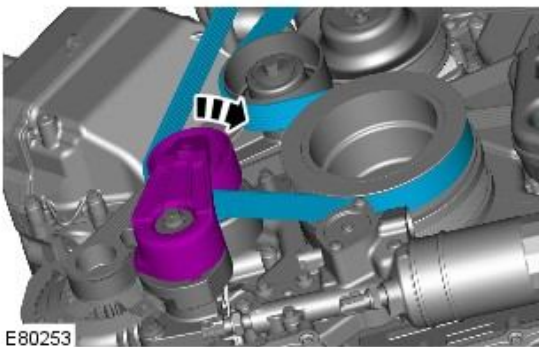
Removal and Installation

<b>Special Tool(s)</b>	
 <p><b>303-191-03</b> E46730</p>	Adapter 303-191-03
 <p><b>303-191-04</b> E59251</p>	Bolts and spacers 303-191-04
 <p><b>303-191</b></p>	Holding Tool Crankshaft Pulley 303-191
 <p><b>303-D121</b> E64849</p>	Remover, crankshaft seal 303-D121
 <p><b>303-645</b> E46881</p>	Timing Setting tool 303-645
 <p><b>303-530</b> E46879</p>	Camshaft setting/locking tool 303-530
 <p><b>303-538</b> E46616</p>	Crankshaft rear oil seal remover/installer 303-538
 <p><b>303-1100-01</b> E67144</p>	Adapter - Crankshaft seal installer 303-1100-01

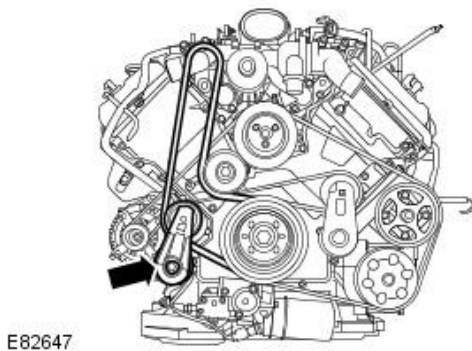
 <p>303-1100</p> <p>E46732</p>	<p>Installer, crankshaft seal</p> <p>303-1100</p>
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## Removal

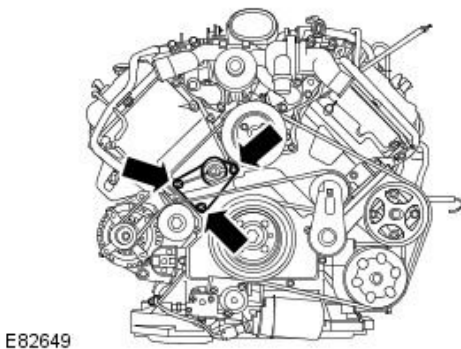
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the engine.  
For additional information, refer to: [Engine](#) (303-01B Engine - 4.2L SC V8 - AJV8, Installation).
4. Mount the engine to an engine stand.
5. Release the supercharger belt.
  - Rotate the drive belt tensioner clockwise. Use a 1/2 inch square drive bar to rotate the drive belt tensioner.



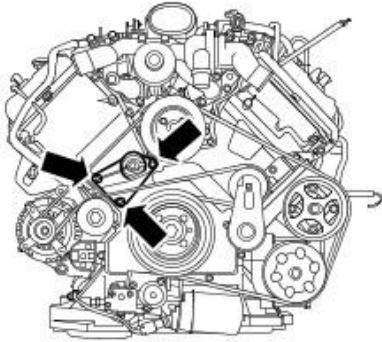
6. Remove the supercharger belt.



7. Remove the supercharger belt idler pulley.

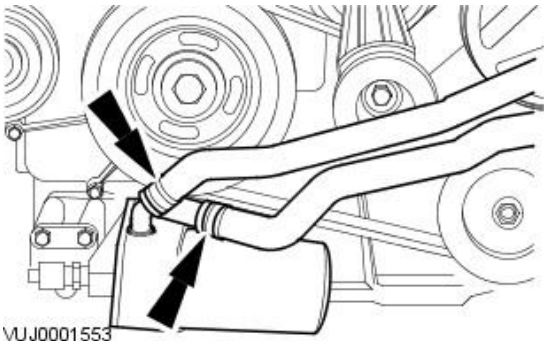


8. Remove the mounting bracket.



E82649

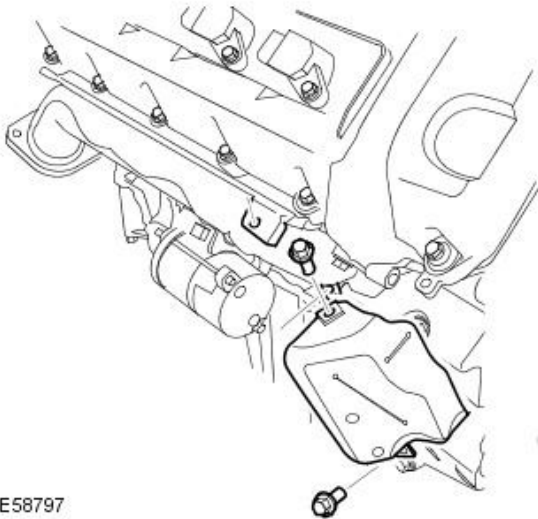
9. Disconnect the 2 oil cooler hoses.



VUJ0001553

10. Remove the exhaust manifold heat shield.

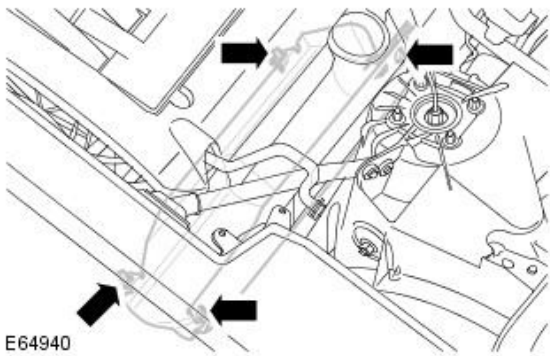
- Remove the 2 bolts.



E58797

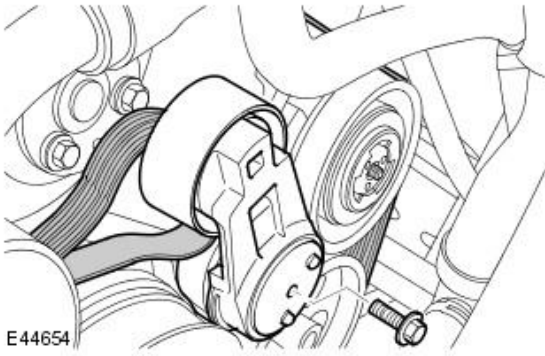
11. Release the accessory drive belt.

- Rotate the accessory drive belt tensioner counter-clockwise, using a 3/8 " drive wrench.



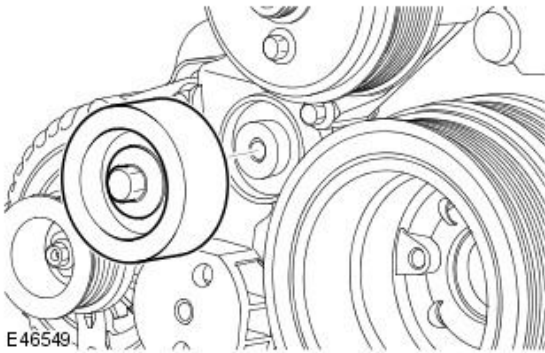
E64940





12. Remove the accessory drive belt tensioner.

- Remove the bolt.

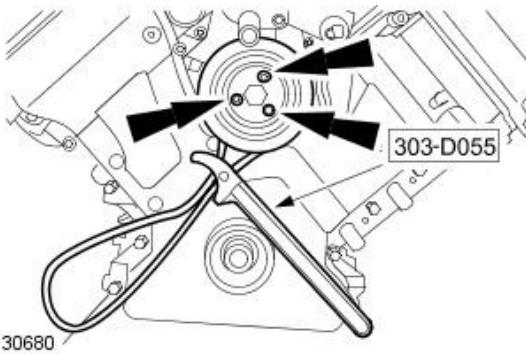


13. NOTE: Note the fitted position of the accessory drive belt.

Remove the accessory drive belt.

14. Remove the accessory drive belt idler pulley.

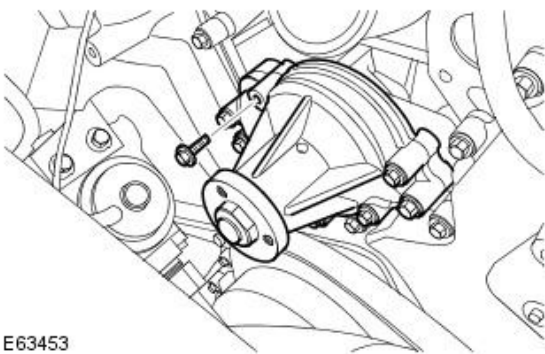
- Remove the bolt.



15. NOTE: Restrain the pulley to aid the removal of the bolts.

Using the special tool, remove the coolant pump pulley.

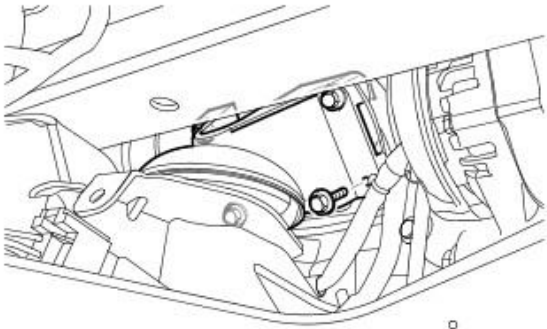
- Remove and discard the 3 bolts.



16. Remove the coolant pump.

- Remove the 5 bolts.
- Remove and discard the gasket.



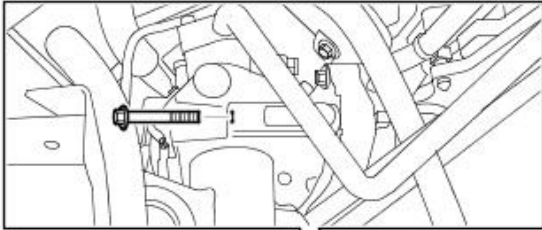


E62722

**17. NOTE:** Right-hand shown, left-hand similar.

Remove both the engine mounts and brackets.

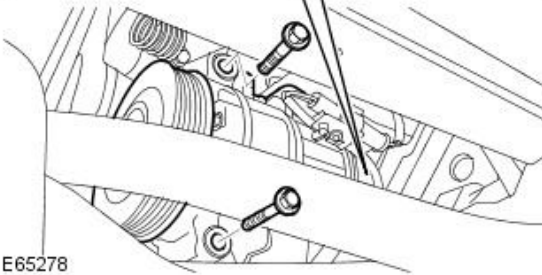
- Remove the 4 bolts.
- Repeat the above procedure for the other side.



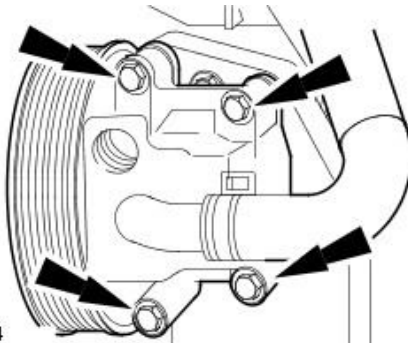
E65278

**18.** Remove the air conditioning (A/C) compressor.

- Remove the 3 bolts.
- Disconnect the electrical connector.

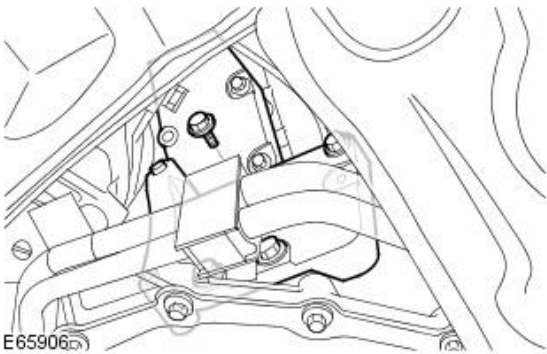


E30644



**19.** Remove the power steering pump.

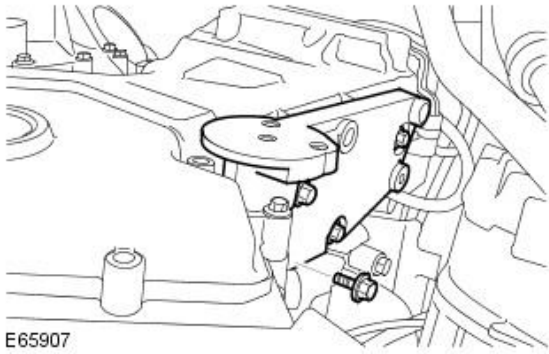
- Remove the 4 bolts.



E65906

**20.** Remove the A/C compressor mounting bracket.

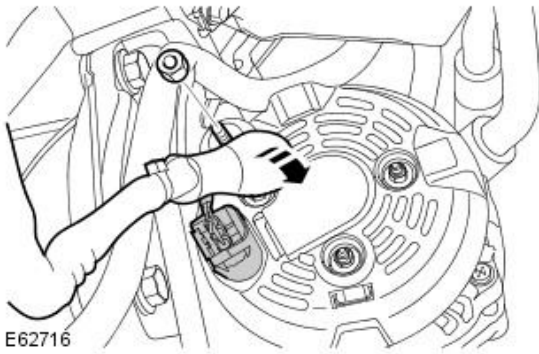
- Remove the 4 bolts.



E65907

21. Remove the power steering pump mounting bracket.

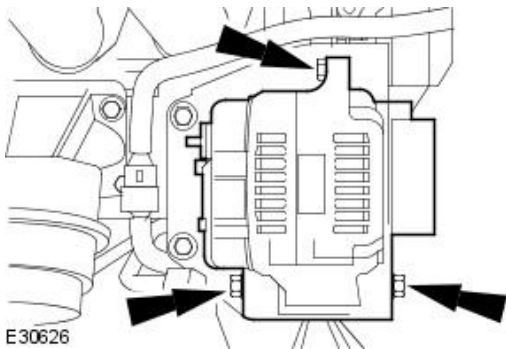
- Remove the 4 bolts.



E62716

22. Disconnect the battery positive cable and the generator electrical connector.

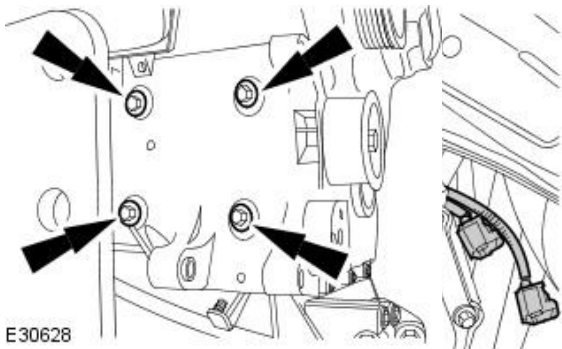
- Release the cover.
- Remove the nut.
- Disconnect the electrical connector.



E30626

23. Remove the generator.

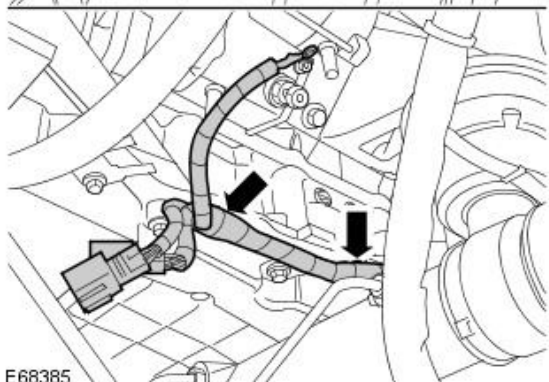
- Remove the nut.
- Remove the nut and bolt.



E30628

24. RH side: Release the engine wiring harness.  
Remove the generator mounting bracket.

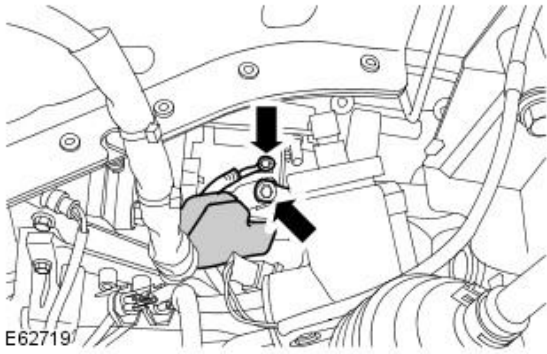
- Remove the 4 bolts.



E68385

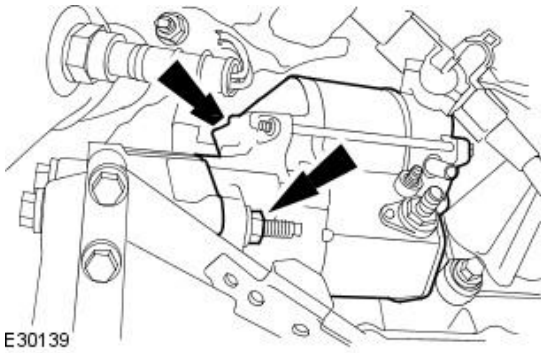
26. Disconnect the battery positive cable.

- Release the cover.
- Remove the nut.



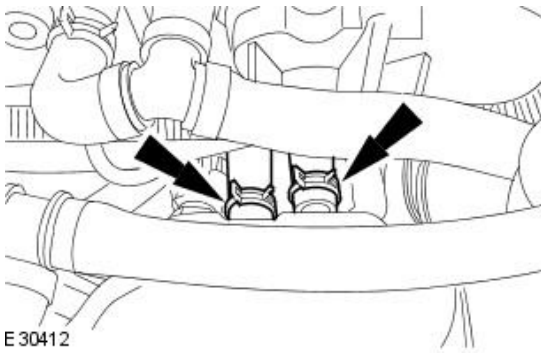
27. Disconnect the starter motor solenoid electrical connector.

- Remove and discard the nut.

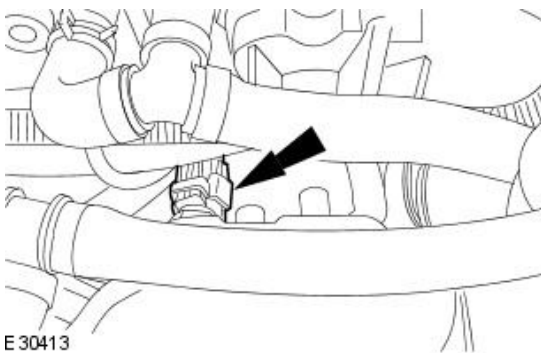


28. Remove the starter motor.

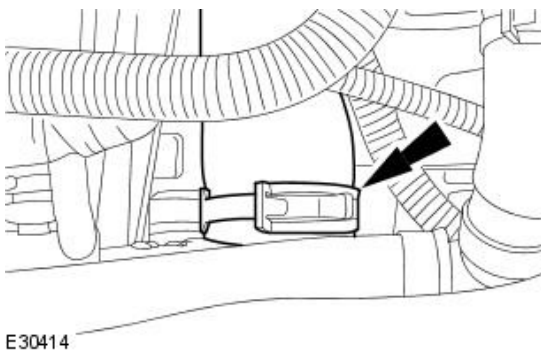
- Remove the 2 bolts.



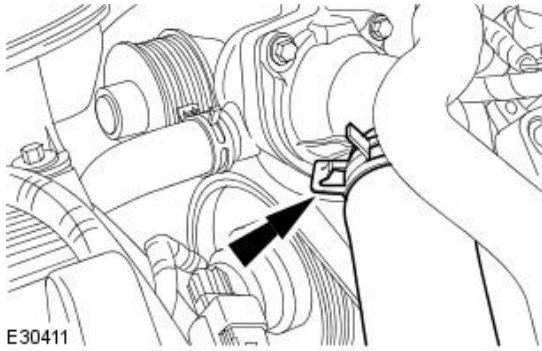
29. Disconnect the coolant hoses from the thermostat housing.



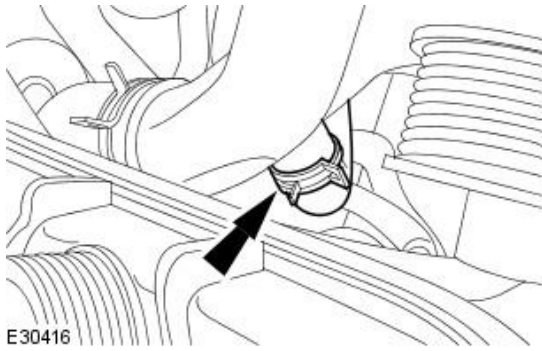
30. Disconnect the engine coolant temperature (ECT) sensor electrical connector.



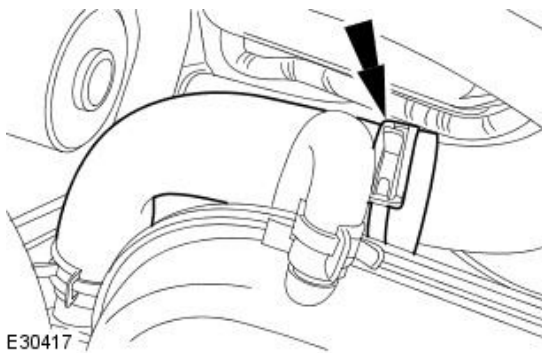
31. Reposition the thermostat housing hose retaining clip.



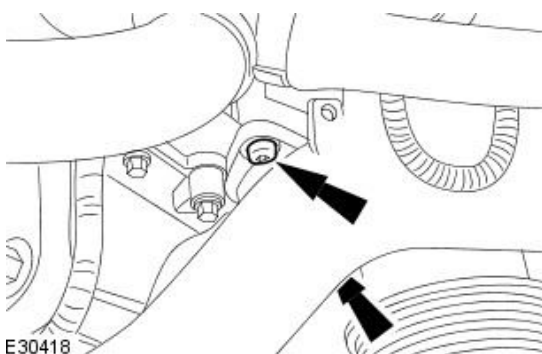
32. Disconnect the coolant hose.



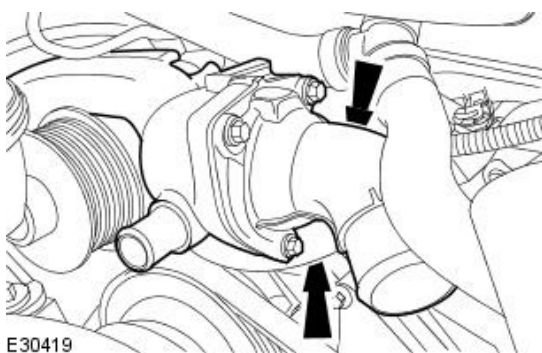
33. Disconnect the heater supply hose from the thermostat housing.



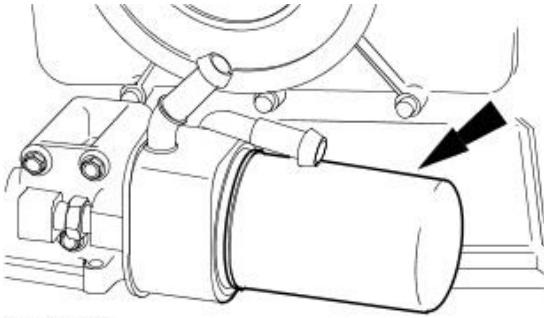
34. Disconnect the coolant hose.



35. Remove the thermostat housing retaining bolts.

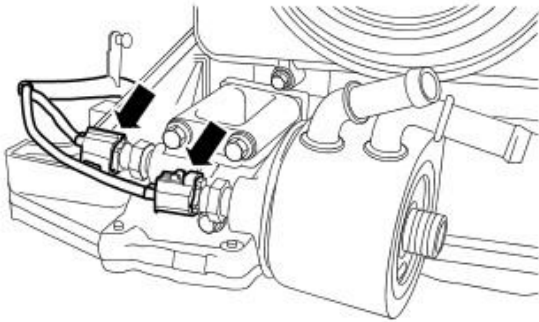


36. Remove the thermostat housing.  
● Remove and discard the O-ring seals.



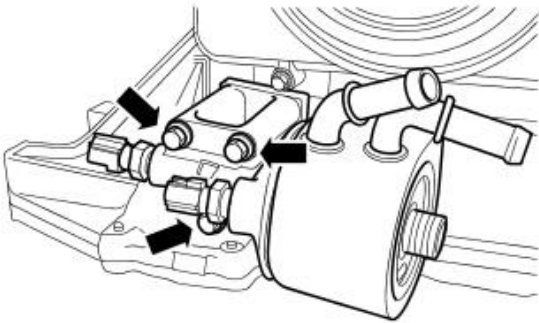
VUJ0001576

- 37. NOTE:** Some oil spillage is inevitable during this operation.
- **NOTE:** Clean the components general area prior to dismantling.
- Remove the oil filter.



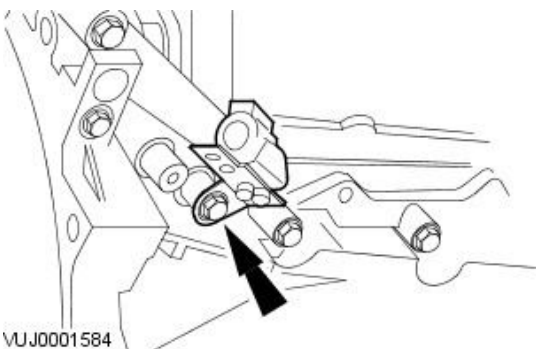
E82652

- 38.** Disconnect the engine oil pressure (EOP) sensor electrical connector.
- 39.** Disconnect the engine oil temperature sensor electrical connector.



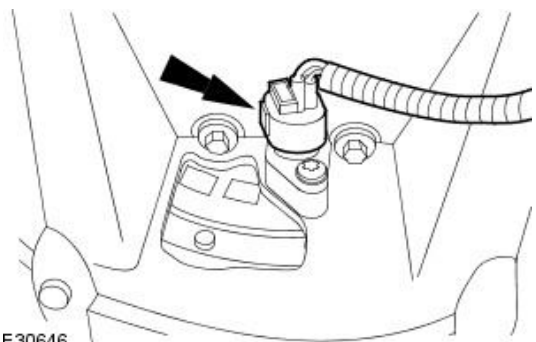
E82653

- 40.** Remove the oil filter housing.
- Remove the 3 bolts.
  - Remove and discard the O-ring seal.



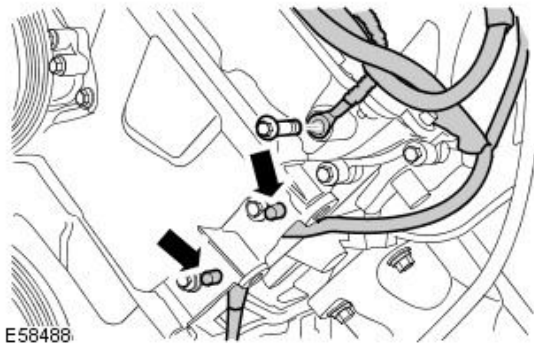
VUJ0001584

- 41. NOTE:** Right-hand shown, left-hand similar.
- Release the 2 heated oxygen sensor (HO2S) harness brackets.



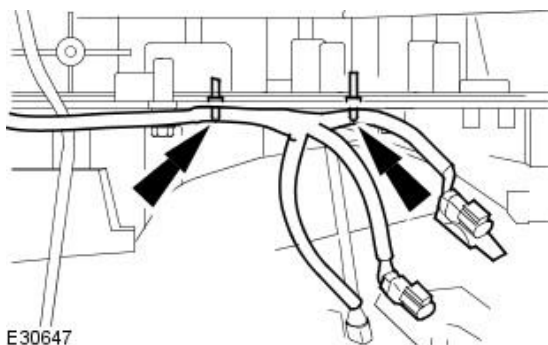
E30646

- 42.** Disconnect the crankshaft position (CKP) sensor electrical connector.



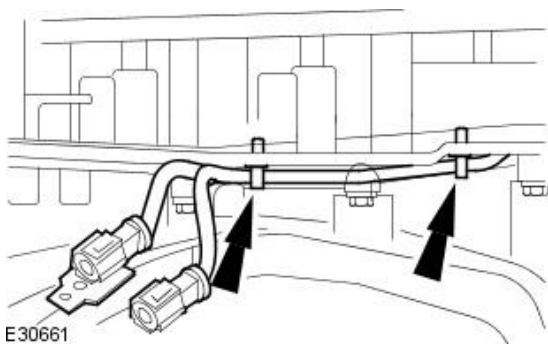
43. Release the engine wiring harness.

- Release the 2 clips.
- Remove the bolt.



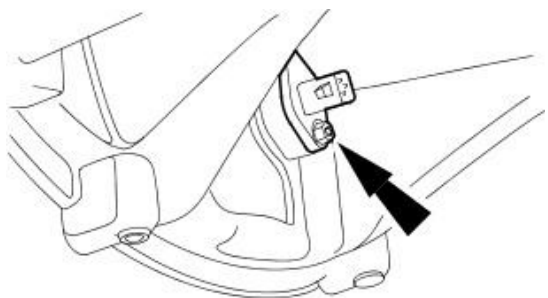
44. Release the wiring harness from the LH side of the engine.

- Release the clips.



45. Release the wiring harness from the RH side of the engine.

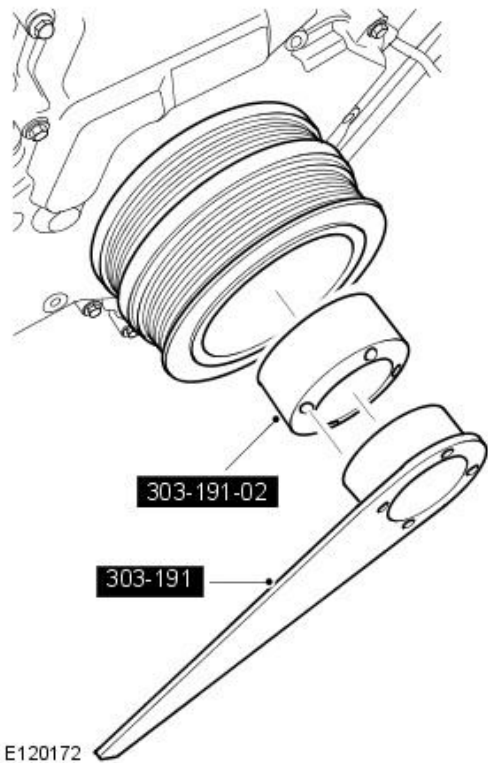
- Release the clips.




46. Remove the CKP sensor.

- Remove the bolt.





47.  CAUTION: Under no circumstances should the crankshaft setting peg, 303-645, be used in the following operations, to restrain the crankshaft.

Using the special tools, retain the crankshaft pulley.

48. NOTE: The crankshaft pulley retaining bolt will be very tight.

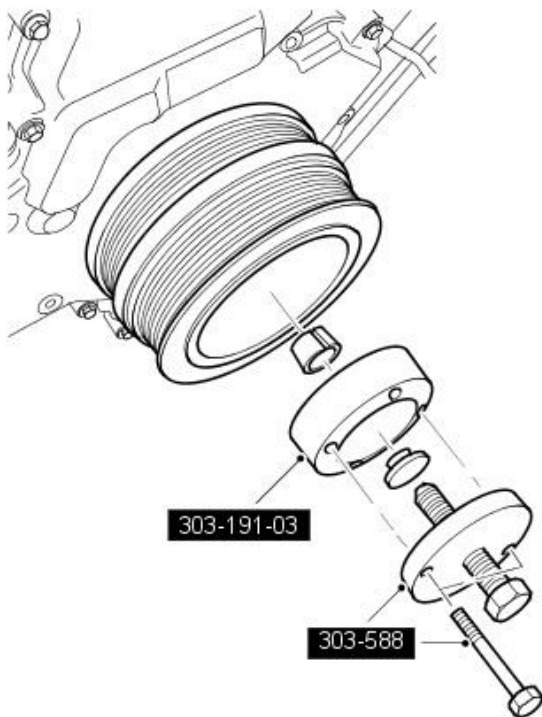
Using the special tools, remove the crankshaft pulley bolt.

- Discard the bolt.
- Remove the special tools.

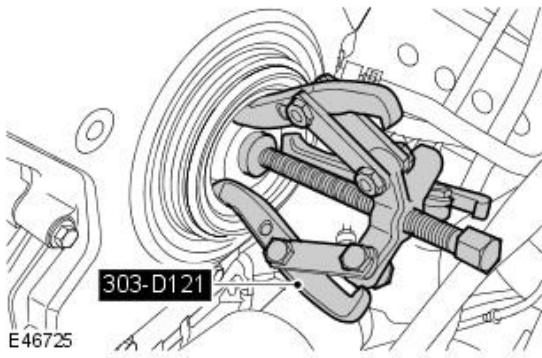
49. NOTE: The crankshaft pulley will be very tight.

Using the special tools, remove the crankshaft pulley.

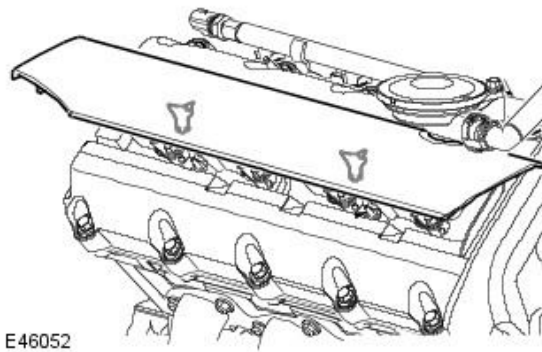
- Collect the locking ring.
- Remove the special tools.



E46724



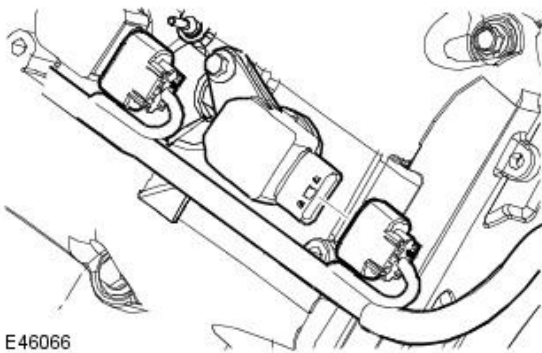
50. Using the special tool, remove and discard the crankshaft front seal.



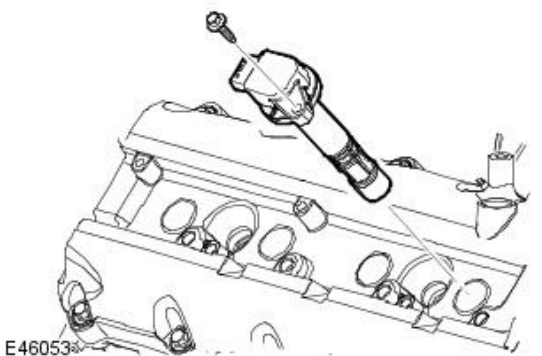
51. NOTE: Right-hand shown, left-hand similar.

Remove both the ignition coil-on-plug covers.

- Release from the 2 clips.



52. Disconnect the RH ignition coil-on-plug electrical connector.



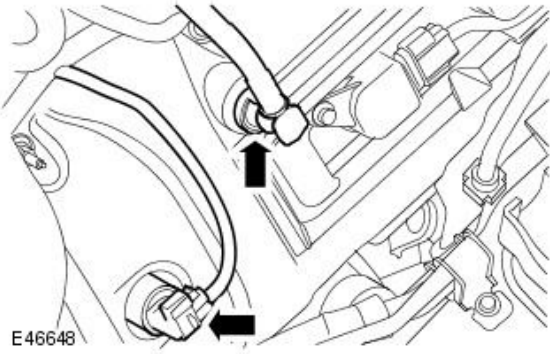
53. Remove the RH ignition coil-on-plug.

- Remove the bolt.
- Remove and discard the seal.

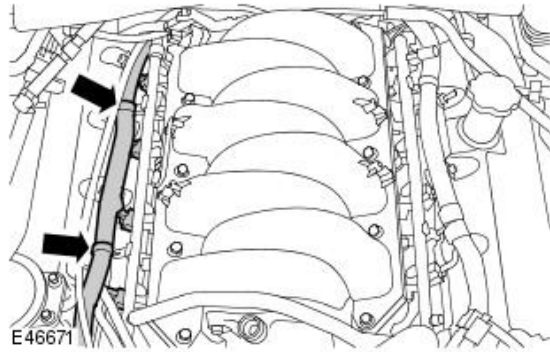
54. Remove the remaining RH ignition coil-on-plugs.

55. Disconnect the LH variable camshaft timing (VCT) oil solenoid electrical connector.

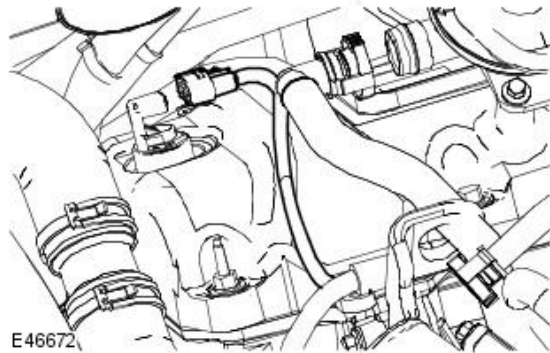
56. Disconnect the valve cover breather hose.



57. Release the engine wiring harness from the retaining bracket.



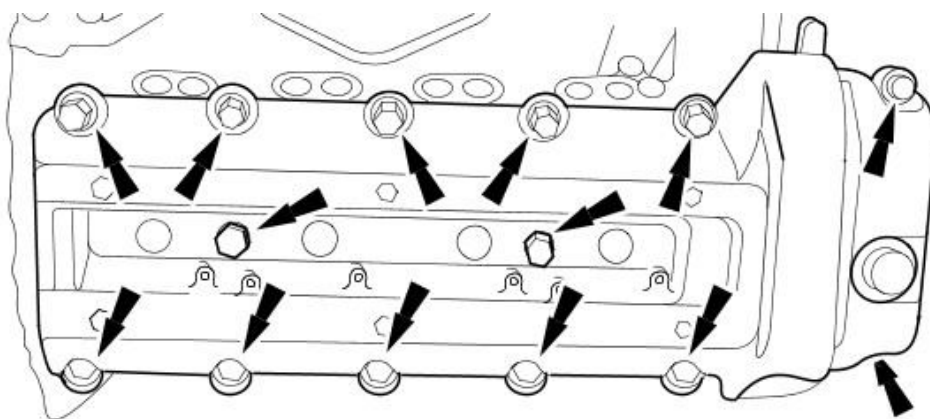
58. Disconnect the RH variable camshaft timing (VCT) oil solenoid electrical connector.



59. NOTE: Note the fitted position of the retaining bolts prior to removal.

Remove the RH valve cover.

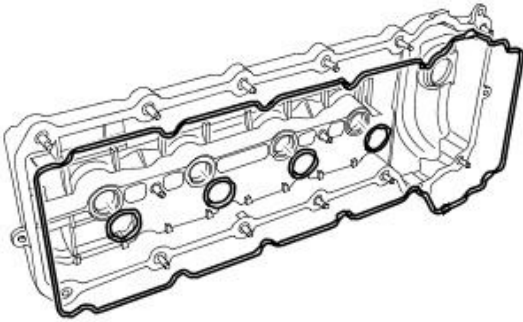
- Remove the 14 valve cover retaining bolts.
- Remove the engine cover bracket.



E30696

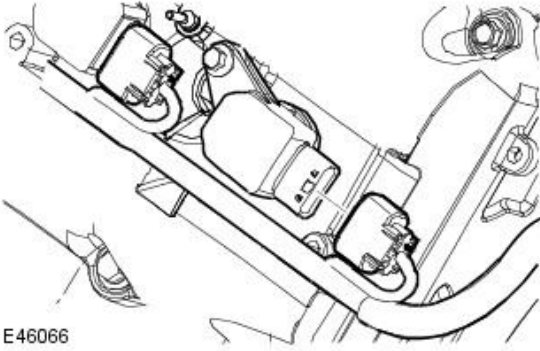
60. Remove and discard the RH valve cover gaskets.

- Remove and discard the seals.



E46677

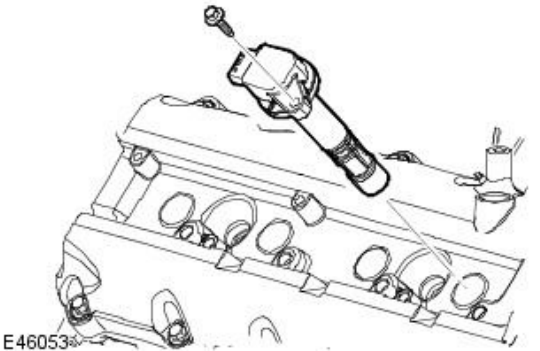
61. Disconnect the LH ignition coil-on-plug electrical connector.



E46066

62. Remove the LH ignition coil-on-plug.

- Remove the bolt.
- Remove and discard the seal.

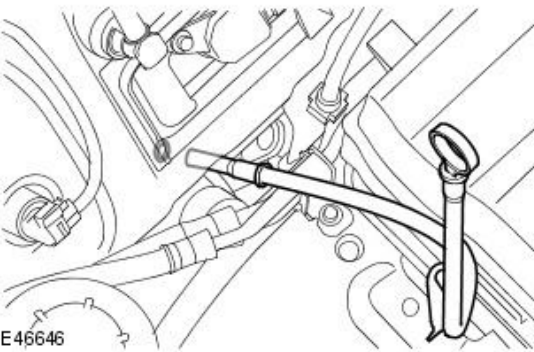


E46053

63. Remove the remaining LH ignition coil-on-plugs.

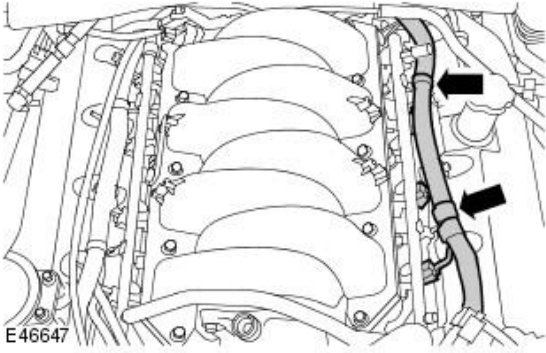
64. Remove the oil level indicator and tube.

- Remove the oil level indicator.
- Remove the nut.
- Remove the tube.
- Remove and discard the O-ring seal.



E46646

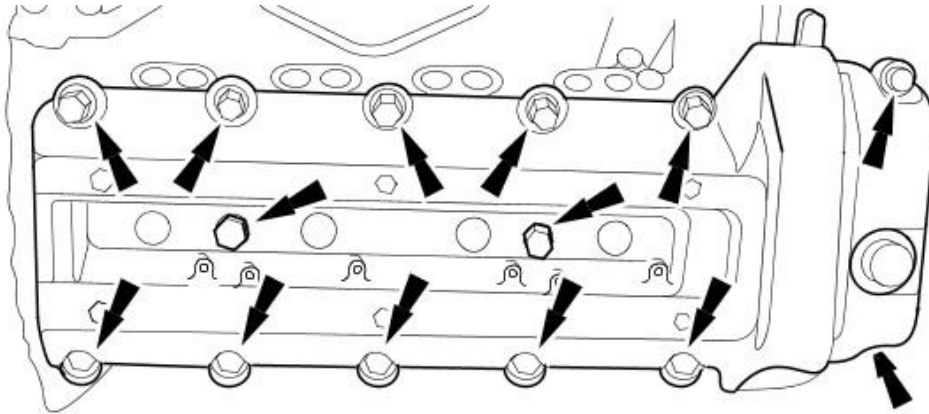
65. Release the engine wiring harness from the retaining bracket.



66. NOTE: Note the fitted position of the retaining bolts prior to removal.

Remove the LH valve cover.

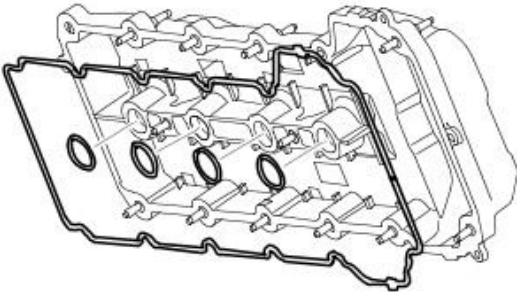
- Remove the 14 valve cover retaining bolts.



E30696

67. Remove and discard the LH valve cover gaskets.

- Remove and discard the seals.



E46652

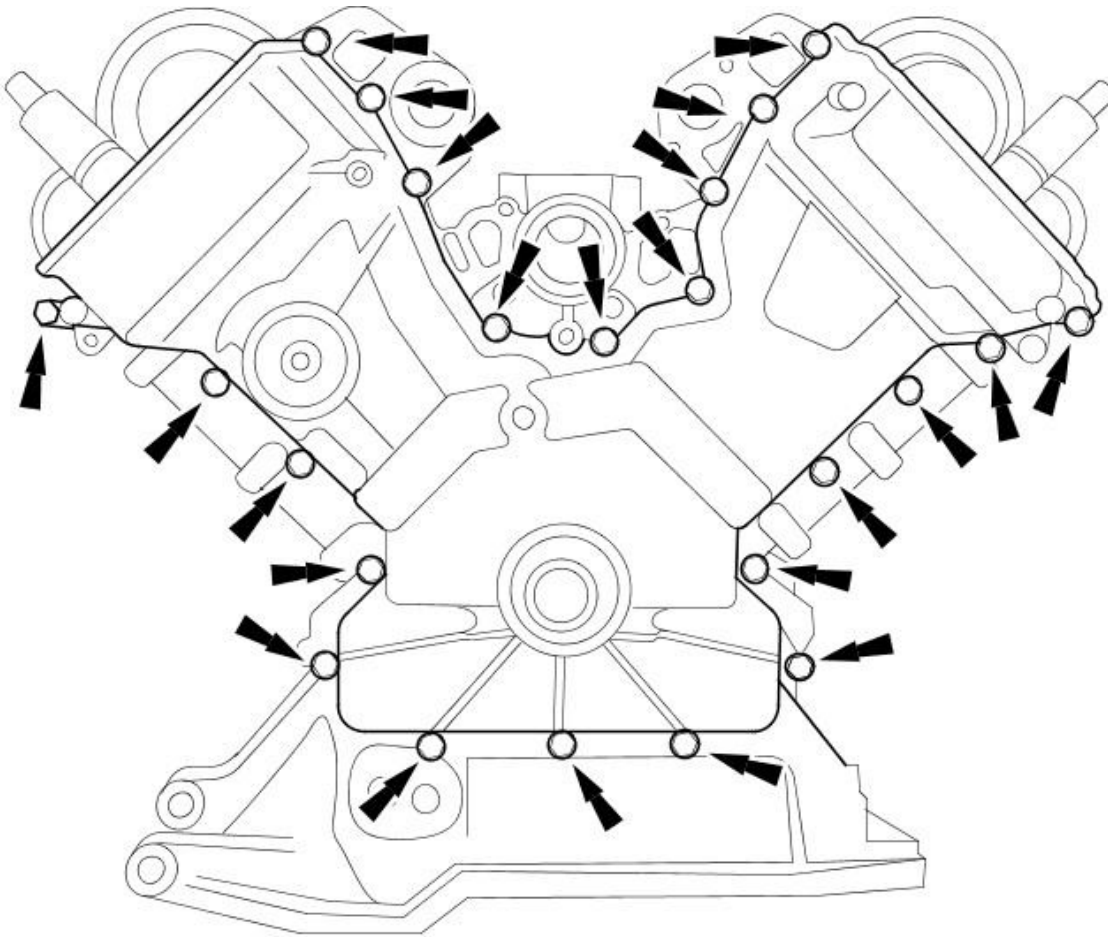
68. NOTE: Install the special tool to the crankshaft sensor aperture.

Lock the crankshaft.

- Install the special tool.
- Install the bolt.



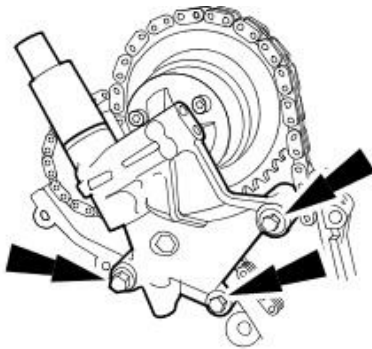




**69.** Remove the engine front cover.

- Remove the 24 bolts.
- Remove and discard the gasket.
- Remove and discard the 3 O-ring seals.

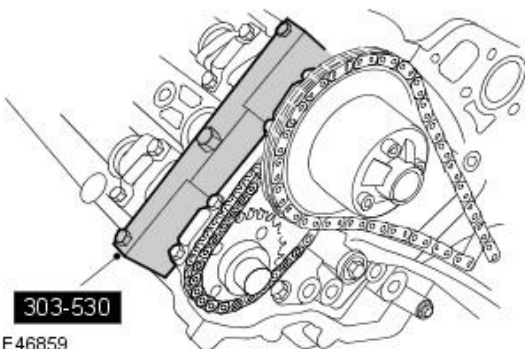
VUJ0002398



**70.** Remove the RH VCT housing.

- Remove the 3 bolts.
- Remove and discard the O-ring seals.

E30699

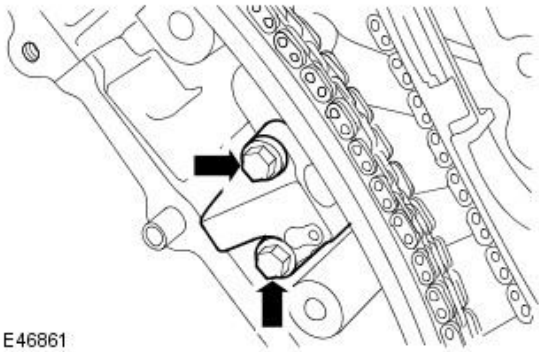


**71.** Install the special tool to the RH cylinder head.

- Install the 3 bolts.

E46859

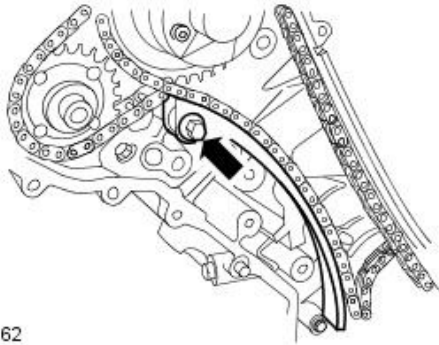




E46861

72. Remove the RH primary timing chain tensioner assembly.

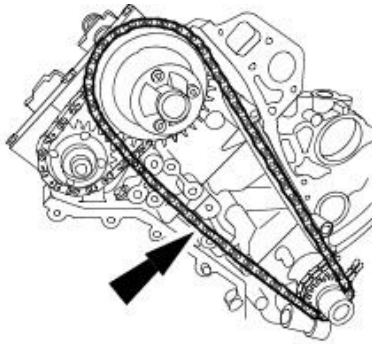
- Remove the 2 bolts.



E46862

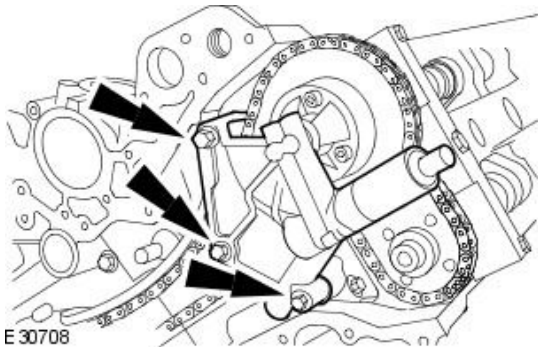
73. Remove the RH primary timing chain tensioner guide.

- Remove the bolt.



E30703

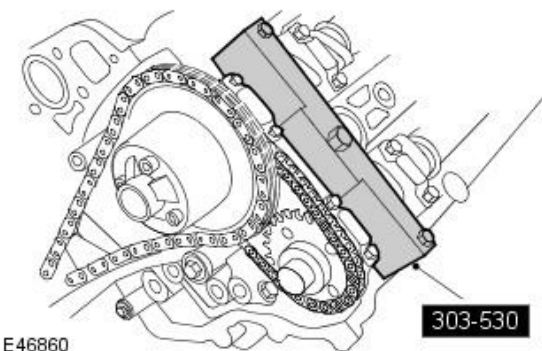
74. Remove the RH primary timing chain.



E30708

75. Remove the LH VCT housing.

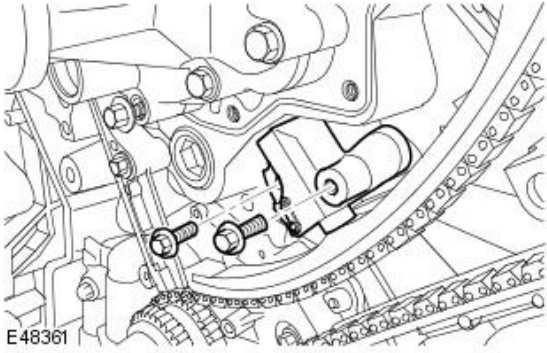
- Remove the 3 bolts.
- Remove and discard the O-ring seals.



E46860

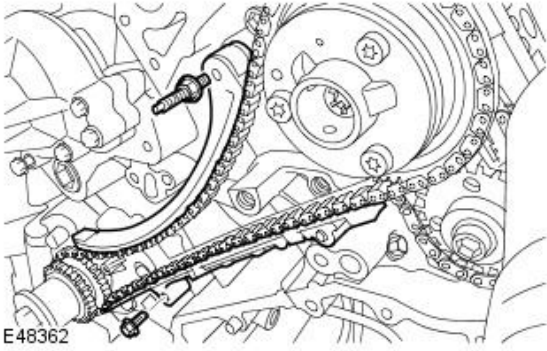
76. Install the special tool to the LH cylinder head.

- Install the 3 bolts.



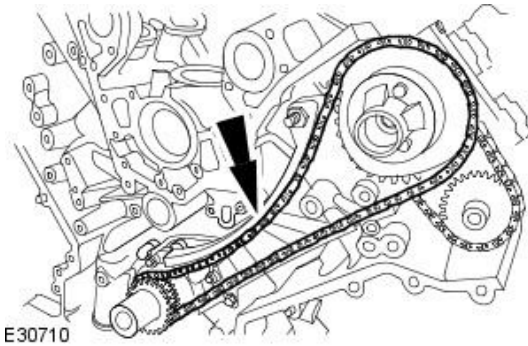
77. Remove the LH primary timing chain tensioner.

- Remove the 2 bolts.

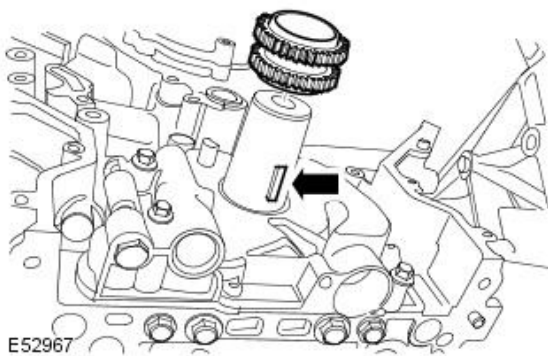


78. Remove the LH upper and lower primary timing chain tensioner guides.

- Remove the 2 bolts.



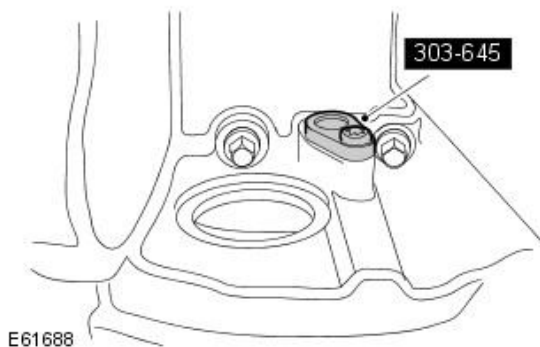
79. Remove the LH primary timing chain.



80. NOTE: Note the orientation of the crankshaft sprocket.

Remove the crankshaft sprocket.

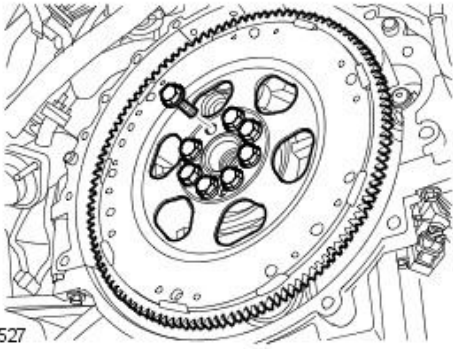
- Remove the crankshaft sprocket key.



81. Remove the special tool.

82. Remove the torque converter flexplate.

- Remove and discard the 8 bolts.

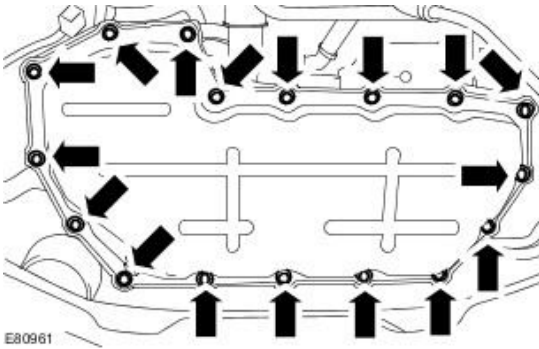


E46527

83.  CAUTION: Note the position of the bolts, prior to removal.

Remove the oil pan.

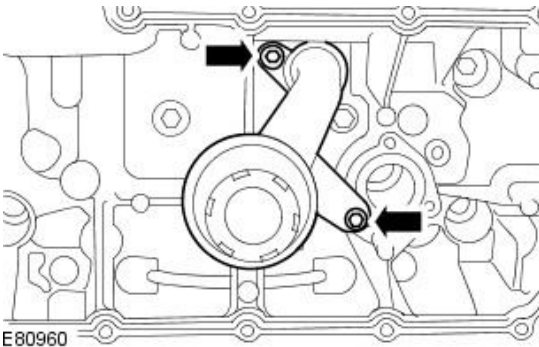
- Remove the 17 bolts.
- Remove and discard the gasket.



E80961

84. Remove the oil strainer pick-up assembly.

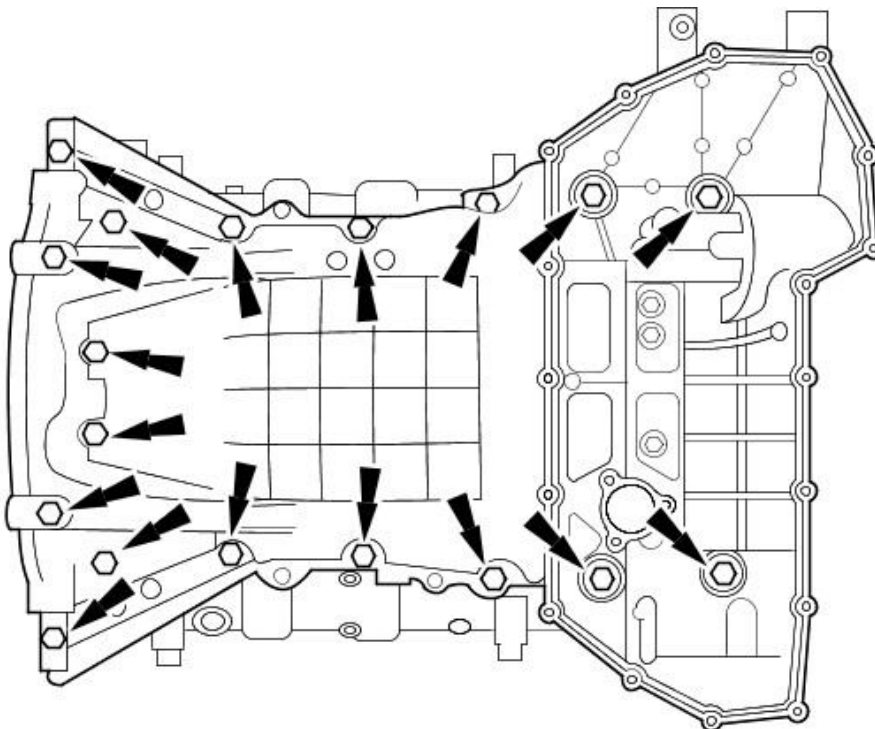
- Remove the 2 bolts.
- Remove and discard the O-ring seal.



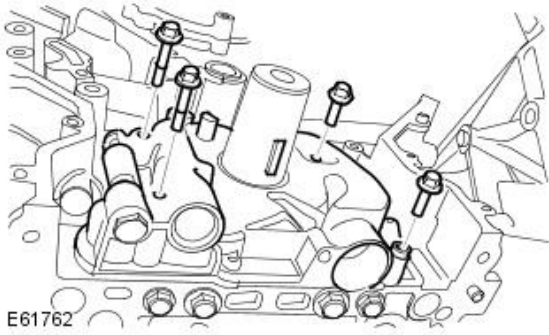
E80960

85. Remove the oil pan extension.

- Remove the 18 bolts.

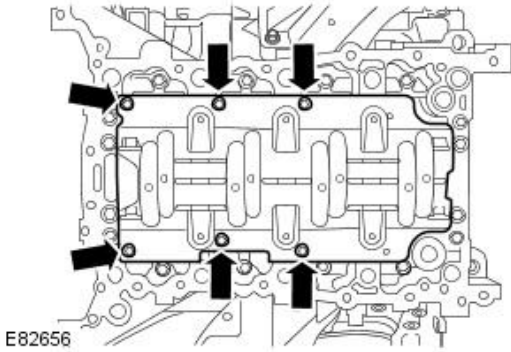


VUJ0002435



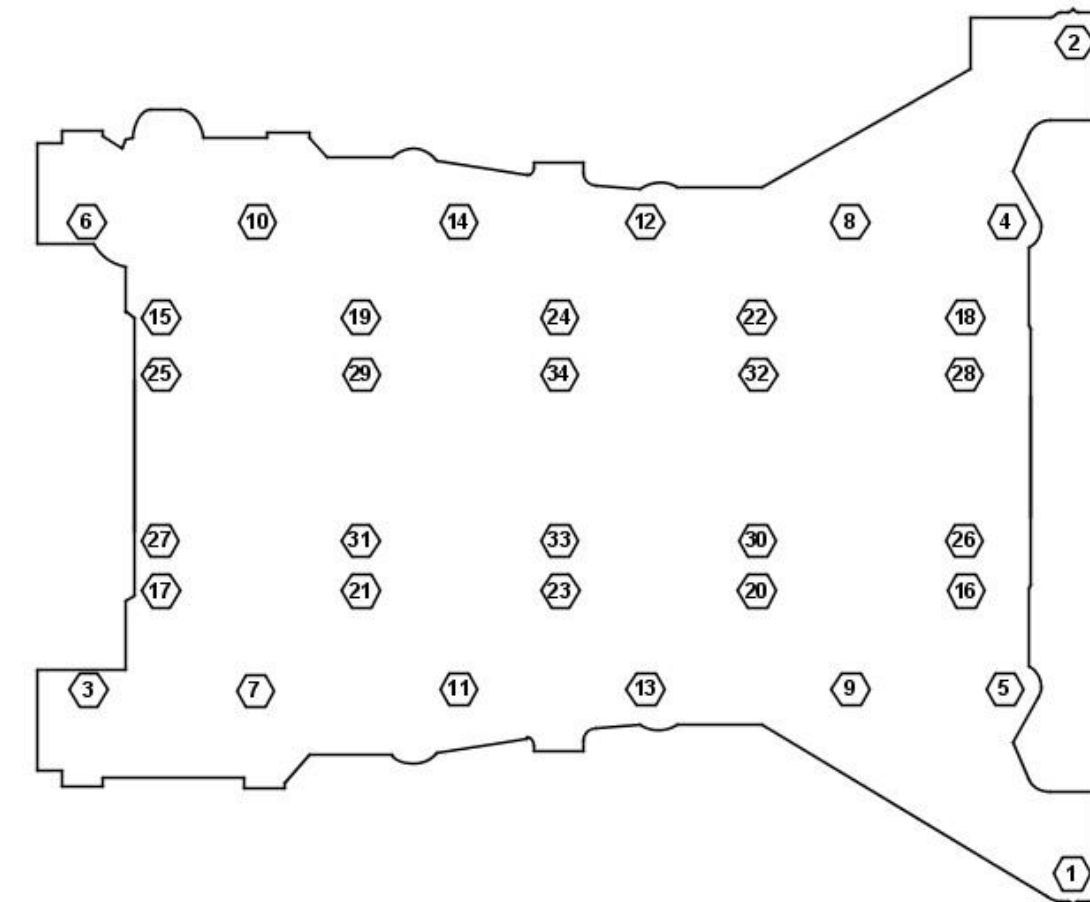
86. Remove the oil pump assembly.


- Remove the 4 bolts.
- Remove and discard the gasket.
- Clean the component mating faces.



87. Remove the baffle plate.

- Remove the 6 bolts.



**88.**  **WARNING:** To make sure damage does not occur to the crankshaft and piston components, the engine must be inverted on the engine stand. Failure to follow this instruction may result in damage to the engine.

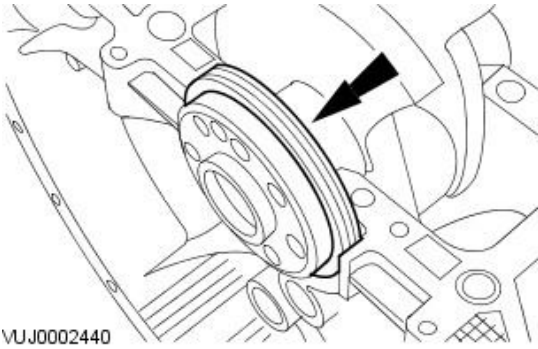
• **NOTE:** If the crankshaft main bearing carrier retaining bolts have been marked with a center punch dot, they must be discarded and new bolts installed.

Remove the crankshaft main bearing carrier.

- Remove the crankshaft main bearing carrier retaining bolts in the indicated sequence.



89. Discard the crankshaft rear main oil seal.



## Installation

### 1. CAUTIONS:



Use only a plastic scraper when removing the sealing material.



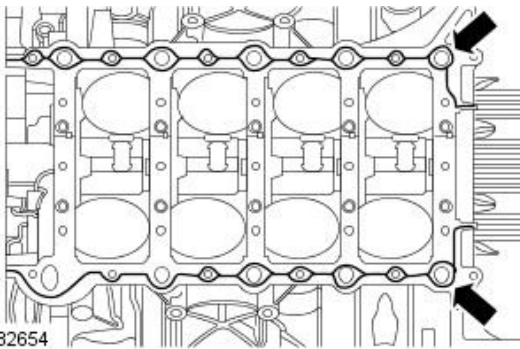
If any new bolts are to be installed to retain the crankshaft main bearing carrier, pre-stress the retaining bolts by installing the crankshaft main bearing carrier without any sealant and tightening the new retaining bolts to the specified torque. Remove the crankshaft main bearing carrier once the bolts have been pre-stressed. Failure to follow this instruction may result in damage to the vehicle.

Clean all the mating faces and reusable parts thoroughly and check for damage.

2. NOTE: Install the crankshaft main bearing carrier and tighten bolts to specification within twenty minutes of applying the sealant.

Apply a 2 mm bead of sealant to the cylinder block in the area shown.

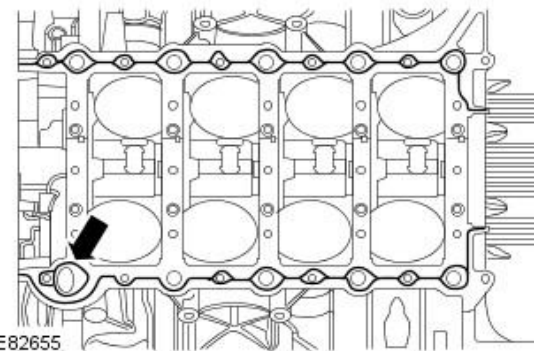
- Use WSS-M4G323-A4-RTV sealant.

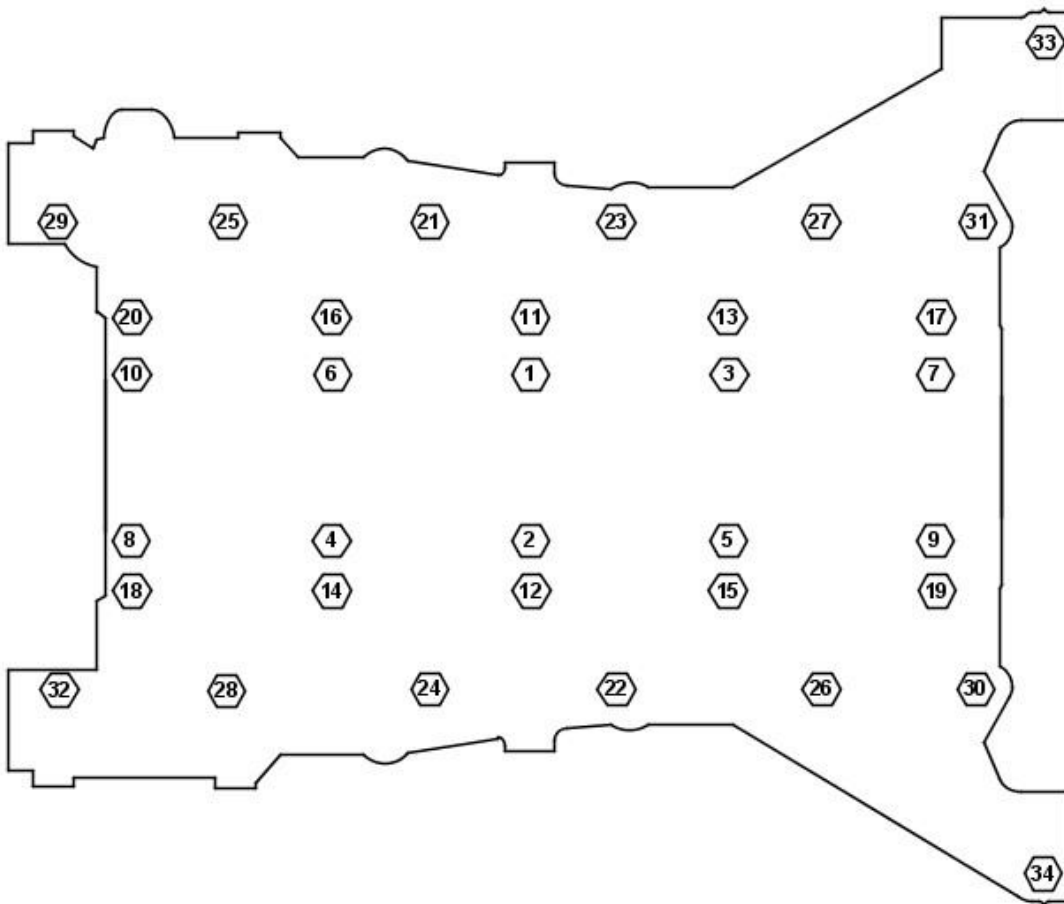



3. NOTE: Install the crankshaft main bearing carrier and tighten bolts to specification within twenty minutes of applying the sealant.

Apply a 1 mm bead of sealant to the cylinder block in the area shown.

- Use WSS-M4G323-A4-RTV sealant.





4.  CAUTION: Make sure all dowels are fully seated into the crankshaft main bearing carrier prior to tightening the bolts.

- NOTE: Do not lubricate the crankshaft main bearing carrier retaining bolts.

- NOTE: Do not rotate the crankshaft until all the retaining bolts are tightened to specification.

- NOTE: The retaining bolts must be tightened within twenty minutes of applying the sealant.

- NOTE: Tighten the retaining bolts in the sequence shown.

Install the crankshaft main bearing carrier to the cylinder block.

1. Stage 1: Bolts 21 to 32, tighten to 15 Nm.
2. Stage 2: Bolts 33 to 34, tighten to 15 Nm.
3. Stage 3: Bolts 1 to 10, tighten to 25 Nm.
4. Stage 4: Bolts 11 to 20, tighten to 15 Nm.
5. Stage 5: Bolts 1 to 10, tighten to 35 Nm, then a further 135 degrees.
6. Stage 6: Bolts 11 to 20, tighten to 20 Nm, then a further 150 degrees.
7. Stage 7: Bolts 21 to 32, tighten to 20 Nm, then a



further  
90  
degrees.

8. Stage 8:  
Bolts 33  
to 34,  
tighten  
to 20  
Nm,  
then a  
further  
150  
degrees.

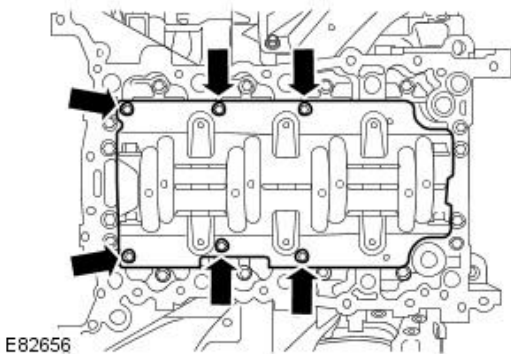
9. Stage 9:  
Center  
punch  
each of  
the bolt  
heads  
to  
indicate  
it has  
been  
reused.

5. Rotate the crankshaft to check correct operation.

6. Remove excess sealant which may squeeze out at the front cover sealing surfaces.

7. Install the baffle plate.

- Tighten the 6 bolts to 6 Nm.



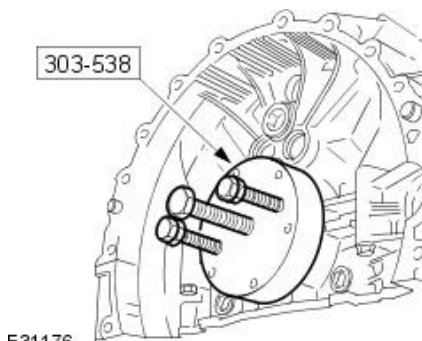
E82656

8. NOTE: Carefully remove the transit sleeve, leaving the seal in place.

• NOTE: Make sure that the transit sleeve is correctly positioned and install the new seal over the crankshaft. Do not use any lubricant on the seal, the transit sleeve or the crankshaft.

Using the special tool, position the crankshaft rear oil seal.

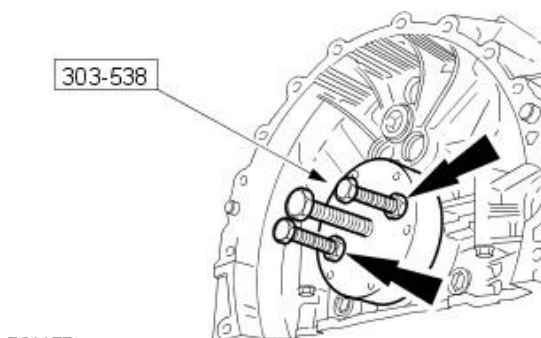
- Install the special tool to the crankshaft.



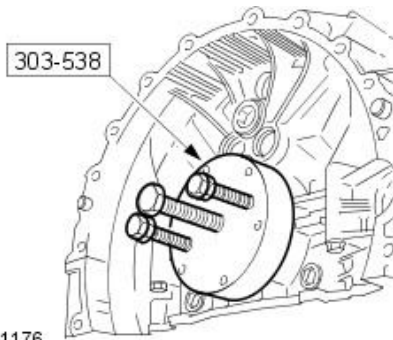
E31176

9.  CAUTION: Alternate the nut tightening to correctly seat the crankshaft rear oil seal.


Using the special tool, install the rear crankshaft oil seal.



E31177



E31176

10.  CAUTION: Make sure that the crankshaft rear oil seal is correctly located.

Remove the special tool.



E61688

11. Install the special tool.

- Install the bolt.

12. NOTE: Install a new gasket.

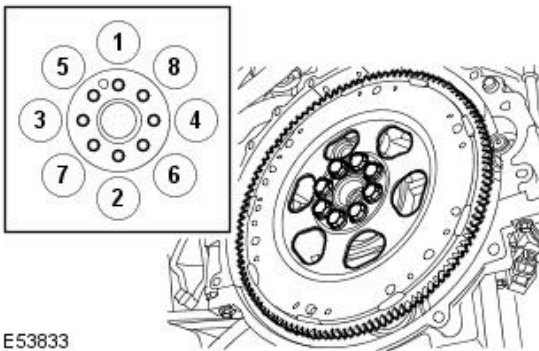
Install the oil pump assembly.

- Clean the component mating faces.
- Install the gasket.
- Tighten the bolts to 10 Nm.

13. NOTE: Prevent the flexplate from rotating.

Install the torque converter flexplate.

- Clean the component mating faces.
- Tighten the bolts evenly in 2 stages to the sequence shown.
- Tighten the bolts to 15 Nm.
- Tighten the bolts to 110 Nm.



E53833

14. NOTE: Install a new O-ring seal.

Install the oil strainer pick-up assembly.

- Install the O-ring seal.
- Tighten the bolts to 12 Nm.

15. Install the crankshaft sprocket.

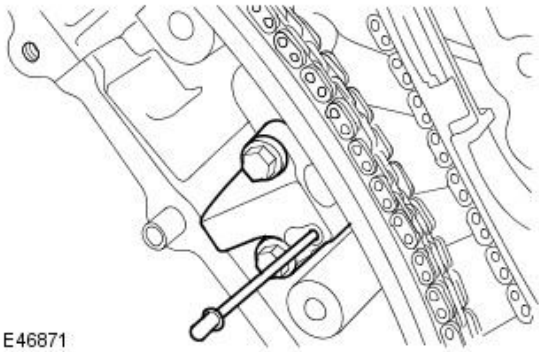
- Clean the component mating faces.
- Install the crankshaft sprocket key.

16. Install the LH primary timing chain.


- Make sure the timing chain slack is on the tensioner side of the timing chain.

17. Install the LH primary timing chain tensioner guides.

- Tighten the bolts to 12 Nm.




E46871

**18.**  **CAUTION:** During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

Install the LH primary timing chain tensioner.

- Using a 3 mm diameter rod, retain the timing chain tensioner adjuster.
- Tighten the bolts to 12 Nm.
- Remove the retaining rod.

**19.**  **CAUTION:** Make sure that new bolts are installed.

• **NOTE:** Install new O-ring seals.

Install the LH VCT control solenoid housing.


- Install the O-ring seals.
- Tighten the bolts to 22 Nm.
- Tighten the nut to 10 Nm.

**20.** Install the RH primary timing chain.

- Make sure the timing chain slack is on the tensioner side of the timing chain.

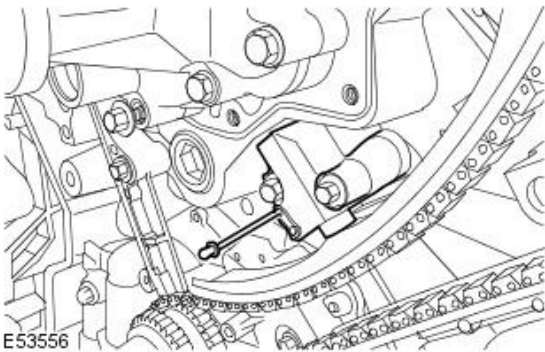
**21.** Install the RH primary timing chain tensioner guide.

- Tighten the bolts to 12 Nm.

**22.**  **CAUTION:** During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

Install the RH primary timing chain tensioner.

- Using a 3 mm diameter rod, retain the timing chain tensioner adjuster.
- Tighten the bolts to 12 Nm.
- Remove the retaining rod.



E53556

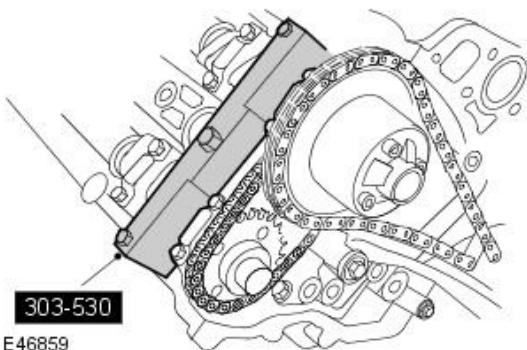
**23.** **NOTE:** Install new O-ring seals.

• **NOTE:** Make sure that new bolts are installed.

Install the RH VCT control solenoid housing.

- Install the O-ring seals.
- Tighten the bolts to 22 Nm.
- Tighten the nut to 10 Nm.

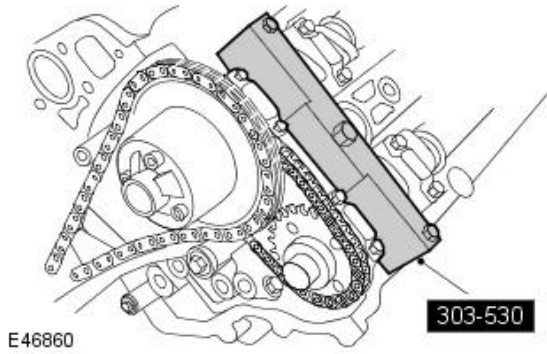
**24.** Remove the special tool from the RH cylinder head.



E46859

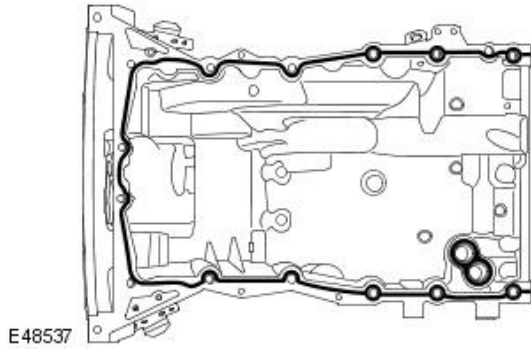
303-530

25. Remove the special tool from the LH cylinder head.

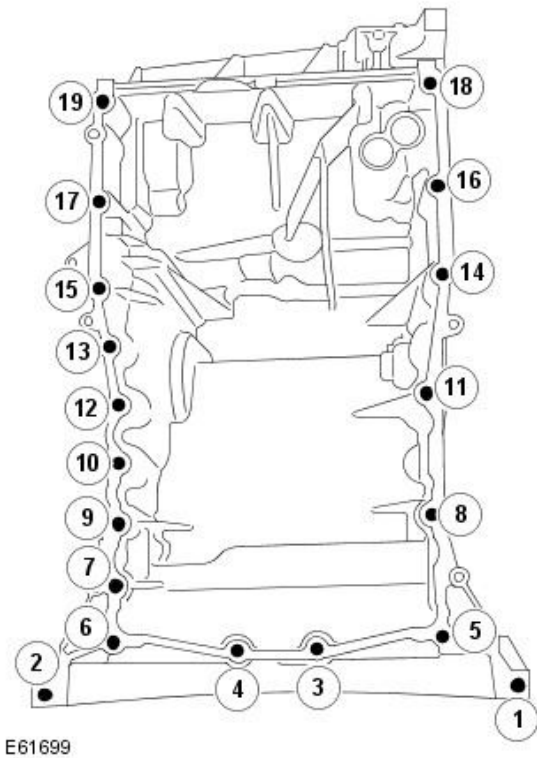


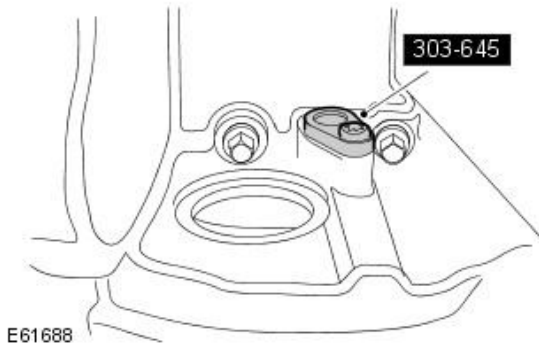
26. Install the oil pan extension.

- Clean the component mating faces.
- Apply a 3 mm diameter bead of sealant, to the area shown.
- Install the bolts, but do not tighten fully at this stage.



27. Tighten the oil pan bolts in the sequence shown to 20 Nm.





28. Remove the special tool.

- Remove the bolt.

29. Install the CKP sensor.

- Tighten the bolt to 8 Nm.

30. Attach the wiring harness to the LH side of the engine.

- Secure the clips.

31. Attach the wiring harness to the RH side of the engine.

- Secure the clips.

32. Install the power steering pump mounting bracket.

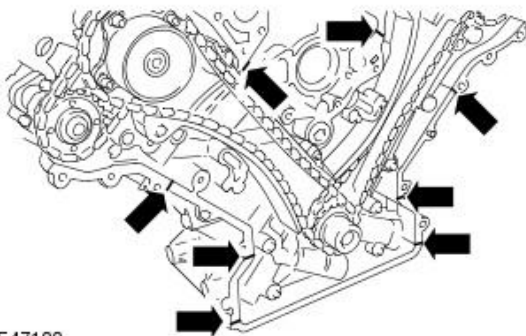
- Tighten the bolts to 25 Nm.

33. NOTE: Install a new gasket.

- NOTE: Install a new O-ring seal.

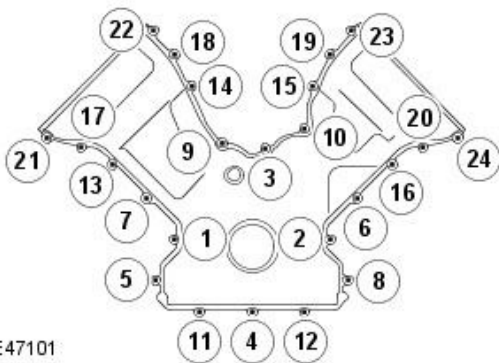
Install the engine front cover.

- Clean the component mating faces.
- Apply a 3 mm diameter bead of sealant 12mm long, to the 8 places shown.
- Install the gasket.
- Install the O-ring seal.



E47100

34. Tighten the bolts in the sequence shown to 12 Nm.



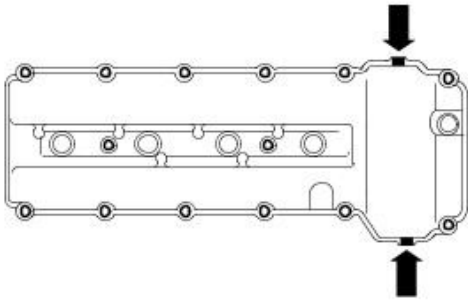
E47101

35. Attach the engine wiring harness.

- Secure the clips.
- Tighten the bolt to 10 Nm.

36. NOTE: Install new seals.

Install the LH valve cover plug aperture seals.



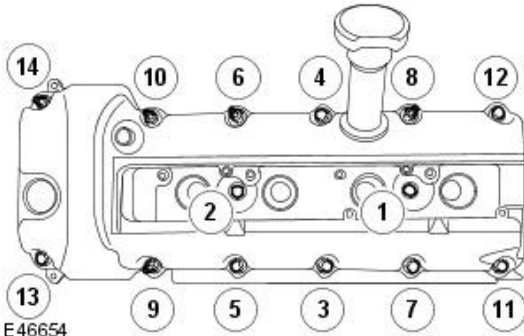
E49922

**37. NOTE:** Install a new gasket.

• NOTE: Apply two beads of silicone gasket sealant as shown on the illustration. The application of the sealant must be 3 mm (0.118 in) diameter 12 mm (0.47 in) long. Install the valve cover immediately after applying the sealant. The cover should be fitted directly to the head without smearing the sealant or the seals.

Install the LH valve cover.

- Clean the component mating faces.
- Install the valve cover gasket.



E46654

**38.** Install the LH valve cover bolts.

- Install the LH valve cover bolts to the positions previously noted.
- Tighten the bolts in the sequence shown to 12 Nm.

**39.** Connect the LH VCT oil solenoid electrical connector.

**40.** Attach the engine wiring harness to the retaining bracket.

**41. NOTE:** Install a new O-ring seal.

With assistance, install the oil level indicator and tube.

- Clean the component mating faces.
- Install the O-ring seal.
- Lubricate the O-ring seal with clean engine oil.
- Tighten the nut to 6 Nm.

**42. NOTE:** Install new O-ring seals.

Install the 4 LH ignition coil-on-plugs.

- Install the O-ring seals.
- Install the 4 ignition coil-on-plugs.
- Tighten the 6 bolts to 6 Nm.

**43.** Connect the 4 electrical connectors.

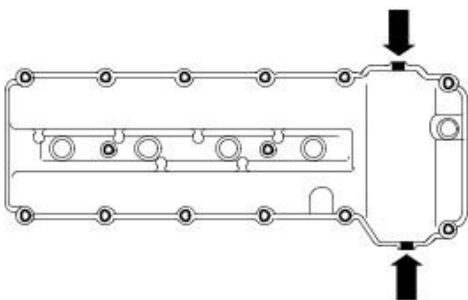
**44.** Install the LH ignition coil-on-plug cover.

**45. NOTE:** Install new seals.

Install new RH valve cover plug aperture seals.

**46. NOTE:** Install a new gasket.

• NOTE: Apply two beads of silicone gasket sealant as shown on the illustration. The application of the sealant must be 3 mm (0.118 in) diameter 12 mm (0.47 in) long. Install the valve cover immediately after applying the sealant. The cover should be fitted directly to the head without smearing the sealant or the seals.

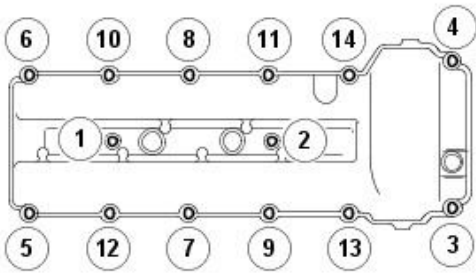


E49922

Install the RH valve cover.

- Clean the component mating faces.
- Install the gasket.





E46679

47. Install the RH valve cover bolts.

- Install the RH valve cover bolts to the positions previously noted.
- Tighten the bolts in the sequence shown to 12 Nm.

48. **NOTE:** Install new O-ring seals.

Install the 4 RH ignition coil-on-plugs.

- Install the O-ring seals.
- Install the 4 ignition coil-on-plugs.
- Tighten the bolts to 6 Nm.

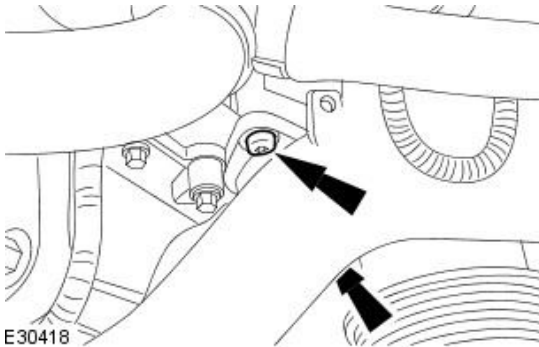
49. Connect the 4 electrical connectors.

50. **NOTE:** Install new O-ring seals.

Install the coolant manifold.

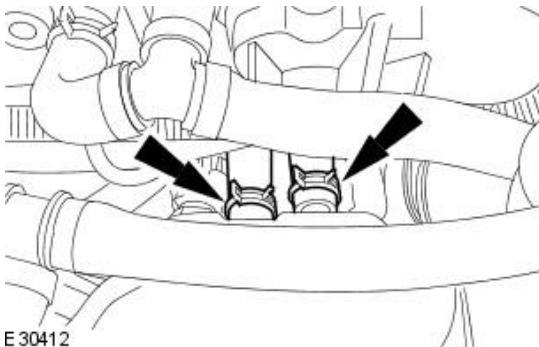
- Clean the components.
- Install the O-ring seals.
- Connect the 4 coolant hoses and install the clips.
- Attach the wiring harness bracket.
- Tighten the bolts to 10 Nm.

51. Install the thermostat housing.

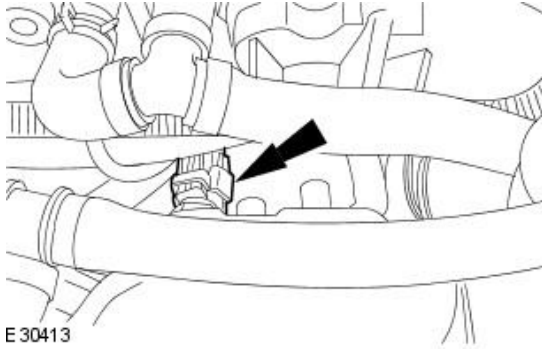


E30418

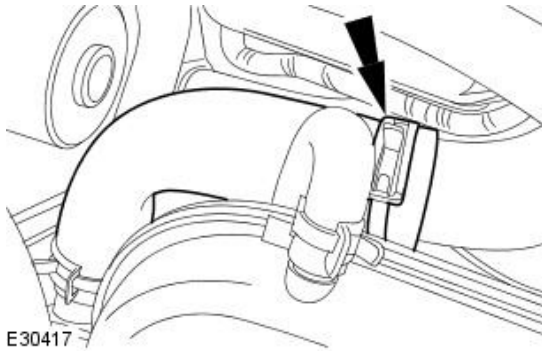
52. Connect the coolant hoses to the thermostat housing.



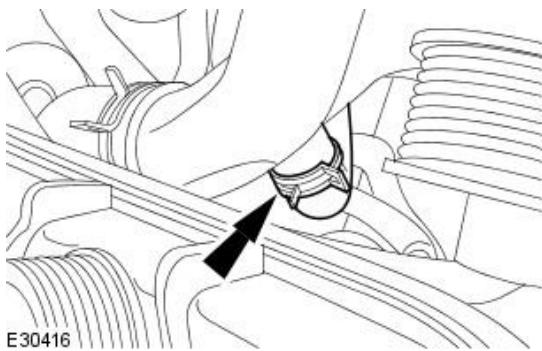
E30412



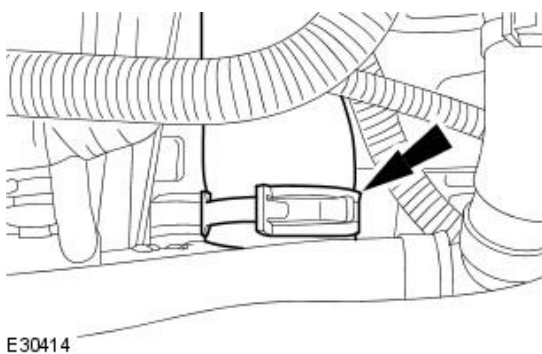
53. Connect and secure the ECT sensor electrical connector.



54. Connect the coolant hose.



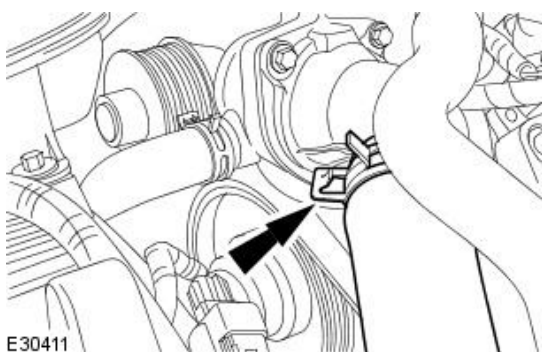
55. Connect the heater supply hose to the thermostat housing.



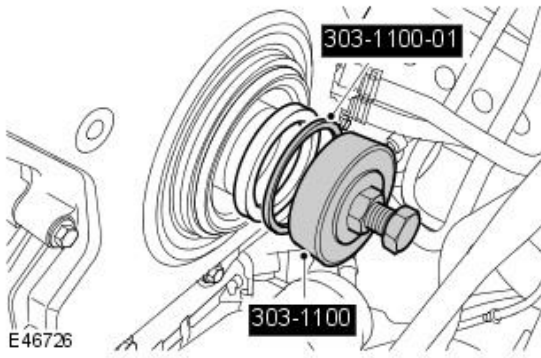
56. Connect the RH VCT oil solenoid electrical connector.

57. Attach the engine wiring harness to the retaining bracket.

58. Reposition the thermostat housing hose retaining clip.



59. Connect the coolant hoses.




60. Clean the crankshaft pulley mating faces.
61. Using the special tool, install the crankshaft front seal.
- Lubricate the seal with clean engine oil.
  - Use the discarded crankshaft bolt with the special tool.
  - Remove the special tools.

62. Install the crankshaft pulley.
- Lubricate the seal with clean engine oil.

63. Install the crankshaft pulley locking ring.

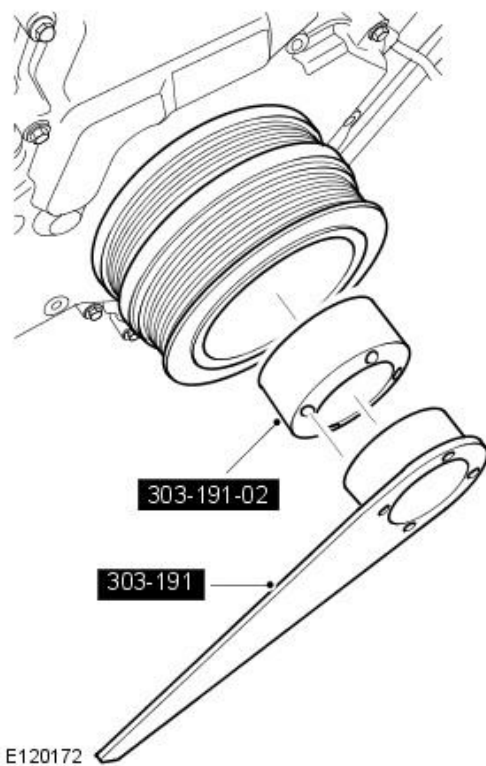
64.  CAUTION: The screw thread in the crankshaft pulley must be cleaned out before installing a new crankshaft pulley bolt.

Install, but do not tighten, the new crankshaft pulley bolt.

65.  CAUTION: Under no circumstances should the crankshaft setting peg, 303-645, be used in the following operations, to restrain the crankshaft.

Using the special tools, tighten the crankshaft pulley bolt.

- Remove the special tools.
- Tighten the crankshaft pulley bolt to 380 Nm.



66. NOTE: Install a new O-ring seal.

Install the oil filter housing.

- Clean the component mating faces.
- Install a new O-ring seal.
- Tighten the bolts to 20 Nm.

67. NOTE: Install a new engine oil filter.

Install the engine oil filter.

- Lubricate the oil filter seal with clean engine oil and tighten to 18 Nm .

68. Connect the EOP sensor electrical connector.

69. Connect the engine oil temperature sensor electrical connector.

70. Install the starter motor.

- Clean the component mating faces.

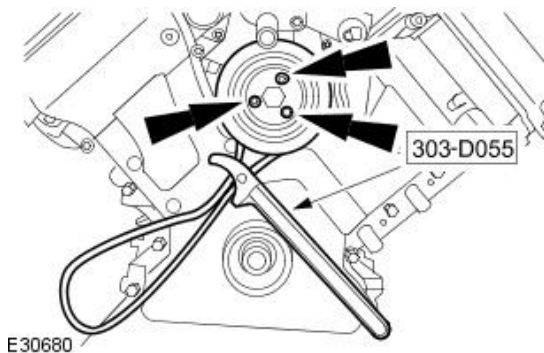
- Tighten the bolts to 45 Nm.
71. Connect the starter motor solenoid electrical connector.
- Tighten the new nut to 7 Nm.
72. Connect the battery positive cable to the starter motor.
- Tighten the nut to 10 Nm.
  - Secure the cover.
73. Install the generator mounting bracket.
- Tighten the bolts to 25 Nm.
74. RH side: Attach the wiring harness.
- Secure the clips.
75. Install the generator.
- Tighten the nut to 25 Nm.
  - Tighten the nut and bolt to 40 Nm.
76. Connect the battery positive cable and generator electrical connector.
- Secure the cover.
  - Tighten the nut to 12 Nm.
77. Install the exhaust manifold heat shield.
- Tighten the 2 bolts.
78. Install the power steering pump mounting bracket.
- Tighten the bolts to 25 Nm.
79. Install the A/C compressor mounting bracket.
- Tighten the bolts to 25 Nm.
80. Install the power steering pump.
- Tighten the bolts to 25 Nm.
81. Install the A/C compressor.
- Tighten the bolts to 25 Nm.
  - Connect the electrical connector.
82. Install both engine mounts and brackets.
- Clean the component mating faces.
  - Tighten the bolts to 45 Nm.
  - Repeat the above procedure for the other side.
83. **NOTE:** Make sure that new bolts are installed.

Using the special tool, install the coolant pump pulley.

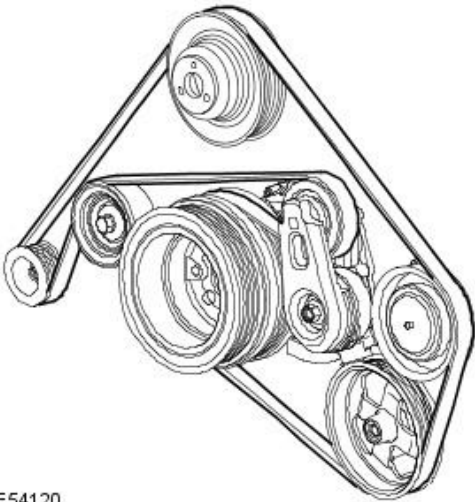
- Tighten the 5 bolts to 10 Nm.
- Tighten the bolts to 25 Nm.

84. Install the accessory drive belt idler pulley.

- Tighten the bolts to 25 Nm.



85. Install the accessory drive belt.

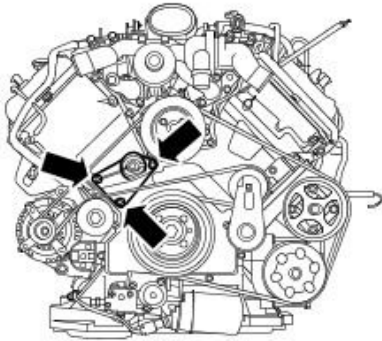


E54120

86. Install the accessory drive belt tensioner.

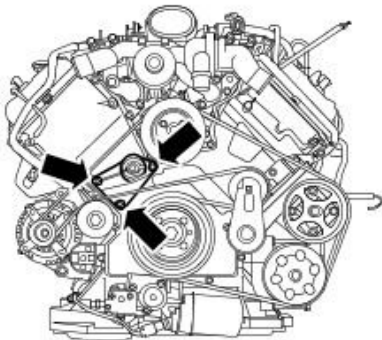
- Clean and inspect the drive pulleys for damage.
- Tighten the accessory drive belt tensioner bolt to 40 Nm.

87. Install the mounting bracket.



E82649

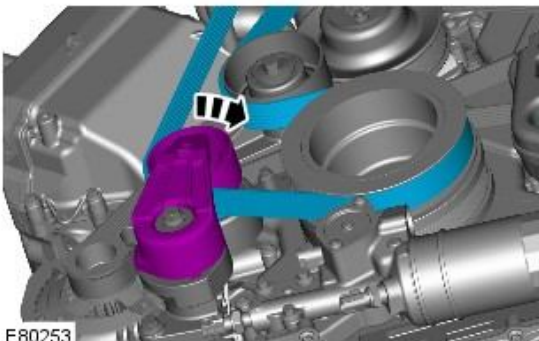
88. Install the supercharger belt idler pulley.



E82649

89. Install the supercharger belt.

- Rotate the drive belt tensioner clockwise. Use a 1/2 inch square drive bar to rotate the drive belt tensioner.



E80253

90. Connect the oil cooler hoses.

91. Remove the engine from the engine stand.

92. Install the engine.



For additional information, refer to: [Engine](#) (303-01B Engine - 4.2L SC V8 - AJV8, Installation).

93. Connect the battery ground cable.


For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

## Engine - 4.2L SC V8 - AJV8 - Engine

Removal

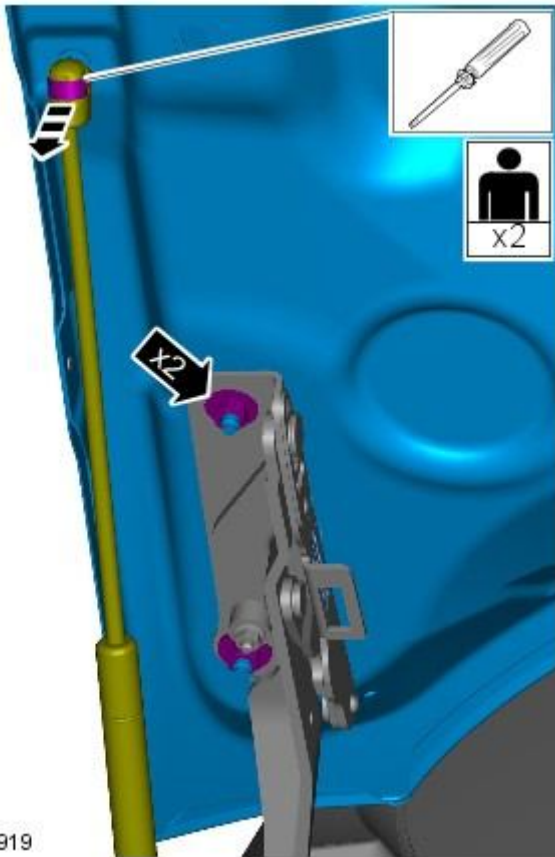
Special Tool(s)	
 303-536	Engine lifting brackets 303-536
 303-749	Engine lifting brackets 303-749

### Removal

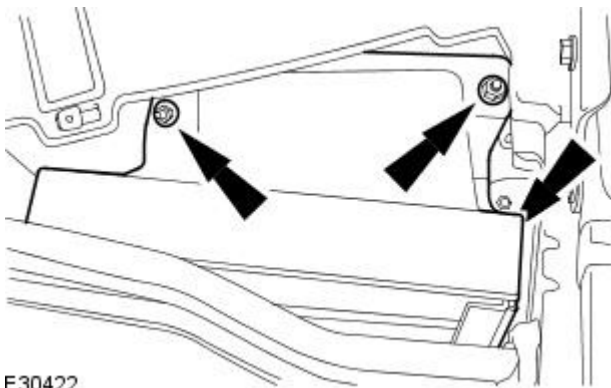
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Evacuate the A/C system.  
For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
4. Remove the transmission.  
For additional information, refer to: [Transmission - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal).
5. Install the torque converter retainer.
6. Remove the cooling module.  
For additional information, refer to: [Cooling Module - 4.2L SC V8 - AJV8](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).



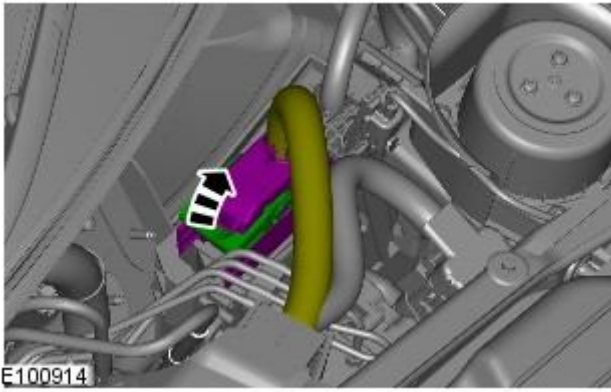
7. Remove the hood.



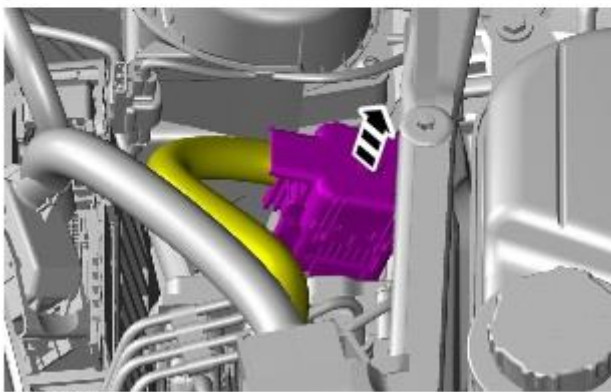
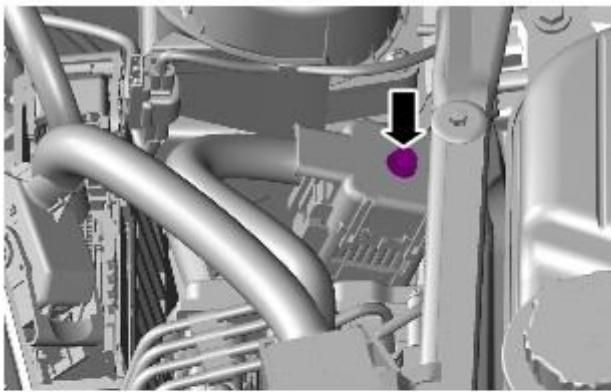
8. Remove the secondary bulkhead LH panel.  
For additional information, refer to: [Secondary Bulkhead Panel LH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).
9. Remove the pedestrian protection hood actuator.  
For additional information, refer to: [Pedestrian Protection Hood Actuator LH](#) (501-20C Pedestrian Protection System, Removal and Installation).
10. Remove the engine control module (ECM) cover.



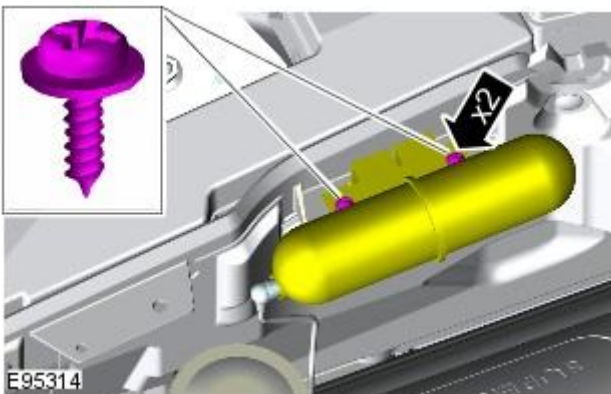
11. Release the ECM wiring harnesses and position aside.



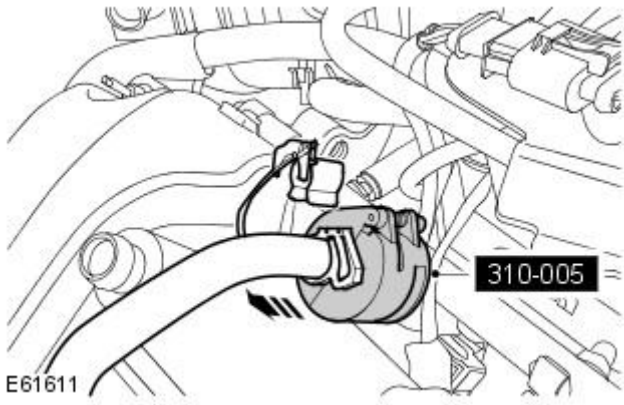
12. Disconnect the engine wiring harness.



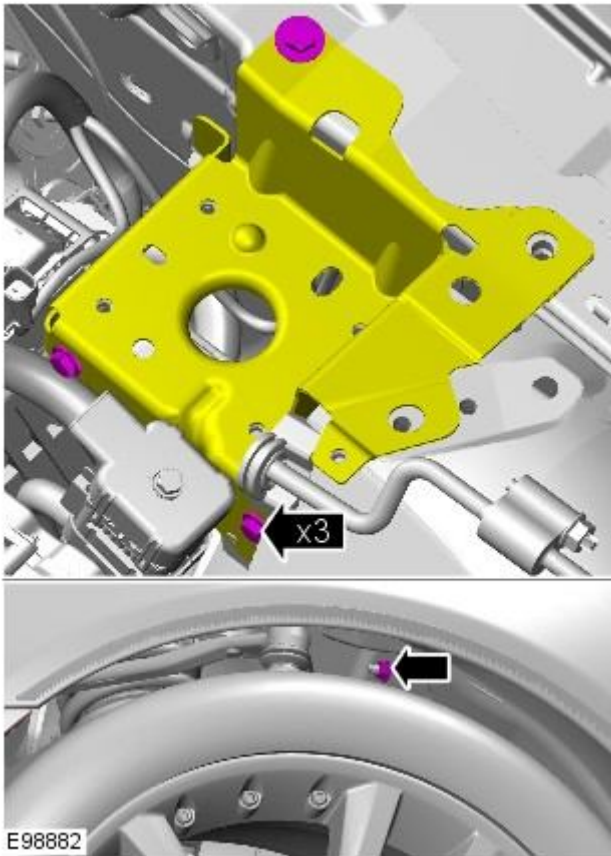
13. Release the secondary air injection (AIR) vacuum reservoir.



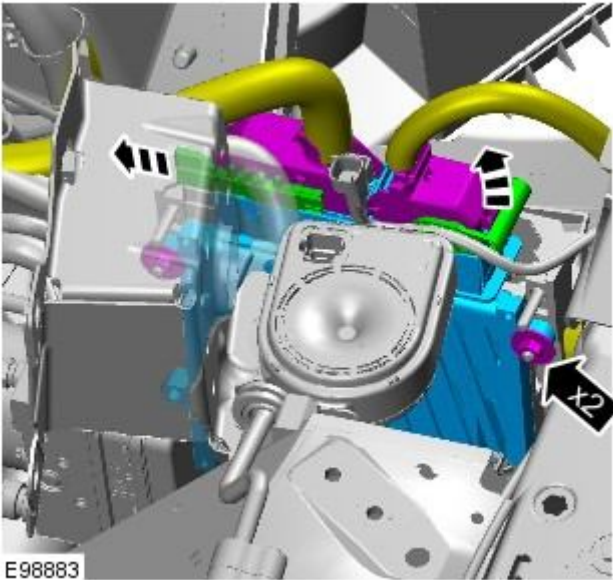
14. Disconnect the fuel line.




15. Release the pedestrian protection actuator bracket.

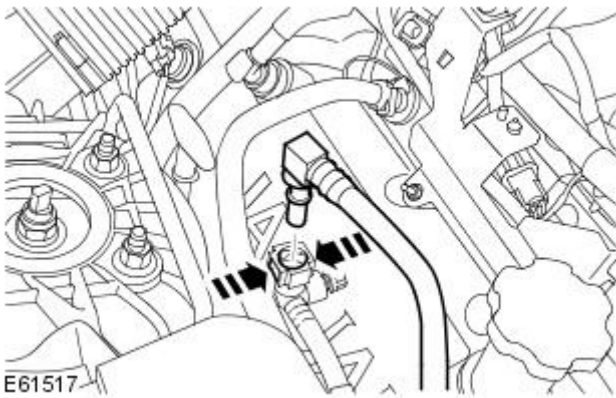


16. Release the ECM wiring harnesses and position aside.

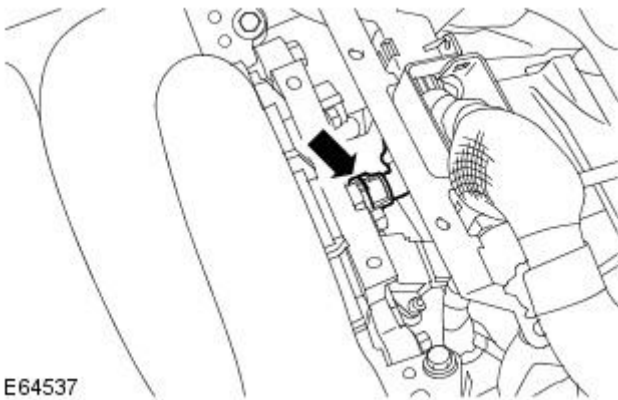


17.  CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

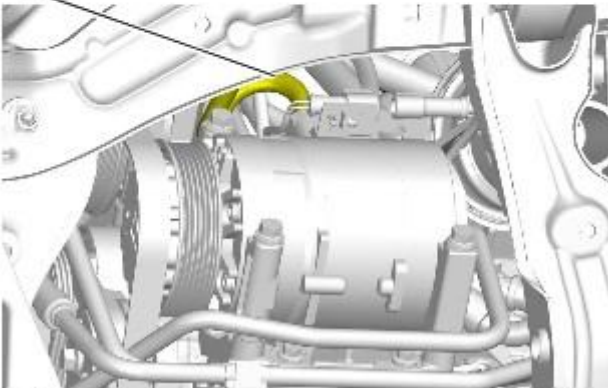
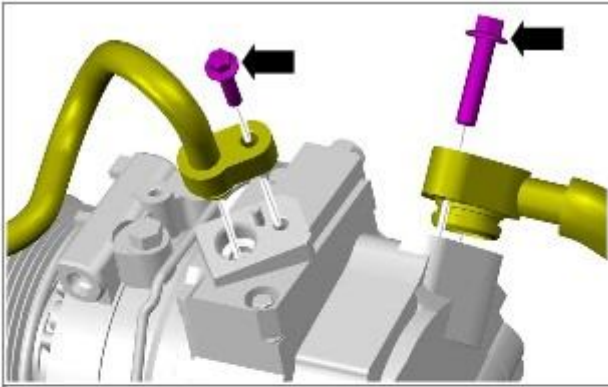
Release the clip and disconnect the purge inlet line.



18. Disconnect the brake booster vacuum hose from the intake manifold.





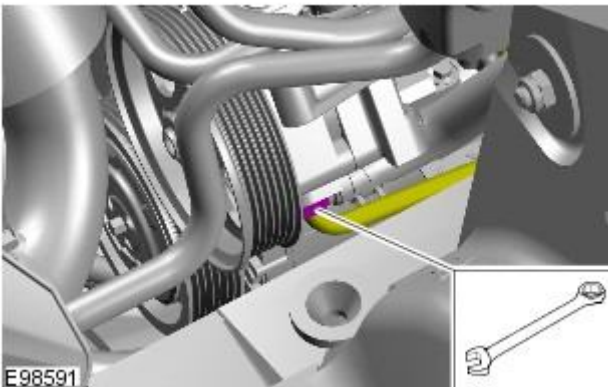


E97758

19.  **CAUTION:** Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

Disconnect the refrigerant lines from the A/C compressor.

- Remove the 2 bolts.
- Remove and discard the 2 O-ring seals.

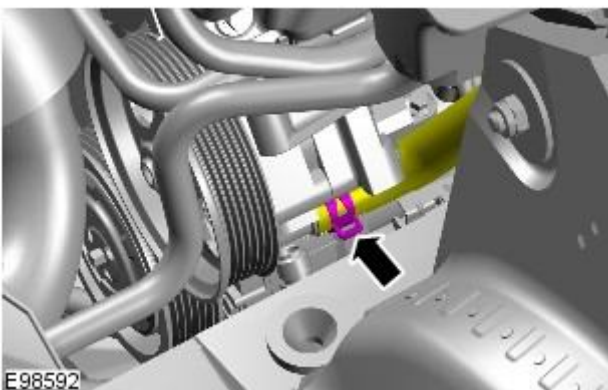


E98591


20.  **CAUTION:** Always plug any open connections to prevent contamination.


Disconnect the high pressure line from the power steering pump.

- Remove and discard the O-ring seal.



E98592

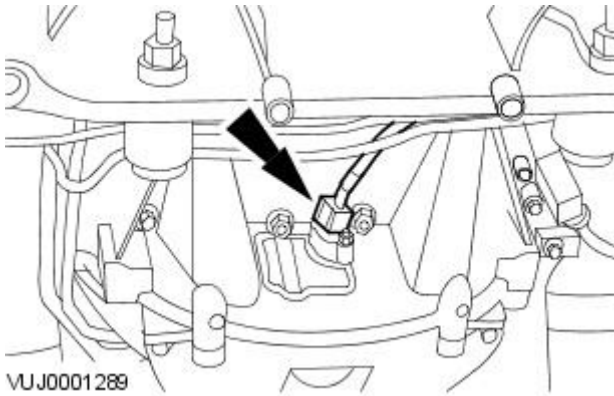
21.  **WARNING:** Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.

 **CAUTION:** Always plug any open connections to prevent contamination.

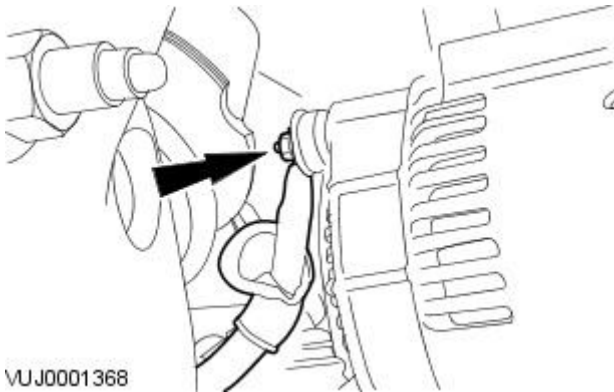
Disconnect the low pressure line from the power steering pump.

- Release the clip.

22. Disconnect the crankshaft position (CKP) sensor electrical connector.



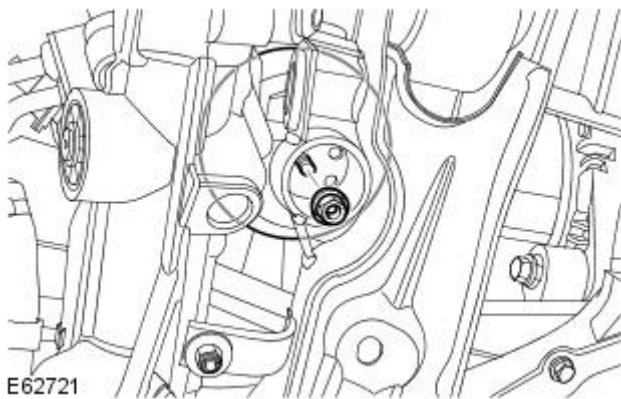
23. Disconnect the battery positive cable from the generator.



24. NOTE: RH illustration shown, LH is similar.

Release the engine mounts.

- Remove and discard the 2 nuts.



25. Lower the vehicle.

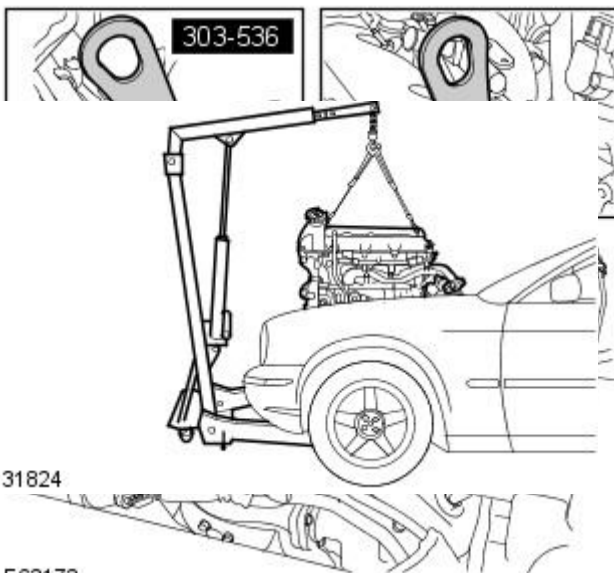
26. Install the special tools to the engine.

- Support the engine.
- Install the lifting chains.

27. Install the lifting equipment to the vehicle.

28. Remove the engine.



- With assistance, carefully remove the engine.





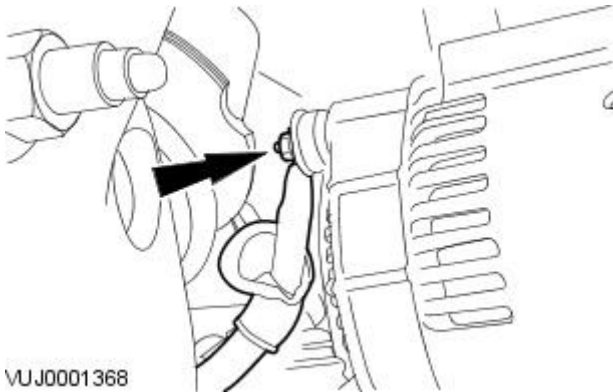
## Engine - 4.2L SC V8 - AJV8 - Engine

Installation

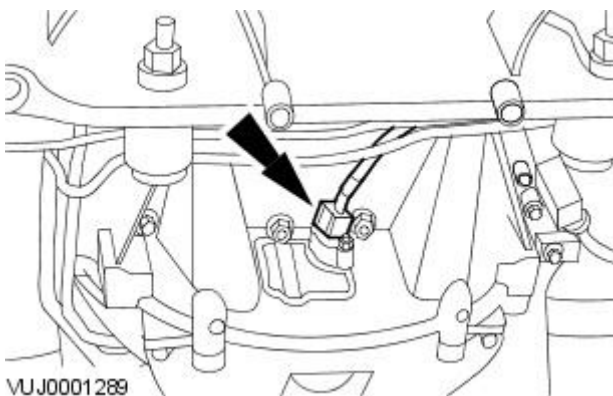
Special Tool(s)	
 <p>303-536</p>	<p>Engine lifting brackets</p> <p>303-536</p>
 <p>303-749</p>	<p>Engine lifting brackets</p> <p>303-749</p>

### Installation

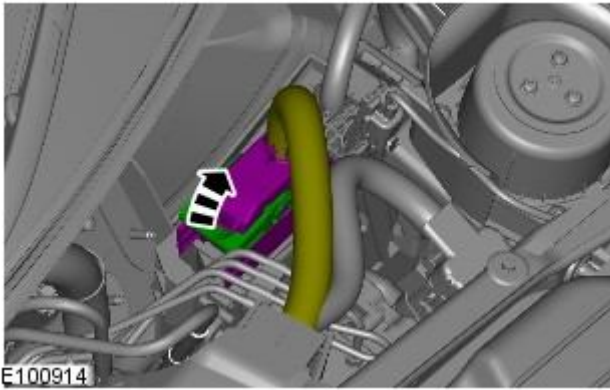
1. Remove the torque converter retainer.
2. Carefully lower the engine onto the engine mounts.
  - Clean the components.
  - Tighten to 63 Nm.
3. Remove the special tools.
4. Connect the battery positive cable to the generator.



5. Connect the CKP sensor electrical connector.

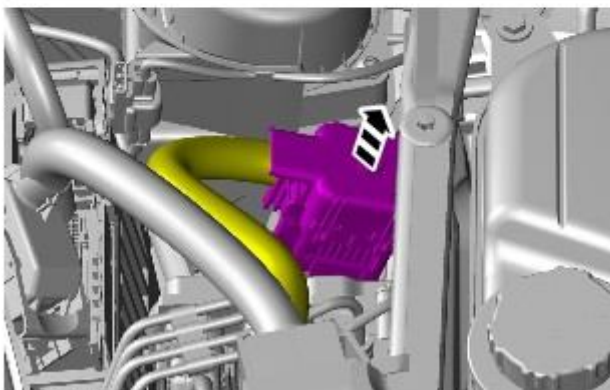
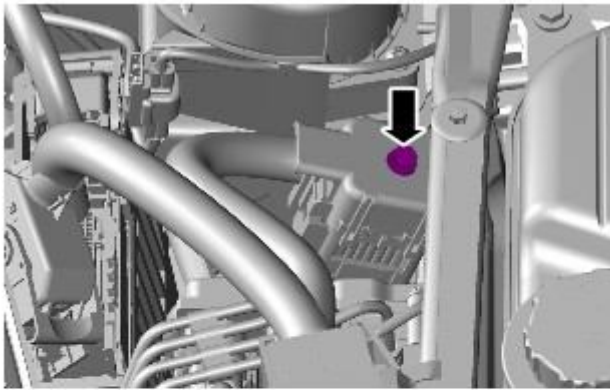


6. Connect the main engine wiring harness to the engine control module (ECM).

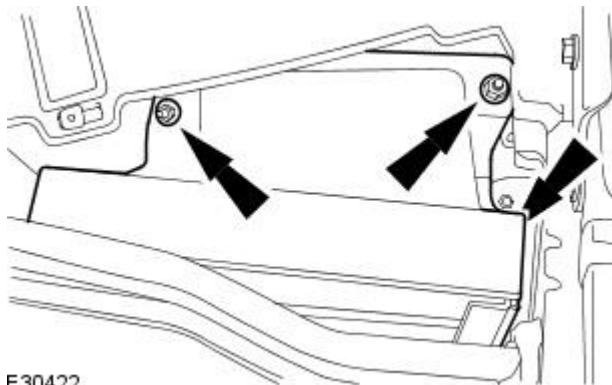


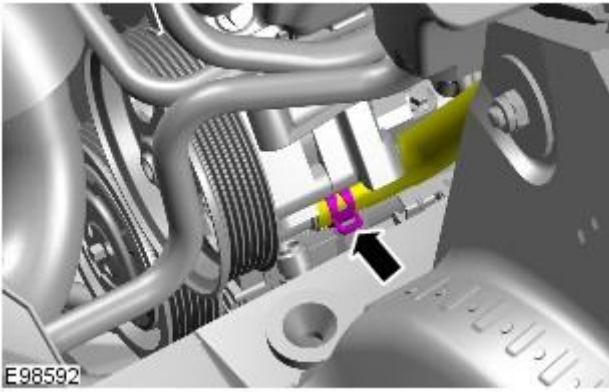
7. Connect the engine wiring harness.


- Tighten to 10 Nm.



8. Install the ECM cover.



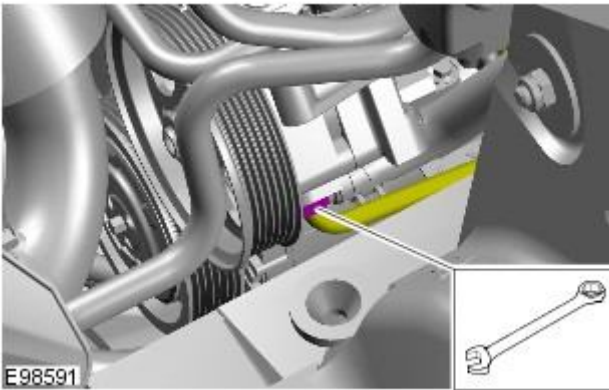


9.  **WARNING:** Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.

 **CAUTION:** Always plug any open connections to prevent contamination.

Connect the low pressure line to the power steering pump.

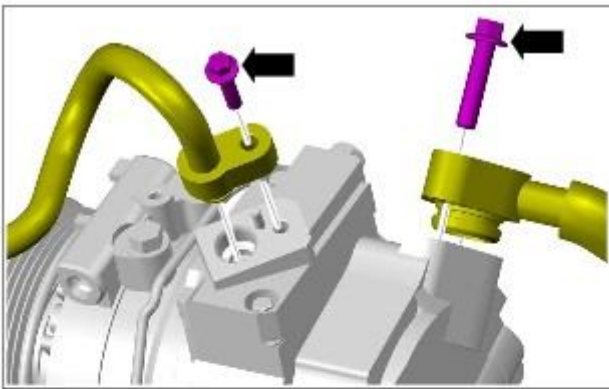
- Secure the clip.



10.  **CAUTION:** Always plug any open connections to prevent contamination.

Connect the high-pressure power steering line to the power steering pump.

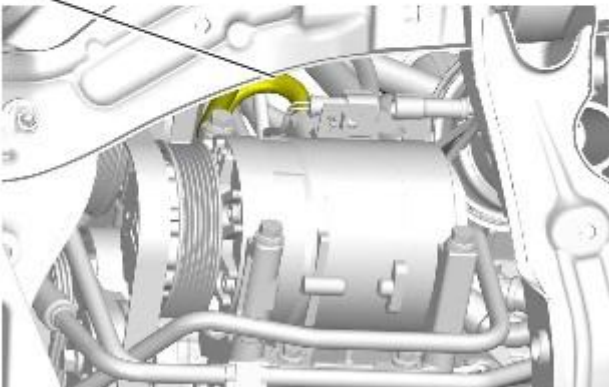
- Install a new O-ring seal.
- Tighten to 20 Nm.



11.  **CAUTION:** Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

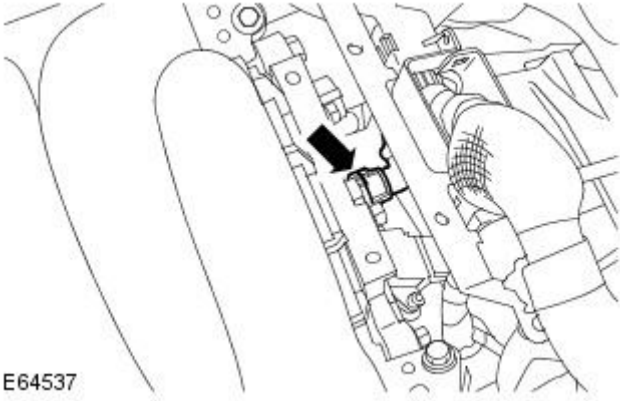
Connect the refrigerant lines to A/C compressor.

- Install new retaining bolts.
- Install new O-ring seals.
- Tighten to 9 Nm.



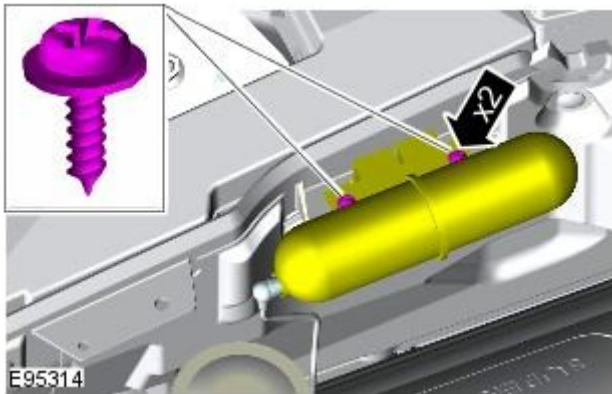
E97758

12. Connect the brake booster vacuum hose to the intake manifold.




E64537

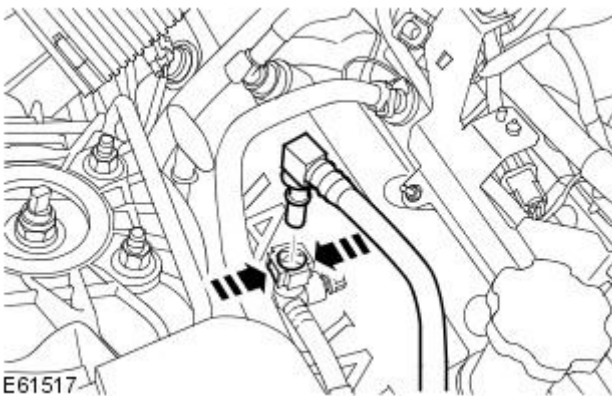
13. Secure the secondary air injection (AIR) vacuum reservoir.



E95314

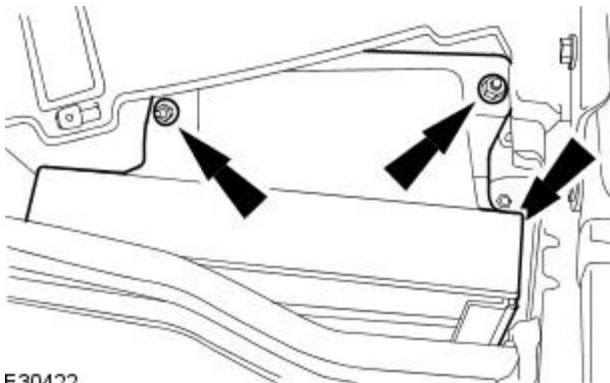
14.  CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Connect the purge valve.



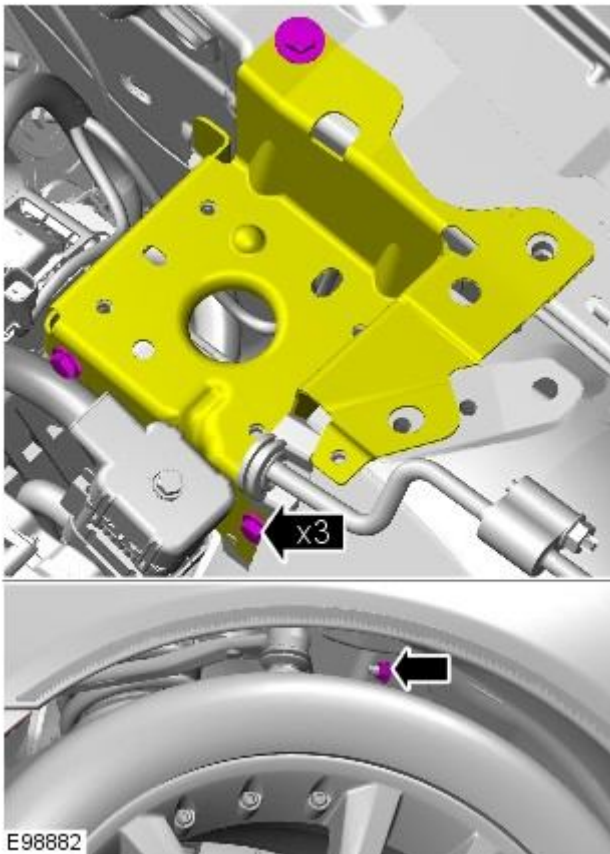
E61517

15. Install the ECM cover.

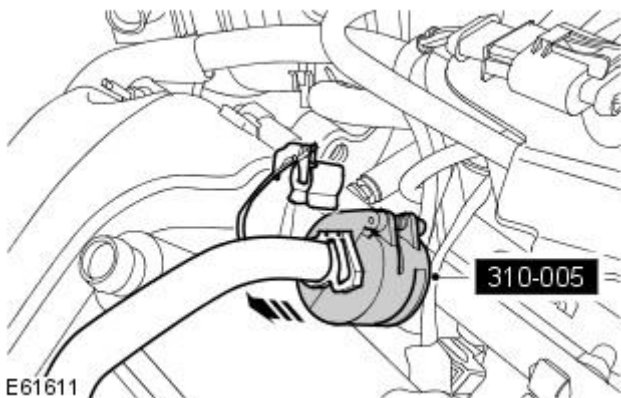


E30422

16. Secure the pedestrian protection actuator bracket.



17. Connect the fuel line.



18. Install the pedestrian protection hood actuator.  
For additional information, refer to: [Pedestrian Protection Hood Actuator LH](#) (501-20C Pedestrian Protection System, Removal and Installation).
19. Install the secondary bulkhead LH panel.  
For additional information, refer to: [Secondary Bulkhead Panel LH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).
20. Install the cooling module.  
For additional information, refer to: [Cooling Module - 4.2L SC V8 - AJV8](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
21. Install the transmission.  
For additional information, refer to: [Transmission - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal).
22. Recharge the A/C system.  
For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
23. Fill and bleed the cooling system.



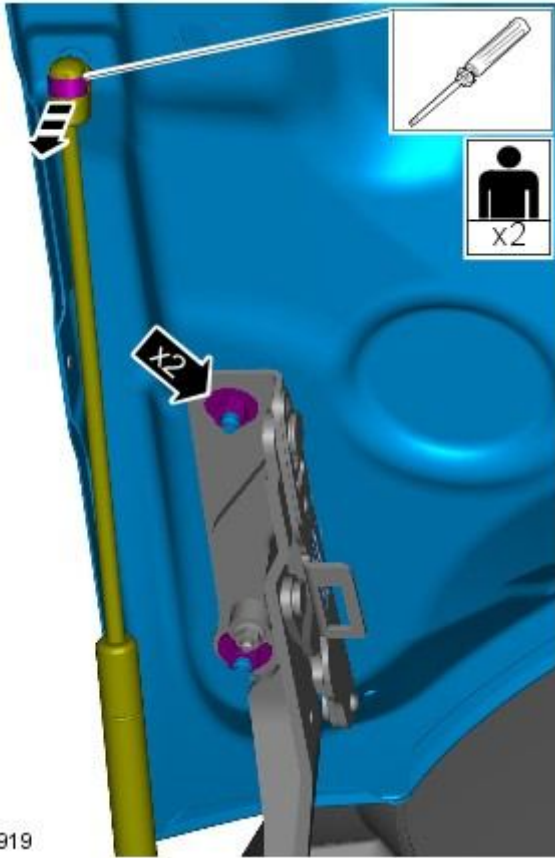
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).

24. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

25. Install the hood.

- Tighten to 25 Nm



E100919



**Engine Cooling - TDV6 2.7L Diesel -****Lubricants, Fluids, Sealers and Adhesives**

Description	Specification
Jaguar Premium Cooling System Fluid	WSS M97B44-D
Jaguar Premium Cooling System Flush	EGR-M14P7-A

**Capacities**

Description	Liters
Cooling system refill	13.5

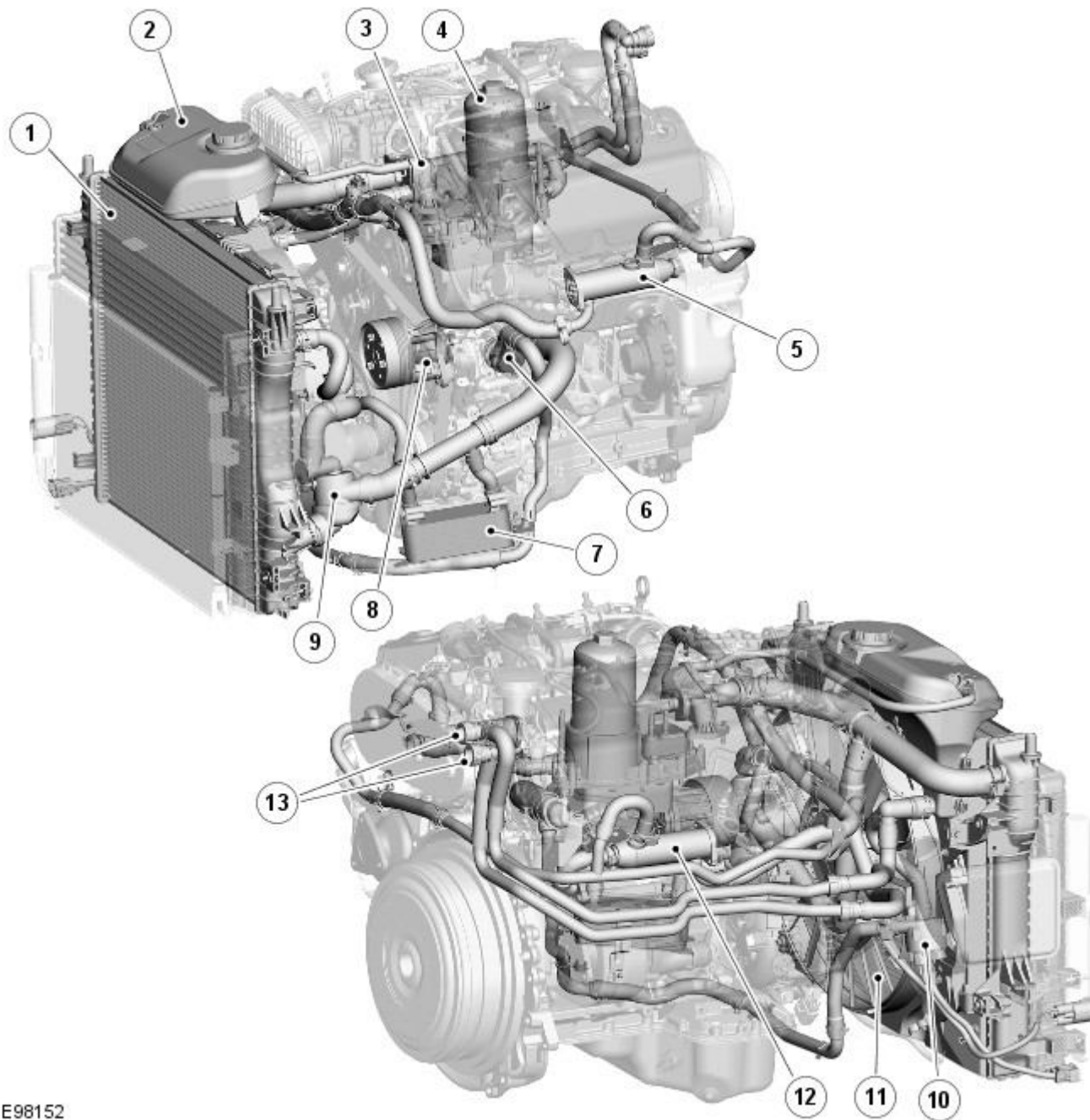
**Torque Specifications**

Description	Nm	lb-ft	lb-in
Coolant expansion tank retaining bolt	7	-	62
Coolant expansion tank bleed screw	3	-	27
Cooling fan motor and shroud retaining bolts	6	-	53
Water pump retaining bolts	10	-	89
Water pump pulley retaining bolts	24	18	-
Charge air cooler to radiator retaining bolts	7	-	62
Air conditioning condenser retaining bolts	7	-	62
Radiator mounting bracket retaining bolts	7	-	62
Charge air cooler intake elbow	7	-	62
Radiator drain plug	2	-	13

# Engine Cooling - TDV6 2.7L Diesel - Engine Cooling - Component Location

Description and Operation

Component Location



E98152

## ItemDescription

1	Radiator
2	Expansion tank
3	Outlet connector assembly
4	Engine oil and fuel coolers
5	LH (left-hand)EGR (exhaust gas recirculation) cooler
6	Inlet connector assembly
7	Transmission oil cooler
8	Coolant pump
9	Thermostat
10	Auxiliary coolant pump
11	Cooling fan
12	RH (right-hand)EGR cooler
13	Heater core supply and return connections

# Engine Cooling - TDV6 2.7L Diesel - Engine Cooling - Overview

Description and Operation

## Overview

The engine cooling system maintains the engine within an optimum temperature range under changing ambient and engine operating conditions. It also provides:

- Heating for the passenger compartment.  
Refer to: [Heating and Ventilation](#) (412-01 Climate Control, Description and Operation).
- Cooling for:
  - The engine oil.
  - The fuel.
  - The [EGR \(exhaust gas recirculation\)](#) system.  
Refer to: [Engine Emission Control](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Description and Operation).
  - The transmission fluid.  
Refer to: [Transmission Cooling - Vehicles With: ZF 6HP26](#) (307-02 Transmission/Transaxle Cooling - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel, Description and Operation).

# Engine Cooling - TDV6 2.7L Diesel - Engine Cooling - System Operation and Component Description

Description and Operation

## System Operation

When the engine is running the coolant is circulated around the engine cooling system by the coolant pump and the auxiliary coolant pump. From the outlet of the coolant pump, coolant flows through the cylinder block and the cylinder heads to the outlet connector. Some of the coolant in the cylinder block is diverted through the engine oil and fuel coolers before returning to the outlet connector. From the outlet connector the bulk of the coolant flows to the thermostat, either directly or via the radiator, depending on the temperature of the coolant. From the outlet of the thermostat the coolant flows to the inlet connector and then to the coolant pump.

Coolant from the outlet connector also flows through the [EGR \(exhaust gas recirculation\)](#) coolers and then the heater core. From the heater core outlet, the coolant flows to the inlet connector via the auxiliary coolant pump. Refer to: [Heating and Ventilation](#) (412-01 Climate Control, Description and Operation).

The transmission coolant control valve controls the flow and temperature of coolant to the transmission oil cooler from the radiator and/or the engine outlet. The transmission control valve regulates the temperature of the coolant supplied to the transmission oil cooler to maintain the transmission oil at the optimum operating temperature. The coolant from the outlet of the transmission oil cooler returns to the inlet connector with the flow of coolant from the thermostat.

If the coolant level in the expansion tank decreases below a predetermined value, the level sensor connects a ground to the instrument cluster, which activates the appropriate warning.

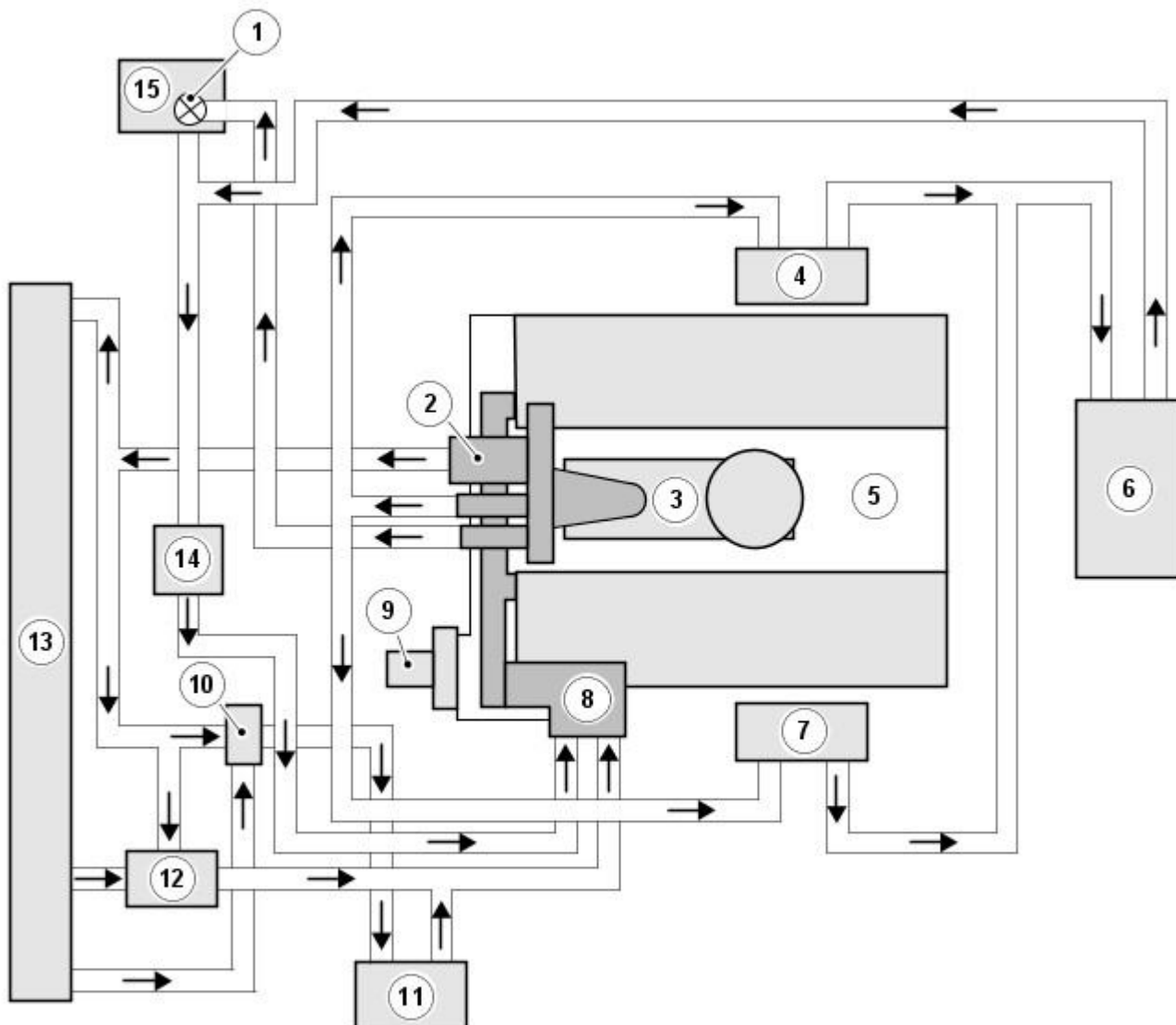
Refer to: [Instrument Cluster](#) (413-01 Instrument Cluster, Description and Operation).

The cooling fan is operated by a fan control module integrated into the cooling fan motor. The fan control module regulates the voltage, and thus speed, of the cooling fan motor in response to a [PWM \(pulse width modulation\)](#) signal from the [ECM \(engine control module\)](#). The [ECM](#) calculates the required fan speed from the engine temperature, [A/C \(air conditioning\)](#) system pressure and transmission oil temperature.

Under hot operating conditions, the fan may continue to operate for four minutes after the engine has been switched off.

Refer to: [Electronic Engine Controls](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Description and Operation).

## Engine Cooling Flow Diagram



**ItemDescription**

1	Bleed screw
2	Outlet connector
3	Engine oil cooler and fuel cooler
4	<a href="#">RH (right-hand)EGR</a> cooler
5	Engine
6	Heater core
7	<a href="#">LH (left-hand)EGR</a> cooler
8	Inlet connector
9	Coolant pump
10	Transmission (coolant) control valve
11	Transmission cooler
12	Thermostat
13	Radiator
14	Auxiliary coolant pump
15	Expansion tank

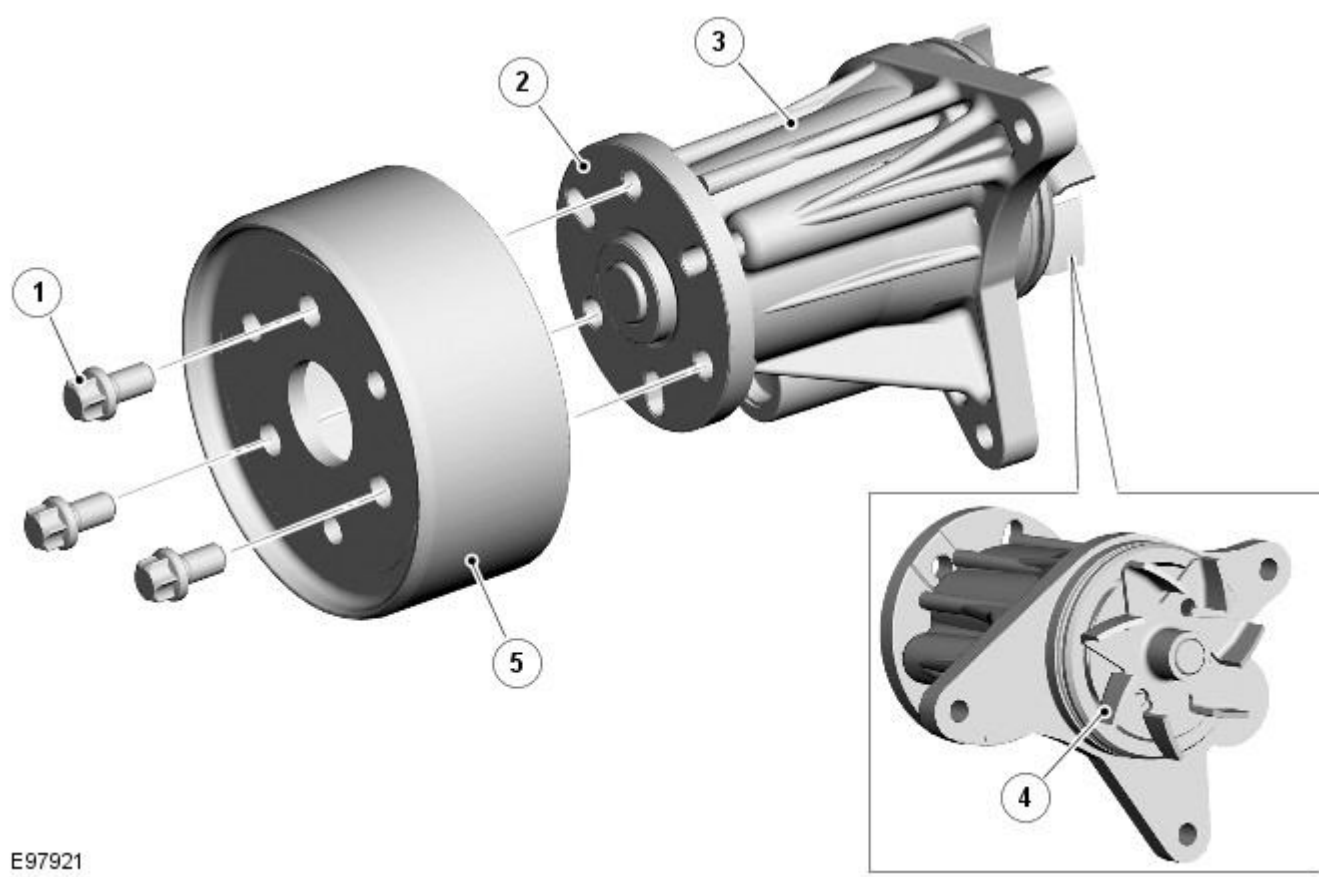
**Component Description****General**

The primary components of the engine cooling system are the:

- Coolant pump.
- Thermostat.
- Radiator.
- Cooling fan.
- Expansion tank.
- Engine oil and fuel coolers.
- Connecting hoses and pipes.

The engine cooling system also supplies coolant to:

- The heater core.  
Refer to: [Heating and Ventilation](#) (412-01 Climate Control, Description and Operation).
- The [EGR](#) coolers.  
Refer to: [Engine Emission Control](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Description and Operation).
- The transmission oil cooler.  
Refer to: [Transmission Cooling - Vehicles With: ZF 6HP26](#) (307-02 Transmission/Transaxle Cooling - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel, Description and Operation).

**Coolant Pump**

E97921

**ItemDescription**

1	Bolt (3 off)
2	Drive hub

3 Housing

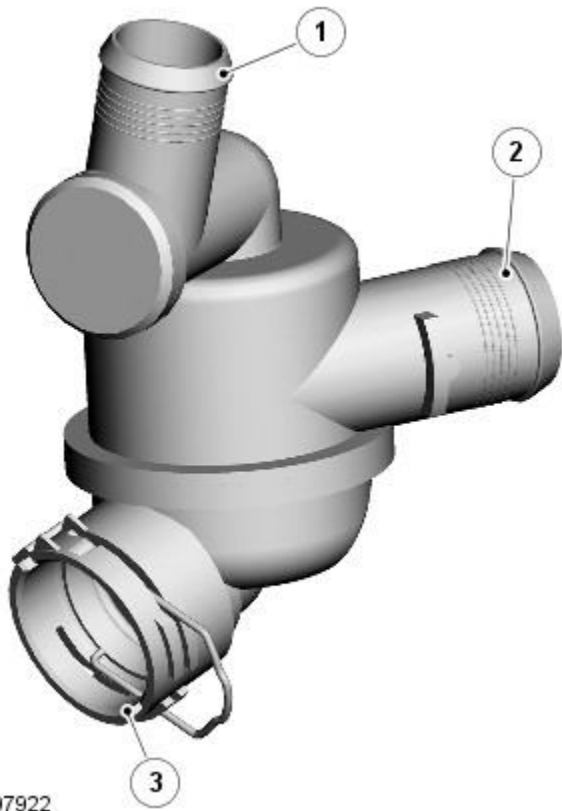
4 Impeller

5 Pulley

The coolant pump has a housing that supports a shaft with an impeller attached to one end and a drive hub at the other. The housing is attached to the front of the cylinder block with the impeller located in a pumping chamber. The pump is driven by a pulley attached to the drive hub and driven by the accessory drive belt.

Refer to: Accessory Drive (303-05 Accessory Drive - 2.7L Diesel, Description and Operation).

## Thermostat



E97922

### ItemDescription

1 From engine outlet connector

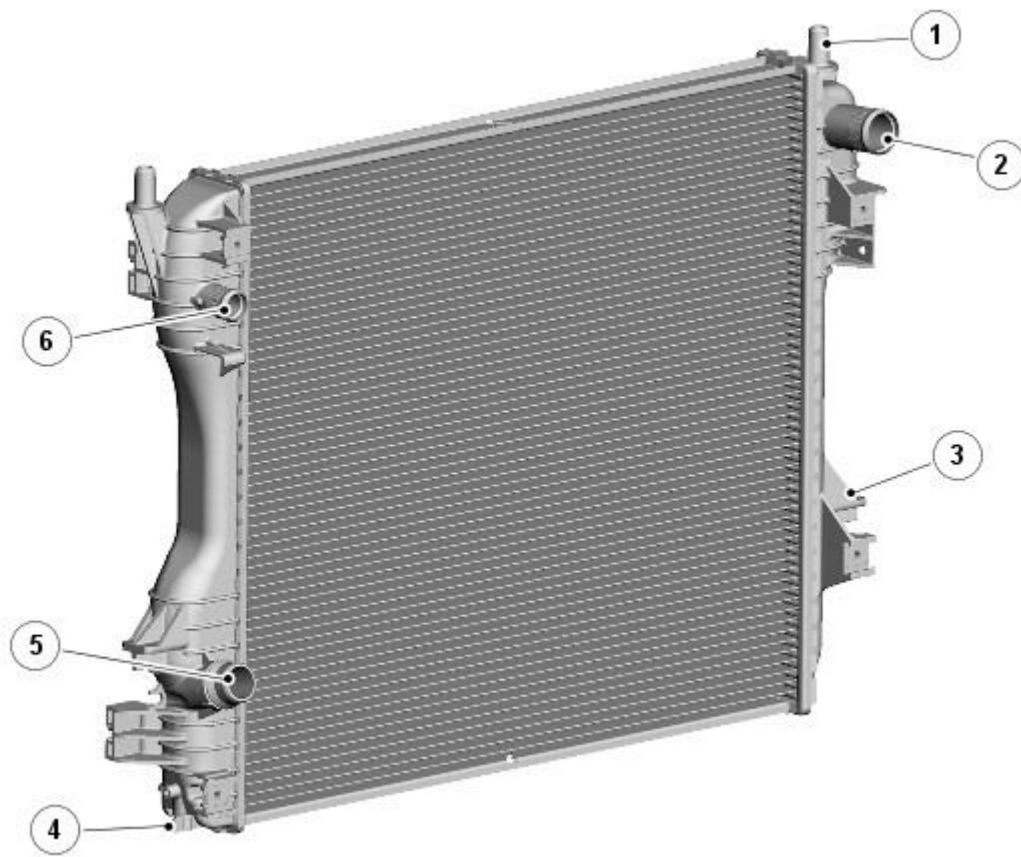
2 To engine inlet connector

3 Radiator end tank connection

The thermostat is an ambient bias thermostat located in a sealed housing attached to the [LH](#) end tank of the radiator. The thermostat opens at a nominal temperature of 82 °C (180 °F). This opening is delayed at lower ambient temperatures to improve heater performance. When the engine is cold the thermostat is closed and directs coolant from the outlet connector to the coolant pump. When the engine is warm the thermostat is open and directs coolant from the radiator to the coolant pump.

## Radiator





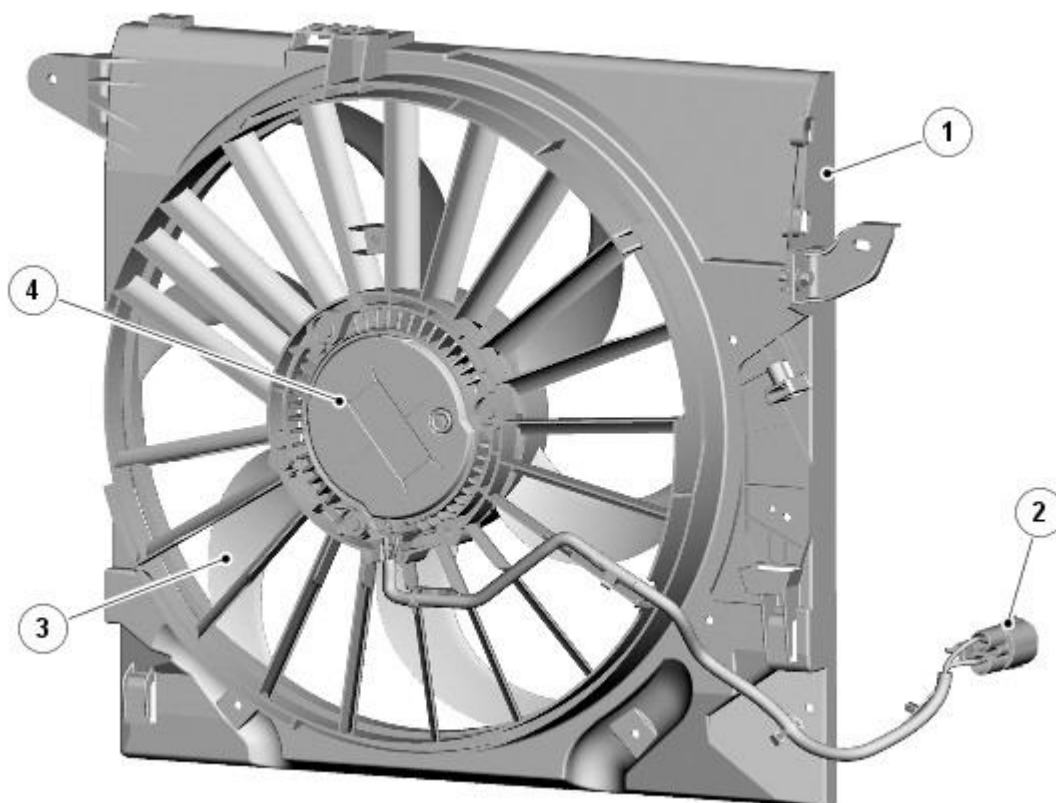
E97923

**ItemDescription**

1	Locating spigot (2 off)
2	Coolant inlet
3	Support (2 off)
4	Drain plug
5	Coolant outlet (to thermostat)
6	Coolant outlet (to transmission (coolant) control valve)

The radiator is a cross flow type with an aluminum core and plastic end tanks. The radiator is located in the vehicle by locating spigots and supports integrated into the end tanks. The supports are installed in rubber bushes in the upper chassis rails. The locating spigots are installed in rubber bushes in the front end carrier. A drain plug is integrated into the LH end tank. Coolant inlet and outlet connections are incorporated into the RH and LH end tanks respectively.

**Cooling Fan**

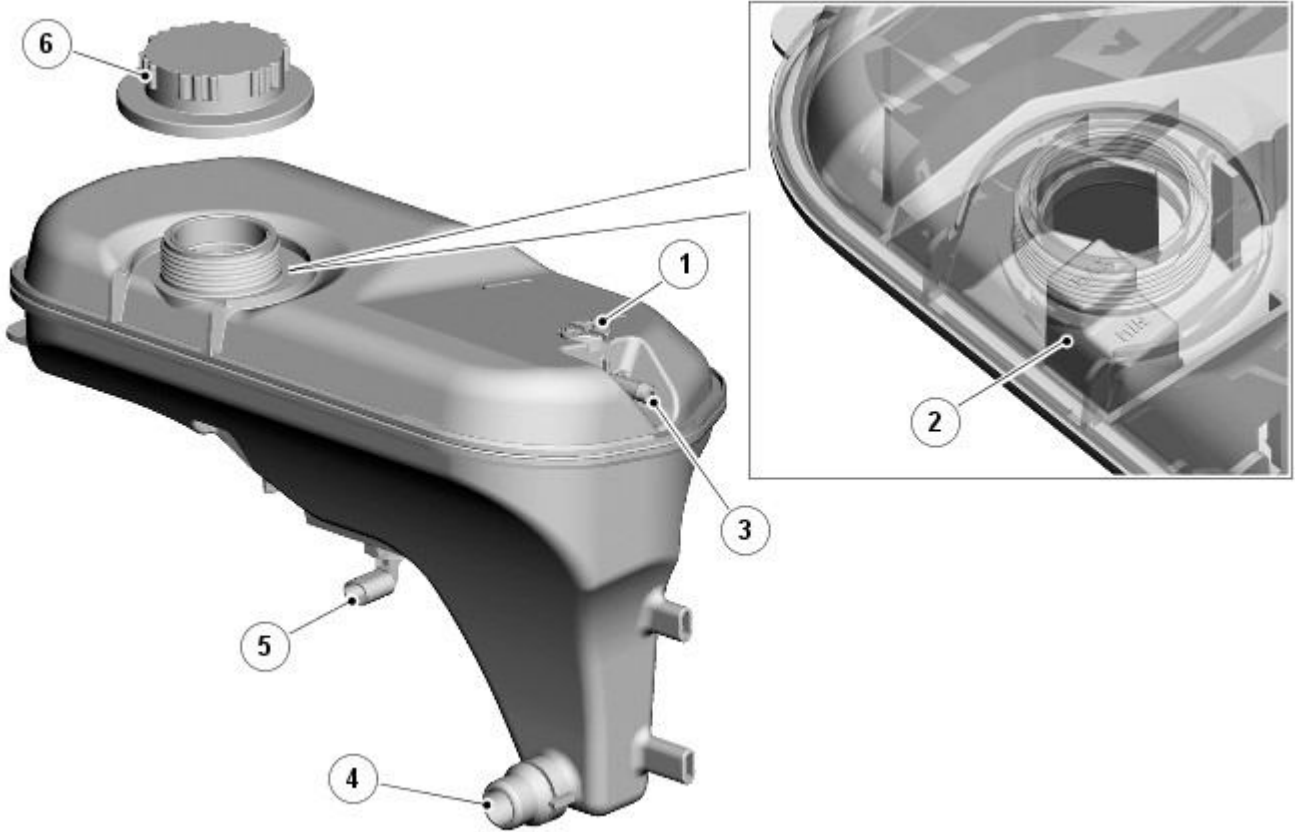


E97924

**ItemDescription**

1	Shroud
2	Electrical connector
3	Fan
4	Motor and fan control module

An electric, variable speed cooling fan is installed in a shroud attached to the rear of the radiator. The cooling fan is operated by a fan control module, integrated into the electric motor, under the control of the [ECM](#). Electrical connectors at the [RH](#) side of the shroud provides the interface between the cooling fan harness and the vehicle wiring.

**Expansion Tank**

E97925

**ItemDescription**

1	Bleed screw
2	Level markings
3	Vent hose connection
4	Expansion hose connection
5	Level sensor
6	Filler cap

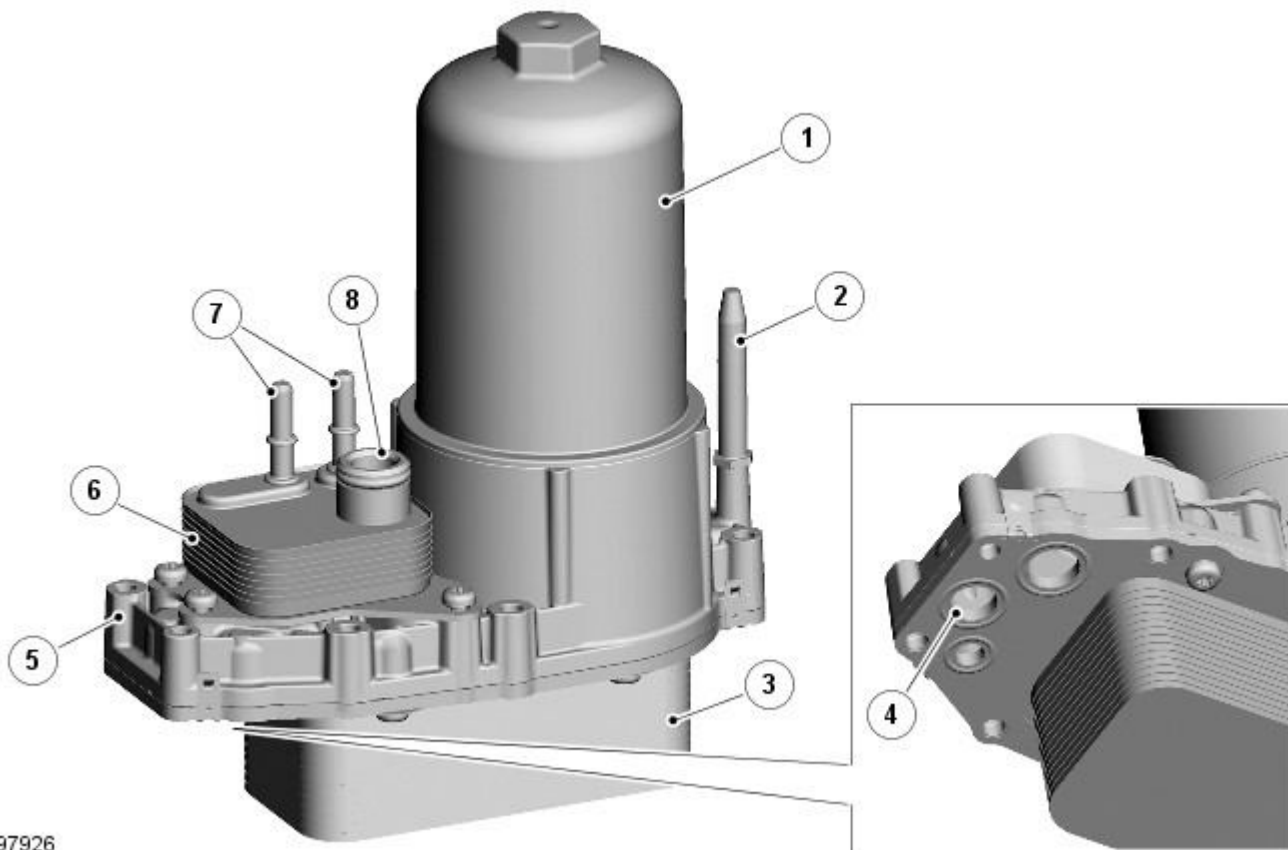
A pressurized expansion tank system is used which continuously separates the air from the cooling system and replenishes the system through a hose connected between the expansion tank and the heater return hose. A continuous vent into the expansion tank, through a hose connected to the engine's coolant outlet connector, prevents air locks from forming in the cooling system.

The expansion tank is installed behind the top right corner of the radiator. A filler cap, bleed screw and level sensor are incorporated into the expansion tank. MAX and MIN level markings are molded into the interior of the tank below the filler cap. The expansion tank provides the following functions:

- Service fill.
- Coolant expansion during warm-up.
- Air separation during operation.
- System pressurization by the filler cap.

The expansion tank has an air space of approximately 0.5 to 1 liter (1.06 to 2,11 US pints), above the MAX level, to allow for coolant expansion.

**Engine Oil and Fuel Coolers**



E97926

**ItemDescription**

1	Engine oil filter
2	Locator pin
3	Engine oil cooler
4	Coolant inlet (from cylinder block)
5	Adapter assembly
6	Fuel cooler
7	Fuel inlet and outlet connections
8	Coolant outlet (to engine coolant outlet connector)

The engine oil cooler and the fuel cooler are attached to a common adapter assembly located in the vee of the cylinder block. Inlet and outlet ports for engine oil, and an inlet port for coolant, are incorporated into the cylinder block mating face of the adapter assembly. A metal gasket seals the joint between the adapter assembly and the cylinder block.

From the cylinder block, coolant flows through the adapter assembly and into the two coolers. After passing through the two coolers, the coolant then flows into the engine coolant outlet connector via an outlet on the fuel cooler.

**Engine Coolant**

The engine coolant is formulated to last for ten years or 240,000 km (150,000 miles). The coolant is silicate free and must not be mixed with conventional engine coolant.

# Engine Cooling - TDV6 2.7L Diesel - Engine Cooling

Diagnosis and Testing

## Principles of Operation

For detailed description of the diesel engine cooling system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (303-03A Engine Cooling - TDV6 2.7L Diesel)

[Engine Cooling](#) (Description and Operation),

[Engine Cooling](#) (Description and Operation),

[Engine Cooling](#) (Description and Operation).

## Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>Leaks</li> <li>Coolant expansion tank</li> <li>Electric fan</li> <li>Radiator</li> </ul>	<ul style="list-style-type: none"> <li>Fuse</li> <li>Wiring harness</li> <li>Loose or corroded connector(s)</li> <li>Engine Coolant Temperature (ECT) sensor</li> </ul>

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If there are clear symptoms refer to the table below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Coolant loss	<ul style="list-style-type: none"> <li>Hoses</li> <li>Hose connections</li> <li>Radiator</li> <li>Coolant pump</li> <li>Heater core</li> <li>Gaskets</li> <li>Engine casting cracks</li> <li>Engine block core plugs</li> </ul>	<ul style="list-style-type: none"> <li>GO to Pinpoint Test <a href="#">A.</a></li> </ul>
Engine overheating	<ul style="list-style-type: none"> <li>Engine coolant (level/condition)</li> <li>Thermostat</li> <li>Fan motor</li> <li>Fan motor fuses and/or circuits</li> <li>ECT sensor</li> <li>Engine control module (ECM)</li> <li>Fan speed module</li> </ul>	<ul style="list-style-type: none"> <li>GO to Pinpoint Test <a href="#">B.</a></li> </ul>
Engine not reaching normal operating temperature	<ul style="list-style-type: none"> <li>Thermostat</li> <li>Electric fan</li> <li>Fan speed module</li> </ul>	<ul style="list-style-type: none"> <li>GO to Pinpoint Test <a href="#">C.</a></li> </ul>

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the module or a component is suspect and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the Check and installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P011626	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>Signal rate of change below threshold</li> </ul>	Refer to the electrical circuit diagrams and check ECT sensor circuits for short, open circuit and poor connection. From engine cold, check and record 'Engine coolant temperature' datalogger signal. After approximately 20 minutes, check and record signal, if value has NOT increased by more than 10°C install a new sensor as required
P011716	Engine Coolant Temperature Sensor 1 Circuit Low Input	<ul style="list-style-type: none"> <li>Circuit voltage below threshold</li> <li>Engine coolant temperature sensor</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor signal circuit for short to ground. Check and install a new sensor as required


DTC	Description	Possible Cause	Action
		failure	
P011817	Engine Coolant Temperature Sensor 1 Circuit High Input	<ul style="list-style-type: none"> <li>● Circuit voltage above threshold</li> <li>● Engine coolant temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor signal circuit for short to power. Check and install a new sensor as required
P011927	Engine Coolant Temperature Sensor 1 Circuit Intermittent/Erratic	<ul style="list-style-type: none"> <li>● Signal rate of change above threshold</li> <li>● Engine coolant temperature sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check engine coolant temperature sensor circuits for short, open circuit and poor connections. Run engine to normal operating temperature, check and record ' <b>Engine coolant temperature</b> ' datalogger signal, increase engine speed by 2000 rpm, after 120 seconds check and record signal. If value of signal has increased faster than 5°C/second install new sensor as required
P048011	Fan 1 Control Circuit	<ul style="list-style-type: none"> <li>● Cooling fan 1 control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check the fan 1 control circuit for short to ground
P048012	Fan 1 Control Circuit	<ul style="list-style-type: none"> <li>● Cooling fan 1 control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check the fan 1 control circuit for short to power
P048013	Fan 1 Control Circuit	<ul style="list-style-type: none"> <li>● Cooling fan 1 control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check the fan 1 control circuit for open circuit
P048397	Fan Rationality Check	<ul style="list-style-type: none"> <li>● Cooling fan obstructed or blocked</li> </ul>	Check and clear any blockage or restriction from fan
P048400	Fan Circuit Over Current	<ul style="list-style-type: none"> <li>● Cooling fan seizure</li> <li>● Cooling fan rotor jammed/blocked</li> <li>● Cooling fan motor damage/fault</li> </ul>	Check and clear any blockage or restriction from fan. Check and install new components as required, refer to the new module/component installation note at the top of the DTC Index
P069100	Fan 1 Control Circuit Low	<ul style="list-style-type: none"> <li>● Cooling fan control circuit - short to ground, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check cooling fan control circuit for short to ground, open circuit
P069200	Fan 1 Control Circuit High	<ul style="list-style-type: none"> <li>● Cooling fan control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check cooling fan control circuit for short to power

## Pinpoint Tests

### PINPOINT TEST A : LOSS OF COOLANT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>A1: VISUAL INSPECTION</b>	
<b>1</b>	Visually inspect for loss of coolant.
<b>2</b>	Carry out a system pressure test. See component tests in this section.
	Is the engine cooling system leaking? <b>Yes</b> Rectify the leak as indicated by the test result. Top-up and fill the cooling system to the correct level with the correct specification fluid as necessary. REFER to: (303-03A Engine Cooling - TDV6 2.7L Diesel) <a href="#">Specifications</a> (Specifications), <a href="#">Cooling System Draining, Filling and Bleeding</a> (General Procedures). TEST the system for correct operation. <b>No</b> Verify the customer complaint.

### PINPOINT TEST B : THE ENGINE OVERHEATS

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>B1: CHECK COOLANT</b>	
 <b>WARNING:</b> The cooling system is pressurized! Ensure the reservoir cap is never released until the system has cooled. Failure to follow these instructions may result in personal injury.	
<b>1</b>	Check the coolant level and condition.
	Does the system contain sufficient coolant of the correct specification? <b>Yes</b> <a href="#">GO to B2.</a> <b>No</b> Top-up and fill the cooling system to the correct level with the correct specification fluid as necessary. REFER to: (303-03A Engine Cooling - TDV6 2.7L Diesel) <a href="#">Specifications</a> (Specifications), <a href="#">Cooling System Draining, Filling and Bleeding</a> (General Procedures). Check for coolant loss. GO to Pinpoint Test <a href="#">A.</a>

### B2: CHECK COOLANT EXPANSION TANK PRESSURE CAP

<b>1</b>	Check the coolant expansion tank pressure cap for damage/correct operation. REFER to the coolant expansion tank pressure cap pressure test in this section.
	Is the coolant expansion tank pressure cap operating correctly? <b>Yes</b> <a href="#">GO to B3.</a> <b>No</b> INSTALL a new coolant expansion tank pressure cap. TEST the system for correct operation.

### B3: CHECK THERMOSTAT

<b>1</b>	Check the thermostat for correct operation. REFER to the thermostat component test in this section.
----------	---

Is the thermostat operating correctly?

**Yes**

Check for correct operation of cooling fans, circuits, sensors, modules, etc.  
REFER to: [Electronic Engine Controls - 2.7L Diesel \(303-14A, Diagnosis and Testing\)](#).

**No**

INSTALL a new thermostat.  
REFER to: [Thermostat \(303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation\)](#).  
TEST the system for correct operation.

## PINPOINT TEST C : THE ENGINE DOES NOT REACH NORMAL OPERATING TEMPERATURE

### TEST CONDITIONS

### DETAILS/RESULTS/ACTIONS

#### C1: CHECK THERMOSTAT

**1** Check the thermostat for correct operation. REFER to the thermostat component test in this section.

Is the thermostat operating correctly?

**Yes**

Check for correct operation of cooling fans, circuits, sensors, modules, etc.  
REFER to: [Electronic Engine Controls - 2.7L Diesel \(303-14A, Diagnosis and Testing\)](#).

**No**

INSTALL a new thermostat.  
REFER to: [Thermostat \(303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation\)](#).  
TEST the system for correct operation.

## Component Tests

### Cooling System Pressure Test



**WARNING:** Never, under any circumstances, remove the coolant expansion tank pressure cap while the engine is operating. To avoid having scalding hot water or steam blow out of the cooling system, use extreme care when removing the coolant expansion tank pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant expansion tank pressure cap and turn it slowly until the pressure begins to release, step back while the pressure is released from the system. When certain all the pressure has been released (still with a cloth) turn and remove the coolant expansion tank pressure cap. Failure to follow these instructions may result in damage to the cooling system, engine and/or cause personal injury.

1. Switch the engine off.
2. Open the hood and install protective fender covers.
3. Carefully remove the coolant expansion tank pressure cap from the coolant expansion tank to relieve pressure in the cooling system. Add coolant to coolant expansion tank as necessary.
4. Install the pressure tester equipment to the cooling system following manufacturers instructions. Reinstall the coolant expansion tank pressure cap (if pressure test equipment is not installed to the coolant expansion tank).
5. Pressurize the cooling system to the coolant expansion tank pressure cap lower limit.
6. Observe the gauge reading for approximately two minutes. Pressure should not drop during this time.
  - If system holds pressure, continue from step 8.
  - If the pressure drops, check the complete cooling system for leaks. Also refer to engine system checks if a leak cannot be located in the cooling system. Correct any leaks found and recheck the system.
7. Release the system pressure and remove the pressure test equipment. Check the coolant level. Replenish as necessary with the correct coolant solution.  
REFER to: [Specifications \(303-03A Engine Cooling - TDV6 2.7L Diesel, Specifications\)](#).
8. Check the radiator overflow hose for any obstructions which may block the flow of coolant either to or from the coolant expansion tank.
9. Conduct the coolant expansion tank pressure cap pressure test in this section.

### Coolant Expansion Tank Pressure Cap Pressure Test



**WARNING:** Never, under any circumstances, remove the coolant expansion tank pressure cap while the engine is operating. To avoid having scalding hot water or steam blow out of the cooling system, use extreme care when removing the coolant expansion tank pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant expansion tank pressure cap and turn it slowly until the pressure begins to release, step back while the pressure is released from the system. When certain all the pressure has been released (still with a cloth) turn and remove the coolant expansion tank pressure cap. Failure to follow these instructions may result in damage to the cooling system, engine and/or cause personal injury.

1. Remove the expansion tank pressure cap from the coolant expansion tank.
2. Use water to clean cap in area of rubber seal and vacuum relief valve. Following manufacturers instructions, install the coolant expansion tank pressure cap to the pressure tester.
3. **NOTE:** If the pressure tester is pressurised too quickly, an erroneous pressure reading may result.
  3. Slowly pressurise the system until the pressure gauge reading stops increasing, and note highest pressure reading obtained.
4. Release pressure and repeat Step 3 at least twice to make sure the pressure test reading is repeatable and within specification.
5. If the pressure test gauge readings are not within specification, install a new coolant expansion tank pressure cap.

### Thermostat Test

Remove the thermostat

REFER to: [Thermostat \(303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation\)](#).

Inspect for visible damage, note its opening temperature and immerse it in water. Heat the water until this temperature is reached. The thermostat should begin to open. If it does not begin to open, install a new thermostat.


REFER to: [Thermostat \(303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation\)](#).

If thermostat begins to open, continue to heat the water until the thermostat fully opens, 5.8 mm (0.2 in) or more off the seat. If it does not fully open, install a new thermostat.



REFER to: [Thermostat](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation).

## Radiator Leak Test - Removed from the Vehicle

 **CAUTION:** Do not leak test an aluminium radiator in the same water that is used to leak test copper/brass radiators. Flux and caustic cleaners may be present in the test water which will corrode aluminium. If a separate tank is not available, drain and rinse the test tank before testing an aluminium radiator.


Clean the radiator before leak testing to prevent contamination of the test tank. Leak test the radiator in clean water with 138 kPa (20 psi) air pressure.

# Engine Cooling - TDV6 2.7L Diesel - Cooling System Draining, Filling and Bleeding


## General Procedures

### • WARNINGS:

 Never remove the coolant expansion tank cap under any circumstances while the engine is operating. Failure to follow this instruction may result in personal injury.

 To avoid the possibility of personal injury, do not operate the engine with the hood open until the fan blades have been examined for cracks and separation. Failure to follow this instruction may result in personal injury.


### • CAUTIONS:

 The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage. Failure to follow this instruction may result in damage to the engine.

 Never remove the coolant expansion tank cap under any circumstances while the engine is operating. Failure to follow this instruction may result in damage to the engine.

-  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

-  **WARNING:** Release the cooling system pressure by slowly turning the coolant expansion tank cap a quarter of a turn. Cover the expansion tank cap with a thick cloth to prevent the possibility of scalding. Failure to follow this instruction may result in personal injury.

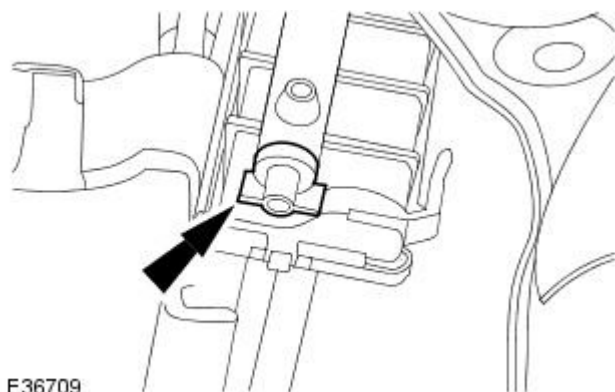
Release the cooling system pressure.

- Remove the coolant expansion tank cap.


- Remove the radiator splash shield.  
For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

- Drain the coolant.

- Position a container to collect the fluid.
- Remove the drain plug.

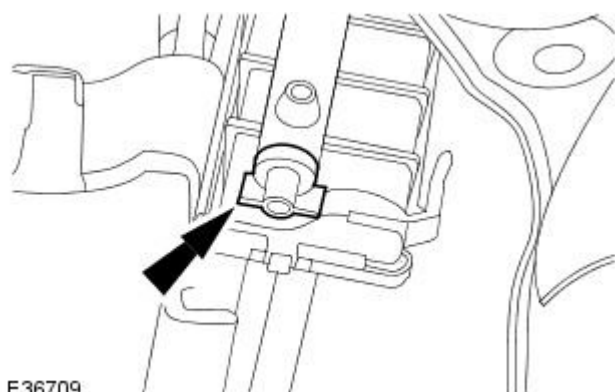


E36709

-  **CAUTION:** Do not over tighten the drain plug. Failure to follow this instruction may result in damage to the vehicle.

Install the drain plug.

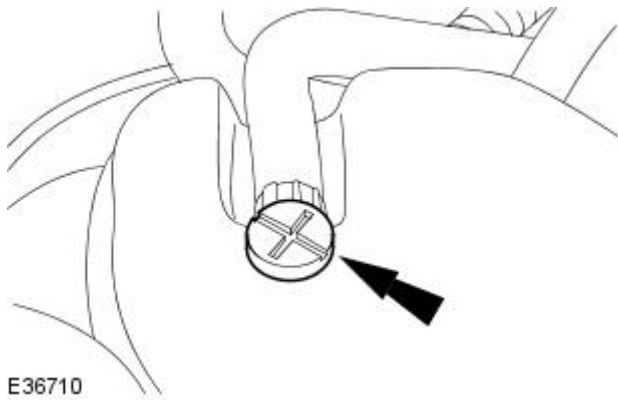
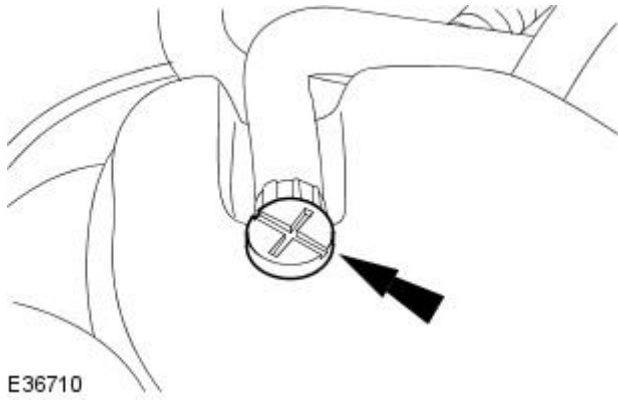
- Remove the drain tray.



E36709

- Lower the vehicle.

7. Loosen the coolant expansion tank bleed screw.




8.  **CAUTION:** Anti-freeze concentration must be maintained at 50%.

Refill the cooling system.

- When coolant runs from the expansion tank bleed point bubble-free, tighten the bleed screw.
- Tighten to 3 Nm.

9. Set the heating to the COLD position.

10.  **WARNING:** Release the cooling system pressure by slowly turning the coolant expansion tank cap a quarter of a turn. Cover the expansion tank cap with a thick cloth to prevent the possibility of scalding. Failure to follow this instruction may result in personal injury.

Set the ignition to the ON position.

11. After 3 minutes, set the heating system to the HOT position.
12. Maintain the coolant level in the coolant expansion tank at the MAX mark using a 50% mixture of Jaguar Premium Cooling System Fluid or equivalent, meeting Jaguar specification WSS M97B44-D and 50% water.
13. After 4 minutes, refit the coolant expansion tank pressure cap.
14. Start the engine and allow to idle for 5 minutes.
15. Raise the engine to 2500 RPM for 30 seconds.
16. Set the ignition to the OFF position.
17. Allow the engine to cool.
18. After 2 minutes, release the cooling system pressure.
  - Remove the coolant expansion tank pressure cap.

19. **NOTE:** Make sure the heating system is set to the HOT position.

Set the ignition to the ON position.

20. Maintain the coolant level in the coolant expansion tank at the MAX mark using a 50% mixture of Jaguar Premium Cooling System Fluid or equivalent, meeting Jaguar specification WSS M97B44-D and 50% water.
21. After 3 minutes, refit the coolant expansion tank pressure cap.
22. Drive the vehicle on the road at varying speeds until the engine reaches normal operating temperature.
23. Allow the engine to cool.
24. Release the cooling system pressure.
  - Remove the coolant expansion tank pressure cap.

25. Fill the cooling system up to the MAX mark on the coolant expansion tank using a 50% mixture of Jaguar Premium Cooling System Fluid or equivalent, meeting Jaguar specification WSS M97B44-D and 50% water.
26. Raise the vehicle.
27. Visually check the engine and cooling system for signs of coolant leakage.
28. Install the radiator splash shield.  
For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

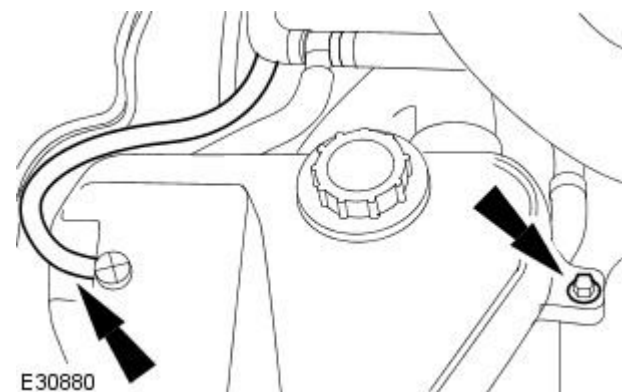
# Engine Cooling - TDV6 2.7L Diesel - Coolant Expansion Tank

Removal and Installation

## Removal

**WARNING:** To avoid having scalding hot coolant or steam blowing out of the cooling system, use extreme care when removing the coolant pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant pressure cap and turn it slowly until the pressure begins to release. Step back while the pressure is released from the system. When certain all the pressure has been released (still with a cloth) turn and remove the coolant pressure cap from the coolant expansion tank. Failure to follow these instructions may result in personal injury.

• **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.



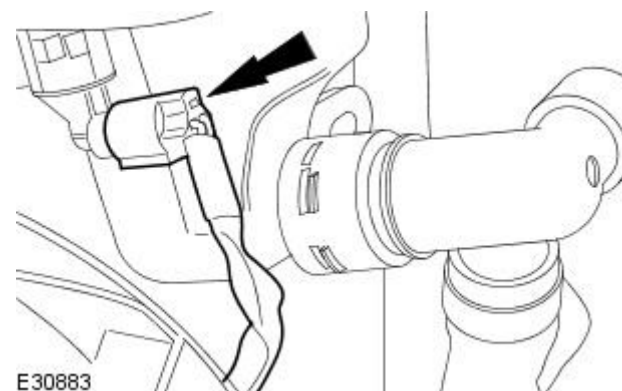
1. **CAUTION:** Take extra care when releasing the vent hose, failure to follow this instruction may result in damage to the coolant expansion tank.

• **NOTE:** Cap the vent hose to minimize coolant loss.

Release the coolant expansion tank.

- Disconnect the vent hose.
- Remove the retaining bolt.
- Release the coolant expansion tank from its mountings for access.

2. Disconnect the coolant expansion tank low level sensor electrical connector.

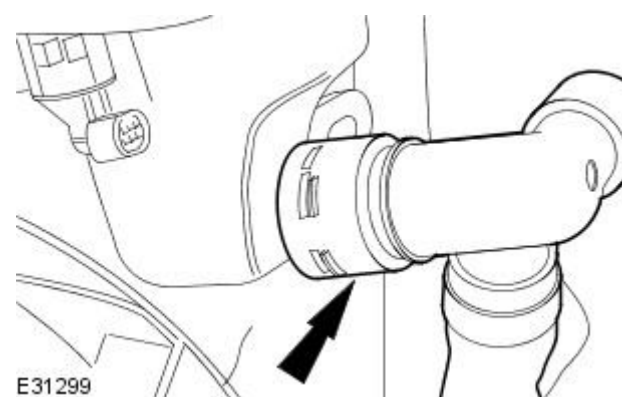


3. **NOTE:** Make sure the retaining clip is not removed.

• **NOTE:** Cap the coolant expansion tank lower hose to minimize coolant loss.

Disconnect the coolant expansion tank lower hose.

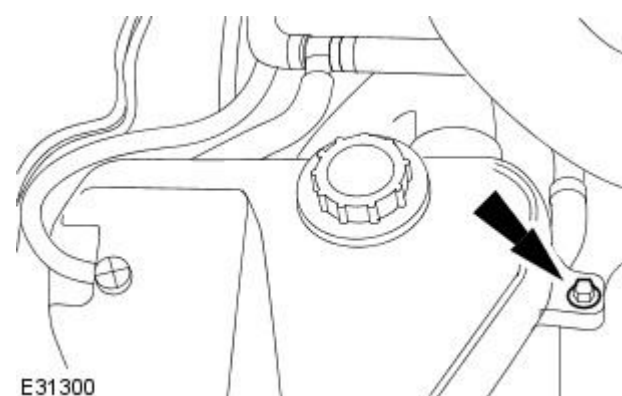
- Remove the coolant expansion tank.



## Installation

1. To install, reverse the removal procedure.

- Tighten the bolt to 3 Nm.



2. Fill the cooling system to the upper level mark of the coolant expansion tank.

# Engine Cooling - TDV6 2.7L Diesel - Cooling Fan Motor and Shroud

Removal and Installation

## Removal

1. Remove fuse F17 from the engine junction box (EJB).

- Remove the engine compartment fuse box cover.
- Remove the engine compartment fuse box inner cover.

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

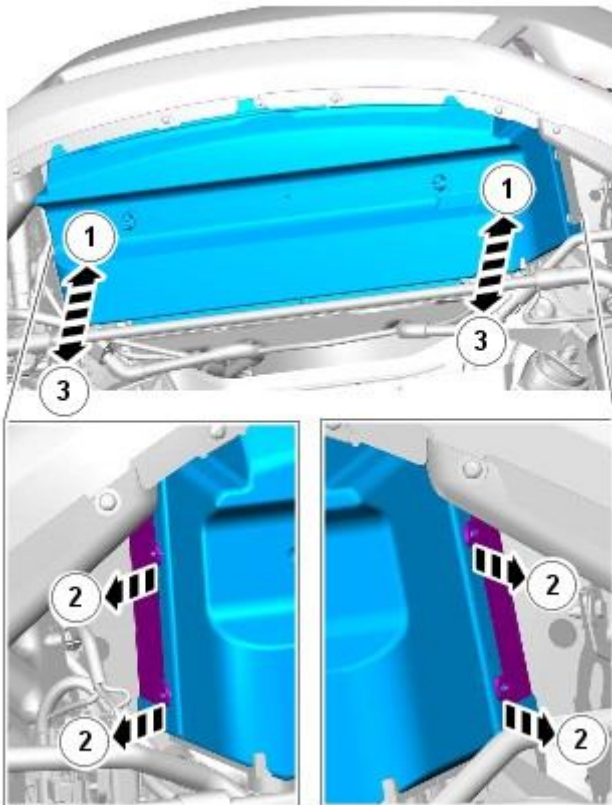
3. Remove the radiator splash shield.

For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

4. Remove the air deflector.

For additional information, refer to: [Air Deflector](#) (501-02, Removal and Installation).

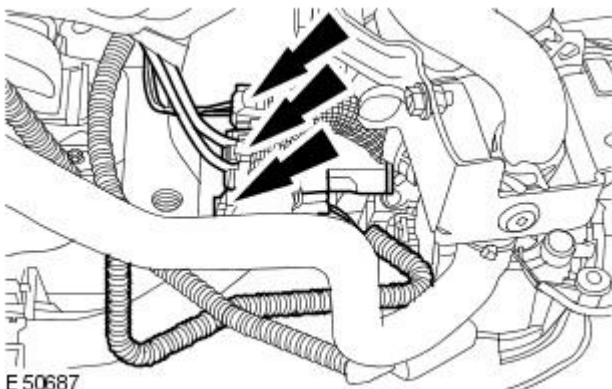
5. Release and remove the cooling fan lower shroud from the cooling pack.



E97870

6. Disconnect the two electrical connectors from the cooling module wiring harness.

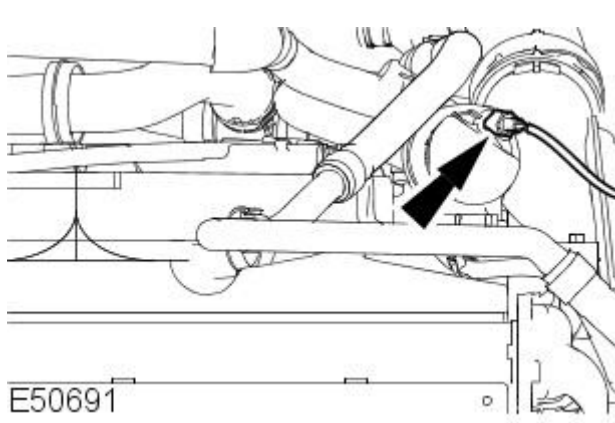
- Release the 2 electrical connectors from the clips.



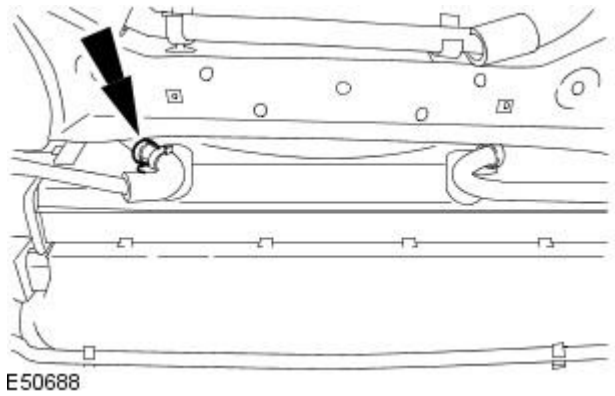
E 50687

**7. NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

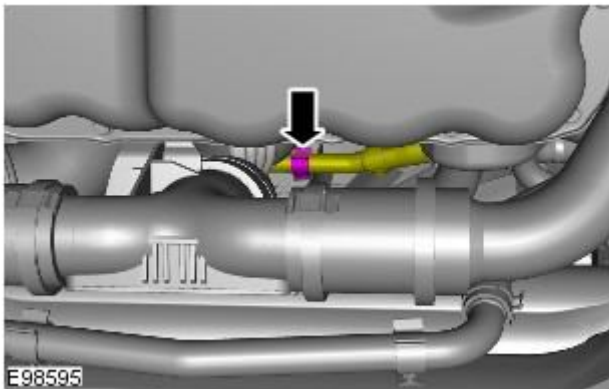
Disconnect the auxillary coolant flow pump electrical connector



**8.** Release the A/C line from the cooling fan shroud.



**9.** Release the coolant hose from the cooling fan shroud.



**10.** Lower the vehicle.

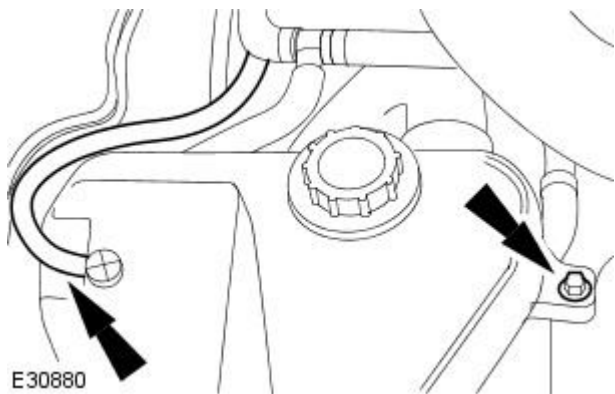
**11.** Remove the air cleaner.

For additional information, refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Removal and Installation).

**12. NOTE:** Cap the vent hose to minimize coolant loss.

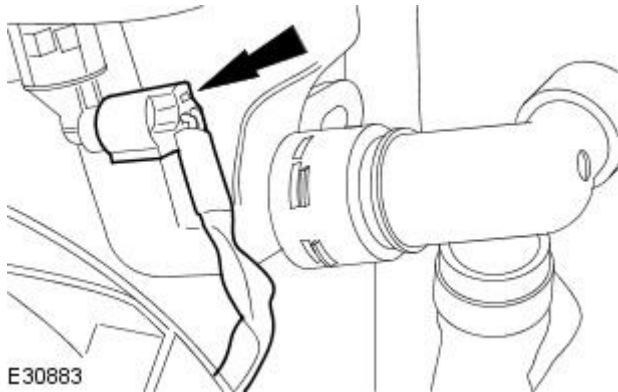
Release the coolant expansion tank.

- Release the vent hose.
- Remove the retaining bolt.
- Release the expansion tank from its mountings for access



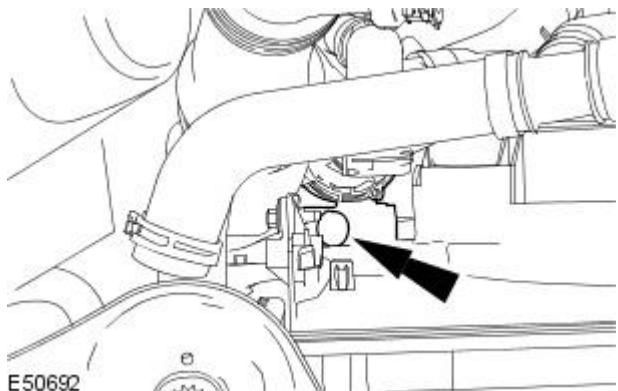


13. Disconnect the coolant expansion tank low level sensor electrical connector.



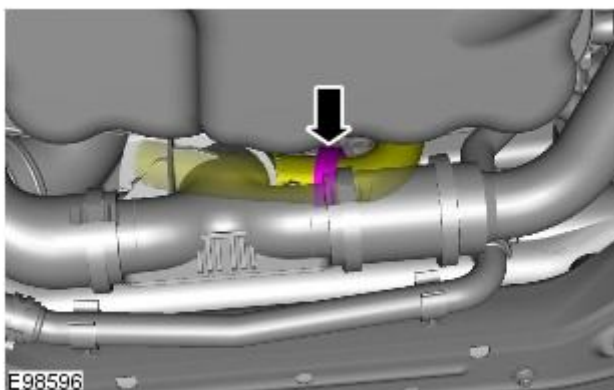
E30883

14. Release the auxiliary coolant pump.



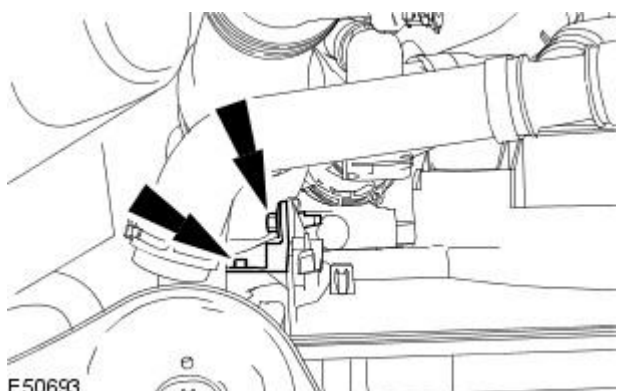
E50692

15. Release the coolant hose from the cooling fan shroud.



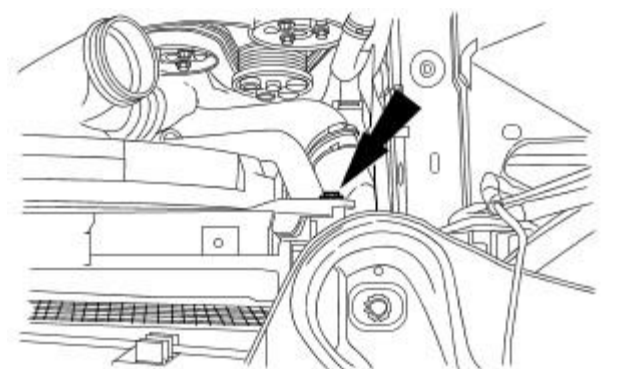
E98596

16. Remove the cooling fan motor and shroud securing bracket.



E50693

17. Remove the cooling fan motor and shroud retaining bolt

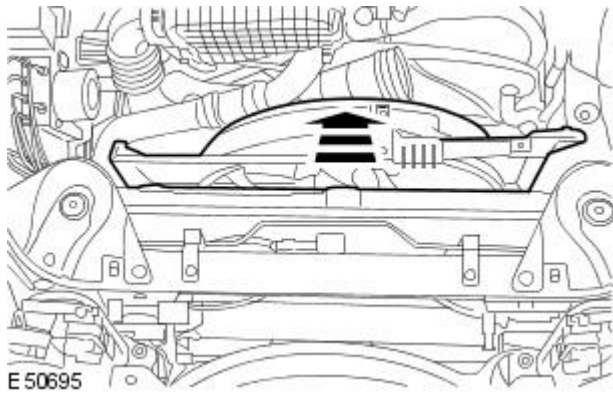


E50694

**18. NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Remove the cooling fan motor and shroud.

- Reposition the wiring harness.

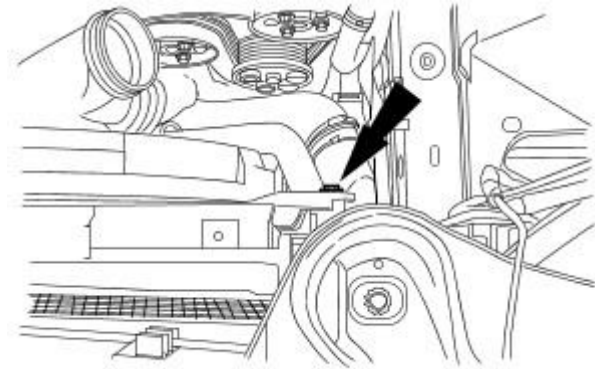


E 50695

## Installation

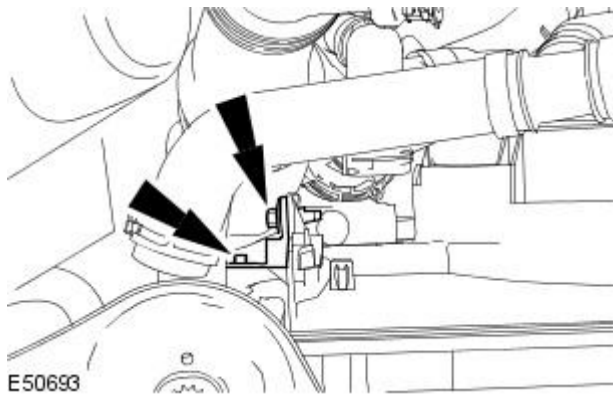
1. To install, reverse the removal procedure.

- Install the cooling fan motor and shroud retaining bolt.
- Tighten to 6 Nm.



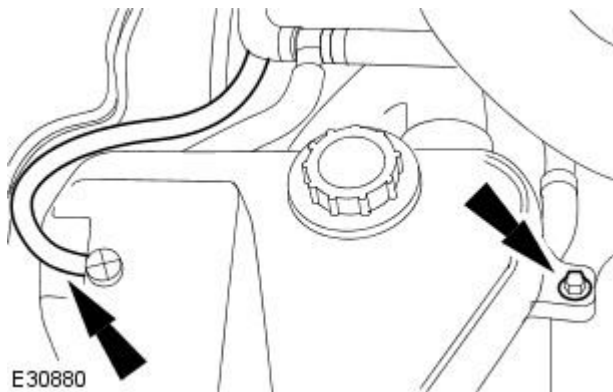
E50694

2. Tighten to 6 Nm.



E50693

3. Tighten to 6 Nm.




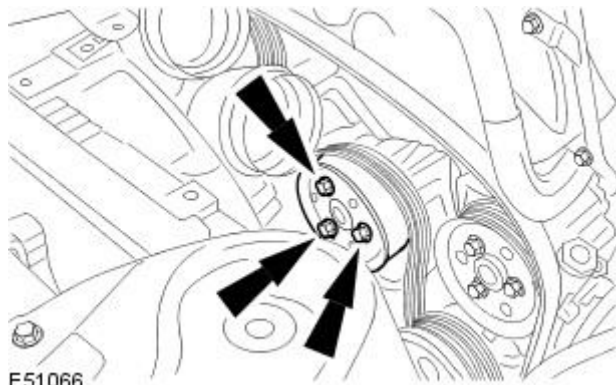
E30880

# Engine Cooling - TDV6 2.7L Diesel - Coolant Pump

Removal and Installation

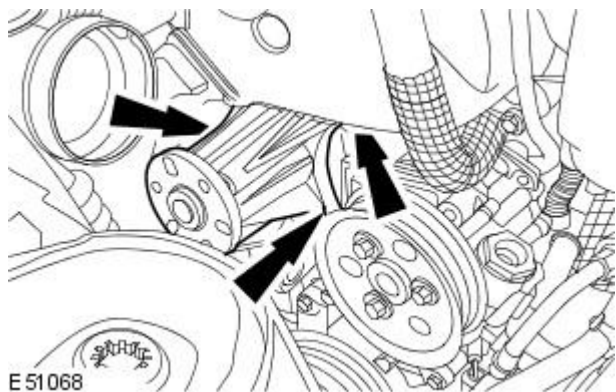
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the air cleaner.  
For additional information, refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Removal and Installation).
4. Drain the cooling system.  
For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 3.0L Petrol, General Procedures).
5. Remove the accessory drive belt.  
For additional information, refer to: [Accessory Drive Belt](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).
6. Remove the coolant pump pulley.
  - Using a suitable 6mm bar, retain the coolant pump pulley.
  - Discard the bolts.



7. **NOTE:** Remove and discard the O-ring seal.

Remove the coolant pump.



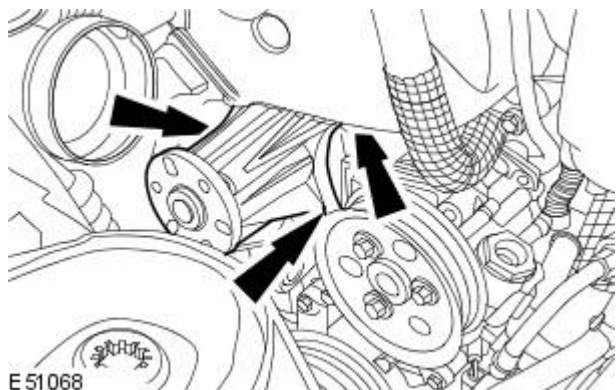
## Installation

1.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

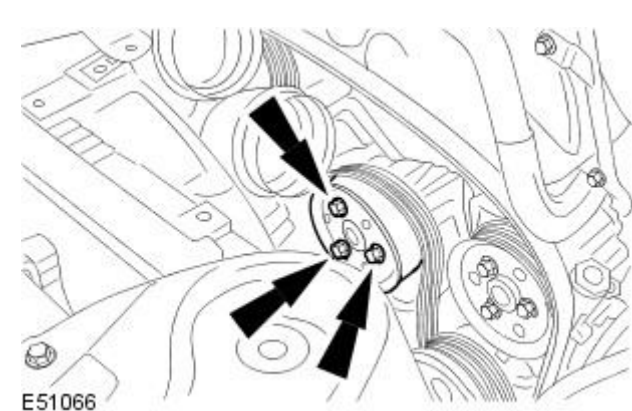
• **NOTE:** Lubricate the O-ring seal with clean coolant.

To install, reverse the removal procedure.

- Tighten to 10 Nm.



2. Tighten to 24 Nm.




E51066

# Engine Cooling - TDV6 2.7L Diesel - Radiator

Removal and Installation

## Removal

 **CAUTION:** Engine coolant will damage the paint finished surfaces. If spilled, immediately remove the coolant and clean the area with water.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

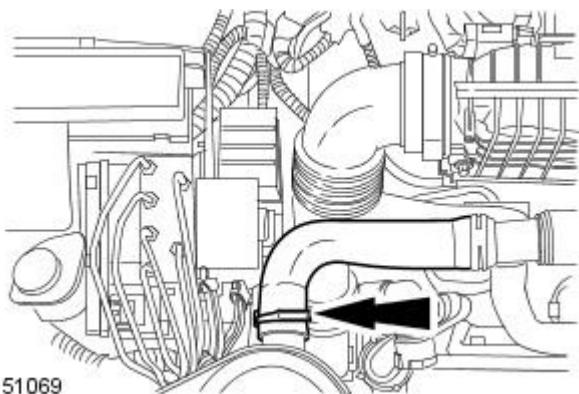
2. Drain the cooling system.

For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 3.0L Petrol, General Procedures).

3. Remove the cooling fan motor and shroud.

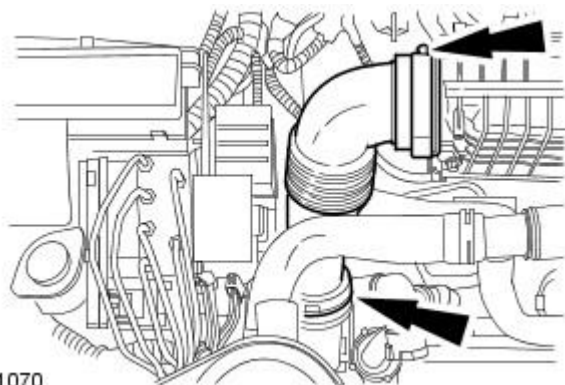
For additional information, refer to: [Cooling Fan Motor and Shroud](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation).

4. Disconnect the coolant top hose from the radiator.



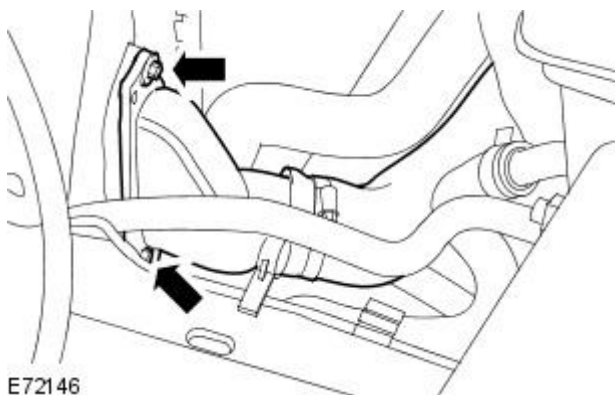
E51069

5. Remove the air intake elbow pipe.



E51070

6. Detach the charge air cooler intake elbow.



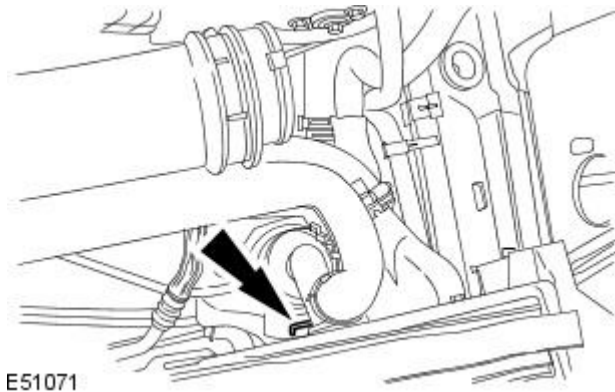
E72146



7.  CAUTION: Be prepared to collect escaping coolant.

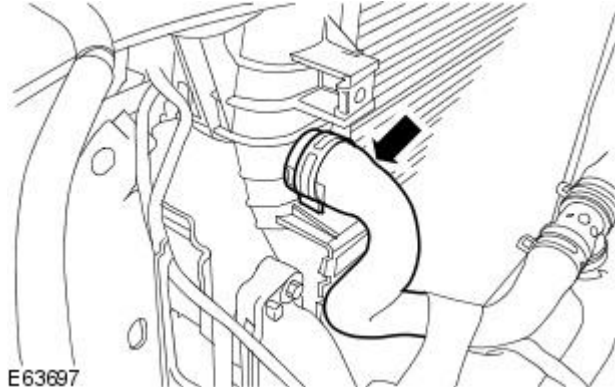
Disconnect the thermostat housing lower radiator hose.

- Release the retaining clip.



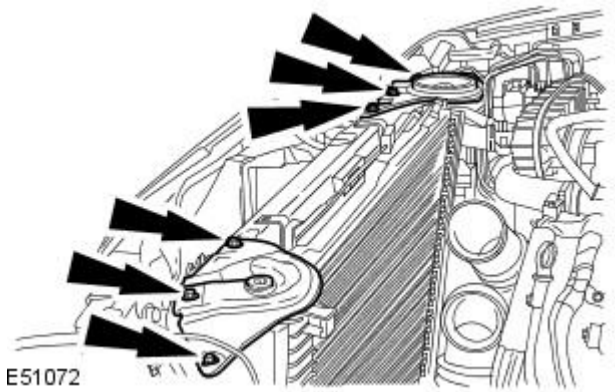
E51071

8. Disconnect the coolant hose.



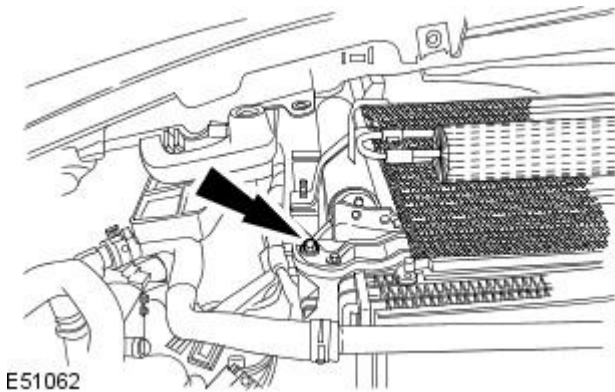
E63697

9. Remove the radiator upper mountings.



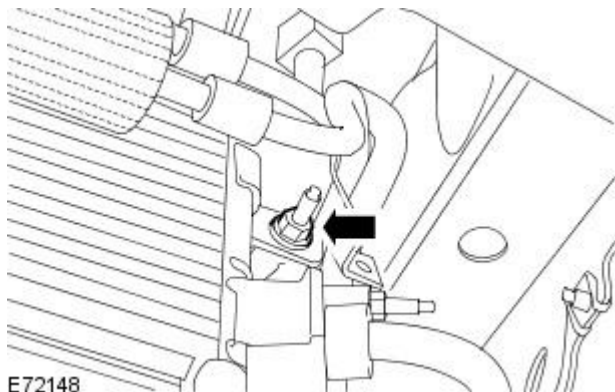
E51072

10. Remove the right-hand A/C condenser retaining bolt.



E51062

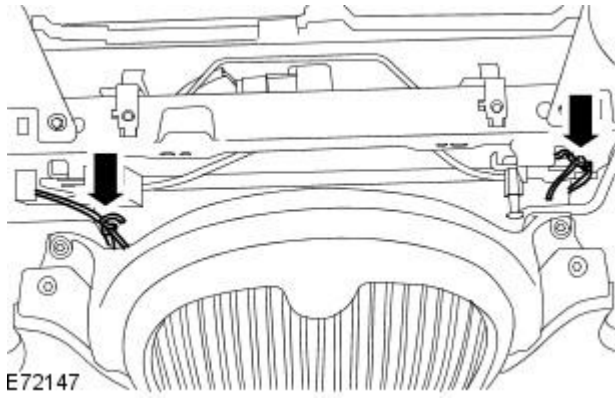
11. Remove the left-hand A/C condenser retaining stud.



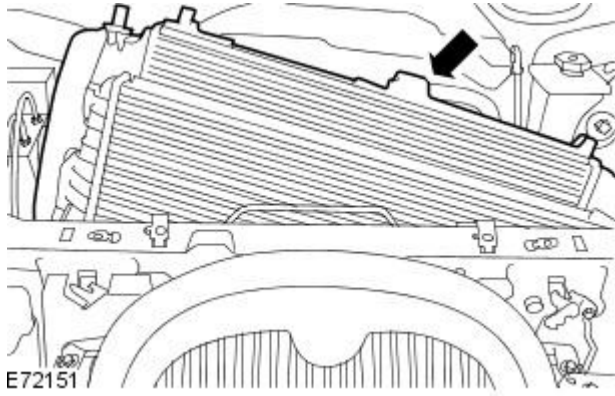
E72148



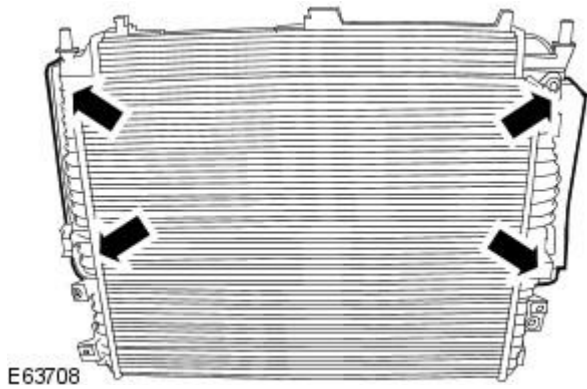
12. Tie the A/C condenser forwards, clear of the radiator.



13. With assistance, remove the radiator assembly.

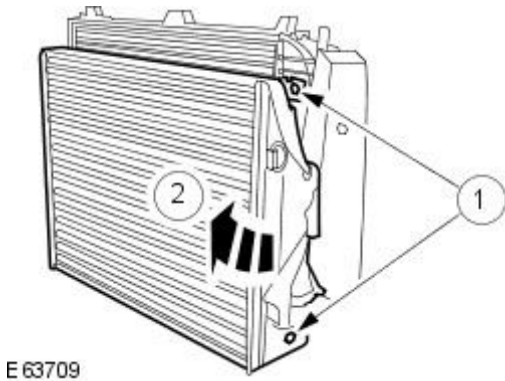


14. Remove the foam insulation pads.



15. Remove the charge air cooler from the radiator.

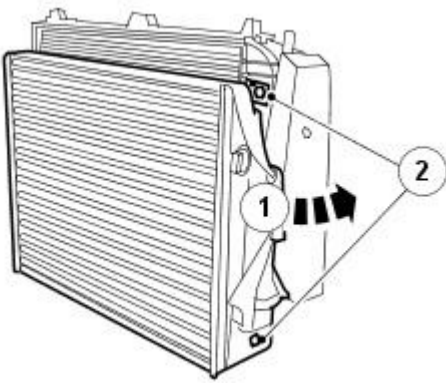
1. Remove the charge air cooler retaining bolts.



## Installation

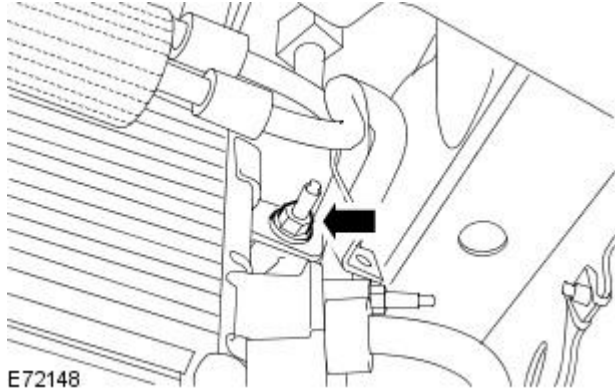
1. To install, reverse the removal procedure.

- Tighten to 7 Nm.



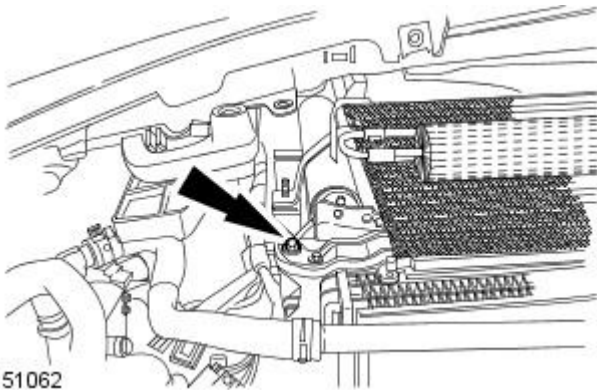
E63764

2. Tighten to 7 Nm.



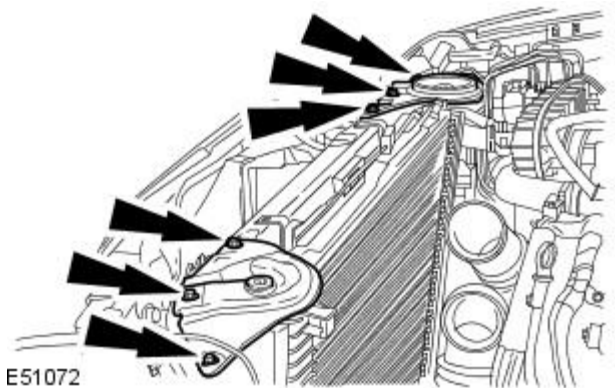
E72148

3. Tighten to 7 Nm.



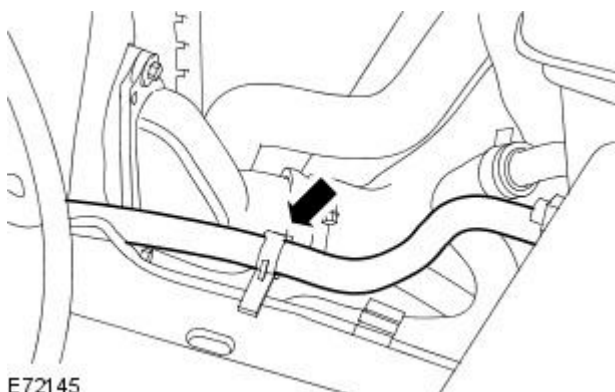
E51062

4. Tighten to 7 Nm.



E51072

5. Tighten to 7 Nm.



E72145

# Engine Cooling - TDV6 2.7L Diesel - Thermostat

Removal and Installation

## Special Tool(s)

Remover/Install, Cooling Hose Clamp


303-397

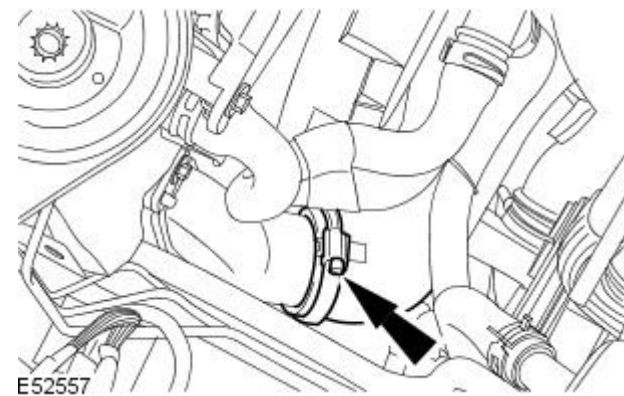
303-397



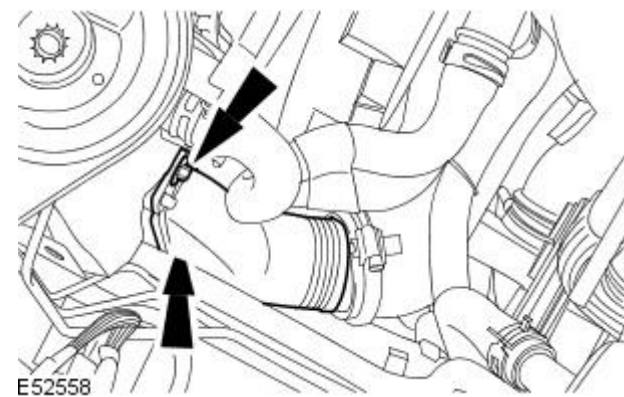
E94108

## Removal

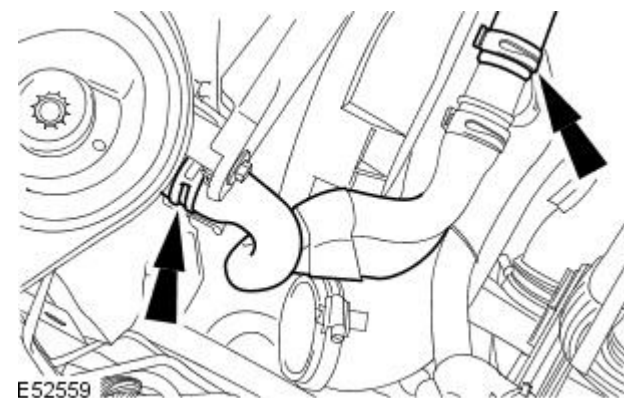
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Make sure to support the vehicle with axle stands.  
  
Raise and support the vehicle.
3. Drain the cooling system.  
For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).
4. Remove the air cleaner.  
For additional information, refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Removal and Installation).
5. Detach the charge air cooler inlet hose.



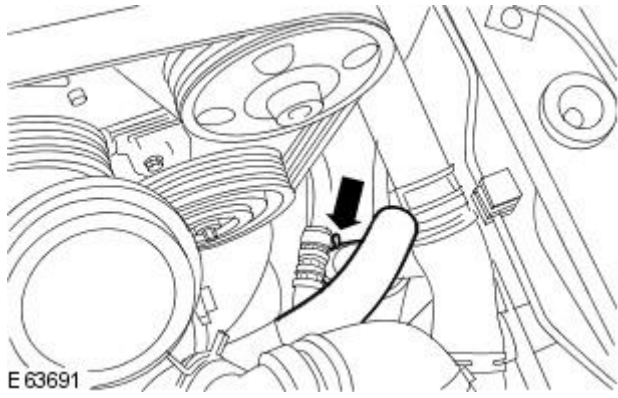
6. Remove the charge air cooler inlet elbow.



7. Detach the coolant hoses.



8. Detach the transmission fluid cooler hose.

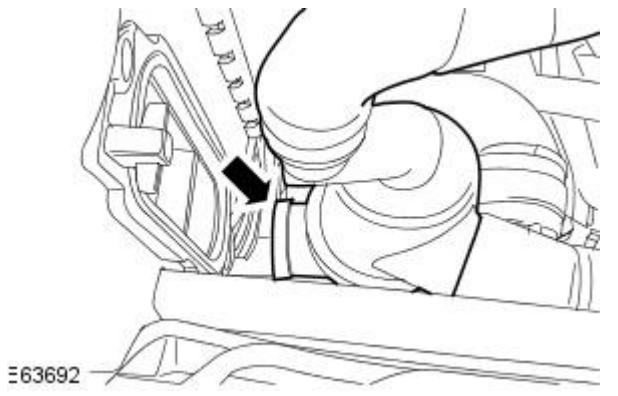


9. Remove the coolant expansion tank.  
For additional information, refer to: [Coolant Expansion Tank](#) (303-03B Engine Cooling - V6 3.0L Petrol, Removal and Installation).

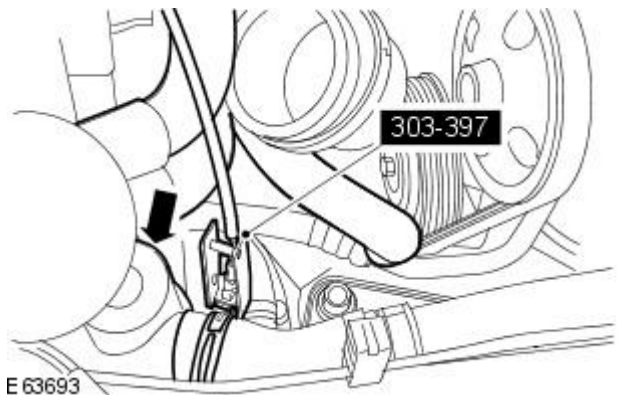
10. Detach the coolant hose.



11. Detach the thermostat and hose assembly.

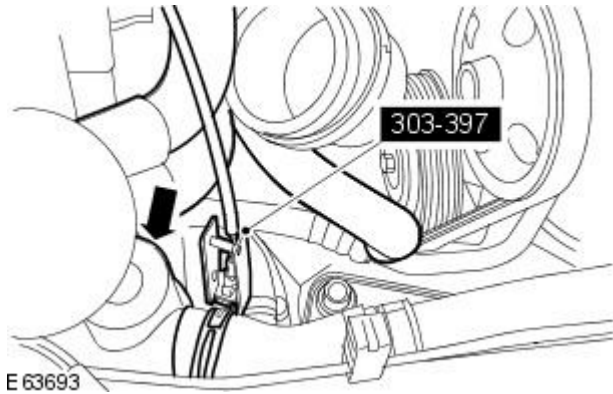


12. Remove the thermostat and hose assembly.

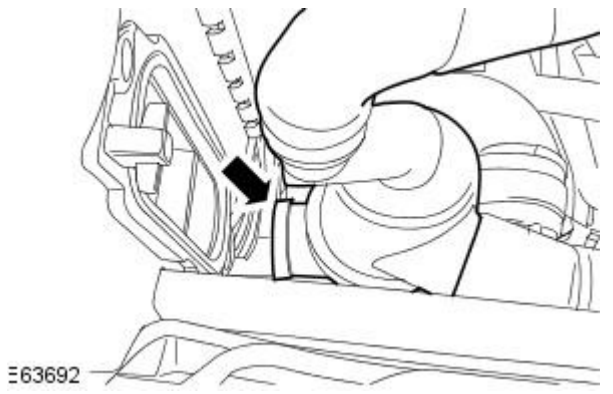


## Installation

1. Install the thermostat and hose assembly.



2. Attach the thermostat and hose assembly.

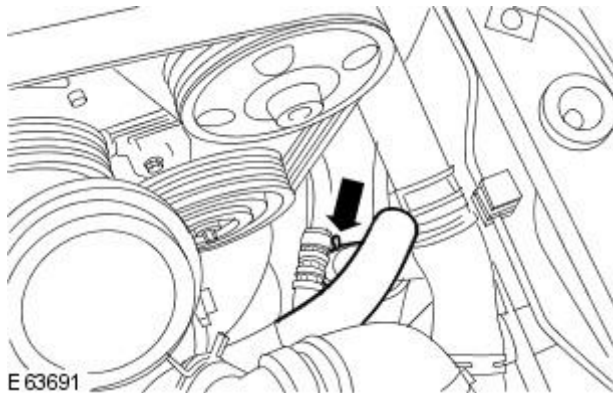


3. Attach the coolant hose.



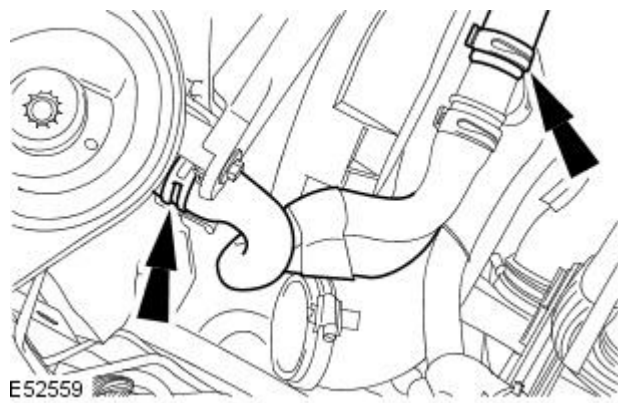
4. Install the coolant expansion tank.  
For additional information, refer to: [Coolant Expansion Tank](#) (303-03B Engine Cooling - V6 3.0L Petrol, Removal and Installation).

5. Attach the transmission fluid cooler hose.



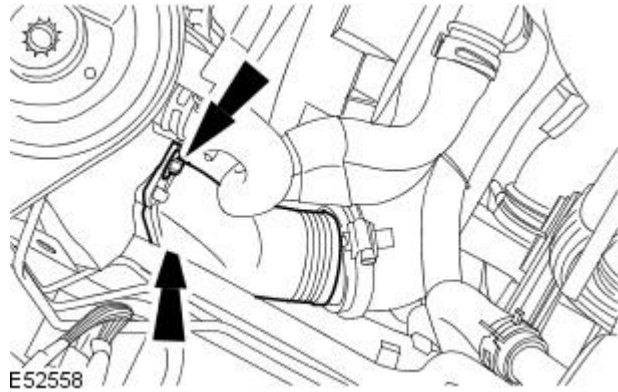


6. Attach the coolant hoses.

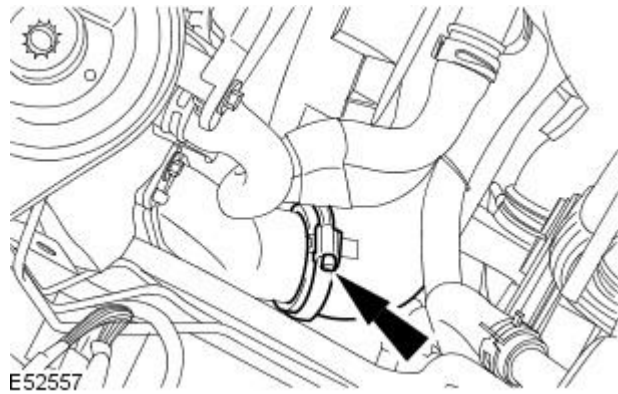


7. Install the charge air cooler inlet elbow.

- Tighten to 7 Nm.



8. Attach the charge air cooler inlet hose.



9. Install the air cleaner.

For additional information, refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Removal and Installation).

10. Refill the cooling system.

For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).

11. Reconnect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).



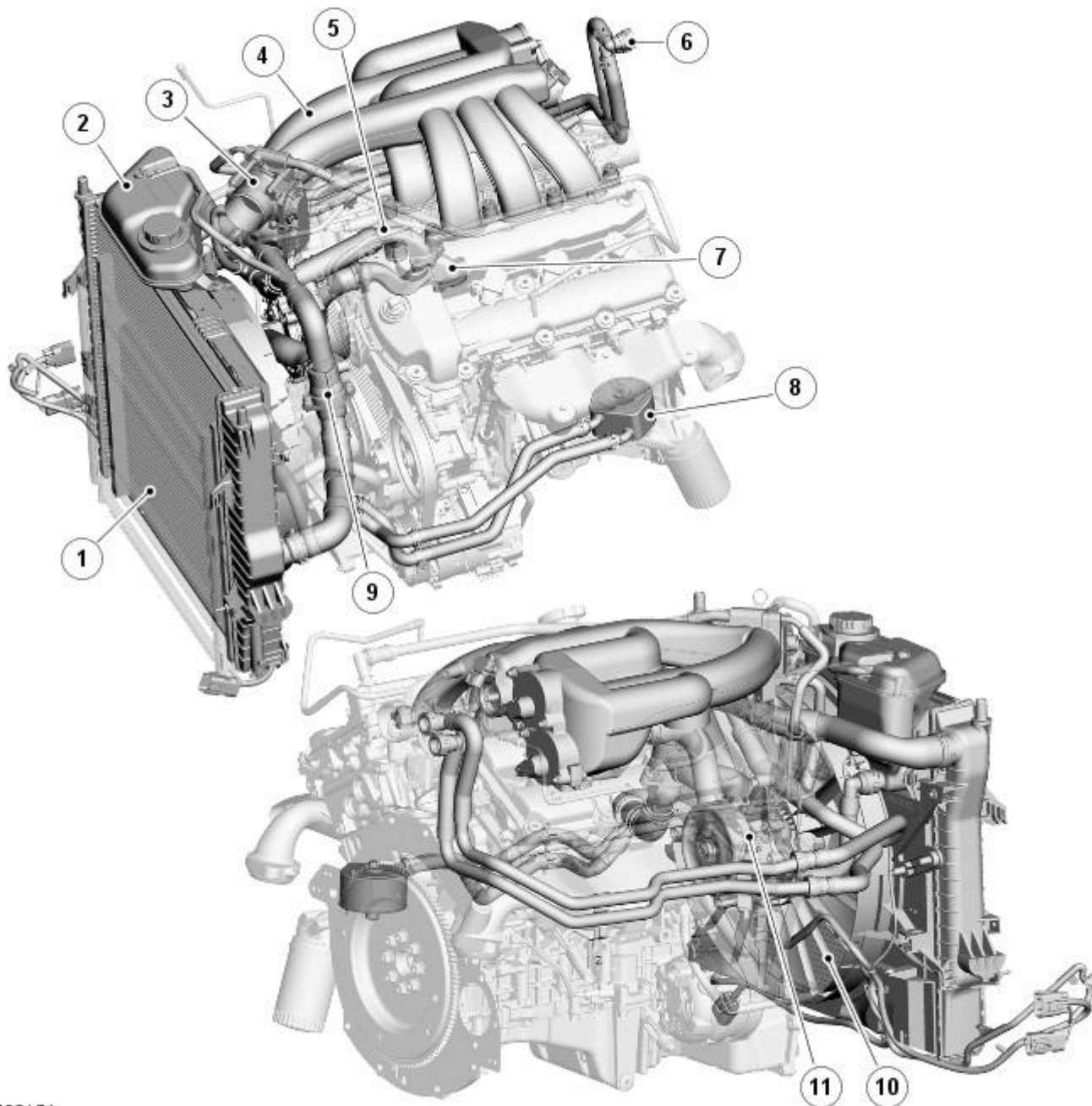
**Engine Cooling - V6 3.0L Petrol -**

Description		Specification		
Jaguar Premium Cooling System Fluid		WSS M97B44-D		
Jaguar Premium Cooling System Flush		EGR-M14P7-A		
Engine	Capacity			
3.0L	9.4L			
Description	Nm	lb-ft	lb-in	
Coolant expansion tank retaining bolt	3	-	27	
Coolant bleed screw(s)	3	-	27	
Cooling fan motor and shroud retaining nuts	7	-	62	
Thermostat housing retaining bolts	10	-	89	
Water pump retaining bolts	25	18	-	
Radiator mounting bracket retaining bolts	7	-	62	
Radiator drain plug	1	-	9	
Engine block drain plug	50	37		

# Engine Cooling - V6 3.0L Petrol - Engine Cooling - Component Location

Description and Operation

Component Location (Sheet 1 of 2)

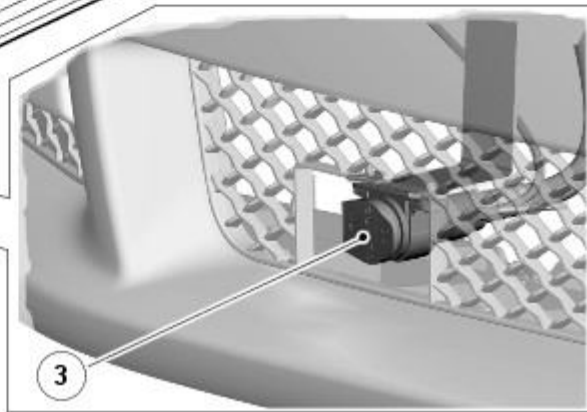
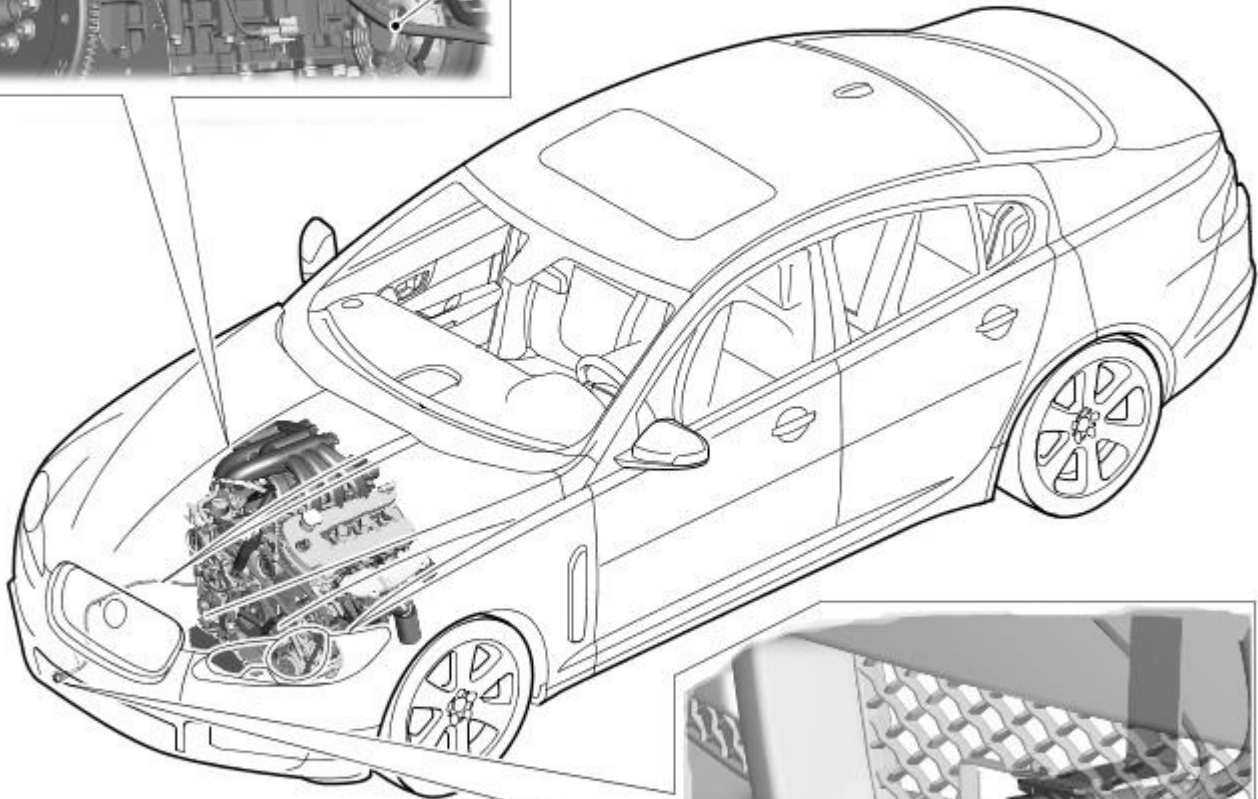
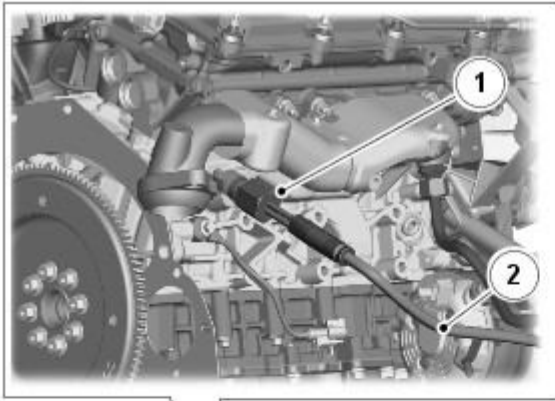


E98154

## ItemDescription

1	Radiator
2	Expansion tank
3	Throttle body
4	Intake manifold
5	Bypass (Outlet) tube assembly
6	Heater core supply and return connections
7	Transfer (Inlet) connector
8	Engine oil cooler
9	Thermostat
10	Cooling fan
11	Coolant pump

Component Location (Sheet 2 of 2)



E97775

**ItemDescription**

- 1 Engine block heater

**Comments:**

240 V ac version shown, 110 V ac version similar.

- 2 Harness

- 3 Connector

# Engine Cooling - V6 3.0L Petrol - Engine Cooling - Overview

Description and Operation

## Overview

The engine cooling system maintains the engine within an optimum temperature range under changing ambient and engine operating conditions. It also provides:

- Heating for:
  - The passenger compartment.  
Refer to: [Heating and Ventilation](#) (412-01 Climate Control, Description and Operation).
  - The inlet manifold and throttle body.
- Cooling for:
  - The engine lubrication system.
  - The transmission lubrication system.  
Refer to: [Transmission Cooling - Vehicles With: ZF 6HP26](#) (307-02 Transmission/Transaxle Cooling - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel, Description and Operation).

# Engine Cooling - V6 3.0L Petrol - Engine Cooling - System Operation and Component Description

## Description and Operation

### System Operation

When the engine is running the coolant is circulated around the engine cooling system by the coolant pump. From the outlet of the coolant pump, coolant flows through the cylinder block and cylinder heads, then into the radiator upper hose. When the coolant is cold, the thermostat is closed and the coolant returns to the inlet of the coolant pump through the thermostat housing. When the coolant is warm, the thermostat is open and the coolant flows to the inlet of the coolant pump via the radiator, the radiator lower hose and the thermostat housing.

When the thermostat is open, the coolant flow through the radiator lower hose generates a coolant flow through the engine oil cooler.

The heater core and the inlet manifold/throttle body are on parallel circuits that are unaffected by the position of the thermostat. A constant flow of coolant is supplied to the heater core and the inlet manifold/throttle body from the radiator upper hose. The return flow from the inlet manifold/throttle body joins the supply to the heater core. From the heater core, the coolant returns to a dedicated inlet on the coolant pump. Expansion and contraction of the coolant is accommodated by the hose connection between the expansion tank and the heater return hose.

If the coolant level in the expansion tank decreases below a predetermined value, the level sensor connects a ground to the instrument cluster, which activates the appropriate warning.

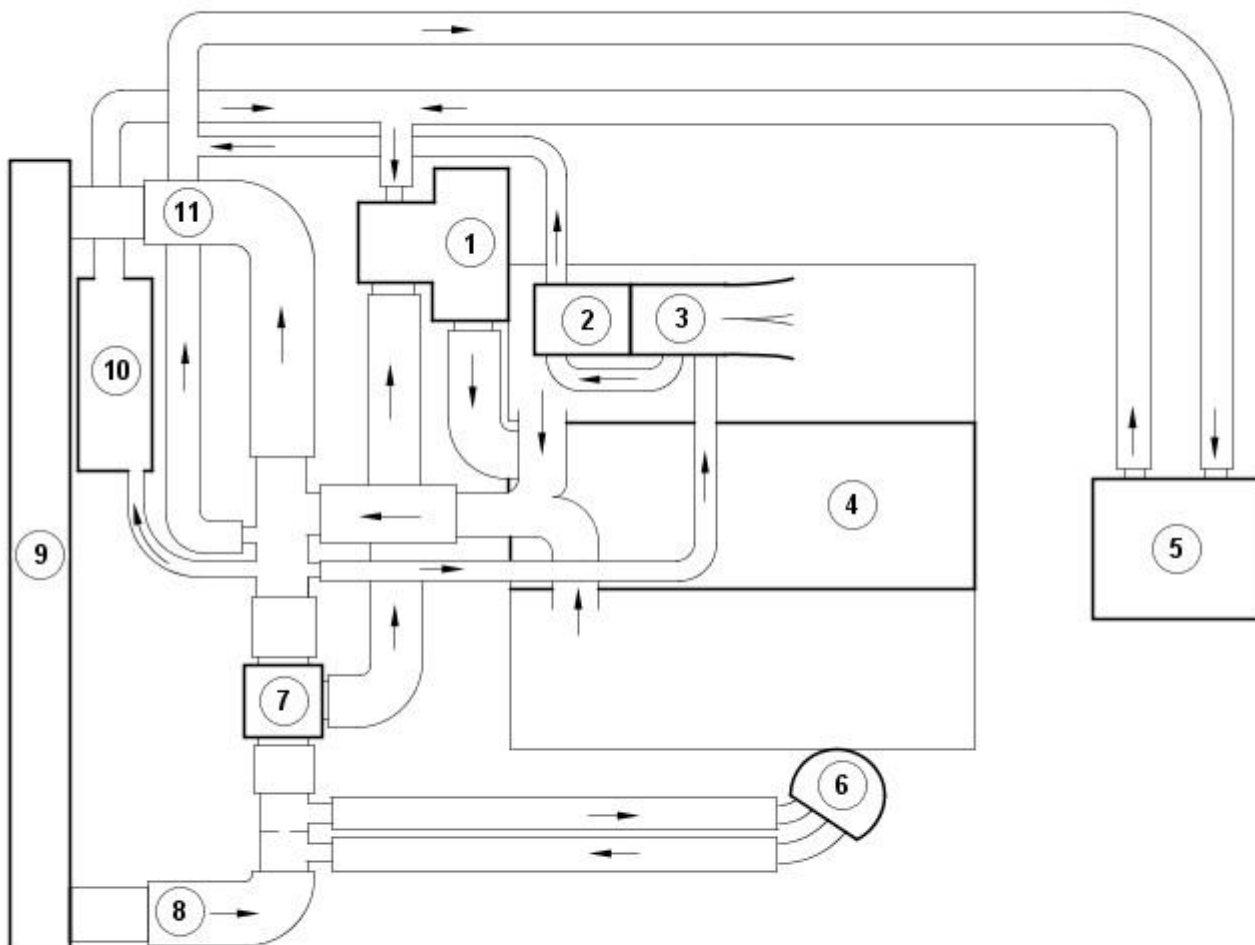
Refer to: [Instrument Cluster](#) (413-01 Instrument Cluster, Description and Operation).

The cooling fan is operated by a fan control module integrated into the cooling fan motor. The fan control module regulates the voltage, and thus speed, of the cooling fan motor in response to a **PWM (pulse width modulation)** signal from the **ECM (engine control module)**. The **ECM** calculates the required fan speed from the engine temperature, **A/C (air conditioning)** system pressure and transmission oil temperature.

Under hot operating conditions, the fan may continue to operate for four minutes after the engine has been switched off.

Refer to: [Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 3.0L Petrol, Description and Operation).

### Engine Cooling Flow Diagram



1	Coolant pump
2	Throttle body
3	Inlet manifold
4	Engine
5	Heater core
6	Engine oil cooler
7	Thermostat
8	Radiator lower hose
9	Radiator
10	Coolant expansion tank
11	Radiator upper hose

## Component Description

### General

The primary components of the engine cooling system are the:

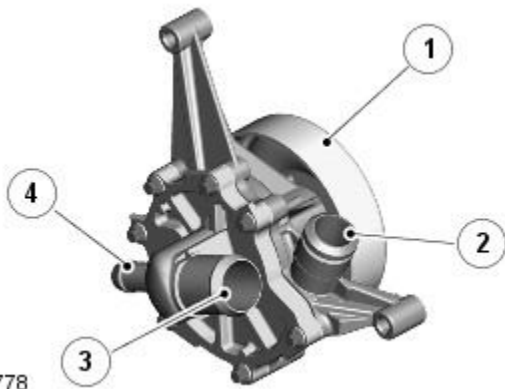
- Coolant pump.
- Thermostat.
- Radiator.
- Cooling fan.
- Expansion tank.
- Engine oil cooler.
- Connecting hoses and pipes.

The engine cooling system also supplies coolant to:

- The heater core.  
Refer to: [Heating and Ventilation](#) (412-01 Climate Control, Description and Operation).
- The transmission oil cooler.  
Refer to: [Transmission Cooling - Vehicles With: ZF 6HP26](#) (307-02 Transmission/Transaxle Cooling - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel, Description and Operation).

In markets subject to very cold climatic conditions, an engine block heater is incorporated into the engine cooling system.

### Coolant Pump



#### ItemDescription

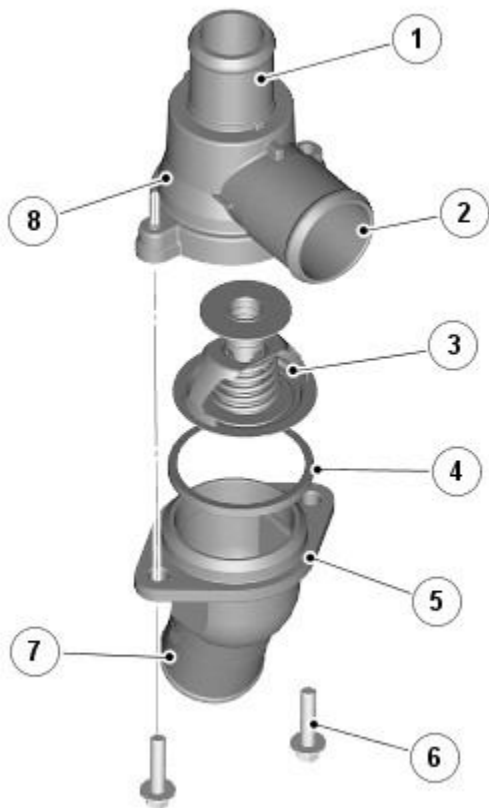
1	Pulley
2	Outlet connection to cylinder block
3	Inlet connection from thermostat
4	Inlet connection from heater core

The coolant pump consists of a body that contains an impeller connected to a pulley at the rear of the body. Coolant inlet and outlet connections are incorporated into the body, which is attached to the front cover of the engine. The pulley is driven by the accessory drive belt.

Refer to: [Accessory Drive](#) (303-05 Accessory Drive - 3.0L, Description and Operation).

### Thermostat





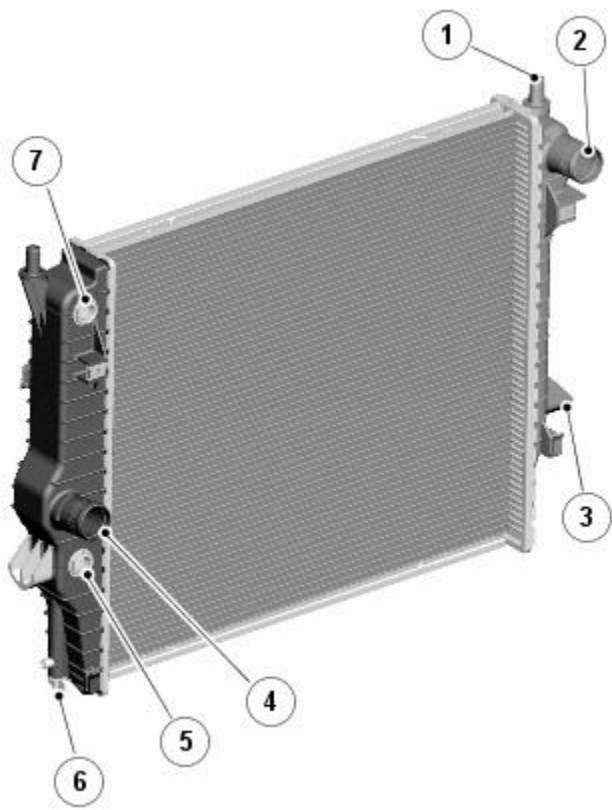
E97779

**ItemDescription**

1	Radiator upper hose connection
2	Coolant pump inlet hose connection
3	Thermostat
4	O-ring
5	Inlet connector
6	Bolt (2 off)
7	Radiator lower hose connection
8	Thermostat housing

The thermostat allows rapid engine warm-up, by restricting coolant flow through the radiator when the engine is cold, and helps to keep the engine operating temperature within predetermined limits. The thermostat is installed in a housing at the junction of the coolant pump inlet hose, the radiator lower hose and the radiator upper hose. The thermostat begins to open at 88 - 92 °C (190 - 198 °F) and is fully open at 102 °C (216 °F).

**Radiator**



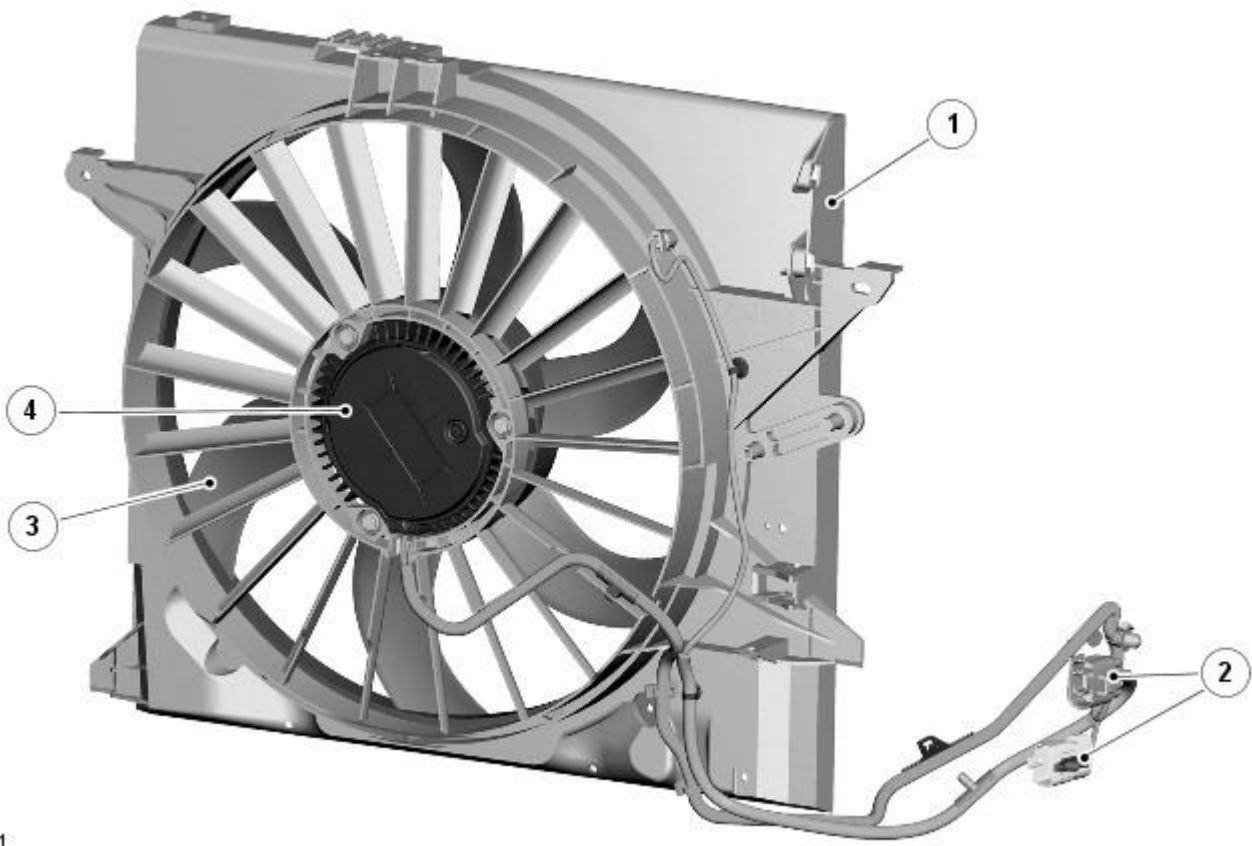
E97780

**ItemDescription**

1	Locating spigot (2 off)
2	Coolant inlet
3	Support (2 off)
4	Coolant outlet
5	Transmission oil outlet
6	Drain plug
7	Transmission oil inlet

The radiator is a cross flow type with an aluminum core and plastic end tanks. The radiator is located in the vehicle by locating spigots and supports integrated into the end tanks. The supports are installed in rubber bushes in the upper chassis rails. The locating spigots are installed in rubber bushes in the front end carrier. The transmission oil cooler and a drain plug are integrated into the **LH (left-hand)** end tank. Coolant inlet and outlet connections are incorporated into the **RH (right-hand)** and **LH** end tanks respectively.

**Cooling Fan**



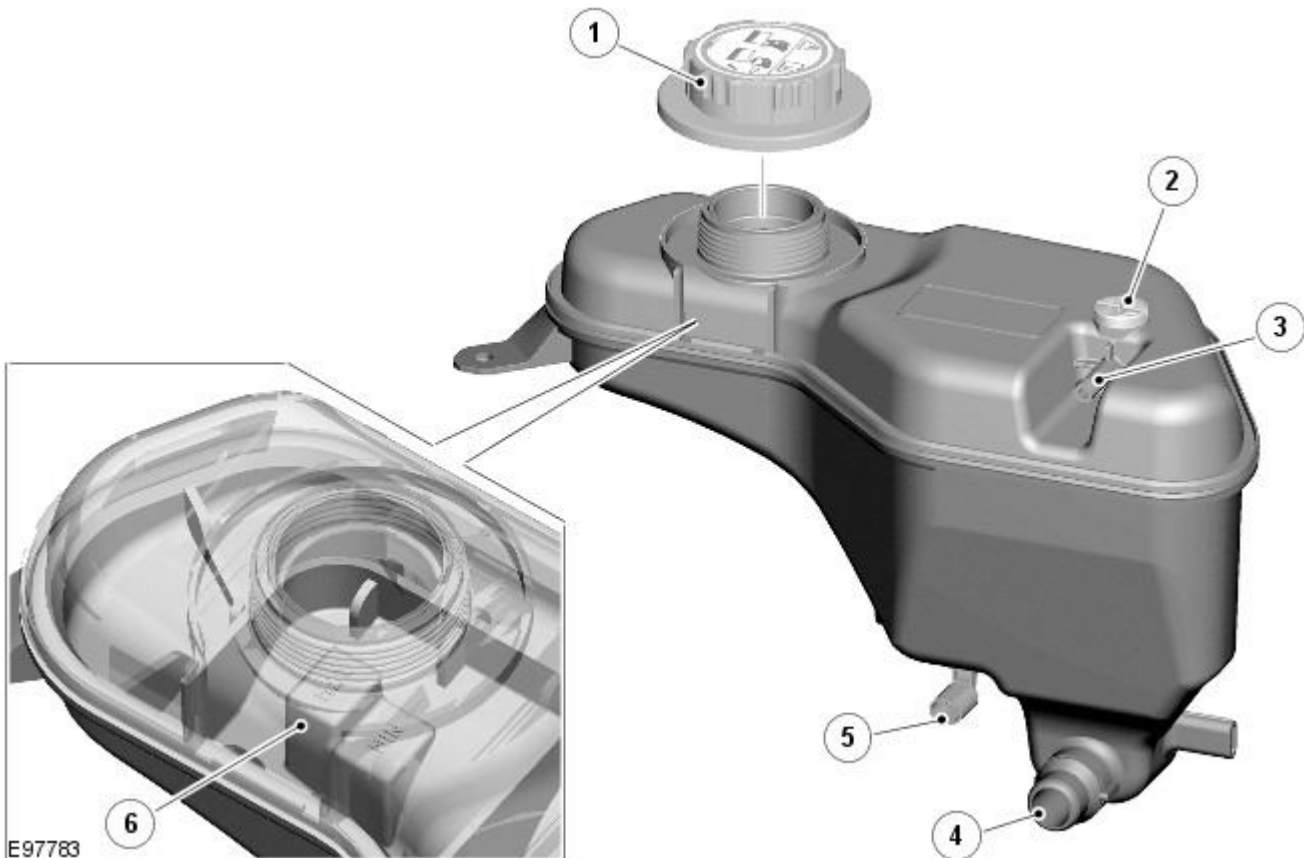
E97781

**ItemDescription**

1	Shroud
2	Electrical connectors
3	Fan
4	Motor and fan control module

An electric, variable speed cooling fan is installed in a shroud attached to the rear of the radiator. The cooling fan is operated by a fan control module, integrated into the electric motor, under the control of the [ECM](#). Two electrical connectors at the [RH](#) side of the shroud provide the interface between the cooling fan harness and the vehicle wiring.

**Expansion Tank**



E97783

**ItemDescription**

1	Filler cap
2	Bleed screw

3	Vent hose connection
4	Expansion hose connection
5	Level sensor
6	Level markings

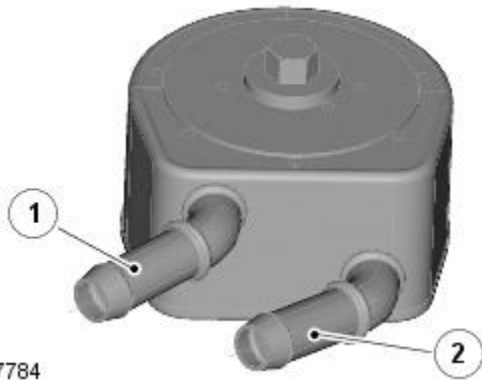
A pressurized expansion tank system is used which continuously separates the air from the cooling system and replenishes the system through a hose connected between the expansion tank and the heater return hose. A continuous vent into the expansion tank, through a hose connected to the radiator upper hose, prevents air locks from forming in the cooling system.

The expansion tank is installed behind the top right corner of the radiator. A filler cap, bleed screw and level sensor are incorporated into the expansion tank. MAX and MIN level markings are molded into the interior of the tank below the filler cap. The expansion tank provides the following functions:

- Service fill.
- Coolant expansion during warm-up.
- Air separation during operation.
- System pressurization by the filler cap.

The expansion tank has an air space of approximately 0.5 to 1 liter (1.06 to 2,11 US pints), above the MAX level, to allow for coolant expansion.

## Engine Oil Cooler



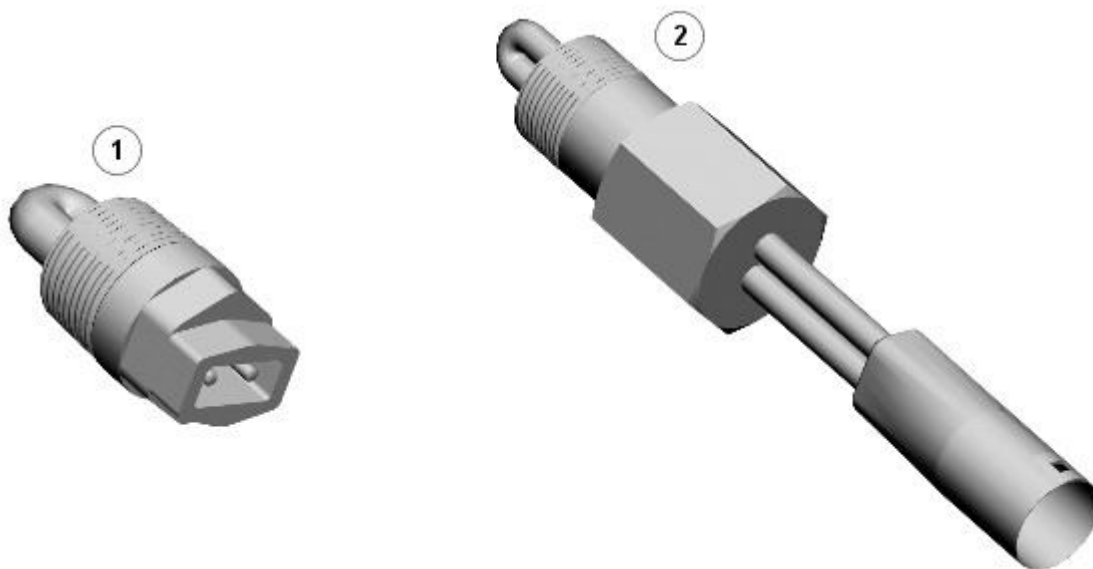
E97784

### ItemDescription

1	Coolant outlet
2	Coolant inlet

The engine oil cooler is located on the [LH](#) side of the engine, on the oil filter adapter. Engine oil is cooled as it flows from the filter back to the cylinder block. The coolant supply and return hoses for the engine oil cooler are connected to a T insert in the radiator lower hose. A restrictor in the T insert, between the two oil cooler connections, induces the flow of coolant through the oil cooler.

## Engine Block Heater



E97782

### ItemDescription

1	110 V ac version
2	240 V ac version

For vehicle markets subject to very cold climatic conditions, an engine block heater is installed in place of the cylinder block drain plug. The engine block heater is either a 110 V ac or 240 V ac electric heater element, depending on the market, which can be connected to a domestic power supply via a connector in the lower center grill of the front bumper.

## Engine Coolant

The engine coolant is formulated to last for ten years or 240,000 km (150,000 miles). The coolant is silicate free and must not be mixed with conventional engine coolant.

# Engine Cooling - V6 3.0L Petrol - Engine Cooling

Diagnosis and Testing

## Principles of Operation

For a detailed description of the petrol engine cooling system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (303-03B Engine Cooling - V6 3.0L Petrol)

[Engine Cooling](#) (Description and Operation),

[Engine Cooling](#) (Description and Operation),

[Engine Cooling](#) (Description and Operation).

## Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>Leaks</li> <li>Coolant expansion tank</li> <li>Electric fan</li> <li>Radiator</li> </ul>	<ul style="list-style-type: none"> <li>Fuse</li> <li>Wiring harness</li> <li>Loose or corroded connector(s)</li> <li>Engine Coolant Temperature (ECT) sensor</li> </ul>

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If there are clear symptoms refer to the table below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Coolant loss	<ul style="list-style-type: none"> <li>Hoses</li> <li>Hose connections</li> <li>Radiator</li> <li>Coolant pump</li> <li>Heater core</li> <li>Gaskets</li> <li>Engine casting cracks</li> <li>Engine block core plugs</li> </ul>	<ul style="list-style-type: none"> <li>GO to Pinpoint Test <a href="#">A.</a></li> </ul>
Engine overheating	<ul style="list-style-type: none"> <li>Engine coolant (level/condition)</li> <li>Thermostat</li> <li>Fan motor</li> <li>Fan motor fuses and/or circuits</li> <li>ECT sensor</li> <li>Engine control module (ECM)</li> <li>Fan speed module</li> </ul>	<ul style="list-style-type: none"> <li>GO to Pinpoint Test <a href="#">B.</a></li> </ul>
Engine not reaching normal operating temperature	<ul style="list-style-type: none"> <li>Thermostat</li> <li>Electric fan</li> <li>Fan speed module</li> </ul>	<ul style="list-style-type: none"> <li>GO to Pinpoint Test <a href="#">C.</a></li> </ul>

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the module or a component is suspect and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the Check and installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P011623	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>Low coolant level</li> <li>ECT sensor sensing circuit - intermittent high resistance</li> <li>Engine thermostat failure</li> <li>ECT sensor failure</li> </ul>	Fill cooling system to correct level and specification. REFER to: <a href="#">Specifications</a> (303-03B Engine Cooling - V6 3.0L Petrol, Specifications). Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor circuits for intermittent high resistance. Check and install new engine thermostat as required. Check and install a new ECT sensor as required

DTC	Description	Possible Cause	Action
P011624	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>Low coolant level</li> <li>ECT sensor sensing circuit - intermittent high resistance</li> <li>Engine thermostat failure</li> <li>ECT sensor failure</li> </ul>	Fill cooling system to correct level and specification. REFER to: <a href="#">Specifications</a> (303-03B Engine Cooling - V6 3.0L Petrol, Specifications). Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor circuits for intermittent high resistance. Check and install new engine thermostat as required. Check and install a new ECT sensor as required
P011629	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>Low coolant level</li> <li>ECT sensor sensing circuit - intermittent high resistance</li> <li>Engine thermostat failure</li> <li>ECT sensor failure</li> </ul>	Fill cooling system to correct level and specification. REFER to: <a href="#">Specifications</a> (303-03B Engine Cooling - V6 3.0L Petrol, Specifications). Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor circuits for intermittent high resistance. Check and install new engine thermostat as required. Check and install a new ECT sensor as required
P011700	Engine Coolant Temperature Sensor 1 Circuit Low	<ul style="list-style-type: none"> <li>ECT sensor sensing circuit - short to power, high resistance, open circuit, disconnected</li> <li>ECT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor circuits for short to power, high resistance, open circuit, disconnected connector. Check and install a new ECT sensor as required
P011800	Engine Coolant Temperature Sensor 1 Circuit High	<ul style="list-style-type: none"> <li>Engine overheat condition/cooling fan failure</li> <li>ECT sensor sensing circuit - short to ground</li> <li>ECT sensor failure</li> </ul>	Check for cooling fan circuit DTCs and refer to relevant action specified in DTC Index. Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor circuits for short to ground. Check and install a new ECT sensor as required
P012500	Insufficient Coolant Temp For Closed Loop Fuel Control	<ul style="list-style-type: none"> <li>Low coolant level</li> <li>ECT sensor sensing circuit - intermittent high resistance</li> <li>Engine thermostat failure</li> <li>ECT sensor failure</li> </ul>	Fill cooling system to correct level and specification. REFER to: <a href="#">Specifications</a> (303-03B Engine Cooling - V6 3.0L Petrol, Specifications). Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor sensing circuit for intermittent high resistance. Check and install new engine thermostat as required. Check and install a new ECT sensor as required
P012800	Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature)	<ul style="list-style-type: none"> <li>Low/contaminated coolant</li> <li>Engine thermostat failure</li> <li>Cooling fan circuit(s)/module</li> </ul>	Drain and re-fill cooling system to correct level and specification. REFER to: <a href="#">Specifications</a> (303-03B Engine Cooling - V6 3.0L Petrol, Specifications). Check and install a new engine thermostat as required. Refer to the electrical circuit diagrams and check cooling fan circuits for short, open circuit. Check for correct operation of cooling fan, check for DTCs and refer to DTC Index
P048023	Fan 1 Control Circuit	<ul style="list-style-type: none"> <li>Electric cooling fan control circuit - short to ground, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check electric cooling fan control circuit for short to ground, high resistance
P048024	Fan 1 Control Circuit	<ul style="list-style-type: none"> <li>Electric cooling fan control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check electric cooling fan control circuit for short to power
P048309	Fan Performance	<ul style="list-style-type: none"> <li>Cooling fan difficult to turn/obstructed</li> <li>Fan/Motor damaged</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear any obstruction and Check and install a new fan as required
P048316	Fan Performance	<ul style="list-style-type: none"> <li>Cooling fan control module reports battery voltage less than nine volts</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check the battery is in fully charged and serviceable condition. Refer to the electrical circuit diagrams and check the charging system and cooling fan circuits for short, open circuit
P048317	Fan Performance	<ul style="list-style-type: none"> <li>Fan control module reports battery voltage greater than 18 volts</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check the charging system and cooling fan circuits for short, open circuit
P048397	Fan Performance	<ul style="list-style-type: none"> <li>Cooling fan jammed</li> </ul>	Clear any obstruction from cooling fan

## Pinpoint Tests

### PINPOINT TEST A : LOSS OF COOLANT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>A1: VISUAL INSPECTION</b>	
	<ol style="list-style-type: none"> <li>Visually inspect for loss of coolant.</li> <li>Carry out a system pressure test. See component tests in this section.</li> </ol>
Is the engine cooling system leaking?	<p><b>Yes</b></p> <p>Rectify the leak as indicated by the test result. Top-up and fill the cooling system to the correct level with the correct specification fluid as necessary. REFER to: (303-03B Engine Cooling - V6 3.0L Petrol) <a href="#">Specifications</a> (Specifications), <a href="#">Cooling System Draining, Filling and Bleeding</a> (General Procedures).</p> <p>TEST the system for correct operation.</p> <p><b>No</b></p> <p>Verify the customer complaint.</p>

### PINPOINT TEST B : THE ENGINE OVERHEATS

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
-----------------	-------------------------



**B1: CHECK COOLANT**

**WARNING:** The cooling system is pressurized! Ensure the reservoir cap is never released until the system has cooled. Failure to follow these instructions may result in personal injury.

**1** Check the coolant level and condition.

Does the system contain sufficient coolant of the correct specification?

**Yes**

[GO to B2.](#)

**No**

Top-up and fill the cooling system to the correct level with the correct specification fluid as necessary. REFER to: (303-03B Engine Cooling - V6 3.0L Petrol)

[Specifications](#) (Specifications),

[Cooling System Draining, Filling and Bleeding](#) (General Procedures).

Check for coolant loss. GO to Pinpoint Test [A](#).

**B2: CHECK COOLANT EXPANSION TANK PRESSURE CAP**

**1** Check the coolant expansion tank pressure cap for damage/correct operation. REFER to the coolant expansion tank pressure cap pressure test in this section.

Is the coolant expansion tank pressure cap operating correctly?

**Yes**

[GO to B3.](#)

**No**

INSTALL a new coolant expansion tank pressure cap. TEST the system for correct operation.

**B3: CHECK THERMOSTAT**

**1** Check the thermostat for correct operation. REFER to the thermostat component test in this section.

Is the thermostat operating correctly?

**Yes**

Check for correct operation of cooling fans, circuits, sensors, modules, etc.

REFER to: [Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 3.0L Petrol, Diagnosis and Testing).

**No**

INSTALL a new thermostat.

REFER to: [Thermostat](#) (303-03B Engine Cooling - V6 3.0L Petrol, Removal and Installation).

TEST the system for correct operation.

**PINPOINT TEST C : THE ENGINE DOES NOT REACH NORMAL OPERATING TEMPERATURE****TEST CONDITIONS****DETAILS/RESULTS/ACTIONS****C1: CHECK THERMOSTAT**

**1** Check the thermostat for correct operation. REFER to the thermostat component test in this section.

Is the thermostat operating correctly?

**Yes**

Check for correct operation of cooling fans, circuits, sensors, modules, etc.

REFER to: [Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 3.0L Petrol, Diagnosis and Testing).

**No**

INSTALL a new thermostat.

REFER to: [Thermostat](#) (303-03B Engine Cooling - V6 3.0L Petrol, Removal and Installation).

TEST the system for correct operation.

**Component Tests****Cooling System Pressure Test**

**WARNING:** Never, under any circumstances, remove the coolant expansion tank pressure cap while the engine is operating. To avoid having scalding hot water or steam blow out of the cooling system, use extreme care when removing the coolant expansion tank pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant expansion tank pressure cap and turn it slowly until the pressure begins to release, step back while the pressure is released from the system. When certain all the pressure has been released (still with a cloth) turn and remove the coolant expansion tank pressure cap. Failure to follow these instructions may result in damage to the cooling system, engine and/or cause personal injury.

1. **1.** Switch the engine off.
2. **2.** Open the hood and install protective fender covers.
3. **3.** Carefully remove the coolant expansion tank pressure cap from the coolant expansion tank to relieve pressure in the cooling system. Add coolant to coolant expansion tank as necessary.
4. **4.** Install the pressure tester equipment to the cooling system following manufacturers instructions. Reinstall the coolant expansion tank pressure cap (if pressure test equipment is not installed to the coolant expansion tank).
5. **5.** Pressurize the cooling system to the coolant expansion tank pressure cap lower limit.
6. **6.** Observe the gauge reading for approximately two minutes. Pressure should not drop during this time.
  - If system holds pressure, continue from step 8.
  - If the pressure drops, check the complete cooling system for leaks. Also refer to engine system checks if a leak cannot be located in the cooling system. Correct any leaks found and recheck the system.
7. **7.** Release the system pressure and remove the pressure test equipment. Check the coolant level. Replenish as necessary with the correct coolant solution.  
REFER to: [Specifications](#) (303-03B Engine Cooling - V6 3.0L Petrol, Specifications).
8. **8.** Check the radiator overflow hose for any obstructions which may block the flow of coolant either to or from the coolant expansion tank.
9. **9.** Conduct the coolant expansion tank pressure cap pressure test in this section.

**Coolant Expansion Tank Pressure Cap Pressure Test**

**WARNING:** Never, under any circumstances, remove the coolant expansion tank pressure cap while the engine is operating. To avoid having scalding hot water or steam blow out of the cooling system, use extreme care when removing the coolant expansion tank pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant expansion tank pressure cap

and turn it slowly until the pressure begins to release, step back while the pressure is released from the system. When certain all the pressure has been released (still with a cloth) turn and remove the coolant expansion tank pressure cap. Failure to follow these instructions may result in damage to the cooling system, engine and/or cause personal injury.

1. Remove the expansion tank pressure cap from the coolant expansion tank.
2. Use water to clean cap in area of rubber seal and vacuum relief valve. Following manufacturers instructions, install the coolant expansion tank pressure cap to the pressure tester.
3. • NOTE: If the pressure tester is pressurised too quickly, an erroneous pressure reading may result.
  3. Slowly pressurise the system until the pressure gauge reading stops increasing, and note highest pressure reading obtained.
4. Release pressure and repeat Step 3 at least twice to make sure the pressure test reading is repeatable and within specification.
5. If the pressure test gauge readings are not within specification, install a new coolant expansion tank pressure cap.

## Thermostat Test

Remove the thermostat

REFER to: [Thermostat](#) (303-03B Engine Cooling - V6 3.0L Petrol, Removal and Installation).

Inspect for visible damage, note its opening temperature and immerse it in water. Heat the water until this temperature is reached. The thermostat should begin to open. If it does not begin to open, install a new thermostat.

REFER to: [Thermostat](#) (303-03B Engine Cooling - V6 3.0L Petrol, Removal and Installation).

If thermostat begins to open, continue to heat the water until the thermostat fully opens, 5.8 mm (0.2 in) or more off the seat. If it does not fully open, install a new thermostat.

REFER to: [Thermostat](#) (303-03B Engine Cooling - V6 3.0L Petrol, Removal and Installation).

## Radiator Leak Test - Removed from the Vehicle



**CAUTION:** Do not leak test an aluminium radiator in the same water that is used to leak test copper/brass radiators. Flux and caustic cleaners may be present in the test water which will corrode aluminium. If a separate tank is not available, drain and rinse the test tank before testing an aluminium radiator.


Clean the radiator before leak testing to prevent contamination of the test tank. Leak test the radiator in clean water with 138 kPa (20 psi) air pressure.

# Engine Cooling - V6 3.0L Petrol - Cooling System Draining, Filling and Bleeding

## General Procedures

### • WARNINGS:

 Never remove the coolant expansion tank cap under any circumstances while the engine is operating. Failure to follow this instruction may result in personal injury.

 To avoid the possibility of personal injury, do not operate the engine with the hood open until the fan blades have been examined for cracks and separation. Failure to follow this instruction may result in personal injury.

### • CAUTIONS:


 The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage. Failure to follow this instruction may result in damage to the engine.

 Never remove the coolant expansion tank cap under any circumstances while the engine is operating. Failure to follow this instruction may result in damage to the engine.

### All vehicles

-  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

-  **WARNING:** Release the cooling system pressure by slowly turning the coolant expansion tank cap a quarter of a turn. Cover the expansion tank cap with a thick cloth to prevent the possibility of scalding. Failure to follow this instruction may result in personal injury.

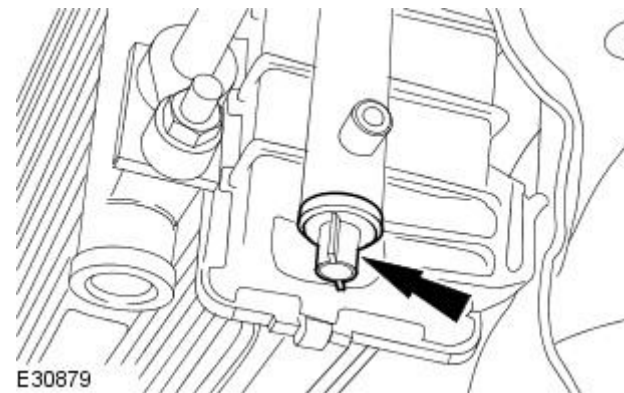
Release the cooling system pressure.

- Remove the coolant expansion tank cap.


- Remove the radiator splash shield.  
For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

- Drain the coolant.

- Position a container to collect the fluid.
- Remove the drain plug.

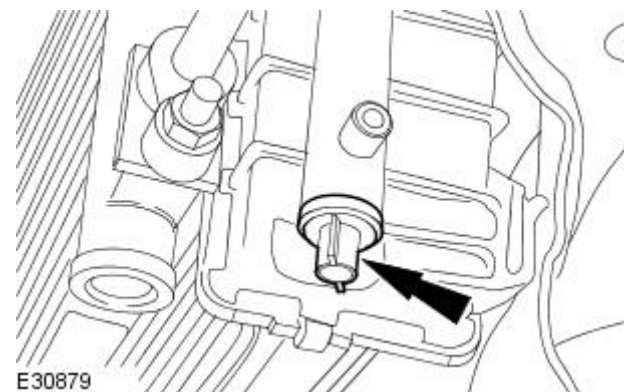


### All vehicles

-  **CAUTION:** Do not over tighten the drain plug. Failure to follow this instruction may result in damage to the vehicle.

Install the drain plug.

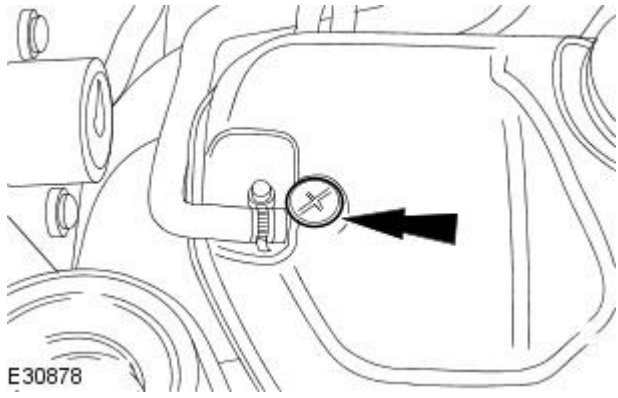
- Remove the drain tray.



- Lower the vehicle.

### Vehicles without supercharger

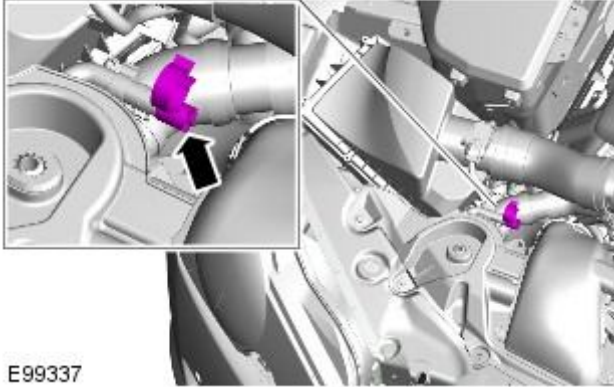
7. Loosen the cooling system bleed screw.



Vehicles with supercharger

8. NOTE: Position cloth to collect fluid spillage.

Loosen the cooling system bleed screw.

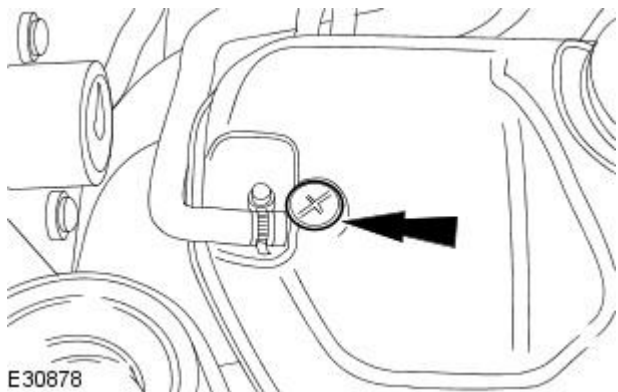


Vehicles without supercharger

9.  CAUTION: Anti-freeze concentration must be maintained at 50%.

Refill the cooling system.

- When coolant runs from the expansion tank bleed point bubble-free, tighten the bleed screw.

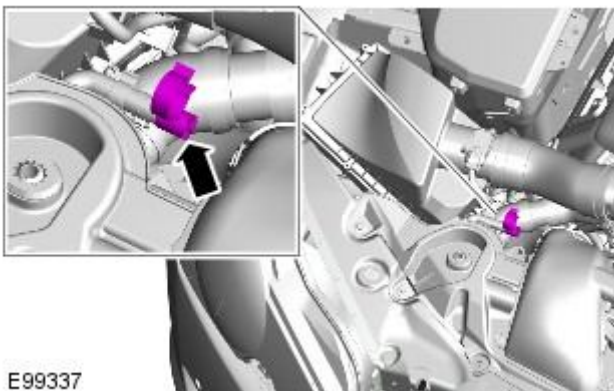


Vehicles with supercharger

10.  CAUTION: Anti-freeze concentration must be maintained at 50%.


Refill the cooling system.

- When coolant runs from the expansion tank bleed point bubble-free, tighten the bleed screw.




All vehicles

11. Install the coolant expansion tank cap.

12.  CAUTION: Do not RUN the engine with the coolant expansion tank pressure cap removed. Failure to follow this instruction may cause damage to the vehicle.

Start and run the engine.

**13.** Set the heating system to MAX heat, the blower motor to MAX speed and the air distribution to the instrument panel registers.

**14.**  **CAUTION:** Observe the engine temperature warning light. If the warning light is displayed, switch off immediately and allow to cool. Failure to follow this instruction may cause damage to the vehicle

Allow the engine to run until hot air is emitted from the instrument panel registers, while observing the engine temperature warning light.

**15.** Switch the engine off.

**16.** Allow the engine to cool.

**17.** Release the cooling system pressure.

- Remove the coolant expansion tank pressure cap.

**18.** Maintain the coolant level in the coolant expansion tank at the MAX mark using a 50% mixture of Jaguar Premium Cooling System Fluid or equivalent, meeting Jaguar specification WSS M97B44-D and 50% water.

**19.** Install the coolant expansion tank pressure cap.

**20.** Raise the vehicle.

**21.** Install the radiator splash shield.



For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

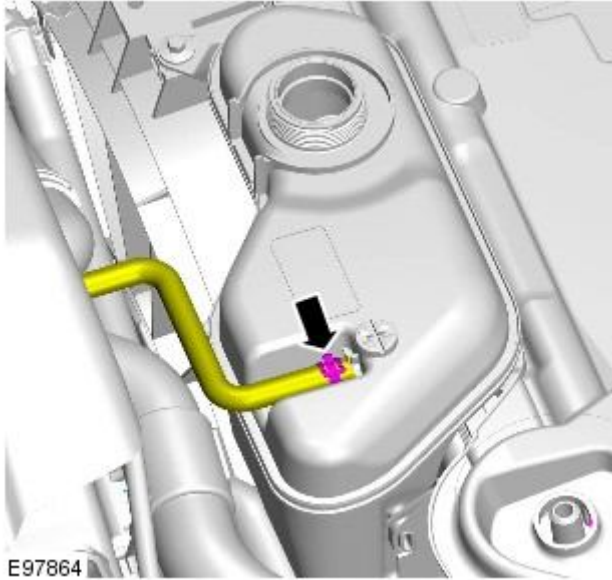
# Engine Cooling - V6 3.0L Petrol - Coolant Expansion Tank

Removal and Installation

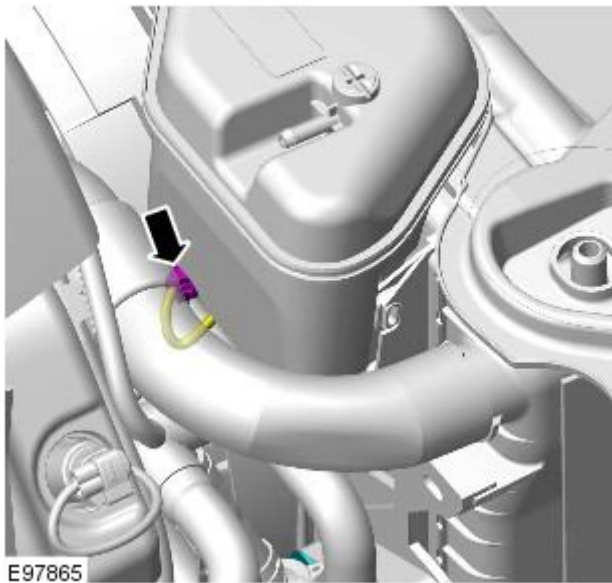
## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.  
Raise and support the vehicle.
2. For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03C Engine Cooling - V8 4.2L Petrol/V8 S/C 4.2L Petrol, General Procedures).
3.  **CAUTION:** Take extra care when handling the component.

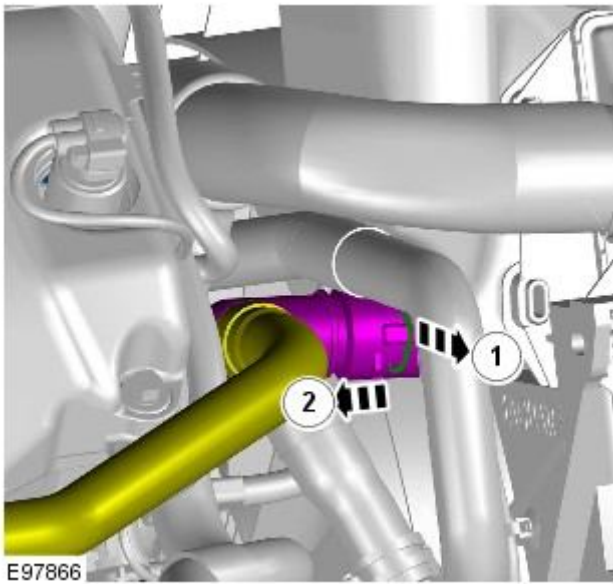


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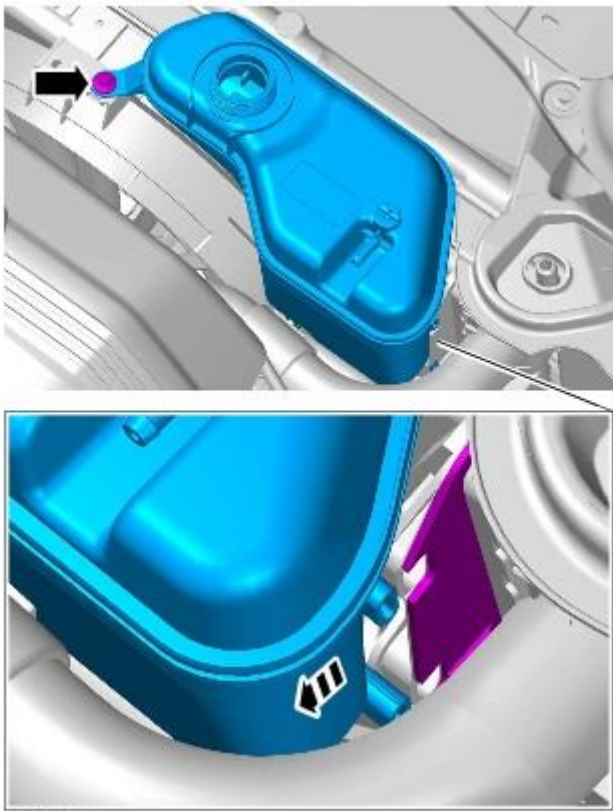




5.



6. TORQUE: 3 Nm



### Installation


1. Install is the reverse of removal.

# Engine Cooling - V6 3.0L Petrol - Cooling Fan Shroud

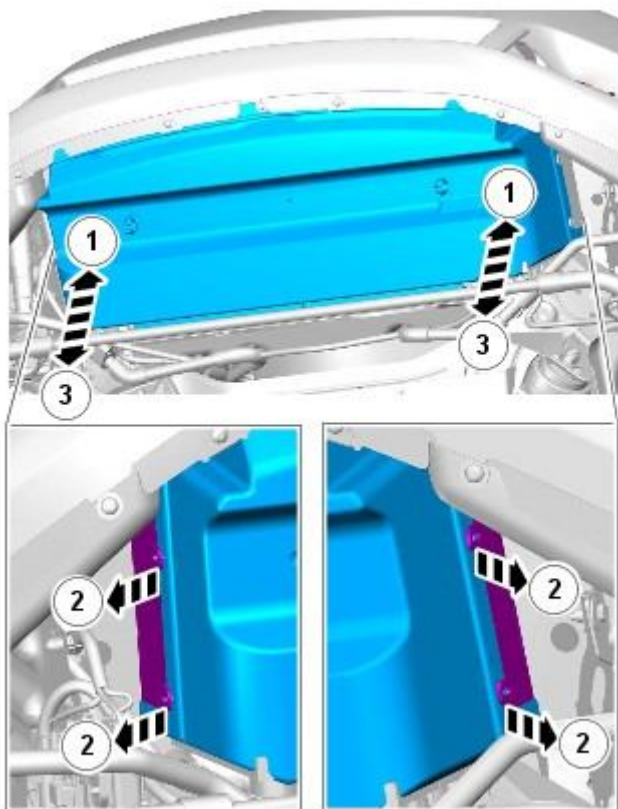
Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

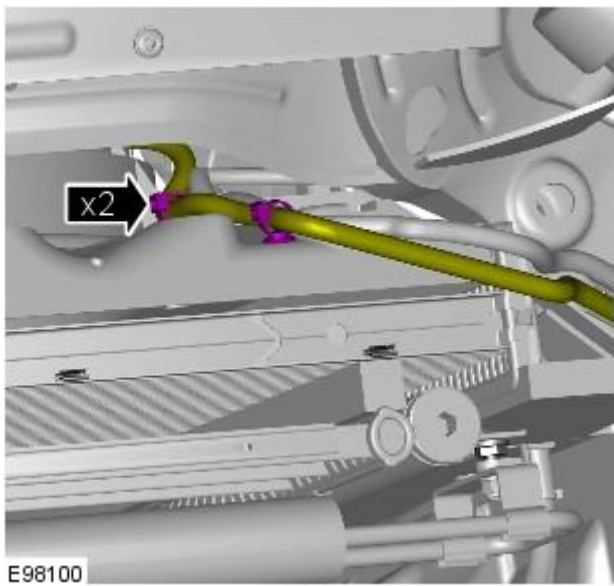
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Coolant Expansion Tank](#) (303-03B Engine Cooling - V6 3.0L Petrol, Removal and Installation).
3. Refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).
4. Refer to: [Air Cleaner](#) (303-12B Intake Air Distribution and Filtering - V6 3.0L Petrol, Removal and Installation).
5.  **WARNING:** Make sure to support the vehicle with axle stands.  
Raise and support the vehicle.

6.



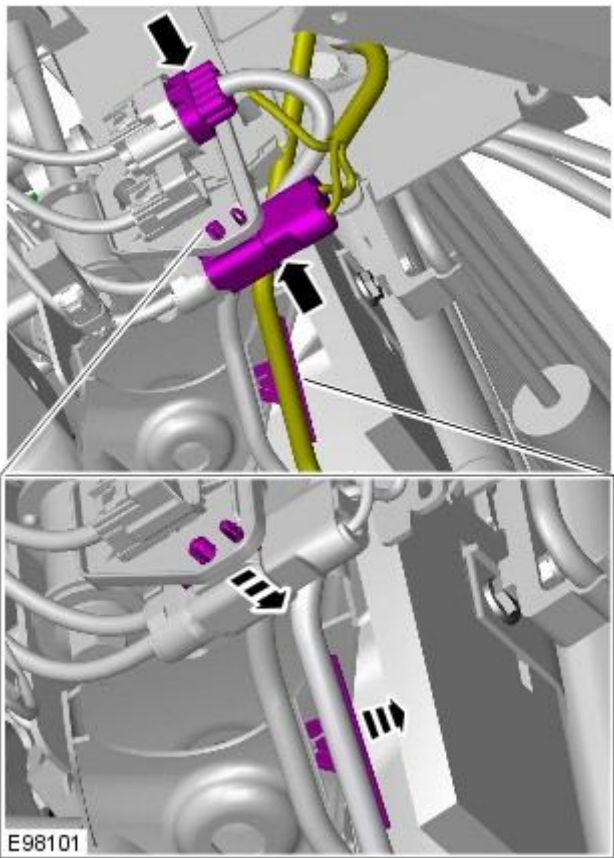
E97870

7.



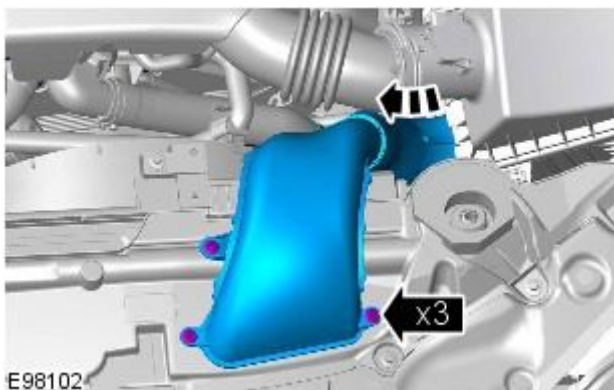
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8.



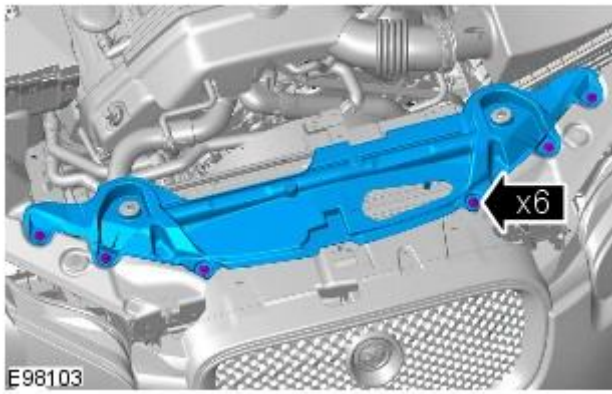
E98101

9. Torque: 7 Nm

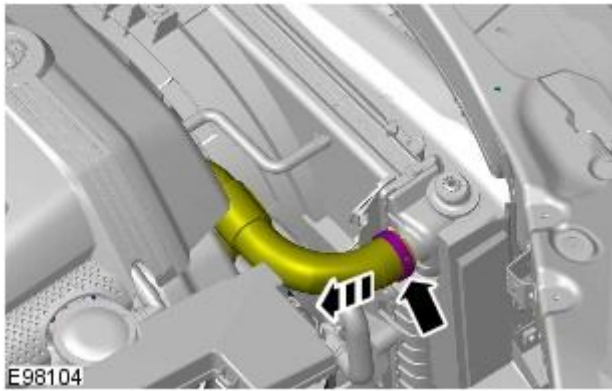


E98102

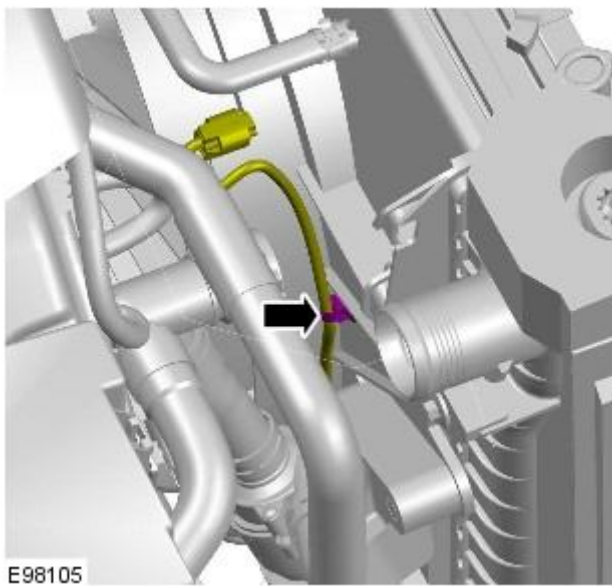
10. Torque: 7 Nm



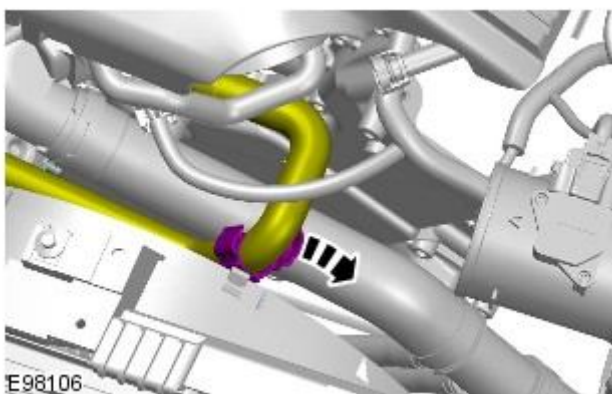
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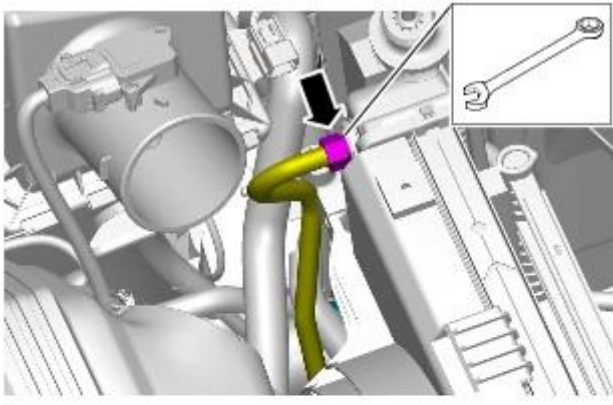
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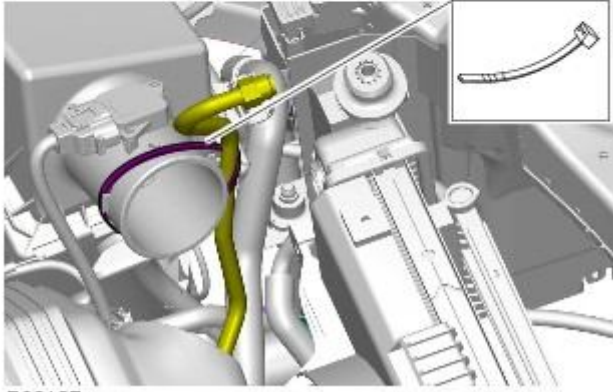
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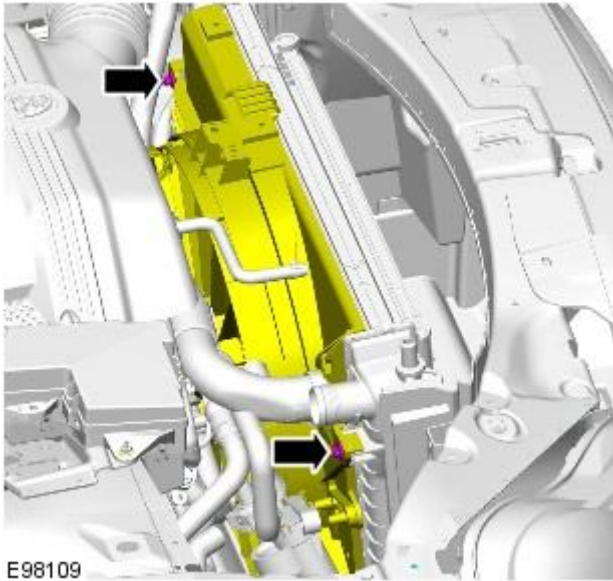


14. **14.**  CAUTION: Be prepared to collect escaping oil.



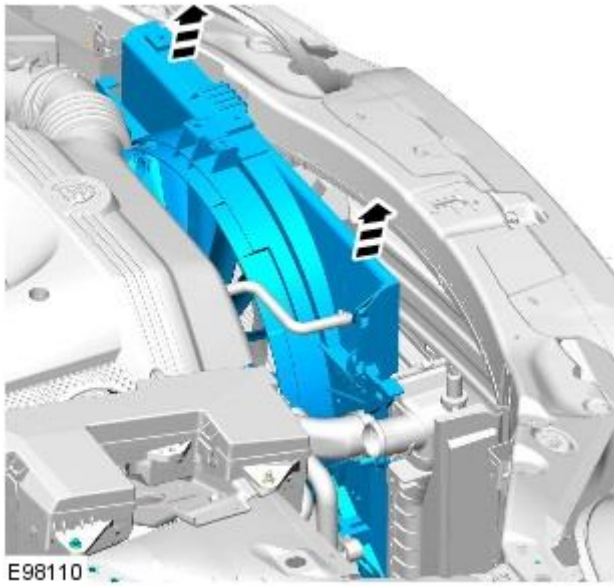
E98107

15.



E98109

16.



E98110

## Installation

1. To install, reverse the removal procedure.



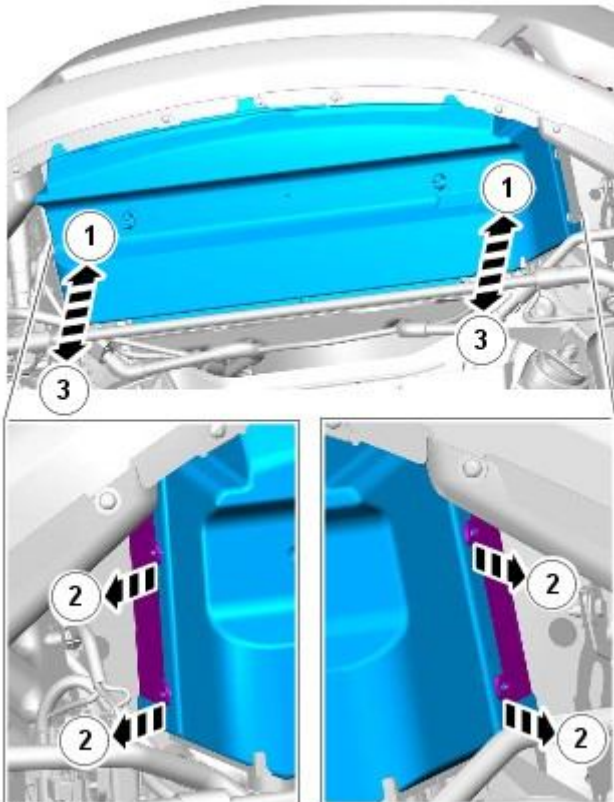
# Engine Cooling - V6 3.0L Petrol - Cooling Module

Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

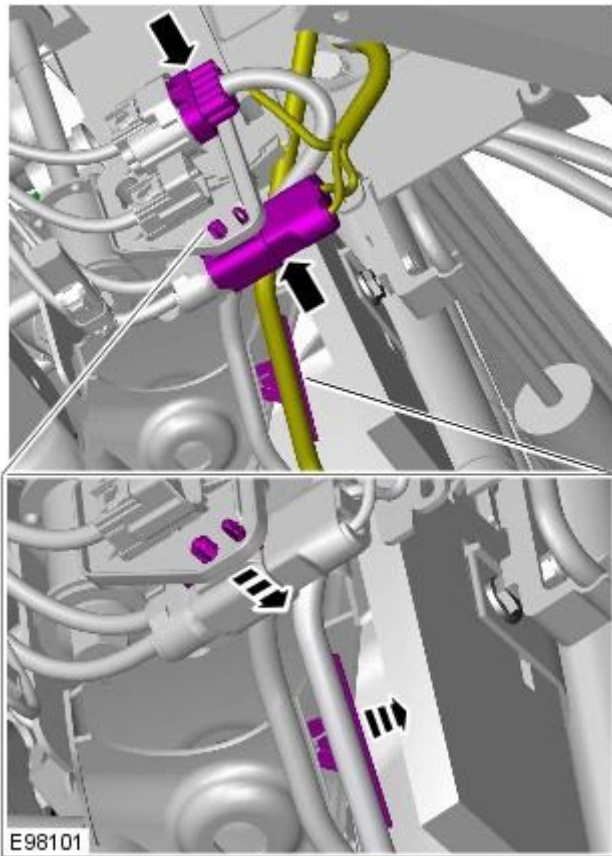
1. For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 3.0L Petrol, General Procedures).
3. For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).
4. For additional information, refer to: [Air Cleaner](#) (303-12B Intake Air Distribution and Filtering - V6 3.0L Petrol, Removal and Installation).
5. Raise and support the vehicle.
- 6.



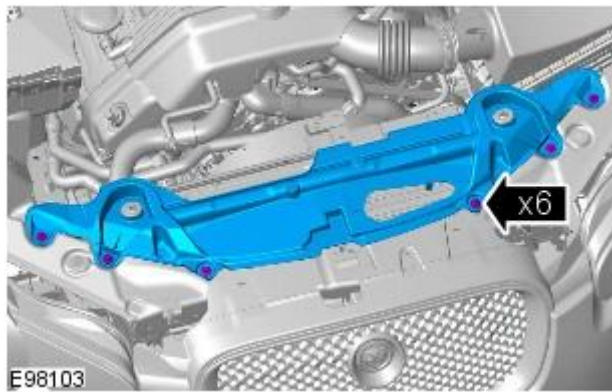
E97870

7. For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

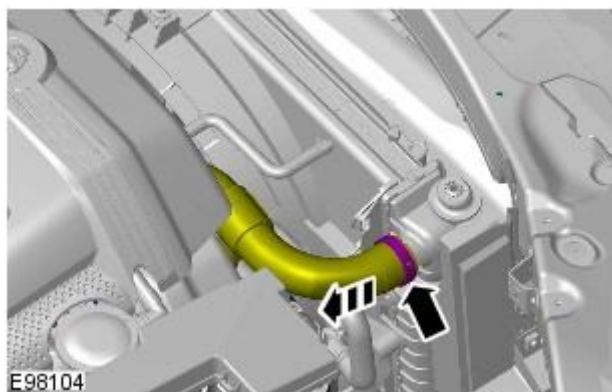
8.



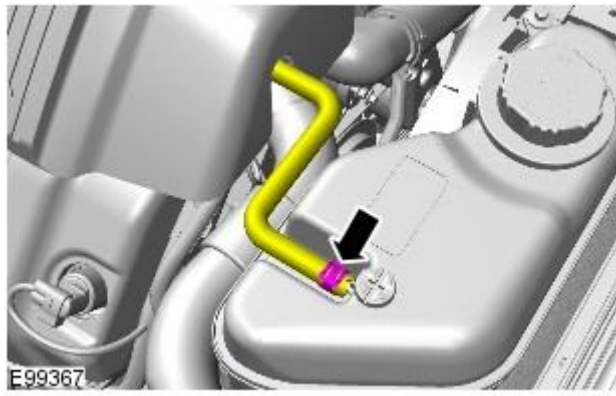
9. TORQUE: 7 Nm



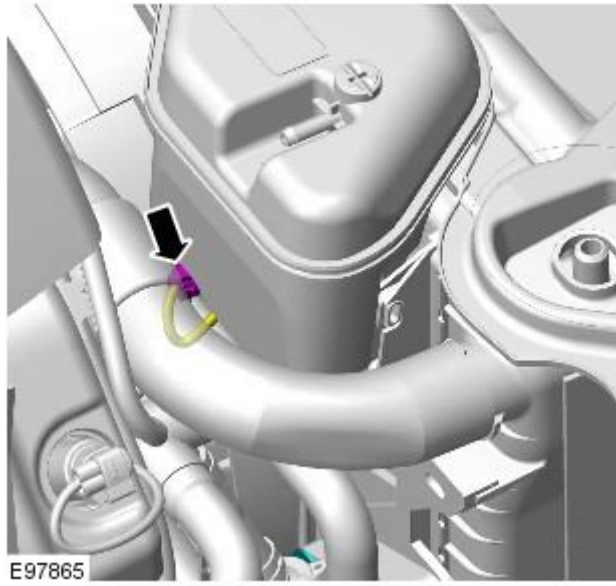
10.



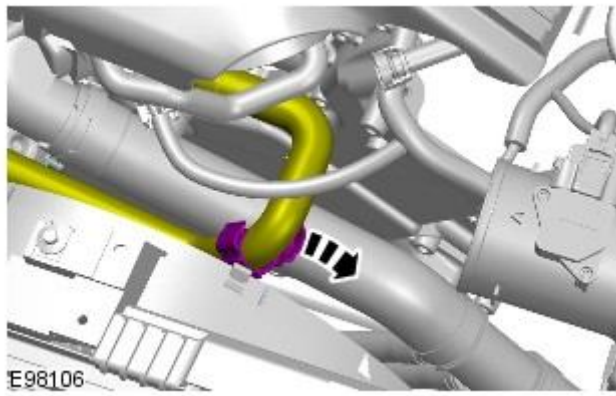
11.



12.

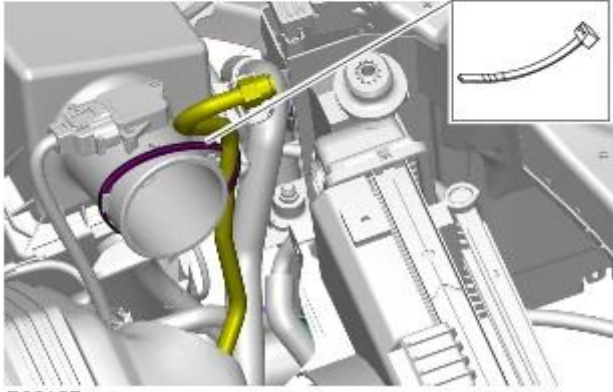
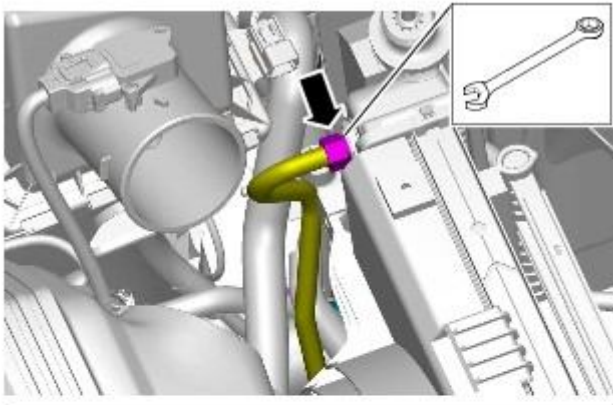


13.



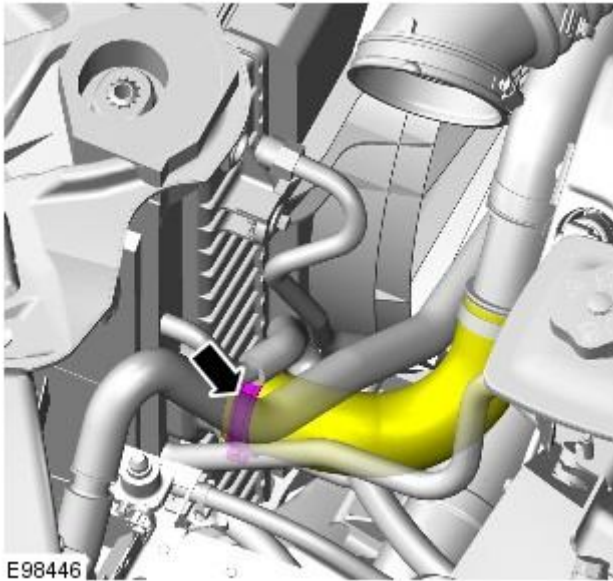
14.  CAUTION: Be prepared to collect escaping oil.

TORQUE: 20 Nm

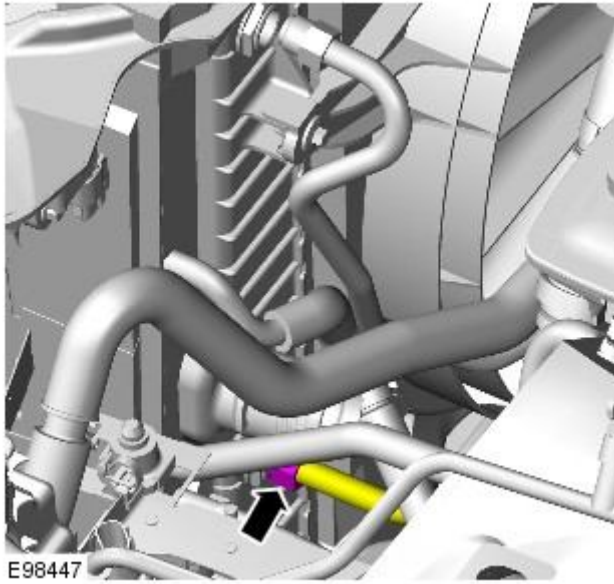


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15.

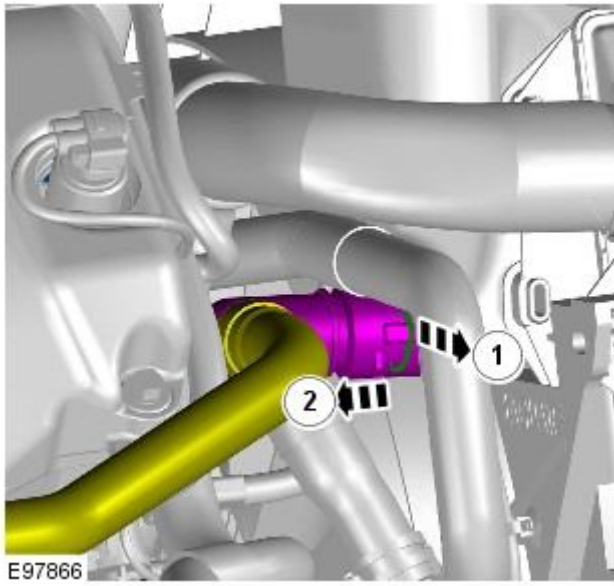


E98446



16.  CAUTION: Be prepared to collect escaping oil.

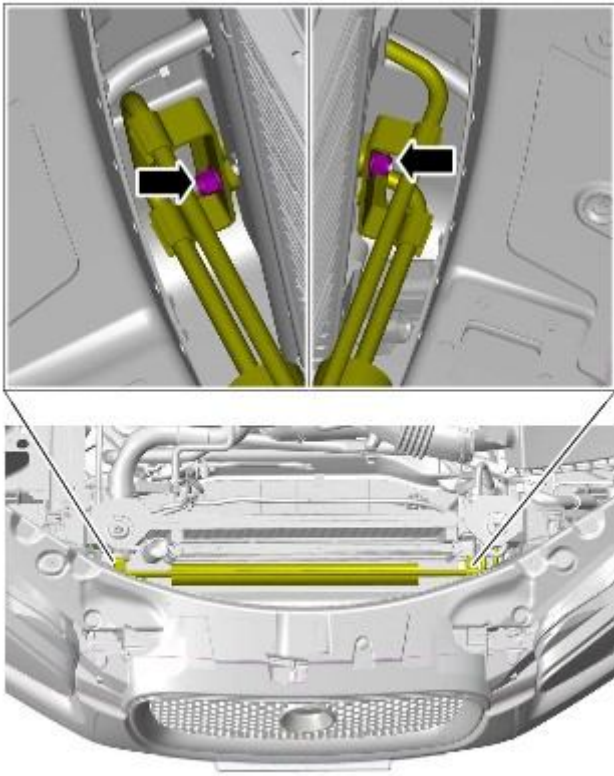
TORQUE: 20 Nm



17. NOTE: Cap the coolant expansion tank lower hose to minimize coolant loss.

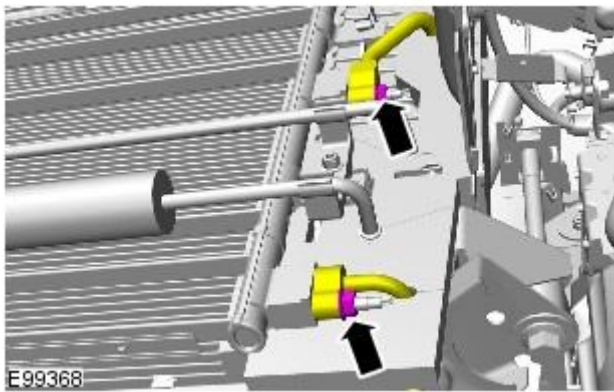


18. TORQUE: 10 Nm



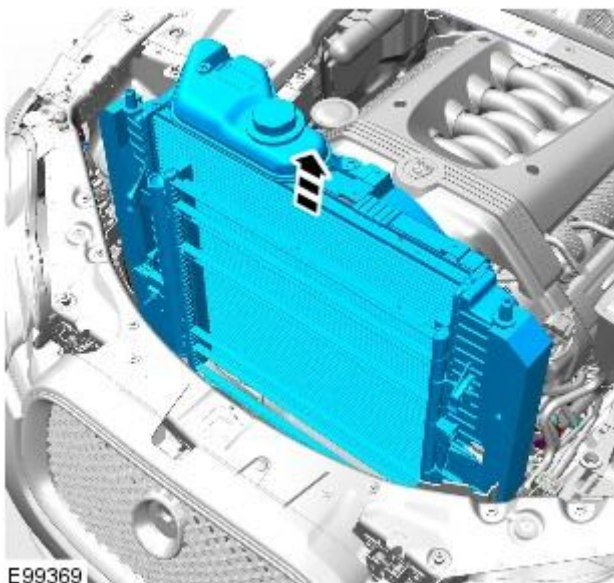
E97747

19. TORQUE: 10 Nm



E99368

20.



E99369

## Installation

1. To install, reverse the removal procedure.
2. Check and top-up the transmission fluid level.  
For additional information, refer to: [Transmission Fluid Level Check](#)

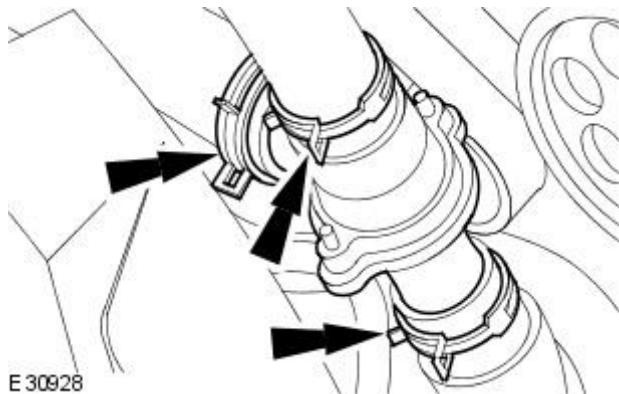


# Engine Cooling - V6 3.0L Petrol - Thermostat

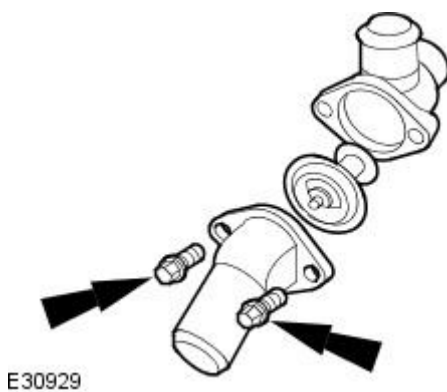
Removal and Installation

## Removal

1. Raise and support the vehicle.
2. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
3. Drain the cooling system.  
For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03C Engine Cooling - V8 4.2L Petrol/V8 S/C 4.2L Petrol, General Procedures).
4. Remove the air cleaner outlet pipe.  
For additional information, refer to: [Air Cleaner Outlet Pipe](#) (303-12, Removal and Installation).
5. Remove the thermostat housing.

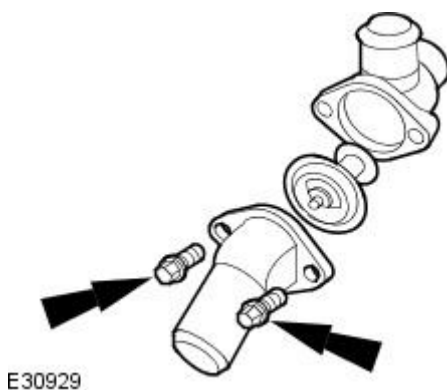


6. Remove the thermostat.
  - Remove and discard the O-ring seal.



## Installation

1. To install, reverse the removal procedure.
  - Install a new O-ring seal.
  - Tighten to 10 Nm.



2. **NOTE:** For NAS vehicles only.

If required, carry out a long drive cycle.  
For additional information, refer to: [Powertrain Control Module \(PCM\) Long Drive Cycle Self-Test](#) (303-14C, General Procedures).

# Engine Cooling - V6 3.0L Petrol - Radiator

Removal and Installation

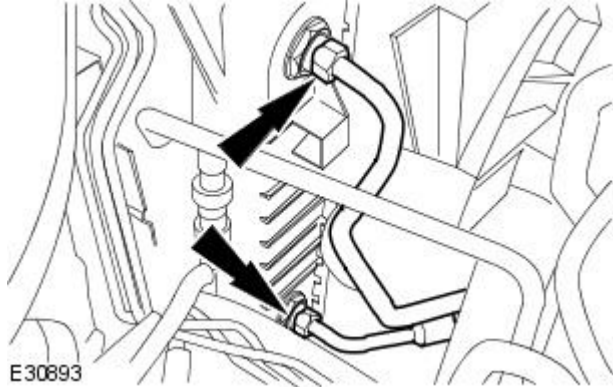
## Removal

All vehicles

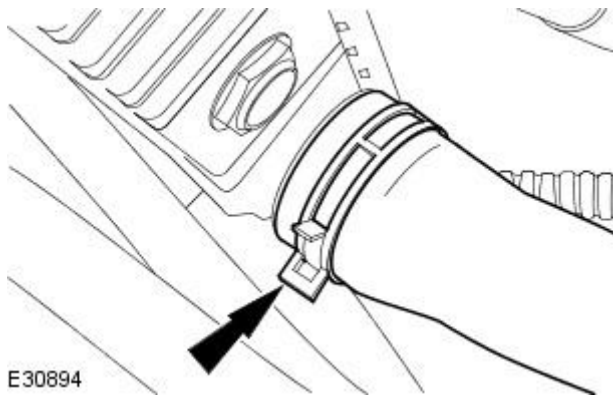
1. Remove the cooling fan motor and shroud.  
For additional information, refer to [Cooling Fan Motor and Shroud](#) in this section.

Vehicles with automatic transmission

2. Detach the transmission oil cooler inlet and return pipes.
  - Remove and discard the O-ring seals.
  - Cap the oil cooler inlet and return pipes and the oil cooler.

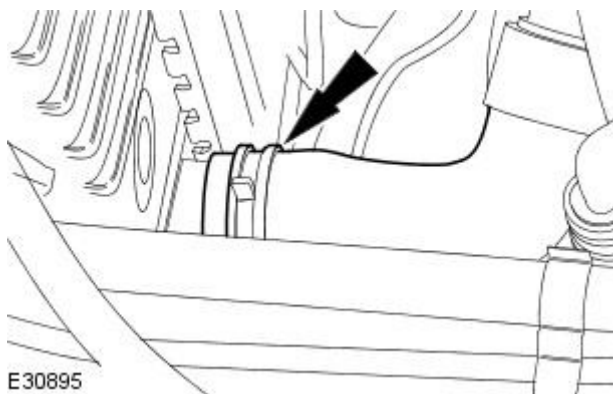


3. Detach the lower coolant hose.



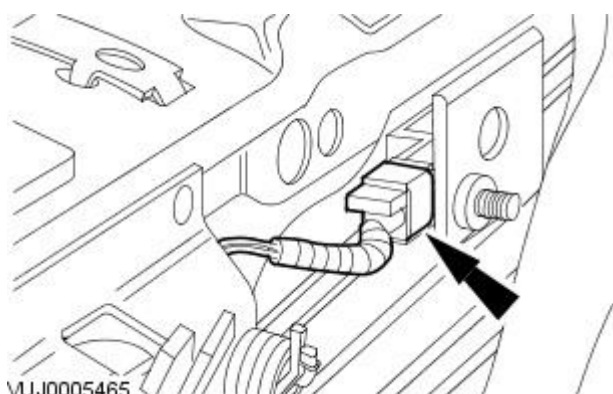
Vehicles with manual transmission

4. Detach the lower coolant hose.

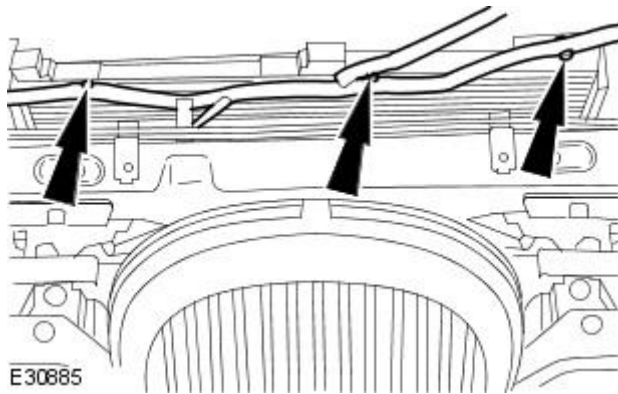


All Vehicles

5. Disconnect the front crash sensor.

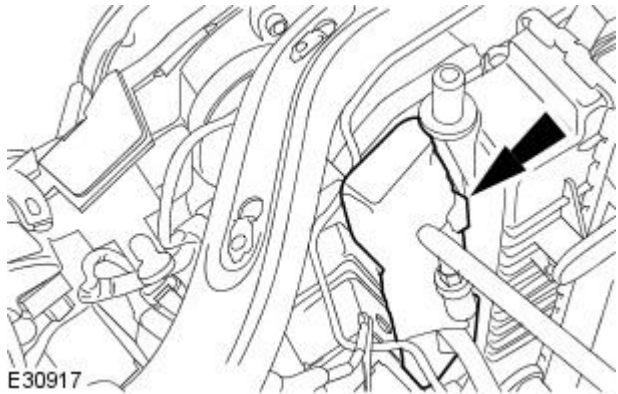


6. Detach the wiring harness.



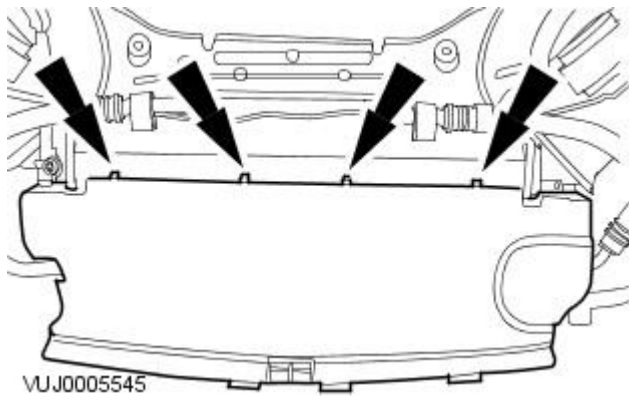
7. Detach the radiator seal.

- Left-hand shown, right-hand similar.
- Remove the double-sided adhesive tape.



8. Raise the vehicle.

9. Remove the radiator lower cowl.

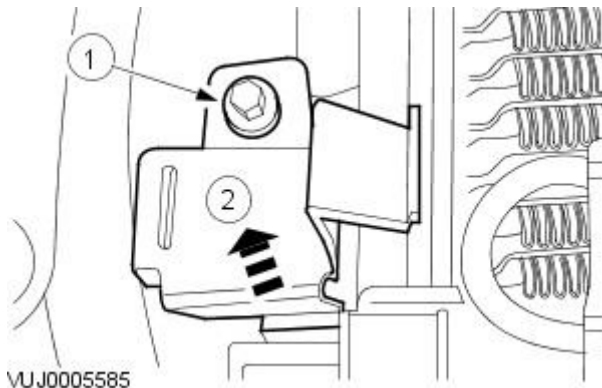


#### Vehicles with supercharger

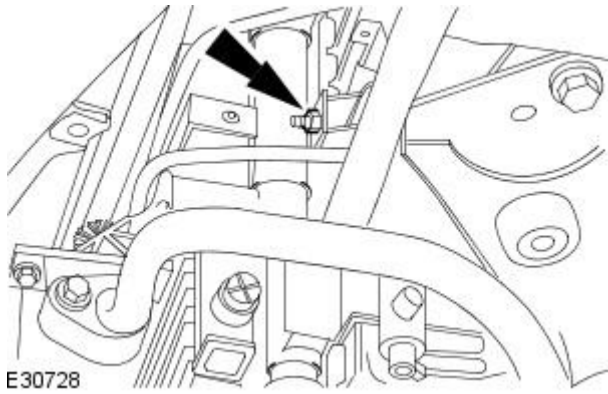
10. Remove the water pump. For additional information, refer to Section [303-03A Engine Cooling](#) / [303-03B Engine Cooling](#) / [303-03C Engine Cooling](#) / [303-03D Supercharger Cooling](#).

11. Remove the water pump retaining bracket.

1. Remove the retaining bolt.
2. Remove the water pump retaining bracket.

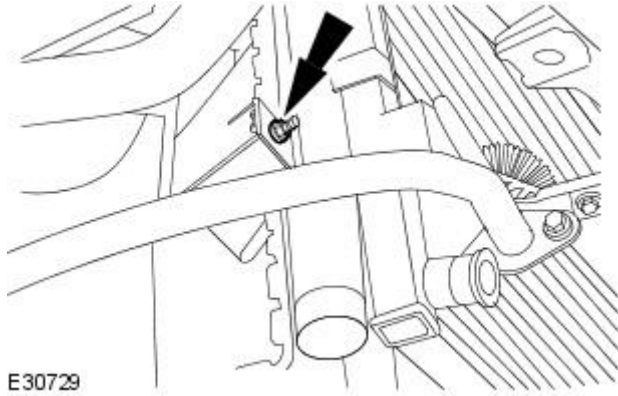


12. Remove the cooling module retaining bolt.



13. Remove the cooling module retaining bolt.

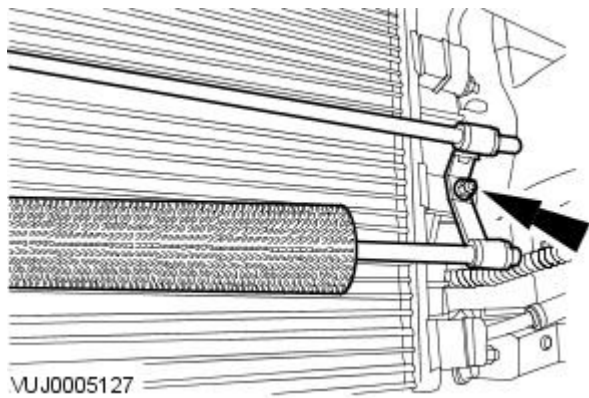
- Secure the supercharger cooling radiator, condenser core and engine oil cooler using suitable retaining straps.



Vehicles without supercharger

14. NOTE: Left-hand shown, right-hand similar.

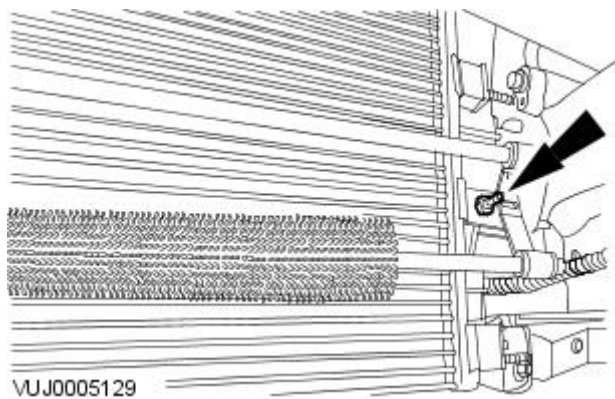
Detach the power steering oil cooler.



15. NOTE: Left-hand shown, right-hand similar.

Remove the condenser core retaining stud.


- Secure the condenser core and PAS cooler using suitable retaining straps.



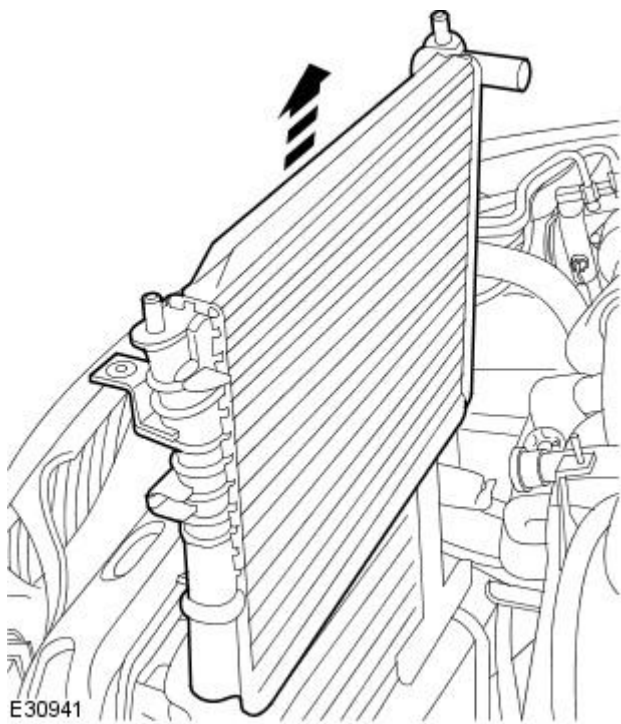
All vehicles

16. Lower the vehicle.



17.  CAUTION: Make sure that the radiator is not damaged when removed.


Remove the radiator.



E30941

## Installation

All vehicles

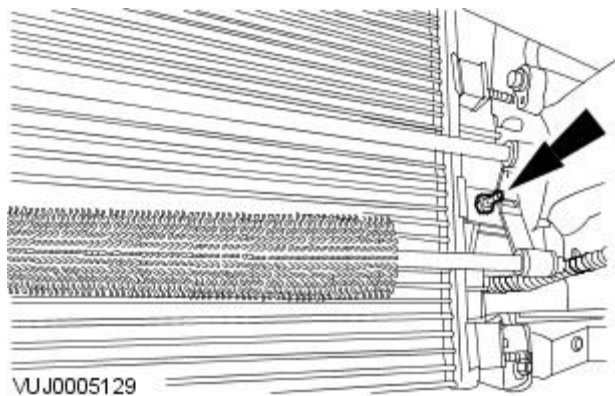
1.  CAUTION: Make sure that the radiator is not damaged when installed.

To install, reverse the removal procedure.

Vehicles without supercharger

2. NOTE: Left-hand shown, right-hand similar.

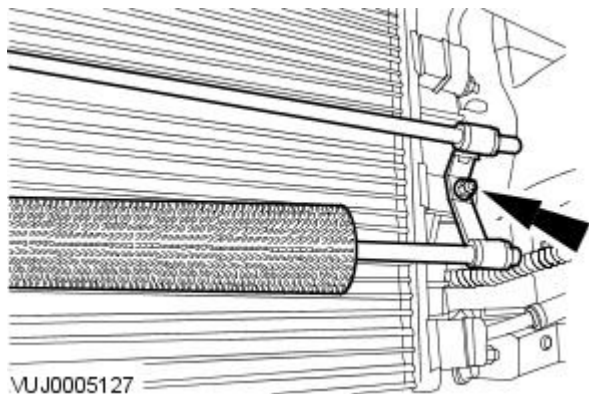
Tighten to 7 Nm.



VUJ0005129

3. NOTE: Left-hand shown, right-hand similar.

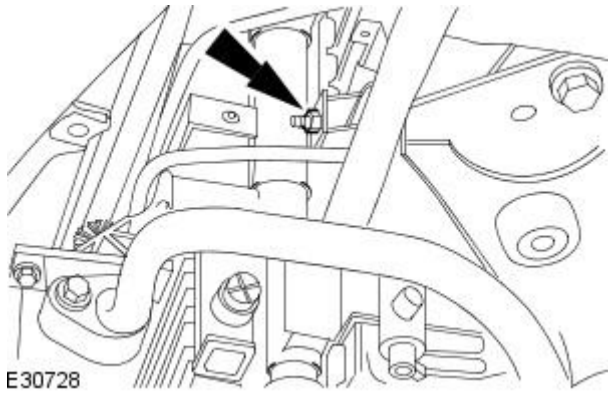
Tighten to 7 Nm.



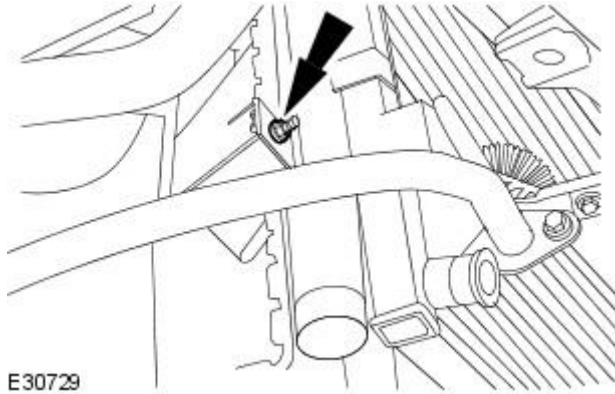
VUJ0005127

Vehicles with supercharger

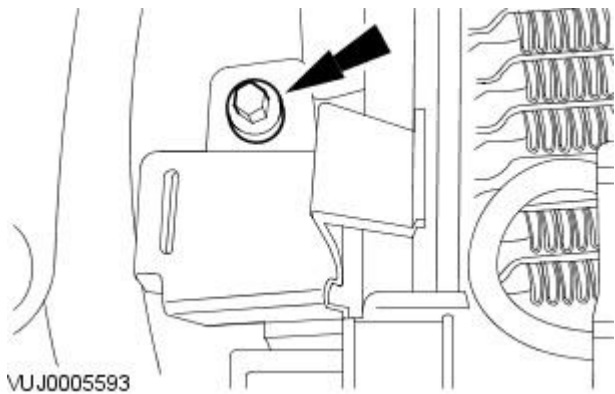
4. Tighten to 7 Nm.



5. Tighten to 7 Nm.



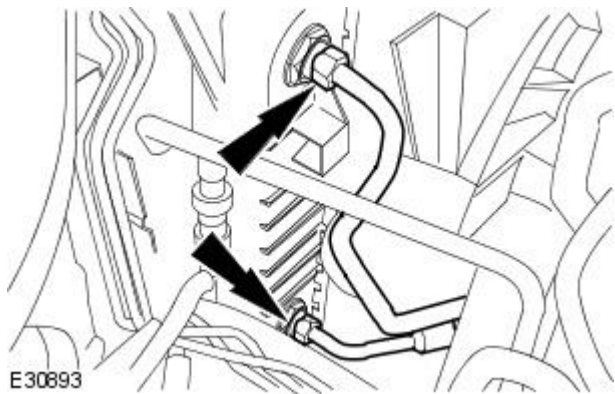
6. Tighten to 7 Nm.



Vehicles with automatic transmission

7. NOTE: Install new O-ring seals.

Tighten to 20 Nm.



8. Carry out transmission fluid level check.  
For additional information, refer to Section [307-01 Automatic Transmission/Transaxle](#).




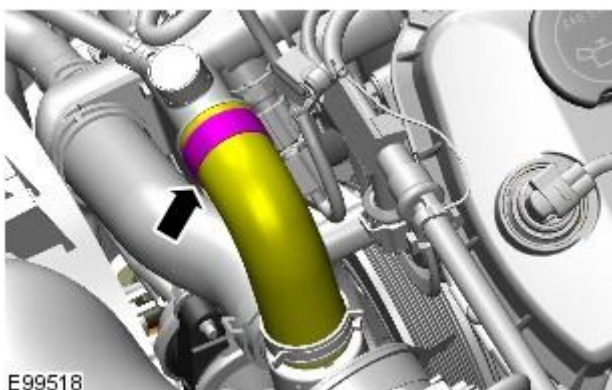
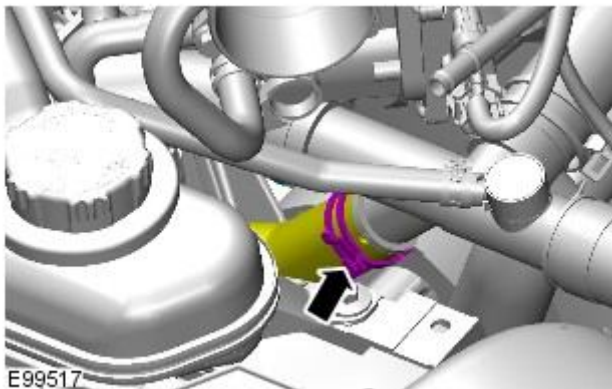
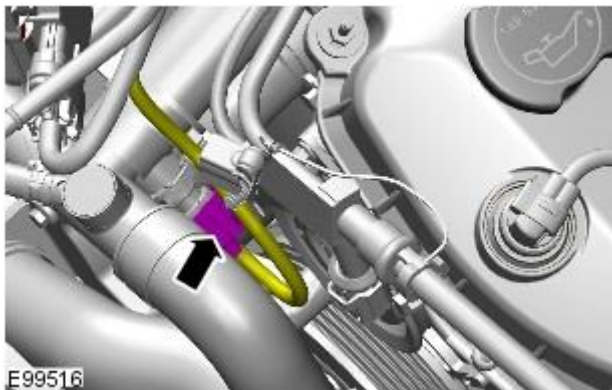
# Engine Cooling - V6 3.0L Petrol - Water Pump

Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

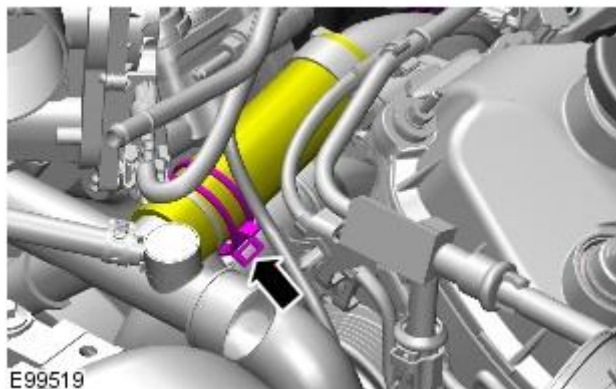
1. For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Make sure to support the vehicle with axle stands.  
Raise and support the vehicle.
3. For additional information, refer to: [Air Cleaner Outlet Pipe](#) (303-12B, Removal and Installation).
4. For additional information, refer to: [Accessory Drive Belt](#) (303-05B Accessory Drive - V6 3.0L Petrol, Removal and Installation).
5. For additional information, refer to: [Secondary Air Injection \(AIR\) Control Valve](#) (303-08B Engine Emission Control - V6 3.0L Petrol, Removal and Installation).
6. For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 3.0L Petrol, General Procedures).
- 7.



8.

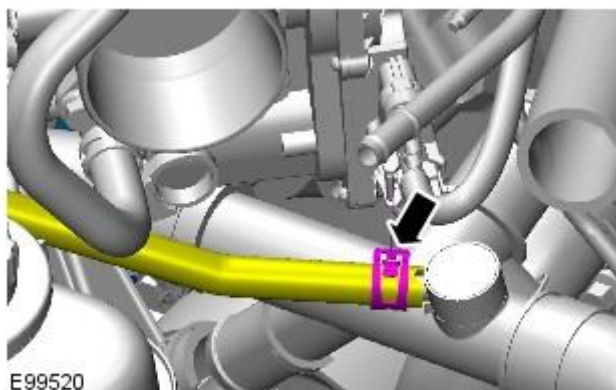
9.

10.



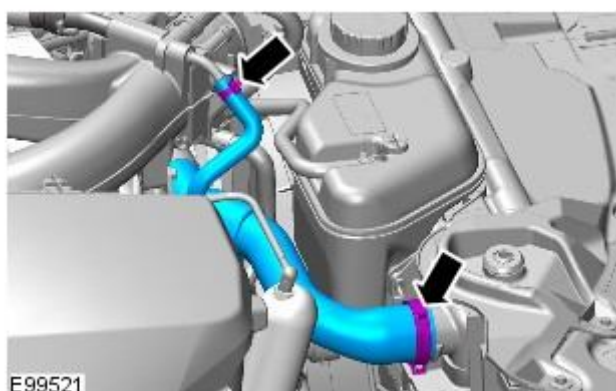
E99519

11.



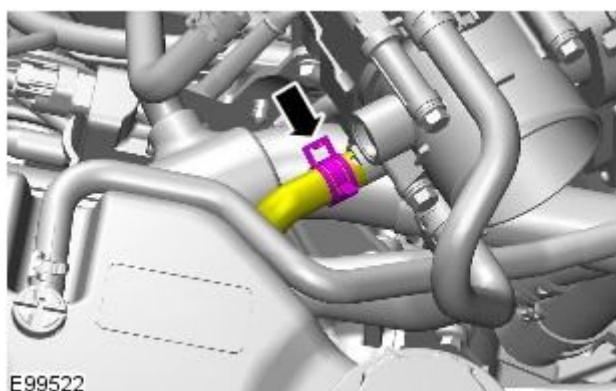
E99520

12.



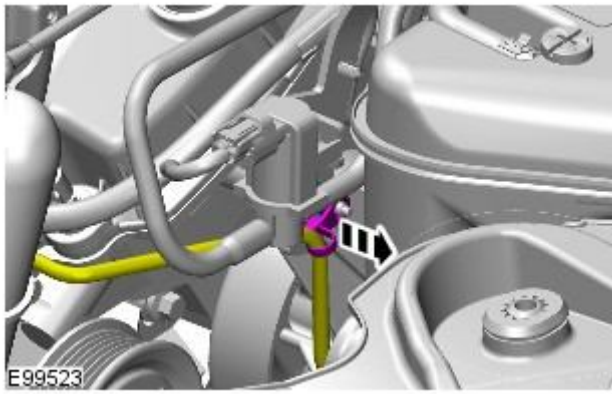
E99521

13.

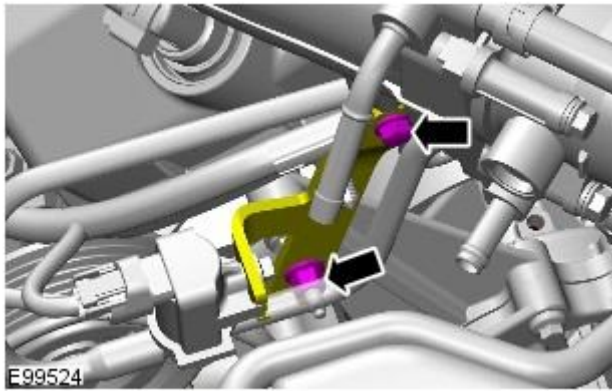


E99522

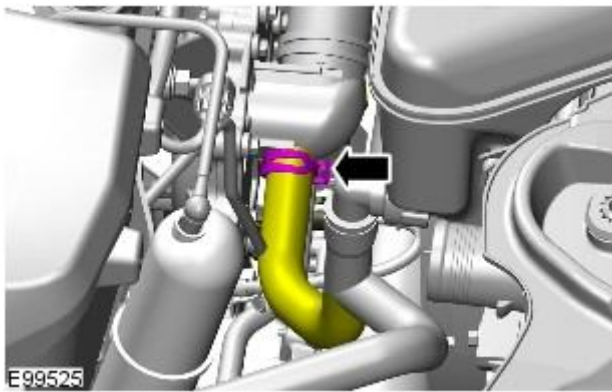
14.



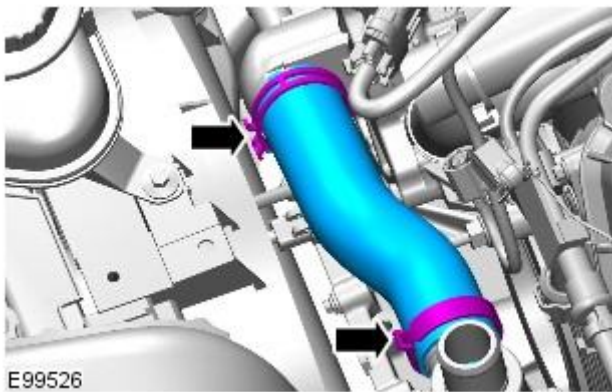
15.



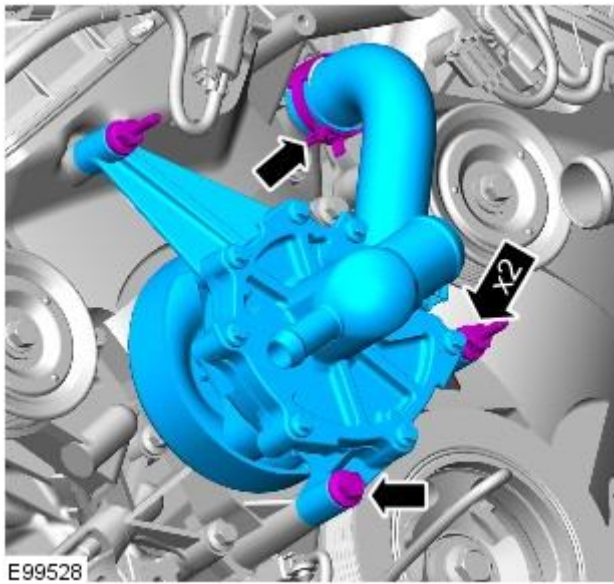
16.



17.



18. TORQUE: 25 Nm



E99528

### Installation

1. To install, reverse the removal procedure.

**Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 -**

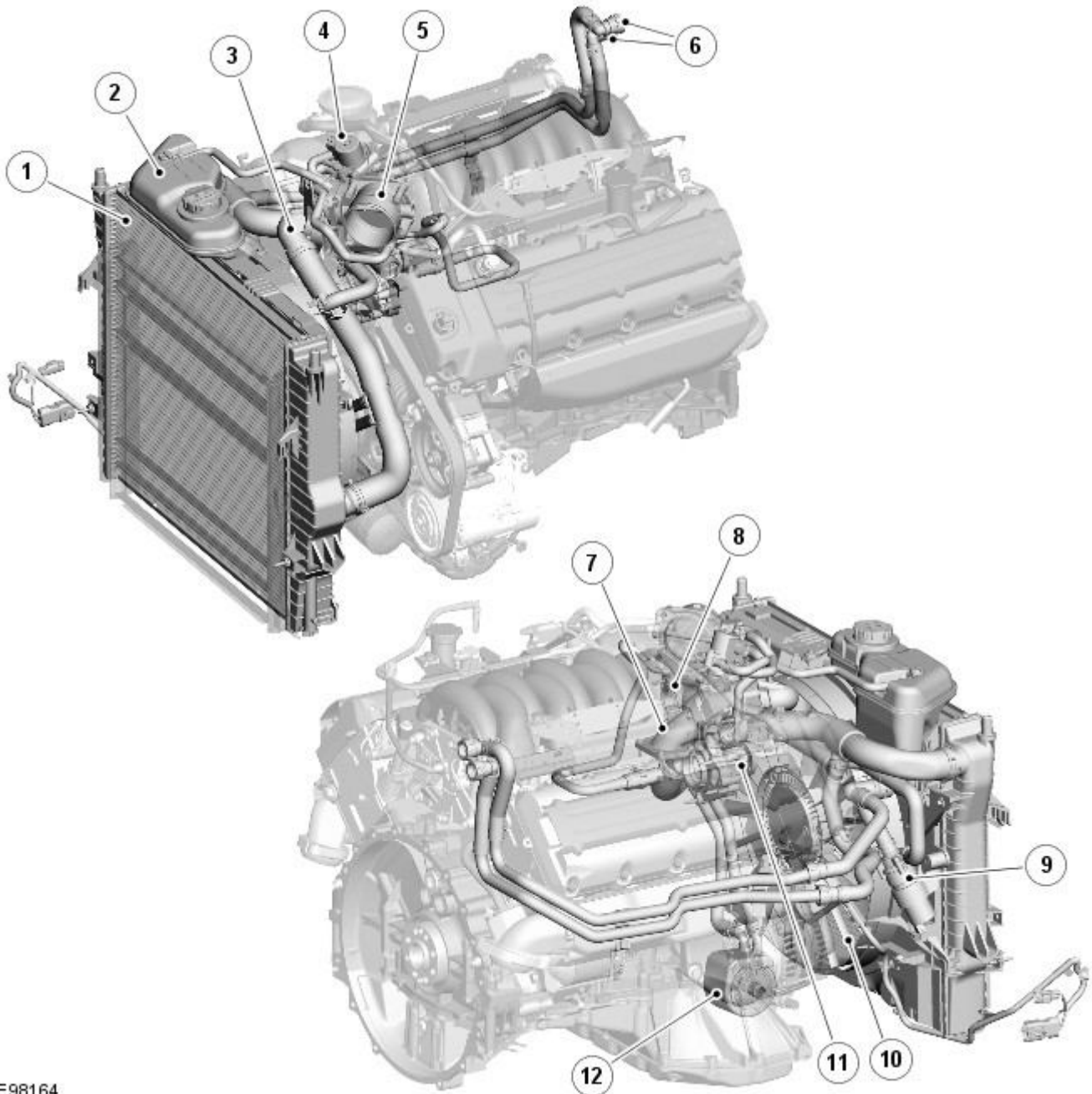
Description		Specification		
Jaguar Premium Cooling System Fluid		WSS M97B44-D		
Jaguar Premium Cooling System Flush		EGR-M14P7-A		
Engine	Capacity			
4.2L	13.3L			
Description	Nm	lb-ft	lb-in	
Coolant expansion tank retaining bolt	3	-	27	
Coolant expansion tank bleed screw	1	-	9	
Cooling fan motor and shroud retaining nuts	7	-	62	
Thermostat housing retaining bolts	9	-	80	
Water pump retaining bolts	A	-	-	
Water pump drive pulley retaining bolts	A	-	-	
Radiator mounting bracket retaining bolts	7	-	62	
Radiator drain plug	1	-	9	
A = refer to the procedure for the correct torque sequence		-	-	-



# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Engine Cooling - Component Location

Description and Operation

Component Location (Sheet 1 of 2 - Vehicles Without Supercharger)

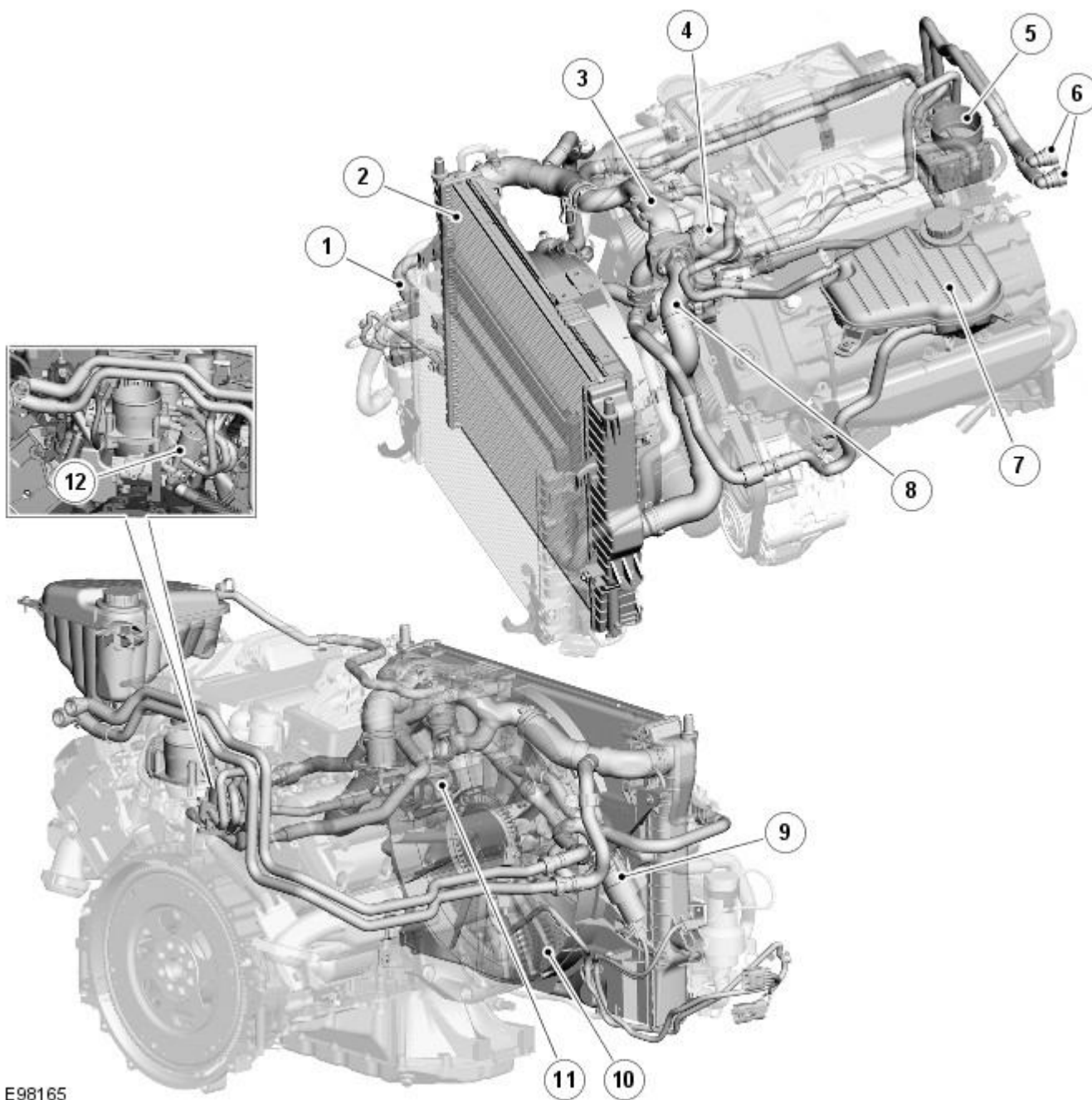


E98164

## ItemDescription

1	Radiator
2	Expansion tank
3	Thermostat cover
4	<a href="#">EGR (exhaust gas recirculation) valve</a>
5	Throttle body
6	Heater core supply and return connections
7	Inlet duct
8	Outlet assembly
9	Auxiliary coolant pump
10	Cooling fan
11	Coolant pump
12	Engine oil cooler

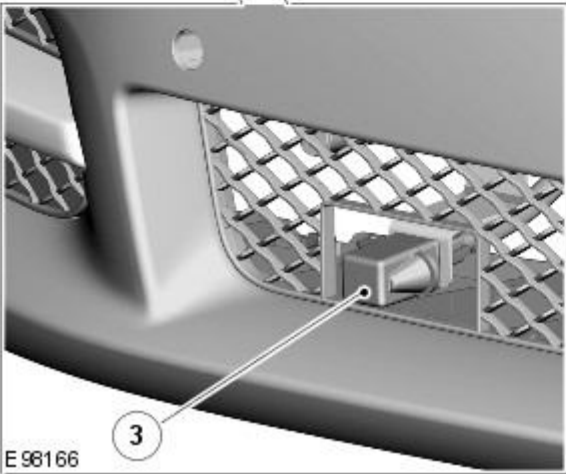
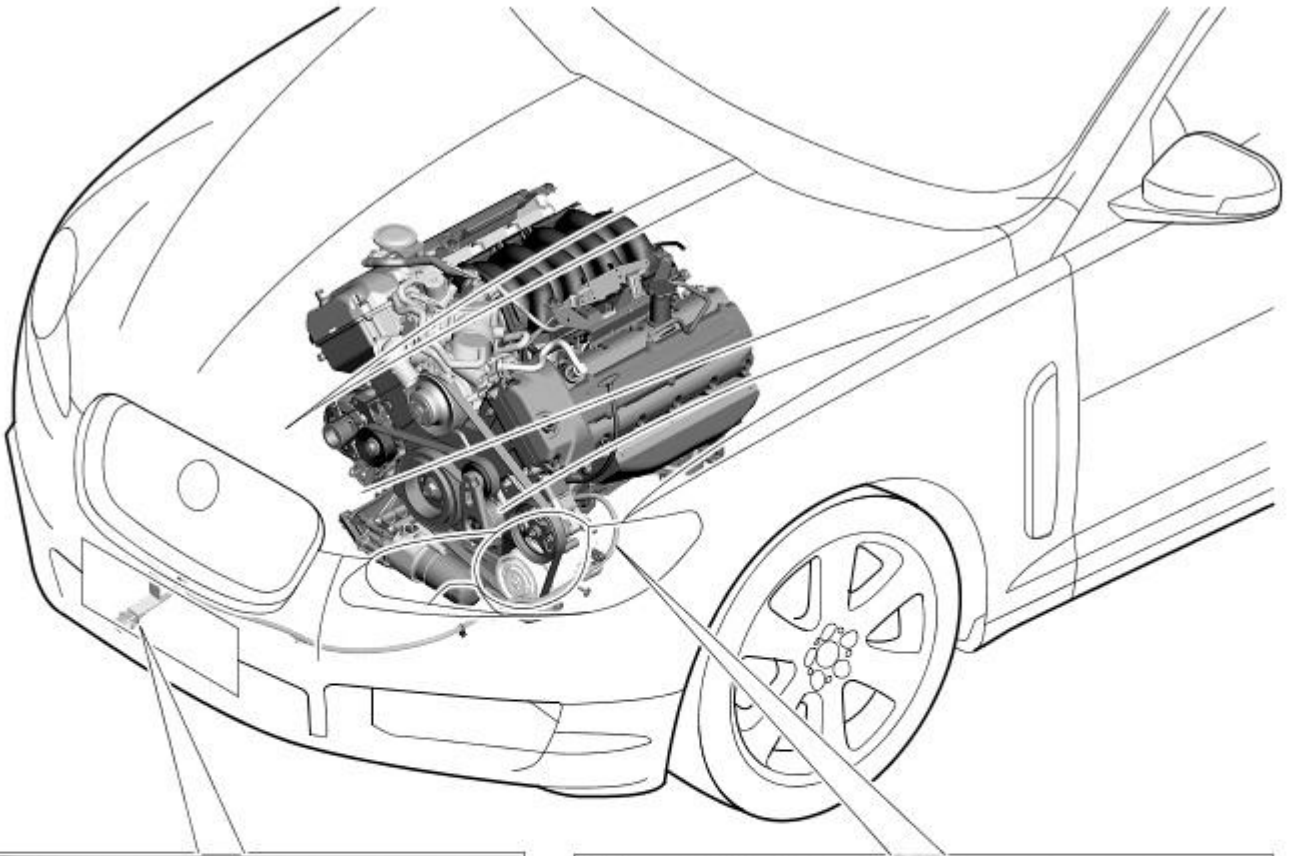




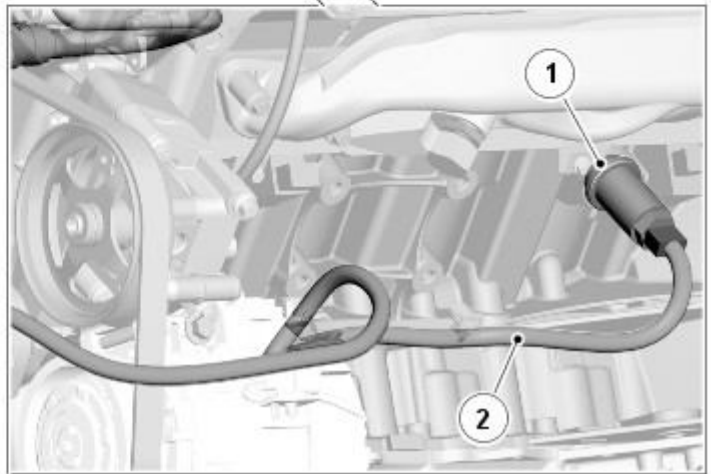
E98165

**ItemDescription**

1	Expansion hose connection to intercooler radiator
2	Radiator
3	Outlet assembly
4	Inlet duct
5	Throttle body
6	Heater core supply and return connections
7	Expansion tank
8	Thermostat cover
9	Auxiliary coolant pump
10	Cooling fan
11	Coolant pump
12	<a href="#">EGR</a> valve



E 98166



**ItemDescription**

- 1 Engine block heater

**Comments:**

110 V ac version shown, 240 V ac version similar.

- 2 Harness

- 3 Connector

# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Engine Cooling - Overview

Description and Operation

## Overview

The engine cooling system maintains the engine within an optimum temperature range under changing ambient and engine operating conditions. It also provides:

- Heating for:
  - The passenger compartment.  
Refer to: [Heating and Ventilation](#) (412-01 Climate Control, Description and Operation).
  - The throttle body.
- Cooling for:
  - The engine lubrication system.
  - The transmission lubrication system.  
Refer to: [Transmission Cooling - Vehicles With: ZF 6HP26](#) (307-02 Transmission/Transaxle Cooling - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).
  - The [EGR \(exhaust gas recirculation\)](#) valve.  
Refer to: [Engine Emission Control](#) (303-08 Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Engine Cooling - System Operation and Component Description

Description and Operation

## System Operation

### General

When the engine is running, the coolant is circulated around the engine cooling system by the coolant pump and the auxiliary coolant pump. From the outlet of the coolant pump, coolant flows through the cylinder block and cylinder heads, then into the outlet assembly. When the coolant is cold, the thermostat is closed and the coolant flows direct from the outlet assembly back to the coolant pump. When the coolant is warm, the thermostat is open and the coolant flows from the outlet assembly to the inlet of the coolant pump via the radiator upper hose, radiator, radiator lower hose and thermostat.

On vehicles without supercharger, when the thermostat is open, the coolant flow through the radiator lower hose generates a coolant flow through the engine oil cooler.

The [EGR \(exhaust gas recirculation\)](#) valve/throttle body and the heater core are on parallel circuits that are unaffected by the position of the thermostat. A constant flow of coolant is supplied to the [EGR](#) valve/throttle body from the outlet assembly. From the throttle body the coolant flows back to a dedicated inlet connection of the coolant pump. A constant flow of coolant is supplied to the heater core from the radiator upper hose. From the heater core outlet, the coolant flows back to the inlet of the coolant pump via the auxiliary coolant pump.

Refer to: [Heating and Ventilation](#) (412-01 Climate Control, Description and Operation).

Expansion and contraction of the coolant is accommodated by the hose connection between the expansion tank and the heater return hose.

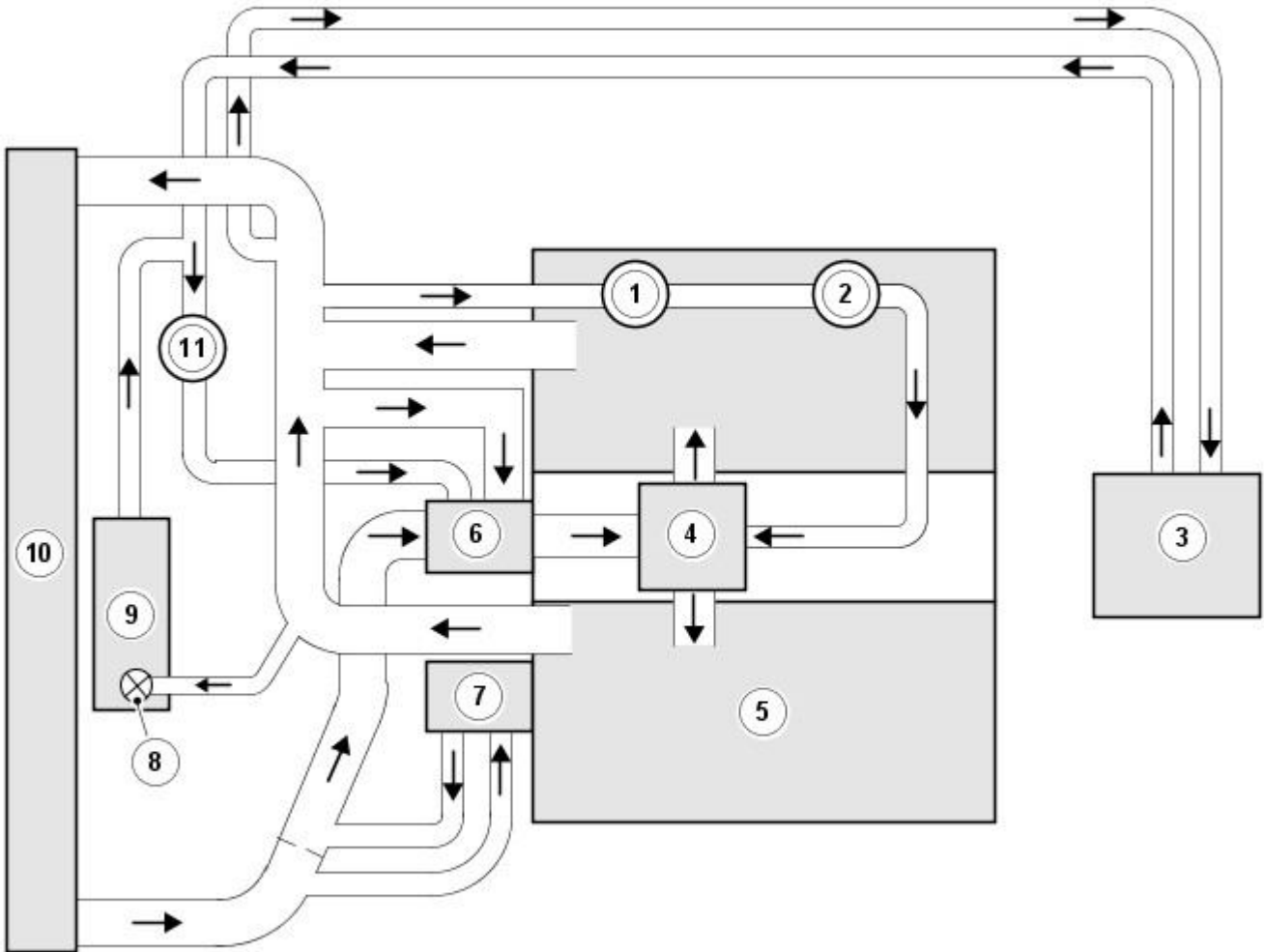
If the coolant level in the expansion tank decreases below a predetermined value, the level sensor connects a ground to the instrument cluster, which activates the appropriate warning.

Refer to: [Instrument Cluster](#) (413-01 Instrument Cluster, Description and Operation).

The cooling fan is operated by a fan control module integrated into the cooling fan motor. The fan control module regulates the voltage, and thus speed, of the cooling fan motor in response to a [PWM \(pulse width modulation\)](#) signal from the [ECM \(engine control module\)](#). The [ECM](#) calculates the required fan speed from the engine temperature, [A/C \(air conditioning\)](#) system pressure and transmission oil temperature. Under hot operating conditions, the fan may continue to operate for four minutes after the engine has been switched off.

Refer to: [Electronic Engine Controls](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

Engine Cooling Flow Diagram (Vehicles Without Supercharger)

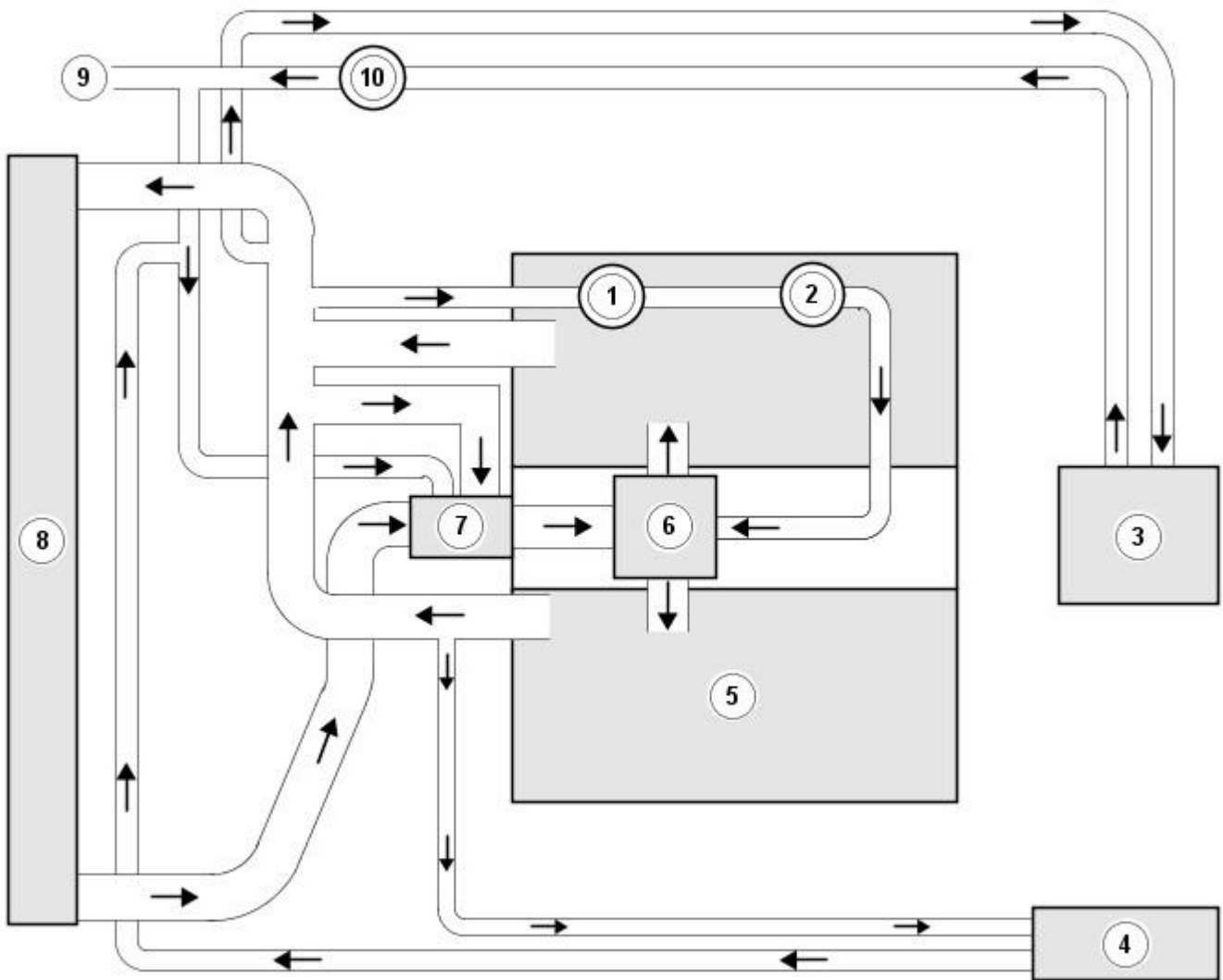


E98064

**ItemDescription**

1	EGR valve
2	Throttle body
3	Heater core
4	Coolant pump
5	Engine
6	Thermostat
7	Engine oil cooler
8	Bleed screw
9	Expansion tank
10	Radiator
11	Auxiliary coolant pump

Engine Cooling Flow Diagram (Vehicles With Supercharger)



E98065

**ItemDescription**

1	<a href="#">EGR</a> valve
2	Throttle body
3	Heater core
4	Expansion tank
5	Engine
6	Coolant pump
7	Thermostat
8	Radiator
9	Connection with supercharger cooling system
<b>Comments:</b>	
Refer to: <a href="#">Supercharger Cooling</a> (303-03B Supercharger Cooling - 4.2L SC V8 - AJV8, Description and Operation).	
10	Auxiliary coolant pump

**Component Description**

**General**

The primary components of the engine cooling system are the:

- Coolant pump.
- Thermostat.
- Radiator.



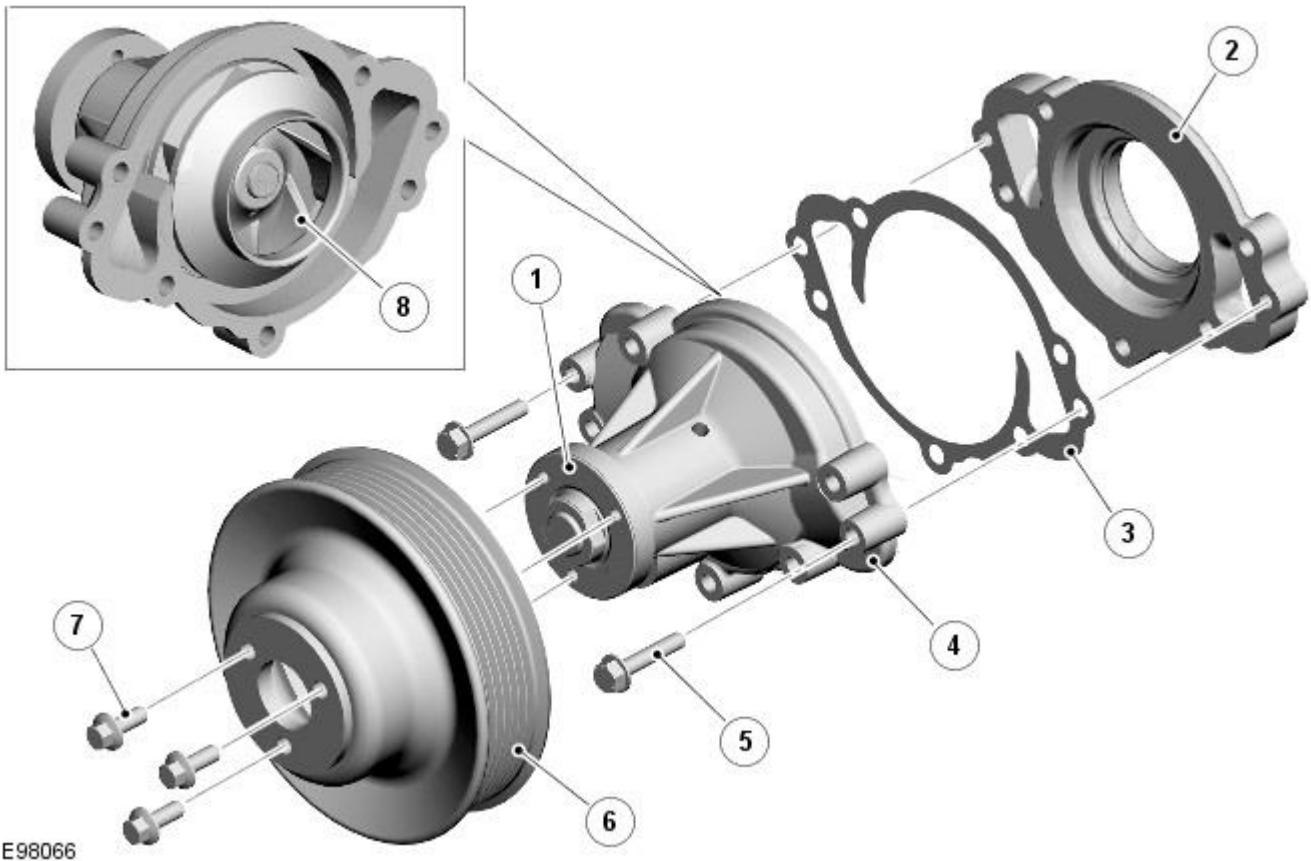
- Cooling fan.
- Expansion tank.
- Engine oil cooler.
- Connecting hoses and pipes.

The engine cooling system also supplies coolant to:

- The heater core.  
Refer to: [Heating and Ventilation](#) (412-01 Climate Control, Description and Operation).
- The EGR cooler.  
Refer to: [Engine Emission Control](#) (303-08 Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).
- The transmission oil cooler (vehicles without supercharger only).  
Refer to: [Transmission Cooling - Vehicles With: ZF 6HP26](#) (307-02 Transmission/Transaxle Cooling - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

In markets subject to very cold climatic conditions, an engine block heater is incorporated into the engine cooling system.

## Coolant Pump



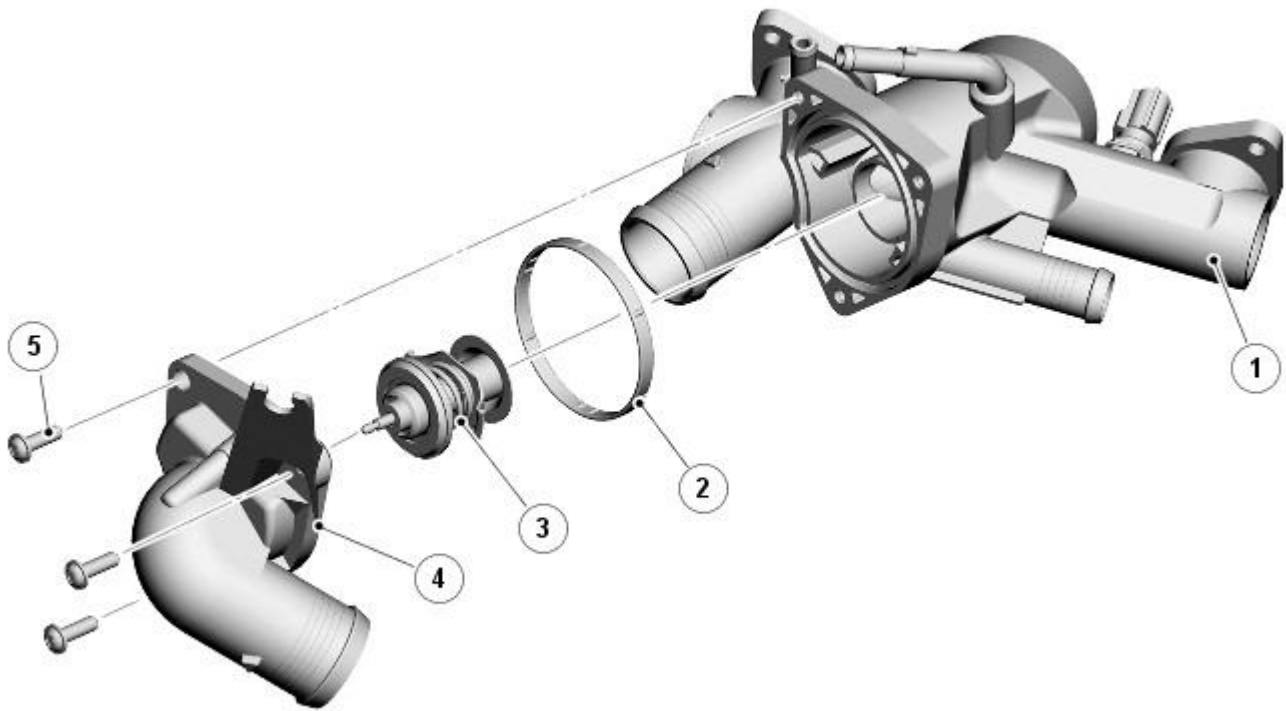
E98066

### ItemDescription

1	Drive hub
2	Adapter
3	Gasket
4	Pump body
5	Bolt (2 off)
6	Pulley
7	Bolt (3 off)
8	Impeller

The coolant pump has a body that supports a shaft with an impeller attached to one end and a drive hub at the other. The body is attached to the front of the cylinder block with an adapter, which encloses the impeller to form the pumping chamber. The pump is driven by a pulley attached to the drive hub and driven by the accessory drive belt. Refer to: [Accessory Drive](#) (303-05 Accessory Drive - 4.2L, Description and Operation).

## Thermostat (Vehicles Without Supercharger)

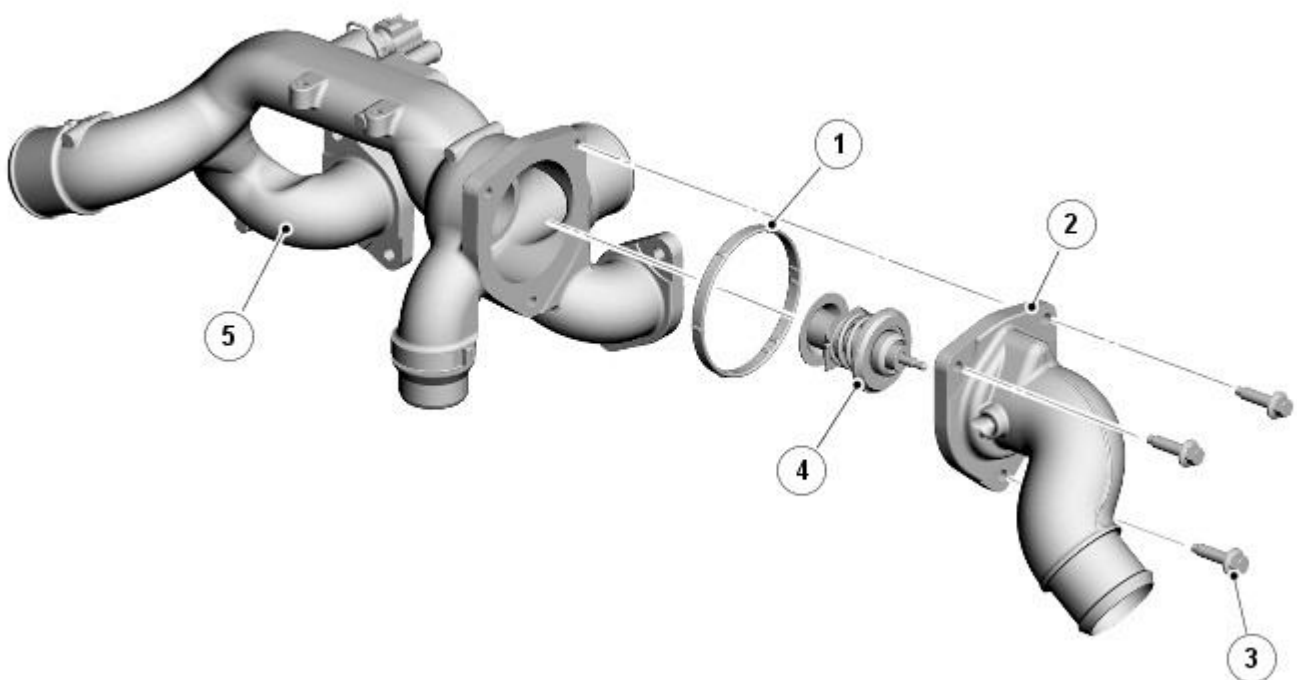


E98067

**ItemDescription**

1	Outlet pipe
2	Seal
3	Thermostat
4	Thermostat cover
5	Bolt (3 off)

Thermostat (Vehicles With Supercharger)



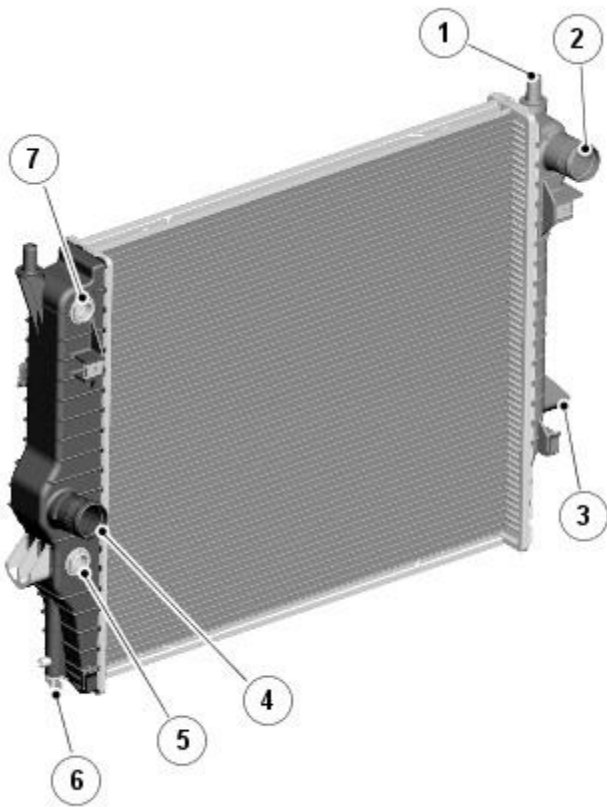
E98068

### ItemDescription

1	Seal
2	Thermostat cover
3	Bolt (3 off)
4	Thermostat
5	Outlet pipe

The thermostat is located in the outlet assembly, under the thermostat cover, and allows rapid engine warm-up by restricting coolant flow through the radiator when the engine is cold. The thermostat also assists in keeping the engine operating temperature within predetermined limits. On vehicles without supercharger, the thermostat begins to open at 88 - 92 °C (190 - 198 °F) and is fully open at 102 °C (216 °F). On vehicles with supercharger, the thermostat begins to open at 84 °C (183 °F) and is fully open at 98 °C (208 °F).

### Radiator



E97780

### ItemDescription

1	Locating spigot (2 off)
2	Coolant inlet
3	Support (2 off)
4	Drain plug
5	Transmission oil outlet
6	Coolant outlet
7	Transmission oil inlet

The radiator is a cross flow type with an aluminum core and plastic end tanks. The radiator is located in the vehicle by locating spigots and supports integrated into the end tanks. The supports are installed in rubber bushes in the upper chassis rails. The locating spigots are installed in rubber bushes in the front end carrier. The transmission oil cooler and a drain plug are integrated into the **LH (left-hand)** end tank. Coolant inlet and outlet connections are incorporated into the **RH (right-hand)** and **LH** end tanks respectively.

### Cooling Fan



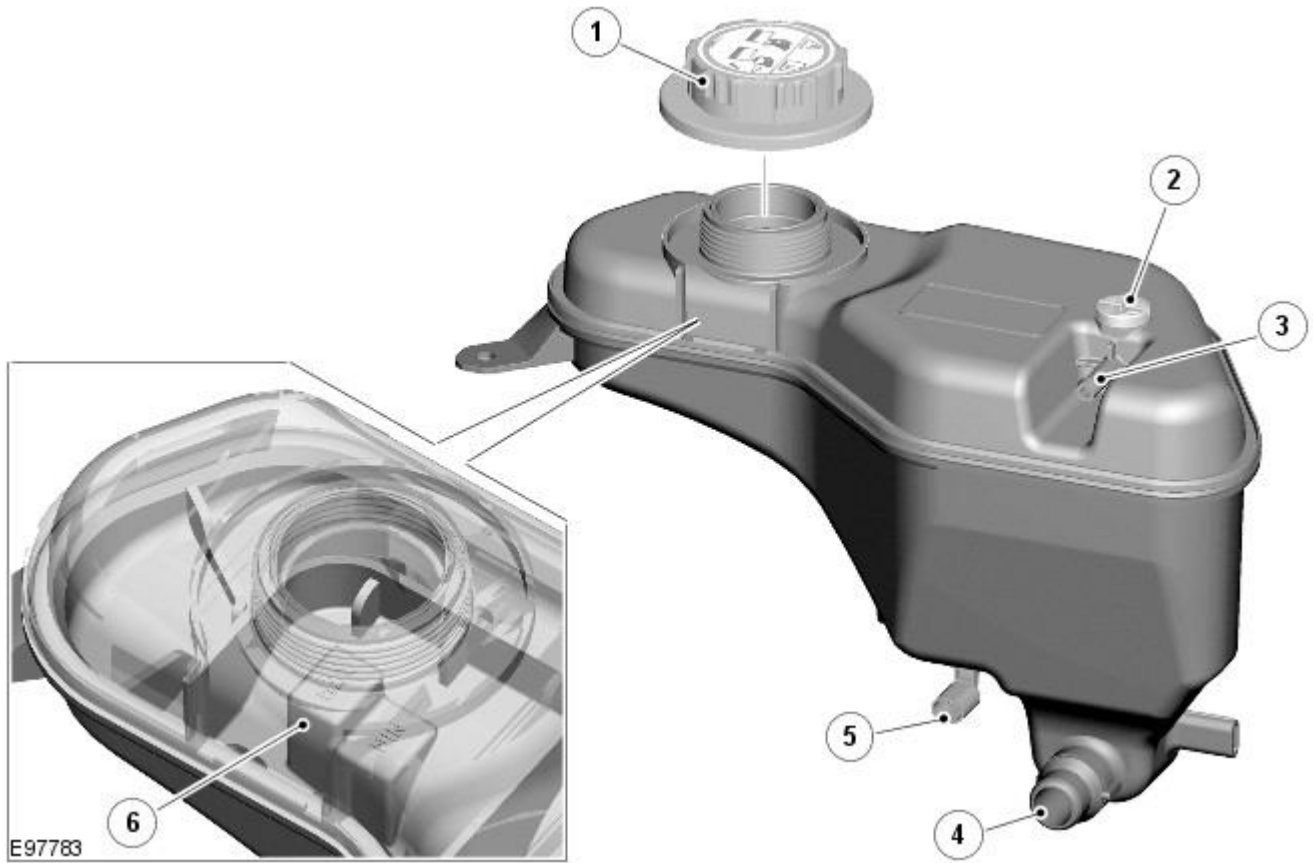
E97781

**ItemDescription**

1	Shroud
2	Electrical connectors
3	Fan
4	Motor and fan control module

An electric, variable speed cooling fan is installed in a shroud attached to the rear of the radiator. The cooling fan is operated by a fan control module, integrated into the electric motor, under the control of the [ECM](#). Two electrical connectors at the [RH](#) side of the shroud provide the interface between the cooling fan harness and the vehicle wiring.

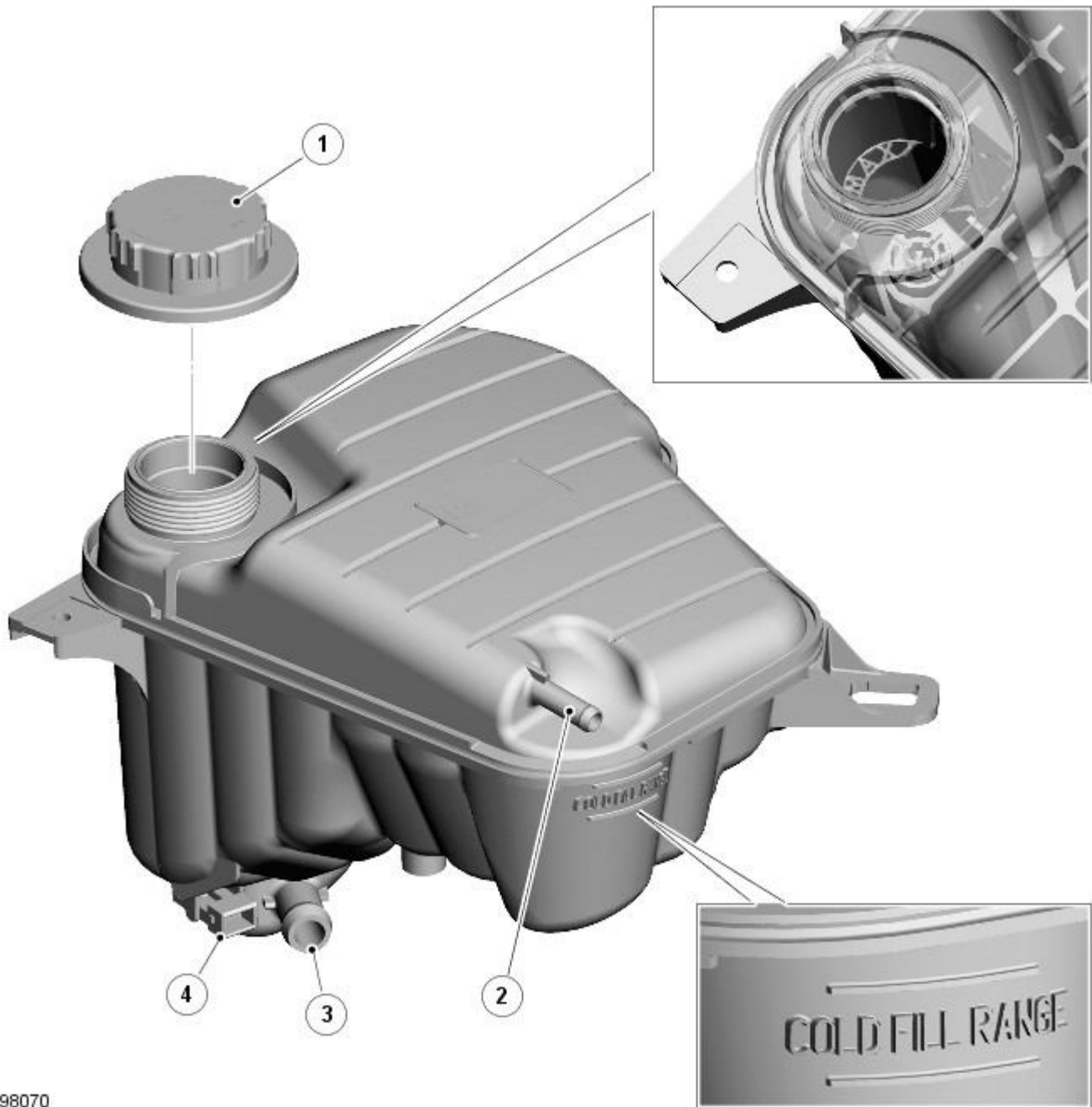
**Expansion Tank (Vehicles Without Supercharger)**



**ItemDescription**

1	Filler cap
2	Bleed screw
3	Vent hose connection
4	Expansion hose connection
5	Level sensor
6	Level markings

Expansion Tank (Vehicles With Supercharger)



E98070

**ItemDescription**

1	Filler cap
2	Vent hose connection
3	Expansion hose connection
4	Level sensor

A pressurized coolant expansion tank system is used, which continuously separates the air from the cooling system and replenishes the system through a hose connected between the expansion tank and the heater return hose. A continuous vent into the expansion tank, through a hose connected to the outlet assembly, prevents air locks from forming in the cooling system.

On vehicles without supercharger, the expansion tank is installed behind the top right corner of the radiator. A filler cap, bleed screw and level sensor are incorporated into the expansion tank. MAX and MIN level markings are molded into the interior of the tank below the filler cap

On vehicles with supercharger, the expansion tank is installed on the [LH](#) front upper suspension housing. A filler cap and level sensor are incorporated into the expansion tank. A MAX level marking is molded into the interior of the tank below the filler cap. Cold fill levels are molded onto the exterior of the tank.

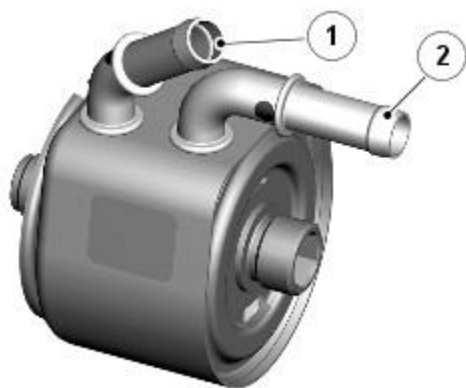
On all vehicles, the expansion tank provides the following functions:

- Service fill.
- Coolant expansion during warm-up.
- Air separation during operation.
- System pressurization by the filler cap.

The expansion tank has an air space of approximately 0.5 to 1 liter (1.06 to 2,11 US pints), above the MAX level, to allow for coolant expansion.



## Engine Oil Cooler (Vehicles Without Supercharger Only)



E98069

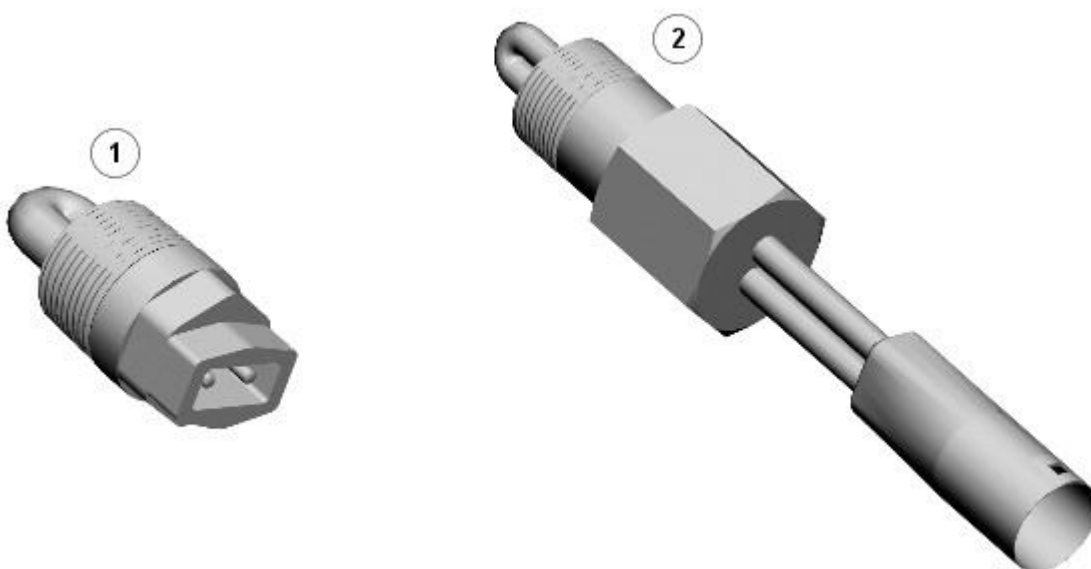
### ItemDescription

- |   |                           |
|---|---------------------------|
| 1 | Coolant outlet connection |
| 2 | coolant inlet connection  |

The engine oil cooler is installed at the front of the engine sump, between the engine oil filter head and the engine oil filter. Engine oil is cooled as it flows back to the filter head from the filter. The coolant supply and return hoses for the engine oil cooler are connected to a T insert in the radiator lower hose. A restrictor in the T insert, between the two oil cooler connections, induces the flow of coolant through the oil cooler.

- NOTE: On vehicles with supercharger, there are two air cooled engine oil coolers.

## Engine Block Heater



E97782

### ItemDescription

- |   |                  |
|---|------------------|
| 1 | 110 V ac version |
| 2 | 240 V ac version |

For vehicle markets subject to very cold climatic conditions, an engine block heater is installed in place of the cylinder block drain plug. The engine block heater is either a 110 V ac or 240 V ac electric heater element, depending on the market, which can be connected to a domestic power supply via a connector in the lower center grill of the front bumper.

## Engine Coolant

The engine coolant is formulated to last for ten years or 240,000 km (150,000 miles). The coolant is silicate free and must not be mixed with conventional engine coolant.

# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Engine Cooling

Diagnosis and Testing

## Principles of Operation

For a detailed description of the petrol engine cooling system, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

[Engine Cooling](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation),  
[Engine Cooling](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation),  
[Engine Cooling](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation),  
[Supercharger Cooling](#) (303-03B Supercharger Cooling - 4.2L SC V8 - AJV8, Description and Operation),  
[Supercharger Cooling](#) (303-03B Supercharger Cooling - 4.2L SC V8 - AJV8, Description and Operation),  
[Supercharger Cooling](#) (303-03B Supercharger Cooling - 4.2L SC V8 - AJV8, Description and Operation).

## Inspection and Verification

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Leaks</li> <li>● Coolant expansion tank</li> <li>● Electric fan</li> <li>● Radiator</li> </ul>	<ul style="list-style-type: none"> <li>● Fuse</li> <li>● Wiring harness</li> <li>● Loose or corroded connector(s)</li> <li>● Engine Coolant Temperature (ECT) sensor</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If there are clear symptoms refer to the table below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Coolant loss	<ul style="list-style-type: none"> <li>● Hoses</li> <li>● Hose connections</li> <li>● Radiator</li> <li>● Coolant pump</li> <li>● Heater core</li> <li>● Gaskets</li> <li>● Engine casting cracks</li> <li>● Engine block core plugs</li> </ul>	<ul style="list-style-type: none"> <li>● GO to Pinpoint Test <a href="#">A.</a></li> </ul>
Engine overheating	<ul style="list-style-type: none"> <li>● Engine coolant (level/condition)</li> <li>● Thermostat</li> <li>● Fan motor</li> <li>● Fan motor fuses and/or circuits</li> <li>● ECT sensor</li> <li>● Engine control module (ECM)</li> <li>● Fan speed module</li> </ul>	<ul style="list-style-type: none"> <li>● GO to Pinpoint Test <a href="#">B.</a></li> </ul>
Engine not reaching normal operating temperature	<ul style="list-style-type: none"> <li>● Thermostat</li> <li>● Electric fan</li> <li>● Fan speed module</li> </ul>	<ul style="list-style-type: none"> <li>● GO to Pinpoint Test <a href="#">C.</a></li> </ul>

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the module or a component is suspect and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the Check and installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.


• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P011623	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Low coolant level</li> <li>● ECT sensor sensing circuit - intermittent high resistance</li> <li>● Engine thermostat failure</li> <li>● ECT sensor failure</li> </ul>	<p>Fill cooling system to correct level and specification. REFER to:</p> <p><a href="#">Specifications</a> (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications), <a href="#">Specifications</a> (303-03B Supercharger Cooling - 4.2L SC V8 - AJV8, Specifications).</p> <p>Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor circuits for intermittent high resistance. Check and install new engine thermostat as required. Check and install a new ECT sensor as required</p>
P011624	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Low coolant level</li> <li>● ECT sensor sensing circuit - intermittent high resistance</li> <li>● Engine thermostat failure</li> <li>● ECT sensor failure</li> </ul>	<p>Fill cooling system to correct level and specification. REFER to:</p> <p><a href="#">Specifications</a> (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications), <a href="#">Specifications</a> (303-03B Supercharger Cooling - 4.2L SC V8 - AJV8, Specifications).</p> <p>Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor circuits for intermittent high resistance. Check and install new engine thermostat as required. Check and install a new ECT sensor as required</p>
P011629	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Low coolant level</li> <li>● ECT sensor sensing circuit - intermittent high resistance</li> <li>● Engine thermostat failure</li> <li>● ECT sensor failure</li> </ul>	<p>Fill cooling system to correct level and specification. REFER to:</p> <p><a href="#">Specifications</a> (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications), <a href="#">Specifications</a> (303-03B Supercharger Cooling - 4.2L SC V8 - AJV8, Specifications).</p> <p>Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor circuits for intermittent high resistance. Check and install new engine thermostat as required. Check and install a new ECT sensor as required</p>
P011700	Engine Coolant Temperature Sensor 1 Circuit Low	<ul style="list-style-type: none"> <li>● ECT sensor sensing circuit - short to power, high resistance, open circuit, disconnected</li> <li>● ECT sensor failure</li> </ul>	<p>Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor circuits for short to power, high resistance, open circuit, disconnected connector. Check and install a new ECT sensor as required</p>
P011800	Engine Coolant Temperature Sensor 1 Circuit High	<ul style="list-style-type: none"> <li>● Engine overheat condition/cooling fan failure</li> <li>● ECT sensor sensing circuit - short to ground</li> <li>● ECT sensor failure</li> </ul>	<p>Check for cooling fan circuit DTCs and refer to relevant action specified in DTC Index. Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor circuits for short to ground. Check and install a new ECT sensor as required</p>
P012500	Insufficient Coolant Temp For Closed Loop Fuel Control	<ul style="list-style-type: none"> <li>● Low coolant level</li> <li>● ECT sensor sensing circuit - intermittent high resistance</li> <li>● Engine thermostat failure</li> <li>● ECT sensor failure</li> </ul>	<p>Fill cooling system to correct level and specification. REFER to:</p> <p><a href="#">Specifications</a> (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications), <a href="#">Specifications</a> (303-03B Supercharger Cooling - 4.2L SC V8 - AJV8, Specifications).</p> <p>Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor sensing circuit for intermittent high resistance. Check and install new engine thermostat as required. Check and install a new ECT sensor as required</p>
P012800	Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature)	<ul style="list-style-type: none"> <li>● Low/contaminated coolant</li> <li>● Engine thermostat failure</li> <li>● Cooling fan circuit(s)/module</li> </ul>	<p>Drain and re-fill cooling system to correct level and specification. REFER to:</p> <p><a href="#">Specifications</a> (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications), <a href="#">Specifications</a> (303-03B Supercharger Cooling - 4.2L SC V8 - AJV8, Specifications).</p> <p>Check and install a new engine thermostat as required. Refer to the electrical circuit diagrams and check cooling fan circuits for short, open circuit. Check for correct operation of cooling fan, check for DTCs and refer to DTC Index</p>
P048023	Fan 1 Control Circuit	<ul style="list-style-type: none"> <li>● Electric cooling fan control circuit - short to ground, high resistance</li> </ul>	<p>Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check electric cooling fan control circuit for short to ground, high resistance</p>
P048024	Fan 1 Control Circuit	<ul style="list-style-type: none"> <li>● Electric cooling fan control circuit - short to power</li> </ul>	<p>Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check electric cooling fan control circuit for short to power</p>

DTC	Description	Possible Cause	Action
P048309	Fan Performance	<ul style="list-style-type: none"> <li>● Cooling fan difficult to turn/obstructed</li> <li>● Fan/Motor damaged</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear any obstruction and Check and install a new fan as required
P048316	Fan Performance	<ul style="list-style-type: none"> <li>● Cooling fan control module reports battery voltage less than nine volts</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check the battery is in fully charged and serviceable condition. Refer to the electrical circuit diagrams and check the charging system and cooling fan circuits for short, open circuit
P048317	Fan Performance	<ul style="list-style-type: none"> <li>● Fan control module reports battery voltage greater than 18 volts</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check the charging system and cooling fan circuits for short, open circuit
P048397	Fan Performance	<ul style="list-style-type: none"> <li>● Cooling fan jammed</li> </ul>	Clear any obstruction from cooling fan
P260100	Coolant Pump Control Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Incorrect installation of electrical connector</li> <li>● Restricted coolant flow</li> <li>● Charge air cooler coolant pump failure</li> <li>● Charge air cooler coolant pump relay failure</li> </ul>	Check for correct installation of the charge air cooler coolant pump electrical connector. Check for restriction in charge air cooler coolant pump and pipes. Check and install a new pump as required. Check for relay failure related DTCs and refer to relevant DTC Index. Check and install a new relay as required

## Pinpoint Tests

PINPOINT TEST A : LOSS OF COOLANT	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>A1: VISUAL INSPECTION</b>	
	<ol style="list-style-type: none"> <li>1 Visually inspect for loss of coolant.</li> <li>2 Carry out a system pressure test. See component tests in this section.</li> </ol>
	<p>Is the engine cooling system leaking?</p> <p><b>Yes</b> Rectify the leak as indicated by the test result. Top-up and fill the cooling system to the correct level with the correct specification fluid as necessary. REFER to:  <a href="#">Specifications</a> (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications),  <a href="#">Specifications</a> (303-03B Supercharger Cooling - 4.2L SC V8 - AJV8, Specifications),  <a href="#">Cooling System Draining, Filling and Bleeding</a> (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, General Procedures).  TEST the system for correct operation.</p> <p><b>No</b> Verify the customer complaint.</p>

PINPOINT TEST B : THE ENGINE OVERHEATS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>B1: CHECK COOLANT</b>	
 <b>WARNING:</b> The cooling system is pressurized! Ensure the reservoir cap is never released until the system has cooled. Failure to follow these instructions may result in personal injury.	
	<ol style="list-style-type: none"> <li>1 Check the coolant level and condition.</li> </ol>
	<p>Does the system contain sufficient coolant of the correct specification?</p> <p><b>Yes</b> <a href="#">GO to B2.</a></p> <p><b>No</b> Top-up and fill the cooling system to the correct level with the correct specification fluid as necessary. REFER to:  <a href="#">Specifications</a> (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications),  <a href="#">Specifications</a> (303-03B Supercharger Cooling - 4.2L SC V8 - AJV8, Specifications),  <a href="#">Cooling System Draining, Filling and Bleeding</a> (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, General Procedures).  Check for coolant loss. <a href="#">GO to Pinpoint Test A.</a></p>
<b>B2: CHECK COOLANT EXPANSION TANK PRESSURE CAP</b>	
	<ol style="list-style-type: none"> <li>1 Check the coolant expansion tank pressure cap for damage/correct operation. REFER to the coolant expansion tank pressure cap pressure test in this section.</li> </ol>
	<p>Is the coolant expansion tank pressure cap operating correctly?</p> <p><b>Yes</b> <a href="#">GO to B3.</a></p> <p><b>No</b> INSTALL a new coolant expansion tank pressure cap. TEST the system for correct operation.</p>
<b>B3: CHECK THERMOSTAT</b>	
	<ol style="list-style-type: none"> <li>1 Check the thermostat for correct operation. REFER to the thermostat component test in this section.</li> </ol>
	<p>Is the thermostat operating correctly?</p> <p><b>Yes</b> Check for correct operation of cooling fans, circuits, sensors, modules, etc. REFER to: <a href="#">Electronic Engine Controls</a> (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC</p>

<b>No</b>	V8 - AJV8, Diagnosis and Testing). INSTALL a new thermostat. REFER to: (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8) <a href="#">Thermostat - 4.2L SC V8 - AJV8</a> (Removal and Installation), <a href="#">Thermostat - 4.2L NA V8 - AJV8</a> (Removal and Installation). TEST the system for correct operation.
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<b>PINPOINT TEST C : THE ENGINE DOES NOT REACH NORMAL OPERATING TEMPERATURE</b>	
<b>TEST CONDITIONS</b>	<b>DETAILS/RESULTS/ACTIONS</b>
<b>C1: CHECK THERMOSTAT</b>	
	<b>1</b> Check the thermostat for correct operation. REFER to the thermostat component test in this section.
	Is the thermostat operating correctly? <b>Yes</b> Check for correct operation of cooling fans, circuits, sensors, modules, etc. REFER to: <a href="#">Electronic Engine Controls</a> (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing). <b>No</b> INSTALL a new thermostat. REFER to: (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8) <a href="#">Thermostat - 4.2L SC V8 - AJV8</a> (Removal and Installation), <a href="#">Thermostat - 4.2L NA V8 - AJV8</a> (Removal and Installation). TEST the system for correct operation.

## Component Tests

### Cooling System Pressure Test



**WARNING:** Never, under any circumstances, remove the coolant expansion tank pressure cap while the engine is operating. To avoid having scalding hot water or steam blow out of the cooling system, use extreme care when removing the coolant expansion tank pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant expansion tank pressure cap and turn it slowly until the pressure begins to release, step back while the pressure is released from the system. When certain all the pressure has been released (still with a cloth) turn and remove the coolant expansion tank pressure cap. Failure to follow these instructions may result in damage to the cooling system, engine and/or cause personal injury.

1. **1.** Switch the engine off.
2. **2.** Open the hood and install protective fender covers.
3. **3.** Carefully remove the coolant expansion tank pressure cap from the coolant expansion tank to relieve pressure in the cooling system. Add coolant to coolant expansion tank as necessary.
4. **4.** Install the pressure tester equipment to the cooling system following manufacturers instructions. Reinstall the coolant expansion tank pressure cap (if pressure test equipment is not installed to the coolant expansion tank).
5. **5.** Pressurize the cooling system to the coolant expansion tank pressure cap lower limit.
6. **6.** Observe the gauge reading for approximately two minutes. Pressure should not drop during this time.
  - If system holds pressure, continue from step 8.
  - If the pressure drops, check the complete cooling system for leaks. Also refer to engine system checks if a leak cannot be located in the cooling system. Correct any leaks found and recheck the system.
7. **7.** Release the system pressure and remove the pressure test equipment. Check the coolant level. Replenish as necessary with the correct coolant solution. REFER to:
  - [Specifications](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications),
  - [Specifications](#) (303-03B Supercharger Cooling - 4.2L SC V8 - AJV8, Specifications).
8. **8.** Check the radiator overflow hose for any obstructions which may block the flow of coolant either to or from the coolant expansion tank.
9. **9.** Conduct the coolant expansion tank pressure cap pressure test in this section.

### Coolant Expansion Tank Pressure Cap Pressure Test



**WARNING:** Never, under any circumstances, remove the coolant expansion tank pressure cap while the engine is operating. To avoid having scalding hot water or steam blow out of the cooling system, use extreme care when removing the coolant expansion tank pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant expansion tank pressure cap and turn it slowly until the pressure begins to release, step back while the pressure is released from the system. When certain all the pressure has been released (still with a cloth) turn and remove the coolant expansion tank pressure cap. Failure to follow these instructions may result in damage to the cooling system, engine and/or cause personal injury.

1. **1.** Remove the expansion tank pressure cap from the coolant expansion tank.
2. **2.** Use water to clean cap in area of rubber seal and vacuum relief valve. Following manufacturers instructions, install the coolant expansion tank pressure cap to the pressure tester.
3. **• NOTE:** If the pressure tester is pressurised too quickly, an erroneous pressure reading may result.

3. Slowly pressurise the system until the pressure gauge reading stops increasing, and note highest pressure reading obtained.
4. 4. Release pressure and repeat Step 3 at least twice to make sure the pressure test reading is repeatable and within specification.
5. 5. If the pressure test gauge readings are not within specification, install a new coolant expansion tank pressure cap.

### Thermostat Test

Remove the thermostat REFER to: (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8)

[Thermostat - 4.2L SC V8 - AJV8](#) (Removal and Installation),

[Thermostat - 4.2L NA V8 - AJV8](#) (Removal and Installation).

Inspect for visible damage, note its opening temperature and immerse it in water. Heat the water until this temperature is reached. The thermostat should begin to open. If it does not begin to open, install a new thermostat. REFER to: (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8)

[Thermostat - 4.2L SC V8 - AJV8](#) (Removal and Installation),

[Thermostat - 4.2L NA V8 - AJV8](#) (Removal and Installation).

If thermostat begins to open, continue to heat the water until the thermostat fully opens, 5.8 mm (0.2 in) or more off the seat. If it does not fully open, install a new thermostat. REFER to: (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8)

[Thermostat - 4.2L SC V8 - AJV8](#) (Removal and Installation),

[Thermostat - 4.2L NA V8 - AJV8](#) (Removal and Installation).

### Radiator Leak Test - Removed from the Vehicle



**CAUTION:** Do not leak test an aluminium radiator in the same water that is used to leak test copper/brass radiators. Flux and caustic cleaners may be present in the test water which will corrode aluminium. If a separate tank is not available, drain and rinse the test tank before testing an aluminium radiator.

Clean the radiator before leak testing to prevent contamination of the test tank. Leak test the radiator in clean water with 138 kPa (20 psi) air pressure.



# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Cooling System Draining, Filling and Bleeding

## General Procedures

### • WARNINGS:



Never remove the coolant expansion tank cap under any circumstances while the engine is operating. Failure to follow this instruction may result in personal injury.



To avoid the possibility of personal injury, do not operate the engine with the hood open until the fan blades have been examined for cracks and separation. Failure to follow this instruction may result in personal injury.

### • CAUTIONS:



The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage. Failure to follow this instruction may result in damage to the engine.



Never remove the coolant expansion tank cap under any circumstances while the engine is operating. Failure to follow this instruction may result in damage to the engine.

### All vehicles



1. **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.



2. **WARNING:** Release the cooling system pressure by slowly turning the coolant expansion tank cap a quarter of a turn. Cover the expansion tank cap with a thick cloth to prevent the possibility of scalding. Failure to follow this instruction may result in personal injury.

Release the cooling system pressure.

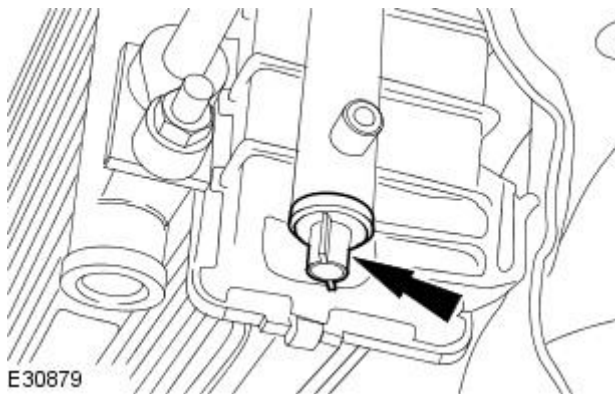
- Remove the coolant expansion tank cap.

3. Remove the radiator splash shield.

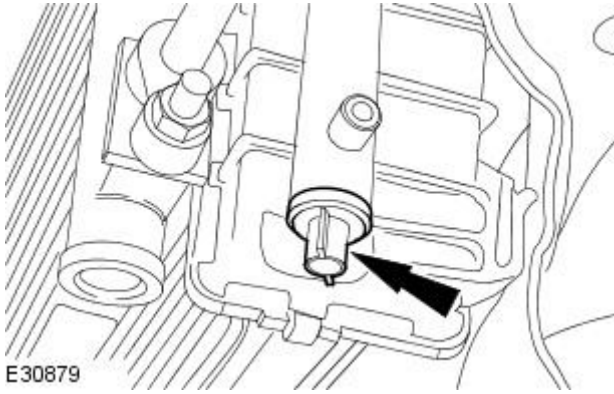
For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).


4. Drain the coolant.

- Position a container to collect the fluid.
- Remove the drain plug.



### All vehicles



5.  **CAUTION:** Do not over tighten the drain plug. Failure to follow this instruction may result in damage to the vehicle.

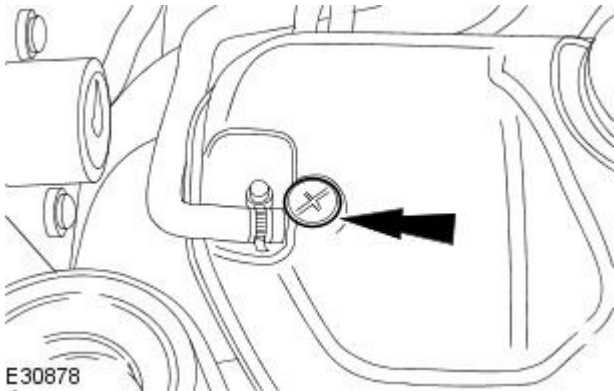
Install the drain plug.

- Remove the drain tray.

6. Lower the vehicle.

Vehicles without supercharger

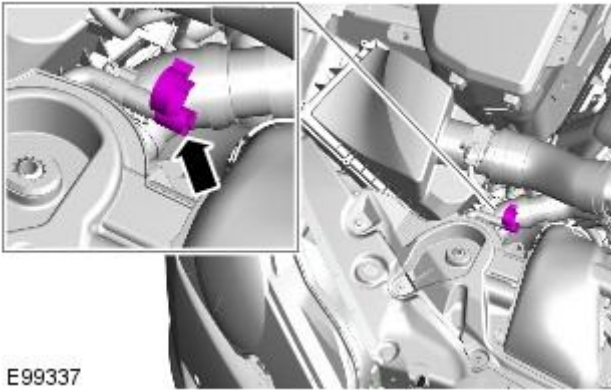
7. Loosen the cooling system bleed screw.



Vehicles with supercharger

8. **NOTE:** Position cloth to collect fluid spillage.

Loosen the cooling system bleed screw.

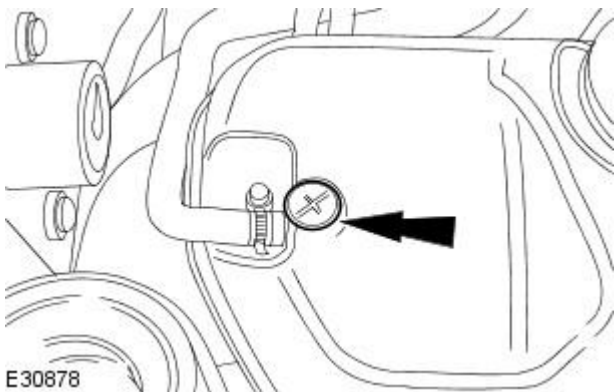


Vehicles without supercharger

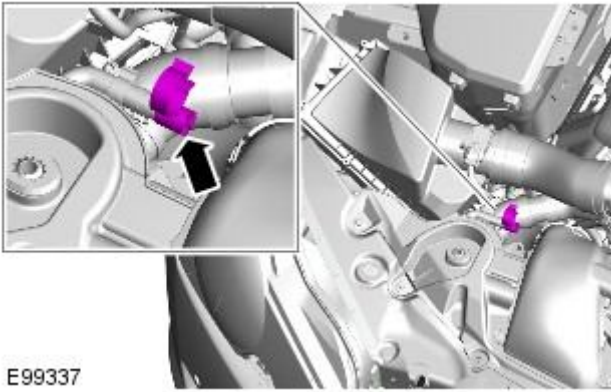
9.  **CAUTION:** Anti-freeze concentration must be maintained at 50%.

Refill the cooling system.

- When coolant runs from the expansion tank bleed point bubble-free, tighten the bleed screw.



## Vehicles with supercharger




10.  CAUTION: Anti-freeze concentration must be maintained at 50%.

Refill the cooling system.

- When coolant runs from the expansion tank bleed point bubble-free, tighten the bleed screw.


## All vehicles

11. Install the coolant expansion tank cap.

12.  CAUTION: Do not RUN the engine with the coolant expansion tank pressure cap removed. Failure to follow this instruction may cause damage to the vehicle.

Start and run the engine.

13. Set the heating system to MAX heat, the blower motor to MAX speed and the air distribution to the instrument panel registers.

14.  CAUTION: Observe the engine temperature warning light. If the warning light is displayed, switch off immediately and allow to cool. Failure to follow this instruction may cause damage to the vehicle

Allow the engine to run until hot air is emitted from the instrument panel registers, while observing the engine temperature warning light.

15. Switch the engine off.

16. Allow the engine to cool.

17. Release the cooling system pressure.

- Remove the coolant expansion tank pressure cap.

18. Maintain the coolant level in the coolant expansion tank at the MAX mark using a 50% mixture of Jaguar Premium Cooling System Fluid or equivalent, meeting Jaguar specification WSS M97B44-D and 50% water.

19. Install the coolant expansion tank pressure cap.

20. Raise the vehicle.

21. Install the radiator splash shield.

For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Coolant Expansion Tank

Removal and Installation

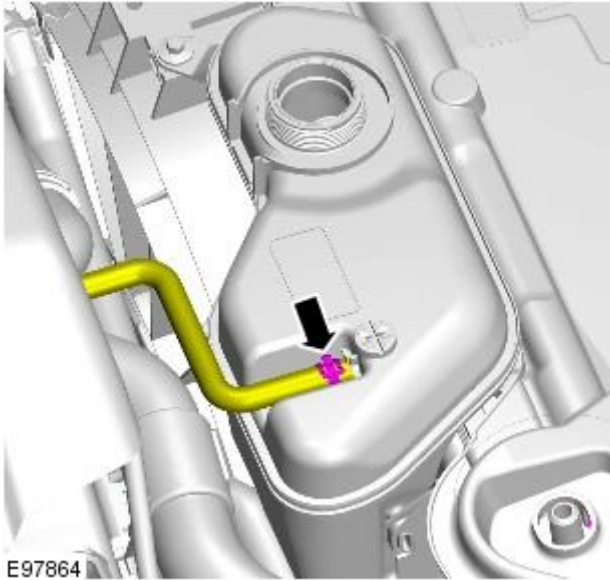
## Removal

• NOTE: Removal steps in this procedure may contain installation details.

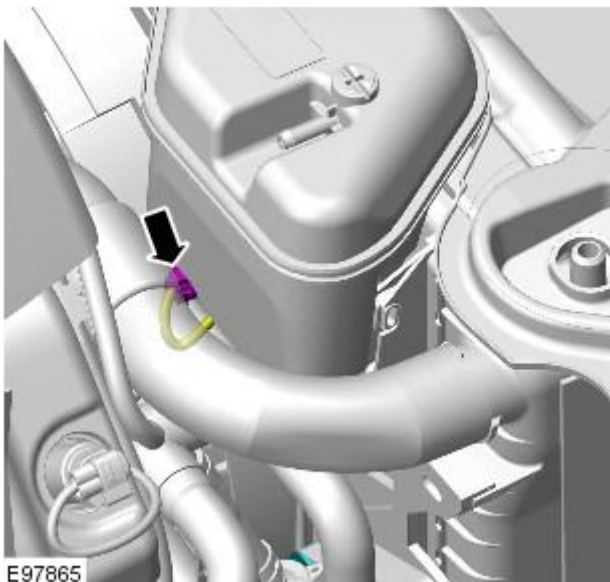
1. Raise and support the vehicle.
2. For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).

3.  CAUTION: Take extra care when handling the component.

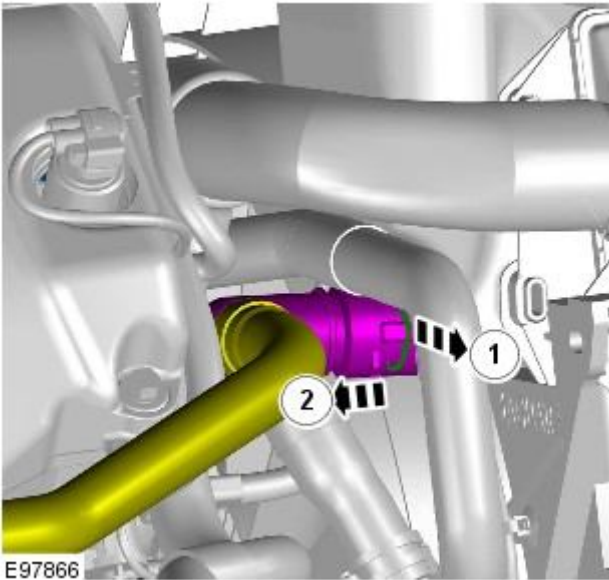
• NOTE: Cap the vent hose to minimize coolant loss.



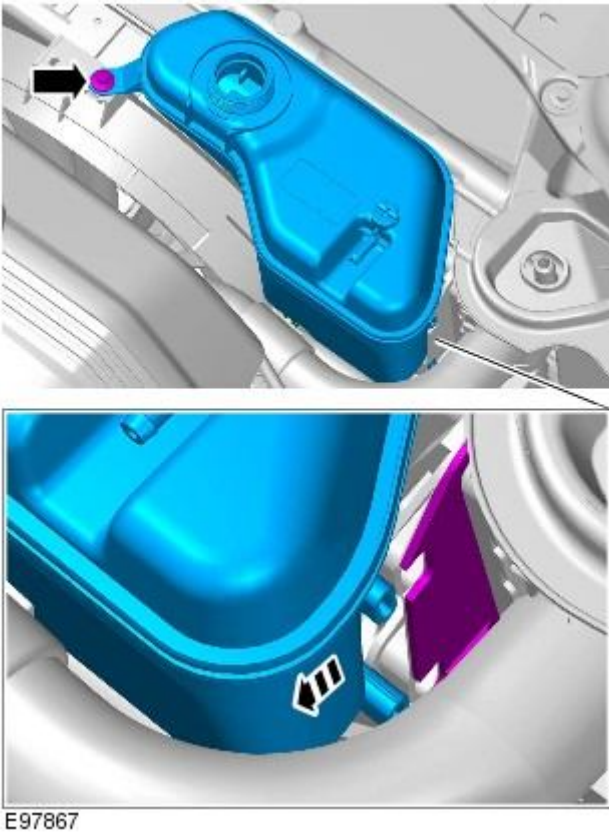
4.



5. NOTE: Cap the coolant expansion tank lower hose to minimize coolant loss.



6. TORQUE: 3 Nm



### Installation

1. Install is the reverse of removal.



# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Cooling Fan Motor and Shroud

Removal and Installation

## Removal

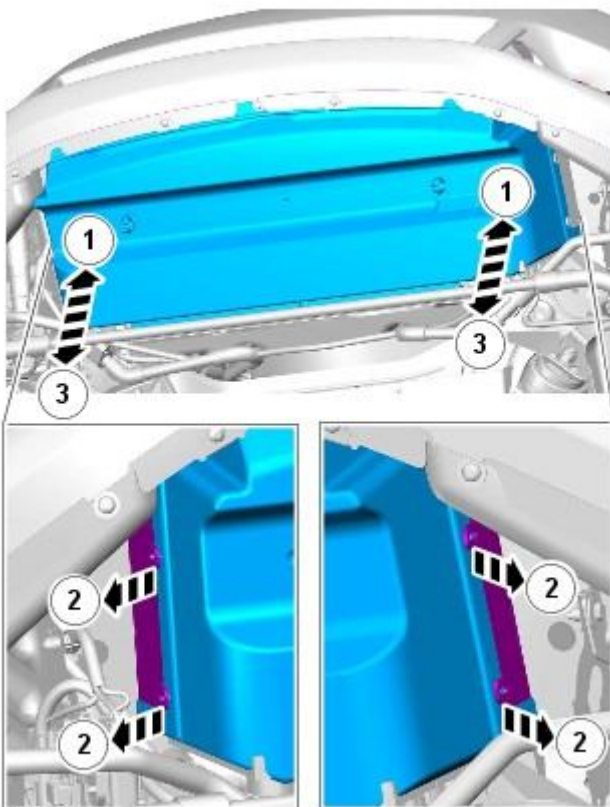
• NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).
3. Refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).
4. Refer to: Air Cleaner LH (303-12, Removal and Installation).
5. Refer to: Air Cleaner RH (303-12, Removal and Installation).
6. Refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).

7.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

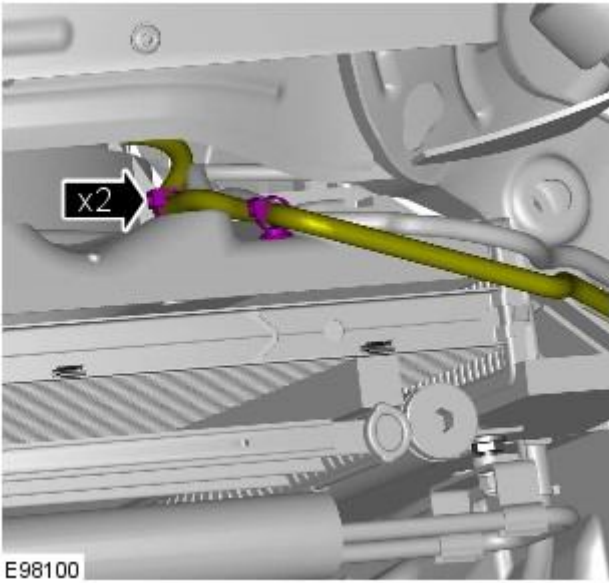
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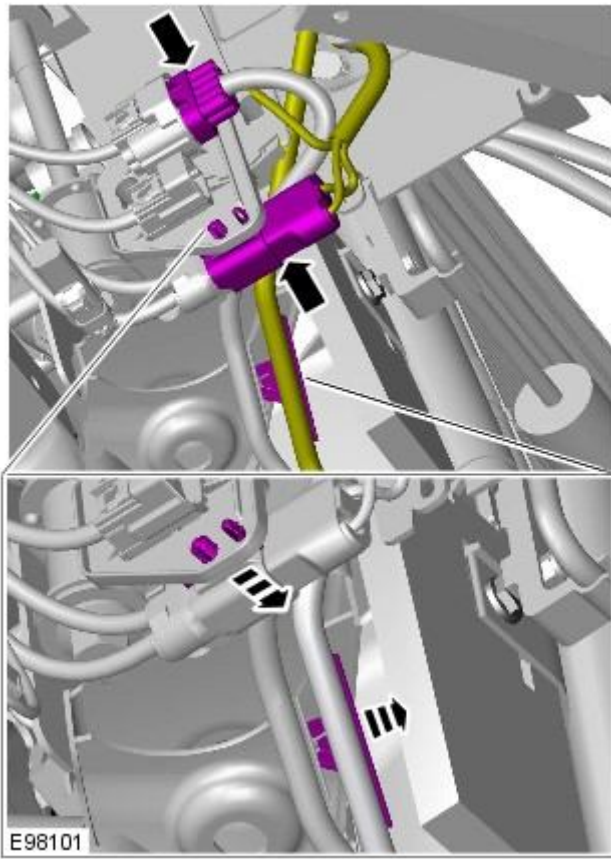
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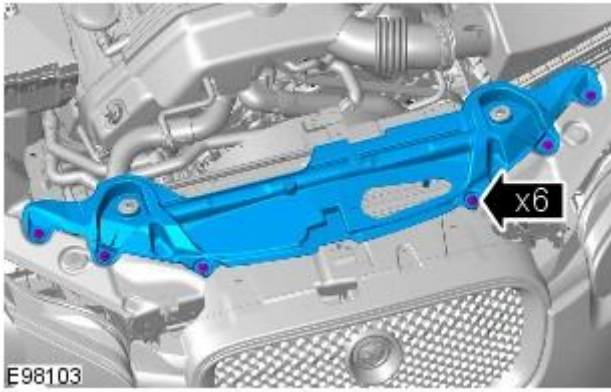


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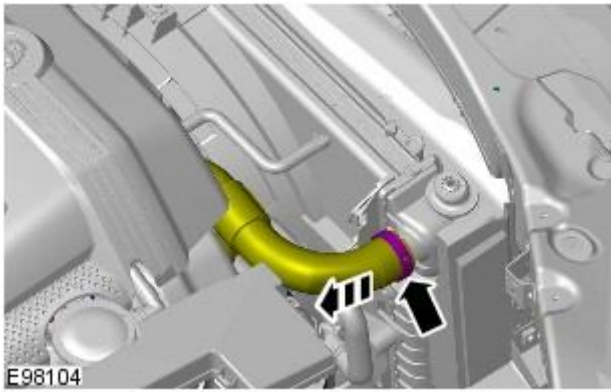


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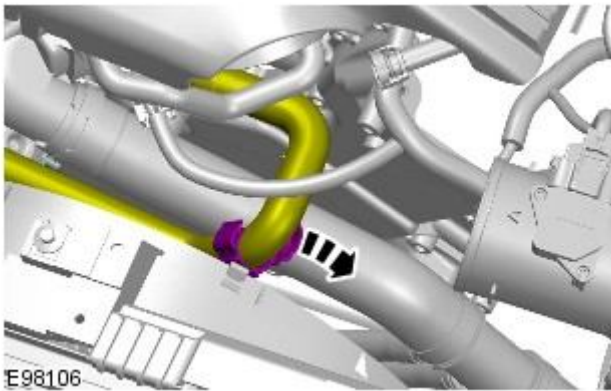




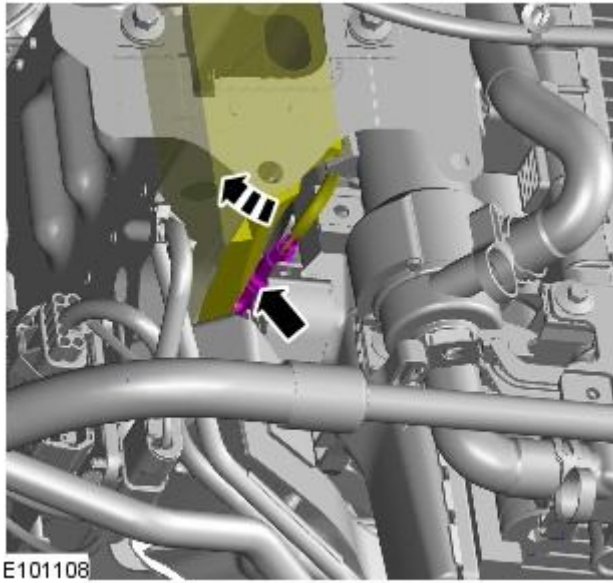
11. Torque: 7 Nm



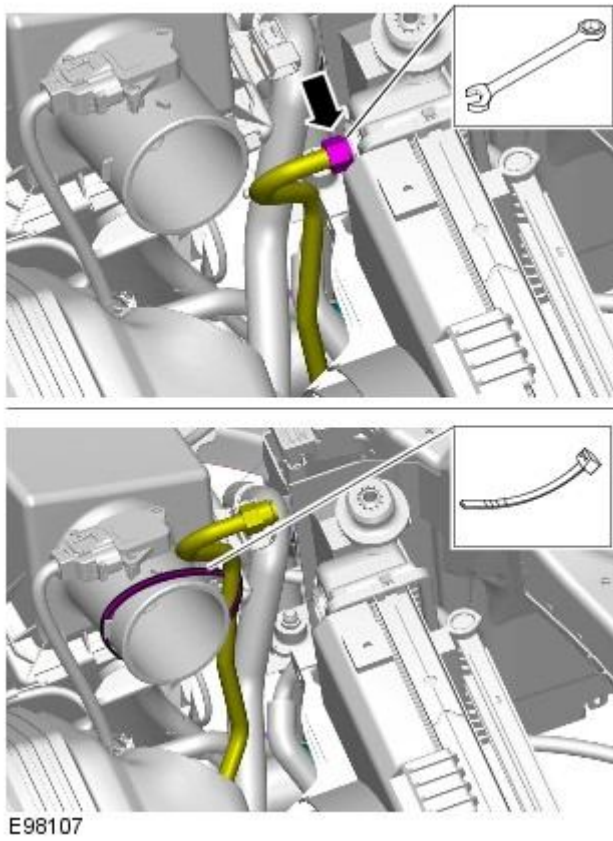
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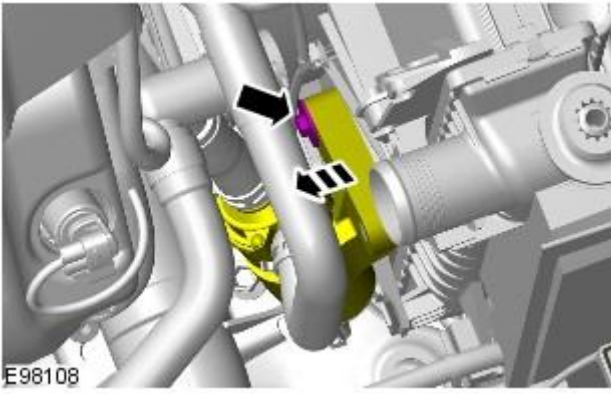
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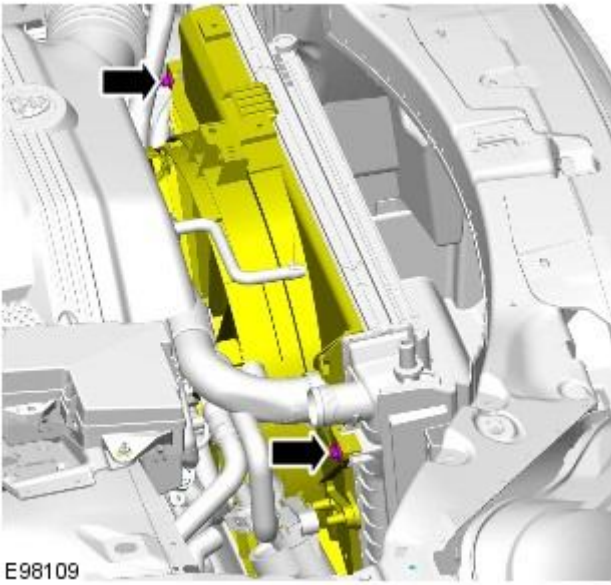
14.



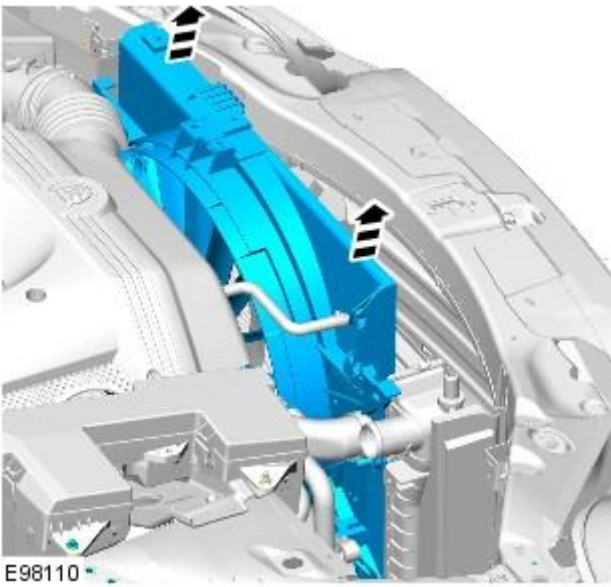
15.



16.



17.



18.

## Installation

1. To install, reverse the removal procedure.


# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Cooling Fan Motor and Shroud

4.2L NA V8 - AJV8  
Removal and Installation

## Removal

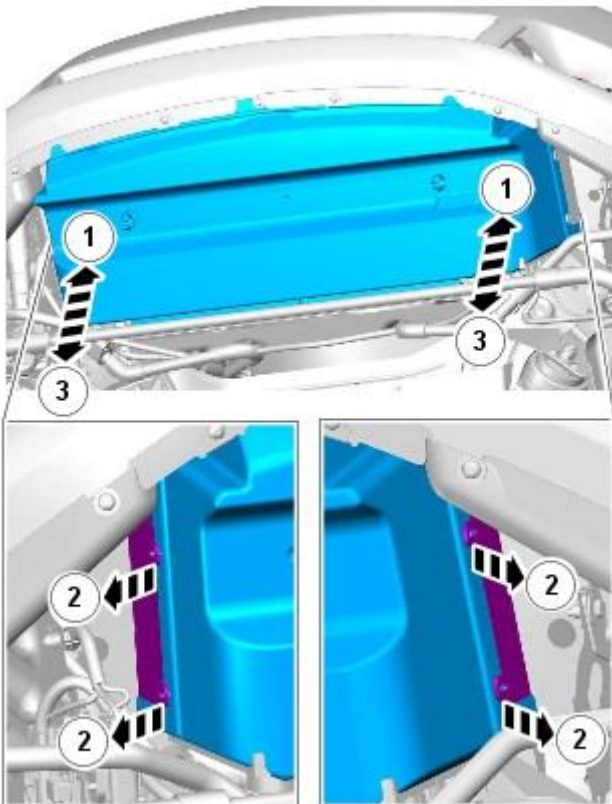
• NOTE: Removal steps in this procedure may contain installation details.

1. For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. For additional information, refer to: [Coolant Expansion Tank](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
3. For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).
4. For additional information, refer to: [Air Cleaner](#) (303-12, Removal and Installation).

5.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

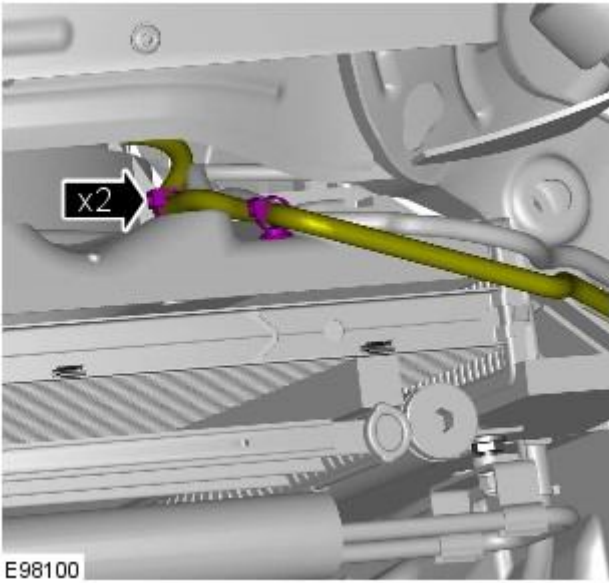
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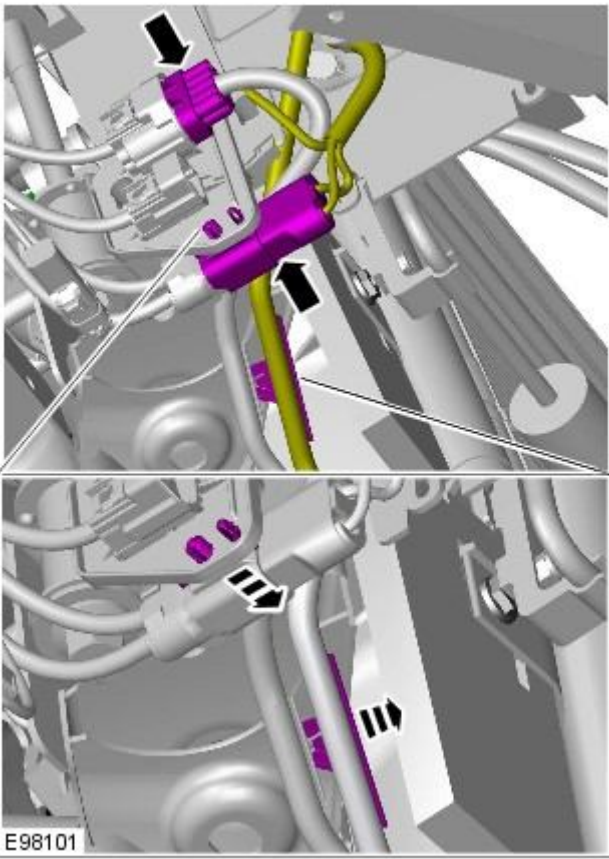
E97870



7.

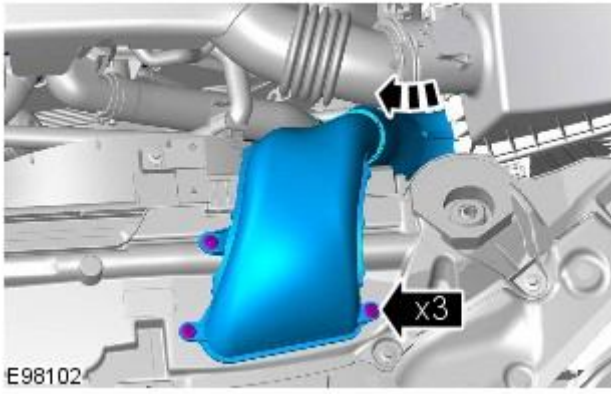


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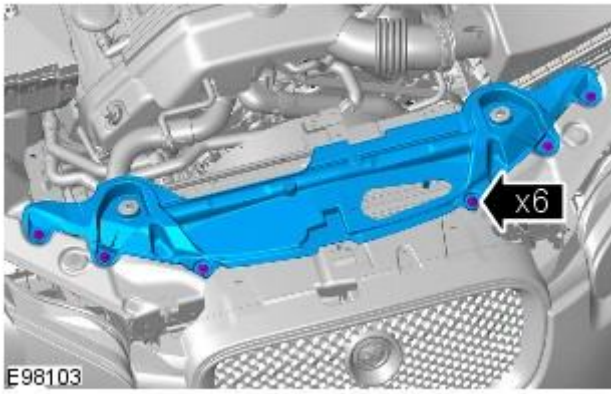




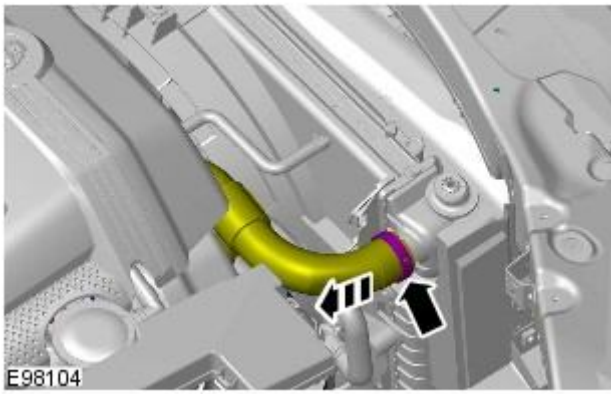
9. TORQUE: 7 Nm



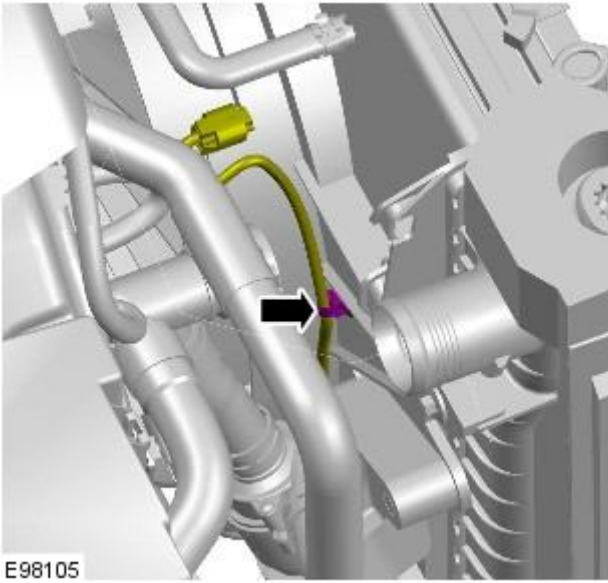
10. TORQUE: 7 Nm



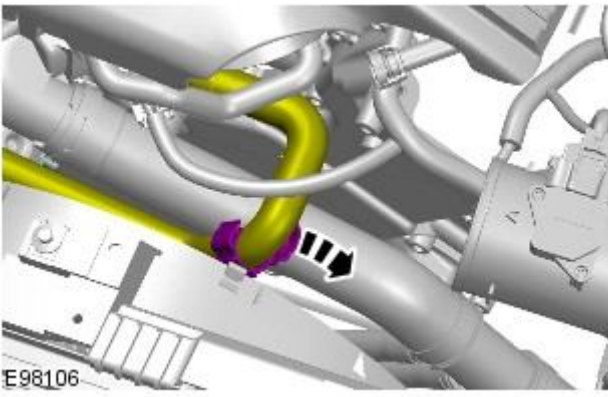
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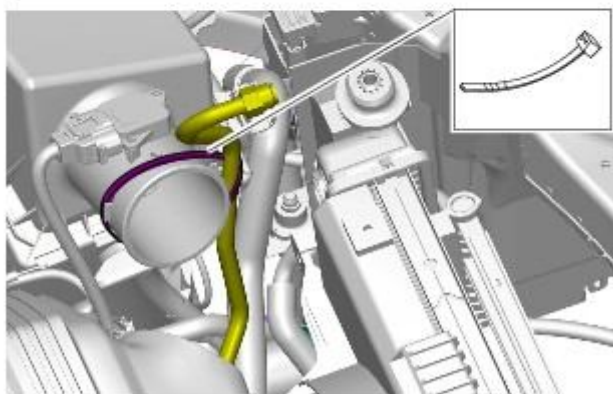
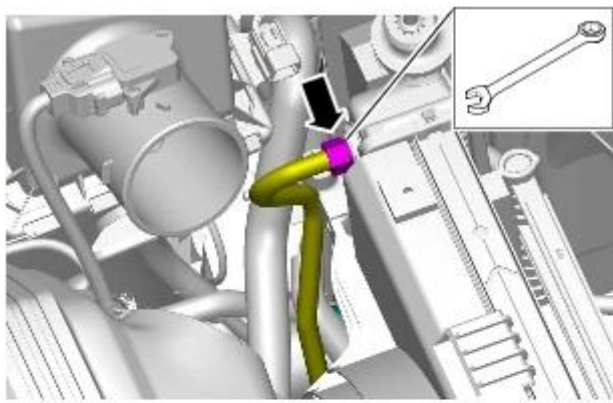
12.



13.

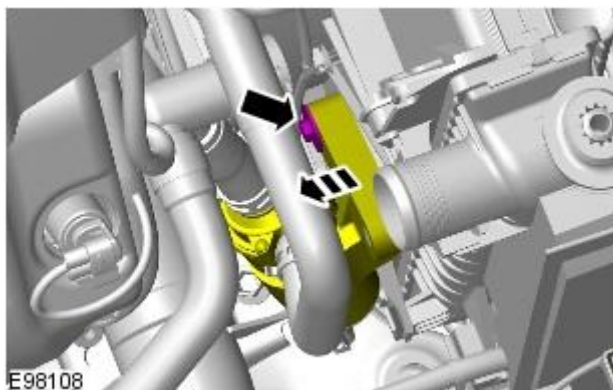


14.  CAUTION: Be prepared to collect escaping oil.



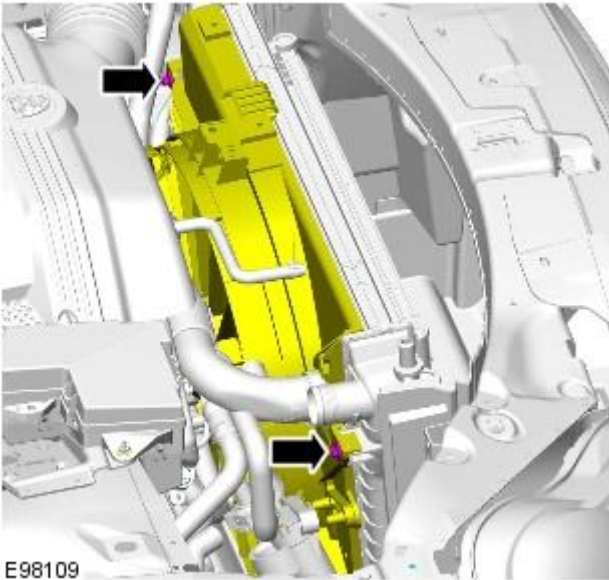
E98107

15.

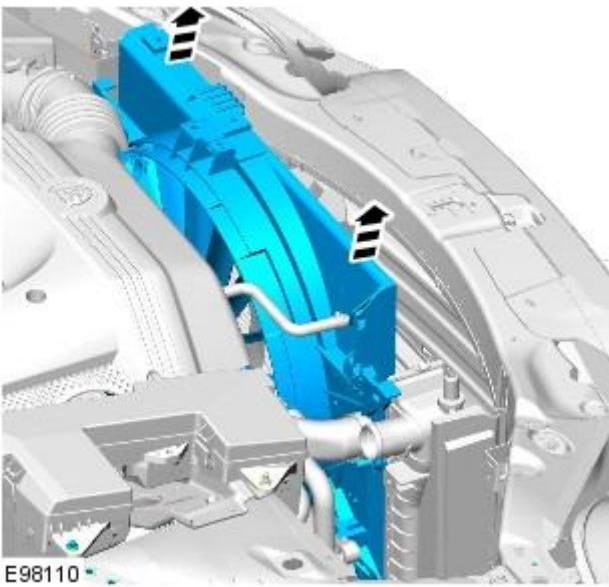


E98108

16.



17.



### Installation

1. To install, reverse the removal procedure.

# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Coolant Manifold 4.2L SC V8 - AJV8


Removal and Installation

## Removal



**CAUTION:** Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.

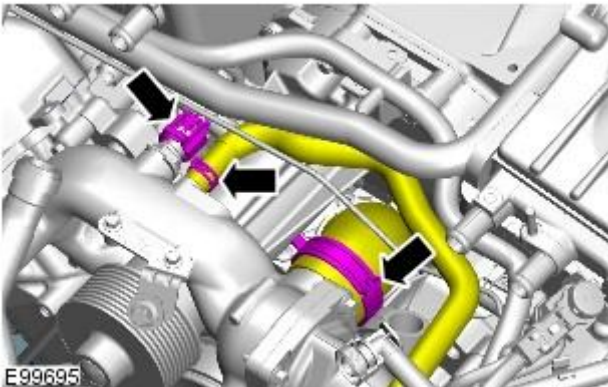
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

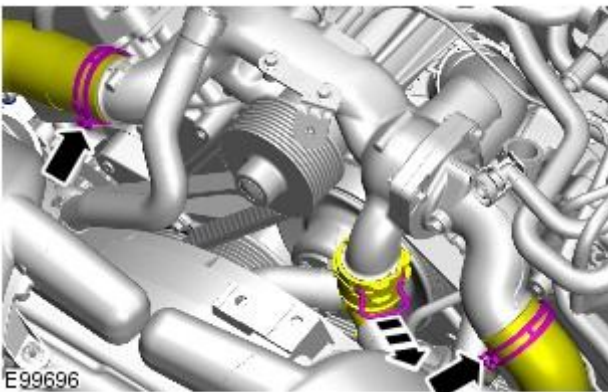
Raise and support the vehicle.

3. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).
4. Refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).
5. Refer to: [Supercharger Belt](#) (303-05B Accessory Drive - 4.2L SC V8 - AJV8, Removal and Installation).

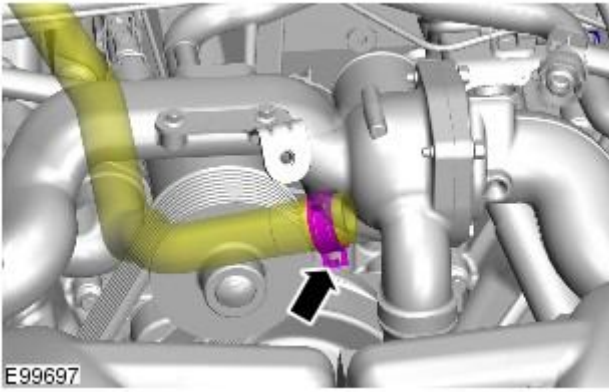
6.



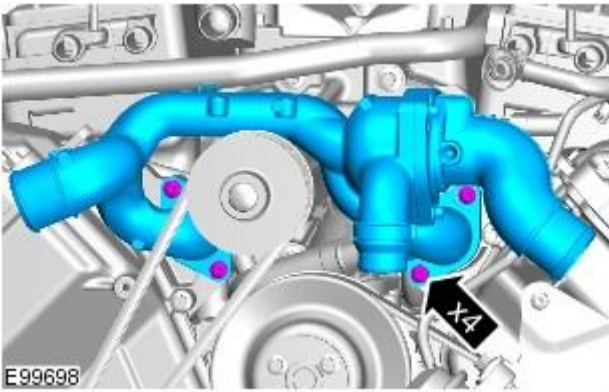
7.







8.



9. Torque: 10 Nm

## Installation

1. To install, reverse the removal procedure.



# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Cooling Module 4.2L SC V8 - AJV8

Removal and Installation

## Removal

1. For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03, General Procedures).

4. For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

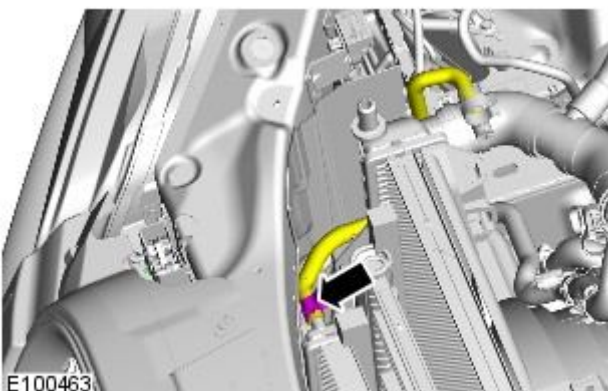
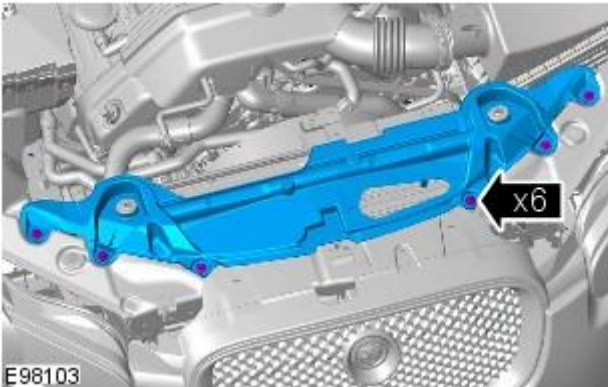
5. For additional information, refer to: [Air Cleaner LH](#) (303-12, Removal and Installation).

6. For additional information, refer to: [Air Cleaner RH](#) (303-12, Removal and Installation).

7. For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

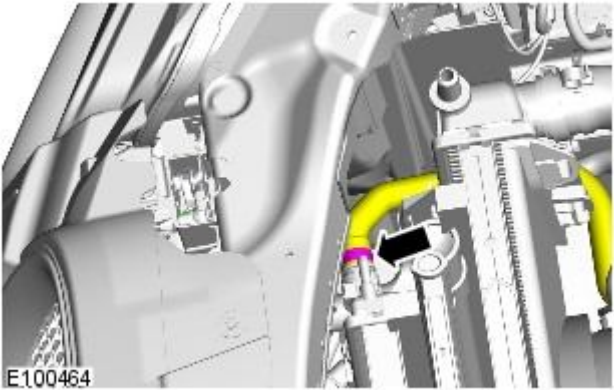
8. **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

TORQUE: 7 Nm

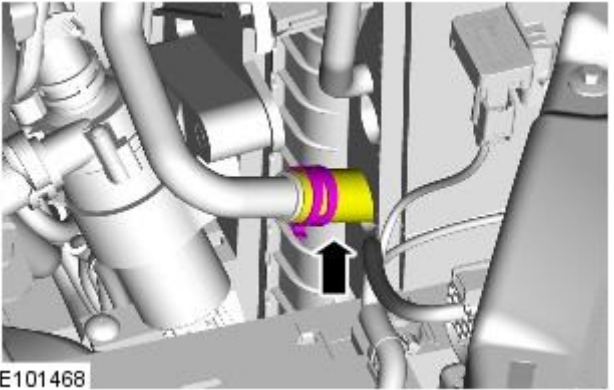


9. **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

10. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

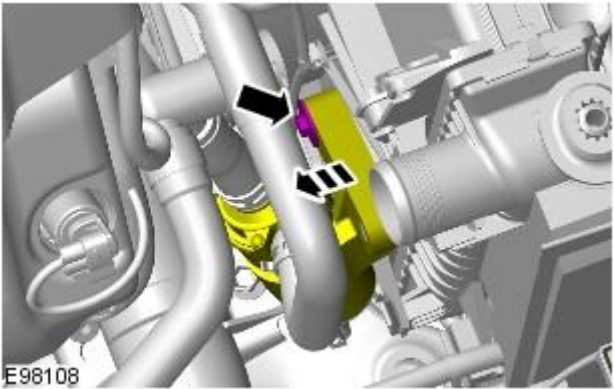


11. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

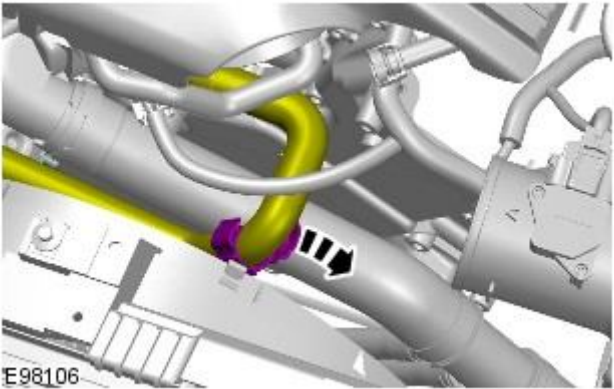


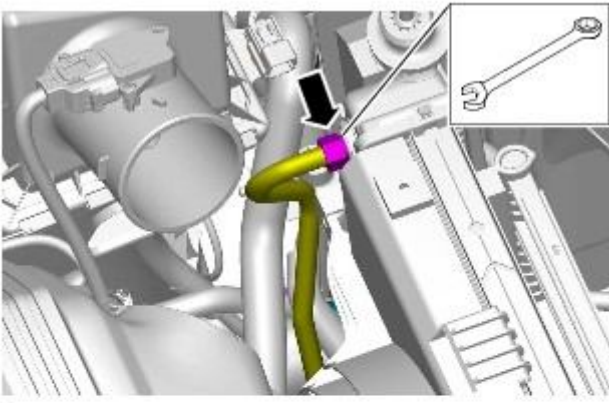
12. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

TORQUE: 7 Nm



13. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

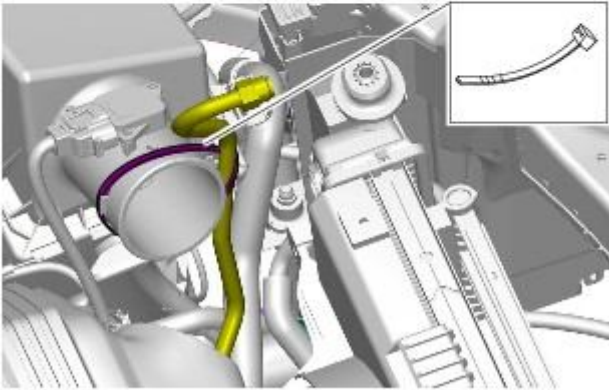




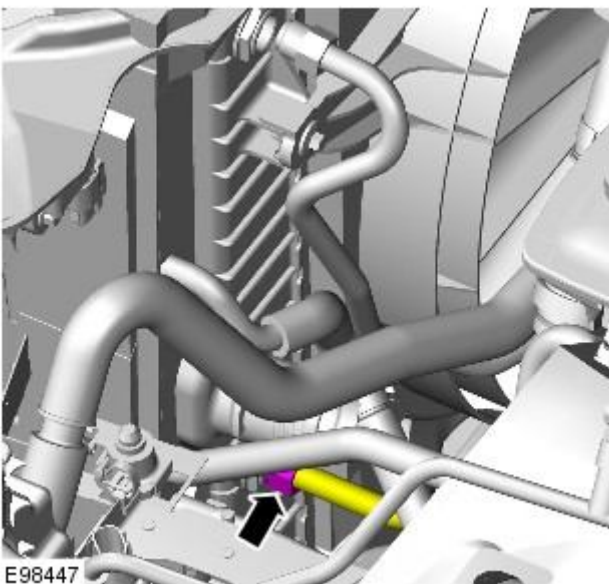
14.  CAUTION: Be prepared to collect escaping oil.

• NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

TORQUE: 20 Nm



E98107



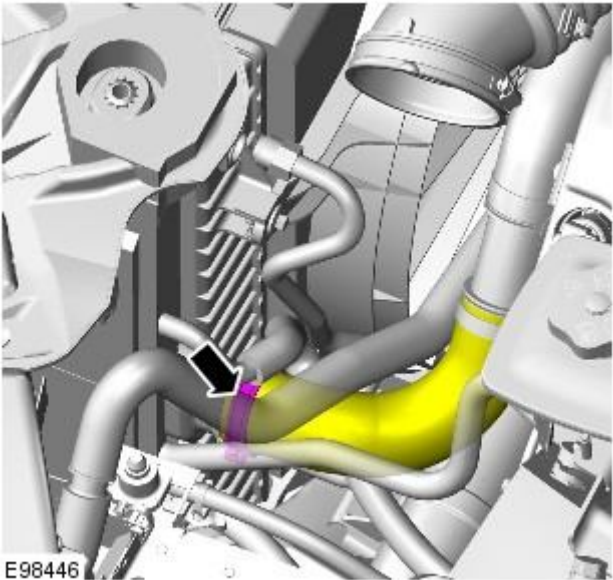
E98447

15.  CAUTION: Be prepared to collect escaping oil.

• NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

TORQUE: 20 Nm

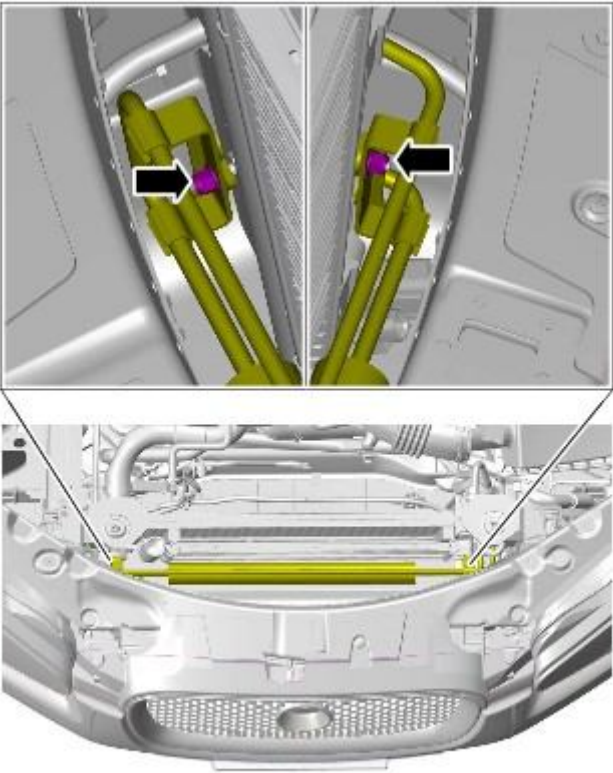
16. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



E98446

17. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

TORQUE: 10 Nm

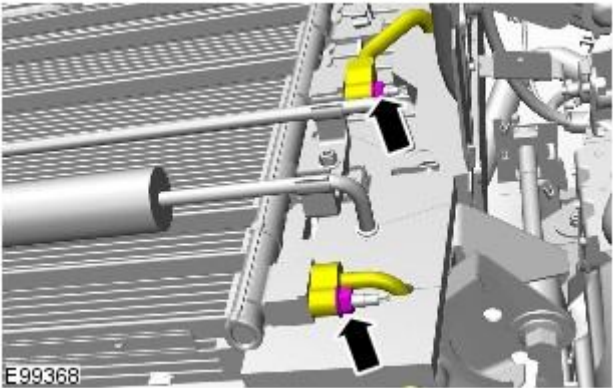


E97747

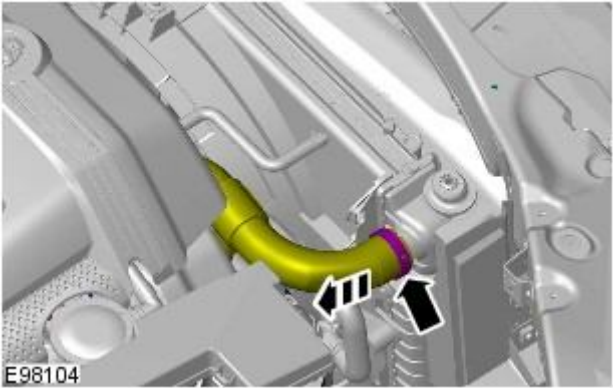


18. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

TORQUE: 10 Nm

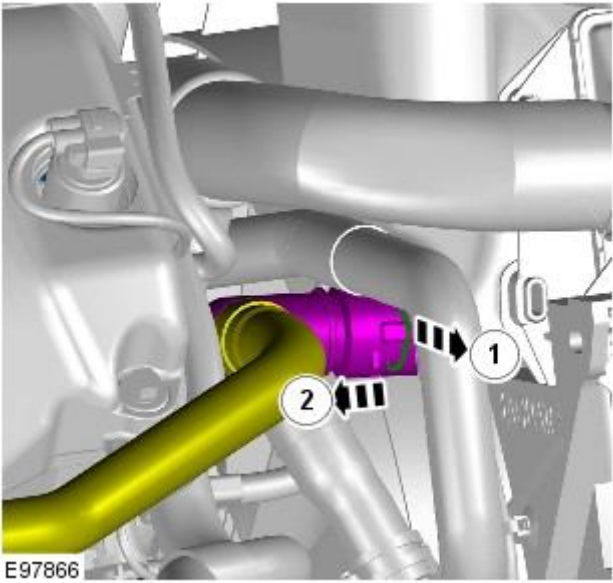


19. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

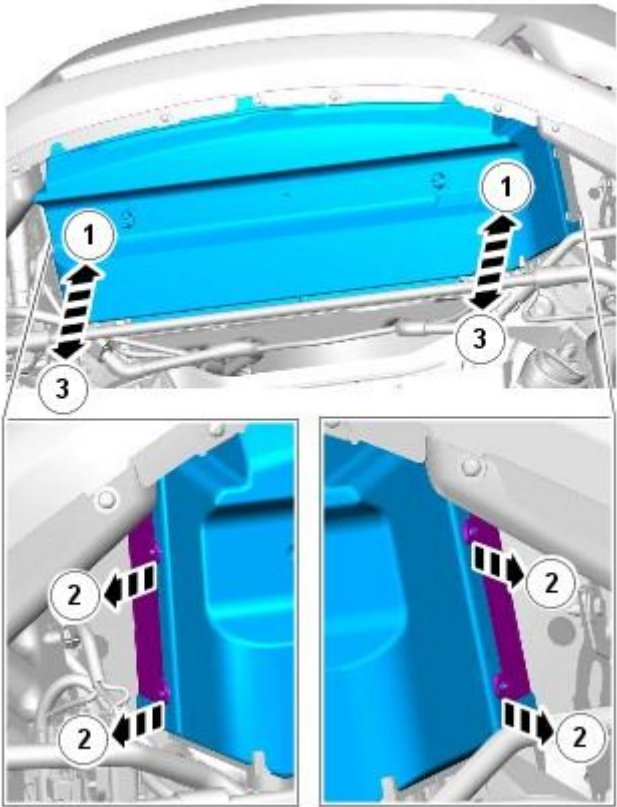


20. NOTE: Cap the coolant expansion tank lower hose to minimize coolant loss.

• NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

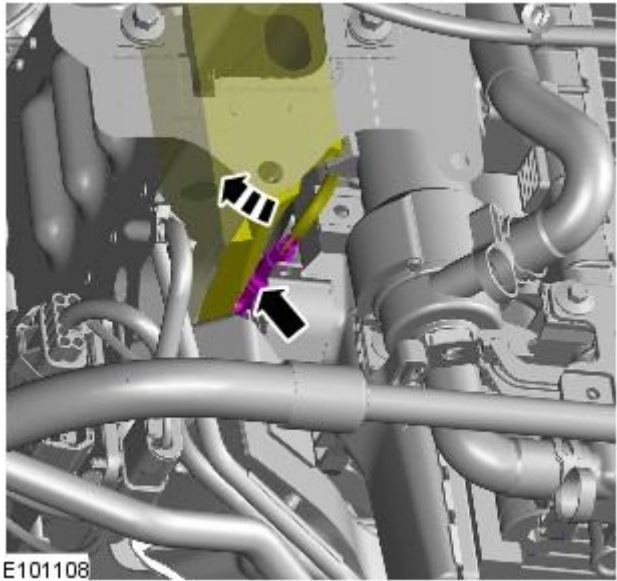


21. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



E97870

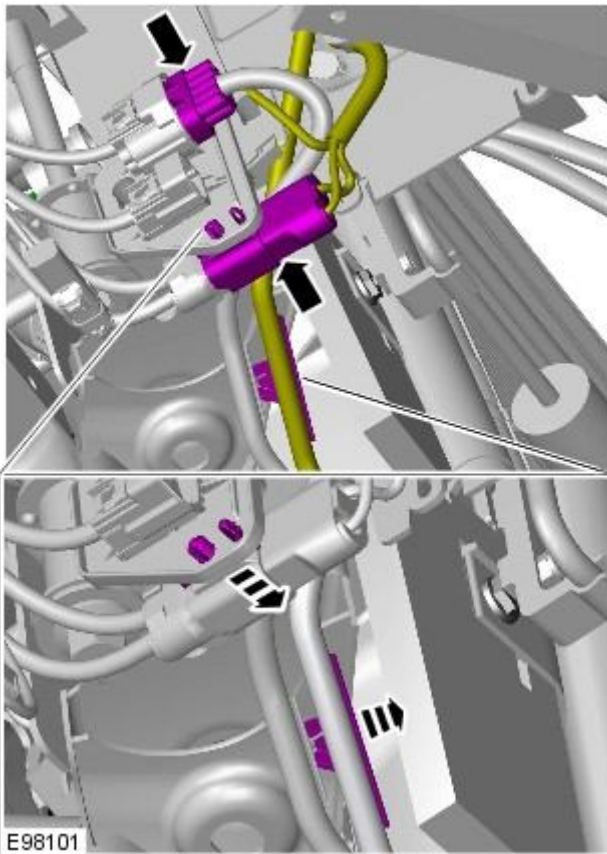
22. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



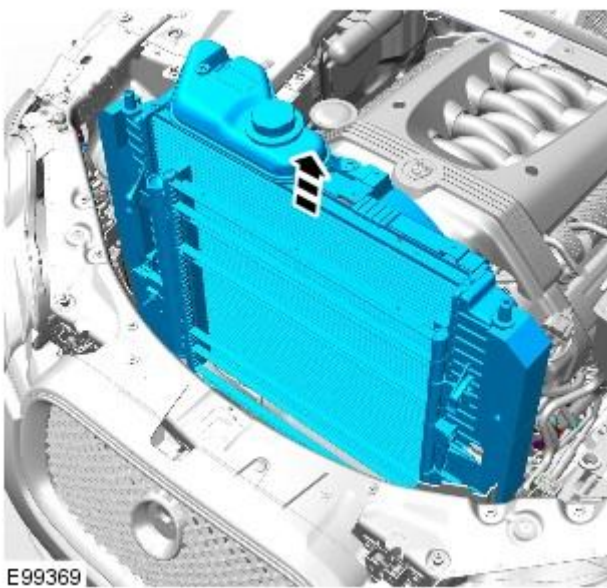
E101108



23. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



24. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



## Installation

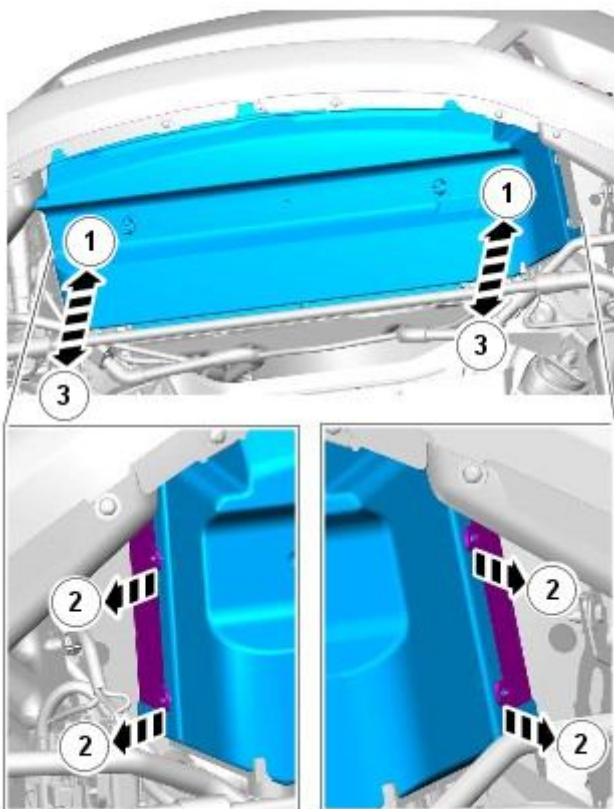
1. To install, reverse the removal procedure.
2. Check and top-up the transmission fluid level.  
For additional information, refer to: [Transmission Fluid Level Check](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, General Procedures).

# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Cooling Module 4.2L NA V8 - AJV8

Removal and Installation

## Removal

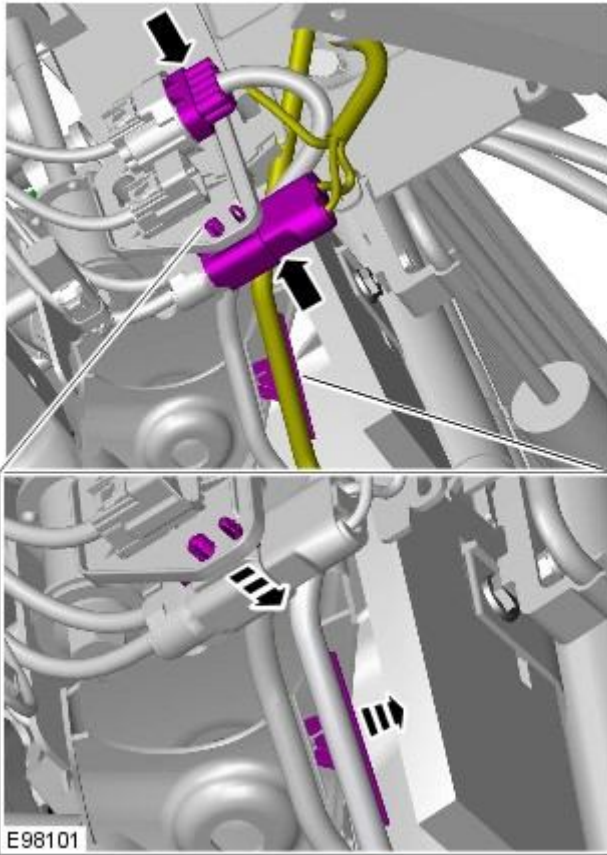
1. For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, General Procedures).
3. For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).
4. For additional information, refer to: Air Cleaner Element (303-12, Removal and Installation).
5. Raise and support the vehicle
- 6.



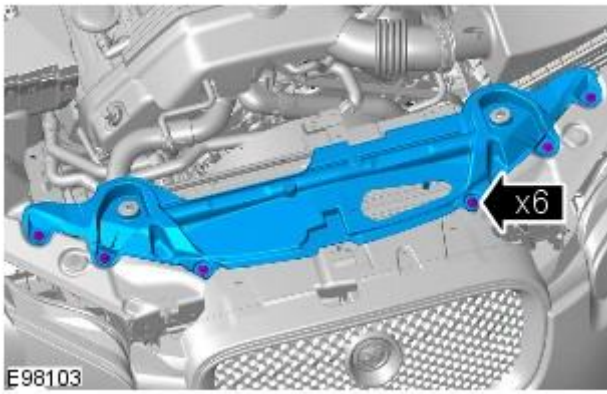
E97870

7. For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

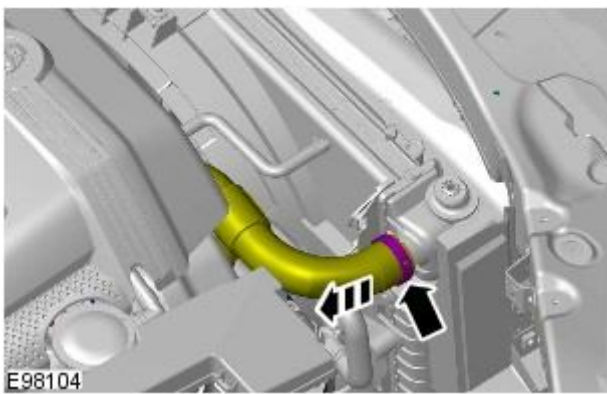
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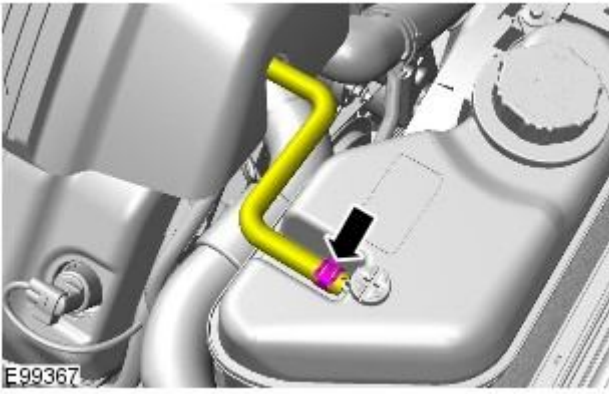
9. TORQUE: 7 Nm



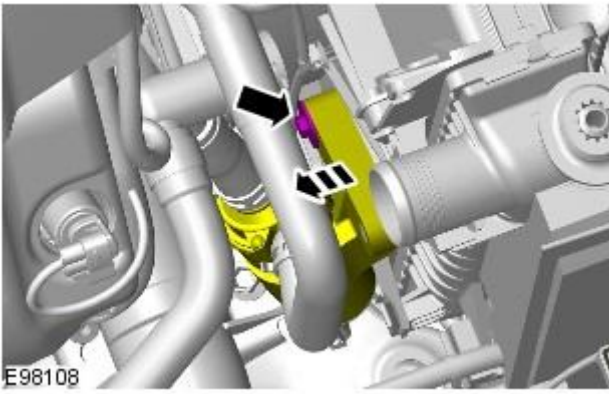
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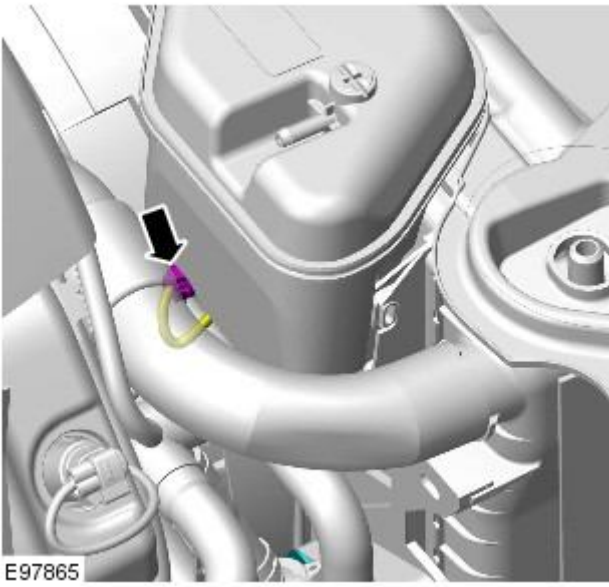
11.



12. TORQUE: 7 Nm

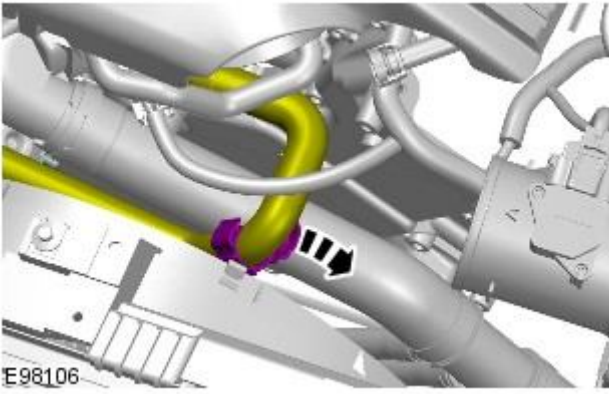


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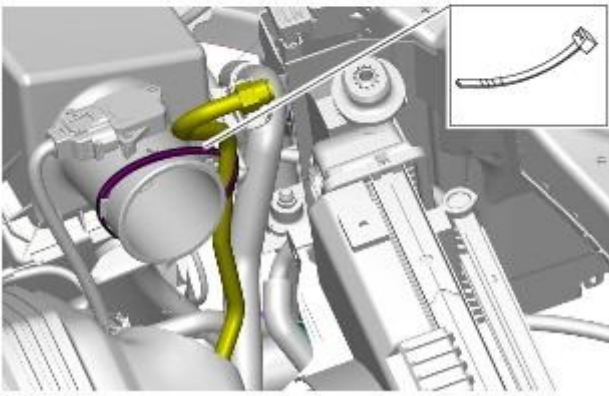
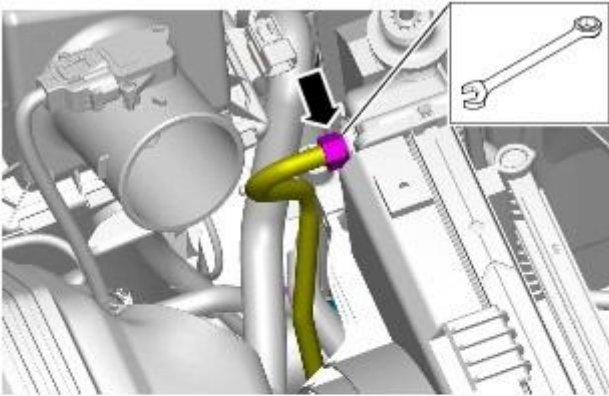




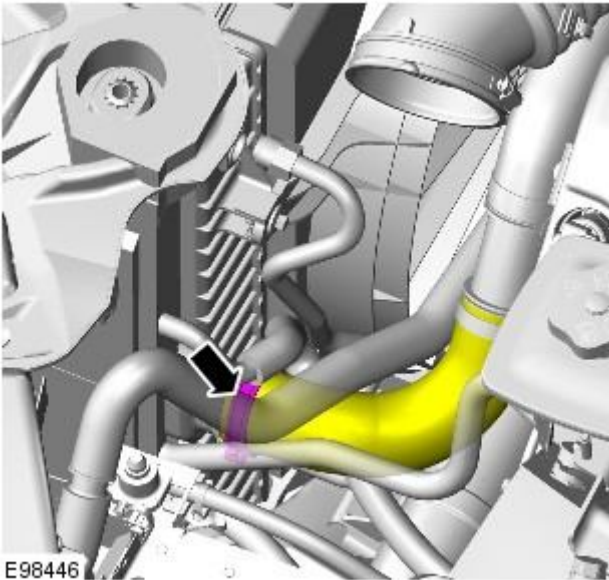
14.



15.  CAUTION: Be prepared to collect escaping oil.

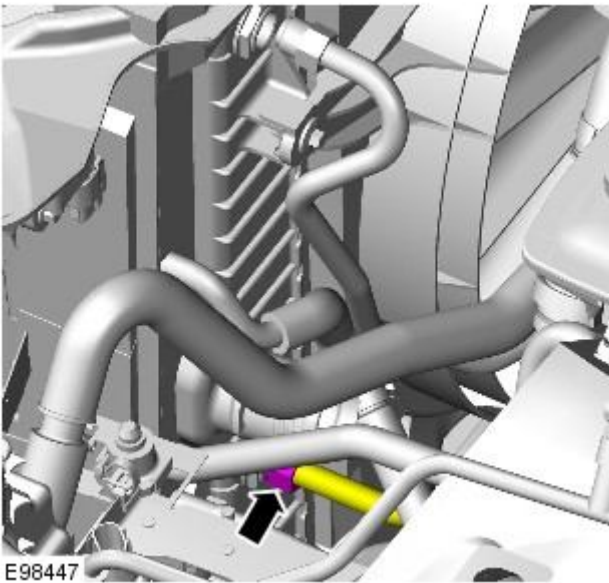


16.



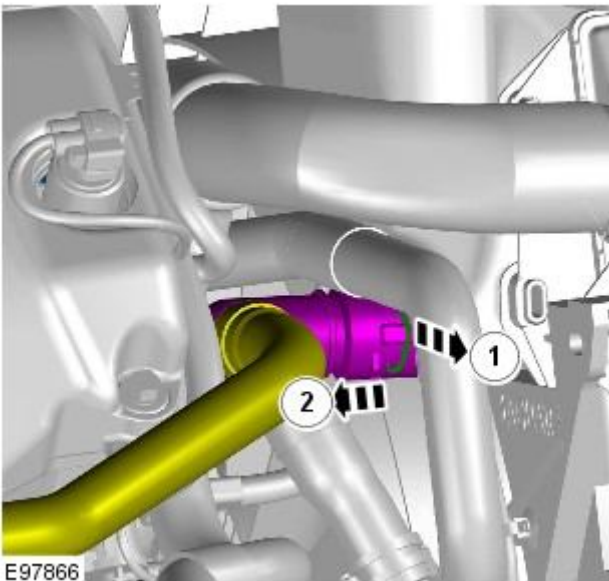
E98446

17.  CAUTION: Be prepared to collect escaping oil.



E98447

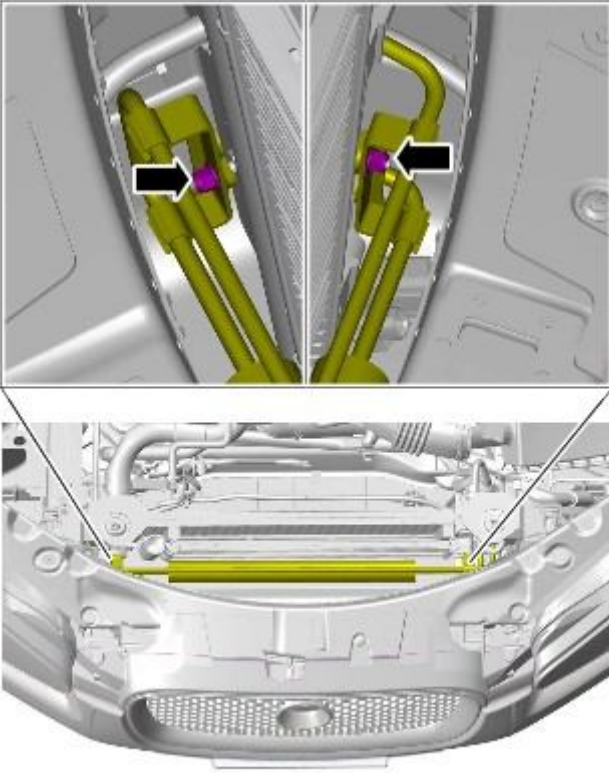
18. NOTE: Cap the coolant expansion tank lower hose to minimize coolant loss.



E97866

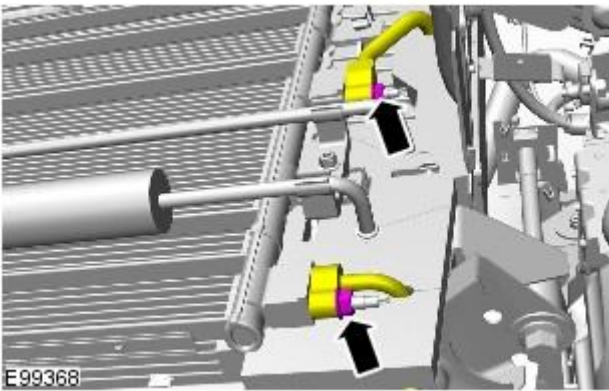


19.



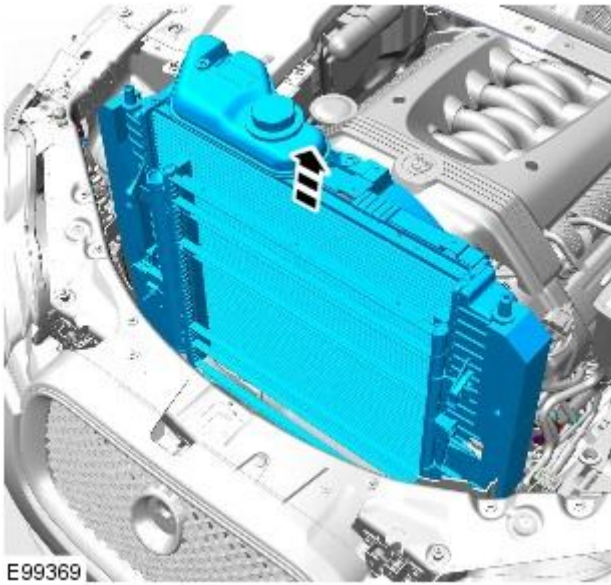
E97747

20.



E99368

21.



### Installation

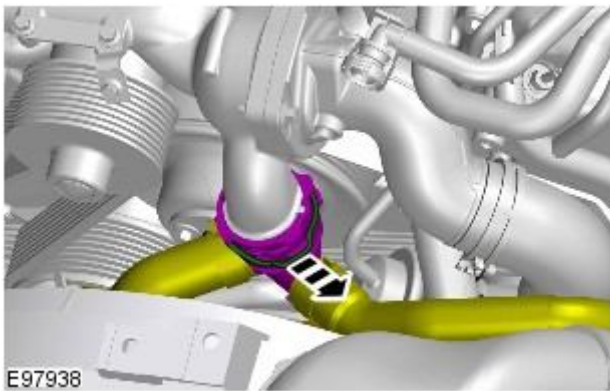
1. To install, reverse the removal procedure.
2. Check and top-up the transmission fluid level.  
For additional information, refer to: [Transmission Fluid Level Check](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, General Procedures).

# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Coolant Pump

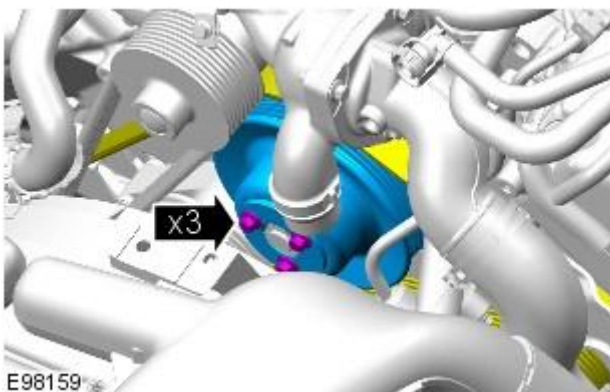
4.2L SC V8 - AJV8  
Removal and Installation

## Removal

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).
3. Refer to: [Engine Cover - 4.2L SC V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
4. Refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).
5. Raise and support the vehicle.



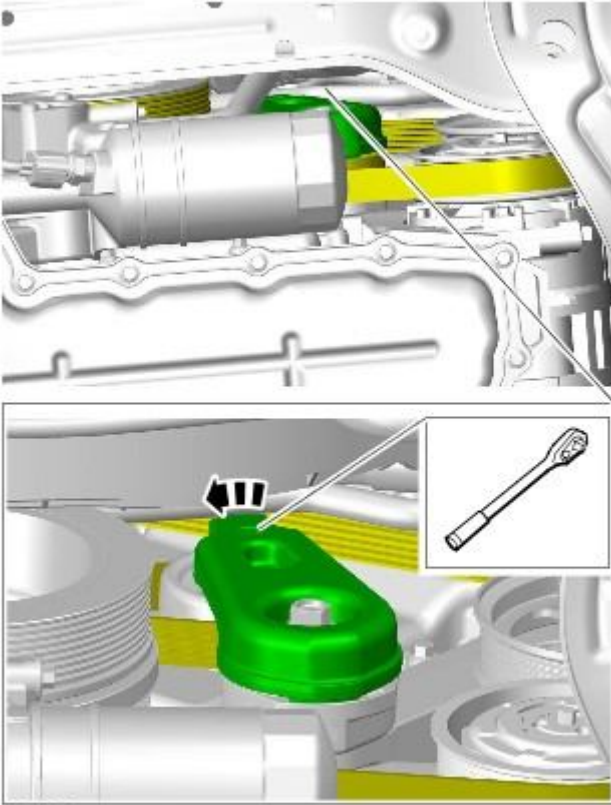
6.



7.

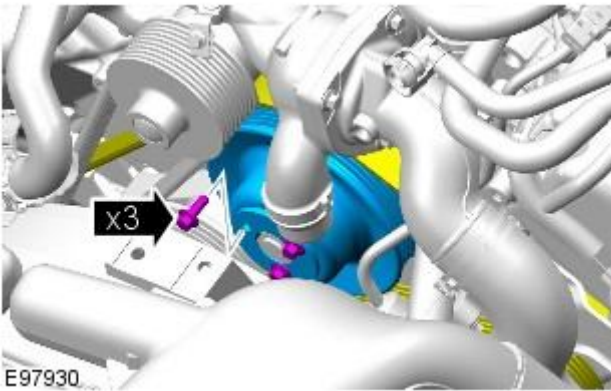
- Loosen only.

8.



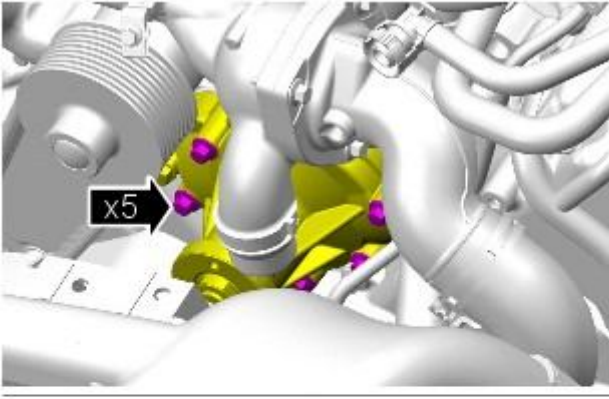
E97939

9. Torque: 7 Nm



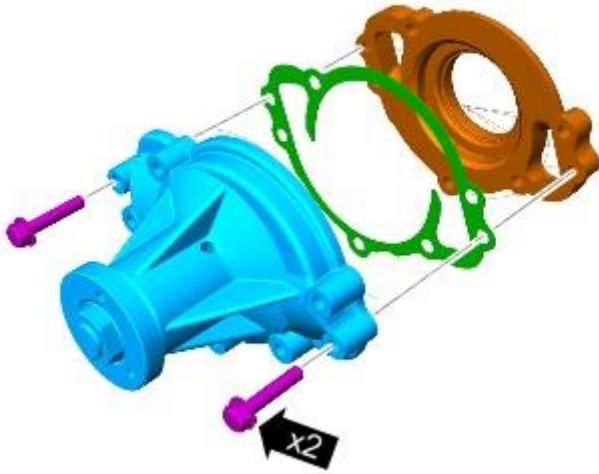
E97930

10. Torque: 10 Nm



E97931

11. Torque: 20 Nm



E100305

## Installation

1. To install, reverse the removal procedure.

# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Coolant Pump 4.2L NA V8 - AJV8

Removal and Installation

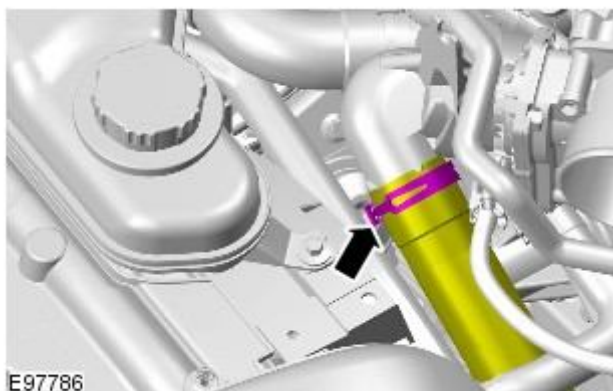
## Removal

• NOTE: Removal steps in this procedure may contain installation details.

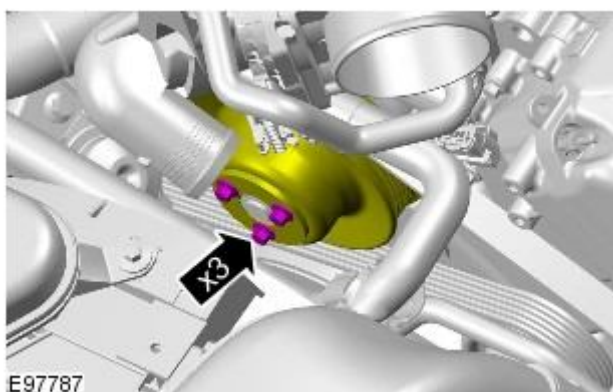
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03, General Procedures).
3. Refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
4. Refer to: [Air Cleaner Outlet Pipe](#) (303-12A Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8, Removal and Installation).

5.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.



6.



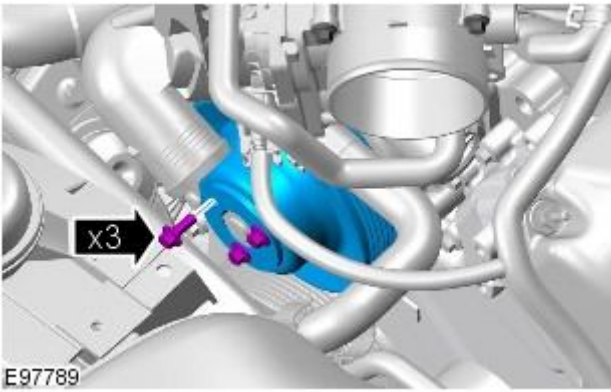
7.

- Loosen only.

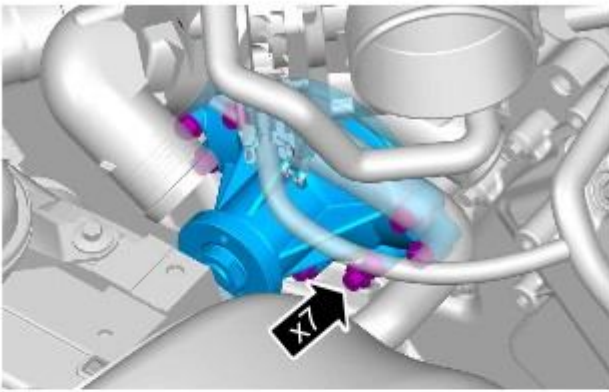




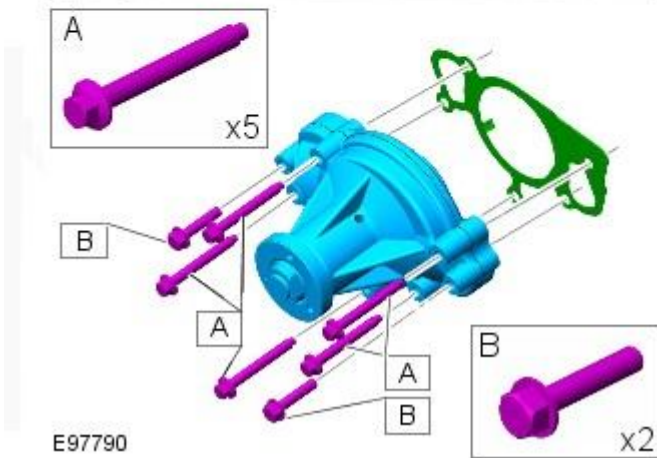
8.



9. Torque: 7 Nm



10. Torque:  
M6 10 Nm  
M8 20 Nm



## Installation

1. To install, reverse the removal procedure.

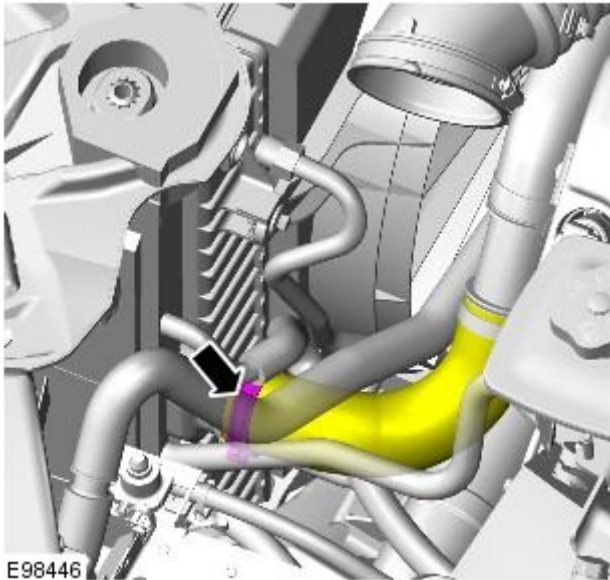
# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Radiator4.2L SC V8 - AJV8

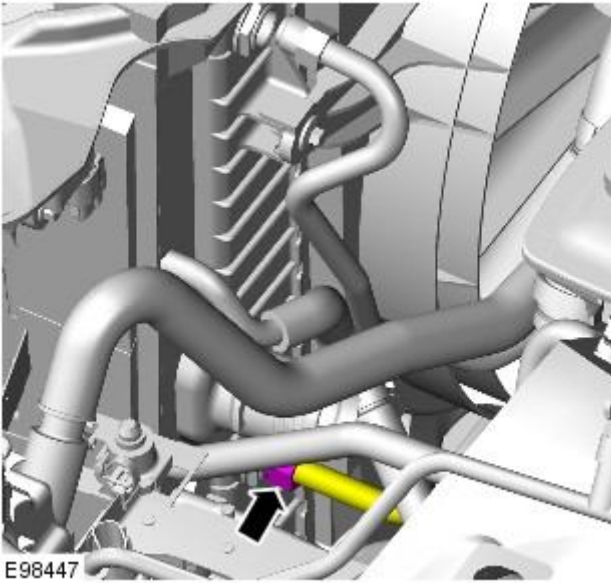
Removal and Installation


## Removal

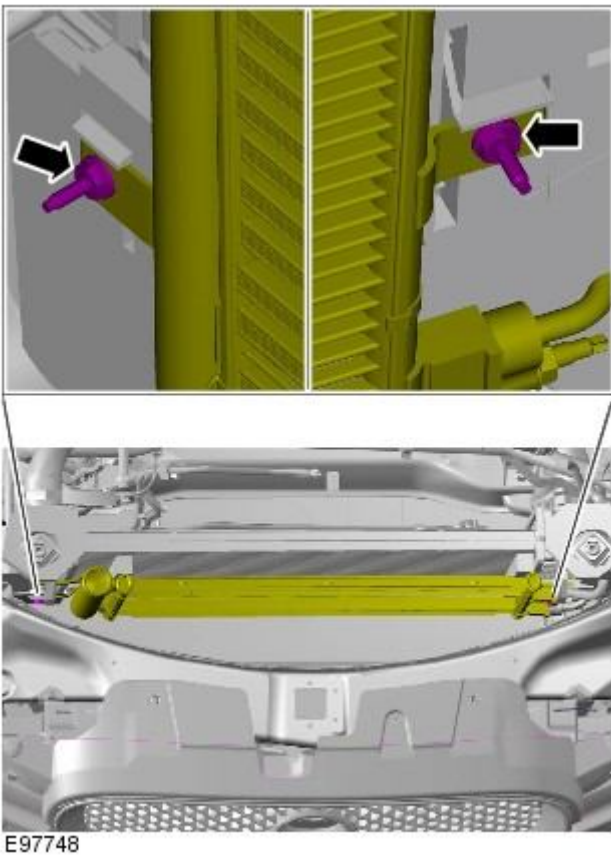
- NOTE: Removal steps in this procedure may contain installation details.
  - NOTE: Some variation in the illustrations may occur, but the essential information is always correct.
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
  2. Refer to: [Engine Cover - 4.2L SC V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
  3. Refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).
  4. Raise and support the vehicle.
  5. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).
  6. Refer to: Cooling Fan Motor and Shroud (303-03A, Removal and Installation).
  7. Refer to: [Radiator](#) (303-03B Supercharger Cooling - 4.2L SC V8 - AJV8, Removal and Installation).

8.

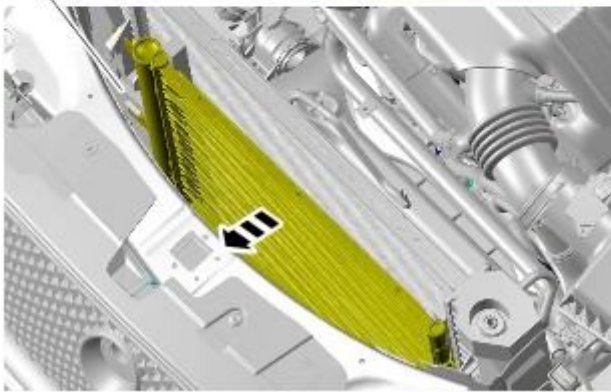
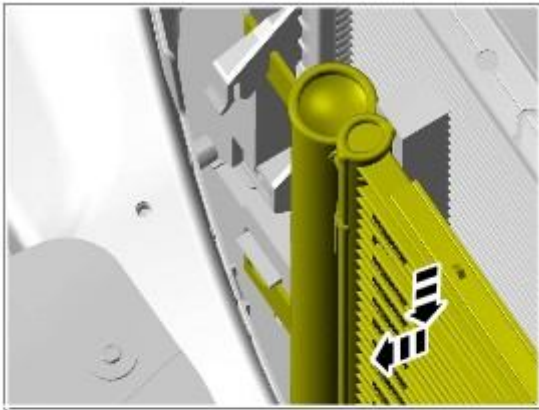




9.  **CAUTION:** Always plug any open connections to prevent contamination.
- Position a container to collect the fluid.

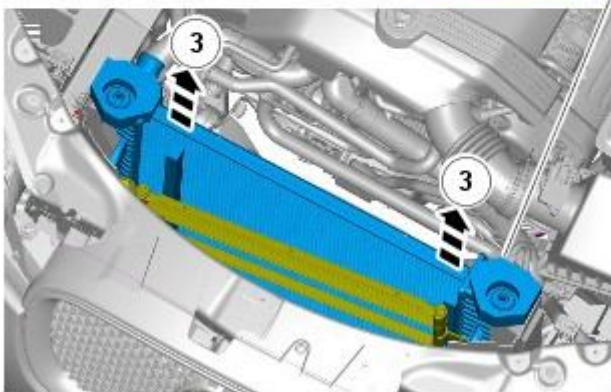
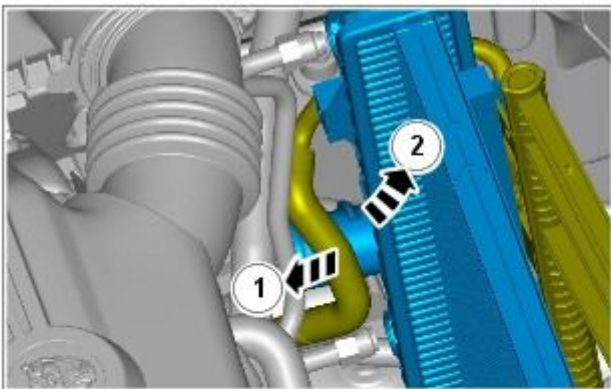


10. *Torque:* 10 Nm





E97749

11.



E97750

12. **12. CAUTIONS:**

-  Be prepared to collect escaping coolant.
-  Be prepared to collect escaping oil.

## Installation

1. To install, reverse the removal procedure.

# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Radiator4.2L NA V8 - AJV8

Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).
3. For additional information, refer to: [Cooling Fan Motor and Shroud - 4.2L NA V8 - AJV8](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
4. For additional information, refer to: Air Cleaner (303-12, Removal and Installation).
5. Raise and support the vehicle.

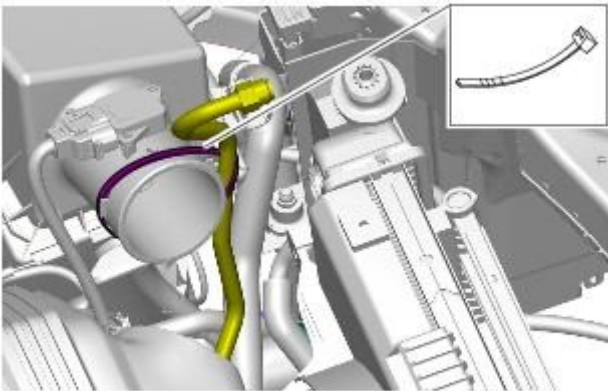
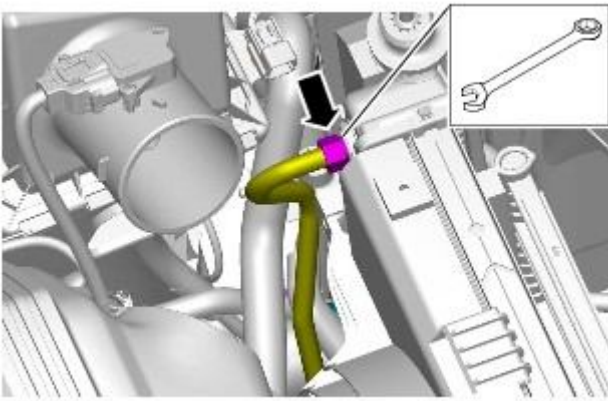
### 6. CAUTIONS:



Be prepared to collect escaping oil.



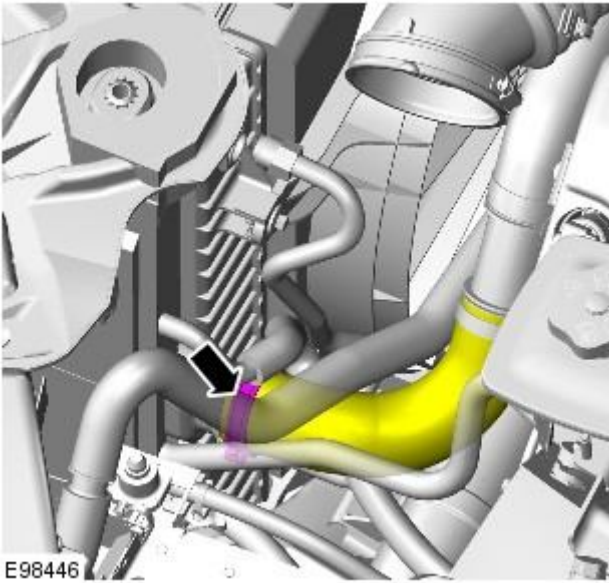
Make sure that all openings are sealed. Use new blanking caps.



E98107



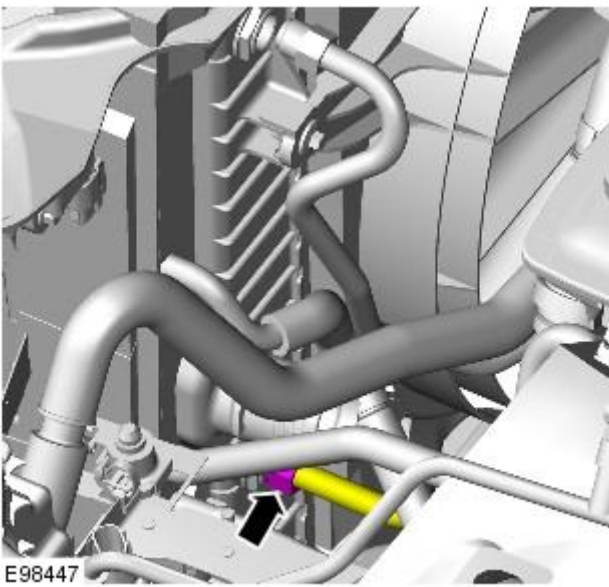
7.



8. CAUTIONS:

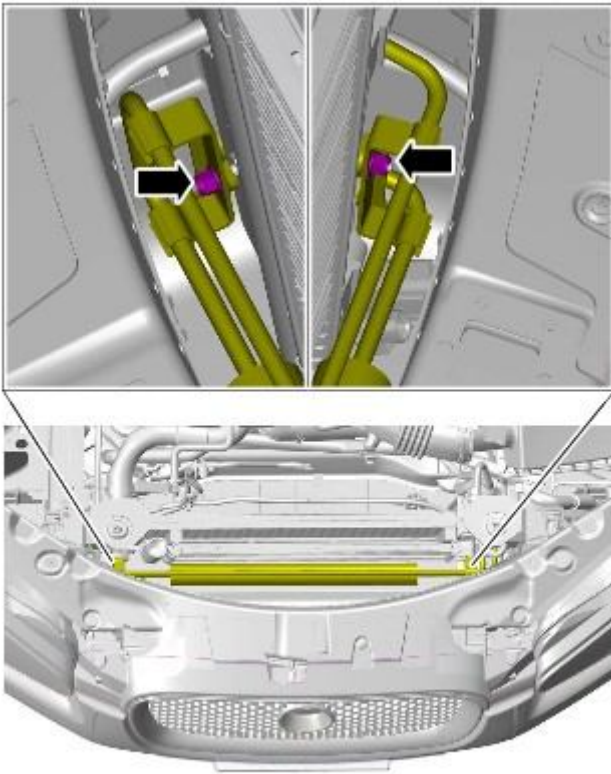
 Be prepared to collect escaping oil.

 Make sure that all openings are sealed. Use new blanking caps.



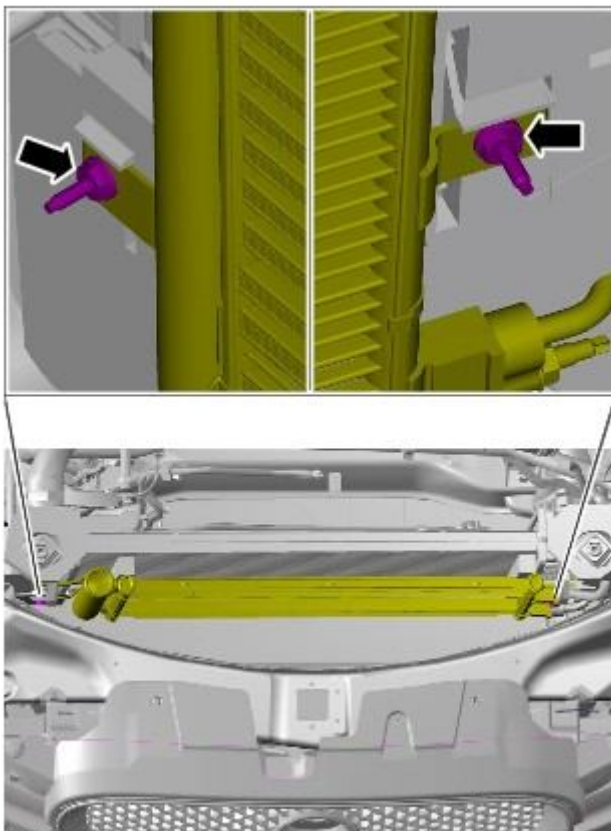


9. TORQUE: 7 Nm



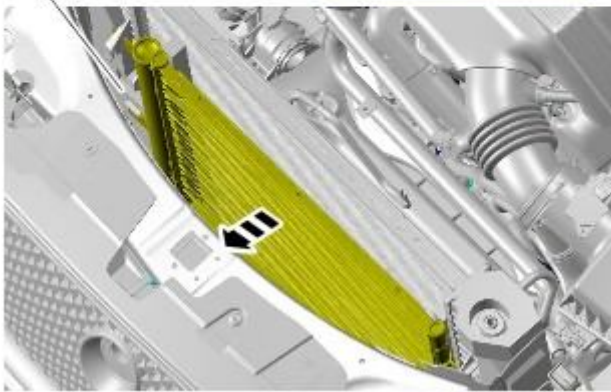
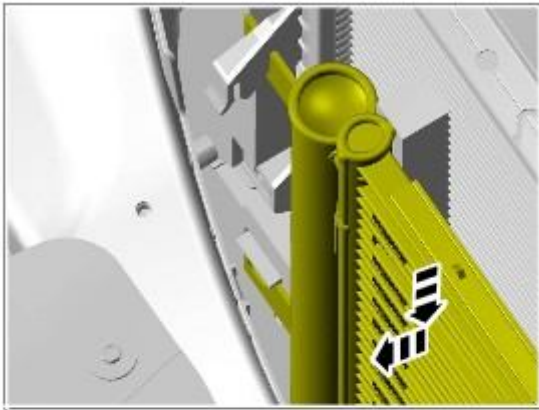
E97747

10. TORQUE: 7 Nm



E97748

11.

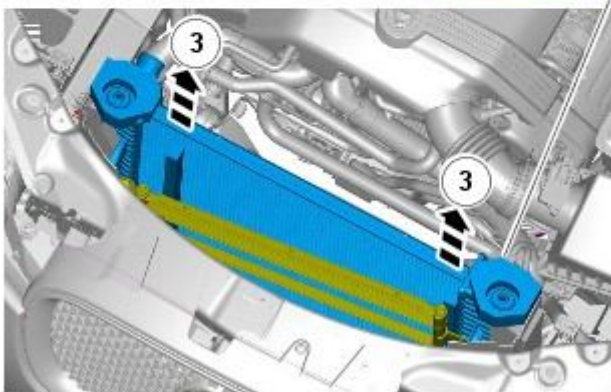
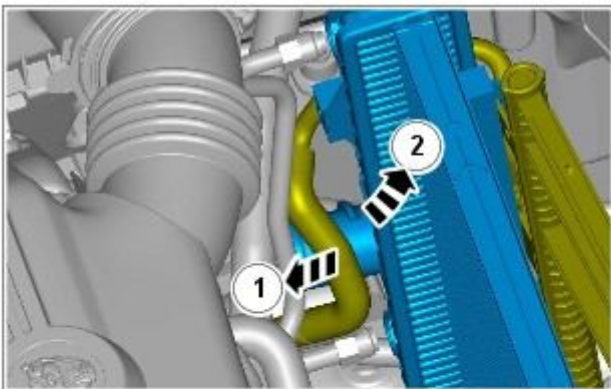


E97749

## 12. CAUTIONS:

 Be prepared to collect escaping coolant.

 Be prepared to collect escaping oil.



E97750

## Installation

1. To install, reverse the removal procedure.
2. Check and top-up the transmission fluid level.  
For additional information, refer to: [Transmission Fluid Level Check](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, General Procedures).


# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Thermostat4.2L SC V8 - AJV8

Removal and Installation


## Removal


• WARNINGS:

 Never remove the coolant expansion tank cap under any circumstances while the engine is operating. Failure to follow this instruction may result in personal injury.

 To avoid the possibility of personal injury, do not operate the engine with the hood open until the fan blades have been examined for cracks and separation. Failure to follow this instruction may result in personal injury.

• CAUTIONS:

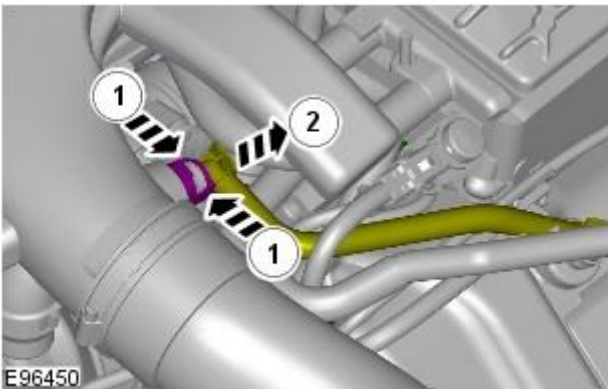
 The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage. Failure to follow this instruction may result in damage to the engine.

 Never remove the coolant expansion tank cap under any circumstances while the engine is operating. Failure to follow this instruction may result in damage to the engine.

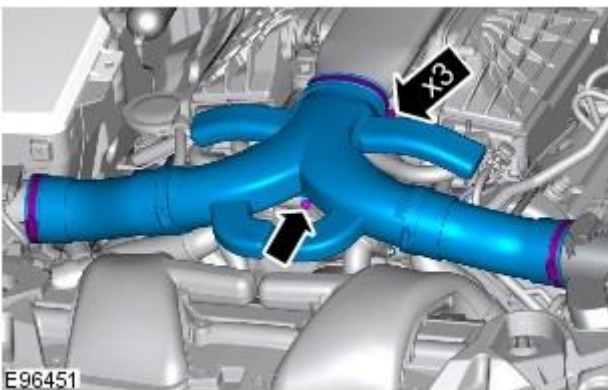
• NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

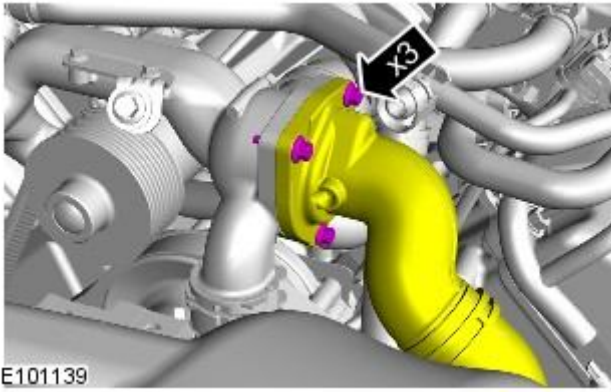
1. Remove the engine cover. For additional information, refer to: [Engine Cover - 4.2L SC V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



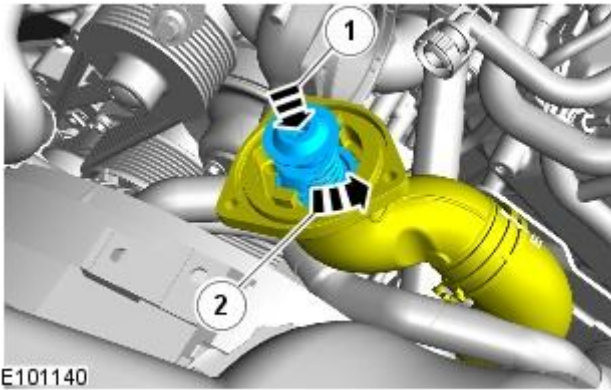
3.





4. NOTE: Position cloth to collect fluid spillage.

- Clamp the relevant hose, to minimise coolant loss.



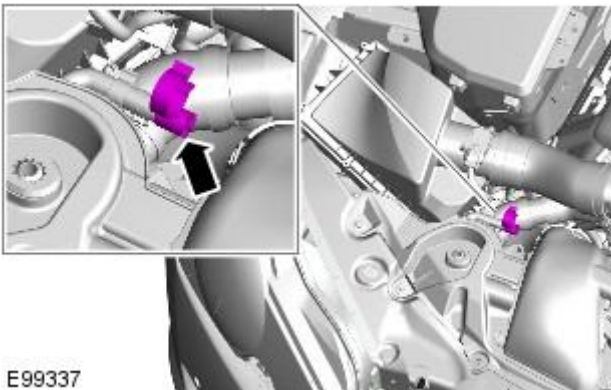
5.

### Installation

1. To install, reverse the removal procedure.

2. NOTE: Position cloth to collect fluid spillage.

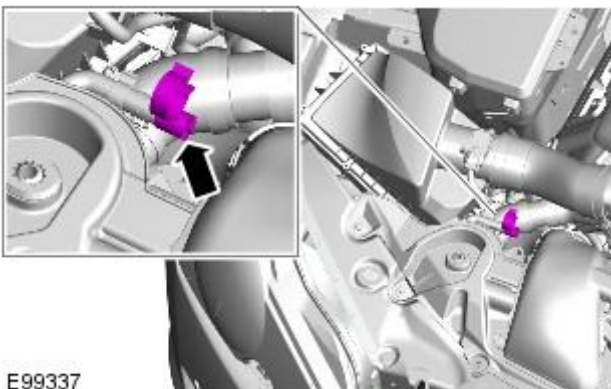
Loosen the cooling system bleed screw.



3.  CAUTION: Anti-freeze concentration must be maintained at 50%.


Fill the cooling system up to the MAX mark on the coolant expansion tank using a fifty percent mixture of Jaguar Premium Cooling System Fluid or equivalent, meeting Jaguar specification WSS M97B44-D and fifty percent water.

- When coolant runs from the bleed point bubble-free, tighten the bleed screw.




4. Install the coolant expansion tank cap.



5.  CAUTION: Do not RUN the engine with the coolant expansion tank pressure cap removed. Failure to follow this instruction may cause damage to the vehicle.

Start and run the engine.

6. Set the heating system to MAX heat, the blower motor to MAX speed and the air distribution to the instrument panel registers.

7.  CAUTION: Observe the engine temperature warning light. If the warning light is displayed, switch off immediately and allow to cool. Failure to follow this instruction may cause damage to the vehicle

Allow the engine to run until hot air is emitted from the instrument panel registers, while observing the engine temperature warning light.

8. Switch the engine off.

9. Allow the engine to cool.

10. Release the cooling system pressure.

- Remove the coolant expansion tank pressure cap.

11. Top up the cooling system.

- Fill the cooling system up to the MAX mark on the coolant expansion tank using a fifty percent mixture of Jaguar Premium Cooling System Fluid or equivalent, meeting Jaguar specification WSS M97B44-D and fifty percent water.

12. Install the coolant expansion tank pressure cap.

13. Install the engine cover. For additional information, refer to: [Engine Cover - 4.2L SC V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).


# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Thermostat4.2L NA V8 - AJV8

Removal and Installation


## Removal


• WARNINGS:

 Never remove the coolant expansion tank cap under any circumstances while the engine is operating. Failure to follow this instruction may result in personal injury.

 To avoid the possibility of personal injury, do not operate the engine with the hood open until the fan blades have been examined for cracks and separation. Failure to follow this instruction may result in personal injury.

• CAUTIONS:

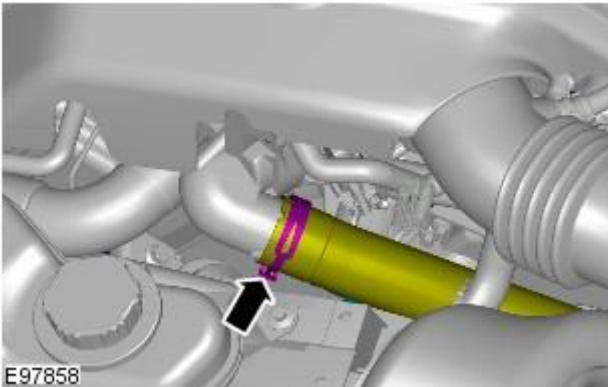
 The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage. Failure to follow this instruction may result in damage to the engine.

 Never remove the coolant expansion tank cap under any circumstances while the engine is operating. Failure to follow this instruction may result in damage to the engine.

• NOTE: Removal steps in this procedure may contain installation details.

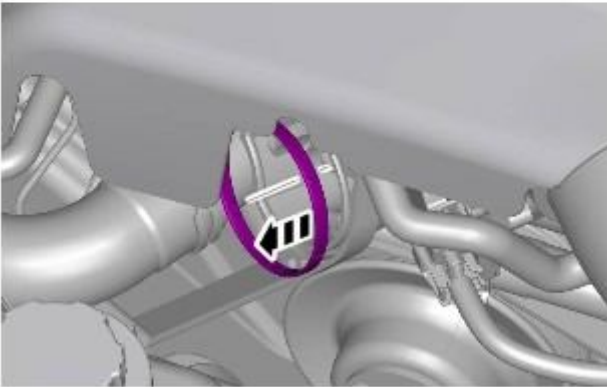
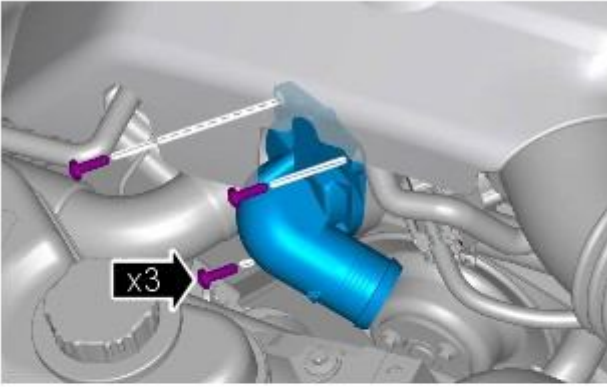
1.

- Clamp the relevant hose, to minimise coolant loss.



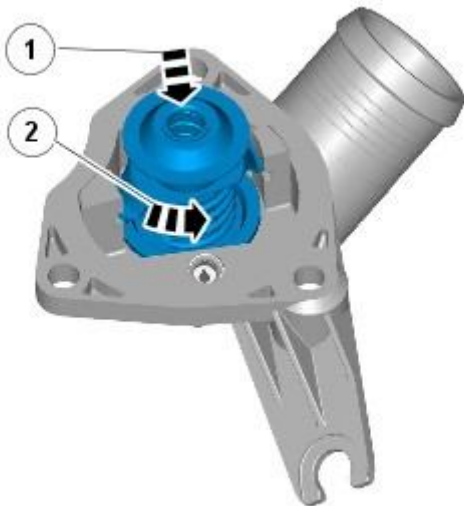


2.



E97859

3.

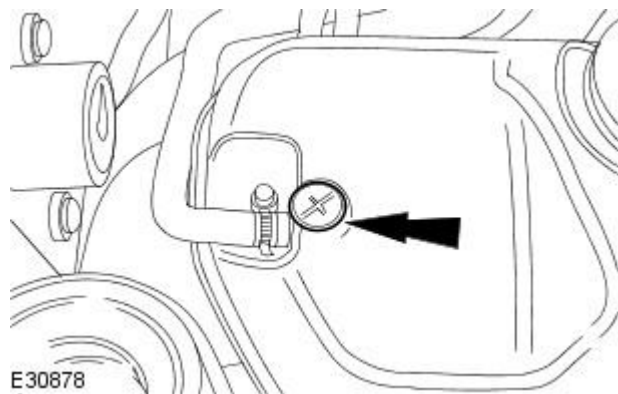


E97860

### Installation

1. To install, reverse the removal procedure.

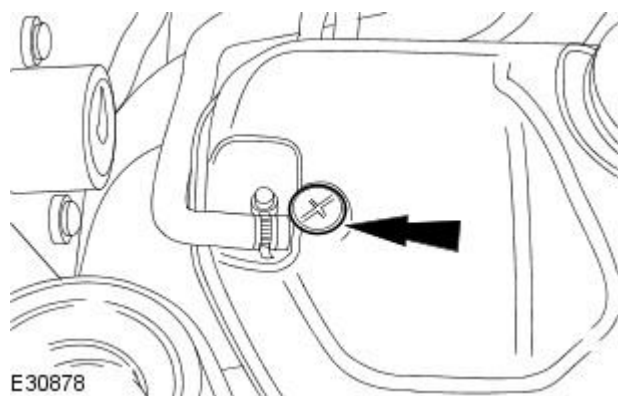
2. Loosen the cooling system bleed screw.




3.  CAUTION: Anti-freeze concentration must be maintained at 50%.

Fill the cooling system up to the MAX mark on the coolant expansion tank using a fifty percent mixture of Jaguar Premium Cooling System Fluid or equivalent, meeting Jaguar specification WSS M97B44-D and fifty percent water.

- When coolant runs from the expansion tank bleed point bubble-free, tighten the bleed screw.




4. Install the coolant expansion tank cap.

5.  CAUTION: Do not RUN the engine with the coolant expansion tank pressure cap removed. Failure to follow this instruction may cause damage to the vehicle.

Start and run the engine.

6. Set the heating system to MAX heat, the blower motor to MAX speed and the air distribution to the instrument panel registers.

7.  CAUTION: Observe the engine temperature warning light. If the warning light is displayed, switch off immediately and allow to cool. Failure to follow this instruction may cause damage to the vehicle

Allow the engine to run until hot air is emitted from the instrument panel registers, while observing the engine temperature warning light.

8. Switch the engine off.

9. Allow the engine to cool.

10. Release the cooling system pressure.

- Remove the coolant expansion tank pressure cap.

11. Top up the cooling system.

- Fill the cooling system up to the MAX mark on the coolant expansion tank using a fifty percent mixture of Jaguar Premium Cooling System Fluid or equivalent, meeting Jaguar specification WSS M97B44-D and fifty percent water.

12. Install the coolant expansion tank pressure cap.

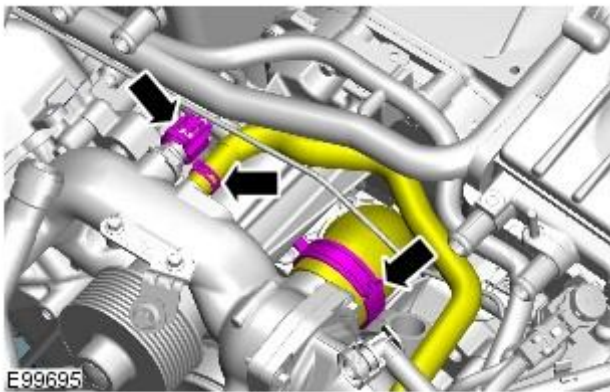
# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Thermostat Housing

4.2L SC V8 - AJV8  
Removal and Installation

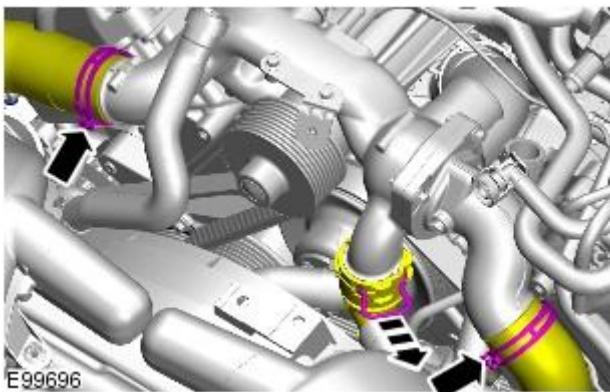
## Removal

• NOTE: Removal steps in this procedure may contain installation details.

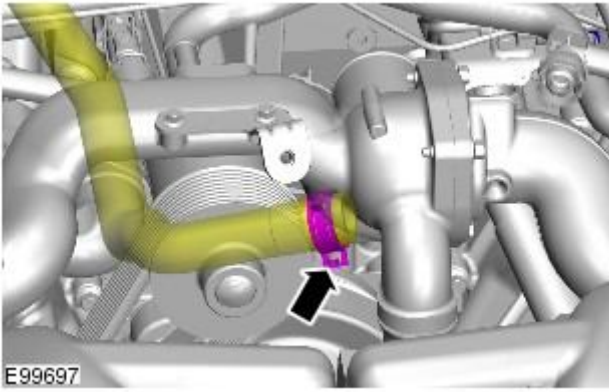
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Engine Cover - 4.2L SC V8 - AJV8](#) (501-05 Interior Trim and Ornementation, Removal and Installation).
3. Refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).
4. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).



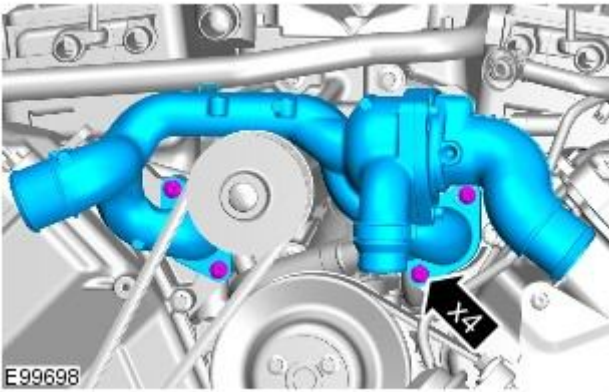
5.



6.



7.



8. Torque: 10 Nm

## Installation

1. To install, reverse the removal procedure.

# Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Thermostat Housing

Removal and Installation

## Removal

### • CAUTIONS:



Anti-freeze concentration must be maintained at 50%.




Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

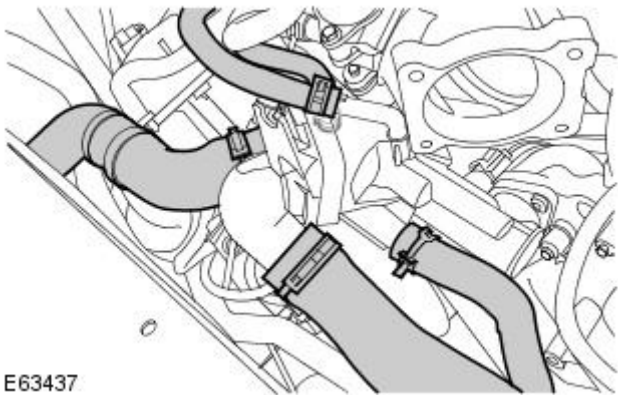
Raise and support the vehicle.

3.  **WARNING:** Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

Drain the cooling system.

For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).

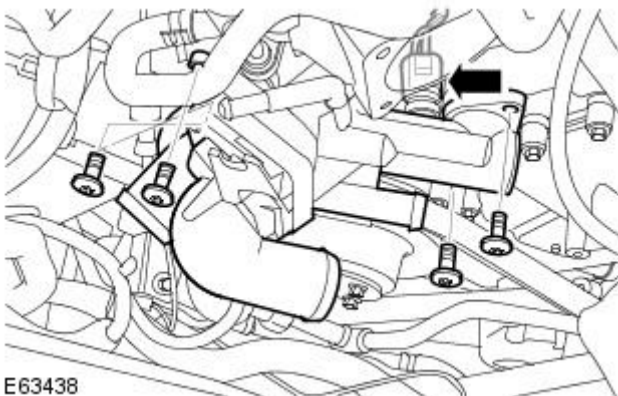
4. Remove the throttle body.  
For additional information, refer to: [Throttle Body](#) (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Removal and Installation).
5. Release the clips and disconnect the 5 coolant hoses.



E63437

6. Remove the thermostat housing.

- Disconnect the engine coolant temperature (ECT) sensor electrical connector.
- Remove the 4 bolts.

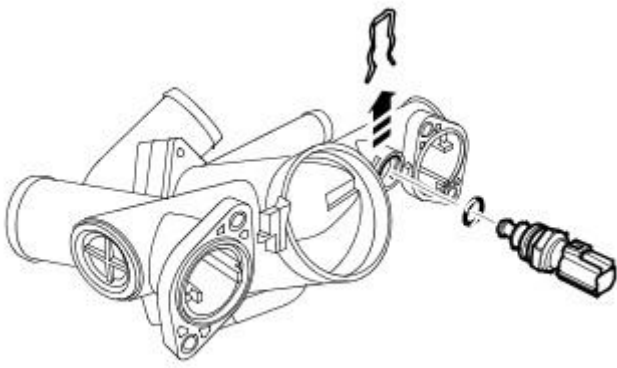


E63438

**7. NOTE:** Do not disassemble further if the component is removed for access only.

Remove the engine coolant temperature (ECT) sensor.

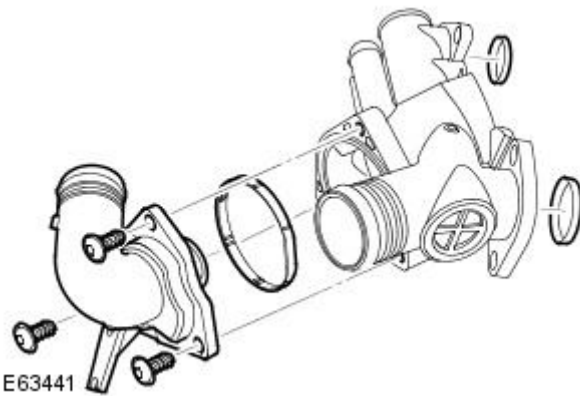
- Remove the retaining clip.



E63440

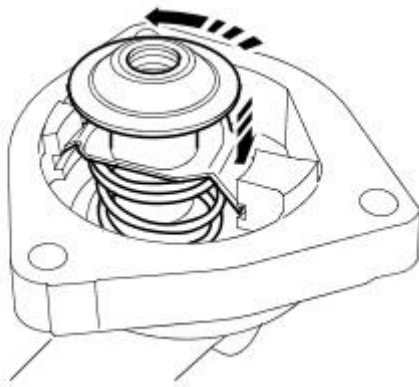
**8.** Remove the thermostat.

- Remove the 3 screws.
- Remove and discard the 3 O-ring seals.



E63441

**9.** Release and remove the thermostat.

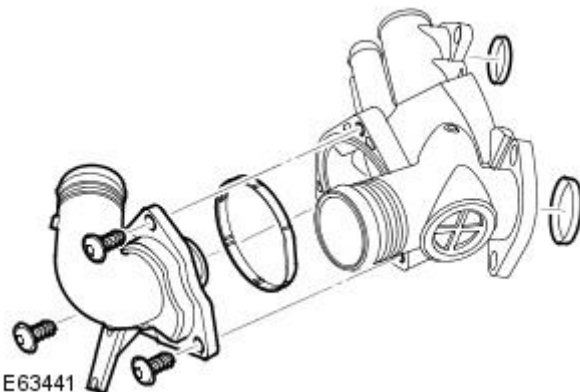


E61932

## Installation

**1.** To install, reverse the removal procedure.

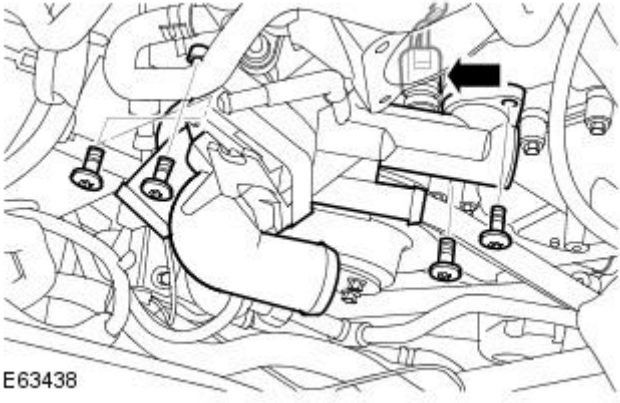
- Tighten to 4 Nm.



E63441



2. Tighten to 10 Nm.



E63438

## Supercharger Cooling - 4.2L SC V8 - AJV8 -

### Torque Specifications

Description	Nm	lb-ft	lb-in
Engine oil cooler retaining bolts	7	-	62
Cooling module retaining bolts	7	-	62
Charge air cooler water pump bracket retaining bolts	7	-	62
Charge air cooler radiator drain plug	1	-	9
Coolant expansion tank bleed screw	1	-	9
Supercharger coolant fill plug	45	33	-

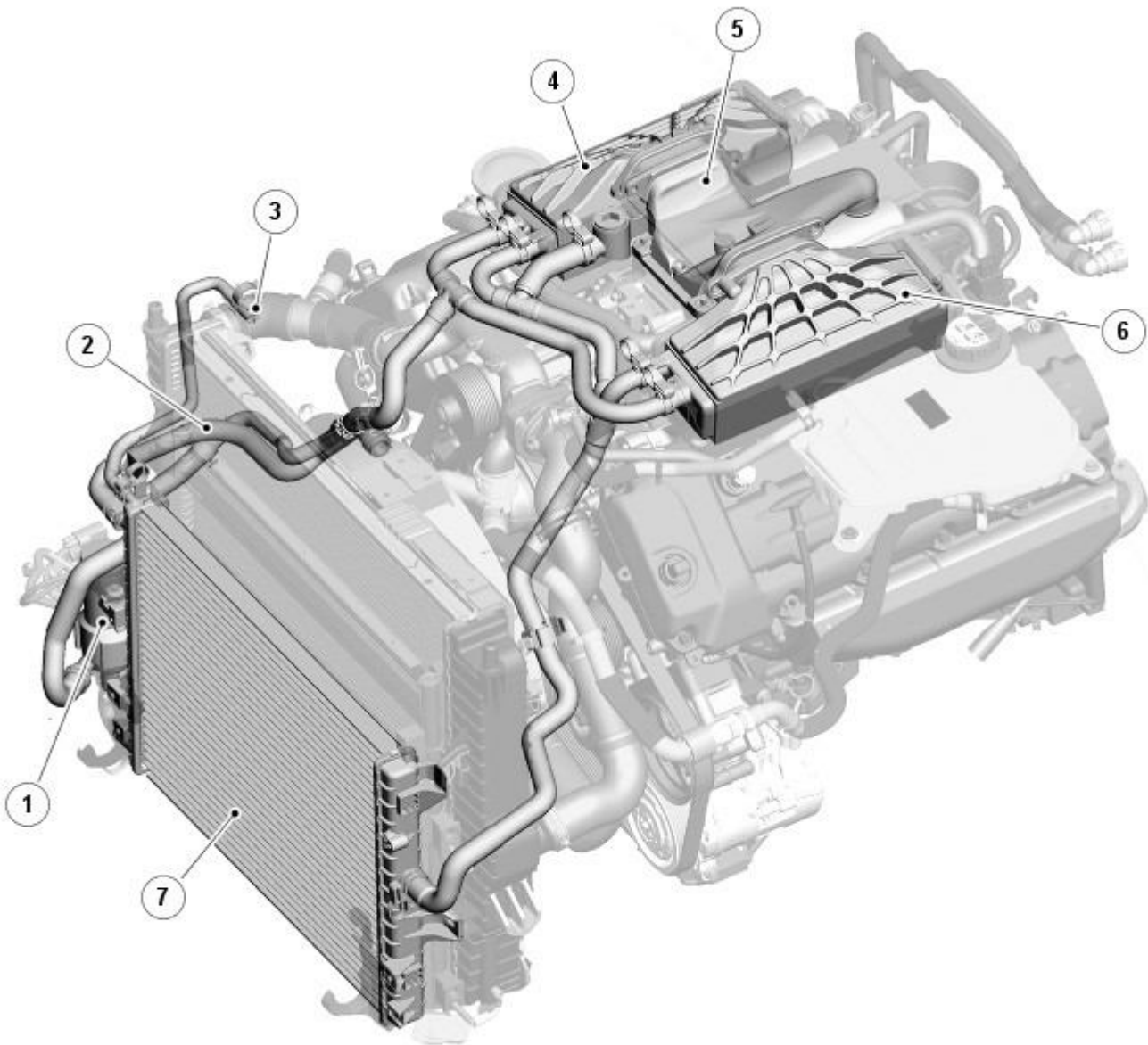
### Lubricants, Fluids, Sealers and Adhesives

Description	Specification
Jaguar Premium Cooling System Fluid	WSS M97B44-D

# Supercharger Cooling - 4.2L SC V8 - AJV8 - Supercharger Cooling - Component Location

Description and Operation

Component Location



E98168

## ItemDescription

1	Charge air coolant pump
2	Expansion hose (connects to engine cooling system)
3	Bleed screw
4	RH (right-hand) charge air cooler
5	Supercharger outlet elbow
6	LH (left-hand) charge air cooler
7	Charge air radiator

# **Supercharger Cooling - 4.2L SC V8 - AJV8 - Supercharger Cooling -**

## **Overview**

Description and Operation

### **Overview**

The supercharger cooling system is installed on 4.2L vehicles with supercharger to cool the pressurized charge air.

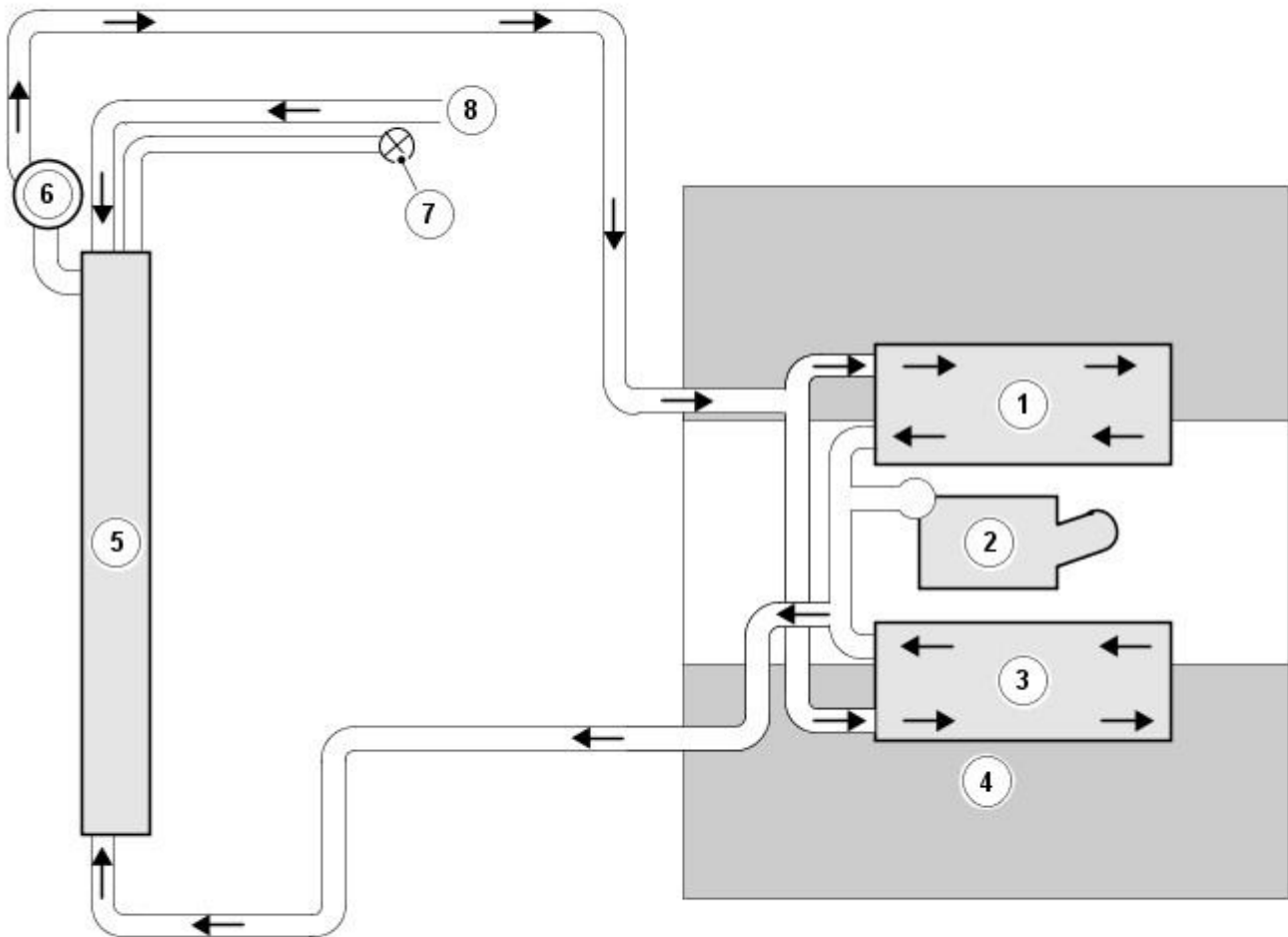
# Supercharger Cooling - 4.2L SC V8 - AJV8 - Supercharger Cooling - System Operation and Component Description

Description and Operation

## System Operation

The charge air coolant pump is energized continuously while the ignition is in power mode 6. Coolant flows from the pump outlet through the charge air coolers, the charge air radiator and back to the pump inlet.

## Supercharger Cooling Flow Diagram



E98149

### ItemDescription

1	RH (right-hand) charge air cooler
2	Supercharger outlet elbow
3	LH (left-hand) charge air cooler
4	Engine
5	Charge air radiator
6	Charge air coolant pump
7	Bleed screw
8	Connection with engine cooling system
<b>Comments:</b>	

## Component Description

### General

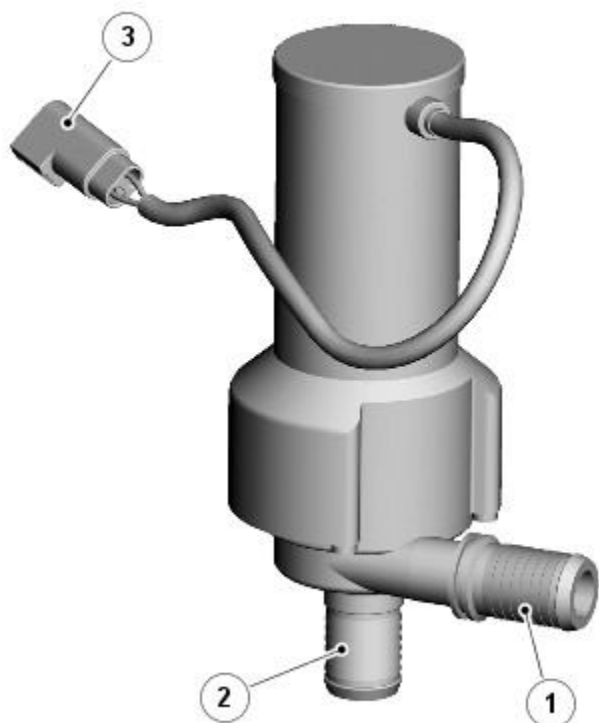
The supercharger cooling system consists of:

- A charge air coolant pump.
- A charge air radiator.
- Two charge air coolers.
- Connecting hoses and pipes.

The supercharger cooling system is operationally independent of the engine cooling system, but connected to it by a hose installed between the charge air radiator and the heater core return line. The connection with the engine cooling system accommodates thermal expansion and retraction of the coolant in the supercharger cooling system, and assists with filling and draining of the supercharger cooling system. A bleed screw, in the end of a hose attached to the charge air radiator, allows air to be bled from the supercharger and engine cooling systems when filling from empty. A filler plug for the supercharger cooling system is incorporated into the supercharger outlet elbow.

Refer to: [Engine](#) (303-01B Engine - 4.2L SC V8 - AJV8, Description and Operation).

### Charge Air Coolant Pump



E98150

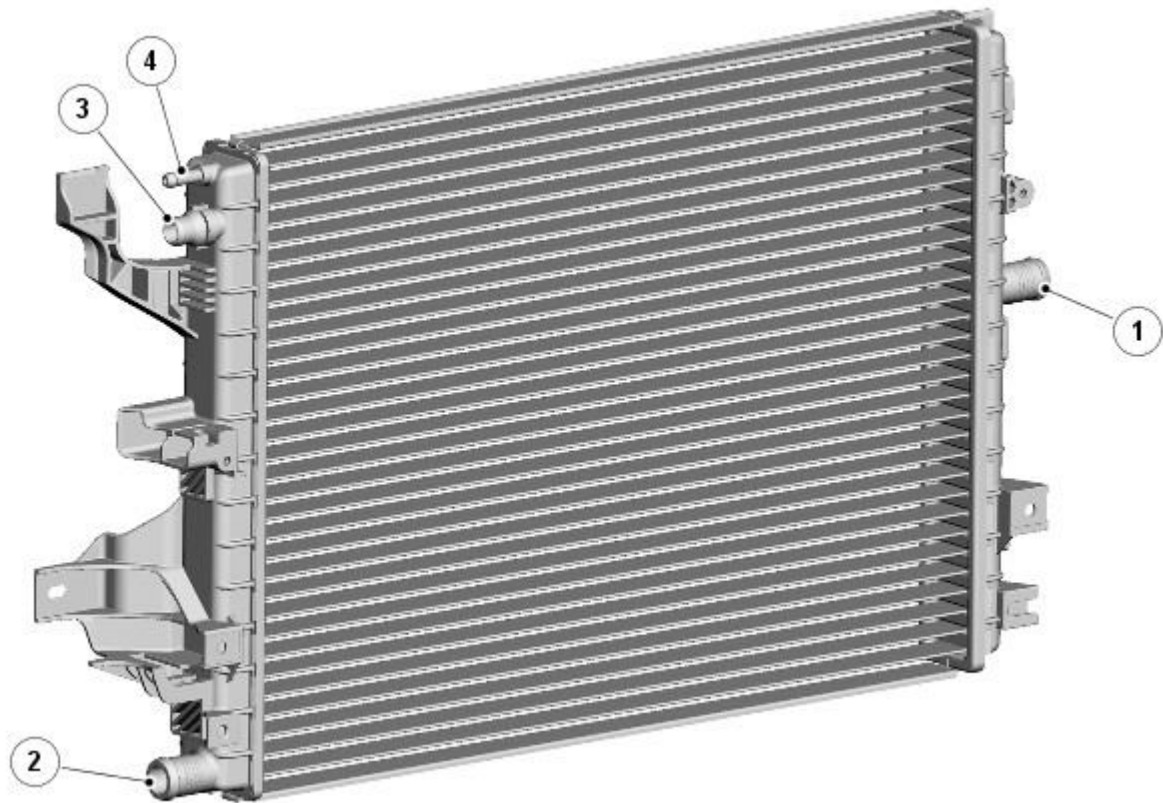
#### ItemDescription

1	Coolant outlet connection
2	Coolant inlet connection
3	Electrical connector

The charge air coolant pump is an electric pump attached to the [RH](#) side of the charge air radiator.

### Charge Air Radiator





E98151

**ItemDescription**

1	Intercooler return hose connection
2	Pump inlet hose connection
3	Engine cooling system connection
4	Bleed hose connection

The charge air radiator is a cross flow type with an aluminum core and plastic end tanks. The charge air radiator is installed in the cooling module, in front of the [A/C \(air conditioning\)](#) condenser.

**Charge Air Coolers**

A charge air cooler is attached to each cylinder bank.

Refer to: [Intake Air Distribution and Filtering](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Description and Operation).

## **Supercharger Cooling - 4.2L SC V8 - AJV8 - Supercharger Cooling**

Diagnosis and Testing

For additional information.

REFER to: [Engine Cooling](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).

# Supercharger Cooling - 4.2L SC V8 - AJV8 - Radiator

Removal and Installation

## Removal

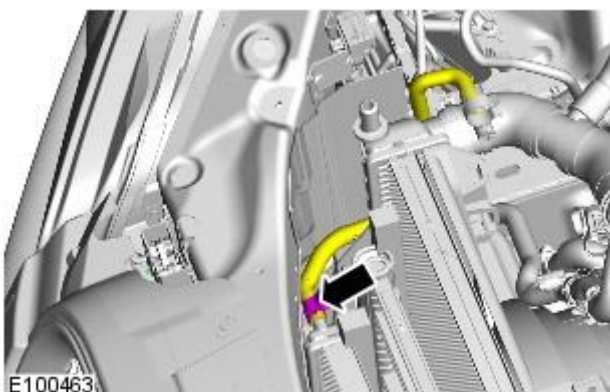
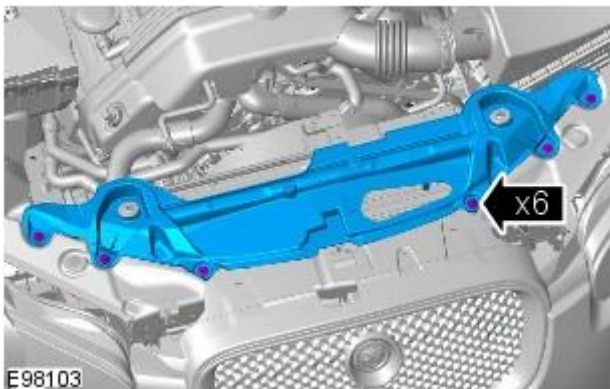
- NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

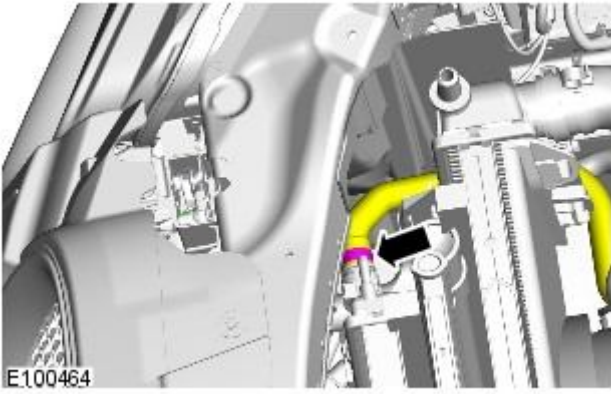
Raise and support the vehicle.

2. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).
3. Refer to: Air Cleaner LH (303-12, Removal and Installation).
4. Refer to: Air Cleaner RH (303-12, Removal and Installation).
5. Refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).

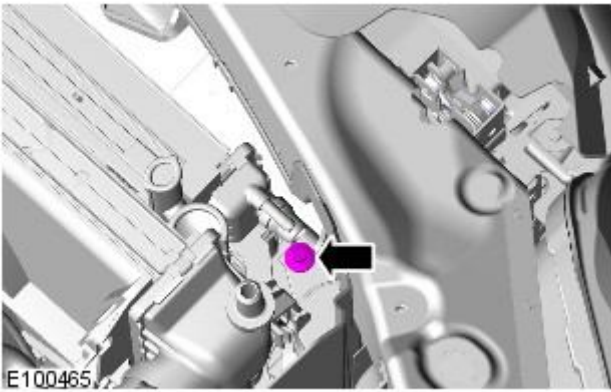
6. Torque: 7 Nm



- 7.



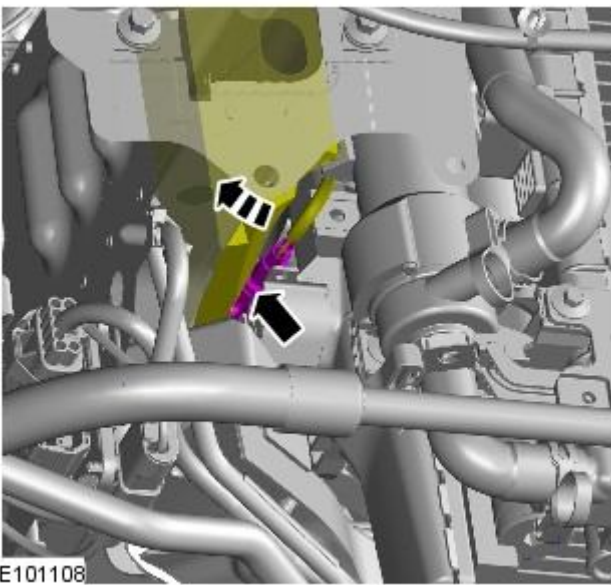
8.



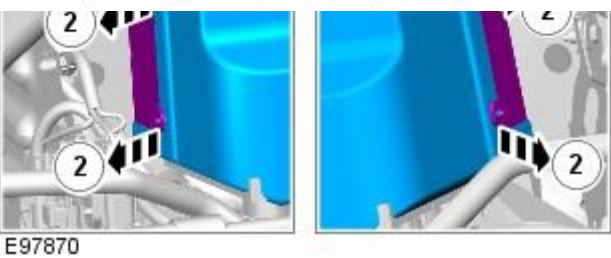
9. Torque: 5 Nm

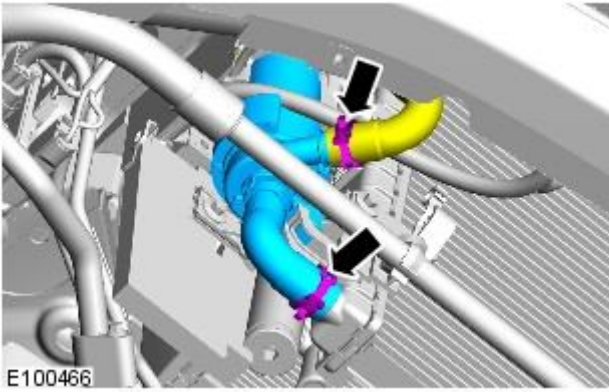
10.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

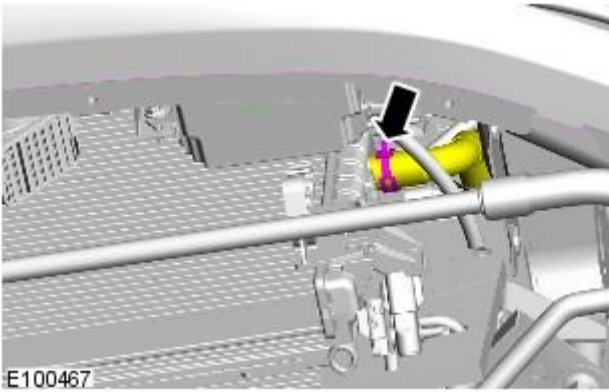


11.

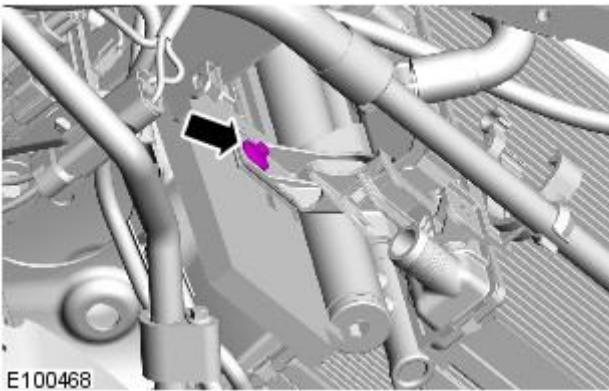




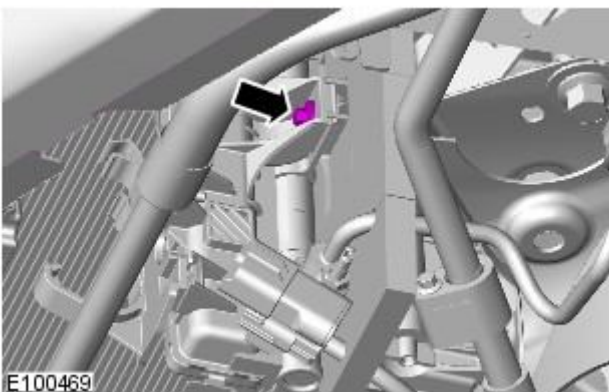
13. **13.**  CAUTION: Be prepared to collect escaping coolant.



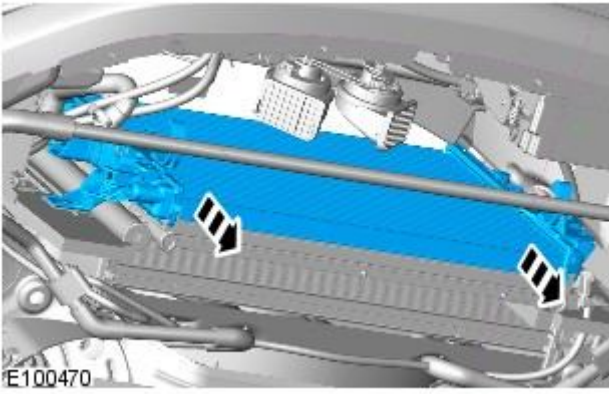
- 14.



15. **15.** NOTE: Support the air conditioning (A/C) condenser.  
*Torque: 10 Nm*



16. **16.** NOTE: Support the air conditioning (A/C) condenser.  
*Torque: 10 Nm*



17.  CAUTION: Be prepared to collect escaping coolant.

## Installation

1. To install, reverse the removal procedure.



## Fuel Charging and Controls - TDV6 2.7L Diesel -

### Torque Specifications

Description	Nm	lb-ft	lb-in
High-pressure fuel supply line unions	A	–	–
High-pressure fuel supply line support bracket retaining nut	10	–	89
Fuel injector retaining bolts	10	–	89
Fuel injector high pressure fuel inlet adaptor union	42	31	–
Fuel injection diverter rail retaining bolts	23	16	–
Fuel injection supply manifold retaining bolts	23	16	–
Fuel injection supply manifold support bracket retaining bolts	23	16	–
Fuel pump retaining bolts	23	16	–
Fuel injection pump belt rear cover retaining bolts	7	–	62
Camshaft rear pulley retaining bolt	A	–	–
Fuel injection pump belt tensioner retaining bolt	25	18	–
Fuel injection pump pulley retaining nut	50	37	–
Fuel injection pump high pressure fuel outlet adaptor union	37	27	–
Exhaust gas recirculation (EGR) valve retaining bolts	10	–	89
Intake manifold retaining nuts	15	11	–

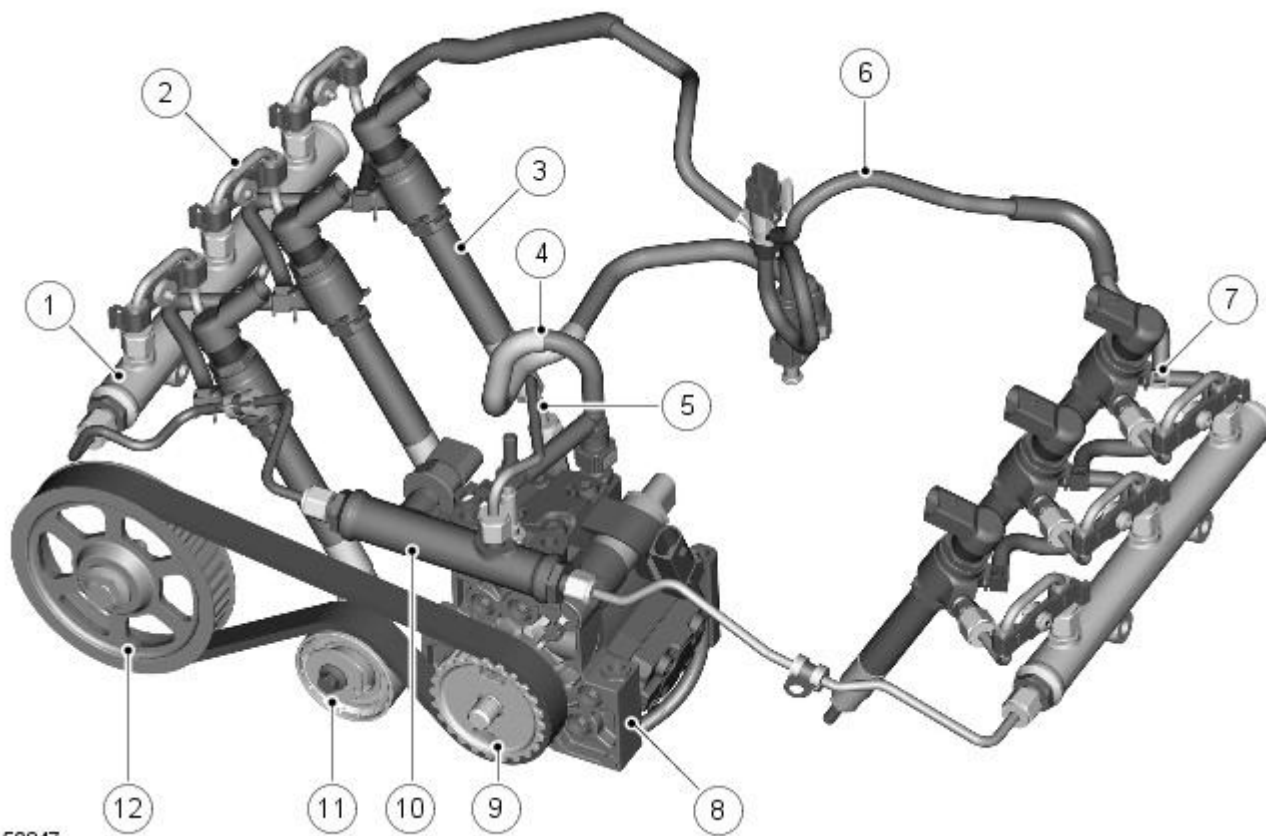
A = refer to the procedure for the correct torque sequence

# Fuel Charging and Controls - TDV6 2.7L Diesel - Fuel Charging and Controls -

## Component Location

Description and Operation

Component Location



E50847

### ItemDescription

1	Fuel rail (2 off)
2	HP (high pressure) pipe - fuel rail to injector (6 off)
3	Fuel injector (6 off)
4	LP (low pressure) pipe - fuel return
5	HP pipe - HP pump to fuel diverter rail
6	LP pipe - injector leak-back
7	LP pipe connection to injector
8	HP pump
9	HP pump pulley
10	HP diverter rail
11	READ (rear end accessory drive) belt tensioner
12	LH (left-hand) exhaust camshaft pulley

# Fuel Charging and Controls - TDV6 2.7L Diesel - Fuel Charging and Controls - Overview

Description and Operation

## Overview

The 2.7L V6 diesel engine is equipped with a HP common rail fuel injection system. With this fuel injection process, a HP pump delivers a uniform level of pressure to the shared fuel lines (the common rails), which serve all 6 fuel injectors. Pressure is controlled to the optimum level for smooth operation.

The common rail system supports a pre-injection (pilot) phase, which reduces combustion noise levels, more commonly referred to as 'diesel knock'.

Fuel injection pressure is generated independently of engine speed and fuel injection events.

The fuel injection timing and volume are calculated by the [ECM \(engine control module\)](#), which then energizes the appropriate piezo actuated injector. The common rail fuel injection system has the following features:

- High fuel injection pressures of up to 1650 bar (23930 lbf/in<sup>2</sup>) for greater atomisation of fuel (increasing performance and lowering emissions).
- Variable injection to optimize combustion in all engine operating conditions.
- Low tolerances and high precision throughout the life of the system.

The fuel system is divided into two sub systems:

- LP system.
- HP system.

The LP system features the following components:

- In-tank fuel pump.
- Fuel pressure regulator (integral to the fuel delivery module).
- Fuel filter.
- Return pipes.
- Injector return pipes.
- Fuel coolers (engine and vehicle).

The LP system is regulated to 0.5 bar (7.25 lbf/in<sup>2</sup>).

The HP system features the following components:

- HP pump.
- Fuel rails and diverter rail
- HP fuel pipes.
- Injectors.

# Fuel Charging and Controls - TDV6 2.7L Diesel - Fuel Charging and Controls - System Operation and Component Description

Description and Operation

## System Operation

### Engine Starting

During starting, the fuel rail pressure must be at least 150 bar (2175 lbf/in<sup>2</sup>). Should the pressure be below this figure, the injectors will not operate, resulting in the vehicle not starting.

### Engine Stopped

To stop the engine the [ECM \(engine control module\)](#) stops energizing the piezo actuators, therefore, no fuel is injected and the engine speed drops to zero.

Refer to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.7L Diesel, Description and Operation).

## Component Description

### LP System

#### In-tank Fuel Pump

The electric fuel pump is located inside the fuel tank. Fuel is pumped from the tank via the in-tank fuel pump, to the HP pump via the fuel filter.

Refer to: Fuel Tank and Lines (310-01 Fuel Tank and Lines - 2.7L Diesel, Description and Operation).

#### Fuel Filter

The fuel filter is located in the engine compartment on the left hand side, packaged to be protected against damage. Incorporated in the fuel filter housing is a bimetallic temperature valve, which will start to close at 30 °C (86 °F) and will fully close at 50 °C (122 °F). This allows pre-heated diesel fuel to circulate inside the fuel filter to prevent waxing in cold operating conditions.

Refer to: Fuel Tank and Lines (310-01 Fuel Tank and Lines - 2.7L Diesel, Description and Operation).

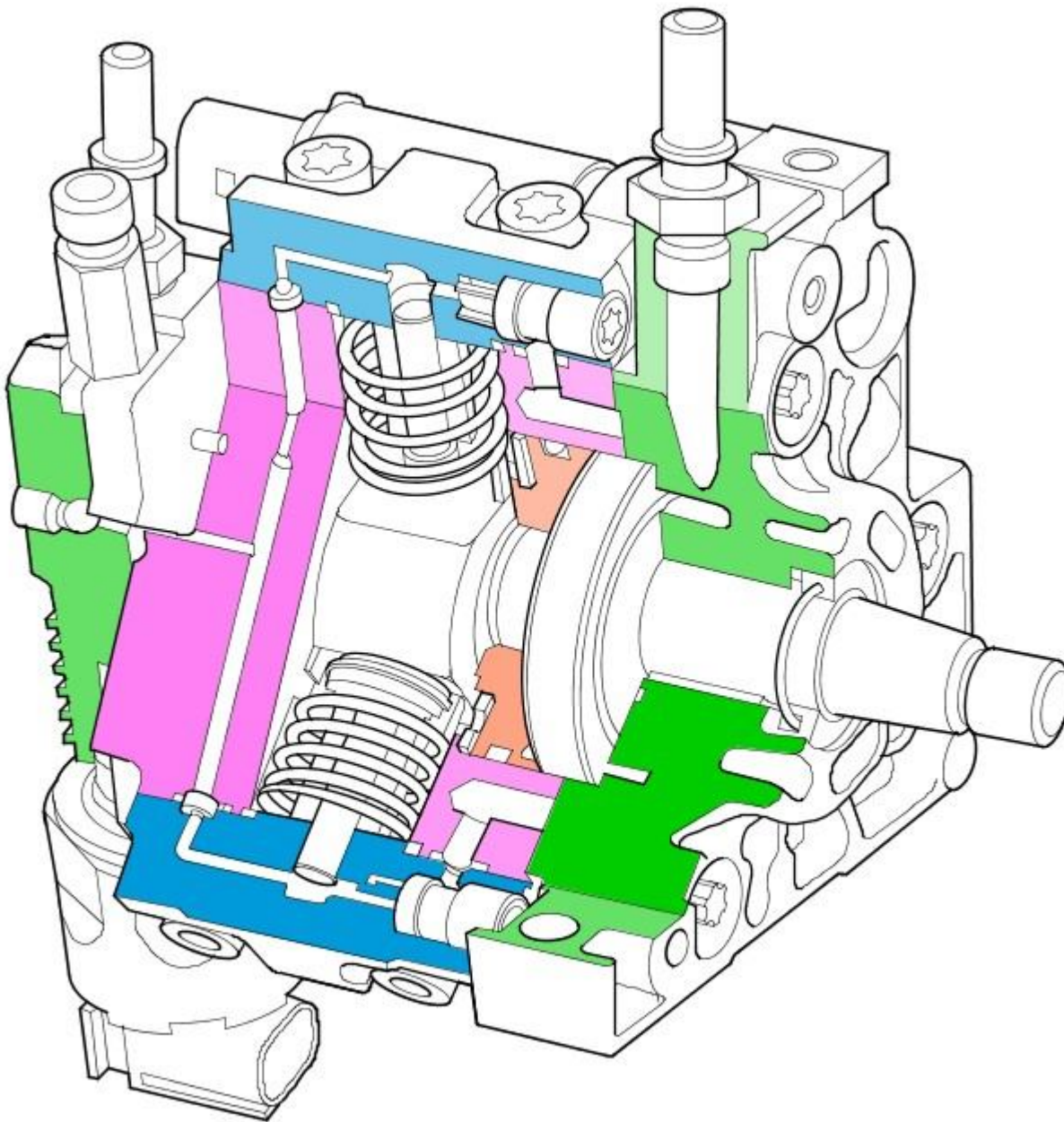
#### Fuel Cooler

Two fuel coolers are fitted to the vehicle. One is located in the 'vee' of the engine block, and has a coolant system connection to aid heat transfer. The second cooler is located in the fuel return line and is a fuel to air cooler.

Refer to: Fuel Tank and Lines (310-01 Fuel Tank and Lines - 2.7L Diesel, Description and Operation).

### HP System

#### HP Pump



## E50833

The HP pump is a three-piston (120 degree apart) radial plunger pump with a HP displacement of 0.8 cc (0.05 in<sup>3</sup>). As mentioned, it has the ability to produce a maximum pressure of 1650 bar (23930 lbf/in<sup>2</sup>). The housing is cast from iron, the flange is cast from aluminum.

The HP pump is driven from the camshaft via a toothed belt. It does not need to be timed to the engine during belt replacement in service.

The required supply pressure to the HP pump is -0.3 to +0.5 bar (-4.4 to 7.25 lbf/in<sup>2</sup>). The return pressure is -0.3 bar to +0.8 bar (-4.4 to 11.6 lbf/in<sup>2</sup>).

The pump is sized to deliver sufficient fuel to the fuel rails for all engine-operating conditions.

The HP pump consists of the following components:

- ITP (internal transfer pump).
- VCV (volume control valve).
- HP pumping elements (3 off).
- PCV (pressure control valve).

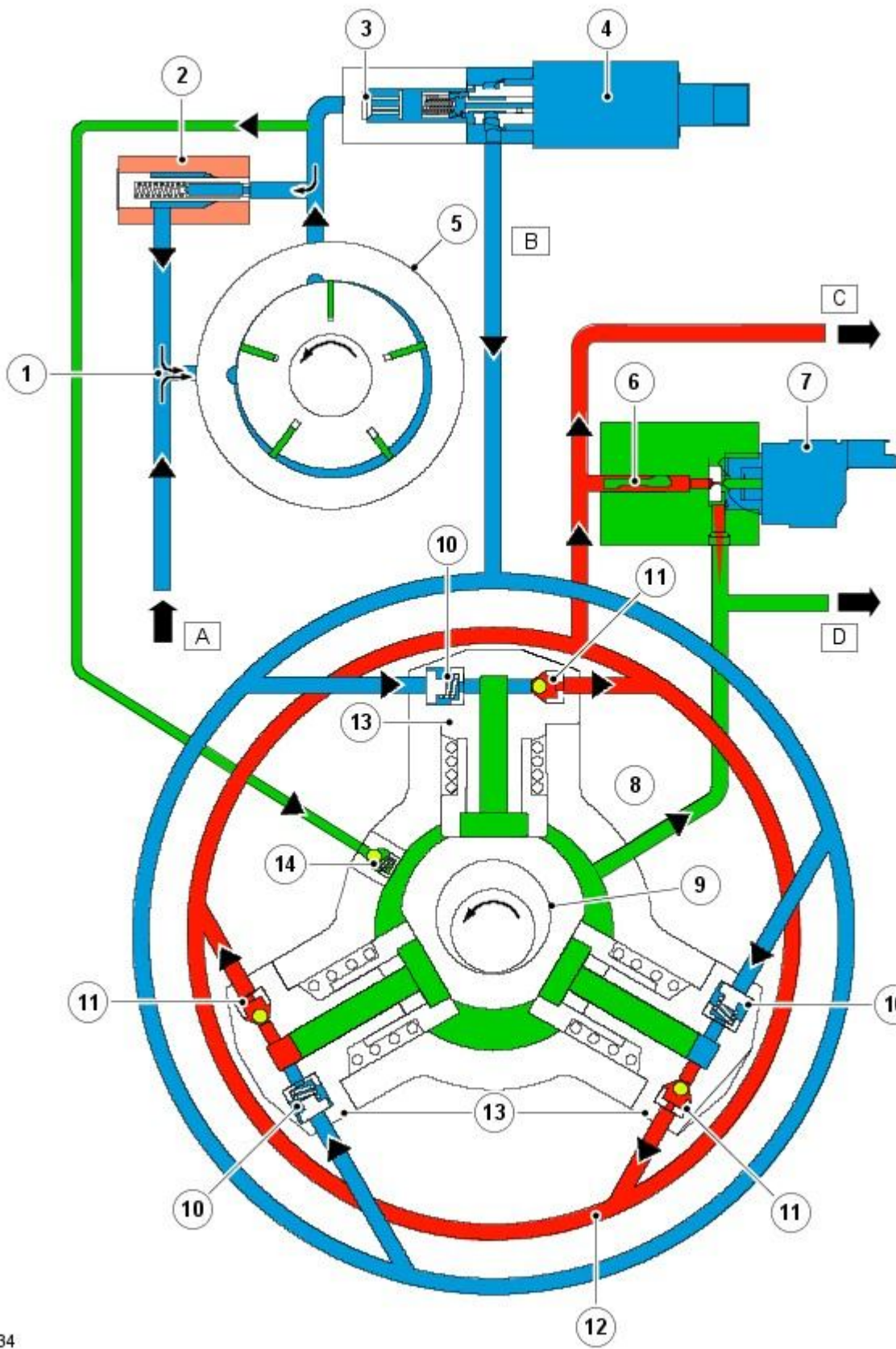
The ITP is a five vane pump. This conveys fuel to the VCV.

The VCV is a variable position solenoid valve electronically controlled by the [ECM](#). The VCV is located between the ITP and the HP pumping elements. The VCV determines the amount of fuel that is delivered to the HP pumping elements. When there is no signal to the VCV the valve is closed and there is no fuel delivery.

The three HP pumping elements are connected together in a fuel ring circuit within the pump. There is a single HP outlet connection for the HP pipe to the HP diverter rail.

The PCV is a variable position solenoid valve electronically controlled by the [ECM](#). The PCV is located between the HP pumping elements and the HP outlet connection. The PCV regulates the amount of fuel pressure in the fuel rails. When there is no signal to the PCV the valve is open, therefore no fuel rail pressure can be generated.

HP Fuel Flow



E50834

**ItemDescription**

A	LP fuel supply
B	Fuel supply to the HP pumping elements
C	HP outlet connection to the HP diverter rail
D	LP fuel return (spill)
1	LP side of ITP
2	ITP pressure relief valve
3	Screen filter
4	VCV
5	ITP
6	Edge filter - to protect PCV
7	PCV
8	N/A
9	Eccentric on HP pump drive shaft



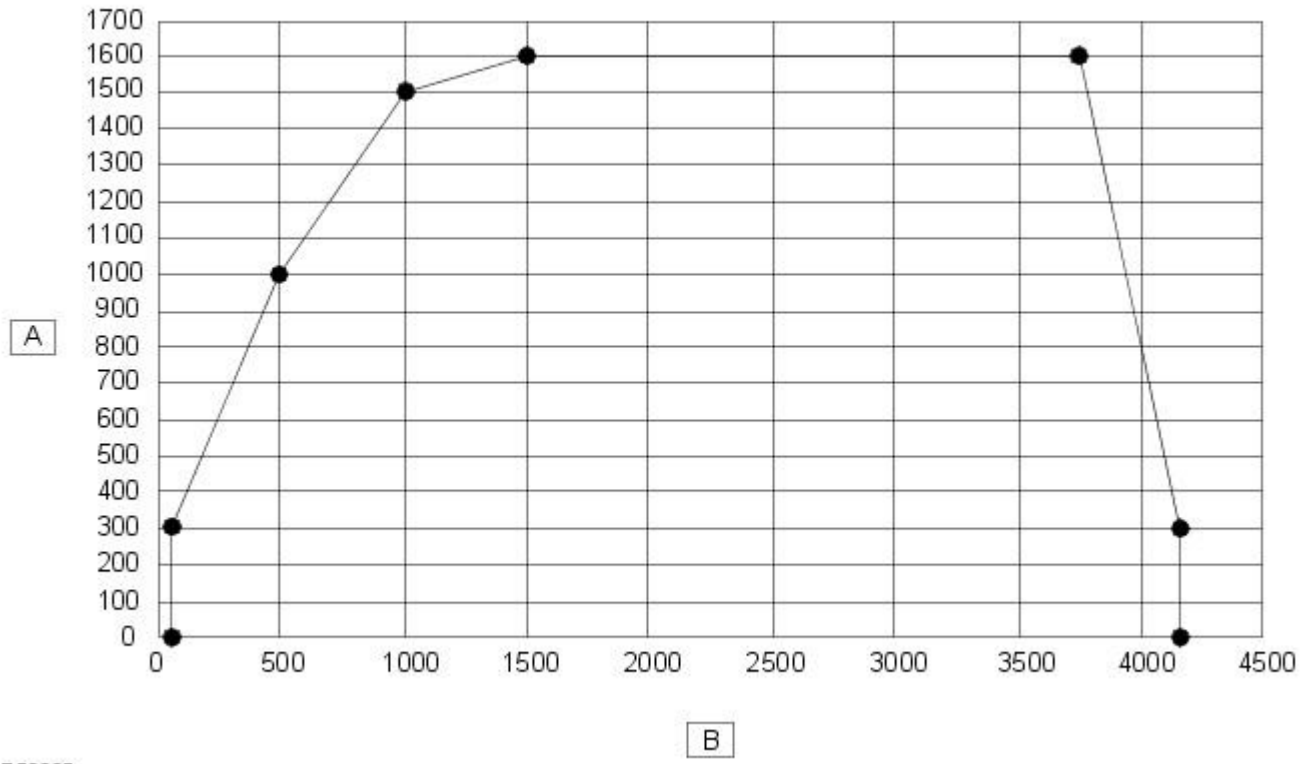
10	Pumping element inlet valve
11	Pumping element outlet valve
12	HP ring line
13	HP pump elements (3 off)
14	Lubricating valve

The fuel induced by the ITP (5) is conveyed to the VCV (4) and the lubricating valve (14). When the VCV is closed, the ITP pressure relief valve (2), lying parallel to the transfer pump, opens and conveys the fuel back to the LP side (1) of the transfer pump. The fuel passes through the lubricating valve (14) into the interior of the HP pump and from there to the fuel return (D). The fuel is used to lubricate the pump.

The VCV (4) determines the quantity of fuel (B) that is supplied to the pumping elements (13). The fuel from the HP outlets (11) of the three pumping elements comes together in a ring line (12) and is conveyed through the HP outlet of the HP pump to the fuel rails.

The PCV (7) regulates the fuel pressure in the fuel rails. Reducing pressure via the PCV results in fuel returning from the fuel rails to the LP fuel return (D).

HP Pump Pressure/Speed Graph



E50835

**ItemDescription**

A	Pump pressure (bar)
B	Pump speed (rpm)

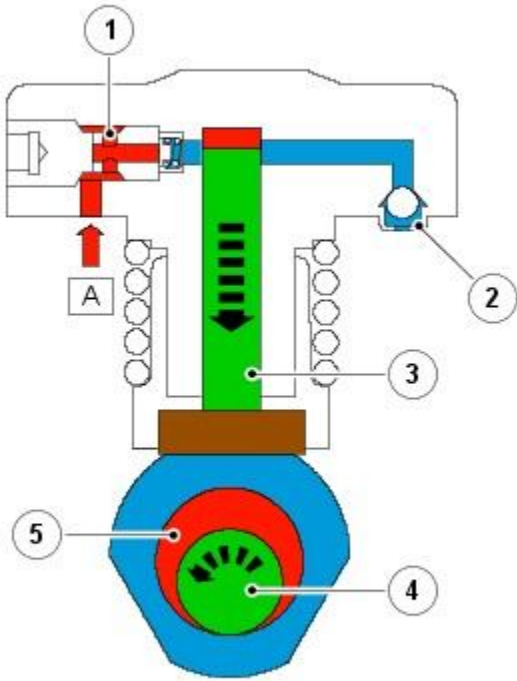
The HP pump can supply up to 1600 bar (23206 lbf/in<sup>2</sup>) fuel pressure continuously with short excursions to 1650 bar (23930 lbf/in<sup>2</sup>). Pump speed is 5/6 engine speed. However, it is calibrated to deliver fuel pressure dependant upon engine speed and load.

When the HP pump is rotated, pressure is created when the VCV is open and the PCV is closed. The VCV and PCV are electronically controlled to allow variable fuel delivery and pressure control.

When the [ECM](#) actuates the piezo actuators, the fuel rail pressure drop is off-set by additional fuel being delivered to the fuel rails by the PCV.

The fuel pressure in the system is reduced within a few seconds after the engine has stopped as the PCV no longer has the holding current it requires, and therefore opens. No residual pressure remains in the system and the fuel is returned to the fuel return line (D) through the open PCV.

High Pressure Element Fuel Induction



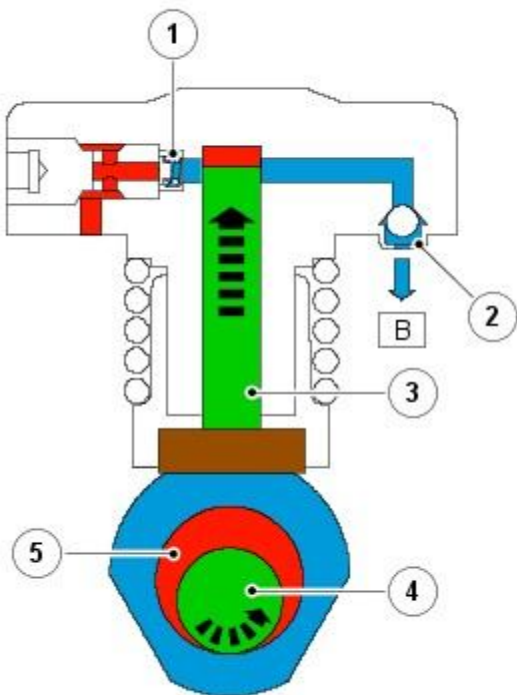
E50836

**ItemDescription**

A	Fuel inlet flow
1	Inlet valve
2	Outlet valve
3	Piston
4	Driveshaft
5	Eccentric cam

During the downward motion of the piston (3), a vacuum in the pump cylinder is generated, which opens the inlet valve (1) against the force exerted by the valve spring. The fuel (A), which is flowing past the VCV, is sucked in. At the same time the outlet valve (2) is closed due to the pressure difference between the pump cylinder and the HP fuel in the ring line.

High Pressure Element Fuel Delivery



E50837

**ItemDescription**

B Fuel outlet flow to ring line

1 Inlet valve

2 Outlet valve

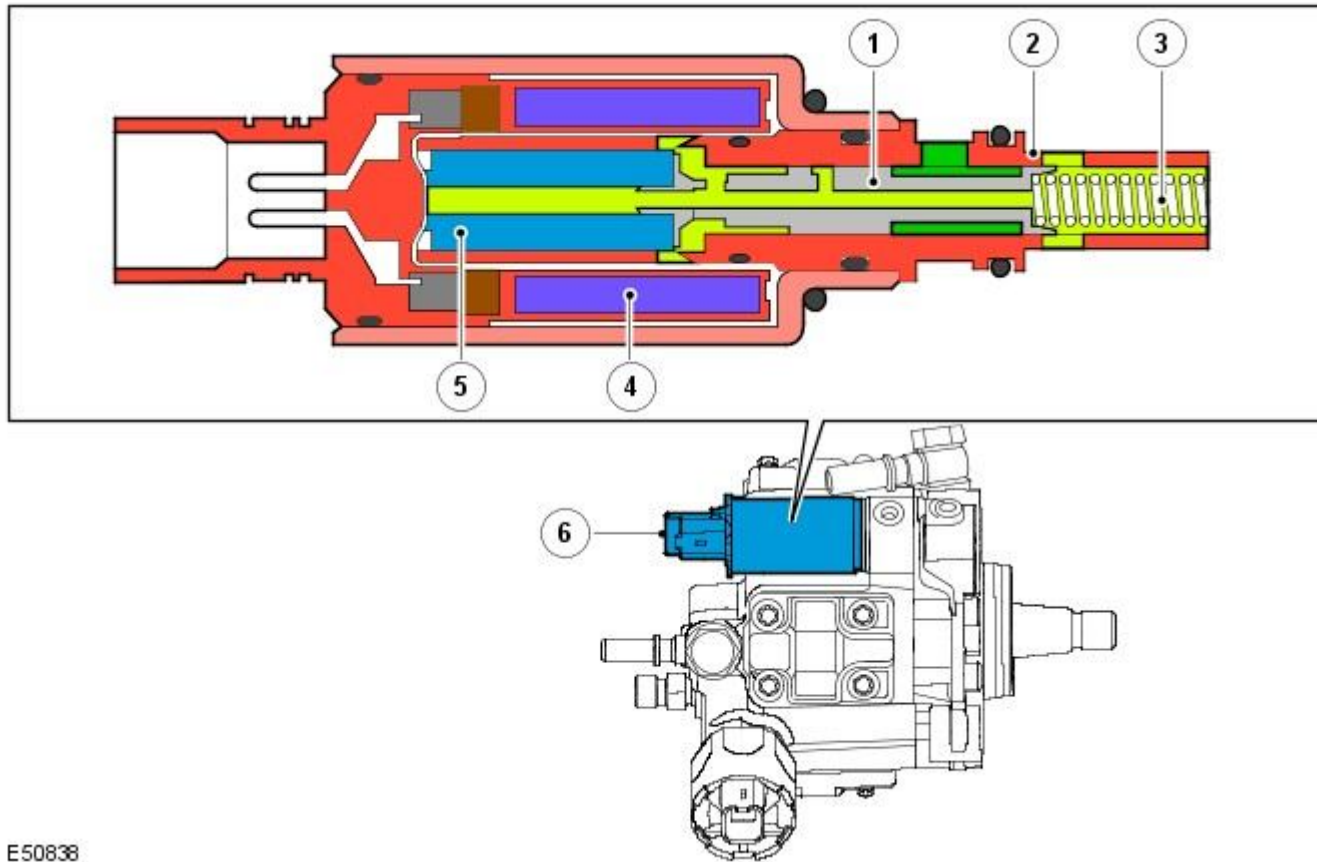
3 Piston

4 Driveshaft

5 Eccentric cam

The eccentric cam on the HP pump driveshaft (5) presses the piston (3) upwards. The inlet valve (1) is then closed through the force exerted by the valve spring and the pressure being built up in the pump cylinder. The outlet valve (2) opens when the pressure in the pump cylinder is greater than the fuel pressure in the ring line (B).

Volume Control Valve



E50838

**ItemDescription**

1 Piston

2 Sleeve

3 Compression spring

4 Coil

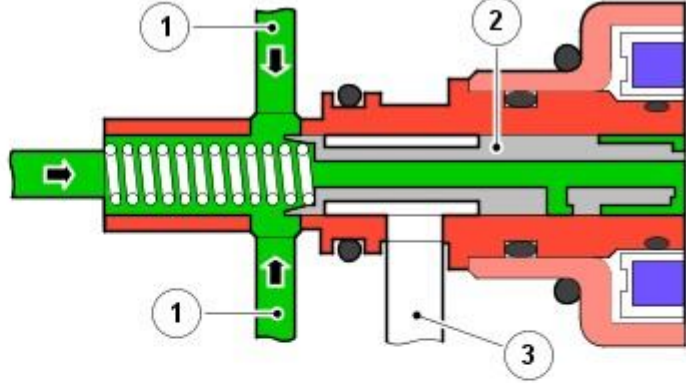
5 Armature

6 VCV

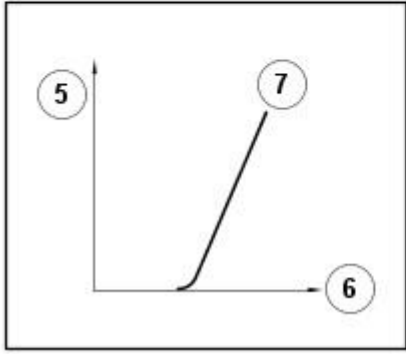
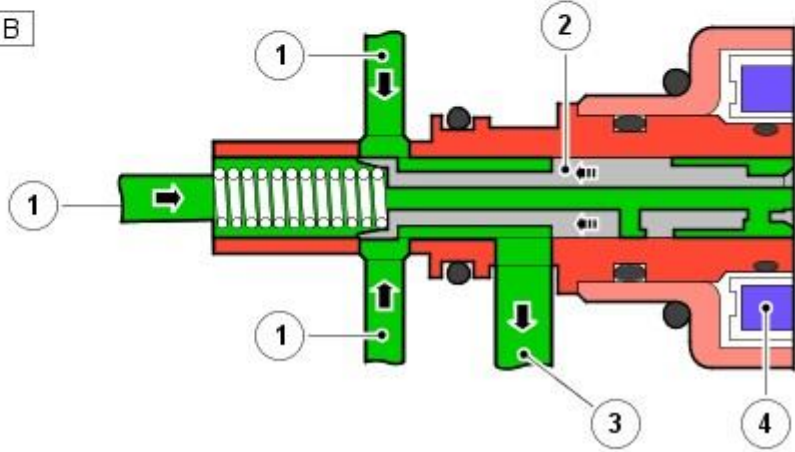
The VCV is fixed directly to the HP pump. The VCV regulates the fuel supply (and hence the quantity of fuel) from the transfer pump to the HP pump elements, depending on the pressure in the fuel rails. This makes it possible to match the delivery of the HP pump to the requirements of the engine from the LP side. The quantity of fuel flowing back to the main fuel supply line is kept to a minimum. In addition, this adjustment reduces the power consumption of the HP pump, improving the efficiency of the engine.

The VCV default position is closed without electrical supply. An open circuit connector will prevent the engine from running.

A



B



E50839

**ItemDescription**

A	VCV not actuated
B	VCV actuated
1	Fuel supply from the transfer pump
2	Piston
3	Fuel supply to the HP pump
4	Coil energized
5	Quantity of fuel
6	Control current
7	VCV at constant engine speed

**VCV Not Actuated (A)**

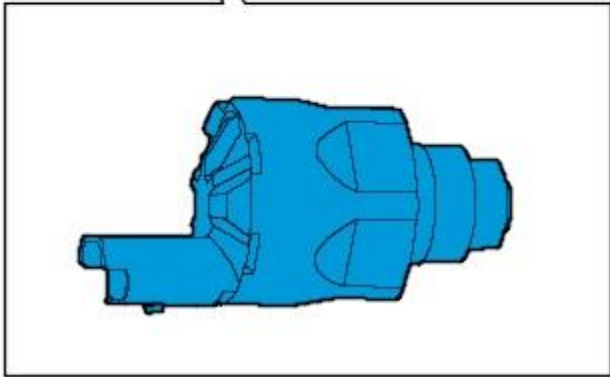
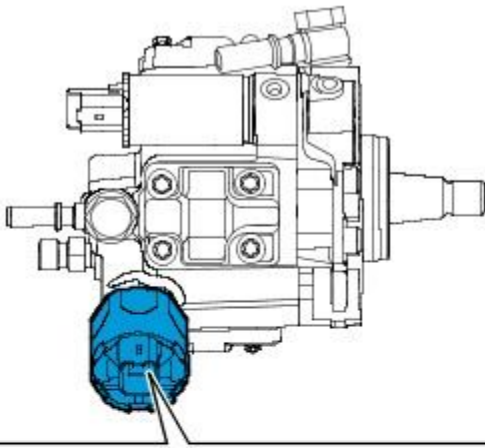
When there is no power supplied, the piston (2) closes the opening between the two connections (1) and (3) through the force of the compression spring. The fuel supply to the HP pump is interrupted.

**VCV Actuated (B)**

The **ECM** energizes the coil (4) of the valve, according to the engines requirements. The armature force is proportional to the control current and counteracts the compression spring through the moving piston (2).

As a result, the opening between the two connections (1) and (3) and hence the quantity of fuel (5) supplied through the connector (3) to the HP pump is also proportional to the control current (6). This means that the greater the opening cross-section, the greater the quantity of fuel supplied.

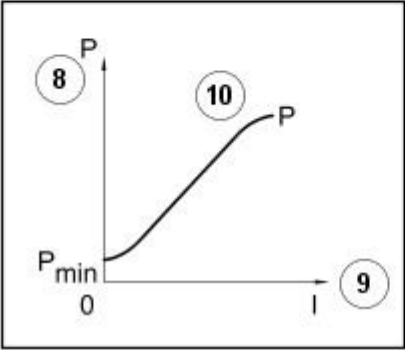
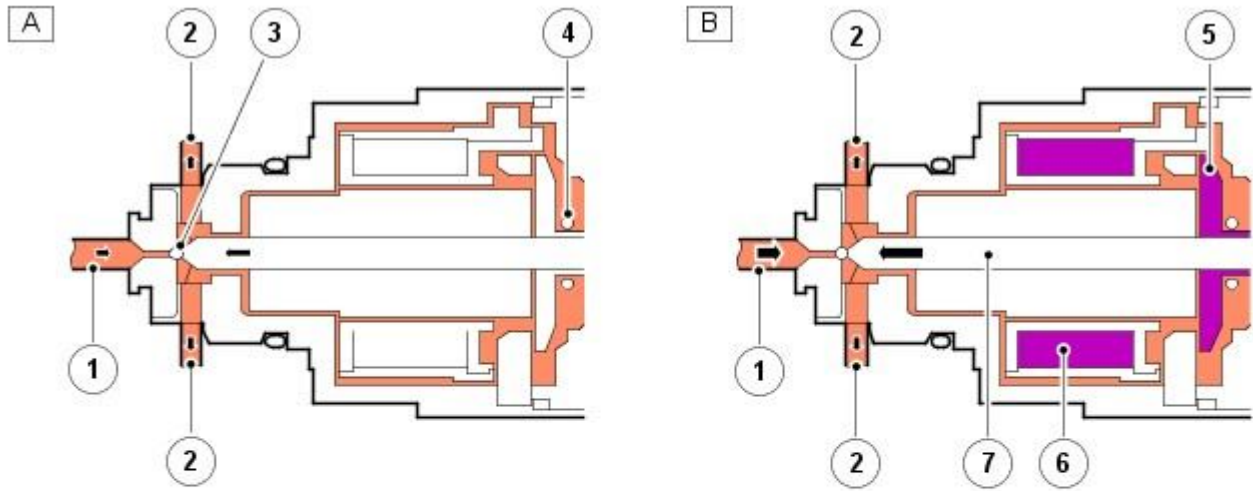
**Pressure Control Valve**



E50840

The PCV is located on the HP pump. It governs the fuel pressure at the HP outlet of the HP pump and thus the pressure within the fuel rails. In addition, the PCV dampens any fluctuations in pressure, which occur during the delivery of fuel through the HP pump and through the injection process. The PCV ensures that optimum pressure exists in the fuel rails for every operating condition of the engine.

The PCV is an electro-magnetically operated valve with spring support. The current supplied by the **ECM** through the solenoid pulls back the control pin. This allows fuel to flow through the ball valve and into the common rails. The entire armature is coated with fuel for lubrication and cooling.



E50841

**ItemDescription**

A	PCV non-controlled
B	PCV controlled
1	Fuel from the HP pump
2	To fuel return
3	Ball valve
4	Compression spring

5	Armature
6	Coil energized
7	Control pin
8	HP fuel
9	Control current
10	Characteristic of the PCV

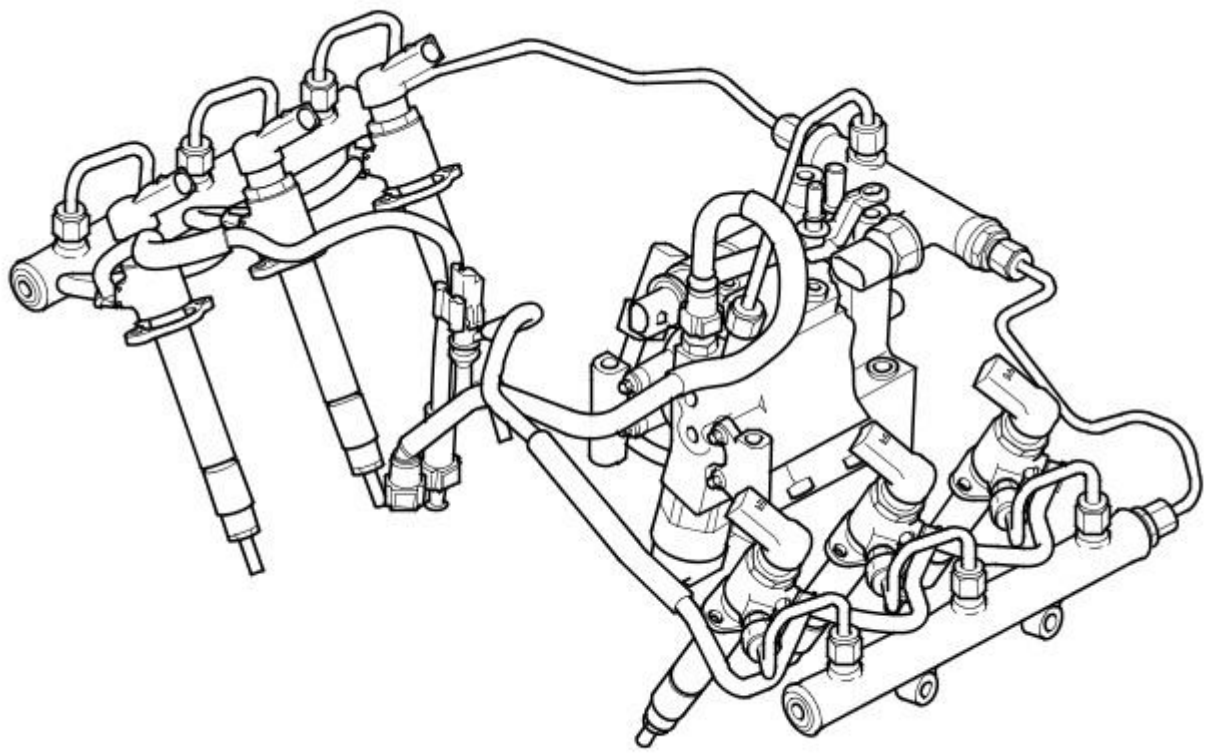
**PCV Non-controlled (A)**

The ball valve (3) will only be operated through the force exerted upon it by the spring (4). Thereby, the PCV is classed as open.

**PCV Controlled (B)**

The current flowing through the solenoid (6) draws the pin (7) down. This in turn transfers the magnetic force via the pin to the ball valve (3). The pull of the pin, and the pressure on the ball valve, is proportional to the valve flow (9).

**Fuel Rails**

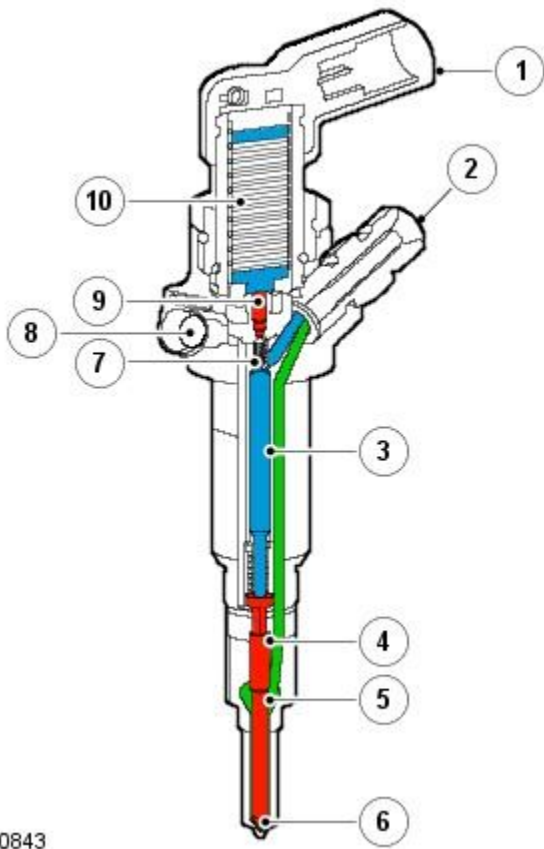


E50842

The fuel rails are manufactured from forged steel. They store the fuel at high pressure and prevent pressure fluctuations in the HP system. All HP pipes have an internal diameter of 2.5 mm (0.098 in.) except the pipes to the injectors, which are 3.0 mm (0.118 in.). Total rail volume is 33 cc (2.01 in<sup>3</sup>).

**Fuel Injectors**





E50843

**ItemDescription**

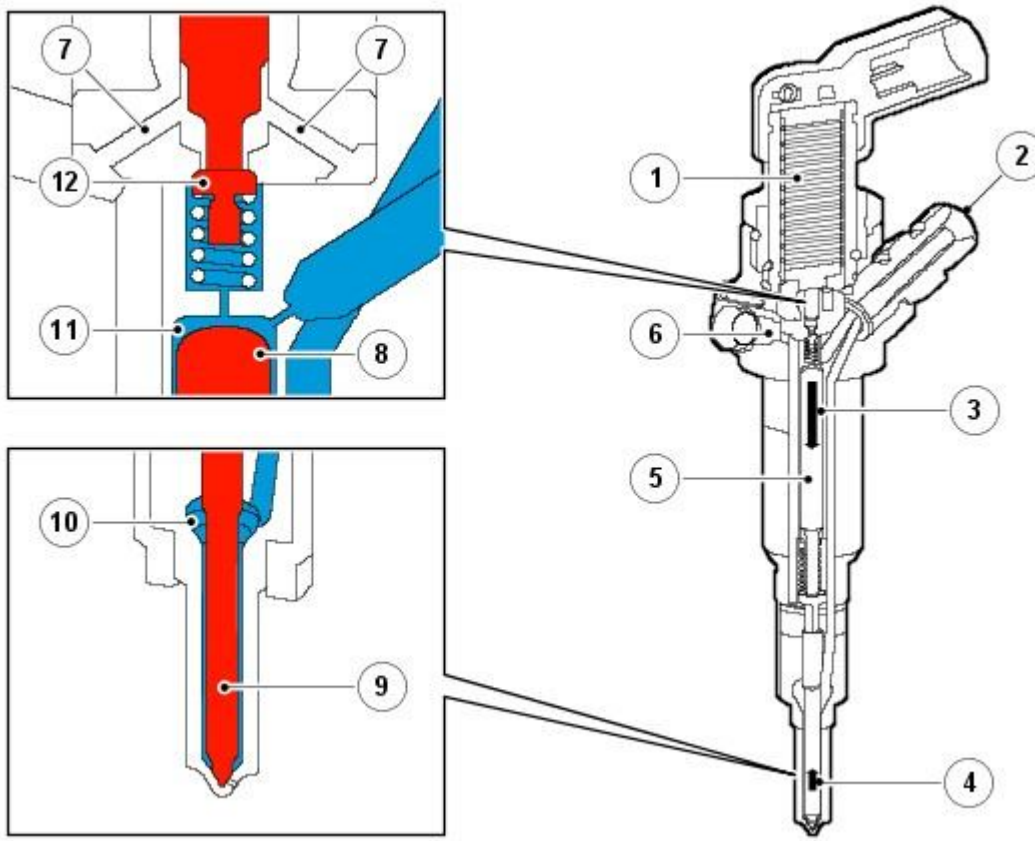
1	Harness connection
2	HP connection
3	Control piston
4	Nozzle needle
5	Nozzle HP chamber
6	Nozzle spray holes
7	Valve mushroom
8	Fuel return
9	Valve piston
10	Piezo actuator

The fuel injectors are controlled by piezo-electric action, activated directly by the [ECM](#) to precisely match instantaneous speed and load conditions. The piezo injector operates four times faster than traditional solenoid injectors, with switching times as little as 0.2 milliseconds. This enables minimal quantities of fuel to be metered with extreme accuracy, and the start of injection to be determined with even greater precision and at multiple times during each engine stroke. The injectors have six orifices, each having a diameter of 145 microns (0.0057 in.). This produces an extremely fine spray of fuel, which ensures the most uniform fuel-air mixture possible. As a result, the combustion process is more complete. The operating components of the piezo fuel injectors are:

- The piezo actuator.
- The injector body containing the hydraulic servo system.
- The fuel injector nozzle.

Each injection event is controlled by a charge and discharge cycle allowing energy to dissipate in, and recover from, the injector. Never disconnect the wiring connector when the vehicle is running. The injector may remain open thus causing engine damage.

Fuel Injector Not Actuated (Not Injecting Fuel)



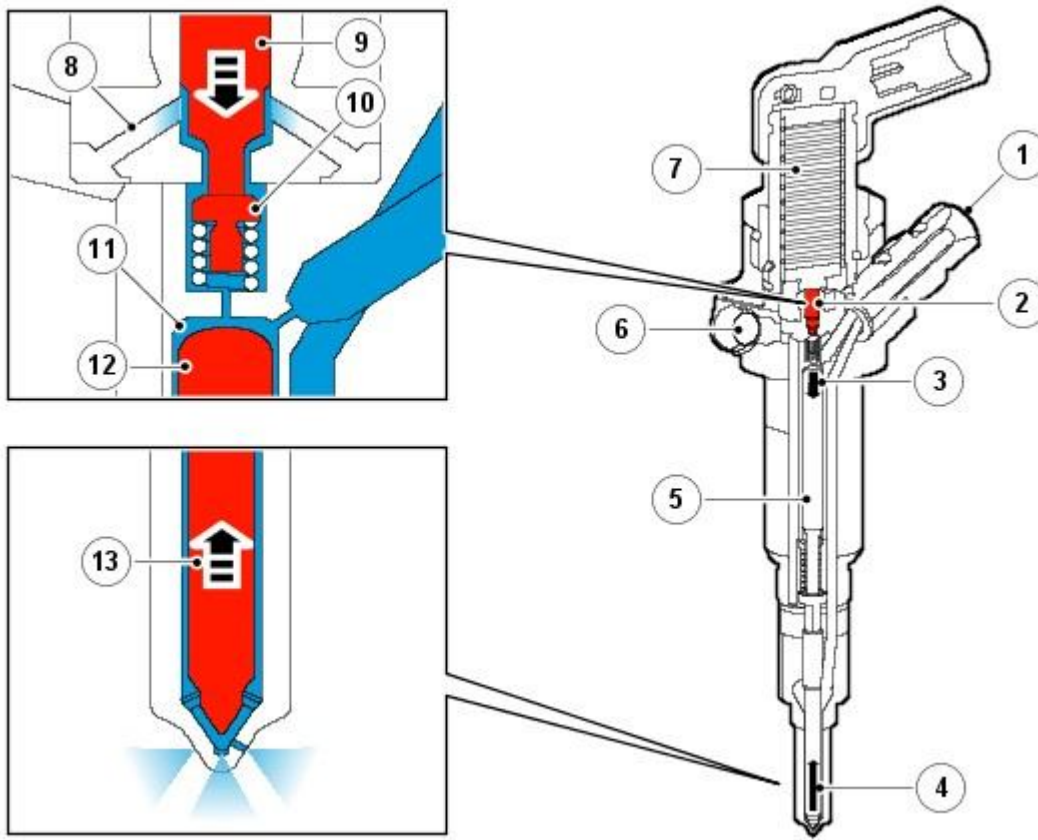
E50844

**ItemDescription**

1	Piezo actuator
2	HP connection
3	Hydraulic force applied on control piston
4	Hydraulic force acting on tip of nozzle
5	Control piston
6	Fuel return
7	Fuel return
8	Control piston
9	Nozzle needle
10	HP chamber of nozzle
11	Control chamber
12	Valve mushroom

The HP fuel from the fuel rail passes through the HP connection (2) into the control chamber (11) and into the HP chamber (10) of the fuel injector nozzle. The piezo actuator (1) is de-energized and the valve mushroom (12) closes the bore to the fuel return (7) by means of spring pressure. There is a continuous fuel return (6) to vent internal leakage within the injector. The hydraulic force (3), which is now applied on the control piston by the fuel under high pressure in the control chamber (11) through the control piston (8), is greater than the hydraulic force (4) acting on the tip of the nozzle (since the area of the control piston in the control chamber is greater than the area of the tip of the nozzle).

Fuel Injector Actuated (Injecting Fuel)



E50845

**ItemDescription**

1	HP supply
2	Valve piston
3	Hydraulic force applied on control piston
4	Hydraulic force acting on tip of nozzle
5	Control piston
6	Fuel return
7	Piezo actuator
8	Fuel return
9	Valve piston
10	Valve mushroom
11	Control chamber
12	Control piston
13	Nozzle needle

The piezo actuator (7) energized by the [ECM](#) extends (charging phase) and presses on the valve piston (9). The valve mushroom (10) opens the bore, which connects the control chamber (11) to the fuel return (8 then 6). As a result, the pressure in the control chamber drops, and the hydraulic force (4) acting on the tip of the nozzle needle is now greater than the force (3) acting on the control piston in the control chamber. The nozzle needle (13) moves upwards and the fuel passes through the six spray holes into the combustion chamber.

# Fuel Charging and Controls - TDV6 2.7L Diesel - Fuel Charging and Controls

Diagnosis and Testing

## Principles of Operation

For a detailed description of the diesel engine fuel charging and controls, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel)

[Fuel Charging and Controls](#) (Description and Operation),  
[Fuel Charging and Controls](#) (Description and Operation),  
[Fuel Charging and Controls](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of mechanical or electrical damage.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Fuel level</li> <li>● Fuel leaks</li> <li>● Damaged fuel lines</li> <li>● Damaged push connect fittings</li> <li>● Fuel contamination/grade/quality</li> <li>● Throttle body</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Loose or corroded electrical connectors</li> <li>● Harnesses</li> <li>● Sensor(s)</li> <li>● Engine Control Module (ECM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. 4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Engine cranks but does not start	<ul style="list-style-type: none"> <li>● Fuel level</li> <li>● Contaminated fuel</li> <li>● Fuel system leaking/blocked</li> <li>● Air intake system</li> <li>● Electronic engine controls</li> </ul>	Check fuel level and for contamination. Check fuel and air intake system integrity. Check for DTCs and refer to the relevant DTC Index
Difficult to start	<ul style="list-style-type: none"> <li>● Fuel level</li> <li>● Contaminated fuel</li> <li>● Fuel system leaking/blocked</li> <li>● Air intake system</li> <li>● Electronic engine controls</li> </ul>	Check fuel level and for contamination. Check fuel and air intake system integrity. Check for DTCs and refer to the relevant DTC Index
Rough idle	<ul style="list-style-type: none"> <li>● Low/contaminated fuel</li> <li>● Fuel system leaking/blocked</li> <li>● Electronic engine controls</li> </ul>	Check fuel level/condition. Check integrity of fuel and engine control systems. Check for DTCs and refer to relevant DTC Index
Lack of power under acceleration	<ul style="list-style-type: none"> <li>● Contaminated fuel</li> <li>● Air intake system</li> <li>● Blocked exhaust/catalytic converter</li> <li>● Turbocharger fault</li> <li>● Fuel system</li> <li>● Electronic engine controls</li> <li>● Low engine compressions</li> </ul>	Check for fuel contamination. Check for DTCs and refer to relevant DTC Index. Check integrity of air intake, exhaust, turbocharger, and engine control systems
Engine stops/stalls	<ul style="list-style-type: none"> <li>● Low/contaminated fuel</li> <li>● Fuel system</li> <li>● Air intake system</li> <li>● Electronic engine controls</li> </ul>	Check for fuel contamination. Check for DTCs and refer to the relevant DTC Index. Check integrity of fuel, air intake, and engine systems

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• NOTE: If the control module/component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P000113	Fuel Volume Regulator Control Circuit/Open	<ul style="list-style-type: none"> <li>Fuel volume regulator control circuit - open circuit</li> <li>Fuel volume regulator control valve failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for open circuit. Check resistance across fuel regulator control valve is between 1.5 and 15 Ohms, install a new valve as required
P000200	Fuel Volume Regulator Control Circuit Range/Performance	<ul style="list-style-type: none"> <li>Fuel volume regulator control circuit - short to ground, power, high resistance</li> <li>Fuel volume regulator control valve failure</li> <li>ECM failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for short to ground, power, high resistance. Check and install new fuel volume regulator control valve/ECM as required, refer to the new module/component installation note at the top of the DTC Index
P000311	Fuel Volume Regulator Control Circuit Low	<ul style="list-style-type: none"> <li>Fuel volume regulator control circuit - short to ground</li> <li>Fuel volume regulator control valve failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for short to ground. Check resistance across fuel regulator control valve is between 1.5 and 15 Ohms, install a new valve as required
P000319	Fuel Volume Regulator Control Circuit Low	<ul style="list-style-type: none"> <li>Fuel volume regulator control circuit - current above threshold</li> <li>Fuel volume regulator control valve failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check fuel volume regulator control valve circuit for short, open circuit. Check resistance across fuel regulator control valve is between 1.5 and 15 Ohms, install a new valve as required
P000412	Fuel Volume Regulator Control Circuit High	<ul style="list-style-type: none"> <li>Fuel volume regulator control circuit - short to ground, power, high resistance</li> <li>Fuel volume regulator control valve failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for short to ground, power, open circuit. Check resistance across fuel regulator control valve is between 1.5 and 15 Ohms, install a new valve as required
P000E21	Fuel Volume Regulator Control Exceeded Learning Limit	<ul style="list-style-type: none"> <li>Signal amplitude &lt; minimum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for short to ground, power, open circuit
P000E22	Fuel Volume Regulator Control Exceeded Learning Limit	<ul style="list-style-type: none"> <li>Signal amplitude &gt; maximum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for short to ground, power, open circuit
P008772	Fuel Rail/System Pressure - Too Low	<ul style="list-style-type: none"> <li>Lift pump relay driven, pump not activated</li> </ul>	Refer to the electrical circuit diagrams: check fuel lift pump relay power and control circuits are operational. Check power supply to rear junction box. Check lift pump motor ground is not open circuit or high resistance. Check Fuse 25 (25 amp) in output to lift pump. Check lift pump relay is operating correctly, remove relay and test winding and contact circuits. Check pump run conditions are met, check run dry switch circuit. Check the fuel lift pump is operating correctly.
P008873	Fuel Rail/System Pressure - Too High	<ul style="list-style-type: none"> <li>Lift pump relay not driven, pump activated</li> </ul>	Refer to the electrical circuit diagrams and check fuel lift pump relay circuits for short to ground, power, open circuit
P009013	Fuel Pressure Regulator Control Circuit	<ul style="list-style-type: none"> <li>Fuel pressure control valve control circuit - open circuit</li> <li>Fuel pressure control valve failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel pressure control valve control circuit for open circuit. Check resistance across fuel pressure control valve is 2.7 Ohms $\pm$ 2.7 Ohms
P009111	Fuel Pressure Regulator Control Circuit Low	<ul style="list-style-type: none"> <li>Fuel pressure control valve control circuit - short to ground, power, open circuit</li> <li>Fuel pressure control valve failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel pressure control valve control circuit for short to ground, power, open circuit. Check resistance across fuel pressure control valve is 2.7 Ohms $\pm$ 2.7 Ohms
P009119	Fuel Pressure Regulator Control Circuit Low	<ul style="list-style-type: none"> <li>Fuel pressure control valve control circuit - current above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel pressure control valve control circuit for short to ground, power, open circuit. Check resistance across fuel pressure control valve is 2.7 Ohms $\pm$ 2.7 Ohms
P009212	Fuel Pressure Regulator Control Circuit High	<ul style="list-style-type: none"> <li>Fuel pressure control valve control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check fuel pressure control valve control circuit for short to power. Check resistance across fuel pressure control valve is 2.7 Ohms $\pm$ 2.7 Ohms
P018126	Fuel Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Signal rate of change below threshold</li> <li>Fuel temperature sensor failure</li> </ul>	<p>• NOTE: This test can only be carried out when the fuel temperature is below 30°C</p> <p>Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short, open circuit and poor connections. Check and record fuel temperature sensor signal, start engine and allow to idle for approximately 10 minutes, check and record fuel temperature sensor signal. If the value of the signal has NOT increased by more than 8°C install a new sensor as required</p>
P018216	Fuel Temperature Sensor A Circuit Low Input	<ul style="list-style-type: none"> <li>Circuit voltage below threshold</li> <li>Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor signal circuit for short to ground. Check and install a new sensor as required

DTC	Description	Possible Cause	Action
P018317	Fuel Temperature Sensor A Circuit High Input	<ul style="list-style-type: none"> <li>● Circuit voltage above threshold</li> <li>● Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor signal circuit for short to power. Check and install a new sensor as required
P018427	Fuel Temperature Sensor A Circuit Intermittent	<ul style="list-style-type: none"> <li>● Signal rate of change above threshold</li> <li>● Fuel temperature sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short, open circuit and poor connections. Run engine to normal operating temperature, check and record fuel temperature sensor signal, increase engine speed to 2000 rpm, after approximately 120 seconds check and record signal. If value of signal has increased by more than 10°C/100ms install a new sensor as required
P019123	Fuel Rail Pressure Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Signal stuck low</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel pump circuits for short to ground, power, open circuit. Check fuel pump for correct operation. Check fuel pressure sensor circuits for short, open circuit. Check for low fuel level and blocked fuel lines
P019124	Fuel Rail Pressure Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Signal stuck high</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel pump circuits for short to ground, power, open circuit. With engine at idle check and record ' <b>Fuel pressure</b> ' datalogger signal, stop engine check and record signal. If signal is greater than 10MPa after approximately 0.40 seconds suspect the fuel pump, check and install a new pump as required
P019165	Fuel Rail Pressure Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Signal has too few transitions/events</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel pump circuits for open circuit. Run engine to normal operating temperature, check and record ' <b>Fuel pressure</b> ' datalogger signal, increase engine speed to 2000 rpm, check and record signal. If value of signal changes by more than 40MPa/10ms suspect the fuel pump, check and install a new pump as required
P019216	Fuel Rail Pressure Sensor A Circuit Low Input	<ul style="list-style-type: none"> <li>● Circuit voltage below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel pump circuits for short to power. Start engine, check and record ' <b>Fuel pressure</b> ' datalogger signal. If value of signal is 0MPa suspect the fuel pump, check and install a new pump as required
P019317	Fuel Rail Pressure Sensor A Circuit High Input	<ul style="list-style-type: none"> <li>● Circuit voltage above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel pump circuits for short to power. Start engine, check and record ' <b>Fuel pressure</b> ' datalogger signal. If value of signal is more than 180MPa suspect the fuel pump, check and install a new pump as required
P019427	Fuel Rail Pressure Sensor A Circuit Intermittent/Erratic	<ul style="list-style-type: none"> <li>● Signal rate of change above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel pump circuit for open circuit. Run engine at idle speed, check and record ' <b>Fuel pressure</b> ' datalogger signal, increase engine speed to 2000 rpm, check and record signal. If value of signal changes by more than 40MPa/10ms suspect the fuel pump, check and install a new pump as required
P020101	Injector Circuit/Open - Cylinder 1	<ul style="list-style-type: none"> <li>● General Electrical Failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P020201	Injector Circuit/Open - Cylinder 2	<ul style="list-style-type: none"> <li>● General Electrical Failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P020301	Injector Circuit/Open - Cylinder 3	<ul style="list-style-type: none"> <li>● General Electrical Failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P020401	Injector Circuit/Open - Cylinder 4	<ul style="list-style-type: none"> <li>● General Electrical Failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P020501	Injector Circuit/Open - Cylinder 5	<ul style="list-style-type: none"> <li>● General Electrical Failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if





DTC	Description	Possible Cause	Action
			check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P020E35	Cylinder 5 Injection Timing	<ul style="list-style-type: none"> <li>● Signal high time &gt; maximum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P020F33	Cylinder 6 Injection Timing	<ul style="list-style-type: none"> <li>● Signal low time &gt; maximum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P020F35	Cylinder 6 Injection Timing	<ul style="list-style-type: none"> <li>● Signal high time &gt; maximum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P026300	Cylinder 1 Contribution/Balance	<ul style="list-style-type: none"> <li>● Fuel injector closed</li> </ul>	Refer to the electrical circuit diagrams and check fuel injector circuit and connector. Disconnect fuel injector connector and inspect for fuel ingress, if fuel is evident, suspect a leaking fuel injector. Clear DTC, start and run engine to 60°C, allow engine to idle (cylinder balance diagnosis is active). If cylinder balance diagnosis detects same DTC again carry out cylinder compression check. If compression check passed, check fuel injector blow-by, install a new fuel injector sealing washer and clamp as required. If no blow-by evident, suspect the fuel injector, check and install a new injector as required
P026600	Cylinder 2 Contribution/Balance	<ul style="list-style-type: none"> <li>● Fuel injector closed</li> </ul>	Refer to the electrical circuit diagrams and check fuel injector circuit and connector. Disconnect fuel injector connector and inspect for fuel ingress, if fuel is evident, suspect a leaking fuel injector. Clear DTC, start and run engine to 60°C, allow engine to idle (cylinder balance diagnosis is active). If cylinder balance diagnosis detects same DTC again carry out cylinder compression check. If compression check passed, check fuel injector blow-by, install a new fuel injector sealing washer and clamp as required. If no blow-by evident, suspect the fuel injector, check and install a new injector as required
P026900	Cylinder 3 Contribution/Balance	<ul style="list-style-type: none"> <li>● Fuel injector closed</li> </ul>	Refer to the electrical circuit diagrams and check fuel injector circuit and connector. Disconnect fuel injector connector and inspect for fuel ingress, if fuel is evident, suspect a leaking fuel injector. Clear DTC, start and run engine to 60°C, allow engine to idle (cylinder balance diagnosis is active). If cylinder balance diagnosis detects same DTC again carry out cylinder compression check. If compression check passed, check fuel injector blow-by, install a new fuel injector sealing washer and clamp as required. If no blow-by evident, suspect the fuel injector, check and install a new injector as required
P027200	Cylinder 4 Contribution/Balance	<ul style="list-style-type: none"> <li>● Fuel injector closed</li> </ul>	Refer to the electrical circuit diagrams and check fuel injector circuit and connector. Disconnect fuel injector connector and inspect for fuel ingress, if fuel is evident, suspect a leaking fuel injector. Clear DTC, start and run engine to 60°C, allow engine to idle (cylinder balance diagnosis is active). If cylinder balance diagnosis detects same DTC again carry out cylinder compression check. If compression check passed, check fuel injector blow-by, install a new fuel injector sealing washer and clamp as required. If no blow-by evident, suspect the fuel injector, check and install a new injector as required
P027500	Cylinder 5 Contribution/Balance	<ul style="list-style-type: none"> <li>● Fuel injector closed</li> </ul>	Refer to the electrical circuit diagrams and check fuel injector circuit and connector. Disconnect fuel injector connector and inspect for fuel ingress, if fuel is evident, suspect a leaking fuel injector. Clear DTC, start and run engine to 60°C, allow engine to idle (cylinder balance diagnosis is active). If cylinder balance diagnosis detects same DTC again carry out cylinder compression check. If compression check passed, check fuel injector blow-by, install a new fuel injector sealing washer and clamp as required. If no blow-by evident, suspect the fuel injector, check and install a new injector as required
P027800	Cylinder 6 Contribution/Balance	<ul style="list-style-type: none"> <li>● Fuel injector closed</li> </ul>	Refer to the electrical circuit diagrams and check fuel injector circuit and connector. Disconnect fuel injector connector and inspect for fuel ingress, if fuel is evident, suspect a leaking fuel injector. Clear DTC, start and run engine to 60°C, allow engine to idle (cylinder balance diagnosis is active). If cylinder balance diagnosis detects same DTC again carry out cylinder compression check. If compression check passed, check fuel injector blow-by, install a new fuel injector sealing washer and clamp as required. If no blow-by evident, suspect the fuel injector, check and install a new injector as required
P029A00	Cylinder 1 Balance - Fuel Trim at Max Limit	<ul style="list-style-type: none"> <li>● Fuel injector circuits - short to ground, power, open circuit</li> <li>● Fuel injector leaking</li> <li>● Cylinder compression low</li> <li>● Fuel injector blow-by</li> </ul>	Refer to the electrical circuit diagrams and check fuel injector circuit and connector. Disconnect fuel injector connector and inspect for fuel ingress, if fuel is evident, suspect a leaking fuel injector. Clear DTC, start and run engine to 60°C, allow engine to idle (cylinder balance diagnosis is active). If cylinder balance diagnosis detects same DTC again carry out cylinder compression check. If compression check passed, check fuel injector blow-by, install a new fuel injector sealing washer and clamp as





DTC	Description	Possible Cause	Action
P02AF00	Cylinder 6 Balance - Fuel Trim at Min Limit	<ul style="list-style-type: none"> <li>Fuel injector circuits - short to ground, power, open circuit</li> <li>Fuel injector leaking</li> <li>Cylinder compression low</li> <li>Fuel injector blow-by</li> <li>Fuel injector failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel injector circuit and connector. Disconnect fuel injector connector and inspect for fuel ingress, if fuel is evident, suspect a leaking fuel injector. Clear DTC, start and run engine to 60°C, allow engine to idle (cylinder balance diagnosis is active). If cylinder balance diagnosis detects same DTC again carry out cylinder compression check. If compression check passed, check fuel injector blow-by, install a new fuel injector sealing washer and clamp as required. If no blow-by evident, suspect the fuel injector, check and install a new injector as required
P02B000	Cylinder 6 Balance - Injector Restricted	<ul style="list-style-type: none"> <li>Fuel injector circuits - short to ground, power, open circuit</li> <li>Fuel injector leaking</li> <li>Cylinder compression low</li> <li>Fuel injector blow-by</li> <li>Fuel injector failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel injector circuit and connector. Disconnect fuel injector connector and inspect for fuel ingress, if fuel is evident, suspect a leaking fuel injector. Clear DTC, start and run engine to 60°C, allow engine to idle (cylinder balance diagnosis is active). If cylinder balance diagnosis detects same DTC again carry out cylinder compression check. If compression check passed, check fuel injector blow-by, install a new fuel injector sealing washer and clamp as required. If no blow-by evident, suspect the fuel injector, check and install a new injector as required
P02B100	Cylinder 6 Balance - Injector Leaking	<ul style="list-style-type: none"> <li>Fuel injector circuits - short to ground, power, open circuit</li> <li>Fuel injector leaking</li> <li>Cylinder compression low</li> <li>Fuel injector blow-by</li> <li>Fuel injector failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel injector circuit and connector. Disconnect fuel injector connector and inspect for fuel ingress, if fuel is evident, suspect a leaking fuel injector. Clear DTC, start and run engine to 60°C, allow engine to idle (cylinder balance diagnosis is active). If cylinder balance diagnosis detects same DTC again carry out cylinder compression check. If compression check passed, check fuel injector blow-by, install a new fuel injector sealing washer and clamp as required. If no blow-by evident, suspect the fuel injector, check and install a new injector as required
P062D01	Fuel Injector Driver Circuit Performance Bank 1	<ul style="list-style-type: none"> <li>Bank 1 injector(s) disconnected</li> <li>Injector failure</li> <li>Bank 1 injector circuit(s) - high resistance, short to ground, short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections to Bank 1 cylinders. Disconnect injectors and check resistance (200kOhm±20) of each injector, if out of specification install new injector(s). Refer to the electrical circuit diagrams and check Bank 1 injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test. If DTC remains, disconnect ECM connector, and with injector(s) connected check resistance across injector pins, this should be no higher than the injector resistance.
P062E01	Fuel Injector Driver Circuit Performance Bank 2	<ul style="list-style-type: none"> <li>Bank 2 injector(s) disconnected</li> <li>Injector failure</li> <li>Bank 2 injector circuit(s) - high resistance, short to ground, short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections to Bank 2 cylinders. Disconnect injectors and check resistance (200kOhm±20) of each injector, if out of specification install new injector(s). Refer to the electrical circuit diagrams and check Bank 2 injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test. If DTC remains, disconnect ECM connector, and with injector(s) connected check resistance across injector pins, this should be no higher than the injector resistance.
P150A00	Injector Circuit Range/Performance - Cylinder 1	<ul style="list-style-type: none"> <li>Injector cylinder 1 - error detected by engine speed evaluation fuel mass (high/low deviation)</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P150A01	Injector Circuit Range/Performance - Cylinder 1	<ul style="list-style-type: none"> <li>Injector circuit range (PPS injector charge)</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P150B00	Injector Circuit Range/Performance - Cylinder 2	<ul style="list-style-type: none"> <li>Injector cylinder 2 - error detected by engine speed evaluation fuel mass (high/low deviation)</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P150B01	Injector Circuit Range/Performance - Cylinder 2	<ul style="list-style-type: none"> <li>Injector circuit range (PPS injector charge)</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P150C00	Injector Circuit Range/Performance - Cylinder 3	<ul style="list-style-type: none"> <li>Injector cylinder 3 - error detected by engine speed evaluation fuel mass (high/low deviation)</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector

DTC	Description	Possible Cause	Action
P150C01	Injector Circuit Range/Performance - Cylinder 3	<ul style="list-style-type: none"> <li>Injector circuit range (PPS injector charge)</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P155400	Injector Circuit Range/Performance - Cylinder 4	<ul style="list-style-type: none"> <li>Injector cylinder 4 - error detected by engine speed evaluation fuel mass (high/low deviation)</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P155401	Injector Circuit Range/Performance - Cylinder 4	<ul style="list-style-type: none"> <li>Injector circuit range (PPS injector charge)</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P155500	Injector circuit range/performance cylinder 5	<ul style="list-style-type: none"> <li>Injector cylinder 5 - error detected by engine speed evaluation fuel mass (high/low deviation)</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P155501	Injector Circuit Range/Performance - Cylinder 5	<ul style="list-style-type: none"> <li>Injector circuit range (PPS injector charge)</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P155600	Injector Circuit Range/Performance - Cylinder 6	<ul style="list-style-type: none"> <li>Injector cylinder 6 - error detected by engine speed evaluation fuel mass (high/low deviation)</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P155601	Injector Circuit Range/Performance - Cylinder 6	<ul style="list-style-type: none"> <li>Injector circuit range (PPS injector charge)</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check injector connections. Disconnect and check resistance (200kOhm±20kOhm) of injector. Refer to the electrical circuit diagrams and check injector circuits for high resistance, short to ground, power, open circuit. Clear DTC and re-test, if DTC remains disconnect the ECM connector and with injector connected check resistance and capacitance of wiring across injector pins, look for intermittent wiring/connector faults. If this is still within specification install a new injector
P158200	Electronic Throttle Monitor Data Available	<ul style="list-style-type: none"> <li>Flight recorder data stored</li> </ul>	Download flight recorder data using manufacturer approved diagnostic system, if required, and clear DTC
P210502	Throttle Actuator Control System - Forced Engine Shutdown	<ul style="list-style-type: none"> <li>Engine stop by throttle</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for additional related DTCs and refer to the relevant DTC Index
P213E01	Fuel Injection System Fault - Forced Engine Shutdown	<ul style="list-style-type: none"> <li>Engine stop by electrical</li> </ul>	Check for additional related DTCs and refer to the relevant DTC Index
P213F07	Fuel Pump System Fault - Forced Engine Shutdown	<ul style="list-style-type: none"> <li>Engine stop by hydraulic</li> </ul>	Check for additional related DTCs and refer to the relevant DTC Index
P228800	Injector Control Pressure Too High	<ul style="list-style-type: none"> <li>Fuel injector control pressure - too high</li> <li>FPCV circuit fault</li> <li>FPCV failure</li> <li>Fuel pump module circuit - short to power</li> <li>Fuel pump module failure</li> <li>Fuel injection pump failure</li> </ul>	Check for additional DTCs and refer to the relevant DTC Index. Refer to the electrical circuit diagrams and check fuel system circuits for short, open circuit. Check integrity of fuel system components
P229000	Injector Control Pressure Too Low	<ul style="list-style-type: none"> <li>Fuel injector control pressure - too low</li> <li>Fuel line leak</li> <li>Fuel filter/system restriction</li> </ul>	Check for additional DTCs and refer to the relevant DTC Index. Refer to the electrical circuit diagrams and check fuel system circuits for short, open circuit. Check integrity of fuel system components



DTC	Description	Possible Cause	Action
		<ul style="list-style-type: none"> <li>● FPCV circuit fault</li> <li>● FPCV failure</li> <li>● Fuel pump module circuit - short to ground</li> <li>● Fuel pump module failure</li> <li>● Fuel injection pump failure</li> </ul>	
P229200	Injector Control Pressure Erratic	<ul style="list-style-type: none"> <li>● Fuel injector control pressure - erratic</li> <li>● FPCV circuit fault</li> <li>● FPCV failure</li> <li>● Fuel pump module circuit(s) - high resistance, short to ground, power</li> <li>● Fuel pump module failure</li> <li>● Fuel injection pump failure</li> </ul>	Check for additional DTCs and refer to the relevant DTC Index. Refer to the electrical circuit diagrams and check fuel system circuits for short, open circuit. Check integrity of fuel system components

# Fuel Charging and Controls - TDV6 2.7L Diesel - Fuel Injection Component Cleaning

General Procedures

## General Equipment

Pneumatic vacuum gun

## Materials

Name	Specification
Cleaning Fluid	W-M5B411-A


### • WARNINGS:

 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

 Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the high-pressure system can be as high as 1650 bar. Failure to follow this instruction may result in personal injury.

 Eye protection must be worn at all times when working on or near any fuel related components. Failure to follow this instruction may result in personal injury.

### • CAUTIONS:

 Make sure that the workshop area in which the vehicle is being worked on is as clean and dust-free as possible. Areas in which work on clutches, brakes or where welding or machining are carried out are not suitable in view of the risk of contamination to the fuel system.

 Make sure that clean non-plated tools are used. Clean tools using a new brush that will not lose its bristles and fresh cleaning fluid, prior to starting work on the vehicle.

 Use a steel topped workbench and cover it with clean, lint-free non-flocking material.

 Make sure that all parts removed from the vehicle are placed on the lint-free non-flocking material.

 Make sure that any protective clothing worn is clean and made from lint-free non-flocking material.

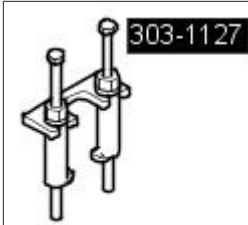
 Make sure that any protective gloves worn are new and are of the non-powdered latex type.

 Before using the cleaning fluid, protect all electrical components and connectors with lint-free non-flocking material.

1. Using a new brush that will not lose its bristles, brush cleaning fluid onto the components being removed and onto the surrounding area.
2. Using a pneumatic vacuum gun, remove all traces of cleaning fluid and foreign material.
3. Dispose of any used cleaning fluid and the brush after completing the repair.

# Fuel Charging and Controls - TDV6 2.7L Diesel - Fuel Injector

Removal and Installation

Special Tool(s)	
	Fuel Injector remover 303-1127


## Removal

### • WARNINGS:


 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.


 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.


 Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.


 Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.


### • CAUTIONS:

 Do not disconnect the fuel injector electrical connectors with the engine running. Failure to follow this instruction may result in serious damage to the engine.

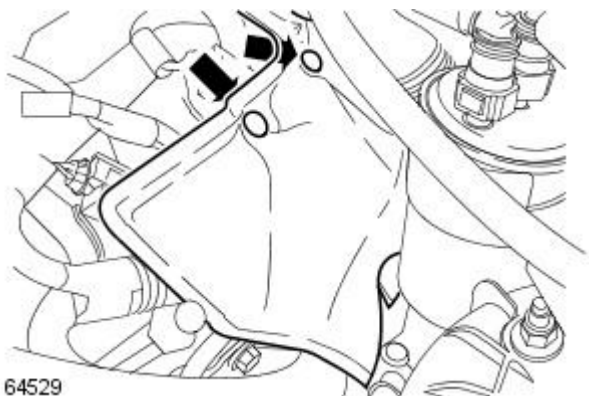
 Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

 Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

 Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

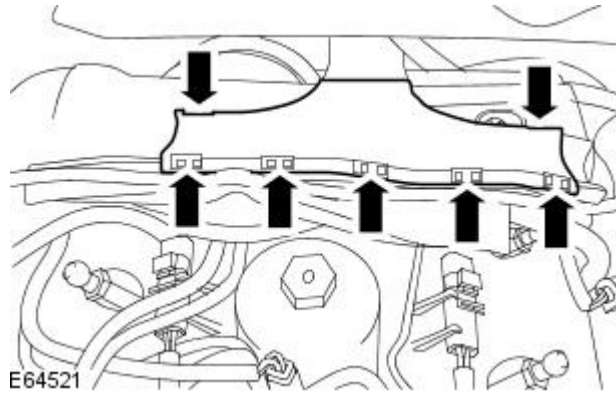
 Do not disassemble the fuel injectors or clean the nozzles, even with an ultrasonic cleaner. Always install new fuel injectors when required.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the exhaust gas recirculation (EGR) valve outlet tube.  
For additional information, refer to: [Exhaust Gas Recirculation \(EGR\) Valve Outlet Tube](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Removal and Installation).
3. Remove the injector sound proofing.

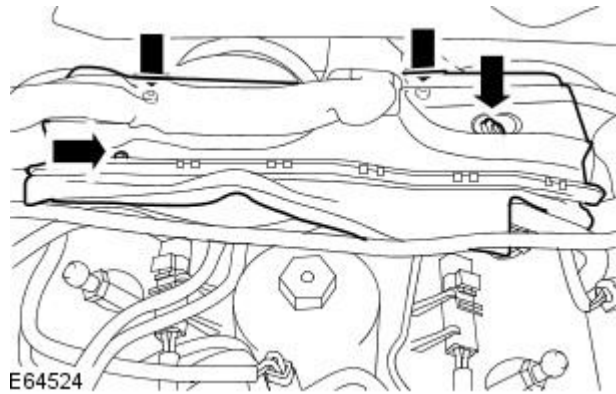


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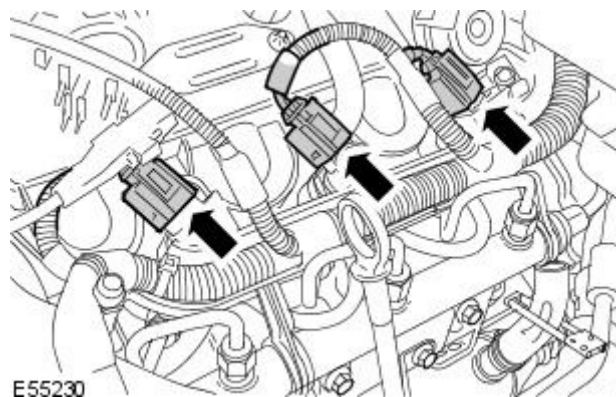
4. Remove the engine harness cover.



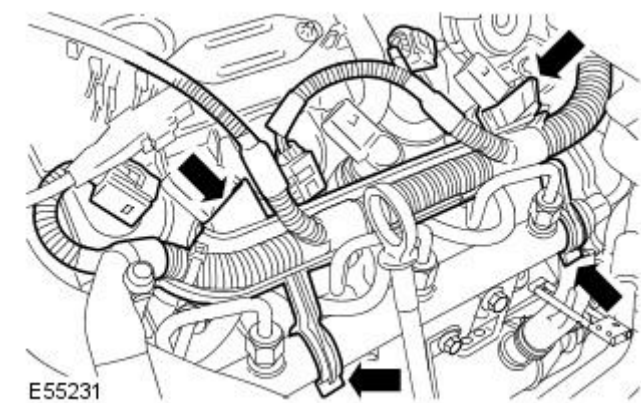
5. Remove the engine wiring harness casing.




6. Disconnect the fuel injector electrical connectors.




7. Detach the fuel injection wiring harness.



#### 8. CAUTIONS:


 Make sure that the high-pressure fuel supply line remains in contact with the fuel injection supply manifold and the fuel injection diverter rail until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.


 Do not use any aggressive cleaning fluid or a wire brush to clean the fuel injector nozzle.

Using the pneumatic vacuum gun, vacuum foreign material from the high-pressure fuel rail supply lines, the fuel injectors, the fuel rail and the fuel pump.

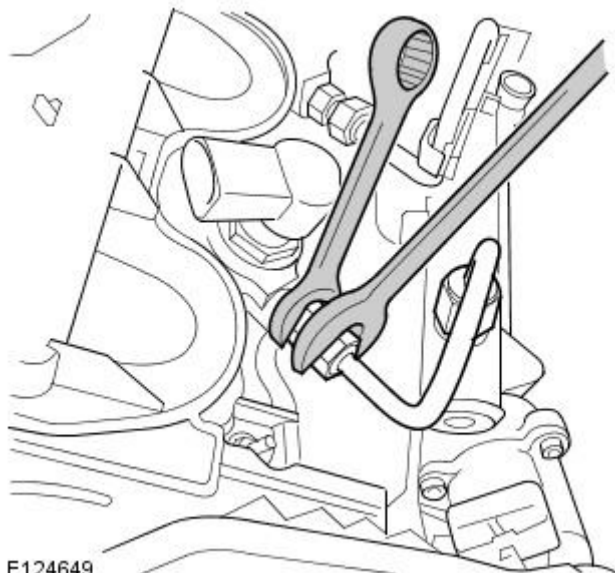
For additional information, refer to: [Fuel Injection Component Cleaning](#)


**9. CAUTIONS:**

 Make sure that the high-pressure fuel supply line remains in contact with the fuel injection supply manifold and the fuel injection diverter rail until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

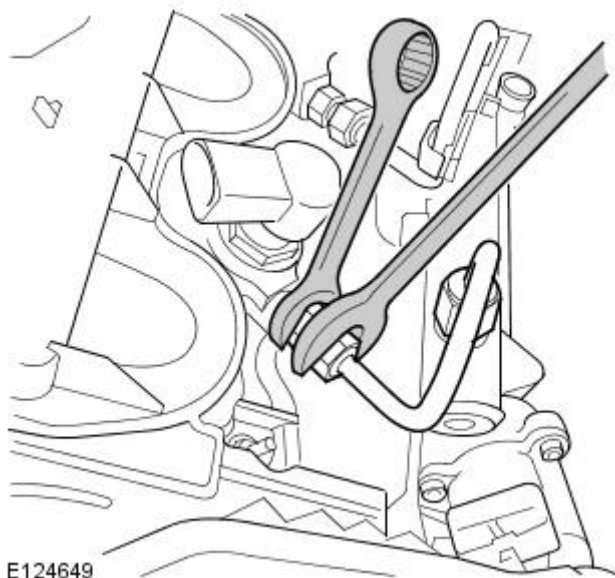
 Make sure that the fuel injector adaptor union does not move when loosening the high-pressure fuel supply lines. Failure to follow this instruction may result in damage to the fuel injector or the fuel injector adaptor union.

Loosen the high-pressure fuel supply line from the fuel injector and fuel rail.



**10.**  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.

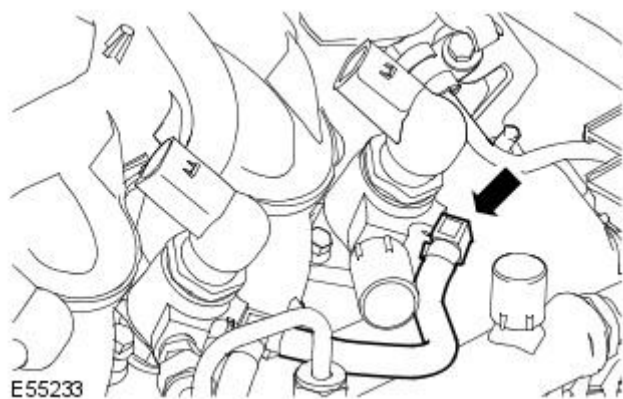
Remove and discard the high-pressure fuel supply line.



**11. NOTE:** Left-hand shown, right-hand similar.

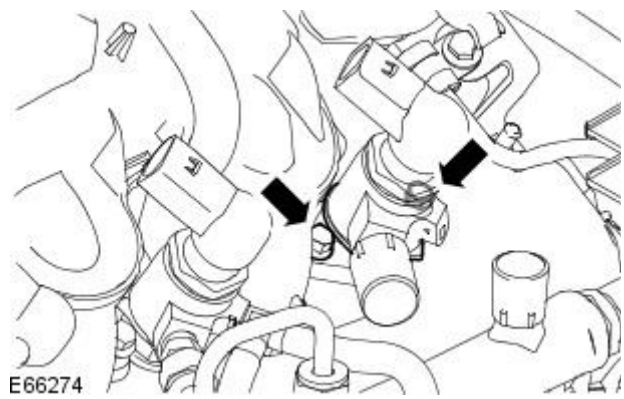
Disconnect the fuel return line from the fuel injector.

- Remove and discard the retaining clip.

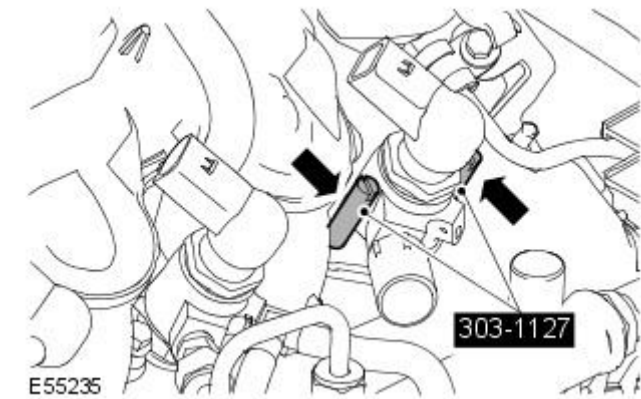




12. Remove the two fuel injector retaining bolts.




13. Install the special tool studs.



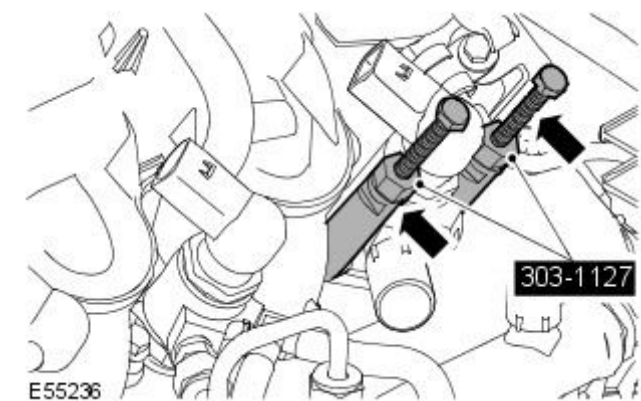
14. CAUTIONS:

 Make sure the fuel injector remover legs are correctly engaged to the fuel injector. Failure to follow this instruction may result in damage to the component.

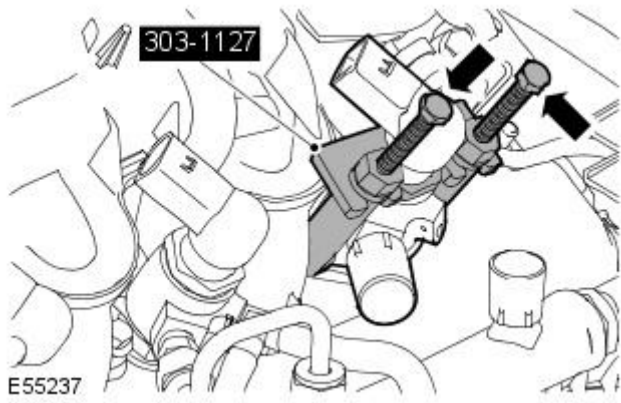
 Make sure the puller bolts are rotated evenly. Failure to follow this instruction may result in damage to the special tool or the fuel injector.

Install the special tool remover legs to the studs.

15. Install the special tool locking plate to the remover legs.





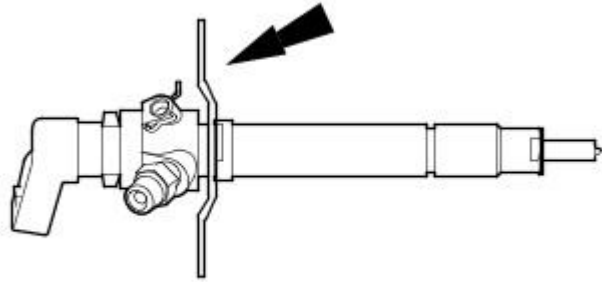


16. CAUTION: Make sure that all openings are sealed. Use new blanking caps.

Remove the fuel injector.

- Rotate the special tool bolts evenly, in a clockwise direction.
- Remove the special tool.
- Remove and discard the fuel injector retaining clamp.
- Remove and discard the sealing washer.

## Installation



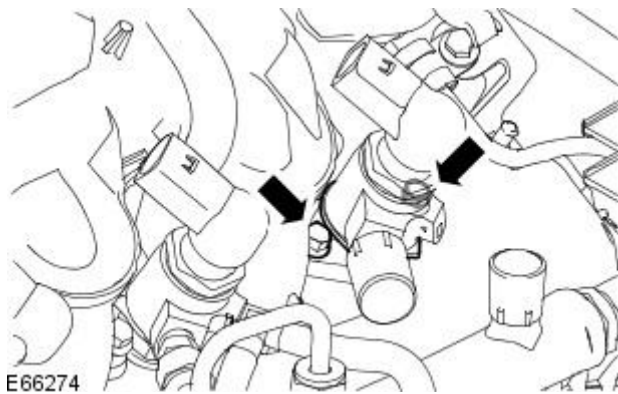
1. CAUTION: Do not use tools to install the new fuel return line retaining clip. Failure to follow this instruction will result in damage to the retaining clip.

- NOTE: Install a new fuel injector sealing washer.
- NOTE: Install a new fuel return line retaining clip.

Install a new fuel injector retaining clamp.

2. Install the fuel injector.

- Tighten to 10 Nm.

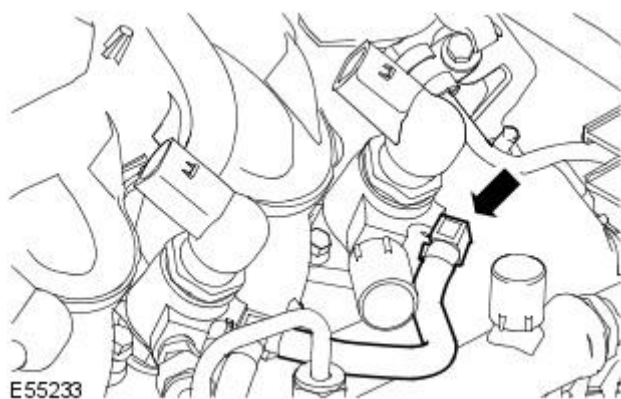


3. CAUTION: Make sure the fuel return line clip is correctly installed to the fuel injector before installing the fuel return line.


- NOTE: Left-hand shown, right-hand similar.


Connect the fuel return line to the fuel injector.

- Visually inspect the fuel return line O-ring seal for damage.
- Apply a light coating of petroleum jelly to the fuel return line O-ring seals.
- Connect the fuel return line to the fuel injector.



#### 4. CAUTIONS:

 Do not allow the unions to hit the olive ends of the high-pressure fuel supply line as this may damage the ends of the high-pressure fuel supply line and allow foreign matter to enter the fuel injection system.

 Maintain pressure on the high-pressure fuel supply lines to keep the olives in contact with the fuel rail and the fuel injector cones while installing unions.

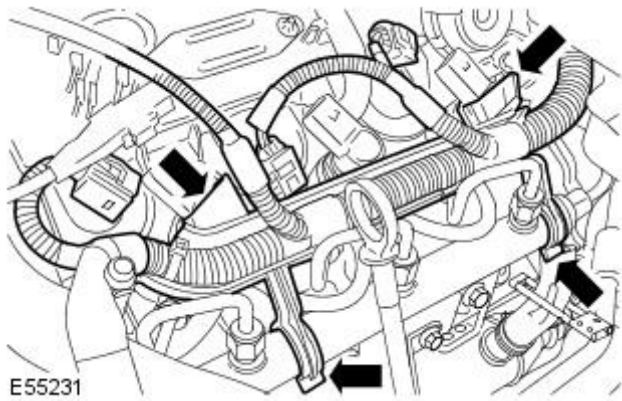
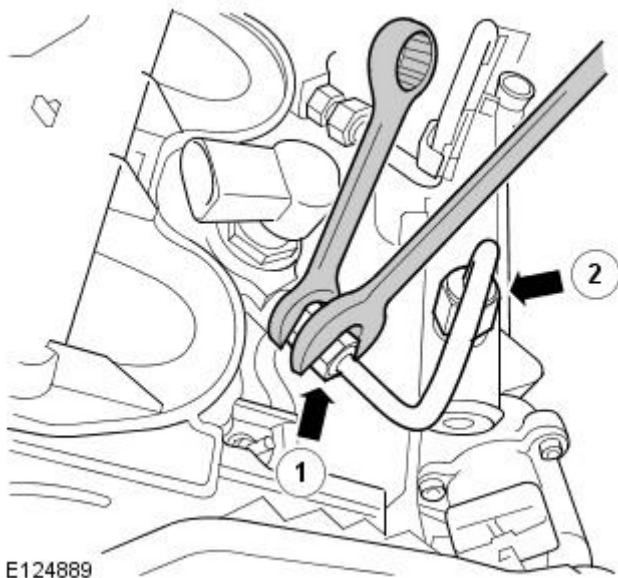
- NOTE: Remove and discard the blanking caps.

Install the new high-pressure fuel supply lines.

- Install the new high-pressure fuel supply line, tighten the fuel supply line unions finger tight.
- Tighten the high-pressure fuel supply line in the shown sequence.
- Tighten the high-pressure fuel supply line union 1 to fuel injector to 15 Nm.
- Tighten the high-pressure fuel supply line union 2 to fuel rail to 15 Nm.
- Tighten the high-pressure fuel supply line union 1 to fuel injector to 30 Nm.
- Tighten the high-pressure fuel supply line union 2 to fuel rail to 30 Nm.

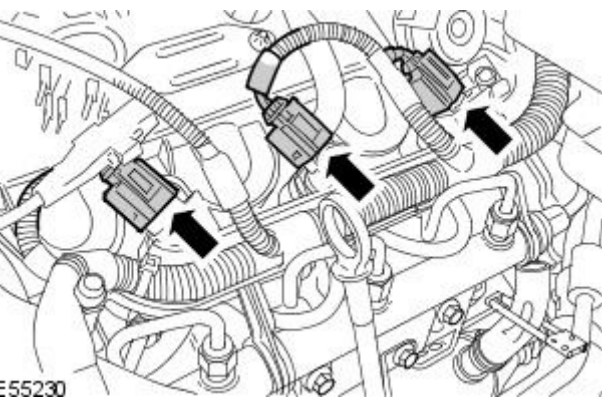
#### 5. NOTE: Left-hand shown, right-hand similar.

Attach the fuel injector wiring harness.



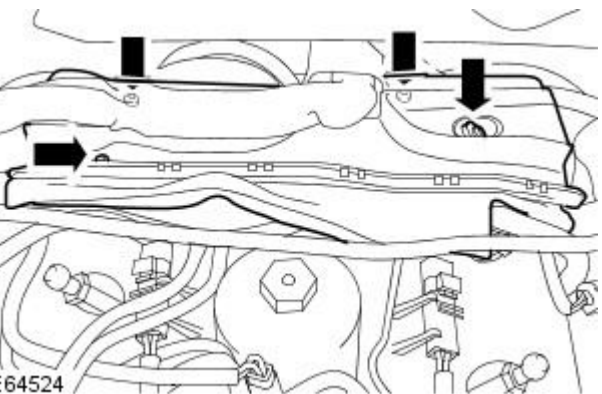
#### 6. NOTE: Left-hand shown, right-hand similar.

Connect the fuel injector electrical connectors.

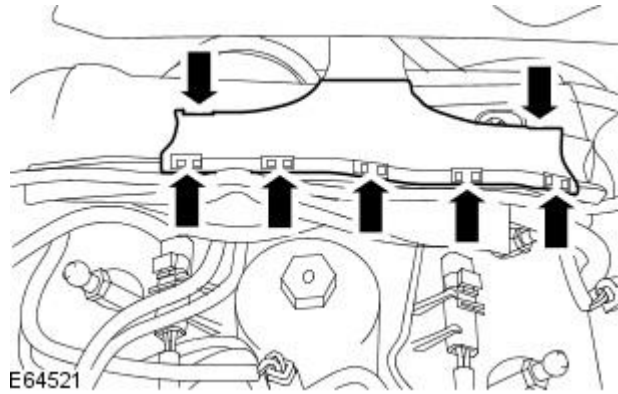


#### 7. Install the engine wiring harness casing.

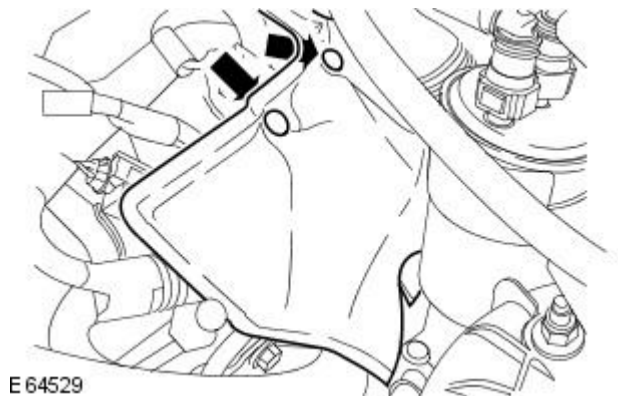
- Tighten to 4 Nm.



8. Install the engine wiring harness cover.



9. Install the injector sound proofing.




10. Install the EGR valve outlet tube.

For additional information, refer to: [Exhaust Gas Recirculation \(EGR\) Valve Outlet Tube](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Removal and Installation).

11. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).



12.  **WARNING:** Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.

Start and run the engine.

- Visually check for fuel leaks.
- The fuel return line must be renewed if any leaks are found from the fuel return line O-rings.

# Fuel Charging and Controls - TDV6 2.7L Diesel - Fuel Injection Pump

Removal and Installation

Special Tool(s)	
 <p>310-139</p> <p>E54548</p>	<p>Holder - Fuel Pump Pulley</p> <p>310-139</p>
 <p>310-138</p> <p>E54547</p>	<p>Reaction Arm - Fuel Pump Pulley</p> <p>310-138</p>

## Removal

### 1. WARNINGS:



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

### • CAUTIONS:



Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.



Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.



Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.



Do not remove the fuel rail pressure sensor from the fuel injection diverter rail.

Disconnect the battery ground cable.

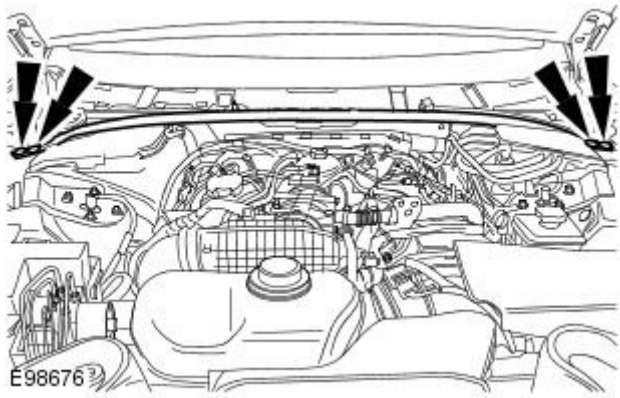
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

### 2. Remove the fuel injection pump belt.

For additional information, refer to: [Fuel Injection Pump Belt](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).

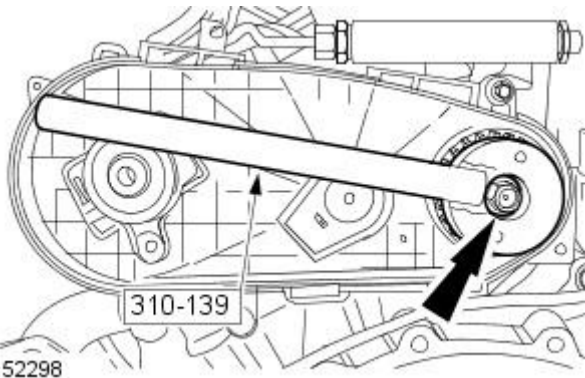


3. Remove the engine compartment brace.



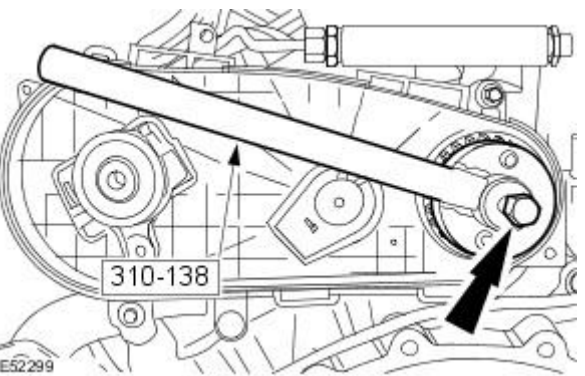
4. Using the special tool, remove the fuel injection pump pulley retaining nut.

- Using the special tool, retain the fuel injection pump pulley.
- Remove the special tool.

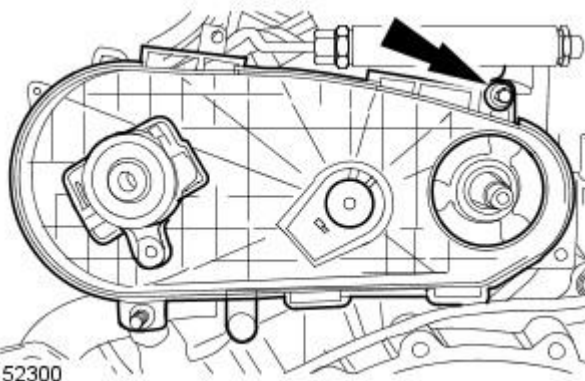


5. Using the special tool, remove the fuel injection pump pulley.


- Remove the special tool.



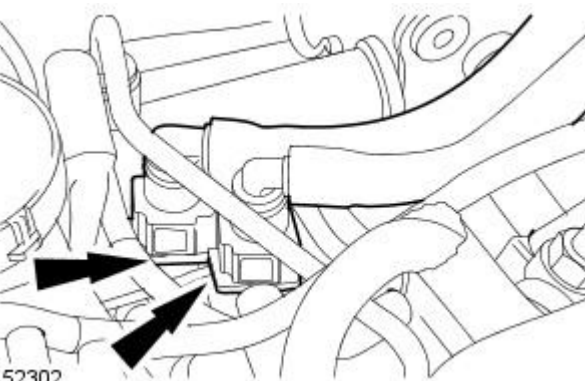
6. Remove the fuel injection pump belt cover backplate retaining bolt.



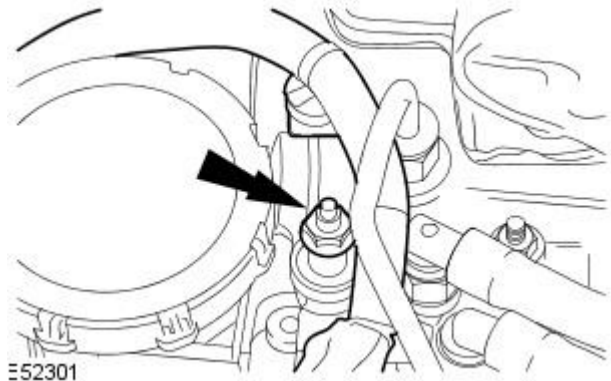
7. Remove the fuel injector sound proofing.

8.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

Disconnect the low pressure fuel inlet and return lines.



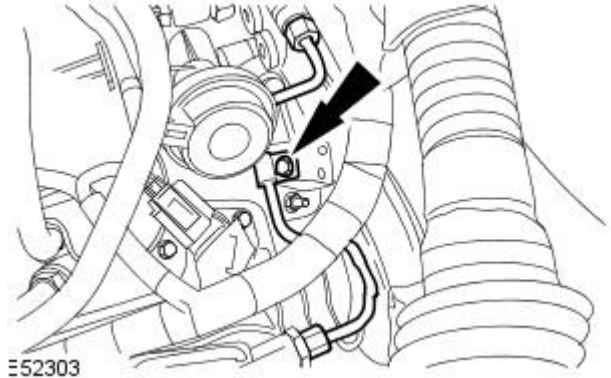
9. Detach the engine wiring harness retaining bracket.




E52301

10. NOTE: Left-hand shown, right-hand similar.

Detach the high-pressure fuel supply lines.

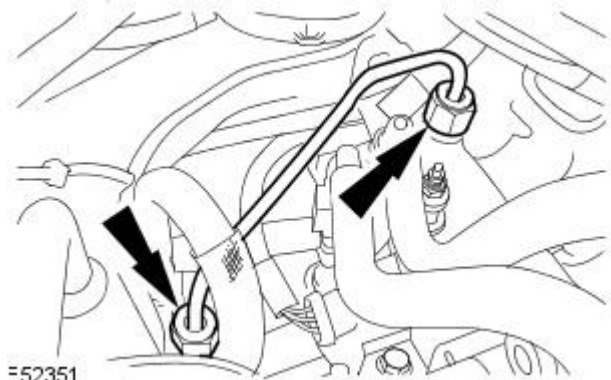


E52303

11.  CAUTION: Make sure that the high-pressure fuel supply line remains in contact with the fuel injection supply manifold and the fuel injection diverter rail until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.


• NOTE: Left-hand shown, right-hand similar.

Loosen the high-pressure fuel supply lines.

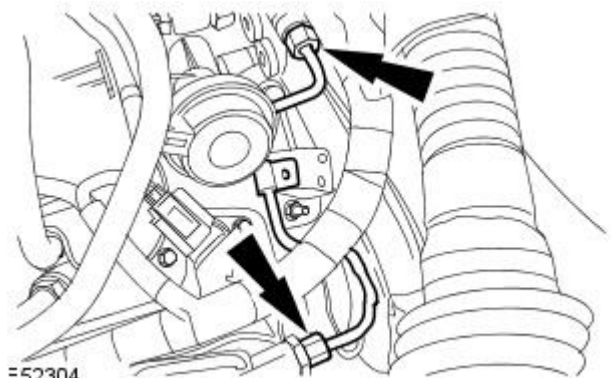


E52351

12. Clean around the fuel injector, high-pressure fuel supply line and surrounding areas.  
For additional information, refer to: Fuel Injection Component Cleaning (303-04, General Procedures).

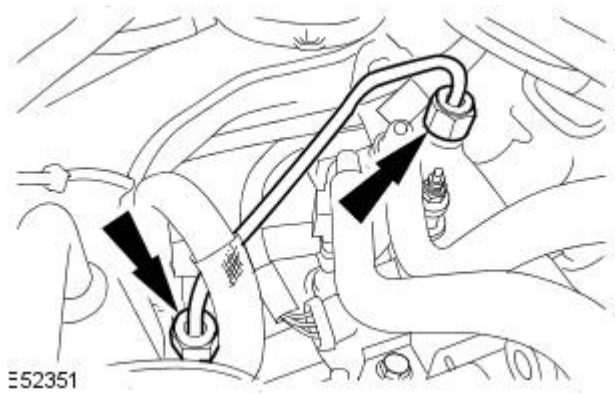
13.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

Remove and discard the high-pressure fuel supply lines.




E52304





E52351

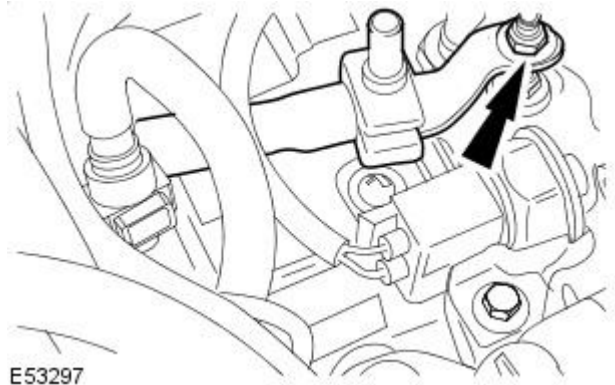
**14. CAUTIONS:**

 Make sure that the high-pressure fuel supply line remains in contact with the fuel injection supply manifold and the fuel injection diverter rail until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

 Make sure that all openings are sealed. Use new blanking caps.

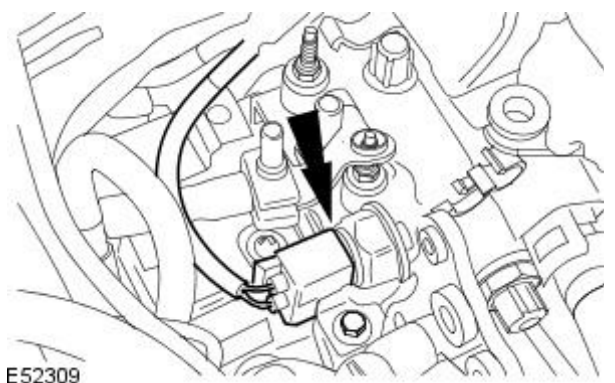
• NOTE: Left-hand shown, right-hand similar.

Remove and discard the high-pressure fuel diverter rail supply line.



E53297

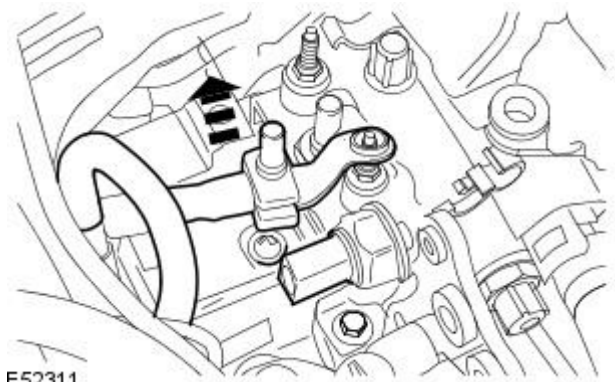
**15.** Remove the fuel line retaining nut.



E52309

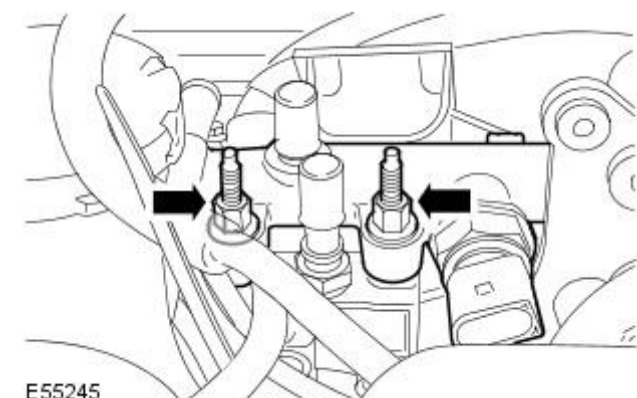
**16.** Disconnect the fuel rail pressure (FRP) sensor electrical connector.

- Release the fuel charging wiring harness.



E52311


**17.** Reposition the fuel line.



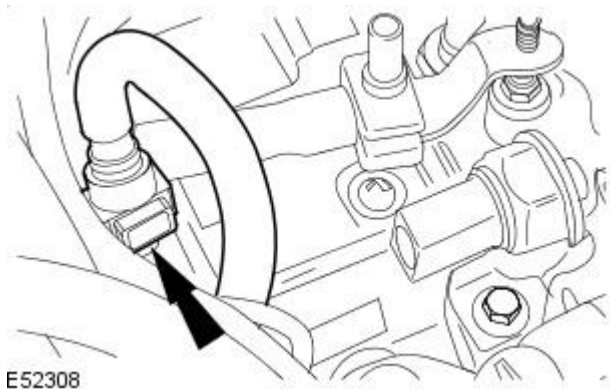
E55245

**18.** Remove the FRP and fuel injection diverter rail assembly.

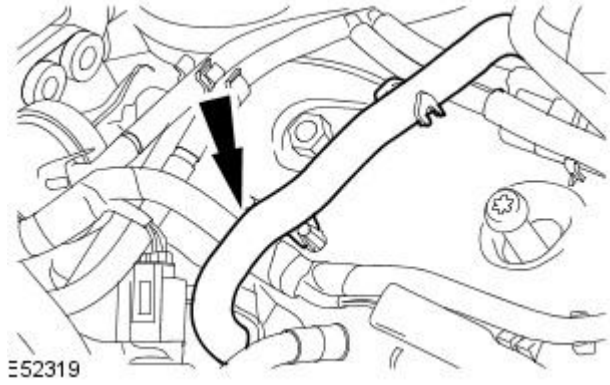
- Remove the 2 studs.

19.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

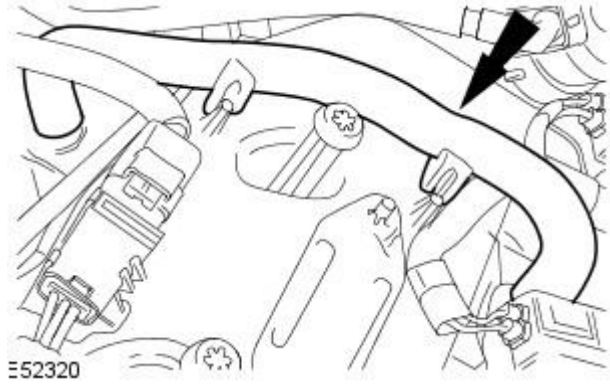
Disconnect the fuel line.



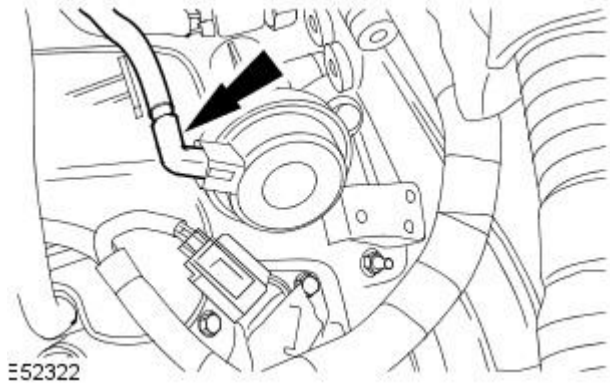
20. Disconnect the left-hand valve cover breather hose.



21. Disconnect the right-hand valve cover breather hose.

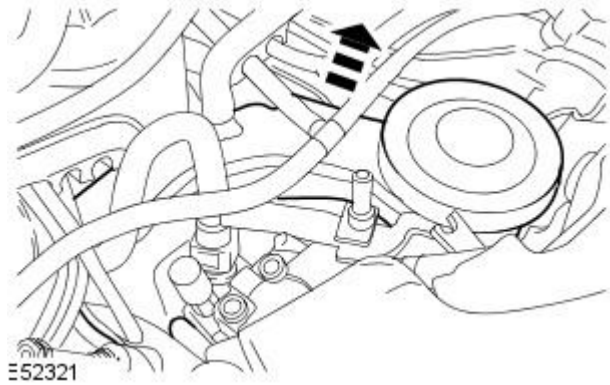


22. Disconnect the left-hand inlet port deactivation vacuum pipe.

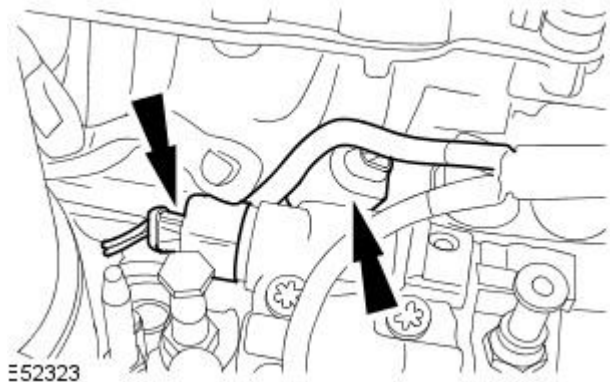


23. Remove the oil separator housing.

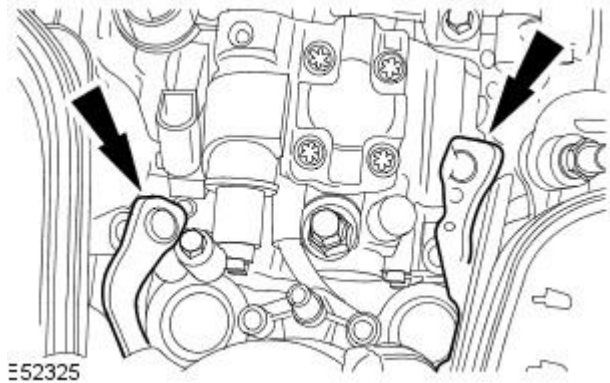
- Remove and discard the oil separator housing and engine block seals.



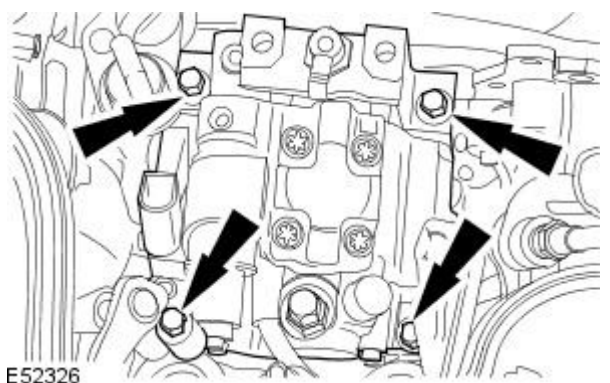
24. Disconnect the fuel injection pump electrical connectors.



25. Detach the glow plug electrical connectors.





26. Remove the fuel injection pump.




## Installation


### 1. WARNINGS:


 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.

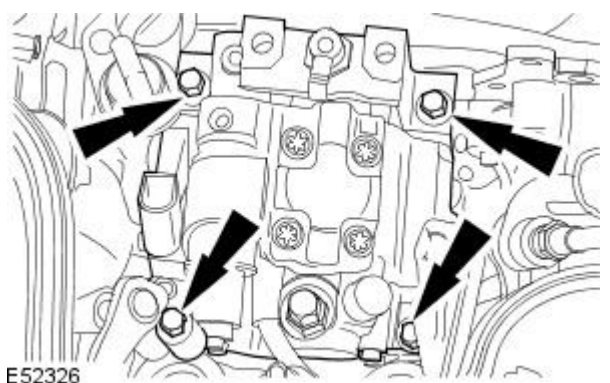
 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

### • CAUTIONS:

 Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

 Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

 Diesel fuel injection equipment is manufactured to very precise





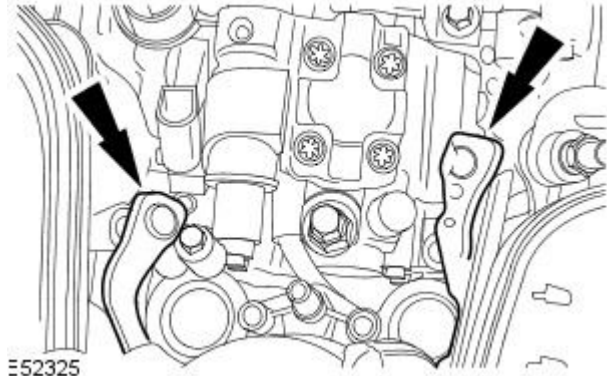
tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

 Do not remove the fuel rail pressure sensor from the fuel injection diverter rail.

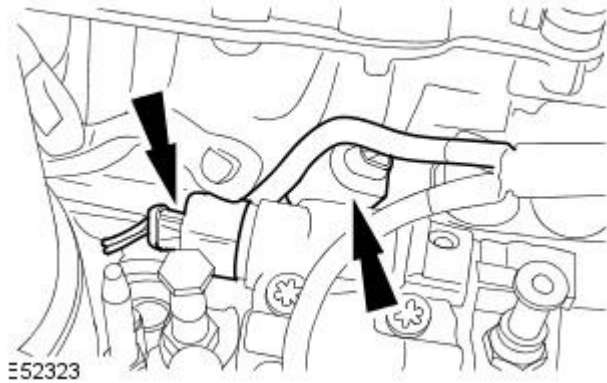
Install the fuel injection pump.

- Tighten to 23 Nm.

2. Attach the glow plug electrical connectors.

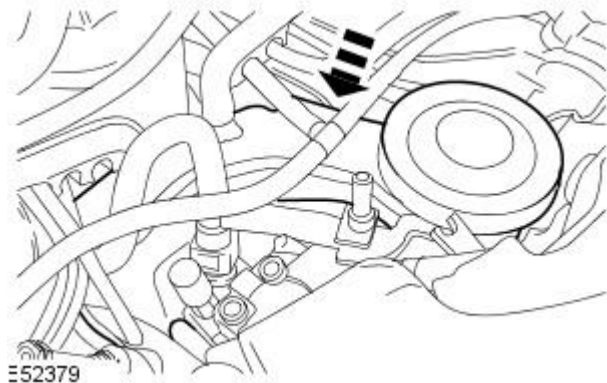


3. Connect the fuel pump electrical connectors.

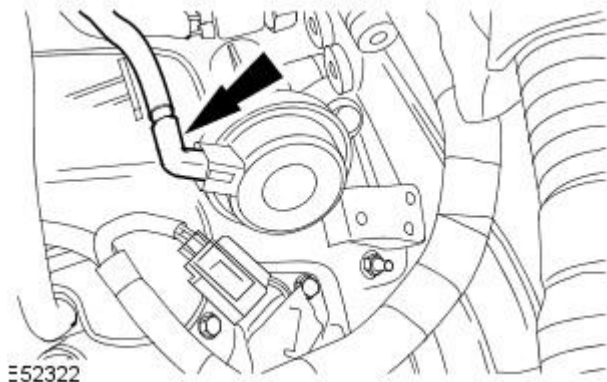


4. Install the oil separator housing.

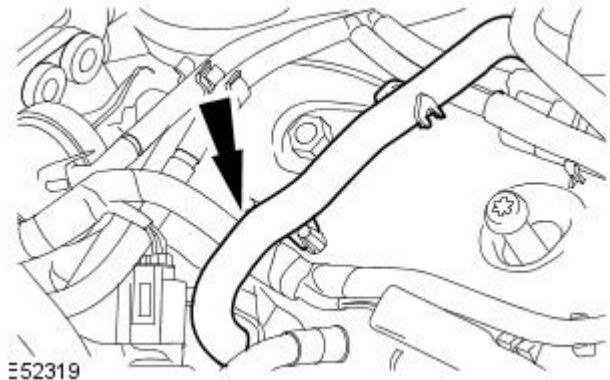
- Install new oil separator housing and engine block seals.



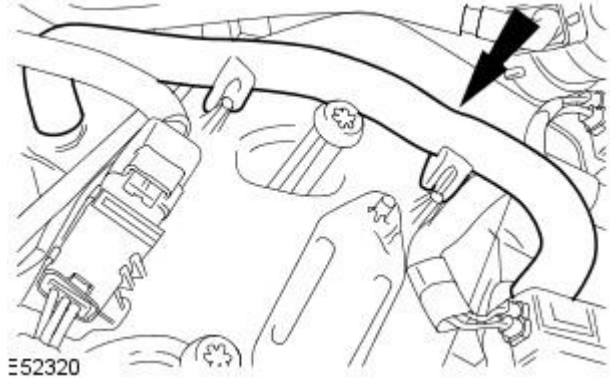
5. Connect the left-hand inlet port deactivation vacuum pipe.



6. Connect the right-hand valve cover breather hose.

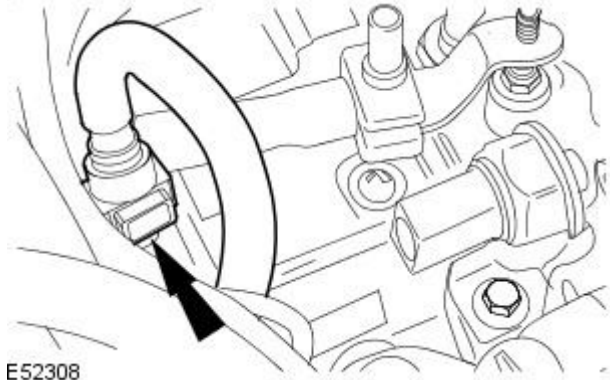


7. Connect the left-hand valve cover breather hose.



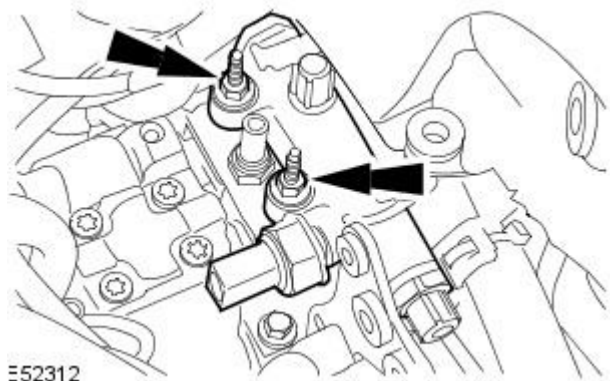
8. NOTE: Remove and discard the blanking caps.

Connect the fuel line.

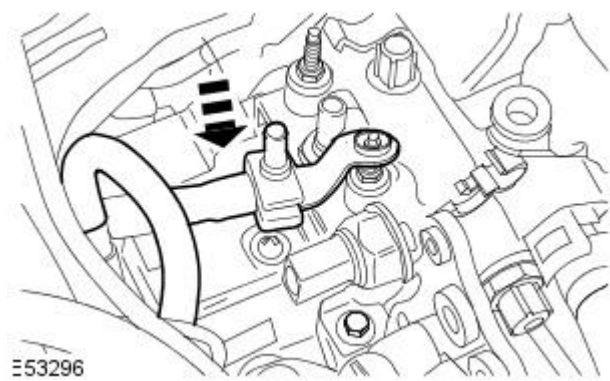


9. Install the FRP and fuel injection diverter rail assembly.

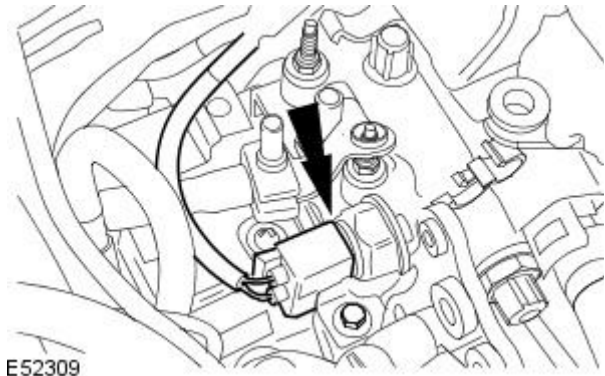
- Install the two retaining studs, but do not fully tighten at this stage.



10. Attach the fuel line.



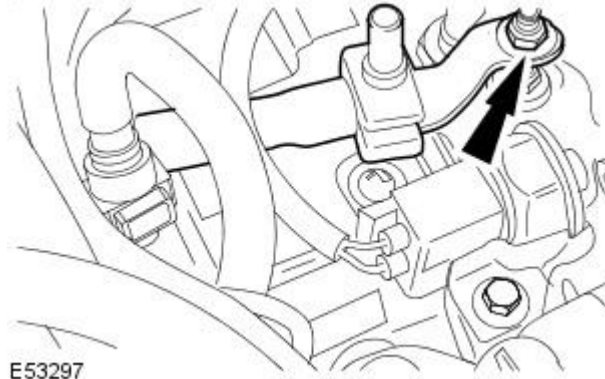
11. Connect the FRP sensor electrical connector.



E52309

12. Install the fuel line retaining nut.

- Tighten to 7 Nm.

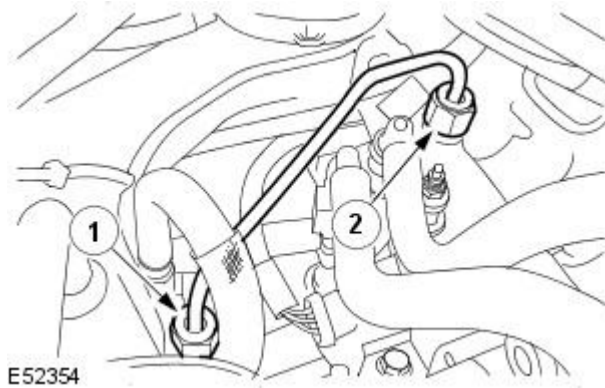


E53297

13. NOTE: Remove and discard the blanking caps.

Install a new high-pressure fuel supply line.

- Install a new high-pressure fuel supply line but do not fully tighten at this stage.
- Tighten the fuel injection diverter rail retaining studs to 23 Nm.
- Tighten the high-pressure fuel supply line in the shown sequence.
- Stage 1: Tighten the high-pressure fuel supply line union at the fuel injection pump to 15 Nm.
- Stage 2: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 15 Nm.
- Stage 3: Tighten the high-pressure fuel supply line union at the fuel injection pump to 30 Nm.
- Stage 4: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 30 Nm.

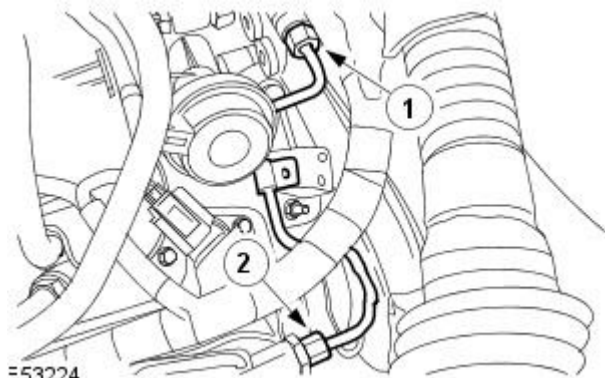


E52354

14. NOTE: Left-hand shown, right-hand similar.

Install the new high-pressure fuel rail supply line.

- Remove the blanking caps from the ports.
- Tighten the high-pressure fuel supply line in the shown sequence.
- Stage 1: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 15 Nm.
- Stage 2: Tighten the high-pressure fuel supply line union at the fuel injection rail to 15 Nm.
- Stage 3: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 30 Nm.
- Stage 4: Tighten the high-pressure fuel supply line union at the fuel injection rail to 30 Nm.



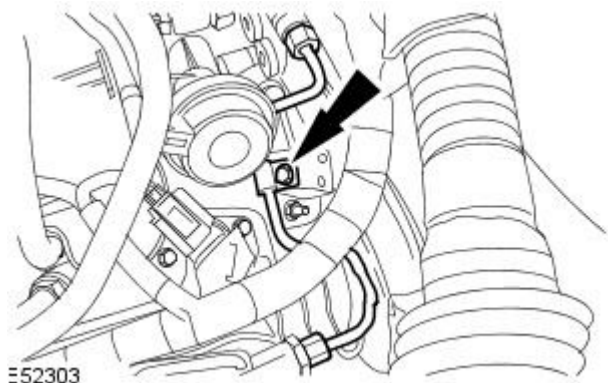
E53224



**15. NOTE:** Left-hand shown, right-hand similar.

Attach the high-pressure fuel supply lines.

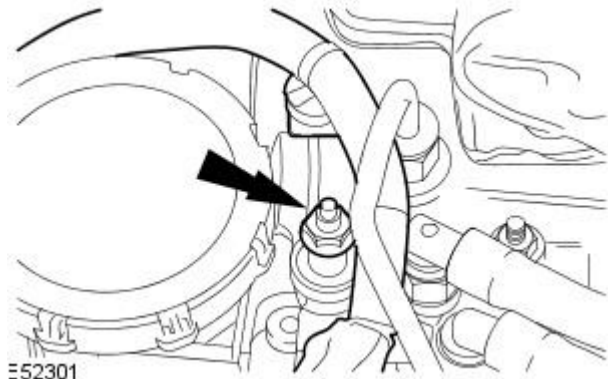
- Tighten to 10 Nm.



E52303

**16.** Attach the engine wiring harness.

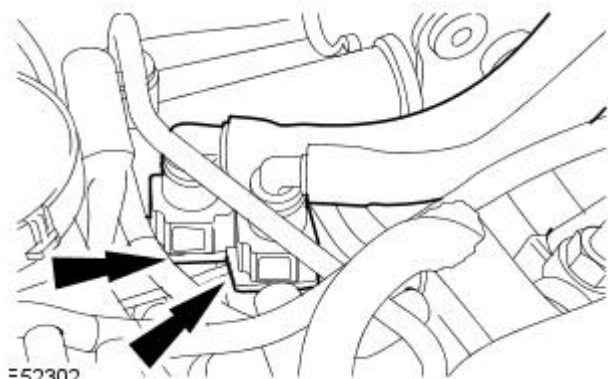
- Tighten to 7 Nm.



E52301

**17.** Attach the low-pressure fuel line.

- Remove the blanking caps from the ports.

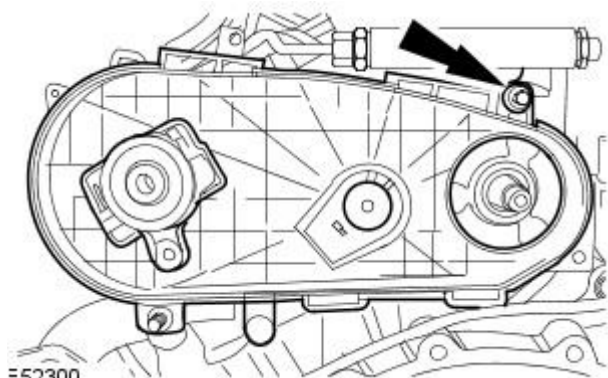


E52302

**18.** Install the fuel injector sound proofing.

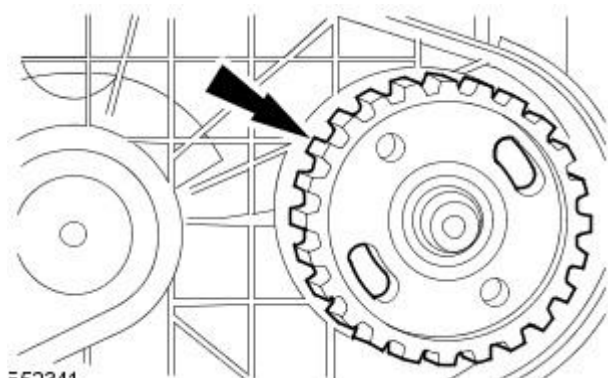
**19.** Install the fuel injection pump belt rear cover retaining bolts.

- Tighten to 7 Nm.



E52300

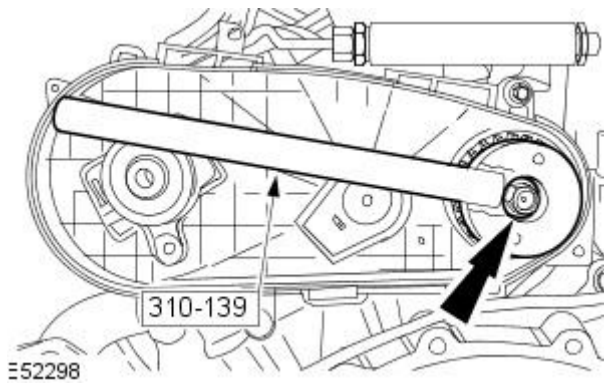
**20.** Install the fuel injection pump pulley.



E52341

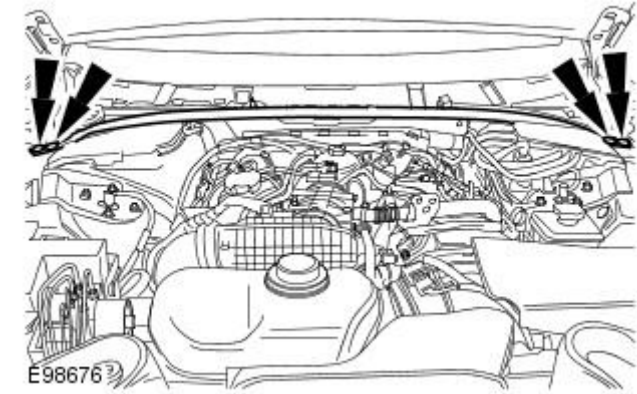
21. Install the retaining nut.

- Tighten to 50 Nm.



22. Install the engine compartment brace.

- Tighten to 25 Nm.



23. Install the fuel injection pump belt.

For additional information, refer to: [Fuel Injection Pump Belt](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).

24. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

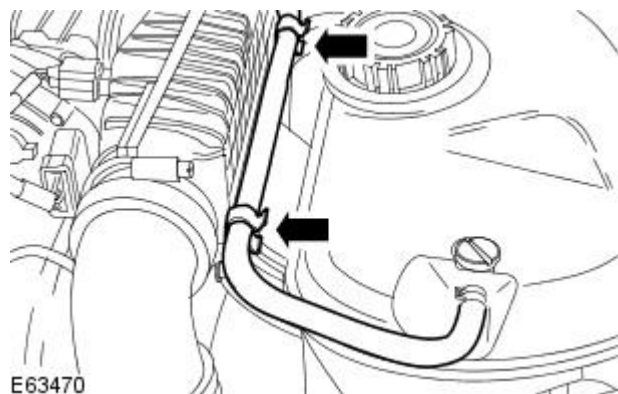
25. Bleed the fuel system.

# Fuel Charging and Controls - TDV6 2.7L Diesel - Intake Air Shutoff Throttle

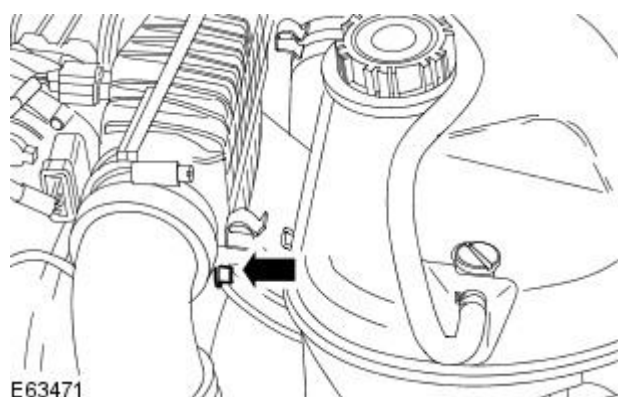
Removal and Installation

## Removal

1. Remove the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Release the coolant expansion tank hose from the clips.



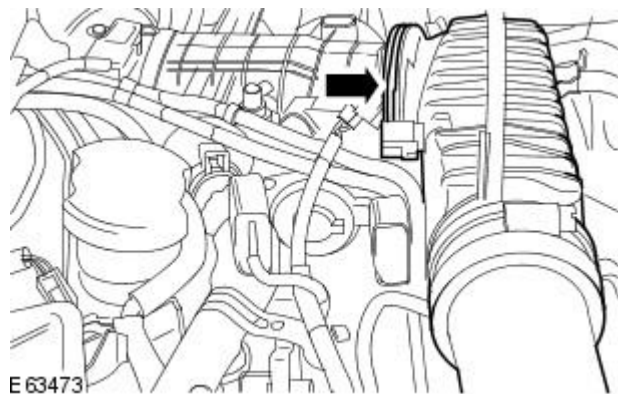
3. Remove the intake air shutoff throttle elbow retaining bolt.



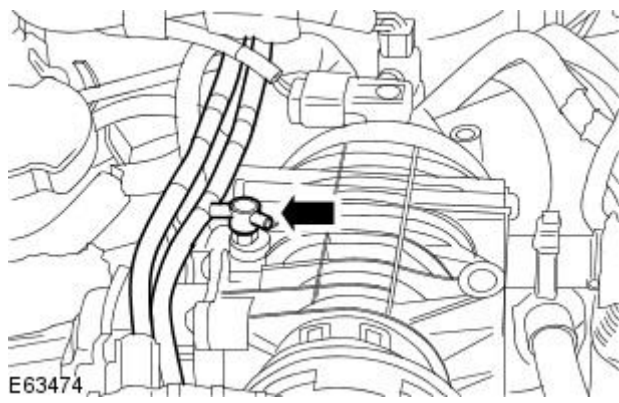
4. Disconnect the 2 electrical connectors.



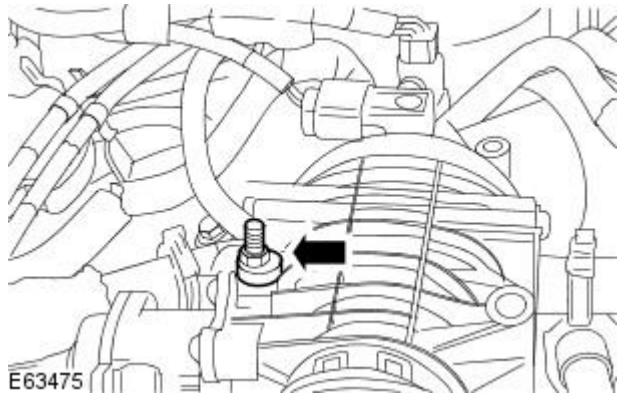
5. Release the clip and disconnect the intake air shutoff throttle elbow.



6. Release the vacuum hose clip from the stud.

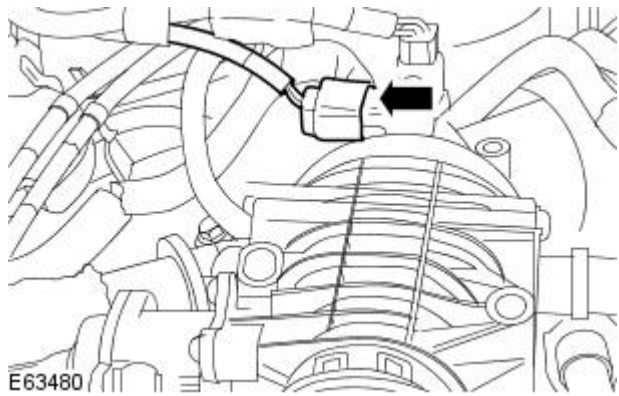


7. Remove the bolt.

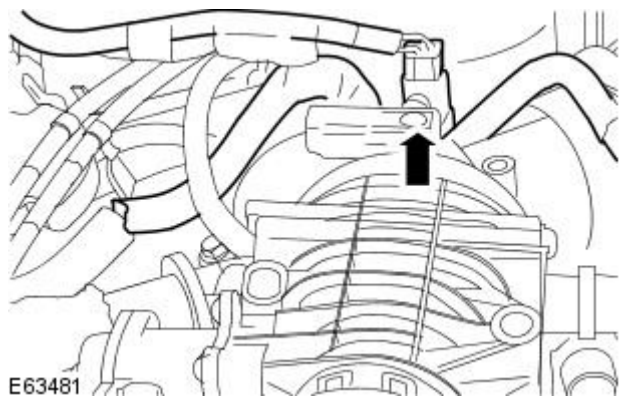


8. Remove both exhaust gas recirculation (EGR) valve outlet tubes.  
For additional information, refer to: [Exhaust Gas Recirculation \(EGR\) Valve Outlet Tube](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Removal and Installation).

9. Disconnect the electrical connector.

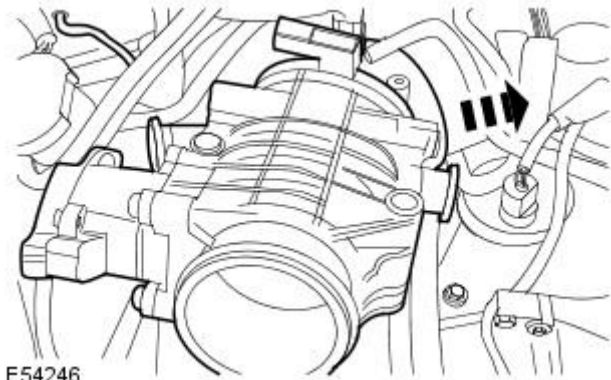


10. Release the fuel return line valve.



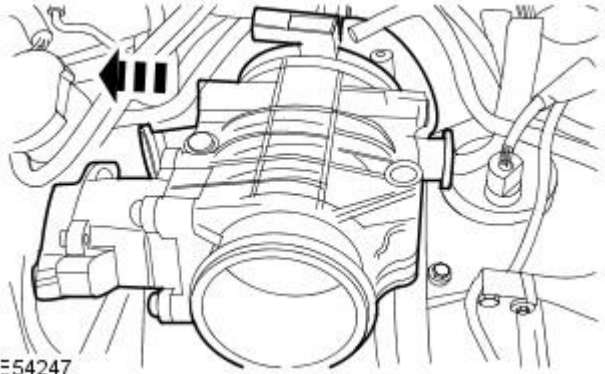


11. Reposition the intake air shutoff throttle.



E54246

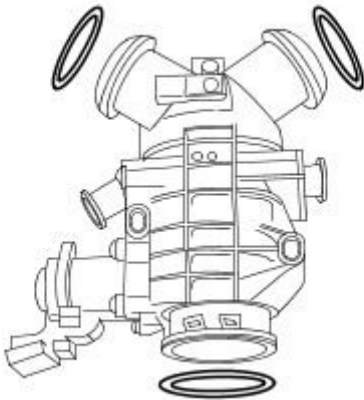
12. Remove the intake air shutoff throttle.



E54247

13.  CAUTION: Discard the seals.

Remove and discard the 3 O-ring seals.



E55935

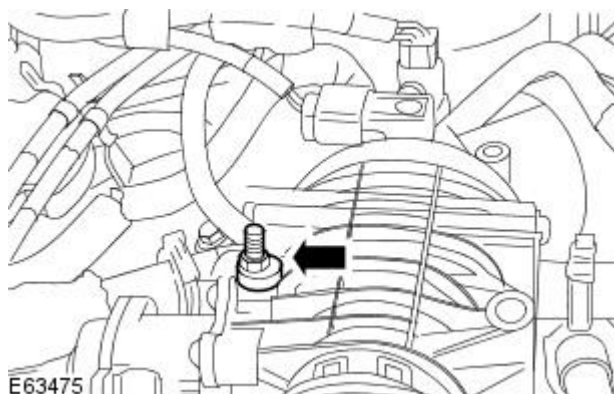
## Installation

1.  CAUTION: Install the new seals.

• NOTE: Make sure that all the component mating faces are clean.

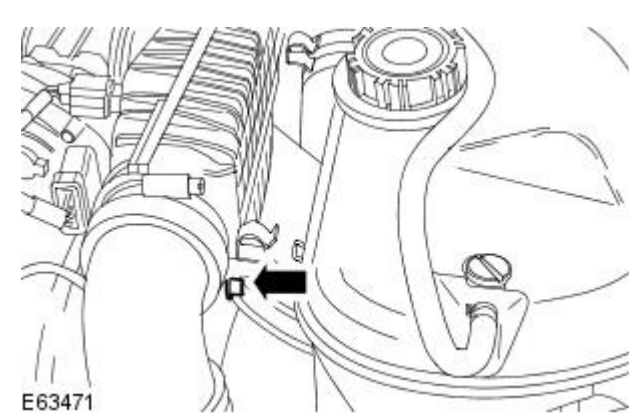
To install, reverse the removal procedure.

- Tighten to 10 Nm.



E63475

2. Tighten to 10 Nm.



E63471



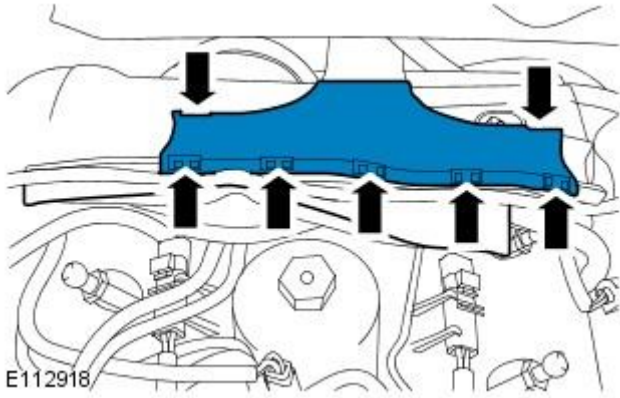
# Fuel Charging and Controls - TDV6 2.7L Diesel - Swirl Plate Actuator Diaphragm

Removal and Installation

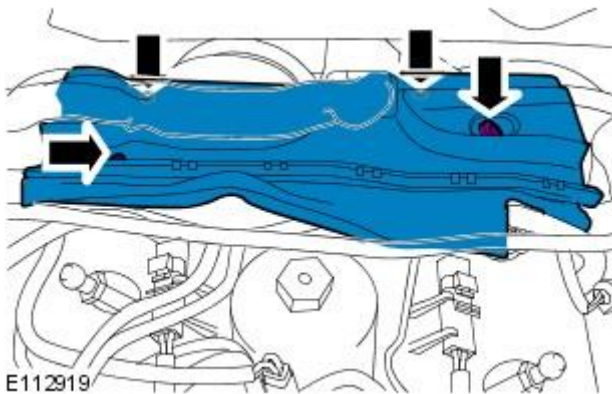
## Removal

• NOTE: Removal steps in this procedure may contain installation details.

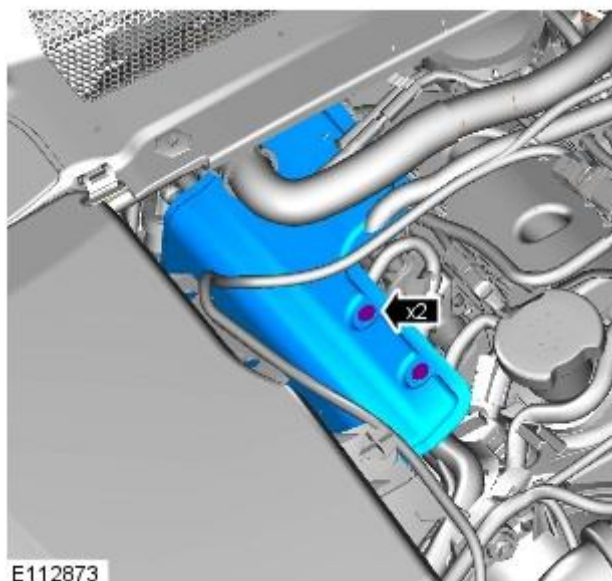
1. For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. For additional information, refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).
3. Remove the wiring harness cover.
  - Release the 7 clips.



4. Remove the wiring harness carrier.
  - Remove the 4 bolts.

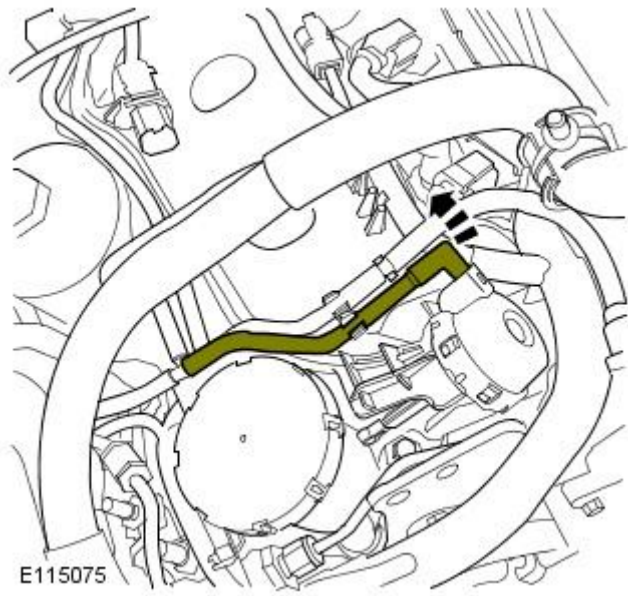


5. Remove the RH injector sound proofing.
  - Release the 2 clips.



6. Check the port deactivation hoses are a secure fit onto the stub pipe and for signs of being trapped or chaffing.
  - If the valve does not hold vacuum continue with the replacement of the diaphragm.
  - If the valve holds vacuum check the valve on the other side of the engine.
  - If one side is found not to hold vacuum then both diaphragms are to be changed.

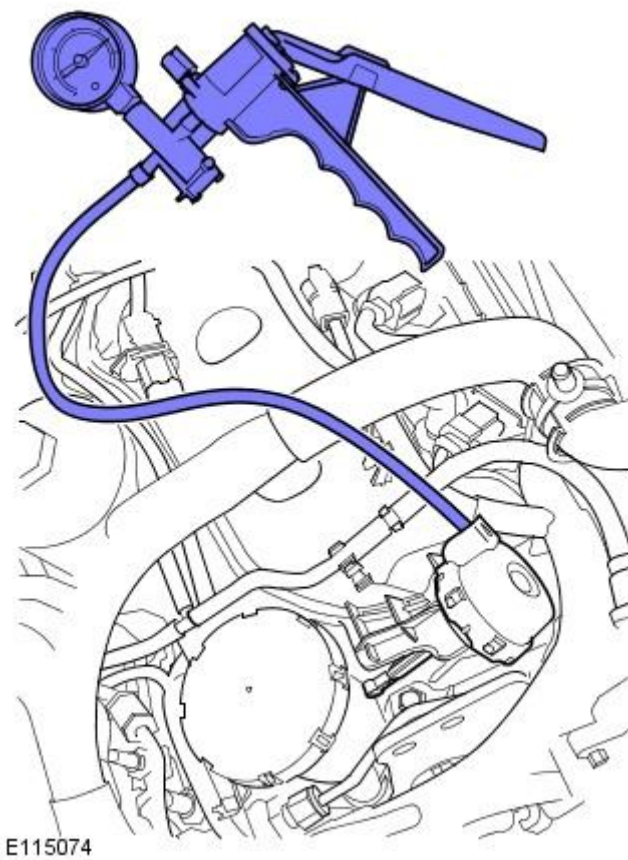
7. Disconnect the port deactivation valve vacuum hoses.



8. NOTE: Check the vacuum gauge and any hoses to be used for leaks prior to using on the vehicle.

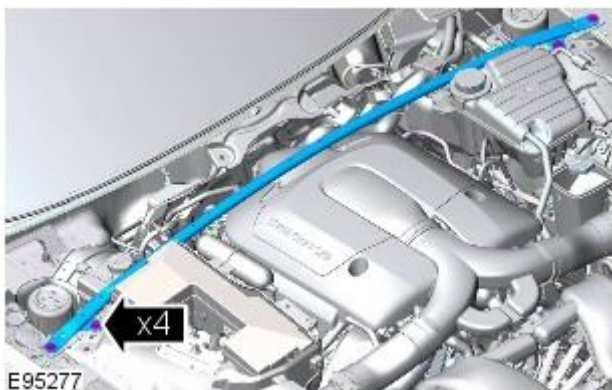
- NOTE: Make sure the vacuum gauge hose is a secure fit to the port deactivation diaphragm caps.

Using a vacuum gauge, check the port deactivation valve diaphragms.

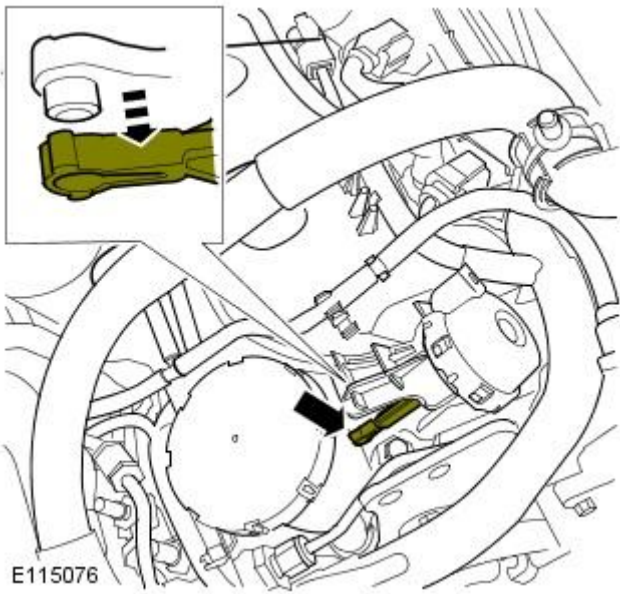


9. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Remove the engine bay brace.



10. Release the port deactivation valve connecting rod.



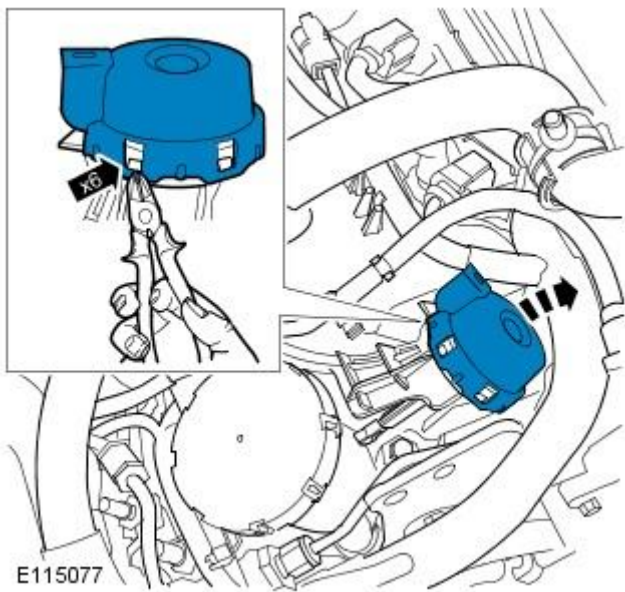
E115076

11. NOTE: Cut the retaining clips off the old port deactivation diaphragm caps to aid removal.

• NOTE: Make sure the valve cover is not damaged during removal of the port deactivation diaphragm cap.

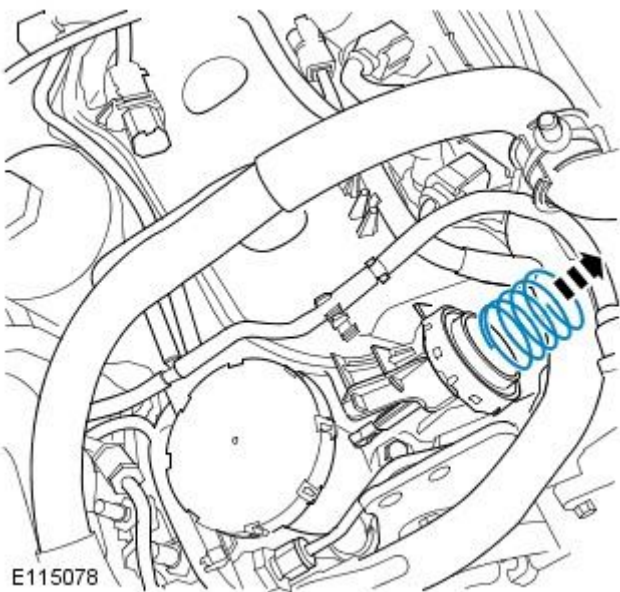
Remove the port deactivation valve cap.

- Release the 6 clips.
- Check the diaphragm for splits or damage.



E115077

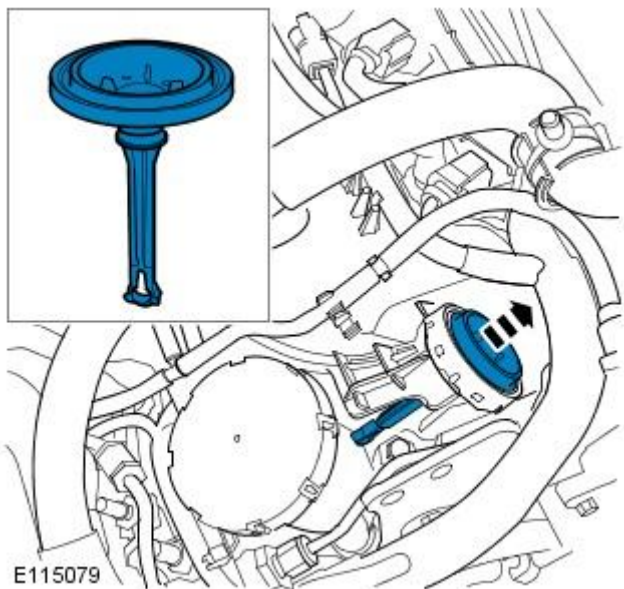
12. Remove the port deactivation valve spring.



E115078



13. Remove the port deactivation valve connecting rod and diaphragm.



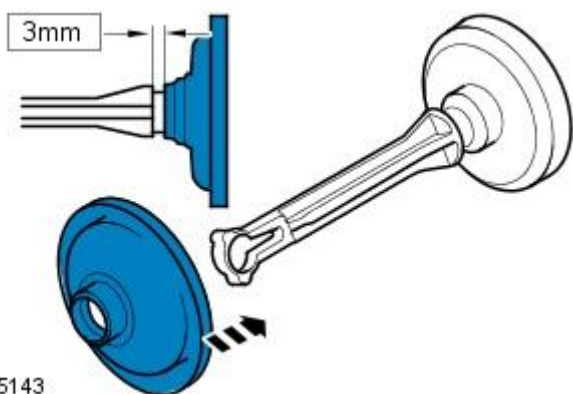
E115079

### Installation

1. NOTE: Apply a small amount water to the diaphragm to aid installation.


• NOTE: Make sure the diaphragm is fully seated on the connecting rod.

Install the new port deactivation diaphragm to the new connecting rod.



E115143

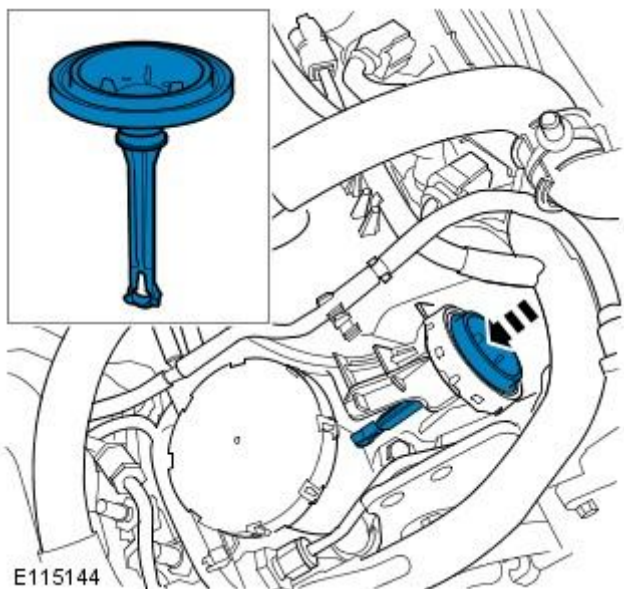
2. CAUTIONS:

 Make sure that the mating faces are clean and free of foreign material.

 Make sure the port deactivation rod is correctly aligned to the port deactivation valve arm.

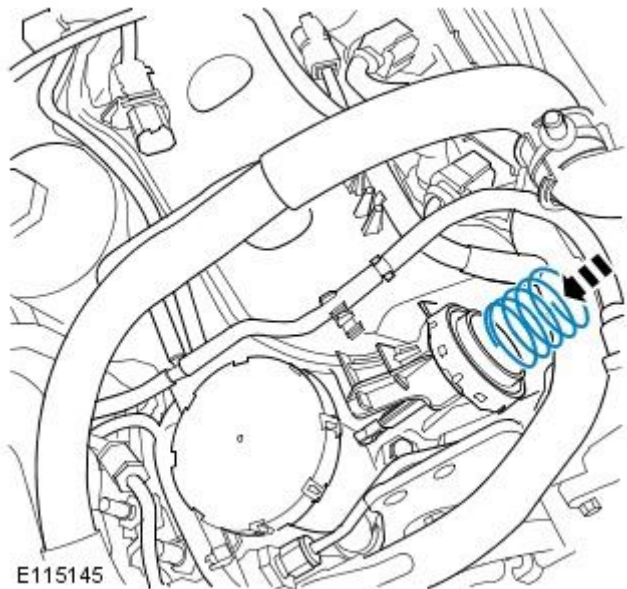
• NOTE: Make sure the new port deactivation diaphragm and rod are installed in the correct orientation to the port deactivation linkage.

Install the port deactivation valve connecting rod and diaphragm.

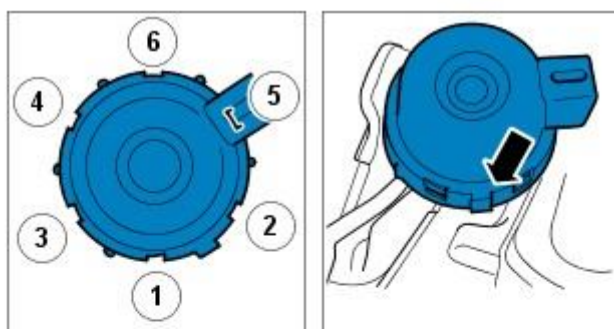


E115144

3. Install the port deactivation valve spring.




E115145



#### 4. CAUTIONS:

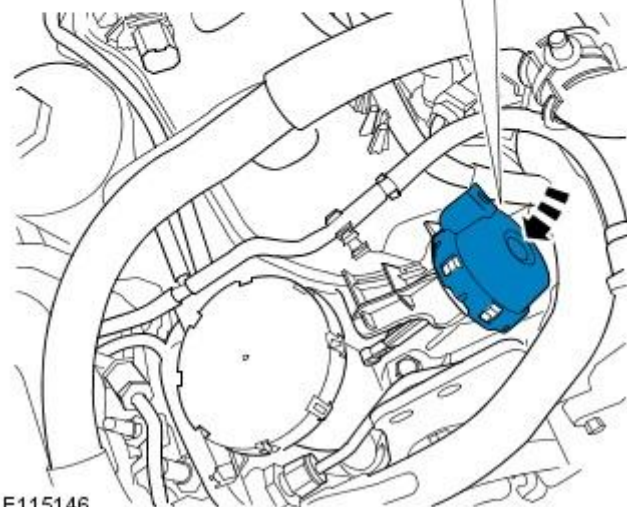
 Using a mirror check all clips are fully latched.

 Make sure the port deactivation rod is not rotated once the cap has been installed, if rotation occurs the diaphragm will be damaged.

• NOTE: An audible click is heard when the clips are fully latched.

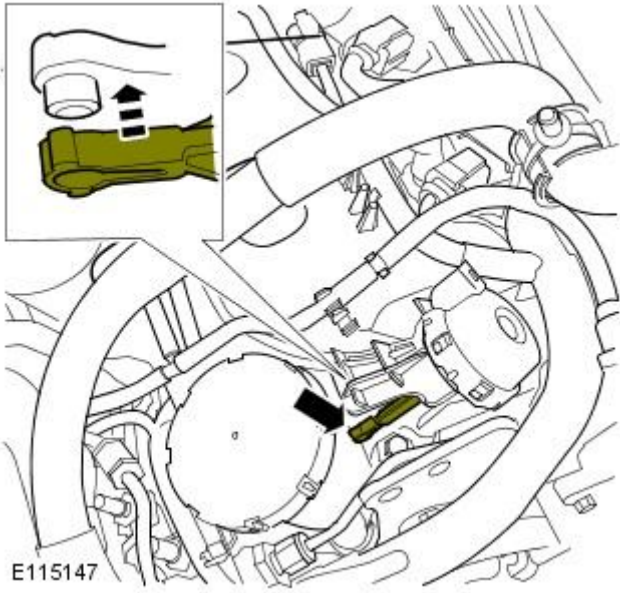
Install the port deactivation valve cap.

- Make sure the cap is correctly aligned within the timing marks.
- Secure the clips in the sequence shown.



E115146

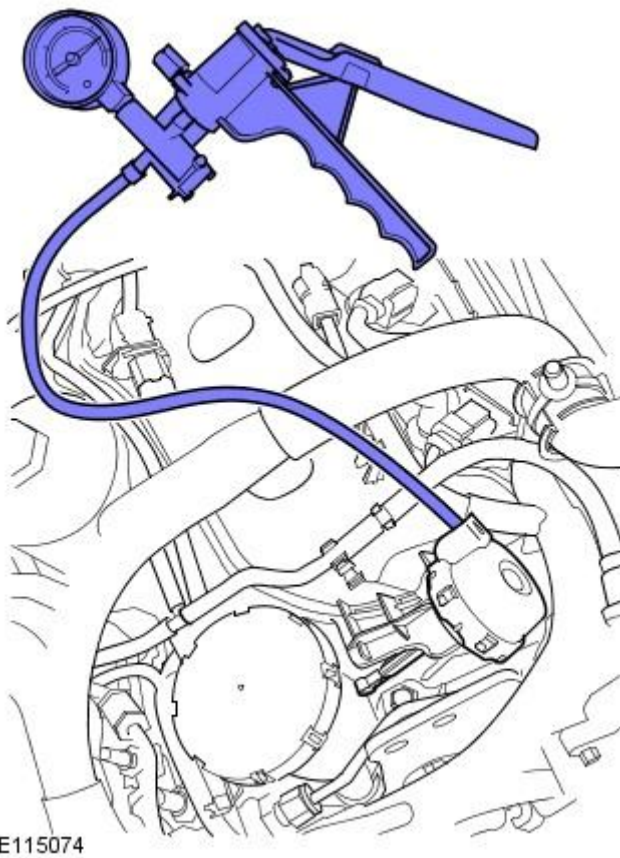
5. Attach the port deactivation valve connecting rod.



6. Repeat the above procedure on the opposite side.

7. NOTE: Check the vacuum gauge and any hoses to be used for leaks prior to using on the vehicle.

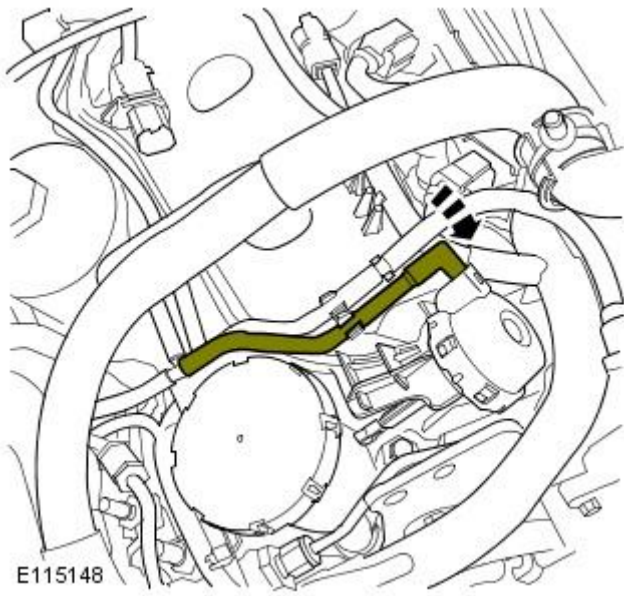
Check the port deactivation valve diaphragms using a vacuum gauge.





**8.** NOTE: When the LH hose is re-connected to the valve the right angle bend must be turned downwards, make sure the hose lies correctly in the gap between the engine cover support and the valve cover.

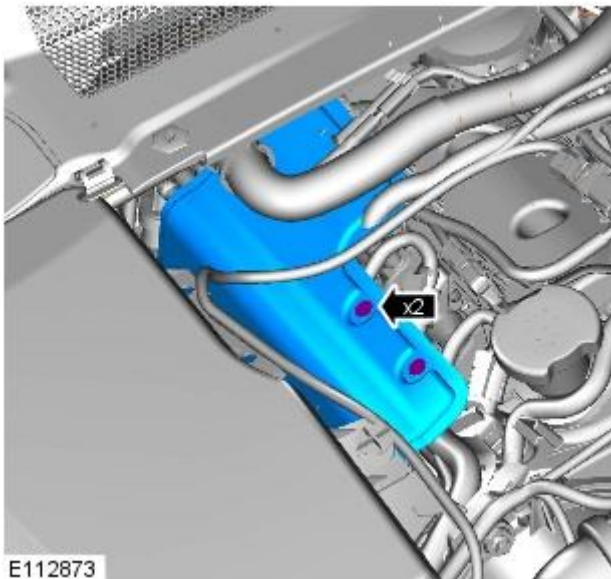
Connect the port deactivation valve vacuum hoses.



**9.** Position the port deactivation hose as shown in illustration.

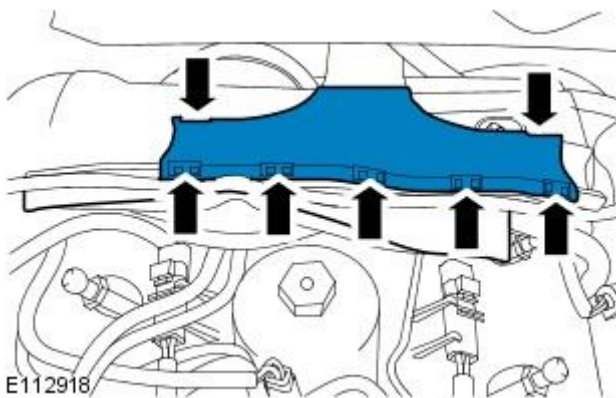
**10.** Install the RH injector sound proofing.

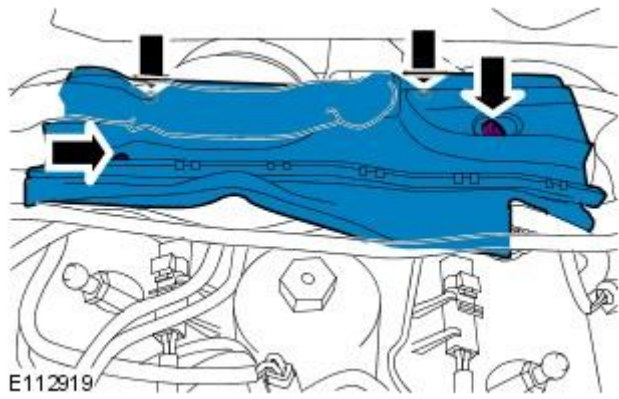
- Secure with the clips.



**11.** Install the wiring harness cover.

- Secure in the clips.





12. Install the wiring harness carrier.

- Install the bolts. TORQUE: 10 Nm

13. For additional information, refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).

14. For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

**Fuel Charging and Controls - Turbocharger - TDV6 2.7L Diesel -****Torque Specifications**

<b>Description</b>	<b>Nm</b>	<b>lb-ft</b>	<b>lb-in</b>
Oil supply tube union to turbocharger retaining bolt	30	22	–
Oil supply tube to cylinder block retaining bolt	10	–	89
Oil return tube to turbocharger retaining bolts	10	–	89
Oil return tube to cylinder block retaining bolt	10	–	89
Exhaust gas recirculation (EGR) valve to cylinder head retaining bolts	10	–	89
EGR cooler mount bracket retaining bolt	10	–	89
EGR valve tube to exhaust manifold retaining bolts	10	–	89
Turbocharger to exhaust manifold retaining nuts	23	17	–
Turbocharger support bracket retaining bolts	23	17	–
Turbocharger heatshield retaining bolts	10	–	89
Exhaust manifold retaining nuts	23	17	–
Engine wiring harness retaining bolts	4	–	35

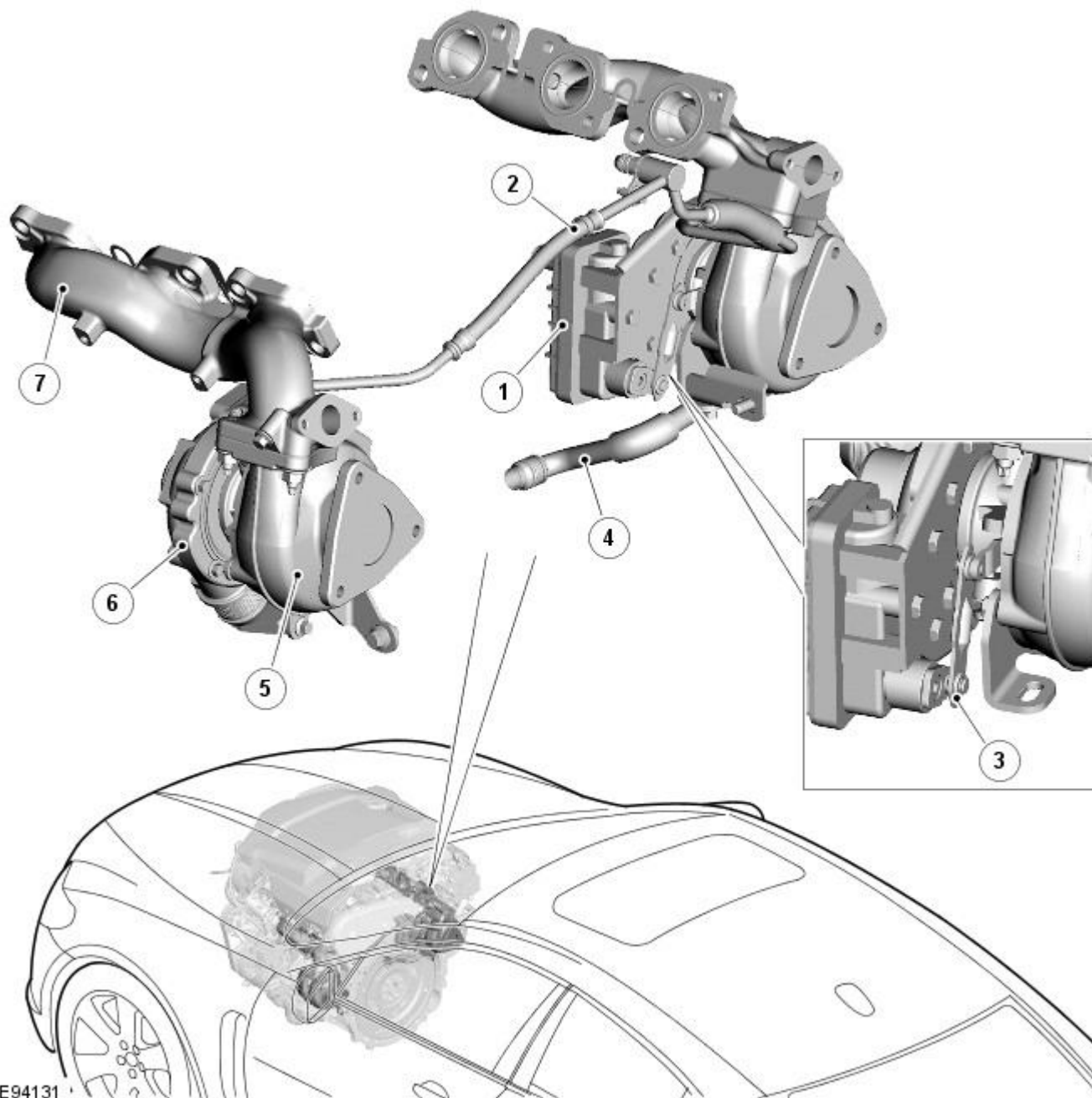
# Fuel Charging and Controls - Turbocharger - TDV6 2.7L Diesel - Turbocharger -

## Component Location

Description and Operation

• NOTE: Refer to: [Intake Air Distribution and Filtering](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Description and Operation).

Component Location



E94131

### ItemDescription

1 Rotary electronic actuator

2 Oil supply pipe

3 Rotary electronic actuator linkage

4 Oil drain pipe

5 Turbine housing

6 Compressor housing

7 Exhaust manifold

# Fuel Charging and Controls - Turbocharger - TDV6 2.7L Diesel - Turbocharger -

## Overview

Description and Operation

## Overview

Refer to: [Intake Air Distribution and Filtering](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Description and Operation).

# Fuel Charging and Controls - Turbocharger - TDV6 2.7L Diesel - Turbocharger - System Operation and Component Description

Description and Operation

## System Operation

Refer to: [Intake Air Distribution and Filtering](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Description and Operation).



# Fuel Charging and Controls - Turbocharger - TDV6 2.7L Diesel - Turbocharger

Diagnosis and Testing

## Principles of Operation

For a detailed description of the turbocharger system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (303-04B Fuel Charging and Controls - Turbocharger - TDV6 2.7L Diesel)

[Turbocharger](#) (Description and Operation),  
[Turbocharger](#) (Description and Operation),  
[Turbocharger](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Intake air system</li> <li>● Hoses/hose connections</li> <li>● Turbochargers</li> <li>● General engine conditions</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Loose or corroded electrical connectors</li> <li>● Harnesses</li> <li>● Sensors/actuators</li> </ul>

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

## Symptom Chart

Symptom	Possible Cause	Action
Poor performance (off-boost)	<ul style="list-style-type: none"> <li>● Low/Contaminated fuel</li> <li>● Restricted intake air system</li> <li>● General engine mechanical condition</li> <li>● Electronic engine control systems failure</li> </ul>	Check the fuel level and condition. Draw off approximately 1 ltr (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel. Check the intake air system for restriction. Check the engine condition, compressions, etc for indications of a mechanical fault. Check for DTCs and refer to the relevant DTC Index
No boost	<ul style="list-style-type: none"> <li>● Electrical connections and harnesses</li> <li>● Restricted intake air system</li> <li>● Charge air cooler restricted/leaking</li> <li>● Turbocharger actuator failure</li> <li>● Turbocharger failure</li> <li>● Electronic engine control systems failure</li> </ul>	Check the electrical connections and harnesses. Check the intake air system for restriction/leakage. Refer to the electrical circuit diagrams and check the turbocharger actuators and circuits. Check the turbochargers for wear. Disconnect the turbocharger intake and outlet pipework and turn the turbochargers by hand. Any roughness indicates a fault. Check any up and down movement in the turbocharger shafts. Excessive movement indicates a fault. If in doubt, compare the suspect unit with a new turbocharger. Check for DTCs and refer to the relevant DTC Index
No boost/excessive noise	<ul style="list-style-type: none"> <li>● Turbocharger failure(s)</li> </ul>	Disconnect the turbocharger intake and outlet pipework and turn the turbochargers by hand. Any roughness indicates a fault. Check any up and down movement in the turbocharger shafts. Excessive movement indicates a fault. If in doubt, compare the suspect unit with a new turbocharger

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• NOTE: If the control module/component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines that involve pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
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DTC	Description	Possible Cause	Action
P004711	Turbocharger/Supercharger Boost Control Solenoid A Circuit Low	<ul style="list-style-type: none"> <li>● Turbocharger boost control solenoid A circuit - short to ground</li> <li>● Turbocharger boost control solenoid A failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check turbocharger boost control solenoid A circuit for short to ground. Suspect the turbocharger boost control solenoid A, check and install a new turbocharger as required, refer to the new module/component installation note at the top of the DTC Index
P004812	Turbocharger/Supercharger Boost Control Solenoid A Circuit High	<ul style="list-style-type: none"> <li>● Turbocharger boost control solenoid A circuit - short to power</li> <li>● Turbocharger boost control solenoid A failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check turbocharger boost control solenoid A circuit for short to power. Suspect the turbocharger boost control solenoid A, check and install a new turbocharger as required, refer to the new module/component installation note at the top of the DTC Index
P004C00	Turbocharger/Supercharger Boost Control Solenoid B Circuit Low	<ul style="list-style-type: none"> <li>● Turbocharger boost control solenoid B circuit - short to ground</li> <li>● Turbocharger boost control solenoid B failure</li> </ul>	Refer to the electrical circuit diagrams and check turbocharger boost control solenoid B circuit for short to ground. Suspect the turbocharger boost control solenoid B, check and install a new turbocharger as required, refer to the new module/component installation note at the top of the DTC Index
P004D00	Turbocharger/Supercharger Boost Control Solenoid B Circuit High	<ul style="list-style-type: none"> <li>● Turbocharger boost control solenoid B circuit - short to power</li> <li>● Turbocharger boost control solenoid B failure</li> </ul>	Refer to the electrical circuit diagrams and check turbocharger boost control solenoid B circuit for short to power. Suspect the turbocharger boost control solenoid B, check and install a new turbocharger as required, refer to the new module/component installation note at the top of the DTC Index
P006A21	MAP - Mass or Volume Air Flow Correlation	<ul style="list-style-type: none"> <li>● Signal amplitude &lt; minimum</li> </ul>	Check high pressure air intake system for leaks and integrity
P006A22	MAP - Mass or Volume Air Flow Correlation	<ul style="list-style-type: none"> <li>● Signal amplitude &gt; maximum</li> </ul>	Refer to the electrical circuit diagrams and check MAP sensor and turbocharger boost control solenoid A and B VREF circuits for short to ground, power, open circuit
P007C16	Charge Air Cooler Temperature Sensor Circuit Low	<ul style="list-style-type: none"> <li>● Circuit voltage below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check charge air cooler temperature sensor signal circuit for short to ground. Check and install a new sensor as required
P007D17	Charge Air Cooler Temperature Sensor Circuit High	<ul style="list-style-type: none"> <li>● Circuit voltage above threshold</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler temperature sensor signal circuit for short to power. Check and install a new sensor as required
P007E27	Charge Air Cooler Temperature Sensor Intermittent/Erratic	<ul style="list-style-type: none"> <li>● Signal rate of change above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check charge air cooler temperature sensor circuits for poor connections. Check and install a new sensor as required
P023627	Turbocharger/Supercharger Boost Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● MAP sensor signal rate of change above threshold</li> </ul>	Refer to the electrical circuit diagrams and check MAP sensor circuits for poor connections. Start engine and allow to idle, check and record ' <b>Manifold air pressure</b> ' datalogger signal, increase engine speed to 1500 rpm, check and record signal. If value of signal has increased by more than 500hPa/10ms suspect the MAP sensor
P023716	Turbocharger/Supercharger Boost Sensor A Circuit Low	<ul style="list-style-type: none"> <li>● Circuit voltage below threshold</li> <li>● MAP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAP sensor signal circuit for short to ground. Suspect the MAP sensor, check and install a new sensor as required
P023817	Turbocharger/Supercharger Boost Sensor A Circuit High	<ul style="list-style-type: none"> <li>● Circuit voltage above threshold</li> <li>● MAP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAP sensor signal circuit for short to power. Suspect the MAP sensor, check and install a new sensor as required
P023D21	Manifold Absolute Pressure - Turbocharger/Supercharger Boost Sensor A Correlation	<ul style="list-style-type: none"> <li>● Signal amplitude below minimum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check low pressure air intake system integrity. Check turbocharger rod connection and oil seals. Check for oil ingestion in intake air system. Set ignition status to 'ON', engine 'OFF', check and record ' <b>Boost Pressure Actuator Bank 1 - Measured Position</b> ' datalogger signal, command ' <b>Boost pressure adjustment bank 0</b> ' datalogger signal from 5% to 95% in 5% increments. Value of signal at 5% should be between 0-20%, value of signal at 95% should be between 80-99%, the incremental data should follow a smooth curve. If turbocharger vanes sticking install a new turbocharger
P023D22	Manifold Absolute Pressure - Turbocharger/Supercharger Boost Sensor A Correlation	<ul style="list-style-type: none"> <li>● Signal amplitude above maximum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check high pressure air intake system integrity. Check turbocharger rod connection and oil seals. Set ignition status to 'ON', engine 'OFF', check and record ' <b>Boost Pressure Actuator Bank 1 - Measured Position</b> ' datalogger signal, command ' <b>Boost pressure adjustment bank 0</b> ' datalogger signal from 5% to 95% in 5% increments. Value of signal at 5% should be between 0-20%, value of signal at 95% should be between 80-99%, the incremental data should follow a smooth curve. If turbocharger vanes sticking install a new turbocharger

DTC	Description	Possible Cause	Action
P123A21	Barometric - Turbocharger/Supercharger Boost Sensor A Correlation	<ul style="list-style-type: none"> <li>Signal amplitude &lt; minimum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Recover freeze frame data to determine conditions when DTC logged. Refer to the electrical circuit diagrams and check MAP sensor circuits for short to ground, power, open circuit. Set ignition status to 'ON' engine 'OFF' with engine coolant temperature >0°C, check and record ' <b>Manifold air pressure</b> ' and ' <b>Ambient pressure</b> ' datalogger signals. If signal values are the same, clear DTCs and re-test. If not, value of ' <b>Ambient pressure</b> ' signal should be between 85-106% of 1 atmosphere, if not suspect the ECM, check and install a new ECM as required. If ' <b>Ambient pressure</b> ' signal correct, start engine and allow to idle, value of ' <b>Manifold air pressure</b> ' signal should be between 580-3000hPa, if not install a new MAP sensor
P123A22	Barometric - Turbocharger/Supercharger Boost Sensor A Correlation	<ul style="list-style-type: none"> <li>Signal amplitude &gt; maximum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Recover freeze frame data to determine conditions when DTC logged. Refer to the electrical circuit diagrams and check MAP sensor circuits for short to ground, power, open circuit. Set ignition status to 'ON' engine 'OFF' with engine coolant temperature >0°C, check and record ' <b>Manifold air pressure</b> ' and ' <b>Ambient pressure</b> ' datalogger signals. If signal values are the same, clear DTCs and re-test. If not, value of ' <b>Ambient pressure</b> ' signal should be between 85-106% of 1 atmosphere, if not suspect the ECM, check and install a new ECM as required. If ' <b>Ambient pressure</b> ' signal correct, start engine and allow to idle, value of ' <b>Manifold air pressure</b> ' signal should be between 580-3000hPa, if not install a new MAP sensor
P132A00	Turbocharger/Supercharger Boost Control A Electrical	<ul style="list-style-type: none"> <li>Turbocharger boost pressure actuator - H-Bridge failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Set ignition status to 'ON' engine 'OFF', check and record ' <b>EGR throttle position</b> ' datalogger signal, command ' <b>EGR throttle command</b> ' actuator to 100%, value of signal should be between 85-99%. Command ' <b>EGR throttle command</b> ' actuator to 0%, value of signal should be between 0-15%. If the signal values are outside of specification, suspect the throttle, check and install a new throttle as required. If the signal values are within specification, manually close and open the throttle and check the feedback voltage/resistance, voltage should range from 0.20-4.80volts, resistance should range from 300-2500 Ohms. If these values are out of specification, suspect the throttle, check and install a new throttle as required. If new throttle has been installed and DTC remains, suspect the ECM, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
P132A19	Turbocharger/Supercharger Boost Control A Electrical	<ul style="list-style-type: none"> <li>Turbocharger boost pressure actuator - H-Bridge overcurrent</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Set ignition status to 'ON' engine 'OFF', check and record ' <b>EGR throttle position</b> ' datalogger signal, command ' <b>EGR throttle command</b> ' actuator to 100%, value of signal should be between 85-99%. Command ' <b>EGR throttle command</b> ' actuator to 0%, value of signal should be between 0-15%. If the signal values are outside of specification, suspect the throttle, check and install a new throttle as required. If the signal values are within specification, manually close and open the throttle and check the feedback voltage/resistance, voltage should range from 0.20-4.80volts, resistance should range from 300-2500 Ohms. If these values are out of specification, suspect the throttle, check and install a new throttle as required. If new throttle has been installed and DTC remains, suspect the ECM, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
P132B00	Turbocharger/Supercharger Boost Control A Performance	<ul style="list-style-type: none"> <li>PWM duty cycle too low - PWM frequency incorrect</li> </ul>	Set ignition status to 'ON' engine 'OFF'. Check and record ' <b>Boost Pressure Actuator Bank 1 - Measured Position</b> ' and ' <b>Boost Pressure Actuator Bank 2 - Measured Position</b> ' datalogger signals, and then command ' <b>Boost pressure adjustment bank 0</b> ' and ' <b>Boost pressure adjustment bank 1</b> ' commands first to 0% and then to 99%. The value of the signals should be comparable to the commanded position
P132B21	Turbocharger/Supercharger Boost Control A Performance	<ul style="list-style-type: none"> <li>Turbocharger boost pressure actuator control deviation below minimum threshold - Bank 1</li> </ul>	Refer to the electrical circuit diagrams and check turbocharger A circuits for short, open circuit. Check and record ' <b>Boost Pressure Actuator Bank 1 - Measured Position</b> ' datalogger signal at idle and at 3000rev/min, then quickly apply and release full throttle. Value of signal should be; at idle, approximately 95%, at 3000 rev/min, approximately 40%, quick application/release of throttle, smooth transition at approximately 25%/100ms. If angle does not change smoothly, or rate of change is slower than expected, suspect the turbocharger vanes are sticking, check and install a new turbocharger as required
P132B22	Turbocharger/Supercharger Boost Control A Performance	<ul style="list-style-type: none"> <li>Turbocharger boost pressure actuator control deviation above maximum threshold - Bank 1</li> </ul>	Refer to the electrical circuit diagrams and check turbocharger A circuits for short, open circuit. Check and record ' <b>Boost Pressure Actuator Bank 1 - Measured Position</b> ' datalogger signal at idle and at 3000rev/min, then quickly apply and release full throttle. Value of signal should be; at idle, approximately 95%, at 3000 rev/min, approximately 40%, quick application/release of throttle, smooth transition at approximately 25%/100ms. If angle does not change smoothly, or rate of change is slower than expected, suspect the turbocharger vanes are sticking, check and install a new turbocharger as required
P132D00	Turbocharger/Supercharger Boost Control B Electrical	<ul style="list-style-type: none"> <li>Turbocharger boost pressure actuator - H-Bridge failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Set ignition status to 'ON' engine 'OFF', check and record ' <b>EGR throttle position</b> ' datalogger signal, command ' <b>EGR throttle command</b> ' actuator to 100%, value of signal should be between 85-99%. Command ' <b>EGR throttle command</b> ' actuator to 0%, value of signal should be between 0-15%. If the signal values are outside of specification, suspect the throttle, check and install a new throttle as required. If the signal values are within specification, manually close and open the throttle and check the feedback voltage/resistance, voltage should range from 0.20-4.80volts, resistance should range from 300-2500 Ohms. If these values are out of specification, suspect the throttle, check and install a new throttle as required. If new throttle has been installed and DTC remains, suspect the ECM, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index

DTC	Description	Possible Cause	Action
P132D19	Turbocharger/Supercharger Boost Control B Electrical	<ul style="list-style-type: none"> <li>Turbocharger boost pressure actuator - H-Bridge overcurrent</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Set ignition status to 'ON' engine 'OFF', check and record ' <b>EGR throttle position</b> ' datalogger signal, command ' <b>EGR throttle command</b> ' actuator to 100%, value of signal should be between 85-99%. Command ' <b>EGR throttle command</b> ' actuator to 0%, value of signal should be between 0-15%. If the signal values are outside of specification, suspect the throttle, check and install a new throttle as required. If the signal values are within specification, manually close and open the throttle and check the feedback voltage/resistance, voltage should range from 0.20-4.80volts, resistance should range from 300-2500 Ohms. If these values are out of specification, suspect the throttle, check and install a new throttle as required. If new throttle has been installed and DTC remains, suspect the ECM, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
P132E00	Turbocharger/Supercharger Boost Control B Performance	<ul style="list-style-type: none"> <li>PWM duty cycle too low - PWM frequency incorrect</li> </ul>	Set ignition status to 'ON' engine 'OFF'. Check and record ' <b>Boost Pressure Actuator Bank 1 - Measured Position</b> ' and ' <b>Boost Pressure Actuator Bank 2 - Measured Position</b> ' datalogger signals, and then command ' <b>Boost pressure adjustment bank 0</b> ' and ' <b>Boost pressure adjustment bank 1</b> ' commands first to 0% and then to 99%. The value of the signals should be comparable to the commanded position
P132E21	Turbocharger/Supercharger Boost Control B Performance	<ul style="list-style-type: none"> <li>Turbocharger boost pressure actuator control deviation below minimum threshold - Bank 2</li> </ul>	Refer to the electrical circuit diagrams and check turbocharger B circuits for short, open circuit. Check and record ' <b>Boost Pressure Actuator Bank 2 - Measured Position</b> ' datalogger signal at idle and at 3000rev/min, then quickly apply and release full throttle. Value of signal should be; at idle, approximately 95%, at 3000 rev/min, approximately 40%, quick application/release of throttle, smooth transition at approximately 25%/100ms. If angle does not change smoothly, or rate of change is slower than expected, suspect the turbocharger vanes are sticking, check and install a new turbocharger as required
P132E22	Turbocharger/Supercharger Boost Control B Performance	<ul style="list-style-type: none"> <li>Turbocharger boost pressure actuator control deviation above maximum threshold - Bank 2</li> </ul>	Refer to the electrical circuit diagrams and check turbocharger B circuits for short, open circuit. Check and record ' <b>Boost Pressure Actuator Bank 2 - Measured Position</b> ' datalogger signal at idle and at 3000rev/min, then quickly apply and release full throttle. Value of signal should be; at idle, approximately 95%, at 3000 rev/min, approximately 40%, quick application/release of throttle, smooth transition at approximately 25%/100ms. If angle does not change smoothly, or rate of change is slower than expected, suspect the turbocharger vanes are sticking, check and install a new turbocharger as required
P138E21	Turbocharger Boost Control Position Sensor A Minimum/Maximum Stop Performance	<ul style="list-style-type: none"> <li>Turbocharger boost pressure actuator adaption diagnosis below bottom limit - Bank 1</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check turbocharger bank 1 circuits for short, open circuit. Set ignition status to 'ON' engine 'OFF', check and record ' <b>Boost Pressure Actuator Bank 1 - Measured Position</b> ' datalogger signal, then command ' <b>Boost pressure adjustment - bank 0</b> ' first to 5% then 95%. If value of signal at 5% is not between 0-15%, or at 95% is not between 85-99%, suspect bank 1 turbocharger, check and install a new turbocharger as required
P138E22	Turbocharger Boost Control Position Sensor A Minimum/Maximum Stop Performance	<ul style="list-style-type: none"> <li>Turbocharger boost pressure actuator adaption diagnosis above top limit - Bank 1</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check turbocharger bank 1 circuits for short, open circuit. Set ignition status to 'ON' engine 'OFF', check and record ' <b>Boost Pressure Actuator Bank 1 - Measured Position</b> ' datalogger signal, then command ' <b>Boost pressure adjustment - bank 0</b> ' first to 5% then 95%. If value of signal at 5% is not between 0-15%, or at 95% is not between 85-99%, suspect bank 1 turbocharger, check and install a new turbocharger as required
P138F21	Turbocharger Boost Control Position Sensor B Minimum/Maximum Stop Performance	<ul style="list-style-type: none"> <li>Turbocharger boost pressure actuator adaption diagnosis below bottom limit - Bank 2</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check turbocharger bank 2 circuits for short, open circuit. Set ignition status to 'ON' engine 'OFF', check and record ' <b>Boost Pressure Actuator Bank 2 - Measured Position</b> ' datalogger signal, then command ' <b>Boost pressure adjustment - bank 1</b> ' first to 5% then 95%. If value of signal at 5% is not between 0-15%, or at 95% is not between 85-99%, suspect bank 2 turbocharger, check and install a new turbocharger as required
P138F22	Turbocharger Boost Control Position Sensor B Minimum/Maximum Stop Performance	<ul style="list-style-type: none"> <li>Turbocharger boost pressure actuator adaption diagnosis above top limit - Bank 2</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check turbocharger bank 2 circuits for short, open circuit. Set ignition status to 'ON' engine 'OFF', check and record ' <b>Boost Pressure Actuator Bank 2 - Measured Position</b> ' datalogger signal, then command ' <b>Boost pressure adjustment - bank 1</b> ' first to 5% then 95%. If value of signal at 5% is not between 0-15%, or at 95% is not between 85-99%, suspect bank 2 turbocharger, check and install a new turbocharger as required
P256327	Turbocharger Boost Control Position Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Signal rate of change above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check turbocharger boost control sensor A circuits for loose contacts, open circuit. Clear DTC and re-test
P256421	Turbocharger Boost Control Position Sensor A Circuit Low	<ul style="list-style-type: none"> <li>Signal amplitude &lt; minimum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check turbocharger boost control sensor A circuit for short to ground. Check and install a new sensor as required
P256522	Turbocharger Boost Control Position Sensor A Circuit High	<ul style="list-style-type: none"> <li>Signal amplitude &gt; maximum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check turbocharger boost control sensor A circuit for short to power. Check and install a new sensor as required
P258727	Turbocharger Boost Control Position Sensor B Circuit Range/Performance	<ul style="list-style-type: none"> <li>Signal rate of change above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check turbocharger boost control sensor B circuits for loose contacts, open circuit. Clear DTC and re-test

DTC	Description	Possible Cause	Action
P258821	Turbocharger Boost Control Position Sensor B Circuit Low	<ul style="list-style-type: none"><li>● Signal amplitude &lt; minimum</li></ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check turbocharger boost control sensor B circuit for short to ground. Check and install a new sensor as required


# Fuel Charging and Controls - Turbocharger - TDV6 2.7L Diesel - Turbocharger LH

Removal and Installation

## Removal

All vehicles

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

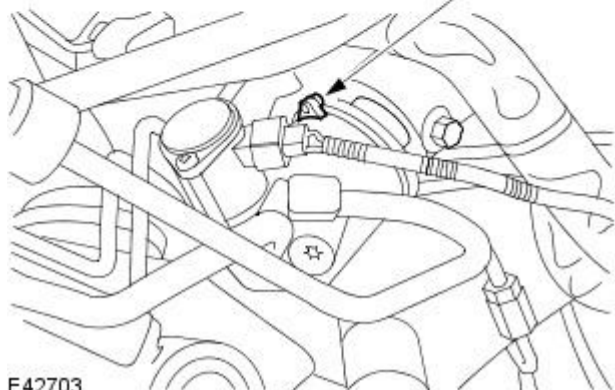
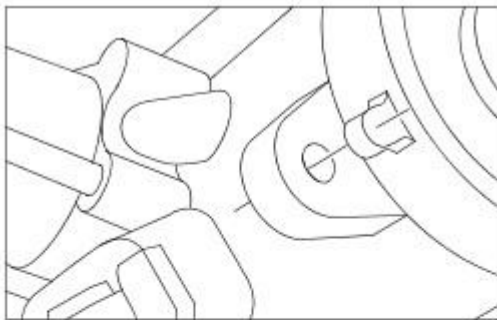
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

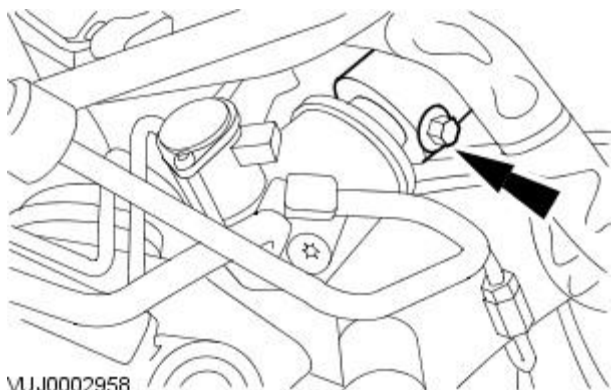
3. Remove the left-hand catalytic converter.  
For additional information, refer to: [Catalytic Converter](#) (309-00A Exhaust System - TDV6 2.7L Diesel, Removal and Installation).

Left-hand drive vehicles


4. Make sure the alignment mark, on the steering gear pinion seal protection cover, is central to the steering gear pinion casting.



E42703



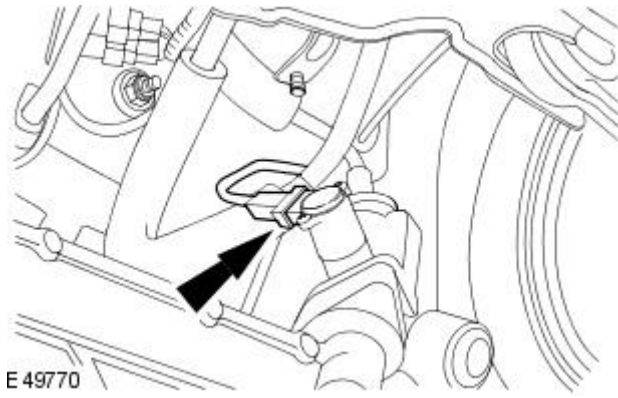
VUJ0002958

5.  **CAUTION:** Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

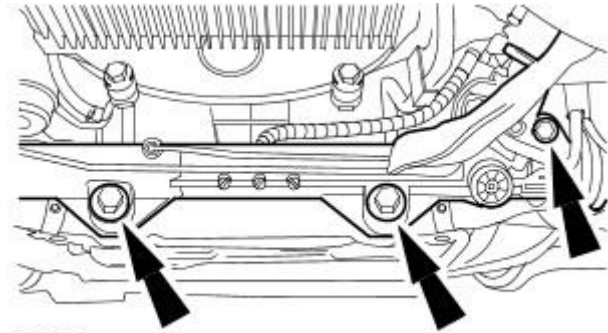
Remove the steering gear shaft pinch bolt.



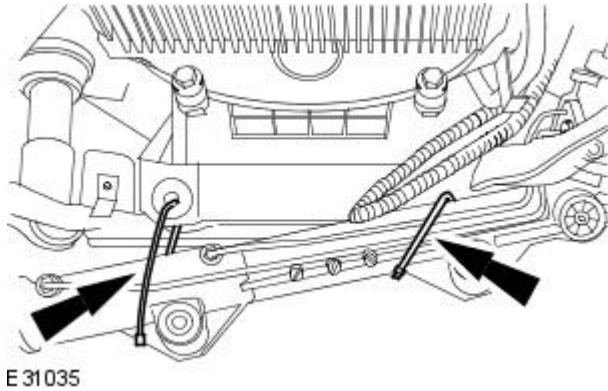
6. Disconnect the power steering control valve actuator electrical connector.



7. Detach the steering gear.



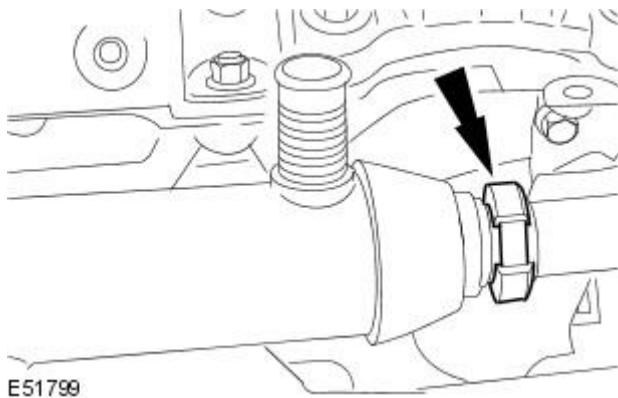
8. Support the steering gear.



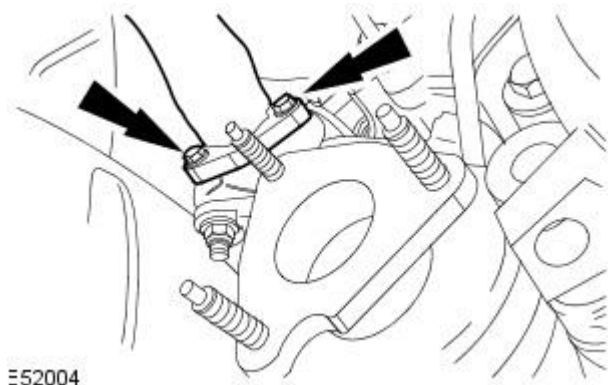
All vehicles

9. Release the EGR valve inlet tube.

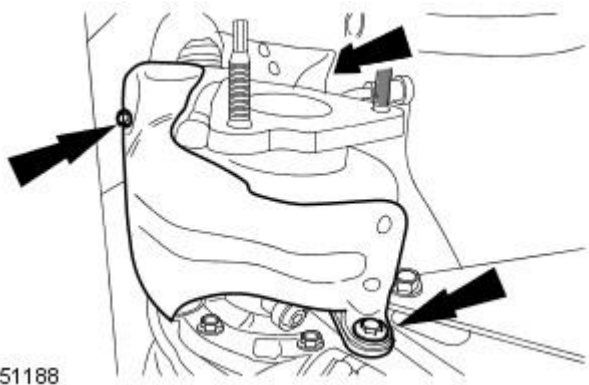
- Remove and discard the clamp.



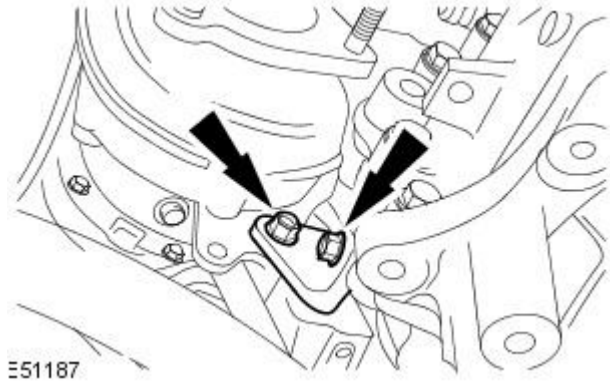
10. Remove the EGR inlet pipe.



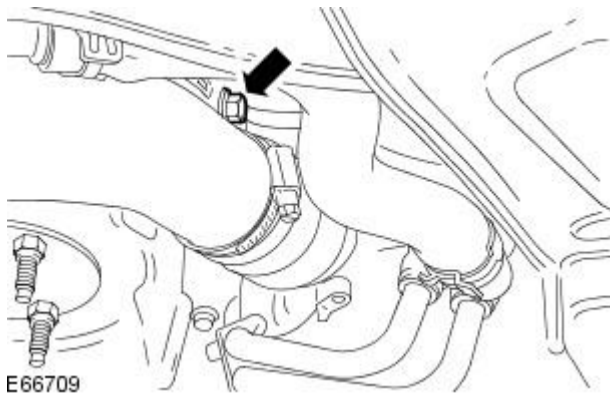
11. Remove the LH turbocharger heat shield.



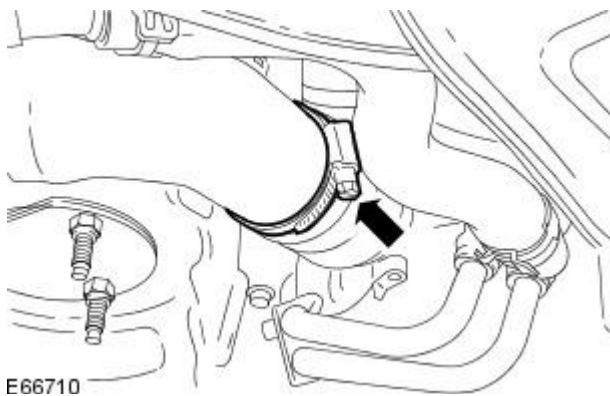
12. Remove the turbocharger support bracket.



13. Remove the turbocharger outlet pipe retaining bolt.

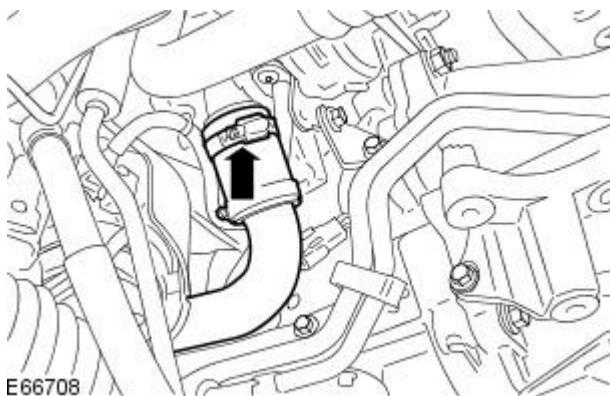


14. Disconnect the turbocharger outlet pipe.

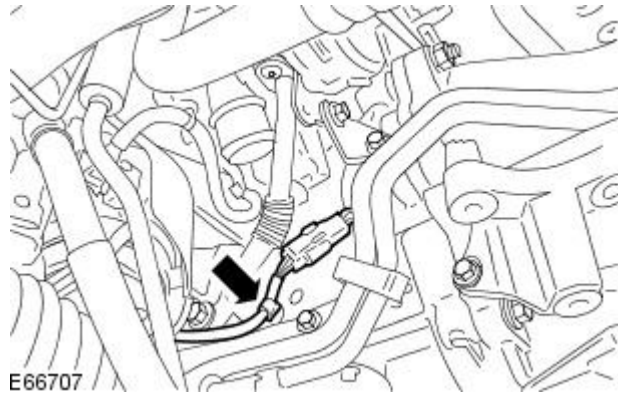


15. Disconnect the turbocharger outlet pipe.

- Reposition the LH turbocharger outlet pipe.

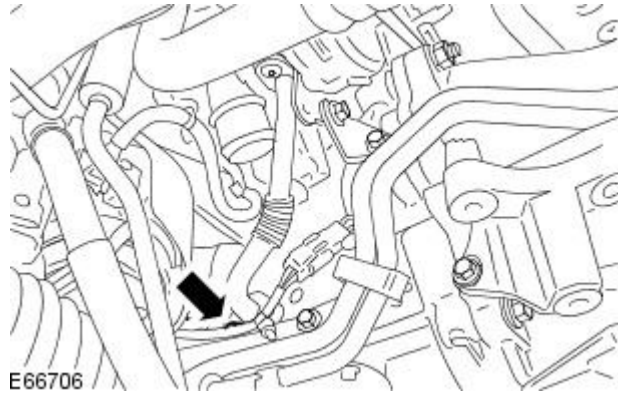


16. Detach the crankshaft position (CKP) sensor wiring harness from the oil return tube retaining plate.



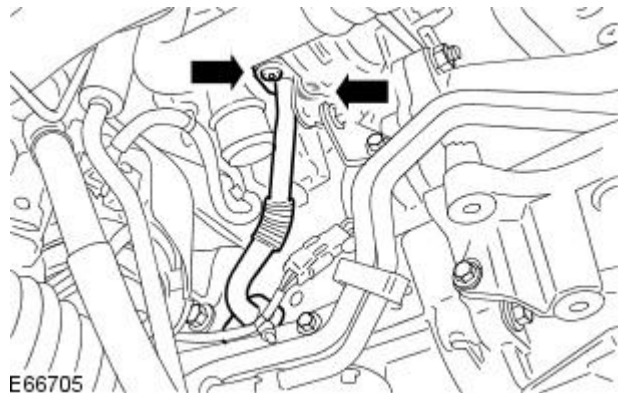
17. Release the LH turbocharger oil return tube.

- Remove and discard the O-ring seal.
- Install blanking caps to the exposed ports.



18. Remove the LH turbocharger oil return tube.

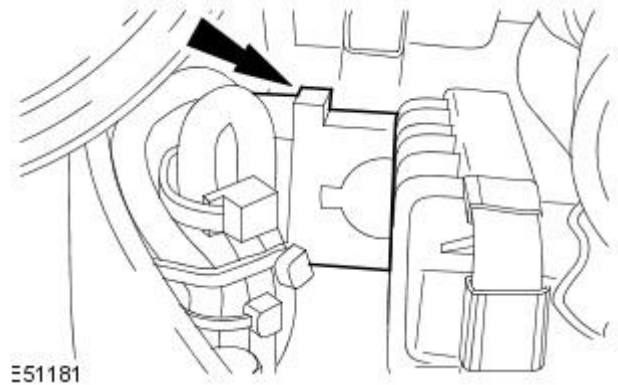
- Remove and discard the gasket.
- Install blanking caps to the exposed ports.



19. Disconnect the LH turbocharger intake tube.



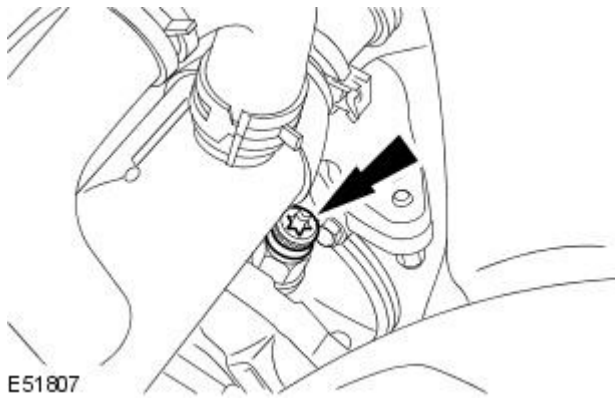
20. Disconnect the turbocharger electrical connector.



21. Lower the vehicle.

22. Disconnect the LH turbocharger oil supply pipe.

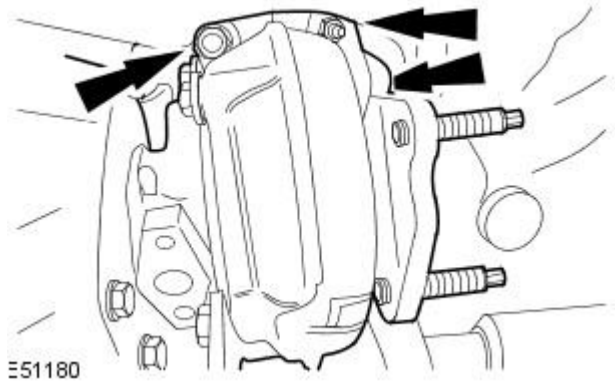
- Remove and discard the copper sealing washer.
- Install blanking caps to the exposed ports.



23. Raise the vehicle.

24. Remove the LH turbocharger.

- Remove and discard the retaining nuts.
- Remove and discard the studs.
- Install blanking caps to the exposed ports.

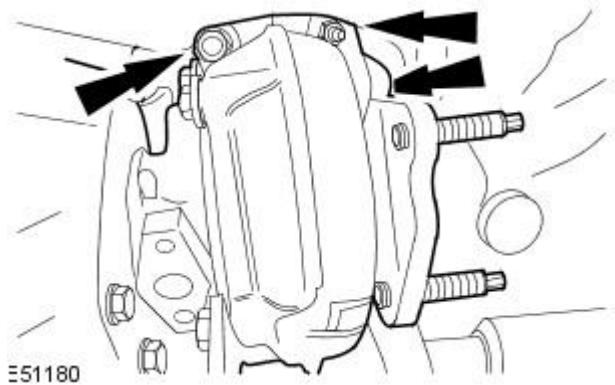


## Installation

All vehicles

1. Install the LH turbocharger.

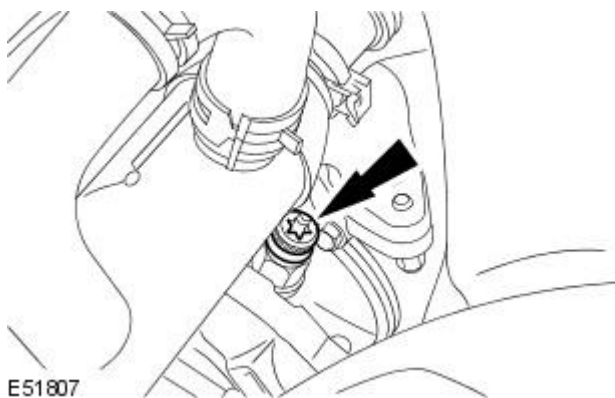
- Remove and discard the blanking caps.
- Install new studs and nuts.
- Tighten to 23 Nm.



2. Lower the vehicle.

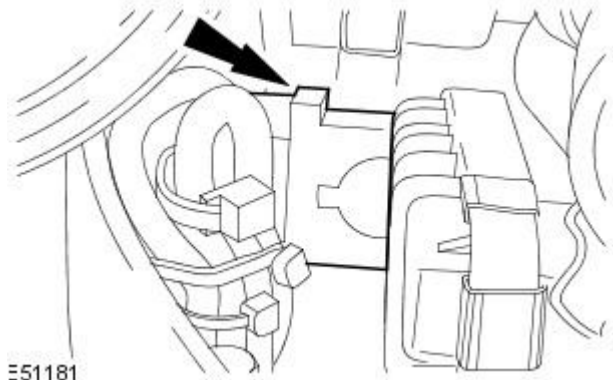
3. Connect the turbocharger oil supply tube.

- Remove and discard the blanking caps.
- Install a new copper sealing washer.
- Tighten to 30 Nm.



4. Raise the vehicle.

5. Connect the LH turbocharger electrical connector.

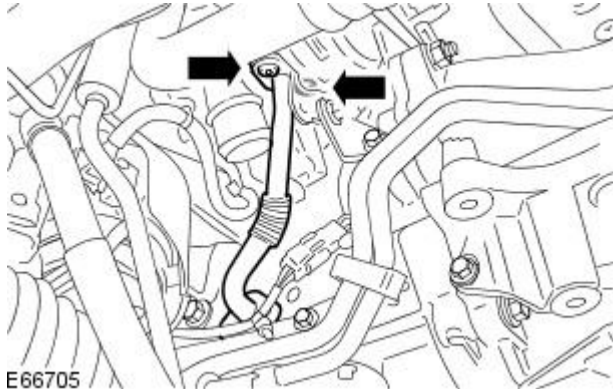


E51181

6. Connect the LH turbocharger intake tube.

7. Install the LH turbocharger oil return tube.

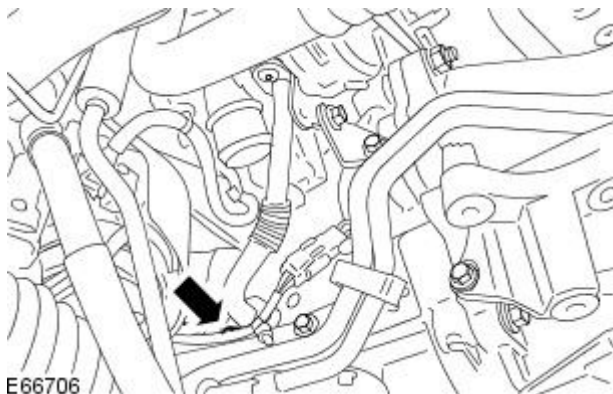
- Remove and discard the blanking caps.
- Install a new gasket.
- Tighten to 10 Nm.



E66705

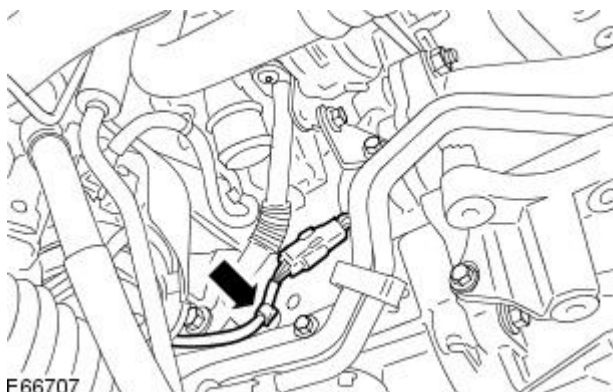
8. Secure the LH turbocharger oil return tube.

- Remove and discard the blanking caps.
- Install a new O-ring seal.
- Tighten to 10 Nm.



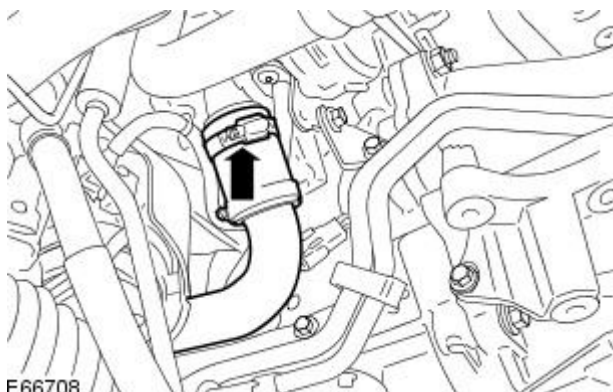
E66706

9. Attach the CKP sensor wiring harness to the oil return tube retaining plate.



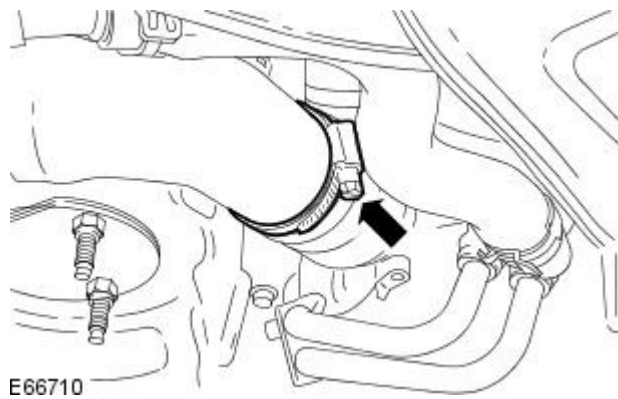
E66707

10. Install the turbocharger outlet pipe.



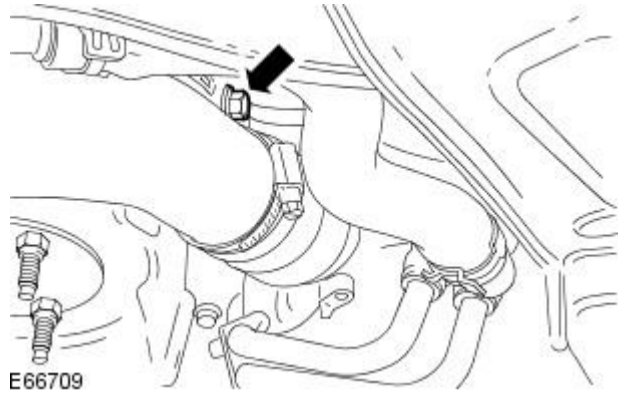
E66708

11. Install the turbocharger outlet pipe.



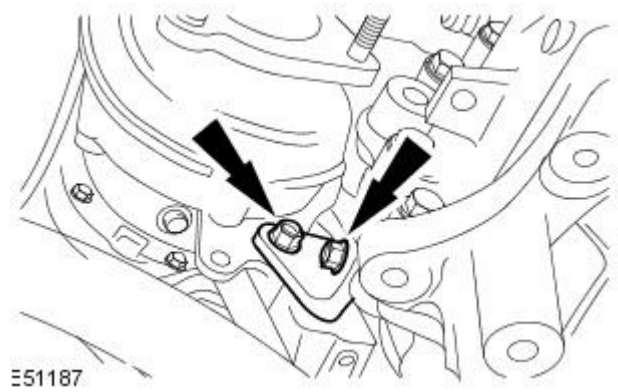
12. Install the LH turbocharger outlet pipe bolt.

- Tighten to 10 Nm.



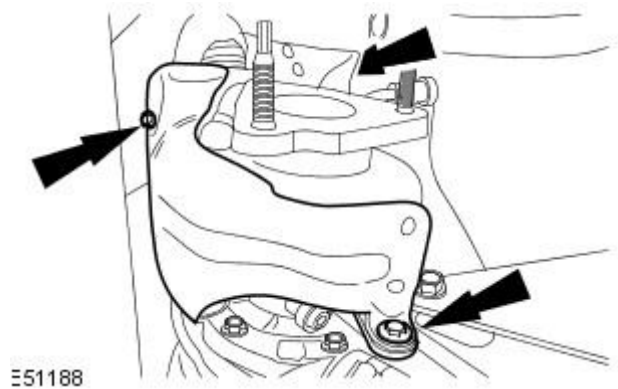
13. Install the turbocharger support bracket.

- Tighten to 23 Nm.



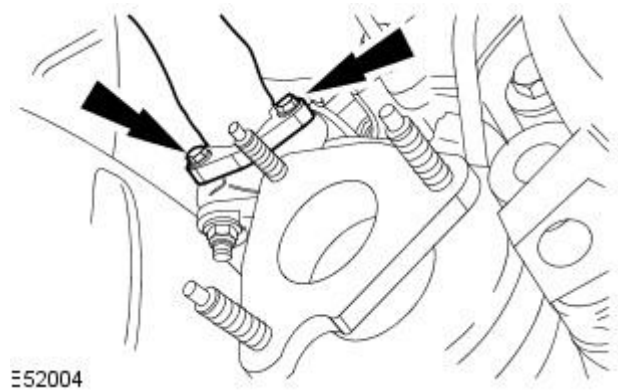
14. Install the LH turbocharger heat shield.

- Tighten to 9 Nm.



15. Install the EGR inlet pipe.

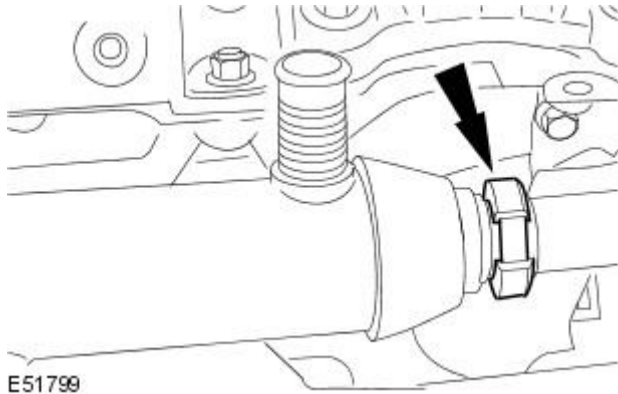
- Tighten to 10 Nm.





16. Attach the EGR valve inlet tube.

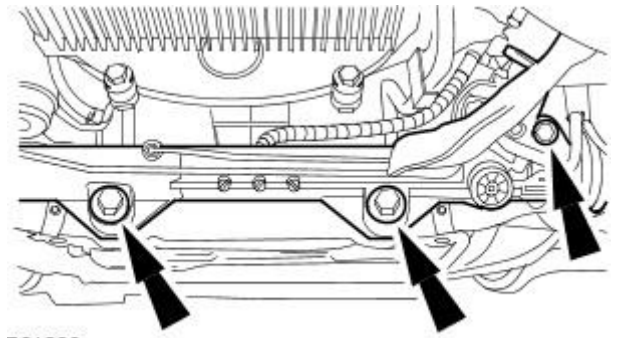
- Install a new clamp.



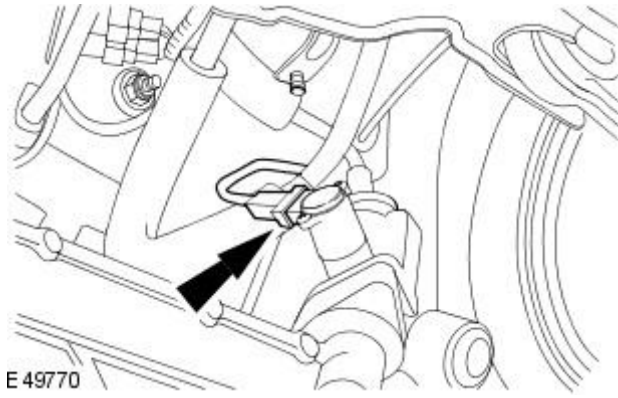
Left-hand drive vehicles

17. Attach the steering gear.

- Tighten to 100 Nm.

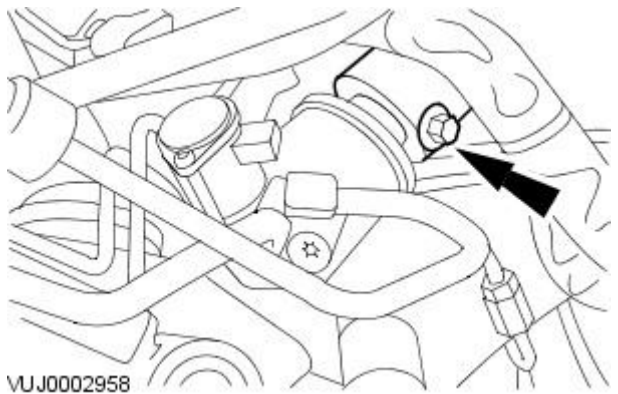


18. Connect the power steering control valve actuator electrical connector.



19. Install the steering gear shaft pinch bolt.

- Tighten to 35 Nm.



All vehicles

20. Install the LH catalytic converter.

For additional information, refer to: [Catalytic Converter](#) (309-00A Exhaust System - TDV6 2.7L Diesel, Removal and Installation).

21. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Fuel Charging and Controls - Turbocharger - TDV6 2.7L Diesel - Turbocharger RH

Removal and Installation

## Special Tool(s)

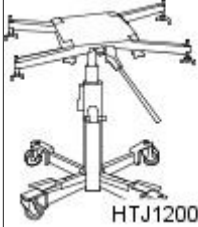
303-703



E95037

Accessory belt tensioner

303-703



HTJ1200-2


Power train assembly jack

HTJ1200-2

## Removal

All vehicles

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

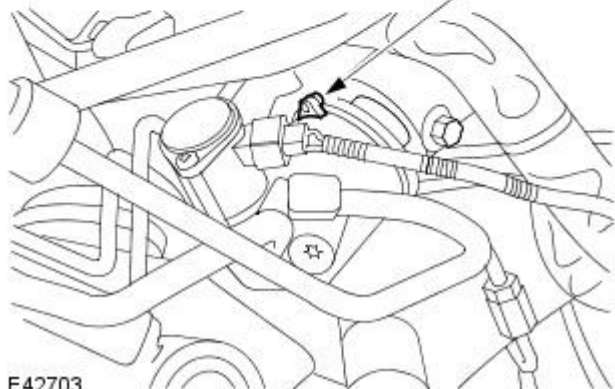
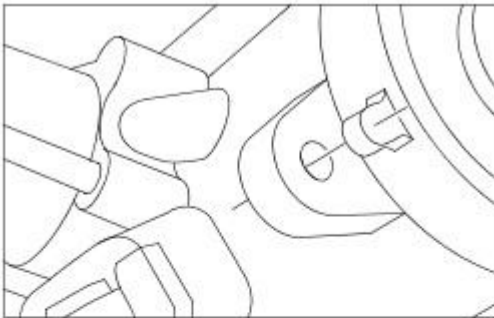
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.


3. Remove the RH catalytic converter.  
For additional information, refer to: [Catalytic Converter](#) (309-00A Exhaust System - TDV6 2.7L Diesel, Removal and Installation).

Right-hand drive vehicles

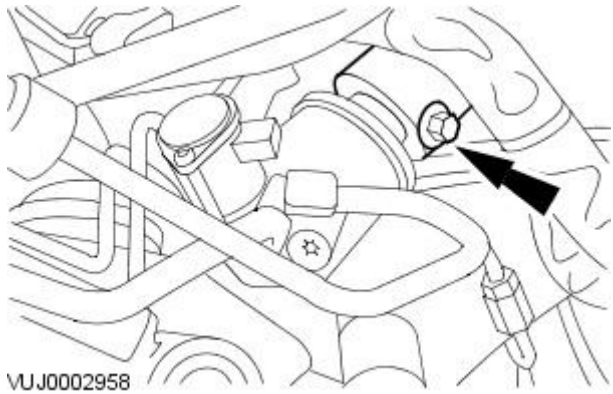
4. Make sure the alignment mark, on the steering gear pinion seal protection cover, is central to the steering gear pinion casting.



E42703

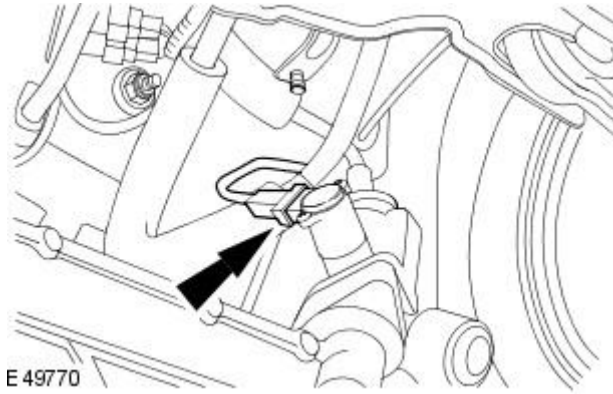
5.  CAUTION: Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

Remove the steering gear shaft pinch bolt.



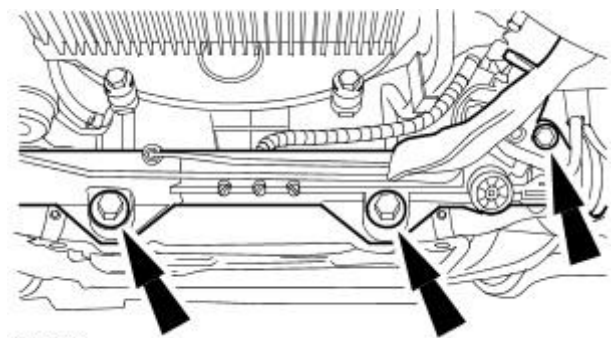
VUJ0002958

6. Disconnect the power steering control valve actuator electrical connector.



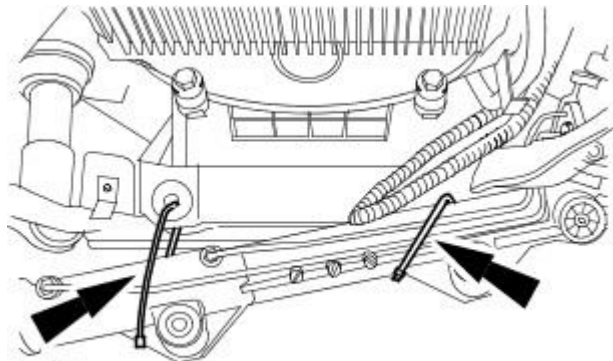
E 49770

7. Detach the steering gear.



E31036

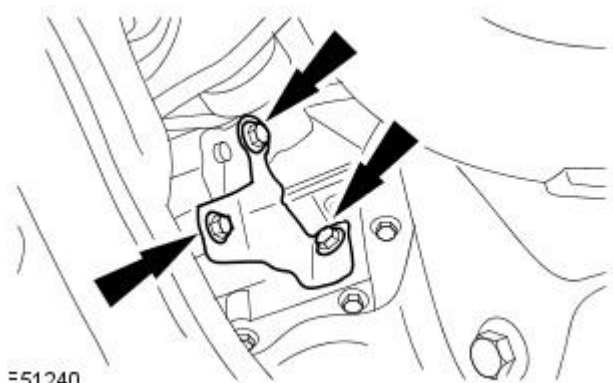
8. Support the steering gear.



E 31035

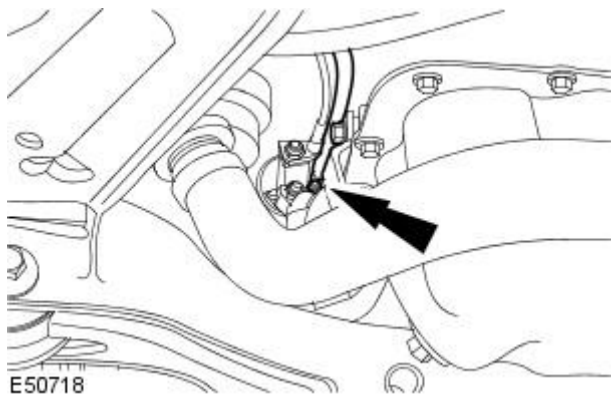
All vehicles

9. Remove the starter motor retaining bracket.

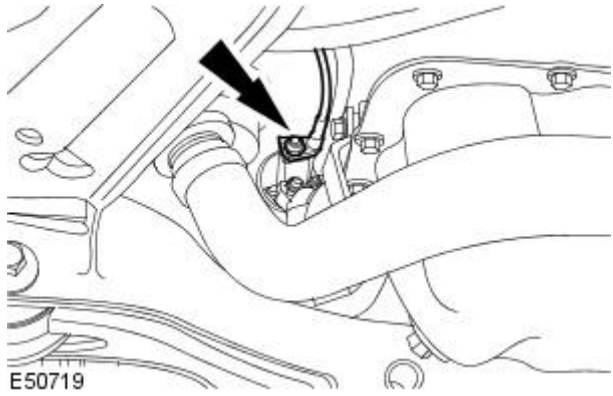


E51240

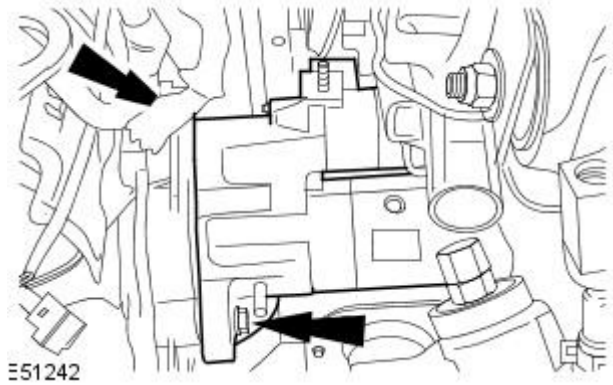
10. Detach the starter motor solenoid harness.



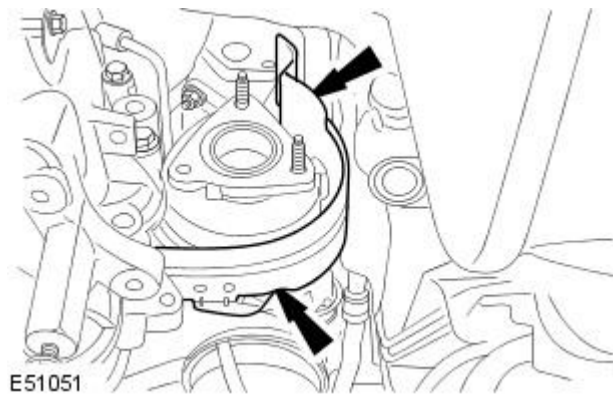
11. Detach the starter motor cable.



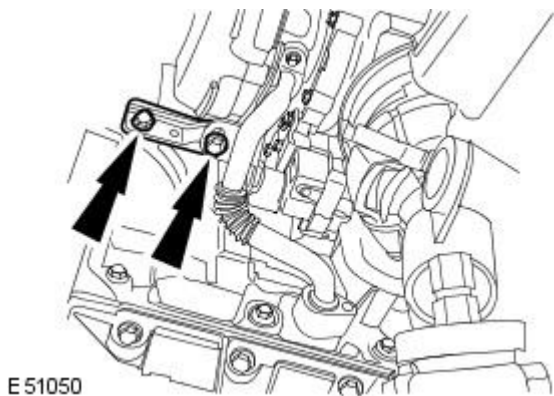
12. Remove the starter motor.



13. Remove the RH turbocharger heat shield.

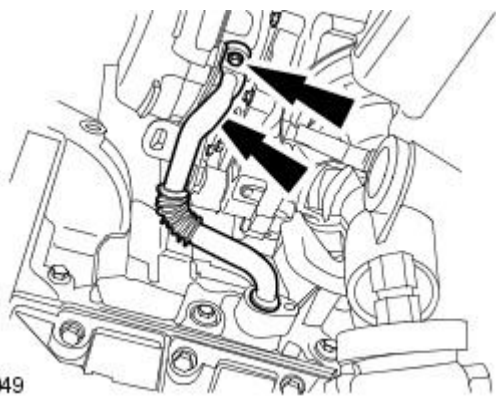


14. Remove the turbocharger support bracket.



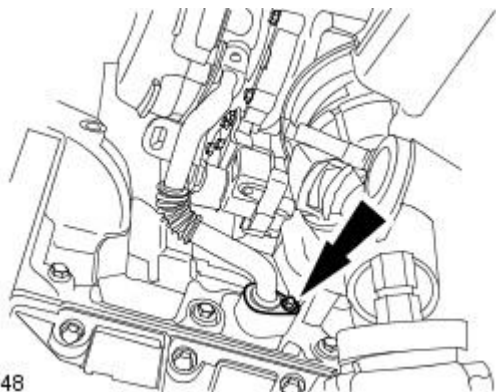
15. Release the RH turbocharger oil return tube.

- Remove and discard the gasket.



E51049

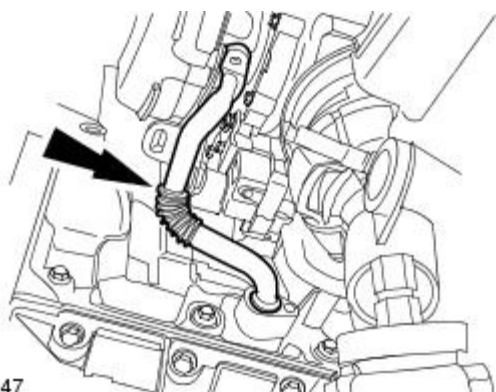
16. Remove the turbocharger oil return tube retaining bolt.



E51048

17. Remove the turbocharger oil return tube.

- Remove and discard the O-ring seal.

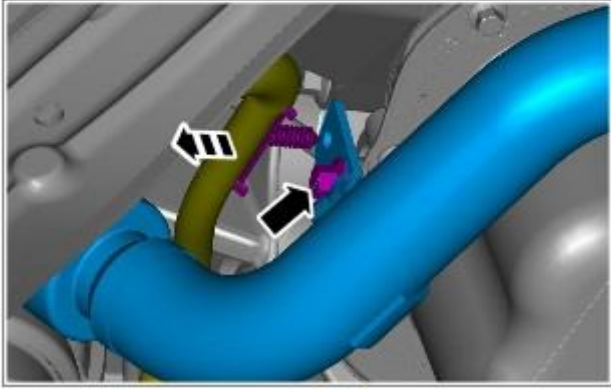
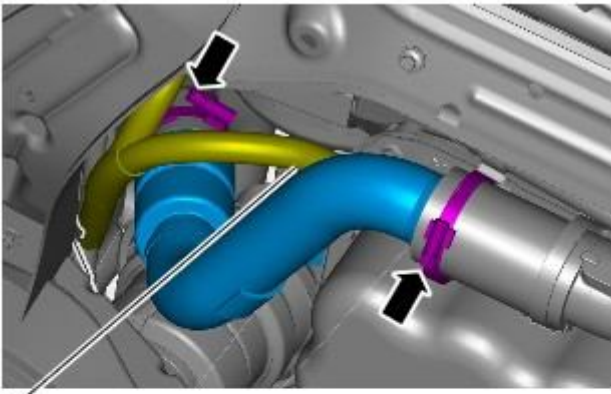


E51047



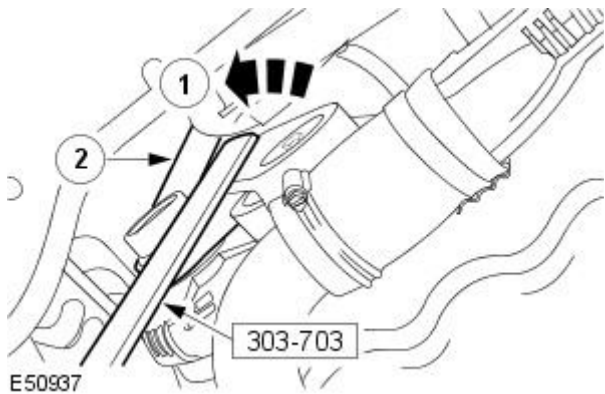
**18.** Remove the right-hand turbocharger outlet pipe.

- Remove the bolt.
- Release the turbocharger outlet pipe clip.
- Detach the wiring harness clip.



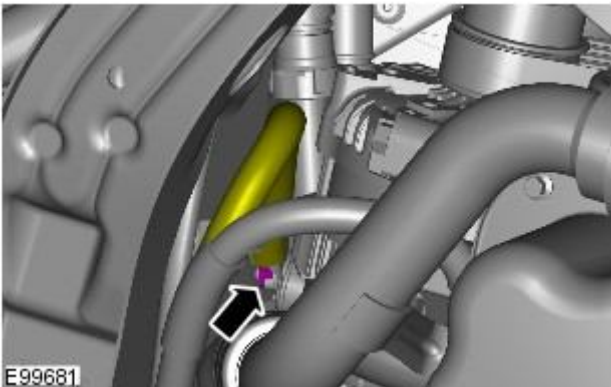
E98753

**19.** Release the accessory drive belt.



E50937

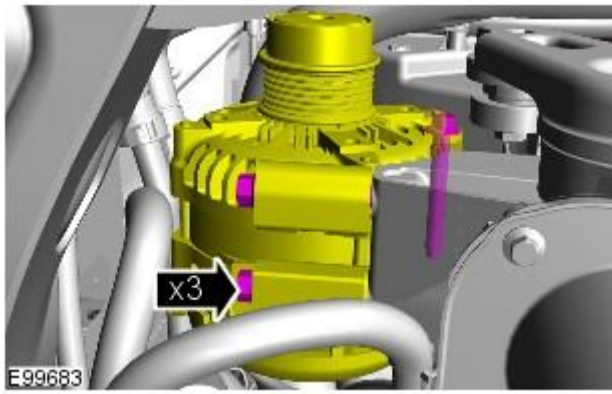
**20.** Disconnect the battery positive cable from the generator.



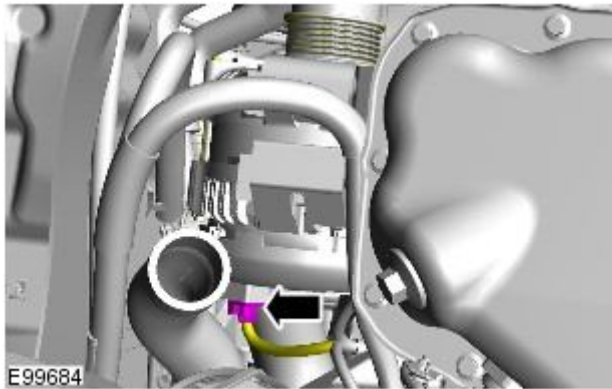
E99681



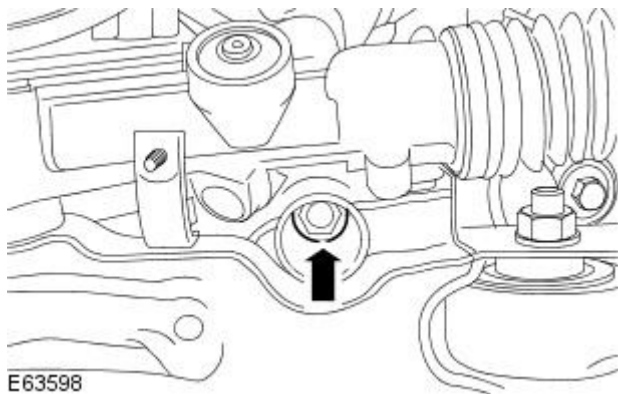
21. Release and reposition the generator.



22. Disconnect the generator electrical connector.



23. Detach the engine mount.

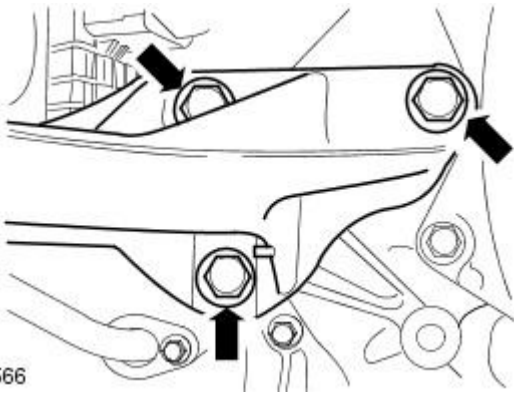


24. Using the special tool, raise and support the engine.

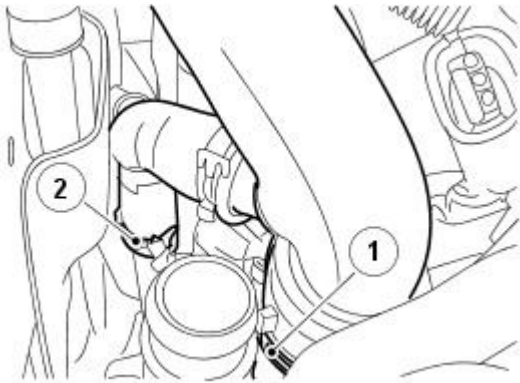
- Raise the RH side of the engine by approximately 15 mm.



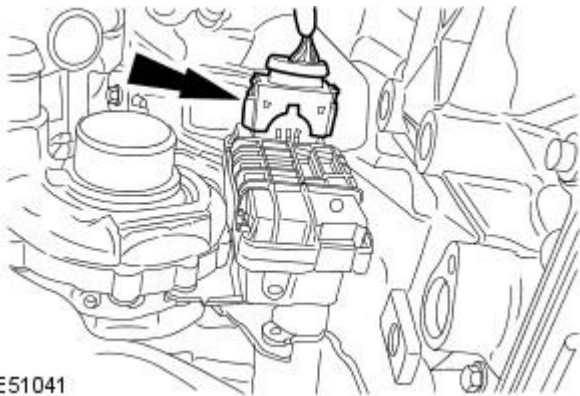
25. Release the engine mount bracket.




26. Release the RH turbocharger intake tube.



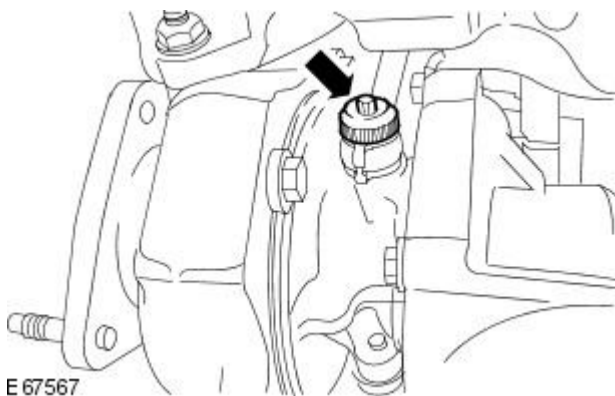
27. Disconnect the RH turbocharger electrical connector.



28.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

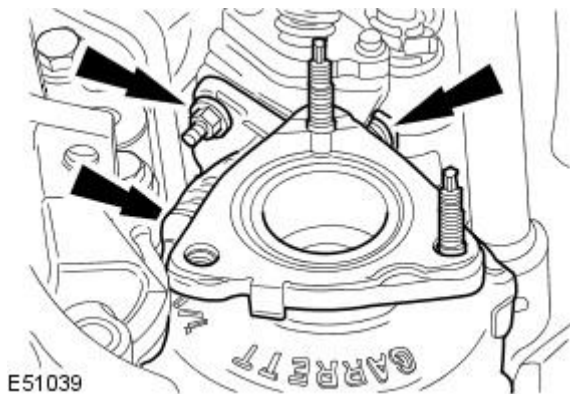
Disconnect the RH turbocharger oil supply pipe.

- Remove and discard the copper sealing washer.



29. Remove the RH turbocharger.

- Remove and discard the retaining nuts.
- Remove and discard the studs.

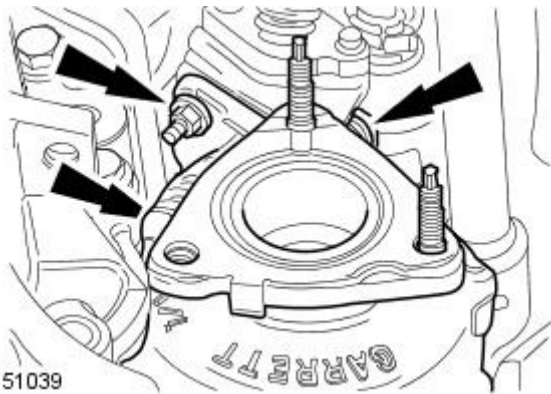


# Installation

All vehicles

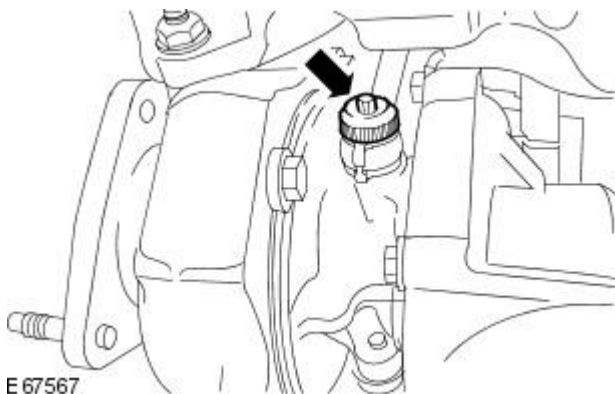
1. Install the RH turbocharger.

- Install new studs and nuts.
- Tighten to 23 Nm.

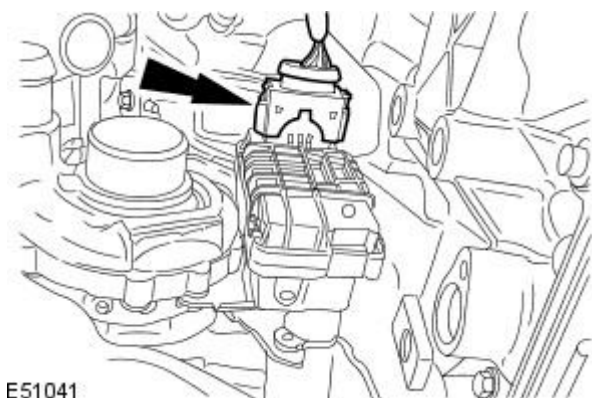


2. Connect the RH turbocharger oil supply pipe.

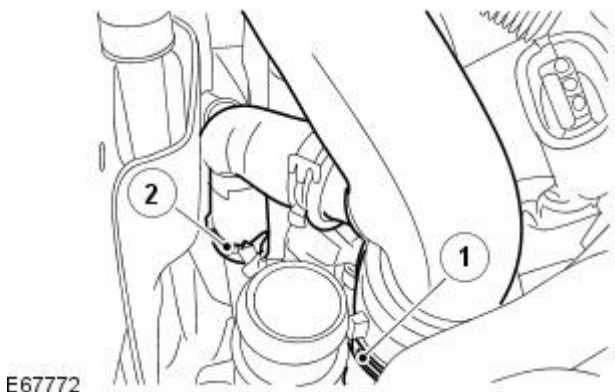
- Install a new copper sealing washer.
- Tighten to 30 Nm.



3. Connect the RH turbocharger electrical connector.

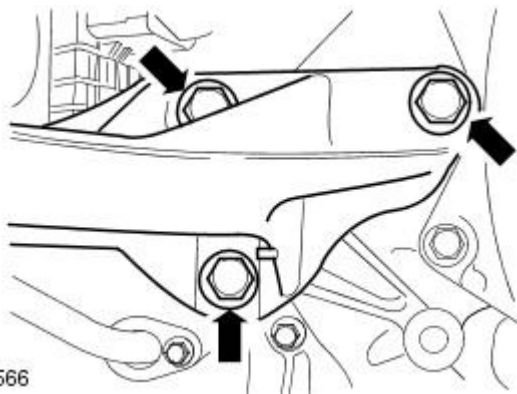


4. Secure the RH turbocharger intake tube.



5. Secure the engine mount bracket.

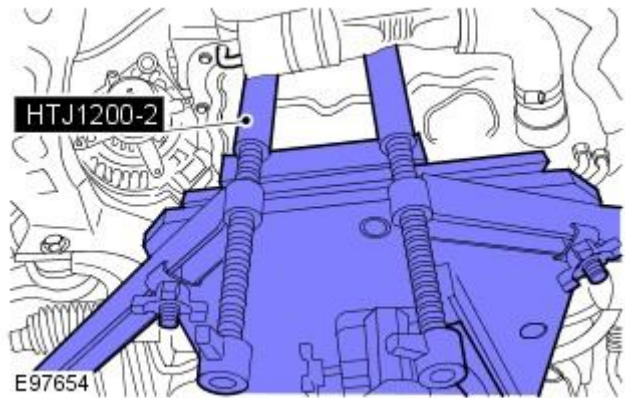
- Tighten to 90 Nm.



E67566

6. Using the special tools, lower the engine.

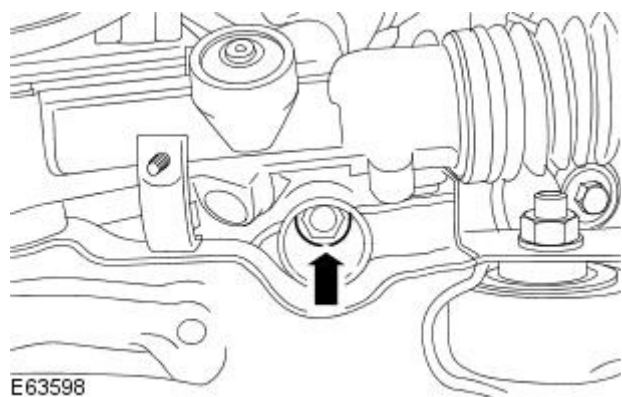
- Raise the RH side of the engine by approximately 15 mm.



E97654

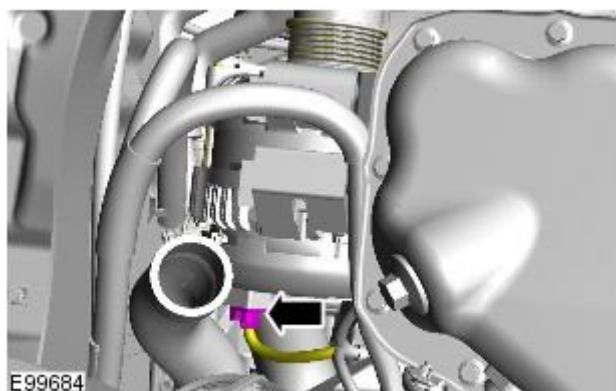
7. Attach the engine mount.

- Tighten to 63 Nm.



E63598

8. Connect the generator electrical connector.

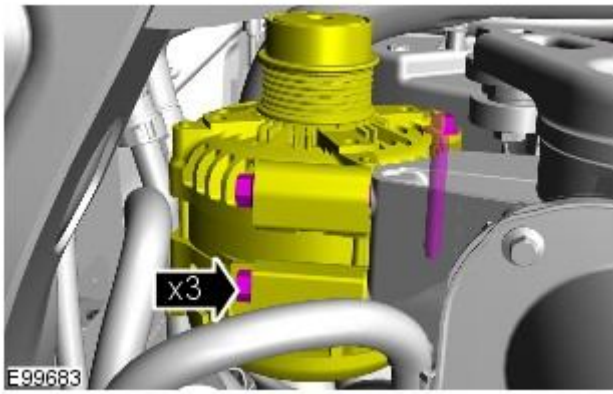


E99684



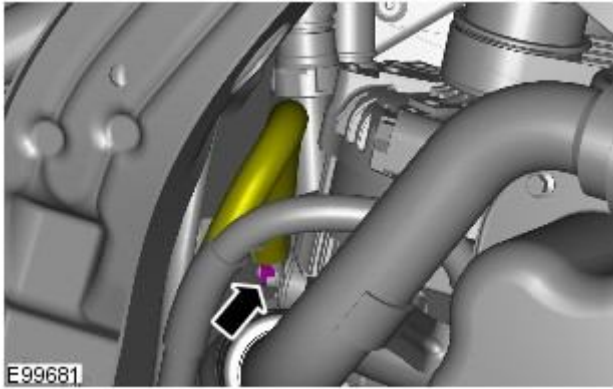
9. Secure the generator.

- Tighten to 47 Nm.

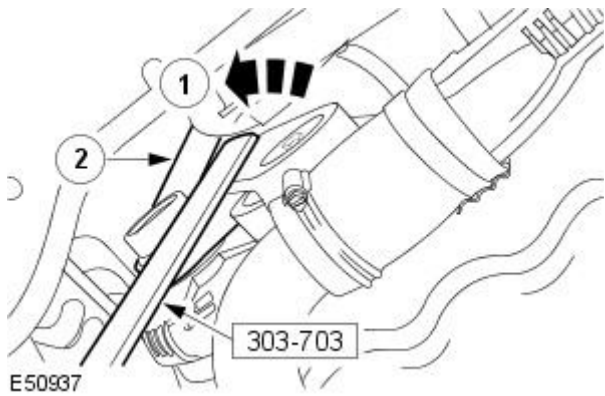


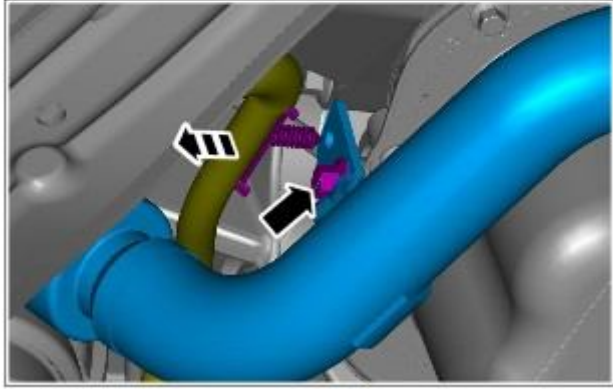
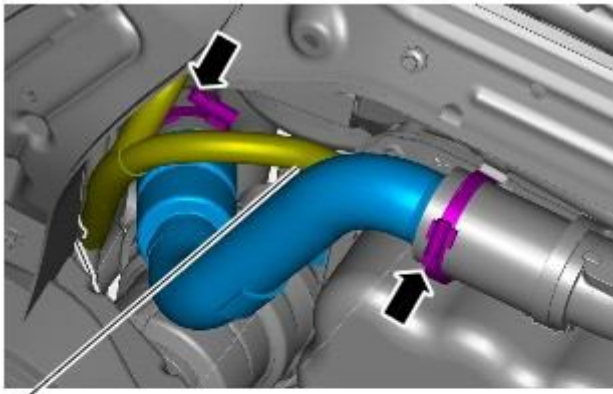
10. Connect the battery positive cable to the generator.

- Tighten to 20 Nm.



11. Attach the accessory drive belt.

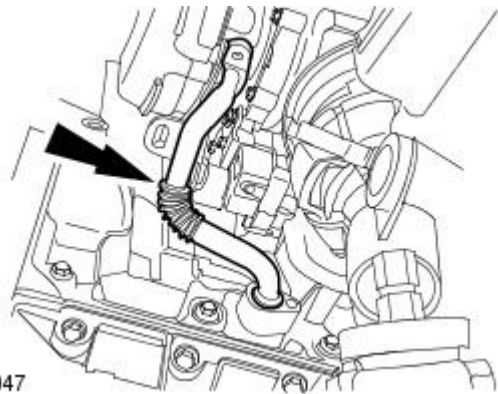




E98753

12. Install the right-hand turbocharger outlet pipe.

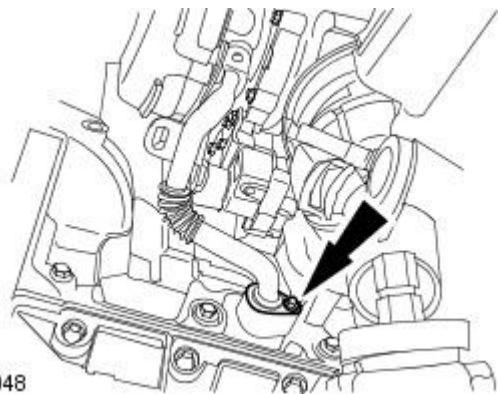
- Install the retaining bolt.
- Secure the turbocharger outlet pipe clip.
- Attach the wiring harness clip.



E 51047

13. Install the turbocharger oil return tube.

- Install a new O-ring seal.



E 51048

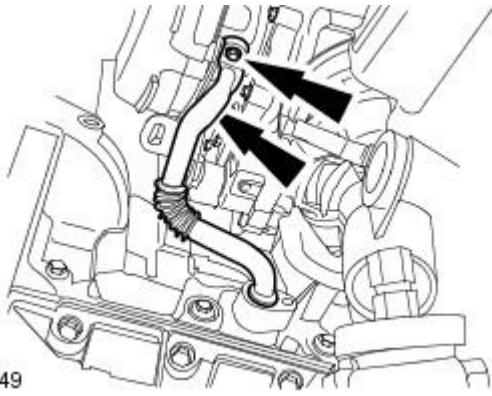
14. Install the turbocharger oil return tube retaining bolt.

- Tighten to 10 Nm.



15. Secure the RH turbocharger oil return tube.

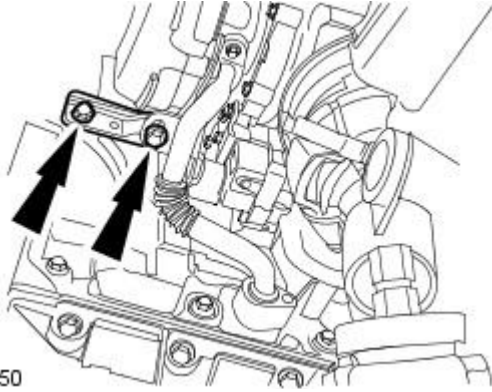
- Install a new gasket.
- Tighten to 10 Nm.



E51049

16. Install the RH turbocharger support bracket.

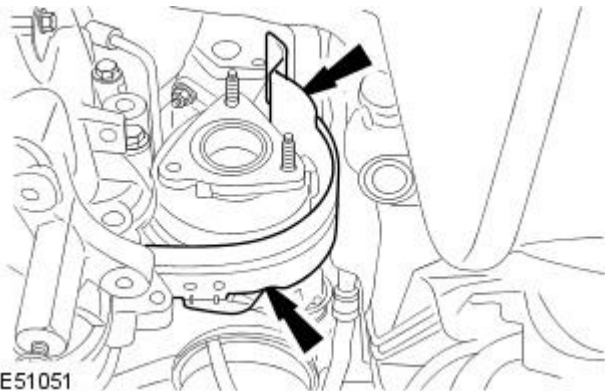
- Tighten to 35 Nm.



E 51050

17. Install the RH turbocharger heat shield.

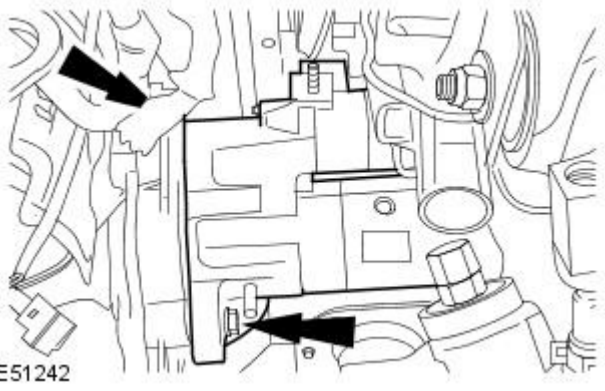
- Tighten to 10 Nm.



E51051

18. Install the starter motor.

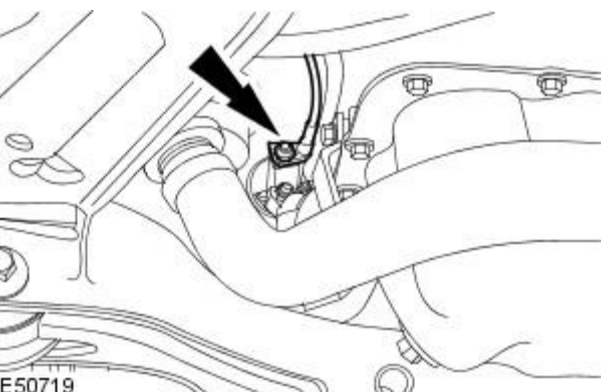
- Tighten to 48 Nm.



E51242

19. Attach the starter motor cable.

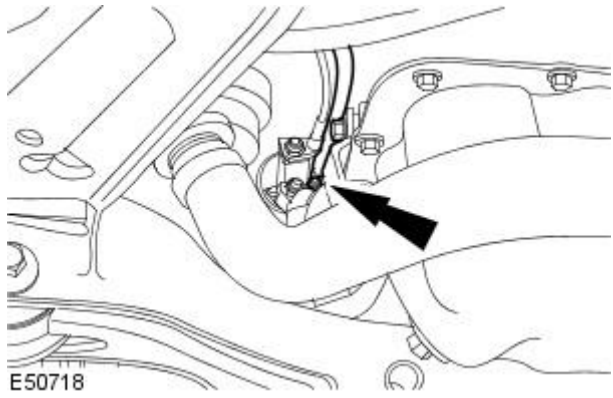
- Tighten to 10 Nm.



E50719

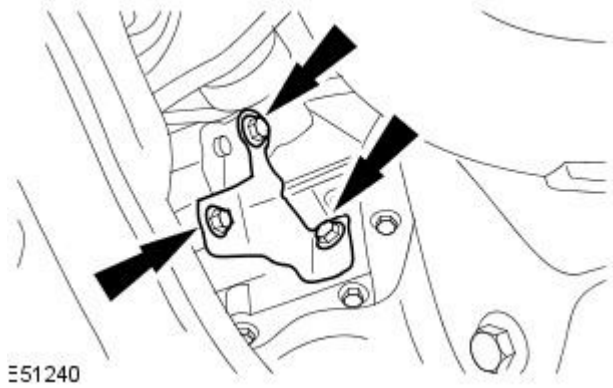
20. Attach the starter motor solenoid harness.

- Tighten to 7 Nm.



21. Install the starter motor support bracket.

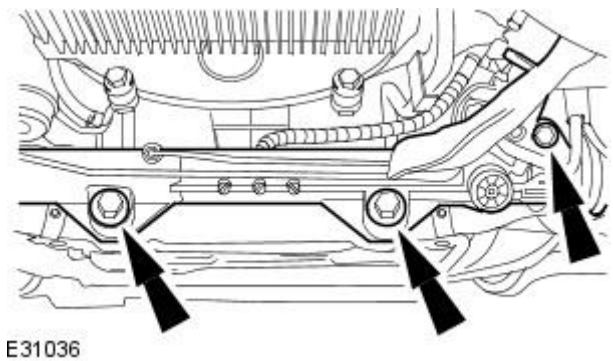
- Tighten to 23 Nm.



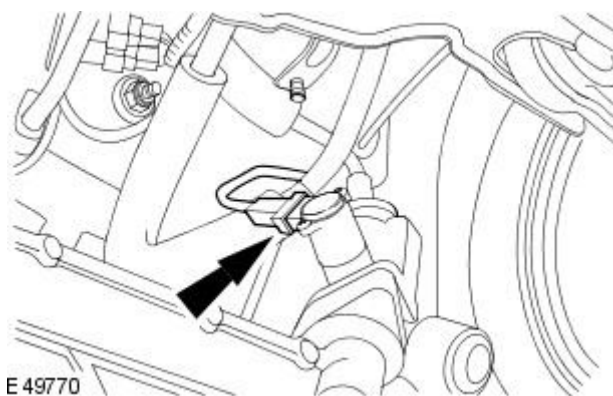
#### Right-hand drive vehicles

22. Attach the steering gear.

- Tighten to 100 Nm.

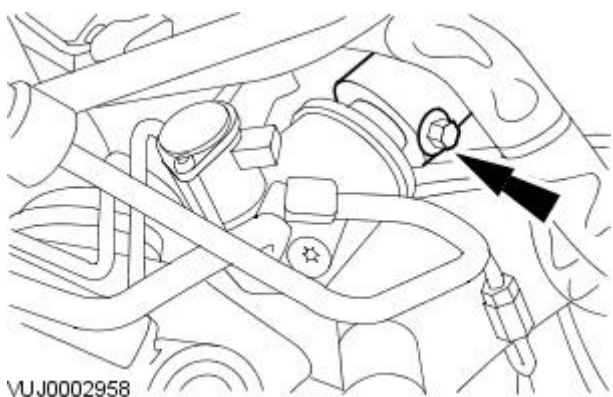


23. Connect the power steering control valve actuator electrical connector.



24. Install the steering gear shaft pinch bolt.

- Tighten to 35 Nm.



All vehicles

**25.** Install the RH catalytic converter.

For additional information, refer to: [Catalytic Converter](#) (309-00A Exhaust System - TDV6 2.7L Diesel, Removal and Installation).

**26.** Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

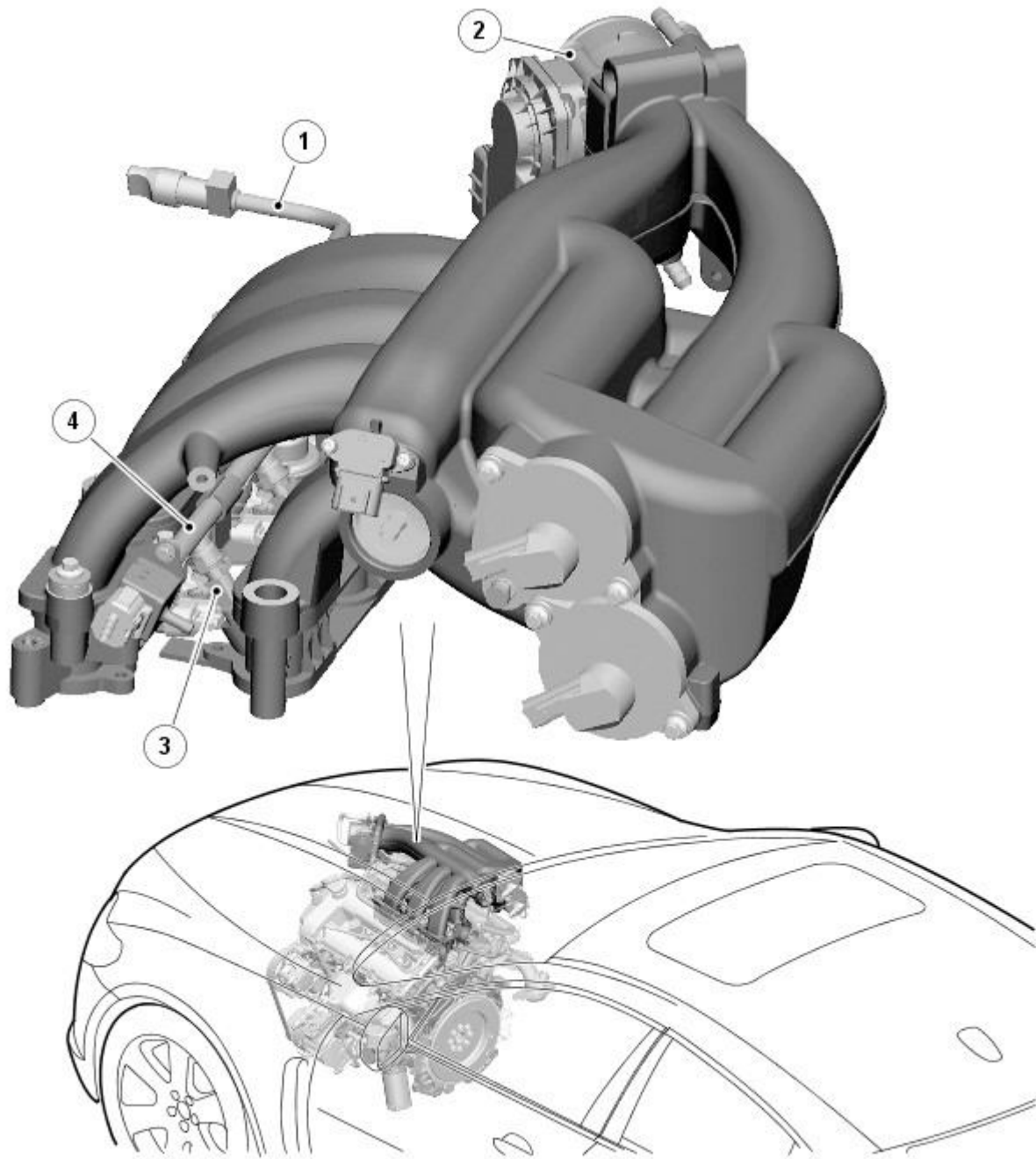
**Fuel Charging and Controls - V6 3.0L Petrol -**

Description	Nm	lb-ft	lb-in
Lower intake manifold retaining bolts	10	-	89
Fuel pressure regulator	4	-	35
Throttle body	10	-	89

# Fuel Charging and Controls - V6 3.0L Petrol - Fuel Charging and Controls - Component Location

Description and Operation

Component Location



E93966

## ItemDescription

- |   |                       |
|---|-----------------------|
| 1 | Fuel supply pipe      |
| 2 | Electric throttle     |
| 3 | Fuel injector (6 off) |
| 4 | Fuel rail             |

# Fuel Charging and Controls - V6 3.0L Petrol - Fuel Charging and Controls - Overview

Description and Operation

## Overview

The fuel charging and control system comprises a fuel pump, [FPDM \(fuel pump driver module\)](#), fuel rail and six fuel injectors. The fuel pump supplies fuel from the tank, via a pipe routed along the outside of the [LH \(left-hand\)](#) chassis box section, to the fuel rail. Refer to: [Fuel Tank and Lines](#) (310-01B Fuel Tank and Lines - V6 3.0L Petrol, Description and Operation).

The fuel rail distributes the fuel equally to each of the fuel injectors. The fuel injectors, which are controlled by the [ECM \(engine control module\)](#), are installed in the fuel rail positioned in the center of the air intake manifold. Refer to: [Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 3.0L Petrol, Description and Operation).



# Fuel Charging and Controls - V6 3.0L Petrol - Fuel Charging and Controls - System Operation and Component Description

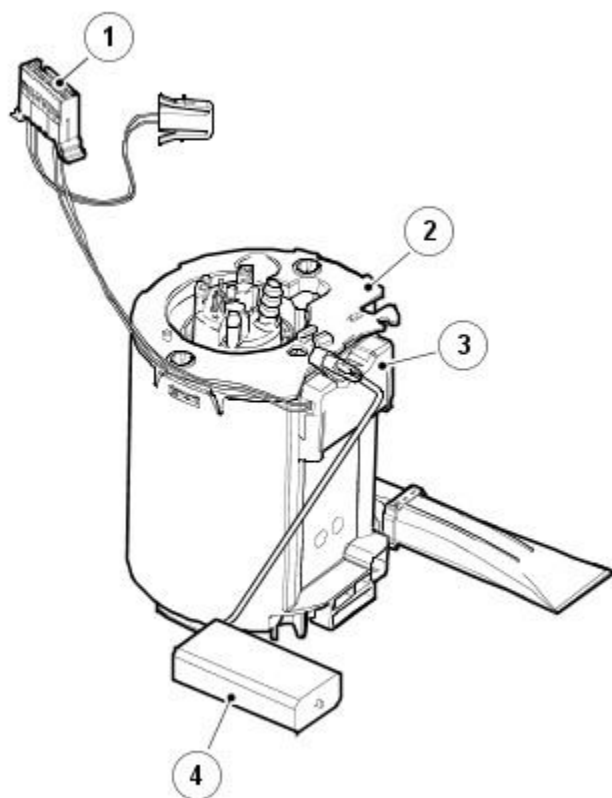
Description and Operation

## System Operation

Operation of the fuel charging and control system is controlled by the [ECM \(engine control module\)](#). Refer to: [Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 3.0L Petrol, Description and Operation).

## Component Description

### Fuel Pump



E74571

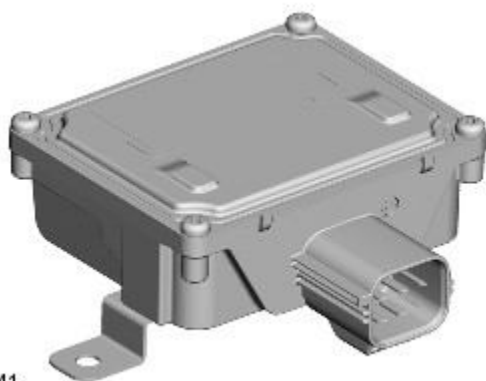
#### ItemDescription

1	Electrical connector
2	Fuel pump module
3	Fuel level sensor
4	Fuel level float

The fuel pump module is mounted in the [RH \(right-hand\)](#) side of the fuel tank and delivers fuel at variable flow and pressure to the fuel rail, which supplies fuel to all fuel injectors. The fuel pump operation is regulated by the [FPDM \(fuel pump driver module\)](#), which is controlled by the [ECM](#).

Refer to: [Fuel Tank and Lines](#) (310-01A Fuel Tank and Lines - TDV6 2.7L Diesel, Description and Operation).

### Fuel Pump Driver Module



E99541

The [FPDM](#) is used to control the speed of the fuel pump based upon the fuel demand of the engine. The [ECM](#) controls the [FPDM](#) in response to inputs from the [FRP \(fuel rail pressure\)](#) sensor, [MAP \(manifold absolute pressure\)](#) sensor, [MAF \(mass air flow\)](#) sensor and the [IAT \(intake air temperature\)](#) sensor. The [FPDM](#) is attached to the [RH](#) end of the evaporative emission canister, which is installed on the underside of the center floor pan, above the rear stabilizer bar.

The [ECM](#) sends a [PWM \(pulse width modulation\)](#) signal to the [FPDM](#). The frequency of the signal determines the duty cycle of the pump. The

[PWM](#) signal to the pump represents half the ON time of the pump. If the [ECM](#) transmits a 50% ON time, this drives the pump at 100%. If the [ECM](#) transmits a 5% ON time, the [FPDM](#) drives the pump at 10%. The [FPDM](#) will only turn the fuel pump ON if it receives a valid signal between 4% and 50%. To turn the fuel pump OFF, the [ECM](#) transmits a duty cycle signal of 75%.

The status of the [FPDM](#) is monitored by the [ECM](#). Any errors can be retrieved from the [ECM](#) using the Jaguar approved diagnostic system. The [FPDM](#) cannot be interrogated for diagnostic purposes.

## Fuel Injectors

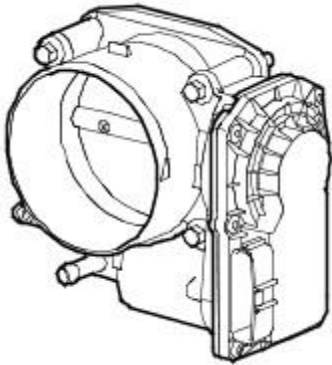


E47305

Six fuel injectors are installed in the fuel rail. Two O-rings seal each injector to the fuel rail. The fuel jets from the injectors are directed onto the back of the intake valves.

The injectors are electromagnetic solenoid valves controlled by the [ECM](#). Each injector contains a solenoid-operated needle valve, which is closed while the solenoid winding is de-energized. The solenoid winding is connected to a power feed from the main relay and to an earth through the [ECM](#). The [ECM](#) switches the earth to control the opening and closing of the needle valve. While the needle valve is open, fuel is sprayed into the cylinder intake tract onto the back of the intake valves. The [ECM](#) meters the amount of fuel injected by adjusting the time that the needle valve is open.

## Electric Throttle



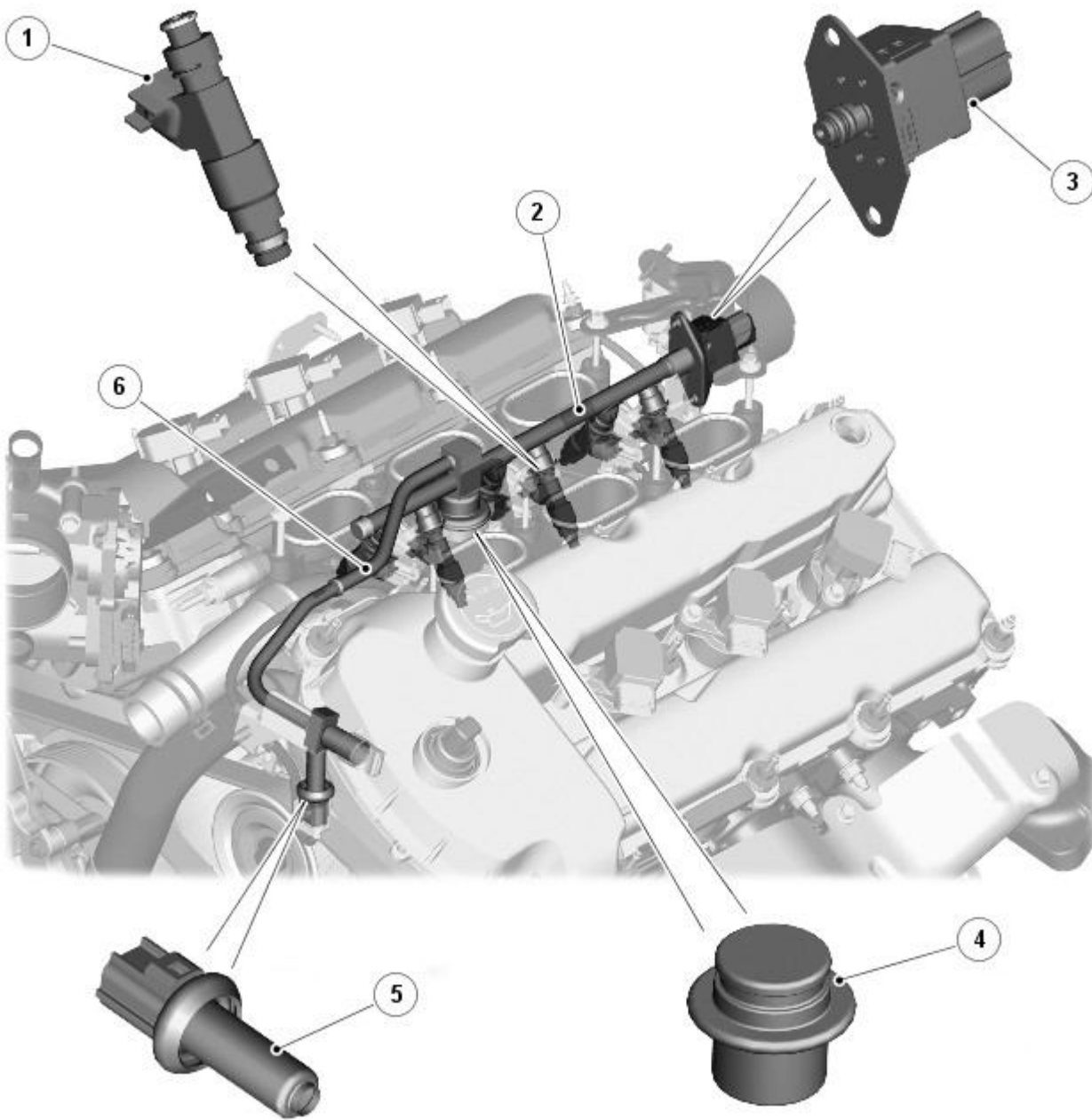
E47298

The electric throttle controls the engine torque and is located on the air intake manifold at the front of the engine. The main components are an electric throttle control valve, an [APP \(accelerator pedal position\)](#) sensor and the [ECM](#).

The [APP](#) sensor determines the driver demand to control throttle opening. This value is received by the [ECM](#) and the throttle is then opened to the correct angle by means of an integral electric motor. Sensors in the throttle body are used to determine the position of the throttle plate and the rate of change in its angle.

Refer to: [Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 3.0L Petrol, Description and Operation).

## Fuel Rail



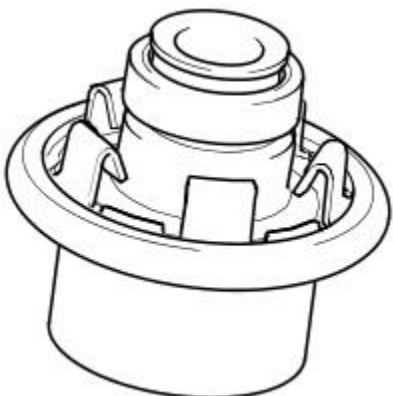
E93967

**ItemDescription**

1	Fuel injector
2	Fuel rail
3	<a href="#">FRP</a> sensor
4	Fuel rail pressure damper
5	Fuel temperature sensor
6	Fuel supply pipe

The fuel rail maintains a fuel pressure of typically 4.5 bar (65 lbf/in<sup>2</sup>), however, this pressure will vary depending on engine requirements; lower at idle, higher at full load. Three fuel injectors are installed in each cylinder head and are connected to the fuel rail. O-ring seals are used to seal the injectors to the fuel rail.

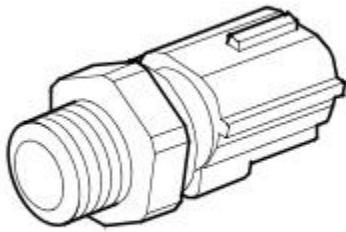
**Fuel Pressure Damper**



E74573

A fuel pressure damper is attached to the fuel rail. The damper acts to damp pressure pulses from the fuel pump.

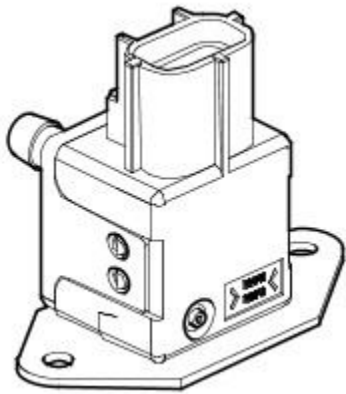
## Fuel Temperature Sensor



E47606

The fuel temperature sensor is located in the fuel supply pipe at the front of the engine. The sensor is an [NTC \(negative temperature coefficient\)](#) sensor, which is connected to the [ECM](#) by two wires.  
Refer to: [Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 3.0L Petrol, Description and Operation).

## Fuel Rail Pressure Sensor



E58945

The [FRP](#) sensor continuously monitors the fuel pressure in the fuel rail. This value is used by the [ECM](#) to calculate the injector pulse-width required to deliver the correct mass of fuel per injection. The [ECM](#) also uses this information to demand a specific fuel flow-rate from the fuel pump via the [FPDM](#).  
Refer to: [Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 3.0L Petrol, Description and Operation).

# Fuel Charging and Controls - V6 3.0L Petrol - Fuel Charging and Controls

Diagnosis and Testing

## Principles of Operation

For a detailed description of the petrol engine fuel charging and controls system, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

- [Fuel Charging and Controls](#) (303-04C Fuel Charging and Controls - V6 3.0L Petrol, Description and Operation),
- [Fuel Charging and Controls](#) (303-04C Fuel Charging and Controls - V6 3.0L Petrol, Description and Operation),
- [Fuel Charging and Controls](#) (303-04C Fuel Charging and Controls - V6 3.0L Petrol, Description and Operation),
- [Fuel Charging and Controls](#) (303-04D Fuel Charging and Controls - V8 4.2L Petrol, Description and Operation),
- [Fuel Charging and Controls](#) (303-04D Fuel Charging and Controls - V8 4.2L Petrol, Description and Operation),
- [Fuel Charging and Controls](#) (303-04D Fuel Charging and Controls - V8 4.2L Petrol, Description and Operation),
- [Fuel Charging and Controls](#) (303-04E Fuel Charging and Controls - V8 S/C 4.2L Petrol, Description and Operation),
- [Fuel Charging and Controls](#) (303-04E Fuel Charging and Controls - V8 S/C 4.2L Petrol, Description and Operation),
- [Fuel Charging and Controls](#) (303-04E Fuel Charging and Controls - V8 S/C 4.2L Petrol, Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Fuel level</li> <li>● Fuel leaks</li> <li>● Damaged fuel lines</li> <li>● Damaged push connect fittings</li> <li>● Fuel contamination/grade/quality</li> <li>● Throttle body</li> <li>● Damaged fuel tank filler pipe cap</li> <li>● Damaged fuel tank filler pipe</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Loose or corroded electrical connectors</li> <li>● Harnesses</li> <li>● Sensor(s)</li> <li>● Engine Control Module (ECM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident and there are clear symptoms refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	<ul style="list-style-type: none"> <li>● Engine breather system disconnected/restricted</li> <li>● Ignition system</li> <li>● Fuel system</li> <li>● Electronic engine control</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed. Check for ignition system, fuel system and electronic engine control DTCs and refer to the relevant DTC Index
Engine cranks and fires, but will not start	<ul style="list-style-type: none"> <li>● Evaporative emissions purge valve</li> <li>● Fuel pump</li> <li>● Spark plugs</li> <li>● HT short to ground (tracking) check rubber boots for cracks/damage</li> <li>● Ignition system</li> </ul>	Check for evaporative emissions, fuel system and ignition system related DTCs and refer to the relevant DTC Index
Difficult cold start	<ul style="list-style-type: none"> <li>● Engine coolant level/anti-freeze content</li> <li>● Battery</li> <li>● Electronic engine controls</li> <li>● Exhaust Gas Recirculation (EGR) valve stuck open</li> <li>● Fuel pump</li> <li>● Purge valve</li> </ul>	Check the engine coolant level and condition. Ensure the battery is in a fully charged and serviceable condition. Check for electronic engine controls, engine emissions, fuel system and evaporative emissions system related DTCs and refer to the relevant DTC Index
Difficult hot start	<ul style="list-style-type: none"> <li>● Injector leak</li> <li>● Electronic engine control</li> <li>● Purge valve</li> <li>● Fuel pump</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> </ul>	Check for injector leak, install new injector as required. Check for electronic engine controls, evaporative emissions, fuel system, ignition system and engine emission system related DTCs and refer to the relevant DTC Index
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	<ul style="list-style-type: none"> <li>● Injector leak</li> <li>● Electronic engine control</li> <li>● Purge valve</li> <li>● Fuel pump</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> </ul>	Check for injector leak, install new injector as required. Check for electronic engine controls, evaporative emissions, fuel system, ignition system and engine emission system related DTCs and refer to the relevant DTC Index

Symptom	Possible Cause	Action
Engine stalls soon after start	<ul style="list-style-type: none"> <li>Breather system disconnected/restricted</li> <li>ECM relay</li> <li>Electronic engine control</li> <li>Ignition system</li> <li>Air intake system restricted</li> <li>Air leakage</li> <li>Fuel lines</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed. Check for electronic engine control, ignition system and fuel system related DTCs and refer to the relevant DTC Index. Check for blockage in air filter element and air intake system. Check for air leakage in air intake system
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> <li>Fuel pressure, fuel pump, fuel lines</li> <li>Injector leak</li> <li>Air leakage</li> <li>Electronic engine control</li> <li>Throttle motor</li> <li>Restricted accelerator pedal travel (carpet, etc)</li> <li>Ignition system</li> <li>EGR valve stuck open</li> <li>Transmission malfunction</li> </ul>	Check for fuel system related DTCs and refer to the relevant DTC Index. Check for injector leak, install new injector as required. Check for air leakage in air intake system. Ensure accelerator pedal is free from restriction. Check for electronic engine controls, ignition, engine emission system and transmission related DTCs and refer to the relevant DTC Index
Engine backfires	<ul style="list-style-type: none"> <li>Fuel pump/lines</li> <li>Air leakage</li> <li>Electronic engine controls</li> <li>Ignition system</li> <li>Sticking variable camshaft timing (VCT) hub</li> </ul>	Check for fuel system failures. Check for air leakage in intake air system. Check for electronic engine controls, ignition system and VCT system related DTCs and refer to the relevant DTC Index
Engine surges	<ul style="list-style-type: none"> <li>Fuel pump/lines</li> <li>Electronic engine controls</li> <li>Throttle motor</li> <li>Ignition system</li> </ul>	Check for fuel system failures. Check for electronic engine controls, throttle system and ignition system related DTCs and refer to the relevant DTC Index
Engine detonates/knocks	<ul style="list-style-type: none"> <li>Fuel pump/lines</li> <li>Air leakage</li> <li>Electronic engine controls</li> <li>Sticking VCT hub</li> </ul>	Check for fuel system failures. Check for air leakage in intake air system. Check for electronic engine controls and VCT system related DTCs and refer to the relevant DTC Index
No throttle response	<ul style="list-style-type: none"> <li>Electronic engine controls</li> <li>Throttle motor</li> </ul>	Check for electronic engine controls and throttle system related DTCs and refer to the relevant DTC Index
Poor throttle response	<ul style="list-style-type: none"> <li>Breather system disconnected/restricted</li> <li>Electronic engine control</li> <li>Transmission malfunction</li> <li>Traction control event</li> <li>Air leakage</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed. Check for electronic engine controls, transmission and traction control related DTCs and refer to the related DTC Index. Check for air leakage in intake air system

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• NOTE: If the control module/component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines that involve pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P008700	Fuel Rail/System Pressure - Too Low	<ul style="list-style-type: none"> <li>Fuel rail pressure (Fuel rail pressure) sensor, sensing circuit - short to ground, open circuit</li> <li>Fuel rail pressure sensor supply circuit - high resistance</li> <li>Fuel rail pressure sensor failure</li> <li>Fuel pump failure</li> <li>Fuel line leak, restriction</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Fuel rail pressure sensor circuits for short to ground, open circuit, high resistance. Check and install a new Fuel rail pressure sensor as required. Check fuel system for failure
P008800	Fuel Rail/System Pressure - Too High	<ul style="list-style-type: none"> <li>Fuel rail pressure sensor supply/sensing circuits - short to each other</li> <li>Fuel rail pressure sensor sensing circuit - short to power</li> <li>Fuel rail pressure sensor ground circuit - high</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Fuel rail pressure sensor circuits for short to each other, power, open circuit, high resistance. Check and install a new Fuel rail pressure sensor as required. Check fuel system for failure



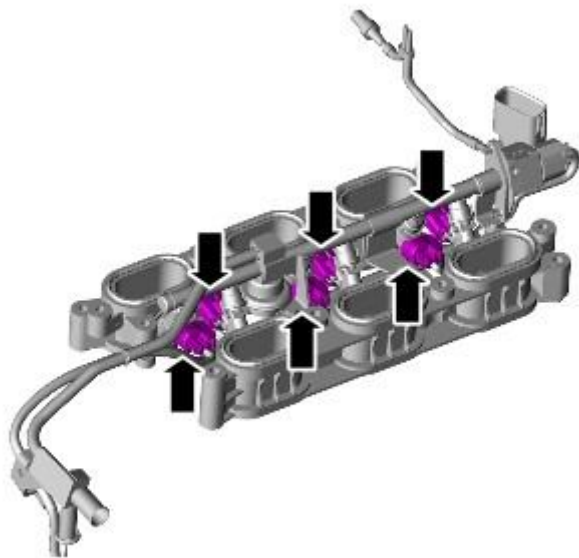
DTC	Description	Possible Cause	Action
		<ul style="list-style-type: none"> <li>resistance</li> <li>● Fuel rail pressure sensor failure</li> <li>● Restricted fuel line</li> <li>● Fuel pump short circuit to power</li> </ul>	
P017100	System too lean (bank 1)	<ul style="list-style-type: none"> <li>● Air intake leak between MAF sensor and cylinder head</li> <li>● Fuel filter, injector, system restriction</li> <li>● MAF sensor fault (low intake air flow)</li> <li>● Exhaust leak (forward of catalytic converter)</li> </ul>	Check for leak from air intake system. Check for fuel system blockage/restriction. Check for additional MAF sensor related DTCs and refer to relevant DTC Index. Check and rectify any exhaust leak prior to catalytic converter
P017200	System Too Rich (Bank 1)	<ul style="list-style-type: none"> <li>● Restricted air cleaner</li> <li>● Leaking fuel injector(s)</li> <li>● Engine oil contaminated with fuel (too many cold starts with vehicle subsequently not getting hot enough for long enough)</li> <li>● MAF sensor fault (high intake air flow)</li> </ul>	Check air cleaner element is free from restriction. Check for leaking injectors, install new injector(s) as required. Check for contaminated engine oil, drain and refill engine oil as required. Check for additional MAF sensor related DTCs and refer to relevant DTC Index
P017400	System Too Lean (Bank 2)	<ul style="list-style-type: none"> <li>● Air intake leak between MAF sensor and cylinder head</li> <li>● Fuel filter, injector, system restriction</li> <li>● MAF sensor fault (low intake air flow)</li> <li>● Exhaust leak (forward of catalytic converter)</li> </ul>	Check for leak from air intake system. Check for fuel system blockage/restriction. Check for additional MAF sensor related DTCs and refer to relevant DTC Index. Check and rectify any exhaust leak prior to catalytic converter
P017500	System Too Rich (Bank 2)	<ul style="list-style-type: none"> <li>● Restricted air cleaner</li> <li>● Leaking fuel injector(s)</li> <li>● Engine oil contaminated with fuel (too many cold starts with vehicle subsequently not getting hot enough for long enough)</li> <li>● MAF sensor fault (high intake air flow)</li> </ul>	Check air cleaner element is free from restriction. Check for leaking injectors, install new injector(s) as required. Check for contaminated engine oil, drain and refill engine oil as required. Check for additional MAF sensor related DTCs and refer to relevant DTC Index
P018123	Fuel Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Fuel temperature sensor sensing circuit - short to ground, short to power, high resistance</li> <li>● Fuel temperature sensor ground circuit - high resistance</li> <li>● Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P018124	Fuel Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Fuel temperature sensor sensing circuit - short to ground, short to power, high resistance</li> <li>● Fuel temperature sensor ground circuit - high resistance</li> <li>● Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P018129	Fuel Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Fuel temperature sensor sensing circuit - short to ground, short to power, high resistance</li> <li>● Fuel temperature sensor ground circuit - high resistance</li> <li>● Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P018200	Fuel Temperature Sensor A Circuit Low	<ul style="list-style-type: none"> <li>● Fuel temperature sensor sensing circuit - short to ground</li> <li>● Fuel temperature sensor ground circuit - short circuit</li> <li>● Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P018300	Fuel Temperature Sensor A Circuit High	<ul style="list-style-type: none"> <li>● Fuel temperature sensor sensing circuit - short to power, high resistance, disconnected</li> <li>● Fuel temperature sensor ground circuit - high resistance</li> <li>● Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required

# Fuel Charging and Controls - V6 3.0L Petrol - Fuel Charging Wiring Harness

Removal and Installation

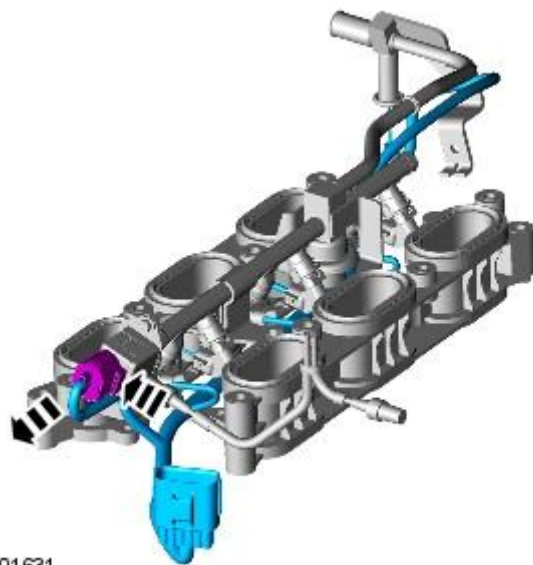
## Removal

1. Remove the lower intake manifold.  
For additional information, refer to: [Lower Intake Manifold](#) (303-01B Engine - V6 3.0L Petrol, Removal and Installation).
2. Disconnect the 6 fuel injector electrical connectors.



E101630

3. Disconnect the fuel rail pressure (FRP) sensor electrical connector.



E101631

## Installation

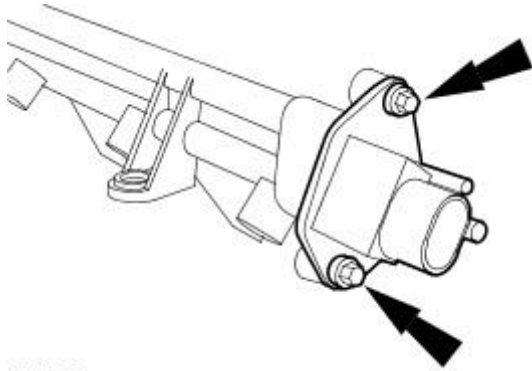
1. To install, reverse the removal procedure.

# Fuel Charging and Controls - V6 3.0L Petrol - Fuel Injection Supply Manifold

Removal and Installation

## Removal

1. Remove the fuel injectors.  
For additional information, refer to [Fuel Injectors](#) in this section.
2. Remove the fuel pressure regulator.
  - Remove and discard the O-ring seals.



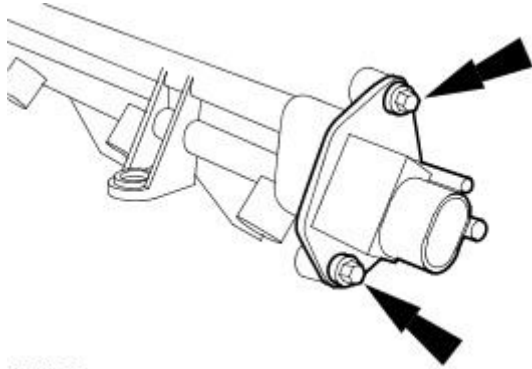
E31166

## Installation

1. **NOTE:** Install new O-ring seals.

To install, reverse the removal procedure.

- Tighten to 10 Nm.



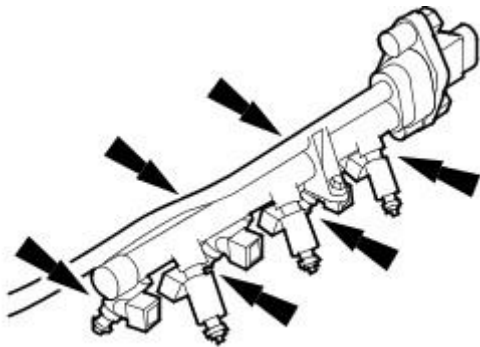
E31166

# Fuel Charging and Controls - V6 3.0L Petrol - Fuel Injectors

Removal and Installation

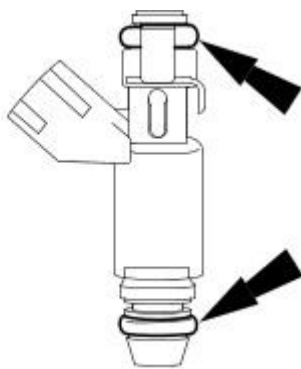
## Removal

1. Remove the fuel charging wiring harness.  
For additional information, refer to [Fuel Charging Wiring Harness](#) in this section.
2. Remove the fuel injectors.
  - Remove the fuel injector locating clips.



VUJ0003076

3. Remove and discard the O-ring seals.



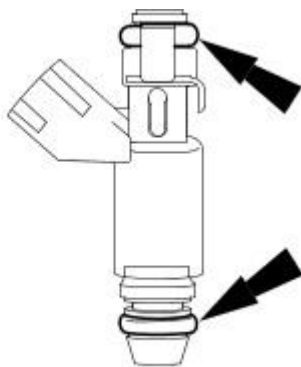
E31162

## Installation

1. **NOTE:** Install new fuel injector O-ring seals.

To install, reverse the removal procedure.

- Lubricate the fuel injector O-ring seals with clean engine oil.



E31162

# Fuel Charging and Controls - V6 3.0L Petrol - Fuel Pressure Regulator

Removal and Installation

## Removal

1. Remove the lower intake manifold.  
For additional information, refer to: [Lower Intake Manifold](#) (303-01B Engine - V6 3.0L Petrol, Removal and Installation).


## Installation

1. To install, reverse the removal procedure.

# Fuel Charging and Controls - V6 3.0L Petrol - Throttle Body

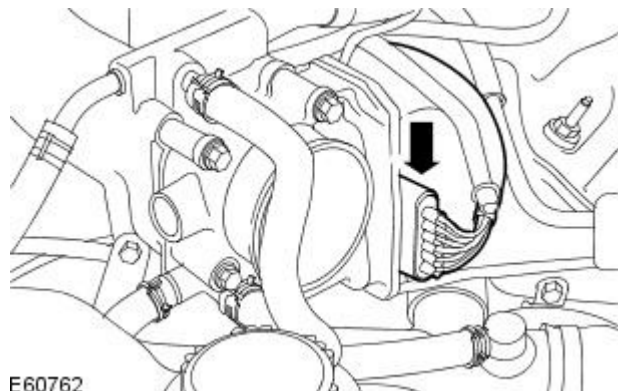
Removal and Installation

## Removal

1.  **WARNING:** When relieving cooling system pressure, cover the expansion tank cap with a thick cloth to prevent the possibility of scalding. Failure to follow these instructions may result in personal injury.

Remove the expansion tank cap to relieve the cooling system pressure.

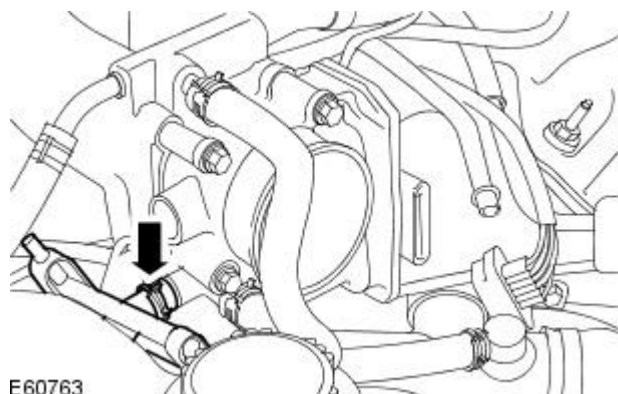
2. Remove the air cleaner outlet pipe.  
For additional information, refer to: Air Cleaner Outlet Pipe (303-12, Removal and Installation).
3. Disconnect the throttle body electrical connector.



E60762

4.  **CAUTION:** Clamp the coolant hose to minimize coolant loss.

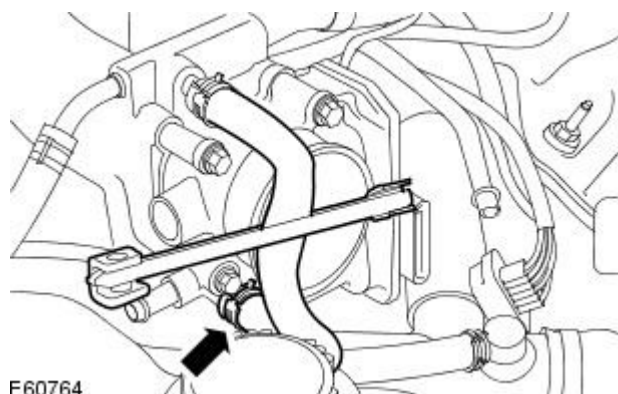
Disconnect the coolant hose.



E60763

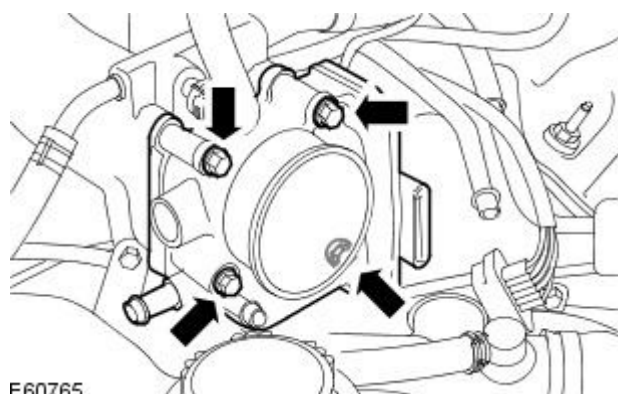
5.  **CAUTION:** Clamp the coolant hose to minimize coolant loss.

Disconnect the coolant hose.



E60764

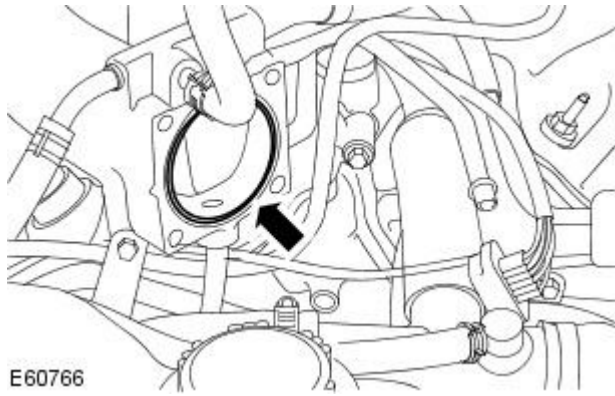
6. Remove the throttle body.



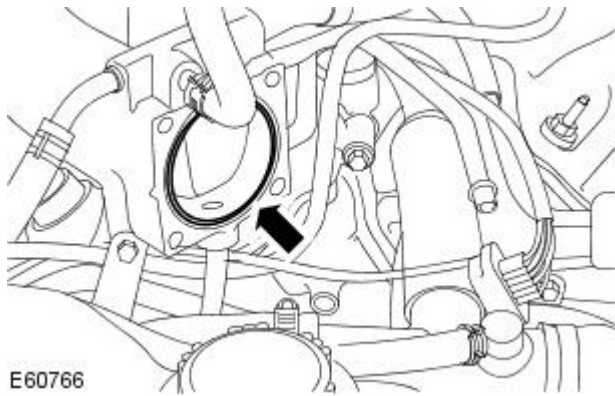
E60765




7. Remove and discard the O-ring seal.



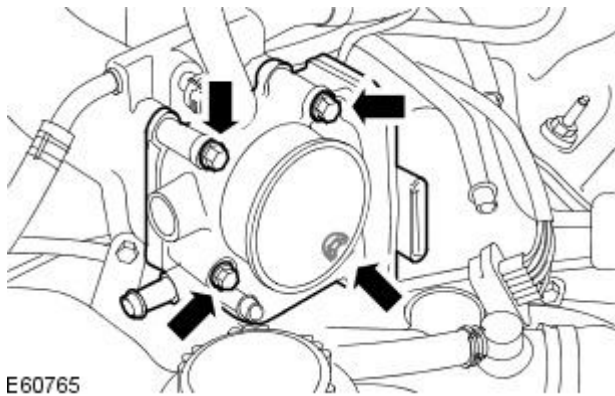
## Installation



1.  **CAUTION:** Do not attempt to clean the throttle body. The bore and the throttle plate has a special coating applied during manufacture which should not be removed.

To install, reverse the removal procedure.

- Install a new O-ring seal.



2. Tighten to 10 Nm.

3. Check and top up the cooling system as required.

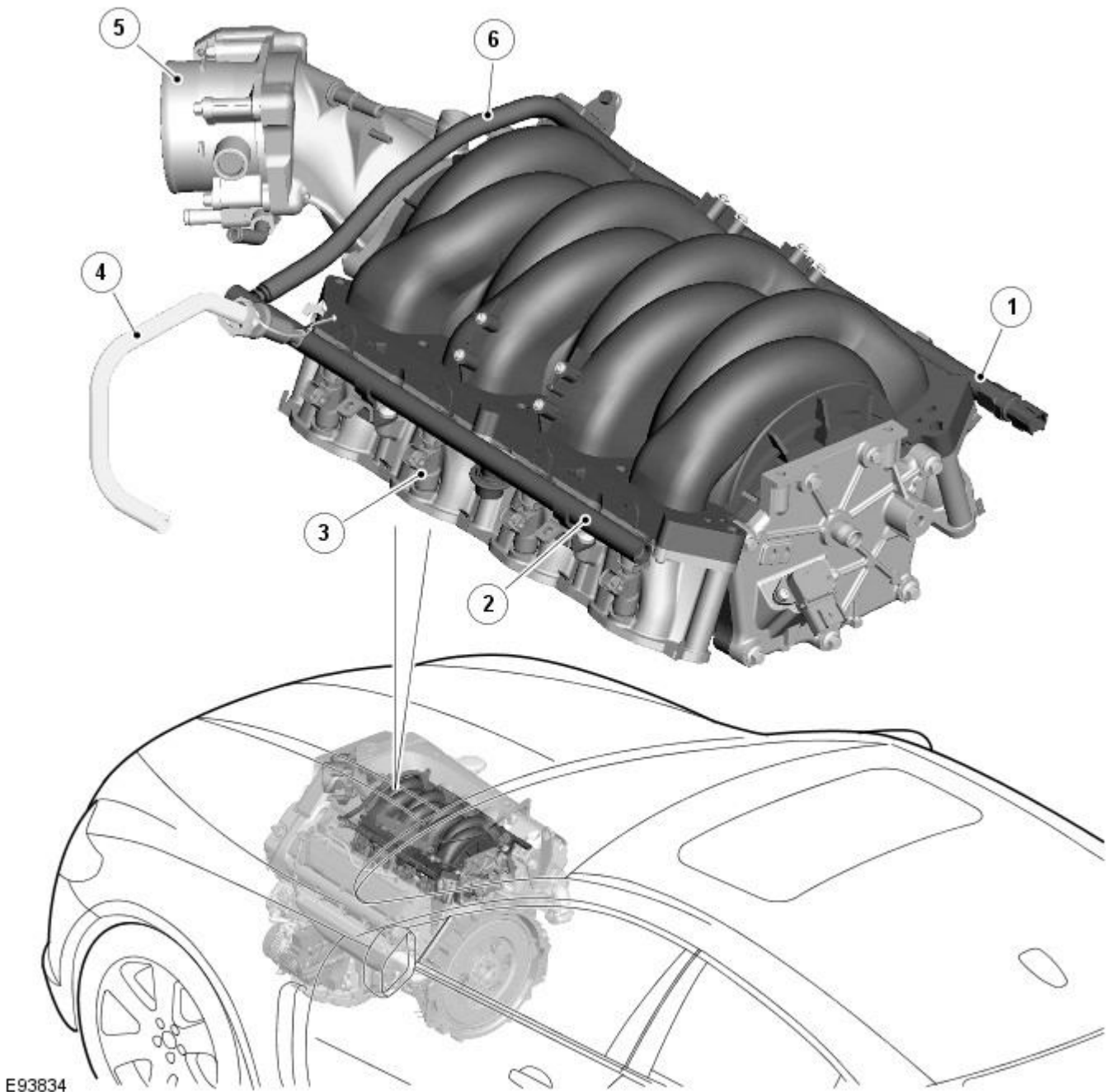
**Fuel Charging and Controls - 4.2L NA V8 - AJV8 -**

<b>Description</b>	<b>Nm</b>	<b>lb-ft</b>	<b>lb-in</b>
Fuel injection supply manifold vehicles with supercharger	21	15	-
Fuel injection supply manifold vehicles without supercharger	22	16	-
Fuel pressure regulator	5	-	44
Throttle body	10	-	89

# Fuel Charging and Controls - 4.2L NA V8 - AJV8 - Fuel Charging and Controls

Description and Operation

## COMPONENT LOCATION



E93834

Item	Part Number	Description
1	-	RH fuel rail
2	-	LH fuel rail
3	-	Injectors (8 off)
4	-	Fuel supply pipe
5	-	Electric throttle body
6	-	Fuel supply cross over pipe

## OVERVIEW

The fuel charging and control system comprises a fuel pump, fuel pump driver module (FPDM), fuel rails and 8 injectors. The fuel pump supplies fuel from the tank, via a pipe routed along the outside of the left hand chassis box section, to the fuel rail. The fuel rail distributes the fuel equally to each of the 8 injectors. The fuel injectors, which are controlled by the engine control module (ECM), are installed in the fuel rails on each side of the air intake manifold. A cross over pipe connects the 2 fuel rails together at the front of the engine. For additional information, refer to:

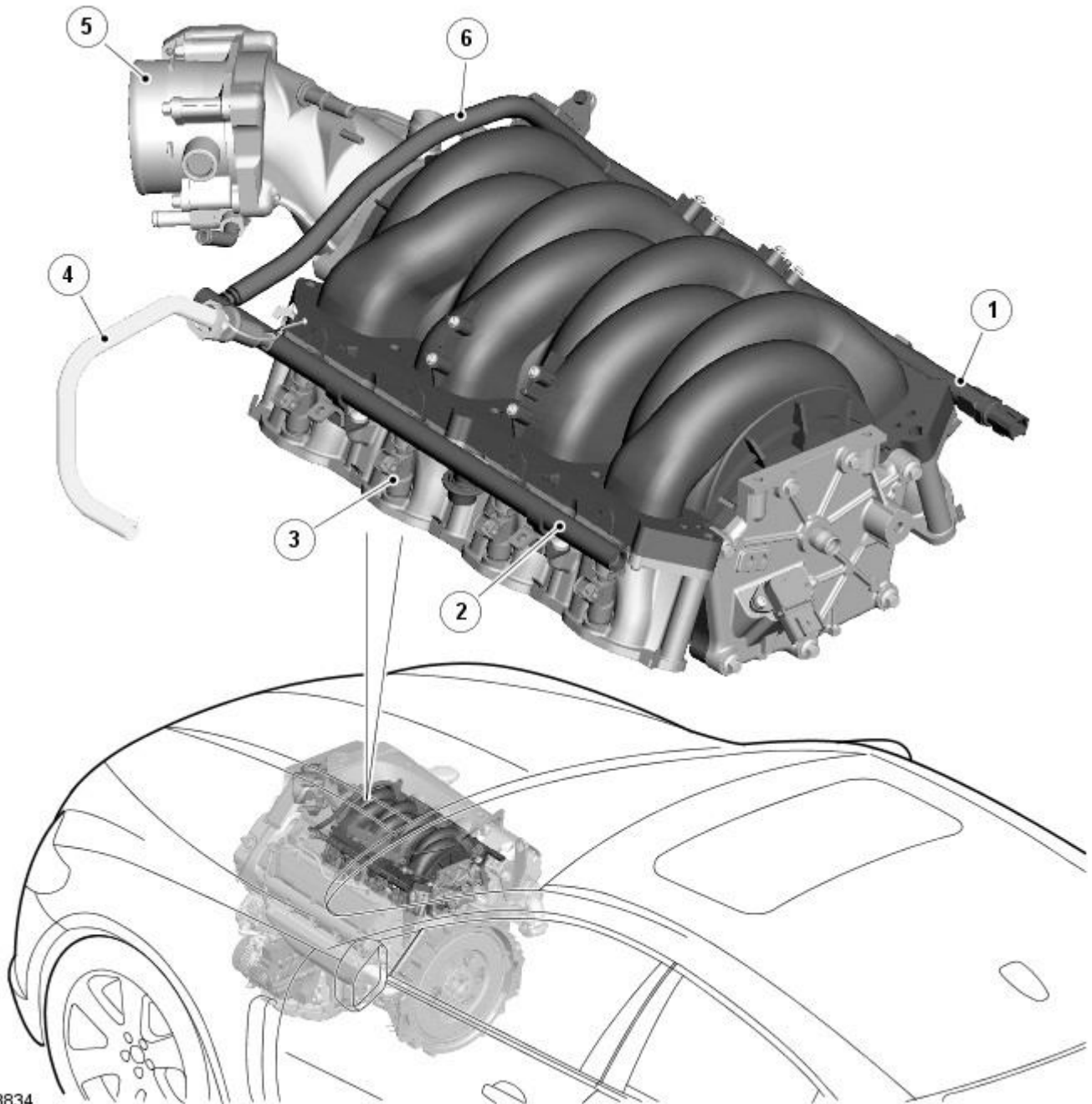
Fuel Tank and Lines (310-01C, Description and Operation),

Electronic Engine Controls (303-14C, Description and Operation).

# Fuel Charging and Controls - 4.2L NA V8 - AJV8 - Fuel Charging and Controls - Component Location

Description and Operation

Component Location



E93834

## ItemDescription

1	RH (right-hand) fuel rail
2	LH (left-hand) fuel rail
3	Injector (8 off)
4	Fuel supply pipe
5	Electric throttle
6	Fuel supply cross over pipe

# Fuel Charging and Controls - 4.2L NA V8 - AJV8 - Fuel Charging and Controls - Overview

Description and Operation

## Overview

The fuel charging and control system comprises a fuel pump, [FPDM \(fuel pump driver module\)](#), fuel rails and eight fuel injectors. The fuel pump supplies fuel from the tank, via a pipe routed along the outside of the left hand chassis box section, to the fuel rail. The fuel rail distributes the fuel equally to each of the fuel injectors. The fuel injectors, which are controlled by the [ECM \(engine control module\)](#), are installed in the fuel rails on each side of the air intake manifold. A cross over pipe connects the two fuel rails together at the front of the engine. Refer to: [Fuel Tank and Lines](#) (310-01 Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

# Fuel Charging and Controls - 4.2L NA V8 - AJV8 - Fuel Charging and Controls - System Operation and Component Description

Description and Operation

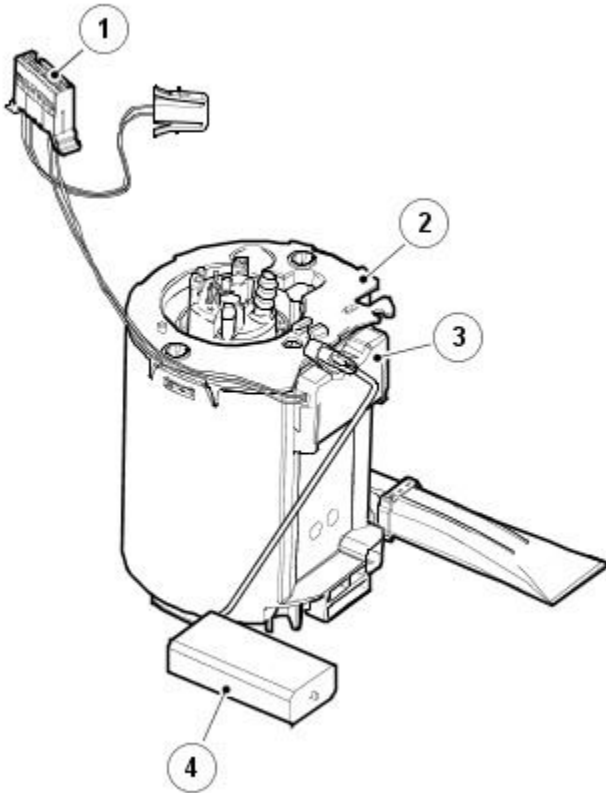
## System Operation

Operation of the fuel charging and control system is controlled by the [ECM \(engine control module\)](#).

Refer to: [Electronic Engine Controls](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

## Component Description

### Fuel Pump



E74571

#### ItemDescription

1	Electrical connector
2	Fuel pump module
3	Fuel level sensor
4	Fuel level float

The fuel pump module is mounted in the **RH (right-hand)** side of the saddle type fuel tank and delivers fuel at variable flow and pressure to the fuel rails, which supply fuel to all fuel injectors. The fuel pump operation is regulated by the [FPDM \(fuel pump driver module\)](#), which is controlled by the [ECM](#).

Refer to: [Fuel Tank and Lines](#) (310-01 Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

### Fuel Pump Driver Module





E99541

The [FPDM](#) is used to control the speed of the fuel pump based upon the fuel demand of the engine. The [ECM](#) controls the [FPDM](#) in response to inputs from the [FRP \(fuel rail pressure\)](#) sensor, [MAP \(manifold absolute pressure\)](#) sensor, [MAF \(mass air flow\)](#) sensor and the [IAT \(intake air temperature\)](#) sensor. The [FPDM](#) is attached to the [RH](#) end of the evaporative emission canister, which is installed on the underside of the center floor pan, above the rear stabilizer bar.

The [ECM](#) sends a [PWM \(pulse width modulation\)](#) signal to the [FPDM](#), the frequency of the signal determines the duty cycle of the pump. The [PWM](#) signal to the pump represents half the ON time of the pump. If the [ECM](#) transmits a 50% ON time, this drives the pump at 100%. If the [ECM](#) transmits a 5% ON time, the [FPDM](#) drives the pump at 10%. The [FPDM](#) will only turn the fuel pump ON if it receives a valid signal between 4% and 50%. To turn the fuel pump OFF, the [ECM](#) transmits a duty cycle signal of 75%.

The status of the [FPDM](#) is monitored by the [ECM](#). Any errors can be retrieved from the [ECM](#) using the Jaguar approved diagnostic system. The [FPDM](#) cannot be interrogated for diagnostic purposes.

## Fuel Injectors



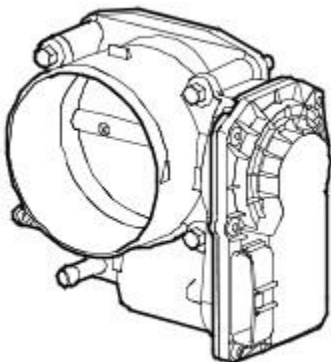
E47305

Eight, top fed, 12 hole, fuel injectors are installed in the fuel rails. Two O-rings seal each injector to the fuel rails. The fuel jets from the injectors are directed onto the back of the intake valves.

The injectors are electromagnetic solenoid valves controlled by the [ECM](#). Each injector contains a solenoid-operated needle valve, which is closed while the solenoid winding is de-energized. The solenoid winding is connected to a power feed from the main relay and to an earth through the [ECM](#). The [ECM](#) switches the earth to control the opening and closing of the needle valve. While the needle valve is open, fuel is sprayed into the cylinder intake tract onto the back of the intake valves. The [ECM](#) meters the amount of fuel injected by adjusting the time that the needle valve is open.

The solenoid winding of the fuel injector has a resistance of  $13.8 \pm 0.7$  ohms @ 20 °C (68 °F).

## Electric Throttle



E47298

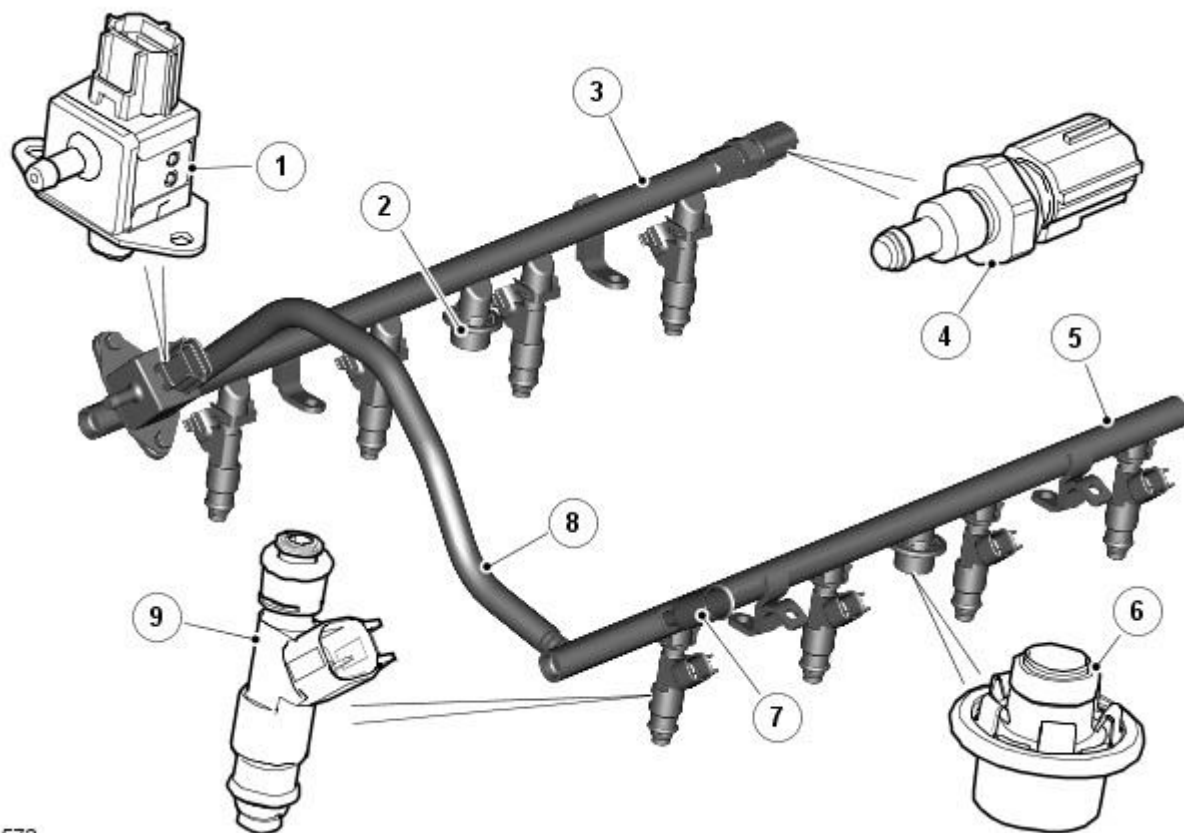
The electric throttle controls the engine torque and is located on the induction elbow at the front of the engine. Its main

components are an electric throttle control valve, an [APP \(accelerator pedal position\)](#) sensor and the [ECM](#).

The [APP](#) sensor determines the driver demand to control throttle opening. This value is received by the [ECM](#) and the throttle is then opened to the correct angle by means of an integral electric motor. Sensors in the throttle body are used to determine the position of the throttle plate and the rate of change in its angle.

Refer to: [Electronic Engine Controls](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

## Fuel Rails



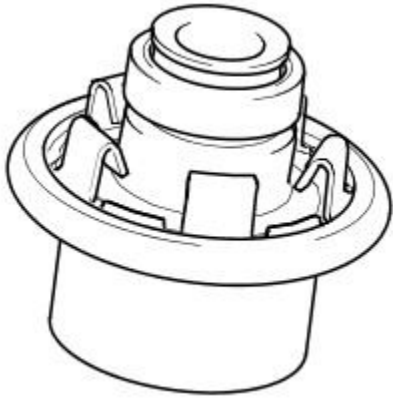
E74572

### ItemDescription

1	<a href="#">FRP</a> sensor
2	Fuel rail pressure damper
3	Fuel rail
4	Fuel rail temperature sensor
5	Fuel rail
6	Fuel rail pressure damper
7	Fuel rail inlet
8	Fuel rail connection pipe
9	Fuel injector

Each fuel rail maintains a fuel pressure of typically 4.5 bar (65 lbf/in<sup>2</sup>), however, this pressure will vary depending on engine requirements; lower at idle, higher at full load. Four fuel injectors are installed in each cylinder head and are connected to the related fuel rail. O-ring seals are used to seal the injectors to the fuel rails.

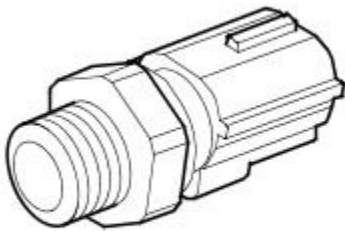
## Fuel Pressure Damper



E74573

A fuel pressure damper is attached centrally to each of the fuel rails. The damper acts to damp pressure pulses from the fuel pump.

### Fuel Temperature Sensor

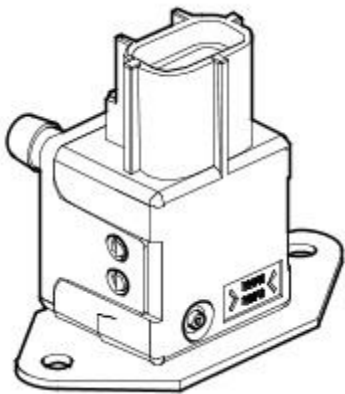


E47606

The fuel temperature sensor is located in the rear of the [RH](#) fuel rail. The sensor is a [NTC \(negative temperature coefficient\)](#) sensor, which is connected to the [ECM](#) by two wires.

Refer to: [Electronic Engine Controls](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

### Fuel Rail Pressure Sensor



E58945

The [FRP](#) sensor continuously monitors the fuel pressure in the fuel rail. This value is used by the [ECM](#) to calculate the injector pulse-width required to deliver the correct mass of fuel per injection. The [ECM](#) also uses this information to demand a specific fuel flow-rate from the fuel pump via the [FPDM](#).

Refer to: [Electronic Engine Controls](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

# Fuel Charging and Controls - 4.2L NA V8 - AJV8 - Fuel Charging and Controls

Diagnosis and Testing

## Principles of Operation

For a detailed description of the petrol engine fuel charging and controls system, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

[Fuel Charging and Controls](#) (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Description and Operation),  
[Fuel Charging and Controls](#) (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Description and Operation),  
[Fuel Charging and Controls](#) (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Description and Operation),  
[Fuel Charging and Controls](#) (303-04B Fuel Charging and Controls - 4.2L SC V8 - AJV8, Description and Operation),  
[Fuel Charging and Controls](#) (303-04B Fuel Charging and Controls - 4.2L SC V8 - AJV8, Description and Operation),  
[Fuel Charging and Controls](#) (303-04B Fuel Charging and Controls - 4.2L SC V8 - AJV8, Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Fuel level</li> <li>● Fuel leaks</li> <li>● Damaged fuel lines</li> <li>● Damaged push connect fittings</li> <li>● Fuel contamination/grade/quality</li> <li>● Throttle body</li> <li>● Damaged fuel tank filler pipe cap</li> <li>● Damaged fuel tank filler pipe</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Loose or corroded electrical connectors</li> <li>● Harnesses</li> <li>● Sensor(s)</li> <li>● Engine Control Module (ECM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident and there are clear symptoms refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	<ul style="list-style-type: none"> <li>● Engine breather system disconnected/restricted</li> <li>● Ignition system</li> <li>● Fuel system</li> <li>● Electronic engine control</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed. Check for ignition system, fuel system and electronic engine control DTCs and refer to the relevant DTC Index
Engine cranks and fires, but will not start	<ul style="list-style-type: none"> <li>● Evaporative emissions purge valve</li> <li>● Fuel pump</li> <li>● Spark plugs</li> <li>● HT short to ground (tracking) check rubber boots for cracks/damage</li> <li>● Ignition system</li> </ul>	Check for evaporative emissions, fuel system and ignition system related DTCs and refer to the relevant DTC Index
Difficult cold start	<ul style="list-style-type: none"> <li>● Engine coolant level/anti-freeze content</li> <li>● Battery</li> <li>● Electronic engine controls</li> <li>● Exhaust Gas Recirculation (EGR) valve stuck open</li> <li>● Fuel pump</li> <li>● Purge valve</li> </ul>	Check the engine coolant level and condition. Ensure the battery is in a fully charged and serviceable condition. Check for electronic engine controls, engine emissions, fuel system and evaporative emissions system related DTCs and refer to the relevant DTC Index
Difficult hot start	<ul style="list-style-type: none"> <li>● Injector leak</li> <li>● Electronic engine control</li> <li>● Purge valve</li> <li>● Fuel pump</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> </ul>	Check for injector leak, install new injector as required. Check for electronic engine controls, evaporative emissions, fuel system, ignition system and engine emission system related DTCs and refer to the relevant DTC Index

Symptom	Possible Cause	Action
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	<ul style="list-style-type: none"> <li>● Injector leak</li> <li>● Electronic engine control</li> <li>● Purge valve</li> <li>● Fuel pump</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> </ul>	Check for injector leak, install new injector as required. Check for electronic engine controls, evaporative emissions, fuel system, ignition system and engine emission system related DTCs and refer to the relevant DTC Index
Engine stalls soon after start	<ul style="list-style-type: none"> <li>● Breather system disconnected/restricted</li> <li>● ECM relay</li> <li>● Electronic engine control</li> <li>● Ignition system</li> <li>● Air intake system restricted</li> <li>● Air leakage</li> <li>● Fuel lines</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed. Check for electronic engine control, ignition system and fuel system related DTCs and refer to the relevant DTC Index. Check for blockage in air filter element and air intake system. Check for air leakage in air intake system
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> <li>● Fuel pressure, fuel pump, fuel lines</li> <li>● Injector leak</li> <li>● Air leakage</li> <li>● Electronic engine control</li> <li>● Throttle motor</li> <li>● Restricted accelerator pedal travel (carpet, etc)</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> <li>● Transmission malfunction</li> </ul>	Check for fuel system related DTCs and refer to the relevant DTC Index. Check for injector leak, install new injector as required. Check for air leakage in air intake system. Ensure accelerator pedal is free from restriction. Check for electronic engine controls, ignition, engine emission system and transmission related DTCs and refer to the relevant DTC Index
Engine backfires	<ul style="list-style-type: none"> <li>● Fuel pump/lines</li> <li>● Air leakage</li> <li>● Electronic engine controls</li> <li>● Ignition system</li> <li>● Sticking variable camshaft timing (VCT) hub</li> </ul>	Check for fuel system failures. Check for air leakage in intake air system. Check for electronic engine controls, ignition system and VCT system related DTCs and refer to the relevant DTC Index
Engine surges	<ul style="list-style-type: none"> <li>● Fuel pump/lines</li> <li>● Electronic engine controls</li> <li>● Throttle motor</li> <li>● Ignition system</li> </ul>	Check for fuel system failures. Check for electronic engine controls, throttle system and ignition system related DTCs and refer to the relevant DTC Index
Engine detonates/knocks	<ul style="list-style-type: none"> <li>● Fuel pump/lines</li> <li>● Air leakage</li> <li>● Electronic engine controls</li> <li>● Sticking VCT hub</li> </ul>	Check for fuel system failures. Check for air leakage in intake air system. Check for electronic engine controls and VCT system related DTCs and refer to the relevant DTC Index
No throttle response	<ul style="list-style-type: none"> <li>● Electronic engine controls</li> <li>● Throttle motor</li> </ul>	Check for electronic engine controls and throttle system related DTCs and refer to the relevant DTC Index
Poor throttle response	<ul style="list-style-type: none"> <li>● Breather system disconnected/restricted</li> <li>● Electronic engine control</li> <li>● Transmission malfunction</li> <li>● Traction control event</li> <li>● Air leakage</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed. Check for electronic engine controls, transmission and traction control related DTCs and refer to the related DTC Index. Check for air leakage in intake air system

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• NOTE: If the control module/component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines that involve pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P008700	Fuel Rail/System Pressure - Too Low	<ul style="list-style-type: none"> <li>● Fuel rail pressure (Fuel rail pressure) sensor, sensing circuit - short to ground, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Fuel rail pressure sensor circuits for short to ground, open circuit,

DTC	Description	Possible Cause	Action
		<ul style="list-style-type: none"> <li>● Fuel rail pressure sensor supply circuit - high resistance</li> <li>● Fuel rail pressure sensor failure</li> <li>● Fuel pump failure</li> <li>● Fuel line leak, restriction</li> </ul>	high resistance. Check and install a new Fuel rail pressure sensor as required. Check fuel system for failure
P008800	Fuel Rail/System Pressure - Too High	<ul style="list-style-type: none"> <li>● Fuel rail pressure sensor supply/sensing circuits - short to each other</li> <li>● Fuel rail pressure sensor sensing circuit - short to power</li> <li>● Fuel rail pressure sensor ground circuit - high resistance</li> <li>● Fuel rail pressure sensor failure</li> <li>● Restricted fuel line</li> <li>● Fuel pump short circuit to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Fuel rail pressure sensor circuits for short to each other, power, open circuit, high resistance. Check and install a new Fuel rail pressure sensor as required. Check fuel system for failure
P017100	System too lean (bank 1)	<ul style="list-style-type: none"> <li>● Air intake leak between MAF sensor and cylinder head</li> <li>● Fuel filter, injector, system restriction</li> <li>● MAF sensor fault (low intake air flow)</li> <li>● Exhaust leak (forward of catalytic converter)</li> </ul>	Check for leak from air intake system. Check for fuel system blockage/restriction. Check for additional MAF sensor related DTCs and refer to relevant DTC Index. Check and rectify any exhaust leak prior to catalytic converter
P017200	System Too Rich (Bank 1)	<ul style="list-style-type: none"> <li>● Restricted air cleaner</li> <li>● Leaking fuel injector(s)</li> <li>● Engine oil contaminated with fuel (too many cold starts with vehicle subsequently not getting hot enough for long enough)</li> <li>● MAF sensor fault (high intake air flow)</li> </ul>	Check air cleaner element is free from restriction. Check for leaking injectors, install new injector(s) as required. Check for contaminated engine oil, drain and refill engine oil as required. Check for additional MAF sensor related DTCs and refer to relevant DTC Index
P017400	System Too Lean (Bank 2)	<ul style="list-style-type: none"> <li>● Air intake leak between MAF sensor and cylinder head</li> <li>● Fuel filter, injector, system restriction</li> <li>● MAF sensor fault (low intake air flow)</li> <li>● Exhaust leak (forward of catalytic converter)</li> </ul>	Check for leak from air intake system. Check for fuel system blockage/restriction. Check for additional MAF sensor related DTCs and refer to relevant DTC Index. Check and rectify any exhaust leak prior to catalytic converter
P017500	System Too Rich (Bank 2)	<ul style="list-style-type: none"> <li>● Restricted air cleaner</li> <li>● Leaking fuel injector(s)</li> <li>● Engine oil contaminated with fuel (too many cold starts with vehicle subsequently not getting hot enough for long enough)</li> <li>● MAF sensor fault (high intake air flow)</li> </ul>	Check air cleaner element is free from restriction. Check for leaking injectors, install new injector(s) as required. Check for contaminated engine oil, drain and refill engine oil as required. Check for additional MAF sensor related DTCs and refer to relevant DTC Index
P018123	Fuel Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Fuel temperature sensor sensing circuit - short to ground, short to power, high resistance</li> <li>● Fuel temperature sensor ground circuit - high resistance</li> <li>● Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P018124	Fuel Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Fuel temperature sensor sensing circuit - short to ground, short to power, high resistance</li> <li>● Fuel temperature sensor ground circuit - high resistance</li> <li>● Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required



# Fuel Charging and Controls - 4.2L NA V8 - AJV8 - Fuel Injectors

Removal and Installation

## Removal

### • WARNINGS:



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

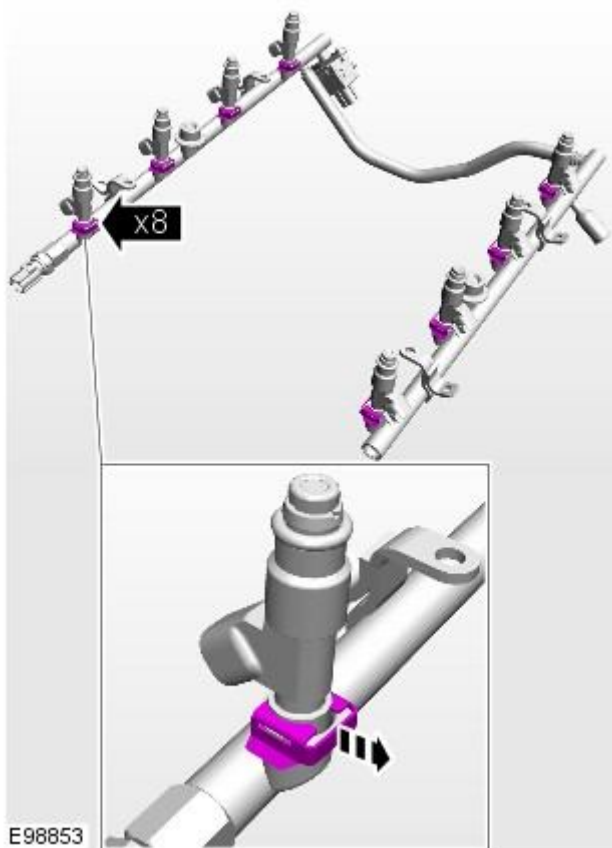


After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.



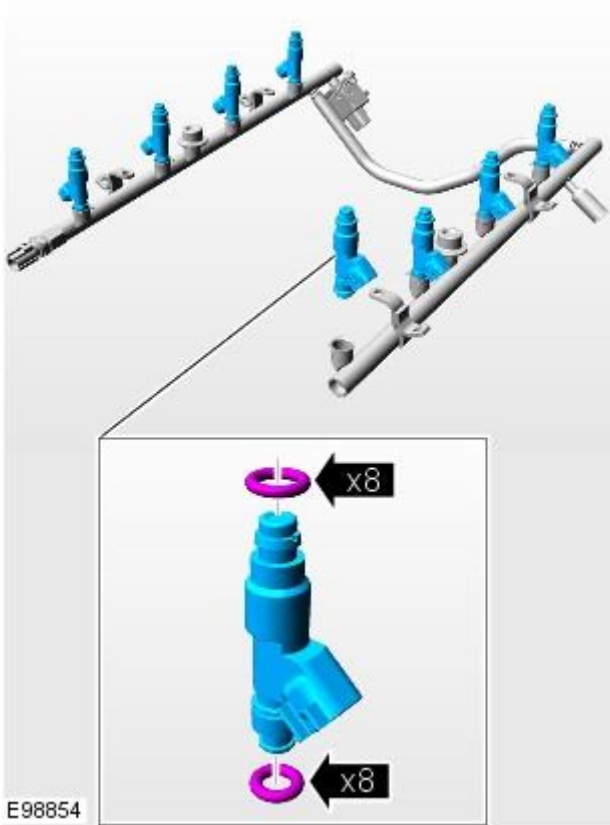
Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the fuel injection supply manifold.  
For additional information, refer to: [Fuel Injection Supply Manifold](#) (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Removal and Installation).
3. Remove the injector retaining clips.



4. Remove the fuel injectors.

- Remove and discard the O-ring seal.
- Repeat the above procedure for the remaining injectors.




## Installation

1. To install, reverse the removal procedure.

# Fuel Charging and Controls - 4.2L NA V8 - AJV8 - Fuel Injection Supply Manifold

Removal and Installation

Special Tool(s)	
 <p>E45289</p>	Fuel spring lock decoupling tool 310-D005

## Removal

### • WARNINGS:



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

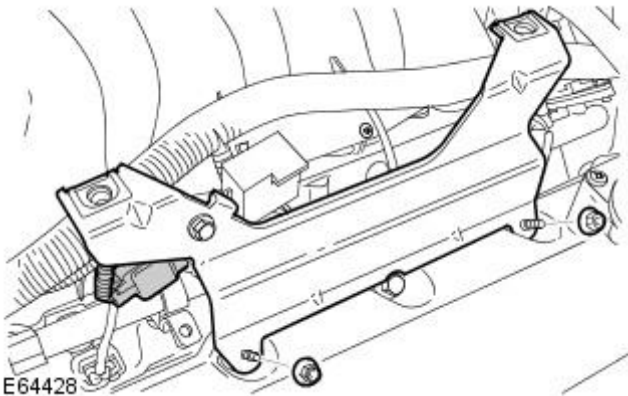


After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.

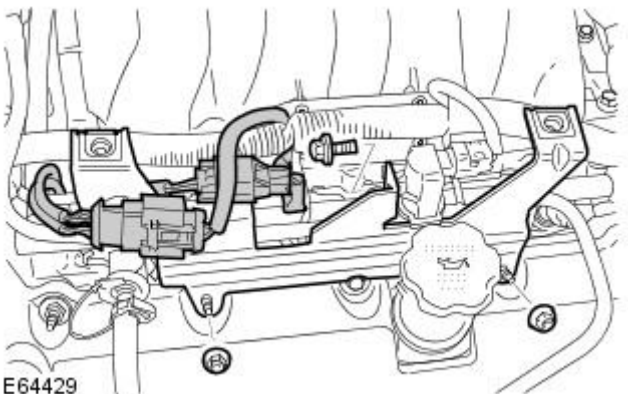


Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the engine cover.  
For additional information, refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Remove the engine cover RH bracket.
  - Remove the 2 nuts.
  - Disconnect the electrical connector.

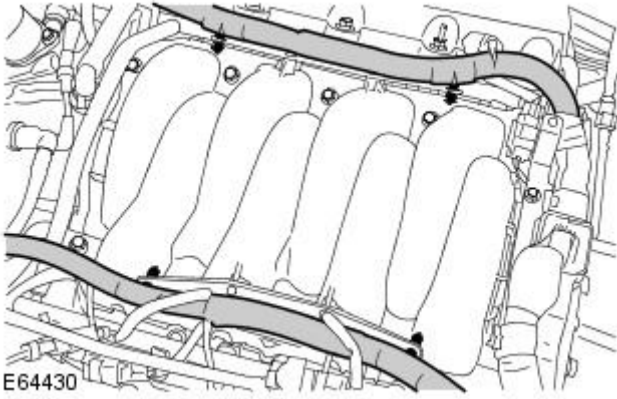


4. Remove the engine cover LH bracket.
  - Remove the 2 nuts.
  - Release the 2 electrical connectors.
  - Remove the purge valve bolt.



5. Release the engine wiring harness.

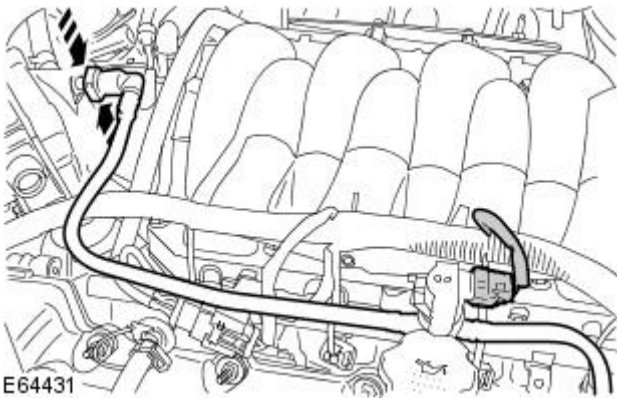
- Release the 4 clips.



E64430

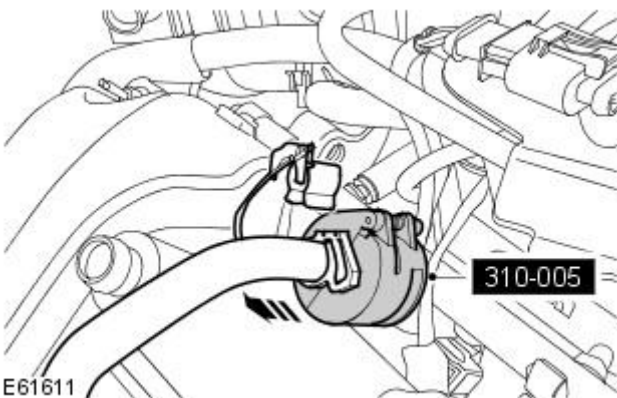
6. Release the purge valve.

- Disconnect the quick release connector.
- Disconnect the electrical connector.



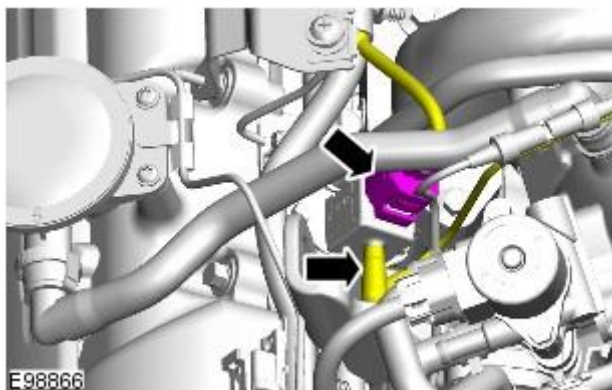
E64431

7. Using the special tool, disconnect the fuel line.



E61611

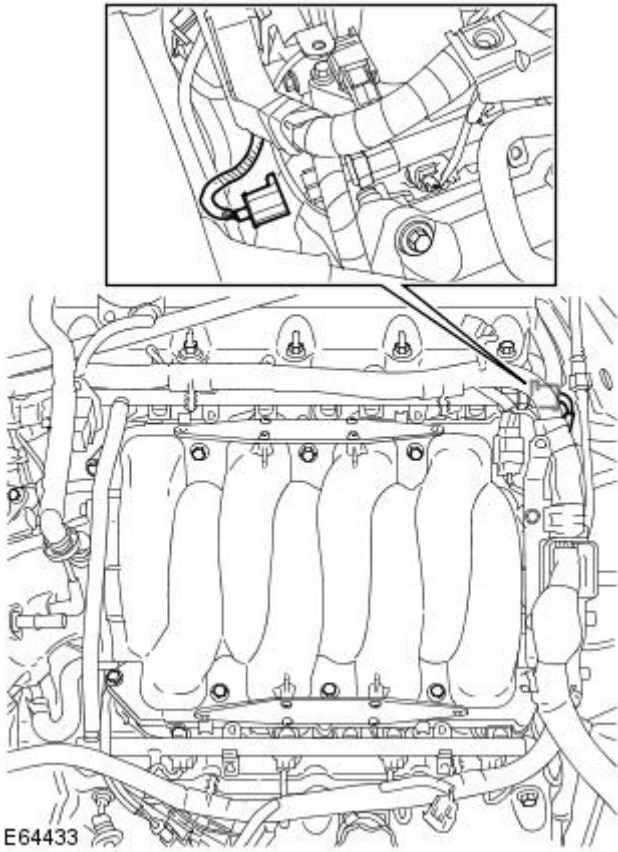
8. Disconnect the fuel rail pressure (FRP) sensor electrical connector.



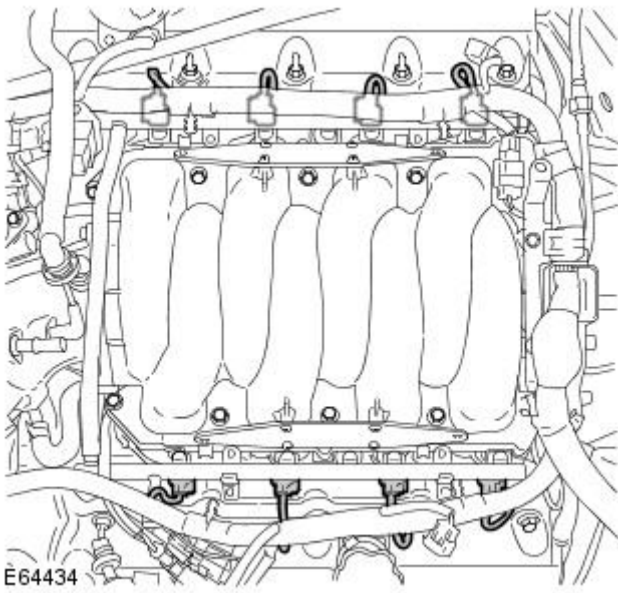
E98866

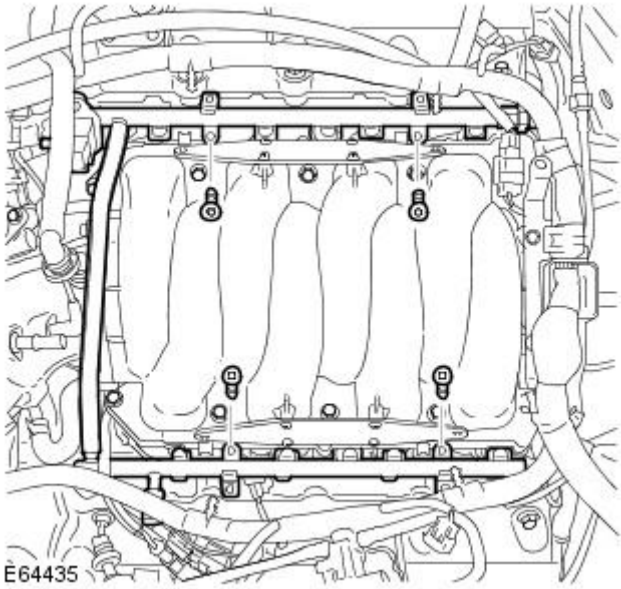
9. Disconnect the FRP sensor vacuum line.


10. Disconnect the fuel temperature sensor electrical connector.



11. Disconnect the 8 fuel injector electrical connectors.





12.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

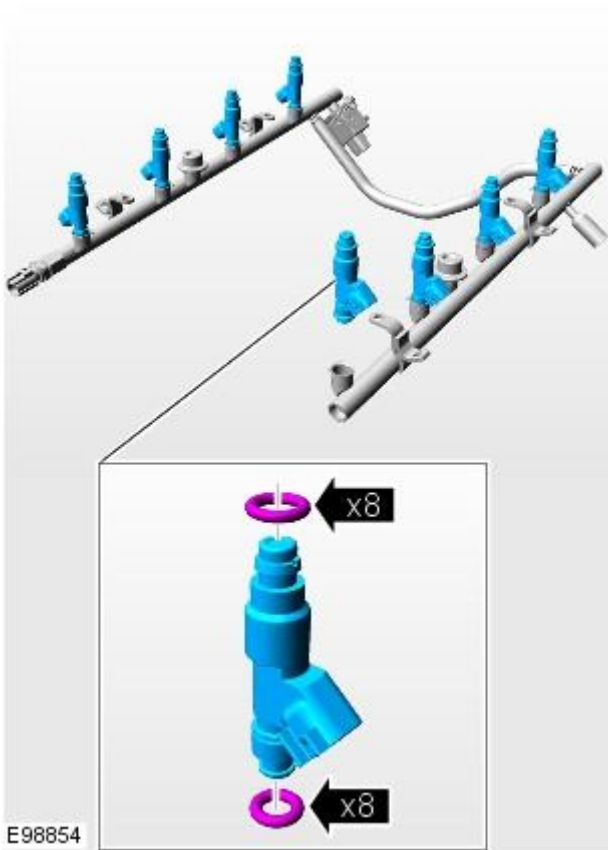
Remove the fuel injection supply manifold.

- Remove the 4 Torx bolts.
- Remove and discard the 8 O-ring seals.

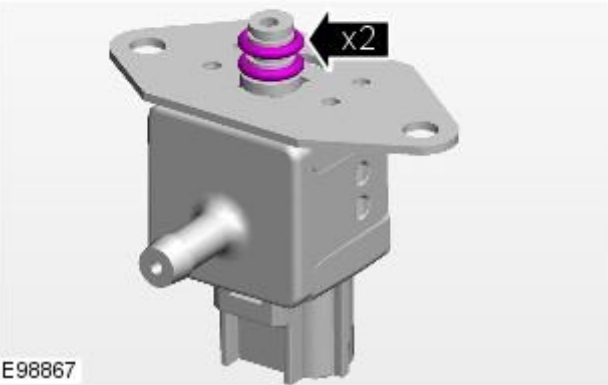
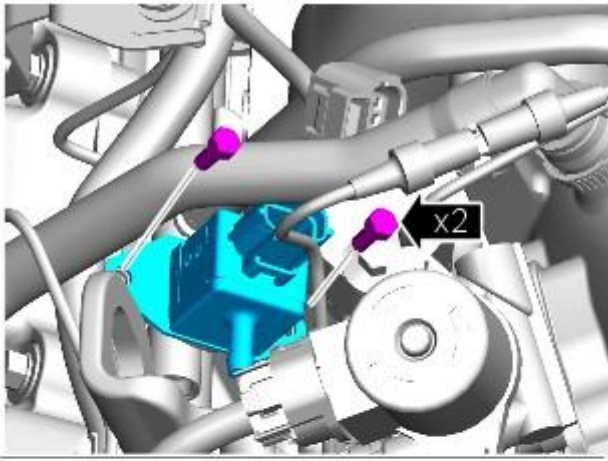
13. **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the fuel injector.

- Remove the clip.
- Remove and discard the O-ring seal.
- Repeat the above procedure for the remaining injectors.



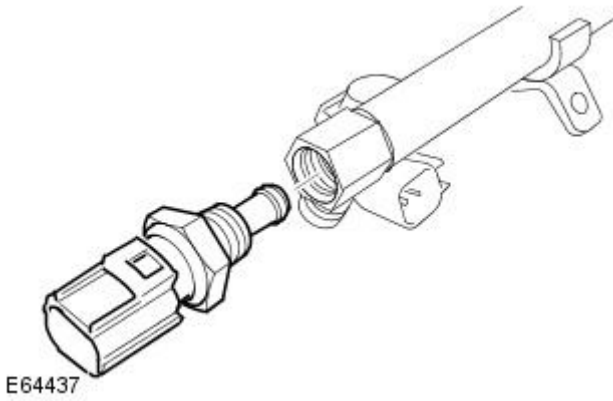




**14. Remove the FRP sensor.**

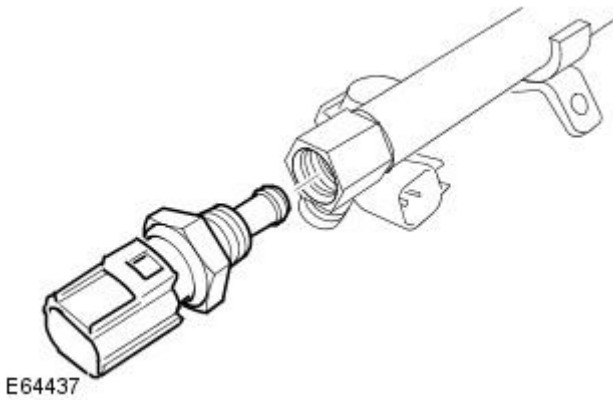
- Remove the 2 bolts.
- Remove and discard the O-ring seal.

**15. Remove the fuel temperature sensor.**

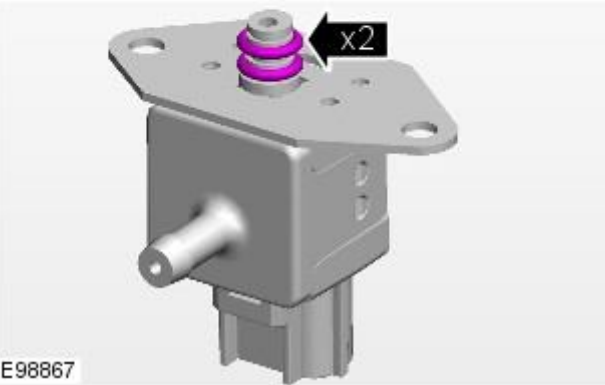
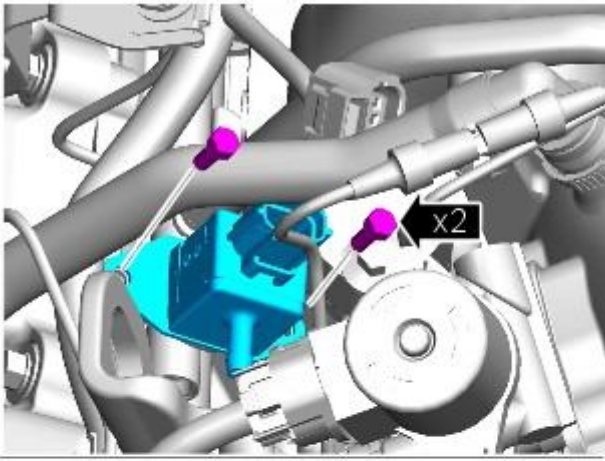


**Installation**

1. To install, reverse the removal procedure.
2. Tighten to 7 Nm.

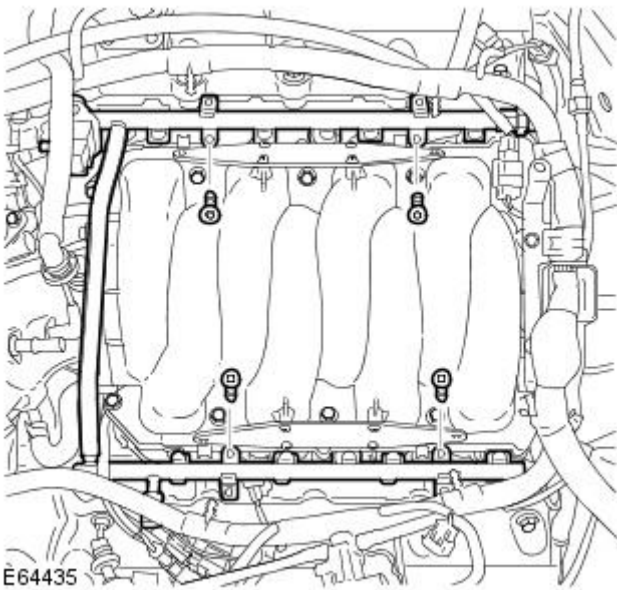


3. Tighten to 5 Nm.



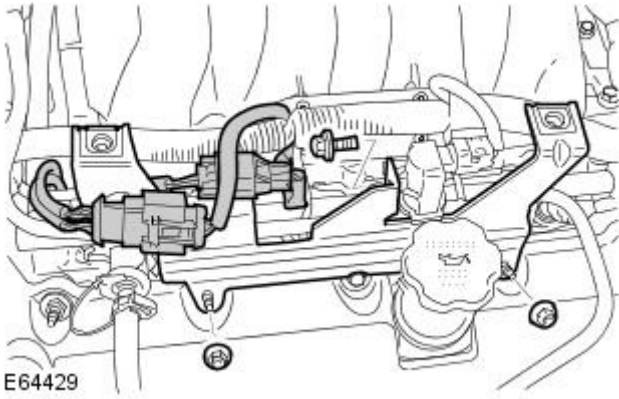
E98867

4. Tighten to 10 Nm.



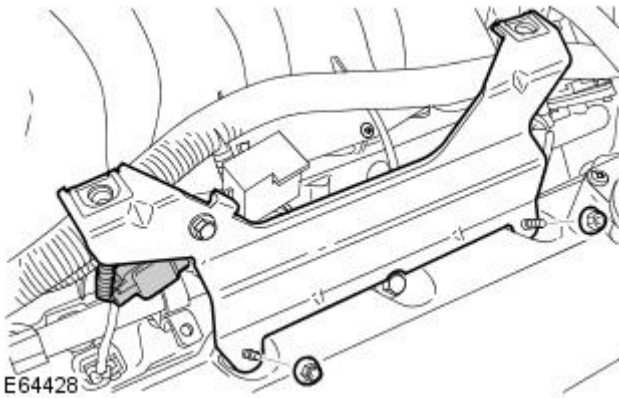
E64435

5. Tighten to 6 Nm.



E64429

6. Tighten to 6 Nm.



E64428

# Fuel Charging and Controls - 4.2L NA V8 - AJV8 - Fuel Pressure Regulator

Removal and Installation

## Removal

### • WARNINGS:



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be relieved before attempting any repairs. Failure to follow these instructions may result in personal injury.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

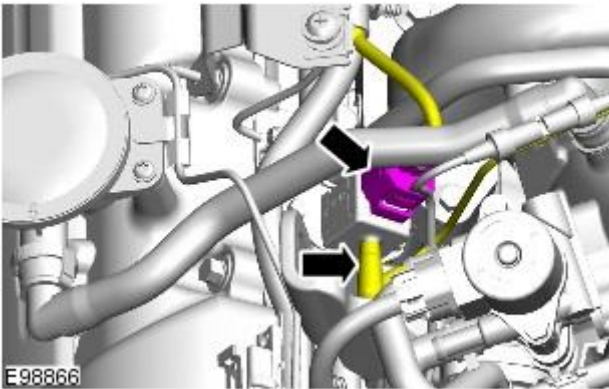
1. Remove the engine cover.

For additional information, refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Oramentation, Removal and Installation).

2. Depressurize the fuel system.

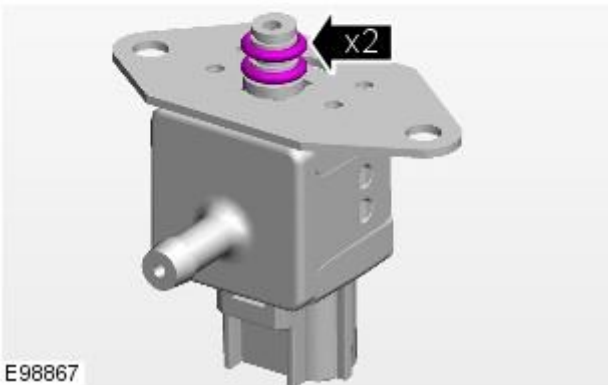
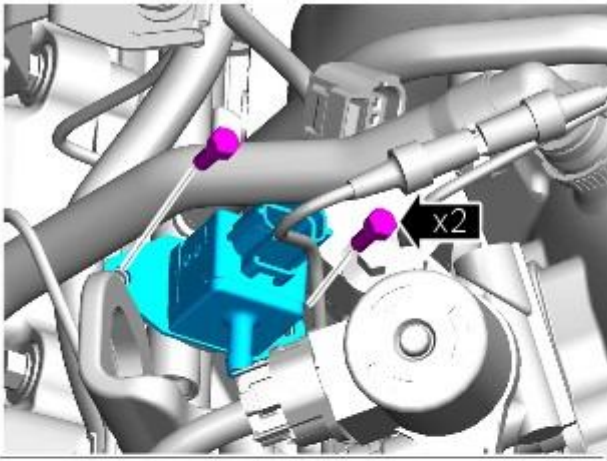
For additional information, refer to: [Fuel System Pressure Release - 3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (310-00 Fuel System - General Information, General Procedures).

3. Disconnect the fuel pressure regulator electrical connector and vacuum hose.



4. Remove the fuel pressure regulator.

- Remove and discard the O-ring seals.



## Installation

1. NOTE: Install new O-ring seals.

To install, reverse the removal procedure.

- Tighten to 10 Nm.

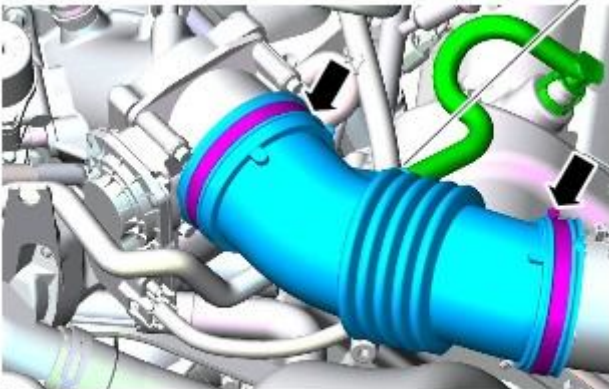
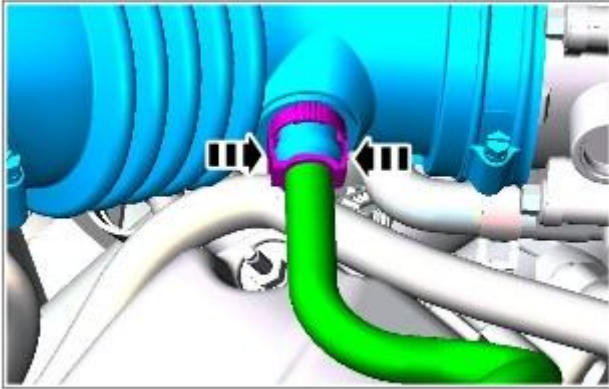
# Fuel Charging and Controls - 4.2L NA V8 - AJV8 - Throttle Body

Removal and Installation

## Removal

1. Remove the engine cover.  
For additional information, refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Remove the air intake duct.

- Release the 2 clips.
- Disconnect the breather hose.



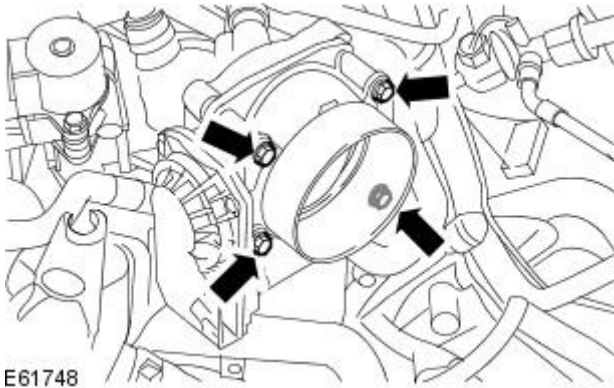
E92642

3. Disconnect the throttle position (TP) sensor electrical connector.



E63455

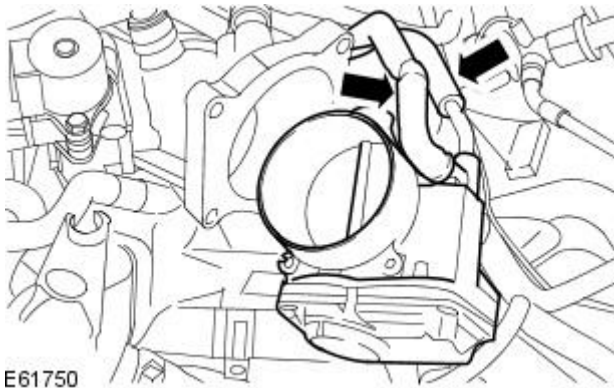





E61748

4. Release the throttle body.

- Remove the 4 bolts.
- Remove and discard the throttle body gasket.



E61750

5.  **WARNING:** Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

• **NOTE:** Do not disassemble further if the component is removed for access only.

Disconnect the coolant hoses from the throttle body.

- Clamp the throttle body coolant hoses to minimize coolant loss.
- Release the throttle body hose clips

## Installation

1. Connect the coolant hoses to the throttle body.

- Remove the hose clamps from the throttle body hoses.
- Secure the throttle body hoses clips.

2. Install the throttle body.

- Clean the component mating faces.
- Install a new gasket.
- Tighten the 4 bolts to 10 Nm (7 lb.ft).

3. Connect the TP sensor electrical connector.

4. Install the intake air duct.

- Tighten the clips.
- Connect the breather hose.

5. Install the engine cover.

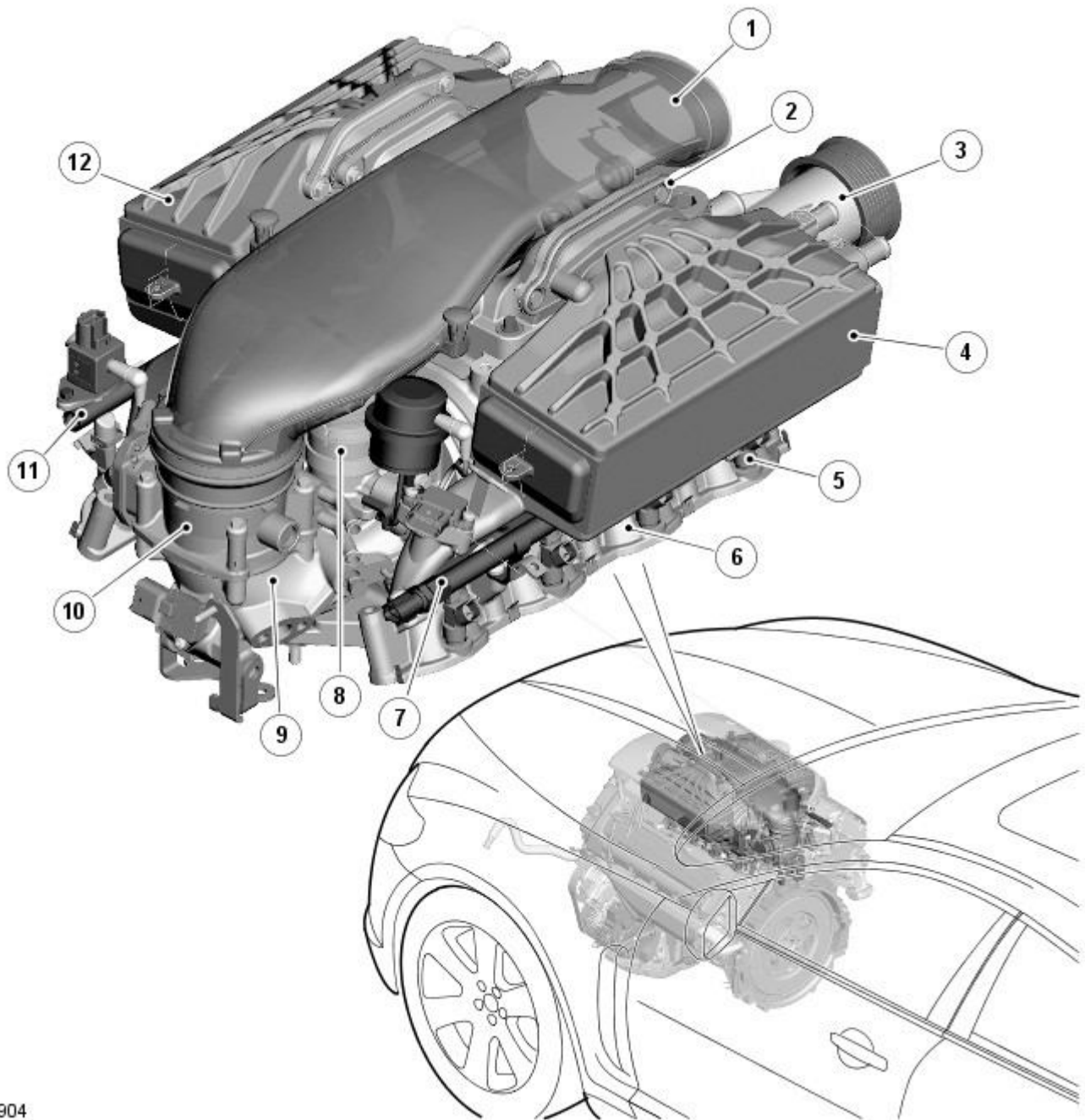
For additional information, refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornammentation, Removal and Installation).

6. Check and top-up the coolant.

# Fuel Charging and Controls - 4.2L SC V8 - AJV8 - Fuel Charging and Controls - Component Location

Description and Operation

Component Location



E93904

## ItemDescription

1	Inlet air duct
2	Charge air ducts
3	Supercharger
4	RH (right-hand) intercooler
5	Fuel injector (8 off)
6	Fuel rail adapter
7	RH fuel rail
8	By-pass valve
9	Induction elbow
10	Electric throttle
11	LH (left-hand) fuel rail
12	LH intercooler

# Fuel Charging and Controls - 4.2L SC V8 - AJV8 - Fuel Charging and Controls - Overview

Description and Operation

## Overview

The fuel charging and control system comprises a supercharger and air induction system, fuel pump, [FPDM \(fuel pump driver module\)](#), fuel rails and fuel injectors. The fuel pump supplies fuel from the tank, via a pipe routed along the outside of the [LH \(left-hand\)](#) chassis box section, to the fuel rail. The fuel rail distributes the fuel equally to each of the fuel injectors. The fuel injectors, which are controlled by the [ECM \(engine control module\)](#), are installed in the fuel rails on each side of the intercoolers. A cross over pipe connects the two fuel rails together at the front of the engine. The supercharger delivers compressed air into the engine through the air induction system.

Refer to: [Electronic Engine Controls](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

# Fuel Charging and Controls - 4.2L SC V8 - AJV8 - Fuel Charging and Controls - System Operation and Component Description

Description and Operation

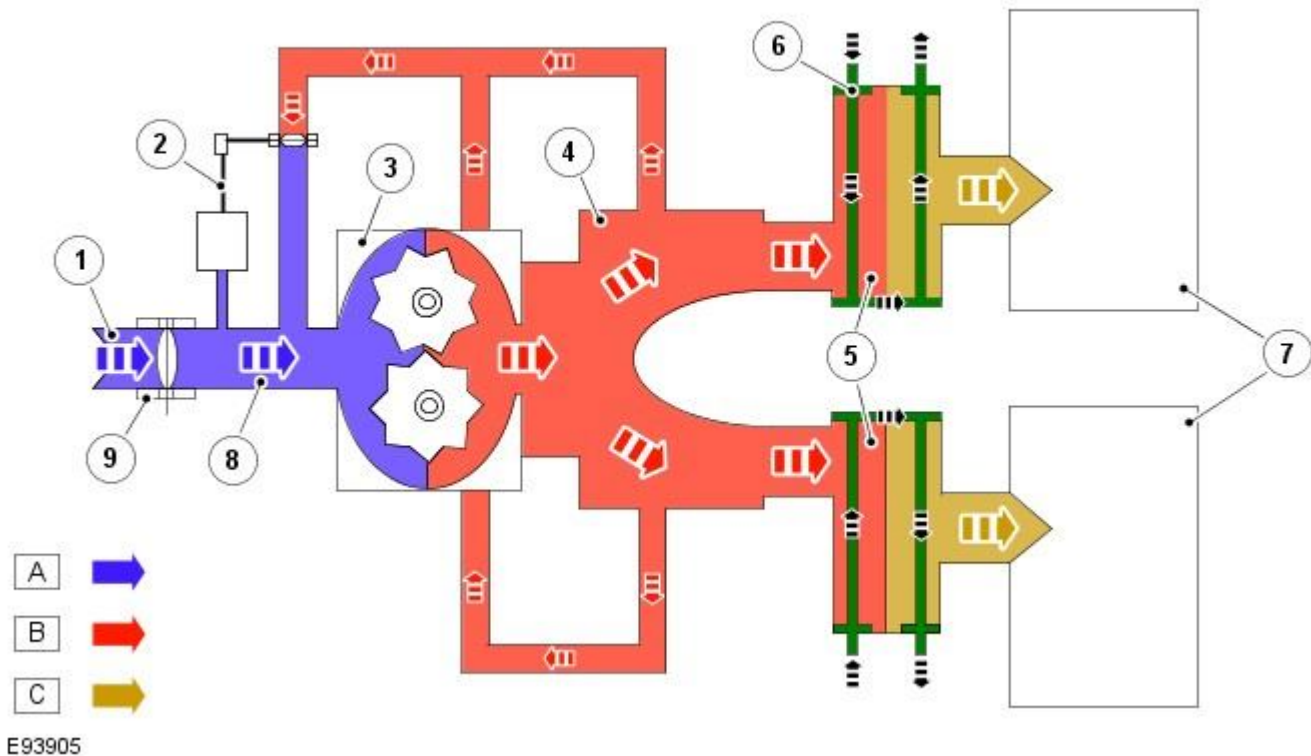
## System Operation

Operation of the fuel charging and control system is controlled by the [ECM \(engine control module\)](#).

Refer to: [Electronic Engine Controls](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

## Component Description

### Air Induction System



#### ItemDescription

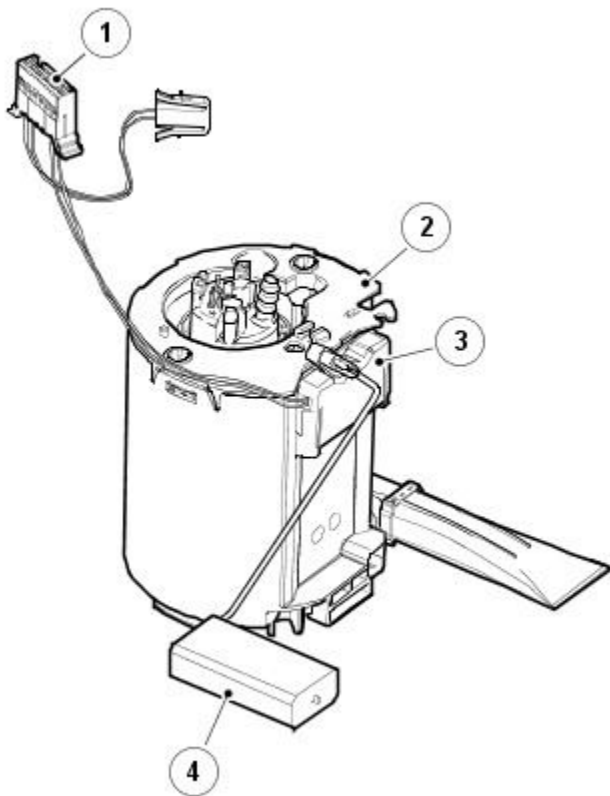
1	Air inlet duct
2	Vacuum operated by-pass valve assembly
3	Supercharger
4	Supercharger exit port
5	Intercoolers
6	Cooling water
7	Cylinder heads
8	Induction elbow
9	Electronic throttle body

The air induction system comprises the supercharger and a series of ducts and ports which direct compressed air into the engine. Air is drawn into the engine through the air inlet duct and into the induction elbow at the back of the engine, which houses the electronic throttle. The air is directed through the induction elbow into the supercharger, where it is compressed above atmospheric pressure. The compressed air exits the supercharger through a port in the upper surface and through the charge air ducts into the two intercoolers, one above each cylinder bank.

After compression in the supercharger, the intake air temperature often exceeds 160 °C (320 °F). For this reason the intercoolers are liquid cooled and act as separate air to liquid heat exchanger matrices for each bank of cylinders. The cooled and denser compressed air passes from the intercoolers to the fuel rail adapters and into the engine.

A vacuum operated bypass valve, situated downstream of the throttle body, opens during part throttle operation. This has the effect of recirculating and controlling the compressed air pressure and reducing unnecessary supercharger pumping operation.

### Fuel Pump



E74571

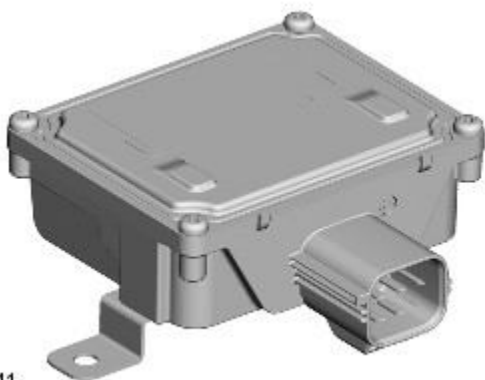
**ItemDescription**

1	Electrical connector
2	Fuel pump module
3	Fuel level sensor
4	Fuel level float

The high flow rate fuel pump module is mounted in the **RH (right-hand)** side of the saddle type fuel tank and delivers fuel at variable flow and pressure to the fuel rails, which supply fuel to all fuel injectors. The fuel pump operation is regulated by the **FPDM (fuel pump driver module)**, which is controlled by the **ECM**.

Refer to: [Fuel Tank and Lines](#) (310-01 Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

**Fuel Pump Driver Module**



E99541

The **FPDM** is used to control the speed of the fuel pump based upon the fuel demand of the engine. The **ECM** controls the **FPDM** in response to inputs from the **FRP (fuel rail pressure)** sensor, **MAP (manifold absolute pressure)** sensor, **MAF (mass air flow)** sensor and the **IAT (intake air temperature)** sensor. The **FPDM** is attached to the **RH** end of the evaporative emission canister, which is installed on the underside of the center floor pan, above the rear stabilizer bar.

The **ECM** sends a **PWM (pulse width modulation)** signal to the **FPDM**, the frequency of the signal determines the duty cycle of the pump. The **PWM** signal to the pump represents half the ON time of the pump. If the **ECM** transmits a 50% ON time this drives the pump at 100%. If the **ECM** transmits a 5% ON time the **FPDM** drives the pump at 10%. The **FPDM** will only turn the fuel pump ON if it receives a valid signal between 4% and 50%. When the **ECM** requires the fuel pump to be turned OFF, it transmits a duty cycle signal of 75%.

The status of the **FPDM** is monitored by the **ECM**. Any errors can be retrieved from the **ECM** using the Jaguar approved diagnostic system. The **FPDM** cannot be interrogated for diagnostic purposes.

## Fuel Injectors



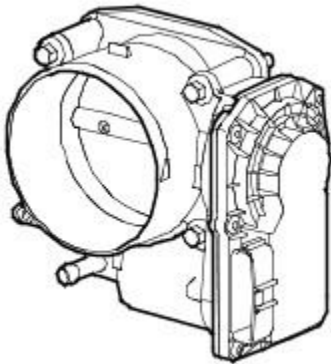
E47305

Eight, top fed, 12 hole, fuel injectors are installed in the fuel rails. Two O-rings seal each injector to the fuel rails. The fuel jets from the injectors are directed onto the back of the intake valves.

The injectors are electromagnetic solenoid valves controlled by the [ECM](#). Each injector contains a solenoid-operated needle valve, which is closed while the solenoid winding is de-energized. The solenoid winding is connected to a power feed from the main relay and to an earth through the [ECM](#). The [ECM](#) switches the earth to control the opening and closing of the needle valve. While the needle valve is open, fuel is sprayed into the cylinder intake tract onto the back of the intake valves. The [ECM](#) meters the amount of fuel injected by adjusting the time that the needle valve is open.

The solenoid winding of the fuel injector has a resistance of  $13.8 \pm 0.7$  ohms @ 20 °C (68 °F).

## Electric Throttle



E47298

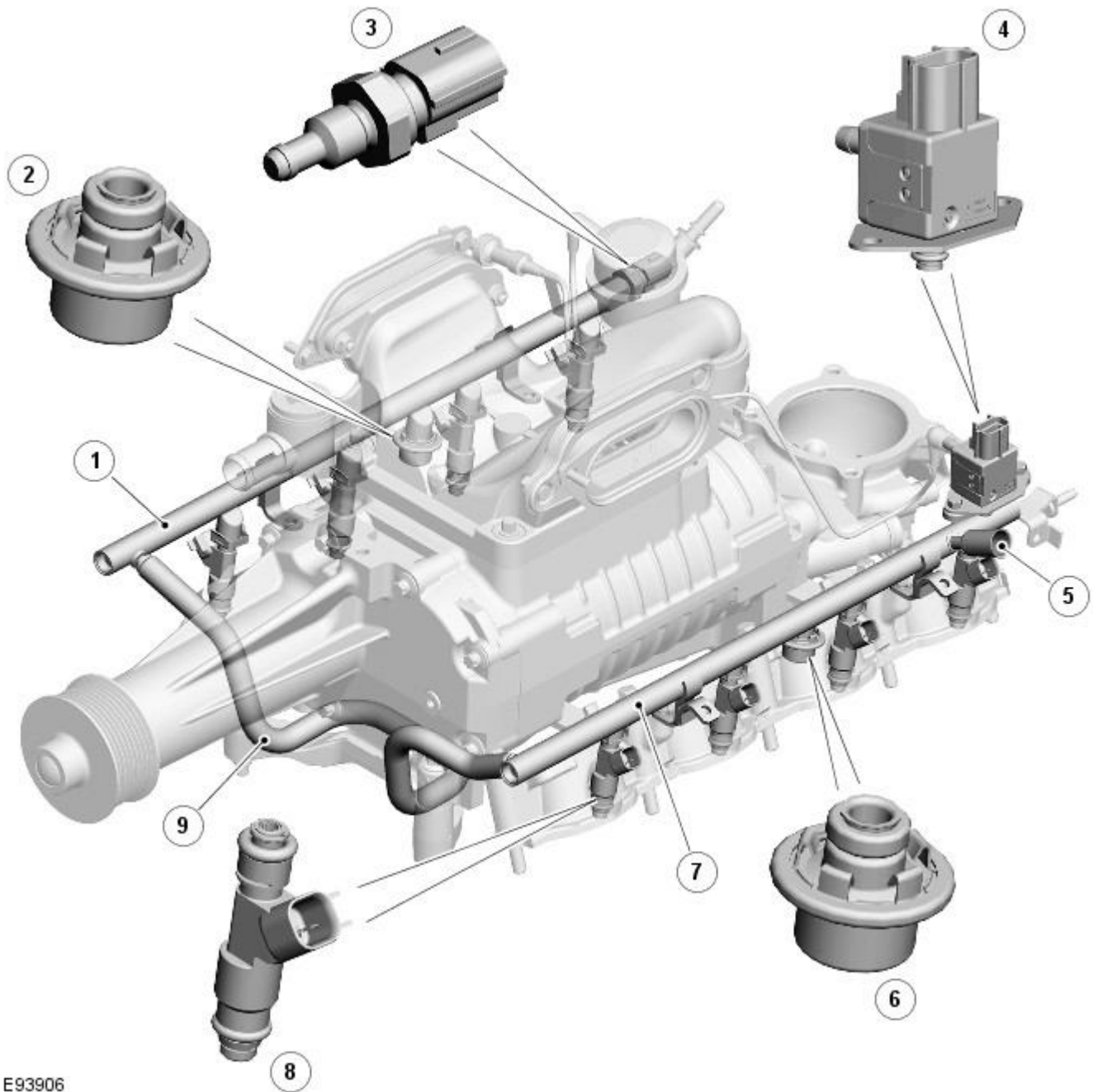
The electric throttle controls the engine torque and is located on the induction elbow at the rear of the engine. Its main components are an electronic throttle control valve, an [APP \(accelerator pedal position\)](#) sensor and the [ECM](#).

The [APP](#) sensor determines the driver demand to control throttle opening. This value is received by the [ECM](#) and the throttle is then opened to the correct angle by means of an integral electric motor. Sensors in the throttle body are used to determine the position of the throttle plate and the rate of change in its angle.

Refer to: [Electronic Engine Controls](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

## Fuel Rails





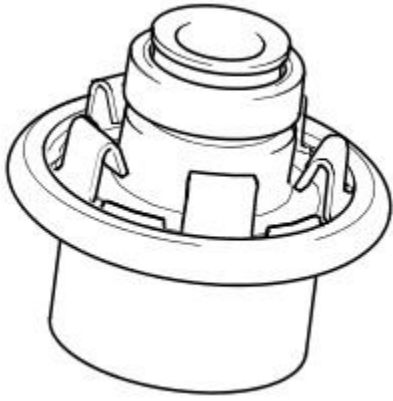
E93906

**ItemDescription**

1	<a href="#">RH</a> fuel rail
2	<a href="#">RH</a> fuel pressure damper
3	Fuel temperature sensor
4	<a href="#">FRP</a> sensor
5	Fuel supply
6	<a href="#">LH (left-hand)</a> fuel pressure damper
7	<a href="#">LH</a> fuel rail
8	Fuel injectors (8 off)
9	Fuel supply cross over pipe

Each fuel rail maintains a fuel pressure of typically 4.5 bar (65 lbf/in<sup>2</sup>), however, this pressure will vary depending on engine requirements; lower at idle, higher at full load. Four fuel injectors are installed in each cylinder head and are connected to the fuel rail. O-ring seals are used to seal the fuel injectors to the fuel rails.

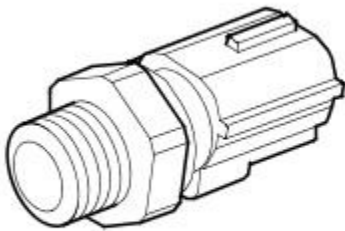
**Fuel Pressure Damper**



E74573

A fuel pressure damper is attached centrally to each of the fuel rails. The damper acts to damp pressure pulses from the fuel pump.

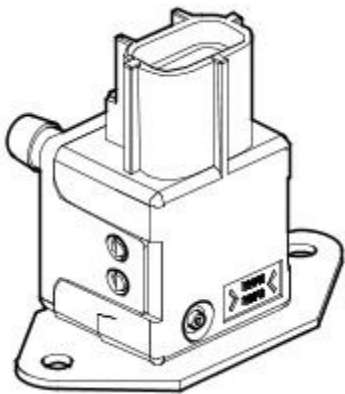
### Fuel Temperature Sensor



E47606

The fuel temperature sensor is located in the rear of the [RH](#) fuel rail. The sensor is a [NTC \(negative temperature coefficient\)](#) sensor, which is connected to the [ECM](#) by two wires. Refer to: [Electronic Engine Controls](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

### Fuel Rail Pressure Sensor



E58945

The [FRP](#) sensor continuously monitors the fuel pressure in the fuel rail, this value is used by the [ECM](#) to calculate the injector pulse-width required to deliver the correct mass of fuel per injection. The [ECM](#) also uses this information to demand a specific fuel flow-rate from the fuel pump via the [FPDM](#). Refer to: [Electronic Engine Controls](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

# **Fuel Charging and Controls - 4.2L SC V8 - AJV8 - Fuel Charging and Controls**

Diagnosis and Testing

For additional information.

REFER to: [Fuel Charging and Controls](#) (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Diagnosis and Testing).

# Fuel Charging and Controls - 4.2L SC V8 - AJV8 - Fuel Injectors

Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

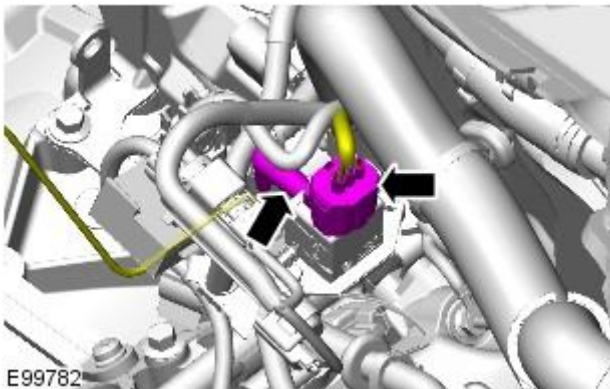
2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

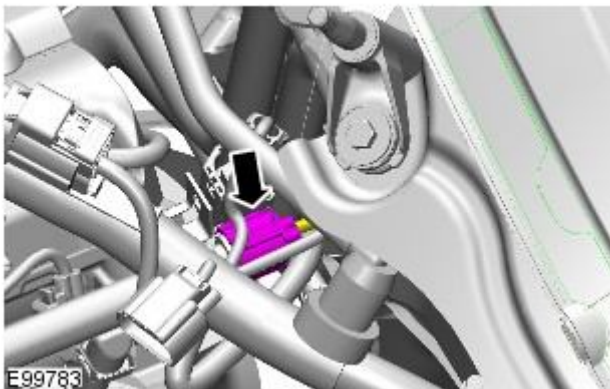
3. Refer to: [Charge Air Cooler](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).

4. Refer to: [Spring Lock Couplings](#) (310-00 Fuel System - General Information, General Procedures).

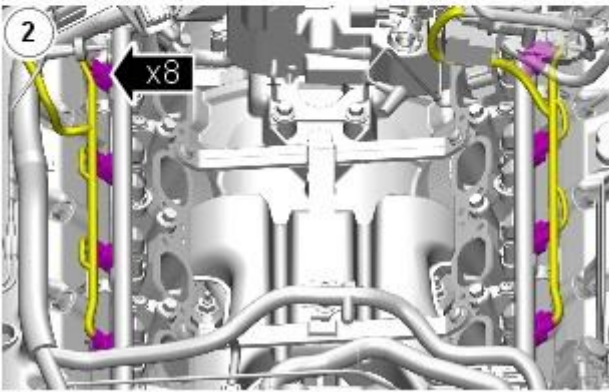
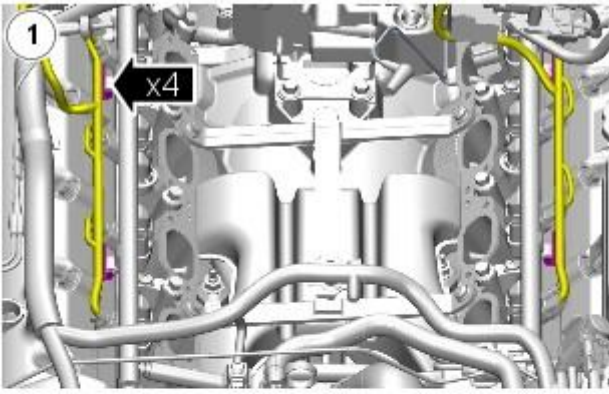
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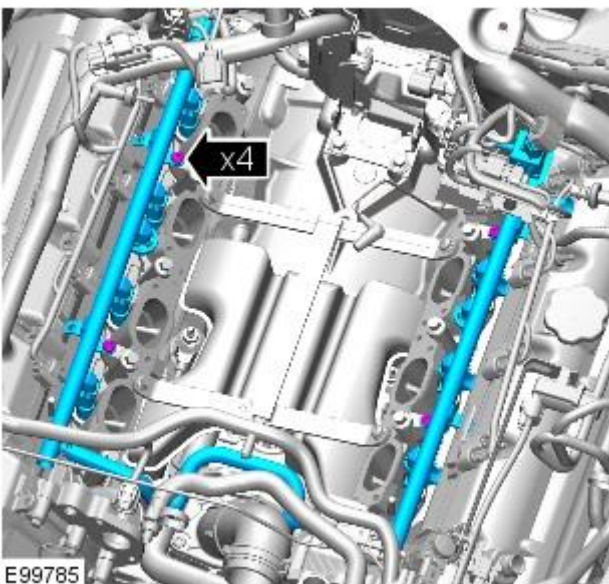
6.



7.



E99784



E99785

8. **8. CAUTIONS:**



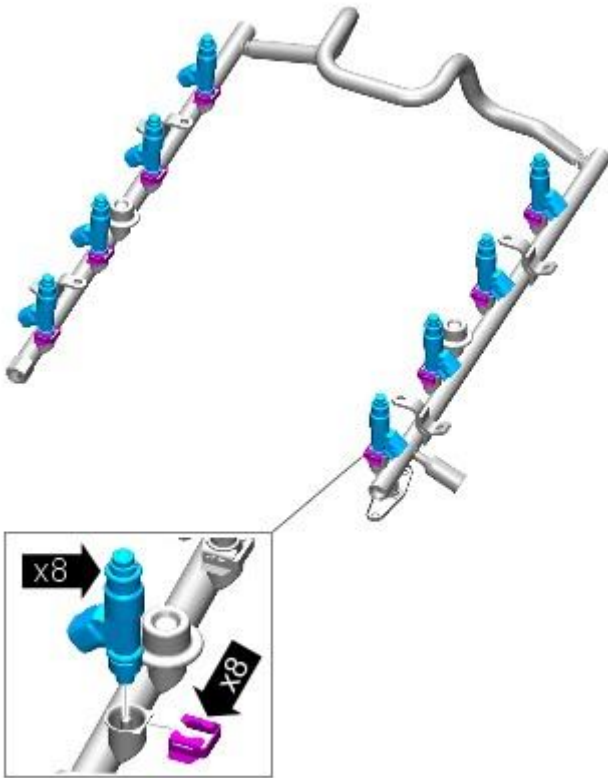
A new O-ring seal is to be installed.



Cap the fuel injector nozzle to prevent damage before storing vertically.

*Torque:* 10 Nm

9.  CAUTION: A new O-ring seal is to be installed.



E99788

## Installation

1. To install, reverse the removal procedure.



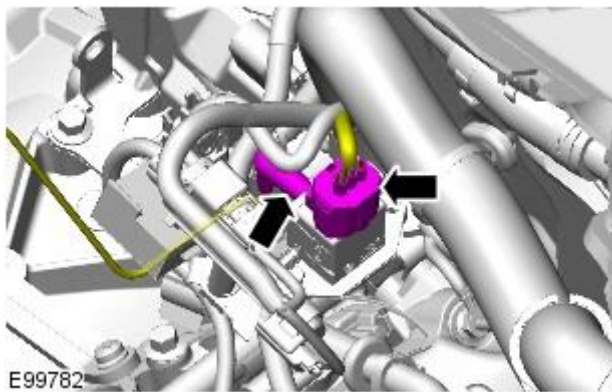
## Fuel Charging and Controls - 4.2L SC V8 - AJV8 - Fuel Rail

Removal and Installation

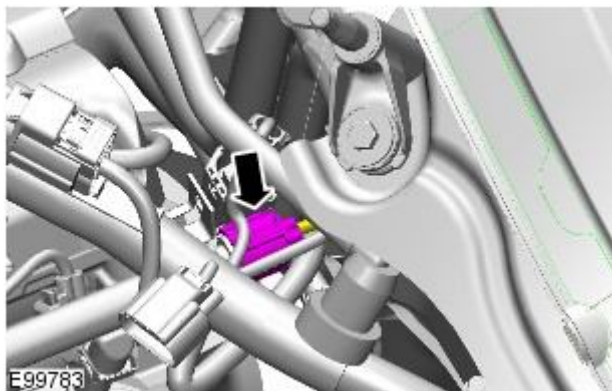
### Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Charge Air Cooler](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).
3. Refer to: [Spring Lock Couplings](#) (310-00 Fuel System - General Information, General Procedures).

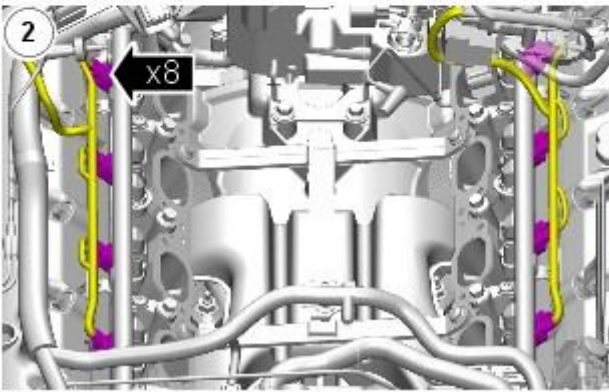
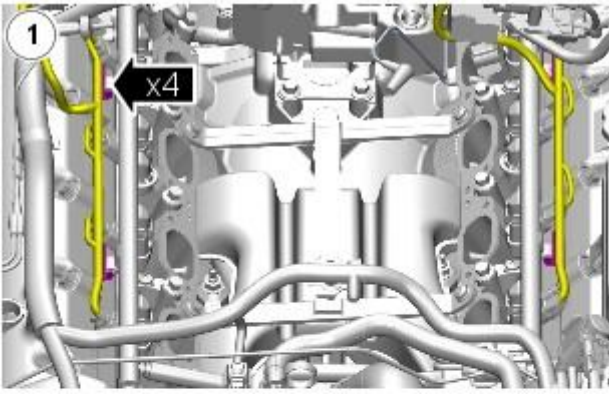


4.

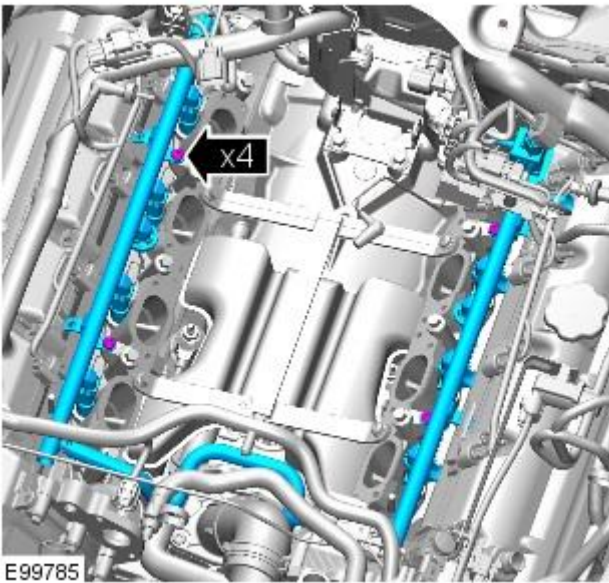


5.

6.



E99784



E99785

7. 7. CAUTIONS:

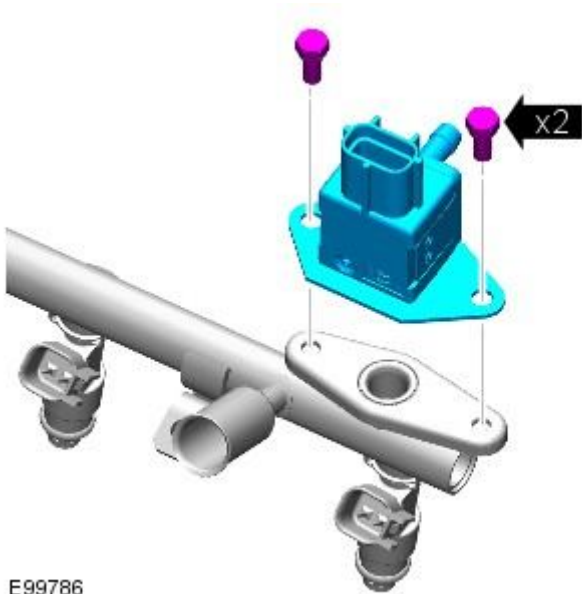


A new O-ring seal is to be installed.



Cap the fuel injector nozzle to prevent damage before storing vertically.

Torque: 10 Nm

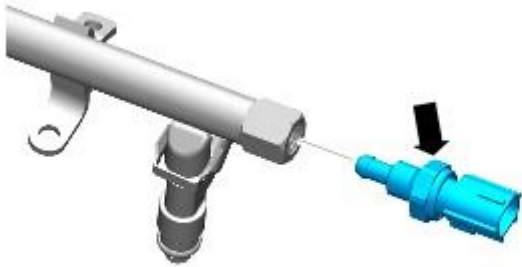


E99786

8. **8.** NOTE: Do not disassemble further if the component is removed for access only.

- NOTE: Install a new gasket.

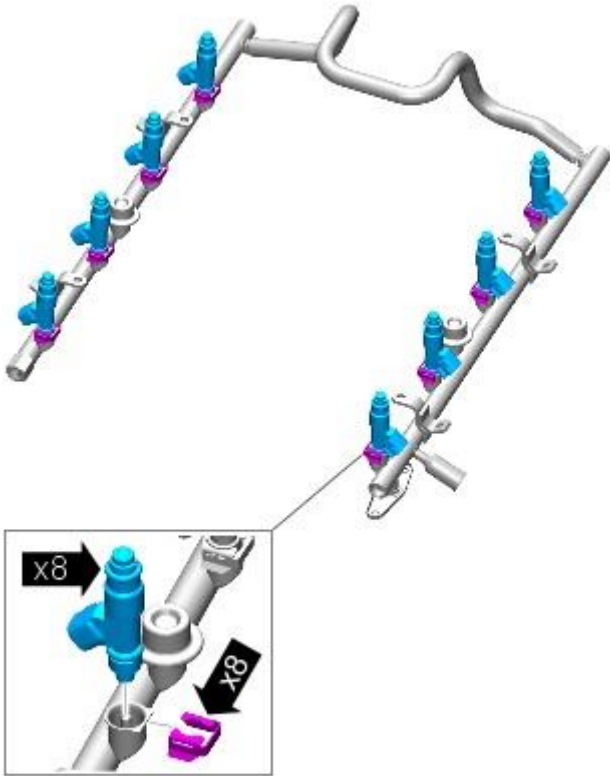
Torque: 5 Nm



E99787

9. **9.** NOTE: Install a new gasket.

Torque: 7 Nm



E99788

10.  CAUTION: A new O-ring seal is to be installed.

## Installation

1. To install, reverse the removal procedure.

# Fuel Charging and Controls - 4.2L SC V8 - AJV8 - Throttle Body

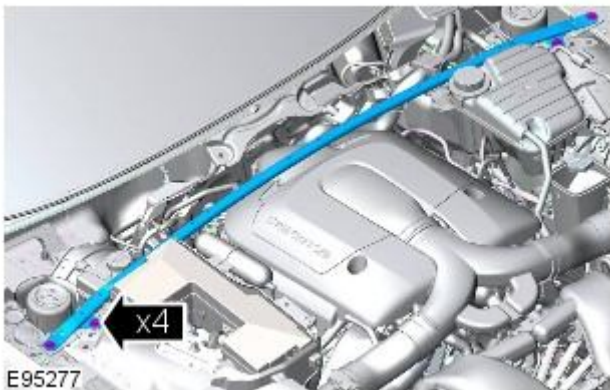
Removal and Installation

## Removal

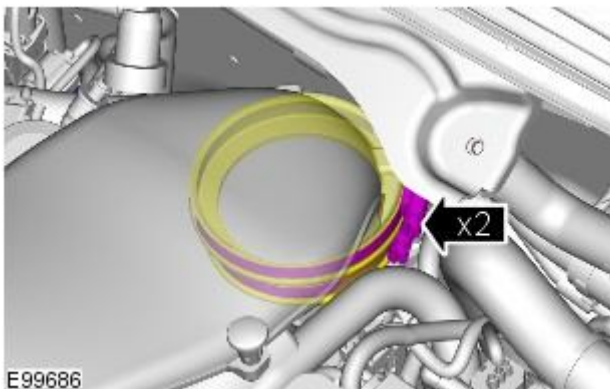
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Engine Cover - 4.2L SC V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).
4. Refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).

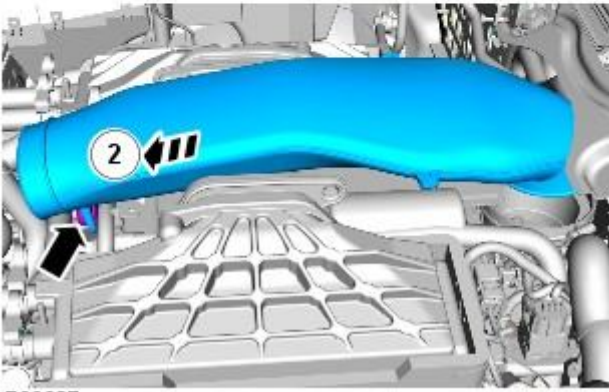
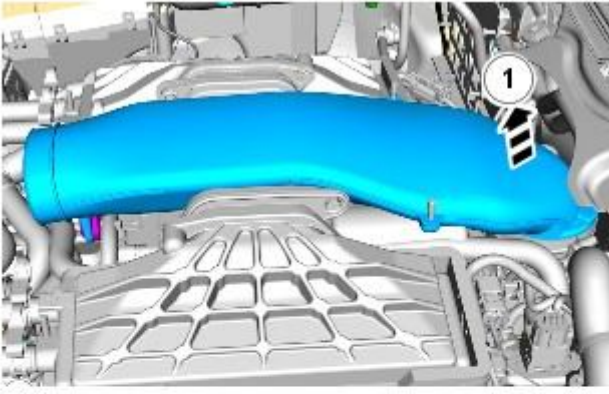
5. Torque: 25 Nm



6.

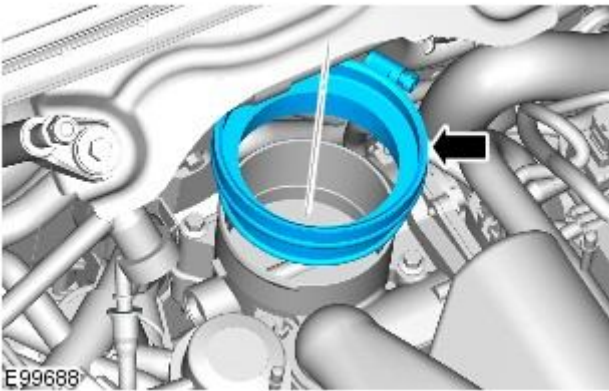


7.



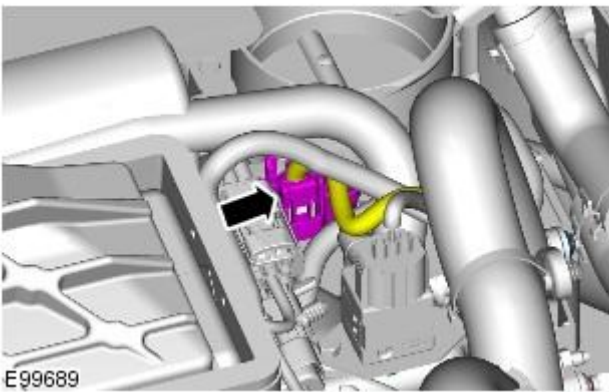
E99687

8.



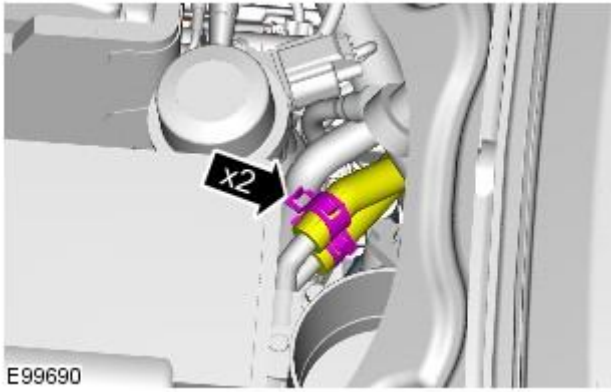
E99688

9.

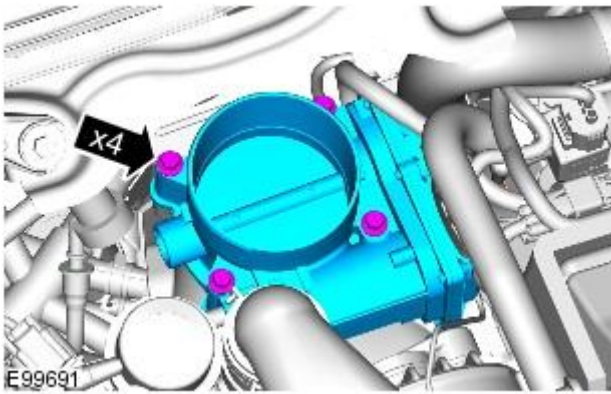


E99689





10.



11. *Torque:* 10 Nm

## Installation

1. To install, reverse the removal procedure.

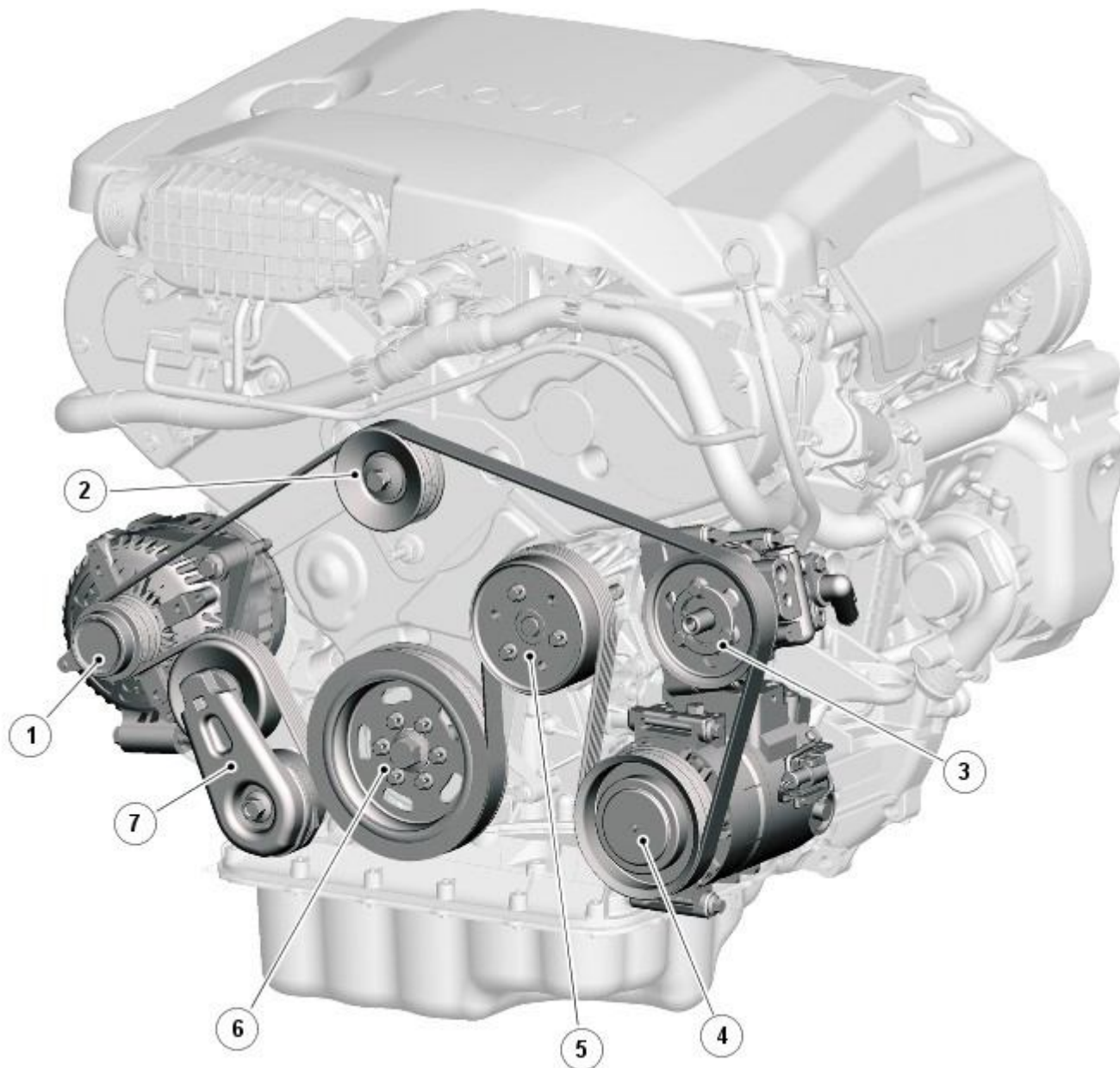
**Accessory Drive - TDV6 2.7L Diesel -**

<b>Description</b>	<b>Nm</b>	<b>lb-ft</b>	<b>lb-in</b>
Accessory drive belt tensioner retaining bolt	47	35	-
Accessory drive belt idler pulley retaining bolt	47	35	-
Fuel injection pump belt rear cover retaining bolts	10	7	-
Camshaft rear pulley retaining bolt	80 (+90 degrees)	59 (+90 degrees)	-
Fuel injection pump pulley retaining nut	50	37	-
Fuel injection pump belt tensioner retaining bolt	26	19	-
A=refer to procedure for correct tightening sequence	-	-	-

# Accessory Drive - TDV6 2.7L Diesel - Accessory Drive - Component Location

Description and Operation

Component Location



E93216

## ItemDescription

1	Generator
2	Idler
3	Power steering pump
4	A/C (air conditioning) compressor
5	Coolant pump
6	Crankshaft
7	Belt tensioner

# Accessory Drive - TDV6 2.7L Diesel - Accessory Drive - Overview

Description and Operation

## Overview

The combined crankshaft pulley and torsional vibration damper drives a single, 6-ribbed vee belt. The belt drives all of the engine-mounted accessories such as the generator, the power steering pump, the [A/C \(air conditioning\)](#) compressor and the coolant pump.

The accessory drive belt, which is a maintenance free poly-V type belt, is automatically pre-loaded by the belt tensioner and routed over idlers in order to maintain sufficient adhesion about the drive wheels. This ensures slip-free drive of the accessory components.

The torsional vibration damper incorporates compressed rubber between its inner and outer diameters to absorb vibration and shock loads.

The belt tensioner is calibrated to provide the correct amount of tension to the belt for a given drive system. Unless a spring within the tensioner assembly breaks, or some other mechanical part of the tensioner fails, there is no need to check the tensioner for correct tension.

The accessory drive belt should be inspected at every routine service for excessive wear and damage.

## Belt tensioner

The belt tensioner consists of an idler pulley, which is free to rotate on a bearing located at the end of a spring-loaded pivot arm.

The accessory drive belt wear indicators are incorporated on the bottom of the accessory drive belt tensioner. When the indicators are aligned the accessory drive belt requires replacing.

# Accessory Drive - TDV6 2.7L Diesel - Accessory Drive

Diagnosis and Testing

## Principles of Operation

The 2.7L diesel engine uses two accessory drive systems, the Front End Accessory Drive (FEAD), and the fuel injection pump drive.

### FEAD Belt

The FEAD belt drives: the coolant pump, the generator, the power assisted steering pump and the air conditioning compressor, driven from the crankshaft pulley via a single six-ribbed belt.

### Fuel Injection Pump Belt

The fuel injection pump is driven from the exhaust camshaft of the left-hand cylinder bank, by a single, toothed belt. The fuel injection pump is **NOT** timed to the engine.

For a detailed description of the diesel engine accessory drive belts, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

- [Accessory Drive](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Description and Operation),
- [Accessory Drive](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Description and Operation),
- Accessory Drive (303-05A, Description and Operation).

## Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of damage and system integrity.

FEAD Belt	Fuel Injection Pump Belt
<ul style="list-style-type: none"> <li>● Belt condition (cracking/damage/contamination)</li> <li>● Belt tension</li> <li>● Function of driven components (seized, etc)</li> <li>● Pulley alignment</li> </ul>	<ul style="list-style-type: none"> <li>● Security/correct fitment of cover</li> <li>● Check for debris inside the cover</li> <li>● Belt condition (cracking/damage/contamination)</li> <li>● Belt tension</li> </ul>

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

## Noise Definitions

Description of Noise	Definition/Possible Cause
Squeal	Continuous shriek, most noticeable when the engine is accelerated (usually associated with lack of belt tension, contamination or wet slip)
Chirp	Continuous shriek, most noticeable when the engine is accelerated (usually associated with lack of belt tension, contamination or wet slip)
Whine	Continuous noise, changing frequency with engine speed, generally associated with rotating components (generator, idler, etc)
Rattle	Metallic knocking, often a loose component or tensioner fault
Rumble	Bearing noise

## Symptom Chart

 **CAUTION:** The engine should not be run for long periods of time with the FEAD belt removed. Failure to follow this instruction may result in damage to the vehicle.

### FEAD Belt

Symptom	Possible Cause	Action
Noise (see definitions above)	<ul style="list-style-type: none"> <li>● Belt condition</li> <li>● Belt tension</li> <li>● Pulleys misaligned</li> <li>● Driven components</li> </ul>	Check the belt condition. Check the tensioner operation. Check the pulley alignment. Check the driven components for excessive resistance to rotation. Remove FEAD belt and start engine to eliminate from source of noise. Rectify as required
Drive belt does not hold tension	<ul style="list-style-type: none"> <li>● Belt condition</li> <li>● Tensioner fault</li> </ul>	Check the belt condition (see visual inspection). Check the tensioner function. Rectify as necessary.

### Fuel Injection Pump Belt

Symptom	Possible Cause	Action
Noise (see definitions above)	<ul style="list-style-type: none"> <li>● Belt condition</li> <li>● Belt fouling cover</li> <li>● Tensioner bearing failure</li> <li>● Fuel injection pump failure</li> </ul>	Check the belt condition. Check the belt cover for indications of fouling (this may indicate a pump misalignment), REFER to: <a href="#">Fuel Injection Pump</a> (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation). The belt tensioner must be renewed if the belt is removed, making a check of the bearing impractical. Remove the belt, check the fuel injection pump pulley for security. Check the fuel injection pump for excessive resistance to rotation (excessive resistance in the pump will cause the pulley securing nut to loosen as a design feature). Check for DTCs indicating a pump malfunction and refer to the relevant DTC Index

<b>Symptom</b>	<b>Possible Cause</b>	<b>Action</b>
Loss of drive (with no drive to the fuel injection pump, the engine will not run)	<ul style="list-style-type: none"><li>● Belt broken/stripped teeth</li><li>● Drive pulleys loose</li></ul>	Investigate the cause of the belt breakage/damage. Check the fuel injection pump for excessive resistance to rotation (excessive resistance in the pump will cause the pulley securing nut to loosen as a design feature). Check for DTCs indicating a pump malfunction and refer to the relevant DTC Index



# Accessory Drive - TDV6 2.7L Diesel - Accessory Drive Belt

Removal and Installation

## Special Tool(s)

303-703



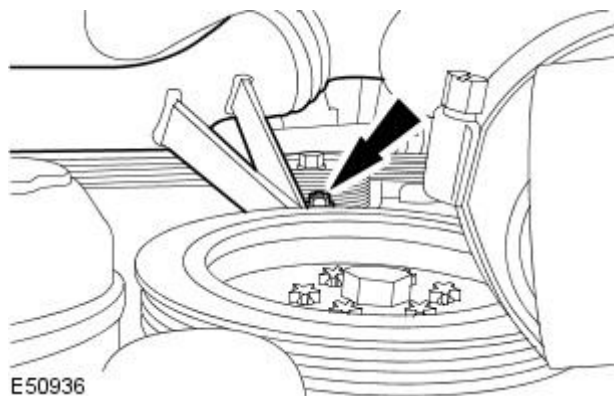
E95037

Accessory belt tensioner

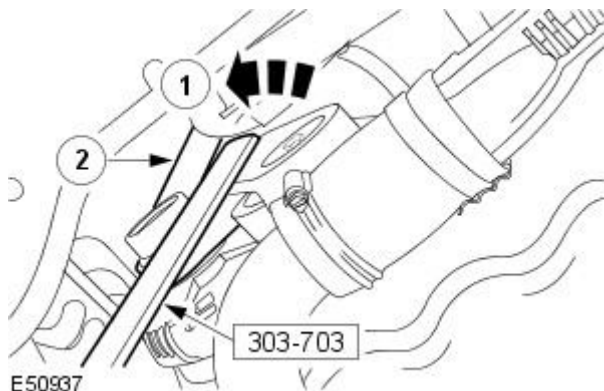
303-703

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Raise and support the vehicle.
3. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
4. Release the air cleaner outlet pipe.



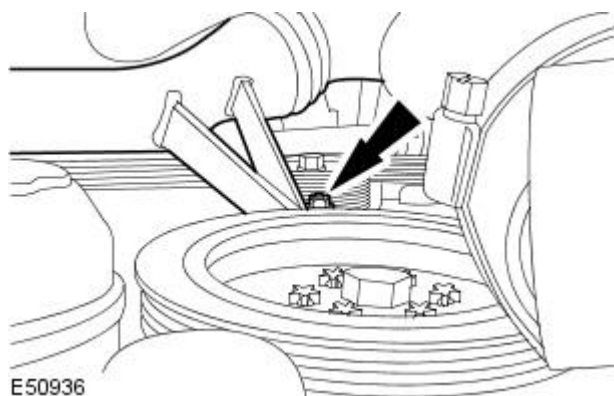
E50936




E50937

5. Remove the accessory drive belt.
  1. Using the special tool, rotate the accessory drive belt tensioner counter-clockwise.

## Installation



E50936

1.  **CAUTION:** Make sure that the accessory drive belt is correctly aligned to the pulleys. Failure to follow this instruction may result in damage to the vehicle.

To install, reverse the removal procedure.

- Clean and inspect the accessory drive belt pulleys for damage.
- Tighten to 25 Nm.

# Accessory Drive - TDV6 2.7L Diesel - Accessory Drive Belt Idler Pulley

Removal and Installation

## Special Tool(s)

303-703



E95037

Accessory belt tensioner

303-703

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

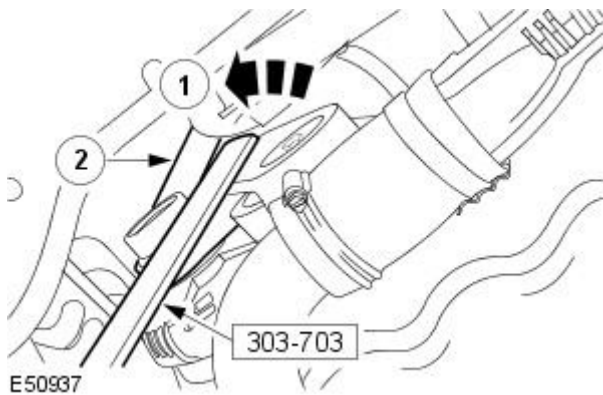
2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

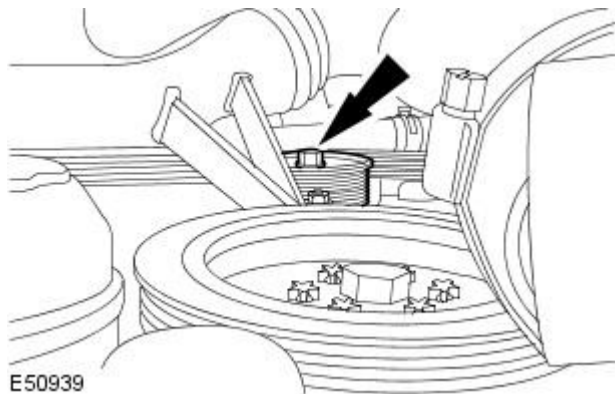
3. Remove the air deflector.

4. Release the accessory drive belt.

1. Using the special tool, rotate the accessory drive belt tensioner counter-clockwise.



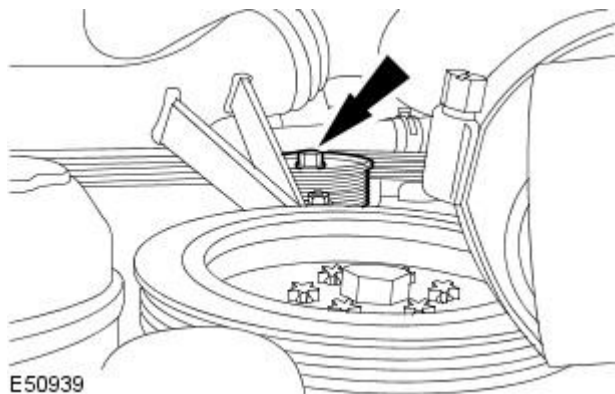
5. Remove the accessory drive belt idler pulley.



## Installation

1. To install, reverse the removal procedure.

- Tighten to 45 Nm.

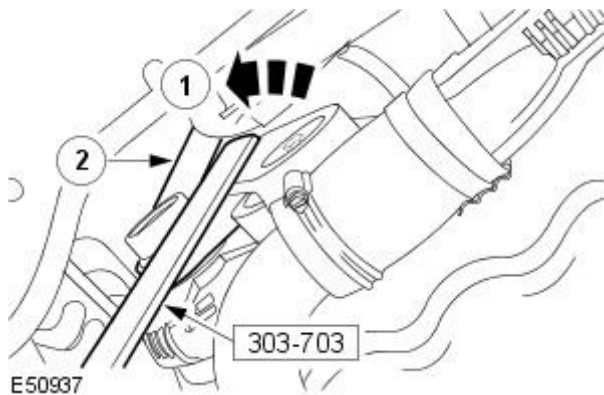


# Accessory Drive - TDV6 2.7L Diesel - Accessory Drive Belt Tensioner

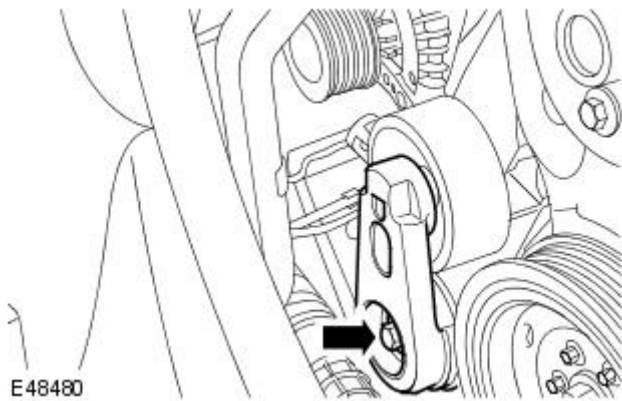
Removal and Installation

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
3. Release the accessory drive belt.
  1. Using the special tool, rotate the accessory drive belt tensioner counter clockwise.
  2. Detach the accessory drive belt.

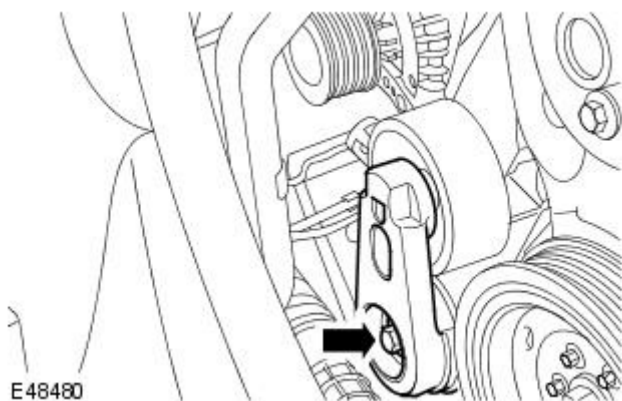


4. Remove the accessory drive belt tensioner.



## Installation

1. To install, reverse the removal procedure.
  - Tighten to 45 Nm.



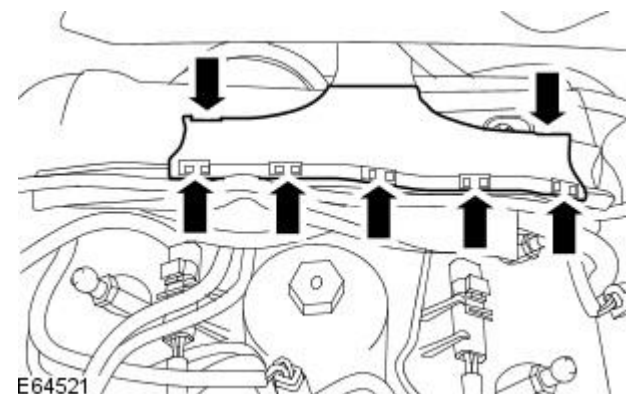
# Accessory Drive - TDV6 2.7L Diesel - Fuel Injection Pump Belt

Removal and Installation

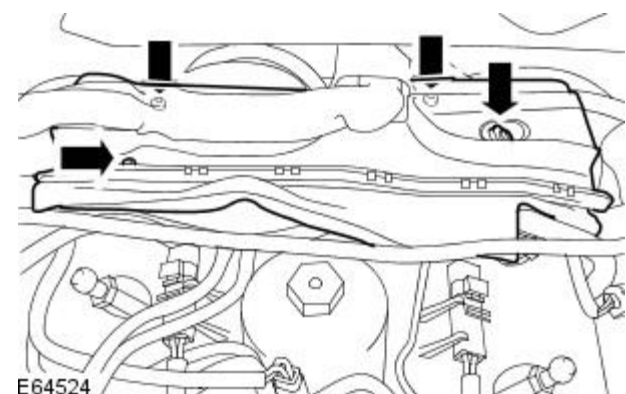
## Removal

• NOTE: Removal steps in this procedure may contain installation details.

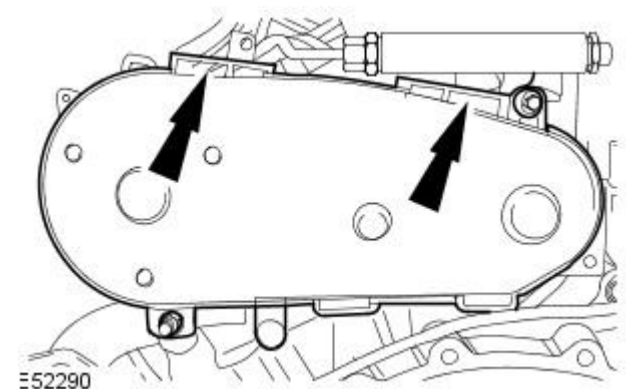
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Remove the secondary bulkhead center panel.  
For additional information, refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).
4. Remove the cover from the engine wiring harness casing.
  - Release the 7 retaining clips.



5. Remove the engine wiring harness casing.
  - Remove the 4 retaining bolts.



6. Remove the fuel injection pump belt cover.





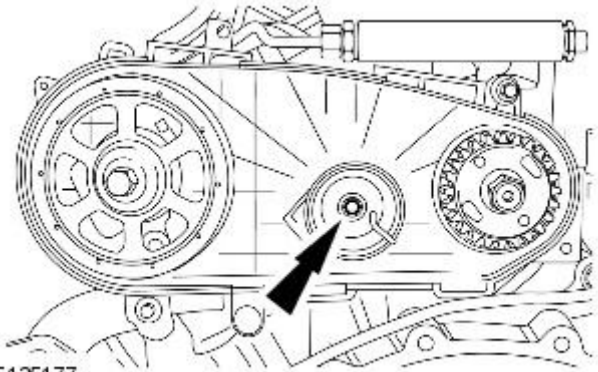
7. Cut off and discard the fuel injection pump belt.



E130869

8. NOTE: The fuel injection pump is not timed to the engine.


Remove and discard the fuel injection pump belt tensioner.



E125177

## Installation

1. CAUTIONS:


 Make sure that the fuel injection pump belt tensioner tang is correctly located to the fuel injection pump belt rear cover. Failure to follow this instruction may result in damage to the engine.

 Make sure that the fuel injection pump belt tensioner locking pin is not removed until the fuel injection pump belt tensioner is fully installed.

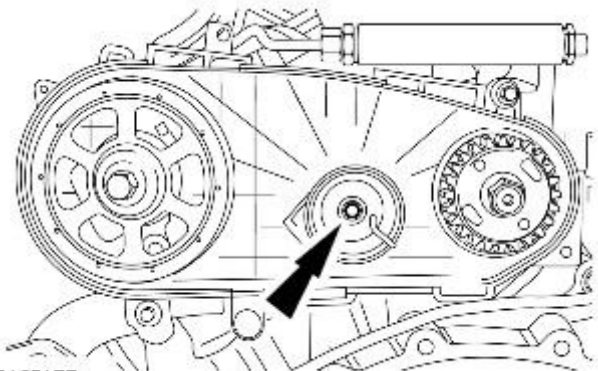
• NOTE: Do not remove the fuel injection pump belt tensioner locking pin before installing the new tensioner.

Install the fuel injection pump belt tensioner retaining bolt.

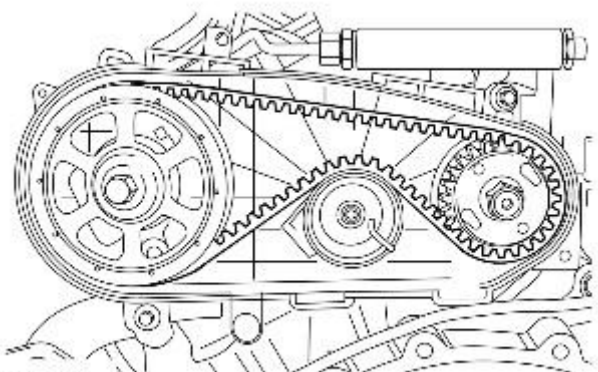
- Locate the tang on the new fuel injection pump belt tensioner into the fuel injection pump rear cover.
- Tighten to 25 Nm.

2.  CAUTION: Make sure that the fuel injection pump belt tensioner tang is correctly located to the fuel injection pump belt rear cover. Failure to follow this instruction may result in damage to the engine.

Install the new fuel injection pump belt.

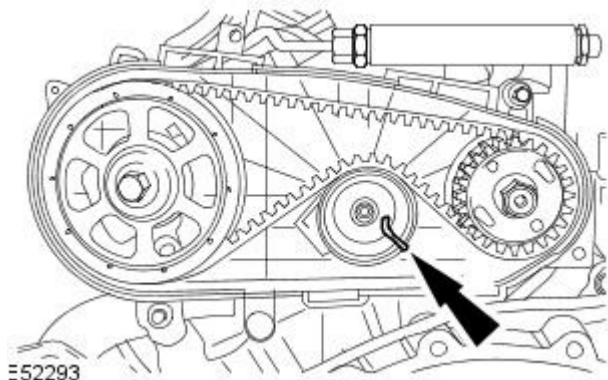


E125177

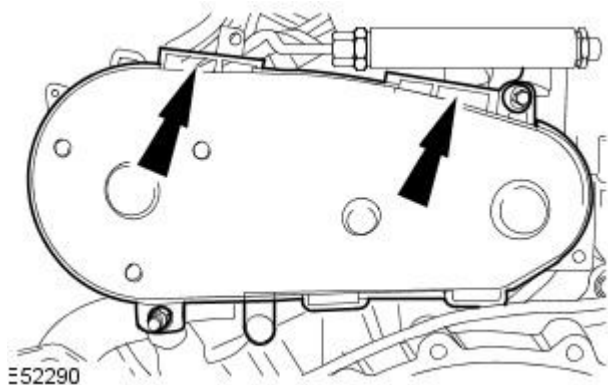


E125178

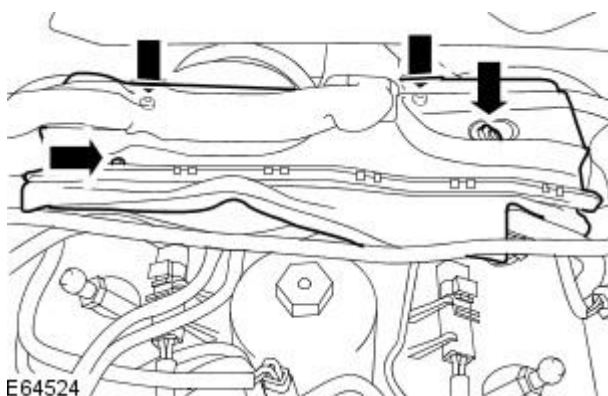
3. Remove and discard the fuel injection pump belt tensioner locking pin.



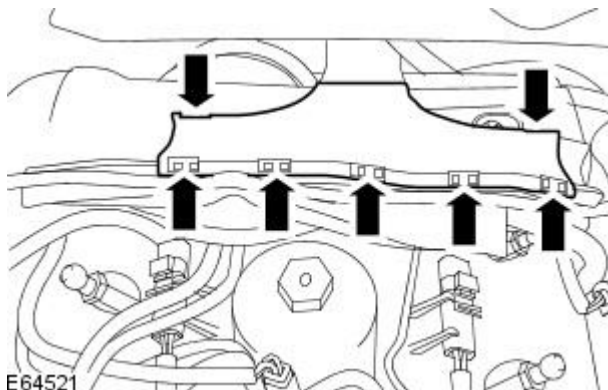
4. Install the fuel injection pump belt cover.



5. Install the engine wiring harness casing.



6. Install the engine wiring harness cover.





7. Install the secondary bulkhead center panel.  
For additional information, refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).
8. Install the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
9. Connect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).



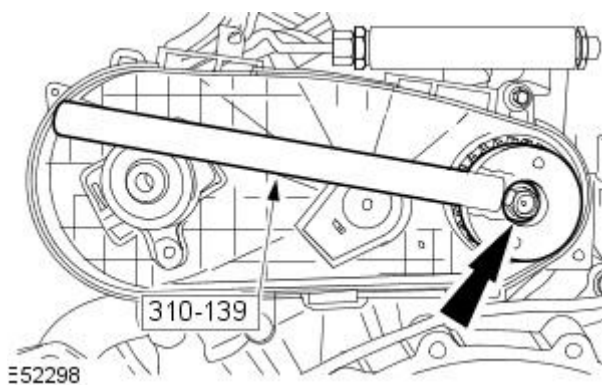
# Accessory Drive - TDV6 2.7L Diesel - Fuel Injection Pump Pulley

Removal and Installation

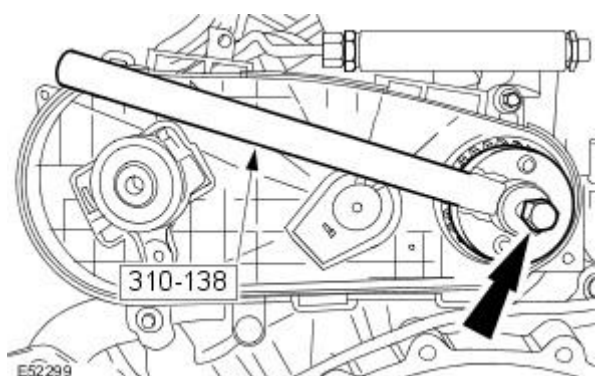
Special Tool(s)	
 <p><b>310-139</b></p> <p>E54548</p>	<p>Holder - Fuel Pump Pulley</p> <p>310-139</p>
 <p><b>310-138</b></p> <p>E54547</p>	<p>Reaction Arm - Fuel Pump Pulley</p> <p>310-138</p>

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the fuel injection pump belt.  
For additional information, refer to: [Fuel Injection Pump Belt](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).
3. Using the special tool, remove the fuel injection pump pulley retaining nut.
  - Using the special tool, retain the fuel injection pump pulley.
  - Remove the special tool.

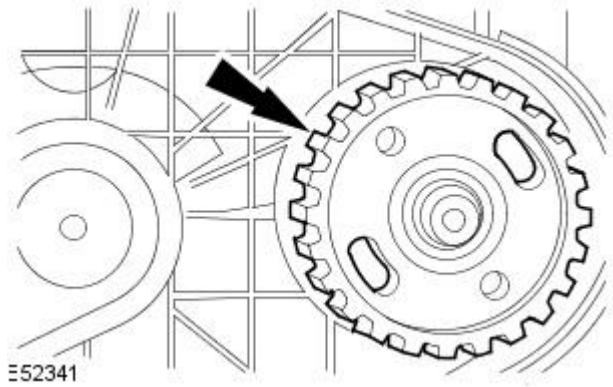


4. Using the special tool, remove the fuel injection pump pulley.
  - Remove the special tool.



## Installation

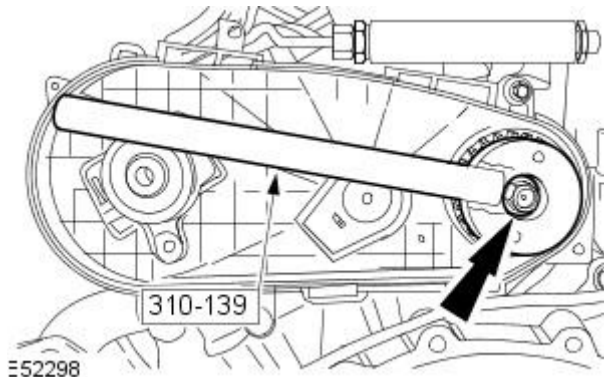
1. Install the fuel injection pump pulley.



E52341

2. Install the retaining nut.

- Tighten to 50 Nm.



E52298

3. Install the fuel injection pump belt.

For additional information, refer to: [Fuel Injection Pump Belt](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).

4. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

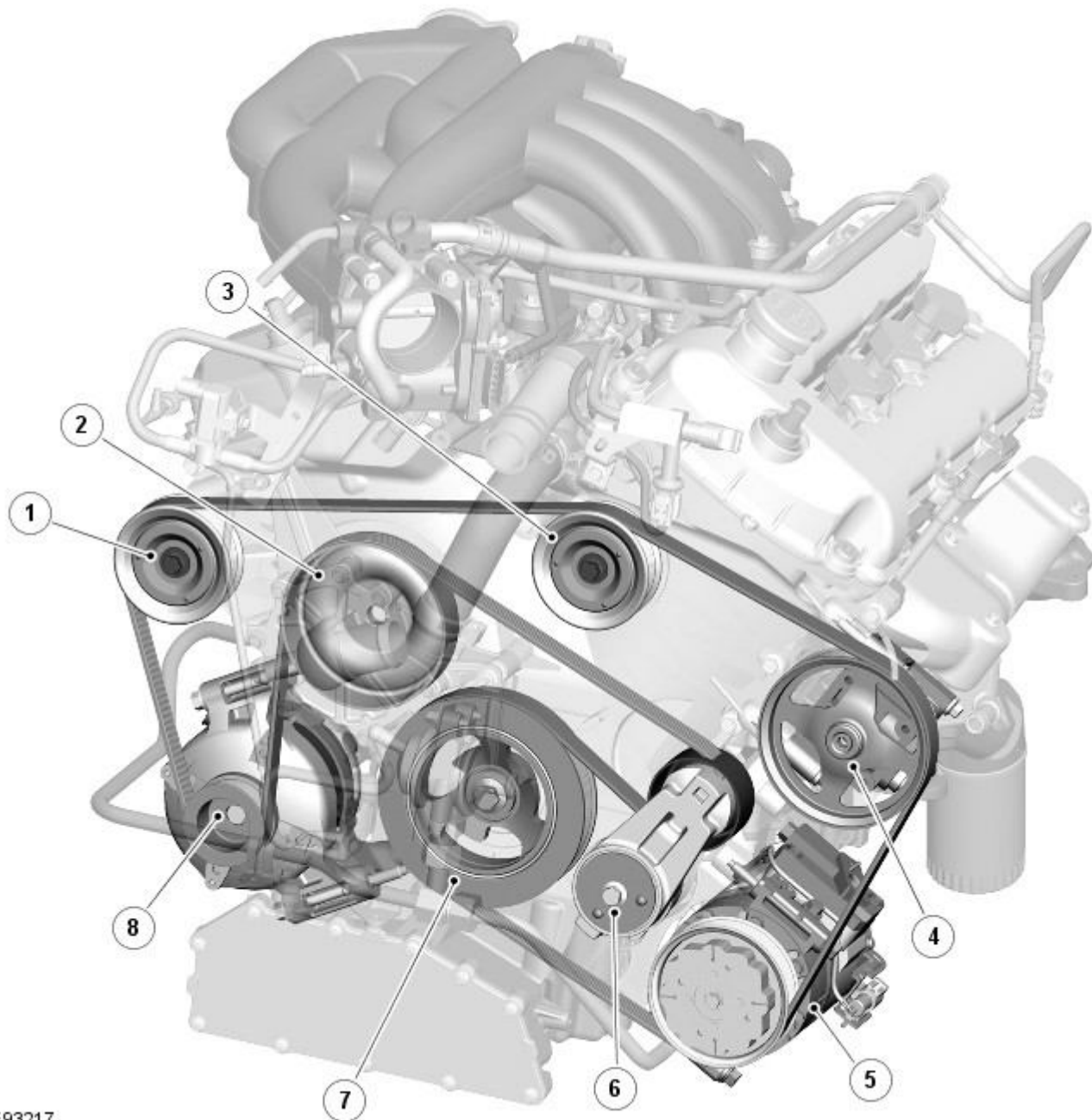
**Accessory Drive - V6 3.0L Petrol -**

Description	Nm	lb-ft	lb-in
Accessory drive belt tensioner retaining bolt	45	33	-
Accessory drive belt idler pulley retaining bolt	25	28	-

# Accessory Drive - V6 3.0L Petrol - Accessory Drive - Component Location

Description and Operation

Component Location



E93217

## ItemDescription

1	Idler
2	Coolant pump
3	Idler
4	Power steering pump
5	A/C (air conditioning) compressor
6	Belt tensioner
7	Crankshaft
8	Generator

# Accessory Drive - V6 3.0L Petrol - Accessory Drive - Overview

Description and Operation

## Overview

The combined crankshaft pulley and torsional vibration damper drives a single, 6-ribbed vee belt. The belt drives all of the engine-mounted accessories such as the generator, the power steering pump, the [A/C \(air conditioning\)](#) compressor and the coolant pump.

The accessory drive belt, which is a maintenance free poly-V type belt, is automatically pre-loaded by the belt tensioner and routed over idlers in order to maintain sufficient adhesion about the drive wheels. This ensures slip-free drive of the accessory components.

The torsional vibration damper incorporates compressed rubber between its inner and outer diameters to absorb vibration and shock loads.

The belt tensioner is calibrated to provide the correct amount of tension to the belt for a given drive system. Unless a spring within the tensioner assembly breaks, or some other mechanical part of the tensioner fails, there is no need to check the tensioner for correct tension.

The accessory drive belt should be inspected at every routine service for excessive wear and damage.

## Belt tensioner

The belt tensioner consists of an idler pulley, which is free to rotate on a bearing located at the end of a spring-loaded pivot arm.

The accessory drive belt wear indicators are incorporated on the bottom of the accessory drive belt tensioner. When the indicators are aligned the accessory drive belt requires replacing.

# Accessory Drive - V6 3.0L Petrol - Accessory Drive

Diagnosis and Testing

## Principles of Operation

For a detailed description of the petrol engine accessory drive belts, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

- [Accessory Drive](#) (303-05B Accessory Drive - V6 3.0L Petrol, Description and Operation),
- [Accessory Drive](#) (303-05B Accessory Drive - V6 3.0L Petrol, Description and Operation),
- [Accessory Drive](#) (303-05B, Description and Operation),
- [Accessory Drive](#) (303-05C Accessory Drive - V8 4.2L Petrol, Description and Operation),
- [Accessory Drive](#) (303-05C Accessory Drive - V8 4.2L Petrol, Description and Operation),
- [Accessory Drive](#) (303-05C, Description and Operation),
- [Accessory Drive](#) (303-05D Accessory Drive - V8 S/C 4.2L Petrol, Description and Operation),
- [Accessory Drive](#) (303-05D Accessory Drive - V8 S/C 4.2L Petrol, Description and Operation),
- [Accessory Drive](#) (303-05D, Description and Operation).

## Inspection and Verification

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical
<ul style="list-style-type: none"> <li>● FEAD belt</li> <li>● FEAD belt tension</li> <li>● FEAD belt tensioner</li> <li>● FEAD belt pulleys</li> <li>● Supercharger belt</li> <li>● Supercharger belt tension</li> <li>● Supercharger belt tensioner</li> <li>● Supercharger belt pulley</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

### Noise Definitions

Description of Noise	Definition/Possible Cause
Squeal	Continuous shriek, most noticeable when the engine is accelerated (usually associated with lack of belt tension, contamination or wet slip)
Chirp	Continuous shriek, most noticeable when the engine is accelerated (usually associated with lack of belt tension, contamination or wet slip)
Whine	Continuous noise, changing frequency with engine speed, generally associated with rotating components (generator, idler, etc)
Rattle	Metallic knocking, often a loose component or tensioner fault
Rumble	Bearing noise

### Symptom Chart

Symptom	Possible Cause	Action
FEAD belt noise or squeal	<ul style="list-style-type: none"> <li>● FEAD belt pulley(s)</li> <li>● Lubricant or other contamination</li> <li>● FEAD belt</li> </ul>	Determine where the noise is coming from (refer to the noise definitions above). Check pulley for correct alignment, freedom of rotation or damage. Install new components as required. Check FEAD belt for contamination. If contaminated, install a new belt as required. Check FEAD belt for correct application
FEAD belt does not hold tension	<ul style="list-style-type: none"> <li>● FEAD belt cracking or damaged</li> <li>● Tensioner worn or damaged</li> </ul>	Inspect FEAD belt for cracking or damage. Install a new belt as required. Check FEAD belt tensioner for damage and correct operation. Install a new FEAD belt tensioner as required
Supercharger belt noise or squeal	<ul style="list-style-type: none"> <li>● Supercharger belt pulley(s)</li> <li>● Lubricant or other contamination</li> <li>● Supercharger belt</li> </ul>	Determine where the noise is coming from (refer to the noise definitions above). Check pulley for correct alignment, freedom of rotation or damage. Install new components as required. Check supercharger belt for contamination. If contaminated, install a new belt as required. Check supercharger belt for correct application
Supercharger belt does not hold tension	<ul style="list-style-type: none"> <li>● Supercharger belt cracking or damaged</li> <li>● Tensioner worn or damaged</li> </ul>	Inspect supercharger belt for cracking or damage. Install a new belt as required. Check supercharger belt tensioner for damage and correct operation. Install a new supercharger belt tensioner as required

### Component Tests

#### FEAD Belt Tensioner

Static

The only checks required for the FEAD belt tensioner are for stick, grab or bind.

1. 1. Remove the drive belt in the area of the tensioner.



2. **2.** Using the correct tool, rotate the tensioner from its relaxed position through its full stroke and back to the relaxed position to make sure there is no stick, grab or bind, and to make sure that there is tension on the tensioner spring.
3. **3.** If the tensioner meets the above criteria, proceed to the dynamic test. If the tensioner does not meet the above criteria install a new tensioner. REFER to:

[Accessory Drive Belt Tensioner](#) (303-05B Accessory Drive - V6 3.0L Petrol, Removal and Installation),  
[Accessory Drive Belt Tensioner](#) (303-05C Accessory Drive - V8 4.2L Petrol, Removal and Installation),  
[Accessory Drive Belt Tensioner](#) (303-05D Accessory Drive - V8 S/C 4.2L Petrol, Removal and Installation).

#### Dynamic

The FEAD belt tensioner can be checked dynamically as follows:

4. **4.** With the engine running, observe drive belt tensioner movement, the FEAD belt tensioner should move (respond) when the air conditioning clutch cycles (if equipped), the FEAD belt tensioner should move (respond) when the engine speed is increased rapidly. If the drive belt tensioner movement is erratic without air conditioning clutch cycling or engine acceleration, a pulley or shaft may be bent, or distorted. Excessive drive belt rideout (uneven depth of grooves in the drive belt) can also cause excessive drive belt tensioner movement. Check condition by installing a known good belt. REFER to:

[Accessory Drive Belt](#) (303-05B Accessory Drive - V6 3.0L Petrol, Removal and Installation),  
[Accessory Drive Belt](#) (303-05C Accessory Drive - V8 4.2L Petrol, Removal and Installation),  
[Accessory Drive Belt](#) (303-05D Accessory Drive - V8 S/C 4.2L Petrol, Removal and Installation).

#### FEAD belt

1. **1.** With the engine off, check routing of the drive belt. REFER to:

[Accessory Drive Belt](#) (303-05B Accessory Drive - V6 3.0L Petrol, Removal and Installation),  
[Accessory Drive Belt](#) (303-05C Accessory Drive - V8 4.2L Petrol, Removal and Installation),  
[Accessory Drive Belt](#) (303-05D Accessory Drive - V8 S/C 4.2L Petrol, Removal and Installation).

2. **2.** Inspect the drive belt tensioner wear indicator to confirm the drive belt is within operating range. Install a new drive belt as required . REFER to:

[Accessory Drive Belt](#) (303-05B Accessory Drive - V6 3.0L Petrol, Removal and Installation),  
[Accessory Drive Belt](#) (303-05C Accessory Drive - V8 4.2L Petrol, Removal and Installation),  
[Accessory Drive Belt](#) (303-05D Accessory Drive - V8 S/C 4.2L Petrol, Removal and Installation).

# Accessory Drive - V6 3.0L Petrol - Accessory Drive Belt

Removal and Installation

## Removal

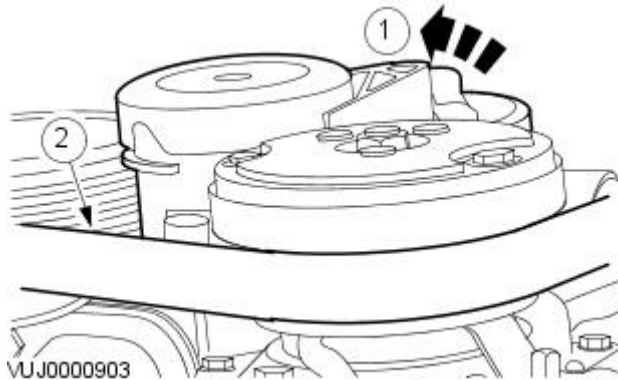
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).

3.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

4. Remove the accessory drive belt.

- Rotate the accessory drive belt tensioner counter-clockwise, using a 3/8 " drive wrench.



## Installation

1. To install, reverse the removal procedure.

# Accessory Drive - V6 3.0L Petrol - Accessory Drive Belt Idler Pulley

Removal and Installation

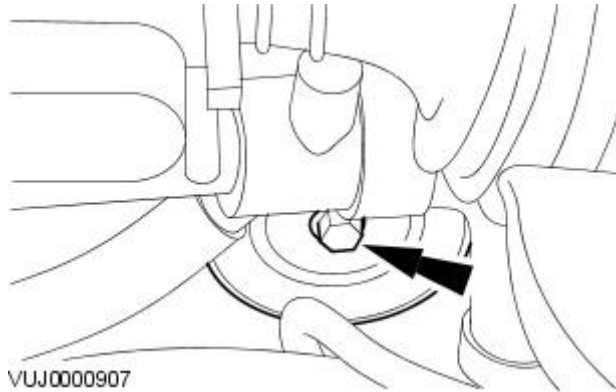
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

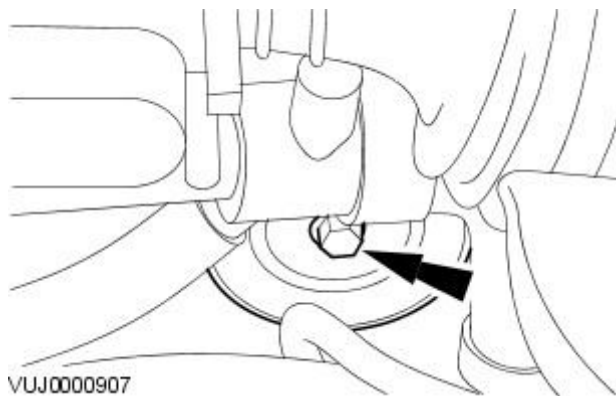
3. Remove the accessory drive belt.  
For additional information, refer to: [Accessory Drive Belt](#) (303-05B Accessory Drive - V6 3.0L Petrol, Removal and Installation).
4. Remove the accessory drive belt idler pulley.



## Installation

1. To install, reverse the removal procedure.


- Tighten to 25 Nm

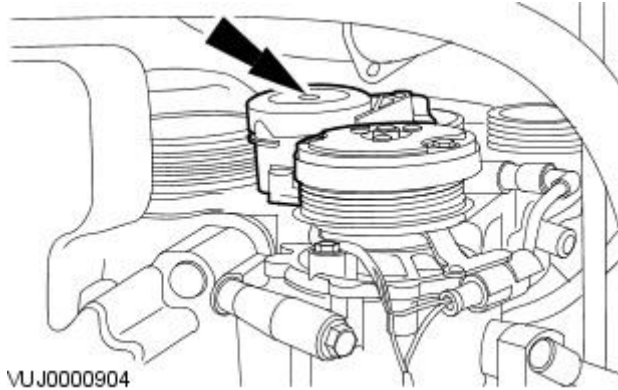


# Accessory Drive - V6 3.0L Petrol - Accessory Drive Belt Tensioner

Removal and Installation

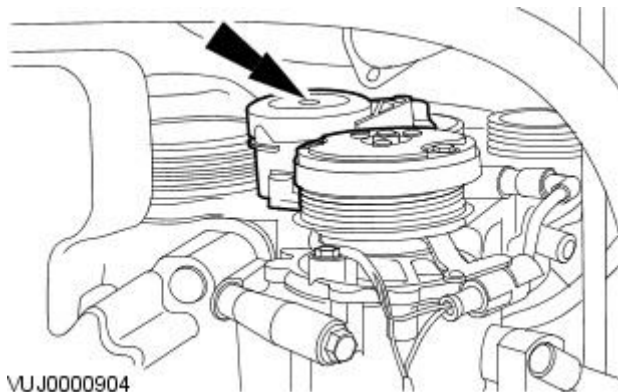
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the accessory drive belt.  
For additional information, refer to: [Accessory Drive Belt](#) (303-05B Accessory Drive - V6 3.0L Petrol, Removal and Installation).
3.  **WARNING:** Make sure to support the vehicle with axle stands.  
Raise and support the vehicle.
4. Remove the accessory drive belt tensioner.



## Installation

1. To install, reverse the removal procedure.
  - Tighten to 45 Nm.



**Accessory Drive - 4.2L NA V8 - AJV8 -**

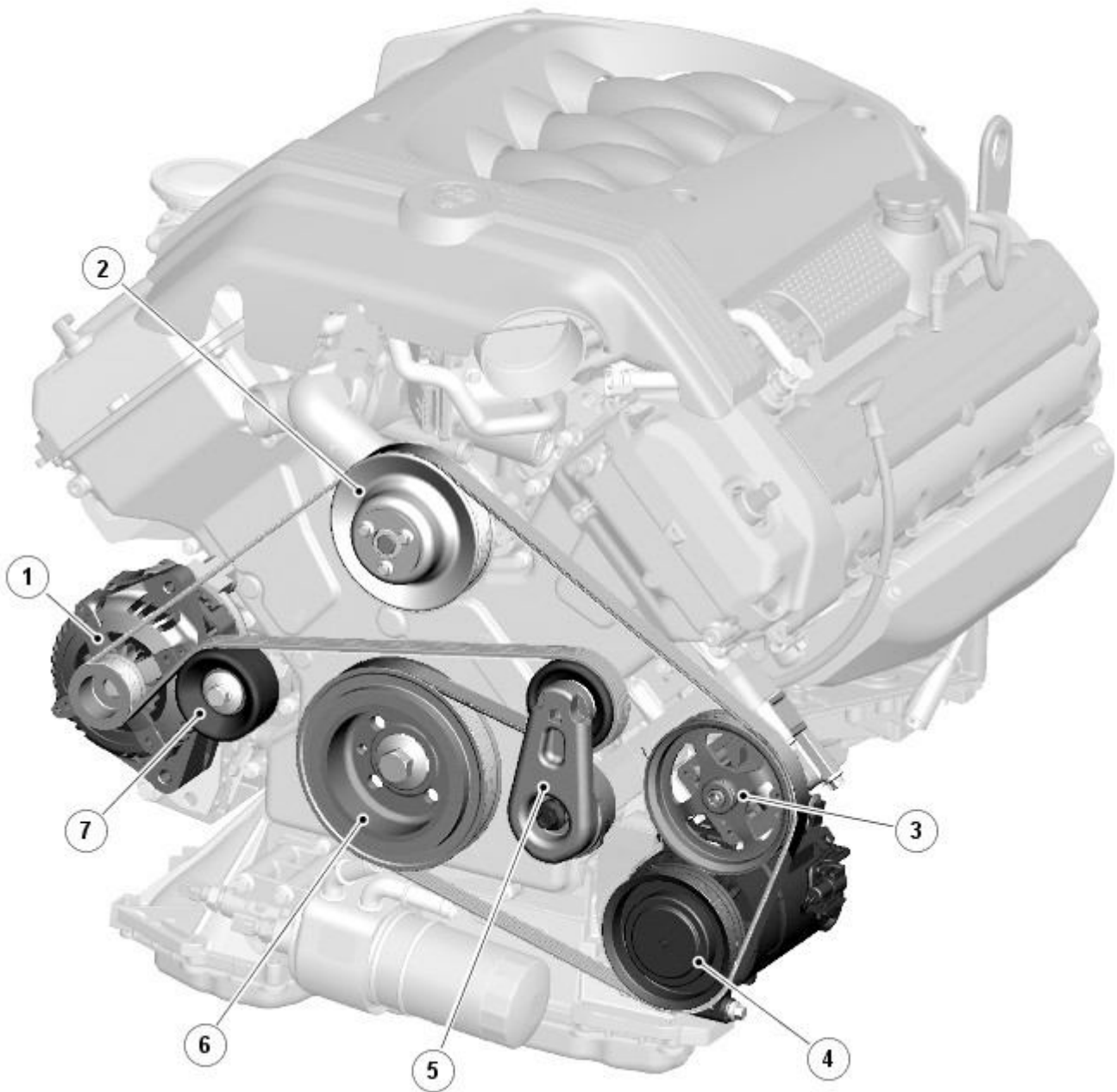
Description	Nm	lb-ft	lb-in
Accessory drive belt tensioner retaining bolt	40	30	-
Accessory drive belt idler pulley retaining bolt	25	18	-

## Accessory Drive - 4.2L NA V8 - AJV8 - Accessory Drive - Component

### Location

Description and Operation

Component Location



E93218

#### ItemDescription

1	Generator
2	Coolant pump
3	Power steering pump
4	<a href="#">A/C (air conditioning)</a> compressor
5	Belt tensioner
6	Crankshaft
7	Idler



## Accessory Drive - 4.2L NA V8 - AJV8 - Accessory Drive - Overview

Description and Operation

### Overview

The combined crankshaft pulley and torsional vibration damper drives a single, 6-ribbed vee belt. The belt drives all of the engine-mounted accessories such as the generator, the power steering pump, the [A/C \(air conditioning\)](#) compressor and the coolant pump.

The accessory drive belt, which is a maintenance free poly-V type belt, is automatically pre-loaded by the belt tensioner and routed over idlers in order to maintain sufficient adhesion about the drive wheels. This ensures slip-free drive of the accessory components.

The torsional vibration damper incorporates compressed rubber between its inner and outer diameters to absorb vibration and shock loads.

The belt tensioner is calibrated to provide the correct amount of tension to the belt for a given drive system. Unless a spring within the tensioner assembly breaks, or some other mechanical part of the tensioner fails, there is no need to check the tensioner for correct tension.

The accessory drive belt should be inspected at every routine service for excessive wear and damage.

### Belt Tensioner

The belt tensioner consists of an idler pulley, which is free to rotate on a bearing located at the end of a spring-loaded pivot arm.

The accessory drive belt wear indicators are incorporated on the bottom of the accessory drive belt tensioner. When the indicators are aligned the accessory drive belt requires replacing.

# Accessory Drive - 4.2L NA V8 - AJV8 - Accessory Drive

Diagnosis and Testing

## Principles of Operation

For a detailed description of the petrol engine accessory drive belts, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

Accessory Drive (303-05C, Description and Operation),  
[Accessory Drive](#) (303-05A Accessory Drive - 4.2L NA V8 - AJV8, Description and Operation),  
[Accessory Drive](#) (303-05A Accessory Drive - 4.2L NA V8 - AJV8, Description and Operation),  
 Accessory Drive (303-05D, Description and Operation),  
[Accessory Drive](#) (303-05B Accessory Drive - 4.2L SC V8 - AJV8, Description and Operation),  
[Accessory Drive](#) (303-05B Accessory Drive - 4.2L SC V8 - AJV8, Description and Operation).

## Inspection and Verification

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical
<ul style="list-style-type: none"> <li>● FEAD belt</li> <li>● FEAD belt tension</li> <li>● FEAD belt tensioner</li> <li>● FEAD belt pulleys</li> <li>● Supercharger belt</li> <li>● Supercharger belt tension</li> <li>● Supercharger belt tensioner</li> <li>● Supercharger belt pulley</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

## Noise Definitions

Description of Noise	Definition/Possible Cause
Squeal	Continuous shriek, most noticeable when the engine is accelerated (usually associated with lack of belt tension, contamination or wet slip)
Chirp	Continuous shriek, most noticeable when the engine is accelerated (usually associated with lack of belt tension, contamination or wet slip)
Whine	Continuous noise, changing frequency with engine speed, generally associated with rotating components (generator, idler, etc)
Rattle	Metallic knocking, often a loose component or tensioner fault
Rumble	Bearing noise

## Symptom Chart

Symptom	Possible Cause	Action
FEAD belt noise or squeal	<ul style="list-style-type: none"> <li>● FEAD belt pulley(s)</li> <li>● Lubricant or other contamination</li> <li>● FEAD belt</li> </ul>	Determine where the noise is coming from (refer to the noise definitions above). Check pulley for correct alignment, freedom of rotation or damage. Install new components as required. Check FEAD belt for contamination. If contaminated, install a new belt as required. Check FEAD belt for correct application
FEAD belt does not hold tension	<ul style="list-style-type: none"> <li>● FEAD belt cracking or damaged</li> <li>● Tensioner worn or damaged</li> </ul>	Inspect FEAD belt for cracking or damage. Install a new belt as required. Check FEAD belt tensioner for damage and correct operation. Install a new FEAD belt tensioner as required
Supercharger belt noise or squeal	<ul style="list-style-type: none"> <li>● Supercharger belt pulley(s)</li> <li>● Lubricant or other contamination</li> <li>● Supercharger belt</li> </ul>	Determine where the noise is coming from (refer to the noise definitions above). Check pulley for correct alignment, freedom of rotation or damage. Install new components as required. Check supercharger belt for contamination. If contaminated, install a new belt as required. Check supercharger belt for correct application
Supercharger belt does not hold tension	<ul style="list-style-type: none"> <li>● Supercharger belt cracking or damaged</li> <li>● Tensioner worn or damaged</li> </ul>	Inspect supercharger belt for cracking or damage. Install a new belt as required. Check supercharger belt tensioner for damage and correct operation. Install a new supercharger belt tensioner as required

## Component Tests

### FEAD Belt Tensioner

## Static

The only checks required for the FEAD belt tensioner are for stick, grab or bind.

1. **1.** Remove the drive belt in the area of the tensioner.
2. **2.** Using the correct tool, rotate the tensioner from its relaxed position through its full stroke and back to the relaxed position to make sure there is no stick, grab or bind, and to make sure that there is tension on the tensioner spring.
3. **3.** If the tensioner meets the above criteria, proceed to the dynamic test. If the tensioner does not meet the above criteria install a new tensioner. REFER to:

[Accessory Drive Belt Tensioner](#) (303-05A Accessory Drive - 4.2L NA V8 - AJV8, Removal and Installation),  
[Accessory Drive Belt Tensioner](#) (303-05B Accessory Drive - 4.2L SC V8 - AJV8, Removal and Installation).

## Dynamic

The FEAD belt tensioner can be checked dynamically as follows:

4. **4.** With the engine running, observe drive belt tensioner movement, the FEAD belt tensioner should move (respond) when the air conditioning clutch cycles (if equipped), the FEAD belt tensioner should move (respond) when the engine speed is increased rapidly. If the drive belt tensioner movement is erratic without air conditioning clutch cycling or engine acceleration, a pulley or shaft may be bent, or distorted. Excessive drive belt rideout (uneven depth of grooves in the drive belt) can also cause excessive drive belt tensioner movement. Check condition by installing a known good belt. REFER to:

[Accessory Drive Belt](#) (303-05A Accessory Drive - 4.2L NA V8 - AJV8, Removal and Installation),  
[Accessory Drive Belt](#) (303-05B Accessory Drive - 4.2L SC V8 - AJV8, Removal and Installation).

## FEAD belt

1. **1.** With the engine off, check routing of the drive belt. REFER to:

[Accessory Drive Belt](#) (303-05A Accessory Drive - 4.2L NA V8 - AJV8, Removal and Installation),  
[Accessory Drive Belt](#) (303-05B Accessory Drive - 4.2L SC V8 - AJV8, Removal and Installation).

2. **2.** Inspect the drive belt tensioner wear indicator to confirm the drive belt is within operating range. Install a new drive belt as required . REFER to:

[Accessory Drive Belt](#) (303-05A Accessory Drive - 4.2L NA V8 - AJV8, Removal and Installation),  
[Accessory Drive Belt](#) (303-05B Accessory Drive - 4.2L SC V8 - AJV8, Removal and Installation).

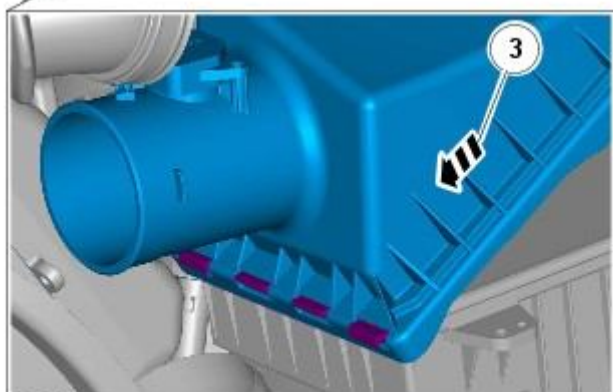
## Accessory Drive - 4.2L NA V8 - AJV8 - Accessory Drive Belt

Removal and Installation

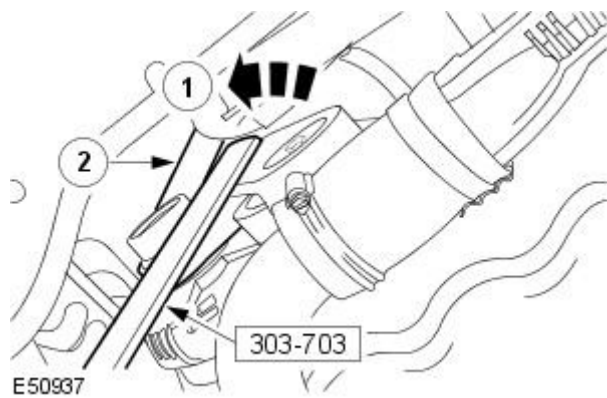
Special Tool(s)	
 <p>303-703</p> <p>E95037</p>	<p>Accessory belt tensioner</p> <p>303-703</p>

### Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the engine cover.  
For additional information, refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Remove the air cleaner outlet pipe.  
For additional information, refer to: [Air Cleaner Outlet Pipe](#) (303-12, Removal and Installation).
4. Remove the air cleaner housing cover.



E96195



5. Remove the accessory drive belt.

- Using the special tool, rotate the accessory drive belt tensioner counter clockwise.


## Installation

1. Install is the reverse of removal.

# Accessory Drive - 4.2L NA V8 - AJV8 - Accessory Drive Belt Tensioner

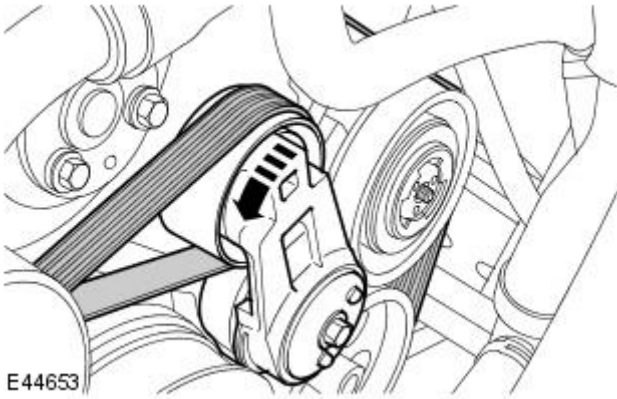
Removal and Installation

## Removal

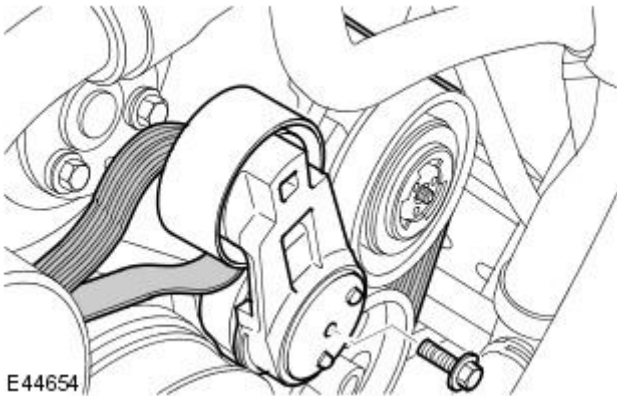
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
3. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02, Removal and Installation).
4. Remove the engine cover.  
For additional information, refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
5. Remove the air cleaner outlet pipe.
6. Release the accessory drive belt.

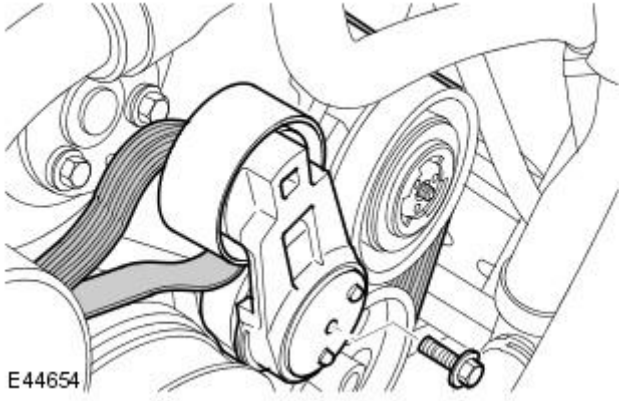


7. Remove the accessory drive belt tensioner.



## Installation





1. Install is the reverse of removal.

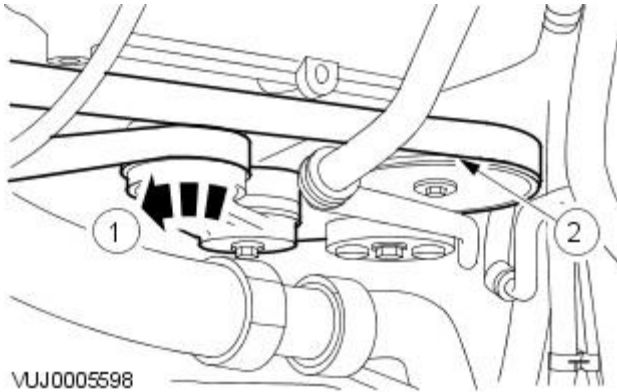
- Tighten to 40 Nm.

# Accessory Drive - 4.2L NA V8 - AJV8 - Accessory Drive Belt Idler Pulley

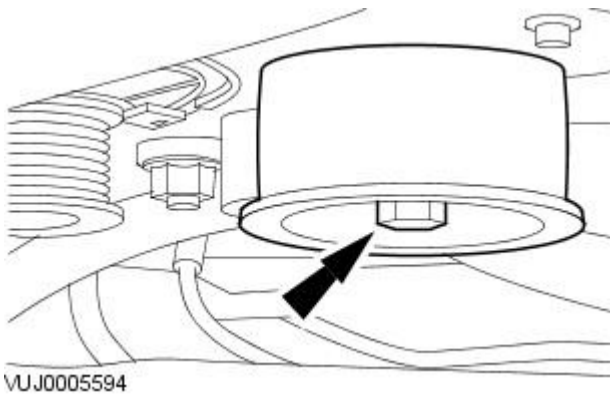
Removal and Installation

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the air cleaner outlet pipe.  
For additional information, refer to: [Air Cleaner Outlet Pipe](#) (303-12, Removal and Installation).
3. Remove the accessory drive belt.
  - Using the special tool, rotate the accessory drive belt tensioner counter clockwise.
  - Release the accessory drive belt.

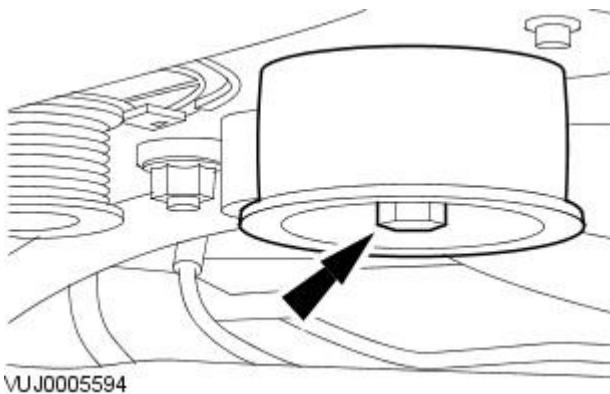


4. Remove the accessory drive belt idler pulley.



## Installation

1. To install, reverse the removal procedure.
  - Tighten to 25 Nm.



**Accessory Drive - 4.2L SC V8 - AJV8 -**

Description	Nm	lb-ft	lb-in
Accessory drive belt tensioner retaining bolt	40	30	-
Accessory drive belt idler pulley retaining bolt	25	18	-
Supercharger belt tensioner retaining bolt	40	30	-
Supercharger belt idler pulley retaining bolt	40	30	-

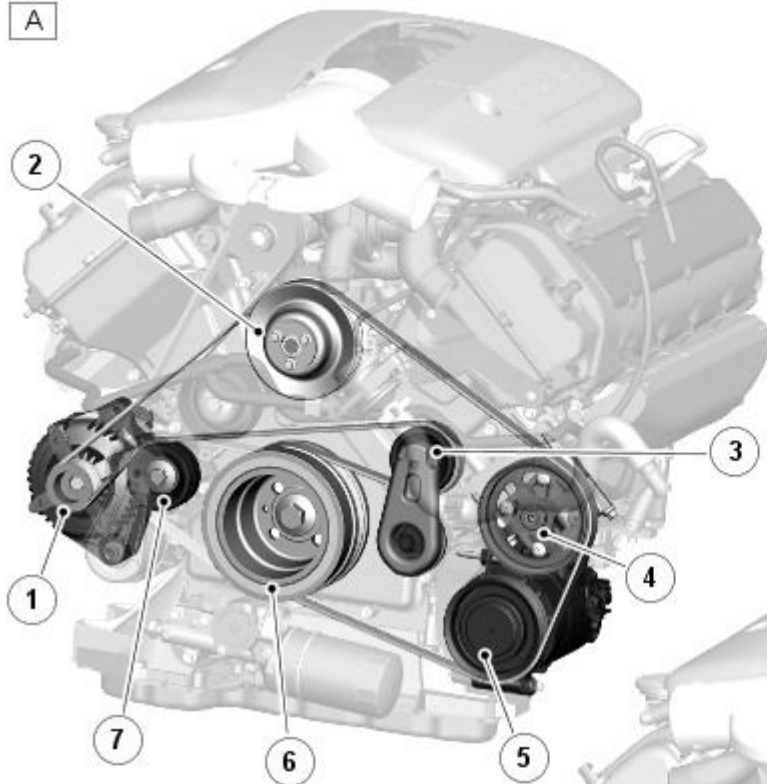
# Accessory Drive - 4.2L SC V8 - AJV8 - Accessory Drive - Component

## Location

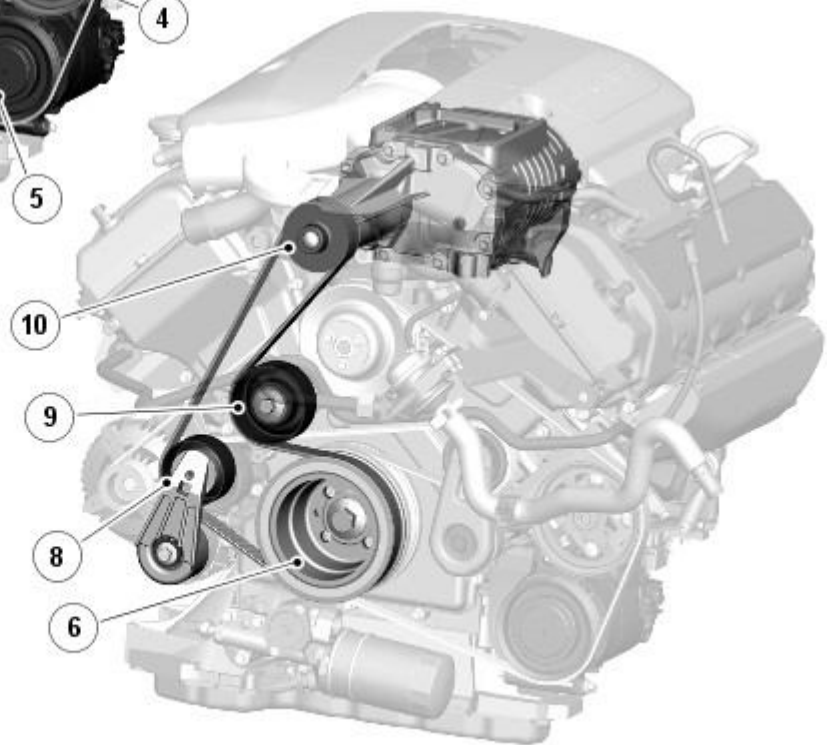
Description and Operation

Component Location

A



B



E93219

### ItemDescription

A	Primary drive
B	Secondary drive
1	Generator
2	Coolant pump
3	Primary belt tensioner
4	Power steering pump
5	A/C (air conditioning) compressor
6	Crankshaft
7	Idler
8	Secondary belt tensioner
9	Idler
10	Supercharger

## Accessory Drive - 4.2L SC V8 - AJV8 - Accessory Drive - Overview

Description and Operation

### Overview

The combined crankshaft pulley and torsional vibration damper drives a single, 6-ribbed primary belt and a double-sided, 8-ribbed secondary belt. The primary belt drives all of the engine-mounted accessories such as the generator, the power steering pump, the [A/C \(air conditioning\)](#) compressor and the coolant pump and the secondary belt drives the supercharger.

The accessory drive belts, which are maintenance free poly-V type belts, are automatically pre-loaded by the belt tensioner and routed over idlers in order to maintain sufficient adhesion about the drive wheels. This ensures slip-free drive of the accessory components.

The torsional vibration damper incorporates compressed rubber between its inner and outer diameters to absorb vibration and shock loads.

The belt tensioner is calibrated to provide the correct amount of tension to the belt for a given drive system. Unless a spring within the tensioner assembly breaks, or some other mechanical part of the tensioner fails, there is no need to check the tensioner for correct tension.

The accessory drive belt should be inspected at every routine service for excessive wear and damage.

### Belt Tensioner

The belt tensioner consists of an idler pulley, which is free to rotate on a bearing located at the end of a spring-loaded pivot arm.

The accessory drive belt wear indicators are incorporated on the bottom of the accessory drive belt tensioner. When the indicators are aligned the accessory drive belt requires replacing.

## **Accessory Drive - 4.2L SC V8 - AJV8 - Accessory Drive**

Diagnosis and Testing

For additional information.

REFER to: [Accessory Drive](#) (303-05A Accessory Drive - 4.2L NA V8 - AJV8, Diagnosis and Testing).




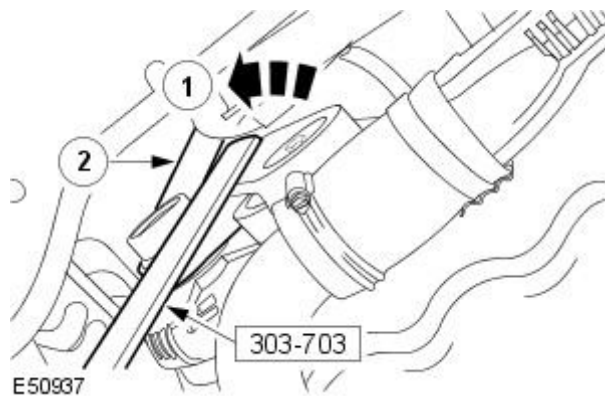
## Accessory Drive - 4.2L SC V8 - AJV8 - Accessory Drive Belt

Removal and Installation

Special Tool(s)	
 <p>303-703</p> <p>E95037</p>	<p>Accessory belt tensioner</p> <p>303-703</p>

### Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the supercharger belt.  
For additional information, refer to: [Supercharger Belt](#) (303-05B Accessory Drive - 4.2L SC V8 - AJV8, Removal and Installation).
4. Remove the accessory drive belt.
  - Using the special tool, rotate the accessory drive belt tensioner counter clockwise.



### Installation

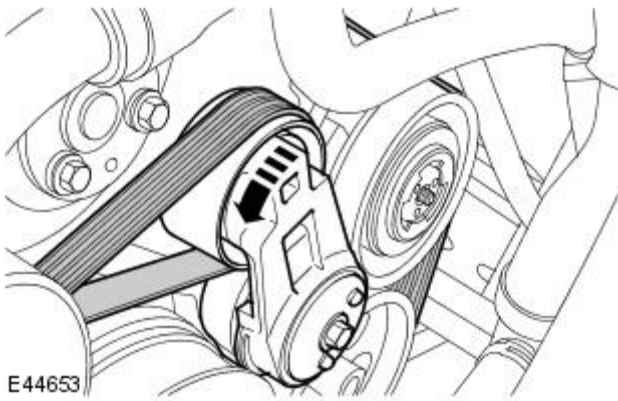
1. Install is the reverse of removal.

## Accessory Drive - 4.2L SC V8 - AJV8 - Accessory Drive Belt Tensioner

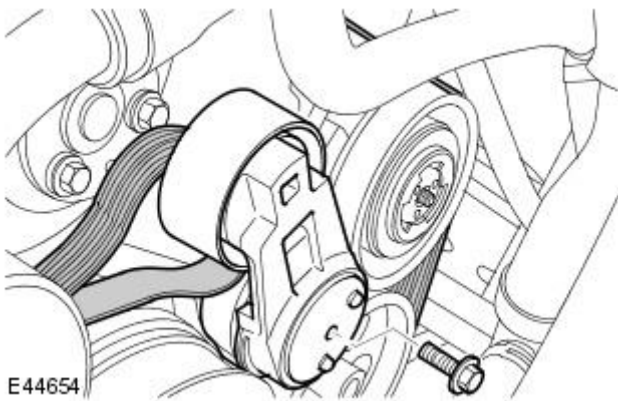
Removal and Installation

### Removal

1. Raise and support the vehicle.
2. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
3. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
4. Remove the air cleaner outlet pipe.  
For additional information, refer to: Air Cleaner Outlet Pipe (303-12, Removal and Installation).
5. Remove the supercharger belt.  
For additional information, refer to: [Supercharger Belt](#) (303-05B Accessory Drive - 4.2L SC V8 - AJV8, Removal and Installation).
6. Release the accessory drive belt.

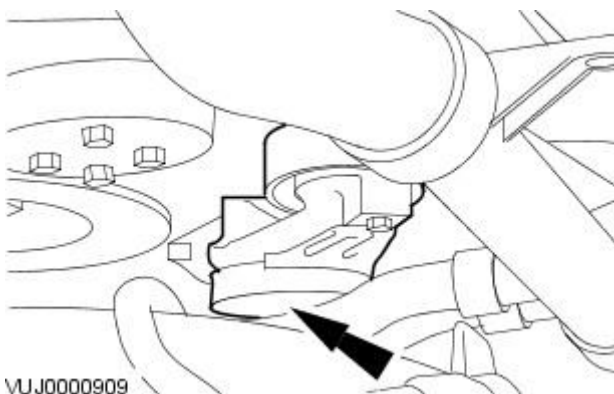


7. Remove the accessory drive belt tensioner.



### Installation

1. Install is the reverse of removal.
  - Tighten to 40 Nm.

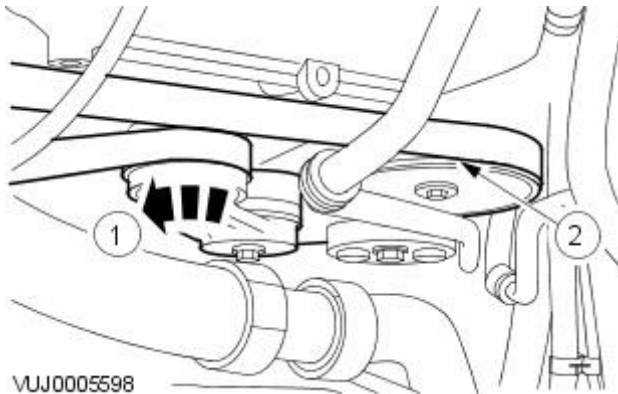


# Accessory Drive - 4.2L SC V8 - AJV8 - Accessory Drive Belt Idler Pulley

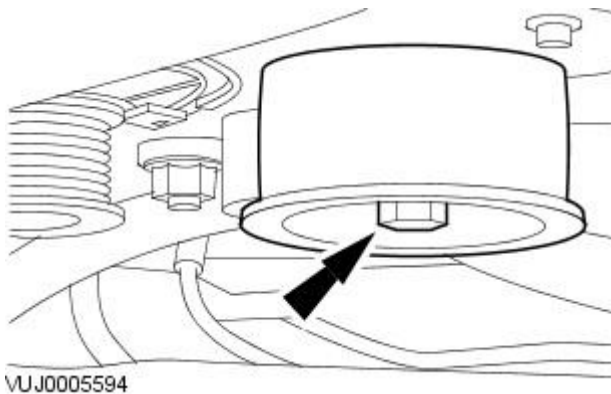
Removal and Installation

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the air filter outlet tube.  
For additional information, refer to: [Air Cleaner Outlet Pipe](#) (303-12, Removal and Installation).
3. Remove the supercharger belt.  
For additional information, refer to: [Supercharger Belt](#) (303-05B Accessory Drive - 4.2L SC V8 - AJV8, Removal and Installation).
4. Release the accessory drive belt.
  - Using the special tool, rotate the accessory drive belt tensioner counter clockwise.
  - Release the accessory drive belt.

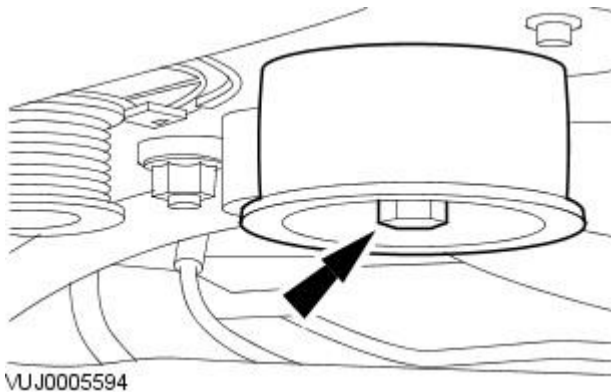


5. Remove the accessory drive belt idler pulley.



## Installation

1. To install, reverse the removal procedure.
  - Tighten to 25 Nm.

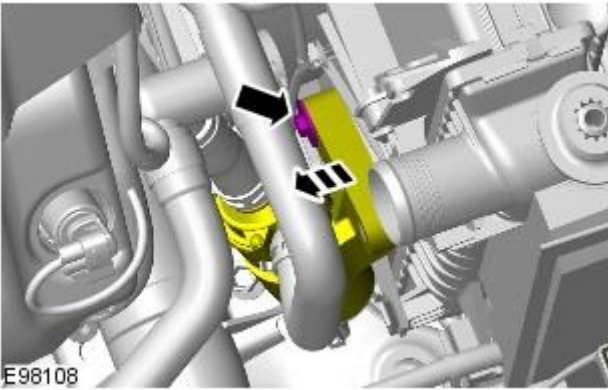


## Accessory Drive - 4.2L SC V8 - AJV8 - Supercharger Belt

Removal and Installation

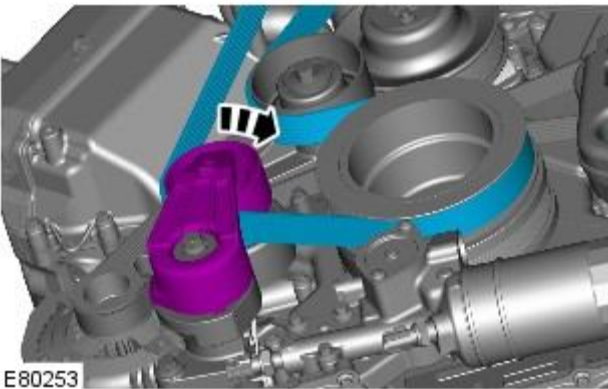
### Removal


1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the RH air cleaner assembly.  
For additional information, refer to: [Air Cleaner RH](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).
3. Remove the air cleaner outlet pipe.  
For additional information, refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).
4. Release the auxiliary coolant pump.
  - Remove the 2 bolts.



- Remove the 2 bolts.

5. Release the supercharger belt.
  - Rotate the drive belt tensioner clockwise. Use a 1/2 inch square drive bar to rotate the drive belt tensioner.

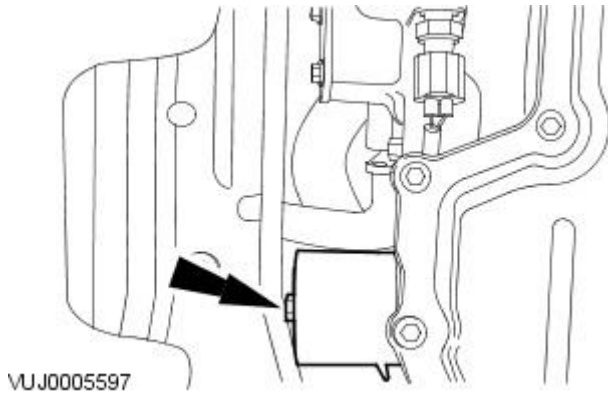


6.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

7. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

8. Release the supercharger belt tensioner.

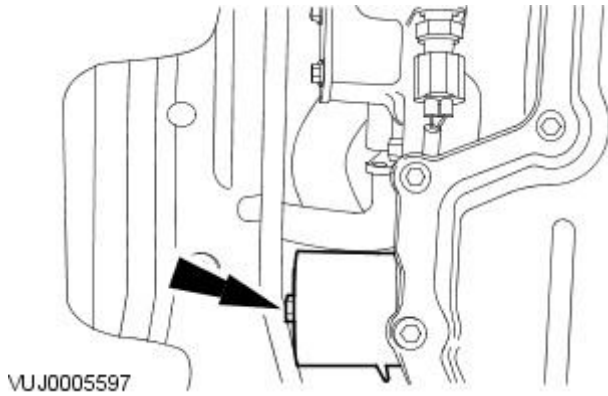


9. Remove the supercharger belt.

### Installation

1. To install, reverse the removal procedure.

- Tighten to 40 Nm.

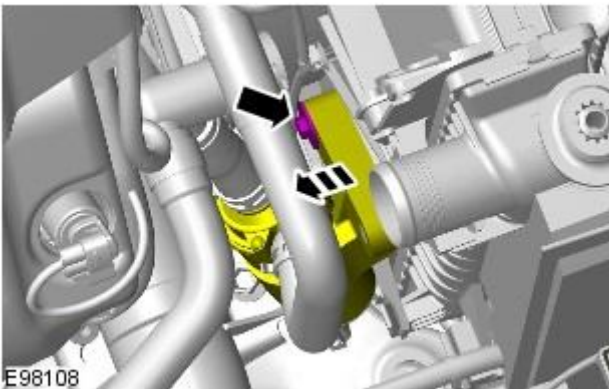


# Accessory Drive - 4.2L SC V8 - AJV8 - Supercharger Belt Tensioner

## Removal and Installation

### Removal


1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the RH air cleaner assembly.  
For additional information, refer to: [Air Cleaner RH](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).
3. Remove the air cleaner outlet pipe.  
For additional information, refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).
4. Release the auxiliary coolant pump.
  - Remove the 2 bolts.



5. Release the supercharger belt.

- Rotate the drive belt tensioner clockwise. Use a 1/2 inch square drive bar to rotate the drive belt tensioner.



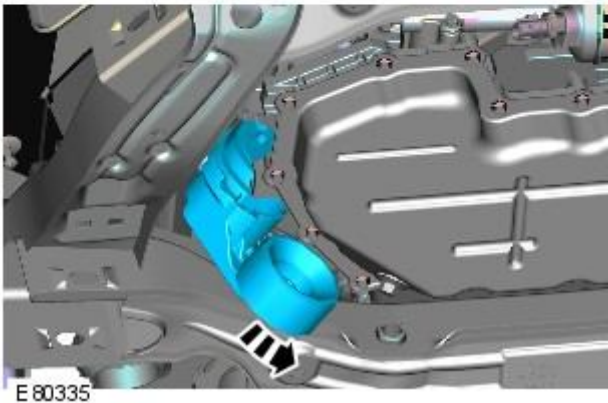
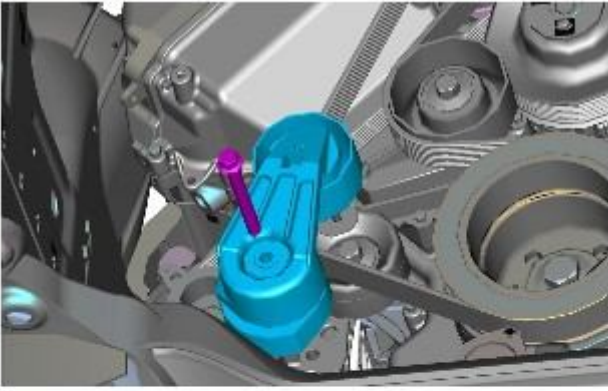
6.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

7. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).



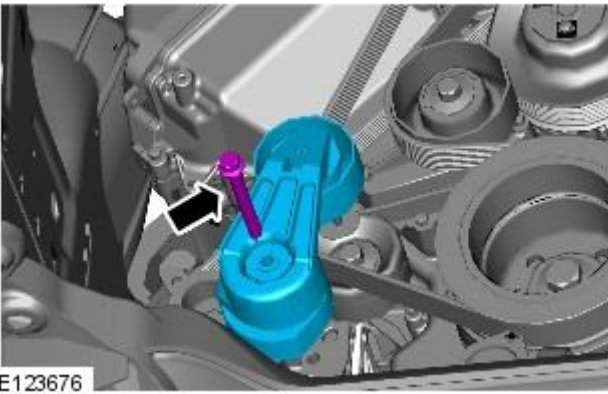
8. Remove the supercharger belt tensioner.



### Installation

1. Install is the reverse of removal.

- Tighten to 40 Nm.

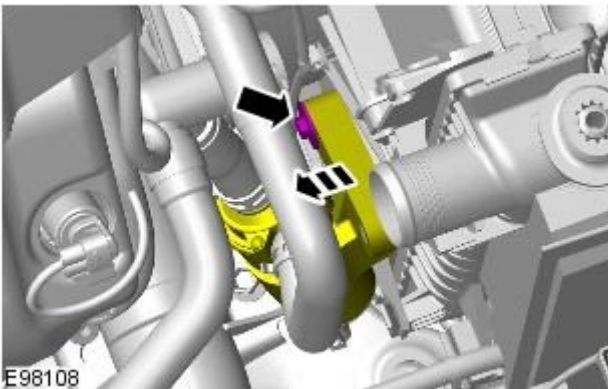


## Accessory Drive - 4.2L SC V8 - AJV8 - Supercharger Belt Idler Pulley

Removal and Installation

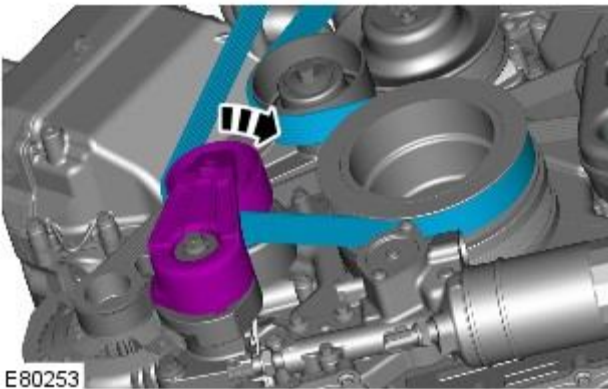
### Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the RH air cleaner assembly.  
For additional information, refer to: [Air Cleaner RH](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).
3. Remove the air cleaner outlet pipe.  
For additional information, refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).
4. Release the auxiliary coolant pump.
  - Remove the 2 bolts.

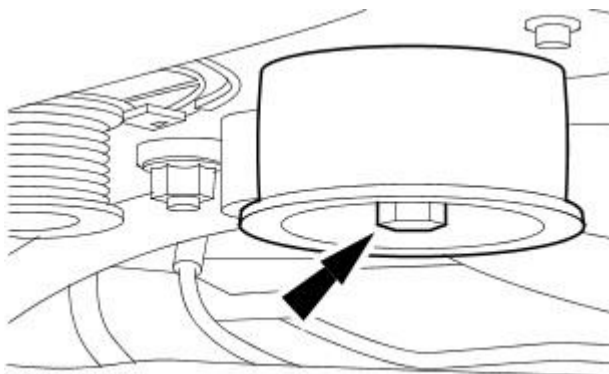


- Remove the 2 bolts.

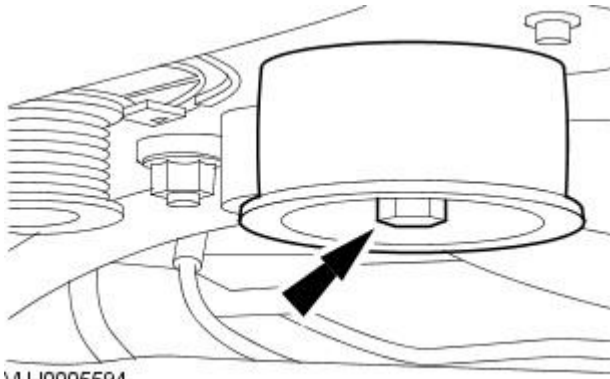
5. Release the supercharger belt.
  - Rotate the drive belt tensioner clockwise. Use a 1/2 inch square drive bar to rotate the drive belt tensioner.



6. Remove the supercharger belt idler pulley.
  - Rotate the drive belt tensioner clockwise. Use a 1/2 inch square drive bar to rotate the drive belt tensioner.



### Installation



VUJ0005594

1. Install is the reverse of removal.

- Tighten to 40 Nm.

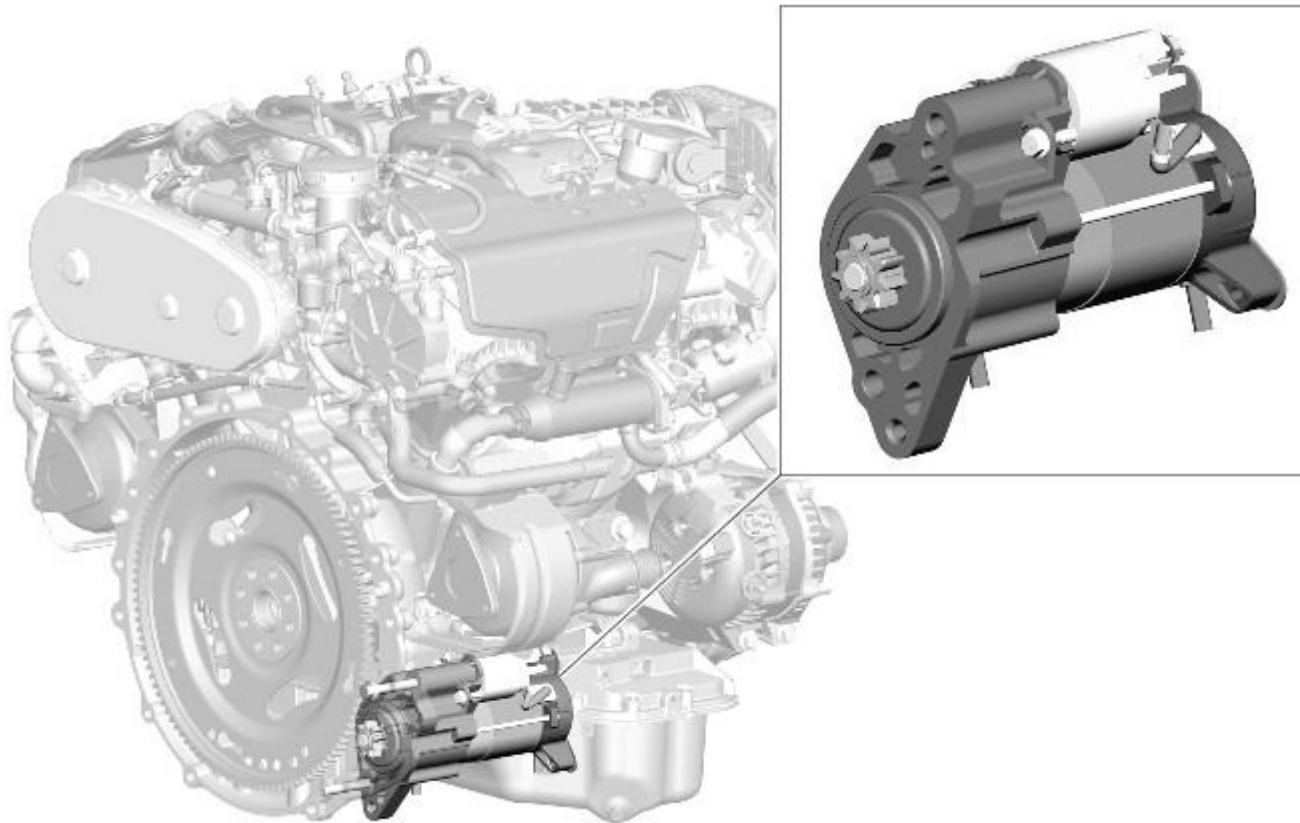
**Starting System - TDV6 2.7L Diesel -**

Description	Nm	lb-ft	lb-in
Starter motor bolts	48	35	-
Battery positive terminal integral connector retaining nut	13	10	-
Solenoid terminal integral connector nut	7	-	62

# Starting System - TDV6 2.7L Diesel - Starting System - Component Location

Description and Operation

Component Location



E93234

# Starting System - TDV6 2.7L Diesel - Starting System - Overview

Description and Operation

## Overview

The starter motor is rated as 2.0 kW and is a Denso level 3-sealed unit. It is a P76S type starter motor and is of conventional design with the motor in line and the drive pinion and solenoid mounted above. Each starter motor is of the pre-engaged type and comprises a series wound motor, an overrunning clutch and an integral solenoid. This starter incorporates labyrinth-breathing tubes to help with sealing and drainage.

The starter solenoid is energised by a signal from the [ECM \(engine control module\)](#) when the ignition switch is moved to the crank position. When engine cranking is requested, the [ECM](#) checks that a valid key code has been received before granting the crank request. The power for starter operation is supplied on a substantial single cable connected direct from the battery positive terminal. The cable is connected to the solenoid via a copper threaded stud and secured with a nut.

The starter motor is located on the rear [RH \(right-hand\)](#) side of the engine block and protrudes through an aperture to drive the flywheel via a ring gear. The motor is secured to the cylinder block by 2 bolts and to the ladder frame by four bolts and a support bracket. The bracket provides crucial support for the starter motor and must not be omitted when installing or reinstalling the unit.



# Starting System - TDV6 2.7L Diesel - Starting System

Diagnosis and Testing

## Principles of Operation

For a detailed description of the starting system, refer to the relevant Description and Operation section in the workshop manual. REFER to:

[Starting System](#) (303-06A Starting System - TDV6 2.7L Diesel, Description and Operation),  
[Starting System](#) (303-06A Starting System - TDV6 2.7L Diesel, Description and Operation),  
 Starting System (303-06A, Description and Operation),  
[Anti-Theft - Passive](#) (419-01B Anti-Theft - Passive, Description and Operation),  
[Anti-Theft - Passive](#) (419-01B Anti-Theft - Passive, Description and Operation),  
[Anti-Theft - Passive](#) (419-01B Anti-Theft - Passive, Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. Verify the customer concern.
2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Starter Motor</li> <li>● Battery</li> </ul>	<ul style="list-style-type: none"> <li>● Battery</li> <li>● Fuses</li> <li>● Wiring harness</li> <li>● Damaged, loose or corroded connectors</li> <li>● Starter relay</li> <li>● Engine Control Module (ECM)</li> </ul>

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to the symptom chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
The engine does not crank (starter motor does not turn)	<ul style="list-style-type: none"> <li>● Gear selector not in <b>P</b> or <b>N</b> position</li> <li>● Battery</li> <li>● Harness/Connectors</li> <li>● Starter motor</li> <li>● Starter relay</li> <li>● Start switch</li> <li>● Transmission control module (TCM)</li> <li>● Engine control module (ECM)</li> <li>● Engine seized</li> </ul>	Make sure the gear selector is in the <b>P</b> or <b>N</b> position. Check the battery is in fully charged and serviceable condition. Check the starter motor and harness. Check for related DTCs and refer to the relevant DTC Index
The engine does not crank (starter motor does turn)	<ul style="list-style-type: none"> <li>● Starter motor installation</li> <li>● Starter motor</li> <li>● Ring gear</li> </ul>	Check the starter motor installation (fasteners tight, starter motor square to engine, etc). Check the ring gear teeth for damage, foreign objects, etc.
Engine cranks too slowly	<ul style="list-style-type: none"> <li>● Battery</li> <li>● Harness/Connectors</li> <li>● Starter motor</li> <li>● Engine oil incorrect grade</li> </ul>	Check the battery is in fully charged and serviceable condition. Refer to the electrical circuit diagrams and test the starter motor and starter motor circuits
Engine cranks too fast	<ul style="list-style-type: none"> <li>● Low engine compression</li> </ul>	Check the engine compressions. REFER to: <a href="#">Engine - TDV6 2.7L Diesel</a> (303-00 Engine System - General Information, Diagnosis and Testing).
Excessive starter motor noise	<ul style="list-style-type: none"> <li>● Starter motor</li> <li>● Starter motor installation/casing</li> <li>● Ring gear</li> </ul>	Check the starter motor installation (fasteners tight, motor square to engine, etc). Check the starter motor casing condition. Check the ring gear teeth for damage, foreign objects, etc.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to 3 decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, the fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B100951	Ignition Authorisation	<ul style="list-style-type: none"> <li>Faulty instrument cluster</li> <li>Target SID re-synchronisation error following programming</li> <li>CAN fault</li> </ul>	Check ignition, power and ground supplies to CJB and instrument cluster. Re-synchronize ID by re-configuring the instrument cluster as a new module. Check CAN communications between instrument cluster and tester
B100962	Ignition Authorisation	<ul style="list-style-type: none"> <li>Low speed CAN fault</li> <li>CJB fault</li> <li>Instrument cluster fault</li> <li>Incorrect module installed (CJB/Instrument cluster)</li> <li>Target SID synchronisation error following re-programming</li> <li>Noise/EMC related error</li> </ul>	Check CAN communications between CJB and instrument cluster. Check ignition, power and ground supplies to CJB and instrument cluster. Confirm correct module is installed. Re-synchronise ID by re-configuring the instrument cluster as a new module. Check CAN network for interference/EMC related issues
B100963	Ignition Authorisation	<ul style="list-style-type: none"> <li>CJB fault</li> <li>Low speed CAN fault</li> <li>Instrument cluster fault</li> <li>Low battery voltage &lt;9V</li> </ul>	Check Power and Ground supplies to CJB and instrument cluster. Check CAN communications between CJB and instrument cluster. Check battery is in fully charged and serviceable condition, refer to the battery care manual
B100964	Ignition Authorisation	<ul style="list-style-type: none"> <li>CJB fault</li> <li>Low speed CAN fault</li> <li>Instrument cluster fault</li> </ul>	Check power and ground supplies to CJB and instrument cluster. Check CAN communications between CJB and instrument cluster
B100A51	Fuel Pump Authorisation	<ul style="list-style-type: none"> <li>RJB fault</li> <li>Low speed CAN fault</li> <li>Instrument cluster fault</li> </ul>	Check power and ground supplies to RJB. Check CAN communications between RJB and instrument cluster. Check power and ground supplies to instrument cluster
B100A62	Fuel Pump Authorisation	<ul style="list-style-type: none"> <li>Low speed CAN fault</li> <li>RJB fault</li> <li>Instrument cluster fault</li> <li>Incorrect module installed (RJB/Instrument cluster)</li> <li>Write target SID synchronisation error following re-programming</li> <li>Noise/EMC related error</li> </ul>	Check CAN communications between RJB and instrument cluster. Check power and ground supplies to RJB and instrument cluster. Confirm correct module installed. Re-synchronise ID by re-configuring the RJB as a new module. Check CAN network for interference/EMC related issues
B100A63	Fuel Pump Authorisation	<ul style="list-style-type: none"> <li>RJB fault</li> <li>Low speed CAN fault</li> <li>Instrument cluster fault</li> <li>Low battery voltage &lt;9V</li> </ul>	Check power and ground supplies to RJB and instrument cluster. Check CAN communications between RJB and instrument cluster. Check battery is in fully charged and serviceable condition, refer to the battery care manual
B100D51	Column lock authorisation	<ul style="list-style-type: none"> <li>Not programmed</li> </ul>	Check ignition, power and ground supplies to steering column lock and instrument cluster. Re-synchronise ID by re-configuring the steering column lock as a new module
B100D62	Column lock authorisation - signal compare failure	<ul style="list-style-type: none"> <li>CAN fault</li> <li>Steering column lock fault</li> <li>Instrument cluster fault</li> <li>Incorrect module installed (Steering column lock/Instrument cluster)</li> <li>Target ID synchronisation error following re-programming</li> <li>Noise/EMC related error</li> </ul>	Check CAN network between steering column lock and instrument cluster. Check power and ground supplies to steering column lock and instrument cluster. Confirm the correct modules are installed. Re-synchronize ID by re-configuring the steering column lock as new. Check CAN network for interference/EMC related issues
B100D64	Column lock authorisation - signal plausibility failure	<ul style="list-style-type: none"> <li>CAN fault</li> <li>Steering column lock fault</li> <li>Instrument cluster fault</li> </ul>	Check CAN network to steering column lock. Check power and ground supplies to steering column lock and instrument cluster
B100D87	Column lock authorisation - missing message	<ul style="list-style-type: none"> <li>CAN fault</li> <li>Steering column lock fault</li> <li>Instrument cluster fault</li> <li>Low voltage at steering column lock &lt; 8V</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check CAN network between steering column lock and instrument cluster. Check power and ground supplies to steering column lock and instrument cluster
B102611	Steering Column Lock	<ul style="list-style-type: none"> <li>Steering column lock power circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check steering column lock power circuit for short to ground
B102612	Steering Column Lock	<ul style="list-style-type: none"> <li>Steering column lock ground circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check steering column lock ground circuit for short to power
B102615	Steering Column Lock	<ul style="list-style-type: none"> <li>Steering column lock power circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check steering column lock power circuit for short to power, open circuit
B102B67	Passive Key	<ul style="list-style-type: none"> <li>CJB fault</li> <li>Low speed CAN fault</li> <li>Remote Keyless Entry (RKE) module fault</li> <li>Write target SID synchronisation error following re-programming</li> </ul>	Check power and ground supplies to CJB and RKE module. Check CAN communications between CJB and RKE module. Re-synchronise ID by re-configuring the RKE module as a new module
B102B87	Passive Key	<ul style="list-style-type: none"> <li>CJB fault</li> <li>Low speed CAN fault</li> <li>RKE module fault</li> <li>Key fob battery low/battery contact issue</li> </ul>	Check power and ground supplies to CJB, RKE module and receiver. Check CAN communications between CJB and instrument cluster. Check key fob battery. Confirm vehicle surroundings, move vehicle. Check CAN network for interference/EMC related issues. Disconnect battery, then

DTC	Description	Possible Cause	Action
		<ul style="list-style-type: none"> <li>● Interference from other RF signal</li> <li>● EMC/noise</li> <li>● Receiver fault</li> <li>● Receiver not programmed correctly</li> <li>● Serial communications fault (between receiver and RKE module)</li> <li>● Key fault</li> <li>● Passive antenna fault</li> <li>● Confirm placement of key within vehicle</li> </ul>	re-connect - confirm operation by re-programming keys. Check serial circuit between receiver and RKE module. Confirm spare key works. Refer to the electrical circuit diagrams and test circuits to all 3 antennas. Check whereabouts of key
B108A11	Start Button	<ul style="list-style-type: none"> <li>● Start/Stop switch analogue input circuits 1 or 2 - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check Start/Stop switch analogue input circuits 1 and 2 for short to ground
B108A12	Start Button	<ul style="list-style-type: none"> <li>● Start/Stop switch analogue input circuits 1 or 2 - short to power</li> </ul>	Refer to the electrical circuit diagrams and check Start/Stop switch analogue input circuits 1 and 2 for short to power
B108A23	Start Button	<ul style="list-style-type: none"> <li>● Start/Stop switch digital input signal circuit - stuck low</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Start/Stop switch digital input signal circuit for short to ground
B10DE11	Low Fuel Warning Switch	<ul style="list-style-type: none"> <li>● Diesel run-dry switch analogue input circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check diesel run-dry switch analogue input circuit for short to ground
B10DE15	Low Fuel Warning Switch	<ul style="list-style-type: none"> <li>● Diesel run-dry switch analogue input circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check diesel run-dry switch analogue input circuit for short to power, open circuit
B10E511	PCM Wake-up Signal	<ul style="list-style-type: none"> <li>● ECM wake-up signal circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check ECM wake-up signal circuit for short to ground
B10F111	Key In Switch	<ul style="list-style-type: none"> <li>● Keyless vehicle module, key IN status circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check keyless vehicle module, key IN status circuit for short to ground
B10FA93	Delayed Power Off relay	<ul style="list-style-type: none"> <li>● ADRC ECM, roof header console lamp, glove box lamp , RH/LH foot well lamps, JAG Sense glove box module, RH/LH sun visor lamps, rear dome lamps switched power circuits - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ADRC ECM, roof header console lamp, glove box lamp , RH/LH foot well lamps, JAG Sense glove box module, RH/LH sun visor lamps, rear dome lamps switched power circuits for short to power, open circuit
B10FF11	Ignition control	<ul style="list-style-type: none"> <li>● ECM and FPDB ignition control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECM and FPDB ignition control circuit for short to ground
B10FF15	Ignition control	<ul style="list-style-type: none"> <li>● ECM and FPDB ignition control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECM and FPDB ignition control circuit for short to power, open circuit
B114011	Engine Crank Authorisation	<ul style="list-style-type: none"> <li>● Engine crank authorisation signal circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check engine crank authorisation signal circuit for short to ground
B114015	Engine Crank Authorisation	<ul style="list-style-type: none"> <li>● Engine crank authorisation signal circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check engine crank authorisation signal circuit for short to power, open circuit
B114211	Ignition Status 1	<ul style="list-style-type: none"> <li>● Ignition supply 1 circuits - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check all ignition supply 1 circuits for short to ground
B114215	Ignition Status 1	<ul style="list-style-type: none"> <li>● Ignition supply 1 circuits - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check all ignition supply 1 circuits for short to power, open circuit
B114311	Ignition Status 2	<ul style="list-style-type: none"> <li>● Ignition supply 2 circuits - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check all ignition supply 2 circuits for short to ground
B114315	Ignition Status 2	<ul style="list-style-type: none"> <li>● Ignition supply 2 circuits - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check all ignition supply 2 circuits for short to power, open circuit
B123711	Gear Shift Module Early Wake-up	<ul style="list-style-type: none"> <li>● Transmission shift module wake-up control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check transmission shift module wake-up control circuit for short to ground
B123E13	Crank Enable	<ul style="list-style-type: none"> <li>● OK to crank signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check OK to crank signal circuit for open circuit
P033578	Crankshaft Position Sensor A Circuit	<ul style="list-style-type: none"> <li>● Crankshaft position (CKP) sensor or circuits - short to ground, power, open circuit</li> <li>● CKP sensor failure</li> <li>● Target wheel failure</li> </ul>	Refer to the electrical circuit diagrams and check CKP sensor and circuits for short to ground, power, open circuit. Check and install a new sensor/target wheel as required

DTC	Description	Possible Cause	Action
P033631	Crankshaft Position Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Crankshaft position (CKP) sensor or circuits - short to ground, power, open circuit</li> <li>● CKP sensor failure</li> <li>● Target wheel failure</li> </ul>	Refer to the electrical circuit diagrams and check CKP sensor and circuits for short to ground, power, open circuit. Check and install a new sensor/target wheel as required
P033638	Crankshaft Position Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Crankshaft position (CKP) sensor or circuits - short to ground, power, open circuit</li> <li>● CKP sensor failure</li> <li>● Target wheel failure</li> </ul>	Refer to the electrical circuit diagrams and check CKP sensor and circuits for short to ground, power, open circuit. Check and install a new sensor/target wheel as required
P033664	Crankshaft Position Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Crankshaft position (CKP) sensor or circuits - short to ground, power, open circuit</li> <li>● CKP sensor failure</li> <li>● Target wheel failure</li> </ul>	Refer to the electrical circuit diagrams and check CKP sensor and circuits for short to ground, power, open circuit. Check and install a new sensor/target wheel as required
P033666	Crankshaft Position Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Crankshaft position (CKP) sensor or circuits - short to ground, power, open circuit</li> <li>● CKP sensor failure</li> <li>● Target wheel failure</li> </ul>	Refer to the electrical circuit diagrams and check CKP sensor and circuits for short to ground, power, open circuit. Check and install a new sensor/target wheel as required
P034129	Camshaft Position Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Camshaft position (CMP) sensor or circuits - short to ground, power, open circuit</li> <li>● CMP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CMP sensor and circuits for short to ground, power, open circuit. Check and install a new sensor as required
P03413A	Camshaft Position Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Camshaft position (CMP) sensor or circuits - short to ground, power, open circuit</li> <li>● CMP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CMP sensor and circuits for short to ground, power, open circuit. Check and install a new sensor as required
P034231	Camshaft Position Sensor A Circuit Low Input	<ul style="list-style-type: none"> <li>● Camshaft position (CMP) sensor or circuits - short to ground, power, open circuit</li> <li>● CMP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CMP sensor and circuits for short to ground, power, open circuit. Check and install a new sensor as required
P038072	Glow Plug/Heater Circuit A	<ul style="list-style-type: none"> <li>● Glowplug relay circuits - short to ground, power, open circuit</li> <li>● Glowplug relay failure</li> </ul>	Refer to the electrical circuit diagrams and check glowplug relay circuits for short to ground, power, open circuit. Check battery voltage. Check and install a new relay as required
P038073	Glow Plug/Heater Circuit A	<ul style="list-style-type: none"> <li>● Glowplug relay circuits - short to ground, power, open circuit</li> <li>● Glowplug relay failure</li> </ul>	Refer to the electrical circuit diagrams and check glowplug relay circuits for short to ground, power, open circuit. Check battery voltage. Check and install a new relay as required
P038311	Glow Plug Control Module Control Circuit Low	<ul style="list-style-type: none"> <li>● Glowplug relay control circuit - short to ground</li> <li>● Glowplug relay failure</li> </ul>	Refer to the electrical circuit diagrams and check glowplug relay control circuit for short to ground. Check and install a new relay as required
P038412	Glow Plug Control Module Control Circuit High	<ul style="list-style-type: none"> <li>● Glowplug relay control circuit - short to power</li> <li>● Glowplug relay failure</li> </ul>	Refer to the electrical circuit diagrams and check glowplug relay control circuit for short to power. Check and install a new relay as required
P046100	Fuel Level Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Low fuel level</li> <li>● Fuel level sensor signal circuit - short to ground, open circuit</li> <li>● Fuel level sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for sufficient amount of fuel in fuel tank. Refer to the electrical circuit diagrams and check fuel level sensor circuits for short to ground, open circuit. Check and install a new fuel level sensor as required
P04611A	Fuel Level Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Low fuel level</li> <li>● Circuit resistance below threshold</li> <li>● Fuel level sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for sufficient amount of fuel in fuel tank. Refer to the electrical circuit diagrams and check fuel level sensor circuits for short circuit. Check and install a new fuel level sensor as required
P04611B	Fuel Level Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Low fuel level</li> <li>● Circuit resistance above threshold</li> <li>● Fuel level sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for sufficient amount of fuel in fuel tank. Refer to the electrical circuit diagrams and check fuel level sensor circuits for High resistance. Check and install a new fuel level sensor as required
P051300	Incorrect Immobilizer Key	<ul style="list-style-type: none"> <li>● Security key invalid</li> </ul>	Programme all keys using the manufacturer approved diagnostic system
P061712	Starter relay circuit high	<ul style="list-style-type: none"> <li>● Starter relay control circuit - short to power</li> <li>● Starter relay failure</li> </ul>	Refer to the electrical circuit diagrams and check starter relay control circuit for short to power. Check and install a new relay as required
P067013	Glow Plug Control Module Control Circuit/Open	<ul style="list-style-type: none"> <li>● Glow plug relay control circuit - open circuit</li> <li>● Glow plug relay failure</li> </ul>	Refer to the electrical circuit diagrams and check glow plug relay control circuit for open circuit. Check and install a new relay as required
P085013	Park/Neutral Switch Input Circuit	<ul style="list-style-type: none"> <li>● Park/Neutral signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check Park/Neutral signal circuit for open circuit
P085062	Park/Neutral Switch Input Circuit	<ul style="list-style-type: none"> <li>● Park/Neutral signal circuit - short to ground, power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Park/Neutral signal circuit for short to ground, power, open circuit


DTC	Description	Possible Cause	Action
P085212	Park/Neutral Switch Input Circuit High	<ul style="list-style-type: none"> <li>● Park/Neutral signal circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check Park/Neutral signal circuit for short to power
P115B68	Low fuel Level - Forced Engine Shutdown	<ul style="list-style-type: none"> <li>● Low level fuel condition</li> <li>● Critical fuel level switch signal circuit - short to ground, power, open circuit</li> <li>● Critical fuel level switch failure</li> <li>● Fuel level sensor signal circuit - short to ground, power, open circuit</li> <li>● Fuel level sensor failure</li> </ul>	Check the fuel level. If there is sufficient fuel, refer to the electrical circuit diagrams and check the critical fuel level switch and fuel level sensor circuits for short, open circuit. Check and install a new critical fuel level switch/fuel level sensor as required
P125900	Immobilizer to PCM Signal Error	<ul style="list-style-type: none"> <li>● Incorrect ID received from instrument cluster</li> </ul>	Re-programme all ignition keys using the manufacturer approved diagnostic system
P133600	Crankshaft/Camshaft Sensor Range/Performance	<ul style="list-style-type: none"> <li>● CMP and CKP sensor circuits - short to ground, power, open circuit</li> <li>● CMP/CKP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CMP and CKP sensor circuits for short to ground, power, open circuit. Check and install a new CMP/CKP sensor as required
P133676	Crankshaft/Camshaft Sensor Range/Performance	<ul style="list-style-type: none"> <li>● CMP and CKP sensor circuits - short to ground, power, open circuit</li> <li>● CMP/CKP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CMP and CKP sensor circuits for short to ground, power, open circuit. Check and install a new CMP/CKP sensor as required
P133678	Crankshaft/Camshaft Sensor Range/Performance	<ul style="list-style-type: none"> <li>● CMP and CKP sensor circuits - short to ground, power, open circuit</li> <li>● CMP/CKP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CMP and CKP sensor circuits for short to ground, power, open circuit. Check and install a new CMP/CKP sensor as required
P162413	Anti-theft System	<ul style="list-style-type: none"> <li>● RJB anti-theft signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check RJB anti-theft signal circuit for open circuit
P162413	Anti-theft System	<ul style="list-style-type: none"> <li>● Anti-theft signal circuit from CJB - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check anti-theft signal circuit from CJB for open circuit
P213E01	Fuel Injection System Fault - Forced Engine Shutdown	<ul style="list-style-type: none"> <li>● Engine stop by electrical</li> </ul>	Check for additional related DTCs and refer to the relevant DTC Index
P213F07	Fuel Pump System Fault - Forced Engine Shutdown	<ul style="list-style-type: none"> <li>● Engine stop by hydraulic</li> </ul>	Check for additional related DTCs and refer to the relevant DTC Index
U016700	Lost Communication with Vehicle Immobilizer Control Module	<ul style="list-style-type: none"> <li>● ECM-ID transfer failed</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Carry out CAN network integrity tests using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies and CAN harness to vehicle immobilizer module
U032600	Software Incompatibility With Vehicle Immobilizer Control Module	<ul style="list-style-type: none"> <li>● Challenge does not match</li> </ul>	Re-configure the instrument cluster and ECM as new using the manufacturer approved diagnostic system

# Starting System - TDV6 2.7L Diesel - Starter Motor

Removal and Installation

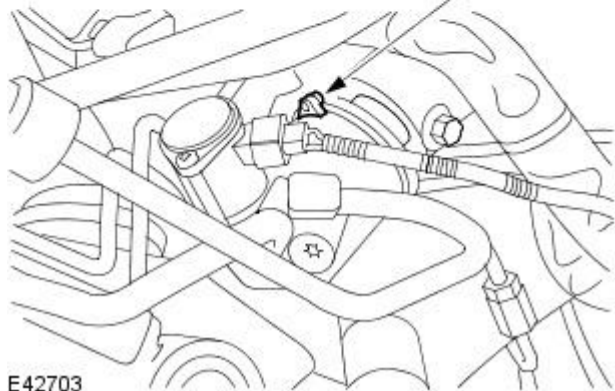
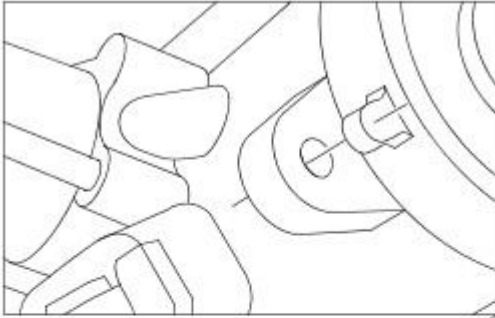
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).

3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

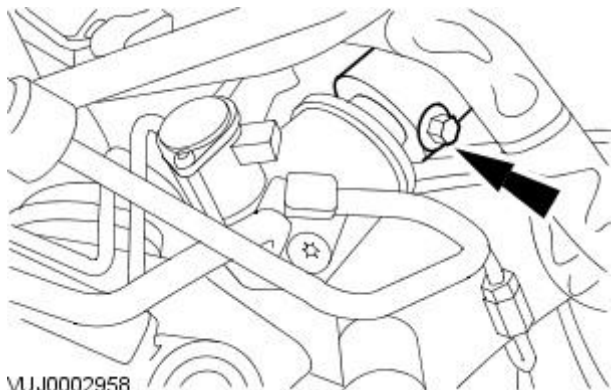
Raise and support the vehicle.

4. Make sure the alignment mark, on the steering gear pinion seal protection cover, is central to the steering gear pinion casting.



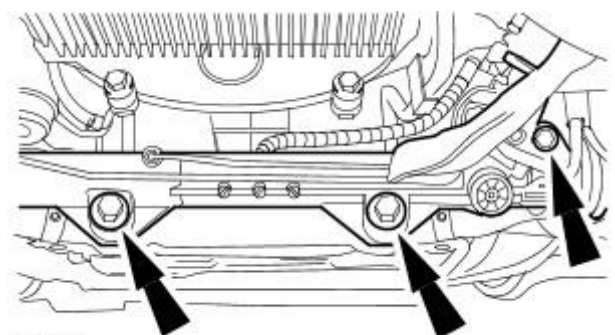
E42703

5. Remove the steering gear shaft pinch bolt.



VUJ0002958

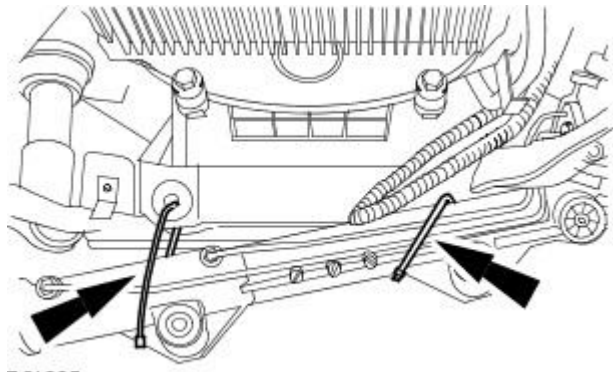
6. Detach the steering gear.



E31036

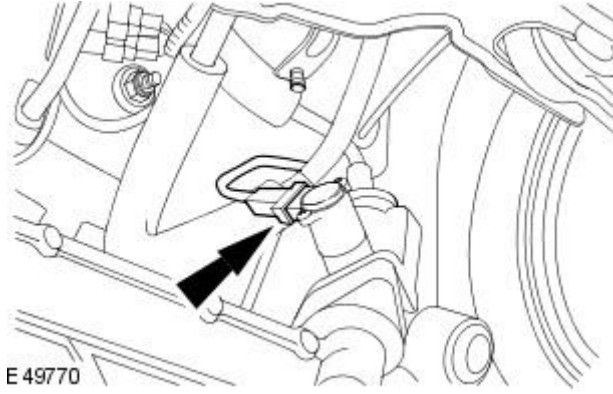


7. Secure the steering gear.



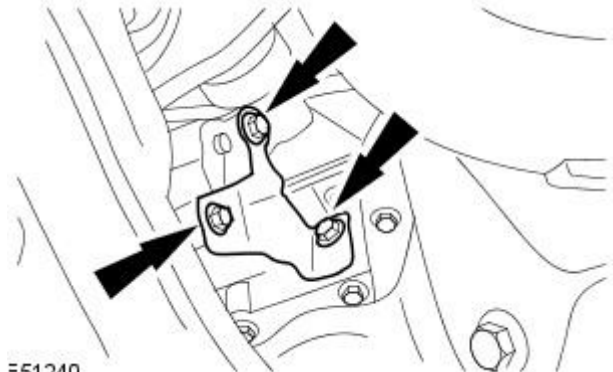
E 31035

8. Disconnect the power steering control valve actuator electrical connector.



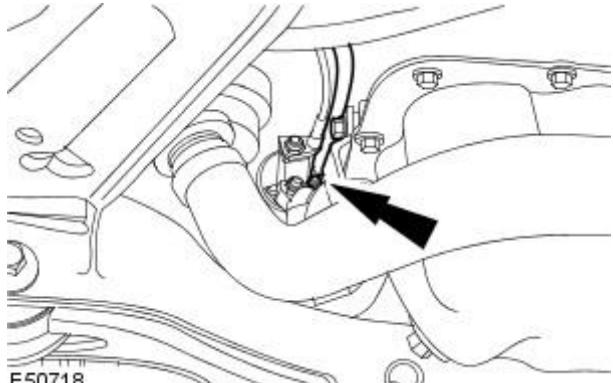
E 49770

9. Remove the starter motor retaining bracket.



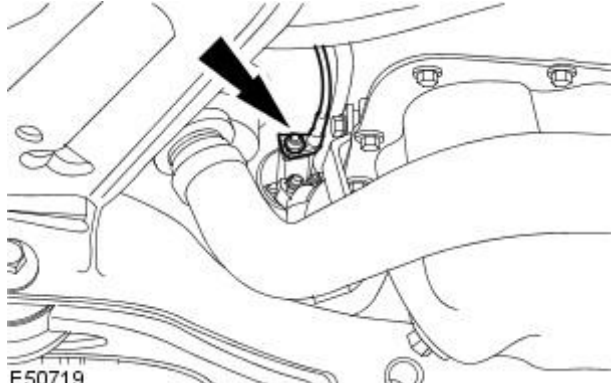
E 51240

10. Detach the starter motor solenoid harness.



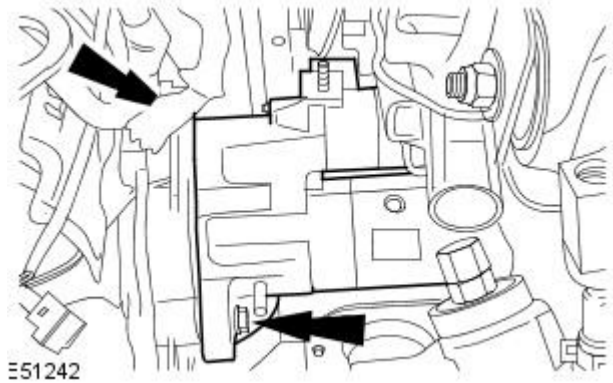
E 50718

11. Detach the starter motor cable.



E 50719

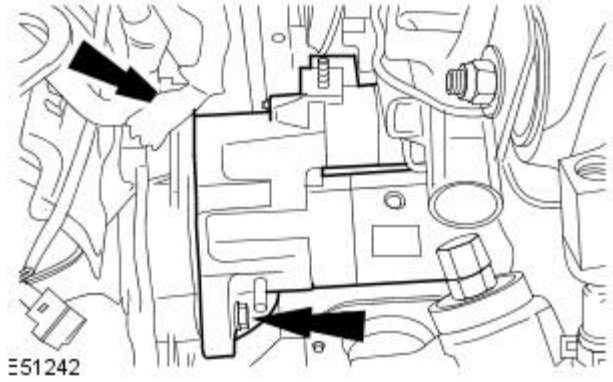
12. Remove the starter motor.



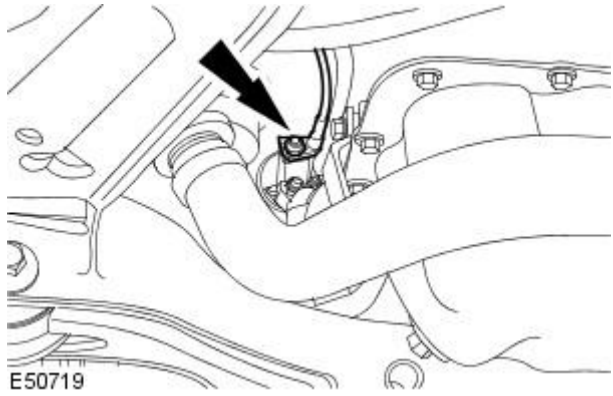
### Installation

1. To install, reverse the removal procedure.

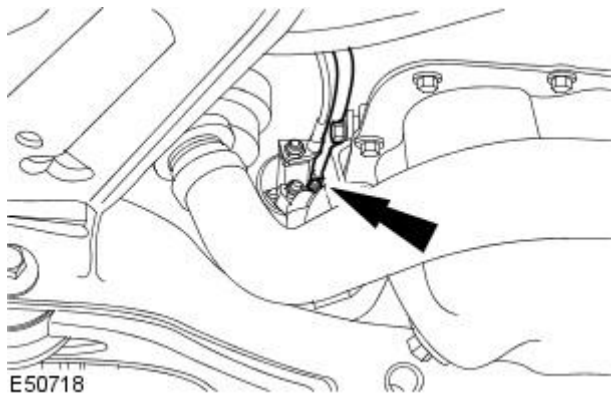
- Tighten to 48 Nm.



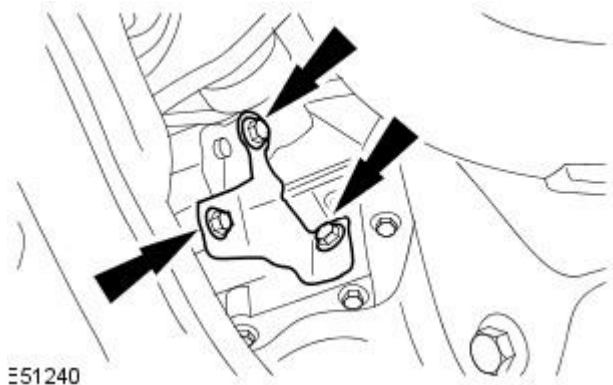
2. Tighten to 10 Nm.



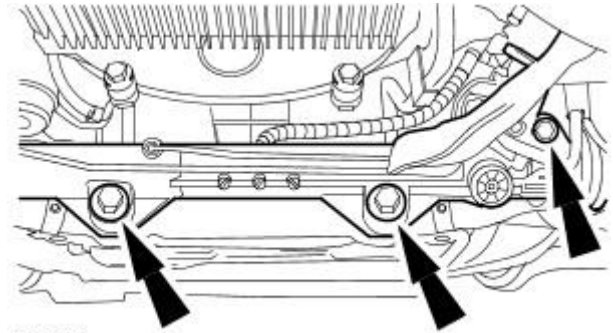
3. Tighten to 7 Nm.



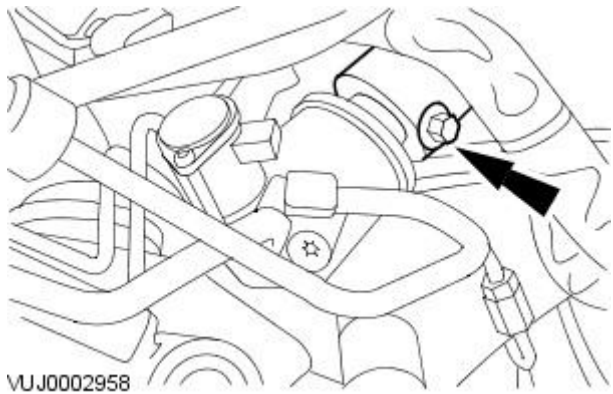
4. Tighten to 23 Nm.



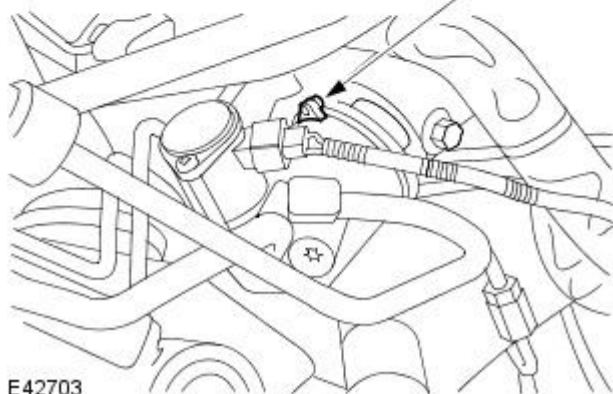
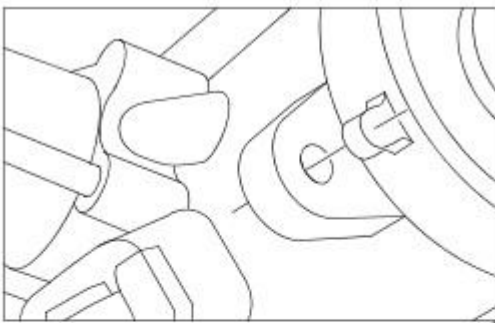
5. Tighten to 100 Nm.



6. Tighten to 35 Nm.



7. Make sure the alignment mark, on the steering gear pinion seal protection cover, is central to the steering gear pinion casting.



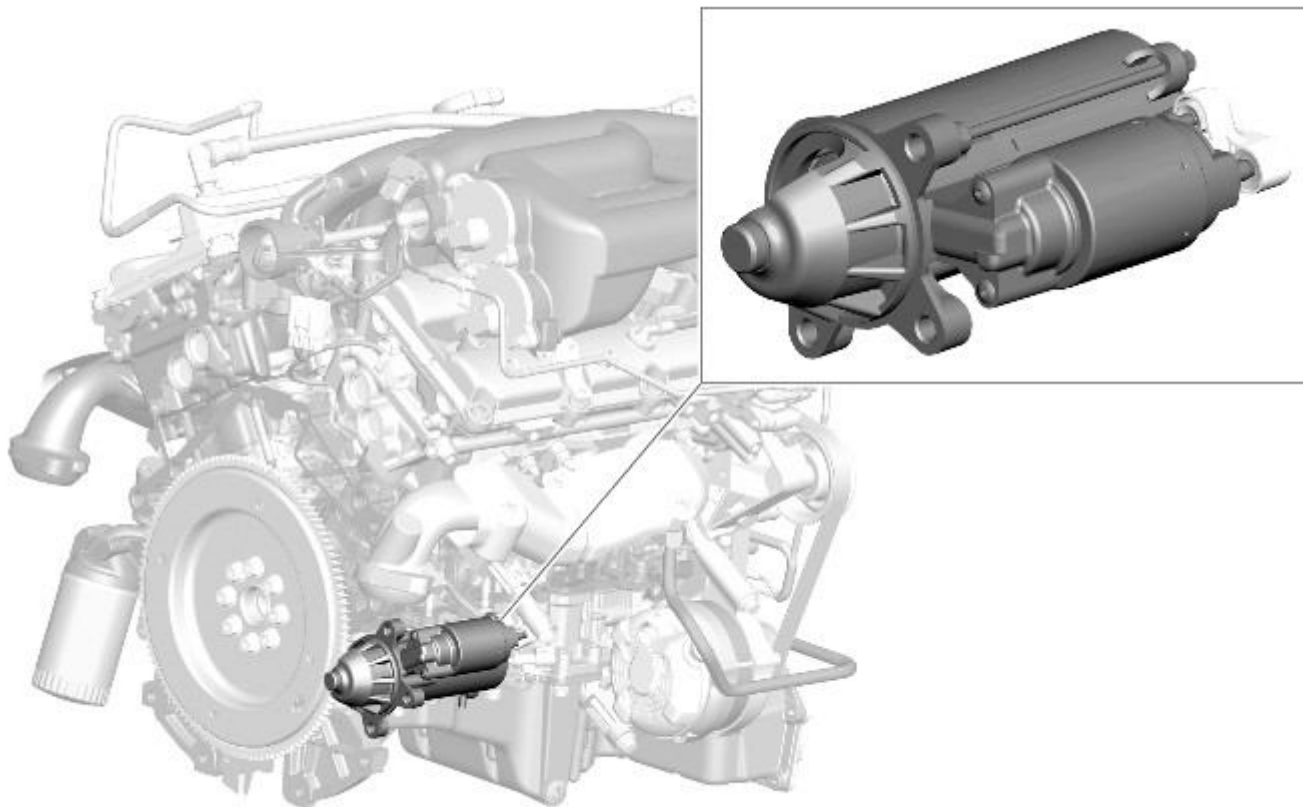
**Starting System - V6 3.0L Petrol -**

Description	Nm	lb-ft	lb-in
Starter motor bolts	25	18	-
Battery positive terminal integral connector retaining nut	12	9	-
Solenoid terminal integral connector nut	6	-	53

# Starting System - V6 3.0L Petrol - Starting System - Component Location

Description and Operation

Component Location



E93235

# Starting System - V6 3.0L Petrol - Starting System - Overview

Description and Operation

## Overview

The starter motor is rated as a 1.8 kW and is a Denso level 3-sealed unit. It is an RA type starter motor, which is of the offset design with the solenoid being directly behind the pinion to give a more positive engagement to the ring gear. The motor is geared directly to the pinion. Each starter motor is of the pre-engaged type and comprises a series wound motor and an overrunning clutch. This starter incorporates labyrinth-breathing tubes to help with sealing and drainage.

The starter solenoid is energised by a signal from the [ECM \(engine control module\)](#) when the ignition switch is moved to the crank position. When engine cranking is requested, the [ECM](#) checks that a valid key code has been received before granting the crank request.

The power for starter operation is supplied on a substantial single cable connected direct from the battery positive terminal. The cable is connected to the solenoid via a copper threaded stud with an anti-rotational device and secured with a nut.

The starter motor is located on the rear [RH \(right-hand\)](#) side of the engine block. The motor is secured to the block and protrudes through an aperture to drive the flywheel via a ring gear.



# Starting System - V6 3.0L Petrol - Starting System

Diagnosis and Testing

## Principles of Operation

For a detailed description of the starting system, refer to the relevant Description and Operation section in the workshop manual. REFER to:

- [Starting System](#) (303-06B Starting System - V6 3.0L Petrol, Description and Operation),
- [Starting System](#) (303-06B Starting System - V6 3.0L Petrol, Description and Operation),
- [Starting System](#) (303-06B, Description and Operation),
- [Starting System](#) (303-06C Starting System - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Description and Operation),
- [Starting System](#) (303-06C Starting System - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Description and Operation),
- [Starting System](#) (303-06C, Description and Operation),
- [Anti-Theft - Passive](#) (419-01B Anti-Theft - Passive, Description and Operation),
- [Anti-Theft - Passive](#) (419-01B Anti-Theft - Passive, Description and Operation),
- [Anti-Theft - Passive](#) (419-01B Anti-Theft - Passive, Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Starter Motor</li> <li>● Battery</li> </ul>	<ul style="list-style-type: none"> <li>● Battery</li> <li>● Fuses</li> <li>● Wiring harness</li> <li>● Damaged, loose or corroded connectors</li> <li>● Starter relay</li> <li>● Engine Control Module (ECM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the concern is not visually evident, verify the symptom and refer to the symptom chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
The engine does not crank (starter motor <b>does not</b> turn)	<ul style="list-style-type: none"> <li>● Gear selector not in <b>P</b> or <b>N</b> position</li> <li>● Battery</li> <li>● Harness/Connectors</li> <li>● Starter motor</li> <li>● Starter relay</li> <li>● Start switch</li> <li>● Transmission control module (TCM)</li> <li>● Engine control module (ECM)</li> <li>● Engine seized</li> </ul>	Make sure the gear selector is in the <b>P</b> or <b>N</b> position. Check the battery is in fully charged and serviceable condition. Check the starter motor and harness. Check for related DTCs and refer to the relevant DTC Index
The engine does not crank (starter motor <b>does</b> turn)	<ul style="list-style-type: none"> <li>● Starter motor installation</li> <li>● Starter motor</li> <li>● Ring gear</li> </ul>	Check the starter motor installation (fasteners tight, starter motor square to engine, etc). Check the ring gear teeth for damage, foreign objects, etc.
Engine cranks too slowly	<ul style="list-style-type: none"> <li>● Battery</li> <li>● Harness/Connectors</li> <li>● Starter motor</li> <li>● Engine oil incorrect grade</li> </ul>	Check the battery is in fully charged and serviceable condition. Refer to the electrical circuit diagrams and test the starter motor and starter motor circuits
Engine cranks too fast	<ul style="list-style-type: none"> <li>● Low engine compression</li> </ul>	Check the engine compressions. REFER to: <a href="#">Engine - V8 4.2L Petrol/V8 S/C 4.2L Petrol/3.0L NA V6 - AJ27</a> (303-00 Engine System - General Information, Diagnosis and Testing).
Excessive starter motor noise	<ul style="list-style-type: none"> <li>● Starter motor</li> <li>● Starter motor installation/casing</li> <li>● Ring gear</li> </ul>	Check the starter motor installation (fasteners tight, motor square to engine, etc). Check the starter motor casing condition. Check the ring gear teeth for damage, foreign objects, etc.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to 3 decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE: If DTCs are recorded and, after performing the pinpoint tests, the fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B100951	Ignition Authorisation	<ul style="list-style-type: none"> <li>Faulty instrument cluster</li> <li>Target SID re-synchronisation error following programming</li> <li>CAN fault</li> </ul>	Check ignition, power and ground supplies to CJB and instrument cluster. Re-synchronize ID by re-configuring the instrument cluster as a new module. Check CAN communications between instrument cluster and tester
B100962	Ignition Authorisation	<ul style="list-style-type: none"> <li>Low speed CAN fault</li> <li>CJB fault</li> <li>Instrument cluster fault</li> <li>Incorrect module installed (CJB/Instrument cluster)</li> <li>Target SID synchronisation error following re-programming</li> <li>Noise/EMC related error</li> </ul>	Check CAN communications between CJB and instrument cluster. Check ignition, power and ground supplies to CJB and instrument cluster. Confirm correct module is installed. Re-synchronise ID by re-configuring the instrument cluster as a new module. Check CAN network for interference/EMC related issues
B100963	Ignition Authorisation	<ul style="list-style-type: none"> <li>CJB fault</li> <li>Low speed CAN fault</li> <li>Instrument cluster fault</li> <li>Low battery voltage &lt;9V</li> </ul>	Check Power and Ground supplies to CJB and instrument cluster. Check CAN communications between CJB and instrument cluster. Check battery is in fully charged and serviceable condition, refer to the battery care manual
B100964	Ignition Authorisation	<ul style="list-style-type: none"> <li>CJB fault</li> <li>Low speed CAN fault</li> <li>Instrument cluster fault</li> </ul>	Check power and ground supplies to CJB and instrument cluster. Check CAN communications between CJB and instrument cluster
B100A51	Fuel Pump Authorisation	<ul style="list-style-type: none"> <li>RJB fault</li> <li>Low speed CAN fault</li> <li>Instrument cluster fault</li> </ul>	Check power and ground supplies to RJB. Check CAN communications between RJB and instrument cluster. Check power and ground supplies to instrument cluster
B100A62	Fuel Pump Authorisation	<ul style="list-style-type: none"> <li>Low speed CAN fault</li> <li>RJB fault</li> <li>Instrument cluster fault</li> <li>Incorrect module installed (RJB/Instrument cluster)</li> <li>Write target SID synchronisation error following re-programming</li> <li>Noise/EMC related error</li> </ul>	Check CAN communications between RJB and instrument cluster. Check power and ground supplies to RJB and instrument cluster. Confirm correct module installed. Re-synchronise ID by re-configuring the RJB as a new module. Check CAN network for interference/EMC related issues
B100A63	Fuel Pump Authorisation	<ul style="list-style-type: none"> <li>RJB fault</li> <li>Low speed CAN fault</li> <li>Instrument cluster fault</li> <li>Low battery voltage &lt;9V</li> </ul>	Check power and ground supplies to RJB and instrument cluster. Check CAN communications between RJB and instrument cluster. Check battery is in fully charged and serviceable condition, refer to the battery care manual
B100D51	Column lock authorisation	<ul style="list-style-type: none"> <li>Not programmed</li> </ul>	Check ignition, power and ground supplies to steering column lock and instrument cluster. Re-synchronise ID by re-configuring the steering column lock as a new module
B100D62	Column lock authorisation - signal compare failure	<ul style="list-style-type: none"> <li>CAN fault</li> <li>Steering column lock fault</li> <li>Instrument cluster fault</li> <li>Incorrect module installed (Steering column lock/Instrument cluster)</li> <li>Target ID synchronisation error following re-programming</li> <li>Noise/EMC related error</li> </ul>	Check CAN network between steering column lock and instrument cluster. Check power and ground supplies to steering column lock and instrument cluster. Confirm the correct modules are installed. Re-synchronize ID by re-configuring the steering column lock as new. Check CAN network for interference/EMC related issues
B100D64	Column lock authorisation - signal plausibility failure	<ul style="list-style-type: none"> <li>CAN fault</li> <li>Steering column lock fault</li> <li>Instrument cluster fault</li> </ul>	Check CAN network to steering column lock. Check power and ground supplies to steering column lock and instrument cluster
B100D87	Column lock authorisation - missing message	<ul style="list-style-type: none"> <li>CAN fault</li> <li>Steering column lock fault</li> <li>Instrument cluster fault</li> <li>Low voltage at steering column lock &lt; 8V</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check CAN network between steering column lock and instrument cluster. Check power and ground supplies to steering column lock and instrument cluster
B102611	Steering Column Lock	<ul style="list-style-type: none"> <li>Steering column lock power circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check steering column lock power circuit for short to ground
B102612	Steering Column Lock	<ul style="list-style-type: none"> <li>Steering column lock ground circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check steering column lock ground circuit for short to power
B102615	Steering Column Lock	<ul style="list-style-type: none"> <li>Steering column lock power circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check steering column lock power circuit for short to power, open circuit
B102B67	Passive Key	<ul style="list-style-type: none"> <li>CJB fault</li> <li>Low speed CAN fault</li> <li>Remote Keyless Entry (RKE) module fault</li> <li>Write target SID synchronisation error following re-programming</li> </ul>	Check power and ground supplies to CJB and RKE module. Check CAN communications between CJB and RKE module. Re-synchronise ID by re-configuring the RKE module as a new module

DTC	Description	Possible Cause	Action
B102B87	Passive Key	<ul style="list-style-type: none"> <li>● CJB fault</li> <li>● Low speed CAN fault</li> <li>● RKE module fault</li> <li>● Key fob battery low/battery contact issue</li> <li>● Interference from other RF signal</li> <li>● EMC/noise</li> <li>● Receiver fault</li> <li>● Receiver not programmed correctly</li> <li>● Serial communications fault (between receiver and RKE module)</li> <li>● Key fault</li> <li>● Passive antenna fault</li> <li>● Confirm placement of key within vehicle</li> </ul>	Check power and ground supplies to CJB, RKE module and receiver. Check CAN communications between CJB and instrument cluster. Check key fob battery. Confirm vehicle surroundings, move vehicle. Check CAN network for interference/EMC related issues. Disconnect battery, then re-connect - confirm operation by re-programming keys. Check serial circuit between receiver and RKE module. Confirm spare key works. Refer to the electrical circuit diagrams and test circuits to all 3 antennas. Check whereabouts of key
B108A11	Start Button	<ul style="list-style-type: none"> <li>● Start/Stop switch analogue input circuits 1 or 2 - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check Start/Stop switch analogue input circuits 1 and 2 for short to ground
B108A12	Start Button	<ul style="list-style-type: none"> <li>● Start/Stop switch analogue input circuits 1 or 2 - short to power</li> </ul>	Refer to the electrical circuit diagrams and check Start/Stop switch analogue input circuits 1 and 2 for short to power
B108A23	Start Button	<ul style="list-style-type: none"> <li>● Start/Stop switch digital input signal circuit - stuck low</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Start/Stop switch digital input signal circuit for short to ground
B10E511	PCM Wake-up Signal	<ul style="list-style-type: none"> <li>● ECM wake-up signal circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check ECM wake-up signal circuit for short to ground
B10F111	Key In Switch	<ul style="list-style-type: none"> <li>● Keyless vehicle module, key IN status circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check keyless vehicle module, key IN status circuit for short to ground
B10FA93	Delayed Power Off relay	<ul style="list-style-type: none"> <li>● ADRC ECM, roof header console lamp, glove box lamp, RH/LH footwell lamps, JAG Sense glove box module, RH/LH sunvisor lamps, rear dome lamps switched power circuits - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ADRC ECM, roof header console lamp, glove box lamp, RH/LH footwell lamps, JAG Sense glove box module, RH/LH sunvisor lamps, rear dome lamps switched power circuits for short to power, open circuit
B10FF11	Ignition control	<ul style="list-style-type: none"> <li>● ECM and FPDB ignition control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECM and FPDB ignition control circuit for short to ground
B10FF15	Ignition control	<ul style="list-style-type: none"> <li>● ECM and FPDB ignition control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECM and FPDB ignition control circuit for short to power, open circuit
B114011	Engine Crank Authorisation	<ul style="list-style-type: none"> <li>● Engine crank authorisation signal circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check engine crank authorisation signal circuit for short to ground
B114015	Engine Crank Authorisation	<ul style="list-style-type: none"> <li>● Engine crank authorisation signal circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check engine crank authorisation signal circuit for short to power, open circuit
B114211	Ignition Status 1	<ul style="list-style-type: none"> <li>● Ignition supply 1 circuits - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check all ignition supply 1 circuits for short to ground
B114215	Ignition Status 1	<ul style="list-style-type: none"> <li>● Ignition supply 1 circuits - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check all ignition supply 1 circuits for short to power, open circuit
B114311	Ignition Status 2	<ul style="list-style-type: none"> <li>● Ignition supply 2 circuits - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check all ignition supply 2 circuits for short to ground
B114315	Ignition Status 2	<ul style="list-style-type: none"> <li>● Ignition supply 2 circuits - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check all ignition supply 2 circuits for short to power, open circuit
B123711	Gear Shift Module Early Wake-up	<ul style="list-style-type: none"> <li>● Transmission shift module wake-up control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check transmission shift module wake-up control circuit for short to ground
B123E13	Crank Enable	<ul style="list-style-type: none"> <li>● OK to crank signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check OK to crank signal circuit for open circuit
P001600	Crankshaft Position - Camshaft Position Correlation - Bank 1 Sensor A	<ul style="list-style-type: none"> <li>● The relative positions of the CKP and CMP teeth are not correct <ul style="list-style-type: none"> <li>- Sensors incorrectly aligned on rebuild</li> </ul> </li> </ul>	Reset the sensor positions
P001800	Crankshaft Position - Camshaft Position Correlation - Bank 2 Sensor A	<ul style="list-style-type: none"> <li>● The relative positions of the CKP and CMP teeth are not correct <ul style="list-style-type: none"> <li>- Sensors incorrectly aligned on rebuild</li> </ul> </li> </ul>	Reset the sensor positions

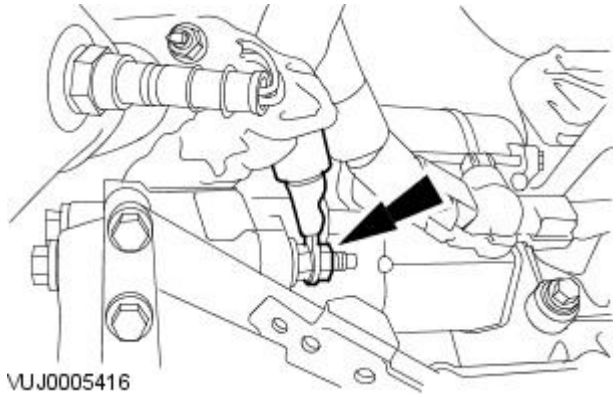
DTC	Description	Possible Cause	Action
P051212	Starter Request Circuit	<ul style="list-style-type: none"> <li>● Crank request circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check crank request circuit for short to power
P051214	Starter Request Circuit	<ul style="list-style-type: none"> <li>● Crank request circuit - short to ground, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check crank request circuit for short to ground, open circuit
P051300	Incorrect Immobilizer Key	<ul style="list-style-type: none"> <li>● Security key invalid</li> </ul>	Check for CAN network interference/EMC related error. Re-synchronise ID by re-configuring the ECM and instrument cluster as new modules
P061614	Starter Relay Circuit Low	<ul style="list-style-type: none"> <li>● Starter relay circuit - short to ground, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check starter relay circuit for short to ground, open circuit
P061712	Starter Relay Circuit High	<ul style="list-style-type: none"> <li>● Starter relay circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check starter relay circuit for short to power
P081713	Starter Disable Circuit/Open	<ul style="list-style-type: none"> <li>● Starter relay negative control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check starter relay negative control circuit for open circuit
P081A11	Starter Disable Circuit Low	<ul style="list-style-type: none"> <li>● Starter relay negative control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check starter relay negative control circuit for short to ground
P081B12	Starter Disable Circuit High	<ul style="list-style-type: none"> <li>● Starter relay negative control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check starter relay negative control circuit for short to power
P085114	Park/Neutral Switch Input Circuit Low	<ul style="list-style-type: none"> <li>● Park/Neutral switch input circuit - low</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Park/Neutral switch input circuit for short to ground, open circuit
P085212	Park/Neutral Switch Input Circuit High	<ul style="list-style-type: none"> <li>● Park/Neutral switch input circuit - high</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Park/Neutral switch input circuit for short to power
P125900	Immobilizer to PCM Signal Error	<ul style="list-style-type: none"> <li>● Incorrect ID received from instrument cluster</li> </ul>	Re-configure the instrument cluster using the manufacturer approved diagnostic system
U016700	Lost Communication With Vehicle Immobilizer Control Module	<ul style="list-style-type: none"> <li>● Security challenge response timeout</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies to vehicle immobilizer module. Carry out the CAN network integrity test using the manufacturer approved diagnostic system
U042600	Invalid Data Received From Vehicle Immobilizer Control Module	<ul style="list-style-type: none"> <li>● Security code mis-match</li> </ul>	Check CAN network between ECM and instrument cluster. Check power and grounds to ECM and instrument cluster. Check correct ECM and instrument cluster installed. Re-synchronise ID by re-configuring the ECM and instrument cluster as new modules

# Starting System - V6 3.0L Petrol - Starter Motor

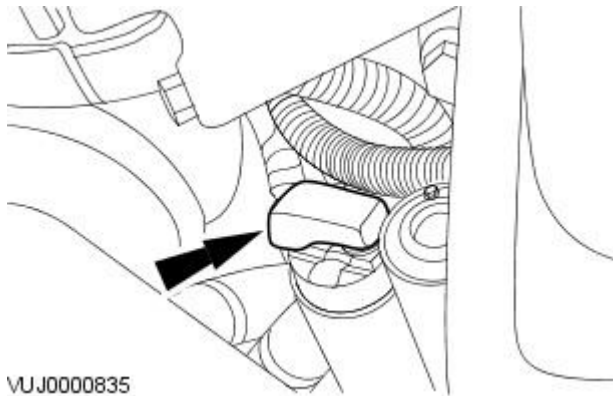
Removal and Installation

## Removal

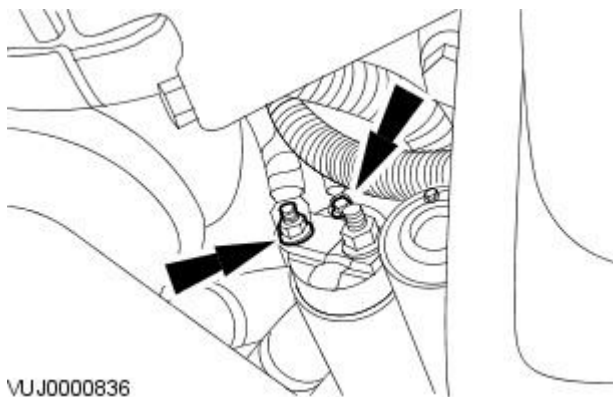
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Raise and support the vehicle.
3. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).
4. Disconnect the engine ground cable.



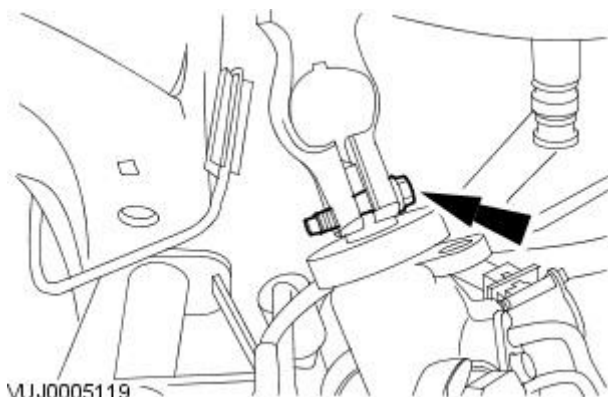
5. Remove the starter motor positive cable cover.



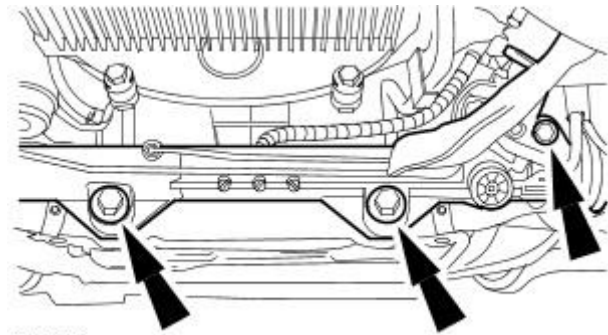
6. Release the starter motor positive cable.



7. Remove the steering gear shaft pinch bolt.



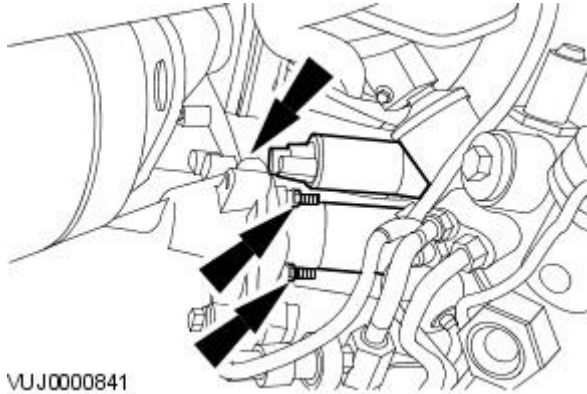
8. Release the steering gear.



E31036

9. Remove the starter motor.

- Remove the starter motor retaining bolts.

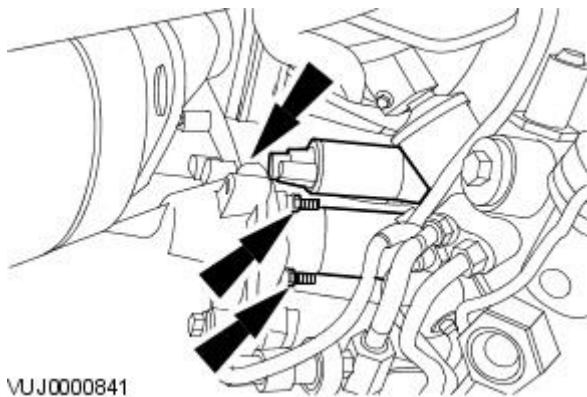


VUJ0000841

### Installation

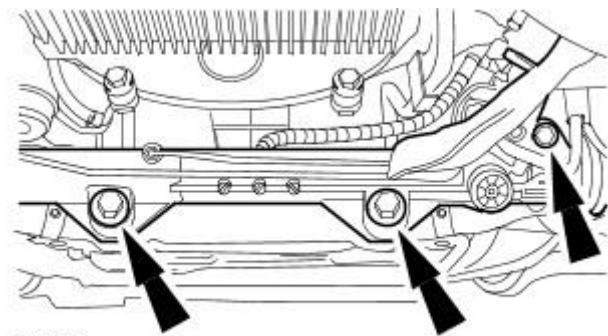
1. To install, reverse the removal procedure.

- Tighten to 25 Nm.



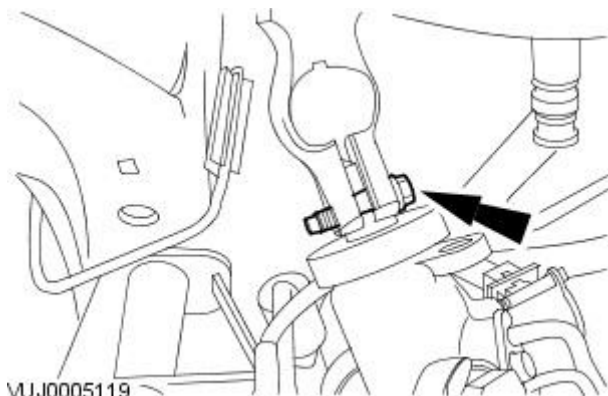
VUJ0000841

2. Tighten to 100 Nm.



E31036

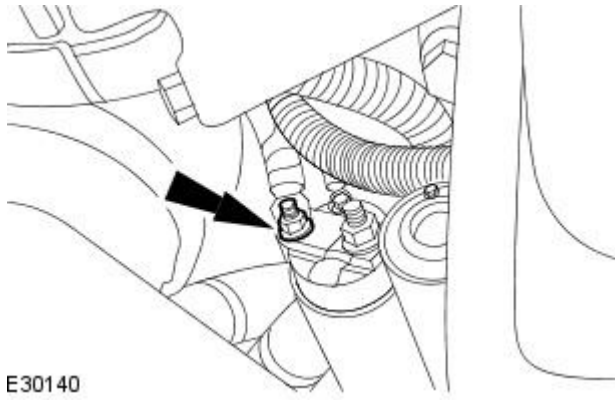
3. Tighten to 35 Nm.



VUJ0005119

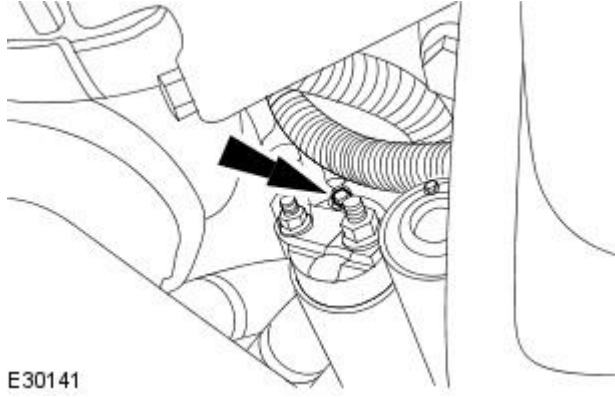


4. Tighten to 13 Nm.



E30140

5. Tighten to 7 Nm.



E30141

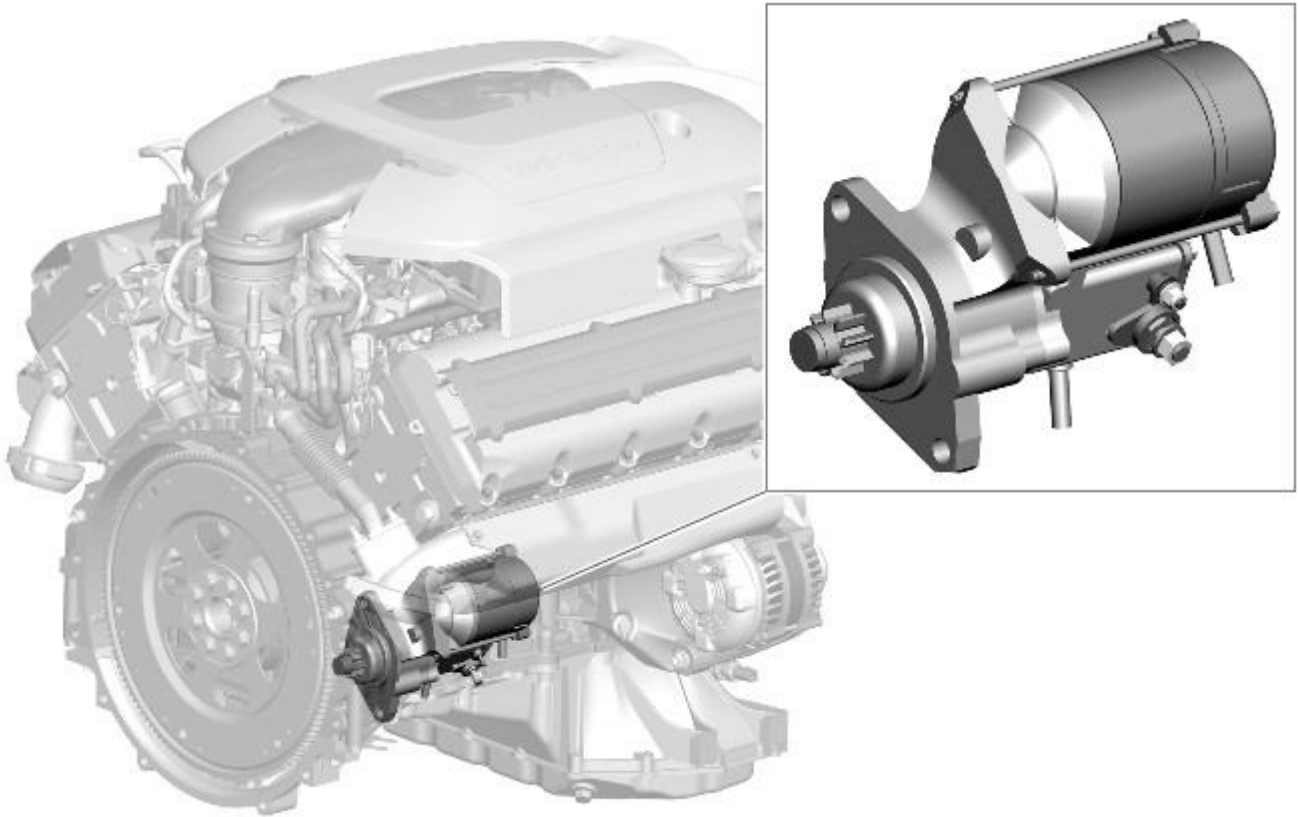
**Starting System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 -**

Description	Nm	lb-ft	lb-in
Starter motor bolts	47	35	-
Battery positive terminal integral connector retaining nut	10	-	89
Solenoid terminal integral connector nut	5	-	44

# Starting System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Starting System - Component Location

Description and Operation

Component Location



E93237

# Starting System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Starting System - Overview

Description and Operation

## Overview

The starter motor is rated as a 1.8 kW and is a Denso level 3-sealed unit. It is an RA type starter motor, which is of the offset design with the solenoid being directly behind the pinion to give a more positive engagement to the ring gear. The motor is geared directly to the pinion. Each starter motor is of the pre-engaged type and comprises a series wound motor and an overrunning clutch. This starter incorporates labyrinth-breathing tubes to help with sealing and drainage.

The starter solenoid is energised by a signal from the [ECM \(engine control module\)](#) when the ignition switch is moved to the crank position. When engine cranking is requested, the [ECM](#) checks that a valid key code has been received before granting the crank request.

The power for starter operation is supplied on a substantial single cable connected direct from the battery positive terminal. The cable is connected to the solenoid via a copper threaded stud with an anti-rotational device and secured with a nut.

The starter motor is located on the rear [RH \(right-hand\)](#) side of the engine block. The motor is secured to the block and protrudes through an aperture to drive the flywheel via a ring gear.

# Starting System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Starting System

Diagnosis and Testing

## Principles of Operation

For a detailed description of the starting system, refer to the relevant Description and Operation section in the workshop manual. REFER to:

[Starting System](#) (303-06 Starting System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation),  
[Starting System](#) (303-06 Starting System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation),  
[Starting System](#) (303-06 Starting System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation),  
[Anti-Theft - Passive](#) (419-01B Anti-Theft - Passive, Description and Operation),  
[Anti-Theft - Passive](#) (419-01B Anti-Theft - Passive, Description and Operation),  
[Anti-Theft - Passive](#) (419-01B Anti-Theft - Passive, Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. Verify the customer concern.
2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Starter Motor</li> <li>● Battery</li> </ul>	<ul style="list-style-type: none"> <li>● Battery</li> <li>● Fuses</li> <li>● Wiring harness</li> <li>● Damaged, loose or corroded connectors</li> <li>● Starter relay</li> <li>● Engine Control Module (ECM)</li> </ul>

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to the symptom chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
The engine does not crank (starter motor <b>does not</b> turn)	<ul style="list-style-type: none"> <li>● Gear selector not in <b>P</b> or <b>N</b> position</li> <li>● Battery</li> <li>● Harness/Connectors</li> <li>● Starter motor</li> <li>● Starter relay</li> <li>● Start switch</li> <li>● Transmission control module (TCM)</li> <li>● Engine control module (ECM)</li> <li>● Engine seized</li> </ul>	Make sure the gear selector is in the <b>P</b> or <b>N</b> position. Check the battery is in fully charged and serviceable condition. Check the starter motor and harness. Check for related DTCs and refer to the relevant DTC Index
The engine does not crank (starter motor <b>does</b> turn)	<ul style="list-style-type: none"> <li>● Starter motor installation</li> <li>● Starter motor</li> <li>● Ring gear</li> </ul>	Check the starter motor installation (fasteners tight, starter motor square to engine, etc). Check the ring gear teeth for damage, foreign objects, etc.
Engine cranks too slowly	<ul style="list-style-type: none"> <li>● Battery</li> <li>● Harness/Connectors</li> <li>● Starter motor</li> <li>● Engine oil incorrect grade</li> </ul>	Check the battery is in fully charged and serviceable condition. Refer to the electrical circuit diagrams and test the starter motor and starter motor circuits
Engine cranks too fast	<ul style="list-style-type: none"> <li>● Low engine compression</li> </ul>	Check the engine compressions. REFER to: <a href="#">Engine - 3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8</a> (303-00 Engine System - General Information, Diagnosis and Testing).
Excessive starter motor noise	<ul style="list-style-type: none"> <li>● Starter motor</li> <li>● Starter motor installation/casing</li> <li>● Ring gear</li> </ul>	Check the starter motor installation (fasteners tight, motor square to engine, etc). Check the starter motor casing condition. Check the ring gear teeth for damage, foreign objects, etc.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00. Failure to follow this instruction may result in damage to the vehicle.

• **NOTE:** Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• **NOTE:** When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to 3 decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• **NOTE:** If DTCs are recorded and, after performing the pinpoint tests, the fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B100951	Ignition Authorisation	<ul style="list-style-type: none"> <li>● Faulty instrument cluster</li> <li>● Target SID re-synchronisation error following programming</li> <li>● CAN fault</li> </ul>	Check ignition, power and ground supplies to CJB and instrument cluster. Re-synchronize ID by re-configuring the instrument cluster as a new module. Check CAN communications between instrument cluster and tester
B100962	Ignition Authorisation	<ul style="list-style-type: none"> <li>● Low speed CAN fault</li> <li>● CJB fault</li> <li>● Instrument cluster fault</li> <li>● Incorrect module installed (CJB/Instrument cluster)</li> <li>● Target SID synchronisation error following re-programming</li> <li>● Noise/EMC related error</li> </ul>	Check CAN communications between CJB and instrument cluster. Check ignition, power and ground supplies to CJB and instrument cluster. Confirm correct module is installed. Re-synchronise ID by re-configuring the instrument cluster as a new module. Check CAN network for interference/EMC related issues
B100963	Ignition Authorisation	<ul style="list-style-type: none"> <li>● CJB fault</li> <li>● Low speed CAN fault</li> <li>● Instrument cluster fault</li> <li>● Low battery voltage &lt;9V</li> </ul>	Check Power and Ground supplies to CJB and instrument cluster. Check CAN communications between CJB and instrument cluster. Check battery is in fully charged and serviceable condition, refer to the battery care manual
B100964	Ignition Authorisation	<ul style="list-style-type: none"> <li>● CJB fault</li> <li>● Low speed CAN fault</li> <li>● Instrument cluster fault</li> </ul>	Check power and ground supplies to CJB and instrument cluster. Check CAN communications between CJB and instrument cluster
B100A51	Fuel Pump Authorisation	<ul style="list-style-type: none"> <li>● RJB fault</li> <li>● Low speed CAN fault</li> <li>● Instrument cluster fault</li> </ul>	Check power and ground supplies to RJB. Check CAN communications between RJB and instrument cluster. Check power and ground supplies to instrument cluster
B100A62	Fuel Pump Authorisation	<ul style="list-style-type: none"> <li>● Low speed CAN fault</li> <li>● RJB fault</li> <li>● Instrument cluster fault</li> <li>● Incorrect module installed (RJB/Instrument cluster)</li> <li>● Write target SID synchronisation error following re-programming</li> <li>● Noise/EMC related error</li> </ul>	Check CAN communications between RJB and instrument cluster. Check power and ground supplies to RJB and instrument cluster. Confirm correct module installed. Re-synchronise ID by re-configuring the RJB as a new module. Check CAN network for interference/EMC related issues
B100A63	Fuel Pump Authorisation	<ul style="list-style-type: none"> <li>● RJB fault</li> <li>● Low speed CAN fault</li> <li>● Instrument cluster fault</li> <li>● Low battery voltage &lt;9V</li> </ul>	Check power and ground supplies to RJB and instrument cluster. Check CAN communications between RJB and instrument cluster. Check battery is in fully charged and serviceable condition, refer to the battery care manual
B100D51	Column lock authorisation	<ul style="list-style-type: none"> <li>● Not programmed</li> </ul>	Check ignition, power and ground supplies to steering column lock and instrument cluster. Re-synchronise ID by re-configuring the steering column lock as a new module
B100D62	Column lock authorisation - signal compare failure	<ul style="list-style-type: none"> <li>● CAN fault</li> <li>● Steering column lock fault</li> <li>● Instrument cluster fault</li> <li>● Incorrect module installed (Steering column lock/Instrument cluster)</li> <li>● Target ID synchronisation error following re-programming</li> <li>● Noise/EMC related error</li> </ul>	Check CAN network between steering column lock and instrument cluster. Check power and ground supplies to steering column lock and instrument cluster. Confirm the correct modules are installed. Re-synchronize ID by re-configuring the steering column lock as new. Check CAN network for interference/EMC related issues
B100D64	Column lock authorisation - signal plausibility failure	<ul style="list-style-type: none"> <li>● CAN fault</li> <li>● Steering column lock fault</li> <li>● Instrument cluster fault</li> </ul>	Check CAN network to steering column lock. Check power and ground supplies to steering column lock and instrument cluster
B100D87	Column lock authorisation - missing message	<ul style="list-style-type: none"> <li>● CAN fault</li> <li>● Steering column lock fault</li> <li>● Instrument cluster fault</li> <li>● Low voltage at steering column lock &lt; 8V</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check CAN network between steering column lock and instrument cluster. Check power and ground supplies to steering column lock and instrument cluster



DTC	Description	Possible Cause	Action
B102611	Steering Column Lock	<ul style="list-style-type: none"> <li>Steering column lock power circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check steering column lock power circuit for short to ground
B102612	Steering Column Lock	<ul style="list-style-type: none"> <li>Steering column lock ground circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check steering column lock ground circuit for short to power
B102615	Steering Column Lock	<ul style="list-style-type: none"> <li>Steering column lock power circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check steering column lock power circuit for short to power, open circuit
B102B67	Passive Key	<ul style="list-style-type: none"> <li>CJB fault</li> <li>Low speed CAN fault</li> <li>Remote Keyless Entry (RKE) module fault</li> <li>Write target SID synchronisation error following re-programming</li> </ul>	Check power and ground supplies to CJB and RKE module. Check CAN communications between CJB and RKE module. Re-synchronise ID by re-configuring the RKE module as a new module
B102B87	Passive Key	<ul style="list-style-type: none"> <li>CJB fault</li> <li>Low speed CAN fault</li> <li>RKE module fault</li> <li>Key fob battery low/battery contact issue</li> <li>Interference from other RF signal</li> <li>EMC/noise</li> <li>Receiver fault</li> <li>Receiver not programmed correctly</li> <li>Serial communications fault (between receiver and RKE module)</li> <li>Key fault</li> <li>Passive antenna fault</li> <li>Confirm placement of key within vehicle</li> </ul>	Check power and ground supplies to CJB, RKE module and receiver. Check CAN communications between CJB and instrument cluster. Check key fob battery. Confirm vehicle surroundings, move vehicle. Check CAN network for interference/EMC related issues. Disconnect battery, then re-connect - confirm operation by re-programming keys. Check serial circuit between receiver and RKE module. Confirm spare key works. Refer to the electrical circuit diagrams and test circuits to all 3 antennas. Check whereabouts of key
B108A11	Start Button	<ul style="list-style-type: none"> <li>Start/Stop switch analogue input circuits 1 or 2 - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check Start/Stop switch analogue input circuits 1 and 2 for short to ground
B108A12	Start Button	<ul style="list-style-type: none"> <li>Start/Stop switch analogue input circuits 1 or 2 - short to power</li> </ul>	Refer to the electrical circuit diagrams and check Start/Stop switch analogue input circuits 1 and 2 for short to power
B108A23	Start Button	<ul style="list-style-type: none"> <li>Start/Stop switch digital input signal circuit - stuck low</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Start/Stop switch digital input signal circuit for short to ground
B10E511	PCM Wake-up Signal	<ul style="list-style-type: none"> <li>ECM wake-up signal circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check ECM wake-up signal circuit for short to ground
B10F111	Key In Switch	<ul style="list-style-type: none"> <li>Keyless vehicle module, key IN status circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check keyless vehicle module, key IN status circuit for short to ground
B10FA93	Delayed Power Off relay	<ul style="list-style-type: none"> <li>ADRC ECM, roof header console lamp, glove box lamp, RH/LH footwell lamps, JAG Sense glove box module, RH/LH sunvisor lamps, rear dome lamps switched power circuits - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ADRC ECM, roof header console lamp, glove box lamp, RH/LH footwell lamps, JAG Sense glove box module, RH/LH sunvisor lamps, rear dome lamps switched power circuits for short to power, open circuit
B10FF11	Ignition control	<ul style="list-style-type: none"> <li>ECM and FPDB ignition control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECM and FPDB ignition control circuit for short to ground
B10FF15	Ignition control	<ul style="list-style-type: none"> <li>ECM and FPDB ignition control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECM and FPDB ignition control circuit for short to power, open circuit
B114011	Engine Crank Authorisation	<ul style="list-style-type: none"> <li>Engine crank authorisation signal circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check engine crank authorisation signal circuit for short to ground

DTC	Description	Possible Cause	Action
B114015	Engine Crank Authorisation	<ul style="list-style-type: none"> <li>Engine crank authorisation signal circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check engine crank authorisation signal circuit for short to power, open circuit
B114211	Ignition Status 1	<ul style="list-style-type: none"> <li>Ignition supply 1 circuits - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check all ignition supply 1 circuits for short to ground
B114215	Ignition Status 1	<ul style="list-style-type: none"> <li>Ignition supply 1 circuits - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check all ignition supply 1 circuits for short to power, open circuit
B114311	Ignition Status 2	<ul style="list-style-type: none"> <li>Ignition supply 2 circuits - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check all ignition supply 2 circuits for short to ground
B114315	Ignition Status 2	<ul style="list-style-type: none"> <li>Ignition supply 2 circuits - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check all ignition supply 2 circuits for short to power, open circuit
B123711	Gear Shift Module Early Wake-up	<ul style="list-style-type: none"> <li>Transmission shift module wake-up control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check transmission shift module wake-up control circuit for short to ground
B123E13	Crank Enable	<ul style="list-style-type: none"> <li>OK to crank signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check OK to crank signal circuit for open circuit
P001600	Crankshaft Position - Camshaft Position Correlation - Bank 1 Sensor A	<ul style="list-style-type: none"> <li>The relative positions of the CKP and CMP teeth are not correct <ul style="list-style-type: none"> <li>Sensors incorrectly aligned on rebuild</li> </ul> </li> </ul>	Reset the sensor positions
P001800	Crankshaft Position - Camshaft Position Correlation - Bank 2 Sensor A	<ul style="list-style-type: none"> <li>The relative positions of the CKP and CMP teeth are not correct <ul style="list-style-type: none"> <li>Sensors incorrectly aligned on rebuild</li> </ul> </li> </ul>	Reset the sensor positions
P051212	Starter Request Circuit	<ul style="list-style-type: none"> <li>Crank request circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check crank request circuit for short to power
P051214	Starter Request Circuit	<ul style="list-style-type: none"> <li>Crank request circuit - short to ground, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check crank request circuit for short to ground, open circuit
P051300	Incorrect Immobilizer Key	<ul style="list-style-type: none"> <li>Security key invalid</li> </ul>	Check for CAN network interference/EMC related error. Re-synchronise ID by re-configuring the ECM and instrument cluster as new modules
P061614	Starter Relay Circuit Low	<ul style="list-style-type: none"> <li>Starter relay circuit - short to ground, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check starter relay circuit for short to ground, open circuit
P061712	Starter Relay Circuit High	<ul style="list-style-type: none"> <li>Starter relay circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check starter relay circuit for short to power
P081713	Starter Disable Circuit/Open	<ul style="list-style-type: none"> <li>Starter relay negative control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check starter relay negative control circuit for open circuit
P081A11	Starter Disable Circuit Low	<ul style="list-style-type: none"> <li>Starter relay negative control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check starter relay negative control circuit for short to ground
P081B12	Starter Disable Circuit High	<ul style="list-style-type: none"> <li>Starter relay negative control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check starter relay negative control circuit for short to power
P085114	Park/Neutral Switch Input Circuit Low	<ul style="list-style-type: none"> <li>Park/Neutral switch input circuit - low</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Park/Neutral switch input circuit for short to ground, open circuit
P085212	Park/Neutral Switch Input Circuit High	<ul style="list-style-type: none"> <li>Park/Neutral switch input circuit - high</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Park/Neutral switch input circuit for short to power
P125900	Immobilizer to PCM Signal Error	<ul style="list-style-type: none"> <li>Incorrect ID received from instrument cluster</li> </ul>	Re-configure the instrument cluster using the manufacturer approved diagnostic system

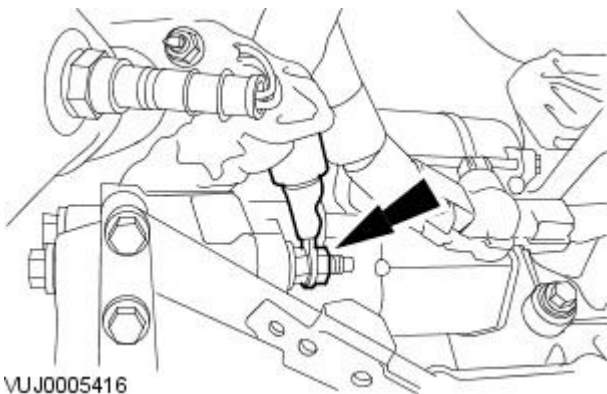
DTC	Description	Possible Cause	Action
U016700	Lost Communication With Vehicle Immobilizer Control Module	<ul style="list-style-type: none"> <li>● Security challenge response timeout</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies to vehicle immobilizer module. Carry out the CAN network integrity test using the manufacturer approved diagnostic system
U042600	Invalid Data Received From Vehicle Immobilizer Control Module	<ul style="list-style-type: none"> <li>● Security code mis-match</li> </ul>	Check CAN network between ECM and instrument cluster. Check power and grounds to ECM and instrument cluster. Check correct ECM and instrument cluster installed. Re-synchronise ID by re-configuring the ECM and instrument cluster as new modules

# Starting System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Starter Motor

Removal and Installation

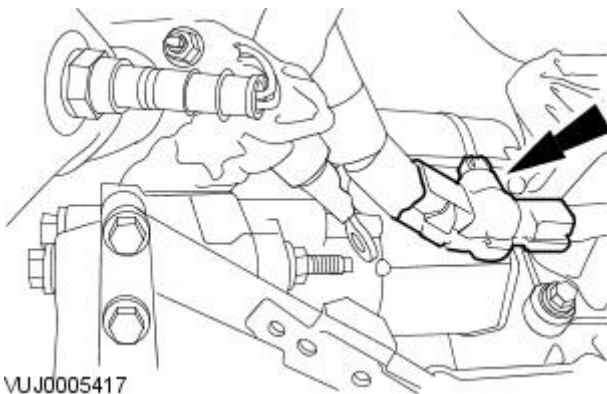
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Raise and support the vehicle.
3. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02, Removal and Installation).
4. Disconnect the engine ground cable.



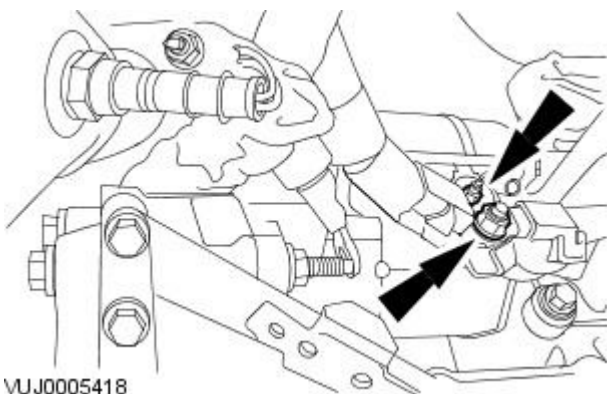
VUJ0005416

5. Remove the starter motor positive cable cover.



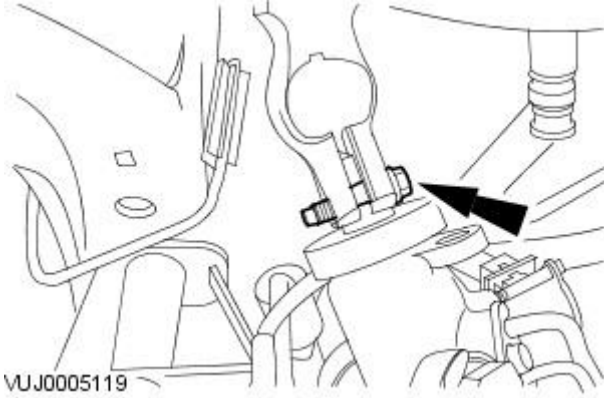
VUJ0005417

6. Release the starter motor positive cable.

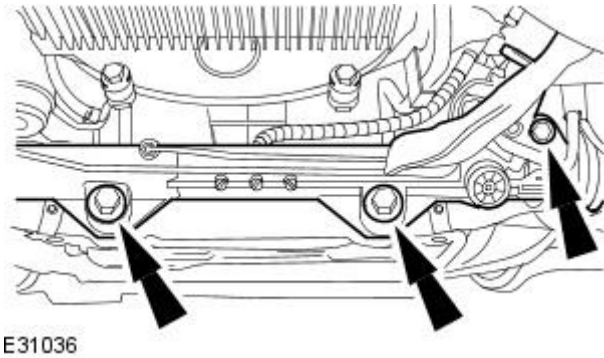


VUJ0005418

7. Remove the steering gear shaft pinch bolt.

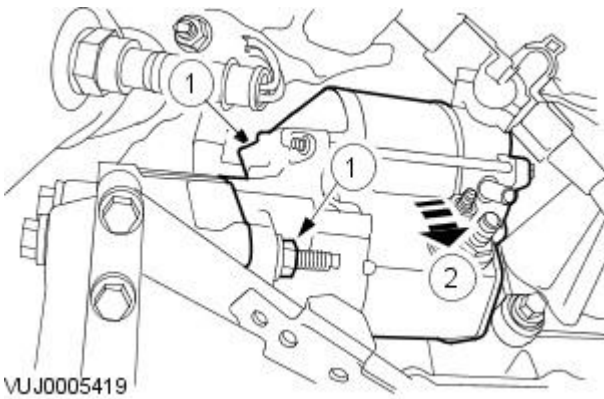


8. Release the steering gear.



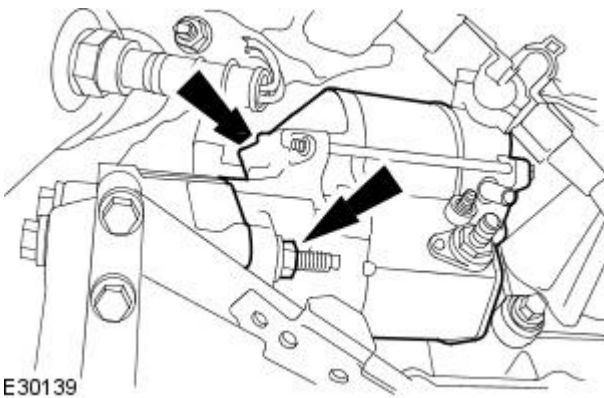
9. Remove the starter motor.

- Remove the starter motor retaining bolts.
- Remove the starter motor.

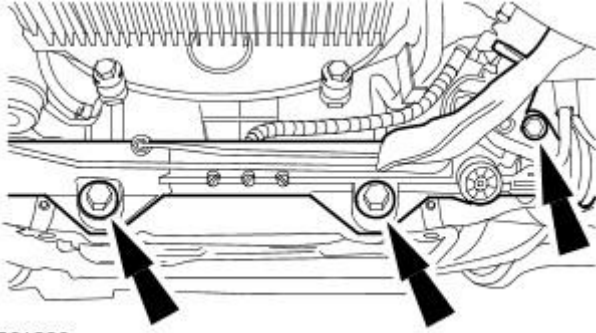


## Installation

1. Install is the reverse of removal.
2. Tighten to 45 Nm.

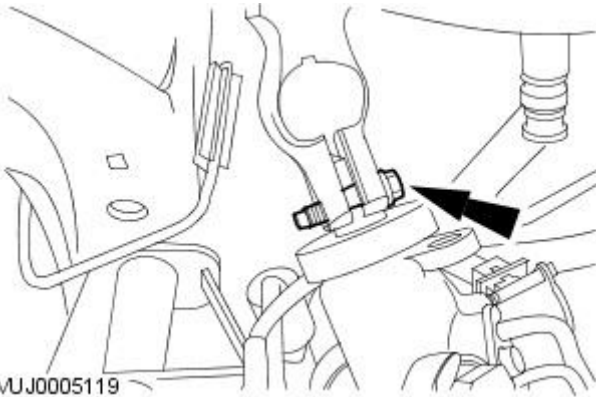


3. Tighten to 100 Nm.



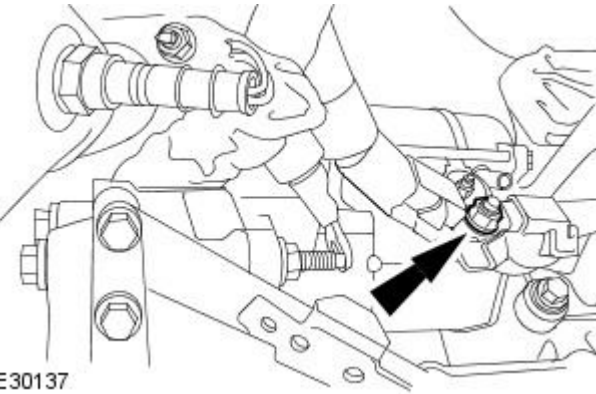
E31036

4. Tighten to 35 Nm.



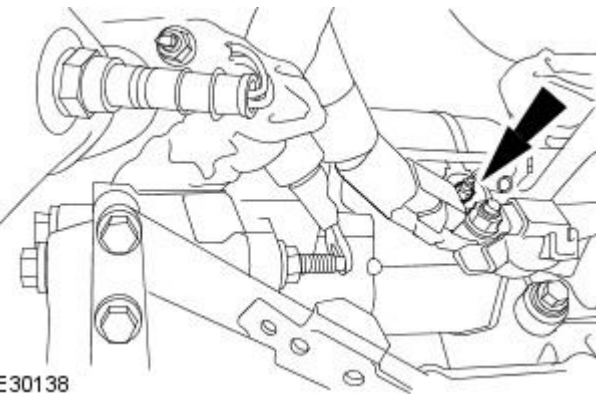
VUJ0005119

5. Tighten to 10 Nm.



E30137

6. Tighten to 7 Nm.



E30138

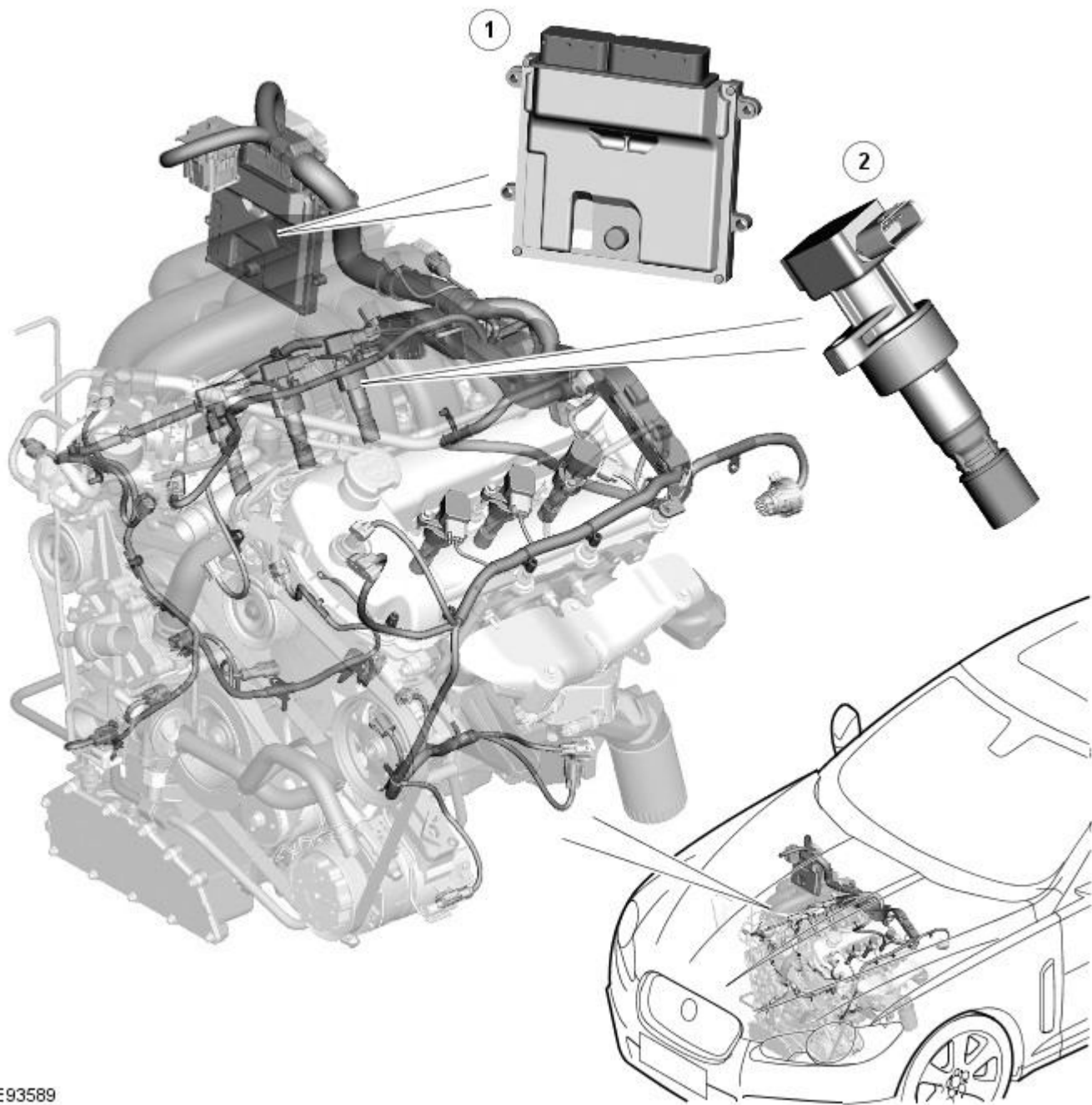


**Engine Ignition - V6 3.0L Petrol -**

<b>Item</b>	<b>Specification</b>		
Firing order	1-4-2-5-3-6		
Spark plug gap	1.3-1.45mm (0.051-0.057in)		
Spark plug type	AGSF22FSM		
High temperature nickel anti-seize lubricant F6AZ-9L494-AA (Spark plug thread)	ESE-M12A4-A		
<b>Description</b>	<b>Nm</b>	<b>lb-ft</b>	<b>lb-in</b>
Spark plugs	15	11	-
Ignition coil-on-plug retaining bolts	6	-	53

# Engine Ignition - V6 3.0L Petrol - Engine Ignition - Component Location

Description and Operation



E93589

**ItemDescription**1 [ECM \(engine control module\)](#)

2 Ignition coil

**Comments:**

6 Off

# Engine Ignition - V6 3.0L Petrol - Engine Ignition - Overview

Description and Operation

## OVERVIEW

The 3.0L V6 engine ignition system has a single iridium tipped spark plug per cylinder, with each spark plug powered by an on-plug ignition coil. The ignition coils are directly driven by the ECM.

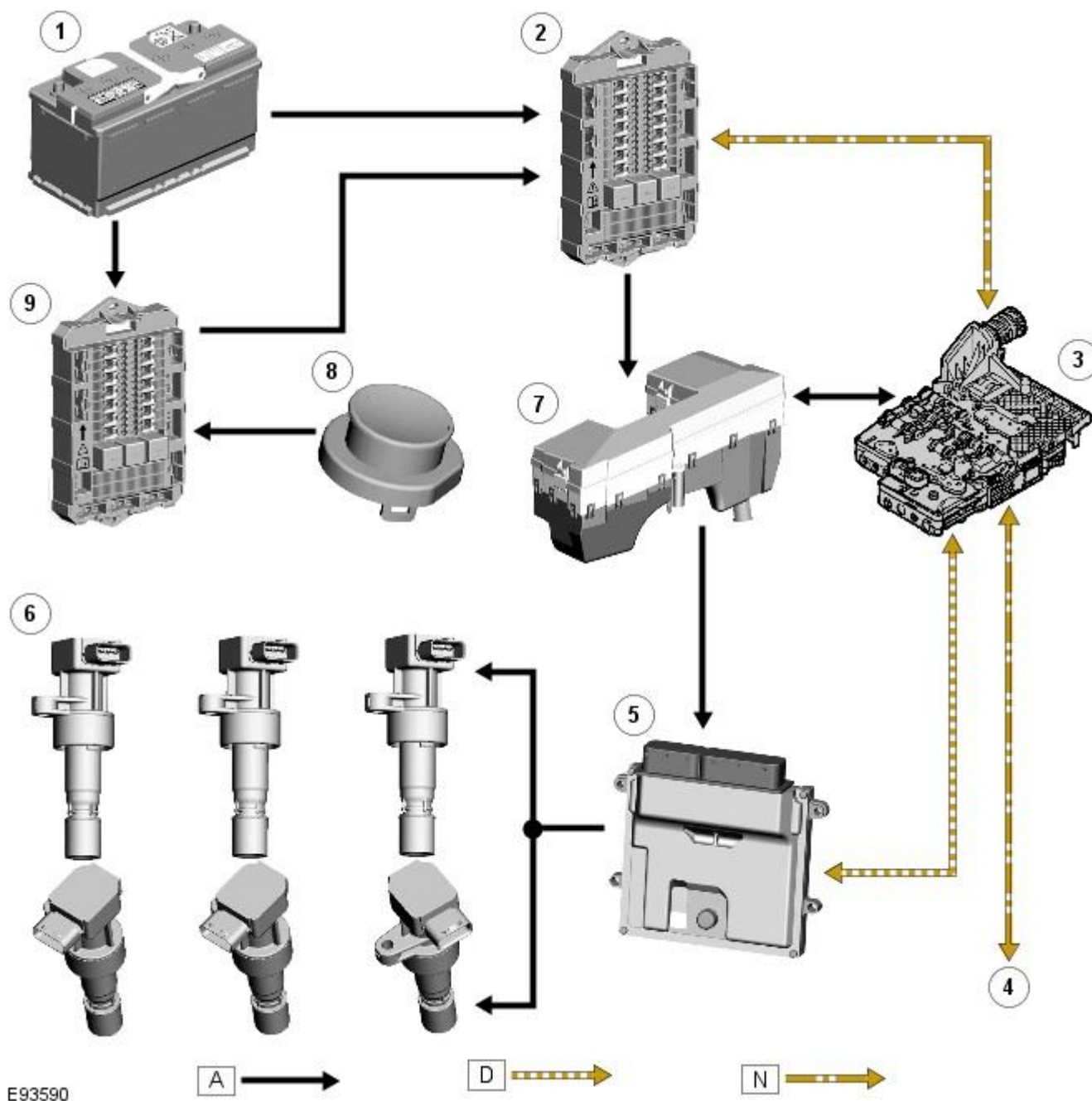
Power for the ignition coils is supplied from the main relay and a fuse in the BJB. A capacitor is connected in parallel with the power supplies to the ignition coils to suppress RFI (radio frequency interference).

# Engine Ignition - V6 3.0L Petrol - Engine Ignition - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **D** = High speed CAN (controller area network) bus; **N** = Medium speed CAN bus



E93590

### ItemDescription

1	Battery
2	<a href="#">CJB (central junction box)</a>
3	<a href="#">TCM (transmission control module)</a>
4	MS <a href="#">CAN</a> bus to other vehicle systems
5	<a href="#">ECM (engine control module)</a>
6	Ignition coils
7	<a href="#">BJB (battery junction box)</a>
8	Start control module and start/stop switch
9	<a href="#">RJB (rear junction box)</a>

## System Operation

### Engine Ignition

Each ignition coil contains a power stage to switch the current in the primary circuit. The [ECM](#) controls the switching with a signal to the power stage. The [ECM](#) monitors operation of the ignition coils using a feedback signal from each of the power stages. If a fault is detected the [ECM](#) stores an appropriate fault code.

Power for the ignition coils is supplied from the main relay and a fuse in the [BJB](#). A capacitor is connected in parallel with the power supplies to the ignition coils to suppress RFI (radio frequency interference).

The [ECM](#) varies the dwell time of the ignition coils depending on battery voltage and engine speed, to ensure a constant energy level is produced in the secondary coil each time the power stage is switched. This ensures a good spark is always produced by the spark plug without excessive primary current flow, thus avoiding overheating or damage to the ignition coils.

The [ECM](#) calculates the ignition timing for individual cylinders from:

- Engine speed
- Camshaft position
- Engine load
- Engine temperature
- The knock control function
- The shift control function
- The idle speed control function.

## Component Description

### Ignition Coils

The engine is fitted with eight plug-top coils that are controlled directly by the [ECM](#). This means that the [ECM](#), at the point where sufficient charge has built up, switches the primary circuit of each coil and a spark is produced in the spark plug. The positive supply to the coil is fed from a common fuse. Each coil contains a power stage to trigger the primary current. The [ECM](#) sends a signal to each of the coils power stage to trigger the power stage switching. Each bank has a feedback signal that is connected to each power stage. If the coil power stage has a failure the feedback signal is not sent, causing the [ECM](#) to store a fault code appropriate to the failure.

The [ECM](#) calculates the dwell time depending on battery voltage and engine speed to ensure constant secondary energy. This ensures sufficient secondary (spark) energy is always available, without excessive primary current flow thus avoiding overheating or damage to the coils.

The individual cylinder spark timing is calculated from a variety of inputs:

- Engine speed and load
- Engine temperature
- Knock control
- Transmission shift control
- Idle speed control.

# Engine Ignition - V6 3.0L Petrol - Engine Ignition

Diagnosis and Testing

## Principles of Operation

For a detailed description of the ignition system, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

- [Engine Ignition](#) (303-07A Engine Ignition - V6 3.0L Petrol, Description and Operation),
- [Engine Ignition](#) (303-07A Engine Ignition - V6 3.0L Petrol, Description and Operation),
- [Engine Ignition](#) (303-07A Engine Ignition - V6 3.0L Petrol, Description and Operation),
- [Engine Ignition](#) (303-07B Engine Ignition - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Description and Operation),
- [Engine Ignition](#) (303-07B Engine Ignition - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Description and Operation),
- [Engine Ignition](#) (303-07B Engine Ignition - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Engine oil level</li> <li>● Cooling system coolant level</li> <li>● Fuel level</li> <li>● Fuel contamination/grade/quality</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Wiring harness</li> <li>● Loose or corroded electrical connectors</li> <li>● Ignition coils</li> <li>● Sensor(s)</li> <li>● Engine Control Module (ECM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	<ul style="list-style-type: none"> <li>● Engine breather system disconnected/restricted</li> <li>● Ignition system</li> <li>● Fuel system</li> <li>● Electronic engine control</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed. Check for ignition system, fuel system and electronic engine control DTCs and refer to the relevant DTC Index
Engine cranks and fires, but will not start	<ul style="list-style-type: none"> <li>● Evaporative emissions purge valve</li> <li>● Fuel pump</li> <li>● Spark plugs</li> <li>● HT short to ground (tracking) check rubber boots for cracks/damage</li> <li>● Ignition system</li> </ul>	Check for evaporative emissions, fuel system and ignition system related DTCs and refer to the relevant DTC Index
Difficult cold start	<ul style="list-style-type: none"> <li>● Engine coolant level/anti-freeze content</li> <li>● Battery</li> <li>● Electronic engine controls</li> <li>● Exhaust Gas Recirculation (EGR) valve stuck open</li> <li>● Fuel pump</li> <li>● Purge valve</li> </ul>	Check the engine coolant level and condition. Ensure the battery is in a fully charged and serviceable condition. Check for electronic engine controls, engine emissions, fuel system and evaporative emissions system related DTCs and refer to the relevant DTC Index
Difficult hot start	<ul style="list-style-type: none"> <li>● Injector leak</li> <li>● Electronic engine control</li> <li>● Purge valve</li> <li>● Fuel pump</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> </ul>	Check for injector leak, install new injector as required. Check for electronic engine controls, evaporative emissions, fuel system, ignition system and engine emission system related DTCs and refer to the relevant DTC Index
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	<ul style="list-style-type: none"> <li>● Injector leak</li> <li>● Electronic engine control</li> <li>● Purge valve</li> <li>● Fuel pump</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> </ul>	Check for injector leak, install new injector as required. Check for electronic engine controls, evaporative emissions, fuel system, ignition system and engine emission system related DTCs and refer to the relevant DTC Index
Engine stalls soon after start	<ul style="list-style-type: none"> <li>● Breather system disconnected/restricted</li> <li>● ECM relay</li> <li>● Electronic engine control</li> <li>● Ignition system</li> <li>● Air intake system restricted</li> <li>● Air leakage</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed. Check for electronic engine control, ignition system and fuel system related DTCs and refer to the relevant DTC Index. Check for blockage in air filter element and air intake system. Check for air leakage in air intake system



Symptom	Possible Cause	Action
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> <li>Fuel lines</li> </ul>	
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> <li>Fuel pressure, fuel pump, fuel lines</li> <li>Injector leak</li> <li>Air leakage</li> <li>Electronic engine control</li> <li>Throttle motor</li> <li>Restricted accelerator pedal travel (carpet, etc)</li> <li>Ignition system</li> <li>EGR valve stuck open</li> <li>Transmission malfunction</li> </ul>	Check for fuel system related DTCs and refer to the relevant DTC Index. Check for injector leak, install new injector as required. Check for air leakage in air intake system. Ensure accelerator pedal is free from restriction. Check for electronic engine controls, ignition, engine emission system and transmission related DTCs and refer to the relevant DTC Index
Engine backfires	<ul style="list-style-type: none"> <li>Fuel pump/lines</li> <li>Air leakage</li> <li>Electronic engine controls</li> <li>Ignition system</li> <li>Sticking variable camshaft timing (VCT) hub</li> </ul>	Check for fuel system failures. Check for air leakage in intake air system. Check for electronic engine controls, ignition system and VCT system related DTCs and refer to the relevant DTC Index
Engine surges	<ul style="list-style-type: none"> <li>Fuel pump/lines</li> <li>Electronic engine controls</li> <li>Throttle motor</li> <li>Ignition system</li> </ul>	Check for fuel system failures. Check for electronic engine controls, throttle system and ignition system related DTCs and refer to the relevant DTC Index
Engine detonates/knocks	<ul style="list-style-type: none"> <li>Fuel pump/lines</li> <li>Air leakage</li> <li>Electronic engine controls</li> <li>Sticking VCT hub</li> </ul>	Check for fuel system failures. Check for air leakage in intake air system. Check for electronic engine controls and VCT system related DTCs and refer to the relevant DTC Index
No throttle response	<ul style="list-style-type: none"> <li>Electronic engine controls</li> <li>Throttle motor</li> </ul>	Check for electronic engine controls and throttle system related DTCs and refer to the relevant DTC Index
Poor throttle response	<ul style="list-style-type: none"> <li>Breather system disconnected/restricted</li> <li>Electronic engine control</li> <li>Transmission malfunction</li> <li>Traction control event</li> <li>Air leakage</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed. Check for electronic engine controls, transmission and traction control related DTCs and refer to the related DTC Index. Check for air leakage in intake air system

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).
- NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.
- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- NOTE: If DTCs are recorded and, after the pinpoint tests have been carried out, the fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P035100	Ignition Coil A Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance
P035200	Ignition Coil B Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance
P035300	Ignition Coil C Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance
P035400	Ignition Coil D Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance
P035500	Ignition Coil E Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance
P035600	Ignition Coil F Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance
P035700	Ignition Coil G Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance

DTC	Description	Possible Cause	Action
P035800	Ignition Coil H Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance
P131500	Persistent Misfire	<ul style="list-style-type: none"> <li>ECM to ignition coil primary circuit fault (cylinder misfire detected DTC also flagged)</li> <li>Fuel injector circuit fault(s) (injector DTCs also flagged)</li> <li>Fuel delivery pressure low</li> <li>Spark plug failure/fouled /incorrect gap</li> <li>Cylinder compression low</li> </ul>	Check for cylinder mis-fire, ignition and injector DTCs and refer to the DTC Index. Check for fuel system failure. Check and install spark plug as required. Carry out cylinder compression tests
P131600	Misfire Rate Exceeds Emissions	<ul style="list-style-type: none"> <li>Misfire rate exceeds emissions thresholds</li> </ul>	Check for individual cylinder misfire DTCs and refer to DTC Index in this section
P136700	Ignition Spare	<ul style="list-style-type: none"> <li>Ignition module/coil monitoring circuit 1 - short to ground, short to power, high resistance</li> </ul>	Refer to the electrical circuit diagrams and check ignition module/coil monitoring circuit 1 for short to ground, short to power, high resistance
P136800	Ignition Spare	<ul style="list-style-type: none"> <li>Ignition module/coil monitoring circuit 2 - short to ground, short to power, high resistance</li> </ul>	Refer to the electrical circuit diagrams and check ignition module/coil monitoring circuit 2 for short to ground, short to power, high resistance

## Pinpoint Tests

### PINPOINT TEST A : CHECK SPARK PLUG

• NOTE: When installing new spark plugs, only spark plugs to the recommended specification must be used.

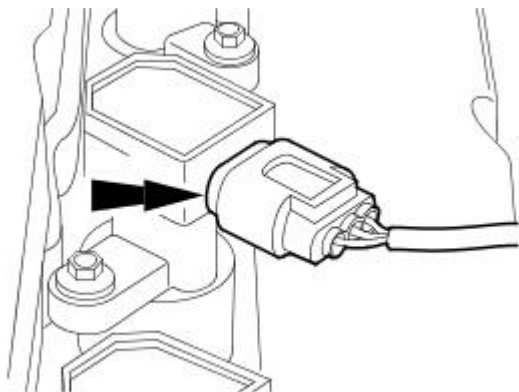
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>A1: CHECK SPARK PLUG</b>	
• NOTE: Some spark plug types cannot be regapped and must be replaced.	
	<ol style="list-style-type: none"> <li>Remove the suspect spark plug(s). REFER to: <a href="#">Ignition Coil-On-Plug LH</a> (303-07A Engine Ignition - V6 3.0L Petrol, Removal and Installation) / <a href="#">Ignition Coil-On-Plug RH</a> (303-07A Engine Ignition - V6 3.0L Petrol, Removal and Installation).</li> <li>Visually inspect the spark plug for cracks, damage, carbon buildup or wet fouling, check the condition of the ground electrode, the center electrode tip and the spark plug HT contact and confirm that the spark plug gap is correctly set using a wire gauge taking care not to cause damage to the center or ground electrode tips. REFER to: <a href="#">Specifications</a> (303-07A Engine Ignition - V6 3.0L Petrol, Specifications).</li> </ol>
	<p>Is the spark plug condition good, and the spark plug gap correct ?</p> <p><b>Yes</b> Check ignition coil and circuits. See possible sources list for misfire.</p> <p><b>No</b> Install a new spark plug(s) as required. REFER to: <a href="#">Specifications</a> (303-07A Engine Ignition - V6 3.0L Petrol, Specifications) / <a href="#">Ignition Coil-On-Plug LH</a> (303-07A Engine Ignition - V6 3.0L Petrol, Removal and Installation) / <a href="#">Ignition Coil-On-Plug RH</a> (303-07A Engine Ignition - V6 3.0L Petrol, Removal and Installation). . CLEAR the DTC. TEST the system for normal operation.</p>

# Engine Ignition - V6 3.0L Petrol - Ignition Coil-On-Plug LH

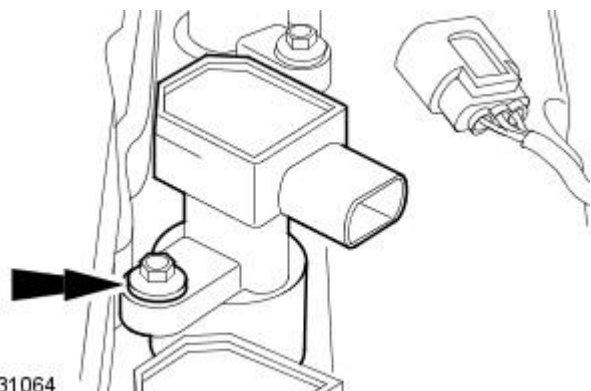
Removal and Installation

## Removal

1. Disconnect the ignition coil-on-plug electrical connector.

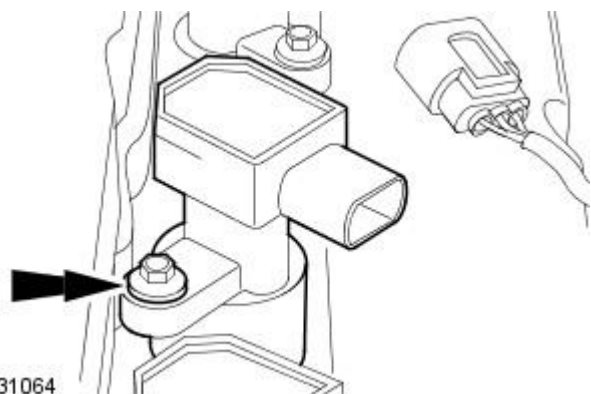


2. Remove the ignition coil-on-plug.



## Installation

1. To install, reverse the removal procedure.
  - Tighten to 6 Nm.

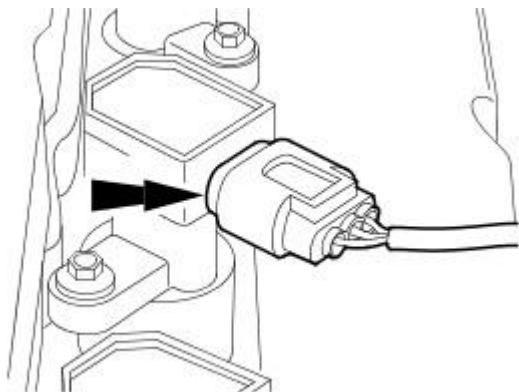


# Engine Ignition - V6 3.0L Petrol - Ignition Coil-On-Plug RH

Removal and Installation

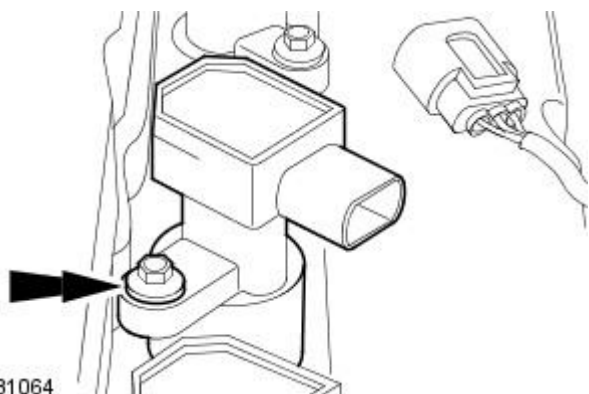
## Removal

1. Remove the intake manifold.  
For additional information, refer to: [Intake Manifold](#) (303-01B Engine - V6 3.0L Petrol, Removal and Installation).
2. Disconnect the ignition coil-on-plug electrical connector.



E31063

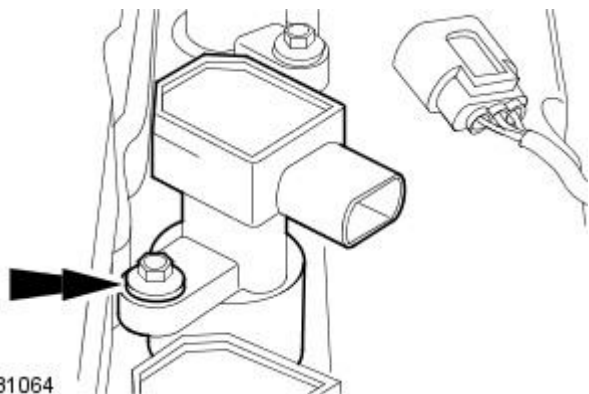
3. Remove the ignition coil-on-plug.



E31064

## Installation

1. To install, reverse the removal procedure.
  - Tighten to 6 Nm.



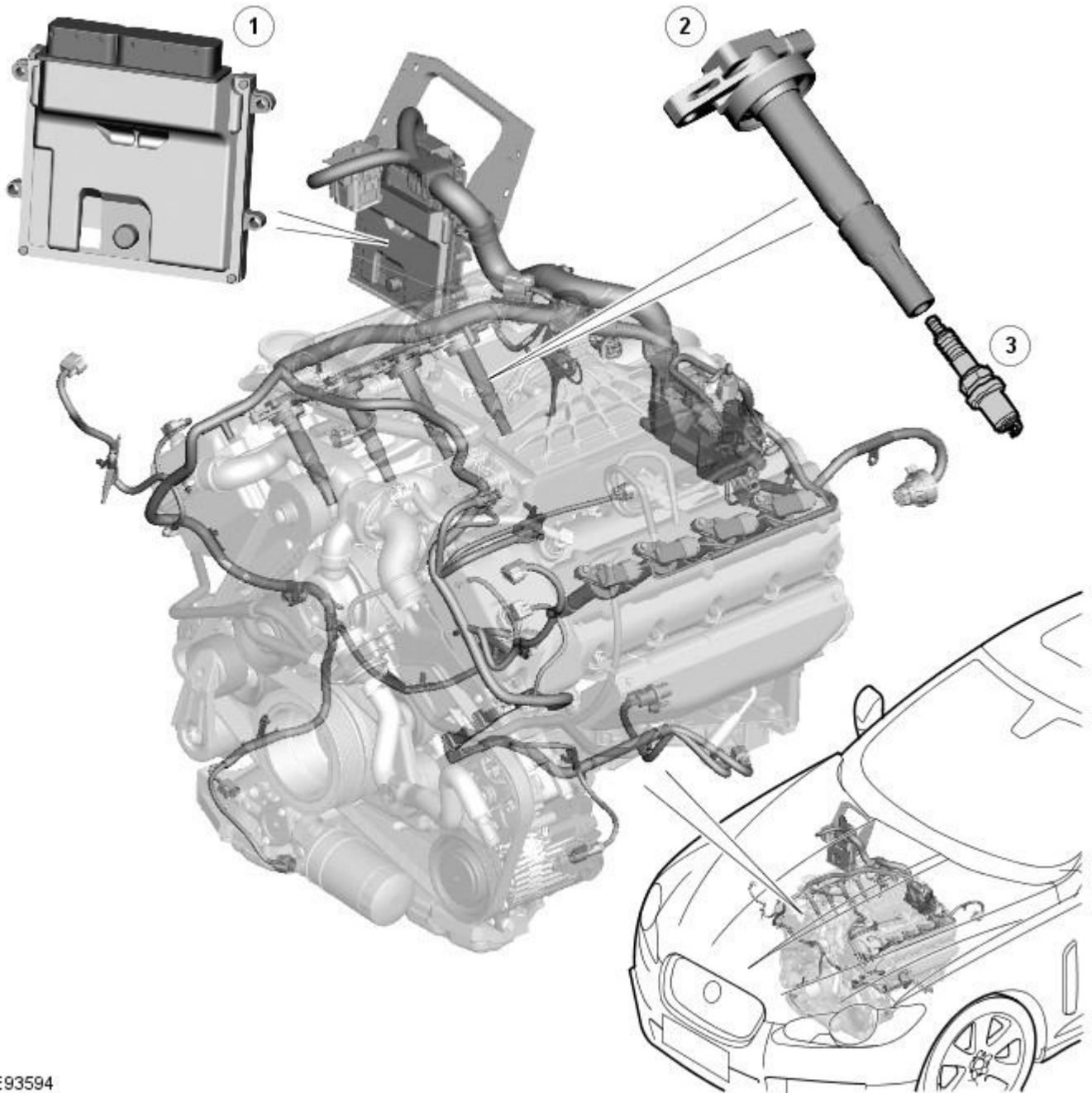
E31064

**Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 -**

<b>Item</b>	<b>Specification</b>		
Firing order	1-5-4-2-6-3-7-8		
Spark plug type - Vehicles with supercharger	NGK-IFR-5N10		
Spark plug type - Vehicles without supercharger	NGK-IFR-5N10		
<b>Description</b>	<b>Nm</b>	<b>lb-ft</b>	<b>lb-in</b>
Spark plugs	27	18	-
Ignition coil-on-plug retaining bolts	5	-	44

# Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Engine Ignition - Component Location

Description and Operation



E93594

## ItemDescription

- |   |   |
|---|---|
| 1 | <a href="#">ECM (engine control module)</a> |
| 2 | Ignition coil                               |
| 3 | Spark plug                                  |



# Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Engine Ignition - Overview

Description and Operation

## OVERVIEW

The 4.2L V8 Normally Aspirated and Supercharged engine ignition systems have a single iridium tipped spark plug per cylinder, with each spark plug powered by an on-plug ignition coil. The ignition coils are directly driven by the [BJB \(battery junction box\)](#).

Power for the ignition coils is supplied from the main relay and a fuse in the [BJB](#). A capacitor is connected in parallel with the power supplies to the ignition coils to suppress RFI (radio frequency interference).

Each ignition coil contains a power stage to switch the current in the primary circuit. The [ECM \(engine control module\)](#) controls the switching with a signal to the power stage. The [ECM](#) monitors operation of the ignition coils using a feedback signal from each of the power stages. If a fault is detected the [ECM](#) stores an appropriate fault code.

The [ECM](#) varies the dwell time of the ignition coils depending on battery voltage and engine speed, to ensure a constant energy level is produced in the secondary coil each time the power stage is switched. This ensures a good spark is always produced by the spark plug without excessive primary current flow, thus avoiding overheating or damage to the ignition coils.

The [ECM](#) calculates the ignition timing for individual cylinders from:

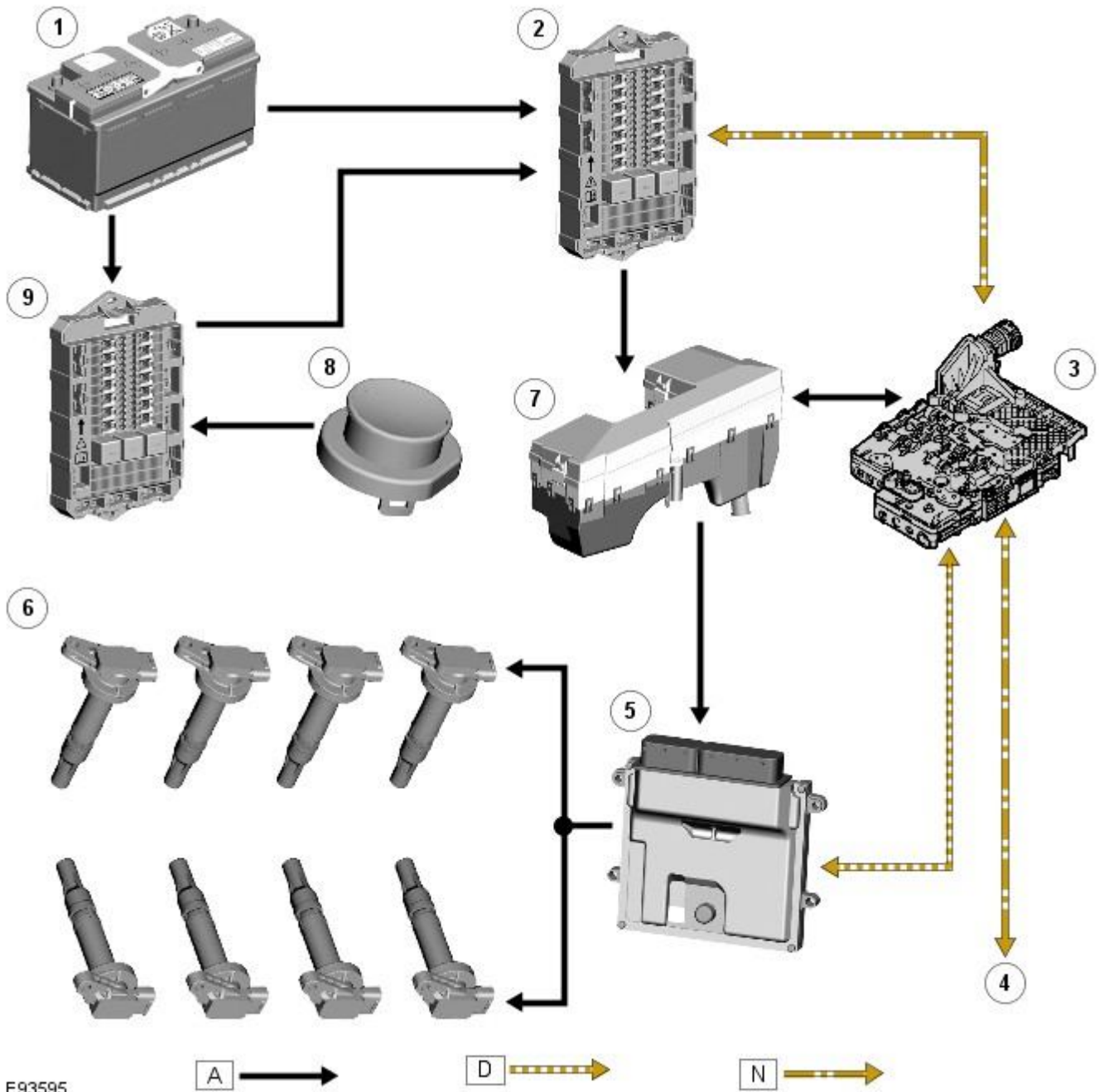
- Engine speed
- Camshaft position
- Engine load
- Engine temperature
- The knock control function
- On automatic transmission models, the shift control function
- The idle speed control function.

# Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Engine Ignition - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **D** = High speed CAN (controller area network) bus; **N** = Medium speed CAN bus



E93595

### ItemDescription

1	Battery
2	<a href="#">CJB (central junction box)</a>
3	<a href="#">TCM (transmission control module)</a>
4	MS <a href="#">CAN</a> bus to other vehicle systems
5	<a href="#">ECM (engine control module)</a>
6	Ignition coils
7	<a href="#">BJB (battery junction box)</a>
8	Start control module and start/stop switch
9	<a href="#">RJB (rear junction box)</a>

## System Operation

## Engine Ignition

Each ignition coil contains a power stage to switch the current in the primary circuit. The [ECM](#) controls the switching with a signal to the power stage. The [ECM](#) monitors operation of the ignition coils using a feedback signal from each of the power stages. If a fault is detected the [ECM](#) stores an appropriate fault code.

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The [ECM](#) varies the dwell time of the ignition coils depending on battery voltage and engine speed, to ensure a constant energy level is produced in the secondary coil each time the power stage is switched. This ensures a good spark is always produced by the spark plug without excessive primary current flow, thus avoiding overheating or damage to the ignition coils.

The [ECM](#) calculates the ignition timing for individual cylinders from:

- Engine speed
- Camshaft position
- Engine load
- Engine temperature
- The knock control function
- The shift control function
- The idle speed control function.

## Component Description

### Ignition Coils

The engine is fitted with eight plug-top coils that are controlled directly by the [ECM](#). This means that the [ECM](#), at the point where sufficient charge has built up, switches the primary circuit of each coil and a spark is produced in the spark plug. The positive supply to the coil is fed from a common fuse. Each coil contains a power stage to trigger the primary current. The [ECM](#) sends a signal to each of the coils power stage to trigger the power stage switching. Each bank has a feedback signal that is connected to each power stage. If the coil power stage has a failure the feedback signal is not sent, causing the [ECM](#) to store a fault code appropriate to the failure.

The [ECM](#) calculates the dwell time depending on battery voltage and engine speed to ensure constant secondary energy. This ensures sufficient secondary (spark) energy is always available, without excessive primary current flow thus avoiding overheating or damage to the coils.

The individual cylinder spark timing is calculated from a variety of inputs:

- Engine speed and load
- Engine temperature
- Knock control
- Transmission shift control
- Idle speed control.

# Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Engine Ignition

Diagnosis and Testing

## Principles of Operation

For a detailed description of the ignition system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8)

[Engine Ignition](#) (Description and Operation),  
[Engine Ignition](#) (Description and Operation),  
[Engine Ignition](#) (Description and Operation).

## Inspection and Verification



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1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Engine oil level</li> <li>● Cooling system coolant level</li> <li>● Fuel level</li> <li>● Fuel contamination/grade/quality</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Wiring harness</li> <li>● Loose or corroded electrical connectors</li> <li>● Ignition coils</li> <li>● Sensor(s)</li> <li>● Engine Control Module (ECM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
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Engine cranks and fires, but will not start	<ul style="list-style-type: none"> <li>● Evaporative emissions purge valve</li> <li>● Fuel pump</li> <li>● Spark plugs</li> <li>● HT short to ground (tracking) check rubber boots for cracks/damage</li> <li>● Ignition system</li> </ul>	Check for evaporative emissions, fuel system and ignition system related DTCs and refer to the relevant DTC Index
Difficult cold start	<ul style="list-style-type: none"> <li>● Engine coolant level/anti-freeze content</li> <li>● Battery</li> <li>● Electronic engine controls</li> <li>● Exhaust Gas Recirculation (EGR) valve stuck open</li> <li>● Fuel pump</li> <li>● Purge valve</li> </ul>	Check the engine coolant level and condition. Ensure the battery is in a fully charged and serviceable condition. Check for electronic engine controls, engine emissions, fuel system and evaporative emissions system related DTCs and refer to the relevant DTC Index
Difficult hot start	<ul style="list-style-type: none"> <li>● Injector leak</li> <li>● Electronic engine control</li> <li>● Purge valve</li> <li>● Fuel pump</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> </ul>	Check for injector leak, install new injector as required. Check for electronic engine controls, evaporative emissions, fuel system, ignition system and engine emission system related DTCs and refer to the relevant DTC Index
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	<ul style="list-style-type: none"> <li>● Injector leak</li> <li>● Electronic engine control</li> <li>● Purge valve</li> <li>● Fuel pump</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> </ul>	Check for injector leak, install new injector as required. Check for electronic engine controls, evaporative emissions, fuel system, ignition system and engine emission system related DTCs and refer to the relevant DTC Index

Symptom	Possible Cause	Action
Engine stalls soon after start	<ul style="list-style-type: none"> <li>● Breather system disconnected/restricted</li> <li>● ECM relay</li> <li>● Electronic engine control</li> <li>● Ignition system</li> <li>● Air intake system restricted</li> <li>● Air leakage</li> <li>● Fuel lines</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed. Check for electronic engine control, ignition system and fuel system related DTCs and refer to the relevant DTC Index. Check for blockage in air filter element and air intake system. Check for air leakage in air intake system
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> <li>● Fuel pressure, fuel pump, fuel lines</li> <li>● Injector leak</li> <li>● Air leakage</li> <li>● Electronic engine control</li> <li>● Throttle motor</li> <li>● Restricted accelerator pedal travel (carpet, etc)</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> <li>● Transmission malfunction</li> </ul>	Check for fuel system related DTCs and refer to the relevant DTC Index. Check for injector leak, install new injector as required. Check for air leakage in air intake system. Ensure accelerator pedal is free from restriction. Check for electronic engine controls, ignition, engine emission system and transmission related DTCs and refer to the relevant DTC Index
Engine backfires	<ul style="list-style-type: none"> <li>● Fuel pump/lines</li> <li>● Air leakage</li> <li>● Electronic engine controls</li> <li>● Ignition system</li> <li>● Sticking variable camshaft timing (VCT) hub</li> </ul>	Check for fuel system failures. Check for air leakage in intake air system. Check for electronic engine controls, ignition system and VCT system related DTCs and refer to the relevant DTC Index
Engine surges	<ul style="list-style-type: none"> <li>● Fuel pump/lines</li> <li>● Electronic engine controls</li> <li>● Throttle motor</li> <li>● Ignition system</li> </ul>	Check for fuel system failures. Check for electronic engine controls, throttle system and ignition system related DTCs and refer to the relevant DTC Index
Engine detonates/knocks	<ul style="list-style-type: none"> <li>● Fuel pump/lines</li> <li>● Air leakage</li> <li>● Electronic engine controls</li> <li>● Sticking VCT hub</li> </ul>	Check for fuel system failures. Check for air leakage in intake air system. Check for electronic engine controls and VCT system related DTCs and refer to the relevant DTC Index
No throttle response	<ul style="list-style-type: none"> <li>● Electronic engine controls</li> <li>● Throttle motor</li> </ul>	Check for electronic engine controls and throttle system related DTCs and refer to the relevant DTC Index
Poor throttle response	<ul style="list-style-type: none"> <li>● Breather system disconnected/restricted</li> <li>● Electronic engine control</li> <li>● Transmission malfunction</li> <li>● Traction control event</li> <li>● Air leakage</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed. Check for electronic engine controls, transmission and traction control related DTCs and refer to the related DTC Index. Check for air leakage in intake air system

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after the pinpoint tests have been carried out, the fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P035100	Ignition Coil A Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>● Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance
P035200	Ignition Coil B Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>● Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance
P035300	Ignition Coil C Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>● Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance

DTC	Description	Possible Cause	Action
P035400	Ignition Coil D Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>● Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance
P035500	Ignition Coil E Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>● Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance
P035600	Ignition Coil F Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>● Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance
P035700	Ignition Coil G Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>● Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance
P035800	Ignition Coil H Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>● Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance
P131500	Persistent Misfire	<ul style="list-style-type: none"> <li>● ECM to ignition coil primary circuit fault (cylinder misfire detected DTC also flagged)</li> <li>● Fuel injector circuit fault(s) (injector DTCs also flagged)</li> <li>● Fuel delivery pressure low</li> <li>● Spark plug failure/fouled /incorrect gap</li> <li>● Cylinder compression low</li> </ul>	Check for cylinder mis-fire, ignition and injector DTCs and refer to the DTC Index. Check for fuel system failure. Check and install spark plug as required. Carry out cylinder compression tests
P131600	Misfire Rate Exceeds Emissions	<ul style="list-style-type: none"> <li>● Misfire rate exceeds emissions thresholds</li> </ul>	Check for individual cylinder misfire DTCs and refer to DTC Index in this section
P136700	Ignition Spare	<ul style="list-style-type: none"> <li>● Ignition module/coil monitoring circuit 1 - short to ground, short to power, high resistance</li> </ul>	Refer to the electrical circuit diagrams and check ignition module/coil monitoring circuit 1 for short to ground, short to power, high resistance
P136800	Ignition Spare	<ul style="list-style-type: none"> <li>● Ignition module/coil monitoring circuit 2 - short to ground, short to power, high resistance</li> </ul>	Refer to the electrical circuit diagrams and check ignition module/coil monitoring circuit 2 for short to ground, short to power, high resistance

## Pinpoint Tests

PINPOINT TEST A : CHECK SPARK PLUG	
• NOTE: When installing new spark plugs, only spark plugs to the recommended specification must be used.	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>A1: CHECK SPARK PLUG</b>	
• NOTE: Some spark plug types cannot be regapped and must be replaced.	
	<ol style="list-style-type: none"> <li>1 Remove the suspect spark plug(s). REFER to: <a href="#">Ignition Coil-On-Plug - 4.2L NA V8 - AJV8</a> (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation) / <a href="#">Ignition Coil-On-Plug - 4.2L SC V8 - AJV8</a> (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).</li> <li>2 Visually inspect the spark plug for cracks, damage, carbon buildup or wet fouling, check the condition of the ground electrode, the center electrode tip and the spark plug HT contact and confirm that the spark plug gap is correctly set using a wire gauge taking care not to cause damage to the center or ground electrode tips. REFER to: <a href="#">Specifications</a> (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications).</li> </ol>
	<p>Is the spark plug condition good, and the spark plug gap correct ?</p> <p><b>Yes</b> Check ignition coil and circuits. See possible sources list for misfire.</p> <p><b>No</b> Install a new spark plug(s) as required. REFER to: <a href="#">Specifications</a> (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications) / <a href="#">Ignition Coil-On-Plug - 4.2L NA V8 - AJV8</a> (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation) / <a href="#">Ignition Coil-On-Plug - 4.2L SC V8 - AJV8</a> (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation). . CLEAR the DTC. TEST the system for normal operation.</p>



# Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Ignition Coil-On-Plug

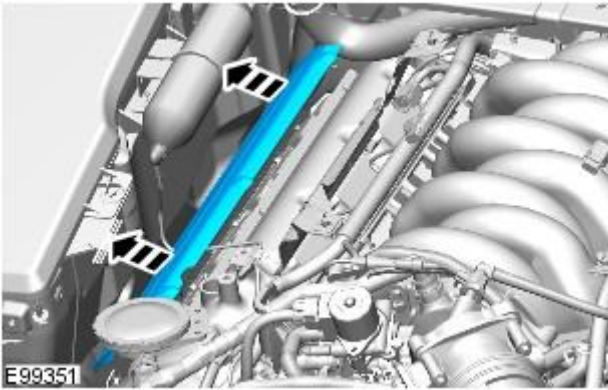
4.2L NA V8 - AJV8  
Removal and Installation

## Removal

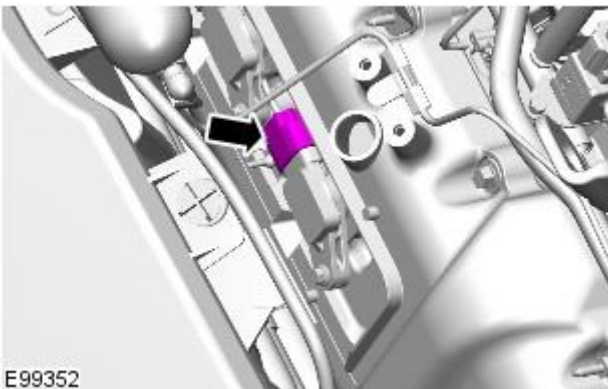
1. Remove the engine cover.  
For additional information, refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. Remove the ignition coil-on-plug cover.

- Release from the 2 clips.

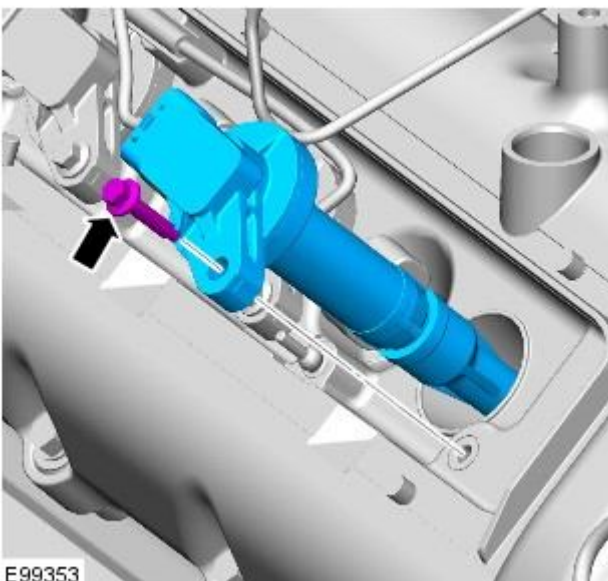


3. Disconnect the ignition coil-on-plug electrical connector.



4. Remove the ignition coil-on-plug.

- Remove the bolt.



## Installation

1. To install, reverse the removal procedure.

# Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Ignition Coil-On-Plug

4.2L SC V8 - AJV8  
Removal and Installation

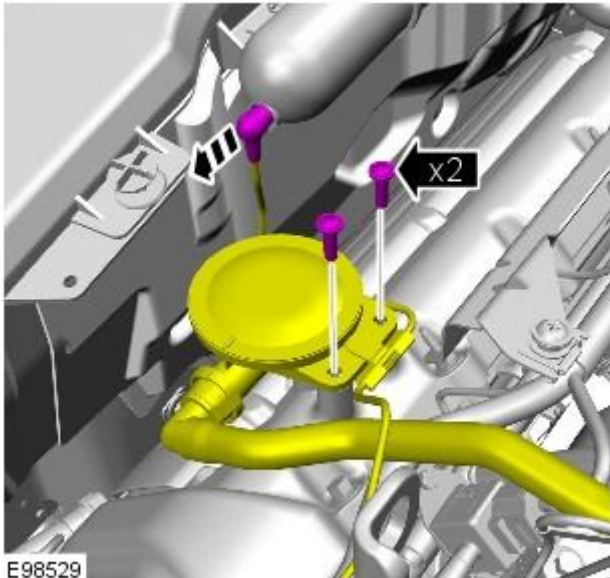
## Removal

1. Remove the engine cover.

For additional information, refer to: [Engine Cover - 4.2L SC V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. Detach the PCV valve from the RH valve cover

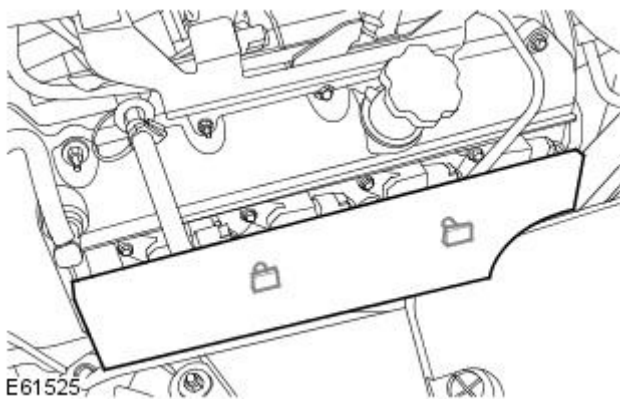
- Disconnect the vacuum hose.



3. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

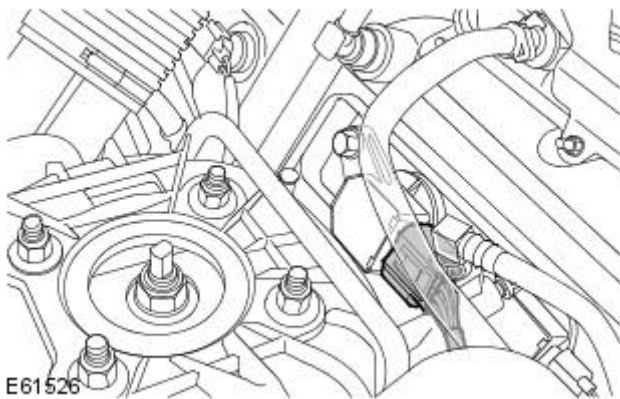
Remove the ignition coil-on-plug cover.

- Release from the 2 clips.



4. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

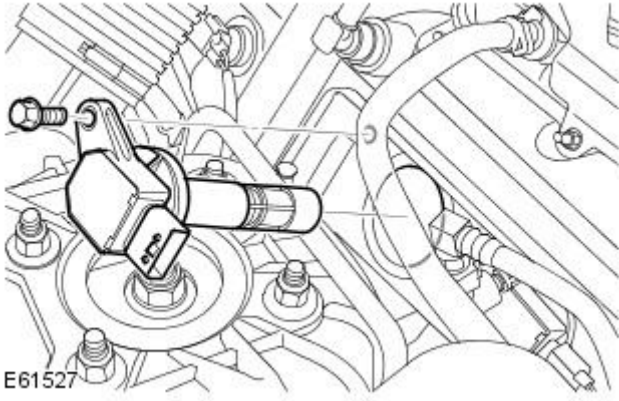
Disconnect the ignition coil-on-plug electrical connector.



5. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Remove the ignition coil-on-plug.

- Remove the bolt.

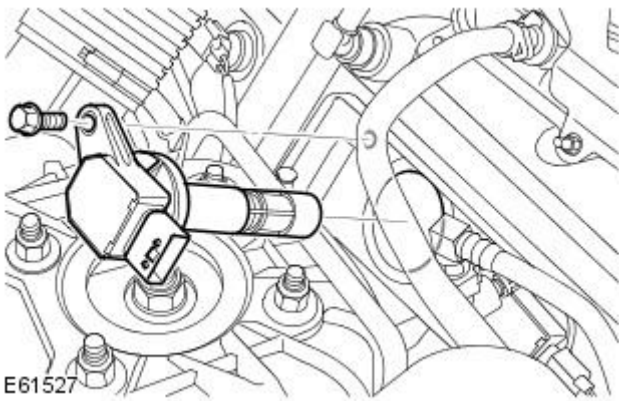


## Installation

1. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Install the ignition coil-on-plug.

- Tighten the bolt to 6 Nm (4 lb.ft).



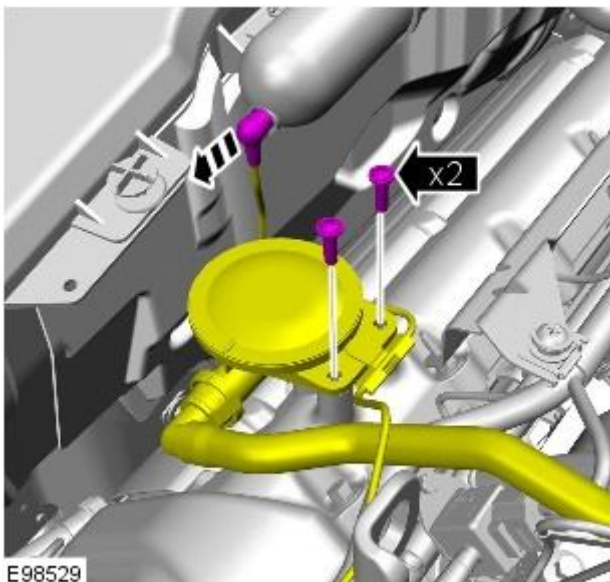
2. Connect and secure the electrical connector.

3. Install the ignition coil-on-plug cover.

- Position and secure the clips.

4. Install the PCV valve.

- Disconnect the vacuum hose.



5. Install the engine cover.

For additional information, refer to: [Engine Cover - 4.2L SC V8 - AJV8](#) (501-05 Interior Trim and Ornammentation, Removal and Installation).

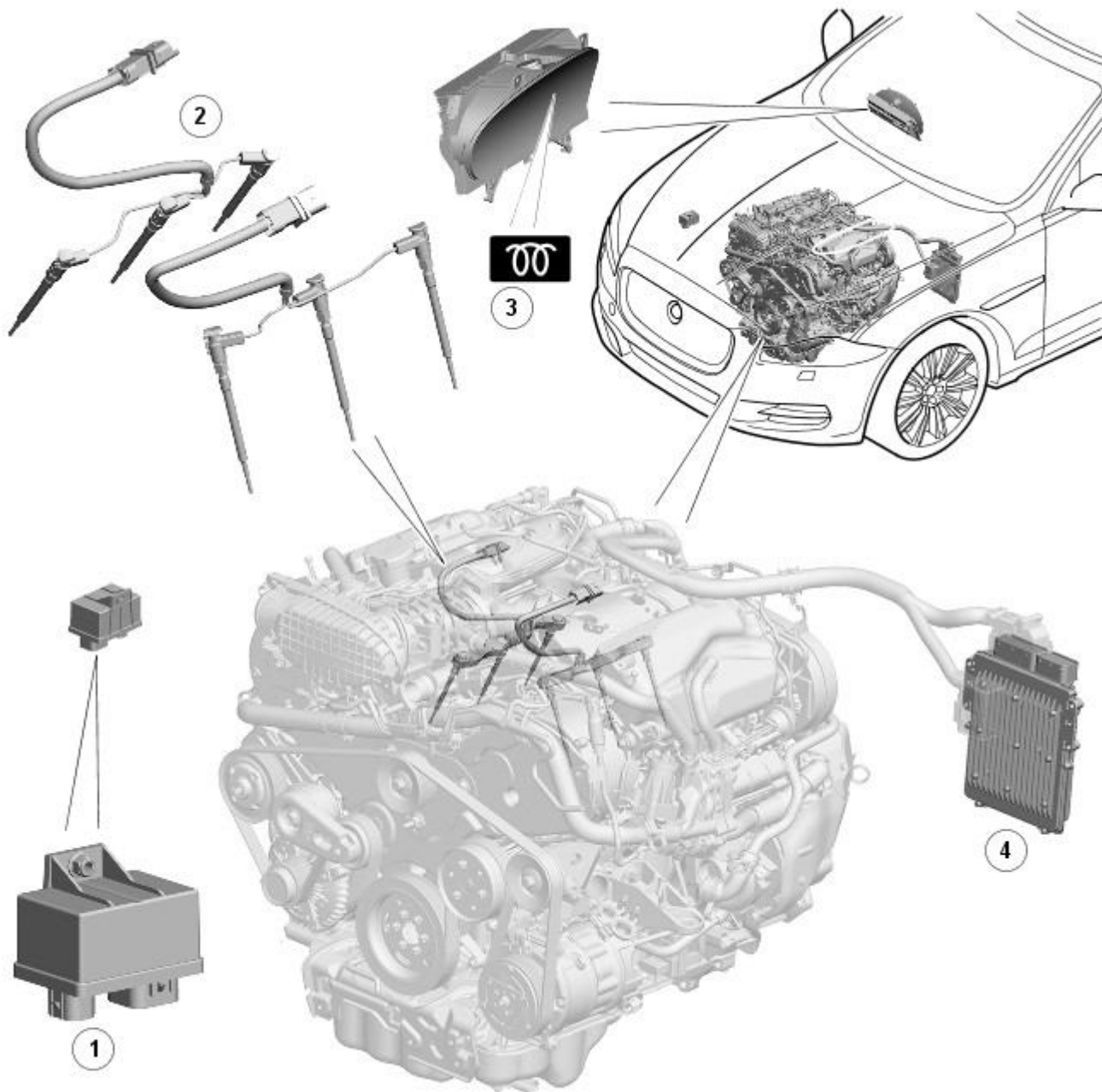
**Glow Plug System -**

Description	Nm	lb-ft	lb-in
Glow plug	10	-	89

# Glow Plug System - Glow Plug System - Component Location

Description and Operation

## COMPONENT LOCATION



E125096

### ItemDescription

- |   |   |
|---|---|
| 1 | Glow plug module                            |
| 2 | Glow plugs                                  |
| 3 | Glow plug warning lamp                      |
| 4 | <a href="#">ECM (engine control module)</a> |



# Glow Plug System - Glow Plug System - Overview

Description and Operation

## OVERVIEW

The glow plug system has a glow plug installed in the inlet side of each cylinder. The glow plugs heat the combustion chambers before and during cranking, to aid cold starting, and after the engine starts to reduce emissions and engine noise when idling with a cold engine.

The glow plugs are connected for each bank by a common harness which is connected into the main engine harness. The harness for each bank connects into a connector block which attaches to each of the glow plugs for that bank. The glow plugs are connected directly to the glow plug module which is controlled by glow plug software contained within the [ECM \(engine control module\)](#).

Each glow plug is a tubular heating element which contains a spiral filament encased in magnesium oxide powder. At the tip of the tubular heating element is the heater coil. Behind the heater coil, and connected in series, is a control coil. The control coil regulates the current to the heater coil to safeguard against overheating.

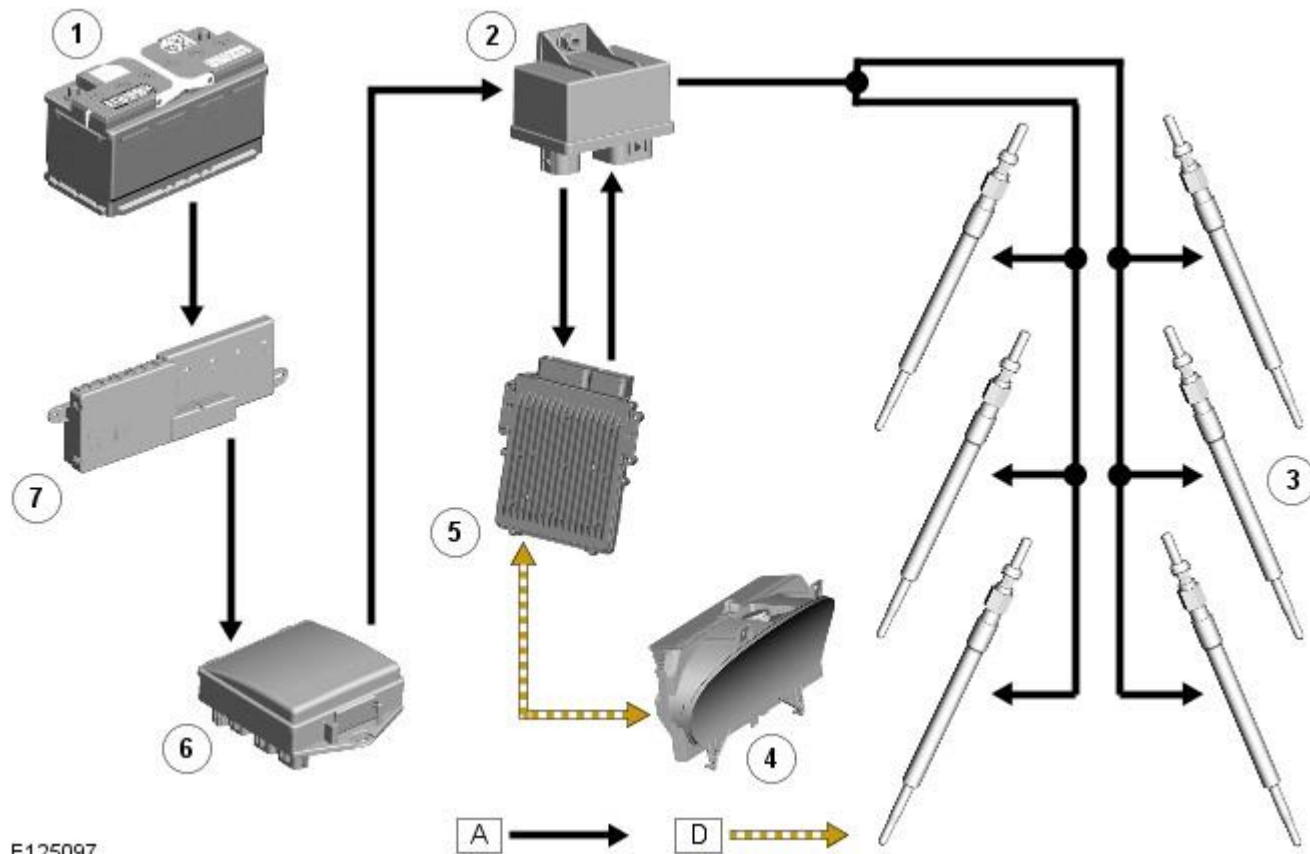


# Glow Plug System - Glow Plug System - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **D** = HS CAN (controller area network)



E125097

### ItemDescription

1	Battery
2	Glow plug module
3	Glow plug (6 off)
4	Instrument cluster
5	Engine Control Module (ECM)
6	Engine Junction Box (EJB) - (100A Midi-Fuse)
7	Battery Junction Box (BJB) - (250A Megafuse)

## System Operation

### System Operation

There are three phases of glow plug heating:

- Pre heating
- Crank heating
- Post heating

The **ECM (engine control module)** determines the heating times from the **ECT (engine coolant temperature)**. The lower the **ECT**, the longer the heating times.

When the ignition is switched to power mode 9 (engine crank), the **ECM** calculates any required heating times and, if heating is required, energizes the glow plug relay in the **BJB (battery junction box)**. The glow plug relay supplies an ignition power supply to the glow plug module. The glow plug module is controlled by the **ECM** which determines the pre-heat time required. The module then supplies power to each of the glow plugs for the required time.

When pre-heating is required, the **ECM** also sends a message to the instrument cluster, on the high speed **CAN**, to request illumination of the glow plug indicator. The glow plug indicator remains illuminated for the duration of the pre heating phase, or until the ignition is switched to crank, whichever occurs first. If required, the **ECM** keeps the glow plug module energized during cranking and for the duration of any post heating phase.

The **ECM** monitors the drive circuit of the glow plug module, via a direct diagnostic connection with the module, for plausibility of operation, continuity, and short and open circuits. If a fault is detected, the glow plug module passes the fault information to the **ECM**, which stores a related fault code and permanently illuminates the glow plug indicator while the ignition is in power mode 9.

### Pre Heating

Pre-heat is the length of time the glow plugs operate prior to engine cranking. The **ECM** controls the pre-heat time based on **ECT** sensor output and battery voltage. If the **ECT** sensor fails, the **ECM** will use the **IAT (intake air temperature)** sensor value as a default value. The pre-heat duration is extended if the coolant temperature is low and the battery is not fully charged.

The **ECM** receives the corresponding temperature signal from the **ECT** sensor.

The pre heating period is dependent on the temperature signal (low temperature = longer pre heating period).

The driver is informed that pre heating is in operation by the glow plug indicator light in the instrument cluster coming on. The pre heating times become longer as the coolant temperature falls.

The [BARO \(barometric pressure\)](#) also has an influence on activation and deactivation of the glow plugs in the event of large altitude differences.

## Crank Heating

Crank heating is carried out at every start where the coolant temperature is below the predefined threshold of 20° C. Crank heating begins if the engine speed exceeds 42 rpm for longer than 50ms, or the starter is active for longer than 4 sec. If the coolant temperature sensor is defective, a default temperature of 0° C is used.

## Post Heating

Post heat is the length of time the glow plugs operate after the engine starts. The [ECM](#) controls the post heating time based on [ECT](#) sensor output. The post heat phase reduces engine noise, improves idle quality and reduces hydrocarbon emissions.

Preheating is followed by the post heating phase once the engine has started. The post heating phase depends upon how the vehicle is driven.

In addition to [ECT](#), [BARO](#) and engine speed, the injected fuel quantity is significant in this context. For example, if the injected fuel quantity is 70 mg per piston stroke and the coolant temperature is below 20 °C, post heating is performed at engine speeds between 1100 and 3500 rpm.

In the case of greater injection quantities and considerably lower engine temperatures, the post heating phase is also activated depending on the engine speed. At 14 mg per piston stroke and an [ECT](#) of below 0 °C, for example, post heating is performed at engine speeds between 1100 and 1500 rpm.

## Component Description

### Glow Plug

The ceramic sheathed element glow plugs are made from a heat-resistant, electrically conductive ceramic material. The ceramic sheathed-element glow plugs outer layer is heated directly and is self regulating. The self regulation allows the resistance of the sheathed element to automatically increase as the heat increases preventing the glow plug from overheating. In addition, during the heating process and under the control of the glow plug relay, the glow plugs can be operated above their nominal voltages. This permits heat-up speeds of 1000°C per second. The sheathed-element glow plugs reach a maximum glow temperature of 1300°C and can hold a temperature of 1150°C for several minutes after the first-start glow or at intervening times.

The glow plug is a tubular heating element that protrudes into the combustion chamber of the engine. The heating element contains a spiral filament encased in magnesium oxide powder. At the tip of the tubular heating element is the heater coil. Behind the heater coil is a control coil. The control coil is connected in series and regulates the heater coil to ensure that it does not overheat.

Each cylinder bank has a separate harness connecting the three glow plugs. The harness connects into the engine wiring harness and each harness has a connector block which attaches to each of the glow plugs for that bank.

The glow plug module receives a battery voltage feed via a 250A megafuse in the [BJB](#) and a 100A midi-fuse in the [EJB \(engine junction box\)](#). Operation of the glow plug module is controlled by the [ECM](#), which also controls the illumination of the glow plug indicator in the instrument cluster.

The system has been designed as a low-voltage glow system. At 7 volts, the nominal voltage of the sheathed-element glow plugs is significantly lower than the 12 volts of the main electrical circuit. The electronic glow plug module matches the voltage to the sheathed-element glow plugs and controls their glow temperature precisely to the specific requirements of the engine. This produces the optimum glow temperature even when the main circuit voltage is interrupted during engine starting. The lower power consumption of the ceramic glow plugs and their time-staggered activation reduce to a minimum the peak load on the main circuit during the cold start and immediate post-start periods.

In the event of glow plug failure, the engine may be difficult to start and excessive smoke emissions may be observed after starting.

### Glow Plug Module

The glow plug module is located in the [RH \(right-hand\)](#) side of the engine compartment. The module is attached to the power steering reservoir bracket with a bolt and nut.

Two connectors are used on the module. One connector receives the power supplies from the battery via the [BJB](#) and [EJB](#) and also provides for the connections to/from the [ECM](#). The second connector supplies the outputs to the glow plugs.

# Glow Plug System - Glow Plug System

Diagnosis and Testing

## Principles of Operation

For a detailed description of the glow plug system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (303-07C Glow Plug System)

[Glow Plug System](#) (Description and Operation),  
[Glow Plug System](#) (Description and Operation),  
[Glow Plug System](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage.

### Visual Inspection

Electrical
<ul style="list-style-type: none"> <li>● Fuse(s)</li> <li>● Glow plug relay</li> <li>● Engine management control relay</li> <li>● Wiring harness</li> <li>● Electrical connector(s)</li> <li>● Glow plug(s)</li> <li>● Engine control module (ECM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P038072	Glow Plug/Heater Circuit A	<ul style="list-style-type: none"> <li>● Glowplug relay circuits - short to ground, power, open circuit</li> <li>● Glowplug relay failure</li> </ul>	Refer to the electrical circuit diagrams and check glowplug relay circuits for short to ground, power, open circuit. Check battery voltage. Check and install a new relay as required
P038073	Glow Plug/Heater Circuit A	<ul style="list-style-type: none"> <li>● Glowplug relay circuits - short to ground, power, open circuit</li> <li>● Glowplug relay failure</li> </ul>	Refer to the electrical circuit diagrams and check glowplug relay circuits for short to ground, power, open circuit. Check battery voltage. Check and install a new relay as required
P038311	Glow Plug Control Module Control Circuit Low	<ul style="list-style-type: none"> <li>● Glowplug relay control circuit - short to ground</li> <li>● Glowplug relay failure</li> </ul>	Refer to the electrical circuit diagrams and check glowplug relay control circuit for short to ground. Check and install a new relay as required
P038412	Glow Plug Control Module Control Circuit High	<ul style="list-style-type: none"> <li>● Glowplug relay control circuit - short to power</li> <li>● Glowplug relay failure</li> </ul>	Refer to the electrical circuit diagrams and check glowplug relay control circuit for short to power. Check and install a new relay as required
P067013	Glow Plug Control Module Control Circuit/Open	<ul style="list-style-type: none"> <li>● Glow plug relay control circuit - open circuit</li> <li>● Glow plug relay failure</li> </ul>	Refer to the electrical circuit diagrams and check glow plug relay control circuit for open circuit. Check and install a new relay as required

**Engine Emission Control - TDV6 2.7L Diesel -****Torque Specifications**

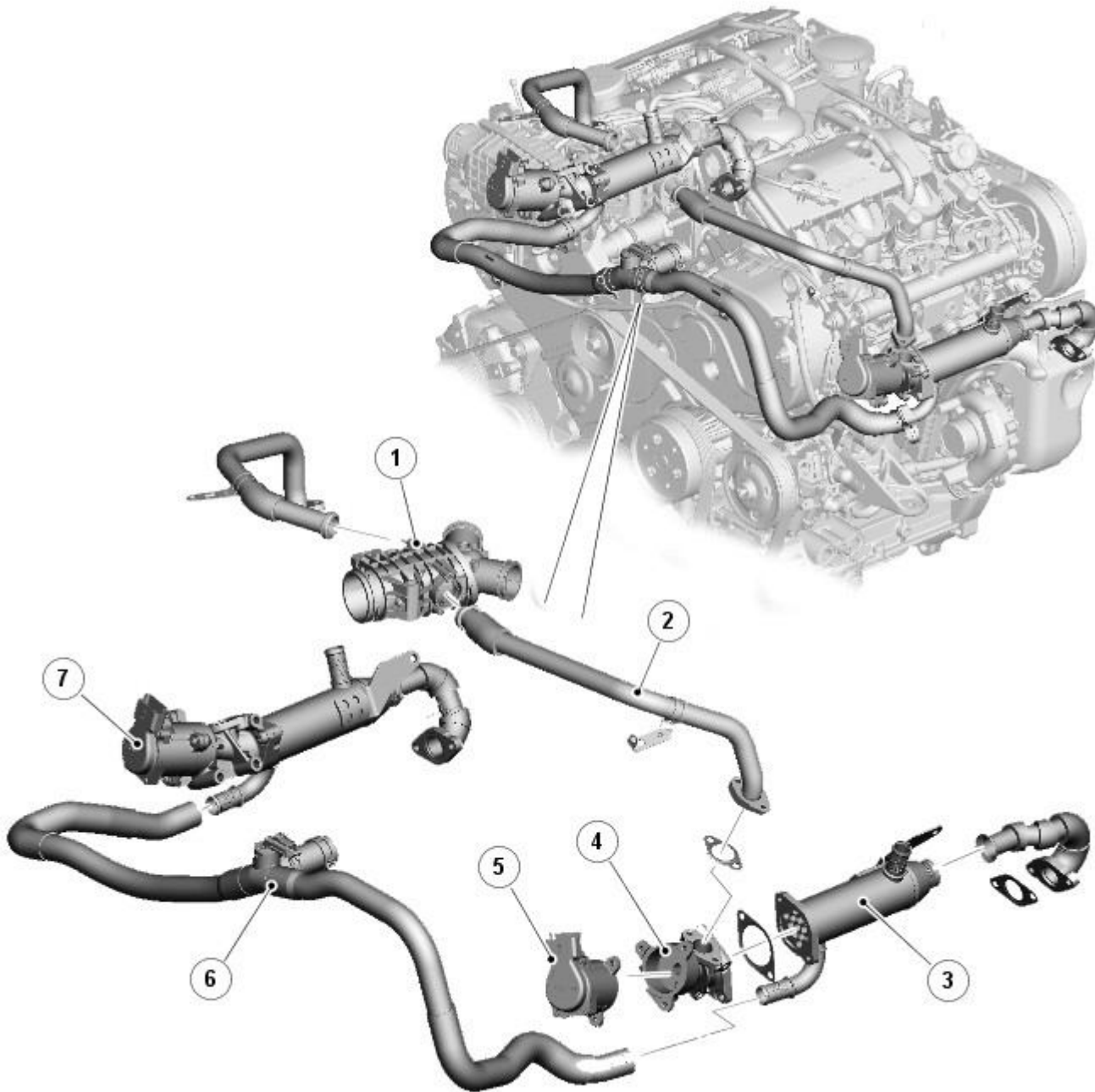
<b>Description</b>	<b>Nm</b>	<b>lb-ft</b>	<b>lb-in</b>
Exhaust gas recirculation (EGR) valve to cylinder head retaining bolts	10	–	89
EGR valve to EGR cooler retaining bolts	10	–	89
EGR valve tube to exhaust manifold retaining bolts	10	–	89
EGR valve cooler mounting bracket retaining bolt	10	–	89
EGR valve outlet tube to EGR valve retaining bolts	10	–	89
EGR valve outlet tube to timing cover retaining bolt	5	–	44
Fuel filter mounting bracket retaining M8 bolt	25	18	–
Fuel filter mounting bracket retaining M6 bolt	10	–	89

# Engine Emission Control - TDV6 2.7L Diesel - Engine Emission Control - Component

## Location

Description and Operation

EGR COMPONENT LOCATION

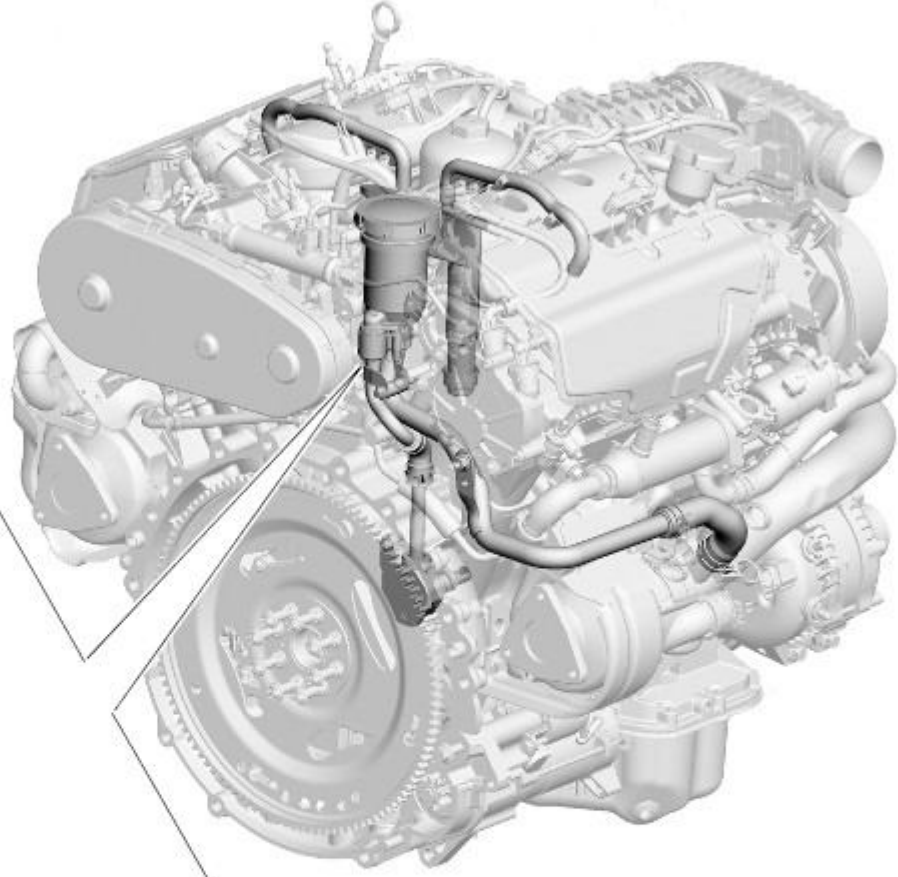
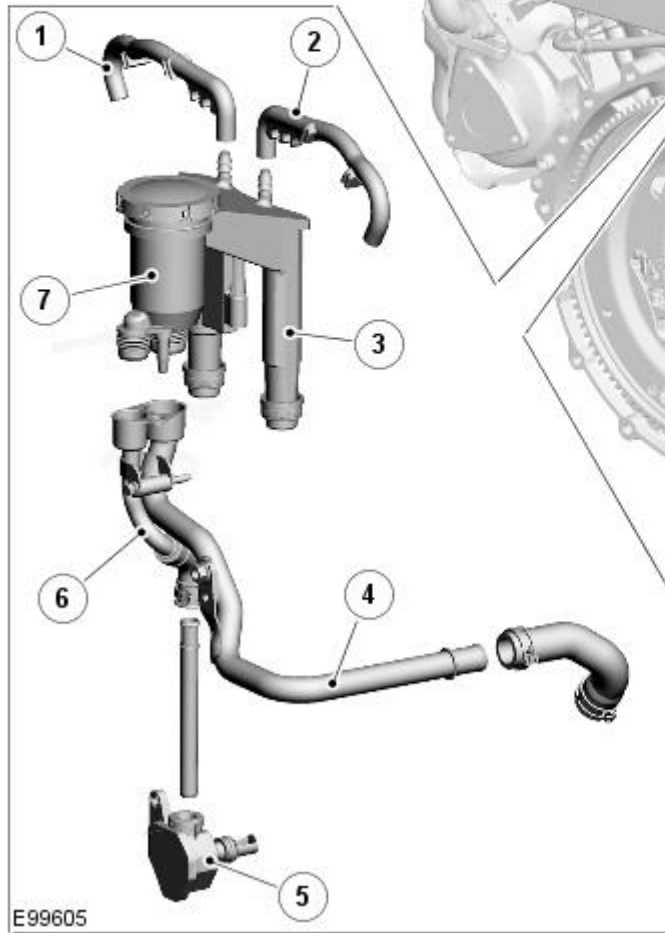


E93713

### ItemDescription

1	Electric throttle
2	<a href="#">EGR (exhaust gas recirculation)</a> to electric throttle tube
3	<a href="#">EGR</a> cooler
4	<a href="#">EGR</a> modulator valve
5	<a href="#">EGR</a> modulator solenoid valve
6	<a href="#">EGR</a> coolant hoses
7	<a href="#">EGR</a> modulator/ cooler assembly

CRANKCASE VENTILATION COMPONENT LOCATION



**ItemDescription**

1	Scavenger pipe
2	Scavenger pipe
3	Crankcase breather connection
4	Crankcase gas to air intake tube
5	Crankcase oil return valve
6	Oil return tube
7	Oil separator



# Engine Emission Control - TDV6 2.7L Diesel - Engine Emission Control - Overview

Description and Operation

## OVERVIEW

The combined [EGR \(exhaust gas recirculation\)](#) modulator and cooler is located under each cylinder bank, between the exhaust manifold and the cylinder head. The cooler side of the [EGR](#) is connected to the vehicle cooling system, via hoses. The inlet exhaust side is connected directly into the exhaust manifolds on each side. A flow regulating, wax thermostat is fitted to the coolant outlet of the [EGR](#) cooler. The purpose of the thermostat is to promote faster engine warm-up, improve cabin heater performance and assist the emissions to comply with the requirements of EU4 regulations. The exhaust gas passes through the cooler and is expelled via the actuator and a metal pipe into the throttle housing. The [EGR](#) modulator is a solenoid operated valve which is controlled by the [ECM \(engine control module\)](#). The [ECM](#) uses the [EGR](#) modulator to control the amount of exhaust gas being recirculated in order to reduce exhaust emissions and combustion noise. [EGR](#) is enabled when the engine is at normal operating temperature and under cruising conditions.

The crankcase ventilation system ensures that all gasses emitted from the crankcase during engine running are separated from any oil particles. Crankcase gasses are drawn into the oil separator unit from the crankcase and the cylinder head covers (both banks) where the gas and oil are separated. The gas is returned to the inlet side of the air induction system prior to the turbo charger. The oil is drained down to the sump via an oil return valve locate at the rear of the cylinder block.

# Engine Emission Control - TDV6 2.7L Diesel - Engine Emission Control - System

## Operation and Component Description

Description and Operation

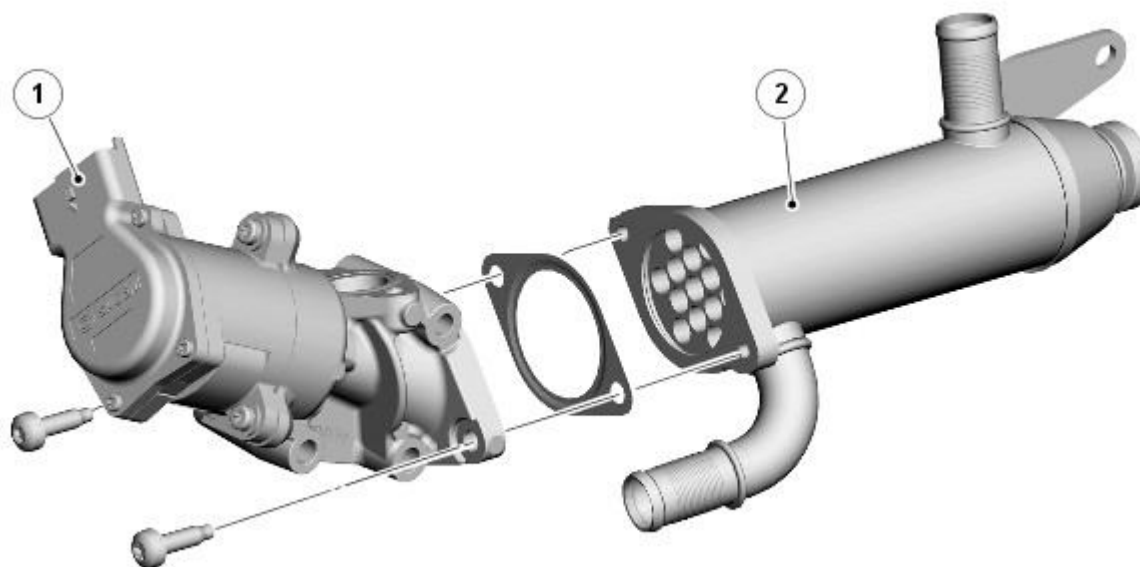
### System Operation

The [EGR \(exhaust gas recirculation\)](#) system comprises: [EGR](#) modulator x 2 [EGR](#) cooler x 2 Associated connecting pipes The combined [EGR](#) modulator and cooler is located between the V of the cylinder banks. The cooler side of the [EGR](#) is connected to the vehicle cooling system, via hoses. The inlet exhaust side is connected to the exhaust manifolds on each side via a metal pipe. The exhaust gas passes through the cooler and is expelled via the actuator and a metal pipe into the throttle housing. The [EGR](#) modulator is a solenoid operated valve which is controlled by the [ECM \(engine control module\)](#). The [ECM](#) uses the [EGR](#) modulator to control the amount of exhaust gas being recirculated in order to reduce exhaust emissions and combustion noise. The [EGR](#) is enabled when the engine is at normal operating temperature and under cruising conditions.

The crankcase ventilation system on the engine ensures that all gasses emitted from the crankcase during engine running are separated from any oil particles.

### Component Description

#### EGR Valve and Cooler



E99983

#### ItemDescription

- |   |                               |
|---|-------------------------------|
| 1 | <a href="#">EGR</a> modulator |
| 2 | <a href="#">EGR</a> cooler    |

The combined [EGR](#) modulator and cooler is located under each cylinder bank, between the exhaust manifold and the cylinder head. The cooler side of the [EGR](#) is connected to the vehicle cooling system, via hoses. The inlet exhaust side is connected directly into the exhaust manifolds on each side. The exhaust gas passes through the cooler and is expelled via the actuator and a metal pipe into the throttle housing. The [EGR](#) modulator is a solenoid operated valve which is controlled by the [ECM](#). The [ECM](#) uses the [EGR](#) modulator to control the amount of exhaust gas being recirculated in order to reduce exhaust emissions and combustion noise. The [EGR](#) is enabled when the engine is at normal operating temperature and under cruising conditions.

A flow regulating, wax thermostat is fitted to the coolant outlet of the [EGR](#) cooler. The purpose of the thermostat is to promote faster engine warm-up, improve cabin heater performance and assist the emissions to comply with the requirements of EU4 regulations. The thermostat is closed when cold, starts to open at 75°C (167°F) and is fully open at normal operating temperatures. The thermostat has a small bleed hole which allows a small amount of leakage when cold.

The [EGR](#) modulator receives a 12V supply from the main relay. The ground for the solenoid is via the [ECM](#) and is controlled using a [PWM \(pulse width modulation\)](#) signal. The [PWM](#) duty signal of the solenoid ground is varied to determine the precise amount of exhaust gas delivered to the cylinders.

The modulators are operated through their full range at each engine start-up, to clear any carbon deposits that may have built up whilst the engine was running

In the event of a failure of the [EGR](#) modulator, the [EGR](#) function will become inoperative. The [ECM](#) can monitor the [EGR](#) modulator solenoid for short circuits and store fault codes in the event of failure. The modulator can also be activated for testing using the recommended Jaguar diagnostic tool.

#### Crankcase Ventilation

Crankcase gasses are drawn into the oil separator unit from the crankcase and the cylinder head covers (both banks) where the gas and oil are separated. The gas is returned to the intake side of the air induction system prior to the turbo charger. The oil is drained down to the sump via an oil return valve located at the rear of the cylinder block.

# Engine Emission Control - TDV6 2.7L Diesel - Engine Emission Control

Diagnosis and Testing

## Principles of Operation

For a detailed description of the diesel engine emission control system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (303-08A Engine Emission Control - TDV6 2.7L Diesel)

[Engine Emission Control](#) (Description and Operation),

[Engine Emission Control](#) (Description and Operation),

[Engine Emission Control](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of mechanical or electrical damage.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● EGR valve</li> <li>● EGR pipes/hoses</li> <li>● Vacuum system</li> <li>● Engine breather system</li> </ul>	<ul style="list-style-type: none"> <li>● Wiring harness</li> <li>● Electrical connector(s)</li> <li>● Fuses(s)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Poor performance, excessive smoke emission	<ul style="list-style-type: none"> <li>● Incorrect EGR flow</li> </ul>	Check EGR valve for correct operation. Check for related DTCs and refer to the relevant DTC Index
Excessive engine blow-by/crankcase pressure	<ul style="list-style-type: none"> <li>● Engine breather system blocked/restricted</li> <li>● Excessive engine wear</li> </ul>	Check engine breather system for blockage/restriction. Check for excessive engine wear. REFER to: <a href="#">Engine - TDV6 2.7L Diesel</a> (303-00 Engine System - General Information, Diagnosis and Testing).

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P040121	Exhaust Gas Recirculation Flow Insufficient Detected	<ul style="list-style-type: none"> <li>● EGR control deviation below minimum threshold</li> <li>● Engine cooling system fault</li> <li>● EGR valve control system fault</li> </ul>	<p>• NOTE: This DTC may log if the engine temperature is more than 98°C and the ambient temperature is between 5 - 15°C.</p> <p>Carry out PWM test on EGR control valve. Set ignition status to 'ON', engine 'OFF'. Check and record '<b>EGR valve position bank 0</b>' and '<b>EGR valve position bank 1</b>' datalogger signals, and command '<b>EGR valve 0 command</b>' and '<b>EGR valve 1 command</b>' to 100% then 0%. Value of the signal should be approximately 95% maximum and 5% minimum, If PWM test is passed check engine cooling system functions correctly. Check correct thermostat is installed. if not, suspect the EGR actuators, check and install new actuators as required</p>
P040222	Exhaust Gas Recirculation Flow Excessive Detected	<ul style="list-style-type: none"> <li>● EGR control deviation above maximum threshold</li> </ul>	Set ignition status to 'ON', engine 'OFF'. Check and record ' <b>EGR valve position bank 0</b> ' and ' <b>EGR valve position bank 1</b> ' datalogger signals, and command ' <b>EGR valve 0 command</b> ' and ' <b>EGR valve 1 command</b> ' to 100% then 0%. Value of the signal should be approximately 95% maximum and 5% minimum, if not, suspect the EGR actuators, check and install new actuators as required

DTC	Description	Possible Cause	Action
P040300	Exhaust Gas Recirculation A Control Circuit	<ul style="list-style-type: none"> <li>EGR actuator A valve circuits - short to ground, power, open circuit</li> <li>EGR actuator failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check EGR valve circuits for short to ground, power, open circuit. Start engine and allow to idle, check and record ' <b>EGR valve 0 command</b> ' and ' <b>EGR valve position 0</b> ' datalogger signals. Turn the ignition status to 'OFF' and check the EGR cleaning cycle is performed, the ' <b>EGR valve 0 command</b> ' should cycle from 0% to 100% approximately 6 times. Set ignition status to 'ON' engine 'OFF' and command ' <b>EGR valve 0 command</b> ' to 0%, check and record ' <b>EGR valve position 0</b> ' datalogger signal. Value of signal should be between 0-20%. Command ' <b>EGR valve 0 command</b> ' to 100%, check and record ' <b>EGR valve position 0</b> ' datalogger signal. Value of signal should be between 80-100%. Check and install a new EGR valve as required, refer to the new module/component installation note at the top of the DTC Index
P040319	Exhaust Gas Recirculation A Control Circuit	<ul style="list-style-type: none"> <li>EGR actuator A circuits - short to ground, power, open circuit</li> <li>EGR actuator failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check EGR valve circuits for short to ground, power, open circuit. Start engine and allow to idle, check and record ' <b>EGR valve 0 command</b> ' and ' <b>EGR valve position 0</b> ' datalogger signals. Turn the ignition status to 'OFF' and check the EGR cleaning cycle is performed, the ' <b>EGR valve 0 command</b> ' should cycle from 0% to 100% approximately 6 times. Set ignition status to 'ON' engine 'OFF' and command ' <b>EGR valve 0 command</b> ' to 0%, check and record ' <b>EGR valve position 0</b> ' datalogger signal. Value of signal should be between 0-20%. Command ' <b>EGR valve 0 command</b> ' to 100%, check and record ' <b>EGR valve position 0</b> ' datalogger signal. Value of signal should be between 80-100%. Check and install a new EGR valve as required, refer to the new module/component installation note at the top of the DTC Index
P040521	Exhaust Gas Recirculation Sensor A Circuit Low	<ul style="list-style-type: none"> <li>EGR actuator A circuits - short to ground</li> <li>EGR actuator failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check the EGR actuator A circuit for short to ground. Set ignition status to 'ON' engine 'OFF', check and record ' <b>EGR valve position 0</b> ' datalogger signal, and command ' <b>EGR valve 0 command</b> ' to 0% then to 99%. Value of signal should be between 0-15% and 85-99%. Check and install a new EGR valve as required
P040622	Exhaust Gas Recirculation Sensor A Circuit High	<ul style="list-style-type: none"> <li>EGR actuator A circuits - short to power</li> <li>EGR actuator failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check the EGR actuator A circuit for short to power. Set ignition status to 'ON' engine 'OFF', check and record ' <b>EGR valve position 0</b> ' datalogger signal, and command ' <b>EGR valve 0 command</b> ' to 0% then to 99%. Value of signal should be between 0-15% and 85-99%. Check and install a new EGR valve as required
P040721	Exhaust Gas Recirculation Sensor B Circuit Low	<ul style="list-style-type: none"> <li>EGR throttle TPS1 circuit - short to ground, open circuit</li> <li>EGR throttle failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EGR throttle TPS1 circuit for short to ground, open circuit. Check and install a new EGR throttle as required
P040822	Exhaust Gas Recirculation Sensor B Circuit High	<ul style="list-style-type: none"> <li>EGR throttle TPS1 circuit - short to power</li> <li>EGR throttle failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EGR throttle TPS1 circuit for short to power. Check and install a new EGR throttle as required
P045A00	Exhaust Gas Recirculation B Control Circuit	<ul style="list-style-type: none"> <li>EGR actuator B valve circuits - short to ground, power, open circuit</li> <li>EGR actuator failure</li> <li>ECM failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check EGR valve circuits for short to ground, power, open circuit. Start engine and allow to idle, check and record ' <b>EGR valve 1 command</b> ' and ' <b>EGR valve position 1</b> ' datalogger signals. Turn the ignition status to 'OFF' and check the EGR cleaning cycle is performed, the ' <b>EGR valve 1 command</b> ' should cycle from 0% to 100% approximately 6 times. Set ignition status to 'ON' engine 'OFF' and command ' <b>EGR valve 1 command</b> ' to 0%, check and record ' <b>EGR valve position 1</b> ' datalogger signal. Value of signal should be between 0-20%. Command ' <b>EGR valve 1 command</b> ' to 100%, check and record ' <b>EGR valve position 1</b> ' datalogger signal. Value of signal should be between 80-100%. Check and install a new EGR valve/ECM as required, refer to the new module/component installation note at the top of the DTC Index
P045A19	Exhaust Gas Recirculation B Control Circuit	<ul style="list-style-type: none"> <li>EGR actuator B circuits - short to ground, power, open circuit</li> <li>EGR actuator failure</li> <li>ECM failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check EGR valve circuits for short to ground, power, open circuit. Start engine and allow to idle, check and record ' <b>EGR valve 1 command</b> ' and ' <b>EGR valve position 1</b> ' datalogger signals. Turn the ignition status to 'OFF' and check the EGR cleaning cycle is performed, the ' <b>EGR valve 1 command</b> ' should cycle from 0% to 100% approximately 6 times. Set ignition status to 'ON' engine 'OFF' and command ' <b>EGR valve 1 command</b> ' to 0%, check and record ' <b>EGR valve position 1</b> ' datalogger signal. Value of signal should be between 0-20%. Command ' <b>EGR valve 1 command</b> ' to 100%, check and record ' <b>EGR valve position 1</b> ' datalogger signal. Value of signal should be between 80-100%. Check and install a new EGR valve/ECM as required, refer to the new module/component installation note at the top of the DTC Index
P045C00	Exhaust Gas Recirculation B Control Circuit Low	<ul style="list-style-type: none"> <li>EGR valve control minimum deviation</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check intake air temperature, ambient pressure, manifold absolute pressure, mass air flow, boost pressure and EGR actuators/sensors and circuits for short to ground, power, open circuit. Start engine and allow to idle, check and record ' <b>EGR valve 1 controller deviation</b> ' datalogger signal, approximately every 30 seconds quickly apply and release throttle pedal. Value of signal should not exceed either +12% or -7%. Check for sticking EGR valve, check and install a new EGR valve as required
P045D00	Exhaust Gas Recirculation B Control Circuit High	<ul style="list-style-type: none"> <li>EGR valve control maximum deviation</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check intake air temperature, ambient pressure, manifold absolute pressure, mass air flow, boost pressure and EGR actuators/sensors and circuits for short to ground, power, open circuit. Start engine and allow to idle, check and record ' <b>EGR valve 1 controller deviation</b> ' datalogger signal, approximately every 30 seconds quickly apply and

DTC	Description	Possible Cause	Action
			release throttle pedal. Value of signal should not exceed either +12% or -7%. Check for sticking EGR valve, check and install a new EGR valve as required
P048700	Exhaust Gas Recirculation Throttle Control Circuit A Open	<ul style="list-style-type: none"> <li>EGR throttle TPA+ circuit - open circuit</li> <li>EGR throttle failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EGR throttle TPA+ circuit for open circuit. Check and install a new EGR throttle as required, refer to the new module/component installation note at the top of the DTC Index
P048819	Exhaust Gas Recirculation Throttle Control Circuit A Range/Performance	<ul style="list-style-type: none"> <li>Circuit current above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Set ignition status to 'ON' engine 'OFF', check and record ' <b>EGR throttle position</b> ' datalogger signal, then command ' <b>EGR throttle command</b> ' to 100%. Value of signal should be between 85-99%, if not install new EGR throttle. Command ' <b>EGR throttle command</b> ' to 0%, value of signal should be between 0-20%, if not install new EGR throttle. Manually close and open the EGR throttle and check the feedback voltage and resistance. Voltage should range between 0.20-4.80 volts, resistance should range between 300-2500 Ohms, if this is not the case install a new EGR throttle. If EGR throttle has been replaced and the DTC remains, suspect the ECM, check and install a new ECM as required, refer to the new module/component installation note at the top of the DTC Index
P048821	Exhaust Gas Recirculation Throttle Control Circuit A Range/Performance	<ul style="list-style-type: none"> <li>Signal Amplitude &lt; minimum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EGR throttle circuits for short, open circuit. Set ignition status to 'ON' engine 'OFF', check and record ' <b>Measured throttle position</b> ' datalogger signal, command ' <b>EGR throttle command</b> ' to 0%. If value of signal is not between 0-20% install a new EGR throttle
P048822	Exhaust Gas Recirculation Throttle Control Circuit A Range/Performance	<ul style="list-style-type: none"> <li>Signal Amplitude &gt; maximum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EGR throttle circuits for short, open circuit. Set ignition status to 'ON' engine 'OFF', check and record ' <b>Measured throttle position</b> ' datalogger signal, command ' <b>EGR throttle command</b> ' to 100%. If value of signal is not between 70-99% install a new EGR throttle
P048900	Exhaust Gas Recirculation A Control Circuit Low	<ul style="list-style-type: none"> <li>EGR valve control minimum deviation</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check intake air temperature, ambient pressure, manifold absolute pressure, mass air flow, boost pressure and EGR actuators/sensors and circuits for short to ground, power, open circuit. Start engine and allow to idle, check and record ' <b>EGR valve 0 controller deviation</b> ' datalogger signal, approximately every 30 seconds quickly apply and release throttle pedal. Value of signal should not exceed either +12% or -7%. Check for sticking EGR valve, check and install a new EGR valve as required
P049000	Exhaust Gas Recirculation A Control Circuit High	<ul style="list-style-type: none"> <li>EGR valve control maximum deviation</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check intake air temperature, ambient pressure, manifold absolute pressure, mass air flow, boost pressure and EGR actuators/sensors and circuits for short to ground, power, open circuit. Start engine and allow to idle, check and record ' <b>EGR valve 0 controller deviation</b> ' datalogger signal, approximately every 30 seconds quickly apply and release throttle pedal. Value of signal should not exceed either +12% or -7%. Check for sticking EGR valve, check and install a new EGR valve as required
P133521	EGR Position Sensor A Minimum/Maximum Stop Performance	<ul style="list-style-type: none"> <li>EGR valve adaption bank 1 bottom limit check</li> </ul>	Refer to the electrical circuit diagrams and check sensor connector and circuits for short, open circuit. Set ignition status to 'ON' engine 'OFF', check and record ' <b>EGR valve position bank 0</b> ' datalogger signal and command ' <b>EGR valve 0 command</b> ' to 0%. If value of signal is between 0-15% clear DTC and re-test, if not suspect the EGR valve bank 1, check and install a new valve as required
P133522	EGR Position Sensor A Minimum/Maximum Stop Performance	<ul style="list-style-type: none"> <li>EGR valve adaption bank 1 top limit check</li> </ul>	Refer to the electrical circuit diagrams and check sensor connector and circuits for short, open circuit. Set ignition status to 'ON' engine 'OFF', check and record ' <b>EGR valve position bank 0</b> ' datalogger signal and command ' <b>EGR valve 0 command</b> ' to 0%. If value of signal is between 0-15% clear DTC and re-test, if not suspect the EGR valve bank 1, check and install a new valve as required
P140A21	Exhaust Gas Recirculation Sensor C Circuit Low	<ul style="list-style-type: none"> <li>EGR actuator bank 2 circuits - short to ground</li> <li>EGR actuator failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check the EGR actuator bank 2 circuits for short to ground. Set ignition status to 'ON' engine 'OFF', check and record ' <b>EGR valve position bank 1</b> ' datalogger signal, and command ' <b>EGR valve 1 command</b> ' to 0% then to 99%. Value of signal should be between 0-15% and 85-99%. Check and install a new EGR valve as required
P140B22	Exhaust Gas Recirculation Sensor C Circuit High	<ul style="list-style-type: none"> <li>EGR actuator bank 2 circuits - short to power</li> <li>EGR actuator failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check the EGR actuator bank 2 circuits for short to power. Set ignition status to 'ON' engine 'OFF', check and record ' <b>EGR valve position bank 1</b> ' datalogger signal, and command ' <b>EGR valve 1 command</b> ' to 0% then to 99%. Value of signal should be between 0-15% and 85-99%. Check and install a new EGR valve as required
P140E21	EGR Position Sensor C Minimum/Maximum Stop Performance	<ul style="list-style-type: none"> <li>EGR valve adaption bank 2 bottom limit check</li> </ul>	Refer to the electrical circuit diagrams and check sensor connector and circuits for short, open circuit. Set ignition status to 'ON' engine 'OFF', check and record ' <b>EGR valve position bank 1</b> ' datalogger signal, and command ' <b>EGR valve 1 command</b> ' to 0%. If value of signal is between 0-15% clear DTC and re-test, if not suspect the EGR valve bank 2, check and install a new valve as required
P140E22	EGR Position Sensor C Minimum/Maximum Stop Performance	<ul style="list-style-type: none"> <li>EGR valve adaption bank 2 top limit check</li> </ul>	Refer to the electrical circuit diagrams and check sensor connector and circuits for short, open circuit. Set ignition status to 'ON' engine 'OFF', check and record ' <b>EGR valve position bank 1</b> ' datalogger signal and command ' <b>EGR valve 1 command</b> ' to 0%. If value of signal is between 0-15% clear DTC and re-test, if not suspect the EGR valve bank 2, check and install a new valve as required
P141A27	Exhaust Gas Recirculation Sensor A Circuit Intermittent/Erratic	<ul style="list-style-type: none"> <li>EGR valve bank 1 - sensor signal not plausible</li> </ul>	Refer to the electrical circuit diagrams and check EGR valve signal circuits for short, open circuit. Start engine and run to normal operating temperature, check and record ' <b>EGR valve position bank 0</b> ' datalogger signal. If after approximately 5 seconds the signal value has increased by more than 80%/10ms, suspect the EGR valve bank 1, check and install a new EGR valve as required

DTC	Description	Possible Cause	Action
P141B1C	Exhaust Gas Recirculation Sensor B Circuit Intermittent/Erratic	<ul style="list-style-type: none"> <li>EGR throttle position sensor signal not plausible</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check throttle position sensor circuits for short, open circuit. Start engine and run to normal operating temperature, check and record ' <b>EGR valve position bank 0</b> ' datalogger signal, then slowly increase engine speed to 3000 rev/min. If signal value has increased by more than 80%/10ms, suspect the EGR throttle bank 1, check and install a new EGR throttle as required
P141C27	Exhaust Gas Recirculation Sensor C Circuit Intermittent/Erratic	<ul style="list-style-type: none"> <li>EGR valve bank 2 - sensor signal not plausible</li> </ul>	Refer to the electrical circuit diagrams and check EGR valve signal circuits for short, open circuit. Start engine and run to normal operating temperature, check and record ' <b>EGR valve position bank 1</b> ' datalogger signal. If after approximately 5 seconds the signal value has increased by more than 80%/10ms, suspect the EGR valve bank 2, check and install a new EGR valve as required
P214100	Exhaust Gas Recirculation Throttle Control Circuit A Low	<ul style="list-style-type: none"> <li>EGR throttle position control deviation below minimum threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EGR throttle circuits for short to ground, power, open circuit. Set ignition status to 'ON' engine 'OFF', check and record ' <b>Throttle controller deviation</b> ' and ' <b>EGR throttle position</b> ' datalogger signals. Check EGR throttle is open, then command ' <b>EGR throttle command</b> ' closed. Value of signal ' <b>EGR throttle position</b> ' should increase above 90%, and ' <b>Throttle controller deviation</b> ' value should not exceed either MAX +5% of MIN -15%. If the values of these signals are outside of the parameters, check for sticking EGR throttle, install a new EGR throttle as required
P214200	Exhaust Gas Recirculation Throttle Control Circuit A High	<ul style="list-style-type: none"> <li>EGR throttle position control deviation above maximum threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EGR throttle circuits for short to ground, power, open circuit. Set ignition status to 'ON' engine 'OFF', check and record ' <b>Throttle controller deviation</b> ' and ' <b>EGR throttle position</b> ' datalogger signals. Check EGR throttle is open, then command ' <b>EGR throttle command</b> ' closed. Value of signal ' <b>EGR throttle position</b> ' should increase above 90%, and ' <b>Throttle controller deviation</b> ' value should not exceed either MAX +5% of MIN -15%. If the values of these signals are outside of the parameters, check for sticking EGR throttle, install a new EGR throttle as required

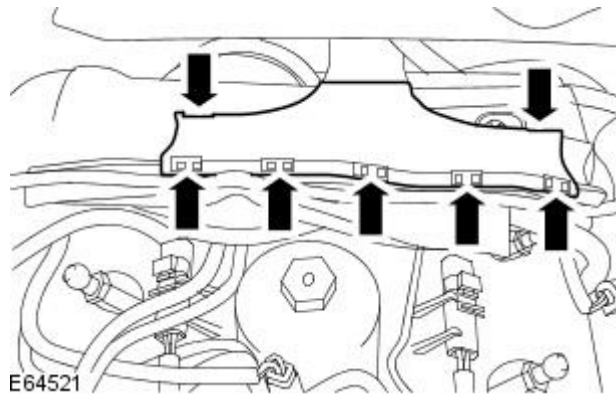


# Engine Emission Control - TDV6 2.7L Diesel - Crankcase Vent Oil Separator

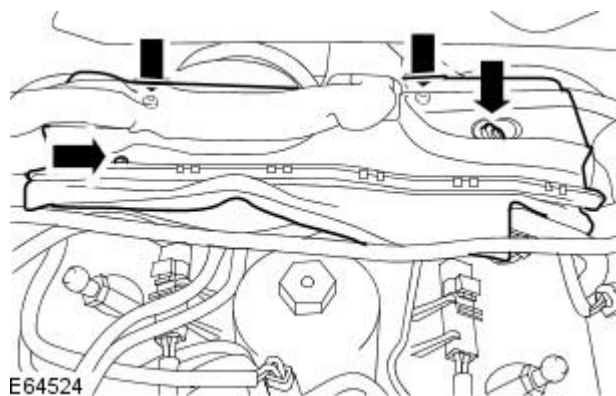
Removal and Installation

## Removal

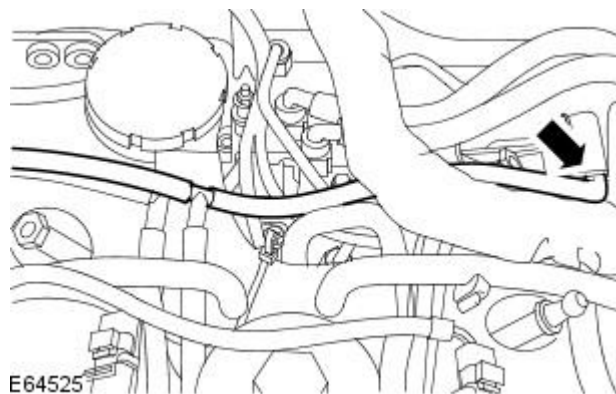
1. Remove the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Remove the secondary bulkhead center panel.  
For additional information, refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).
3. Remove the cover from the engine wiring harness casing.



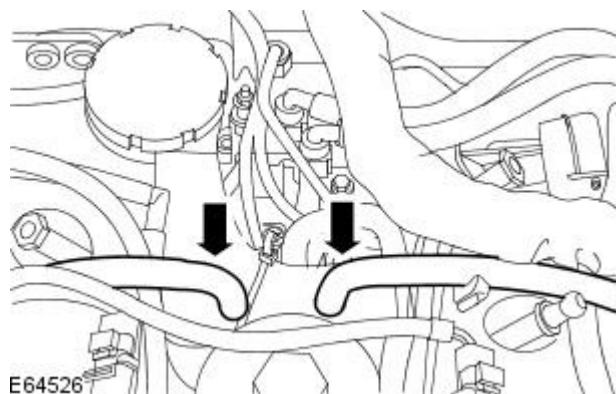
4. Remove the engine wiring harness casing.



5. Disconnect the port deactivation vacuum hose.



6. Disconnect the crankcase vent hoses.



## 7. CAUTIONS:

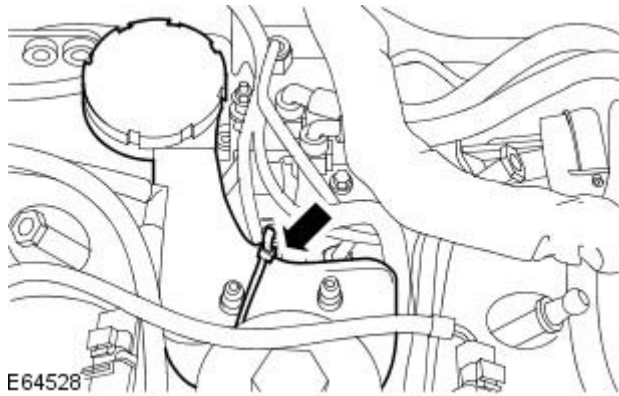


Discard the seals.



Make sure that all openings are sealed.

Release and remove the crankcase vent oil separator.



## Installation



1. CAUTION: Install the new seals.

• NOTE: Make sure that all the component mating faces are clean.

To install, reverse the removal procedure.

# Engine Emission Control - TDV6 2.7L Diesel - Exhaust Gas Recirculation (EGR) Valve Outlet Tube

## Removal and Installation

### Removal

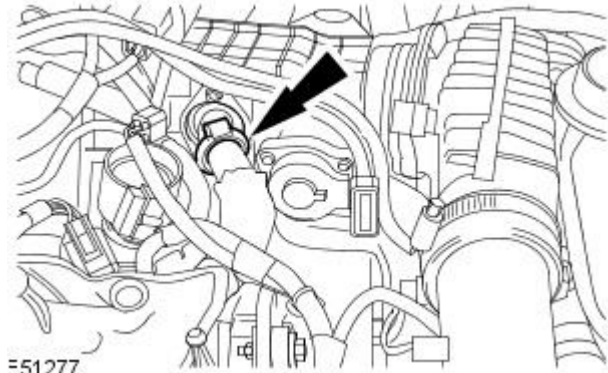
1. Remove the engine cover.

For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel \(501-05 Interior Trim and Ornamentation, Removal and Installation\)](#).

2. **NOTE:** Right-hand shown, left-hand similar.

Detach the exhaust gas recirculation (EGR) valve outlet tube.

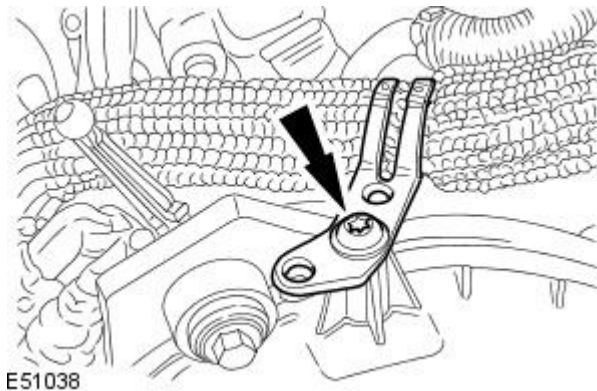
- Remove and discard the clamp.



3. **NOTE:** Right-hand shown, left-hand similar.

Detach the EGR valve outlet tube.

- Release the engine wiring harness.
- Remove the Torx screw.

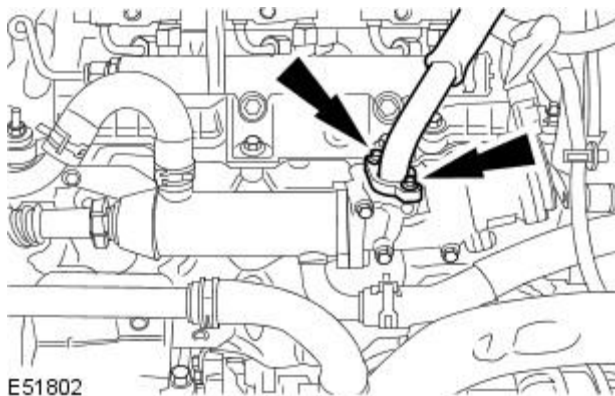


4. **NOTE:** Right-hand shown, left-hand similar.

- **NOTE:** Discard the gasket.

Remove the EGR valve outlet tube.

- Remove the 2 bolts.

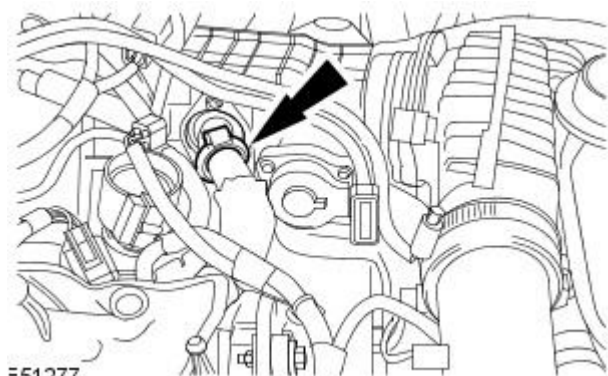


### Installation

1. **NOTE:** Right-hand shown, left-hand similar.

Loosely install the EGR valve outlet tube.

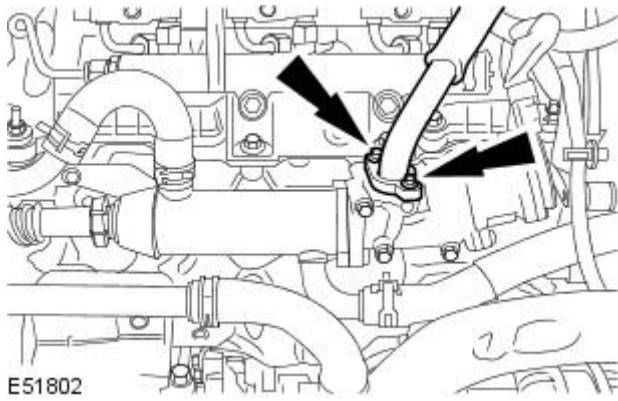
- Install a new clamp.
- Do not fully close the retaining clamp at this stage.



2. NOTE: Right-hand shown, left-hand similar.

Loosely install the EGR valve outlet tube bolts.

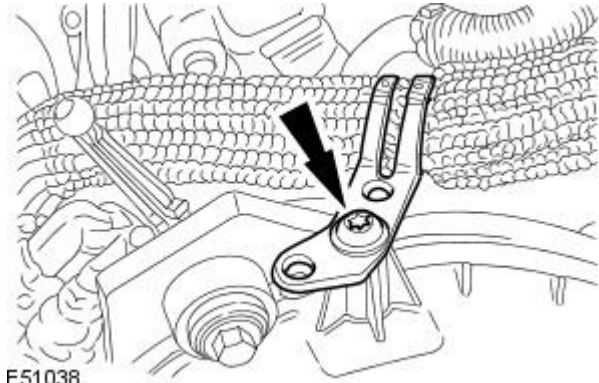
- Install a new gasket.



E51802

3. NOTE: Right-hand shown, left-hand similar.

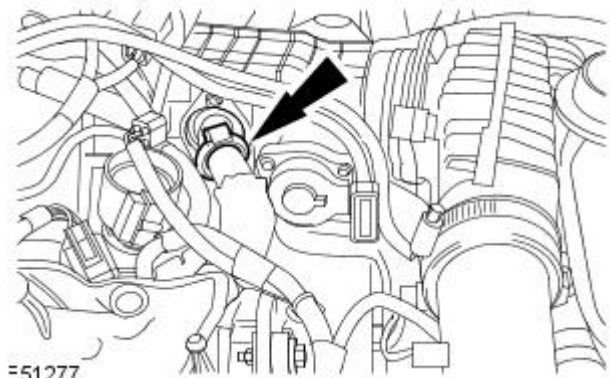
Loosely install the bolt.



E51038

4. NOTE: Right-hand shown, left-hand similar.

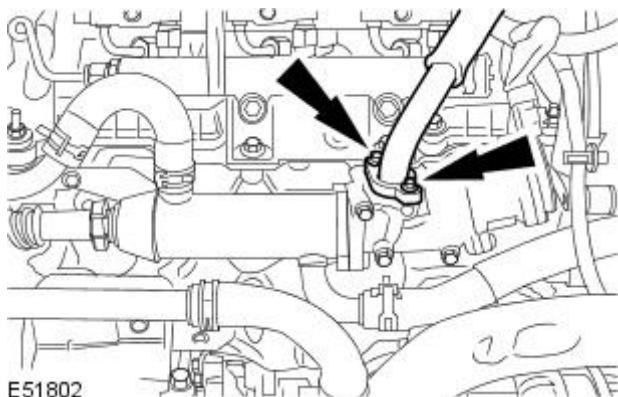
Fully close the EGR valve outlet tube retaining clamp.



E51277

5. NOTE: Right-hand shown, left-hand similar.

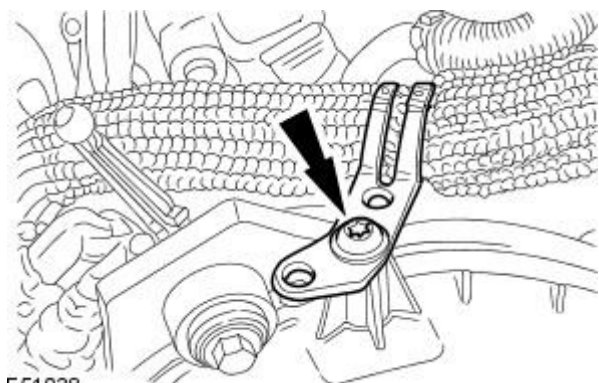
Tighten to 10 Nm.



E51802

6. NOTE: Right-hand shown, left-hand similar.

Tighten to 5 Nm.



E51038

7. Install the engine cover.



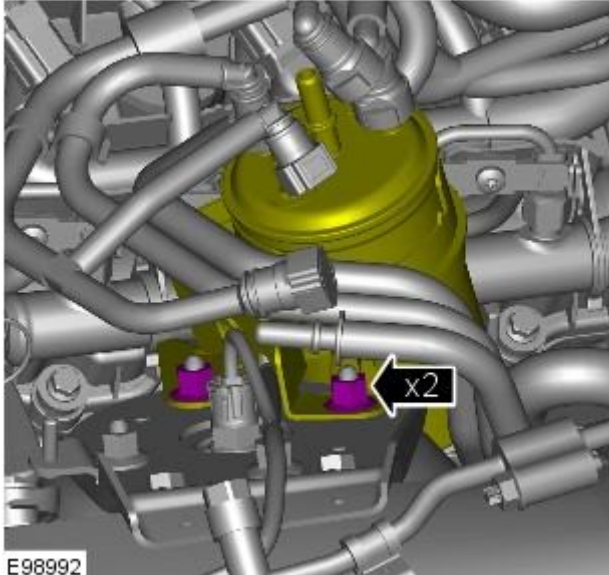
# Engine Emission Control - TDV6 2.7L Diesel - Exhaust Gas Recirculation (EGR) Valve LH

## Removal and Installation

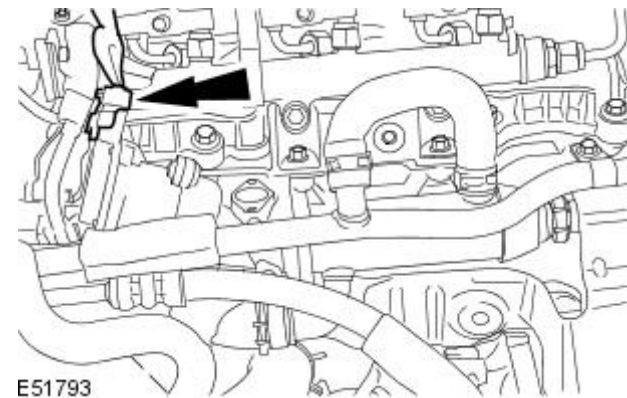
### Removal

 **WARNING:** Since injury such as scalding could be caused by escaping steam or coolant, make sure the vehicle cooling system is cool prior to carrying out this procedure.

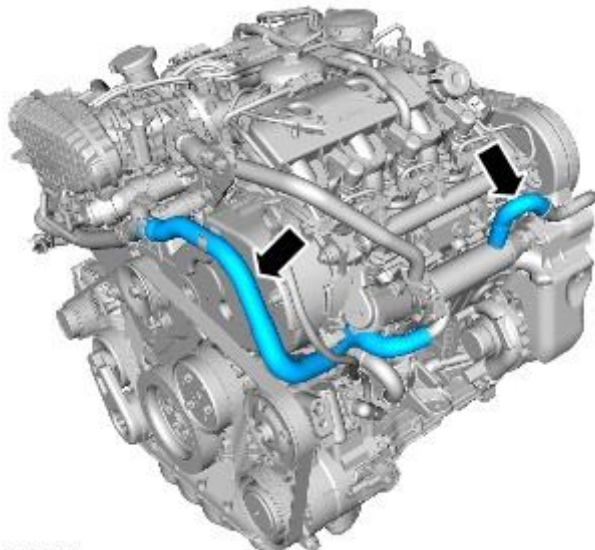
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the exhaust gas recirculation (EGR) valve outlet tube.  
For additional information, refer to: [Exhaust Gas Recirculation \(EGR\) Valve Outlet Tube](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Removal and Installation).
3. Reposition the fuel filter and support bracket.



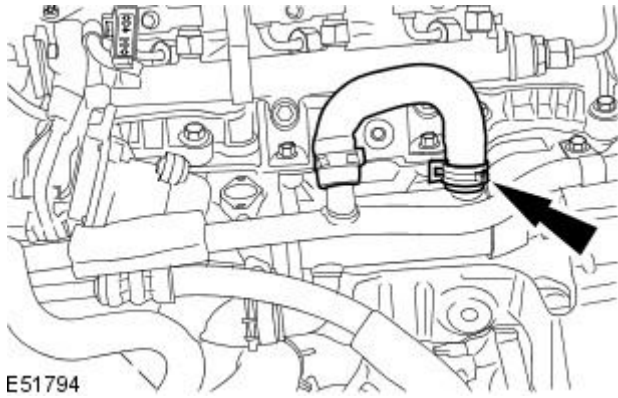
4. Disconnect the EGR valve electrical connector.



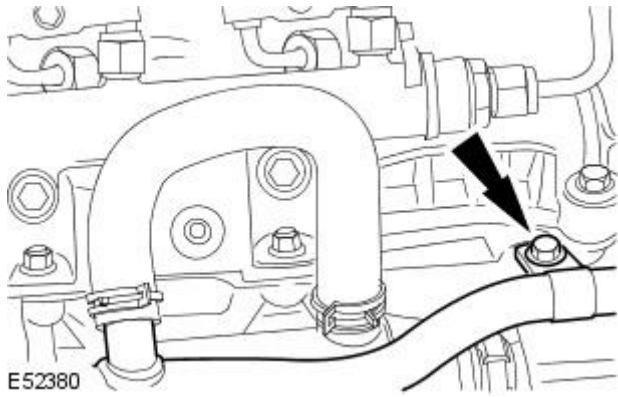
5. Clamp the coolant hoses in the locations shown to minimise coolant loss.



6. Disconnect the coolant hose from the EGR valve.

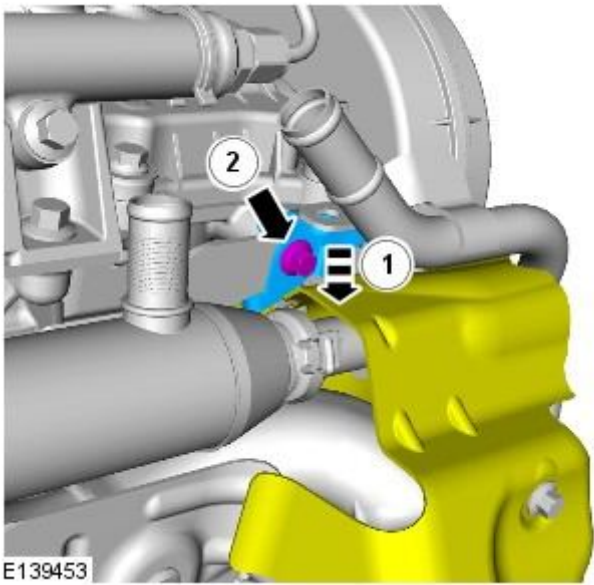


7. Detach the coolant hose.



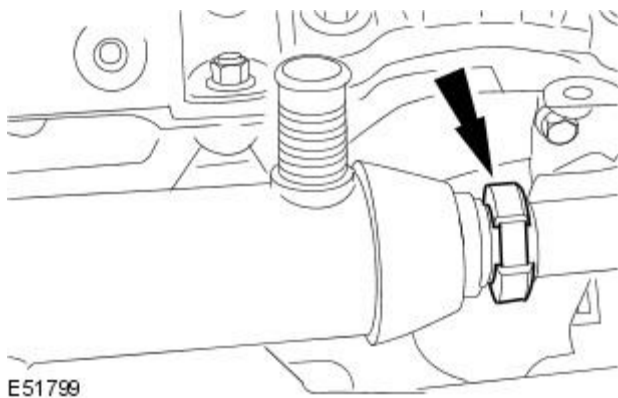
8. Remove the EGR valve retaining bolt and coolant hose bracket.

- Displace the catalytic converter heatshield downwards to access the bolt.



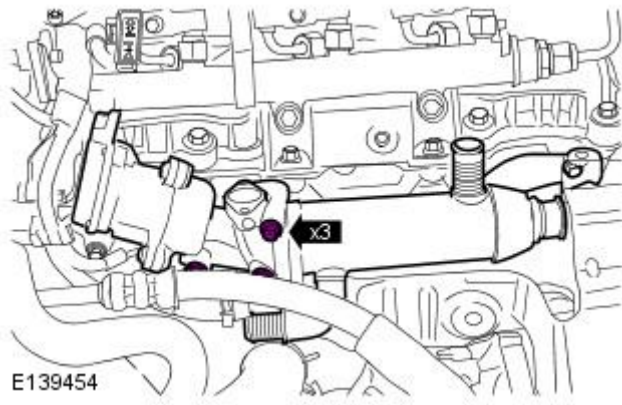
9. Disconnect the EGR valve inlet tube.

- Remove and discard the clamp.



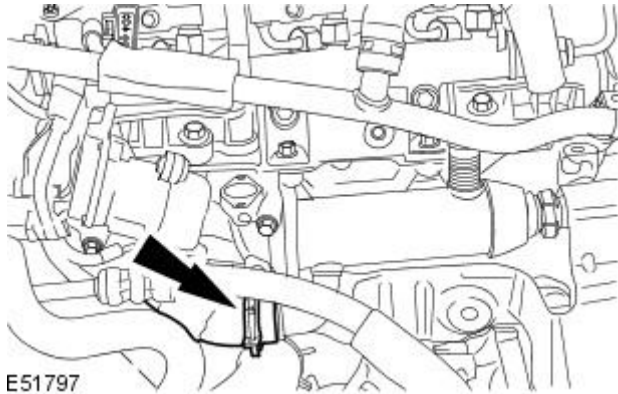


10. Release the EGR valve.



11. Remove the EGR valve.

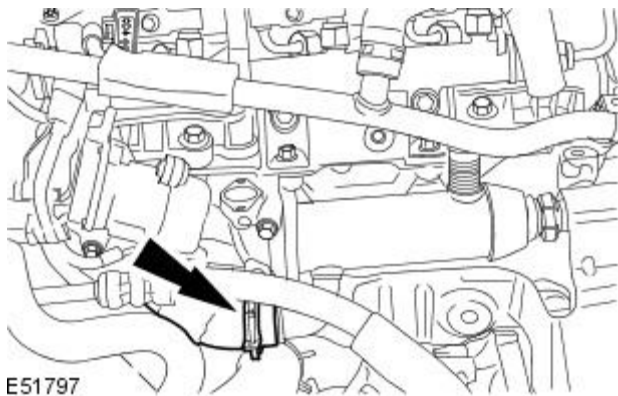
- Disconnect the coolant hose.



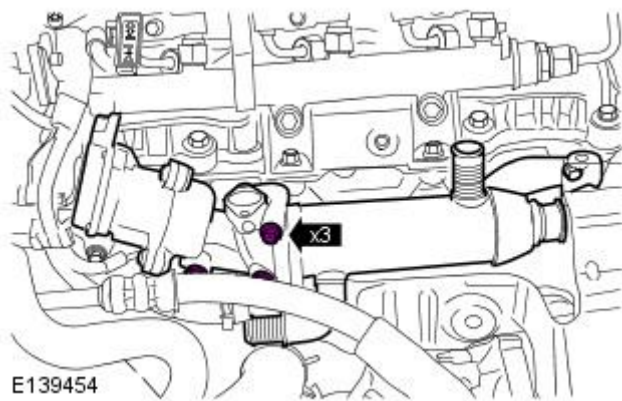
### Installation

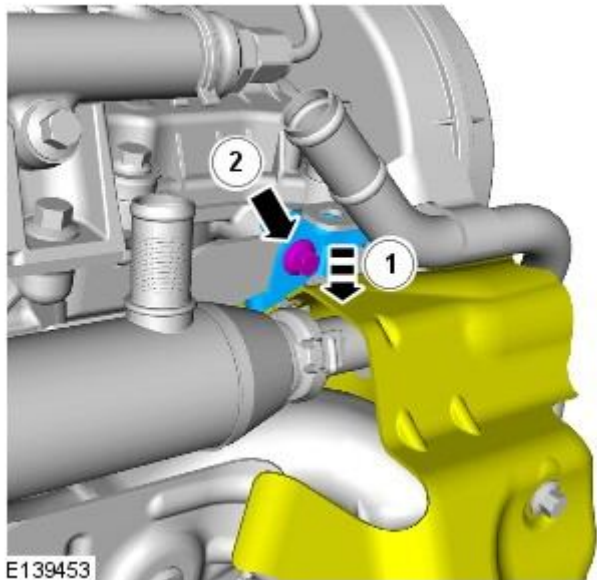
1. Install the EGR valve.

- Connect the coolant hose.



2. Loosely install the EGR valve.

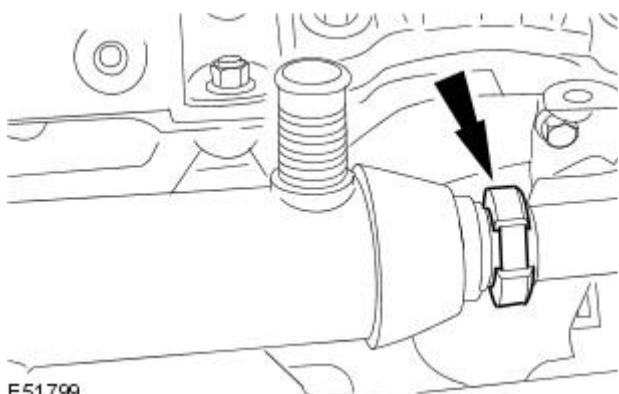




E139453

3. Install the bracket.

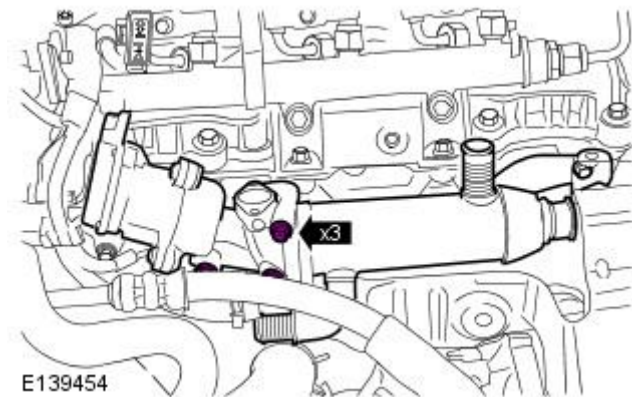
- Displace the catalytic converter heatshield downwards to access the bolt.



E51799

4. Connect the EGR valve inlet tube.

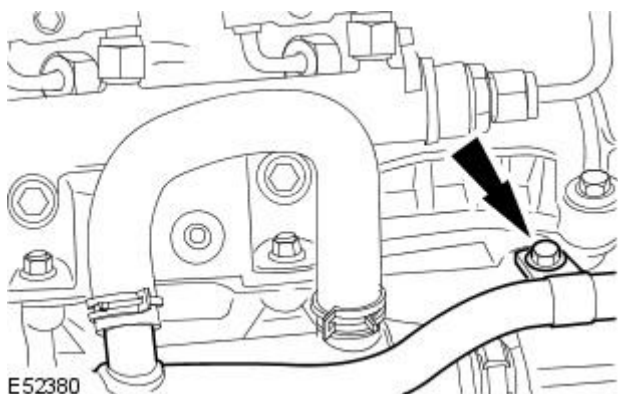
- Install a new clamp.



E139454

5. Secure the EGR valve.

- Tighten to 10 Nm.

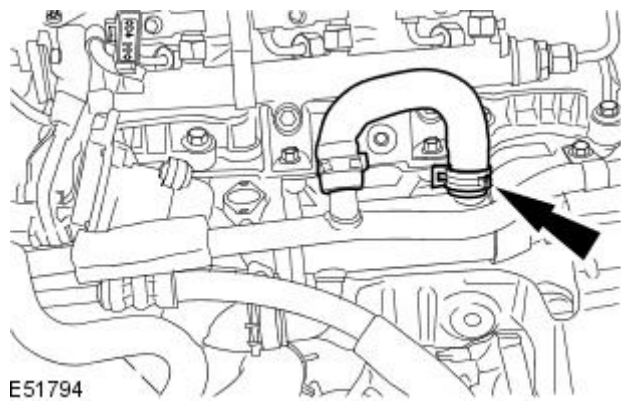


E52380

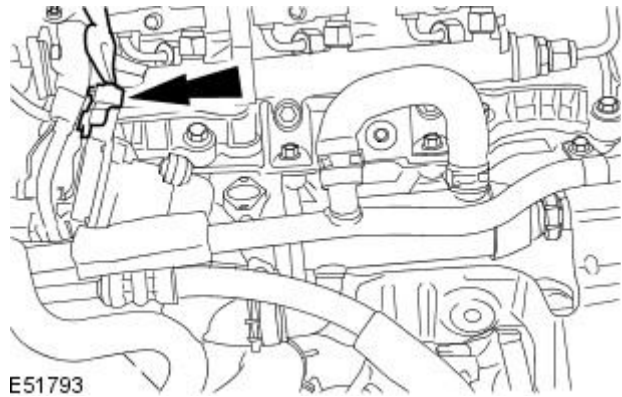
6. Attach the coolant hose.

- Tighten to 10 Nm.

7. Connect the coolant hose to the EGR valve.

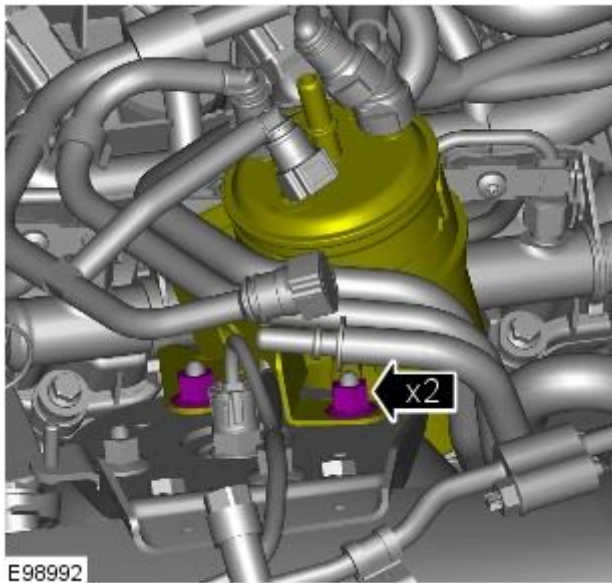


8. Connect the EGR valve electrical connector.



9. Secure the fuel filter and support bracket.

- Tighten to 27 Nm.



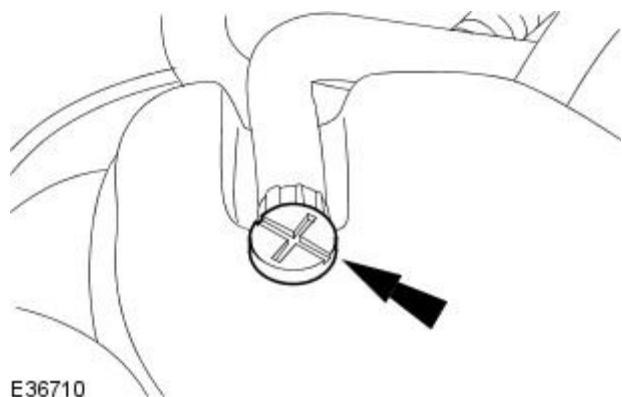
10. Install the EGR valve outlet tube.

For additional information, refer to: [Exhaust Gas Recirculation \(EGR\) Valve Outlet Tube](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Removal and Installation).

11.  **CAUTION:** Anti-freeze concentration must be maintained at 50%.

Fill the cooling system to the upper level mark of the coolant expansion tank.

- Remove the coolant expansion tank bleed screw.
- When coolant runs from the expansion tank bleed point bubble-free, tighten the bleed screw.
- Tighten to 3 Nm.



12. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

13. Start and run the engine.

- Increase engine speed to 2000rpm and cycle between this and idle for 60 seconds.
- Remove the coolant expansion tank cap.

**14.** Check and top up the cooling system as required.

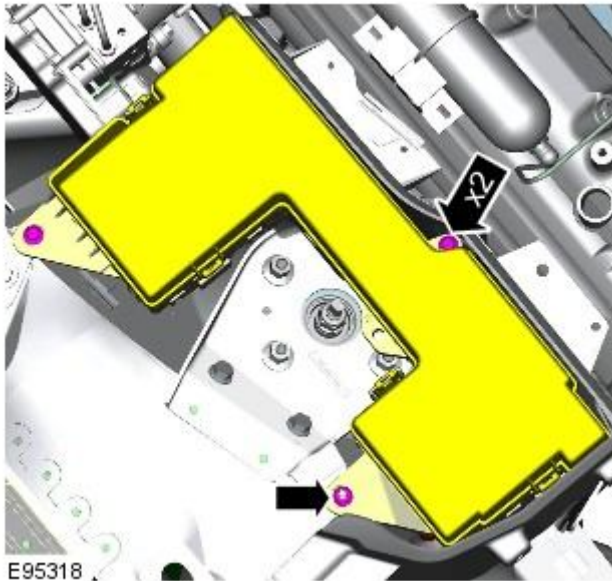
# Engine Emission Control - TDV6 2.7L Diesel - Exhaust Gas Recirculation (EGR) Valve RH

Removal and Installation

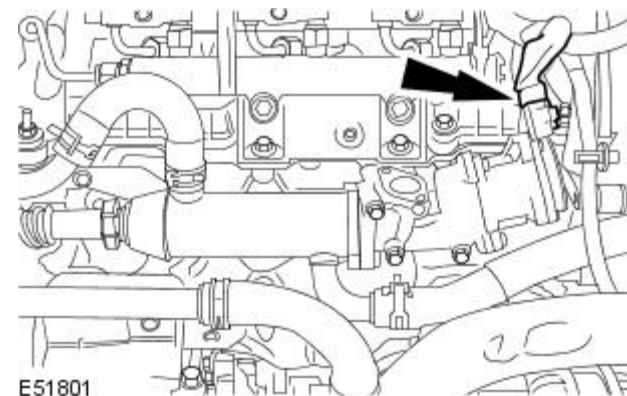
## Removal

 **WARNING:** Since injury such as scalding could be caused by escaping steam or coolant, make sure the vehicle cooling system is cool prior to carrying out this procedure.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the exhaust gas recirculation (EGR) valve outlet tube.  
For additional information, refer to: [Exhaust Gas Recirculation \(EGR\) Valve Outlet Tube](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Removal and Installation).
3. Remove the secondary bulkhead RH panel.  
For additional information, refer to: [Secondary Bulkhead Panel RH - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel](#) (501-02 Front End Body Panels, Removal and Installation).
4. Reposition the engine junction box (EJB).
  - Remove the two bolts.
  - Remove the nut.

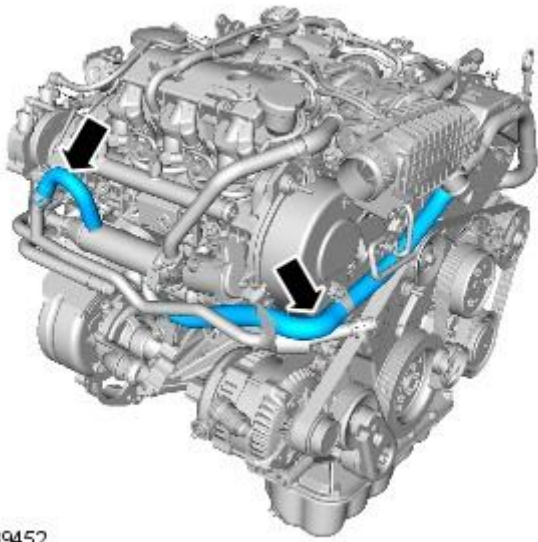


5. Disconnect the EGR valve electrical connector.



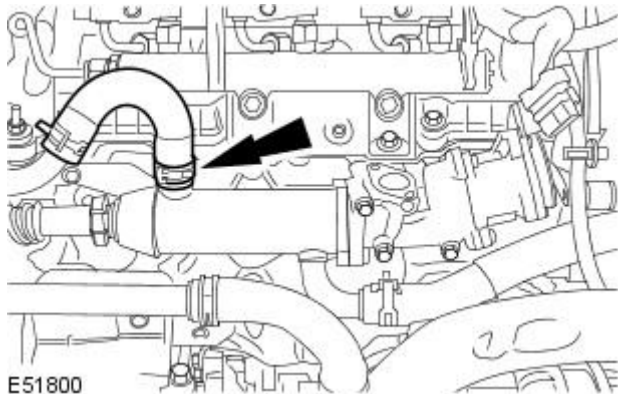


6. Clamp the coolant hoses in the locations shown to minimise coolant loss.



E139452

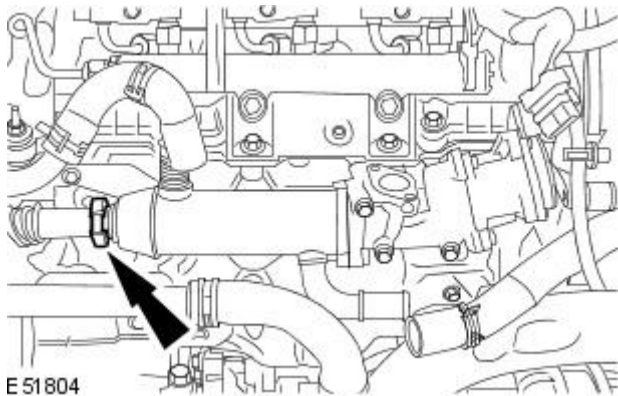
7. Disconnect the coolant hose from the EGR valve.



E51800

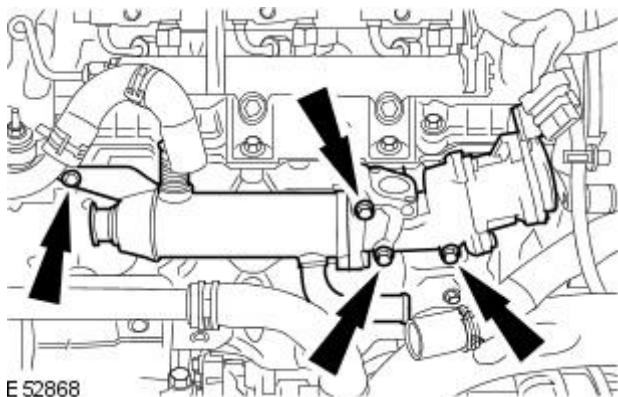
8. Disconnect the EGR valve inlet tube.

- Remove and discard the clamp.



E 51804

9. Release the EGR valve.

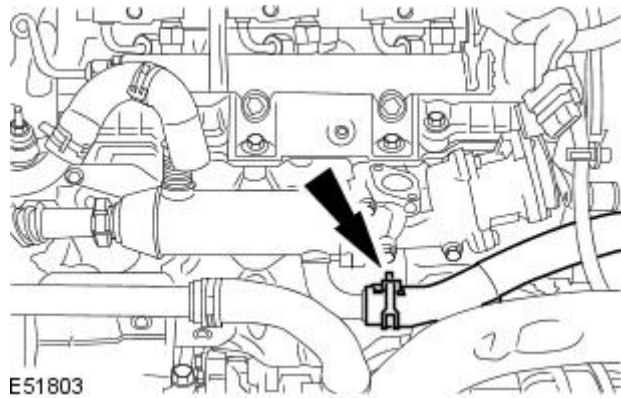


E 52868



10. Remove the EGR valve.

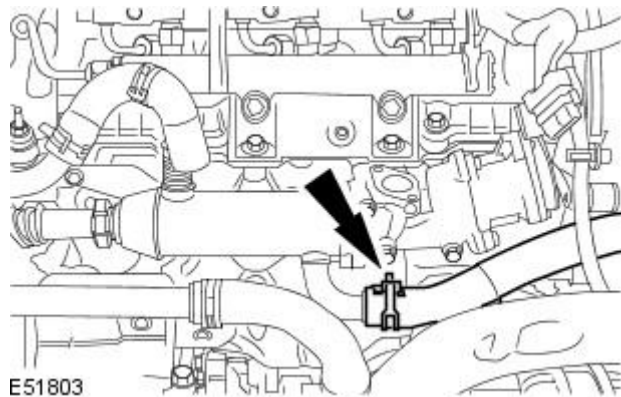
- Disconnect the coolant hose.



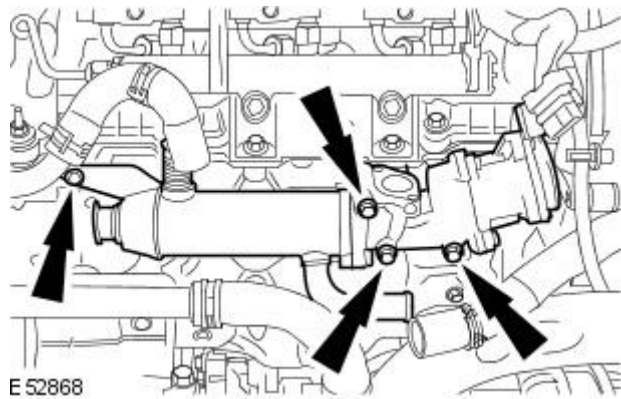
## Installation

1. Install the EGR valve.

- Connect the coolant hose.

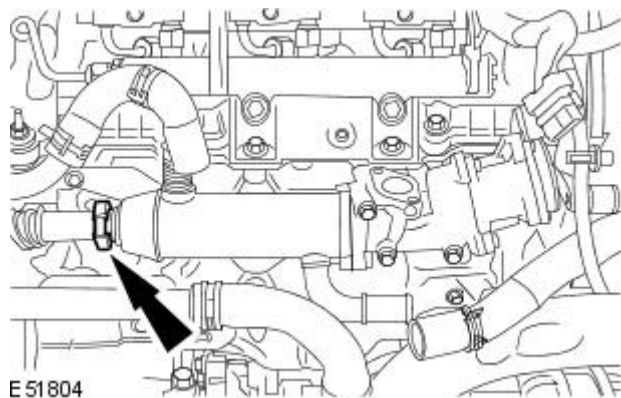


2. Loosely install the EGR valve.



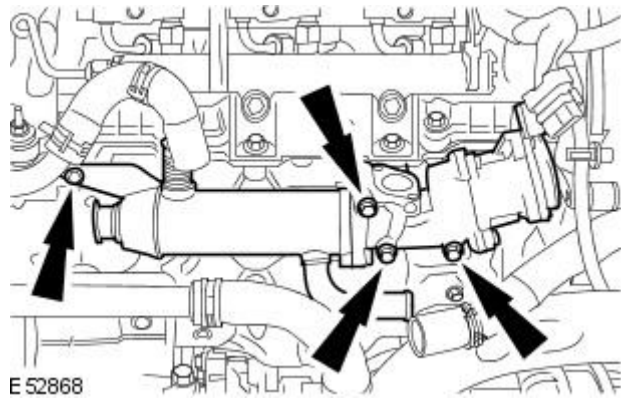
3. Connect the EGR valve inlet tube.

- Install a new clamp.

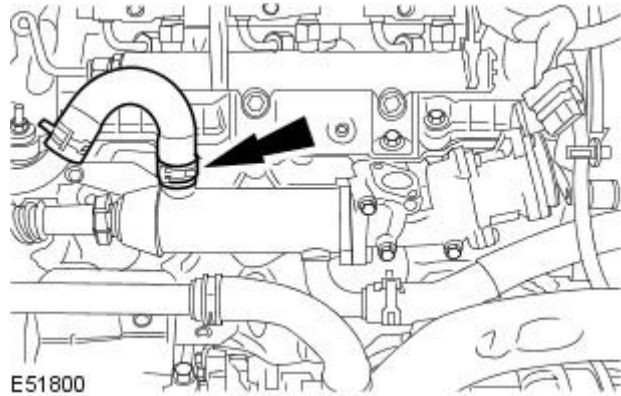


4. Secure the EGR valve.

- Tighten to 10 Nm.

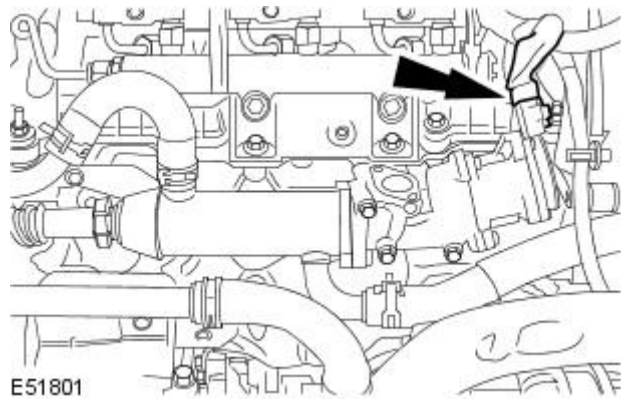


5. Connect the coolant hose to the EGR valve.



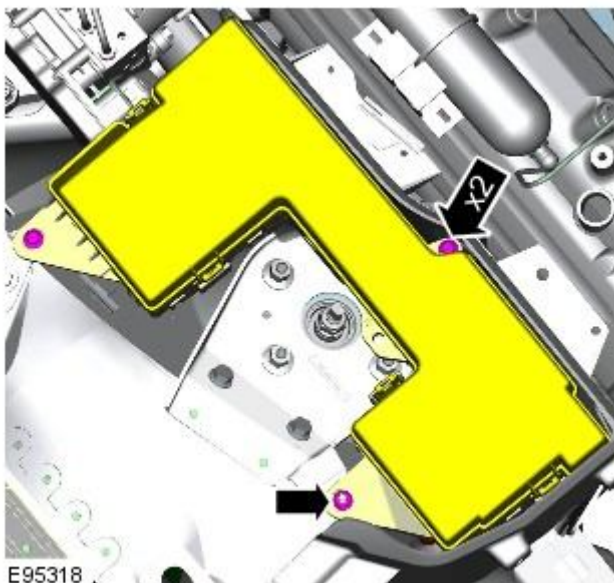
6. Remove the coolant hose clamps.

7. Connect the EGR valve electrical connector.



8. Secure the EJB.

- Tighten to 10 Nm.



9. Install the secondary bulkhead RH panel.

For additional information, refer to: [Secondary Bulkhead Panel RH - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel](#) (501-02 Front End Body Panels, Removal and Installation).

10. Install the EGR valve outlet tube.

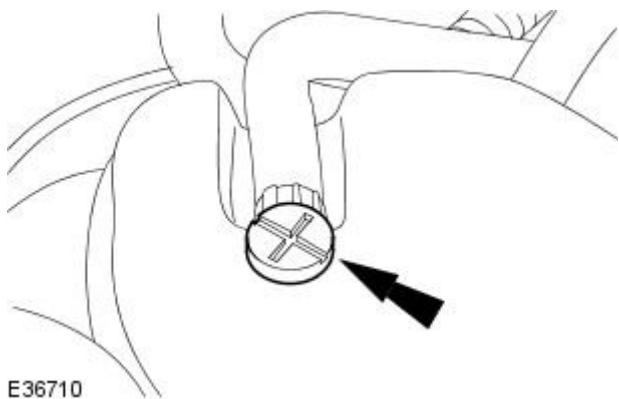
For additional information, refer to: [Exhaust Gas Recirculation \(EGR\) Valve Outlet Tube](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel,

Removal and Installation).

11.  CAUTION: Anti-freeze concentration must be maintained at 50%.

Fill the cooling system to the upper level mark of the coolant expansion tank.

- Remove the coolant expansion tank bleed screw.
- When coolant runs from the expansion tank bleed point bubble-free, tighten the bleed screw.
- Tighten to 3 Nm.



12. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

13. Start and run the engine.

- Remove the coolant expansion tank cap.
- Increase engine speed to 2000rpm and cycle between this and idle for 60 seconds.

14.  CAUTION: Anti-freeze concentration must be maintained at 50%.

Check and top up the cooling system as required.

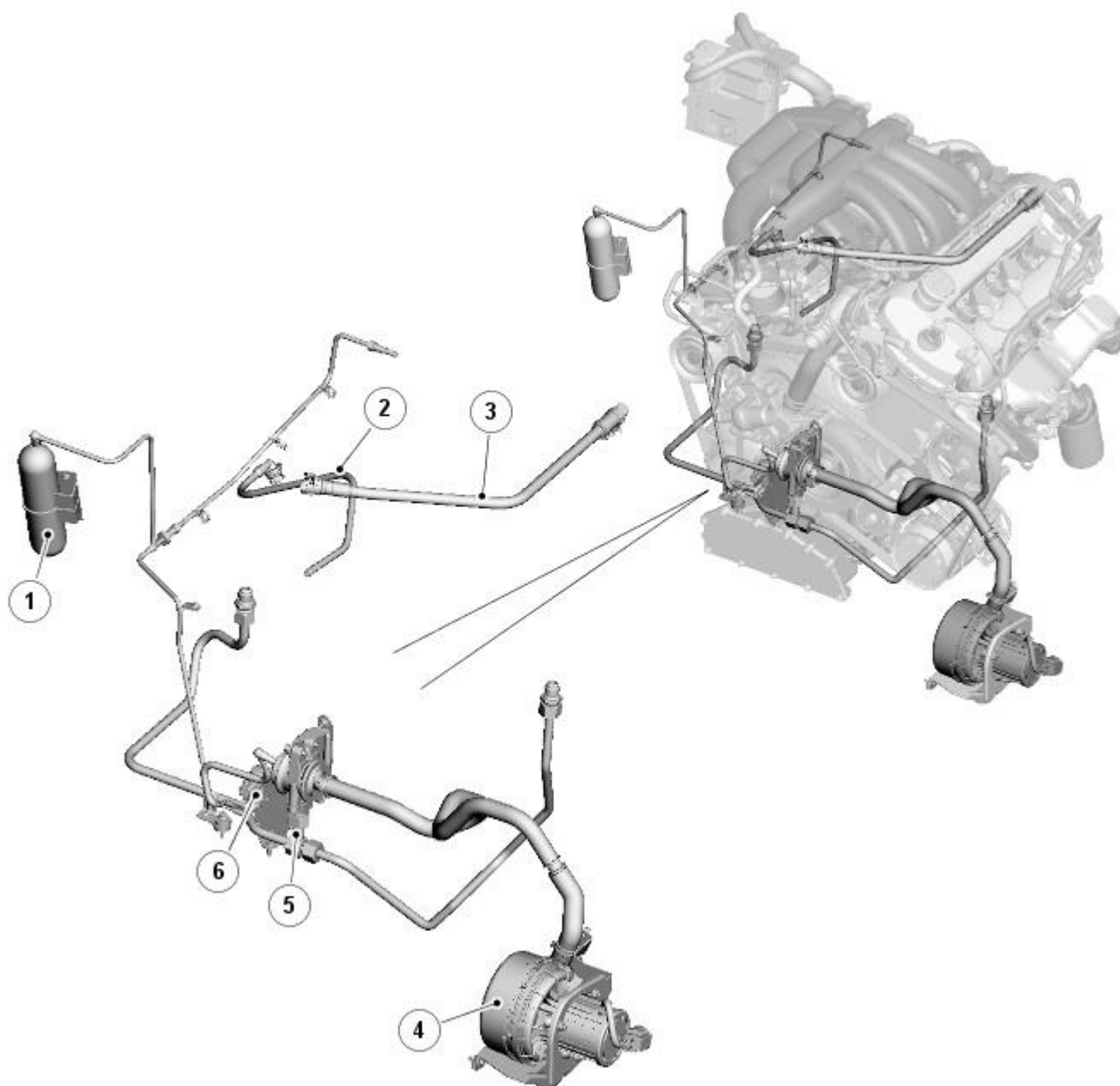
**Engine Emission Control - V6 3.0L Petrol -**

<b>Description</b>	<b>Nm</b>	<b>lb-ft</b>	<b>lb-in</b>
Secondary air injection (AIR) control valve to exhaust manifold tube retaining nuts	35	26	-
AIR control valve to exhaust manifold tube to exhaust manifold adaptor	35	26	-
Exhaust manifold blanking plug	35	26	-
AIR control valve bracket retaining bolt	8	-	71
AIR control valve bracket retaining nut	8	-	71
AIR pump bracket bolts and nuts	9	-	80
AIR pump to bracket nuts	8	-	71
AIR vacuum reservoir retaining bolt	5	-	44

# Engine Emission Control - V6 3.0L Petrol - Engine Emission Control - Component

## Location

Description and Operation



E93764

### ItemDescription

1	<a href="#">AIR (secondary air injection)</a> vacuum reservoir
2	Full load breather
3	<a href="#">PCV (positive crankcase ventilation)</a> valve
4	<a href="#">AIR</a> pump
5	<a href="#">AIR</a> switching valve
6	<a href="#">AIR</a> control valve

# Engine Emission Control - V6 3.0L Petrol - Engine Emission Control - Overview

Description and Operation

## OVERVIEW

The engine emission control system on the 3.0L engine comprise:

- Crankcase ventilation system
- [AIR \(secondary air injection\)](#) system

The crankcase ventilation system consists of two hoses, connected between the left-hand valve cover and the intake manifold and the right-hand valve cover and the air cleaner outlet pipe and a [PCV \(positive crankcase ventilation\)](#) valve located on the top on the [LH \(left-hand\)](#) engine cam cover. The [PCV](#) system recycles crankcase gases back through the engine where they mix with incoming air/fuel charge and help to reduce hydrocarbon emissions.

The [AIR](#) system comprises the following components:

- [AIR](#) pump
- [AIR](#) switching valve
- [AIR](#) control valve
- [AIR](#) vacuum reservoir
- [AIR](#) pump relay
- [AIR](#) pressure sensor (North American specification vehicles only)



# Engine Emission Control - V6 3.0L Petrol - Engine Emission Control - System Operation and Component Description

Description and Operation

## System Operation

### CRANKCASE VENTILATION SYSTEM

The crank system recycles crankcase gases back through the engine where they mix with incoming air/fuel charge and help to reduce hydrocarbon emissions. The [PCV \(positive crankcase ventilation\)](#) system consists of two hoses, connected between the left-hand valve cover and the intake manifold and the right-hand valve cover and the air cleaner outlet pipe. The [LH \(left-hand\)](#) hose has a [PCV](#) valve at the engine cover end.

The [PCV](#) valve regulates the amount of ventilation air and crankcase gas supplied to the intake manifold and also prevents backfiring into the crankcase.

### SECONDARY AIR INJECTION SYSTEM

The [AIR \(secondary air injection\)](#) pump is used to provide a supply of air into the exhaust manifolds during the cold start period of the engine. The [AIR](#) cycle lasts for up to 65 seconds. The hot unburnt fuel particles leaving the combustion chamber mix with the air injected into the exhaust manifolds and immediately combust.

This subsequent combustion of the unburnt and partially burnt carbon monoxide (CO)[CO \(carbon monoxide\)](#) and hydrocarbon (HC)[HC \(hydrocarbon\)](#) particles help to reduce the emission of these pollutants from the exhaust system. The additional heat generated in the exhaust manifold also provides rapid heating of the exhaust system catalytic converters. The additional oxygen which is delivered to the catalytic converters also generates an exothermic reaction which causes the catalytic converters to reach their optimum operating temperature and 'light off' quickly.

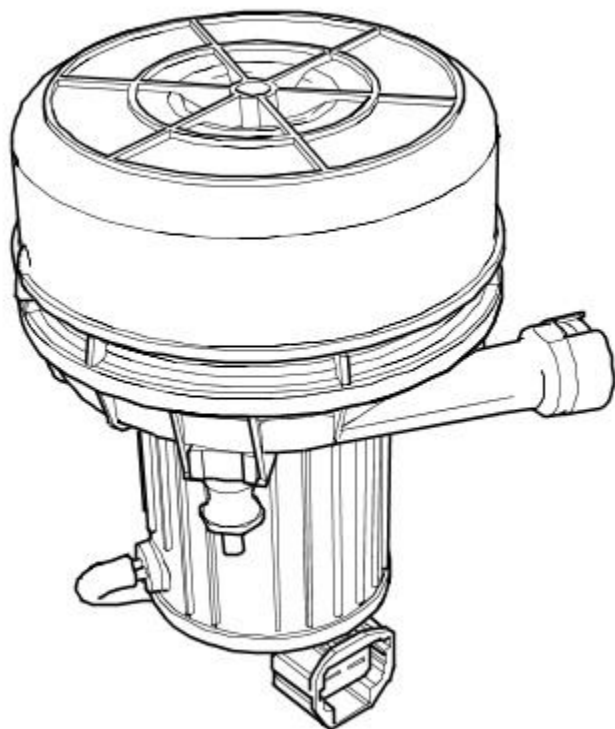
The catalytic converters only start to provide effective treatment of emission pollutants when they reach an operating temperature of approximately 250°C (482°F) and need to be between temperatures of 400°C (752°F) and 800°C (1472°F) for optimum efficiency. Consequently, the heat produced by the [AIR](#) 'afterburning' reduces the time delay before the catalysts reach an efficient operating temperature.

## Component Description

### POSITIVE CRANKCASE VENTILATION VALVE

The [PCV](#) valve is a spring loaded valve that opens when the engine is under full load. Once open the valve allows crankcase gasses to flow to the intake manifold. The [PCV](#) valve prevents reverse flow into the crankcase.

### SECONDARY AIR INJECTION PUMP



E62274

The [AIR](#) pump is fitted on rubber mountings to help prevent noise which is generated by [AIR](#) pump operation. The [AIR](#) pump is powered from the vehicle battery by a dedicated relay and supplies approximately 10 to 15 kg/hr (22 to 33 lb/hr) of air when the engine is at idle speed and the ambient temperature is below 20°C (68°F).

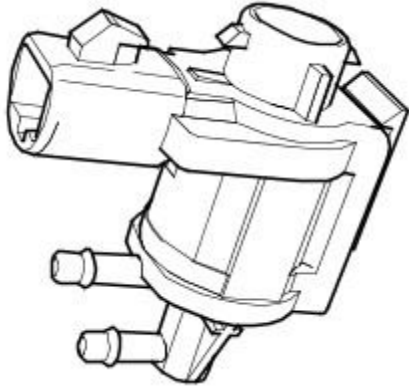
Air is drawn into the [AIR](#) pump through vents in its front cover and is then passed through a foam filter. The air is delivered to the exhaust manifold on each side of the engine through a combination of plastic pipes and stainless steel tubes.

One second after the [AIR](#) pump is energised, the ECM switches on the [AIR](#) switching valve, which opens to allow vacuum from the [AIR](#) vacuum reservoir to be applied to the vacuum operated [AIR](#) control valve. When the vacuum is applied to the [AIR](#) control valve, it opens to

allow the air from the [AIR](#) pump through to the exhaust manifolds.

When the ECM switches off the [AIR](#) switching valve, the vacuum supply to the [AIR](#) control valve is cut-off and the valve closes to prevent further air being injected into the exhaust manifolds. With an approximate five second delay after as the [AIR](#) switching valve is closed, the ECM removes power from the [AIR](#) pump relay, and this in turn stops the [AIR](#) pump from operating.

## SECONDARY AIR INJECTION SWITCHING VALVE

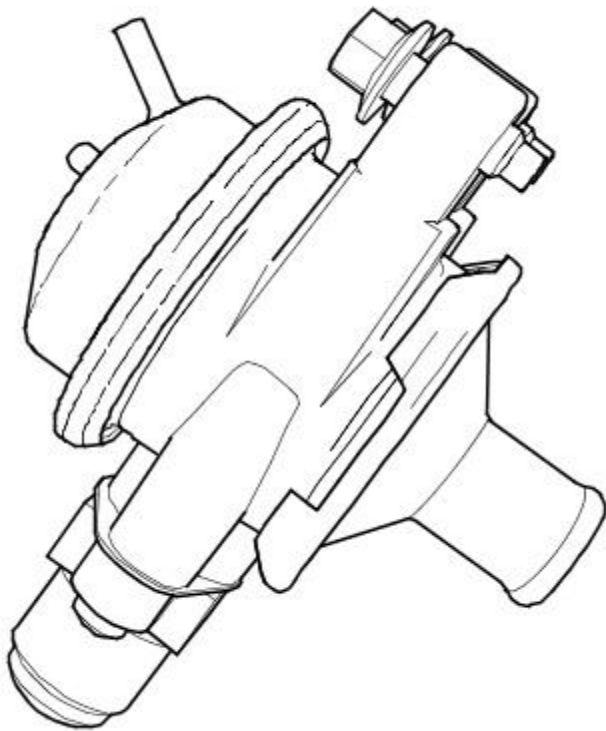


E62276

The ECM switches on the [AIR](#) switching valve with a one second delay after initiating [AIR](#) pump operation. When the [AIR](#) switching valve is open, a steady vacuum supply is allowed through to open the vacuum operated [AIR](#) control valve. When the ECM switches off the [AIR](#) switching valve, the valve closes and immediately shuts off the vacuum supply to the [AIR](#) control valve. The pump continues to operate for a further five seconds for system diagnostic purposes.

When the [AIR](#) switching valve is switched off, the vacuum supply line opens to atmosphere, and this causes the [AIR](#) switching valve to close automatically to prevent any further injection of air.

## SECONDARY AIR INJECTION CONTROL VALVE



E62275

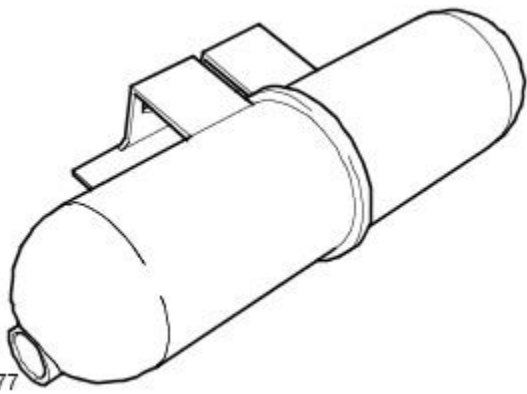
The injected air from the [AIR](#) pump is controlled by the [AIR](#) control valve. This allows the correct amount of air to be injected directly into the exhaust manifolds. The [AIR](#) control valve prevents exhaust gasses from blowing back into the [AIR](#) pump. Vacuum to the [AIR](#) switching valve is provided from the intake manifold vacuum by the [AIR](#) vacuum reservoir. A small bore vacuum hose provides the vacuum route between the [AIR](#) vacuum reservoir and [AIR](#) switching valve. A further small bore vacuum hose is used to connect the [AIR](#) switching valve to the [AIR](#) control valve.

The [AIR](#) control valve is assisted in operation by a vacuum source from the [AIR](#) vacuum reservoir located in the right-hand side of the engine bay. This assistance allows the actuation of the [AIR](#) control valve independently from the intake manifold vacuum levels available.

When the pressure in the exhaust system is higher than in the [AIR](#) system, the [AIR](#) control valve closes the circuit, and this protects the [AIR](#) system from exhaust gasses blowing back into the [AIR](#) system.

Vacuum to the [AIR](#) switching valve is provided from the intake manifold vacuum by the [AIR](#) vacuum reservoir. A small bore vacuum hose provides the vacuum route between the [AIR](#) vacuum reservoir and [AIR](#) switching valve. A further small bore vacuum hose is used to connect the [AIR](#) switching valve to the [AIR](#) control valve.

## SECONDARY AIR INJECTION RESERVOIR

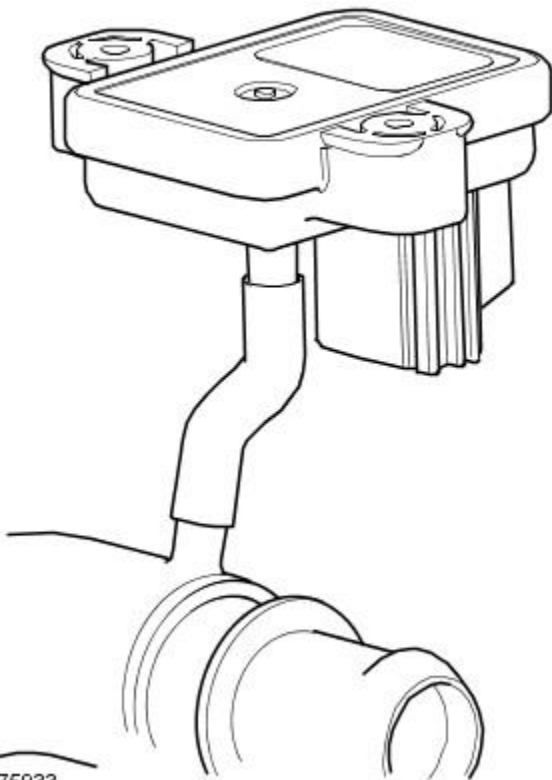


E62277

The [AIR](#) vacuum reservoir is included in the vacuum supply line between the intake manifold and the [AIR](#) switching valve. The [AIR](#) vacuum reservoir contains a one-way valve to stop vacuum leaking back towards the intake manifold side.

The [AIR](#) vacuum reservoir holds a constant vacuum so that the [AIR](#) control valve opens as soon as the [AIR](#) switching valve is switched on.

## SECONDARY AIR INJECTION PRESSURE SENSOR



E75933

The [AIR](#) system is monitored by measuring the system pressure by using the [AIR](#) pressure sensor at several instances during its cycle of operation.

The [AIR](#) system pressure is measured before operation of the [AIR](#) pump. The [AIR](#) pump is then switched on and with a one second delay, the [AIR](#) switching valve is opened. After a stabilizing period, the system pressure is measured again, this time by taking the average of a one second duration of readings, and normalising for variations in battery voltage and atmospheric pressure. If the system pressure measured at this time has not risen enough with respect to the initial [AIR](#) pressure reading then a failure will be flagged.

A second pressure measurement is made after the requirement for [AIR](#) into the exhaust system has expired, but continuing on from the same period of [AIR](#) pump operation, i.e. the pump is left running, against a closed [AIR](#) switching valve. Again this pressure measurement is the average of a one second duration of readings normalised for variations in battery voltage and atmospheric pressure. If the system pressure measured at this time has not risen enough or has risen too much with respect to the system pressure during normal operation of [AIR](#) then a failure will be flagged.

A final pressure reading is taken after the [AIR](#) system has been switched off to ensure the system shuts down.

# Engine Emission Control - V6 3.0L Petrol - Engine Emission Control

Diagnosis and Testing

## Principle of Operation

For a detailed description of the Engine Emission Control system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (303-08B Engine Emission Control - V6 3.0L Petrol)

[Engine Emission Control](#) (Description and Operation),

[Engine Emission Control](#) (Description and Operation),

[Engine Emission Control](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Engine breather hoses</li> <li>● Cyclone separator</li> <li>● Exhaust gas recirculation (EGR) pipes (check for cracks)</li> <li>● EGR valve</li> <li>● Secondary air injection (AIR) pump</li> <li>● Secondary air injection (AIR) valve</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Wiring harness</li> <li>● Loose or corroded electrical connectors</li> <li>● Sensor(s)</li> <li>● Stepper motor(s)</li> <li>● Secondary air injection (AIR) pump</li> <li>● Secondary air injection (AIR) valve</li> <li>● Engine control module (ECM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the customer concern and refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	<ul style="list-style-type: none"> <li>● Engine breather system disconnected/restricted</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed
Difficult to start cold	<ul style="list-style-type: none"> <li>● Exhaust gas recirculation (EGR) valve stuck open</li> </ul>	Check for related DTCs and refer to the relevant DTC Index
Engine stalls soon after start	<ul style="list-style-type: none"> <li>● Breather system disconnected/restricted</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed
Engine stops/stalls	<ul style="list-style-type: none"> <li>● EGR valve stuck open</li> </ul>	Check for related DTCs and refer to the relevant DTC Index
Poor idle quality	<ul style="list-style-type: none"> <li>● EGR valve stuck open</li> </ul>	Check for related DTCs and refer to the relevant DTC Index
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> <li>● EGR valve stuck open</li> </ul>	Check for related DTCs and refer to the relevant DTC Index
Poor throttle response	<ul style="list-style-type: none"> <li>● Breather system disconnected/restricted</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed
Excessive fuel consumption, black smoke, emissions	<ul style="list-style-type: none"> <li>● EGR valve stuck open</li> <li>● EGR system not operating</li> <li>● Engine breather system restricted</li> </ul>	Check for related DTCs and refer to the relevant DTC Index. Ensure the engine breather system is free from restriction and is correctly installed
Loud 'ticking' noise with engine running	<ul style="list-style-type: none"> <li>● EGR pipes cracked</li> </ul>	Inspect the EGR pipes, paying particular attention to the ribbed sections. Replace as required
Engine oil leaks	<ul style="list-style-type: none"> <li>● Engine breather system restricted</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE: If DTCs are recorded and, after the pinpoint tests have been carried out, the fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Causes	Action
P040100	Exhaust Gas Recirculation Flow Insufficient Detected	<ul style="list-style-type: none"> <li>EGR valve/pipe incorrectly installed or loose</li> <li>EGR pipe blocked</li> <li>EGR valve stuck closed, blocked</li> <li>EGR valve failure</li> </ul>	Check for correct installation of the EGR valve and pipe. Check for blockage in EGR valve and pipe. Check for stuck EGR valve. Check and install a new EGR valve as required
P041100	Secondary Air Injection Incorrect Upstream Flow Detected	<ul style="list-style-type: none"> <li>Low airflow being delivered from secondary air injection (AIR) pump</li> </ul>	Check AIR pump, vacuum solenoid and AIR control valve hardware. Refer to the electrical circuit diagrams and check AIR pump and vacuum solenoid power supply circuits. Check stuck/partially stuck vacuum solenoid. Check for loose/split vacuum pipe from solenoid to AIR control valve. Check for loose/split AIR pump outlet pipe
P041300	Secondary Air Injection Switching Valve A Circuit Open	<ul style="list-style-type: none"> <li>AIR vacuum solenoid control circuit high</li> </ul>	Refer to the electrical circuit diagrams and check AIR vacuum solenoid control circuit for short to power
P041400	Secondary Air Injection Switching Valve A Circuit Shorted	<ul style="list-style-type: none"> <li>AIR vacuum solenoid control circuit low</li> </ul>	Refer to the electrical circuit diagrams and check AIR vacuum solenoid control circuit for short to ground, high resistance
P048900	Exhaust Gas Recirculation Control Circuit Low	<ul style="list-style-type: none"> <li>EGR valve power supply circuit - short to ground, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EGR valve power supply circuit for short to ground, high resistance
P049000	Exhaust Gas Recirculation Control Circuit High	<ul style="list-style-type: none"> <li>EGR valve control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EGR valve control circuit for short to power
P049100	Secondary Air Injection System Insufficient Flow (Bank 1)	<ul style="list-style-type: none"> <li>Low airflow being delivered to secondary air injection (AIR) system (Bank 1)</li> </ul>	Check (Bank 1) AIR system pipe for blockage. Check for loose/split AIR pump outlet pipe
P049200	Secondary Air Injection System Insufficient Flow (Bank 2)	<ul style="list-style-type: none"> <li>Low airflow being delivered to secondary air injection (AIR) system (Bank 2)</li> </ul>	Check (Bank 2) AIR system pipe for blockage. Check for loose/split AIR pump outlet pipe
P243100	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Range/Performance Bank 1	<ul style="list-style-type: none"> <li>Secondary air injection system leaks</li> <li>Secondary air injection pump</li> <li>Secondary air injection valve</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check secondary air injection system circuits for short, open circuit. Check the integrity of the secondary air injection system
P243200	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Low Bank 1	<ul style="list-style-type: none"> <li>Secondary air injection manifold absolute pressure sensor circuit - short to ground, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check secondary air injection manifold absolute pressure sensor circuit for short to ground, high resistance
P243300	Secondary Air Injection System Air Flow/Pressure Sensor Circuit High Bank 1	<ul style="list-style-type: none"> <li>Secondary air injection manifold pressure (MAP) sensor circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check secondary air injection manifold pressure (MAP) sensor circuit for short to power
P244400	Secondary Air Injection System Pump Stuck On Bank 1	<ul style="list-style-type: none"> <li>Secondary air injection pump control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check secondary air injection pump control circuit for short to ground
P244500	Secondary Air Injection System Pump Stuck Off Bank 1	<ul style="list-style-type: none"> <li>Secondary air injection pump control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check secondary air injection pump control circuit for short to power

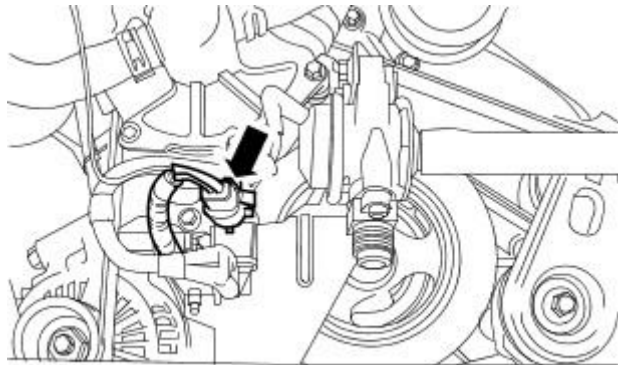


# Engine Emission Control - V6 3.0L Petrol - Secondary Air Injection (AIR) Control Valve

## Removal and Installation

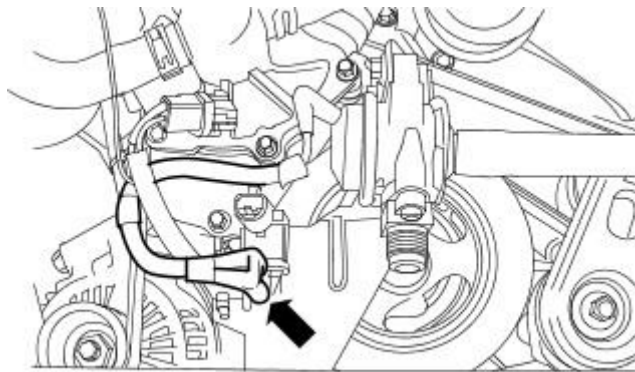
### Removal

1. Remove the secondary air injection (AIR) control valve to exhaust manifold right-hand tube.  
For additional information, refer to: [Secondary Air Injection \(AIR\) Control Valve to Exhaust Manifold Tube RH](#) (303-08B Engine Emission Control - V6 3.0L Petrol, Removal and Installation).
2. Raise and support the vehicle.
3. Disconnect the AIR switching valve electrical connector.



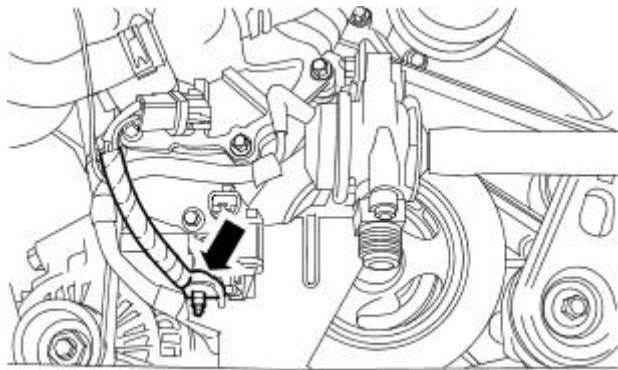
E63556

4. Disconnect the AIR switching valve vacuum hoses.



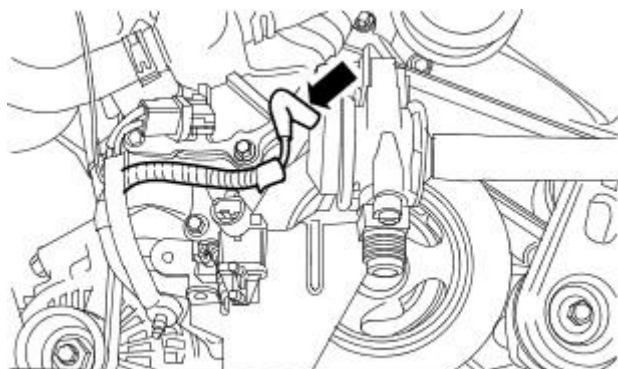
E63557

5. Detach the AIR wiring harness.



E63558

6. Disconnect the AIR control valve vacuum hose.

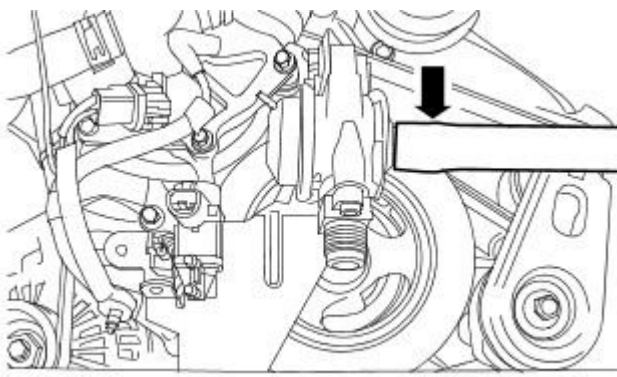


E63559



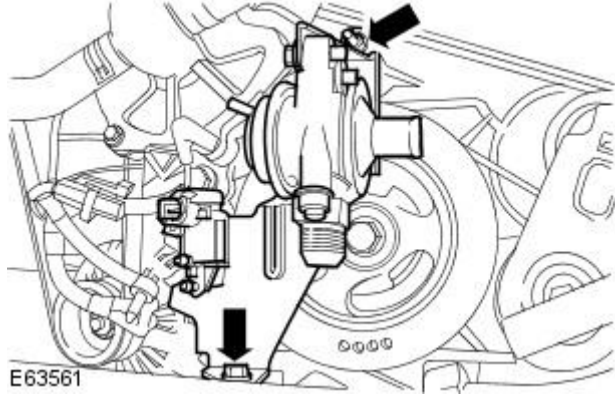
7. NOTE: Note the position of the timing marks on the AIR control valve and the AIR supply hose.

Disconnect the AIR supply hose.



E63560

8. Remove the AIR control valve and bracket assembly.

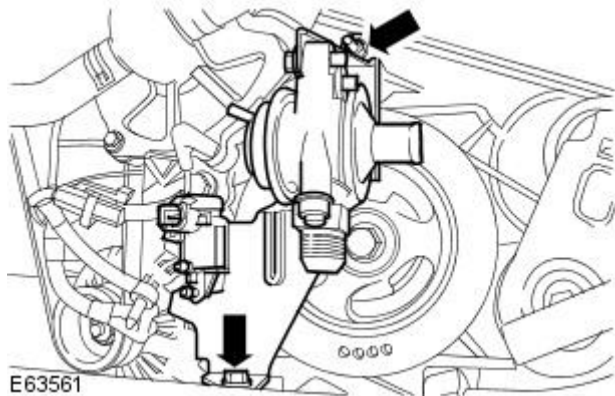


E63561

## Installation

1. To install, reverse the removal procedure.

- Tighten to 8 Nm.



E63561

2. NOTE: For NAS vehicles only.

If required, carry out a short drive cycle.

For additional information, refer to: Powertrain Control Module (PCM) Short Drive Cycle Self-Test (303-14C, General Procedures).

# Engine Emission Control - V6 3.0L Petrol - Secondary Air Injection (AIR) Control Valve to Exhaust Manifold Tube LH

Removal and Installation

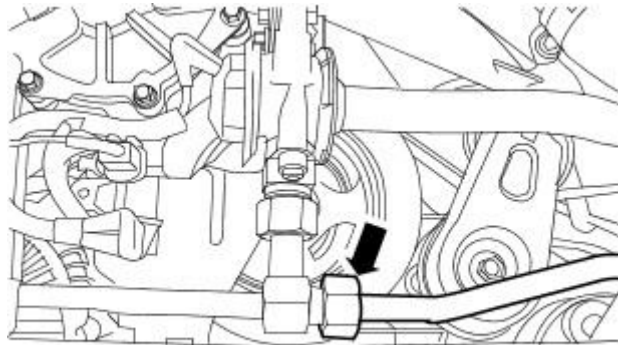
## Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

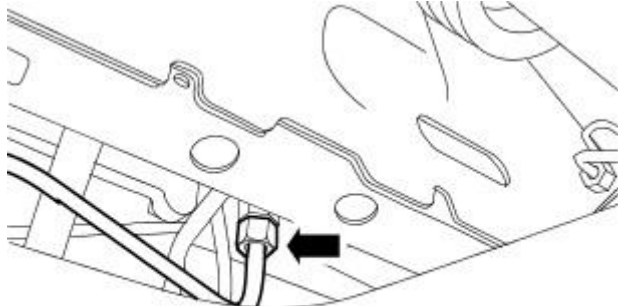
2. **NOTE:** Note the position of the timing mark on the secondary air injection (AIR) control valve to exhaust manifold left-hand tube. The timing mark indicates the correct end of the AIR control valve to exhaust manifold left-hand tube that should be connected to the AIR control valve to exhaust manifold right-hand tube.

Disconnect the secondary air injection (AIR) control valve to exhaust manifold left-hand tube.



E63553

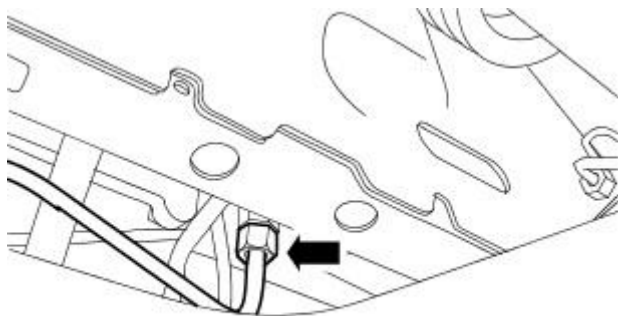
3. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
4. Remove the AIR control valve to exhaust manifold left-hand tube from the left-hand exhaust manifold.



E63171

## Installation

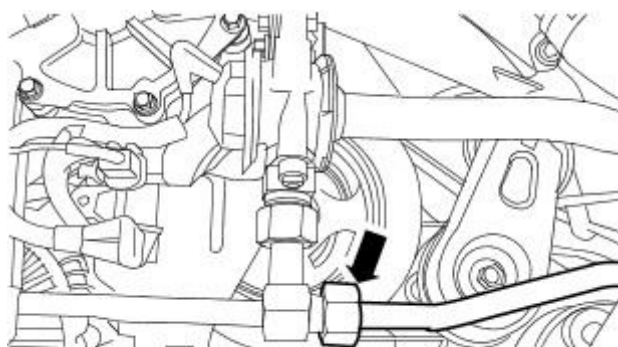
1. To install, reverse the removal procedure.
  - Tighten to 35 Nm.



E63171

2. **NOTE:** Make sure that the timing mark on the AIR control valve to exhaust manifold left-hand tube is correctly aligned.

Tighten to 35 Nm.



E63553

# Engine Emission Control - V6 3.0L Petrol - Secondary Air Injection (AIR) Control Valve to Exhaust Manifold Tube RH

Removal and Installation

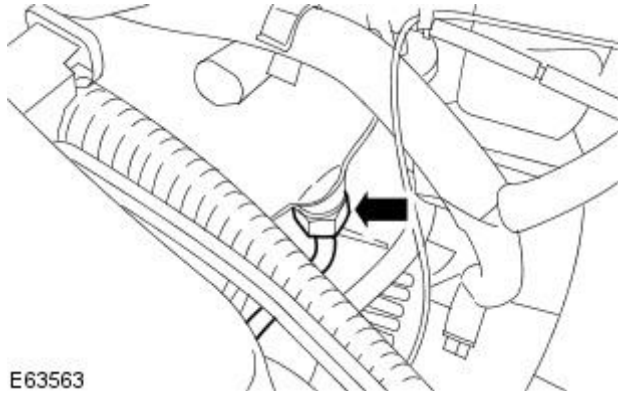
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

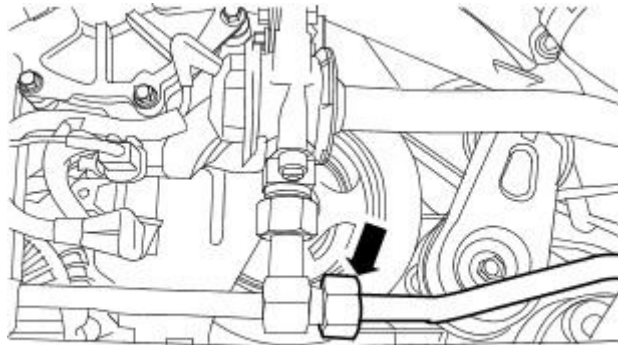
Raise and support the vehicle.

3. Remove the air cleaner outlet pipe.  
For additional information, refer to: [Air Cleaner Outlet Pipe](#) (303-12, Removal and Installation).
4. Disconnect the secondary air injection (AIR) control valve to exhaust manifold right-hand tube from the right-hand exhaust manifold.



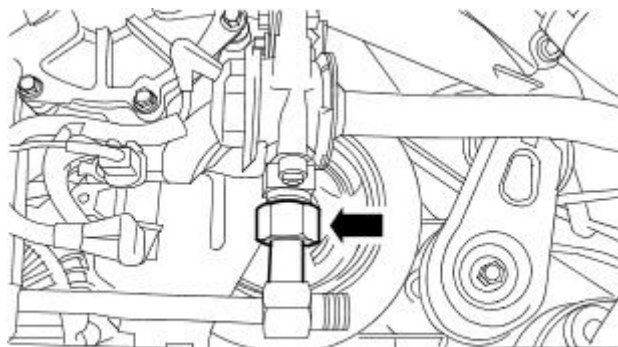
E63563

5. Disconnect the AIR control valve to exhaust manifold left-hand tube.



E63553

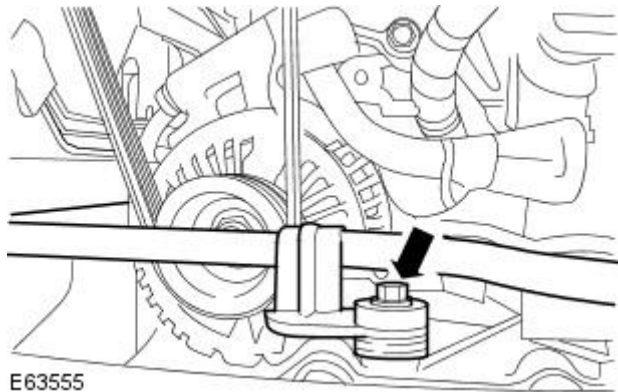
6. Disconnect the AIR control valve to exhaust manifold right-hand tube.



E63554

7. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02, Removal and Installation).

8. Remove the AIR control valve to exhaust manifold right-hand tube.

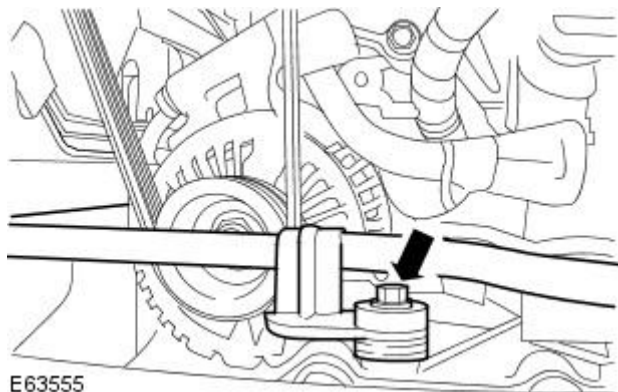


E63555

### Installation

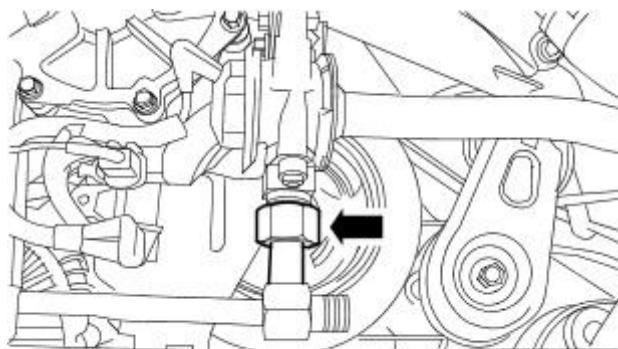
1. To install, reverse the removal procedure.

- Tighten to 8 Nm.



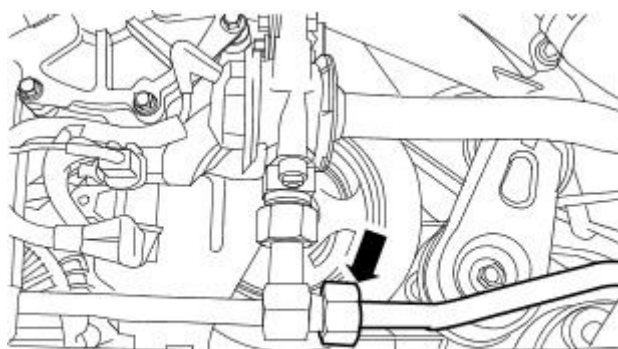
E63555

2. Tighten to 35 Nm.



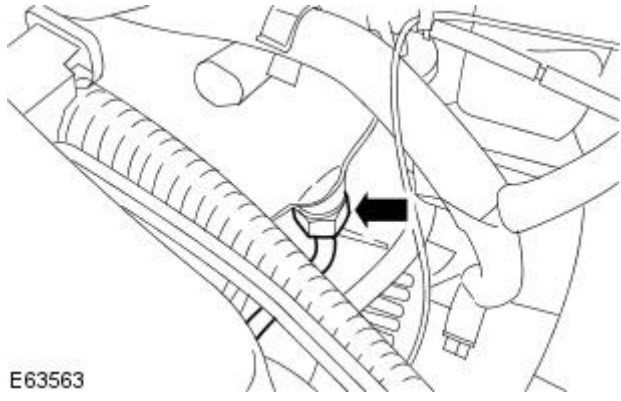
E63554

3. Tighten to 35 Nm.



E63553

4. Tighten to 35 Nm.




E63563



# Engine Emission Control - V6 3.0L Petrol - Secondary Air Injection (AIR) Pump

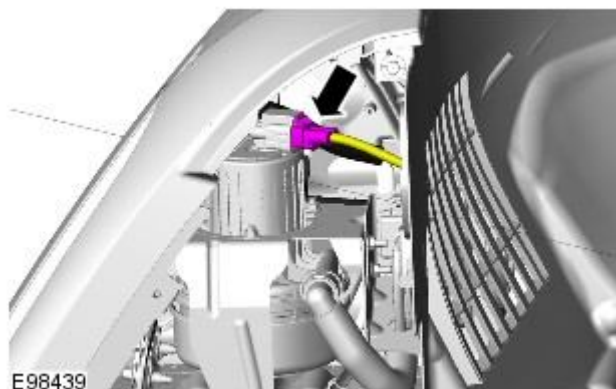
Removal and Installation

## Removal

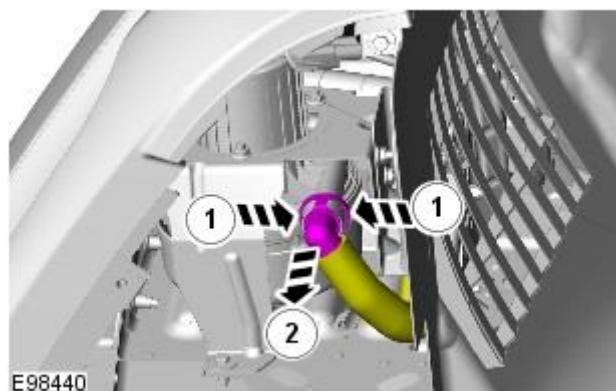
-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

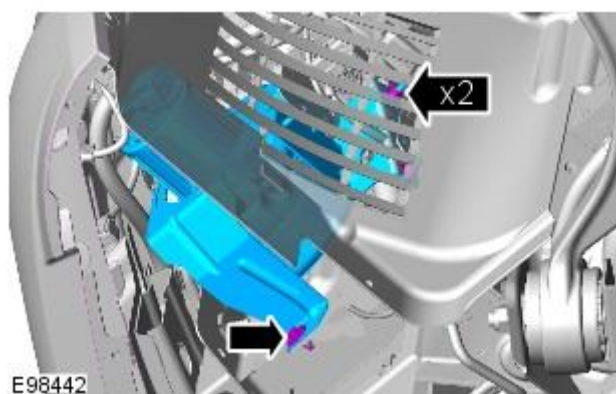
- Remove the radiator splash shield.  
For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).
- Disconnect the secondary air injection (AIR) pump electrical connector.



- Disconnect the AIR pump hose.



- Remove the AIR pump and bracket assembly.
  - Disconnect the vacuum hose.

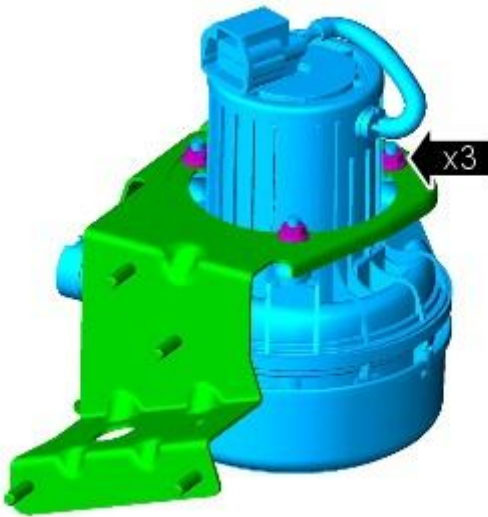




6. NOTE: Do not disassemble further if the component is removed for access only.

Remove the 3 nuts.

- Remove the AIR pump and bracket assembly.

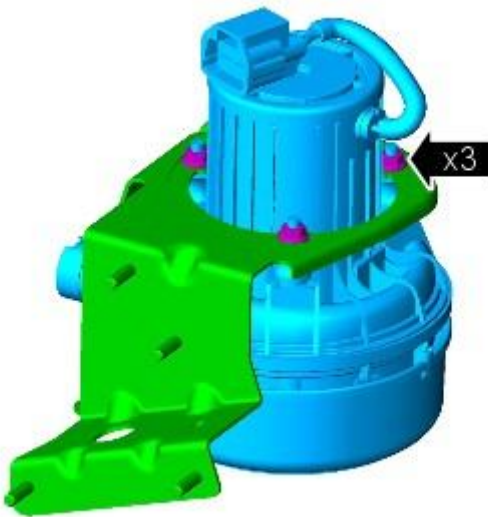


E98443

### Installation

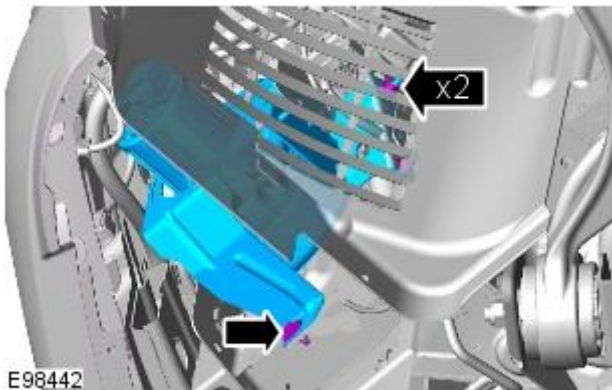
1. Install is the reverse of removal.

- Tighten to 8 Nm.



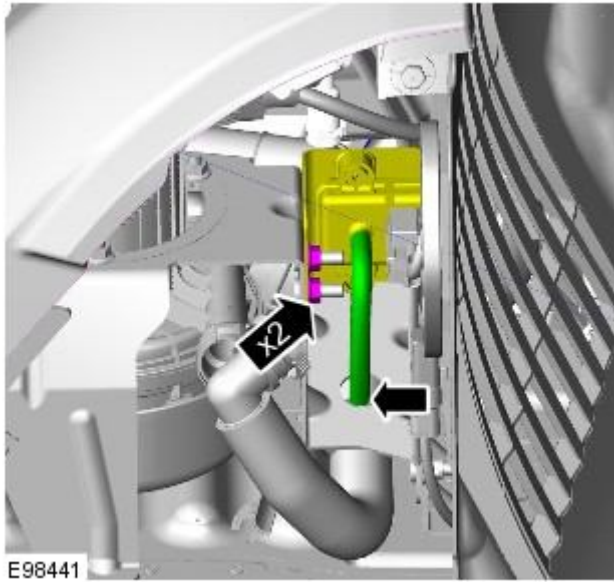
E98443

2. Tighten to 9 Nm.



E98442

3. Tighten to 8 Nm.



4. NOTE: For NAS vehicles only.

If required, carry out a short drive cycle.  
For additional information, refer to: Powertrain Control Module (PCM)  
Short Drive Cycle Self-Test (303-14C, General Procedures).

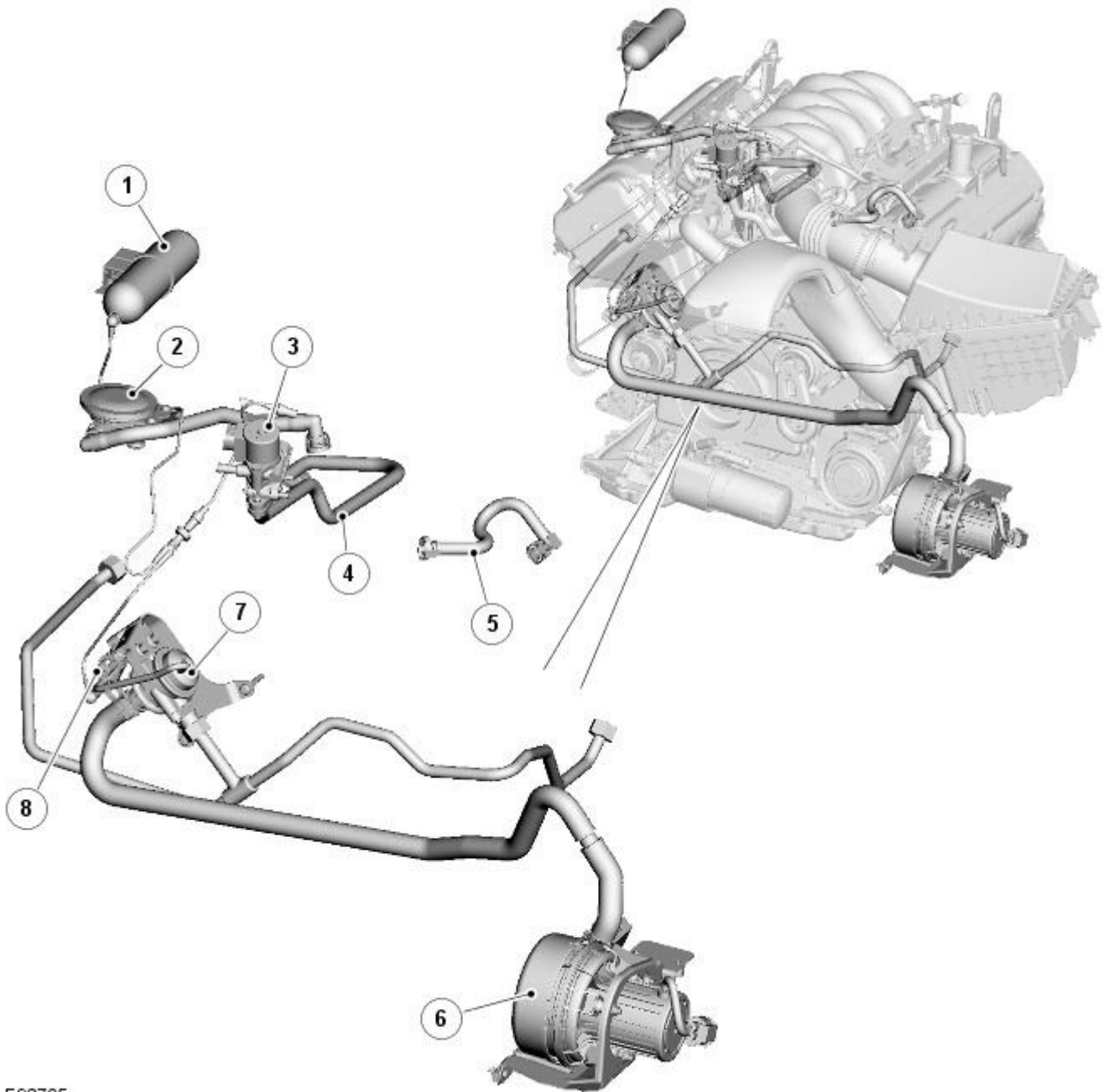
**Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 -**

<b>Description</b>	<b>Nm</b>	<b>lb-ft</b>	<b>lb-in</b>
Exhaust gas recirculation (EGR) valve to intake manifold retaining bolts	10	7	-
EGR valve tube to EGR valve retaining bolts	21	15	-
Exhaust manifold to EGR valve tube retaining nuts	21	15	-
Secondary air injection (AIR) control valve to exhaust manifold tube retaining nuts	35	26	-
AIR control valve to exhaust manifold tube to exhaust manifold adaptor	35	26	-
AIR control valve retaining bolts	25	18	-
AIR pump retaining nuts	9	-	80
AIR pump retaining bolt	9	-	80
AIR vacuum reservoir retaining bolts	5	-	44

# Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Engine Emission Control - Component Location

Description and Operation

NATURALLY ASPIRATED ENGINE

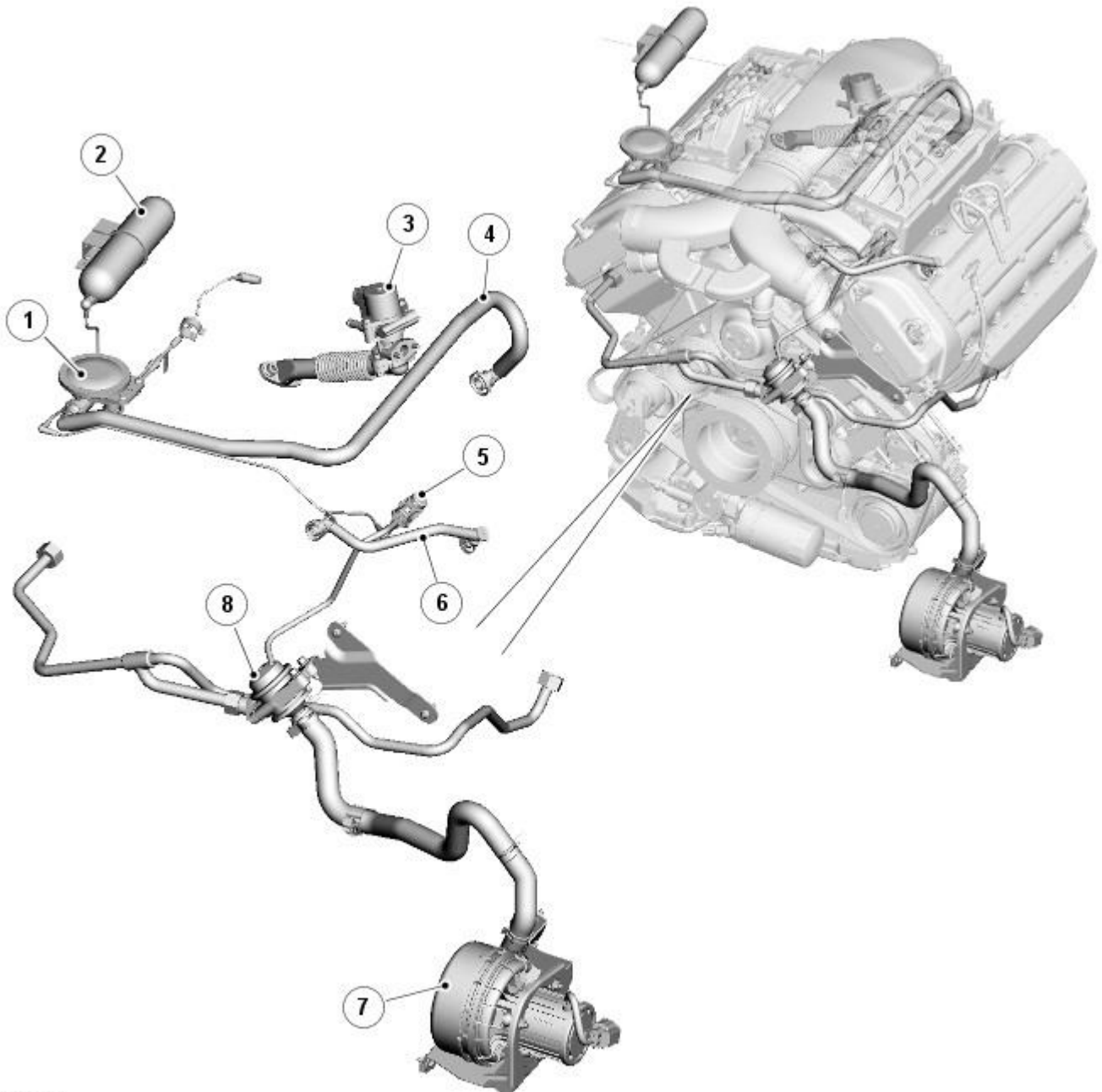


E93765

## ItemDescription

1	<a href="#">AIR (secondary air injection)</a> vacuum reservoir
2	<a href="#">PCV (positive crankcase ventilation)</a> valve
3	<a href="#">EGR (exhaust gas recirculation)</a> valve
4	Gas transfer pipe
5	Full load breather
6	<a href="#">AIR</a> pump
7	<a href="#">AIR</a> control valve
8	<a href="#">AIR</a> switching valve

SUPERCHARGED ENGINE



E95063

**ItemDescription**

1	<a href="#">PCV</a> valve
2	<a href="#">AIR</a> vacuum reservoir
3	<a href="#">EGR</a> valve
4	Gas transfer pipe
5	<a href="#">AIR</a> switching valve
6	Full load breather
7	<a href="#">AIR</a> pump
8	<a href="#">AIR</a> control valve

# Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Engine Emission Control - Overview

Description and Operation

## OVERVIEW

The engine emission control system on the 4.2L engines (Supercharged and NA) comprise:

- Crankcase ventilation system
- [AIR \(secondary air injection\)](#) system

The crankcase ventilation system consists of two hoses, connected between the left-hand valve cover and the intake manifold and the right-hand valve cover and the air cleaner outlet pipe and a [PCV \(positive crankcase ventilation\)](#) valve located on the top on the [LH \(left-hand\)](#) engine cam cover. The [PCV](#) system recycles crankcase gases back through the engine where they mix with incoming air/fuel charge and help to reduce hydrocarbon emissions.

The [AIR](#) system comprises the following components:

- [AIR](#) pump
- [AIR](#) switching valve
- [AIR](#) control valve
- [AIR](#) vacuum reservoir
- [AIR](#) pump relay
- [AIR](#) pressure sensor (North American specification vehicles only)



# Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Engine Emission Control - System Operation and Component Description

Description and Operation

## System Operation

### CRANKCASE VENTILATION

The engine is ventilated through a part load and a full load breather. The part load breather is a flexible composite hose connected between the [PCV \(positive crankcase ventilation\)](#) valve mounted above the oil separator in the [RH \(right-hand\)](#) bank camshaft cover and the induction elbow.

### SECONDARY AIR INJECTION

[AIR \(secondary air injection\)](#) is fitted to the vehicle to reduce exhaust emissions to meet European Union (EU) Stage 4 and Federal Petrol Emission standards. The [AIR](#) system comprises:

- [AIR](#) pump
- [AIR](#) valve
- Associated pipes
- [AIR](#) pressure sensor (NAS only)

The [AIR](#) pump is used to provide a supply of air into the exhaust manifolds during the cold start period of the engine. The [AIR](#) cycle lasts for up to 65 seconds. The hot unburnt fuel particles leaving the combustion chamber mix with the air injected into the exhaust manifolds and immediately combust.

This subsequent combustion of the unburnt and partially burnt [CO \(carbon monoxide\)](#) and [HC \(hydrocarbon\)](#) particles help to reduce the emission of these pollutants from the exhaust system. The additional heat generated in the exhaust manifold also provides rapid heating of the exhaust system catalytic converters. The additional oxygen which is delivered to the catalytic converters also generates an exothermic reaction which causes the catalytic converters to reach their optimum operating temperature and 'light off' quickly.

The catalytic converters only start to provide effective treatment of emission pollutants when they reach an operating temperature of approximately 250°C (482°F) and need to be between temperatures of 400°C (752°F) and 800°C (1472°F) for optimum efficiency. Consequently, the heat produced by the [AIR](#) 'afterburning' reduces the time delay before the catalysts reach an efficient operating temperature.

### EGR SYSTEM

The [EGR \(exhaust gas recirculation\)](#) system comprises of an [EGR](#) valve and exhaust manifold to [EGR](#) valve tube. The [EGR](#) system allows a measured quantity of exhaust gas to be directed back to the intake manifold. The exhaust gas is introduced to the incoming charge air in the intake manifold, where it mixes with the air/fuel mixture and lowers the peak gas temperature, reducing [NOX \(oxides of nitrogen\)](#) exhaust emissions. The gas is drawn through the exhaust manifold to [EGR](#) valve tube from the exhaust to the inlet manifold through the [EGR](#) valve. The [EGR](#) valve is electrically operated and is controlled through an input from the [ECM \(engine control module\)](#).

The [ECM](#) monitors the operation of the [EGR](#) system from inputs from the [MAP \(manifold absolute pressure\)](#) sensor and can detect high or low flow through the valve as a result of changes to the pressure readings.

High or low flow outside the expected range results in the setting of a [DTC \(diagnostic trouble code\)](#).

On vehicles without a supercharger the [MAP](#) sensor is mounted on the rear of intake manifold. On vehicles with a supercharger the [MAP](#) sensor is mounted on the rear of the throttle body elbow.)

## Component Description

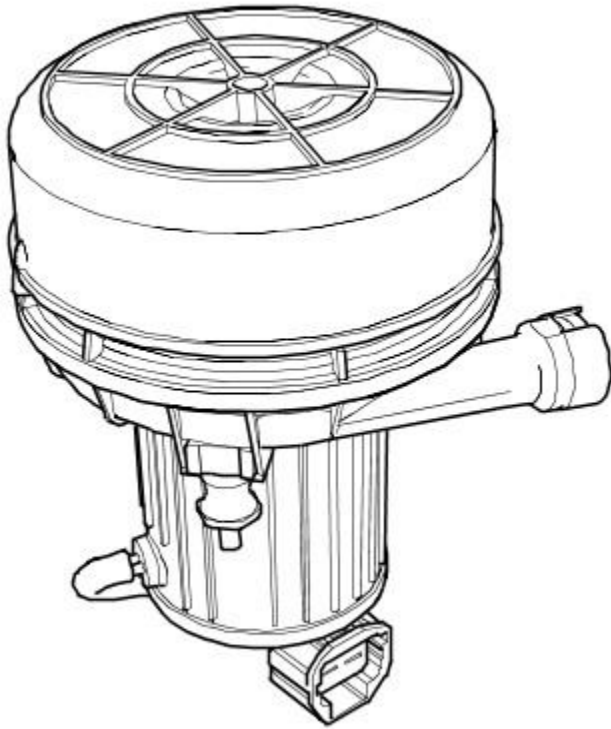
### POSITIVE CRANKCASE VENTILATION VALVE



E48519

The [PCV](#) valve is a spring loaded valve that opens when the engine is under full load. Once open the valve allows crankcase gasses to flow to the intake manifold. The [PCV](#) valve also prevents reverse flow into the crankcase.

### SECONDARY AIR INJECTION PUMP



E62274

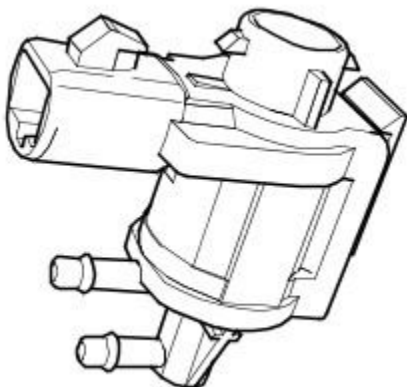
The [AIR](#) pump is fitted on rubber mountings to help prevent noise which is generated by [AIR](#) pump operation. The [AIR](#) pump is powered from the vehicle battery by a dedicated relay and supplies approximately 10 to 15 kg/hr (22 to 33 lb/hr) of air when the engine is at idle speed and the ambient temperature is below 20°C (68°F).

Air is drawn into the [AIR](#) pump through vents in its front cover and is then passed through a foam filter. The air is delivered to the exhaust manifold on each side of the engine through a combination of plastic pipes and stainless steel tubes.

One second after the [AIR](#) pump is energized, the [ECM](#) switches on the [AIR](#) switching valve, which opens to allow vacuum from the [AIR](#) vacuum reservoir to be applied to the vacuum operated [AIR](#) control valve. When the vacuum is applied to the [AIR](#) control valve, it opens to allow the air from the [AIR](#) pump through to the exhaust manifolds.

When the [ECM](#) switches off the [AIR](#) switching valve, the vacuum supply to the [AIR](#) control valve is cut-off and the valve closes to prevent further air being injected into the exhaust manifolds. With an approximate five second delay after as the [AIR](#) switching valve is closed, the [ECM](#) removes power from the [AIR](#) pump relay, and this in turn stops the [AIR](#) pump from operating.

## SECONDARY AIR INJECTION SWITCHING VALVE

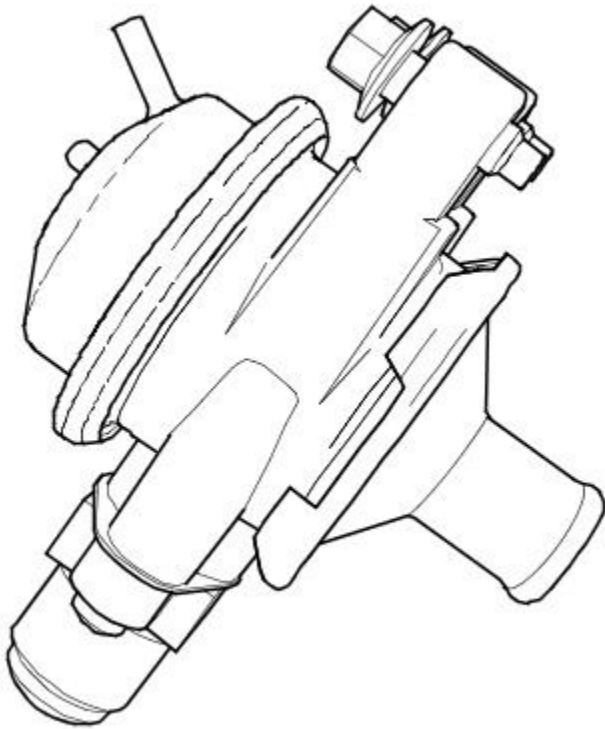


E62276

The [ECM](#) switches on the [AIR](#) switching valve with a one second delay after initiating [AIR](#) pump operation. When the [AIR](#) switching valve is open, a steady vacuum supply is allowed through to open the vacuum operated [AIR](#) control valve. When the [ECM](#) switches off the [AIR](#) switching valve, the valve closes and immediately shuts off the vacuum supply to the [AIR](#) control valve. The pump continues to operate for a further five seconds for system diagnostic purposes.

When the [AIR](#) switching valve is switched off, the vacuum supply line opens to atmosphere, and this causes the [AIR](#) switching valve to close automatically to prevent any further injection of air.

## SECONDARY AIR INJECTION CONTROL VALVE



E62275

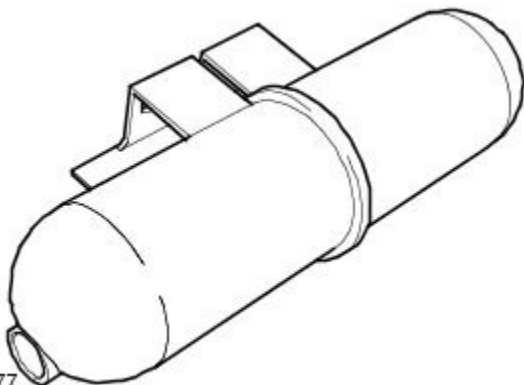
The injected air from the [AIR](#) pump is controlled by the [AIR](#) control valve. This allows the correct amount of air to be injected directly into the exhaust manifolds. The [AIR](#) control valve prevents exhaust gasses from blowing back into the [AIR](#) pump. Vacuum to the [AIR](#) switching valve is provided from the intake manifold vacuum by the [AIR](#) vacuum reservoir. A small bore vacuum hose provides the vacuum route between the [AIR](#) vacuum reservoir and [AIR](#) switching valve. A further small bore vacuum hose is used to connect the [AIR](#) switching valve to the [AIR](#) control valve.

The [AIR](#) control valve is assisted in operation by a vacuum source from the [AIR](#) vacuum reservoir located in the right-hand side of the engine bay. This assistance allows the actuation of the [AIR](#) control valve independently from the intake manifold vacuum levels available.

When the pressure in the exhaust system is higher than in the [AIR](#) system, the [AIR](#) control valve closes the circuit, and this protects the [AIR](#) system from exhaust gasses blowing back into the [AIR](#) system.

Vacuum to the [AIR](#) switching valve is provided from the intake manifold vacuum by the [AIR](#) vacuum reservoir. A small bore vacuum hose provides the vacuum route between the [AIR](#) vacuum reservoir and [AIR](#) switching valve. A further small bore vacuum hose is used to connect the [AIR](#) switching valve to the [AIR](#) control valve.

## SECONDARY AIR INJECTION RESERVOIR

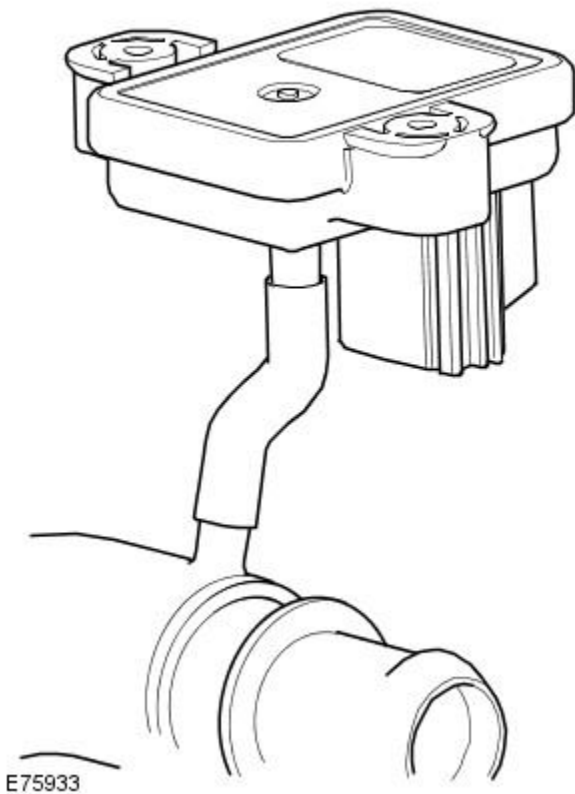


E62277

The [AIR](#) vacuum reservoir is included in the vacuum supply line between the intake manifold and the [AIR](#) switching valve. The [AIR](#) vacuum reservoir contains a one-way valve to stop vacuum leaking back towards the intake manifold side.

The [AIR](#) vacuum reservoir holds a constant vacuum so that the [AIR](#) control valve opens as soon as the [AIR](#) switching valve is switched on.

## SECONDARY AIR INJECTION PRESSURE SENSOR (NAS only)



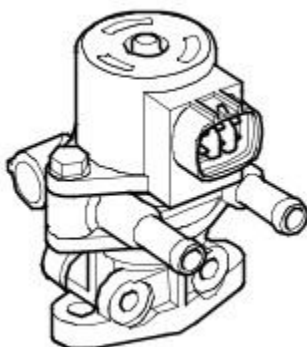
The [AIR](#) system is monitored by measuring the system pressure by using the [AIR](#) pressure sensor at several instances during its cycle of operation.

The [AIR](#) system pressure is measured before operation of the [AIR](#) pump. The [AIR](#) pump is then switched on and with a one second delay, the [AIR](#) switching valve is opened. After a stabilizing period, the system pressure is measured again, this time by taking the average of a one second duration of readings, and normalizing for variations in battery voltage and atmospheric pressure. If the system pressure measured at this time has not risen enough with respect to the initial [AIR](#) pressure reading then a failure will be flagged.

A second pressure measurement is made after the requirement for [AIR](#) into the exhaust system has expired, but continuing on from the same period of [AIR](#) pump operation, i.e. the pump is left running, against a closed [AIR](#) switching valve. Again this pressure measurement is the average of a one second duration of readings normalized for variations in battery voltage and atmospheric pressure. If the system pressure measured at this time has not risen enough or has risen too much with respect to the system pressure during normal operation of [AIR](#) then a failure will be flagged.

A final pressure reading is taken after the [AIR](#) system has been switched off to ensure the system shuts down.

## EGR VALVE



The [EGR](#) valve is a 4 pole 60 point stepper motor with an integral cooler unit which is mounted on the side of the induction elbow. The [EGR](#) valve receives four 12 Volt signals from the [ECM](#). The [EGR](#) valve is cooled by the return coolant flow from the electric throttle. The [EGR](#) valve is connected to the [LH \(left-hand\)](#) exhaust manifold via the gas transfer pipe.

# Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Engine Emission Control

Diagnosis and Testing

## Principle of Operation

For a detailed description of the Engine Emission Control system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (303-08 Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8)

[Engine Emission Control](#) (Description and Operation),  
[Engine Emission Control](#) (Description and Operation),  
[Engine Emission Control](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Engine breather hoses</li> <li>● Cyclone separator</li> <li>● Exhaust gas recirculation (EGR) pipes (check for cracks)</li> <li>● EGR valve</li> <li>● Secondary air injection (AIR) pump</li> <li>● Secondary air injection (AIR) valve</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Wiring harness</li> <li>● Loose or corroded electrical connectors</li> <li>● Sensor(s)</li> <li>● Stepper motor(s)</li> <li>● Secondary air injection (AIR) pump</li> <li>● Secondary air injection (AIR) valve</li> <li>● Engine control module (ECM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the customer concern and refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	<ul style="list-style-type: none"> <li>● Engine breather system disconnected/restricted</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed
Difficult to start cold	<ul style="list-style-type: none"> <li>● Exhaust gas recirculation (EGR) valve stuck open</li> </ul>	Check for related DTCs and refer to the relevant DTC Index
Engine stalls soon after start	<ul style="list-style-type: none"> <li>● Breather system disconnected/restricted</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed
Engine stops/stalls	<ul style="list-style-type: none"> <li>● EGR valve stuck open</li> </ul>	Check for related DTCs and refer to the relevant DTC Index
Poor idle quality	<ul style="list-style-type: none"> <li>● EGR valve stuck open</li> </ul>	Check for related DTCs and refer to the relevant DTC Index
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> <li>● EGR valve stuck open</li> </ul>	Check for related DTCs and refer to the relevant DTC Index
Poor throttle response	<ul style="list-style-type: none"> <li>● Breather system disconnected/restricted</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed
Excessive fuel consumption, black smoke, emissions	<ul style="list-style-type: none"> <li>● EGR valve stuck open</li> <li>● EGR system not operating</li> <li>● Engine breather system restricted</li> </ul>	Check for related DTCs and refer to the relevant DTC Index. Ensure the engine breather system is free from restriction and is correctly installed
Loud 'ticking' noise with engine running	<ul style="list-style-type: none"> <li>● EGR pipes cracked</li> </ul>	Inspect the EGR pipes, paying particular attention to the ribbed sections. Replace as required
Engine oil leaks	<ul style="list-style-type: none"> <li>● Engine breather system restricted</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after the pinpoint tests have been carried out, the fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Causes	Action
P040100	Exhaust Gas Recirculation Flow Insufficient Detected	<ul style="list-style-type: none"> <li>EGR valve/pipe incorrectly installed or loose</li> <li>EGR pipe blocked</li> <li>EGR valve stuck closed, blocked</li> <li>EGR valve failure</li> </ul>	Check for correct installation of the EGR valve and pipe. Check for blockage in EGR valve and pipe. Check for stuck EGR valve. Check and install a new EGR valve as required
P041100	Secondary Air Injection Incorrect Upstream Flow Detected	<ul style="list-style-type: none"> <li>Low airflow being delivered from secondary air injection (AIR) pump</li> </ul>	Check AIR pump, vacuum solenoid and AIR control valve hardware. Refer to the electrical circuit diagrams and check AIR pump and vacuum solenoid power supply circuits. Check stuck/partially stuck vacuum solenoid. Check for loose/split vacuum pipe from solenoid to AIR control valve. Check for loose/split AIR pump outlet pipe
P041300	Secondary Air Injection Switching Valve A Circuit Open	<ul style="list-style-type: none"> <li>AIR vacuum solenoid control circuit high</li> </ul>	Refer to the electrical circuit diagrams and check AIR vacuum solenoid control circuit for short to power
P041400	Secondary Air Injection Switching Valve A Circuit Shorted	<ul style="list-style-type: none"> <li>AIR vacuum solenoid control circuit low</li> </ul>	Refer to the electrical circuit diagrams and check AIR vacuum solenoid control circuit for short to ground, high resistance
P048900	Exhaust Gas Recirculation Control Circuit Low	<ul style="list-style-type: none"> <li>EGR valve power supply circuit - short to ground, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EGR valve power supply circuit for short to ground, high resistance
P049000	Exhaust Gas Recirculation Control Circuit High	<ul style="list-style-type: none"> <li>EGR valve control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EGR valve control circuit for short to power
P049100	Secondary Air Injection System Insufficient Flow (Bank 1)	<ul style="list-style-type: none"> <li>Low airflow being delivered to secondary air injection (AIR) system (Bank 1)</li> </ul>	Check (Bank 1) AIR system pipe for blockage. Check for loose/split AIR pump outlet pipe
P049200	Secondary Air Injection System Insufficient Flow (Bank 2)	<ul style="list-style-type: none"> <li>Low airflow being delivered to secondary air injection (AIR) system (Bank 2)</li> </ul>	Check (Bank 2) AIR system pipe for blockage. Check for loose/split AIR pump outlet pipe
P243100	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Range/Performance Bank 1	<ul style="list-style-type: none"> <li>Secondary air injection system leaks</li> <li>Secondary air injection pump</li> <li>Secondary air injection valve</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check secondary air injection system circuits for short, open circuit. Check the integrity of the secondary air injection system
P243200	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Low Bank 1	<ul style="list-style-type: none"> <li>Secondary air injection manifold absolute pressure sensor circuit - short to ground, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check secondary air injection manifold absolute pressure sensor circuit for short to ground, high resistance
P243300	Secondary Air Injection System Air Flow/Pressure Sensor Circuit High Bank 1	<ul style="list-style-type: none"> <li>Secondary air injection manifold pressure (MAP) sensor circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check secondary air injection manifold pressure (MAP) sensor circuit for short to power



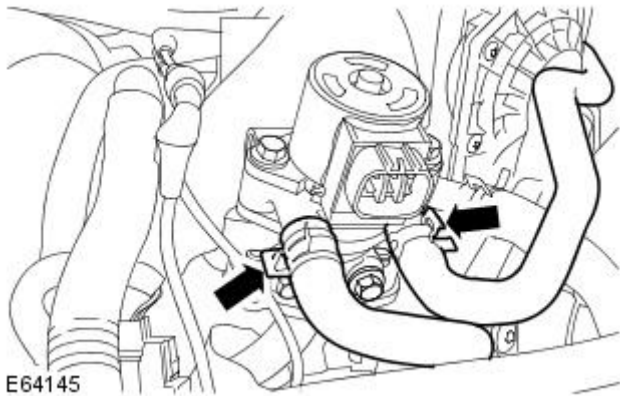
DTC	Description	Possible Causes	Action
P244400	Secondary Air Injection System Pump Stuck On Bank 1	<ul style="list-style-type: none"> <li>● Secondary air injection pump control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check secondary air injection pump control circuit for short to ground
P244500	Secondary Air Injection System Pump Stuck Off Bank 1	<ul style="list-style-type: none"> <li>● Secondary air injection pump control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check secondary air injection pump control circuit for short to power


# Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Exhaust Gas Recirculation (EGR) Valve


4.2L NA V8 - AJV8  
Removal and Installation

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the engine cover.  
For additional information, refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Disconnect the EGR valve electrical connector.

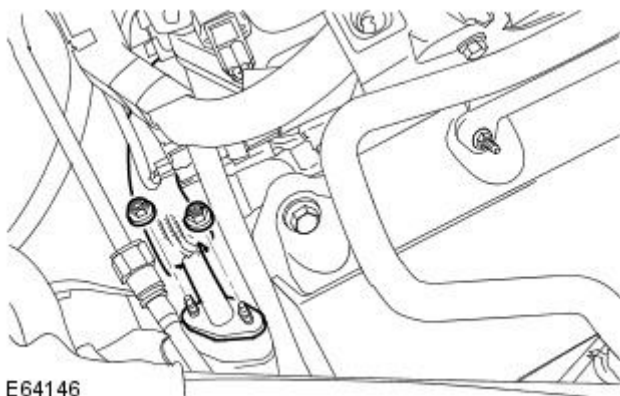


4.  **WARNING:** Since injury such as scalding could be caused by escaping steam or coolant, allow the vehicle cooling system to cool prior to carrying out this procedure.

 **CAUTION:** Always plug any open connections to prevent contamination.

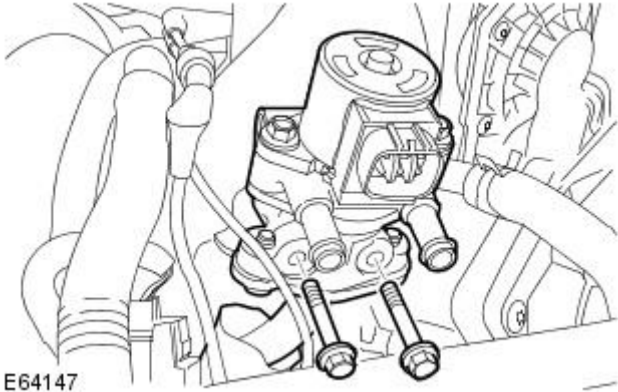
Disconnect the 2 EGR valve coolant hoses.

- Clamp the EGR coolant hoses to minimize coolant loss.
- Release the 2 clips.



5. Release the EGR valve to exhaust manifold pipe.

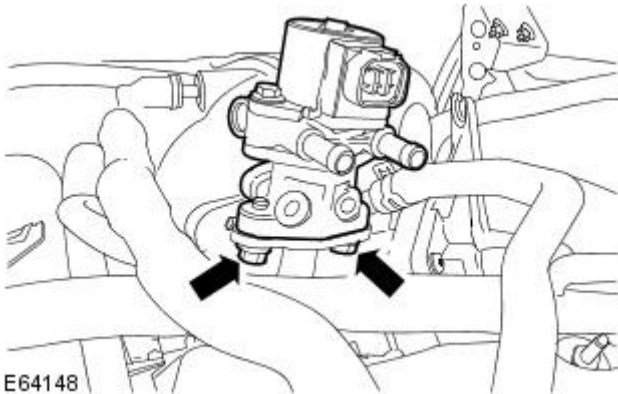
- Remove the 2 nuts.
- Remove and discard the gasket.



E64147

6. Release the EGR valve from the throttle body elbow.

- Remove the 2 bolts.
- Remove and discard the gasket.



E64148

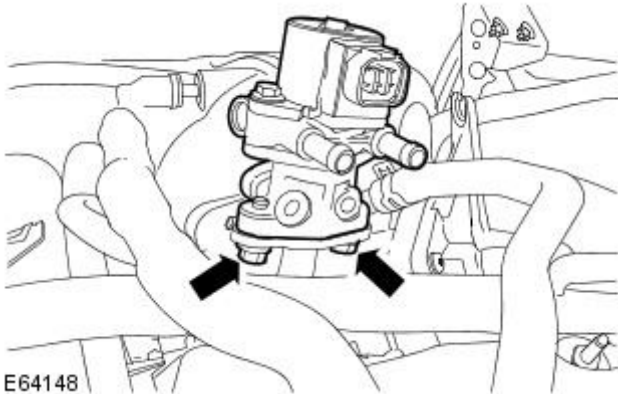
7. Remove the EGR valve.

- Remove the 2 bolts.
- Remove and discard the gasket.

### Installation

1. Attach the EGR valve to the EGR valve pipe.

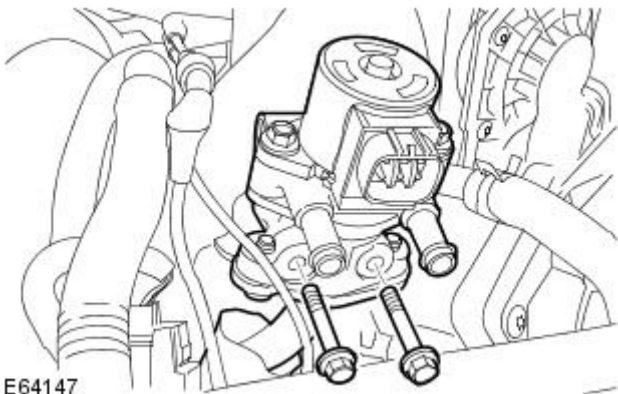
- Clean the component mating faces.
- Install a new gasket.
- Tighten the bolts to 21 Nm (15 lb.ft).



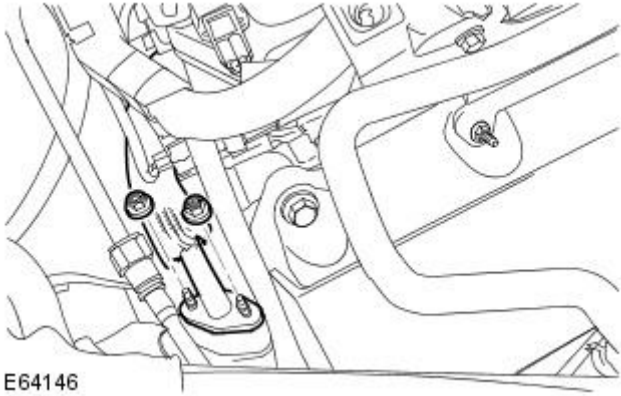
E64148

2. Attach the EGR valve to the throttle body elbow.

- Clean the component mating faces.
- Install a new gasket.
- Tighten the bolts to 10 Nm (7 lb.ft).



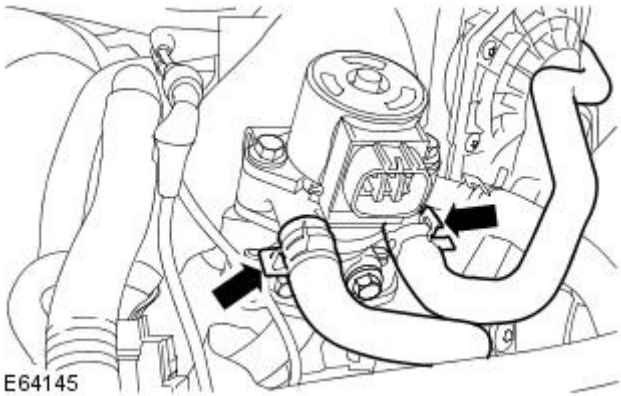
E64147



E64146

3. Attach the EGR valve to exhaust manifold pipe.

- Clean the component mating faces.
- Install a new gasket.
- Tighten the nuts to 25 Nm (18 lb.ft).



E64145

4. Connect the coolant hoses.

- Secure with the clips.



E64144

5. Connect the electrical connector.

6. Install the engine cover.

For additional information, refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

7. Connect the battery ground cable and install the cover.

For additional information, refer to: Specifications (414-01 Battery, Mounting and Cables, Specifications).

8. Check and top-up the coolant.

9. **NOTE:** For NAS vehicles only.

If required, carry out a long drive cycle.


For additional information, refer to: Powertrain Control Module (PCM) Long Drive Cycle Self-Test (303-14C, General Procedures).

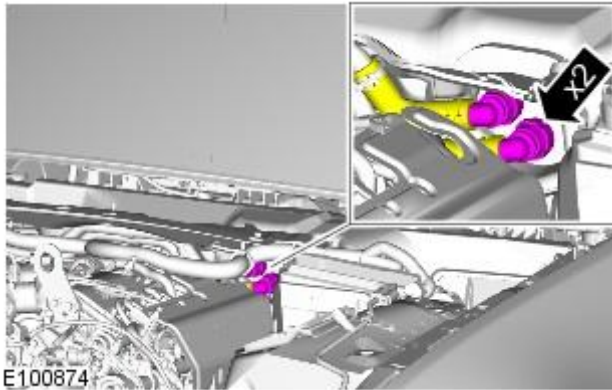
# Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Exhaust Gas Recirculation (EGR) Valve


4.2L SC V8 - AJV8  
Removal and Installation

## Removal

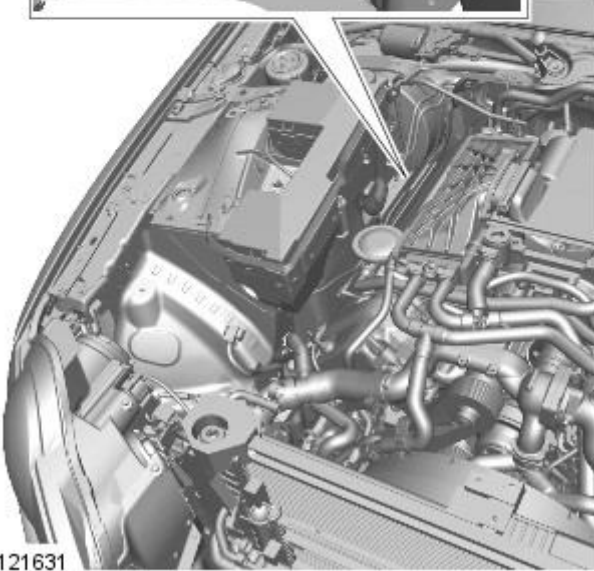
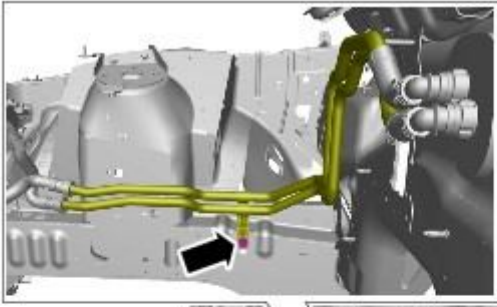
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  WARNING: Make sure to support the vehicle with axle stands.  
  
Raise and support the vehicle.
3. Refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, General Procedures).
4. Refer to: [Secondary Bulkhead Panel RH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).
5. Refer to: [Throttle Body](#) (303-04B Fuel Charging and Controls - 4.2L SC V8 - AJV8, Removal and Installation).



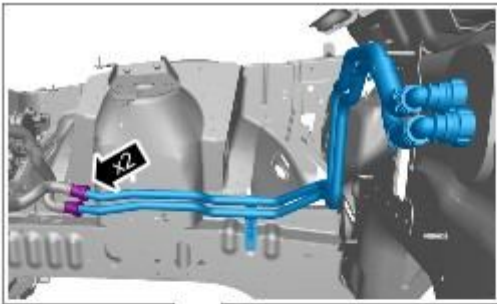
6.  CAUTION: Be prepared to collect escaping coolant.

7.



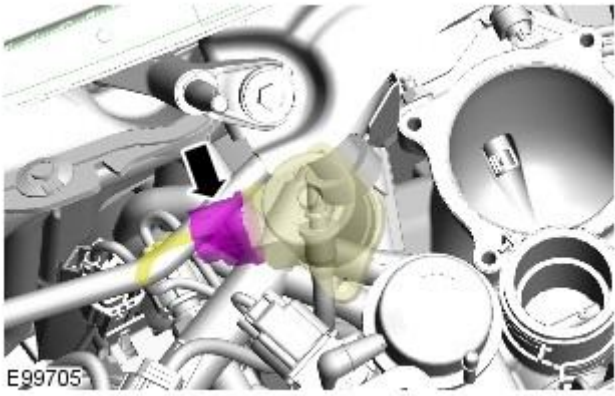
E121631

8.  CAUTION: Be prepared to collect escaping coolant.

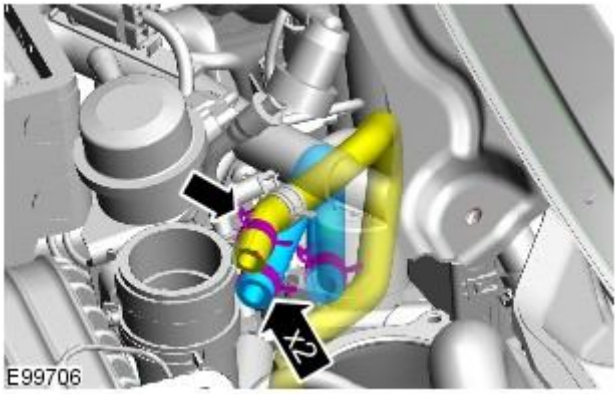


E121630

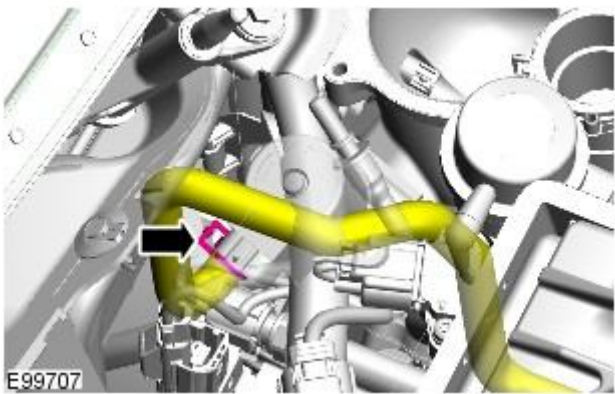




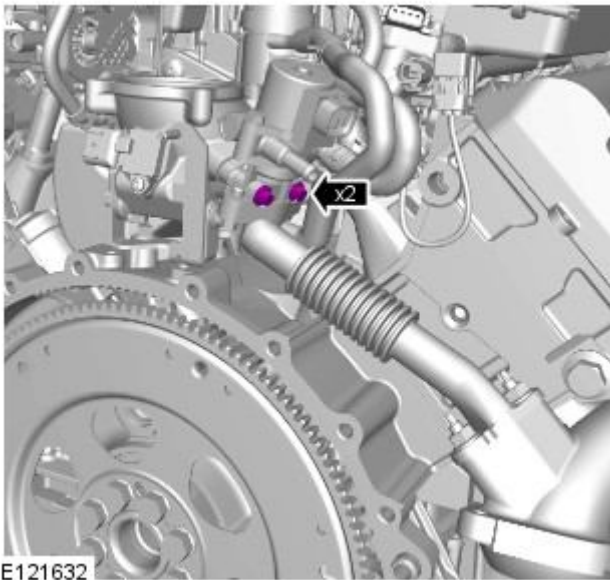
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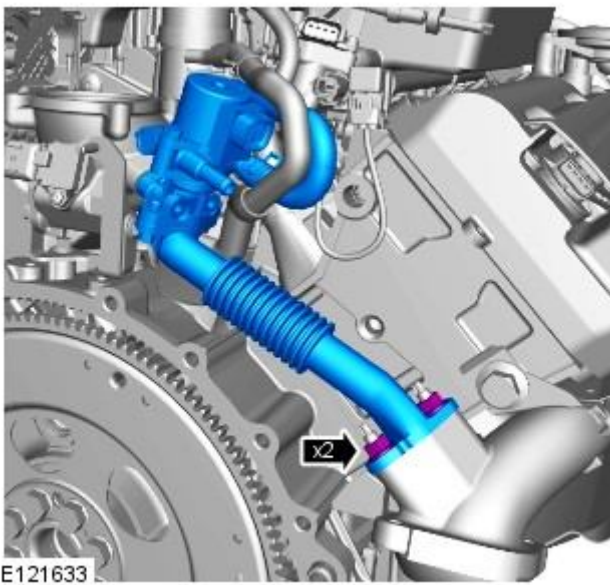
10.




11.




12. **12.**  CAUTION: Discard the bolts.
- NOTE: Discard the gasket.
- Torque: 10 Nm



13. **13.**  CAUTION: Discard the nuts.
- NOTE: Discard the gasket.
- Torque: 21 Nm



14. **14.**  CAUTION: Discard the bolts.
- NOTE: Discard the gasket.
- Torque: 21 Nm

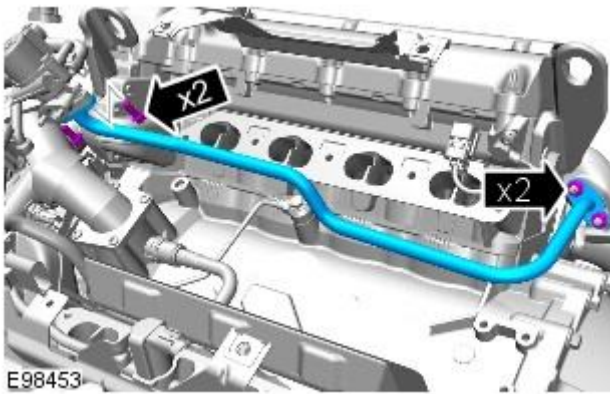
## Installation

1. To install, reverse the removal procedure.
2. **2.** NOTE: For NAS vehicles only.

# Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Exhaust Manifold to Exhaust Gas Recirculation (EGR) Valve Tube 4.2L NA V8 - AJV8 Removal and Installation

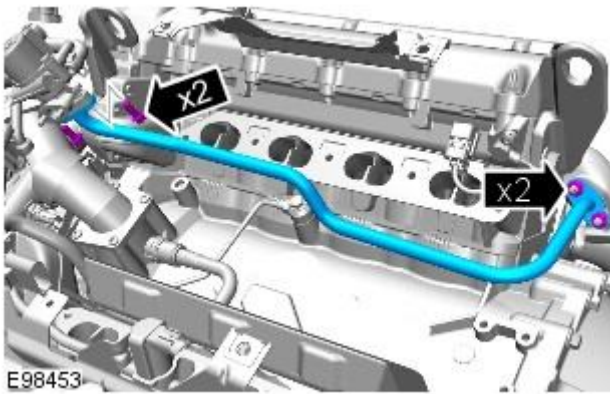
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the engine cover.  
For additional information, refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Remove the intake manifold.  
For additional information, refer to: [Intake Manifold](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).
4. Remove the exhaust gas recirculation (EGR) valve inlet tube.
  - Remove and discard the gasket.



## Installation

1. To install, reverse the removal procedure.
2. Tighten to 21 Nm.
  - Install a new gasket.



# Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Exhaust Manifold to Exhaust Gas Recirculation (EGR) Valve Tube 4.2L SC V8 - AJV8

Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Exhaust Gas Recirculation \(EGR\) Valve - 4.2L SC V8 - AJV8](#) (303-08 Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

3.  CAUTION: Discard the bolts.

- NOTE: Discard the gasket.

Torque: 21 Nm



E121635

## Installation

1. To install, reverse the removal procedure.

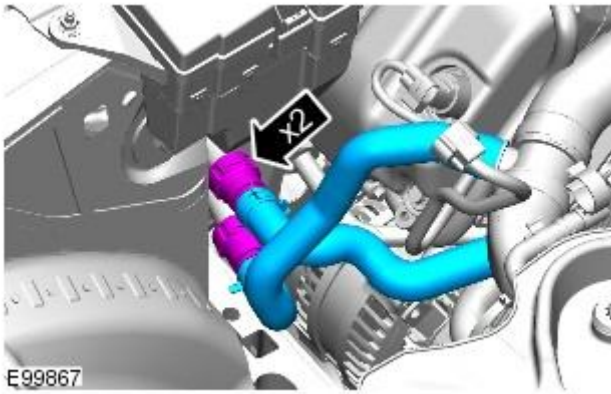
# Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Secondary Air Injection (AIR) Control Valve to Exhaust Manifold Tube

Removal and Installation

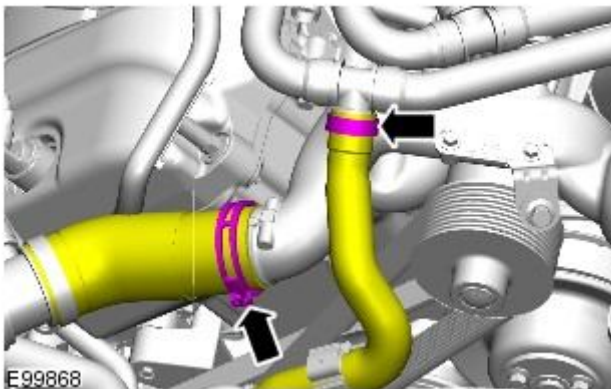
## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Secondary Air Injection \(AIR\) Control Valve - 4.2L SC V8 - AJV8](#) (303-08 Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
3. Refer to: Air Deflector (501-02, Removal and Installation).
4. Refer to: Air Cleaner RH (303-12, Removal and Installation).
5. Refer to: Air Cleaner LH (303-12, Removal and Installation).



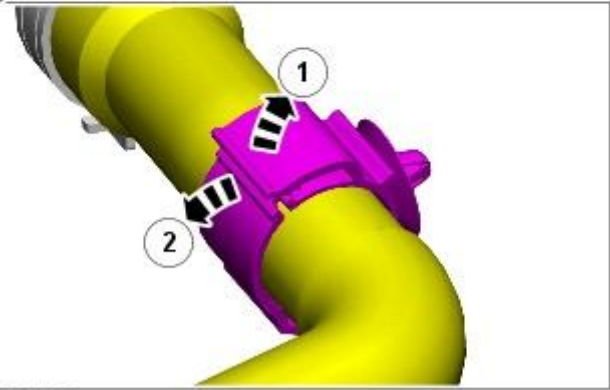
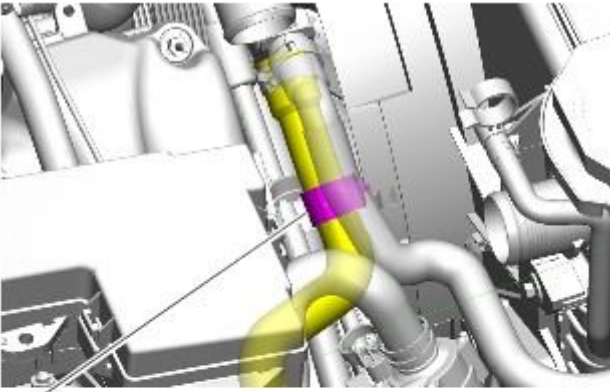
6.



7.



8.



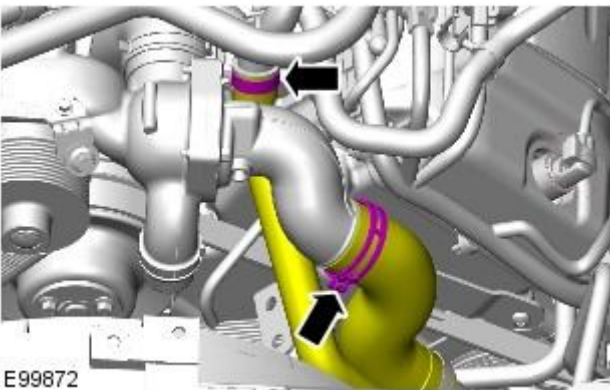
E99869

9. Torque: 8 Nm




E99871

10.

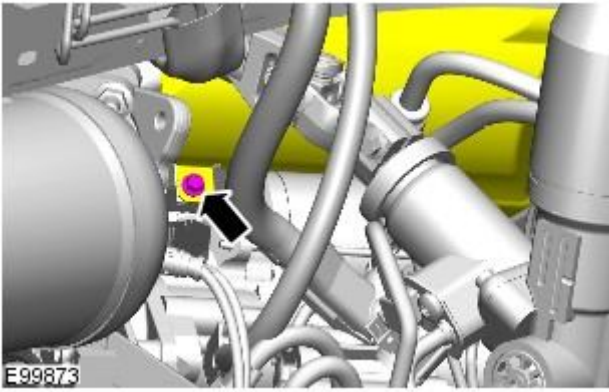


E99872

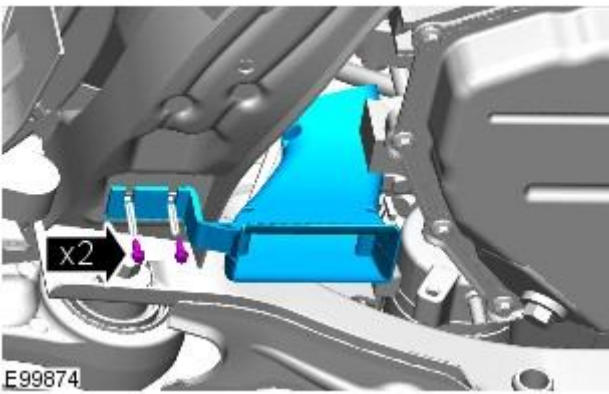
11. **11.**  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

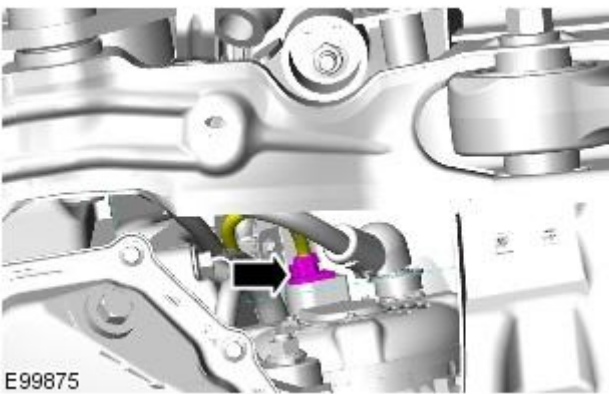




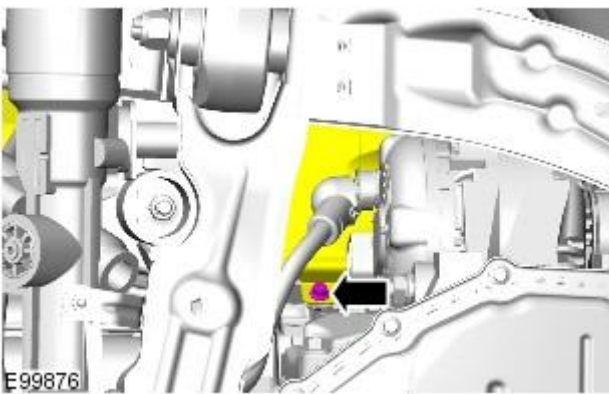
12. Torque: 8 Nm



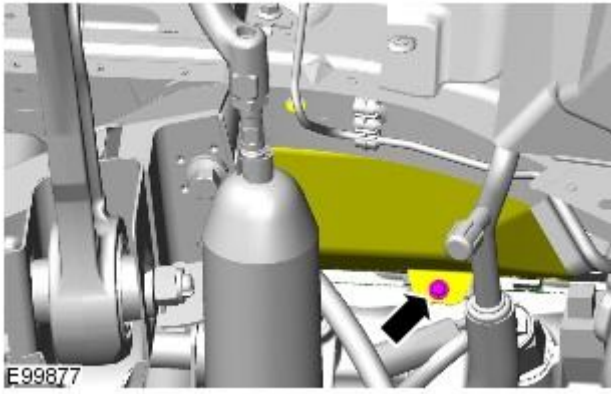
13. Torque: 8 Nm



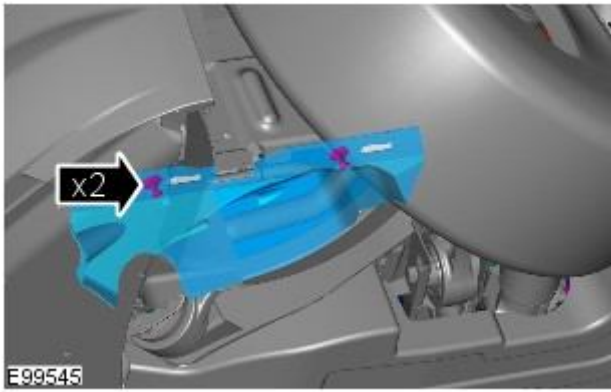
14.



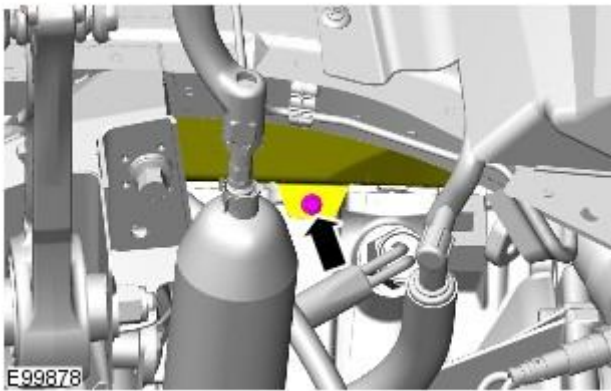
15. Torque: 8 Nm



16. Torque: 8 Nm

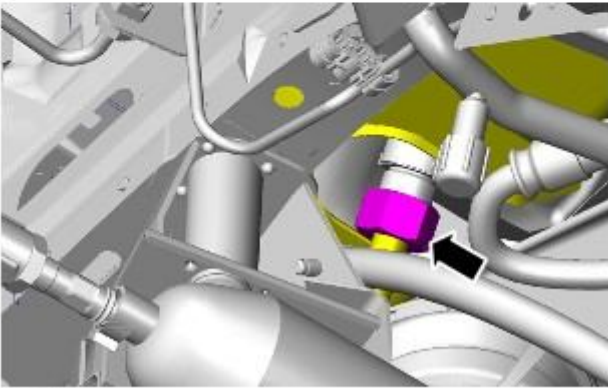
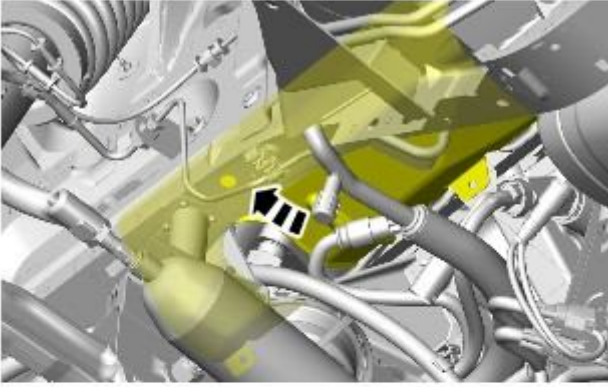


17.



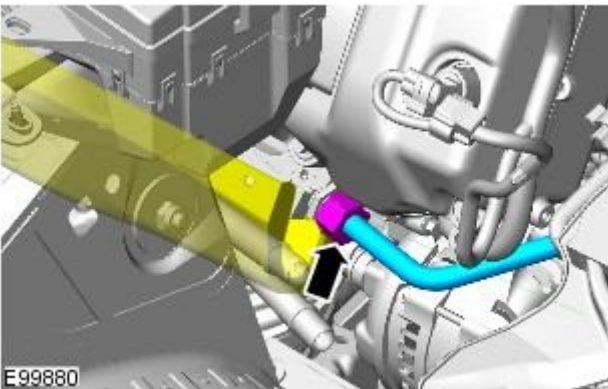
18. Torque: 8 Nm

19. Torque: 35 Nm



E99879

20. Torque: 35 Nm



E99880

## Installation

1. To install, reverse the removal procedure.

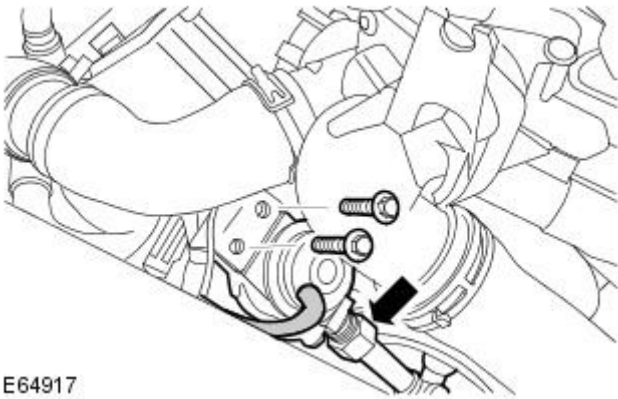
# Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Secondary Air Injection (AIR) Control Valve

## 4.2L NA V8 - AJV8

Removal and Installation

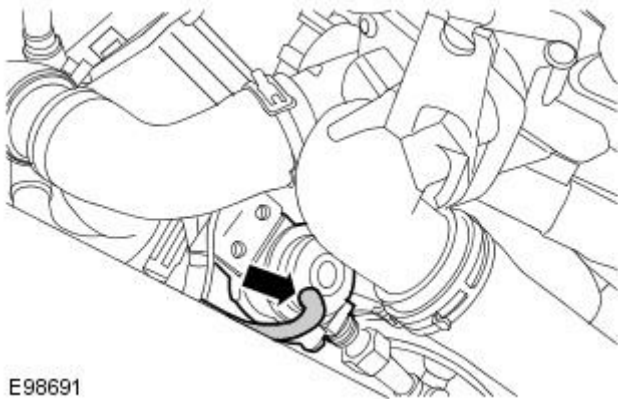
### Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the engine cover.  
For additional information, refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Release the AIR tube from the AIR control valve.
  - Remove the 2 bolts.



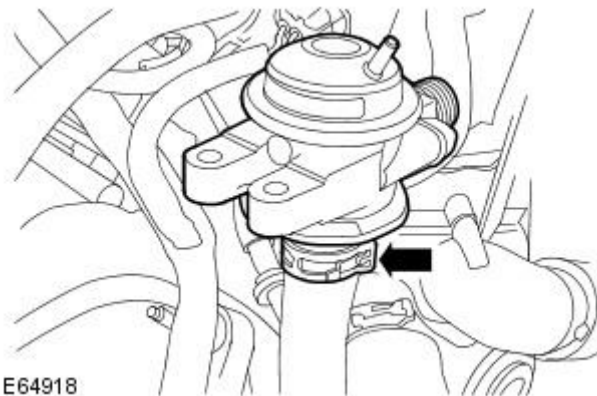
E64917

4. Release the AIR control valve.
  - Disconnect the vacuum hose.



E98691

5. Remove the AIR control valve.
  - Release the clip and disconnect the hose.



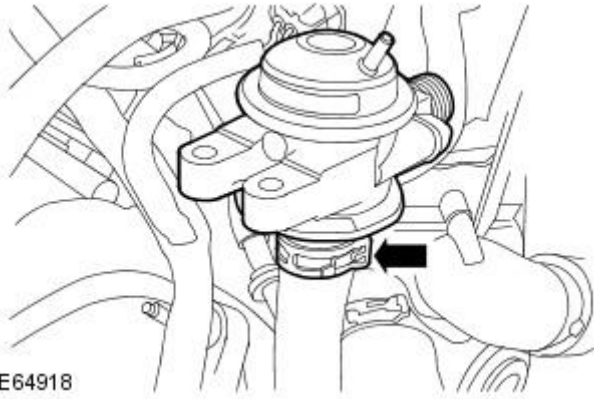
E64918

### Installation

1. Install is the reverse of removal.

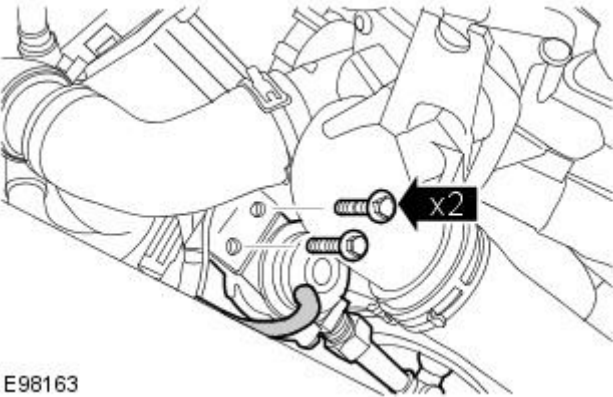
2. Attach the AIR control valve hose.

- Secure with the clip.



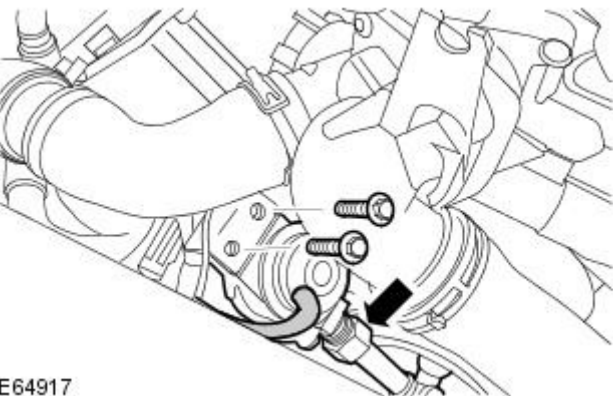
E64918

3. Tighten to 25 Nm



E98163

4. Tighten to 35 Nm.



E64917

5. NOTE: For NAS vehicles only.

If required, carry out a short drive cycle.  
For additional information, refer to: Powertrain Control Module (PCM) Short Drive Cycle Self-Test (303-14C, General Procedures).




# Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Secondary Air Injection (AIR) Control Valve

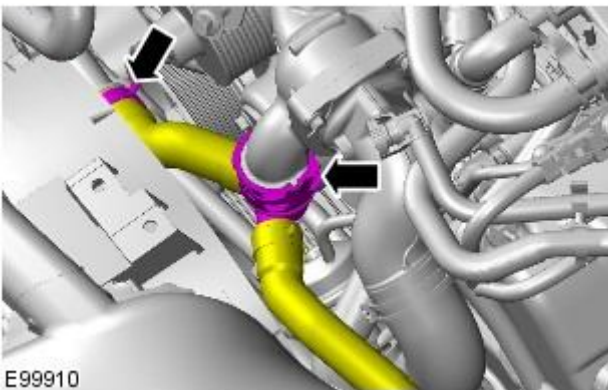
4.2L SC V8 - AJV8  
Removal and Installation

## Removal

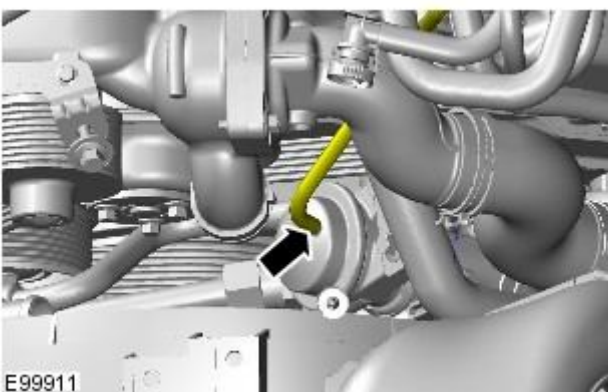
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Make sure to support the vehicle with axle stands.  
  
Raise and support the vehicle.
3. Refer to: Air Cleaner Outlet Pipe (303-12, Removal and Installation).
4. Refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, General Procedures).

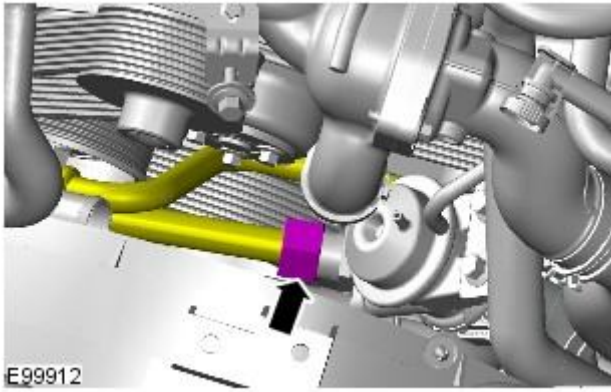
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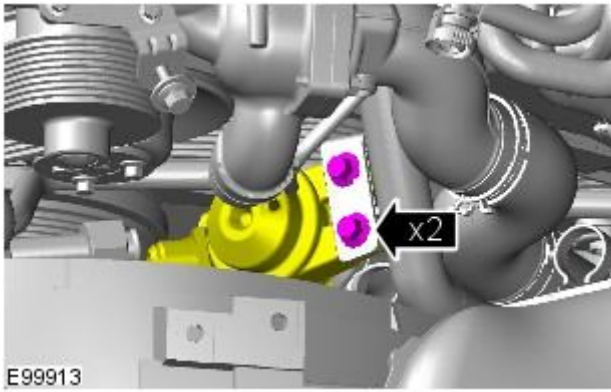
6.



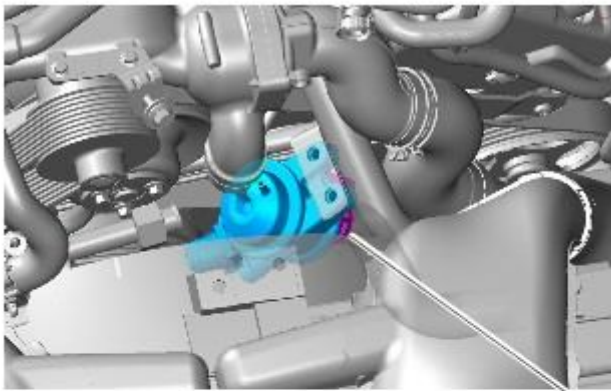




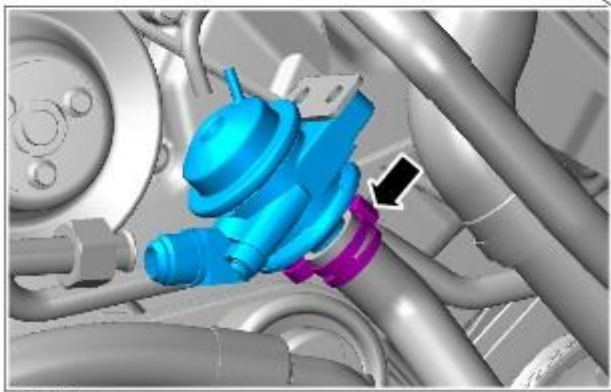
7. Torque: 35 Nm



8. Torque: 25 Nm



9.




## Installation

1. To install, reverse the removal procedure.

# Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Secondary Air Injection (AIR) Pump

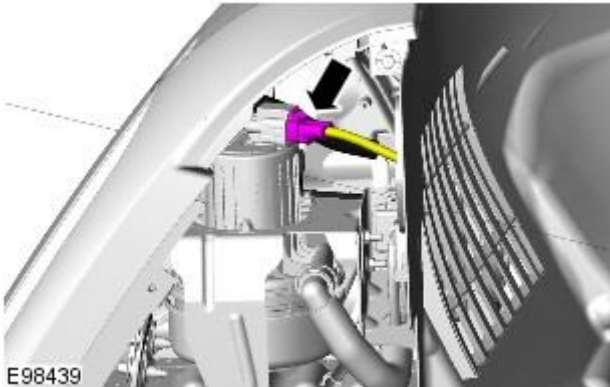
Removal and Installation

## Removal

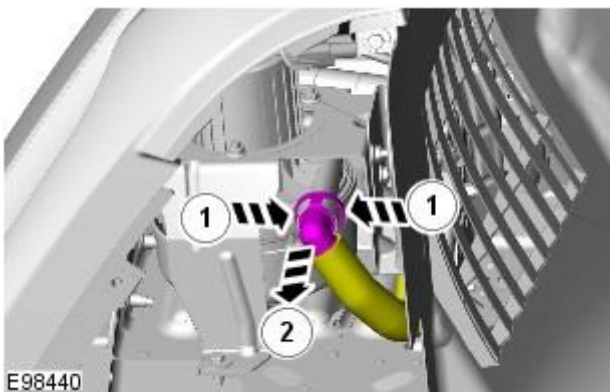
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the radiator splash shield.  
For additional information, refer to: [Radiator Splash Shield \(501-02 Front End Body Panels, Removal and Installation\)](#).
3. Disconnect the secondary air injection (AIR) pump electrical connector.

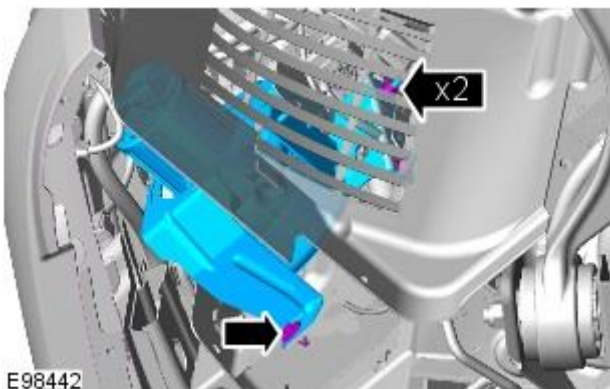


4. Disconnect the AIR pump hose.



5. Remove the AIR pump and bracket assembly.

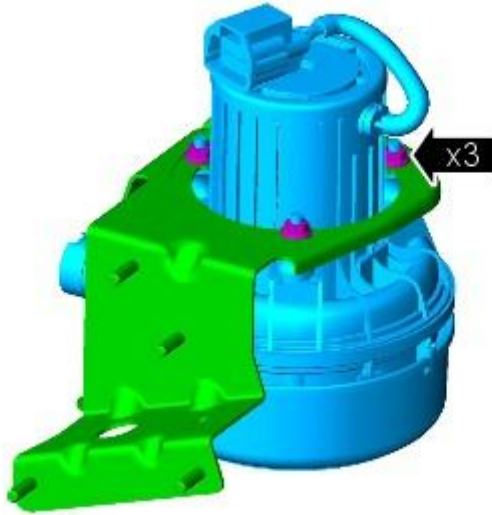
- Disconnect the vacuum hose.



6. NOTE: Do not disassemble further if the component is removed for access only.

Remove the 3 nuts.

- Tighten to 8 Nm.

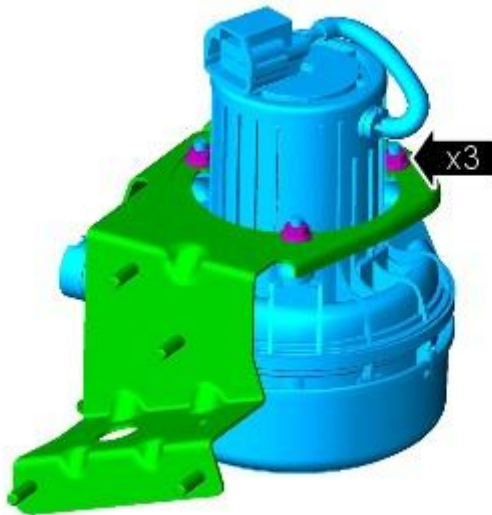


E98443

### Installation

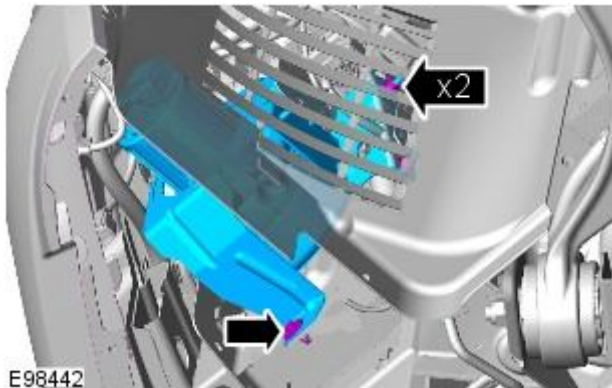
1. Install is the reverse of removal.

- Tighten to 8 Nm.



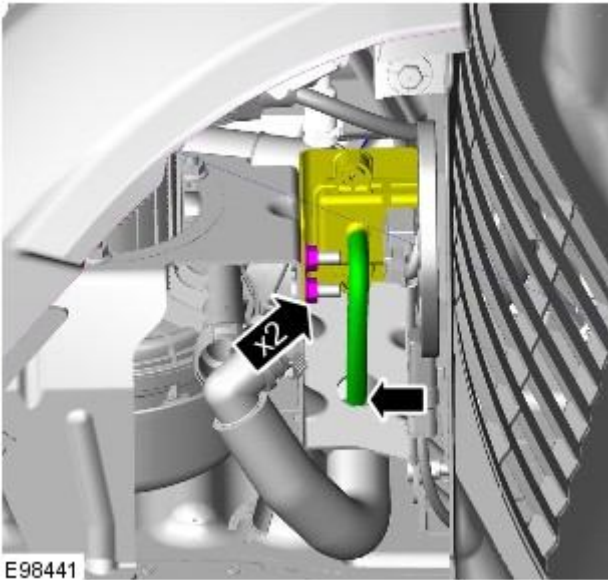
E98443

2. Tighten to 9 Nm.



E98442

3. Tighten to 8 Nm.



4. NOTE: For NAS vehicles only.

If required, carry out a short drive cycle.  
For additional information, refer to: Powertrain Control Module (PCM) Short Drive Cycle Self-Test (303-14C, General Procedures).

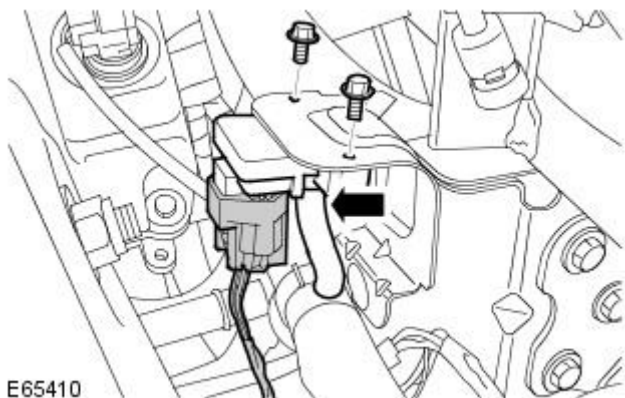
# Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Secondary Air Injection Manifold Absolute Pressure Sensor

Removal and Installation

## Removal

1. Remove the secondary air injection manifold absolute pressure sensor.

- Disconnect the electrical connector.
- Remove the 2 screws.
- Disconnect the hose.

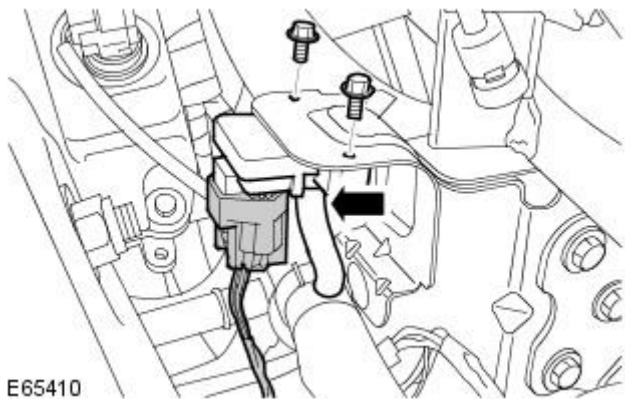


E65410

## Installation

1. To install, reverse the removal procedure.

- Tighten to 5 Nm.



E65410

2. **NOTE:** For NAS vehicles only.

If required, carry out a short drive cycle.  
For additional information, refer to: Powertrain Control Module (PCM) Short Drive Cycle Self-Test (303-14C, General Procedures).

# Intake Air Distribution and Filtering - TDV6 2.7L Diesel -

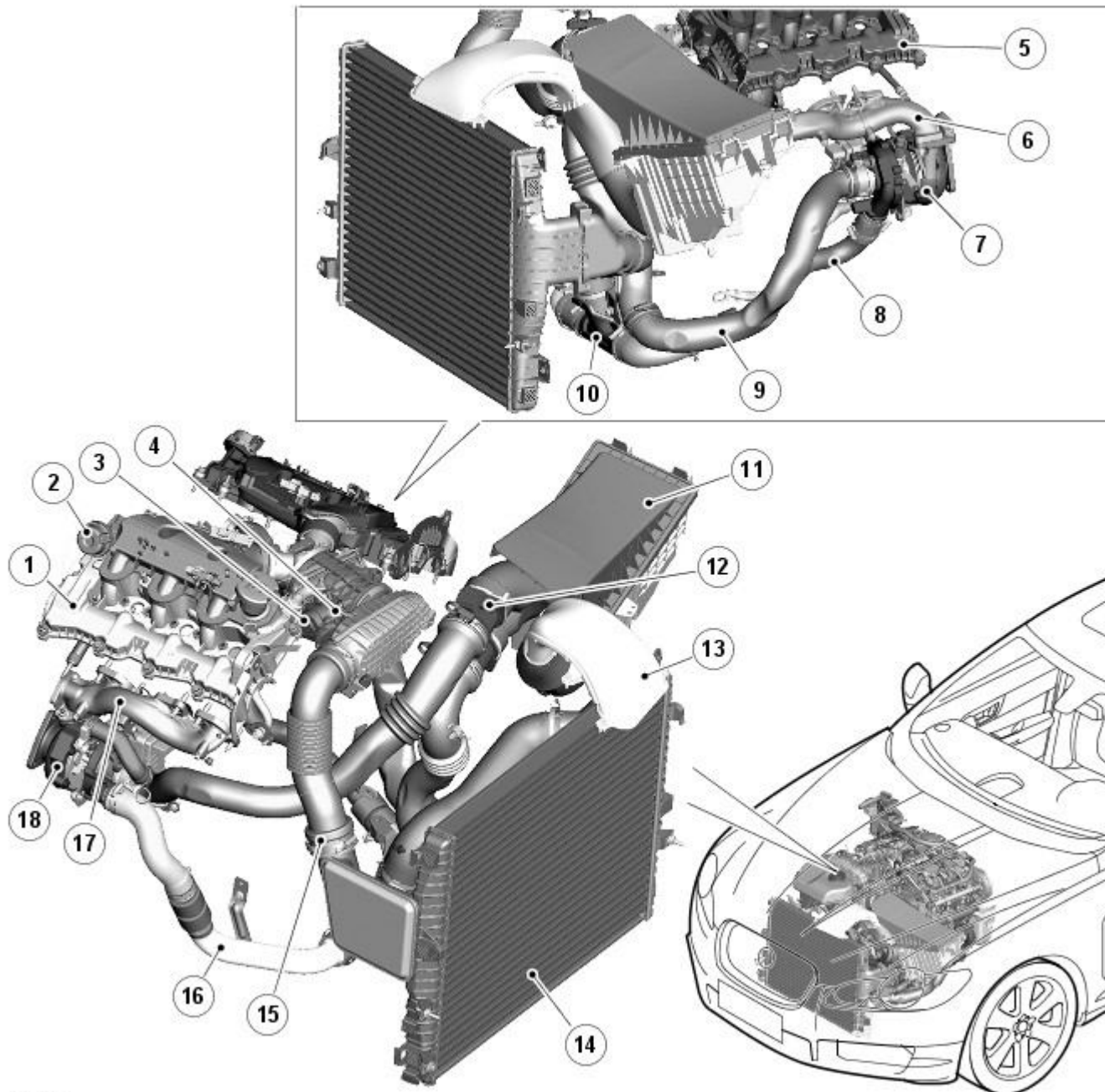
## Torque Specifications

Description	Nm	lb-ft	lb-in
Air cleaner retaining bolt	8	-	71



# Intake Air Distribution and Filtering - TDV6 2.7L Diesel - Intake Air Distribution and Filtering - Component Location

Description and Operation



E93805

## ItemDescription

1	<a href="#">RH (right-hand)</a> intake manifold
2	<a href="#">RH</a> port deactivation actuator
3	Electric throttle body
4	Charge air temperature sensor
5	<a href="#">LH (left-hand)</a> intake manifold
6	<a href="#">LH</a> exhaust manifold
7	<a href="#">LH</a> turbo
8	<a href="#">LH</a> turbo to charge air cooler pipe
9	Air cleaner to turbo pipe
10	Turbo to charge air cleaner 'T' piece
11	Air cleaner box
12	<a href="#">MAF (mass air flow)/IAT (intake air temperature)</a> sensors
13	Dirty air intake
14	Charge air cooler
15	Charge air cooler to throttle pipe
16	<a href="#">RH</a> turbo to charge air cooler pipe
17	<a href="#">RH</a> exhaust manifold
18	<a href="#">RH</a> Turbo

# Intake Air Distribution and Filtering - TDV6 2.7L Diesel - Intake Air Distribution and Filtering - Overview

Description and Operation

Authoring Template

## OVERVIEW

The intake air distribution system comprises:

- Twin [MAF \(mass air flow\)/IAT \(intake air temperature\)](#)
- Charge air temperature sensor
- Air cleaner and air cleaner housing
- Charge air cooler
- Twin turbochargers
- Intake port deactivation system

Air is drawn in from the vehicle exterior via the intake duct, at the front of the engine to the air cleaner box. The air passes through the air cleaner and exits the air cleaner housing via 2 ports. The clean air then passes through two [MAF/IAT](#) sensors and is drawn down to the turbochargers. The turbochargers force the air up to the charge air cooler via a T piece and out to the electric throttle, where it then flows into the respective intake air manifolds and down to the cylinder heads.

# **Intake Air Distribution and Filtering - TDV6 2.7L Diesel - Intake Air Distribution and Filtering - System Operation and Component Description**

Description and Operation

## **System Operation**

Refer to: [Intake Air Distribution and Filtering](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Description and Operation).

# Intake Air Distribution and Filtering - TDV6 2.7L Diesel - Intake Air Distribution and Filtering

Diagnosis and Testing

## Principles of Operation

For a detailed description of the diesel engine air intake distribution and filtering system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel)

[Intake Air Distribution and Filtering](#) (Description and Operation),  
[Intake Air Distribution and Filtering](#) (Description and Operation),  
[Intake Air Distribution and Filtering](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Hoses and ducts (damage/connections)</li> <li>● Air cleaner element (contaminated/blocked)</li> <li>● Restricted air intake</li> <li>● Seals and gaskets</li> </ul>	<ul style="list-style-type: none"> <li>● Mass Air Flow (MAF) sensor</li> <li>● Secondary Air Injection (AIR), Manifold Absolute Pressure (MAP) sensors</li> <li>● Throttle body</li> <li>● Harness (security/damage)</li> <li>● Connections (security/damage)</li> </ul>

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Vehicle does not start/hard starting/poor performance	<ul style="list-style-type: none"> <li>● Restricted/blocked air intake</li> <li>● Restricted/blocked air cleaner element</li> </ul>	Ensure the air intake system is free from blockage and is correctly installed. Install a new air cleaner element as required. REFER to: <a href="#">Air Cleaner Element</a> (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Removal and Installation).
Excessive intake noise	<ul style="list-style-type: none"> <li>● Intake pipe disconnected/damaged after the air cleaner</li> <li>● Air cleaner assembly incorrectly assembled/damaged</li> </ul>	Check for correct installation and integrity of air intake system. Check for correct installation and integrity of the air cleaner assembly. REFER to: (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel) <a href="#">Air Cleaner</a> (Removal and Installation), <a href="#">Air Cleaner Element</a> (Removal and Installation).

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

- NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).
- NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.
- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.
- NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Causes	Action
P007C16	Charge Air Cooler Temperature Sensor Circuit Low	<ul style="list-style-type: none"> <li>● Circuit voltage below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check charge air cooler temperature sensor signal circuit for short to ground. Check and install a new sensor as required
P007D17	Charge Air Cooler Temperature Sensor Circuit High	<ul style="list-style-type: none"> <li>● Circuit voltage above threshold</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler temperature sensor signal circuit for short to power. Check and install a new sensor as required
P007E27	Charge Air Cooler Temperature Sensor Intermittent/Erratic	<ul style="list-style-type: none"> <li>● Signal rate of change above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check charge air cooler temperature sensor circuits for poor connections. Check and install a new sensor as required

DTC	Description	Possible Causes	Action
P010036	Mass or Volume Air Flow A Circuit	<ul style="list-style-type: none"> <li>MAF sensor A signal circuit - signal frequency too low</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for additional DTCs and refer to relevant DTC Index. Refer to the electrical circuit diagrams and check MAF sensor A signal circuit for short to ground, power, open circuit. Check ' <b>Frequent mass air flow A</b> ' datalogger signal, if reading outside of parameters 40-50 kg/h, install a new MAF sensor and re-test
P010116	Mass or Volume Air Flow Sensor A/B Correlation	<ul style="list-style-type: none"> <li>Circuit voltage below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for additional DTCs and refer to relevant DTC Index. Refer to the electrical circuit diagrams and check MAF sensor A signal circuit for short to ground, power, open circuit. Check ' <b>Frequent mass air flow A</b> ' datalogger signal, if reading is below 40 kg/h, install a new MAF sensor and re-test
P010117	Mass or Volume Air Flow Sensor A/B Correlation	<ul style="list-style-type: none"> <li>Circuit voltage above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for additional DTCs and refer to relevant DTC Index. Refer to the electrical circuit diagrams and check MAF sensor A signal circuit for short to ground, power, open circuit. Check ' <b>Frequent mass air flow A</b> ' datalogger signal, if reading is above 50 kg/h, install a new MAF sensor and re-test
P010221	Mass or Volume Air Flow A Circuit Low	<ul style="list-style-type: none"> <li>Signal amplitude &lt; minimum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check low pressure air intake system for leaks and integrity. Refer to the electrical circuit diagrams and check MAF sensor A signal circuit for short to ground, power, open circuit. Check for sticking EGR valve
P010322	Mass or Volume Air Flow A Circuit High	<ul style="list-style-type: none"> <li>Signal amplitude &gt; maximum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check high pressure air intake system for leaks and integrity. Check for signs of water ingress around air cleaner, intake and MAF sensor. Refer to the electrical circuit diagrams and check MAF sensor A signal circuit for short to ground, power, open circuit
P010438	Mass or Volume Air Flow A Circuit Intermittent/Erratic	<ul style="list-style-type: none"> <li>Signal frequency incorrect</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor A signal circuit for short to ground, power, open circuit. With engine at idle speed check and record ' <b>Frequent mass air flow A</b> ' datalogger signal, increase engine speed to 2,000 rpm then check and record signal. If value changed by more than 110 kg/h, install a new MAF sensor and re-test
P010A36	Mass or Volume Air Flow B Circuit	<ul style="list-style-type: none"> <li>Signal frequency too low</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for additional DTCs and refer to the relevant DTC Index. Refer to the electrical circuit diagrams and check MAF sensor B signal circuit for short to ground, power, open circuit. Check ' <b>Frequent mass air flow B</b> ' using datalogger, if reading outside of parameters 40-50 kg/h, install a new MAF sensor and re-test
P010C21	Mass or Volume Air Flow B Circuit Low	<ul style="list-style-type: none"> <li>Signal amplitude &lt; minimum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check low pressure air intake system for leaks and integrity. Refer to the electrical circuit diagrams and check MAF sensor B signal circuit for short to ground, power, open circuit. Check for sticking EGR valve
P010D22	Mass or Volume Air Flow B Circuit High	<ul style="list-style-type: none"> <li>Signal amplitude &gt; maximum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check high pressure air intake system for leaks and integrity. Check for signs of water ingress around air cleaner, intake and MAF sensor. Refer to the electrical circuit diagrams and check MAF sensor B signal circuit for short to ground, power, open circuit
P010E38	Mass or Volume Air Flow B Circuit Intermittent/Erratic	<ul style="list-style-type: none"> <li>Signal frequency incorrect</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor B signal circuit for short to ground, power, open circuit. With engine at idle speed check and record ' <b>Frequent mass air flow B</b> ', increase engine speed to 2,000 rpm then check and record signal. If value changed by more than 110 kg/h, install a new MAF sensor and re-test
P010F62	Mass or Volume Air Flow Sensor A/B Correlation	<ul style="list-style-type: none"> <li>Signal compare failure</li> </ul>	Check for additional DTCs and refer to the relevant DTC Index. Check for air leaks between each MAF sensor and turbocharger inlet. Check for correct operation of turbochargers and EGR actuators
P011216	Intake Air Temperature Sensor 1 Circuit Low Input	<ul style="list-style-type: none"> <li>Circuit voltage above threshold</li> <li>Intake air temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor signal circuit for short to ground. Check and install a new sensor as required
P011317	Intake Air Temperature Sensor 1 Circuit High Input	<ul style="list-style-type: none"> <li>Circuit voltage below threshold</li> <li>Intake air temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor signal circuit for short to power. Check and install a new sensor as required
P011427	Intake Air Temperature Sensor 1 Intermittent/Erratic	<ul style="list-style-type: none"> <li>Signal rate of change above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check IAT sensor signal circuit for short, open circuit and poor connections. Run engine to normal operating temperature, check and record ' <b>Intake air temperature</b> ' datalogger signal, after approximately 10 minutes check and record ' <b>Intake air temperature</b> ' signal. If value of signal has increased by more than 10°C/100ms install a new sensor as required
P219900	Intake Air Temperature 1/2 Correlation	<ul style="list-style-type: none"> <li>Intake Air Temperature (IAT) or Air Charge Temperature (ACT) sensor circuits - short to ground, power, open circuit</li> <li>IAT/ACT sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check IAT and ACT sensor circuits for short to ground, power, open circuit. Check and install a new IAT/ACT sensor as required

DTC	Description	Possible Causes	Action
P219921	Intake Air Temperature 1/2 Correlation	<ul style="list-style-type: none"> <li>Off-set between Intake Air Temperature (IAT) and Air Charge Temperature (ACT) sensors</li> </ul>	<p>Refer to the electrical circuit diagrams and check IAT and ACT sensor circuits for short to ground, power, open circuit. Check and record <b>'Intake air temperature'</b>, <b>'Boost air temperature 0'</b> and <b>'Boost air temperature 1'</b> datalogger signals. If value of <b>'Boost air temperature 0'</b> and <b>'Boost air temperature 1'</b> signals are similar, install a new IAT sensor as required. The <b>'Boost air temperature 1'</b> temperature should be approximately <math>\pm 15^{\circ}\text{C}</math> from the ambient temperature, after the engine has been running and <b>'Intake air temperature'</b> which should have an operating range of approximately <math>+40^{\circ}\text{C}</math> to <math>-30^{\circ}\text{C}</math>. Install a new Boost air temperature bank 1 sensor or IAT sensor as required</p>
P219922	Intake Air Temperature 1/2 Correlation	<ul style="list-style-type: none"> <li>Off-set between Intake Air Temperature (IAT) and Air Charge Temperature (ACT) sensors</li> </ul>	<p>Refer to the electrical circuit diagrams and check IAT and ACT sensor circuits for short to ground, power, open circuit. Check and record <b>'Intake air temperature'</b>, <b>'Boost air temperature 0'</b> and <b>'Boost air temperature 1'</b> datalogger signals. If value of <b>'Boost air temperature 0'</b> and <b>'Boost air temperature 1'</b> signals are similar, install a new IAT sensor as required. The <b>'Boost air temperature 1'</b> temperature should be approximately <math>\pm 15^{\circ}\text{C}</math> from the ambient temperature, after the engine has been running and <b>'Intake air temperature'</b> which should have an operating range of approximately <math>+40^{\circ}\text{C}</math> to <math>-30^{\circ}\text{C}</math>. Install a new Boost air temperature bank 1 sensor or IAT sensor as required</p>



# Intake Air Distribution and Filtering - TDV6 2.7L Diesel - Air Cleaner

Removal and Installation

## Special Tool(s)

Remover/Install, Cooling Hose Clamp

303-397

303-397

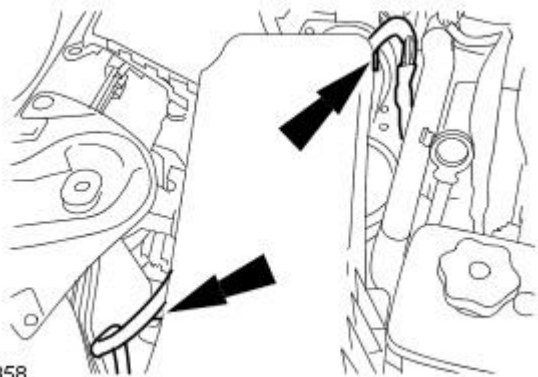


E 94108

## Removal

**1. NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

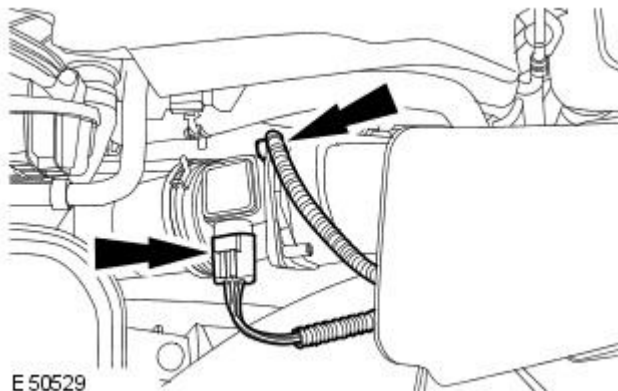
Release the mass air flow (MAF) sensors wiring harness.



E 52358

**2. NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Disconnect the 2 MAF sensor electrical connectors.

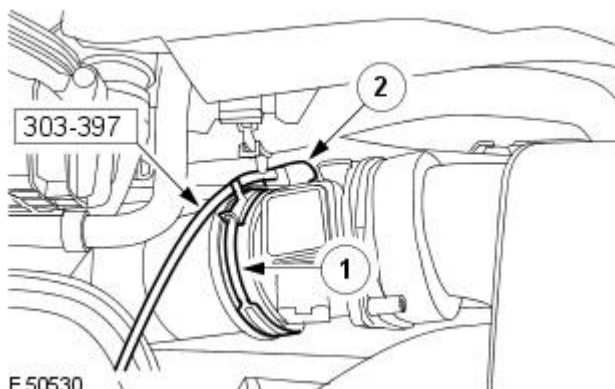


E 50529

**3. NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Using special tool 303-397, detach the MAF sensor outlet pipes.

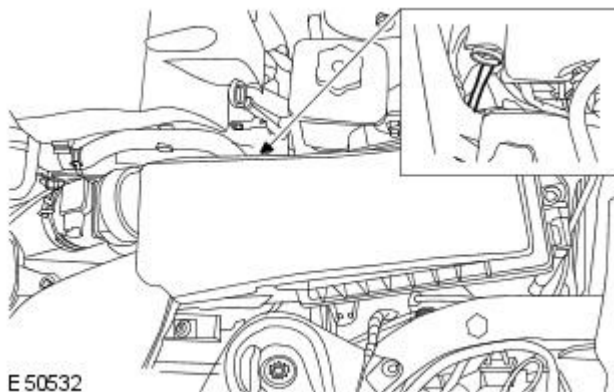
- Release the upper MAF sensor outlet pipe.
- Release the lower MAF sensor outlet pipe.



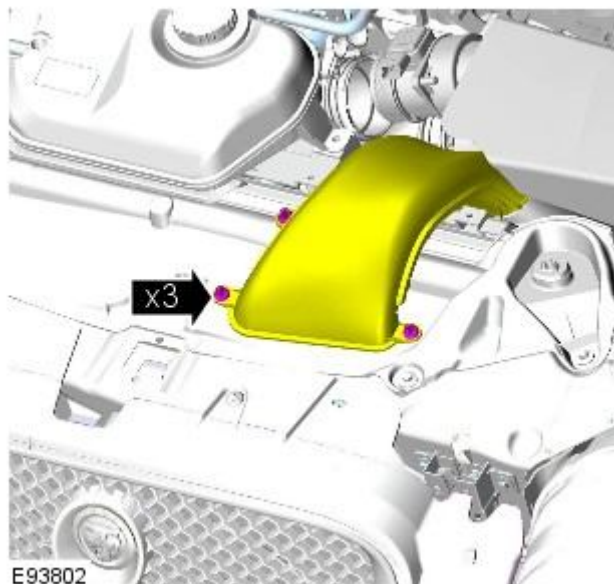
E 50530

4. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Disconnect the port deactivation vacuum hose.

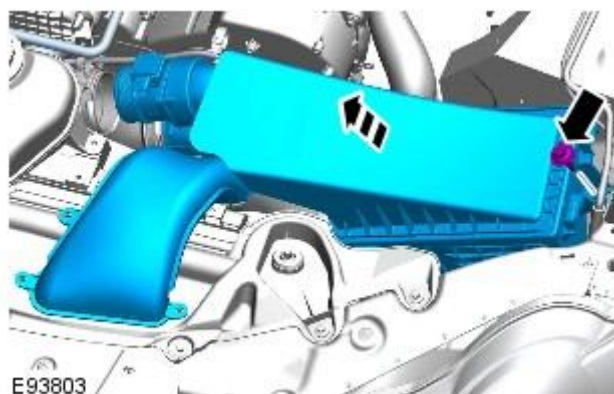


5. Release the air intake scoop.



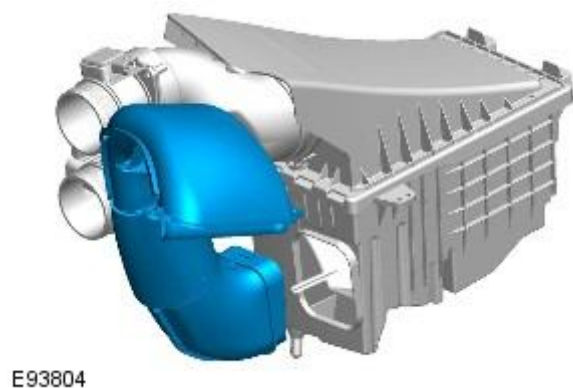
6. Remove the air cleaner.

- Remove the bolt.
- Release from the locating grommet.



7. NOTE: Do not disassemble further if the component is removed for access only.

Remove the air intake scoop.

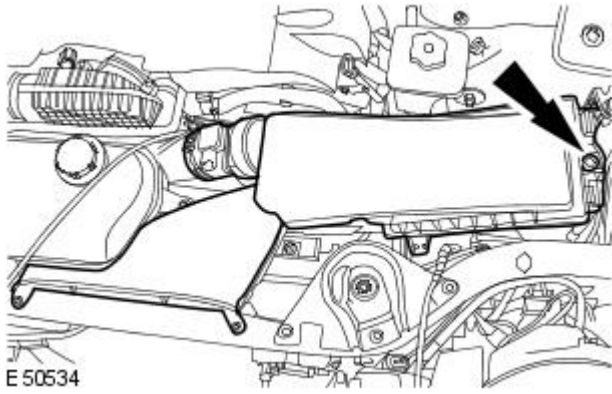


## Installation

**1.** NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

To install, reverse the removal procedure.

- Tighten to 8 Nm.



E 50534

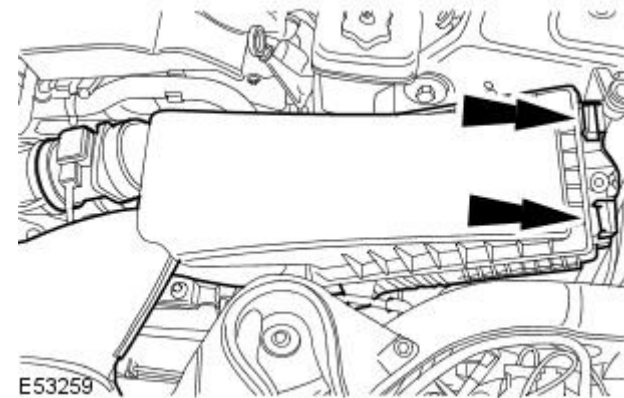
# Intake Air Distribution and Filtering - TDV6 2.7L Diesel - Air Cleaner Element

## Removal and Installation

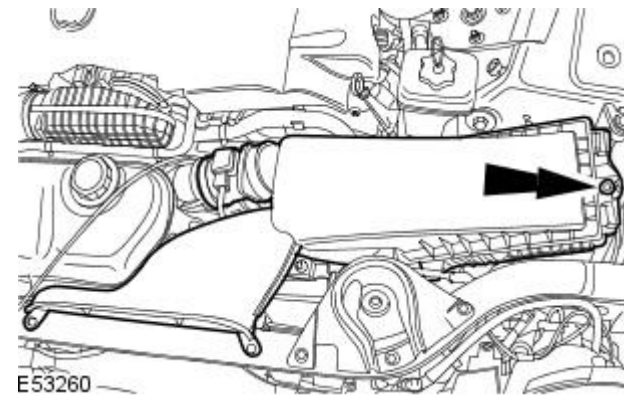
### Removal

- NOTE: Removal steps in this procedure may contain installation details.

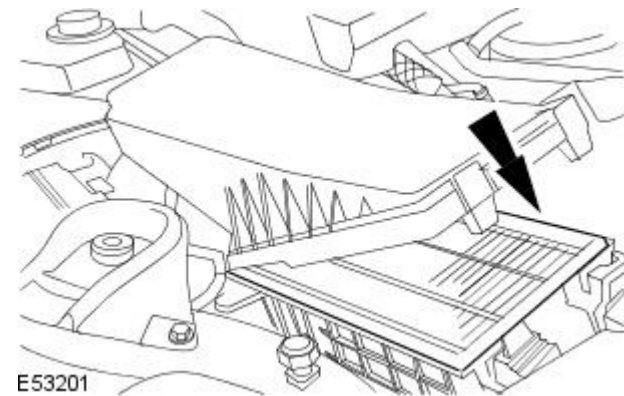
1.



2. TORQUE: 8 Nm



3.




### Installation


1. To install, reverse the removal procedure.

# Intake Air Distribution and Filtering - TDV6 2.7L Diesel - Charge Air Cooler

Removal and Installation

## Removal

 **CAUTION:** Engine coolant will damage the paint finished surfaces. If spilled, immediately remove the coolant and clean the area with water.

 **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

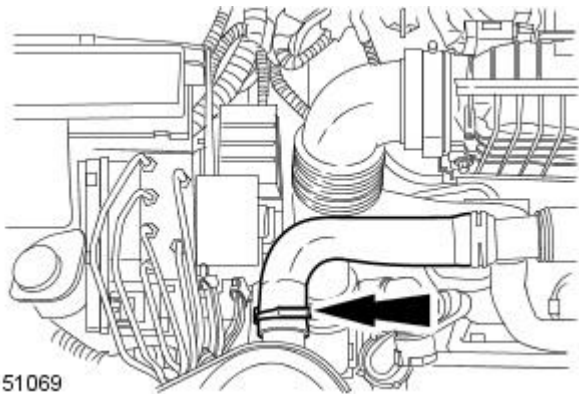
2. Drain the cooling system.

For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).

3. Remove the cooling fan motor and shroud.

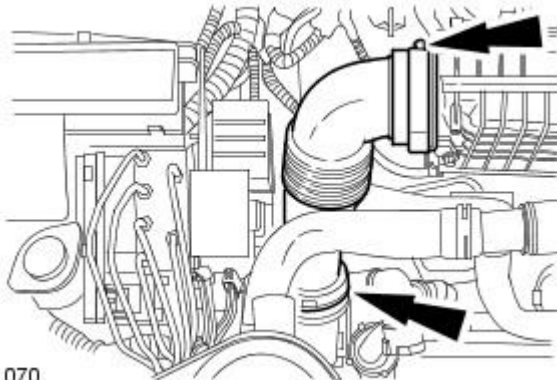
For additional information, refer to: [Cooling Fan Motor and Shroud](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation).

4. Disconnect the coolant top hose from the radiator.



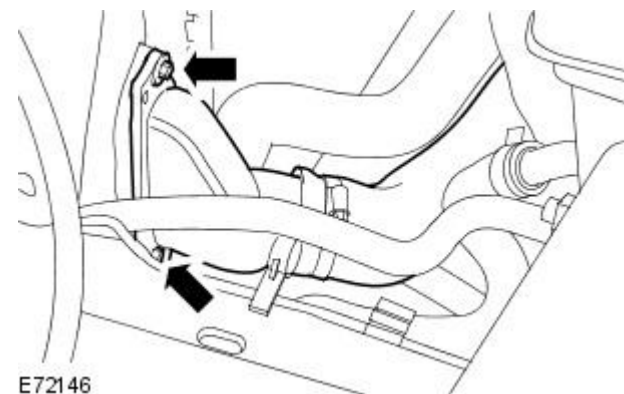
E51069

5. Remove the air intake elbow pipe.



E51070

6. Detach the charge air cooler intake elbow.



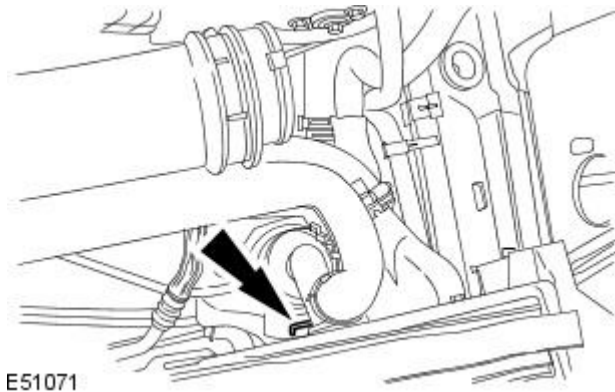
E72146



7.  **CAUTION:** Be prepared to collect escaping coolant.

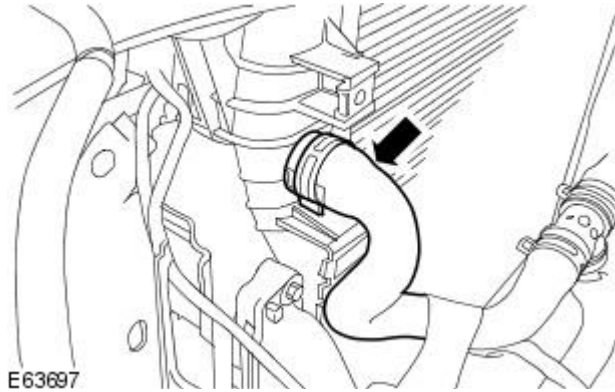
Disconnect the thermostat housing lower radiator hose.

- Release the retaining clip.



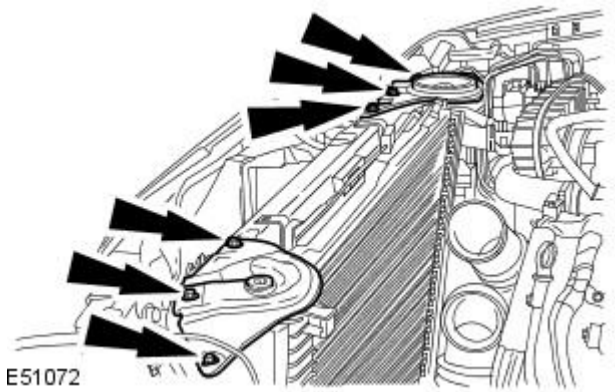
E51071

8. Disconnect the coolant hose.



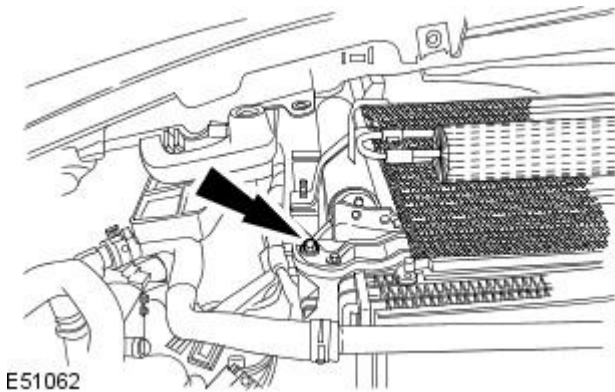
E63697

9. Remove the radiator upper mountings.



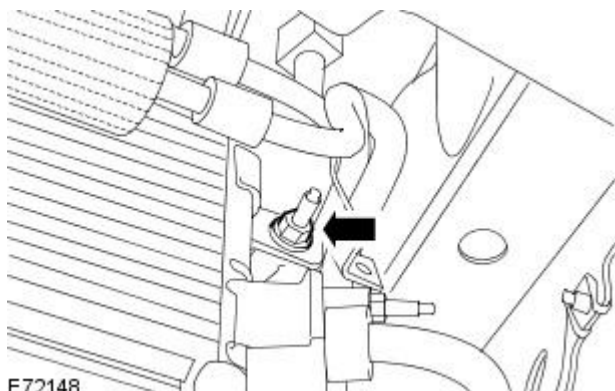
E51072

10. Remove the right-hand A/C condenser retaining bolt.



E51062

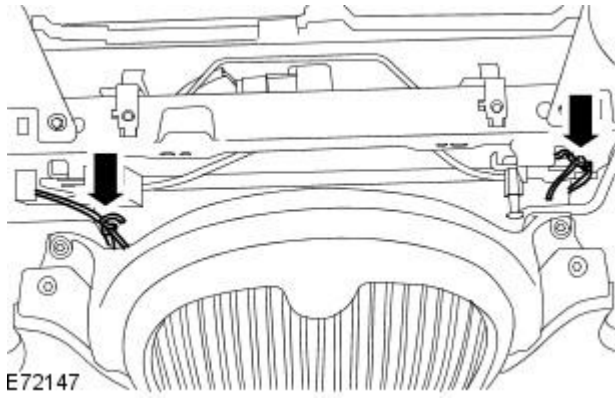
11. Remove the left-hand A/C condenser retaining stud.



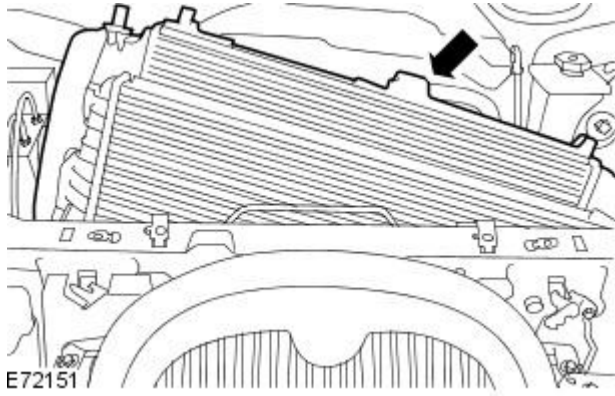
E72148



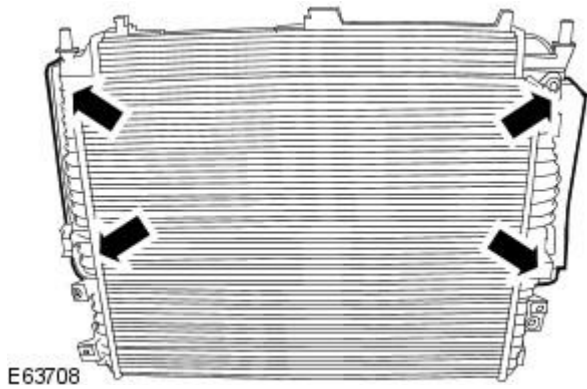
12. Tie the A/C condenser forwards, clear of the radiator.



13. With assistance, remove the radiator assembly.

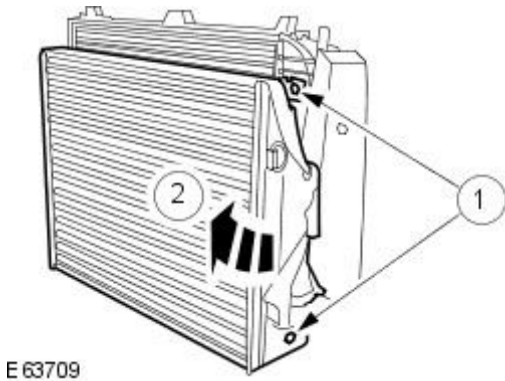


14. Remove the foam insulation pads.



15. Remove the charge air cooler from the radiator.

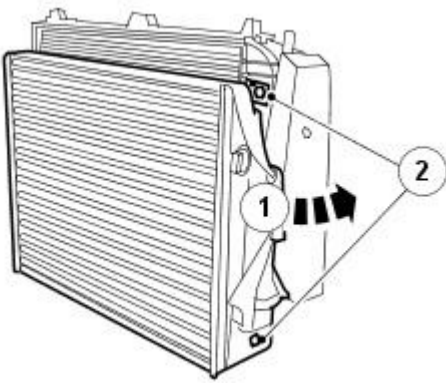
1. Remove the charge air cooler retaining bolts.



## Installation

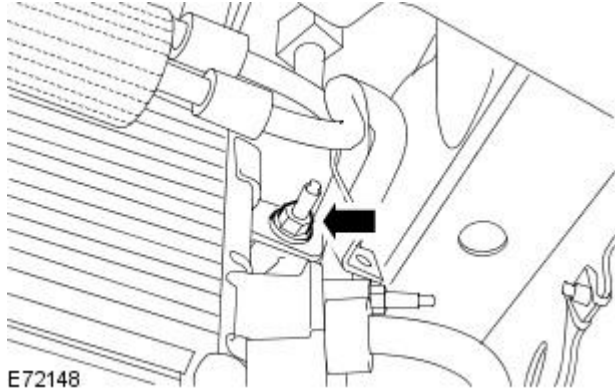
1. To install, reverse the removal procedure.

- Tighten to 7 Nm.



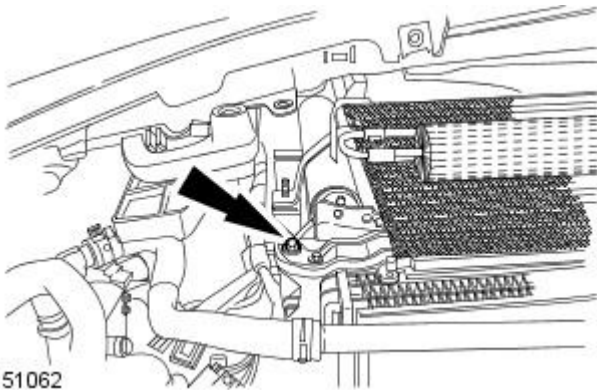
E63764

2. Tighten to 7 Nm.



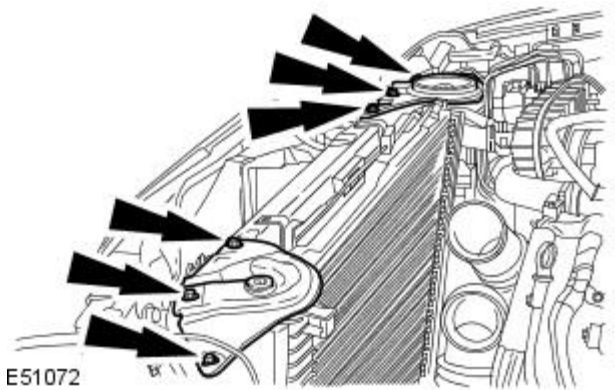
E72148

3. Tighten to 7 Nm.



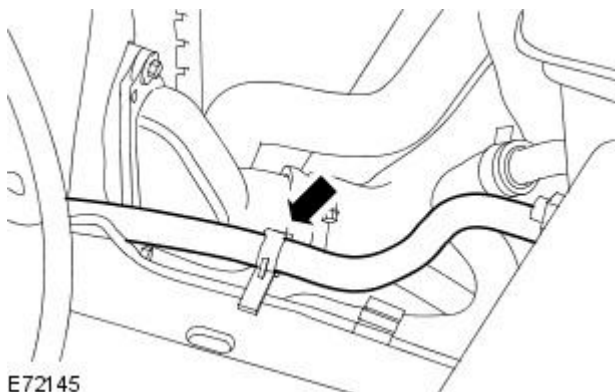
E51062

4. Tighten to 7 Nm.



E51072

5. Tighten to 7 Nm.



E72145

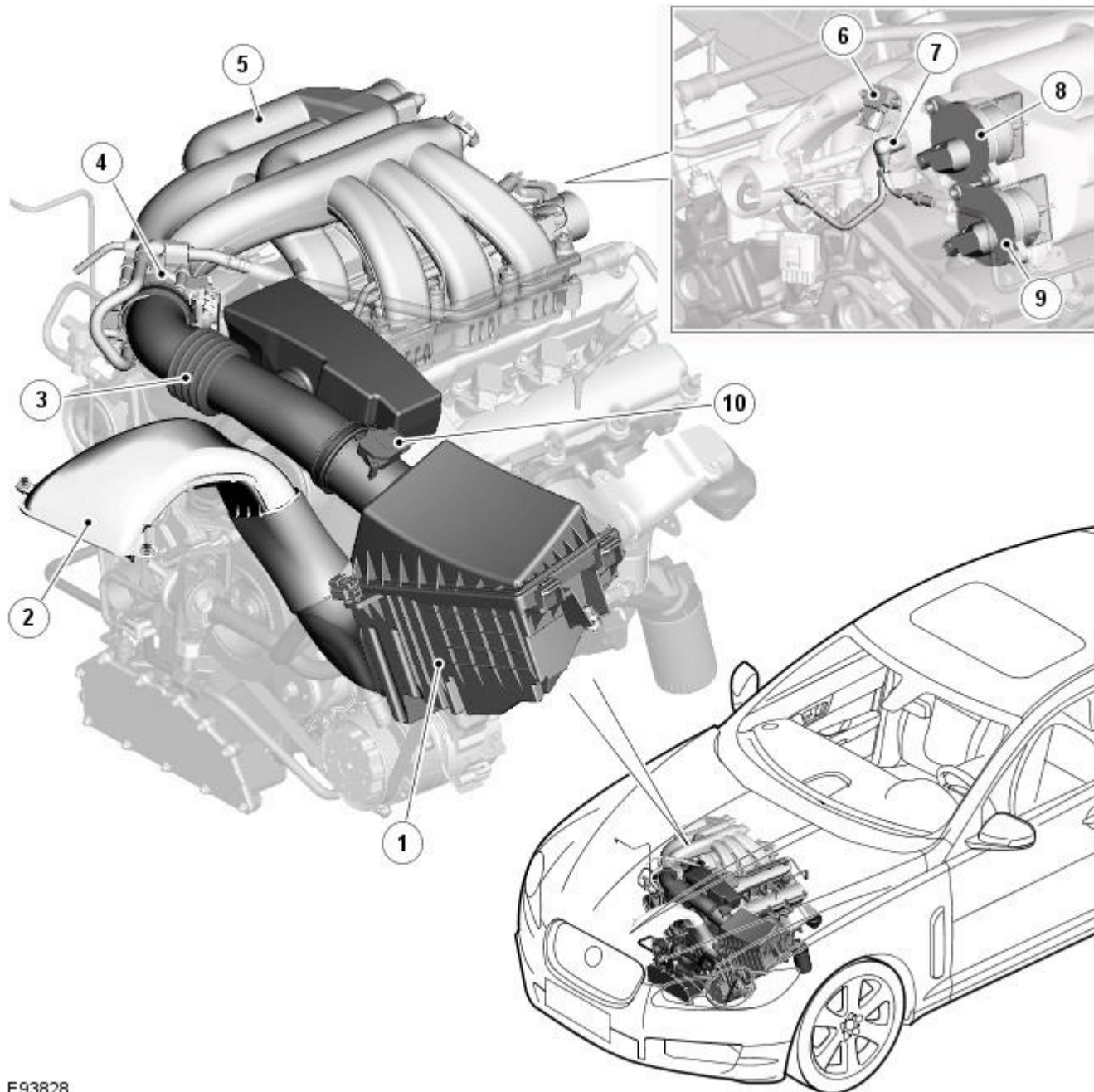
# Intake Air Distribution and Filtering - V6 3.0L Petrol -

## Torque Specifications

Description	Nm	lb-ft	lb-in
Air cleaner	8	—	71

# Intake Air Distribution and Filtering - V6 3.0L Petrol - Intake Air Distribution and Filtering - Component Location

Description and Operation



E93828

## ItemDescription

1	Air cleaner box
2	Dirty air intake
3	Clean air duct
4	Electric throttle
5	Air intake manifold
6	MAP (manifold absolute pressure) sensor
7	Vacuum take off
8	IMT (intake manifold tuning) valve
9	IMT valve
10	MAF (mass air flow) sensor

# Intake Air Distribution and Filtering - V6 3.0L Petrol - Intake Air Distribution and Filtering - Overview

Description and Operation

## OVERVIEW

The air induction system comprises:

- Dirty air intake duct
- Air cleaner and housing
- [IMT \(intake manifold tuning\)](#) valves
- Air intake manifold
- Associated clean air ducts
- [MAP \(manifold absolute pressure\)](#)
- Electric throttle

Dirty air is drawn through the air intake mounted at the front [LH \(left-hand\)](#) side of the engine compartment and routed into the base of the air cleaner box. The air cleaner is a replaceable paper filter element which is accessed by removing the top of the air cleaner box. The air is drawn through the air cleaner out of the air cleaner box past the [MAF \(mass air flow\)](#) along a tube to the electric throttle. From the electric throttle the clean air is drawn to the intake manifold. The intake manifold is one unit which is divided into two separate halves. Each half supplies clean air to one bank of cylinders. Two [IMT](#) valves control the airways between the two halves of the intake manifolds.

There are two intake manifold tuning (IMT) valves, an upper and a lower, sometimes referred to as number one and two respectively. They are a two position (open and close) device used to create a variable air intake system. The [IMT](#) valve positions are switched by signals from the [ECM \(engine control module\)](#) to optimize torque across the engine's speed and load range. The upper [IMT](#) valve opens between 4,100 and 6,150 rpm while the lower [IMT](#) valve opens between 3,900 and 6,150 rpm.

# **Intake Air Distribution and Filtering - V6 3.0L Petrol - Intake Air Distribution and Filtering - System Operation and Component Description**

Description and Operation

## **System Operation**

Refer to: [Intake Air Distribution and Filtering](#) (303-12B Intake Air Distribution and Filtering - V6 3.0L Petrol, Description and Operation).



# Intake Air Distribution and Filtering - V6 3.0L Petrol - Intake Air Distribution and Filtering

Diagnosis and Testing

## Principles of Operation

For a detailed description of the Intake Air Distribution and Filtering system, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

[Intake Air Distribution and Filtering](#) (303-12B Intake Air Distribution and Filtering - V6 3.0L Petrol, Description and Operation),  
[Intake Air Distribution and Filtering](#) (303-12B Intake Air Distribution and Filtering - V6 3.0L Petrol, Description and Operation),  
[Intake Air Distribution and Filtering](#) (303-12B Intake Air Distribution and Filtering - V6 3.0L Petrol, Description and Operation),  
[Intake Air Distribution and Filtering](#) (303-12C Intake Air Distribution and Filtering - V8 4.2L Petrol, Description and Operation),  
[Intake Air Distribution and Filtering](#) (303-12C Intake Air Distribution and Filtering - V8 4.2L Petrol, Description and Operation),  
[Intake Air Distribution and Filtering](#) (303-12C Intake Air Distribution and Filtering - V8 4.2L Petrol, Description and Operation),  
[Intake Air Distribution and Filtering](#) (303-12D Intake Air Distribution and Filtering - V8 S/C 4.2L Petrol, Description and Operation),  
[Intake Air Distribution and Filtering](#) (303-12D Intake Air Distribution and Filtering - V8 S/C 4.2L Petrol, Description and Operation),  
[Intake Air Distribution and Filtering](#) (303-12D Intake Air Distribution and Filtering - V8 S/C 4.2L Petrol, Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. Verify the customer concern.
2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Hoses and ducts (damage/connections)</li> <li>● Air cleaner element (contaminated/blocked)</li> <li>● Restricted air intake</li> <li>● Seals and gaskets</li> </ul>	<ul style="list-style-type: none"> <li>● Mass Air Flow (MAF) sensor</li> <li>● Secondary Air Injection (AIR) Manifold Absolute Pressure (MAP) sensor</li> <li>● Throttle body</li> <li>● Harness (security/damage)</li> <li>● Connections (security/damage)</li> </ul>

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the customer concern and refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Vehicle does not start/hard starting/poor performance	<ul style="list-style-type: none"> <li>● Restricted/blocked air intake</li> <li>● Restricted/blocked air cleaner element</li> </ul>	Ensure the air intake system is free from blockage and is correctly installed. Install a new air cleaner element as necessary. REFER to: Air Cleaner Element (303-12B, Removal and Installation), Air Cleaner Element (303-12C, Removal and Installation), Air Cleaner Element (303-12D, Removal and Installation).
Excessive intake noise	<ul style="list-style-type: none"> <li>● Intake pipe disconnected/damaged after the air cleaner</li> <li>● Air cleaner assembly incorrectly assembled/damaged</li> </ul>	Check for correct installation and integrity of air intake system. Check for correct installation and integrity of the air cleaner assembly. REFER to: Air Cleaner (303-12B, Removal and Installation), Air Cleaner (303-12C, Removal and Installation), Air Cleaner LH (303-12D, Removal and Installation), Air Cleaner RH (303-12D, Removal and Installation).

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are logged and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Causes	Action
P009623	Intake Air Temperature Sensor 2 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Charge air cooler air temperature sensor circuit - signal stuck low</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to ground, high resistance

DTC	Description	Possible Causes	Action
P009624	Intake Air Temperature Sensor 2 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Charge air cooler air temperature sensor circuit - signal stuck high</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to power
P009629	Intake Air Temperature Sensor 2 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Charge air cooler air temperature sensor circuit - signal invalid</li> <li>● Charge air cooler air temperature sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short, open circuit. Check and install a new sensor as required
P009700	Intake Air Temperature Sensor 2 Circuit Low	<ul style="list-style-type: none"> <li>● No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to ground, high resistance
P009800	Intake Air Temperature Sensor 2 Circuit High	<ul style="list-style-type: none"> <li>● No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to power
P010100	Mass or Volume Air Flow A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Blocked air cleaner element</li> <li>● Leakage from air intake system</li> <li>● Engine breather leak</li> <li>● MAF sensor sensing circuit - high resistance, intermittent short to ground</li> <li>● MAF sensor supply circuit - high resistance</li> <li>● MAF sensor failure</li> </ul>	Check air cleaner element is free from restriction. Check for leak from air intake system, rectify as required. Ensure the engine breather system is correctly installed and in serviceable condition. Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuit for intermittent short to ground, high resistance. Check and install a new MAF sensor as required
P010200	Mass or Volume Air Flow A Circuit Low	<ul style="list-style-type: none"> <li>● MAF sensor circuits - short to ground, high resistance</li> <li>● MAF sensor ground circuit - high resistance</li> <li>● MAF sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuits for short to power ground, high resistance. Check and install a new MAF sensor as required
P010300	Mass or Volume Air Flow A Circuit High	<ul style="list-style-type: none"> <li>● MAF sensor circuits - short to power</li> <li>● MAF sensor ground circuit - high resistance</li> <li>● MAF sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuits for short to power, ground, high resistance. Check and install a new MAF sensor as required
P010B00	Mass or Volume Air Flow B Circuit Range/Performance	<ul style="list-style-type: none"> <li>● No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuits for short, open circuit
P010C00	Mass or Volume Air Flow B Circuit Low	<ul style="list-style-type: none"> <li>● MAF sensor circuits - short to ground, high resistance</li> <li>● MAF sensor ground circuit - high resistance</li> <li>● MAF sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuits for short to ground, high resistance. Check and install a new MAF sensor as required
P010D00	Mass or Volume Air Flow B Circuit High	<ul style="list-style-type: none"> <li>● MAF sensor circuits - short to power</li> <li>● MAF sensor ground circuit - high resistance</li> <li>● MAF sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuits for short to power, ground, high resistance. Check and install a new MAF sensor as required
P010F00	Mass or Volume Air Flow Sensor A/B Correlation	<ul style="list-style-type: none"> <li>● Blocked Air cleaner in 1 bank</li> <li>● Leakage from intake air system</li> <li>● Engine breather leak</li> <li>● Flow Diffusor blocking MAF sensor</li> <li>● Failure of A bank MAF sensor</li> <li>● Failure of B bank MAF sensor</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for any P0101 or P010B DTCs. Check air cleaner is free from restriction. Check for any leaks in the intake air system and all joints. Check engine breather system is correctly installed and in a serviceable condition. Check flow diffusors are not obstructing MAF sensors. Check and install new MAF sensors as required
P011123	Intake Air Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● IAT sensor sensing circuit - high resistance</li> <li>● IAT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor circuits for short, open circuit, high resistance. Check and install a new MAF sensor as required
P011124	Intake Air Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● IAT sensor sensing circuit - high resistance</li> <li>● IAT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor circuits for short, open circuit, high resistance. Check and install a new MAF sensor as required
P011129	Intake Air Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● IAT sensor sensing circuit - high resistance</li> <li>● IAT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor circuits for short, open circuit, high resistance. Check and install a new MAF sensor as required
P011200	Intake Air Temperature Sensor 1 Circuit Low	<ul style="list-style-type: none"> <li>● IAT sensor sensing circuit - high resistance, disconnected</li> <li>● IAT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor circuits for short, open circuit, high resistance, disconnected connector. Check and install a new MAF sensor as required

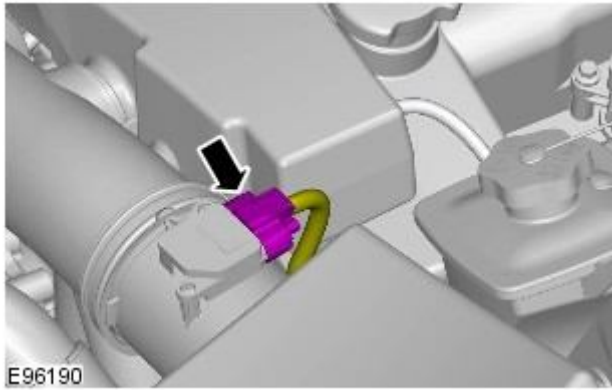
<b>DTC</b>	<b>Description</b>	<b>Possible Causes</b>	<b>Action</b>
P011300	Intake Air Temperature Sensor 1 Circuit High	<ul style="list-style-type: none"> <li>● IAT sensor sensing circuit - short to ground, short to power</li> <li>● IAT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor circuits for short, open circuit, high resistance. Check and install a new MAF sensor as required
P050600	Idle Air Control System RPM Lower Than Expected	<ul style="list-style-type: none"> <li>● Air intake restriction</li> <li>● Front End Accessory Drive (FEAD) overload (defective/seized component)</li> </ul>	Ensure the air intake system is free from restriction. Check the FEAD belt and components for failure
P050624	Idle Air Control System RPM Lower Than Expected	<ul style="list-style-type: none"> <li>● Air intake restriction</li> <li>● Front End Accessory Drive (FEAD) overload (defective/seized component)</li> </ul>	Ensure the air intake system is free from restriction. Check the FEAD belt and components for failure
P050700	Idle Air Control System RPM Higher Than Expected	<ul style="list-style-type: none"> <li>● Intake air leak between MAF sensor and engine</li> <li>● Engine crankcase breather leak</li> </ul>	Check for leakage and correct installation of air intake system. Check for leakage and correct installation of engine crankcase breather system
P050723	Idle Air Control System RPM Higher Than Expected	<ul style="list-style-type: none"> <li>● Intake air leak between MAF sensor and engine</li> <li>● Engine crankcase breather leak</li> </ul>	Check for leakage and correct installation of air intake system. Check for leakage and correct installation of engine crankcase breather system

# Intake Air Distribution and Filtering - V6 3.0L Petrol - Air Cleaner

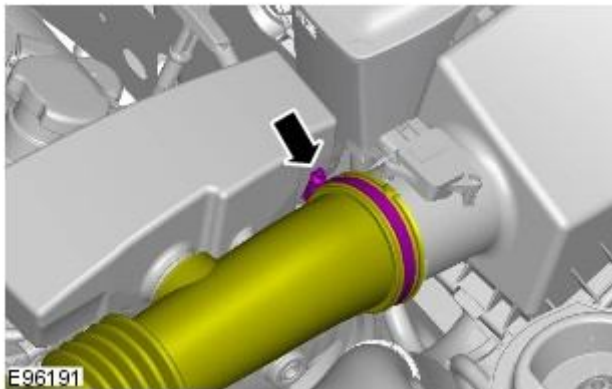
Removal and Installation

## Removal

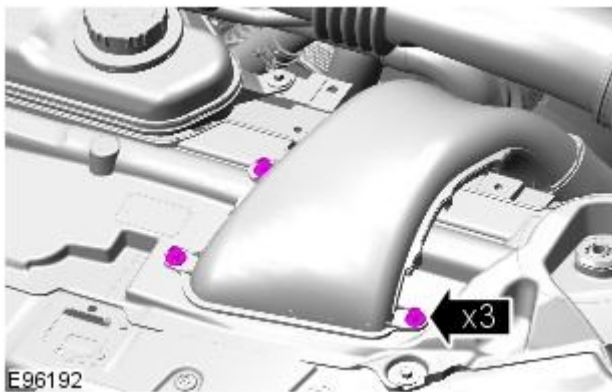
- NOTE: Removal steps in this procedure may contain installation details.



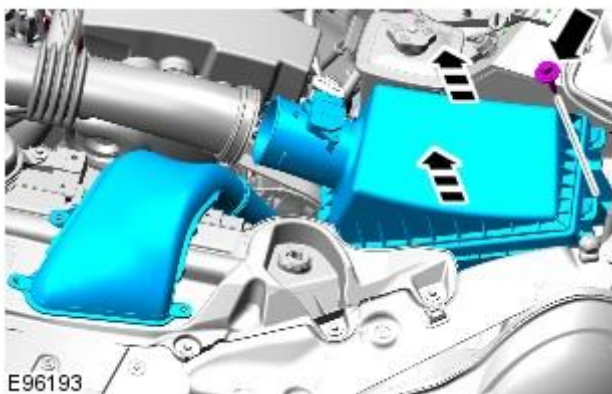
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2.

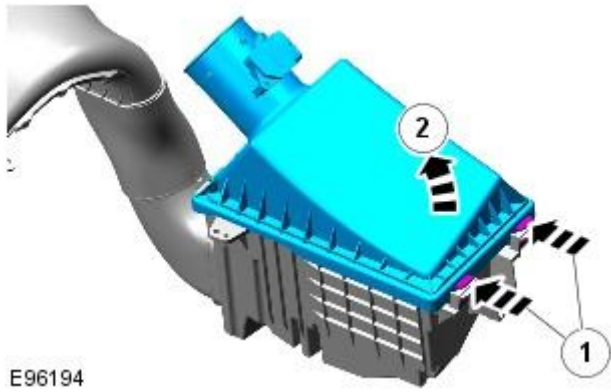


3.



4. Torque: 8 Nm

5. **5. NOTE:** Do not disassemble further if the component is removed for access only.



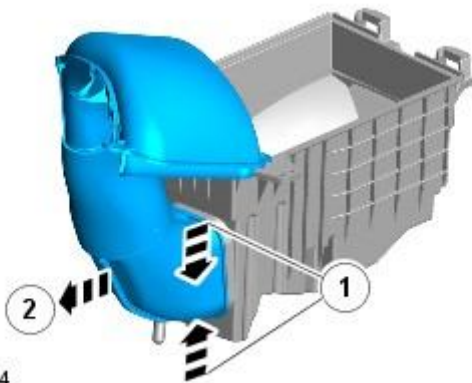
E96194

6.



E100473

7.



E100474

## Installation

1. To install, reverse the removal procedure.

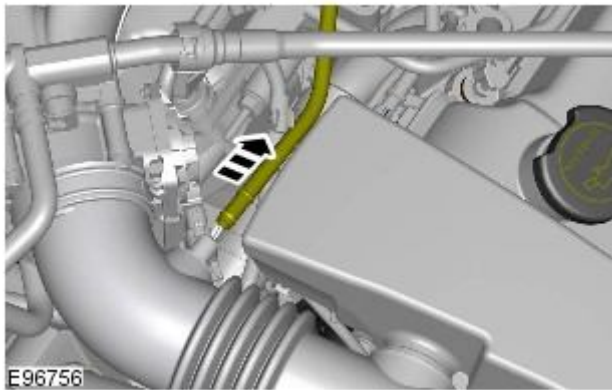
# Intake Air Distribution and Filtering - V6 3.0L Petrol - Air Cleaner Outlet Pipe

Removal and Installation

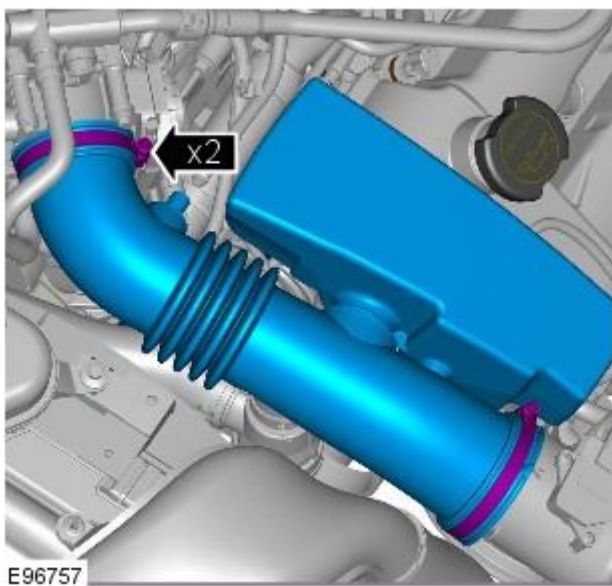
## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1.



2.



## Installation

1. To install, reverse the removal procedure.



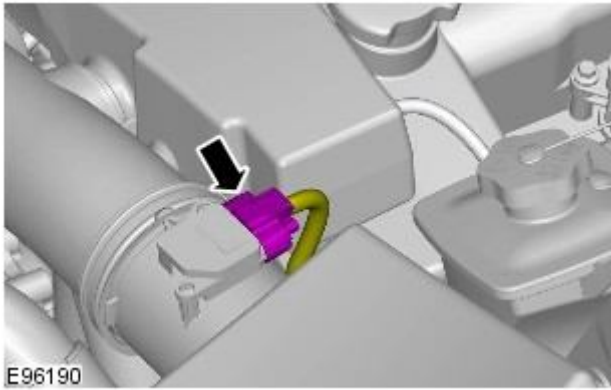
# Intake Air Distribution and Filtering - V6 3.0L Petrol - Air Cleaner Element

Removal and Installation

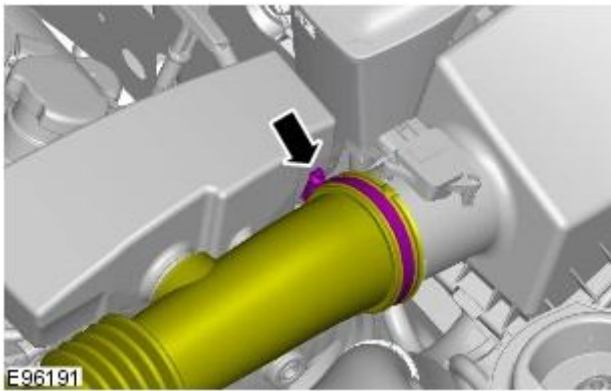
## Removal

- NOTE: Removal steps in this procedure may contain installation details.

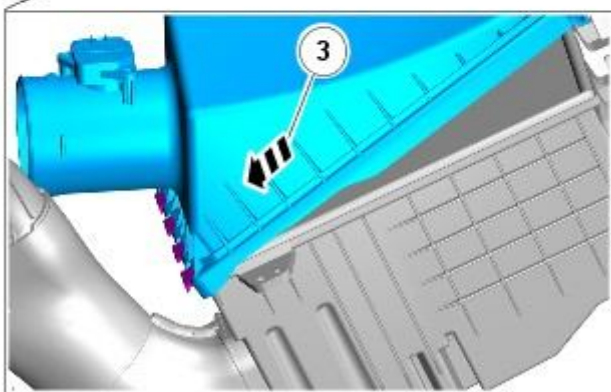
1.



2.

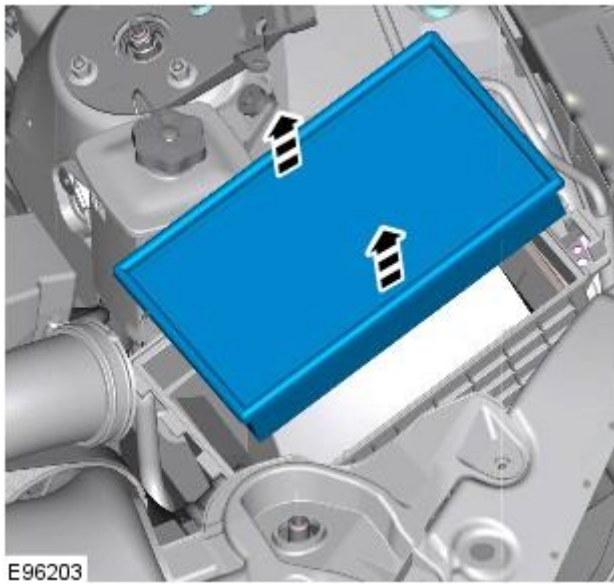


3.



E96202

4.



## Installation

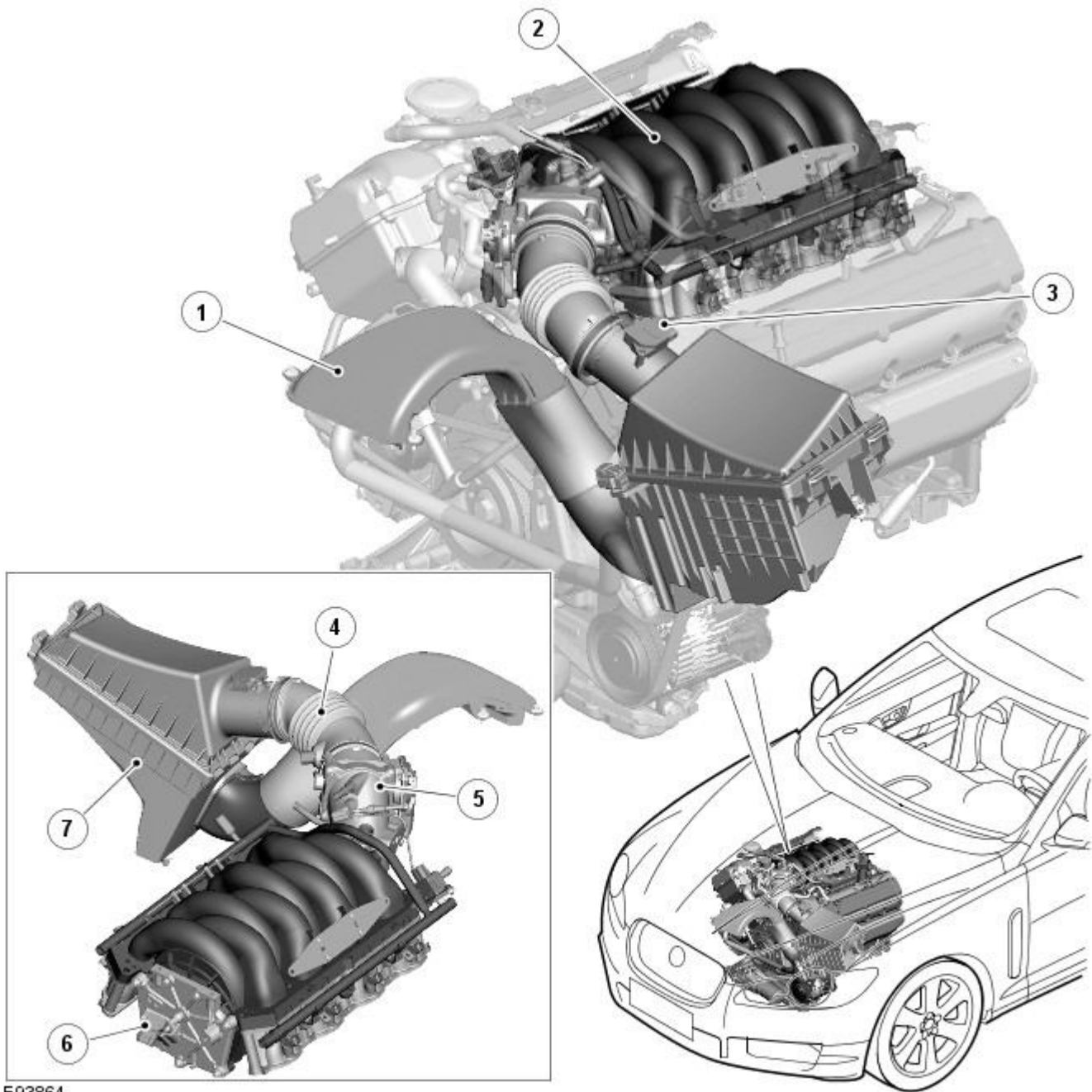
1. To install, reverse the removal procedure.

**Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8 -**

Description	Nm	lb-ft	lb-in
Air cleaner retaining bolt	8	-	71
Supercharger outlet pipe retaining nuts	9	-	80
Supercharger outlet pipe retaining bolts	9	-	80
Supercharger retaining bolts	24	18	-
Air intake elbow retaining bolts	24	18	-
Air intake elbow lower bracket retaining bolts	20	15	-
Exhaust gas recirculation (EGR) valve retaining bolts	10	7	-
Exhaust manifold to EGR valve tube retaining bolts	21	15	-
Exhaust manifold to EGR valve tube retaining nuts	21	15	-
Thermostat housing retaining bolts	10	7	-
Throttle body intake hose retaining clip	10	7	-

# Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8 - Intake Air Distribution and Filtering - Component Location

Description and Operation



E93864

## ItemDescription

1	Dirty air intake
2	Intake manifold
3	MAF (mass air flow) sensor
4	Clean air pipe
5	Electric throttle
6	MAP (manifold absolute pressure) sensor
7	Air cleaner box

# Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8 - Intake Air Distribution and Filtering - Overview

Description and Operation

Authoring Template

## OVERVIEW

The 4.2 Liter NA V8 engine air intake and distribution system comprises:

- Air cleaner
- Air cleaner box
- Air Intake manifold
- Electronic throttle

The air cleaner box is located in front of the [LH \(left-hand\)](#) front wheel, inside the engine compartment and contains a replaceable paper filter element.

Dirty air is drawn through the air intake which is located behind the radiator grill on the [LH](#) side and into the air filter box past the paper filter element. Clean air is then passed over the [MAF \(mass air flow\)](#) sensor located in the ducting directly behind the air filter box, through the electric throttle and up to the air intake manifold where it is distributed to the individual cylinders.

The intake manifold is located on top of the engine between the two engine banks. The manifold is manufactured from a composite material with metal insert fixings. The intake manifold comprises a central chamber with eight tracts leading to the inlet ports on the engine.

# **Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8 - Intake Air Distribution and Filtering - System Operation and Component Description**

Description and Operation

## **System Operation**

Refer to: [Intake Air Distribution and Filtering](#) (303-12A Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8, Description and Operation).



# Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8 - Intake Air Distribution and Filtering

Diagnosis and Testing

## Principles of Operation

For a detailed description of the Intake Air Distribution and Filtering system, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

[Intake Air Distribution and Filtering](#) (303-12A Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8, Description and Operation),  
[Intake Air Distribution and Filtering](#) (303-12A Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8, Description and Operation),  
[Intake Air Distribution and Filtering](#) (303-12A Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8, Description and Operation),  
[Intake Air Distribution and Filtering](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Description and Operation),  
[Intake Air Distribution and Filtering](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Description and Operation),  
[Intake Air Distribution and Filtering](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Hoses and ducts (damage/connections)</li> <li>● Air cleaner element (contaminated/blocked)</li> <li>● Restricted air intake</li> <li>● Seals and gaskets</li> </ul>	<ul style="list-style-type: none"> <li>● Mass Air Flow (MAF) sensor</li> <li>● Secondary Air Injection (AIR) Manifold Absolute Pressure (MAP) sensor</li> <li>● Throttle body</li> <li>● Harness (security/damage)</li> <li>● Connections (security/damage)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the customer concern and refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Vehicle does not start/hard starting/poor performance	<ul style="list-style-type: none"> <li>● Restricted/blocked air intake</li> <li>● Restricted/blocked air cleaner element</li> </ul>	Ensure the air intake system is free from blockage and is correctly installed. Install a new air cleaner element as necessary. REFER to: <a href="#">Air Cleaner Element</a> (303-12A Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8, Removal and Installation), Air Cleaner Element (303-12D, Removal and Installation).
Excessive intake noise	<ul style="list-style-type: none"> <li>● Intake pipe disconnected/damaged after the air cleaner</li> <li>● Air cleaner assembly incorrectly assembled/damaged</li> </ul>	Check for correct installation and integrity of air intake system. Check for correct installation and integrity of the air cleaner assembly. REFER to: <a href="#">Air Cleaner</a> (303-12A Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8, Removal and Installation), Air Cleaner LH (303-12D, Removal and Installation), Air Cleaner RH (303-12D, Removal and Installation).

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• **NOTE:** If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are logged and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Causes	Action
P009623	Intake Air Temperature Sensor 2 Circuit Range/Performance	<ul style="list-style-type: none"> <li>Charge air cooler air temperature sensor circuit - signal stuck low</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to ground, high resistance
P009624	Intake Air Temperature Sensor 2 Circuit Range/Performance	<ul style="list-style-type: none"> <li>Charge air cooler air temperature sensor circuit - signal stuck high</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to power
P009629	Intake Air Temperature Sensor 2 Circuit Range/Performance	<ul style="list-style-type: none"> <li>Charge air cooler air temperature sensor circuit - signal invalid</li> <li>Charge air cooler air temperature sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short, open circuit. Check and install a new sensor as required
P009700	Intake Air Temperature Sensor 2 Circuit Low	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to ground, high resistance
P009800	Intake Air Temperature Sensor 2 Circuit High	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to power
P010100	Mass or Volume Air Flow A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Blocked air cleaner element</li> <li>Leakage from air intake system</li> <li>Engine breather leak</li> <li>MAF sensor sensing circuit - high resistance, intermittent short to ground</li> <li>MAF sensor supply circuit - high resistance</li> <li>MAF sensor failure</li> </ul>	Check air cleaner element is free from restriction. Check for leak from air intake system, rectify as required. Ensure the engine breather system is correctly installed and in serviceable condition. Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuit for intermittent short to ground, high resistance. Check and install a new MAF sensor as required
P010200	Mass or Volume Air Flow A Circuit Low	<ul style="list-style-type: none"> <li>MAF sensor circuits - short to ground, high resistance</li> <li>MAF sensor ground circuit - high resistance</li> <li>MAF sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuits for short to power ground, high resistance. Check and install a new MAF sensor as required
P010300	Mass or Volume Air Flow A Circuit High	<ul style="list-style-type: none"> <li>MAF sensor circuits - short to power</li> <li>MAF sensor ground circuit - high resistance</li> <li>MAF sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuits for short to power, ground, high resistance. Check and install a new MAF sensor as required
P010B00	Mass or Volume Air Flow B Circuit Range/Performance	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuits for short, open circuit
P010C00	Mass or Volume Air Flow B Circuit Low	<ul style="list-style-type: none"> <li>MAF sensor circuits - short to ground, high resistance</li> <li>MAF sensor ground circuit - high resistance</li> <li>MAF sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuits for short to ground, high resistance. Check and install a new MAF sensor as required

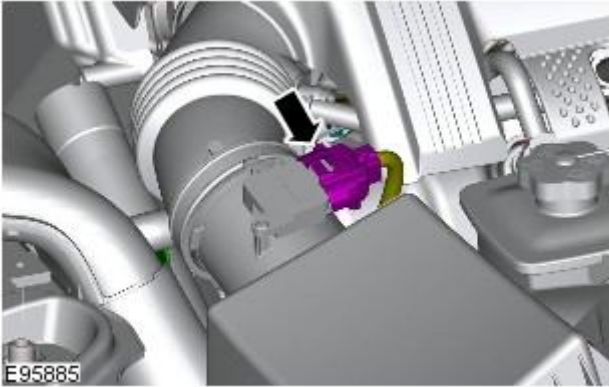
<b>DTC</b>	<b>Description</b>	<b>Possible Causes</b>	<b>Action</b>
P010D00	Mass or Volume Air Flow B Circuit High	<ul style="list-style-type: none"> <li>● MAF sensor circuits - short to power</li> <li>● MAF sensor ground circuit - high resistance</li> <li>● MAF sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuits for short to power, ground, high resistance. Check and install a new MAF sensor as required
P010F00	Mass or Volume Air Flow Sensor A/B Correlation	<ul style="list-style-type: none"> <li>● Blocked Air cleaner in 1 bank</li> <li>● Leakage from intake air system</li> <li>● Engine breather leak</li> <li>● Flow Diffusor blocking MAF sensor</li> <li>● Failure of A bank MAF sensor</li> <li>● Failure of B bank MAF sensor</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for any P0101 or P010B DTCs. Check air cleaner is free from restriction. Check for any leaks in the intake air system and all joints. Check engine breather system is correctly installed and in a serviceable condition. Check flow diffusors are not obstructing MAF sensors. Check and install new MAF sensors as required
P011123	Intake Air Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● IAT sensor sensing circuit - high resistance</li> <li>● IAT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor circuits for short, open circuit, high resistance. Check and install a new MAF sensor as required
P011124	Intake Air Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● IAT sensor sensing circuit - high resistance</li> <li>● IAT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor circuits for short, open circuit, high resistance. Check and install a new MAF sensor as required
P011129	Intake Air Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● IAT sensor sensing circuit - high resistance</li> <li>● IAT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor circuits for short, open circuit, high resistance. Check and install a new MAF sensor as required
P011200	Intake Air Temperature Sensor 1 Circuit Low	<ul style="list-style-type: none"> <li>● IAT sensor sensing circuit - high resistance, disconnected</li> <li>● IAT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor circuits for short, open circuit, high resistance, disconnected connector. Check and install a new MAF sensor as required
P011300	Intake Air Temperature Sensor 1 Circuit High	<ul style="list-style-type: none"> <li>● IAT sensor sensing circuit - short to ground, short to power</li> <li>● IAT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor circuits for short, open circuit, high resistance. Check and install a new MAF sensor as required
P050600	Idle Air Control System RPM Lower Than Expected	<ul style="list-style-type: none"> <li>● Air intake restriction</li> <li>● Front End Accessory Drive (FEAD) overload (defective/seized component)</li> </ul>	Ensure the air intake system is free from restriction. Check the FEAD belt and components for failure
P050624	Idle Air Control System RPM Lower Than Expected	<ul style="list-style-type: none"> <li>● Air intake restriction</li> <li>● Front End Accessory Drive (FEAD) overload (defective/seized component)</li> </ul>	Ensure the air intake system is free from restriction. Check the FEAD belt and components for failure
P050700	Idle Air Control System RPM Higher Than Expected	<ul style="list-style-type: none"> <li>● Intake air leak between MAF sensor and engine</li> <li>● Engine crankcase breather leak</li> </ul>	Check for leakage and correct installation of air intake system. Check for leakage and correct installation of engine crankcase breather system
P050723	Idle Air Control System RPM Higher Than Expected	<ul style="list-style-type: none"> <li>● Intake air leak between MAF sensor and engine</li> <li>● Engine crankcase breather leak</li> </ul>	Check for leakage and correct installation of air intake system. Check for leakage and correct installation of engine crankcase breather system

# Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8 - Air Cleaner

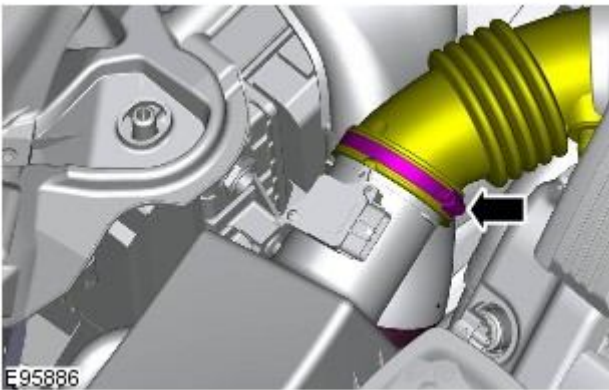
Removal and Installation

## Removal

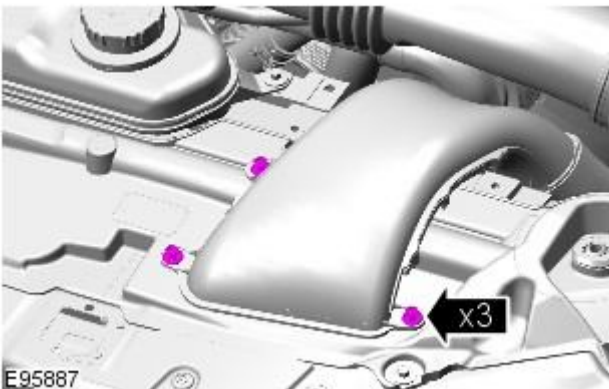
- NOTE: Removal steps in this procedure may contain installation details.



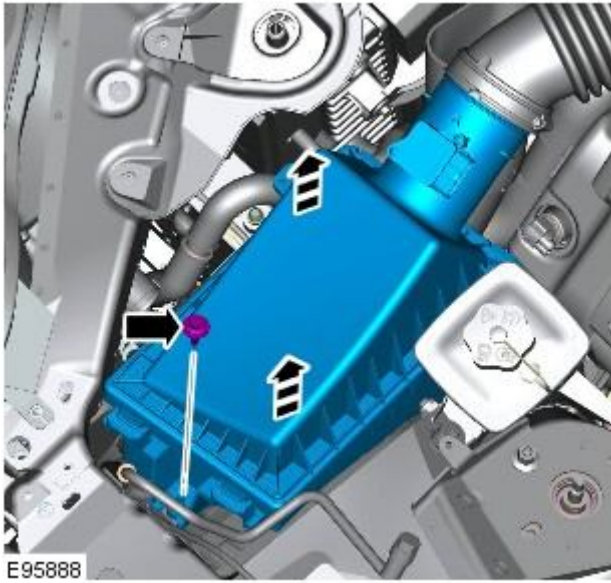
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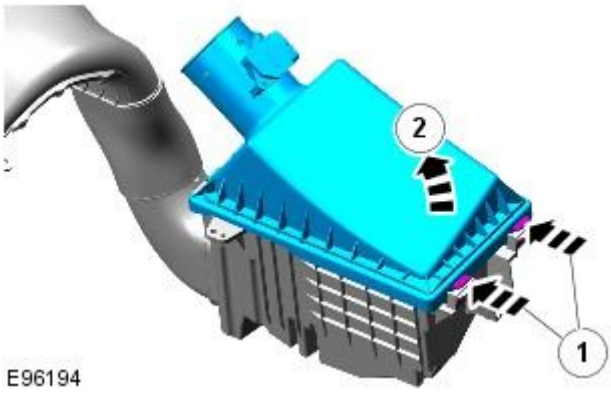
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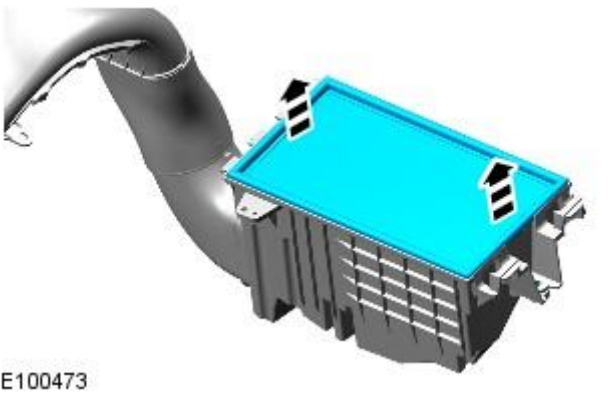
3.



4. Torque: 8 Nm

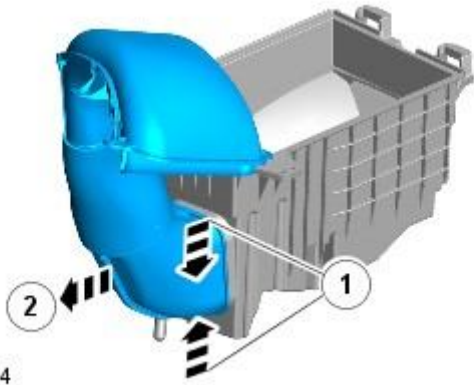


5. **5.** NOTE: Do not disassemble further if the component is removed for access only.



6.

7.



E100474

## Installation

1. To install, reverse the removal procedure.



# Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8 - Air Cleaner Outlet Pipe

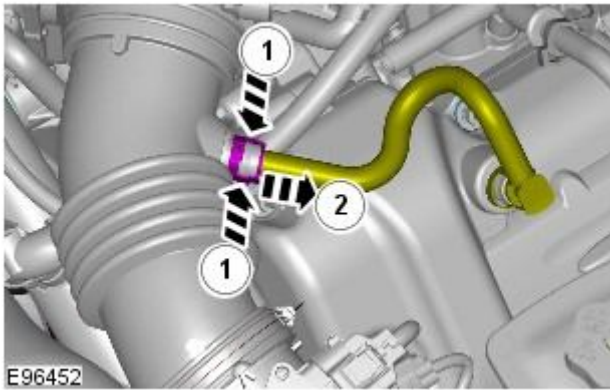
Removal and Installation

## Removal

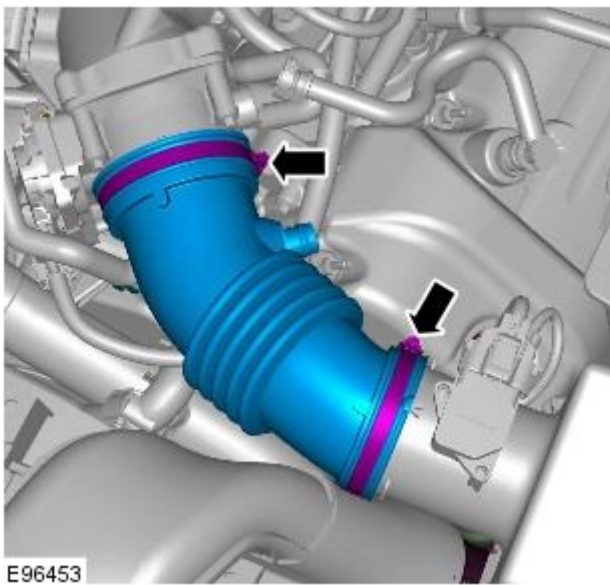
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



3.



## Installation

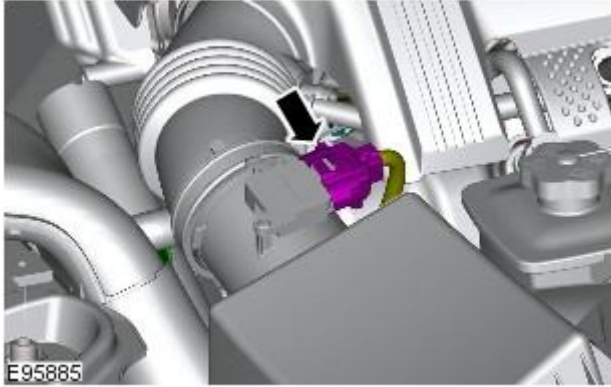
1. To install, reverse the removal procedure.

# Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8 - Air Cleaner Element

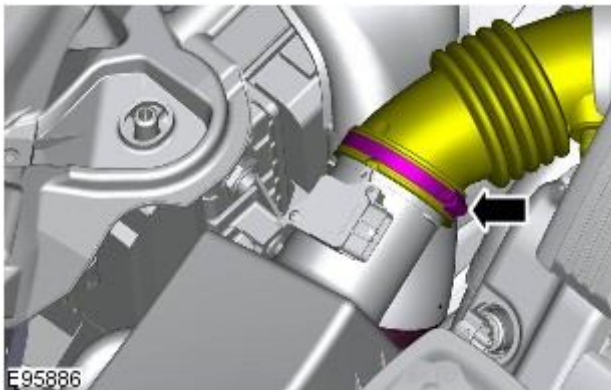
Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.



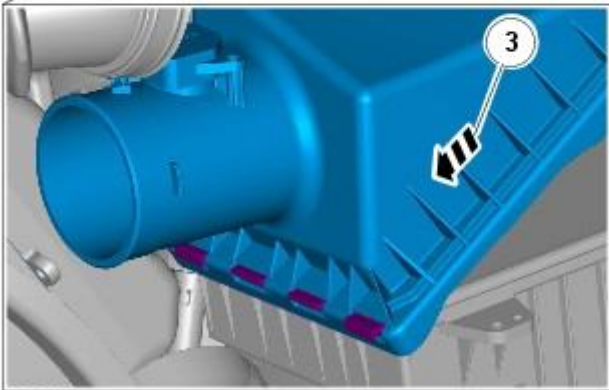
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2.

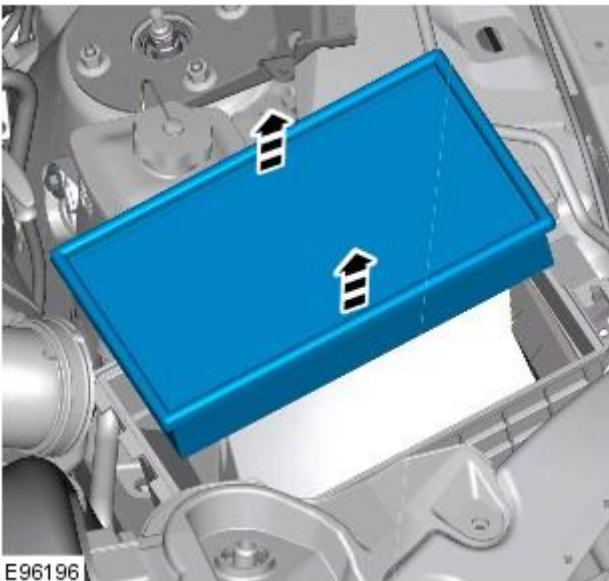


3.



E96195

4.



E96196

## Installation

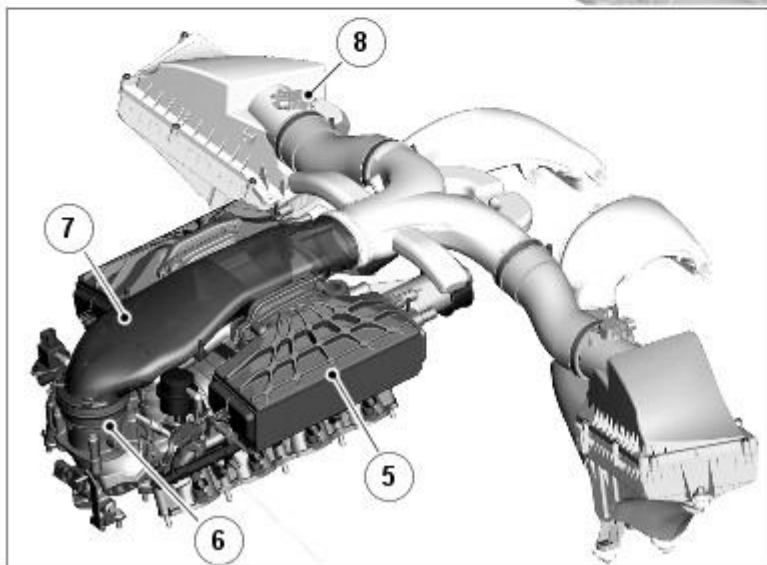
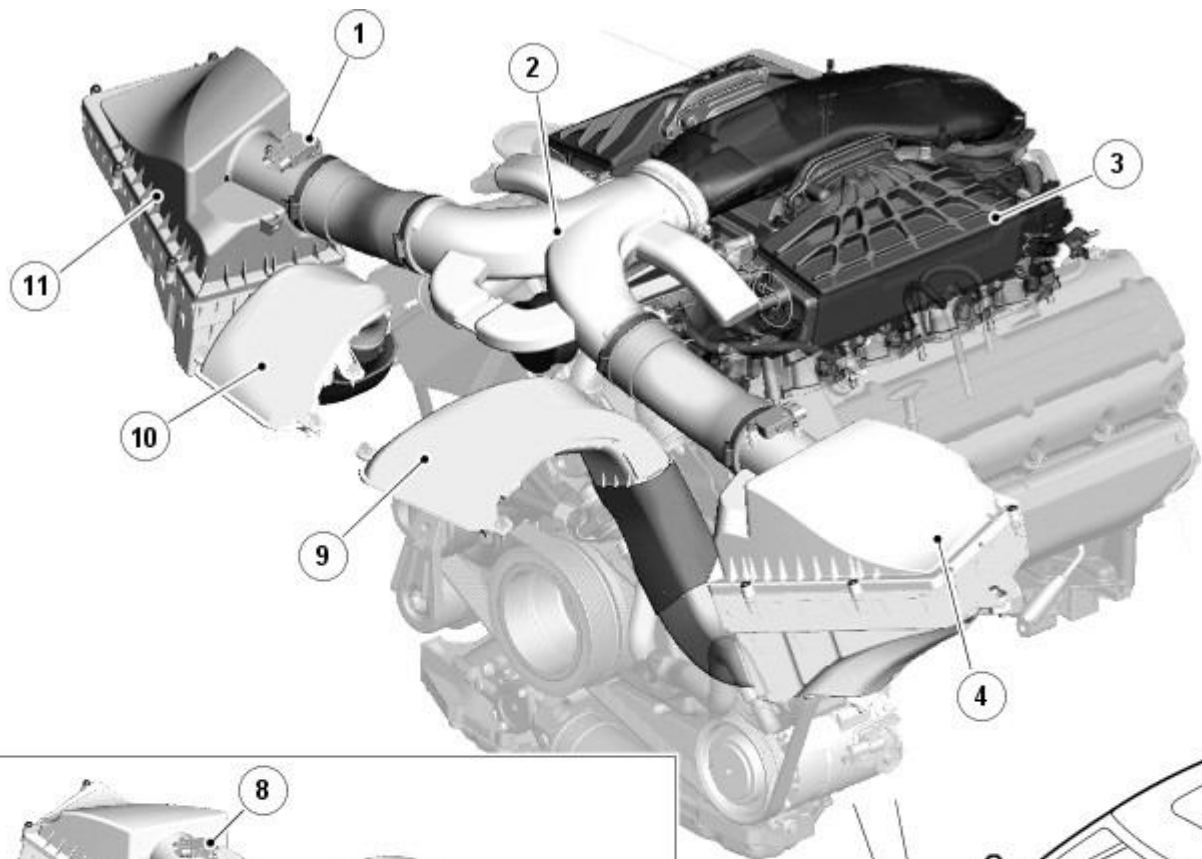
1. To install, reverse the removal procedure.

**Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8 -**

Description	Nm	lb-ft	lb-in
Air cleaner retaining bolt	8	-	71
Supercharger outlet pipe retaining nuts	9	-	80
Supercharger outlet pipe retaining bolts	9	-	80
Supercharger retaining bolts	24	18	-
Air intake elbow retaining bolts	24	18	-
Air intake elbow lower bracket retaining bolts	20	15	-
Exhaust gas recirculation (EGR) valve retaining bolts	10	7	-
Exhaust manifold to EGR valve tube retaining bolts	21	15	-
Exhaust manifold to EGR valve tube retaining nuts	21	15	-
Thermostat housing retaining bolts	10	7	-
Throttle body intake hose retaining clip	10	7	-

# Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8 - Intake Air Distribution and Filtering - Component Location

Description and Operation



E93878



## ItemDescription

1	<a href="#">RH (right-hand)MAF (mass air flow) sensor</a>
2	Clean air Y piece
3	<a href="#">LH (left-hand) intercooler</a>
4	<a href="#">LH</a> air cleaner box
5	<a href="#">LH</a> intercooler
6	Electric throttle
7	Clean air duct
8	<a href="#">LHMAF</a> sensor
9	<a href="#">RH</a> dirty air intake
10	<a href="#">LH</a> dirty air intake
11	<a href="#">LH</a> air cleaner box

# Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8 - Intake Air Distribution and Filtering - Overview

Description and Operation

## OVERVIEW

The engine air intake and distribution system comprises:

- Two air cleaner boxes
- Two air intakes
- Electric throttle
- A supercharger
- Two [MAF \(mass air flow\)](#) sensors
- Two supercharger charge air coolers

Air is supplied to the supercharger via the 2 air cleaners, air cleaner outlet pipes, throttle body intake pipe, throttle body and induction elbow. The supercharger delivers pressurized air to two separate charge air cooler units mounted onto the cylinder bank it supplies. Pressurized cooled air is fed from the charge air coolers directly into each inlet port. The supercharger is attached to the three mounting bosses between the two cylinder heads. The supercharger has a filled for life internal lubrication system. The supercharger is positively aligned with the drive belt by a doweled mounting bracket.

A [MAF](#) sensor is fitted at the outlet of each air cleaner box. The sensor provides an input to the [ECM \(engine control module\)](#). The intake elbow directs the metered airflow from the throttle body outlet (underside of the throttle body) into the intake of the supercharger.

A supercharger by-pass valve assembly is located between the supercharger outlet and the induction elbow. A butterfly valve inside the assembly is opened by a diaphragm actuator operated by vacuum feed from the elbow. At closed or partially open throttle positions, the butterfly valve opens, allowing the airflow from the two charge air cooler inlets to be directed back to the supercharger inlet. This action inhibits the supercharging effect and reduces engine torque. Progressive opening of the throttle causes the by-pass valve to gradually close.

Each cylinder bank is fitted with a charge air cooler which supplies pressurized air to the four cylinders. The inlet ports to the two charge air coolers are connected to the supercharger via the supercharger outlet pipe consisting of adjustable metal ducts with bonded rubber seals. The charge air coolers are water cooled via a radiator and water pump.



# **Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8 - Intake Air Distribution and Filtering - System Operation and Component Description**

Description and Operation

## **System Operation**

Refer to: [Intake Air Distribution and Filtering](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Description and Operation).

## **Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8 - Intake Air Distribution and Filtering**

Diagnosis and Testing

For additional information.

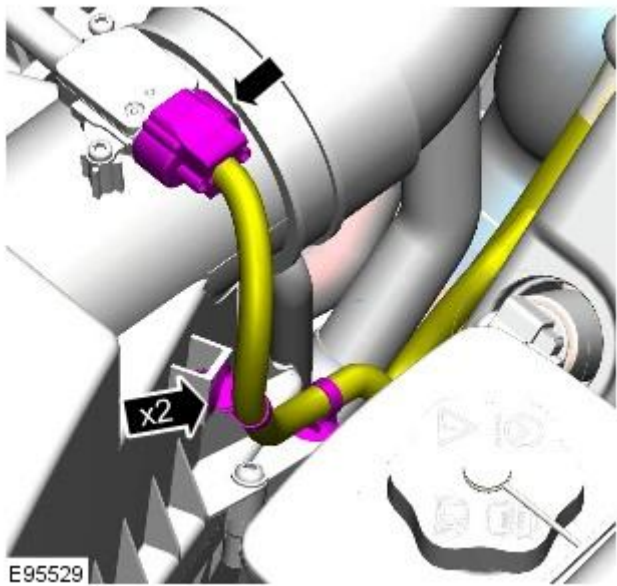
REFER to: [Intake Air Distribution and Filtering](#) (303-12A Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8, Diagnosis and Testing).

# Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8 - Air Cleaner LH

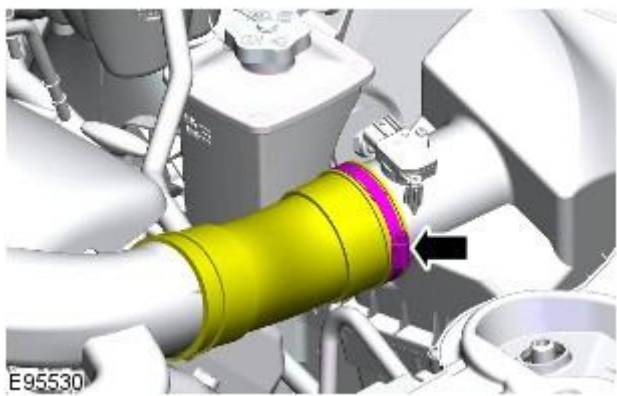
Removal and Installation

## Removal

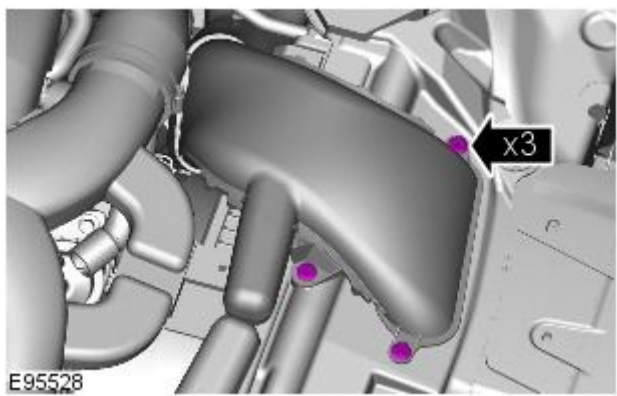
- NOTE: Removal steps in this procedure may contain installation details.



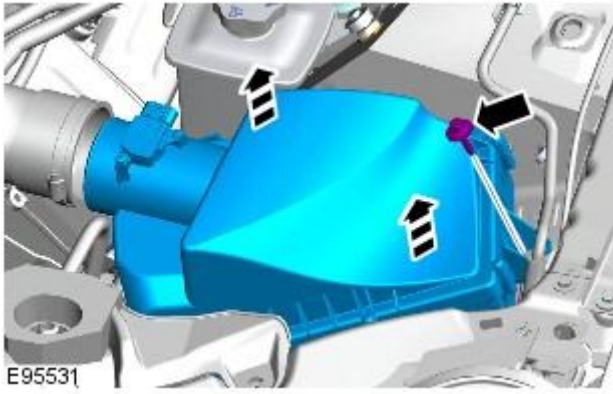
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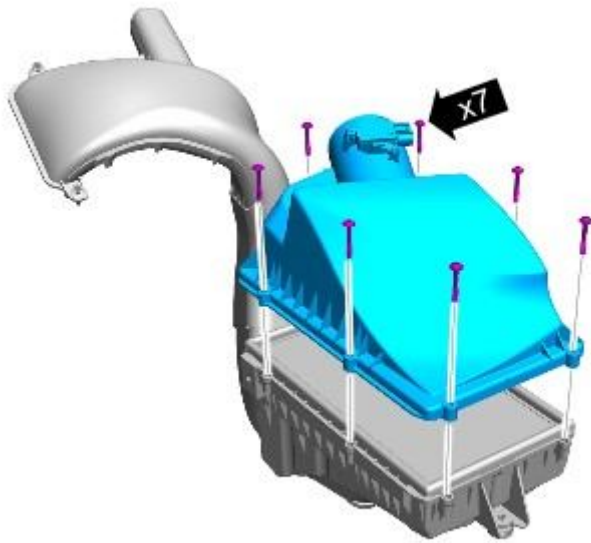
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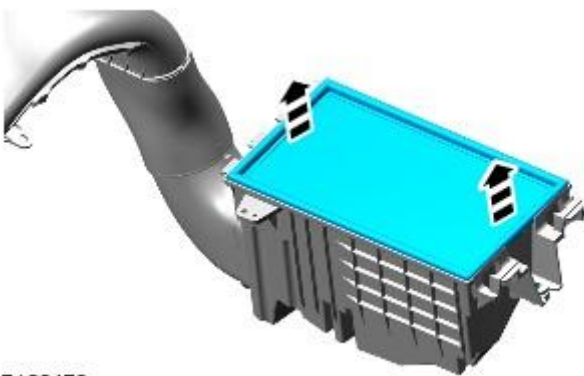
3.



4. Torque: 8 Nm

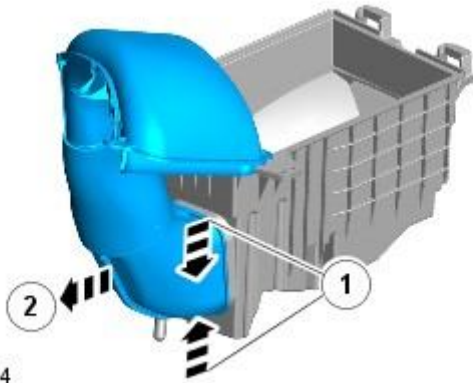


5. **5.** NOTE: Do not disassemble further if the component is removed for access only.



6. **6.** NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

7. **7. NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.



## Installation

1. To install, reverse the removal procedure.

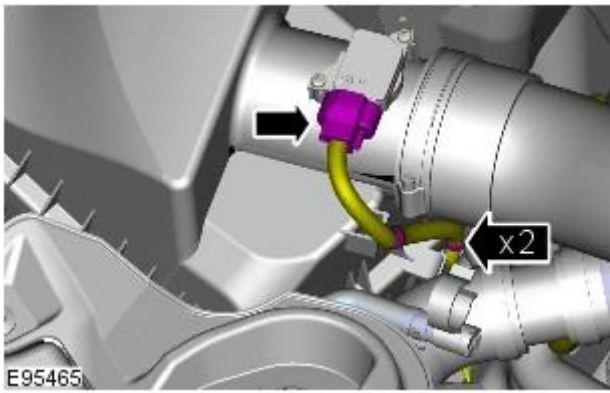
# Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8 - Air Cleaner RH

Removal and Installation

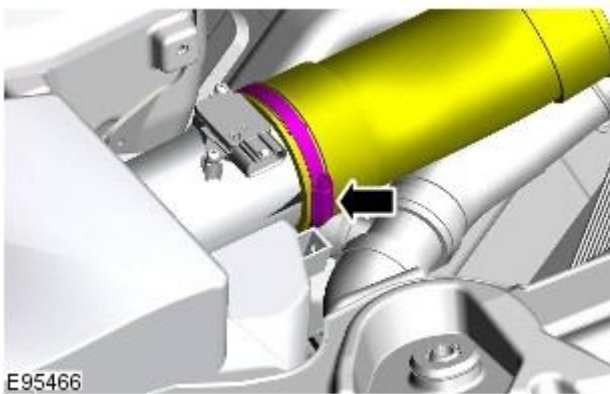
## Removal

- NOTE: Removal steps in this procedure may contain installation details.

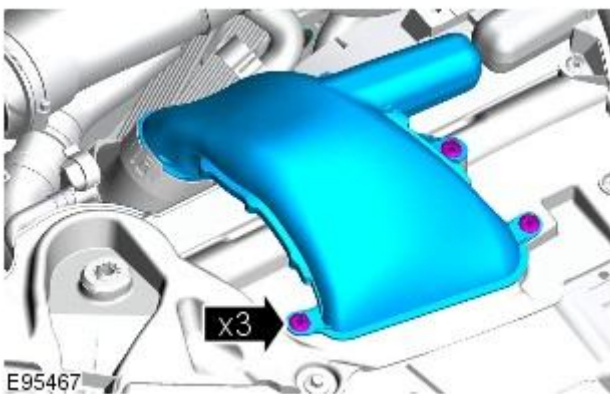
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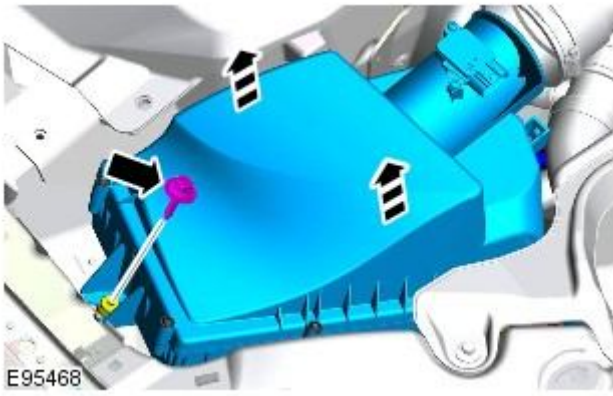
2.



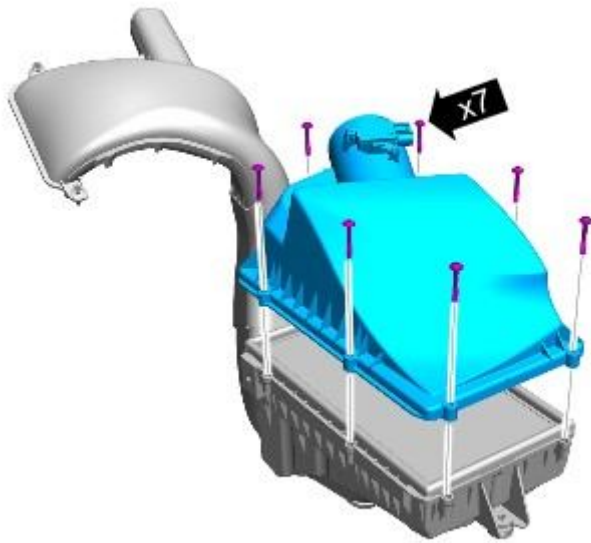
3.



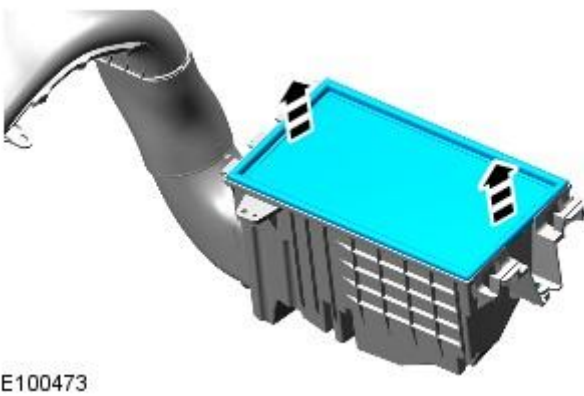




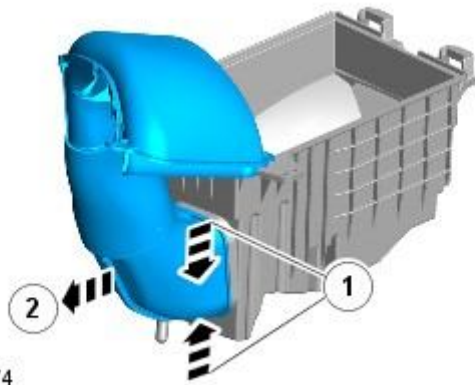
4.
  - Torque: 8 Nm



5. **5.** NOTE: Do not disassemble further if the component is removed for access only.
  - NOTE: Some variation in the illustrations may occur, but the essential information is always correct.
  - NOTE: LH shown, RH similar.



6. **6.** NOTE: Some variation in the illustrations may occur, but the essential information is always correct.
  - NOTE: LH shown, RH similar.



E100474

## Installation

7. **7.** NOTE: Some variation in the illustrations may occur, but the essential information is always correct.
  - NOTE: LH shown, RH similar.

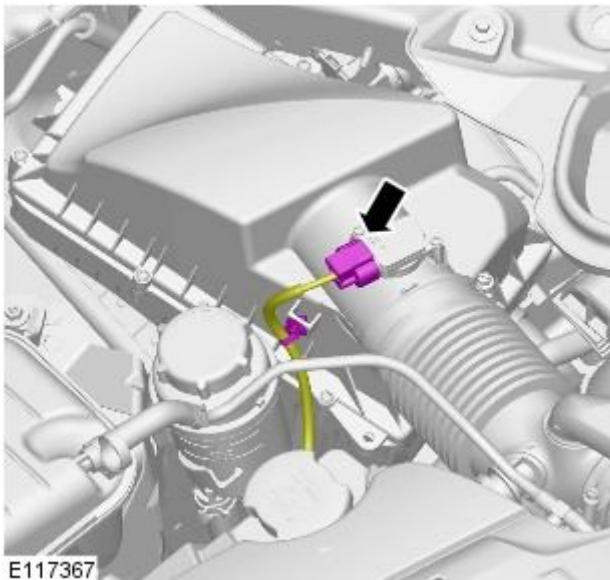
1. To install, reverse the removal procedure.

# Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8 - Air Cleaner Element

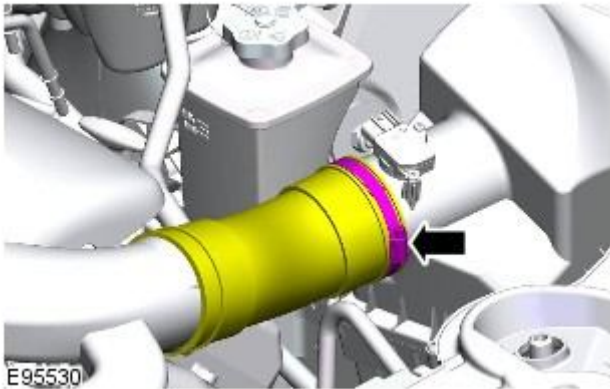
Removal and Installation

## Removal

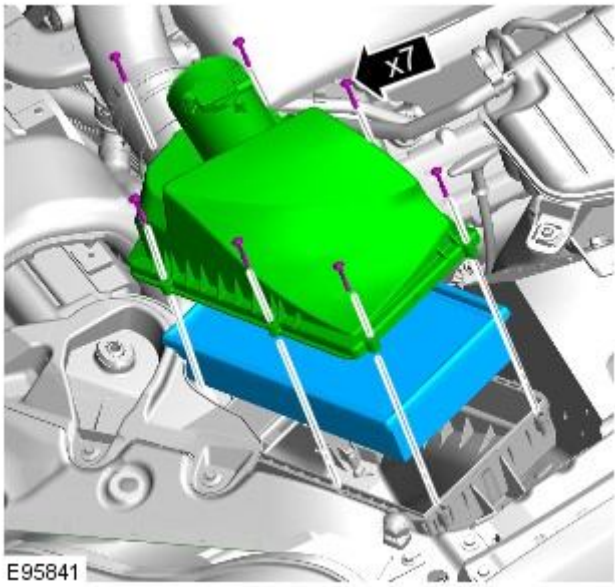
- NOTE: Removal steps in this procedure may contain installation details.
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



1. **1.** NOTE: Left-hand shown, right-hand similar.



2. **2.** NOTE: Left-hand shown, right-hand similar.



3. **3.** NOTE: Left-hand shown, right-hand similar.

4. Repeat the above procedure on the opposite side.

## Installation

1. To install, reverse the removal procedure.

# Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8 - Air Cleaner Outlet Pipe

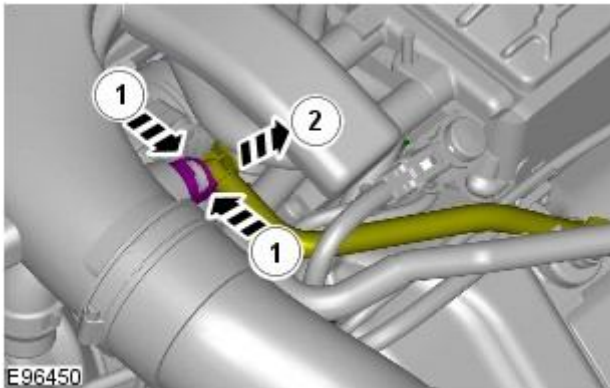
Removal and Installation

## Removal

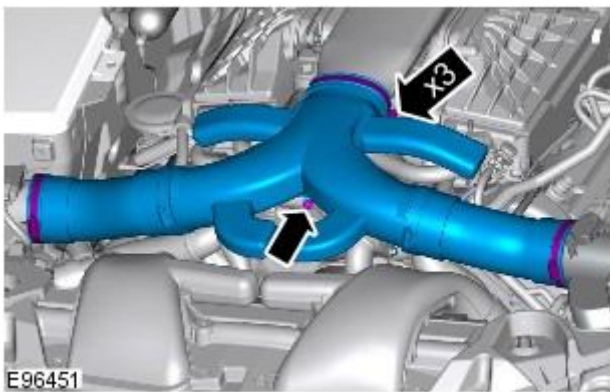
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Engine Cover - 4.2L SC V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



3. Torque: 6 Nm



## Installation

1. To install, reverse the removal procedure.

# Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8 - Charge Air Cooler

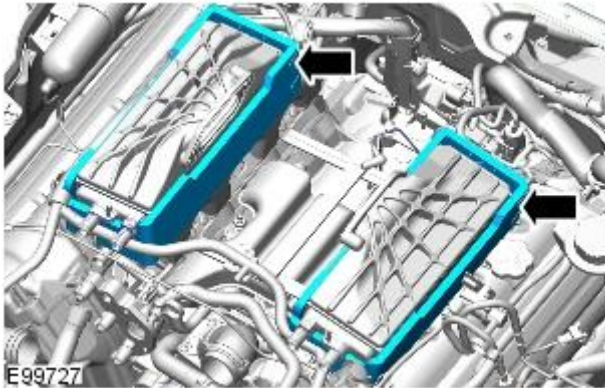
Removal and Installation

## Removal

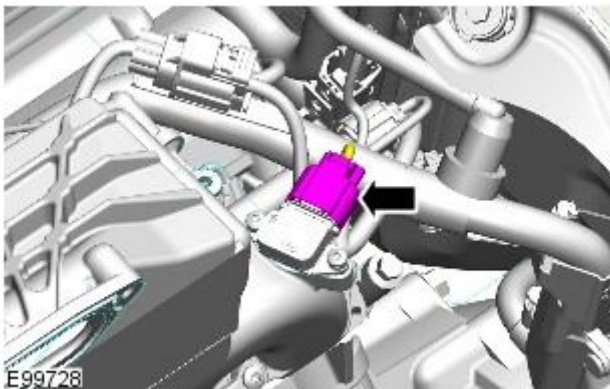
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Supercharger](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).

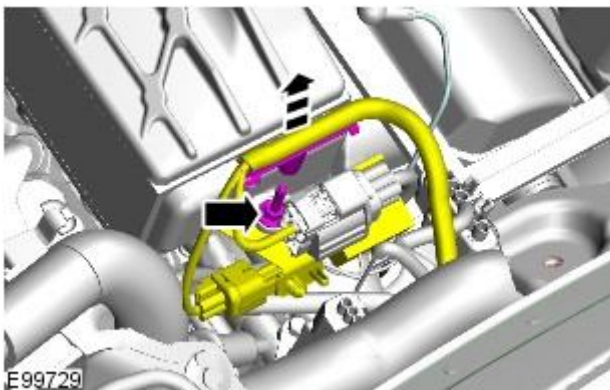
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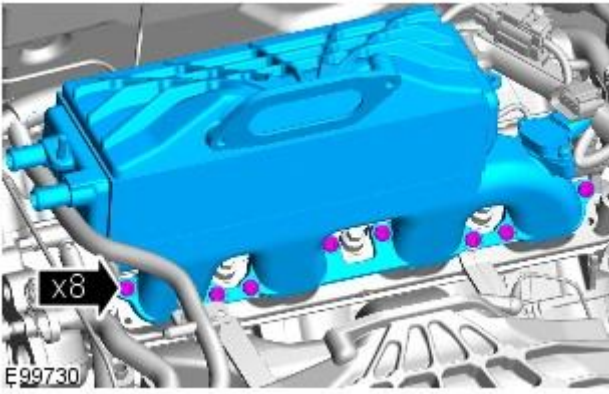
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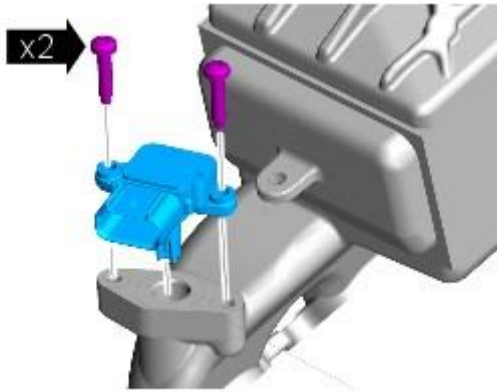
5. Torque: 10 Nm



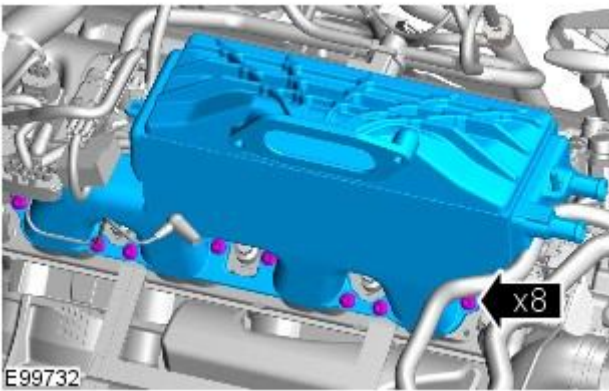




6. Torque: 13 Nm



7. Torque: 10 Nm



8. Torque: 13 Nm

## Installation

1. To install, reverse the removal procedure.

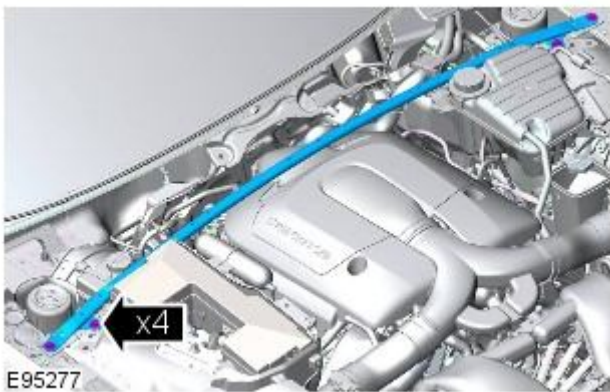
# Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8 - Supercharger

Removal and Installation

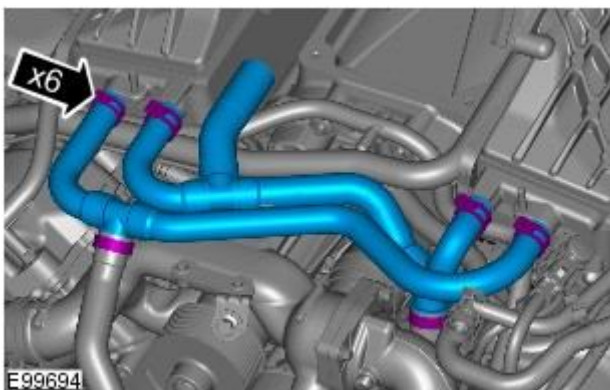
## Removal

• NOTE: Removal steps in this procedure may contain installation details.

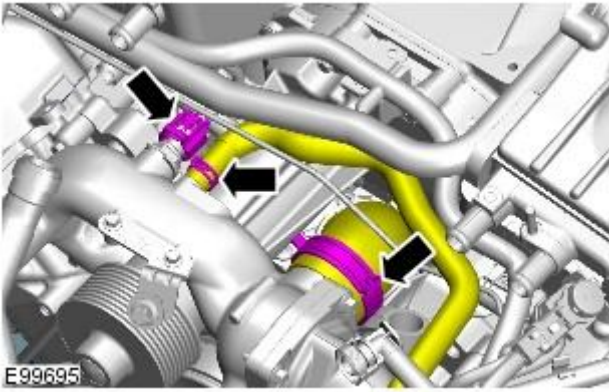
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03 Engine Cooling - 3.0L, General Procedures).
3. Refer to: [Cowl Vent Screen](#) (501-02 Front End Body Panels, Removal and Installation).
4. Refer to: [Supercharger Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).
5. Refer to: [Exhaust Manifold to Exhaust Gas Recirculation \(EGR\) Valve Tube - 4.2L NA V8 - AJV8](#) (303-08 Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).



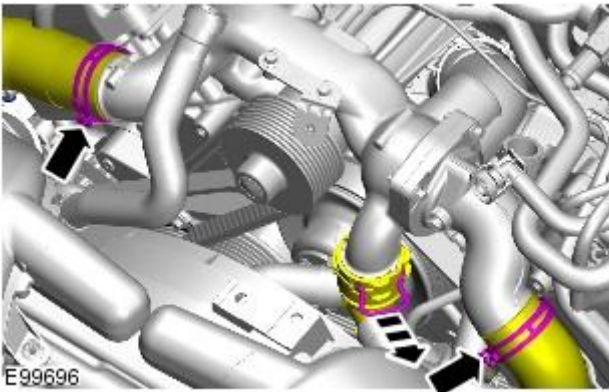
6. Torque: 25 Nm



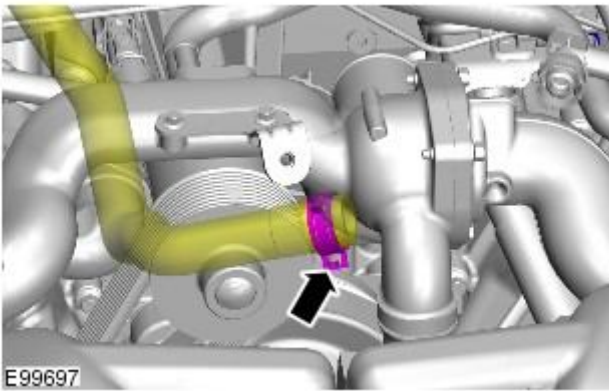
7.



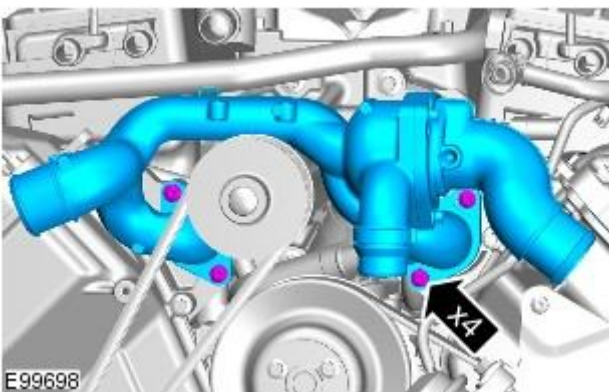
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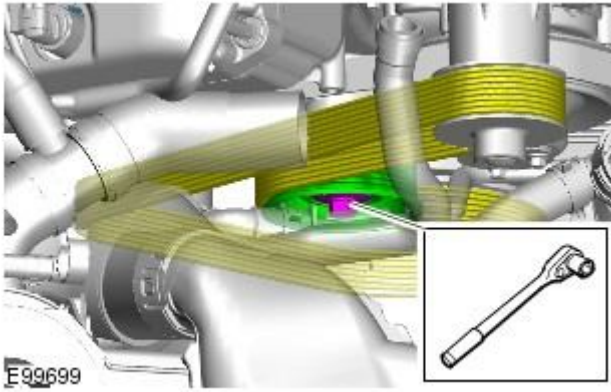
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10.

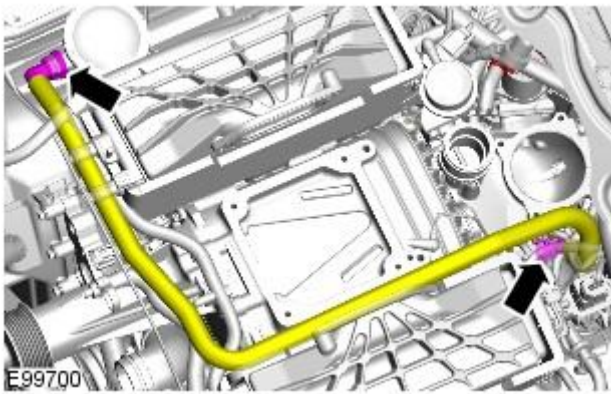


11. Torque: 10 Nm

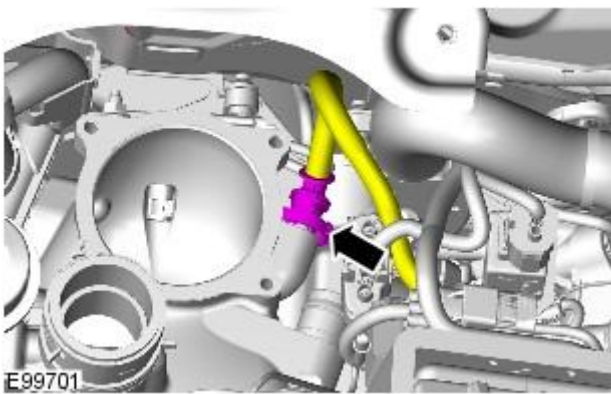


12.

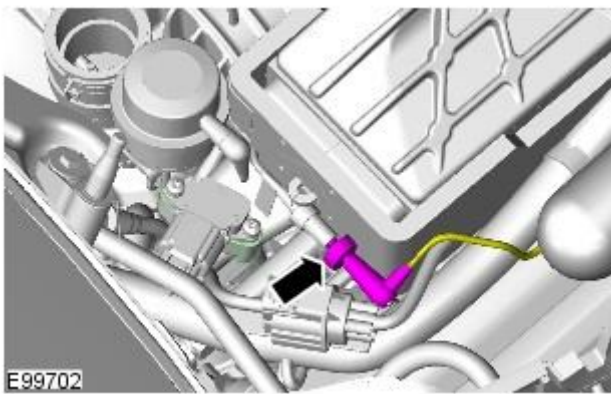
- Rotate the drive belt tensioner clockwise. Use a 1/2 inch square drive bar to rotate the drive belt tensioner.



13.

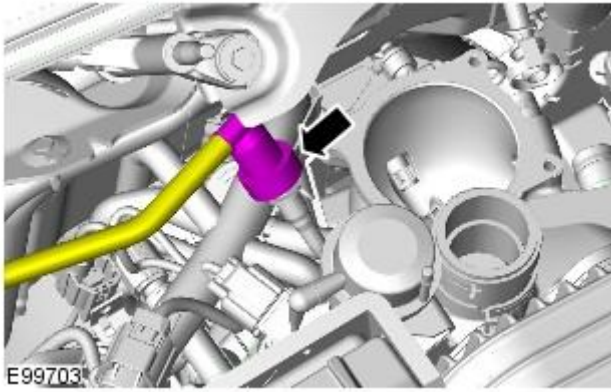


14.

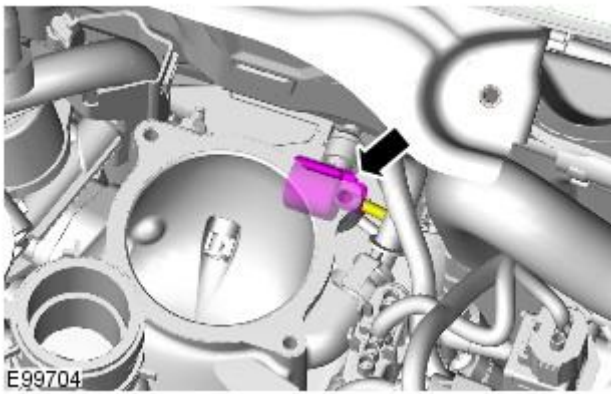


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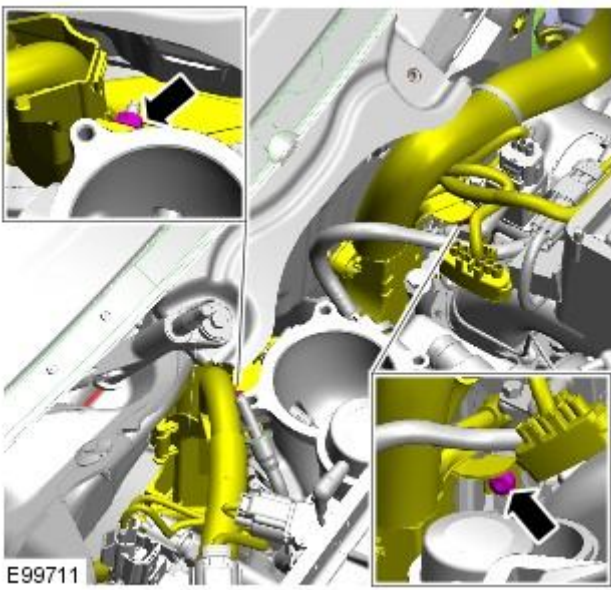




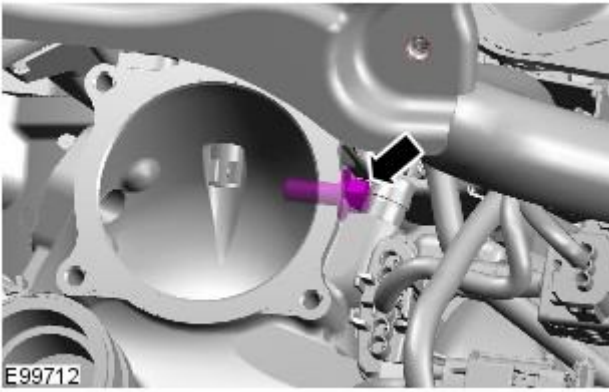
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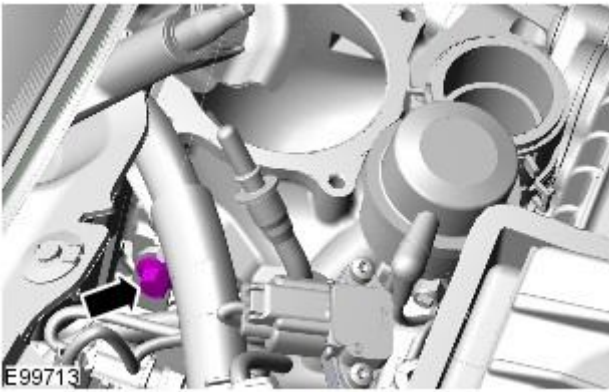
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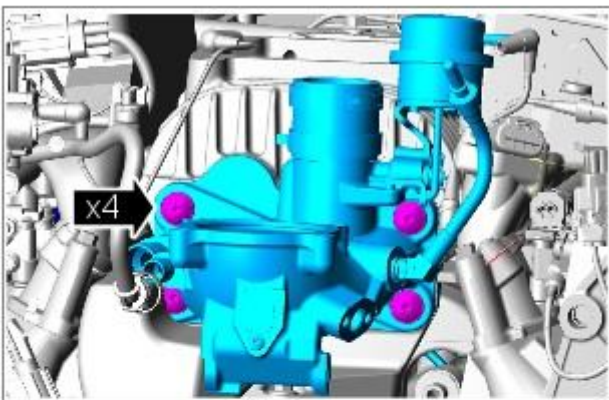
18. Torque: 8 Nm



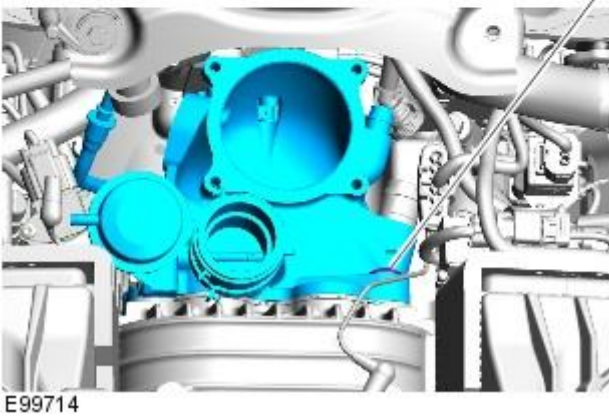
19. Torque: 25 Nm



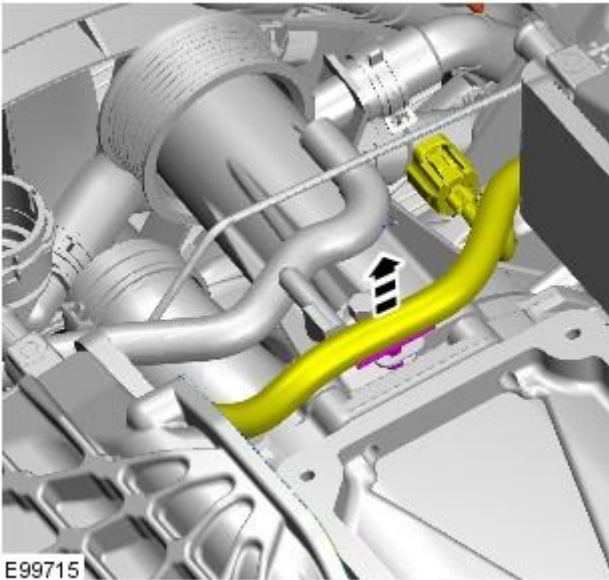
20. Torque: 25 Nm



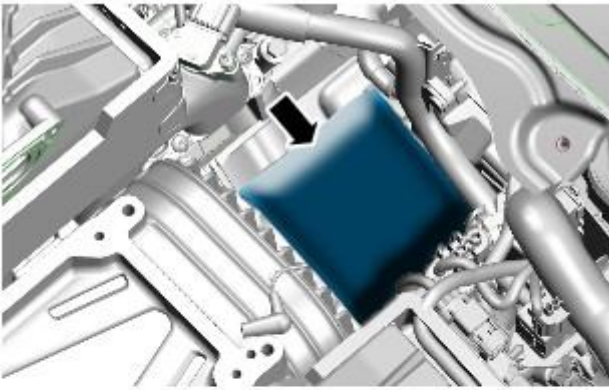
21. Torque: 25 Nm



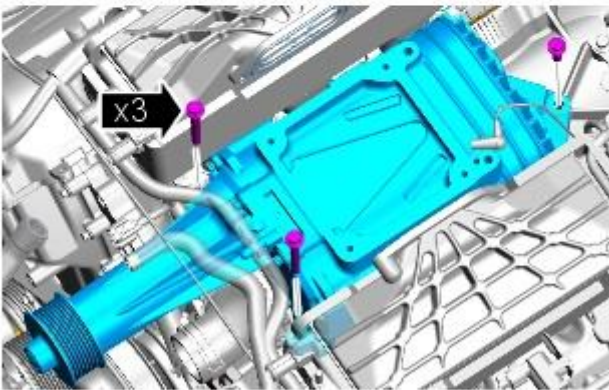




22.



23. *Torque:* 25 Nm



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## Installation

1. To install, reverse the removal procedure.

# Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8 - Supercharger Outlet Pipe

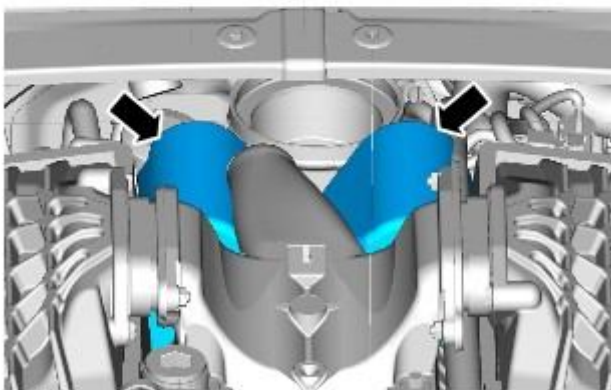
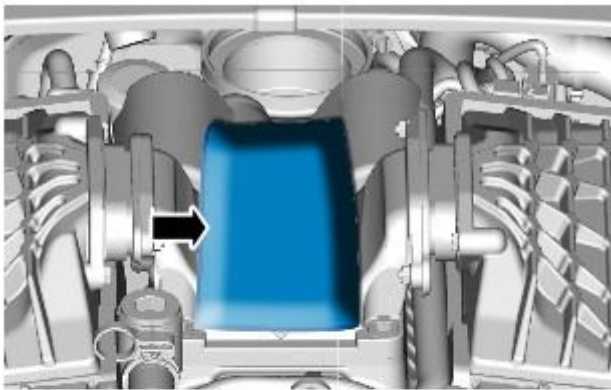
Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

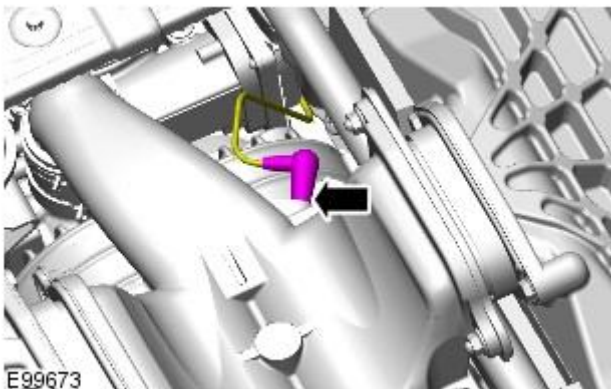
1. Refer to: [Engine Cover - 4.2L SC V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).

3.

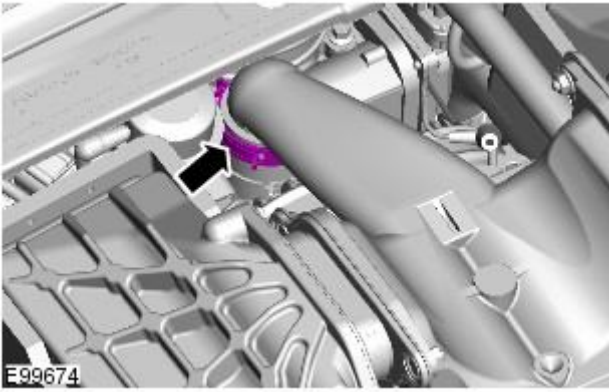


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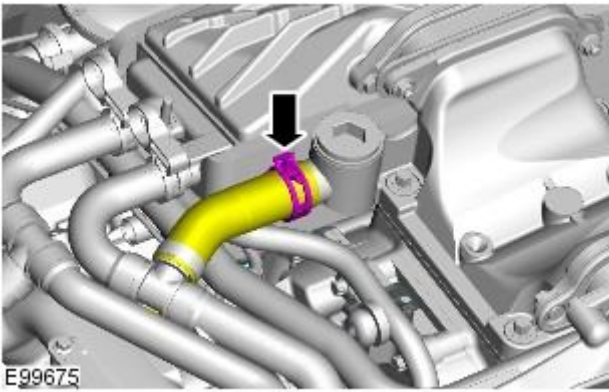
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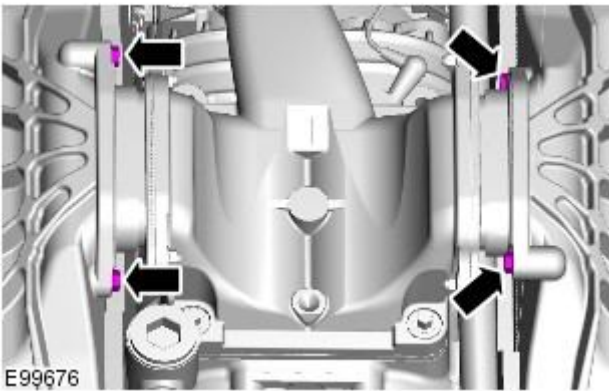
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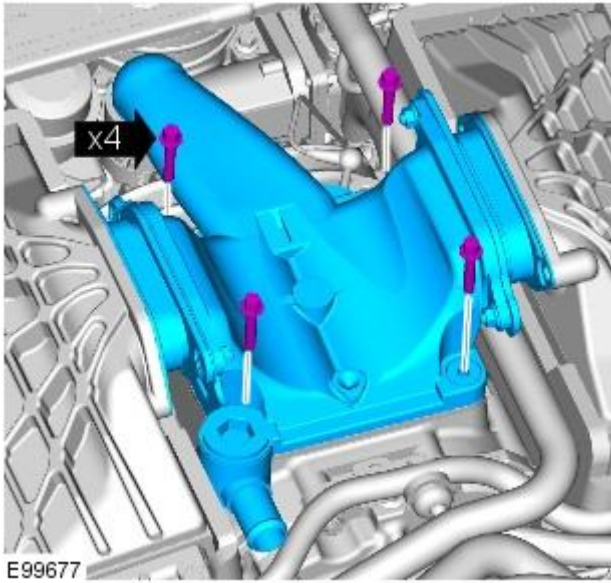
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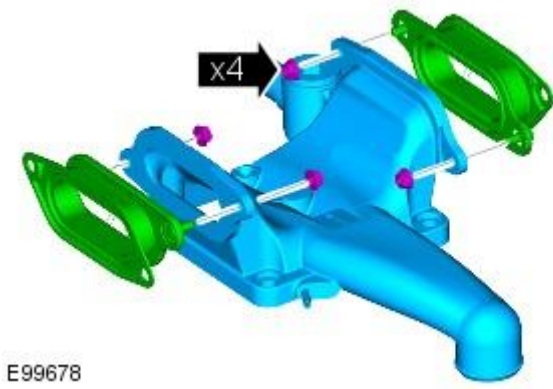
6.



7. Torque: 9 Nm



8. Torque: 9 Nm



9. Torque: 8 Nm

## Installation

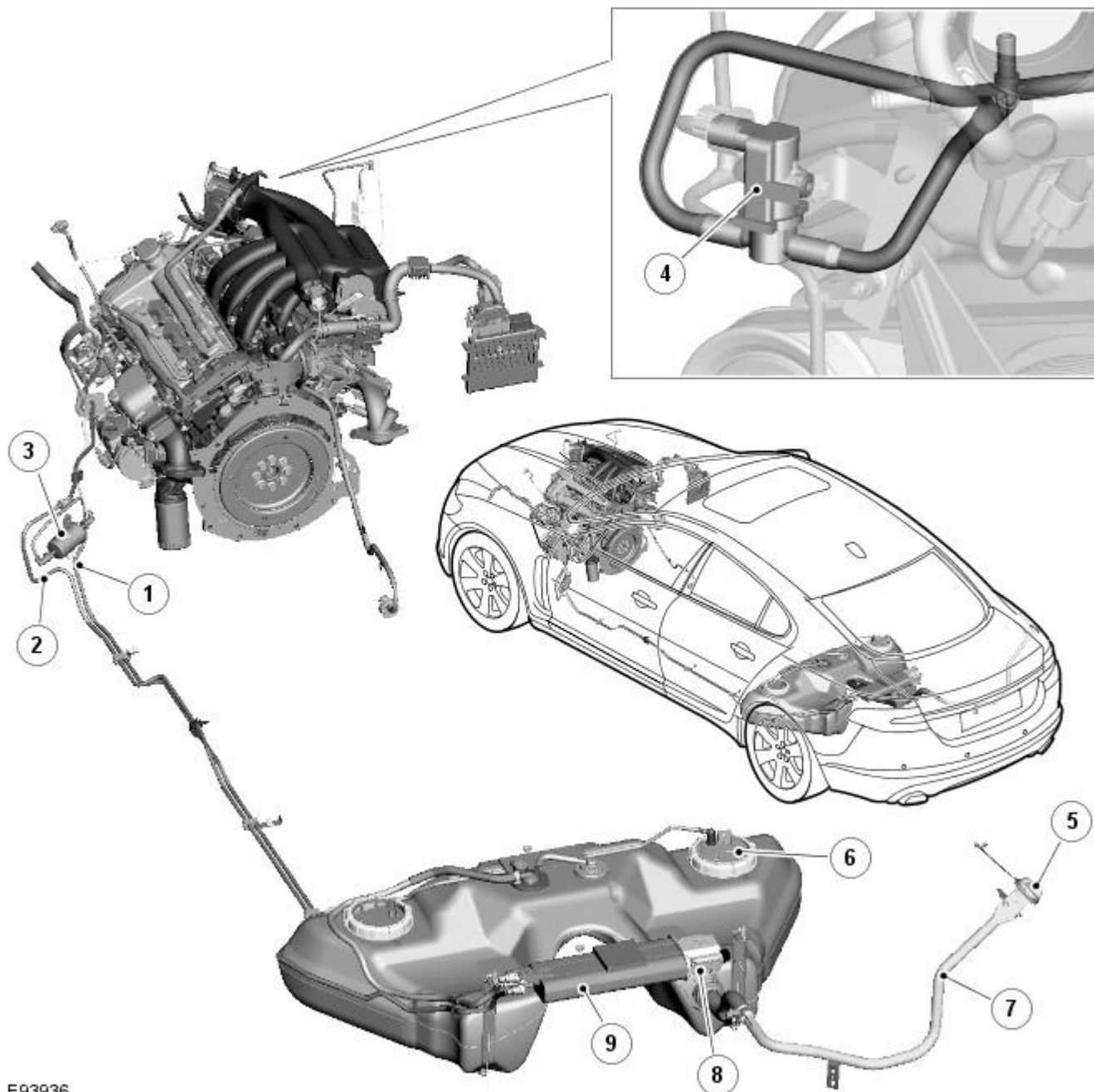
1. To install, reverse the removal procedure.

**Evaporative Emissions - V6 3.0L Petrol -**

Description	Nm	lb-ft	lb-in
Evaporative emission canister carrier bolts	10	7	-

# Evaporative Emissions - V6 3.0L Petrol - Evaporative Emissions - Component Location

Description and Operation



E93936

## ItemDescription

1	Fuel feed line
2	Charcoal cannister purge line
3	Fuel filter
4	Purge valve
5	Fuel filler cap
6	Fuel pump
7	Filler neck
8	Fuel pump driver module
9	Charcoal cannister



# Evaporative Emissions - V6 3.0L Petrol - Evaporative Emissions - Overview

Description and Operation

## OVERVIEW

The [EVAP \(evaporative emission\)](#) control system reduces the level of hydrocarbons released into the atmosphere by fuel vapor venting from the fuel tank. The system comprises a charcoal canister, purge valve and interconnecting vent pipes and hoses. The vent pipes are connected to the system components using quick release connectors.

Fuel vapor is generated by the fuel in the tank and the amount of vapor produced increases as the fuel heats up. Fuel vapor can flow freely to the charcoal canister via the tank venting system. The venting system consists of roll over valves and a liquid vapor separator mounted internally in the tank and then externally via a breather line. The breather line allows the fuel vapor to flow to the charcoal canister via a 'Y' piece mounted on the filler pipe.

On all vehicles the fuel vapor is restricted in its path to the charcoal canister but can flow freely during the refueling operation to atmosphere, via the filler opening.

The vapor passes into the charcoal canister where it is absorbed and stored by the charcoal. Because there is a limit to the amount of vapor the canister can contain, the fuel vapor is purged from the canister when the engine is running and burned in the engine.

# Evaporative Emissions - V6 3.0L Petrol - Evaporative Emissions - System Operation and Component Description

Description and Operation

## System Operation

The atmospheric pressure at the air intake vent of the system is higher than the inlet manifold pressure under all throttled engine running conditions. It is this pressure differential across the system that causes the air to flow through the air intake, through the purge system, and in to the engine.

The **ECM (engine control module)** waits until the engine is running above 40°C (104°F) coolant temperature with closed loop fuel operational before the purging process is activated. Under these conditions the engine should be running smoothly with no warm up enrichment. The purge valve duty (and flow) is initially ramped slowly because the vapor concentration is unknown (a sudden increase in purge could cause unstable engine running or cause it to stall due to an extremely "rich" air/fuel mixture.). The concentration is then determined from the amount of adjustment that the closed loop fueling is required to make to achieve the target Air Fuel Ratio (AFR). Once the concentration has been determined, the purge flow can be increased rapidly and the injected fuel can be proactively adjusted to compensate for the known purge vapor and the target AFR control is maintained.

When the purging process is active, fresh air is drawn into the charcoal canister via the vent hose connection and the spider trap.

## Component Description

### Charcoal Cannister

The charcoal canister is located in a central position, forward of the spare wheel. It is attached at the rear with two bolts which screw into the spare wheel carrier. At the front, the canister has two lugs which locate in the parking brake module support bracket.

The canister has a capacity of 1400cc (85.4 in3).

The canister has three ports which allow for the attachment of the atmospheric vent hose, the purge hose and the tank vent hose.

The canister contains a bed of activated charcoal or carbon. The charcoal is produced using special manufacturing techniques to treat the charcoal with oxygen. The oxygen treatment opens up millions of pores between the carbon atoms resulting in a highly porous charcoal with a very large effective surface area which is capable of absorbing large quantities of fuel vapor. Once treated the charcoal is known as 'activated' carbon or charcoal.

### Purge Valve

The purge valve is located **LH (left-hand)** side of the engine, on a bracket which is attached to the cylinder block. The purge hose is routed from the purge valve, along the left hand side of the air intake manifold, to the elbow assembly which locates the electric throttle. The purge valve is controlled by the **ECM** and is operated when engine operating conditions are correct to allow purging of the charcoal canister. The purge valve is a solenoid operated valve which is closed when de-energized.

The purge hose is connected, at the right hand rear of the engine, with a quick release coupling to the purge line which runs parallel with the fuel feed line along the top of the fuel tank to the charcoal canister.

The purge hose continues from the purge valve and is routed to a connection on the air intake elbow assembly. The hose is connected to the elbow with a quick release connector.

The purge valve is **PWM (pulse width modulation)** at 10Hz by the **ECM**. At this high frequency, the pulses of purge gas flow into the inlet manifold in an almost a continuous flow. The valve operates between 7% and 100% duty or mark space ratio (% open time).

# Evaporative Emissions - V6 3.0L Petrol - Evaporative Emissions

Diagnosis and Testing

## Principles of Operation

For a detailed description of the evaporative emission system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Evaporative Emissions (303-13 Evaporative Emissions - V8 5.0L Petrol/V8 S/C 5.0L Petrol, Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.

• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of mechanical or electrical damage.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Fuel filler cap and seal</li> <li>● Fuel filler neck</li> <li>● DMTL fresh air filter (restriction, etc)</li> <li>● Fuel tank (leaks, damage, etc)</li> <li>● Fuel lines and joints, etc</li> <li>● Carbon canister</li> <li>● Purge valve</li> <li>● Diagnostic module fuel tank leak (DMTL) pump module</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Connectors</li> <li>● Harness</li> <li>● Purge valve</li> <li>● Diagnostic module fuel tank leak (DMTL) pump</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.
5. 5. Where K-Line, Vacutec or other proprietary smoke test equipment is available, it should be utilized to assist with Evaporative Emissions System leak diagnosis.

## Symptom Chart

Symptom	Possible Causes	Action
Difficulty in filling fuel tank	<ul style="list-style-type: none"> <li>● Restriction in the vapour line between the fuel tank and the carbon canister outlet/atmospheric port</li> </ul>	Check for restrictions/damage, etc (see visual inspection)
Fuel smell	<ul style="list-style-type: none"> <li>● System leak</li> <li>● Purge valve inoperative</li> </ul>	Check for leaks, check the purge valve operation
'Check Fuel Filler Cap' displayed on Message Center	<ul style="list-style-type: none"> <li>● Fuel filler cap missing/not tightened after refuelling</li> </ul>	Check the fuel filler cap and seal

## DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

## Evaporative Leak OBD Fault Rectification Guide

Determine Which DTC Has Been Stored

Using the manufacturer approved diagnostic system, choose **diagnostic session**, then choose the following symptom paths : **Powertrain/engine system/fuel vapour and odor**, **Powertrain/engine system/fuel tank**, **Electrical/instruments/warning lamps/engine malfunction lamp/lamp illuminated**, **Powertrain/engine system/engine performance/fuel consumption high**

• **NOTE:** This guide covers DTCs that relate to evaporative leak monitoring, as listed in the table below

DTC	Description
P0442-00	DMTL small leak
P0447-00	DMTL COV electrical low (open)
P0448-00	DMTL COV electrical high
P0455-00	DMTL rough leak
P2401-00	DMTL pump electrical low (open)
P2402-00	DMTL pump electrical high
P2404-2F	DMTL noise fault
P2404-29	DMTL reference leak
P2405-00	DMTL reference current low
P2406-00	DMTL reference current high
P2450-00	DMTL COV stuck open
P2451-00	DMTL COV stuck closed
P240B-00	DMTL heater electrical low (open)
P240C-00	DMTL heater electrical high

Attempt To Replicate The Fault Using The "Fuel Leak Check" Forced Test

1. 1. Record any DTCs that has been logged
2. 2. Using the manufacturer approved diagnostic system, in the **Recommendations** tab run the **Fuel Leak Check** forced test

3. **3.** For the test to be successful the fuel level must be between 15% and 85%
4. **4.** During this procedure the engine must be off
5. **5.** The possible responses from the test and the associated DTCs are listed below
6. **6.** If again no fault is found it could suggest that the failure mode is a borderline condition (refer to section 3) or that it was caused by incorrect fitment of the fuel cap or the fuel filler neck is at fault therefore it is important not disturb the fuel cap
7. **7.** Disconnect purge pipe from the purge valve, observe the condition of connection (the seating and condition of the "O" ring) and then reconnect. Using the manufacturer approved diagnostic system, run **Purge Valve Self Test** (to clean the purge valve) then run the **Fuel Leak Check**
8. **8.** If the test failed, a smoke test is required to determine the cause of the leak

• **NOTE:** P240B & P240C are not included in the **Fuel Leak Check** forced test (these monitors run at every ignition on and complete within 30 seconds)

Response Description	ID	Equivalent DTC
Function running: Reference leak measurement	1	
Function running: Rough leak measurement	2	
Function running: Small leak measurement	3	
Function running: 2nd ref leak measurement	4	
Function running: COV Cleaning	5	
Function aborted due to conditions: Vbatt conditions not correct (too high/ low)	11	
Function aborted due to conditions: Variation Ref. I (reference current) too high	12	P2404-29
Function aborted due to conditions: DMTL electrical fault	13	P0447, P0448
Function aborted due to conditions: Maximum diagnostic time exceeded	14	
Function aborted due to conditions: Crash detected	15	
Function aborted due to conditions: Refuel detected	20	
Function aborted due to conditions: Filler cap opened	21	
Function aborted due to conditions: Engine start	23	
Function aborted due to conditions: Noisy current measurement	24	P2404-2F
Function aborted due to conditions: Ambient temp outside range	26	
Function aborted due to conditions: Ambient pressure outside range	27	
Function aborted due to conditions: Other conditions	29	
Function complete - Tight system, fault free	30	
Function complete - Fine leak detected	31	P0442
Function complete - Rough leak detected	32	P0455
Function complete - Module error	33	P2401, P2402, P2450, P2451, P2405, P2406, P2404-29
Function complete - Medium leak detected	34	P0442, P0455

Read The "Ranking values" To Determine How Far Away The Result Is From The Failure Threshold

9. **9.** When the **Fuel Leak Check** forced test has completed the test results (known as ranking values) will be displayed
10. **10.** These should be compared against the limits shown in the table below
11. **11.** If the test result is borderline then there is a risk that a failure will occur at a later date (during customer usage of the vehicle)
12. **12.** To avoid this the vehicle should be carefully checked for any small leaks

Ranking Value	Normal Result For Tight System	Leak Failure Condition
Rough Leak (40 thou+)	0 > = 50	>= 128
Small Leak (20 thou+)	0 > = 60	>= 128

TRACE THE ROOT CAUSE OF THE FAULT

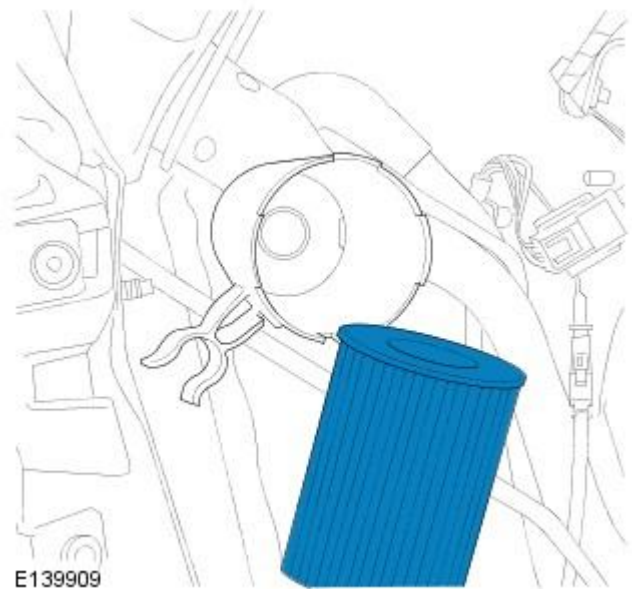
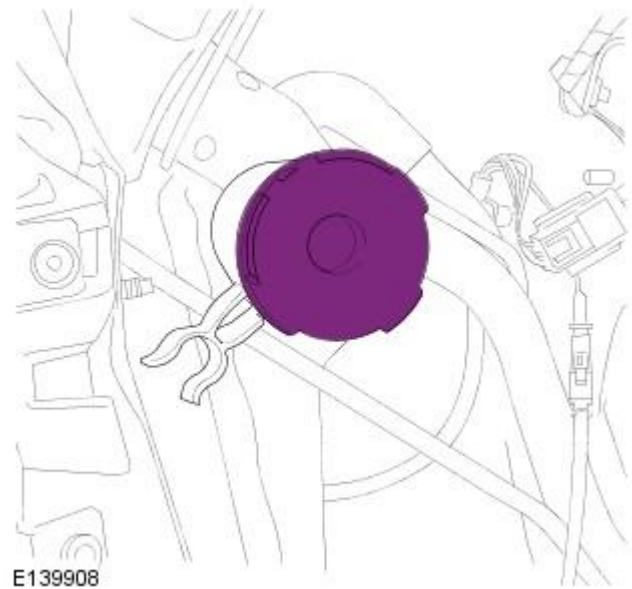
The list below provides some suggested actions to help trace the root cause of the fault

Each action should be followed up with a **Fuel Leak Check** forced test (and ranking value check) in order to determine if any improvement has been made

DTC	Fault Description	Fault Rectification Actions after smoke test
P0442-00	DMTL small leak	<ul style="list-style-type: none"> <li>● 1. Inspect / refit filler cap after smoke test (inspect filler neck for correct fitment to pocket so that filler neck protrudes)</li> <li>● 2. Run engine at idle; Using the manufacturer approved diagnostic system, run <b>Purge Valve Self Test</b> (to clean the purge valve)</li> <li>● 3. Check that the DMTL module wiring connector has been installed correctly and that the seals around the connector body and individual wires are in good condition</li> <li>● 4. Check all fuel system connections are correctly installed and secure</li> <li>● 5. Visually inspect purge canister, purge pipes, fuel tank and filler neck for any obvious damage</li> <li>● 6. Try isolating the purge valve by fitting a blanking plug to the purge pipe</li> <li>● 7. Carry out a smoke test</li> <li>● 8. Replace the DMTL module</li> </ul>
P0447-00	DMTL COV electrical low (open)	<ul style="list-style-type: none"> <li>● 1. Check fuse</li> <li>● 2. Check that fuse fits tightly into the fuse holder</li> <li>● 3. Check that the DMTL module wiring connector has been fitted correctly</li> <li>● 4. Check wiring harness continuity between DMTL module and ECU connectors</li> <li>● 5. Replace DMTL module</li> </ul>
P0448-00	DMTL COV electrical high	<ul style="list-style-type: none"> <li>● 1. Check wiring</li> <li>● 2. Replace DMTL module</li> </ul>
P0455-00	DMTL rough leak	<ul style="list-style-type: none"> <li>● 1. Inspect / refit filler cap after smoke test (inspect filler neck for correct fitment to pocket so that filler neck protrudes)</li> <li>● 2. Run engine at idle; Using the manufacturer approved diagnostic system, run "Purge Valve Self Test" (to help clean the purge valve)</li> <li>● 3. Check that the DMTL module wiring connector has been installed correctly and that the seals around the connector body and individual wires are in good condition (surprisingly, this is a potential leakage path!)</li> <li>● 4. Check all fuel system connections are correctly installed and secure</li> </ul>

DTC	Fault Description	Fault Rectification Actions after smoke test
		<ul style="list-style-type: none"> <li>● 5. Visually inspect purge canister, purge pipes, fuel tank and filler neck for any obvious damage</li> <li>● 6. Try isolating the purge valve by fitting a blanking plug to the purge pipe</li> <li>● 7. Carry out a smoke test</li> <li>● 8. Replace DMTL module</li> </ul>
P2401-00	DMTL pump electrical low (open)	<ul style="list-style-type: none"> <li>● 1. Check fuse</li> <li>● 2. Check that fuse fits correctly into the fuse holder</li> <li>● 3. Check that the DMTL module wiring connector has been fitted correctly</li> <li>● 4. Check wiring harness continuity between DMTL module and ECU connectors</li> <li>● 5. Replace DMTL module</li> </ul>
P2402-00	DMTL pump electrical high	<ul style="list-style-type: none"> <li>● 1. Check wiring</li> <li>● 2. Replace DMTL module</li> </ul>
P2404-2F	DMTL noise fault	<ul style="list-style-type: none"> <li>● Replace DMTL module</li> </ul>
P2404-29	DMTL reference leak	<ul style="list-style-type: none"> <li>● Replace DMTL module</li> </ul>
P2405-00	DMTL reference current low	<ul style="list-style-type: none"> <li>● Replace DMTL module</li> </ul>
P2406-00	DMTL reference current high	<ul style="list-style-type: none"> <li>● 1. Check for any blockages in the DMTL ventilation pipe &amp; filter</li> <li>● 2. Replace DMTL module</li> </ul>
P2450-00	DMTL COV stuck open	<ul style="list-style-type: none"> <li>● Replace DMTL module</li> </ul>
P2451-00	DMTL COV stuck close	<ul style="list-style-type: none"> <li>● Replace DMTL module</li> </ul>
P240B-00	DMTL heater electrical low (open)	<ul style="list-style-type: none"> <li>● 1. Check fuse</li> <li>● 2. Check that fuse fits tightly into the fuse holder</li> <li>● 3. Check that the DMTL module wiring connector has been fitted correctly</li> <li>● 4. Check wiring harness continuity between DMTL module and ECU connectors</li> <li>● 5. Replace DMTL module</li> </ul>
P240C-00	DMTL heater electrical high	<ul style="list-style-type: none"> <li>● 1. Check wiring</li> <li>● 2. Replace DMTL module</li> </ul>

Pre and 10MY Denso/Bosch PCM Systems

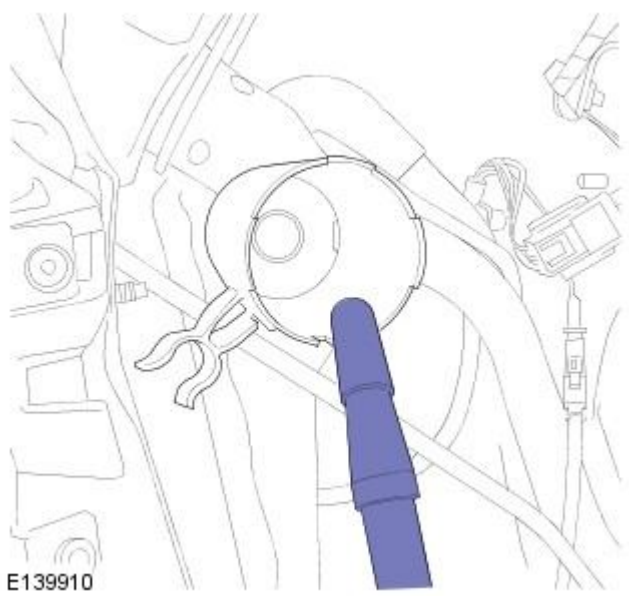




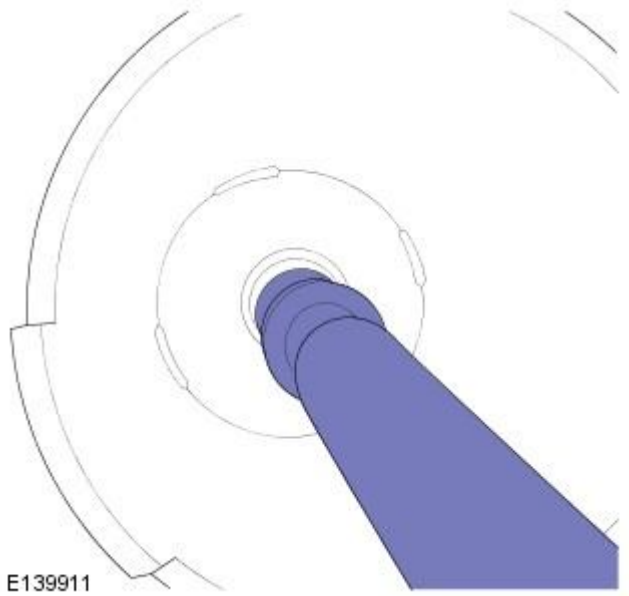
CAUTION: The Maximum pressure of the EVAP system is 0.07 bar **do not exceed**

• NOTE: Apart from the purge valve connection, it is recommended to smoke test the EVAP system without disturbing any joints associated with the system, this will determine the leak more accurately and quickly

- 1. Remove rear wheel arch liner to access fuel filler neck
- 2. On the fuel filler neck the DMTL filter will be visible as shown in picture. Unclip filter housing from fuel filler neck to gain better access to DMTL filter
- 3. Remove carefully the top of filter to expose filter and remove
- 4. Attach rubber adapter to tip of smoke machine nozzle to ensure tight seal to filter housing. Disconnect the purge pipe from purge valve; this will be an escape point for the smoke to exit
- 5. Allow tester to complete self-test and green READY light to turn ON 2. For best Tester performance; completely unwind Tester's supply hose
- 6. Press **Smoke** on control panel to fill EVAP system with smoke vapour. The control panel **Smoke** light will light indicating smoke production. The smoke setting is on a 15 minute timer. Pressing the **Smoke** button again turns Tester off. It is normal for the flow meter ball, while in the smoke mode, not to be as steady as when it is in the **Test** mode. Note: The pressure gauge is active only after smoke cycle is complete
- 7. Continue introducing smoke into the EVAP System until the flow meter's ball stops descending and this assures the system test pressure is met and smoke will appear from the purge pipe, then close off purge pipe with special tool (Test Adapter Hose/EVAP Port 310-142)

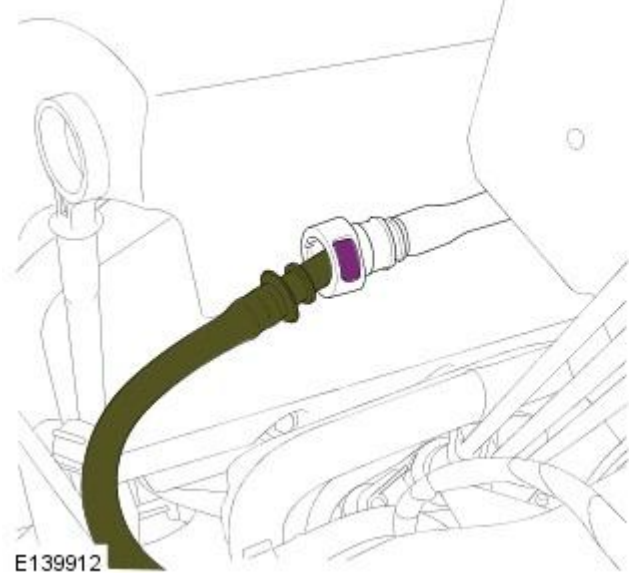


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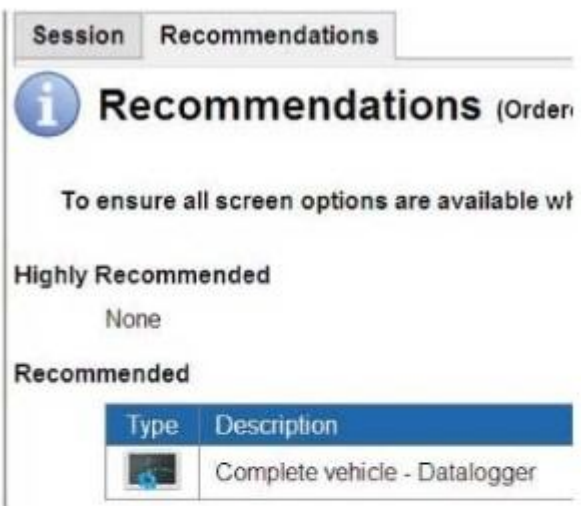




**CAUTION:** On some vehicles, the DMTL filter can not be removed, in these instances fill the system through the purge valve and smoke will appear from the filter

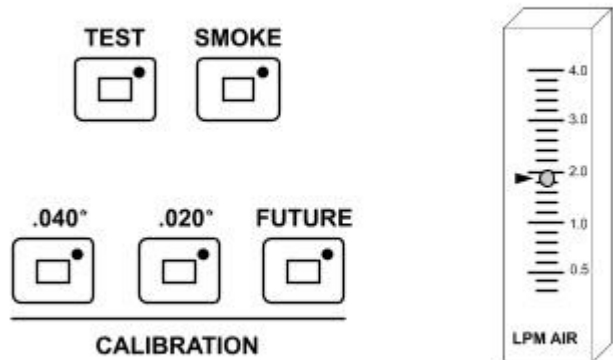
Pre 10MY Vehicles

On pre 10MY DMTL systems, Using the manufacturer approved diagnostic system, select **Measurement application** session then select the **Recommendations** tab which will give you access to **Datalogger**. Then select **Engine systems** then select the **Output state control** data-logger signal **Engine output 1 – diagnostic module – tank leakage -change over valve active** which will close the system. Then select **Engine output 1 – diagnostic module – tank leakage – pump active** this will pressurize the EVAP system



- Engine output 1 - engine management system warning lamp.
- Engine output 1 - malfunction indicator warning lamp.
- Engine output 1 - diagnostics module - tank leakage - test complete.
- Engine output 1 - diagnostics module - tank leakage - heater active.
- Engine output 1 - diagnostics module - tank leakage - pump active.
- Engine output 1 - diagnostics module - tank leakage - changeover valve active.
- Engine output 2 - heated exhaust gas oxygen heater active - bank 2.

E139916



E139913

10MY vehicles

On 10MY vehicles a smoke test application is available so therefore only smoke fill the system and then run the application

- 8. Follow the EVAP system path with the halogen light provided and looks for the smoke exiting the leak(s) or use the UV light provided and look for the dye deposited at the exact location of the leak(s)
- 9. Repair the leak(s) and perform the **Fuel Leak Check** application again or smoke test to verify repair, as well as to make sure there are no additional leaks in the EVAP system

The UltraTraceUV® smoke solution's dye feature is especially helpful when the leak is in an area that is not readily visible, as on the top of the fuel tank or behind a panel. Once you gain access to the area of the leak, wear the yellow UV glasses and shine the UV light provided to identify the exact location of the leak(s). Smoke exiting a very small leak is even easier to see with lower pressure. If you encounter smoke leaking out of an area but find it difficult to pinpoint exactly where the source of the leak is; try reducing the pressure in the system being tested by turning the Tester OFF and allow the pressure to dissipate. The longer a particular leak is allowed to leak, the more fluorescent dye material will be deposited at that leak. With some vapour system leaks, the leak may only present itself under vacuum and not under pressure. If equipment permits, test the system in both states. Purge valve faults [P0441, P0444, P0458 and P0459] should all inhibit DMTL leak test and therefore need to be resolved prior to any DMTL issues. For this reason, when smoke testing the vapour system, it should be sufficient to enter the system at the connection up stream of the purge valve. If no leak is found then testing the remainder of the system up to the purge valve is recommended

• NOTE: It may be possible to search for small leaks using a gas analyzer and looking for HC (hydro carbon) spikes. This should enable leaks to be detected in areas of the vapor system that our out of sight of the technician. The solenoid should be deactivated after five minutes to prevent potential damage. Check that connector and individual terminals are sealed correctly

Phase-One – (quantifying the leak)



E139914

1. Connect the tester supply hose to vehicle EVAP system. > Refer to appropriate vehicle application
2. Determine if the vehicle's EVAP system you are testing is governed by a .020" (0.5 mm) or .040" (1 mm) acceptable leak standard. Press the appropriate calibration standard on the tester's control panel and observe the position of the flow meter ball. > This function automatically turns off in 10 seconds
3. Position the flow meter's pointer flag so that it aligns with the measurement observed in step 2 above. > This sets PASS / FAIL mark
4. Close vehicle's EVAP Vent Solenoid. > Refer to appropriate vehicle application
5. Press TEST on control panel and fill EVAP system. > This introduces 5-minutes of nitrogen gas
6. Look for flow meter ball to stop descending indicating that the vehicle system is full. > Fill time 1-4 minutes depending on system volume
7. Compare flow meter ball reading to pointer flag. > ABOVE flag = FAIL (go to Phase-Two). > BELOW flag = PASS (test complete)

Testing With Pressure and Vacuum Decay

In addition to quantifying the leak with the Phase-One flow test, the Tester allows you the flexibility of testing the vehicle's EVAP system

by using either **Pressure Decay** or **Vacuum Decay** methods. Below are instructions for performing both decay tests

#### Pressure-Decay Test

• **NOTE:** The Pressure Decay test is best performed immediately after the Phase-one flow test, since the system has already built up pressure

At the completion of the Phase-one flow test, the EVAP system is fully pressurized, since the Phase-one test uses pressure to perform its flow test. Testing pressure decay with the Vacutec® 522B-J/LR is very simple. All you need to do is the following:

- 1. Allow tester to complete self-test and green **READY** light to turn ON
- 2. Connect Tester supply hose to vehicle EVAP system
- 3. Close vehicle's EVAP Vent solenoid > Refer to appropriate vehicle application
- 4. Press **VACUUM** switch on the tester control panel
  - **NOTE:** The vacuum switch is on a 30-second timer, which should be sufficient time to draw the appropriate vacuum from the EVAP system. Press VACUUM switch again if additional time is required
- 5. After vacuum timer turns off, observe the vacuum gauge for any decay (loss of vacuum) indicating a leak in the EVAP system



E139915

• **NOTE:** Disconnect the Tester from the vehicle after the Vacuum Decay Test. The fuel pressure in the vehicle's fuel tank is constantly changing due to the vehicle's fuel volatility and that could cause the Tester's pressure gauge to exceed its maximum reading limits

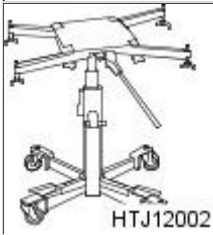
# Evaporative Emissions - V6 3.0L Petrol - Evaporative Emission Canister

## Removal and Installation

### Special Tool(s)

Power train assembly jack

HTJ1200-2




## Removal

-  **WARNING:** Make sure to support the vehicle with axle stands.

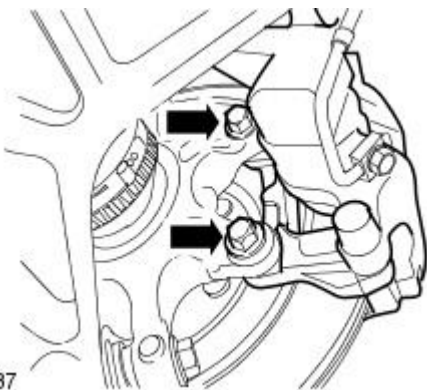
Raise and support the vehicle.

- Remove the left-hand shock absorber and spring assembly.  
For additional information, refer to: [Shock Absorber and Spring Assembly \(204-02 Rear Suspension, Removal and Installation\)](#).


-  **CAUTION:** The brake caliper must be supported at all times. Failure to follow this instruction may result in damage to the vehicle.

Detach the left-hand rear brake caliper and anchor plate.

- Remove and discard the brake caliper anchor plate retaining bolts.

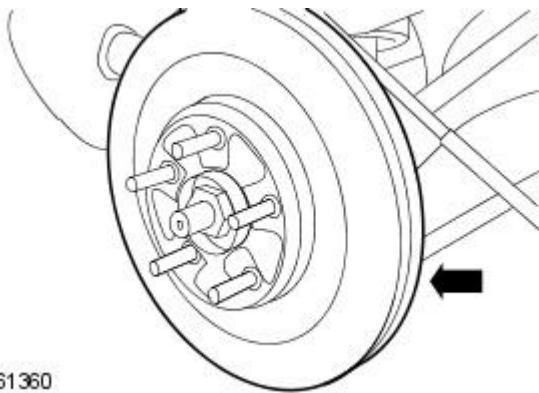


E62537

-  **CAUTION:** The brake caliper must be supported at all times. Failure to follow this instruction may result in damage to the vehicle.

- NOTE:** Mark the brake disc position in relation to the hub.

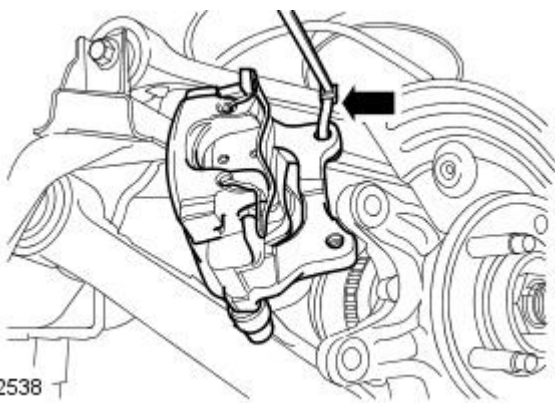
Remove the left-hand brake disc.



E61360

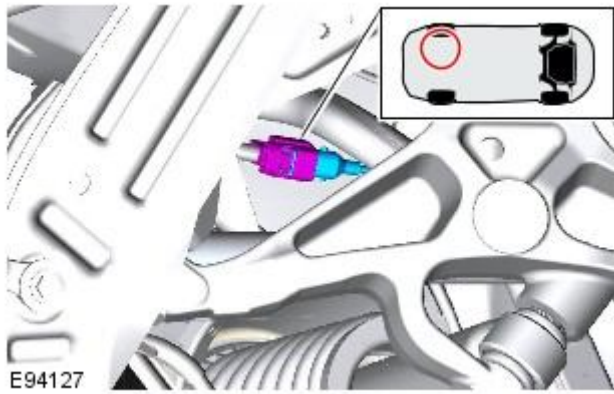
-  **CAUTION:** The brake caliper must be supported at all times. Failure to follow this instruction may result in damage to the vehicle.

Using a suitable tie strap, secure the left-hand brake caliper to the upper arm.

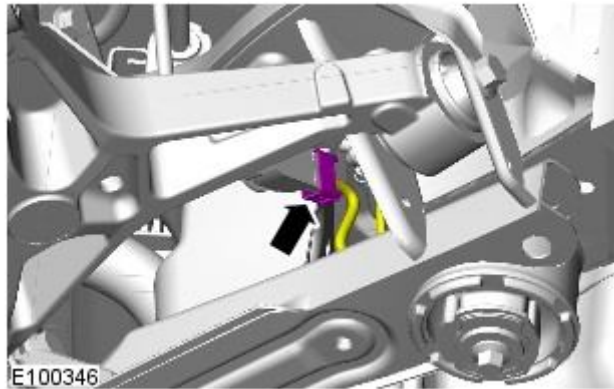


E62538

6. Disconnect the left-hand rear wheel speed sensor electrical connector.




7. Disconnect the headlamp levelling sensor.

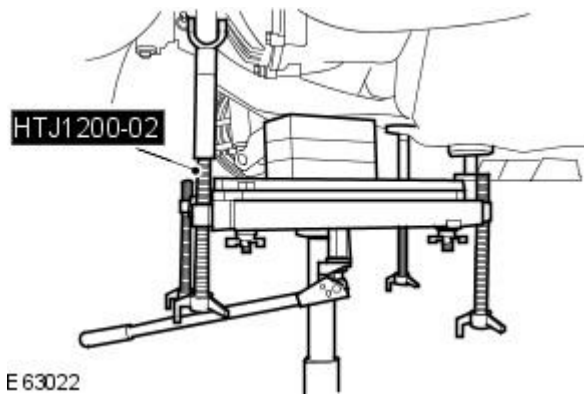


8. Remove the front muffler.

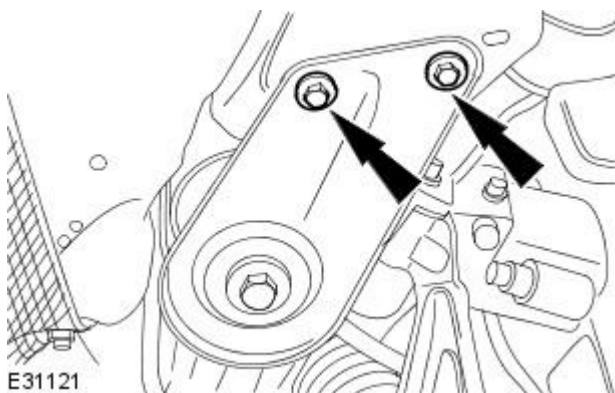
For additional information, refer to: [Front Muffler](#) (309-00A Exhaust System - TDV6 2.7L Diesel, Removal and Installation).

9.  **WARNING:** Rotate the special tool height adjustment valve slowly. Failure to follow this instruction may result in personal injury.

Install the special tool to support the left-hand side of the rear subframe.

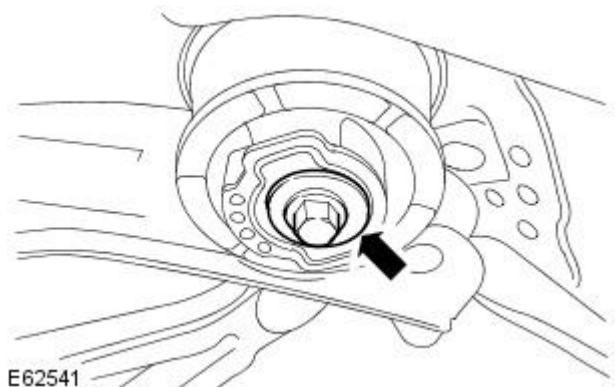


10. Remove the rear subframe left-hand reinforcement plate retaining bolts.



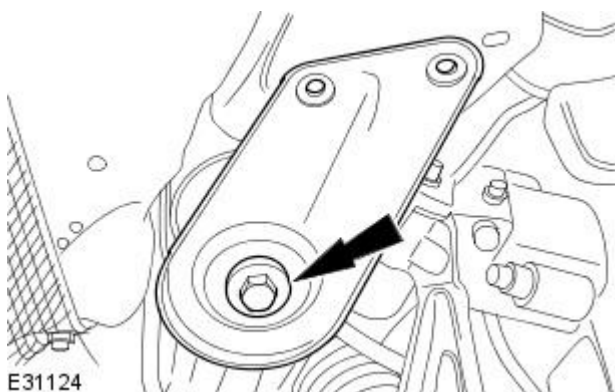


11. Remove and discard the rear subframe left-hand rear retaining bolt.




12. Remove the rear subframe left-hand reinforcement plate.


- Remove and discard the rear subframe left-hand front retaining bolt.



13.  **WARNING:** Rotate the special tool height adjustment valve slowly. Failure to follow this instruction may result in personal injury.

• CAUTIONS:

 Make sure the rear subframe weight is evenly supported on the special tool. Failure to follow this instruction may result in damage to the vehicle.

 Make sure when lowering the rear subframe damage does not occur to the surrounding components. Failure to follow this instruction may result in damage to the vehicle.

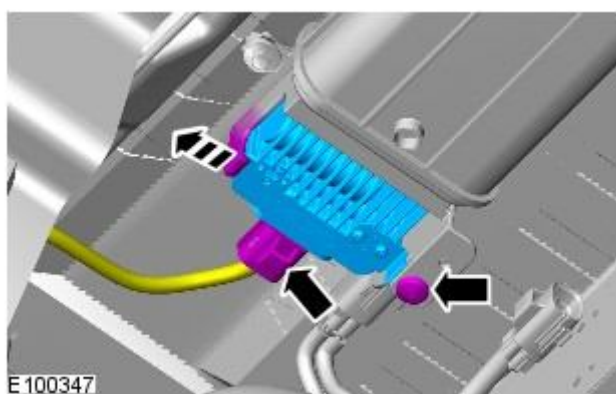
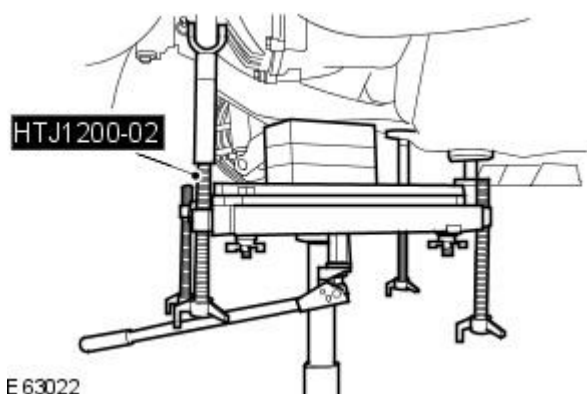
Using the special tool, lower the left-hand side of the rear subframe to a maximum of 152mm.

14. **NOTE:** Non federal market vehicles only.

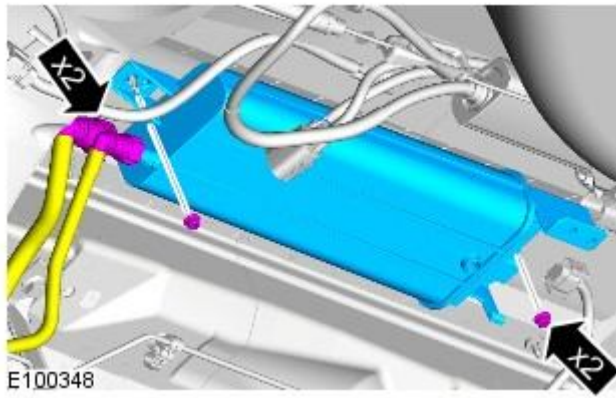
• **NOTE:** Rear subframe shown removed for clarity.

Remove the fuel pump driver module.

- Disconnect the electrical connection.
- Remove 1 screw.





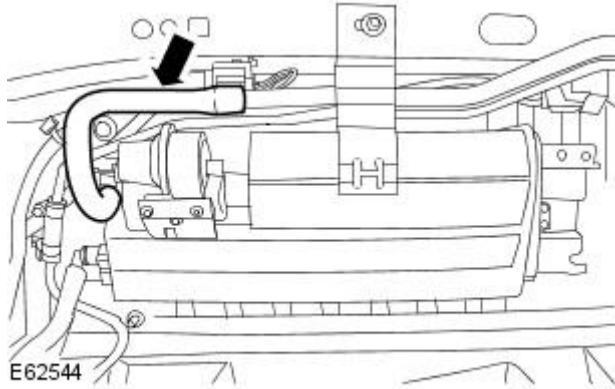


**15. NOTE:** Non federal market vehicles only.

- NOTE: Rear subframe shown removed for clarity.

Remove the evaporative emissions canister.

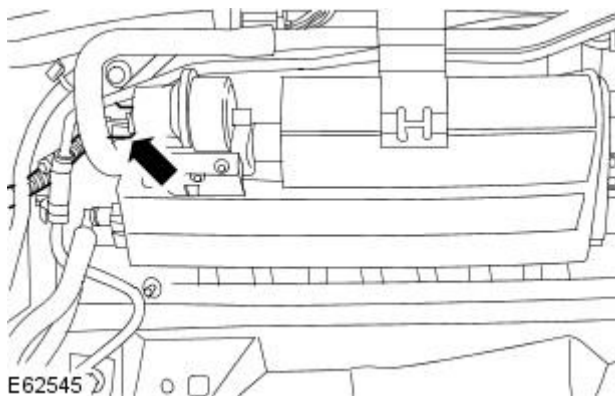
- Disconnect the 2 quick release connectors.
- Remove the 2 nuts.



**16. NOTE:** Rear subframe shown removed for clarity.

- NOTE: Federal market vehicles only.

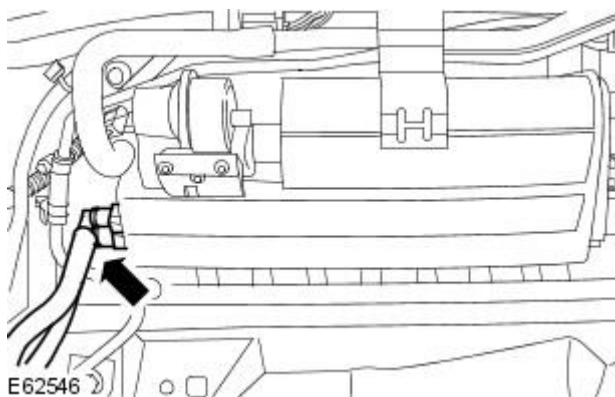
Disconnect the evaporative emission canister vent solenoid vapor hose.



**17. NOTE:** Rear subframe shown removed for clarity.

- NOTE: Federal market vehicles only.

Disconnect the evaporative emission canister vent solenoid electrical connector.



**18. NOTE:** Rear subframe shown removed for clarity.

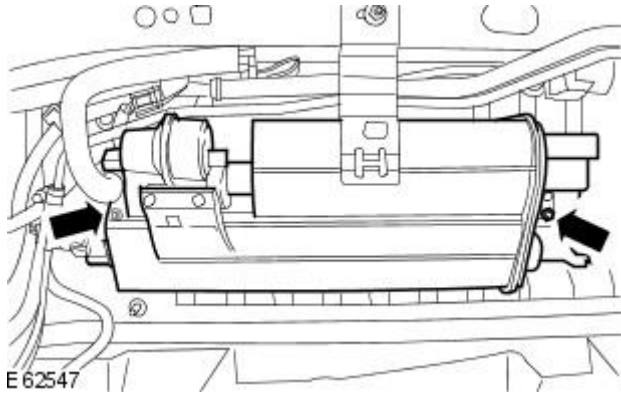
- NOTE: Federal market vehicles only.

Disconnect the evaporative emission canister vapor pipes.

19. NOTE: Rear subframe shown removed for clarity.

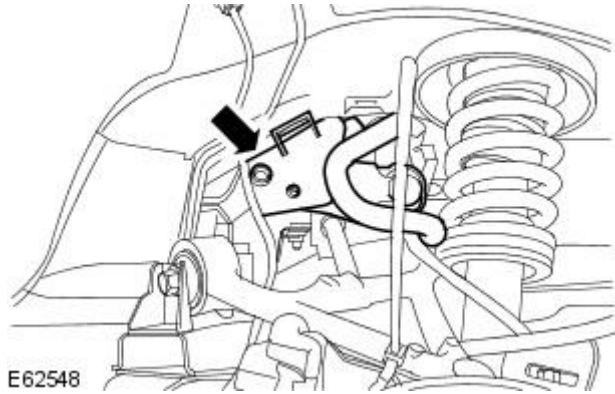
• NOTE: Federal market vehicles only.

Detach the evaporative emission canister.



20. NOTE: Federal market vehicles only.

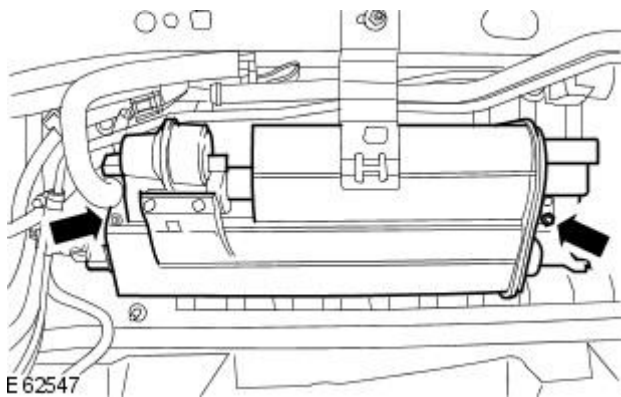
Remove the evaporative emission canister.



## Installation

1. To install, reverse the removal procedure.

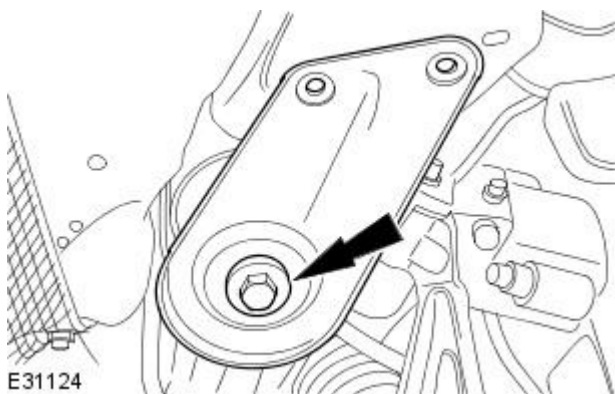
- Tighten to 7 Nm.



2. NOTE: Install new rear subframe retaining bolts.

Loosely install the rear subframe left-hand front retaining bolt.

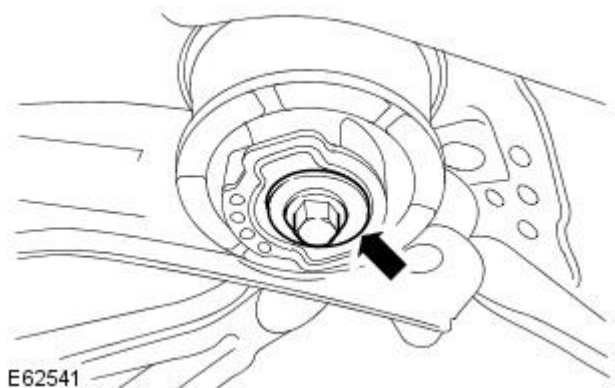
- Install the rear subframe left-hand reinforcement plate.



3. NOTE: Install new rear subframe retaining bolts.

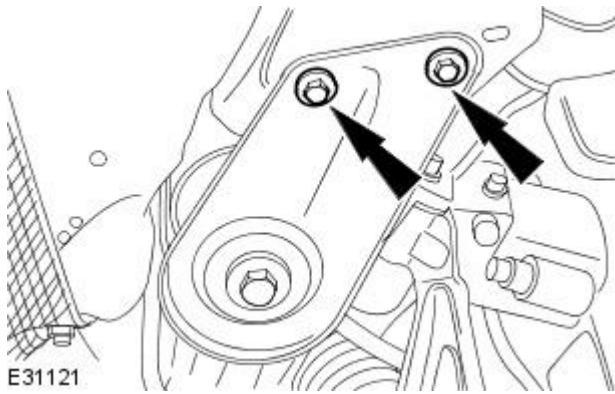
Install the rear subframe left-hand rear retaining bolt.

- Tighten to 125 Nm.



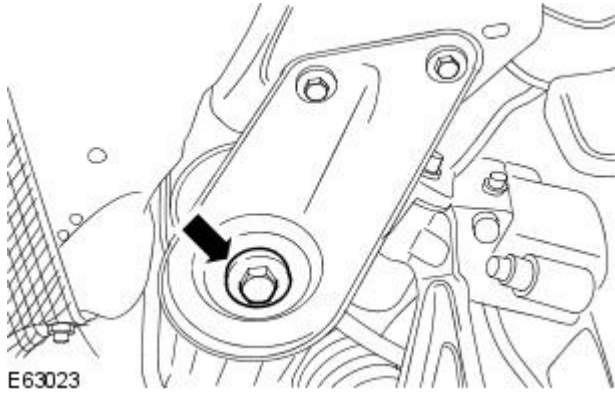
4. Install the rear subframe left-hand reinforcement plate retaining bolts.


- Tighten to 47 Nm.



5. Tighten the rear subframe left-hand front retaining bolt.

- Tighten to 125 Nm.

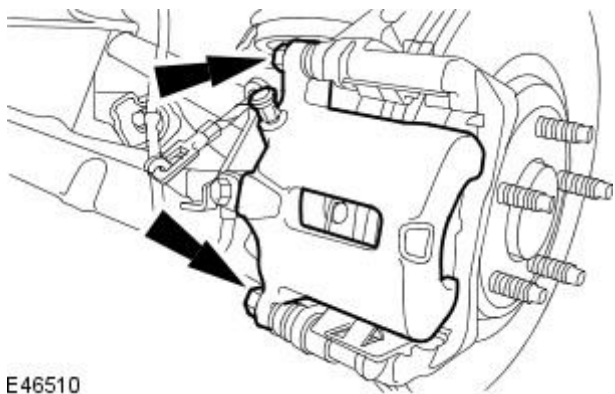


6.  CAUTION: The brake caliper must be supported at all times. Failure to follow this instruction may result in damage to the vehicle.

- NOTE: Remove and discard the securing tie strap.
- NOTE: Install new brake caliper anchor plate retaining bolts.

Install the left-hand brake caliper and anchor plate.

- Tighten the bolts to 103 Nm.

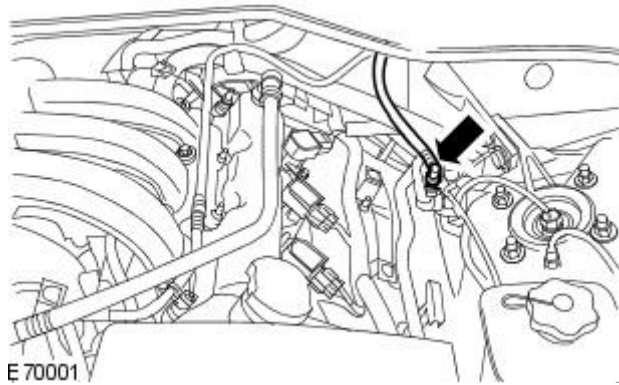


# Evaporative Emissions - V6 3.0L Petrol - Evaporative Emission Canister Purge Valve

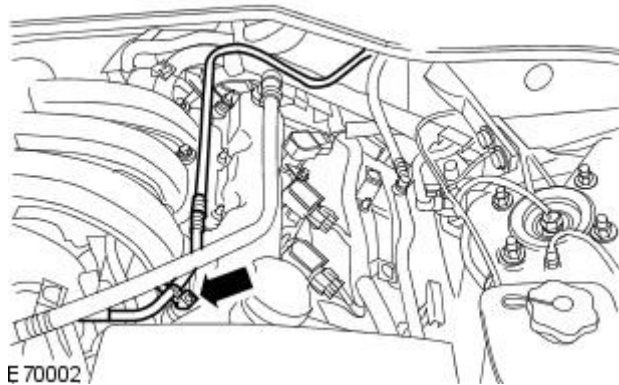
Removal and Installation

## Removal

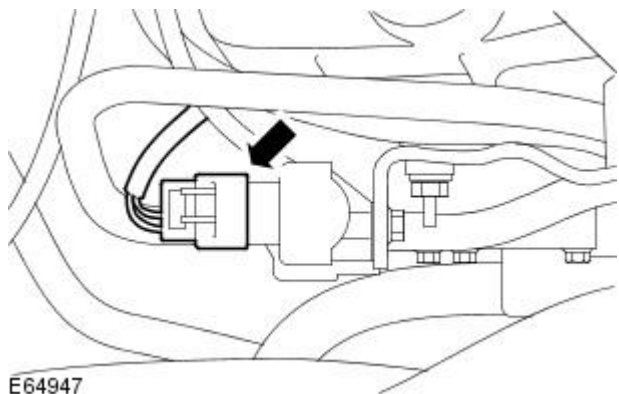
1. Disconnect the evaporative emission canister purge valve hose.



2. Detach the evaporative emission canister purge valve hose.

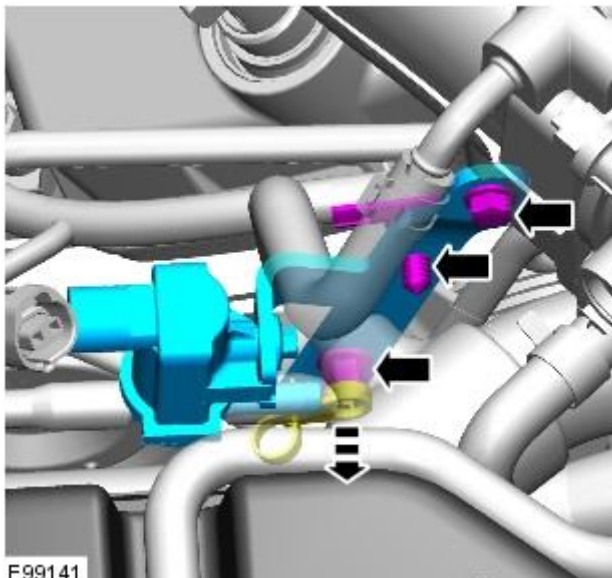


3. Disconnect the evaporative emission canister purge valve electrical connector.



4. Remove the evaporative emission canister purge valve and bracket assembly.

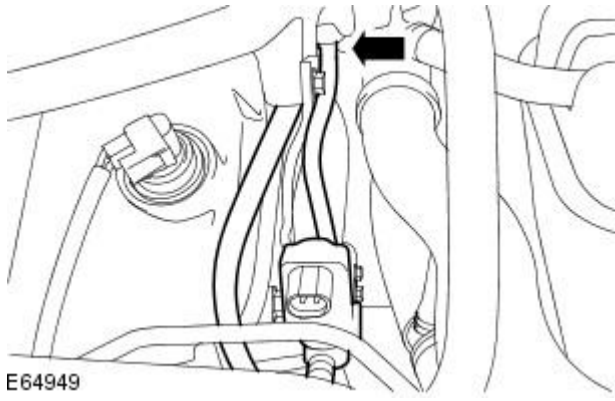
- Detach the wiring harness from the bracket.
- Detach the vacuum hose retaining clip from the stud.
- Remove the retaining nut and bolt.



E99141

5. Remove the evaporative emission canister purge valve.

- Disconnect the evaporative emission canister purge valve hose.

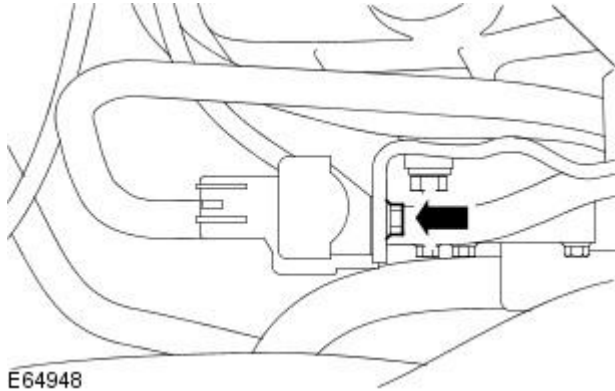


E64949

### Installation

1. To install, reverse the removal procedure.

- Tighten to 10 Nm.



E64948




# Evaporative Emissions - V6 3.0L Petrol - Evaporative Emission Canister Vent Solenoid

Removal and Installation

## Removal

### • WARNINGS:

 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

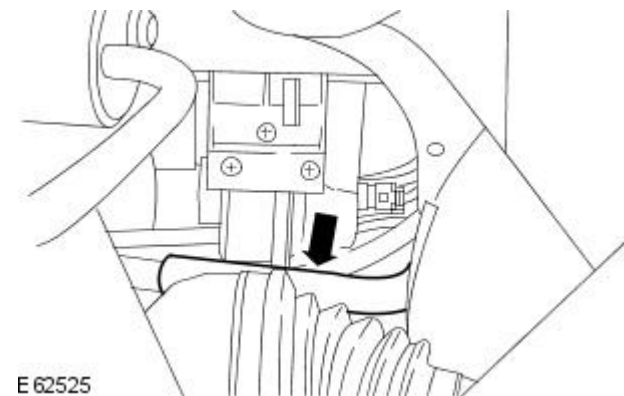
 Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapours are always present and may ignite. Failure to follow these instructions may result in personal injury.

 **CAUTION:** Make sure the working surfaces are thoroughly clean to avoid contamination of the sensitive components.

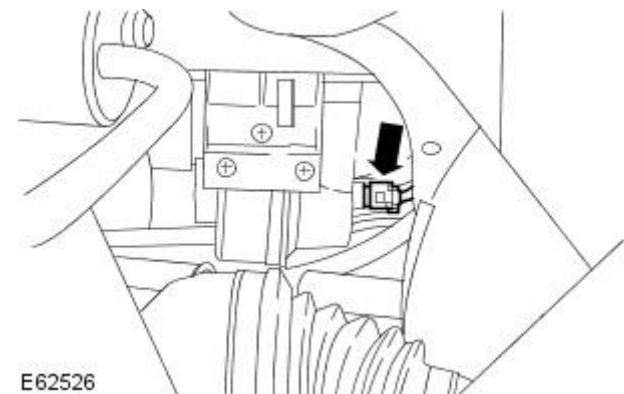
1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Disconnect the evaporative emission canister vent solenoid vapor hose.

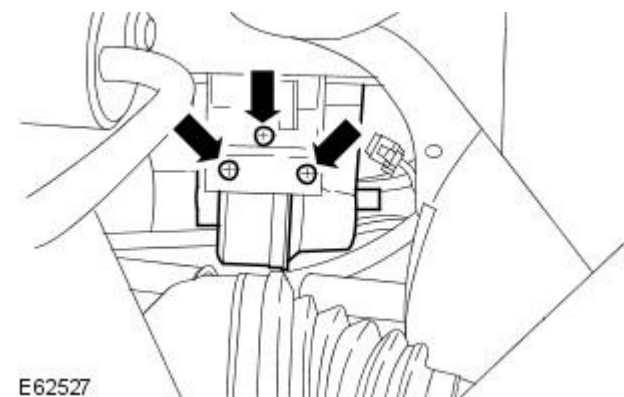


3. Disconnect the evaporative emission canister vent solenoid electrical connector.



4. Remove the evaporative emission canister vent solenoid.

- Remove and discard the evaporative emission canister vent solenoid O-ring seal.



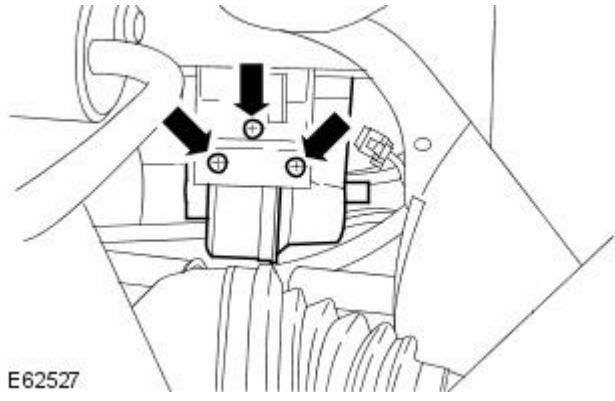
## Installation



**1. NOTE: Install a new O-ring seal.**

To install, reverse the removal procedure.

- Tighten to 6 Nm.



E62527

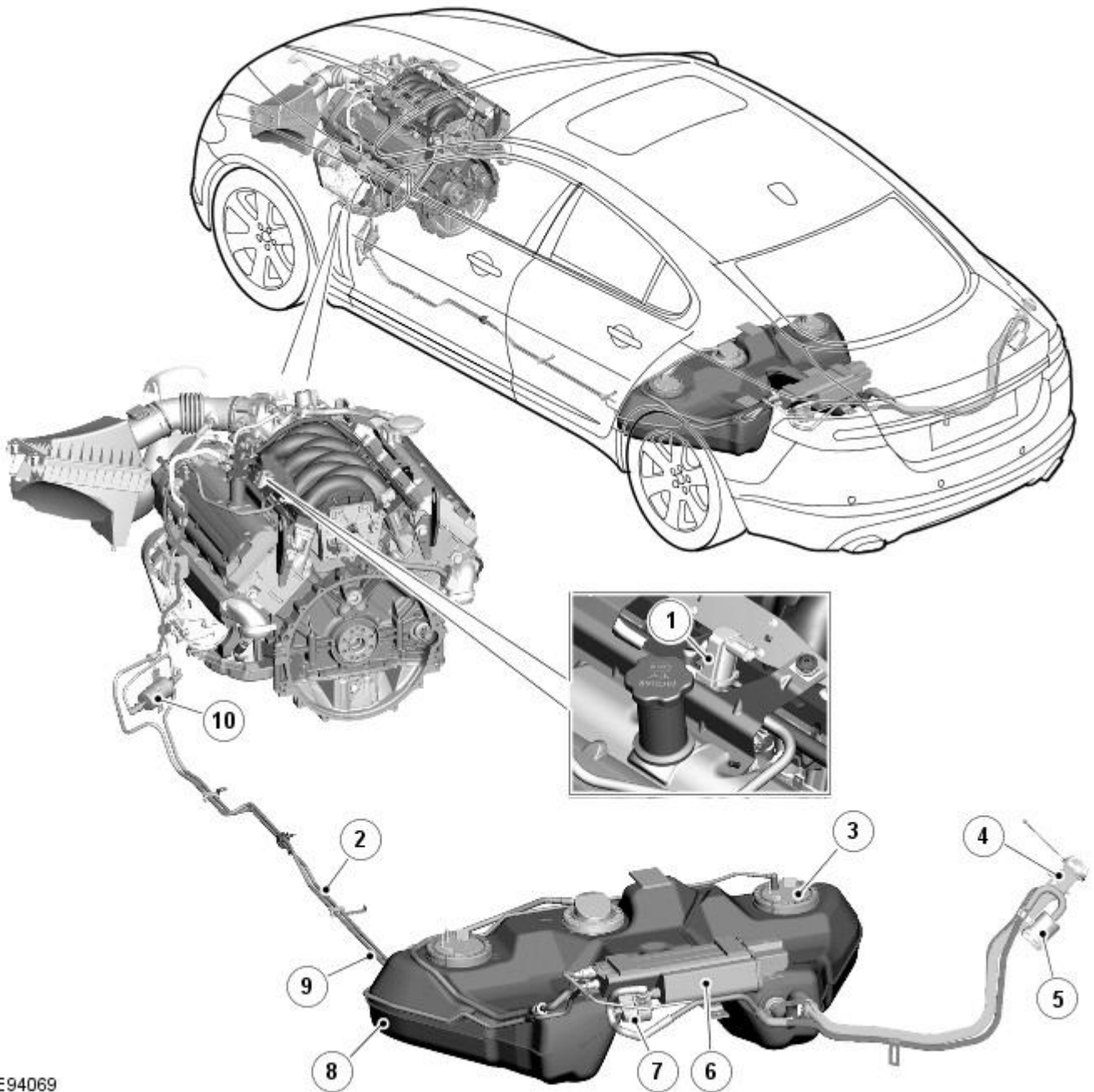
**Evaporative Emissions - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 -**

Description	Nm	lb-ft	lb-in
Evaporative emission canister carrier bolts	10	7	-

# Evaporative Emissions - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Evaporative Emissions - Component Location

Description and Operation

Naturally Aspirated

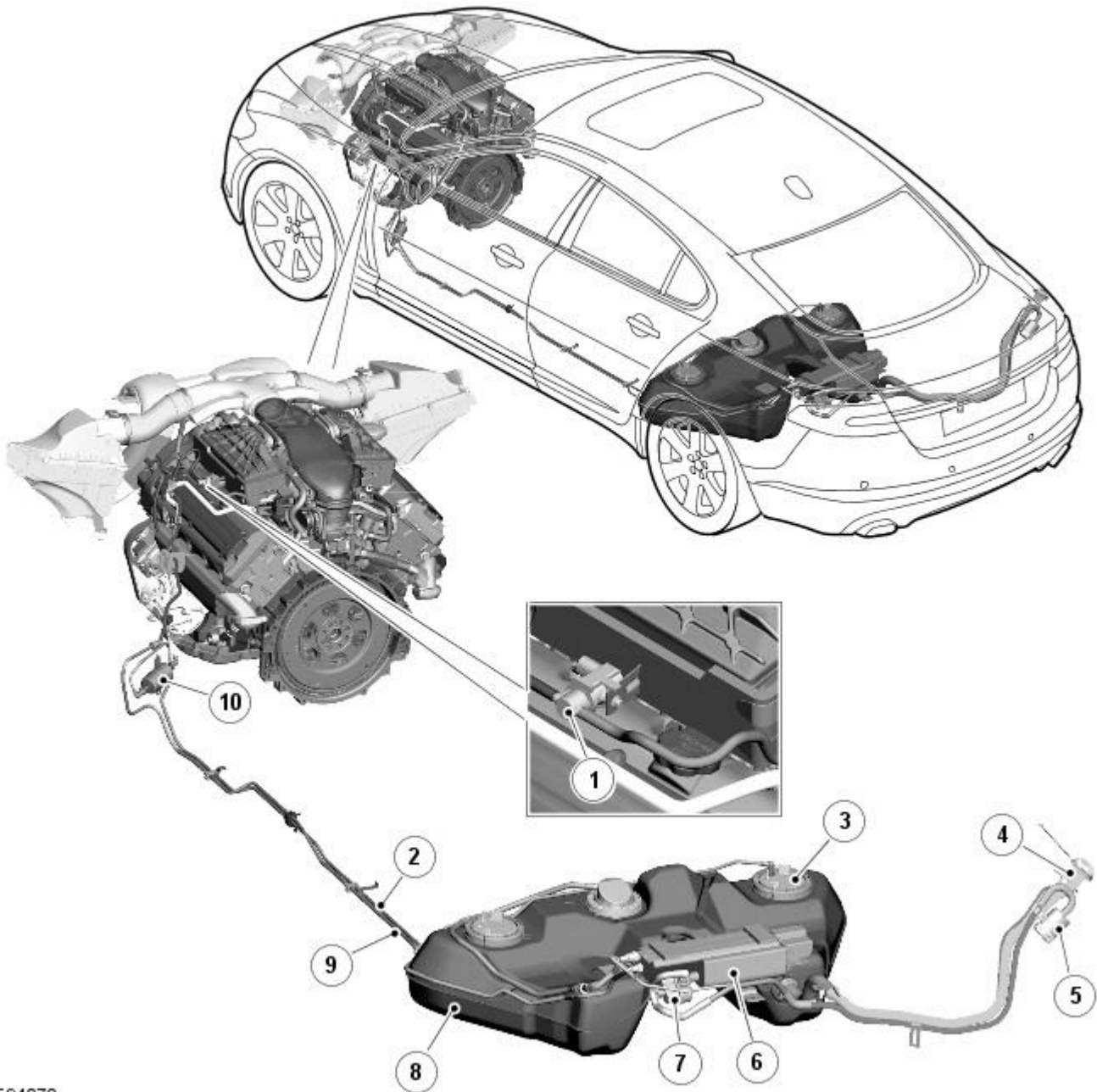


E94069

## ItemDescription

1	Purge valve
2	Fuel delivery pipe
3	Fuel pump
4	Fuel filler
5	Tank leakage detection filter
6	Charcoal cannister
7	Tank leakage detection pump
8	Fuel tank
9	Purge pipe
10	Fuel Filter

Naturally Aspirated



E94070

**ItemDescription**

1	Purge valve
2	Fuel delivery pipe
3	Fuel pump
4	Fuel filler
5	Tank leakage detection filter
6	Charcoal cannister
7	Tank leakage detection pump
8	Fuel tank
9	Purge pipe
10	Fuel Filter

# Evaporative Emissions - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Evaporative Emissions - Overview

Description and Operation

## OVERVIEW

The [EVAP \(evaporative emission\)](#) control system reduces the level of hydrocarbons released into the atmosphere by fuel vapor venting from the fuel tank. The system comprises a charcoal canister, purge valve and interconnecting vent pipes and hoses. The vent pipes are connected to the system components using quick release connectors.

Fuel vapor is generated by the fuel in the tank and the amount of vapor produced increases as the fuel heats up. Fuel vapor can flow freely to the charcoal canister via the tank venting system. The venting system consists of roll over valves and a liquid vapor separator mounted internally in the tank and then externally via a breather line. The breather line allows the fuel vapor to flow to the charcoal canister via a 'Y' piece mounted on the filler pipe.

On NAS vehicles the vapor generated in the fuel tank during refueling flows without restriction to the charcoal canister.

On all vehicles except NAS, the vapor is restricted in its path to the charcoal canister but can flow freely during the refueling operation to atmosphere, via the filler opening.

The vapor passes into the charcoal canister where it is absorbed and stored by the charcoal. Because there is a limit to the amount of vapor the canister can contain, the fuel vapor is purged from the canister when the engine is running and burned in the engine.

All NAS vehicles have a fuel tank leakage monitoring system. This is a legislative requirement. The fuel tank leakage monitoring system periodically checks the [EVAP](#) system and the fuel tank for leaks when the ignition is switched off. The fuel tank leakage monitoring system comprises the previously described components of the [EVAP](#) system with the addition of a fuel tank leakage monitoring pump and a fuel tank leakage monitoring filter.

# Evaporative Emissions - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Evaporative Emissions - System Operation and Component Description

Description and Operation

## System Operation

The atmospheric pressure at the air intake vent of the system is higher than the inlet manifold pressure under all throttled engine running conditions. It is this pressure differential across the system that causes the air to flow through the air intake, through the purge system, and in to the engine.

The **ECM (engine control module)** waits until the engine is running above 40°C (104°F) coolant temperature with closed loop fuel operational before the purging process is activated. Under these conditions the engine should be running smoothly with no warm up enrichment. The purge valve duty (and flow) is initially ramped slowly because the vapor concentration is unknown (a sudden increase in purge could cause unstable engine running or cause it to stall due to an extremely "rich" air/fuel mixture.). The concentration is then determined from the amount of adjustment that the closed loop fueling is required to make to achieve the target Air Fuel Ratio (AFR). Once the concentration has been determined, the purge flow can be increased rapidly and the injected fuel can be proactively adjusted to compensate for the known purge vapor and the target AFR control is maintained.

When the purging process is active, fresh air is drawn into the charcoal canister via the tank leakage detection valve atmospheric vent connection and its filter on NAS vehicles or, via the vent hose connection and the spider trap on non NAS vehicles.

## Tank Leakage Detection

The tank leakage detection system is a legislative requirement for NAS vehicles. The tank leakage detection system periodically checks the **EVAP (evaporative emission)** system and the fuel tank for leaks when the ignition is switched off. The tank leakage detection system comprises the previously described components of the **EVAP** system with the following additional components; a tank leakage detection pump and a tank leakage detection filter.

To check the fuel tank and the **EVAP** system for leaks, the **ECM** operates the tank leakage detection pump and monitors the current draw. Initially, the **ECM** establishes a reference current by pumping air through the reference orifice and back to atmosphere. Once the reference current is determined, the **ECM** closes the normally open valve which seals the **EVAP** system. The purge valve remains de-energized and is therefore closed. The output from the air pump is diverted from the reference orifice and into the **EVAP** system.

When the normally open valve is closed, the load on the air pump falls to zero. Providing there are no leaks, the air pump will begin to pressurize the **EVAP** system and the load and current draw in the pump increases. By monitoring the rate and level of the current increase, the **ECM** can determine if there is a leak in the **EVAP** system.

During normal vehicle operation, 15 seconds after the engine has started, the **ECM** energizes the heating element in the pump to prevent condensation formation and possible incorrect readings. The heater remains energized until either the engine and ignition are off (if no tank leakage detection test is running) or until after the tank leakage detection test is completed.

Leaks are classified as:

- Minor - equivalent to a hole diameter of 0.5 to 1.0 mm (0.02 to 0.04 in)
- Major - equivalent to hole diameter of 1.0 mm (0.04 in) or greater.

The **ECM** performs a check for major leaks each time the ignition is switched off, providing the following conditions are met:

- The vehicle speed is zero
- The engine speed is zero
- The pressure altitude (70 kPa (10.15 lbf/in<sup>2</sup>) derived from engine load calculations) is below 3047 m (10000 feet)
- The ambient temperature is between 0 and 40°C (32 and 104°F)
- The charcoal canister load factor is 2.5 or less (where the load factor is a measure, between -1 and +30, of the fuel vapor stored in the charcoal canister. Where -1 is 0% fuel vapor, 0 is stoichiometric fuel vapor level and +30 is 100% saturated with fuel vapor.
- The fuel tank level is valid and between 15 and 85% of nominal capacity
- The engine running time during the previous cycle was more than 10 minutes
- The battery voltage is between 10 and 15 volts
- The last engine off time was more than 180 minutes
- No errors are detected with the **EVAP** components, the ambient air temperature and the fuel level.

• **NOTE: A leak test can be performed using the Jaguar approved diagnostic system. This overrides the above conditions and is useful for checking correct system and component operation.**

The **ECM** performs a check for minor leaks after every 2nd major leak check or after refueling is detected.

When the leak check is complete, the **ECM** stops the tank leakage detection pump and opens (de-energizes) the normally open valve.

If the fuel filler cap is opened or refueling is detected during the leak check, by a sudden drop in the current draw or a rise in the fuel level, the **ECM** aborts the leak check.

If a leak is detected during the check, the **ECM** stores an appropriate fault code in its memory. If a leak is detected on two consecutive checks, the **ECM** illuminates the **MIL (malfunction indicator lamp)** in the instrument cluster on the next drive cycle.

The duration of a leak check can be between 60 and 600 seconds depending on the results and fuel tank level.



## Component Description

### Tank Leakage Detection Pump



E67816

The tank leakage detection pump is connected to the atmospheric vent of the charcoal canister and incorporates a [PTC \(positive temperature coefficient\)](#) heating element, a normally open valve and a reference orifice.

The tank leakage detection filter protects the pump from dust being drawn into the system when the pump is being operated. The filter is located on the fuel filler head and is connected to the tank leakage detection pump by a hose.

The tank leakage detection pump is only operated when the ignition is switched off and is controlled by the [ECM](#). The [ECM](#) also monitors the electric air pump operation and the normally open valve for faults. The tank leakage detection test is performed after the engine has stopped following a 10 minute run, providing that the vehicle fuel tank is between 15 and 85 percent full, the ambient temperature is above 0°C (32°F) and less than 40°C (104°F) and the vehicle was not started for at least 3hrs prior to this run.

The tank leakage detection pump is driven to pressurize the fuel tank and the current is measured with the change-over valve in different states.

A comparison of the current draw in each state indicates the degree of any leak, and the [ECM](#) then sets the appropriate [DTC \(diagnostic trouble code\)](#).

### Charcoal Cannister

The charcoal canister is located in a central position, forward of the spare wheel. It is attached at the rear with two bolts which screw into the spare wheel carrier. At the front, the canister has two lugs which locate in the parking brake module support bracket.

The canister on ROW vehicles has a capacity of 1400cc (85.4 in<sup>3</sup>). The canister on NAS vehicles has a capacity of 3000cc (183 in<sup>3</sup>).

The canister has three ports which allow for the attachment of the atmospheric vent hose, the purge hose and the tank vent hose. On NAS vehicles the atmospheric vent hose connection allows for the attachment of the tank leakage detection pump.

The canister contains a bed of activated charcoal or carbon. The charcoal is produced using special manufacturing techniques to treat the charcoal with oxygen. The oxygen treatment opens up millions of pores between the carbon atoms resulting in a highly porous charcoal with a very large effective surface area which is capable of absorbing large quantities of fuel vapor. Once treated the charcoal is known as 'activated' carbon or charcoal. The charcoal canister on NAS vehicles uses a higher grade charcoal to meet the requirements of LEV2 emission regulations.

### Purge Valve

The purge valve is located [RH \(right-hand\)](#) side of the engine, on a bracket which is attached to the water pump. The purge hose is routed from the purge valve to the electric throttle. The purge valve is controlled by the [ECM](#) and is operated when engine operating conditions are correct to allow purging of the charcoal canister. The purge valve is a solenoid operated valve which is closed when de-energized.

The purge hose is connected, at the front [RH](#) side of the engine, with a quick release coupling to the purge line which runs parallel with the fuel feed line along the top of the fuel tank to the charcoal canister.

The purge hose continues from the purge valve and is routed to a connection on the air intake elbow assembly. The hose is connected to the elbow with a quick release connector.

The purge valve is [PWM \(pulse width modulation\)](#) at 10Hz by the [ECM](#). At this high frequency, the pulses of purge gas flow into the inlet manifold in an almost a continuous flow. The valve operates between 7% and 100% duty or mark space ratio (% open time).

On NAS vehicles the system does not include a pressure test point. Pressure testing of the purge valve hose is achieved by disconnecting the purge valve joint on the underside of the vehicle, forward of the fuel tank and connecting a special tool to allow the system to be pressure tested. The test performs a pressure test on the purge hose connection forward of the fuel tank back to the charcoal canister. The special tool is then connected to the purge hose connection forward of the fuel tank to perform a pressure test on the purge hose to the purge valve.

# Evaporative Emissions - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Evaporative Emissions

Diagnosis and Testing

## Principles of Operation

For a detailed description of the Evaporative Emissions system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (303-13 Evaporative Emissions - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8)

[Evaporative Emissions](#) (Description and Operation),  
[Evaporative Emissions](#) (Description and Operation),  
[Evaporative Emissions](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Fuel filler cap and seal</li> <li>● Fuel filler neck</li> <li>● Diagnostic Monitoring of Tank Leakage (DMTL) fresh air filter (restriction, etc)</li> <li>● Fuel tank (leaks, damage, etc)</li> <li>● Fuel lines and joints, etc</li> <li>● Carbon canister</li> <li>● Purge valve</li> <li>● DMTL pump module</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Connectors</li> <li>● Harnesses</li> <li>● Purge valve</li> <li>● DMTL pump</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, and there are clear symptoms, refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) then proceed to the DTC Index.
5. • NOTE: On all vehicles equipped with Diagnostic Monitor Tank Leakage (DMTL), there is a requirement to blank off the ventilation port (large diameter stub pipe) of the DMTL module, to prevent mis-diagnosis when carrying out a smoke test.
5. Where K-Line, Vacutec or other proprietary smoke test equipment is available, it should be utilised to assist with Evaporative Emissions System leak diagnosis.

## Symptom Chart

Symptom	Possible Cause	Action
Difficulty in filling fuel tank	<ul style="list-style-type: none"> <li>● Restriction in the vapour line between the fuel tank and the carbon canister outlet/atmospheric port</li> </ul>	Check for restrictions/damage, etc (see visual inspection)
Fuel smell	<ul style="list-style-type: none"> <li>● System leak</li> <li>● Purge valve inoperative</li> </ul>	Check for leaks, check the purge valve operation
'Check Fuel Filler Cap' displayed on Message Center	<ul style="list-style-type: none"> <li>● Fuel filler cap missing/not tightened after refuelling</li> </ul>	Check the fuel filler cap and seal

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the diagnostic tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the module or a component is suspect and the vehicle remains under the manufacturer warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P044100	Evaporative Emission System Incorrect Purge Flow	<ul style="list-style-type: none"> <li>Purge valve - range/performance</li> </ul>	Refer to the electrical circuit diagrams and check EVAP purge valve control circuit for short, open circuit
P044200	Evaporative Emission System Leak Detected (small leak)	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Check EVAP system for leak using appropriate smoke/leak tester
P044700	Evaporative Emission System Vent Control Circuit Open	<ul style="list-style-type: none"> <li>DMTL COV circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL COV circuit for short to ground
P044800	Evaporative Emission System Vent Control Circuit Shorted	<ul style="list-style-type: none"> <li>DMTL COV circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL COV circuit for short to power
P045600	Evaporative Emission System Leak Detected (very small leak)	<ul style="list-style-type: none"> <li>DMTL system has detected a leak</li> </ul>	Check EVAP system for leak using appropriate smoke/leak tester
P045800	Evaporative Emission System Purge Control Valve Circuit Low	<ul style="list-style-type: none"> <li>EVAP canister purge valve control circuit - short to ground, high resistance</li> <li>EVAP canister purge valve failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EVAP canister purge valve control circuit for short to ground, high resistance. Check and install a new EVAP canister purge valve as required
P045900	Evaporative Emission System Purge Control Valve Circuit High	<ul style="list-style-type: none"> <li>EVAP canister purge valve control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EVAP canister purge valve control circuit for short to power
P240100	Evaporative Emission System Leak Detection Pump Control Circuit Low	<ul style="list-style-type: none"> <li>DMTL pump circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground
P240200	Evaporative Emission System Leak Detection Pump Control Circuit High	<ul style="list-style-type: none"> <li>DMTL pump circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL pump circuit for short to power
P240429	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	<ul style="list-style-type: none"> <li>DMTL reference leak</li> <li>DMTL pump circuit - short to ground, power, high resistance</li> <li>DMTL pipework blocked/leaking</li> </ul>	Check integrity of evaporative emissions system, i.e. blocked/leaking. Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground, power, high resistance
P24042F	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	<ul style="list-style-type: none"> <li>DMTL reference leak</li> <li>DMTL pump circuit - short to ground, power, high resistance</li> <li>DMTL pipework blocked/leaking</li> </ul>	Check integrity of evaporative emissions system, i.e. blocked/leaking. Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground, power, high resistance
P240500	Evaporative Emission System Leak Detection Pump Sense Circuit Low	<ul style="list-style-type: none"> <li>DMTL pump circuit - short to ground, power, high resistance</li> </ul>	Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground, power, high resistance
P240600	Evaporative Emission System Leak Detection Pump Sense Circuit High	<ul style="list-style-type: none"> <li>DMTL pump circuit - short to ground, power, high resistance</li> </ul>	Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground, power, high resistance
P240B00	Evaporative Emission System Leak Detection Pump Heater Circuit Low	<ul style="list-style-type: none"> <li>DMTL heater control circuit low</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL heater control circuit for short to ground, open circuit
P240C00	Evaporative Emission System Leak Detection Pump Heater Circuit High	<ul style="list-style-type: none"> <li>DMTL heater control circuit high</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL heater control circuit for short to power
P245000	Evaporative Emission Control System Switching Valve Performance/Stuck Open	<ul style="list-style-type: none"> <li>DMTL system circuit - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL system circuit for short to ground, power, high resistance. Check for stuck valve
P245100	Evaporative Emission Control System Switching Valve Stuck Closed	<ul style="list-style-type: none"> <li>DMTL system circuit - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL system circuit for short to ground, power, high resistance. Check for stuck valve

# Evaporative Emissions - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Evaporative Emission Canister

Removal and Installation

## Removal



**WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



**1. WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

**2. Remove the rear differential.**

For additional information, refer to: Axle Assembly (205-02, Removal and Installation).

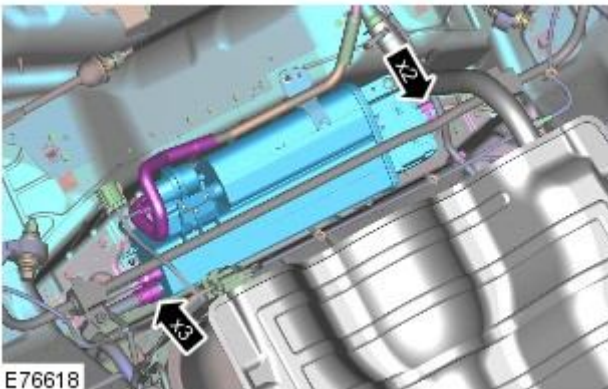


**3. CAUTION:** Always plug any open connections to prevent contamination.

• **NOTE:** Sub-frame shown removed for clarity.

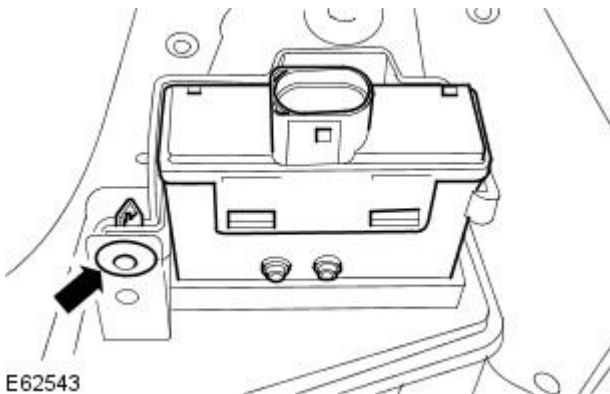
Disconnect the evaporative emissions canister.

- Disconnect the 3 lines.
- Disconnect the 2 electrical connectors.



**4. Remove the fuel pump driver module.**

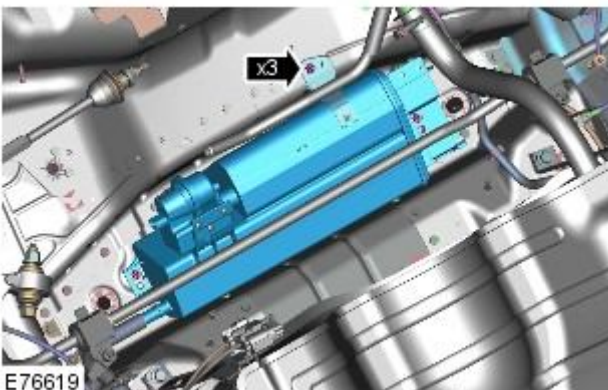
- Remove the clip.



**5. NOTE:** Sub-frame shown removed for clarity.

Remove the evaporative emissions canister.

- Remove the 3 nuts.



## Installation

**1. Install the evaporative emissions canister.**

- Torque: 10 Nm (7 lb.ft)

2. Install the fuel pump driver module.

3. Connect the evaporative emissions canister.

4. Install the rear differential.

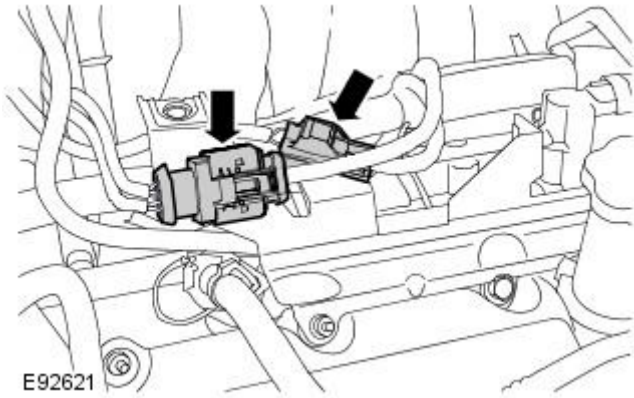
For additional information, refer to: Axle Assembly (205-02, Removal and Installation).


# Evaporative Emissions - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Evaporative Emission Canister Purge Valve

4.2L NA V8 - AJV8  
Removal and Installation

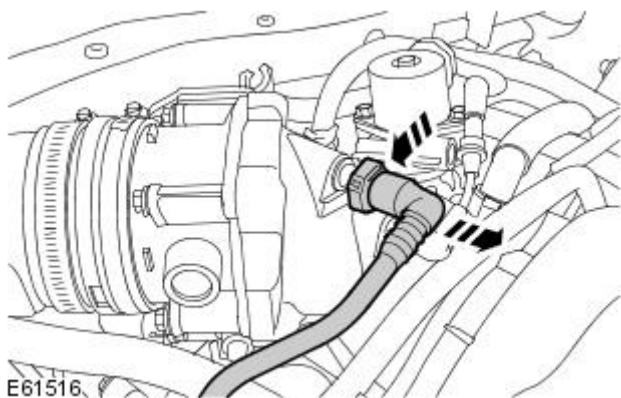
## Removal


1. Remove the engine cover.  
For additional information, refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Release the 2 electrical connectors.



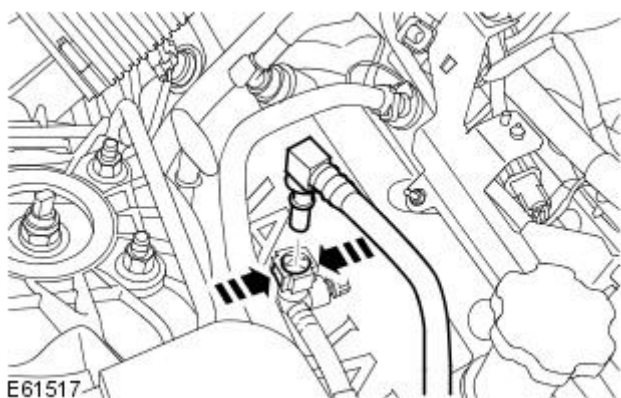
3.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Disconnect the evaporative emission canister purge valve outlet line at the throttle body elbow.

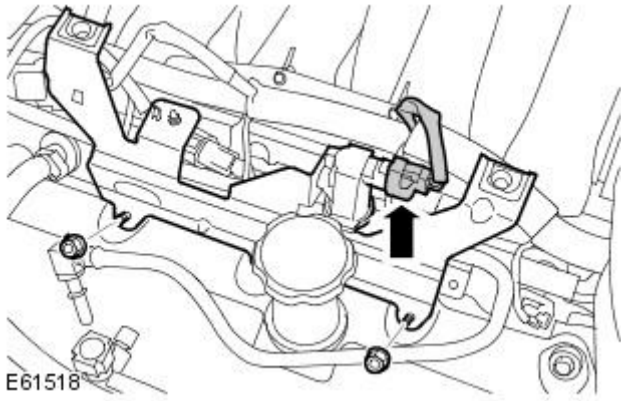


4.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Disconnect the evaporative emission canister purge valve inlet line.

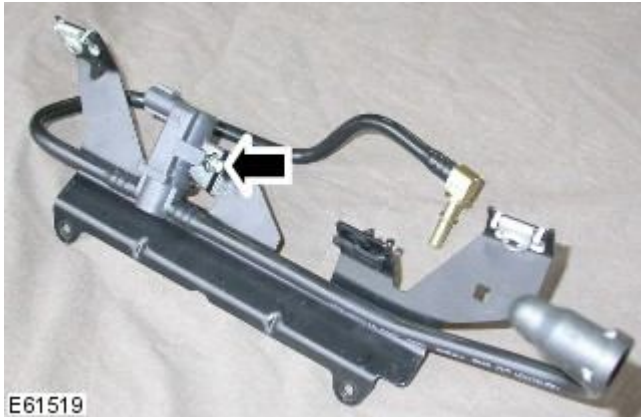






5. Remove the evaporative emission canister purge valve assembly.

- Disconnect the electrical connector.
- Remove the 2 nuts.



6. NOTE: Do not disassemble further if the component is removed for access only.

- NOTE: Note the fitted position.

Remove the evaporative emission canister purge valve.

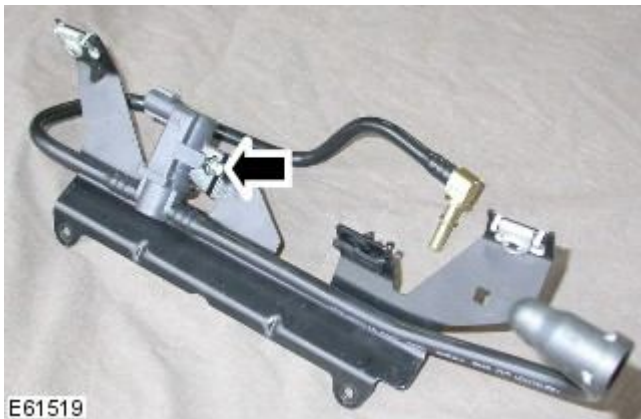
- Remove the bolt.

## Installation

1. NOTE: Make sure that this component is installed to the noted removal position.

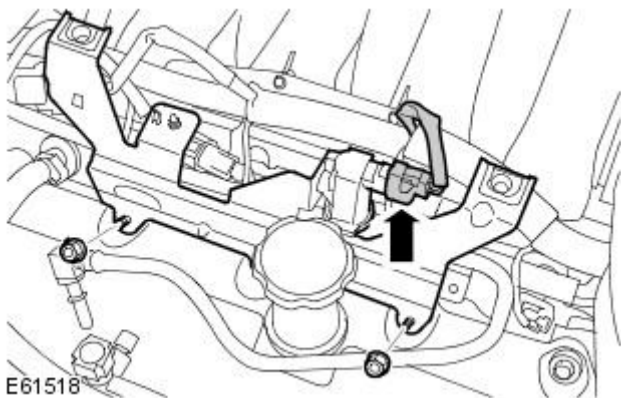
Install the evaporative emission canister purge valve.

- Tighten the bolt to 10 Nm.



2. Install the evaporative emission canister purge valve assembly.

- Tighten the nuts to 10 Nm.
- Connect the electrical connector.



3. Connect the evaporative emission canister purge valve lines.

4. Secure the electrical connectors.

5. Clean the component mating faces.

- Install the engine cover.

# Evaporative Emissions - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Evaporative Emission Canister Purge Valve

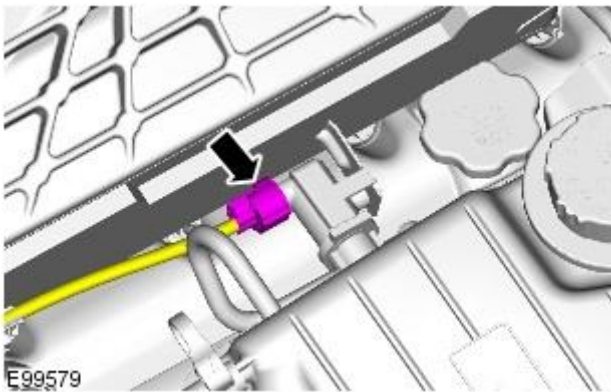
4.2L SC V8 - AJV8  
Removal and Installation

## Removal

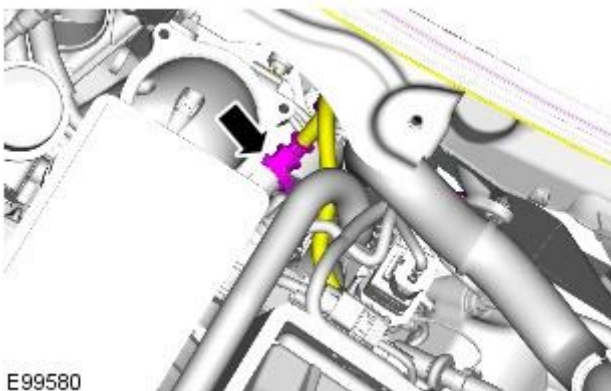
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Throttle Body](#) (303-04B Fuel Charging and Controls - 4.2L SC V8 - AJV8, Removal and Installation).

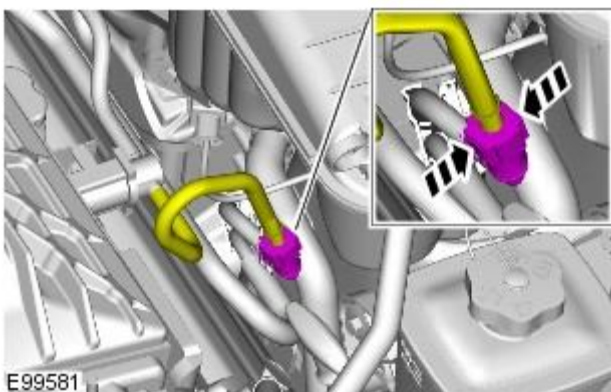
3.

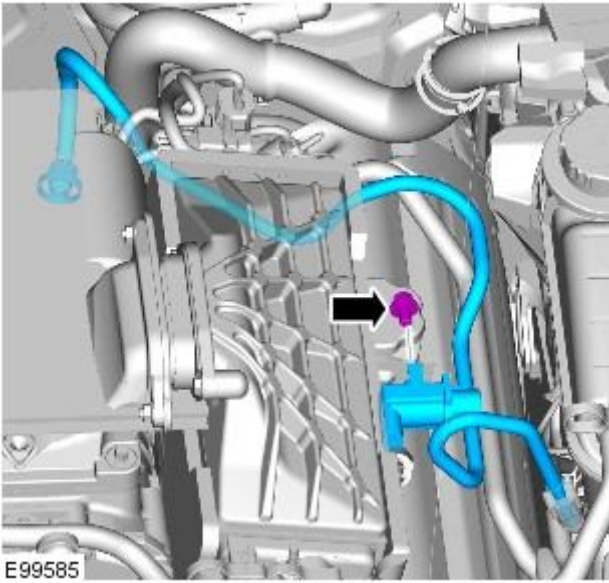


4.



5.





6. Torque: 10 Nm

## Installation

1. To install, reverse the removal procedure.

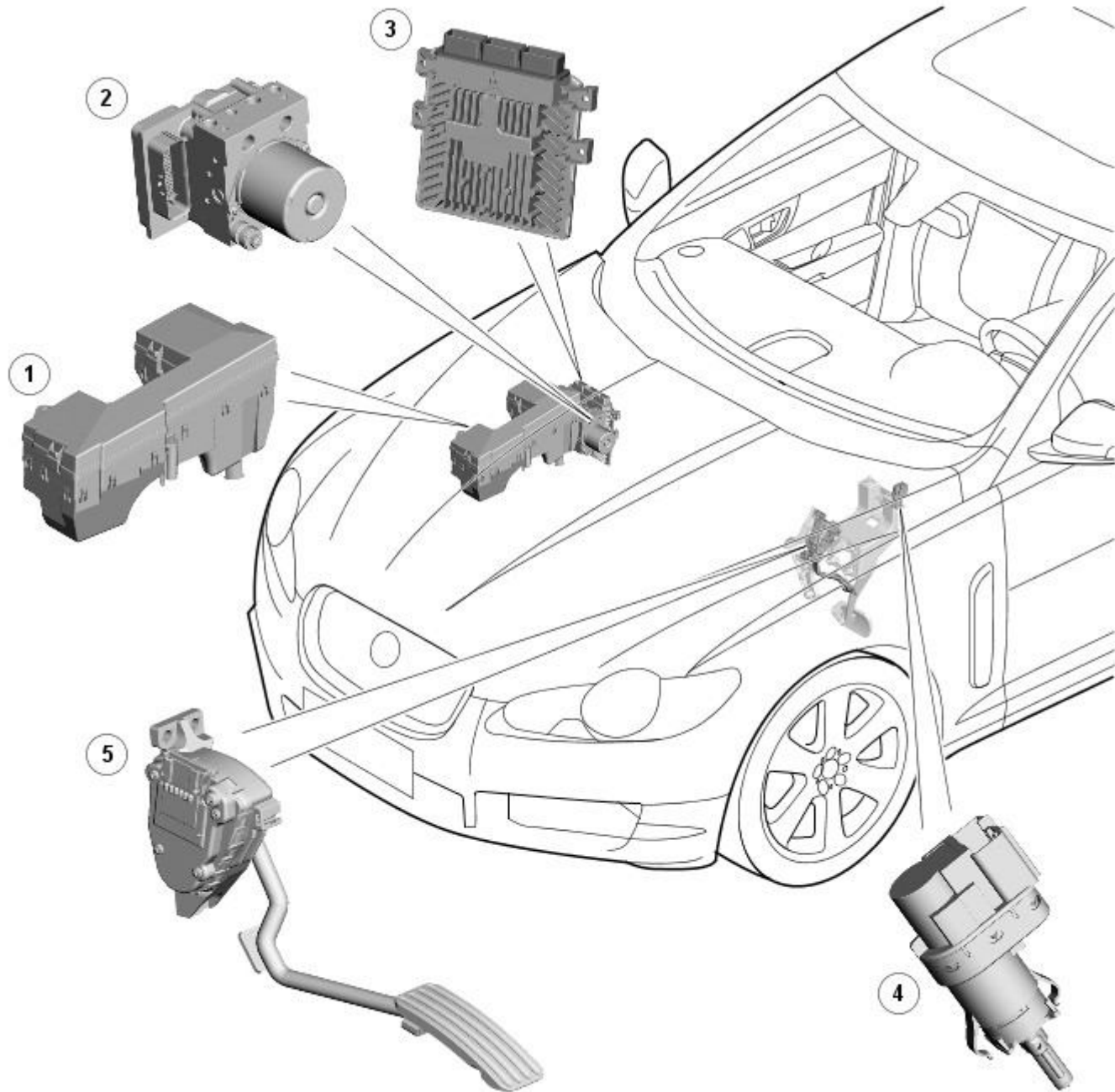
**Electronic Engine Controls - TDV6 2.7L Diesel -****Torque Specifications**

<b>Description</b>	<b>Nm</b>	<b>lb-ft</b>	<b>lb-in</b>
Camshaft position <a href="#">CMP (camshaft position)</a> sensor retaining bolt	10	-	89
Crankshaft position <a href="#">CKP (crankshaft position)</a> sensor retaining bolt	5	-	44
<a href="#">RHD (right-hand drive)ECM (engine control module)</a> Bracket to Dash Panel Retaining Nuts	7	-	62
<a href="#">RHDECM</a> to Bracket retaining nuts	7	-	62
<a href="#">LHD (left-hand drive)ECM</a> Bracket to Dash Panel retaining Nuts	7	-	62
<a href="#">LHDECM</a> to Bracket Retaining Bolts	7	-	62
Engine oil pressure <a href="#">EOP (engine oil pressure)</a> sensor	15	11	-
Knock sensor Left-Hand retaining bolt	20	15	-
Knock Sensor Right-Hand retaining bolt	20	15	-
Manifold absolute pressure <a href="#">MAP (manifold absolute pressure)</a> sensor	3	-	26
Mass air flow <a href="#">MAF (mass air flow)</a> sensor retaining screws	2	-	18

# Electronic Engine Controls - TDV6 2.7L Diesel - Electronic Engine Controls - Component Location

Description and Operation

COMPONENT LOCATION SHEET 1 OF 3



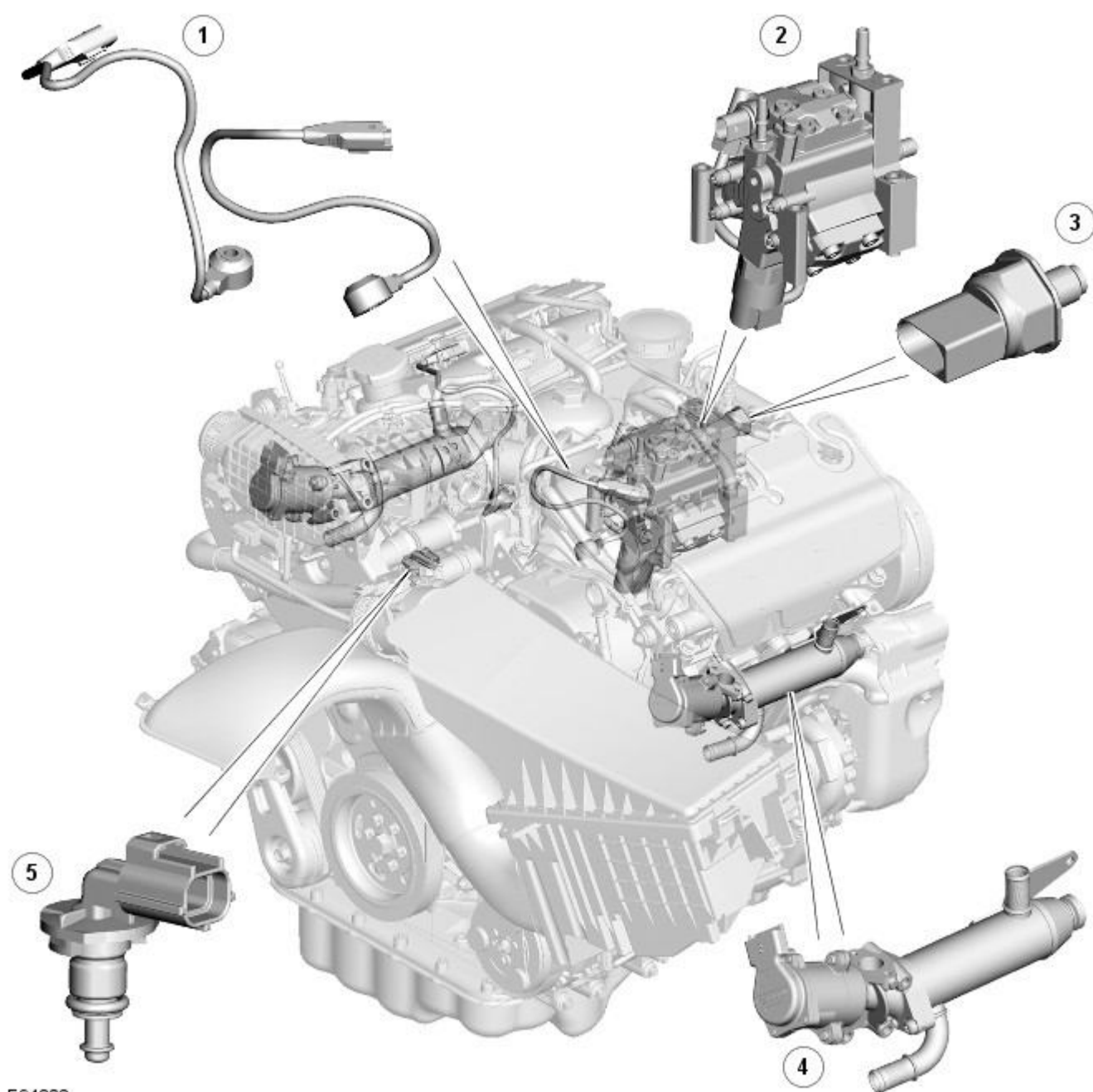
E95036

## ItemDescription

- |   |   |
|---|---|
| 1 | <a href="#">BJB (battery junction box)</a>                  |
| 2 | <a href="#">ABS (anti-lock brake system) control module</a> |
| 3 | <a href="#">ECM (engine control module)</a>                 |
| 4 | Brake pedal switch  |
| 5 | <a href="#">APP (accelerator pedal position) sensor</a>     |

COMPONENT LOCATION SHEET 2 OF 3



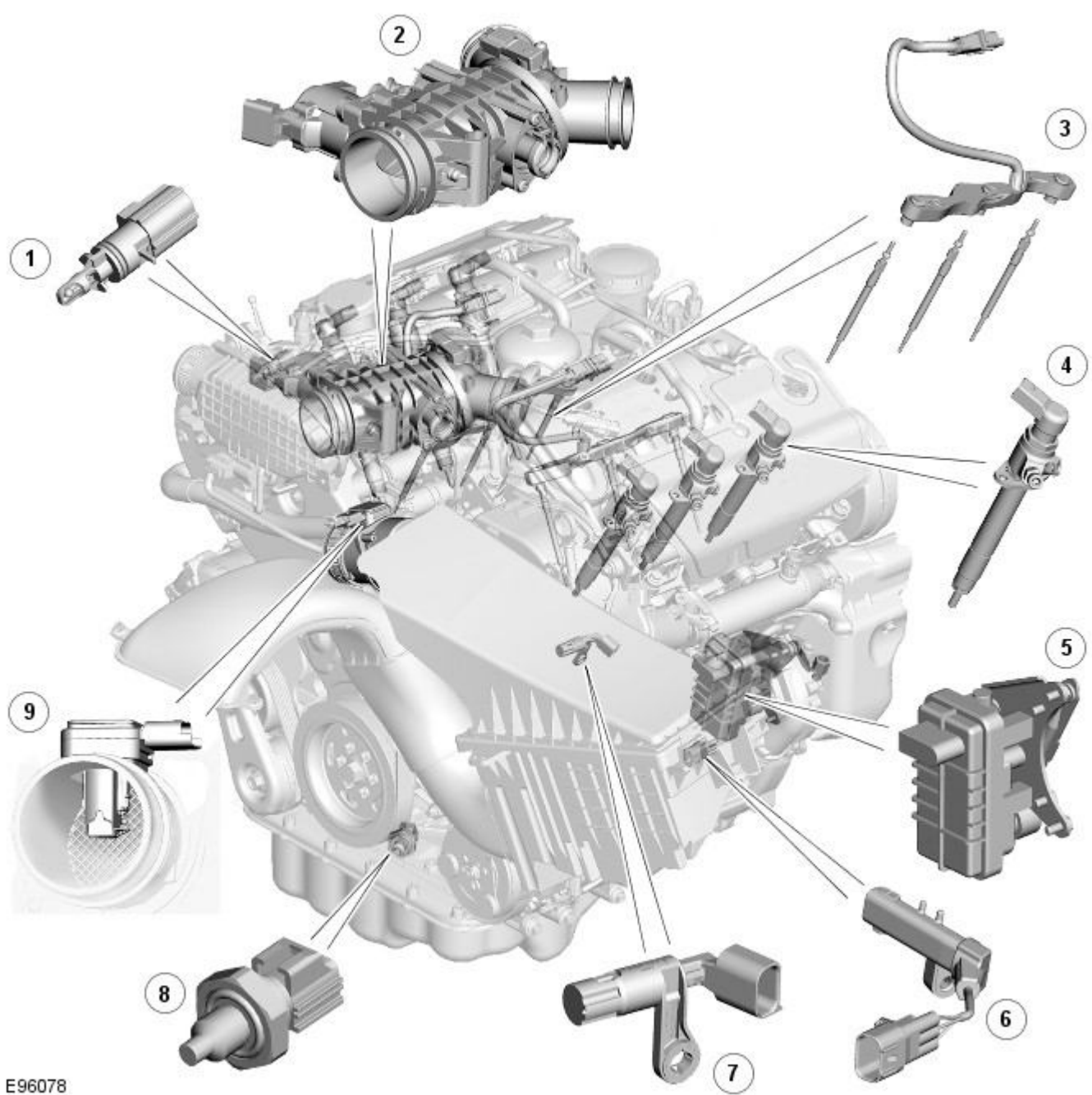


E94202

**ItemDescription**

- |   |   |
|---|---|
| 1 | KS (knock sensor)                       |
| 2 | Fuel pump                               |
| 3 | Fuel pressure sensor                    |
| 4 | EGR (exhaust gas recirculation) valve   |
| 5 | ECT (engine coolant temperature) sensor |





E96078

**ItemDescription**

1	Boost temperature sensor
2	Electric throttle body
3	Glow plugs
4	Injectors
5	Turbo vane controller
6	CKP (crankshaft position) sensor
7	CMP (camshaft position) sensorRCM (restraints control module)BPP (brake pedal position)
8	Oil temperature sensor
9	MAF (mass air flow)/IAT (intake air temperature) sensor

# Electronic Engine Controls - TDV6 2.7L Diesel - Electronic Engine Controls - Overview

Description and Operation

## OVERVIEW

The V6 Diesel engine has an engine management system controlled by an [ECM \(engine control module\)](#) and is able to monitor, adapt and precisely control the fuel injection. The [ECM](#) uses multiple sensor inputs and precision control of actuators to achieve optimum performance during all driving conditions.

The [ECM](#) controls fuel delivery to all 6 cylinders via a Common Rail (CR) injection system. The CR system uses a fuel rail to accumulate highly pressurized fuel and feed the 6, electronically controlled injectors. The fuel rail is located in close proximity to the injectors, which assists in maintaining full system pressure at each injector at all times.

[BJB \(battery junction box\)](#)[ABS \(anti-lock brake system\)](#)[IAT \(intake air temperature\)](#)[AJB \(auxiliary junction box\)](#)[APP \(accelerator pedal position\)](#)[KS \(knock sensor\)](#)[ECT \(engine coolant temperature\)](#)[MAF \(mass air flow\)](#)

The [ECM](#) uses the drive by wire principle for acceleration control. There are no control cables or physical connections between the accelerator pedal and the engine. Accelerator pedal demand is communicated to the [ECM](#) by two potentiometers located in a throttle position sensor.

The [ECM](#) uses the two signals to determine the position, rate of movement and direction of movement of the pedal. The [ECM](#) then uses this data, along with other engine information from other sensors, to achieve the optimum engine response.

The [ECM](#) processes information from the following input sources:

- [CKP \(crankshaft position\)](#) sensor
- [CMP \(camshaft position\)](#) sensor
- Manifold air temperature and pressure
- Coolant temperature
- Oil temperature
- Inlet air flow and temperature
- Fuel rail temperature
- [KS](#) (1 per cylinder bank)

The [ECM](#) outputs controlling signals to the following sensors and actuators:

- Fuel injectors
- Cooling fan control
- Electronic Throttle
- Electronic vane controlled turbo
- Port deactivation
- Fuel pressure control valve
- Fuel volume control valve
- Electronic [EGR \(exhaust gas recirculation\)](#)
- Glow plugs.

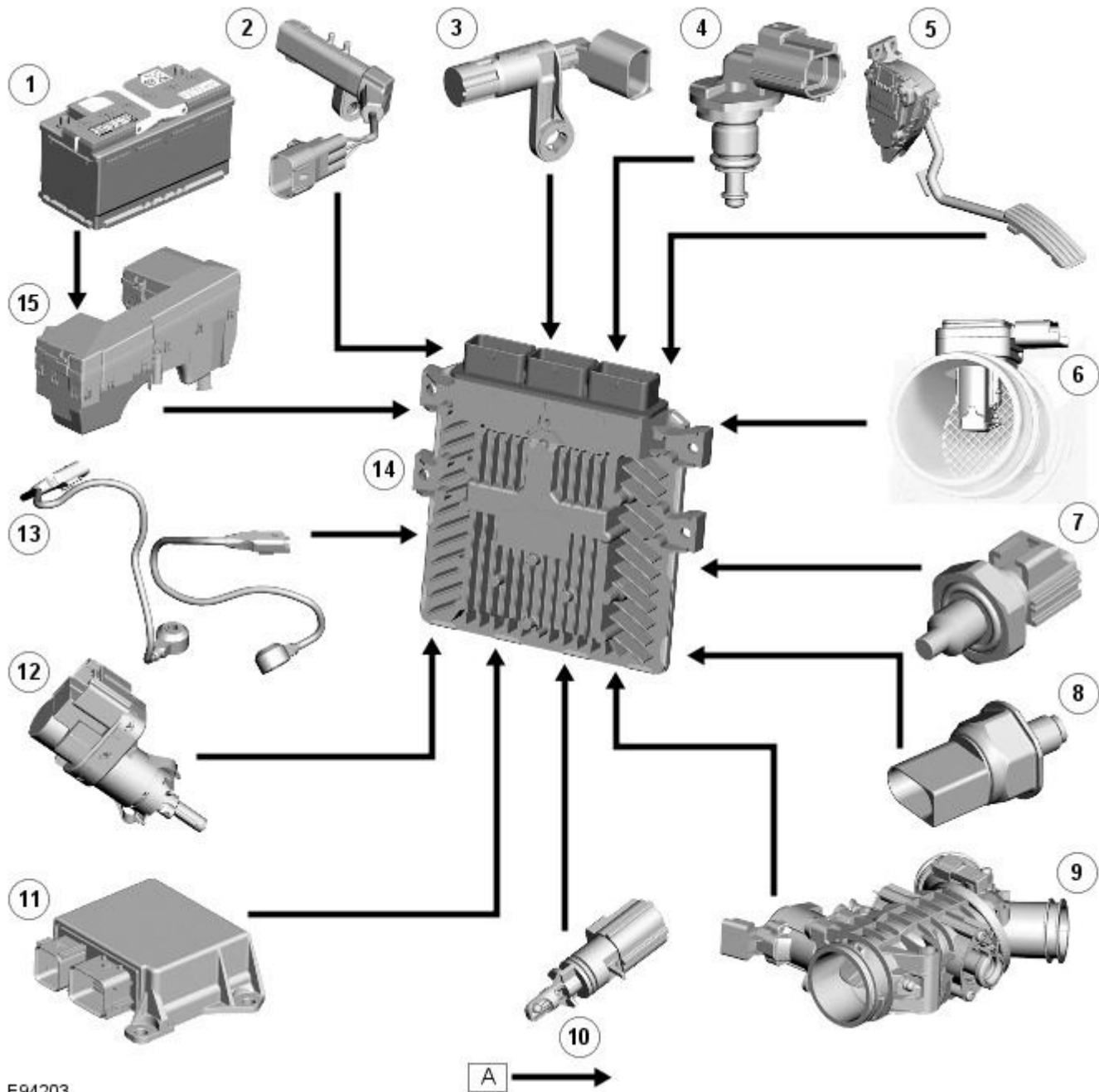
# Electronic Engine Controls - TDV6 2.7L Diesel - Electronic Engine Controls - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: A = Hardwired; D = High speed CAN (controller area network); O = LIN bus

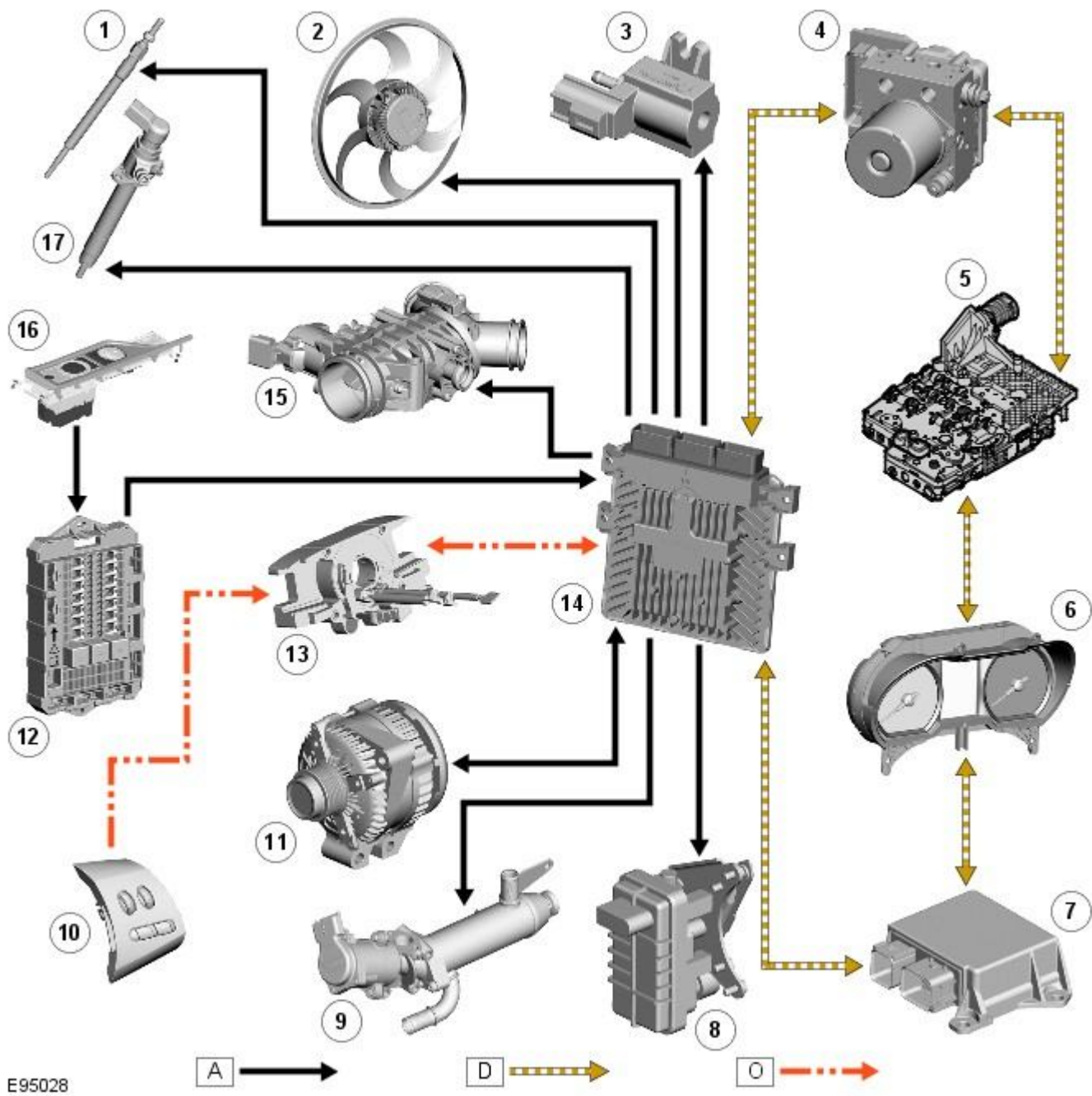
Control diagram Sheet 1 of 2



E94203

### ItemDescription

1	Battery
2	CKP (crankshaft position) sensor
3	CMP (camshaft position) sensor
4	ECT (engine coolant temperature) sensor
5	APP (accelerator pedal position) sensor
6	MAF (mass air flow) sensor
7	Oil temperature sensor
8	EOP (engine oil pressure) sensor
9	Electric throttle body
10	Boost pressure sensor
11	RCM (restraints control module)
12	BPP (brake pedal position) switch
13	KS (knock sensor)
14	ECM (engine control module)
15	BJB (battery junction box)



E95028

Item	Description
1	Glow plugs
2	Electric cooling fan
3	Vacuum control valve
4	ABS (anti-lock brake system) control module
5	CJB (central junction box)
6	Start switch
7	TCM (transmission control module)
8	Start control module
9	Smart key
10	Instrument cluster
11	RCM
12	Turbo vane controller
13	EGR (exhaust gas recirculation) valve
14	Generator
15	Speed control switches
16	Clock spring
17	ECM
18	Electric throttle body
19	Injectors

**System Operation**

**DIESEL PARTICULATE FILTER (DPF) CONTROL**

Vehicles are fitted with a Diesel Particulate Filter (DPF) which collects the particulate matter produced during the combustion process and reduces the particulates entering the atmosphere.

The DPF is located in the exhaust system, downstream of the catalytic converter. A major feature of the DPF is its ability for regeneration. Regeneration is the burning of particulates trapped by the filter to prevent obstruction to the free flow of exhaust gasses. The regeneration process is controlled by the [ECM](#) and takes place at calculated intervals and is not noticeable by the driver of the vehicle.

Regeneration is most important, since an overfilled filter can damage the engine through excessive exhaust back pressure and can itself be damaged or destroyed.

The exhaust gas and DPF temperatures are controlled by the DPF software located in the [ECM](#). The DPF software monitors the load status of the DPF based on driving style, distance travelled and signals from a differential pressure sensor and temperature sensors located before and after the DPF in the exhaust system. When the particulate loading of the DPF reaches predetermined levels, the DPF is actively regenerated by adjusting, in conjunction with the [ECM](#), various engine control functions such as:

- fuel injection
- intake air throttle
- [EGR](#)
- turbocharger boost pressure control.

The regeneration process is possible because of the flexibility of the common-rail fuel injection engine which provides precise control of fuel flow, fuel pressure and injection timing which are essential requirements to promote the efficient regeneration process.

The [ECM](#) contains the DPF software which controls and monitors the DPF and the regeneration process. The software is broken down into three separate modules; a DPF supervisor module, a DPF fuel management module and a DPF air management module, which interact with each other to provide precise DPF control.

These three modules are controlled by a fourth software module known as the DPF co-ordinator module. The co-ordinator module manages the operation of the other modules when an active regeneration is requested. The DPF supervisor module is a sub-system of the DPF co-ordinator module.

The DPF co-ordinator module reacts to a regeneration request from the supervisor module by initiating and controlling the following DPF regeneration requests:

- [EGR](#) cut-off
- Turbocharger boost pressure control
- Engine load increase
- Control of air pressure and temperature in the intake manifold
- Fuel injection control.

When the supervisor module issues a regeneration request, the co-ordinator module requests [EGR](#) cut-off and a regeneration specific turbocharger boost pressure control. It then waits for a feedback signal from the [EGR](#) system confirming that the [EGR](#) valve is closed.

• **NOTE:** The [EGR](#) valve is open at idle to allow reduced NO. [EGR](#) is not used during part load due to intake manifold contamination.

When the [EGR](#) valve is closed, the co-ordinator module initiates requests to increase engine load by controlling the intake air temperature and pressure.

Once confirmation is received that intake conditions are controlled or a calibration time has expired, the co-ordinator module then changes to a state awaiting an accelerator pedal release manoeuvre from the driver. If this occurs or a calibration time has expired, the co-ordinator module generates a request to control fuel injections to increase exhaust gas temperature.

The DPF air management module controls the following functions:

- [EGR](#) control
- Turbocharger boost pressure control
- Intake air temperature and pressure control.

During active regeneration, the [EGR](#) operation is disabled and the closed-loop activation of the turbocharger boost controller is calculated. The air management module controls the air in the intake manifold to a predetermined level of pressure and temperature. This control is required to achieve the correct in-cylinder conditions for stable and robust combustion of the post injected fuel.

Restricting the air intake during DPF regeneration has the following functions:

- Increase in engine load
- Slower combustion
- Reduction in the mass of air taken in
- A reduction in the speed of the exhaust gases and therefore an increase in the time for which the gases are in the catalytic converter.

The module controls the intake air temperature by actuating the [EGR](#) throttle and by adjustment of the turbocharger boost pressure control.

## Component Description

### Engine Control Module

The [ECM](#) is located in the plenum area attached to the bulkhead. The [ECM](#) is always on the opposite side to the hand of drive.

#### Inputs

The [ECM](#) has the following inputs:

- Engine Coolant Temperature
- [MAF](#) (2 off)
- Stop lamp switch (via [ABS](#) module on [CAN](#)) and hardwired to the [ECM](#)
- [IAT](#) (intake air temperature)
- Throttle Pedal Position 1
- Throttle Pedal Position 2
- Electronic throttle Position
- Engine speed and position sensor ([CKP](#))
- [CMP](#) sensor
- Engine Oil Temperature
- Speed Control Switches (resistive ladders)
- Vehicle Speed (via [CAN](#))
- Generator Monitor



- [RCM](#)
- [MAP \(manifold absolute pressure\)](#)
- [KS \(4 off\)](#)
- Fuel temperature and pressure
- Water in fuel sensor
- Boost air temperature
- Park/neutral switch

## Outputs

The [ECM](#) outputs to the following:

- Throttle actuator
- Fuel injectors (6 off)
- [EGR](#) Valves
- Electric cooling fan
- Fuel pump relay
- Starter relay
- Air conditioning condenser fan module
- EMS Main relay
- Electric fan control
- Generator control
- Glow plugs
- Fuel volume control valve
- Fuel pressure control valve
- Active engine mounts
- Port deactivation control solenoid valve

The [ECM](#) connected to the vehicle harnesses via three connectors. The [ECM](#) contains data processors and memory microchips. The output signals to the actuators are in the form of ground paths provided by driver circuits within the [ECM](#). The [ECM](#) driver circuits produce heat during normal operation and dissipate this heat via the casing. Some sensors receive a regulated voltage supplied by the [ECM](#). This avoids incorrect signals caused by voltage drop during cranking.

The [ECM](#) performs self diagnostic routines and stores fault codes in its memory. These fault codes and diagnostics can be accessed using the Jaguar approved diagnostic system. If the [ECM](#) is to be replaced, the new [ECM](#) is supplied 'blank' and must be configured to the vehicle using the Jaguar approved diagnostic system. A 'flash' [EEPROM \(electrically erasable programmable read only memory\)](#) allows the [ECM](#) to be externally configured, using the Jaguar approved diagnostic system, with market specific or new tune information. The current engine tune data can be accessed and read using the Jaguar approved diagnostic system.

When a new [ECM](#) is fitted, it must also be synchronized to the immobilization control module using the Jaguar approved diagnostic system. [ECM](#)'s cannot be 'swapped' between vehicles.

The [ECM](#) is connected to the engine sensors which allow it to monitor the engine operating conditions. The [ECM](#) processes these signals and decides the actions necessary to maintain optimum engine performance in terms of driveability, fuel efficiency and exhaust emissions. The memory of the [ECM](#) is programmed with instructions for how to control the engine, this known as the strategy. The memory also contains data in the form of maps which the [ECM](#) uses as a basis for fueling and emission control. By comparing the information from the sensors to the data in the maps, the [ECM](#) is able to calculate the various output requirements. The [ECM](#) contains an adaptive strategy which updates the system when components vary due to production tolerances or ageing.

The [ECM](#) receives a vehicle speed signal on a [CAN](#) bus connection from the [ABS](#) Module. Vehicle speed is an important input to the [ECM](#) strategies. The [ABS](#) derives the speed signal from the [ABS](#) wheel speed sensors. The frequency of this signal changes according to road speed. The [ECM](#) uses this signal to determine the following:

- How much to reduce engine torque during gear changes.
- When to permit speed control operation.
- To control the operation of the speed control system.
- Implementation of the idle strategy when the vehicle is stationary.

## Camshaft Position Sensor (CMP)



E46902

The [CMP](#) is located on the front face of the left hand cylinder head. The sensor tip protrudes through the face to pick up on the reluctor behind the camshaft pulley. The [CMP](#) is a Hall effect type sensor

The [ECM](#) uses the [CMP](#) sensor signal to determine if the piston in No. 1 cylinder is at injection [TDC \(top dead center\)](#) or exhaust [TDC](#). Once this has been established, the [ECM](#) can then operate the correct injector to inject fuel into the cylinder when the piston is at injection [TDC](#).

The [CMP](#) sensor is a Hall effect sensor which used by the [ECM](#) at engine start-up to synchronize the [ECM](#) with the [CKP](#) sensor signal. The [ECM](#) does this by using the [CMP](#) sensor signal to identify number one cylinder to ensure the correct injector timing. Once the [ECM](#) has established the injector timing, the [CMP](#) sensor signal is no longer used.

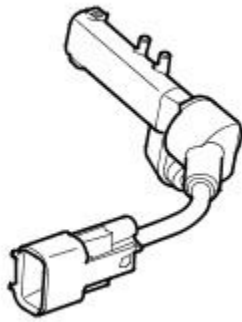
The [CMP](#) sensor receives a 5V supply from the [ECM](#). Two further connections to the [ECM](#) provide ground and signal output.

If a fault occurs, an error is registered in the [ECM](#). Two types of failure can occur; camshaft signal frequency too high or total failure of the camshaft signal. The error recorded by the [ECM](#) can also relate to a total failure of the crankshaft signal or crankshaft signal dynamically implausible. Both components should be checked to determine the cause of the fault.



If a fault with the [CMP](#) sensor is running, the engine will continue to run but the [ECM](#) will deactivate boost pressure control. Once the engine is switched off, the engine will crank but will not restart while the fault is present.

## Crankshaft Position Sensor (CKP)



E46903

The [CKP](#) sensor is located at the rear of the engine block on the left hand side. The sensor tip is aligned with a magnetic trigger which is attached to the crankshaft. The reluctor is a press fit on the end of the crankshaft. The trigger wheel must be carefully aligned to the crankshaft to ensure correct timing. The sensor produces a square wave signal, the frequency of which is proportional to engine speed.

The [ECM](#) monitors the [CKP](#) sensor signal and can detect engine over-speed. The [ECM](#) counteracts engine over-speed by gradually fading out speed synchronized functions. The [CKP](#) is a Hall effect sensor. The sensor measures the magnetic field variation induced by the magnetized trigger wheel.

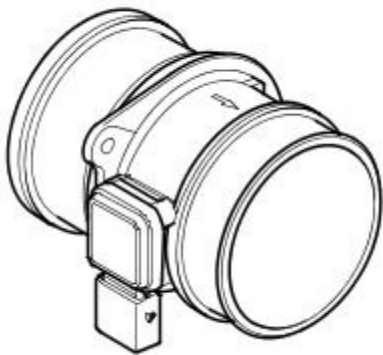
The trigger wheel has two missing teeth representing 6° of crankshaft rotation. The two missing teeth provide a reference point for the angular position of the crankshaft.

When the space with the two missing teeth pass the sensor tip, a gap in the signal is produced which the [ECM](#) uses to determine the crankshaft position. The air gap between the sensor tip and the ring is important to ensure correct signals are output to the [ECM](#). The recommended air gap between the [CKP](#) and the trigger wheel is 0.4 mm- 1.5 mm.

The [ECM](#) uses the signal from the [CKP](#) sensor for the following functions:

- Synchronisation.
- Determine fuel injection timing.
- Enable the fuel pump relay circuit (after the priming period).
- Produce an engine speed signal which is broadcast on the [CAN](#) bus for use by other systems.

## Mass Air Flow/Intake Air Temperature (MAF/IAT) Sensor



E46904

The [MAF/IAT](#) sensor is located on the inlet air duct directly after the air filter box. The sensor combines the two functions of a [MAF](#) sensor and an [IAT](#) sensor in one unit. The sensor is housed in a plastic molding which is connected between the intake manifold and the air intake pipe.

The [MAF](#) sensor works on the hot film principle. Two sensing elements are contained within a film. One element is maintained at ambient (air intake) temperature, e.g. 25° Celsius (77°F). The other element is heated to 200° Celsius (392°F) above the ambient temperature, e.g. 225° Celsius (437°F). Intake air entering the engine passes through the [MAF](#) sensor and has a cooling effect on the film. The [ECM](#) monitors the current required to maintain the 200° Celsius (392°F) differential between the two elements and uses the differential to provide a precise, non-linear, signal which equates to the volume of air being drawn into the engine.

The [MAF](#) sensor output is a digital signal proportional to the mass of the incoming air. The [ECM](#) uses this data, in conjunction with signals from other sensors and information from stored fueling maps, to determine the precise fuel quantity to be injected into the cylinders. The signal is also used as a feedback signal for the [EGR](#) system.

The [IAT](#) sensor incorporates a [NTC \(negative temperature coefficient\)](#) thermistor in a voltage divider circuit. The [NTC](#) thermistor works on the principle of decreasing resistance in the sensor as the temperature of the intake air increases. As the thermistor allows more current to pass to ground, the voltage sensed by the [ECM](#) decreases. The change in voltage is proportional to the temperature change of the intake air. Using the voltage output from the [IAT](#) sensor, the [ECM](#) can correct the fueling map for intake air temperature. The correction is an important requirement because hot air contains less oxygen than cold air for any given volume.

The [MAF](#) sensor receives a 12V supply from the [BJB](#) and a ground connection via the [ECM](#). Two further connections to the [ECM](#) provide a [MAF](#) signal and [IAT](#) signal.

The [IAT](#) sensor receives a 5V reference voltage from the [ECM](#) and shares a ground with the [MAF](#) sensor. The signal output from the [IAT](#) sensor is calculated by the [ECM](#) by monitoring changes in the supplied reference voltage to the [IAT](#) sensor voltage divider circuit.

The [ECM](#) checks the calculated air mass against the engine speed. If the calculated air mass is not plausible, the [ECM](#) uses a default air mass figure which is derived from the average engine speed compared to a stored characteristic map. The air mass value will be corrected

using values for boost pressure, atmospheric pressure and air temperature.

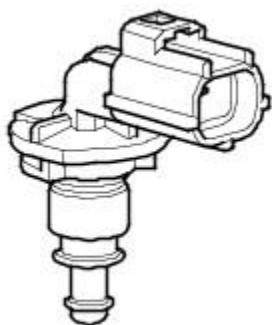
If the [MAF](#) sensor fails the [ECM](#) implements the default strategy based on engine speed. In the event of a [MAF](#) sensor signal failure, the following symptoms may be observed:

- [EGR](#) system off
- Delayed engine response
- Reduced engine performance.

If the [IAT](#) sensor fails the [ECM](#) uses a default intake air temperature of 40°Celsius (104°F). In the event of an [IAT](#) sensor failure, any of the following symptoms may be observed:

- Under fueling, resulting in reduced engine performance.

## Engine Coolant Temperature sensor



E46905

The [ECT](#) is located in the top hose at the coolant manifold junction. The [ECT](#) sensor provides the [ECM](#) and the instrument cluster with engine coolant temperature status.

The [ECM](#) uses the temperature information for the following functions:

- Fueling calculations
- Limit engine operation if engine coolant temperature becomes too high
- Cooling fan operation
- Glow plug activation time.

The instrument cluster uses the temperature information for temperature gauge operation. The engine coolant temperature signal is also transmitted on the [CAN](#) bus by the instrument cluster for use by other systems.

The [ECM/ECT](#) sensor circuit consists of an internal voltage divider circuit which incorporates an [NTC](#) thermistor. As the coolant temperature rises the resistance through the sensor decreases and vice versa. The output from the sensor is the change in voltage as the thermistor allows more current to pass to earth relative to the temperature of the coolant.

The [ECM](#) compares the signal voltage to stored values and adjusts fuel delivery to ensure optimum driveability at all times. The engine will require more fuel when it is cold to overcome fuel condensing on the cold metal surfaces inside the combustion chamber. To achieve a richer air/fuel ratio, the [ECM](#) extends the injector opening time. As the engine warms up the air/fuel ratio is leaned off.

The input to the sensor is a 5V reference voltage supplied from the voltage divider circuit within the [ECM](#). The ground from the sensor is also connected to the [ECM](#) which measures the returned current and calculates a resistance figure for the sensor which relates to the coolant temperature.

The following table shows engine coolant temperature values and the corresponding sensor resistance and voltage values.

Coolant Temperature Sensor Response

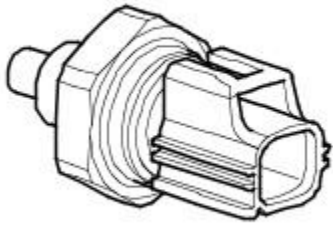
Temperature (Degrees Celsius)	Resistance (Kohms)	Voltage (Volts)
-40	925	4.54
-30	496	4.46
-20	277	4.34
-10	160	4.15
0	96	3.88
10	59	3.52
20	37	3.09
30	24	2.62
40	16	2.15
50	11	1.72
60	7.5	1.34
70	5.6	1.04
80	3.8	0.79
90	2.9	0.64
100	2.08	0.49
110	1.56	0.38
120	1.19	0.29
130	0.918	0.22
140	0.673	0.17
150	0.563	0.14

If the [ECT](#) sensor fails, the following symptoms may be observed:

- Difficult cold start (under extreme conditions).
- Engine performance compromised.
- Temperature gauge inoperative or inaccurate reading.

In the event of [ECT](#) sensor signal failure, the [ECM](#) applies a default value of 80°Celsius (176°F) coolant temperature for fueling purposes. The [ECM](#) will also permanently operate the cooling fan at all times when the ignition is switched on, to protect the engine from overheating.

## Engine Oil Temperature Sensor



E46906

The oil temperature sensor is located in the engine sump. The temperature sensor is a [NTC](#) type which operates in the -30 Degrees Celsius to +150 Degrees Celsius temperature range.

### Oil Temperature Sensor Response

Temperature Degrees Celsius	Resistance Ohms
60	620
90	255
120	117
150	60

## Fuel Rail Temperature Sensor

The fuel rail temperature sensor is located on the LP return line.

The sensor is an [NTC](#) sensor which is connected to the [ECM](#) by two wires. The [ECM](#) fuel temperature sensor circuit consists of an internal voltage divider circuit which incorporates an [NTC](#) thermistor. As the fuel temperature rises the resistance through the sensor decreases. The output from the sensor is the change in voltage as the thermistor allows more current to pass to earth relative to the temperature of the fuel.

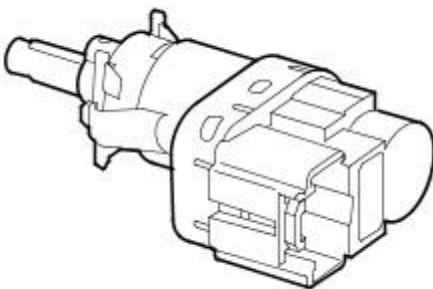
The [ECM](#) monitors the fuel temperature constantly. If the fuel temperature exceeds 130°Celsius (185°F), the [ECM](#) invokes an engine 'derate' strategy. This reduces the amount of fuel delivered to the injectors in order to allow the fuel to cool. When this occurs, the driver may notice a loss of performance.

Further fuel cooling is available by a bi-metallic valve diverting fuel through the fuel cooler when the fuel reaches a predetermined temperature.

The wires to the fuel sensor are monitored by the [ECM](#) for short and open circuit. The [ECM](#) also monitors the 5V supply. If a failure occurs a fault is recorded in the [ECM](#) memory and the [ECM](#) uses a default fuel pressure value.

If the [ECM](#) registers an 'out of range' deviation between the pressure signal from the sensor and the pre-programmed 'set point' a fault is stored in the [ECM](#) memory. Depending on the extent of the deviation, the [ECM](#) will reduce the injection quantity, stop the engine immediately or prevent further engine starting.

## Brake Light Switch



E46910

The brake switch is located on the brake pedal and is operated by the brake pedal. The switch has a normally open circuit switch which closes the circuit when the driver has applied the brakes. The switch is connected directly to the [ECM](#) and the [ECM](#) also receives a brake light signal on the [CAN](#) bus from the [ABS](#) control module.

The [ECM](#) uses the brake signal for the following:

- To limit fuelling during braking (only when adaptive speed control is active)
- To inhibit/cancel Speed control if the brakes are applied.

In the event of a brake switch failure, the following symptoms may be observed:

- Speed control inactive
- Increased fuel consumption.

## Glow Plugs



E46912

Three glow plugs are located in each of the cylinder heads, on the inlet side. The glow plugs and the glow plug relay are a vital part of the engine starting strategy. The glow plugs heat the air inside the cylinder during cold starts to assist combustion. The use of glow plugs helps reduce the amount of additional fuel required on start-up, and consequently reduces the emission of black smoke. The use of glow plugs also reduces the amount of injection advance required, which reduces engine noise, particularly when idling with a cold engine.

There are three phases of glow plug activity:

- Pre-heat
- During crank
- Post heat

The main part of the glow plug is a tubular heating element which protrudes into the combustion chamber of the engine. The heating element contains a spiral filament encased in magnesium oxide powder. At the tip of the tubular heating element is the heater coil. Behind the heater coil, and connected in series, is a control coil. The control coil regulates the heater coil to ensure that it does not overheat.

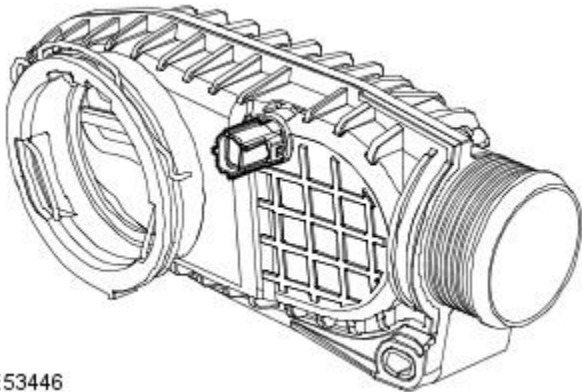
Pre-heat is the length of time the glow plugs operate prior to engine cranking. The [ECM](#) controls the pre-heat time based on [ECT](#) sensor output and battery voltage. If the [ECT](#) sensor fails, the [ECM](#) will use the fuel temperature sensor value as a default value. The pre-heat duration is extended if the coolant temperature is low and the battery is not fully charged.

Post heat is the length of time the glow plugs operate after the engine starts. The [ECM](#) controls the post heating time based on [ECT](#) sensor output. The post heat phase reduces engine noise, improves idle quality and reduces hydrocarbon emissions.

At [ECT](#)s below 0 degrees celcius instrument cluster displays 'COLD START IN PROGRESS' in the message center. The glow-lamp is activated separately from the glow-plugs, so is not illuminated during or after start. The plugs can still be ON when the lamp is off in these two phases.

In the event of glow plug failure, the engine may be difficult to start.

## Boost Air Temperature Sensor



E53446

The boost air temperature sensor is located in the rear of the intake chamber immediately preceding the electric throttle. The sensor is used to measure the intake air temperature from the turbo in order to calculate the required amount of fueling.

## Boost Pressure Control

The Boost Pressure (BP) sensor is located post turbo after the electric throttle valve. The sensor provides a voltage signal to the [ECM](#) relative to the intake manifold pressure. The BP sensor has a three pin connector which is connected to the [ECM](#) and provides a 5V reference supply from the [ECM](#), a signal input to the [ECM](#) and a ground for the sensor.

The BP sensor uses diaphragm transducer to measure pressure. The [ECM](#) uses the BP sensor signal for the following functions:

- Maintain manifold boost pressure.
- Reduce exhaust smoke emissions when driving at high altitude.
- Control of the [EGR](#) system.

If the BP sensor fails, the [ECM](#) uses a default pressure of 1013 mbar (14 lbf/in<sup>2</sup>). In the event of a BP sensor failure, the following symptoms may be observed:

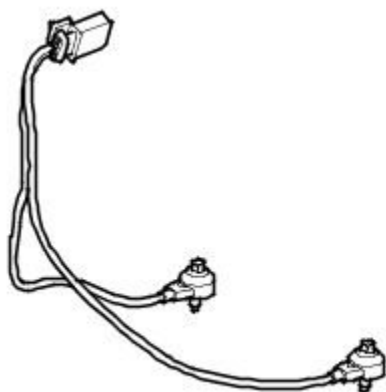
- Altitude compensation inoperative (black smoke emitted from the exhaust).
- Active boost control inoperative.

Boost control is achieved by the use of a direct drive electric actuator. The actuator is attached to the side of the turbo unit and is connected with the control mechanism via a linkage. The electric actuator works on the torque motor principal and has integrated control module.

The electric actuator moves the control vanes through an 60 degree stroke and has the capability to learn its own maximum stroke positions. The electric actuator is controlled via [PWM \(pulse width modulation\)](#) signals from the [ECM](#).

If the [ECM](#) detects a fault with the Boost Pressure (BP) sensor, it uses an open loop boost control based on engine speed and airflow as a default value.

## Knock Sensors



E47296

The TDV6 EMS has two knock sensors located in the V of the engine, one per cylinder bank. The sensors are connected to the [ECM](#) via a twisted pair.

The knock sensors produce a voltage signal in proportion to the amount of mechanical vibration generated at each ignition point. Each sensor monitors the related cylinder bank.

The knock sensors incorporate a piezo-ceramic crystal. This crystal produces a voltage whenever an outside force tries to deflect it, (i.e. exerts a mechanical load on it). When the engine is running, the compression waves in the material of the cylinder block, caused by the combustion of the fuel/air mixture within the cylinders, deflect the crystal and produce an output voltage signal. The signals are supplied to the [ECM](#), which compares them with 'mapped' signals stored in memory. From this, the [ECM](#) can determine when detonation occurs on individual cylinders. When detonation is detected, the [ECM](#) retards the ignition timing on that cylinder for a number of engine cycles, then gradually returns it to the original setting.

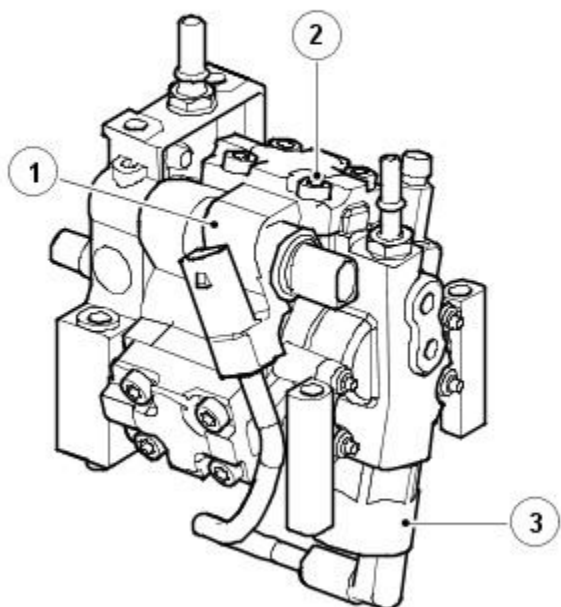
Care must be taken at all times to avoid damaging the knock sensors, but particularly during removal and fitting procedures. The recommendations regarding torque and surface preparation must be adhered to. The torque applied to the sensor and the quality of the surface preparation both have an influence over the transfer of mechanical noise from the cylinder block to the crystal.

The [ECM](#) uses the signals supplied by the knock sensors, in conjunction with the signal it receives from the camshaft sensor, to determine the optimum ignition point for each cylinder. The ignition point is set according to preprogrammed ignition maps stored within the [ECM](#). If the only fuel available is of poor quality, or the customer switches to a lower grade of fuel after using a high grade for a period of time, the engine may suffer slight pre-ignition for a short period. This amount of pre-ignition will not damage the engine. This situation will be evident while the [ECM](#) learns and then modifies its internal mapping to compensate for the variation in fuel quality. This feature is called adaption. The [ECM](#) has the capability of adapting its fuel and ignition control outputs in response to several sensor inputs.

The [ECM](#) will cancel closed loop control of the ignition system if the signal received from either knock sensor becomes implausible. In these circumstances the [ECM](#) will default to a safe ignition map. This measure ensures the engine will not become damaged if low quality fuel is used. The [MIL \(malfunction indicator lamp\)](#) will not illuminate, although the driver may notice that the engine 'pinks' in some driving conditions and displays a drop in performance and smoothness.

When a knock sensor fault is stored, the [ECM](#) will also store details of the engine speed, engine load and the coolant temperature.

## Fuel Rail Pressure Control Valve



E46984

## Item Description

1	Fuel volume control valve
2	High pressure fuel pump
3	Fuel rail pressure control valve

The fuel rail pressure control valve is incorporated into the high pressure fuel pump. The control valve regulates the fuel pressure within the fuel rail and is controlled by the [ECM](#). The control valve is a [PWM](#) controlled solenoid valve.

When the solenoid is de-energized, an internal spring holds an internal valve closed. At fuel pressure of 100 bar (1450 lbf/in<sup>2</sup>) or higher, the force of the spring is overcome, opening the valve and allowing fuel pressure to decay into the fuel return pipe. When the pressure in the fuel rail decays to approximately 100 bar (1450 lbf/in<sup>2</sup>) or less, the spring force overcomes the fuel pressure and closes the valve. When the [ECM](#) energizes the solenoid, the valve is closed allowing the fuel pressure to build. The pressure in the fuel rail in this condition can reach approximately 1600 bar.

The [ECM](#) controls the fuel rail pressure by operating the control valve solenoid using a [PWM](#) signal. By varying the duty cycle of the [PWM](#) signal, the [ECM](#) can accurately control the fuel rail pressure and hence the pressure delivered to the injectors according to engine load. This is achieved by the control valve allowing a greater or lesser volume of fuel to pass from the high pressure side of the pump to the un-pressurized fuel return line, regulating the pressure on the high pressure side.

The fuel rail pressure control valve receives a [PWM](#) signal from the [ECM](#) of between 0 and 12V. The [ECM](#) controls the operation of the control valve using the following information to determine the required fuel pressure:

- Fuel rail pressure
- Engine load
- Accelerator pedal position
- Engine temperature
- Engine speed.

In the event of a total failure of the fuel rail pressure control valve, the engine will not start.

In the event of a partial failure of the fuel rail pressure control valve, the [ECM](#) will activate the solenoid with the minimum duty cycle which results in the injection quantity being limited.

## Fuel Volume Control Valve

The fuel rail volume control valve is incorporated into the high pressure fuel pump. The VCV spills unwanted fuel back to the tank (or LP system) or forwards it to the PCV. This avoids unused fuel being pressurized by the HP stage of the pump, only to be spilt back to LP by the PCV wasting energy and heating the fuel.

## Injectors

There are six electronic fuel injectors located in a central position between the four valves of each cylinder. The [ECM](#) divides the injectors into two banks of three with cylinders 1 to 3 being designated bank A and cylinders 4 to 6 designated bank B, with injector numbers 1 and 4 at the front of the engine.

Each injector is supplied with pressurized fuel from the fuel rail and delivers finely atomized fuel directly into the combustion chambers. Each injector is individually controlled by the [ECM](#) which operates each injector in the firing order and controls the injector opening period via [PWM](#) signals. Each injector receives a 120V supply from the [ECM](#) and, using programmed injection/timing maps and sensor signals, determines the precise pilot and main injector timing for each cylinder. If battery voltage falls to between 6 and 9V, fuel injector operation is restricted, affecting emissions, engine speed range and idle speed. In the event of a failure of a fuel injector, the following symptoms may be observed:

- Engine misfire
- Idle irregular
- Reduced engine performance
- Reduced fuel economy
- Difficult starting
- Increased smoke emissions.

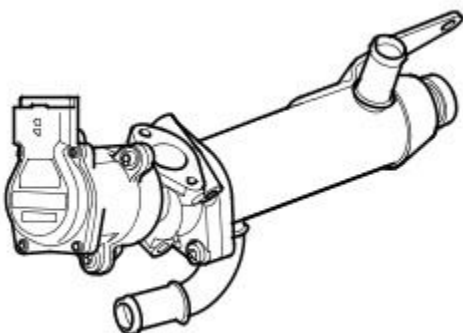
The [ECM](#) monitors the wires for each injector for short circuit and open circuit, each injector and the transient current within the [ECM](#). If a defect is found, an error is registered in the [ECM](#) for the injector in question.

## EGR System

The [EGR](#) system comprises:

- [EGR](#) modulator x 2
- [EGR](#) cooler x 2
- Associated connecting pipes

EGR Modulator and Cooler



E46914

The combined [EGR](#) modulator and cooler is located under each cylinder bank, between the exhaust manifold and the cylinder head. The cooler side of the [EGR](#) is connected to the vehicle cooling system via hoses. The inlet exhaust side is connected directly into the exhaust



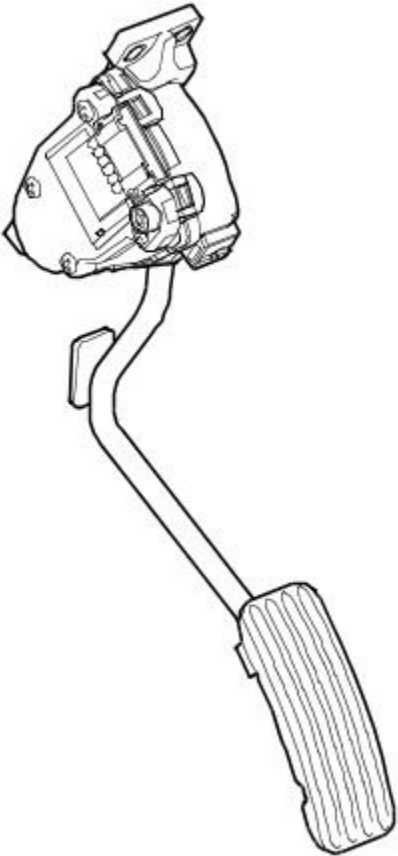
manifolds on each side. The exhaust gas passes through the cooler and is expelled via the actuator and a metal pipe into the throttle housing. The [EGR](#) modulator is a solenoid operated valve which is controlled by the [ECM](#). The [ECM](#) uses the [EGR](#) modulator to control the amount of exhaust gas being re-circulated in order to reduce exhaust emissions and combustion noise.

The [EGR](#) modulator is controlled by an H bridge driver to control the precise amount of exhaust gas delivered to the cylinders.

The modulators are operated through their full range at each engine shut down, to clear any carbon deposits that may have built up whilst the engine was running

In the event of a failure of the [EGR](#) modulator, the [EGR](#) function will become inoperative. The [ECM](#) can monitor the [EGR](#) modulator solenoid for short circuits and store fault codes in the event of failure. The modulator can also be activated for testing using the Jaguar recommended diagnostic equipment.

## Accelerator Pedal Position Sensor (APP)

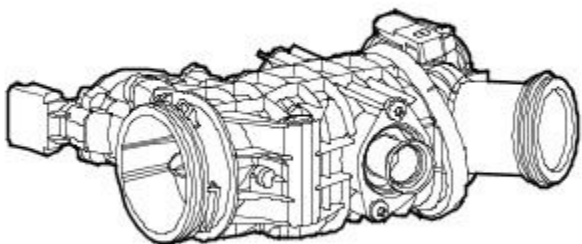


The [APP](#) is incorporated into the pedal assembly. The sensor is a twin track rotary potentiometer type.

The [APP](#) sensor is located in plastic housing which is integral with the throttle pedal. The housing is injection molded and provides location for the [APP](#) sensor. The sensor is mounted externally on the housing and is secured with two Torx screws. The external body of the sensor has a six pin connector which accepts a connector on the vehicle wiring harness.

The sensor has a spigot which protrudes into the housing and provides the pivot point for the pedal mechanism. The spigot has a slot which allows for a pin, which is attached to the sensor potentiometers, to rotate through approximately 90°, which relates to pedal movement. The pedal is connected via a link to a drum, which engages with the sensor pin, changing the linear movement of the pedal into rotary movement of the drum. The drum has two steel cables attached to it. The cables are secured to two tension springs which are secured in the opposite end of the housing. The springs provide 'feel' on the pedal movement and require an effort from the driver similar to that of a cable controlled throttle. A detente mechanism is located at the forward end of the housing and is operated by a ball located on the drum. At near maximum throttle pedal movement, the ball contacts the detente mechanism. A spring in the mechanism is compressed and gives the driver the feeling of depressing a 'kickdown' switch when full pedal travel is achieved.

## Electronic Throttle

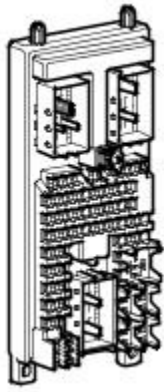


E46900

The electric throttle body is located in the inlet tract prior to where the inlet splits to divert air flow into the two separate air intake manifolds. The electric throttle controls the volume of air allowed into the inlet manifold by means of a DC motor which controls a flap in the body of the throttle. This is done in response to inputs from the engine management system.

Just after the throttle flap the tubes from the [EGR](#) valves/coolers are joined into the assembly.

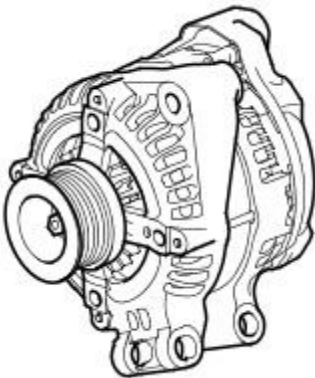
## Central Junction Box



E47607

The [CJB](#) initiates the power up and power down routines within the [ECM](#). When the ignition is turned on 12V is applied to the Ignition Sense input. The [ECM](#) then starts its power up routines and turns on the [ECM](#) main relay; the main power to the [ECM](#) and it's associated system components. When the ignition is turned OFF the [ECM](#) will maintain its powered up state for up to 60 seconds while it initiates its power down routine and on completion will turn off the [ECM](#) main relay.

## Generator



E47591

The generator has a multifunction voltage regulator for use in a 14V charging system with 6÷12 zener diode bridge rectifiers.

The [ECM](#) monitors the load on the electrical system via [PWM](#) signal and adjusts the generator output to match the required load. The [ECM](#) also monitors the battery temperature to determine the generator regulator set point. This characteristic is necessary to protect the battery; at low temperatures battery charge acceptance is very poor so the voltage needs to be high to maximize any rechargeability, but at high temperatures the charge voltage must be restricted to prevent excessive gassing of the battery with consequent water loss.

The generator has a smart charge capability that will reduce the electrical load on the generator reducing torque requirements, this is implemented to utilize the engine torque for other purposes. This is achieved by monitoring three signals to the [ECM](#):

- Generator sense (A sense), measures the battery voltage at the [CJB](#).
- Generator communication (Alt Com) communicates desired generator voltage set point from [ECM](#) to generator.
- Generator monitor (Alt Mon) communicates the extent of generator current draw to [ECM](#). This signal also transmits faults to the [ECM](#) which will then sends a message to the instrument cluster on the [CAN](#) bus to illuminate the charge warning lamp.

## DPF Temperature Sensors

Three temperature sensors are used in the DPF system. One is located before the catalytic convertor, the second sensor is after the catalytic converter and the third sensor is located before the DPF.

The sensors measure the temperature of exhaust gas exiting the turbocharger, before it passes through the DPF and after it has passed through the DPF and provides the information required by the [ECM](#) to calculate the DPF temperature. The information is used, in conjunction with other data, to estimate the amount of accumulated particulate and to control the DPF temperature.

The sensors are Negative Temperature Co-efficient (NTC) type resistors, which measure the temperature of the exhaust gases. The resistance, and subsequently the voltage at the sensor will decrease as the exhaust gas temperature increases.

In the event of a fault in a temperature sensor, the [ECM](#) uses a substitute value of 350°C (1202°F).

## Differential Pressure Sensor

The differential pressure sensor is used by the DPF software to monitor the condition of the DPF. Two pipe connections on the sensor are connected by pipes to the inlet and outlet ends of the DPF. The pipes allow the sensor to measure the inlet and outlet pressures of the DPF.

As the amount of particulates trapped by the DPF increases, the pressure at the inlet side of the DPF increases in comparison to the DPF outlet. The DPF software uses this comparison, in conduction with other data, to calculate the accumulated amount of trapped particulates.

By measuring the pressure difference between the DPF inlet and outlet air flow and the DPF temperature, the DPF software can determine if the DPF is becoming blocked and requires regeneration.

A DPF is recognized as overloaded if the differential pressure under certain operating conditions exceeds the overload limit calculated by the [ECM](#). The DPF software may start regeneration attempts but be unable to complete them. These attempts are counted by the [ECM](#) and, if the maximum number of regeneration attempts is reached, a fault entry is recorded in the [ECM](#) at the next ignition on cycle.

The DPF software performs the following checks using the DPF differential pressure sensor:

- Plausibility check
- Diesel particulate filter efficiency
- Diesel particulate filter overloaded
- Diesel particulate filter clogged
- Monitoring of the maximum regeneration attempts in the lower load range.

# Electronic Engine Controls - TDV6 2.7L Diesel - Electronic Engine Controls

Diagnosis and Testing

## Principles of Operation

For a detailed description of the 2.7L Diesel electronic engine controls, refer to the relevant Description and Operation section in the workshop manual. REFER to: (303-14 Electronic Engine Controls - 2.7L Diesel)

Electronic Engine Controls (Description and Operation),  
 Electronic Engine Controls (Description and Operation),  
 Electronic Engine Controls (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Engine oil level</li> <li>● Cooling system coolant level</li> <li>● Fuel level</li> <li>● Fuel contamination</li> <li>● Fuel leaks</li> <li>● Front End Accessory Drive (FEAD) belt</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Wiring harness</li> <li>● Electrical connector(s)</li> <li>● Sensor(s)</li> <li>● Engine control module (ECM)</li> <li>● Transmission control module (TCM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

• **NOTE:** If the module or a component is suspect and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

Symptom	Possible source	Action
Engine cranks, but does not start	<ul style="list-style-type: none"> <li>● Low/contaminated fuel</li> <li>● Air leakage</li> <li>● Fuel system low pressure circuit fault</li> <li>● Fuel pump module fault</li> <li>● Blocked fuel filter</li> <li>● Fuel volume control valve (FVCV) blocked/contaminated</li> <li>● Fuel pressure control valve (FPCV) blocked/contaminated</li> <li>● Fuel injection pump failure</li> <li>● Crankshaft position (CKP) sensor</li> <li>● ECM fault</li> </ul>	Check the fuel level/condition. Check the integrity of the air intake system and for correct installation. Check the fuel pump module operation, check the fuel system low pressure circuit for leaks/damage. Check the fuel filter, check the FVCV and FPCV. Check the fuel injection pump. Check the CKP sensor and circuits. Refer to the new module/component installation note at the top of the Symptom Chart if an ECM is suspect
Difficult to start	<ul style="list-style-type: none"> <li>● Glow plug system fault (very cold conditions)</li> <li>● Low/contaminated fuel</li> <li>● Air leakage</li> <li>● Fuel pump module fault</li> <li>● Fuel system low pressure circuit fault</li> <li>● Blocked fuel filter</li> <li>● Fuel volume control valve (FVCV) blocked/contaminated</li> <li>● Fuel pressure control valve (FPCV) blocked/contaminated</li> <li>● Exhaust gas recirculation (EGR) valve(s) fault</li> </ul>	Check the glow plugs and circuits. Check the fuel level/condition. Check the integrity of the air intake system and for correct installation. Check the fuel pump module operation, check the fuel system low pressure circuit for leaks/damage. Check the fuel filter, FVCV and FPCV. Check the EGR system
Rough idle	<ul style="list-style-type: none"> <li>● Air ingress</li> <li>● Low/contaminated fuel</li> <li>● Fuel system low pressure circuit fault</li> <li>● Blocked fuel filter</li> <li>● Fuel volume control valve (FVCV) blocked/contaminated</li> <li>● Fuel pressure control valve (FPCV)</li> </ul>	Check the integrity of the air intake system and for correct installation. Check the fuel level/condition. Check the fuel system low pressure circuit for leaks/damage. Check the fuel filter, FVCV and FPCV. Check the EGR system

Symptom	Possible source	Action
	<ul style="list-style-type: none"> <li>blocked/contaminated</li> <li>● Exhaust gas recirculation (EGR) valve(s) fault</li> </ul>	
Lack of power when accelerating	<ul style="list-style-type: none"> <li>● Air intake system fault</li> <li>● Diesel particulate filter (DPF) blocked/restricted</li> <li>● Restricted exhaust system</li> <li>● Low fuel pressure</li> <li>● Exhaust gas recirculation (EGR) valve(s) fault</li> <li>● Variable geometry turbocharger (VGT) actuator fault</li> </ul>	Check the integrity of the air intake system and for correct installation. Check for a blocked DPF or catalytic converter, install new components as required. Check the fuel pressure. Check the EGR system. Check the VGT actuators
Engine stops/stalls	<ul style="list-style-type: none"> <li>● Low/contaminated fuel</li> <li>● Air ingress</li> <li>● Fuel system low pressure circuit fault</li> <li>● Fuel volume control valve (FVCV) blocked/contaminated</li> <li>● Fuel pressure control valve (FPCV) blocked/contaminated</li> <li>● High pressure fuel leak</li> <li>● Exhaust gas recirculation (EGR) valve(s) fault</li> </ul>	Check the fuel level/condition. Check the fuel system low pressure circuit for leaks/damage. Check for fuel system leaks, FVCV and FPCV. Check the EGR system
Engine judders	<ul style="list-style-type: none"> <li>● Low/contaminated fuel</li> <li>● Air ingress</li> <li>● Fuel system low pressure circuit fault</li> <li>● Fuel metering valve blocked/contaminated</li> <li>● Fuel volume control valve (FVCV) blocked/contaminated</li> <li>● Fuel pressure control valve (FPCV) blocked/contaminated</li> <li>● High pressure fuel leak</li> <li>● Fuel injection pump fault</li> </ul>	Check the fuel level/condition. Check the fuel system low pressure circuit for leaks/damage. Check for fuel system leaks, FVCV and FPCV. Check the fuel injection pump
Excessive fuel consumption	<ul style="list-style-type: none"> <li>● Fuel system low pressure circuit fault</li> <li>● Fuel volume control valve (FVCV) blocked/contaminated</li> <li>● Fuel pressure control valve (FPCV) blocked/contaminated</li> <li>● Fuel temperature sensor leak</li> <li>● High pressure fuel leak</li> <li>● Injector(s) failure</li> <li>● Exhaust gas recirculation (EGR) valve(s) fault</li> </ul>	Check the fuel system low pressure circuit for leaks/damage. Check the FVCV and FPCV. Check the fuel temperature sensor, fuel injection pump, etc for leaks. Check for injector DTCs. Check the EGR system

## DTC index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

- NOTE: If the module or a component is suspect and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).
- NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.
- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B10A231	Crash Input	<ul style="list-style-type: none"> <li>● RCM PWM signal circuit - no signal</li> </ul>	Refer to the electrical circuit diagrams and check RCM PWM signal circuit for short, open circuit
B10A236	Crash Input	<ul style="list-style-type: none"> <li>● Signal frequency too low</li> </ul>	Check RCM for related DTCs and refer to the relevant DTC Index
B10A237	Crash Input	<ul style="list-style-type: none"> <li>● Signal frequency too high</li> </ul>	Check RCM for related DTCs and refer to the relevant DTC Index

DTC	Description	Possible Cause	Action
B10A239	Crash Input	<ul style="list-style-type: none"> <li>Incorrect has too few pulses</li> </ul>	Check RCM for related DTCs and refer to the relevant DTC Index
B10A23A	Crash Input	<ul style="list-style-type: none"> <li>Incorrect has too many pulses</li> </ul>	Check RCM for related DTCs and refer to the relevant DTC Index
B11D901	Battery Voltage	<ul style="list-style-type: none"> <li>General electrical failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check battery is in fully charged and serviceable condition, refer to the battery care manual
B11DB01	Battery Monitoring Module	<ul style="list-style-type: none"> <li>Battery monitoring system hardware fault</li> </ul>	Disconnect vehicle battery, re-connect after 60 seconds, clear DTC and retest. If DTC remains install a new battery monitoring module
B11DB87	Battery Monitoring Module	<ul style="list-style-type: none"> <li>Battery monitoring module connector dis-connected/poor connection</li> <li>Battery monitoring module to RJB LIN circuit - open circuit</li> <li>Battery monitoring module to battery positive monitor circuit - open circuit</li> <li>Battery monitoring module/RJB failure</li> </ul>	If additional DTCs B108783, B108786, B108787 are logged, suspect the RJB. Check and install a new RJB as required, refer to the new module/component installation note at the top of the DTC Index. If additional DTCs B108783, B108786, B108787 are NOT logged, check for good/clean contact at battery monitoring module connector, refer to electrical circuit diagrams and check battery monitoring module to RJB LIN circuit and battery monitoring module to battery positive monitor circuit for open circuit. Clear DTC and repeat automated diagnostic procedure using manufacturer approved diagnostic system. If DTC remains suspect the battery monitoring module, check and install a new battery monitoring module as required, refer to the new module/component installation note at the top of the DTC Index
B120668	Crash Occurred	<ul style="list-style-type: none"> <li>ECU has detected the vehicle has crashed - Event information DTC only</li> </ul>	Check RCM and RJB for related DTCs and refer to the relevant DTC Index
P000113	Fuel Volume Regulator Control Circuit/Open	<ul style="list-style-type: none"> <li>Fuel volume regulator control circuit - open circuit</li> <li>Fuel volume regulator control valve failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for open circuit. Check resistance across fuel regulator control valve is between 1.5 and 15 Ohms, install a new valve as required
P000200	Fuel Volume Regulator Control Circuit Range/Performance	<ul style="list-style-type: none"> <li>Fuel volume regulator control circuit - short to ground, power, high resistance</li> <li>Fuel volume regulator control valve failure</li> <li>ECM failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for short to ground, power, high resistance. Check and install new fuel volume regulator control valve/ECM as required, refer to the new module/component installation note at the top of the DTC Index
P000311	Fuel Volume Regulator Control Circuit Low	<ul style="list-style-type: none"> <li>Fuel volume regulator control circuit - short to ground</li> <li>Fuel volume regulator control valve failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for short to ground. Check resistance across fuel regulator control valve is between 1.5 and 15 Ohms, install a new valve as required
P000319	Fuel Volume Regulator Control Circuit Low	<ul style="list-style-type: none"> <li>Fuel volume regulator control circuit - current above threshold</li> <li>Fuel volume regulator control valve failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check fuel volume regulator control valve circuit for short, open circuit. Check resistance across fuel regulator control valve is between 1.5 and 15 Ohms, install a new valve as required
P000412	Fuel Volume Regulator Control Circuit High	<ul style="list-style-type: none"> <li>Fuel volume regulator control circuit - short to ground, power, high resistance</li> <li>Fuel volume regulator control valve failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for short to ground, power, open circuit. Check resistance across fuel regulator control valve is between 1.5 and 15 Ohms, install a new valve as required
P000E21	Fuel Volume Regulator Control Exceeded Learning Limit	<ul style="list-style-type: none"> <li>Signal amplitude &lt; minimum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for short to ground, power, open circuit
P000E22	Fuel Volume Regulator Control Exceeded Learning Limit	<ul style="list-style-type: none"> <li>Signal amplitude &gt; maximum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for short to ground, power, open circuit
P004711	Turbocharger/Supercharger Boost Control Solenoid A Circuit Low	<ul style="list-style-type: none"> <li>Turbocharger boost control solenoid A circuit - short to ground</li> <li>Turbocharger boost control solenoid A failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check turbocharger boost control solenoid A circuit for short to ground. Suspect the turbocharger boost control solenoid A, check and install a new turbocharger as required, refer to the new module/component installation note at the top of the DTC Index
P004812	Turbocharger/Supercharger Boost Control Solenoid A Circuit High	<ul style="list-style-type: none"> <li>Turbocharger boost control solenoid A circuit - short to power</li> <li>Turbocharger boost control solenoid A failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check turbocharger boost control solenoid A circuit for short to power. Suspect the turbocharger boost control solenoid A, check and install a new turbocharger as required, refer to the new module/component installation note at the top of the DTC Index
P004C00	Turbocharger/Supercharger Boost Control Solenoid B Circuit Low	<ul style="list-style-type: none"> <li>Turbocharger boost control solenoid B circuit - short to ground</li> <li>Turbocharger boost control solenoid B failure</li> </ul>	Refer to the electrical circuit diagrams and check turbocharger boost control solenoid B circuit for short to ground. Suspect the turbocharger boost control solenoid B, check and install a new turbocharger as required, refer to the new module/component installation note at the top of the DTC Index



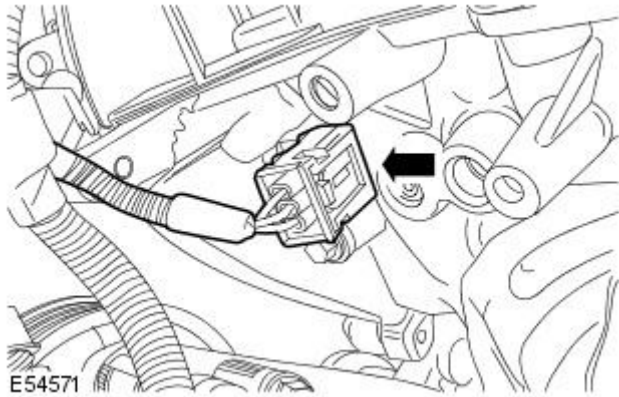
# Electronic Engine Controls - TDV6 2.7L Diesel - Camshaft Position (CMP) Sensor

## Removal and Installation

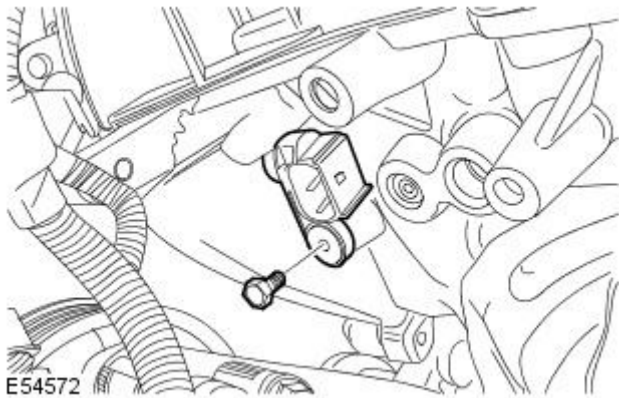
### Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the LH exhaust gas recirculation (EGR) valve.  
For additional information, refer to: [Exhaust Gas Recirculation \(EGR\) Valve LH](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Removal and Installation).
3. Disconnect the camshaft position (CMP) sensor electrical connector.



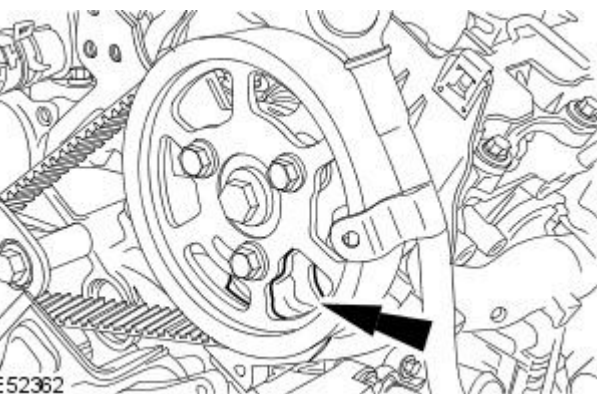
4. Remove the CMP sensor.

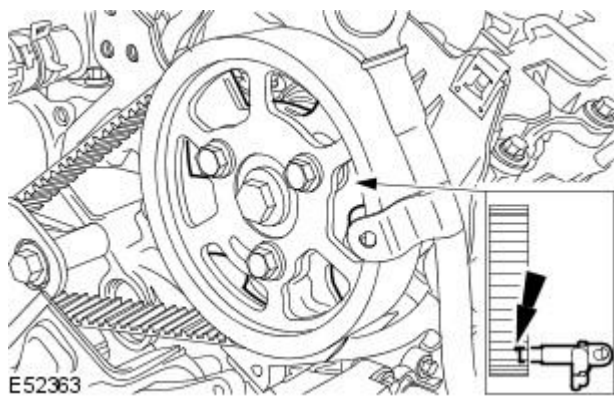



### Installation

1. NOTE: Only turn the engine in the normal direction of rotation.
- NOTE: Timing belt left hand cover shown removed for clarity.

Turn the engine until one of the three webs on the back of the camshaft pulley is visible through the CMP sensor housing.

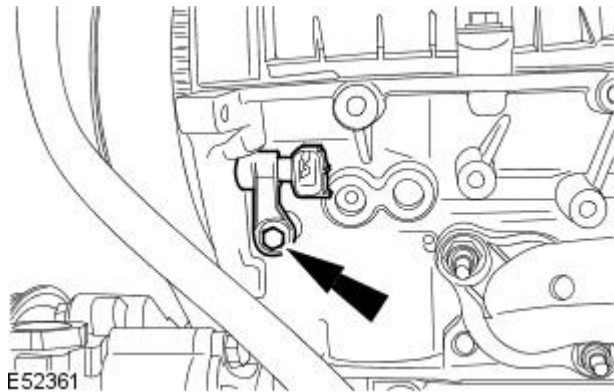




2.  **CAUTION:** The CMP sensor tip must rest on one of the three webs on the back of the camshaft pulley. Incorrect installation may result in the CMP sensor being damaged.

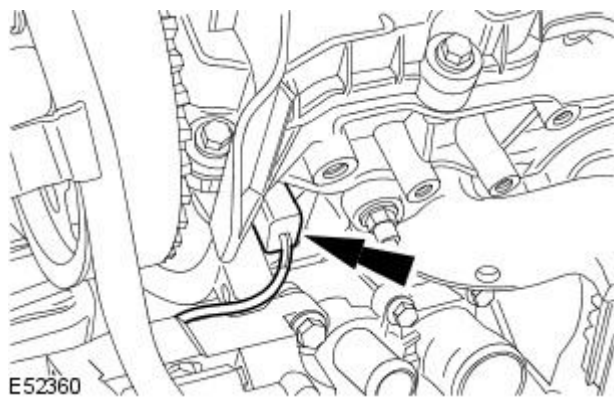
• **NOTE:** Timing belt left hand cover shown removed for clarity.

Install the CMP sensor until the tip of the sensor touches the back of the camshaft pulley.



3. Install the CMP sensor retaining bolt.

- Tighten to 10 Nm.



4. Connect the CMP sensor electrical connector.

5. Install the LH EGR valve.

For additional information, refer to: [Exhaust Gas Recirculation \(EGR\) Valve LH](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Removal and Installation).

6. Connect the battery ground cable.


For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Electronic Engine Controls - TDV6 2.7L Diesel - Crankshaft Position (CKP) Sensor

Removal and Installation

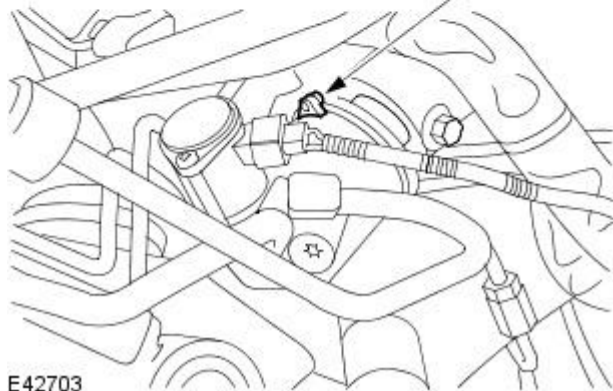
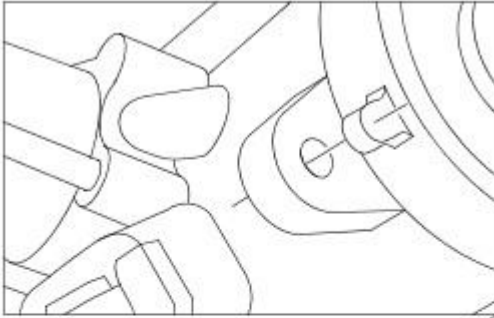
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

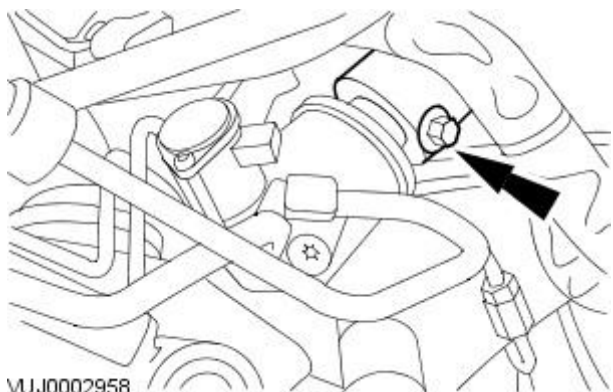
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
4. Make sure the alignment mark, on the steering gear pinion seal protection cover, is central to the steering gear pinion casting.

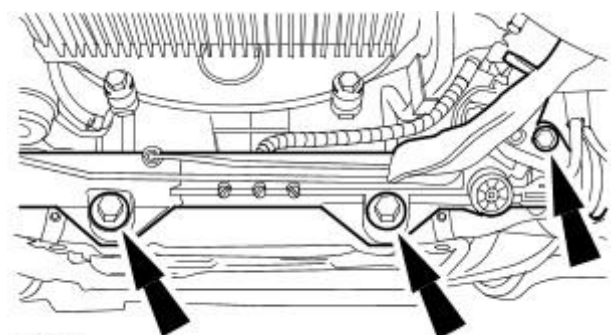


E42703



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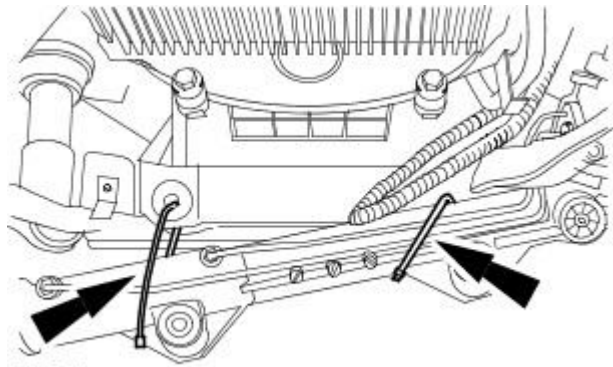
5. Remove the steering gear shaft pinch bolt.



E31036

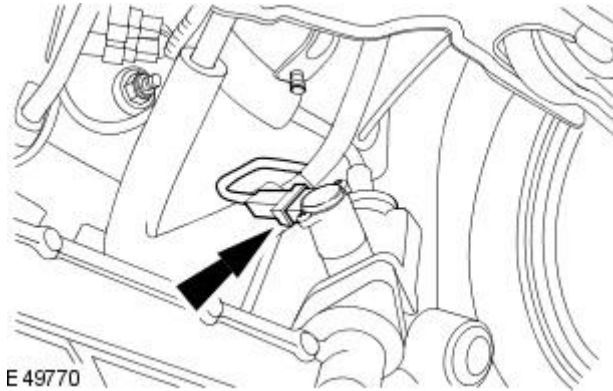
6. Detach the steering gear.

7. Secure the steering gear.



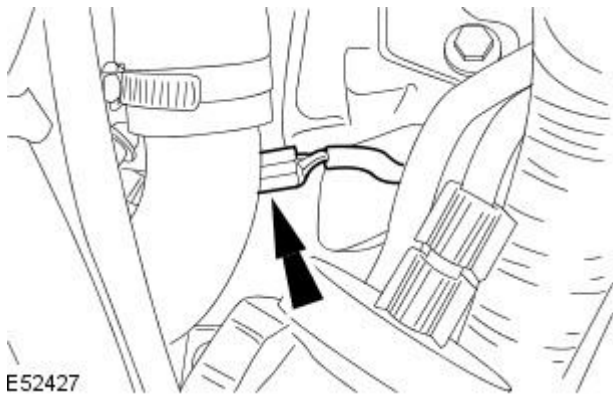
E 31035

8. Disconnect the power steering control valve actuator electrical connector.



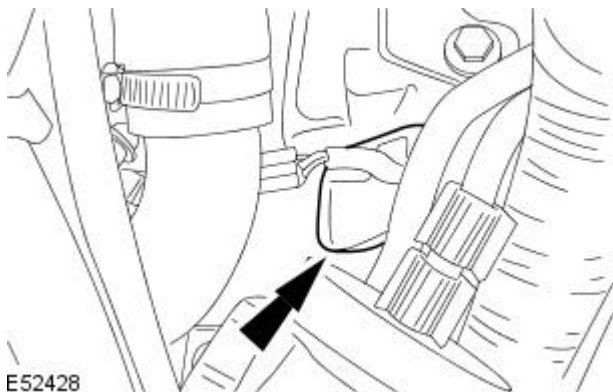
E 49770

9. Disconnect the crankshaft position (CKP) sensor electrical connector.



E 52427

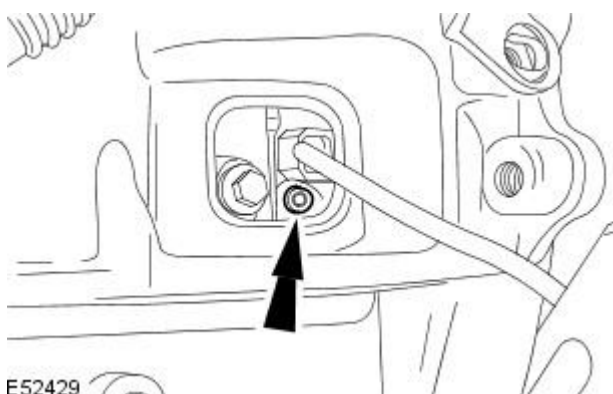
10. Remove the CKP sensor blanking cover.



E 52428

11. NOTE: The CKP sensor retaining bolt should not be removed from the CKP sensor.

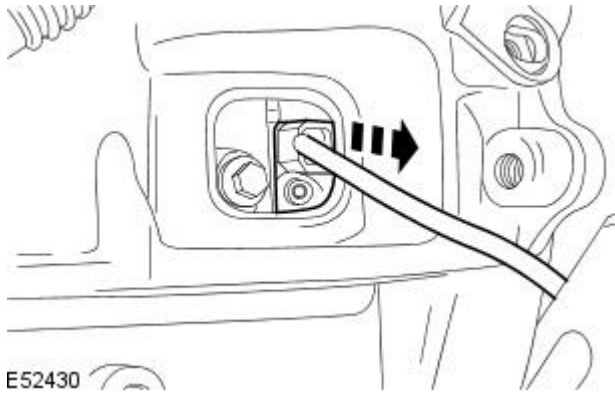
Fully loosen the CKP sensor retaining bolt.



E 52429



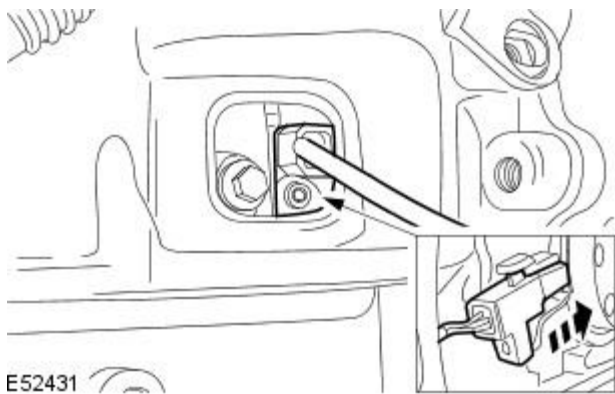
12. Remove the CKP sensor.



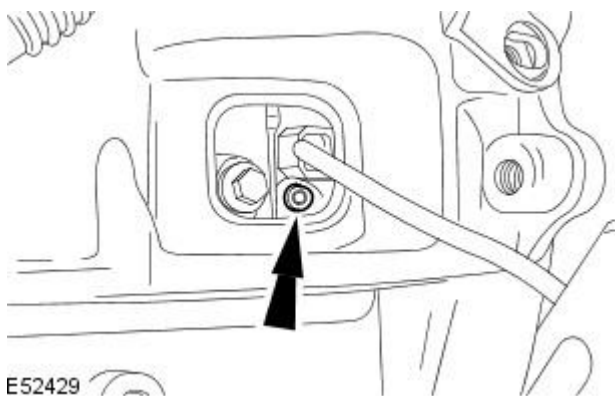
## Installation

1.  CAUTION: Install the CKP sensor correctly into the housing. Failure to follow this instruction may result in damage to the CKP sensor.

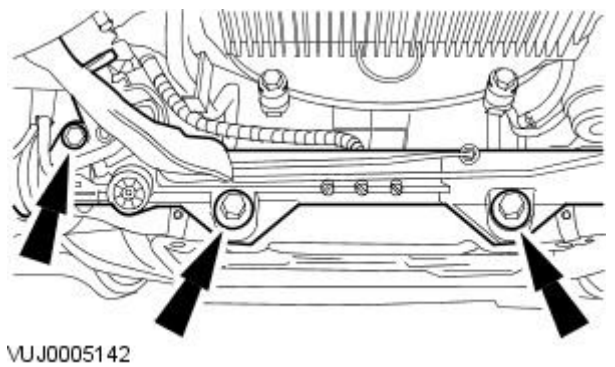
To install, reverse the removal procedure.



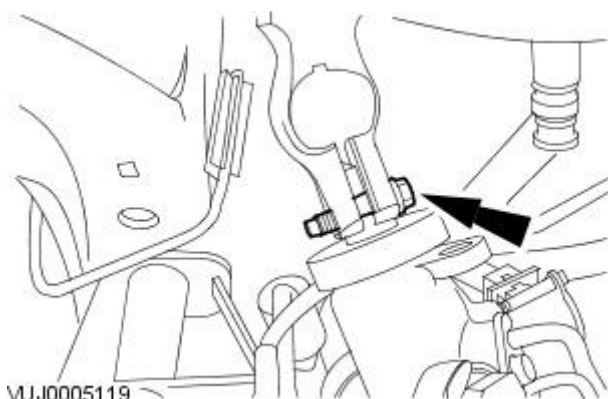
2. Tighten to 5 Nm.



3. Tighten to 100 Nm.



4. Tighten to 35 Nm.




# Electronic Engine Controls - TDV6 2.7L Diesel - Crankshaft Position (CKP) Sensor Ring

Removal and Installation

Special Tool(s)	
	Installer - Crankshaft Position (CKP) Sensor Ring
	303-1130

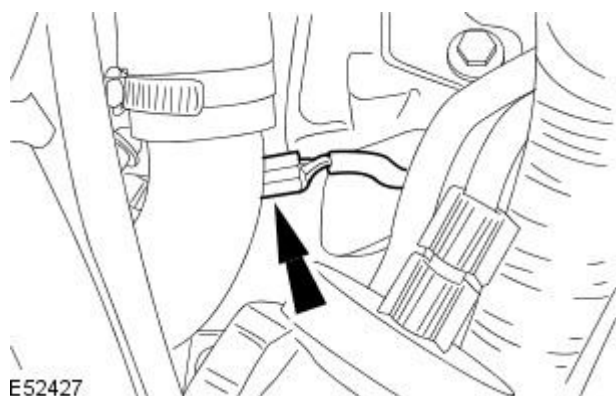
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

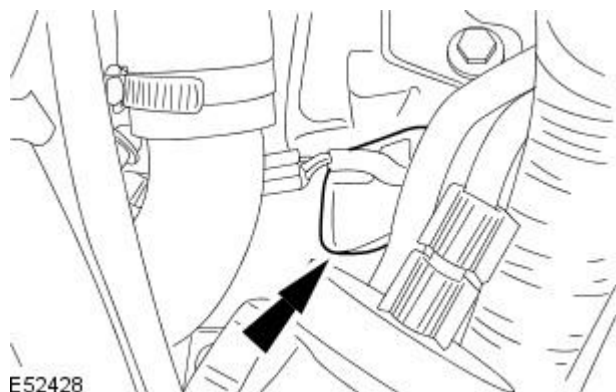
Raise and support the vehicle.

3. Remove the flexplate.  
For additional information, refer to: [Flexplate](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).
4. Disconnect the crankshaft position (CKP) sensor electrical connector.



E52427

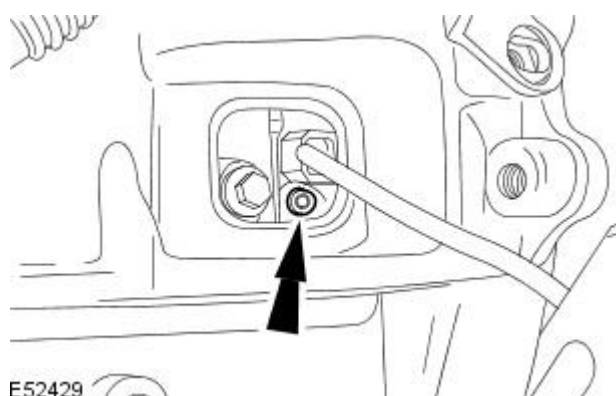
5. Remove the CKP sensor blanking cover.



E52428

6. **NOTE:** The CKP sensor retaining bolt should not be removed from the CKP sensor.

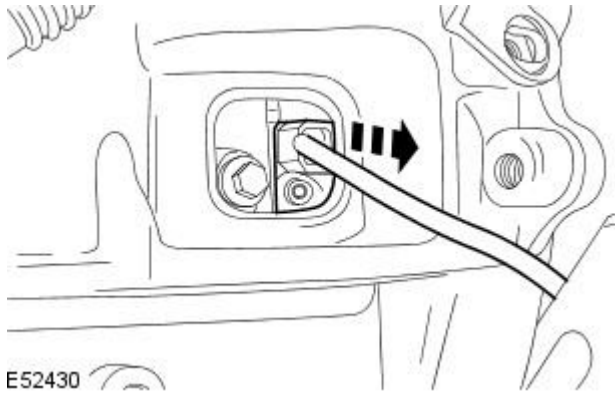
Fully loosen the CKP sensor retaining bolt.



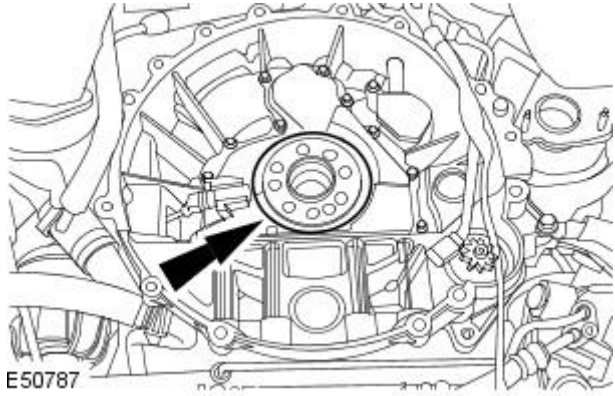
E52429



7. Remove the CKP sensor.



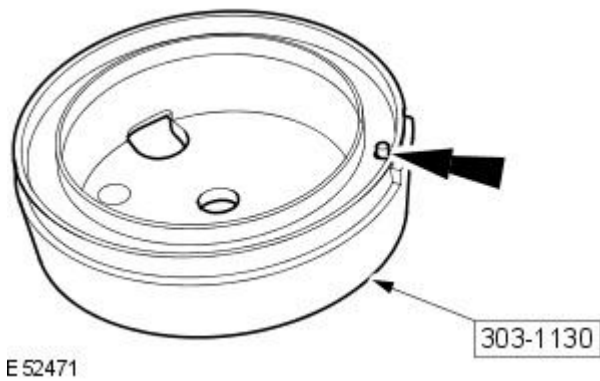
8. Remove and discard the CKP sensor ring.



### Installation

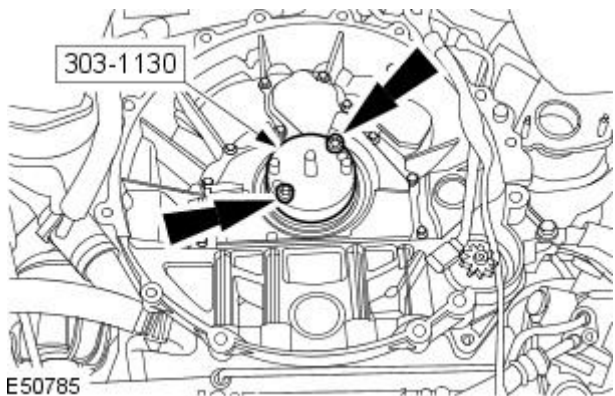
1. Install a new CKP sensor ring to the special tool.

- Make sure that the CKP sensor ring is aligned correctly with the special tool pip and that both mating surfaces are fully seated.



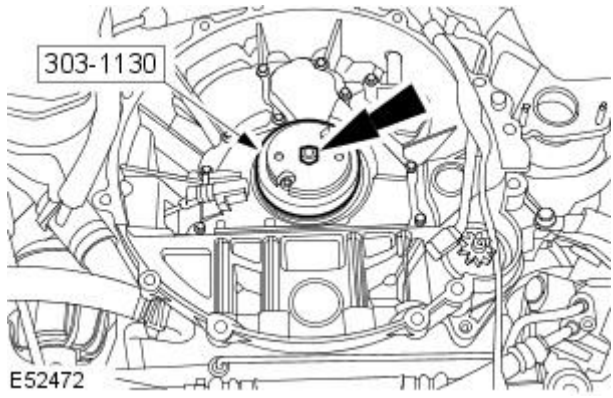
2. Install the special tool to the crankshaft.

- Align the special tool alignment peg to the timing hole on the crankshaft.

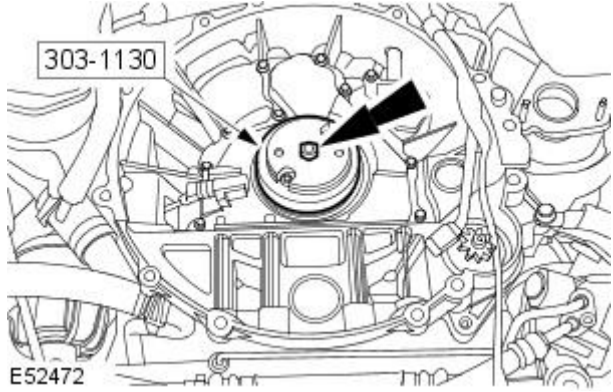


3. Install a new CKP sensor ring.

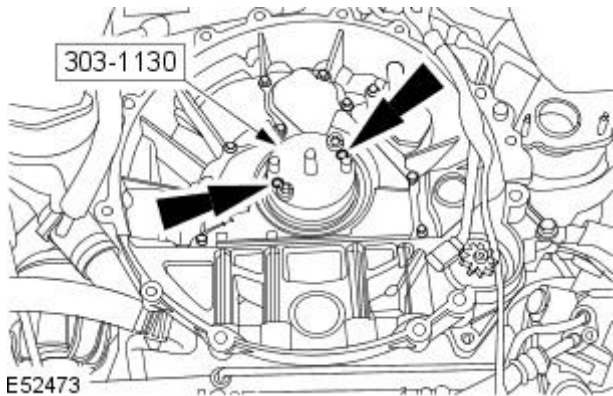
- Tighten the special tool nut, to install the CKP sensor ring to the crankshaft.



4. Loosen the special tool nut.



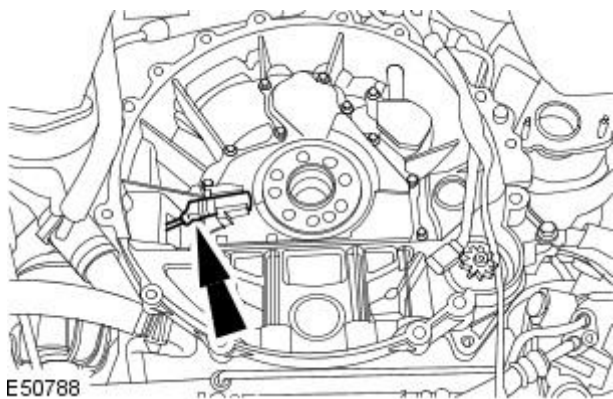
5. Remove the special tool.



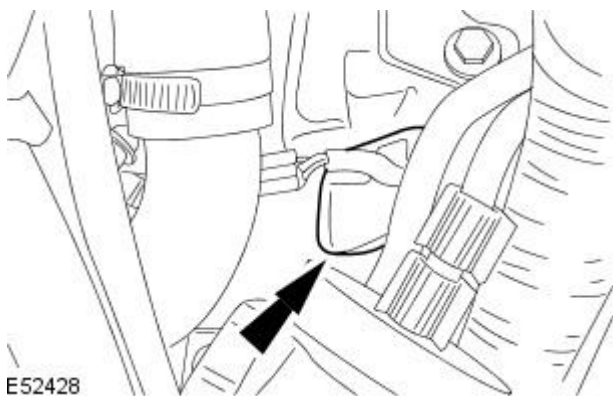
6.  **CAUTION:** Install the CKP sensor correctly into the housing. Failure to follow this instruction may result in damage to the CKP sensor.

Install the CKP sensor.

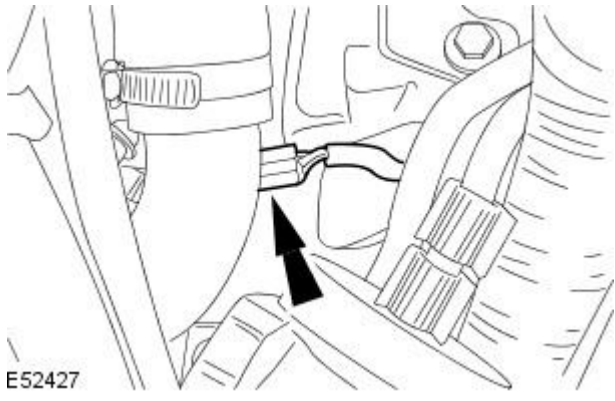
- Tighten to 5 Nm.



7. Install the CKP sensor blanking cover



**8.** Connect the CKP sensor electrical connector.



**9.** Install the flexplate.

For additional information, refer to: [Flexplate](#) (303-01A Engine - TDV6 2.7L Diesel, Removal and Installation).

**10.** Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Electronic Engine Controls - TDV6 2.7L Diesel - Engine Control Module (ECM)

Removal and Installation

## Removal

All vehicles

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the cowl vent screen.  
For additional information, refer to: [Cowl Vent Screen](#) (501-02 Front End Body Panels, Removal and Installation).

Right-hand drive vehicles

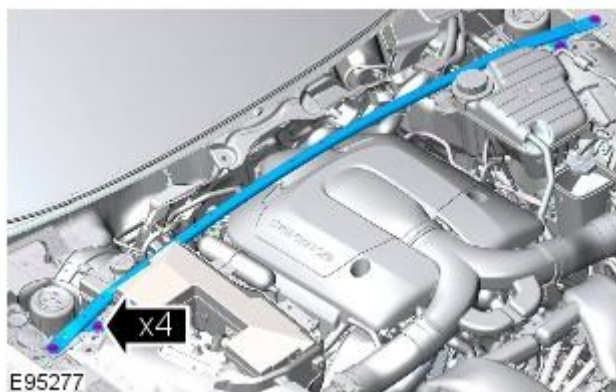
3. Remove the secondary bulkhead LH panel.  
For additional information, refer to: [Secondary Bulkhead Panel LH - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel](#) (501-02 Front End Body Panels, Removal and Installation).

Left-hand drive vehicles

4. Remove the secondary bulkhead RH panel.  
For additional information, refer to: [Secondary Bulkhead Panel RH - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel](#) (501-02 Front End Body Panels, Removal and Installation).

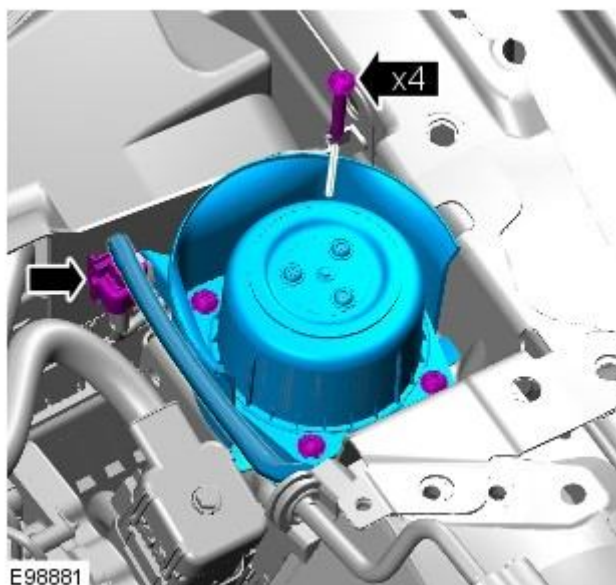
All vehicles

5. Remove the engine compartment brace.



6. NOTE: Left-hand shown, right-hand similar.

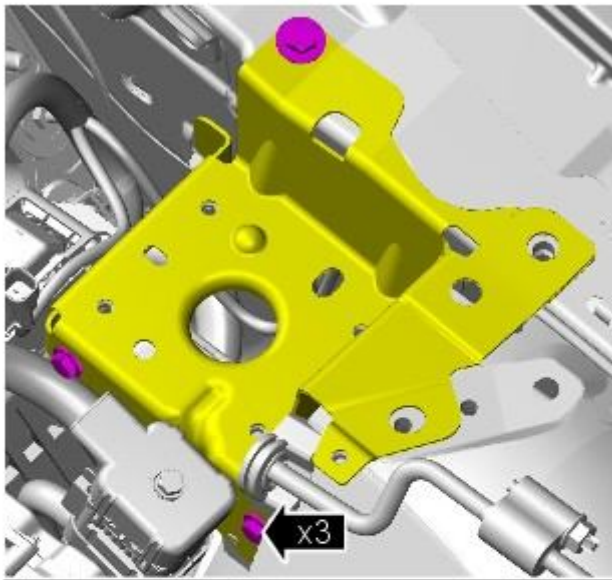
Remove the pedestrian protection actuator.





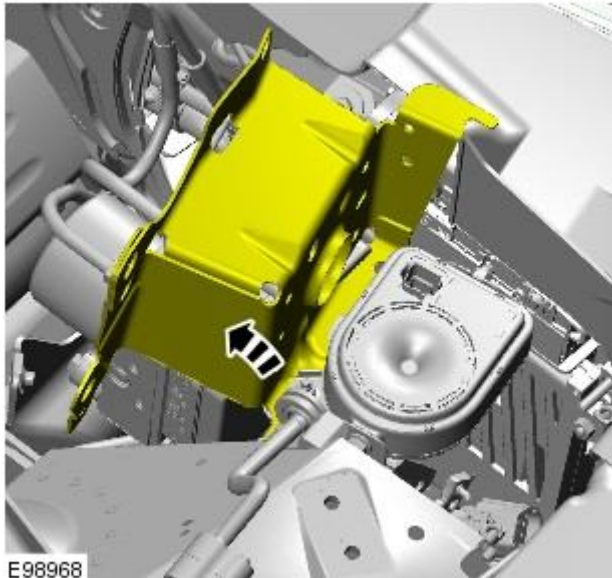
7. NOTE: Left-hand shown, right-hand similar.

Release the pedestrian protection actuator bracket.



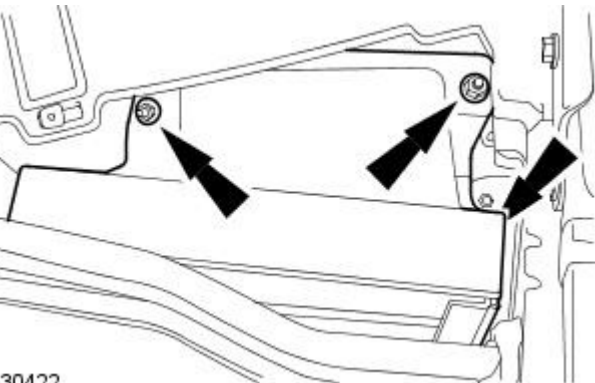
8. NOTE: Left-hand shown, right-hand similar.

Reposition the pedestrian protection actuator bracket.



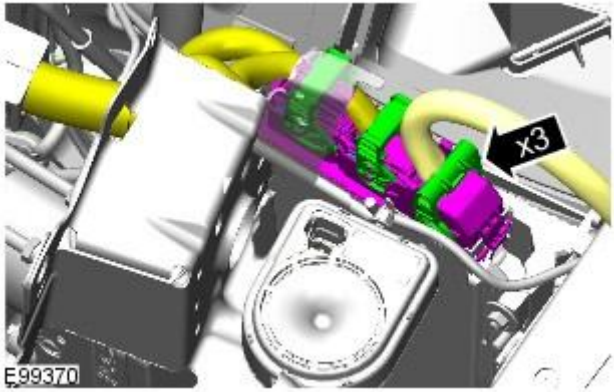
9. NOTE: Left-hand shown, right-hand similar.

Remove the engine control module (ECM) cover.



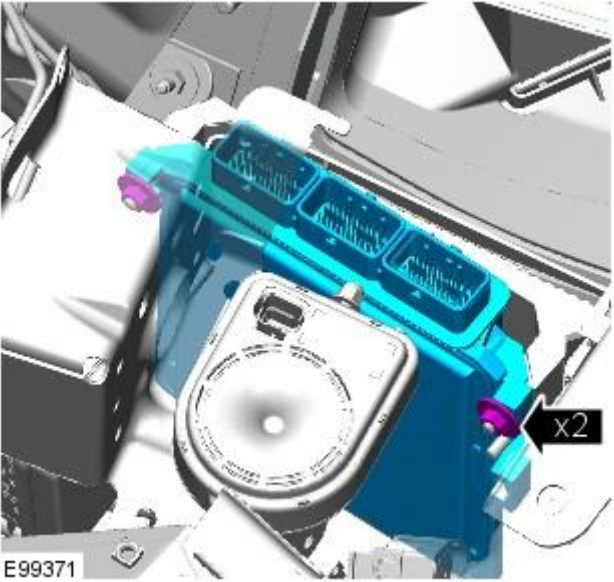
**10. NOTE:** Left-hand shown, right-hand similar.

Disconnect the 3 electrical connectors from the engine control module (ECM).



**11. NOTE:** Left-hand shown, right-hand similar.

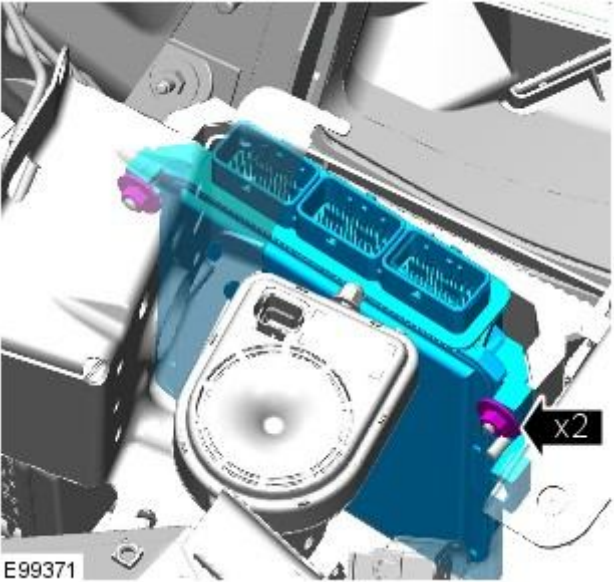
Remove the ECM.



## Installation

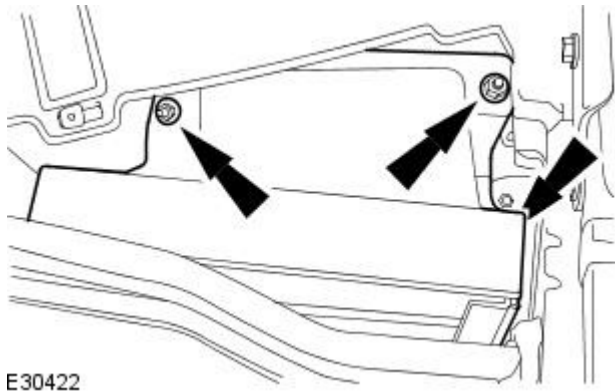
1. Install is the reverse of removal.

- Tighten to 10 Nm.



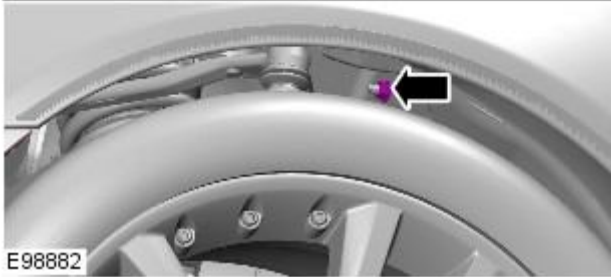
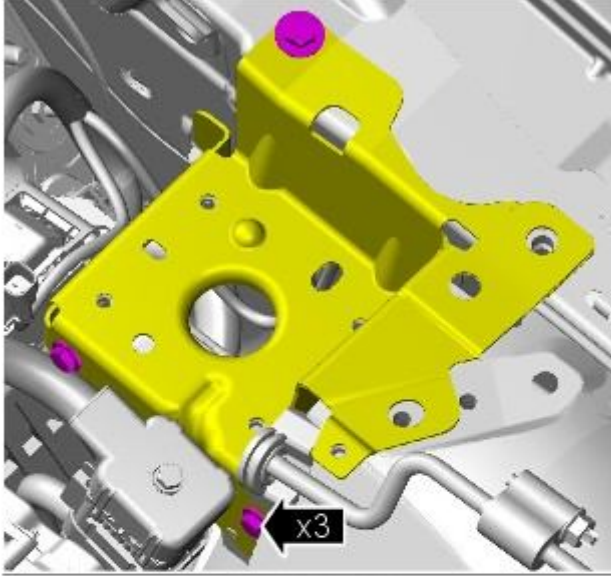


2. Tighten to 6 Nm.



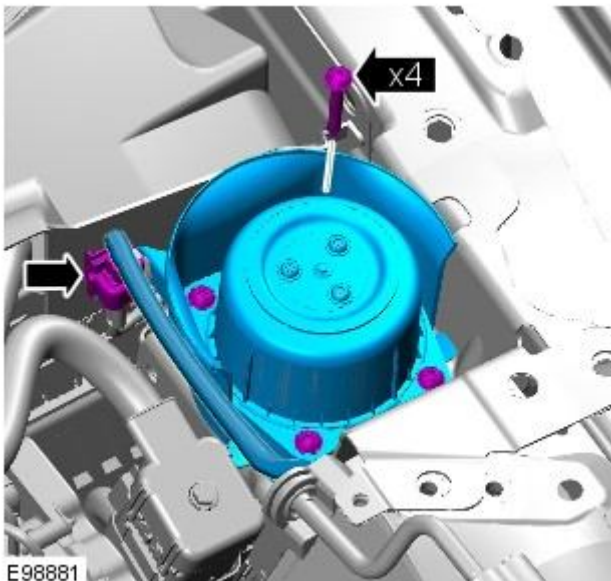
E30422

3. Tighten to 25 Nm.



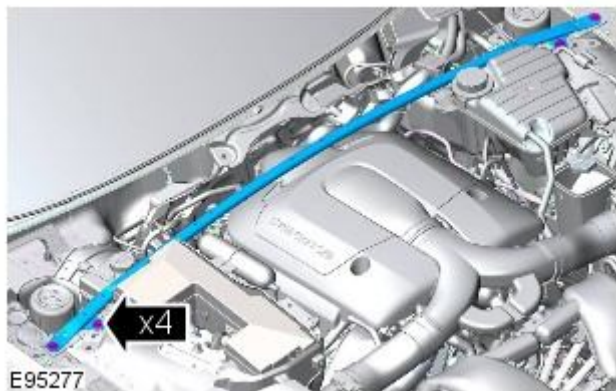
E98882

4. Tighten to 8 Nm.



E98881

5. Tighten to 25 Nm.



# Electronic Engine Controls - TDV6 2.7L Diesel - Engine Coolant Temperature (ECT) Sensor

## Sensor

### Removal and Installation

#### Removal



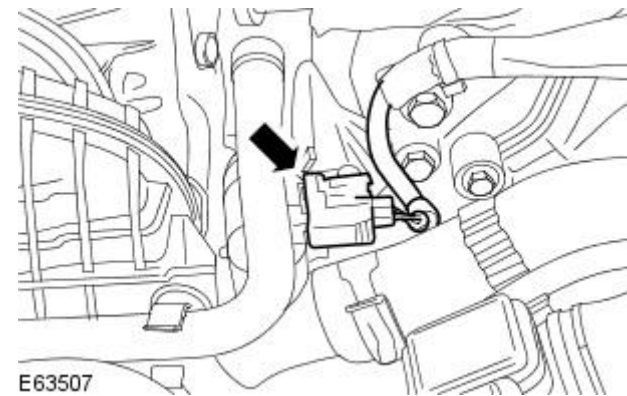
**CAUTION:** Since injury such as scalding could be caused by escaping steam or coolant, make sure the vehicle cooling system is cool prior to carrying out this procedure

• **NOTE:** Removal steps in this procedure may contain installation details.

1. Remove the engine cover.

For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. Disconnect the electrical connector.



3. **CAUTIONS:**



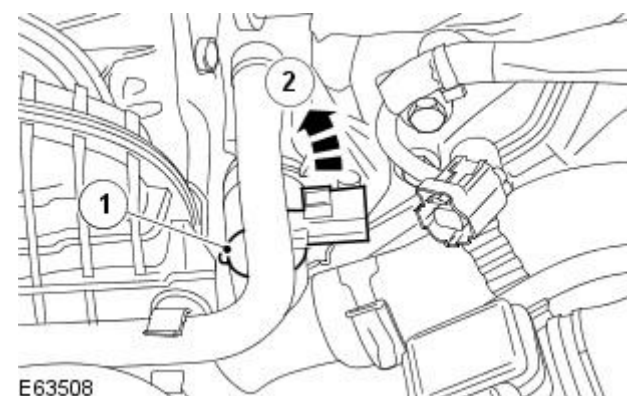
Be prepared to collect escaping fluids.



The seal is to be reused unless damaged.

Remove the engine coolant temperature (ECT) sensor.

- Lift the tang and rotate the ECT sensor anti-clockwise.



#### Installation

1. **NOTE:** Make sure that all the component mating faces are clean.

To install, reverse the removal procedure.

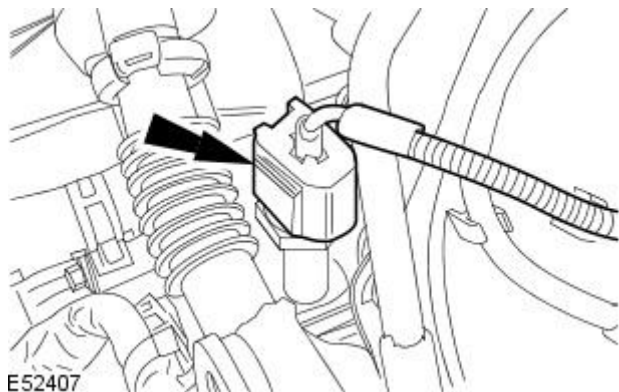
2. Fill the cooling system, keeping coolant to the upper level mark of the expansion tank.

# Electronic Engine Controls - TDV6 2.7L Diesel - Engine Oil Pressure (EOP) Sensor

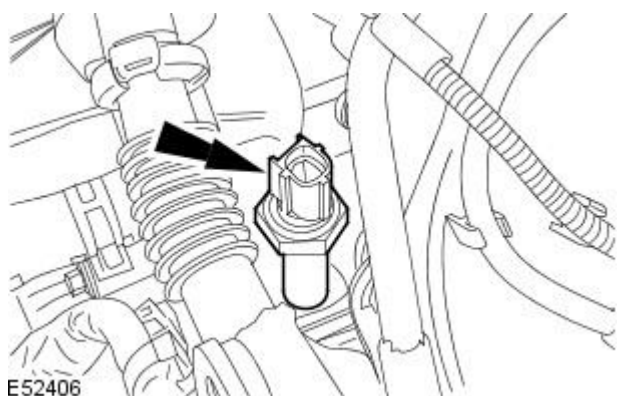
Removal and Installation

## Removal

1. Remove the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Disconnect the engine oil pressure (EOP) sensor electrical connector.

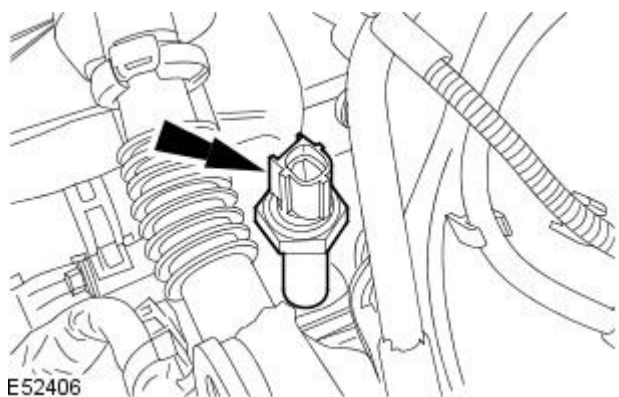


3. Remove the EOP sensor.



## Installation

1. To install, reverse the removal procedure.
  - Tighten to 15 Nm.



# Electronic Engine Controls - TDV6 2.7L Diesel - Fuel Rail Pressure (FRP) Sensor

Removal and Installation

## General Equipment

Pneumatic vacuum gun


## Removal

### • WARNINGS:


 Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.


 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.


 The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

 Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.

### • CAUTIONS:

 Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

 Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

 Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

 Do not remove the fuel rail pressure sensor from the fuel injection diverter rail.

**1. NOTE:** If a new fuel rail pressure sensor is to be installed, a new fuel injection diverter rail and fuel rail pressure sensor must be installed as an assembly.

Disconnect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

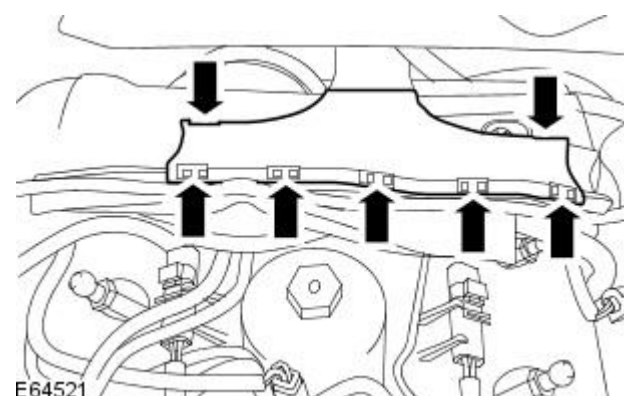
**2.** Remove the engine cover.

For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

**3.** Remove the secondary bulkhead center panel.

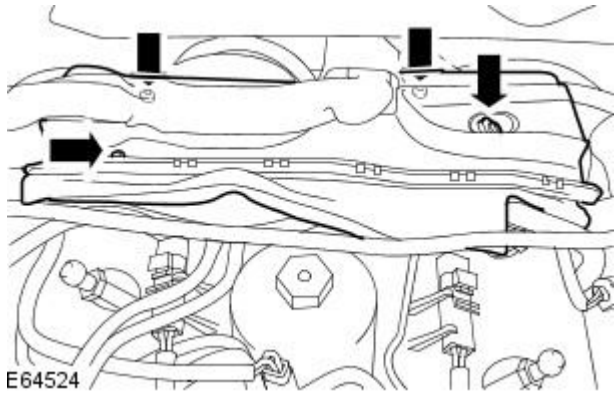
For additional information, refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).

**4.** Remove the cover from the engine wiring harness casing.





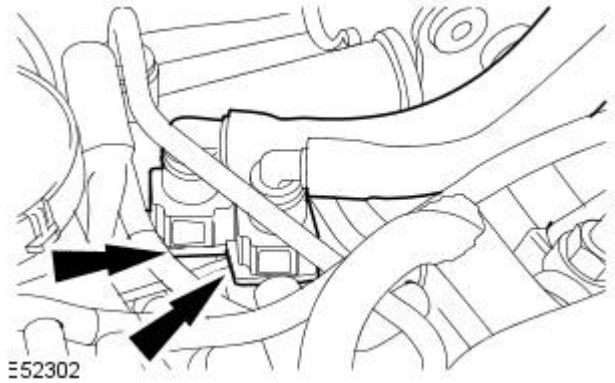
5. Remove the engine wiring harness casing.



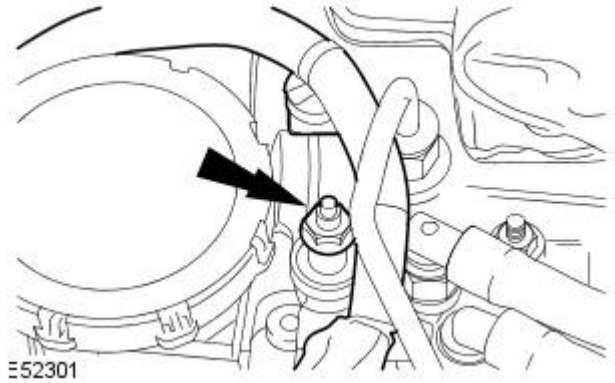
6. Remove the injector sound proofing.

7. Disconnect the low pressure fuel inlet and return lines.

- Install suitable blanking caps to the fuel lines and unions.

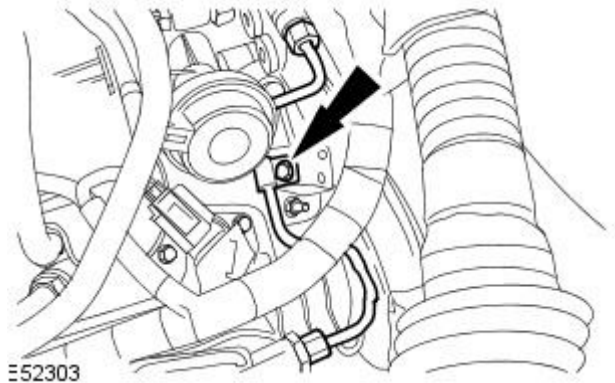



8. Detach the engine wiring harness retaining bracket.



9. NOTE: Left-hand shown, right-hand similar.

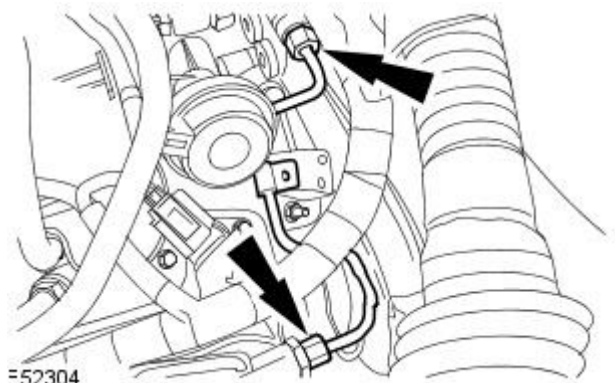
Detach the high-pressure fuel supply lines.



10.  CAUTION: Make sure that the high-pressure fuel supply line remains in contact with the fuel injection supply manifold and the fuel injection diverter rail until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

• NOTE: Left-hand shown, right-hand similar.

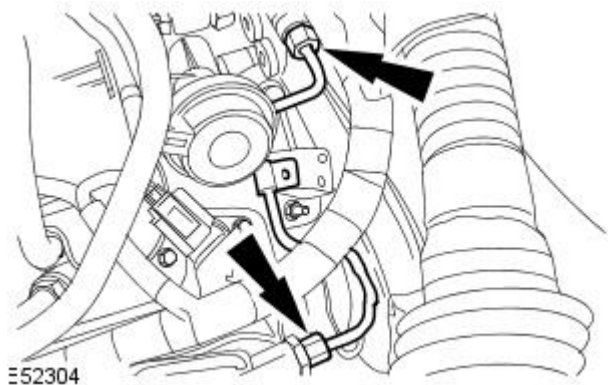
Loosen the high-pressure fuel supply lines.






11. Remove and discard the high-pressure fuel supply lines.

- Install blanking caps to the exposed ports.

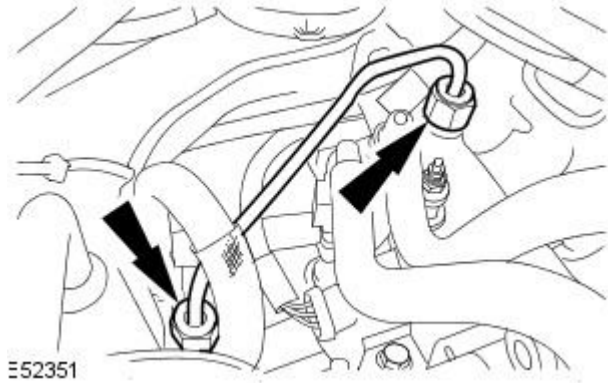


E52304

12.  CAUTION: Make sure that the high-pressure fuel supply line remains in contact with the fuel injection supply manifold and the fuel injection diverter rail until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

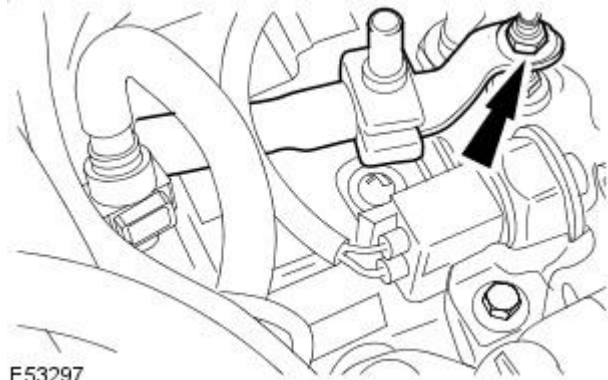
Remove and discard the high-pressure fuel diverter rail supply line.

- Install blanking caps to the exposed ports.



E52351

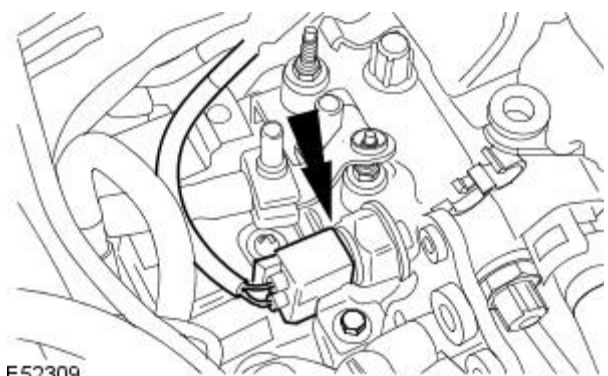
13. Remove the fuel line retaining nut.



E53297

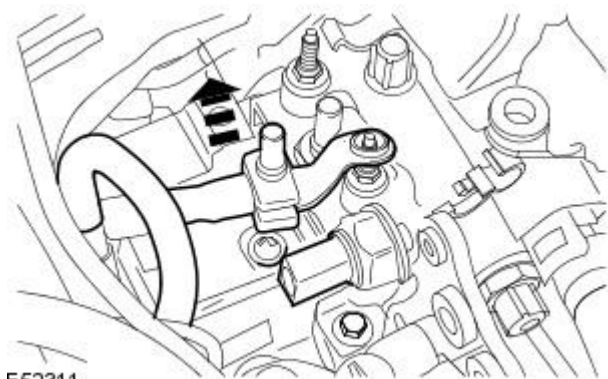
14. Disconnect the fuel rail pressure (FRP) sensor electrical connector.

- Release the fuel charging wiring harness.



E52309

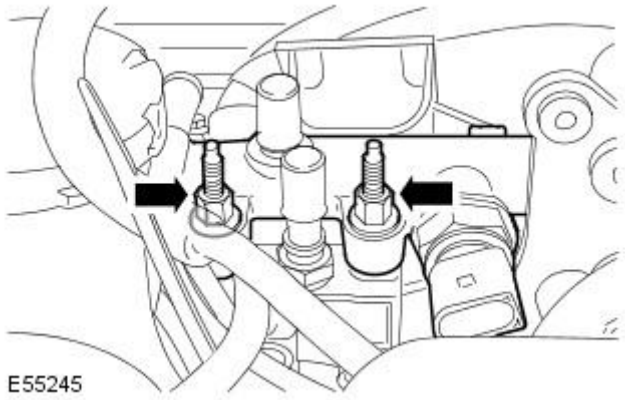
15. Reposition the fuel line.



E52311


16. Remove the FRP and fuel injection diverter rail assembly.


- Remove the 2 studs.





## Installation

### 1. WARNINGS:


 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.


 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.


 Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.

 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

### • CAUTIONS:

 Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

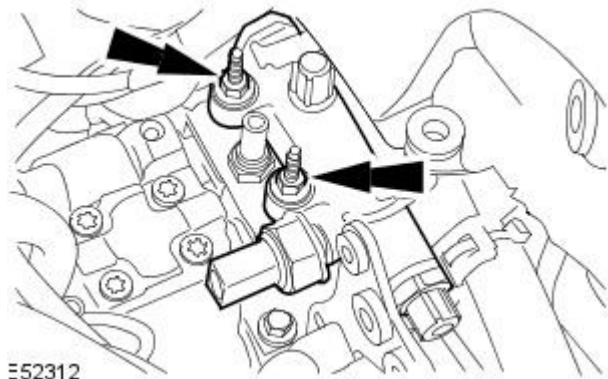
 Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

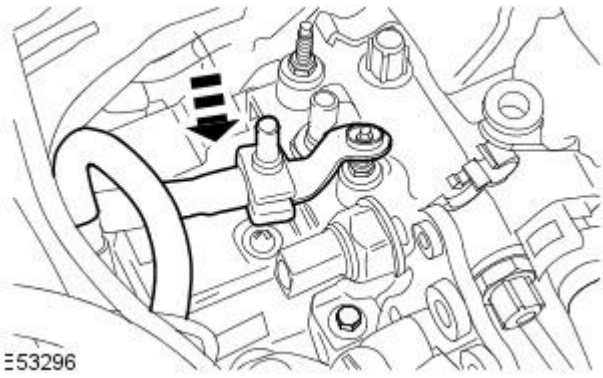
 Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

 Do not remove the fuel rail pressure sensor from the fuel injection diverter rail.

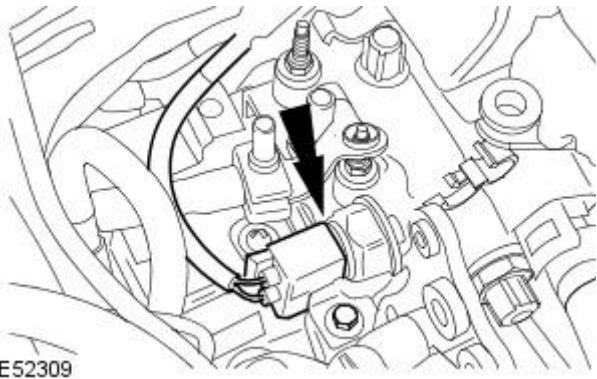
Install the FRP and fuel injection diverter rail assembly.

- Install the two retaining studs, but do not fully tighten at this stage.

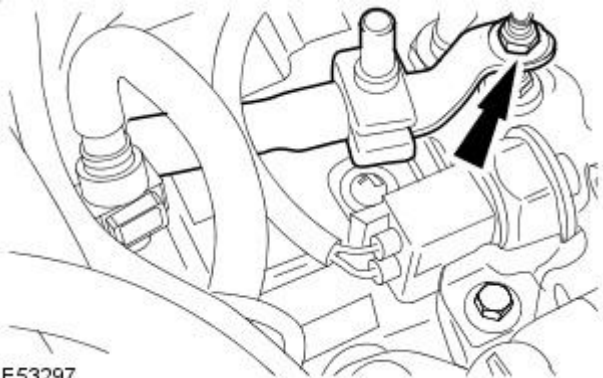




2. Attach the fuel line.

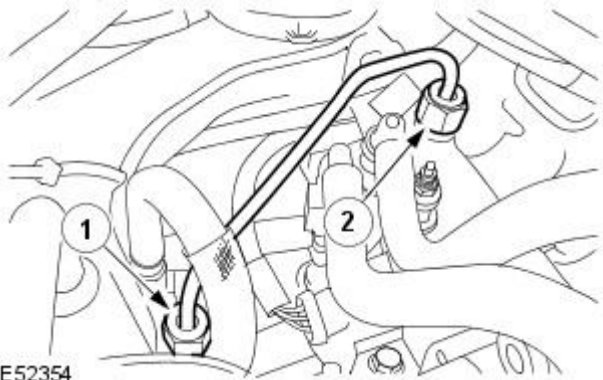


3. Connect the FRP sensor electrical connector.



4. Install the fuel line retaining nut.

- Tighten to 7 Nm.



5. Install a new high-pressure fuel supply line.

- Remove the blanking caps from the ports.
- Install the new high-pressure fuel supply line, tighten the fuel supply line unions finger tight.
- Tighten the fuel injection diverter rail retaining studs to 23 Nm.
- Tighten the high-pressure fuel supply line in the shown sequence.
- Stage 1: Tighten the high-pressure fuel supply line union at the fuel injection pump to 15 Nm.
- Stage 2: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 15 Nm.
- Stage 3: Tighten the high-pressure fuel supply line union at the fuel injection pump to 30 Nm.
- Stage 4: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 30 Nm.

**6. NOTE: Left-hand shown, right-hand similar.**

Install the new high-pressure fuel rail supply line.

- Remove the blanking caps from the ports.
- Install the new high-pressure fuel supply line, tighten the fuel supply line unions finger tight.
- Tighten the high-pressure fuel supply line in the shown sequence.
- Stage 1: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 15 Nm.
- Stage 2: Tighten the high-pressure fuel supply line union at the fuel injection rail to 15 Nm.
- Stage 3: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 30 Nm.
- Stage 4: Tighten the high-pressure fuel supply line union at the fuel injection rail to 30 Nm.

**7. NOTE: Left-hand shown, right-hand similar.**

Attach the high-pressure fuel supply lines.

- Tighten to 10 Nm.

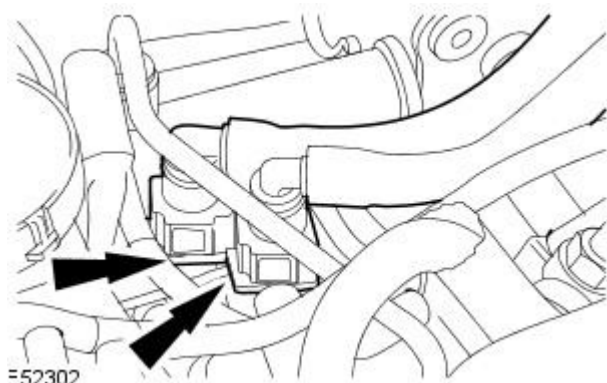
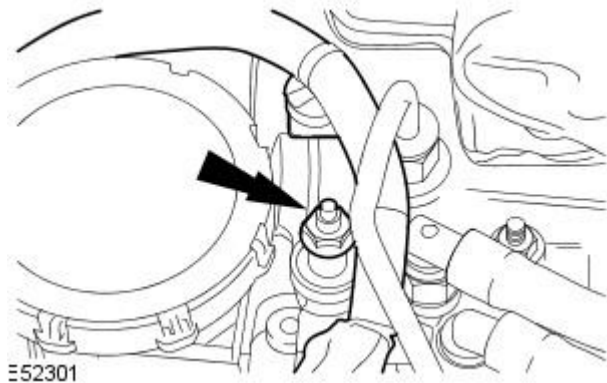
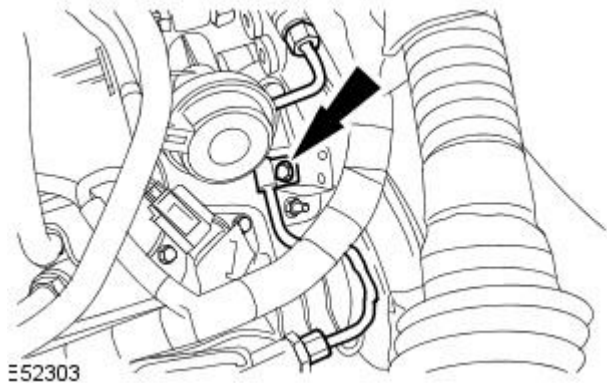
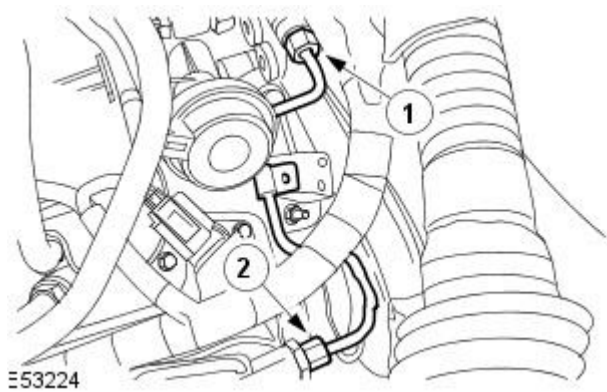
**8. Attach the engine wiring harness.**

- Tighten to 7 Nm.

**9. Attach the low-pressure fuel line.**

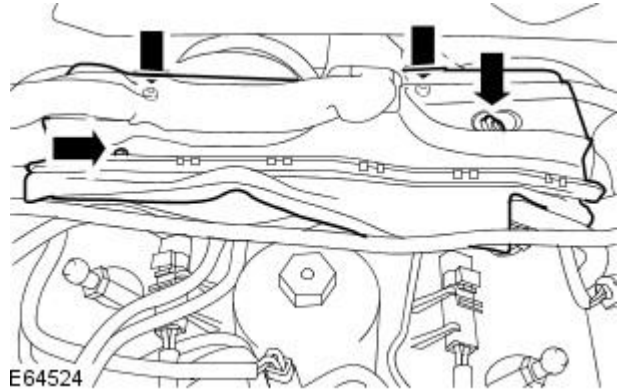
- Remove the blanking caps from the ports.

**10. Install the injector sound proofing.**

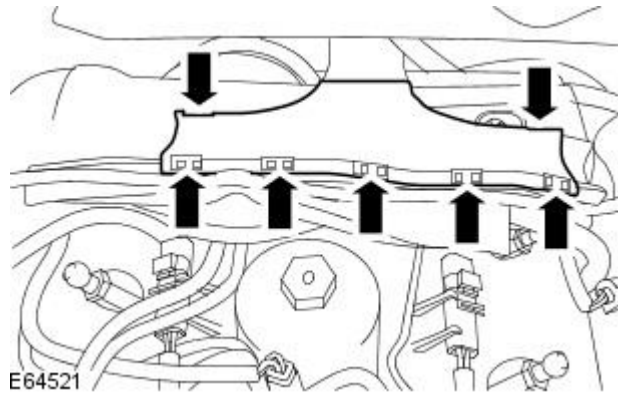




**11.** Install the engine wiring harness casing.



**12.** Install the engine wiring harness cover.




- 13.** Install the secondary bulkhead center panel.  
For additional information, refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).
- 14.** Install the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
- 15.** Connect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
- 16.** Bleed the fuel system.

# Electronic Engine Controls - TDV6 2.7L Diesel - Fuel Temperature Sensor


Removal and Installation


## Removal


 **WARNING:** This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

 **CAUTION:** Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

### 1. WARNINGS:

 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.

 **CAUTION:** Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

Disconnect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

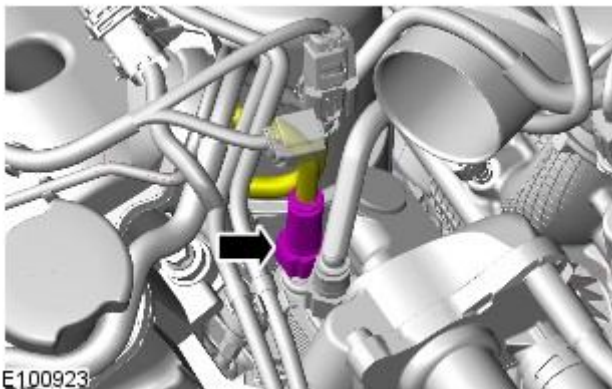
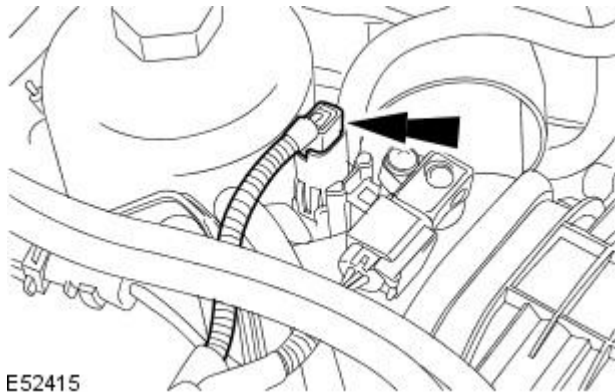
2. Remove the intake air shutoff throttle.

For additional information, refer to: [Intake Air Shutoff Throttle](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

3. Remove the injector sound proofing.

4. Disconnect the electrical connector.

5. Disconnect the fuel return line from the fuel cooler.

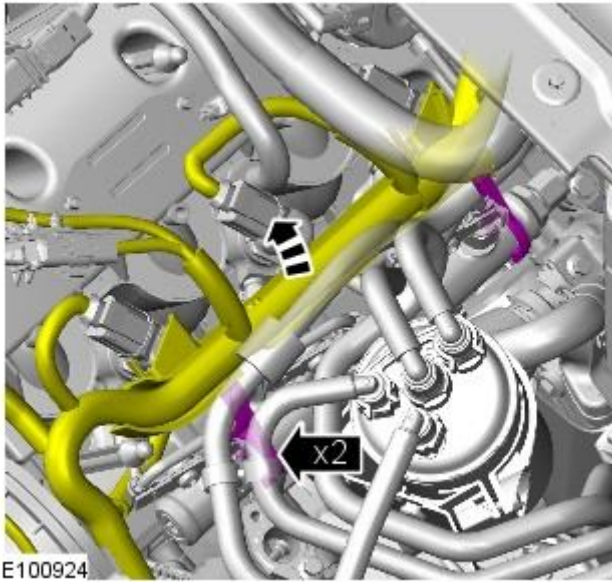




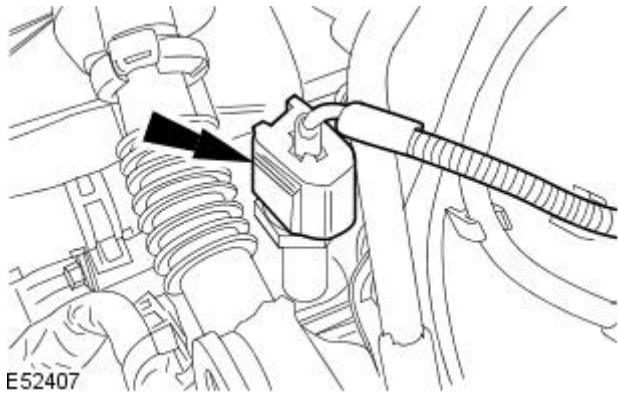
6. NOTE: Left-hand shown, right-hand similar.

Release the engine wiring harness from the fuel supply manifolds.

- Release and reposition the wiring harness.



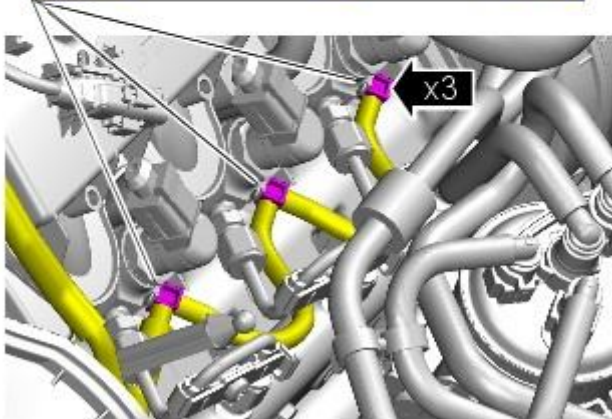
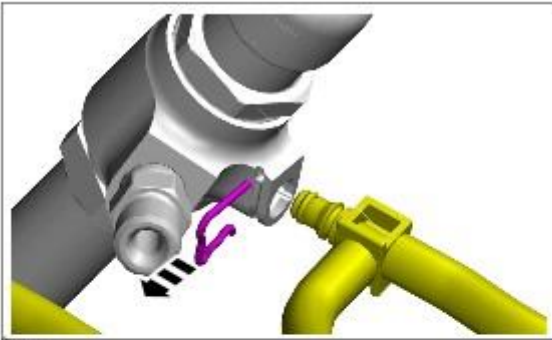
7. Disconnect the engine oil pressure (EOP) switch electrical connector.



8. NOTE: Left-hand shown, right-hand similar.

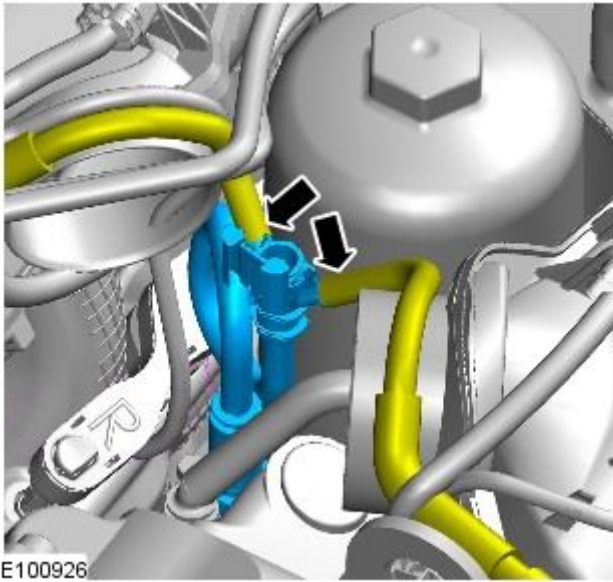
Remove and discard the fuel injector leak off pipe retaining clips.

- Disconnect the fuel injector leak off pipe.



9. Remove the fuel injector leak off pipe.

- Clean any spilt fuel from the engine.



## Installation

### 1. CAUTIONS:



Install new fuel injector leak off pipe retaining clips.



Make sure that the mating faces are clean and free of foreign material.

To install, reverse the removal procedure.

# Electronic Engine Controls - TDV6 2.7L Diesel - Knock Sensor (KS) LH

## Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.

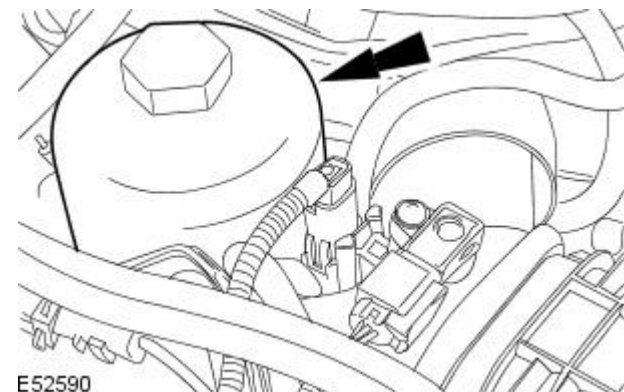
1. Remove the crankcase vent oil separator.  
For additional information, refer to: [Crankcase Vent Oil Separator \(303-08A Engine Emission Control - TDV6 2.7L Diesel, Removal and Installation\)](#).

2.  **WARNING:** Be prepared to collect escaping oil.

- NOTE: Remove and discard the O-ring seal.

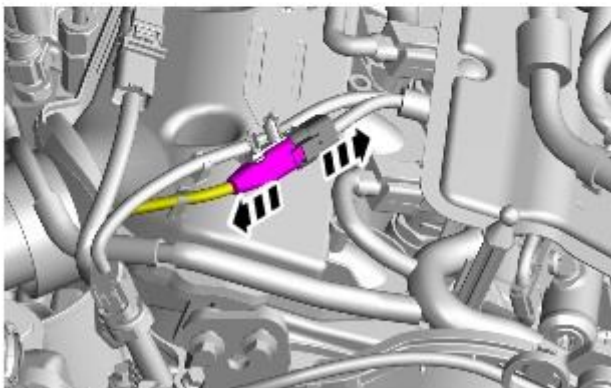
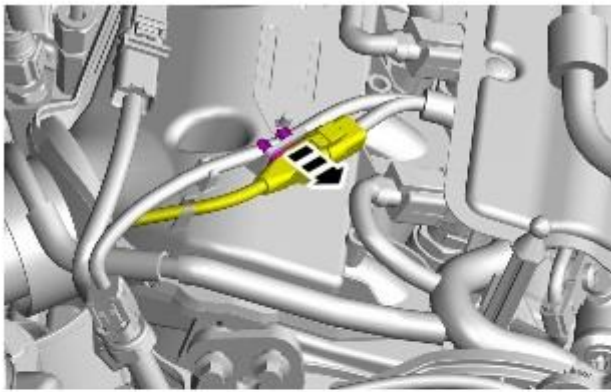
Remove the engine oil filter.

- Loosen the element cover 4 complete turns to allow engine oil to drain from the filter cover.
- Remove element cover.



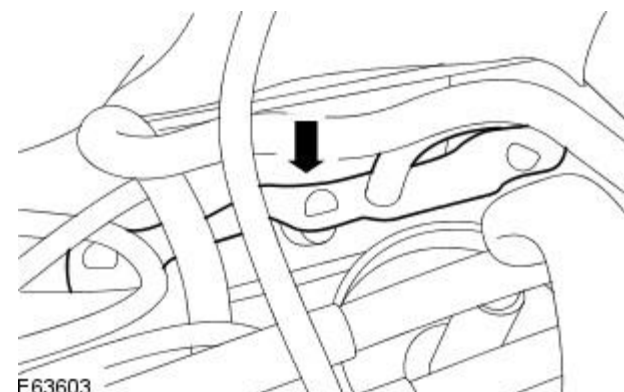
E52590

3. Disconnect the knock sensors (KS) electrical connector.



E100824

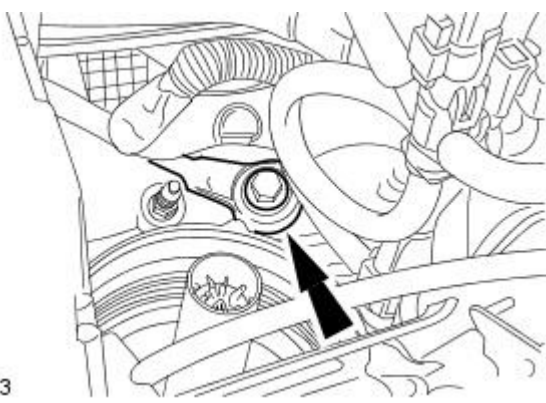
4. Disconnect the LH glow plug wiring harness electrical connector.



E63603

5.  CAUTION: Note the fitted position of the component prior to removal.


Remove the LH knock sensor (KS).




E52443

## Installation

1. CAUTIONS:

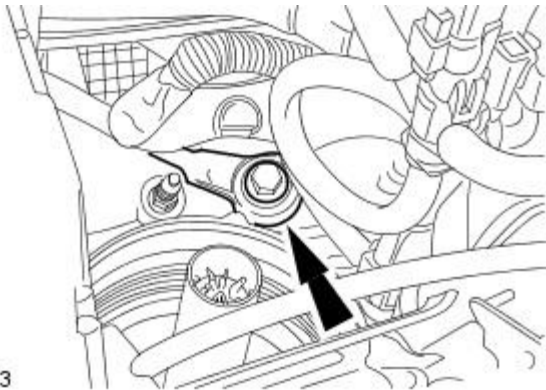
 Make sure that the mating faces are clean and free of foreign material.

 Make sure that the cable is correctly routed.

• NOTE: Make sure that this component is installed to the noted removal position.

To install, reverse the removal procedure.

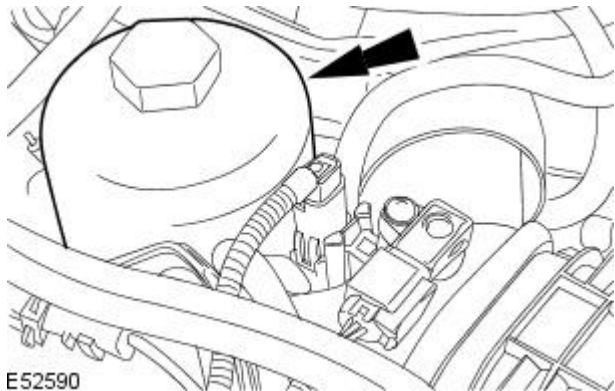
- Tighten to 20 Nm.



E52443

2.  CAUTION: Install a new seal.

Tighten to 25 Nm.



E52590

3. Check and top-up the engine oil if required.



# Electronic Engine Controls - TDV6 2.7L Diesel - Knock Sensor (KS) RH

Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the crankcase vent oil separator.

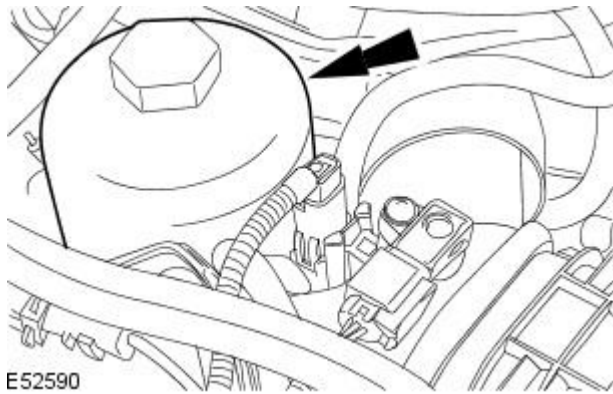
2.  **WARNING:** Be prepared to collect escaping oil.

- NOTE: Remove and discard the O-ring seal.

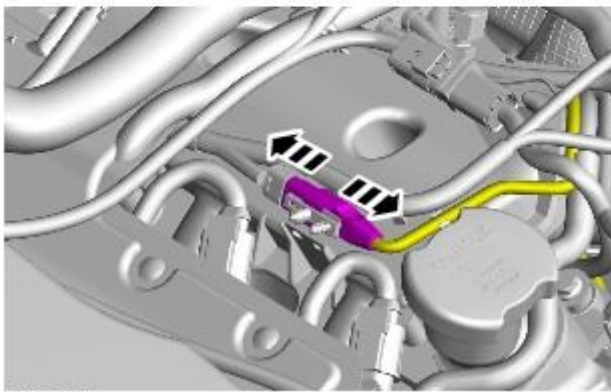
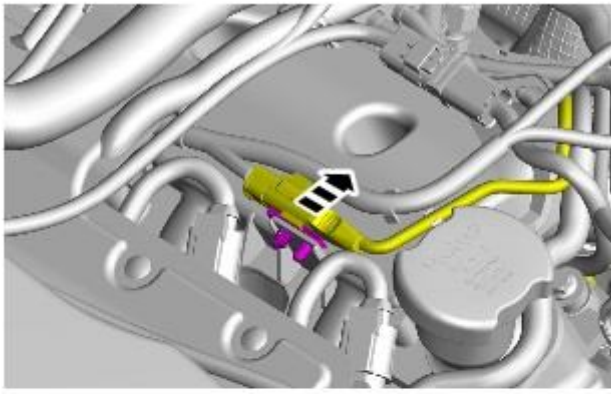
Remove the engine oil filter.

- Loosen the element cover 4 complete turns to allow engine oil to drain from the filter cover.
- Remove element cover.

3. Disconnect the knock sensor (KS) electrical connectors.

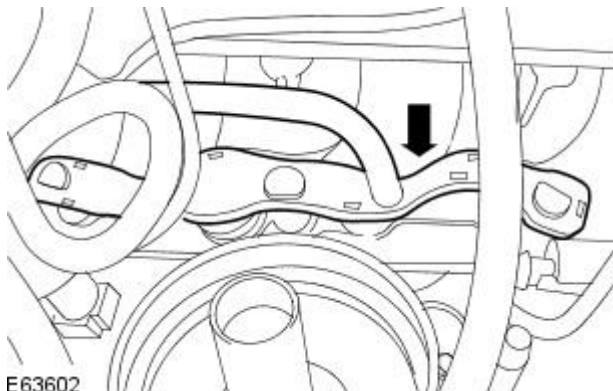


E52590

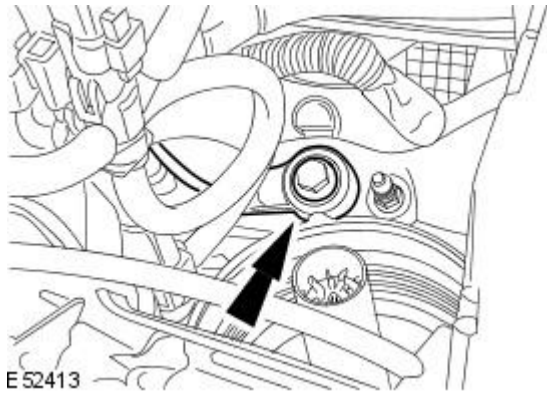


E100825

4. Disconnect the glow plug electrical connectors.



E63602




5.  CAUTION: Note the fitted position of the component prior to removal.

Remove the knock sensor (KS).

## Installation

### 1. CAUTIONS:

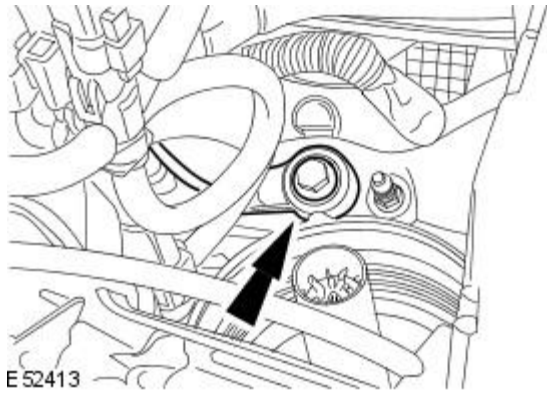
 Make sure that the mating faces are clean and free of foreign material.

 Make sure that the cable is correctly routed.

• NOTE: Make sure that this component is installed to the noted removal position.

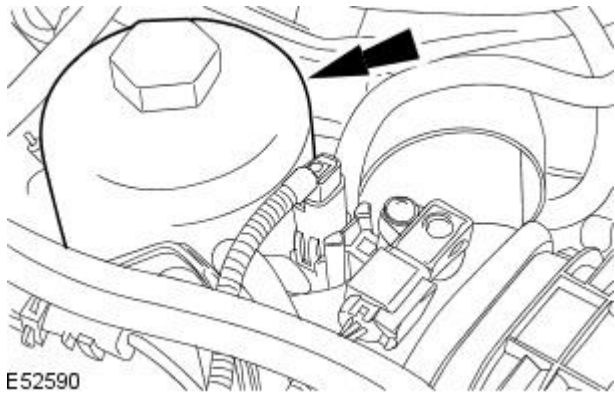
To install, reverse the removal procedure.

- Tighten to 20 Nm.



2.  CAUTION: Install a new seal.

Tighten to 25 Nm.



3. Check and top-up the engine oil if required.

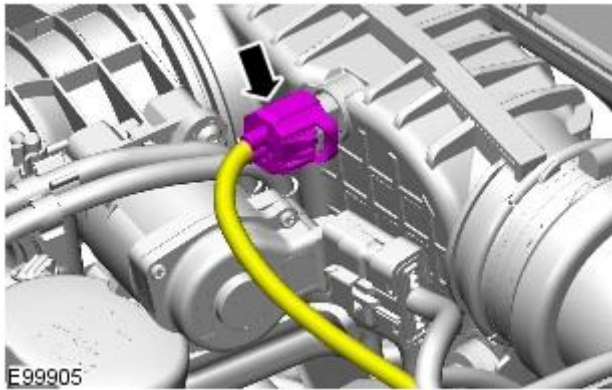


# Electronic Engine Controls - TDV6 2.7L Diesel - Intake Air Temperature (IAT) Sensor

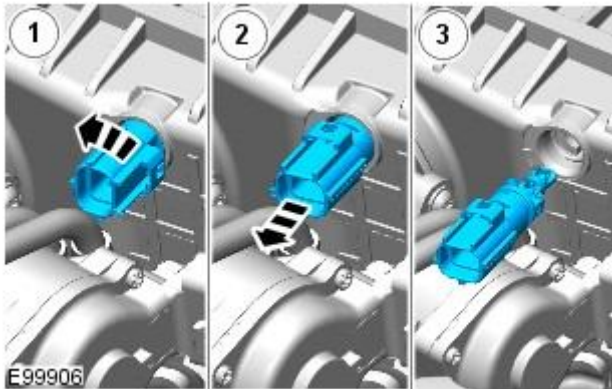
## Removal and Installation

### Removal

1. Refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).



2.



3.

### Installation

1. To install, reverse the removal procedure.

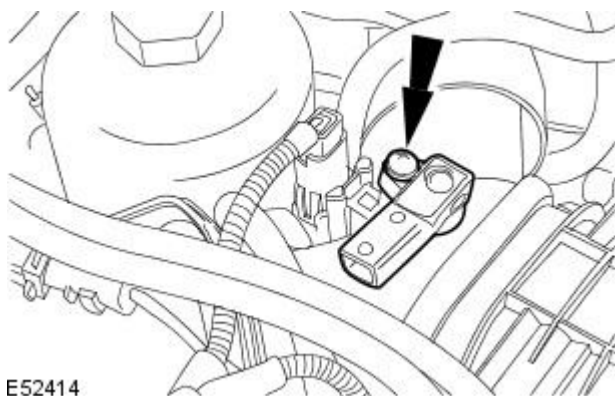
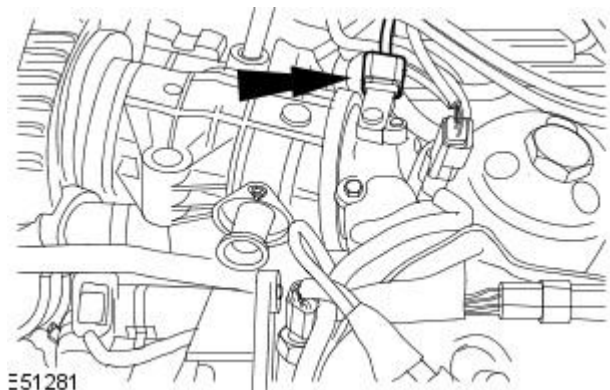
# Electronic Engine Controls - TDV6 2.7L Diesel - Manifold Absolute Pressure (MAP) Sensor

## Sensor

Removal and Installation

### Removal

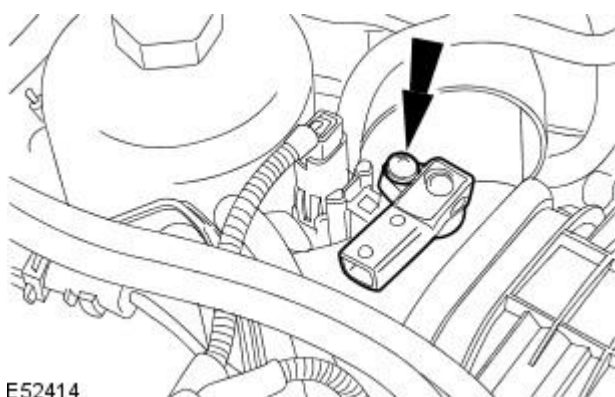
1. Remove the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Disconnect the manifold absolute pressure (MAP) sensor electrical connector.



3. Remove the MAP sensor.

### Installation

1. To install, reverse the removal procedure.
  - Tighten to 3 Nm.



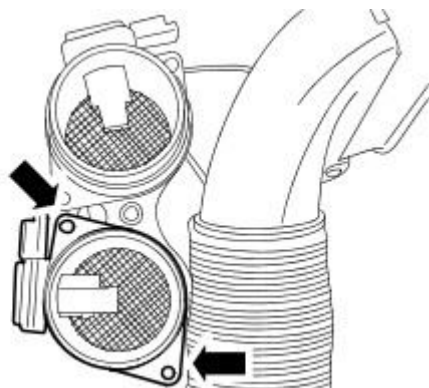
# Electronic Engine Controls - TDV6 2.7L Diesel - Mass Air Flow (MAF) Sensor

Removal and Installation

## Removal


• NOTE: This procedure is showing the lower mass air flow (MAF) sensor removal and installation. The upper MAF sensor removal and installation is similar.

1. Remove the air cleaner assembly.  
For additional information, refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Removal and Installation).
2. Remove the mass air flow (MAF) sensor.



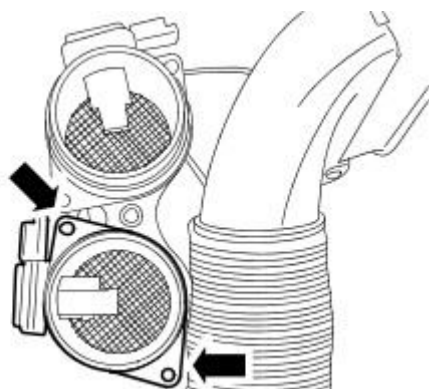
E 63506

## Installation

1.  CAUTION: Make sure that the mating faces are clean and free of foreign material.

To install, reverse the removal procedure.

- Tighten to 2 Nm.




E 63506

# Electronic Engine Controls - TDV6 2.7L Diesel - Oil Temperature Sensor

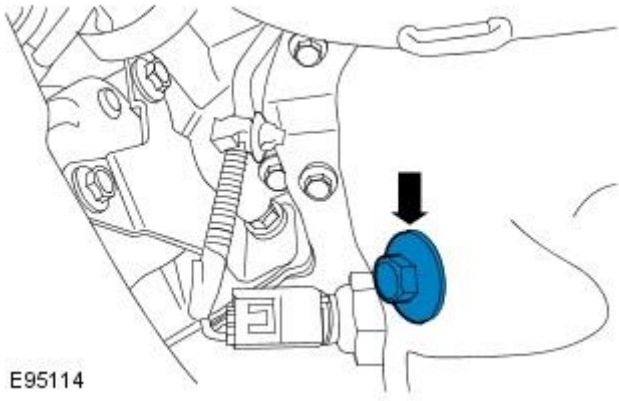
Removal and Installation

## Removal

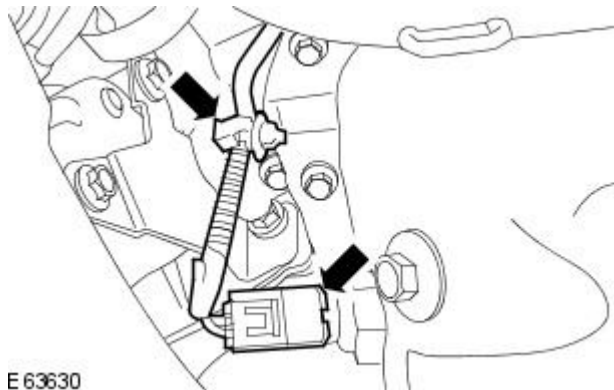
-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

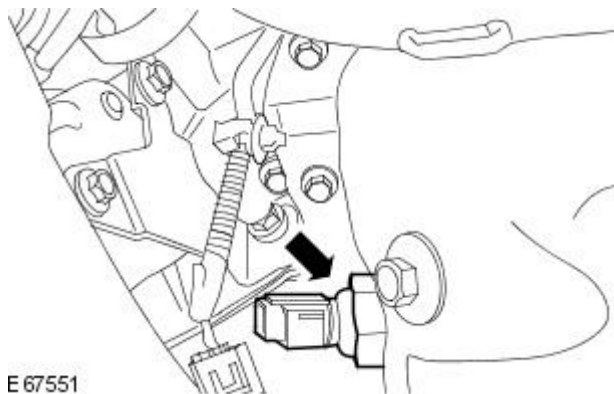
- Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).
- Drain the engine oil.  
For additional information, refer to: [Engine Oil Draining and Filling](#) (303-01A Engine - TDV6 2.7L Diesel, General Procedures).



- Disconnect the oil temperature sensor electrical connector.



- Remove the engine oil temperature sensor.

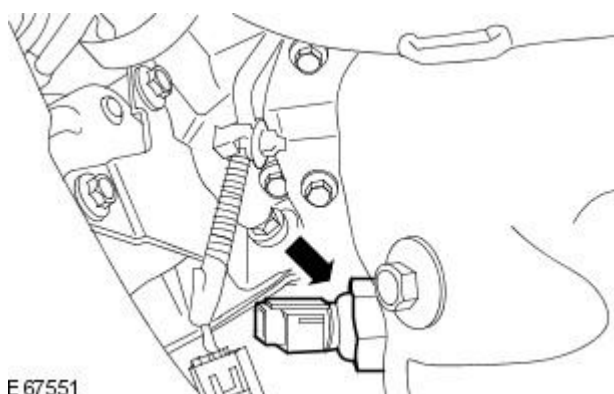


## Installation

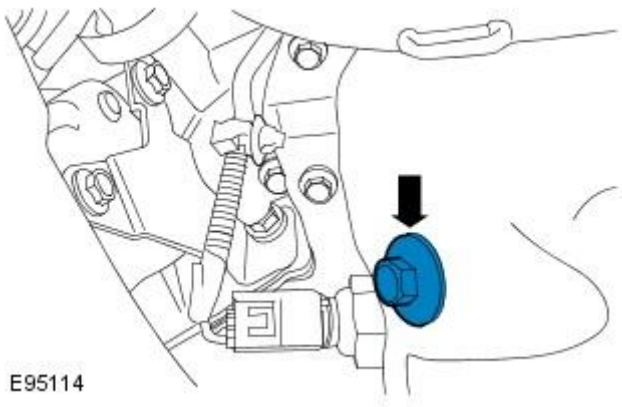
-  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

Install is the reverse of removal.

- Tighten to 24 Nm.



2. Tighten to 25 Nm.



E95114

**Electronic Engine Controls - V6 3.0L Petrol -****Torque Specifications**

<b>Description</b>	<b>Nm</b>	<b>lb-ft</b>	<b>lb-in</b>
Camshaft position (CMP) sensor retaining bolt	7	-	62
Heated oxygen sensor (HO2S)	40	30	-
Catalyst monitor sensor	40	30	-
Crankshaft position (CKP) sensor retaining bolt	7	-	62
Knock sensor retaining bolt	25	18	-
Variable camshaft timing oil control solenoid	10	7	-
Intake manifold tuning valve	10	7	-
Engine coolant temperature (ECT) sensor	17	13	-
Manifold absolute pressure (MAP) sensor	10	7	-
Oil temperature sensor	15	11	-

**Lubricants, fluids, sealers and adhesives**

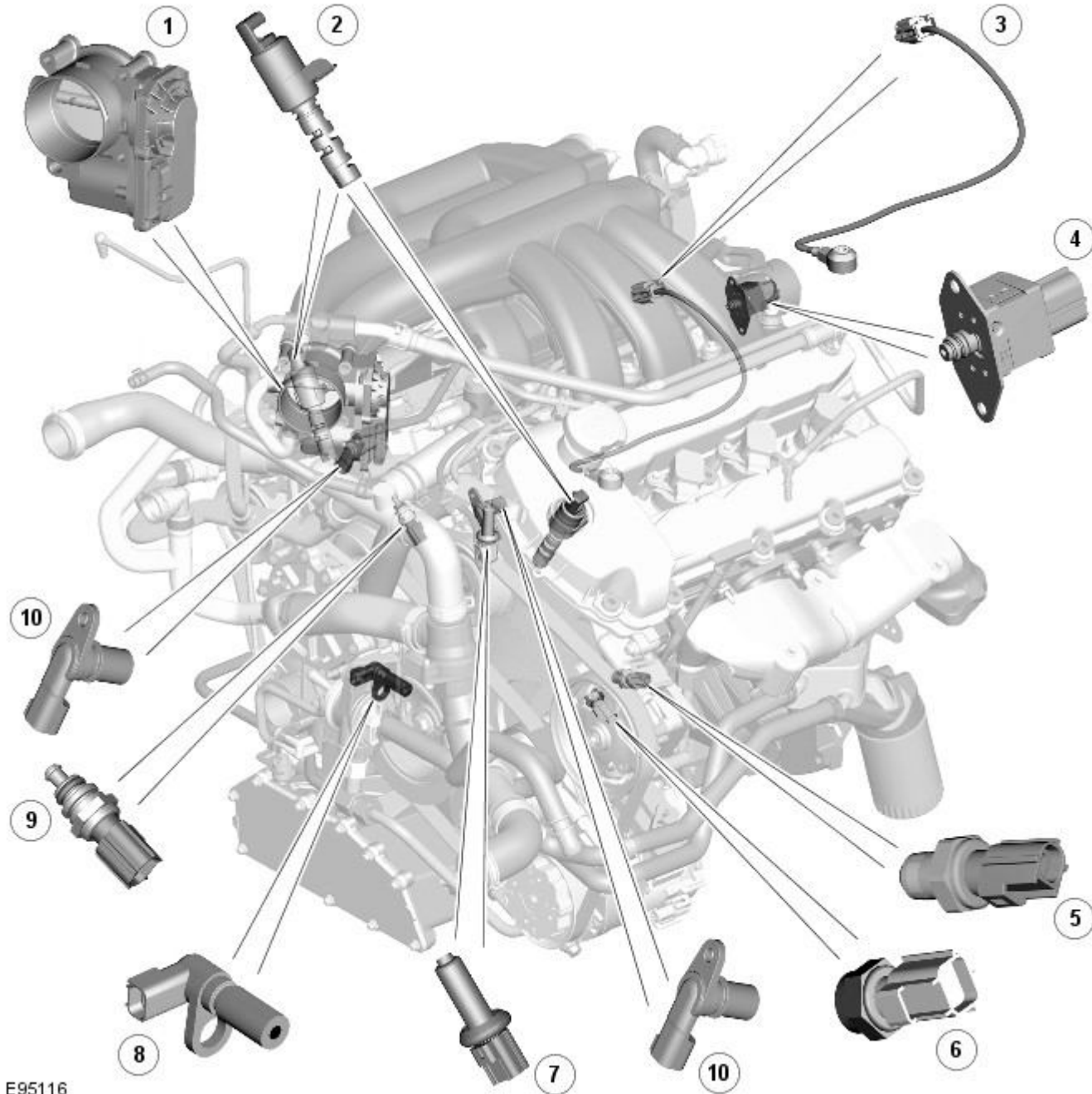
<b>Description</b>	<b>Specification</b>
Sealant	WSK-M4G-328-A3



# Electronic Engine Controls - V6 3.0L Petrol - Electronic Engine Controls - Component Location

Description and Operation

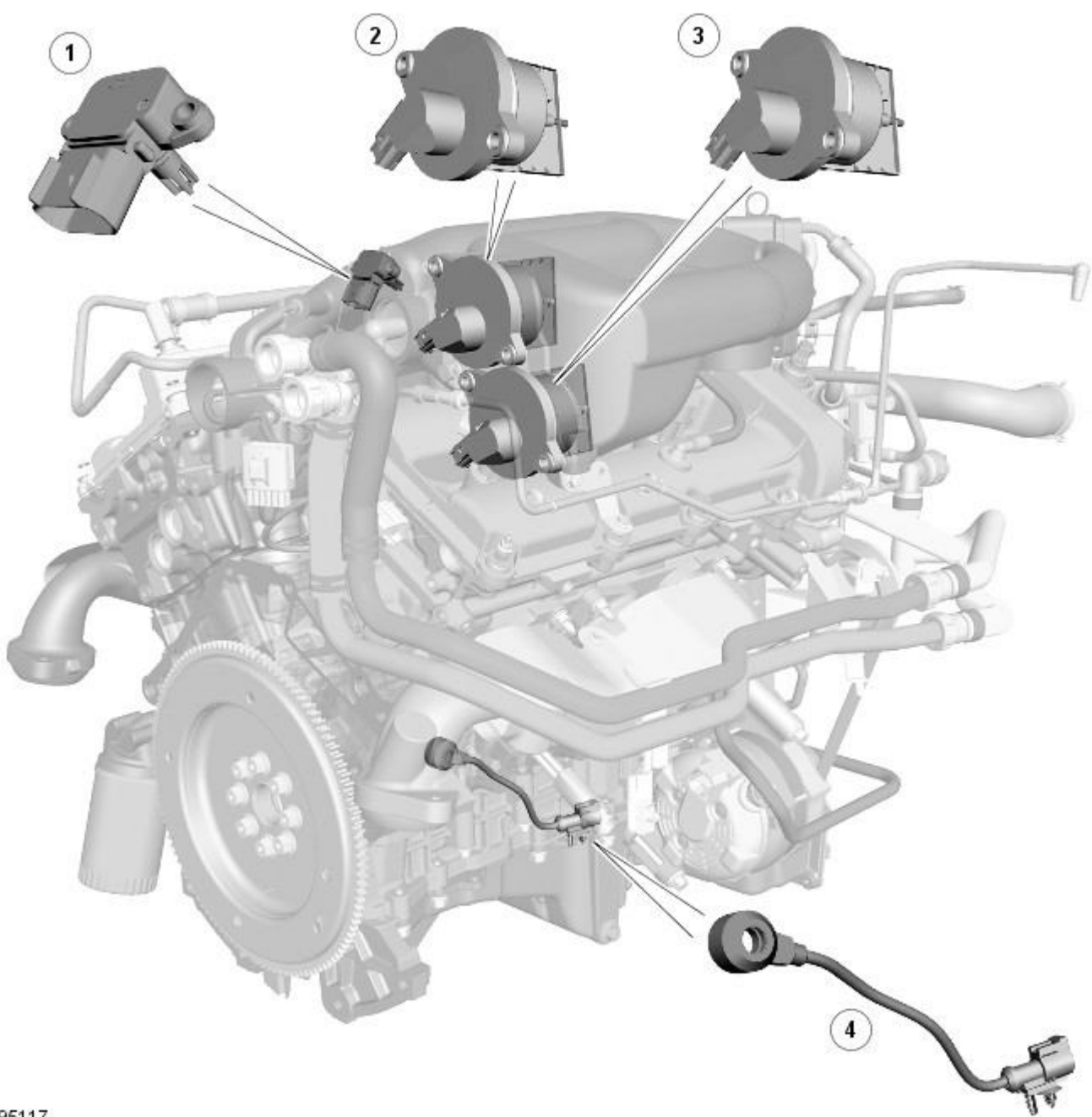
COMPONENT LOCATION SHEET 1 OF 2



E95116

Item	Description
1	Electric throttle
2	VCT (variable camshaft timing) solenoid
3	KS (knock sensor)
4	Fuel rail pressure sensor
5	EOP (engine oil pressure) sensor
6	Engine oil temperature sensor
7	Fuel temperature sensor
8	CKP (crankshaft position)
9	ECT (engine coolant temperature) sensor
10	CMP (camshaft position) sensor

COMPONENT LOCATION SHEET 2 OF 2



E95117

**ItemDescription**

- |   |   |
|---|---|
| 1 | <a href="#">MAP (manifold absolute pressure) sensor</a> |
| 2 | <a href="#">IMT (intake manifold tuning) valve</a>      |
| 3 | <a href="#">IMT valve</a>                               |
| 4 | <a href="#">KS</a>                                      |

# Electronic Engine Controls - V6 3.0L Petrol - Electronic Engine Controls - Overview

Description and Operation

## OVERVIEW

The V6 3 Liter engine is controlled by an [ECM \(engine control module\)](#) manufactured by DENSO. The Engine Management System (EMS) controls the following:

- Engine fueling
- Ignition timing
- Closed loop fueling
- Knock control
- Idle speed control
- Emission control
- On Board Diagnostic
- Interface with the immobilization system
- Speed control

The [ECM](#) controls the engine fueling by providing sequential fuel injection to all cylinders. Ignition is controlled by a direct ignition system, provided by six plug top coils. The [ECM](#) is able to detect and correct for ignition knock on each cylinder and adjust the ignition timing for each cylinder to achieve optimum performance.

The [ECM](#) uses a torque-based strategy to generate the torque required by the driver and other vehicle control modules. The EMS uses various sensors to determine the torque required from the engine. The EMS also interfaces with other vehicle electronic control modules's, via the [CAN \(controller area network\)](#) bus, to obtain additional information (e.g. road speed from the [ABS \(anti-lock brake system\)](#) control module). The EMS processes these signals and decides how much torque to generate. Torque is then generated by using various actuators to supply air, fuel and spark to the engine (electronic throttle, injectors, coils, etc.).

The EMS comprises the following inputs:

- [CMP \(camshaft position\)](#) sensor
- [CKP \(crankshaft position\)](#) sensor
- Fuel rail pressure sensor
- MAF sensor
- Knock sensors
- Fuel rail temperature sensor
- [ECT \(engine coolant temperature\)](#) sensor
- Engine oil temperature sensor
- [MAP \(manifold absolute pressure\)](#) sensor
- Electric throttle feedback sensor
- [AIR \(secondary air injection\)MAP](#) sensor
- [APP \(accelerator pedal position\)](#) sensor
- Tank leakage detection system (NAS only)
- Cooling fan speed feedback
- Oxygen sensors
- Brake switch
- Speed control cancel/suspend switch
- Automatic speed limiter switch
- Crank request signal
- [IAT \(intake air temperature\)](#) sensor
- External air temperature sensor

The EMS comprises the following outputs:

- Fuel injectors
- Ignition coils
- Engine cooling fan
- Electric throttle
- Electric fuel pump driver module
- [VCT \(variable camshaft timing\)](#) solenoids
- Purge valve
- [EGR \(exhaust gas recirculation\)](#) valve
- [AIR](#) pump
- Starter relay control

# Electronic Engine Controls - V6 3.0L Petrol - Electronic Engine Controls - System

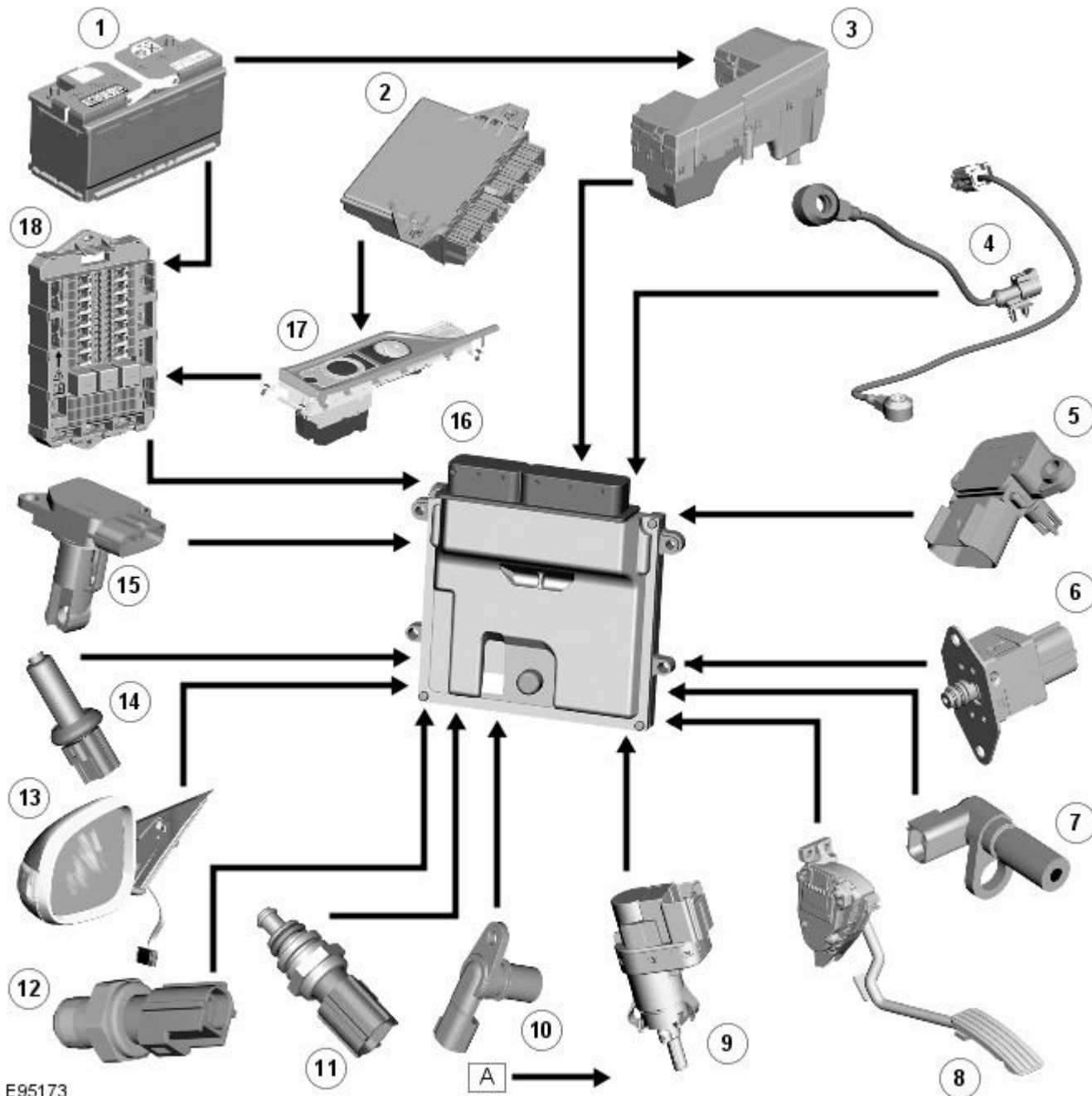
## Operation and Component Description

Description and Operation

### Control Diagram

• NOTE: A = Hardwired, D = High speed CAN (controller area network) bus, N = Medium speed CAN bus, O = LIN (local interconnect network) bus

CONTROL DIAGRAM SHEET 1 OF 3

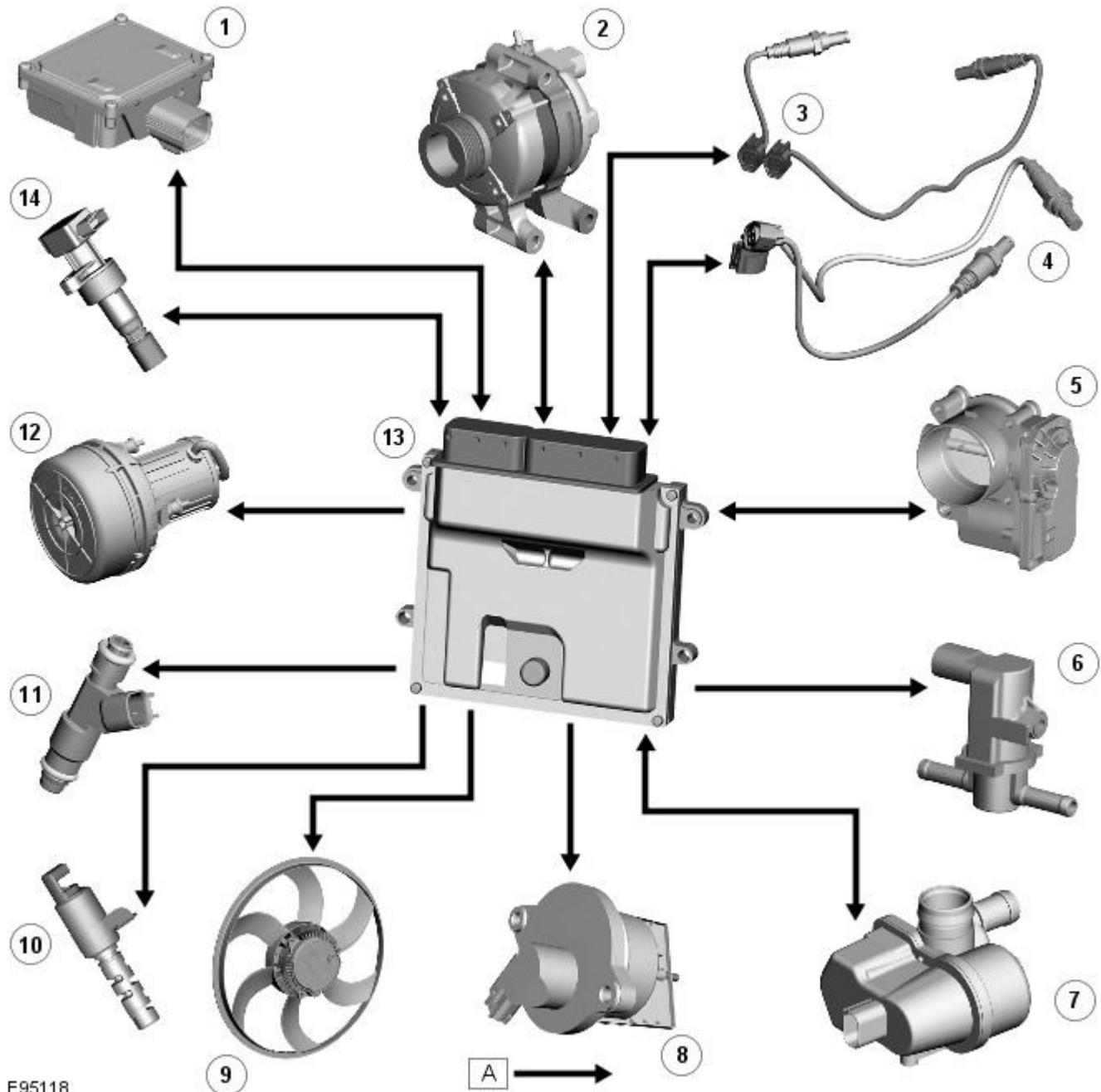


E95173

#### ItemDescription

1	Battery
2	Keyless vehicle module
3	BJB (battery junction box)
4	KS (knock sensor)
5	MAP (manifold absolute pressure) sensor
6	Fuel rail pressure sensor
7	CKP (crankshaft position) sensor
8	APP (accelerator pedal position) sensor
9	BPP (brake pedal position) switch
10	CMP (camshaft position) sensor
11	Engine oil temperature sensor
12	EOP (engine oil pressure) switch
13	Exterior air temperature sensor
14	Fuel temperature sensor

- 15 MAF (mass air flow) sensor
- 16 ECM (engine control module)
- 17 Start/stop switch
- 18 RJB (rear junction box)

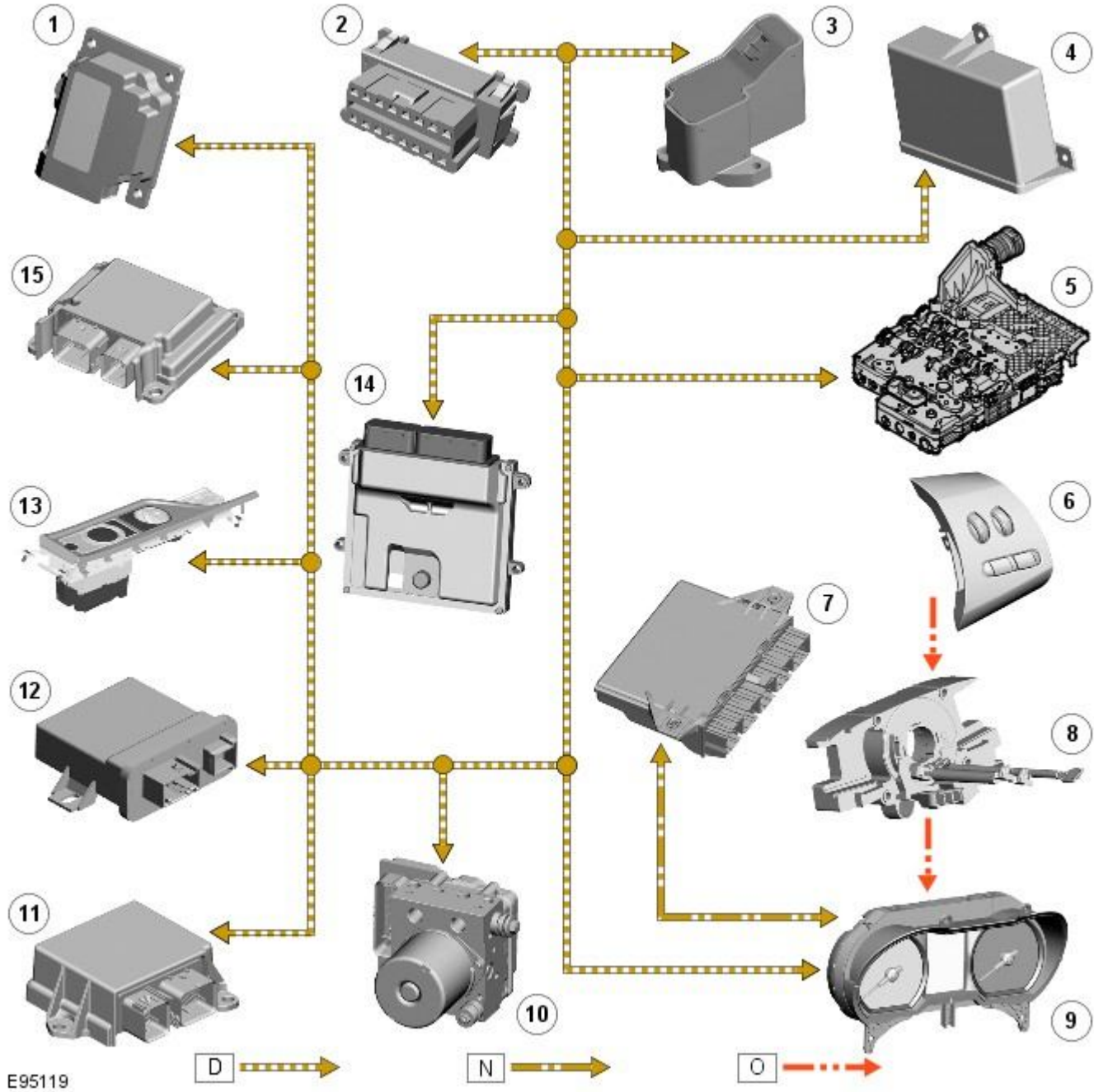


E95118

**ItemDescription**

1	FPDM (fuel pump driver module)
2	Generator
3	O2S (oxygen sensor) upstream
4	O2S downstream
5	Electric throttle
6	Purge valve
7	Tank leakage detection pump
8	IMT (intake manifold tuning) valve
9	Electric cooling fan
10	VCT (variable camshaft timing) solenoid
11	AIR (secondary air injection) pump
12	ECM
13	Injectors
14	Plug top coils





E95119

Item	Description
1	Adaptive speed control module
2	Diagnostic socket
3	Steering column lock
4	Electronic parking brake module
5	<a href="#">TCM (transmission control module)</a>
6	Speed control switches
7	Keyless vehicle module
8	Clock spring
9	Instrument cluster
10	<a href="#">ABS (anti-lock brake system) control module</a>
11	<a href="#">RCM (restraints control module)</a>
12	Adaptive front lighting module
13	Start/ stop switch
14	<a href="#">ECM</a>
15	Pedestrian protection system control module

### System Operation

The [ECM](#) controls the engine fueling by providing sequential fuel injection to all cylinders. Ignition is controlled by a direct ignition system, provided by six plug top coils. The [ECM](#) is able to detect and correct for ignition knock on each cylinder and adjust the ignition timing for each cylinder to achieve optimum performance.

The [ECM](#) uses a torque-based strategy to generate the torque required by the driver and other vehicle control modules. The [ECM](#) uses various sensors to determine the torque required from the engine. The EMS also interfaces with other vehicle electronic control modules's, via the [CAN](#) bus, to obtain additional information (e.g. road speed from the [ABS](#) control module). The EMS processes these signals and decides how much torque to generate. Torque is then generated by using various actuators to supply air, fuel and spark to the engine (electronic throttle, injectors, coils, etc.).



## System Inputs

The EMS has the following inputs:

- [RCM](#)
- Park/neutral switch
- Ignition coil feedback
- Fuel rail temperature
- [MAF](#)
- Engine speed
- Camshaft position
- Driver demand
- Brake pedal position switch
- Speed control switches
- Generator load
- [HO2S \(heated oxygen sensor\)](#) pre catalyst
- [HO2S](#) post catalyst
- Throttle position
- Cooling fan speed
- Ignition switch
- Knock sensors
- [MAP](#)
- [ECT \(engine coolant temperature\)](#)
- Engine oil temperature
- [EOP](#)
- Fuel pressure
- Fuel temperature

## System Outputs

The EMS has the following outputs:

- Throttle Actuator
- Brake vacuum pump relay
- Ignition coils
- Oxygen sensor heaters
- Fuel injectors
- Purge Valve
- Engine Cooling Fan
- Fuel pump relay
- Starter Relay
- [ECM](#) Main Relay
- Generator Control
- Fuel tank leakage detection

## ECM Adaptions

The [ECM](#) has the ability to adapt the values it uses to control certain outputs. This capability ensures the EMS can meet emissions legislation and improve the refinement of the engine throughout its operating range.

The components which have adaptions associated with them are:

- The [APP](#) sensor
- The oxygen sensors
- The [MAF/IAT \(intake air temperature\)](#) sensor
- The [CKP](#) sensor
- The Electric throttle body.

## Oxygen Sensors and MAF/AT Sensor

There are several adaptive maps associated with the fueling strategy. Within the fueling strategy the [ECM](#) calculates short-term adaptions and long term adaptions. The [ECM](#) will monitor the deterioration of the oxygen sensors over a period of time. It will also monitor the current correction associated with the sensors.

The [ECM](#) will store a fault code in circumstances where an adaption is forced to exceed its operating parameters. At the same time, the [ECM](#) will record the engine speed, engine load and intake air temperature.

## Crankshaft Position Sensor

The characteristics of the signal supplied by the [CKP](#) sensor is learnt by the [ECM](#). This enables the [ECM](#) to set an adaption and support the engine misfire detection function. Due to the small variation between different flywheels and different [CKP](#) sensors, the adaption must be reset if either component is renewed, or removed and refitted. It is also necessary to reset the flywheel adaption if the [ECM](#) is renewed or replaced. The [ECM](#) supports four flywheel adaptions for the [CKP](#) sensor. Each adaption relates to a specific engine speed range. The engine speed ranges are detailed in the table below:

Adaptions	Engine Speed, rev/min
1	1800 - 3000
2	3001 - 3800
3	3801 - 4600
4	4601 - 5400

## Misfire Detection

Legislation requires that the [ECM](#) must be able to detect the presence of an engine misfire. It must be able to detect misfires at two separate levels. The first level is a misfire that could lead to the vehicle emissions exceeding 1.5 times the Federal Test Procedure (FTP) requirements for the engine. The second level is a misfire that may cause catalyst damage.

The [ECM](#) sensor monitors the number of misfire occurrences within two engine speed ranges. If the [ECM](#) detects more than a predetermined number of misfire occurrences within either of these two ranges, over two consecutive journeys, the [ECM](#) will record a fault code and details of the engine speed, engine load and engine coolant temperature. In addition, the [ECM](#) monitors the number of misfire occurrences that happen in a 'window' of 200 engine revolutions. The misfire occurrences are assigned a weighting according to their likely impact on the

catalysts. If the number of misfires exceeds a certain value, the [ECM](#) stores catalyst-damaging fault codes, along with the engine speed, engine load and engine coolant temperature.

The signal from the [CKP](#) indicates how fast the poles on the flywheel are passing the sensor tip. A sine wave is generated each time a pole passes the sensor tip. The [ECM](#) can detect variations in flywheel speed by monitoring the sine wave signal supplied by the [CKP](#) sensor.

By assessing this signal, the [ECM](#) can detect the presence of an engine misfire. At this time, the [ECM](#) will assess the amount of variation in the signal received from the [CKP](#) and assigns a roughness value to it. This roughness value can be viewed within the real time monitoring feature, using a Land Rover approved diagnostic system. The [ECM](#) will evaluate the signal against a number of factors and will decide whether to count the occurrence or ignore it. The [ECM](#) can assign a roughness and misfire signal for each cylinder, (i.e. identify which cylinder is misfiring).

## Diagnostics

The [ECM](#) stores faults as [DTC \(diagnostic trouble code\)](#), referred to as 'P' codes. The 'P' codes are defined by [OBD \(on-board diagnostic\)](#) legislation and, together with their associated environmental and freeze frame data, can be read using a third party scan tool or a Land Rover approved diagnostic system. A Land Rover approved diagnostic system can also read real time data from each sensor, the adaptive values currently being employed and the current fueling, ignition and idle settings.

## Component Description

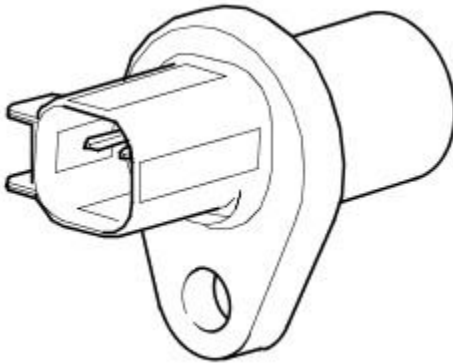
### Engine Control Module

The [ECM](#) is located in the engine bay attached to the bulkhead. On [LHD \(left-hand drive\)](#) vehicles the [ECM](#) is located on the [RH \(right-hand\)](#) side of the compartment behind the [BJB](#). On [RHD \(right-hand drive\)](#) vehicles the [ECM](#) is located on the [LH \(left-hand\)](#) side of the engine compartment.

The [ECM](#) controls the engine fueling by providing sequential fuel injection to all cylinders. Ignition is controlled by a direct ignition system, provided by eight plug top coils. The [ECM](#) is able to detect and correct for ignition knock on each cylinder and adjust the ignition timing for each cylinder to achieve optimum performance.

The [ECM](#) uses a torque-based strategy to generate the torque required by the driver and other vehicle control modules. The EMS uses various sensors to determine the torque required from the engine. The EMS also interfaces with other vehicle electronic control modules's, via the [CAN](#) bus, to obtain additional information (e.g. road speed from the [ABS](#) control module). The EMS processes these signals and decides how much torque to generate. Torque is then generated by using various actuators to supply air, fuel and spark to the engine (electronic throttle, injectors, coils, etc.).

### Crankshaft Position Sensor (CKP)



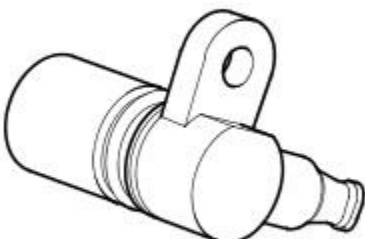
E46331

The crankshaft position sensor is mounted at the rear underside of the engine near the transmission bell housing. Connection between the sensor and the harness is via a link harness and a two-way connector. Both wires go directly to the [ECM](#). The sensor produces the signal which enables the [ECM](#) to determine the angle of the crankshaft, and the engine rpm. From this, the point of ignition, fuel injection, etc. is calculated. If the signal wires are reversed a 3° advance in timing will occur, as the electronics within the [ECM](#) uses the falling edge of the signal waveform as its reference/timing point for each tooth.

The reluctor is pressed into the flywheel and has a "tooth" pattern based on 36 teeth at 10° intervals and approximately 5° wide: one of the teeth is removed to provide a hardware reference mark which is 60 degrees [BTDC \(before top dead center\)](#) No.1 cylinder. Because of the crankshaft sensor's orientation, the target wheel uses windows machined into the face, rather than actual teeth.

The sensor operates by generating an output voltage caused by the change in magnetic field that occurs as the windows pass in front of the sensor. The output voltage varies with the speed of the windows passing the sensor, the higher the engine speed, the higher the output voltage. Note that the output is also dependent on the air gap between the sensor and the teeth (the larger the gap, the weaker the signal, the lower the output voltage). The [ECM](#) transmits the engine speed to other vehicle control modules on [CAN](#).

### Camshaft Position Sensor (CMP)



E46332

Two sensors are located at the rear of the engine, in the cylinder head (one per bank), above the rear cylinders. This is a Variable Reluctor Sensor (VRS) producing four pulses for every two engine revolutions. The sensing element is positioned between 0 and 2mm from the side of the cam gear wheel.

The variable cam intake is parked in the retarded position and can advance up to 48 degrees.

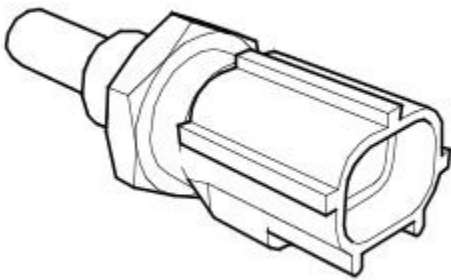
The camshaft timing wheel is a sintered component which has four teeth on it to enable the EMS to detect cylinder identification. The signal is used for:

- Variable intake cam timing
- Cylinder recognition
- Enabling sequential fuel injection
- Knock control
- Cylinder identification for diagnostic purposes.

Failure symptoms include:

- Ignition timing reverting to the base mapping, with no cylinder correction.
- Active knock control is disabled, along with its diagnostic (safe ignition map-loss of performance).
- Quick cam/crank synchronisation on start disabled.
- Variable cam timing is disabled

## Engine coolant Temperature Sensor



E47309

The sensor is located at the front of the engine in the water pipe below the throttle body. The [ECT](#) sensor is a thermistor used to monitor the engine coolant temperature. The [ECT](#) sensor is vital to the correct running of the engine as a richer mixture is required at lower block temperatures for good quality starts and smooth running, leaning off as the temperature rises to maintain emissions and performance.

The sensor has an operating temperature range of -40 Degrees Celsius to 119 Degrees Celsius. When a defective coolant sensor is detected, the [ECM](#) uses the oil temperature sensor value. [PTC \(positive temperature coefficient\)](#)

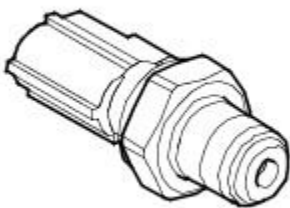
## Tank Leakage Detection-NAS ONLY

The tank leakage detection system periodically checks the evaporative system and the fuel tank for leaks when the ignition is switched off. The tank leakage detection pump is connected to the atmospheric vent of the charcoal cannister and incorporates a [PTC](#) heating element a normally open valve and a reference orifice. The tank leakage detection pump is only operated when the ignition is switched off and is controlled by the [ECM](#). The [ECM](#) also monitors the electric air pump operation and the normally open valve for faults. To check the fuel tank and EVAP system for leaks the [ECM](#) operates the tank leakage detection pump and monitors the current draw. This is compared to a referenced figure established from the current draw when air is pumped through the reference orifice.

## Purge Valve

The purge valve is located at the rear of the engine on a bracket which is attached to the transmission bell housing. The purge valve is a solenoid operated valve which is closed when de-energized. The purge valve is controlled by a 10Hz [PWM \(pulse width modulation\)](#) signal from the [ECM](#). When the engine operating conditions are correct, the [ECM](#) opens the purge valve which causes fuel vapor and fresh air to be drawn through the charcoal cannister. The fresh air is drawn through the charcoal cannister via the tank leakage detection pump fresh air vent. [NTC \(negative temperature coefficient\)](#)

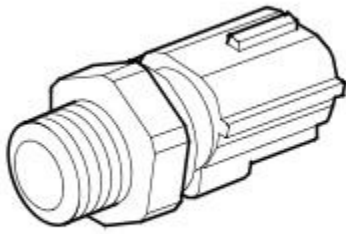
## Engine Oil Temperature Sensor



E46333

Oil temperature is monitored through a temperature sensor mounted in the oil system. This component is a [NTC](#). The sensor is mounted next to the oil pressure sensor at the front of the engine and locates into the oil filter bracket.

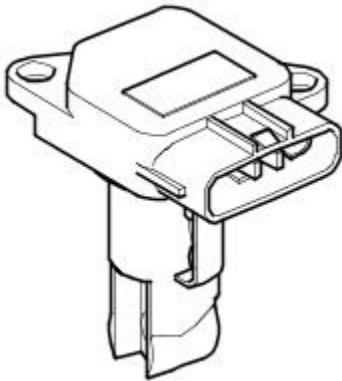
## Fuel Rail Temperature Sensor



E47606

The fuel rail temperature sensor measures the temperature of the fuel in the fuel rail. This input is then used to deliver the correct quantity of fuel to the engine. Operating Range -40 Degrees Celsius to 150 Degrees Celsius. The fuel rail temperature sensor is fitted on the rear of the right hand bank (bank A) fuel rail.

### Mass Air Flow/Intake Air Temperature Sensor (MAF/IAT)



E47308

The air flow meter is located in the clean air duct immediately after the air filter box.

The air mass flow is determined by the cooling effect of intake air passing over a "hot film" element contained within the device. The higher the air flow the greater the cooling effect and the lower the electrical resistance of the "hot film" element. The [ECM](#) then uses this signal from the Mass Air Flow meter to calculate the air mass flowing into the engine.

The measured air mass flow is used in determining the fuel quantity to be injected in order to maintain the stoichiometric air/fuel mixture required for correct operation of the engine and exhaust catalysts. Should the device fail there is a software backup strategy that will be evoked once a fault has been diagnosed.

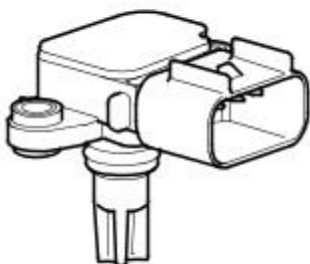
The following symptoms may be observed if the sensor fails:

- During driving the engine RPM might dip, before recovering.
- Difficulty in starting or start-stall.
- Poor throttle response/engine performance.
- Lambda control and idle speed control halted.
- Emissions incorrect.
- AFM signal offset

The [IAT](#) sensor is integrated into the [MAF](#) sensor. It is a temperature dependent resistor (thermistor), i.e. the resistance of the sensor varies with temperature. This thermistor is a [NTC](#) type element meaning that the sensor resistance decreases as the sensor temperature increases. The sensor forms part of a voltage divider chain with an additional resistor in the [ECM](#). The voltage from this sensor changes as the sensor resistance changes, thus relating the air temperature to the voltage measured by the [ECM](#).

The [ECM](#) stores a 25 Degrees Celsius default value for air temperature in the event of a sensor failure.

### Manifold Absolute Pressure Sensor (MAP)



E47588

The [MAP](#) sensor provides a voltage proportional to the absolute pressure in the intake manifold. This signal allows the load on the engine to be calculated and used within the internal calculations of the [ECM](#). The sensor is located on the rear of the air intake manifold.

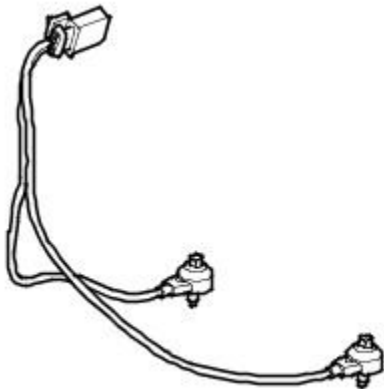
The output signal from the [MAP](#) sensor, together with the [CKP](#) and [IAT](#) sensors, is used by the [ECM](#) to calculate the amount of air induced

into the cylinders. This enables the [ECM](#) to determine ignition timing and fuel injection duration values.

The [MAP](#) sensor receives a 5V supply voltage from the [ECM](#) and provides an analogue signal to [ECM](#), which relates to the absolute manifold pressure and allows the [ECM](#) to calculate engine load. The [ECM](#) provides a ground for the sensor.

If the [MAP](#) signal is missing, the [ECM](#) will substitute a default manifold pressure reading based on crankshaft speed and throttle angle. The engine will continue to run with reduced drivability and increased emissions, although this may not be immediately apparent to the driver. The [ECM](#) will store fault codes which can be retrieved using the recommended Jaguar diagnostic tool.

## Knock Sensors



E47296

The EMS has two knock sensors located in the V of the engine, one per cylinder bank. The sensors are connected to the [ECM](#) via a twisted pair of wires.

The knock sensors produce a voltage signal in proportion to the amount of mechanical vibration generated at each ignition point. Each sensor monitors the related cylinder bank.

The knock sensors incorporate a piezo-ceramic crystal. This crystal produces a voltage whenever an outside force tries to deflect it, (i.e. exerts a mechanical load on it). When the engine is running, the compression waves in the material of the cylinder block, caused by the combustion of the fuel/air mixture within the cylinders, deflect the crystal and produce an output voltage signal. The signals are supplied to the [ECM](#), which compares them with 'mapped' signals stored in memory. From this, the [ECM](#) can determine when detonation occurs on individual cylinders. When detonation is detected, the [ECM](#) retards the ignition timing on that cylinder for a number of engine cycles, then gradually returns it to the original setting.

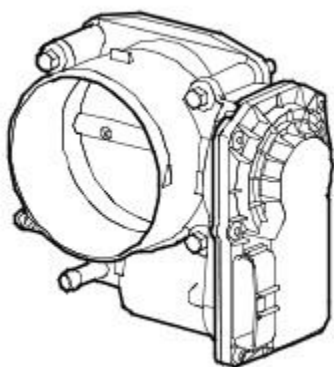
Care must be taken at all times to avoid damaging the knock sensors, but particularly during removal and fitting procedures. The recommendations regarding torque and surface preparation must be adhered to. The torque applied to the sensor and the quality of the surface preparation both have an influence over the transfer of mechanical noise from the cylinder block to the crystal.

The [ECM](#) uses the signals supplied by the knock sensors, in conjunction with the signal it receives from the camshaft sensor, to determine the optimum ignition point for each cylinder. The ignition point is set according to preprogrammed ignition maps stored within the [ECM](#). The [ECM](#) is programmed to use ignition maps for 98 RON premium specification fuel. It will also function on 91 RON regular specification fuel and learn new adaptations. If the only fuel available is of poor quality, or the customer switches to a lower grade of fuel after using a high grade for a period of time, the engine may suffer slight pre-ignition for a short period. This amount of pre-ignition will not damage the engine. This situation will be evident while the [ECM](#) learns and then modifies its internal mapping to compensate for the variation in fuel quality. This feature is called adaption. The [ECM](#) has the capability of adapting its fuel and ignition control outputs in response to several sensor inputs.

The [ECM](#) will cancel closed loop control of the ignition system if the signal received from either knock sensor becomes implausible. In these circumstances the [ECM](#) will default to a safe ignition map. This measure ensures the engine will not become damaged if low quality fuel is used. The [MIL](#) (malfunction indicator lamp) will not illuminate, although the driver may notice that the engine 'pinks' in some driving conditions and displays a drop in performance and smoothness.

When a knock sensor fault is stored, the [ECM](#) will also store details of the engine speed, engine load and the coolant temperature.

## Electric Throttle



E47298

The V6 EMS incorporates an electric throttle control system. The electronic throttle body is located on the air intake manifold in the engine compartment. The system comprises three main components:

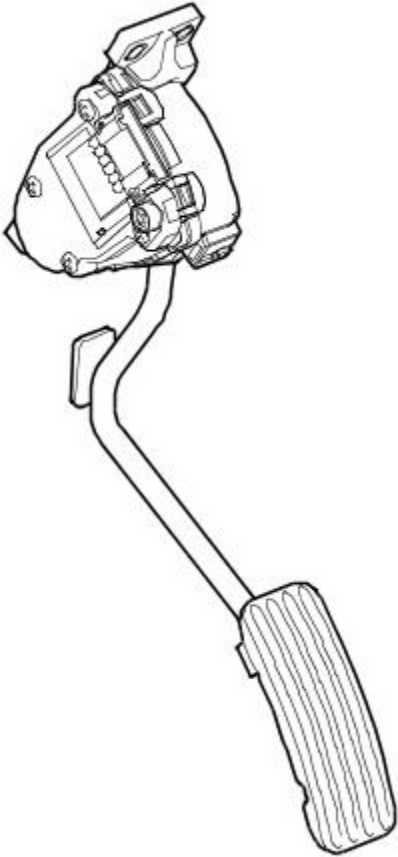
- Electronic throttle control valve
- [APP](#)
- [ECM](#)

When the accelerator pedal is depressed the [APP](#) sensor provides a change in the monitored signals. The [ECM](#) compares this against an electronic "map" and moves the electronic throttle valve via a [PWM](#) control signal which is in proportion to the [APP](#) angle signal. The system is required to:

- Regulate the calculated intake air load based on the accelerator pedal sensor input signals and programmed mapping.
- Monitor the drivers input request for cruise control operation.
- Automatically position the electronic throttle for accurate cruise control.
- Perform all dynamic stability control throttle control interventions.
- Monitor and carry out maximum engine and road speed cut out.

A software strategy within the [ECM](#) enables the throttle position to be calibrated each ignition cycle. When the ignition is turned OFF, the [ECM](#) performs a self test and calibration routine on the electronic throttle by closing the throttle fully. The power is then removed and the [ECM](#) checks that the throttle returns to the reference position under the pressure from the spring.

## Accelerator Pedal Position Sensor (APP)



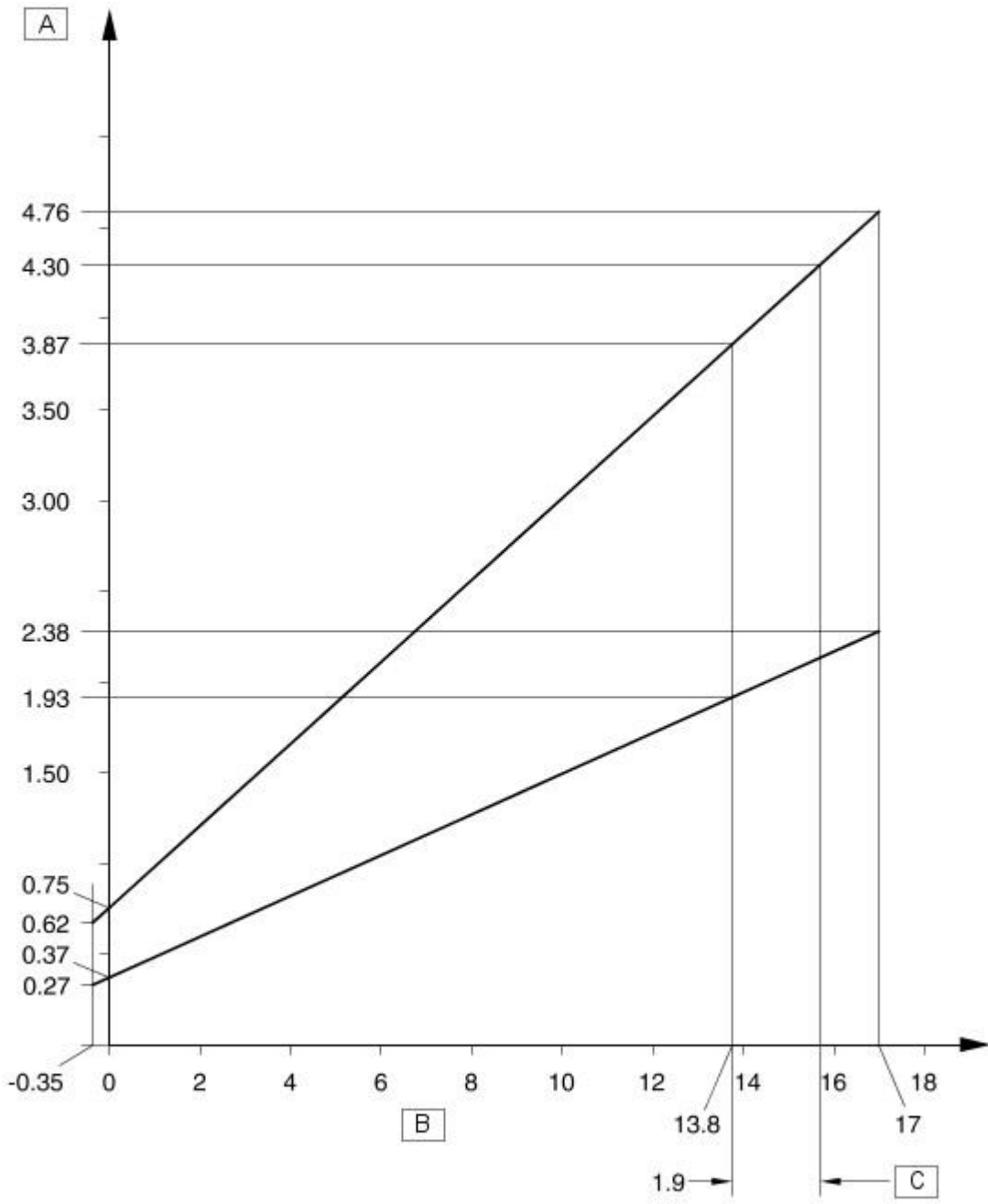
The [APP](#) sensor is located in a plastic housing which is integral with the throttle pedal. The housing is injection molded and provides location for the [APP](#) sensor. The sensor is mounted externally on the housing and is secured with two Torx screws. The external body of the sensor has a six pin connector which accepts a connector on the vehicle wiring harness.

The sensor has a spigot which protrudes into the housing and provides the pivot point for the pedal mechanism. The spigot has a slot which allows for a pin, which is attached to the sensor potentiometers, to rotate through approximately 90 degrees, which relates to pedal movement. The pedal is connected via a link to a drum, which engages with the sensor pin, changing the linear movement of the pedal into rotary movement of the drum. The drum has two steel cables attached to it. The cables are secured to two tension springs which are secured in the opposite end of the housing. The springs provide 'feel' on the pedal movement and require an effort from the driver similar to that of a cable controlled throttle. A detente mechanism is located at the forward end of the housing and is operated by a ball located on the drum. At near maximum throttle pedal movement, the ball contacts the detente mechanism. A spring in the mechanism is compressed and gives the driver the feeling of depressing a 'kickdown' switch when full pedal travel is achieved.

The [APP](#) sensor signals are checked for range and plausibility. Two separate reference voltages are supplied to the pedal. Should one sensor fail, the other is used as a 'limp-home' input. In limp home mode due to an [APP](#) signal failure the [ECM](#) will limit the maximum engine speed to 2000 rpm.

APP Sensor Output Graph





M180795

**ItemDescription**

A	Voltage
B	APP sensor angle
C	Kick down angle

The APP sensor has two potentiometer tracks which each receive a 5V input voltage from the ECM. Track 1 provides an output of 0.5V with the pedal at rest and 2.0V at 100% full throttle. Track 2 provides an output of 0.5V with the pedal at rest and 4.5V at 100% full throttle. The signals from the two tracks are used by the ECM to determine fueling for engine operation and also by the ECM and the TCM to initiate a kickdown request for the automatic transmission.

The ECM monitors the outputs from each of the potentiometer tracks and can determine the position, rate of change and direction of movement of the throttle pedal. The 'closed throttle' position signal is used by the ECM to initiate idle speed control and also overrun fuel cut-off.

**Oxygen Sensors**

There are four oxygen sensors located in the exhaust system. Two upstream before the catalytic converter (HO2S) and two down stream after the catalytic converter (O2S). The sensor monitors the level of oxygen in the exhaust gases and is used to control the fuel/air mixture. Positioning a sensor in the stream of exhaust gasses from each bank enables the ECM to control the fueling on each bank independently of the other, allowing much closer control of the air/fuel ratio and catalyst conversion efficiency.

The oxygen sensors need to operate at high temperatures in order to function correctly. To achieve the high temperatures required, the sensors are fitted with heater elements that are controlled by a [PWM](#) signal from the [ECM](#). The heater elements are operated immediately following engine start and also during low load conditions when the temperature of the exhaust gases is insufficient to maintain the required sensor temperatures. A non-functioning heater delays the sensor's readiness for closed loop control and influences emissions. The [PWM](#) duty cycle is carefully controlled to prevent thermal shock to cold sensors.

[HO2S](#) sensors also known as Linear or "Wide Band" sensors produces a constant voltage, with a variable current that is proportional to the oxygen content. This allows closed loop fueling control to a target lambda, i.e. during engine warm up (after the sensor has reached operating temperature and is ready for operation). This improves emission control.

The [O2S](#) sensor uses Zirconium technology that produces an output voltage dependant upon the ratio of exhaust gas oxygen to the ambient oxygen. The device contains a Galvanic cell surrounded by a gas permeable ceramic, the voltage of which depends upon the level of [O2](#) (oxygen) diffusing through. Nominal output voltage of the device for  $\lambda = 1$  is 300 to 500m volts. As the fuel mixture becomes richer ( $\lambda < 1$ ) the voltage tends towards 900m volts and as it becomes leaner ( $\lambda > 1$ ) the voltage tends towards 0 volts. Maximum tip temperature is 1,000 Degrees Celsius for a maximum of 100 hours.

Sensors age with mileage, increasing their response time to switch from rich to lean and lean to rich. This increase in response time influences the [ECM](#) closed loop control and leads to progressively increased emissions. Measuring the period of rich to lean and lean to rich switching monitors the response rate of the upstream sensors.

Diagnosis of electrical faults is continually monitored in both the upstream and downstream sensors. This is achieved by checking the signal against maximum and minimum threshold, for open and short circuit conditions.

Oxygen sensors must be treated with the utmost care before and during the fitting process. The sensors have ceramic material within them that can easily crack if dropped/banged or over-torqued. The sensors must be torqued to the required figure, (40-50Nm), with a calibrated torque wrench. Care should be taken not to contaminate the sensor tip when anti-seize compound is used on the thread. Heated sensor signal pins are tinned and universal are gold plated. Mixing up sensors could contaminate the connectors and affect system performance.

#### Failure Modes

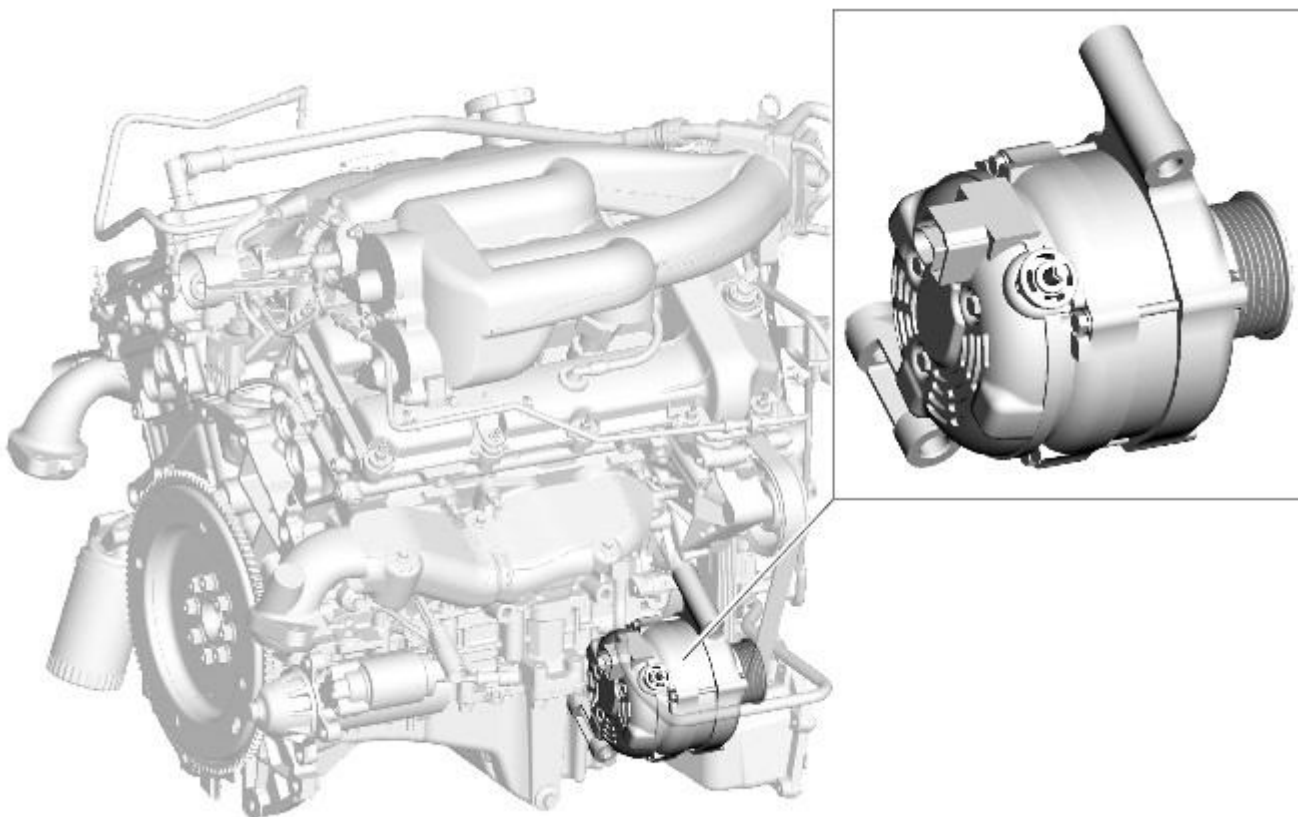
- Mechanical fitting & integrity of the sensor.
- Sensor open circuit/disconnected.
- Short circuit to vehicle supply or ground.
- Lambda ratio outside operating band.
- Crossed sensors bank A & B.
- Contamination from leaded fuel or other sources.
- Change in sensor characteristic.
- Harness damage.
- Air leak into exhaust system.

#### Failure Symptoms

- Default to Open Loop fueling for the particular cylinder bank
- High [CO](#) (carbon monoxide) reading.
- Strong smell of [HO2S](#) till default condition.
- Excess Emissions.

It is possible to fit front and rear sensors in their opposite location. However the harness connections are of different gender and color to ensure that the sensors cannot be incorrectly connected. In addition to this the upstream sensors have two holes in the shroud, whereas the down stream sensors have four holes in the shroud for the gas to pass through.

## Generator



E93662

The Generator has a power control module voltage regulator for use in a 14V charging system with 6÷12 zener diode bridge rectifiers.

The [ECM](#) monitors the load on the electrical system via [PWM](#) signal and adjusts the generator output to match the required load. The [ECM](#)

also monitors the battery temperature to determine the generator regulator set point. This characteristic is necessary to protect the battery; at low temperatures battery charge acceptance is very poor so the voltage needs to be high to maximize any rechargeability, but at high temperatures the charge voltage must be restricted to prevent excessive gassing of the battery with consequent water loss.

The Generator has a smart charge capability that will reduce the electrical load on the Generator reducing torque requirements, this is implemented to utilize the engine torque for other purposes. This is achieved by monitoring three signals to the [ECM](#):

- Generator sense (A sense), measures the battery voltage at the [CJB \(central junction box\)](#).
- Generator communication (Alt Com) communicates desired Generator voltage set point from [ECM](#) to Generator.
- Generator monitor (Alt Mon) communicates the extent of Generator current draw to [ECM](#). This signal also transmits faults to the [ECM](#) which will then send a message to the instrument pack on the [CAN](#) bus to illuminate the charge warning lamp.

## Fuel Injectors

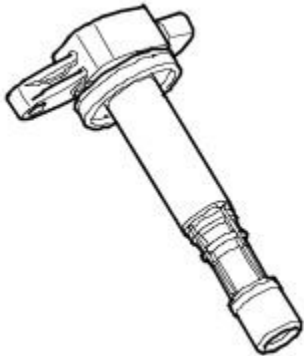


E47305

The engine has 6 fuel injectors (one per cylinder), each injector is directly driven by the [ECM](#). The injectors are fed by a common fuel rail as part of a 'returnless' fuel system. The fuel rail pressure is regulated to 4.5 bar by a fuel pressure regulator which is integral to the fuel pump module, within the fuel tank. The injectors can be checked by resistance checks. There is a fuel pressure test Schrader valve attached to the fuel rail on the front LH side for fuel pressure testing purposes. The [ECM](#) monitors the output power stages of the injector drivers for electrical faults.

The injectors have a resistance of 13.8 Ohms  $\pm$  0.7 Ohms @ 20 Degrees Celsius.

## Ignition Coils



E47306

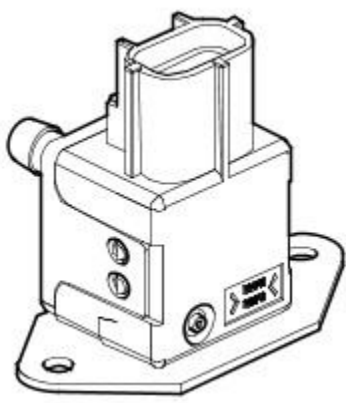
The engine is fitted with six plug-top coils that are driven directly by the [ECM](#). This means that the [ECM](#), at the point where sufficient charge has built up, switches the primary circuit of each coil and a spark is produced in the spark plug. The positive supply to the coil is fed from a common fuse. Each coil contains a power stage to trigger the primary current. The [ECM](#) sends a signal to each of the coils power stage to trigger the power stage switching. Each bank has a feedback signal that is connected to each power stage. If the coil power stage has a failure the feedback signal is not sent, causing the [ECM](#) to store a fault code appropriate to the failure.

The [ECM](#) calculates the dwell time depending on battery voltage and engine speed to ensure constant secondary energy. This ensures sufficient secondary (spark) energy is always available, without excessive primary current flow thus avoiding overheating or damage to the coils.

The individual cylinder spark timing is calculated from a variety of inputs:

- Engine speed and load
- Engine temperature
- Knock control
- Auto gearbox shift control
- Idle speed control.

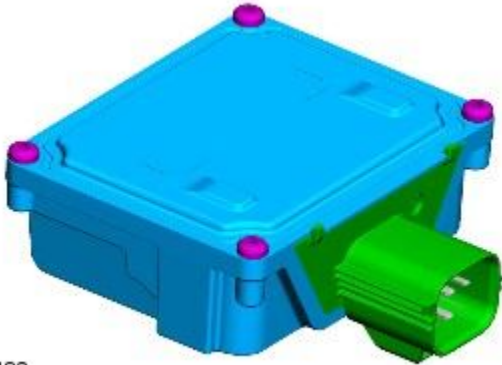
## Fuel Rail Pressure Sensor



E58945

The fuel rail pressure sensor is located on top of the fuel rail adjacent to the fuel inlet. The fuel rail pressure sensor measures the pressure of the fuel in the fuel rail. This input is then used by the fuel pump control module to control the amount of fuel delivered to the fuel rail.

## Fuel Pump Driver Module



E84483

The [FPDM](#) is located on the RH side of the charcoal canister on top of the fuel tank. The fuel pump control module receives a power supply via the fuel pump relay in the auxiliary fuse box.

The [ECM](#) sends a [PWM](#) signal to the [FPDM](#), the duty cycle of the signal determines the duty cycle of the pump. The [ECM](#) sets a target fuel pressure based on engine load. The target fuel pressure is maintained by using feedback from the fuel rail pressure sensor which is used to control the fuel pump via a closed loop [PWM](#) signal. The [PWM](#) signal to the pump represents half the ON time of the pump. If the [ECM](#) transmits a 50% on time the fuel pump control module drives the pump at 100%. If the [ECM](#) transmits a 5% ON time the fuel pump control module drives the pump at 10%. The fuel pump control module will only turn the fuel pump ON if it receives a valid signal between 4% and 50%. When the [ECM](#) requires the fuel pump to be turned OFF the [ECM](#) transmits a duty cycle signal of 75%.

The status of the [FPDM](#) is monitored by the [ECM](#). Any errors can be retrieved from the [ECM](#). The fuel pump control module cannot be interrogated for diagnostic purposes.

The [ECM](#) controls the [FPDM](#) in response to inputs from the fuel rail pressure sensor, [MAP](#) and the [MAF/IAT](#) sensor.

## Variable Valve Timing (VVT)

Variable valve timing is used on the V6 engine to enhance low and high speed engine performance and idle speed quality.

For each intake camshaft the [VVT](#) (variable valve timing) system comprises:

- [VVT](#) unit
- Valve timing solenoid

The [VVT](#) system alters the phase of the intake valves relative to the fixed timing of the exhaust valves, to alter:

- The mass of air flow to the cylinders.
- The engine torque response.
- Emissions.

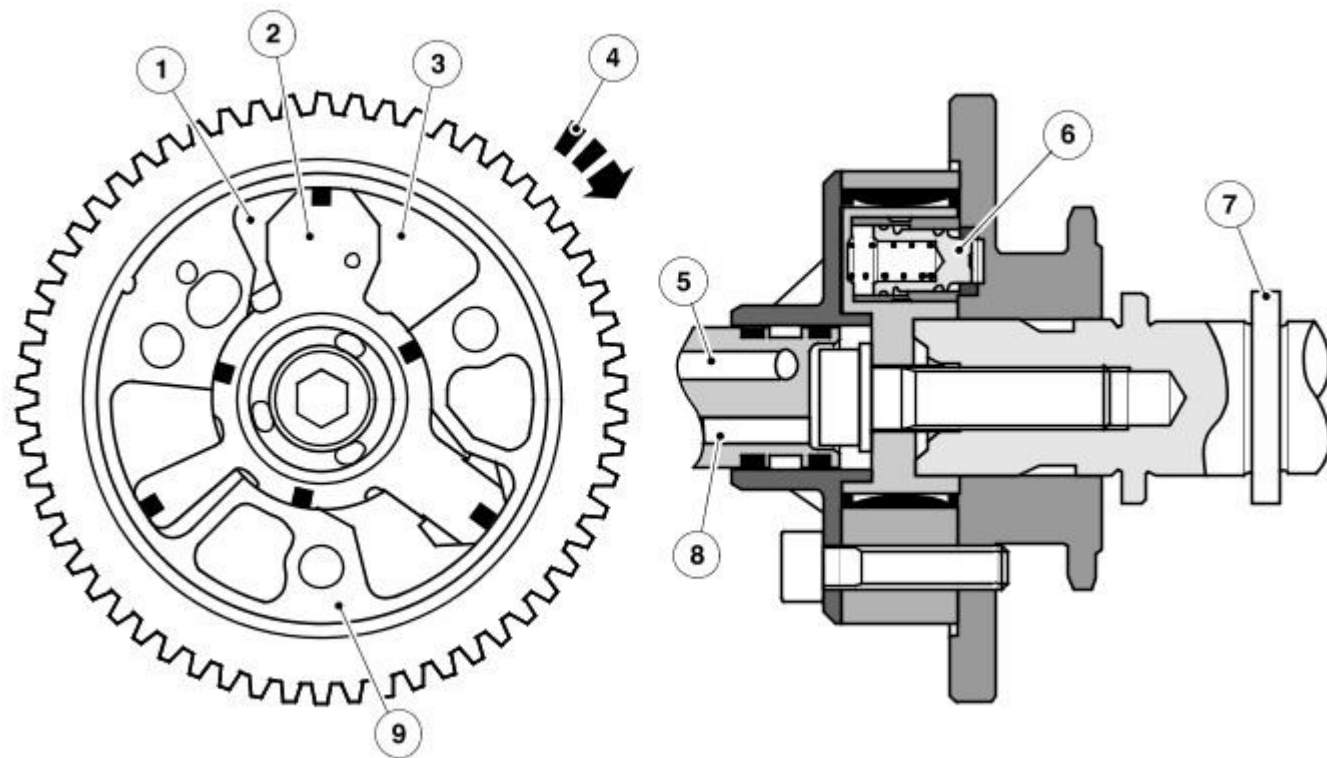
The [VVT](#) unit uses a vane type device to control the camshaft angle. The system operates over a range of 48 degrees and is advanced or retarded to its optimum position within this range.

The [VVT](#) system is controlled by the [ECM](#) based on engine load and speed along with engine oil temperature to calculate the appropriate camshaft position.

The [VVT](#) system provides the following advantages:

- Reduced engine emissions and improved fuel consumption which in turn improves the engines internal [EGR \(exhaust gas recirculation\)](#) effect over a wider operating range.
- Enhanced full load torque characteristics.
- Improved fuel economy through optimized torque over the engine speed range.

Variable Valve Timing Unit



E62237

**ItemDescription**

1	Vane housing
2	Vane shaft
3	Retard chamber
4	Rotation direction
5	Advance chamber oil channel
6	Stopper pin
7	Intake camshaft
8	Retard chamber oil channel
9	Advance chamber

The [VVT](#) unit is a hydraulic actuator mounted on the end of the intake camshaft. The unit advances or retards the camshaft timing to alter the camshaft to crankshaft phase. The [ECM](#) controls the [VVT](#) timing unit via an oil control solenoid. The oil control solenoid routes oil pressure to the advance or retard chambers either side of the vanes within the [VVT](#) unit.

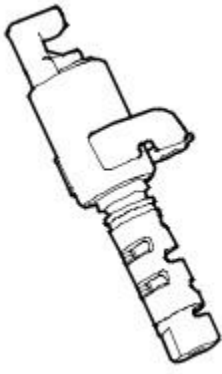
The [VVT](#) unit is driven by the primary drive chain and rotates relative to the exhaust camshaft. When the [ECM](#) requests a retard in camshaft timing the oil control solenoid is energized which moves the shuttle valve in the solenoid to the relevant position allowing oil pressure to flow out of the advance chambers in the [VVT](#) unit whilst simultaneously allowing oil pressure into the retard chambers.

The [ECM](#) controls the advancing and retarding of the [VVT](#) unit based on engine load and speed. The [ECM](#) sends an energize signal to the oil control solenoid until the desired [VVT](#) position is achieved. When the desired [VVT](#) position is reached, the energizing signal is reduced to hold the oil control solenoid position and consequently desired [VVT](#) position. This function is under closed loop control and the [ECM](#) can sense any variance in shuttle valve oil pressure via the camshaft position sensor and can adjust the energizing signal to maintain the shuttle valve hold position.

operation can be affected by engine oil temperature and properties. At very low oil temperatures the movement of the [VVT](#) mechanism will be slow due to the high viscosity of the oil. While at high oil temperatures the low oil viscosity may impair the [VVT](#) operation at low oil pressures. The oil pump has the capacity to cope with these variations in oil pressure while an oil temperature sensor is monitored by the [ECM](#) to provide oil temperature feedback. At extremely high oil temperatures the [ECM](#) may limit the amount of [VVT](#) advance in order to prevent the engine from stalling when returning to idle speed.

[VVT](#) does not operate when engine oil pressure is below 1.25 bar. This is because there is insufficient pressure to release the [VVT](#) units internal stopper pin. This occurs when the engine is shut down and the [VVT](#) unit has returned to the retarded position. The stopper pin locks the [VVT](#) unit to the camshaft to ensure camshaft stability during the next start up.

Valve Timing Solenoid



E47302

### Valve Timing Solenoid

The valve timing solenoid controls the position of the shuttle valve in the bush carrier. A plunger on the solenoid extends when the solenoid is energized and retracts when the solenoid is de-energized.

When the valve timing solenoids are de-energized, the coil springs in the bush carriers position the shuttle valves to connect the valve timing units to drain. In the valve timing units, the return springs hold the ring pistons and gears in the retarded position. When the valve timing solenoids are energized by the [ECM](#), the solenoid plungers position the shuttle valves to direct engine oil to the valve timing units. In the valve timing units, the oil pressure overcomes the force of the return springs and moves the gears and ring pistons to the advanced position. System response times are 1.0 second maximum for advancing and 0.7 second maximum for retarding. While the valve timing is in the retarded mode, the [ECM](#) produces a periodic lubrication pulse. This momentarily energizes the valve timing solenoids to allow a spurt of oil into the valve timing units. The lubrication pulse occurs once every 5 minutes.



# Electronic Engine Controls - V6 3.0L Petrol - Electronic Engine Controls

Diagnosis and Testing

## Principles of Operation

For a detailed description of the 3.0L petrol electronic engine controls, refer to the relevant Description and Operation section in the workshop manual. REFER to: (303-14B Electronic Engine Controls - V6 3.0L Petrol)

[Electronic Engine Controls](#) (Description and Operation),  
[Electronic Engine Controls](#) (Description and Operation),  
[Electronic Engine Controls](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.


### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Engine oil level and condition</li> <li>● Cooling system coolant level</li> <li>● Fuel level</li> <li>● Fuel contamination/grade/quality</li> <li>● Throttle body</li> <li>● Front End Accessory Drive (FEAD) belt</li> <li>● Air cleaner condition</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Wiring harness</li> <li>● Electrical connector(s)</li> <li>● Sensor(s)</li> <li>● Engine Control Module (ECM)</li> <li>● Transmission Control Module (TCM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the customer concern and refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
<b>Engine non-start</b> Engine does not crank	<ul style="list-style-type: none"> <li>● Security system/Immobilizer engaged</li> <li>● Engine in shut-down mode</li> <li>● ECM relay</li> <li>● Battery</li> <li>● Starting system</li> <li>● Engine seized</li> </ul>	<ul style="list-style-type: none"> <li>● Check that the security system is disarmed</li> <li>● Read DTCs and refer to DTC Index in this section for ECM relay tests</li> <li>● Ensure the battery is in fully charged and serviceable condition</li> <li>● For starting system tests. REFER to: <a href="#">Starting System</a> (303-06B Starting System - V6 3.0L Petrol, Diagnosis and Testing).</li> <li>● For engine system tests. REFER to: <a href="#">Engine</a> (303-01B Engine - V6 3.0L Petrol, Diagnosis and Testing).</li> </ul>
Engine cranks, but does not fire	<ul style="list-style-type: none"> <li>● Engine breather system disconnected/restricted</li> <li>● Ignition system</li> <li>● Fuel system</li> <li>● Electronic engine controls</li> </ul>	<ul style="list-style-type: none"> <li>● Ensure the engine breather system is free from restriction and is correctly installed</li> <li>● For ignition system tests. REFER to: <a href="#">Engine Ignition</a> (303-07A Engine Ignition - V6 3.0L Petrol, Diagnosis and Testing).</li> <li>● For fuel system tests. REFER to: <a href="#">Fuel Tank and Lines</a> (310-01B Fuel Tank and Lines - V6 3.0L Petrol, Diagnosis and Testing).</li> <li>● Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> </ul>
Engine cranks and fires, but will not start	<ul style="list-style-type: none"> <li>● Evaporative emissions purge valve</li> <li>● Fuel pump</li> <li>● Spark plugs</li> <li>● Ignition coil failure(s)</li> </ul>	<ul style="list-style-type: none"> <li>● For purge valve tests. REFER to: <a href="#">Evaporative Emissions - 3.0L</a> (303-13 Evaporative Emissions - 3.0L, Diagnosis and Testing).</li> <li>● For fuel system tests. REFER to: <a href="#">Fuel Tank and Lines</a> (310-01B Fuel Tank and Lines - V6 3.0L Petrol, Diagnosis and Testing).</li> <li>● For ignition system tests. REFER to: <a href="#">Engine Ignition</a> (303-07A Engine Ignition - V6 3.0L Petrol, Diagnosis and Testing).</li> </ul>
<b>Difficult to start</b> Difficult cold start	<ul style="list-style-type: none"> <li>● Check engine coolant level/anti-freeze content</li> <li>● Battery</li> <li>● Electronic engine controls</li> <li>● Exhaust gas recirculation (EGR) valve stuck open</li> <li>● Fuel pump</li> <li>● Evaporative emissions purge valve</li> </ul>	<ul style="list-style-type: none"> <li>● Check the engine coolant level and condition. REFER to: <a href="#">Specifications</a> (303-03B Engine Cooling - V6 3.0L Petrol, Specifications).</li> <li>● Ensure the battery is in a fully charged and serviceable condition</li> <li>● Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> <li>● For EGR valve tests. REFER to: <a href="#">Engine Emission Control</a> (303-08B Engine Emission Control - V6 3.0L Petrol, Diagnosis and Testing).</li> <li>● For fuel system tests.</li> </ul>

Symptom	Possible Cause	Action
Difficult hot start	<ul style="list-style-type: none"> <li>● Injector leak</li> <li>● Electronic engine controls</li> <li>● Evaporative emissions purge valve</li> <li>● Fuel pump</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> </ul>	<p>REFER to: <a href="#">Fuel Tank and Lines</a> (310-01B Fuel Tank and Lines - V6 3.0L Petrol, Diagnosis and Testing).</p> <ul style="list-style-type: none"> <li>● For purge valve tests.</li> </ul> <p>REFER to: <a href="#">Evaporative Emissions - 3.0L (303-13 Evaporative Emissions - 3.0L, Diagnosis and Testing)</a>.</p> <ul style="list-style-type: none"> <li>● Carry out injector leak tests, check and install new injectors as required.</li> </ul> <p>REFER to: <a href="#">Fuel Injectors</a> (303-04C Fuel Charging and Controls - V6 3.0L Petrol, Removal and Installation).</p> <ul style="list-style-type: none"> <li>● Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> <li>● For purge valve tests.</li> </ul> <p>REFER to: <a href="#">Evaporative Emissions - 3.0L (303-13 Evaporative Emissions - 3.0L, Diagnosis and Testing)</a>.</p> <ul style="list-style-type: none"> <li>● For fuel system tests.</li> </ul> <p>REFER to: <a href="#">Fuel Tank and Lines</a> (310-01B Fuel Tank and Lines - V6 3.0L Petrol, Diagnosis and Testing).</p> <ul style="list-style-type: none"> <li>● For ignition system tests.</li> </ul> <p>REFER to: <a href="#">Engine Ignition</a> (303-07A Engine Ignition - V6 3.0L Petrol, Diagnosis and Testing).</p> <ul style="list-style-type: none"> <li>● For EGR valve tests.</li> </ul> <p>REFER to: <a href="#">Engine Emission Control</a> (303-08B Engine Emission Control - V6 3.0L Petrol, Diagnosis and Testing).</p>
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	<ul style="list-style-type: none"> <li>● Injector leak</li> <li>● Electronic engine controls</li> <li>● Evaporative emissions purge valve</li> <li>● Fuel pump</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> </ul>	<ul style="list-style-type: none"> <li>● Carry out injector leak tests, check and install new injectors as required.</li> </ul> <p>REFER to: <a href="#">Fuel Injectors</a> (303-04C Fuel Charging and Controls - V6 3.0L Petrol, Removal and Installation).</p> <ul style="list-style-type: none"> <li>● Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> <li>● For purge valve tests.</li> </ul> <p>REFER to: <a href="#">Evaporative Emissions - 3.0L (303-13 Evaporative Emissions - 3.0L, Diagnosis and Testing)</a>.</p> <ul style="list-style-type: none"> <li>● For fuel system tests.</li> </ul> <p>REFER to: <a href="#">Fuel Tank and Lines</a> (310-01B Fuel Tank and Lines - V6 3.0L Petrol, Diagnosis and Testing).</p> <ul style="list-style-type: none"> <li>● For ignition system tests.</li> </ul> <p>REFER to: <a href="#">Engine Ignition</a> (303-07A Engine Ignition - V6 3.0L Petrol, Diagnosis and Testing).</p> <ul style="list-style-type: none"> <li>● For EGR valve tests.</li> </ul> <p>REFER to: <a href="#">Engine Emission Control</a> (303-08B Engine Emission Control - V6 3.0L Petrol, Diagnosis and Testing).</p>
Engine cranks too fast/slow	<ul style="list-style-type: none"> <li>● Compressions high/low</li> <li>● Battery</li> <li>● Starting system</li> </ul>	<ul style="list-style-type: none"> <li>● Carry out cylinder compression tests</li> <li>● Ensure battery is in a fully charged and serviceable condition</li> <li>● For starting system tests.</li> </ul> <p>REFER to: <a href="#">Starting System</a> (303-06B Starting System - V6 3.0L Petrol, Diagnosis and Testing).</p>
<b>Engine stalls</b>		
Engine stalls soon after start	<ul style="list-style-type: none"> <li>● Breather system disconnected/restricted</li> <li>● ECM relay</li> <li>● Electronic engine controls</li> <li>● Ignition system</li> <li>● Air intake system restricted</li> <li>● Air leakage</li> <li>● Fuel lines</li> </ul>	<ul style="list-style-type: none"> <li>● Ensure the engine breather system is free from restriction and is correctly installed</li> <li>● Read DTCs and refer to DTC Index in this section for ECM relay tests</li> <li>● Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> <li>● For ignition system tests.</li> </ul> <p>REFER to: <a href="#">Engine Ignition</a> (303-07A Engine Ignition - V6 3.0L Petrol, Diagnosis and Testing).</p> <ul style="list-style-type: none"> <li>● Check for blockage in air cleaner element and air intake system</li> <li>● Check for leakage in air intake system</li> <li>● For fuel system tests.</li> </ul> <p>REFER to: <a href="#">Fuel Tank and Lines</a> (310-01B Fuel Tank and Lines - V6 3.0L Petrol, Diagnosis and Testing).</p>
Engine stalls on overrun	<ul style="list-style-type: none"> <li>● ECM relay</li> <li>● Throttle position (TP) sensors</li> </ul>	<ul style="list-style-type: none"> <li>● Read DTCs and refer to DTC Index in this section for ECM relay and TP sensor tests</li> </ul>
Engine stalls at steady speed	<ul style="list-style-type: none"> <li>● ECM relay</li> <li>● CKP sensor</li> <li>● TP sensors</li> </ul>	<ul style="list-style-type: none"> <li>● Read DTCs and refer to DTC Index in this section for ECM relay, CKP, and TP sensor tests</li> </ul>
Engine stalls with speed control enabled	<ul style="list-style-type: none"> <li>● ECM relay</li> </ul>	<ul style="list-style-type: none"> <li>● Read DTCs and refer to DTC Index in this section for ECM relay tests</li> </ul>
<p>Engine stalls when manoeuvring</p> <p><b>DTC Index</b></p>  <p><b>CAUTION:</b> When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.</p> <p>• NOTE: If the module or a component is suspect and the vehicle remains under the Manufacturer's warranty, refer to the Warranty, Service and Procedure manual (section B1.2), or determine if any prior approval programme is in place, prior to the Check and installation of a new module/component.</p> <p>• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes.</p>	<ul style="list-style-type: none"> <li>● ECM relay</li> <li>● TP sensors</li> <li>● Additional engine loads (power steering, air conditioning, etc)</li> <li>● Transmission malfunction</li> <li>● CAN malfunction</li> </ul>	<ul style="list-style-type: none"> <li>● Read DTCs and refer to DTC Index in this section for ECM relay, and TP sensor tests</li> <li>● Check for excessive loads being placed on the engine from power steering, air conditioning systems etc.</li> <li>● For transmission system tests</li> </ul> <p>REFER to: <a href="#">Diagnostic Strategy</a> (307-01 Automatic Transmission/Transaxle - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TD V6 2.7L Diesel, Diagnosis and Testing).</p> <ul style="list-style-type: none"> <li>● For CAN network tests.</li> </ul> <p>REFER to: <a href="#">Communications Network</a> (418-00 Module Communications Network, Diagnosis and Testing)</p>

first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B10A231	Crash Input	<ul style="list-style-type: none"> <li>No signal</li> </ul>	Refer to the electrical circuit diagrams and check RCM PWM signal circuit for short, open circuit
B11DB01	Battery Monitoring Module	<ul style="list-style-type: none"> <li>Battery monitoring system hardware fault</li> </ul>	Disconnect vehicle battery, re-connect after 60 seconds, clear DTC and retest. If DTC remains Check and install a new battery monitoring module
B11DB87	Battery Monitoring Module	<ul style="list-style-type: none"> <li>Battery monitoring module connector dis-connected/poor connection</li> <li>Battery monitoring module to RJB LIN circuit - open circuit</li> <li>Battery monitoring module to battery positive monitor circuit - open circuit</li> <li>Battery monitoring module/RJB failure</li> </ul>	If additional DTCs B108783, B108786, B108787 are logged, suspect the RJB. Check and Check and install a new RJB as required, refer to the new module/component Check and installation note at the top of the DTC Index. If additional DTCs B108783, B108786, B108787 are NOT logged, check for good/clean contact at battery monitoring module connector, refer to electrical circuit diagrams and check battery monitoring module to RJB LIN circuit and battery monitoring module to battery positive monitor circuit for open circuit. Clear DTC and repeat automated diagnostic procedure using manufacturer approved diagnostic system. If DTC remains suspect the battery monitoring module, check and Check and install a new battery monitoring module as required, refer to the new module/component Check and installation note at the top of the DTC Index
B120668	Crash Occurred	<ul style="list-style-type: none"> <li>ECM has detected the vehicle has crashed - event information DTC only</li> </ul>	Check RCM for related DTCs and refer to the relevant DTC Index
C003100	Left Front Wheel Speed Sensor	<ul style="list-style-type: none"> <li>Invalid data received from ABS - left front wheel speed signal</li> </ul>	Check ABS module for related DTCs and refer to relevant DTC Index
C003400	Right Front Wheel Speed Sensor	<ul style="list-style-type: none"> <li>Invalid data received from ABS - right front wheel speed signal</li> </ul>	Check ABS module for related DTCs and refer to relevant DTC Index
C003700	Left Rear Wheel Speed Sensor	<ul style="list-style-type: none"> <li>Invalid data received from ABS - left rear wheel speed signal</li> </ul>	Check ABS module for related DTCs and refer to relevant DTC Index
C003A00	Right Rear Wheel Speed Sensor	<ul style="list-style-type: none"> <li>Invalid data received from ABS - right rear wheel speed signal</li> </ul>	Check ABS module for related DTCs and refer to relevant DTC Index
P001100	Intake (A) Camshaft Position Timing - Over-Advanced (Bank 1)	<ul style="list-style-type: none"> <li>Variable Camshaft Timing (VCT) circuit fault</li> <li>Valve timing incorrectly set</li> <li>Timing chain has slipped</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check VCT circuits for short, open circuit. Check the valve timing
P001200	Intake (A) Camshaft Position Timing - Over-Retarded (Bank 1)	<ul style="list-style-type: none"> <li>Variable Camshaft Timing (VCT) circuit fault</li> <li>Valve timing incorrectly set</li> <li>Timing chain has slipped</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check VCT circuits for short, open circuit. Check the valve timing
P001600	Crankshaft Position - Camshaft Position Correlation - Bank 1 Sensor A	<ul style="list-style-type: none"> <li>The relative positions of the CKP and CMP teeth are not correct - Sensors incorrectly aligned on rebuild</li> </ul>	Reset the sensor positions
P001800	Crankshaft Position - Camshaft Position Correlation - Bank 2 Sensor A	<ul style="list-style-type: none"> <li>The relative positions of the CKP and CMP teeth are not correct - Sensors incorrectly aligned on rebuild</li> </ul>	Reset the sensor positions
P002100	Intake (A) Camshaft Position Timing - Over-Advanced (Bank 2)	<ul style="list-style-type: none"> <li>Variable Camshaft Timing (VCT) circuit fault</li> <li>Valve timing incorrectly set</li> <li>Timing chain has slipped</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check VCT circuits for short, open circuit. Check the valve timing
P002200	Intake (A) Camshaft Position Timing - Over-Retarded (Bank 2)	<ul style="list-style-type: none"> <li>Variable Camshaft Timing (VCT) circuit fault</li> <li>Valve timing incorrectly set</li> <li>Timing chain has slipped</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check VCT circuits for short, open circuit. Check the valve timing
P002672	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	<ul style="list-style-type: none"> <li>VCT solenoid fault</li> <li>Oil contamination</li> <li>VCT oil flow fault</li> <li>VCT/Camshaft mechanical failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check VCT circuits for short, open circuit. Check the oil condition and flow. Check for mechanical failure of components
P002677	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	<ul style="list-style-type: none"> <li>VCT solenoid fault</li> <li>Oil contamination</li> <li>VCT oil flow fault</li> <li>VCT/Camshaft mechanical failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check VCT circuits for short, open circuit. Check the oil condition and flow. Check for mechanical failure of components

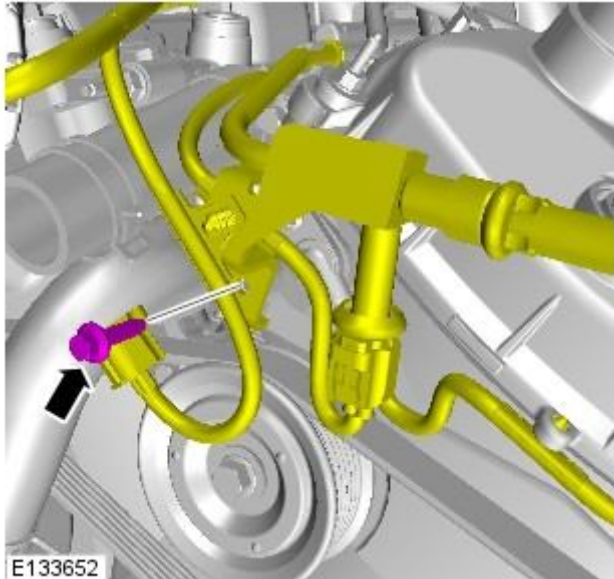
# Electronic Engine Controls - V6 3.0L Petrol - Camshaft Position (CMP) Sensor LH

## Removal and Installation

### Removal

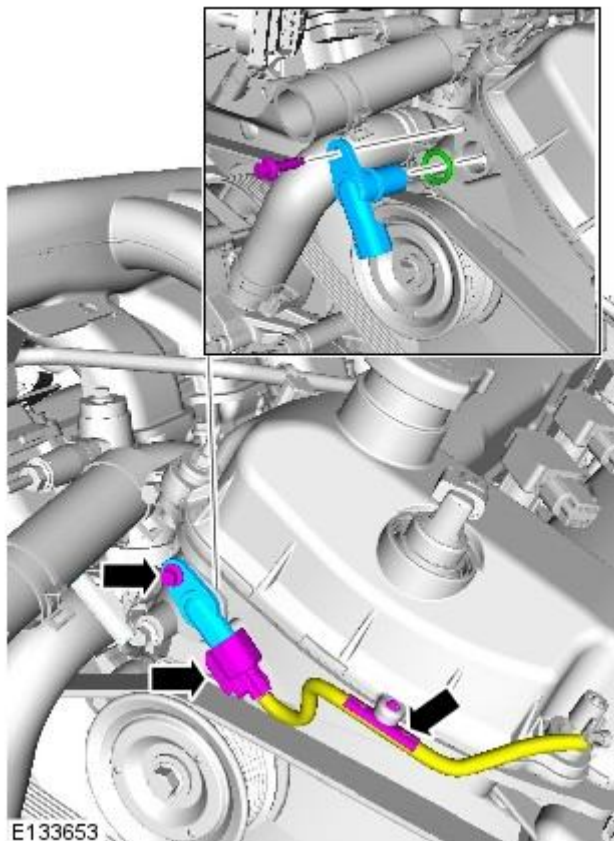
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.
- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.  
For additional information, refer to: Battery Disconnect and Connect (414-01, General Procedures).
2. Remove the air cleaner outlet pipe.  
For additional information, refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - V6 3.0L Petrol, Removal and Installation).
3. TORQUE: 12 Nm



4.  CAUTION: A new O-ring seal is to be installed.

TORQUE: 7 Nm



### Installation

1. To install, reverse the removal procedure.

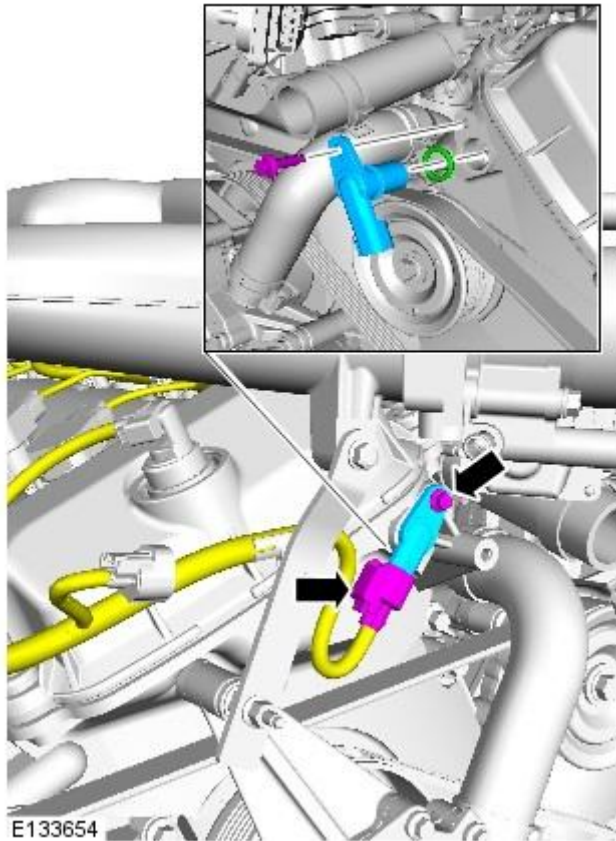
# Electronic Engine Controls - V6 3.0L Petrol - Camshaft Position (CMP) Sensor RH

## Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.
- NOTE: Some illustrations may show the engine removed for clarity.

1. Disconnect the battery ground cable.  
For additional information, refer to: Battery Disconnect and Connect (414-01, General Procedures).
2. Remove the throttle body.  
For additional information, refer to: [Throttle Body](#) (303-04C Fuel Charging and Controls - V6 3.0L Petrol, Removal and Installation).
3. TORQUE: 7 Nm



### Installation

1. To install, reverse the removal procedure.



# Electronic Engine Controls - V6 3.0L Petrol - Catalyst Monitor Sensor

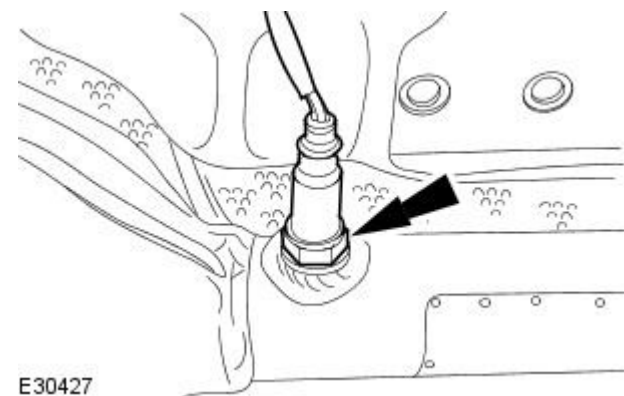
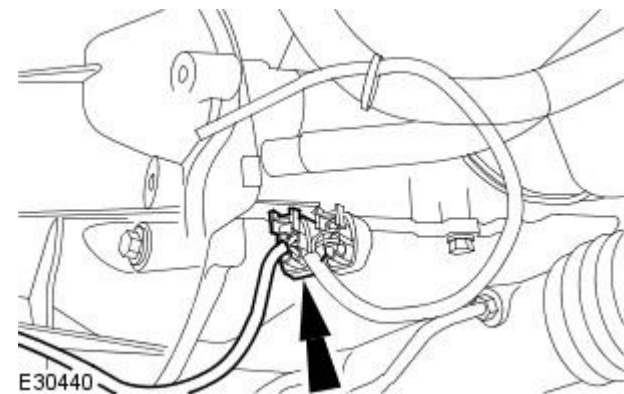
Removal and Installation


## General Equipment

Snap-on tool S6176

## Removal


1. Raise and support the vehicle.  
For additional information, refer to Section [100-02 Jacking and Lifting](#).
2. Disconnect the catalyst monitor sensor.



3.  CAUTION: Make sure the wiring harness is not twisted or damaged on removal. Failure to follow this instruction may result in damage to the vehicle.

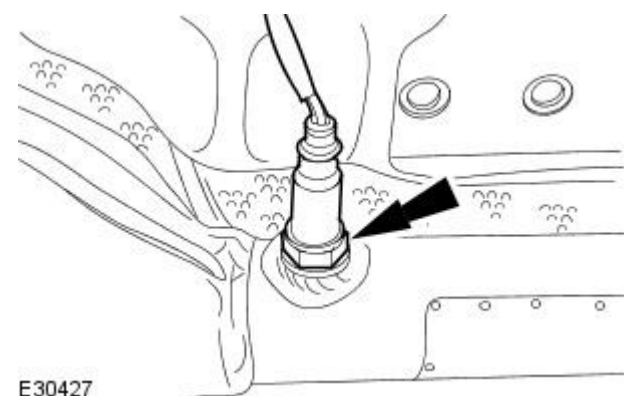
Using the Snap-on tool S6176, remove the catalyst monitor sensor.

## Installation

1.  CAUTION: Make sure the wiring harness is not twisted or damaged on installation. Failure to follow this instruction may result in damage to the vehicle.

To install, reverse the removal procedure.

- Tighten to 45 Nm.




E30427

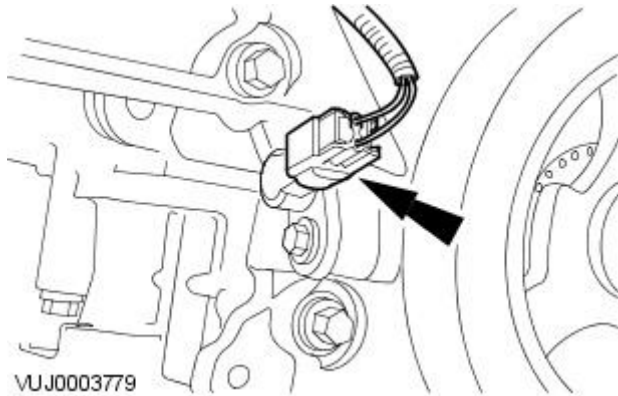


# Electronic Engine Controls - V6 3.0L Petrol - Crankshaft Position (CKP) Sensor

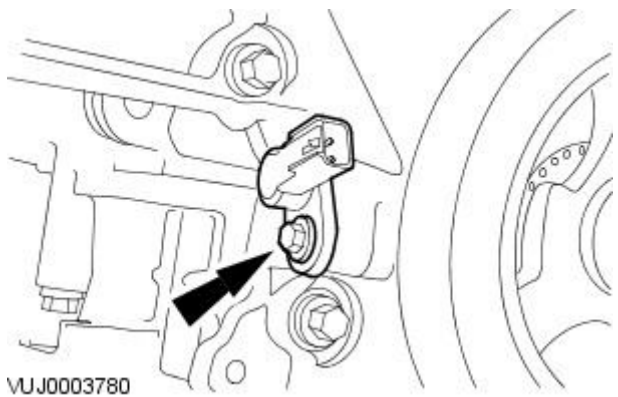
Removal and Installation

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Make sure to support the vehicle with axle stands.  
  
Raise and support the vehicle.
3. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
4. Disconnect the crankshaft position (CKP) sensor electrical connector.

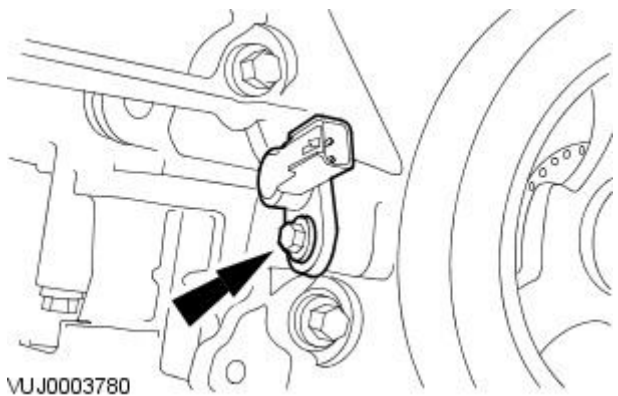


5. Remove the CKP sensor.



## Installation

1. To install, reverse the removal procedure.
  - Tighten to 10 Nm.



# Electronic Engine Controls - V6 3.0L Petrol - Engine Control Module (ECM)

Removal and Installation

## Removal

All vehicles

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the cowl vent screen.  
For additional information, refer to: [Cowl Vent Screen](#) (501-02 Front End Body Panels, Removal and Installation).

Right-hand drive vehicles

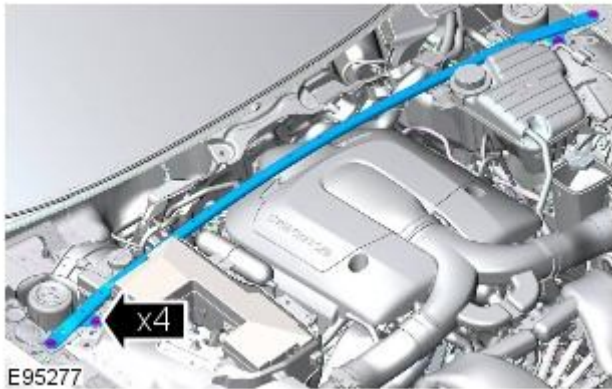
3. Remove the secondary bulkhead LH panel.  
For additional information, refer to: [Secondary Bulkhead Panel LH - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel](#) (501-02 Front End Body Panels, Removal and Installation).

Left-hand drive vehicles

4. Remove the secondary bulkhead RH panel.  
For additional information, refer to: [Secondary Bulkhead Panel RH - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel](#) (501-02 Front End Body Panels, Removal and Installation).

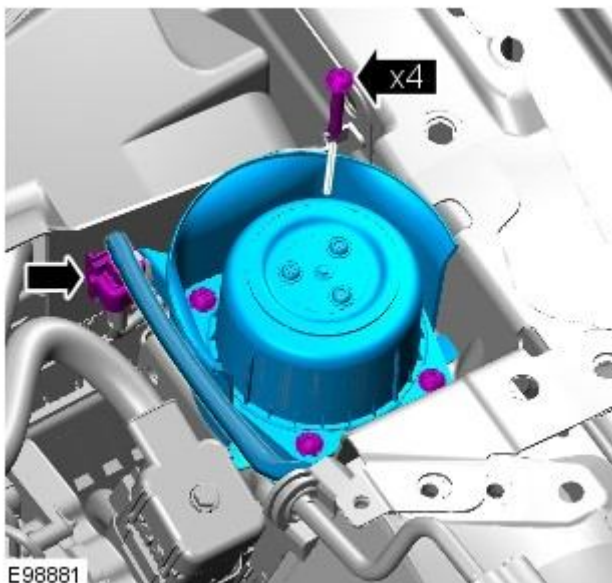
All vehicles

5. Remove the engine compartment brace.



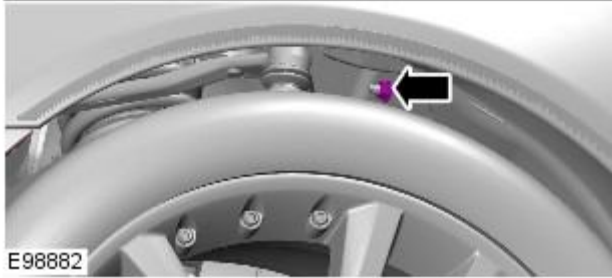
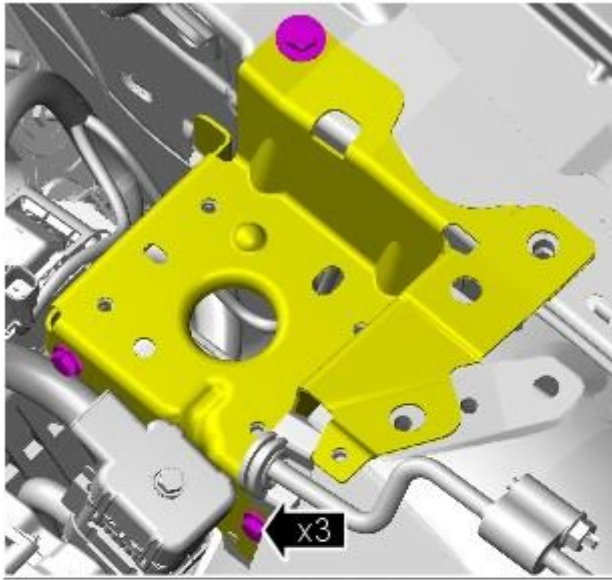
6. NOTE: Left-hand shown, right-hand similar.

Remove the pedestrian protection actuator.



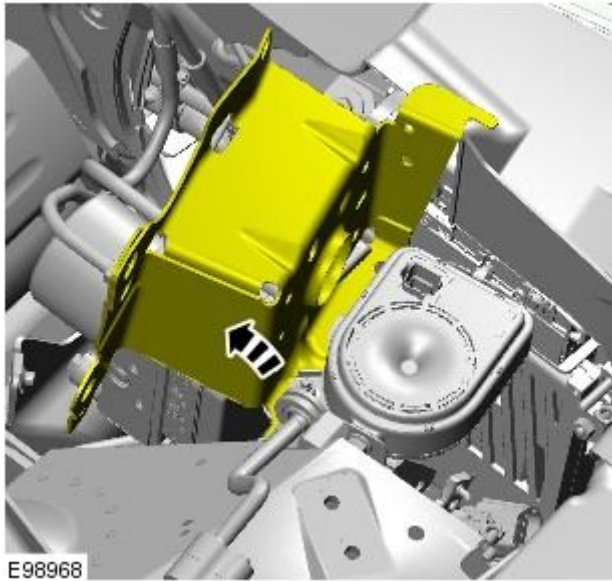
7. NOTE: Left-hand shown, right-hand similar.

Release the pedestrian protection actuator bracket.



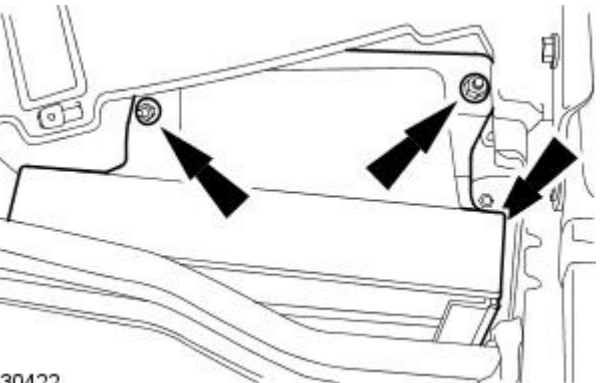
8. NOTE: Left-hand shown, right-hand similar.

Reposition the pedestrian protection actuator bracket.



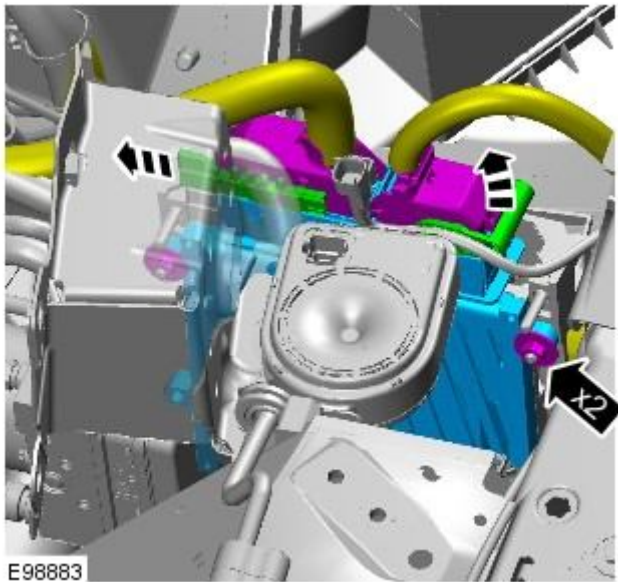
9. NOTE: Left-hand shown, right-hand similar.

Remove the engine control module (ECM) cover.



10. NOTE: Left-hand shown, right-hand similar.

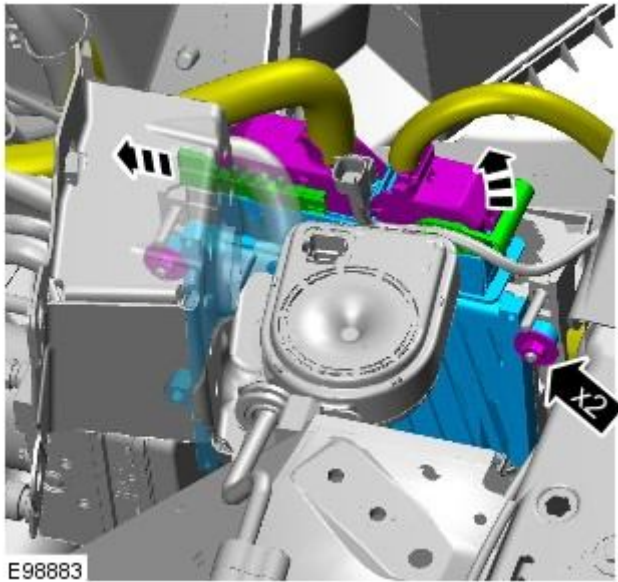
Remove the ECM.



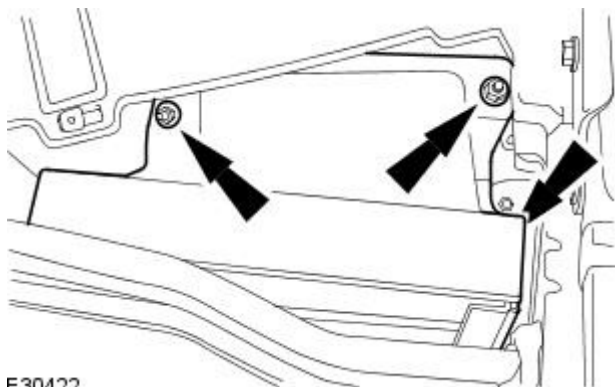
### Installation

1. Install is the reverse of removal.

- Tighten to 10 Nm.

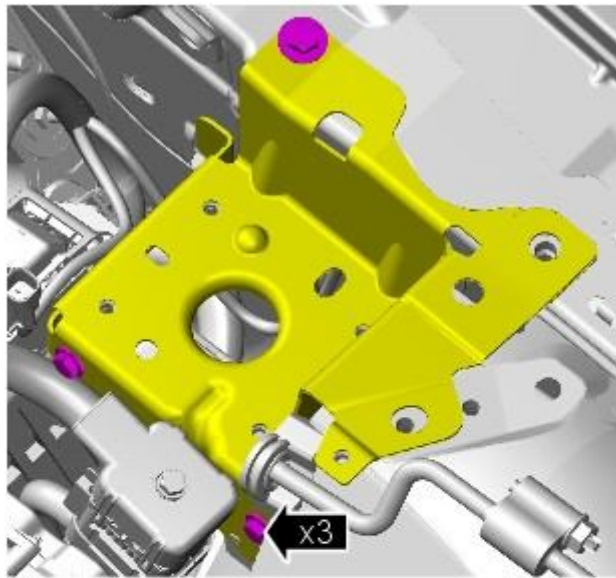


2. Tighten to 6 Nm.



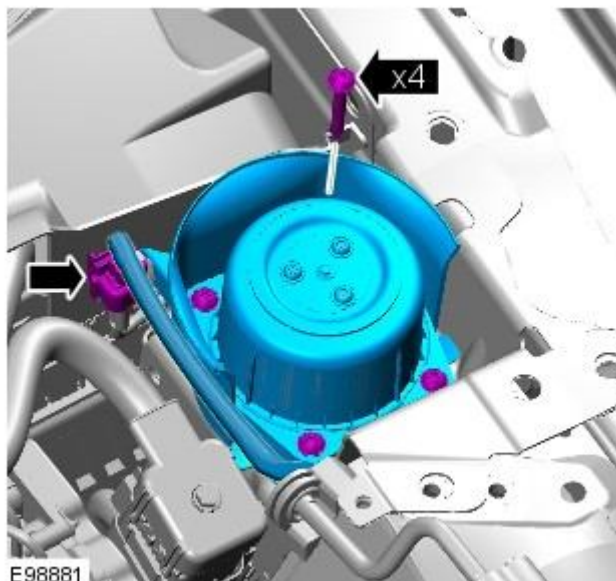


3. Tighten to 25 Nm.



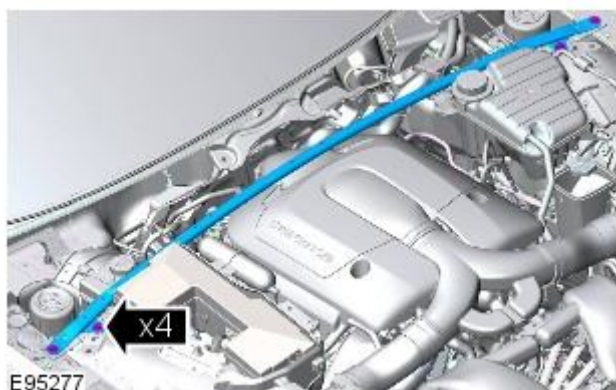
E98882

4. Tighten to 8 Nm.



E98881

5. Tighten to 25 Nm.




E95277

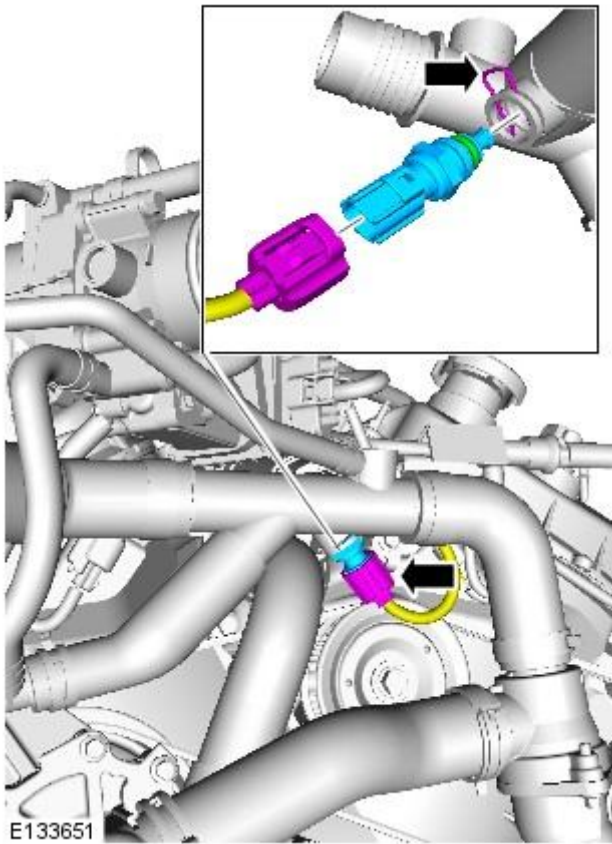
# Electronic Engine Controls - V6 3.0L Petrol - Engine Coolant Temperature (ECT) Sensor Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
2. Refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03C Engine Cooling - V8 4.2L Petrol/V8 S/C 4.2L Petrol, General Procedures).
3. Refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - V6 3.0L Petrol, Removal and Installation).

4.  **CAUTION:** A new O-ring seal is to be installed.



## Installation

1. To install, reverse the removal procedure.



# Electronic Engine Controls - V6 3.0L Petrol - Fuel Temperature Sensor

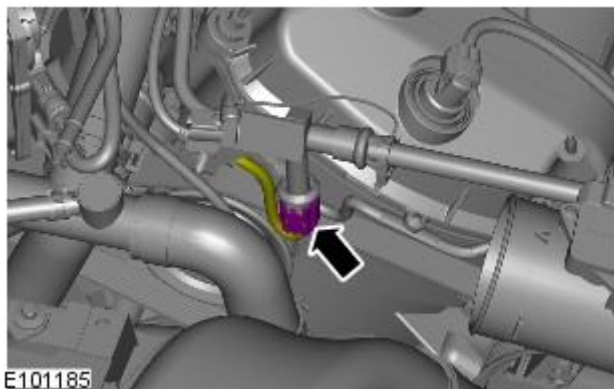
## Removal and Installation

### Removal

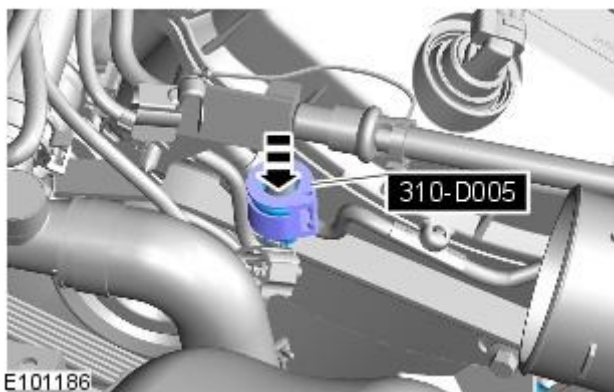
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Fuel System Pressure Release - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol](#) (310-00 Fuel System - General Information, General Procedures).
3. Refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - V6 3.0L Petrol, Removal and Installation).

4.



5.



### Installation

1. To install, reverse the removal procedure.

# Electronic Engine Controls - V6 3.0L Petrol - Heated Oxygen Sensor (HO2S)


Removal and Installation

## General Equipment

Snap-on tool S6176

## Removal

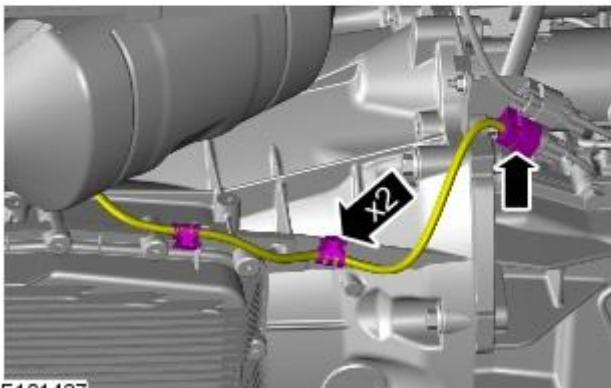
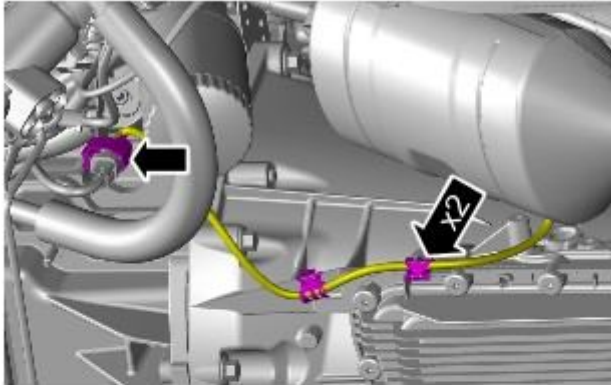
1. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

2.  **WARNING:** Make sure to support the vehicle with axle stands.  
Raise and support the vehicle.


3.  **CAUTION:** Note the fitted position of the component prior to removal.

Disconnect the heated oxygen sensor (HO2S) electrical connector.

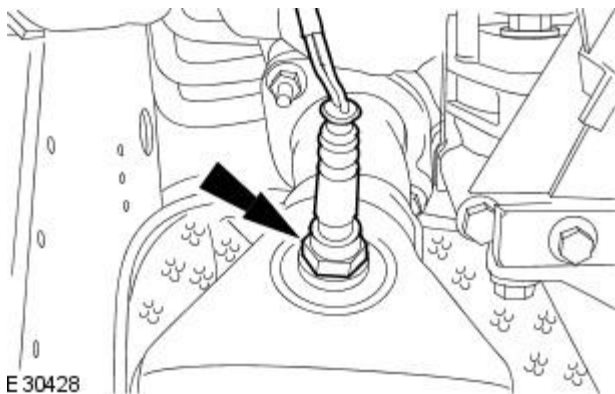
- Release the harness from the two clips.



E101437

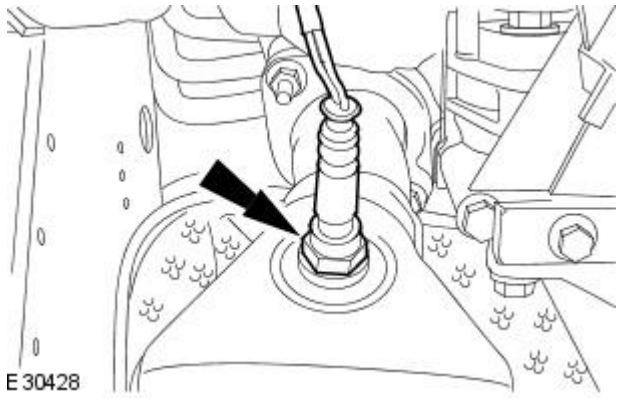
4.  **CAUTION:** Make sure that the wiring harness is not twisted or damaged on removal. Failure to follow this instruction may result in damage to the vehicle.


Using the Snap-on tool S6176, remove the HO2S.



E30428

## Installation



1.  CAUTION: Make sure that the wiring harness is not twisted or damaged on installation. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Apply lubricant meeting specification ESE-M12A4-A (Never-Seez Pure Nickel Special) to the thread of the HO2S.

• NOTE: Care must be taken not to contaminate the sensitive areas of the HO2S.

To install, reverse the removal procedure.

- Tighten to 45 Nm.

2. NOTE: For NAS vehicles only.

If required, carry out a long drive cycle.

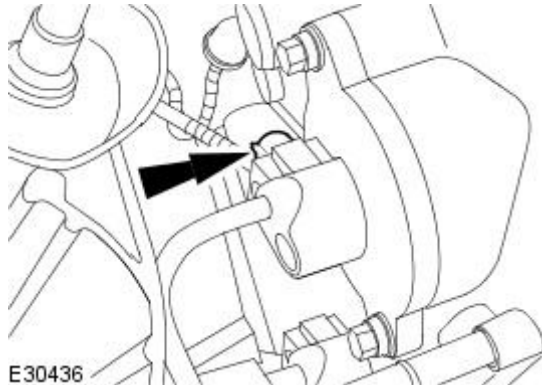
For additional information, refer to: Powertrain Control Module (PCM) Long Drive Cycle Self-Test (303-14C, General Procedures).

# Electronic Engine Controls - V6 3.0L Petrol - Intake Manifold Tuning (IMT) Valve LH

Removal and Installation

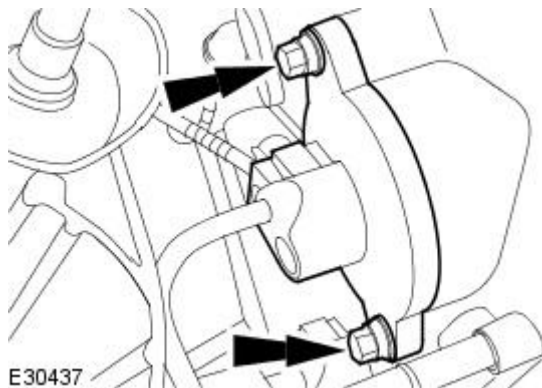
## Removal

1. Remove the secondary bulkhead center panel.  
For additional information, refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).
2. Disconnect the intake manifold tuning (IMT) valve electrical connector.



E30436

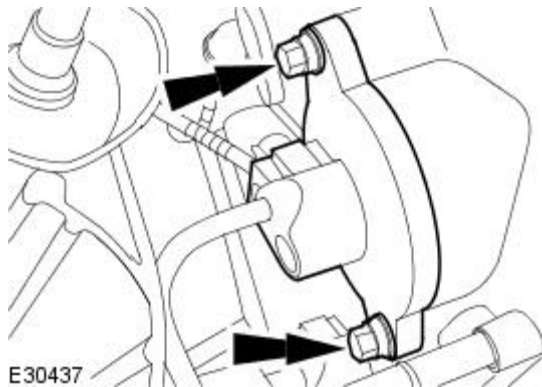
3. Remove the IMT valve.
  - Remove and discard the O-ring seal.



E30437

## Installation

1. To install, reverse the removal procedure.
  - Install a new O-ring seal.
  - Tighten to 10 Nm.



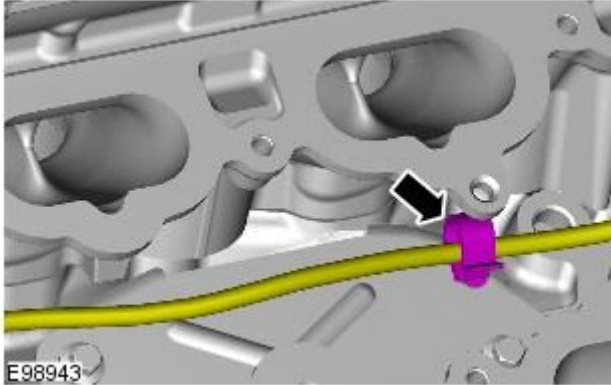
E30437

# Electronic Engine Controls - V6 3.0L Petrol - Knock Sensor (KS) LH

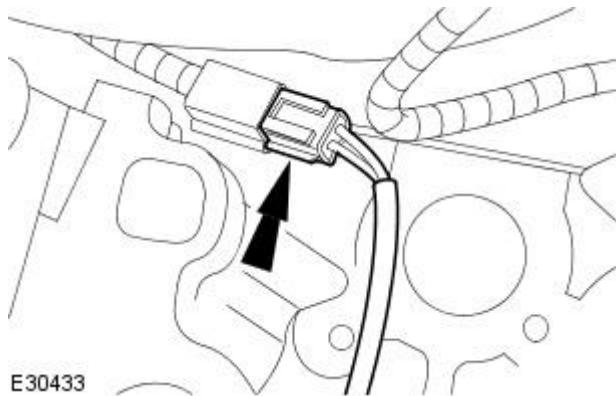
Removal and Installation

## Removal

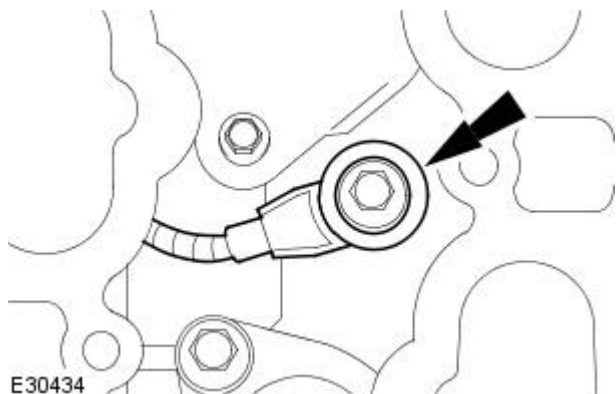
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the fuel injection supply manifold.  
For additional information, refer to: [Fuel Injection Supply Manifold](#) (303-04C Fuel Charging and Controls - V6 3.0L Petrol, Removal and Installation).
3. Detach the knock sensor (KS) electrical harness from the clip.



4. Disconnect the KS electrical connector.

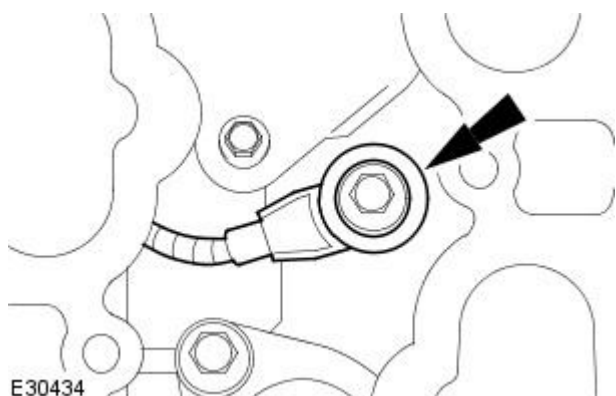


5. Remove the KS.



## Installation

1. To install, reverse the removal procedure.
  - Tighten to 25 Nm



# Electronic Engine Controls - V6 3.0L Petrol - Knock Sensor (KS) RH

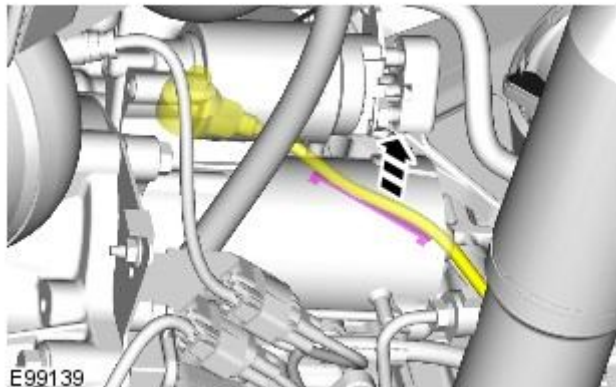
Removal and Installation

## Removal

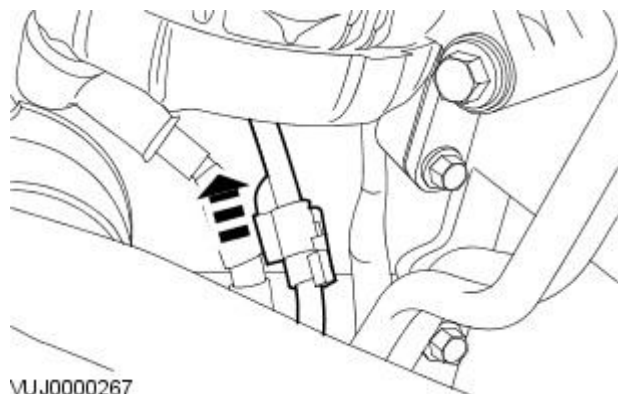
1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

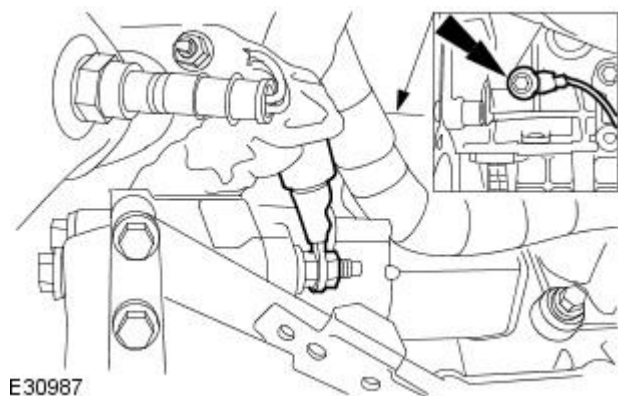
2. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
3. Release the knock sensor (KS) electrical harness from the engine cylinder block.



4. Disconnect the KS electrical connector.



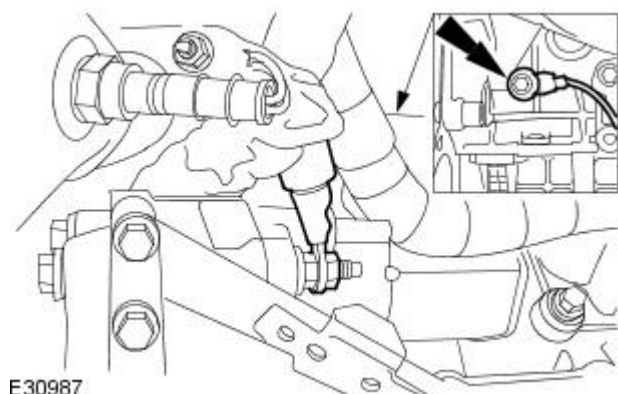
5. Remove the KS.



## Installation

1. To install, reverse the removal procedure.

- Tighten to 25 Nm.



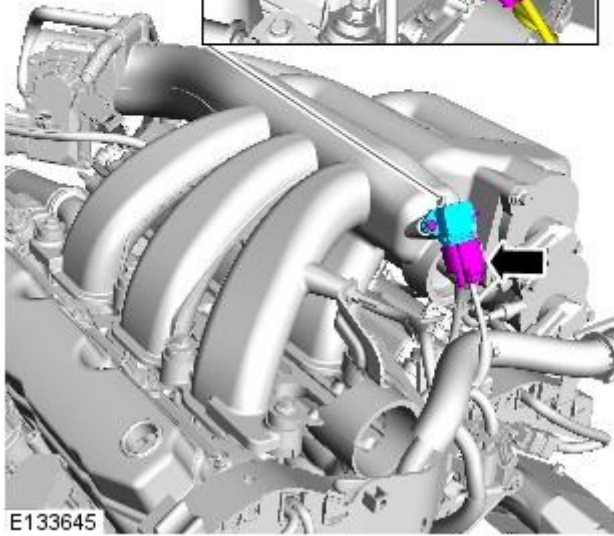
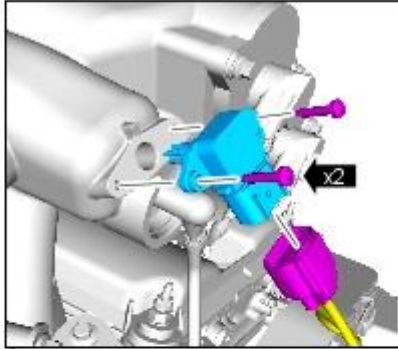


# Electronic Engine Controls - V6 3.0L Petrol - Manifold Absolute Pressure (MAP) Sensor Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.
- NOTE: Some illustrations may show the engine removed for clarity.

1. TORQUE: 3 Nm



## Installation

1. To install, reverse the removal procedure.

# Electronic Engine Controls - V6 3.0L Petrol - Mass Air Flow (MAF) Sensor

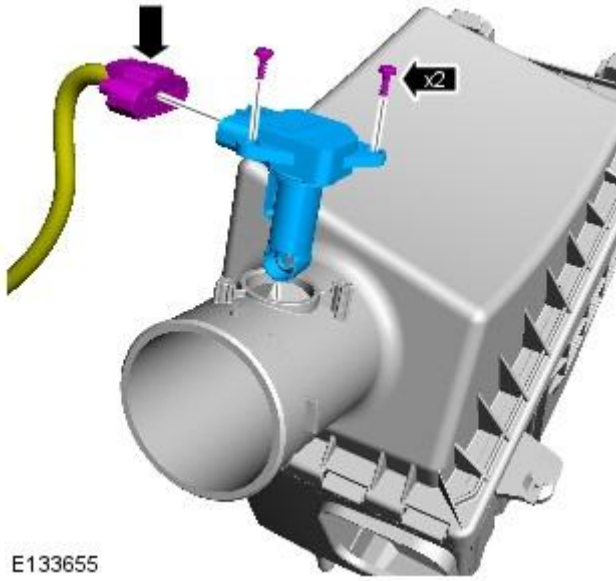
## Removal and Installation

### Removal

- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. NOTE: Remove and discard the O-ring seal.

TORQUE: 1.2 Nm



### Installation

1. NOTE: Install a new O-ring seal.

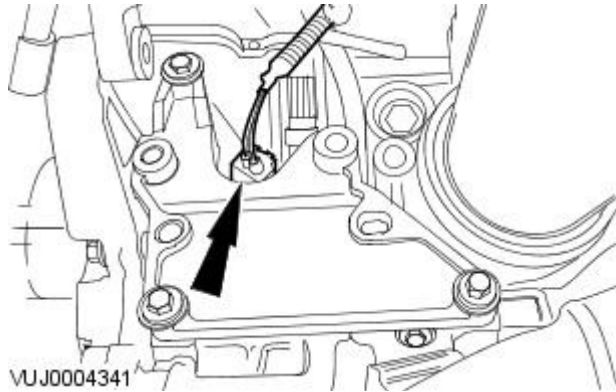
To install, reverse the removal procedure.

# Electronic Engine Controls - V6 3.0L Petrol - Oil Temperature Sensor

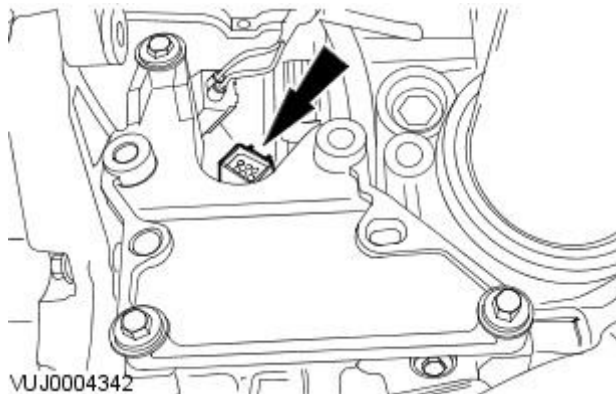
Removal and Installation

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Raise and support the vehicle.
3. Remove the air conditioning (A/C) compressor.  
For additional information, refer to: [Air Conditioning \(A/C\) Compressor - V6 3.0L Petrol](#) (412-03 Air Conditioning, Removal and Installation).
4. Disconnect the oil temperature sensor electrical connector.



5. Remove the oil temperature sensor.

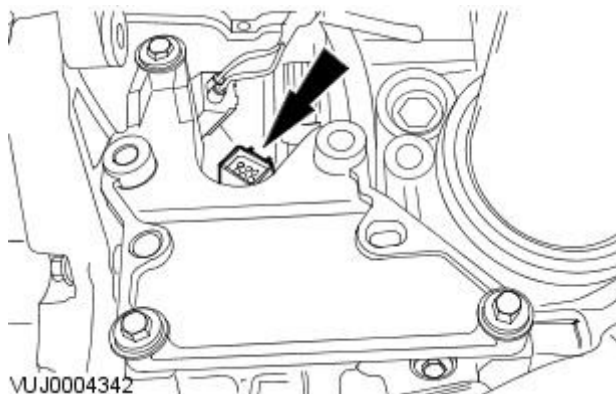


## Installation

1. **NOTE:** If the oil temperature sensor is to be re-used apply a small bead of sealant meeting Jaguar specification on the first three threads of the oil temperature sensor.

To install, reverse the removal procedure.

- Tighten to 15 Nm.



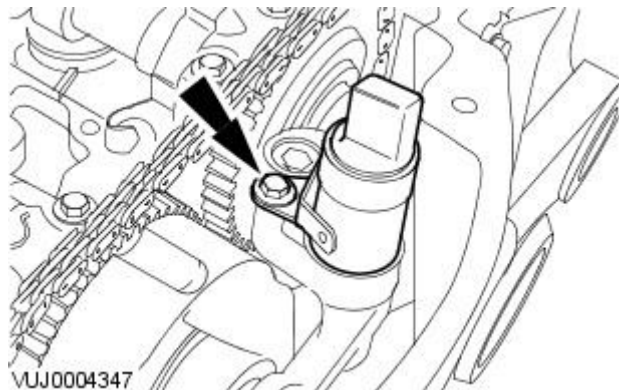
# Electronic Engine Controls - V6 3.0L Petrol - Variable Camshaft Timing (VCT) Oil

## Control Solenoid

### Removal and Installation

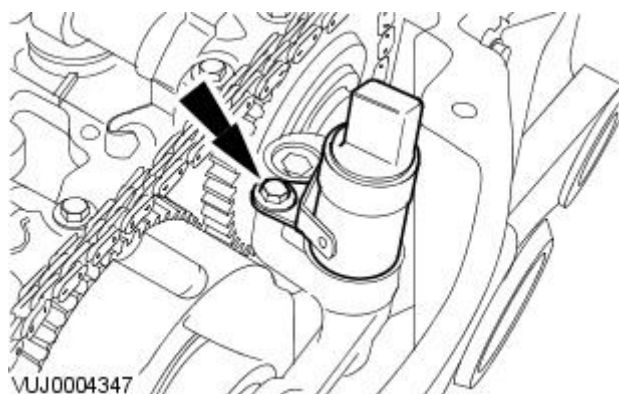
#### Removal

1. Remove the valve cover.  
For additional information, refer to: [Valve Cover RH](#) (303-01B Engine - V6 3.0L Petrol, In-vehicle Repair).
2. Remove the variable camshaft timing (VCT) oil control solenoid.



#### Installation

1. To install, reverse the removal procedure.
  - Tighten to 10 Nm.



2. **NOTE:** For NAS vehicles only.

If required, carry out a short drive cycle.

For additional information, refer to: Powertrain Control Module (PCM) Short Drive Cycle Self-Test (303-14C, General Procedures).

**Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 -****Torque Specifications**

<b>Description</b>	<b>Nm</b>	<b>lb-ft</b>	<b>lb-in</b>
Camshaft position (CMP) sensor retaining bolt	7	-	62
Heated oxygen sensor (HO2S)	40	30	-
Catalyst monitor sensor	40	30	-
Crankshaft position (CKP) sensor retaining bolt	7	-	62
Knock sensor retaining bolt	25	18	-
Fuel temperature sensor	7	-	62
Intake air temperature (IAT) sensor	35	26	-
Engine coolant temperature (ECT) sensor	17	13	-
Manifold absolute pressure (MAP) sensor	10	7	-
Oil temperature sensor	15	11	-

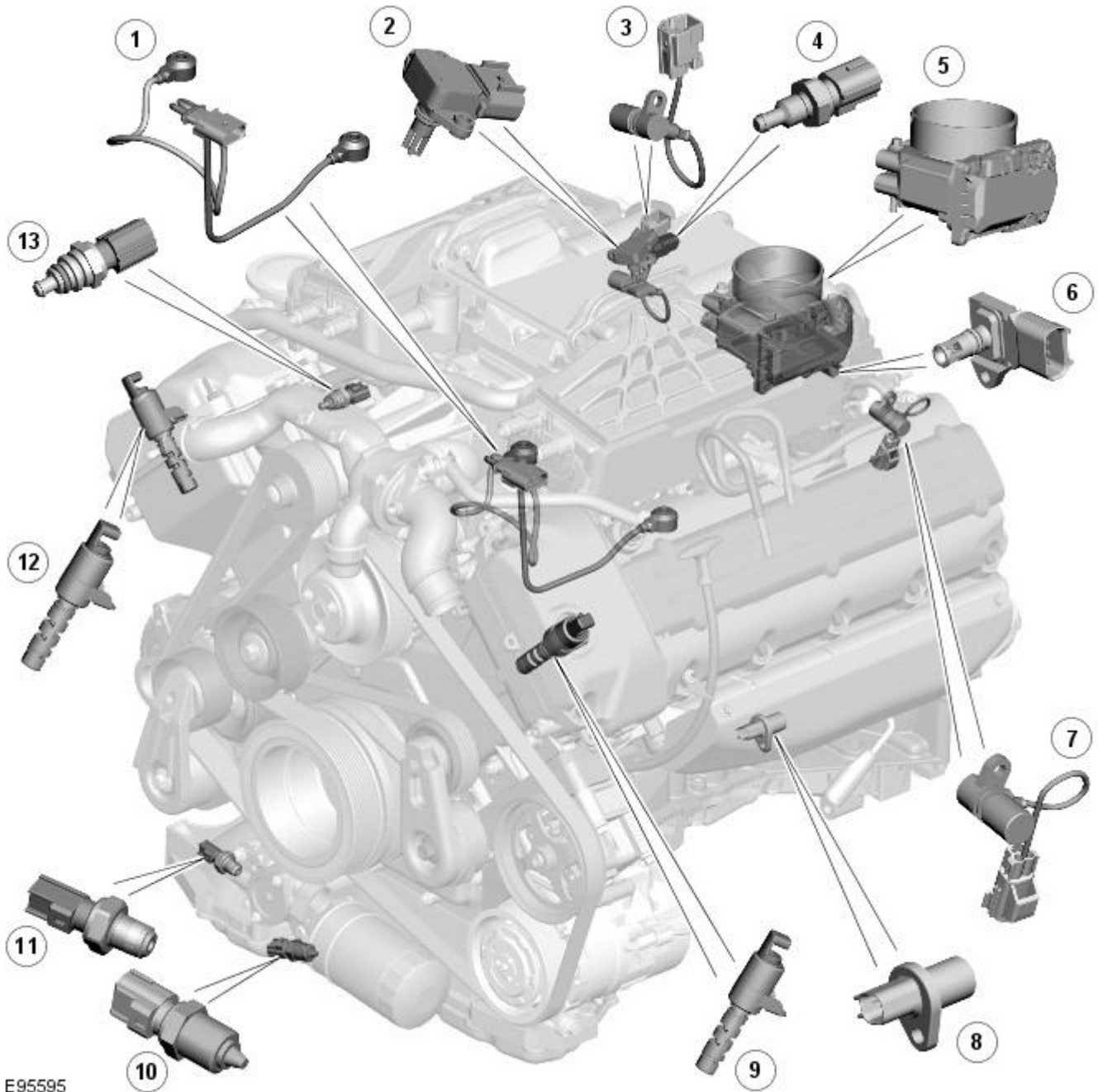
**Lubricants, fluids, sealers and adhesives**

<b>Description</b>	<b>Specification</b>
Sealant	WSK-M4G-328-A3

# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Electronic Engine Controls - Component Location

Description and Operation

COMPONENT LOCATION SHEET 1 OF 2

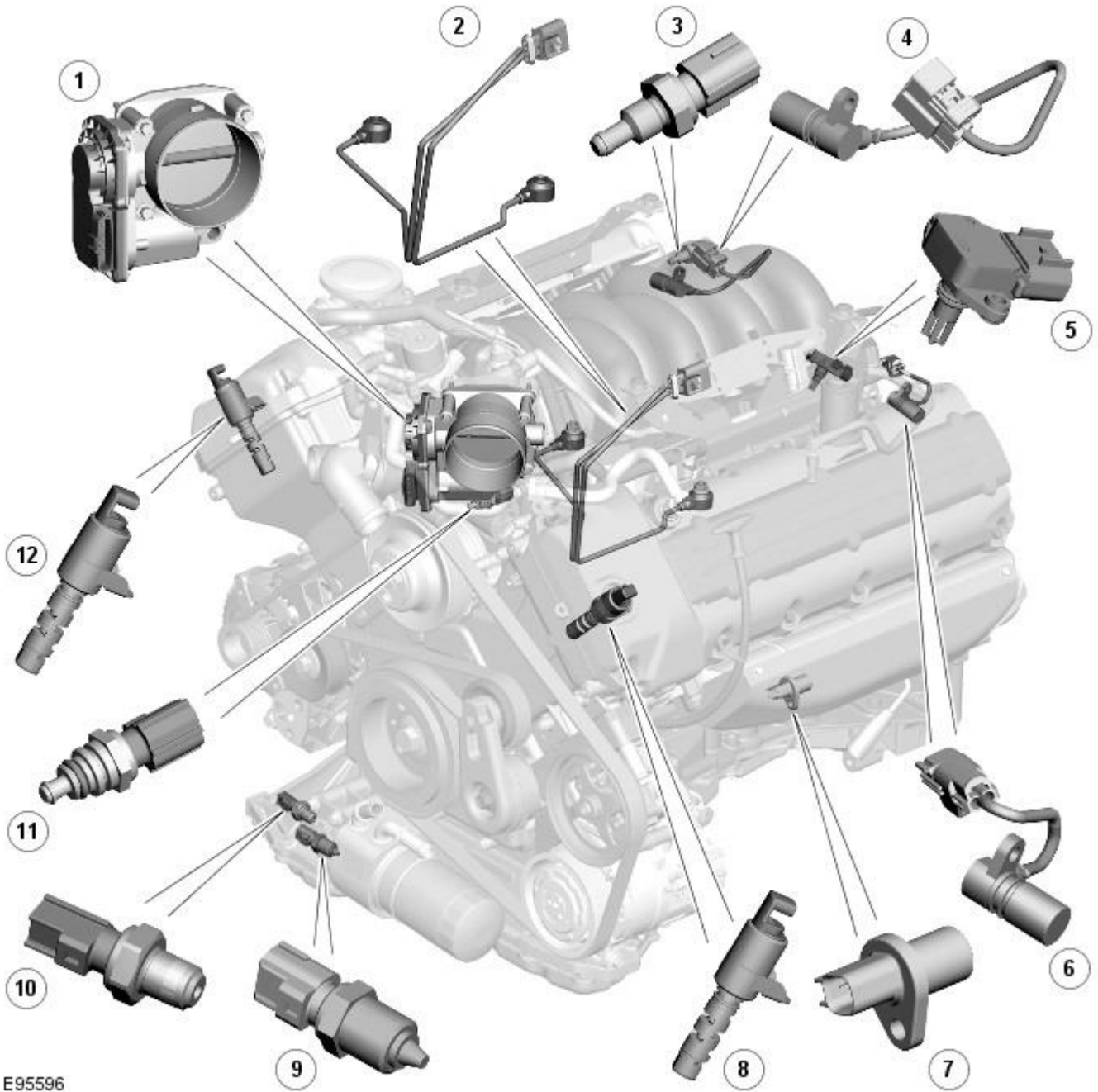


E95595

## ItemDescription

1	<a href="#">KS (knock sensor)s</a>
2	<a href="#">MAPT (manifold absolute pressure and temperature) sensor</a>
3	<a href="#">CMP (camshaft position) sensor</a>
4	Fuel rail temperature sensor
5	Electric throttle
6	<a href="#">MAP (manifold absolute pressure) sensor</a>
7	<a href="#">CMP sensor</a>
8	<a href="#">CKP (crankshaft position)</a>
9	<a href="#">VCT (variable camshaft timing) solenoid</a>
10	Engine oil temperature sensor
11	Engine oil pressure sensor
12	<a href="#">VCT solenoid</a>





E95596

**ItemDescription**

1	Electric throttle
2	KSs
3	Fuel temperature sensor
4	CMP sensor
5	MAP sensor
6	CMP sensor
7	CKP sensor
8	VCT solenoid
9	Engine oil temperature sensor
10	Engine oil pressure sensor
11	ECT sensor
12	VCT solenoid

# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Electronic Engine Controls - Overview

Description and Operation

## Overview

The V8 4.2 Liter naturally aspirated and supercharged engines are controlled by an [ECM \(engine control module\)](#) manufactured by DENSO. The Engine Management System (EMS) controls the following:

- Engine fueling
- Ignition timing
- Closed loop fueling
- Knock control
- Idle speed control
- Emission control
- [OBD \(on-board diagnostic\)](#)
- Interface with the immobilization system
- Speed control

The [ECM](#) controls the engine fueling by providing sequential fuel injection to all cylinders. Ignition is controlled by a direct ignition system, provided by eight plug top coils. The [ECM](#) is able to detect and correct for ignition knock on each cylinder and adjust the ignition timing for each cylinder to achieve optimum performance.

The [ECM](#) uses a torque-based strategy to generate the torque required by the driver and other vehicle control modules. The EMS uses various sensors to determine the torque required from the engine. The EMS also interfaces with other vehicle electronic control modules's, via the [CAN \(controller area network\)](#) bus, to obtain additional information (e.g. road speed from the [ABS \(anti-lock brake system\)](#) control module). The EMS processes these signals and decides how much torque to generate. Torque is then generated by using various actuators to supply air, fuel and spark to the engine (electronic throttle, injectors, coils, etc.).

The EMS comprises the following inputs:

- [CMP \(camshaft position\)](#) sensor
- [CKP \(crankshaft position\)](#) sensor
- Fuel rail pressure sensor
- [MAF \(mass air flow\)](#) sensor
- Knock sensors
- Fuel rail temperature sensor
- [ECT \(engine coolant temperature\)](#) sensor
- Engine oil temperature sensor
- [MAP \(manifold absolute pressure\)](#) sensor
- Electric throttle feedback sensor
- [AIR \(secondary air injection\)/MAP](#) sensor
- [APP \(accelerator pedal position\)](#) sensor
- Fuel tank leakage monitoring (NAS only)
- Cooling fan speed feedback
- [HO2S \(heated oxygen sensor\)](#)
- Brake switch
- Speed control cancel/suspend switch
- Automatic speed limiter switch
- Crank request signal
- [IAT \(intake air temperature\)](#) sensor
- External air temperature sensor

The EMS comprises the following outputs:

- Fuel injectors
- Ignition coils
- Engine cooling fan
- Electric throttle
- Electric fuel pump driver module
- [VCT \(variable camshaft timing\)](#) solenoids
- Purge valve
- [EGR \(exhaust gas recirculation\)](#) valve
- [AIR](#) pump
- Starter relay control

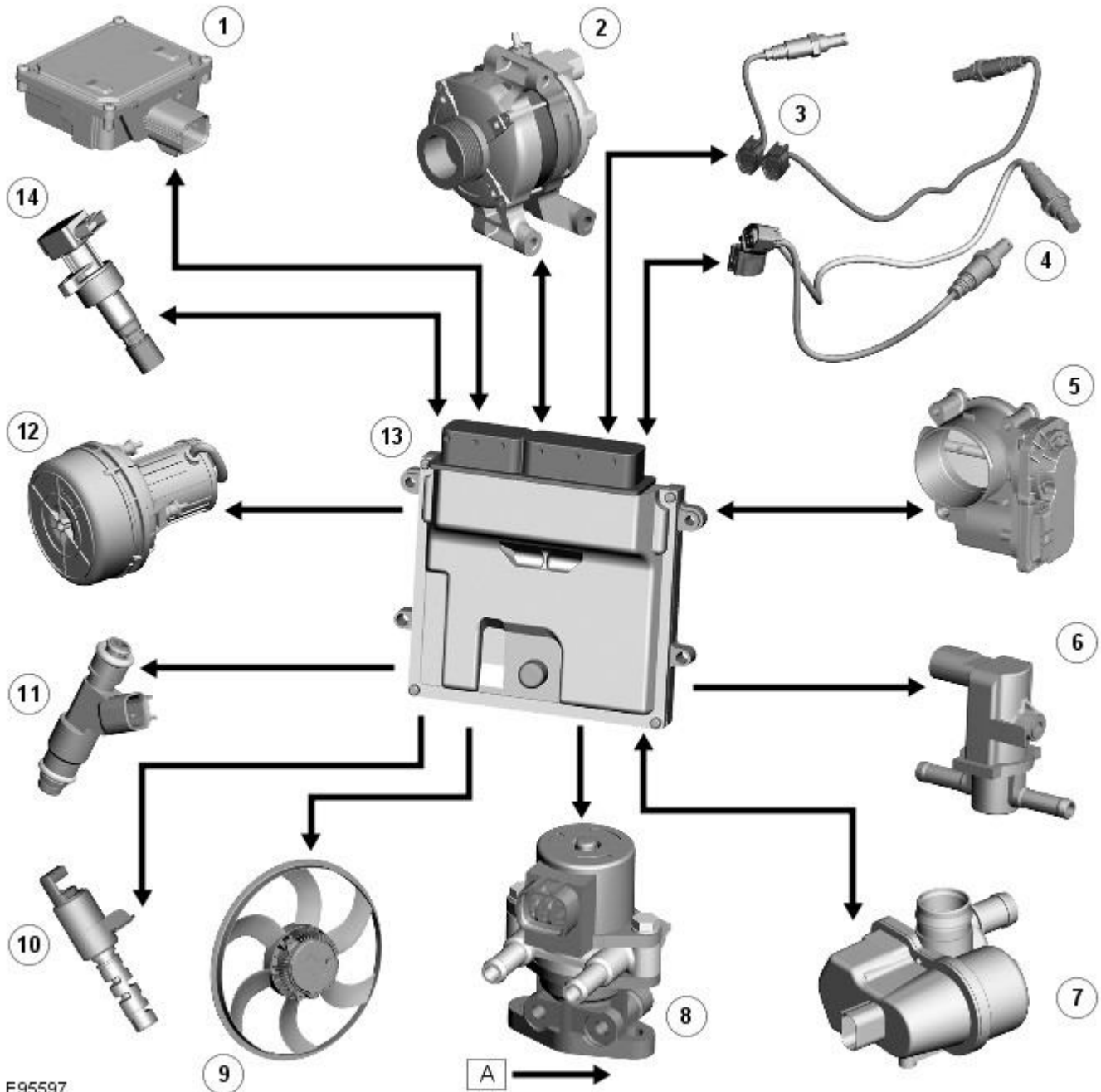
# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Electronic Engine Controls - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: A = Hardwired, D = High speed CAN (controller area network) bus, N = Medium speed CAN bus, O = LIN (local interconnect network) bus

CONTROL DIAGRAM SHEET 1 OF 3



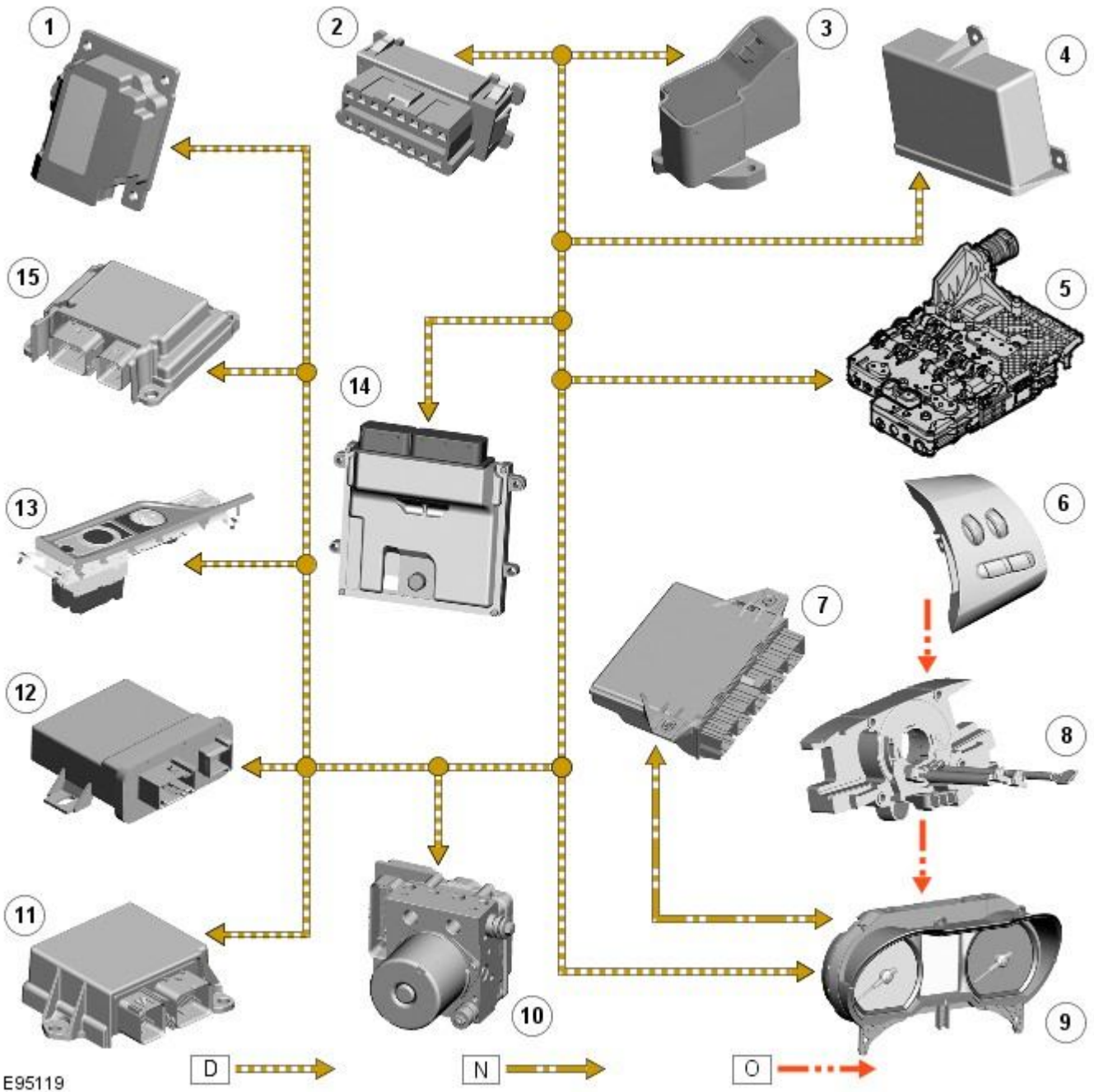
E95597

### ItemDescription

1	FPDM (fuel pump driver module)
2	Generator
3	O2S (oxygen sensor) upstream
4	O2S downstream
5	Electric throttle
6	Purge valve
7	Tank leakage detection pump
8	EGR (exhaust gas recirculation) valve
9	Electric cooling fan

10	VCT (variable camshaft timing) solenoid
11	Injectors
12	AIR (secondary air injection) pump
13	ECM (engine control module)
14	Plug top coils

CONTROL DIAGRAM SHEET 2 OF 3



E95119

**ItemDescription**

1	Adaptive speed control module
2	Diagnostic socket
3	Steering column lock
4	EPB (electronic parking brake) module
5	TCM (transmission control module)
6	Speed control switches
7	Keyless vehicle module
8	Clock spring
9	Instrument cluster
10	ABS (anti-lock brake system) control module
11	RCM (restraints control module)
12	Adaptive front lighting module

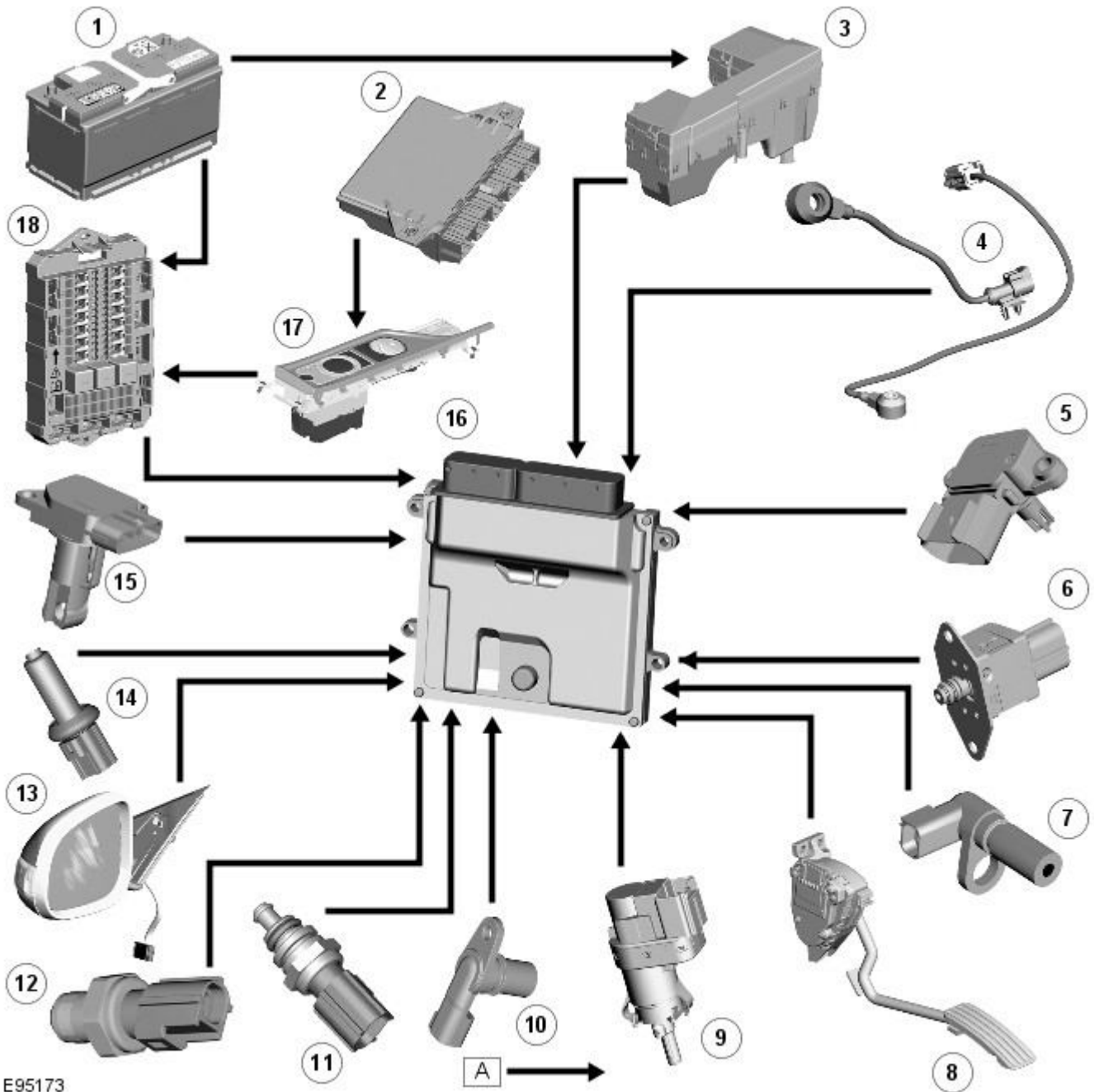


13 Start/ stop switch

14 [ECM](#)

15 Pedestrian protection system control module

CONTROL DIAGRAM SHEET 3 OF 3



E95173

ItemDescription

1	Battery
2	Keyless vehicle module
3	<a href="#">BJB (battery junction box)</a>
4	<a href="#">KS (knock sensor)</a>
5	<a href="#">MAP (manifold absolute pressure) sensor</a>
6	Fuel rail pressure sensor
7	<a href="#">CKP (crankshaft position) sensor</a>
8	<a href="#">APP (accelerator pedal position) sensor</a>
9	<a href="#">BPP (brake pedal position) switch</a>
10	<a href="#">CMP (camshaft position) sensor</a>
11	Engine oil temperature sensor
12	<a href="#">EOP (engine oil pressure) switch</a>
13	Exterior air temperature sensor
14	Fuel temperature sensor

15	<a href="#">MAF (mass air flow)</a> sensor
16	<a href="#">ECM</a>
17	Start/stop switch
18	<a href="#">RJB (rear junction box)</a>

## System Operation

The [ECM](#) controls the engine fueling by providing sequential fuel injection to all cylinders. Ignition is controlled by a direct ignition system, provided by six plug top coils. The [ECM](#) is able to detect and correct for ignition knock on each cylinder and adjust the ignition timing for each cylinder to achieve optimum performance.

The [ECM](#) uses a torque-based strategy to generate the torque required by the driver and other vehicle control modules. The [ECM](#) uses various sensors to determine the torque required from the engine. The EMS also interfaces with other vehicle electronic control modules's, via the [CAN](#) bus, to obtain additional information (e.g. road speed from the [ABS](#) control module). The EMS processes these signals and decides how much torque to generate. Torque is then generated by using various actuators to supply air, fuel and spark to the engine (electronic throttle, injectors, coils, etc.).

## System Inputs

The EMS has the following inputs:

- [RCM](#)
- Park/neutral switch
- Ignition coil feedback
- Fuel rail temperature
- [MAF](#)
- Engine speed
- Camshaft position
- Driver demand
- Brake pedal position switch
- Speed control switches
- Generator load
- [HO2S \(heated oxygen sensor\)](#) pre catalyst
- [HO2S](#) post catalyst
- Throttle position
- Cooling fan speed
- Ignition switch
- Knock sensors
- [MAP](#)
- [ECT \(engine coolant temperature\)](#)
- Engine oil temperature
- [EOP](#)
- Fuel pressure
- Fuel temperature

## System Outputs

The EMS has the following outputs:

- Throttle Actuator
- Brake vacuum pump relay
- Ignition coils
- Oxygen sensor heaters
- Fuel injectors
- Purge Valve
- Engine Cooling Fan
- Fuel pump relay
- Starter Relay
- [ECM](#) Main Relay
- Generator Control
- Fuel tank leakage detection

## ECM Adaptions

The [ECM](#) has the ability to adapt the values it uses to control certain outputs. This capability ensures the EMS can meet emissions legislation and improve the refinement of the engine throughout its operating range.

The components which have adaptions associated with them are:

- The [APP](#) sensor
- The oxygen sensors
- The [MAF/IAT \(intake air temperature\)](#) sensor
- The [CKP](#) sensor
- The Electric throttle body.

## Oxygen Sensors and MAF/AT Sensor

There are several adaptive maps associated with the fueling strategy. Within the fueling strategy the [ECM](#) calculates short-term adaptions and long term adaptions. The [ECM](#) will monitor the deterioration of the oxygen sensors over a period of time. It will also monitor the current correction associated with the sensors.

The [ECM](#) will store a fault code in circumstances where an adaption is forced to exceed its operating parameters. At the same time, the [ECM](#) will record the engine speed, engine load and intake air temperature.



## Crankshaft Position Sensor

The characteristics of the signal supplied by the [CKP](#) sensor is learnt by the [ECM](#). This enables the [ECM](#) to set an adaption and support the engine misfire detection function. Due to the small variation between different flywheels and different [CKP](#) sensors, the adaption must be reset if either component is renewed, or removed and refitted. It is also necessary to reset the flywheel adaption if the [ECM](#) is renewed or replaced. The [ECM](#) supports four flywheel adaptations for the [CKP](#) sensor. Each adaptation relates to a specific engine speed range. The engine speed ranges are detailed in the table below:

Adaptions	Engine Speed, rev/min
1	1800 - 3000
2	3001 - 3800
3	3801 - 4600
4	4601 - 5400

## Misfire Detection

Legislation requires that the [ECM](#) must be able to detect the presence of an engine misfire. It must be able to detect misfires at two separate levels. The first level is a misfire that could lead to the vehicle emissions exceeding 1.5 times the Federal Test Procedure (FTP) requirements for the engine. The second level is a misfire that may cause catalyst damage.

The [ECM](#) sensor monitors the number of misfire occurrences within two engine speed ranges. If the [ECM](#) detects more than a predetermined number of misfire occurrences within either of these two ranges, over two consecutive journeys, the [ECM](#) will record a fault code and details of the engine speed, engine load and engine coolant temperature. In addition, the [ECM](#) monitors the number of misfire occurrences that happen in a 'window' of 200 engine revolutions. The misfire occurrences are assigned a weighting according to their likely impact on the catalysts. If the number of misfires exceeds a certain value, the [ECM](#) stores catalyst-damaging fault codes, along with the engine speed, engine load and engine coolant temperature.

The signal from the [CKP](#) indicates how fast the poles on the flywheel are passing the sensor tip. A sine wave is generated each time a pole passes the sensor tip. The [ECM](#) can detect variations in flywheel speed by monitoring the sine wave signal supplied by the [CKP](#) sensor.

By assessing this signal, the [ECM](#) can detect the presence of an engine misfire. At this time, the [ECM](#) will assess the amount of variation in the signal received from the [CKP](#) and assigns a roughness value to it. This roughness value can be viewed within the real time monitoring feature, using a Land Rover approved diagnostic system. The [ECM](#) will evaluate the signal against a number of factors and will decide whether to count the occurrence or ignore it. The [ECM](#) can assign a roughness and misfire signal for each cylinder, (i.e. identify which cylinder is misfiring).

## Diagnostics

The [ECM](#) stores faults as [DTC \(diagnostic trouble code\)](#), referred to as 'P' codes. The 'P' codes are defined by [OBD \(on-board diagnostic\)](#) legislation and, together with their associated environmental and freeze frame data, can be read using a third party scan tool or a Land Rover approved diagnostic system. A Land Rover approved diagnostic system can also read real time data from each sensor, the adaptive values currently being employed and the current fueling, ignition and idle settings.

## Component Description

### Engine Control Module

The [ECM](#) is located in the engine bay attached to the bulkhead. On [LHD \(left-hand drive\)](#) vehicles the [ECM](#) is located on the [RH \(right-hand\)](#) side of the compartment behind the [BJB](#). On [RHD \(right-hand drive\)](#) vehicles the [ECM](#) is located on the [LH \(left-hand\)](#) side of the engine compartment.

The [ECM](#) controls the engine fueling by providing sequential fuel injection to all cylinders. Ignition is controlled by a direct ignition system, provided by eight plug top coils. The [ECM](#) is able to detect and correct for ignition knock on each cylinder and adjust the ignition timing for each cylinder to achieve optimum performance.

The [ECM](#) uses a torque-based strategy to generate the torque required by the driver and other vehicle control modules. The EMS uses various sensors to determine the torque required from the engine. The EMS also interfaces with other vehicle electronic control modules's, via the [CAN](#) bus, to obtain additional information (e.g. road speed from the [ABS](#) control module). The EMS processes these signals and decides how much torque to generate. Torque is then generated by using various actuators to supply air, fuel and spark to the engine (electronic throttle, injectors, coils, etc.).

### Crankshaft Position Sensor (CKP)

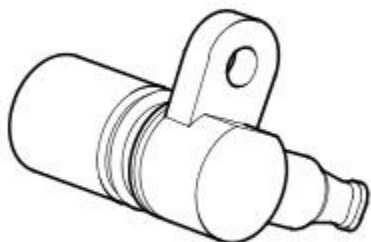


The crankshaft position sensor is mounted at the rear underside of the engine near the transmission bell housing. Connection between the sensor and the harness is via a link harness and a two-way connector. Both wires go directly to the [ECM](#). The sensor produces the signal which enables the [ECM](#) to determine the angle of the crankshaft, and the engine rpm. From this, the point of ignition, fuel injection, etc. is calculated. If the signal wires are reversed a 3° advance in timing will occur, as the electronics within the [ECM](#) uses the falling edge of the signal waveform as its reference/timing point for each tooth.

The reluctor is pressed into the flywheel and has a "tooth" pattern based on 36 teeth at 10° intervals and approximately 5° wide: one of the teeth is removed to provide a hardware reference mark which is 60 degrees [BTDC \(before top dead center\)](#) No.1 cylinder. Because of the crankshaft sensor's orientation, the target wheel uses windows machined into the face, rather than actual teeth.

The sensor operates by generating an output voltage caused by the change in magnetic field that occurs as the windows pass in front of the sensor. The output voltage varies with the speed of the windows passing the sensor, the higher the engine speed, the higher the output voltage. Note that the output is also dependent on the air gap between the sensor and the teeth (the larger the gap, the weaker the signal, the lower the output voltage). The [ECM](#) transmits the engine speed to other vehicle control modules on [CAN](#).

## Camshaft Position Sensor (CMP)



E46332

Two sensors are located at the rear of the engine, in the cylinder head (one per bank), above the rear cylinders. This is a Variable Reluctor Sensor (VRS) producing four pulses for every two engine revolutions. The sensing element is positioned between 0 and 2mm from the side of the cam gear wheel.

The variable cam intake is parked in the retarded position and can advance up to 48 degrees.

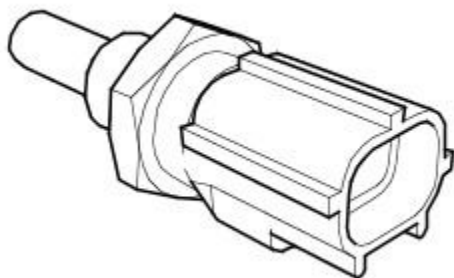
The camshaft timing wheel is a sintered component which has four teeth on it to enable the EMS to detect cylinder identification. The signal is used for:

- Variable intake cam timing
- Cylinder recognition
- Enabling sequential fuel injection
- Knock control
- Cylinder identification for diagnostic purposes.

Failure symptoms include:

- Ignition timing reverting to the base mapping, with no cylinder correction.
- Active knock control is disabled, along with its diagnostic (safe ignition map-loss of performance).
- Quick cam/crank synchronisation on start disabled.
- Variable cam timing is disabled

## Engine coolant Temperature Sensor



E47309

The sensor is located at the front of the engine in the water pipe below the throttle body. The [ECT](#) sensor is a thermistor used to monitor the engine coolant temperature. The [ECT](#) sensor is vital to the correct running of the engine as a richer mixture is required at lower block temperatures for good quality starts and smooth running, leaning off as the temperature rises to maintain emissions and performance.

The sensor has an operating temperature range of -40 Degrees Celsius to 119 Degrees Celsius. When a defective coolant sensor is detected, the [ECM](#) uses the oil temperature sensor value. [PTC \(positive temperature coefficient\)](#)

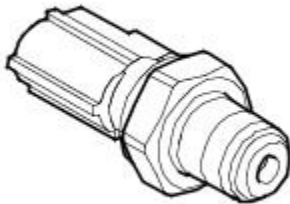
## Tank Leakage Detection-NAS ONLY

The tank leakage detection system periodically checks the evaporative system and the fuel tank for leaks when the ignition is switched off. The tank leakage detection pump is connected to the atmospheric vent of the charcoal cannister and incorporates a [PTC](#) heating element a normally open valve and a reference orifice. The tank leakage detection pump is only operated when the ignition is switched off and is controlled by the [ECM](#). The [ECM](#) also monitors the electric air pump operation and the normally open valve for faults. To check the fuel tank and EVAP system for leaks the [ECM](#) operates the tank leakage detection pump and monitors the current draw. This is compared to a referenced figure established from the current draw when air is pumped through the reference orifice.

## Purge Valve

The purge valve is located at the rear of the engine on a bracket which is attached to the transmission bell housing. The purge valve is a solenoid operated valve which is closed when de-energized. The purge valve is controlled by a 10Hz [PWM \(pulse width modulation\)](#) signal from the [ECM](#). When the engine operating conditions are correct, the [ECM](#) opens the purge valve which causes fuel vapor and fresh air to be drawn through the charcoal cannister. The fresh air is drawn through the charcoal cannister via the tank leakage detection pump fresh air vent. [NTC \(negative temperature coefficient\)](#)

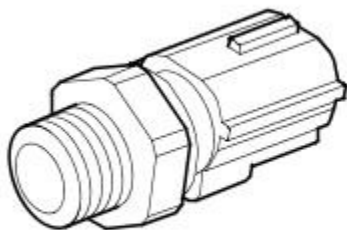
## Engine Oil Temperature Sensor



E46333

Oil temperature is monitored through a temperature sensor mounted in the oil system. This component is a [NTC](#). The sensor is mounted next to the oil pressure sensor at the front of the engine and locates into the oil filter bracket.

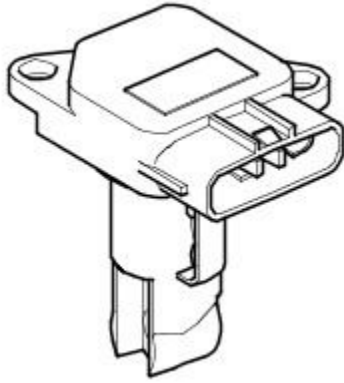
## Fuel Rail Temperature Sensor



E47606

The fuel rail temperature sensor measures the temperature of the fuel in the fuel rail. This input is then used to deliver the correct quantity of fuel to the engine. Operating Range -40 Degrees Celsius to 150 Degrees Celsius. The fuel rail temperature sensor is fitted on the rear of the right hand bank (bank A) fuel rail.

## Mass Air Flow/Intake Air Temperature Sensor (MAF/IAT)



E47308

The air flow meter is located in the clean air duct immediately after the air filter box.

The air mass flow is determined by the cooling effect of intake air passing over a “hot film” element contained within the device. The higher the air flow the greater the cooling effect and the lower the electrical resistance of the “hot film” element. The [ECM](#) then uses this signal from the Mass Air Flow meter to calculate the air mass flowing into the engine.

The measured air mass flow is used in determining the fuel quantity to be injected in order to maintain the stoichiometric air/fuel mixture required for correct operation of the engine and exhaust catalysts. Should the device fail there is a software backup strategy that will be evoked once a fault has been diagnosed.

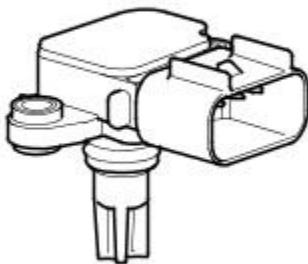
The following symptoms may be observed if the sensor fails:

- During driving the engine RPM might dip, before recovering.
- Difficulty in starting or start-stall.
- Poor throttle response/engine performance.
- Lambda control and idle speed control halted.
- Emissions incorrect.
- AFM signal offset

The [IAT](#) sensor is integrated into the [MAF](#) sensor. It is a temperature dependent resistor (thermistor), i.e. the resistance of the sensor varies with temperature. This thermistor is a [NTC](#) type element meaning that the sensor resistance decreases as the sensor temperature increases. The sensor forms part of a voltage divider chain with an additional resistor in the [ECM](#). The voltage from this sensor changes as the sensor resistance changes, thus relating the air temperature to the voltage measured by the [ECM](#).

The [ECM](#) stores a 25 Degrees Celsius default value for air temperature in the event of a sensor failure.

## Manifold Absolute Pressure Sensor (MAP)



E47588

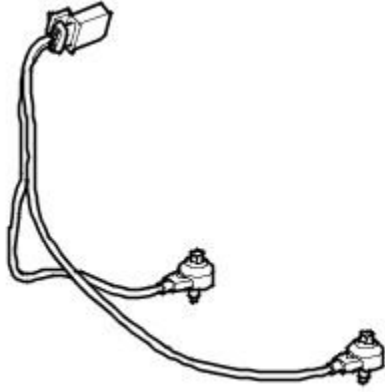
The [MAP](#) sensor provides a voltage proportional to the absolute pressure in the intake manifold. This signal allows the load on the engine to be calculated and used within the internal calculations of the [ECM](#). The sensor is located on the rear of the air intake manifold.

The output signal from the [MAP](#) sensor, together with the [CKP](#) and [IAT](#) sensors, is used by the [ECM](#) to calculate the amount of air induced into the cylinders. This enables the [ECM](#) to determine ignition timing and fuel injection duration values.

The [MAP](#) sensor receives a 5V supply voltage from the [ECM](#) and provides an analogue signal to [ECM](#), which relates to the absolute manifold pressure and allows the [ECM](#) to calculate engine load. The [ECM](#) provides a ground for the sensor.

If the [MAP](#) signal is missing, the [ECM](#) will substitute a default manifold pressure reading based on crankshaft speed and throttle angle. The engine will continue to run with reduced drivability and increased emissions, although this may not be immediately apparent to the driver. The [ECM](#) will store fault codes which can be retrieved using the recommended Jaguar diagnostic tool.

## Knock Sensors



E47296

The EMS has two knock sensors located in the V of the engine, one per cylinder bank. The sensors are connected to the [ECM](#) via a twisted pair of wires.

The knock sensors produce a voltage signal in proportion to the amount of mechanical vibration generated at each ignition point. Each sensor monitors the related cylinder bank.

The knock sensors incorporate a piezo-ceramic crystal. This crystal produces a voltage whenever an outside force tries to deflect it, (i.e. exerts a mechanical load on it). When the engine is running, the compression waves in the material of the cylinder block, caused by the combustion of the fuel/air mixture within the cylinders, deflect the crystal and produce an output voltage signal. The signals are supplied to the [ECM](#), which compares them with 'mapped' signals stored in memory. From this, the [ECM](#) can determine when detonation occurs on individual cylinders. When detonation is detected, the [ECM](#) retards the ignition timing on that cylinder for a number of engine cycles, then gradually returns it to the original setting.

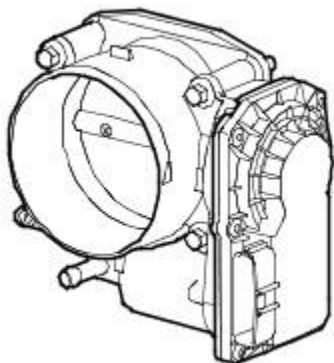
Care must be taken at all times to avoid damaging the knock sensors, but particularly during removal and fitting procedures. The recommendations regarding torque and surface preparation must be adhered to. The torque applied to the sensor and the quality of the surface preparation both have an influence over the transfer of mechanical noise from the cylinder block to the crystal.

The [ECM](#) uses the signals supplied by the knock sensors, in conjunction with the signal it receives from the camshaft sensor, to determine the optimum ignition point for each cylinder. The ignition point is set according to preprogrammed ignition maps stored within the [ECM](#). The [ECM](#) is programmed to use ignition maps for 98 RON premium specification fuel. It will also function on 91 RON regular specification fuel and learn new adaptations. If the only fuel available is of poor quality, or the customer switches to a lower grade of fuel after using a high grade for a period of time, the engine may suffer slight pre-ignition for a short period. This amount of pre-ignition will not damage the engine. This situation will be evident while the [ECM](#) learns and then modifies its internal mapping to compensate for the variation in fuel quality. This feature is called adaptation. The [ECM](#) has the capability of adapting its fuel and ignition control outputs in response to several sensor inputs.

The [ECM](#) will cancel closed loop control of the ignition system if the signal received from either knock sensor becomes implausible. In these circumstances the [ECM](#) will default to a safe ignition map. This measure ensures the engine will not become damaged if low quality fuel is used. The [MIL \(malfunction indicator lamp\)](#) lamp will not illuminate, although the driver may notice that the engine 'pinks' in some driving conditions and displays a drop in performance and smoothness.

When a knock sensor fault is stored, the [ECM](#) will also store details of the engine speed, engine load and the coolant temperature.

## Electric Throttle



E47298

The V6 EMS incorporates an electric throttle control system. The electronic throttle body is located on the air intake manifold in the engine compartment. The system comprises three main components:

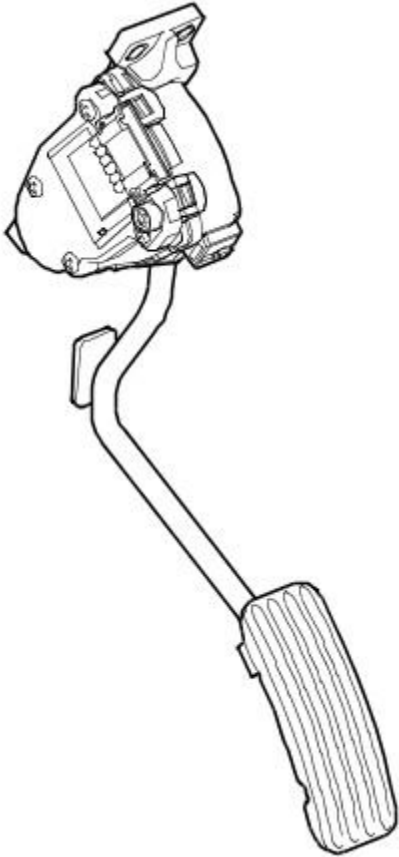
- Electronic throttle control valve
- [APP](#)
- [ECM](#)

When the accelerator pedal is depressed the [APP](#) sensor provides a change in the monitored signals. The [ECM](#) compares this against an electronic "map" and moves the electronic throttle valve via a [PWM](#) control signal which is in proportion to the [APP](#) angle signal. The system is required to:

- Regulate the calculated intake air load based on the accelerator pedal sensor input signals and programmed mapping.
- Monitor the drivers input request for cruise control operation.
- Automatically position the electronic throttle for accurate cruise control.
- Perform all dynamic stability control throttle control interventions.
- Monitor and carry out maximum engine and road speed cut out.

A software strategy within the [ECM](#) enables the throttle position to be calibrated each ignition cycle. When the ignition is turned OFF, the [ECM](#) performs a self test and calibration routine on the electronic throttle by closing the throttle fully. The power is then removed and the [ECM](#) checks that the throttle returns to the reference position under the pressure from the spring.

## Accelerator Pedal Position Sensor (APP)



E75881

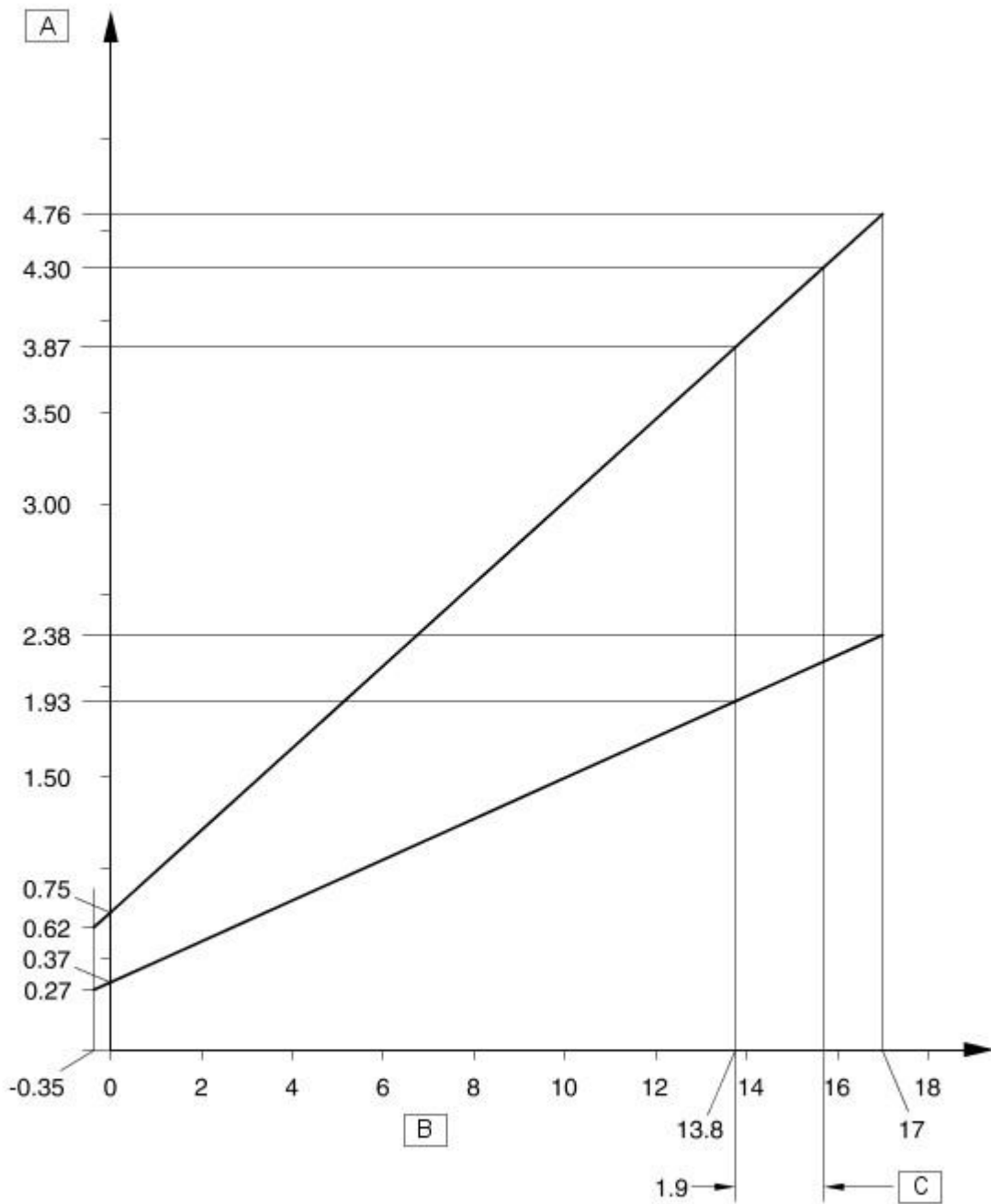
The [APP](#) sensor is located in a plastic housing which is integral with the throttle pedal. The housing is injection molded and provides location for the [APP](#) sensor. The sensor is mounted externally on the housing and is secured with two Torx screws. The external body of the sensor has a six pin connector which accepts a connector on the vehicle wiring harness.

The sensor has a spigot which protrudes into the housing and provides the pivot point for the pedal mechanism. The spigot has a slot which allows for a pin, which is attached to the sensor potentiometers, to rotate through approximately 90 degrees, which relates to pedal movement. The pedal is connected via a link to a drum, which engages with the sensor pin, changing the linear movement of the pedal into rotary movement of the drum. The drum has two steel cables attached to it. The cables are secured to two tension springs which are secured in the opposite end of the housing. The springs provide 'feel' on the pedal movement and require an effort from the driver similar to that of a cable controlled throttle. A detente mechanism is located at the forward end of the housing and is operated by a ball located on the drum. At near maximum throttle pedal movement, the ball contacts the detente mechanism. A spring in the mechanism is compressed and gives the driver the feeling of depressing a 'kickdown' switch when full pedal travel is achieved.

The [APP](#) sensor signals are checked for range and plausibility. Two separate reference voltages are supplied to the pedal. Should one sensor fail, the other is used as a 'limp-home' input. In limp home mode due to an [APP](#) signal failure the [ECM](#) will limit the maximum engine speed to 2000 rpm.

APP Sensor Output Graph





M180795

**ItemDescription**

A	Voltage
B	APP sensor angle
C	Kick down angle

The APP sensor has two potentiometer tracks which each receive a 5V input voltage from the ECM. Track 1 provides an output of 0.5V with the pedal at rest and 2.0V at 100% full throttle. Track 2 provides an output of 0.5V with the pedal at rest and 4.5V at 100% full throttle. The signals from the two tracks are used by the ECM to determine fueling for engine operation and also by the ECM and the TCM to initiate a kickdown request for the automatic transmission.

The ECM monitors the outputs from each of the potentiometer tracks and can determine the position, rate of change and direction of movement of the throttle pedal. The 'closed throttle' position signal is used by the ECM to initiate idle speed control and also overrun fuel cut-off.

## Oxygen Sensors

There are four oxygen sensors located in the exhaust system. Two upstream before the catalytic converter ([HO2S](#)) and two down stream after the catalytic converter ([O2S](#)). The sensor monitors the level of oxygen in the exhaust gases and is used to control the fuel/air mixture. Positioning a sensor in the stream of exhaust gasses from each bank enables the [ECM](#) to control the fueling on each bank independently of the other, allowing much closer control of the air/fuel ratio and catalyst conversion efficiency.

The oxygen sensors need to operate at high temperatures in order to function correctly. To achieve the high temperatures required, the sensors are fitted with heater elements that are controlled by a [PWM](#) signal from the [ECM](#). The heater elements are operated immediately following engine start and also during low load conditions when the temperature of the exhaust gases is insufficient to maintain the required sensor temperatures. A non-functioning heater delays the sensor's readiness for closed loop control and influences emissions. The [PWM](#) duty cycle is carefully controlled to prevent thermal shock to cold sensors.

[HO2S](#) sensors also known as Linear or "Wide Band" sensors produces a constant voltage, with a variable current that is proportional to the oxygen content. This allows closed loop fueling control to a target lambda, i.e. during engine warm up (after the sensor has reached operating temperature and is ready for operation). This improves emission control.

The [O2S](#) sensor uses Zirconium technology that produces an output voltage dependant upon the ratio of exhaust gas oxygen to the ambient oxygen. The device contains a Galvanic cell surrounded by a gas permeable ceramic, the voltage of which depends upon the level of [O2 \(oxygen\)](#) defusing through. Nominal output voltage of the device for  $\lambda = 1$  is 300 to 500m volts. As the fuel mixture becomes richer ( $\lambda < 1$ ) the voltage tends towards 900m volts and as it becomes leaner ( $\lambda > 1$ ) the voltage tends towards 0 volts. Maximum tip temperature is 1,000 Degrees Celsius for a maximum of 100 hours.

Sensors age with mileage, increasing their response time to switch from rich to lean and lean to rich. This increase in response time influences the [ECM](#) closed loop control and leads to progressively increased emissions. Measuring the period of rich to lean and lean to rich switching monitors the response rate of the upstream sensors.

Diagnosis of electrical faults is continually monitored in both the upstream and downstream sensors. This is achieved by checking the signal against maximum and minimum threshold, for open and short circuit conditions.

Oxygen sensors must be treated with the utmost care before and during the fitting process. The sensors have ceramic material within them that can easily crack if dropped/banged or over-torqued. The sensors must be torqued to the required figure, (40-50Nm), with a calibrated torque wrench. Care should be taken not to contaminate the sensor tip when anti-seize compound is used on the thread. Heated sensor signal pins are tinned and universal are gold plated. Mixing up sensors could contaminate the connectors and affect system performance.

### Failure Modes

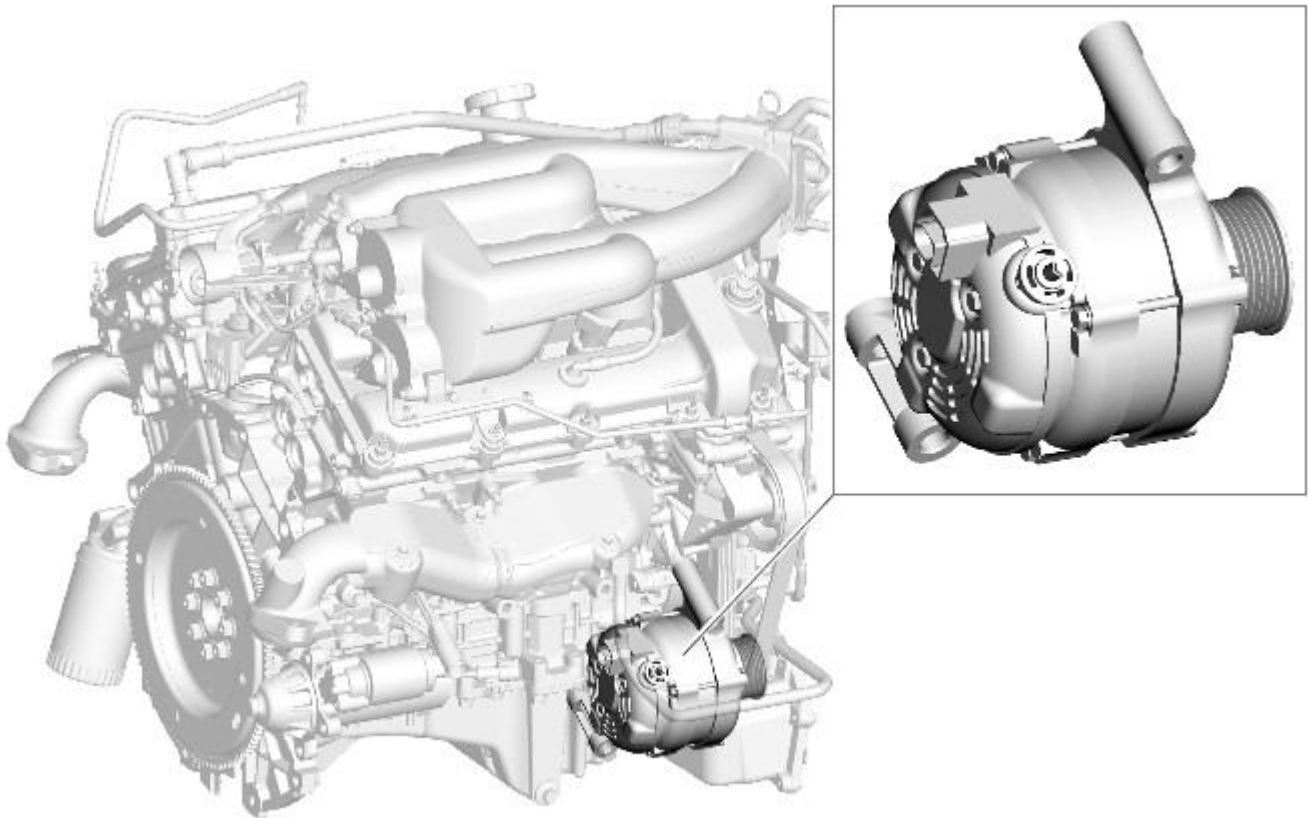
- Mechanical fitting & integrity of the sensor.
- Sensor open circuit/disconnected.
- Short circuit to vehicle supply or ground.
- Lambda ratio outside operating band.
- Crossed sensors bank A & B.
- Contamination from leaded fuel or other sources.
- Change in sensor characteristic.
- Harness damage.
- Air leak into exhaust system.

### Failure Symptoms

- Default to Open Loop fueling for the particular cylinder bank
- High [CO \(carbon monoxide\)](#) reading.
- Strong smell of [HO2S](#) till default condition.
- Excess Emissions.

It is possible to fit front and rear sensors in their opposite location. However the harness connections are of different gender and color to ensure that the sensors cannot be incorrectly connected. In addition to this the upstream sensors have two holes in the shroud, whereas the down stream sensors have four holes in the shroud for the gas to pass through.

## Generator



E93662

The Generator has a power control module voltage regulator for use in a 14V charging system with 6÷12 zener diode bridge rectifiers.

The [ECM](#) monitors the load on the electrical system via [PWM](#) signal and adjusts the generator output to match the required load. The [ECM](#) also monitors the battery temperature to determine the generator regulator set point. This characteristic is necessary to protect the battery; at low temperatures battery charge acceptance is very poor so the voltage needs to be high to maximize any rechargeability, but at high temperatures the charge voltage must be restricted to prevent excessive gassing of the battery with consequent water loss.

The Generator has a smart charge capability that will reduce the electrical load on the Generator reducing torque requirements, this is implemented to utilize the engine torque for other purposes. This is achieved by monitoring three signals to the [ECM](#):

- Generator sense (A sense), measures the battery voltage at the [CJB \(central junction box\)](#).
- Generator communication (Alt Com) communicates desired Generator voltage set point from [ECM](#) to Generator.
- Generator monitor (Alt Mon) communicates the extent of Generator current draw to [ECM](#). This signal also transmits faults to the [ECM](#) which will then sends a message to the instrument pack on the [CAN](#) bus to illuminate the charge warning lamp.

## Fuel Injectors

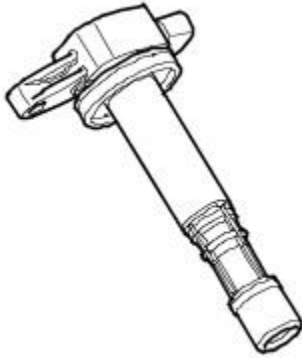


E47305

The engine has 6 fuel injectors (one per cylinder), each injector is directly driven by the [ECM](#). The injectors are fed by a common fuel rail as part of a 'returnless' fuel system. The fuel rail pressure is regulated to 4.5 bar by a fuel pressure regulator which is integral to the fuel pump module, within the fuel tank. The injectors can be checked by resistance checks. There is a fuel pressure test Schrader valve attached to the fuel rail on the front LH side for fuel pressure testing purposes. The [ECM](#) monitors the output power stages of the injector drivers for electrical faults.

The injectors have a resistance of 13.8 Ohms ± 0.7 Ohms @ 20 Degrees Celsius.

## Ignition Coils



E47306

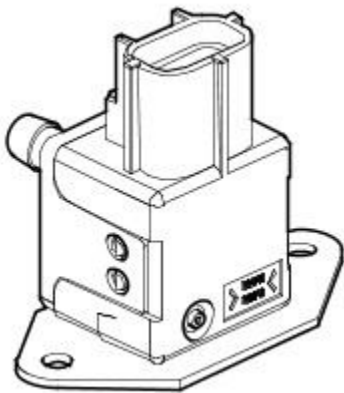
The engine is fitted with six plug-top coils that are driven directly by the [ECM](#). This means that the [ECM](#), at the point where sufficient charge has built up, switches the primary circuit of each coil and a spark is produced in the spark plug. The positive supply to the coil is fed from a common fuse. Each coil contains a power stage to trigger the primary current. The [ECM](#) sends a signal to each of the coils power stage to trigger the power stage switching. Each bank has a feedback signal that is connected to each power stage. If the coil power stage has a failure the feedback signal is not sent, causing the [ECM](#) to store a fault code appropriate to the failure.

The [ECM](#) calculates the dwell time depending on battery voltage and engine speed to ensure constant secondary energy. This ensures sufficient secondary (spark) energy is always available, without excessive primary current flow thus avoiding overheating or damage to the coils.

The individual cylinder spark timing is calculated from a variety of inputs:

- Engine speed and load.
- Engine temperature.
- Knock control.
- Auto gearbox shift control.
- Idle speed control.

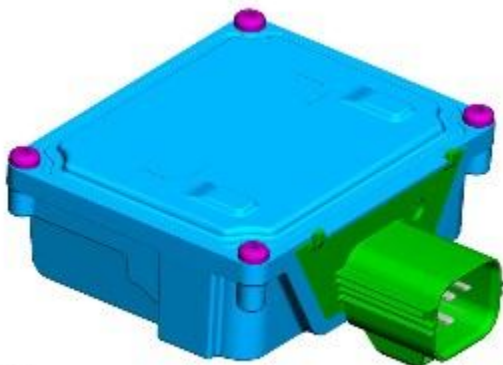
## Fuel Rail Pressure Sensor



E58945

The fuel rail pressure sensor is located on top of the fuel rail adjacent to the fuel inlet. The fuel rail pressure sensor measures the pressure of the fuel in the fuel rail. This input is then used by the fuel pump control module to control the amount of fuel delivered to the fuel rail.

## Fuel Pump Driver Module



E84483

The [FPDM](#) is located on the RH side of the charcoal canister on top of the fuel tank. The fuel pump control module receives a power supply via the fuel pump relay in the auxiliary fuse box.

The [ECM](#) sends a [PWM](#) signal to the [FPDM](#), the duty cycle of the signal determines the duty cycle of the pump. The [ECM](#) sets a target fuel pressure based on engine load. The target fuel pressure is maintained by using feedback from the fuel rail pressure sensor which is used to control the fuel pump via a closed loop [PWM](#) signal. The [PWM](#) signal to the pump represents half the ON time of the pump. If the [ECM](#) transmits a 50% on time the fuel pump control module drives the pump at 100%. If the [ECM](#) transmits a 5% ON time the fuel pump control module drives the pump at 10%. The fuel pump control module will only turn the fuel pump ON if it receives a valid signal between 4% and 50%. When the [ECM](#) requires the fuel pump to be turned OFF the [ECM](#) transmits a duty cycle signal of 75%.

The status of the [FPDM](#) is monitored by the [ECM](#). Any errors can be retrieved from the [ECM](#). The fuel pump control module cannot be interrogated for diagnostic purposes.

The [ECM](#) controls the [FPDM](#) in response to inputs from the fuel rail pressure sensor, [MAP](#) and the [MAF/IAT](#) sensor.

## Variable Valve Timing (VVT)

Variable valve timing is used on the V6 engine to enhance low and high speed engine performance and idle speed quality.

For each intake camshaft the [VVT \(variable valve timing\)](#) system comprises:

- [VVT](#) unit
- Valve timing solenoid

The [VVT](#) system alters the phase of the intake valves relative to the fixed timing of the exhaust valves, to alter:

- The mass of air flow to the cylinders.
- The engine torque response.
- Emissions.

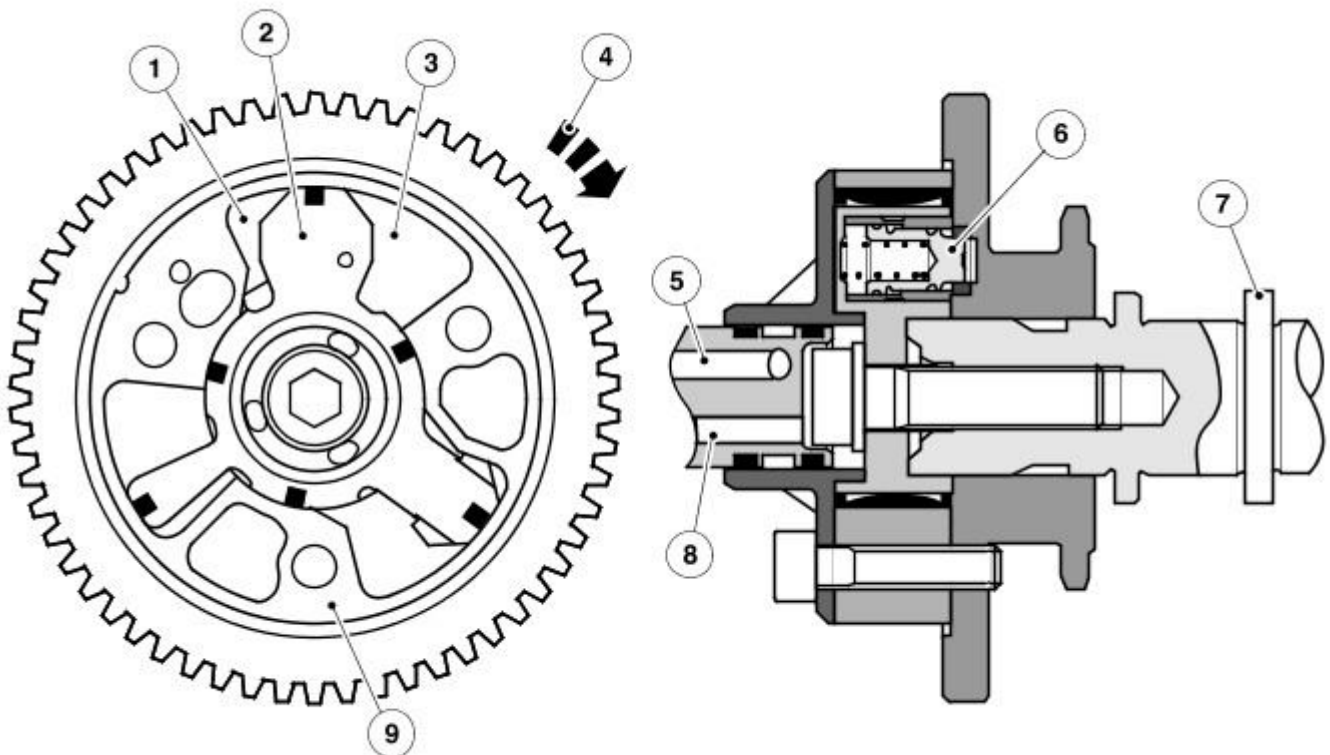
The [VVT](#) unit uses a vane type device to control the camshaft angle. The system operates over a range of 48 degrees and is advanced or retarded to its optimum position within this range.

The [VVT](#) system is controlled by the [ECM](#) based on engine load and speed along with engine oil temperature to calculate the appropriate camshaft position.

The [VVT](#) system provides the following advantages:

- Reduced engine emissions and improved fuel consumption which in turn improves the engines internal [EGR](#) effect over a wider operating range.
- Enhanced full load torque characteristics.
- Improved fuel economy through optimized torque over the engine speed range.

Variable Valve Timing Unit



E62237

### ItemDescription

1 Vane housing

2	Vane shaft
3	Retard chamber
4	Rotation direction
5	Advance chamber oil channel
6	Stopper pin
7	Intake camshaft
8	Retard chamber oil channel
9	Advance chamber

The [VVT](#) unit is a hydraulic actuator mounted on the end of the intake camshaft. The unit advances or retards the camshaft timing to alter the camshaft to crankshaft phase. The [ECM](#) controls the [VVT](#) timing unit via an oil control solenoid. The oil control solenoid routes oil pressure to the advance or retard chambers either side of the vanes within the [VVT](#) unit.

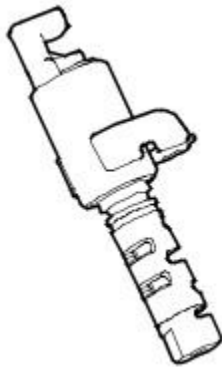
The [VVT](#) unit is driven by the primary drive chain and rotates relative to the exhaust camshaft. When the [ECM](#) requests a retard in camshaft timing the oil control solenoid is energized which moves the shuttle valve in the solenoid to the relevant position allowing oil pressure to flow out of the advance chambers in the [VVT](#) unit whilst simultaneously allowing oil pressure into the retard chambers.

The [ECM](#) controls the advancing and retarding of the [VVT](#) unit based on engine load and speed. The [ECM](#) sends an energize signal to the oil control solenoid until the desired [VVT](#) position is achieved. When the desired [VVT](#) position is reached, the energizing signal is reduced to hold the oil control solenoid position and consequently desired [VVT](#) position. This function is under closed loop control and the [ECM](#) can sense any variance in shuttle valve oil pressure via the camshaft position sensor and can adjust the energizing signal to maintain the shuttle valve hold position.

operation can be affected by engine oil temperature and properties. At very low oil temperatures the movement of the [VVT](#) mechanism will be slow due to the high viscosity of the oil. While at high oil temperatures the low oil viscosity may impair the [VVT](#) operation at low oil pressures. The oil pump has the capacity to cope with these variations in oil pressure while an oil temperature sensor is monitored by the [ECM](#) to provide oil temperature feedback. At extremely high oil temperatures the [ECM](#) may limit the amount of [VVT](#) advance in order to prevent the engine from stalling when returning to idle speed.

[VVT](#) does not operate when engine oil pressure is below 1.25 bar. This is because there is insufficient pressure to release the [VVT](#) units internal stopper pin. This occurs when the engine is shut down and the [VVT](#) unit has returned to the retarded position. The stopper pin locks the [VVT](#) unit to the camshaft to ensure camshaft stability during the next start up.

#### Valve Timing Solenoid



E47302

#### Valve Timing Solenoid

The valve timing solenoid controls the position of the shuttle valve in the bush carrier. A plunger on the solenoid extends when the solenoid is energized and retracts when the solenoid is de-energized.

When the valve timing solenoids are de-energized, the coil springs in the bush carriers position the shuttle valves to connect the valve timing units to drain. In the valve timing units, the return springs hold the ring pistons and gears in the retarded position. When the valve timing solenoids are energized by the [ECM](#), the solenoid plungers position the shuttle valves to direct engine oil to the valve timing units. In the valve timing units, the oil pressure overcomes the force of the return springs and moves the gears and ring pistons to the advanced position. System response times are 1.0 second maximum for advancing and 0.7 second maximum for retarding. While the valve timing is in the retarded mode, the [ECM](#) produces a periodic lubrication pulse. This momentarily energizes the valve timing solenoids to allow a spurt of oil into the valve timing units. The lubrication pulse occurs once every 5 minutes.



# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Electronic Engine Controls

Diagnosis and Testing

## Principles of Operation

For a detailed description of the 4.2L petrol electronic engine controls, refer to the relevant Description and Operation section in the workshop manual. REFER to: (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8)

[Electronic Engine Controls](#) (Description and Operation),  
[Electronic Engine Controls](#) (Description and Operation),  
[Electronic Engine Controls](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Engine oil level and condition</li> <li>● Cooling system coolant level</li> <li>● Fuel level</li> <li>● Fuel contamination/grade/quality</li> <li>● Throttle body</li> <li>● Front End Accessory Drive (FEAD) belt</li> <li>● Air cleaner condition</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Wiring harness</li> <li>● Electrical connector(s)</li> <li>● Sensor(s)</li> <li>● Engine Control Module (ECM)</li> <li>● Transmission Control Module (TCM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the customer concern and refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
<b>Engine non-start</b>		
Engine does not crank	<ul style="list-style-type: none"> <li>● Security system/Immobilizer engaged</li> <li>● Engine in shut-down mode</li> <li>● ECM relay</li> <li>● Battery</li> <li>● Starting system</li> <li>● Engine seized</li> </ul>	<ul style="list-style-type: none"> <li>● Check that the security system is disarmed</li> <li>● Read DTCs and refer to DTC Index in this section for ECM relay tests</li> <li>● Ensure the battery is in fully charged and serviceable condition</li> <li>● For starting system tests. REFER to: <a href="#">Starting System</a> (303-06 Starting System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● For engine system tests. REFER to: <a href="#">Engine</a> (303-01A Engine - 4.2L NA V8 - AJV8, Diagnosis and Testing).</li> </ul>
Engine cranks, but does not fire	<ul style="list-style-type: none"> <li>● Engine breather system disconnected/restricted</li> <li>● Ignition system</li> <li>● Fuel system</li> <li>● Electronic engine controls</li> </ul>	<ul style="list-style-type: none"> <li>● Ensure the engine breather system is free from restriction and is correctly installed</li> <li>● For ignition system tests. REFER to: <a href="#">Engine Ignition</a> (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● For fuel system tests. REFER to: <a href="#">Fuel Tank and Lines</a> (310-01 Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> </ul>
Engine cranks and fires, but will not start	<ul style="list-style-type: none"> <li>● Evaporative emissions purge valve</li> <li>● Fuel pump</li> <li>● Spark plugs</li> <li>● Ignition coil failure(s)</li> </ul>	<ul style="list-style-type: none"> <li>● For purge valve tests. REFER to: <a href="#">Evaporative Emissions</a> (303-13 Evaporative Emissions - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● For fuel system tests. REFER to: <a href="#">Fuel Tank and Lines</a> (310-01 Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● For ignition system tests.</li> </ul>

Symptom	Possible Cause	Action
		REFER to: <a href="#">Engine Ignition</a> (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).
<b>Difficult to start</b>		
Difficult cold start	<ul style="list-style-type: none"> <li>● Check engine coolant level/anti-freeze content</li> <li>● Battery</li> <li>● Electronic engine controls</li> <li>● Exhaust gas recirculation (EGR) valve stuck open</li> <li>● Fuel pump</li> <li>● Evaporative emissions purge valve</li> </ul>	<ul style="list-style-type: none"> <li>● Check the engine coolant level and condition. REFER to: <a href="#">Engine Cooling</a> (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● Ensure the battery is in a fully charged and serviceable condition</li> <li>● Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> <li>● For EGR valve tests. REFER to: <a href="#">Engine Emission Control</a> (303-08 Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● For fuel system tests. REFER to: <a href="#">Fuel Tank and Lines</a> (310-01 Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● For purge valve tests. REFER to: <a href="#">Evaporative Emissions</a> (303-13 Evaporative Emissions - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> </ul>
Difficult hot start	<ul style="list-style-type: none"> <li>● Injector leak</li> <li>● Electronic engine controls</li> <li>● Evaporative emissions purge valve</li> <li>● Fuel pump</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> </ul>	<ul style="list-style-type: none"> <li>● Carry out injector leak tests, check and install new injectors as required. REFER to: <a href="#">Fuel Injectors</a> (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Removal and Installation).</li> <li>● Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> <li>● For purge valve tests. REFER to: <a href="#">Evaporative Emissions</a> (303-13 Evaporative Emissions - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● For fuel system tests. REFER to: <a href="#">Fuel Tank and Lines</a> (310-01 Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● For ignition system tests. REFER to: <a href="#">Engine Ignition</a> (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● For EGR valve tests. REFER to: <a href="#">Engine Emission Control</a> (303-08 Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> </ul>
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	<ul style="list-style-type: none"> <li>● Injector leak</li> <li>● Electronic engine controls</li> <li>● Evaporative emissions purge valve</li> <li>● Fuel pump</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> </ul>	<ul style="list-style-type: none"> <li>● Carry out injector leak tests, check and install new injectors as required. REFER to: <a href="#">Fuel Injectors</a> (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Removal and Installation).</li> <li>● Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> <li>● For purge valve tests. REFER to: <a href="#">Evaporative Emissions</a> (303-13 Evaporative Emissions - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● For fuel system tests. REFER to: <a href="#">Fuel Tank and Lines</a> (310-01 Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● For ignition system tests. REFER to: <a href="#">Engine Ignition</a> (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● For EGR valve tests. REFER to: <a href="#">Engine Emission Control</a> (303-08 Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> </ul>

Symptom	Possible Cause	Action
Engine cranks too fast/slow	<ul style="list-style-type: none"> <li>● Compressions high/low</li> <li>● Battery</li> <li>● Starting system</li> </ul>	<ul style="list-style-type: none"> <li>● Carry out cylinder compression tests</li> <li>● Ensure battery is in a fully charged and serviceable condition</li> <li>● For starting system tests. REFER to: <a href="#">Starting System</a> (303-06 Starting System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> </ul>
<b>Engine stalls</b>		
Engine stalls soon after start	<ul style="list-style-type: none"> <li>● Breather system disconnected/restricted</li> <li>● ECM relay</li> <li>● Electronic engine controls</li> <li>● Ignition system</li> <li>● Air intake system restricted</li> <li>● Air leakage</li> <li>● Fuel lines</li> </ul>	<ul style="list-style-type: none"> <li>● Ensure the engine breather system is free from restriction and is correctly installed</li> <li>● Read DTCs and refer to DTC Index in this section for ECM relay tests</li> <li>● Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> <li>● For ignition system tests. REFER to: <a href="#">Engine Ignition</a> (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● Check for blockage in air cleaner element and air intake system</li> <li>● Check for leakage in air intake system</li> <li>● For fuel system tests. REFER to: <a href="#">Fuel Tank and Lines</a> (310-01 Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> </ul>
Engine stalls on overrun	<ul style="list-style-type: none"> <li>● ECM relay</li> <li>● Throttle position (TP) sensors</li> </ul>	<ul style="list-style-type: none"> <li>● Read DTCs and refer to DTC Index in this section for ECM relay and TP sensor tests</li> </ul>
Engine stalls at steady speed	<ul style="list-style-type: none"> <li>● ECM relay</li> <li>● CKP sensor</li> <li>● TP sensors</li> </ul>	<ul style="list-style-type: none"> <li>● Read DTCs and refer to DTC Index in this section for ECM relay, CKP, and TP sensor tests</li> </ul>
Engine stalls with speed control enabled	<ul style="list-style-type: none"> <li>● ECM relay</li> </ul>	<ul style="list-style-type: none"> <li>● Read DTCs and refer to DTC Index in this section for ECM relay tests</li> </ul>
Engine stalls when manoeuvring	<ul style="list-style-type: none"> <li>● ECM relay</li> <li>● TP sensors</li> <li>● Additional engine loads (power steering, air conditioning, etc)</li> <li>● Transmission malfunction</li> <li>● CAN malfunction</li> </ul>	<ul style="list-style-type: none"> <li>● Read DTCs and refer to DTC Index in this section for ECM relay, and TP sensor tests</li> <li>● Check for excessive loads being placed on the engine from power steering, air conditioning systems etc.</li> <li>● For transmission system tests. REFER to: <a href="#">Diagnostic Strategy</a> (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● For CAN network tests. REFER to: <a href="#">Communications Network</a> (418-00 Module Communications Network, Diagnosis and Testing).</li> </ul>
<b>Poor driveability</b>		
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> <li>● Fuel pressure, fuel pump, fuel lines</li> <li>● Injector leak</li> <li>● Air leakage</li> <li>● Electronic engine controls</li> <li>● Ignition system</li> <li>● EGR valve stuck</li> <li>● Transmission malfunction</li> <li>● Restricted pedal travel (carpet, etc)</li> </ul>	<ul style="list-style-type: none"> <li>● For fuel system tests. REFER to: <a href="#">Fuel Tank and Lines</a> (310-01 Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● Carry out fuel injector leak tests, check and install new injectors as required. REFER to: <a href="#">Fuel Injectors</a> (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Removal and Installation).</li> <li>● Check for leakage from air intake system</li> <li>● Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> <li>● For ignition system tests. REFER to: <a href="#">Engine Ignition</a> (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● For EGR valve tests. REFER to: <a href="#">Engine Emission Control</a> (303-08 Engine Emission Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● For transmission system tests. REFER to: <a href="#">Diagnostic Strategy</a> (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● Ensure accelerator pedal is free from</li> </ul>

Symptom	Possible Cause	Action
		restriction
Engine backfires	<ul style="list-style-type: none"> <li>Fuel pump, fuel lines</li> <li>Air leakage</li> <li>Electronic engine controls</li> <li>Ignition system</li> <li>Sticking variable camshaft timing (VCT) hub</li> </ul>	<ul style="list-style-type: none"> <li>For fuel system tests. REFER to: <a href="#">Fuel Tank and Lines</a> (310-01 Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>Check for leakage from air intake system</li> <li>Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> <li>For ignition system tests. REFER to: <a href="#">Engine Ignition</a> (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>Read DTCs and refer to DTC Index in this section for VCT system tests</li> </ul>
Engine surges	<ul style="list-style-type: none"> <li>Fuel pump, fuel lines</li> <li>Electronic engine controls</li> <li>Ignition system</li> </ul>	<ul style="list-style-type: none"> <li>For fuel system tests. REFER to: <a href="#">Fuel Tank and Lines</a> (310-01 Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> <li>For ignition system tests. REFER to: <a href="#">Engine Ignition</a> (303-07 Engine Ignition - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> </ul>
Engine detonates/knocks	<ul style="list-style-type: none"> <li>Electronic engine controls</li> <li>Fuel pump, fuel lines, fuel quality</li> <li>Air leakage</li> <li>Sticking VCT hub</li> </ul>	<ul style="list-style-type: none"> <li>Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> <li>For fuel system tests. REFER to: <a href="#">Fuel Tank and Lines</a> (310-01 Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>Check for leakage from air intake system</li> <li>Read DTCs and refer to DTC Index in this section for VCT system tests</li> </ul>
No throttle response	<ul style="list-style-type: none"> <li>Electronic engine controls</li> </ul>	<ul style="list-style-type: none"> <li>Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> </ul>
Speed control inhibited or disabled	<ul style="list-style-type: none"> <li>Default mode enabled</li> <li>Speed control, brake switch</li> <li>Electronic engine controls</li> <li>CAN fault</li> </ul>	<ul style="list-style-type: none"> <li>Check message center for default message, read DTCs and refer to DTC Index</li> <li>For speed control, and brake switch tests. REFER to: <a href="#">Speed Control</a> (310-03 Speed Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing), <a href="#">Electronic Engine Controls</a> (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> <li>For CAN network tests. REFER to: <a href="#">Communications Network</a> (418-00 Module Communications Network, Diagnosis and Testing).</li> </ul>
Poor throttle response	<ul style="list-style-type: none"> <li>Breather system disconnected/restricted</li> <li>Electronic engine controls</li> <li>Transmission malfunction</li> <li>Traction control event</li> <li>Air leakage</li> </ul>	<ul style="list-style-type: none"> <li>Ensure engine breather system is free from restriction and is correctly installed</li> <li>Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> <li>For transmission system tests. REFER to: <a href="#">Diagnostic Strategy</a> (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>Check for leakage in air intake system</li> </ul>
Engine defaults, warning light and messages. Refer to the owner handbook	<ul style="list-style-type: none"> <li>Electronic engine controls</li> </ul>	<ul style="list-style-type: none"> <li>Read DTCs and refer to DTC Index in this section for electronic engine control tests</li> </ul>

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• **NOTE:** If the module or a component is suspect and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the Check and installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B10A231	Crash Input	<ul style="list-style-type: none"> <li>No signal</li> </ul>	Refer to the electrical circuit diagrams and check RCM PWM signal circuit for short, open circuit
B11DB01	Battery Monitoring Module	<ul style="list-style-type: none"> <li>Battery monitoring system hardware fault</li> </ul>	Disconnect vehicle battery, re-connect after 60 seconds, clear DTC and retest. If DTC remains Check and install a new battery monitoring module
B11DB87	Battery Monitoring Module	<ul style="list-style-type: none"> <li>Battery monitoring module connector dis-connected/poor connection</li> <li>Battery monitoring module to RJB LIN circuit - open circuit</li> <li>Battery monitoring module to battery positive monitor circuit - open circuit</li> <li>Battery monitoring module/RJB failure</li> </ul>	If additional DTCs B108783, B108786, B108787 are logged, suspect the RJB. Check and Check and install a new RJB as required, refer to the new module/component Check and installation note at the top of the DTC Index. If additional DTCs B108783, B108786, B108787 are NOT logged, check for good/clean contact at battery monitoring module connector, refer to electrical circuit diagrams and check battery monitoring module to RJB LIN circuit and battery monitoring module to battery positive monitor circuit for open circuit. Clear DTC and repeat automated diagnostic procedure using manufacturer approved diagnostic system. If DTC remains suspect the battery monitoring module, check and Check and install a new battery monitoring module as required, refer to the new module/component Check and installation note at the top of the DTC Index
B120668	Crash Occurred	<ul style="list-style-type: none"> <li>ECM has detected the vehicle has crashed - event information DTC only</li> </ul>	Check RCM for related DTCs and refer to the relevant DTC Index
C003100	Left Front Wheel Speed Sensor	<ul style="list-style-type: none"> <li>Invalid data received from ABS - left front wheel speed signal</li> </ul>	Check ABS module for related DTCs and refer to relevant DTC Index
C003400	Right Front Wheel Speed Sensor	<ul style="list-style-type: none"> <li>Invalid data received from ABS - right front wheel speed signal</li> </ul>	Check ABS module for related DTCs and refer to relevant DTC Index
C003700	Left Rear Wheel Speed Sensor	<ul style="list-style-type: none"> <li>Invalid data received from ABS - left rear wheel speed signal</li> </ul>	Check ABS module for related DTCs and refer to relevant DTC Index
C003A00	Right Rear Wheel Speed Sensor	<ul style="list-style-type: none"> <li>Invalid data received from ABS - right rear wheel speed signal</li> </ul>	Check ABS module for related DTCs and refer to relevant DTC Index
P001100	Intake (A) Camshaft Position Timing - Over-Advanced (Bank 1)	<ul style="list-style-type: none"> <li>Variable Camshaft Timing (VCT) circuit fault</li> <li>Valve timing incorrectly set</li> <li>Timing chain has slipped</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check VCT circuits for short, open circuit. Check the valve timing
P001200	Intake (A) Camshaft Position Timing - Over-Retarded (Bank 1)	<ul style="list-style-type: none"> <li>Variable Camshaft Timing (VCT) circuit fault</li> <li>Valve timing incorrectly set</li> <li>Timing chain has slipped</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check VCT circuits for short, open circuit. Check the valve timing
P001600	Crankshaft Position - Camshaft Position Correlation - Bank 1 Sensor A	<ul style="list-style-type: none"> <li>The relative positions of the CKP and CMP teeth are not correct <ul style="list-style-type: none"> <li>Sensors incorrectly aligned on rebuild</li> </ul> </li> </ul>	Reset the sensor positions
P001800	Crankshaft Position - Camshaft Position Correlation - Bank 2 Sensor A	<ul style="list-style-type: none"> <li>The relative positions of the CKP and CMP teeth are not correct <ul style="list-style-type: none"> <li>Sensors incorrectly aligned on rebuild</li> </ul> </li> </ul>	Reset the sensor positions

DTC	Description	Possible Cause	Action
P002100	Intake (A) Camshaft Position Timing - Over-Advanced (Bank 2)	<ul style="list-style-type: none"> <li>Variable Camshaft Timing (VCT) circuit fault</li> <li>Valve timing incorrectly set</li> <li>Timing chain has slipped</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check VCT circuits for short, open circuit. Check the valve timing
P002200	Intake (A) Camshaft Position Timing - Over-Retarded (Bank 2)	<ul style="list-style-type: none"> <li>Variable Camshaft Timing (VCT) circuit fault</li> <li>Valve timing incorrectly set</li> <li>Timing chain has slipped</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check VCT circuits for short, open circuit. Check the valve timing
P002672	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	<ul style="list-style-type: none"> <li>VCT solenoid fault</li> <li>Oil contamination</li> <li>VCT oil flow fault</li> <li>VCT/Camshaft mechanical failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check VCT circuits for short, open circuit. Check the oil condition and flow. Check for mechanical failure of components
P002677	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	<ul style="list-style-type: none"> <li>VCT solenoid fault</li> <li>Oil contamination</li> <li>VCT oil flow fault</li> <li>VCT/Camshaft mechanical failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check VCT circuits for short, open circuit. Check the oil condition and flow. Check for mechanical failure of components
P002872	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	<ul style="list-style-type: none"> <li>VCT solenoid fault</li> <li>Oil contamination</li> <li>VCT oil flow fault</li> <li>VCT/Camshaft mechanical failure</li> </ul>	Refer to the electrical circuit diagrams and check VCT circuits for short, open circuit. Check the oil condition and flow. Check for mechanical failure of components
P002877	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	<ul style="list-style-type: none"> <li>VCT solenoid fault</li> <li>Oil contamination</li> <li>VCT oil flow fault</li> <li>VCT/Camshaft mechanical failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check VCT circuits for short, open circuit. Check the oil condition and flow. Check for mechanical failure of components
P003100	HO2S Heater Control Circuit Low (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>HO2S heater circuit - circuit fault</li> <li>HO2S heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S heater circuits for short, open circuit. Check and install a new HO2S as required
P003200	HO2S Heater Control Circuit High (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>HO2S heater circuit - circuit fault</li> <li>HO2S heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S heater circuits for short, open circuit. Check and install a new HO2S as required
P003600	HO2S Heater Control Circuit (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>Catalytic converter monitor sensor heater circuit - circuit fault</li> <li>Catalytic converter monitor sensor heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor heater circuits for short, open circuit. Check and install new Catalytic converter monitor sensor as required
P005100	HO2S Heater Control Circuit Low (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>HO2S heater circuit - circuit fault</li> <li>HO2S heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S heater circuits for short, open circuit. Check and install a new HO2S as required
P005200	HO2S Heater Control Circuit High (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>HO2S heater circuit - circuit fault</li> <li>HO2S heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S heater circuits for short, open circuit. Check and install a new HO2S as required
P005600	HO2S Heater Control Circuit (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>Catalytic converter monitor sensor heater circuit - circuit fault</li> <li>Catalytic converter monitor sensor heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor heater circuits for short, open circuit. Check and install new Catalytic converter monitor sensor as required
P006900	MAP - Barometric Pressure Correlation	<ul style="list-style-type: none"> <li>MAP sensor failure</li> <li>BARO sensor failure (internal ECM fault)</li> </ul>	Check for MAP sensor related DTCs and refer to the DTC Index in this section. Check and install a new ECM. Refer to new module/component Check and installation Note at top of DTC Index
P007100	Ambient Air Temperature Sensor Range/Performance	<ul style="list-style-type: none"> <li>Ambient temperature value missing from CAN bus</li> </ul>	Refer to the electrical circuit diagrams and check ambient air temperature sensor circuits for short to ground, power, open circuit. Check and install a new sensor as required



DTC	Description	Possible Cause	Action
P007200	Ambient Air Temperature Sensor Circuit Low	<ul style="list-style-type: none"> <li>● Ambient air temperature sensor circuit - short to ground, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ambient air temperature sensor circuits for short to ground, high resistance
P007300	Ambient Air Temperature Sensor Circuit High	<ul style="list-style-type: none"> <li>● Ambient air temperature sensor circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ambient air temperature sensor circuits for short to power
P007514	Intake Valve Control Circuit (Bank 1)	<ul style="list-style-type: none"> <li>● VCT control solenoid circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check VCT control solenoid circuit for short to ground, open circuit
P007700	Intake Valve Control Circuit High (Bank 1)	<ul style="list-style-type: none"> <li>● VCT control solenoid circuit - short to power</li> <li>● VCT solenoid failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check VCT circuits for short to power. Check and install a new VCT control solenoid as required
P008114	Intake Valve Control Circuit High (Bank 2)	<ul style="list-style-type: none"> <li>● VCT control solenoid circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check VCT control solenoid circuit for short to ground, open circuit
P008300	Intake Valve Control Circuit High (Bank 2)	<ul style="list-style-type: none"> <li>● VCT control solenoid circuit - short to power</li> <li>● VCT solenoid failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check VCT circuits for short to power. Check and install a new VCT control solenoid as required
P008700	Fuel Rail/System Pressure - Too Low	<ul style="list-style-type: none"> <li>● Fuel rail pressure (Fuel rail pressure) sensor, sensing circuit - short to ground, open circuit</li> <li>● Fuel rail pressure sensor supply circuit - high resistance</li> <li>● Fuel rail pressure sensor failure</li> <li>● Fuel pump failure</li> <li>● Fuel line leak, restriction</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Fuel rail pressure sensor circuits for short to ground, open circuit, high resistance. Check and install a new Fuel rail pressure sensor as required. Check fuel system for failure
P008800	Fuel Rail/System Pressure - Too High	<ul style="list-style-type: none"> <li>● Fuel rail pressure sensor supply/sensing circuits - short to each other</li> <li>● Fuel rail pressure sensor sensing circuit - short to power</li> <li>● Fuel rail pressure sensor ground circuit - high resistance</li> <li>● Fuel rail pressure sensor failure</li> <li>● Restricted fuel line</li> <li>● Fuel pump short circuit to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Fuel rail pressure sensor circuits for short to each other, power, open circuit, high resistance. Check and install a new Fuel rail pressure sensor as required. Check fuel system for failure
P009623	Intake Air Temperature Sensor 2 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Charge air cooler air temperature sensor circuit - signal stuck low</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to ground, high resistance
P009624	Intake Air Temperature Sensor 2 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Charge air cooler air temperature sensor circuit - signal stuck high</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to power
P009629	Intake Air Temperature Sensor 2 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Charge air cooler air temperature sensor circuit - signal invalid</li> <li>● Charge air cooler air temperature sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short, open circuit. Check and install a new sensor as required
P009700	Intake Air Temperature Sensor 2 Circuit Low	<ul style="list-style-type: none"> <li>● No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to ground, high resistance
P009800	Intake Air Temperature Sensor 2 Circuit High	<ul style="list-style-type: none"> <li>● No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to power

DTC	Description	Possible Cause	Action
P00AB23	Intake Air Temperature Sensor 1 Circuit Range/Performance (Bank 2)	<ul style="list-style-type: none"> <li>● Charge air cooler air temperature sensor circuit - signal stuck low</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to ground, high resistance
P00AB24	Intake Air Temperature Sensor 1 Circuit Range/Performance (Bank 2)	<ul style="list-style-type: none"> <li>● Charge air cooler air temperature sensor circuit - signal stuck high</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to power
P00AB25	Intake Air Temperature Sensor 1 Circuit Range/Performance (Bank 2)	<ul style="list-style-type: none"> <li>● Signal shape/waveform failure</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to ground, power, open circuit
P00AB29	Intake Air Temperature Sensor 1 Circuit Range/Performance (Bank 2)	<ul style="list-style-type: none"> <li>● Charge air cooler air temperature sensor circuit - signal invalid</li> <li>● Charge air cooler air temperature sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short, open circuit. Check and install a new sensor as required
P00AC00	Intake Air Temperature Sensor 1 Circuit Low (Bank 2)	<ul style="list-style-type: none"> <li>● No sub type information</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to ground, high resistance
P00AD00	Intake Air Temperature Sensor 1 Circuit High (Bank 2)	<ul style="list-style-type: none"> <li>● No sub type information</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler air temperature sensor circuit for short to power
P010100	Mass or Volume Air Flow A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Blocked air cleaner element</li> <li>● Leakage from air intake system</li> <li>● Engine breather leak</li> <li>● MAF sensor sensing circuit - high resistance, intermittent short to ground</li> <li>● MAF sensor supply circuit - high resistance</li> <li>● MAF sensor failure</li> </ul>	Check air cleaner element is free from restriction. Check for leak from air intake system, rectify as required. Ensure the engine breather system is correctly installed and in serviceable condition. Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuit for intermittent short to ground, high resistance. Check and install a new MAF sensor as required
P010200	Mass or Volume Air Flow A Circuit Low	<ul style="list-style-type: none"> <li>● MAF sensor circuits - short to ground, high resistance</li> <li>● MAF sensor ground circuit - high resistance</li> <li>● MAF sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuits for short to power ground, high resistance. Check and install a new MAF sensor as required
P010300	Mass or Volume Air Flow A Circuit High	<ul style="list-style-type: none"> <li>● MAF sensor circuits - short to power</li> <li>● MAF sensor ground circuit - high resistance</li> <li>● MAF sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuits for short to power, ground, high resistance. Check and install a new MAF sensor as required
P010600	Manifold Absolute Pressure/BARO Sensor Range/Performance	<ul style="list-style-type: none"> <li>● Intake manifold air leak (loose or missing component)</li> <li>● MAP sensor signal circuit fault</li> <li>● MAP sensor failure</li> </ul>	Check for correct installation and serviceability of intake manifold and associated components. Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAP sensor circuits for short, open circuit. Check and install a new MAP sensor as required
P010700	Manifold Absolute Pressure/BARO Sensor Low	<ul style="list-style-type: none"> <li>● MAP sensor circuits - short to ground, high resistance</li> <li>● MAP sensor ground circuits - high resistance</li> <li>● MAP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAP sensor circuits for short to ground, high resistance. Check and install a new MAP sensor as required
P010800	Manifold Absolute Pressure/BARO Sensor High	<ul style="list-style-type: none"> <li>● MAP sensor circuits - short to power</li> <li>● MAP sensor power circuits - high resistance</li> <li>● MAP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAP sensor circuits for short to power, high resistance. Check and install a new MAP sensor as required
P010B00	Mass or Volume Air Flow B Circuit Range/Performance	<ul style="list-style-type: none"> <li>● No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuits for short, open circuit
P010C00	Mass or Volume Air Flow B Circuit Low	<ul style="list-style-type: none"> <li>● MAF sensor circuits - short to ground, high resistance</li> <li>● MAF sensor ground circuit - high resistance</li> <li>● MAF sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuits for short to ground, high resistance. Check and install a new MAF sensor as required
P010D00	Mass or Volume Air Flow B Circuit High	<ul style="list-style-type: none"> <li>● MAF sensor circuits - short to power</li> <li>● MAF sensor ground circuit - high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAF sensor circuits for short to power,

DTC	Description	Possible Cause	Action
		<ul style="list-style-type: none"> <li>● MAF sensor failure</li> </ul>	ground, high resistance. Check and install a new MAF sensor as required
P010F00	Mass or Volume Air Flow Sensor A/B Correlation	<ul style="list-style-type: none"> <li>● Blocked Air cleaner in 1 bank</li> <li>● Leakage from intake air system</li> <li>● Engine breather leak</li> <li>● Flow Diffusor blocking MAF sensor</li> <li>● Failure of A bank MAF sensor</li> <li>● Failure of B bank MAF sensor</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for any P0101 or P010B DTCs. Check air cleaner is free from restriction. Check for any leaks in the intake air system and all joints. Check engine breather system is correctly installed and in a serviceable condition. Check flow diffusors are not obstructing MAF sensors. Check and install new MAF sensors as required
P011123	Intake Air Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● IAT sensor sensing circuit - high resistance</li> <li>● IAT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor circuits for short, open circuit, high resistance. Check and install a new MAF sensor as required
P011124	Intake Air Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● IAT sensor sensing circuit - high resistance</li> <li>● IAT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor circuits for short, open circuit, high resistance. Check and install a new MAF sensor as required
P011129	Intake Air Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● IAT sensor sensing circuit - high resistance</li> <li>● IAT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor circuits for short, open circuit, high resistance. Check and install a new MAF sensor as required
P011200	Intake Air Temperature Sensor 1 Circuit Low	<ul style="list-style-type: none"> <li>● IAT sensor sensing circuit - high resistance, disconnected</li> <li>● IAT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor circuits for short, open circuit, high resistance, disconnected connector. Check and install a new MAF sensor as required
P011300	Intake Air Temperature Sensor 1 Circuit High	<ul style="list-style-type: none"> <li>● IAT sensor sensing circuit - short to ground, short to power</li> <li>● IAT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check IAT sensor circuits for short, open circuit, high resistance. Check and install a new MAF sensor as required
P011623	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Low coolant level</li> <li>● ECT sensor sensing circuit - intermittent high resistance</li> <li>● Engine thermostat failure</li> <li>● ECT sensor failure</li> </ul>	Fill cooling system to correct level and specification. REFER to: <a href="#">Specifications</a> (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications). Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor circuits for intermittent high resistance. Check and install new engine thermostat as required. Check and install a new ECT sensor as required
P011624	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Low coolant level</li> <li>● ECT sensor sensing circuit - intermittent high resistance</li> <li>● Engine thermostat failure</li> <li>● ECT sensor failure</li> </ul>	Fill cooling system to correct level and specification. REFER to: <a href="#">Specifications</a> (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications). Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor circuits for intermittent high resistance. Check and install new engine thermostat as required. Check and install a new ECT sensor as required
P011629	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Low coolant level</li> <li>● ECT sensor sensing circuit - intermittent high resistance</li> <li>● Engine thermostat failure</li> <li>● ECT sensor failure</li> </ul>	Fill cooling system to correct level and specification. REFER to: <a href="#">Specifications</a> (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications). Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor circuits for intermittent high resistance. Check and install new engine thermostat as required. Check and install a new ECT sensor as required
P011700	Engine Coolant Temperature Sensor 1 Circuit Low	<ul style="list-style-type: none"> <li>● ECT sensor sensing circuit - short to power, high resistance, open circuit, disconnected</li> <li>● ECT sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor circuits for short to power, high resistance, open circuit, disconnected connector. Check and install a new ECT sensor

DTC	Description	Possible Cause	Action
			as required
P011800	Engine Coolant Temperature Sensor 1 Circuit High	<ul style="list-style-type: none"> <li>● Engine overheat condition/cooling fan failure</li> <li>● ECT sensor sensing circuit - short to ground</li> <li>● ECT sensor failure</li> </ul>	Check for cooling fan circuit DTCs and refer to relevant action specified in DTC Index. Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor circuits for short to ground. Check and install a new ECT sensor as required
P012100	Throttle/Pedal Position Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● TP sensor sensing circuits TP 1 and TP 2 - short to power, high resistance</li> <li>● TP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check TP sensor sensing circuits TP 1 and TP 2 for short to power, high resistance. Check and install a new throttle body as required
P012200	Throttle/Pedal Position Sensor A Circuit Low	<ul style="list-style-type: none"> <li>● TP sensor sensing circuit TP 1 - short to ground, high resistance</li> <li>● TP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check TP sensor sensing circuit TP 1 for short to ground, high resistance. Check and install a new throttle body as required
P012300	Throttle/Pedal Position Sensor A Circuit High	<ul style="list-style-type: none"> <li>● TP sensor sensing circuit TP1 - short to power</li> <li>● TP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check TP sensor sensing circuit TP 1 for short to power. Check and install a new throttle body as required
P012500	Insufficient Coolant Temp For Closed Loop Fuel Control	<ul style="list-style-type: none"> <li>● Low coolant level</li> <li>● ECT sensor sensing circuit - intermittent high resistance</li> <li>● Engine thermostat failure</li> <li>● ECT sensor failure</li> </ul>	Fill cooling system to correct level and specification. REFER to: <a href="#">Specifications</a> (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications). Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECT sensor sensing circuit for intermittent high resistance. Check and install new engine thermostat as required. Check and install a new ECT sensor as required
P012800	Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature)	<ul style="list-style-type: none"> <li>● Low/contaminated coolant</li> <li>● Engine thermostat failure</li> <li>● Cooling fan circuit(s)/module</li> </ul>	Drain and re-fill cooling system to correct level and specification. REFER to: <a href="#">Specifications</a> (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications). Check and install a new engine thermostat as required. Refer to the electrical circuit diagrams and check cooling fan circuits for short, open circuit. Check for correct operation of cooling fan, check for DTCs and refer to DTC Index
P01311A	O2 Circuit Low Voltage (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>● Exhaust gas leakage</li> <li>● HO2S variable/constant circuit - circuit fault, disconnected</li> <li>● HO2S failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.). Refer to the electrical circuit diagrams and check HO2S variable/constant circuit for short, open circuit, disconnected connector. Check and install a new HO2S as required
P01321B	O2 Circuit High Voltage (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>● Exhaust gas leakage</li> <li>● HO2S variable/constant circuit - circuit fault, disconnected</li> <li>● HO2S failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.). Refer to the electrical circuit diagrams and check HO2S variable/constant circuit for short, open circuit, disconnected connector. Check and install a new HO2S as required
P013300	O2 Circuit Slow Response (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>● Exhaust leak</li> <li>● HO2S to ECM wiring shield high resistance</li> <li>● Fuel control system fault</li> <li>● HO2 sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.). Refer to the electrical circuit diagrams and check HO2S to ECM wiring shield for high resistance. Check fuel control system for failure. Check and install a new HO2S as required
P013400	O2 Circuit No Activity Detected (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S slow activation</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
P013700	O2 Circuit Low Voltage (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor sensing circuit - short to ground, high resistance, disconnected</li> <li>● Catalytic converter monitor sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor sensing circuit for short to ground, high resistance, disconnected connector. Check and install new Catalytic converter monitor sensor as required
P013800	O2 Circuit High Voltage (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor sensing circuit - short to power</li> <li>● Catalytic converter monitor sensor ground braided shield - high resistance</li> <li>● Catalytic converter monitor sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor circuits for short to power, and ground braided shield for high resistance. Check and install new Catalytic converter monitor sensor as required
P013900	O2 Circuit Slow Response (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor tip damaged or blocked</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check Catalytic converter monitor sensor tip for damage or blockage, install a new sensor as required
P014000	O2 Circuit No Activity Detected (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor sensing circuit - short to ground, short to power, high resistance, disconnected</li> <li>● Catalytic converter monitor sensor ground braided shield - high resistance</li> <li>● Catalytic converter monitor sensor - mechanical damage</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor circuits for short to ground, power, high resistance, disconnected connector and ground braided shield for high resistance. Check and install new Catalytic converter monitor sensor as required
P014100	O2 Heater Circuit (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor heater control circuit - high resistance</li> <li>● Catalytic converter monitor sensor heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor heater control circuit for high resistance. Check and install a new Catalytic converter monitor sensor as required
P01511A	O2 Circuit Low Voltage (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S sensing circuit - short to ground, short to power, high resistance</li> <li>● HO2S failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S sensing circuit for short to ground, power, high resistance. Check and install a new HO2S as required
P01521B	O2 Circuit High Voltage (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S sensing circuit - short to ground, short to power, high resistance</li> <li>● HO2S failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S sensing circuit for short to ground, power, high resistance. Check and install a new HO2S as required
P015300	O2 Circuit Slow Response (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S to ECM wiring shield high resistance</li> <li>● Exhaust leak</li> <li>● Fuel control system fault</li> <li>● HO2 sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S to ECM wiring shield for high resistance. Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.). Check fuel control system for failure. Check and install a new HO2S as required
P015400	O2 Circuit No Activity Detected (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S slow activation</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P015700	O2 Circuit Low Voltage (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor sensing circuit - short to ground, high resistance, disconnected</li> <li>● Catalytic converter monitor sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor sensing circuit for short to ground, high resistance, disconnected connector. Check and install a new Catalytic converter monitor sensor as required
P015800	O2 Circuit High Voltage (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor sensing circuit - short to power</li> <li>● Catalytic converter monitor sensor ground braided shield - high resistance</li> <li>● Catalytic converter monitor sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor sensing circuit for short to power, and sensor ground braided shield for high resistance. Check and install a new Catalytic converter monitor sensor as required

DTC	Description	Possible Cause	Action
P015900	O2 Circuit Slow Response (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor tip damaged or blocked</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check Catalytic converter monitor sensor tip for damage or blockage, install a new sensor as required
P016000	O2 Circuit No Activity Detected (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensing circuit - short to ground, short to power, high resistance, disconnected</li> <li>● Catalytic converter monitor sensor ground braided shield - high resistance</li> <li>● Catalytic converter monitor sensor - mechanical damage</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensing circuit for short to ground, short to power, high resistance, disconnected connector, and sensor ground braided shield for high resistance. Check and install a new Catalytic converter monitor sensor as required
P016100	O2 Heater Circuit (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor heater control circuit malfunction</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor heater control circuit for short, open circuit
P017100	System too lean (bank 1)	<ul style="list-style-type: none"> <li>● Air intake leak between MAF sensor and cylinder head</li> <li>● Fuel filter, injector, system restriction</li> <li>● MAF sensor fault (low intake air flow)</li> <li>● Exhaust leak (forward of catalytic converter)</li> </ul>	Check for leak from air intake system. Check for fuel system blockage/restriction. Check for additional MAF sensor related DTCs and refer to relevant DTC Index. Check and rectify any exhaust leak prior to catalytic converter
P017200	System Too Rich (Bank 1)	<ul style="list-style-type: none"> <li>● Restricted air cleaner</li> <li>● Leaking fuel injector(s)</li> <li>● Engine oil contaminated with fuel (too many cold starts with vehicle subsequently not getting hot enough for long enough)</li> <li>● MAF sensor fault (high intake air flow)</li> </ul>	Check air cleaner element is free from restriction. Check for leaking injectors, install new injector(s) as required. Check for contaminated engine oil, drain and refill engine oil as required. Check for additional MAF sensor related DTCs and refer to relevant DTC Index
P017400	System Too Lean (Bank 2)	<ul style="list-style-type: none"> <li>● Air intake leak between MAF sensor and cylinder head</li> <li>● Fuel filter, injector, system restriction</li> <li>● MAF sensor fault (low intake air flow)</li> <li>● Exhaust leak (forward of catalytic converter)</li> </ul>	Check for leak from air intake system. Check for fuel system blockage/restriction. Check for additional MAF sensor related DTCs and refer to relevant DTC Index. Check and rectify any exhaust leak prior to catalytic converter
P017500	System Too Rich (Bank 2)	<ul style="list-style-type: none"> <li>● Restricted air cleaner</li> <li>● Leaking fuel injector(s)</li> <li>● Engine oil contaminated with fuel (too many cold starts with vehicle subsequently not getting hot enough for long enough)</li> <li>● MAF sensor fault (high intake air flow)</li> </ul>	Check air cleaner element is free from restriction. Check for leaking injectors, install new injector(s) as required. Check for contaminated engine oil, drain and refill engine oil as required. Check for additional MAF sensor related DTCs and refer to relevant DTC Index
P018123	Fuel Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Fuel temperature sensor sensing circuit - short to ground, short to power, high resistance</li> <li>● Fuel temperature sensor ground circuit - high resistance</li> <li>● Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P018124	Fuel Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Fuel temperature sensor sensing circuit - short to ground, short to power, high resistance</li> <li>● Fuel temperature sensor ground circuit - high resistance</li> <li>● Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P018129	Fuel Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Fuel temperature sensor sensing circuit - short to ground, short to power, high resistance</li> <li>● Fuel temperature sensor</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check



DTC	Description	Possible Cause	Action
		<ul style="list-style-type: none"> <li>ground circuit - high resistance</li> <li>Fuel temperature sensor failure</li> </ul>	and install a new Fuel temperature sensor as required
P018200	Fuel Temperature Sensor A Circuit Low	<ul style="list-style-type: none"> <li>Fuel temperature sensor sensing circuit - short to ground</li> <li>Fuel temperature sensor ground circuit - short circuit</li> <li>Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P018300	Fuel Temperature Sensor A Circuit High	<ul style="list-style-type: none"> <li>Fuel temperature sensor sensing circuit - short to power, high resistance, disconnected</li> <li>Fuel temperature sensor ground circuit - high resistance</li> <li>Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P019100	Fuel Rail Pressure Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Fuel rail pressure sensor stuck</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P019200	Fuel Rail Pressure Sensor A Circuit Low	<ul style="list-style-type: none"> <li>Fuel rail pressure sensor sensing circuit - short to ground, high resistance, disconnected</li> <li>Fuel rail pressure sensor 5V supply circuit - high resistance</li> <li>Fuel rail pressure sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuits for short to ground, power, high resistance, disconnected connector. Check and install a new Fuel rail pressure sensor as required
P019300	Fuel Rail Pressure Sensor A Circuit High	<ul style="list-style-type: none"> <li>Fuel rail pressure sensor supply/sensing circuits - short circuit to each other</li> <li>Fuel rail pressure sensor sensing circuit - short to power</li> <li>Fuel rail pressure sensor ground circuit - high resistance</li> <li>Fuel rail pressure sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuits for short to ground, power, high resistance, disconnected connector. Check and install a new Fuel rail pressure sensor as required
P019623	Engine Oil Temperature Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>Engine oil temperature sensor sensing circuit - intermittent high resistance</li> <li>Engine oil temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check engine oil temperature sensor circuits for short to ground, power, high resistance. Check and install a new engine oil temperature sensor as required
P019624	Engine Oil Temperature Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>Engine oil temperature sensor sensing circuit - intermittent high resistance</li> <li>Engine oil temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check engine oil temperature sensor circuits for short to ground, power, high resistance. Check and install a new engine oil temperature sensor as required
P019629	Engine Oil Temperature Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>Engine oil temperature sensor sensing circuit - intermittent high resistance</li> <li>Engine oil temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check engine oil temperature sensor circuits for short to ground, power, high resistance. Check and install a new engine oil temperature sensor as required
P019700	Engine Oil Temperature Sensor Circuit Low	<ul style="list-style-type: none"> <li>Engine oil temperature sensor sensing circuit - short to ground</li> <li>Engine oil temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check engine oil temperature sensor circuits for short to ground, power, high resistance. Check and install a new engine oil temperature sensor as required
P019800	Engine Oil Temperature Sensor Circuit High	<ul style="list-style-type: none"> <li>Engine oil temperature sensor sensing circuit - short to power, high resistance, disconnected</li> <li>Engine oil temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check engine oil temperature sensor circuits for short to ground, power, high resistance, disconnected connector. Check and install a new engine oil temperature sensor as required

DTC	Description	Possible Cause	Action
P020100	Cylinder 1 Injector Circuit / Open	<ul style="list-style-type: none"> <li>● Injector circuit - short to ground, high resistance, disconnected</li> <li>● Injector failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check injector circuits for short to ground, high resistance, disconnected connector. Check and install a new injector as required
P020200	Cylinder 2 Injector Circuit / Open	<ul style="list-style-type: none"> <li>● Injector circuit - short to ground, high resistance, disconnected</li> <li>● Injector failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check injector circuits for short to ground, high resistance, disconnected connector. Check and install a new injector as required
P020300	Cylinder 3 Injector Circuit / Open	<ul style="list-style-type: none"> <li>● Injector circuit - short to ground, high resistance, disconnected</li> <li>● Injector failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check injector circuits for short to ground, high resistance, disconnected connector. Check and install a new injector as required
P020400	Cylinder 4 Injector Circuit / Open	<ul style="list-style-type: none"> <li>● Injector circuit - short to ground, high resistance, disconnected</li> <li>● Injector failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check injector circuits for short to ground, high resistance, disconnected connector. Check and install a new injector as required
P020500	Cylinder 5 Injector Circuit / Open	<ul style="list-style-type: none"> <li>● Injector circuit - short to ground, high resistance, disconnected</li> <li>● Injector failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check injector circuits for short to ground, high resistance, disconnected connector. Check and install a new injector as required
P020600	Cylinder 6 Injector Circuit / Open	<ul style="list-style-type: none"> <li>● Injector circuit - short to ground, high resistance, disconnected</li> <li>● Injector failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check injector circuits for short to ground, high resistance, disconnected connector. Check and install a new injector as required
P020700	Cylinder 7 Injector Circuit / Open	<ul style="list-style-type: none"> <li>● Injector circuit - short to ground, high resistance, disconnected</li> <li>● Injector failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check injector circuits for short to ground, high resistance, disconnected connector. Check and install a new injector as required
P020800	Cylinder 8 Injector Circuit / Open	<ul style="list-style-type: none"> <li>● Injector circuit - short to ground, high resistance, disconnected</li> <li>● Injector failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check injector circuits for short to ground, high resistance, disconnected connector. Check and install a new injector as required
P022200	Throttle/Pedal Position Sensor/Switch B Circuit Low	<ul style="list-style-type: none"> <li>● TP sensor sensing circuit TP 2 - short to ground, high resistance</li> <li>● TP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check TP sensor sensing circuit TP 2 for short to ground, high resistance. Check and install a new throttle body as required
P022300	Throttle/Pedal Position Sensor/Switch B Circuit High	<ul style="list-style-type: none"> <li>● TP sensor sensing circuit TP 2- short to power</li> <li>● TP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check TP sensor sensing circuit TP 2 for short to power. Check and install a new throttle body as required
P022700	Throttle/Pedal Position Sensor/Switch C Circuit Low	<ul style="list-style-type: none"> <li>● APP sensor circuit APP 1 - short to ground, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check APP sensor circuit APP 1 for short to ground, high resistance
P022800	Throttle/Pedal Position Sensor/Switch C Circuit High	<ul style="list-style-type: none"> <li>● APP sensor circuit APP 1 - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check APP sensor circuit APP 1 for short to power
P023100	Fuel Pump Secondary Circuit Low	<ul style="list-style-type: none"> <li>● No sub type information</li> </ul>	Refer to the electrical circuit diagrams and check FPDM monitor circuit to ECM for short to ground, high resistance
P023200	Fuel Pump Secondary Circuit High	<ul style="list-style-type: none"> <li>● No sub type information</li> </ul>	Refer to the electrical circuit diagrams and check FPDM monitor circuit to ECM for short to power
P023600	Turbocharger/Supercharger Boost Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Intake manifold air leak (loose or missing component)</li> <li>● MAP sensor signal circuit fault</li> <li>● MAP sensor failure</li> </ul>	Check for correct installation and serviceability of intake manifold and associated components. Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAP sensor circuits for short, open circuit. Check and install a new MAP sensor as

DTC	Description	Possible Cause	Action
			required
P023700	Turbocharger/Supercharger Boost Sensor A Circuit Low	<ul style="list-style-type: none"> <li>● MAP sensor circuits - short to ground, high resistance</li> <li>● MAP sensor ground circuits - high resistance</li> <li>● MAP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAP sensor circuits for short to ground, high resistance. Check and Check and install a new MAP sensor as required
P023800	Turbocharger/Supercharger Boost Sensor A Circuit High	<ul style="list-style-type: none"> <li>● MAP sensor circuits - short to power</li> <li>● MAP sensor power circuits - high resistance</li> <li>● MAP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check MAP sensor circuits for short to power, high resistance. Check and Check and install a new MAP sensor as required
P023800	Turbocharger/Supercharger Boost Sensor A Circuit High	<ul style="list-style-type: none"> <li>● Turbocharger/supercharger boost sensor A circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check turbocharger/supercharger boost sensor A circuit for short to power
P023B13	Charge Air Cooler Coolant Pump Control Circuit Low	<ul style="list-style-type: none"> <li>● Charge air cooler coolant pump control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler coolant pump control circuit for open circuit
P023C12	Charge Air Cooler Coolant Pump Control Circuit High	<ul style="list-style-type: none"> <li>● Charge air cooler coolant pump control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check charge air cooler coolant pump control circuit for short to power
P032700	Knock Sensor 1 Circuit Low (Bank1)	<ul style="list-style-type: none"> <li>● Poor sensor contact with the cylinder block</li> <li>● KS circuit - short to ground</li> <li>● KS failure</li> </ul>	Ensure a good electrical contact with the cylinder block. Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check KS circuits for short to ground. Check and install a new KS as required
P032800	Knock Sensor 1 Circuit High (Bank 1)	<ul style="list-style-type: none"> <li>● Poor sensor contact with the cylinder block</li> <li>● KS circuit - high resistance, short to power</li> <li>● KS failure</li> </ul>	Ensure a good electrical contact with the cylinder block. Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check KS circuits for short to power, high resistance. Check and install a new KS as required
P033200	Knock Sensor 2 Circuit Low (Bank 2)	<ul style="list-style-type: none"> <li>● Poor sensor contact with the cylinder block</li> <li>● KS circuit - short to ground</li> <li>● KS failure</li> </ul>	Ensure a good electrical contact with the cylinder block. Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check KS circuits for short to ground. Check and install a new KS as required
P033300	Knock Sensor 2 Circuit High (Bank 2)	<ul style="list-style-type: none"> <li>● Poor sensor contact with the cylinder block</li> <li>● KS circuit - high resistance, short to power</li> <li>● KS failure</li> </ul>	Ensure a good electrical contact with the cylinder block. Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check KS circuits for short to power, high resistance. Check and install a new KS as required
P033592	Crankshaft Position Sensor A Circuit	<ul style="list-style-type: none"> <li>● CKP sensor circuit - short to ground, short to power, high resistance, disconnected</li> <li>● CKP sensor gap incorrect, foreign matter on sensor face, damaged teeth on rotor</li> <li>● CKP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CKP sensor circuit for short to ground, short to power, high resistance, disconnected connector. Check CKP sensor for damage and check air gap (check at 90° intervals, should be no greater than 4.5mm). Check and install a new CKP sensor as required
P033594	Crankshaft Position Sensor A Circuit	<ul style="list-style-type: none"> <li>● CKP sensor circuit - short to ground, short to power, high resistance, disconnected</li> <li>● CKP sensor gap incorrect, foreign matter on sensor face, damaged teeth on rotor</li> <li>● CKP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CKP sensor circuit for short to ground, short to power, high resistance, disconnected connector. Check CKP sensor for damage and check air gap (check at 90° intervals, should be no greater than 4.5mm). Check and install a new CKP sensor as required
P033600	Crankshaft Position Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● CKP sensor circuit - short to ground, short to power, high resistance, disconnected</li> <li>● CKP sensor gap incorrect, foreign matter on sensor face, damaged teeth on rotor</li> <li>● CKP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CKP sensor circuit for short to ground, short to power, high resistance, disconnected connector. Check CKP sensor for damage and check air gap (check at 90° intervals, should be no greater than 4.5mm). Check and install a new CKP sensor as required



DTC	Description	Possible Cause	Action
			to ground, power, high resistance
P035800	Ignition Coil H Primary/Secondary Circuit	<ul style="list-style-type: none"> <li>● Ignition module/coil circuits - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ignition module/coil circuits for short to ground, power, high resistance
P040100	Exhaust Gas Recirculation Flow Insufficient Detected	<ul style="list-style-type: none"> <li>● EGR valve/pipe incorrectly installed or loose</li> <li>● EGR pipe blocked</li> <li>● EGR valve stuck closed, blocked</li> <li>● EGR valve failure</li> </ul>	Check for correct installation of the EGR valve and pipe. Check for blockage in EGR valve and pipe. Check for stuck EGR valve. Check and install a new EGR valve as required
P041100	Secondary Air Injection Incorrect Upstream Flow Detected	<ul style="list-style-type: none"> <li>● Low airflow being delivered from secondary air injection (AIR) pump</li> </ul>	Check AIR pump, vacuum solenoid and AIR control valve hardware. Refer to the electrical circuit diagrams and check AIR pump and vacuum solenoid power supply circuits. Check stuck/partially stuck vacuum solenoid. Check for loose/split vacuum pipe from solenoid to AIR control valve. Check for loose/split AIR pump outlet pipe
P041300	Secondary Air Injection Switching Valve A Circuit Open	<ul style="list-style-type: none"> <li>● AIR vacuum solenoid control circuit high</li> </ul>	Refer to the electrical circuit diagrams and check AIR vacuum solenoid control circuit for short to power
P041400	Secondary Air Injection Switching Valve A Circuit Shorted	<ul style="list-style-type: none"> <li>● AIR vacuum solenoid control circuit low</li> </ul>	Refer to the electrical circuit diagrams and check AIR vacuum solenoid control circuit for short to ground, high resistance
P042000	Catalytic converter System Efficiency Below Threshold (Bank 1)	<ul style="list-style-type: none"> <li>● Catalytic converter failure due to overheating damage caused by misfire and/or lean combustion</li> <li>● Catalytic converter failure due to poisoning caused by excessive oil consumption and/or contaminated fuel</li> </ul>	Check for misfire/lean combustion DTCs and refer to DTC Index in this section. Check the oil and fuel condition/level. Check the catalytic converter for damage
P043000	Catalytic converter System Efficiency Below Threshold (Bank 2)	<ul style="list-style-type: none"> <li>● Catalytic converter failure due to overheating damage caused by misfire and/or lean combustion</li> <li>● Catalytic converter failure due to poisoning caused by excessive oil consumption and/or contaminated fuel</li> </ul>	Check for misfire/lean combustion DTCs and refer to DTC Index in this section. Check the oil and fuel condition/level. Check the catalytic converter for damage
P044100	Evaporative Emission System Incorrect Purge Flow	<ul style="list-style-type: none"> <li>● Purge valve - range/performance</li> </ul>	Refer to the electrical circuit diagrams and check EVAP purge valve control circuit for short, open circuit
P044200	Evaporative Emission System Leak Detected (small leak)	<ul style="list-style-type: none"> <li>● No sub type information</li> </ul>	Check EVAP system for leak using appropriate smoke/leak tester
P044700	Evaporative Emission System Vent Control Circuit Open	<ul style="list-style-type: none"> <li>● DMTL COV circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL COV circuit for short to ground
P044800	Evaporative Emission System Vent Control Circuit Shorted	<ul style="list-style-type: none"> <li>● DMTL COV circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL COV circuit for short to power
P045600	Evaporative Emission System Leak Detected (very small leak)	<ul style="list-style-type: none"> <li>● DMTL system has detected a leak</li> </ul>	Check EVAP system for leak using appropriate smoke/leak tester
P045800	Evaporative Emission System Purge Control Valve Circuit Low	<ul style="list-style-type: none"> <li>● EVAP canister purge valve control circuit - short to ground, high resistance</li> <li>● EVAP canister purge valve failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EVAP canister purge valve control circuit for short to ground, high resistance. Check and install a new EVAP canister purge valve as required
P045900	Evaporative Emission System Purge Control Valve Circuit High	<ul style="list-style-type: none"> <li>● EVAP canister purge valve control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EVAP canister purge valve control circuit for short to power
P046129	Fuel Level Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Fuel level sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel level sensor circuits for short, open circuit, high resistance
P04612F	Fuel Level Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Fuel level sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel level sensor circuits for short, open circuit, high resistance

DTC	Description	Possible Cause	Action
P046200	Fuel Level Sensor A Circuit Low	<ul style="list-style-type: none"> <li>Fuel level sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel level sensor circuits for short, open circuit, high resistance
P046300	Fuel Level Sensor A Circuit High	<ul style="list-style-type: none"> <li>Fuel level sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel level sensor circuits for short, open circuit, high resistance
P048023	Fan 1 Control Circuit	<ul style="list-style-type: none"> <li>Electric cooling fan control circuit - short to ground, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check electric cooling fan control circuit for short to ground, high resistance
P048024	Fan 1 Control Circuit	<ul style="list-style-type: none"> <li>Electric cooling fan control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check electric cooling fan control circuit for short to power
P048309	Fan Performance	<ul style="list-style-type: none"> <li>Cooling fan difficult to turn/obstructed</li> <li>Fan/Motor damaged</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. CLEAR any obstruction and Check and install a new fan as required
P048316	Fan Performance	<ul style="list-style-type: none"> <li>Cooling fan control module reports battery voltage less than nine volts</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check the battery is in fully charged and serviceable condition. Refer to the electrical circuit diagrams and check the charging system and cooling fan circuits for short, open circuit
P048317	Fan Performance	<ul style="list-style-type: none"> <li>Fan control module reports battery voltage greater than 18 volts</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check the charging system and cooling fan circuits for short, open circuit
P048397	Fan Performance	<ul style="list-style-type: none"> <li>Cooling fan jammed</li> </ul>	Clear any obstruction from cooling fan
P048900	Exhaust Gas Recirculation Control Circuit Low	<ul style="list-style-type: none"> <li>EGR valve power supply circuit - short to ground, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EGR valve power supply circuit for short to ground, high resistance
P049000	Exhaust Gas Recirculation Control Circuit High	<ul style="list-style-type: none"> <li>EGR valve control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EGR valve control circuit for short to power
P049100	Secondary Air Injection System Insufficient Flow (Bank 1)	<ul style="list-style-type: none"> <li>Low airflow being delivered to secondary air injection (AIR) system (Bank 1)</li> </ul>	Check (Bank 1) AIR system pipe for blockage. Check for loose/split AIR pump outlet pipe
P049200	Secondary Air Injection System Insufficient Flow (Bank 2)	<ul style="list-style-type: none"> <li>Low airflow being delivered to secondary air injection (AIR) system (Bank 2)</li> </ul>	Check (Bank 2) AIR system pipe for blockage. Check for loose/split AIR pump outlet pipe
P050082	Vehicle Speed Sensor A	<ul style="list-style-type: none"> <li>Vehicle speed - invalid signal received over CAN</li> </ul>	Check ABS for related DTCs and refer to relevant DTC Index
P050086	Vehicle Speed Sensor A	<ul style="list-style-type: none"> <li>Vehicle speed - invalid signal received over CAN</li> </ul>	Check ABS for related DTCs and refer to relevant DTC Index
P050162	Vehicle Speed Sensor A Range/Performance	<ul style="list-style-type: none"> <li>Vehicle speed - range performance</li> </ul>	Check ABS/TCM for related DTCs and refer to relevant DTC Index
P050400	Brake Switch A / B Correlation	<ul style="list-style-type: none"> <li>The brake pressure reading does not agree with the brake light switch value</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check brake switch circuits for short, open circuit, high resistance
P050401	Brake Switch A / B Correlation	<ul style="list-style-type: none"> <li>Brake switch high fault: <ul style="list-style-type: none"> <li>Brake lights stuck on</li> <li>Gearshift interlock inoperative</li> <li>Speed control inoperative</li> </ul> </li> <li>Brake switch low fault: <ul style="list-style-type: none"> <li>Brake lights inoperative</li> <li>Gearshift stuck in Park</li> <li>Reduced engine braking</li> </ul> </li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check brake switch circuits for short, open circuit, high resistance
P050600	Idle Air Control System RPM Lower Than Expected	<ul style="list-style-type: none"> <li>Air intake restriction</li> <li>Front End Accessory Drive (FEAD) overload (defective/seized component)</li> </ul>	Ensure the air intake system is free from restriction. Check the FEAD belt and components for failure



DTC	Description	Possible Cause	Action
P050624	Idle Air Control System RPM Lower Than Expected	<ul style="list-style-type: none"> <li>● Air intake restriction</li> <li>● Front End Accessory Drive (FEAD) overload (defective/seized component)</li> </ul>	Ensure the air intake system is free from restriction. Check the FEAD belt and components for failure
P050700	Idle Air Control System RPM Higher Than Expected	<ul style="list-style-type: none"> <li>● Intake air leak between MAF sensor and engine</li> <li>● Engine crankcase breather leak</li> </ul>	Check for leakage and correct installation of air intake system. Check for leakage and correct installation of engine crankcase breather system
P050723	Idle Air Control System RPM Higher Than Expected	<ul style="list-style-type: none"> <li>● Intake air leak between MAF sensor and engine</li> <li>● Engine crankcase breather leak</li> </ul>	Check for leakage and correct installation of air intake system. Check for leakage and correct installation of engine crankcase breather system
P050A84	Cold Start Idle Air Control System Performance	<ul style="list-style-type: none"> <li>● Signal below allowable range</li> </ul>	Check for leakage and correct installation of air intake system. Check for leakage and correct installation of engine crankcase breather system. Check for additional related DTCs and refer to the relevant DTC Index
P050A85	Cold Start Idle Air Control System Performance	<ul style="list-style-type: none"> <li>● Signal above allowable range</li> </ul>	Check for leakage and correct installation of air intake system. Check for leakage and correct installation of engine crankcase breather system. Check for additional related DTCs and refer to the relevant DTC Index
P050B84	Cold Start Ignition Timing Performance	<ul style="list-style-type: none"> <li>● Sticking throttle</li> </ul>	Check for additional throttle and torque related DTCs and refer to the DTC Index
P050B85	Cold Start Ignition Timing Performance	<ul style="list-style-type: none"> <li>● Sticking throttle</li> </ul>	Check for additional throttle and torque related DTCs and refer to the DTC Index
P051212	Starter Request Circuit	<ul style="list-style-type: none"> <li>● Crank request circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check crank request circuit for short to power
P051214	Starter Request Circuit	<ul style="list-style-type: none"> <li>● Crank request circuit - short to ground, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check crank request circuit for short to ground, open circuit
P051300	Incorrect Immobilizer Key	<ul style="list-style-type: none"> <li>● Security key invalid</li> </ul>	Check for CAN network interference/EMC related error. Re-synchronise ID by re-configuring the ECM and instrument cluster as new modules
P056013	System Voltage	<ul style="list-style-type: none"> <li>● ECM power supply circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check ECM power supply circuit for open circuit
P056100	System Voltage Unstable	<ul style="list-style-type: none"> <li>● System voltage comparison</li> </ul>	Check for sensor 5 volt supply related DTCs and refer to DTC Index in this section
P056200	System Voltage Low	<ul style="list-style-type: none"> <li>● Sensor 5 volt power supply circuit - low input</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check sensor 5 volt power supply circuit for short to ground, open circuit
P056300	System Voltage High	<ul style="list-style-type: none"> <li>● Sensor 5 volt power supply circuit - high input</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check sensor 5 volt power supply circuit for short to power
P057501	Cruise Control Input Circuit	<ul style="list-style-type: none"> <li>● General electrical failure</li> </ul>	Check speed control system for related DTCs and refer to relevant DTC Index. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
P057616	Cruise Control Input Circuit Low	<ul style="list-style-type: none"> <li>● Circuit voltage below threshold</li> </ul>	Check speed control system for related DTCs and refer to relevant DTC Index. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
P057717	Cruise Control Input Circuit High	<ul style="list-style-type: none"> <li>● Circuit voltage above threshold</li> </ul>	Check speed control system for related DTCs and refer to relevant DTC Index. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
P057800	Cruise Control Multi-Function Input A Circuit Stuck	<ul style="list-style-type: none"> <li>● One of speed control switches stuck</li> </ul>	Check for stuck speed control switch, install a new switch pack as required
P05791C	Cruise Control Multi-Function Input A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Speed control switch pack internal failure</li> </ul>	Check and install a new speed control switch pack as required
P059000	Cruise Control Multi-Function Input B Circuit Stuck	<ul style="list-style-type: none"> <li>● Active speed limiter fault</li> </ul>	Check for active speed limiter fault, install a new transmission shift module as required
P060143	Internal Control Module Memory Check Sum Error	<ul style="list-style-type: none"> <li>● Special memory failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index

<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
P060145	Internal Control Module Memory Check Sum Error	<ul style="list-style-type: none"> <li>● Program memory failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060442	Internal Control Module Random Access Memory (RAM) Error	<ul style="list-style-type: none"> <li>● General memory failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060443	Internal Control Module Random Access Memory (RAM) Error	<ul style="list-style-type: none"> <li>● Special memory failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060444	Internal Control Module Random Access Memory (RAM) Error	<ul style="list-style-type: none"> <li>● Data memory failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060445	Internal Control Module Random Access Memory (RAM) Error	<ul style="list-style-type: none"> <li>● Program memory failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060500	Internal Control Module Read Only Memory (ROM) Error	<ul style="list-style-type: none"> <li>● EEPROM/flash checksum error</li> </ul>	Configure the module using the Jaguar approved diagnostic system
P060529	Internal Control Module Read Only Memory (ROM) Error	<ul style="list-style-type: none"> <li>● Signal invalid</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060542	Internal Control Module Read Only Memory (ROM) Error	<ul style="list-style-type: none"> <li>● General memory failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060543	Internal Control Module Read Only Memory (ROM) Error	<ul style="list-style-type: none"> <li>● Special memory failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060544	Internal Control Module Read Only Memory (ROM) Error	<ul style="list-style-type: none"> <li>● Data memory failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060545	Internal Control Module Read Only Memory (ROM) Error	<ul style="list-style-type: none"> <li>● Program memory failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060546	Internal Control Module Read Only Memory (ROM) Error	<ul style="list-style-type: none"> <li>● Calibration/parameter memory failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060548	Internal Control Module Read Only Memory (ROM) Error	<ul style="list-style-type: none"> <li>● Supervision software failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060564	Internal Control Module Read Only Memory (ROM) Error	<ul style="list-style-type: none"> <li>● Signal plausibility failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060600	ECM/PCM Processor	<ul style="list-style-type: none"> <li>● No sub type information</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060601	ECM/PCM Processor	<ul style="list-style-type: none"> <li>● General Electrical Failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060604	ECM/PCM Processor	<ul style="list-style-type: none"> <li>● System Internal Failures</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060605	ECM/PCM Processor	<ul style="list-style-type: none"> <li>● System Programming Failures</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060641	ECM/PCM Processor	<ul style="list-style-type: none"> <li>● General checksum failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060642	ECM/PCM Processor	<ul style="list-style-type: none"> <li>● General memory failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index

<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
P060643	ECM/PCM Processor	<ul style="list-style-type: none"> <li>● Special memory failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060644	ECM/PCM Processor	<ul style="list-style-type: none"> <li>● Data memory failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060645	ECM/PCM Processor	<ul style="list-style-type: none"> <li>● Program memory failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060646	ECM/PCM Processor	<ul style="list-style-type: none"> <li>● Calibration/parameter memory failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060647	ECM/PCM Processor	<ul style="list-style-type: none"> <li>● Watchdog/safety MicroController failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060648	ECM/PCM Processor	<ul style="list-style-type: none"> <li>● Supervision software failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060649	ECM/PCM Processor	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060700	Control Module Performance	<ul style="list-style-type: none"> <li>● No sub type information</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P060A64	Internal Control Module Monitoring Processor Performance	<ul style="list-style-type: none"> <li>● Signal plausibility failure</li> </ul>	Clear the DTC and retest. If the DTC resets, suspect the ECM, check and install a new module as required, refer to new module/component installation note at top of DTC Index
P060A67	Internal Control Module Monitoring Processor Performance	<ul style="list-style-type: none"> <li>● Signal incorrect after event</li> </ul>	Clear the DTC and retest. If the DTC resets, suspect the ECM, check and install a new module as required, refer to new module/component installation note at top of DTC Index
P060D00	Internal Control Module Accelerator Pedal Position Performance	<ul style="list-style-type: none"> <li>● APS Communication</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check the accelerator pedal position sensor circuits for short, open circuit, high resistance
P060E62	Internal Control Module Throttle Position Performance	<ul style="list-style-type: none"> <li>● Signal compare failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check throttle position sensor circuits for short, open circuit, high resistance
P060E64	Internal Control Module Throttle Position Performance	<ul style="list-style-type: none"> <li>● Signal plausibility failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check throttle position sensor circuits for short, open circuit, high resistance
P061043	Control Module Vehicle Options Error	<ul style="list-style-type: none"> <li>● Special memory failure</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system
P061614	Starter Relay Circuit Low	<ul style="list-style-type: none"> <li>● Starter relay circuit - short to ground, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check starter relay circuit for short to ground, open circuit
P061712	Starter Relay Circuit High	<ul style="list-style-type: none"> <li>● Starter relay circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check starter relay circuit for short to power
P061A00	Internal Control Module Torque Performance	<ul style="list-style-type: none"> <li>● No sub type information</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P061A29	Internal Control Module Torque Performance	<ul style="list-style-type: none"> <li>● Signal invalid</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P061A64	Internal Control Module Torque Performance	<ul style="list-style-type: none"> <li>● Signal plausibility failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index

DTC	Description	Possible Cause	Action
P061B29	Internal Control Module Torque Calculation Performance	<ul style="list-style-type: none"> <li>● Signal invalid</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P061B64	Internal Control Module Torque Calculation Performance	<ul style="list-style-type: none"> <li>● Signal plausibility failure</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at top of DTC Index
P062001	Generator Control Circuit	<ul style="list-style-type: none"> <li>● Generator B+ or battery terminal disconnected/poor connection</li> <li>● Charging circuit - short, open circuit</li> <li>● Generator failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for good/clean contact at generator B+ and battery terminal connectors. Refer to the electrical circuit diagrams and check charging circuit for short, open circuit. Clear DTC and repeat automated diagnostic procedure using the manufacturer approved diagnostic system. If DTC remains suspect the generator, check and install a new generator as required, refer to the new module/component installation note at the top of the DTC Index
P062700	Fuel Pump A Control Circuit/Open	<ul style="list-style-type: none"> <li>● Fuel pump control circuit fault (FPDM to ECM)</li> </ul>	Refer to the electrical circuit diagrams and check the FPDM to ECM circuit for short to ground, power, open circuit
P062A00	Fuel Pump A Control Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Invalid fuel pump duty requested by the ECM</li> </ul>	Refer to the electrical circuit diagrams and check the FPDM to ECM circuit for short to ground, power, open circuit
P063000	VIN Not Programmed or Incompatible - ECM/PCM	<ul style="list-style-type: none"> <li>● CCF to CAN VIN mismatch</li> </ul>	Configure the ECM using the manufacturer approved diagnostic system, clear DTC and re-test, if DTC remains suspect the ECM. Check and install a new ECM as required, refer to the new module/component installation note at the top of the DTC Index
P065B16	Generator Control Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Charging circuit - short, open circuit</li> <li>● Quiescent current high</li> <li>● Battery damaged/worn out</li> <li>● Generator failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check charging circuit for short, open circuit. Clear DTC and repeat automated diagnostic procedure using the manufacturer approved diagnostic system. If DTC remains check battery is in fully charged and serviceable condition using the Midtronics battery tester and battery care manual. If ok suspect the generator, check and install a new generator as required, refer to the new module/component installation note at the top of the DTC Index
P065B17	Generator Control Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Charging circuit - short, open circuit</li> <li>● Generator/ECM failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check ECM for over charging related DTCs and refer to the relevant DTC Index. Clear DTC and re-test, if DTC remains suspect the generator. Check and install a new generator as required, refer to the new module/component installation note at the top of the DTC Index
P065C00	Generator Mechanical Performance	<ul style="list-style-type: none"> <li>● Poor FEAD belt tension</li> <li>● Generator pulley loose/failure</li> <li>● Generator failure</li> </ul>	Check FEAD belt condition/contamination and for correct tension. Check generator pulley for failure. Clear DTC and repeat automated diagnostic procedure using manufacturer approved diagnostic system. If DTC remains check and install a new generator as required, refer to the new module/component installation note at the top of the DTC Index
P068773	ECM/PCM Power Relay Control Circuit High	<ul style="list-style-type: none"> <li>● EMS relay stuck closed</li> </ul>	Refer to electrical circuit diagrams and check EMS relay control circuit for short to ground
P072186	Output Shaft Speed Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Signal invalid</li> </ul>	Check the TCM for related DTCs and refer to the relevant DTC Index
P081713	Starter Disable Circuit/Open	<ul style="list-style-type: none"> <li>● Starter relay negative control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check starter relay negative control circuit for open circuit
P081A11	Starter Disable Circuit Low	<ul style="list-style-type: none"> <li>● Starter relay negative control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check starter relay negative control circuit for short to ground
P081B12	Starter Disable Circuit High	<ul style="list-style-type: none"> <li>● Starter relay negative control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check starter relay negative control circuit for short to power
P085086	Park/Neutral Switch Input Circuit	<ul style="list-style-type: none"> <li>● Park/Neutral switch input circuit - signal invalid</li> </ul>	Refer to the electrical circuit diagrams and check Park/Neutral switch input circuit for short to ground, power, open circuit
P08508F	Park/Neutral Switch Input Circuit	<ul style="list-style-type: none"> <li>● Park/Neutral switch input circuit - erratic</li> </ul>	Refer to the electrical circuit diagrams and check Park/Neutral switch input circuit for short to ground, power, open circuit

DTC	Description	Possible Cause	Action
P085114	Park/Neutral Switch Input Circuit Low	<ul style="list-style-type: none"> <li>● Park/Neutral switch input circuit - low</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Park/Neutral switch input circuit for short to ground, open circuit
P085212	Park/Neutral Switch Input Circuit High	<ul style="list-style-type: none"> <li>● Park/Neutral switch input circuit - high</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Park/Neutral switch input circuit for short to power
P0A1A87	Generator Control Module	<ul style="list-style-type: none"> <li>● Generator to ECM LIN circuit - open circuit</li> <li>● Generator/ECM failure</li> </ul>	Check for good/clean contact at generator and ECM LIN circuit connectors/pins. Refer to the electrical circuit diagrams and check generator to ECM LIN circuit for open circuit. Check for ECM hardware DTCs and refer to relevant DTC Index. Clear DTCs and repeat automated diagnostic procedure using the manufacturer approved diagnostic system. If DTC remains check and install a new generator/ECM as required, refer to the new module/component installation note at the top of the DTC Index
P0A3B68	Generator Over Temperature	<ul style="list-style-type: none"> <li>● Generator wiring/connectors heat damaged</li> <li>● Generator failure</li> </ul>	Check the generator wiring and connectors for heat damage. Clear the DTC and repeat the automated diagnostic procedure using the manufacturer approved diagnostic system. If DTC remains check and install a new generator as required, refer to the new module/component installation note at the top of the DTC Index
P125900	Immobilizer to PCM Signal Error	<ul style="list-style-type: none"> <li>● Incorrect ID received from instrument cluster</li> </ul>	Re-configure the instrument cluster using the manufacturer approved diagnostic system
P131500	Persistent Misfire	<ul style="list-style-type: none"> <li>● ECM to ignition coil primary circuit fault (cylinder misfire detected DTC also flagged)</li> <li>● Fuel injector circuit fault(s) (injector DTCs also flagged)</li> <li>● Fuel delivery pressure low</li> <li>● Spark plug failure/fouled /incorrect gap</li> <li>● Cylinder compression low</li> </ul>	Check for cylinder mis-fire, ignition and injector DTCs and refer to the DTC Index. Check for fuel system failure. Check and install spark plug as required. Carry out cylinder compression tests
P131600	Misfire Rate Exceeds Emissions	<ul style="list-style-type: none"> <li>● Misfire rate exceeds emissions thresholds</li> </ul>	Check for individual cylinder misfire DTCs and refer to DTC Index in this section
P136700	Ignition Spare	<ul style="list-style-type: none"> <li>● Ignition module/coil monitoring circuit 1 - short to ground, short to power, high resistance</li> </ul>	Refer to the electrical circuit diagrams and check ignition module/coil monitoring circuit 1 for short to ground, short to power, high resistance
P136800	Ignition Spare	<ul style="list-style-type: none"> <li>● Ignition module/coil monitoring circuit 2 - short to ground, short to power, high resistance</li> </ul>	Refer to the electrical circuit diagrams and check ignition module/coil monitoring circuit 2 for short to ground, short to power, high resistance
P160300	EEPROM Malfunction	<ul style="list-style-type: none"> <li>● ECM fault</li> </ul>	Suspect the ECM, check and install a new module as required. Refer to the new module/component installation note at top of DTC Index
P209600	Post Catalytic converter Fuel Trim System Too Lean Bank 1	<ul style="list-style-type: none"> <li>● Heated Oxygen Sensor (HO2S) fuel adaption - lean</li> </ul>	Check integrity and correct installation of air intake system. Check for any HO2S codes also logged and refer to DTC Index in this section. Check for air leaks between, or on, upstream and downstream sensors. Check for air leak on Catalytic converter and exhaust path pre-Catalytic converter
P209700	Post Catalytic converter Fuel Trim System Too Rich Bank 1	<ul style="list-style-type: none"> <li>● Heated Oxygen Sensor (HO2S) fuel adaption - rich</li> </ul>	Check integrity and correct installation of air intake system. Check for any HO2S codes also logged and refer to DTC Index in this section. Check for air leaks between, or on, upstream and downstream sensors. Check for air leak on Catalytic converter and exhaust path pre-Catalytic converter
P209800	Post Catalytic converter Fuel Trim System Too Lean Bank 2	<ul style="list-style-type: none"> <li>● Heated Oxygen Sensor (HO2S) fuel adaption - lean</li> </ul>	Check integrity and correct installation of air intake system. Check for any HO2S codes also logged and refer to DTC Index in this section. Check for air leaks between, or on, upstream and downstream sensors. Check for air leak on Catalytic converter and exhaust path pre-Catalytic converter

DTC	Description	Possible Cause	Action
P209900	Post Catalytic converter Fuel Trim System Too Rich Bank 2	<ul style="list-style-type: none"> <li>● Heated Oxygen Sensor (HO2S) fuel adaption - rich</li> </ul>	Check integrity and correct installation of air intake system. Check for any HO2S codes also logged and refer to DTC Index in this section. Check for air leaks between, or on, upstream and downstream sensors. Check for air leak on Catalytic converter and exhaust path pre-Catalytic converter
P210129	Throttle Actuator Control Motor Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Signal invalid</li> <li>● Jammed throttle blade, gearing or motor</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test throttle actuator control motor circuit for short to ground, power, high resistance. Suspect the throttle body, check and install a new throttle body as required, refer to the new module/component installation note at the top of the DTC Index
P210162	Throttle Actuator Control Motor Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Signal compare failure</li> <li>● Jammed throttle blade, gearing or motor</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test throttle actuator control motor circuit for short to ground, power, high resistance. Suspect the throttle body, check and install a new throttle body as required, refer to the new module/component installation note at the top of the DTC Index
P210164	Throttle Actuator Control Motor Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Signal plausibility failure</li> <li>● Jammed throttle blade, gearing or motor</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test throttle actuator control motor circuit for short to ground, power, high resistance. Suspect the throttle body, check and install a new throttle body as required, refer to the new module/component installation note at the top of the DTC Index
P210177	Throttle Actuator Control Motor Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Commanded position not achievable</li> <li>● Throttle blade stuck open</li> <li>● Intake air system leak</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test throttle actuator control motor circuit for short to ground, power, high resistance. Suspect the throttle body, check and install a new throttle body as required, refer to the new module/component installation note at the top of the DTC Index
P210329	Throttle Actuator Control Motor Circuit High	<ul style="list-style-type: none"> <li>● Signal invalid</li> <li>● Throttle motor control circuit - short to power</li> <li>● ECM fault</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check throttle motor control circuit for short to power. If ECM is suspect, check and install a new module as required, refer to new module/component installation note at top of DTC Index
P210364	Throttle Actuator Control Motor Circuit High	<ul style="list-style-type: none"> <li>● Signal plausibility failure</li> <li>● Throttle motor control circuit - short to power</li> <li>● ECM fault</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check throttle motor control circuit for short to power. If ECM is suspect, check and install a new module as required, refer to new module/component installation note at top of DTC Index
P210500	Throttle Actuator Control System - Forced Engine Shutdown	<ul style="list-style-type: none"> <li>● Throttle MIL request due to fuel cut</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P211800	Throttle Actuator Control Motor Current Range/Performance	<ul style="list-style-type: none"> <li>● Throttle motor control circuit - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check throttle motor control circuit for short to ground, power, high resistance
P211900	Throttle Actuator Control Throttle Body Range/Performance	<ul style="list-style-type: none"> <li>● Throttle spring faulty</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect throttle body faulty. Check and install a new throttle body as required, refer to the new module/component installation note at top of DTC Index
P212200	Throttle/Pedal Position Sensor/Switch D Circuit Low	<ul style="list-style-type: none"> <li>● APP sensor circuit 2 - low input</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check APP sensor circuit 2 for short to ground, open circuit
P212300	Throttle/Pedal Position Sensor/Switch D Circuit High	<ul style="list-style-type: none"> <li>● APP sensor circuit 2 - high input</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check APP sensor circuit 2 for short to power



DTC	Description	Possible Cause	Action
P213528	Throttle/Pedal Position Sensor/Switch A/B Voltage Correlation	<ul style="list-style-type: none"> <li>APP sensor circuit 1 and 2 range performance - sub-processor</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check APP sensor circuits 1 and 2 for short to ground, power and high resistance. Clear the DTCs and retest. If the code remains, replace the APP sensor
P213529	Throttle/Pedal Position Sensor/Switch A/B Voltage Correlation	<ul style="list-style-type: none"> <li>APP sensor - excessive difference between raw values of circuit 1 and 2 - sub-processor</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check APP sensor circuits 1 and 2 for short, open circuit
P213562	Throttle/Pedal Position Sensor/Switch A/B Voltage Correlation	<ul style="list-style-type: none"> <li>APP sensor circuit 1 and 2 range performance - sub-processor</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check APP sensor circuits 1 and 2 for short to ground, power and high resistance. Clear the DTCs and retest. If the code remains, replace the APP sensor
P213564	Throttle/Pedal Position Sensor/Switch A/B Voltage Correlation	<ul style="list-style-type: none"> <li>APP sensor circuit 1 and 2 range performance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check APP sensor circuits 1 and 2 for short, open circuit
P222800	Barometric Pressure Circuit Low	<ul style="list-style-type: none"> <li>BARO sensor failure (internal ECM fault)</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
P222900	Barometric Pressure Circuit High	<ul style="list-style-type: none"> <li>BARO sensor failure (internal ECM fault)</li> </ul>	Suspect the ECM, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
P240100	Evaporative Emission System Leak Detection Pump Control Circuit Low	<ul style="list-style-type: none"> <li>DMTL pump circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground
P240200	Evaporative Emission System Leak Detection Pump Control Circuit High	<ul style="list-style-type: none"> <li>DMTL pump circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL pump circuit for short to power
P240429	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	<ul style="list-style-type: none"> <li>DMTL reference leak</li> <li>DMTL pump circuit - short to ground, power, high resistance</li> <li>DMTL pipework blocked/leaking</li> </ul>	Check integrity of evaporative emissions system, i.e. blocked/leaking. Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground, power, high resistance
P24042F	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	<ul style="list-style-type: none"> <li>DMTL reference leak</li> <li>DMTL pump circuit - short to ground, power, high resistance</li> <li>DMTL pipework blocked/leaking</li> </ul>	Check integrity of evaporative emissions system, i.e. blocked/leaking. Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground, power, high resistance
P240500	Evaporative Emission System Leak Detection Pump Sense Circuit Low	<ul style="list-style-type: none"> <li>DMTL pump circuit - short to ground, power, high resistance</li> </ul>	Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground, power, high resistance
P240600	Evaporative Emission System Leak Detection Pump Sense Circuit High	<ul style="list-style-type: none"> <li>DMTL pump circuit - short to ground, power, high resistance</li> </ul>	Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground, power, high resistance
P240B00	Evaporative Emission System Leak Detection Pump Heater Circuit Low	<ul style="list-style-type: none"> <li>DMTL heater control circuit low</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL heater control circuit for short to ground, open circuit
P240C00	Evaporative Emission System Leak Detection Pump Heater Circuit High	<ul style="list-style-type: none"> <li>DMTL heater control circuit high</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL heater control circuit for short to power
P243100	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Range/Performance Bank 1	<ul style="list-style-type: none"> <li>Secondary air injection system leaks</li> <li>Secondary air injection pump</li> <li>Secondary air injection valve</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check secondary air injection system circuits for short, open circuit. Check the integrity of the secondary air injection system
P243200	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Low Bank 1	<ul style="list-style-type: none"> <li>Secondary air injection manifold absolute pressure sensor circuit - short to ground, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check secondary air injection manifold

DTC	Description	Possible Cause	Action
			absolute pressure sensor circuit for short to ground, high resistance
P243300	Secondary Air Injection System Air Flow/Pressure Sensor Circuit High Bank 1	<ul style="list-style-type: none"> <li>Secondary air injection manifold pressure (MAP) sensor circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check secondary air injection manifold pressure (MAP) sensor circuit for short to power
P244400	Secondary Air Injection System Pump Stuck On Bank 1	<ul style="list-style-type: none"> <li>Secondary air injection pump control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check secondary air injection pump control circuit for short to ground
P244500	Secondary Air Injection System Pump Stuck Off Bank 1	<ul style="list-style-type: none"> <li>Secondary air injection pump control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check secondary air injection pump control circuit for short to power
P245000	Evaporative Emission Control System Switching Valve Performance/Stuck Open	<ul style="list-style-type: none"> <li>DMTL system circuit - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL system circuit for short to ground, power, high resistance. Check for stuck valve
P245100	Evaporative Emission Control System Switching Valve Stuck Closed	<ul style="list-style-type: none"> <li>DMTL system circuit - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL system circuit for short to ground, power, high resistance. Check for stuck valve
P260100	Coolant Pump Control Circuit Range/Performance	<ul style="list-style-type: none"> <li>Incorrect installation of electrical connector</li> <li>Restricted coolant flow</li> <li>Charge air cooler coolant pump failure</li> <li>Charge air cooler coolant pump relay failure</li> </ul>	Check for correct installation of the charge air cooler coolant pump electrical connector. Check for restriction in charge air cooler coolant pump and pipes. Check and install a new pump as required. Check for relay failure related DTCs and refer to relevant DTC Index. Check and install a new relay as required
P261064	ECM/PCM Internal Engine Off Timer Performance	<ul style="list-style-type: none"> <li>Instrument cluster fault</li> <li>ECT sensor fault</li> <li>Ambient temperature sensor fault</li> <li>Body processor module fault (time)</li> <li>CAN error</li> </ul>	Check for DTCs related to any of the components listed, and refer to relevant DTC Index. Refer to the electrical circuit diagrams and check ECT sensor, ambient air temperature sensor circuits for short, open circuit. Carry out the CAN network integrity test using the manufacturer approved diagnostic system
P261087	ECM/PCM Internal Engine Off Timer Performance	<ul style="list-style-type: none"> <li>Instrument cluster fault</li> <li>ECT sensor fault</li> <li>Ambient temperature sensor fault</li> <li>Body processor module fault (time)</li> <li>CAN error</li> </ul>	Check for DTCs related to any of the components listed, and refer to relevant DTC Index. Refer to the electrical circuit diagrams and check ECT sensor, ambient air temperature sensor circuits for short, open circuit. Carry out the CAN network integrity test using the manufacturer approved diagnostic system
U000188	High Speed CAN Communication Bus	<ul style="list-style-type: none"> <li>Bus off</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CAN network for short, open circuit. Carry out CAN network integrity test using the manufacturer approved diagnostic system
U010100	Lost Communication with TCM	<ul style="list-style-type: none"> <li>CAN Link ECM/TCM network malfunction</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies to TCM. Carry out the CAN network integrity test using the manufacturer approved diagnostic system
U010300	Lost Communication With Gear Shift Module	<ul style="list-style-type: none"> <li>CAN Link ECM/gear shift network malfunction</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies to transmission shift module. Carry out the CAN network integrity test using the manufacturer approved diagnostic system
U010400	Lost Communication With Cruise Control Module	<ul style="list-style-type: none"> <li>CAN Link ECM/speed control module network malfunction</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies to speed control module. Carry out the CAN network integrity test using the manufacturer approved diagnostic system

<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
U012100	Lost Communication With Anti-Lock Brake System (ABS) Control Module	<ul style="list-style-type: none"> <li>● CAN Link ECM/ABS module network malfunction</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies to ABS module. Carry out the CAN network integrity test using the manufacturer approved diagnostic system
U012800	Lost Communication With Park Brake Control Module	<ul style="list-style-type: none"> <li>● CAN Link ECM/Electronic parking brake signal missing network malfunction</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies to parking brake module. Carry out the CAN network integrity test using the manufacturer approved diagnostic system
U015100	Lost Communication With Restraints Control Module	<ul style="list-style-type: none"> <li>● Lost communication - CAN or hardwired</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies to RCM. Carry out the CAN network integrity test using the manufacturer approved diagnostic system
U015187	Lost Communication With Restraints Control Module	<ul style="list-style-type: none"> <li>● Lost communication - SRS fault</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies to RCM. Carry out the CAN network integrity test using the manufacturer approved diagnostic system
U015500	Lost Communication With Instrument Panel Cluster (IPC) Control Module	<ul style="list-style-type: none"> <li>● CAN Link ECM/instrument cluster network malfunction</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies to instrument cluster. Carry out the CAN network integrity test using the manufacturer approved diagnostic system
U016400	Lost Communication With HVAC Control Module	<ul style="list-style-type: none"> <li>● no sub type information</li> </ul>	Refer to electrical circuit diagrams and check power and ground feeds to HVAC module. Carry out the CAN network integrity test using the manufacturer approved diagnostic system. Check HVAC module for DTCs and refer to the relevant DTC Index
U016700	Lost Communication With Vehicle Immobilizer Control Module	<ul style="list-style-type: none"> <li>● Security challenge response timeout</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies to vehicle immobilizer module. Carry out the CAN network integrity test using the manufacturer approved diagnostic system
U030000	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>● The ECM is in Expulsion mode. An incorrect specification module has been installed to the vehicle</li> </ul>	Check and install the correct ECM as required, refer to the new module/component installation note at the top of the DTC Index
U040208	Invalid Data Received from TCM	<ul style="list-style-type: none"> <li>● TCM engine speed control monitor</li> </ul>	Check TCM for related DTCs and refer to relevant DTC Index
U040264	Invalid Data Received from TCM	<ul style="list-style-type: none"> <li>● Actual gear position status</li> </ul>	Check TCM for related DTCs and refer to relevant DTC Index
U040267	Invalid Data Received from TCM	<ul style="list-style-type: none"> <li>● Selector lever position status</li> </ul>	Check TCM for related DTCs and refer to relevant DTC Index
U040281	Invalid Data Received from TCM	<ul style="list-style-type: none"> <li>● Output shaft speed signal</li> </ul>	Check TCM for related DTCs and refer to relevant DTC Index
U040282	Invalid Data Received from TCM	<ul style="list-style-type: none"> <li>● Alive/sequence counter incorrect/not updated</li> </ul>	Check TCM for related DTCs and refer to relevant DTC Index
U040283	Invalid Data Received from TCM	<ul style="list-style-type: none"> <li>● TCM engine speed control monitor - plausibility</li> </ul>	Check TCM for related DTCs and refer to relevant DTC Index
U040286	Invalid Data Received from TCM	<ul style="list-style-type: none"> <li>● TCM engine speed control monitor - rationality</li> </ul>	Check TCM for related DTCs and refer to relevant DTC Index
U040581	Invalid Data Received From Cruise Control Module	<ul style="list-style-type: none"> <li>● Invalid data received from speed control module</li> </ul>	Check speed control module for related DTCs and refer to relevant DTC Index
U040583	Invalid Data Received From Cruise Control Module	<ul style="list-style-type: none"> <li>● Invalid data received from speed control module</li> </ul>	Check speed control module for related DTCs and refer to relevant DTC Index
U04058F	Invalid Data Received From Cruise Control Module	<ul style="list-style-type: none"> <li>● Invalid data received from speed control module</li> </ul>	Check speed control module for related DTCs and refer to relevant DTC Index
U041500	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module	<ul style="list-style-type: none"> <li>● Brake Position Switch</li> </ul>	Check ABS module for related DTCs and refer to relevant DTC Index

<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
U041564	Invalid Data Received From Anti-Lock Brake System Control Module	<ul style="list-style-type: none"> <li>● Engine drag torque control monitoring - plausibility</li> </ul>	Check ABS module for related DTCs and refer to relevant DTC Index
U041567	Invalid Data Received From Anti-Lock Brake System Control Module	<ul style="list-style-type: none"> <li>● Engine drag torque control monitoring - rationality</li> </ul>	Check ABS module for related DTCs and refer to relevant DTC Index
U042386	Invalid Data Received From Instrument Panel Control Module	<ul style="list-style-type: none"> <li>● Battery voltage level</li> </ul>	Check instrument cluster for related DTCs and refer to relevant DTC Index
U042481	Invalid Data Received From HVAC Control Module	<ul style="list-style-type: none"> <li>● External ambient temperature</li> </ul>	Check HVAC module for related DTCs and refer to relevant DTC Index
U042600	Invalid Data Received From Vehicle Immobilizer Control Module	<ul style="list-style-type: none"> <li>● Security code mis-match</li> </ul>	Check CAN network between ECM and instrument cluster. Check power and grounds to ECM and instrument cluster. Check correct ECM and instrument cluster installed. Re-synchronise ID by re-configuring the ECM and instrument cluster as new modules

# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Powertrain Control Module (PCM) Long Drive Cycle Self-Test

## General Procedures



**WARNING:** Where possible, all road tests should be on well surfaced and dry roads. Always comply with speed limits and local traffic regulations.

- **NOTE:** This procedure is an overcheck only. If fault codes are found, interrogation of the relevant system must be carried out and claimed against.
- **NOTE:** The vehicle must exceed 50mph (80 km/h) during the road test.

1. Connect the diagnostic equipment to the vehicle.
2. Follow on screen prompts and check for engine management fault codes.
3. Clear the fault codes following the on screen procedure.
4. Disconnect the diagnostic equipment from the vehicle.
5. **NOTE:** Make sure cruise control is not engaged.

Make sure the engine temperature is above 60 °C (140 °F).

Carry out a road test and perform the following operations.

1. Accelerate to 55 mph (88 km/h) in 5th gear and cruise for 2 minutes with the engine speed at or above 1800rpm.
  2. Lift off the throttle and allow the vehicle to decelerate until the engine speed is less than 1000 rpm.
  3. Stop the vehicle.
  4. Release brake, allow the vehicle to move with no throttle for 1 minute.
  5. Road test is now complete.
6. Connect the diagnostic equipment to the vehicle.
  7. **NOTE:** If fault codes are found, interrogation of the relevant system must be carried out and claimed against.  
  
Follow on screen prompts and check for engine management fault codes.
  8. Disconnect the diagnostic equipment from the vehicle.

# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Powertrain Control Module (PCM) Short Drive Cycle Self-Test

## General Procedures

• NOTE: This procedure is an overcheck only. If fault codes are found, interrogation of the relevant system must be carried out and claimed against.

1. Connect the diagnostic equipment to the vehicle.
2. Follow on screen prompts and check for engine management fault codes.
3. Clear the fault codes following the on screen procedure.
4. Start the engine.
  - Allow the engine to idle for 30 seconds.
  - Raise the engine speed to 1500 rpm and hold for 3 minutes until a temperature of 70°C (158 °F) is achieved.
  - Allow the engine to idle for 30 seconds.
  - Switch off the engine.

5. NOTE: If fault codes are found, interrogation of the relevant system must be carried out and claimed against.

Follow on screen prompts and check for engine management fault codes.

6. Disconnect the diagnostic equipment from the vehicle.

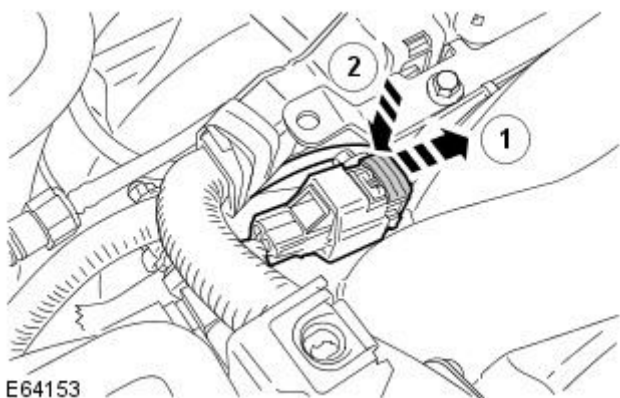


# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Camshaft Position (CMP) Sensor LH

Removal and Installation

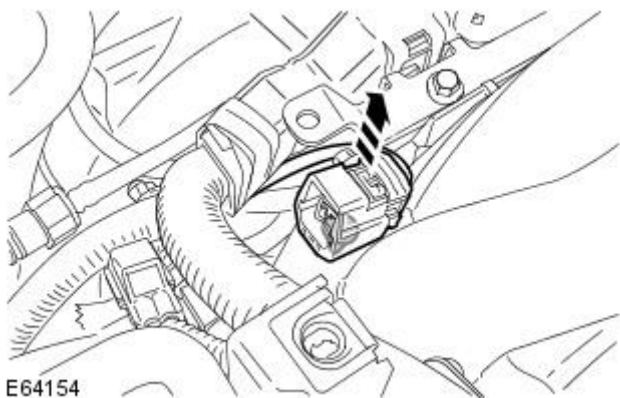
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the engine cover.  
For additional information, refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Disconnect the camshaft position (CMP) sensor electrical connector.



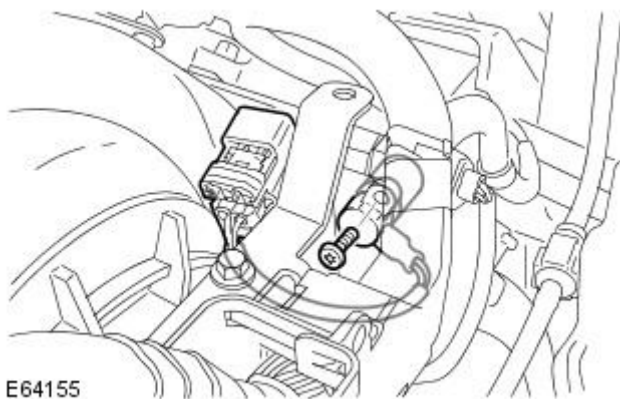
E64153

4. Release the CMP sensor electrical connector.



E64154

5. Remove the CMP sensor.
  - Remove the Torx bolt.
  - Remove and discard the O-ring seal.



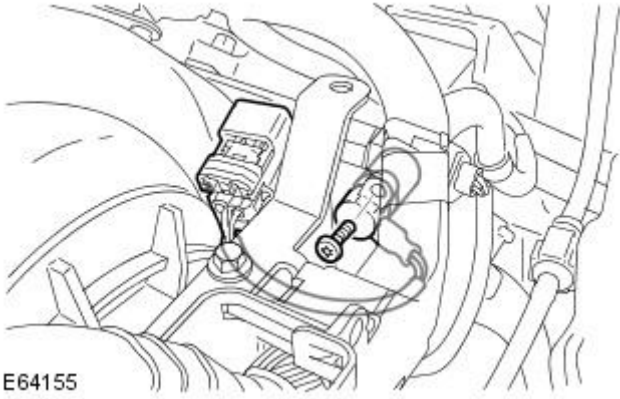
E64155

## Installation

1. Install is the reverse of removal.

2. Tighten to 7 Nm.

- Install a new O-ring seal.



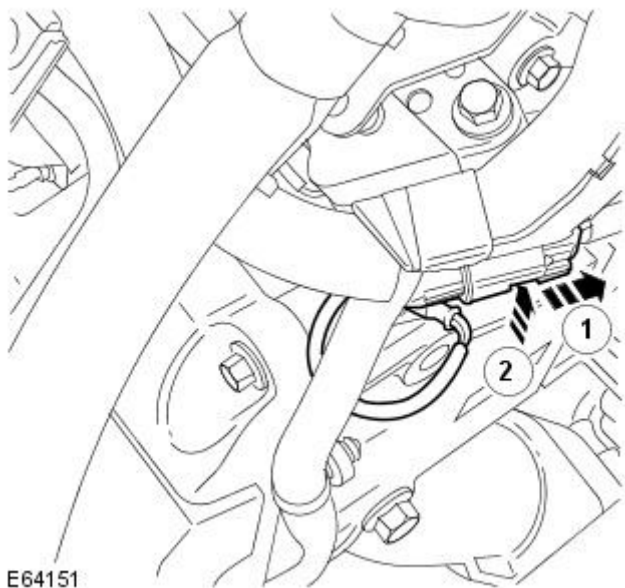
E64155

# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Camshaft Position (CMP) Sensor RH

Removal and Installation

## Removal

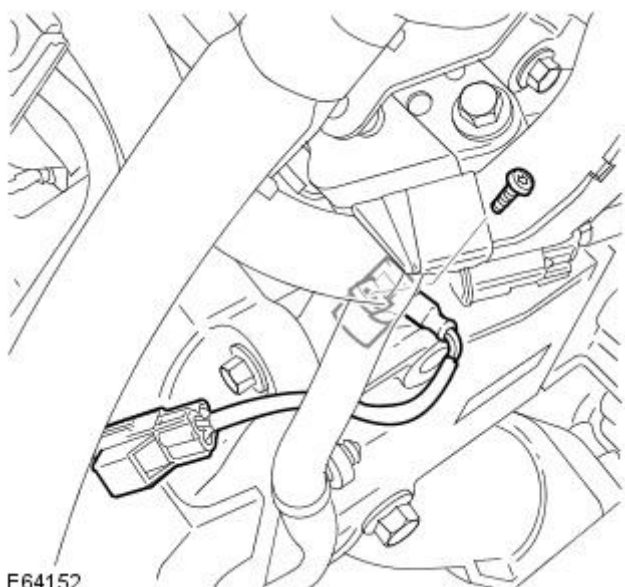
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the engine cover.  
For additional information, refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Disconnect the camshaft position (CMP) sensor electrical connector.



4. Remove the CMP sensor.
  - Remove and discard the O-ring seals.

## Installation

1. To install, reverse the removal procedure.
2. Tighten to 7 Nm.
  - Install the new O-ring seals.



# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Catalyst Monitor Sensor

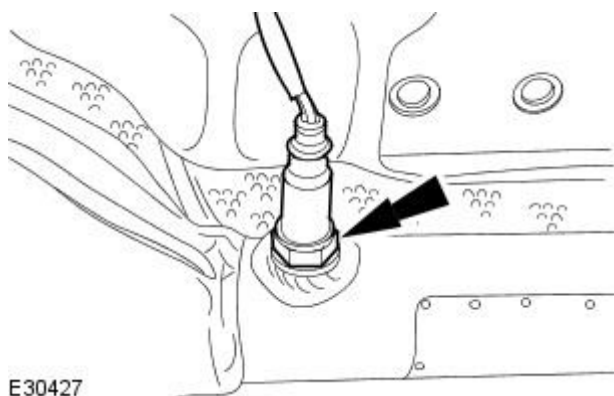
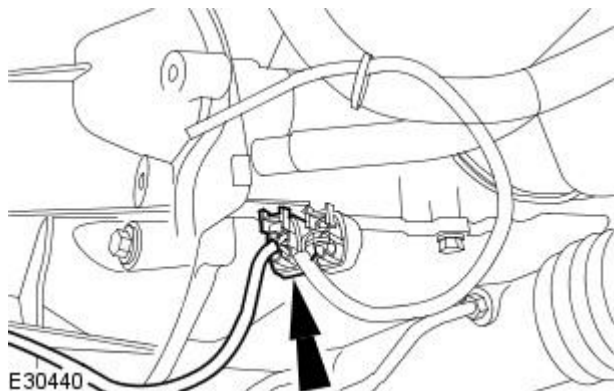
## Removal and Installation


### General Equipment

Snap-on tool S6176

### Removal


1. Raise and support the vehicle.  
For additional information, refer to Section [100-02 Jacking and Lifting](#).
2. Disconnect the catalyst monitor sensor.



3.  **CAUTION:** Make sure the wiring harness is not twisted or damaged on removal. Failure to follow this instruction may result in damage to the vehicle.

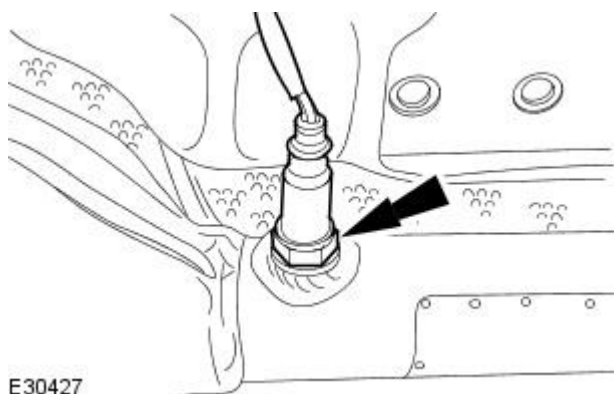
Using the Snap-on tool S6176, remove the catalyst monitor sensor.

### Installation

1.  **CAUTION:** Make sure the wiring harness is not twisted or damaged on installation. Failure to follow this instruction may result in damage to the vehicle.

To install, reverse the removal procedure.

- Tighten to 45 Nm.



# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Crankshaft Position (CKP) Sensor

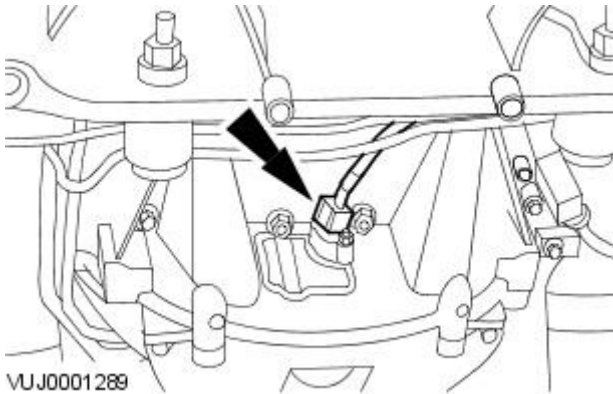
4.2L NA V8 - AJV8  
Removal and Installation

## Removal

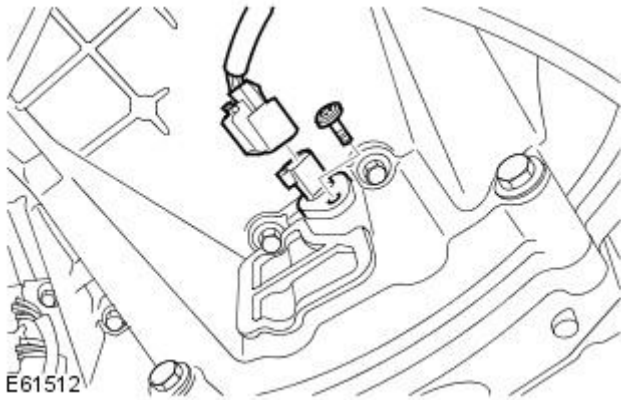


**WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

1. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
2. Disconnect the crankshaft position (CKP) sensor electrical connector.

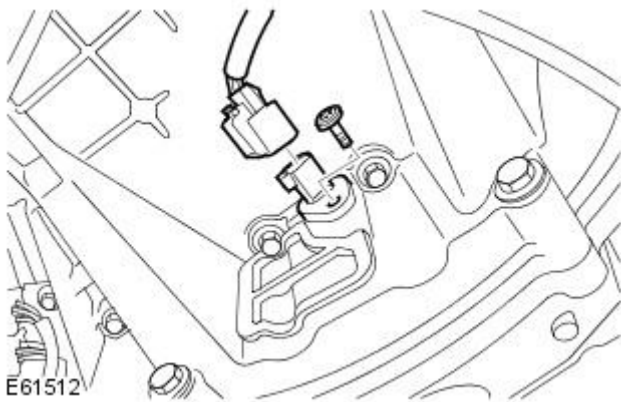


3. Remove the CKP sensor.



## Installation

1. Install is the reverse of removal.
  - Tighten to 7 Nm.



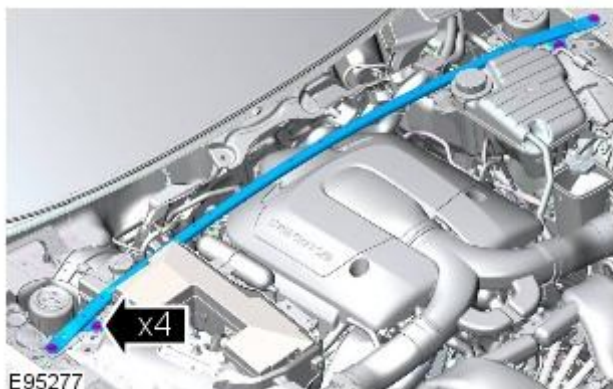


# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Engine Control Module (ECM)

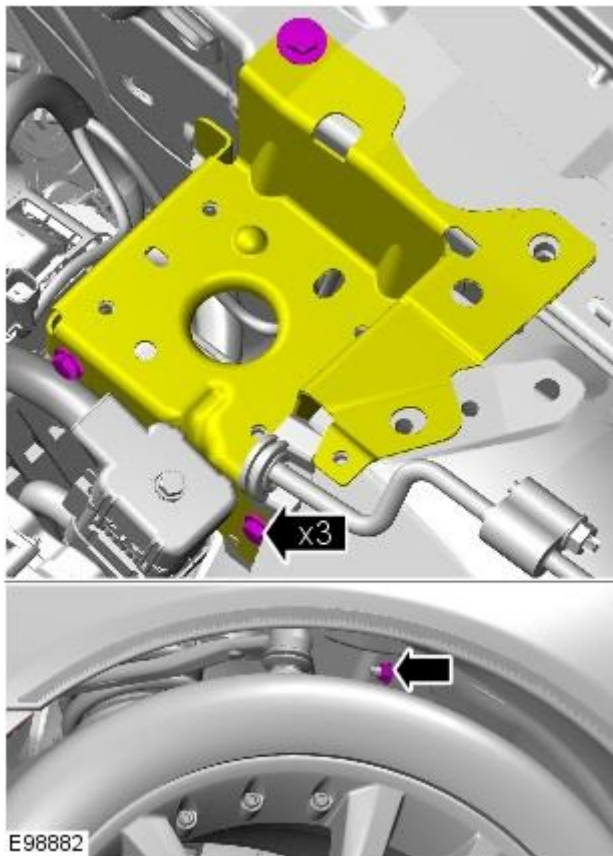
Removal and Installation

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the cowl vent screen.  
For additional information, refer to: [Cowl Vent Screen](#) (501-02 Front End Body Panels, Removal and Installation).
3. Remove the secondary bulkhead LH panel.  
For additional information, refer to: [Secondary Bulkhead Panel LH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).
4. Remove the engine compartment brace.

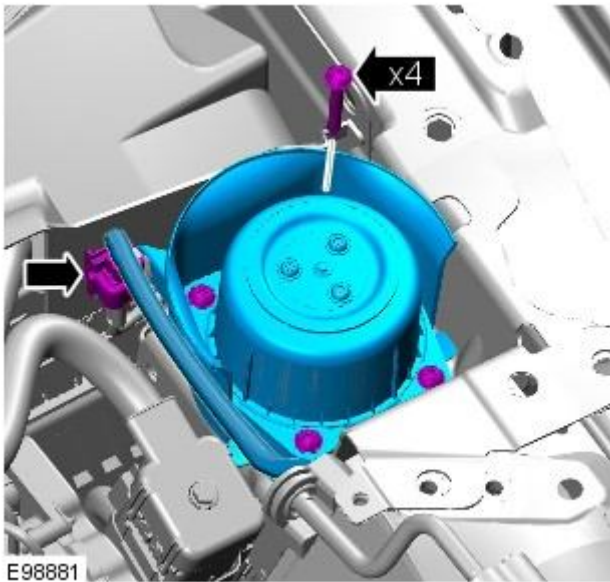


5. Release the pedestrian protection actuator bracket.

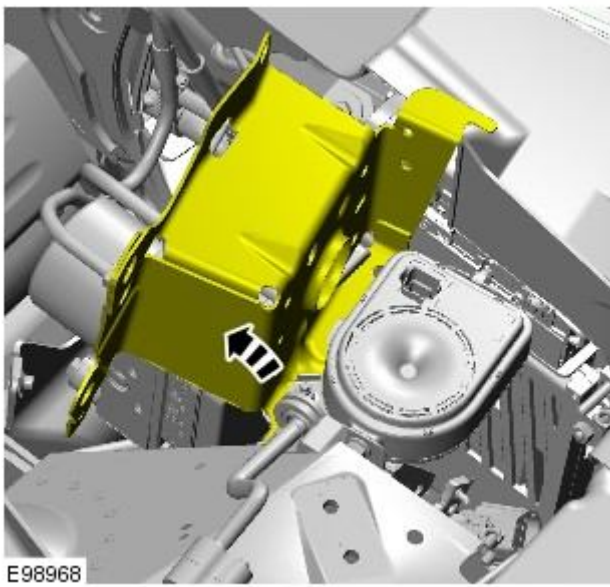




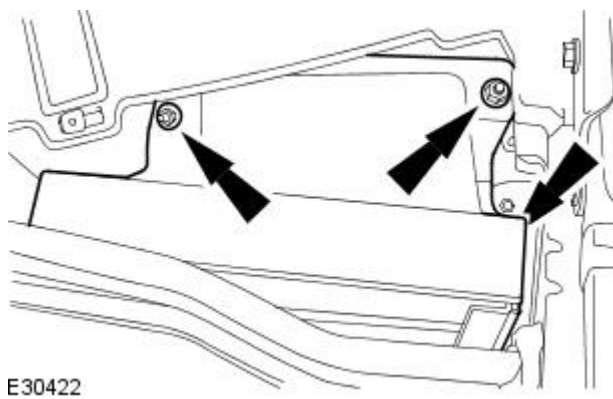
6. Remove the pedestrian protection actuator.



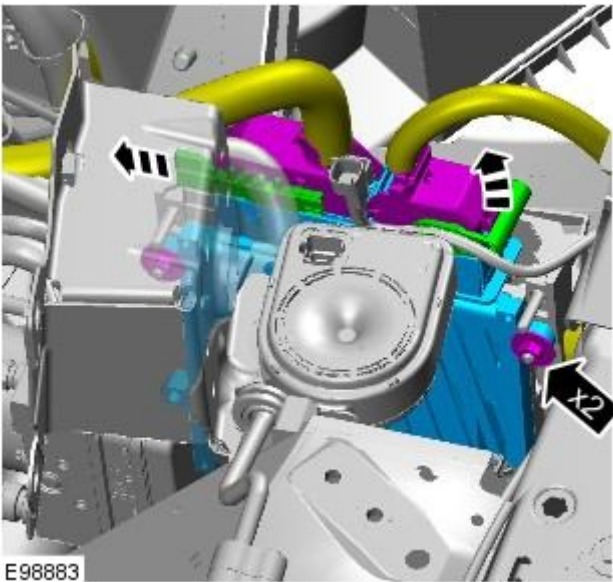
7. Reposition the pedestrian protection actuator bracket.



8. Remove the engine control module (ECM) cover.

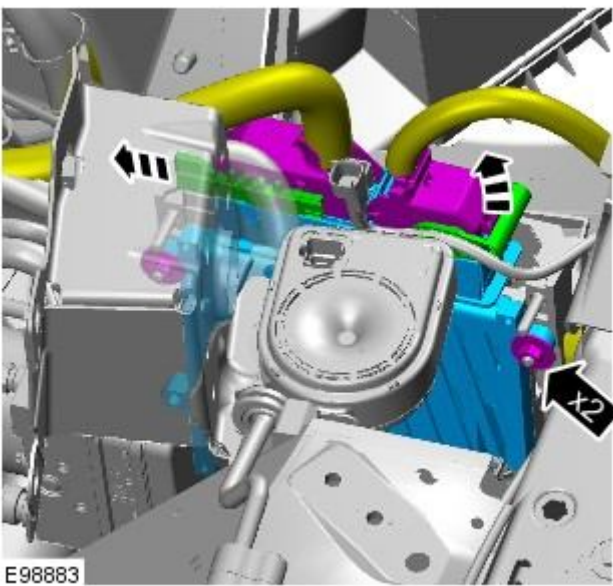


9. Remove the ECM.

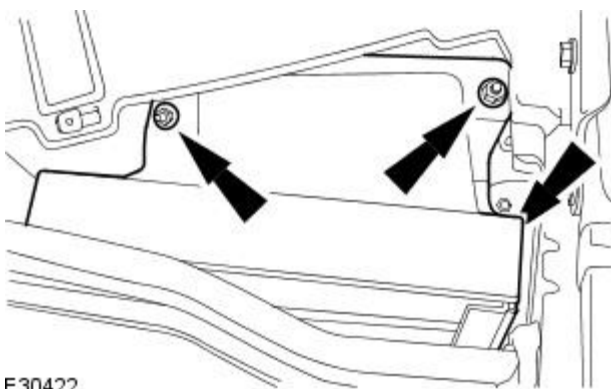


### Installation

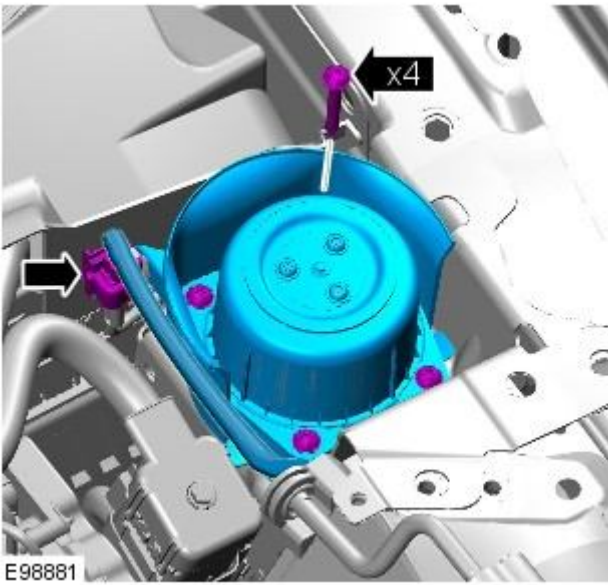
1. Install is the reverse of removal.
2. Tighten to 10 Nm.



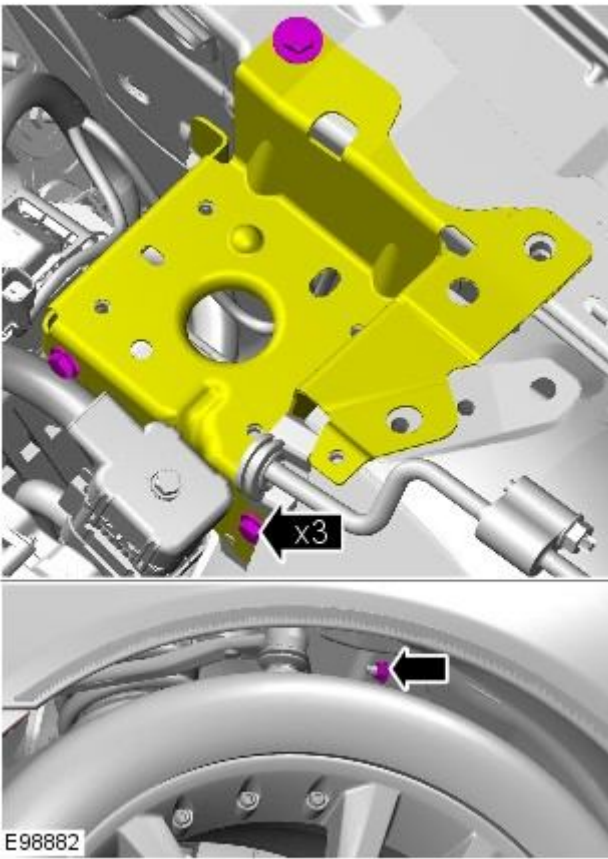
3. Tighten to 6 Nm.



4. Tighten to 8 Nm.



5. Tighten to 25 Nm.



6. Tighten to 25 Nm.




# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Engine Coolant Temperature (ECT) Sensor


Removal and Installation

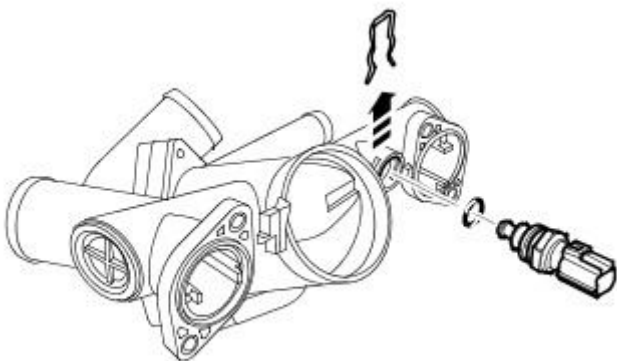
## Removal

• **WARNINGS:**

 Never remove the coolant pressure cap under any circumstances while the engine is operating. Failure to follow this instruction may result in personal injury.

 To avoid having scalding hot coolant or steam blowing out of the cooling system, use extreme care when removing the coolant pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant pressure cap and turn it slowly until the pressure begins to release. Step back while the pressure is released from the system. When certain all the pressure has been released (still with a cloth) turn and remove the coolant pressure cap from the coolant expansion tank. Failure to follow these instructions may result in personal injury.

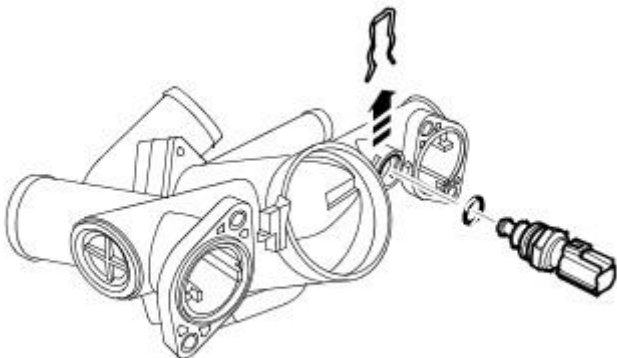
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Make sure to support the vehicle with axle stands.  
  
Raise and support the vehicle.
3. Drain the cooling system.  
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).
4. Remove the throttle body.  
For additional information, refer to: [Throttle Body](#) (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Removal and Installation).
5. Remove the engine coolant temperature (ECT) sensor.
  - Remove the retaining clip.
  - Remove and discard the O-rings.



E63440

## Installation

1. Install is the reverse of removal.
  - Fill the cooling system up to the MAX mark on the coolant expansion tank using a fifty percent mixture of Jaguar Premium Cooling System Fluid or equivalent, meeting Jaguar specification WSS M97B44-D and fifty percent water.



E63440



# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Fuel Temperature Sensor

Removal and Installation

## Removal

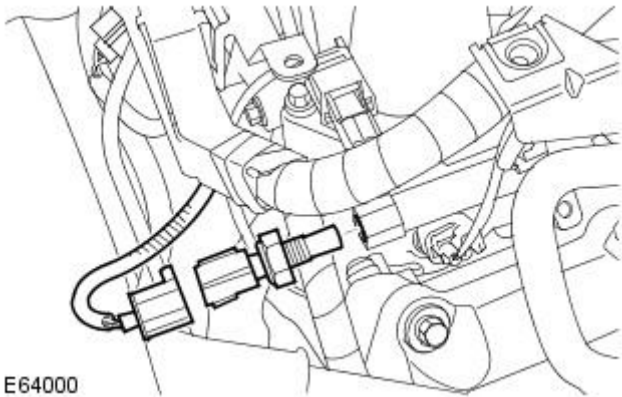
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the engine cover.  
For additional information, refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

**3. ⚠ WARNING:** The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

**⚠ CAUTION:** Always plug any open connections to prevent contamination.

Remove the fuel temperature sensor.

- Disconnect the electrical connector.
- Position an absorbent cloth to collect fluid spillage.

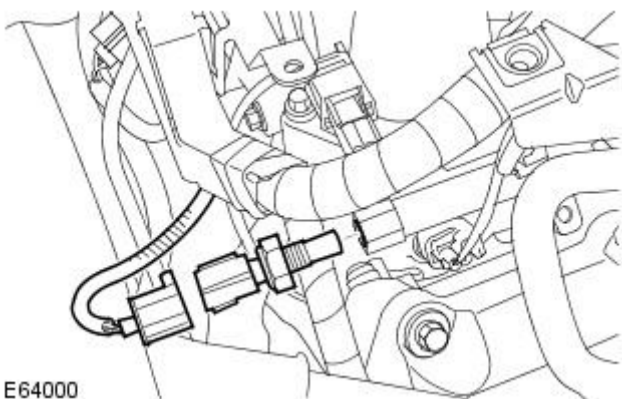


## Installation

**1. ⚠ WARNING:** After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.

Install is the reverse of removal.

- Tighten to 7 Nm.
- Clean the components.






# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Heated Oxygen Sensor (HO2S)

Removal and Installation

## General Equipment

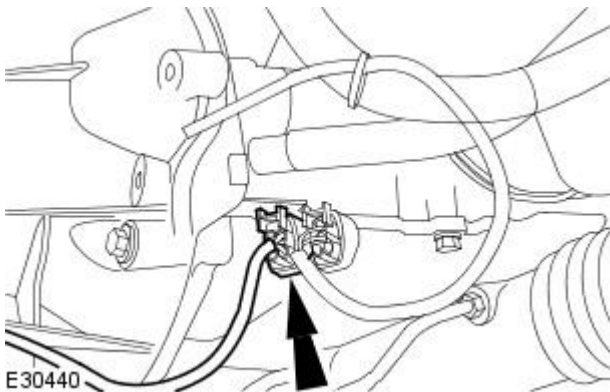
Snap-on tool S6176


## Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

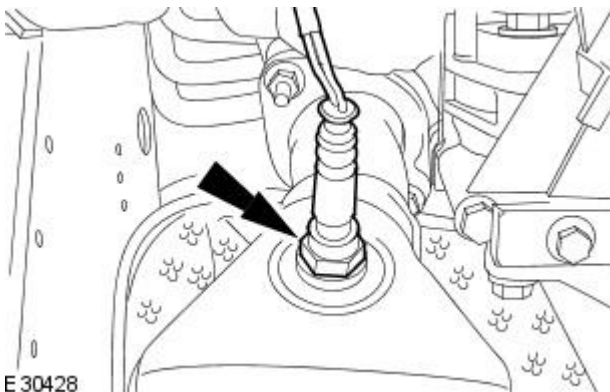
2. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
3. Disconnect the heated oxygen sensor (HO2S) electrical connector.




4.  **CAUTION:** Make sure the HO2S wiring harness is not twisted more than 180 degrees and is not in contact with either the exhaust or driveshaft.

Remove the HO2S.

- Using the Snap-on tool S6176, remove the HO2S.

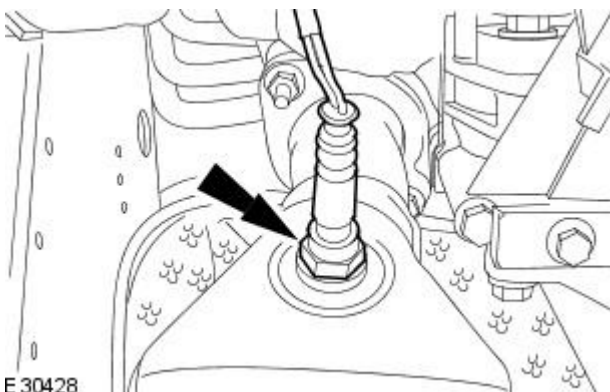


## Installation

1.  **WARNING:** Make sure the HO2S wiring harness is not twisted more than 180 degrees and is not in contact with the exhaust.

Install is the reverse of removal.

- Tighten to 45 Nm.

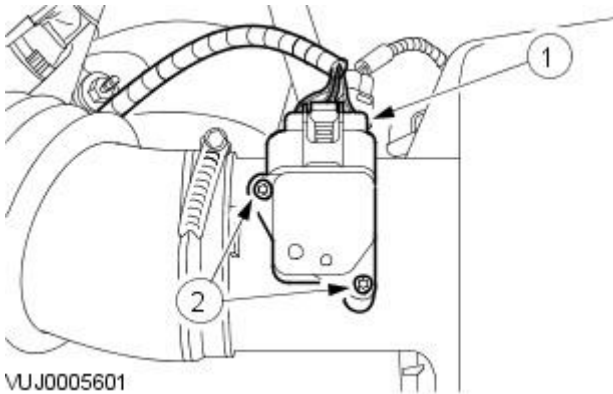


# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Intake Air Temperature (IAT) Sensor

Removal and Installation

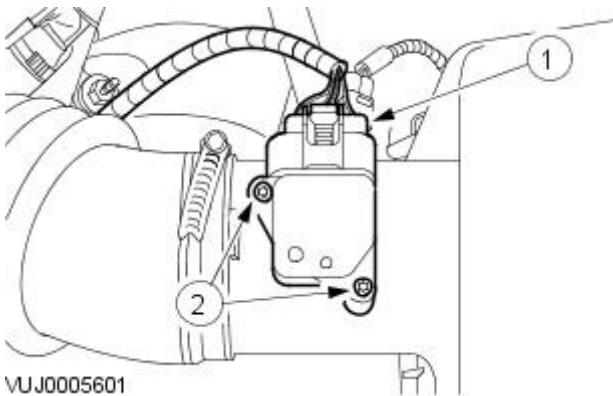
## Removal

1. Remove the air temperature sensor.
  - Remove and discard the O-ring seal.



## Installation

1. Install is the reverse of removal.
  - Tighten to 3 Nm.



# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Knock Sensor (KS)

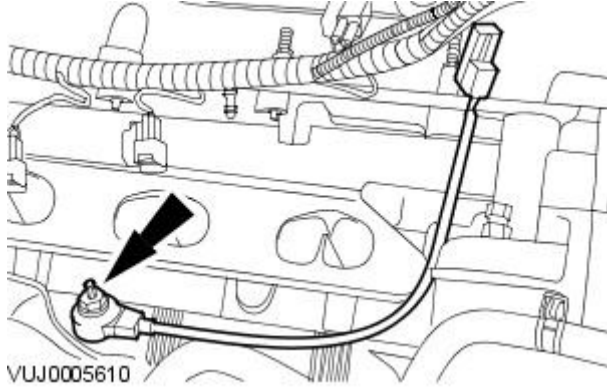
Removal and Installation

## Removal

1. Remove the intake manifold assembly.  
For additional information, refer to: [Intake Manifold](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).
2. NOTE: LH illustration shown, RH is similar.

Remove the knock sensor.

- Remove the knock sensor.

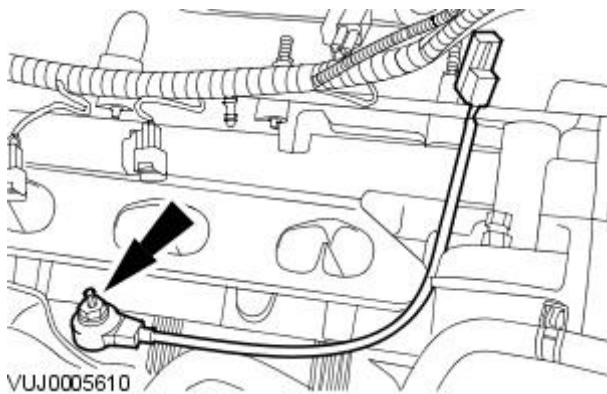


## Installation

1. NOTE: LH illustration shown, RH is similar.

To install, reverse the removal procedure.

- Tighten to 25 Nm

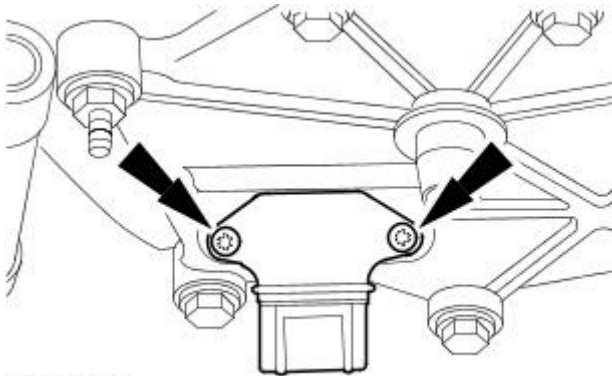


# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Manifold Absolute Pressure (MAP) Sensor

Removal and Installation

## Removal

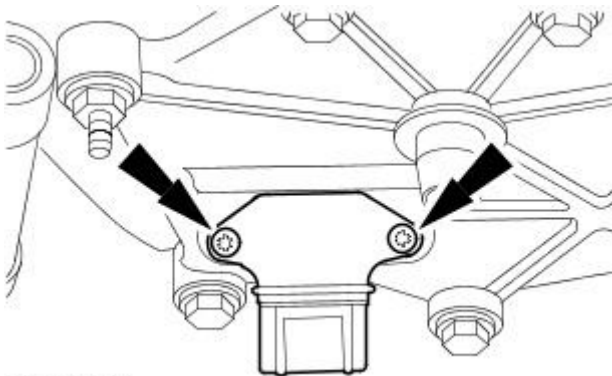
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the intake manifold.  
For additional information, refer to: [Intake Manifold](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).
3. Remove the manifold absolute pressure (MAP) sensor.
  - Remove and discard the MAP sensor O-ring seal.



VUJ0005611

## Installation

1. Install is the reverse of removal.
2. Tighten to 10 Nm.
  - Install a new MAP sensor O-ring seal.



VUJ0005611

3. **NOTE:** For NAS vehicles only.

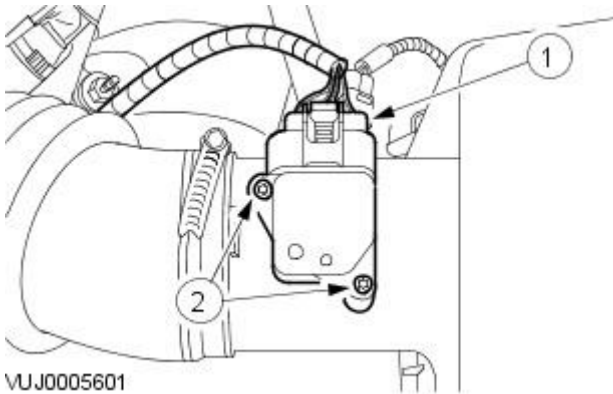
If required, carry out a short drive cycle.  
For additional information, refer to: Powertrain Control Module (PCM) Short Drive Cycle Self-Test (303-14C, General Procedures).

# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Mass Air Flow (MAF) Sensor

## Removal and Installation

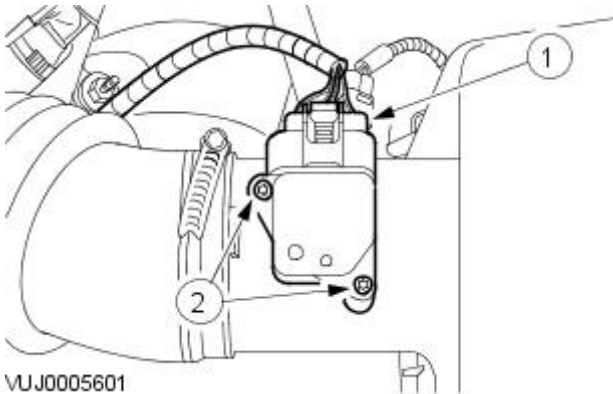
### Removal

1. Remove the mass air flow (MAF) sensor.
  - Remove and discard the O-ring seal.



### Installation

1. To install, reverse the removal procedure.
  - Tighten to 3 Nm.



2. **NOTE:** For NAS vehicles only.

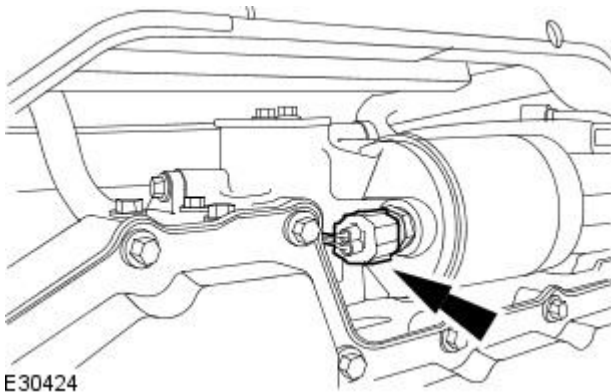
If required, carry out a short drive cycle.  
For additional information, refer to: Powertrain Control Module (PCM) Short Drive Cycle Self-Test (303-14C, General Procedures).

# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Oil Temperature Sensor

Removal and Installation

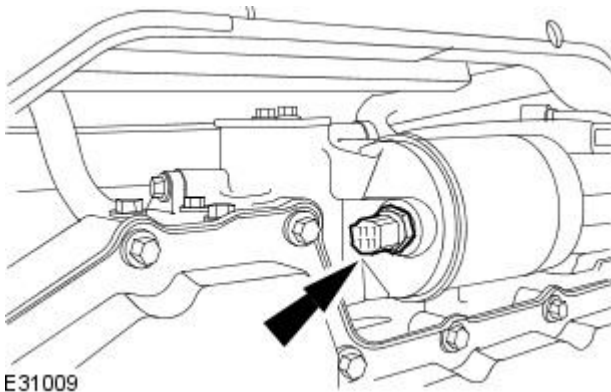
## Removal

1. Raise and support the vehicle.
2. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
3. Disconnect the oil temperature sensor electrical connector.



E30424

4. Remove the oil temperature sensor.



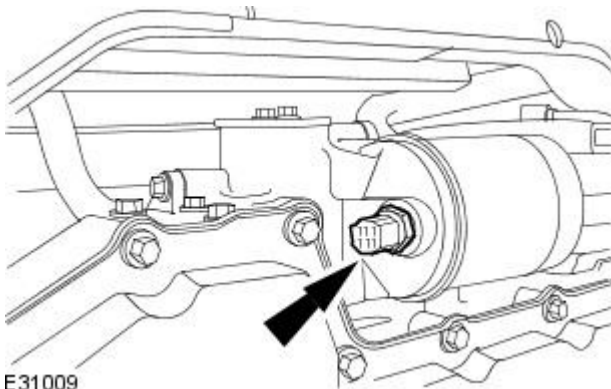
E31009

## Installation

1. **NOTE:** Apply a small bead of sealant meeting Jaguar specification on the first three threads of the oil temperature sensor.

To install, reverse the removal procedure.

- Tighten to 15 Nm.



E31009



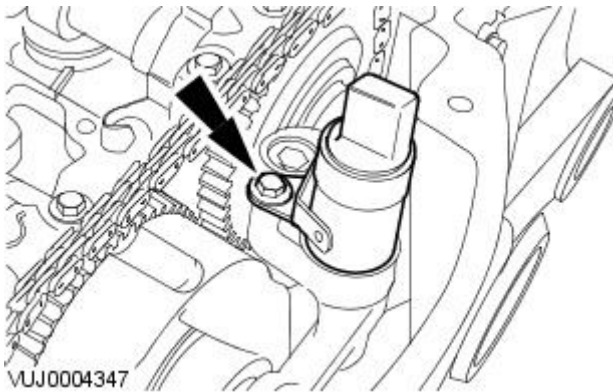
# Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Variable Camshaft Timing (VCT) Oil Control Solenoid

## Removal and Installation

### Removal

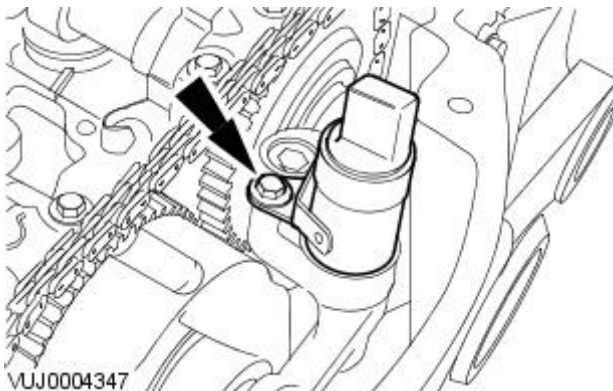
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the valve cover.  
For additional information, refer to: [Valve Cover LH](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).
3. **NOTE:** Left-hand shown, right-hand similar.

Remove the variable camshaft timing (VCT) oil control solenoid.



### Installation

1. To install, reverse the removal procedure.
  - Tighten to 10 Nm.

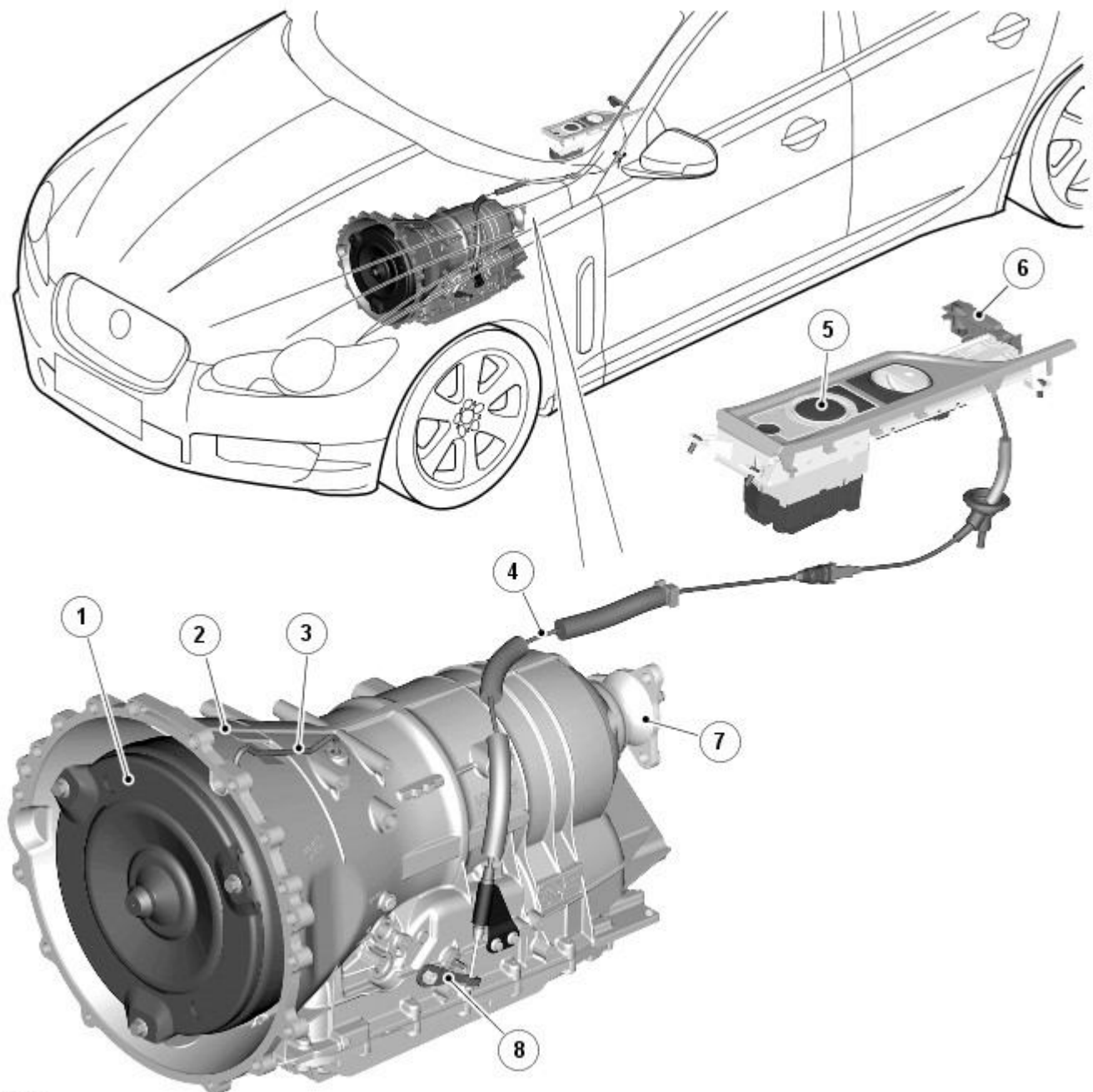


2. **NOTE:** For NAS vehicles only.

If required, carry out a short drive cycle.  
For additional information, refer to: Powertrain Control Module (PCM) Short Drive Cycle Self-Test (303-14C, General Procedures).

**Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 -  
AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Transmission**  
**Description Vehicles With: ZF 6HP26 - Component Location**  
 Description and Operation

Component Location



E94245

**ItemDescription**

1	Torque converter
2	Transmission assembly
3	Breather
4	Emergency park release cable
5	JaguarDrive selector
6	Emergency park release lever
7	Drive shaft flange
8	Emergency park release arm

# Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Transmission

## Description Vehicles With: ZF 6HP26 - Overview

Description and Operation

### OVERVIEW

The ZF 6HP26 transmission is an electronically controlled, six speed unit. The transmission is manufactured by ZF Transmissions GmbH in Saarbrücken, Germany.

This transmission represents the latest in automatic transmission technology and incorporates new features to enhance the transmission functionality:

- The hydraulic and electronic control elements of the transmission, including the [TCM \(transmission control module\)](#), are incorporated in a single unit located inside the transmission and is known as 'Mechatronic'
- Another new strategy is Adaptive Shift Strategy (ASIS). ASIS represents the continuous adaptation of shift changes to suit the driving style of the driver which can vary from sporting to economical.

On supercharged models, the transmission used is an uprated derivative of the 6HP26 transmission used in the 4.2L naturally aspirated model. The uprated transmission includes additional clutch plates to enable the transmission to manage the additional power output of the supercharged engine.

The 6HP26 transmission has the following features:

- Designed to be maintenance free
- Transmission fluid is 'fill for life'
- The torque converter features a controlled slip feature with electronically regulated control of lock-up, creating a smooth transition to the fully locked condition
- Shift programs controlled by the [TCM](#)
- Connected to the [ECM \(engine control module\)](#) via the High Speed [CAN \(controller area network\)](#) bus for communications
- Uses a High Speed [CAN](#) bus and a 'K' Line (early build vehicles only) connection to the diagnostic socket for diagnostic connection
- Default mode if major faults occur
- Diagnostics available from the [TCM](#) via the high speed [CAN](#) bus.

The gearbox comprises the main casing which houses all of the transmission components. The main case also incorporates an integral bell housing. A fluid pan is bolted to the lower face of the main case and is secured with bolts. The fluid pan is sealed to the main case with a gasket. Removal of the fluid pan allows access to the Mechatronic valve block. The fluid pan has a magnet located around the drain plug which collects any metallic particles present in the transmission fluid. A fluid filter is located inside the fluid pan. If the transmission fluid becomes contaminated or after any service work, the fluid pan with integral filter must be replaced.

The integral bell housing provides protection for the torque converter assembly and also provides the attachment for the gearbox to the engine cylinder block. The torque converter is a non-serviceable assembly which also contains the lock-up clutch mechanism.

The torque converter drives a crescent type pump via drive tangs. The fluid pump is located in the main case, behind the torque converter.

The main case contains the following major components:

- Input shaft
- Output shaft
- Mechatronic valve block which contains the solenoids, speed sensors and the [TCM](#)
- Three rotating multiplate drive clutches
- Two fixed multiplate brake clutches
- A single planetary gear train and a double planetary gear train.

# Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Transmission

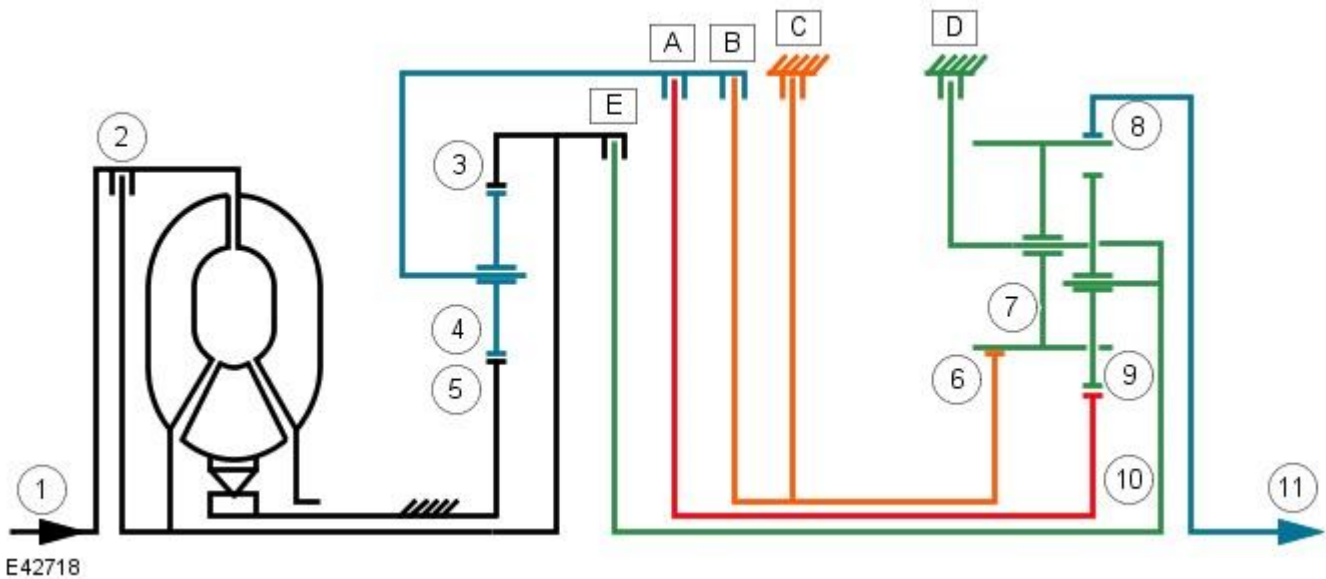
## Description Vehicles With: ZF 6HP26 - System Operation and Component Description

Description and Operation

### System Operation

#### POWER FLOWS

Operation of the transmission is controlled by the [TCM \(transmission control module\)](#) which electrically activates various solenoids to control the transmission gear selection. The sequence of solenoid activation is based on programmed information in the [TCM](#) memory and physical transmission operating conditions such as vehicle speed, throttle position, engine load and JaguarDrive selector position.



#### ItemDescription

1	Torque input from engine
2	Torque converter lock-up clutch
3	Single web planetary gear carrier
4	Single web planetary gears
5	Single web sunwheel 1
6	Double web sunwheel 2
7	Double web planetary gears - Long
8	Double web planetary gear carrier
9	Double web planetary gears - Short
10	Double web sunwheel 3
11	Torque output from transmission
A	Multiplate clutch
B	Multiplate clutch
C	Multiplate brake
D	Multiplate brake
E	Multiplate clutch

Engine torque is transferred, via operation of single or combinations of clutches to the 2 planetary gear trains. Both gear trains are controlled by reactionary inputs from brake clutches to produce the 6 forward gears and 1 reverse gear. The ratios are as follows:

Gear	1st	2nd	3rd	4th	5th	6th	Reverse
Ratio	4.171	2.340	1.521	1.143	0.867	0.691	3.403

The following table shows which solenoids are activated to produce the required torque output from the transmission.

Electronic Transmission Selector Position	Shift Control Solenoid Valve	Electronic Pressure Regulator Solenoids (EPRS)					
		1	2	3	4	5	6
P	-	-	-	-	ON	-ON-	-
R	-	-	ON	-	ON	-ON-	-

Electronic Transmission Selector Position	Shift Control Solenoid Valve	Electronic Pressure Regulator Solenoids (EPRS)					
		1	2	3	4	5	6
N	-	-	-	-	ON	-ON-	-
D 1	-	ON	-	-	ON	-ON-	-ON-
D 2	-	ON	-	ON	-	-ON-	-ON-
D 3	-	ON	ON	-	-	-ON-	-ON-
D 4	ON	ON	-	-	ON	-ON-	-ON-
D 5	ON	-	ON	-	ON	-ON-	-ON-
D 6	ON	-	-	ON	ON	-ON-	-ON-

**ON** = Active (pressure build up)

**OFF** = Inactive

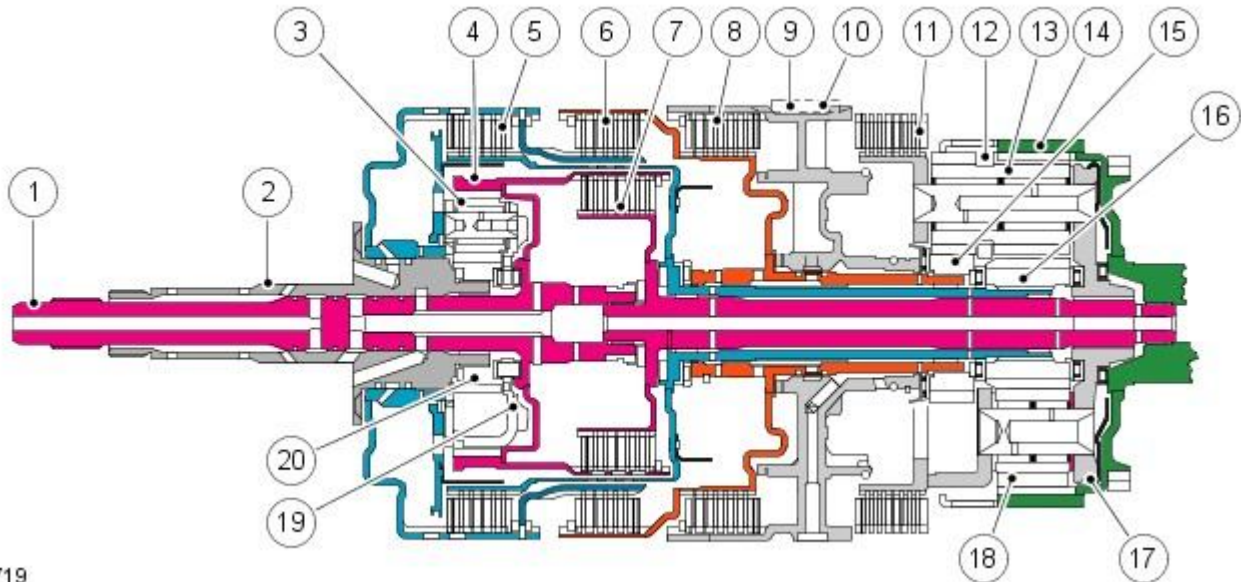
**-ON-** = Inactive (pressure drain)

The following table shows which clutches are operating for selected gear ratios to produce the required torque output from the transmission.

JaguarDrive Selector Position	Shift Control Solenoid Valve	Clutch				Brake	
		A	B	E	WK	C	D
P	-	-	-	-	-	-	X
R	-	-	X	-	-	-	X
N	-	-	-	-	-	-	X
D 1	-	X	-	-	X	-	X
D 2	-	X	-	-	X	X	-
D 3	-	X	X	-	X	-	-
D 4	ON	X	-	X	X	-	-
D 5	ON	-	X	X	X	-	-
D 6	ON	-	-	X	X	X	-

**X** = clutch applied

Shift Elements



E42719

**ItemDescription**

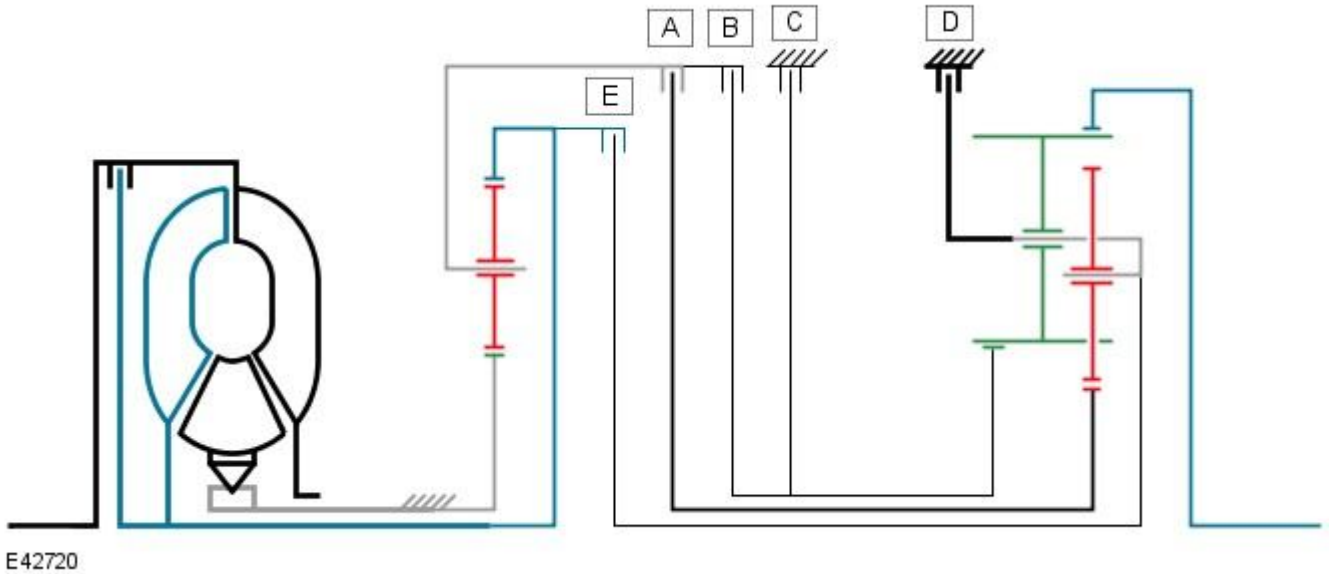
1	Turbine shaft
2	Stator shaft
3	Single web planetary gear train
4	Ring gear 1
5	Clutch A
6	Clutch B
7	Clutch E
8	Brake clutch C
9	Fixed connection to transmission housing
10	Shaft key
11	Brake clutch D
12	Double web planetary gear train
13	Planetary gears - Long
14	Ring gear 2
15	Sunwheel 2
16	Sunwheel 3

17	Double web planetary gear carrier
18	Planetary gears - short
19	Single web planetary gear carrier
20	Sunwheel 1

The shift elements are 3 rotating multiplate clutches (A, B and E) and 2 fixed multiplate brakes © and D). All shifts from 1st to 6th gears are power-on overlapping shifts. Overlapping shifts can be described as one of the clutches continuing to transmit drive at a lower main pressure until the next required clutch is able to accept the input torque.

The shift elements, clutches and brakes are actuated hydraulically. Fluid pressure is applied to the required clutch and/or brake, pressing the plates together and allowing drive to be transmitted through the plates. The purpose of the shift elements is to perform power-on shifts with no interruption to traction and smooth transition between gear ratios.

**POWER FLOW 1st GEAR**



The JaguarDrive selector and the selector valve spool are in the 'D' position. Engine torque is transmitted from the torque converter turbine shaft to the ring gear 1 of the single web planetary gear train and the outer plate carrier of clutch 'E'.

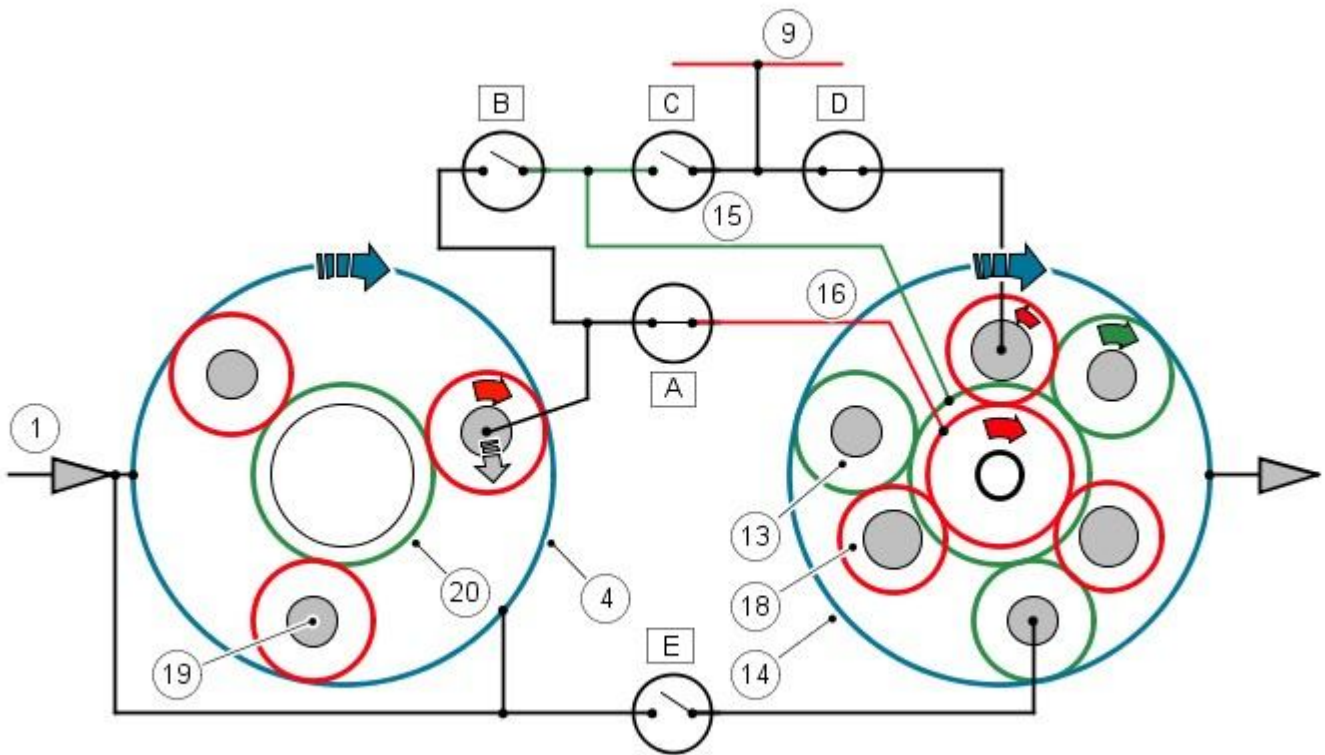
Ring gear 1 drives the planetary gears which rotate around sunwheel 1. This drives the planetary gear carrier 1 and also the outer plate carrier of clutch 'A' and the inner plate carrier of clutch 'B'.

When clutch 'A' is engaged, sunwheel 3 in the double web planetary gear train is driven and meshes with the short planetary gears.

The double web planetary gear train is locked against the transmission housing by brake 'D'. This allows ring gear 2 (output shaft) to be driven in the same direction as the engine via the long planetary gears.

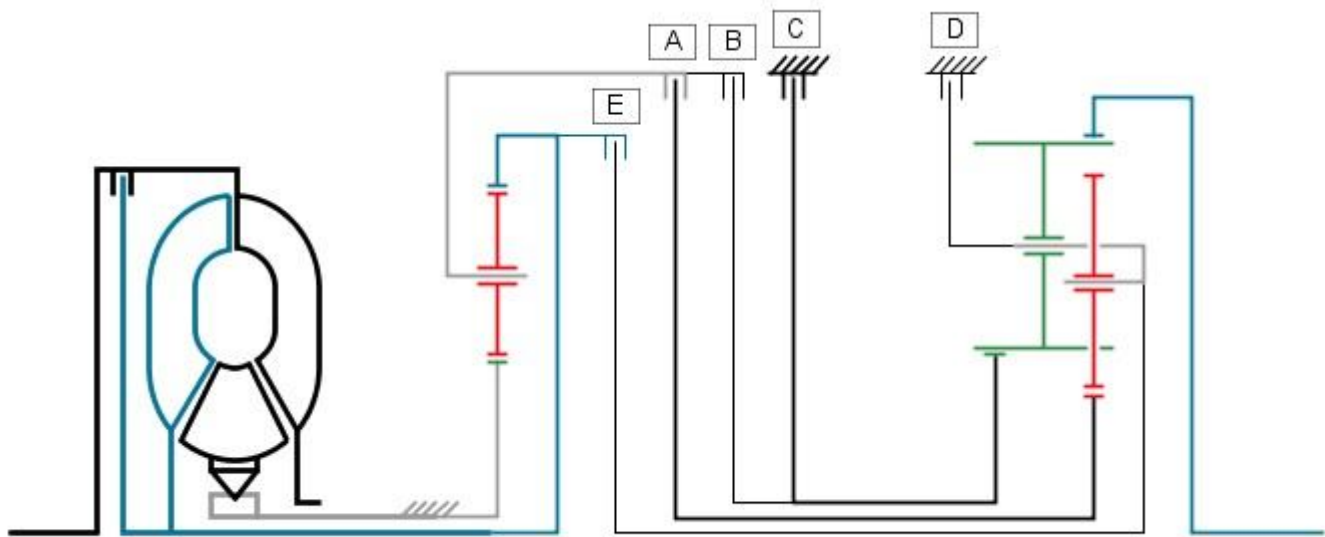
- NOTE: Refer to 'Shift Elements' illustration for key





E42721

**POWER FLOW 2nd GEAR**



E42722

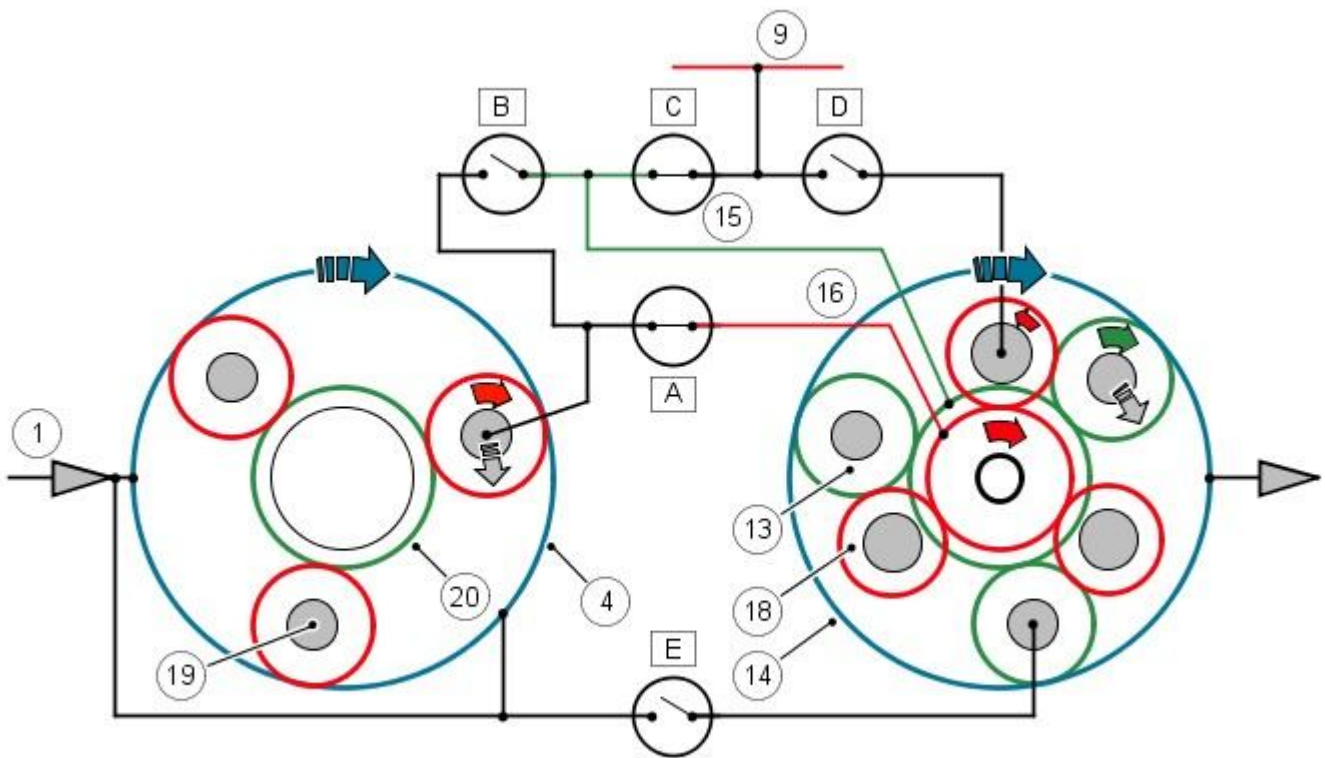
The JaguarDrive selector and the selector spool valve are in the 'D' position. Engine torque is transmitted from the torque converter turbine shaft to the ring gear 1 of the single web planetary gear train and the outer plate carrier of clutch 'E'.

Ring gear 1 drives the planetary gears which rotate around sunwheel 1. This drives the planetary gear carrier 1 and also the outer plate carrier of clutch 'A' and the inner plate carrier of clutch 'B'.

When clutch 'A' is engaged, sunwheel 3 in the double web planetary gear train is driven and meshes with the short planetary gears.

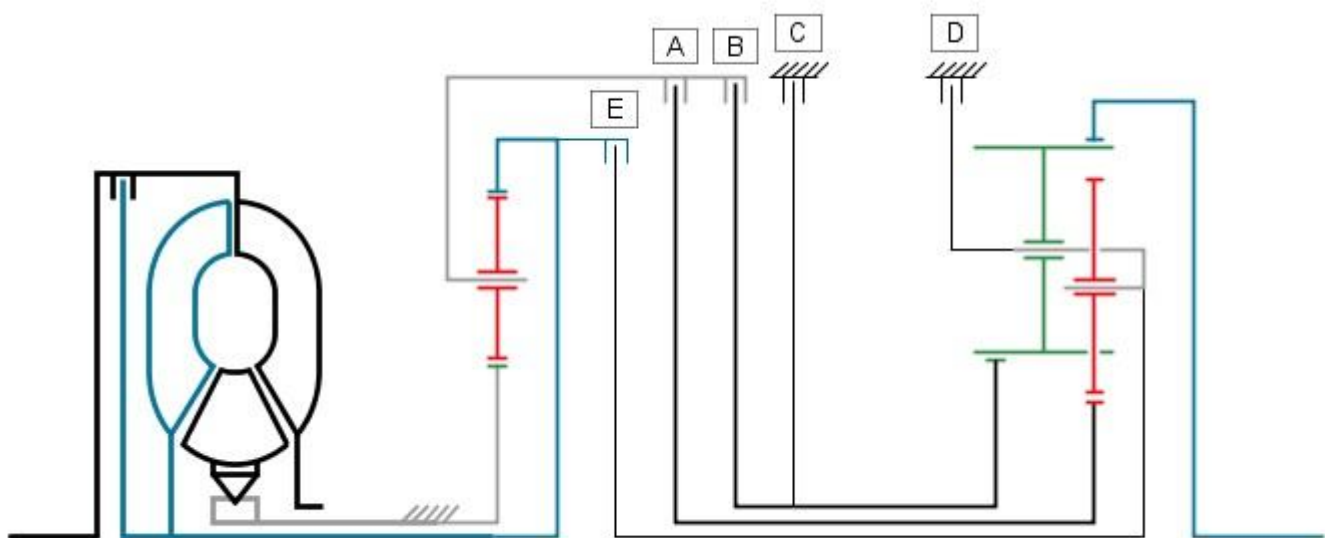
Sunwheel 2 is locked to the transmission housing by brake clutch 'C'. The long planetary gears, which are also meshed with the short planetary gears, roll around the fixed sunwheel 2 and transmit drive to the double web planetary gear train carrier and ring gear 2 in the direction of engine rotation.

• NOTE: Refer to 'Shift Elements' illustration for key



E42723

**POWER FLOW 3rd GEAR**



E 42724

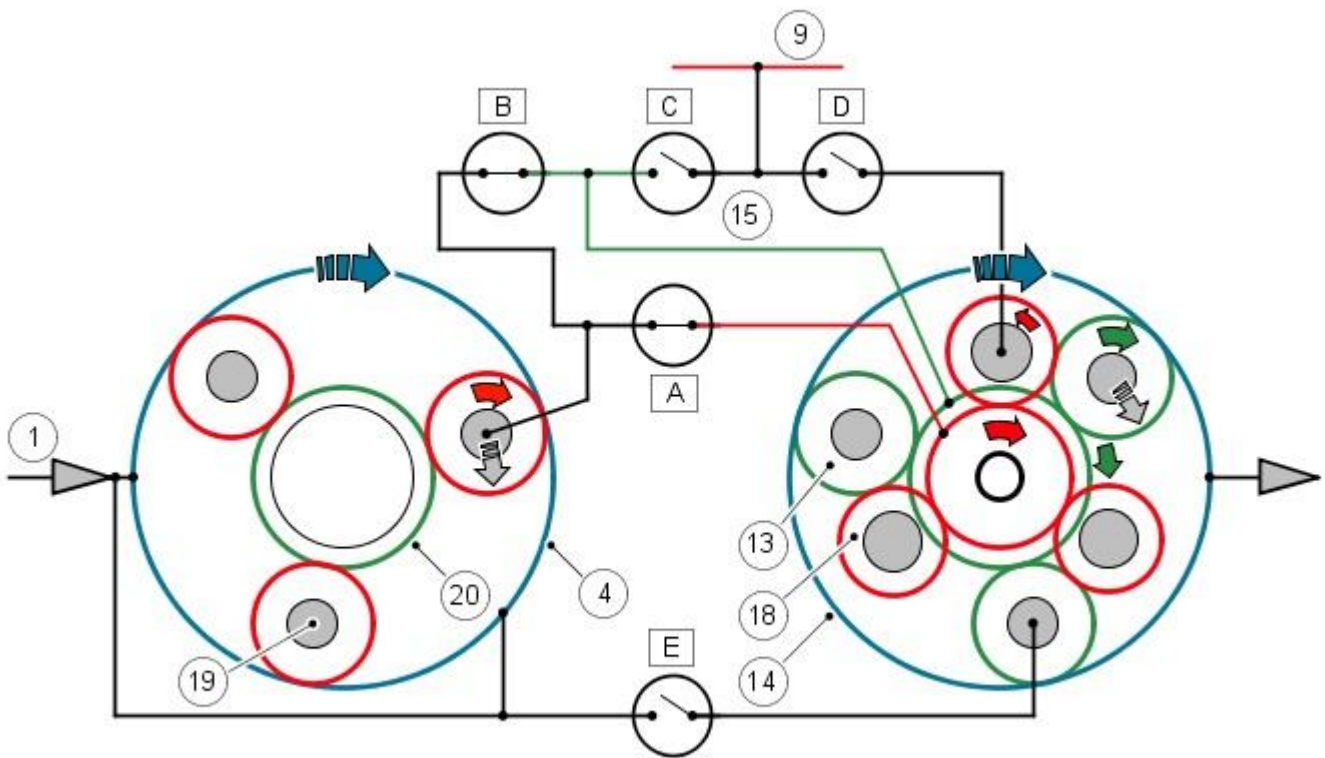
The JaguarDrive selector and the selector spool valve are in the 'D' position. Engine torque is transmitted from the torque converter turbine shaft to the ring gear 1 of the single web planetary gear train and the outer plate carrier of clutch 'E'.

Ring gear 1 drives the planetary gears which rotate around sunwheel 1. This drives the planetary gear carrier 1 and also the outer plate carrier of clutch 'A' and the inner plate carrier of clutch 'B'.

When clutch 'A' is engaged, sunwheel 3 in the double web planetary gear train is driven and meshes with the short planetary gears.

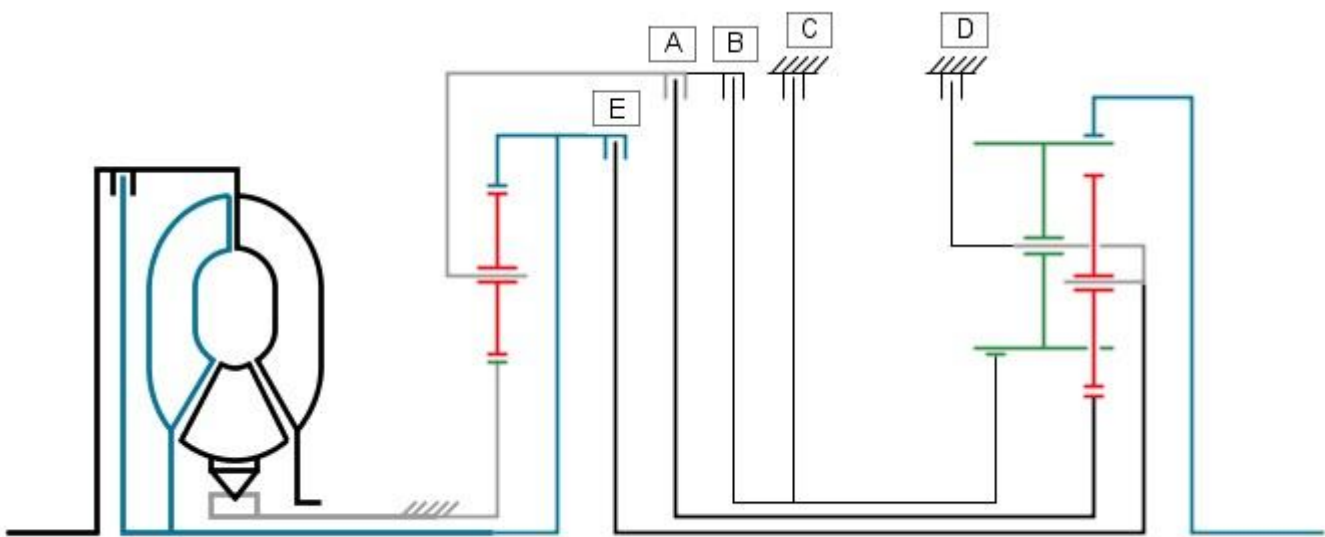
Sunwheel 2 is driven via clutch 'B' which is engaged. The long planetary gears, which are also meshed with the short planetary gears, cannot roll around the fixed sunwheel 2 and therefore transmit drive to the locked double web planetary gear train carrier in the direction of engine rotation.

• NOTE: Refer to 'Shift Elements' illustration for key



E42725

**POWER FLOW 4th GEAR**



E42726

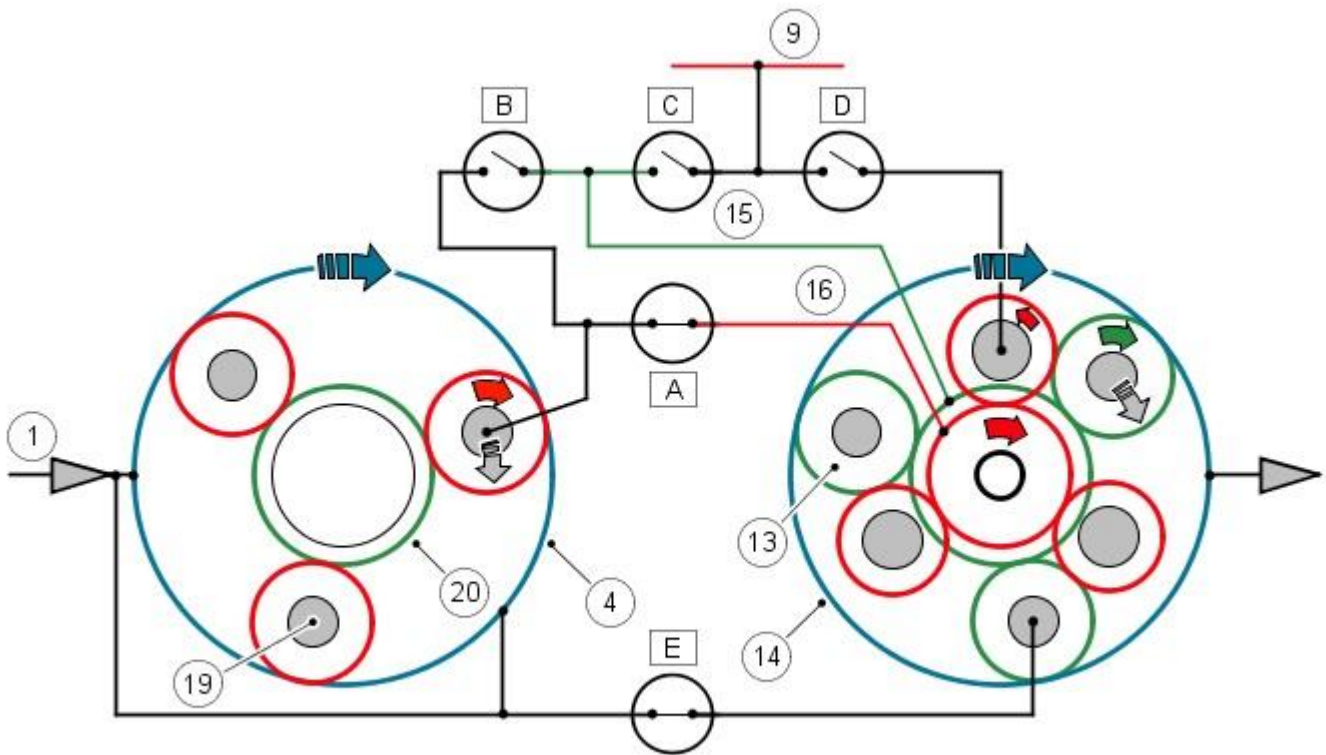
The JaguarDrive selector and the selector spool valve are in the 'D' position. Engine torque is transmitted from the torque converter turbine shaft to ring gear 1 of the single web planetary gear train and the outer plate carrier of clutch 'E'.

Ring gear 1 drives the planetary gears which rotate around sunwheel 1. This drives the planetary gear carrier 1 and also the outer plate carrier of clutch 'A' and the inner plate carrier of clutch 'B'.

When clutch 'A' is engaged, sunwheel 3 in the double web planetary gear train is driven and meshes with the short planetary gears.

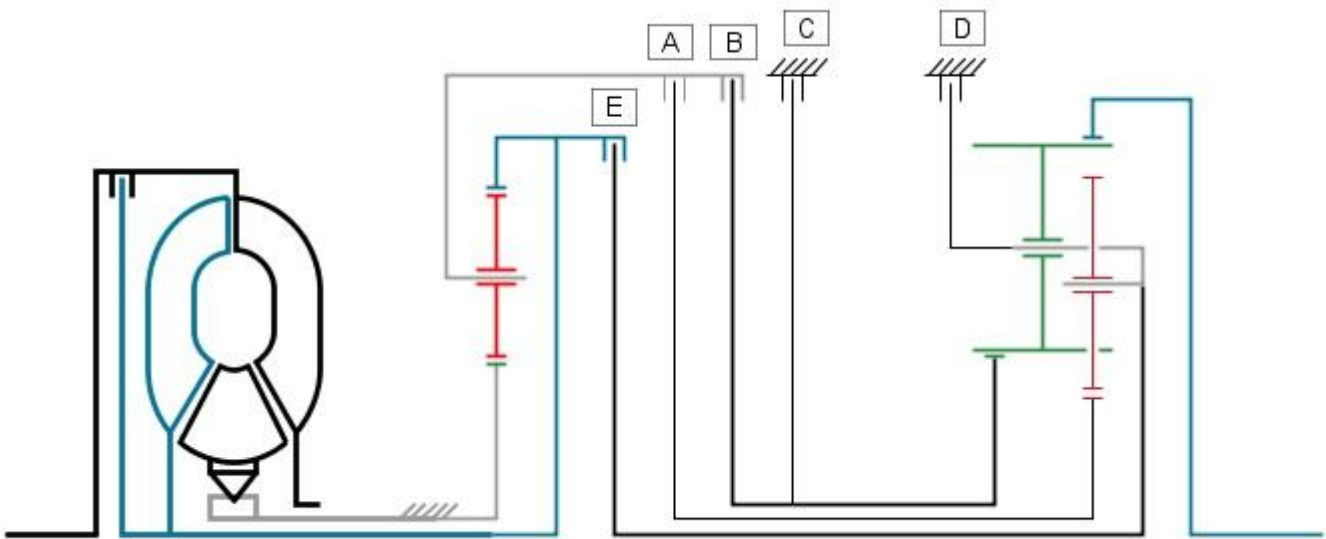
The double web planetary gear carrier is driven via clutch 'E' which is engaged. The long planetary gears, which are also meshed with the short planetary gears and the double web planetary gear carrier, drive ring gear 2 in the direction of engine rotation.

• NOTE: Refer to 'Shift Elements' illustration for key



E42727

### POWER FLOW 5th GEAR



E42728

The JaguarDrive selector and the selector spool valve are in the 'D' position. Engine torque is transmitted from the torque converter turbine shaft to ring gear 1 of the single web planetary gear train and the outer plate carrier of clutch 'E'.

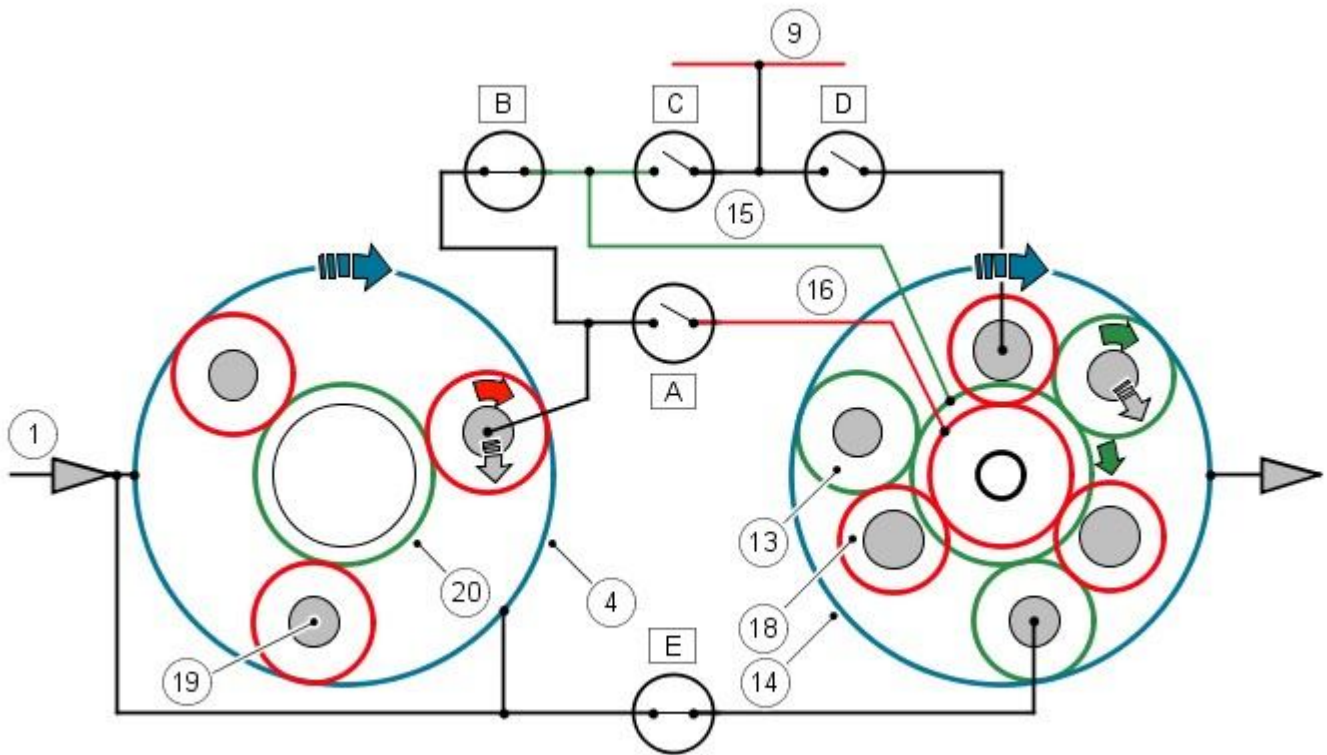
Ring gear 1 drives the planetary gears which rotate around sunwheel 1. This drives the planetary gear carrier 1 and also the outer plate carrier of clutch 'A' and the inner plate carrier of clutch 'B'.

When clutch 'A' is engaged, sunwheel 3 in the double web planetary gear train is driven and meshes with the short planetary gears.

The long planetary gears, which are also meshed with the short planetary gears and the double web planetary gear carrier, drive ring gear 2 in the direction of engine rotation.

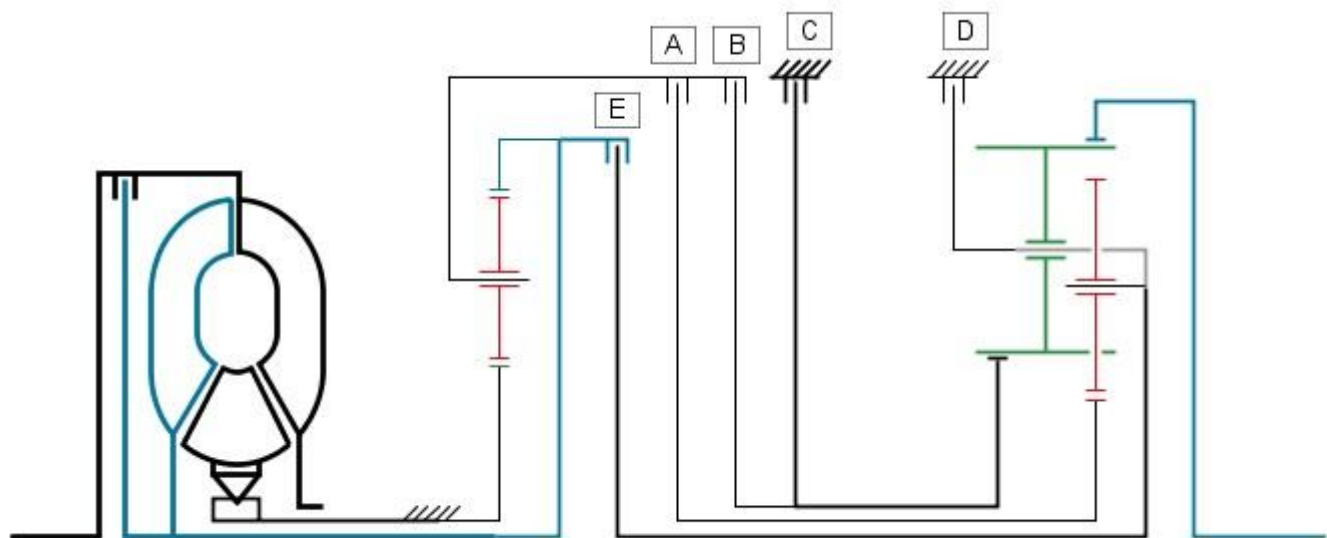
• NOTE: Refer to 'Shift Elements' illustration for key





E42729

### POWER FLOW 6th GEAR



E42730

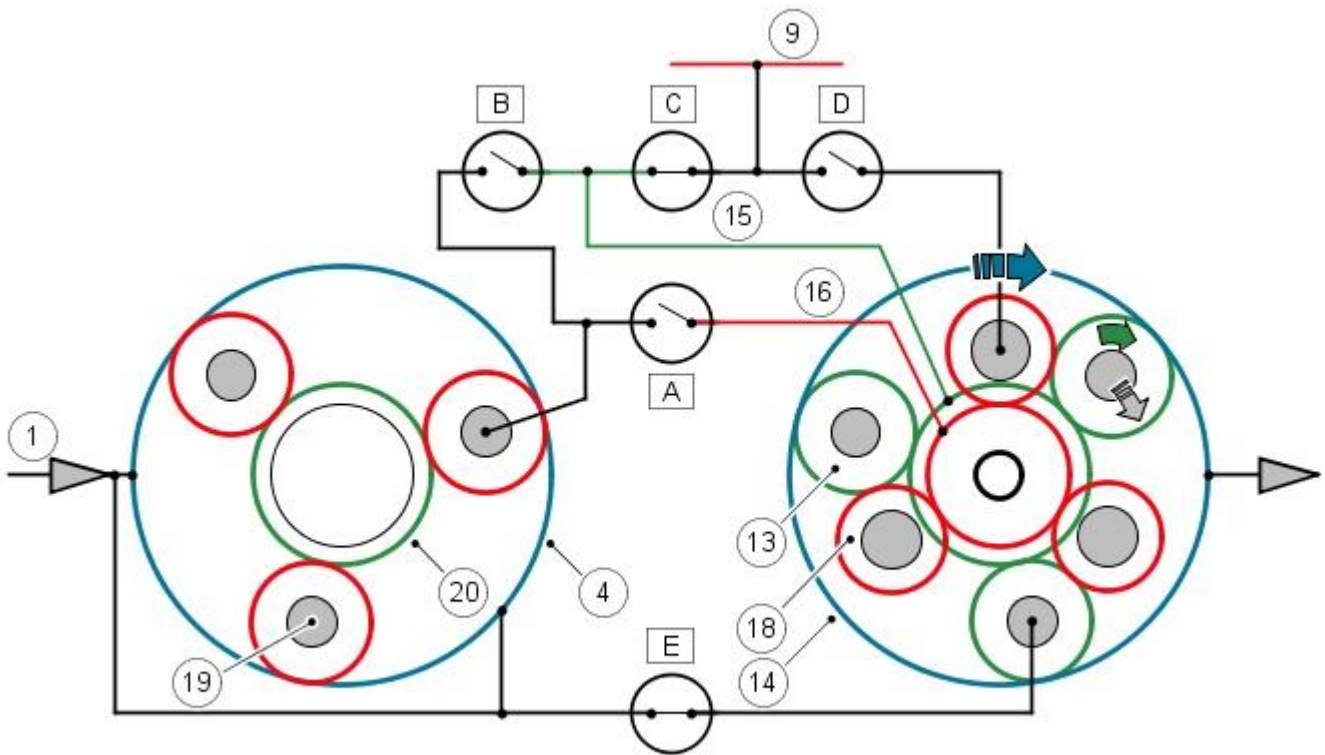
The JaguarDrive selector and the selector spool valve are in the 'D' position. Engine torque is transmitted from the torque converter turbine shaft to ring gear 1 of the single web planetary gear train and the outer plate carrier of clutch 'E'.

Clutches 'A' and 'B' are released, removing the effect of the single web planetary gear train.

Clutch brake 'C' is applied which locks sunwheel 2 to the transmission housing.

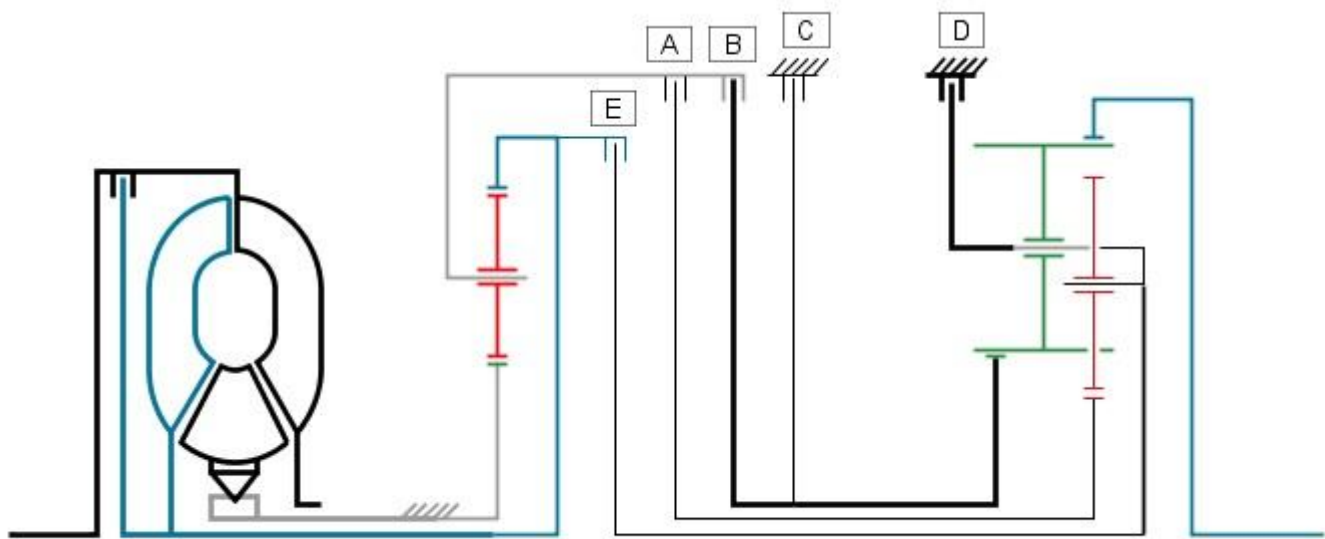
Clutch 'E' is engaged and drives the double web planetary gear carrier. This causes the long planetary gears to rotate around the fixed sunwheel 2 and transmit drive to ring gear 2 which is driven in the direction of engine rotation.

• NOTE: Refer to 'Shift Elements' illustration for key



E42731

### POWER FLOW REVERSE GEAR



E42732

The JaguarDrive selector and the selector spool valve are in the 'R' position. Engine torque is transmitted from the torque converter turbine shaft to ring gear 1 of the single web planetary gear train and the outer plate carrier of clutch 'E'.

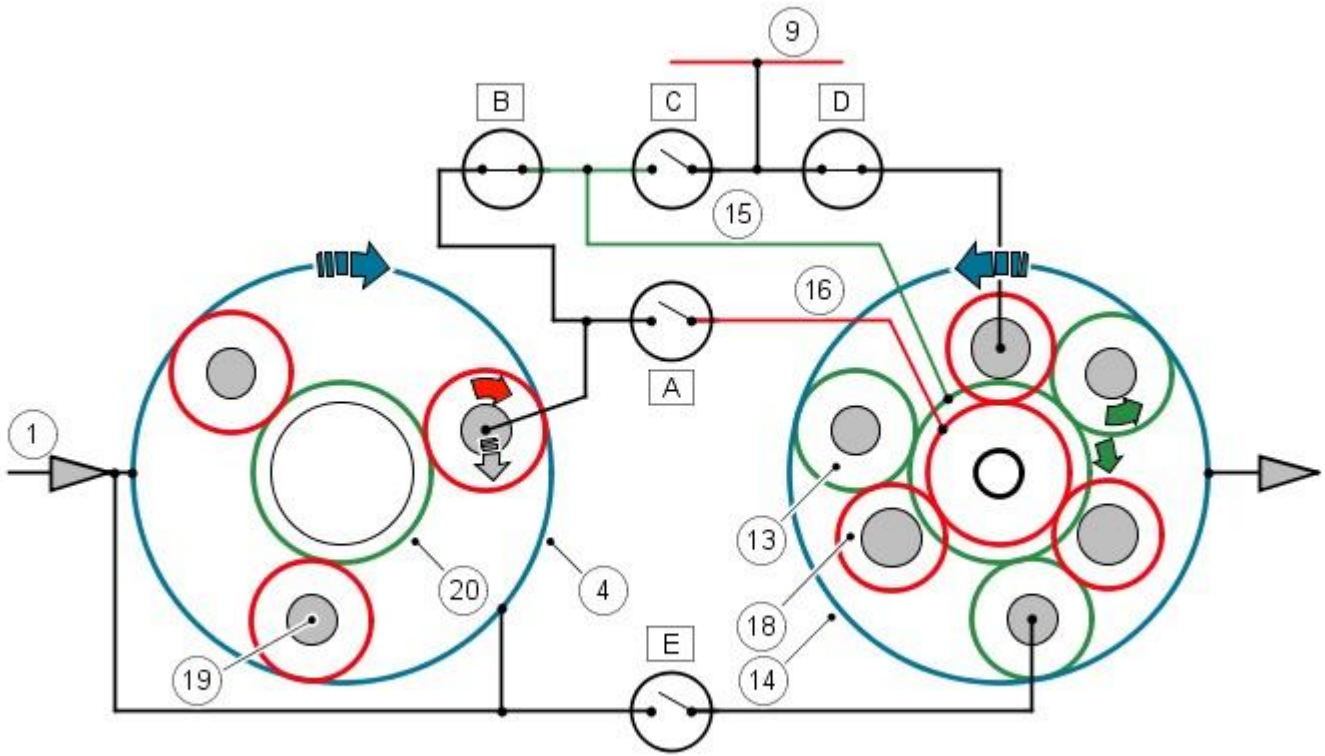
Ring gear 1 drives the planetary gears of the single web planetary gear train which rotate around the fixed sunwheel 1. This transmits the drive to the single web planetary gear carrier, the outer plate carrier of clutch 'A' and the inner plate carrier of clutch 'B'.

With clutch 'B' applied, sunwheel 2 in the double web planetary gear train is driven and meshes with the long planetary gears.

The double web planetary gear carrier is locked to the transmission housing by brake clutch 'D'. This allows ring gear 2 to be driven in the opposite direction to engine rotation by the long planetary gears.

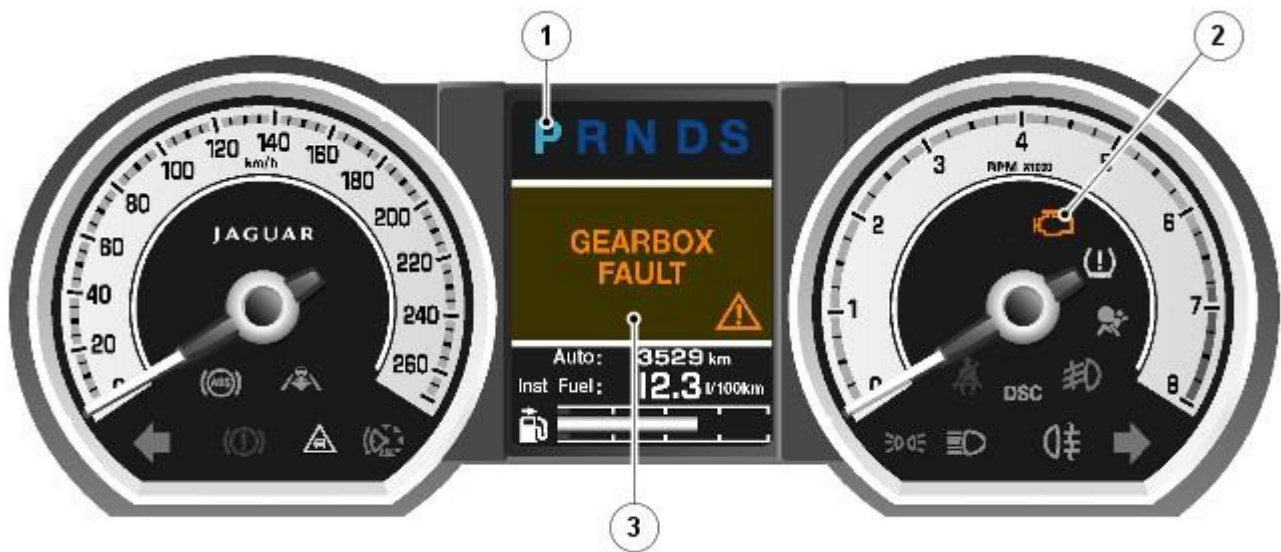
• NOTE: Refer to 'Shift Elements' illustration for key





E42733

## INSTRUMENT CLUSTER



E95414

### ItemDescription

1	Transmission selected gear status
2	Malfunction Indicator Lamp (MIL)
3	Message center

The instrument cluster is connected to the [TCM](#) via the high speed [CAN \(controller area network\)](#) bus. Transmission status is transmitted by the [TCM](#) and displayed to the driver in one of 2 displays in the instrument cluster.

Refer to: [Information and Message Center](#) (413-08 Information and Message Center, Description and Operation).

### Malfunction Indicator Lamp (MIL)

The [MIL \(malfunction indicator lamp\)](#) is located in the tachometer in the instrument cluster. Transmission related faults which may affect the vehicle emissions output will illuminate the [MIL](#).

The [MIL](#) is illuminated by the [ECM \(engine control module\)](#) on receipt of a relevant fault message from the [TCM](#) on the high speed [CAN](#). The nature of the fault can be diagnosed using a Jaguar approved diagnostic system which reads the fault codes stored in the [TCM](#) memory.

## Transmission Status Display

The transmission status display is located in a [LCD \(liquid crystal display\)](#) at the top of the instrument cluster, between the speedometer and the tachometer. The [LCD](#) shows the JaguarDrive selector position or the selected gear when in manual 'Jaguar Sequential Shift' mode.

The following table shows the displays and their descriptions.

Symbol	Description
P	Park selected
R	Reverse selected
N	Neutral selected
D	Drive selected
S	Sport mode selected
1	1st gear selected (Manual 'Jaguar Sequential Shift' mode)
2	2nd gear selected (Manual 'Jaguar Sequential Shift' mode)
3	3rd gear selected (Manual 'Jaguar Sequential Shift' mode)
4	4th gear selected (Manual 'Jaguar Sequential Shift' mode)
5	5th gear selected (Manual 'Jaguar Sequential Shift' mode)
6	6th gear selected (Manual 'Jaguar Sequential Shift' mode)

## Message Center Display

The message center is located in the lower center of the instrument cluster. The message center is a [LCD](#) to relay vehicle status and operating information to the driver and can display messages relating to a number of the vehicle systems. If a transmission fault occurs, the message center will display the message 'GEARBOX FAULT'.

## TRANSMISSION CONTROL MODULE (TCM)

The [TCM](#) is an integral part of the Mechatronic valve block which is located at the bottom of the transmission, within the fluid pan. The [TCM](#) is the main controlling component of the transmission.

The [TCM](#) processes signals from the transmission speed and temperature sensors, [ECM](#) and other vehicle systems. From the received signal inputs and pre-programmed data, the [TCM](#) calculates the correct gear, torque converter clutch setting and optimum pressure settings for gear shift and lock-up clutch control.

The [TCM](#) outputs signals to control the shift control solenoid valve and the Electronic Pressure Regulator Solenoids (EPRS) to control the hydraulic operation of the transmission.

The [ECM](#) supplies the engine management data on the high speed [CAN](#) bus system. The [TCM](#) requires engine data to efficiently control the transmission operation, for example; flywheel torque, engine speed, accelerator pedal angle, engine temperature etc.

The steering angle sensor and the [ABS \(anti-lock brake system\)](#) module also supply data to the [TCM](#) on the high speed [CAN](#) bus system. The [TCM](#) uses data from these systems to suspend gear changes when the vehicle is cornering and/or the [ABS](#) module is controlling braking or traction control.

The Mechatronic valve block also contains the speed and temperature sensors. These are integral with the Mechatronic valve block and cannot be serviced individually. The speed sensors measure the transmission input and output speeds and pass signals to the [TCM](#). The fluid temperature sensor is also located in the valve block and measures the fluid temperature of the transmission fluid in the fluid pan.

## CONTROLLER AREA NETWORK (CAN)

The high speed [CAN](#) bus is used to connect the powertrain modules. The [CAN](#) bus is connected between the following electronic units:

### High Speed CAN Bus

- [TCM](#)
- Instrument cluster
- Adaptive Damping Control Module (ADCM) - if fitted
- Steering angle sensor
- Electric park brake module
- Restraints control module
- [ECM](#)
- [ABS](#) module
- Adaptive speed control module - if fitted
- Diagnostic socket.

The [CAN](#) bus allows a fast exchange of data between modules. The [CAN](#) bus comprises 2 wires which are identified as [CAN](#) high (H) and [CAN](#) low (L). The 2 wires are coloured white/blue (H) and white (L) and are twisted together to minimise electromagnetic interference (noise) produced by the [CAN](#) bus messages.

Refer to: [Communications Network](#) (418-00 Module Communications Network, Description and Operation).

In the event of [CAN](#) bus failure, the following symptoms may be observed:

- Transmission operates in default (limp home) mode
- Torque converter lock-up clutch control is disabled (unlocked)
- Gear position indication in instrument cluster message center inoperative (this will also occur with any transmission fault).

## DRIVING MODES

There are a number of different driving modes of operation. Some can be selected by the driver and some are

automatically initiated by the [TCM](#) during driving:

- Normal mode (driver selected)
- Sport mode (driver selected)
- Manual ('Jaguar Sequential Shift') mode (driver selected)
- Adaptive Shift Strategy (ASIS) which comprises the following:
  - Cruise mode
  - Hill mode
  - Default (Limp home) mode
  - Reverse lock-out mode
  - Cooling strategy
  - Curve recognition mode
  - Fast off recognition.

### **Normal Mode**

Normal mode is automatically selected by the [TCM](#) on power up. In this mode all automatic and adaptive modes are active. Normal mode uses gear shift and lock-up maps to allow for vehicle operation which offers fuel consumption and emissions or driveability depending on the driving style. If the transmission is operated in sport or manual mode and the JaguarDrive selector is moved to the 'D' position, normal mode is automatically resumed.

Sport mode is selected by moving the JaguarDrive selector to the 'S' position. When the sport mode is first selected, if 6th gear is currently engaged, the [TCM](#) downshifts to 5th provided the correct engine speed parameters are met.

### **Manual ('Jaguar Sequential Shift') Mode**

Manual mode allows the transmission to operate as a semi-automatic 'Jaguar Sequential Shift' unit. The driver can change up and down the 6 forward gears with the freedom of a manual transmission.

Shift maps are provided for manual mode to protect the engine at high engine speeds. The [TCM](#) will automatically change up to a higher gear ratio to prevent engine overspeed and change down to a lower gear ratio to avoid engine labouring and stalling.

When kickdown is requested the [TCM](#) downshifts to the lowest available gear within the allowed engine speed parameters.

When the vehicle is stationary, to drive off, the driver can select 1st , 2nd or 3rd gear. Any other gear selection will be rejected by the [TCM](#).

When driving off, upshifts can be pre-selected by making + selections with the appropriate steering wheel upshift or downshift paddle for the number of upshifts required. The [TCM](#) then automatically performs a corresponding number of upshifts when the appropriate shift points are reached. So, for example, when starting off in 1st gear, if three upshift (+) selections are made in quick succession, the [TCM](#) will automatically change up through the box to 4th gear as the vehicle accelerates, without any further selections being made.

In manual mode a low gear can be selected to provide engine braking for descending a slope without continuous use of the brake pedal. The driver can prepare for the end of the descent by moving the JaguarDrive selector to the 'D' position. The [TCM](#) will maintain the low gear and only revert to automatic shift control when the throttle is opened and vehicle speed increases.

### **Adaptive Shift Strategy (ASIS)**

With the [TCM](#) linked via the [CAN](#) bus to other vehicle systems, signals are received which can allow the [TCM](#) to calculate the way in which the vehicle is being driven. The type of signals include the following:

- Longitudinal and lateral acceleration
- Engine speed
- Engine torque
- Oil temperature
- Accelerator pedal position
- Wheel speed.

Using these signals, additional transmission control can be obtained. The [TCM](#) can calculate when the vehicle is cornering, all wheels are gripping, the driver is braking or if the driver is accelerating. This is the conventional 'Adaptive' transmission control. ASIS uses this system but adds the continuous adaptation of the gear changes to suit the individual driving style of the driver.

### **Cruise Mode**

When speed control is activated, the [TCM](#) receives a cruise active message on the [CAN](#) bus. The [TCM](#) activates a speed control map which prevents locking and unlocking of the torque converter clutch and minimizes up and down shifts.

### **Hill Mode**

Hill mode is initiated by the [TCM](#) when the engine torque, received via [ECM](#) signals on the [CAN](#) bus, exceeds the theoretical load curve for normal operation. The [TCM](#) monitors this signal to determine when the vehicle is travelling up or down a steep gradient.

In hill mode the [TCM](#) adopts one of four shift maps, three uphill and one downhill. The shift map chosen depends on the severity of the slope as determined from the engine signals and the appropriate gear is selected to assist with the ascent or descent.

Hill mode can also be initiated when the vehicle is at very high altitudes or ambient temperatures.

### **Default (Limp Home) Mode**

If a transmission fault is detected by the [TCM](#), the [TCM](#) adopts a limp home mode strategy. 'GEARBOX FAULT' is displayed in the message center and, if the fault has an effect on engine emissions, the [MIL](#) will also be illuminated.

In default mode, P, R and N functions operate normally (if the fault allows these selections) and the [TCM](#) locks the transmission in 3rd or 5th gear to allow the driver to take the vehicle to the nearest dealer. The torque converter lock-up clutch is disabled and reverse lock-out will not function.

If the vehicle is stopped and subsequently restarted in the default mode condition, the [TCM](#) operates normally until the fault which caused the condition is detected again.

If electrical power is lost and the transmission is operating in mechanical limp home mode, the transmission will be electronically locked in the 'P' position when the ignition is off. This can be released mechanically if required by operating the emergency park release lever located in the floor console.

Refer to: [External Controls - Vehicles With: ZF 6HP26](#) (307-05 Automatic Transmission/Transaxle External Controls, Description and Operation).

### Reverse Lock-Out Mode

When the vehicle is travelling forwards, selecting reverse could cause transmission damage. To protect against this, reverse gear is prohibited if the vehicle is travelling forwards at a road speed of 5 mph (8 km/h) or higher.

### Cooling Strategy

The purpose of the cooling strategy is to reduce engine and transmission temperatures during high load conditions. Under these conditions the engine and transmission may generate excessive heat.

If the transmission fluid temperature increases to 125°C (257°F) or higher, the [TCM](#) employs the cooling strategy. No message is displayed in the message center for transmission overheat.

The strategy uses a specific shift and torque converter lock-up clutch map. This map allows torque converter clutch lock-up and gear shifts to operate outside of their normal operation. This will reduce the engine speed and/or slip in the torque converter, therefore reducing heat generated by the engine and the transmission.

If the transmission fluid temperature increases to 137°C (278°F) or higher, the transmission will use the default (limp home mode). If the temperature exceeds 140°C (284°F), [CAN](#) bus transmission is disabled.

The cooling strategy is cancelled when the transmission fluid temperature decreases to less than 120°C (248°F) or below.

### Curve Recognition

Curve recognition is activated when high levels of lateral acceleration and/or steering angle are detected via the [ABS](#) module and steering angle sensor signals on the [CAN](#) bus. When this condition is detected, the [TCM](#) prevents the transmission from changing to a higher gear to assist with cornering. When the vehicle completes its manoeuvre, the transmission will shift to the correct ratio.

### Fast Off Recognition

Fast off recognition is activated when the [TCM](#) detects that the driver has backed off the accelerator pedal quickly in a 'change of mind' manoeuvre. This is detected by monitoring for a high level of negative pedal angle from the [ECM](#) signal on the high speed [CAN](#) bus. If this condition is detected, the [TCM](#) holds the current gear ratio to allow the driver to complete his original action without the need for a downshift. The mode remains active for a predetermined time period or if the driving style remains passive.

## TRANSMISSION FAULT STATUS

If the [TCM](#) detects a fault with the transmission system, it will enter a default mode to prevent further damage to the transmission and allow the vehicle to be driven.

When a fault is detected a high speed [CAN](#) message is sent from the [TCM](#) and is received by the instrument cluster. The instrument cluster illuminates the [MIL](#) if an emissions related fault occurs and displays 'GEARBOX FAULT' in the message center.

Some transmission faults may not illuminate the [MIL](#) or display a fault message, but the driver may notice a reduction in shift quality.

## ENGINE SPEED AND TORQUE MONITORING

The [ECM](#) constantly supplies the [TCM](#) with information on engine speed and torque through messages on the high speed [CAN](#) bus. The [TCM](#) uses this information to calculate the correct and appropriate timing of shift changes.

If the messages are not received by the [ECM](#), the [TCM](#) will implement a back-up strategy to protect the transmission from damage and allow the vehicle to be driven.

In the event of an engine speed or torque signal failure, the transmission will adopt the electrical limp home mode with the transmission operating in a fixed gear.

## TOWING FOR RECOVERY

The following procedure must be used to ensure that the vehicle is towed in a safe condition and damage to the vehicle transmission systems is prevented.

- Secure the towing attachment from the recovery vehicle to the towing eye of the vehicle to be recovered.
- Make sure that the parking brake is on. Press the start/stop button to switch the ignition on.
- Apply the footbrake and move the JaguarDrive selector to the neutral position. If electrical power is not available, use the emergency park release lever to select neutral.  
Refer to: [External Controls - Vehicles With: ZF 6HP26](#) (307-05 Automatic Transmission/Transaxle External Controls, Description and Operation).
- Make sure that the Smart Key is placed in the start control module to ensure that the electric steering lock is disengaged and, if the stop lamps and turn signal indicators are required, the start/stop button is pressed and the

ignition is on.

- Make sure that the parking brake is released before the vehicle is towed.
- The vehicle can only be towed for a maximum of 0.5 miles (0.8 km) at a maximum speed of 30 mph (48 km/h).



**WARNING:** Do not remove the Smart Key from the vehicle when the vehicle is being towed. The electric steering lock will be engaged preventing the steering from being turned.

With the engine not running, the brake booster and power steering pump will be inoperative. Care must be taken to ensure the vehicle is manoeuvred and driven accordingly.

## **Component Description**

### **ZF 6HP26 Automatic Transmission – Exploded View**

- NOTE: The transmission shown is exploded to the extent of the serviceable items





9	Mechatronic valve block
10	Element seal
11	Electrical connector – guide sleeve
12	O-ring
13	O-ring
14	Pump housing
15	Input shaft seal
16	Torque converter

The transmission comprises the main casing which houses all of the transmission components. The main case also incorporates an integral bell housing.

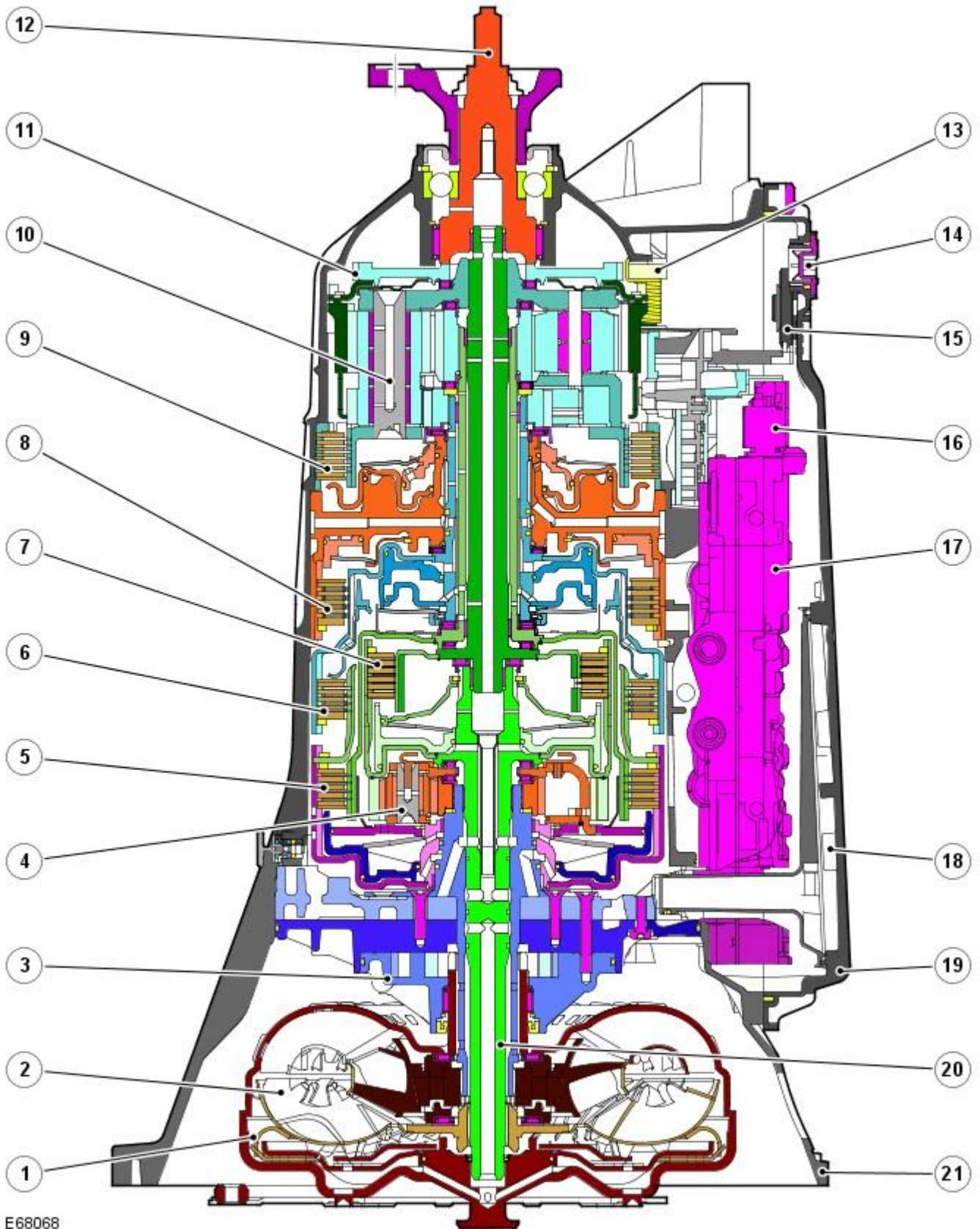
A fluid pan is attached to the lower face of the main case and is secured with bolts. The fluid pan is sealed to the main case with a gasket. Removal of the fluid pan allows access to the Mechatronic valve block. The fluid pan has a magnet located around the drain plug which collects any metallic particles present in the transmission fluid.

A fluid filter is located inside the fluid pan. If the transmission fluid becomes contaminated or after any service work, the fluid pan with integral filter must be replaced.

The integral bell housing provides protection for the torque converter assembly and also provides the attachment for the gearbox to the engine cylinder block. The torque converter is a non-serviceable assembly which also contains the lock-up clutch mechanism. The torque converter drives a crescent type pump via drive tangs. The fluid pump is located in the main case, behind the torque converter.

The main case contains the following major components:

- Input shaft
- Output shaft
- Mechatronic valve block which contains the solenoids, speed sensors and the [TCM](#)
- 3 rotating multiplate drive clutches
- 2 fixed multiplate brake clutches
- A single planetary gear train and a double planetary gear train.



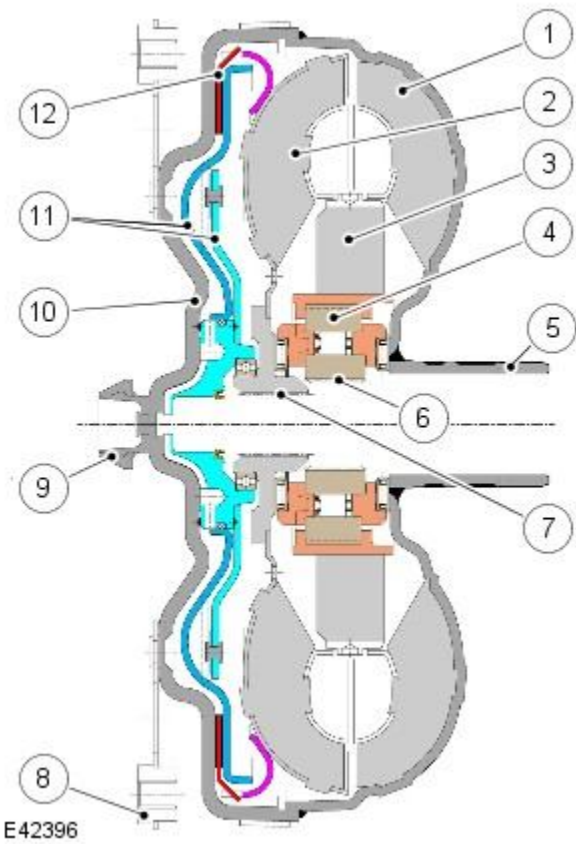
E68068

**ItemDescription**

1	Torque converter lock-up clutch
2	Torque converter
3	Fluid pump
4	Single planetary gearset
5	Clutch A
6	Clutch B
7	Clutch E
8	Brake C

9	Brake D
10	Double planetary gearset
11	Park lock gear
12	Output shaft
13	Park lock pawl
14	Drain plug
15	Magnet
16	Pressure regulator
17	Mechatronic valve block
18	Fluid filter
19	Fluid filter
20	Input shaft
21	Bell housing

**TORQUE CONVERTER**



Item	Description
1	Impeller
2	Turbine
3	Stator
4	Freewheel clutch
5	Torque converter hub
6	Stator shaft
7	Turbine shaft
8	Drive plate
9	Journal - Drive plate/crankshaft location
10	Torque converter cover
11	Lock-up clutch piston
12	Lock-up clutch plate

The torque converter is the coupling element between the engine and the transmission and is located in the bell housing, on the engine side of the transmission. The driven power from the engine crankshaft is transmitted hydraulically and mechanically through the torque converter to the transmission. The torque converter is connected to the engine by a drive plate.

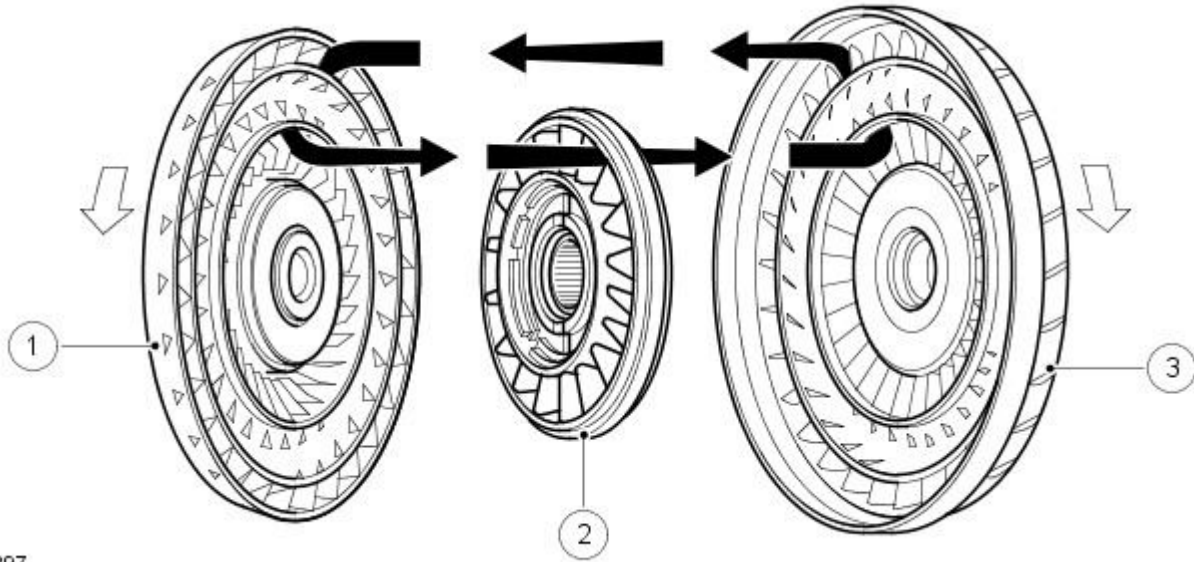
The torque converter comprises an impeller, a stator and a turbine. The torque converter is a sealed unit with all

components located between the converter housing cover and the impeller. The two components are welded together to form a sealed, fluid filled housing. With the impeller welded to the converter housing cover, the impeller is therefore driven at engine crankshaft speed.

The converter housing cover has 4 threaded bosses which provide for attachment of the engine drive plate which is connected to the engine crankshaft. The threaded bosses also provide for location of special tools which are required to remove the torque converter from the bell housing.

**Impeller**

Fluid Flow



E42397

**ItemDescription**

1	Turbine
2	Stator
3	Impeller

When the engine is running the rotating impeller acts as a centrifugal pump, picking up fluid at its center and discharging it at high velocity through the blades on its outer rim. The design and shape of the blades and the curve of the impeller body cause the fluid to rotate in a clockwise direction as it leaves the impeller. This rotation improves the efficiency of the fluid as it contacts the outer row of blades on the turbine.

The centrifugal force of the fluid leaving the blades of the impeller is passed to the curved inner surface of the turbine via the tip of the blades. The velocity and clockwise rotation of the fluid causes the turbine to rotate.

**Turbine**

The turbine is similar in design to the impeller with a continuous row of blades. Fluid from the impeller enters the turbine through the tip of the blades and is directed around the curved body of the turbine to the root of the blades. The curved surface redirects the fluid back in the opposite direction to which it entered the turbine, effectively increasing the turning force applied to the turbine from the impeller. This principle is known as torque multiplication.

When engine speed increases, turbine speed also increases. The fluid leaving the inner row of the turbine blades is rotated in a counter-clockwise direction due to the curve of the turbine and the shape of the blades. The fluid is now flowing in the opposite direction to the engine rotation and therefore the impeller. If the fluid was allowed to hit the impeller in this condition, it would have the effect of applying a brake to the impeller, eliminating the torque multiplication effect. To prevent this, the stator is located between the impeller and the turbine.

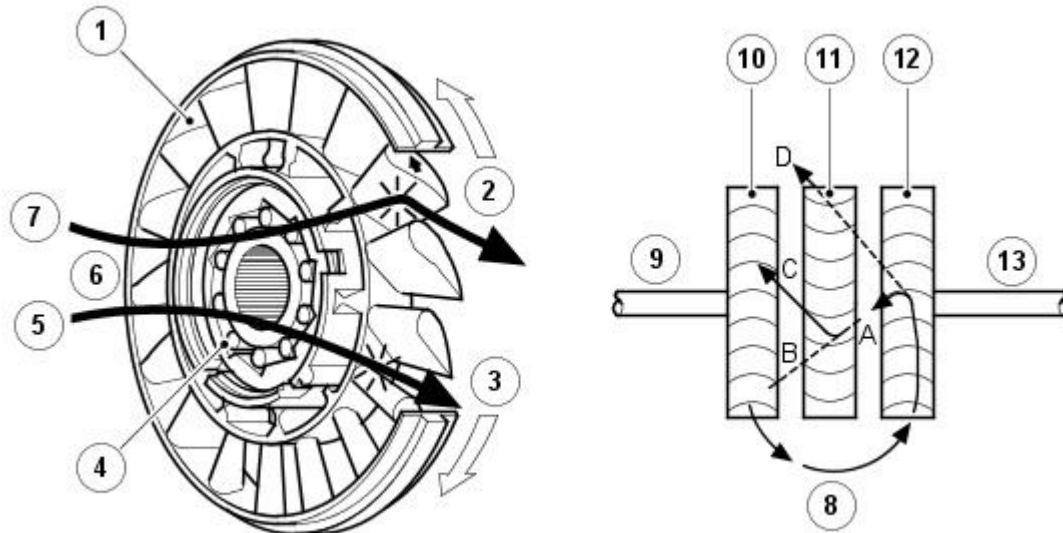
**Stator**

The stator is located on the splined transmission input shaft via a freewheel clutch. The stator comprises a number of blades which are aligned in an opposite direction to those of the impeller and turbine. The main function of the stator is to redirect the returning fluid from the turbine, changing its direction to that of the impeller.

The redirected fluid from the stator is directed at the inner row of blades of the impeller, assisting the engine in turning the impeller. This sequence increases the force of the fluid emitted from the impeller and thereby increases the torque multiplication effect of the torque converter.

• NOTE: The following illustration shows a typical stator

Stator Functions



E 42398

**ItemDescription**

1	Blades
2	Stator held – fluid flow redirected
3	Stator rotates freely
4	Roller
5	Converter at coupling speed
6	Fluid flow from turbine
7	Converter multiplying
8	Fluid flow from impeller
9	Drive from engine
10	Impeller
11	Stator
12	Turbine
13	Output to transmission

Refer to the 'Stator Functions' illustration

Fluid emitted from the impeller acts on the turbine. If the turbine is rotating at a slower speed than the fluid from the impeller, the fluid will be deflected by the turbine blades in the path 'A'. The fluid is directed at and deflected by the stator blades from path 'B' to path 'C'. This ensures that the fluid is directed back to the pump in the optimum direction. In this condition the sprag clutch is engaged and the force of the fluid on the stator blades assists the engine in rotating the impeller.

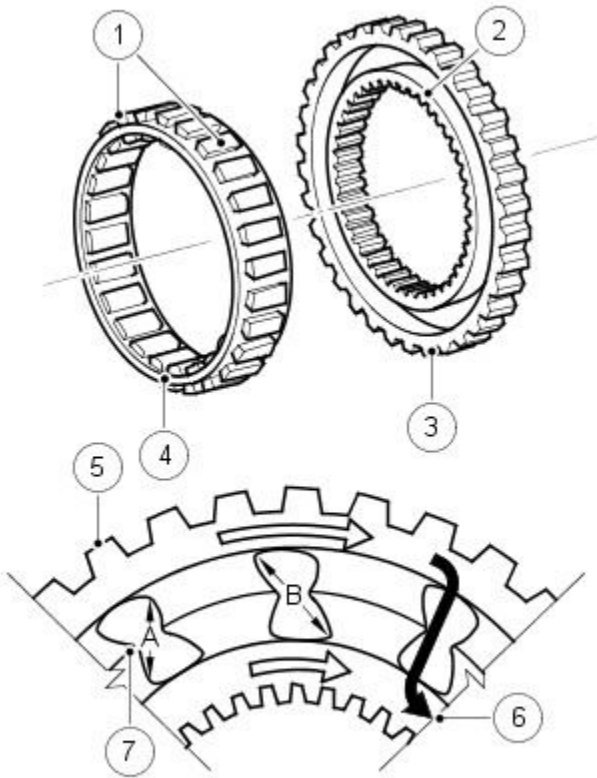
As the rotational speed of the engine and therefore the turbine increases, the direction of the fluid leaving the turbine changes to path 'D'. The fluid is now directed from the turbine to the opposite side of the stator blades, rotating the stator in the opposite direction. To prevent the stator from resisting the smooth flow of the fluid from the turbine, the sprag clutch releases, allowing the stator to rotate freely on its shaft.

When the stator becomes inactive, the torque converter no longer multiplies the engine torque. When the torque converter reaches this operational condition it ceases to multiply the engine torque and acts solely as a fluid coupling, with the impeller and the turbine rotating at approximately the same speed.

The stator uses a sprag type, one way, freewheel clutch. When the stator is rotated in a clockwise direction the sprags twist and are wedged between the inner and outer races. In this condition the sprags transfer the rotation of the outer race to the inner race which rotates at the same speed.

**One Way Free Wheel Clutch – Typical**





E 42712

#### ItemDescription

1	Sprags
2	Inner race
3	Outer race
4	Sprag and cage assembly
5	Sprag outer race
6	Sprag inner race
7	Retaining ring

The free wheel clutch can perform three functions; hold the stator stationary, drive the stator and free wheel allowing the stator to rotate without a drive output. The free wheel clutch used in the 6HP26 transmission is of the sprag type and comprises an inner and outer race and a sprag and cage assembly. The inner and outer races are pressed into their related components with which they rotate. The sprag and cage assembly is located between the inner and outer races.

The sprags are located in a cage which is a spring which holds the sprags in the 'wedge' direction and maintains them in contact with the inner and outer races.

Referring to the illustration, the sprags are designed so that the dimension 'B' is larger than the distance between the inner and outer race bearing surfaces. When the outer race rotates in a clockwise direction, the sprags twist and the edges across the dimension 'B' wedge between the races, providing a positive drive through each sprag to the inner race. The dimension 'A' is smaller than the distance between the inner and outer race bearing surfaces. When the outer race rotates in an anti-clockwise direction, the dimension 'A' is too small to allow the sprags to wedge between the races, allowing the outer race to rotate freely.

On the illustration shown, when the outer race is rotated in a clockwise direction, the sprags twist and are 'wedged' between the inner and outer races. The sprags then transfer the rotation of the outer race to the inner race, which rotates at the same speed.

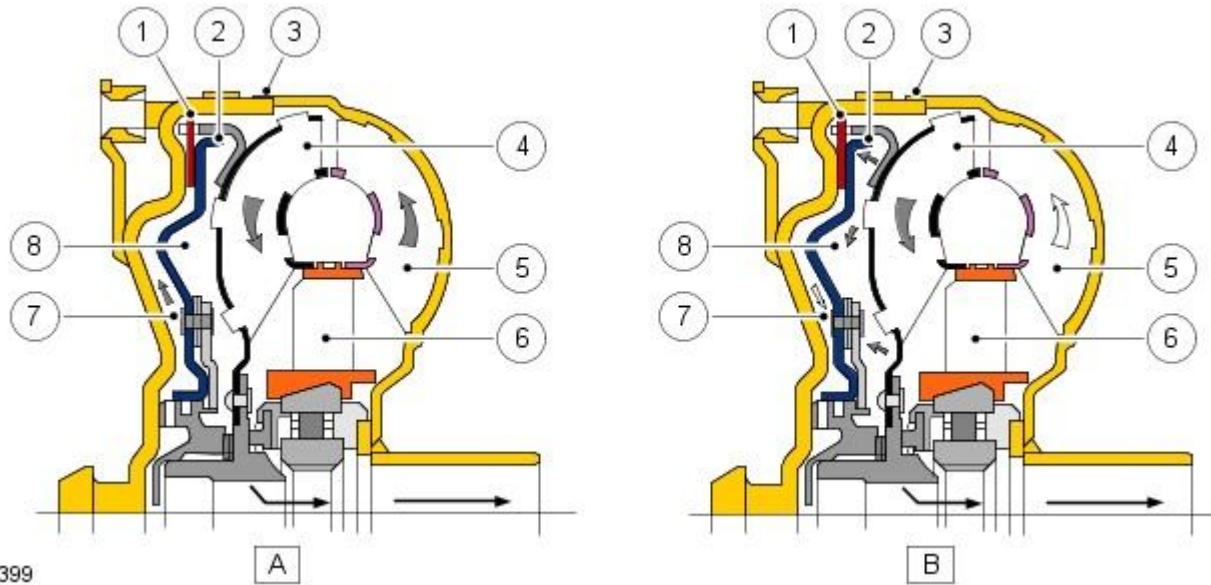
#### Lock-Up Clutch Mechanism

The Torque Converter Clutch (TCC) is hydraulically controlled by an electronic pressure regulating solenoid (EPRS6) which is controlled by the [TCM](#). This allows the torque converter to have 3 states of operation as follows:

- Fully engaged
- Controlled slip variable engagement
- Fully disengaged.

The TCC is controlled by two hydraulic spool valves located in the valve block. These valves are actuated by pilot pressure supplied via a solenoid valve which is also located in the valve block. The solenoid valve is operated by PWM (pulse width modulation) signals from the [TCM](#) to give full, partial or no lock-up of the torque converter.





E 42399

#### ItemDescription

A	Unlocked condition
B	Locked condition
1	Clutch plate
2	Clutch piston
3	Torque converter body
4	Turbine
5	Impeller
6	Stator
7	Piston chamber
8	Turbine chamber

The lock-up clutch is a hydro-mechanical device which eliminates torque converter slip, improving fuel consumption. The engagement and disengagement is controlled by the [TCM](#) to allow a certain amount of controlled 'slip'. This allows a small difference in the rotational speeds of the impeller and the turbine which results in improved shift quality. The lock-up clutch comprises a piston and a clutch friction plate.

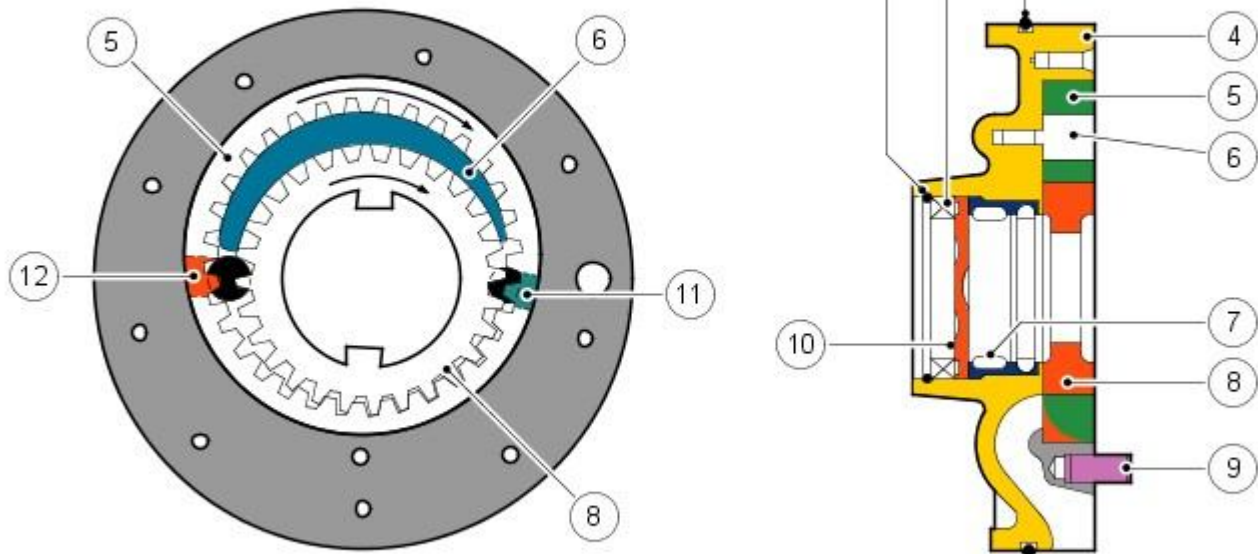
In the unlocked condition, the oil pressure supplied to the piston chamber and the turbine chamber is equal. Pressurized fluid flows through a drilling in the turbine shaft and through the piston chamber to the turbine chamber. In this condition the clutch plate is held away from the torque converter body and torque converter slip is permitted.

In the locked condition, the TCC spool valves are actuated by the electronic pressure regulating solenoid (EPRS6). The fluid flow in the unlocked condition is reversed and the piston chamber is vented. Pressurized fluid is directed into the turbine chamber and is applied to the clutch piston. The piston moves with the pressure and pushes the clutch plate against the torque converter body. As the pressure increases, the friction between the clutch plate and the body increases, finally resulting in full lock-up of the clutch plate with the body. In this condition there is direct mechanical drive from the engine crankshaft to the transmission planetary gear train.

#### FLUID PUMP

The fluid pump is an integral part of the transmission. The fluid pump is used to supply hydraulic pressure for the operation of the control valves and clutches, to pass the fluid through the transmission cooler and to lubricate the gears and shafts.

The 6HP26 fluid pump is a crescent type pump and is located between the intermediate plate and the torque converter. The pump has a delivery rate of 16 cm<sup>3</sup> per revolution.



E42400

**ItemDescription**

1	Securing ring
2	Shaft oil seal
3	O-ring seal
4	Pump housing
5	Ring gear
6	Crescent spacer
7	Roller bearing
8	Impeller
9	Centring pin
10	Spring washer
11	Outlet port (high pressure)
12	Inlet port (low pressure)

The pump comprises a housing, a crescent spacer, an impeller and a ring gear. The housing has inlet and outlet ports to direct flow and is located in the intermediate plate by a centring pin. The pump action is achieved by the impeller, ring gear and crescent spacer.

The crescent spacer is fixed in its position by a pin and is located between the ring gear and the impeller. The impeller is driven by drive from the torque converter hub which is located on a needle roller bearing in the pump housing. The impeller teeth mesh with those of the ring gear. When the impeller is rotated, the motion is transferred to the ring gear which rotates in the same direction.

The rotational motion of the ring gear and the impeller collects fluid from the intake port in the spaces between the teeth. When the teeth reach the crescent spacer, the oil is trapped in the spaces between the teeth and is carried with the rotation of the gears. The spacer tapers near the outlet port. This reduces the space between the gear teeth causing a build up of fluid pressure as the oil reaches the outlet port. When the teeth pass the end of the spacer the pressurized fluid is released into the outlet port.

The fluid emerging from the outlet port is passed through the fluid pressure control valve. At high operating speeds the pressure control valve maintains the output pressure to the gearbox at a predetermined maximum level. Excess fluid is relieved from the pressure control valve and is directed, via the main pressure valve in the valve block, back to the pump inlet port. This provides a pressurized feed to the pump inlet which prevents cavitation and reduces pump noise.

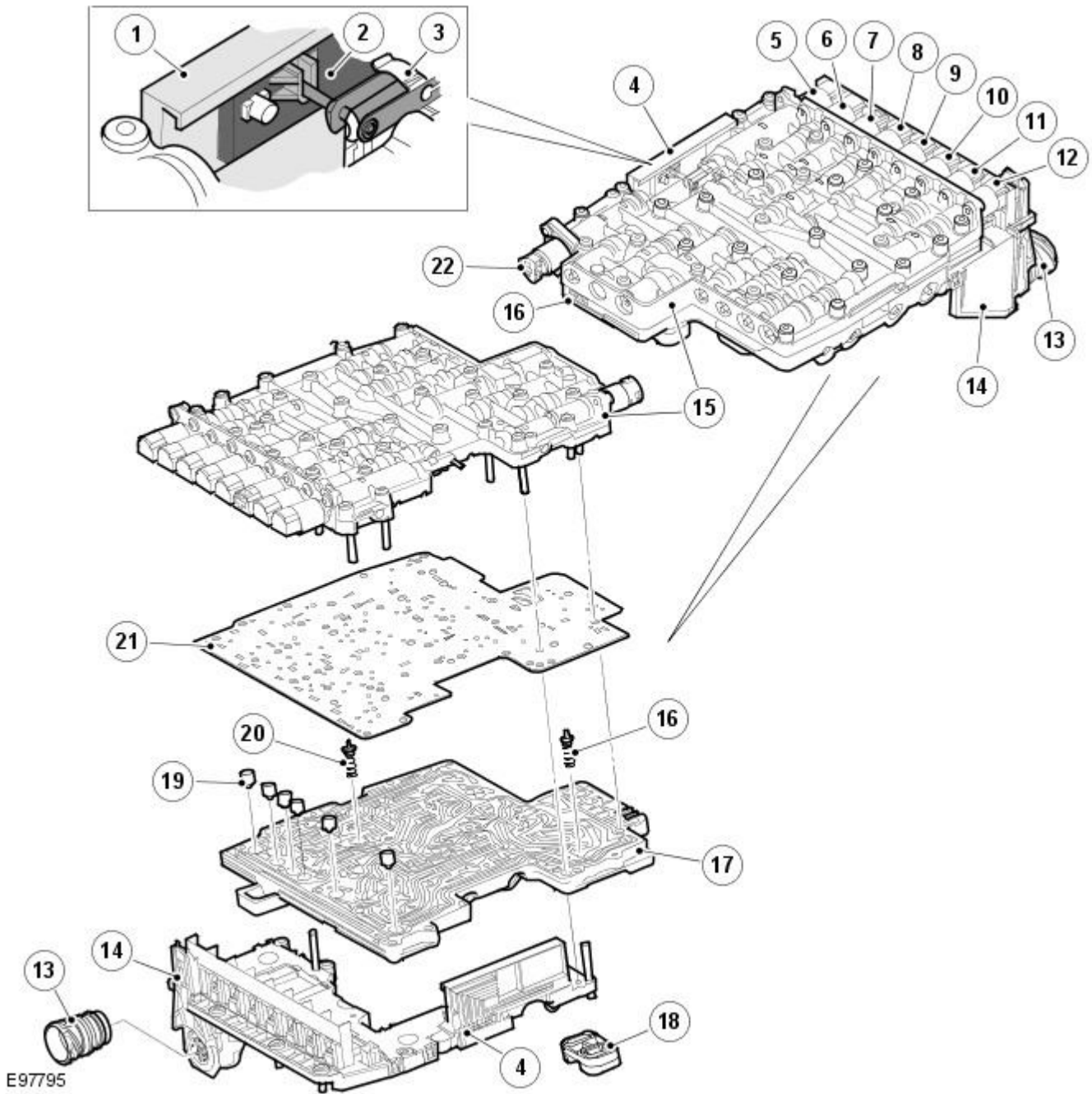
**MECHATRONIC VALVE BLOCK**

The Mechatronic valve block is located in the bottom of the transmission and is covered by the fluid pan. The valve block houses the TCM, electrical actuators, speed sensors and control valves which provide all electro-hydraulic control for all transmission functions. The Mechatronic valve block comprises the following components:

- TCM
- 6 pressure regulator solenoids

- 1 shift control solenoid
- 1 damper
- 21 hydraulic spool valves
- Manually operated selector valve
- Temperature sensor
- Turbine speed sensor
- Output shaft speed sensor.

ZF 6HP26 Automatic Transmission – Mechatronic Valve Block

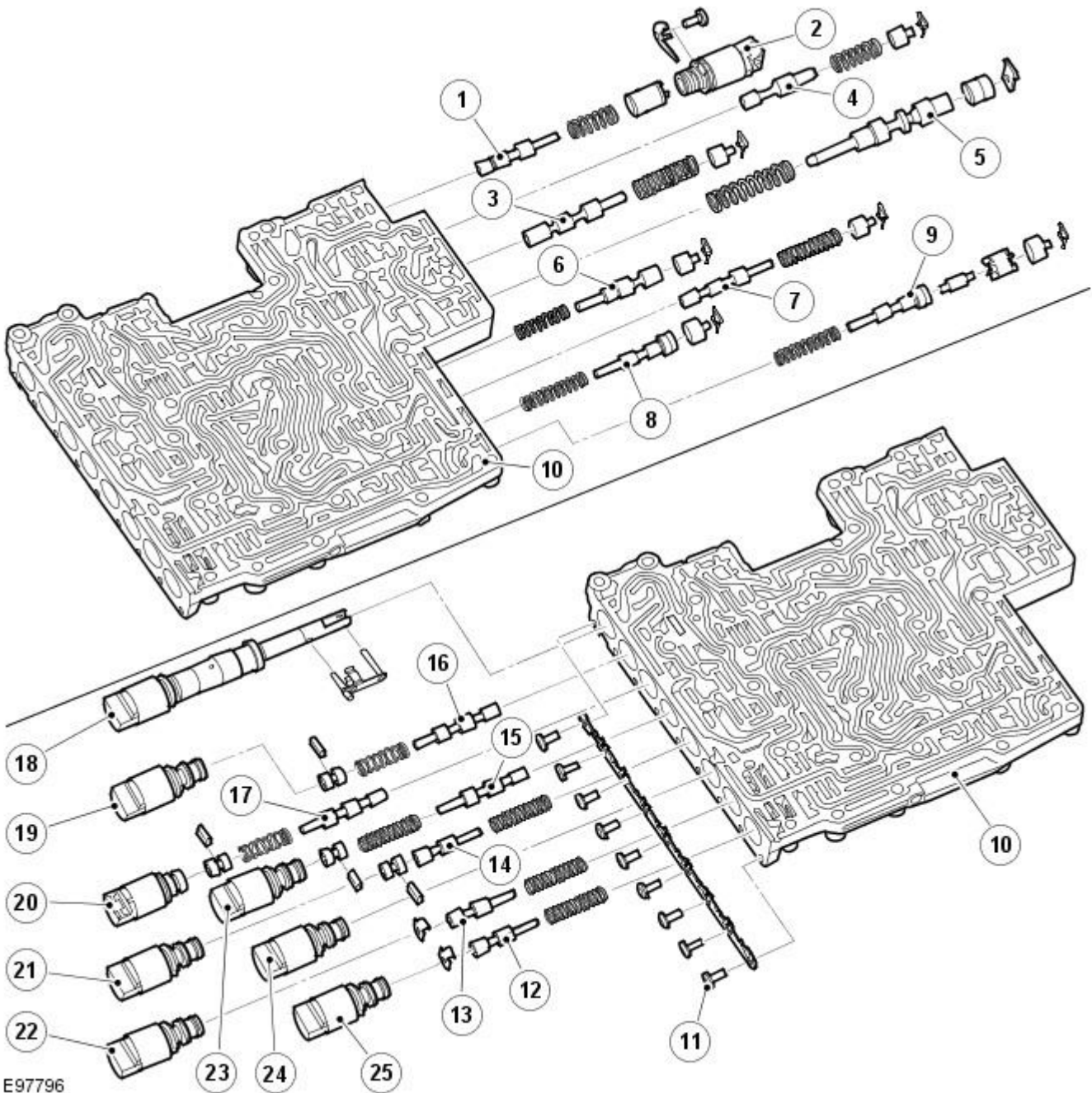


**ItemDescription**

1	Position switch
2	Sliding block
3	Park lock cylinder
4	Position switch assembly
5	Solenoid valve 2
6	Electronic Pressure Regulator Solenoid (EPRS) 6
7	Solenoid valve 1
8	EPRS 4
9	EPRS 5
10	EPRS 3
11	EPRS 2

12	EPRS 1
13	Electrical connector
14	<a href="#">TCM</a>
15	Valve housing
16	Valve plate
17	Torque converter retaining valve
18	Element seal
19	Pressure regulator dampers
20	Clutch return valve
21	Intermediate plate
22	Solenoid valve 3 (park lock)

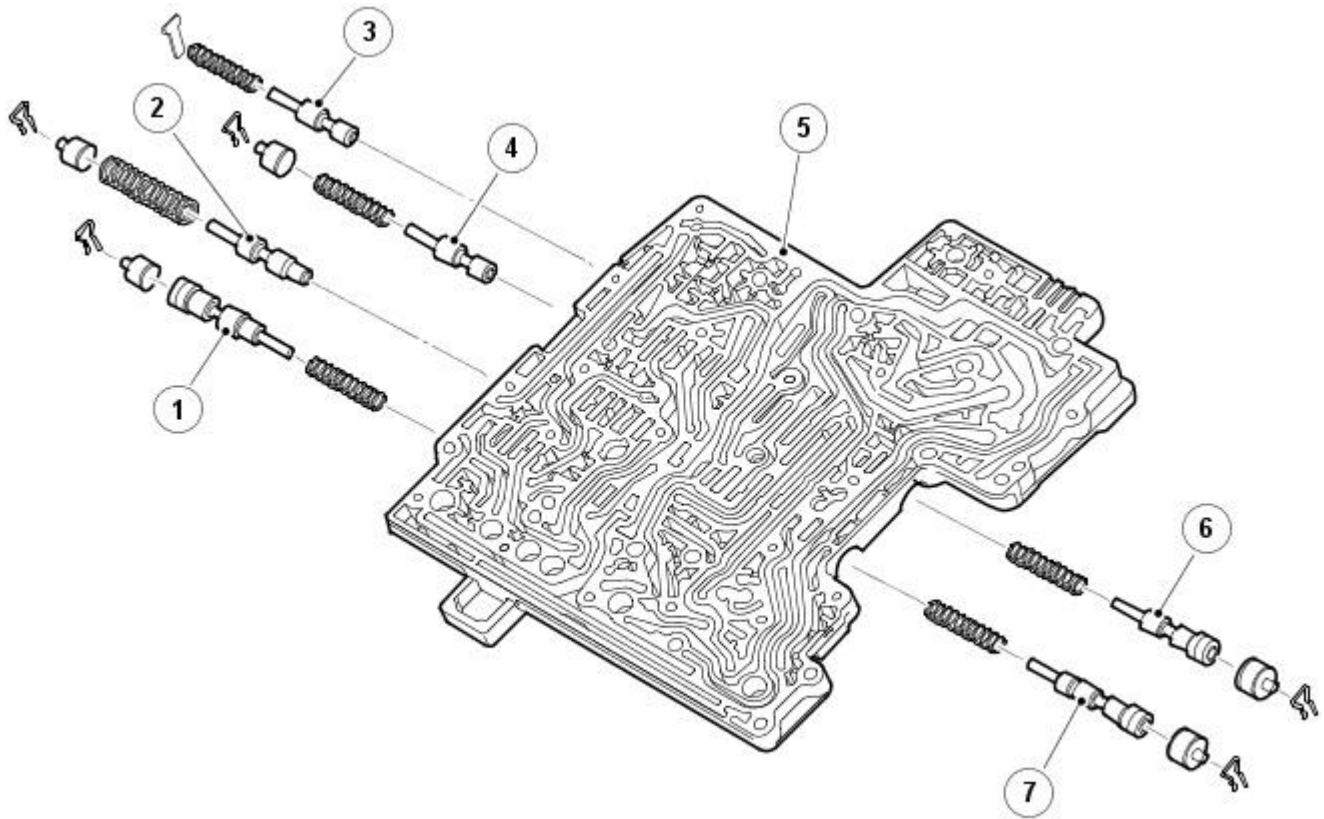
ZF 6HP26 Automatic Transmission – Valve Housing Components



Item	Description
1	Park lock valve
2	Solenoid valve 2
3	Torque converter pressure valve
4	Lubricating valve
5	System pressure valve
6	Torque converter lock-up clutch valve

7	Retaining valve – Clutch E
8	Clutch valve E
9	Clutch valve A
10	Valve housing
11	Bolts
12	Retaining valve – Clutch A
13	Retaining valve – Clutch B
14	Pressure reducing valve
15	Retaining valve – Brake D
16	Shift valve 2
17	Shift valve 1
18	Solenoid valve 3 (park lock)
19	Electronic Pressure Regulator Solenoid (EPRS) 6
20	Solenoid valve 1
21	EPRS 5
22	EPRS 2
23	EPRS 4
24	EPRS 3
25	EPRS 1

ZF 6HP26 Automatic Transmission – Valve Plate Components



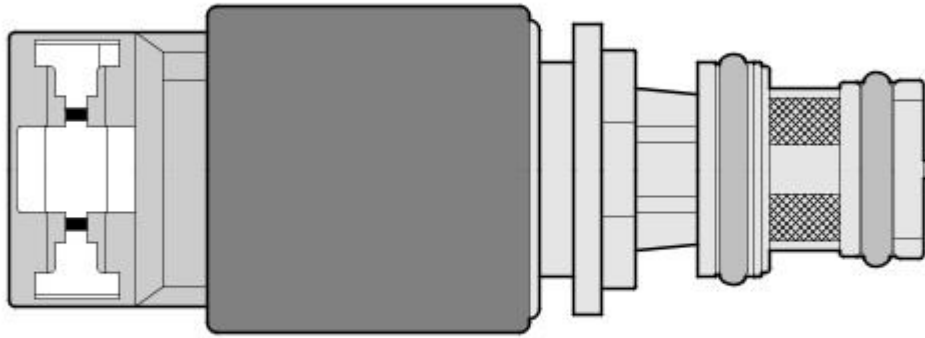
E97797

**ItemDescription**

1	Clutch valve B
2	Clutch valve – Brake D2
3	Position valve D
4	Retaining valve – Brake D2
5	Valve plate
6	Clutch valve – Brake D1
7	Clutch valve – Brake C

Electronic Pressure Regulator Solenoids (EPRS)





### E42713

Six Electronic Pressure Regulator Solenoids (EPRS) are located in the valve block. The solenoids are controlled by [PWM](#) signals from the [TCM](#). The solenoids convert the electrical signals into hydraulic control pressure proportional to the signal to actuate the spool valves for precise transmission operation.

The following table shows the EPRS and their associated functions:

EPRS	Function
1	Clutch A
2	Clutch B
3	Clutch C
4	Brake clutches D and E
5	System pressure control
6	Torque converter lock-up control

Solenoids EPRS 1, 3 and 6 supply a lower control pressure as the signal amperage increases and can be identified by a black connector cap. The [TCM](#) operates the solenoids using [PWM](#) signals. The [TCM](#) monitors engine load and clutch slip and varies the solenoid duty cycle accordingly. The solenoids have a 12 V operating voltage and a pressure range of 0 - 4.6 bar (0 - 67 lbf.in<sup>2</sup>).

Solenoids EPRS 2, 4 and 5 supply a higher control pressure as the signal amperage increases and can be identified by a green connector cap. The solenoids are normally open, regulating flow solenoid valves. The [TCM](#) operates the solenoids using a [PWM](#) ground proportional to the required increasing or decreasing clutch pressures. The solenoids have a 12 V operating voltage and a pressure range of 4.6 - 0 bar (67 - 0 lbf.in<sup>2</sup>).

The resistance of the coil winding for the EPRS solenoids is 5.05 ohms at 20°C (68°F).

### Solenoid Valves



### E42714

Solenoid Valves (SV) are located in the valve block. The solenoids are controlled by the [TCM](#) and converts electrical signals into hydraulic control signals to control clutch application and park lock cylinder operation.

The control solenoids are open/closed, on/off solenoids which are controlled by the [TCM](#) switching the solenoid to earth. The [TCM](#) also supplies power to the solenoids. The [TCM](#) energises the solenoids in a programmed sequence for clutch application for gear ratio changes, shift control and park lock application.

The resistance of the solenoid coil winding within the solenoid is between 26 to 30.4 ohms at 20°C (68°F).

## SENSORS

### Speed Sensors



The turbine speed sensor and the output shaft speed sensor are Hall effect type sensors located in the Mechatronic valve block and are not serviceable items. The [TCM](#) monitors the signals from each sensor to determine the input (turbine) speed and the output shaft speed.

The turbine speed is monitored by the [TCM](#) to calculate the slip of the torque converter clutch and internal clutch slip. This signal allows the [TCM](#) to accurately control the slip timing during shifts and adjust clutch application or release pressure for overlap shift control.

The output shaft speed is monitored by the [TCM](#) and compared to engine speed signals received on the [CAN](#) bus from the [ECM](#). Using a comparison of the two signals the [TCM](#) calculates the transmission slip ratio for plausibility and maintains adaptive pressure control.

### Temperature Sensor

The temperature sensor is also located in the Mechatronic valve block. The [TCM](#) uses the temperature sensor signals to determine the temperature of the transmission fluid. These signals are used by the [TCM](#) to control the transmission operation to promote faster warm-up in cold conditions or to assist with fluid cooling by controlling the transmission operation when high fluid temperatures are experienced. If the sensor fails, the [TCM](#) will use a default value and a fault code will be stored in the [TCM](#).

### DAMPER

There is one damper located in the valve housing. The damper is used to regulate and dampen the regulated pressure supplied via EPRS 5. The damper is load dependent through modulation of the damper against return spring pressure.

The damper comprises a piston, a housing bore and a spring. The piston is subject to the pressure applied by the spring. The bore has a connecting port to the function to which it applies. Fluid pressure applied to the applicable component (i.e. a clutch) is also subjected to the full area of the piston, which moves against the opposing force applied by the spring. The movement of the piston creates an action similar to a shock absorber, momentarily delaying the build up of pressure in the circuit. This results in a more gradual application of clutches improving shift quality.

### SPOOL VALVES

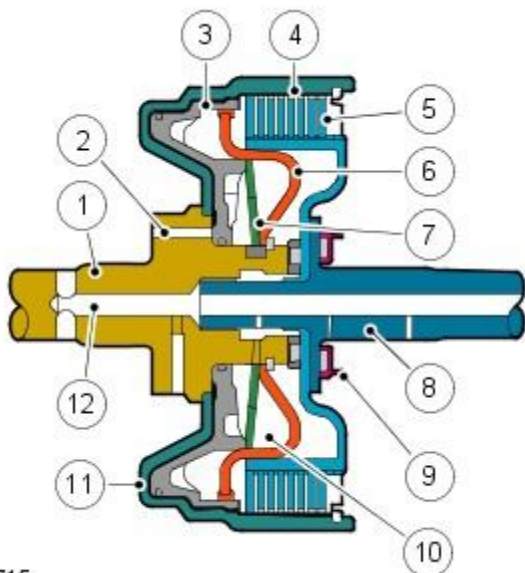
The valve block contains 21 spool valves which control various functions of the transmission. The spool valves are of conventional design and are operated by fluid pressure.

Each spool valve is located in its spool bore and held in a default (unpressurized) position by a spring. The spool bore has a number of ports which allow fluid to flow to other valves and clutches to enable transmission operation. Each spool has a piston which is waisted to allow fluid to be diverted into the applicable ports when the valve is operated.

When fluid pressure moves a spool, one or more ports in the spool bore are covered or uncovered. Fluid is prevented from flowing or is allowed to flow around the applicable waisted area of the spool and into another uncovered port. The fluid is either passed through galleries to actuate another spool, operate a clutch or is returned to the fluid pan.

### DRIVE CLUTCHES

Multiplate Drive or Brake Clutch – Typical



E42715

Item	Description
1	Input shaft
2	Main pressure supply port
3	Piston
4	Cylinder – External plate carrier
5	Clutch plate assembly
6	Baffle plate

7	Diaphragm spring
8	Output shaft
9	Bearing
10	Dynamic pressure equalisation chamber
11	Piston chamber
12	Lubrication channel

There are 3 drive clutches and 2 brake clutches used in the 6HP26 transmission. Each clutch comprises one or more friction plates dependent on the output controlled. A typical clutch consists of a number of steel outer plates and inner plates with friction material bonded to each face.

On supercharged models, the uprated transmission includes additional clutch plates to enable the transmission to manage the additional power output of the supercharged engine.

The clutch plates are held apart mechanically by a diaphragm spring and hydraulically by dynamic pressure. The pressure is derived from a lubrication channel which supplies fluid to the bearings etc. The fluid is passed via a drilling in the output shaft into the chamber between the baffle plate and the piston. To prevent inadvertent clutch application due to pressure build up produced by centrifugal force, the fluid in the dynamic pressure equalisation chamber overcomes any pressure in the piston chamber and holds the piston off the clutch plate assembly.

When clutch application is required, main pressure from the fluid pump is applied to the piston chamber from the supply port. This main pressure overcomes the low pressure fluid present in the dynamic pressure equalisation chamber. The piston moves, against the pressure applied by the diaphragm spring, and compresses the clutch plate assembly. When the main pressure falls, the diaphragm spring pushes the piston away from the clutch plate assembly, disengaging the clutch.

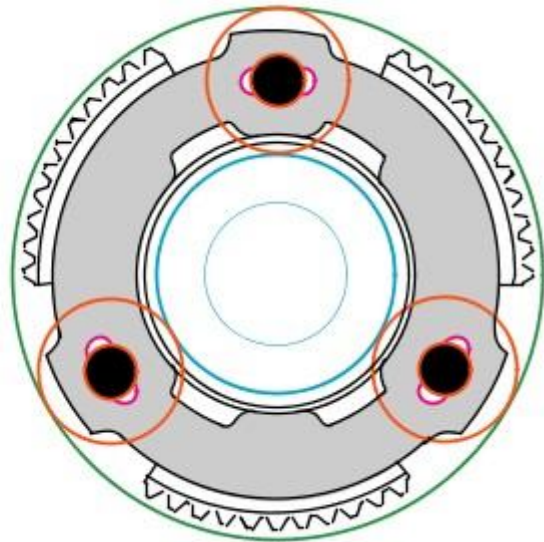
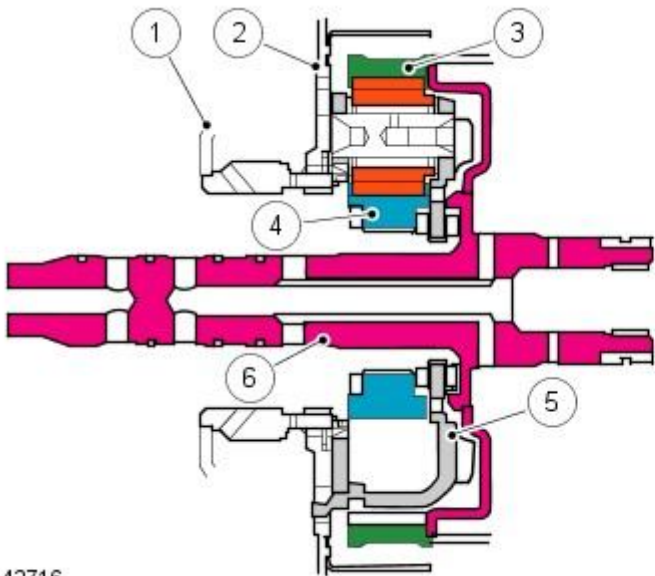
**PLANETARY GEAR TRAINS**

The planetary gear trains used on the 6HP26 transmission comprise a single web planetary gear train and a double web planetary gear train. These gear trains are known as Lepelletier type gear trains and together produce the 6 forward gears and the 1 reverse gear.

**Single Web Planetary Gear Train**

The single web planetary gear train comprises:

- 1 sunwheel
- 3 planetary gears
- 1 planetary gear carrier (spider)
- 1 ring gear or annulus

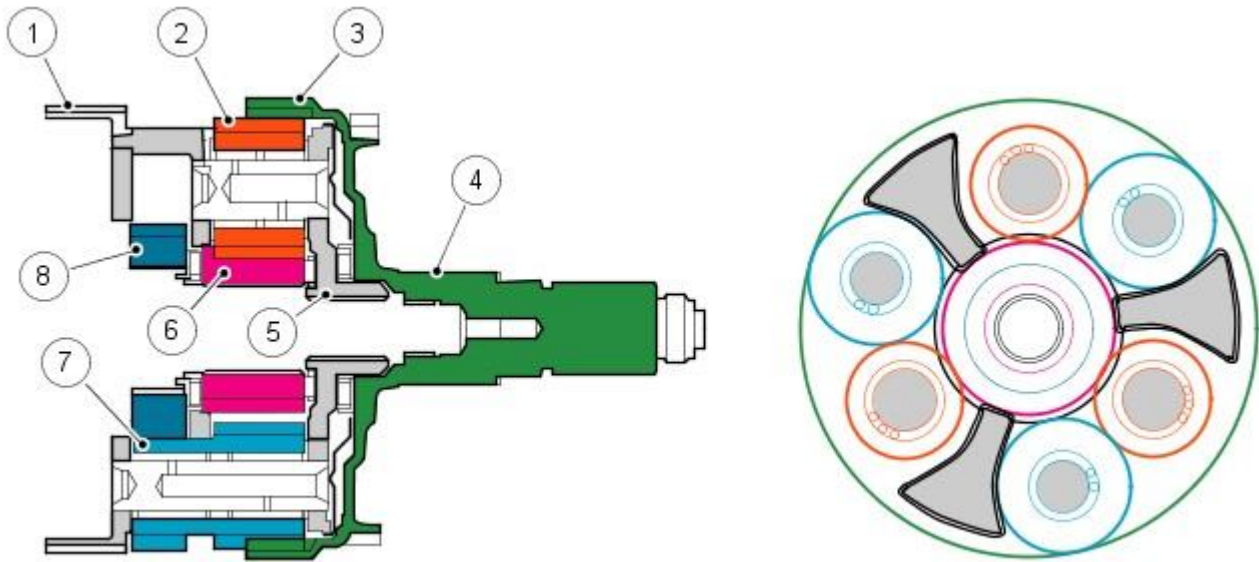


E42716

**ItemDescription**

1	Cylinder
2	Baffle plate
3	Ring gear
4	Sun gear
5	Planetary gear spider
6	Torque converter input shaft

**Torque converter input shaft**



E42717

**ItemDescription**

1	Planetary gear spider
2	Planetary gears (short)
3	Ring gear
4	Output shaft
5	Planetary gear carrier
6	Sunwheel
7	Double planetary gears (long)
8	Sunwheel

The double planetary gear train comprises:

- 2 sunwheels
- 3 short planetary gears
- 3 long planetary gears
- 1 planetary gear carrier
- 1 ring gear or annulus

**ELECTRONIC PARK LOCK**

The park lock is electronically actuated by solenoid valve located in the valve block. The park lock is engaged by a mechanical spring system comprising a parking disc and a lock cylinder controlled by a solenoid valve.

The park lock is engaged when the [TCM](#) receives a park request from the JaguarDrive selector. When the park lock is released, a solenoid valve in the valve housing directs hydraulic pressure to the lock cylinder, which moves the piston within the cylinder and releases the park lock pawl at the rear of the transmission by means of a connecting rod. The solenoid on the lock cylinder is energized and locks the cylinder piston in the unlocked position. Additional locking of the piston is achieved with ball catches within the lock cylinder.

When park is selected, the solenoid on the lock cylinder is de-energized, the ball catches are released and the piston is free to move in the lock cylinder. The solenoid in the valve housing is also de-energized. The spring loaded parking disc pulls the cylinder piston in the park direction which allows the park disc to move on its mounting. This movement is transferred via the connecting rod to parking pawl, which is engaged in the park lock gear.

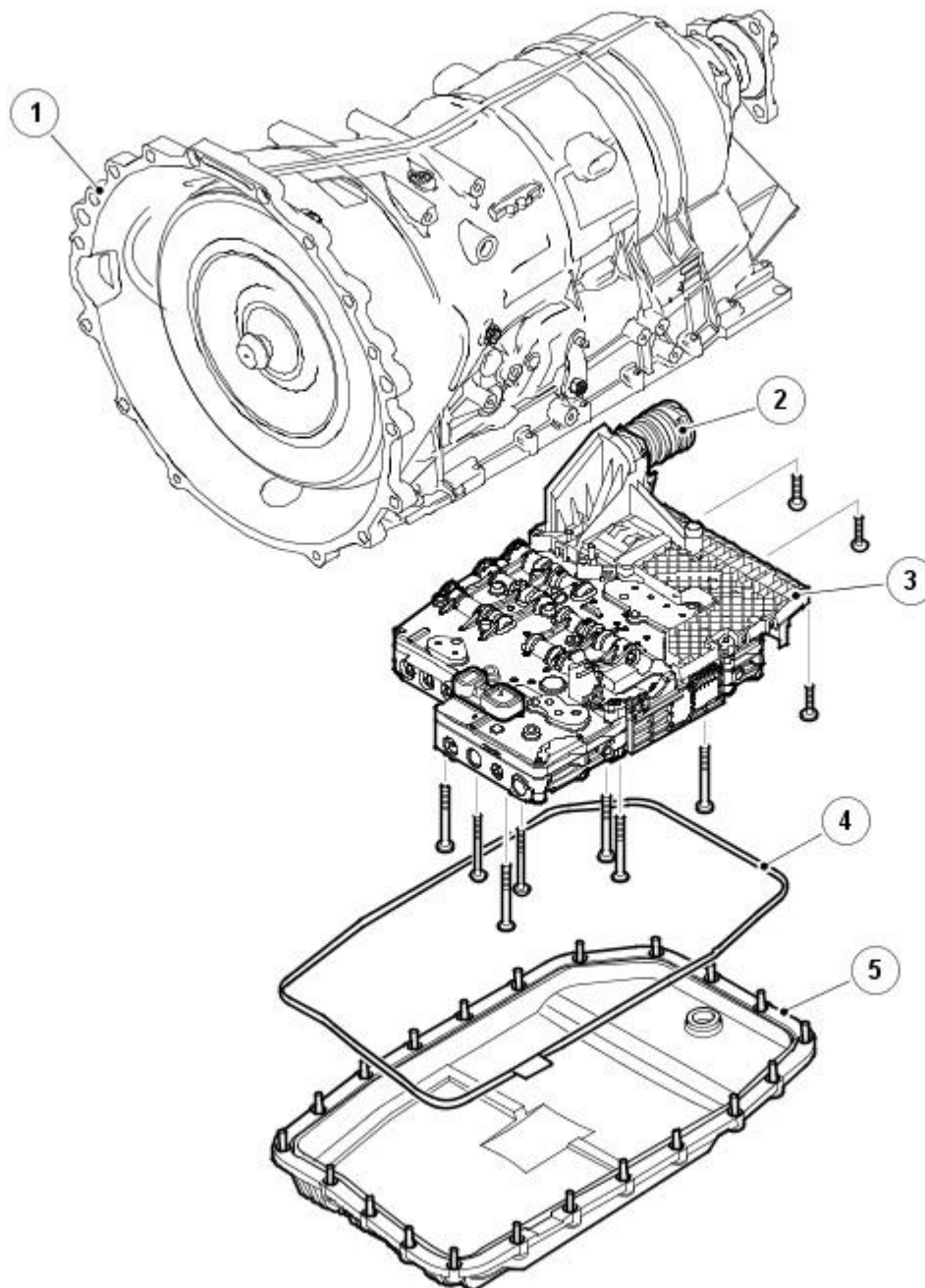
If an electrical failure occurs, the park lock can be manually released by means of an emergency park release lever located in the floor console. The lever is connected to the parking disc by a cable and allows the park lock to be released manually.

Refer to: [External Controls - Vehicles With: ZF 6HP26](#) (307-05 Automatic Transmission/Transaxle External Controls, Description and Operation).

# Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Transmission Electronic Control System Vehicles With: ZF 6HP26 - Component Location

Description and Operation

## COMPONENT LOCATION



E94415

### ItemDescription

1	Automatic Transmission
2	Electrical connector
3	<a href="#">TCM (transmission control module)</a>
4	Gasket
5	Fluid pan

# **Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Transmission Electronic Control System Vehicles With: ZF 6HP26 - Overview**

Description and Operation

## **OVERVIEW**

The [TCM \(transmission control module\)](#) is an integral part of the Mechatronic valve block which is located at the bottom of the transmission, within the fluid pan. The [TCM](#) is the main controlling component of the transmission.

The [TCM](#) processes signals from the transmission speed and temperature sensors, [ECM \(engine control module\)](#) and other vehicle systems. From the received signal inputs and pre-programmed data, the module calculates the correct gear, torque converter clutch setting and optimum pressure settings for gear shift and lock-up clutch control.

Unlike previous transmissions, this application has a fully electronic, JaguarDrive selector with no Bowden cable connection to the transmission. The transmission selections are made using a rotary JaguarDrive selector which rises from the floor console once the engine is running. Rotation of the JaguarDrive selector to any of the 5 positions is sensed by the [TCM](#) which reacts according to the selected position.

Another new feature is the electronic park lock which is controlled by the [TCM](#). A mechanical link is fitted for emergency park release in the event of an electrical failure.

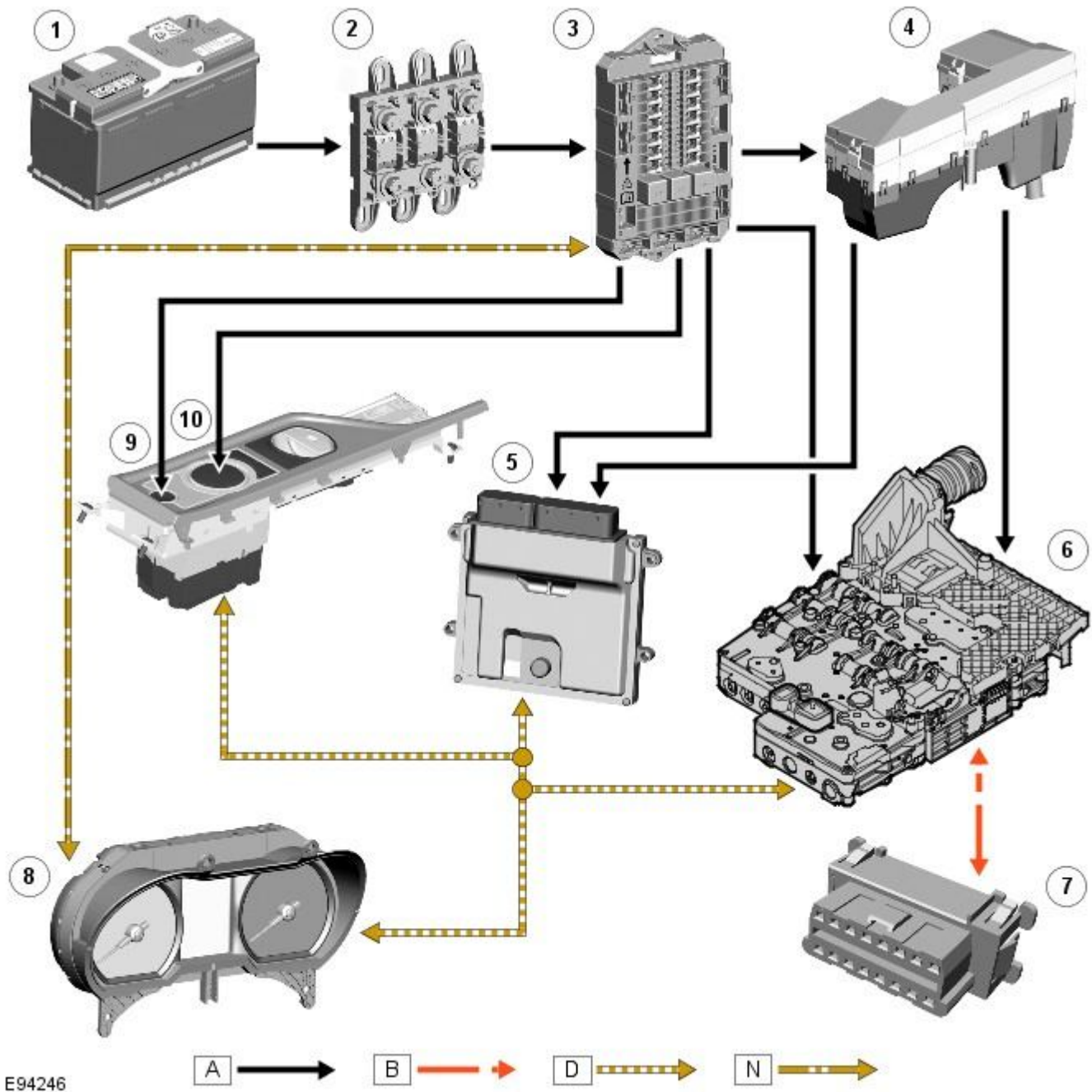


# Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Transmission Electronic Control System Vehicles With: ZF 6HP26 - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **B** = K bus; **D** = High speed CAN bus; **N** = Medium speed CAN bus



E94246

### ItemDescription

1	Battery
2	BJB (battery junction box)
3	CJB (central junction box)
4	EJB (engine junction box)
5	ECM (engine control module)
6	TCM (transmission control module)
7	Diagnostic socket
8	Instrument cluster
9	Engine start/stop switch



## System Operation

### TRANSMISSION CONTROL MODULE OPERATION

The [TCM](#) outputs signals to control the shift control solenoid valve and the Electronic Pressure Regulator Solenoids (EPRS) to control the hydraulic operation of the transmission.

The [TCM](#) processes signals from the transmission speed and temperature sensors, the [ECM](#) and other vehicle systems. From the received signal inputs and pre-programmed data, the module calculates the correct gear, torque converter clutch setting and optimum pressure settings for gear shift and lock-up clutch control.

The [ECM](#) supplies the engine management data over the high speed [CAN \(controller area network\)](#) bus. The [TCM](#) requires engine data to efficiently control the transmission operation, for example; flywheel torque, engine speed, accelerator pedal angle, engine temperature. The steering angle sensor and the [ABS \(anti-lock brake system\)](#) module also supply data to the [TCM](#) on the high speed [CAN](#) bus. The [TCM](#) uses data from these systems to suspend gear changes when the vehicle is cornering and/or the [ABS](#) module is controlling braking or traction control.

Using the signal inputs and the memorized data, the [TCM](#) control program computes the correct gear and torque converter lock-up clutch setting and the optimum pressure settings for gear shift and lock-up clutch control. Special output-side modules (power output stages, current regulator circuits), allow the [TCM](#) to control the solenoid valves and pressure regulators and consequently precisely control the hydraulics of the automatic transmission. In addition, the amount and duration of engine interventions are supplied to the engine management by way of the [CAN](#) bus.

The transmission has a fully electronic JaguarDrive selector with no Bowden cable connection to the transmission. The transmission selections are made using a rotary JaguarDrive selector which rises from the floor console once the engine is running. Rotation of the JaguarDrive selector to any of the 5 positions is sensed by the [TCM](#) via the high speed [CAN](#) bus. The [TCM](#) then reacts according to the selected position. The 'Sport' (S) position selection allows the [TCM](#) to operate the transmission using the semi-automatic 'Jaguar Sequential Shift'.

Gear selections are sensed by the [TCM](#) when the driver operates the steering wheel paddle switches. Once the JaguarDrive selector position is confirmed, the [TCM](#) outputs appropriate information on the high speed [CAN](#) bus.

If the JaguarDrive selector is in 'D', 'Jaguar Sequential Shift' is temporary and will cancel after a time period or can be cancelled by pressing and holding the + paddle for approximately 2 seconds.

If the JaguarDrive selector is in 'S', 'Jaguar Sequential Shift' is permanent and can only be cancelled by pressing and holding the + paddle for approximately 2 seconds or by moving the JaguarDrive selector to the 'D' position.

The [TCM](#) can be reprogrammed using an approved Jaguar diagnostic system using a flash code. The [TCM](#)'s processor has a 440 Kb internal flash memory. Of this capacity, approximately 370 Kb are used by the basic transmission program. The remainder, approximately 70 Kb is used to store vehicle-specific application data.

#### Engine Stall

If the vehicle stalls it will coast down in gear, with the transmission providing drive to the engine. A restart can be attempted at this point and the engine may start and the driver can continue.

If the coast down speed reduces such that the speed of the engine is less than 600rpm, the transmission will go to neutral, D illumination will flash in the instrument cluster. The driver needs to select neutral or park and then press the brake pedal to restart the engine.

If the driver presses the start/stop button when driving, there will be no change to the ignition state, the driver will receive a message in the instrument cluster "Start button Pressed". If the driver requires to switch off the engine, the start/stop button must be pressed for a second time. The engine will be stopped and will be back driven by the transmission as the vehicle coasts down. When the engine speed is less than 600 rpm the transmission engages neutral (flashing D illumination in the instrument cluster). When vehicle speed is less than 2 km/h (1.2 mph) Park is engaged. The JaguarDrive selector automatically rotates back to its lowered P position and the vehicle ignition is switched off.

The park engagement is prevented in a stall case as the ignition power is on and D was the last selected gear. The park engagement speed at ignition off is from the least value of the wheel speeds ([CAN](#) signal) and transmission output speed (internal signal).

## Component Description

### TRANSMISSION CONTROL MODULE DESCRIPTION

The [TCM](#) is an integral part of the Mechatronic valve block which is located at the bottom of the transmission, within the fluid pan. The [TCM](#) is the main controlling component of the transmission.

The Mechatronic valve block also contains the speed and temperature sensors. These are integral with the Mechatronic valve block and cannot be serviced individually. The speed sensors measure the transmission input and output speeds and pass signals to the [TCM](#). The fluid temperature sensor is also located in the valve block and measures the fluid temperature of the transmission fluid in the fluid pan.

# Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Diagnostic Strategy

Diagnosis and Testing

## Principle of Operation

For a detailed description of the automatic transmission/transaxle, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8)

[Transmission Description - Vehicles With: ZF 6HP26](#) (Description and Operation),  
[Transmission Description - Vehicles With: ZF 6HP26](#) (Description and Operation),  
[Transmission Description - Vehicles With: ZF 6HP26](#) (Description and Operation),  
[Transmission Electronic Control System - Vehicles With: ZF 6HP26](#) (Description and Operation),  
[Transmission Electronic Control System - Vehicles With: ZF 6HP26](#) (Description and Operation),  
[Transmission Electronic Control System - Vehicles With: ZF 6HP26](#) (Description and Operation).

## Fluid Level and Condition Check



**CAUTION:** The vehicle should not be driven if the fluid level is low as internal failure can result.

• **NOTE:** The transmission fluid temperature must not be allowed to exceed 50°C (122°F) whilst checking level. Should the temperature rise above this figure, abort the check and allow the transmission fluid to cool to below 30°C (86°F).

This vehicle is not equipped with a fluid level indicator. An incorrect level may affect the transmission operation and could result in transmission damage. To correctly check and add fluid to the transmission.

REFER to: [Transmission Fluid Level Check](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, General Procedures).

### High Fluid Level

A fluid level that is too high may cause the fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of fluid from the vent tube and possible transmission damage. If an overfill condition is identified, with the engine at idle ensure the fluid temperature is within the specified range and allow the excess fluid to drain until a small thread of fluid runs from the filler/level plug hole.

### Low Fluid Level

A low fluid level could result in poor transmission engagement, slipping, or damage. This could also indicate a leak in one of the transmission seals or gaskets.

REFER to: [Transmission Fluid Level Check](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, General Procedures).

### Adding Fluid



**CAUTION:** The use of any other type of transmission fluid other than that specified can result in transmission damage.

If fluid needs to be added, add fluid in 0.50 liter increments through the fill hole opening. Do not overfill the fluid. For fluid type, refer to the Specification section in this section.

REFER to: [Specifications](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications).

### Fluid Condition Check

1. **1.** Check the fluid level.  
REFER to: [Transmission Fluid Level Check](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, General Procedures).
2. **2.** Observe the color and the odor of the fluid. The color under normal circumstances should be like honey, not dark brown or black.
3. **3.** Allow the fluid to drip onto a facial tissue and examine the stain.
4. **4.** If evidence of solid material is found, the transmission fluid pan should be removed for further inspection.

**NOTE:** In the event of a transmission unit replacement for internal failure, the oil cooler and pipes must also be replaced.

### Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of damage and system integrity.

## Visual Inspection

Mechanical	Electrical	Hydraulic
<ul style="list-style-type: none"> <li>● Damaged/stuck shift mechanism</li> <li>● Damaged automatic transmission casing</li> </ul>	<ul style="list-style-type: none"> <li>● Blown fuse(s)</li> <li>● Damaged, loose or corroded connectors</li> <li>● Wiring harness</li> </ul>	<ul style="list-style-type: none"> <li>● Fluid level too high/low</li> <li>● Poor condition of fluid</li> <li>● Fluid leak</li> </ul>

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **4.** If the cause is not visually evident check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• **NOTE:** If the control module/transmission is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/transmission.

• **NOTE:** Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• **NOTE:** When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• **NOTE:** Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• **NOTE:** If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B108782	Lost LIN Communications with ETS	<ul style="list-style-type: none"> <li>● Alivecounter fault</li> </ul>	Check transmission shift module for related DTCs and refer to the relevant DTC Index. Refer to the electrical circuit diagrams and check TCM to transmission shift module for short, open circuit
B108783	Lost LIN Communications with ETS	<ul style="list-style-type: none"> <li>● Checksum error</li> </ul>	Check transmission shift module for related DTCs and refer to the relevant DTC Index. Refer to the electrical circuit diagrams and check TCM to transmission shift module for short, open circuit
B108787	Lost LIN Communications with ETS	<ul style="list-style-type: none"> <li>● LIN-timeout</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check transmission shift module for related DTCs and refer to the relevant DTC Index. Refer to the electrical circuit diagrams and check TCM to transmission shift module for short, open circuit
B108788	Lost LIN Communications with ETS	<ul style="list-style-type: none"> <li>● LIN Bus off</li> </ul>	Check transmission shift module for related DTCs and refer to the relevant DTC Index. Refer to the electrical circuit diagrams and check TCM to transmission shift module for short, open circuit
P012186	Throttle/Pedal Position Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Kickdown flag set erroneously at low pedal values</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check ECM for related DTCs and refer to the relevant DTC Index
P021986	Engine Overspeed Condition	<ul style="list-style-type: none"> <li>● Engine speed too low or too high</li> </ul>	Check ECM for related DTCs and refer to the relevant DTC Index
P050081	Vehicle Speed Signal Not Detected	<ul style="list-style-type: none"> <li>● Fault with any wheel speed on CAN</li> </ul>	Check ABS for vehicle speed related DTCs and refer to the relevant DTC Index
P050181	Vehicle Speed Sensor A Range/Performance	<ul style="list-style-type: none"> <li>● Difference between output shaft speed and wheels speeds on CAN</li> </ul>	Check ABS for vehicle speed related DTCs and refer to the relevant DTC Index. Check correct differential is installed to the vehicle
P05611C	System Voltage Unstable	<ul style="list-style-type: none"> <li>● Power supply voltage - out of range when engine running</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check ECM for charging system related DTCs and refer to the relevant DTC Index. Check output of generator, voltage regulator and battery
P056221	System Voltage Low	<ul style="list-style-type: none"> <li>● Battery supply voltage to TCM circuit - low voltage</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Ensure battery is in a fully charged and serviceable condition, refer to the battery care manual. Also check for additional charging system DTCs and refer to relevant DTC Index

DTC	Description	Possible Cause	Action
P056322	System Voltage High	<ul style="list-style-type: none"> <li>High battery charge, alternator fault</li> </ul>	Check output of generator, voltage regulator and battery. Check for additional generator related DTCs and refer to relevant DTC Index
P060141	Internal Control Module Memory Check Sum Error	<ul style="list-style-type: none"> <li>Software error</li> <li>TCM failure</li> </ul>	Re-configure the transmission using the manufacturer approved diagnostic system, clear DTC and re-test. If DTC remains, suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P060400	Internal Control Module RAM error	<ul style="list-style-type: none"> <li>Shift-by-Wire Level2/Data calibration error</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P060541	Internal Control Module Read Only Memory (ROM) Error	<ul style="list-style-type: none"> <li>General checksum failure</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P061300	TCM processor	<ul style="list-style-type: none"> <li>Watchdog fault</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P061304	TCM processor	<ul style="list-style-type: none"> <li>Microcontroller component faults</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P061311	TCM Processor	<ul style="list-style-type: none"> <li>Watchdog fault</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P061312	TCM Processor	<ul style="list-style-type: none"> <li>Watchdog fault</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P061313	TCM Processor	<ul style="list-style-type: none"> <li>Watchdog fault</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P061314	TCM Processor	<ul style="list-style-type: none"> <li>Watchdog fault</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P061321	TCM Processor	<ul style="list-style-type: none"> <li>Watchdog fault</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P061322	TCM Processor	<ul style="list-style-type: none"> <li>Watchdog fault</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P061326	TCM Processor	<ul style="list-style-type: none"> <li>Microcontroller component faults</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P061347	TCM Processor	<ul style="list-style-type: none"> <li>Watchdog fault</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P061349	TCM Processor	<ul style="list-style-type: none"> <li>Microcontroller component faults</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P061B26	Internal Control Module Torque Calculation Performance	<ul style="list-style-type: none"> <li>TCM positive torque signal not valid</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P062F04	Internal Control Module EEPROM Error	<ul style="list-style-type: none"> <li>EEPROM communication error</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P064221	Sensor Reference Voltage A Circuit Low	<ul style="list-style-type: none"> <li>Sensor supply voltage fault low</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P064322	Sensor Reference Voltage A Circuit High	<ul style="list-style-type: none"> <li>Sensor supply voltage fault high</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P065713	Actuator Supply Voltage A Circuit/Open	<ul style="list-style-type: none"> <li>Actuator supply (pressure control valves etc) open circuit</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P06571C	Actuator Supply Voltage A Circuit/Open	<ul style="list-style-type: none"> <li>Actuator supply (pressure control valves etc) voltage plausibility fault</li> </ul>	Refer to electrical circuit diagrams and check TCM connector pin 7 for short to ground. If no fault identified, suspect the TCM. Check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P065811	Actuator Supply Voltage A Circuit Low	<ul style="list-style-type: none"> <li>Actuator supply (pressure control valves etc) voltage short to ground</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index

DTC	Description	Possible Cause	Action
P065912	Actuator Supply Voltage A Circuit High	<ul style="list-style-type: none"> <li>Actuator supply (pressure control valves etc) voltage short to power</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P066701	PCM/ECM/TCM Internal Temperature Sensor A Range/Performance	<ul style="list-style-type: none"> <li>General electrical failure</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P066749	PCM/ECM/TCM Internal Temperature Sensor A Range/Performance	<ul style="list-style-type: none"> <li>Internal electronic failure</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P070002	Transmission Control System (MIL Request)	<ul style="list-style-type: none"> <li>General signal failure</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and re-test, if DTC remains check for additional DTCs and refer to the relevant DTC Index
P070022	Transmission Control System (MIL Request)	<ul style="list-style-type: none"> <li>Double fault from monitoring of internal power supply and pressure regulator/solenoid control software</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. If any of the following DTCs are also present; P096312, P096712, P096413, P097112, P272112, P273012, P272713, P276312, P074013, suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P071013	Transmission Fluid Temperature Sensor A Circuit	<ul style="list-style-type: none"> <li>Transmission fluid temperature sensor circuit - open circuit</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P071101	Transmission Fluid Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>General electrical failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P071122	Transmission Fluid Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Signal amplitude &gt; maximum. Excessive jump in temperature</li> </ul>	Clear DTC and re-test from cold and at normal operating temperature. If DTC remains, suspect the TCM. Check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P071211	Transmission Fluid Temperature Sensor A Circuit Low	<ul style="list-style-type: none"> <li>Transmission fluid temperature sensor circuit - short to ground</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P071301	Transmission Fluid Temperature Sensor A Circuit High	<ul style="list-style-type: none"> <li>General electrical failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P071312	Transmission Fluid Temperature Sensor A Circuit High	<ul style="list-style-type: none"> <li>Transmission fluid temperature sensor circuit - short to power</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P071614	Turbine/Input Shaft Speed Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Turbine/Input Shaft Speed Sensor circuit - short to ground, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P071621	Turbine/Input Shaft Speed Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Turbine/Input Shaft Speed Sensor signal too small</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and re-test, if DTC remains suspect the TCM. Check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P071622	Turbine/Input Shaft Speed Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Turbine/Input Shaft Speed Sensor signal too large</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and re-test, if DTC remains suspect the TCM. Check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P071712	Turbine/Input Shaft Speed Sensor A Circuit No Signal	<ul style="list-style-type: none"> <li>Turbine/input shaft speed sensor A circuit - short to power</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P072012	Output Shaft Speed Sensor Circuit	<ul style="list-style-type: none"> <li>Transmission output shaft speed sensor circuit - short to power</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P072014	Output Shaft Speed Sensor Circuit	<ul style="list-style-type: none"> <li>Transmission output shaft speed sensor circuit - short to ground, open circuit</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index

DTC	Description	Possible Cause	Action
P072122	Output Shaft Speed Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>Transmission output shaft speed sensor signal too large</li> </ul>	Clear DTC and re-test, if DTC remains suspect the TCM. Check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P072127	Output Shaft Speed Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>Output shaft speed negative gradient too high</li> </ul>	Clear DTC and re-test, if DTC remains suspect the TCM. Check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P072164	Output Shaft Speed Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>Signal plausibility failure</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P073007	Gear 1 Incorrect Ratio	<ul style="list-style-type: none"> <li>Gear ratio monitoring. Mechanical failures</li> </ul>	Check oil level, top up if required. Delete DTC and recheck system.
P074013	Torque Converter Clutch Pressure Solenoid Circuit/Open	<ul style="list-style-type: none"> <li>Pressure control solenoid 6 circuit - open circuit</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P074107	Torque Converter Clutch Solenoid Circuit Performance Or Stuck Off	<ul style="list-style-type: none"> <li>Too high slip at torque converter clutch. Mechanical failures</li> </ul>	Suspect torque converter lockup clutch. Install a new torque converter, refer to the new module/component installation note at the top of the DTC Index. If transmission fluid is in very poor condition and dirty, install a new transmission, refer to the new module/component installation note at the top of the DTC Index
P074500	Pressure Control Solenoid A	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P075113	Shift Solenoid A Performance/Stuck off	<ul style="list-style-type: none"> <li>Solenoid valve 1 or Pressure control Solenoid G circuit - open circuit</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P075114	Shift Solenoid A Performance/Stuck off	<ul style="list-style-type: none"> <li>Solenoid valve 1 or Pressure control solenoid 7 circuit - short to ground, open circuit</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P075211	Shift Solenoid A Stuck on	<ul style="list-style-type: none"> <li>Solenoid valve 1 or Pressure control solenoid 7 circuit - short to ground</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P075312	Shift Solenoid A Electrical	<ul style="list-style-type: none"> <li>Solenoid valve 1 or Pressure control Solenoid G circuit - short to power</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P075812	Shift Solenoid B Electrical	<ul style="list-style-type: none"> <li>Solenoid valve 2 circuit - short to power</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P075813	Shift Solenoid B Electrical	<ul style="list-style-type: none"> <li>Solenoid valve 2 circuit - open circuit</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P077171	Shift Solenoid E Performance/Stuck off	<ul style="list-style-type: none"> <li>Actuator stuck</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P077500	Pressure Control Solenoid B	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P077811	Pressure Control Solenoid B Electrical	<ul style="list-style-type: none"> <li>Pressure control solenoid B electrical circuit - short to ground</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P077821	Pressure Control Solenoid B Electrical	<ul style="list-style-type: none"> <li>Pressure control solenoid 2 current too small</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P078107	1-2 Shift	<ul style="list-style-type: none"> <li>Gear ratio monitoring. Mechanical failures</li> </ul>	Check oil level, top up if required. Delete DTC and recheck the system.
P078207	2-3 Shift	<ul style="list-style-type: none"> <li>Gear ratio monitoring. Mechanical failures</li> </ul>	Check oil level, top up if required. Delete DTC and recheck the system.
P078307	3-4 Shift	<ul style="list-style-type: none"> <li>Gear ratio monitoring. Mechanical failures</li> </ul>	Check oil level, top up if required. Delete DTC and recheck the system.
P078407	4-5 Shift	<ul style="list-style-type: none"> <li>Gear ratio monitoring. Mechanical failures</li> </ul>	Check oil level, top up if required. Delete DTC and recheck the system.



DTC	Description	Possible Cause	Action
P079500	Pressure Control Solenoid C	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P079811	Pressure Control Solenoid C Electrical	<ul style="list-style-type: none"> <li>Pressure control solenoid C circuit - short to ground</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P079822	Pressure Control Solenoid C Electrical	<ul style="list-style-type: none"> <li>Pressure control solenoid 3 current too large</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P081462	Reverse Output Circuit	<ul style="list-style-type: none"> <li>Transmission range display circuit</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P082907	5-6 Shift	<ul style="list-style-type: none"> <li>Gear ratio monitoring. Mechanical failures</li> </ul>	Check oil level, top up if required. Delete DTC and recheck the system.
P085001	Park/Neutral Switch Input Circuit	<ul style="list-style-type: none"> <li>General electrical failure</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P085002	Park/Neutral Switch Input Circuit	<ul style="list-style-type: none"> <li>General signal failure</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P085029	Park/Neutral Switch Input Circuit	<ul style="list-style-type: none"> <li>Wrong voltage level detected on Park/No Park signal</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for correct output at TCM Park signal pin (check in all positions) 12 volts in Park, 0 volts in all other positions. If NO fault identified, check Park signal circuit to transmission shift module for short, open circuit. If fault identified, suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P091993	Gear Shift Position Control Error	<ul style="list-style-type: none"> <li>No shifting despite driver request</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P091994	Gear Shift Position Control Error	<ul style="list-style-type: none"> <li>Shifting without driver request</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P093829	Hydraulic Oil Temperature Sensor Range/Performance	<ul style="list-style-type: none"> <li>Transmission fluid temperature compared with module temperature fault</li> </ul>	Clear DTC and re-test from cold and at normal operating temperature. If DTC remains suspect the TCM. Check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P096312	Pressure Control Solenoid A Control Circuit High	<ul style="list-style-type: none"> <li>Pressure control solenoid 1 circuit - short to power</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P096611	Pressure Control Solenoid B Control Circuit Low	<ul style="list-style-type: none"> <li>Pressure control solenoid 2 circuit - short to ground</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P096712	Pressure Control Solenoid B Control Circuit High	<ul style="list-style-type: none"> <li>Pressure control solenoid 2 circuit - short to power</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P096814	Pressure Control Solenoid C Control Circuit/Open	<ul style="list-style-type: none"> <li>Pressure control solenoid 3 circuit - short to ground, open circuit</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P097011	Pressure Control Solenoid C Control Circuit Low	<ul style="list-style-type: none"> <li>Pressure control solenoid 3 circuit - short to ground</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P097112	Pressure Control Solenoid C Control Circuit High	<ul style="list-style-type: none"> <li>Pressure control solenoid 3 circuit - short to power</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P097222	Shift Solenoid A Control Circuit Range/Performance	<ul style="list-style-type: none"> <li>Pressure control solenoid 1 - current too large</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index

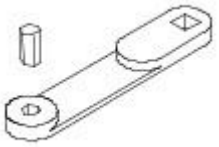
DTC	Description	Possible Cause	Action
P097311	Shift Solenoid A Control Circuit Low	<ul style="list-style-type: none"> <li>Shift solenoid A control circuit - short to ground</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P097314	Shift Solenoid A Control Circuit Low	<ul style="list-style-type: none"> <li>Pressure control solenoid 1 circuit - short to ground, open circuit</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P097611	Shift Solenoid B	<ul style="list-style-type: none"> <li>Solenoid valve 2 circuit - short to ground</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P097614	Shift Solenoid B	<ul style="list-style-type: none"> <li>Solenoid valve 2 circuit - short to ground, open circuit</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P167400	Control Module Software Corrupted	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P170777	Transfer case Neutral OR Park/Neutral Indication Circuit	<ul style="list-style-type: none"> <li>commanded position not reachable</li> </ul>	Make sure the emergency park position release lever has not been activated, and is not sticking. Clear the DTC and re-test, engaging and dis-engaging the park lock several times. If DTC remains, check and install new park lock components as required. Clear the DTC and re-test, engaging and dis-engaging the park lock several times. If DTC still remains, suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P270007	Transmission Friction Element A Apply Time Range/Performance	<ul style="list-style-type: none"> <li>Gear ratio monitoring. Mechanical failures</li> </ul>	Check oil level, top up if required. Delete DTC and recheck the system.
P270107	Transmission Friction Element B Apply Time Range/Performance	<ul style="list-style-type: none"> <li>Gear ratio monitoring. Mechanical failures</li> </ul>	Check oil level, top up if required. Delete DTC and recheck the system.
P270207	Transmission Friction Element C Apply Time Range/Performance	<ul style="list-style-type: none"> <li>Gear ratio monitoring. Mechanical failures</li> </ul>	Check oil level, top up if required. Delete DTC and recheck the system.
P270307	Transmission Friction Element D Apply Time Range/Performance	<ul style="list-style-type: none"> <li>Gear ratio monitoring. Mechanical failures</li> </ul>	Check oil level, top up if required. Delete DTC and recheck the system.
P270407	Transmission Friction Element E Apply Time Range/Performance	<ul style="list-style-type: none"> <li>Gear ratio monitoring. Mechanical failures</li> </ul>	Check oil level, top up if required. Delete DTC and recheck the system.
P271300	Pressure Control Solenoid D	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P271611	Pressure Control Solenoid D Electrical	<ul style="list-style-type: none"> <li>Pressure control solenoid D circuit - short to ground</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P271621	Pressure Control Solenoid D Electrical	<ul style="list-style-type: none"> <li>Pressure control solenoid D circuit - current too small</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P271814	Pressure Control Solenoid D Control Circuit/Open	<ul style="list-style-type: none"> <li>Pressure control solenoid D circuit - short to ground, open circuit</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P272011	Pressure Control Solenoid D Control Circuit Low	<ul style="list-style-type: none"> <li>Pressure control solenoid D circuit - short to ground</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P272112	Pressure Control Solenoid D Control Circuit High	<ul style="list-style-type: none"> <li>Pressure control solenoid D circuit - short to power</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P272511	Pressure Control Solenoid E Electrical	<ul style="list-style-type: none"> <li>Pressure control solenoid E circuit - short to ground</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P272713	Pressure Control Solenoid E Control Circuit/Open	<ul style="list-style-type: none"> <li>Pressure control solenoid E circuit - open circuit</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P272911	Pressure Control Solenoid E Control Circuit Low	<ul style="list-style-type: none"> <li>Pressure control solenoid E circuit - short to ground</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index


DTC	Description	Possible Cause	Action
P273012	Pressure Control Solenoid E Control Circuit High	<ul style="list-style-type: none"> <li>Pressure control solenoid E circuit - short to power</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P276312	Torque Converter Clutch Pressure Control Solenoid Control Circuit High	<ul style="list-style-type: none"> <li>Pressure control solenoid F circuit - short to power</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P276411	Torque Converter Clutch Pressure Control Solenoid Control Circuit Low	<ul style="list-style-type: none"> <li>Torque converter clutch pressure control solenoid control circuit - short to ground</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P280711	Pressure Control Solenoid G	<ul style="list-style-type: none"> <li>Park solenoid circuit - short to ground</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P280712	Pressure Control Solenoid G	<ul style="list-style-type: none"> <li>Park solenoid circuit - short to power</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P280713	Pressure Control Solenoid G	<ul style="list-style-type: none"> <li>Park solenoid circuit - open circuit</li> </ul>	Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
P280714	Pressure Control Solenoid G	<ul style="list-style-type: none"> <li>Park solenoid circuit - short to ground, open circuit</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the TCM, check and install a new TCM as required, refer to the new module/component installation note at the top of the DTC Index
U000188	High speed CAN communication Bus	<ul style="list-style-type: none"> <li>CAN Bus off</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U010082	Lost Communication With Engine/Powertrain Control Module	<ul style="list-style-type: none"> <li>Alivecounter fault</li> </ul>	Check ECM for DTCs and refer to the relevant DTC Index
U010083	Lost Communication With Engine/Powertrain Control Module	<ul style="list-style-type: none"> <li>Checksum fault</li> </ul>	Check ECM for DTCs and refer to the relevant DTC Index
U010087	Lost Communication With Engine/Powertrain Control Module	<ul style="list-style-type: none"> <li>CAN Timeout</li> </ul>	<ul style="list-style-type: none"> <li><b>NOTE: Do NOT install a new ECM if an ECM Timeout DTC is only logged in the TCM, the failure is NOT with the ECM</b></li> </ul> <p>Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Carry out CAN network integrity test using the manufacturer approved diagnostic system</p>
U010382	Lost CAN Communications with Gear Shift Module	<ul style="list-style-type: none"> <li>Alivecounter fault</li> </ul>	Check transmission shift module for DTCs and refer to the relevant DTC Index
U010383	Lost CAN Communications with Gear Shift Module	<ul style="list-style-type: none"> <li>Checksum fault</li> </ul>	Check transmission shift module for DTCs and refer to the relevant DTC Index
U010387	Lost CAN Communications with Gear Shift Module	<ul style="list-style-type: none"> <li>CAN Timeout</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check transmission shift module for DTCs and refer to the relevant DTC Index
U012282	Lost Communication With Vehicle Dynamics Control Module	<ul style="list-style-type: none"> <li>Alivecounter fault</li> </ul>	Check ABS module for DTCs and refer to the relevant DTC Index
U012283	Lost Communication With Vehicle Dynamics Control Module	<ul style="list-style-type: none"> <li>Checksum fault</li> </ul>	Check ABS module for DTCs and refer to the relevant DTC Index
U012287	Lost Communication With Vehicle Dynamics Control Module	<ul style="list-style-type: none"> <li>CAN Timeout</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check ABS module for DTCs and refer to the relevant DTC Index
U012887	Lost Communication With Electric Park Brake Module	<ul style="list-style-type: none"> <li>CAN timeout electronic parking brake module</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check electronic parking brake module for DTCs and refer to the relevant DTC Index
U014082	Lost Communication with Body Control Module	<ul style="list-style-type: none"> <li>Alivecounter fault</li> </ul>	Check CJB for DTCs and refer to the relevant DTC Index
U014083	Lost Communication with Body Control Module	<ul style="list-style-type: none"> <li>Checksum fault</li> </ul>	Check CJB for DTCs and refer to the relevant DTC Index
U014087	Lost Communication with Body Control Module	<ul style="list-style-type: none"> <li>CAN Timeout</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check CJB for DTCs and refer to the relevant DTC Index
U015587	Lost Communication With Instrument Panel Cluster (IPC) Control Module	<ul style="list-style-type: none"> <li>CAN timeout instrument cluster</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check instrument cluster for DTCs and refer to the relevant DTC Index

<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
U030068	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>● CAN level</li> </ul>	Re-configure the TCM using the manufacturer approved diagnostic system
U040168	Invalid Data Received from Engine/Powertrain Control Module	<ul style="list-style-type: none"> <li>● Faulty/inaccurate engine speed, torque information</li> </ul>	Check ECM for DTCs and refer to relevant DTC Index
U040468	Invalid CAN/LIN Data received from Gear Shift Module	<ul style="list-style-type: none"> <li>● Invalid transmission shift information</li> </ul>	Check transmission shift module for DTCs and refer to the relevant DTC Index
U041668	Invalid Data Received from Vehicle Dynamics Control Module	<ul style="list-style-type: none"> <li>● Event information - brake information</li> </ul>	Check ECM and ABS module for DTCs and refer to the relevant DTC Index
U042268	Invalid CAN Data received from Body Control Module	<ul style="list-style-type: none"> <li>● Event information - invalid power mode information</li> </ul>	Check instrument cluster and CJB for DTCs and refer to the relevant DTC Index
U101B87	Lost CAN and LIN Communication with ETS	<ul style="list-style-type: none"> <li>● Missing message - lost communication with transmission shift module - multiple Bus</li> </ul>	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check transmission shift module for DTCs and refer to the relevant DTC Index. Check CAN and LIN networks to TCM
U300081	Control Module	<ul style="list-style-type: none"> <li>● Invalid serial data received</li> </ul>	Re-configure the TCM using the manufacturer approved diagnostic system

# Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Transmission Fluid Drain and Refill

General Procedures

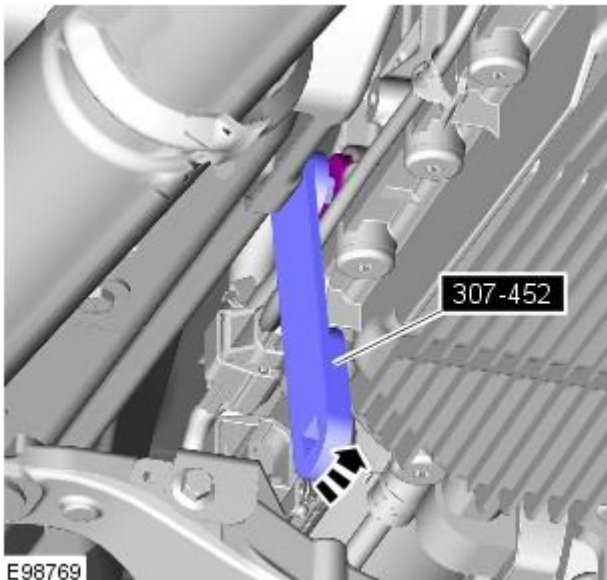
Special Tool(s)	
 <p>307-452</p>	Adapter
	307-452

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.


Raise and support the vehicle.

- Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
- Place a container under the transmission.

#### 4. WARNINGS:




 Observe due care when draining, as the fluid can be very hot.

 Observe due care when working near a hot exhaust system.

Using the special tool, remove the transmission fluid filler/level plug.

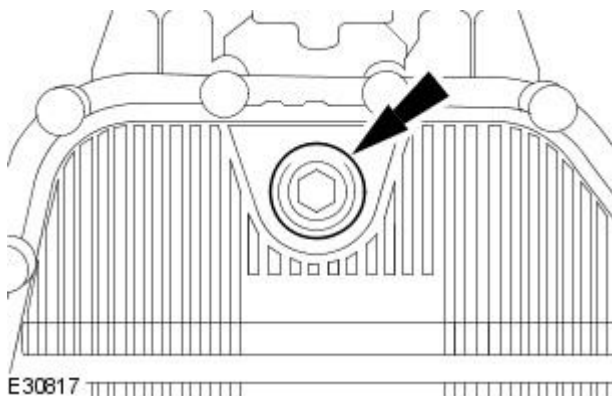
#### 5. WARNINGS:

 Observe due care when draining, as the fluid can be very hot.

 Observe due care when working near a hot exhaust system.

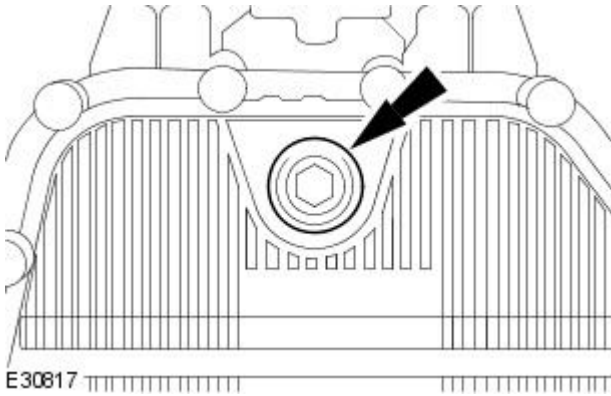
Remove the transmission fluid drain plug.

- Allow the fluid to drain.



6. Install the new transmission fluid drain plug.

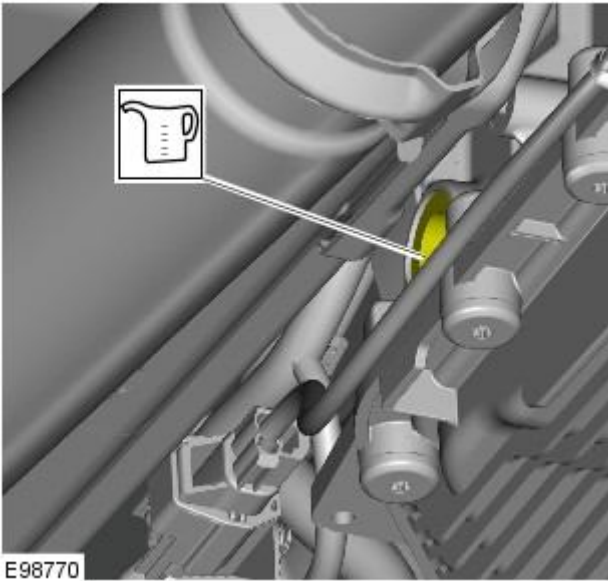
- Tighten to 8 Nm.



E30817

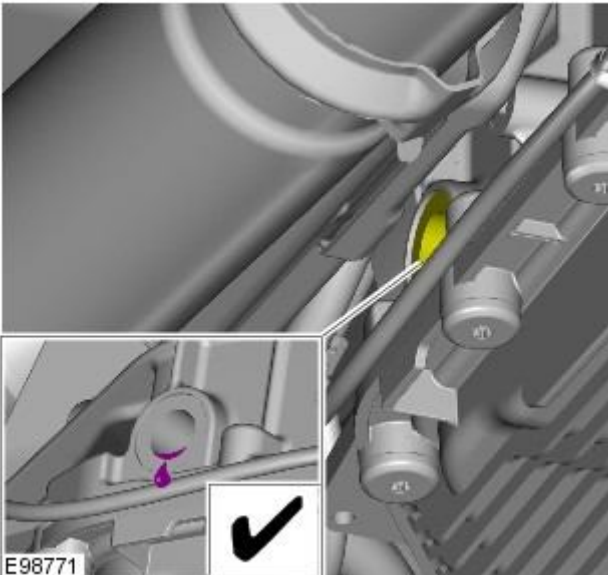
7. NOTE: Use transmission fluid meeting Jaguar specification.

Refill the transmission with fluid.



E98770

8. Allow the transmission fluid to drain from the transmission fluid filler plug hole until the flow almost stops.



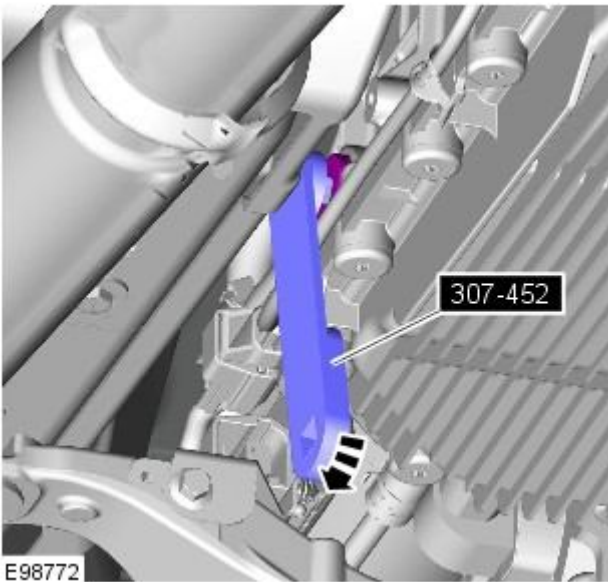
E98771



**9. NOTE:** Install a new sealing washer.

Using the special tool, install the new transmission fluid fill plug.

- Loosely install the transmission fluid fill plug.



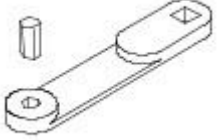
**10.** Lower the vehicle.

**11.** Carry out a transmission fluid level check.

For additional information, refer to: [Transmission Fluid Level Check](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, General Procedures).

## Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Transmission Fluid Level Check

General Procedures

Special Tool(s)	
 <p>307-452</p>	Adapter 307-452

1. The following steps must be observed before starting the transmission fluid level check.

- The vehicle must be on a horizontal ramp.
- The parking brake must be applied.
- The engine must be running for 2 minutes with the transmission control switch (TCS) in the "P" position.


2. Connect the Jaguar approved diagnostic system.

3. Make sure that the TCS is in the "P" position.

4. **NOTE:** Make sure the transmission fluid temperature is below 30 °C (86 °F) on the Jaguar approved diagnostic system.

With the engine running and the foot brake applied, circulate the transmission fluid by:

- Moving the TCS to the "R" position.
- Waiting for 3 seconds.
- Moving the TCS to the "D" position.
- Waiting for 3 seconds.
- Moving the TCS to the "P" position.

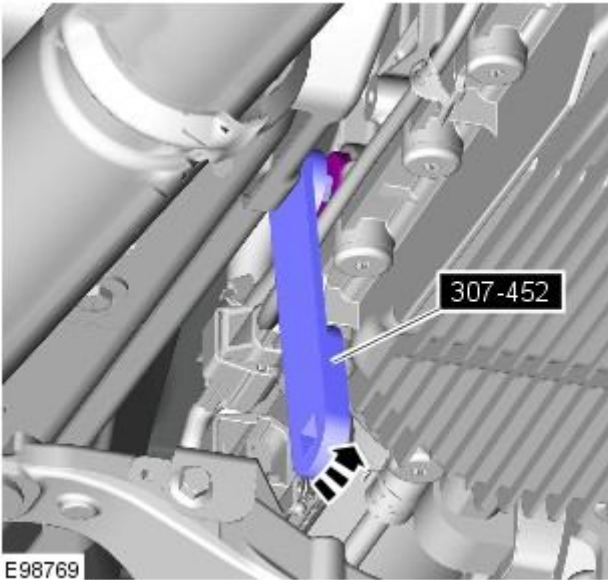
5.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.


Raise and support the vehicle.

6. Remove the air deflector.

For additional information, refer to: Air Deflector (501-02, Removal and Installation).

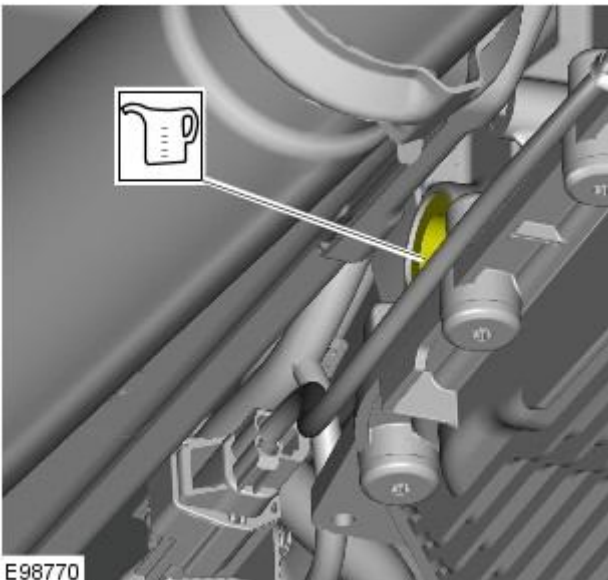
7. Place a suitable container under the transmission fluid fill plug.



8.  **WARNING:** Make sure that care is exercised near rotating parts. Failure to follow this instruction may result in personal injury.

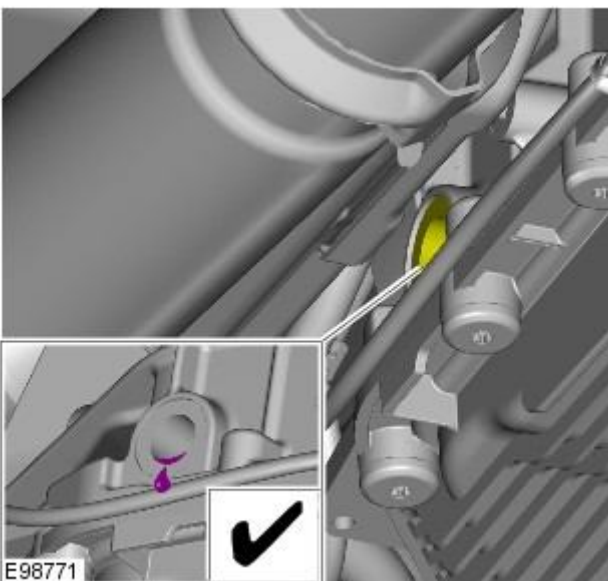
With the engine running, using the special tool remove the transmission fluid fill plug.

- Remove and discard the transmission fluid fill plug.



9. **NOTE:** Use transmission fluid meeting Jaguar specification.

If the transmission fluid does not come out of the transmission fluid fill plug hole the transmission fluid level is insufficient. If this is the case add the transmission fluid in 0.5 liter units into the transmission fluid fill plug hole until fluid comes out.

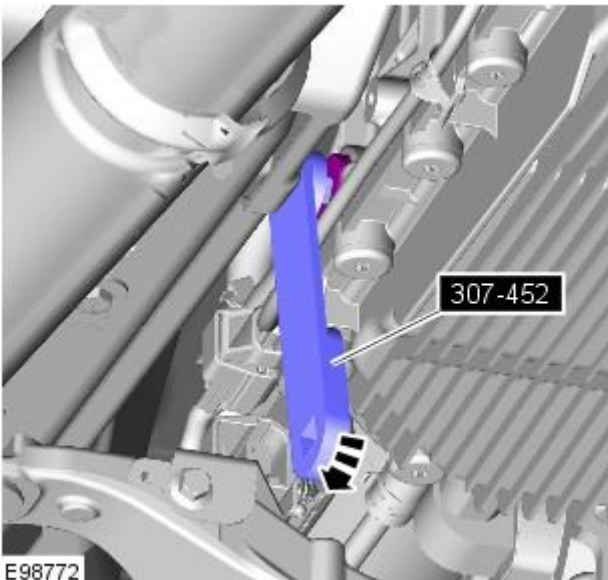


10. **NOTE:** Make sure the transmission fluid temperature does not exceed 50 °C (122 °F). If the transmission fluid temperature does exceed 50 °C (122 °F) stop the transmission fluid level check and allow the transmission fluid to cool until the temperature is below 30 °C (86 °F).

Allow the transmission fluid to drain from the transmission fluid filler plug hole until the flow almost stops.

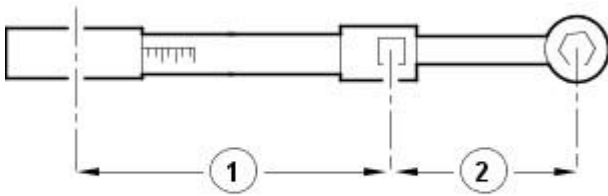
**11. NOTE:** Install a new sealing washer.

Using the special tool, install the new transmission fluid fill plug.



**12. ⚠ CAUTION:** Make sure the transmission fluid fill plug is tightened to the correct specification. Failure to follow this instruction may result in damage to the vehicle.

Using the special tool and torque wrench, tighten the transmission fluid fill plug.



E37107

- To make sure the transmission fill plug is torqued to the correct specification. Using the special tool and torque wrench the following calculation steps must be followed.
- Step 1. Multiply 35 Nm by the effective length of the torque wrench (1).
- Step 2. Add the effective length of the special tool (2) to the effective length of the torque wrench (1).
- Step 3. Divide the total of step 1 by the total of step 2.
- Step 4. Set the torque wrench to the figure arrived at in step 3.
- Tighten the transmission fluid fill plug to the torque given by the calculation.

**13.** Remove the special tool.

**14.** Remove the container.

**15.** Install the air deflector.


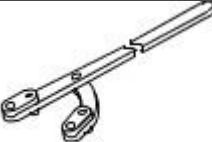
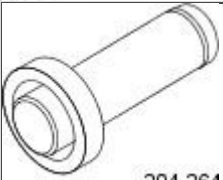


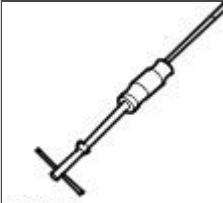
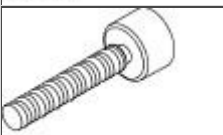

For additional information, refer to: Air Deflector (501-02, Removal and Installation).

**16.** Lower the vehicle.

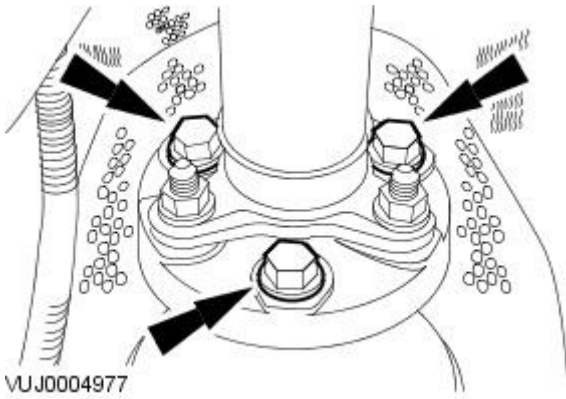
**17.** Disconnect the Jaguar approved diagnostic system.

# Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Extension Housing Seal


In-vehicle Repair


Special Tool(s)	
 303D121	Crankshaft Damper Remover 303-D121
 205053	Output Shaft Flange Holding Tool 205-053
 204-264	Pinion Seal Replacer 204-264
 HTJ12002	Powertrain Assembly Jack HTJ1200-2
 308-375	Seal Remover Input and Output 308-375
 100012	Slide Hammer 100-012
 100-012-01	Slide Hammer Adaptor 100-012-01
 E52696	Socket Output Flange Remover/Installer 205-789

**Removal**



#### 1. CAUTIONS:

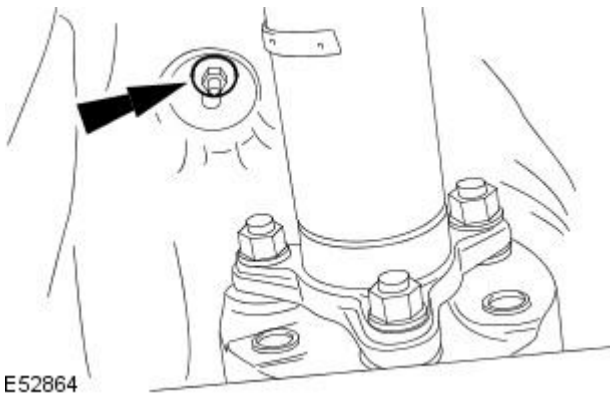
 Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the driveshaft. Failure to follow this instruction may result in damage to the vehicle.

 Make sure the front of the driveshaft does not put an excessive load on the center bearing. Failure to follow this instruction may result in damage to the vehicle.

Detach the driveshaft from the transmission flange.

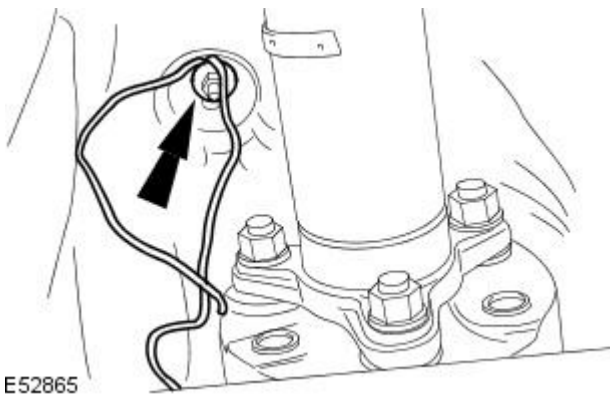
- Mark the position of the driveshaft in relation to the transmission flange.
- Mark the position of each nut and bolt in relation to the transmission flexible joint.

2. Loosen the heat shield retaining nut.

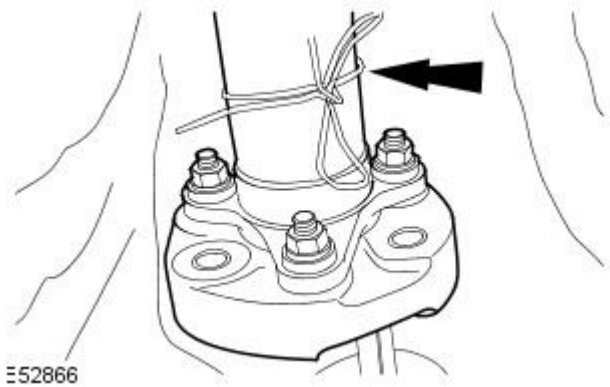


3. Install suitable cord to the heat shield retaining nut stud.

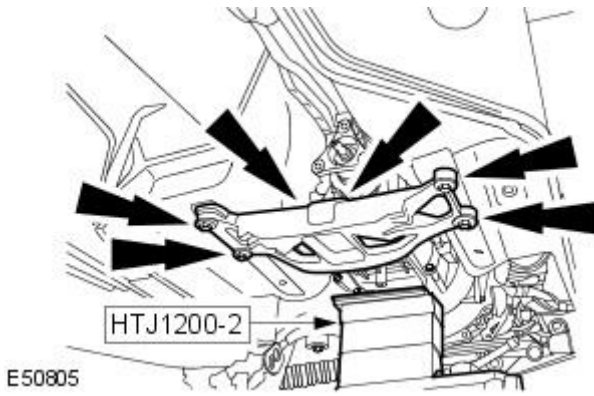
- Tighten the retaining nut.



4. Reposition the driveshaft.

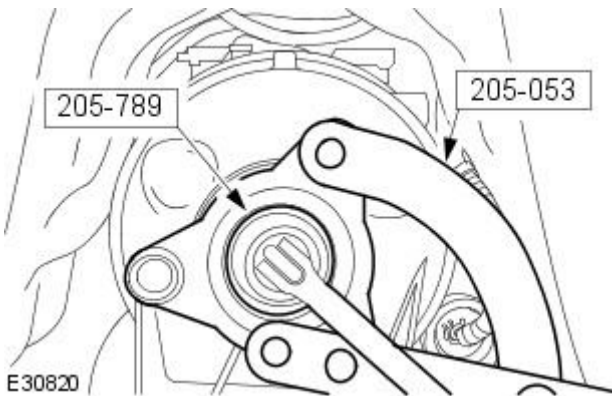




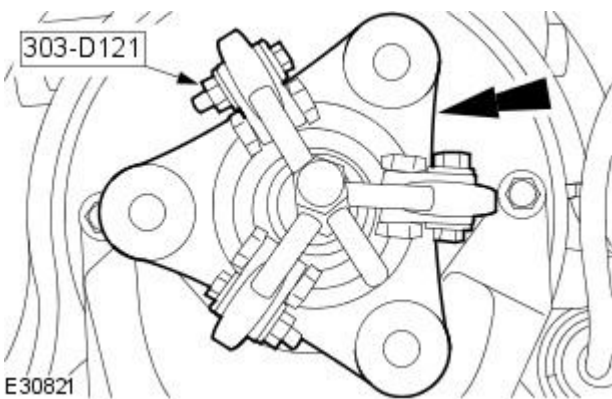


5. Using the special tool, remove the transmission support.

- Lower the transmission to a suitable height.

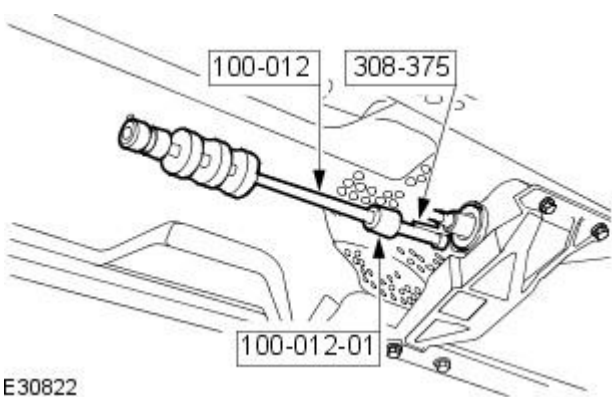


6. Using the special tools, remove and discard the output shaft flange retaining nut.



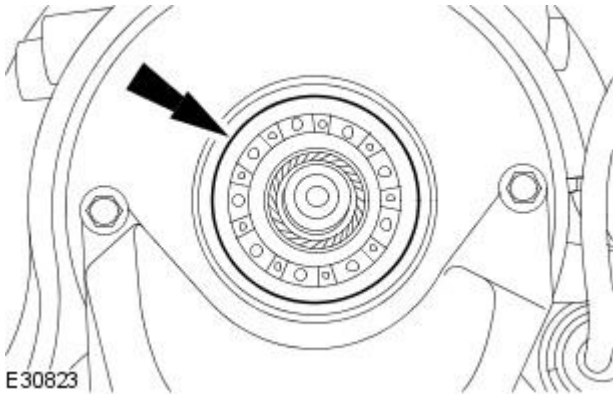
7. Using the special tool, remove the output shaft flange.

- Remove the output shaft flange spacing shim.



8. **⚠ CAUTION:** Make sure the transmission housing seal face is not damaged when removing the extension housing seal. Failure to follow this instruction may result in damage to the vehicle.

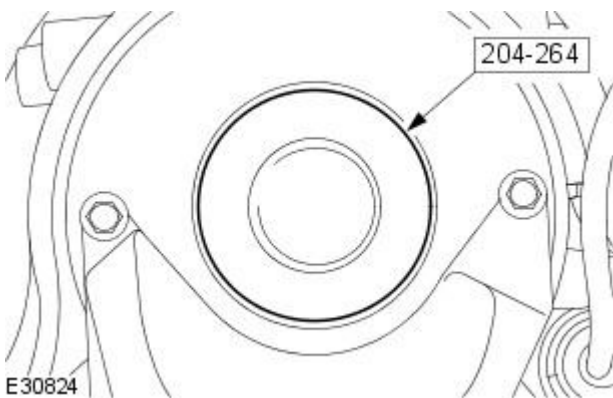
Using the special tools, remove the extension housing seal.



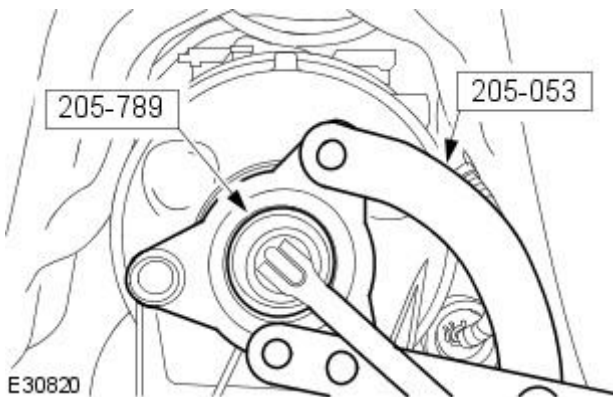
**9. NOTE:** Using a suitable metal surface cleaner meeting Jaguar specification, clean the seal face on the housing before installing the new seal.

Clean and inspect the transmission housing seal face.

### Installation

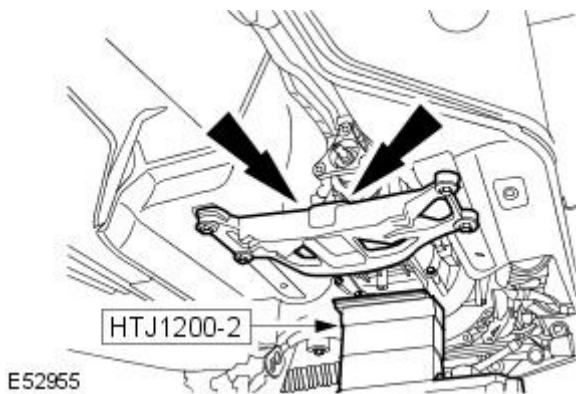


1. Using the special tool, install the extension housing seal.



2. Using the special tools install a new output shaft flange retaining nut.

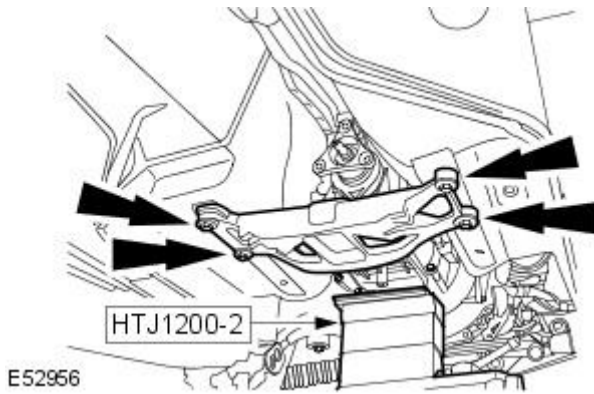
- Install the output shaft flange spacing shim.
- Install the output shaft flange.
- Tighten to 60 Nm.




3. Install the transmission support.

- Using the special tool, raise the transmission.
- Tighten to 55 Nm.

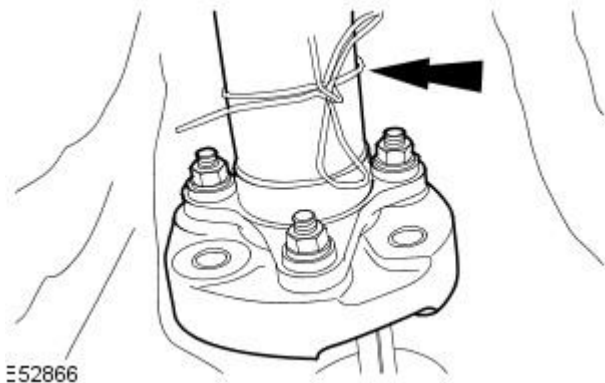
4. Tighten to 48 Nm.



5.  CAUTION: Make sure the front of the driveshaft does not put an excessive load on the center bearing. Failure to follow this instruction may result in damage to the vehicle.

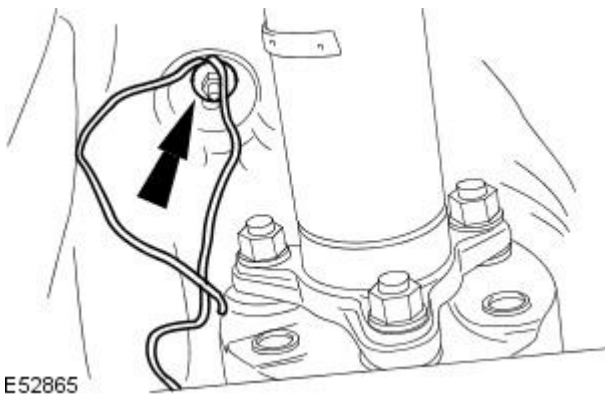
Reposition the driveshaft.

- Undo the cord.

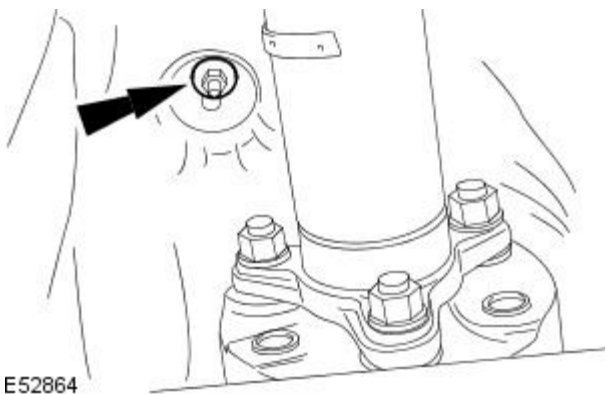


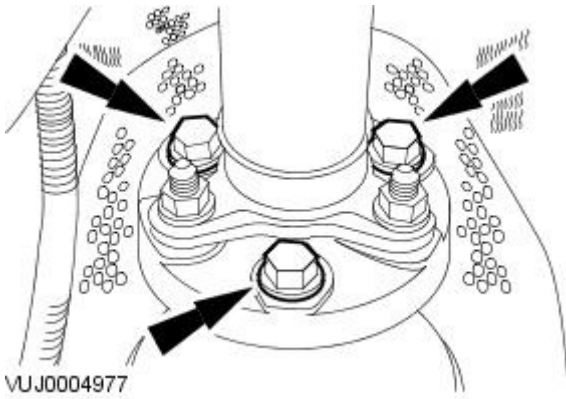
6. Loosen the retaining nut.

- Remove the cord from the heat shield retaining nut stud.





7. Tighten the retaining nut.





#### 8. CAUTIONS:

 Make sure the front of the driveshaft does not put an excessive load on the center bearing. Failure to follow this instruction may result in damage to the vehicle.

 Make sure all components are installed to the position they were removed from. Failure to follow this instruction may result in damage to the vehicle.

Attach the driveshaft to the transmission flange.

- Tighten to 88 Nm.

9. Carry out a transmission fluid level check.  
For additional information, refer to: Transmission Fluid Level Check (307-01, General Procedures).

# Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Transmission Fluid Pan, Gasket and Filter

In-vehicle Repair

## Removal

All vehicles

1. Disconnect the battery ground cable.  
For additional information, refer to: Battery Disconnect (414-01, General Procedures).

Vehicles with diesel engine

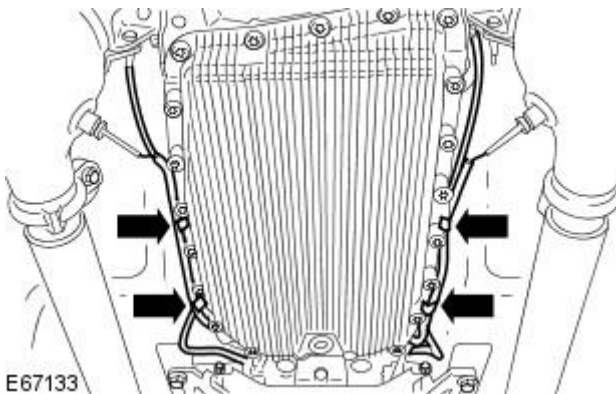
2. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).

All vehicles

3. Drain the transmission.  
For additional information, refer to: Transmission Fluid Drain and Refill (307-01, General Procedures).

Vehicles with diesel engine

4. Detach the catalytic converter temperature sensor wiring harness from the fluid pan.

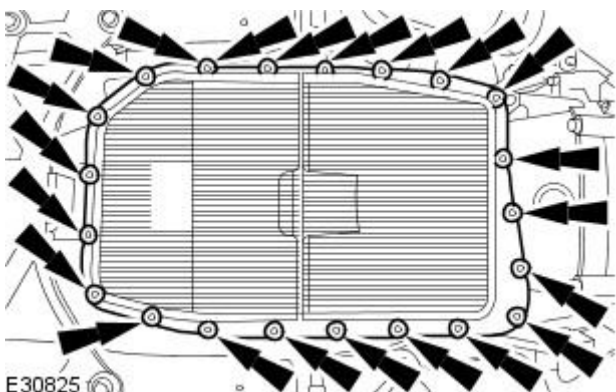


All vehicles

5. **NOTE:** Discard the fluid pan, gasket and filter.

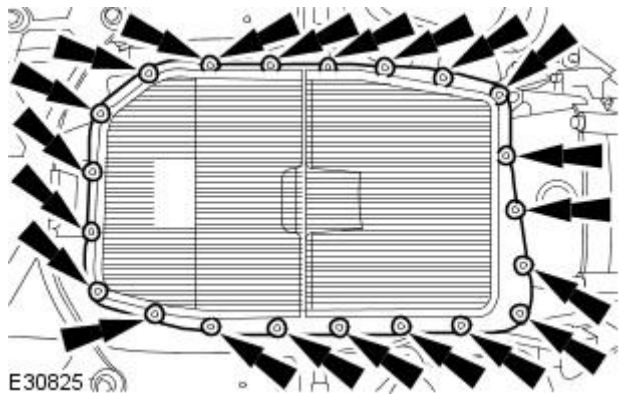
Remove the fluid pan, gasket and filter.

- Remove the retaining bolts.



## Installation

All vehicles

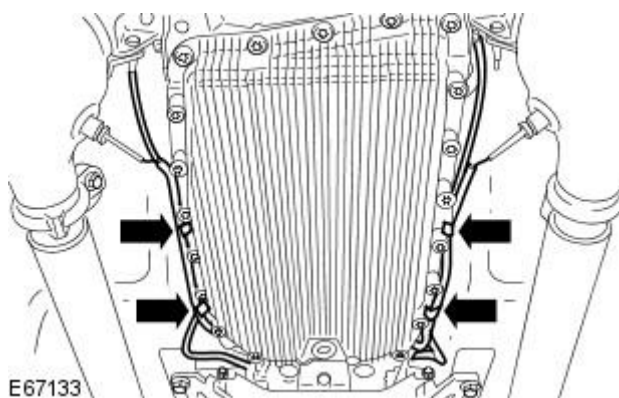


1. Install the new fluid pan, gasket and filter.

- Tighten to 8 Nm.

Vehicles with diesel engine

2. Attach the catalytic converter temperature sensor wiring harness onto the fluid pan.



All vehicles

3. Fill the transmission.  
For additional information, refer to: Transmission Fluid Drain and Refill (307-01, General Procedures).

Vehicles with diesel engine

4. Install the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).

All vehicles

5. Lower the vehicle.  
6. Connect the battery ground cable.  
For additional information, refer to: Battery Connect (414-01, General Procedures).



# Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Transmission Control Module (TCM) and Main Control Valve Body

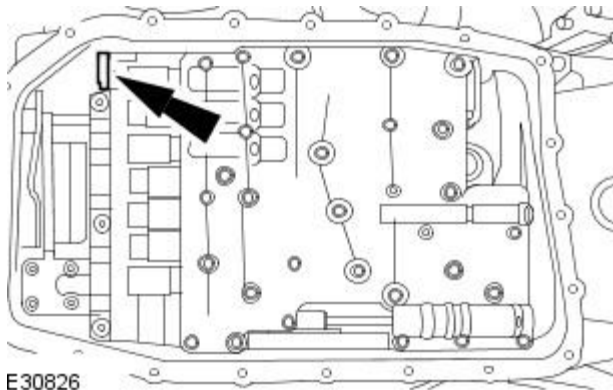
In-vehicle Repair

## General Equipment


Anti-Static Wrist Strap

## Removal

1. Remove the fluid pan, gasket and filter.  
For additional information, refer to: [Transmission Fluid Pan, Gasket and Filter](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, In-vehicle Repair).



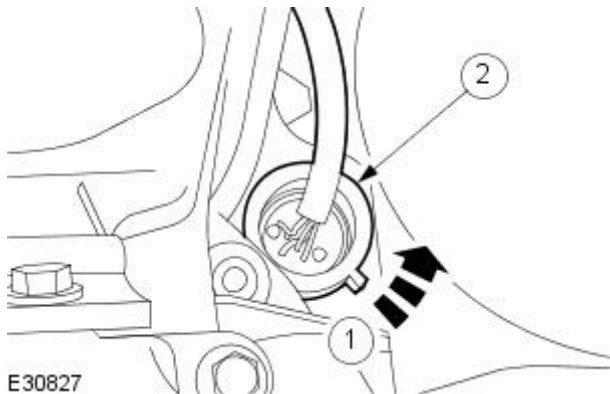
E30826

2.  **CAUTION:** Make sure the transmission control module (TCM) and main control valve body are protected against electrostatic discharge. Failure to follow this instruction may result in component damage.


Reposition the locking device.

3. Disconnect the TCM and main control valve body electrical connector.

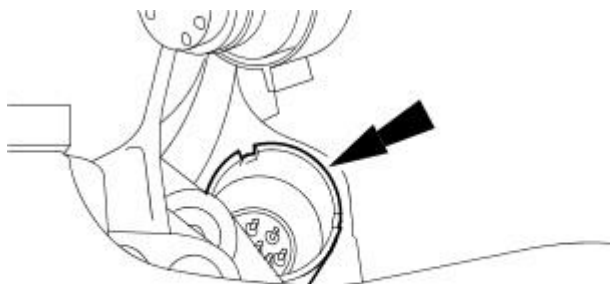
1. Reposition the electrical connector retaining ring.
2. Disconnect the electrical connector.



E30827

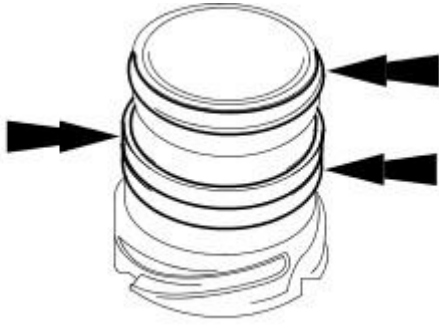
4.  **CAUTION:** Make sure all suitable safety precautions are taken to protect the TCM and main control valve body electrical connector pins against electrostatic discharge.

Remove the sealing tube.



E30828

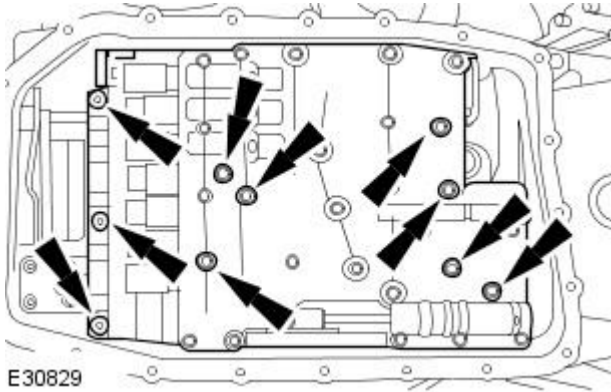
5. Remove and discard the seals.



E30831

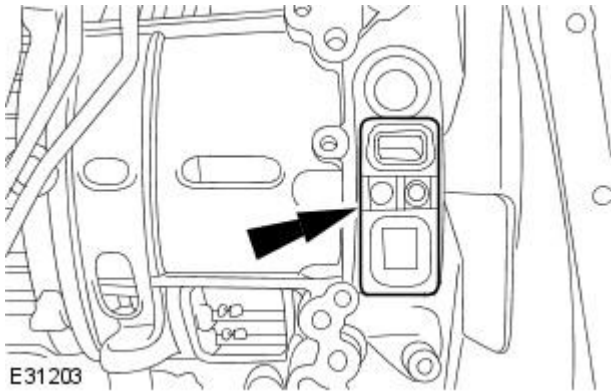
6. Remove the TCM and main control valve body.

- Remove the retaining bolts.



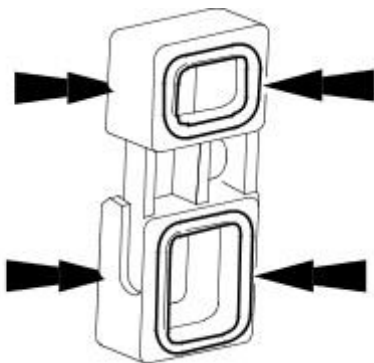
E30829

7. Remove the TCM and main control valve body sealing block.



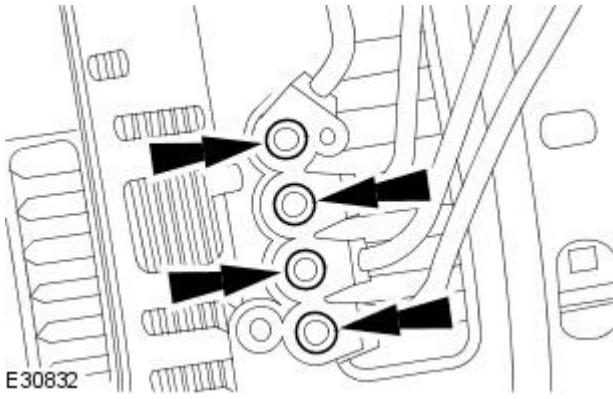
E31203

8. Remove and discard the seals.



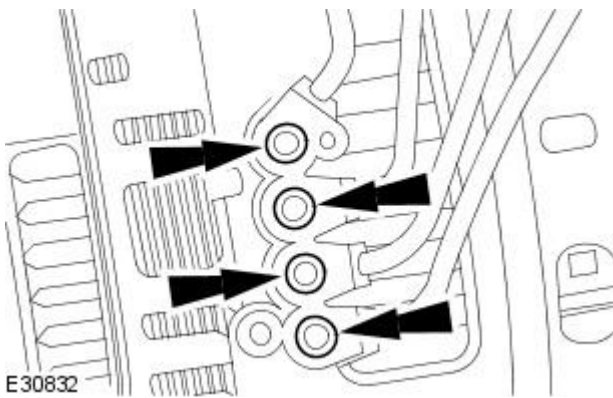
E30830

9. Remove and discard the seals.

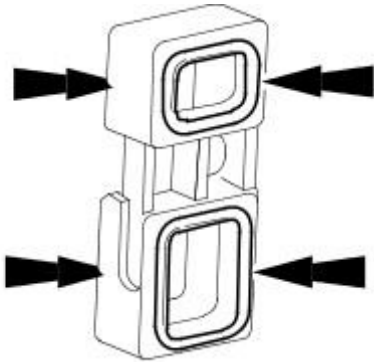


### Installation

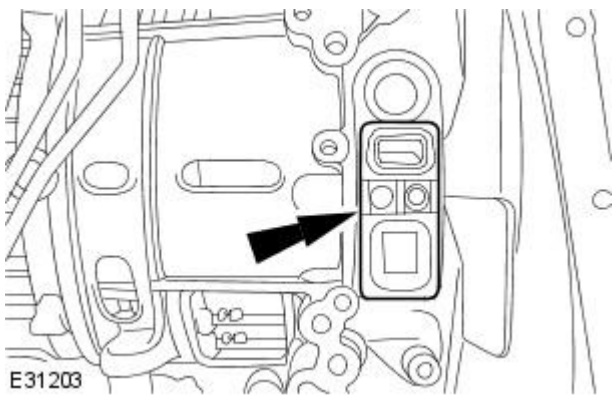
1. Install the new seals.

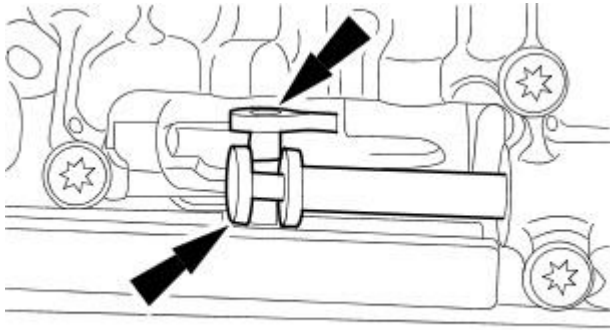


2. Install the new seals.




3. Install the TCM and main control valve body sealing block.

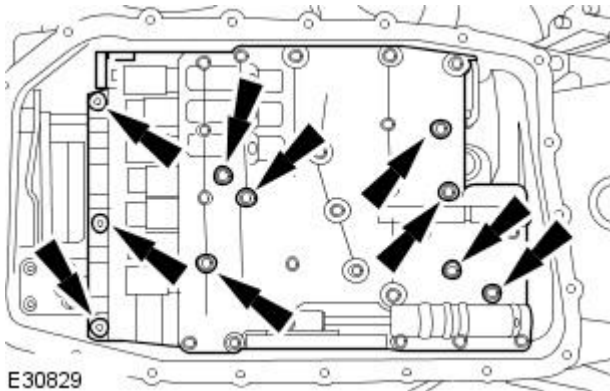




E30833

4.  CAUTION: Make sure the TCM and main control valve body are protected against electrostatic discharge. Failure to follow this instruction may result in component damage.

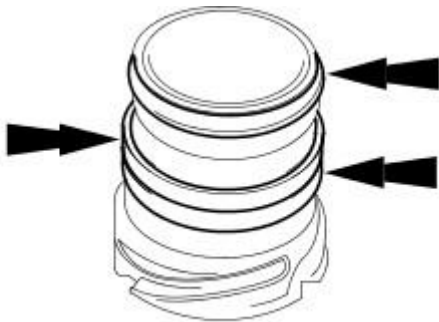
Align the transmission selector shaft to the TCM and main control valve body.



E30829

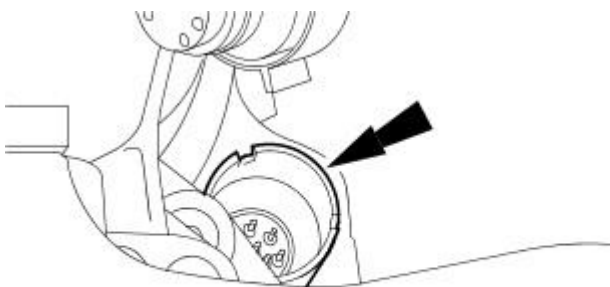
5. Install the TCM and main control valve body retaining bolts.

- Tighten to 8 Nm.




E30831

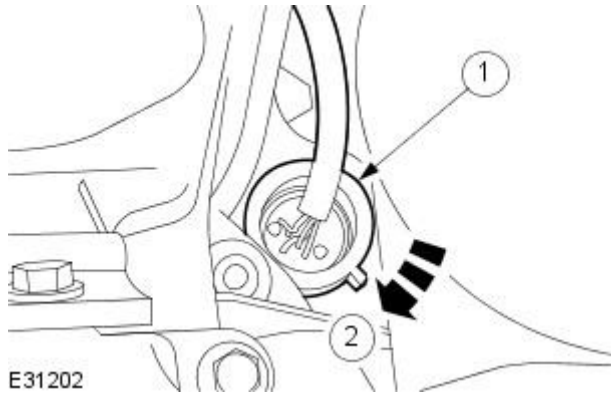
6. Install the new seals.



E30828

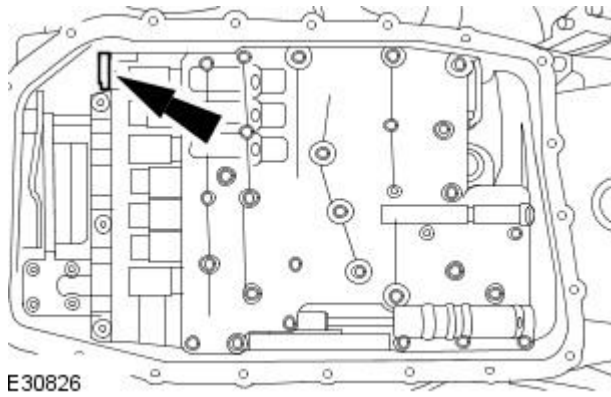
7.  CAUTION: Make sure all suitable safety precautions are taken to protect the TCM and main control valve body electrical connector pins against electrostatic discharge.

Install the sealing tube.



8. Reposition the TCM and main control valve body electrical connector retaining ring.

1. Connect the electrical connector.
2. Reposition the electrical connector retaining ring.



9. Reposition the locking device.


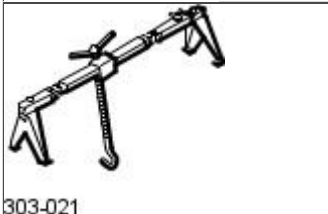
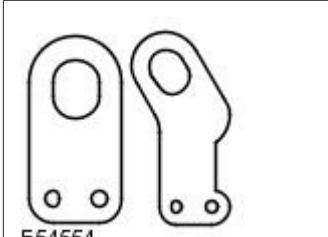
10. Install the fluid pan, gasket and filter.

For additional information, refer to: [Transmission Fluid Pan, Gasket and Filter](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, In-vehicle Repair).

# Automatic Transmission/Transaxle - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel - Transmission

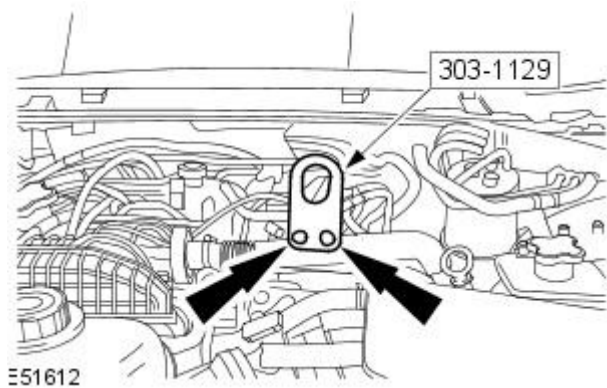
## TDV6 2.7L Diesel

### Removal

Special Tool(s)	
 HTJ12002	Powertrain Assembly Jack, HTJ 1200-2
 303-021	Engine support bracket 303-021
 E54554	Lifting Brackets - Engine 303-1129

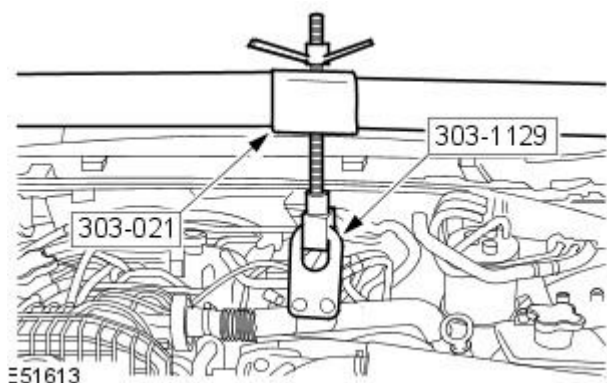
### Removal


1. Place the transmission control switch (TCS) knob in the N position.
2. Release the electronic parking brake.
3. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
4. Remove the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
5. Install the special tool.



6. Install the special tool.

- Rotate the special tool adjustment bolt a suitable amount of turns to support the engine.



7.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

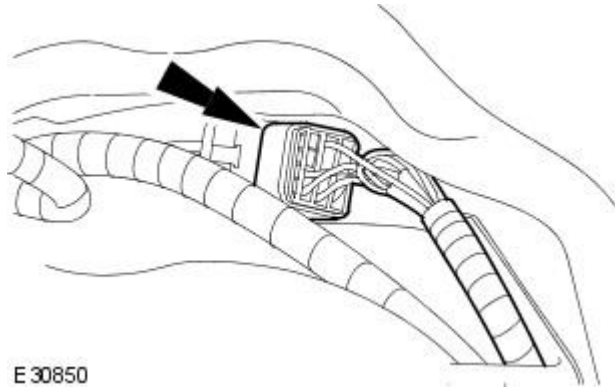


8. Remove the catalytic converters.

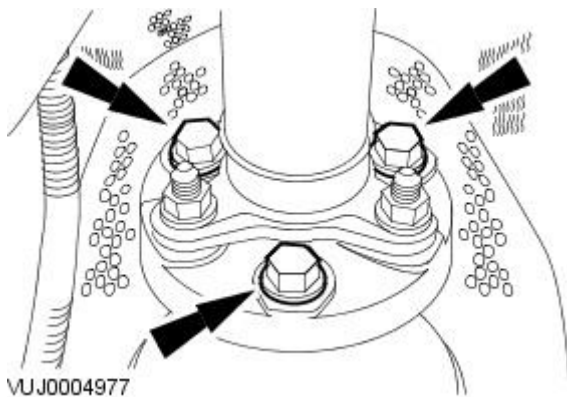
For additional information, refer to: [Catalytic Converter \(309-00A Exhaust System - TDV6 2.7L Diesel, Removal and Installation\)](#).

9. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Release and disconnect the 2 transmission wiring harness electrical connectors.



E 30850



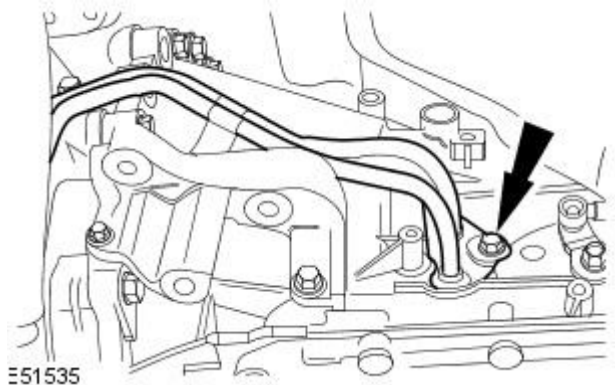
VUJ0004977

10.  CAUTION: Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the driveshaft.

• NOTE: Note the fitted position of the component/s prior to removal.

Detach the driveshaft from the transmission flange.

- Mark the position of the driveshaft in relation to the transmission flange.
- Mark the position of each nut and bolt in relation to the transmission flexible joint.
- Tie aside.



E51535

11. Release the transmission fluid cooler tubes.

- Allow the transmission fluid to drain into a suitable container.
- Remove and discard the O-ring seals.
- Install blanking caps to the exposed ports.

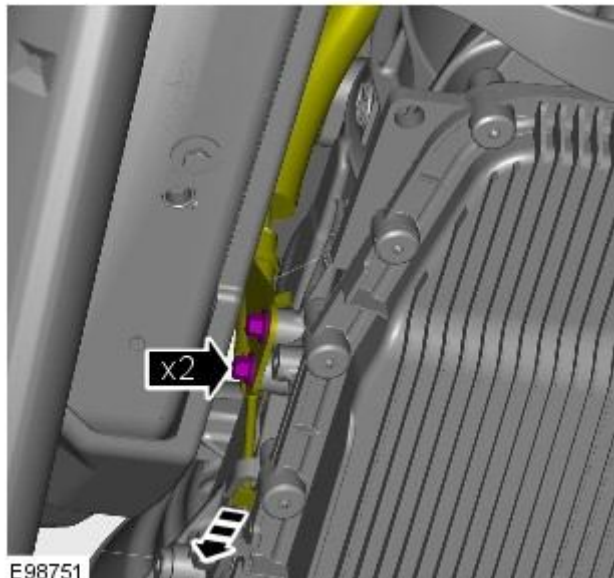


E52091

12. Detach the transmission fluid cooler tubes from the retaining bracket.

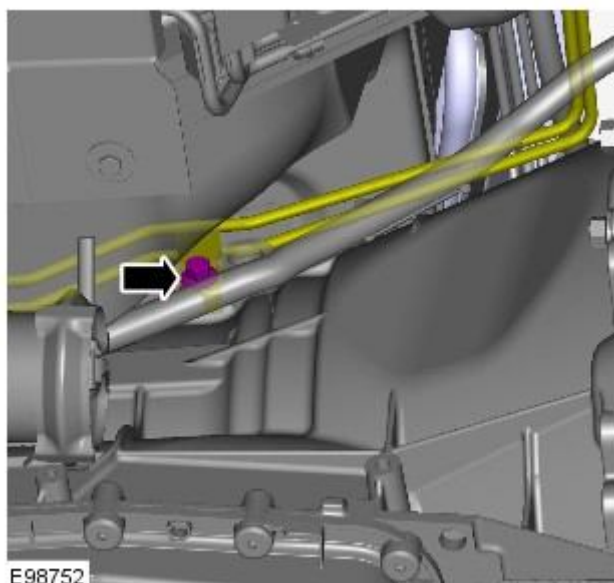
**13.** Detach the transmission park interlock release cable from the transmission.

- Release the transmission park interlock release cable from the transmission park interlock release lever.



E98751

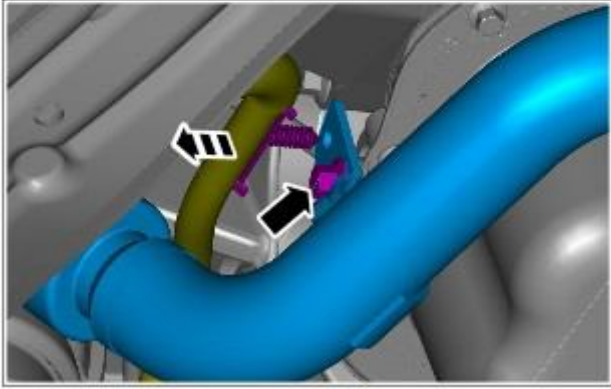
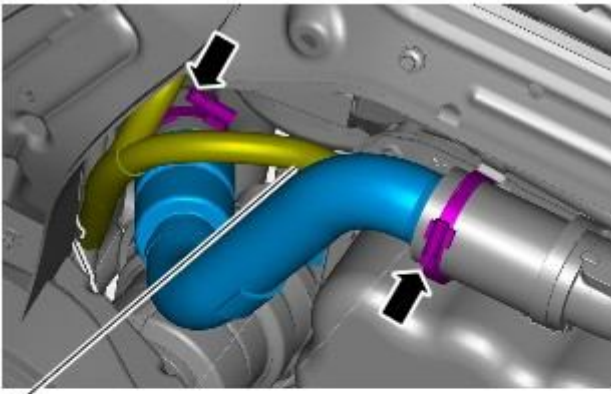
**14.** Detach the diesel particulate filter (DPF) high and low-pressure pipes from the transmission.



E98752

15. Remove the right-hand turbocharger outlet pipe.

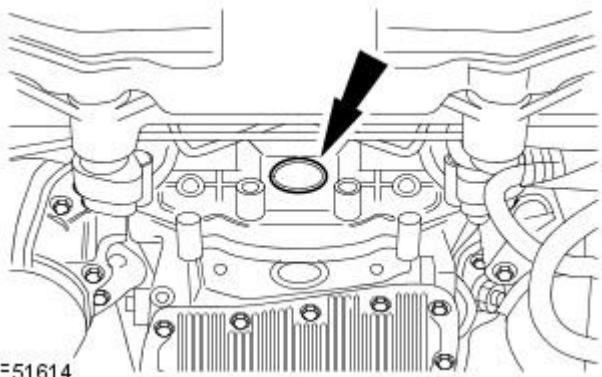
- Remove the bolt.
- Release the turbocharger outlet pipe clip.
- Detach the wiring harness clip.



E98753

16. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Remove the rubber access cover.

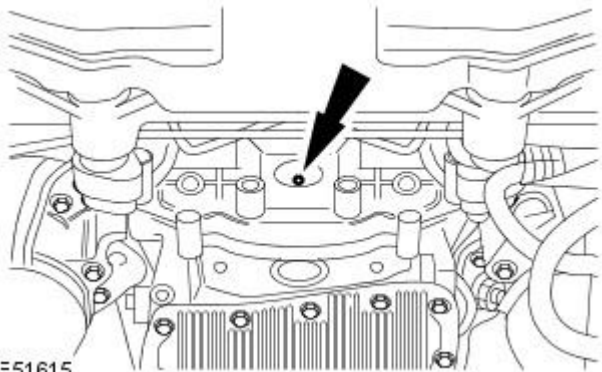


E51614

17. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

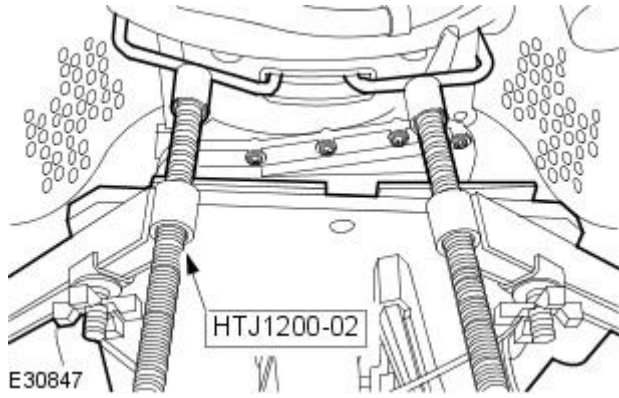
Remove the 4 retaining bolts.

- Rotate the torque converter to align with the flexplate bolt holes.



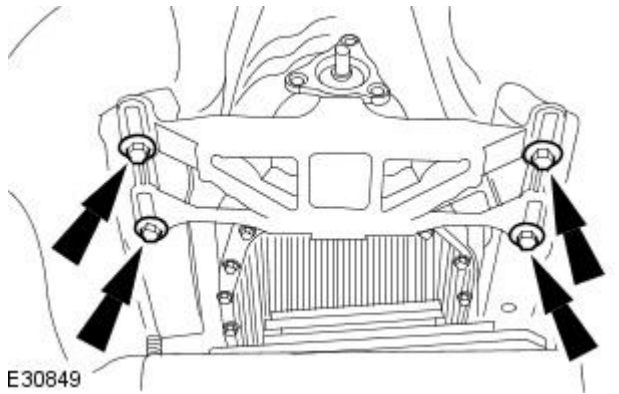
E51615

18. Install the special tool.

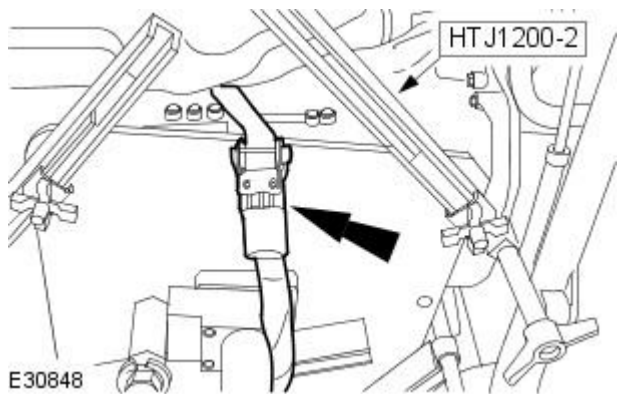


19. Using the special tool, lower the rear of the transmission.

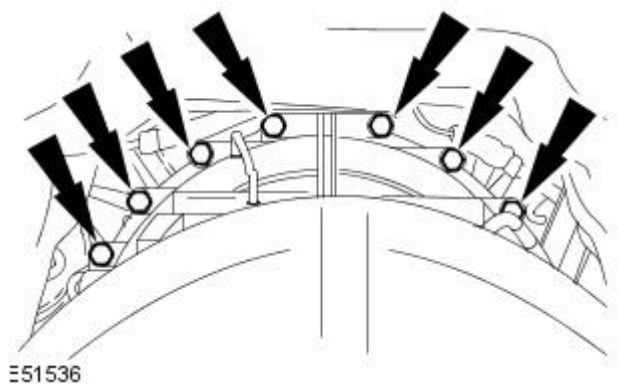
- Remove the retaining bolts.



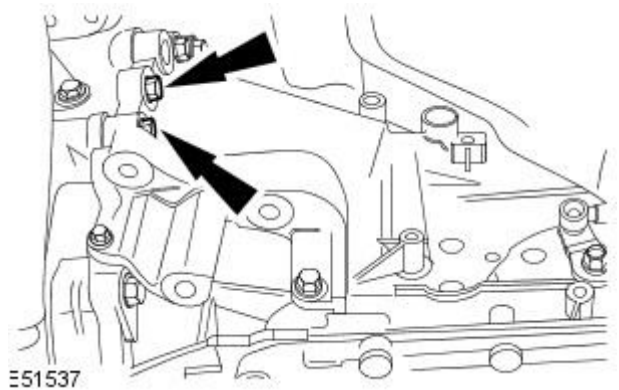
20.  **WARNING:** Secure the transmission to the transmission jack.  
Secure the retaining strap.



21. Remove the retaining bolts.

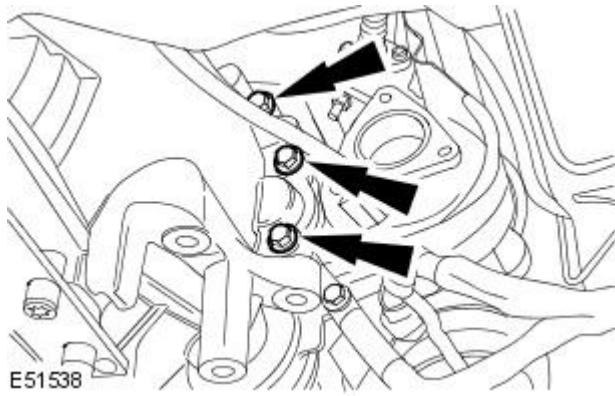


22. Remove the retaining bolts.



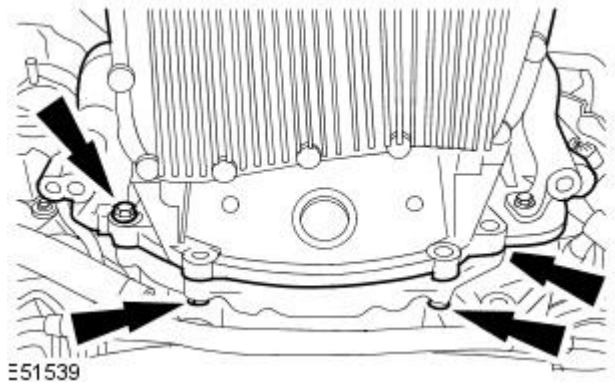


23. Remove the retaining bolts.



24. Remove the transmission and converter.

1. Remove the retaining bolts.
2. Displace the transmission from the engine locating dowels.
3. Lower the transmission.

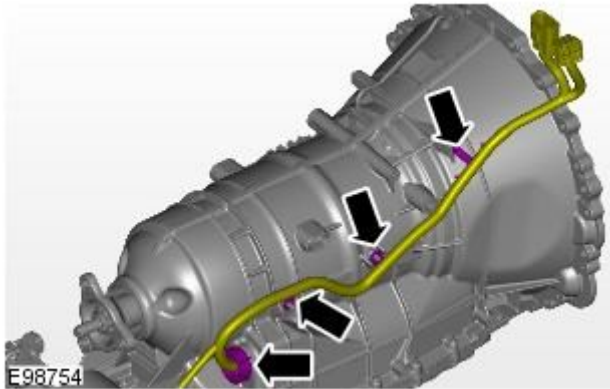


25. With assistance, remove the transmission from the special tool.

26. NOTE: Do not disassemble further if the component is removed for access only.

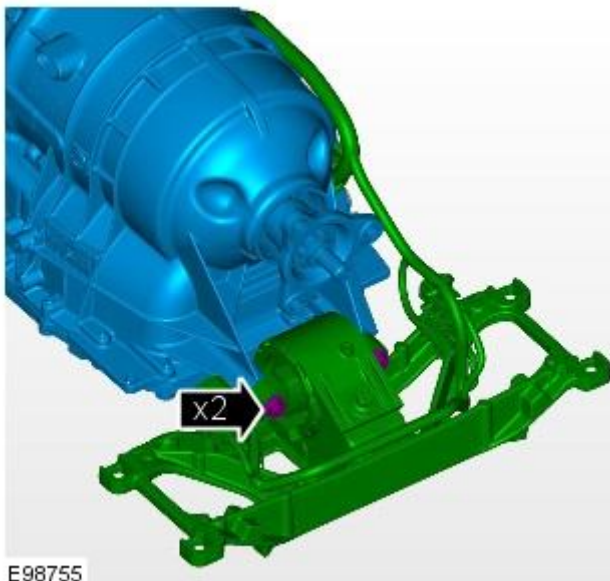
Remove the wiring harness.

- Disconnect the electrical connector.
- Release the 3 wiring harness clips.





27. Remove the transmission rear support bracket.

- Remove the two support bracket retaining bolts.




# Automatic Transmission/Transaxle - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel - Transmission V6 3.0L Petrol

## Removal

Special Tool(s)	
 303-021	Engine support bracket 303-021
 HTJ1200-2	Power train assembly jack HTJ1200-2

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).
4. Remove the engine rear undershield.  
For additional information, refer to: [Engine Rear Undershield](#) (501-02 Front End Body Panels, Removal and Installation).
5. Remove the catalytic converters.  
For additional information, refer to: [Catalytic Converter](#) (309-00B Exhaust System - V6 3.0L Petrol, Removal and Installation).
6. Remove the starter motor.  
For additional information, refer to: [Starter Motor](#) (303-06B Starting System - V6 3.0L Petrol, Removal and Installation).

7.  **CAUTION:** Under no circumstances must the flexible coupling (or it's fixings) be loosened or removed from the driveshaft.

- **NOTE:** Note the fitted position of the component/s prior to removal.

Detach the driveshaft from the transmission flange.

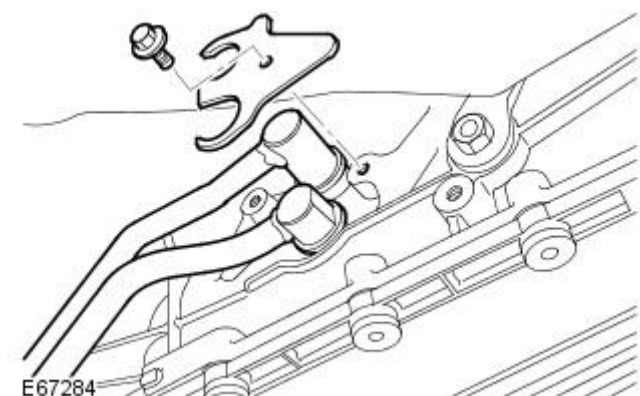
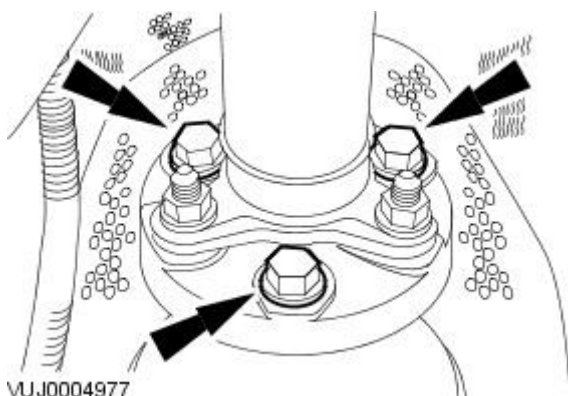
- Mark the position of the driveshaft in relation to the transmission flange.
- Mark the position of each nut and bolt in relation to the transmission flexible joint.

8.  **CAUTION:** Always plug any open connections to prevent contamination.

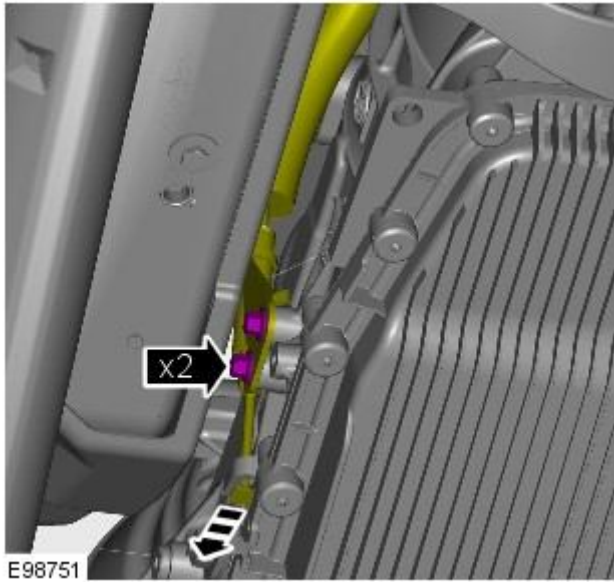
- **NOTE:** Position cloth to collect fluid spillage.

Release the transmission fluid lines.

- Remove the bolt.
- Remove and discard both O-ring seals.

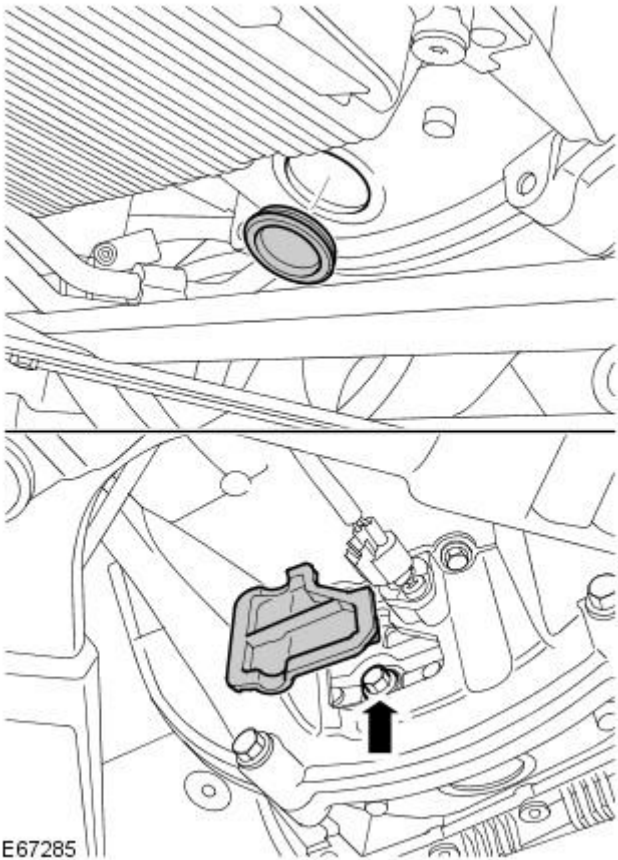






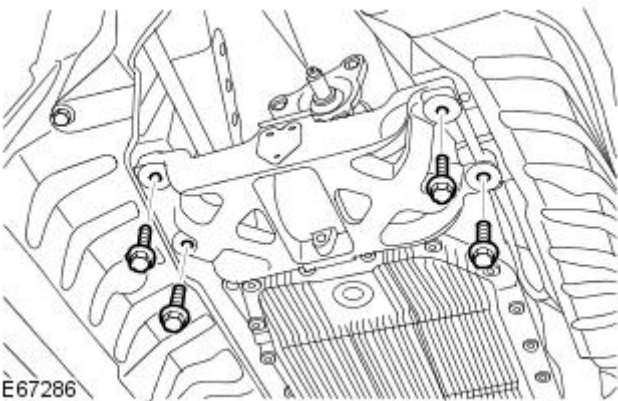
9. Detach the transmission park interlock release cable from the transmission.

- Release the transmission park interlock release cable from the transmission park interlock release lever.



10. Release the torque converter from the flexplate.

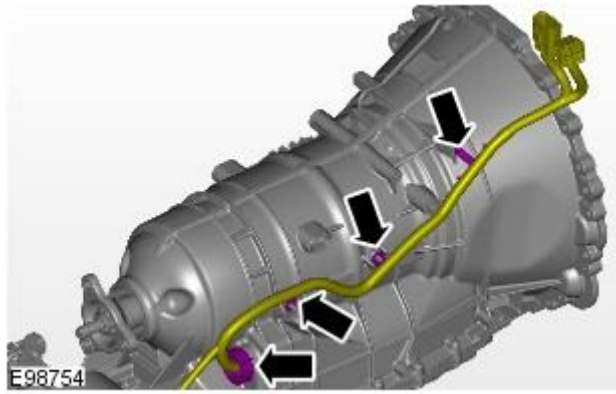
- Remove the access plugs.
- Rotate the crankshaft to access the retaining bolts.
- Remove the 3 bolts.



11. Using a transmission jack, support the transmission.

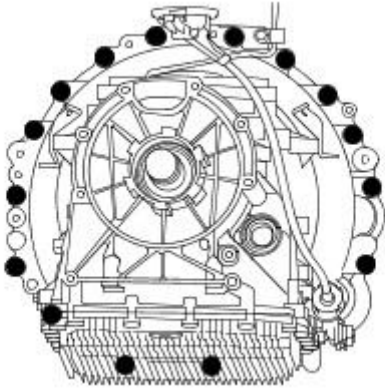
12. Release the transmission support insulator.

- Remove the 4 bolts.



13. Release the wiring harness from the RH side of the transmission.

- Disconnect the transmission electrical connector.
- Carefully release the 3 clips.



14. Install the torque converter retainer.

15. WARNINGS:



Secure the transmission to the transmission jack.



Support the engine. The engine will fall forward when the transmission is removed.





CAUTION: Make sure the torque converter remains connected to the transmission.

With assistance, remove the transmission.



- Remove the 15 bolts.

# Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Transmission 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Removal

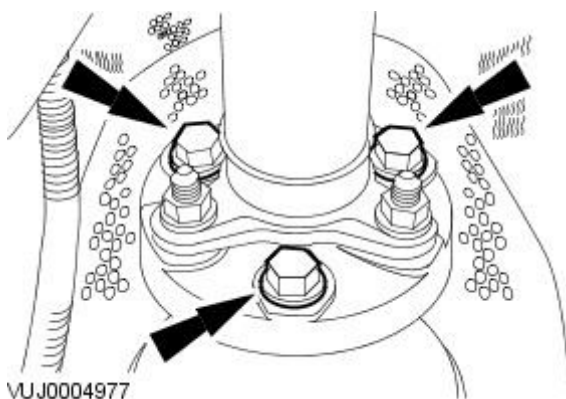
Special Tool(s)	
 303-021	Engine support bracket 303-021
 HTJ1200-2	Power train assembly jack HTJ1200-2

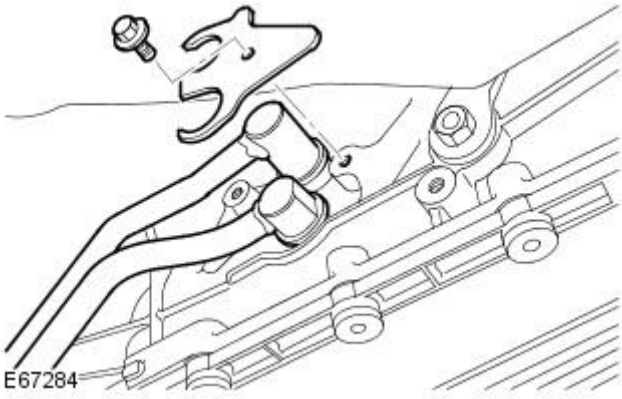
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the engine rear undershield.  
For additional information, refer to: [Engine Rear Undershield](#) (501-02 Front End Body Panels, Removal and Installation).
4. Remove the starter motor.  
For additional information, refer to: [Starter Motor](#) (303-06 Starting System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
5. Remove the catalytic converters.  
For additional information, refer to: [Catalytic Converter](#) (309-00, Removal and Installation).
6.  **CAUTION:** Under no circumstances must the flexible coupling (or it's fixings) be loosened or removed from the driveshaft.  
  
• **NOTE:** Note the fitted position of the component/s prior to removal.

Detach the driveshaft from the transmission flange.

- Mark the position of the driveshaft in relation to the transmission flange.
- Mark the position of each nut and bolt in relation to the transmission flexible joint.



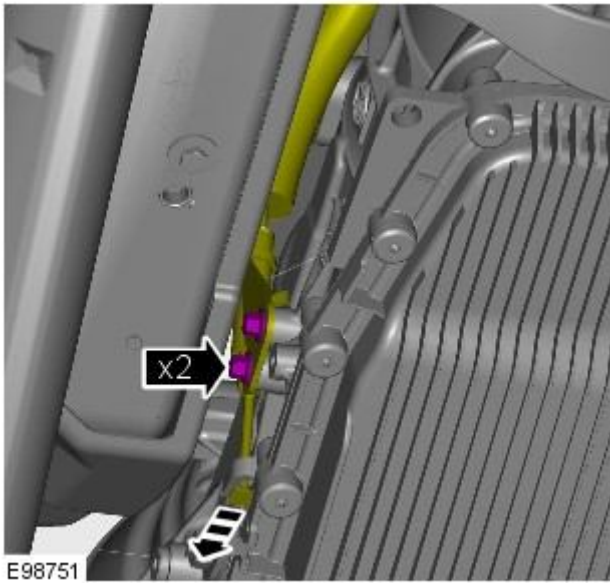


7.  **CAUTION:** Always plug any open connections to prevent contamination.

- **NOTE:** Position cloth to collect fluid spillage.

Release the transmission fluid lines.

- Remove the bolt.
- Remove and discard both O-ring seals.

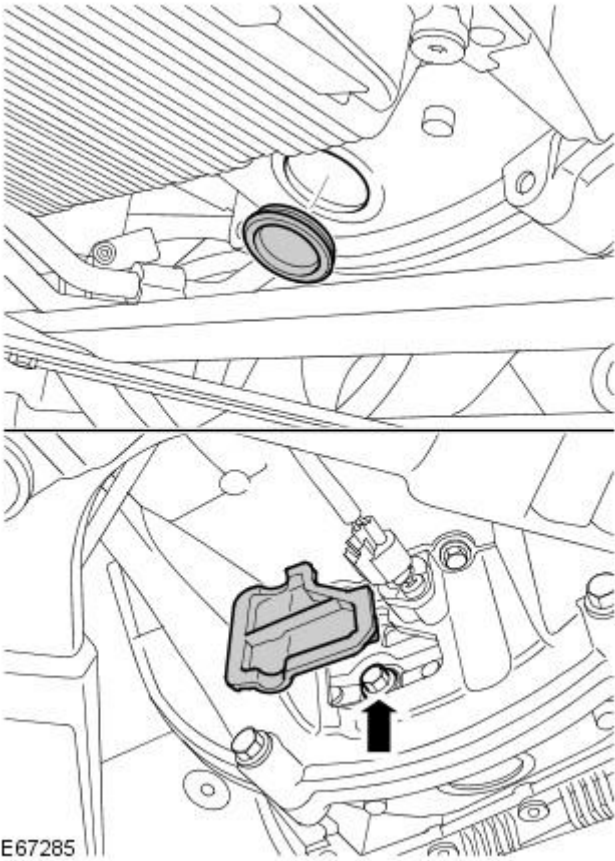


8. Detach the transmission park interlock release cable from the transmission.

- Release the transmission park interlock release cable from the transmission park interlock release lever.

9. Release the torque converter from the flexplate.

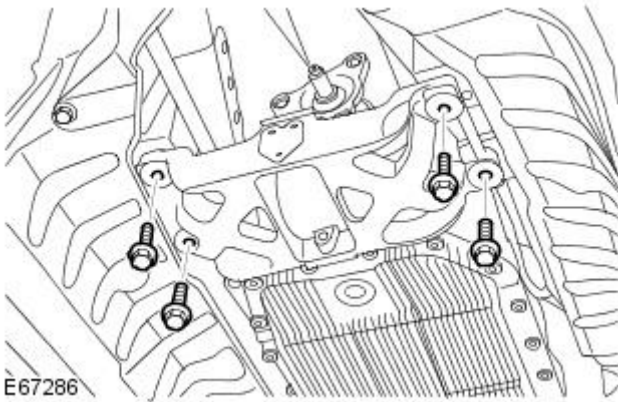
- Remove the access plugs.
- Rotate the crankshaft to access the retaining bolts.
- Remove the 3 bolts.



10. Using a transmission jack, support the transmission.

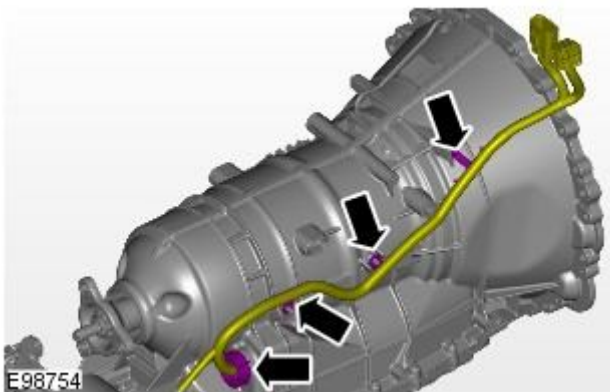
11. Release the transmission support insulator.

- Remove the 4 bolts.



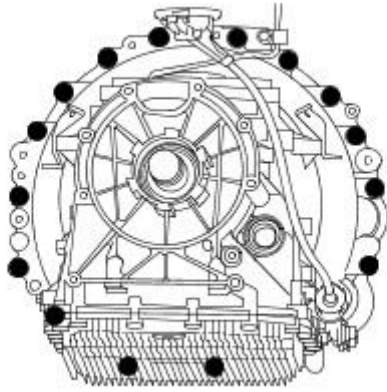
12. Release the wiring harness from the RH side of the transmission.

- Disconnect the transmission electrical connector.
- Carefully release the 3 clips.



13. Install the torque converter retainer.





E68824

#### 14. WARNINGS:



Secure the transmission to the transmission jack.



Support the engine. The engine will fall forward when the transmission is removed.



**CAUTION:** Make sure the torque converter remains connected to the transmission.




With assistance, remove the transmission.

- Remove the 15 bolts.



# Automatic Transmission/Transaxle - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel - TransmissionTDV6 2.7L Diesel

## Installation

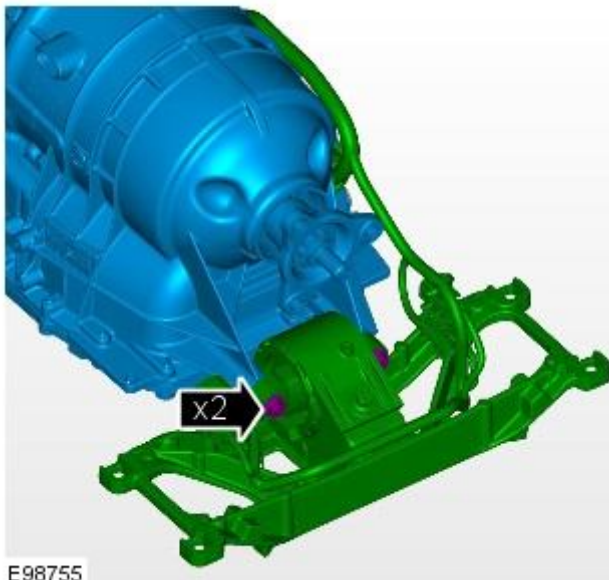
Special Tool(s)	
 HTJ12002	Powertrain Assembly Jack, HTJ 1200-2
 303-021	Engine support bracket 303-021
 E54554	Lifting Brackets - Engine 303-1129

## Installation

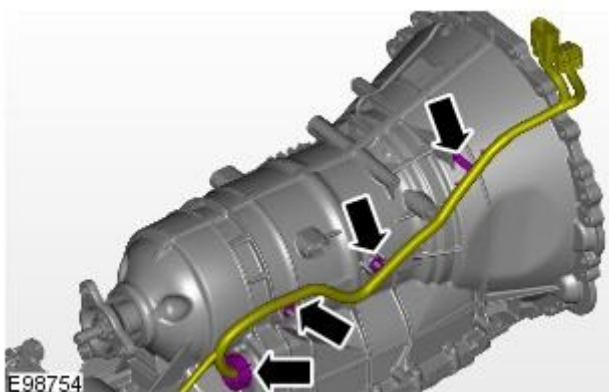
-  **CAUTION:** If installing a new transmission, the oil cooler must be flushed.

Flush the transmission oil cooler and fluid tubes.

- Install the transmission rear support bracket.
  - Install the the two support bracket retaining bolts.
  - Tighten to 45 Nm.



- Attach the wiring harness.
  - Attach the 3 wiring harness clips.
  - Connect the electrical connector.



4. With assistance, install the transmission to the special tool.

- Secure the retaining strap.

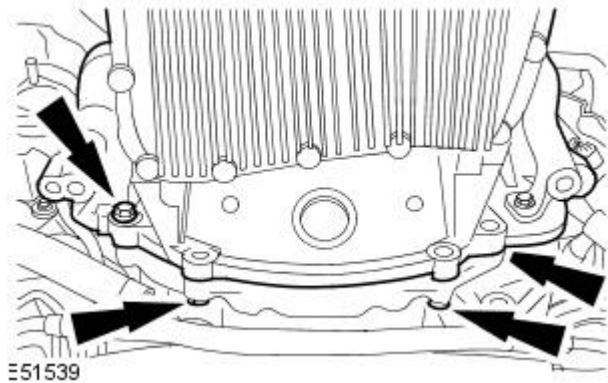
5.  **CAUTION:** Apply grease of the correct specification to the torque converter spigot.

Apply a thin layer of high-temperature grease to the centering spigot bore on the torque converter.

6.  **CAUTION:** Make sure the torque converter remains connected to the transmission.

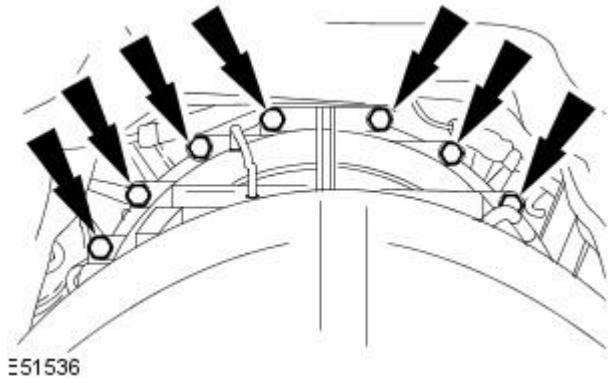
Install the transmission and converter.

- Using a transmission jack, carefully raise the assembly.
- Make sure the transmission engages correctly with the engine locating dowels.
- Loosely install the bolts.



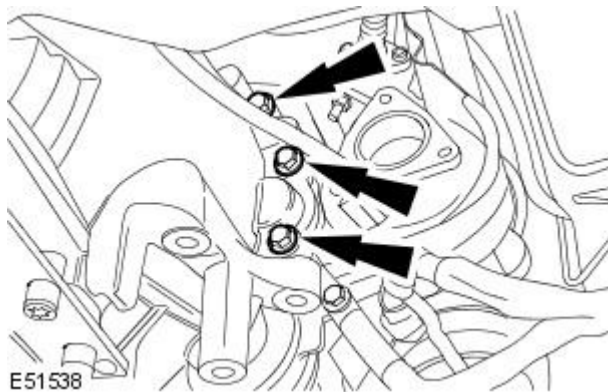
7. Install the retaining bolts.

- Tighten to 48 Nm.



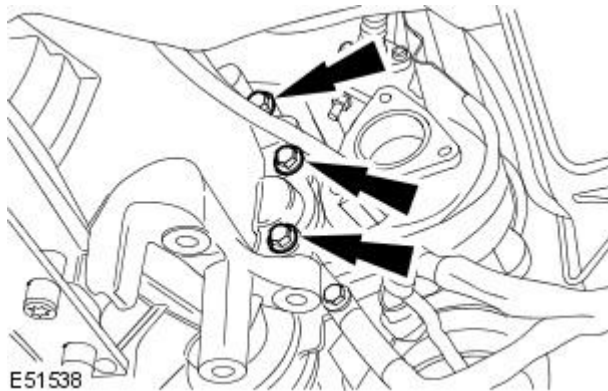
8. Install the retaining bolts.

- Tighten to 48 Nm.



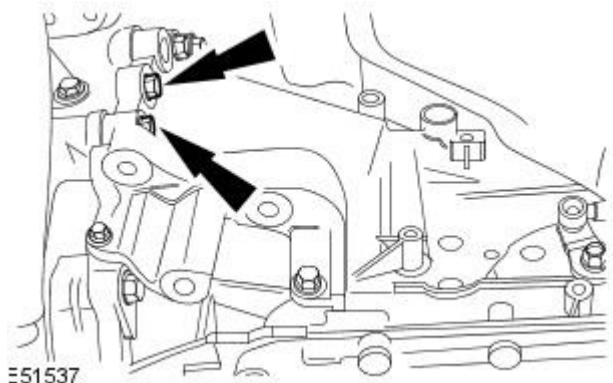
9. Install the retaining bolts.

- Tighten to 48 Nm.

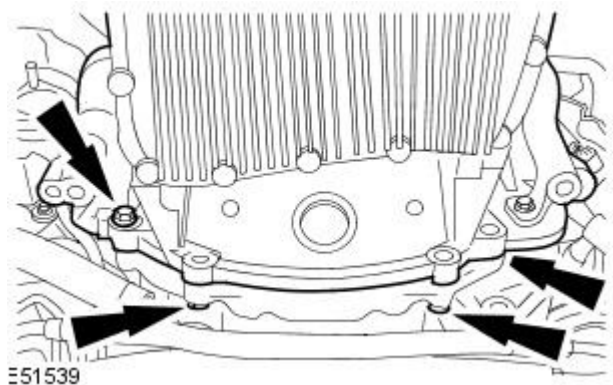


10. Install the retaining bolts.

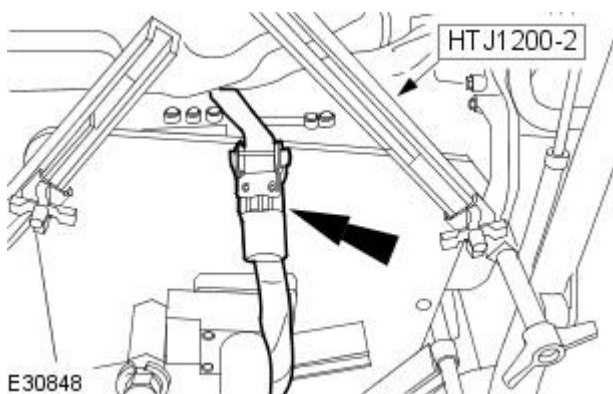
- Tighten to 48 Nm.



11. Tighten to 48 Nm.

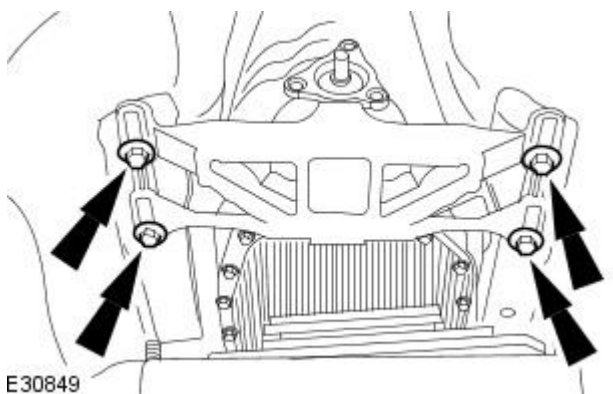


12. Remove the retaining strap.

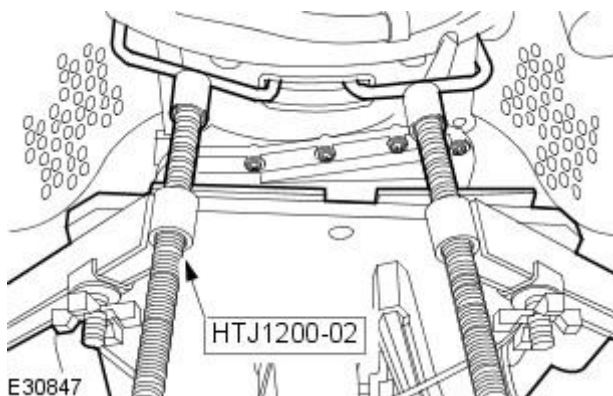


13. Using the special tool, raise the rear of the transmission.

- Install the retaining bolts.
- Tighten to 50 Nm.



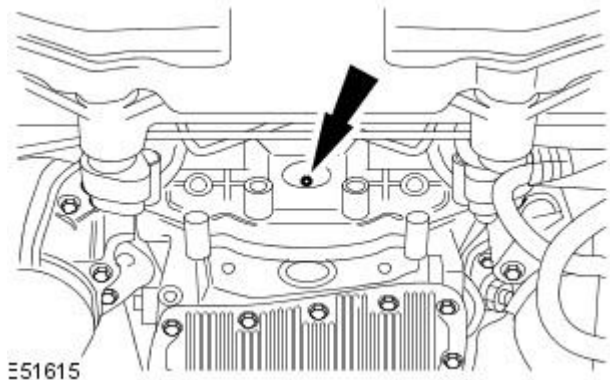
14. Remove the special tool.



**15.** NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Install the retaining bolts.

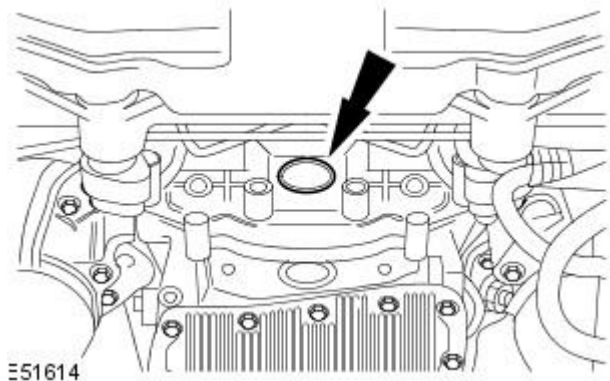
- Rotate the torque converter to align with the flexplate bolt holes.
- Tighten to 55 Nm.



E51615

**16.** NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

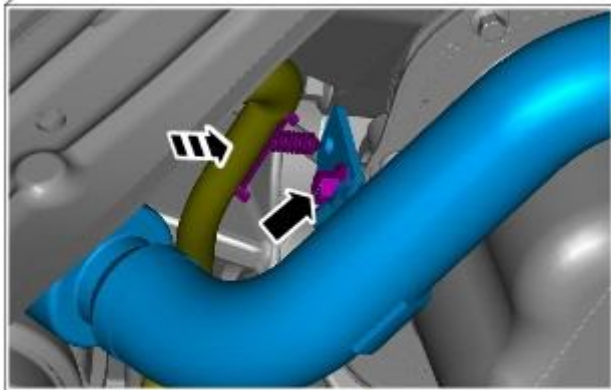
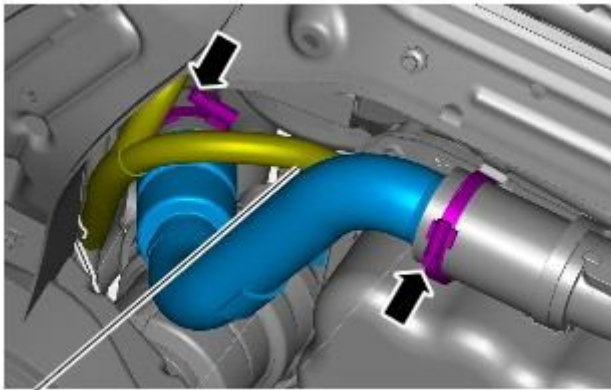
Install the rubber access cover.



E51614

**17.** Install the right-hand turbocharger outlet pipe.

- Secure the turbocharger outlet pipe clip.
- Install and tighten the bolt.
- Tighten to 9 Nm.
- Attach the wiring harness clip.

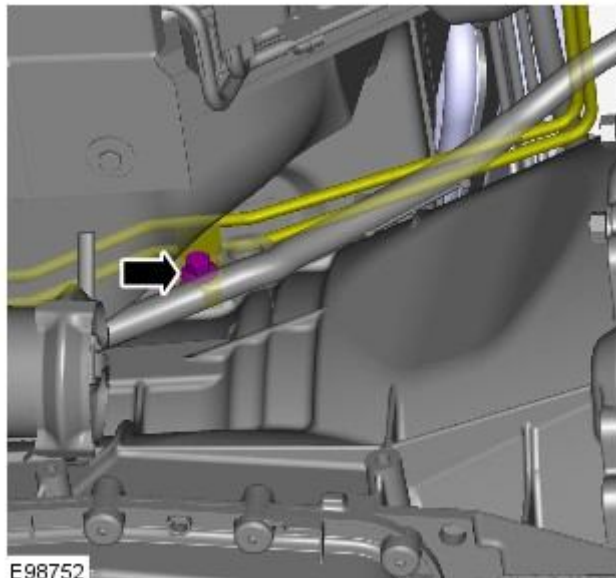


E98850



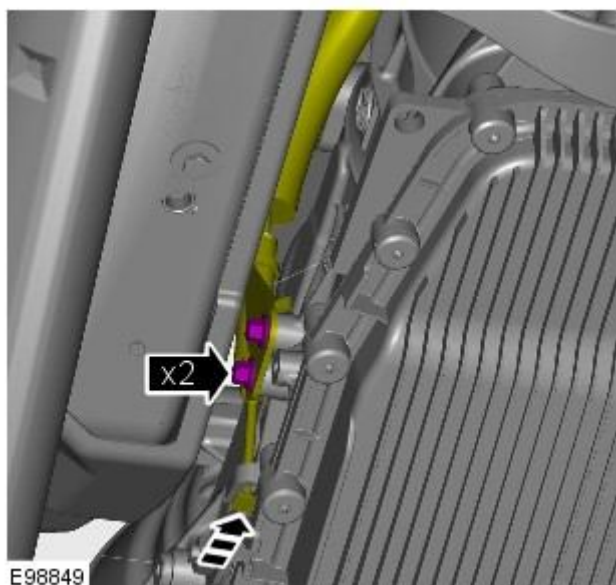
18. Attach the DPF high and low-pressure pipes to the transmission.

- Tighten to 9 Nm.



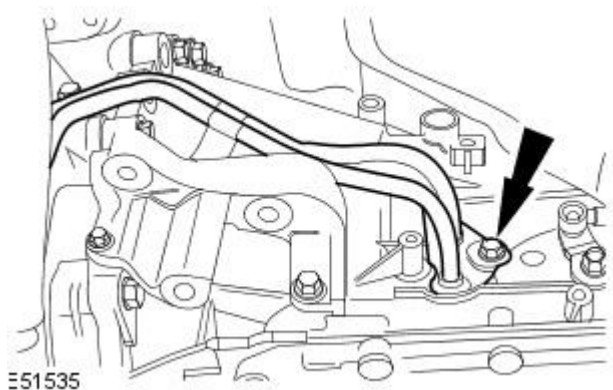
19. Attach the transmission park interlock release cable to the transmission.

- Secure the transmission park interlock release cable to the transmission park interlock release lever.
- Tighten to 9 Nm.



20. Attach the transmission fluid cooler tubes to the automatic transmission.

- Install new O-ring seals.
- Lubricate the O-ring seals.
- Tighten to 23 Nm.



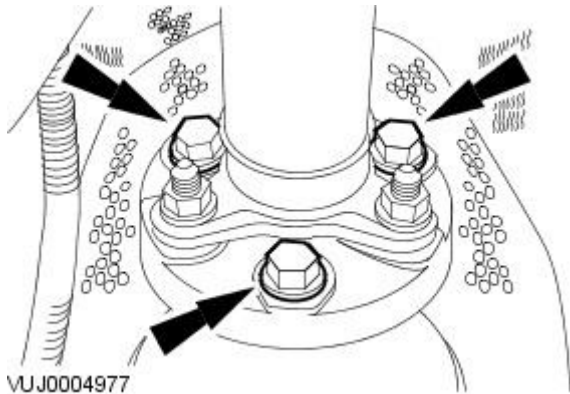
21. Attach the transmission fluid cooler tubes to the retaining bracket.



22. NOTE: Install the components to their original fitted positions.

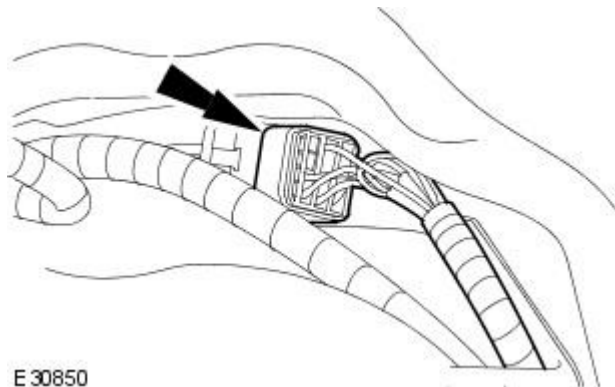
Attach the driveshaft to the transmission flange.

- Tighten to 127 Nm.



23. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Connect the transmission wiring harness electrical connectors.

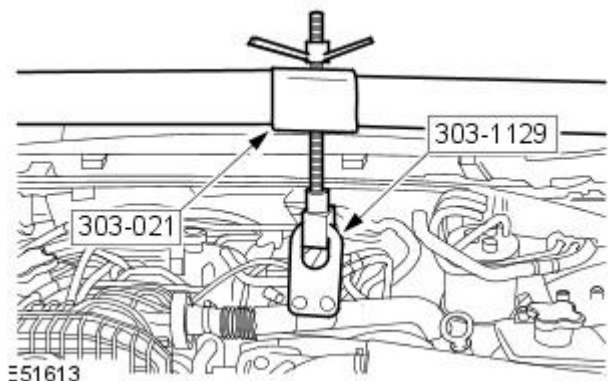


24. Install the catalytic converters.

For additional information, refer to: [Catalytic Converter](#) (309-00A Exhaust System - TDV6 2.7L Diesel, Removal and Installation).

25. Lower the vehicle.

26. Remove the special tool.



27. Install the engine cover.

For additional information, refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).

28. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

29. Apply the electronic parking brake.


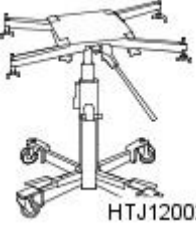
30. Check and top-up the transmission fluid level.

For additional information, refer to: [Transmission Fluid Level Check](#) (307-01 Automatic Transmission/Transaxle - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel, General Procedures).

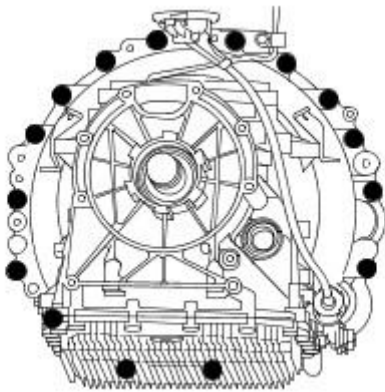


# Automatic Transmission/Transaxle - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel - Transmission/V6 3.0L Petrol

## Installation

Special Tool(s)	
 303-021	Engine support bracket 303-021
 HTJ12002	Power train assembly jack HTJ1200-2

## Installation



E68824

1.  **WARNING:** Secure the transmission to the transmission jack.

 **CAUTION:** Make sure the torque converter remains connected to the transmission.

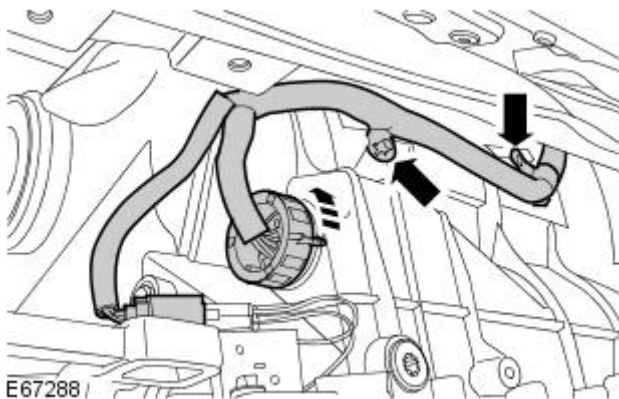
With assistance, install the transmission.

- Install the 15 bolts.
- Tighten to 48 Nm.

2. Remove the torque converter retainer.

3. Install the transmission wiring harness.

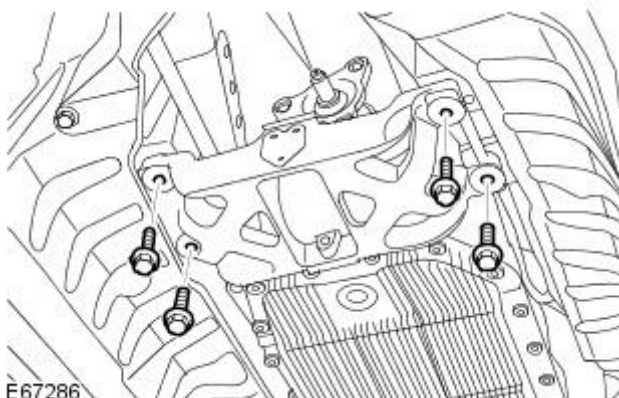
- Connect the transmission electrical connector.
- Carefully secure the 3 clips.



E67288

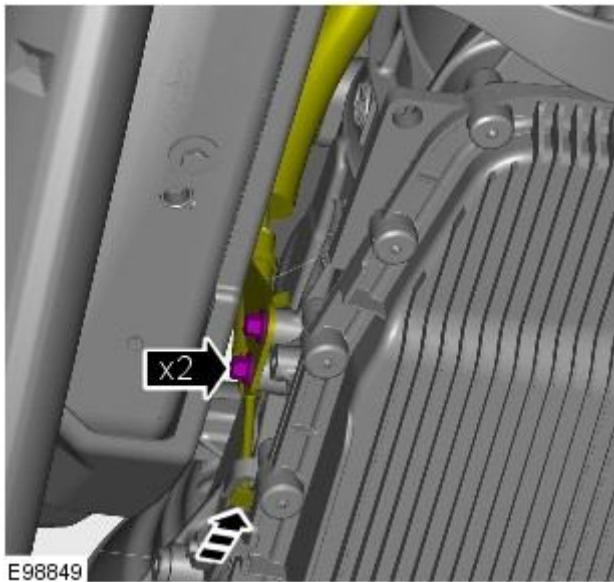
4. Install the transmission support insulator.

- Install the 4 bolts.



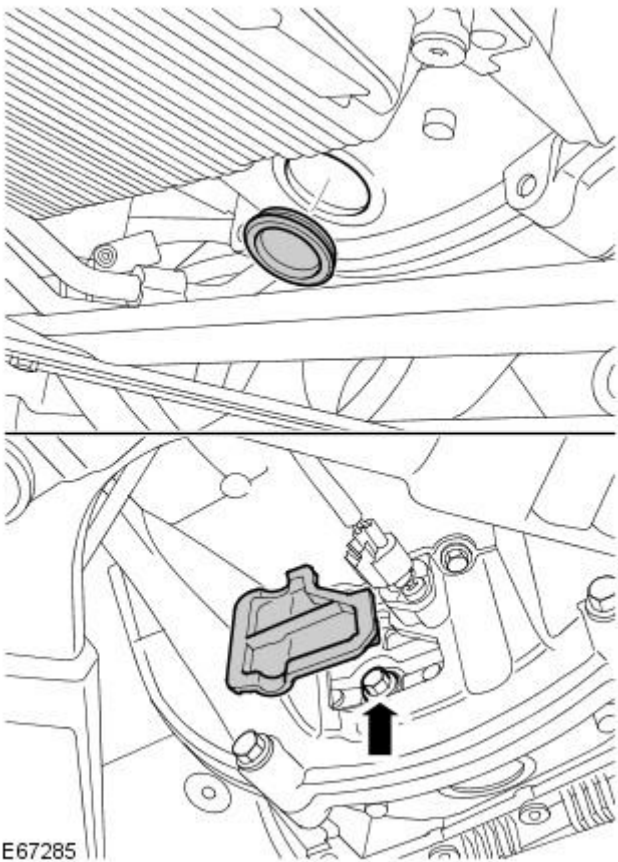
E67286

5. Using a transmission jack, support the transmission.



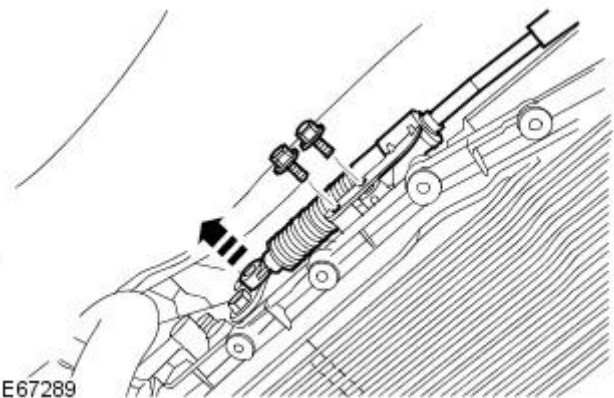
6. Attach the transmission park interlock release cable to the transmission.

- Secure the transmission park interlock release cable to the transmission park interlock release lever.
- Tighten to 9 Nm.



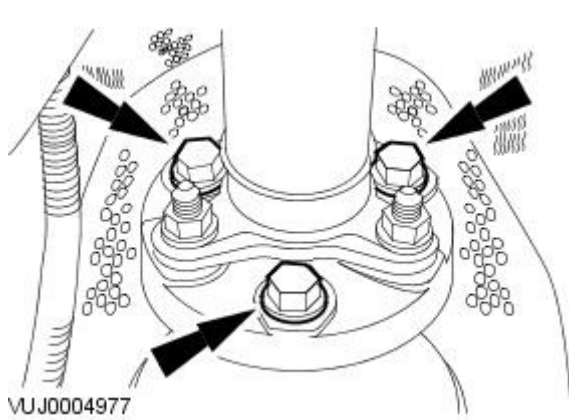
7. Attach the flexplate to the torque converter.

- Install the access plugs.
- Rotate the crankshaft to access the retaining bolts.
- Install the 3 bolts.
- Tighten to 55 Nm.



8. Secure and connect the selector lever cable.

- Install the 2 bolts.



9.  CAUTION: Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the driveshaft.

• NOTE: Note the fitted position of the component/s prior to removal.

Connect the driveshaft to the rear flange.

- Mark the position of the driveshaft in relation to the transmission flange.
- Mark the position of each nut and bolt in relation to the transmission flexible joint.
- Tighten to 127 Nm.

10. Check and top-up the transmission fluid level.

11. Install the starter motor.

For additional information, refer to: [Starter Motor](#) (303-06B Starting System - V6 3.0L Petrol, Removal and Installation).

12. Install the catalytic converters.

For additional information, refer to: [Catalytic Converter](#) (309-00B Exhaust System - V6 3.0L Petrol, Removal and Installation).

13. Install the engine rear undershield.

For additional information, refer to: [Engine Rear Undershield](#) (501-02 Front End Body Panels, Removal and Installation).

14. Install the air deflector.

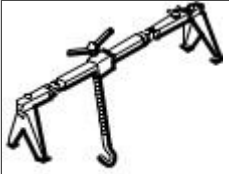

For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

15. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Transmission 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Installation

Special Tool(s)	
 303-021	Engine support bracket 303-021
 HTJ1200-2	Power train assembly jack HTJ1200-2

## Installation

### 1. WARNINGS:



Secure the transmission to the transmission jack.



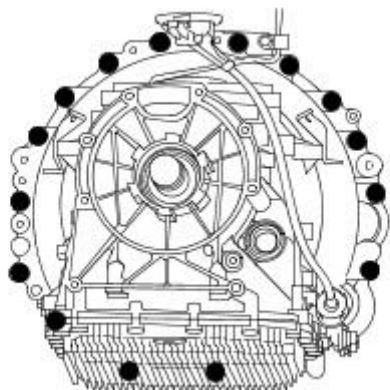
Support the engine. The engine will fall forward when the transmission is removed.



**CAUTION:** Make sure the torque converter remains connected to the transmission.

With assistance, install the transmission.

- Tighten the 15 bolts to 48 Nm.

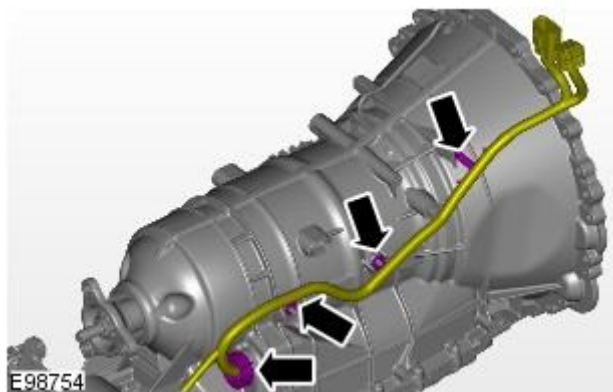


E68824

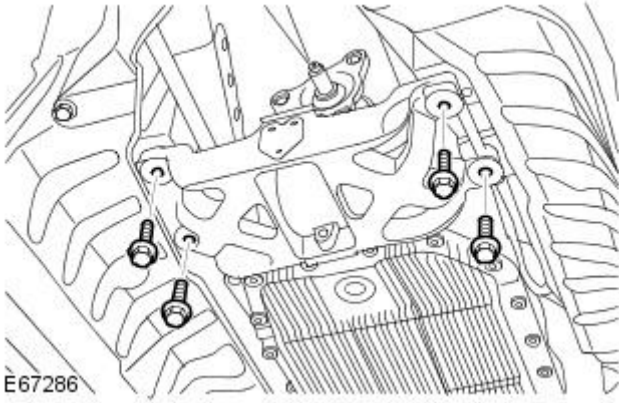
### 2. Remove the torque converter retainer.

### 3. Install the transmission wiring harness.

- Connect the transmission electrical connector.
- Attach the 3 wiring harness clips.



E98754



E67286

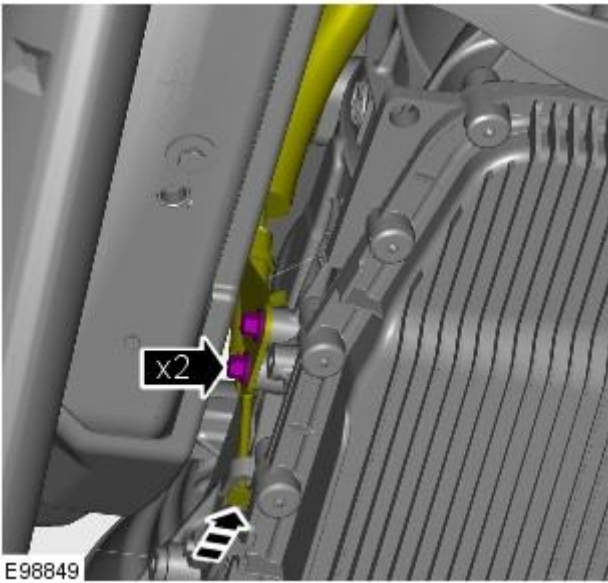
4. Install the transmission support insulator.

- Install the 4 bolts.

5. Using a transmission jack, support the transmission.

6. Attach the transmission park interlock release cable to the transmission.

- Secure the transmission park interlock release cable to the transmission park interlock release lever.
- Tighten to 9 Nm.

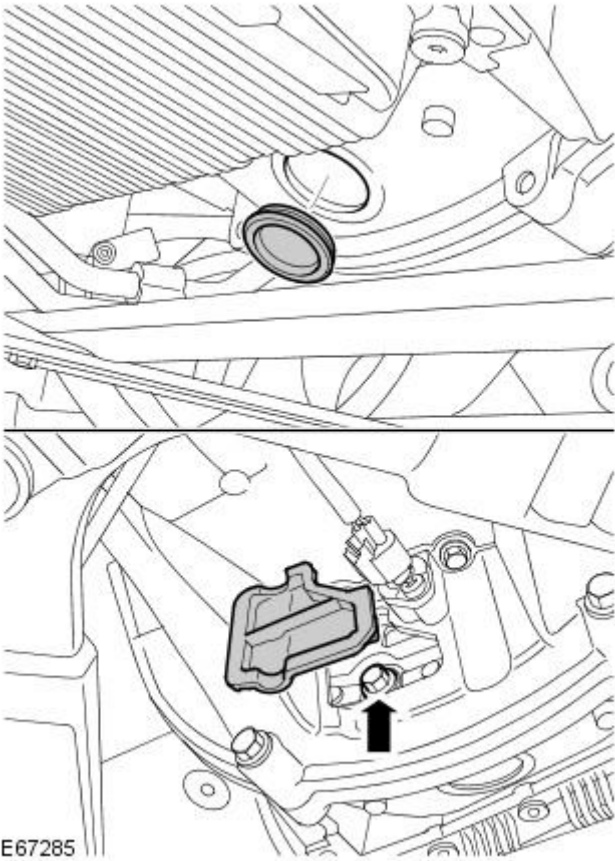


E98849



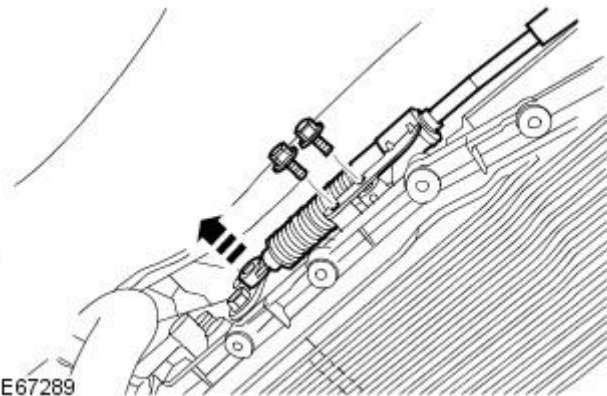
7. Attach the flexplate to the torque converter.


- Rotate the crankshaft to access the retaining bolts.
- Tighten to 55 Nm.
- Install the access plugs.
- Install the 3 bolts.



8. Secure and connect the selector lever cable.

- Install the 2 bolts.

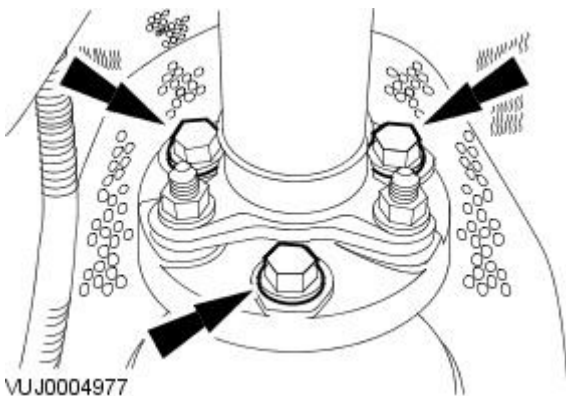


9.  CAUTION: Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the driveshaft.

- NOTE: Note the fitted position of the component/s prior to removal.

Connect the driveshaft to the rear flange.

- Tighten to 127 Nm.



10. Check and top-up the transmission fluid level.

11. Install the starter motor.

For additional information, refer to: [Starter Motor](#) (303-06 Starting System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).

12. Install the catalytic converters.



For additional information, refer to: Catalytic Converter (309-00 Exhaust System - 3.0L NA V6 - AJ27, Removal and Installation).

**13.** Install the engine rear undershield.

For additional information, refer to: [Engine Rear Undershield](#) (501-02 Front End Body Panels, Removal and Installation).

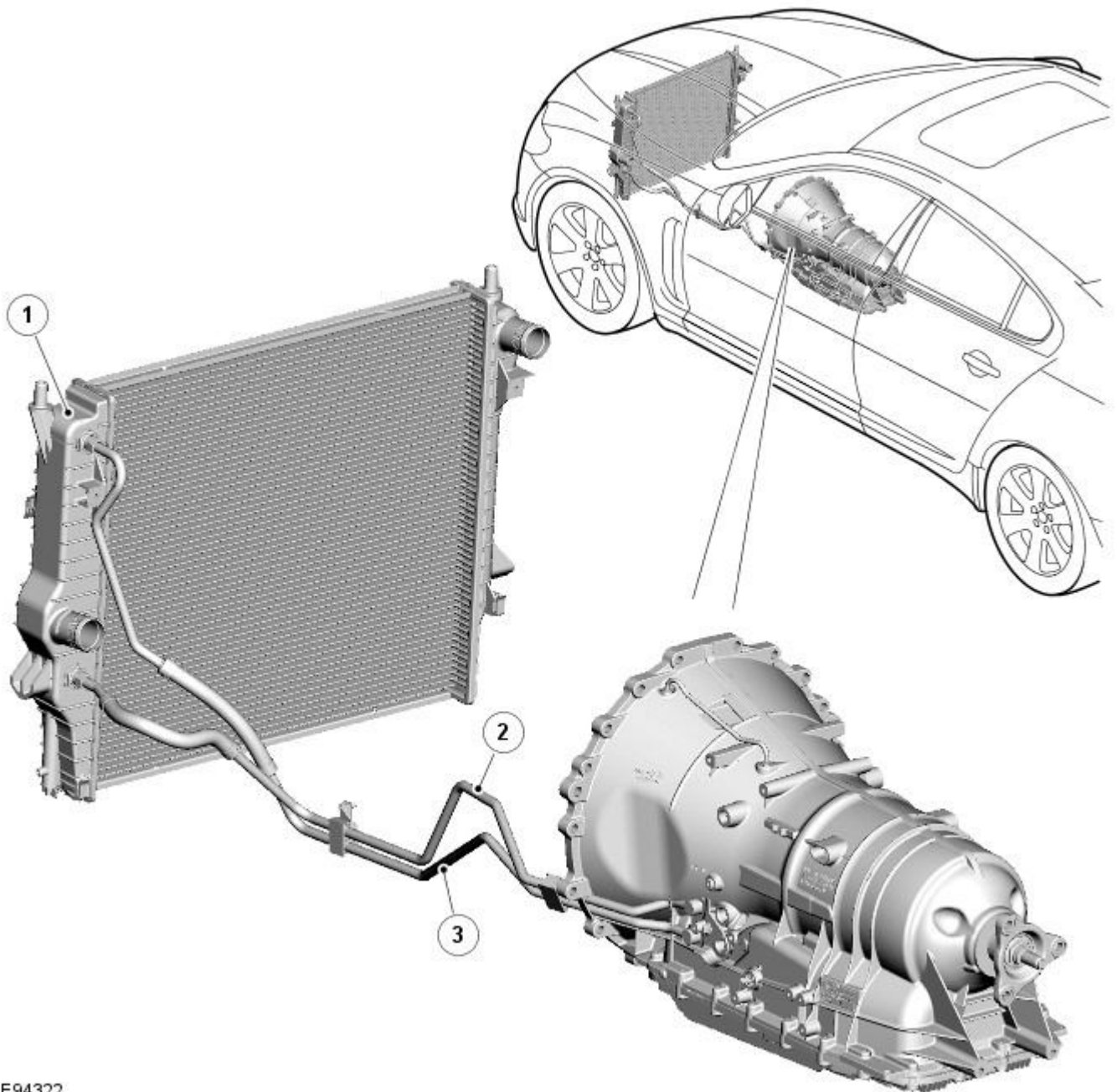
**14.** Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Transmission/Transaxle Cooling - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Transmission Cooling Vehicles With: ZF 6HP26 - Component Location

Description and Operation

COMPONENT LOCATION - PETROL ENGINES

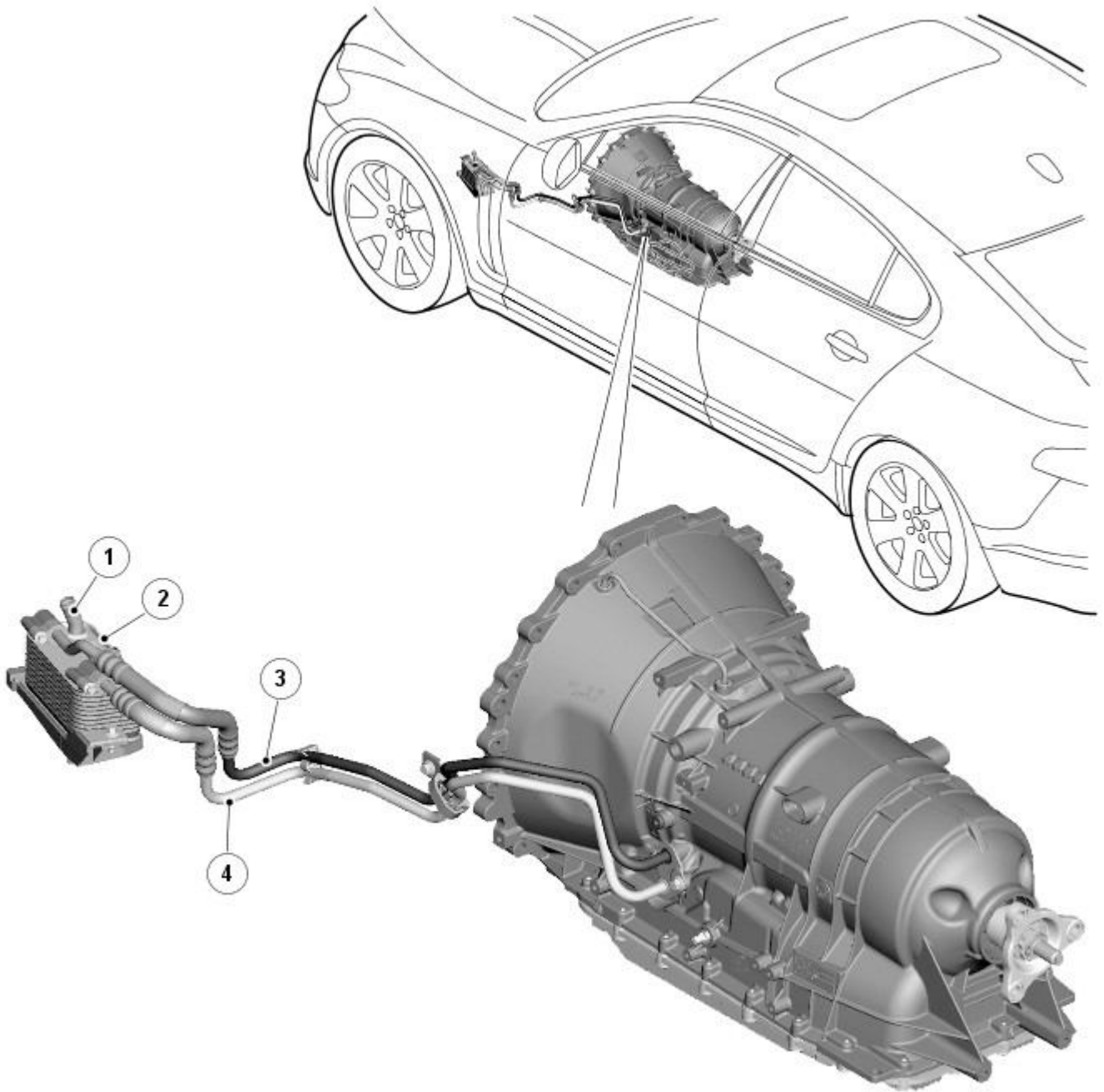


E94322

## ItemDescription

1	Engine cooling radiator
2	Return pipe (to transmission)
3	Feed pipe (from transmission)

COMPONENT LOCATION - DIESEL ENGINE



E94323

**ItemDescription**

- |   |                                 |
|---|---------------------------------|
| 1 | Engine coolant hose connections |
| 2 | Transmission fluid cooler       |
| 3 | Return pipe (to transmission)   |
| 4 | Feed pipe (from transmission)   |

# Transmission/Transaxle Cooling - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Transmission Cooling Vehicles With: ZF 6HP26 - Overview

Description and Operation

## OVERVIEW

All models have transmission fluid coolers.

On models with petrol engines, the fluid cooler is incorporated into the [LH \(left-hand\)](#) end tank of the engine cooling radiator.

On models with diesel engines, the fluid cooler is a dedicated cooler unit located near the lower front [LH](#) side of the engine compartment.

# Transmission/Transaxle Cooling - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Transmission Cooling Vehicles With: ZF 6HP26 - System Operation and Component Description

Description and Operation

## System Operation

### MODELS WITH V8 AND V6 PETROL ENGINES

Fluid is supplied from the transmission fluid pump into the upper connection of the engine cooling radiator. After passing through the radiator in tank cooler, the fluid passes out of the lower connection and is returned to the transmission fluid pan.

### MODELS WITH 2.7L V6 DIESEL ENGINE

Fluid is supplied from the transmission fluid pump into the forward most connection of the cooler. After passing through the cooler, the fluid passes out of the rearmost connection and is returned to the transmission fluid pan.

## Component Description

### MODELS WITH V8 AND V6 PETROL ENGINES

The transmission fluid cooler is integrated into the [LH \(left-hand\)](#) end tank of the engine cooling radiator. The transmission fluid is cooled by the temperature differential between the transmission fluid and the engine coolant.

The fluid cooler is an aluminium cooler comprising louvered fins and plates. The plates allow a cross-flow of transmission fluid through the cooler. The fins are immersed in engine coolant on the 'cold' side of the radiator which provides cooling of the transmission fluid via heat transfer.

This fluid cooler design provides an advantage over an air-cooled cooler in that the fluid cooling is controlled with engine coolant temperature. Fluid temperature control is also improved when the vehicle is moving slowly or is stationary with the engine running.

### MODELS WITH 2.7L V6 DIESEL ENGINE

The transmission fluid cooler is a separate cooling unit located behind the engine cooling radiator. The transmission is connected to the fluid cooler via flexible hoses and metal pipes.

The transmission fluid cooler is a dedicated fluid cooler which is connected into the engine cooling system circuit. The transmission fluid is cooled by the temperature differential between the transmission fluid and the engine coolant flowing through the cooler.

# Transmission/Transaxle Cooling - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Transmission Cooling

Diagnosis and Testing

## Principle of Operation

For a detailed description of the automatic transmission cooling system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (307-02 Transmission/Transaxle Cooling - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8)

[Transmission Cooling - Vehicles With: ZF 6HP26](#) (Description and Operation),  
[Transmission Cooling - Vehicles With: ZF 6HP26](#) (Description and Operation),  
[Transmission Cooling - Vehicles With: ZF 6HP26](#) (Description and Operation).

## Inspection and Verification

1. 1. Verify the customer concern by operating the system.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical
<ul style="list-style-type: none"> <li>● Feed and return tubes</li> <li>● Connections to the automatic transmission and the automatic transmission fluid cooler</li> <li>● Automatic transmission fluid level</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

## Symptom Chart

Condition	Possible Cause	Action
Over heating of the automatic transmission	Obstruction in the automatic transmission fluid cooler	Flush out the automatic transmission fluid cooler with new automatic transmission fluid. If the flushing is unsuccessful, install a new transmission fluid cooler. REFER to: Transmission Fluid Cooler (307-02, Removal and Installation).
Over heating of the automatic transmission	Obstruction in the automatic transmission fluid tubes	Flush out the automatic transmission fluid cooler tubes with new automatic transmission fluid. If the flushing is unsuccessful install new automatic transmission fluid cooler tubes. REFER to: Transmission Fluid Cooler Tubes (307-02, Removal and Installation).
Loss of automatic transmission fluid	Connections to the automatic transmission and the automatic transmission fluid cooler	Check the integrity of the tubes, connections and seals. Check the torque of the tube fixings. REFER to: Specifications (307-02, Specifications).
Loss of automatic transmission fluid	Leak at oil cooler	Check the integrity of tubes, connections and seals. Check the torque of the tube fixings. REFER to: Specifications (307-02, Specifications).



# Transmission/Transaxle Cooling - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel - Transmission Fluid Cooler

## Removal and Installation

### Special Tool(s)


Remover/Install, Cooling Hose Clamp

303-397



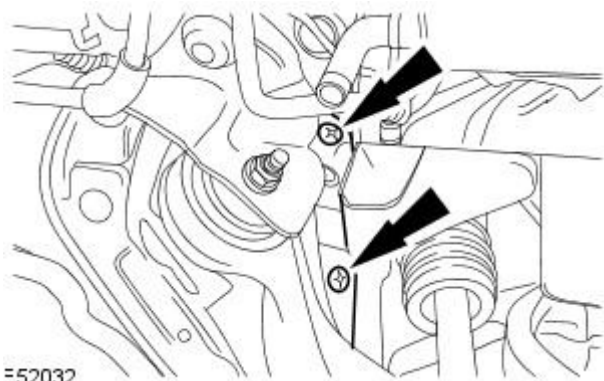
E 94108

## Removal

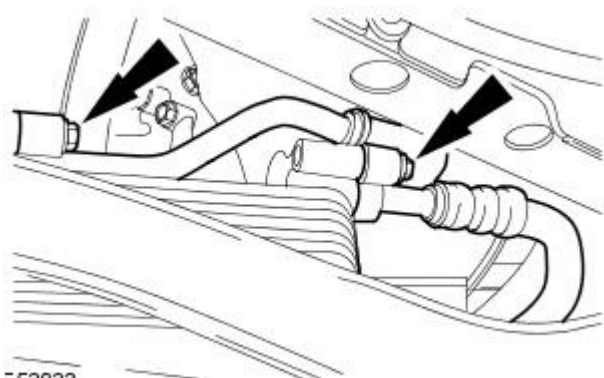
-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

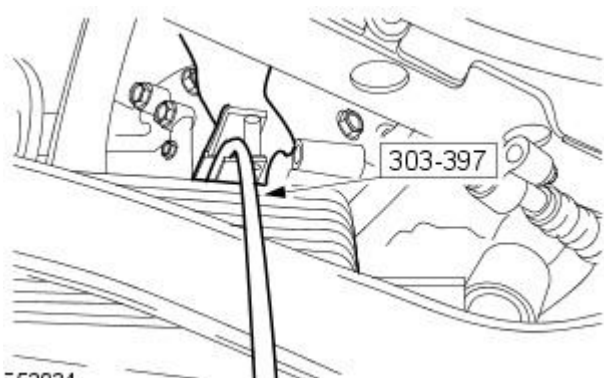
- Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
- Drain the coolant.  
For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).
- Remove the splash shield.



E52032



E52033

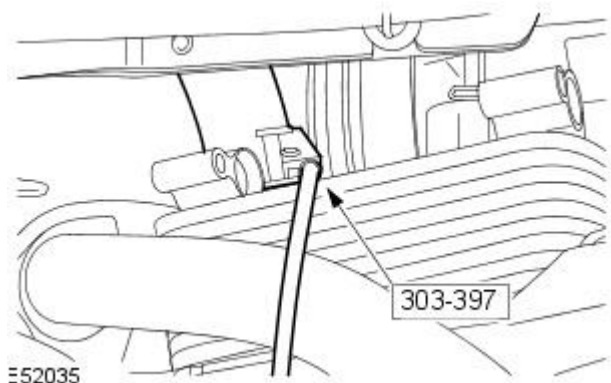


E52034

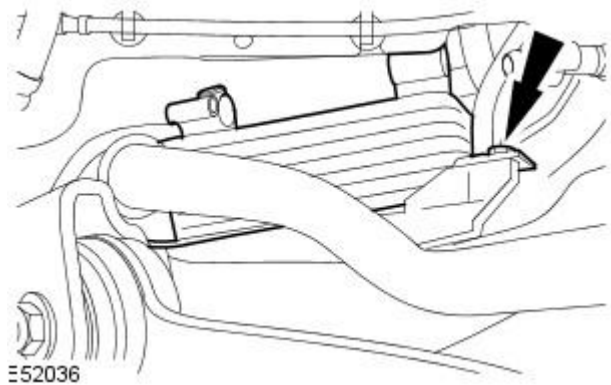
- Detach the transmission fluid cooler tubes.
  - Allow the transmission fluid to drain into a suitable container.
  - Remove and discard the O-ring seals.

- Using the special tool, detach the transmission fluid cooler coolant hose.

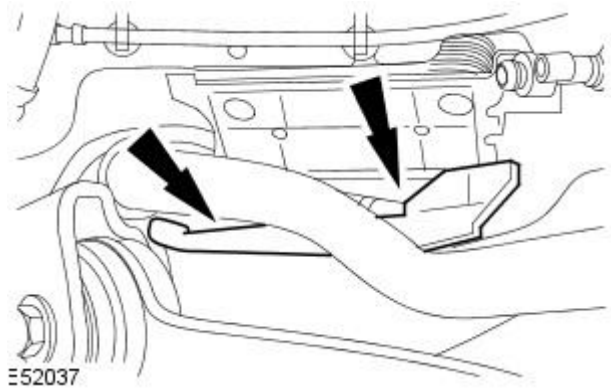
7. Using the special tool, detach the transmission fluid cooler coolant hose.



8. Detach the transmission fluid cooler.

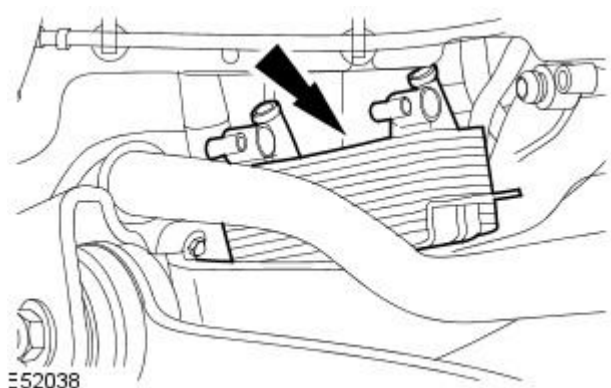


9. Remove the transmission fluid cooler retaining bracket.



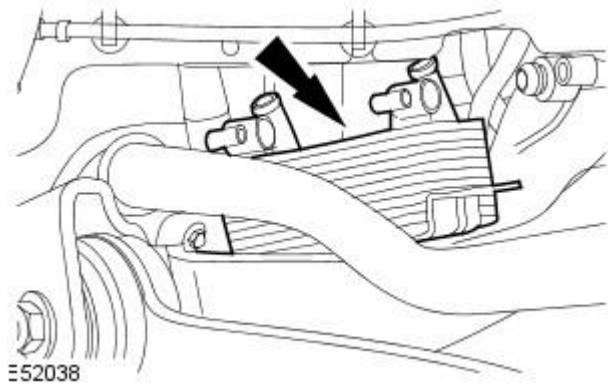
10.  **WARNING:** Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.

Remove the transmission fluid cooler.



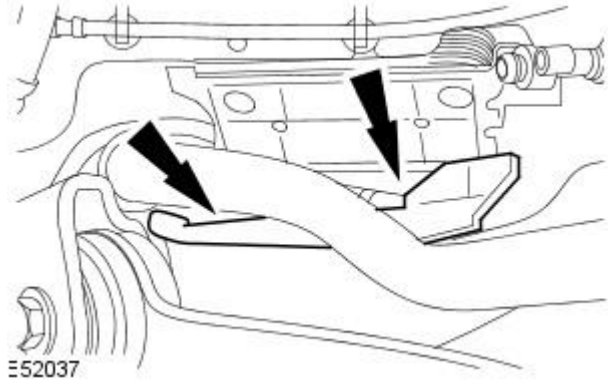
## Installation

1. Attach the transmission fluid cooler.



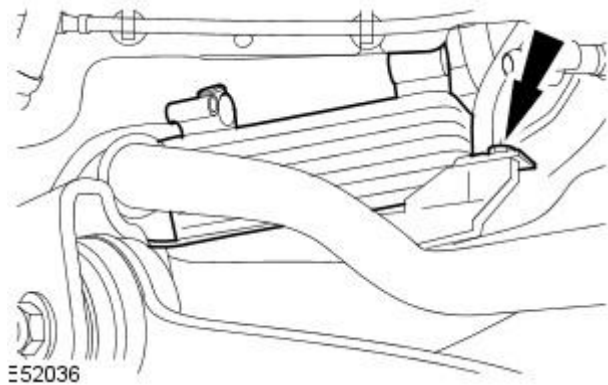
2. Install the transmission fluid cooler retaining bracket.

- Tighten to 20 Nm.



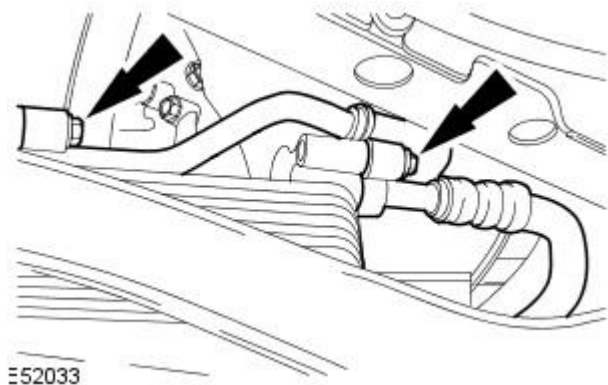
3. Install the transmission fluid cooler.

- Tighten to 10 Nm.

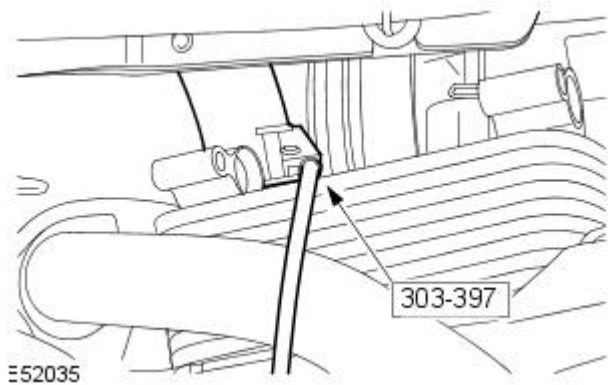


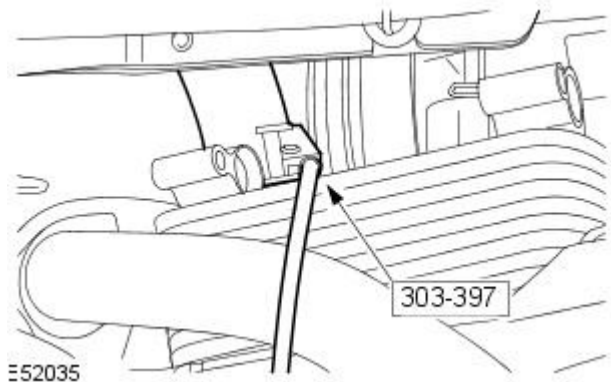
4. Attach the transmission fluid cooler tubes.

- Install new O-ring seals.
- Tighten to 11 Nm.



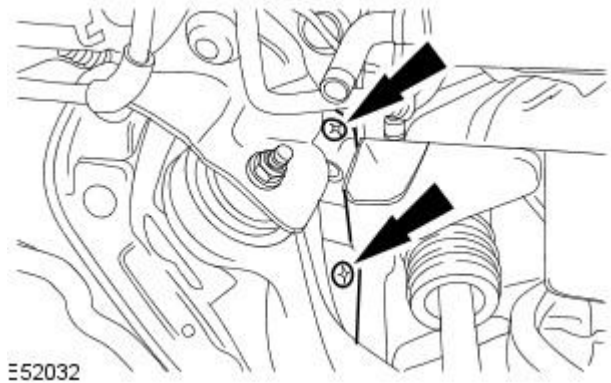
5. Using the special tool, attach the transmission fluid cooler coolant hose.





6. Using the special tool, attach the transmission fluid cooler coolant hose.


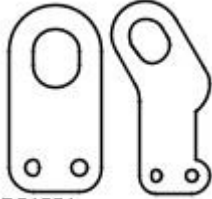
7. Install the splash shield.




8. Carry out a transmission fluid level check.  
For additional information, refer to: [Transmission Fluid Level Check](#) (307-01 Automatic Transmission/Transaxle - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel, General Procedures).
9. Install the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
10. Refill and bleed the cooling system.  
For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).

# Transmission/Transaxle Cooling - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel - Transmission Fluid Cooler Tubes

Removal and Installation

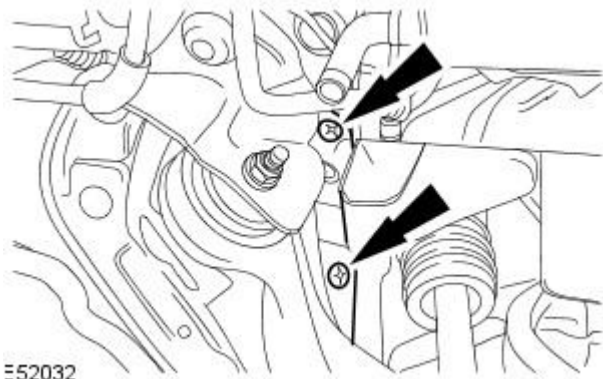
Special Tool(s)	
 <p>303-021</p>	<p>Engine support bracket 303-021</p>
 <p>E54554</p>	<p>Lifting Brackets - Engine 303-1129</p>


## Removal

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

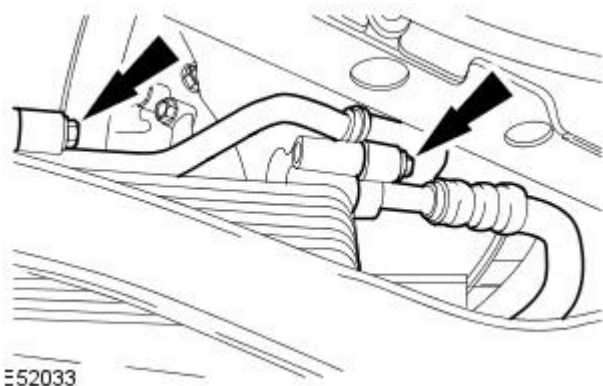
- Center the steering wheel.
- Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
- Remove the splash shield.



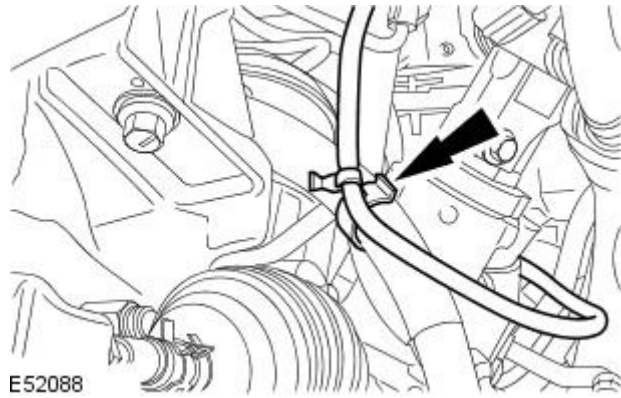
-  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.

Detach the transmission fluid cooler tubes.

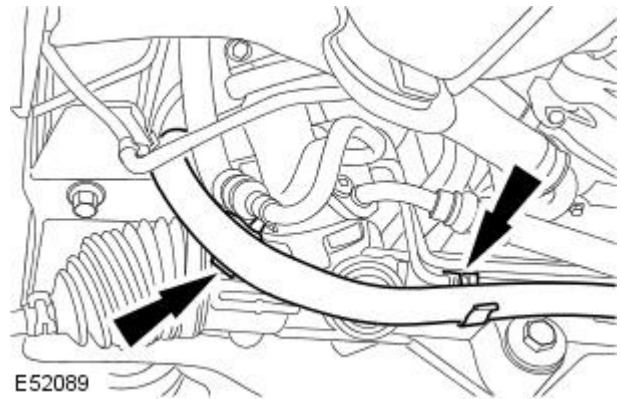
- Remove the 2 retaining bolts.
- Allow the transmission fluid to drain into a suitable container.
- Remove and discard the O-ring seals.



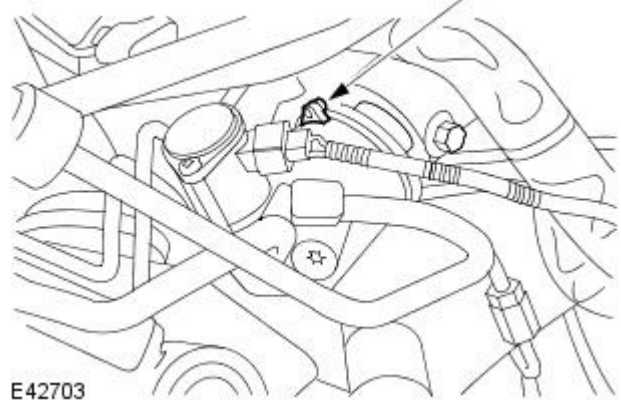
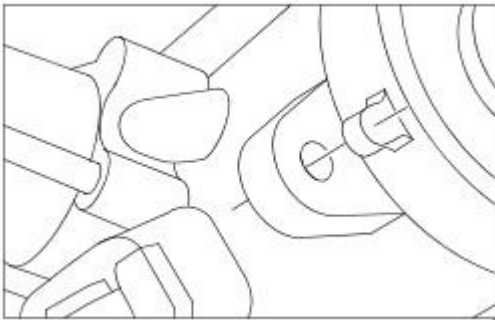
6. Detach the wiring harness.



7. Detach the hose.

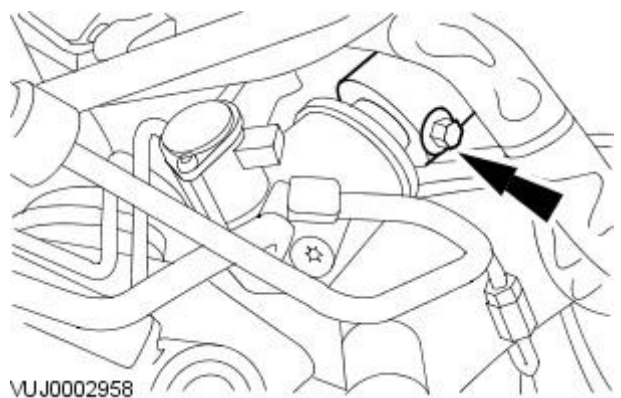


8. Make sure the alignment mark, on the steering gear pinion seal protection cover, is central to the steering gear pinion casting.



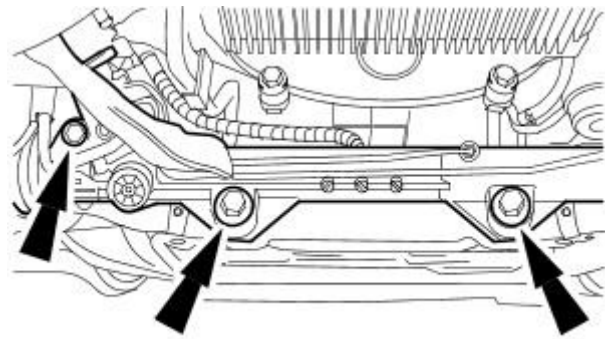
9. Detach the lower steering column.

- Remove the steering gear shaft pinch bolt.



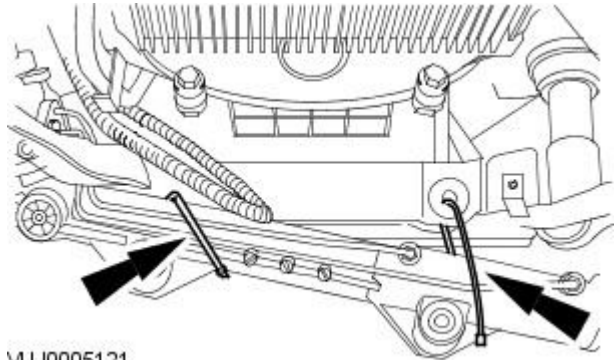


10. Detach the steering gear.



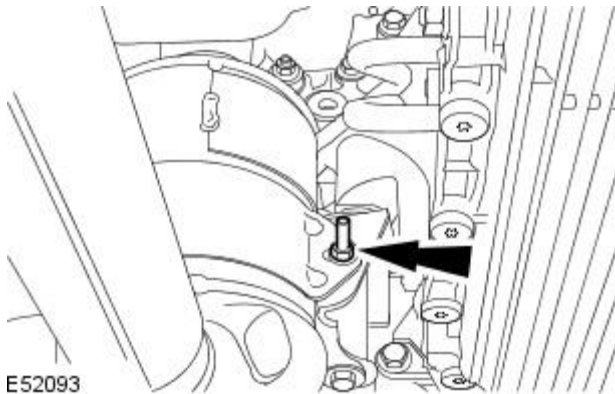
VUJ0005142

11. Secure the steering gear.



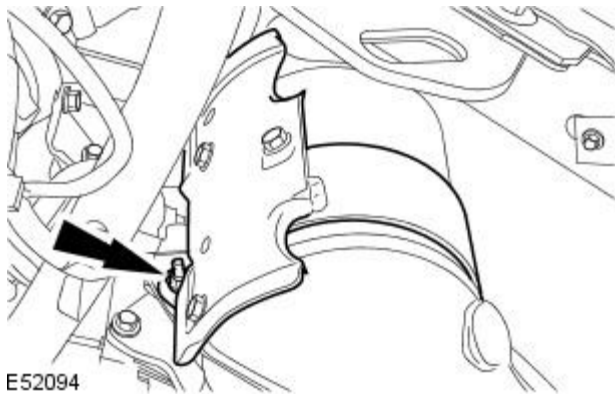
VUJ0005121

12. Remove the retaining nut.



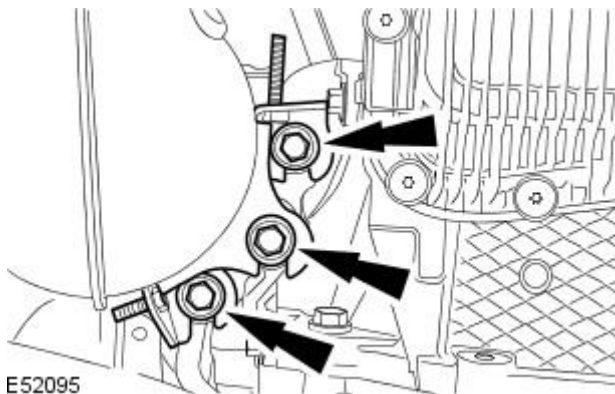
E52093

13. Remove the left-hand catalytic converter heat shield.



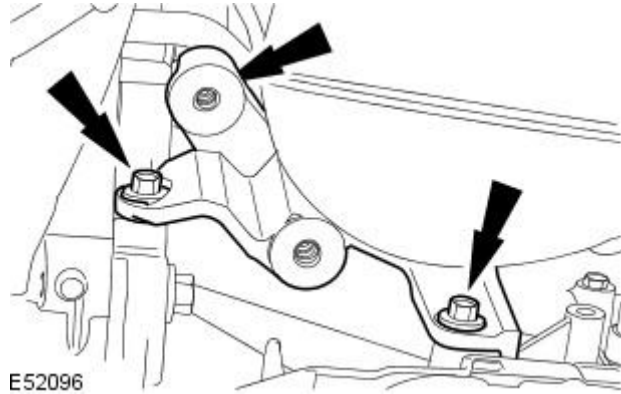
E52094

14. Remove the left-hand catalytic converter heat shield retaining bracket.

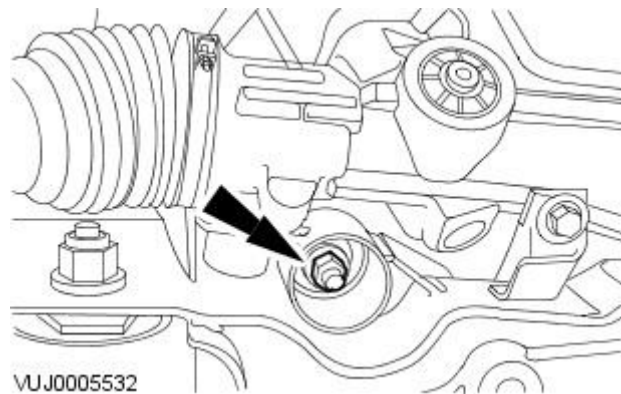


E52095

15. Remove the retaining bracket.



16. Remove the left-hand engine mounting retaining nut.

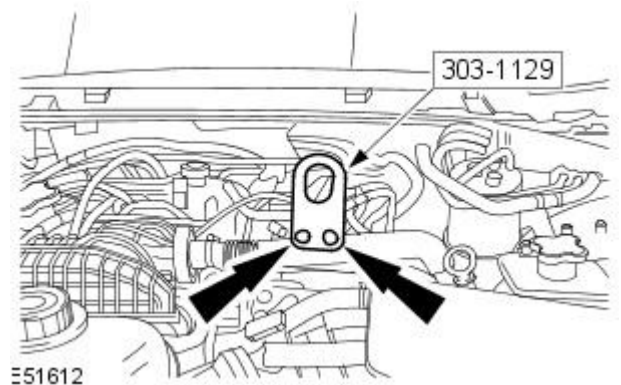


17. Lower the vehicle.

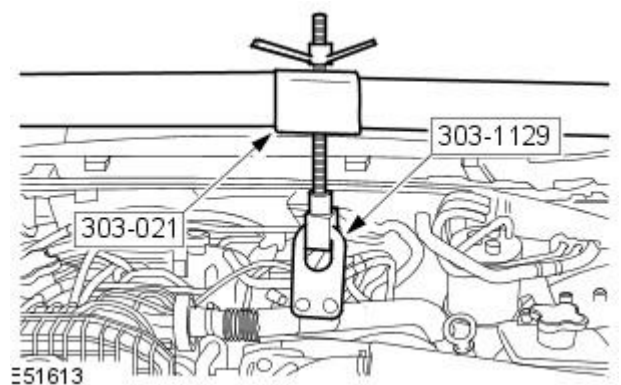
18. Remove the engine cover.

For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

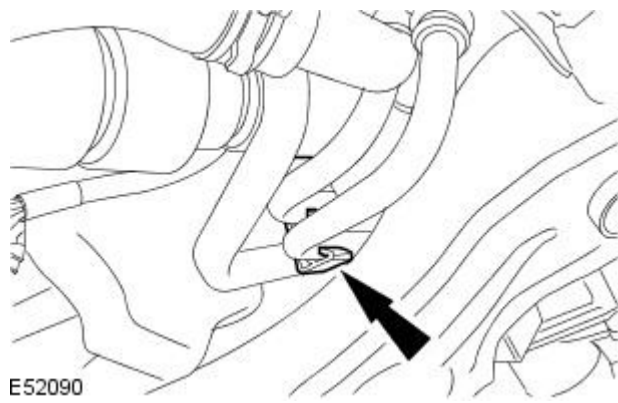
19. Install the special tool.



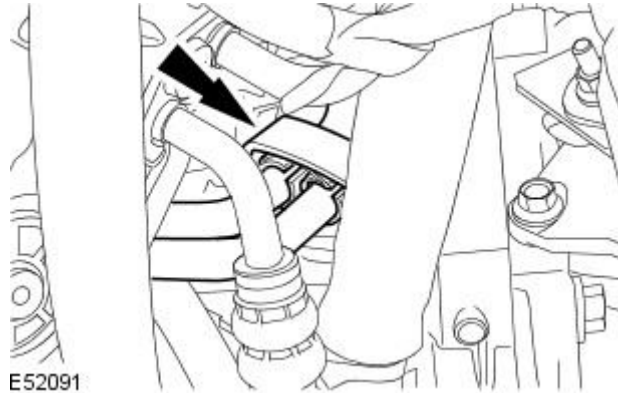
20. Using the special tools, raise the engine to a suitable height.



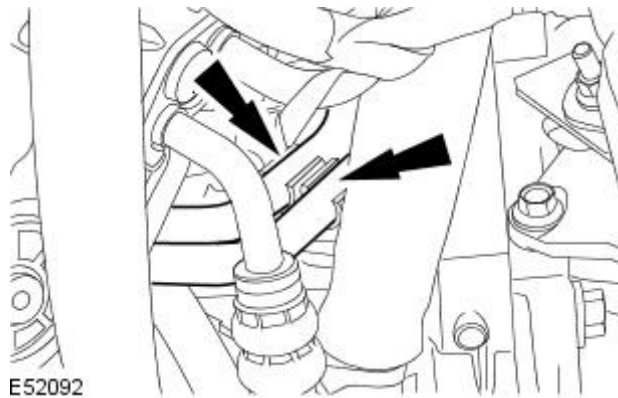
21. Release the bracket.




22. Release the transmission fluid cooler tubes bracket.



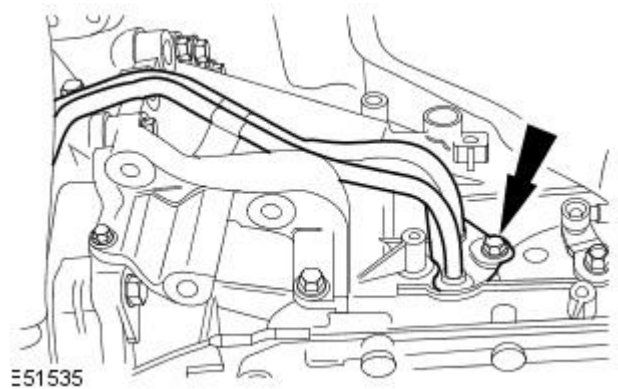
23. Detach the transmission fluid cooler tubes from the retaining bracket.



24.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

Remove the transmission fluid cooler tubes.

- Allow the transmission fluid to drain into a suitable container.
- Remove and discard the O-ring seals.

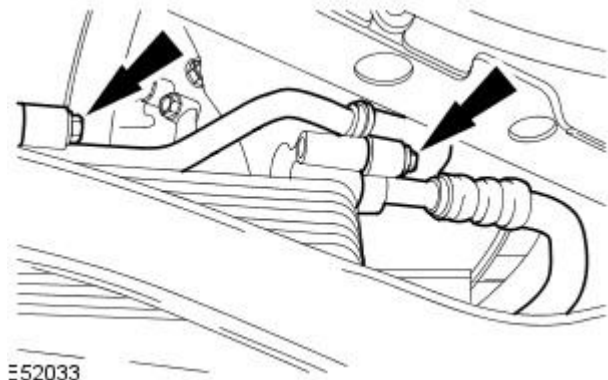


## Installation

1. NOTE: Remove and discard the blanking caps.

Install the transmission fluid cooler tubes.

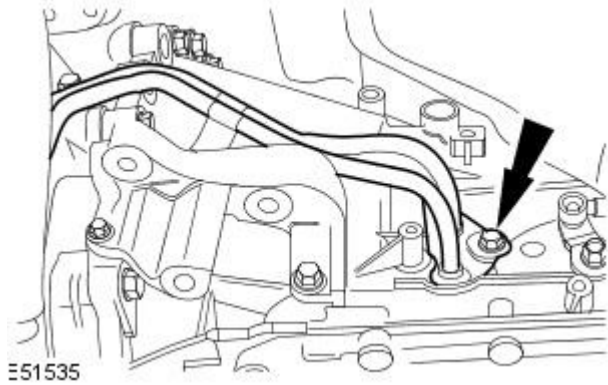
- Install new O-ring seals.
- Tighten to 11 Nm.



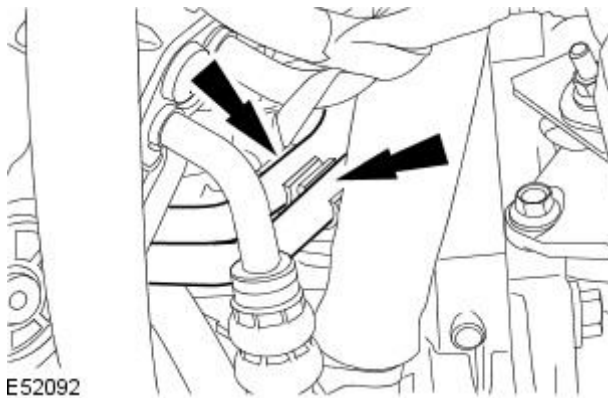
2. NOTE: Remove and discard the blanking caps.

Install the transmission fluid cooler tubes.

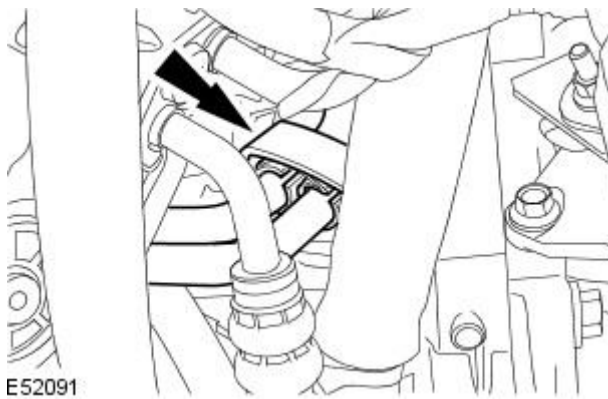
- Install new O-ring seals.
- Tighten to 23 Nm.



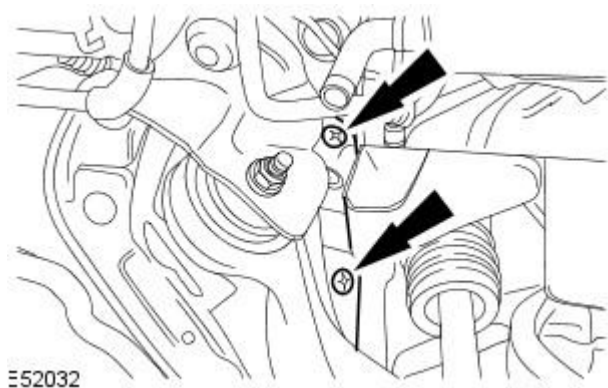
3. Attach the transmission fluid cooler tubes to the retaining bracket.



4. Attach the transmission fluid cooler tubes to the retaining bracket.

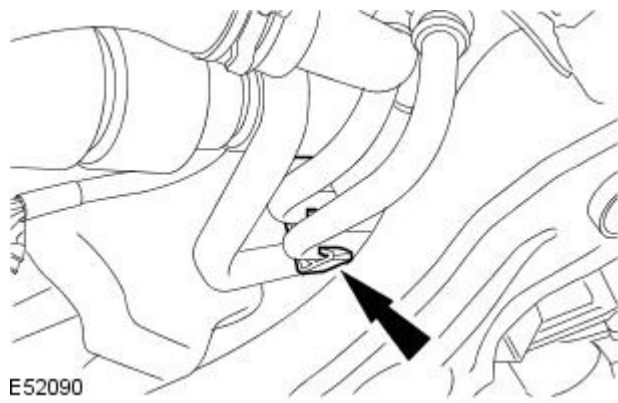


5. Install the splash shield.



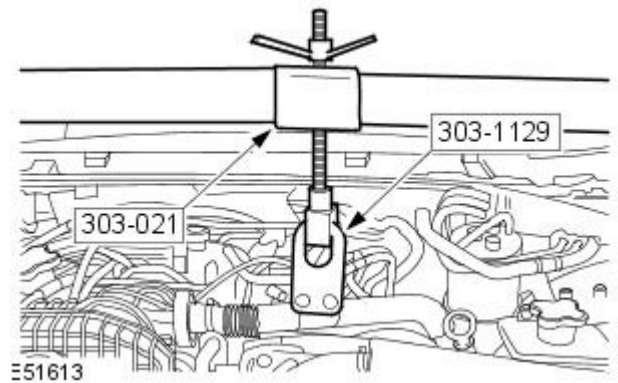


6. Install the retaining bracket.



7. Lower the vehicle.

8. Remove the special tool.



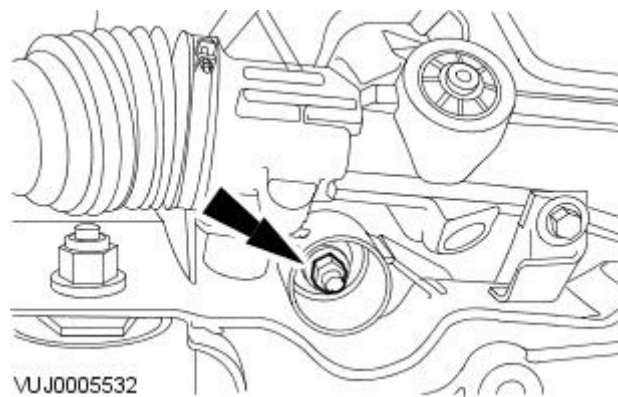
9. Install the engine cover.

For additional information, refer to: [Engine Cover - TDV6 2.7L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

10. Raise and support the vehicle.

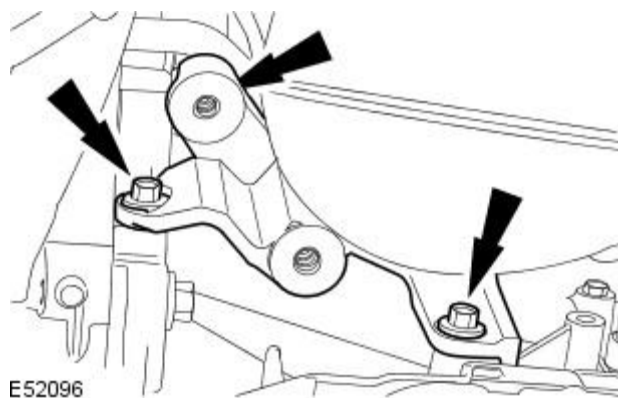
11. Install the left-hand engine mounting retaining nut.

- Tighten to 63 Nm.



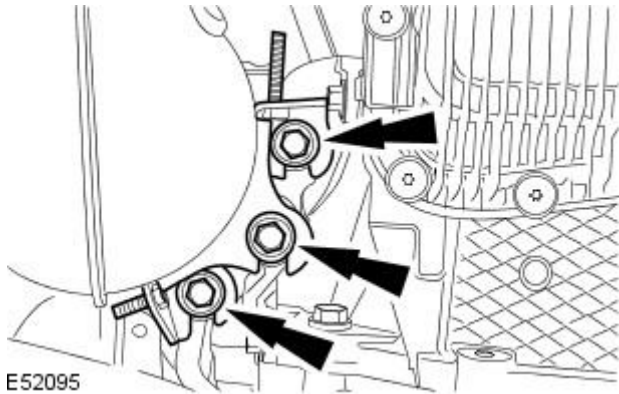
12. Install the retaining bracket.

- Tighten to 9 Nm.



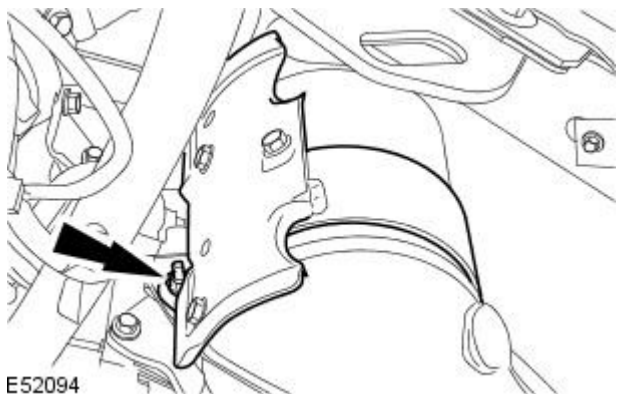
13. Install the left-hand catalytic converter heat shield retaining bracket.

- Tighten to 22 Nm.

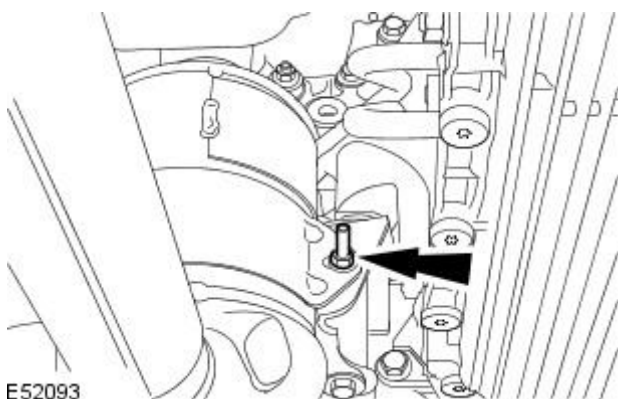


14. Install the left-hand catalytic converter heat shield.

- Tighten to 22 Nm.

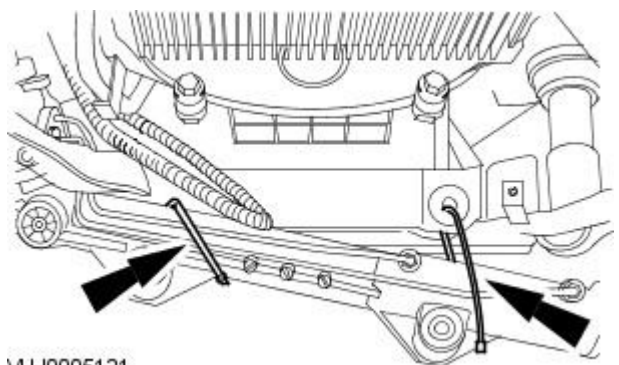


15. Install the retaining nut.



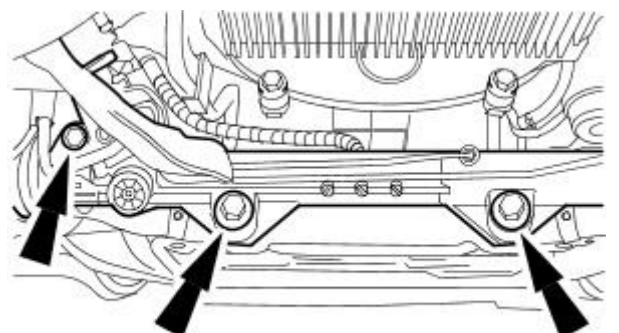
16. Detach the steering gear.

- Remove the cable tie.



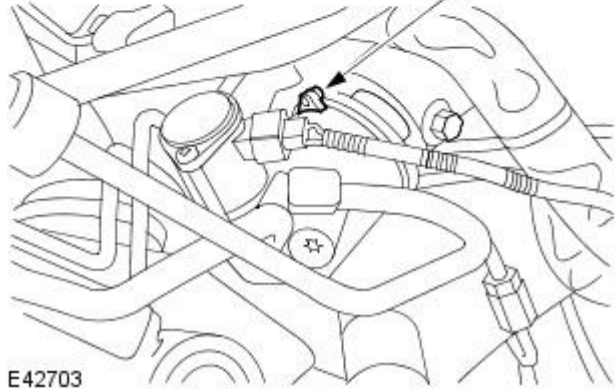
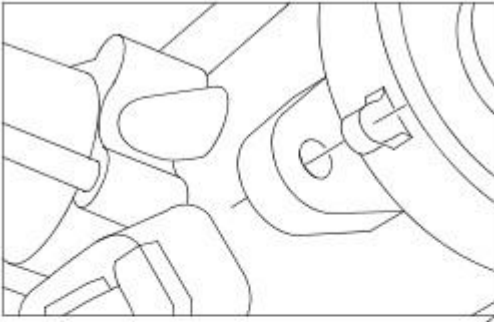
17. Install the steering gear.

- Tighten to 100 Nm.





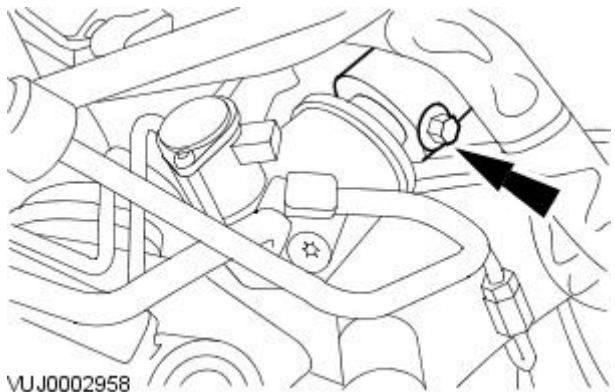
18. Make sure the alignment mark, on the steering gear pinion seal protection cover, is central to the steering gear pinion casting.



E42703

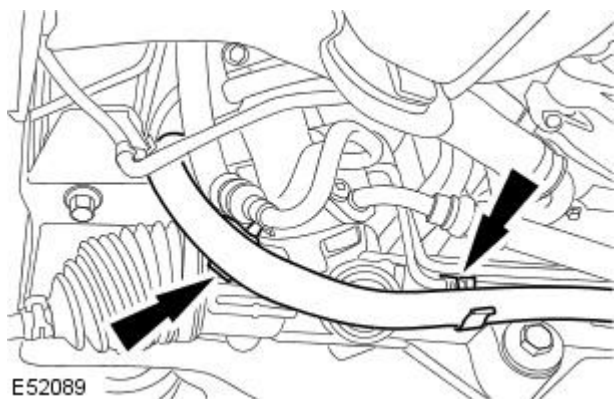
19. Attach the lower steering column.

- Install the steering gear shaft pinch bolt.



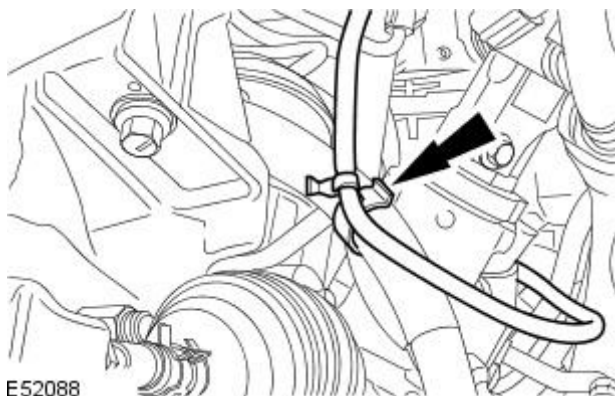
VUJ0002958

20. Attach the hose.



E52089

21. Attach the wiring harness.



E52088

- 22.** Carry out a transmission fluid level check.  
For additional information, refer to: [Transmission Fluid Level Check](#) (307-01 Automatic Transmission/Transaxle - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol/TDV6 2.7L Diesel, General Procedures).
- 23.** Install the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
- 24.** Lower the vehicle.

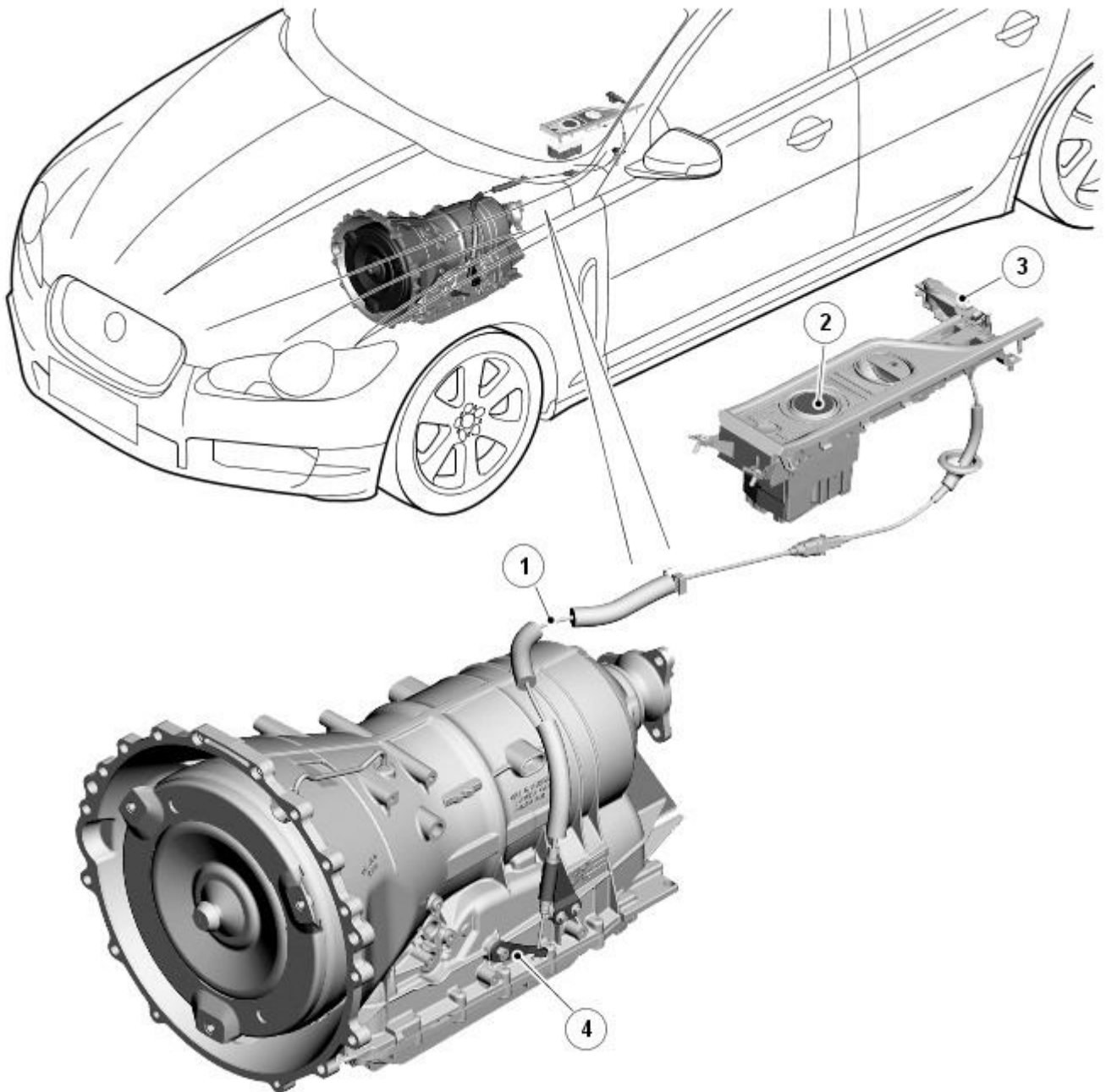
**Automatic Transmission/Transaxle External Controls -****Torque Specifications**

Description	Nm	lb-ft	lb-in
Emergency park release arm retaining bolt	12	9	-
Emergency park release cable bracket retaining bolts	10	-	89

# Automatic Transmission/Transaxle External Controls - External Controls Vehicles With: ZF 6HP26 - Component Location

Description and Operation

## COMPONENT LOCATION



E94656

### ItemDescription

1	Emergency park release cable
2	JaguarDrive selector
3	Emergency park release lever
4	Transmission control lever

# Automatic Transmission/Transaxle External Controls - External Controls Vehicles With: ZF 6HP26 - Overview

Description and Operation

## OVERVIEW

The [TCM \(transmission control module\)](#) contains software to provide operation as a semi-automatic 'Jaguar Sequential Shift' transmission.

The [TCM](#) allows the transmission to be operated as a conventional automatic unit by selecting P, R, N, D on the JaguarDrive selector. Unlike previous transmissions, this application uses a fully electronic rotary transmission selector with no mechanical connection to the transmission.

Rotation of the JaguarDrive selector allows the selection of Park (P), Reverse (R), Neutral (N) and Drive (D). By depressing the JaguarDrive selector and rotating clockwise from the 'D' position, Sport (S) mode can be selected.

Two gear change 'paddle' switches are fitted at the rear of the steering wheel and allow the driver to operate the transmission as a semi-automatic manual gearbox using the Jaguar Sequential Shift feature.

Four additional switches are located adjacent to the JaguarDrive selector and control the JaguarDrive Optimisation Control functions.

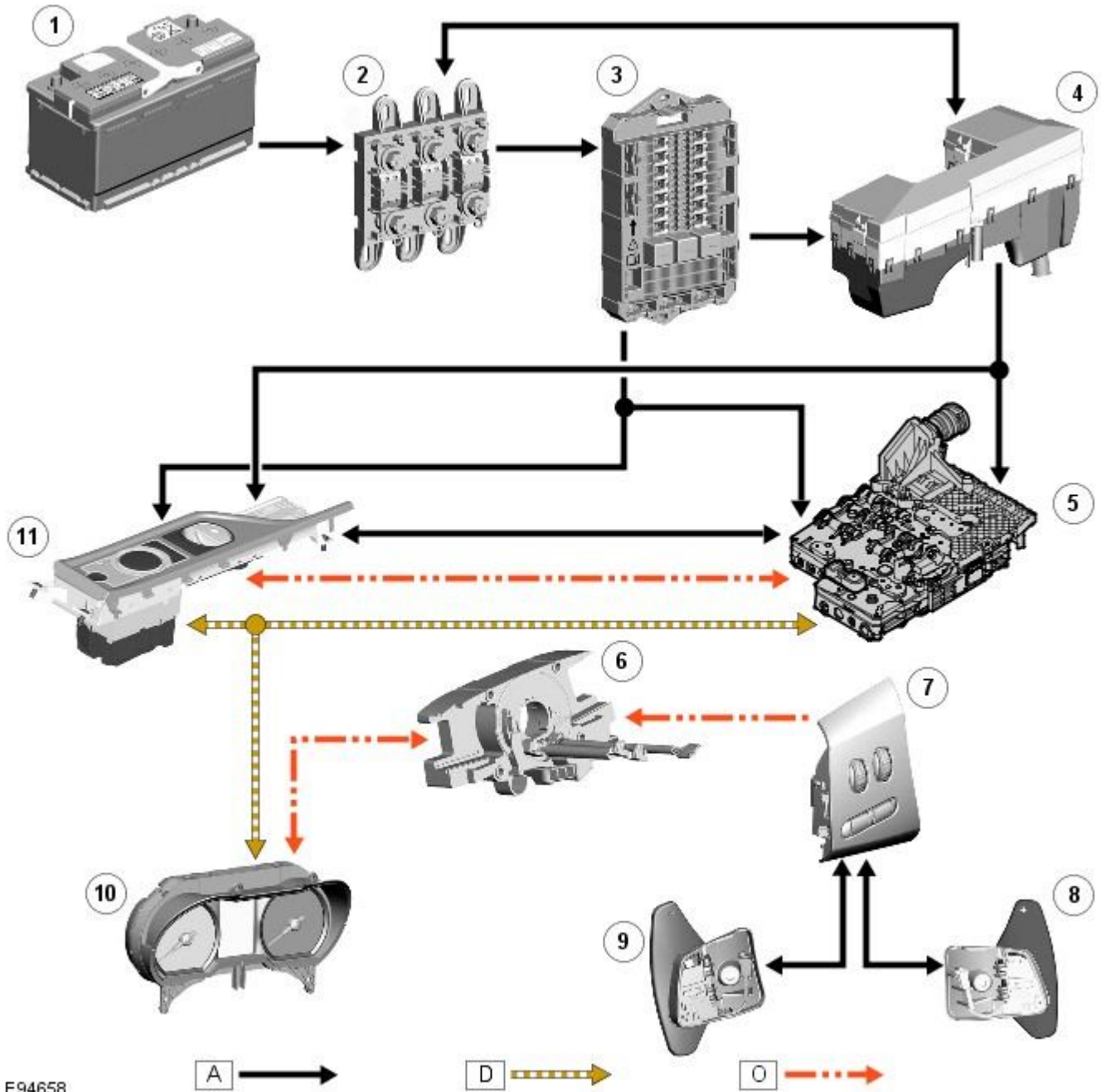
Refer to: [Anti-Lock Control - Stability Assist](#) (206-09 Anti-Lock Control - Stability Assist, Description and Operation).

# Automatic Transmission/Transaxle External Controls - External Controls Vehicles With: ZF 6HP26 - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **D** = High speed CAN bus; **O** = LIN bus



E94658

### ItemDescription

1	Battery
2	BJB (battery junction box) - Megafuse
3	CJB (central junction box)
4	EJB (engine junction box)
5	TCM (transmission control module)
6	Clockspring
7	Steering wheel audio switch assembly
8	Upshift paddle switch
9	Downshift paddle switch
10	Instrument cluster



## System Operation

### JAGUARDRIVE SELECTOR

Rotation of the JaguarDrive selector to any of the 5 positions is sensed by the [TCM](#) via the high speed [CAN \(controller area network\)](#) bus. A [LIN \(local interconnect network\)](#) bus connection is also provided but is only used in the event of a [CAN](#) bus failure as a back-up. The [TCM](#) then reacts according to the selected position. The JaguarDrive selector is a magnetic system using Hall effect sensors to determine the selected position of the selector.

The 'Sport' (S) position selection allows the [TCM](#) to operate the transmission using the semi-automatic 'Jaguar Sequential Shift'. Gear selections are sensed by the [TCM](#) when the driver operates the steering wheel paddle switches. Once the JaguarDrive selector position is confirmed, the [TCM](#) outputs appropriate information on the high speed [CAN](#) bus which is received by the instrument cluster to display the gear selection information in the message center. Refer to: [Information and Message Center](#) (413-08 Information and Message Center, Description and Operation) / [Information and Message Center](#) (413-08, Description and Operation).

The paddles can also be used on a temporary basis when the JaguarDrive selector is in the 'D' position to override the automatic gear selection if required.

### PADDLE SWITCHES

Each paddle switch has 3 connections; ground, illumination ([PWM \(pulse width modulation\)](#)) supply and ground switch signal. The paddle switches are hardwired to the steering wheel audio switches. Operation of the paddle switch completes a ground path to the audio switch assembly. The audio switch assembly converts the completed ground signal into a [LIN](#) bus signal which is passed via the clockspring to the instrument cluster. The instrument cluster converts the signal into a high speed [CAN](#) bus signal to the [TCM](#).

Pulling the [LH \(left-hand\)](#) downshift - paddle provides down changes and pulling the [RH \(right-hand\)](#) upshift (+) paddle provides up changes. The first operation of either paddle, after Sport mode is selected, puts the transmission into permanent manual 'Jaguar Sequential Shift' mode. Rotation of the JaguarDrive selector back to the 'D' position, returns the transmission to conventional automatic operation.

Temporary operation of manual 'Jaguar Sequential Shift' mode can also be operated with the JaguarDrive selector in the 'D' position. Operation of either the upshift or downshift paddles activates the manual mode operation. If the JaguarDrive selector is in 'D', 'Jaguar Sequential Shift' will cancel after a time period or can be cancelled by pressing and holding the + paddle for approximately 2 seconds.

## Component Description

### JAGUARDRIVE SELECTOR



E94657

#### ItemDescription

1	Emergency park release lever locking mechanism
2	Emergency park release lever
3	Trim cover - emergency park release lever
4	Parking brake switch
5	Dynamic mode switch
6	Automatic speed limiter switch
7	Slip control mode switch
8	Dynamic Stability Control (DSC) switch
9	JaguarDrive selector
10	Selector position LED (light emitting diode)
11	Start/Stop switch
12	Screw (5 off)
13	Release cable connector
14	Emergency park release lever cable

The JaguarDrive selector assembly is located in a central position in the floor console. The assembly is attached to a molding in the floor console with 5 screws.

Transmission selections are made using the rotary JaguarDrive selector which rises from the floor console once the engine is running. When the engine is stopped with the selector in any position other than 'N', the JaguarDrive selector retracts into the floor console. If the selector remains in position 'N' when the engine is stopped, the selector will remain in the

raised position for up to 10 minutes, for use in a drive through car wash for example. After 10 minutes the selector will automatically retract into the floor console or if 'P' is selected before the 10 minute period the selector will retract.

If JaguarDrive selector does not rise from the console when the engine is started but electrical power is supplied to the selector, selections can still be made by rotating the selector to the required position using your fingertip. If electrical power to the JaguarDrive selector is lost, the selector will not rise from the console when the engine is started and selections cannot be made by rotating the selector using your fingertip.

The JaguarDrive selector contains an internal interlock solenoid to prevent the selector from being rotated when the engine is not running.

The engine can be stopped with the JaguarDrive selector in any position. Once the engine is stopped the selector will automatically reset to the Park (P) position and the transmission park lock will be engaged, except if the selector is moved to the 'N' position when the engine is stopped.

## Emergency Park Release

In the event of the vehicle requiring recovery, Park can be released manually with the use of the Emergency Park Release cable. To de-select Park, remove the trim cover from the rear of the floor console and locate the emergency park release lever. Rotate the locking mechanism of the release lever through 90 degrees in a counterclockwise direction to unlock the lever. Apply the footbrake and pull the lever upwards and ensure it is locked in the vertical position. This mechanically disengages the parking pawl and engages the transmission in neutral via a cable to the transmission.

When the Emergency Park Release lever is pulled, the vehicle will be able to free wheel.

To re-engage the transmission into Park, hold the strap on the emergency park release hand lever; release the latch and lower the hand lever to its horizontal position. Lock the hand lever by turning the locking mechanism 90 degrees in a clockwise direction and replace trim cover.

## PARK INTERLOCK AND NEUTRAL LOCK

Neutral lock is a new feature introduced as a requirement for the JaguarDrive selector. The selector is always locked at ignition on when the engine is not running, except after an engine stall when the selector is not in 'P' or 'N'.

If, when driving with the JaguarDrive selector in 'S', 'D' or 'R' at a speed of more than 5 km/h (3 mph), the driver selects 'P' or 'N':

- without the brake pedal pressed, the JaguarDrive selector will be immediately locked once the vehicle speed falls to below 5 km/h (3 mph)
- with the brake pedal pressed, the JaguarDrive selector will remain locked for as long as the brake pedal remains pressed, regardless of vehicle speed.

The transmission will only engage Park once the vehicle speed is less than 2 km/h (1 mph).

If the driver selects 'N' and releases the brake pedal with a vehicle speed of less than 5 km/h (3 mph), the JaguarDrive selector will be locked 2 seconds after 'N' is selected. The selector will remain locked until the driver presses the brake pedal again.

To ensure that a driver request to change from a non-driving range ('N' for example) to a driving range ('D' for example), the park interlock and neutral lock features are used in conjunction with the 'intermediate position'.

If the transmission receives a range change request without the brake pedal pressed, the [TCM](#) initiates a 'soft lock' function. The transmission will remain in Park or Neutral, depending on the starting position.

If a transmission position letter is flashing in the message center and the vehicle has no drive, the driver must:

- press the brake pedal
- reselect 'N' or 'P' on the JaguarDrive selector
- then select the required driving range, ensuring that the brake pedal is pressed.

## Rocking Function

The rocking function is a new feature introduced to compliment the neutral lock function. For all changes from a non-driving range to a driving range, it is necessary to press the brake pedal (to release either the Park interlock or Neutral lock).

In situations where the driver will require to change the gear selection from 'R' to 'D' or from 'D' to 'R' without brake pedal input (car park manoeuvring, 3 point turns or 'rocking' the vehicle from a slippery surface for example) the 'rocking function' gives a 2 second lock delay when 'N' is selected on the JaguarDrive selector and the brake pedal is not pressed.

## Intermediate Position

If the JaguarDrive selector is rotated slowly from 'P' to 'S' and back to position 'P' with the brake pedal pressed, the 'R' or 'D' position display letter in the message center will flash and the transmission will remain in Park or Neutral depending on the previous starting position of the selector.

If the brake pedal is released when 'R' or 'D' is flashing in the message center and the JaguarDrive selector is rotated to the 'R' or 'D' position, the driver's required range will not be selected and the transmission will remain in Park or Neutral, depending on the previous starting position. This feature is known as 'soft lock'.

If the driving range letter in the message center is flashing and the vehicle has no drive, the driver should depress the brake pedal to reselect 'N' or 'P', and then select the required driving range ensuring the brake pedal is pressed.

# Automatic Transmission/Transaxle External Controls - External Controls

Diagnosis and Testing

## Principles of Operation

For a detailed description of the transmission external controls, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (307-05 Automatic Transmission/Transaxle External Controls)

[External Controls - Vehicles With: ZF 6HP26](#) (Description and Operation),  
[External Controls - Vehicles With: ZF 6HP26](#) (Description and Operation),  
[External Controls - Vehicles With: ZF 6HP26](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Check for stuck/jammed switches and buttons</li> <li>● Visibly damaged or worn components</li> <li>● Loose or missing fasteners</li> </ul>	<ul style="list-style-type: none"> <li>● Fuse(s)</li> <li>● Loose or corroded electrical connector(s)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

- NOTE: If the control module/component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).
- NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.
- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.
- NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Causes	Action
B1087-08	LIN Bus "A" - Bus Signal / Message Failures	<ul style="list-style-type: none"> <li>● LIN Bus "A" Error</li> </ul>	Refer to the electrical circuit diagrams and check LIN input signal circuit for short, open circuit
B1087-81	LIN Bus "A" - invalid serial data received	<ul style="list-style-type: none"> <li>● Transmission control module LIN message error: complement fault</li> </ul>	Refer to the electrical circuit diagrams and check LIN input signal circuit for short, open circuit faults. Check Transmission control module for related DTCs and refer to relevant DTC Index
B1087-82	LIN Bus "A" - alive / sequence counter incorrect / not updated	<ul style="list-style-type: none"> <li>● Transmission control module LIN message error: Alive counter fault</li> </ul>	Refer to the electrical circuit diagrams and check LIN input signal circuit for short, open circuit faults. Check Transmission control module for related DTCs and refer to relevant DTC Index
B1087-83	LIN Bus "A" - value of signal protection calculation incorrect	<ul style="list-style-type: none"> <li>● Transmission control module LIN message error: checksum fault</li> </ul>	Refer to the electrical circuit diagrams and check LIN input signal circuit for short, open circuit faults. Check Transmission control module for related DTCs and refer to relevant DTC Index

DTC	Description	Possible Causes	Action
B1087-87	LIN Bus "A" - missing message	<ul style="list-style-type: none"> <li>Transmission control module LIN message error: missing message</li> </ul>	Refer to the electrical circuit diagrams and check LIN input signal circuit for short, open circuit faults. Check Transmission control module for related DTCs and refer to relevant DTC Index
B1142-62	Ignition Status 1 - signal compare failure	<ul style="list-style-type: none"> <li>Hardwired Ignition and CAN powermode signals differ</li> </ul>	Refer to the electrical circuit diagrams and check ignition supply circuit for short, open circuit
B123C-01	Dynamic Stability Control Status Indicator - General Electrical Failure	<ul style="list-style-type: none"> <li>Dynamic stability control LED failure</li> </ul>	Suspect transmission shift module, check operation of the Dynamic stability control button status illumination, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
B123D-64	Dynamic Stability Control Button - signal plausibility failure	<ul style="list-style-type: none"> <li>Dynamic stability control button may be stuck, May be due to a faulty button or to the user holding the button for a prolonged period. (Dynamic stability control button detected as pressed for 30 seconds) (S1)</li> </ul>	Check for normal Dynamic stability control button functionality. If it operates normally then no further action required. If the Dynamic stability control button fails to operate normally then may be due to an internal fault, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
B123F-01	Adaptive Speed Limiter Mode Indicator - General Electrical Failure	<ul style="list-style-type: none"> <li>Adaptive Speed Limiter LED failure</li> </ul>	Suspect transmission shift module, check operation of the active speed limiter button status illumination, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
B1241-64	Adaptive Speed Limiter Button - signal plausibility failure	<ul style="list-style-type: none"> <li>May be due to a faulty button or to the user holding the button for a prolonged period (Adaptive Speed Limiter button detected as pressed for 30 seconds)</li> </ul>	Check for normal adaptive speed limiter button functionality. If it operates normally then no further action required. If the adaptive speed limiter button fails to operate normally then may be due to an internal fault, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
B1242-64	Winter Button - signal plausibility failure	<ul style="list-style-type: none"> <li>May be due to a faulty button or to the user holding the button for a prolonged period. (Winter button detected as pressed for 30 seconds)</li> </ul>	Check for normal winter button functionality. If it operates normally then no further action required. If the winter button fails to operate normally then may be due to an internal fault, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
B1243-01	Winter Button Mode Indicator - General Electrical Failure	<ul style="list-style-type: none"> <li>Winter LED failure</li> </ul>	Suspect transmission shift module, check operation of the winter button status illumination, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
B1244-64	Dynamic / Sport Button - signal plausibility failure	<ul style="list-style-type: none"> <li>May be due to a faulty button or to the user holding the button for a prolonged period. (Dynamic/Performance button detected as pressed for 30 seconds)</li> </ul>	Check for normal dynamic mode button functionality. If it operates normally then no further action required. If the dynamic mode button fails to operate normally then may be due to an internal fault, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
B1245-01	Dynamic / Sport Button Mode Indicator - General Electrical Failure	<ul style="list-style-type: none"> <li>Dynamic / Sport LED Failure</li> </ul>	Suspect transmission shift module, check operation of the dynamic mode button status illumination, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
C113A-62	Wake up Control - signal compare failure	<ul style="list-style-type: none"> <li>Hardwired delayed power and CAN Bus Engine Running status differ.</li> </ul>	Refer to the electrical circuit diagrams and check hardwired wake up (start stop illumination) input circuit for short, open circuit
P0603-44	Internal Control Module Keep Alive Memory (KAM) Error - data memory failure	<ul style="list-style-type: none"> <li>Transmission shift module Internal failure</li> </ul>	Suspect transmission shift module, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
P0604-44	Internal Control Module Random Access Memory (RAM) Error - data	<ul style="list-style-type: none"> <li>Transmission shift module Internal failure</li> </ul>	Suspect transmission shift module, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index

DTC	Description	Possible Causes	Action
	memory failure		top of the DTC Index
P0605-45	Internal Control Module Read Only Memory (ROM) Error - program memory failure	<ul style="list-style-type: none"> <li>Transmission shift module Internal failure</li> </ul>	Suspect transmission shift module, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
P0606-2F	Control Module Processor - signal erratic	<ul style="list-style-type: none"> <li>Transmission shift module Internal failure</li> </ul>	Suspect transmission shift module, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
P0606-47	Control Module Processor - watchdog / safety Micro controller failure	<ul style="list-style-type: none"> <li>Transmission shift module Internal failure</li> </ul>	Suspect transmission shift module, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
P0705-09	Transmission Range Sensor A Circuit (PRNDL Input) - Component Failures	<ul style="list-style-type: none"> <li>PRNDS sensor fault</li> </ul>	Suspect transmission shift module, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
P0705-46	Transmission Range Sensor A Circuit (PRNDL Input) - calibration / parameter memory failure	<ul style="list-style-type: none"> <li>PRNDS calibration missing/invalid</li> </ul>	Suspect transmission shift module, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
P0705-86	Transmission Range Sensor A Circuit (PRNDL Input) - signal invalid	<ul style="list-style-type: none"> <li>Received signal incorrect</li> </ul>	Suspect transmission shift module, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
P0814-01	Transmission Range Display Circuit - General Electrical Failure	<ul style="list-style-type: none"> <li>PRNDS LED failure</li> </ul>	Suspect transmission shift module, check operation of PRNDS display, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
P081C-64	Park Input Circuit - signal plausibility failure	<ul style="list-style-type: none"> <li>Hardwired Park and Transmission control module Position Display signals are not consistent</li> </ul>	Refer to electrical circuit diagrams and check Park input signal circuit for short, open circuit. Check Transmission control module for Park signal failure DTCs. Check operation of signal - should be set (equal to vehicle supply voltage) when transmission in P and un-set (equal to vehicle ground) when transmission in R,N,D,S
P084F-11	Park/Neutral Switch Output Circuit - circuit short to ground	<ul style="list-style-type: none"> <li>Park/neutral signal circuit short to ground</li> </ul>	Refer to the electrical circuit diagrams and check the park/neutral signal circuit for short to ground
P084F-15	Park / Neutral Switch Output Circuit - circuit short to battery or open	<ul style="list-style-type: none"> <li>Park/neutral signal circuit short to power or open circuit</li> </ul>	Refer to the electrical circuit diagrams and check the park/neutral signal circuit for short to power or open circuit
P176A-01	Transmission Range Selector Up and Down Position Circuit - General Electrical Failure	<ul style="list-style-type: none"> <li>Raise/Lower mechanism up / down sensor fault</li> </ul>	Suspect transmission shift module, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
P176A-13	Transmission Range Selector Up and Down Position Circuit - circuit open	<ul style="list-style-type: none"> <li>Raise/Lower mechanism current sense fault</li> </ul>	Suspect transmission shift module, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
P176A-19	Transmission Range Selector Up and Down Position Circuit - circuit current above threshold	<ul style="list-style-type: none"> <li>Raise/Lower mechanism motor over current</li> </ul>	Suspect transmission shift module, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
P176A-94	Transmission Range Selector Up and Down Position Circuit - unexpected operation	<ul style="list-style-type: none"> <li>Motor current detected while gear selector knob not moving up or down for 100ms</li> </ul>	Suspect transmission shift module, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
P176B-71	Transmission Range Selector Up and Down Position Control Error - actuator stuck	<ul style="list-style-type: none"> <li>Raise Lower failure. Note: Can be due to driver abuse! If DTC is detected then test raise/lower functionality to confirm OK with no abuse forces or obstructions present. Only replace Transmission shift module if raise/lower issues are present</li> </ul>	Check that no visible obstructions are present and test for normal raise/lower operation. If transmission shift module raises and lowers normally then no further action is required. If the transmission shift module fails to raise and lower normally



DTC	Description	Possible Causes	Action
		with no abuse forces or obstructions present.	even though no obstructions or abuse forces are present then may be due to an internal fault, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
P176C-07	Transmission Range Selector Lock Control Error - Mechanical Failures	<ul style="list-style-type: none"> <li>● Gear selector movement detected while locked. DTC set after 100ms. Park lock failure Transmission shift module has detected that the selector has been turned while a lock request has been received from the Transmission control module This is usually due to the driver releasing the brake pedal with the selector in between positions and does not represent a fault.</li> </ul>	Check for normal shift interlock lock/unlock operation, and check for short circuit DTCs. If the transmission shift module locks and unlocks normally then no further action is required. If the transmission shift module fails to lock normally when fully in the P position then may be due to an internal fault, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
P176C-11	Transmission Range Selector Lock Control Error - circuit short to ground	<ul style="list-style-type: none"> <li>● Short to ground detected while solenoid active for 100ms.</li> </ul>	Suspect transmission shift module, check operation of the shift interlock, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
P176C-12	Transmission Range Selector Lock Control Error - circuit short to power	<ul style="list-style-type: none"> <li>● Short to power detected for 100ms.</li> </ul>	Suspect transmission shift module, check operation of the shift interlock, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
P176C-73	Transmission Range Selector Lock Control Error - actuator stuck closed	<ul style="list-style-type: none"> <li>● Solenoid Unlock Failure. This may be due either to the user applying a prolonged rotational force against the selector lock mechanism while it is attempting to unlock or due to an internal failure</li> </ul>	Check for normal shift interlock lock/unlock operation. If the transmission shift module locks and unlocks normally then no further action is required. If the transmission shift module fails to lock and unlock normally then may be due to an internal fault, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
U0001-88	High Speed CAN Communication Bus - bus off	<ul style="list-style-type: none"> <li>● HS CAN Failure (Bus Off)</li> </ul>	Refer to the electrical circuit diagrams and check CAN bus for short, open circuit
U0100-00	Lost Communication With ECM/PCM "A" - missing message	<ul style="list-style-type: none"> <li>● Lost communication with the engine control module</li> <li>● Engine speed signal not received for 450mS (S3)</li> </ul>	Refer to the electrical circuit diagrams and check the CAN Bus connection to the engine control module for short, open circuit. Check the engine control module for related DTCs and refer to the relevant DTC Index
U0101-00	Lost Communication with TCM - missing message	<ul style="list-style-type: none"> <li>● Lost communication with the transmission control module</li> <li>● TCM_PosDisp signal not received for 75mS. (S3)</li> </ul>	Refer to the electrical circuit diagrams and check the CAN Bus connection to the transmission control module for short, open circuit. Check the transmission control module for related DTCs and refer to the relevant DTC Index
U0121-00	Lost Communication With Anti-Lock Brake System (ABS) Control Module - missing message	<ul style="list-style-type: none"> <li>● Lost communication with the anti-lock brake system (ABS) control module</li> <li>● Message containing TCSSwitchSports is not received for 450mS. (S3)</li> </ul>	Refer to the electrical circuit diagrams and check the CAN Bus connection to the anti-lock brake system (ABS) control module for short, open circuit. Check the anti-lock brake system (ABS) control module for related DTCs and refer to the relevant DTC Index
U0139-00	Lost Communication With Suspension Control Module "B" - missing message	<ul style="list-style-type: none"> <li>● Lost communication with the suspension control module "B"</li> <li>● Message containing SUMB signals is not received for 750mS. (S3)</li> </ul>	Refer to the electrical circuit diagrams and check the CAN Bus connection to the suspension control module "B" for short, open circuit. Check the suspension control module "B" for related DTCs and refer to the relevant DTC Index
U0155-00	Lost Communication With Instrument Panel Cluster (IPC) Control Module - missing message	<ul style="list-style-type: none"> <li>● Lost communication with instrument panel cluster</li> <li>● Message containing Powermode is not received for 350mS. (S3)</li> </ul>	Refer to the electrical circuit diagrams and check the CAN Bus connection to the instrument panel cluster for short, open circuit. Check the instrument panel cluster for related DTCs and refer to the relevant DTC Index
U0300-00	Internal Control Module Software Incompatibility - no sub type information	<ul style="list-style-type: none"> <li>● Invalid master configuration ID received</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTC and re-test, if DTC remains suspect the transmission shift module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index

DTC	Description	Possible Causes	Action
U0401-92	Invalid Data Received From ECM/PCM - performance or incorrect operation	<ul style="list-style-type: none"> <li>Jaguar Drive Optimisation Winter/ Performance modes not available. Fault message if a Jaguar Drive Optimization mode button is pressed</li> <li>Message received from Engine Control Module indicates it is unable to support Jaguar Drive Optimisation modes.</li> </ul>	Check ECM for related DTCs and refer to the relevant DTC Index
U0402-64	Invalid Data Received from Transmission control module - signal plausibility failure	<ul style="list-style-type: none"> <li>Implausible lock request received</li> </ul>	Unexpected lock data received from Transmission control module. Check for additional communication DTCs and follow relevant service actions. If no other communication DTCs present, check Transmission control module for related DTCs and refer to the relevant DTC Index
U0402-81	Invalid Data Received from Transmission control module - invalid serial data received	<ul style="list-style-type: none"> <li>Transmission control module CAN message error: complement fault</li> </ul>	Check Transmission control module for DTCs and refer to the relevant DTC Index. If no fault found then refer to the electrical circuit diagrams and check CAN bus for short, open circuit
U0402-82	Invalid Data Received from Transmission control module - alive / sequence counter incorrect / not updated	<ul style="list-style-type: none"> <li>Alive Counter fault detected (Stuck, jumps or Fault Flag). More than 1 fault in 200ms.</li> </ul>	Check Transmission control module for DTCs and refer to the relevant DTC Index. If no fault found then refer to the electrical circuit diagrams and check CAN bus for short, open circuit
U0402-83	Invalid Data Received from Transmission control module - value of signal protection calculation incorrect	<ul style="list-style-type: none"> <li>Calculated checksum for Transmission control module message data does not match received checksum. More than 1 fault in 200ms.</li> </ul>	Check Transmission control module for DTCs and refer to the relevant DTC Index. If no fault found then refer to the electrical circuit diagrams and check CAN bus for short, open circuit
U0402-92	Invalid Data Received from Transmission control module - performance or incorrect operation	<ul style="list-style-type: none"> <li>Message received from Transmission Control Module indicates it is unable to support Jaguar Drive Optimisation modes.</li> </ul>	Check Transmission control module for DTCs and refer to the relevant DTC Index
U0415-92	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - performance or incorrect operation	<ul style="list-style-type: none"> <li>Information only. Message received from Anti-Lock Brake System module indicates it is unable to support Jaguar Drive Optimisation modes.</li> </ul>	Check ABS module for DTCs and refer to the relevant DTC Index
U0422-08	Invalid Data Received From Body Control Module - Bus Signal / Message Failures	<ul style="list-style-type: none"> <li>Update bit for powermode signal not received from central junction box. Possible CAN fault</li> </ul>	Check central junction box for DTCs and refer to the relevant DTC Index
U0422-81	Invalid Data Received From central junction box - invalid serial data received	<ul style="list-style-type: none"> <li>Invalid powermode complement data received from central junction box</li> </ul>	Check central junction box for DTCs and refer to the relevant DTC Index
U0422-92	Invalid Data Received From central junction box - performance or incorrect operation	<ul style="list-style-type: none"> <li>Message received from power assisted steering module indicates that it is unable to support Jaguar Drive Optimisation modes</li> </ul>	Check instrument cluster and central junction box for DTCs and refer to the relevant DTC Index. If no fault found then refer to the electrical circuit diagrams and check CAN bus for short, open circuit
U043A-92	Invalid Data Received From Suspension Control Module "B" - performance or incorrect operation	<ul style="list-style-type: none"> <li>Information only, Suspension Module unable to support Jaguar Drive Optimisation modes( Invalid Data is received from the SUMB )</li> </ul>	Check Suspension Control Module "B" for related DTCs and refer to the relevant DTC Index
U101A-86	Lost Communication With Transmission control module (Multiple Bus) - signal invalid	<ul style="list-style-type: none"> <li>CAN and LIN bus failed. FOR INFORMATION ONLY - No action necessary if no additional CAN or LIN DTCs present</li> </ul>	Check for Transmission control module CAN and/or LIN DTCs present in transmission shift module then refer to actions for these specific DTCs. If no additional Transmission control module CAN and/or LIN DTCs present in transmission shift module then no further action required
U1A14-04	CAN Initialization Failure - System Internal Failures	<ul style="list-style-type: none"> <li>Signal configuration not present / incorrect.</li> </ul>	Suspect transmission shift module, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index

<b>DTC</b>	<b>Description</b>	<b>Possible Causes</b>	<b>Action</b>
U2012-4A	Car Configuration Parameter(s) - incorrect component installed	<ul style="list-style-type: none"> <li>● Mismatch detected between vehicle configuration and installed gear selector variant. Check correct part fitted, and if fault still present, check vehicle configuration</li> </ul>	Check correct transmission shift hardware variant is installed for the vehicle configuration - i.e. for supercharged variants, transmission shift modules with dynamic mode button should be installed only. All other vehicles should contain hardware without the dynamic mode button. If correct hardware installed then check/amend car configuration parameters using the manufacturer approved diagnostic system
U2100-00	Initial Configuration Not Complete - no sub type information	<ul style="list-style-type: none"> <li>● Transmission shift module not fully configured.</li> </ul>	Suspect transmission shift module, check and install new transmission shift module as required, refer to the new module/component installation note at the top of the DTC Index
U3003-16	Battery Voltage - circuit voltage below threshold	<ul style="list-style-type: none"> <li>● Low voltage detected at Transmission shift module (Battery voltage &lt; 8.5V for 660mS)</li> </ul>	Ensure battery is in a fully charged and serviceable condition, refer to the battery care manual. Check ECM for alternator related DTCs, Check battery power feed circuit to Transmission shift module, Clear DTCs, Cycle ignition
U3003-17	Battery Voltage - circuit voltage above threshold	<ul style="list-style-type: none"> <li>● High voltage detected at Transmission shift module (Battery voltage &gt; 16.5V for 660mS)</li> </ul>	Check ECM for alternator/over charging related DTCs, Clear DTCs, Cycle ignition
U3003-62	Battery Voltage - signal compare failure	<ul style="list-style-type: none"> <li>● Measured voltage different to CAN received voltage (Voltage difference &gt; 2V for &gt; 10s)</li> </ul>	Compare vehicle voltage to voltage present at the Transmission shift module, Repair fault, Clear DTCs, Cycle ignition

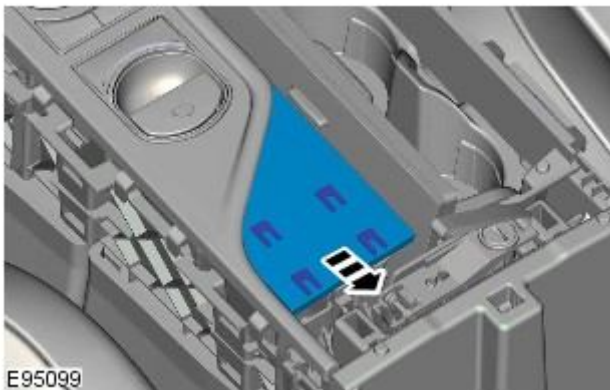
# Automatic Transmission/Transaxle External Controls - Transmission Control Switch (TCS)

Removal and Installation

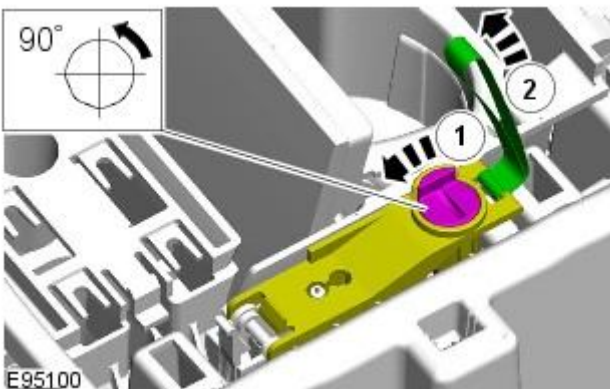
## Removal

• NOTE: Removal steps in this procedure may contain installation details.

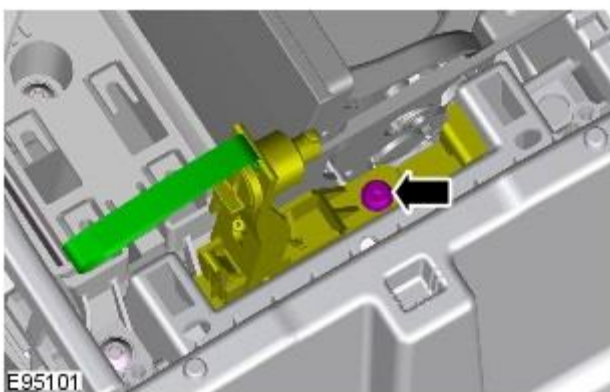
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Audio and Climate Control Assembly](#) (415-01 Information and Entertainment System, Removal and Installation).



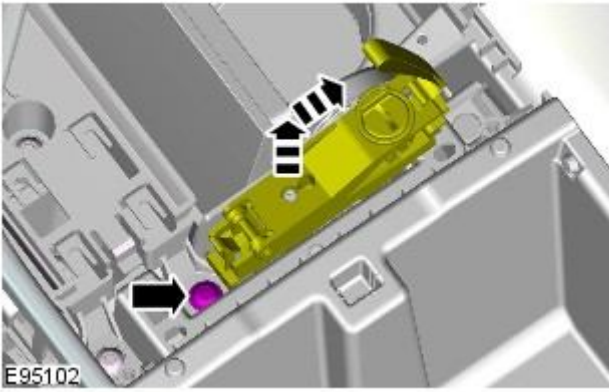
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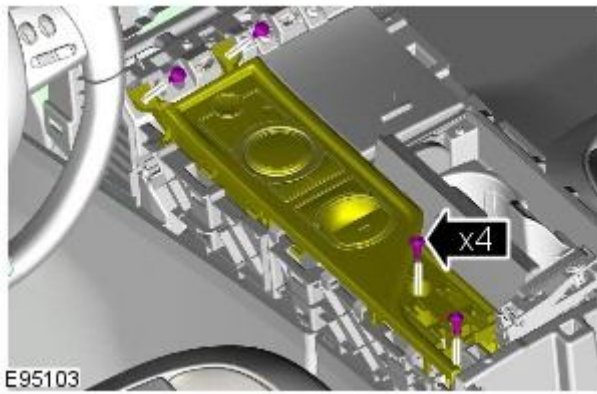
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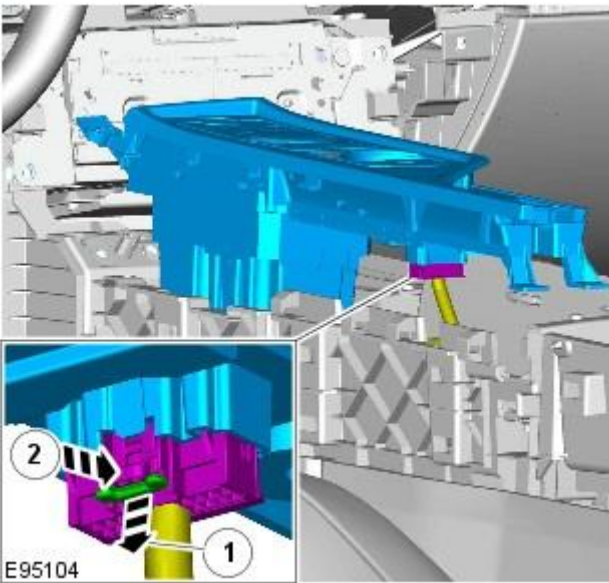
5. Torque: 4 Nm



6. Torque: 4 Nm




7. Torque: 4 Nm



8.

## Installation

1.  CAUTION: Make sure that all diagnostic trouble codes (DTCs) have been removed after the road test.

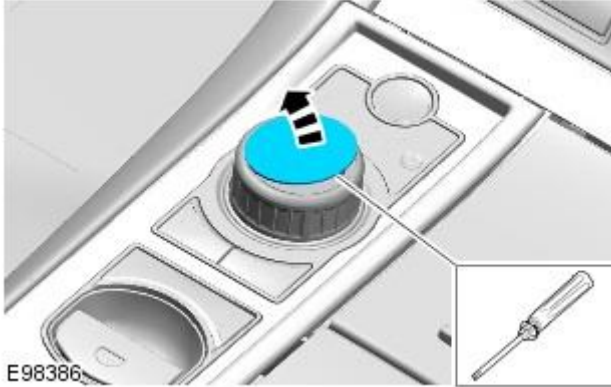
To install, reverse the removal procedure.

# Automatic Transmission/Transaxle External Controls - Transmission Control Switch (TCS) Knob

Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.



1.
  - Start the engine and make sure that 'P' is selected.



2. Torque: 2 Nm

## Installation

1. To install, reverse the removal procedure.



# Automatic Transmission/Transaxle External Controls - Emergency Park Position Release Lever

Removal and Installation

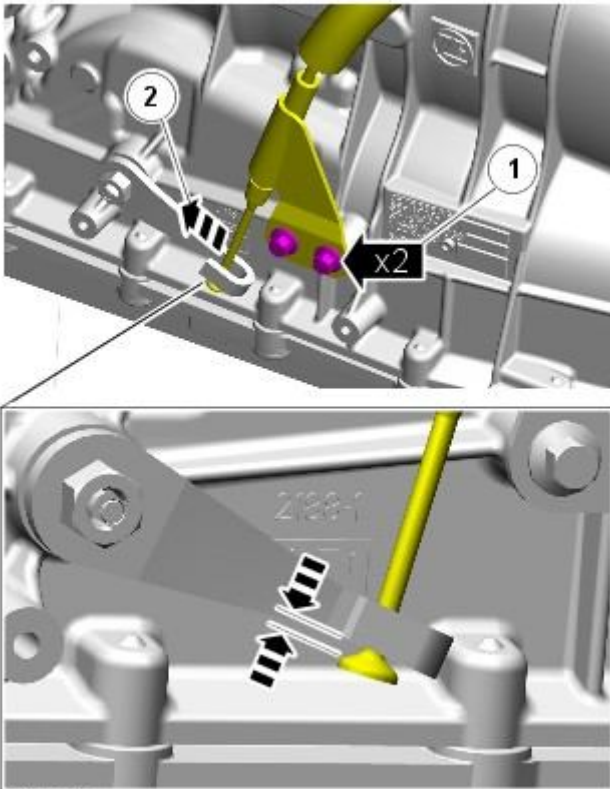
## Removal

• NOTE: Removal steps in this procedure may contain installation details.

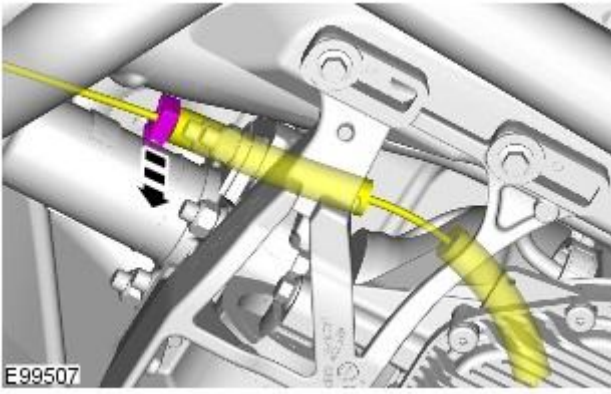
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Air Deflector](#) (501-02, Removal and Installation).
3. Refer to: [Engine Rear Undershield](#) (501-02 Front End Body Panels, Removal and Installation).
4. Refer to: [Floor Console Side Trim Panel](#) (501-12 Instrument Panel and Console, Removal and Installation).

5.  **WARNING:** Make sure to support the vehicle with axle stands.

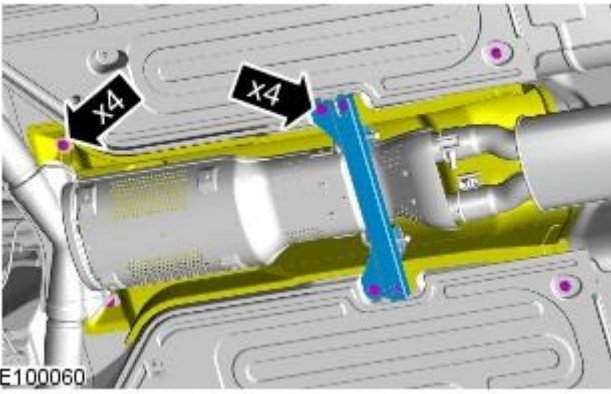
Torque: 11 Nm



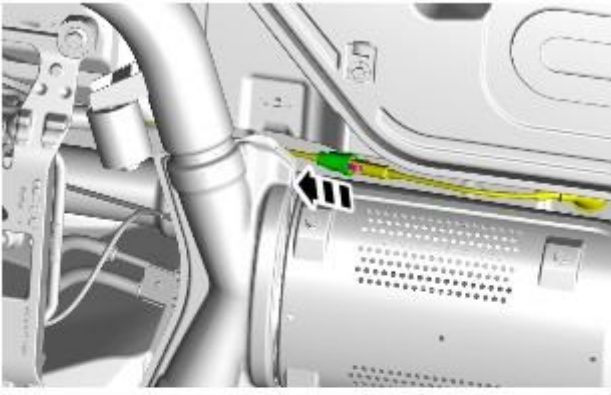
E100350



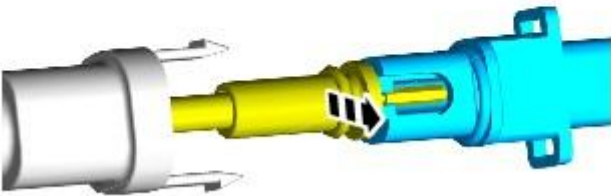
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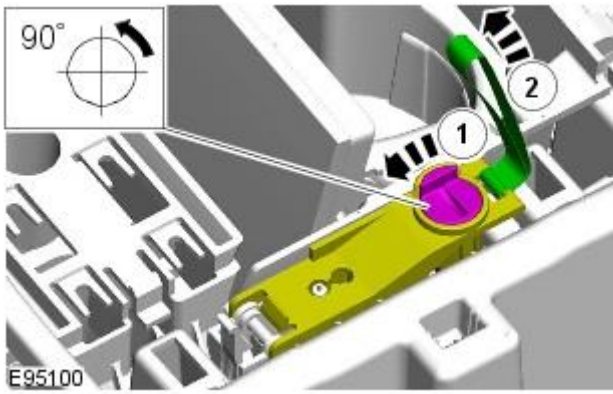
7. Torque: 7 Nm



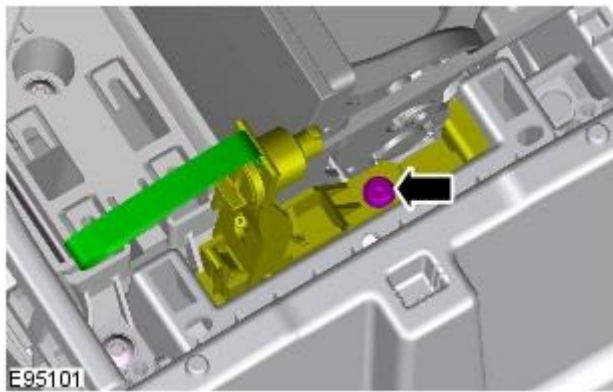
8.



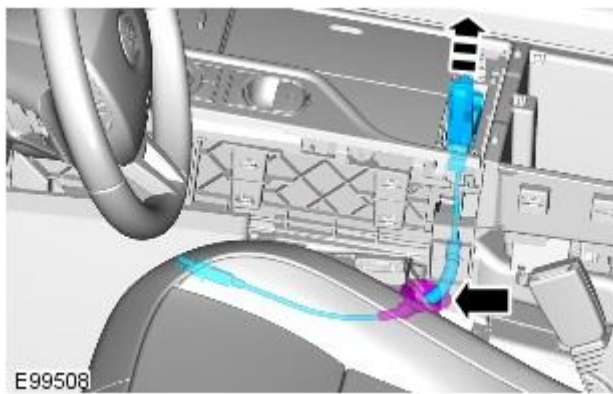
E100061



9.

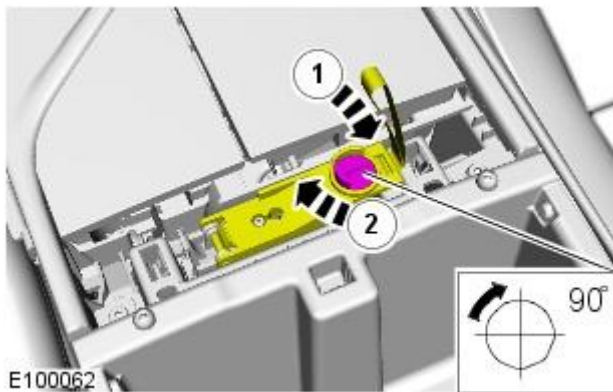


10. Torque: 3 Nm



11.

## Installation



1. To install, reverse the removal procedure.

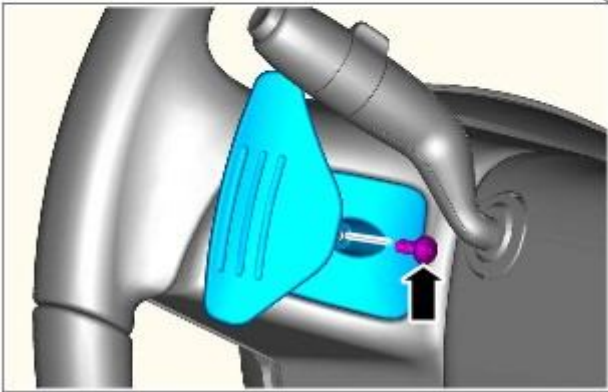
# Automatic Transmission/Transaxle External Controls - Upshift Paddle Switch

Removal and Installation

## Removal

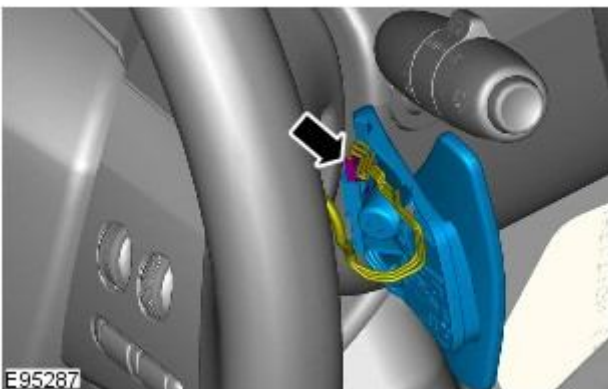
- NOTE: Removal steps in this procedure may contain installation details.

1. Torque: 3 Nm



E95286

- 2.



E95287

## Installation

1. NOTE: Make sure the wiring harness is routed correctly.  
To install, reverse the removal procedure.

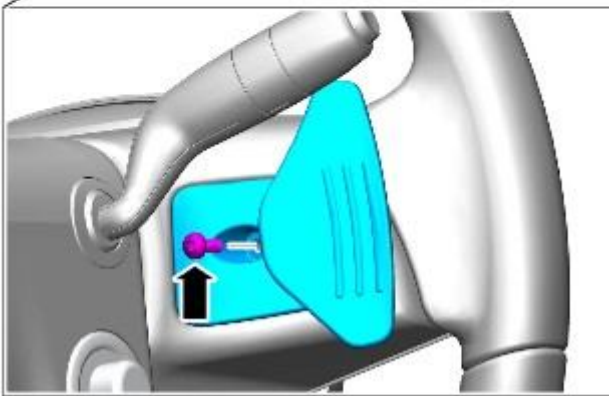
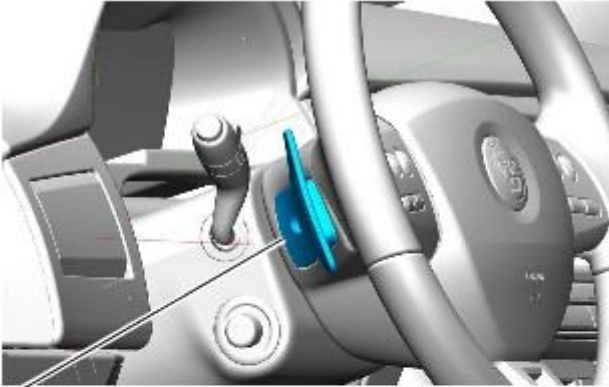
# Automatic Transmission/Transaxle External Controls - Downshift Paddle Switch

Removal and Installation

## Removal

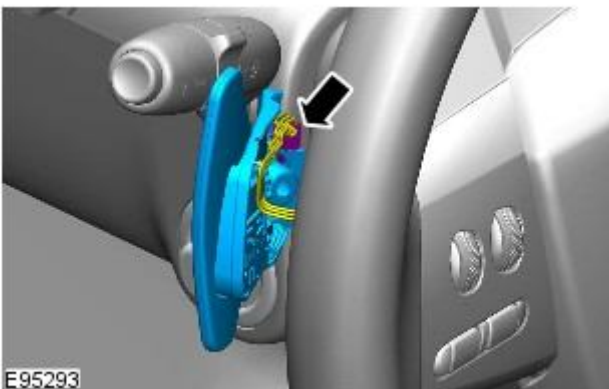
- NOTE: Removal steps in this procedure may contain installation details.

1. Torque: 3 Nm



E95292

- 2.



E95293

## Installation

1. NOTE: Make sure the wiring harness is routed correctly.  
To install, reverse the removal procedure.

**Exhaust System - TDV6 2.7L Diesel -**

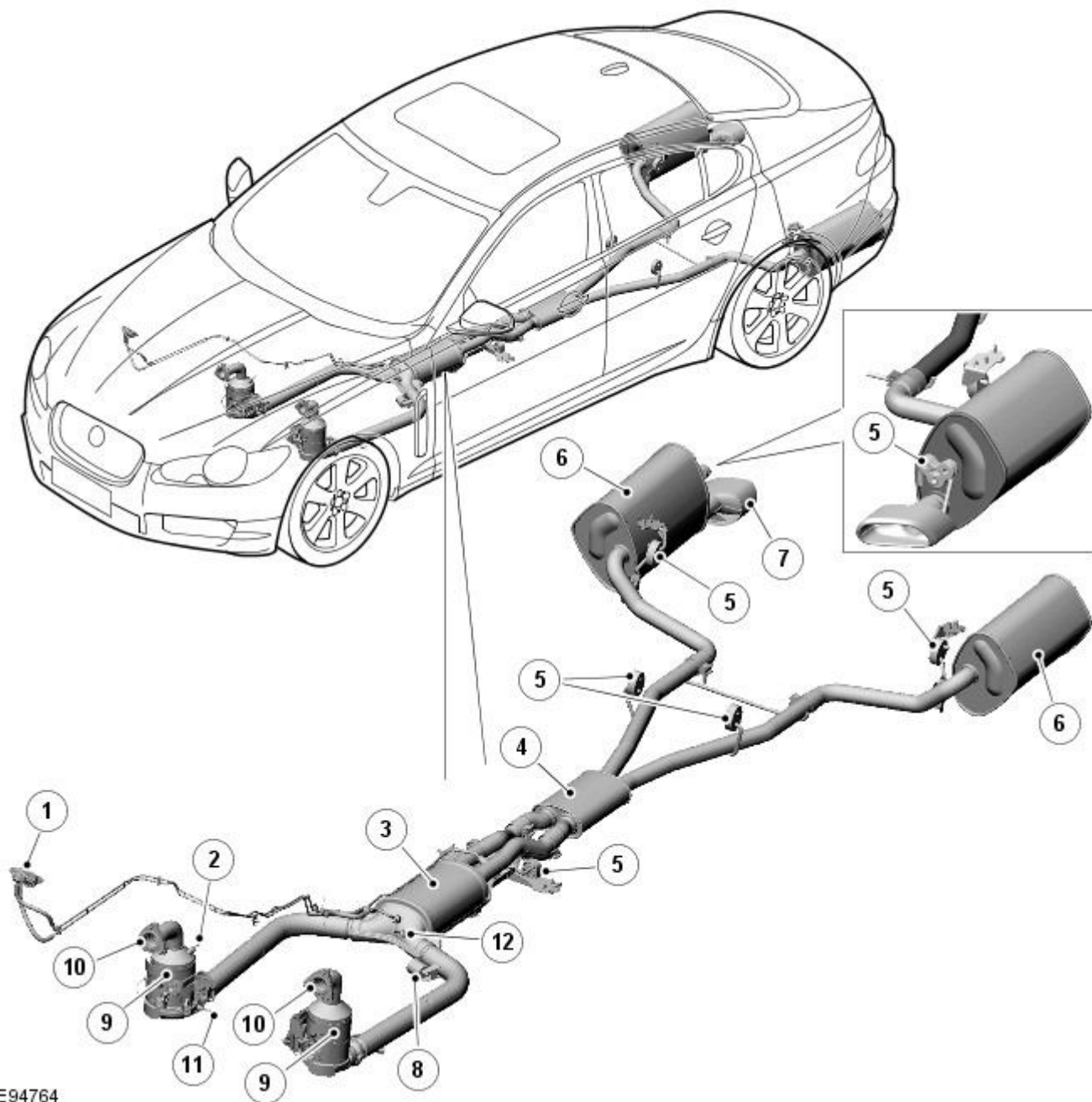
<b>Description</b>	<b>Nm</b>	<b>lb-ft</b>	<b>lb-in</b>
Catalyst support bracket	22	16	-
Muffler under body support bracket	30	22	-
Front muffler retaining clamps	55	41	-
Muffler and tailpipe retaining clamp	55	41	-
Catalyst temperature sensors	35	26	-
Diesel particulate filter (DPF) temperature sensor	35	26	-
Turbocharger to downpipe catalytic converter retaining studs	15	11	-
Turbocharger to downpipe catalytic converter retaining nuts	25	18	-
Downpipe catalytic converter to DPF securing clamp retaining bolts	11	8	-
DPF to front muffler securing clamp retaining bolts	55	41	-
DPF differential pressure sensor retaining nuts	17	12	-
DPF support bracket to body retaining screws	9	-	80
Bracket to catalyst retaining nuts	7	-	62
DPF shield retaining screws	6	-	53
Pressure pipe clamp retaining bolt	2	-	18
DPF isolater to bracket retaining fixings	6	-	53



# Exhaust System - TDV6 2.7L Diesel - Exhaust System - Component Location

Description and Operation

COMPONENT LOCATION 2.7L V6



E94764

## ItemDescription

1	Differential pressure sensor
2	Pre-catalyst exhaust gas temperature sensor (2 off)
3	Diesel Particulate Filter (DPF)
4	Center silencer
5	Mounting rubber (8 off)
6	Rear silencer (2 off)
7	Exhaust trim (2 off)
8	Damper
9	Catalytic converter (2 off)
10	Manifold flange (2 off)
11	Post catalyst exhaust gas temperature sensor (2 off)
12	Pre DPF temperature sensor

# Exhaust System - TDV6 2.7L Diesel - Exhaust System - Overview

Description and Operation

## OVERVIEW

The 2.7L V6 diesel exhaust system is fabricated from stainless steel and is supplied as 6 separate assemblies; a front section incorporating a catalytic converter for each bank of cylinders and the Diesel Particulate Filter (DPF) and a rear section incorporating a center silencer and two rear silencers.

The system is attached to the underside of the body with mounting rubbers which are located on mild steel hanger bars that are welded to the system. The mounting rubbers locate on corresponding hangers which are welded or bolted to the underside of the vehicle body.

The exhaust system incorporates a DPF which allows the vehicle to exceed European Stage 4 emission standards.

# Exhaust System - TDV6 2.7L Diesel - Exhaust System - System Operation and Component Description

Description and Operation

## System Operation

### DIESEL PARTICULATE FILTER (DPF)

#### Passive Regeneration

Passive regeneration requires no special engine management intervention and occurs during normal engine operation. The passive regeneration involves a slow conversion of the particulate matter deposited in the DPF into carbon dioxide. This process is active when the DPF temperature reaches 250°C (482°F) and is a continuous process when the vehicle is being driven at higher engine loads and speeds.

During passive regeneration, only a portion of the particulate matter is converted into carbon dioxide. This is due to the chemical reaction process which is only effective within the normal operating temperature range of 250°C to 500°C (482°F to 932°F).

Above this temperature range the conversion efficiency of the particulates into carbon dioxide increases as the DPF temperature is raised. These temperatures can only be achieved using the active regeneration process.

#### Active Regeneration

Active regeneration starts when the particulate loading of the DPF reaches a threshold as monitored or determined by the DPF control software. The threshold calculation is based on driving style, distance travelled and back pressure signals from the differential pressure sensor.

Active regeneration generally occurs every 450 miles (725 km) although this is highly dependant on how the vehicle is driven. For example, if the vehicle is driven at low loads in urban traffic regularly, active regeneration will occur more often. This is due to the rapid build-up of particulates in the DPF than if the vehicle is driven at high speeds when passive regeneration will have occurred.

The DPF software incorporates a mileage trigger which is used as back-up for active regeneration. If active regeneration has not been initiated by a back pressure signal from the differential pressure sensor, regeneration is requested based on distance travelled.

Active regeneration of the DPF is commenced when the temperature of the DPF is increased to the combustion temperature of the particles. The DPF temperature is raised by increasing the exhaust gas temperature. This is achieved by introducing post-injection of fuel after the pilot and main fuel injections have occurred.

This is determined by the DPF software monitoring the signals from the two DPF temperature sensors to establish the temperature of the DPF. Depending on the DPF temperature, the DPF software requests the ECM to perform either one or two post-injections of fuel:

- The first post-injection of fuel retards combustion inside the cylinder which increases the temperature of the exhaust gas
- The second post-injection of fuel is injected late in the power stroke cycle. The fuel partly combusts in the cylinder, but some unburnt fuel also passes into the exhaust where it creates an exothermic event within the catalytic converter, further increasing the temperature of the DPF.

The active regeneration process takes approximately 20 minutes to complete. The first phase increases the DPF temperature to 500°C (932°F). The second phase further increases the DPF temperature to 600°C (1112°F) which is the optimum temperature for particle combustion. This temperature is then maintained for 15-20 minutes to ensure complete incineration of the particles within the DPF. The incineration process converts the carbon particles to carbon dioxide and water.

The active regeneration temperature of the DPF is closely monitored by the DPF software to maintain a target temperature of 600°C (1112°F) at the DPF inlet. The temperature control ensures that the temperatures do not exceed the operational limits of the turbocharger and the catalytic converter. The turbocharger inlet temperature must not exceed 830°C (1526°F) and the catalytic converter brick temperature must not exceed 800°C (1472°F) and the exit temperature must remain below 750°C (1382°F).

During the active regeneration process the following ECM controlled events occur:

- The turbocharger is maintained in the fully open position. This minimizes heat transmission from the exhaust gas to the turbocharger and reduces the rate of exhaust gas flow allowing optimum heating of the DPF. If the driver demands an increase in engine torque, the turbocharger will respond by closing the vanes as necessary
- The throttle is closed as this assists in increasing the exhaust gas temperature and reduces the rate of exhaust gas flow which has the effect of reducing the time for the DPF to reach the optimum temperature
- The Exhaust Gas Recirculation (EGR) valve is closed. The use of EGR decreases the exhaust gas temperature and therefore prevents the optimum DPF temperature being achieved.

If, due to vehicle usage and/or driving style, the active regeneration process cannot take place or is unable to regenerate the DPF, the dealer can force regenerate the DPF. This is achieved by either driving the vehicle until the engine is at its normal operating temperature and then driving for a further 20 minutes at speeds of not less than 30 mph (48 km/h) or by connecting a Jaguar approved diagnostic system to the vehicle which will guide the technician through an automated regeneration procedure to clean the DPF.

#### Diesel Particulate Filter Control

The DPF requires constant monitoring to ensure that it is operating at its optimum efficiency and does not become blocked. The ECM contains DPF software which controls the monitoring and operation of the DPF system and also monitors other vehicle data to determine regeneration periods and service intervals.

The DPF software can be divided into three separate control software modules; a DPF supervisor module, a DPF fuel management module and a DPF air management module.

These three modules are controlled by a fourth software module known as the DPF co-ordinator module. The co-ordinator module manages the operation of the other modules when an active regeneration is requested. The DPF supervisor module is a sub-system of the DPF co-ordinator module.

#### DPF Fuel Management Module

The DPF fuel management module controls the following functions:

- Timing and quantity of the four split injections per stroke (pilot, main and two post injections)
- Injection pressure and the transition between the three different calibration levels of injection.

The above functions are dependant on the condition of the catalytic converter and the DPF.

The controlled injection determines the required injection level in addition to measuring the activity of the catalytic converter and the DPF. The fuel management calculates the quantity and timing for the four split injections, for each of the three calibration levels for injection pressure, and also manages the transition between the levels.

The two post injections are required to separate the functionality of increasing in-cylinder gas temperatures and the production of hydrocarbons. The first post injection is used to generate the higher in-cylinder gas temperature while simultaneously retaining the same engine torque output produced during normal (non-regeneration) engine operation. The second post injection is used to generate hydrocarbons by allowing unburnt fuel into the catalytic converter without producing increased engine torque.

### **DPF Air Management Module**

The DPF air management module controls the following functions:

- EGR control
- Turbocharger boost pressure control
- Intake air temperature and pressure control.

During active regeneration, the EGR operation is disabled and the closed-loop activation of the turbocharger boost controller is calculated. The air management module controls the air in the intake manifold to a predetermined level of pressure and temperature. This control is required to achieve the correct in-cylinder conditions for stable and robust combustion of the post injected fuel.

The module controls the intake air temperature by actuating the EGR throttle and by adjustment of the turbocharger boost pressure control.

### **DPF Co-ordinator Module**

The DPF co-ordinator module reacts to a regeneration request from the supervisor module by initiating and co-ordinating the following DPF regeneration requests:

- • EGR cut-off
- • Turbocharger boost pressure control
- • Engine load increase
- • Control of air pressure and temperature in the intake manifold
- • Fuel injection control.

When the supervisor module issues a regeneration request, the co-ordinator module requests EGR cut-off and a regeneration specific turbocharger boost pressure control. It then waits for a feedback signal from the EGR system confirming that the EGR valve is closed.

When the EGR valve is closed, the co-ordinator module initiates requests to increase engine load by controlling the intake air temperature and pressure.

Once confirmation is received that intake conditions are controlled or a calibration time has expired, the co-ordinator module then changes to a state awaiting an accelerator pedal release manoeuvre from the driver. If this occurs or a calibration time has expired, the co-ordinator module generates a request to control fuel injections to increase exhaust gas temperature.

## **Component Description**

### **FRONT SECTION**

The front section comprises two catalytic converters. Each catalytic converter has an welded inlet pipe which is curved through 90 degrees. The outer end of the pipe is fitted with a flange which mates with the turbocharger for each bank of cylinders. Three holes in each flange locate on studs in the mating flange on the turbocharger and is secured with 3 flanged nuts. The base of each catalytic converter has an outlet pipe which is fitted with a cone. Two curved pipes from the front of the DPF locate over the outlet pipe on each catalytic converter and are sealed with a gasket against the cone. The joint is compressed and sealed with a clamp.

The curved pipes are welded to the front inlet cone which forms part of the DPF body. The curved pipe has an inner pipe which is secured in the outer pipe by 2 crimped indentations. The DPF inlet cone has 2 bosses which provide for the connection of a DPF temperature sensor and the high pressure pipe for the differential pressure sensor. The DPF is oval in shape and is closed at the rear by an outlet cone with 2 welded short pipes. The **LH (left-hand)** pipe has a bosses which allows for the attachment of the low pressure pipe for the differential pressure sensor. The 2 pipes are held together by a welded hanger brackets which supports the front section of the exhaust system on 2 mounting rubbers.

### **REAR SECTION**

The 2 pipes from the DPF connect into 2 pipes which are welded to the front of the center resonator silencer. The resonator silencer is oval in shape and houses 2 perforated tubes separated by a baffle plate. Exhaust gasses exit the resonator silencer via one of 2 outlet pipes. The outlet pipes are braced together with a bracket and also each have a welded hanger bracket which allow the rear section to be supported on mounting rubbers.

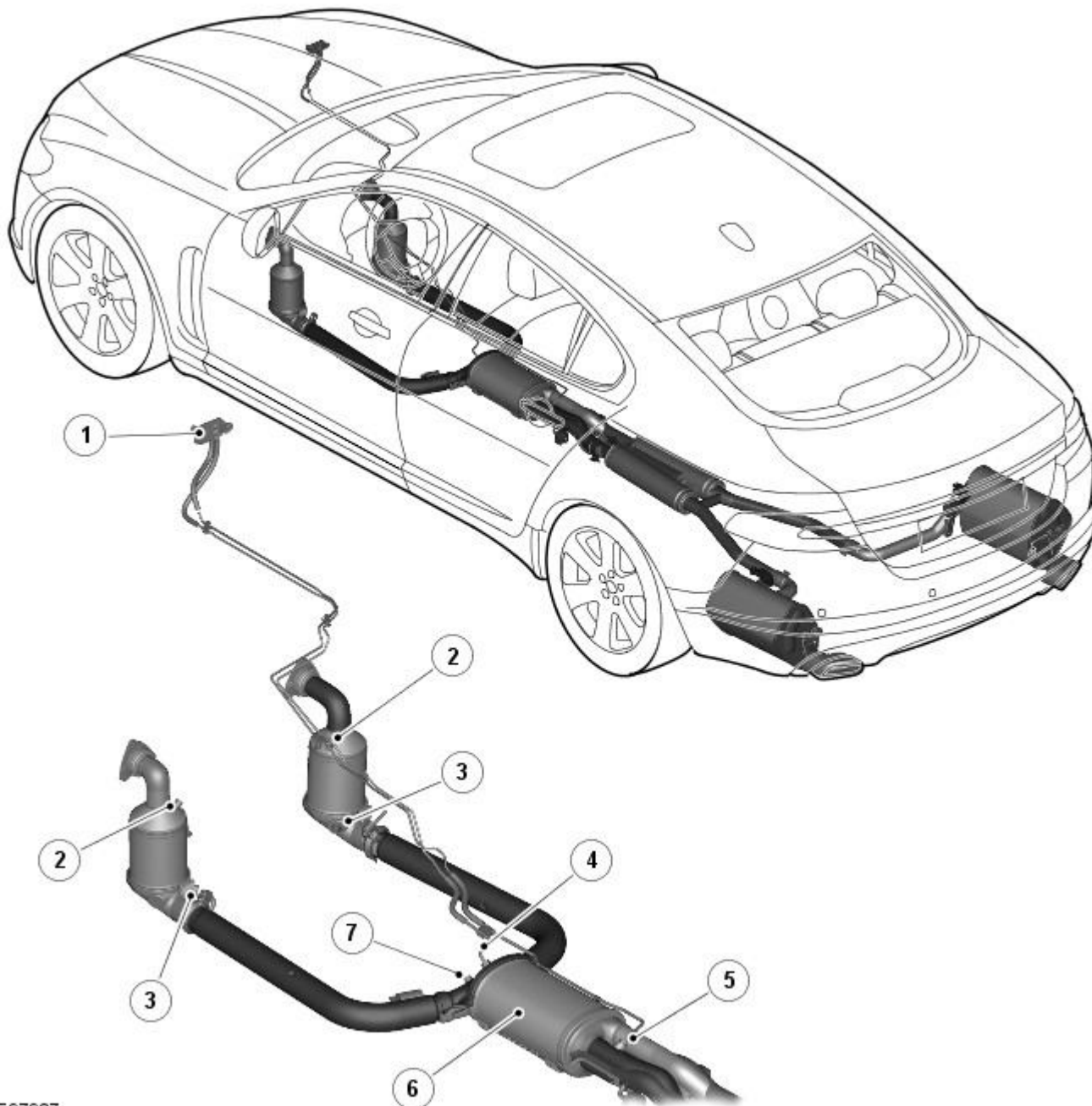
The 2 rear silencers each have a welded inlet pipe which mate with the 2 outlet pipes from the center resonator silencer and are each secured with a clamp. The inlet pipes each have a welded hanger bracket which support each rear silencer at the rear of the vehicle on mounting rubbers. The fabricated rear silencers have 3 perforated tubes which are supported on 2 perforated baffle plates. The exhaust gasses are expelled from the rear silencer via a single outlet pipe. The outlet pipe from each silencer has a welded hanger bar which support the rear silencer on mounting rubbers. The outlet pipe is fitted with a welded outlet which is covered with a polished stainless steel finisher.

### **CATALYTIC CONVERTERS**

The oxidizing catalytic converters are fitted in the front section of each exhaust system, after the pre-catalyst exhaust gas temperature sensor. The pre and post catalyst exhaust gas temperature sensors are used by the engine management system to monitor the DPF for regeneration purposes.

The engine management system provides accurately metered quantities of fuel to the combustion chambers to ensure the most efficient use of fuel and to minimise the exhaust emissions. To further reduce the carbon monoxide and hydrocarbons content of the exhaust gases, a catalytic converter is integrated into each front pipe of the exhaust system. In the catalytic converter the exhaust gases are passed through honeycombed ceramic elements coated with a special surface treatment called 'washcoat'. The washcoat increases the surface area of the ceramic elements by a factor of approximately 7000. On top of the washcoat is a coating containing platinum and palladium, which are the active constituents for converting harmful emissions into inert by-products. The platinum and palladium add oxygen to the carbon monoxide and the hydrocarbons in the exhaust gases, to convert them into carbon dioxide and water respectively.

### **DIESEL PARTICULATE FILTER (DPF)**



E97937

#### ItemDescription

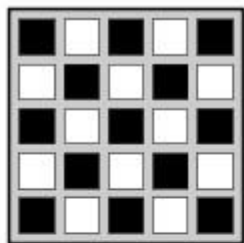
1	Differential pressure sensor
2	Pre-catalyst exhaust gas temperature sensor (2 off)
3	Post catalyst exhaust gas temperature sensor (2 off)
4	High pressure pipe
5	Low pressure pipe
6	DPF
7	DPF temperature sensor

The DPF system reduces diesel particulate emissions to negligible levels to meet current European stage 4 emission standards. The particulate emissions are the black fumes emitted from the diesel engine under certain load conditions. The emissions are a complex mixture of solid and liquid components with the majority of the particulates being carbon microspheres on which hydrocarbons from the engine's fuel and lubricant condense.

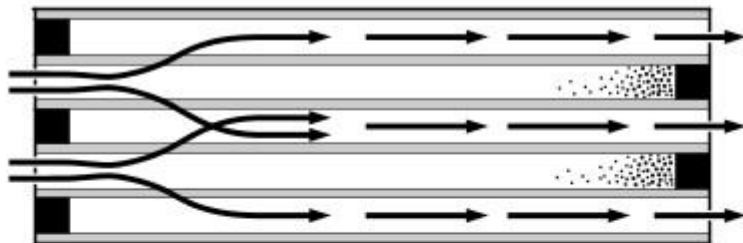
The DPF is located in the exhaust system, downstream of the catalytic converters. A major feature of the DPF is its ability for regeneration. Regeneration is the burning of particulates trapped by the filter to prevent obstruction to the free flow of exhaust gasses. The regeneration process takes place at calculated intervals and is not noticeable by the driver of the vehicle. Regeneration is most important, since an overfilled filter can damage the engine through excessive exhaust back pressure and can itself be damaged or destroyed. The material trapped in the filter is in the most part carbon particles with some absorbed hydrocarbons.

The DPF system comprises the following components:

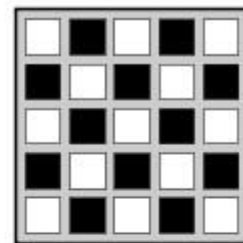
- Diesel particulate filter
- DPF control software incorporated into the [ECM \(engine control module\)](#)
- Exhaust gas temperature sensors
- Differential pressure sensor.



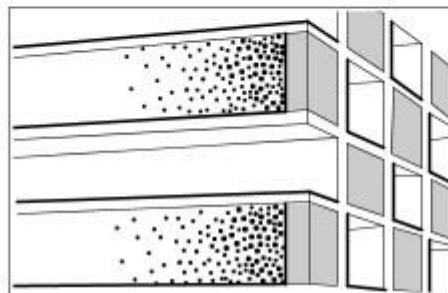
A



B



C



E68716

**ItemDescription**

A	Front face showing alternate closed cells
B	Side view showing exhaust gas flow through the filter and particulate build up
C	Rear face showing alternate closed cells

The DPF uses a filter technology based on a filter with a catalytic coating. The DPF is made from silicon carbide housed in a steel container and has excellent thermal shock resistance and thermal conductivity properties. The DPF is designed for the engine's operating requirements to maintain the optimum back pressure requirements.

The porous surface of the filter consists of a number of small parallel channels positioned in the longitudinal direction of the exhaust system. Adjacent channels in the filter are alternately plugged at the end. This design forces the exhaust gasses to flow through the porous filter walls, which act as the filter medium. Particulate matter which are too big to pass through the porous surface are collected and stored in the channels.

The collected particulate matter, if not removed, can create an obstruction to exhaust gas flow. The particles are removed by a regeneration process which oxidizes the particles.

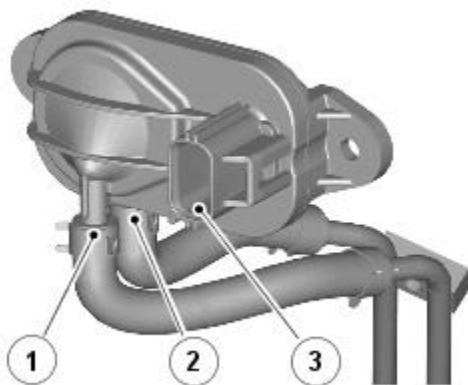
DPF regeneration is controlled by the temperature of the exhaust gasses and the DPF. The DPF includes a wash coat to the filter surface which comprises platinum and other active components and is similar to the catalytic converter. At certain exhaust gas and DPF temperatures the wash coat promotes combustion of the particles in addition to oxidizing carbon monoxide and hydrocarbon emissions.

The exhaust gas and DPF temperatures are controlled by the DPF software located in the ECM. The DPF software monitors the load status of the DPF based on driving style, distance travelled and signals from the differential pressure sensor and temperature sensors. When the particulate loading of the DPF reaches predetermined levels, the DPF is actively regenerated by adjusting, in conjunction with the ECM, various engine control functions such as:

- fuel injection
- intake air throttle
- exhaust gas recirculation
- turbocharger boost pressure control.

The regeneration process is possible because of the flexibility of the common-rail fuel injection engine which provides precise control of fuel flow, fuel pressure and injection timing which are essential requirements to promote the efficient regeneration process. Two processes are used to regenerate the DPF; passive and active.

**DIFFERENTIAL PRESSURE SENSOR**



E68718

**ItemDescription**

1	Low pressure connection
2	High pressure connection
3	Electrical connector

The differential pressure sensor is located in the engine compartment, on the lower RH (right-hand) side of the secondary bulkhead. The sensor is secured with 2 screws.

The differential pressure sensor is used by the DPF software to monitor the condition of the DPF. Two pipe connections on the sensor are connected by pipes to the inlet and outlet ends of the DPF. The pipes allow the sensor to measure the inlet (high) and outlet (low )



pressures of the DPF.

As the amount of particulates trapped by the DPF increases, the pressure at the inlet side of the DPF increases in comparison to the DPF outlet. The DPF software uses this comparison, in conjunction with other data, to calculate the accumulated amount of trapped particulates.

By measuring the pressure difference between the DPF inlet and outlet and the DPF temperature, the DPF software can determine if the DPF is becoming blocked and requires regeneration.

## **DIFFERENTIAL PARTICULATE FILTER TEMPERATURE SENSORS**

Five temperature sensors are used in the DPF system. Two temperature sensors are located in the inlet and outlet sides of each catalytic converter and the fifth sensor is located in the front of the DPF.

The sensors measure the temperature of exhaust gas entering and exiting the catalytic converters and before it passes through the DPF and provides the information needed to calculate the DPF temperature.

The information is used, in conjunction with other data, to estimate the amount of accumulated particulates and to control the DPF temperature.

## **INSTRUMENT CLUSTER INDICATIONS**

For drivers who make regular short journeys at low speeds, it may not be possible to efficiently regenerate the DPF. In this case, the DPF software will detect a blockage of the DPF from signals from the differential pressure sensor and will alert the driver as follows.

When the DPF becomes full the driver will be alerted to this condition by a message 'DPF FULL' accompanied by a handbook symbol. As detailed in the Owners Handbook, the driver should drive the vehicle until the engine is at its normal operating temperature and then drive for a further 20 minutes at speeds of not less than 30 mph (48 km/h). Successful regeneration of the DPF is indicated to the driver by the 'DPF FULL' message no longer being displayed.

If the DPF software detects that the DPF is still blocked, the message will change to 'DPF FULL VISIT DEALER', the driver should take the vehicle to an authorized dealer to have the DPF force regenerated.

## **DIESEL PARTICULATE FILTER SIDE EFFECTS**

The following section details some side effects caused by the active regeneration process.

### **Engine Oil Dilution**

Engine oil dilution can occur due to small amounts of fuel entering the engine crankcase during the post-injection phases. This has made it necessary to introduce a calculation based on driving style to reduce oil service intervals if necessary. The driver is alerted to the oil service by a message in the instrument cluster.

The DPF software monitors the driving style, the frequency of the active regeneration and duration. Using this information a calculation can be made on the engine oil dilution. When the DPF software calculates the engine oil dilution has reached a predetermined threshold (fuel being 7% of engine oil volume) a service message is displayed in the instrument cluster.

Depending on driving style, some vehicles may require an oil service before the designated interval. If an service message is displayed, the vehicle will be required have a full service and the service interval counter will be reset.

### **Fuel Consumption**

During the active regeneration process of the DPF, there will be an increase in fuel consumption. However, because active regeneration occurs infrequently and for limited periods of time, the overall effect on fuel consumption is approximately 2%. The additional fuel used during the active regeneration process is accounted for in the instantaneous and average fuel consumption displays in the instrument cluster.

# Exhaust System - TDV6 2.7L Diesel - Exhaust System

Diagnosis and Testing

## Principles of Operation

For a detailed description of the diesel engine exhaust system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (309-00A)

Exhaust System (Description and Operation),  
Exhaust System (Description and Operation),  
Exhaust System (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical
<ul style="list-style-type: none"> <li>● Leaks</li> <li>● Metal fatigue</li> <li>● Pipes, mufflers and catalytic converters</li> <li>● Joints</li> <li>● Mountings</li> <li>● Clearance around components</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Excessively noisy/leaking exhaust	<ul style="list-style-type: none"> <li>● Exhaust system/components</li> </ul>	Inspect exhaust system, refer to Visual Inspection above. Rectify leaks and install new components as required. Refer to Removal and Installation instructions in this section
Loss of power	<ul style="list-style-type: none"> <li>● Restricted exhaust system</li> <li>● Fuel system</li> <li>● Ignition system</li> <li>● Electronic engine control</li> </ul>	Install new exhaust components as required. Refer to Removal and Installation instructions in this section. Check for fuel, ignition and electronic engine control DTCs and refer to the relevant DTC Index

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

- NOTE: If the module or a component is suspect and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).
- NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.
- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P042600	Catalyst Temperature Sensor Circuit Range/Performance (Bank 1, Sensor Circuit 1)	<ul style="list-style-type: none"> <li>● Upstream catalytic converter A temperature sensor signal circuit - short to ground, power, open circuit</li> <li>● Upstream catalytic converter A temperature sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check Upstream catalytic converter A temperature sensor signal circuit for short to ground, power, open circuit, intermittent poor or dirty connections. Check and install a new sensor as required
P042626	Catalyst Temperature Sensor Circuit Range/Performance (Bank 1, Sensor Circuit 1)	<ul style="list-style-type: none"> <li>● TPC plausibility check at cold engine</li> </ul>	Refer to the electrical circuit diagrams and check catalytic converter temperature sensor circuits for short, open circuit. Check and install a new sensor as required
P042627	Catalyst Temperature Sensor Circuit Range/Performance (Bank 1, Sensor Circuit 1)	<ul style="list-style-type: none"> <li>● TPC gradient check</li> </ul>	Refer to the electrical circuit diagrams and check catalytic converter temperature sensor circuits for intermittent short, open circuit. Check for poor, loose connections. Check and install a new sensor as required




<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
		temperature sensor failure	
P244A00	Diesel Particulate Filter Differential pressure too Low	<ul style="list-style-type: none"> <li>● Differential pressure sensor tubes/hoses split/leaking</li> <li>● DPF split/leaking</li> </ul>	Check integrity of differential pressure sensor tubes/hoses. Check integrity of Diesel Particulate Filter
P244B00	Diesel Particulate Filter Differential Pressure Too High	<ul style="list-style-type: none"> <li>● Differential pressure sensor tubes/hoses blockage/restriction</li> <li>● DPF blockage/restriction</li> </ul>	Check integrity of differential pressure sensor tubes/hoses. Check integrity of Diesel Particulate Filter. Contact Dealer Technical Support for further information
P245300	Diesel Particulate Filter Differential Pressure Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Exhaust blockage/restriction</li> <li>● DPF blockage/restriction</li> <li>● Differential pressure sensor signal circuit - short to ground, power, open circuit</li> <li>● Differential pressure sensor failure</li> </ul>	Check integrity of exhaust system. Check integrity of Diesel Particulate Filter. Refer to the electrical circuit diagrams and check differential pressure sensor signal circuit for short to ground, power, open circuit. Check and install a new sensor as required
P245400	Diesel Particulate Filter Differential Pressure Sensor Circuit Low	<ul style="list-style-type: none"> <li>● Differential pressure sensor signal circuit - short to ground, power, open circuit</li> <li>● Differential pressure sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check differential pressure sensor signal circuit for short to ground, power, open circuit. Check and install a new sensor as required
P245500	Diesel Particulate Filter Differential Pressure Sensor Circuit High	<ul style="list-style-type: none"> <li>● Differential pressure sensor signal circuit - short to ground, power, open circuit</li> <li>● Differential pressure sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check differential pressure sensor signal circuit for short to ground, power, open circuit. Check and install a new sensor as required
P245600	Diesel Particulate Filter Differential Pressure Sensor Circuit Intermittent/Erratic	<ul style="list-style-type: none"> <li>● Differential pressure sensor tubes/hoses split/leaking</li> <li>● Differential pressure sensor circuit - short to ground, power, open circuit</li> <li>● Differential pressure sensor failure</li> </ul>	Check integrity of differential pressure sensor tubes/hoses. Refer to the electrical circuit diagrams and check differential pressure sensor circuit for short to ground, power, open circuit. Check and install a new sensor as required
P245900	Diesel particulate filter regeneration frequency	<ul style="list-style-type: none"> <li>● DPF load too high due to inappropriate driving condition</li> </ul>	Carry out DPF service regeneration procedure using the manufacturer approved diagnostic system

# Exhaust System - TDV6 2.7L Diesel - Catalytic Converter

Removal and Installation

## Removal

 **WARNING:** Observe due care when working near a hot exhaust system.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

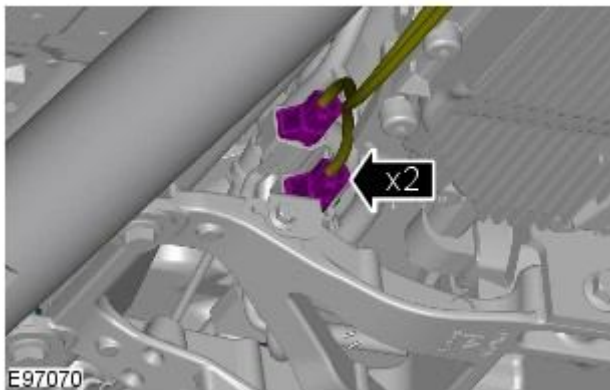
 **CAUTION:** Make sure that the exhaust system is supported with a suitable transmission stand.

Raise and support the vehicle.

2. Remove the engine rear undershield.  
For additional information, refer to: Engine Rear Undershield (501-02, Removal and Installation).
3. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).

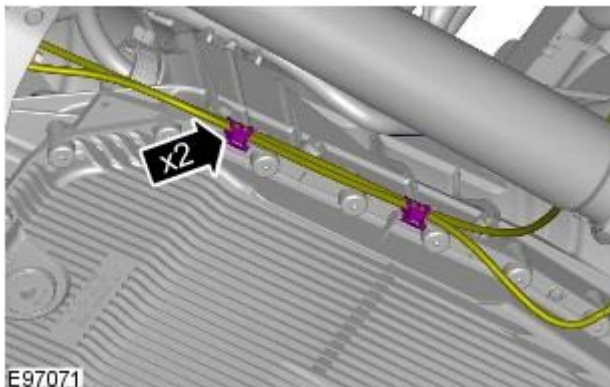
4. **NOTE:** Right-hand shown, left-hand similar.


Disconnect the diesel particulate filter (DPF) wiring harness electrical connectors.



5. **NOTE:** Right-hand shown, left-hand similar.

Release the catalyst monitor sensor wiring harness.

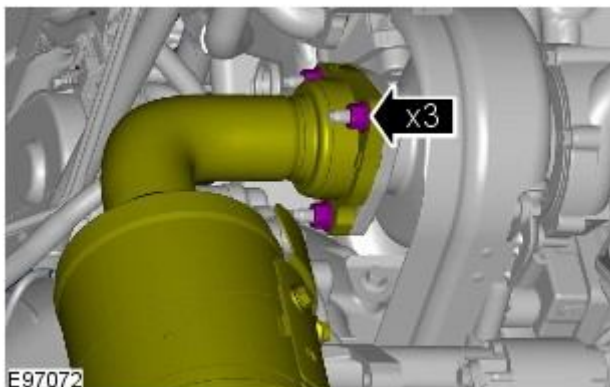


6.  **CAUTION:** Make sure that the catalytic converter is supported using suitable retaining straps.

• **NOTE:** Right-hand shown, left-hand similar.

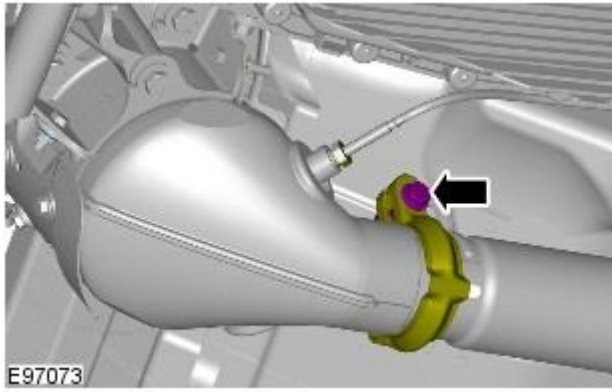
Detach the catalytic converter.


- Remove and discard the retaining nuts.



7. NOTE: Right-hand shown, left-hand similar.

Loosen the catalytic converter to diesel particulate filter (DPF) retaining clamp.

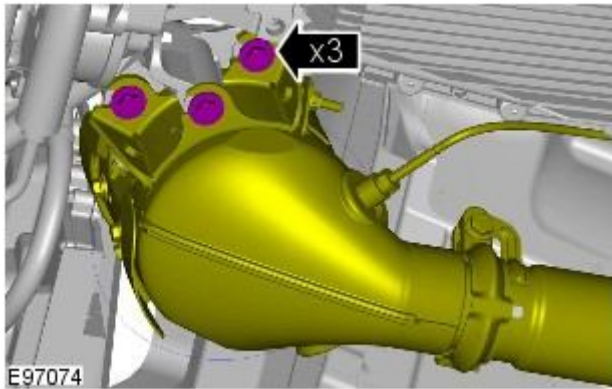


8.  CAUTION: Make sure that the catalytic converter is supported using suitable retaining straps.

• NOTE: Right-hand shown, left-hand similar.

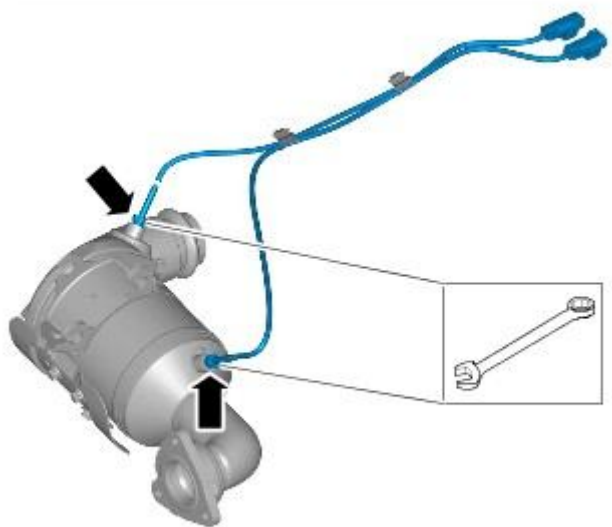
Remove the catalytic converter.

- Remove and discard the gasket.



9. NOTE: Do not disassemble further if the component is removed for access only.

Remove the catalytic converter temperature sensors.

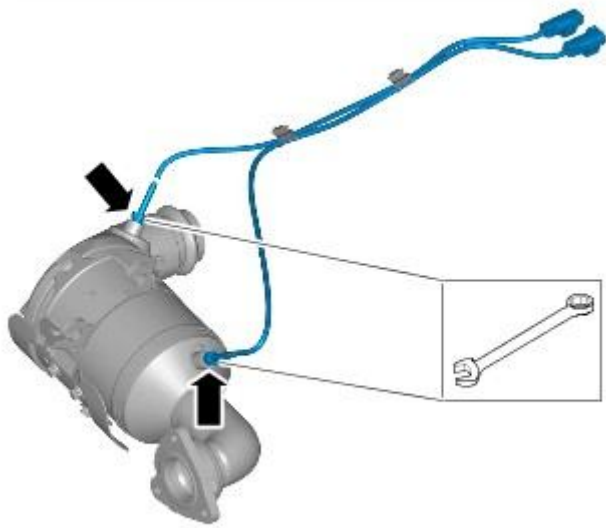


## Installation



1. Install the catalytic converter temperature sensors.

- Tighten to 35 Nm.



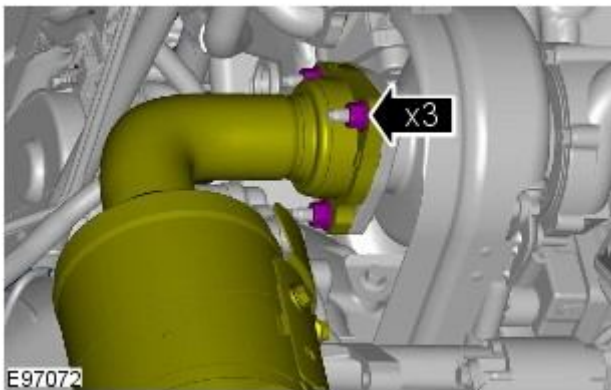
E96854

2.  CAUTION: Jointing compound must not be used forward of the catalytic converter.

- NOTE: Right-hand shown, left-hand similar.

Loosely install the catalytic converter.

- Install a new gasket.
- Install new nuts.

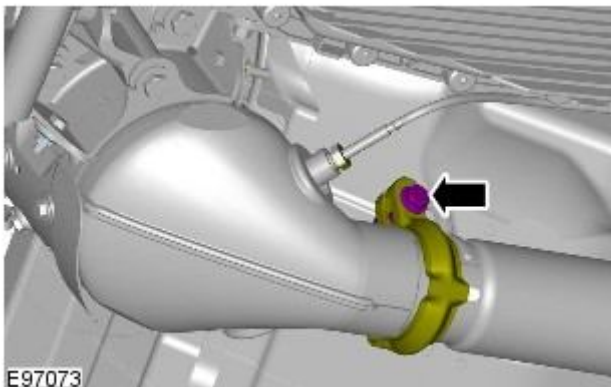


E97072


3. NOTE: Right-hand shown, left-hand similar.

Tighten the catalytic converter to DPF retaining clamp.

- Tighten to 55 Nm.



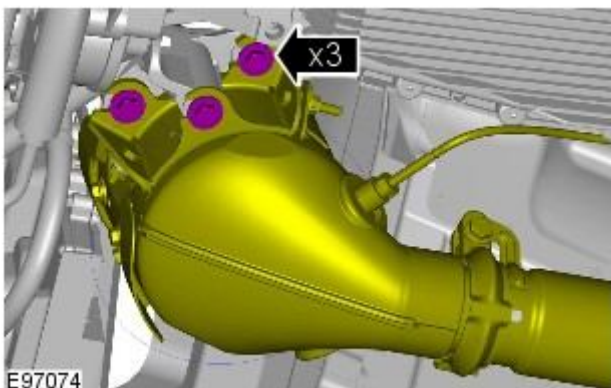
E97073

4.  CAUTION: Make sure that the catalytic converter is supported using suitable retaining straps.

- NOTE: Right-hand shown, left-hand similar.

Attach the catalytic coverter.

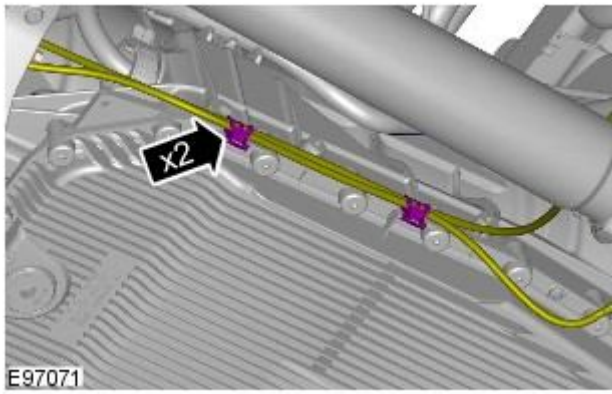
- Tighten to 22 Nm.



E97074

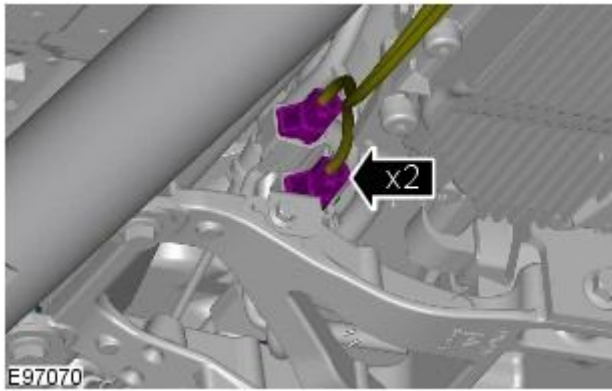
5. NOTE: Right-hand shown, left-hand similar.

Attach the catalyst monitor sensor wiring harness.



6. NOTE: Right-hand shown, left-hand similar.

Connect the DPF wiring harness electrical connectors.



7. NOTE: For NAS vehicles only.

If required, carry out a long drive cycle.


For additional information, refer to: Powertrain Control Module (PCM) Long Drive Cycle Self-Test (303-14C, General Procedures).

# Exhaust System - TDV6 2.7L Diesel - Exhaust System

Removal and Installation

## Removal

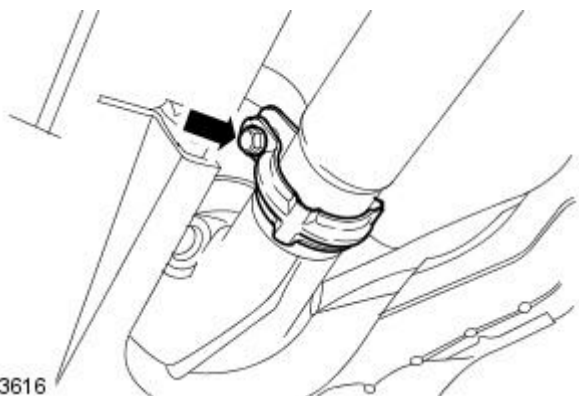
 **WARNING:** Observe due care when working near a hot exhaust system.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

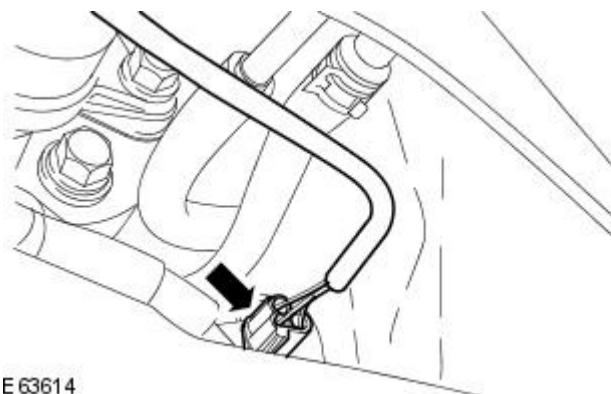
2. Remove both muffler and tailpipes.  
For additional information, refer to: Muffler and Tailpipe (309-00, Removal and Installation).
3. Remove the engine rear undershield.  
For additional information, refer to: Engine Rear Undershield (501-02, Removal and Installation).
4. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
5. **NOTE:** Right-hand shown, left-hand similar.

Loosen the catalytic converter to diesel particulate filter (DPF) retaining clamp.




E63616

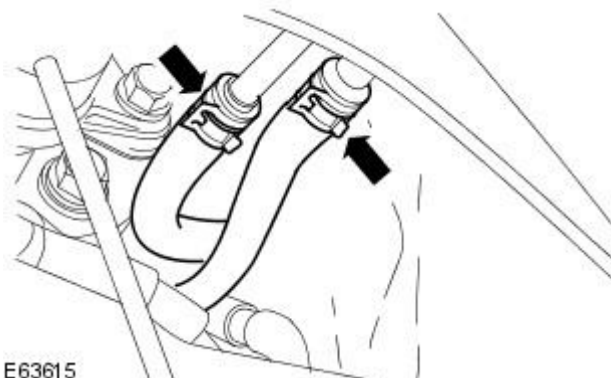
6. Disconnect the DPF wiring harness electrical connector.



E63614

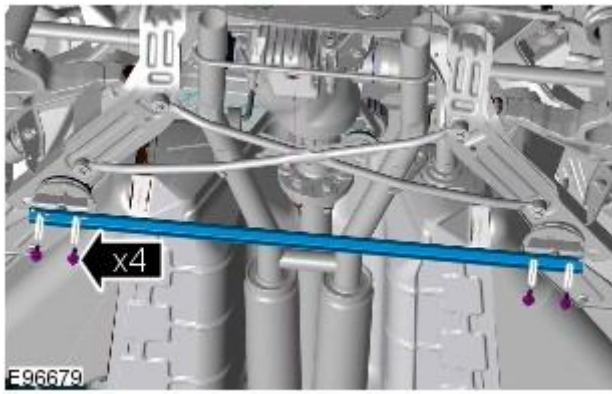
7.  **CAUTION:** Make a note of the connection orientation of the high and low pressure hoses to the sensor ports. Make sure the hoses are located to the correct sensor port when installed. Failure to follow these instructions may result in damage to the vehicle.

Disconnect the high and low pressure hoses from the DPF differential pressure sensor.

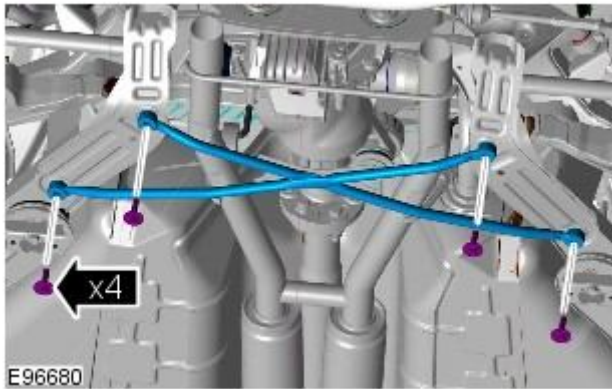



E63615

8. Remove the rear crossmember.



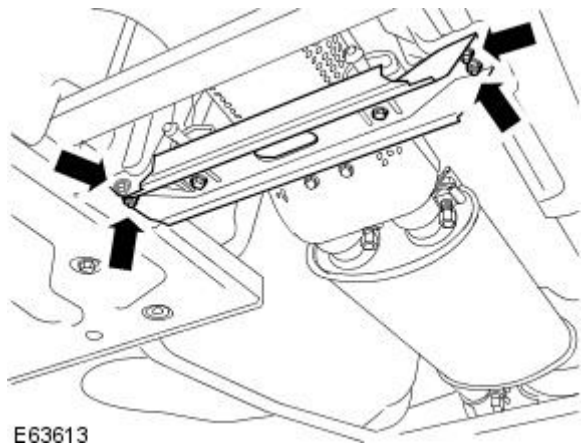
9. Remove the rear subframe crossbrace.



10.  CAUTION: Make sure that the exhaust system is supported with a suitable transmission stand.

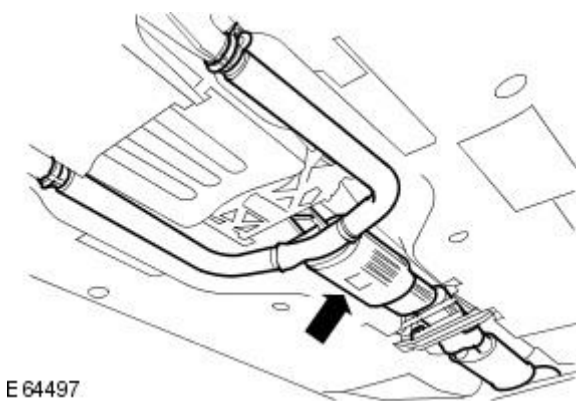
Release the DPF mount bracket.

- Remove and discard the 4 nuts.



11. With assistance, remove the exhaust system.

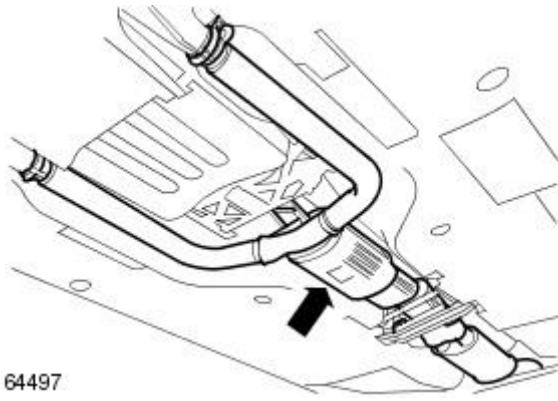
- Discard the gaskets.



## Installation

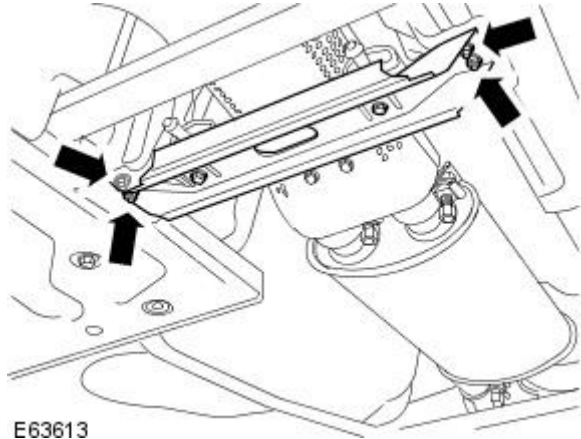


1. To install, reverse the removal procedure.



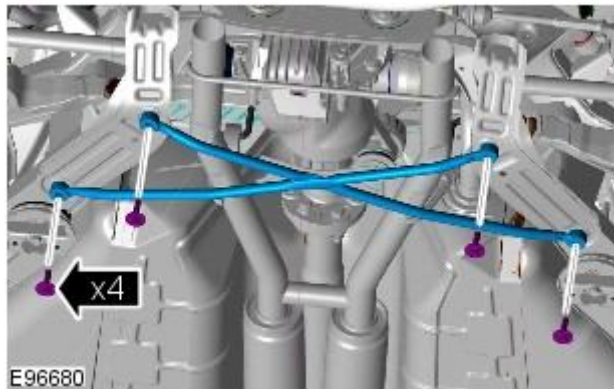
E64497

2. Tighten to 10 Nm.



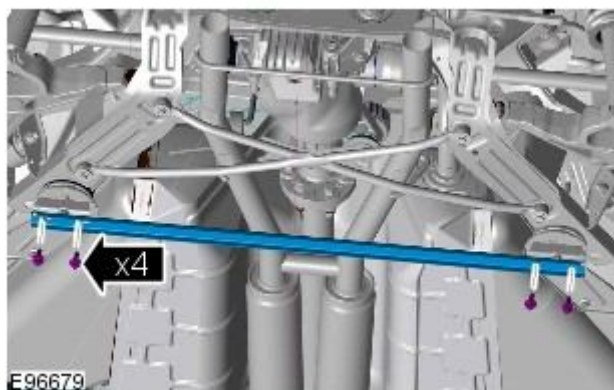
E63613

3. Tighten to 62 Nm.



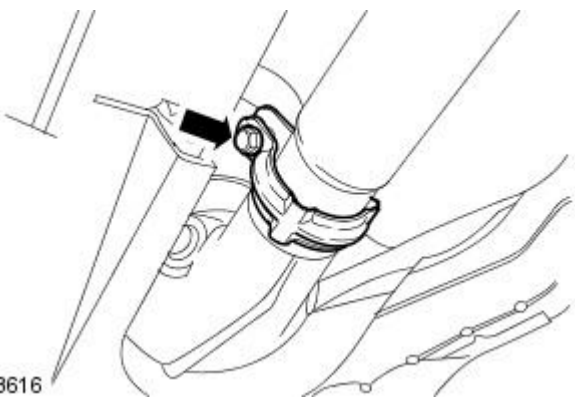
E96680

4. Tighten to 30 Nm.



E96679

5. Tighten to 9 Nm.



E63616




# Exhaust System - TDV6 2.7L Diesel - Diesel Particulate Filter (DPF)

Removal and Installation

## Removal

 **WARNING:** Observe due care when working near a hot exhaust system.

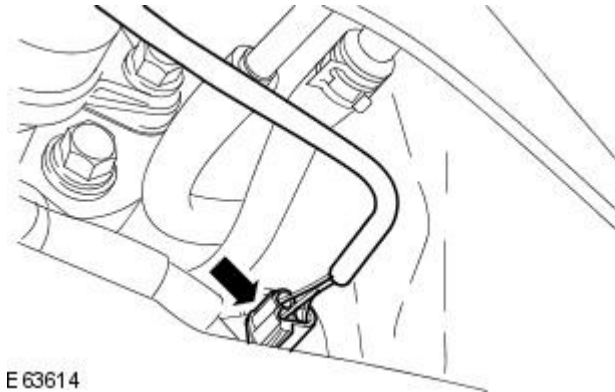
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise the vehicle.

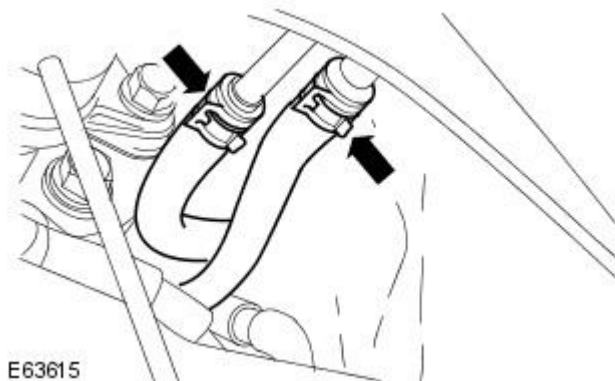
2. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).

3. Remove the engine rear undershield.  
For additional information, refer to: Engine Rear Undershield (501-02, Removal and Installation).


4. Disconnect the diesel particulate filter (DPF) wiring harness electrical connector.



E63614

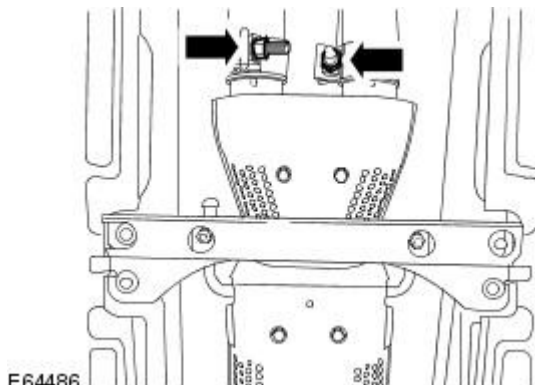


E63615

5.  **CAUTION:** Make a note of the connection orientation of the high and low pressure hoses to the sensor ports. Make sure the hoses are located to the correct sensor port when installed. Failure to follow these instructions may result in damage to the vehicle.

Disconnect the high and low pressure hoses from the DPF differential pressure sensor.

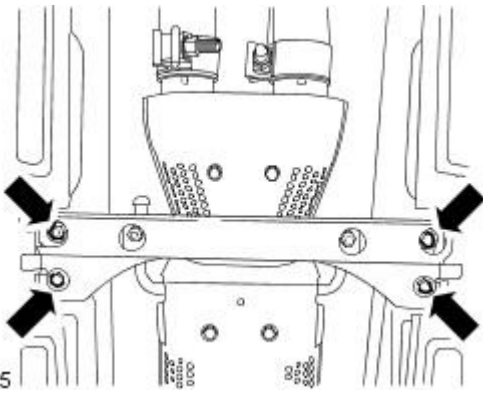
6. Loosen the DPF to center muffler retaining clamps.



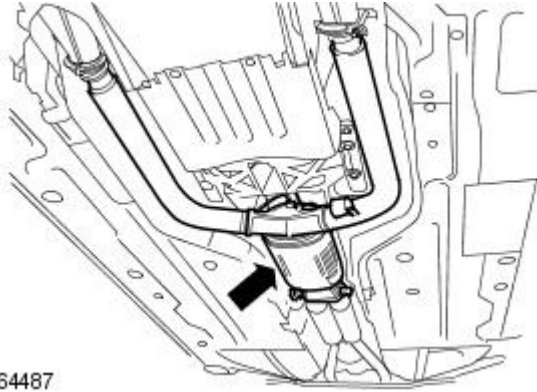
E64486

7. Remove the DPF mount bracket.

- Remove and discard the 4 nuts.

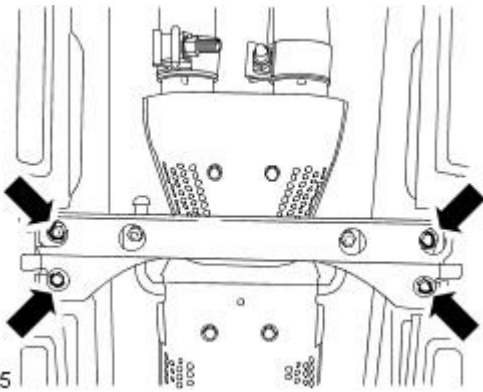


8. With assistance, remove the DPF.



### Installation

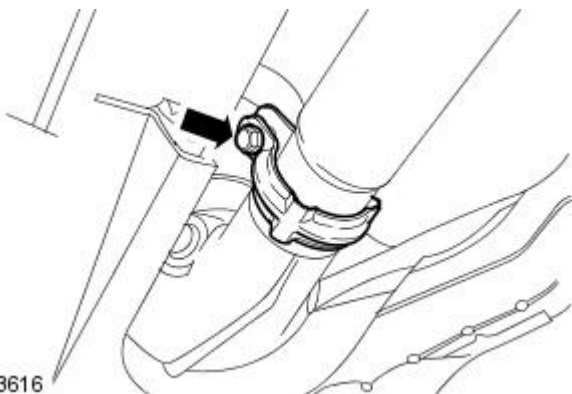
1. To install, reverse the removal procedure.
2. Tighten to 9 Nm.



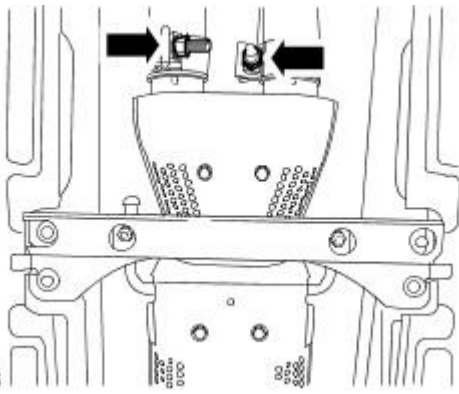
3. NOTE: Install a new gasket.

- NOTE: Right-hand shown, left-hand similar.

Tighten to 11 Nm.



4. Tighten to 55 Nm.



E64486

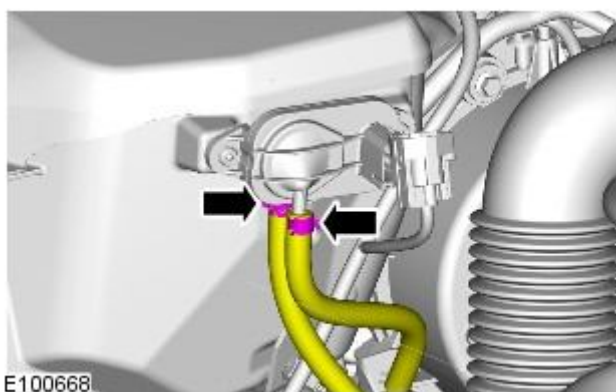
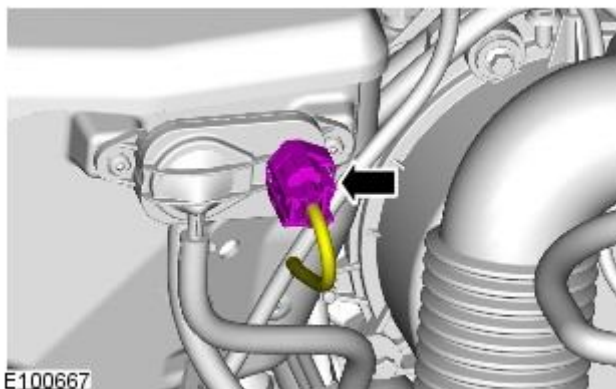
# Exhaust System - TDV6 2.7L Diesel - Diesel Particulate Filter (DPF) Differential


## Pressure Sensor

### Removal and Installation

#### Removal

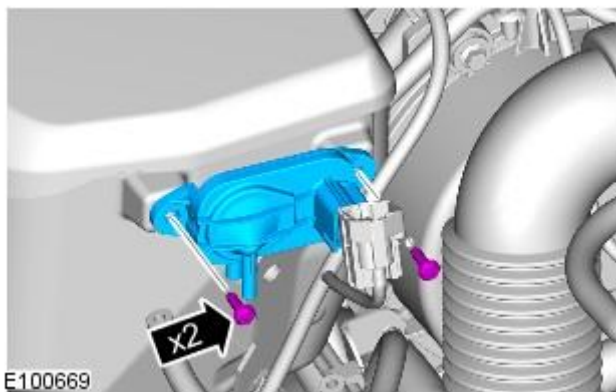
1. Disconnect the battery ground cable.
2. Disconnect the diesel particulate filter (DPF) differential pressure sensor electrical connector.



3.  **CAUTION:** Make a note of the connection orientation of the high and low pressure hoses to the sensor ports. Make sure the hoses are located to the correct sensor port when installed. Failure to follow these instructions may result in damage to the vehicle.

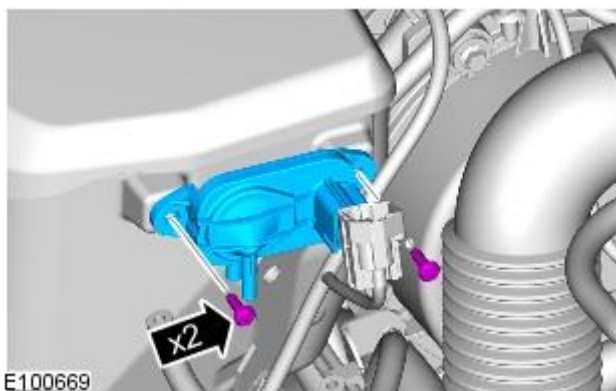
Disconnect the high and low pressure hoses from the DPF differential pressure sensor.

4. Remove the DPF differential pressure sensor.



#### Installation

1. To install, reverse the removal procedure.
  - Tighten to 2 Nm.



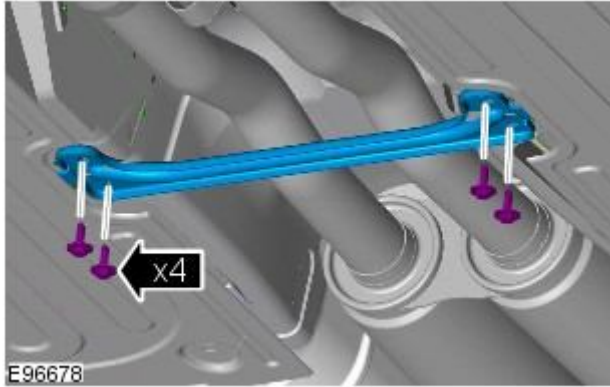
# Exhaust System - TDV6 2.7L Diesel - Front Muffler

Removal and Installation

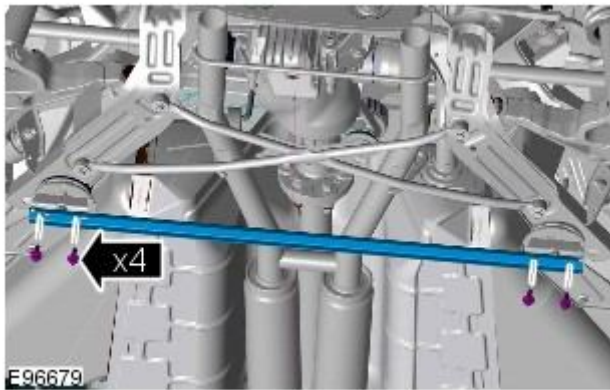
## Removal

 **WARNING:** Observe due care when working near a hot exhaust system.

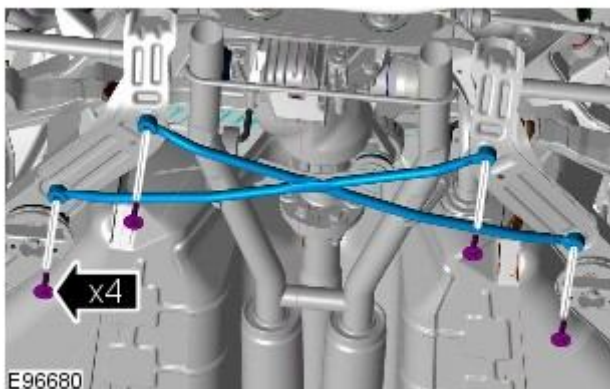
1. Raise the vehicle.
2. Remove the muffler and tailpipe.  
For additional information, refer to: Muffler and Tailpipe (309-00, Removal and Installation).
3. Repeat the above procedure on the opposite side.
4. Remove the engine rear undershield.
5. Remove the support bracket.
  - Remove the 4 bolts.



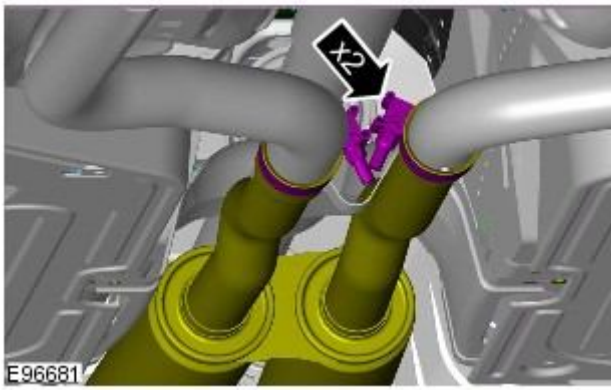
6. Remove the rear crossmember.



7. Remove the rear subframe crossbrace.

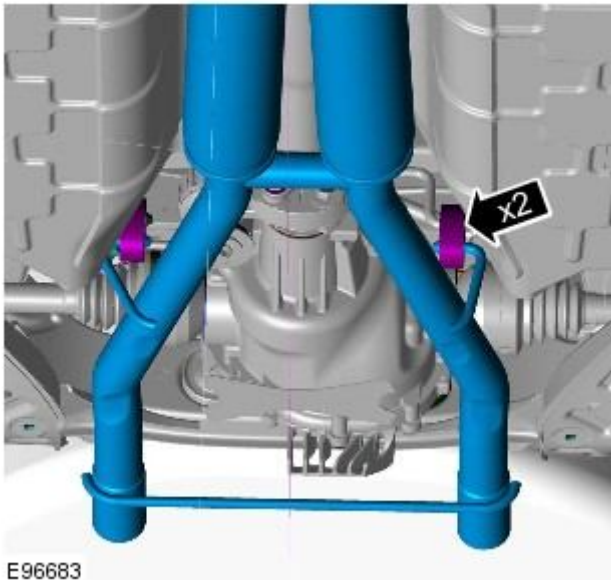


8. Release the exhaust clamps.



9. With assistance, remove the front muffler.

- Release both front muffler hanger insulators.



## Installation

1.  **CAUTION:** The hanger insulators are constructed of a special material. Use only the correct specification insulators.

• **NOTE:** Check the hanger insulators for damage or fatigue. Install new hangers if required

To install, reverse the removal procedure.

- Tighten the catalytic converter retaining clamp to 55 Nm.
- Tighten to 62 Nm.
- Tighten to 30 Nm.
- Tighten to 6 Nm.




# Exhaust System - TDV6 2.7L Diesel - Rear Muffler


Removal and Installation

## Removal

 **WARNING:** Observe due care when working near a hot exhaust system.

• **NOTE:** Removal steps in this procedure may contain installation details.

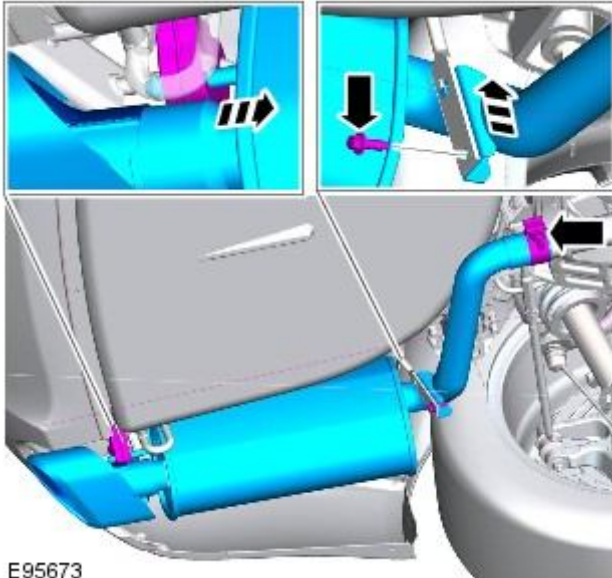
1.  **WARNING:** Make sure to support the vehicle with axle stands.  
Raise and support the vehicle.

2.  **CAUTION:** Make sure that these components are installed to the noted removal position.

*Torque:*

M8 25 Nm

M10 55 Nm



E95673

## Installation

1. To install, reverse the removal procedure.

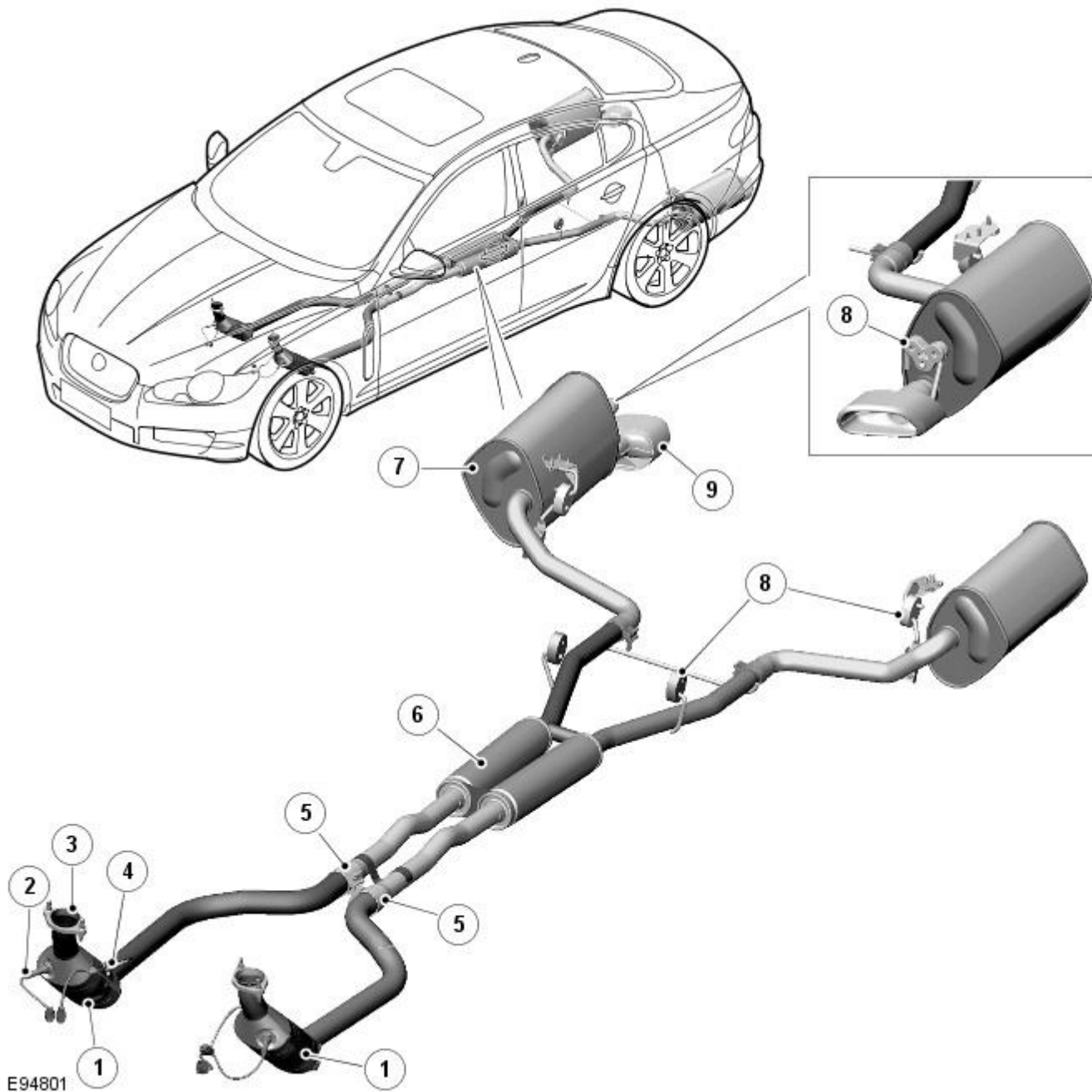
**Exhaust System - V6 3.0L Petrol -**

<b>Description</b>	<b>Nm</b>	<b>lb-ft</b>	<b>lb-in</b>
Exhaust manifold to catalytic converter studs	40	30	-
Exhaust clamps	55	41	-
Heated oxygen sensors	48	35	-
Catalyst monitor sensors	48	35	-
Muffler under body support bracket	25	18	-
Exhaust manifold to catalytic converter retaining nuts	40	30	-
Front muffler retaining clamps	55	41	-
Muffler and tailpipe retaining clamp	55	41	-

# Exhaust System - V6 3.0L Petrol - Exhaust System - Component Location

Description and Operation

COMPONENT LOCATION - 3.0L V6



## ItemDescription

1	Catalytic converter (2 off)
2	Pre-catalyst HO2S (heated oxygen sensor) (2 off)
3	Manifold flange (2 off)
4	Post catalyst HO2S
5	Clamp (2 off)
6	Center resonator silencer (2 off)
7	Rear silencer (2 off)
8	Mounting rubber (6 off)
9	Exhaust trim (2 off)

# Exhaust System - V6 3.0L Petrol - Exhaust System - Overview

Description and Operation

## OVERVIEW

The 3.0L V6 exhaust system is fabricated from stainless steel and is supplied as 5 separate assemblies. The system is very similar in design to the system used on the 4.2L V8 naturally aspirated engine variant.

The front section comprises 2 separate assemblies; [LH \(left-hand\)](#) and [RH \(right-hand\)](#), incorporating a catalytic converter for each bank of cylinders. The rear section comprises of 3 separate sections incorporating a center resonator silencer and a rear silencer.

The system is attached to the underside of the body with mounting rubbers which are located on mild steel hanger bars that are welded to the system. The mounting rubbers locate on corresponding hangers which are welded or bolted to the underside of the vehicle body.

# Exhaust System - V6 3.0L Petrol - Exhaust System - System Operation and Component Description

Description and Operation

## System Operation

### CATALYTIC CONVERTERS

In the catalytic converters, the exhaust gases are passed through honeycombed ceramic elements coated with a special surface treatment called 'washcoat'. The washcoat increases the surface area of the ceramic elements by a factor of approximately 7000. On top of the washcoat is a coating containing palladium and rhodium, which is the active constituent for converting harmful emissions into inert by-products. The palladium and rhodium add oxygen to the carbon monoxide and the hydrocarbons in the exhaust gases, to convert them into carbon dioxide and water respectively.

## Component Description

### FRONT SECTION

The front section comprises two separate pipes, each incorporating a catalytic converter. Each catalytic converter has a welded inlet pipe with a flange. The inlet pipe is flared into a cone which mates with the exhaust manifold. The flange has two holes which locate on studs in the exhaust manifold and is secured with flanged nuts. Each catalytic converter is fitted with a pre and post catalyst [HO2S \(heated oxygen sensor\)](#).

Each catalytic converter has a curved outlet pipe which mates with the respective inlet pipe for the applicable resonator silencer. The joint is secured compressed and sealed with a clamp.

### REAR SECTION

The 2 inlet pipes each connect into a separate resonator silencer. Each resonator silencer is cylindrical in shape and houses 2 perforated tubes separated by 2 baffle plates. Exhaust gasses exit each resonator silencer via an outlet pipe. The 2 outlet pipes are joined together behind the resonator silencers with a cross over pipe. Each pipe also has a welded hanger bracket which allow the rear section to be supported on mounting rubbers. A further bracket is welded to each pipe which braces the 2 pipes together.

The 2 rear silencers each have a welded inlet pipe which mate with the outlet pipes from the resonator silencers and are each secured with a clamp. The inlet pipes each have a welded hanger bracket which support each rear silencer at the rear of the vehicle on mounting rubbers. The fabricated rear silencers have 3 perforated tubes which are supported on 3 perforated baffle plates. The exhaust gasses are expelled from the rear silencer via a single outlet pipe. The outlet pipe from each silencer has a welded hanger bar which support the rear silencer on mounting rubbers. The outlet pipe is fitted with a welded outlet which is covered with a polished stainless steel finisher.

### CATALYTIC CONVERTERS

A catalytic converter is fitted in each front section of the exhaust system. Each catalytic converter is fitted with 2 [HO2S](#).

The [HO2S](#) monitors the exhaust gasses leaving the engine. The [ECM \(engine control module\)](#) uses this information to provide accurately metered quantities of fuel to the combustion chambers to ensure the most efficient use of fuel and to minimize the exhaust emissions.

# Exhaust System - V6 3.0L Petrol - Exhaust System

Diagnosis and Testing

## Principle of Operation

For a detailed description of the exhaust system, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

- [Exhaust System](#) (309-00B Exhaust System - V6 3.0L Petrol, Description and Operation),
- [Exhaust System](#) (309-00B Exhaust System - V6 3.0L Petrol, Description and Operation),
- [Exhaust System](#) (309-00B Exhaust System - V6 3.0L Petrol, Description and Operation),
- [Exhaust System](#) (309-00C Exhaust System - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Description and Operation),
- [Exhaust System](#) (309-00C Exhaust System - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Description and Operation),
- [Exhaust System](#) (309-00C Exhaust System - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern by operating the system.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical
<ul style="list-style-type: none"> <li>● Leaks</li> <li>● Metal fatigue</li> <li>● Pipes, mufflers and catalytic converters</li> <li>● Joints</li> <li>● Mountings</li> <li>● Clearance around components</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Excessively noisy/leaking exhaust	<ul style="list-style-type: none"> <li>● Exhaust system/components</li> </ul>	Inspect exhaust system, refer to Visual Inspection above. Rectify leaks and install new components as required. Refer to Removal and Installation instructions in this section
Loss of power	<ul style="list-style-type: none"> <li>● Restricted exhaust system</li> <li>● Exhaust sound enhancement valve stuck closed</li> <li>● Fuel system</li> <li>● Ignition system</li> <li>● Electronic engine control</li> </ul>	Inspect exhaust system, refer to Visual Inspection above. Install new exhaust components as required. Refer to Removal and Installation instructions in this section. Check for fuel, ignition and electronic engine control system DTCs and refer to the relevant DTC Index

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

- NOTE: If the module or a component is suspect and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the Check and installation of a new module/component.
- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).
- NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.
- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P003100	HO2S Heater Control Circuit Low (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S heater circuit - circuit fault</li> <li>● HO2S heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S heater circuits for short, open circuit. Check and install a new HO2S as required
P003200	HO2S Heater Control Circuit High (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S heater circuit - circuit fault</li> <li>● HO2S heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S heater circuits for short, open circuit. Check and install a new HO2S as required



DTC	Description	Possible Cause	Action
P003600	HO2S Heater Control Circuit (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor heater circuit - circuit fault</li> <li>● Catalytic converter monitor sensor heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor heater circuits for short, open circuit. Check and install new Catalytic converter monitor sensor as required
P005100	HO2S Heater Control Circuit Low (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S heater circuit - circuit fault</li> <li>● HO2S heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S heater circuits for short, open circuit. Check and install a new HO2S as required
P005200	HO2S Heater Control Circuit High (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S heater circuit - circuit fault</li> <li>● HO2S heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S heater circuits for short, open circuit. Check and install a new HO2S as required
P005600	HO2S Heater Control Circuit (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor heater circuit - circuit fault</li> <li>● Catalytic converter monitor sensor heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor heater circuits for short, open circuit. Check and install new Catalytic converter monitor sensor as required
P01311A	O2 Circuit Low Voltage (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>● Exhaust gas leakage</li> <li>● HO2S variable/constant circuit - circuit fault, disconnected</li> <li>● HO2S failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.). Refer to the electrical circuit diagrams and check HO2S variable/constant circuit for short, open circuit, disconnected connector. Check and install a new HO2S as required
P01321B	O2 Circuit High Voltage (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>● Exhaust gas leakage</li> <li>● HO2S variable/constant circuit - circuit fault, disconnected</li> <li>● HO2S failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.). Refer to the electrical circuit diagrams and check HO2S variable/constant circuit for short, open circuit, disconnected connector. Check and install a new HO2S as required
P013300	O2 Circuit Slow Response (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>● Exhaust leak</li> <li>● HO2S to ECM wiring shield high resistance</li> <li>● Fuel control system fault</li> <li>● HO2 sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.). Refer to the electrical circuit diagrams and check HO2S to ECM wiring shield for high resistance. Check fuel control system for failure. Check and install a new HO2S as required
P013400	O2 Circuit No Activity Detected (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S slow activation</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P013700	O2 Circuit Low Voltage (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor sensing circuit - short to ground, high resistance, disconnected</li> <li>● Catalytic converter monitor sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor sensing circuit for short to ground, high resistance, disconnected connector. Check and install new Catalytic converter monitor sensor as required
P013800	O2 Circuit High Voltage (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor sensing circuit - short to power</li> <li>● Catalytic converter monitor sensor ground braided shield - high resistance</li> <li>● Catalytic converter monitor sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor circuits for short to power, and ground braided shield for high resistance. Check and install new Catalytic converter monitor sensor as required
P013900	O2 Circuit Slow Response (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor tip damaged or blocked</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check Catalytic converter monitor sensor tip for damage or blockage, install a new sensor as required
P014000	O2 Circuit No Activity Detected (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensing circuit - short to ground, short to power, high resistance, disconnected</li> <li>● Catalytic converter monitor sensor ground braided shield - high resistance</li> <li>● Catalytic converter monitor sensor - mechanical damage</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor circuits for short to ground, power, high resistance, disconnected connector and ground braided shield for high resistance. Check and install new Catalytic converter monitor sensor as required
P014100	O2 Heater Circuit (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor heater control circuit - high resistance</li> <li>● Catalytic converter monitor sensor heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor heater control circuit for high resistance. Check and install a new Catalytic converter monitor sensor as required
P01511A	O2 Circuit Low Voltage (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S sensing circuit - short to ground, short to power, high resistance</li> <li>● HO2S failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S sensing circuit for short to ground, power, high resistance. Check and install a new HO2S as required
P01521B	O2 Circuit High Voltage (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S sensing circuit - short to ground, short to power, high resistance</li> <li>● HO2S failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S sensing circuit for short to ground, power, high resistance. Check and install a new HO2S as required


DTC	Description	Possible Cause	Action
P015300	O2 Circuit Slow Response (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S to ECM wiring shield high resistance</li> <li>● Exhaust leak</li> <li>● Fuel control system fault</li> <li>● HO2 sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S to ECM wiring shield for high resistance. Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.). Check fuel control system for failure. Check and install a new HO2S as required
P015400	O2 Circuit No Activity Detected (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S slow activation</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P015700	O2 Circuit Low Voltage (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor sensing circuit - short to ground, high resistance, disconnected</li> <li>● Catalytic converter monitor sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor sensing circuit for short to ground, high resistance, disconnected connector. Check and install a new Catalytic converter monitor sensor as required
P015800	O2 Circuit High Voltage (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor sensing circuit - short to power</li> <li>● Catalytic converter monitor sensor ground braided shield - high resistance</li> <li>● Catalytic converter monitor sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor sensing circuit for short to power, and sensor ground braided shield for high resistance. Check and install a new Catalytic converter monitor sensor as required
P015900	O2 Circuit Slow Response (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor tip damaged or blocked</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check Catalytic converter monitor sensor tip for damage or blockage, install a new sensor as required
P016000	O2 Circuit No Activity Detected (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor sensing circuit - short to ground, short to power, high resistance, disconnected</li> <li>● Catalytic converter monitor sensor ground braided shield - high resistance</li> <li>● Catalytic converter monitor sensor - mechanical damage</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor sensing circuit for short to ground, short to power, high resistance, disconnected connector, and sensor ground braided shield for high resistance. Check and install a new Catalytic converter monitor sensor as required
P016100	O2 Heater Circuit (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor heater control circuit malfunction</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor heater control circuit for short, open circuit
P042000	Catalytic converter System Efficiency Below Threshold (Bank 1)	<ul style="list-style-type: none"> <li>● Catalytic converter failure due to overheating damage caused by misfire and/or lean combustion</li> <li>● Catalytic converter failure due to poisoning caused by excessive oil consumption and/or contaminated fuel</li> </ul>	Check for misfire/lean combustion DTCs and refer to DTC Index in this section. Check the oil and fuel condition/level. Check the catalytic converter for damage
P043000	Catalytic converter System Efficiency Below Threshold (Bank 2)	<ul style="list-style-type: none"> <li>● Catalytic converter failure due to overheating damage caused by misfire and/or lean combustion</li> <li>● Catalytic converter failure due to poisoning caused by excessive oil consumption and/or contaminated fuel</li> </ul>	Check for misfire/lean combustion DTCs and refer to DTC Index in this section. Check the oil and fuel condition/level. Check the catalytic converter for damage
P209600	Post Catalytic converter Fuel Trim System Too Lean Bank 1	<ul style="list-style-type: none"> <li>● Heated Oxygen Sensor (HO2S) fuel adaption - lean</li> </ul>	Check integrity and correct installation of air intake system. Check for any HO2S codes also logged and refer to DTC Index in this section. Check for air leaks between, or on, upstream and downstream sensors. Check for air leak on Catalytic converter and exhaust path pre-Catalytic converter
P209700	Post Catalytic converter Fuel Trim System Too Rich Bank 1	<ul style="list-style-type: none"> <li>● Heated Oxygen Sensor (HO2S) fuel adaption - rich</li> </ul>	Check integrity and correct installation of air intake system. Check for any HO2S codes also logged and refer to DTC Index in this section. Check for air leaks between, or on, upstream and downstream sensors. Check for air leak on Catalytic converter and exhaust path pre-Catalytic converter
P209800	Post Catalytic converter Fuel Trim System Too Lean Bank 2	<ul style="list-style-type: none"> <li>● Heated Oxygen Sensor (HO2S) fuel adaption - lean</li> </ul>	Check integrity and correct installation of air intake system. Check for any HO2S codes also logged and refer to DTC Index in this section. Check for air leaks between, or on, upstream and downstream sensors. Check for air leak on Catalytic converter and exhaust path pre-Catalytic converter
P209900	Post Catalytic converter Fuel Trim System Too Rich Bank 2	<ul style="list-style-type: none"> <li>● Heated Oxygen Sensor (HO2S) fuel adaption - rich</li> </ul>	Check integrity and correct installation of air intake system. Check for any HO2S codes also logged and refer to DTC Index in this section. Check for air leaks between, or on, upstream and downstream sensors. Check for air leak on Catalytic converter and exhaust path pre-Catalytic converter

# Exhaust System - V6 3.0L Petrol - Catalytic Converter

Removal and Installation

## Removal

 **WARNING:** Observe due care when working near a hot exhaust system.

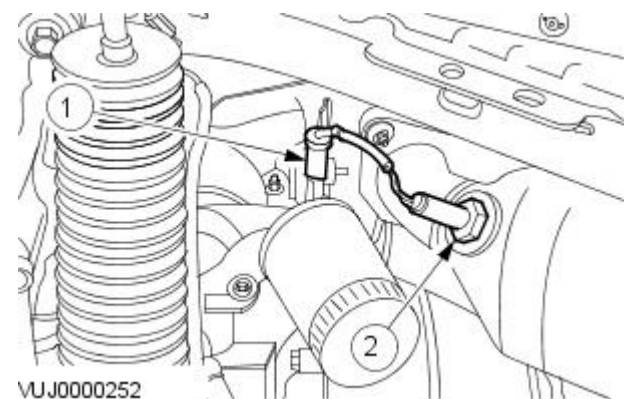
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise the vehicle.

2. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).

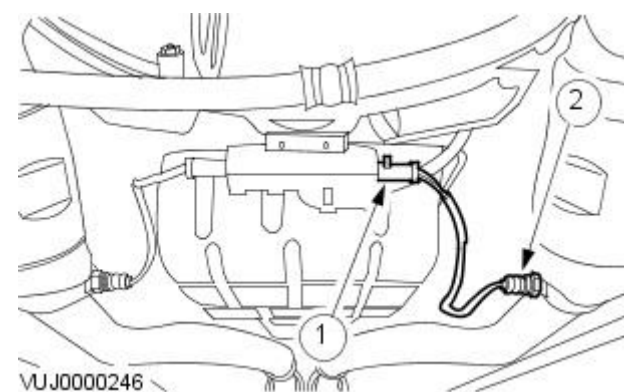
3. Remove the heated oxygen sensor (HO2S).

1. Release the electrical connector from the bracket.
2. Disconnect the electrical connector.
3. Remove the HO2S.

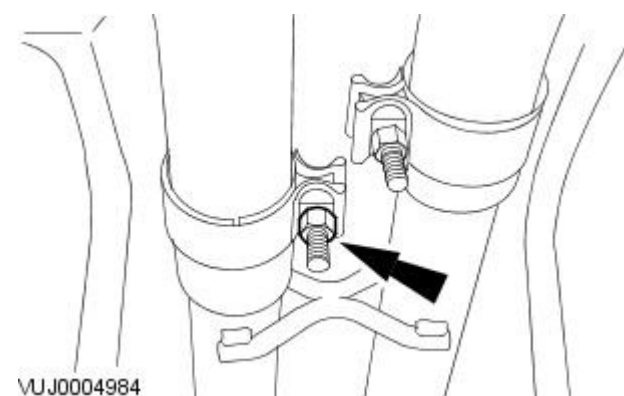


4. Remove the catalyst monitor sensor.

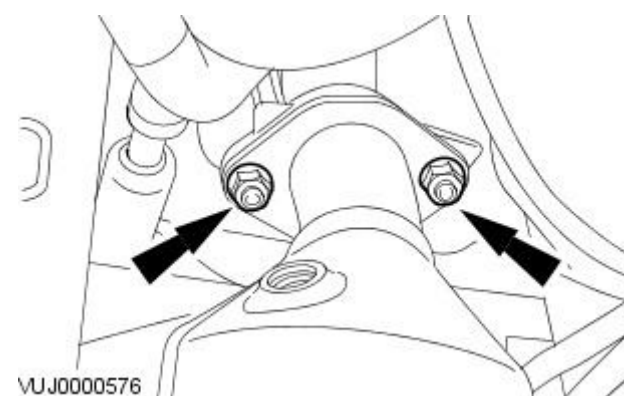
- Release the electrical connector from the bracket.
- Disconnect the electrical connector.
- Remove the catalyst monitor sensor.



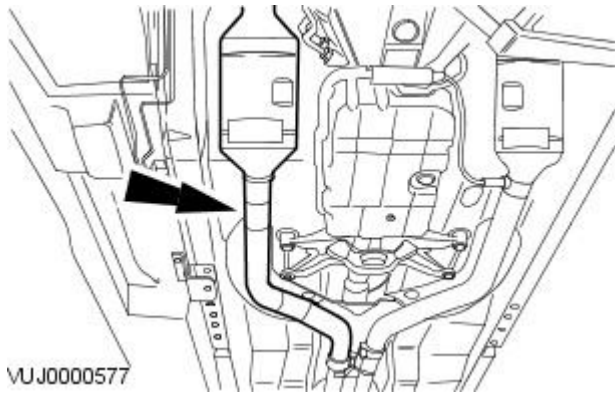
5. Loosen the catalytic converter exhaust clamps and release the front silencer.



6. Release the catalytic converter.

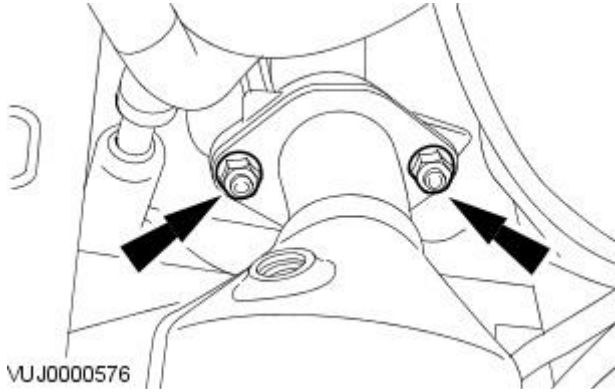


7. Remove the catalytic converter.

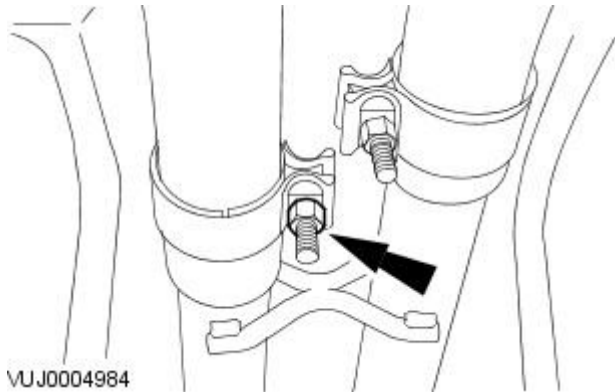


### Installation

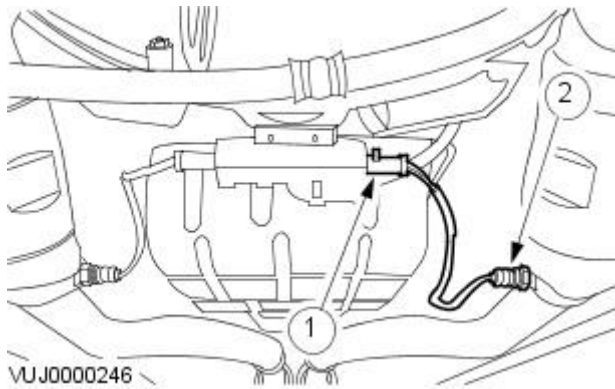
1. To install, reverse the removal procedure.
2. Tighten to 40 Nm.



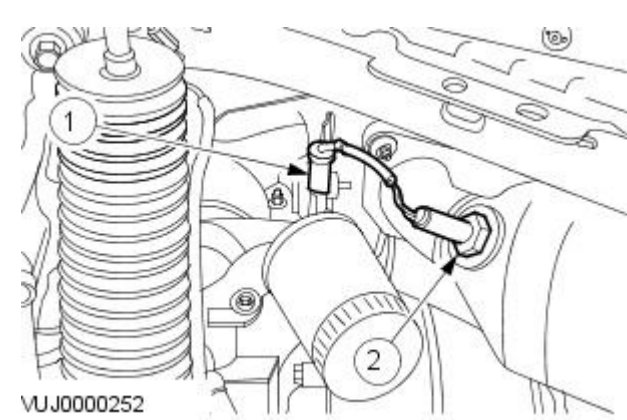
3. Tighten to 55 Nm.



4. Install catalyst monitor sensor and tighten to 40 Nm.



5. Install the HO2S and tighten to 40 Nm.



6. NOTE: For NAS vehicles only.

If required, carry out a long drive cycle.


For additional information, refer to: Powertrain Control Module (PCM)  
Long Drive Cycle Self-Test (303-14C, General Procedures).

# Exhaust System - V6 3.0L Petrol - Exhaust System

Removal and Installation

## Removal

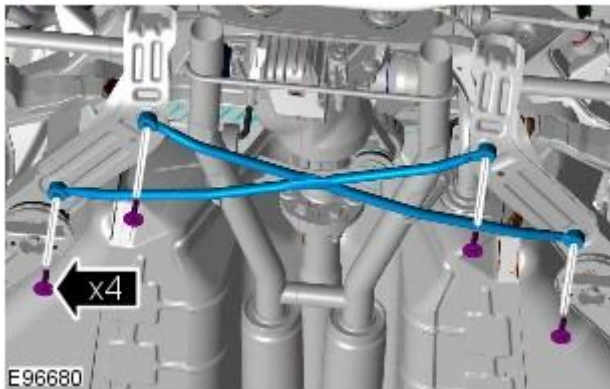
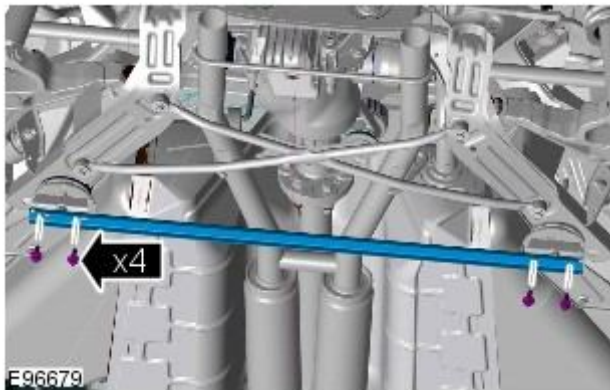
 **WARNING:** Observe due care when working near a hot exhaust system.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

 **CAUTION:** Make sure that the exhaust system is supported with a suitable transmission stand.

Raise and support the vehicle.

2. Remove both muffler and tailpipes.
3. Remove the engine rear undershield.
4. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
5. Remove the rear crossmember.

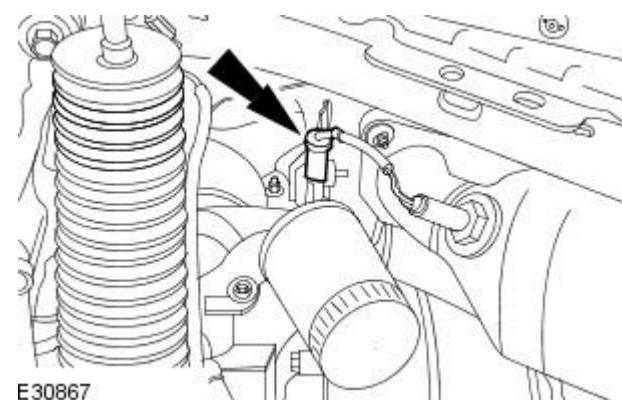


6. Remove the rear subframe crossbrace.

- Remove the rear subframe crossbrace.

7. **NOTE:** Right-hand shown, left-hand similar.

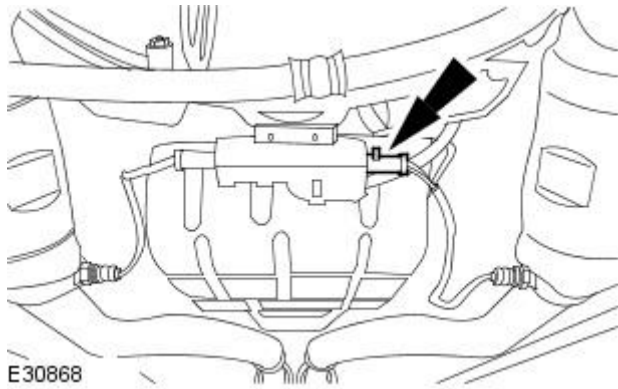
Disconnect the heated oxygen sensor (HO2S) electrical connector.





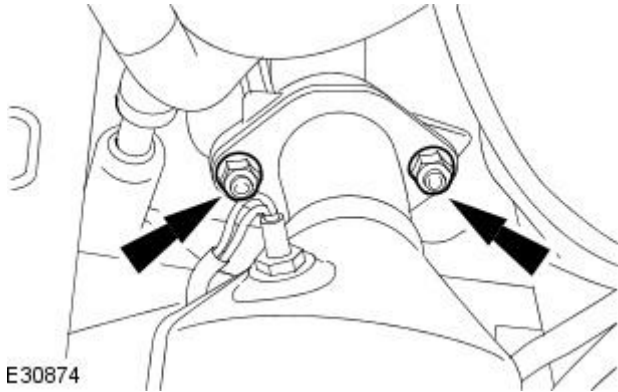
8. NOTE: Right-hand shown, left-hand similar.

Disconnect the catalyst monitor sensor electrical connector.



9. NOTE: Right-hand shown, left-hand similar.

Detach the catalytic converter.



10. NOTE: Check the hanger insulators for damage or fatigue. Install new hangers if required

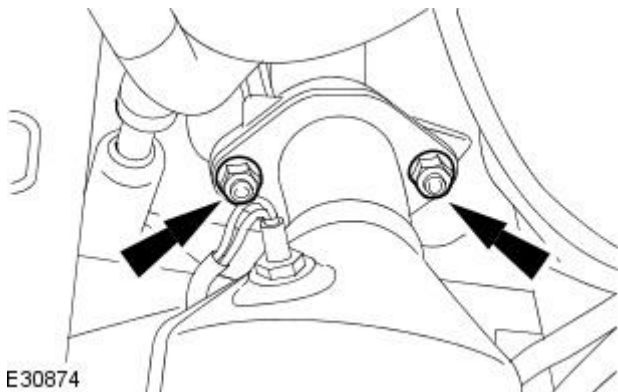
Release the 2 exhaust hangers.

11. With assistance, remove the exhaust system.

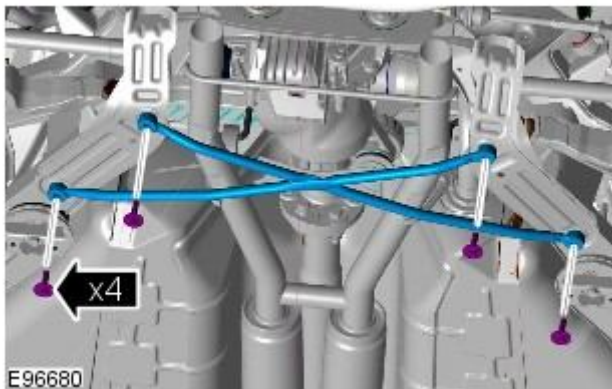
## Installation

1. To install, reverse the removal procedure.

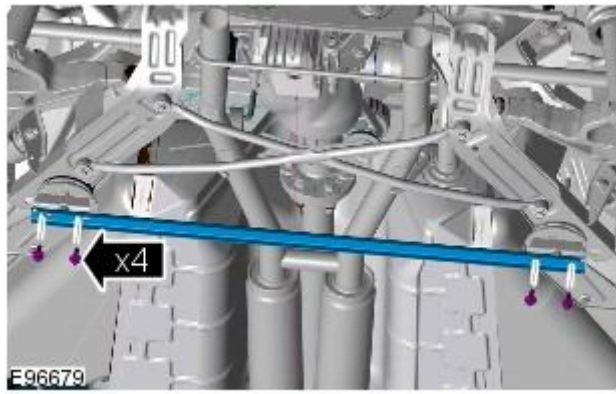
2. Tighten to 40 Nm.



3. Tighten to 30 Nm.



4. Tighten to 62 Nm.



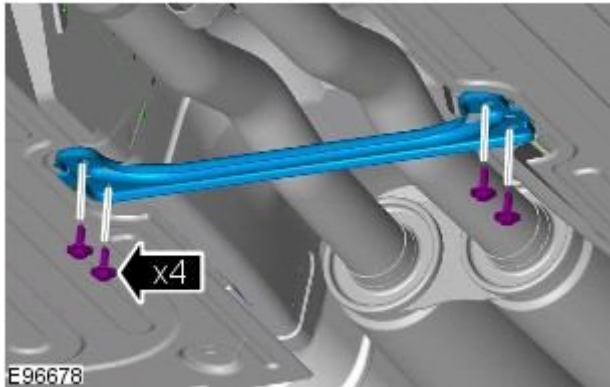
# Exhaust System - V6 3.0L Petrol - Front Muffler

Removal and Installation

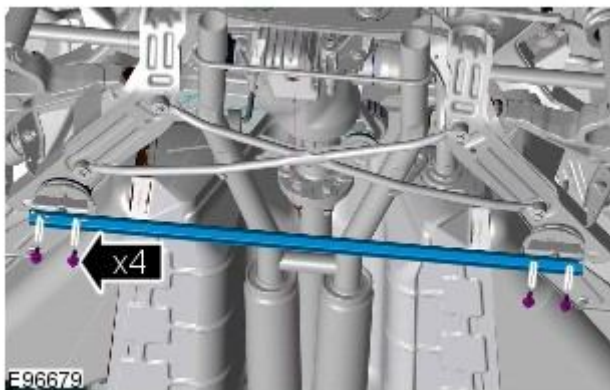
## Removal

 **WARNING:** Observe due care when working near a hot exhaust system.

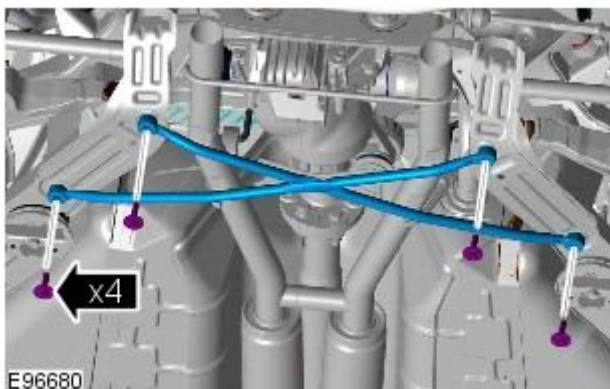
1. Raise the vehicle.
2. Remove the muffler and tailpipe.  
For additional information, refer to: Muffler and Tailpipe (309-00, Removal and Installation).
3. Repeat the above procedure on the opposite side.
4. Remove the engine rear undershield.
5. Remove the support bracket.
  - Remove the 4 bolts.



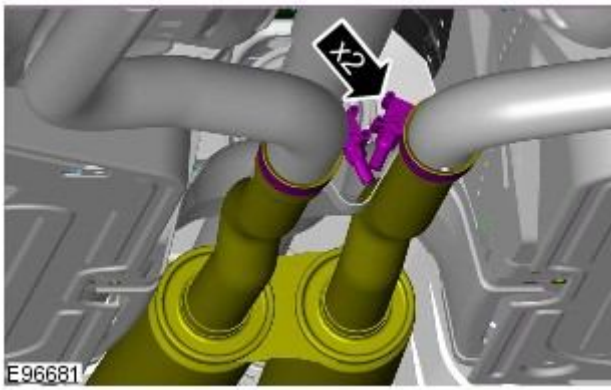
6. Remove the rear crossmember.



7. Remove the rear subframe crossbrace.

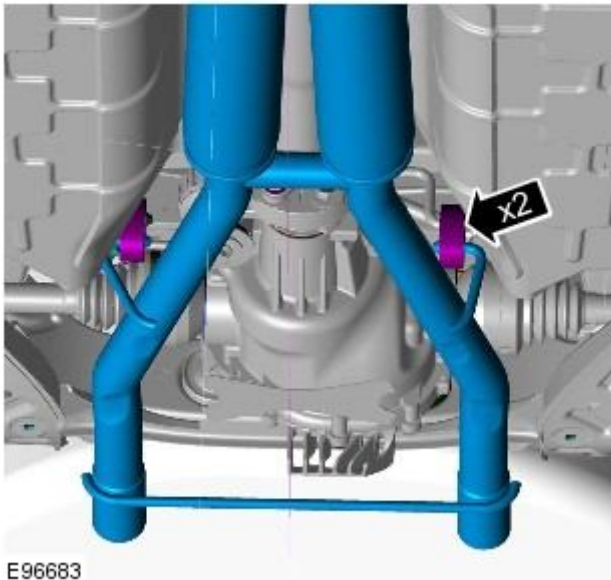


8. Release the exhaust clamps.



9. With assistance, remove the front muffler.

- Release both front muffler hanger insulators.



## Installation

1.  **CAUTION:** The hanger insulators are constructed of a special material. Use only the correct specification insulators.

• **NOTE:** Check the hanger insulators for damage or fatigue. Install new hangers if required

To install, reverse the removal procedure.

- Tighten the catalytic converter retaining clamp to 55 Nm.
- Tighten to 62 Nm.
- Tighten to 30 Nm.
- Tighten to 6 Nm.


# Exhaust System - V6 3.0L Petrol - Rear Muffler

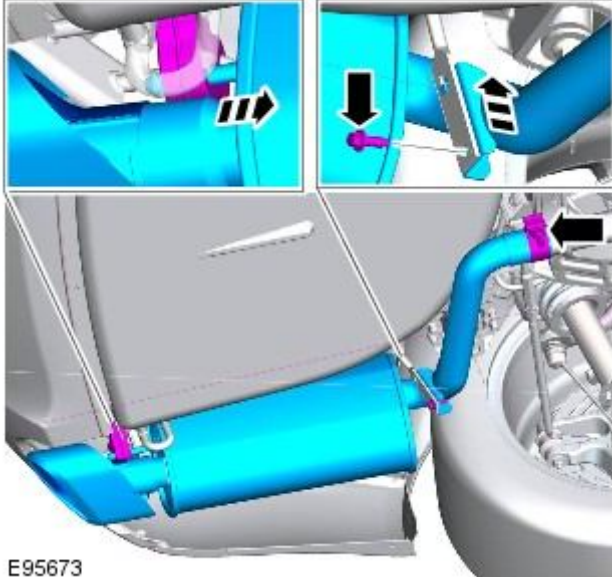
Removal and Installation


## Removal

 **WARNING:** Observe due care when working near a hot exhaust system.

• **NOTE:** Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.  
Raise and support the vehicle.



2.  **CAUTION:** Make sure that these components are installed to the noted removal position.

*Torque:*

M8 25 Nm

M10 55 Nm

## Installation

1. To install, reverse the removal procedure.

**Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 -**

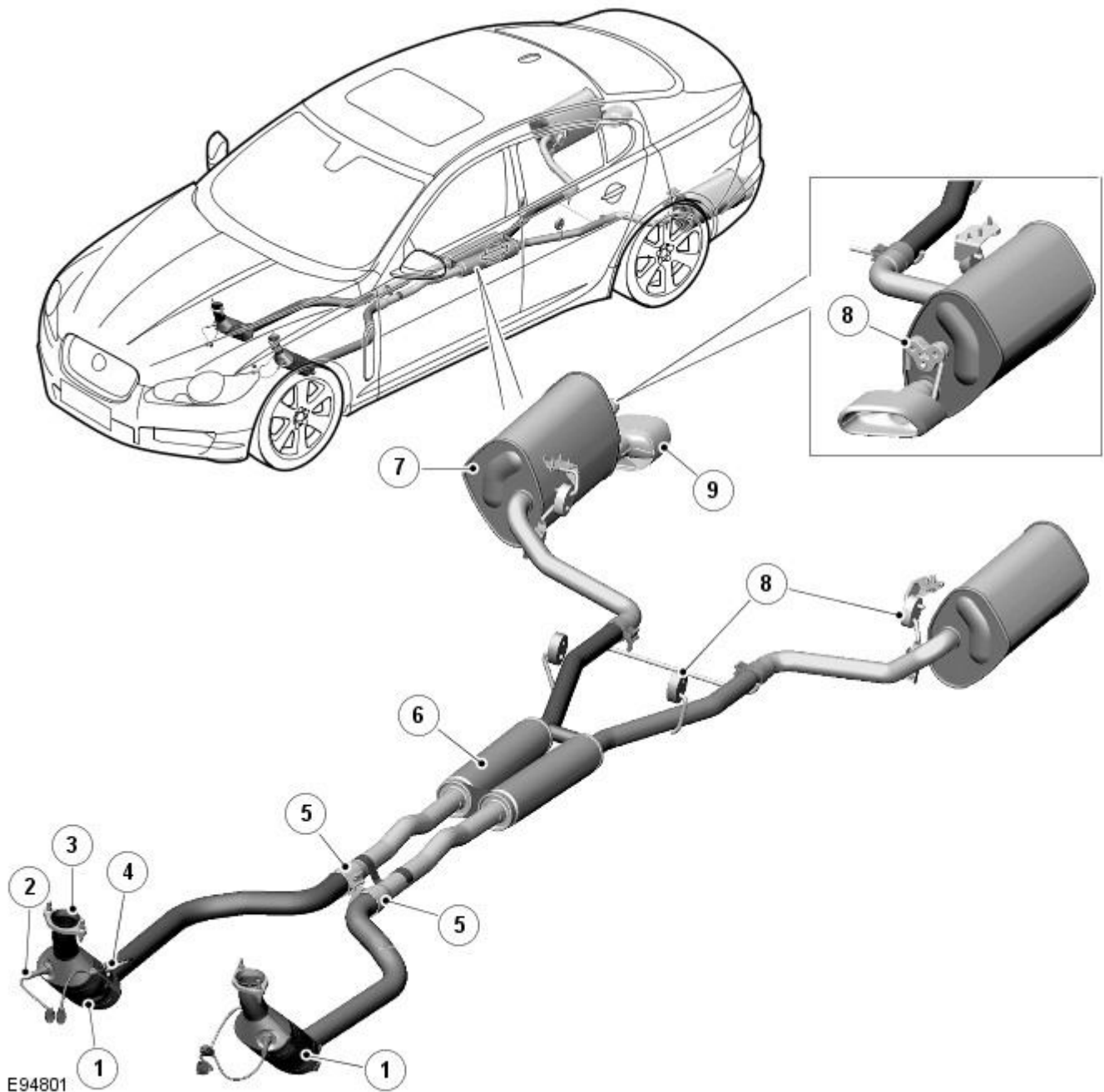
Description	Nm	lb-ft	lb-in
Exhaust manifold to catalytic converter studs	40	30	-
Exhaust clamps	55	41	-
Heated oxygen sensors	40	30	-
Catalyst monitor sensors	40	30	-
Muffler under body support bracket	30	22	-
Exhaust manifold to catalytic converter retaining nuts	40	30	-
Front muffler retaining clamps	55	41	-
Muffler and tailpipe retaining clamp	55	41	-



# Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Exhaust System - Component Location

Description and Operation

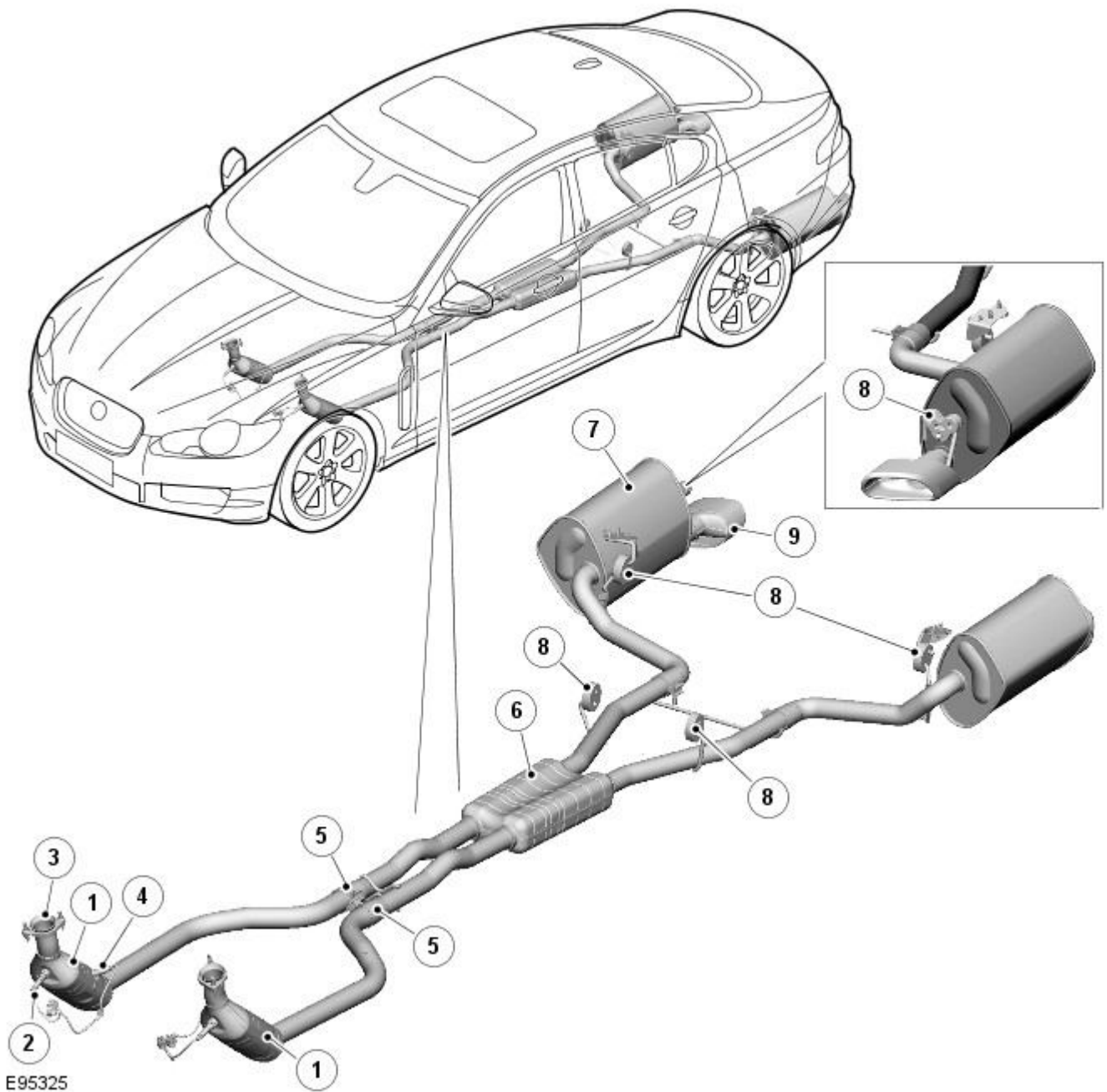
COMPONENT LOCATION - 4.2L V8 NATURALLY ASPIRATED



## ItemDescription

1	Catalytic converter (2 off)
2	Pre-catalyst <a href="#">HO2S</a> (heated oxygen sensor) (2 off)
3	Manifold flange (2 off)
4	Post catalyst <a href="#">HO2S</a> (2 off)
5	Clamp (2 off)
6	Center resonator silencer (2 off)
7	Rear silencer (2 off)
8	Mounting rubber (6 off)
9	Exhaust trim (2 off)

COMPONENT LOCATION - 4.2L V8 SUPERCHARGED



E95325

**ItemDescription**

1	Catalytic converter (2 off)
2	Pre-catalyst <a href="#">HO2S</a> (2 off)
3	Manifold flange (2 off)
4	Post catalyst <a href="#">HO2S</a> (2 off)
5	Clamp (2 off)
6	Center resonator silencer
7	Rear silencer (2 off)
8	Mounting rubber (6 off)
9	Exhaust trim (2 off)

# Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Exhaust System - Overview

Description and Operation

## OVERVIEW

The 4.2L V8 exhaust system is fabricated from stainless steel and is supplied as 5 separate assemblies. The 4.2L V8 naturally aspirated system is similar in design to the system used on the 3.0L V6 engine variant. The 4.2L V8 supercharged system is also similar but uses a different design of center resonator silencer.

The front section comprises 2 separate assemblies ([LH \(left-hand\)](#) and [RH \(right-hand\)](#)) incorporating a catalytic converter for each bank of cylinders. The rear section also comprises 3 separate sections. Each section incorporates a center resonator silencer and a rear silencer.

The system is attached to the underside of the body with mounting rubbers which are located on mild steel hanger bars that are welded to the system. The mounting rubbers locate on corresponding hangers which are welded or bolted to the underside of the vehicle body.

# Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Exhaust System - System Operation and Component Description

Description and Operation

## System Operation

### CATALYTIC CONVERTERS

In the catalytic converters, the exhaust gases are passed through honeycombed ceramic elements coated with a special surface treatment called 'washcoat'. The washcoat increases the surface area of the ceramic elements by a factor of approximately 7000. On top of the washcoat is a coating containing palladium and rhodium, which are the active constituents for converting harmful emissions into inert by-products. The palladium and rhodium add oxygen to the carbon monoxide and the hydrocarbons in the exhaust gases, to convert them into carbon dioxide and water respectively.

### Component Description

#### FRONT SECTION - NORMALLY ASPIRATED ENGINES

The front section comprises two separate pipes, each incorporating a catalytic converter. Each catalytic converter has a welded inlet pipe with a flange. The inlet pipe is flared into a cone which mates with the exhaust manifold. The flange has two holes which locate on studs in the exhaust manifold and is secured with flanged nuts. Each catalytic converter is fitted with a pre and post catalyst [HO2S \(heated oxygen sensor\)](#).

Each catalytic converter has a curved outlet pipe which mates with the respective inlet pipe for the applicable resonator. The joint is secured compressed and sealed with a clamp.

#### FRONT SECTION - SUPERCHARGED ENGINES

The front section comprises two separate pipes, each incorporating a catalytic converter. Each catalytic converter has a welded inlet pipe with a flange. The inlet pipe is flared into a cone which mates with the exhaust manifold. The flange has two holes which locate on studs in the exhaust manifold and is secured with flanged nuts. Each catalytic converter is fitted with a pre and post catalyst [HO2S](#).

Each catalytic converter has a curved outlet pipe which mates with the respective inlet pipe for the resonator. The joint is secured compressed and sealed with a clamp.

#### REAR SECTION - NORMALLY ASPIRATED ENGINES

The 2 inlet pipes each connect into a separate resonator silencer. Each resonator silencer is cylindrical in shape and houses 2 perforated tubes separated by 2 baffle plates. Exhaust gasses exit each resonator silencer via an outlet pipe. The 2 outlet pipes are joined together behind the resonators with a cross over pipe. Each pipe also has a welded hanger bracket which allow the rear section to be supported on mounting rubbers. A further bracket is welded to each pipe which braces the 2 pipes together.

The 2 rear silencers each have a welded inlet pipe which mate with the outlet pipes from the resonator silencers and are each secured with a clamp. The inlet pipes each have a welded hanger bracket which support each rear silencer at the rear of the vehicle on mounting rubbers. The fabricated rear silencers have 2 perforated tubes which are supported on 2 perforated baffle plates. The exhaust gasses are expelled from the rear silencer via a single outlet pipe. The outlet pipe from each silencer has a welded hanger bar which support the rear silencer on mounting rubbers. The outlet pipe is fitted with a welded outlet which is covered with a polished stainless steel finisher.

#### REAR SECTION - SUPERCHARGED ENGINES

The 2 inlet pipes each connect into a single resonator silencer housing perforated tubes separated by 2 baffle plates. Exhaust gasses exit the resonator silencer via 2 outlet pipes. Each outlet pipe has a welded hanger bracket which allow the rear section to be supported on mounting rubbers. A further bracket is welded to each pipe which braces the 2 pipes together.

The 2 rear silencers each have a welded inlet pipe which mate with the outlet pipes from the resonator silencer and are each secured with a clamp. The inlet pipes each have a welded hanger bracket which support each rear silencer at the rear of the vehicle on mounting rubbers. The fabricated rear silencers have 2 perforated baffle tubes which are supported on 2 perforated baffle plates. The exhaust gasses are expelled from the rear silencer via a single outlet pipe. The outlet pipe from each silencer has a welded hanger bar which support the rear silencer on mounting rubbers. The outlet pipe is fitted with a welded outlet which is covered with a polished stainless steel finisher.

### CATALYTIC CONVERTERS

A catalytic converter is fitted in each front section of the exhaust system. Each catalytic converter is fitted with 2 [HO2S](#).

The [HO2S](#) monitors the exhaust gasses leaving the engine. The [ECM \(engine control module\)](#) uses this information to provide accurately metered quantities of fuel to the combustion chambers to ensure the most efficient use of fuel and to minimize the exhaust emissions.

# Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Exhaust System

Diagnosis and Testing

## Principle of Operation

For a detailed description of the exhaust system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (309-00 Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8)

[Exhaust System](#) (Description and Operation),  
[Exhaust System](#) (Description and Operation),  
[Exhaust System](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical
<ul style="list-style-type: none"> <li>● Leaks</li> <li>● Metal fatigue</li> <li>● Pipes, mufflers and catalytic converters</li> <li>● Joints</li> <li>● Mountings</li> <li>● Clearance around components</li> </ul>

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Excessively noisy/leaking exhaust	<ul style="list-style-type: none"> <li>● Exhaust system/components</li> </ul>	Inspect exhaust system, refer to Visual Inspection above. Rectify leaks and install new components as required. Refer to Removal and Installation instructions in this section
Loss of power	<ul style="list-style-type: none"> <li>● Restricted exhaust system</li> <li>● Exhaust sound enhancement valve stuck closed</li> <li>● Fuel system</li> <li>● Ignition system</li> <li>● Electronic engine control</li> </ul>	Inspect exhaust system, refer to Visual Inspection above. Install new exhaust components as required. Refer to Removal and Installation instructions in this section. Check for fuel, ignition and electronic engine control system DTCs and refer to the relevant DTC Index

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the module or a component is suspect and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the Check and installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P003100	HO2S Heater Control Circuit	<ul style="list-style-type: none"> <li>● HO2S heater circuit - circuit fault</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the

DTC	Description	Possible Cause	Action
	Low (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>HO2S heater failure</li> </ul>	electrical circuit diagrams and check HO2S heater circuits for short, open circuit. Check and install a new HO2S as required
P003200	HO2S Heater Control Circuit High (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>HO2S heater circuit - circuit fault</li> <li>HO2S heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S heater circuits for short, open circuit. Check and install a new HO2S as required
P003600	HO2S Heater Control Circuit (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>Catalytic converter monitor sensor heater circuit - circuit fault</li> <li>Catalytic converter monitor sensor heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor heater circuits for short, open circuit. Check and install new Catalytic converter monitor sensor as required
P005100	HO2S Heater Control Circuit Low (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>HO2S heater circuit - circuit fault</li> <li>HO2S heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S heater circuits for short, open circuit. Check and install a new HO2S as required
P005200	HO2S Heater Control Circuit High (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>HO2S heater circuit - circuit fault</li> <li>HO2S heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S heater circuits for short, open circuit. Check and install a new HO2S as required
P005600	HO2S Heater Control Circuit (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>Catalytic converter monitor sensor heater circuit - circuit fault</li> <li>Catalytic converter monitor sensor heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor heater circuits for short, open circuit. Check and install new Catalytic converter monitor sensor as required
P01311A	O2 Circuit Low Voltage (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>Exhaust gas leakage</li> <li>HO2S variable/constant circuit - circuit fault, disconnected</li> <li>HO2S failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.). Refer to the electrical circuit diagrams and check HO2S variable/constant circuit for short, open circuit, disconnected connector. Check and install a new HO2S as required
P01321B	O2 Circuit High Voltage (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>Exhaust gas leakage</li> <li>HO2S variable/constant circuit - circuit fault, disconnected</li> <li>HO2S failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.). Refer to the electrical circuit diagrams and check HO2S variable/constant circuit for short, open circuit, disconnected connector. Check and install a new HO2S as required
P013300	O2 Circuit Slow Response (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>Exhaust leak</li> <li>HO2S to ECM wiring shield high resistance</li> <li>Fuel control system fault</li> <li>HO2 sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.). Refer to the electrical circuit diagrams and check HO2S to ECM wiring shield for high resistance. Check fuel control system for failure. Check and install a new HO2S as required
P013400	O2 Circuit No Activity Detected (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>HO2S slow activation</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P013700	O2 Circuit Low Voltage (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>Catalytic converter monitor sensor sensing circuit - short to ground, high resistance, disconnected</li> <li>Catalytic converter monitor sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor sensing circuit for short to ground, high resistance, disconnected connector. Check and install new Catalytic converter monitor sensor as required
P013800	O2 Circuit High Voltage (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>Catalytic converter monitor sensor sensing circuit - short to power</li> <li>Catalytic converter monitor sensor ground braided shield - high resistance</li> <li>Catalytic converter monitor sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor circuits for short to power, and ground braided shield for high resistance. Check and install new Catalytic converter monitor sensor as required
P013900	O2 Circuit Slow Response (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>Catalytic converter monitor sensor tip damaged or blocked</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check Catalytic converter monitor sensor tip for damage or blockage, install a new sensor as required
P014000	O2 Circuit No Activity Detected (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>Catalytic converter monitor sensor sensing circuit - short to ground, short to power, high resistance, disconnected</li> <li>Catalytic converter monitor sensor ground braided shield - high resistance</li> <li>Catalytic converter monitor sensor - mechanical damage</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor circuits for short to ground, power, high resistance, disconnected connector and ground braided shield for high resistance. Check and install new Catalytic converter monitor sensor as required



DTC	Description	Possible Cause	Action
P014100	O2 Heater Circuit (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor heater control circuit - high resistance</li> <li>● Catalytic converter monitor sensor heater failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor heater control circuit for high resistance. Check and install a new Catalytic converter monitor sensor as required
P01511A	O2 Circuit Low Voltage (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S sensing circuit - short to ground, short to power, high resistance</li> <li>● HO2S failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S sensing circuit for short to ground, power, high resistance. Check and install a new HO2S as required
P01521B	O2 Circuit High Voltage (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S sensing circuit - short to ground, short to power, high resistance</li> <li>● HO2S failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S sensing circuit for short to ground, power, high resistance. Check and install a new HO2S as required
P015300	O2 Circuit Slow Response (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S to ECM wiring shield high resistance</li> <li>● Exhaust leak</li> <li>● Fuel control system fault</li> <li>● HO2 sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check HO2S to ECM wiring shield for high resistance. Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.). Check fuel control system for failure. Check and install a new HO2S as required
P015400	O2 Circuit No Activity Detected (Bank 2, Sensor 1)	<ul style="list-style-type: none"> <li>● HO2S slow activation</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P015700	O2 Circuit Low Voltage (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor sensing circuit - short to ground, high resistance, disconnected</li> <li>● Catalytic converter monitor sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor sensing circuit for short to ground, high resistance, disconnected connector. Check and install a new Catalytic converter monitor sensor as required
P015800	O2 Circuit High Voltage (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor sensing circuit - short to power</li> <li>● Catalytic converter monitor sensor ground braided shield - high resistance</li> <li>● Catalytic converter monitor sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor sensing circuit for short to power, and sensor ground braided shield for high resistance. Check and install a new Catalytic converter monitor sensor as required
P015900	O2 Circuit Slow Response (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor tip damaged or blocked</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check Catalytic converter monitor sensor tip for damage or blockage, install a new sensor as required
P016000	O2 Circuit No Activity Detected (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensing circuit - short to ground, short to power, high resistance, disconnected</li> <li>● Catalytic converter monitor sensor ground braided shield - high resistance</li> <li>● Catalytic converter monitor sensor - mechanical damage</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensing circuit for short to ground, short to power, high resistance, disconnected connector, and sensor ground braided shield for high resistance. Check and install a new Catalytic converter monitor sensor as required
P016100	O2 Heater Circuit (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>● Catalytic converter monitor sensor heater control circuit malfunction</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Catalytic converter monitor sensor heater control circuit for short, open circuit
P042000	Catalytic converter System Efficiency Below Threshold (Bank 1)	<ul style="list-style-type: none"> <li>● Catalytic converter failure due to overheating damage caused by misfire and/or lean combustion</li> <li>● Catalytic converter failure due to poisoning caused by excessive oil consumption and/or contaminated fuel</li> </ul>	Check for misfire/lean combustion DTCs and refer to DTC Index in this section. Check the oil and fuel condition/level. Check the catalytic converter for damage
P043000	Catalytic converter System Efficiency Below Threshold (Bank 2)	<ul style="list-style-type: none"> <li>● Catalytic converter failure due to overheating damage caused by misfire and/or lean combustion</li> <li>● Catalytic converter failure due to poisoning caused by excessive oil consumption and/or contaminated fuel</li> </ul>	Check for misfire/lean combustion DTCs and refer to DTC Index in this section. Check the oil and fuel condition/level. Check the catalytic converter for damage

<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
P209600	Post Catalytic converter Fuel Trim System Too Lean Bank 1	<ul style="list-style-type: none"> <li>● Heated Oxygen Sensor (HO2S) fuel adaption - lean</li> </ul>	Check integrity and correct installation of air intake system. Check for any HO2S codes also logged and refer to DTC Index in this section. Check for air leaks between, or on, upstream and downstream sensors. Check for air leak on Catalytic converter and exhaust path pre-Catalytic converter
P209700	Post Catalytic converter Fuel Trim System Too Rich Bank 1	<ul style="list-style-type: none"> <li>● Heated Oxygen Sensor (HO2S) fuel adaption - rich</li> </ul>	Check integrity and correct installation of air intake system. Check for any HO2S codes also logged and refer to DTC Index in this section. Check for air leaks between, or on, upstream and downstream sensors. Check for air leak on Catalytic converter and exhaust path pre-Catalytic converter
P209800	Post Catalytic converter Fuel Trim System Too Lean Bank 2	<ul style="list-style-type: none"> <li>● Heated Oxygen Sensor (HO2S) fuel adaption - lean</li> </ul>	Check integrity and correct installation of air intake system. Check for any HO2S codes also logged and refer to DTC Index in this section. Check for air leaks between, or on, upstream and downstream sensors. Check for air leak on Catalytic converter and exhaust path pre-Catalytic converter
P209900	Post Catalytic converter Fuel Trim System Too Rich Bank 2	<ul style="list-style-type: none"> <li>● Heated Oxygen Sensor (HO2S) fuel adaption - rich</li> </ul>	Check integrity and correct installation of air intake system. Check for any HO2S codes also logged and refer to DTC Index in this section. Check for air leaks between, or on, upstream and downstream sensors. Check for air leak on Catalytic converter and exhaust path pre-Catalytic converter

# Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Catalytic Converter

Removal and Installation

## Removal

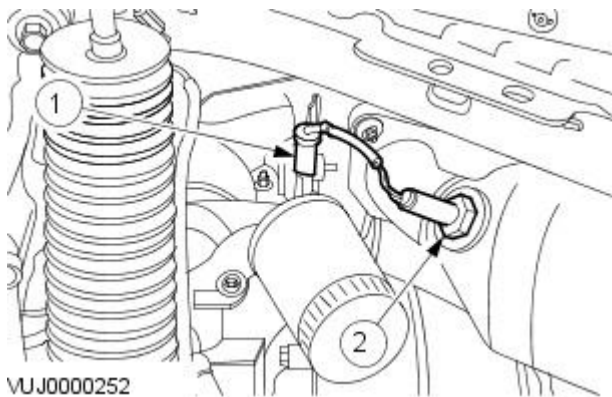


**WARNING:** Observe due care when working near a hot exhaust system.

- WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

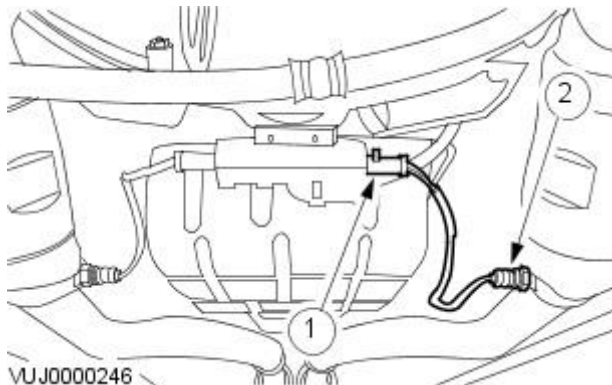
Raise the vehicle.

- Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
- Remove the heated oxygen sensor (HO2S).
  - Release the electrical connector from the bracket.
  - Disconnect the electrical connector.
  - Remove the HO2S.



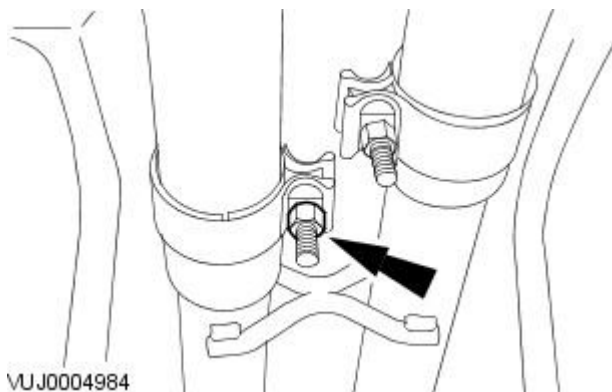
VUJ0000252

- Remove the catalyst monitor sensor.
  - Release the electrical connector from the bracket.
  - Disconnect the electrical connector.
  - Remove the catalyst monitor sensor.



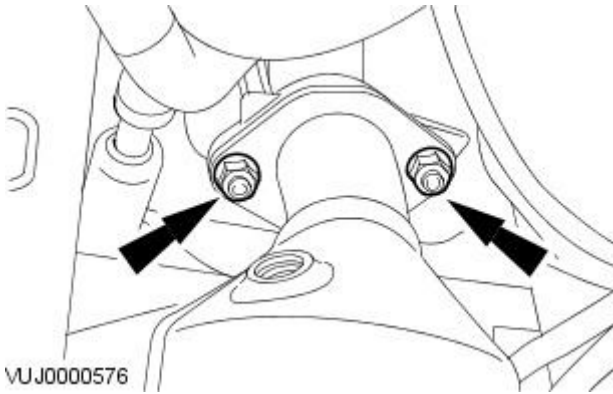
VUJ0000246

- Loosen the catalytic converter exhaust clamps and release the front silencer.

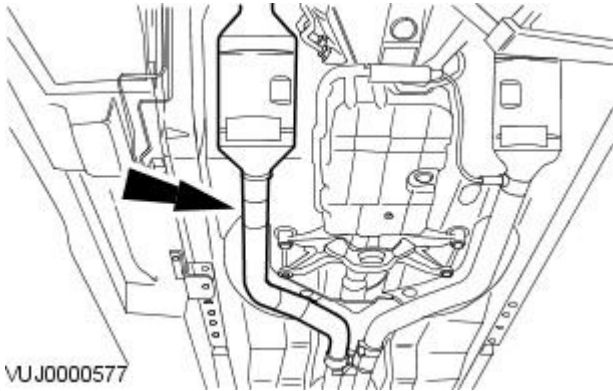


VUJ0004984

6. Release the catalytic converter.

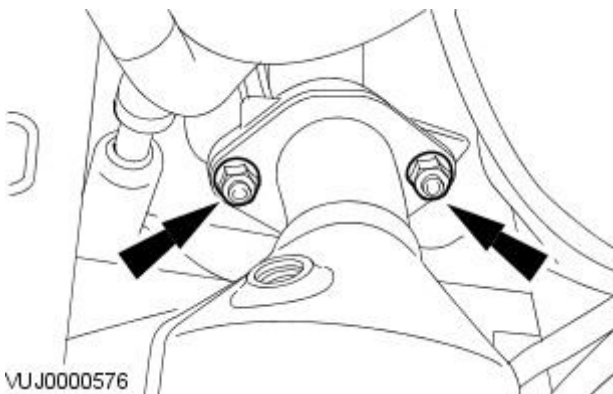


7. Remove the catalytic converter.

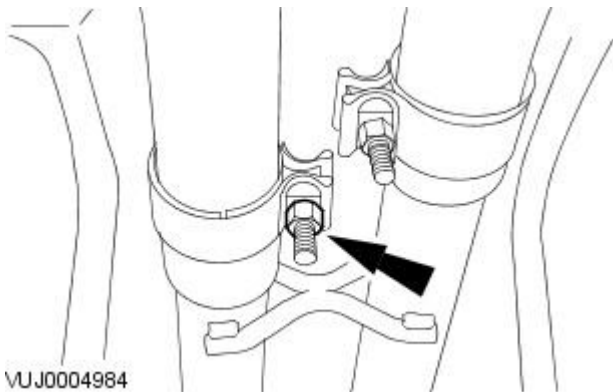


### Installation

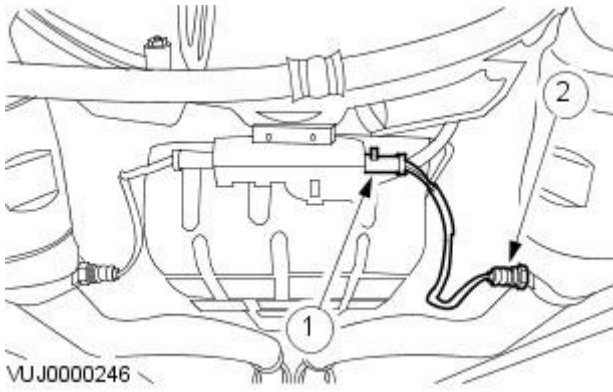
1. To install, reverse the removal procedure.
2. Tighten to 40 Nm.



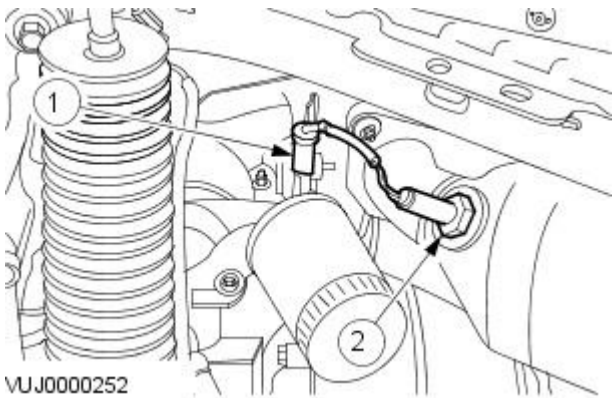
3. Tighten to 55 Nm.



4. Install catalyst monitor sensor and tighten to 40 Nm.



5. Install the HO2S and tighten to 40 Nm.



6. NOTE: For NAS vehicles only.


If required, carry out a long drive cycle.  
For additional information, refer to: Powertrain Control Module (PCM) Long Drive Cycle Self-Test (303-14C, General Procedures).


# Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Exhaust System

Removal and Installation

## Removal

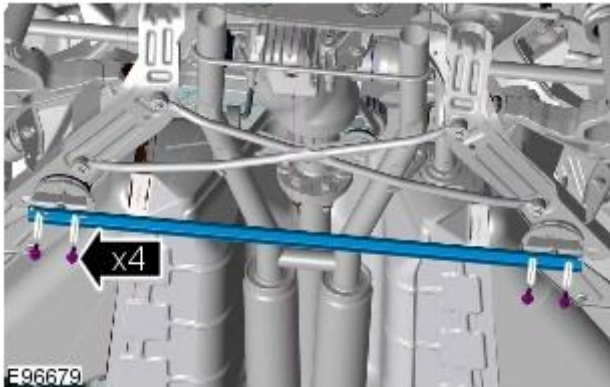
 **WARNING:** Observe due care when working near a hot exhaust system.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

 **CAUTION:** Make sure that the exhaust system is supported with a suitable transmission stand.

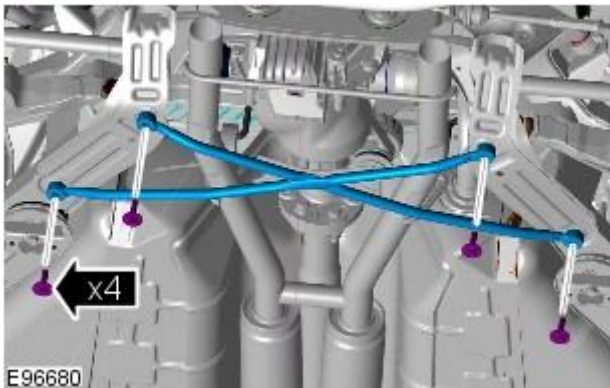
Raise and support the vehicle.

2. Remove both muffler and tailpipes.
3. Remove the engine rear undershield.
4. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
5. Remove the rear crossmember.



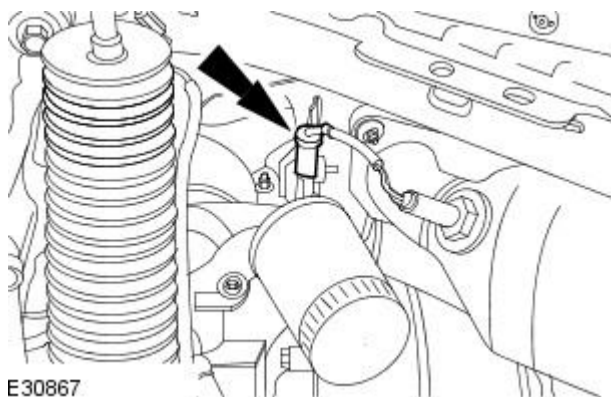
6. Remove the rear subframe crossbrace.

- Remove the rear subframe crossbrace.

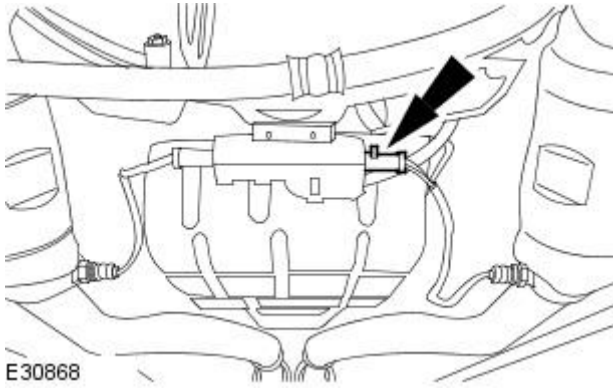


7. **NOTE:** Right-hand shown, left-hand similar.

Disconnect the heated oxygen sensor (HO2S) electrical connector.

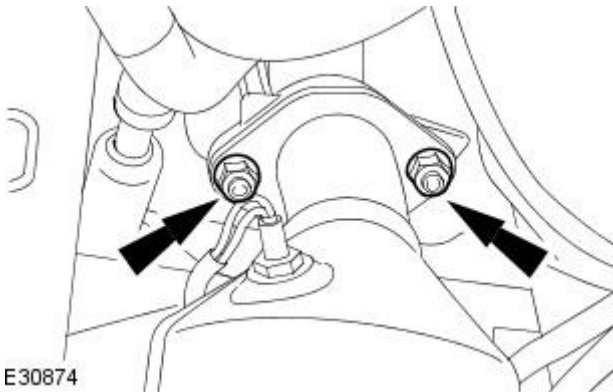






8. NOTE: Right-hand shown, left-hand similar.

Disconnect the catalytic monitor sensor electrical connector.



9. NOTE: Right-hand shown, left-hand similar.

Detach the catalytic converter.

10. NOTE: Check the hanger insulators for damage or fatigue. Install new hangers if required

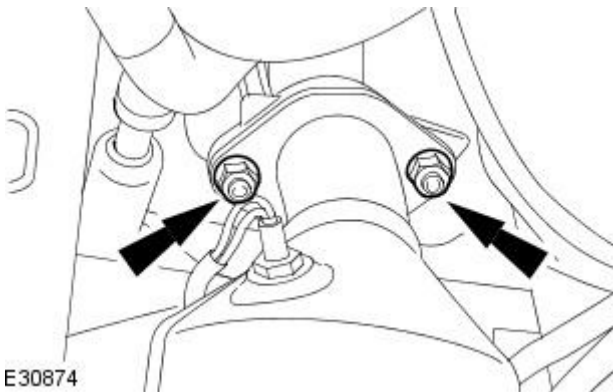
Release the 2 exhaust hangers.

11. With assistance, remove the exhaust system.

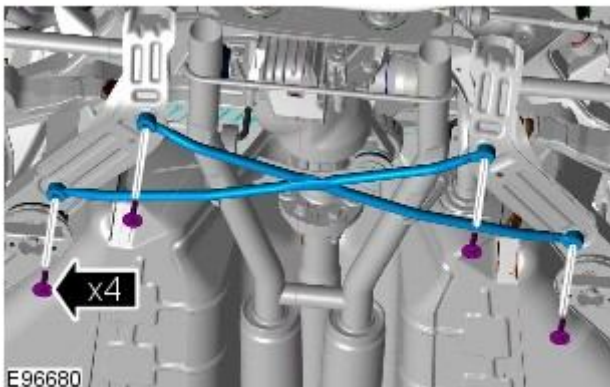
## Installation

1. To install, reverse the removal procedure.

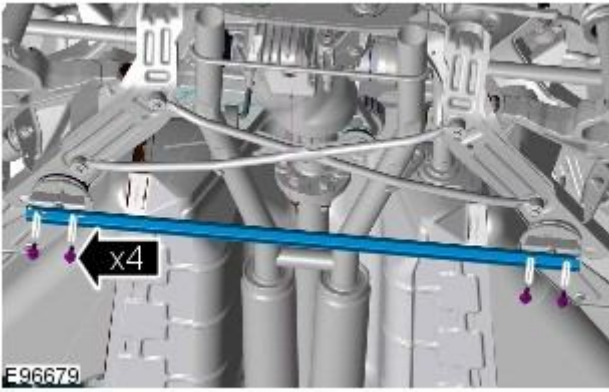
2. Tighten to 40 Nm.



3. Tighten to 30 Nm.



4. Tighten to 62 Nm.



# Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Front Muffler

Removal and Installation

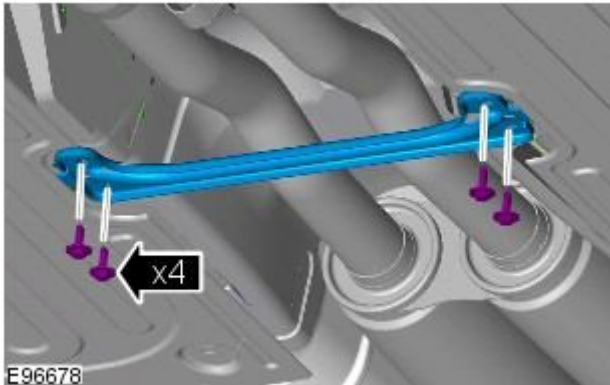
## Removal



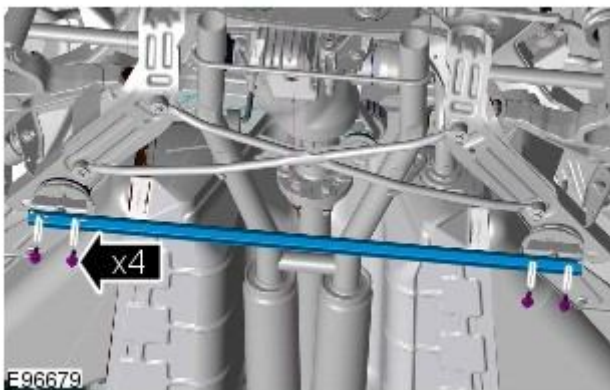
**WARNING:** Observe due care when working near a hot exhaust system.

1. Raise the vehicle.
2. Remove the muffler and tailpipe.  
For additional information, refer to: Muffler and Tailpipe (309-00, Removal and Installation).
3. Repeat the above procedure on the opposite side.
4. Remove the engine rear undershield.
5. Remove the support bracket.

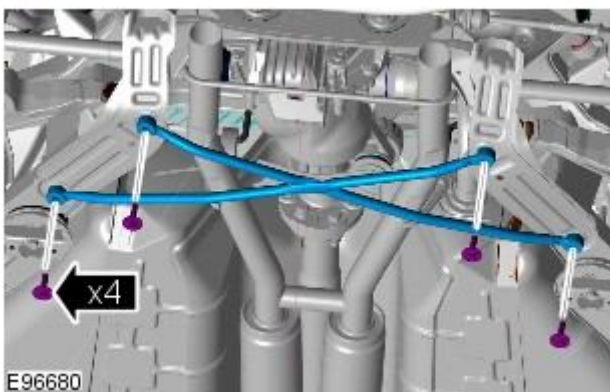
- Remove the 4 bolts.



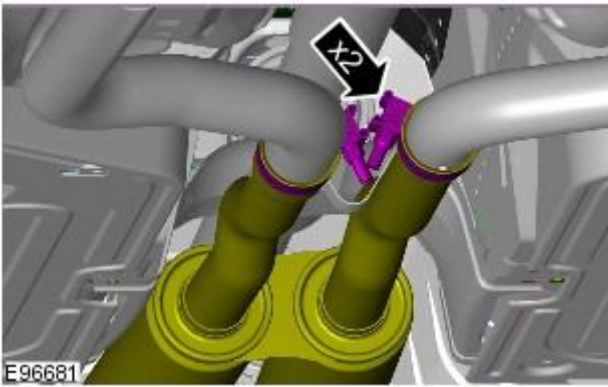
6. Remove the rear crossmember.



7. Remove the rear subframe crossbrace.

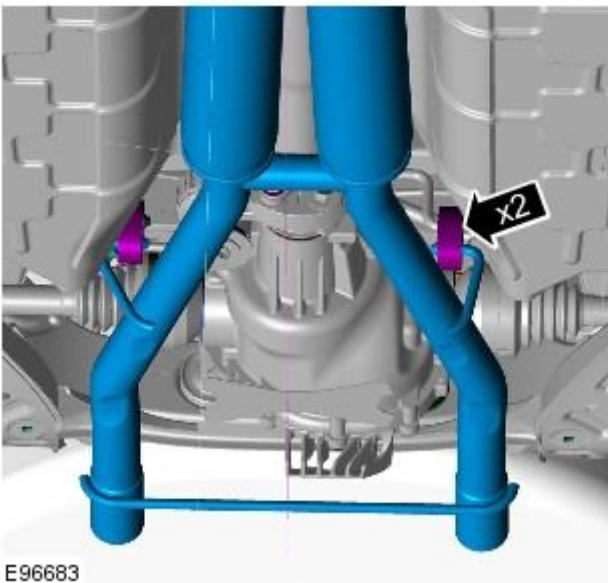


8. Release the exhaust clamps.




9. With assistance, remove the front muffler.

- Release both front muffler hanger insulators.



## Installation

1.  CAUTION: The hanger insulators are constructed of a special material. Use only the correct specification insulators.

• NOTE: Check the hanger insulators for damage or fatigue. Install new hangers if required

To install, reverse the removal procedure.

- Tighten the catalytic converter retaining clamp to 55 Nm.
- Tighten to 62 Nm.
- Tighten to 30 Nm.
- Tighten to 6 Nm.

# Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Rear Muffler

Removal and Installation

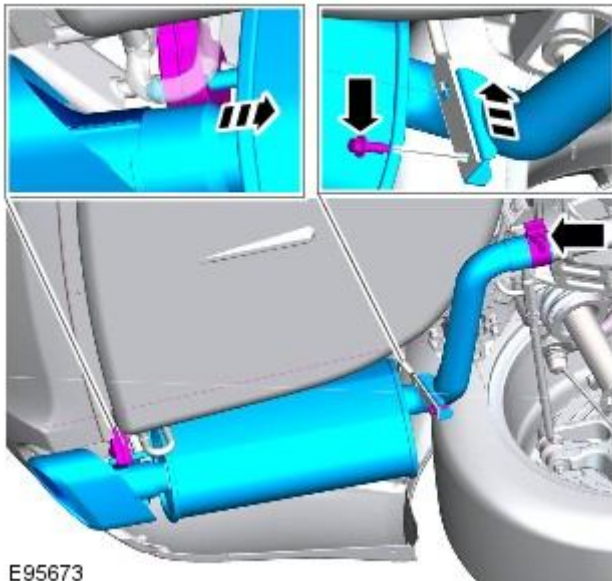
## Removal

 **WARNING:** Observe due care when working near a hot exhaust system.

- **NOTE:** Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.



2.  **CAUTION:** Make sure that these components are installed to the noted removal position.

*Torque:*

M8 25 Nm  
M10 55 Nm

## Installation

1. To install, reverse the removal procedure.

## Fuel System - General Information -

### General Specifications

Item	Specification
Fuel tank gross capacity - all vehicles	77 liters
Fuel tank capacity - vehicles with 3.0L, 4.2L, 2.7L Diesel	69.5 (total) / 64 (usable) liters
Fuel tank capacity - vehicles with 3.0L Diesel	71.1 (total) / 68.1 (usable) liters
Fuel tank capacity - vehicles with 5.0L	71.1 (total) / 69.5 (useable) liters
Fuel tank capacity - when fuel gauge indicates empty - vehicles with 3.0L Diesel	64 liters
Reserve capacity - when fuel gauge indicates empty - vehicles with 3.0L, 4.2L, 2.7L Diesel	5.5 liters
Reserve capacity - when fuel gauge indicates empty - vehicles with 5.0L, 3.0L Diesel	7 liters



# Fuel System - General Information - Fuel System Pressure Check 3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

General Procedures

All vehicles

• NOTE: This procedure is for the installation of the adaptor into the fuel line due to the removal of the schraeder valve from the fuel line.

## 1. WARNINGS:



Place the vehicle in a quarantined area and arrange "No Smoking/Petrol Fumes" signs about the vehicle.



Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be relieved before attempting any repairs. Failure to follow these instructions may result in personal injury.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.



After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.

Disconnect the battery ground cable.

For additional information, refer to: Battery Disconnect (414-01, General Procedures).

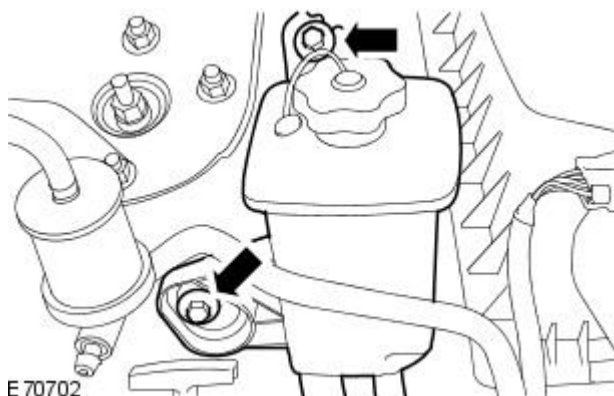
## 2. Remove the engine cover.

Vehicles with 2.5L or 3.0L engine

## 3. Remove the air cleaner outlet pipe.

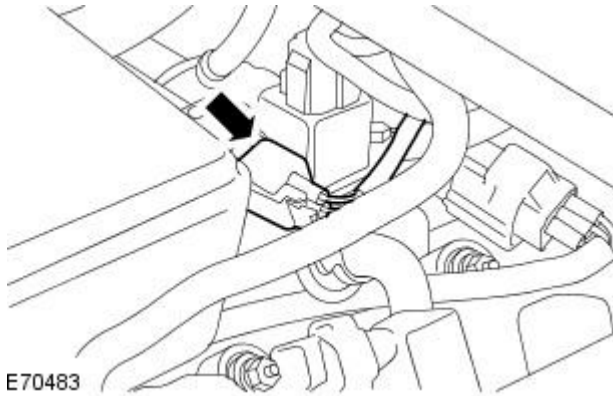
For additional information, refer to: Air Cleaner Outlet Pipe - VIN Range: N52048->N99999 (303-12A, Removal and Installation).

## 4. Detach the power steering fluid reservoir and reposition.



Vehicles with supercharger

5. Disconnect the electrical connector.



E70483

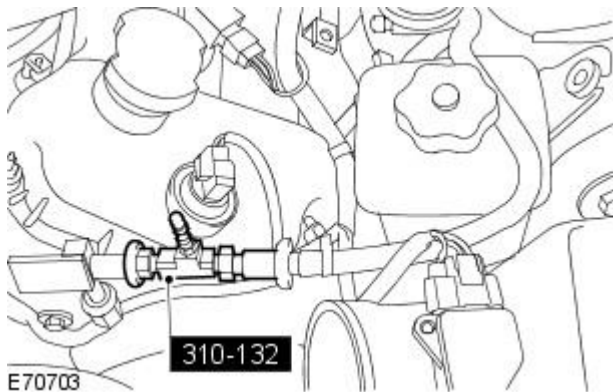
All vehicles

6. Disconnect the fuel rail feed pipe.  
For additional information, refer to: [Spring Lock Couplings](#)  
(310-00 Fuel System - General Information, General Procedures).

Vehicles with 2.5L or 3.0L engine

7. NOTE: Make sure the special tool is fully seated to the fuel pipe connections.

Install the special tool.

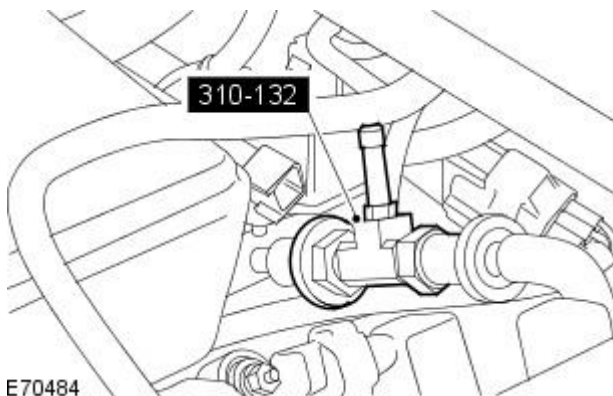


E70703

Vehicles with supercharger

8. NOTE: Make sure the special tool is fully seated to the fuel pipe connections.

Install the special tool.

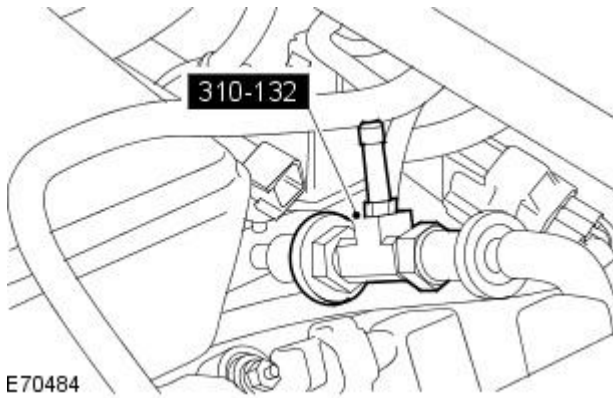


E70484

Vehicles with 4.0L or 4.2L engine without supercharger

**9. NOTE:** Make sure the special tool is fully seated to the fuel pipe connections.

Install the special tool.

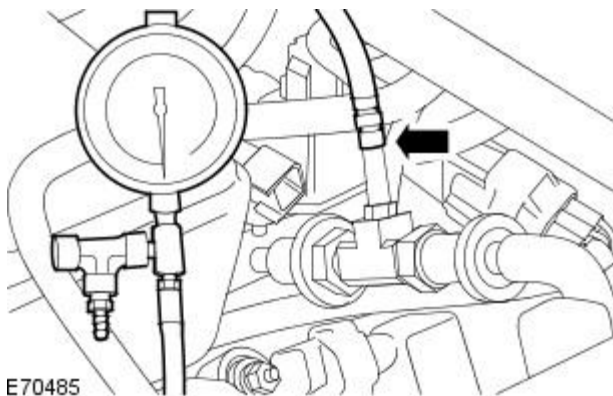


E70484

All vehicles

**10. NOTE:** Vehicles with supercharger shown, others vehicles similar.

Install the fuel pressure gauge.



E70485

Vehicles with 2.5L or 3.0L engine

**11. Install the air cleaner outlet pipe.**

For additional information, refer to: Air Cleaner Outlet Pipe - VIN Range: N52048->N99999 (303-12A, Removal and Installation).

All vehicles

**12. Connect the battery ground cable.**

For additional information, refer to: Battery Connect (414-01, General Procedures).

**13. Carry out the fuel system pressure check.**

For additional information, refer to: Fuel Charging and Controls - VIN Range: N52048->N99999 (303-04A, Diagnosis and Testing) /

Fuel Charging and Controls - VIN Range: N52048->N99999 (303-04B, Diagnosis and Testing).

# Fuel System - General Information - Fuel System Pressure Release 3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

General Procedures



**CAUTION:** When depressurising the fuel system, make sure that there is no throttle input. Failure to follow this instruction may cause damage to the vehicle.

## 1. WARNINGS:



Place the vehicle in a quarantined area and arrange 'No Smoking/Petrol Fumes' signs about the vehicle.



The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be relieved before attempting any repairs. Failure to follow these instructions may result in personal injury.



**CAUTION:** Make sure the engine is cold before this procedure is carried out. Failure to follow this instruction may result in damage to the vehicle.

Remove the fuel pump and sender unit fuse.

## 2. CAUTIONS:



When depressurising the fuel system, make sure that there is no throttle input. Failure to follow this instruction may cause damage to the vehicle.



Make sure that as soon as the vehicle is running roughly/misfiring that the engine is immediately switched off. Failure to follow this instruction may result in damage to the vehicle.

Start and run the engine until it runs roughly or starts misfiring.


3. Refit the fuel pump fuse.

4. Start and run the engine.

5. Read and clear stored DTC fault codes.

# Fuel System - General Information - Fuel Tank Draining

General Procedures

Special Tool(s)	
 <p>E69364</p>	<p>Fuel tank drain adaptor 310-154</p>

Vehicles with diesel engine

1. For additional information, refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

All except vehicles with diesel engine

2. For additional information, refer to: [Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions](#) (100-00 General Information, Description and Operation).

Vehicles with 3.0L or 4.2L engine

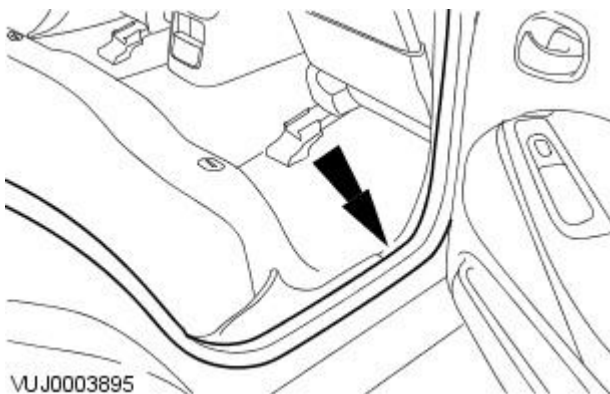
3. Release the pressure in the fuel system.  
For additional information, refer to: [Fuel System Pressure Release - 3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (310-00 Fuel System - General Information, General Procedures).

Vehicles with 5.0L engine

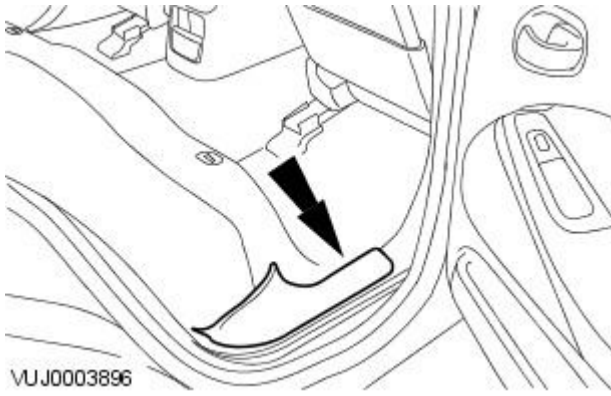
4. Release the pressure in the fuel system.  
For additional information, refer to: Fuel System Pressure Release - 5.0L (310-00 Fuel System - General Information, General Procedures).

All vehicles

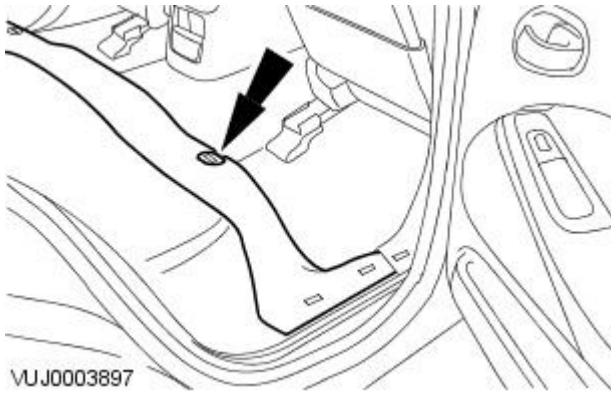
5. Remove the rear seat cushion.  
For additional information, refer to: [Rear Seat Cushion](#) (501-10 Seating, Removal and Installation).
6. Detach and reposition the door opening weatherstrip.



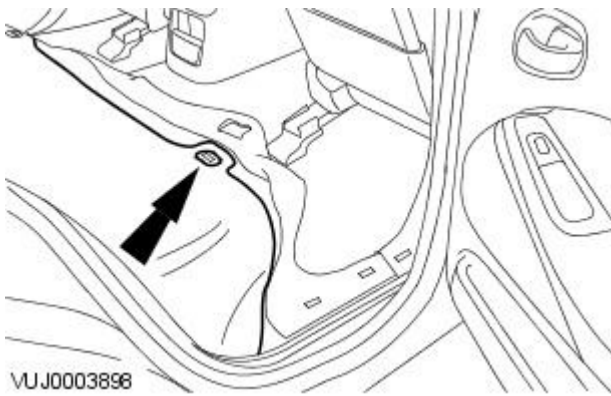
7. Remove the scuff plate trim panel.



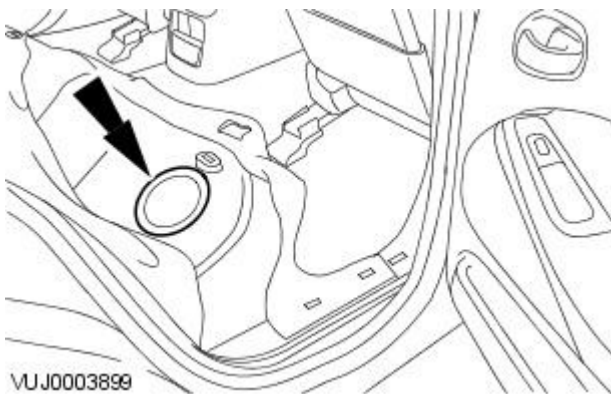
8. Detach and reposition the floor covering.



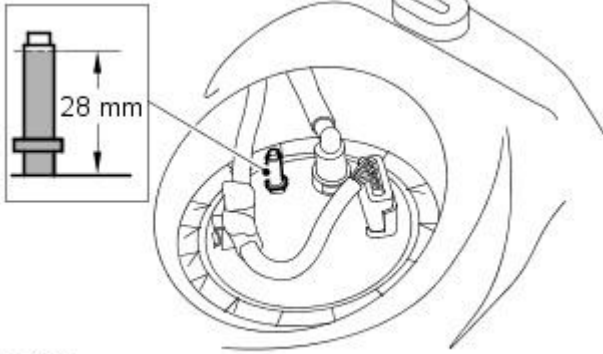
9. Detach and reposition the rear seat cushion insulation.




10. Remove the floor aperture cover.







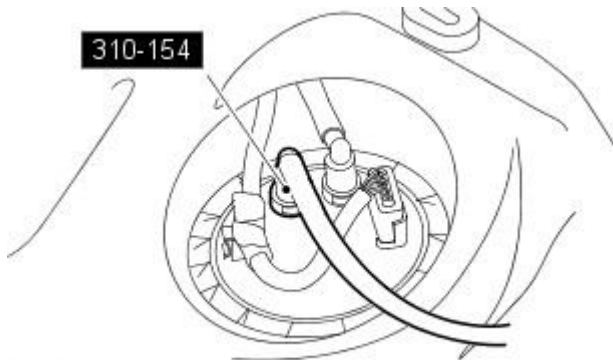
E64337

**11.**  **CAUTION:** The correct measurement must be used to remove the fuel tank drain port top. Failure to follow this instruction may result in damage to the vehicle.

- **NOTE:** The fuel tank drain port is marked with **DRAIN**.

- **NOTE:** Vehicles without Diesel engine shown, vehicles with Diesel engine similar.

Using a suitable tool, remove the top of the fuel tank drain port.

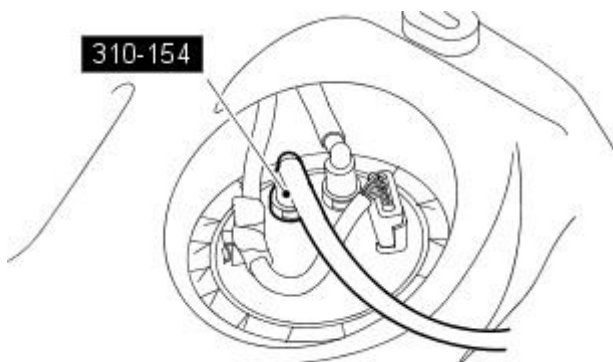


E64338

**12.** **NOTE:** A fuel vacuum drain unit must be attached to the special tool to achieve full fuel tank drain.

- **NOTE:** Vehicles without Diesel engine shown, vehicles with Diesel engine similar.

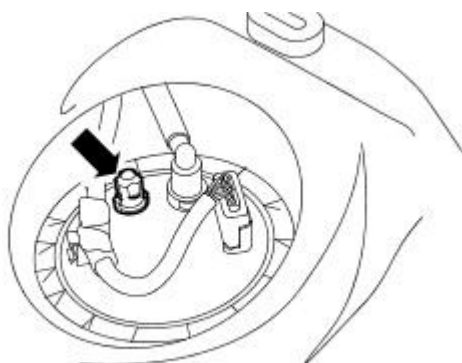
Using the special tool, drain the right-hand side of the fuel tank.




E64338

**13.** **NOTE:** Vehicles without Diesel engine shown, vehicles with Diesel engine similar.

Remove the special tool.



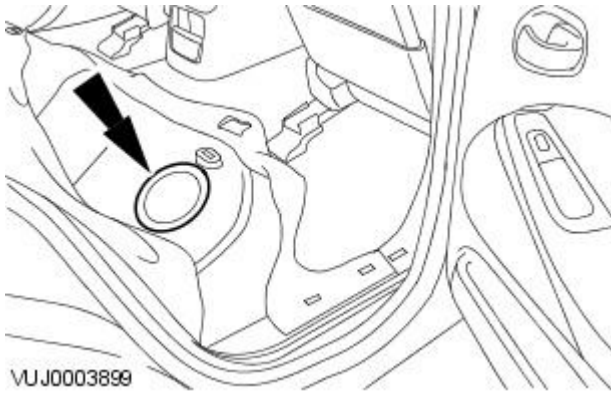
E64339

**14.**  **CAUTION:** Make sure the new fuel tank drain port sealing cap is correctly installed. Failure to follow this instruction may result in damage to the vehicle.

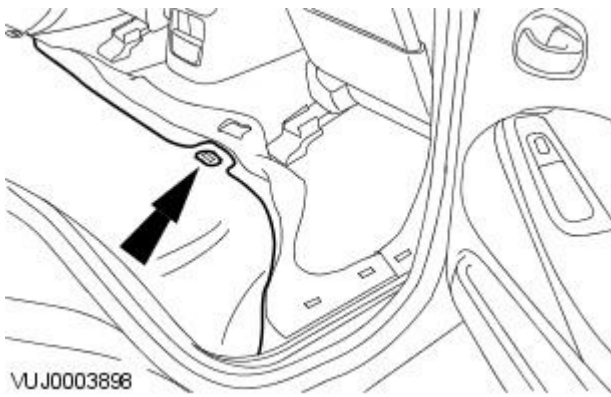
- **NOTE:** Vehicles without Diesel engine shown, vehicles with Diesel engine similar.

Install a new fuel tank drain port sealing cap.

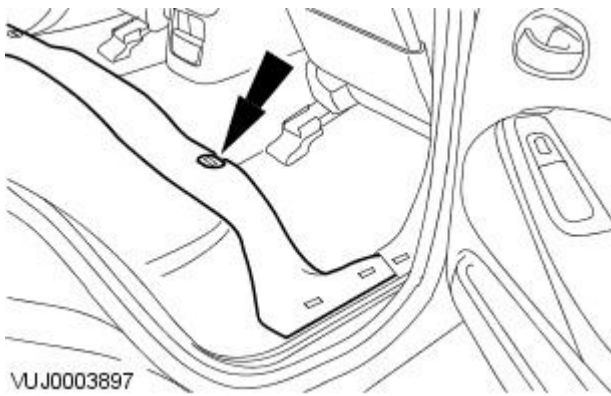
15. Install the floor aperture cover.



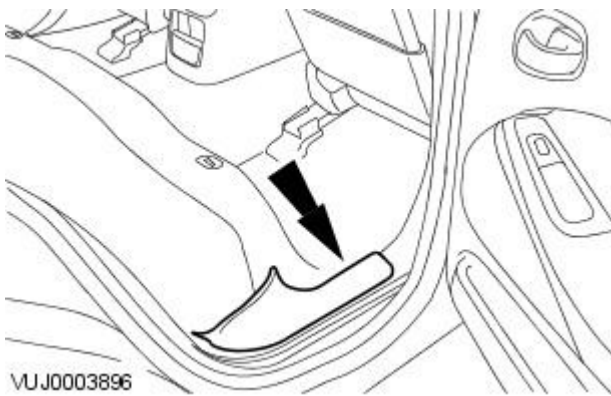
16. Attach the rear seat cushion insulation.



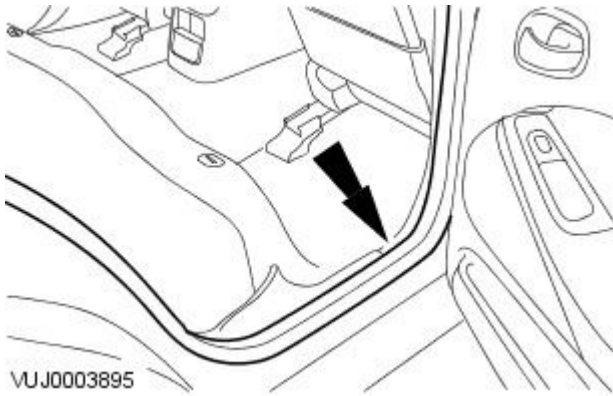
17. Attach the floor covering.



18. Install the scuff plate trim panel.

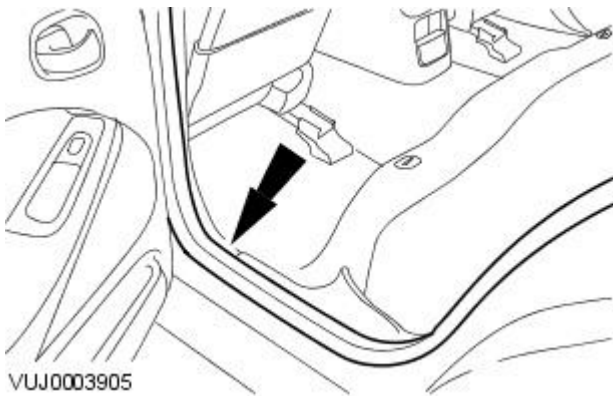


19. Attach the door opening weatherstrip.

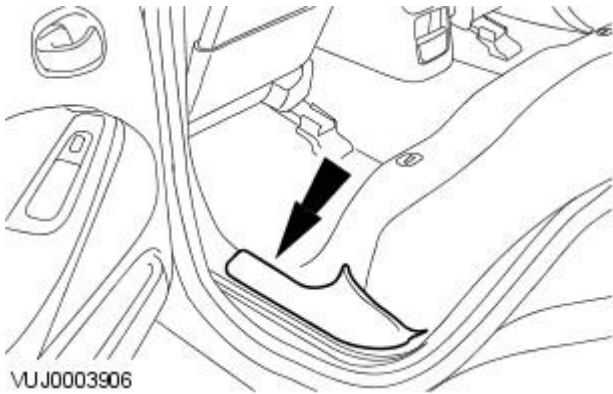


Vehicles with fuel transfer unit

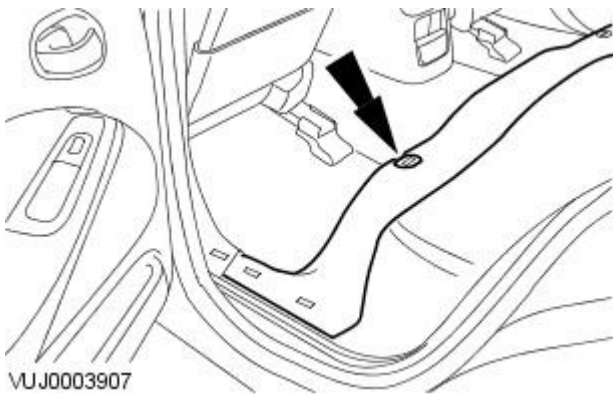
20. Detach and reposition the door opening weatherstrip.



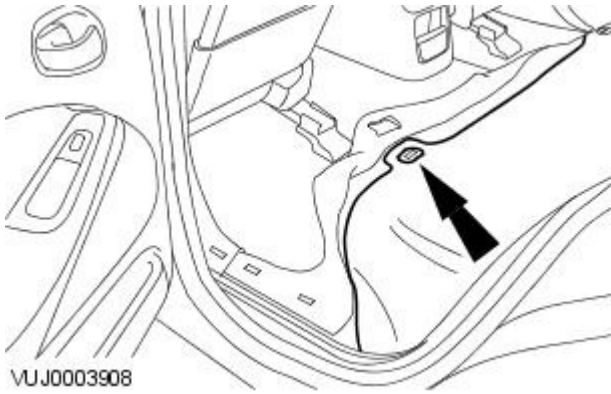
21. Remove the scuff plate trim panel.



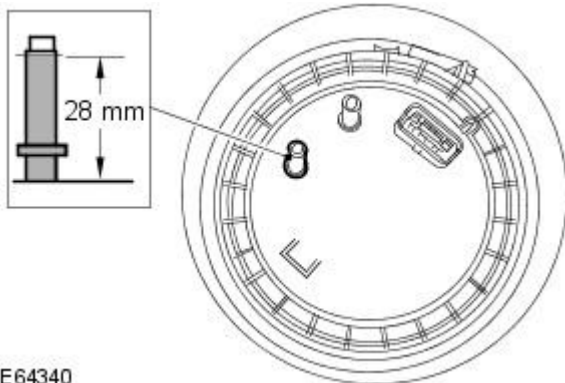
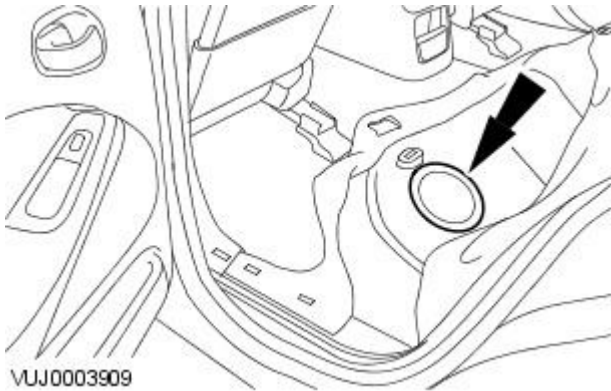
22. Detach and reposition the floor covering.




23. Detach and reposition the rear seat cushion insulation.



24. Remove the floor aperture cover.



25.  CAUTION: The correct measurement must be used to remove the fuel tank drain port top. Failure to follow this instruction may result in damage to the vehicle.

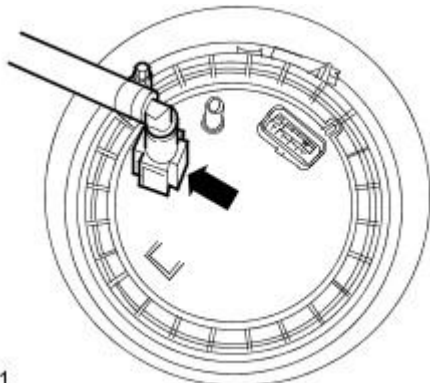
- NOTE: The fuel tank drain port is marked with **DRAIN**.
- NOTE: Vehicles without Diesel engine shown, vehicles with Diesel engine similar.

Using a suitable tool, remove the top of the fuel tank drain port.

26. NOTE: A fuel vacuum drain unit must be attached to the special tool to achieve full fuel tank drain.

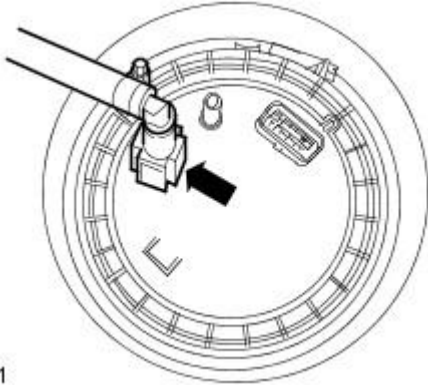
- NOTE: Vehicles without Diesel engine shown, vehicles with Diesel engine similar.

Using the special tool, drain the left-hand side of the fuel tank.




27. NOTE: Vehicles without Diesel engine shown, vehicles with Diesel engine similar.

Remove the special tool.



E64341

28.  CAUTION: Make sure the new fuel tank drain port sealing cap is correctly installed. Failure to follow this instruction may result in damage to the vehicle.

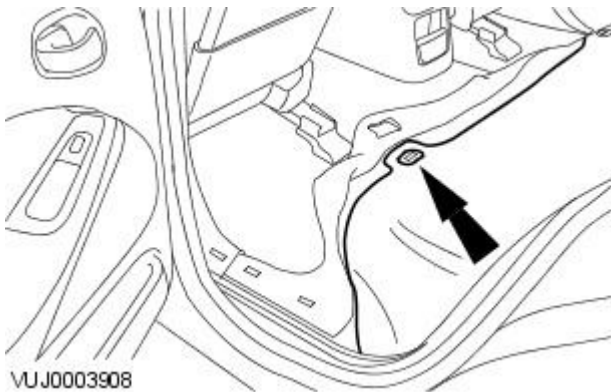
• NOTE: Vehicles without Diesel engine shown, vehicles with Diesel engine similar.

Install a new fuel tank drain port sealing cap.



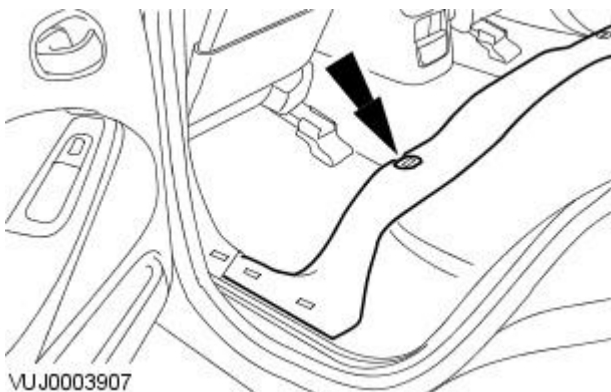
E64342

29. Attach the rear seat cushion insulation.



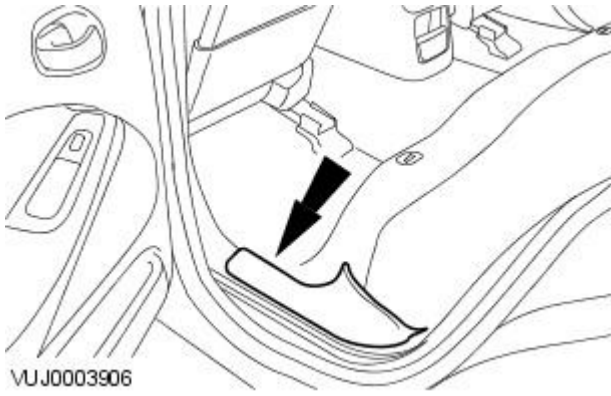
VUJ0003908

30. Attach the floor covering.

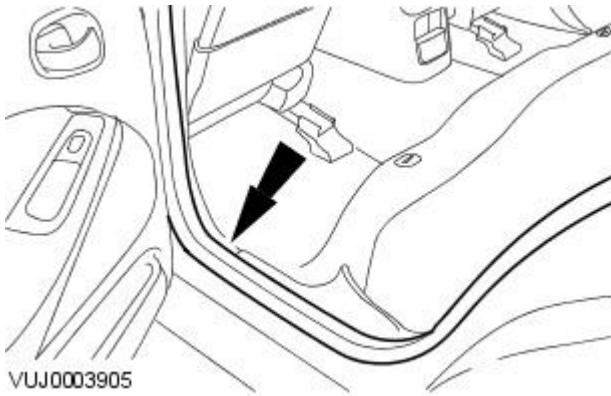


VUJ0003907

**31.** Install the scuff plate trim panel.



**32.** Attach the door opening weatherstrip.



All vehicles

**33.** Install the rear seat cushion.

For additional information, refer to: [Rear Seat Cushion](#) (501-10 Seating, Removal and Installation).



# Fuel System - General Information - Low-Pressure Fuel System Bleeding TDV6 2.7L

## Diesel

### General Procedures

#### • WARNINGS:



Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.



Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.



If taken internally, do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.



If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.



Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

#### • CAUTIONS:



Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.



This procedure must be carried out before the engine is attempted to be started, following removal or replacement of any fuel system component involving fuel line intrusion. Failure to follow this instruction will result in damage to the fuel injection pump.

• NOTE: This procedure is necessary if any low-pressure fuel system components are removed or replaced. These include the fuel filter, fuel lines, fuel tank or fuel cooler.

**1. NOTE:** If the ignition is switched on for more than 10 seconds without the engine starting the fuel pump will switch off to protect itself.

Switch ignition on for 10 seconds. The fuel pump in the fuel tank will be audible.

**2.** Switch the ignition off.

**3. NOTE:** Do not start the vehicle.

• NOTE: Allow 15 seconds between **each** ignition cycle (between each ignition **ON** and ignition **OFF**) to allow the fuel tank pump to pump fuel to the fuel injection pump correctly.

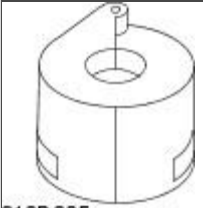
Switch the ignition on and off four times.

**4. NOTE:** The engine must be allowed to idle for two minutes to allow a full system bleed.

Crank the engine until it starts and allow to idle.

# Fuel System - General Information - Spring Lock Couplings

General Procedures

Special Tool(s)	
 <p>310D005</p>	<p>Spring Lock Coupling Tool or Equivalent</p> <p>310-D005 (23-040)</p>

## Disconnect

### 1. WARNINGS:



Place the vehicle in a quarantined area and arrange "No Smoking/Petrol Fumes" signs about the vehicle.



Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be relieved before attempting any repairs. Failure to follow these instructions may result in personal injury.



After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.



If taken internally do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.



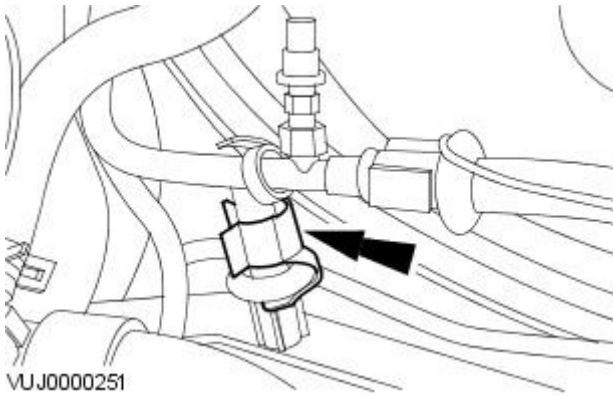
If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek medical attention.



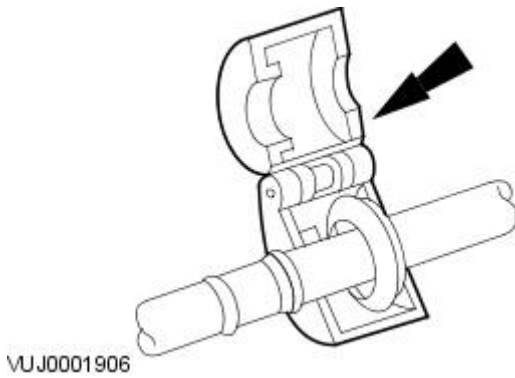
Wash hands thoroughly after handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

Relieve the fuel system pressure. For additional information, refer to the procedure in this section: [Pressure Relief](#).

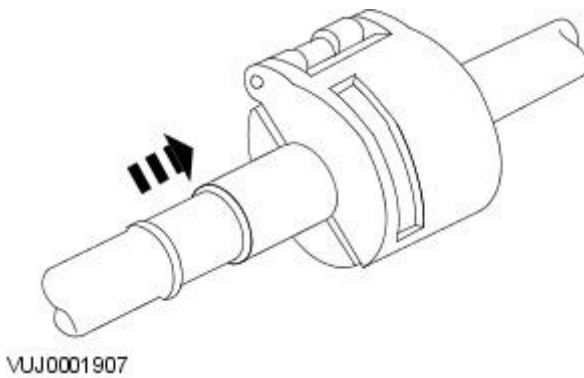
2. Remove the safety clip from the spring lock coupling.



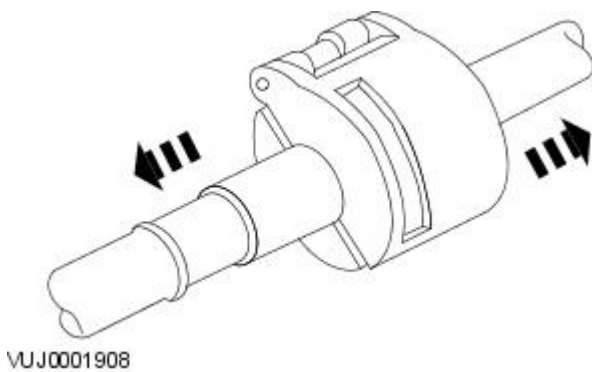
3. Install the special tool.



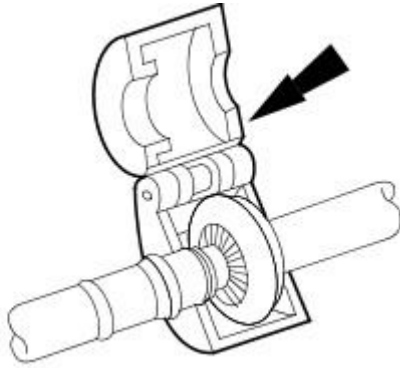
4. Close the special tool and push it into the female end of the spring lock coupling.



5. Disconnect the spring lock coupling.



6. Remove the special tool.



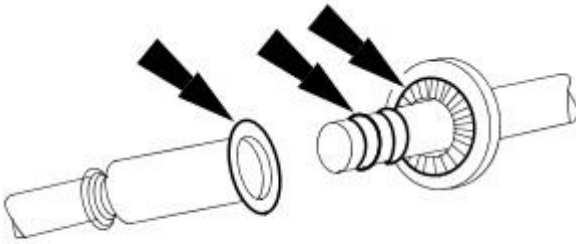
VUJ0001909

### Connect


1. NOTE: Install new O-ring seals.

• NOTE: Install a new garter spring.

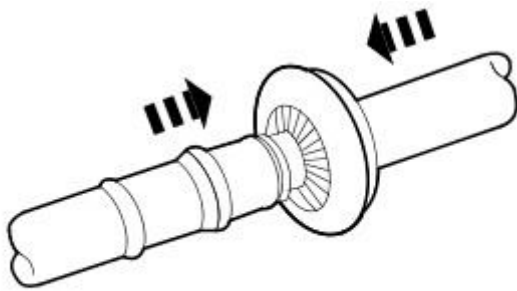
Clean and inspect the male and female ends of the spring lock coupling.



VUJ0001910

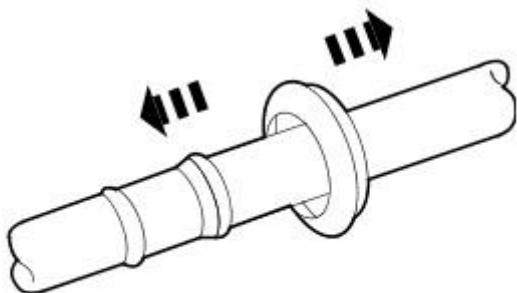
2.  WARNING: Make sure the garter spring snaps over the male end of the spring lock coupling.

Connect the spring lock coupling.



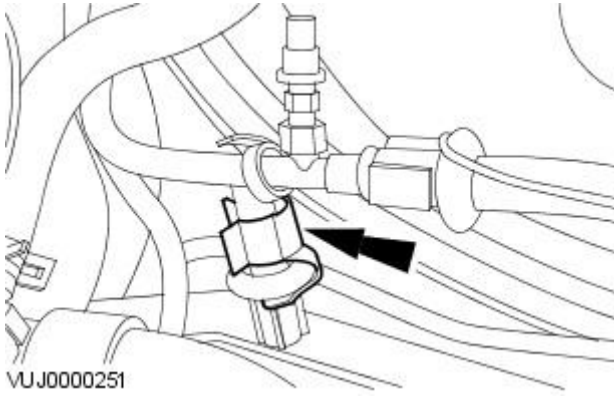
E31439

3. Check the spring lock coupling to make sure it is correctly connected.



E31440

4. Install the safety clip to the spring lock coupling.




VUJ0000251


# Fuel System - General Information - Quick Release Coupling


General Procedures


## Disconnect


### 1. WARNINGS:


 Place the vehicle in a quarantined area and arrange "No Smoking/Petrol Fumes" signs about the vehicle.


 Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.

 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.


 The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be relieved before attempting any repairs. Failure to follow these instructions may result in personal injury.

 After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.

 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

 If taken internally do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.

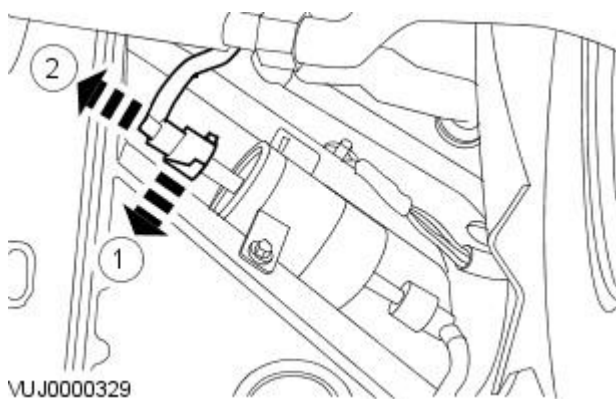
 If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek medical attention.

 Wash hands thoroughly after handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

Relieve the fuel system pressure. For additional information, refer to the procedure in this section: [Pressure Relief](#).

### 2. Disconnect the quick release fitting.

1. Release the retaining clip.
2. Disconnect the quick release fitting.



## Connect

1. To connect, reverse the disconnect procedure.





# Fuel System - General Information - Quick Release Coupling - Push Connect


General Procedures


## Disconnect


### 1. WARNINGS:


 Place the vehicle in a quarantined area and arrange "No Smoking/Petrol Fumes" signs about the vehicle.


 Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.

 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.


 The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be relieved before attempting any repairs. Failure to follow these instructions may result in personal injury.

 After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.

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 If taken internally do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.

 If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek medical attention.

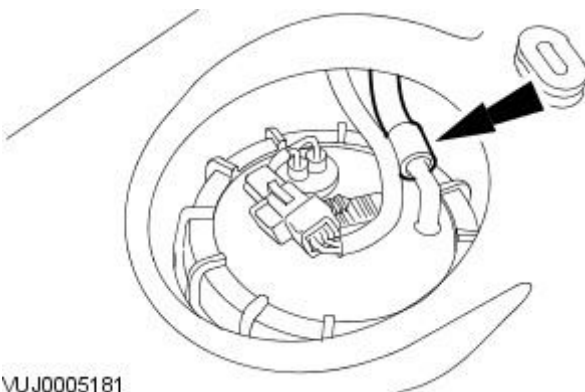
 Wash hands thoroughly after handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

Relieve the fuel system pressure. For additional information, refer to the procedure in this section:

For additional information, refer to: Fuel System Pressure Release (310-00 Fuel System - General Information, General Procedures).

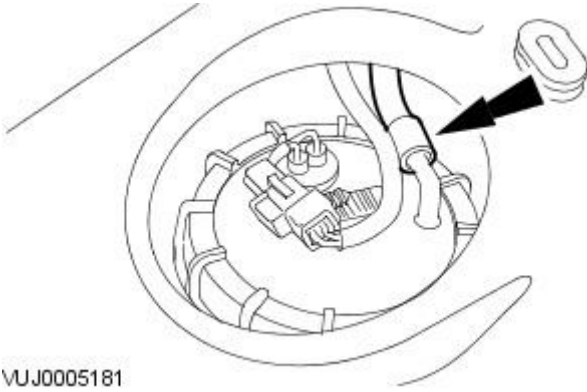
### 2. Disconnect the push connect fitting.

1. Press the tang.
2. Disconnect the push connect fitting.



VUJ0005181

## Connect



VUJ0005181

**1. To connect.**

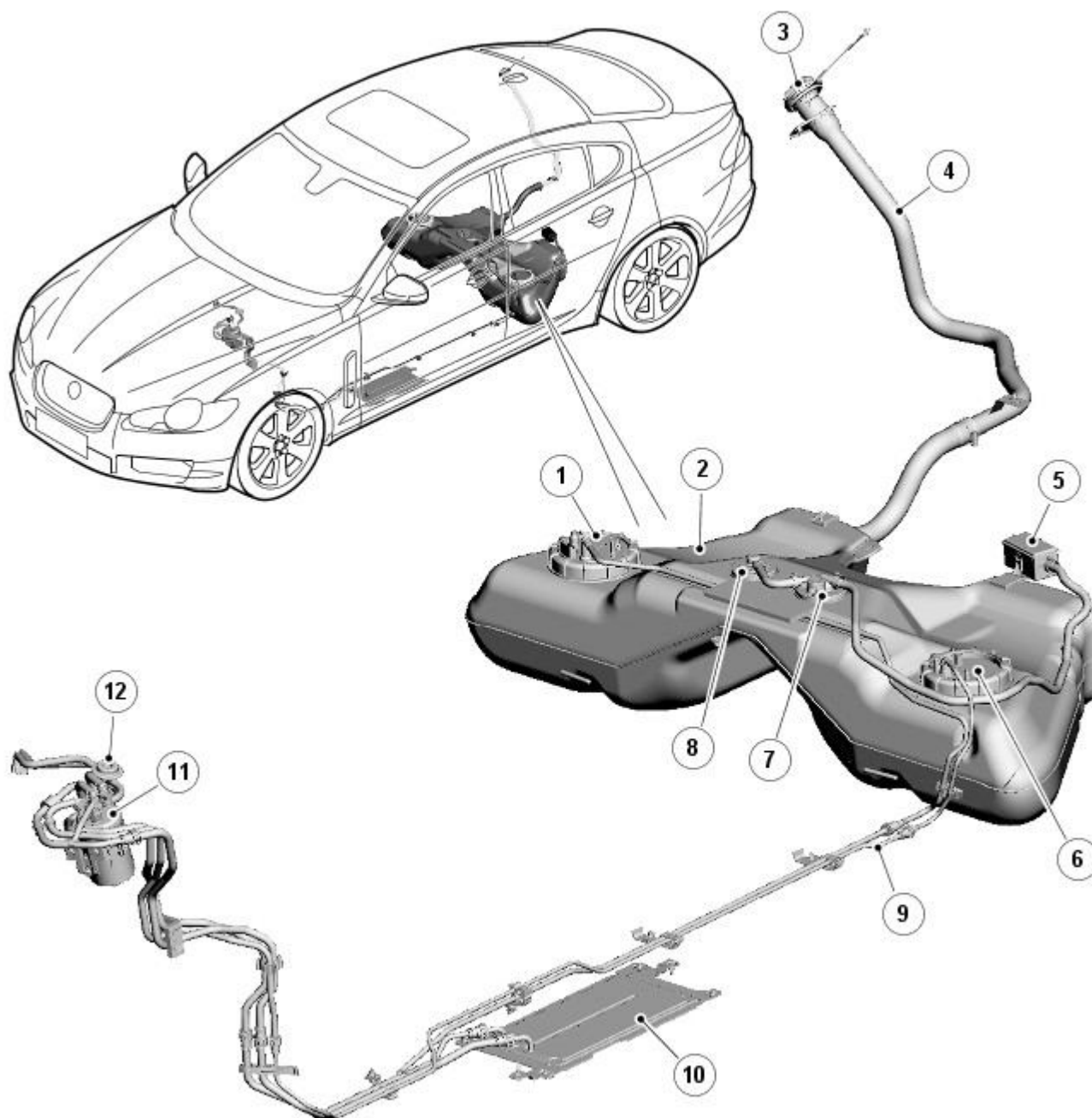
- Support the male stub.
- Push the connector fitting onto the stub until an audible click can be heard.
- Check the connection by a gentle tug test.

**Fuel Tank and Lines - TDV6 2.7L Diesel -**

<b>Variant</b>	<b>Fuel Pressure at Idle</b>	<b>Fuel Pressure at Wide Open Throttle</b>	
Vehicles with PTEC engine management:	-	-	
All	2.2 bar (31.9 lb/in <sup>2</sup> ) (220 kPa)	2.8 bar (40.6 lb/in <sup>2</sup> ) (280 kPa)	
<b>Description</b>		<b>Nm</b>	<b>lb-ft</b>
Fuel tank support strap retaining bolts		35	26
Fuel pump module locking ring		60	44
Fuel transfer pump locking ring		60	44

# Fuel Tank and Lines - TDV6 2.7L Diesel - Fuel Tank and Lines - Component Location

Description and Operation



E94662

## ItemDescription

1	Fuel pump module assembly
2	Fuel tank
3	Filler cap and tether
4	Fuel filler pipe
5	Tank breather filter
6	Transfer pump module assembly
7	Fuel level vent valve
8	ROV (roll over valve)
9	Fuel delivery and return pipes
10	Fuel cooler
11	Fuel filter
12	Fuel damper

# Fuel Tank and Lines - TDV6 2.7L Diesel - Fuel Tank and Lines - Overview

Description and Operation

## OVERVIEW

The fuel tank houses an internal fuel lift pump, located in the fuel pump module. The lift pump is employed to provide a low-pressure supply to the common rail high pressure fuel system.

Two fuel level sensors are installed in either side of the saddle tank. The sensors are a MAPPS (magnetic passive position sensor) which provide a variable resistance to ground for the output from the fuel gauge.

Two fuel coolers are fitted to the vehicle. One is located in the low pressure side of the system in the fuel return line and is a fuel to air cooler. The second cooler, in the high pressure side, is located in the 'vee' of the engine block, and has a coolant system connection to aid heat transfer.

The fuel tank breather system consists of a ROV (roll over valve), fuel level vent valve and a fuel tank breather filter.

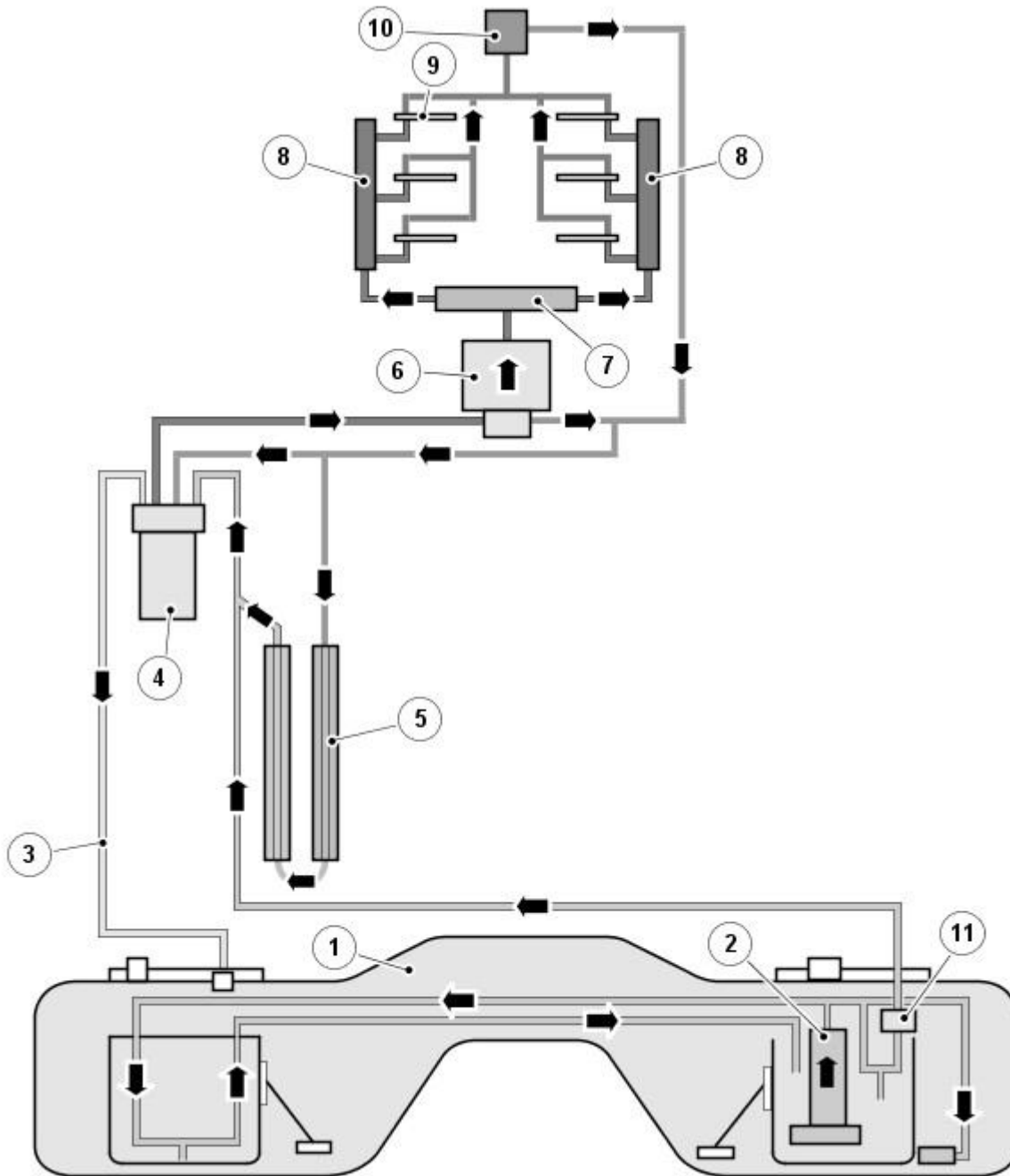
The fuel filter is a disposable canister type and is located on the left hand front inner wing turret.

• NOTE: The fuel fired additional heating system is discontinued, eliminating the dosing pump and pipework from the fuel tank and lines system.

# Fuel Tank and Lines - TDV6 2.7L Diesel - Fuel Tank and Lines - System Operation and Component Description

Description and Operation

Control Diagram



E94670

## ItemDescription

1	Fuel tank
2	Fuel lift pump
3	Air bleed return
4	Fuel filter
5	Fuel cooler (under vehicle)
6	Fuel injection pump
7	Distribution rail
8	Piezo injector
9	Fuel rail
10	Fuel cooler (engine)
11	Lift pump pressure regulator

## System Operation

Diesel fuel is drawn from the tank by the internal electric lift pump. The fuel pressure regulator located in the fuel pump module assembly regulates the delivery pressure at approximately 0.5 bar to the transfer pump housed in the HPP (high pressure pump). A VCV (volume control valve) governs the amount of fuel supplied to the HPP (high-pressure pump).

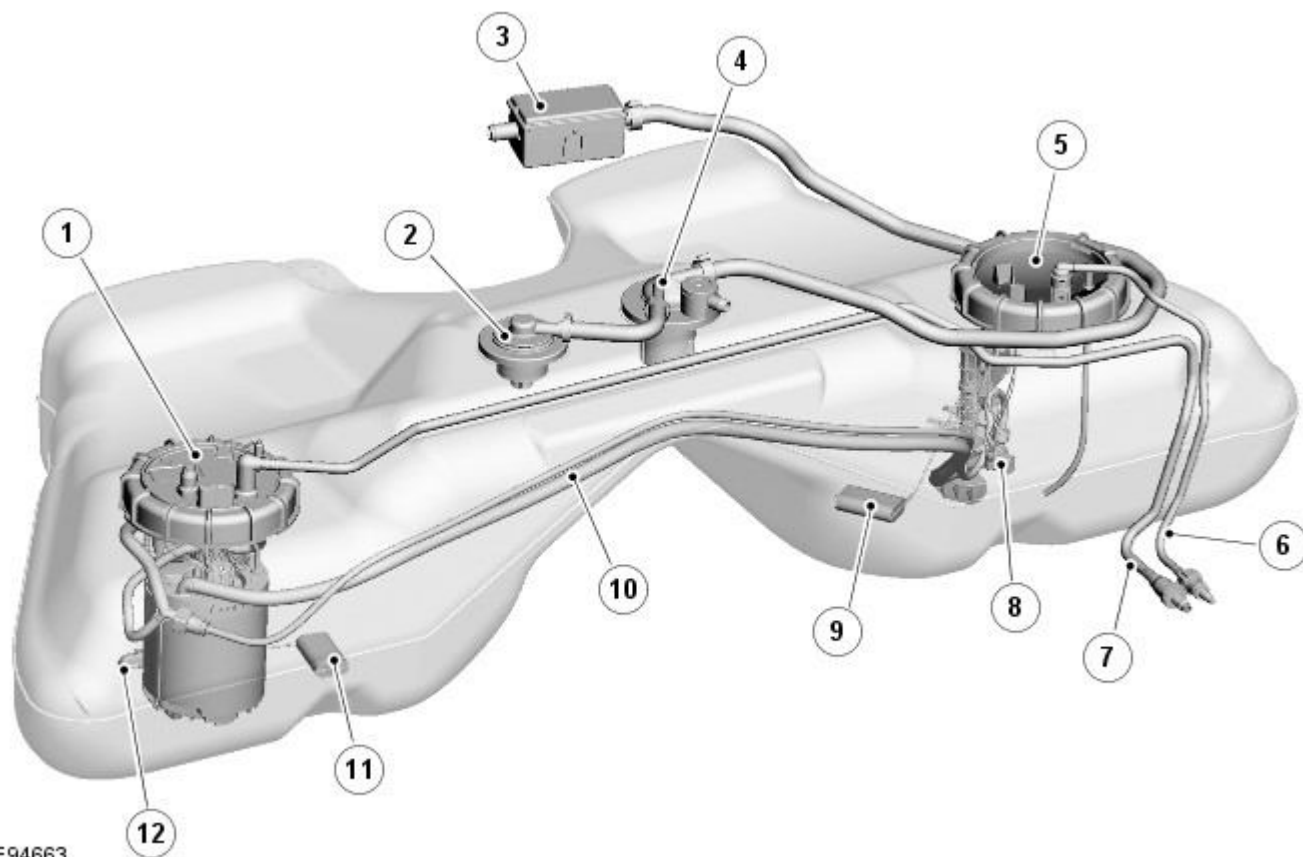
The transfer and high pressure pump are driven directly by the engine. Due to the storage volume of the common rail, the injection pressure will remain practically constant over the complete duration of the injection process.



The HPP (high pressure pump) has a return pipe circuit which is separate from the injector return pipes.  
 Refer to: Fuel Charging and Controls (303-04A, Description and Operation).

## Component Description

### FUEL TANK



E94663

#### ItemDescription

1	Fuel pump module
2	ROV (roll over valve)
3	Tank breather filter
4	Fuel level vent valve
5	Transfer pump module assembly
6	Fuel return pipe
7	Fuel supply to engine
8	Jet pump
9	LH (left-hand) fuel level sensor float
10	Internal fuel transfer pipes
11	RH (right-hand) fuel level sensor float
12	Fuel pick up pipe with integrated coarse filter

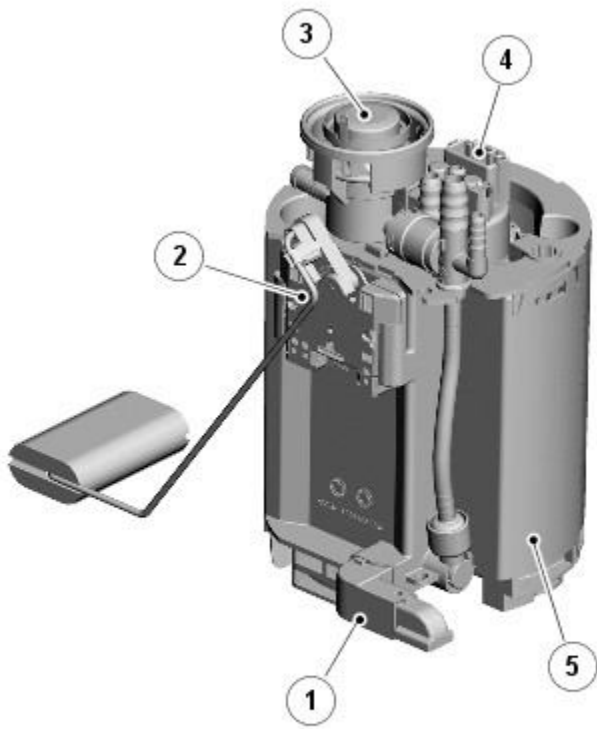
The fuel tank is a saddle type tank constructed of HDPE (high density polyethylene), a plastic blow molded material. The tank is located forward of the rear suspension and is mounted using two metal straps. The tank is a sealed unit with the only internal access being through the fuel pump module and transfer pump module flange apertures on the top of the tank.

The fuel pump module flange has a six pin external connector which provides the electrical connections for the fuel pump, low fuel level switch and the right hand fuel level sensor. A quick release connector provides for the connection of the fuel feed pipe.

The transfer pump module flange has a two pin external connector which provides the electrical connection for the left hand fuel level sensor. A quick release connector provides for the connection of the fuel return pipe.

Each flange is fitted with a collar, clamp and seal which locate in the tank apertures. An arrow on each flange must be aligned between two molded lines on the tank, adjacent to the fuel pump module or transfer pump flange aperture, to obtain the correct pump orientation. A collar is located over each flange and is secured with a clamp.

### FUEL PUMP MODULE



E94664

**ItemDescription**

1	Fuel pick up pipe with integrated coarse filter
2	<a href="#">RH</a> fuel level sensor
3	Lift pump pressure regulator
4	Electrical connector
5	Fuel pump module

The low pressure fuel lift pump is located in the fuel pump module and is designed with low level fuel pick-up features. The lift pump is employed to provide a low pressure supply, approximately 0.5 bar, to the common-rail high pressure fuel system and maintain an equal fuel level in both compartments of the saddle tank.

The lift pump operation is controlled by the [ECM \(engine control module\)](#), via the fuel pump relay located in the [RJB \(rear junction box\)](#). When the ignition is switched on the fuel pump operates for 25 seconds to build up fuel pressure. As engine cranking commences the fuel pump stops running until the engine starts. This function is employed to decrease load on the battery.

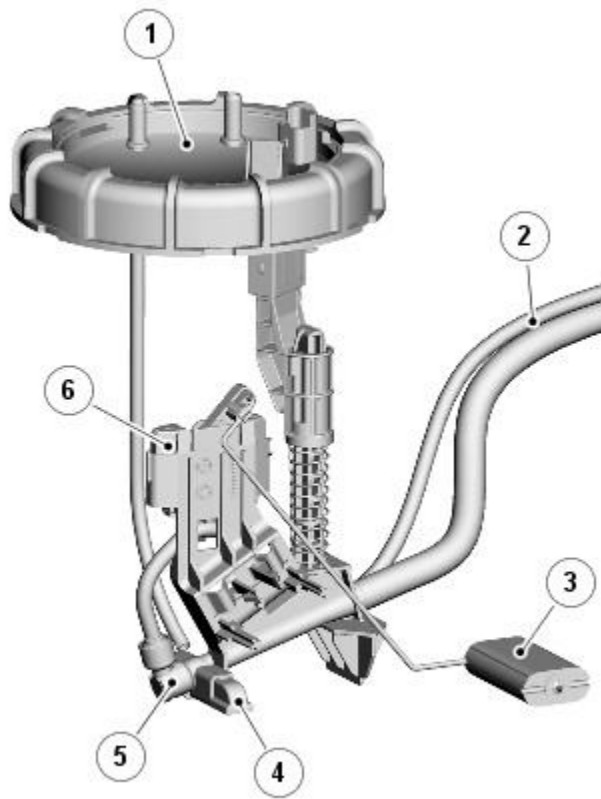
In cold conditions, 'waxing' of the fuel can occur. For this reason a coarse mesh filter is attached to the swirl pot inlet port at the bottom of the pump module.

A four pipe manifold connection is located next to the fuel pressure regulator at the top of the fuel pump module. One connection is the fuel pump outlet connection which feeds into the manifold. A second connection allows fuel at pump outlet pressure to flow back through the pump module housing from the manifold to the lower swirl pot area. The third connection feeds the pressure regulator and fuel delivery line. When the regulator has opened, due to excessive pump output pressure, fuel returns through the fourth manifold connection to the swirlpot.

The right hand fuel level sensor and low fuel level switch are mounted into the pump module housing.

**FUEL LEVEL SENSORS**

Left Hand Fuel Level Sensor



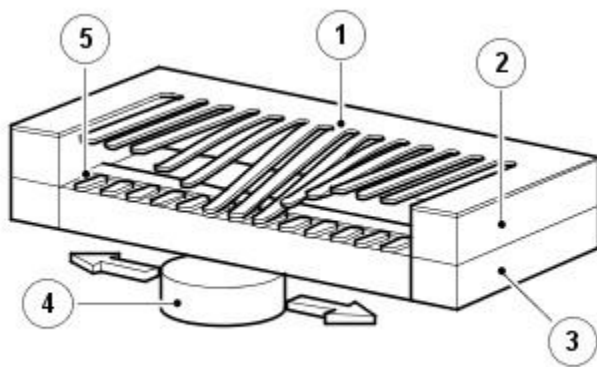
E94665

**ItemDescription**

1	Transfer pump module
2	Fuel cross-over pipes
3	Fuel level sensor float
4	Filter
5	Jet pump
6	Fuel level sensor

Two fuel level sensors are installed in either side of the saddle tank. One is mounted on the fuel pump module, the other is mounted on the transfer pump module in the other side of the fuel tank. The sensors are a MAPPS (magnetic passive position sensor) which provide a variable resistance to ground for the output from the fuel gauge. The sensor is sealed from the fuel preventing contamination of the contacts, increasing reliability. The fuel level sensors are connected to external electrical connectors on the underside of the fuel and transfer pump module flanges.

The sensor comprises a series of 51 film resistors mounted in an arc on a ceramic surface. The resistors are wired in series with individual contacts. A soft magnetic foil with 51 flexible contacts is mounted a small distance above the film resistors. A magnet, located below the ceramic surface, is attached to the sender unit float arm. As the float arm moves, the magnet follows the same arc as the film resistors. The magnet pulls the flexible contacts onto the opposite film resistor contacts forming an electrical circuit.



E44504

**ItemDescription**

1	Magnetic foil
2	Spacer
3	Ceramic surface
4	Magnet
5	Resistance film

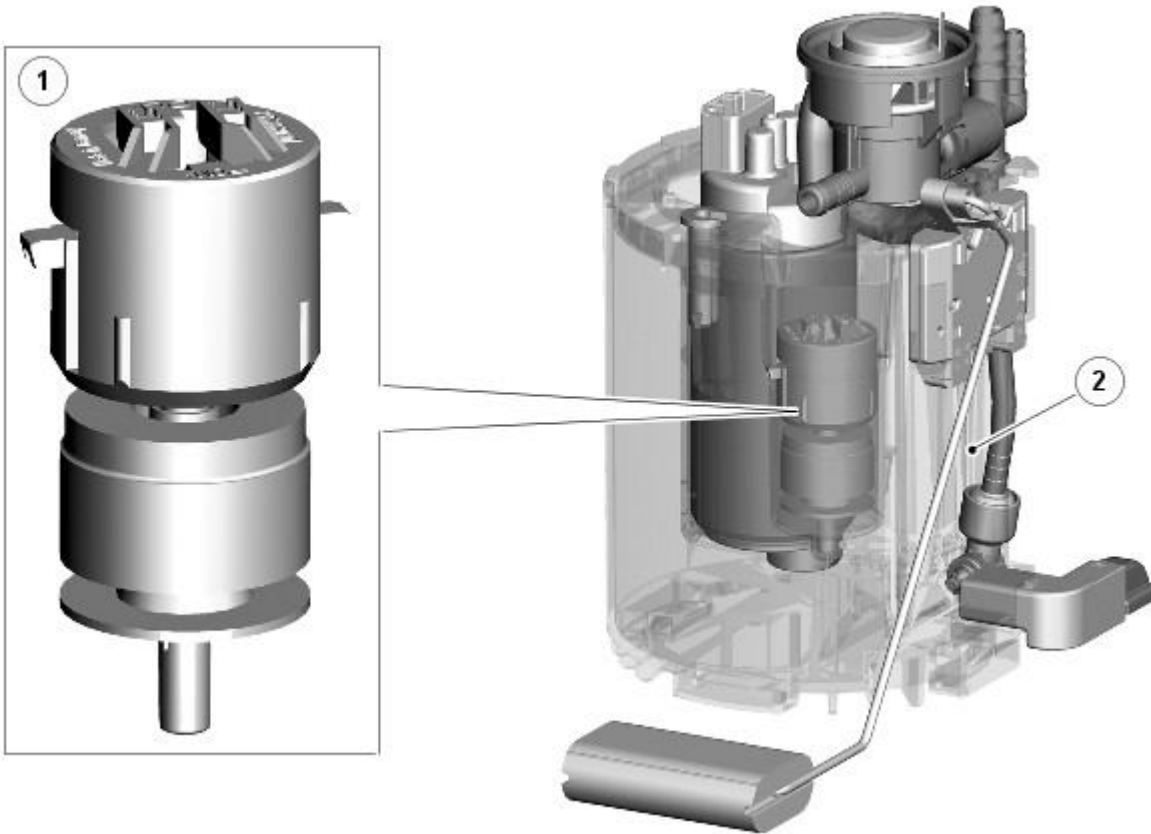
The film resistors are arranged in a linear arc with resistance ranging from 51.2 to 992.11 Ohms. The electrical output signal is proportional to the amount of fuel in the tank and the position of the float arm. The measured resistance is processed by the instrument cluster to implement an anti-slosh function. This monitors the signal and updates the fuel gauge pointer position at regular intervals, preventing constant pointer movement caused by fuel movement in the tank due to cornering or braking.

A warning lamp is incorporated in the instrument cluster and illuminates when the fuel level is low.

The fuel level sender signal is converted into a CAN (controller area network) message by the instrument cluster as a direct interpretation of

the fuel tank contents in liters.

## LOW FUEL LEVEL SWITCH



E94666

### ItemDescription

- |   |                       |
|---|-----------------------|
| 1 | Low fuel level switch |
| 2 | Fuel pump module      |

A fuel run-dry strategy has been programmed into the [ECM](#) software to prevent the fuel tank emptying completely. This strategy prevents damage to the fuel tank pump and the necessity of priming the fuel system.

In the event that the fuel is allowed to run too low, signals transmitted from a low-level switch, located in the swirl-pot of the fuel pump module, and both fuel level sensors initiate the fuel run-dry strategy.

Due to the location of the low-level switch there will only be a small amount of fuel left in the tank when the fuel run-dry strategy initiates. The driver will have been notified much earlier that the vehicle was low on fuel.

Although this is a simulated run-dry procedure, it provides the symptoms of the vehicle running out of fuel and the driver will perceive it as such. The engine will stop when there is approximately 4-liters of fuel remaining in the fuel tank.

## JET PUMP

The fuel system incorporates a single jet pump in the [LH](#) side of the tank. The jet pump is located on the [LH](#) fuel level sensor carrier. The jet pump operates on a venturi effect created by the fuel at pump output pressure passing through the jet pump. This draws additional fuel from the tank through ports in the jet pump body.

The prime function of the jet pump is to collect fuel from the [LH](#) side of the tank and transfer it into the fuel pump module swirl pot on the [RH](#) side of the tank. The jet pump feature also serves to maintain an equal fuel level in the fuel tank compartments.

## ROLL OVER VALVE

The ROV (roll over valve) is located in the upper half of the fuel tank and is connected via a pipe to the fuel level vent valve. The ROV (roll over valve) contains a non-return valve which closes in the event of the vehicle overturning, preventing liquid fuel escaping from the tank via the breather pipe.

## FUEL LEVEL VENT VALVE

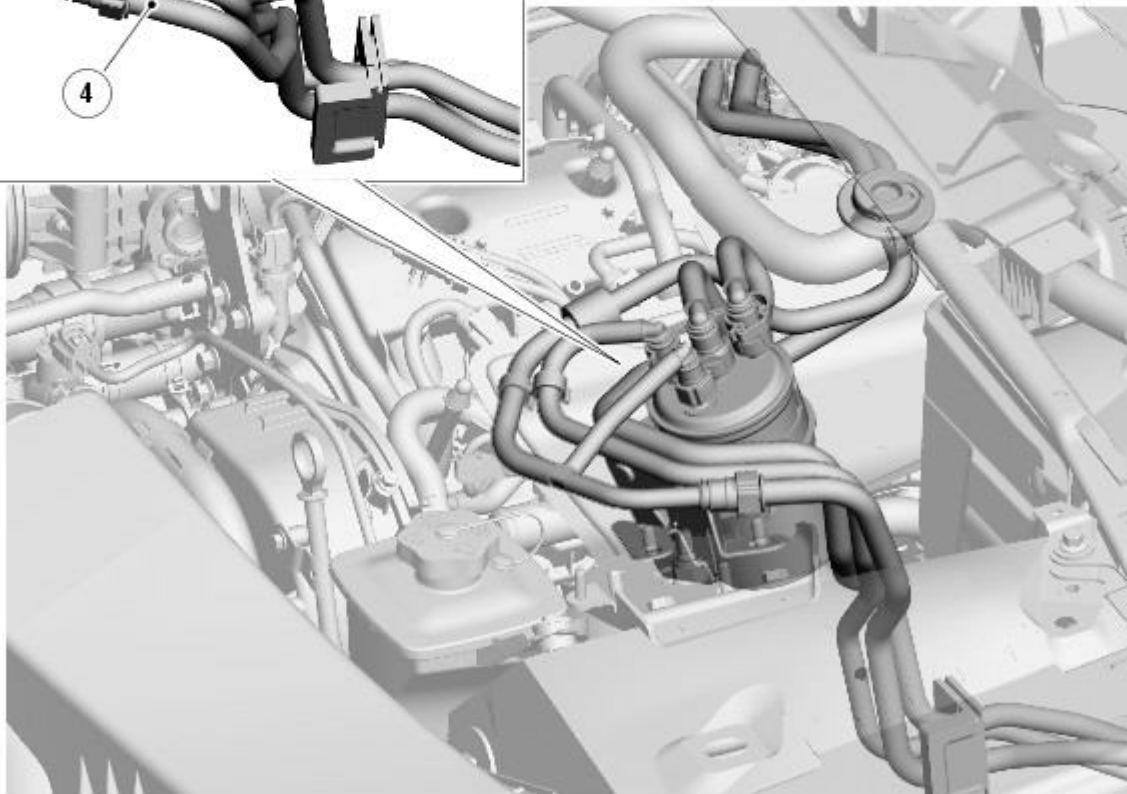
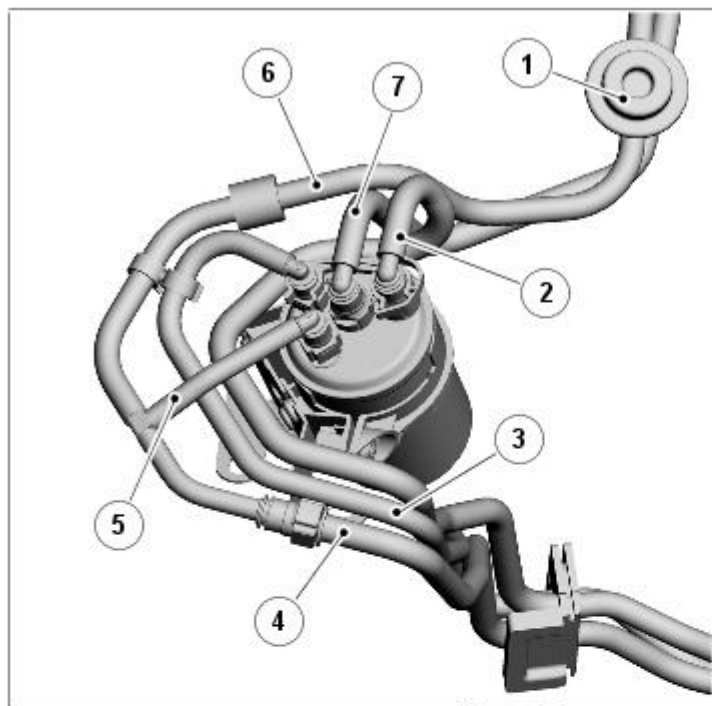
The fuel level vent valve is located in the upper half of the tank and is connected via pipework to the ROV (roll over valve) and the tank breather filter. The main purpose of the fuel level vent valve is to control the fill volume of the tank. During filling air, trapped inside the tank and a small amount of vapor is passed via the fuel level vent valve to the tank breather filter. The air and vapor mix then vents to atmosphere through the breather filter. During filling, when the tank reaches its full level, the fuel level vent valve closes and prevents air/vapor passing through to the tank breather filter. The resulting back pressure causes refueling to stop automatically.

Any further rise in air pressure is vented to the tank breather filter via the ROV (roll over valve).

The fuel level vent valve is always open when the fuel tank is below full, providing an unrestricted air/vapor outlet to the tank breather filter.

If a malfunction occurs in the fuel tank delivery system and the tank overfills, an integral pressure relief valve in the fuel level vent valve opens to provide a direct vent to the atmosphere.

## FUEL FILTER



E94667

**ItemDescription**

1	Fuel damper
2	Fuel supply from fuel tank and under vehicle cooler
3	Air bleed to fuel tank
4	Fuel return to under vehicle cooler
5	Fuel diverter pipe
6	Fuel return from engine
7	Fuel feed to common-rail fuel pump

The fuel filter is a disposable canister type.

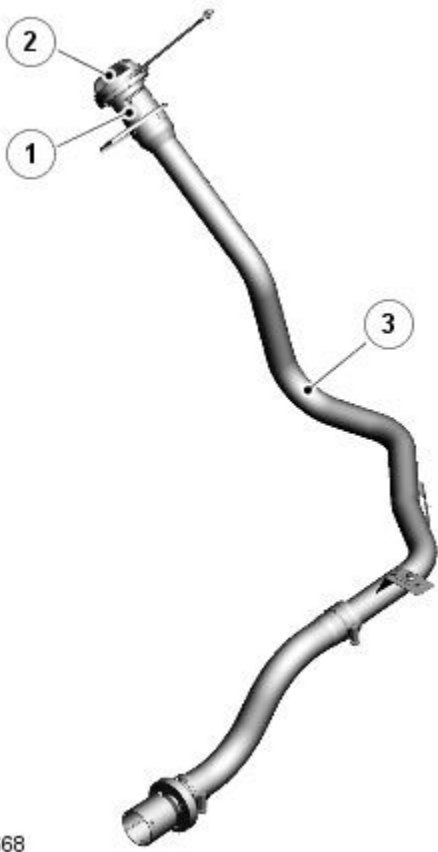
To prevent diesel waxing in cold conditions and to aid warm-up, a temperature sensitive regulating valve incorporated in the fuel filter housing, diverts a portion of the warm fuel returning from the engine into the fuel filter.

The regulating valve commences closing at 30 C (86°F) and fully closes at 50 C (122°F). When the valve is closed the returning fuel is diverted to the fuel filter via the under vehicle fuel cooler to maintain an optimum fuel temperature.

The filter has an air bleed return to the fuel tank which returns excess air and fuel to the tank.

The filter canister incorporates a chamber for collecting moisture. The moisture contained in the diesel fuel collects on the internal filter element and forms droplets, which fall into the moisture chamber. A drain plug located on the bottom of the filter canister is used to discharge the water.

**FUEL FILLER PIPE ASSEMBLY**



E94668

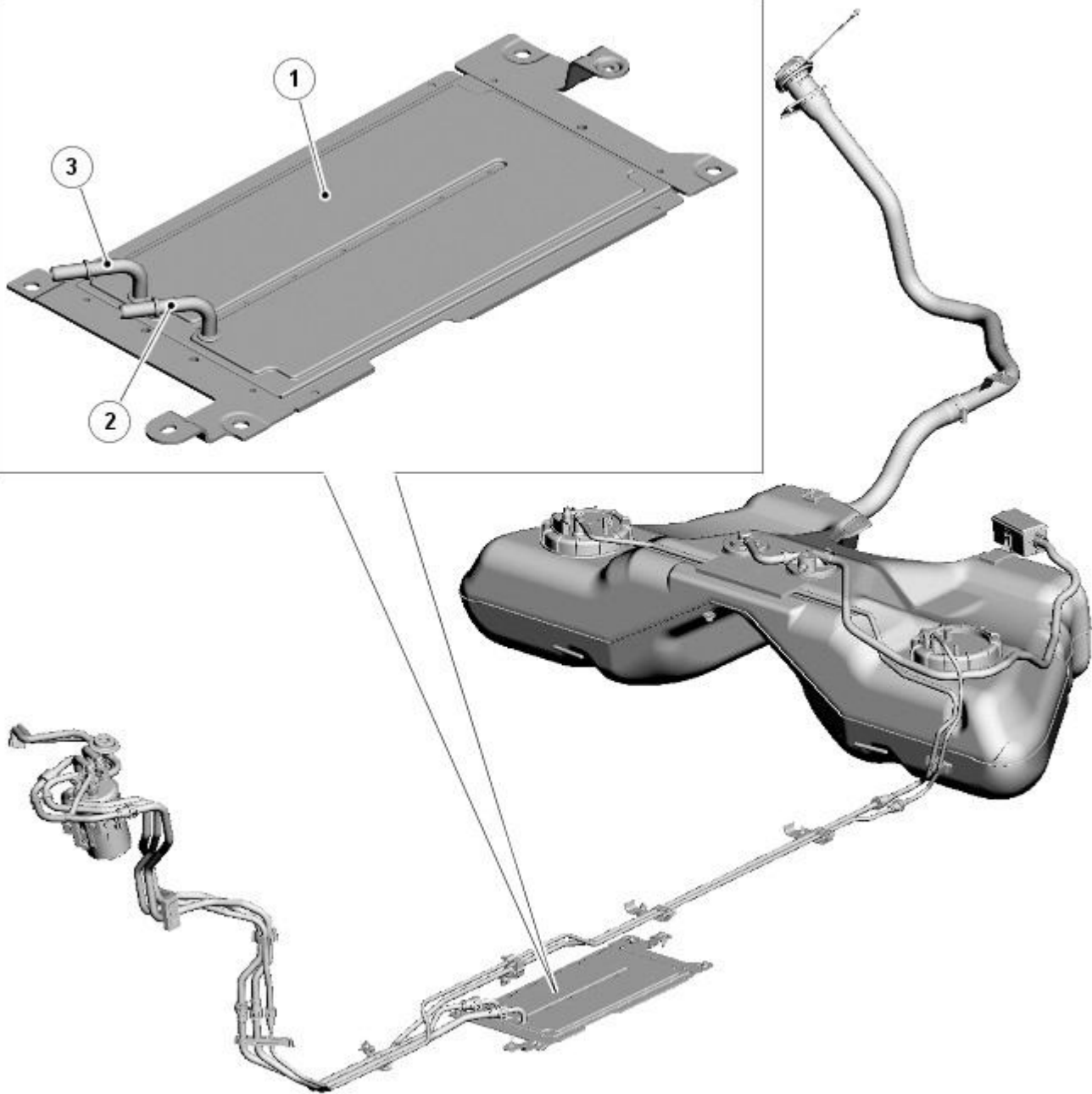
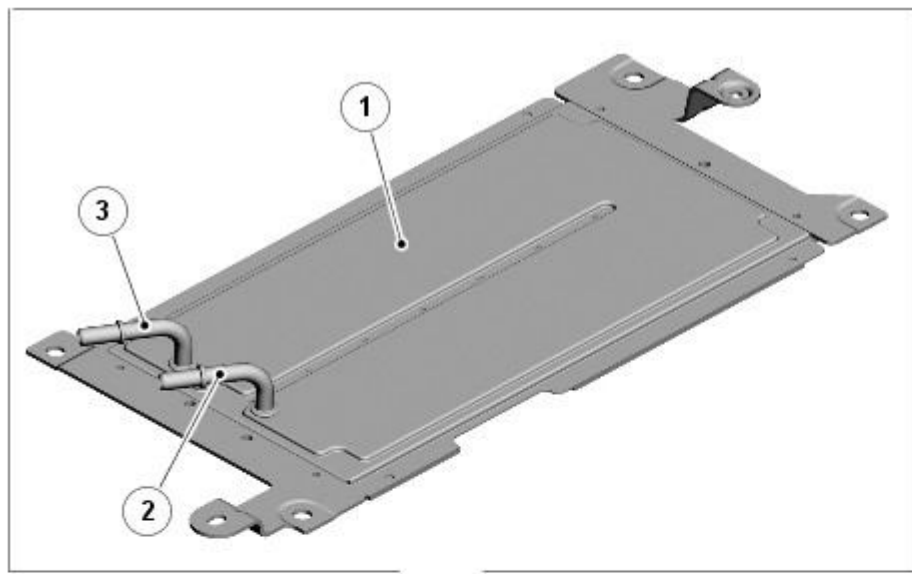
**ItemDescription**

- |   |                       |
|---|-----------------------|
| 1 | Wide bore filler neck |
| 2 | Filler cap and tether |
| 3 | Fuel filler pipe      |

The aluminum filler neck has a wide bore neck specially designed to reduce diesel frothing while the fuel tank is being replenished.

**FUEL COOLER**





E94669

**ItemDescription**

- 1 Fuel cooler (low pressure side – under vehicle)
- 2 Fuel return to under vehicle cooler
- 3 Fuel return from engine

The low-pressure-side fuel cooler is situated under the vehicle, below the LH (left hand) front seat. The cooler is fuel to air cooled. Fuel flow through the underfloor cooler is controlled by the fuel filter.

# Fuel Tank and Lines - TDV6 2.7L Diesel - Fuel Tank and Lines

Diagnosis and Testing

## Principles of Operation

For a detailed description of the fuel tank and lines systems, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (310-01A Fuel Tank and Lines - TDV6 2.7L Diesel)

[Fuel Tank and Lines](#) (Description and Operation),  
[Fuel Tank and Lines](#) (Description and Operation),  
[Fuel Tank and Lines](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Fuel leaks</li> <li>● Damaged fuel lines</li> <li>● Damaged push connect fittings</li> <li>● Fuel level</li> <li>● Fuel contamination/grade/quality</li> <li>● Damaged fuel tank filler pipe cap</li> <li>● Damaged fuel tank filler pipe</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Loose or corroded electrical connectors</li> <li>● Harnesses</li> <li>● Fuel Pump Driver Module (FPDM)</li> <li>● Central Junction Box (CJB)</li> <li>● Fuel pump relay</li> <li>● Engine Control Module (ECM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	<ul style="list-style-type: none"> <li>● Low/contaminated fuel</li> <li>● Intake air leakage</li> <li>● Fuel system leak, blocked/restricted</li> <li>● Electronic engine controls</li> </ul>	Check for low/contaminated fuel. Check integrity of intake air system. Check fuel system for leaks and blockage/restriction. Check for fuel and electronic engine control system related DTCs and refer to relevant DTC Index
Difficult to start	<ul style="list-style-type: none"> <li>● Glowplug fault</li> <li>● Low/contaminated fuel</li> <li>● Check engine coolant level/anti-freeze content</li> <li>● Battery</li> <li>● Intake air system leak</li> <li>● Electronic engine controls</li> <li>● Injector leak</li> <li>● Fuel system leak, blocked/restricted</li> </ul>	Check integrity of glowplug system. Check for low/contaminated fuel. Check the engine coolant level and condition. REFER to: <a href="#">Specifications</a> (303-03A Engine Cooling - TDV6 2.7L Diesel, Specifications). Ensure the battery is in a fully charged and serviceable condition. Check intake air system for leaks. Check for electronic engine control DTCs and refer to the relevant DTC Index. Carry out injector leak tests, install new injectors as required. REFER to: <a href="#">Fuel Injector</a> (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation). Check fuel system for leaks and blockage/restriction. Check for fuel system related DTCs and refer to relevant DTC Index
Rough idle	<ul style="list-style-type: none"> <li>● Intake air system leak</li> <li>● Low/contaminated fuel</li> <li>● Fuel system leak, blocked/restricted</li> <li>● EGR valve fault</li> </ul>	Check intake air system for leaks. Check for low/contaminated fuel. Check fuel system for leaks and blockage/restriction. Check for fuel system related DTCs and refer to relevant DTC Index. Check EGR system for failure. REFER to: <a href="#">Engine Emission Control</a> (303-08A Engine Emission Control - TDV6 2.7L Diesel, Diagnosis and Testing).
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> <li>● Intake air system leak</li> <li>● Restricted exhaust system</li> <li>● Fuel system leak, blocked/restricted</li> <li>● EGR valve fault</li> <li>● Turbocharger actuator fault</li> </ul>	Check intake air system for leaks. Check exhaust system for blockage/restriction. Check fuel system for leaks and blockage/restriction. Check for fuel system related DTCs and refer to relevant DTC Index. Check EGR system for failure. REFER to: <a href="#">Engine Emission Control</a> (303-08A Engine Emission Control - TDV6 2.7L Diesel, Diagnosis and Testing). Check for turbocharger actuator fault. Check for turbocharger actuator DTCs and refer to relevant DTC Index
Engine stops/stalls	<ul style="list-style-type: none"> <li>● Breather system disconnected/restricted</li> <li>● Intake air system leak/restricted</li> <li>● Electronic engine controls</li> <li>● Fuel system leak, blocked/restricted</li> <li>● EGR valve fault</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed. Check intake air system for leaks/restriction. Check for electronic engine control DTCs and refer to the relevant DTC Index. Check fuel system for leaks and blockage/restriction. Check for fuel system related DTCs and refer to relevant DTC Index. Check EGR system for failure. REFER to: <a href="#">Engine Emission Control</a> (303-08A Engine Emission Control - TDV6 2.7L Diesel, Diagnosis and Testing).
Excessive fuel consumption	<ul style="list-style-type: none"> <li>● Fuel pressure, fuel pump, fuel lines blocked/contaminated, leaking</li> <li>● Injector leak</li> <li>● Electronic engine controls</li> <li>● EGR valve fault</li> </ul>	Check fuel lines for leakage, blockage/restriction. Check for fuel system related DTCs and refer to relevant DTC Index. Carry out fuel injector leak tests, install new injectors as necessary. REFER to: <a href="#">Fuel Injector</a> (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation). Check for electronic engine control DTCs and refer to the relevant DTC Index. Check EGR system for failure. REFER to: <a href="#">Engine Emission Control</a> (303-08A Engine Emission Control - TDV6 2.7L Diesel, Diagnosis and Testing).

Symptom	Possible Cause	Action
		Diesel, Diagnosis and Testing).

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• **NOTE:** If a module or component is suspect, and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• **NOTE:** Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• **NOTE:** When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• **NOTE:** If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P000113	Fuel Volume Regulator Control Circuit/Open	<ul style="list-style-type: none"> <li>Fuel volume regulator control circuit - open circuit</li> <li>Fuel volume regulator control valve failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for open circuit. Check resistance across fuel regulator control valve is between 1.5 and 15 Ohms, install a new valve as required
P000200	Fuel Volume Regulator Control Circuit Range/Performance	<ul style="list-style-type: none"> <li>Fuel volume regulator control circuit - short to ground, power, high resistance</li> <li>Fuel volume regulator control valve failure</li> <li>ECM failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for short to ground, power, high resistance. Check and install new fuel volume regulator control valve/ECM as required, refer to the new module/component installation note at the top of the DTC Index
P000311	Fuel Volume Regulator Control Circuit Low	<ul style="list-style-type: none"> <li>Fuel volume regulator control circuit - short to ground</li> <li>Fuel volume regulator control valve failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for short to ground. Check resistance across fuel regulator control valve is between 1.5 and 15 Ohms, install a new valve as required
P000319	Fuel Volume Regulator Control Circuit Low	<ul style="list-style-type: none"> <li>Fuel volume regulator control circuit - current above threshold</li> <li>Fuel volume regulator control valve failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check fuel volume regulator control valve circuit for short, open circuit. Check resistance across fuel regulator control valve is between 1.5 and 15 Ohms, install a new valve as required
P000412	Fuel Volume Regulator Control Circuit High	<ul style="list-style-type: none"> <li>Fuel volume regulator control circuit - short to ground, power, high resistance</li> <li>Fuel volume regulator control valve failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for short to ground, power, open circuit. Check resistance across fuel regulator control valve is between 1.5 and 15 Ohms, install a new valve as required
P000E21	Fuel Volume Regulator Control Exceeded Learning Limit	<ul style="list-style-type: none"> <li>Signal amplitude &lt; minimum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for short to ground, power, open circuit
P000E22	Fuel Volume Regulator Control Exceeded Learning Limit	<ul style="list-style-type: none"> <li>Signal amplitude &gt; maximum</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel volume regulator control circuit for short to ground, power, open circuit
P008772	Fuel Rail/System Pressure - Too Low	<ul style="list-style-type: none"> <li>Lift pump relay driven, pump not activated</li> </ul>	Refer to the electrical circuit diagrams and check fuel lift pump relay circuits and is operating correctly. Check the fuel lift pump is operating correctly
P008873	Fuel Rail/System Pressure - Too High	<ul style="list-style-type: none"> <li>Lift pump relay not driven, pump activated</li> </ul>	Refer to the electrical circuit diagrams and check fuel lift pump relay circuits for short to ground, power, open circuit
P009013	Fuel Pressure Regulator Control Circuit	<ul style="list-style-type: none"> <li>Fuel pressure control valve control circuit - open circuit</li> <li>Fuel pressure control valve failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel pressure control valve control circuit for open circuit. Check resistance across fuel pressure control valve is 2.7 Ohms $\pm$ 2.7 Ohms
P009111	Fuel Pressure Regulator Control Circuit Low	<ul style="list-style-type: none"> <li>Fuel pressure control valve control circuit - short to ground, power, open circuit</li> <li>Fuel pressure control valve failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel pressure control valve control circuit for short to ground, power, open circuit. Check resistance across fuel pressure control valve is 2.7 Ohms $\pm$ 2.7 Ohms
P009119	Fuel Pressure Regulator Control Circuit Low	<ul style="list-style-type: none"> <li>Fuel pressure control valve control circuit - current above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel pressure control valve control circuit for short to ground, power, open circuit. Check resistance across fuel pressure control valve is 2.7 Ohms $\pm$ 2.7 Ohms

DTC	Description	Possible Cause	Action
P009212	Fuel Pressure Regulator Control Circuit High	<ul style="list-style-type: none"> <li>Fuel pressure control valve control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check fuel pressure control valve control circuit for short to power. Check resistance across fuel pressure control valve is 2.7 Ohms $\pm$ 2.7 Ohms
P018126	Fuel Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Signal rate of change below threshold</li> <li>Fuel temperature sensor failure</li> </ul>	<ul style="list-style-type: none"> <li><b>NOTE: This test can only be carried out when the fuel temperature is below 30°C</b></li> </ul> Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short, open circuit and poor connections. Check and record fuel temperature sensor signal, start engine and allow to idle for approximately 10 minutes, check and record fuel temperature sensor signal. If the value of the signal has NOT increased by more than 8°C install a new sensor as required
P018216	Fuel Temperature Sensor A Circuit Low Input	<ul style="list-style-type: none"> <li>Circuit voltage below threshold</li> <li>Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor signal circuit for short to ground. Check and install a new sensor as required
P018317	Fuel Temperature Sensor A Circuit High Input	<ul style="list-style-type: none"> <li>Circuit voltage above threshold</li> <li>Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor signal circuit for short to power. Check and install a new sensor as required
P018427	Fuel Temperature Sensor A Circuit Intermittent	<ul style="list-style-type: none"> <li>Signal rate of change above threshold</li> <li>Fuel temperature sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short, open circuit and poor connections. Run engine to normal operating temperature, check and record fuel temperature sensor signal, increase engine speed to 2000 rpm, after approximately 120 seconds check and record signal. If value of signal has increased by more than 10°C/100ms install a new sensor as required
P019123	Fuel Rail Pressure Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Signal stuck low</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel pump circuits for short to ground, power, open circuit. Check fuel pump for correct operation. Check fuel pressure sensor circuits for short, open circuit. Check for low fuel level and blocked fuel lines
P019124	Fuel Rail Pressure Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel pump circuits for short to ground, power, open circuit. With engine at idle check and record ' <b>Fuel pressure</b> ' datalogger signal, stop engine check and record signal. If signal is greater than 10MPa after approximately 0.40 seconds suspect the fuel pump, check and install a new pump as required
P019165	Fuel Rail Pressure Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Signal has too few transitions/events</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel pump circuits for open circuit. Run engine to normal operating temperature, check and record ' <b>Fuel pressure</b> ' datalogger signal, increase engine speed to 2000 rpm, check and record signal. If value of signal changes by more than 40MPa/10ms suspect the fuel pump, check and install a new pump as required
P019216	Fuel Rail Pressure Sensor A Circuit Low Input	<ul style="list-style-type: none"> <li>Circuit voltage below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel pump circuits for short to power. Start engine, check and record ' <b>Fuel pressure</b> ' datalogger signal. If value of signal is 0MPa suspect the fuel pump, check and install a new pump as required
P019317	Fuel Rail Pressure Sensor A Circuit High Input	<ul style="list-style-type: none"> <li>Circuit voltage above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel pump circuits for short to power. Start engine, check and record ' <b>Fuel pressure</b> ' datalogger signal. If value of signal is more than 180MPa suspect the fuel pump, check and install a new pump as required
P019427	Fuel Rail Pressure Sensor A Circuit Intermittent/Erratic	<ul style="list-style-type: none"> <li>Signal rate of change above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel pump circuit for open circuit. Run engine at idle speed, check and record ' <b>Fuel pressure</b> ' datalogger signal, increase engine speed to 2000 rpm, check and record signal. If value of signal changes by more than 40MPa/10ms suspect the fuel pump, check and install a new pump as required
P046100	Fuel Level Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Low fuel level</li> <li>Fuel level sensor signal circuit - short to ground, open circuit</li> <li>Fuel level sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for sufficient amount of fuel in fuel tank. Refer to the electrical circuit diagrams and check fuel level sensor circuits for short to ground, open circuit. Check and install a new fuel level sensor as required
P04611A	Fuel Level Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Low fuel level</li> <li>Circuit resistance below threshold</li> <li>Fuel level sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for sufficient amount of fuel in fuel tank. Refer to the electrical circuit diagrams and check fuel level sensor circuits for short circuit. Check and install a new fuel level sensor as required
P04611B	Fuel Level Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Low fuel level</li> <li>Circuit resistance above threshold</li> <li>Fuel level sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for sufficient amount of fuel in fuel tank. Refer to the electrical circuit diagrams and check fuel level sensor circuits for High resistance. Check and install a new fuel level sensor as required
P062712	Fuel Pump A Control Circuit/Open	<ul style="list-style-type: none"> <li>Fuel lift pump relay control circuit - short to power</li> <li>Fuel lift pump relay failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel lift pump relay control circuit for short to power. Check and install a new fuel lift pump relay as required


<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
P062811	Fuel Pump A Control Circuit Low	<ul style="list-style-type: none"> <li>● Fuel lift pump relay control circuit - short to ground</li> <li>● Fuel lift pump relay failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel lift pump relay control circuit for short to ground. Check and install a new fuel lift pump relay as required
P062913	Fuel Pump A Control Circuit High	<ul style="list-style-type: none"> <li>● Fuel lift pump relay control circuit - open circuit</li> <li>● Fuel lift pump relay failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel lift pump relay control circuit for open circuit. Check and install a new fuel lift pump relay as required
P115A68	Low Fuel Level - Forced Limited Power	<ul style="list-style-type: none"> <li>● Low level fuel condition</li> <li>● Critical fuel level switch signal circuit - short to ground, power, open circuit</li> <li>● Critical fuel level switch failure</li> <li>● Fuel level sensor signal circuit - short to ground, power, open circuit</li> <li>● Fuel level sensor failure</li> </ul>	Check the fuel level. If there is sufficient fuel, refer to the electrical circuit diagrams and check the critical fuel level switch and fuel level sensor circuits for short, open circuit. Check and install a new critical fuel level switch/fuel level sensor as required
P115B68	Low Fuel Level - Forced Engine Shutdown	<ul style="list-style-type: none"> <li>● Low level fuel condition</li> <li>● Critical fuel level switch signal circuit - short to ground, power, open circuit</li> <li>● Critical fuel level switch failure</li> <li>● Fuel level sensor signal circuit - short to ground, power, open circuit</li> <li>● Fuel level sensor failure</li> </ul>	Check the fuel level. If there is sufficient fuel, refer to the electrical circuit diagrams and check the critical fuel level switch and fuel level sensor circuits for short, open circuit. Check and install a new critical fuel level switch/fuel level sensor as required
P213E01	Fuel Injection System Fault - Forced Engine Shutdown	<ul style="list-style-type: none"> <li>● Engine stop by electrical</li> </ul>	Check for additional related DTCs and refer to the relevant DTC Index
P213F07	Fuel Pump System Fault - Forced Engine Shutdown	<ul style="list-style-type: none"> <li>● Engine stop by hydraulic</li> </ul>	Check for additional related DTCs and refer to the relevant DTC Index

# Fuel Tank and Lines - TDV6 2.7L Diesel - Fuel Cooler

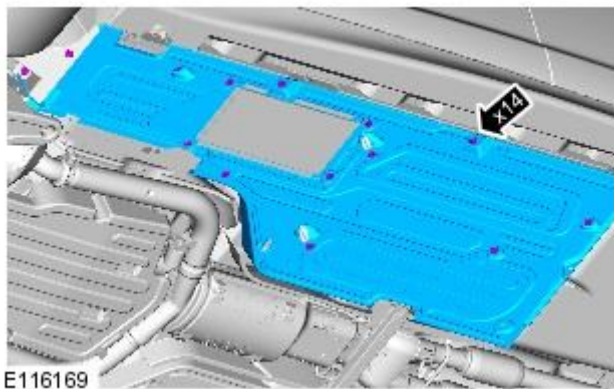
Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Diesel Fuel System Health and Safety Precautions](#) (100-00 General Information, Description and Operation).
2. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
Raise and support the vehicle.
4. Refer to: [Engine Rear Undershield](#) (501-02 Front End Body Panels, Removal and Installation).

5. Torque: 10 Nm



6. **CAUTIONS:**



Be prepared to collect escaping fluids.



Make sure that all openings are sealed. Use new blanking caps.

Torque:

M6 Bolt 9 Nm

M6 Nut 5 Nm



## Installation

1. **NOTE:** Remove and discard the blanking caps.  
To install, reverse the removal procedure.



# Fuel Tank and Lines - TDV6 2.7L Diesel - Fuel Filter

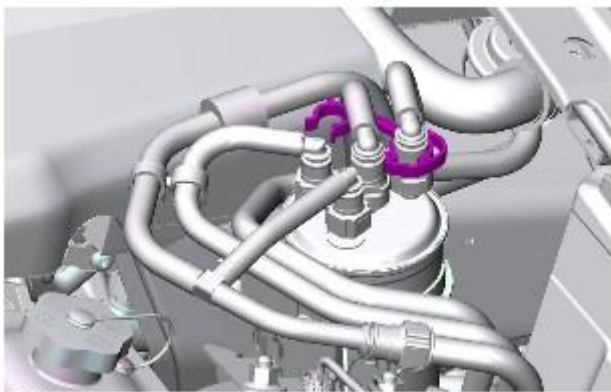
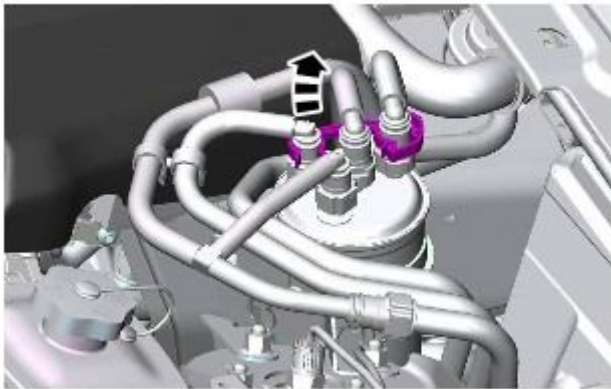
Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

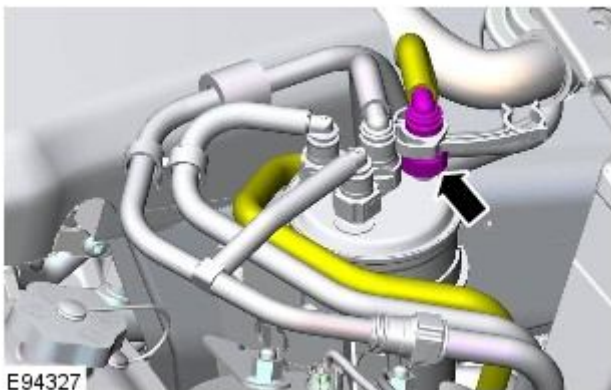
All vehicles

1.



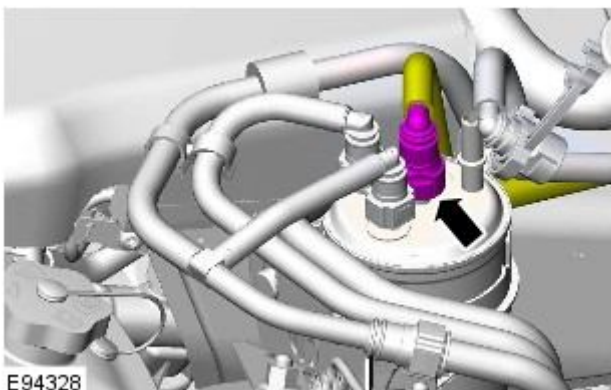
E94326

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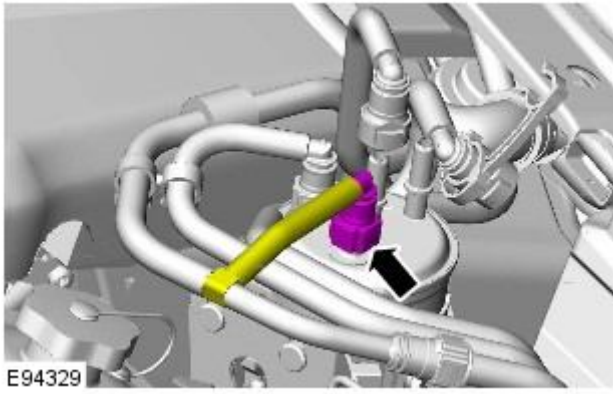


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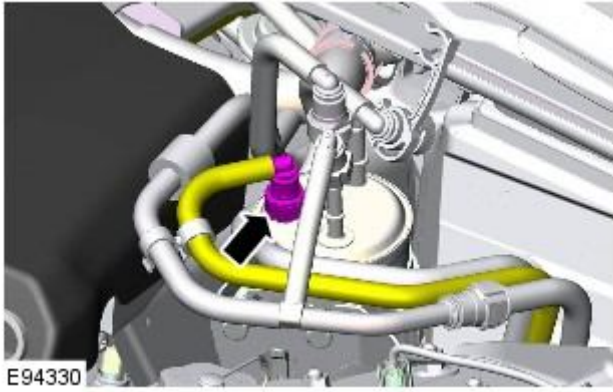
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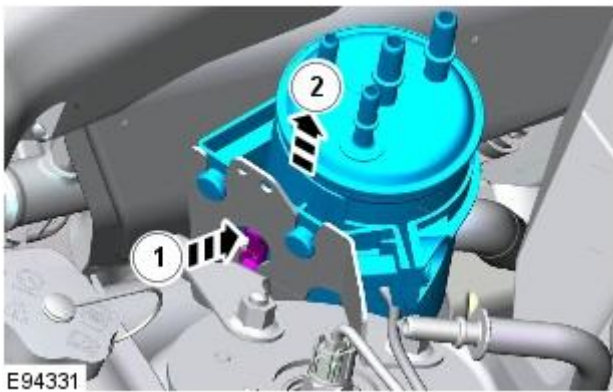
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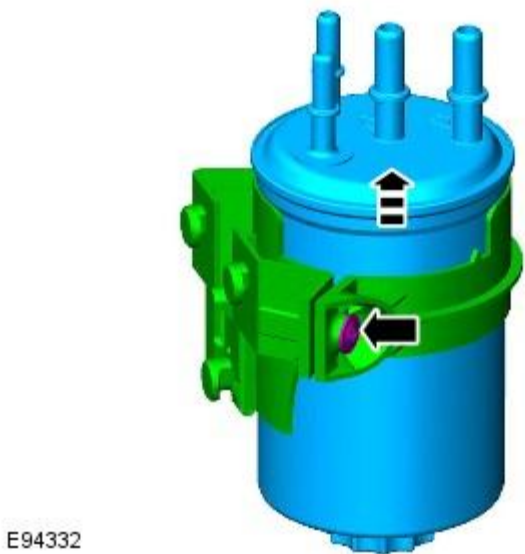


5.



6.

7. Torque: 3 Nm



Vehicles with 3.0L diesel engine

8.



E116377

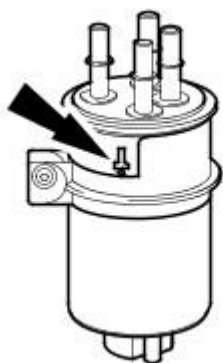
All vehicles

9. Torque: 3 Nm




E94332

## Installation



E52063

1.  CAUTION: Make sure that the fuel filter is correctly aligned. Failure to follow this instruction may result in damage to the vehicle.

To install, reverse the removal procedure.

2. Carry out the low-pressure fuel system bleeding.

Refer to: [Low-Pressure Fuel System Bleeding - TDV6 2.7L Diesel](#) (310-00 Fuel System - General Information, General Procedures).

# Fuel Tank and Lines - TDV6 2.7L Diesel - Fuel Tank


Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

All vehicles

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Fuel Tank Draining](#) (310-00 Fuel System - General Information, General Procedures).

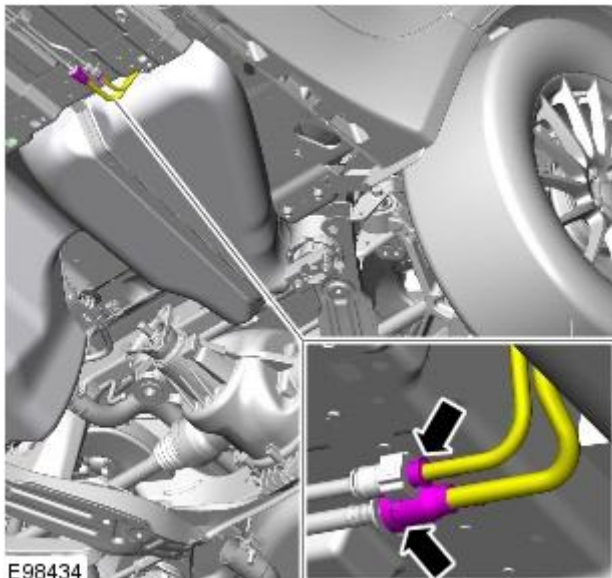
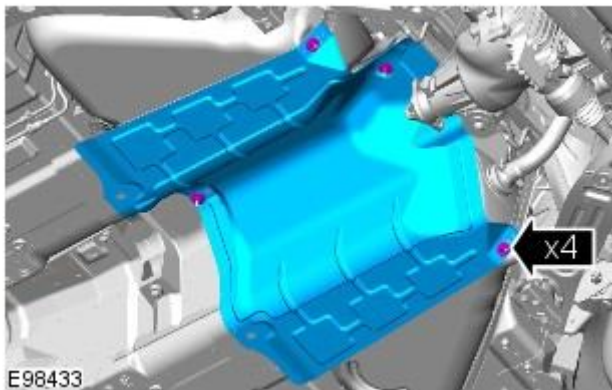
3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.


Raise and support the vehicle.

4. Refer to: [Driveshaft](#) (205-01 Driveshaft, Removal and Installation).

5.

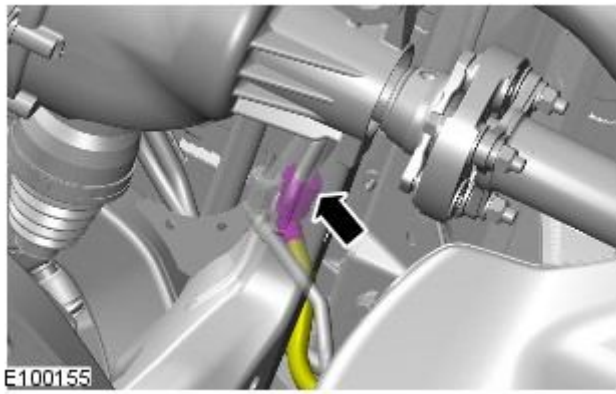
- Torque: 5 Nm



6.  **WARNING:** The spilling of fuel is unavoidable during this operation. Make sure that all necessary precautions are taken to prevent fire and explosion.

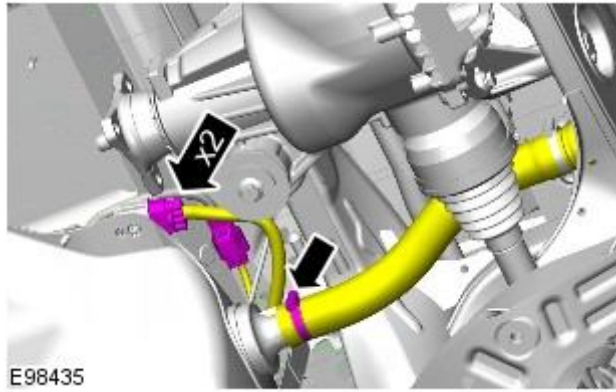
Vehicles with petrol engine





7.

All vehicles



8.

- Torque: 3 Nm



9.  **WARNING:** Secure the component to the transmission jack.

 **CAUTION:** Use suitable packing material to prevent damage to the component.

- Torque: 35 Nm

## Installation

1. To install, reverse the removal procedure.

# Fuel Tank and Lines - TDV6 2.7L Diesel - Fuel Pump Module

Removal and Installation

## Special Tool(s)

Remover/Installer, Fuel Pump Module/Fuel Transfer Unit Locking Ring

310-146

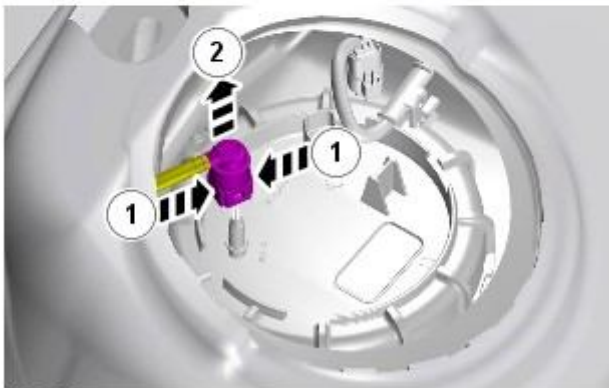


E60768

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. For additional information, refer to: [Fuel Transfer Unit](#) (310-01A Fuel Tank and Lines - TDV6 2.7L Diesel, Removal and Installation).
- 3.



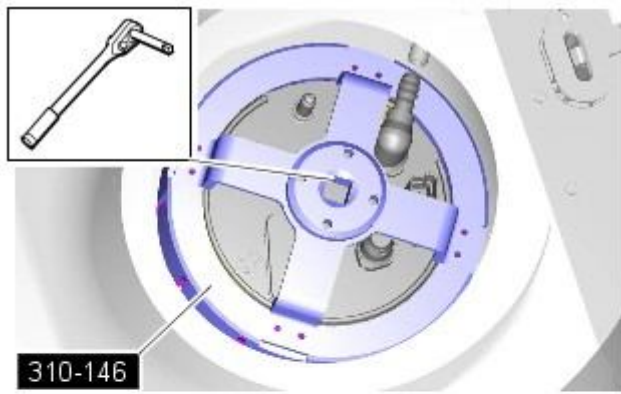
E98203



E98233

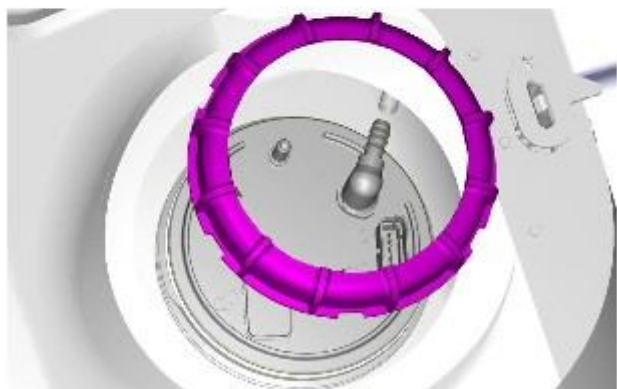
4.  CAUTION: Note the fitted position of the component prior to removal.



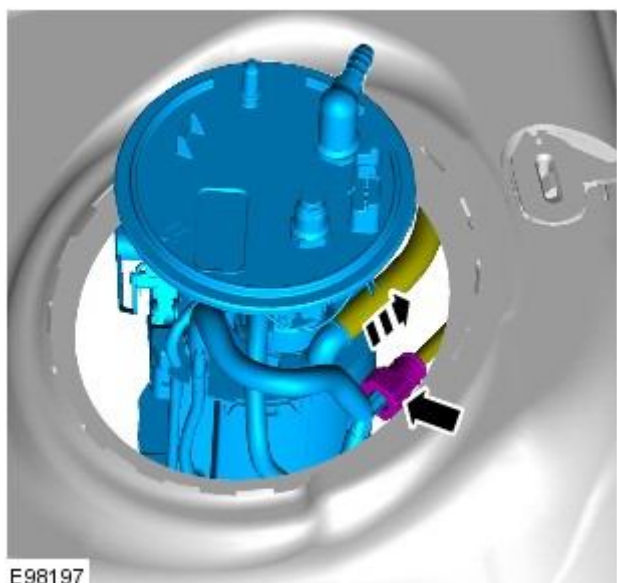


5.  CAUTION: Note the fitted position of the component prior to removal.

- TORQUE: 70 Nm



E98196



6. CAUTIONS:

 Note the fitted position of the component prior to removal.

 Take extra care not to damage the fuel tank level sensor float and arm.

- NOTE: Discard the gasket.

E98197

## Installation



1.  CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

- NOTE: Install a new gasket.
- NOTE: Make sure that the component is installed to the position noted on removal.

To install, reverse the removal procedure.

E98233

# Fuel Tank and Lines - TDV6 2.7L Diesel - Fuel Transfer Unit

## Removal and Installation

### Special Tool(s)

Remover/Installer, Fuel Pump Module/Fuel Transfer Unit Locking Ring

310-146

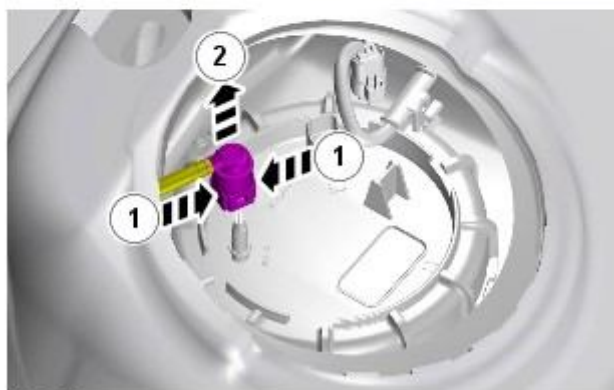


E60768

### Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. For additional information, refer to: [Fuel Tank Draining](#) (310-00 Fuel System - General Information, General Procedures).
- 3.



E98203

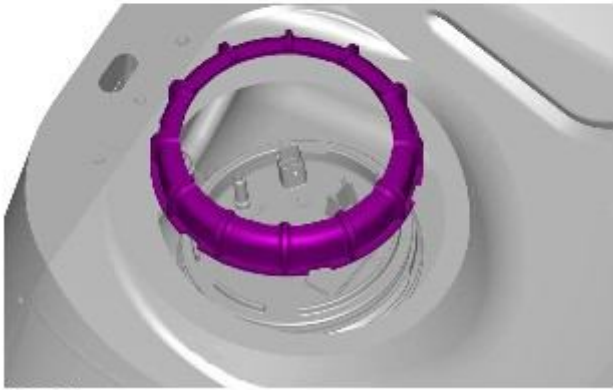
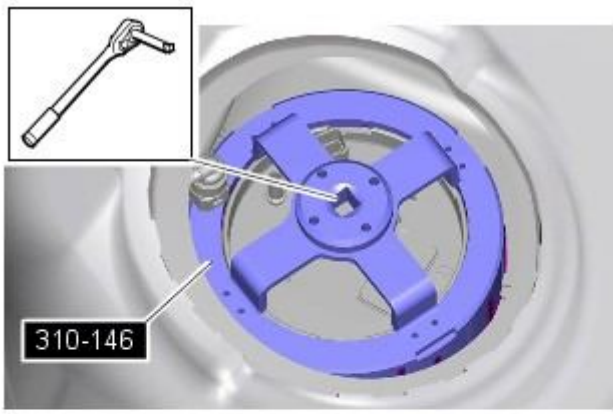


E98233

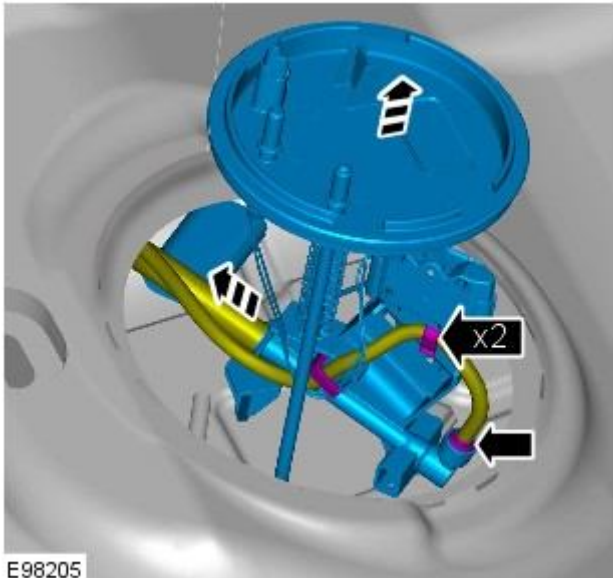
4.  CAUTION: Note the fitted position of the component prior to removal.

5.

- TORQUE: 70 Nm



E98204



#### 6. CAUTIONS:



Note the fitted position of the component prior to removal.



Take extra care not to damage the fuel tank level sensor float and arm.

- NOTE: Discard the gasket.

### Installation



1. CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

- NOTE: Install a new gasket.

• NOTE: Make sure that the component is installed to the position noted on removal.

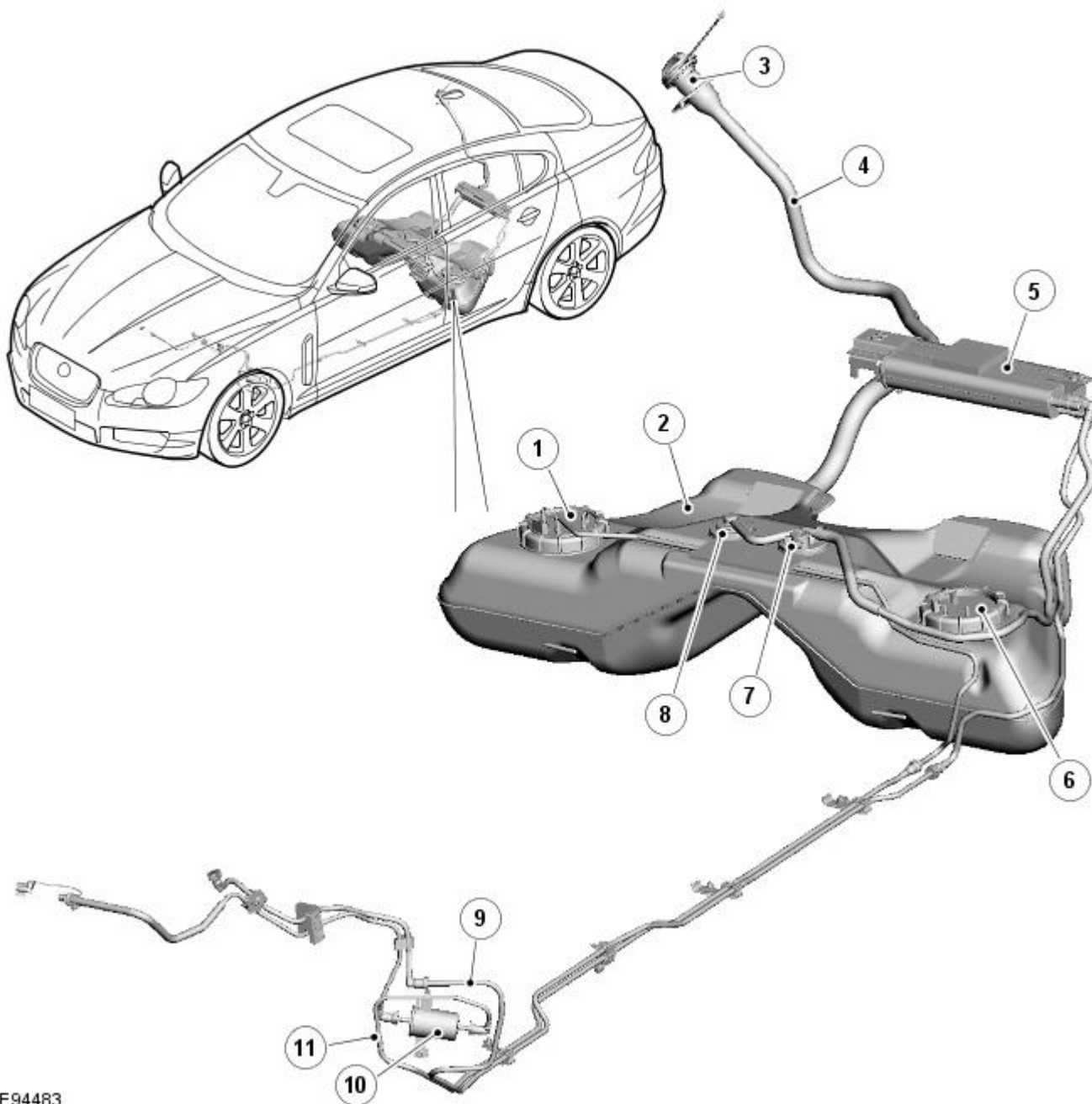
To install, reverse the removal procedure.

**Fuel Tank and Lines - V6 3.0L Petrol -**

<b>Variant</b>	<b>Fuel Pressure at Idle</b>	<b>Fuel Pressure at Wide Open Throttle</b>	
Vehicles with PTEC engine management:	-	-	
All	2.2 bar (31.9 lb/in <sup>2</sup> ) (220 kPa)	2.8 bar (40.6 lb/in <sup>2</sup> ) (280 kPa)	
<b>Description</b>		<b>Nm</b>	<b>lb-ft</b>
Fuel tank support strap retaining bolts		35	26
Fuel pump module locking ring		60	44
Fuel transfer pump locking ring		60	44

# Fuel Tank and Lines - V6 3.0L Petrol - Fuel Tank and Lines - Component Location

Description and Operation



E94483

## ItemDescription

1	Fuel pump module assembly
2	Fuel tank
3	Filler cap and tether
4	Fuel filler pipe
5	Charcoal canister assembly
6	Fuel transfer pump
7	Pressure control valve
8	Fuel vapor valve
9	Pipe - EVAP charcoal canister to purge valve
10	Fuel filter
11	Pipe - Fuel pump to engine (feed)

# Fuel Tank and Lines - V6 3.0L Petrol - Fuel Tank and Lines - Overview

Description and Operation

Authoring Template

## OVERVIEW

The fuel system uses an electronic returnless system. The system comprises a pump module mounted in the fuel tank to deliver fuel at variable flow and pressure to the fuel rails which in turn supply fuel to the fuel injectors. The fuel pump operation is regulated by a [FPDM \(fuel pump driver module\)](#) which is controlled by the [ECM \(engine control module\)](#). The [FPDM](#) regulates the flow and pressure supplied by controlling the operation of the fuel pump using a [PWM \(pulse width modulation\)](#) output.

Two fuel level sensors are installed in either side of the saddle tank. The sensors are a MAPPS (magnetic passive position sensor) which provide a variable resistance to ground for the output from the fuel gauge.

The fuel system also incorporates an [EVAP \(evaporative emission\)](#) system which is part of the on-board refueling and vapor recovery feature. The function and operation of the system is designed to meet evaporative emission requirements to minimize fuel vapor losses. For additional information, refer to:

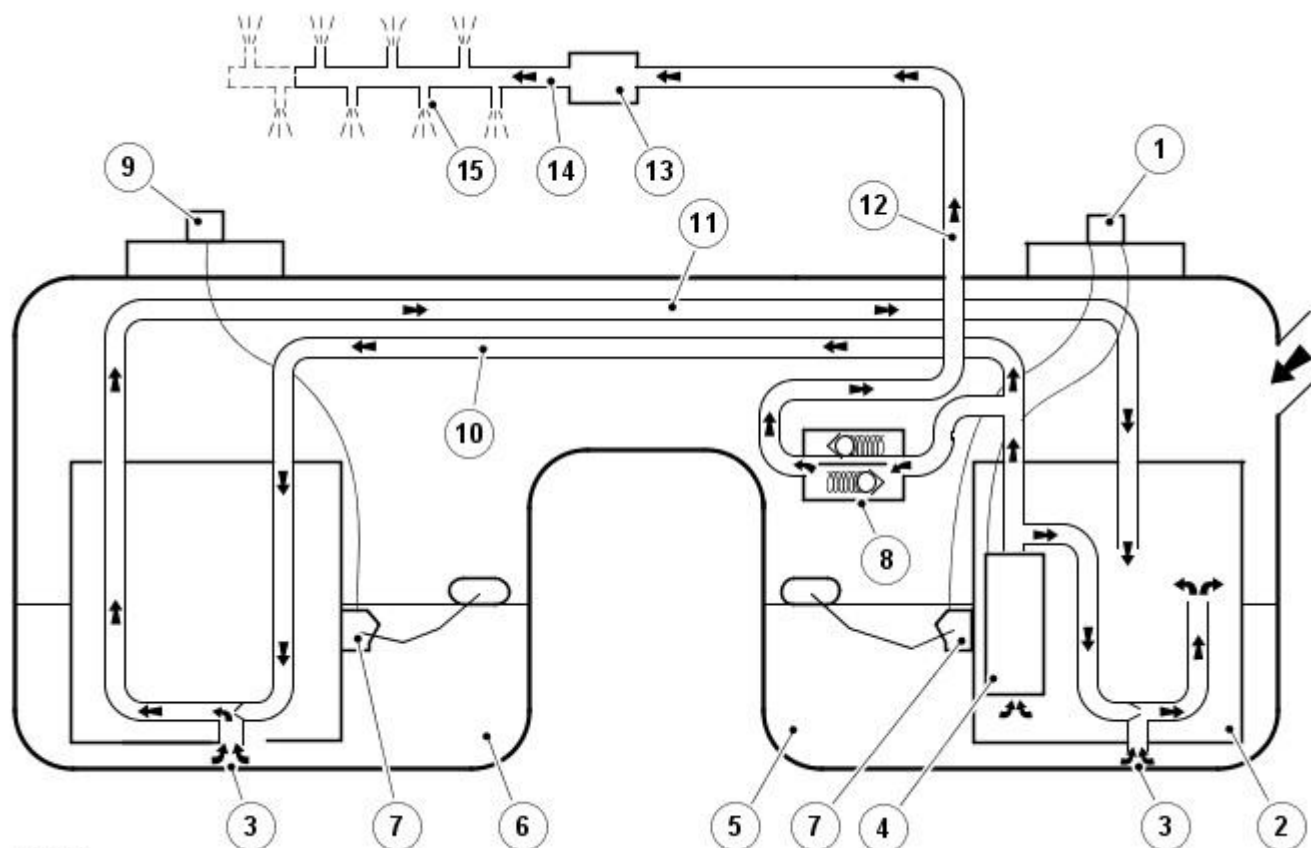
- Evaporative Emissions (303-13B, Description and Operation),
- Fuel Charging and Controls (303-04D, Description and Operation),
- Electronic Engine Controls (303-14C, Description and Operation).



# Fuel Tank and Lines - V6 3.0L Petrol - Fuel Tank and Lines - System Operation and Component Description

Description and Operation

Control Diagram



E94422

## ItemDescription

1	Fuel pump and level sensor electrical connector
2	Fuel pump module
3	Suction jet pump
4	Fuel pump
5	RH (right-hand) fuel compartment
6	LH (left-hand) fuel compartment
7	Fuel level sensor
8	Parallel pressure relief valve
9	Fuel transfer pump module
10	High-pressure cross-over circulation pipe
11	Low-pressure cross-over circulation pipe
12	Engine fuel delivery pipe
13	Fuel filter
14	Fuel rail
15	Fuel injector

## System Operation

The fuel pump is a variable-speed rotary-vane type, which operates in a fuel module located in the right hand fuel tank compartment. A fuel transfer pump is located in the left hand compartment. Both components are secured by screw on plastic closure rings. The fuel pump module has an integral top plate for the external pipe work and electrical connectors.

Fuel level is maintained equally in the fuel tank compartments by circulating the fuel through internal crossover pipes via suction jet pumps which also serve to deliver a constant supply of fuel to the transfer pump and swirl pot assembly. High pressure fuel from the fuel pump is directed through the jet pump's orifice, creating a low pressure area to be formed around the orifice. The fuel is drawn into this low pressure area and directed into the swirl pot delivery pipes. This is achieved using the cross-over pipe from the left hand module and a direct link pipe from the right hand module.

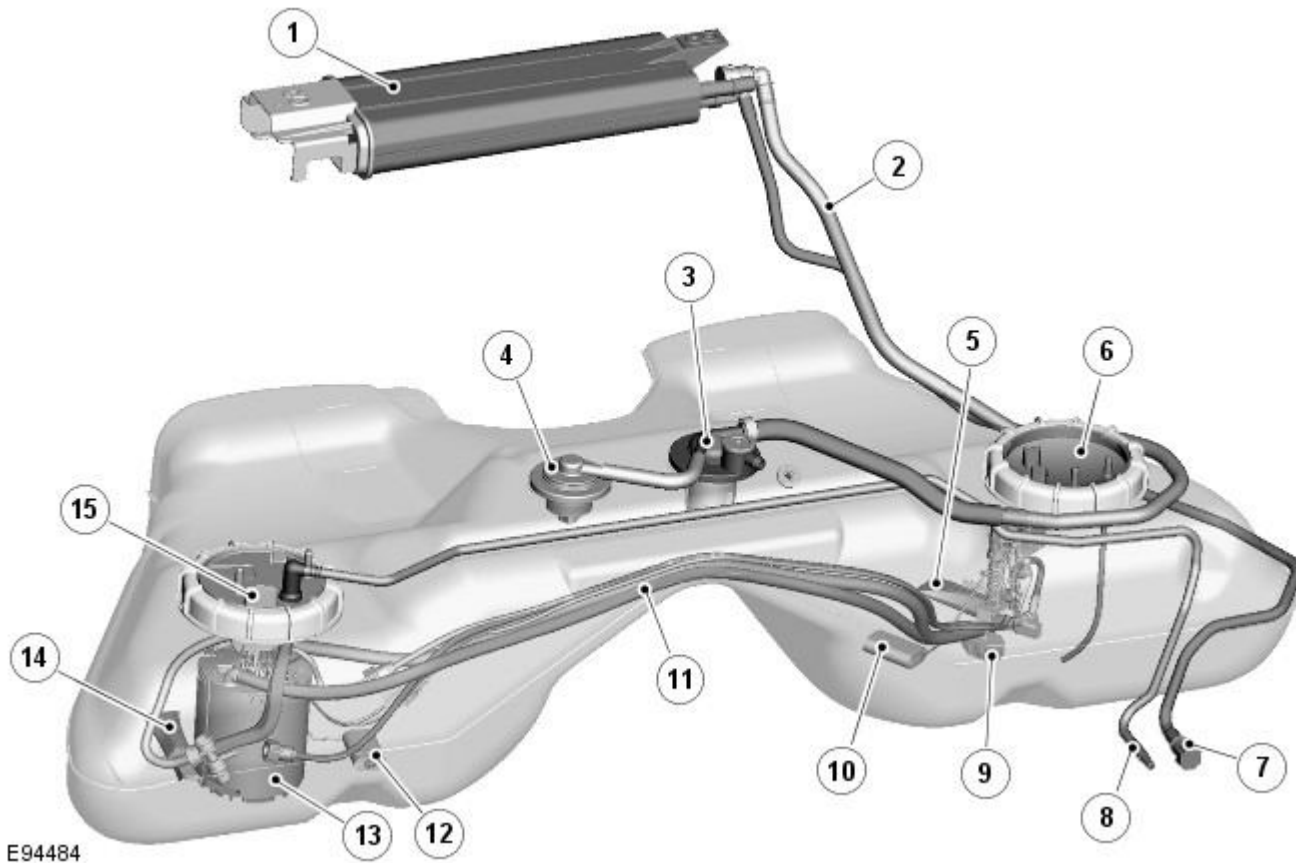
Fuel is pumped from the fuel pump to the fuel rail via the parallel pressure relief valve and fuel filter. The parallel pressure relief valve contains two spring loaded valves, which operate in opposite directions.

The pressure relief valve assists engine starting by retaining a pre-set fuel pressure in the supply pipe and fuel rail. The fuel pressure valve also limits fuel rail pressure due to temporary vapor increase in hot conditions and pressure caused by sudden load changes, for example, a fully open to closed throttle transition. In the event of the fuel delivery pipe being severed, the fuel pressure relief valve will prevent leakage from the fuel tank.

To meet **ORVR (on-board refueling vapor recovery)** requirements, the fuel tank and associated components are designed to minimize fuel vapor loss during refueling. This is achieved by preventing fuel vapor from the fuel tank venting directly to the atmosphere. Instead fuel vapor is directed into the **EVAP (evaporative emission)** canister where it is stored before being purged at intervals to the engine's intake

## Component Description

### FUEL TANK



E94484

#### ItemDescription

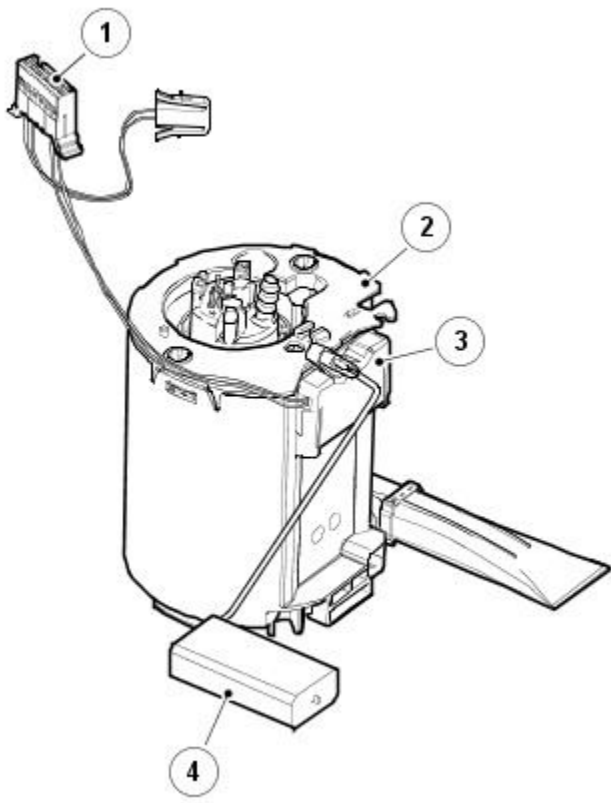
1	Charcoal canister
2	<a href="#">EVAP</a> hose
3	Vapor pressure control valve
4	Fuel vapor valve
5	<a href="#">LH</a> fine mesh filter pick up
6	Fuel transfer pump
7	Pipe - <a href="#">EVAP</a> charcoal canister to purge valve
8	Fuel supply to engine
9	Jet pump
10	<a href="#">LH</a> fuel level sensor float
11	Internal fuel transfer pipes
12	<a href="#">RH</a> fuel level sensor float
13	Fuel pump module
14	<a href="#">RH</a> fine mesh filter pick up
15	Fuel pump electrical connection

The fuel tank is a saddle type tank constructed of HDPE (high density polyethylene), a plastic blow molded material. The tank is located forward of the rear suspension and is mounted using two metal straps. The tank is a sealed unit with the only internal access being through the fuel pump module and transfer pump module flange apertures on the top of the tank.

The fuel pump module flange has a six pin external connector which provides the electrical connections for the fuel pump and level sensors. A quick release connector provides for the connection of the fuel feed pipe.

Each flange is fitted with a collar, clamp and seal which locate in the tank apertures. An arrow on each flange must be aligned between two molded lines on the tank, adjacent to the fuel pump module or transfer pump flange aperture, to obtain the correct pump orientation. A collar is located over each flange and is secured with a clamp. The flange, seal, collar and clamp arrangements meet the sealing requirements of LEV2 emissions.

### FUEL PUMP MODULE



E74571

**ItemDescription**

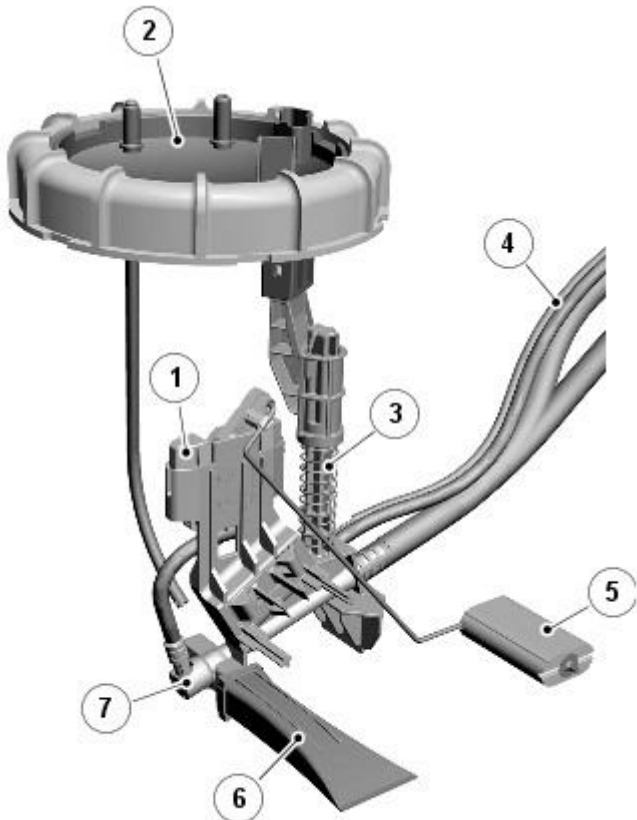
1	Electrical connector
2	Fuel pump module
3	Fuel level sensor
4	Level sensor float

The fuel pump is a variable speed rotary vane type. The pump is energized by the fuel pump relay which is located in the [RJB \(rear junction box\)](#) and the [FPDM \(fuel pump driver module\)](#) which is located under the [RH](#) floor pan above the rear suspension stabilizer bar. The relay and [FPDM](#) are controlled by the [ECM \(engine control module\)](#).

A fine mesh filter is located in the lower section of the pump module. This provides filtration to the fuel as it is drawn into the module.

The right hand fuel level sensor is mounted into the pump module housing.

**FUEL LEVEL SENSORS**



E94420

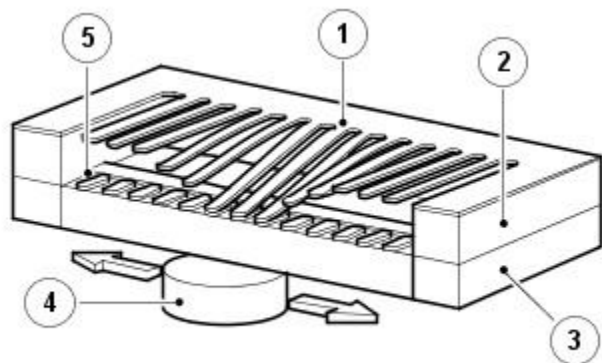
#### ItemDescription

1	Fuel level sensor
2	Transfer pump module
3	Sensor mounting bracket
4	Fuel cross-over pipes
5	Fuel level sensor float
6	Fine mesh filter
7	Jet pump

Two fuel level sensors are installed in either side of the saddle tank. One is mounted on the fuel pump module, the other is mounted on the transfer pump module in the other side of the fuel tank. The sensors are a MAPPS (magnetic passive position sensor) which provide a variable resistance to ground for the output from the fuel gage. The sensor is sealed from the fuel preventing contamination of the contacts, increasing reliability. The fuel level sensors are connected to the external electrical connector on the flange via the connector on the underside of the fuel pump module flange.

The sensor comprises a series of 51 film resistors mounted in an arc on a ceramic surface. The resistors are wired in series with individual contacts. A soft magnetic foil with 51 flexible contacts is mounted a small distance above the film resistors. A magnet, located below the ceramic surface, is attached to the sender unit float arm. As the float arm moves, the magnet follows the same arc as the film resistors. The magnet pulls the flexible contacts onto the opposite film resistor contacts forming an electrical circuit.

### MAPP Sensor Operating Principle



E44504

#### ItemDescription

1	Magnetic foil
2	Spacer
3	Ceramic surface
4	Magnet
5	Resistance film

The film resistors are arranged in a linear arc with resistance ranging from 51.2 to 992.11 Ohms. The electrical output signal is proportional to the amount of fuel in the tank and the position of the float arm. The measured resistance is processed by the instrument cluster to implement an anti-slosh function. This monitors the signal and updates the fuel gage pointer position at regular intervals, preventing constant pointer movement caused by fuel movement in the tank due to cornering or braking.

A warning lamp is incorporated in the instrument cluster and illuminates when the fuel level is low.

The fuel level sender signal is converted into a [CAN \(controller area network\)](#) message by the instrument cluster as a direct interpretation of the fuel tank contents in liters. The [ECM](#) uses the [CAN](#) message to store additional [OBD \(on-board diagnostic\)](#) 'P' Codes for misfire detection when the fuel level is below a predetermined capacity.

### JET PUMPS

The fuel system incorporates two jet pumps. The [LH](#) jet pump is located on the fuel level sensor carrier on the [LH](#) side of the fuel tank. The [RH](#) jet pump is located in the swirl pot below the fuel pump. Both jet pumps operate on a venturi effect created by the fuel at pump output pressure passing through the jet pump. This draws additional fuel from the tank through ports in the jet pump body, delivering additional fuel to the swirl pot. This function also serves to maintain an equal fuel level in the fuel tank compartments.

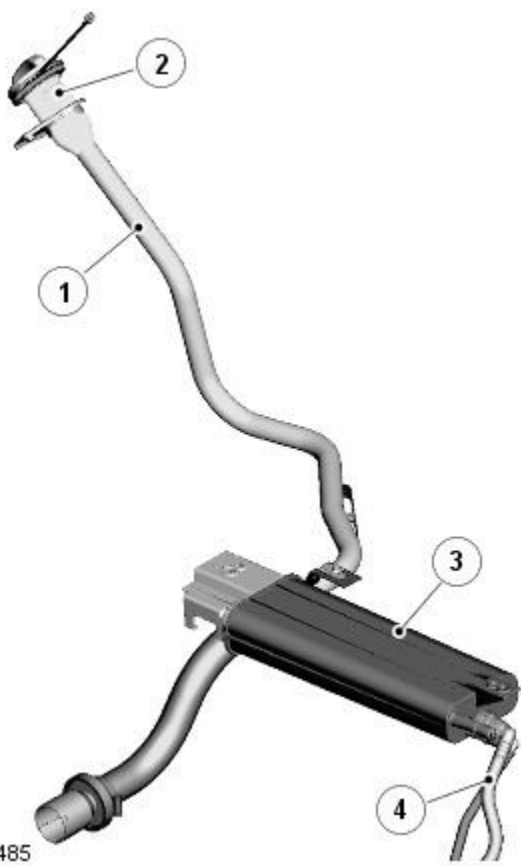
The [LH](#) jet pump collects fuel from the [LH](#) side of the tank and transfers it into the swirl pot on the [RH](#) side of the tank.

The [RH](#) jet pump collects fuel from below the swirl pot and transfers it to the upper section of the swirl pot. The action of the jet pumps ensures a constant supply of fuel to the swirl pot and fuel pump. Both jet pumps have a jet nozzle of 0.5 mm diameter.

### FUEL FILTER

The fuel filter is of a conventional construction being that of a paper element sealed within a steel canister. The fuel filter is located behind the left-hand front fender splash shield.

### FUEL FILLER PIPE ASSEMBLY



E94485

**ItemDescription**

1	Fuel filler pipe
2	Filler cap and tether
3	Charcoal canister
4	EVAP pipe work

The fuel filler head is positioned at the rear of the vehicle, above the right hand rear wheel. The filler head is covered by a molded plastic cover which is electrically locked when the vehicle is locked. The filler cap is a conventional screw in type which is secured to the vehicle with a tether.

The filler head is an aluminum fabrication which is secured to the vehicle body by a bracket. The formed aluminum filler pipe locates in a short flexible hose attached to the tank which is secured with worm drive clamps.

# Fuel Tank and Lines - V6 3.0L Petrol - Fuel Tank and Lines

Diagnosis and Testing

## Principle of Operation

For a detailed description of the fuel tank and lines, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

- [Fuel Tank and Lines](#) (310-01B Fuel Tank and Lines - V6 3.0L Petrol, Description and Operation),
- [Fuel Tank and Lines](#) (310-01B Fuel Tank and Lines - V6 3.0L Petrol, Description and Operation),
- [Fuel Tank and Lines](#) (310-01B Fuel Tank and Lines - V6 3.0L Petrol, Description and Operation),
- [Fuel Tank and Lines](#) (310-01C Fuel Tank and Lines - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Description and Operation),
- [Fuel Tank and Lines](#) (310-01C Fuel Tank and Lines - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Description and Operation),
- [Fuel Tank and Lines](#) (310-01C Fuel Tank and Lines - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Fuel leaks</li> <li>● Damaged fuel lines</li> <li>● Damaged push connect fittings</li> <li>● Fuel level</li> <li>● Fuel contamination/grade/quality</li> <li>● Damaged fuel tank filler pipe cap</li> <li>● Damaged fuel tank filler pipe</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Loose or corroded electrical connectors</li> <li>● Harnesses</li> <li>● Fuel Pump Driver Module (FPDM)</li> <li>● Rear Junction Box (RJB)</li> <li>● Fuel pump relay</li> <li>● Engine Control Module (ECM)</li> </ul>

3. 3. If an obvious cause for an observed or reported symptom is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and proceed to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	<ul style="list-style-type: none"> <li>● Engine breather system disconnected/restricted</li> <li>● Ignition system</li> <li>● Fuel system</li> <li>● Electronic engine controls</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed. Check for fuel, ignition and electronic engine control system DTCs and refer to the relevant DTC Index
Engine cranks and fires, but will not start	<ul style="list-style-type: none"> <li>● Evaporative emissions purge valve</li> <li>● Fuel pump</li> <li>● Spark plugs</li> <li>● Ignition coil failure(s)</li> </ul>	Check for purge valve, fuel and ignition system DTCs and refer to the relevant DTC Index
Difficult cold start	<ul style="list-style-type: none"> <li>● Check engine coolant level/anti-freeze content</li> <li>● Battery</li> <li>● Electronic engine controls</li> <li>● Exhaust gas recirculation (EGR) valve stuck open</li> <li>● Fuel pump</li> <li>● Evaporative emissions purge valve</li> </ul>	Check the engine coolant level and condition. REFER to: <a href="#">Specifications</a> (303-03B Engine Cooling - V6 3.0L Petrol, Specifications), <a href="#">Specifications</a> (303-03C Engine Cooling - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Specifications). Ensure the battery is in a fully charged and serviceable condition. Check for electronic engine control, EGR valve, fuel system and purge valve related DTCs and refer to the relevant DTC Index
Difficult hot start	<ul style="list-style-type: none"> <li>● Injector leak</li> <li>● Electronic engine controls</li> <li>● Evaporative emissions purge valve</li> <li>● Fuel pump</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> </ul>	Carry out injector leak tests, install new injectors as required. REFER to: <a href="#">Fuel Injectors</a> (303-04C Fuel Charging and Controls - V6 3.0L Petrol, Removal and Installation), <a href="#">Fuel Injectors</a> (303-04D Fuel Charging and Controls - V8 4.2L Petrol, Removal and Installation). Check for electronic engine control, EGR valve, fuel system, ignition system and purge valve related DTCs and refer to the relevant DTC Index
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	<ul style="list-style-type: none"> <li>● Injector leak</li> <li>● Electronic engine controls</li> <li>● Evaporative emissions purge valve</li> <li>● Fuel pump</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> </ul>	Carry out injector leak tests, install new injectors as required. REFER to: <a href="#">Fuel Injectors</a> (303-04C Fuel Charging and Controls - V6 3.0L Petrol, Removal and Installation), <a href="#">Fuel Injectors</a> (303-04D Fuel Charging and Controls - V8 4.2L Petrol, Removal and Installation). Check for electronic engine control, EGR valve, fuel system, ignition system and purge valve related DTCs and refer to the relevant DTC Index
Engine stalls soon after start	<ul style="list-style-type: none"> <li>● Breather system disconnected/restricted</li> <li>● ECM relay</li> <li>● Electronic engine controls</li> <li>● Ignition system</li> <li>● Air intake system</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed. Check for ECM relay, electronic engine control and ignition system DTCs and refer to the relevant DTC Index. Check for blockage in air cleaner element and air intake system. Check for leakage in air intake system. Check fuel lines for blockage/restriction. Clear blockage/restriction and install new fuel lines as required



Symptom	Possible Cause	Action
	<ul style="list-style-type: none"> <li>restricted</li> <li>Air leakage</li> <li>Fuel lines</li> </ul>	
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> <li>Fuel pressure, fuel pump, fuel lines</li> <li>Injector leak</li> <li>Air leakage</li> <li>Electronic engine controls</li> <li>Ignition system</li> <li>EGR valve stuck</li> <li>Transmission malfunction</li> <li>Restricted pedal travel (carpet, etc)</li> </ul>	<p>Carry out fuel pressure check. REFER to: <a href="#">Fuel System Pressure Check - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol</a> (310-00 Fuel System - General Information, General Procedures).</p> <p>Check fuel lines for blockage/restriction. Clear blockage/restriction and install new fuel lines as required. Check for fuel system DTCs and refer to the relevant DTC Index. Carry out fuel injector leak tests, install new injectors as required. REFER to: <a href="#">Fuel Injectors</a> (303-04C Fuel Charging and Controls - V6 3.0L Petrol, Removal and Installation), <a href="#">Fuel Injectors</a> (303-04D Fuel Charging and Controls - V8 4.2L Petrol, Removal and Installation).</p> <p>Check for leakage from air intake system. Check for electronic engine control, EGR valve, ignition system and transmission related DTCs and refer to the relevant DTC Index. Ensure accelerator pedal is free from restriction</p>
Engine backfires	<ul style="list-style-type: none"> <li>Fuel pump, fuel lines</li> <li>Air leakage</li> <li>Electronic engine controls</li> <li>Ignition system</li> <li>Sticking variable camshaft timing (VCT) hub</li> </ul>	<p>Check for fuel system related DTCs and refer to the relevant DTC Index. Check fuel lines for blockage/restriction. Clear blockage/restriction and install new fuel lines as required. Check for leakage from air intake system. Check for electronic engine control, ignition system and VCT related DTCs and refer to the relevant DTC Index</p>
Engine surges	<ul style="list-style-type: none"> <li>Fuel pump, fuel lines</li> <li>Electronic engine controls</li> <li>Ignition system</li> </ul>	<p>Check for fuel system related DTCs and refer to the relevant DTC Index. Check fuel lines for blockage/restriction. Clear blockage/restriction and install new fuel lines as required. Check for electronic engine control and ignition system related DTCs and refer to the relevant DTC Index</p>
Engine detonates/knocks	<ul style="list-style-type: none"> <li>Fuel pump, fuel lines, fuel quality</li> <li>Air leakage</li> <li>Electronic engine controls</li> <li>Sticking VCT hub</li> </ul>	<p>Check for fuel system related DTCs and refer to the relevant DTC Index. Check fuel lines for blockage/restriction. Clear blockage/restriction and install new fuel lines as required. Check for leakage from air intake system. Check for electronic engine control and VCT related DTCs and refer to the relevant DTC Index</p>

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If a module or component is suspect, and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P008700	Fuel Rail/System Pressure - Too Low	<ul style="list-style-type: none"> <li>Fuel rail pressure (Fuel rail pressure) sensor, sensing circuit - short to ground, open circuit</li> <li>Fuel rail pressure sensor supply circuit - high resistance</li> <li>Fuel rail pressure sensor failure</li> <li>Fuel pump failure</li> <li>Fuel line leak, restriction</li> </ul>	<p>Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Fuel rail pressure sensor circuits for short to ground, open circuit, high resistance. Check and install a new Fuel rail pressure sensor as required. Check fuel system for failure</p>
P008800	Fuel Rail/System Pressure - Too High	<ul style="list-style-type: none"> <li>Fuel rail pressure sensor supply/sensing circuits - short to each other</li> <li>Fuel rail pressure sensor sensing circuit - short to power</li> <li>Fuel rail pressure sensor ground circuit - high resistance</li> <li>Fuel rail pressure sensor failure</li> <li>Restricted fuel line</li> <li>Fuel pump short circuit to power</li> </ul>	<p>Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Fuel rail pressure sensor circuits for short to each other, power, open circuit, high resistance. Check and install a new Fuel rail pressure sensor as required. Check fuel system for failure</p>

DTC	Description	Possible Cause	Action
P018123	Fuel Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Fuel temperature sensor sensing circuit - short to ground, short to power, high resistance</li> <li>Fuel temperature sensor ground circuit - high resistance</li> <li>Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P018124	Fuel Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Fuel temperature sensor sensing circuit - short to ground, short to power, high resistance</li> <li>Fuel temperature sensor ground circuit - high resistance</li> <li>Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P018129	Fuel Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Fuel temperature sensor sensing circuit - short to ground, short to power, high resistance</li> <li>Fuel temperature sensor ground circuit - high resistance</li> <li>Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P018200	Fuel Temperature Sensor A Circuit Low	<ul style="list-style-type: none"> <li>Fuel temperature sensor sensing circuit - short to ground</li> <li>Fuel temperature sensor ground circuit - short circuit</li> <li>Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P018300	Fuel Temperature Sensor A Circuit High	<ul style="list-style-type: none"> <li>Fuel temperature sensor sensing circuit - short to power, high resistance, disconnected</li> <li>Fuel temperature sensor ground circuit - high resistance</li> <li>Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P019100	Fuel Rail Pressure Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Fuel rail pressure sensor stuck</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P019200	Fuel Rail Pressure Sensor A Circuit Low	<ul style="list-style-type: none"> <li>Fuel rail pressure sensor sensing circuit - short to ground, high resistance, disconnected</li> <li>Fuel rail pressure sensor 5V supply circuit - high resistance</li> <li>Fuel rail pressure sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuits for short to ground, power, high resistance, disconnected connector. Check and install a new Fuel rail pressure sensor as required
P019300	Fuel Rail Pressure Sensor A Circuit High	<ul style="list-style-type: none"> <li>Fuel rail pressure sensor supply/sensing circuits - short circuit to each other</li> <li>Fuel rail pressure sensor sensing circuit - short to power</li> <li>Fuel rail pressure sensor ground circuit - high resistance</li> <li>Fuel rail pressure sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuits for short to ground, power, high resistance, disconnected connector. Check and install a new Fuel rail pressure sensor as required
P023100	Fuel Pump Secondary Circuit Low	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Refer to the electrical circuit diagrams and check FPDM monitor circuit to ECM for short to ground, high resistance
P023200	Fuel Pump Secondary Circuit High	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Refer to the electrical circuit diagrams and check FPDM monitor circuit to ECM for short to power
P044100	Evaporative Emission System Incorrect Purge Flow	<ul style="list-style-type: none"> <li>Purge valve - range/performance</li> </ul>	Refer to the electrical circuit diagrams and check EVAP purge valve control circuit for short, open circuit
P044200	Evaporative Emission System Leak Detected (small leak)	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Check EVAP system for leak using appropriate smoke/leak tester
P044700	Evaporative Emission System Vent Control Circuit Open	<ul style="list-style-type: none"> <li>DMTL COV circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL COV circuit for short to ground
P044800	Evaporative Emission System Vent Control Circuit Shorted	<ul style="list-style-type: none"> <li>DMTL COV circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL COV circuit for short to power

DTC	Description	Possible Cause	Action
P045600	Evaporative Emission System Leak Detected (very small leak)	<ul style="list-style-type: none"> <li>DMTL system has detected a leak</li> </ul>	Check EVAP system for leak using appropriate smoke/leak tester
P045800	Evaporative Emission System Purge Control Valve Circuit Low	<ul style="list-style-type: none"> <li>EVAP canister purge valve control circuit - short to ground, high resistance</li> <li>EVAP canister purge valve failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EVAP canister purge valve control circuit for short to ground, high resistance. Check and install a new EVAP canister purge valve as required
P045900	Evaporative Emission System Purge Control Valve Circuit High	<ul style="list-style-type: none"> <li>EVAP canister purge valve control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EVAP canister purge valve control circuit for short to power
P046129	Fuel Level Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Fuel level sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel level sensor circuits for short, open circuit, high resistance
P04612F	Fuel Level Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Fuel level sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel level sensor circuits for short, open circuit, high resistance
P046200	Fuel Level Sensor A Circuit Low	<ul style="list-style-type: none"> <li>Fuel level sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel level sensor circuits for short, open circuit, high resistance
P046300	Fuel Level Sensor A Circuit High	<ul style="list-style-type: none"> <li>Fuel level sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel level sensor circuits for short, open circuit, high resistance
P062700	Fuel Pump A Control Circuit/Open	<ul style="list-style-type: none"> <li>Fuel pump control circuit fault (FPDM to ECM)</li> </ul>	Refer to the electrical circuit diagrams and check the FPDM to ECM circuit for short to ground, power, open circuit
P062A00	Fuel Pump A Control Circuit Range/Performance	<ul style="list-style-type: none"> <li>Invalid fuel pump duty requested by the ECM</li> </ul>	Refer to the electrical circuit diagrams and check the FPDM to ECM circuit for short to ground, power, open circuit
P240100	Evaporative Emission System Leak Detection Pump Control Circuit Low	<ul style="list-style-type: none"> <li>DMTL pump circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground
P240200	Evaporative Emission System Leak Detection Pump Control Circuit High	<ul style="list-style-type: none"> <li>DMTL pump circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL pump circuit for short to power
P240429	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	<ul style="list-style-type: none"> <li>DMTL reference leak</li> <li>DMTL pump circuit - short to ground, power, high resistance</li> <li>DMTL pipework blocked/leaking</li> </ul>	Check integrity of evaporative emissions system, i.e. blocked/leaking. Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground, power, high resistance
P24042F	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	<ul style="list-style-type: none"> <li>DMTL reference leak</li> <li>DMTL pump circuit - short to ground, power, high resistance</li> <li>DMTL pipework blocked/leaking</li> </ul>	Check integrity of evaporative emissions system, i.e. blocked/leaking. Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground, power, high resistance
P240500	Evaporative Emission System Leak Detection Pump Sense Circuit Low	<ul style="list-style-type: none"> <li>DMTL pump circuit - short to ground, power, high resistance</li> </ul>	Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground, power, high resistance
P240600	Evaporative Emission System Leak Detection Pump Sense Circuit High	<ul style="list-style-type: none"> <li>DMTL pump circuit - short to ground, power, high resistance</li> </ul>	Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground, power, high resistance
P240B00	Evaporative Emission System Leak Detection Pump Heater Circuit Low	<ul style="list-style-type: none"> <li>DMTL heater control circuit low</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL heater control circuit for short to ground, open circuit
P240C00	Evaporative Emission System Leak Detection Pump Heater Circuit High	<ul style="list-style-type: none"> <li>DMTL heater control circuit high</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL heater control circuit for short to power
P245000	Evaporative Emission Control System Switching Valve Performance/Stuck Open	<ul style="list-style-type: none"> <li>DMTL system circuit - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL system circuit for short to ground, power, high resistance. Check for stuck valve
P245100	Evaporative Emission Control System Switching Valve Stuck Closed	<ul style="list-style-type: none"> <li>DMTL system circuit - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL system circuit for short to ground, power, high resistance. Check for stuck valve

# Fuel Tank and Lines - V6 3.0L Petrol - Fuel Filter

Removal and Installation


## Removal

 **WARNING:** Refer to: [Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions](#) (100-00 General Information, Description and Operation).

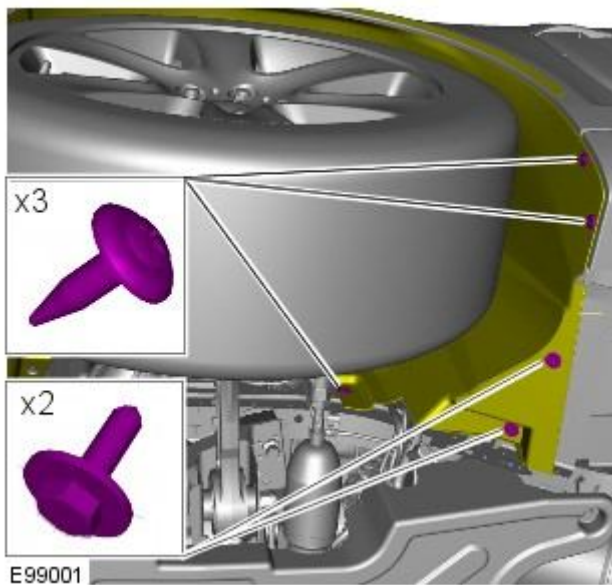
• **NOTE:** Removal steps in this procedure may contain installation details.


1. De-pressurize the fuel system.

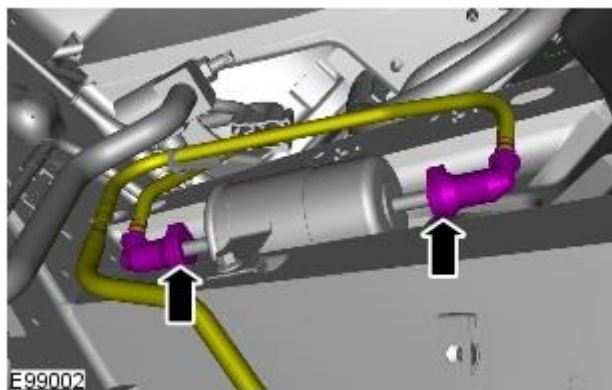
Refer to: [Fuel System Pressure Release - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol](#) (310-00 Fuel System - General Information, General Procedures).

2.  **WARNING:** Make sure to support the vehicle with axle stands.  
Raise and support the vehicle.

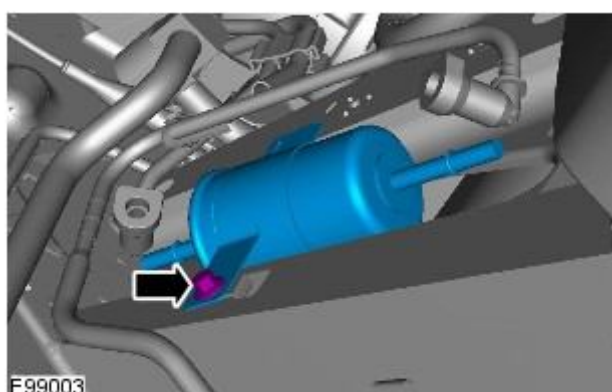
3.



4.  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.



5.



6. **6.** NOTE: Note the fitted position.



E99004

## Installation

1. To install, reverse the removal procedure.


# Fuel Tank and Lines - V6 3.0L Petrol - Fuel Level Sender LH

Removal and Installation

## Removal

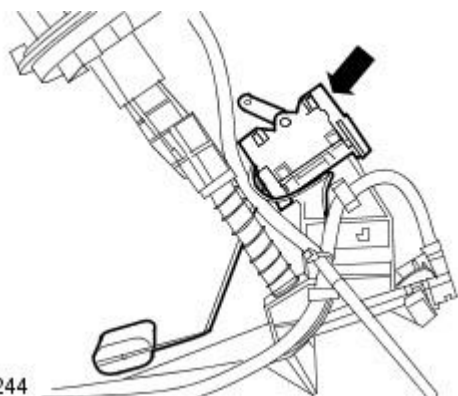
### • WARNINGS:

 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.


1. Remove the fuel transfer unit.  
For additional information, refer to: [Fuel Transfer Unit](#) (310-01B Fuel Tank and Lines - V6 3.0L Petrol, Removal and Installation).
2. Remove the fuel level sender and harness.
  - Remove and discard the fuel level sender harness tie straps.





E 63244

## Installation

### 1. WARNINGS:

 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

To install, reverse the removal procedure.




# Fuel Tank and Lines - V6 3.0L Petrol - Fuel Level Sender RH

Removal and Installation

## Removal

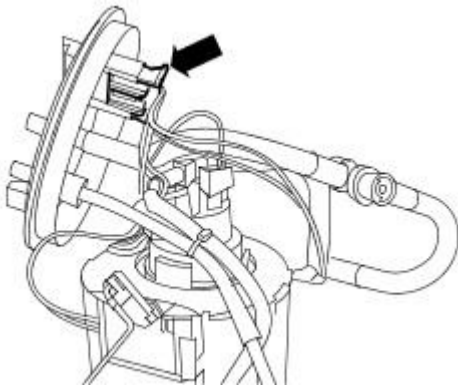
### • WARNINGS:

 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

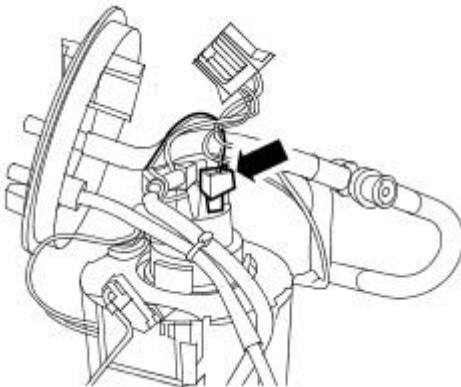
 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

1. Remove the fuel pump module.  
For additional information, refer to: [Fuel Pump Module](#) (310-01B Fuel Tank and Lines - V6 3.0L Petrol, Removal and Installation).
2. Disconnect the fuel pump module electrical connector.



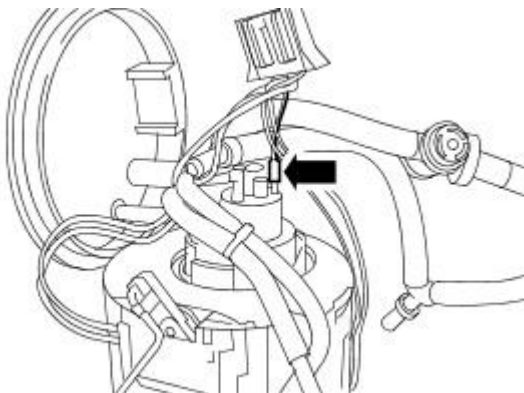
E63239

3. Disconnect the fuel level sender electrical connector.



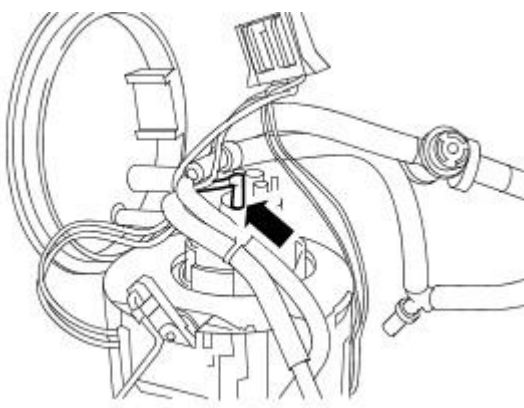
E63240

4. Disconnect the fuel level sender electrical connector.



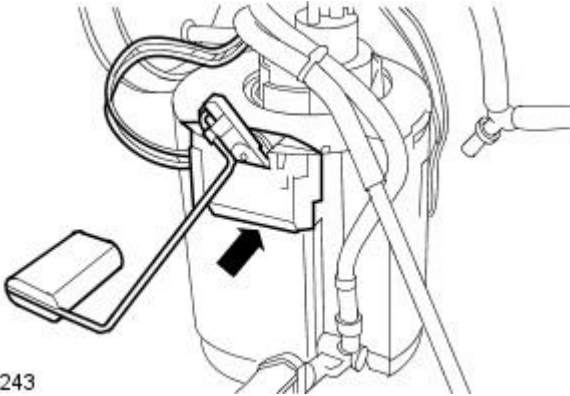
E63241

5. Disconnect the fuel level sender electrical connector.



E 63242

6. Remove the fuel level sender and harness.



E 63243

## Installation

### 1. WARNINGS:



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

To install, reverse the removal procedure.

# Fuel Tank and Lines - V6 3.0L Petrol - Fuel Pump Module

Removal and Installation

## Special Tool(s)

Remover/Installer, Fuel Pump Module/Fuel Transfer Unit Locking Ring










310-146



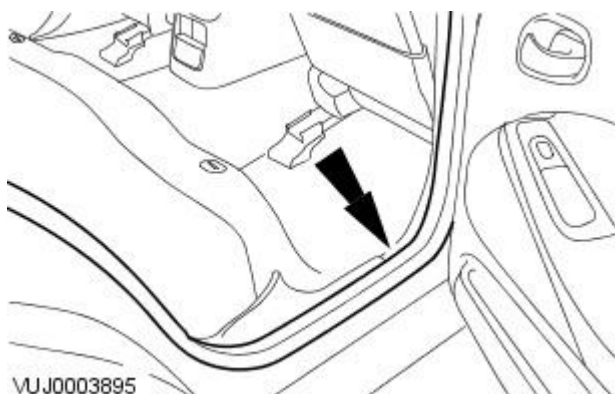
E60768

## Removal

### • WARNINGS:

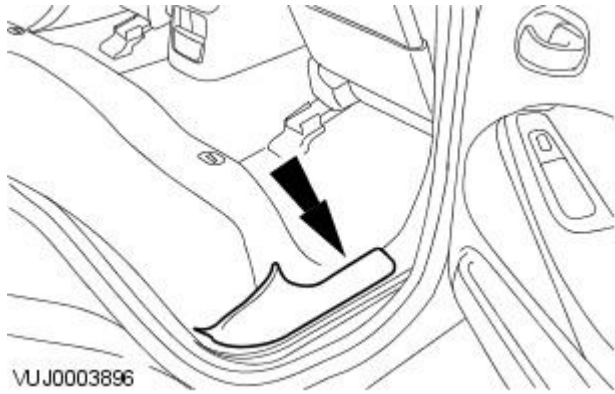
-  Place the vehicle in a quarantined area and arrange "No Smoking/Petrol Fumes" signs about the vehicle.
-  Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.
-  Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.
-  The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be relieved before attempting any repairs. Failure to follow these instructions may result in personal injury.
-  After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.
-  This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.
-  If taken internally, do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.
-  If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.
-  Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

1. Raise and support the vehicle.
2. **NOTE: All vehicles.**  
Open the fuel tank filler pipe flap.
3. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
4. Detach the fuel tank filler pipe cap.
5. Release the pressure in the fuel system.  
For additional information, refer to: [Fuel System Pressure Release - V8 4.2L Petrol/V8 S/C 4.2L Petrol/V6 3.0L Petrol](#) (310-00 Fuel System - General Information, General Procedures).
6. Drain the fuel system.  
For additional information, refer to: [Fuel Tank Draining](#) (310-00 Fuel System - General Information, General Procedures).
7. Detach and reposition the door opening weatherstrip.



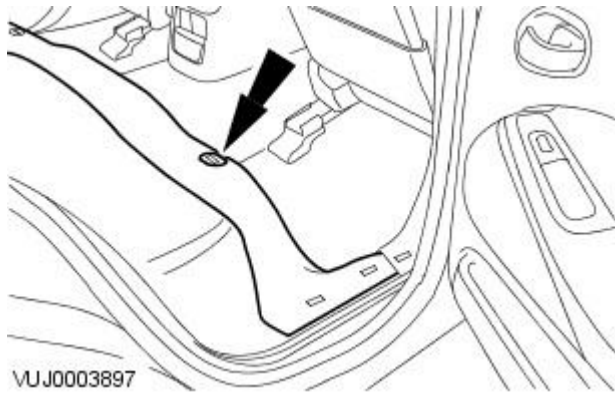
VUJ0003895

8. Remove the scuff plate trim panel.



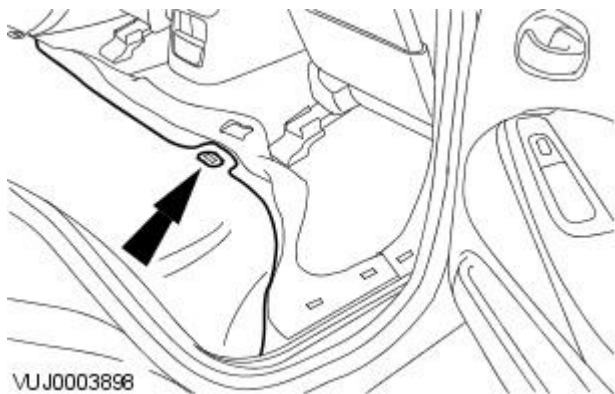
VUJ0003896

9. Detach and reposition the floor covering.



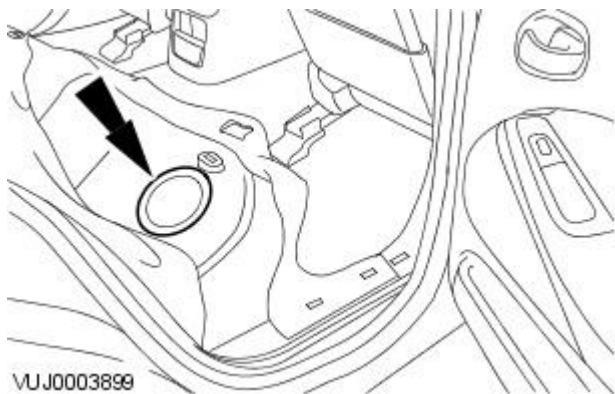
VUJ0003897

10. Detach and reposition the rear seat cushion insulation.



VUJ0003898

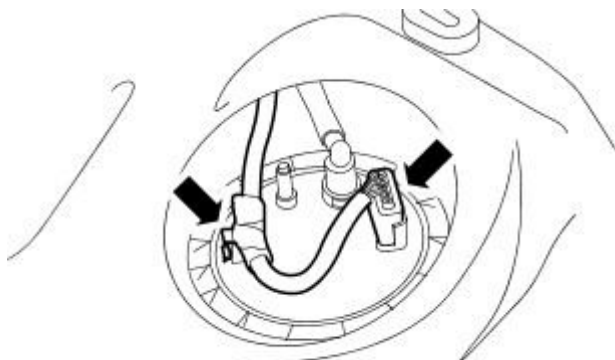
11. Remove the floor aperture cover.



VUJ0003899

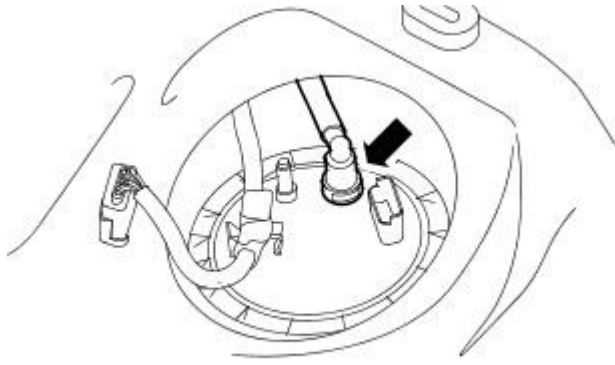
12. Disconnect the fuel pump module electrical connector.

- Detach the fuel pump module wiring harness from the retaining bracket.



E63231

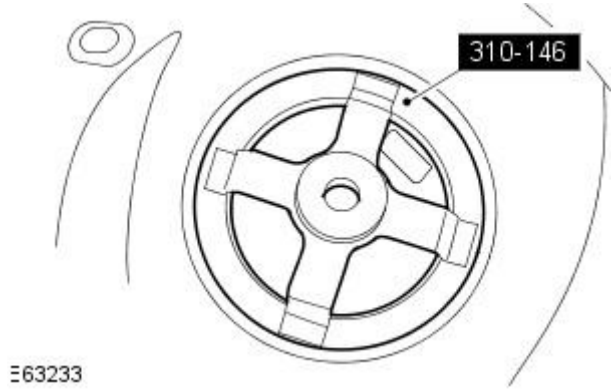
13. Disconnect the fuel pump module quick release coupling.



E63232

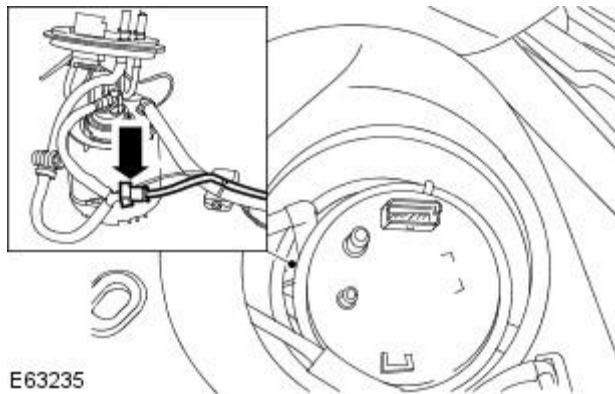
14. Using the special tool, remove the fuel pump module locking ring.

- Remove and discard the O-ring seal.



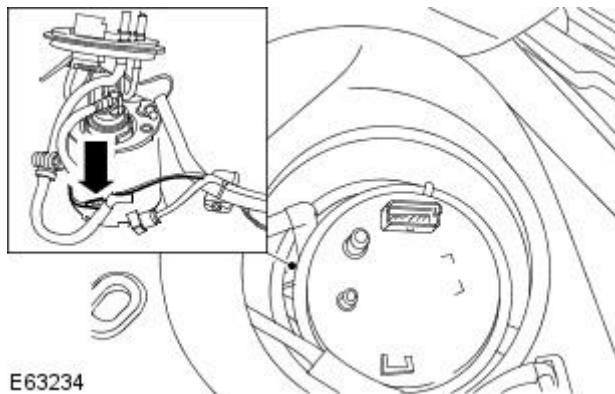
E63233

15. Disconnect the fuel transfer module transfer feed tube.



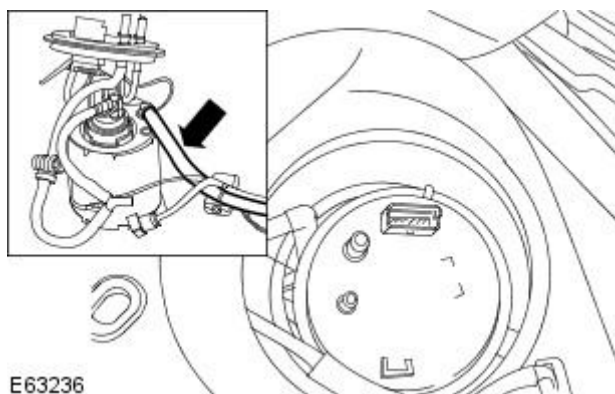
E63235

16. Disconnect the left-hand fuel sender gauge electrical connector.

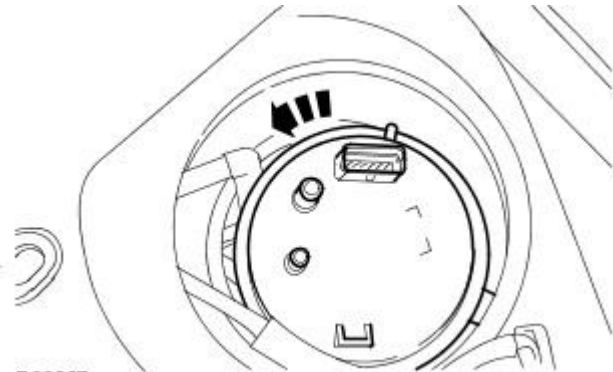


E63234

17. Disconnect the fuel transfer module transfer return tube.



E63236



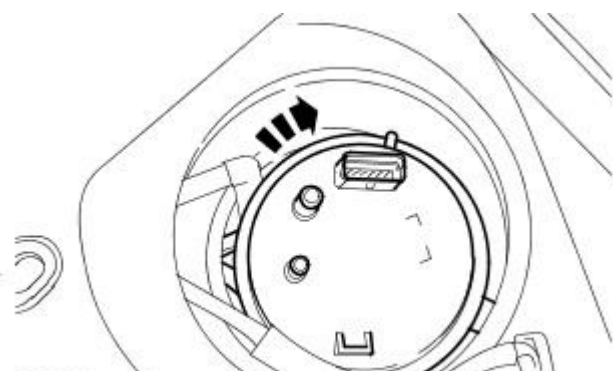
E63237

18.  CAUTION: Make sure no damage occurs to the fuel level float.

Remove the fuel pump module.


- Press down and rotate the base of the fuel pump module counter-clockwise.

### Installation



E63238

1. CAUTIONS:

 On vehicles with supercharger make sure the arrow on the fuel pump module and the 'SC' marker on the fuel tank are aligned.

 On vehicles without supercharger make sure the arrow on the fuel transfer module and the 'NA' marker on the fuel tank are aligned.

 Make sure no damage occurs to the fuel level float.

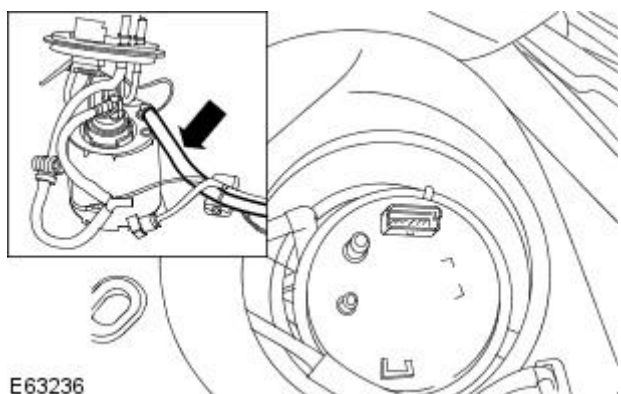
• NOTE: All vehicles.

Install the fuel pump module.

- Press down and rotate the base of the fuel pump module clockwise.

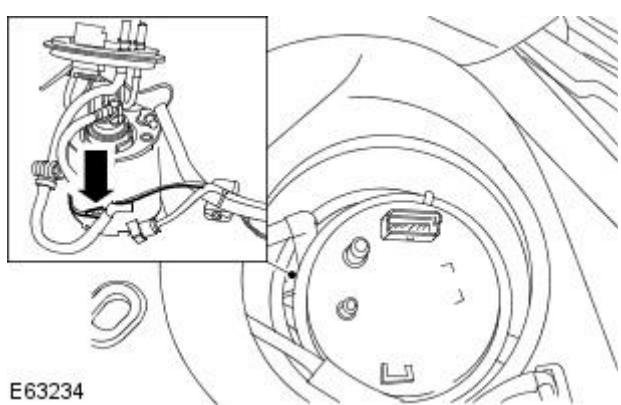
2. Connect the transfer module transfer return tube.

- Make sure the coupling has latched onto the fuel pump module by pulling the tube after the connection has been made.



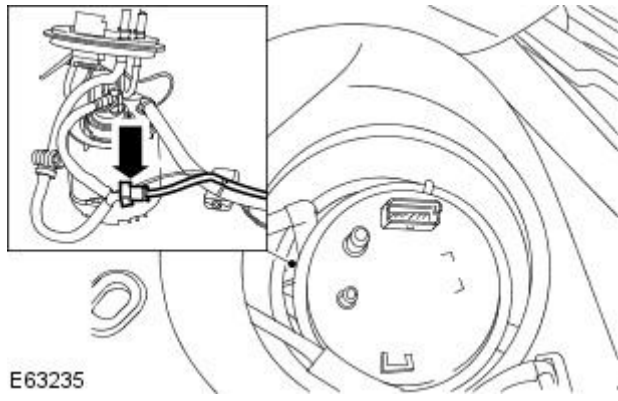
E63236

3. Connect the left-hand fuel sender gauge electrical connector.



E63234

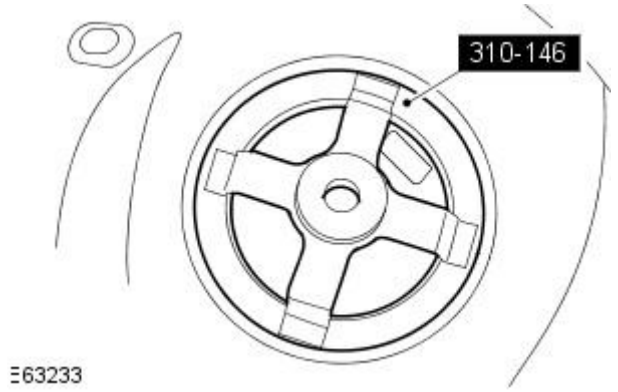




E63235

4. Connect the fuel transfer module transfer feed tube.

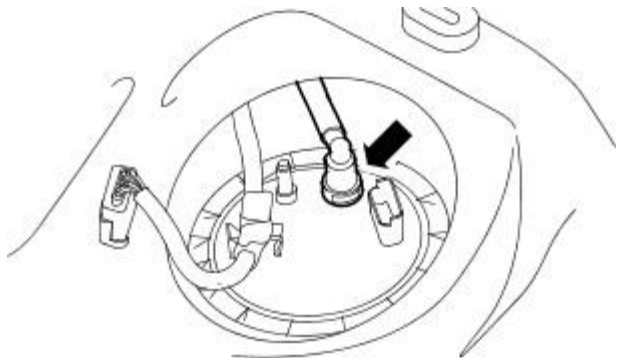
- Make sure the quick release coupling has latched onto the fuel pump module fuel tube by pulling the tube after the connection has been made.



E63233

5. Using the special tool, install the fuel pump module locking ring.

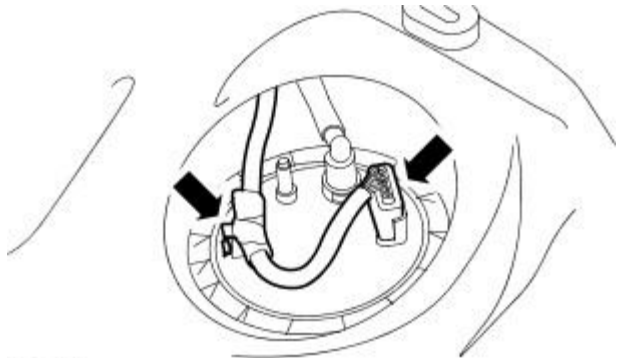
- Install a new O-ring seal.
- Tighten to 60 Nm.



E63232

6. Connect the fuel pump module quick release coupling.

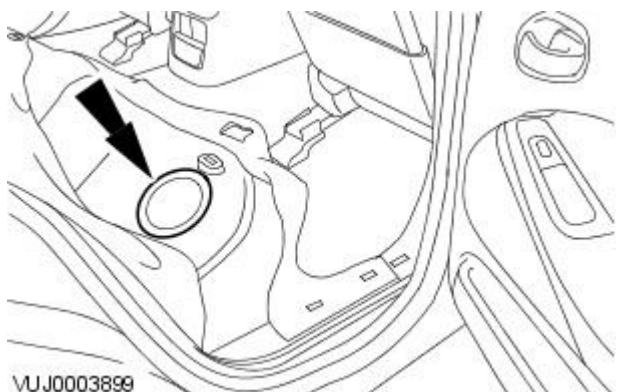
- Make sure the quick release coupling has latched onto the fuel pump module fuel pipe by pulling the pipe after the connection has been made.



E63231

7. Connect the fuel pump module electrical connector.

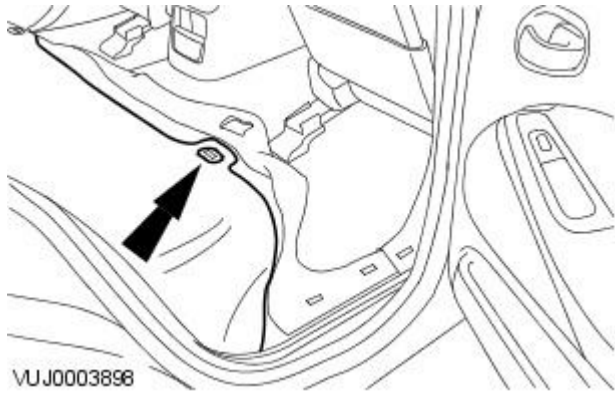
- Attach the fuel pump module wiring harness to the retaining bracket.



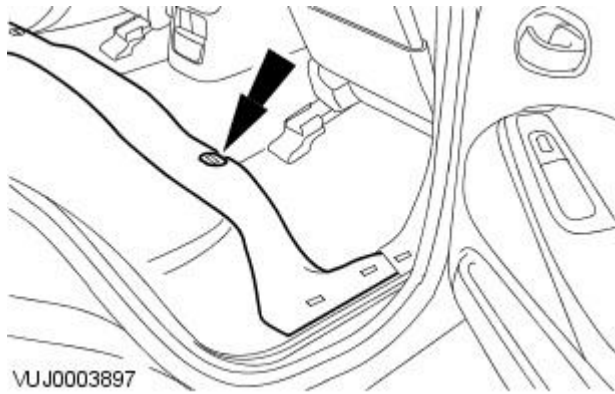
VUJ0003899

8. Install the floor aperture cover.

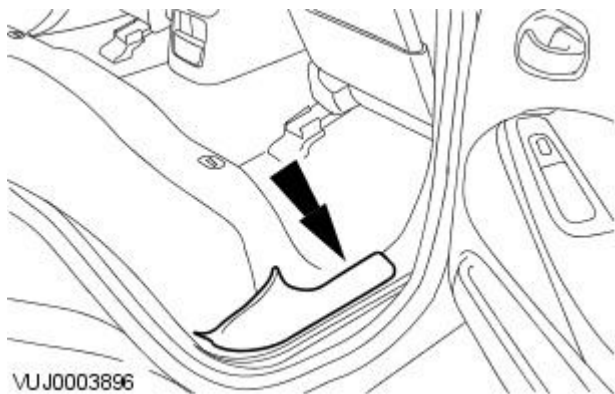
9. Attach the rear seat cushion insulation.



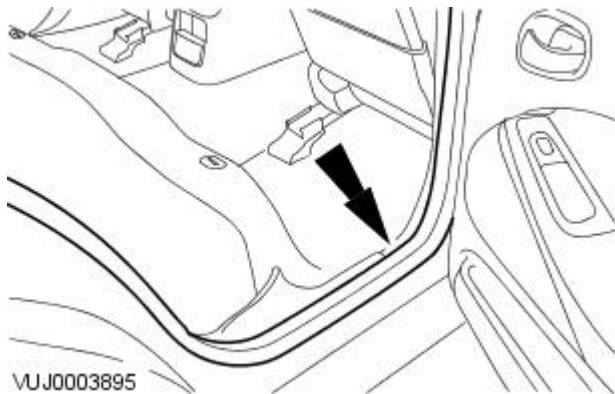
10. Attach the floor covering.



11. Install the scuff plate trim panel.



12. Attach the door opening weatherstrip.



13. Attach the fuel tank filler pipe cap.

14. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

15. Close the fuel tank filler pipe flap.

# Fuel Tank and Lines - V6 3.0L Petrol - Fuel Tank


Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

All vehicles

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Fuel Tank Draining](#) (310-00 Fuel System - General Information, General Procedures).

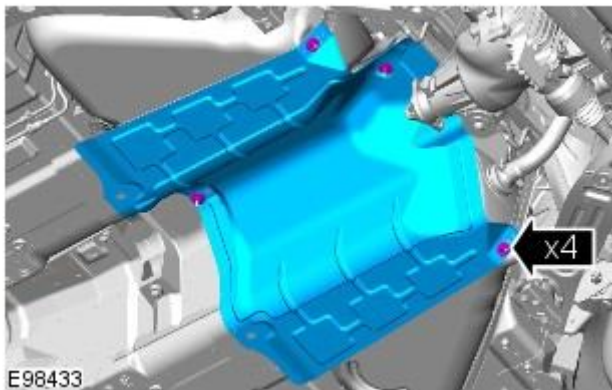
3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.


Raise and support the vehicle.

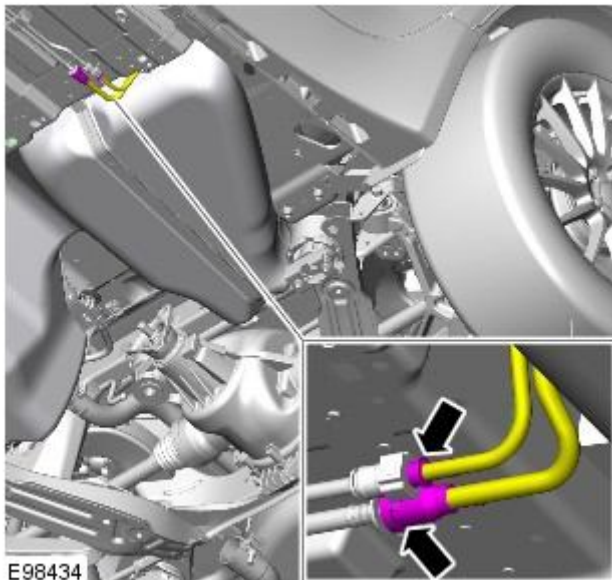
4. Refer to: [Driveshaft](#) (205-01 Driveshaft, Removal and Installation).

5.

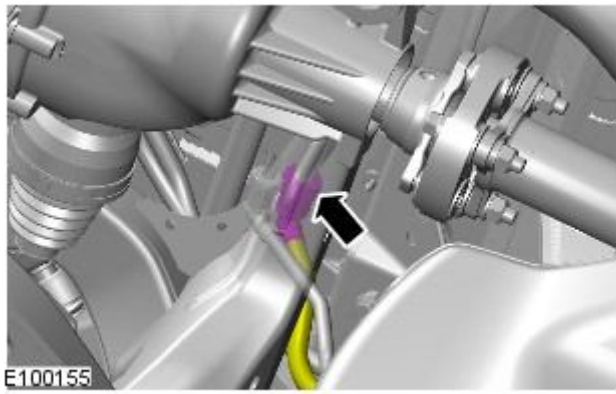
- Torque: 5 Nm



6.  **WARNING:** The spilling of fuel is unavoidable during this operation. Make sure that all necessary precautions are taken to prevent fire and explosion.

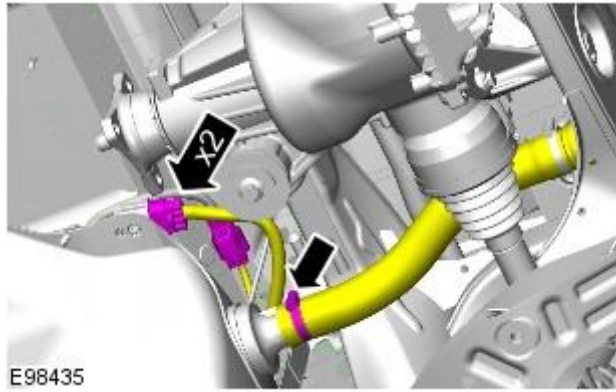


Vehicles with petrol engine



7.

All vehicles



8.

- Torque: 3 Nm



9.  **WARNING:** Secure the component to the transmission jack.

 **CAUTION:** Use suitable packing material to prevent damage to the component.

- Torque: 35 Nm

## Installation


1. To install, reverse the removal procedure.

# Fuel Tank and Lines - V6 3.0L Petrol - Fuel Tank Filler Pipe

Removal and Installation

## Removal


### • WARNINGS:

 Before any work is carried out on the vehicle the fuel tank must have less than a 1/4 of a tank of fuel. This will prevent excessive fuel loss.

 Place the vehicle in a well ventilated, quarantined area and arrange 'No Smoking/Petrol Fumes' signs about the vehicle.

 Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.

 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be relieved before attempting any repairs. Failure to follow these instructions may result in personal injury.

 After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.

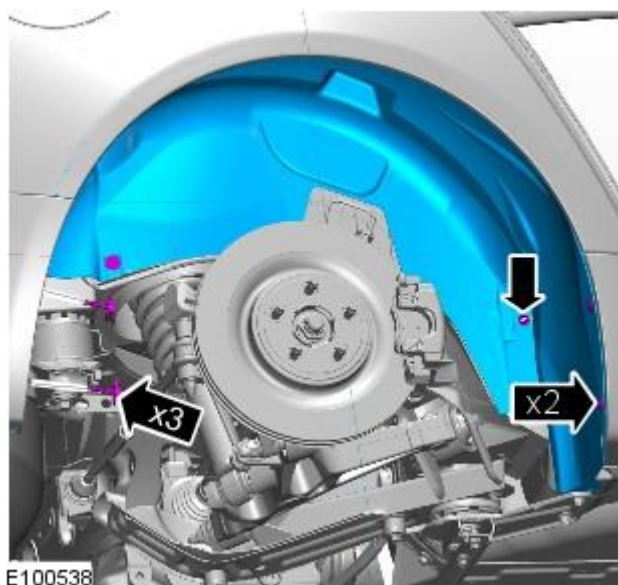
 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

 If taken internally, do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.

 If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.

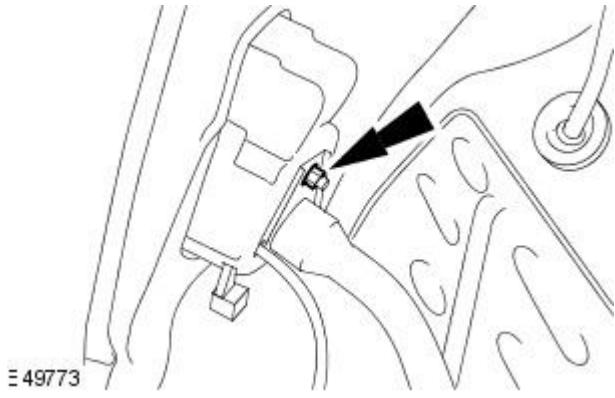
 Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

1. Raise and support the vehicle.
2. Remove the fuel tank filler pipe cap.
3. Remove the right-hand rear wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
4. Remove the right-hand rear fender splash shield.

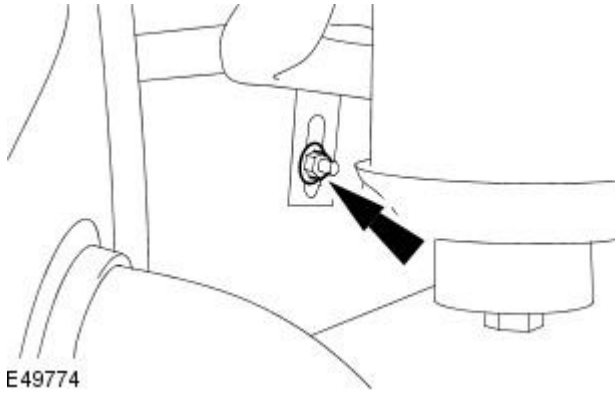




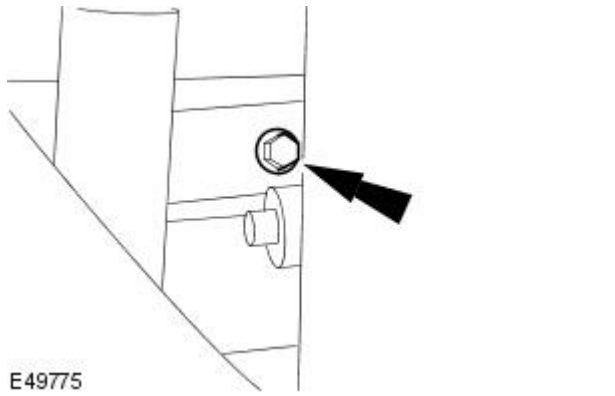
5. Remove the fuel tank filler pipe retaining nut.



6. Remove the fuel tank filler pipe retaining nut.



7. Remove the fuel tank filler pipe retaining bolt.



8. Detach the fuel tank filler pipe.



9. Remove the fuel tank filler pipe.

### Installation

1. To install, reverse the removal procedure.



# Fuel Tank and Lines - V6 3.0L Petrol - Fuel Transfer Unit

Removal and Installation

## Special Tool(s)

Remover/Installer, Fuel Pump Module/Fuel Transfer Unit Locking Ring










310-146



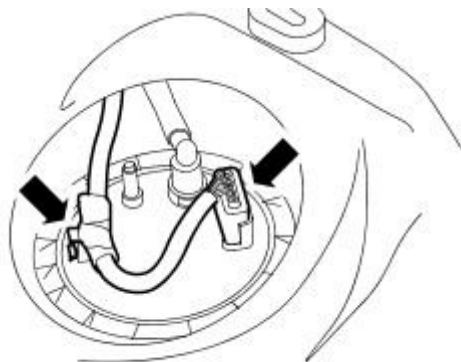
E60768

## Removal

### • WARNINGS:

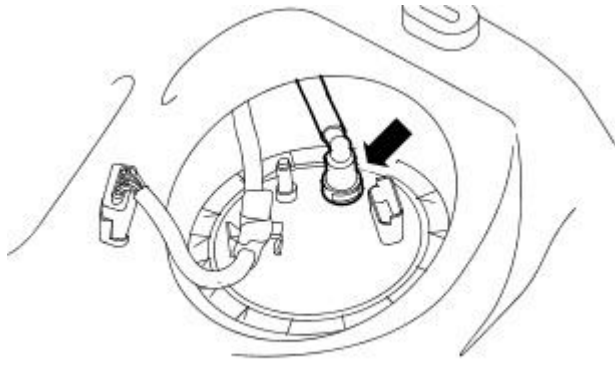
-  Place the vehicle in a quarantined area and arrange "No Smoking/Petrol Fumes" signs about the vehicle.
-  Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.
-  Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.
-  The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be relieved before attempting any repairs. Failure to follow these instructions may result in personal injury.
-  After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.
-  This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.
-  If taken internally, do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.
-  If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.
-  Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Drain the fuel system.  
For additional information, refer to: [Fuel Tank Draining](#) (310-00 Fuel System - General Information, General Procedures).
3. Disconnect the fuel pump module electrical connector.
  - Detach the fuel pump module wiring harness from the retaining bracket.



E63231

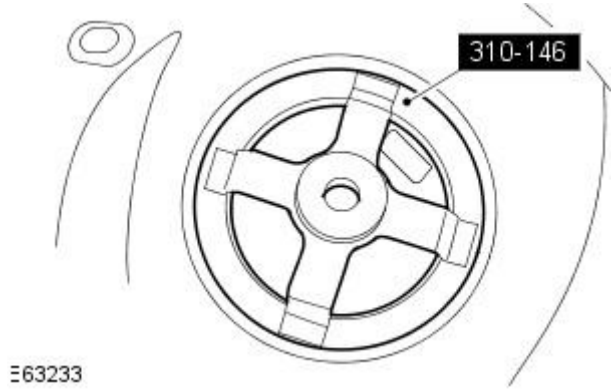
4. Disconnect the fuel pump module quick release coupling.



E63232

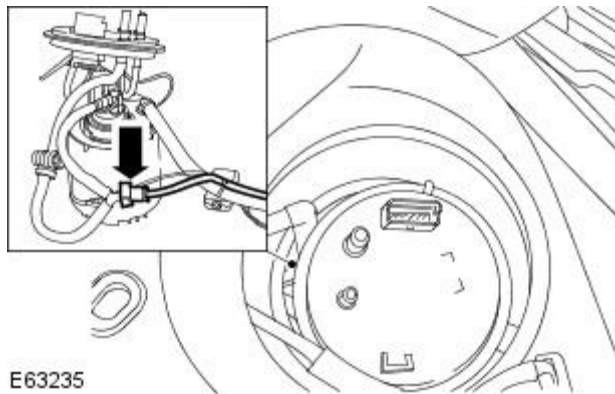
5. Using the special tool, remove the fuel pump module locking ring.

- Remove and discard the O-ring seal.



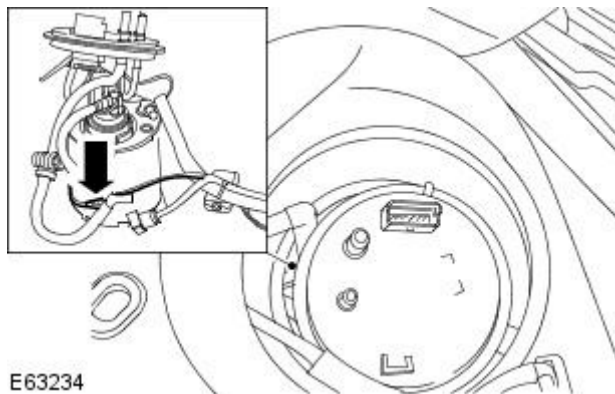
E63233

6. Disconnect the fuel transfer module transfer feed tube.



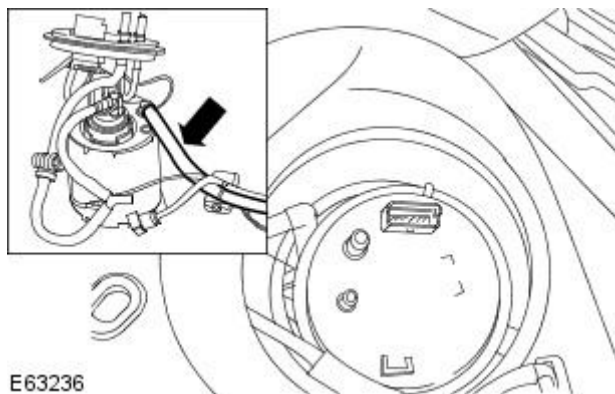
E63235

7. Disconnect the left-hand fuel sender gauge electrical connector.



E63234

8. Disconnect the fuel transfer module transfer return tube.

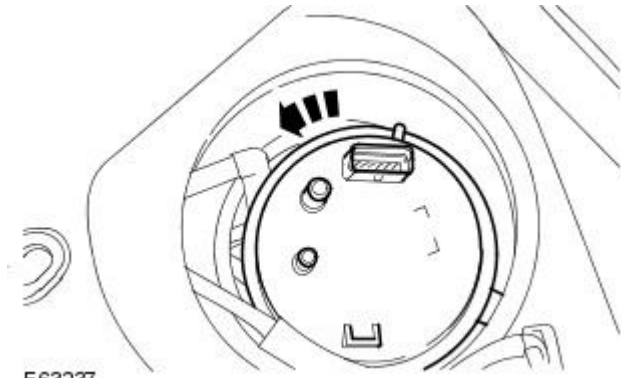


E63236

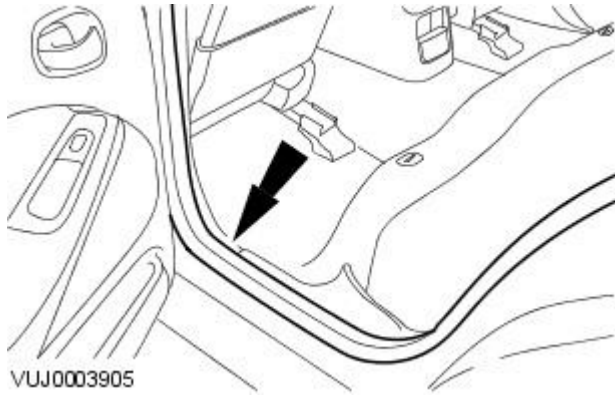
9.  CAUTION: Make sure no damage occurs to the fuel level float.

Release the fuel pump module.

- Press down and rotate the base of the fuel pump module counter-clockwise.

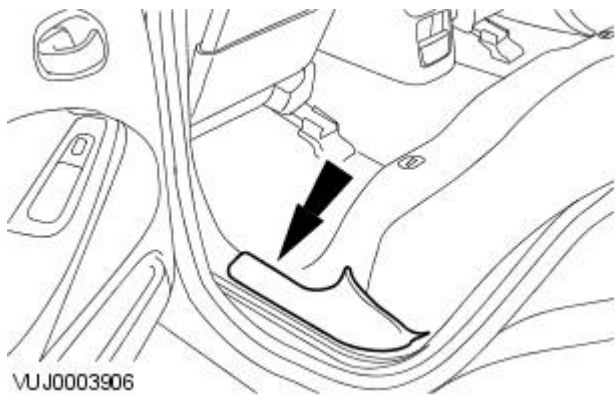


E63237



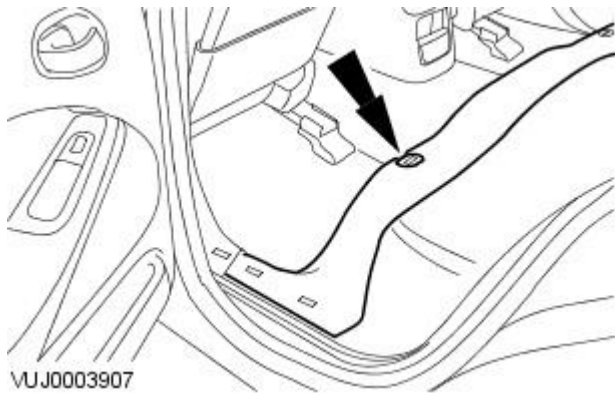
VUJ0003905

10. Detach and reposition the door opening weatherstrip.



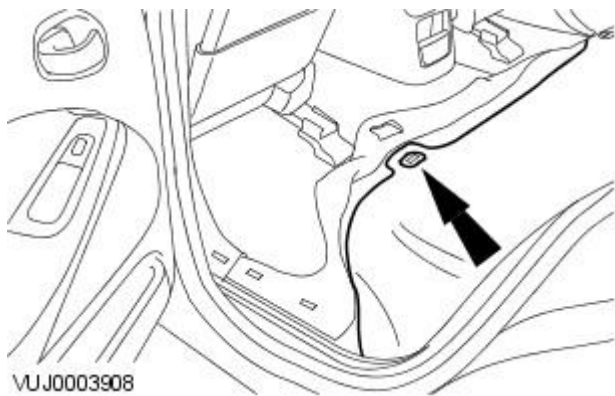
VUJ0003906

11. Remove the scuff plate trim panel.



VUJ0003907

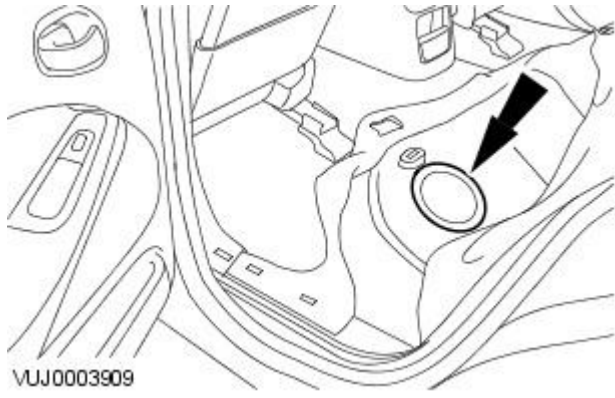
12. Detach and reposition the floor covering.



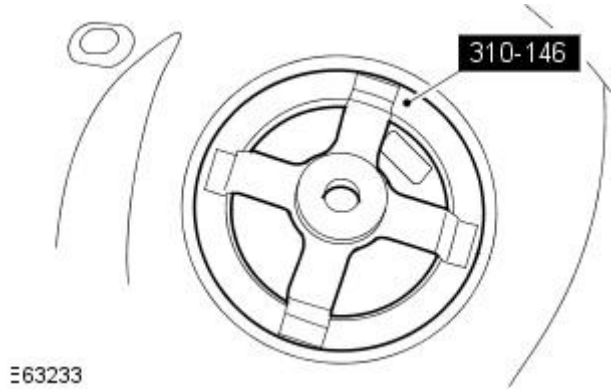
VUJ0003908

13. Detach and reposition the rear seat cushion insulation.

14. Remove the floor aperture cover.



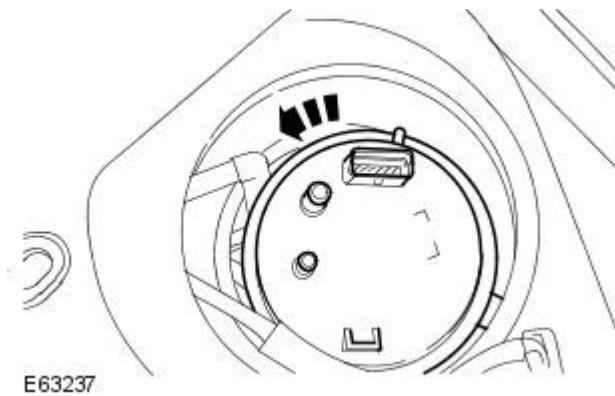
15. Using the special tool, remove the fuel transfer unit locking ring.



16.  CAUTION: Make sure no damage occurs to the fuel level float.

Remove the fuel transfer unit.

- Press down and rotate the base of the fuel transfer unit counter-clockwise.
- Remove and discard the O-ring seal.

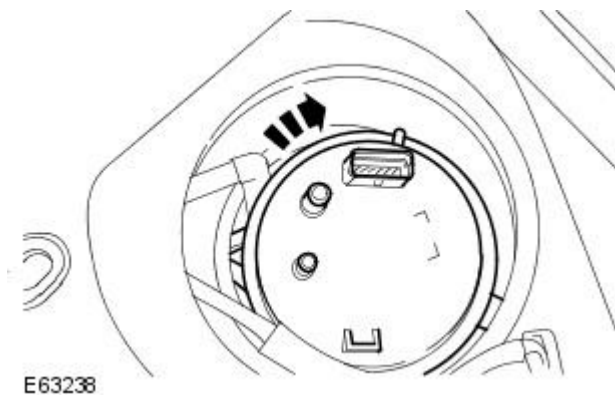


## Installation

1.  CAUTION: Make sure no damage occurs to the fuel level float.

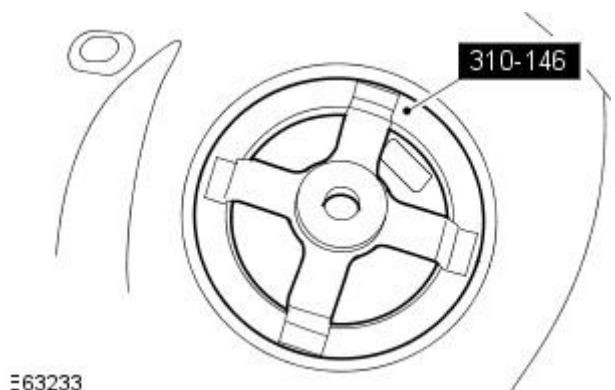
Install the fuel transfer unit.

- Press down and rotate the base of the fuel transfer unit clockwise.
- Install a new O-ring seal.

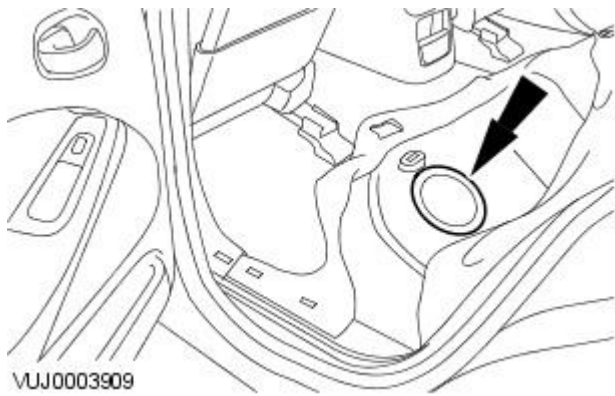


2. Using the special tool, install the fuel transfer unit locking ring.

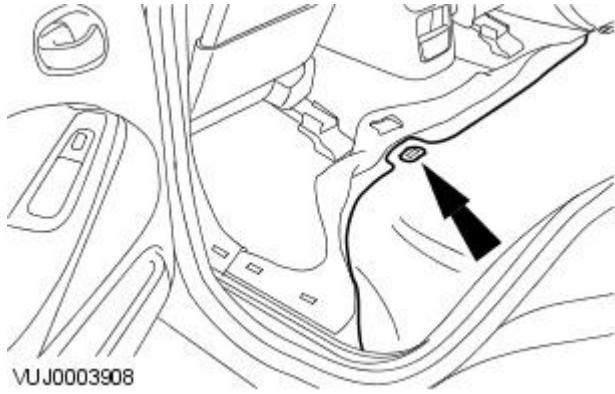
- Tighten to 60 Nm.



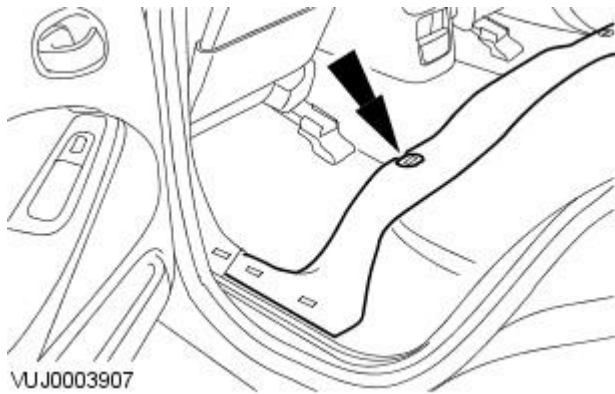
3. Install the floor aperture cover.



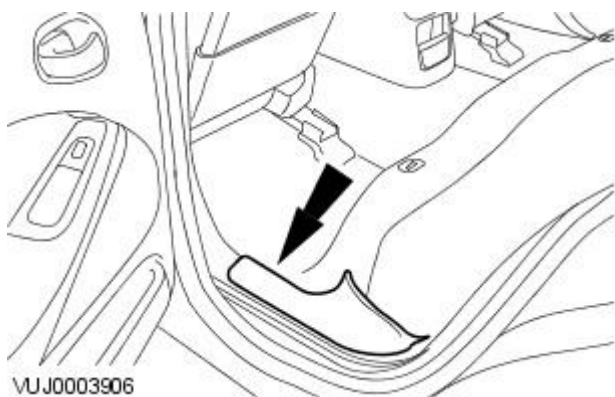
4. Attach the rear seat cushion insulation.



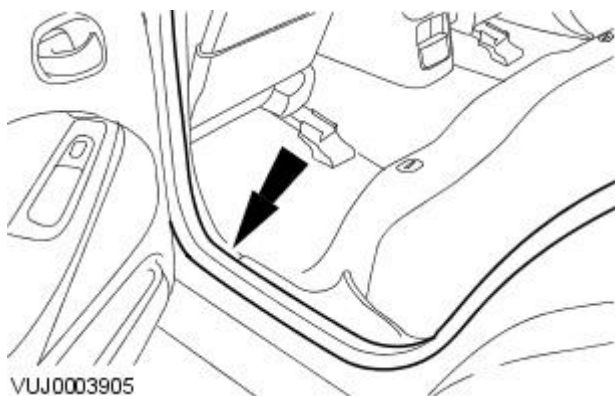
5. Attach the floor covering.



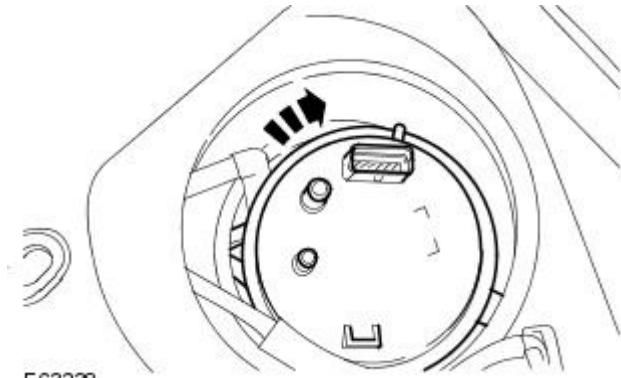
6. Install the scuff plate trim panel.



7. Attach the door opening weatherstrip.








E63238

**8. CAUTIONS:**

 On vehicles with supercharger make sure the arrow on the fuel pump module and the 'SC' marker on the fuel tank are aligned.

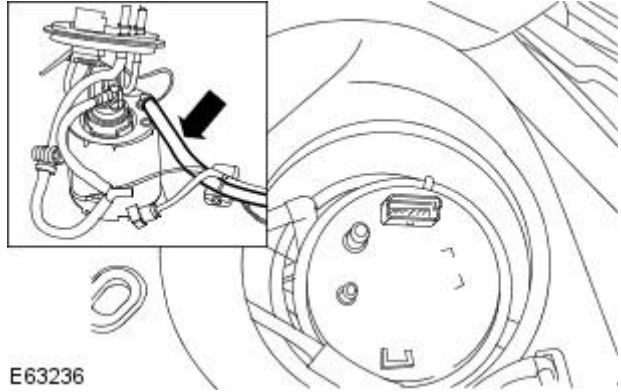
 On vehicles without supercharger make sure the arrow on the fuel transfer module and the 'NA' marker on the fuel tank are aligned.

Secure the fuel pump module.

- Press down and rotate the base of the fuel pump module clockwise.

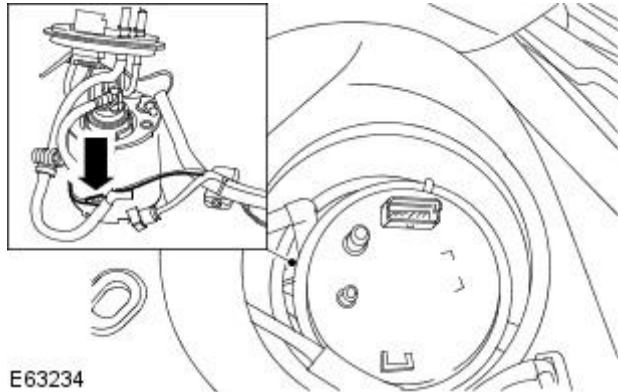
**9. Connect the fuel transfer unit transfer return tube.**

- Make sure the coupling has latched onto the fuel pump module by pulling the tube after the connection has been made.



E63236

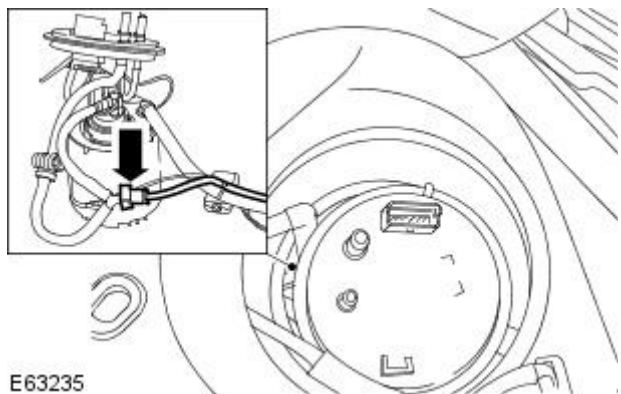
**10. Connect the left-hand fuel sender gauge electrical connector.**



E63234

**11. Connect the fuel transfer unit transfer feed tube.**

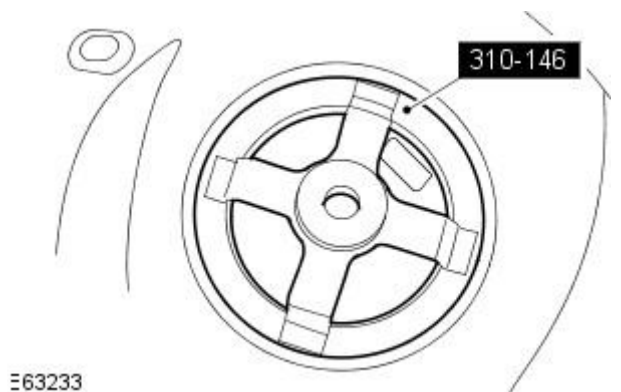
- Make sure the quick release coupling has latched onto the fuel pump module fuel tube by pulling the tube after the connection has been made.



E63235

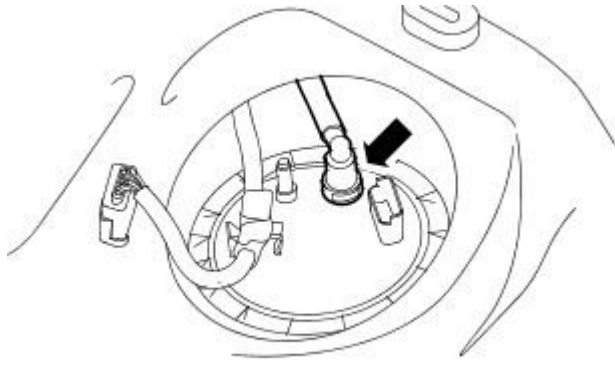
**12. Using the special tool, install the fuel pump module locking ring.**

- Install a new O-ring seal.
- Tighten to 60 Nm.



E63233

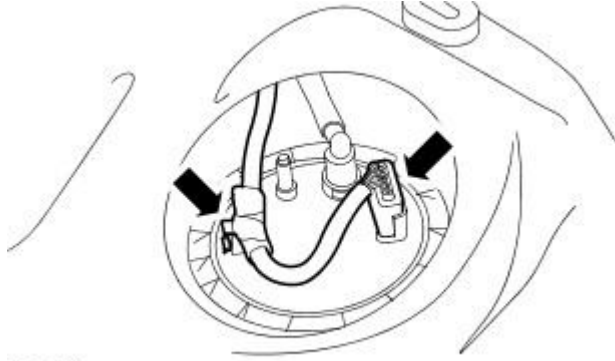




E63232

13. Connect the fuel pump module quick release coupling.

- Make sure the quick release coupling has latched onto the fuel pump module fuel pipe by pulling the pipe after the connection has been made.



E63231

14. Connect the fuel pump module electrical connector.

- Attach the fuel pump module wiring harness to the retaining bracket.

15. Connect the battery ground cable.

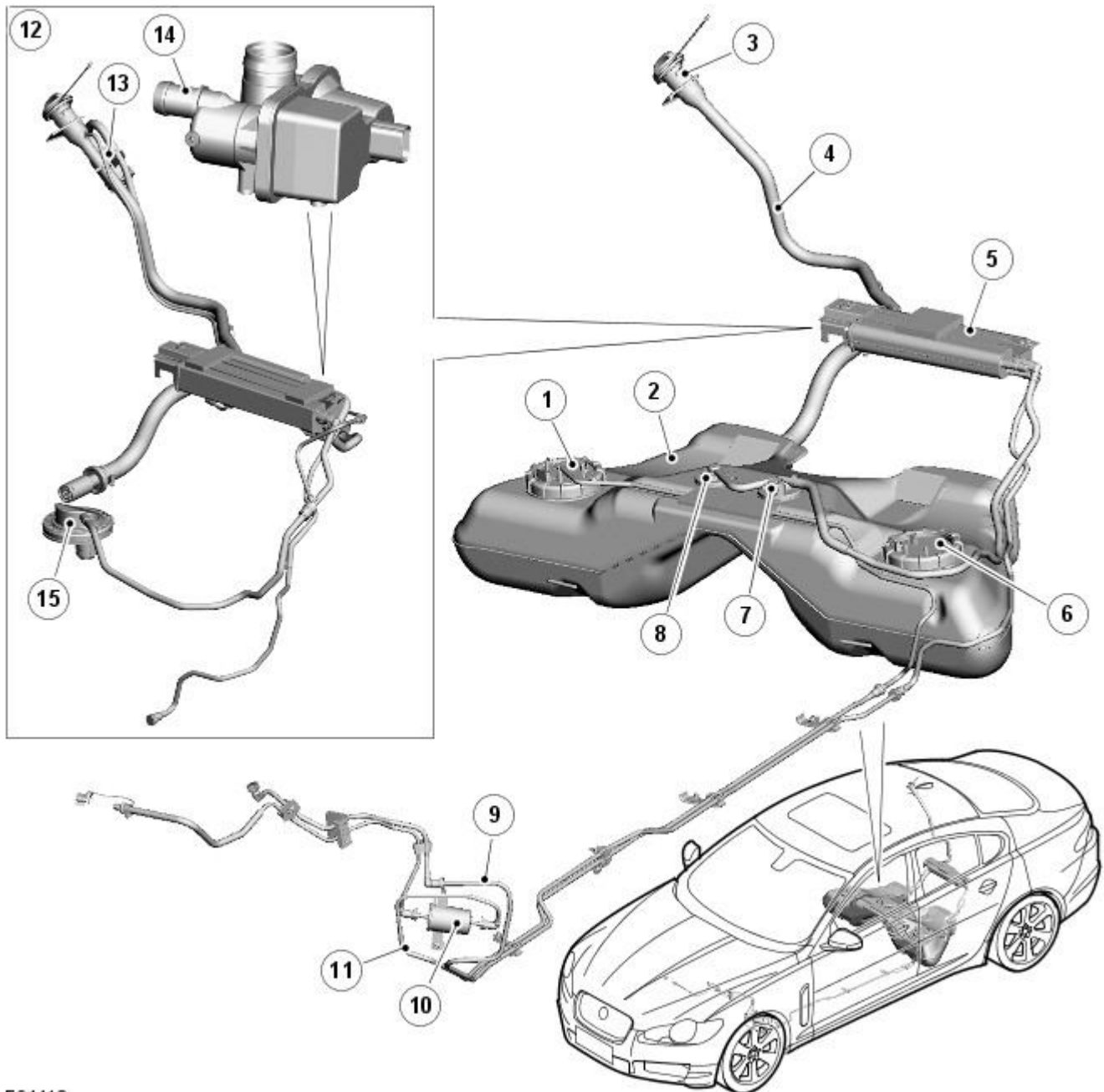
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

**Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 -**

<b>Variety</b>	<b>Fuel Pressure at Idle</b>	<b>Fuel Pressure at Wide Open Throttle</b>	
Vehicles with Denso engine management:	-	-	
V8 Naturally aspirated	3 bar (43.5 lb/in <sup>2</sup> ) (300 kPa)	3.8 bar (55.1 lb/in <sup>2</sup> ) (380 kPa)	
V6 Naturally aspirated	3.3 bar (47.9 lb/in <sup>2</sup> ) (330 kPa)	3.8 bar (55.1 lb/in <sup>2</sup> ) (380 kPa)	
V8 Supercharged	3 bar (43.5 lb/in <sup>2</sup> ) (300 kPa)	5 bar (72.5 lb/in <sup>2</sup> ) (500 kPa)	
<b>Description</b>		<b>Nm</b>	<b>lb-ft</b>
Fuel tank support strap retaining bolts		35	26
Fuel pump module locking ring		60	44
Fuel transfer pump locking ring		60	44

# Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Fuel Tank and Lines - Component Location

Description and Operation



E94418

## ItemDescription

1	Fuel pump module assembly
2	Fuel tank
3	Filler cap and lanyard
4	Fuel filler pipe
5	Charcoal canister assembly
6	Fuel transfer pump
7	Vapor pressure control valve
8	Fuel vapor valve
9	Pipe - EVAP charcoal canister to purge valve
10	Fuel filter
11	Pipe - Fuel pump to engine (feed)
12	NAS vehicles only
13	Fuel tank leakage monitoring filter (NAS only)

14	Fuel tank leakage monitoring pump (NAS only)
----	--

15	Fuel vapor pressure control valve (NAS only)
----	--

# Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Fuel Tank and Lines - Overview

Description and Operation

## OVERVIEW

The fuel system uses an electronic returnless system. The system comprises a pump module mounted in the fuel tank to deliver fuel at variable flow and pressure to the fuel rails which in turn supply fuel to the fuel injectors. Fuel pump operation is regulated by a [FPDM \(fuel pump driver module\)](#) which is controlled by the [ECM \(engine control module\)](#). The [FPDM](#) regulates the flow and pressure supplied by controlling the operation of the fuel pump using a [PWM \(pulse width modulation\)](#) output.

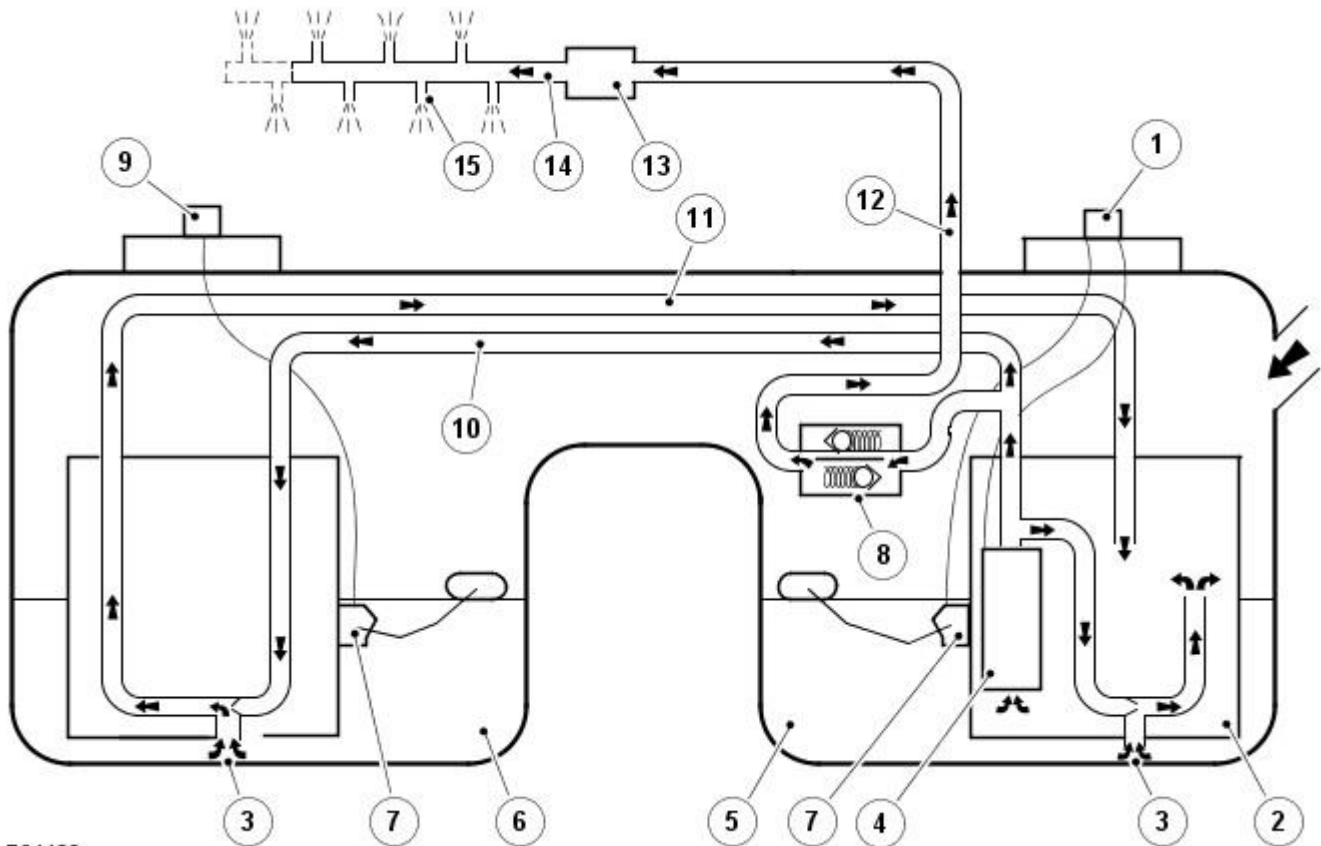
Two fuel level sensors are installed in either side of the saddle tank. The sensors are a MAPPS (magnetic passive position sensor) which provide a variable resistance to ground for the output from the fuel gauge.

The fuel system also incorporates an [EVAP \(evaporative emission\)](#) system which is part of the on-board refueling and vapor recovery feature. The function and operation of the system is designed to meet [EVAP](#) requirements to minimize fuel vapor losses.

# Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Fuel Tank and Lines - System Operation and Component Description

Description and Operation

Control Diagram



E94422

## ItemDescription

1	Fuel pump and level sensor electrical connector
2	Fuel pump module
3	Suction jet pump
4	Fuel pump
5	Right hand fuel compartment
6	Left hand fuel compartment
7	Fuel level sensor
8	Parallel pressure relief valve
9	Fuel transfer pump module
10	High-pressure cross-over circulation pipe
11	Low-pressure cross-over circulation pipe
12	Engine fuel delivery pipe
13	Fuel filter
14	Fuel rail
15	Fuel injector

## System Operation

### System Operation

The fuel pump is a variable-speed rotary-vane type, which operates in a fuel module located in the right hand fuel tank compartment. A fuel transfer pump is located in the left hand compartment. Both components are secured by screw on plastic closure rings. The fuel pump module has an integral top plate for the external pipe work and electrical connectors.

Fuel level is maintained equally in the fuel tank compartments by circulating the fuel through internal crossover pipes via suction jet pumps which also serve to deliver a constant supply of fuel to the transfer pump and swirl pot assembly. High pressure fuel from the fuel pump is directed through the jet pump's orifice, creating a low pressure area to be formed around the orifice. The fuel is drawn into this low pressure area and directed into the swirl pot delivery pipes. This is achieved using the cross-over pipe from the left hand module and a direct link pipe from the right hand module.



Fuel is pumped from the fuel pump to the fuel rail via the parallel pressure relief valve and fuel filter. The parallel pressure relief valve contains two spring loaded valves, which operate in opposite directions.

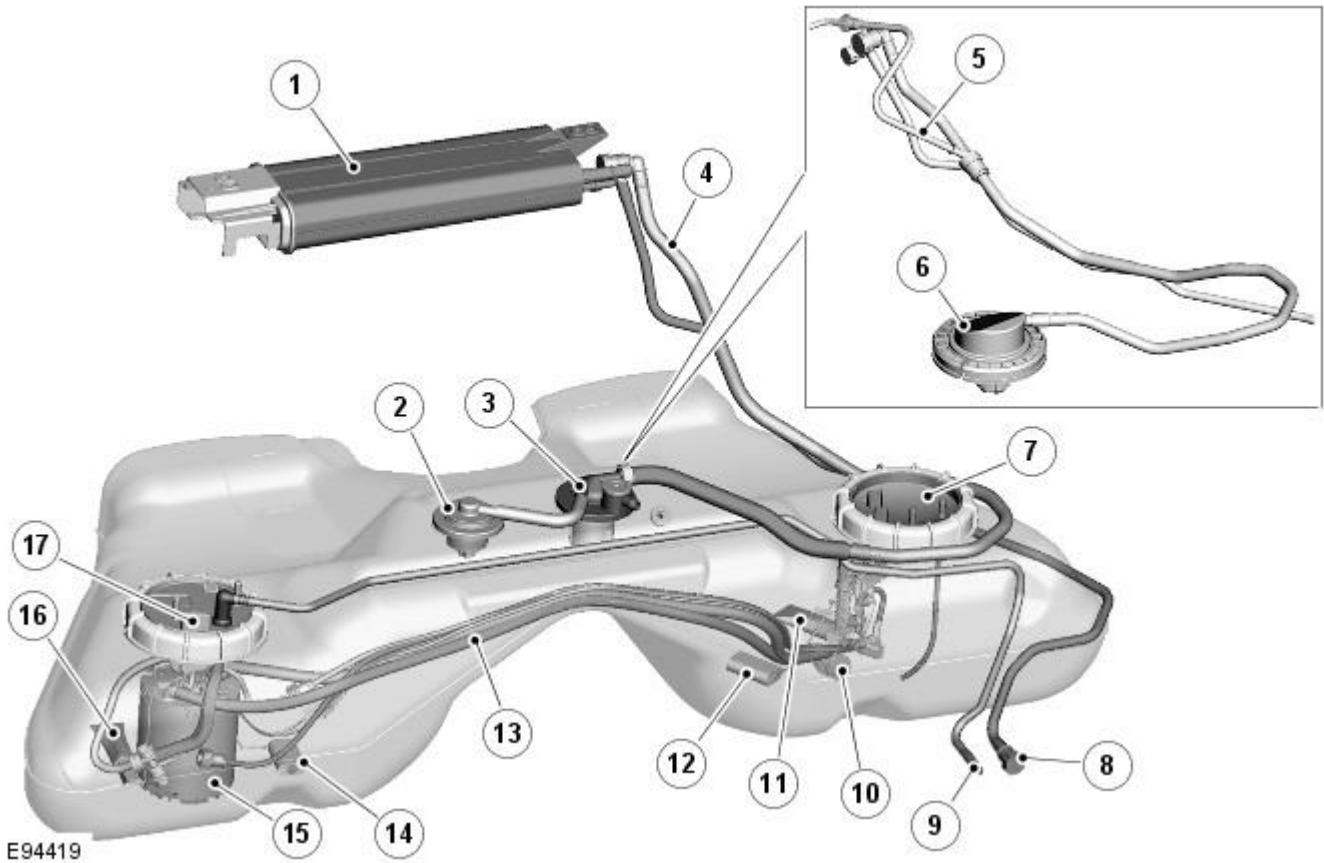
The function of the valve is to

- Assist engine starting by retaining a pre-set fuel pressure in the supply pipe and fuel rail
- Limit fuel rail pressure due to temporary vapor increase in hot conditions
- Limit fuel rail pressure caused by sudden load changes, for example, a fully open to closed throttle transition
- Prevent leakage from the tank in the event that the fuel delivery pipe is severed

To meet ORVR (on-board refueling vapor recovery) requirements, the fuel tank and associated components are designed to minimize fuel vapor loss during refueling. This is achieved by preventing fuel vapor from the fuel tank venting directly to the atmosphere. Instead fuel vapor is directed into the EVAP (evaporative emission) canister where it is stored before being purged at intervals to the engine's intake manifold.

### Component Description

#### FUEL TANK



E94419

#### ItemDescription

1	Charcoal canister
2	Fuel vapor valve
3	Vapor pressure control valve
4	EVAP hose
5	Fuel filler pipe breather hose (NAS only)
6	Fuel vapor pressure control valve (NAS only)
7	Fuel transfer pump
8	Pipe - EVAP charcoal canister to purge valve
9	Fuel supply to engine
10	Jet pump
11	LH fine mesh filter pick up
12	LH fuel level sensor float
13	Internal fuel transfer pipes
14	RH fuel level sensor float
15	Fuel pump module
16	RH fine mesh filter pick up
17	Fuel pump electrical connection

The fuel tank is a saddle type tank constructed of HDPE (high density polyethylene), a plastic blow molded material. The tank is located forward of the rear suspension and is mounted using two metal straps. The tank is a sealed unit with the

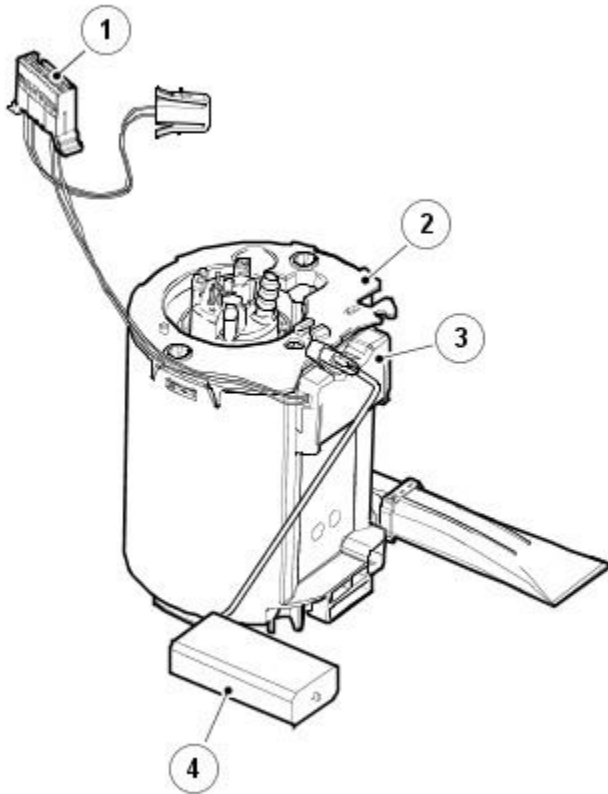
only internal access being through the fuel pump module and transfer pump module flange apertures on the top of the tank.

The fuel pump module flange has a six pin external connector which provides the electrical connections for the fuel pump and level sensors. A quick release connector provides for the connection of the fuel feed pipe.

Each flange is fitted with a collar, clamp and seal which locate in the tank apertures. An arrow on each flange must be aligned between two molded lines on the tank, adjacent to the fuel pump module or transfer pump flange aperture, to obtain the correct pump orientation. A collar is located over each flange and is secured with a clamp. The flange, seal, collar and clamp arrangements meet the sealing requirements of LEV2 emissions.

paragraph

## FUEL PUMP MODULE



E74571

### ItemDescription

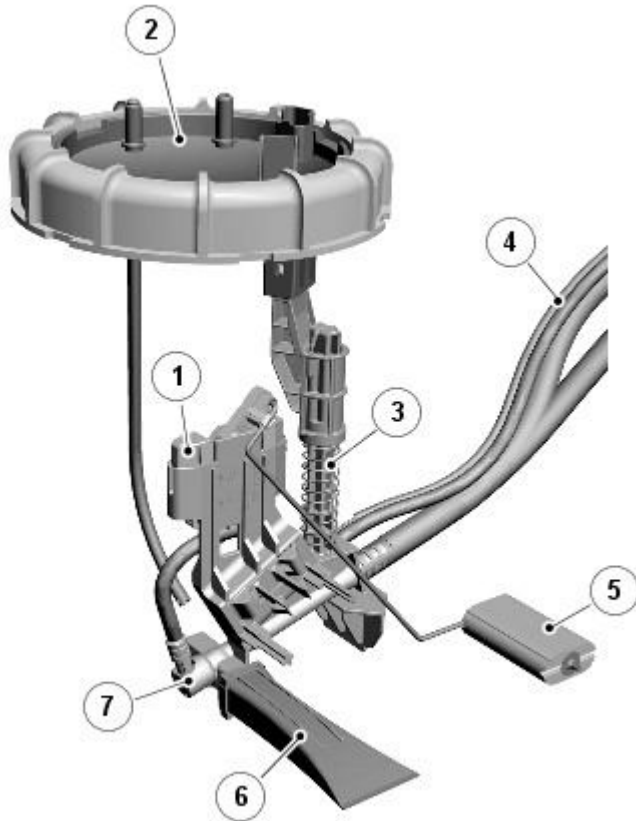
1	Electrical connector
2	Fuel pump module
3	Fuel level sensor
4	Level sensor float

The fuel pump is a variable speed rotary vane type. The supercharged variant incorporates a high flow rate pump . The pump is energized by the fuel pump relay which is located in the [RJB \(rear junction box\)](#) and the [FPDM \(fuel pump driver module\)](#) which is located under the RH floor pan above the rear suspension stabilizer bar . The relay and [FPDM](#) are controlled by the [ECM \(engine control module\)](#).

A fine mesh filter is located in the lower section of the pump module. This provides filtration to the fuel as it is drawn into the module.

The right hand fuel level sensor is mounted into the pump module housing.

## FUEL LEVEL SENSORS



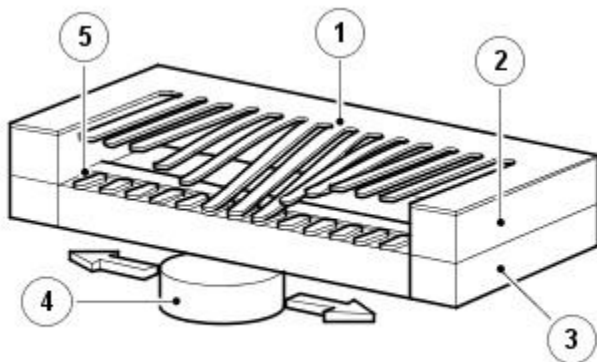
E94420

**ItemDescription**

1	Fuel level sensor
2	Transfer pump module
3	Sensor mounting bracket
4	Fuel cross-over pipes
5	Fuel level sensor float
6	Fine mesh filter
7	Jet pump

Two fuel level sensors are installed in either side of the saddle tank. One is mounted on the fuel pump module, the other is mounted on the transfer pump module in the other side of the fuel tank. The sensors are a MAPPS (magnetic passive position sensor) which provide a variable resistance to ground for the output from the fuel gage. The sensor is sealed from the fuel preventing contamination of the contacts, increasing reliability. The fuel level sensors are connected to the external electrical connector on the flange via the connector on the underside of the fuel pump module flange.

The sensor comprises a series of 51 film resistors mounted in an arc on a ceramic surface. The resistors are wired in series with individual contacts. A soft magnetic foil with 51 flexible contacts is mounted a small distance above the film resistors. A magnet, located below the ceramic surface, is attached to the sender unit float arm. As the float arm moves, the magnet follows the same arc as the film resistors. The magnet pulls the flexible contacts onto the opposite film resistor contacts forming an electrical circuit.



E44504

**ItemDescription**

1	Magnetic foil
2	Spacer
3	Ceramic surface

4 Magnet

5 Resistance film

The film resistors are arranged in a linear arc with resistance ranging from 51.2 to 992.11 Ohms. The electrical output signal is proportional to the amount of fuel in the tank and the position of the float arm. The measured resistance is processed by the instrument cluster to implement an anti-slosh function. This monitors the signal and updates the fuel gage pointer position at regular intervals, preventing constant pointer movement caused by fuel movement in the tank due to cornering or braking.

A warning lamp is incorporated in the instrument cluster and illuminates when the fuel level is low.

The fuel level sender signal is converted into a [CAN \(controller area network\)](#) message by the instrument cluster as a direct interpretation of the fuel tank contents in liters. The [ECM](#) uses the [CAN](#) message to store additional [OBD \(on-board diagnostic\)](#) 'P' Codes for misfire detection when the fuel level is below a predetermined capacity.

## JET PUMPS

The fuel system incorporates two jet pumps. The LH (left hand) jet pump is located on the fuel level sensor carrier on the LH (left hand) side of the fuel tank. The RH jet pump is located in the swirl pot below the fuel pump. Both jet pumps operate on a venturi effect created by the fuel at pump output pressure passing through the jet pump. This draws additional fuel from the tank through ports in the jet pump body, delivering additional fuel to the swirl pot. This function also serves to maintain an equal fuel level in the fuel tank compartments.

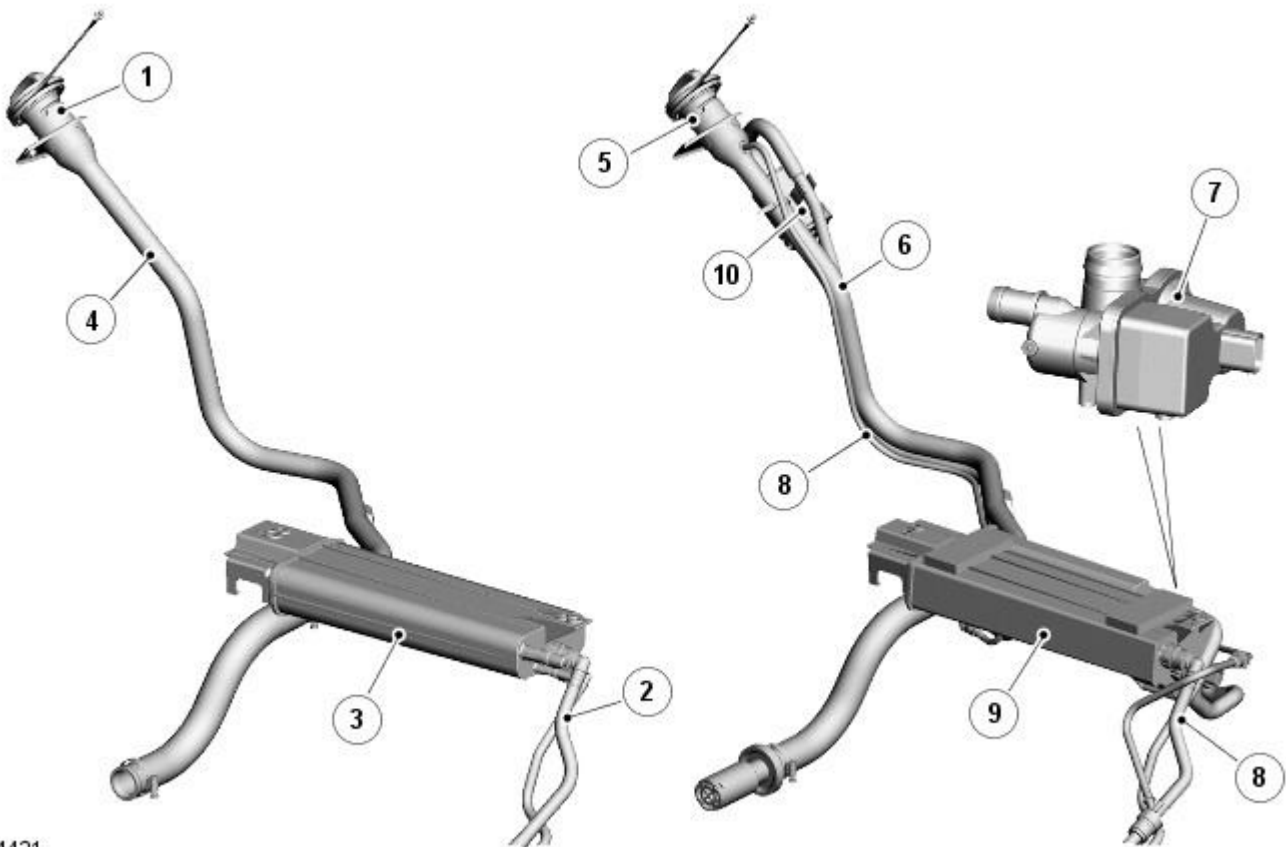
The LH (left hand) jet pump collects fuel from the LH (left hand) side of the tank and transfers it into the swirl pot on the RH (right hand) side of the tank.

The RH (right hand) jet pump collects fuel from below the swirl pot and transfers it to the upper section of the swirl pot. The action of the jet pumps ensures a constant supply of fuel to the swirl pot and fuel pump. Both jet pumps have a jet nozzle of 0.5 mm diameter.

## FUEL FILTER

The fuel filter is of a conventional construction being that of a paper element sealed within a steel canister. The fuel filter is located behind the left-hand front fender splash shield.

## FUEL FILLER PIPE ASSEMBLY



E94421

### ItemDescription

1 Filler cap and lanyard

2 EVAP pipe work

3 Charcoal canister

4 Fuel filler pipe

5 Filler cap and lanyard (NAS only)

6 Fuel filler pipe (NAS only) only

7	Fuel tank leakage monitoring pump (NAS only)
8	EVAP pipe work (NAS only)
9	Charcoal canister (NAS only)
10	Fuel tank leakage monitoring fresh air filter (NAS)

The fuel filler head is positioned at the rear of the vehicle, above the right hand rear wheel. The filler head is covered by a molded plastic cover which is electrically locked when the vehicle is locked. The filler cap is a conventional screw in type which is secured to the vehicle with a lanyard.

The filler head is an aluminum fabrication which is secured to the vehicle body by a bracket. The formed aluminum filler pipe locates in a short flexible hose attached to the tank which is secured with worm drive clamps.

NAS (North American Specification) vehicles feature connections and pipework on the rear of the filler head to allow for the functioning of the fuel tank [EVAP \(evaporative emission\)](#) system.

# Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Fuel Tank and Lines

Diagnosis and Testing

## Principle of Operation

For a detailed description of the fuel tank and lines, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (310-01 Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8)

[Fuel Tank and Lines](#) (Description and Operation),  
[Fuel Tank and Lines](#) (Description and Operation),  
[Fuel Tank and Lines](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Fuel leaks</li> <li>● Damaged fuel lines</li> <li>● Damaged push connect fittings</li> <li>● Fuel level</li> <li>● Fuel contamination/grade/quality</li> <li>● Damaged fuel tank filler pipe cap</li> <li>● Damaged fuel tank filler pipe</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Loose or corroded electrical connectors</li> <li>● Harnesses</li> <li>● Fuel Pump Driver Module (FPDM)</li> <li>● Rear Junction Box (RJB)</li> <li>● Fuel pump relay</li> <li>● Engine Control Module (ECM)</li> </ul>

3. 3. If an obvious cause for an observed or reported symptom is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and proceed to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	<ul style="list-style-type: none"> <li>● Engine breather system disconnected/restricted</li> <li>● Ignition system</li> <li>● Fuel system</li> <li>● Electronic engine controls</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed. Check for fuel, ignition and electronic engine control system DTCs and refer to the relevant DTC Index
Engine cranks and fires, but will not start	<ul style="list-style-type: none"> <li>● Evaporative emissions purge valve</li> <li>● Fuel pump</li> <li>● Spark plugs</li> <li>● Ignition coil failure(s)</li> </ul>	Check for purge valve, fuel and ignition system DTCs and refer to the relevant DTC Index
Difficult cold start	<ul style="list-style-type: none"> <li>● Check engine coolant level/anti-freeze content</li> <li>● Battery</li> <li>● Electronic engine controls</li> <li>● Exhaust gas recirculation (EGR) valve stuck open</li> <li>● Fuel pump</li> <li>● Evaporative emissions purge valve</li> </ul>	Check the engine coolant level and condition. REFER to: <a href="#">Specifications</a> (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Specifications). Ensure the battery is in a fully charged and serviceable condition. Check for electronic engine control, EGR valve, fuel system and purge valve related DTCs and refer to the relevant DTC Index
Difficult hot start	<ul style="list-style-type: none"> <li>● Injector leak</li> <li>● Electronic engine controls</li> <li>● Evaporative emissions purge valve</li> <li>● Fuel pump</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> </ul>	Carry out injector leak tests, install new injectors as required. REFER to: <a href="#">Fuel Injectors</a> (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Removal and Installation). Check for electronic engine control, EGR valve, fuel system, ignition system and purge valve related DTCs and refer to the relevant DTC Index



Symptom	Possible Cause	Action
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	<ul style="list-style-type: none"> <li>● Injector leak</li> <li>● Electronic engine controls</li> <li>● Evaporative emissions purge valve</li> <li>● Fuel pump</li> <li>● Ignition system</li> <li>● EGR valve stuck open</li> </ul>	Carry out injector leak tests, install new injectors as required. REFER to: <a href="#">Fuel Injectors</a> (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Removal and Installation). Check for electronic engine control, EGR valve, fuel system, ignition system and purge valve related DTCs and refer to the relevant DTC Index
Engine stalls soon after start	<ul style="list-style-type: none"> <li>● Breather system disconnected/restricted</li> <li>● ECM relay</li> <li>● Electronic engine controls</li> <li>● Ignition system</li> <li>● Air intake system restricted</li> <li>● Air leakage</li> <li>● Fuel lines</li> </ul>	Ensure the engine breather system is free from restriction and is correctly installed. Check for ECM relay, electronic engine control and ignition system DTCs and refer to the relevant DTC Index. Check for blockage in air cleaner element and air intake system. Check for leakage in air intake system. Check fuel lines for blockage/restriction. Clear blockage/restriction and install new fuel lines as required
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> <li>● Fuel pressure, fuel pump, fuel lines</li> <li>● Injector leak</li> <li>● Air leakage</li> <li>● Electronic engine controls</li> <li>● Ignition system</li> <li>● EGR valve stuck</li> <li>● Transmission malfunction</li> <li>● Restricted pedal travel (carpet, etc)</li> </ul>	Carry out fuel pressure check. Check fuel lines for blockage/restriction. Clear blockage/restriction and install new fuel lines as required. Check for fuel system DTCs and refer to the relevant DTC Index. Carry out fuel injector leak tests, install new injectors as required. REFER to: <a href="#">Fuel Injectors</a> (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Removal and Installation). Check for leakage from air intake system. Check for electronic engine control, EGR valve, ignition system and transmission related DTCs and refer to the relevant DTC Index. Ensure accelerator pedal is free from restriction
Engine backfires	<ul style="list-style-type: none"> <li>● Fuel pump, fuel lines</li> <li>● Air leakage</li> <li>● Electronic engine controls</li> <li>● Ignition system</li> <li>● Sticking variable camshaft timing (VCT) hub</li> </ul>	Check for fuel system related DTCs and refer to the relevant DTC Index. Check fuel lines for blockage/restriction. Clear blockage/restriction and install new fuel lines as required. Check for leakage from air intake system. Check for electronic engine control, ignition system and VCT related DTCs and refer to the relevant DTC Index
Engine surges	<ul style="list-style-type: none"> <li>● Fuel pump, fuel lines</li> <li>● Electronic engine controls</li> <li>● Ignition system</li> </ul>	Check for fuel system related DTCs and refer to the relevant DTC Index. Check fuel lines for blockage/restriction. Clear blockage/restriction and install new fuel lines as required. Check for electronic engine control and ignition system related DTCs and refer to the relevant DTC Index
Engine detonates/knocks	<ul style="list-style-type: none"> <li>● Fuel pump, fuel lines, fuel quality</li> <li>● Air leakage</li> <li>● Electronic engine controls</li> <li>● Sticking VCT hub</li> </ul>	Check for fuel system related DTCs and refer to the relevant DTC Index. Check fuel lines for blockage/restriction. Clear blockage/restriction and install new fuel lines as required. Check for leakage from air intake system. Check for electronic engine control and VCT related DTCs and refer to the relevant DTC Index

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If a module or component is suspect, and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P008700	Fuel Rail/System Pressure - Too Low	<ul style="list-style-type: none"> <li>● Fuel rail pressure (Fuel rail pressure) sensor, sensing circuit - short to ground, open circuit</li> <li>● Fuel rail pressure sensor</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Fuel rail pressure sensor circuits for short to ground, open circuit, high resistance. Check and

DTC	Description	Possible Cause	Action
		supply circuit - high resistance <ul style="list-style-type: none"> <li>● Fuel rail pressure sensor failure</li> <li>● Fuel pump failure</li> <li>● Fuel line leak, restriction</li> </ul>	install a new Fuel rail pressure sensor as required. Check fuel system for failure
P008800	Fuel Rail/System Pressure - Too High	<ul style="list-style-type: none"> <li>● Fuel rail pressure sensor supply/sensing circuits - short to each other</li> <li>● Fuel rail pressure sensor sensing circuit - short to power</li> <li>● Fuel rail pressure sensor ground circuit - high resistance</li> <li>● Fuel rail pressure sensor failure</li> <li>● Restricted fuel line</li> <li>● Fuel pump short circuit to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Fuel rail pressure sensor circuits for short to each other, power, open circuit, high resistance. Check and install a new Fuel rail pressure sensor as required. Check fuel system for failure
P018123	Fuel Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Fuel temperature sensor sensing circuit - short to ground, short to power, high resistance</li> <li>● Fuel temperature sensor ground circuit - high resistance</li> <li>● Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P018124	Fuel Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Fuel temperature sensor sensing circuit - short to ground, short to power, high resistance</li> <li>● Fuel temperature sensor ground circuit - high resistance</li> <li>● Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P018129	Fuel Temperature Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Fuel temperature sensor sensing circuit - short to ground, short to power, high resistance</li> <li>● Fuel temperature sensor ground circuit - high resistance</li> <li>● Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P018200	Fuel Temperature Sensor A Circuit Low	<ul style="list-style-type: none"> <li>● Fuel temperature sensor sensing circuit - short to ground</li> <li>● Fuel temperature sensor ground circuit - short circuit</li> <li>● Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P018300	Fuel Temperature Sensor A Circuit High	<ul style="list-style-type: none"> <li>● Fuel temperature sensor sensing circuit - short to power, high resistance, disconnected</li> <li>● Fuel temperature sensor ground circuit - high resistance</li> <li>● Fuel temperature sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel temperature sensor circuits for short to ground, power, high resistance. Check and install a new Fuel temperature sensor as required
P019100	Fuel Rail Pressure Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Fuel rail pressure sensor stuck</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P019200	Fuel Rail Pressure Sensor A Circuit Low	<ul style="list-style-type: none"> <li>● Fuel rail pressure sensor sensing circuit - short to ground, high resistance, disconnected</li> <li>● Fuel rail pressure sensor 5V supply circuit - high resistance</li> <li>● Fuel rail pressure sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuits for short to ground, power, high resistance, disconnected connector. Check and install a new Fuel rail pressure sensor as required


DTC	Description	Possible Cause	Action
P019300	Fuel Rail Pressure Sensor A Circuit High	<ul style="list-style-type: none"> <li>Fuel rail pressure sensor supply/sensing circuits - short circuit to each other</li> <li>Fuel rail pressure sensor sensing circuit - short to power</li> <li>Fuel rail pressure sensor ground circuit - high resistance</li> <li>Fuel rail pressure sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuits for short to ground, power, high resistance, disconnected connector. Check and install a new Fuel rail pressure sensor as required
P023100	Fuel Pump Secondary Circuit Low	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Refer to the electrical circuit diagrams and check FPDM monitor circuit to ECM for short to ground, high resistance
P023200	Fuel Pump Secondary Circuit High	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Refer to the electrical circuit diagrams and check FPDM monitor circuit to ECM for short to power
P044100	Evaporative Emission System Incorrect Purge Flow	<ul style="list-style-type: none"> <li>Purge valve - range/performance</li> </ul>	Refer to the electrical circuit diagrams and check EVAP purge valve control circuit for short, open circuit
P044200	Evaporative Emission System Leak Detected (small leak)	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Check EVAP system for leak using appropriate smoke/leak tester
P044700	Evaporative Emission System Vent Control Circuit Open	<ul style="list-style-type: none"> <li>DMTL COV circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL COV circuit for short to ground
P044800	Evaporative Emission System Vent Control Circuit Shorted	<ul style="list-style-type: none"> <li>DMTL COV circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL COV circuit for short to power
P045600	Evaporative Emission System Leak Detected (very small leak)	<ul style="list-style-type: none"> <li>DMTL system has detected a leak</li> </ul>	Check EVAP system for leak using appropriate smoke/leak tester
P045800	Evaporative Emission System Purge Control Valve Circuit Low	<ul style="list-style-type: none"> <li>EVAP canister purge valve control circuit - short to ground, high resistance</li> <li>EVAP canister purge valve failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EVAP canister purge valve control circuit for short to ground, high resistance. Check and install a new EVAP canister purge valve as required
P045900	Evaporative Emission System Purge Control Valve Circuit High	<ul style="list-style-type: none"> <li>EVAP canister purge valve control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check EVAP canister purge valve control circuit for short to power
P046129	Fuel Level Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Fuel level sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel level sensor circuits for short, open circuit, high resistance
P04612F	Fuel Level Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>Fuel level sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel level sensor circuits for short, open circuit, high resistance
P046200	Fuel Level Sensor A Circuit Low	<ul style="list-style-type: none"> <li>Fuel level sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel level sensor circuits for short, open circuit, high resistance
P046300	Fuel Level Sensor A Circuit High	<ul style="list-style-type: none"> <li>Fuel level sensor failure</li> </ul>	Refer to the electrical circuit diagrams and check fuel level sensor circuits for short, open circuit, high resistance
P062700	Fuel Pump A Control Circuit/Open	<ul style="list-style-type: none"> <li>Fuel pump control circuit fault (FPDM to ECM)</li> </ul>	Refer to the electrical circuit diagrams and check the FPDM to ECM circuit for short to ground, power, open circuit
P062A00	Fuel Pump A Control Circuit Range/Performance	<ul style="list-style-type: none"> <li>Invalid fuel pump duty requested by the ECM</li> </ul>	Refer to the electrical circuit diagrams and check the FPDM to ECM circuit for short to ground, power, open circuit
P240100	Evaporative Emission System Leak Detection Pump Control Circuit Low	<ul style="list-style-type: none"> <li>DMTL pump circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground
P240200	Evaporative Emission System Leak Detection Pump Control Circuit High	<ul style="list-style-type: none"> <li>DMTL pump circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL pump circuit for short to power
P240429	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	<ul style="list-style-type: none"> <li>DMTL reference leak</li> <li>DMTL pump circuit - short to ground, power, high resistance</li> <li>DMTL pipework blocked/leaking</li> </ul>	Check integrity of evaporative emissions system, i.e. blocked/leaking. Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground, power, high resistance

<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
P24042F	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	<ul style="list-style-type: none"> <li>● DMTL reference leak</li> <li>● DMTL pump circuit - short to ground, power, high resistance</li> <li>● DMTL pipework blocked/leaking</li> </ul>	Check integrity of evaporative emissions system, i.e. blocked/leaking. Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground, power, high resistance
P240500	Evaporative Emission System Leak Detection Pump Sense Circuit Low	<ul style="list-style-type: none"> <li>● DMTL pump circuit - short to ground, power, high resistance</li> </ul>	Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground, power, high resistance
P240600	Evaporative Emission System Leak Detection Pump Sense Circuit High	<ul style="list-style-type: none"> <li>● DMTL pump circuit - short to ground, power, high resistance</li> </ul>	Refer to the electrical circuit diagrams and check DMTL pump circuit for short to ground, power, high resistance
P240B00	Evaporative Emission System Leak Detection Pump Heater Circuit Low	<ul style="list-style-type: none"> <li>● DMTL heater control circuit low</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL heater control circuit for short to ground, open circuit
P240C00	Evaporative Emission System Leak Detection Pump Heater Circuit High	<ul style="list-style-type: none"> <li>● DMTL heater control circuit high</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL heater control circuit for short to power
P245000	Evaporative Emission Control System Switching Valve Performance/Stuck Open	<ul style="list-style-type: none"> <li>● DMTL system circuit - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL system circuit for short to ground, power, high resistance. Check for stuck valve
P245100	Evaporative Emission Control System Switching Valve Stuck Closed	<ul style="list-style-type: none"> <li>● DMTL system circuit - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check DMTL system circuit for short to ground, power, high resistance. Check for stuck valve

# Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Fuel Filter

Removal and Installation

## Removal

 **WARNING:** Refer to: [Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions](#) (100-00 General Information, Description and Operation).

• NOTE: Removal steps in this procedure may contain installation details.

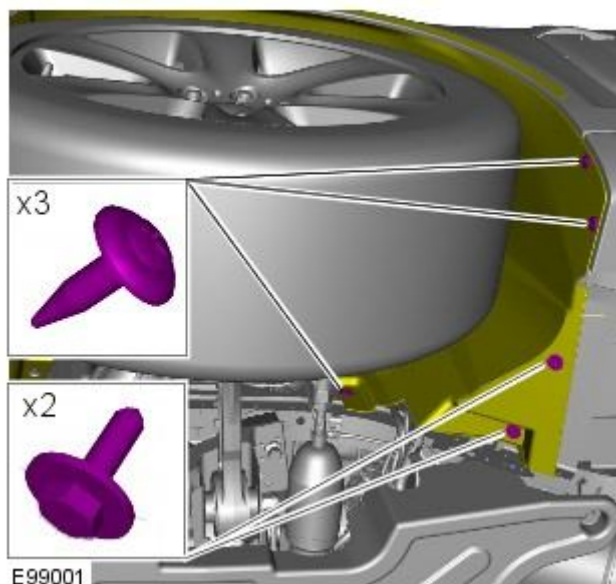
1. De-pressurize the fuel system.


Refer to: [Fuel System Pressure Release - 3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (310-00 Fuel System - General Information, General Procedures).

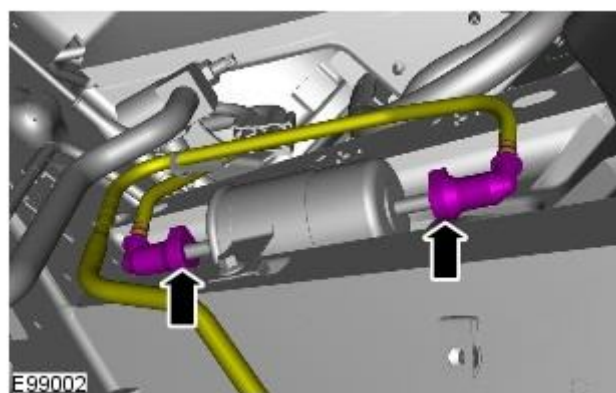
2.  **WARNING:** Make sure to support the vehicle with axle stands.

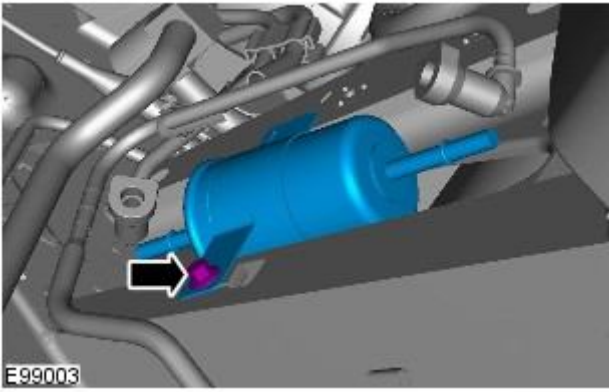
Raise and support the vehicle.

- 3.



4.  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.





5.



6. **6.** NOTE: Note the fitted position.

## Installation

1. To install, reverse the removal procedure.





# Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Fuel Level Sender LH


Removal and Installation

## Removal

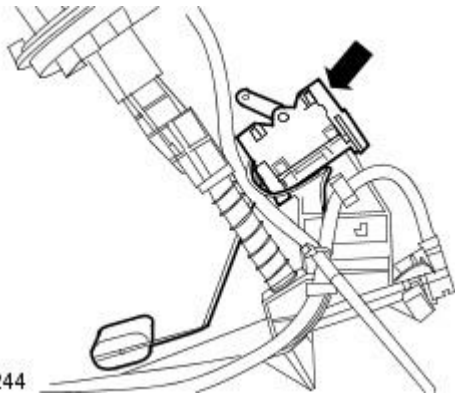
• WARNINGS:

 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.


1. Remove the fuel transfer unit.  
For additional information, refer to: Fuel Transfer Unit (310-01, Removal and Installation).
2. Remove the fuel level sender and harness.
  - Remove and discard the fuel level sender harness tie straps.





E 63244

## Installation

1. WARNINGS:

 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.


To install, reverse the removal procedure.


## Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Fuel Level Sender RH


Removal and Installation

### Removal

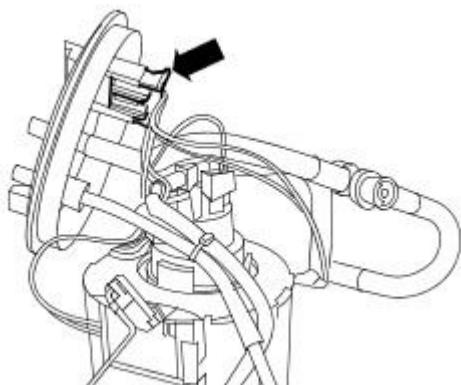
• WARNINGS:

 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

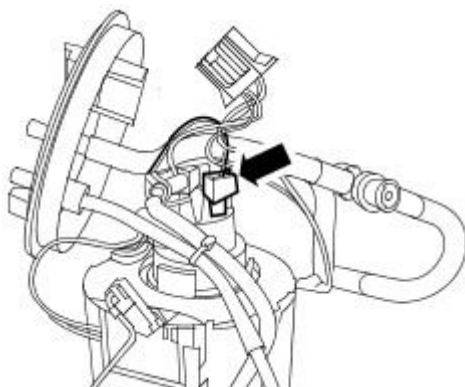
 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

1. Remove the fuel pump module.  
For additional information, refer to: Fuel Pump Module (310-01, Removal and Installation).
2. Disconnect the fuel pump module electrical connector.



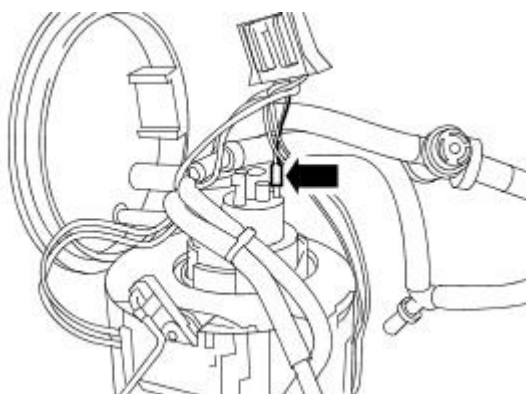
E63239

3. Disconnect the fuel level sender electrical connector.



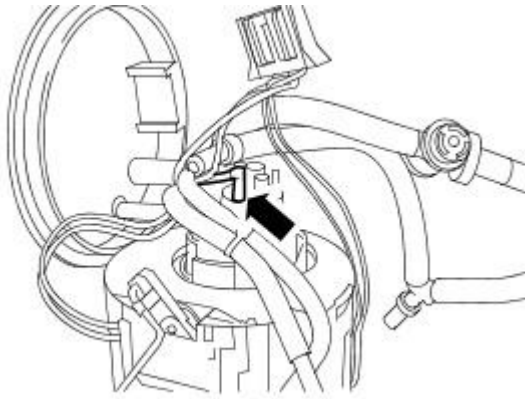
E63240

4. Disconnect the fuel level sender electrical connector.



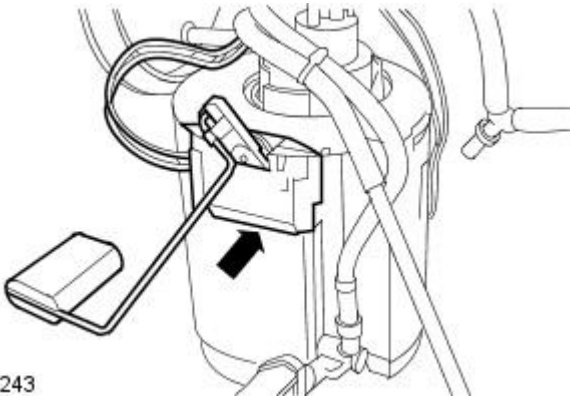
E63241

5. Disconnect the fuel level sender electrical connector.



E 63242

6. Remove the fuel level sender and harness.



E 63243

## Installation

1. WARNINGS:



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.




This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

To install, reverse the removal procedure.

# Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Fuel Pump Module

Removal and Installation

Special Tool(s)	
	Remover/Installer, Fuel Pump Module/Fuel Transfer Unit Locking Ring 310-146

## Removal

### • WARNINGS:



Place the vehicle in a quarantined area and arrange "No Smoking/Petrol Fumes" signs about the vehicle.



Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be relieved before attempting any repairs. Failure to follow these instructions may result in personal injury.



After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.



If taken internally, do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.



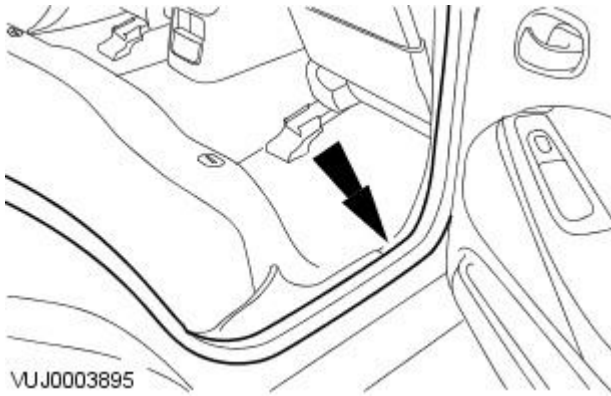
If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.



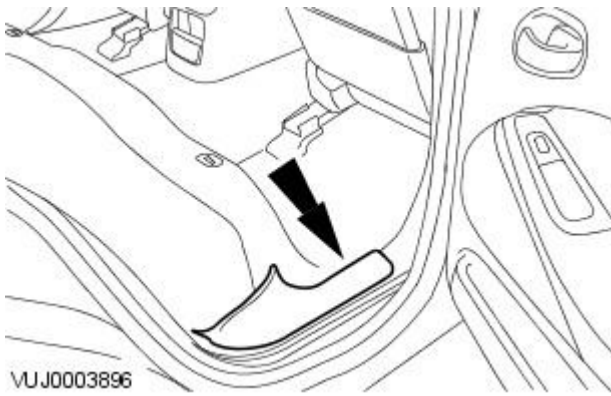
Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

1. Raise and support the vehicle.
2. NOTE: All vehicles.  
Open the fuel tank filler pipe flap.
3. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
4. Detach the fuel tank filler pipe cap.
5. Release the pressure in the fuel system.  
For additional information, refer to: [Fuel System Pressure Release - 3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (310-00 Fuel System - General Information, General Procedures).
6. Drain the fuel system.  
For additional information, refer to: [Fuel Tank Draining](#) (310-00 Fuel System - General Information, General Procedures).

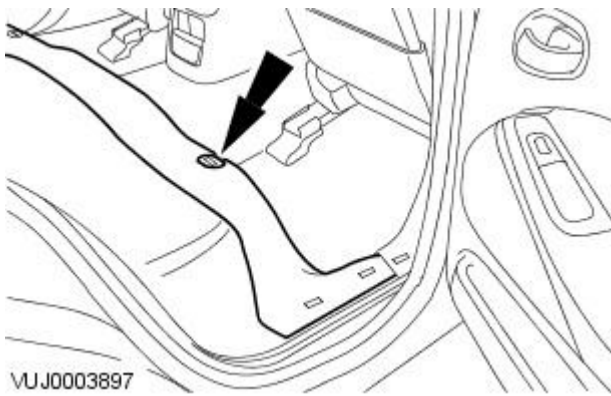
7. Detach and reposition the door opening weatherstrip.



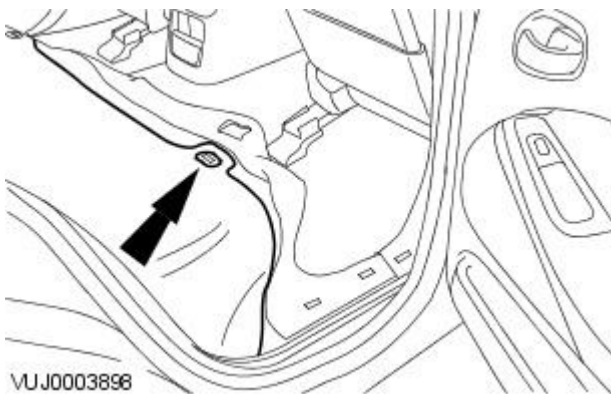
8. Remove the scuff plate trim panel.



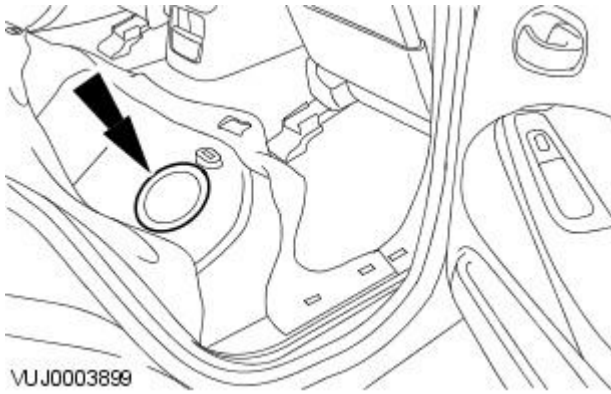
9. Detach and reposition the floor covering.



10. Detach and reposition the rear seat cushion insulation.

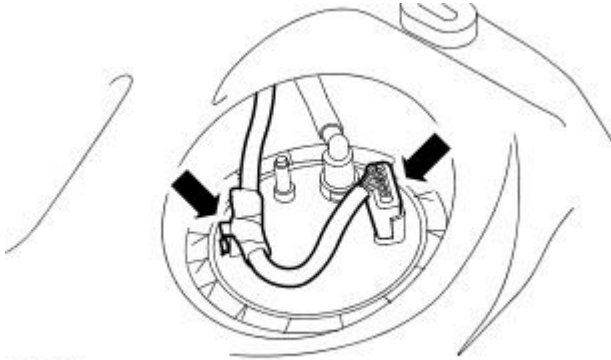


11. Remove the floor aperture cover.

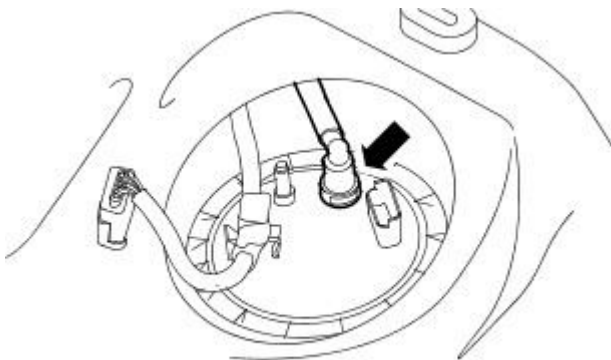


12. Disconnect the fuel pump module electrical connector.

- Detach the fuel pump module wiring harness from the retaining bracket.

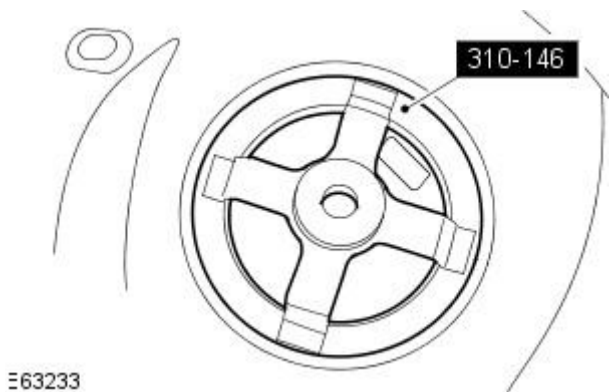


13. Disconnect the fuel pump module quick release coupling.

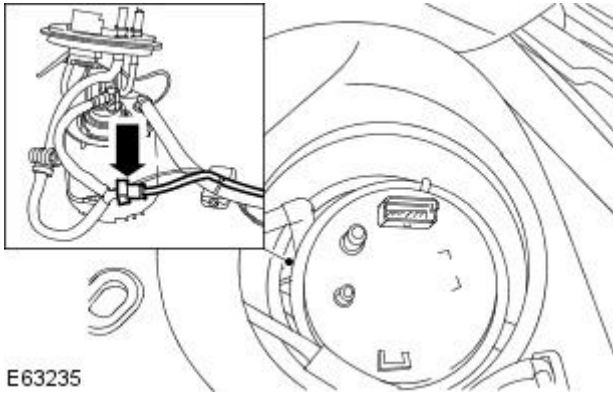


14. Using the special tool, remove the fuel pump module locking ring.

- Remove and discard the O-ring seal.

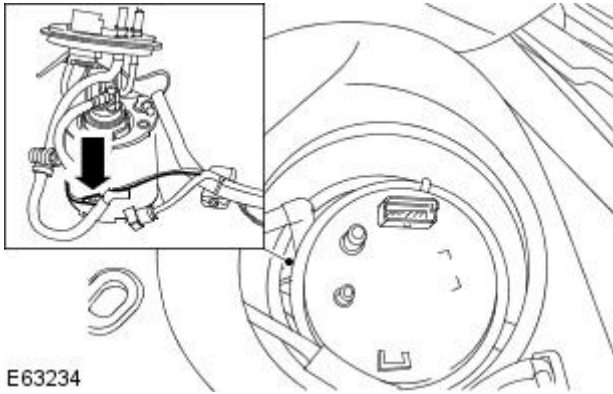






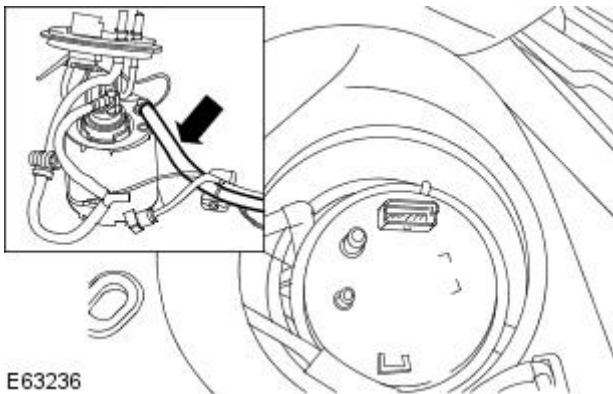
E63235

15. Disconnect the fuel transfer module transfer feed tube.



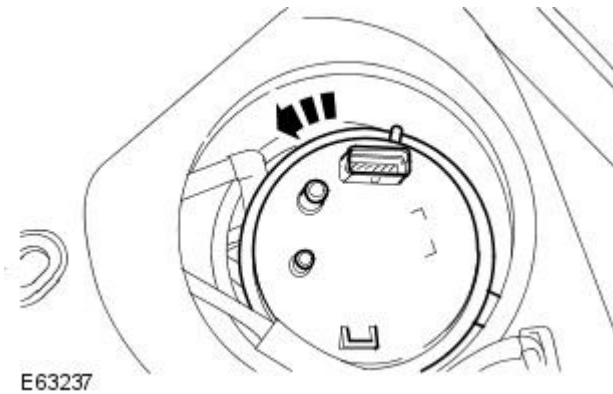
E63234

16. Disconnect the left-hand fuel sender gauge electrical connector.



E63236

17. Disconnect the fuel transfer module transfer return tube.



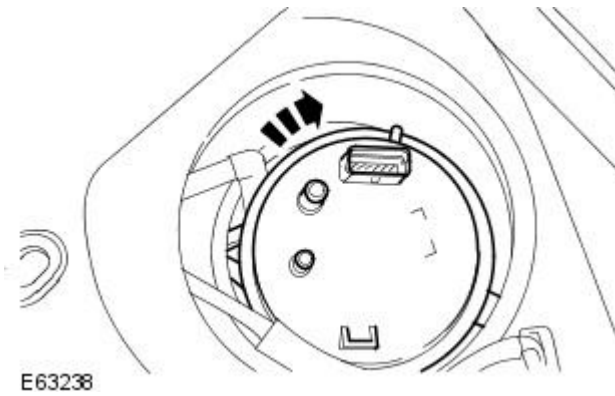
E63237

18.  CAUTION: Make sure no damage occurs to the fuel level float.

Remove the fuel pump module.

- Press down and rotate the base of the fuel pump module counter-clockwise.

## Installation



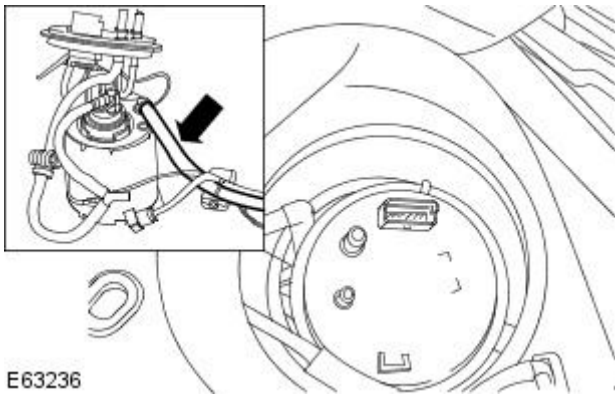
1. CAUTIONS:

- ⚠ On vehicles with supercharger make sure the arrow on the fuel pump module and the 'SC' marker on the fuel tank are aligned.
- ⚠ On vehicles without supercharger make sure the arrow on the fuel transfer module and the 'NA' marker on the fuel tank are aligned.
- ⚠ Make sure no damage occurs to the fuel level float.

• NOTE: All vehicles.

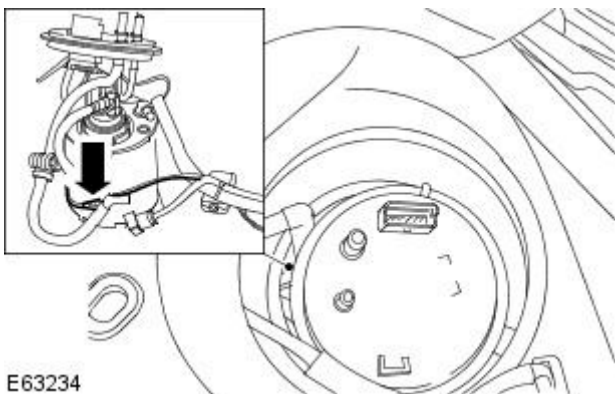
Install the fuel pump module.

- Press down and rotate the base of the fuel pump module clockwise.

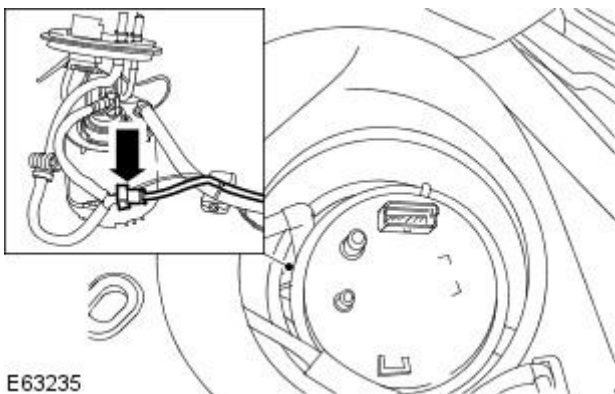


2. Connect the transfer module transfer return tube.

- Make sure the coupling has latched onto the fuel pump module by pulling the tube after the connection has been made.

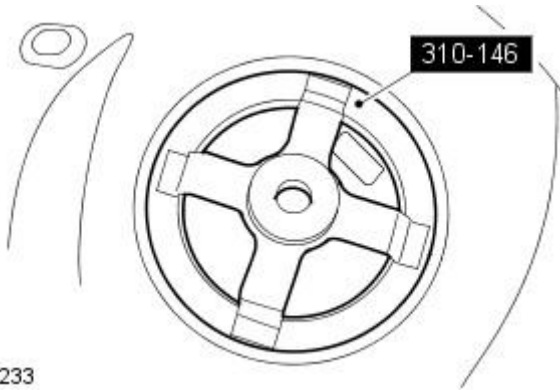


3. Connect the left-hand fuel sender gauge electrical connector.



4. Connect the fuel transfer module transfer feed tube.

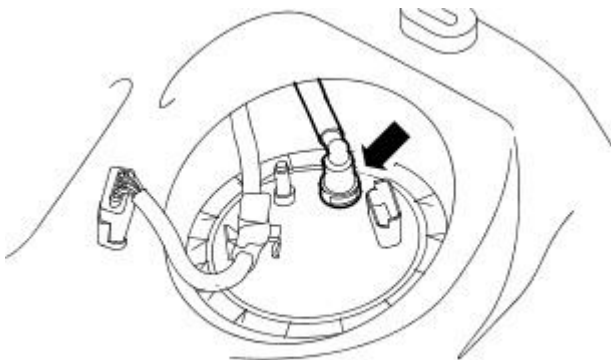
- Make sure the quick release coupling has latched onto the fuel pump module fuel tube by pulling the tube after the connection has been made.



E63233

5. Using the special tool, install the fuel pump module locking ring.

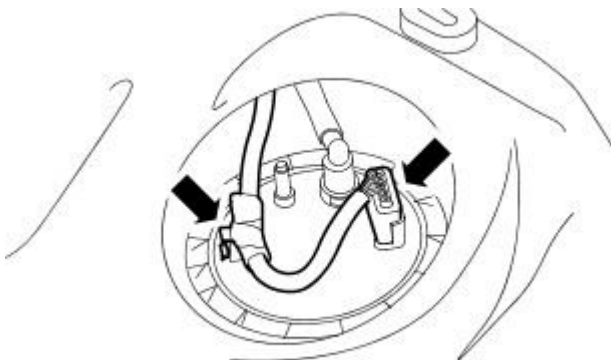
- Install a new O-ring seal.
- Tighten to 60 Nm.



E63232

6. Connect the fuel pump module quick release coupling.

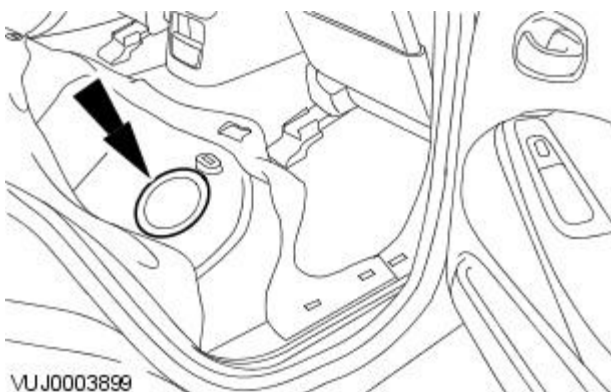
- Make sure the quick release coupling has latched onto the fuel pump module fuel pipe by pulling the pipe after the connection has been made.



E63231

7. Connect the fuel pump module electrical connector.

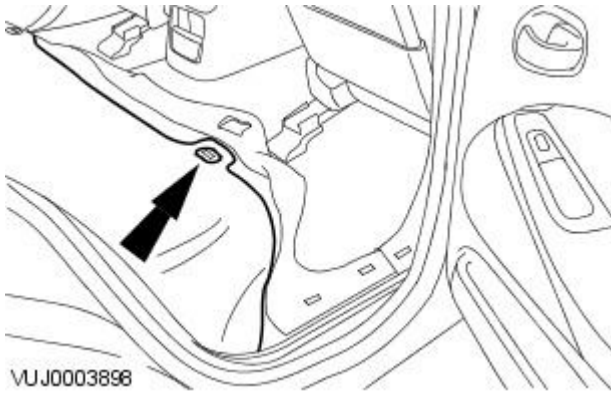
- Attach the fuel pump module wiring harness to the retaining bracket.



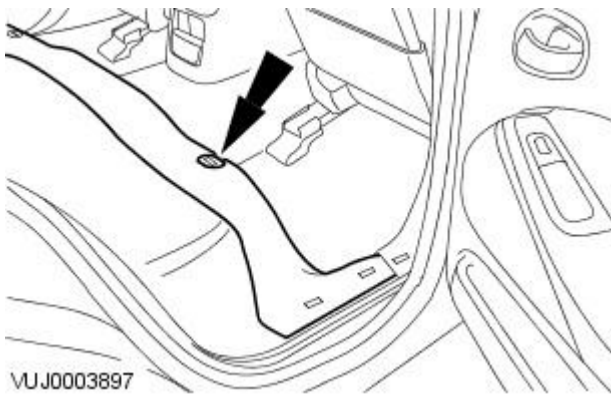
VUJ0003899

8. Install the floor aperture cover.

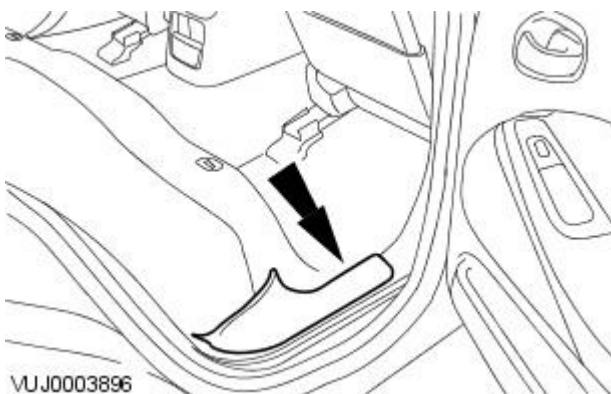
9. Attach the rear seat cushion insulation.



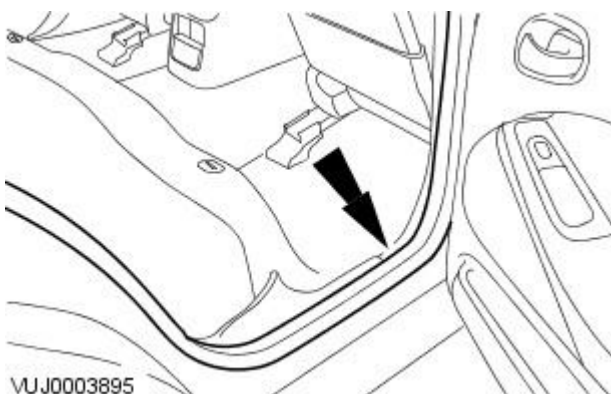
10. Attach the floor covering.



11. Install the scuff plate trim panel.



12. Attach the door opening weatherstrip.



13. Attach the fuel tank filler pipe cap.

14. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

15. Close the fuel tank filler pipe flap.

# Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Fuel Tank


Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

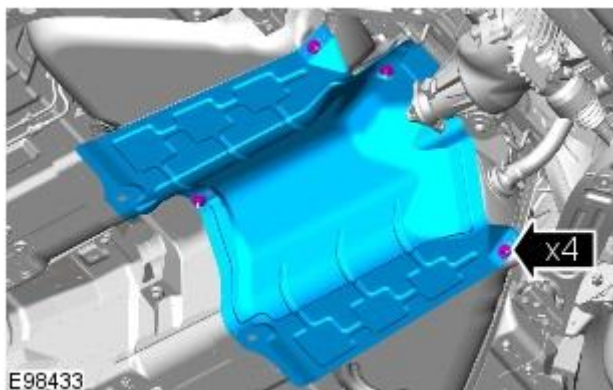
All vehicles

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Fuel Tank Draining](#) (310-00 Fuel System - General Information, General Procedures).

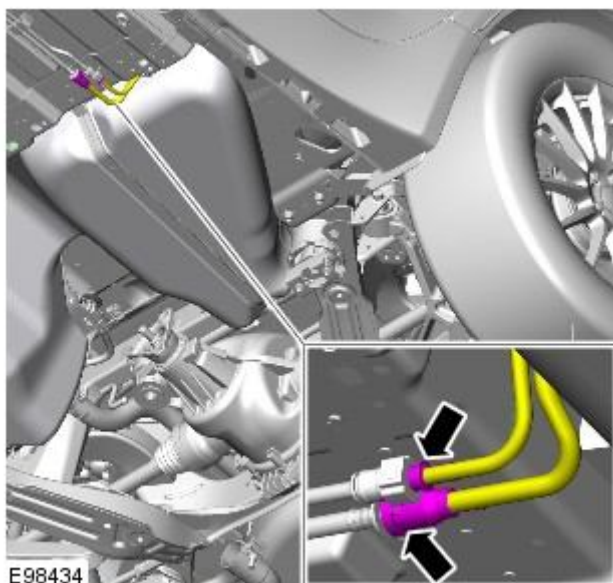
3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.


Raise and support the vehicle.

4. Refer to: [Driveshaft](#) (205-01 Driveshaft, Removal and Installation).



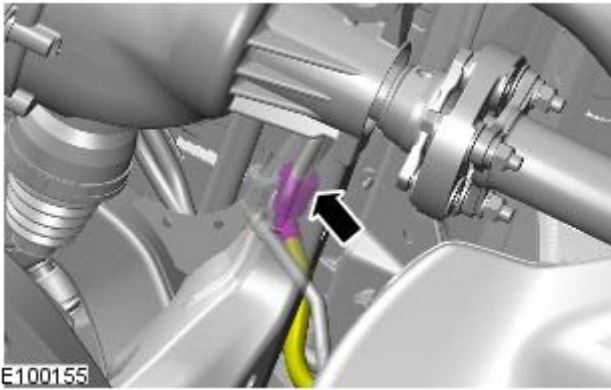
5.
  - Torque: 5 Nm



6.  **WARNING:** The spilling of fuel is unavoidable during this operation. Make sure that all necessary precautions are taken to prevent fire and explosion.

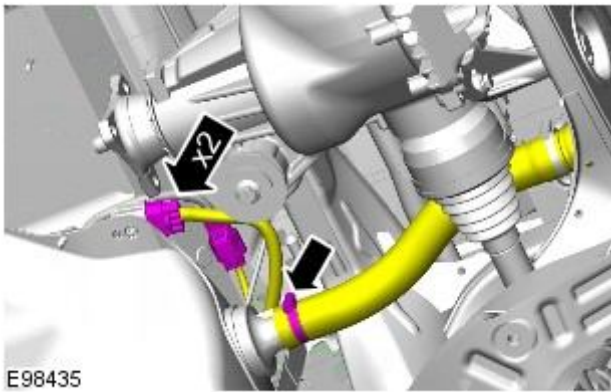
Vehicles with petrol engine





7.

All vehicles



8.

- Torque: 3 Nm



9.  **WARNING:** Secure the component to the transmission jack.

 **CAUTION:** Use suitable packing material to prevent damage to the component.

- Torque: 35 Nm

## Installation

1. To install, reverse the removal procedure.













# Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Fuel Tank Filler Pipe

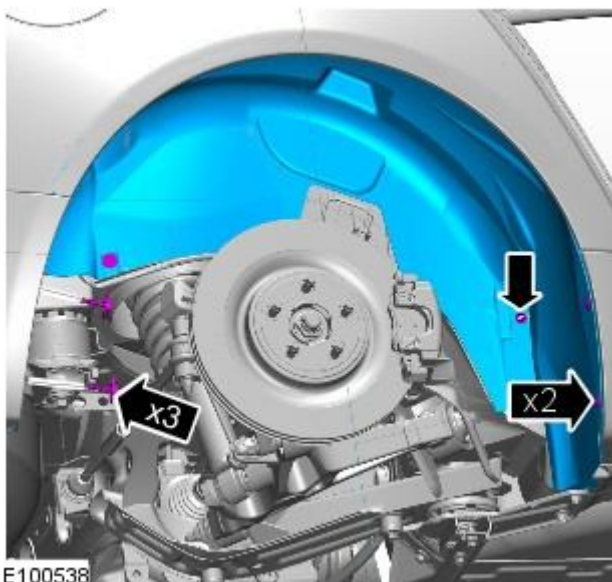
Removal and Installation

## Removal

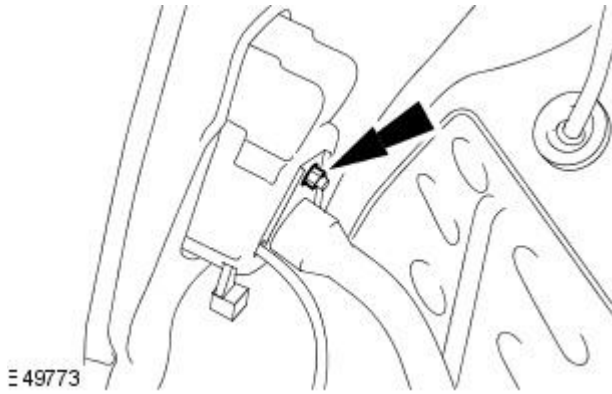
### • WARNINGS:

-  Before any work is carried out on the vehicle the fuel tank must have less than a 1/4 of a tank of fuel. This will prevent excessive fuel loss.
-  Place the vehicle in a well ventilated, quarantined area and arrange ' No Smoking/Petrol Fumes' signs about the vehicle.
-  Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.
-  Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.
-  The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be relieved before attempting any repairs. Failure to follow these instructions may result in personal injury.
-  After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.
-  This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.
-  If taken internally, do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.
-  If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.
-  Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

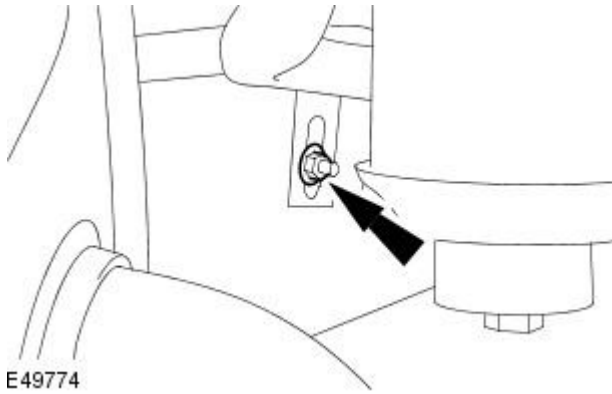
1. Raise and support the vehicle.
2. Remove the fuel tank filler pipe cap.
3. Remove the right-hand rear wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
4. Remove the right-hand rear fender splash shield.



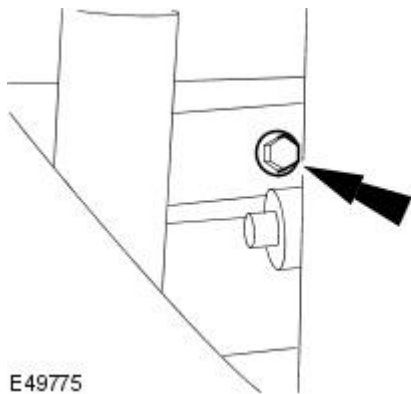
5. Remove the fuel tank filler pipe retaining nut.



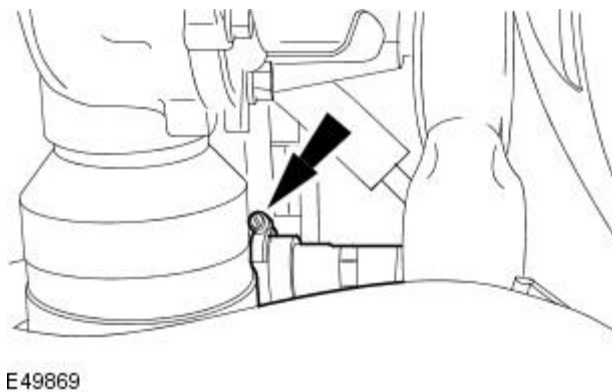
6. Remove the fuel tank filler pipe retaining nut.



7. Remove the fuel tank filler pipe retaining bolt.



8. Detach the fuel tank filler pipe.




9. Remove the fuel tank filler pipe.

## Installation

1. To install, reverse the removal procedure.










# Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Fuel Transfer Unit

Removal and Installation

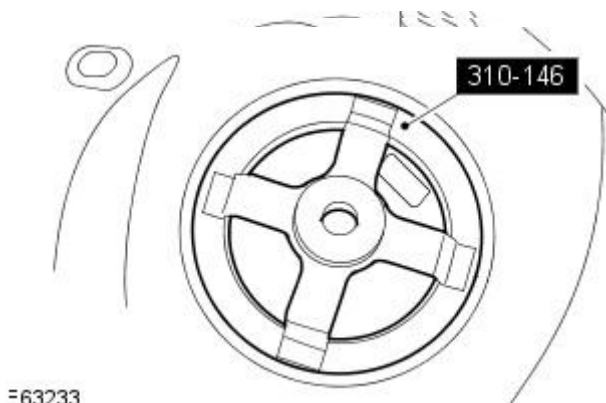
Special Tool(s)	
	Remover/Installer, Fuel Pump Module/Fuel Transfer Unit Locking Ring
	310-146

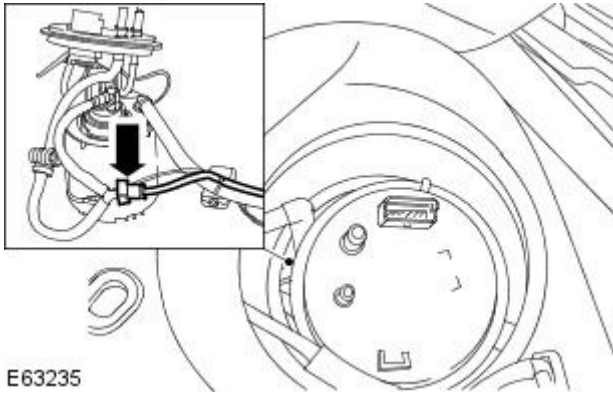
## Removal

### • WARNINGS:

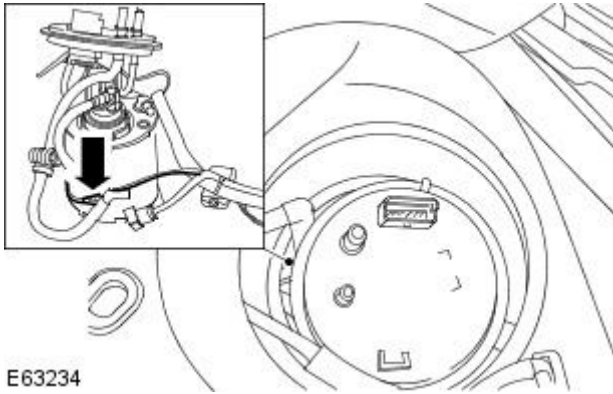
-  Place the vehicle in a quarantined area and arrange "No Smoking/Petrol Fumes" signs about the vehicle.
-  Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.
-  Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.
-  The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be relieved before attempting any repairs. Failure to follow these instructions may result in personal injury.
-  After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.
-  This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.
-  If taken internally, do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.
-  If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.
-  Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Drain the fuel system.  
For additional information, refer to: [Fuel Tank Draining](#) (310-00 Fuel System - General Information, General Procedures).
3. Disconnect the fuel pump module electrical connector.
4. Using the special tool, remove the fuel pump module locking ring.
  - Detach the fuel pump module wiring harness from the retaining bracket.
  - Remove and discard the O-ring seal.

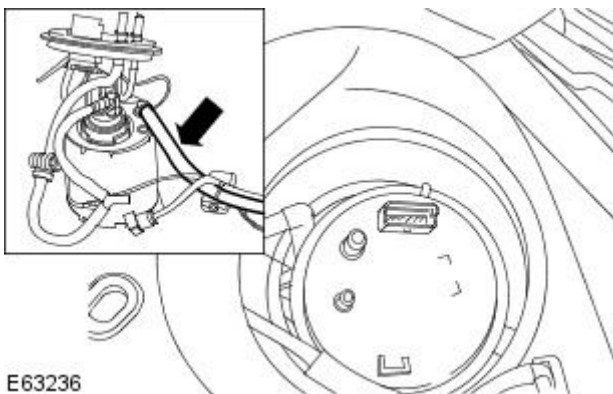




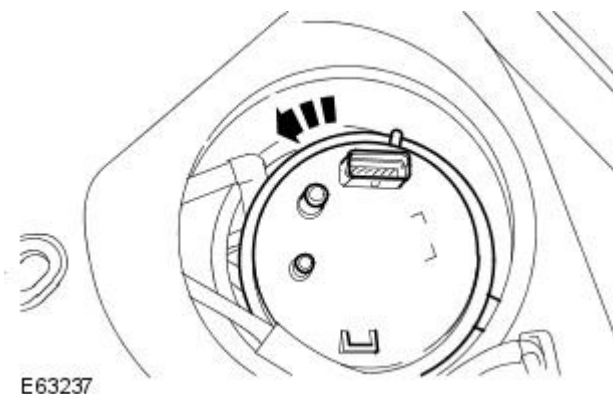
6. Disconnect the fuel transfer module transfer feed tube.



7. Disconnect the left-hand fuel sender gauge electrical connector.



8. Disconnect the fuel transfer module transfer return tube.

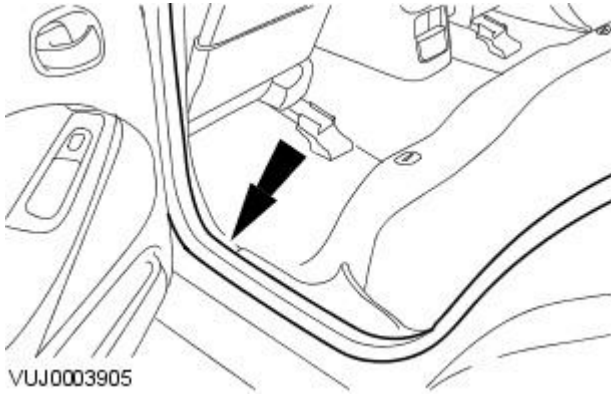


9.  CAUTION: Make sure no damage occurs to the fuel level float.

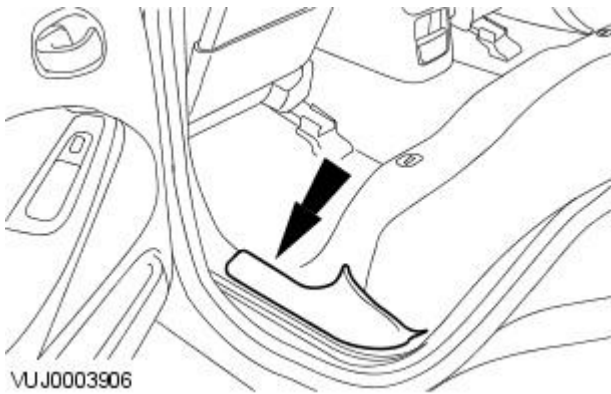
Release the fuel pump module.

- Press down and rotate the base of the fuel pump module counter-clockwise.

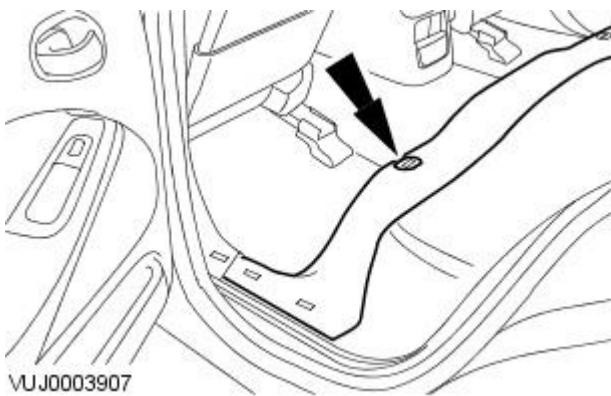
10. Detach and reposition the door opening weatherstrip.



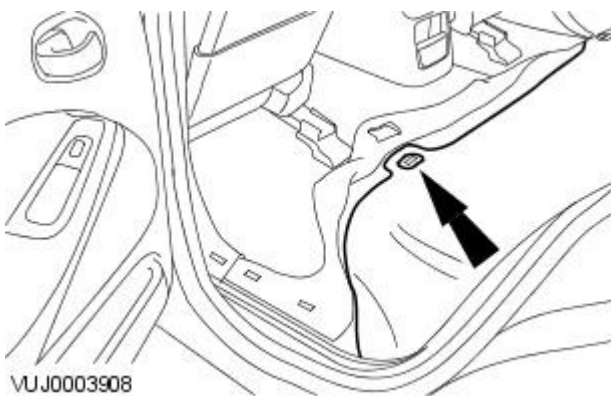
11. Remove the scuff plate trim panel.



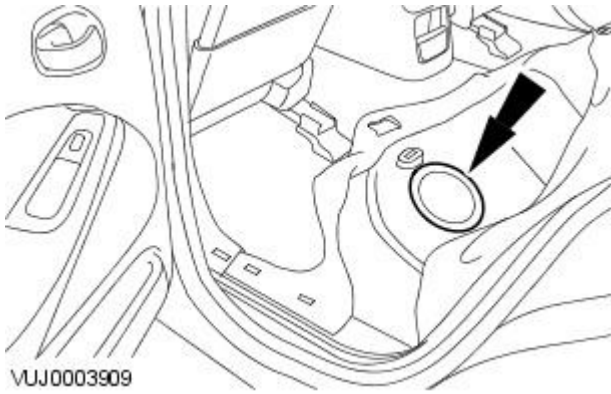
12. Detach and reposition the floor covering.



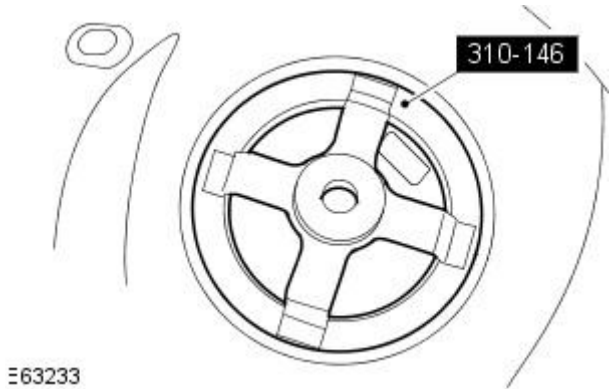
13. Detach and reposition the rear seat cushion insulation.



14. Remove the floor aperture cover.



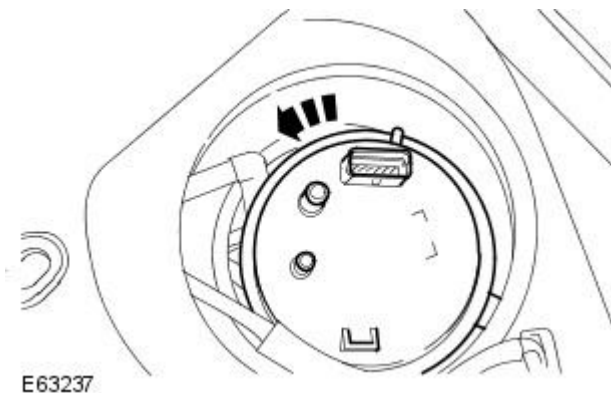
15. Using the special tool, remove the fuel transfer unit locking ring.




16.  CAUTION: Make sure no damage occurs to the fuel level float.

Remove the fuel transfer unit.

- Press down and rotate the base of the fuel transfer unit counter-clockwise.
- Remove and discard the O-ring seal.

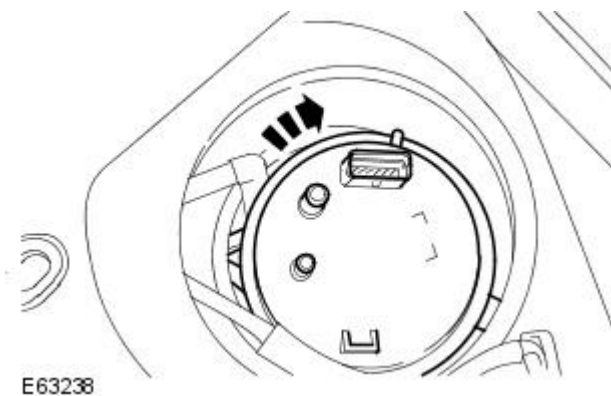


## Installation

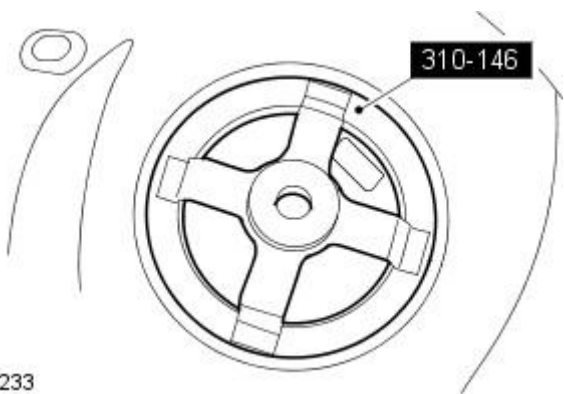
1.  CAUTION: Make sure no damage occurs to the fuel level float.

Install the fuel transfer unit.

- Press down and rotate the base of the fuel transfer unit clockwise.
- Install a new O-ring seal.





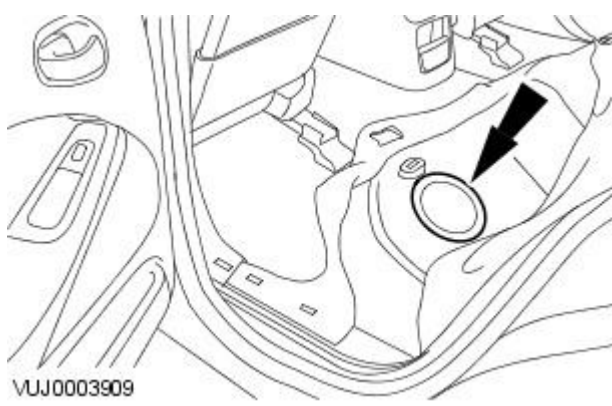


2. Using the special tool, install the fuel transfer unit locking ring.

- Tighten to 60 Nm.

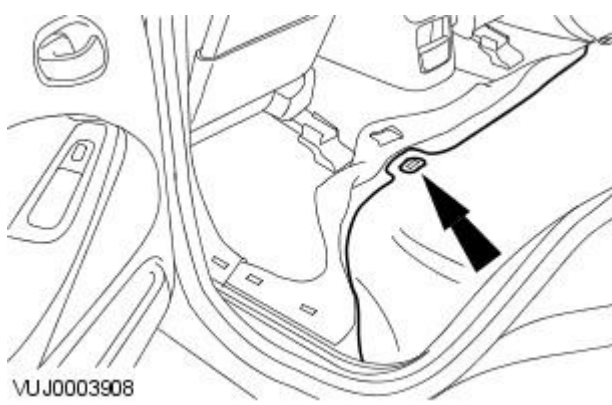
E63233

3. Install the floor aperture cover.



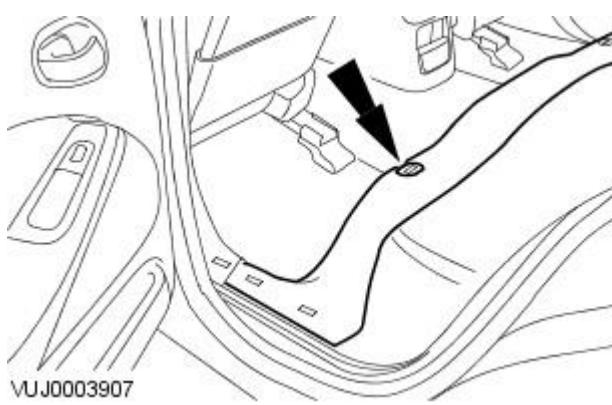
VUJ0003909

4. Attach the rear seat cushion insulation.



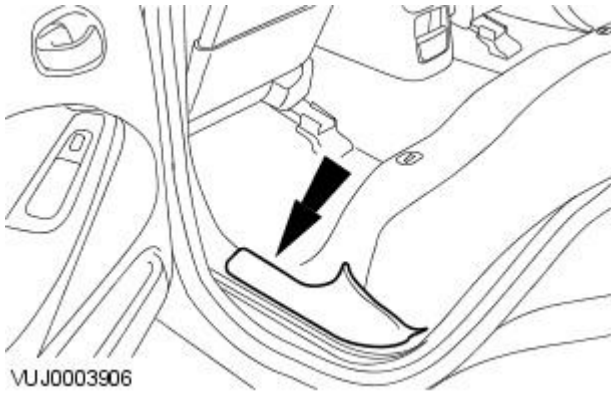
VUJ0003908

5. Attach the floor covering.

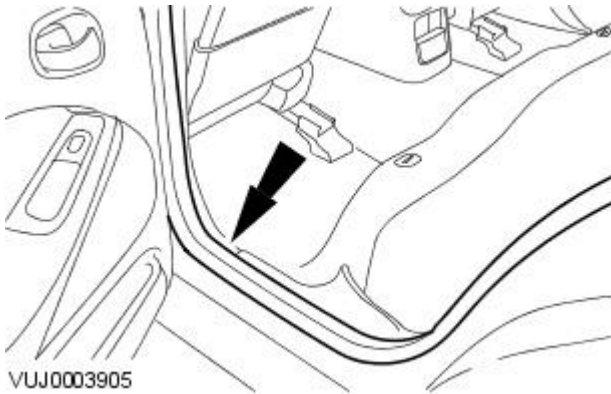


VUJ0003907

6. Install the scuff plate trim panel.



7. Attach the door opening weatherstrip.



8. CAUTIONS:

 On vehicles with supercharger make sure the arrow on the fuel pump module and the 'SC' marker on the fuel tank are aligned.

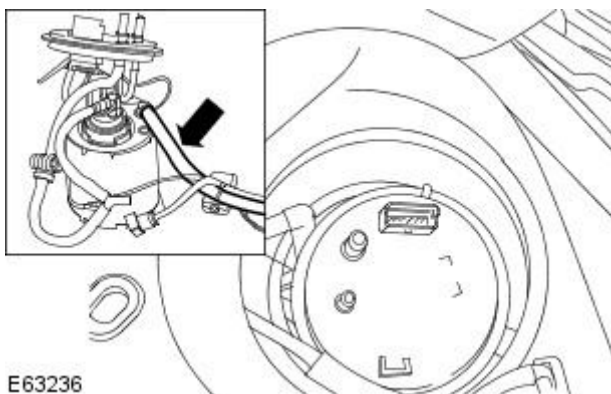
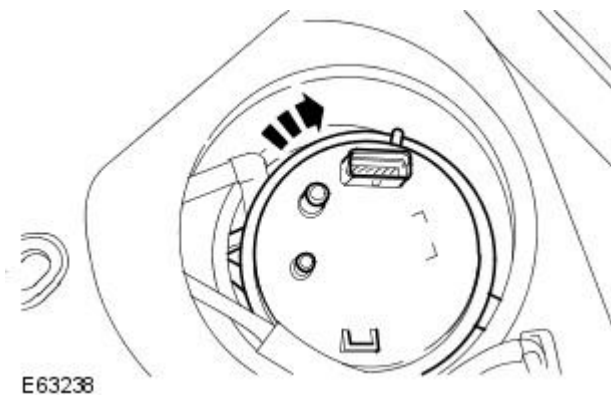
 On vehicles without supercharger make sure the arrow on the fuel transfer module and the 'NA' marker on the fuel tank are aligned.

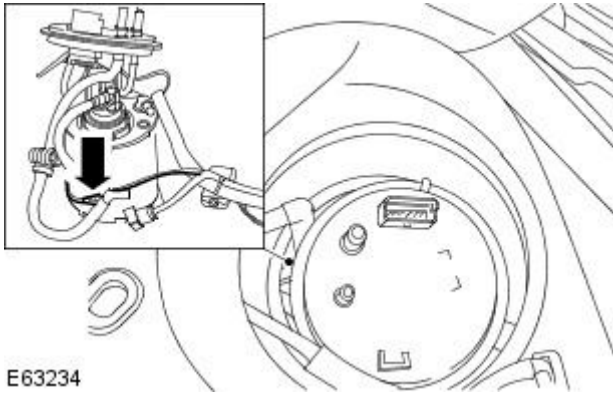
Secure the fuel pump module.

- Press down and rotate the base of the fuel pump module clockwise.

9. Connect the fuel transfer unit transfer return tube.

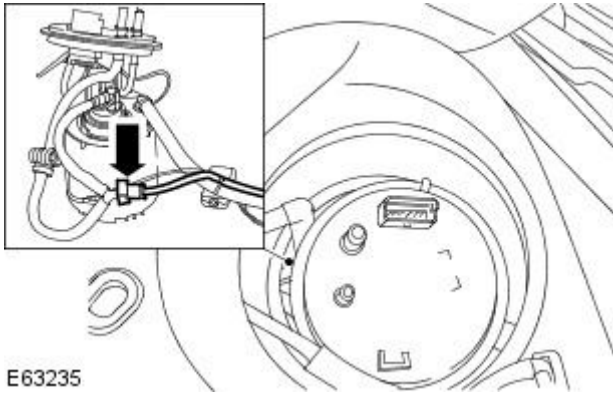
- Make sure the coupling has latched onto the fuel pump module by pulling the tube after the connection has been made.





E63234

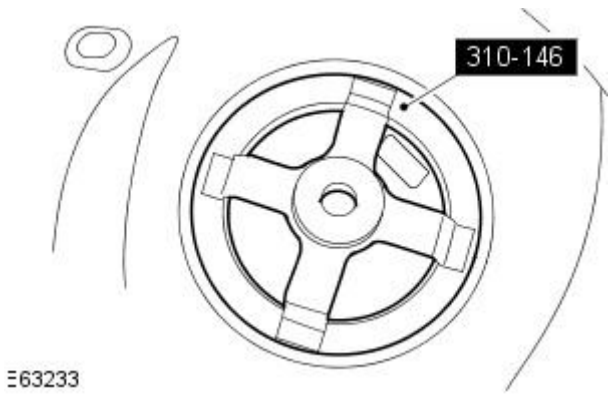
10. Connect the left-hand fuel sender gauge electrical connector.



E63235

11. Connect the fuel transfer unit transfer feed tube.

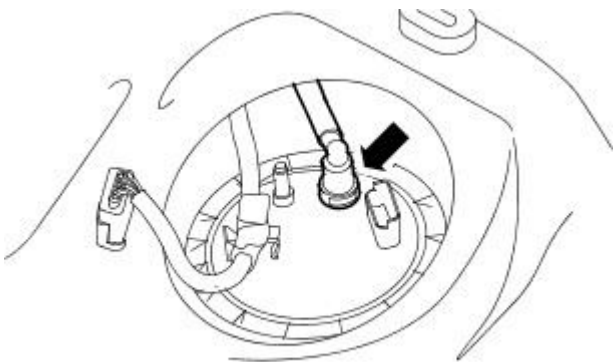
- Make sure the quick release coupling has latched onto the fuel pump module fuel tube by pulling the tube after the connection has been made.



E63233

12. Using the special tool, install the fuel pump module locking ring.

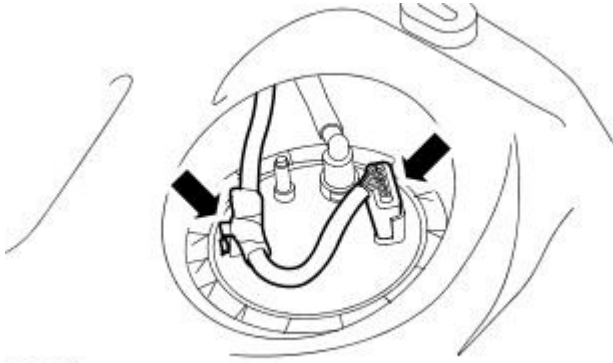
- Install a new O-ring seal.
- Tighten to 60 Nm.



E63232

13. Connect the fuel pump module quick release coupling.

- Make sure the quick release coupling has latched onto the fuel pump module fuel pipe by pulling the pipe after the connection has been made.



E63231

**14.** Connect the fuel pump module electrical connector.

- Attach the fuel pump module wiring harness to the retaining bracket.

**15.** Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

## Acceleration Control -

### Torque Specifications

Description	Nm	lb-ft	lb-in
Accelerator pedal	10	7	89

# Acceleration Control - Acceleration Control

Diagnosis and Testing

## Principles of Operation

For a detailed description of the acceleration controls, refer to the relevant Description and Operation sections in the workshop manual. REFER to: Acceleration Control (310-02, Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Accelerator pedal</li> <li>● Throttle body</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Wiring harness</li> <li>● Electrical connector(s)</li> <li>● Sensor(s)</li> <li>● Engine control module (ECM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the module or a component is suspect and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P012100	Throttle/Pedal Position Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● TP sensor sensing circuits TP 1 and TP 2 - short to power, high resistance</li> <li>● TP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check TP sensor sensing circuits TP 1 and TP 2 for short to power, high resistance. Check and install a new throttle body as required
P012200	Throttle/Pedal Position Sensor A Circuit Low	<ul style="list-style-type: none"> <li>● TP sensor sensing circuit TP 1 - short to ground, high resistance</li> <li>● TP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check TP sensor sensing circuit TP 1 for short to ground, high resistance. Check and install a new throttle body as required
P012300	Throttle/Pedal Position Sensor A Circuit High	<ul style="list-style-type: none"> <li>● TP sensor sensing circuit TP1 - short to power</li> <li>● TP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check TP sensor sensing circuit TP 1 for short to power. Check and install a new throttle body as required
P022200	Throttle/Pedal Position Sensor/Switch B Circuit Low	<ul style="list-style-type: none"> <li>● TP sensor sensing circuit TP 2 - short to ground, high resistance</li> <li>● TP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check TP sensor sensing circuit TP 2 for short to ground, high resistance. Check and install a new throttle body as required



DTC	Description	Possible Cause	Action
P022300	Throttle/Pedal Position Sensor/Switch B Circuit High	<ul style="list-style-type: none"> <li>TP sensor sensing circuit TP 2- short to power</li> <li>TP sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check TP sensor sensing circuit TP 2 for short to power. Check and install a new throttle body as required
P022700	Throttle/Pedal Position Sensor/Switch C Circuit Low	<ul style="list-style-type: none"> <li>APP sensor circuit APP 1 - short to ground, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check APP sensor circuit APP 1 for short to ground, high resistance
P022800	Throttle/Pedal Position Sensor/Switch C Circuit High	<ul style="list-style-type: none"> <li>APP sensor circuit APP 1 - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check APP sensor circuit APP 1 for short to power
P210129	Throttle Actuator Control Motor Circuit Range/Performance	<ul style="list-style-type: none"> <li>Signal invalid</li> <li>Jammed throttle blade, gearing or motor</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test throttle actuator control motor circuit for short to ground, power, high resistance. Suspect the throttle body, check and install a new throttle body as required, refer to the new module/component installation note at the top of the DTC Index
P210162	Throttle Actuator Control Motor Circuit Range/Performance	<ul style="list-style-type: none"> <li>Signal compare failure</li> <li>Jammed throttle blade, gearing or motor</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test throttle actuator control motor circuit for short to ground, power, high resistance. Suspect the throttle body, check and install a new throttle body as required, refer to the new module/component installation note at the top of the DTC Index
P210164	Throttle Actuator Control Motor Circuit Range/Performance	<ul style="list-style-type: none"> <li>Signal plausibility failure</li> <li>Jammed throttle blade, gearing or motor</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test throttle actuator control motor circuit for short to ground, power, high resistance. Suspect the throttle body, check and install a new throttle body as required, refer to the new module/component installation note at the top of the DTC Index
P210177	Throttle Actuator Control Motor Circuit Range/Performance	<ul style="list-style-type: none"> <li>Commanded position not achievable</li> <li>Throttle blade stuck open</li> <li>Intake air system leak</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test throttle actuator control motor circuit for short to ground, power, high resistance. Suspect the throttle body, check and install a new throttle body as required, refer to the new module/component installation note at the top of the DTC Index
P210329	Throttle Actuator Control Motor Circuit High	<ul style="list-style-type: none"> <li>Signal invalid</li> <li>Throttle motor control circuit - short to power</li> <li>ECM fault</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check throttle motor control circuit for short to power. If ECM is suspect, check and install a new module as required, refer to new module/component installation note at top of DTC Index
P210364	Throttle Actuator Control Motor Circuit High	<ul style="list-style-type: none"> <li>Signal plausibility failure</li> <li>Throttle motor control circuit - short to power</li> <li>ECM fault</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check throttle motor control circuit for short to power. If ECM is suspect, check and install a new module as required, refer to new module/component installation note at top of DTC Index
P210500	Throttle Actuator Control System - Forced Engine Shutdown	<ul style="list-style-type: none"> <li>Throttle MIL request due to fuel cut</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P211800	Throttle Actuator Control Motor Current Range/Performance	<ul style="list-style-type: none"> <li>Throttle motor control circuit - short to ground, power, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check throttle motor control circuit for short to ground, power, high resistance
P211900	Throttle Actuator Control Throttle Body Range/Performance	<ul style="list-style-type: none"> <li>Throttle spring faulty</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect throttle body faulty. Check and install a new throttle body as required, refer to the new module/component installation note at top of DTC Index
P212200	Throttle/Pedal Position Sensor/Switch D Circuit Low	<ul style="list-style-type: none"> <li>APP sensor circuit 2 - low input</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check APP sensor circuit 2 for short to ground, open circuit
P212216	Throttle/Pedal Position Sensor/Switch D Circuit Low Input	<ul style="list-style-type: none"> <li>Accelerator pedal position (APP) sensor circuit 1 - short to ground, power</li> <li>Accelerator pedal position (APP) sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check accelerator pedal position (APP) sensor circuit 1 for short to ground, power. Set ignition status to 'ON' engine 'OFF' check and record ' <b>Pedal value sensor 1</b> ' datalogger signal. With pedal in idle position, value of signal should be approximately 0%, if not suspect the pedal position sensor, check and install a new sensor as required

## Acceleration Control - Accelerator Pedal

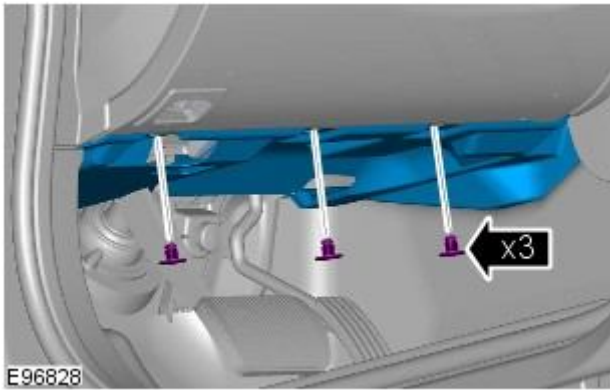
### Removal and Installation

#### Removal

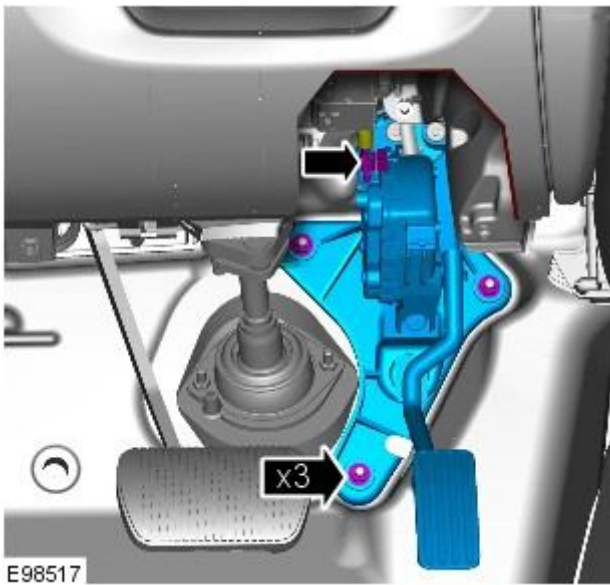
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.



3. Torque: 9 Nm



#### Installation

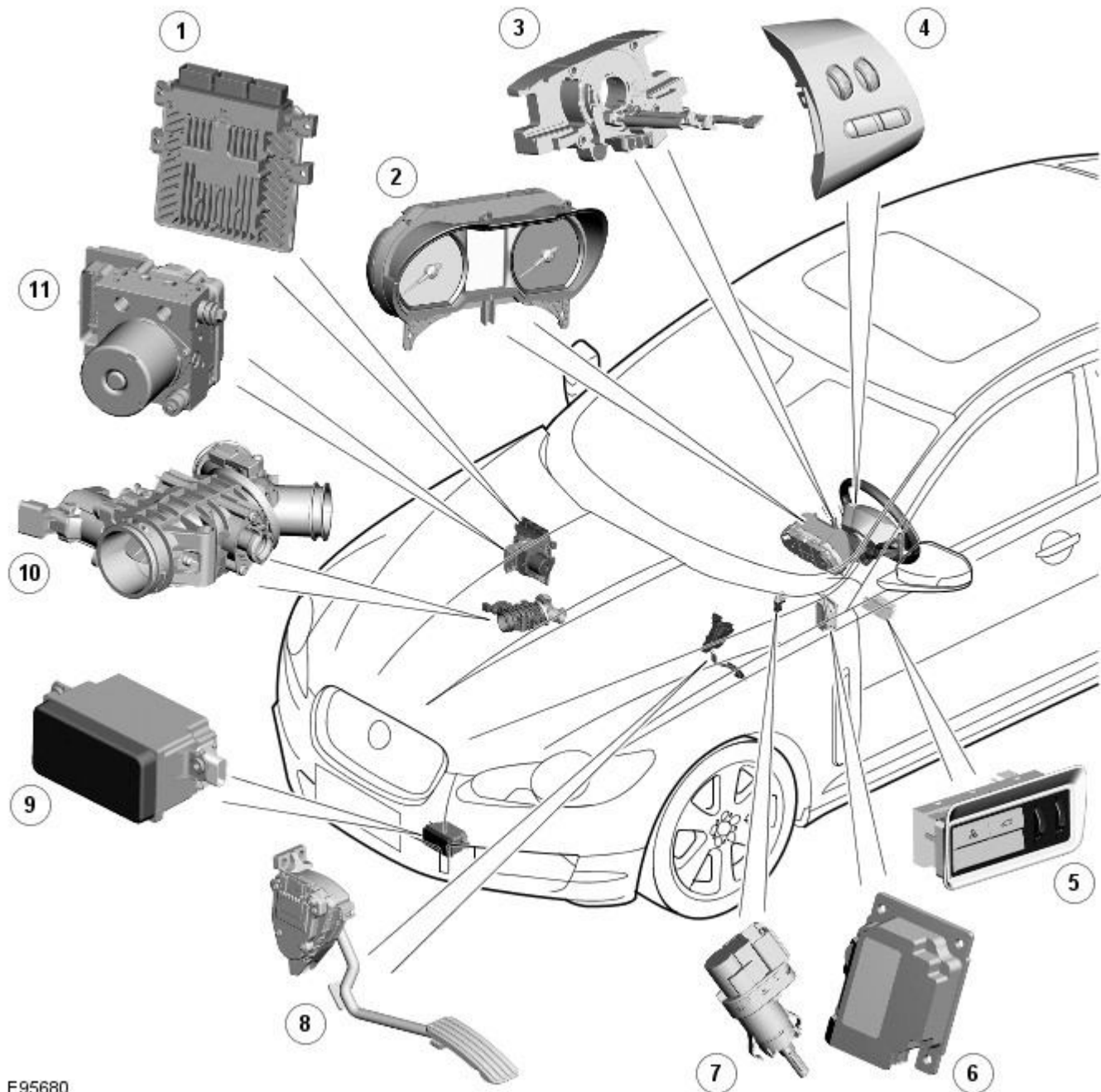
1. To install, reverse the removal procedure.

**Speed Control - TDV6 2.7L Diesel -**

Item	Specification		
Speed control module vertical alignment	90° ± 0.75°		
Description	Nm	lb-ft	lb-in
Speed control module retaining nuts	5	-	44
Speed control module alignment bolt lock nut	5	-	44

# Speed Control - TDV6 2.7L Diesel - Speed Control - Component Location

Description and Operation



E95680

## ItemDescription

1	<a href="#">ECM (engine control module)</a>
2	Instrument cluster
3	Clock spring
4	Speed control switches
5	Forward alert switch
6	Adaptive speed control module
7	<a href="#">BPP (brake pedal position) switch</a>
8	<a href="#">APP (accelerator pedal position)</a>
9	Adaptive speed control radar sensor
10	Electric throttle
11	<a href="#">ABS (anti-lock brake system) module</a>

# Speed Control - TDV6 2.7L Diesel - Speed Control - Overview

Description and Operation

## Overview

There are two variants of speed control available, a standard system and an adaptive system. The standard system maintains a set speed selected by the driver until operation is suspended or cancelled by a further input from the driver and is controlled by the [ECM \(engine control module\)](#)ECM. The adaptive system includes the same functionality as the standard system, but also has the ability to:

- Reduce vehicle speed, to less than the set speed, in order to maintain a selected distance behind a slower moving vehicle
- Accelerate the vehicle back to the set speed, once the way ahead is clear, after reducing the set speed because of a slower moving vehicle
- Alert the driver when the vehicle comes within a given distance of a slower moving vehicle

The standard system and the adaptive system both have the following components:

- A set +/- switch
- A RESUME switch
- A CANCEL switch

Both systems also use:

- The [ECM](#)
- The brake switch.
- The [APP \(accelerator pedal position\)](#) sensor.

The adaptive system incorporates the following additional components:

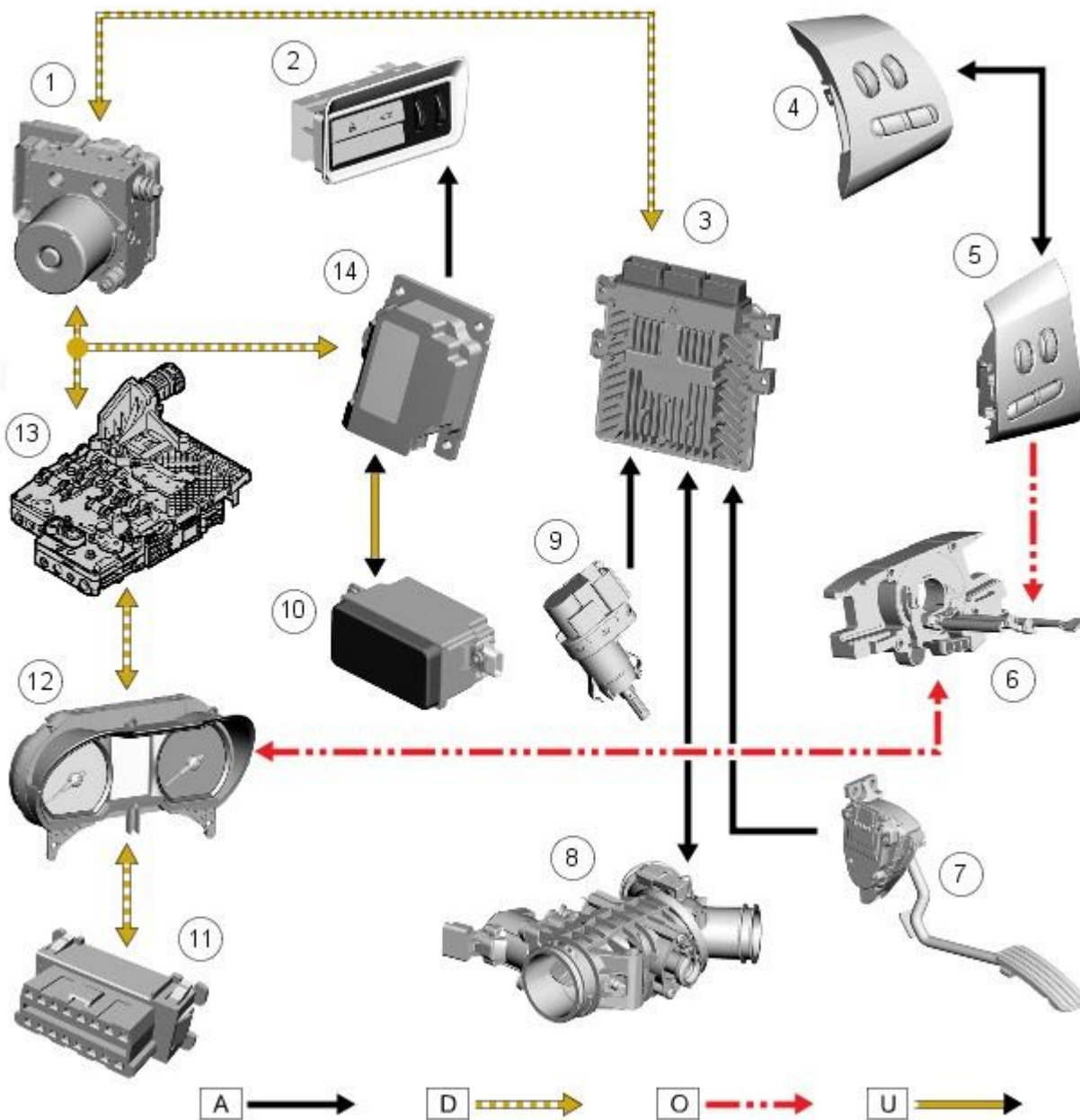
- An adaptive speed control module
- An adaptive speed control sensor
- A forward alert switch
- The [ABS \(anti-lock brake system\)](#) control module

# Speed Control - TDV6 2.7L Diesel - Speed Control - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **D** = High speed CAN (controller area network) bus; **O** = LIN bus; **U** = Private CAN bus



E139709

### ItemDescription

1	ABS (anti-lock brake system) module
2	Forward alert switch
3	ECM (engine control module)
4	Speed control switches
5	Audio control switches
6	Clockspring
7	APP (accelerator pedal position) sensor
8	Electric throttle
9	BPP (brake pedal position) switch
10	Adaptive speed control radar sensor
11	Diagnostic socket
12	Instrument cluster
13	TCM (transmission control module)
14	Adaptive speed control module

## System Operation



## Overview

The speed control system is integrated with the engine management system and uses Fueling intervention to automatically maintain a set vehicle speed. Once engaged, the system can also be used to accelerate the vehicle without using the accelerator pedal. The speed control system comprises the following components:

- '+' and '-' (set/accelerate and decelerate) steering wheel switches
- Resume switch
- Clock spring
- Speed control warning lamp.

The speed control system also uses inputs from the brake pedal switch, the [APP](#) sensor, the [ECM](#) and the [ABS](#) control module.

The speed control is operated by the driver using only the steering wheel switches. When speed control is active, the [ECM](#) regulates the [PWM \(pulse width modulation\)](#) signals to the fuel injectors to adjust the fuel supply as required to maintain the set speed.

During speed control operation, the [ECM](#) controls vehicle speed by adjusting fuel injection duration and timing. When the accelerator pedal is pressed with speed control active, the [ECM](#) outputs a calculated throttle angle signal in place of the actual throttle angle signals produced by the [APP](#) sensor. The calculated throttle angle is derived from fuel demand.

The minimum set speed for speed control is 20 mph (32 (km/h)). Speed control is automatically suspended if the following conditions apply:

- Vehicle speed falls below 16 mph (26 km/h).
- The brake pedal is pressed.
- The cancel button is pressed.
- Neutral, park or reverse gear is selected.
- The difference between actual speed and the set speed is too great.
- When the vehicle speed reaches a maximum speed of 150 mph (240 kph).
- If the accelerator pedal is used to accelerate beyond the set speed for too long.

## Adaptive Speed Control

The adaptive speed control system comprises the following components:

- Adaptive Speed Control Sensor
- Adaptive Speed Control module
- Steering wheel control switches
- [ECM](#)
- Electric throttle
- [ABS](#) module and pump
- Adaptive Speed Control warning lamp (in the instrument cluster)

The adaptive speed control system uses a forward looking radar sensor to scan the road ahead, looking for objects that are moving at a different rate to itself. When a target is identified the adaptive speed control system will monitor the time gap between it and the target vehicle. When that gap falls below a set driver selected level the adaptive speed control system will intervene slowing the vehicle by backing off the throttle and/ or applying the brakes, until the correct gap is attained. The driver can chose between four gap settings, 1, 1.4, 1.8 and 2.2 seconds.

The system will detect but not react to the following:

- Vehicles in the oncoming lane
- Stationary vehicles
- Pedestrians
- Vehicles not in the same lane

Adaptive speed control is active when the vehicle is moving. Adaptive Speed Control only functions when a set speed is entered in normal speed control mode. The adaptive speed control system only intervenes with the set speed when it detects a target vehicle, and then only if the minimum time gap is breached.

It is important to note that the system is intended for use in limited driving situations, does not remove control and responsibility from the driver, and at all times can be quickly overridden. The adaptive speed control system is not a collision warning system and will not react to stationary objects. The system does not operate below a minimum speed of approximately 16 mph (26 km/h) since it is unsuitable for use in cities or congested traffic. The system is best suited to main roads/ highways with gradual bends.

The [ECM](#), throttle body and throttle control are unchanged from those used for non Adaptive Speed Control variants.

The adaptive speed control system is based on the use of a front mounted radar sensor. The sensor transmits a 1.5° wide beam forward of the vehicle and detects the returning signals reflected off other vehicles and objects ahead.

The 1.5° wide radar beam is mechanically scanned at a rate of 10 sweeps/second across a total arc of 15° centered on the longitudinal axis of the vehicle. The radar operates at millimetric wavelengths (76 - 77 GHz) and transmits a frequency modulated continuous wave signal at a relatively low power level (no high power pulses).

With the ignition switched ON, the adaptive speed control module is powered up but no radar transmissions are emitted until the vehicle is in motion.

In follow mode a set speed is selected in the normal speed control manner and this speed is maintained until a slower vehicle is encountered in the lane ahead. When the vehicle ahead comes within the effective range of the radar sensor, the system identifies it as a target vehicle and an icon is illuminated on the instrument cluster to indicate that the system is in "follow mode". When the distance between the two vehicles closes to a set time gap, the adaptive speed control system closes the throttle and if necessary applies the brakes to maintain the set time gap. Follow mode is effectively a closed loop system. If several vehicles are ahead, the closest vehicle is chosen as the target to follow. If the target vehicle moves out of radar range, or if either vehicle changes lane or drops below the minimum operating speed, the system exits follow mode and the follow mode icon is extinguished. The adaptive speed control system will only raise its speed to the originally set speed, it will not accelerate past this speed to maintain a time gap.

Driver operation of the foot brake or control switches will immediately cancel adaptive speed control.

When the vehicle is in follow mode the follow mode warning indicator is illuminated in the instrument cluster and the current gap setting will be displayed in the message center.



E98452

### ItemDescription

- |   |                                 |
|---|---------------------------------|
| 1 | Forward Alert warning indicator |
| 2 | Follow mode warning indicator   |

The radar sensor detects three primary parameters of objects within the scanned arc. These are:

- Range
- Relative velocity
- Angle

**Range:** The radar sensor detects the presence and ranges of different vehicles and objects within the scanned arc up to a distance of approximately 130 meters. The transmitted signal frequency changes continuously in a cyclic pattern (modulation). This means that, in the time taken for the signal wave front, to travel to and from a target vehicle (or other object), the transmission frequency will have changed. The difference between the received signal frequency and the new transmission frequency is proportional to the distance between the transmitting vehicle and the target vehicle.

**Relative velocity:** When the signal is reflected off a vehicle moving at a different speed (opening or closing gap) an effect known as the Doppler shift causes an extra frequency modulation to be imposed on the signal. This Doppler frequency varies with the relative speed of the vehicle being followed, enabling the system to differentiate between vehicles traveling at different speeds and also between moving vehicles and stationary objects.

**Angle:** Using a narrow angle beam to scan horizontally enables the system to distinguish between vehicles in different lanes and between vehicles and roadside objects.

### System Restrictions

The adaptive speed control system is only intended to provide enhanced speed control as described above in certain restricted conditions. The following points should be noted:

- Automatic braking is limited to approximately 30% of full pressure (0.3G deceleration) and is intended to provide a smooth, gradual deceleration in follow mode conditions. Harsh braking by the target vehicle or following the target vehicle down to very low speeds or to a halt will require driver override of the brakes.
- While the radar sensor detects moving and stationary targets for assessment of the environment ahead, the system does not react to or provide any control in situations other than follow mode conditions. Stationary or slow moving vehicles (below 10 km/h), pedestrians, objects on the road and oncoming vehicles in the same lane are not recognized.

**WARNING:** It must be emphasized that the adaptive speed control system is not a collision warning or avoidance system and that, other than the limited conditions of follow mode, driver intervention will be necessary to control the vehicle speed.

In follow mode, some situations may cause target ambiguities for the detection system. These situations include:

- The nearby presence of a third vehicle when driving on a line slightly offset to the target vehicle.
- Vehicles edging into the lane ahead which are not detected by the system until they have moved into the radar beam.

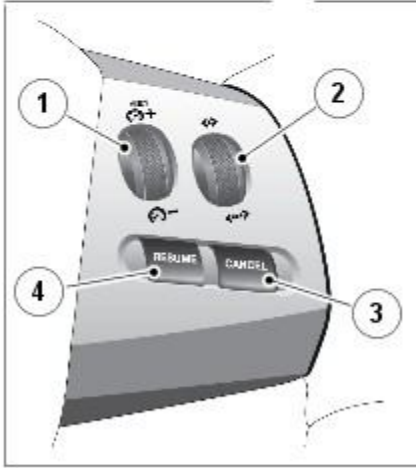
On the approach to, or exit from a bend, a target vehicle may be lost or a new target acquired as vehicles ahead change their angular position with respect to the radar sensor. On a straight road, if the sensing vehicle is in follow mode below its selected set speed, losing the target vehicle will cause the sensing vehicle to accelerate to this set speed. This acceleration is undesirable either on, or entering a bend when the target is suddenly lost, and in this situation the system inhibits the resumption of the set speed.

The speed control system compares vehicle speed data from the [ABS](#) system with the relative speed of an external object as detected by the radar sensor to ascertain whether the object is stationary or not.

• **NOTE:** If tires are fitted which are different in diameter from those specified for the vehicle, the vehicle speed calculated by the [ABS](#) will not be the true road speed. This situation may cause stationary objects to be falsely identified as moving vehicles and result in automatic deceleration on a clear road.

## Component Description

### Speed Control Switches



E98448

**ItemDescription**

1	Set speed adjustment switch
2	Time gap switch
3	Cancel switch
4	Resume switch

The speed control switches are located on the RH (Right-hand) side of the steering wheel. The switches are connected via fly leads to the clock spring. The speed control switches are resistive ladder type switches which vary the resistance of a 5 volt signal sent to them. The signal is returned along a Lin bus to the instrument cluster. The instrument cluster routes the control signals to the [ECM](#) on the HS [CAN](#).

Speed control is engaged by rotating the speed adjustment switch to the + or - positions. Once engaged the speed can be varied by the speed adjustment switches. Each press of the speed adjustment switch will increase or decrease the set speed in steps of 1 mph (2 kph).

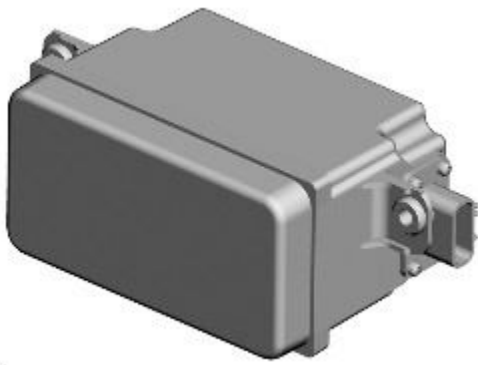
**Adaptive Speed Control Module**



E98450

The Adaptive Speed Control module, located on the drivers side at the bottom of the A post. The control module is connected to the other vehicle systems via the high speed [CAN](#) bus. Signals from the Adaptive Speed Control forward looking radar sensor are received on a dedicated [CAN](#) bus between the two modules.

**Adaptive Speed Control Radar Sensor**



E98451

The adaptive speed control radar sensor is located in the front bumper, on the **RH (right-hand)** side above the radiator grill behind the bumper cover. The sensor is connected to the Adaptive Speed Control, module via a private **CAN** bus. If the unit is replaced in service the unit must be re-aligned vertically. Horizontal alignment is achieved by putting the sensor in service mode via the recommended Jaguar diagnostic tool.

The vehicle is then driven for a short period while the sensor calibrates itself. Calibration is complete when the 'follow' icon in the instrument cluster stops flashing.

## Forward Alert Switches



E98449

### ItemDescription

1 Forward alert switch

The forward alert system utilizes the Adaptive Speed Control system components. Forward alert is turned on and off independently of Adaptive Speed Control, via a switch mounted in the lower outboard knee bolster switchpack. Forward alert will notify the driver by means of a chime, and warning indicator in the instrument cluster and indication in the message center, when a target vehicle comes into range. The system will NOT use throttle or brake intervention to slow the vehicle.

The forward alert switch is connected to the instrument cluster in a resistive ladder with the luggage compartment opening switch and the fuel filler flap switch. The instrument cluster sends the forward alert information to the Adaptive speed control module on the **CAN** bus.

• **NOTE: This system is intended as a driver aid and should be used as such. The system is NOT a collision warning or avoidance device.**

The system sensitivity can be adjusted in the same manner as the Adaptive Speed Control, via the steering wheel mounted switches. Each adjustment is accompanied by a message in the message center.

# Speed Control - TDV6 2.7L Diesel - Speed Control

Diagnosis and Testing

## Principles of Operation

For a detailed description of the speed control system, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

- [Speed Control](#) (310-03A Speed Control - TDV6 2.7L Diesel, Description and Operation),
- [Speed Control](#) (310-03A Speed Control - TDV6 2.7L Diesel, Description and Operation),
- [Speed Control](#) (310-03A Speed Control - TDV6 2.7L Diesel, Description and Operation),
- [Speed Control](#) (310-03 Speed Control - 3.0L, Description and Operation),
- [Speed Control](#) (310-03 Speed Control - 3.0L, Description and Operation),
- [Speed Control](#) (310-03 Speed Control - 3.0L, Description and Operation),
- [Speed Control](#) (310-03C Speed Control - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Description and Operation),
- [Speed Control](#) (310-03C Speed Control - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Description and Operation),
- [Speed Control](#) (310-03C Speed Control - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Speed control sensor</li> <li>● Ensure the speed control sensor is free from obstructions</li> <li>● Speed control module</li> <li>● Brake switch</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Wiring harness</li> <li>● Electrical connector(s)</li> <li>● Steering wheel switches</li> <li>● Brake switch</li> <li>● Speed control sensor</li> <li>● Speed control module</li> <li>● Engine Control Module (ECM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Speed Control Sensor Adjustment (vehicles with adaptive system installed)

An incorrectly aligned speed control sensor can cause incorrect system operation. Before starting any repair work on the speed control system, on vehicles with the adaptive system installed, check speed control sensor for correct vertical alignment, and carry out speed control sensor alignment procedure using manufacturer approved diagnostic system.

## Symptom Chart

Symptom	Possible Cause	Action
Speed control inhibited or disabled	<ul style="list-style-type: none"> <li>● Power or ground supply to speed control module or speed control sensor</li> <li>● Steering wheel speed control switch/circuits</li> <li>● Throttle sensors</li> <li>● Brake switch</li> <li>● Anti-Lock Brake System fault</li> </ul>	<ul style="list-style-type: none"> <li>● Check for DTCs that could be caused by power or ground failure to the module or sensor and refer to DTC Index</li> <li>● Check for sticking, jammed and broken speed control switches. Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit</li> <li>● For throttle position sensor tests. REFER to: <ul style="list-style-type: none"> <li><a href="#">Electronic Engine Controls</a> (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Diagnosis and Testing),</li> <li><a href="#">Electronic Engine Controls</a> (303-14B Electronic Engine Controls - V6 3.0L Petrol, Diagnosis and Testing),</li> <li><a href="#">Electronic Engine Controls</a> (303-14C Electronic Engine Controls - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Diagnosis and Testing).</li> </ul> </li> <li>● Check for correct installation and adjustment of brake switch. Refer to the electrical circuit diagrams and check brake switch circuits for short, open circuit</li> <li>● Check ABS system for related DTCs and refer to the relevant DTC Index</li> </ul>
Unable to regulate/adjust vehicle speed	<ul style="list-style-type: none"> <li>● Steering wheel switch malfunction</li> </ul>	<ul style="list-style-type: none"> <li>● Check for sticking, jammed and broken speed control switches. Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit</li> </ul>
Unable to cancel speed control from steering wheel	<ul style="list-style-type: none"> <li>● Steering wheel switch malfunction</li> </ul>	<ul style="list-style-type: none"> <li>● Check for sticking, jammed and broken speed control switches. Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit</li> </ul>
Unable to cancel speed control from brake pedal	<ul style="list-style-type: none"> <li>● Brake switch malfunction</li> </ul>	<ul style="list-style-type: none"> <li>● Check for correct installation and adjustment of brake switch. Refer to the electrical circuit diagrams and check brake switch circuits for short, open circuit</li> </ul>

## DTC Index

## Vehicles WITH Adaptive System Installed



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

- NOTE: If a module or component is suspect, and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).
- NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.
- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1A8481	Car Configuration Data	<ul style="list-style-type: none"> <li>RJB reporting invalid data</li> </ul>	Re-configure the RJB using manufacturer approved diagnostic system
C1A6754	Forward Looking Sensor	<ul style="list-style-type: none"> <li>Speed control sensor out of alignment</li> </ul>	Check speed control sensor for correct vertical alignment, and carry out speed control sensor alignment procedure using manufacturer approved diagnostic system
C1A6781	Forward Looking Sensor	<ul style="list-style-type: none"> <li>Yaw voltage unreasonable for 0.5 seconds or unchanged for 1.2 seconds. Note: Yaw sensor internal to speed control sensor</li> </ul>	Clear DTC and re-test, if DTC remains suspect speed control sensor. Check and install a new sensor as required, refer to the new module/component installation note at the top of the DTC Index
C1A6787	Forward Looking Sensor	Incorrect or missing data from speed control sensor	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies for short, open circuit. Check private CAN network between speed control sensor and speed control module for failure, clear DTC and re-test. If DTC remains suspect the speed control sensor, check and install a new sensor as required, refer to the new module/component installation note at the top of the DTC Index
C1A6796	Forward Looking Sensor	<ul style="list-style-type: none"> <li>Internal hardware failure</li> </ul>	Suspect the speed control sensor. Check and install a new sensor as required, refer to the new module/component installation note at the top of the DTC Index
C1A6797	Forward Looking Sensor	<ul style="list-style-type: none"> <li>Sensor reduced visibility</li> </ul>	Check for blockage in front of radar. Note: This DTC will be cleared automatically when environmental conditions allow
C1A6798	Forward Looking Sensor	<ul style="list-style-type: none"> <li>Speed control sensor internal temperature exceeded threshold</li> </ul>	Allow system to cool. Note: This DTC will be cleared automatically when environmental conditions allow
P174E81	Output Shaft Speed/ABS Wheel Speed Correlation	<ul style="list-style-type: none"> <li>Follow speed is mis-calculated to too high a value</li> </ul>	Clear DTC and re-test
U000188	High Speed CAN Communication Bus	<ul style="list-style-type: none"> <li>Vehicle CAN Bus off condition</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
U010000	Lost Communications With ECM/PCM "A"	<ul style="list-style-type: none"> <li>ECM missing message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check ECM for related DTCs and refer to the relevant DTC Index
U010100	Lost Communications With TCM	<ul style="list-style-type: none"> <li>TCM missing message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check TCM for related DTCs and refer to the relevant DTC Index
U010387	Lost Communication With Gear Shift Module	<ul style="list-style-type: none"> <li>Transmission shift module missing message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check transmission shift module for related DTCs and refer to the relevant DTC Index
U012100	Lost Communication With Anti-lock Brake System (ABS) Control Module	<ul style="list-style-type: none"> <li>ABS missing message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check ABS for related DTCs and refer to the relevant DTC Index
U012800	Lost Communications With Park Brake Module	<ul style="list-style-type: none"> <li>Parking brake missing message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check parking brake module for related DTCs and refer to the relevant DTC Index
U015500	Lost Communications With Instrument Panel Cluster (IPC) Control Module	<ul style="list-style-type: none"> <li>Instrument cluster missing message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check instrument cluster for related DTCs and refer to the relevant DTC Index
U030000	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>Invalid configuration message is received</li> </ul>	Re-configure the speed control module using the manufacturer approved diagnostic system. Clear DTCs and re-test. If DTC still logged, suspect incorrect speed control module installed. Check and install a new module as required, refer to new module/component installation note at top of DTC Index
U030055	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>RJB - at least one of the car configuration parameters is not configured</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system



DTC	Description	Possible Cause	Action
U040100	Invalid Data Received From ECM/PCM A	<ul style="list-style-type: none"> <li>ECM did not respond properly to speed control cancel or auto brake cancel request</li> </ul>	Check ECM for related DTCs and refer to relevant DTC Index
U040167	Invalid Data Received From ECM/PCM A	<ul style="list-style-type: none"> <li>ECM did not respond properly to speed control resume request</li> </ul>	Check ECM for related DTCs and refer to relevant DTC Index
U040181	Invalid Data Received From ECM/PCM A	<ul style="list-style-type: none"> <li>Invalid data received from engine control module</li> <li>Bus signal/message failure</li> <li>Speed control inhibited by ECM</li> </ul>	Check the Engine Control Module for related DTCs and refer to relevant DTC Index. If U040181 is logged as historic but no other DTCs have logged in the engine control module at the same time and distance, it may be caused by cranking with low voltage conditions. Check battery and charging system according to instructions in the battery care manual. Install the latest Engine Control Module software using the manufacturer approved diagnostic system, contact Dealer Technical Support before replacing components
U041581	Invalid Data Received From Anti-lock Brake System (ABS) Control Module	<ul style="list-style-type: none"> <li>Stability assist fault</li> </ul>	Check ABS module for related DTCs and refer to relevant DTC Index
U041767	Invalid Data Received From Park Brake Control Module	<ul style="list-style-type: none"> <li>Parking brake module did not respond properly to apply request</li> </ul>	Check parking brake module for related DTCs and refer to relevant DTC Index
U041781	Invalid Data Received From Park Brake Control Module	<ul style="list-style-type: none"> <li>Speed control inhibited by parking brake module</li> </ul>	Check parking brake module for related DTCs and refer to relevant DTC Index
U042381	Invalid Data Received From Instrument Panel Control Module	<ul style="list-style-type: none"> <li>Speed control inhibited by instrument cluster</li> </ul>	Check instrument cluster, CJB and RJB for related DTCs and refer to relevant DTC Index
U1A1449	CAN Initialisation Failure	<ul style="list-style-type: none"> <li>Internal electronic failure</li> </ul>	Suspect the speed control module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U210100	Control Module Configuration Incompatible	<ul style="list-style-type: none"> <li>Data sent from RJB is invalid</li> </ul>	Check/amend Car Configuration File using the manufacturer approved diagnostic system, clear DTC and re-test. If DTC remains, re-configure RJB using manufacturer approved diagnostic system, clear DTC and re-test. If DTC remains check RJB for DTCs and refer to DTC Index
U300041	Control Module	<ul style="list-style-type: none"> <li>Internal micro controller error</li> <li>Checksum fault</li> </ul>	Suspect the speed control module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300042	Control Module	<ul style="list-style-type: none"> <li>Internal RAM test fault</li> </ul>	Suspect the speed control module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300049	Control Module	<ul style="list-style-type: none"> <li>Internal control module failure</li> </ul>	Suspect the speed control module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index

### Vehicles WITHOUT Adaptive System Installed



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

- NOTE: If a module or component is suspect, and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).
- NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.
- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P050082	Vehicle Speed Sensor A	<ul style="list-style-type: none"> <li>Vehicle speed - invalid signal received over CAN</li> </ul>	Check ABS for related DTCs and refer to relevant DTC Index
P050086	Vehicle Speed Sensor A	<ul style="list-style-type: none"> <li>Vehicle speed - invalid signal received over CAN</li> </ul>	Check ABS for related DTCs and refer to relevant DTC Index
P050100	Vehicle Speed Sensor A Range/Performance	<ul style="list-style-type: none"> <li>Vehicle speed signal from ABS not plausible</li> </ul>	Carry out CAN network integrity test using the manufacturer approved diagnostic system. Contact Dealer Technical Support for further assistance
P050162	Vehicle Speed Sensor A Range/Performance	<ul style="list-style-type: none"> <li>Vehicle speed - range performance</li> </ul>	Check ABS/TCM for related DTCs and refer to relevant DTC Index
P050400	Brake Switch A / B Correlation	<ul style="list-style-type: none"> <li>The brake pressure reading does not agree with the brake light switch value</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check brake switch circuits for short, open circuit, high resistance

DTC	Description	Possible Cause	Action
P050401	Brake Switch A / B Correlation	<ul style="list-style-type: none"> <li>● Brake switch high fault: <ul style="list-style-type: none"> <li>- Brake lights stuck on</li> <li>- Gearshift interlock inoperative</li> <li>- Speed control inoperative</li> </ul> </li> <li>● Brake switch low fault: <ul style="list-style-type: none"> <li>- Brake lights inoperative</li> <li>- Gearshift stuck in Park</li> <li>- Reduced engine braking</li> </ul> </li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check brake switch circuits for short, open circuit, high resistance
P056600	Cruise Control OFF Signal	<ul style="list-style-type: none"> <li>● Speed control Cancel switch 2 stuck closed</li> </ul>	Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit. Check for stuck switch. Check and install a new speed control switch as required
P056700	Cruise Control DECREASE DISTANCE Signal	<ul style="list-style-type: none"> <li>● Speed control Resume switch 7 stuck closed</li> </ul>	Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit. Check for stuck switch. Check and install a new speed control switch as required
P056800	Cruise Control INCREASE DISTANCE Signal	<ul style="list-style-type: none"> <li>● Speed control Accel Set Plus Switch 6 stuck closed</li> </ul>	Check and install a new speed control switch as required
P056900	Cruise Control COAST Signal	<ul style="list-style-type: none"> <li>● Speed control Coast Set Minus switch 3 stuck closed</li> </ul>	Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit. Check for stuck switch. Check and install a new speed control switch as required
P056A00	Cruise Control INCREASE DISTANCE Signal	<ul style="list-style-type: none"> <li>● Speed control Headway Plus switch 4 stuck closed</li> </ul>	Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit. Check for stuck switch. Check and install a new speed control switch as required
P056B00	Cruise Control DECREASE DISTANCE Signal	<ul style="list-style-type: none"> <li>● Speed control Headway Minus switch 5 stuck closed</li> </ul>	Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit. Check for stuck switch. Check and install a new speed control switch as required
P057162	Brake Switch A Circuit	<ul style="list-style-type: none"> <li>● Plausibility error</li> </ul>	Refer to the electrical circuit diagrams and check brake light switch signal circuits for short, open circuit. Check and install a new brake light switch as required
P057501	Cruise Control Input Circuit	<ul style="list-style-type: none"> <li>● General electrical failure</li> </ul>	Check speed control system for related DTCs and refer to relevant DTC Index. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
P057616	Cruise Control Input Circuit Low	<ul style="list-style-type: none"> <li>● Circuit voltage below threshold</li> </ul>	Check speed control system for related DTCs and refer to relevant DTC Index. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
P057717	Cruise Control Input Circuit High	<ul style="list-style-type: none"> <li>● Circuit voltage above threshold</li> </ul>	Check speed control system for related DTCs and refer to relevant DTC Index. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
P057800	Cruise Control Multi-Function Input A Circuit Stuck	<ul style="list-style-type: none"> <li>● One of speed control switches stuck</li> </ul>	Check for stuck speed control switch, install a new switch pack as required
P05781C	Cruise Control Multi-Function Input A Circuit Stuck	<ul style="list-style-type: none"> <li>● Circuit voltage out of range</li> </ul>	Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit. Check for stuck switch. Check and install a new speed control switch as required
P05791C	Cruise Control Multi-Function Input A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Speed control switch pack internal failure</li> </ul>	Check and install a new speed control switch pack as required
P057929	Cruise Control Multi-Function Input A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Signal invalid</li> </ul>	Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit. Check for stuck switch. Check and install a new speed control switch as required
P059000	Cruise Control Multi-Function Input B Circuit Stuck	<ul style="list-style-type: none"> <li>● Active speed limiter fault</li> </ul>	Check for active speed limiter fault, install a new transmission shift module as required

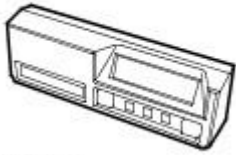
# Speed Control - TDV6 2.7L Diesel - Speed Control Sensor Adjustment

General Procedures

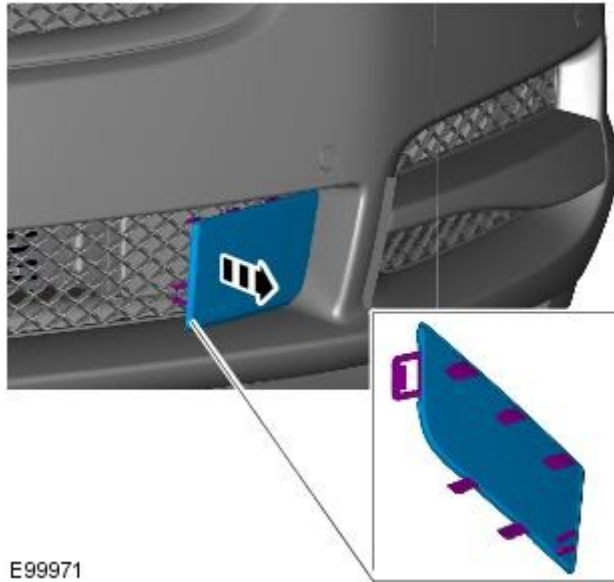
## Special Tool(s)

501-F007

501-F007  
Inclinometer



E65956



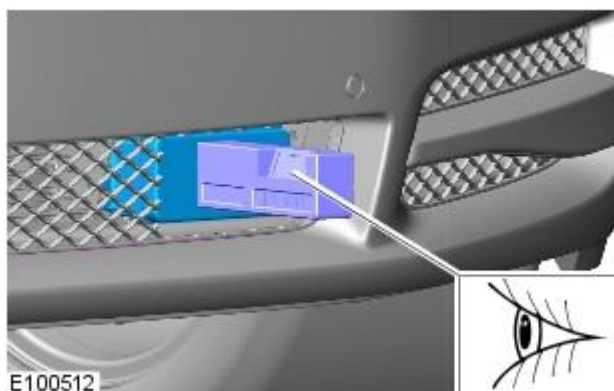
E99971

1.  CAUTION: Protect the surrounding paintwork to avoid damage.



E100511

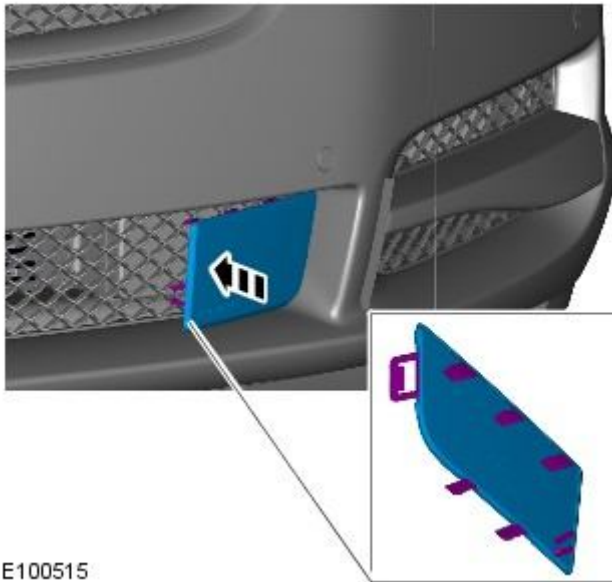
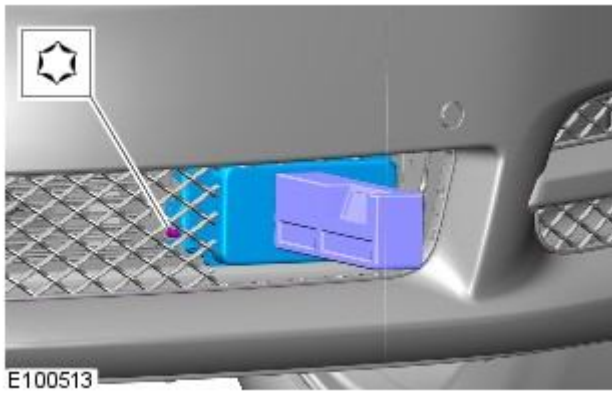
2. 2. NOTE: Make sure that the vehicle is standing on a level surface.



E100512

3. 3. NOTE: Make sure that the vehicle is standing on a level surface.

Special Tool(s): [501-F007](#)



4. **4. NOTE:** Do not release the lock nut.

- **NOTE:** Make sure that the vehicle is standing on a level surface.

*Special Tool(s):* [501-F007](#)

5. **5. ⚠ CAUTION:** Protect the surrounding paintwork to avoid damage.

6.

- Configure the ACC module using the diagnostic tool.
- This procedure is required if:
- A new ACC radar and, or ACC module are installed.
- The ACC radar needed to be removed or is misaligned in its position due to another repair operation.

7.

- From the diagnostic tool menu, select: Service Alignment Mode.
- The follow indicator will now be flashing, this indicates that the vehicle is in "service alignment" and now requires driving.
- The vehicle speed must be above 30mph (48 kph).
- Choose a road with plenty of stationary objects, like street lights, road signs, or barriers. Use an inside or outside lane.
- Following vehicles too closely will obscure the stationary targets from the radar, a time gap of 2 seconds is recommended.
- A straight road will produce a quicker and better result, although the process will still operate on a curved road.
- The time that the ACC module takes to align will vary, depending on the route, speed, number of targets, and individual module.
- When the flashing follow indicator light extinguishes, the ACC system is now functional, and a required vehicle speed can now be set by the driver and the ACC system will operate as normal.

# Speed Control - TDV6 2.7L Diesel - Speed Control Deactivator Switch

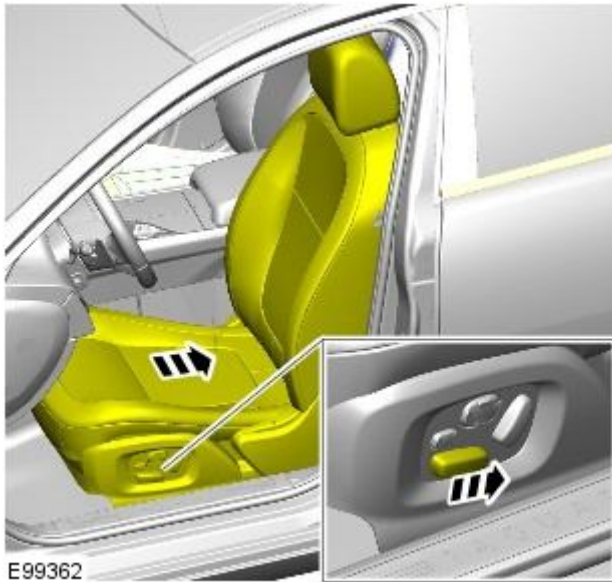
Removal and Installation

## Removal

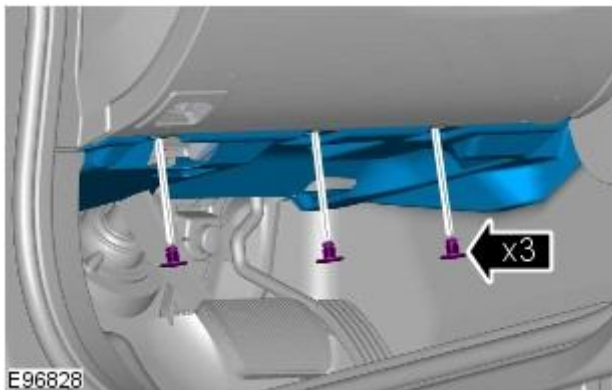
- NOTE: Removal steps in this procedure may contain installation details.


1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

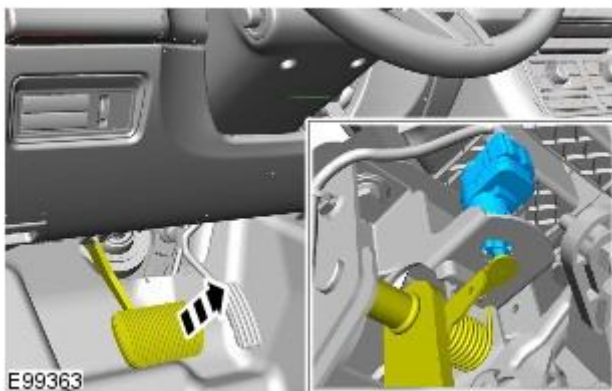
2.

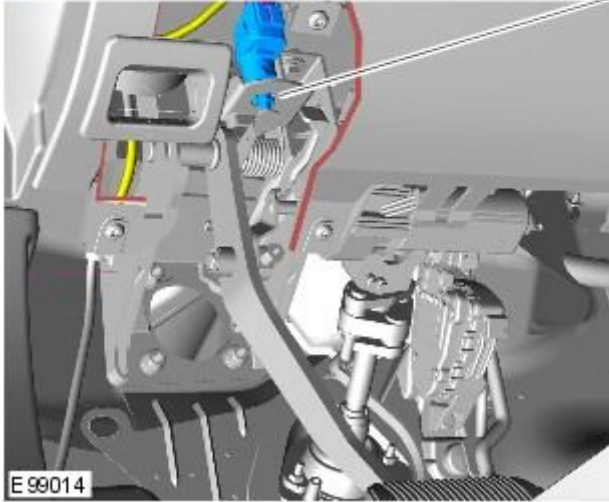
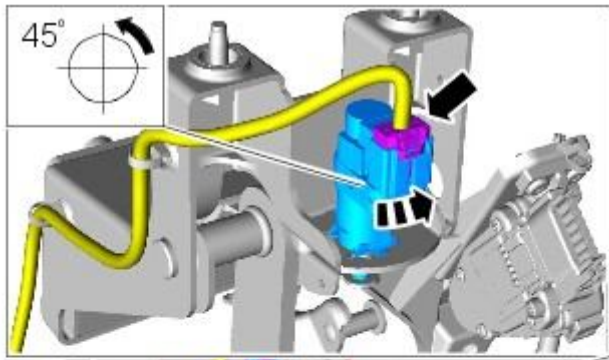



3.

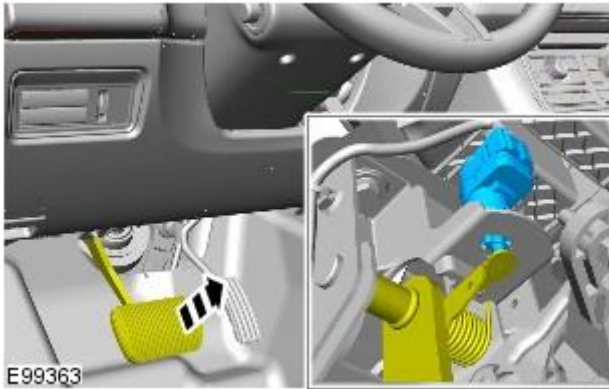



4.  CAUTION: Make sure that the brake pedal remains in the rest position during this procedure.





5.  CAUTION: Make sure that the brake pedal remains in the rest position during this procedure.



6.  CAUTION: Make sure that the brake pedal remains in the rest position during this procedure.

## Installation

1. To install, reverse the removal procedure.



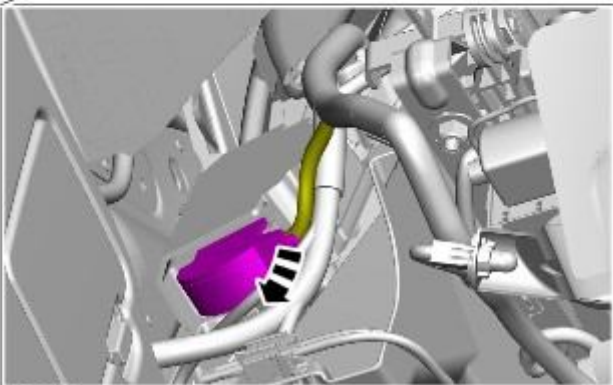
# Speed Control - TDV6 2.7L Diesel - Speed Control Module

Removal and Installation

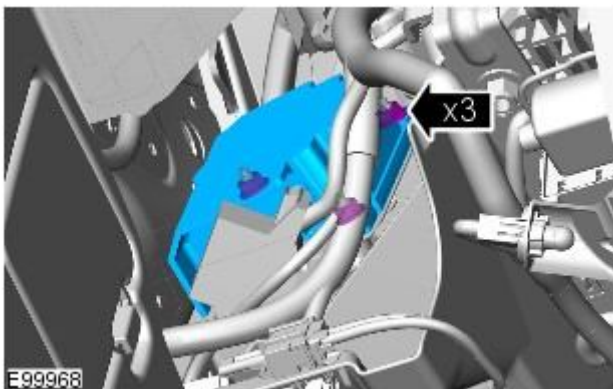
## Removal

• NOTE: Removal steps in this procedure may contain installation details.


1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Speed Control Sensor Adjustment (310-03, General Procedures).
3. Refer to: [Instrument Panel Lower Trim Panel](#) (501-12 Instrument Panel and Console, Removal and Installation).
- 4.



E99967



E99968

5.  CAUTION: Make sure that all diagnostic trouble codes (DTCs) have been removed after the road test.

Torque: 4 Nm

## Installation

1. To install, reverse the removal procedure.

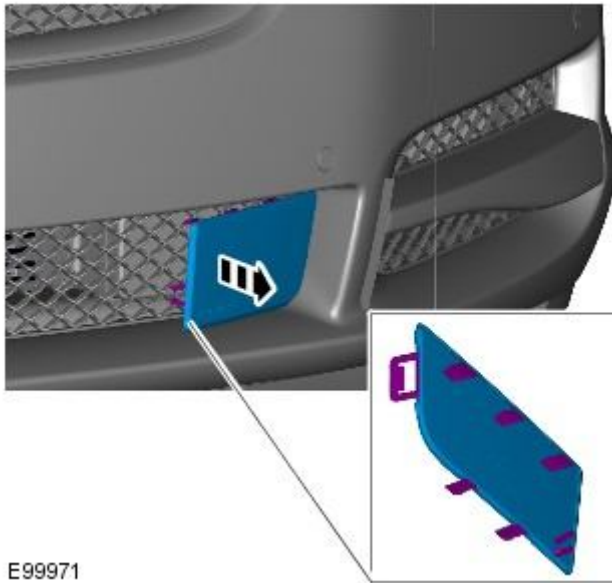
# Speed Control - TDV6 2.7L Diesel - Speed Control Sensor

## Removal and Installation

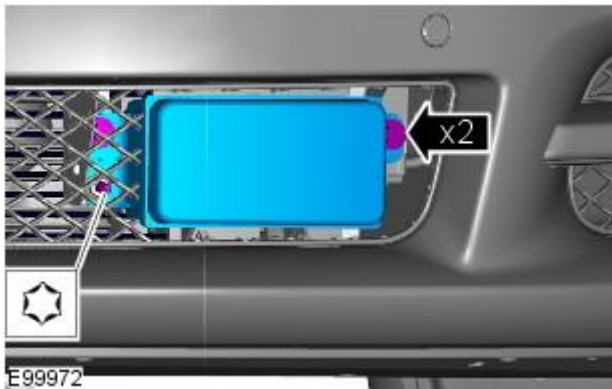
### Removal

- NOTE: Removal steps in this procedure may contain installation details.

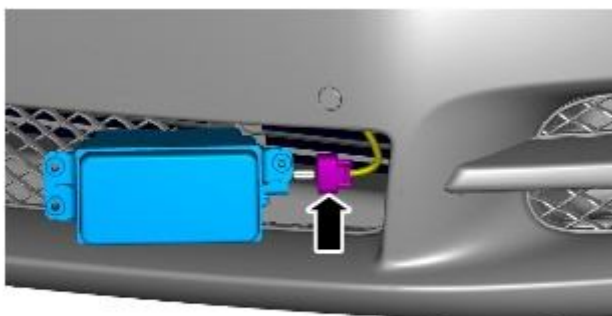
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Speed Control Sensor Adjustment (310-03, General Procedures).




3.  CAUTION: Protect the surrounding paintwork to avoid damage.



4. Torque: 5 Nm



5.  CAUTION: Make sure that all diagnostic trouble codes (DTCs) have been removed after the road test.
  - NOTE: Make sure that the sensor is aligned after installation as described in the speed control sensor adjustment procedure.

### Installation

1. To install, reverse the removal procedure.

# Speed Control - TDV6 2.7L Diesel - Speed Control Switch

Removal and Installation

## Removal

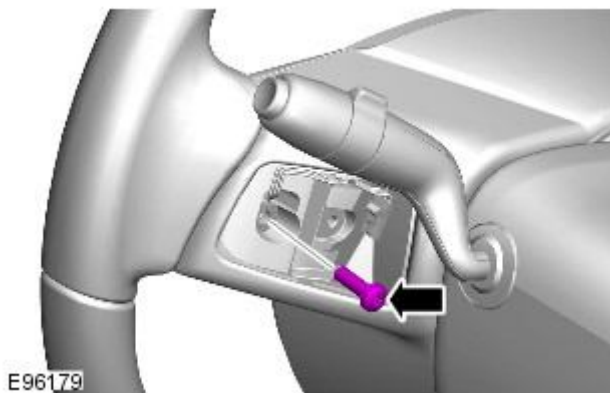
• NOTE: Removal steps in this procedure may contain installation details.

1. Make the SRS system safe.

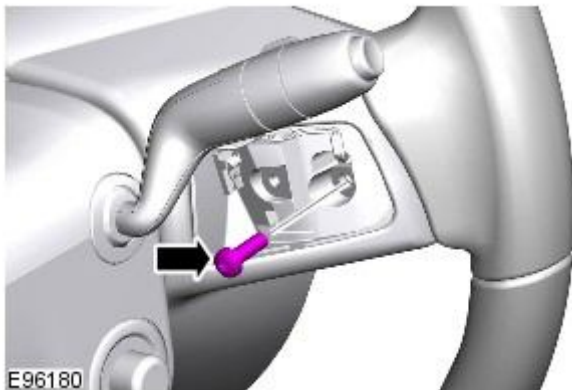
Refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).

2. Refer to: [Driver Air Bag Module](#) (501-20B Supplemental Restraint System, Removal and Installation).
3. Refer to: [Upshift Paddle Switch](#) (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation).
4. Refer to: [Downshift Paddle Switch](#) (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation).

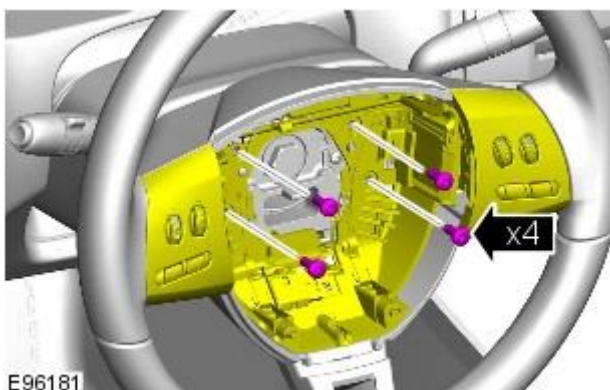
5. Torque: 3 Nm



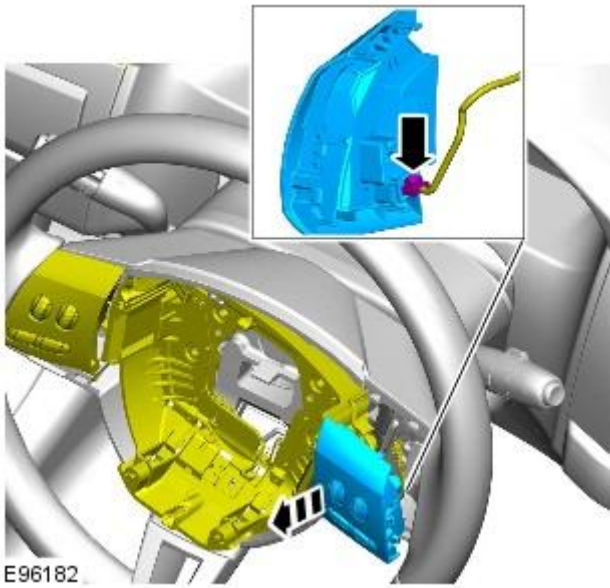
6. Torque: 3 Nm



7. Torque: 6 Nm



8.



## Installation

1. To install, reverse the removal procedure.

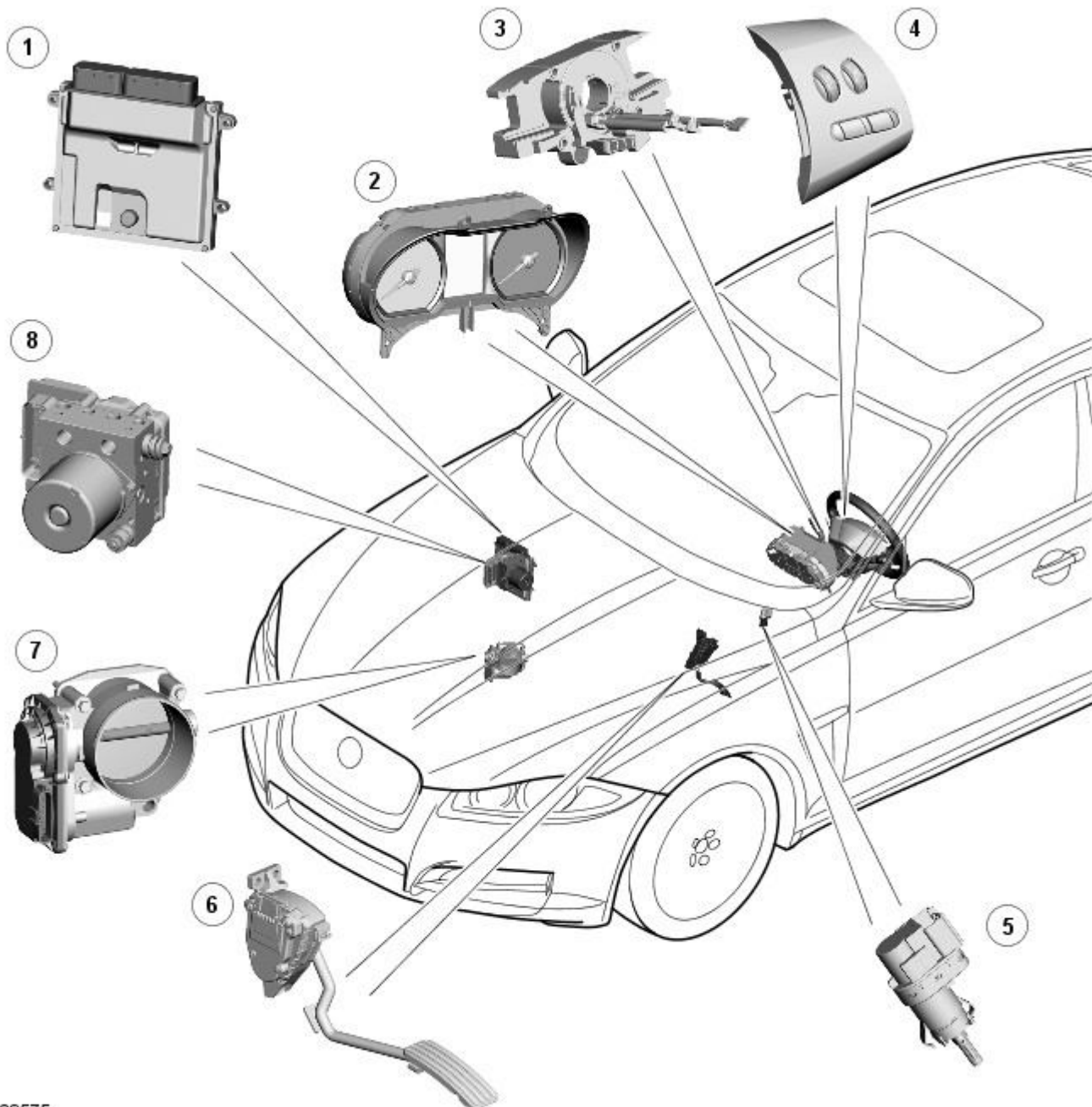
**Speed Control - V6 3.0L Petrol -**

Item	Specification		
Speed control module vertical alignment	90° ± 0.75°		
Description	Nm	lb-ft	lb-in
Speed control module retaining nuts	5	-	44
Speed control module alignment bolt lock nut	5	-	44

# Speed Control - V6 3.0L Petrol - Speed Control - Component Location

Description and Operation

COMPONENT LOCATION 3.0L V6 PETROL



E138575

## ItemDescription

1	Engine Control Module (ECM)
2	Instrument cluster
3	Clockspring
4	Speed control switches
5	Stop lamp/brake test switch
6	Accelerator Pedal Position (APP) sensor
7	Electric throttle
8	Anti-lock Brake System (ABS) module



# Speed Control - V6 3.0L Petrol - Speed Control - Overview

Description and Operation

## OVERVIEW

The speed control system maintains a set speed selected by the driver until operation is suspended or cancelled by a further input from the driver and is controlled by the [ECM \(engine control module\)](#).

The speed control system has the following components:

- A SET + switch
- A - switch
- A RESUME switch
- A CANCEL switch

The speed control system also uses:

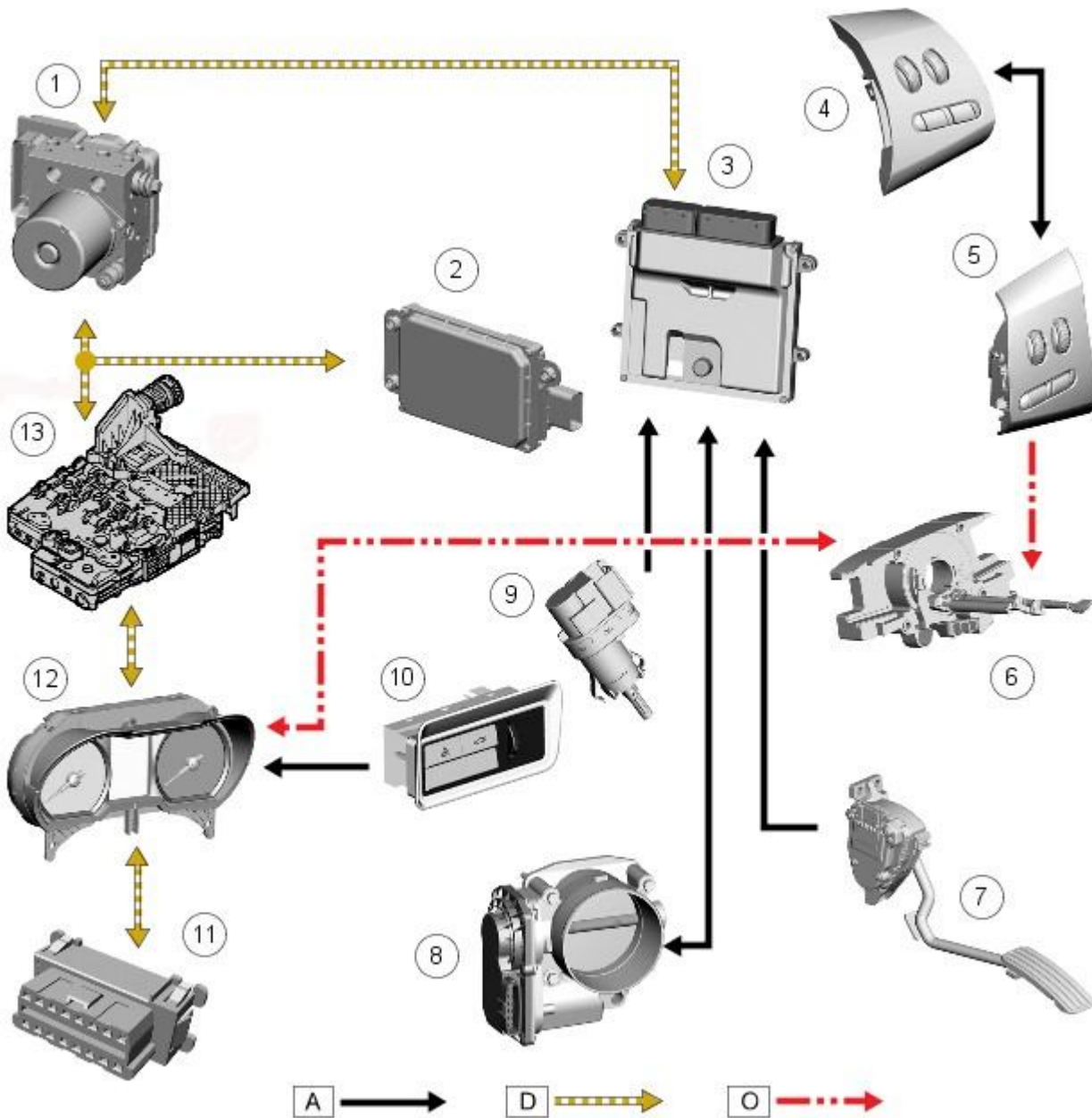
- The [ECM](#)
- The stop lamp switch
- The [APP \(accelerator pedal position\)](#) sensor.

# Speed Control - V6 3.0L Petrol - Speed Control - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **D** = High speed CAN (controller area network) bus; **O** = LIN bus;



E139731

### ItemDescription

1	ABS (anti-lock brake system) module
2	Adaptive speed control radar sensor
3	ECM (engine control module)
4	Speed control switches
5	Audio system control switches
6	Clockspring
7	APP (accelerator pedal position) sensor
8	Electric throttle
9	Stop lamp/brake test switch
10	Forward alert switch
11	Diagnostic socket
12	Instrument cluster
13	TCM (transmission control module)

## System Operation

### SPEED CONTROL

The speed control system is integrated with the engine management system and uses fueling intervention to automatically maintain a set vehicle speed. Once engaged, the system can also be used to accelerate the vehicle without using the accelerator pedal. The speed control system comprises the following components:

- '+' and '-' (set/accelerate and decelerate) steering wheel switches
- Resume switch
- Cancel switch
- Clock spring
- Speed control warning indicator.

The speed control system also uses inputs from the brake pedal switch, the [APP](#) sensor, the [ECM](#) and the [ABS](#) module.

The speed control is operated by the driver using only the steering wheel switches. When speed control is active, the [ECM](#) regulates the [PWM \(pulse width modulation\)](#) signals to the fuel injectors to adjust the fuel supply as required to maintain the set speed.

During speed control operation, the [ECM](#) controls vehicle speed by adjusting fuel injection duration and timing. When the accelerator pedal is pressed with speed control active, the [ECM](#) outputs a calculated throttle angle signal in place of the actual throttle angle signals produced by the [APP](#) sensor. The calculated throttle angle is derived from fuel demand based on the torque required to overcome the rolling resistance (vehicle motion drag).

The minimum set speed for speed control is 20 mph (32 (km/h)). Speed control is automatically suspended if the following conditions apply:

- Vehicle speed falls below 20 mph (32 km/h).
- The brake pedal is pressed.
- The cancel button is pressed.
- Neutral, park or reverse gear is selected.
- The difference between actual speed and the set speed is too great.
- If the accelerator pedal is used to accelerate beyond the set speed for too long (more than 5 minutes).
- Stability control system intervention
- System error causes shut-off.

There are 4 standard speed control switches:

- Set speed + accelerate switch
- Decelerate - switch
- Cancel switch
- Resume switch.

The standard speed control switches are located on the [RH \(right-hand\)](#) side of the steering wheel. The switches are resistive ladder type switches which vary the resistance of a voltage signal sent to them. The resistive ladder is wired to a control module within the switch assembly, the control module is a [LIN \(local interconnect network\)](#) node which transmits the data to the [CJB \(central junction box\)](#) which passes the data onto the high speed [CAN](#) bus. In the event of the [ECM](#) logging a cruise switch fault [DTC \(diagnostic trouble code\)](#), fault finding should start at the switch assembly and clockspring. The [ECM](#) diagnostic detects that the switch assembly control module hasn't provided an updated live counter.

### Engage Speed Control

Speed control is engaged by pressing the set speed accelerate + switch. Once engaged the speed can be increased by one of 3 methods:

- Press and hold the set speed accelerate + switch which will cause the vehicle to accelerate. When the switch is released the attained speed will be set as the cruise speed.
- Repeatedly pressing the set speed accelerate + switch. Each press increases the vehicle speed by 1 mph (2 km/h).
- Use the accelerator pedal to increase the vehicle speed. Once the required speed is reached, a single press of the set speed accelerate + switch will set the cruise speed.

### Reduce Cruising Speed

The set speed can be reduced by pressing and holding the decelerate - switch until the required speed is reached. When the switch is released the speed is reset at that value. The set speed can be reduced incrementally by pressing and releasing the decelerate - switch. Each press will reduce the speed by 1 mph (2 km/h). Adaptive speed control braking can be induced by using the SET – switch to decelerate the vehicle.

### Set Speed Adjustment

Speed control adjustment is limited around the current vehicle speed. This means speed adjustment won't occur when resuming or if the vehicle speed is noticeably different to set speed. This is noticeable when resuming speed control and a large difference exists between the set speed and the current speed. The driver can set a new speed, but can't adjust the old speed.

### Suspend Speed control

Suspending speed control means speed control has been deactivated without loss of the memory speed. In all suspend events the memory speed is maintained. Speed control can be suspended in a number of ways, as described in the general description.

A single press of the RESUME switch will resume speed control at the previously set speed.

• **NOTE:** In the event that a memory speed has been lost during a driving cycle, confirm with the customer if the "Cruise Not Available" message was observed. Loss of memory speed implies a fault has occurred. The message 'Cruise Not Available' may only be displayed on demand for some errors, so speed control needs to be requested via the SET + switch to drive the message.

# Speed Control - V6 3.0L Petrol - Speed Control

Diagnosis and Testing

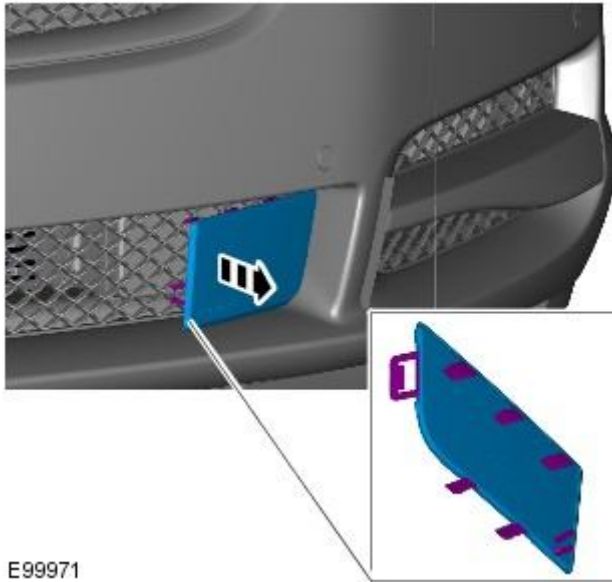
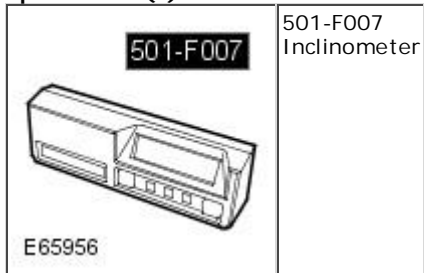
For additional information.

REFER to: Speed Control (310-03A, Diagnosis and Testing).

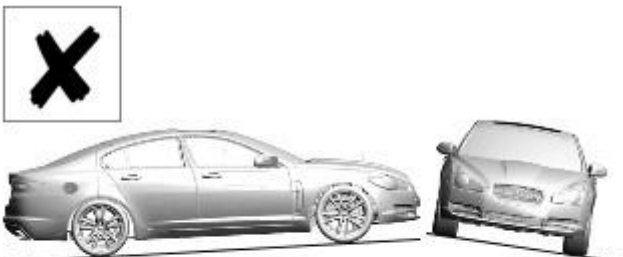
# Speed Control - V6 3.0L Petrol - Speed Control Sensor Adjustment

General Procedures

## Special Tool(s)



1.  CAUTION: Protect the surrounding paintwork to avoid damage.



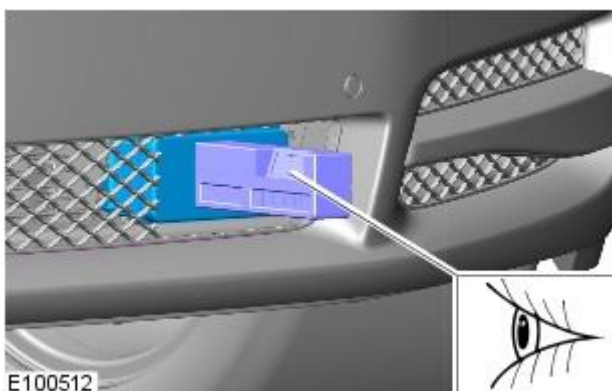
2. 2. NOTE: Make sure that the vehicle is standing on a level surface.

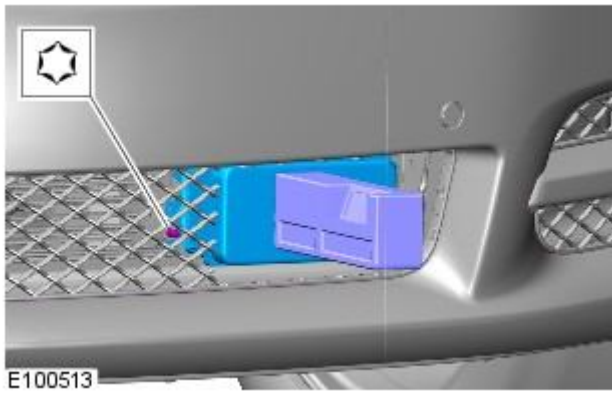


E100511

3. 3. NOTE: Make sure that the vehicle is standing on a level surface.

Special Tool(s): [501-F007](#)

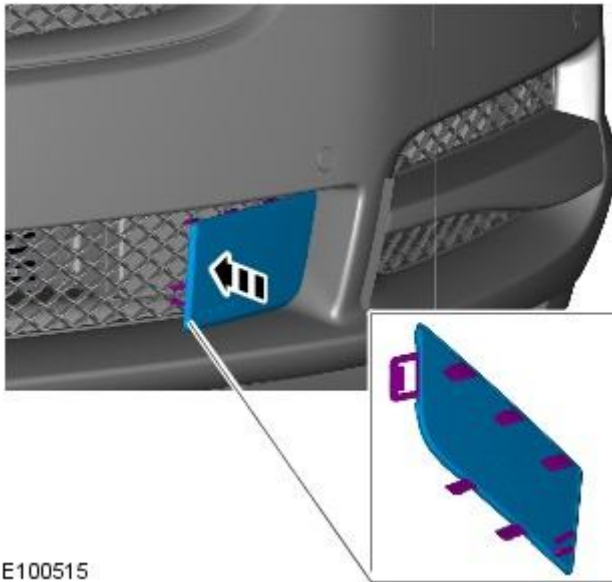




4. **4. NOTE:** Do not release the lock nut.

- **NOTE:** Make sure that the vehicle is standing on a level surface.

*Special Tool(s):* [501-F007](#)



5. **5. ⚠ CAUTION:** Protect the surrounding paintwork to avoid damage.

6.

- Configure the ACC module using the diagnostic tool.
- This procedure is required if:
- A new ACC radar and, or ACC module are installed.
- The ACC radar needed to be removed or is misaligned in its position due to another repair operation.

7.

- From the diagnostic tool menu, select: Service Alignment Mode.
- The follow indicator will now be flashing, this indicates that the vehicle is in "service alignment" and now requires driving.
- The vehicle speed must be above 30mph (48 kph).
- Choose a road with plenty of stationary objects, like street lights, road signs, or barriers. Use an inside or outside lane.
- Following vehicles too closely will obscure the stationary targets from the radar, a time gap of 2 seconds is recommended.
- A straight road will produce a quicker and better result, although the process will still operate on a curved road.
- The time that the ACC module takes to align will vary, depending on the route, speed, number of targets, and individual module.
- When the flashing follow indicator light extinguishes, the ACC system is now functional, and a required vehicle speed can now be set by the driver and the ACC system will operate as normal.



# Speed Control - V6 3.0L Petrol - Speed Control Deactivator Switch

Removal and Installation

## Removal

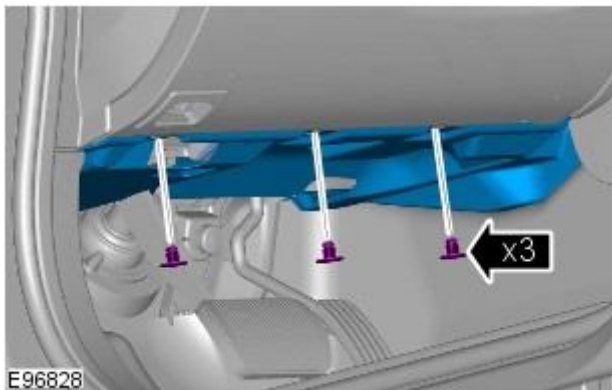
- NOTE: Removal steps in this procedure may contain installation details.


1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

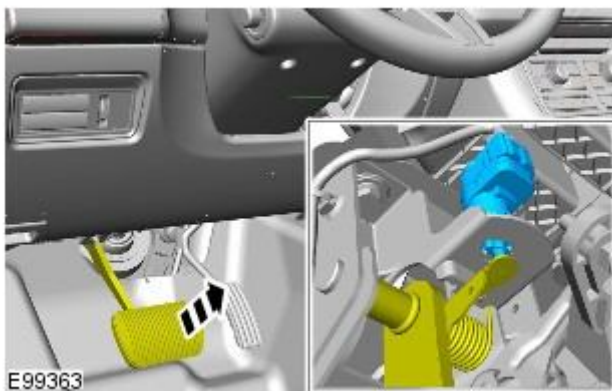
2.

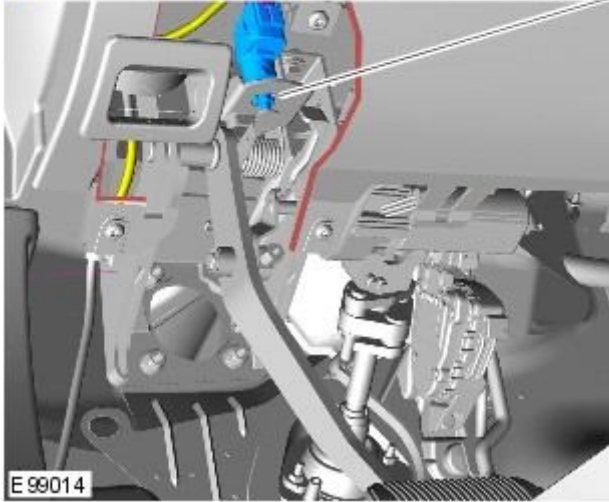
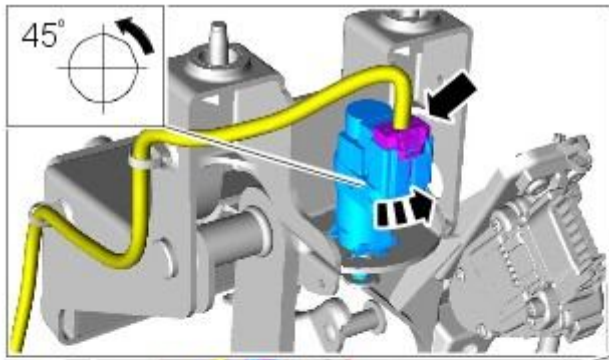



3.

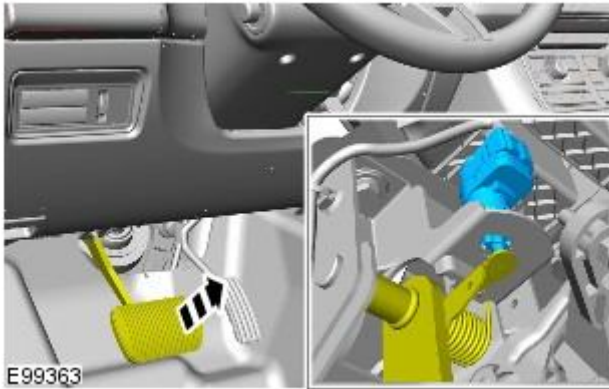



4.  CAUTION: Make sure that the brake pedal remains in the rest position during this procedure.





5.  CAUTION: Make sure that the brake pedal remains in the rest position during this procedure.



6.  CAUTION: Make sure that the brake pedal remains in the rest position during this procedure.

## Installation

1. To install, reverse the removal procedure.

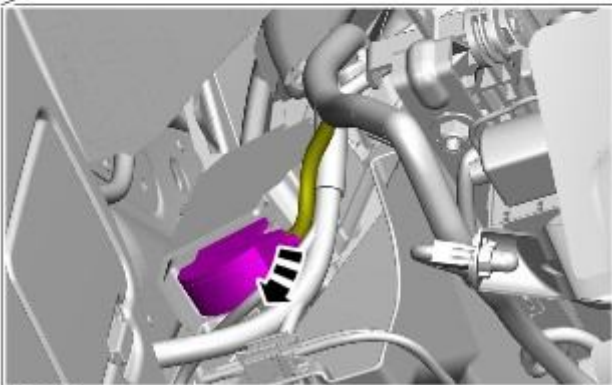
# Speed Control - V6 3.0L Petrol - Speed Control Module

Removal and Installation

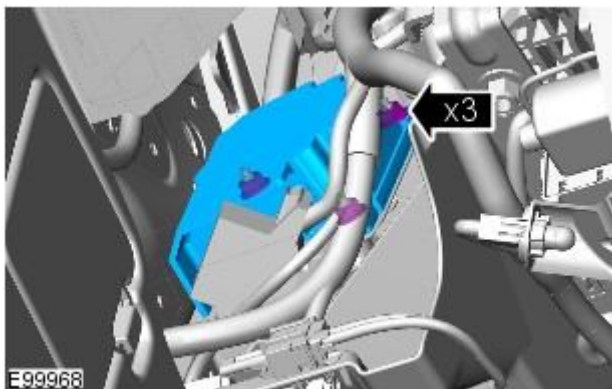
## Removal

• NOTE: Removal steps in this procedure may contain installation details.


1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Speed Control Sensor Adjustment (310-03, General Procedures).
3. Refer to: [Instrument Panel Lower Trim Panel](#) (501-12 Instrument Panel and Console, Removal and Installation).
- 4.



E99967



E99968

5.  CAUTION: Make sure that all diagnostic trouble codes (DTCs) have been removed after the road test.

Torque: 4 Nm

## Installation

1. To install, reverse the removal procedure.

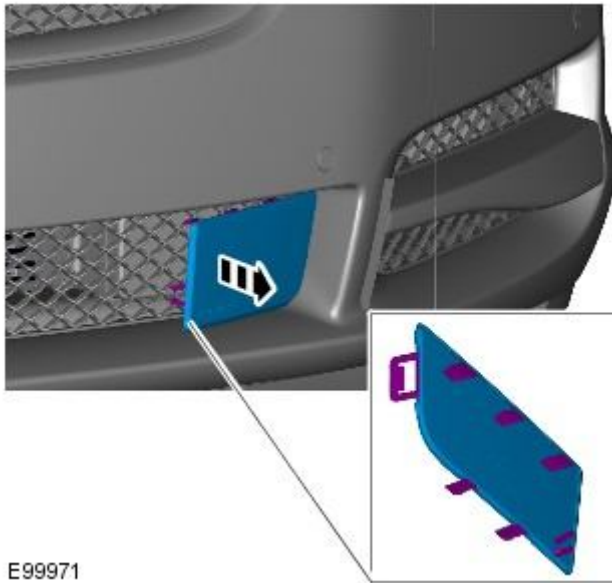
# Speed Control - V6 3.0L Petrol - Speed Control Sensor

Removal and Installation

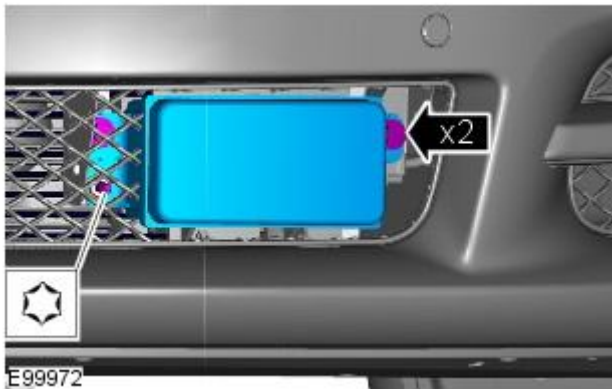
## Removal

• NOTE: Removal steps in this procedure may contain installation details.

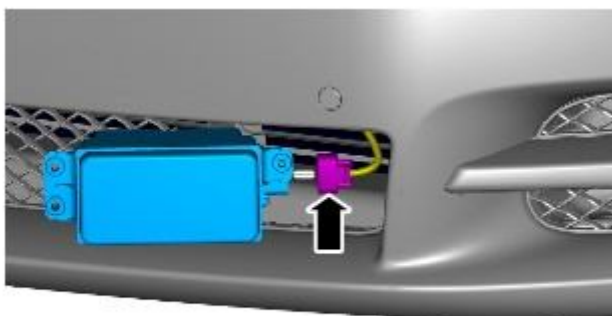
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Speed Control Sensor Adjustment (310-03, General Procedures).




3.  CAUTION: Protect the surrounding paintwork to avoid damage.



4. Torque: 5 Nm



5.  CAUTION: Make sure that all diagnostic trouble codes (DTCs) have been removed after the road test.
  - NOTE: Make sure that the sensor is aligned after installation as described in the speed control sensor adjustment procedure.

## Installation

1. To install, reverse the removal procedure.

# Speed Control - V6 3.0L Petrol - Speed Control Switch

Removal and Installation

## Removal

1. Refer to: Speed Control Switch (310-03A, Removal and Installation).

## Installation

- 1.

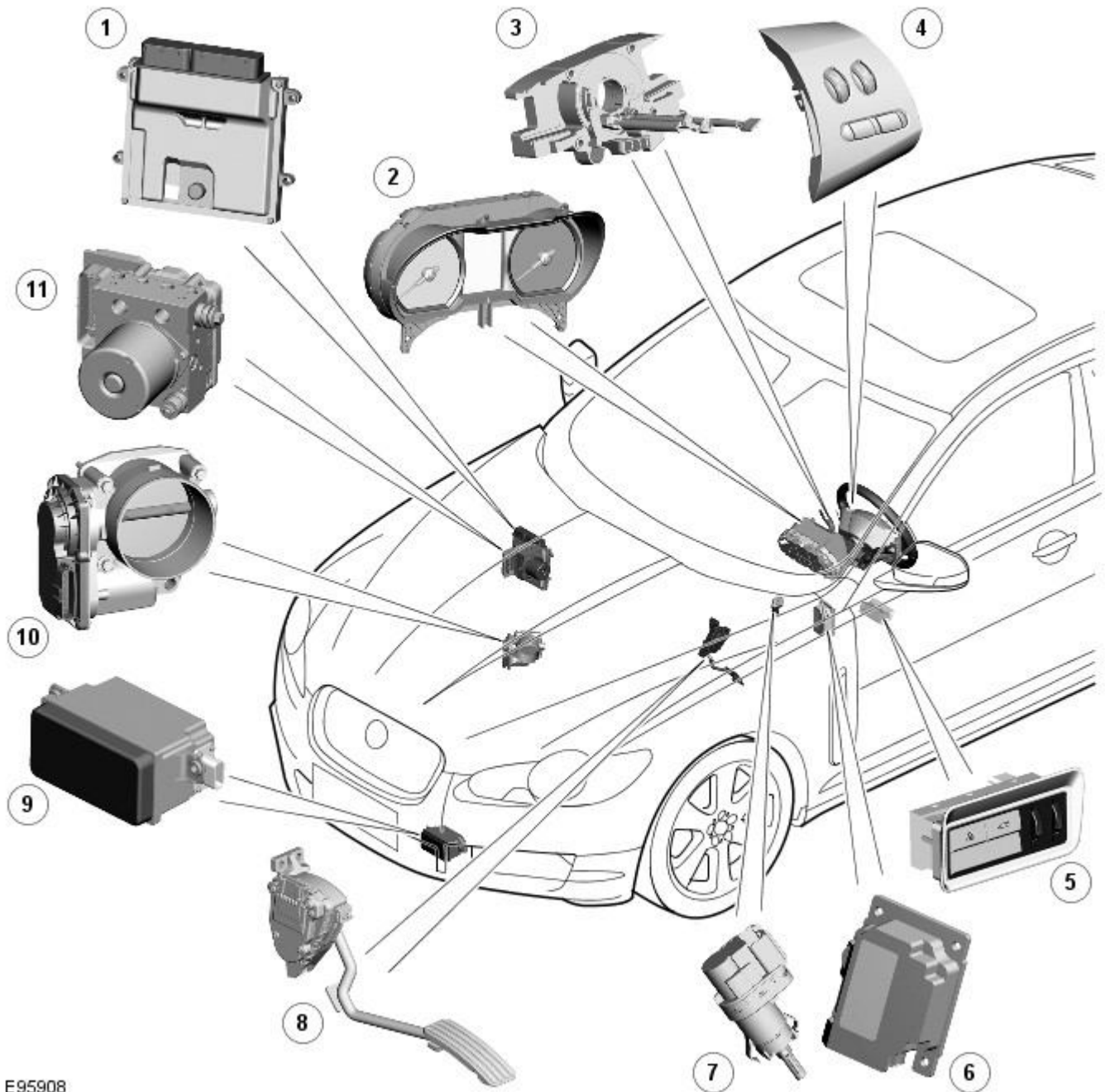
**Speed Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 -**

Item	Specification		
Speed control module vertical alignment	90° ± 0.75°		
Description	Nm	lb-ft	lb-in
Speed control module retaining nuts	5	-	44
Speed control module alignment bolt lock nut	5	-	44



# Speed Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Speed Control - Component Location

Description and Operation



E95908

## ItemDescription

1	<a href="#">ECM (engine control module)</a>
2	Instrument cluster
3	Clock spring
4	Speed control switches
5	Forward alert switch
6	Adaptive speed control module
7	<a href="#">BPP (brake pedal position) switch</a>
8	<a href="#">APP (accelerator pedal position)</a>
9	Adaptive speed control radar sensor
10	Electric throttle
11	<a href="#">ABS (anti-lock brake system) module</a>

# Speed Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Speed Control - Overview

Description and Operation

## Speed Control

The speed control system is integrated with the engine management system and uses fueling intervention to automatically maintain a set vehicle speed. Once engaged, the system can also be used to accelerate the vehicle without using the accelerator pedal. The speed control system comprises the following components:

- On/Off/Suspend switch
- '+' and '-' (set/accelerate and decelerate) steering wheel switches
- Resume switch
- Clock spring
- Speed control warning lamp.

The speed control system also uses inputs from the brake pedal switch, the [APP \(accelerator pedal position\)](#) sensor, the [ECM \(engine control module\)](#) and the [ABS \(anti-lock brake system\)](#) control module.

The speed control is operated by the driver using only the steering wheel switches. When speed is active, the [ECM](#) regulates the PWM signals to the fuel injectors to adjust the fuel supply as required to maintain the set speed.

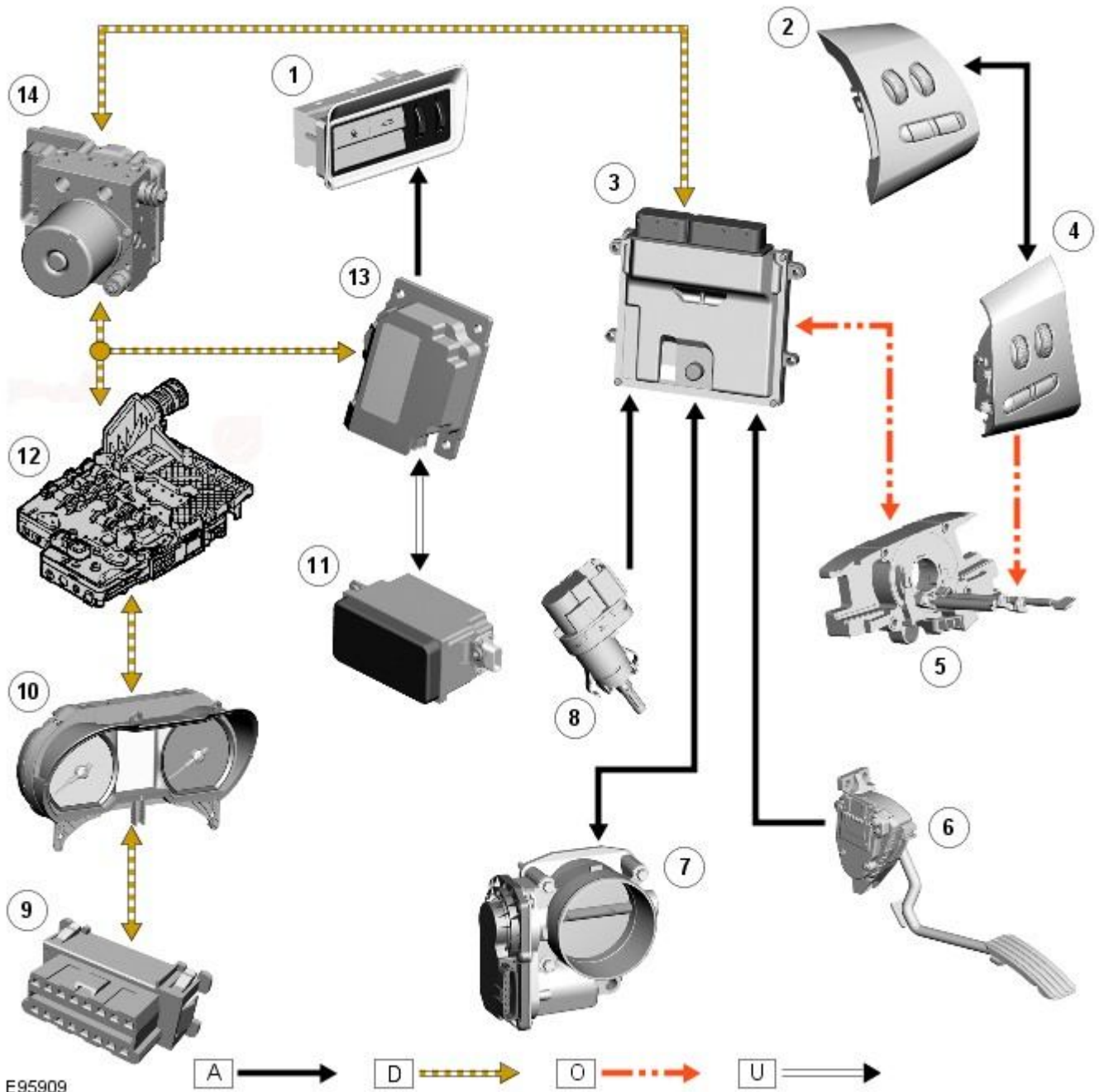
During speed control operation, the [ECM](#) controls vehicle speed by adjusting fuel injection duration and timing. When the accelerator pedal is pressed with speed control active, the [ECM](#) outputs a calculated throttle angle signal in place of the actual throttle angle signals produced by the [APP](#) sensor. The calculated throttle angle is derived from fuel demand.

# Speed Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Speed Control - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **D** = High speed CAN (controller area network) bus; **O** = LIN bus; **U** = Private CAN bus



### ItemDescription

1	Forward alert switch
2	Speed control switches
3	ECM (engine control module)
4	Audio system control switches
5	Clock spring
6	APP (accelerator pedal position)
7	Electric throttle
8	Diagnostic socket
9	Instrument cluster
10	Adaptive speed control radar sensor
11	BPP (brake pedal position) switch

12	Transmission control module
13	Adaptive speed control module
14	ABS (anti-lock brake system) module

## System Operation

### Overview

The speed control system is integrated with the engine management system and uses Fueling intervention to automatically maintain a set vehicle speed. Once engaged, the system can also be used to accelerate the vehicle without using the accelerator pedal. The speed control system comprises the following components:

- On/Off/Suspend switch
- '+' and '-' (set/accelerate and decelerate) steering wheel switches
- Resume switch
- Clock spring
- Speed control warning lamp.

The speed control system also uses inputs from the brake pedal switch, the [APP](#) sensor, the [ECM](#) and the [ABS](#) control module.

The speed control is operated by the driver using only the steering wheel switches. When speed control is active, the [ECM](#) regulates the [PWM \(pulse width modulation\)](#) signals to the fuel injectors to adjust the fuel supply as required to maintain the set speed.

During speed control operation, the [ECM](#) controls vehicle speed by adjusting the electronic throttle. When the accelerator pedal is pressed with speed control active, the [ECM](#) outputs a calculated throttle angle signal in place of the actual throttle angle signals produced by the [APP](#) sensor. The calculated throttle angle is derived from fuel demand.

The minimum set speed for speed control is 18 mph (30 km/h). Speed control is automatically suspended if the following conditions apply:

- Vehicle speed falls below 18 mph (30 km/h).
- The brake pedal is pressed.
- The cancel button is pressed.
- Neutral, park or reverse gear is selected.
- The difference between actual speed and the set speed is too great.
- When the vehicle speed reaches a maximum speed of 120 mph (192 kph).
- If the accelerator pedal is used to accelerate beyond the set speed for too long.

### Adaptive Speed Control

The adaptive speed control system comprises the following components:

- Adaptive Speed Control Sensor
- Adaptive Speed Control module
- Steering wheel control switches
- [ECM](#)
- Electric throttle
- [ABS](#) module and pump
- Adaptive Speed Control warning lamp (in the instrument cluster)

The adaptive speed control system uses a forward looking radar sensor to scan the road ahead, looking for objects that are moving at a different rate to itself. When a target is identified the adaptive speed control system will monitor the time gap between it and the target vehicle. When that gap falls below a set driver selected level the adaptive speed control system will intervene slowing the vehicle by backing off the throttle and/ or applying the brakes, until the correct gap is attained. The driver can chose between four gap settings, 1, 1.4, 1.8 and 2.2 seconds.

The system will detect but not react to the following:

- Vehicles in the oncoming lane
- Stationary vehicles
- Pedestrians
- Vehicles not in the same lane

Adaptive speed control is active when the vehicle is moving. Adaptive Speed Control only functions when a set speed is entered in normal speed control mode. The adaptive speed control system only intervenes with the set speed when it detects a target vehicle, and then only if the minimum time gap is breached.

It is important to note that the system is intended for use in limited driving situations, does not remove control and responsibility from the driver, and at all times can be quickly overridden. The adaptive speed control system is not a collision warning system and will not react to stationary objects. The system does not operate below a minimum speed of approximately 30 km/h (20 mph) since it is unsuitable for use in cities or congested traffic. The system is best suited to main roads/ highways with gradual bends.

The [ECM](#), throttle body and throttle control are unchanged from those used for non Adaptive Speed Control variants.

The adaptive speed control system is based on the use of a front mounted radar sensor. The sensor transmits a 1.5° wide beam forward of the vehicle and detects the returning signals reflected off other vehicles and objects ahead.

The 1.5° wide radar beam is mechanically scanned at a rate of 10 sweeps/second across a total arc of 15° centered on the longitudinal axis of the vehicle. The radar operates at millimetric wavelengths (76 - 77 GHz) and transmits a frequency modulated continuous wave signal at a relatively low power level (no high power pulses).

With the ignition switched ON, the adaptive speed control module is powered up but no radar transmissions are emitted until the vehicle is in motion.

In follow mode a set speed is selected in the normal speed control manner and this speed is maintained until a slower vehicle is encountered in the lane ahead. When the vehicle ahead comes within the effective range of the radar sensor, the system identifies it as a target vehicle and an icon is illuminated on the instrument cluster to indicate that the system is in "follow mode". When the distance between the two vehicles closes to a set time gap, the adaptive speed control system closes the throttle and if necessary applies the brakes to maintain the set time gap. Follow mode is effectively a closed loop system. If several vehicles are ahead, the closest vehicle is chosen as the target to follow. If the target vehicle moves out of radar range, or if either vehicle changes lane or drops below the minimum operating speed, the system exits follow mode and the follow mode icon is extinguished. The adaptive speed control system will only raise its speed to the originally set speed, it will not accelerate past this speed to maintain a time gap.

Driver operation of the foot brake or control switches will immediately cancel adaptive speed control.

When the vehicle is in follow mode the follow mode warning indicator is illuminated in the instrument cluster and the current gap setting will be displayed in the message center.



E98452

#### ItemDescription

1	Forward Alert warning indicator
2	Follow mode warning indicator

The radar sensor detects three primary parameters of objects within the scanned arc. These are:

- Range
- Relative velocity
- Angle

**Range:** The radar sensor detects the presence and ranges of different vehicles and objects within the scanned arc up to a distance of approximately 130 meters. The transmitted signal frequency changes continuously in a cyclic pattern (modulation). This means that, in the time taken for the signal wave front, to travel to and from a target vehicle (or other object), the transmission frequency will have changed. The difference between the received signal frequency and the new transmission frequency is proportional to the distance between the transmitting vehicle and the target vehicle.

**Relative velocity:** When the signal is reflected off a vehicle moving at a different speed (opening or closing gap) an effect known as the Doppler shift causes an extra frequency modulation to be imposed on the signal. This Doppler frequency varies with the relative speed of the vehicle being followed, enabling the system to differentiate between vehicles traveling at different speeds and also between moving vehicles and stationary objects.

**Angle:** Using a narrow angle beam to scan horizontally enables the system to distinguish between vehicles in different lanes and between vehicles and roadside objects.

### System Restrictions

The adaptive speed control system is only intended to provide enhanced speed control as described above in certain restricted conditions. The following points should be noted:

- Automatic braking is limited to approximately 30% of full pressure (0.3G deceleration) and is intended to provide a smooth, gradual deceleration in follow mode conditions. Harsh braking by the target vehicle or following the target vehicle down to very low speeds or to a halt will require driver override of the brakes.
- While the radar sensor detects moving and stationary targets for assessment of the environment ahead, the system does not react to or provide any control in situations other than follow mode conditions. Stationary or slow moving vehicles (below 10 km/h), pedestrians, objects on the road and oncoming vehicles in the same lane are not recognized.





**WARNING:** It must be emphasized that the adaptive speed control system is not a collision warning or avoidance system and that, other than the limited conditions of follow mode, driver intervention will be necessary to control the vehicle speed.

In follow mode, some situations may cause target ambiguities for the detection system. These situations include:

- The nearby presence of a third vehicle when driving on a line slightly offset to the target vehicle.
- Vehicles edging into the lane ahead which are not detected by the system until they have moved into the radar beam.

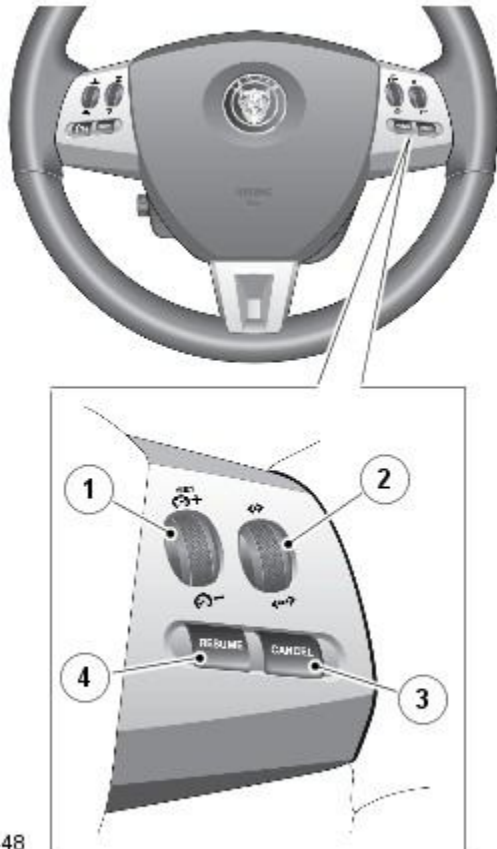
On the approach to, or exit from a bend, a target vehicle may be lost or a new target acquired as vehicles ahead change their angular position with respect to the radar sensor. On a straight road, if the sensing vehicle is in follow mode below its selected set speed, losing the target vehicle will cause the sensing vehicle to accelerate to this set speed. This acceleration is undesirable either on, or entering a bend when the target is suddenly lost, and in this situation the system inhibits the resumption of the set speed.

The speed control system compares vehicle speed data from the [ABS](#) system with the relative speed of an external object as detected by the radar sensor to ascertain whether the object is stationary or not.

• **NOTE:** If tires are fitted which are different in diameter from those specified for the vehicle, the vehicle speed calculated by the [ABS](#) will not be the true road speed. This situation may cause stationary objects to be falsely identified as moving vehicles and result in automatic deceleration on a clear road.

## Component Description

### Speed Control Switches



E98448

#### ItemDescription

1	Set speed adjustment switch
2	Time gap switch
3	Cancel switch
4	Resume switch

The speed control switches are located on the RH (Right-hand) side of the steering wheel. The switches are connected via fly leads to the clock spring. The speed control switches are resistive ladder type switches which vary the resistance of a 5 volt signal sent to them. The signal is returned along a Lin bus to the instrument cluster. The instrument cluster routes the control signals to the [ECM](#) on the MS [CAN](#).

Speed control is engaged by rotating the speed adjustment switch to the + or - positions. Once engaged the speed can be varied by the speed adjustment switches. Each press of the speed adjustment switch will increase or decrease the set speed in steps of 1 mph (2 kph).



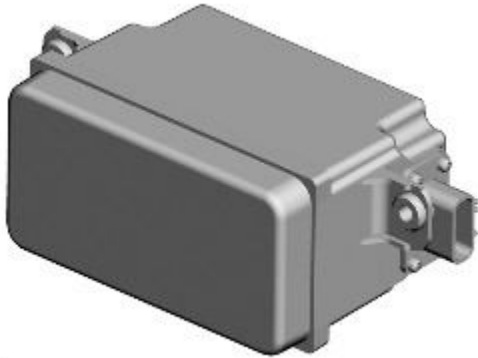
## Adaptive Speed Control Module



E98450

The Adaptive Speed Control module, located on the drivers side at the bottom of the A post. The control module is connected to the other vehicle systems via the high speed [CAN](#) bus. Signals from the Adaptive Speed Control forward looking radar sensor are received on a dedicated [CAN](#) bus between the two modules.

## Adaptive Speed Control Radar Sensor

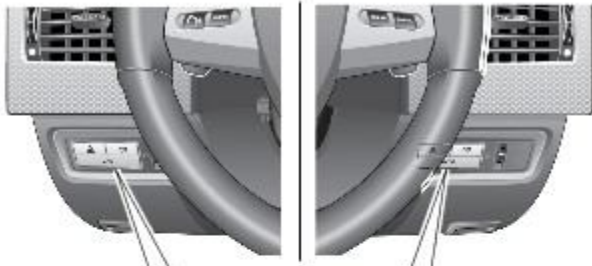


E98451

The adaptive speed control radar sensor is located in the front bumper, on the RH side above the radiator grill behind the bumper cover. The sensor is connected to the Adaptive Speed Control, module via a private [CAN](#) bus. If the unit is replaced in service the unit must be re-aligned vertically. Horizontal alignment is achieved by putting the sensor in service mode via the recommended Jaguar diagnostic tool.

The vehicle is then driven for a short period while the sensor calibrates itself. Calibration is complete when the 'follow' icon in the instrument cluster stops flashing.

## Forward Alert Switches



E98449

The forward alert system utilizes the Adaptive Speed Control system components. Forward alert is turned on and off independently of Adaptive Speed Control, via a switch mounted in the lower outboard knee bolster switchpack. Forward alert will notify the driver by means of a chime, and warning indicator in the instrument cluster and indication in the message center, when a target vehicle comes into range. The system will NOT use throttle or brake intervention to slow the vehicle.

The forward alert switch is connected to the instrument cluster in a resistive ladder with the luggage compartment opening switch and the fuel filler flap switch. The instrument cluster sends the forward alert information to the Adaptive speed control module on the [CAN](#) bus.

• **NOTE:** This system is intended as a driver aid and should be used as such. The system is NOT a collision warning or avoidance device.

The system sensitivity can be adjusted in the same manner as the Adaptive Speed Control, via the steering wheel mounted switches. Each adjustment is accompanied by a message in the message center.

# Speed Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Speed Control

Diagnosis and Testing

## Principles of Operation

For a detailed description of the speed control system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (310-03 Speed Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8)

[Speed Control](#) (Description and Operation),  
[Speed Control](#) (Description and Operation),  
[Speed Control](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Speed control sensor</li> <li>● Ensure the speed control sensor is free from obstructions</li> <li>● Speed control module</li> <li>● Brake switch</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Wiring harness</li> <li>● Electrical connector(s)</li> <li>● Steering wheel switches</li> <li>● Brake switch</li> <li>● Speed control sensor</li> <li>● Speed control module</li> <li>● Engine Control Module (ECM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Speed Control Sensor Adjustment (vehicles with adaptive system installed)

An incorrectly aligned speed control sensor can cause incorrect system operation. Before starting any repair work on the speed control system, on vehicles with the adaptive system installed, check speed control sensor for correct vertical alignment, and carry out speed control sensor alignment procedure using manufacturer approved diagnostic system.

## Symptom Chart

Symptom	Possible Cause	Action
Speed control inhibited or disabled	<ul style="list-style-type: none"> <li>● Power or ground supply to speed control module or speed control sensor</li> <li>● Steering wheel speed control switch/circuits</li> <li>● Throttle sensors</li> <li>● Brake switch</li> <li>● Anti-Lock Brake System fault</li> </ul>	<ul style="list-style-type: none"> <li>● Check for DTCs that could be caused by power or ground failure to the module or sensor and refer to DTC Index</li> <li>● Check for sticking, jammed and broken speed control switches. Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit</li> <li>● For throttle position sensor tests. REFER to: <a href="#">Electronic Engine Controls</a> (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Diagnosis and Testing).</li> <li>● Check for correct installation and adjustment of brake switch. Refer to the electrical circuit diagrams and check brake switch circuits for short, open circuit</li> <li>● Check ABS system for related DTCs and refer to the relevant DTC Index</li> </ul>
Unable to regulate/adjust vehicle speed	<ul style="list-style-type: none"> <li>● Steering wheel switch malfunction</li> </ul>	<ul style="list-style-type: none"> <li>● Check for sticking, jammed and broken speed control switches. Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit</li> </ul>
Unable to cancel speed control from steering wheel	<ul style="list-style-type: none"> <li>● Steering wheel switch malfunction</li> </ul>	<ul style="list-style-type: none"> <li>● Check for sticking, jammed and broken speed control switches. Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit</li> </ul>
Unable to cancel speed control from brake pedal	<ul style="list-style-type: none"> <li>● Brake switch malfunction</li> </ul>	<ul style="list-style-type: none"> <li>● Check for correct installation and adjustment of brake switch. Refer to the electrical circuit diagrams and check brake switch circuits for short, open circuit</li> </ul>

## DTC Index

### Vehicles WITH Adaptive System Installed



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• **NOTE:** If a module or component is suspect, and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• **NOTE:** Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• **NOTE:** When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• **NOTE:** If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1A8481	Car Configuration Data	<ul style="list-style-type: none"> <li>RJB reporting invalid data</li> </ul>	Re-configure the RJB using manufacturer approved diagnostic system
C1A6754	Forward Looking Sensor	<ul style="list-style-type: none"> <li>Speed control sensor out of alignment</li> </ul>	Check speed control sensor for correct vertical alignment, and carry out speed control sensor alignment procedure using manufacturer approved diagnostic system
C1A6781	Forward Looking Sensor	<ul style="list-style-type: none"> <li>Yaw voltage unreasonable for 0.5 seconds or unchanged for 1.2 seconds. Note: Yaw sensor internal to speed control sensor</li> </ul>	Clear DTC and re-test, if DTC remains suspect speed control sensor. Check and install a new sensor as required, refer to the new module/component installation note at the top of the DTC Index
C1A6787	Forward Looking Sensor	Incorrect or missing data from speed control sensor	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies for short, open circuit. Check private CAN network between speed control sensor and speed control module for failure, clear DTC and re-test. If DTC remains suspect the speed control sensor, check and install a new sensor as required, refer to the new module/component installation note at the top of the DTC Index
C1A6796	Forward Looking Sensor	<ul style="list-style-type: none"> <li>Internal hardware failure</li> </ul>	Suspect the speed control sensor. Check and install a new sensor as required, refer to the new module/component installation note at the top of the DTC Index
C1A6797	Forward Looking Sensor	<ul style="list-style-type: none"> <li>Sensor reduced visibility</li> </ul>	Check for blockage in front of radar. Note: This DTC will be cleared automatically when environmental conditions allow
C1A6798	Forward Looking Sensor	<ul style="list-style-type: none"> <li>Speed control sensor internal temperature exceeded threshold</li> </ul>	Allow system to cool. Note: This DTC will be cleared automatically when environmental conditions allow
P174E81	Output Shaft Speed/ABS Wheel Speed Correlation	<ul style="list-style-type: none"> <li>Follow speed is mis-calculated to too high a value</li> </ul>	Clear DTC and re-test
U000188	High Speed CAN Communication Bus	<ul style="list-style-type: none"> <li>Vehicle CAN Bus off condition</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
U010000	Lost Communications With ECM/PCM "A"	<ul style="list-style-type: none"> <li>ECM missing message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check ECM for related DTCs and refer to the relevant DTC Index
U010100	Lost Communications With TCM	<ul style="list-style-type: none"> <li>TCM missing message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check TCM for related DTCs and refer to the relevant DTC Index
U010387	Lost Communication With Gear Shift Module	<ul style="list-style-type: none"> <li>Transmission shift module missing message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check transmission shift module for related DTCs and refer to the relevant DTC Index
U012100	Lost Communication With Anti-lock Brake System (ABS) Control Module	<ul style="list-style-type: none"> <li>ABS missing message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check ABS for related DTCs and refer to the relevant DTC Index
U012800	Lost Communications With Park Brake Module	<ul style="list-style-type: none"> <li>Parking brake missing message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check parking brake module for related DTCs and refer to the relevant DTC Index

DTC	Description	Possible Cause	Action
U015500	Lost Communications With Instrument Panel Cluster (IPC) Control Module	<ul style="list-style-type: none"> <li>Instrument cluster missing message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check instrument cluster for related DTCs and refer to the relevant DTC Index
U030000	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>Invalid configuration message is received</li> </ul>	Re-configure the speed control module using the manufacturer approved diagnostic system. Clear DTCs and re-test. If DTC still logged, suspect incorrect speed control module installed. Check and install a new module as required, refer to new module/component installation note at top of DTC Index
U030055	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>RJB - at least one of the car configuration parameters is not configured</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system
U040100	Invalid Data Received From ECM/PCM A	<ul style="list-style-type: none"> <li>ECM did not respond properly to speed control cancel or auto brake cancel request</li> </ul>	Check ECM for related DTCs and refer to relevant DTC Index
U040167	Invalid Data Received From ECM/PCM A	<ul style="list-style-type: none"> <li>ECM did not respond properly to speed control resume request</li> </ul>	Check ECM for related DTCs and refer to relevant DTC Index
U040181	Invalid Data Received From ECM/PCM A	<ul style="list-style-type: none"> <li>Speed control inhibited by ECM</li> </ul>	Check ECM for related DTCs and refer to relevant DTC Index
U041581	Invalid Data Received From Anti-lock Brake System (ABS) Control Module	<ul style="list-style-type: none"> <li>Stability assist fault</li> </ul>	Check ABS module for related DTCs and refer to relevant DTC Index
U041767	Invalid Data Received From Park Brake Control Module	<ul style="list-style-type: none"> <li>Parking brake module did not respond properly to apply request</li> </ul>	Check parking brake module for related DTCs and refer to relevant DTC Index
U041781	Invalid Data Received From Park Brake Control Module	<ul style="list-style-type: none"> <li>Speed control inhibited by parking brake module</li> </ul>	Check parking brake module for related DTCs and refer to relevant DTC Index
U042381	Invalid Data Received From Instrument Panel Control Module	<ul style="list-style-type: none"> <li>Speed control inhibited by instrument cluster</li> </ul>	Check instrument cluster, CJB and RJB for related DTCs and refer to relevant DTC Index
U1A1449	CAN Initialisation Failure	<ul style="list-style-type: none"> <li>Internal electronic failure</li> </ul>	Suspect the speed control module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U210100	Control Module Configuration Incompatible	<ul style="list-style-type: none"> <li>Data sent from RJB is invalid</li> </ul>	Check/amend Car Configuration File using the manufacturer approved diagnostic system, clear DTC and re-test. If DTC remains, re-configure RJB using manufacturer approved diagnostic system, clear DTC and re-test. If DTC remains check RJB for DTCs and refer to DTC Index
U300041	Control Module	<ul style="list-style-type: none"> <li>Internal micro controller error</li> <li>Checksum fault</li> </ul>	Suspect the speed control module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300042	Control Module	<ul style="list-style-type: none"> <li>Internal RAM test fault</li> </ul>	Suspect the speed control module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300049	Control Module	<ul style="list-style-type: none"> <li>Internal control module failure</li> </ul>	Suspect the speed control module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index

### Vehicles WITHOUT Adaptive System Installed



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• NOTE: If a module or component is suspect, and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P050082	Vehicle Speed Sensor A	<ul style="list-style-type: none"> <li>Vehicle speed - invalid signal received over CAN</li> </ul>	Check ABS for related DTCs and refer to relevant DTC Index
P050086	Vehicle Speed Sensor A	<ul style="list-style-type: none"> <li>Vehicle speed - invalid signal received over CAN</li> </ul>	Check ABS for related DTCs and refer to relevant DTC Index
P050100	Vehicle Speed Sensor A Range/Performance	<ul style="list-style-type: none"> <li>Vehicle speed signal from ABS not plausible</li> </ul>	Carry out CAN network integrity test using the manufacturer approved diagnostic system. Contact Dealer Technical Support for further assistance
P050162	Vehicle Speed Sensor A Range/Performance	<ul style="list-style-type: none"> <li>Vehicle speed - range performance</li> </ul>	Check ABS/TCM for related DTCs and refer to relevant DTC Index
P050400	Brake Switch A / B Correlation	<ul style="list-style-type: none"> <li>The brake pressure reading does not agree with the brake light switch value</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check brake switch circuits for short, open circuit, high resistance
P050401	Brake Switch A / B Correlation	<ul style="list-style-type: none"> <li>Brake switch high fault: <ul style="list-style-type: none"> <li>Brake lights stuck on</li> <li>Gearshift interlock inoperative</li> <li>Speed control inoperative</li> </ul> </li> <li>Brake switch low fault: <ul style="list-style-type: none"> <li>Brake lights inoperative</li> <li>Gearshift stuck in Park</li> <li>Reduced engine braking</li> </ul> </li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check brake switch circuits for short, open circuit, high resistance
P056600	Cruise Control OFF Signal	<ul style="list-style-type: none"> <li>Speed control Cancel switch 2 stuck closed</li> </ul>	Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit. Check for stuck switch. Check and install a new speed control switch as required
P056700	Cruise Control DECREASE DISTANCE Signal	<ul style="list-style-type: none"> <li>Speed control Resume switch 7 stuck closed</li> </ul>	Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit. Check for stuck switch. Check and install a new speed control switch as required
P056800	Cruise Control INCREASE DISTANCE Signal	<ul style="list-style-type: none"> <li>Speed control Accel Set Plus Switch 6 stuck closed</li> </ul>	Check and install a new speed control switch as required
P056900	Cruise Control COAST Signal	<ul style="list-style-type: none"> <li>Speed control Coast Set Minus switch 3 stuck closed</li> </ul>	Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit. Check for stuck switch. Check and install a new speed control switch as required
P056A00	Cruise Control INCREASE DISTANCE Signal	<ul style="list-style-type: none"> <li>Speed control Headway Plus switch 4 stuck closed</li> </ul>	Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit. Check for stuck switch. Check and install a new speed control switch as required
P056B00	Cruise Control DECREASE DISTANCE Signal	<ul style="list-style-type: none"> <li>Speed control Headway Minus switch 5 stuck closed</li> </ul>	Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit. Check for stuck switch. Check and install a new speed control switch as required
P057162	Brake Switch A Circuit	<ul style="list-style-type: none"> <li>Plausibility error</li> </ul>	Refer to the electrical circuit diagrams and check brake light switch signal circuits for short, open circuit. Check and install a new brake light switch as required
P057501	Cruise Control Input Circuit	<ul style="list-style-type: none"> <li>General electrical failure</li> </ul>	Check speed control system for related DTCs and refer to relevant DTC Index. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
P057616	Cruise Control Input Circuit Low	<ul style="list-style-type: none"> <li>Circuit voltage below threshold</li> </ul>	Check speed control system for related DTCs and refer to relevant DTC Index. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
P057717	Cruise Control Input Circuit High	<ul style="list-style-type: none"> <li>Circuit voltage above threshold</li> </ul>	Check speed control system for related DTCs and refer to relevant DTC Index. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
P057800	Cruise Control Multi-Function Input A Circuit Stuck	<ul style="list-style-type: none"> <li>One of speed control switches stuck</li> </ul>	Check for stuck speed control switch, install a new switch pack as required
P05781C	Cruise Control Multi-Function Input A Circuit Stuck	<ul style="list-style-type: none"> <li>Circuit voltage out of range</li> </ul>	Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit. Check for stuck switch. Check and install a new speed control switch as required

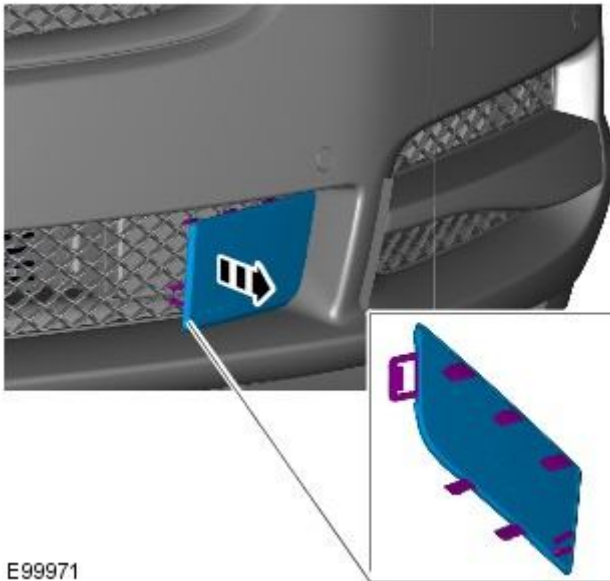
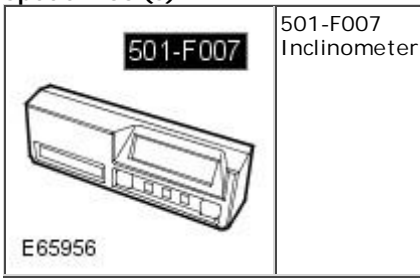


<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
P05791C	Cruise Control Multi-Function Input A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Speed control switch pack internal failure</li> </ul>	Check and install a new speed control switch pack as required
P057929	Cruise Control Multi-Function Input A Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Signal invalid</li> </ul>	Refer to the electrical circuit diagrams and check speed control switch circuits for short, open circuit. Check for stuck switch. Check and install a new speed control switch as required
P059000	Cruise Control Multi-Function Input B Circuit Stuck	<ul style="list-style-type: none"> <li>● Active speed limiter fault</li> </ul>	Check for active speed limiter fault, install a new transmission shift module as required

# Speed Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Speed Control Sensor Adjustment

General Procedures

## Special Tool(s)

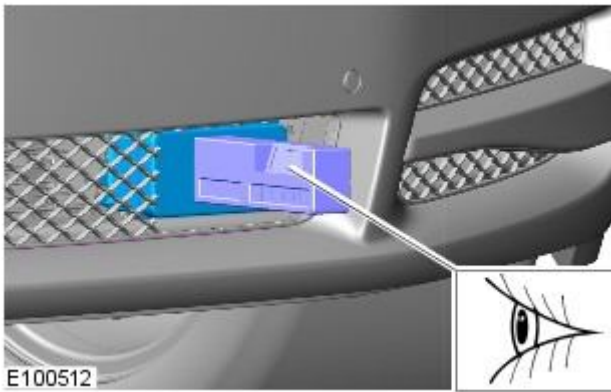


1.  CAUTION: Protect the surrounding paintwork to avoid damage.



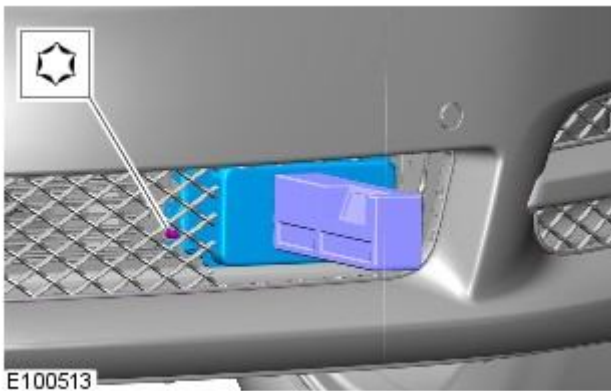
2. 2. NOTE: Make sure that the vehicle is standing on a level surface.

E100511



3. **NOTE:** Make sure that the vehicle is standing on a level surface.

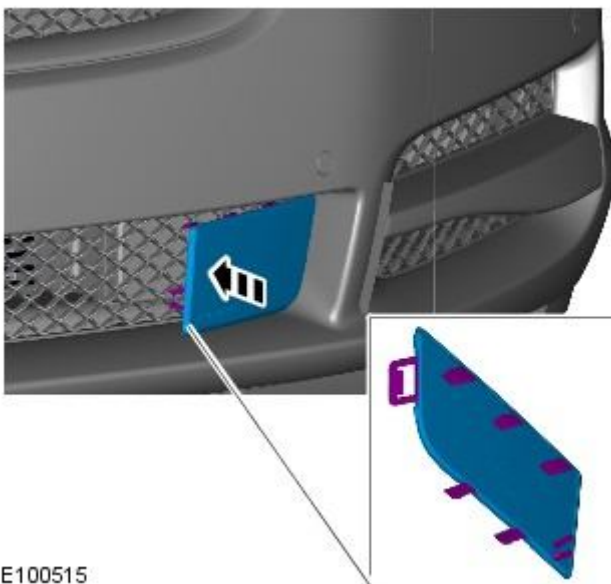
*Special Tool(s):* [501-F007](#)




4. **NOTE:** Do not release the lock nut.

- **NOTE:** Make sure that the vehicle is standing on a level surface.

*Special Tool(s):* [501-F007](#)



5.  **CAUTION:** Protect the surrounding paintwork to avoid damage.

6.
  - Configure the ACC module using the diagnostic tool.
  - This procedure is required if:
  - A new ACC radar and, or ACC module are installed.
  - The ACC radar needed to be removed or is misaligned in its position due to another repair operation.
7.
  - From the diagnostic tool menu, select: Service Alignment Mode.
  - The follow indicator will now be flashing, this indicates that the vehicle is in "service alignment" and now requires driving.
  - The vehicle speed must be above 30mph (48 kph).
  - Choose a road with plenty of stationary objects, like street lights, road signs, or barriers. Use an inside or outside lane.

- Following vehicles too closely will obscure the stationary targets from the radar, a time gap of 2 seconds is recommended.
- A straight road will produce a quicker and better result, although the process will still operate on a curved road.
- The time that the ACC module takes to align will vary, depending on the route, speed, number of targets, and individual module.
- When the flashing follow indicator light extinguishes, the ACC system is now functional, and a required vehicle speed can now be set by the driver and the ACC system will operate as normal.

# Speed Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Speed Control Deactivator Switch

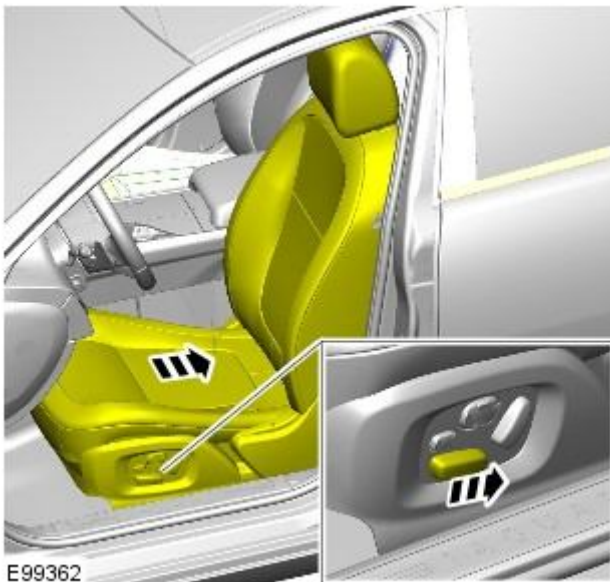
Removal and Installation

## Removal

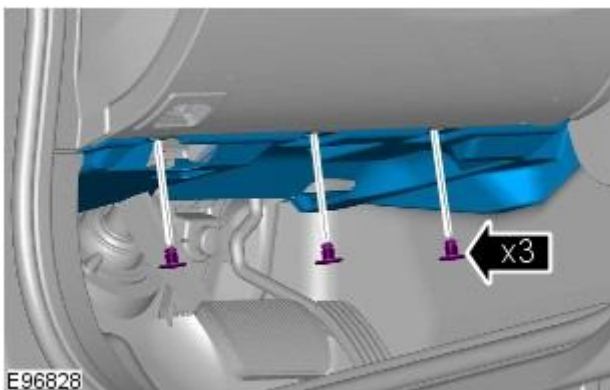
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

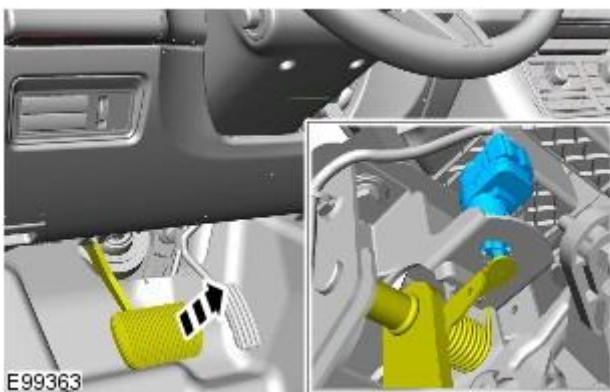
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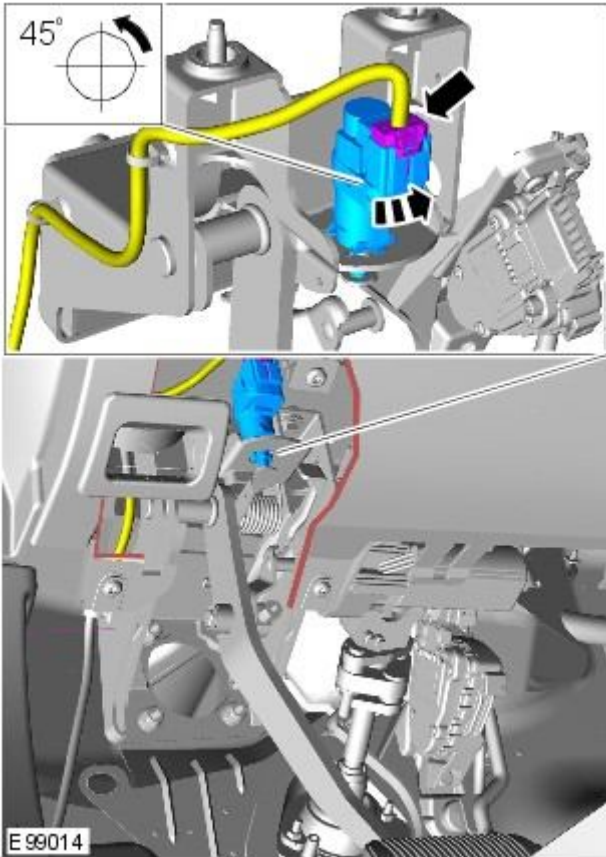


3.

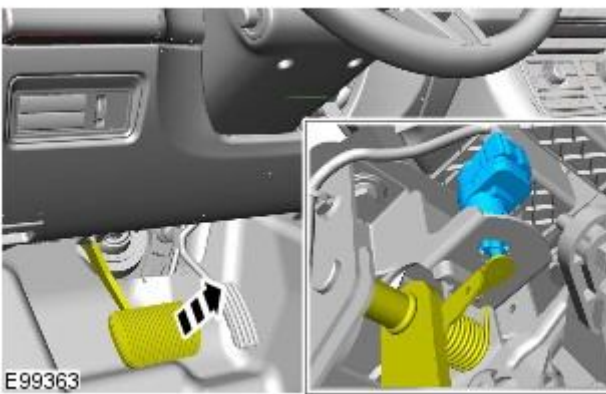


4.  CAUTION: Make sure that the brake pedal remains in the rest position during this procedure.





5.  CAUTION: Make sure that the brake pedal remains in the rest position during this procedure.



6.  CAUTION: Make sure that the brake pedal remains in the rest position during this procedure.

## Installation

1. To install, reverse the removal procedure.



# Speed Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Speed Control Module

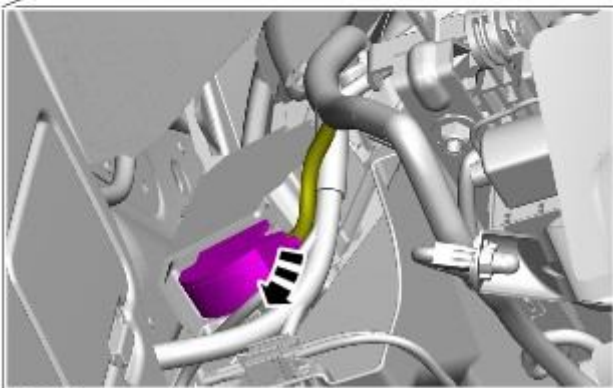
Removal and Installation

## Removal

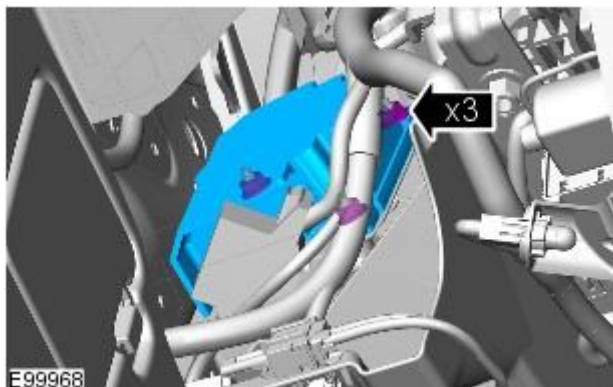
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Speed Control Sensor Adjustment](#) (310-03, General Procedures).
3. Refer to: [Instrument Panel Lower Trim Panel](#) (501-12 Instrument Panel and Console, Removal and Installation).

4.



E99967



E99968

5.  CAUTION: Make sure that all diagnostic trouble codes (DTCs) have been removed after the road test.

Torque: 4 Nm

## Installation

1. To install, reverse the removal procedure.

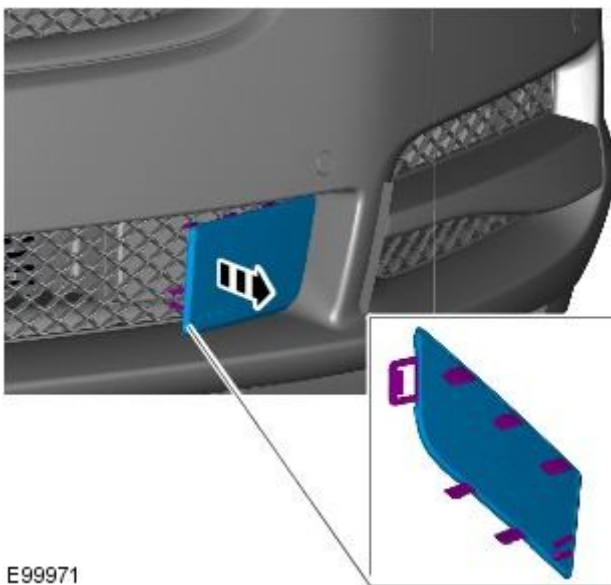
# Speed Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Speed Control Sensor

Removal and Installation

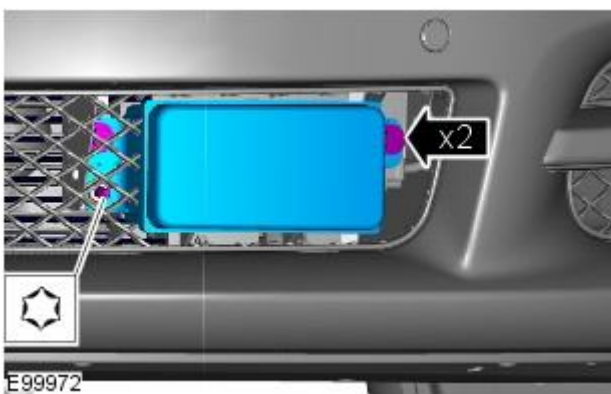
## Removal

• NOTE: Removal steps in this procedure may contain installation details.

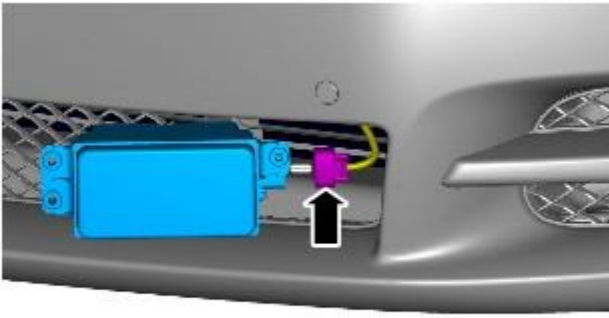
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Speed Control Sensor Adjustment (310-03, General Procedures).



3.  CAUTION: Protect the surrounding paintwork to avoid damage.




4. Torque: 5 Nm



E99973

## Installation

5.  **CAUTION:** Make sure that all diagnostic trouble codes (DTCs) have been removed after the road test.
  - **NOTE:** Make sure that the sensor is aligned after installation as described in the speed control sensor adjustment procedure.

1. To install, reverse the removal procedure.

# **Speed Control - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Speed Control Switch**

Removal and Installation

## **Removal**

1. Refer to: Speed Control Switch (310-03A, Removal and Installation).

## **Installation**

- 1.

## Climate Control System - General Information -

### Lubricants, Fluids, Sealers and Adhesives

Description	Specification
Air conditioning refrigerant	HFC 134a
Air conditioning compressor oil	ND-OIL8

### Capacities

Description	Grammes
Air conditioning refrigerant - All except vehicles with diesel engine	750
Air conditioning refrigerant - Vehicles with diesel engine	750

### Refrigerant Oil Adding Capacities

Item	Milliliters
Condenser core and desiccant bag	Add 33
Desiccant bag	Add 8
Evaporator	Add 46
Air conditioning (A/C) compressor	Drain the oil from the new compressor and replace it with the same quantity as that drained from the compressor being replaced.
Air conditioning lines - If air conditioning has been operational.	Add 10 per line

# Climate Control System - General Information - Climate Control System

Diagnosis and Testing

## Principles of Operation

For a detailed description of the Climate Control system, refer to the relevant Description and Operation sections in the Workshop Manual. REFER to:

[Air Distribution and Filtering](#) (412-01 Climate Control, Description and Operation),  
[Air Distribution and Filtering](#) (412-01 Climate Control, Description and Operation),  
[Air Distribution and Filtering](#) (412-01 Climate Control, Description and Operation),  
[Heating and Ventilation](#) (412-01 Climate Control, Description and Operation),  
[Heating and Ventilation](#) (412-01 Climate Control, Description and Operation),  
[Heating and Ventilation](#) (412-01 Climate Control, Description and Operation),  
[Air Conditioning](#) (412-01 Climate Control, Description and Operation),  
[Air Conditioning](#) (412-01 Climate Control, Description and Operation),  
[Air Conditioning](#) (412-01 Climate Control, Description and Operation),  
[Control Components](#) (412-01 Climate Control, Description and Operation),  
[Control Components](#) (412-01 Climate Control, Description and Operation),  
[Control Components](#) (412-01 Climate Control, Description and Operation),  
 Electric Booster Heater (412-02 Auxiliary Climate Control, Description and Operation),  
 Electric Booster Heater (412-02 Auxiliary Climate Control, Description and Operation),  
 Electric Booster Heater (412-02 Auxiliary Climate Control, Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Front End Accessory Drive (FEAD) belt</li> <li>● Refrigerant</li> <li>● Heater control flaps</li> <li>● Ducting</li> </ul>	<ul style="list-style-type: none"> <li>● Fuse(s)</li> <li>● Harness</li> <li>● Electrical connectors</li> <li>● Switch(s)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B105A01	Cabin Temperature Sensor Fan	<ul style="list-style-type: none"> <li>● Aspirator motor diagnostic circuit - short to ground, open circuit</li> <li>● Aspirator fan component failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check aspirator motor diagnostic circuit for short to ground, open circuit
B108100	Left Temperature Damper Motor	<ul style="list-style-type: none"> <li>● Left hand blend stepper motor internal or external fault</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system




DTC	Description	Possible Cause	Action
B108149	Left Temperature Damper Motor	<ul style="list-style-type: none"> <li>Left hand blend stepper motor internal electronic failure</li> </ul>	Suspect the left hand blend stepper motor. Check and install a new stepper motor as required, refer to the new module/component installation note at the top of the DTC Index
B108200	Right Temperature Damper Motor	<ul style="list-style-type: none"> <li>Right hand blend stepper motor internal or external fault</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B108249	Right Temperature Damper Motor	<ul style="list-style-type: none"> <li>Right hand blend stepper motor internal electronic failure</li> </ul>	Suspect the right hand blend stepper motor. Check and install a new stepper motor as required, refer to the new module/component installation note at the top of the DTC Index
B108301	Recirculation Damper Motor	<ul style="list-style-type: none"> <li>RECIRC servo motor circuits - short to ground, power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check RECIRC servo motor circuit for short to ground, power, open circuit
B108500	Defroster Damper Motor	<ul style="list-style-type: none"> <li>Defrost stepper motor internal or external fault</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B108549	Defroster Damper Motor	<ul style="list-style-type: none"> <li>Defrost stepper motor internal electronic failure</li> </ul>	Suspect the defrost stepper motor. Check and install a new stepper motor as required, refer to the new module/component installation note at the top of the DTC Index
B108600	Air Distribution Damper Motor	<ul style="list-style-type: none"> <li>Panel/foot stepper motor internal or external fault</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B108649	Air Distribution Damper Motor	<ul style="list-style-type: none"> <li>Panel/foot stepper motor internal electronic failure</li> </ul>	Suspect the panel/foot stepper motor. Check and install a new stepper motor as required, refer to the new module/component installation note at the top of the DTC Index
B108788	LIN Bus "A"	<ul style="list-style-type: none"> <li>LIN Bus power #1 circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check LIN Bus power #1 circuit for open circuit
B108888	LIN Bus "B"	<ul style="list-style-type: none"> <li>LIN Bus power #2 circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check LIN Bus power #2 circuit for open circuit
B11ED68	Electric Heater Control Module	<ul style="list-style-type: none"> <li>Event information. Electric heater - invalid communication message</li> </ul>	Clear DTC. With engine coolant temperature low, set climate temperature to high and re-test. If DTC remains in isolation suspect the PTC heater, check and install a new heater as required, refer to the new module/component installation note at the top of the DTC Index. If additional LIN related DTCs are logged refer to the Actions for these DTCs
B11ED87	Electric Heater Control Module	<ul style="list-style-type: none"> <li>Electric heater - missing communication message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B11ED96	Electric Heater Control Module	<ul style="list-style-type: none"> <li>Component internal failure</li> </ul>	Suspect the PTC heater, check and install a new heater as required, refer to the new module/component installation note at the top of the DTC Index
B11ED98	Electric Heater Control Module	<ul style="list-style-type: none"> <li>Component or system over temperature</li> </ul>	Clear DTC. With engine coolant temperature low, set climate temperature to high and re-test. If DTC remains suspect the PTC heater, check and install a new heater as required, refer to the new module/component installation note at the top of the DTC Index
B11EE01	A/C Compressor	<ul style="list-style-type: none"> <li>Air conditioning compressor clutch solenoid circuits - short to ground, power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check air conditioning compressor clutch solenoid circuits for short to ground, power, open circuit
B11F011	Air Intake Damper Position Sensor	<ul style="list-style-type: none"> <li>RECIRC servo motor air intake feedback and 5 volt supply circuits - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check RECIRC servo motor air intake feedback and 5 volt supply circuits for short to ground
B11F015	Air Intake Damper Position Sensor	<ul style="list-style-type: none"> <li>RECIRC servo motor air intake feedback and ground circuits - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check RECIRC servo motor air intake feedback and ground circuits for short to power, open circuit
B11F800	Left Outer Vent	<ul style="list-style-type: none"> <li>Left outer IP vent actuator internal or external fault</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B11F849	Left Outer Vent	<ul style="list-style-type: none"> <li>Left outer IP vent actuator internal electronic failure</li> </ul>	Suspect the left outer IP vent actuator. Check and install a new actuator as required, refer to the new module/component installation note at the top of the DTC Index

DTC	Description	Possible Cause	Action
B11F900	Left Inner Vent	<ul style="list-style-type: none"> <li>Left inner IP vent actuator internal or external fault</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B11F949	Left Inner Vent	<ul style="list-style-type: none"> <li>Left inner IP vent actuator internal electronic failure</li> </ul>	Suspect the left inner IP vent actuator. Check and install a new actuator as required, refer to the new module/component installation note at the top of the DTC Index
B11FA00	Right Inner Vent	<ul style="list-style-type: none"> <li>Right inner IP vent actuator internal or external fault</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B11FA49	Right Inner Vent	<ul style="list-style-type: none"> <li>Right inner IP vent actuator internal electronic failure</li> </ul>	Suspect the right inner IP vent actuator. Check and install a new actuator as required, refer to the new module/component installation note at the top of the DTC Index
B11FB00	Right Outer Vent	<ul style="list-style-type: none"> <li>Right outer IP vent actuator internal or external fault</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B11FB49	Right Outer Vent	<ul style="list-style-type: none"> <li>Right outer IP vent actuator internal electronic failure</li> </ul>	Suspect the right outer IP vent actuator. Check and install a new actuator as required, refer to the new module/component installation note at the top of the DTC Index
B11FF84	A/C Refrigerant Pressure	<ul style="list-style-type: none"> <li>Signal below allowable range. A/C System Refrigerant Pressure too low</li> </ul>	This DTC can be logged by the system due to low ambient temperature soak (below 3°C) reducing the pressure in the refrigerant gas system. If the cabin temperature logged along with the DTC at the time is below 10°C this could indicate low temperature. If the air conditioning performance is satisfactory and the in-cabin temperature is below 10°C then it is likely that the system contains a suitable amount of gas and the DTC is being recorded as an effect of the low ambient temperature. If this is not the case carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check air conditioning pressure sensor circuits for short, open circuit. Check for correct charge weight
B11FF85	A/C Refrigerant Pressure	<ul style="list-style-type: none"> <li>Signal above allowable range. A/C System Refrigerant pressure too high</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check air conditioning pressure sensor circuits for short, open circuit
B1A5911	Sensor 5 Volt Supply	<ul style="list-style-type: none"> <li>Air conditioning pressure sensor or RECIRC servo motor 5 volt supply circuits - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check air conditioning pressure sensor and RECIRC servo motor 5 volt supply circuits for short to ground
B1A5913	Sensor 5 Volt Supply	<ul style="list-style-type: none"> <li>Air conditioning pressure sensor 5 volt supply circuits - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check air conditioning pressure sensor 5 volt supply circuit for open circuit
B1A6011	Pollution Sensor - Hydrocarbon	<ul style="list-style-type: none"> <li>Pollution sensor hydrocarbon input circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check pollution sensor hydrocarbon input circuit for short to ground
B1A6111	Cabin Temperature Sensor	<ul style="list-style-type: none"> <li>In car temperature sensor circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check In car temperature sensor circuit for short to ground
B1A6115	Cabin Temperature Sensor	<ul style="list-style-type: none"> <li>In car temperature sensor circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check In car temperature sensor circuit for short to power, open circuit
B1A6311	Right Solar Sensor	<ul style="list-style-type: none"> <li>Right sun load sensor signal circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check right sun load sensor signal circuit for short to ground
B1A6411	Left Solar Sensor	<ul style="list-style-type: none"> <li>Left sun load sensor signal circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check left sun load sensor signal circuit for short to ground
B1A6713	Sensor Ground	<ul style="list-style-type: none"> <li>Sensor ground circuits - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check sensor ground circuits for open circuit
B1A6901	Humidity Sensor	<ul style="list-style-type: none"> <li>Humidity sensor PWM input circuit - short to ground, power, open circuit</li> <li>Sensor component failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check humidity sensor PWM input circuit for short to ground, power, open circuit. Check and install a new sensor as required

DTC	Description	Possible Cause	Action
B1B6211	Pollution Sensor - NOx	<ul style="list-style-type: none"> <li>● Pollution sensor NOx input circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check pollution sensor NOx input circuit for short to ground
B1B7111	Evaporator Temperature Sensor	<ul style="list-style-type: none"> <li>● Evaporator temperature sensor signal circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check evaporator temperature sensor signal circuit for short to ground
B1B7115	Evaporator Temperature Sensor	<ul style="list-style-type: none"> <li>● Evaporator temperature sensor signal circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check evaporator temperature sensor signal circuit for short to power, open circuit
B1B7211	LIN Bus #1 Power Supply Circuit	<ul style="list-style-type: none"> <li>● Stepper motor circuit LIN Bus #1 power supply - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check stepper motor circuit LIN Bus #1 power supply for short to ground
C1B1413	Sensor Supply Voltage A	<ul style="list-style-type: none"> <li>● RECIRC servo motor 5 volt supply circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check RECIRC servo motor 5 volt supply circuit for open circuit
C1B1513	Sensor Supply Voltage B	<ul style="list-style-type: none"> <li>● RECIRC servo motor and EVAP sensor ground circuits - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check RECIRC servo motor and EVAP sensor ground circuits for open circuit
P053011	A/C Refrigerant Pressure Sensor A Circuit	<ul style="list-style-type: none"> <li>● Air conditioning pressure sensor signal circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check air conditioning pressure sensor signal circuit for short to ground
P053015	A/C Refrigerant Pressure Sensor A Circuit	<ul style="list-style-type: none"> <li>● Air conditioning pressure sensor signal circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check air conditioning pressure sensor signal circuit for short to power, open circuit
U001088	Medium Speed CAN Communication Bus	<ul style="list-style-type: none"> <li>● Bus off</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U030000	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>● Invalid configuration message is received</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the climate control module, refer to the new module/component installation note at the top of the DTC Index
U1A1449	CAN Initialisation Failure	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Suspect the climate control module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300055	Control Module	<ul style="list-style-type: none"> <li>● Incorrect car configuration data received</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the climate control module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300087	Control Module	<ul style="list-style-type: none"> <li>● Missing message</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. Check climate control module for DTCs and refer to the DTC Index. Carry out CAN network integrity tests using the manufacturer approved diagnostic system. If DTC remains suspect the climate control module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300281	Vehicle Identification Number	<ul style="list-style-type: none"> <li>● Vehicle/component mis-match. Corrupt VIN data being transmitted, module previously installed to other vehicle</li> </ul>	Check and install original/new module as required, refer to the new module/component installation note at the top of the DTC Index

# Climate Control System - General Information - Air Conditioning (A/C) System Recovery, Evacuation and Charging

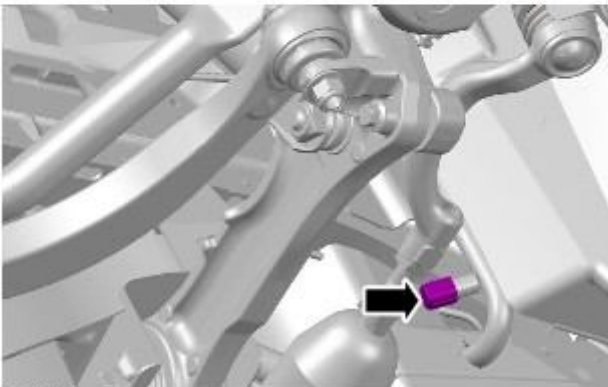
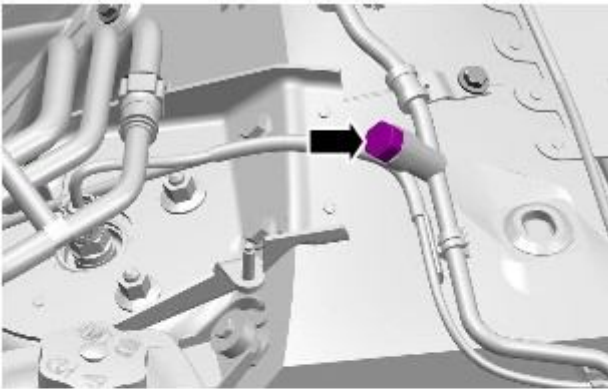
General Procedures

1.  **WARNING:** Servicing must be carried out by personnel familiar with both vehicle system and the charging and testing equipment. All operations must be carried out in a well ventilated area away from open flame and heat sources.

• **NOTE:** The receiver drier need only be changed under the following circumstances: There is dirt in the refrigerant circuit ( eg. compressor seizure ), the system is leaking and refrigerant has been lost to atmosphere, or the refrigerant circuit has been open more than 24 hours, due to repair.

Refrigerant recovery.

2. Remove the dust covers from the high and low pressure connections.



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3. Connect the high and low pressure lines to the appropriate connections.

4. Open the valves on the connections.

5. Turn the valves on the station to the correct positions.

6. Turn the process switch to the correct position.


7. Turn the main switch to 'ON'.

8.  **WARNING:** Refrigerant must always be recycled before re-use to ensure that the purity of the refrigerant is high enough for safe use in the air conditioning system. Recycling should always be carried out with equipment which is design certified by Underwriter Laboratory Inc. for compliance with SEA J1991. Other equipment may not recycle refrigerant to the required level of purity. R143a Refrigerant Recover Recycling Recharging station must not be used with any other type of refrigerant. Refrigerant R134a from domestic and commercial sources must not be used in motor vehicles air conditioning systems.

Allow the system to recover the refrigerant from the system.

9. Close the valves on the refrigerant station.

10. Turn the main switch 'OFF'.

11. Close the valves on the connections.
12. Disconnect the high and low pressure connections.
13. Install the dust covers to the connectors.
14. Open the tap at the rear of the station to drain the refrigerant oil.
15. Measure and record the quantity of refrigerant oil recovered from the system.
16. Close the tap at the rear of the station.
17. Evacuation.
18. Remove the dust covers from the high and low pressure connections.
19. Connect the high and low pressure lines to the appropriate connections.
20. Open the valves on the connections.
21. Turn the valves on the station to the correct positions.
22. Turn the process switch to the correct position.
23. Turn the main switch to 'ON'.
24. Allow the station to evacuate the A/C system.
25.  **CAUTION:** The system must be evacuated immediately before recharging commences. Delay between evacuation and recharging is not permitted

#### Recharging

26. Close the valves on the refrigerant station.
27. Close the valve on the oil charger.
28. Disconnect the yellow line from the refrigerant station.
29. Remove the cover from the oil charger.
30. Pour the correct quantity of refrigerant oil into the oil charger.
31. Install the cover to the oil charger.
32. Connect the yellow line to the refrigerant station.
33. Open the valve on the oil charger.
34. Move the pointer on the refrigerant gauge to mark the position of the refrigerant drop.
35. Slowly open the correct valve on the refrigerant to allow the vacuum to pull the refrigerant into the system.
36. Close the valve on the refrigerant station when the correct amount of refrigerant has been drawn into the air conditioning system.
37. Turn the main switch 'OFF'.
38. Close the valves on the connections.
39. Disconnect the high and low pressure connections.

# Climate Control System - General Information - Air Conditioning (A/C) System Flushing

## General Procedures

### 1. WARNINGS:



Use extreme care and observe all safety precautions related to the use of refrigerants. Due to refrigerant hazards, always wear safety goggles and non-penetrable gloves when working on or flushing air conditioning (A/C) systems. Failure to follow this instruction may result in personal injury.



When flushing the A/C system, refer to the manufacturers equipment instructions for additional information. Failure to do so may result in system damage or personal injury.



The A/C refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts shop bulk refrigerant at risk of contamination. If the vehicle A/C refrigerant is contaminated, refer the customer to return to the repair facility that performed the last A/C repair. If the customer wishes to pay the additional cost, use the A/C recovery equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For additional information, refer to the manufacturers equipment instructions. Failure to follow this instruction may result in personal injury.



Prior to using the A/C flushing equipment for the first time, follow the operating instructions. Failure to follow this instruction may result in personal injury.



**CAUTION:** Prior to flushing, remove and discard the desiccant sack. Depending on the equipment used, other A/C components may have to be removed prior to flushing. For additional information, refer to the manufacturers equipment instructions before flushing the A/C system.

Recover the refrigerant.

For additional information, refer to [Air conditioning \(A/C\) System Recovery, Evacuation and Charging](#) in this section.

2. Remove the desiccant sack.  
For additional information, refer to Section [412-03 Air Conditioning](#).
3. Flush the system. For additional information, refer to the manufacturers equipment instructions.
4. Install new refrigerant lines if blocked with debris.
5. Install a new desiccant sack.  
For additional information, refer to Section [412-03 Air Conditioning](#).
6. Add the required amount of oil to the A/C system depending on the repair procedure.  
For additional information, refer to [Refrigerant Oil Adding](#) in this section.
7. Evacuate and charge the A/C system.  
For additional information, refer to [Air conditioning \(A/C\) System Recovery, Evacuation and Charging](#) in this section.
8. Carry out fluorescent dye leak detection test.  
For additional information, refer to [Flourescent Dye Leak Detection](#) in this section.
9. Check the A/C system for correct operation.




# Climate Control System - General Information - Contaminated Refrigerant Handling

## General Procedures

1. If contaminated refrigerant is detected DO NOT recover the refrigerant into your R-134a OR R-12 recovery/recycling equipment. Take the follow actions:
  1. Repeat the test to verify contaminated refrigerant is present.
  2. Advise the customer of the contaminated A/C system and any additional cost to repair the system. The customer may wish to return to the repair facility performing the last A/C repair.
  3. Recover the contaminated refrigerant using suitable recovery only equipment designed for capturing and storing contaminated refrigerant. This equipment must only be used to recover contaminated refrigerant to prevent the spread to other vehicles. As an alternative, contact an A/C repair facility in your area with the proper equipment to perform the repair.
  4. On completion of the recovery of the contaminated refrigerant, it will be necessary to carry out the A/C system flushing procedure.  
For additional information, refer to [Air Conditioning \(AC\) System Flushing](#) in this section.

# Climate Control System - General Information - Electronic Leak Detection

## General Procedures

-  **WARNING:** Good ventilation is necessary in the area where A/C leak testing is to be carried out. If the surrounding air is contaminated with refrigerant gas, the leak detector will indicate this gas all the time. Odors from other chemicals such as antifreeze, diesel fuel, disc brake cleaner, or other cleaning solvents can cause the same problem. A fan, even in a well ventilated area, is very helpful in removing small traces of contamination from the air that might affect the leak detector. Failure to follow this instruction may result in personal injury.

Attach an R-134a manifold gauge set or use a UL-approved recovery/recycling device such as an R-134a A/C refrigerant center (which meets SAE Standard J 1991). For additional information, refer to the manufacturers equipment instructions.

- Both gauges should indicate 413-551 kPa (60-80 psi) at 24°C (75°F) with the engine off.
  - If little or no pressure is indicated, carry out the air conditioning (A/C) system recovery, evacuation and charging procedure.  
For additional information, refer to [Air Conditioning \(AC\) System Recovery, Evacuation and Charging](#) in this section.
2. Use an R134-a Automatic calibration halogen leak detector to leak test the refrigerant system. For additional information, refer to the manufacturers equipment instructions.
  3. If a leak is found, carry out the air conditioning (A/C) system recovery procedure.  
For additional information, refer to [Air Conditioning \(AC\) System Recovery, Evacuation and Charging](#) in this section.

# Climate Control System - General Information - Fluorescent Dye Leak Detection

## General Procedures



1. **WARNING:** Eye protection glasses supplied with the ultraviolet (UV) lamp should be used to protect eyesight from harm.

• **NOTE:** The air conditioning (A/C) system has an R-134a leak trace dye wafer incorporated into the desiccant bag. The exact location of leaks can be pinpointed by the bright yellow/green glow of the tracer dye. Since more than one leak may exist, always inspect each component. If it is necessary to add dye (due to a severe leakage for example) use proprietary tracer dye injection equipment.

Check for leaks using ultraviolet (UV) lamp.

2. Check all components, fittings and lines of the A/C system.
3. Carry out the repair. For additional information, refer to Section [412-03 Air Conditioning](#).
4. After the leak is repaired, remove any traces of leak trace dye with a general purpose oil solvent.
5. Check the A/C system for correct operation.
6. Verify the repair by operating the system for a short time and inspecting with the (UV) lamp.

# Climate Control System - General Information - Inspection and Assembly Requirements

## General Procedures

1. Check for leaks using ultraviolet (UV) Lamp.  
For additional information, refer to [Flourescent Dye Leak Detection](#) in this section.
  2. NOTE: Any time a hose or component connection leak is observed, the component and fitting must be separated, cleaned and a new O-ring fitted and lubricated with air conditioning compressor oil.  
For additional information, refer to [Specifications](#) in this section.
- NOTE: When separating A/C joints, cap the open connections immediately. Do not leave open to atmosphere.

O-ring seal surfaces must be free of dirt, lint, burrs and scratches. The O-ring and connector should be lubricated with air conditioning compressor oil.  
For additional information, refer to [Specifications](#) in this section.

# Climate Control System - General Information - Manifold Gauge Set Connection

General Procedures

## 1. WARNINGS:



Use extreme care and observe all safety precautions related to the use of refrigerants. Failure to follow this instruction may result in personal injury.



For additional information, refer to the manufacturers equipment instructions. Failure to follow this instruction may result in personal injury and system damage.

Install the manifold gauge set. For additional information, refer to the manufacturers equipment instructions.

2. Carry out the repair.

3. Remove the manifold gauge set. For additional information, refer to the manufacturers equipment instructions.

4. Carry out fluorescent dye leak detection test.  
For additional information, refer to [Flourescent Dye Leak Detection](#) in this section.

5. Check air conditioning (A/C) system for correct operation.

# Climate Control System - General Information - Refrigerant Oil Adding

General Procedures



**CAUTION:** Collect the refrigerant oil in a clean measuring cylinder.

1. **NOTE:** This step only needs to be carried out when removing the A/C compressor.

- **NOTE:** Rotate the compressor shaft at least 6 to 8 turns when draining the refrigerant oil.

Drain the refrigerant oil from the defective A/C compressor and dispose of it.

2. **CAUTIONS:**



The refrigerant oil top-up quantity must not exceed the refrigerant oil fill quantity.



If other A/C components are being renewed in addition to the A/C compressor, there is no need to top up with additional refrigerant oil, apart from filling the compressor.

Top up with the calculated quantity of new refrigerant oil.

Refer to: [Specifications](#) (412-00 Climate Control System - General Information, Specifications).



# Climate Control System - General Information - Refrigerant System Tests

## General Procedures

### 1. WARNINGS:



Use extreme care and observe all safety precautions related to the use of refrigerants. Failure to follow this instruction may result in personal injury.



The A/C refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts shop bulk refrigerant at risk of contamination. If the vehicle A/C refrigerant is contaminated, refer the customer to return to the repair facility that carried out the last A/C repair. If the customer wishes to pay the additional cost, use the A/C recovery equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For all equipment, follow the equipment manufacturers procedures and instructions. Failure to follow this instruction may result in personal injury.

• NOTE: Jaguar Cars Ltd. supports the efficient usage, recovery and recycling of the refrigerant used in passenger car air conditioners. Jaguar Cars Ltd. recommends the use of UL-approved recovery/recycling device such as R-134a A/C refrigerant center (which meets SAE Standard J 1991) during any A/C system repair and recharge procedure which requires that the system be evacuated.

Use R-134a A/C Refrigerant Centre to evacuate and recover the A/C system.

- Follow the equipment manufactures procedures and instructions for use of equipment.

**Climate Control -**

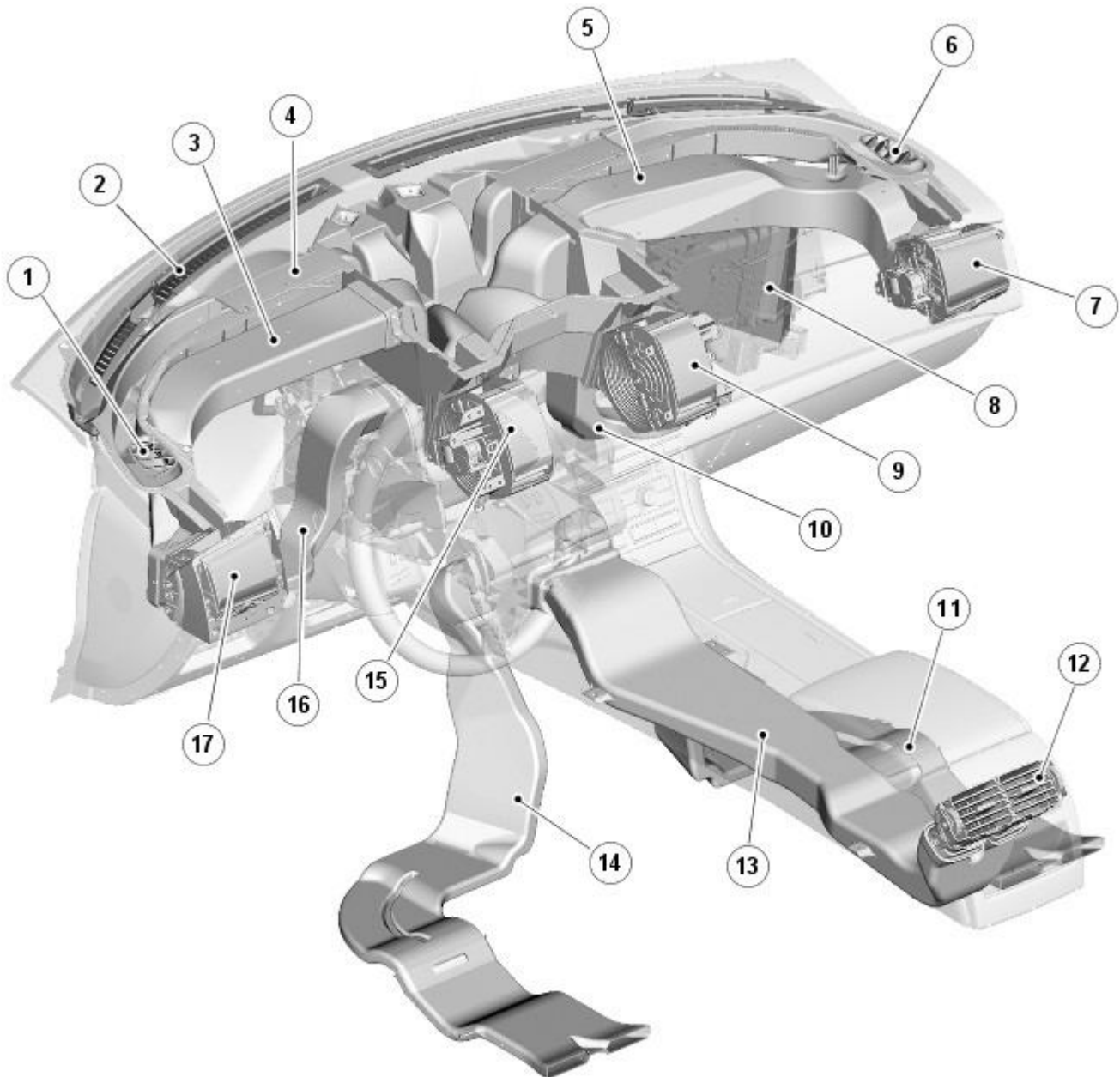
Description	Nm	lb-ft	lb-in
Blower motor control module retaining bolts	1	-	9
Foot duct to cross car beam retaining bolt	5	-	44
Climate control assembly to cross car beam retaining bolts	9	-	80
Climate control module retaining bolts	1	-	9
Defrost vent/register blend door actuator retaining bolts	1	-	9
Evaporator pipe bracket retaining bolts	1	-	9
Evaporator housing retaining bolts	1	-	9
Footwell vent/duct blend door actuator retaining bolt	1	-	9
Heater core housing retaining bolts	2	-	18
Sunload sensor retaining bolt	2	-	18
Evaporator core pipes mounting bracket retaining bolts	1	-	9
Evaporator core pipes to thermostatic expansion valve retaining bolt	5	-	44
Thermostatic expansion valve retaining bolts	3	-	26

# Climate Control - Air Distribution and Filtering - Component Location

## Description and Operation

• NOTE: LHD (left-hand drive) vehicle shown, RHD (right-hand drive) vehicle similar.

## Component Location



E98200

### ItemDescription

1	LH (left-hand) side window vent
2	Windshield vent
3	Driver's face level duct
4	Windshield/Side window vent duct
5	Front passenger's face level duct
6	RH (right-hand) side window vent
7	Front passenger's face level register
8	Pollen filter
9	RH inner face level register
10	Front passenger's footwell duct
11	RH rear footwell duct
12	Rear face level registers

13	Rear face level duct
14	<a href="#">LH</a> rear footwell duct
15	<a href="#">LH</a> inner face level register
16	Driver's footwell duct
17	Driver's face level register

# **Climate Control - Air Distribution and Filtering - Overview**

Description and Operation

## **Overview**

The air distribution and filtering system controls the distribution and quality of air supplied to the passenger compartment. The system comprises of a pollen filter and a number of ducts, vents and registers.





11	Face/Feet distribution stepper motor
12	<a href="#">RH</a> temperature blend stepper motor
13	Windshield (defrost) distribution stepper motor
14	<a href="#">LH</a> temperature blend stepper motor

## System Operation

### Face Level Registers

Operation of the face level registers is controlled by the [ATC](#) module, using [LIN](#) bus messages to the integral stepper motors. The four registers operate together in both the opening and closing phases.

The face level registers can be selected to run in one of two modes; 'automatic' or 'always open'. The mode is selected on the climate control screen of the TSD.

Refer to: [Navigation System](#) (415-01 Information and Entertainment System, Description and Operation).

In the automatic mode, operation of the face level registers is synchronized with the engine START/STOP button. When the engine starts the [ATC](#) module opens the registers. When the engine stops, the [ATC](#) module closes the registers.

If a face level register is fouled, when it receives an open or close request, the register concerned makes a number of attempts to reach the requested position. If the register still does not move, it is left in the fouled position. The remaining registers will continue to open and close as normal.

The automatic mode is disabled when the climate control system is off. The [ATC](#) module closes the registers if they are open in the automatic mode and the climate control system is selected off.

### Diagnostics

If a fault occurs with the face level registers, a [DTC \(diagnostic trouble code\)](#) is stored in the [ATC](#) module. The [DTC](#) can be read using the Jaguar approved diagnostic system. The Jaguar approved diagnostic system can also initiate a self test routine to check the operation of the face level registers.

Refer to: [Climate Control System](#) (412-00 Climate Control System - General Information, Diagnosis and Testing).

## Component Description

### Air Ducts

The air ducts distribute air from the heater assembly to the registers and vents in the instrument panel and the center floor console. Air ducts also direct air from the heater assembly into the front and rear footwells.

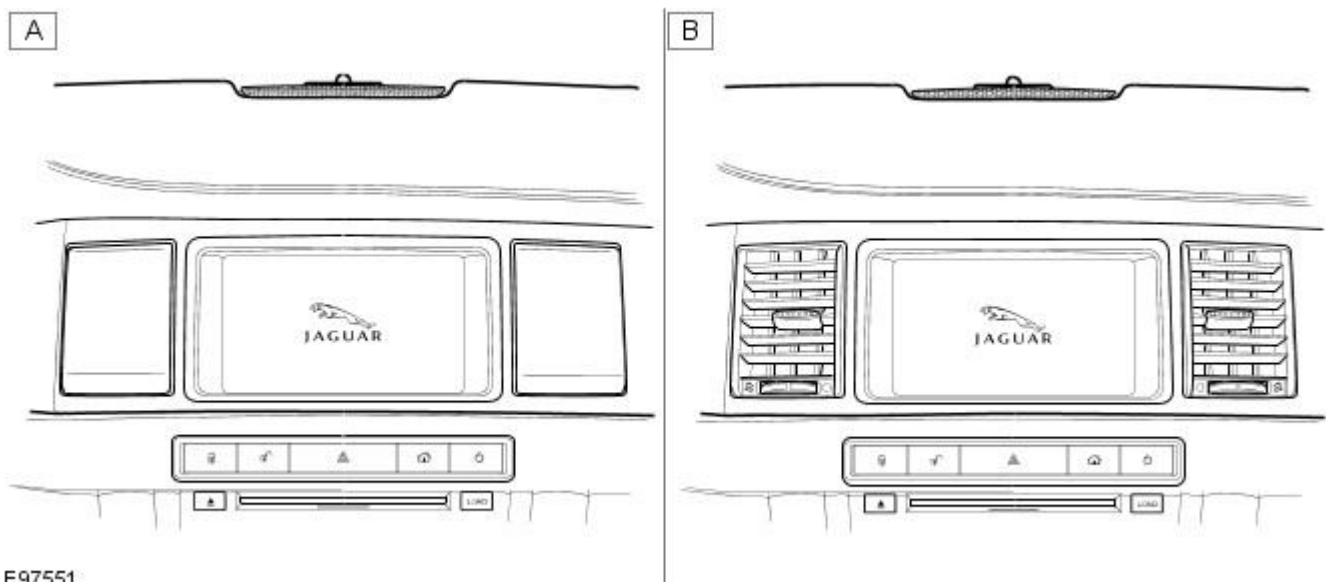
### Registers and Vents

The registers control the flow and direction of air from the air ducts. The instrument panel contains four face level registers; one at each end and two mounted centrally. For the rear seat occupants, two registers are installed in the rear face of the center floor console. All of the registers incorporate vertical and horizontal directional vane adjustment and full air flow adjustment down to zero.

The four face level registers in the instrument panel each contain an integral stepper motor. The stepper motors enable the registers to rotate between the open and closed positions. In the open position, the registers have normal appearance and functionality. In the closed position, the registers present a smooth surface flush with the surrounding instrument panel.

The vents are fixed outlets. There are four vents in the upper surface of the instrument panel; one in each end to direct air onto the side windows and two along the front edge to direct air onto the windshield.

Central Face Level Registers



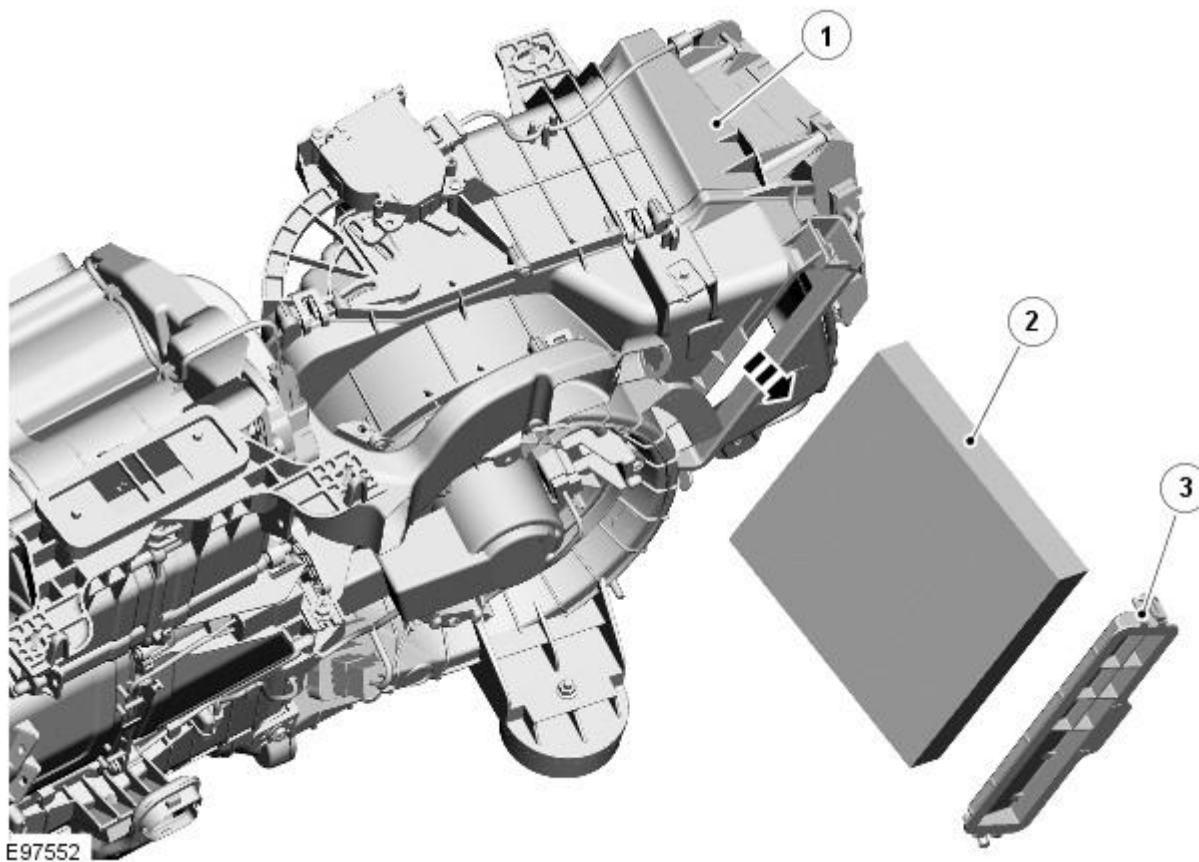
**ItemDescription**

A Registers closed

B Registers open

**Pollen Filter**

- NOTE: LHD (left-hand drive) vehicle shown, RHD (right-hand drive) vehicle similar.

**ItemDescription**

1 Air inlet duct

2 Pollen filter

3 Cover

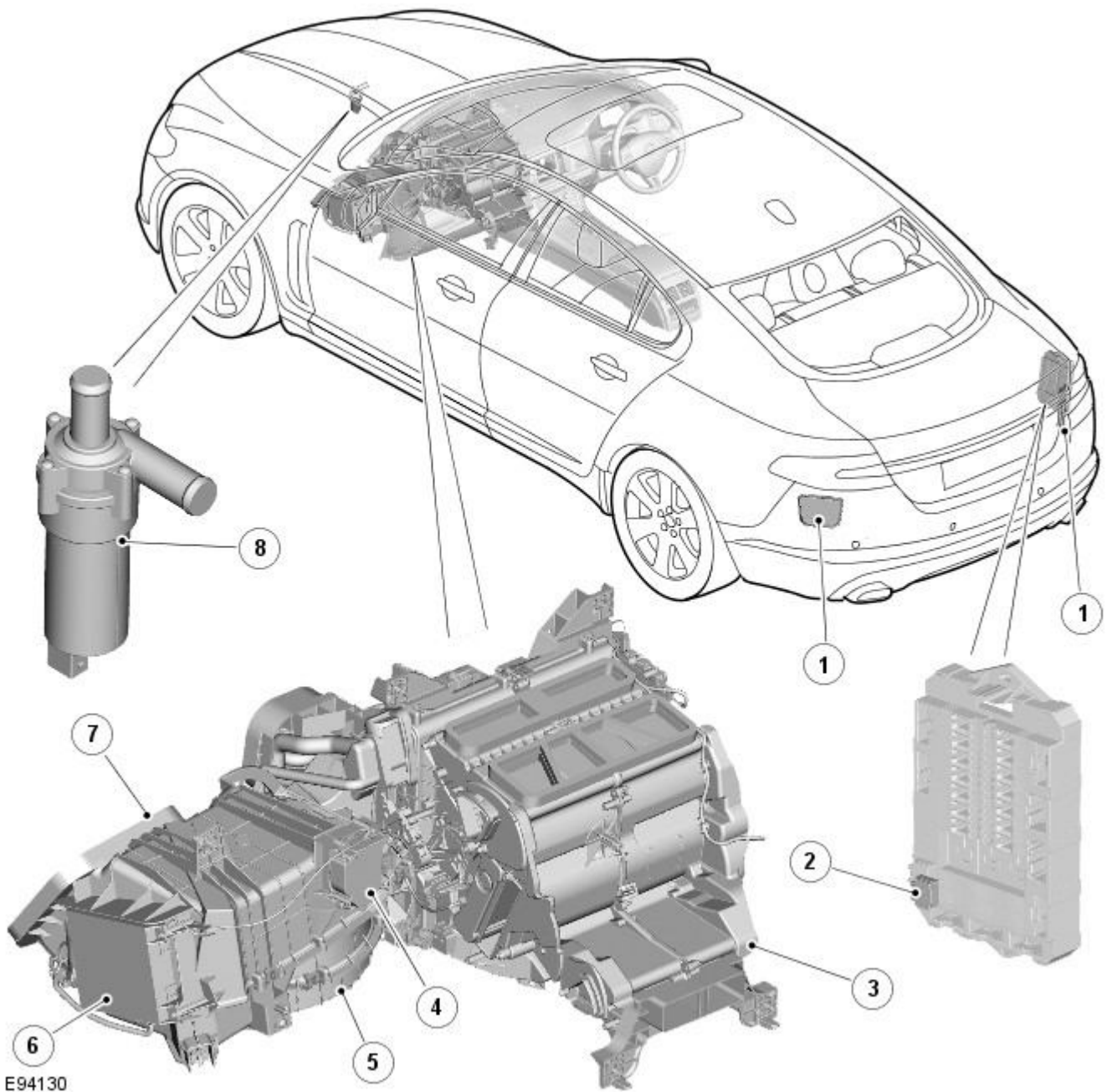
The pollen filter removes odors and fine particles from fresh air entering the passenger compartment. The pollen filter is located in the air inlet duct, in the inlet to the blower. A cover on the underside of the air inlet duct provides access to the pollen filter for servicing.

# Climate Control - Heating and Ventilation - Component Location

## Description and Operation

- NOTE: RHD (right-hand drive) vehicle shown, LHD (left-hand drive) vehicle similar.

## Component Location



### ItemDescription

1	Ventilation outlet
2	Blower relay (on RJB (rear junction box))
3	Heater assembly
4	Blower control module
5	Blower
6	ATC (automatic temperature control) module
7	Air inlet duct
8	Auxiliary coolant pump
<b>Comments:</b>	
All except 3.0L vehicles: 4.2L version shown, 2.7L diesel version similar.	

# Climate Control - Heating and Ventilation - Overview

Description and Operation

## Overview

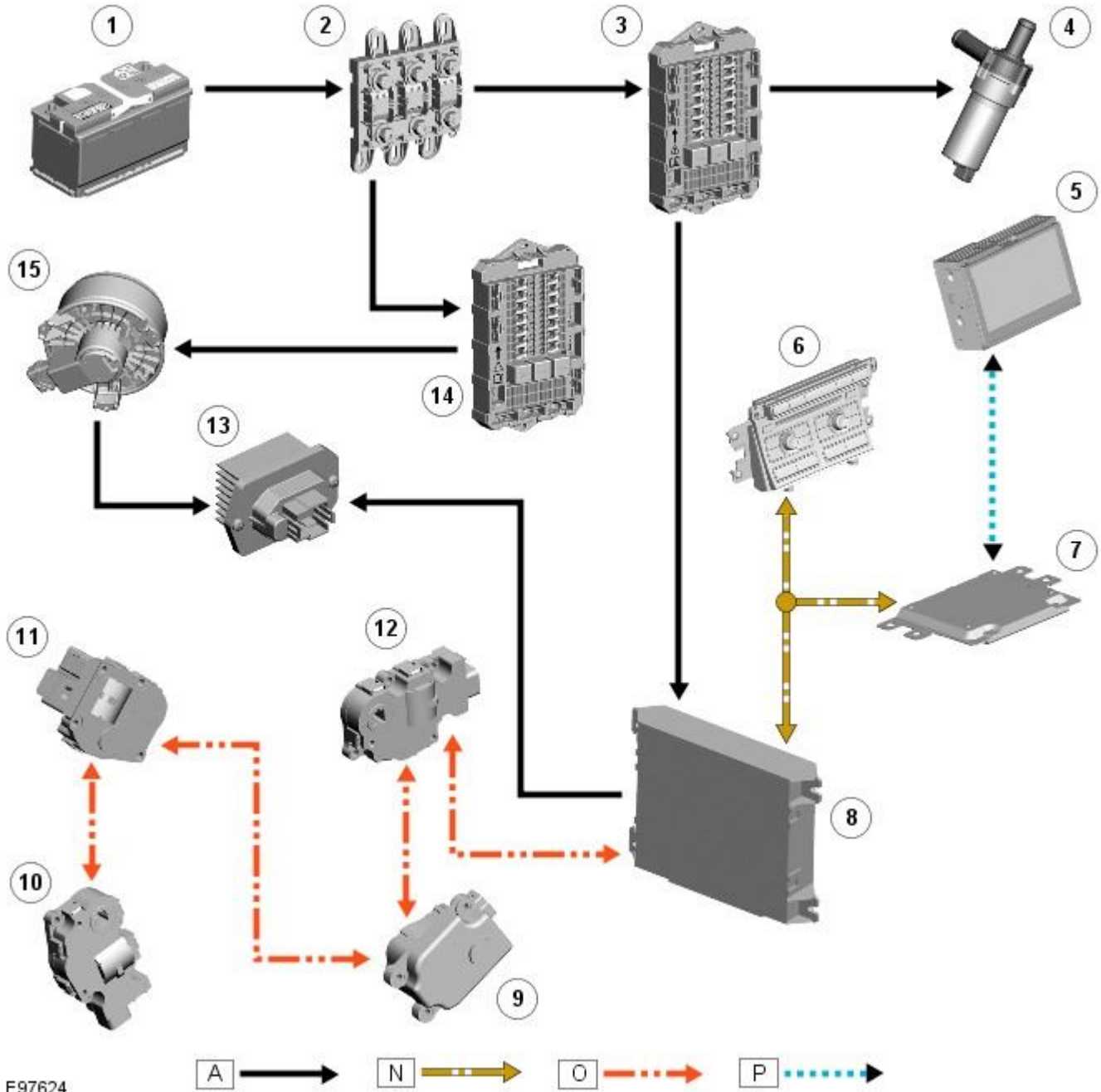
The heating and ventilation system controls the temperature and flow of air supplied to the passenger compartment. The system is a dual zone automatic system, which can provide different temperature settings for the [LH \(left-hand\)](#) and [RH \(right-hand\)](#) sides of the passenger compartment.

# Climate Control - Heating and Ventilation - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **N** = Medium speed CAN (controller area network) bus; **O** = LIN (local interconnect network) bus; **P** = Media orientated system transport (MOST) ring.



E97624

### ItemDescription

1	Battery
2	BJB (battery junction box)
3	CJB (central junction box)
4	Auxiliary coolant pump <b>Comments:</b> all except 3.0L vehicles; 4.2L version shown, 2.7L diesel version similar
5	Touch screen display (TSD)
6	Integrated control panel
7	Information control module
8	ATC (automatic temperature control) module
9	Face/Feet distribution stepper motor

10	<a href="#">RH (right-hand)</a> temperature blend stepper motor
11	<a href="#">LH (left-hand)</a> temperature blend stepper motor
12	Windshield (defrost) distribution stepper motor
13	Blower control module
14	<a href="#">RJB (rear junction box)</a>
15	Blower

## System Operation

Operation of the heating and ventilation system is controlled by the [ATC](#) module.  
Refer to: [Control Components](#) (412-01 Climate Control, Description and Operation).

The system can be operated in automatic or manual mode, with temperature settings selected using the switches on the integrated control panel.

When the engine is running, coolant is constantly circulated through the heater core by the engine coolant pump and the auxiliary coolant pump. Where fitted, the auxiliary coolant pump is energized by the [CJB](#) on receipt of medium speed [CAN](#) bus signals from the [ATC](#) module. The [CJB](#) broadcasts auxiliary coolant pump status over the medium speed [CAN](#) bus for use by other vehicle systems.

The blower is supplied with power by the blower relay on the [RJB](#) and connected to ground via the blower control module. The blower control module regulates the voltage across the blower motor to control blower speed. The voltage set by the blower control module is controlled by a [PWM \(pulse width modulation\)](#) signal from the [ATC](#) module. The [ATC](#) module uses a feedback signal from the blower control module to monitor blower speed.  
Refer to: [Control Components](#) (412-01 Climate Control, Description and Operation).

## Component Description

### Heater Assembly

The heater assembly controls the temperature and flow of air supplied to the air distribution ducts. The heater assembly is mounted on the vehicle centerline, between the instrument panel and the engine bulkhead.

The heater assembly consists of a casing that contains an [A/C \(air conditioning\)](#) evaporator, a heater core, two air distribution control doors and two temperature blend control doors. On 2.7L diesel vehicles, the heater assembly also contains an electric booster heater.  
Refer to: Electric Booster Heater (412-02, Description and Operation).

Mounted on the heater casing are four stepper motors. Each of the stepper motors is connected to either an air distribution control door or a temperature blend control door.

The [A/C](#) evaporator is part of the [A/C](#) system.  
Refer to: [Air Conditioning](#) (412-01 Climate Control, Description and Operation).

The heater core provides the heat source to warm the air supplied to the passenger compartment. The heater core is an aluminum two pass, fin and tube heat exchanger, and is installed across the width of the heater housing. Two aluminum tubes attached to the heater core extend through the engine bulkhead and connect to the engine cooling system. For additional information, refer to:

Engine Cooling (303-03A, Description and Operation),  
Engine Cooling (303-03B, Description and Operation),  
[Engine Cooling](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

### Air Inlet Duct

The air inlet duct connects the fresh air inlet in the engine bulkhead to the heater assembly. The air inlet duct is installed behind the instrument panel on the passenger side.

The air inlet duct consists of a casing that contains a pollen filter, an air inlet door, a blower and a blower control module. A recirculation air inlet is incorporated into the casing. A servo motor is mounted on the casing and connected to the air inlet door, to allow selection between fresh and recirculated air.  
Refer to: [Control Components](#) (412-01 Climate Control, Description and Operation).

The pollen filter is part of the air distribution and filtering system.  
Refer to: [Air Distribution and Filtering](#) (412-01 Climate Control, Description and Operation).

The blower regulates the volume of air flowing through the air inlet duct to the heater assembly. The blower consists of an open hub, centrifugal fan and an electric motor.

The blower control module regulates the power supply to the blower motor. The blower control module is installed in the air inlet duct downstream of the blower, where any heat generated during operation is dissipated by the air flow.

### Auxiliary Coolant Pump

On all vehicles except 3.0L, an auxiliary coolant pump is installed on the rear right side of the radiator housing, in the return line from the heater core. The auxiliary coolant pump is an electric pump that boosts the flow of coolant through the heater core.

### Ventilation Outlets

The ventilation outlets allow the free flow of air through the passenger compartment. The outlets are installed in the LH and RH rear quarter panels, below the rear lamps. Each ventilation outlet consists of a grille covered by a soft rubber flap, and is effectively a non-return valve. The flaps open and close automatically depending on the pressure differential between the air inside and outside the vehicle.

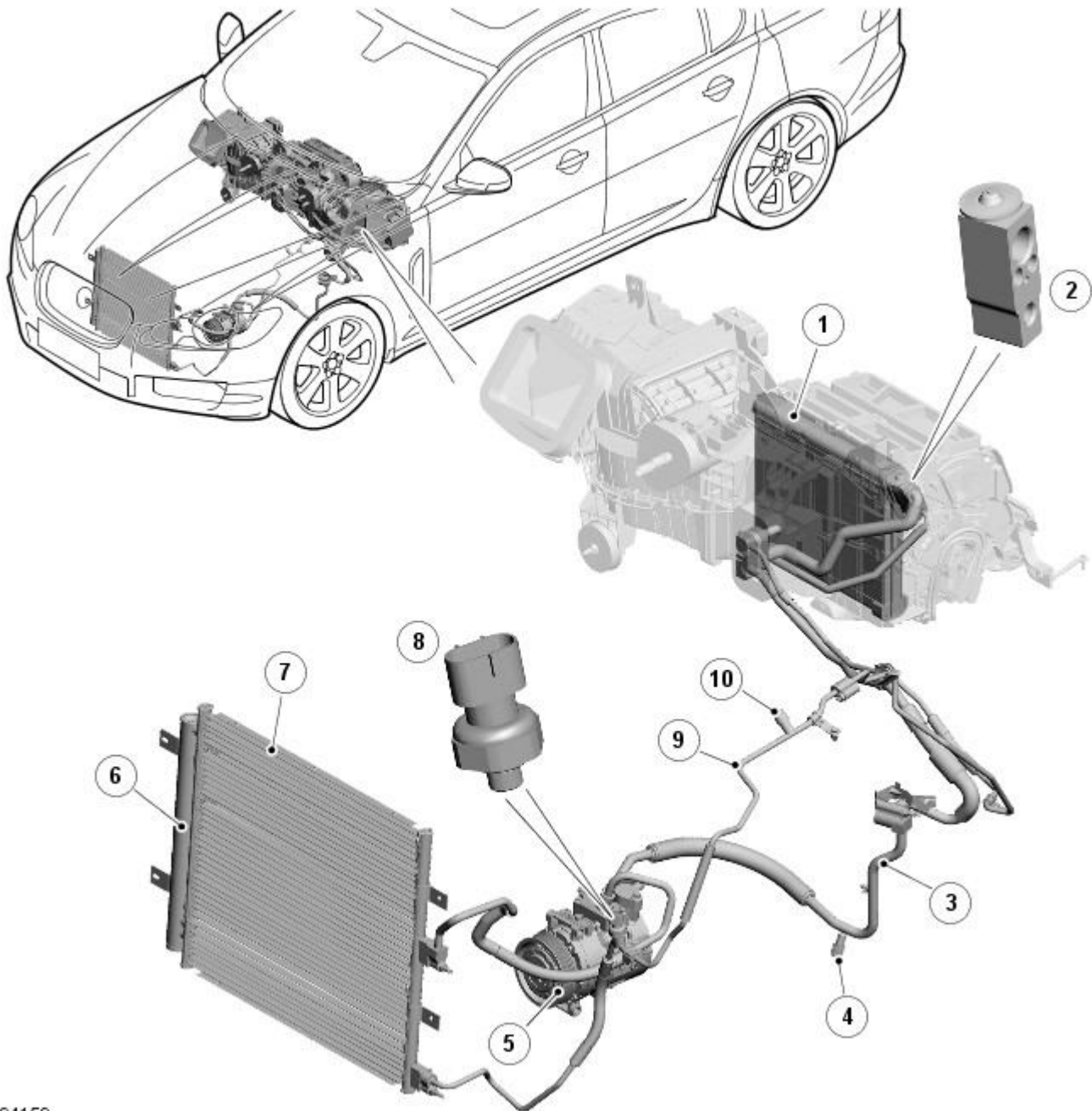


# Climate Control - Air Conditioning - Component Location

## Description and Operation

- NOTE: LHD (left-hand drive) 4.2L vehicle shown, other vehicles similar.

## Component Location



E94159

### ItemDescription

1	Evaporator
2	Thermostatic expansion valve
3	Low pressure line
4	Low pressure servicing connection
5	A/C (air conditioning) compressor
6	Receiver/Drier
7	Condenser
8	Refrigerant pressure sensor
9	High pressure line
10	High pressure servicing connection

# Climate Control - Air Conditioning - Overview

Description and Operation

## Overview

The [A/C \(air conditioning\)](#) system transfers heat from the passenger compartment to the outside atmosphere to provide the heater assembly with dehumidified cold air. It is a sealed, closed loop system filled with a charge weight of R134a refrigerant as the heat transfer medium. Oil is added to the refrigerant to lubricate the internal components of the [A/C](#) compressor.

# Climate Control - Air Conditioning - System Operation and Component Description

Description and Operation

## System Operation

### General

To accomplish the transfer of heat, refrigerant is circulated around a sealed system, where it passes through two pressure/temperature regimes. In each of the regimes the refrigerant changes state, during which process maximum heat absorption or dissipation occurs.

The low pressure/temperature regime is from the thermostatic expansion valve, through the evaporator to the compressor. The refrigerant decreases in pressure and temperature at the thermostatic expansion valve, then changes state from a liquid to a vapor in the evaporator to absorb heat.

The high pressure/temperature regime is from the compressor, through the condenser and receiver drier assembly to the thermostatic expansion valve. The refrigerant increases in pressure and temperature as it passes through the compressor, then releases heat and changes state from a vapor to a liquid in the condenser.

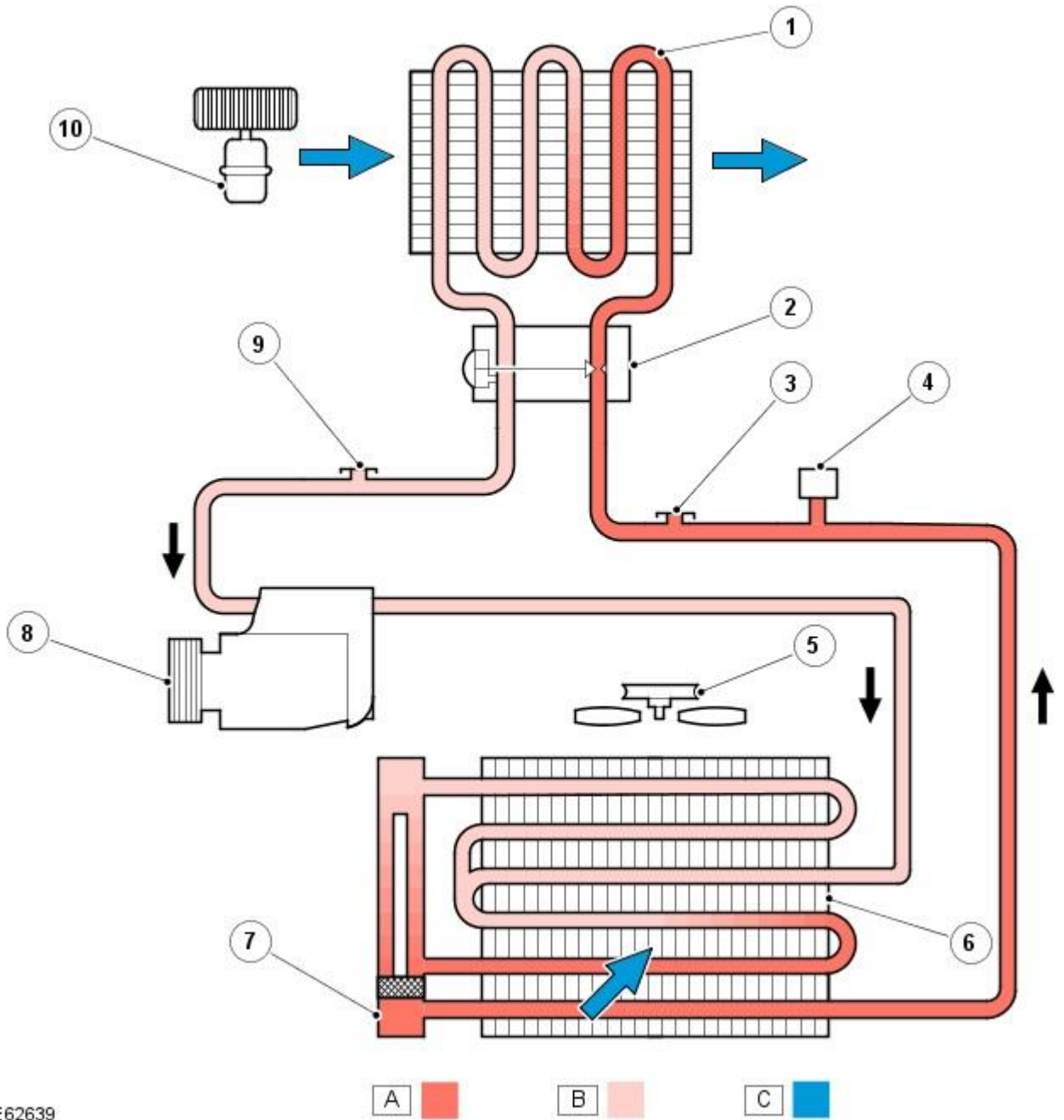
Operation of the [A/C \(air conditioning\)](#) system is controlled by the [ATC \(automatic temperature control\)](#) module. Refer to: [Control Components](#) (412-01 Climate Control, Description and Operation).

The [A/C](#) system works in conjunction with:

- The air distribution and filtering system.  
Refer to: [Air Distribution and Filtering](#) (412-01 Climate Control, Description and Operation).
- The heating and ventilation system.  
Refer to: [Heating and Ventilation](#) (412-01 Climate Control, Description and Operation).

### A/C System Flow Diagram

- NOTE: A = Refrigerant liquid; B = Refrigerant vapor; C = Air flow.



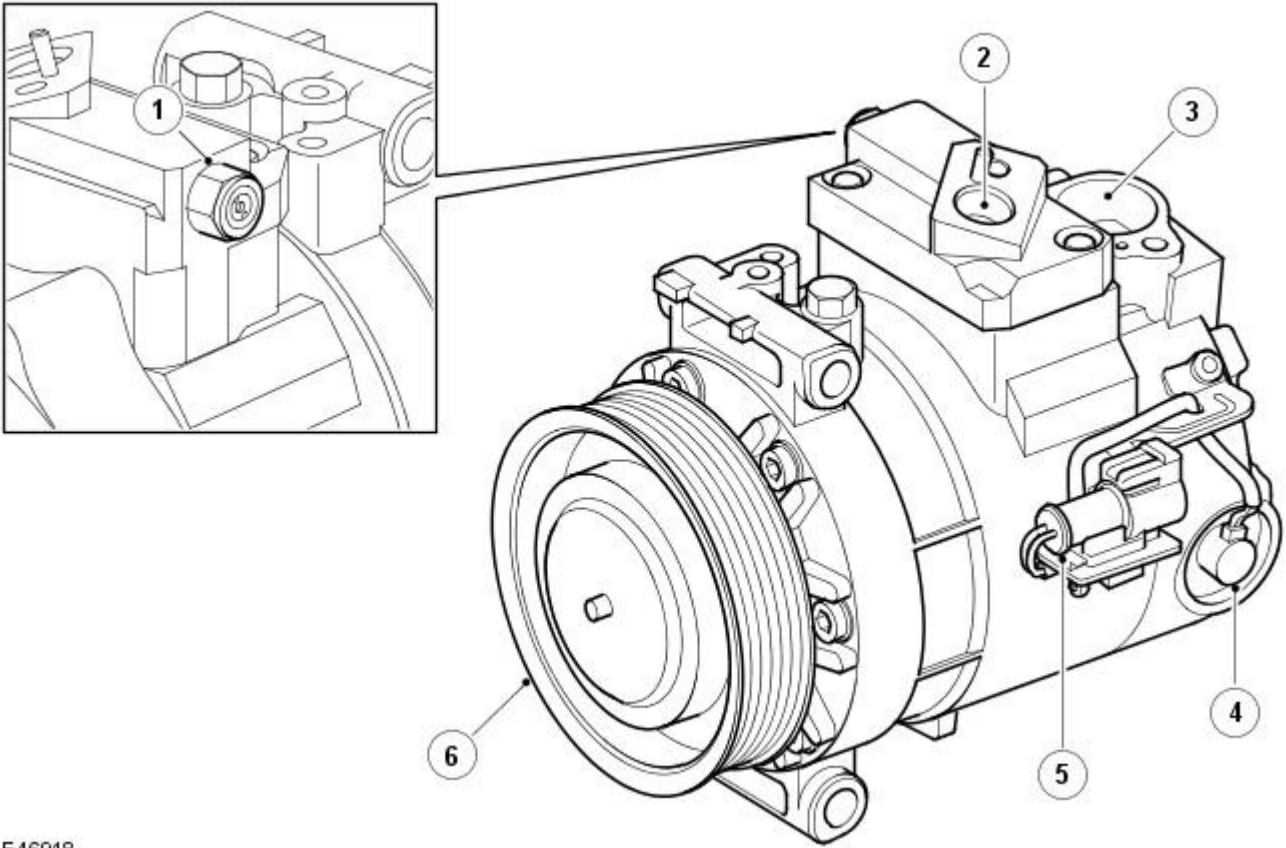
E62639

**ItemDescription**

1	Evaporator
2	Thermostatic expansion valve
3	High pressure servicing connection
4	Refrigerant pressure sensor
5	Engine cooling fan
6	Condenser
7	Receiver/Drier
8	A/C compressor
9	Low pressure servicing connection
10	Blower

**Component Description**

**A/C Compressor**



E46918

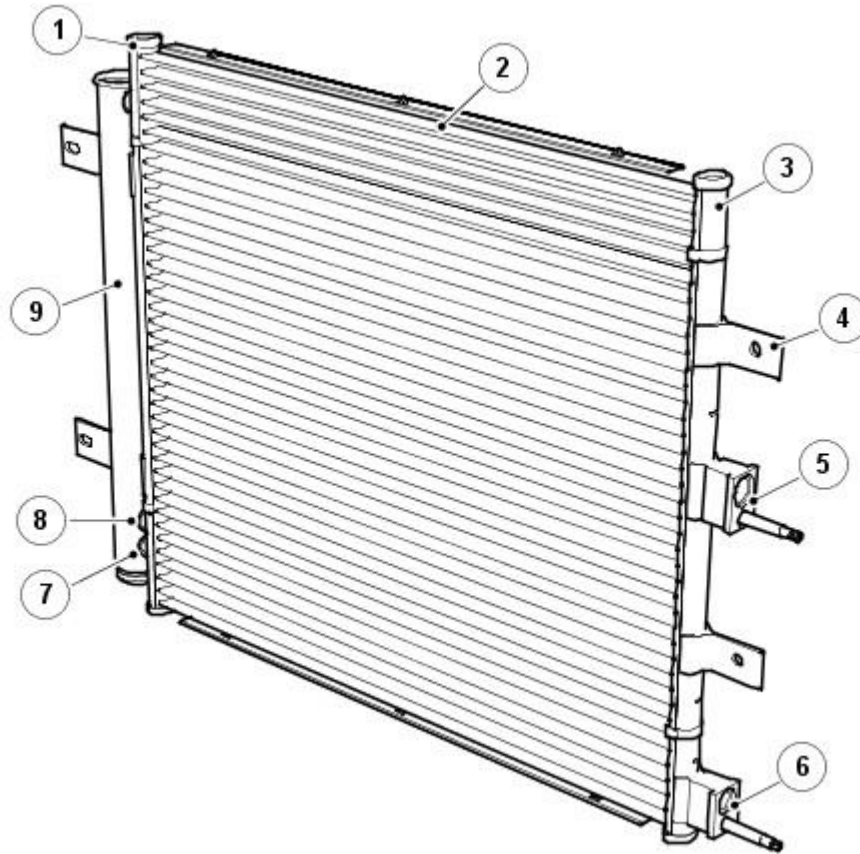
**ItemDescription**

1	Pressure relief valve
2	Outlet port
3	Inlet port
4	Solenoid valve
5	Electrical connector
6	Pulley

The [A/C](#) compressor circulates refrigerant around the system by compressing low pressure, low temperature vapor from the evaporator and discharging the resultant high pressure, high temperature vapor to the condenser.

The [A/C](#) compressor is a permanently engaged variable displacement unit which is driven by the engine accessory drive belt. To protect the system from excessive pressure, a pressure relief valve is installed in the outlet side of the [A/C](#) compressor. The pressure relief valve vents excess pressure into the engine compartment.

**Condenser**



E72963

**ItemDescription**

1	RH (right-hand) end tank
2	Condenser core
3	LH (left-hand) end tank
4	Mounting brackets (4 off)
5	High pressure compressor discharge line connector block
6	High pressure liquid outlet line connector block
7	Receiver/Drier outlet pipe
8	Receiver/Drier inlet pipe
9	Receiver/Drier

The condenser transfers heat from the refrigerant to the surrounding air to convert the high pressure vapor from the compressor into a liquid. The condenser is installed immediately in front of the radiator. Two brackets on each end tank attach the condenser to the end tanks of the radiator.

The condenser is classified as a sub-cooling condenser and consists of a fin and tube heat exchanger core installed between two end tanks. Divisions in the end tanks separate the heat exchanger into a four pass upper (condenser) section and a two pass lower (sub-cooler) section.

The LH end tank provides the connections to the high pressure line from the A/C compressor and the high pressure liquid line to the evaporator.

The RH end tank provides the connections to the receiver drier.

**Receiver Drier**

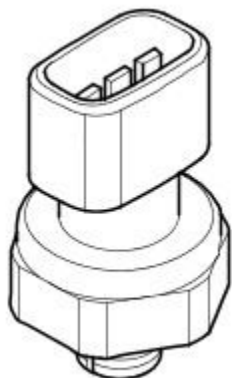
The receiver drier is integrated into the RH end tank of the condenser to remove solid impurities and moisture from the refrigerant. It also provides a reservoir for liquid refrigerant to accommodate changes of heat load at the evaporator.

• NOTE: The receiver drier is part of the condenser assembly and is not serviceable separately.

Refrigerant entering the receiver drier passes through a filter and a desiccant pack, then collects in the base of the unit before flowing through the outlet pipe back to the condenser.

**Refrigerant Pressure Sensor**



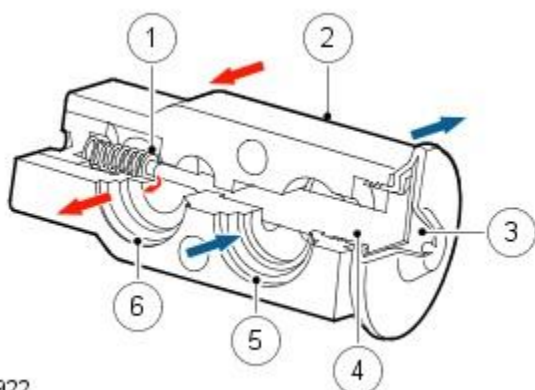


E43581

The refrigerant pressure sensor is located in the high pressure/temperature refrigerant line between the condenser and the thermostatic expansion valve.

Refer to: [Control Components](#) (412-01 Climate Control, Description and Operation).

## Thermostatic Expansion Valve



E46922

### ItemDescription

1	Metering valve
2	Housing
3	Diaphragm
4	Temperature sensor
5	Outlet passage from evaporator
6	Inlet passage to evaporator

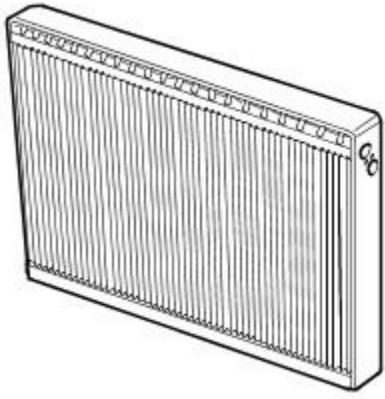
The thermostatic expansion valve meters the flow of refrigerant into the evaporator, to match the refrigerant flow with the heat load of the air passing through the evaporator.

The thermostatic expansion valve is a block type valve located behind the heater assembly, and attached to the inlet and outlet ports of the evaporator. The thermostatic expansion valve consists of an aluminium housing containing inlet and outlet passages. A ball and spring metering valve is installed in the inlet passage and a temperature sensor is installed in the outlet passage. The temperature sensor consists of a temperature sensitive tube connected to a diaphragm. The bottom end of the temperature sensitive tube acts on the ball of the metering valve. Pressure on top of the diaphragm is controlled by the evaporator outlet temperature conducted through the temperature sensitive tube. The bottom of the diaphragm senses evaporator outlet pressure.

Liquid refrigerant flows through the metering valve into the evaporator. The restriction across the metering valve reduces the pressure and temperature of the refrigerant. The restriction also changes the liquid stream of refrigerant into a fine spray, to improve the evaporation process. As the refrigerant passes through the evaporator, it absorbs heat from the air flowing through the evaporator. The increase in temperature causes the refrigerant to vaporise and increase in pressure.

The temperature and pressure of the refrigerant leaving the evaporator acts on the diaphragm and temperature sensitive tube, which regulate the metering valve opening and so control the volume of refrigerant flowing through the evaporator. The warmer the air flowing through the evaporator, the more heat available to evaporate refrigerant and thus the greater volume of refrigerant allowed through the metering valve.

## Evaporator



E46923

The evaporator is installed in the heater assembly, between the blower and the heater matrix, to absorb heat from the exterior or recirculated air.

Most of the moisture in the air passing through the evaporator condenses into water, which drains out of the vehicle by passing through a drain tube to the underside of the vehicle.

### **Refrigerant Lines**

To maintain similar flow velocities around the [A/C](#) system, the diameter of the refrigerant lines varies to suit the two pressure/temperature regimes. Larger diameter pipes are installed in the low pressure/temperature regime and smaller diameter pipes are installed in the high pressure/temperature regime.

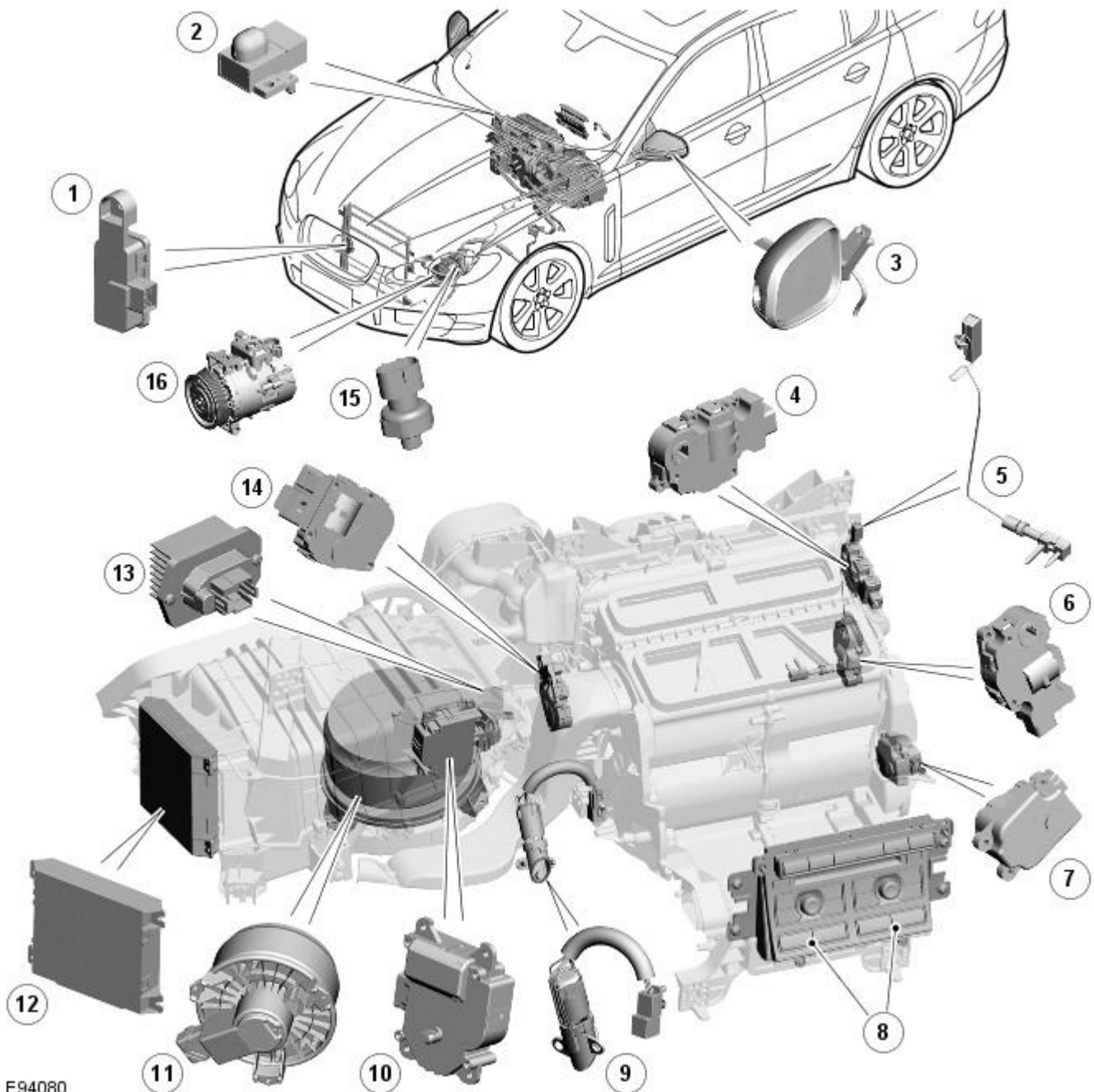
Low and high pressure charging connections are incorporated into the refrigerant lines for system servicing.

# Climate Control - Control Components - Component Location

## Description and Operation

- NOTE: RHD (right-hand drive) vehicle shown, LHD (left-hand drive) vehicle similar.

## Component Location



E94080

### ItemDescription

1	Pollution sensor <b>Comments:</b> where fitted
2	Unload sensor
3	Ambient air temperature sensor
4	Windshield (Defrost) distribution stepper motor
5	Evaporator temperature sensor
6	RH (right-hand) temperature blend stepper motor
7	LH (left-hand) temperature blend stepper motor
8	Control switches
9	Humidity and temperature sensor
10	Air inlet servo motor

11	Blower
12	ATC (automatic temperature control) module
13	Blower control module
14	Face/Feet distribution stepper motor
15	Refrigerant pressure sensor
16	A/C (air conditioning) compressor solenoid valve

# Climate Control - Control Components - Overview

Description and Operation

## Overview

The climate control system is controlled by the [ATC \(automatic temperature control\)](#) module. It controls the heating and ventilation system and the [A/C \(air conditioning\)](#) system to regulate the temperature, volume and distribution of air into the passenger compartment. The system is a fully automatic dual zone system capable of maintaining individual temperature levels selected for the [LH \(left-hand\)](#) and [RH \(right-hand\)](#) sides of the passenger compartment, up to a maximum differential of approximately 3 °C (5.4 °F). Manual overrides for the system include inlet air source, blower speed and air distribution. These selections can be made using either the soft switches on the home and climate control screens of the touch screen display (TSD), or the switches on the integrated control panel.

The [ATC](#) module also controls:

- The rear window heater.
- The windshield heater (where fitted).
- The exterior mirror heaters.
- The seat heaters (where fitted).
- The steering wheel heater.

TSD Home Screen



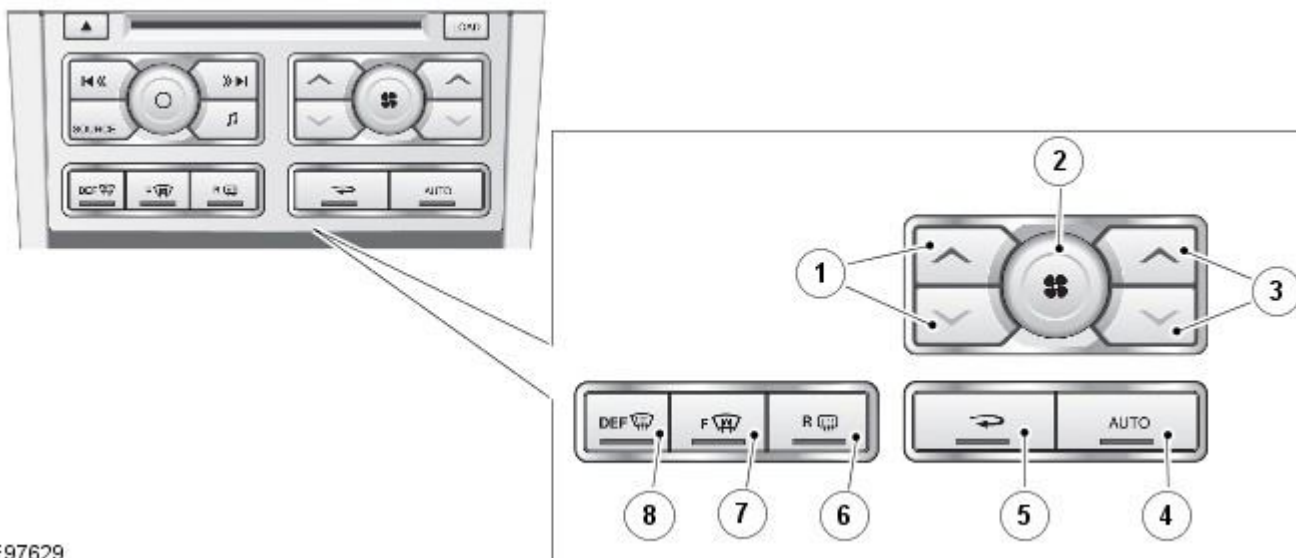
E95068

TSD Climate Control Screen



E95064

Integrated Control Panel



E97629

### ItemDescription

1	<a href="#">LH</a> temperature switches
2	Blower switch

3	<a href="#">RH</a> temperature switches
4	Automatic climate control switch
5	Recirculation switch
6	Rear window heater switch
7	Windshield heater switch <b>Comments:</b> where fitted
8	Programmed defrost switch

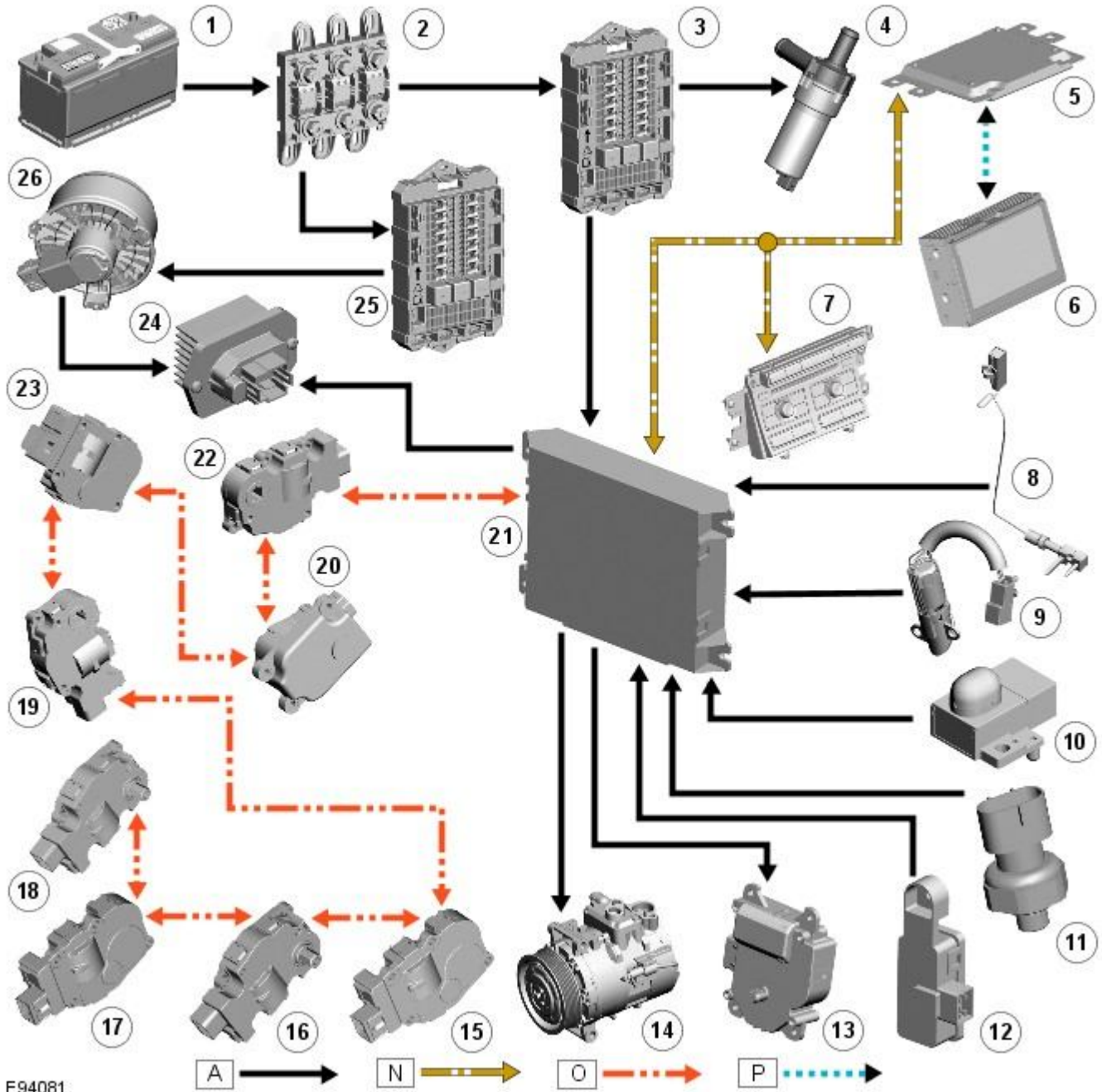


# Climate Control - Control Components - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **N** = Medium speed CAN (controller area network) bus; **O** = LIN (local interconnect network) bus; **P** = Media orientated system transport (MOST) ring.



E94081

### ItemDescription

1	Battery
2	BJB (battery junction box)
3	CJB (central junction box)
4	Auxiliary coolant pump
5	Information and entertainment module
6	TSD (touch screen display)
7	Integrated control panel
8	Evaporator temperature sensor
9	Humidity and temperature sensor

Comments: All except 3.0L vehicles; 4.2L version shown, 2.7L diesel version similar.

10	Sunload sensor
11	Refrigerant pressure sensor
12	Pollution sensor <b>Comments:</b> where fitted
13	Air inlet servo motor
14	<a href="#">A/C (air conditioning)</a> compressor solenoid valve
15	<a href="#">RH (right-hand)</a> outer face level register
16	<a href="#">RH</a> inner face level register
17	<a href="#">LH (left-hand)</a> inner face level register
18	<a href="#">LH</a> outer face level register
19	<a href="#">RH</a> temperature blend stepper motor
20	Face/Feet distribution stepper motor
21	<a href="#">ATC (automatic temperature control)</a> module
22	<a href="#">LH</a> temperature blend stepper motor
23	Windshield (Defrost) stepper motor
24	Blower control module
25	<a href="#">RJB (rear junction box)</a>
26	Blower

## System Operation

### Air Inlet Control

The source of inlet air is automatically controlled unless overridden by pressing the air recirculation switch on the integrated control panel. During automatic control, the [ATC](#) module determines the required position of the recirculation door from its 'comfort' algorithm and, if fitted, the pollution sensor.

The [ATC](#) module provides analogue signals to the air inlet servo motor along a hardwired connection. A potentiometer in the motor supplies the [ATC](#) module with a position feedback signal for closed loop control.

### Air Temperature Control

Cooled air from the evaporator enters the heater assembly, where temperature blend doors direct a proportion of the air through the heater core to produce the required output air temperature.

The two temperature blend doors operate independently to enable individual temperature settings for the left and right sides of the passenger compartment. The temperature blend doors are operated by stepper motors, which are controlled by the [ATC](#) module using [LIN](#) bus messages.

The [ATC](#) module calculates the temperature blend stepper motor positions required to achieve the selected temperature and compares it against the current position. If there is any difference, the [ATC](#) module signals the stepper motors to adopt the new position.

Air temperature is controlled automatically unless maximum heating (HI) or maximum cooling (LO) is selected. When maximum heating or cooling is selected, a 'comfort' algorithm in the [ATC](#) module adopts an appropriate strategy for air distribution, blower speed, and air source.

Temperature control in one side of the passenger compartment can be compromised by the other side of the passenger compartment being set to a high level of heating or cooling. True maximum heating or cooling (displayed as 'HI' or 'LO' on the TSD) can only be selected for the driver's side of the passenger compartment. If 'HI' or 'LO' is selected for the driver's side, the temperature for the front passenger's side is automatically set to match the driver's side.

If [A/C](#) is selected off in the automatic mode, no cooling of the inlet air will take place. The minimum output air temperature from the system will be ambient air temperature plus any heat pick up in the air inlet path.

If the Temp. sync. soft button on the TSD is pressed, the [ATC](#) module synchronizes the temperature of the passenger side of the passenger compartment with the driver's side.

### Blower Control

When the system is in the automatic mode, the [ATC](#) module determines the blower speed required from a comfort algorithm. When the system is in the manual mode, the [ATC](#) module operates the blower at the speed selected using either the rotary control switch on the integrated control panel or the + and - soft buttons on the touch screen display (TSD). The [ATC](#) module also adjusts blower speed to compensate for the ram effect on inlet air produced by forward movement of the vehicle. As vehicle speed and ram effect increases, blower motor speed is reduced, and vice versa.

### Air Distribution Control

Two air distribution doors are used to direct air into the passenger compartment. The doors are operated by stepper motors, which are controlled by the [ATC](#) module using [LIN](#) bus messages.

When the [A/C](#) system is in automatic mode, the [ATC](#) module automatically controls air distribution into the passenger compartment in line with its 'comfort' algorithm. Automatic control is overridden if any of the TSD air distribution soft buttons are selected. Air distribution in the passenger compartment will remain as selected until the 'Auto' switch is pressed or a different manual selection is made.

## A/C Compressor Control

When [A/C](#) is selected the [ATC](#) module maintains the evaporator at an operating temperature that varies with the passenger compartment cooling requirements. If the requirement for cooled air decreases, the [ATC](#) module raises the evaporator operating temperature by reducing the flow of refrigerant provided by the [A/C](#) compressor. The [ATC](#) module closely controls the rate of temperature increase to avoid introducing moisture into the passenger compartment.

If the requirement for cooled air increases, the [ATC](#) module lowers the evaporator operating temperature by increasing the flow of refrigerant provided by the [A/C](#) compressor.

When [A/C](#) is off, the compressor current signal supplied by the [ATC](#) module holds the [A/C](#) compressor solenoid valve in the minimum flow position, effectively switching off the [A/C](#) function.

The [ATC](#) module incorporates limits for the operating pressure of the refrigerant system. If the system approaches the high pressure limit, the compressor current signal is progressively reduced until the system pressure decreases. If the system falls below the low pressure limit, the compressor current signal is held at its lowest setting so that the [A/C](#) compressor is maintained at its minimum stroke. This avoids depletion of the lubricant from the [A/C](#) compressor.

## A/C Compressor Torque

The [ATC](#) module transmits refrigerant pressure and [A/C](#) compressor current values to the [ECM \(engine control module\)](#) over the medium speed then high speed [CAN](#) bus, using the [CJB](#) as a gateway. The [ECM](#) uses these values to calculate the torque being used to drive the [A/C](#) compressor. The [ECM](#) compares the calculated value with its allowable value and if necessary forces the [ATC](#) module to inhibit the [A/C](#) compressor by transmitting the 'ACClutchInhibit' [CAN](#) message. This forces the [ATC](#) module to reduce the drive current to the [A/C](#) compressor solenoid valve, which reduces refrigerant flow. This in turn reduces the torque required to drive the [A/C](#) compressor.

By reducing the maximum [A/C](#) compressor torque, the [ECM](#) is able to reduce the load on the engine when it needs to maintain vehicle performance or cooling system integrity.

## Cooling Fan Control

The [ATC](#) module determines the amount of condenser cooling required from the refrigerant pressure sensor, since there is a direct relationship between the temperature and pressure of the refrigerant. The cooling requirement is broadcast to the [ECM](#) on the medium speed [CAN](#) bus. The [ECM](#) then controls the temperature of the condenser using the cooling fan.

## Programmed Defrost

The programmed defrost DEF switch is located on the integrated control panel. When the switch is pressed, the [ATC](#) module instigates the programmed defrost function. When selected, the [ATC](#) module configures the system as follows:

- Automatic mode off.
- [A/C](#) on.
- Selected temperature unchanged.
- Air inlet set to fresh air.
- Air distribution set to windshield.
- Blower speed set to level 6.
- Windshield heater (where fitted) and rear window heater on.

The programmed defrost function can be cancelled by one of the following:

- Selecting any air distribution switch on the TSD.
- Pressing the AUTO switch on the integrated control panel.
- A second press of the DEF button.
- Switching the ignition OFF.

The blower speed can be adjusted without terminating the programmed defrost function.

## Rear Window Heater

Rear window heater operation is only enabled when the engine is running. The [ATC](#) module controls operation of the rear window heater using a relay in the [RJB](#). When rear window heater operation is required, the [ATC](#) module broadcasts a message to the [RJB](#) on the medium speed [CAN](#) bus. On receipt of the message, the [RJB](#) energizes the relay by providing a ground path for the relay coil. This allows a battery feed to flow across the relay to power the rear window heater element.

There are two modes of rear window heater operation; manual and automatic.

Manual operation is activated by pressing the rear window heater switch on the integrated control panel. When the switch is pressed, the status [LED \(light emitting diode\)](#) in the switch illuminates and the rear window heater element is energized. Manual operation is discontinued when the rear window heater switch is pressed a second time, 21 minutes have elapsed (the heating phase), or the engine stops. If manual operation is discontinued by the engine stopping, the previous heating phase is resumed if the engine is re-started within 30 seconds.

There are two variants of automatic operation; automatic operation at the start of a journey and automatic operation during a journey.

Automatic operation at the start of a journey is initiated if the ambient air temperature is below 5 °C (41 °F). In this instance, the switch [LED](#) is illuminated and the heater element is energized for 21 minutes. Automatic operation is discontinued if the rear window heater switch is pressed or the engine stops.

Automatic operation during a journey is initiated when low ambient air temperatures are experienced and the vehicle has been travelling for a set period of time above a threshold speed. In this instance, no feedback is given to the driver to inform him the rear window heater is operational (the switch [LED](#) is not illuminated). The duration of heater operation is variable depending on the ambient air temperature, vehicle speed and the amount of time the vehicle has been travelling.

## Windshield Heater (Where Fitted)

Windshield heater operation is only enabled when the engine is running. The [ATC](#) module controls operation of the windshield heater using two relays in the [EJB \(engine junction box\)](#). When windshield heater operation is required, the [ATC](#) module broadcasts a message to the [CJB](#) on the medium speed [CAN](#) bus. On receipt of the message, the [CJB](#) energizes the relays by providing a ground path for both relay coils. This allows a battery feed to flow across the relays to power the windshield left and right heater elements.

There are two modes of windshield heater operation; manual and automatic.

Manual operation is activated by pressing the windshield heater switch on the integrated control panel. When the switch is pressed, the status [LED](#) in the switch illuminates and the windshield heater elements are energized. Manual operation is discontinued when the windshield heater switch is pressed a second time, 5 minutes have elapsed (the heating phase), or the engine stops. If manual operation is discontinued by the engine stopping, the previous heating phase is resumed if the engine is re-started within 30 seconds.

There are two variants of automatic operation; automatic operation at the start of a journey and automatic operation during a journey.

Automatic operation at the start of a journey is initiated if the ambient air temperature is below 5 °C (41 °F). In this instance, the switch [LED](#) is illuminated and the heater elements are energized for 6.5 minutes. Automatic operation is discontinued if the windshield heater switch is pressed or the engine stops.

Automatic operation during a journey is initiated when low ambient air temperatures are experienced and the vehicle has been travelling for a set period of time above a threshold speed. In this instance, no feedback is given to the driver to inform him the windshield heater is operational (the switch [LED](#) is not illuminated) and the duration of operation is variable depending upon the ambient air temperature, vehicle speed and the amount of time the vehicle has been travelling.

## Exterior Mirror Heaters

Operation of the exterior mirror heaters is fully automatic and not controllable by the driver. Exterior mirror heater operation is determined by ambient air temperature and windshield wiper status. When ambient air temperature reaches a pre-determined level, the [ATC](#) module broadcasts an exterior mirror heating request to the door modules over the medium speed [CAN](#) bus. On receipt of this message, the door modules provide feed and ground connections to both exterior mirror heater elements.

The amount of time the exterior mirror heaters are operational increases if the windshield wipers are switched on. This ensures the mirrors remain mist free in damp and wet conditions, where there is an increased risk of misting.

## Seat Heaters (Where Fitted)

There are four seat heater settings available; off, 1, 2 and 3, which can be selected on the home and climate control screens of the TSD. The heat setting is relayed to the vehicle occupants through a graduated display on the TSD.

Operation of the heated seats is controlled by the [ATC](#) module. When the [ATC](#) module receives a heating request from the TSD, it broadcasts a message to the [CJB](#) over the medium speed [CAN](#) bus. The [CJB](#) then provides a hardwired 12 V supply to the three heater elements in the related front seat. The heater elements, two in the seat cushion and one in the seat squab, are wired in series. The [ATC](#) module monitors seat temperature using a temperature sensor located in each seat cushion. The [CJB](#) provides the temperature sensors with a 5 V supply. The level of the returned voltage back to the [CJB](#) is proportional to the seat temperature. The value of the return signal is broadcast to the [ATC](#) module, over the medium speed [CAN](#) bus, which allows it to control the seat temperature to the required level. The [ATC](#) module will suspend or disable operation of the seat heaters if any of the following occur:

- Battery voltage exceeds  $16.5 \pm 0.3$  V for more than 5 seconds. Seat heating is re-enabled when battery voltage decreases to  $16.2 \pm 0.3$  V.
- If a short or open circuit is detected.
- If the seat heat temperature rises significantly above the target temperature setting.

The graduated display on the TSD remains illuminated until the seat heaters are turned off or the engine stops. If the engine is restarted within 30 seconds the seat heater resumes the previous heating level.

## Steering Wheel Heater

The steering wheel heater has a single heat setting and is turned on/off on the home and climate control screens of the TSD. The on/off status of the steering wheel heater is relayed to the vehicle occupants through the TSD. When the ignition is switched off, the steering wheel heater will reset to off.

Power for the heater element is supplied by the [CJB](#) on receipt of a request from the [ATC](#) module over the medium speed [CAN](#) bus. Temperature control for the heater element is provided by the steering wheel heater control module which receives a temperature feedback signal from a [NTC \(negative temperature coefficient\)](#) thermistor located within the steering wheel.

## Component Description

### ATC Module



E97625

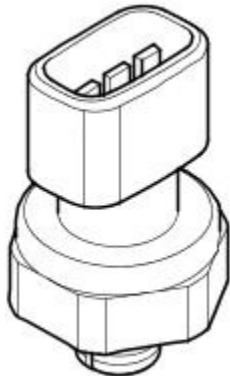
The [ATC](#) module is mounted on the outboard end of the air inlet duct, behind the front passenger side of the instrument panel. The [ATC](#) module processes inputs from the TSD, the switches on the integrated control panel and the system sensors. In response to these inputs, the [ATC](#) module outputs control signals to the [A/C](#) system and the heating and ventilation system.

Two electrical connectors provide the interface between the [ATC](#) module and the vehicle wiring. The [ATC](#) module uses hardwired inputs from the system sensors, the [LIN](#) bus to communicate with the stepper motors and the medium speed [CAN](#) bus to communicate with other control modules on the vehicle.

### A/C Compressor Solenoid Valve

The [A/C](#) compressor solenoid valve is integral with the [A/C](#) compressor. Operation of the solenoid valve is controlled by the [ATC](#) module using a hardwired drive current of differing values. By controlling the flow of refrigerant through the compressor, the solenoid valve can control the [A/C](#) system pressure and the evaporator operating temperature.

### Refrigerant Pressure Sensor



E43581

The refrigerant pressure sensor provides the [ATC](#) module with a pressure input from the high pressure side of the refrigerant system. The refrigerant pressure sensor is located in the refrigerant line between the condenser and the thermostatic expansion valve.

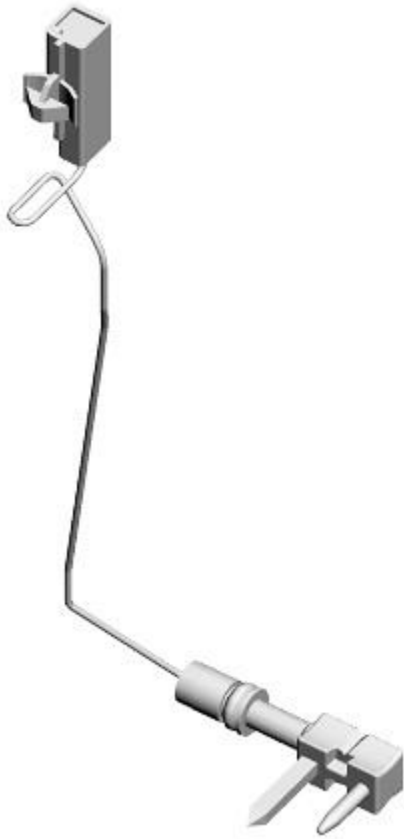
The [ATC](#) module supplies a 5 V reference voltage to the refrigerant pressure sensor and receives a return signal voltage, between 0 V and 5 V, related to system pressure.

The [ATC](#) module uses the signal from the pressure sensor to protect the refrigerant system from extremes of pressure. The [ATC](#) module transmits the [A/C](#) pressure, along with the compressor drive current value, to the instrument cluster on the medium speed [CAN](#) bus. These signals are broadcast to the [ECM](#) on the high speed [CAN](#) bus to allow it to calculate the torque being applied to the engine by the compressor.

To protect the system from extremes of pressure, the [ATC](#) module sets the [A/C](#) compressor to the minimum flow position if the pressure:

- Decreases to  $2.1 \pm 0.2$  bar ( $31.5 \pm 3$  lbf/in<sup>2</sup>); the [ATC](#) module loads the [A/C](#) compressor again when the pressure increases to  $2.3 \pm 0.2$  bar ( $33.4 \pm 3$  lbf/in<sup>2</sup>).
- Increases to  $31 \pm 1$  bar ( $450 \pm 14.5$  lbf/in<sup>2</sup>); the [ATC](#) module loads the [A/C](#) compressor again when the pressure decreases to  $26 \pm 1$  bar ( $377 \pm 14.5$  lbf/in<sup>2</sup>).

### Evaporator Temperature Sensor



E97626

The evaporator temperature sensor is a [NTC](#) thermistor that provides the [ATC](#) module with a temperature signal from the downstream side of the evaporator. The evaporator temperature sensor is mounted directly onto the evaporator matrix fins.

The [ATC](#) module uses the input from the evaporator temperature sensor to control the load of the [A/C](#) compressor and thus the operating temperature of the evaporator.

### Humidity and Temperature Sensor



E97627



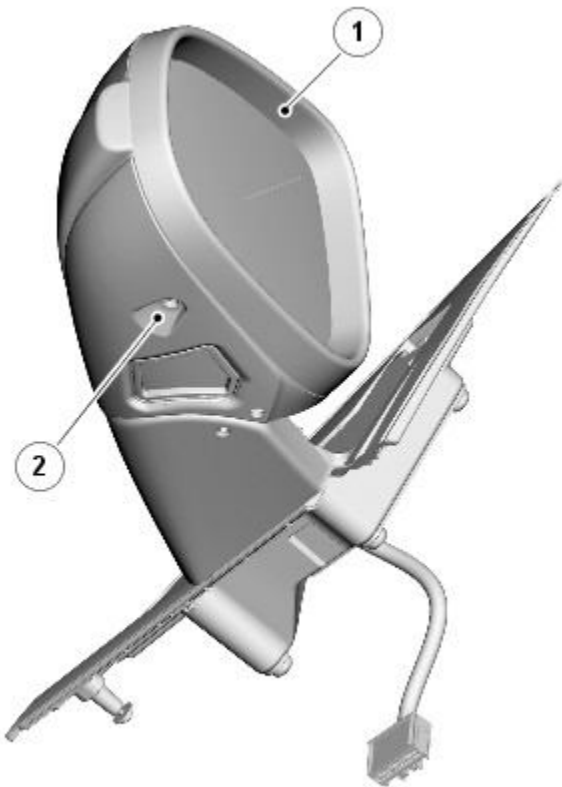
The humidity and temperature sensor is installed above the glovebox in the instrument panel. The sensor incorporates:

- A [NTC](#) thermistor to measure temperature.
- A capacitive sensor element to measure humidity.
- A motor driven fan to draw air through the sensor and over the sensing elements.

The humidity sensor element is built out of a film capacitor on different substrates. The dielectric is a polymer which absorbs or releases water proportional to the relative humidity of the air being drawn through the sensor, and thus changes the capacitance of the capacitor. For protection, the sensor element is contained in a nylon mesh cover.

Humidity within the passenger compartment is controlled by raising and lowering the evaporator temperature. An increase in evaporator temperature increases the moisture content of the air entering the passenger compartment. Lowering the evaporator temperature reduces the moisture content of the air entering the passenger compartment.

## Ambient Air Temperature Sensor



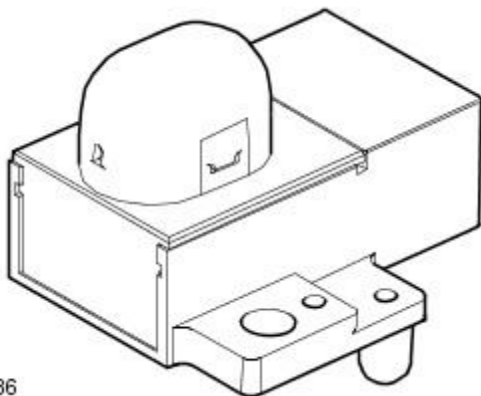
E97628

### ItemDescription

1	<a href="#">LH</a> door mirror
2	Ambient air temperature sensor

The ambient air temperature sensor is a [NTC](#) thermistor that provides the [ATC](#) module with an input of external air temperature. The sensor is hard wired to the [ECM](#) and its signal is transmitted to the instrument cluster on the high speed [CAN](#) bus. The instrument cluster acts as a gateway and transmits the ambient air temperature signal to the [ATC](#) module on the medium speed [CAN](#) bus. The sensor is installed in the [LH](#) door mirror, and is accessed by removing the mirror glass, cap and actuator.

## Sunload Sensor



E71886

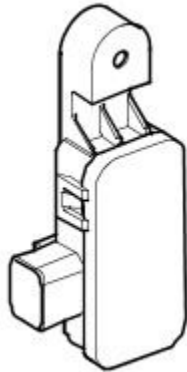
The sunload sensor consists of two photoelectric cells that provide the [ATC](#) module with inputs of light intensity; one as sensed coming from the left of the vehicle and one as sensed coming from the right. The inputs are a measure of the solar heating effect on vehicle occupants, and are used by the [ATC](#) module to adjust blower speed, temperature and distribution to improve comfort.

The sensor is installed in the speaker grill on the upper surface of the instrument panel. Power for the sensor is provided by a 5 V feed from the instrument cluster.

The sensor also contains the active anti-theft alarm indicator.

Refer to: Anti-Theft - Active (419-01 Anti-Theft - Active, Description and Operation).

### **Pollution Sensor (Where Fitted)**



E43588

The pollution sensor allows the [ATC](#) module to monitor the ambient air for the level of hydrocarbons and oxidized gases such as nitrous oxides, sulphur oxides and carbon monoxide. The sensor is attached to the center of the upper front crossmember.

The pollution sensor is powered by an ignition controlled voltage feed from the [CJB](#) and provides the [ATC](#) module with separate signals of hydrocarbon and oxidized gas levels. With a pollution sensor fitted, the [ATC](#) module can control the air inlet source to reduce the amount of contaminants entering the passenger compartment. This function is fully automatic, but can be overridden by manual selection of the air source using the recirculation switch on the integrated control panel.

If there is a fault with the sensor, the [ATC](#) module disables automatic operation of the recirculation door.

# Climate Control - Ambient Air Temperature Sensor

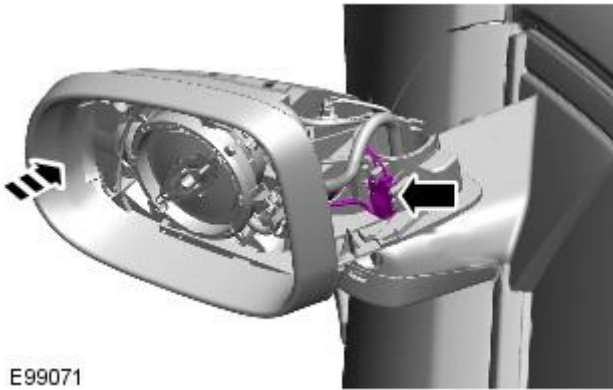
Removal and Installation

## Removal

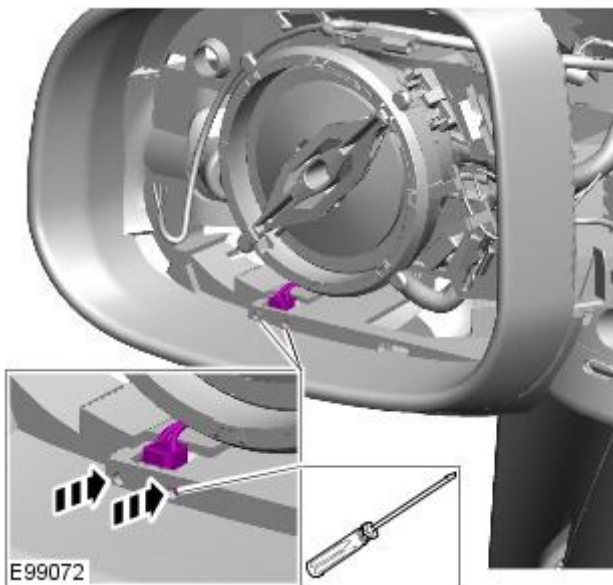
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Exterior Mirror Cover](#) (501-09 Rear View Mirrors, Removal and Installation).

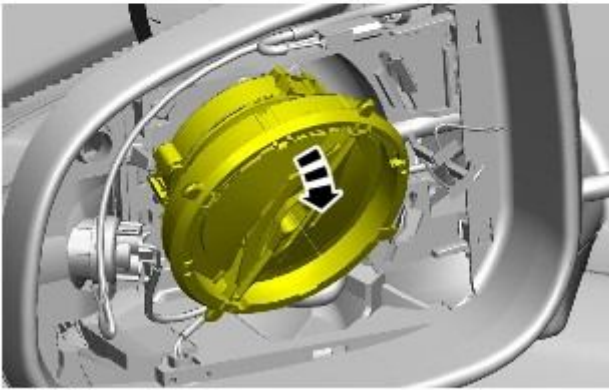
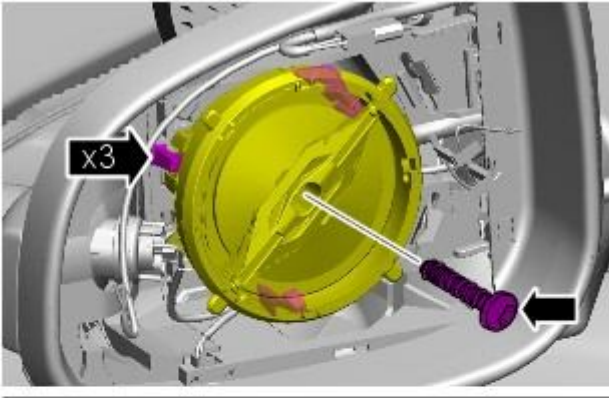
2.



3.

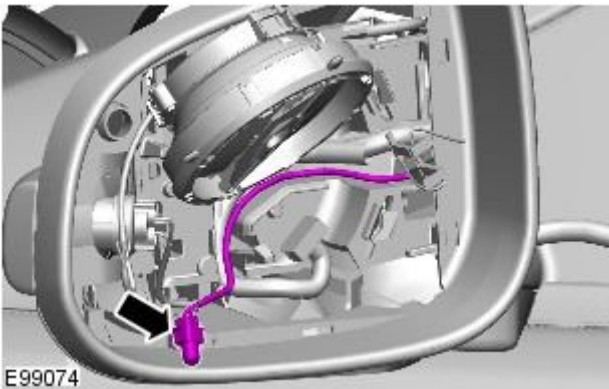


4.



E99073

5.



E99074

## Installation

1. To install, reverse the removal procedure.

## Climate Control - Blower Motor

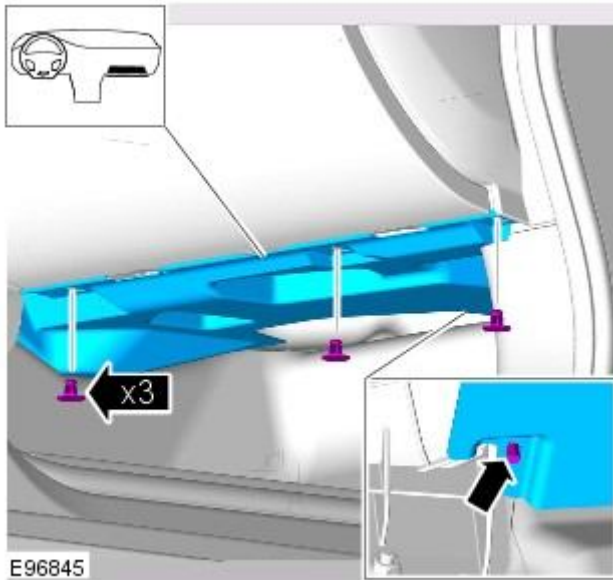
Removal and Installation

### Removal

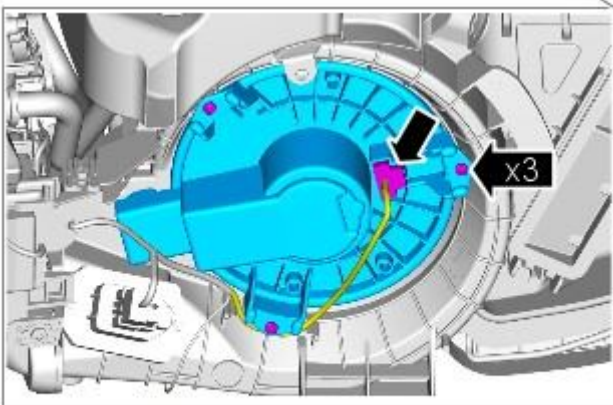
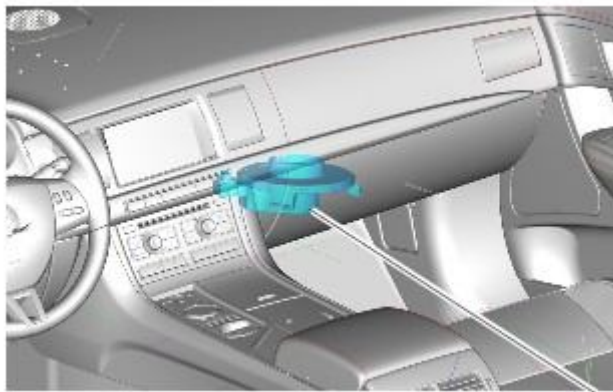
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.



3.



### Installation

1. To install, reverse the removal procedure.

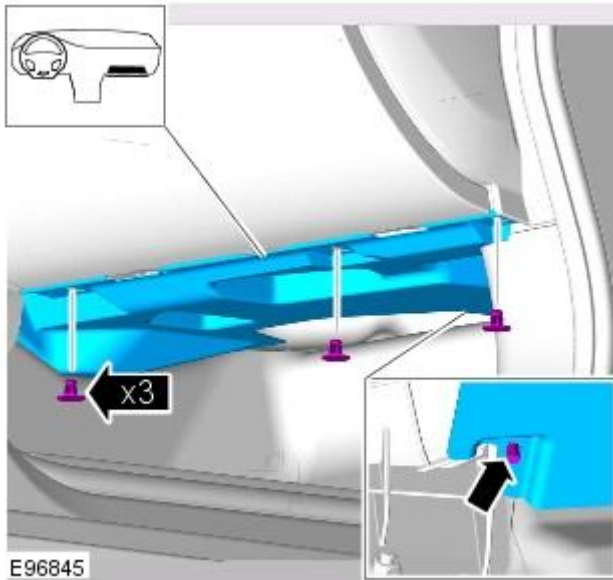
# Climate Control - Blower Motor Control Module


Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

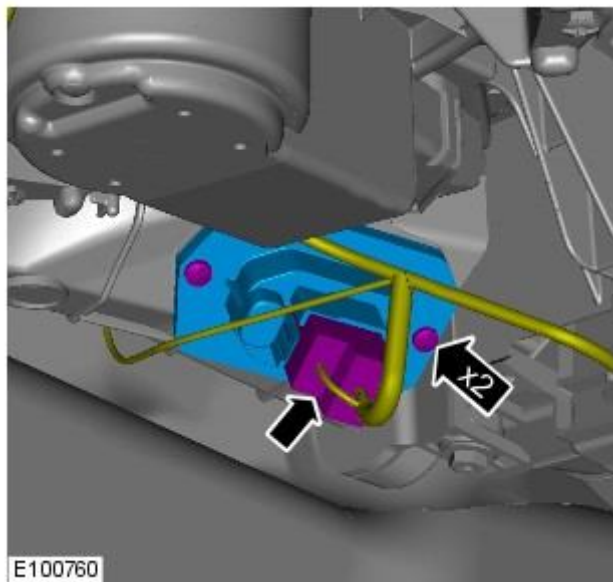
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).



2.  CAUTION: Take extra care not to damage the clips or screw threads. Failure to follow this instruction may result in damage to the climate control assembly.

- NOTE: RHD illustration shown, LHD is similar.

3. Torque: 1.3 Nm



## Installation

1. To install, reverse the removal procedure.



## Climate Control - Center Registers

Removal and Installation

### Removal



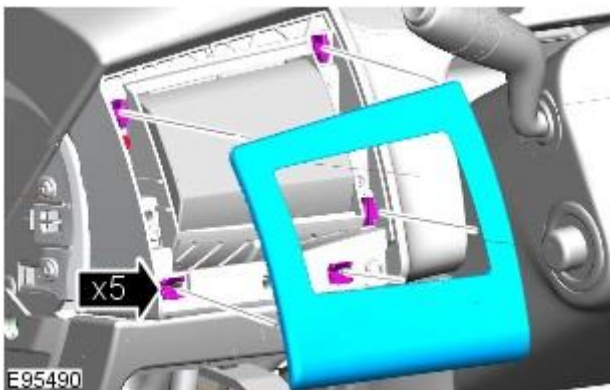
**CAUTION:** Do not manually open the registers. Failure to follow this instruction may result in damage to the internal components.

• **NOTE:** The center registers must be open before carrying out this procedure. To achieve this set the registers to 'Always Open' using the climate settings tab on the information and entertainment display. If the registers are set to 'Automatic' mode (rotating with ignition on/off) and one or more are disconnected during an ignition cycle, a vehicle battery reset may be required to reconnect the affected registers to the LIN BUS.

• **NOTE:** Removal steps in this procedure may contain installation details.

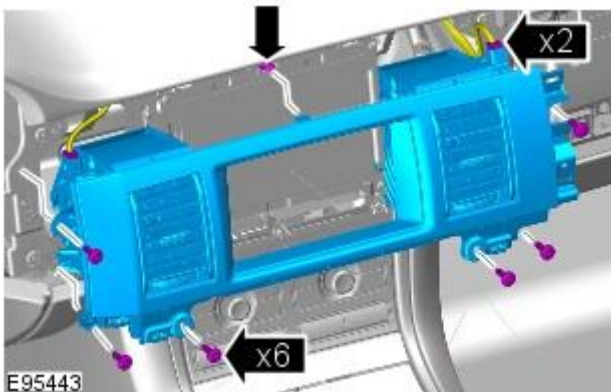
1. Set the registers to 'Always Open', using the information and entertainment display.
2. Refer to: [Passenger Side Register](#) (412-01 Climate Control, Removal and Installation).
3. Fully extend and lower the steering column for access.

4.

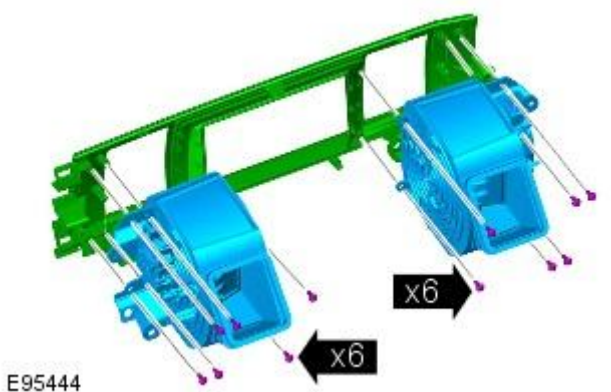




E95491




E95443




E95444

5.

6. 6. CAUTIONS:

 The center registers must be open to aid access and prevent damage to surrounding trim.

 Do not manually open the registers. Failure to follow this instruction may result in damage to the internal components.

7. 7. NOTE: Do not disassemble further if the component is removed for access only.

**Installation**

1. To install, reverse the removal procedure.
2. Return the registers to their original setting - 'Automatic' - using the information and entertainment display.

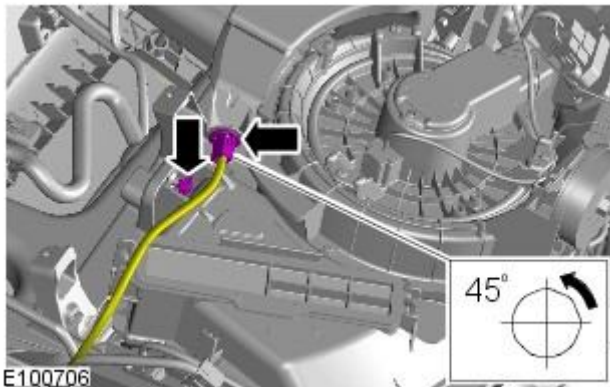
# Climate Control - Climate Control Assembly


## Removal and Installation

### Removal

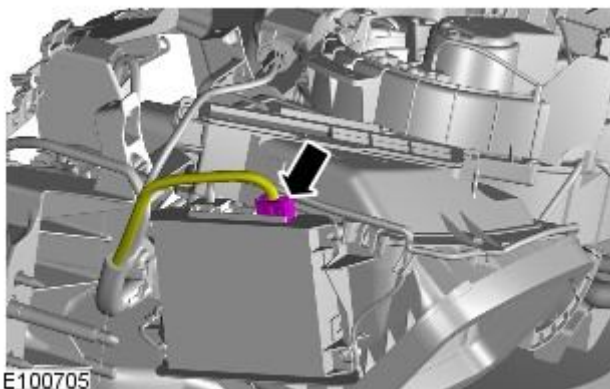
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Instrument Panel Console](#) (501-12 Instrument Panel and Console, Removal and Installation).



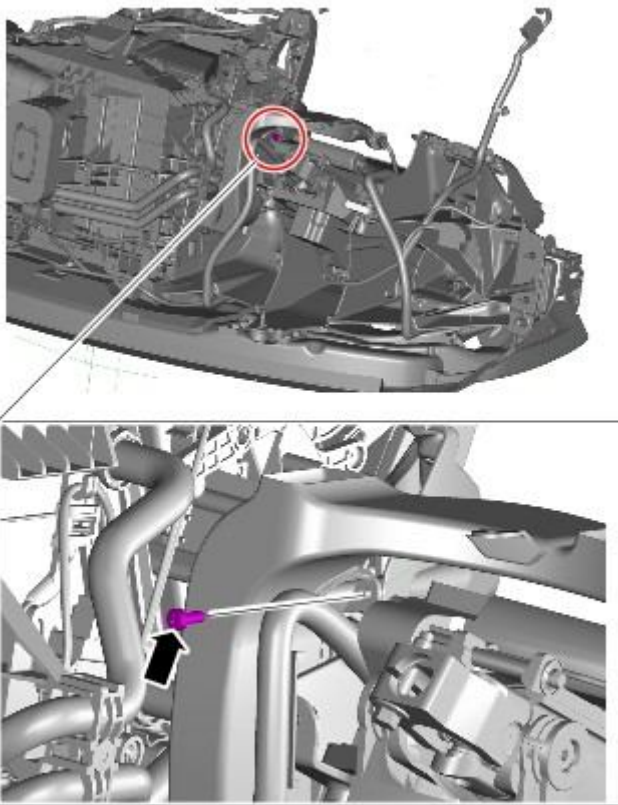
3.  CAUTION: Take extra care not to damage the clips or screw threads. Failure to follow this instruction may result in damage to the climate control assembly.

- NOTE: RHD illustration shown, LHD is similar.



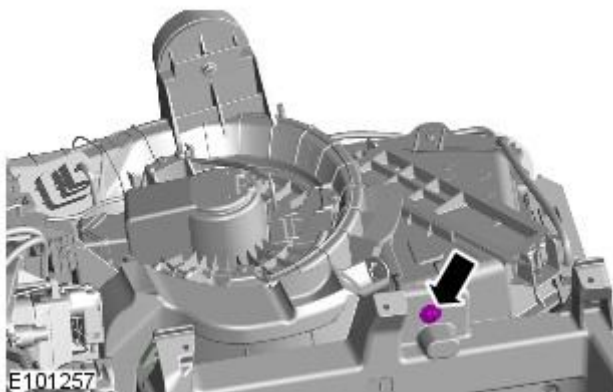
- 4.

5. Torque: 5 Nm

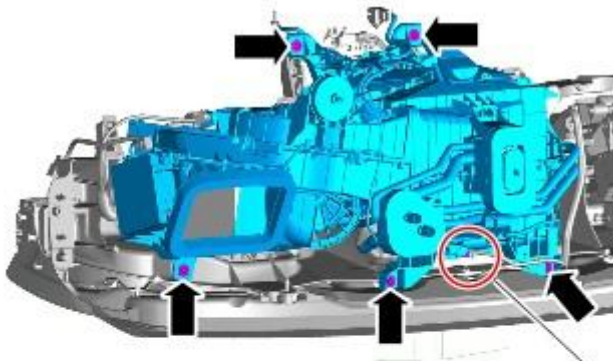


E100704

6. Torque: 9 Nm

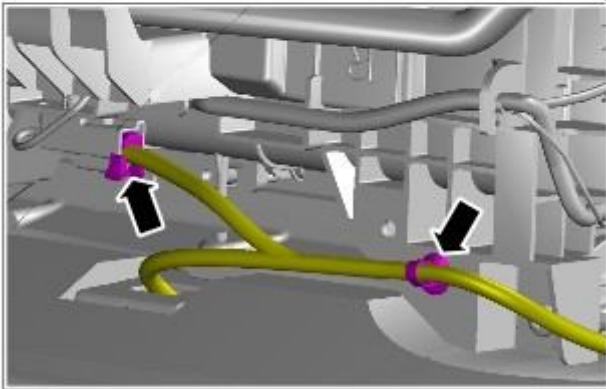


E101257



7.  CAUTION: Be prepared to collect escaping coolant.

Torque: 9 Nm



E100707

## Installation

1. To install, reverse the removal procedure.

## Climate Control - Climate Control Module


Removal and Installation

### Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Instrument Panel Console](#) (501-12 Instrument Panel and Console, Removal and Installation).

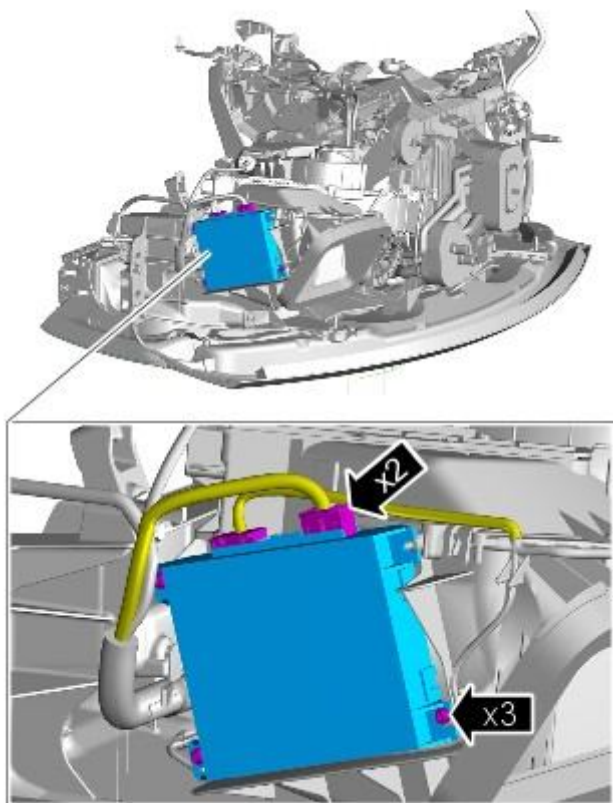
3. **3. CAUTIONS:**

 Take extra care not to damage the clips or screw threads. Failure to follow this instruction may result in damage to the climate control assembly.

 Make sure that the component is correctly located on the locating dowels.

• NOTE: RHD illustration shown, LHD is similar.

Torque: 1.3 Nm



E100701

### Installation

1. To install, reverse the removal procedure.



# Climate Control - Defrost Vent/Register Blend Door Actuator


Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Battery Disconnect and Connect (414-01, General Procedures).
2. Refer to: Instrument Panel Console (501-12, Removal and Installation).

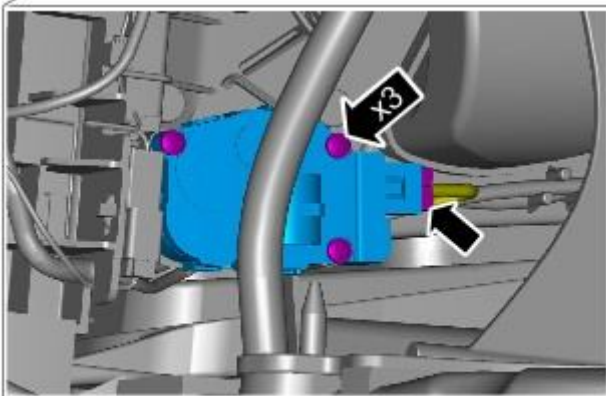
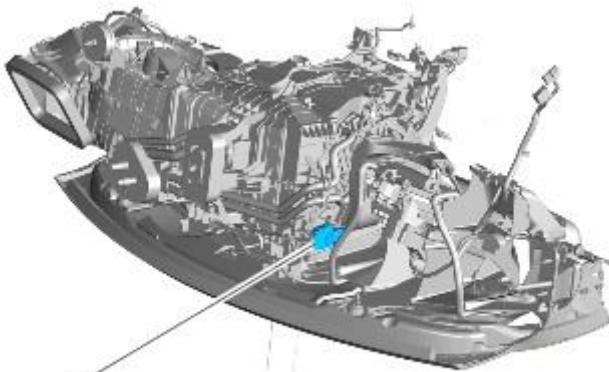
3. **3. CAUTIONS:**

 Take extra care not to damage the clips or screw threads. Failure to follow this instruction may result in damage to the climate control assembly.

 Make sure that the component is correctly located on the locating dowels.

• NOTE: RHD illustration shown, LHD is similar.

Torque: 1.3 Nm



E100698

## Installation

1. To install, reverse the removal procedure.

# Climate Control - Driver Side Register

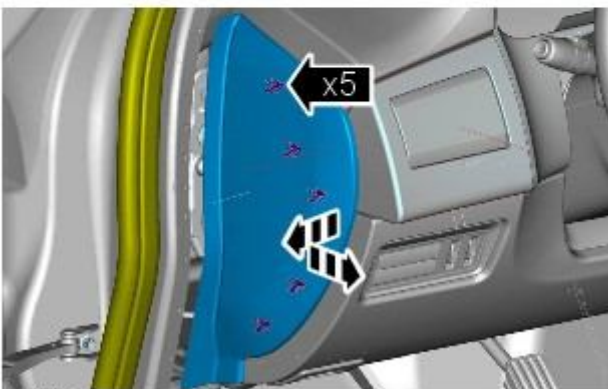
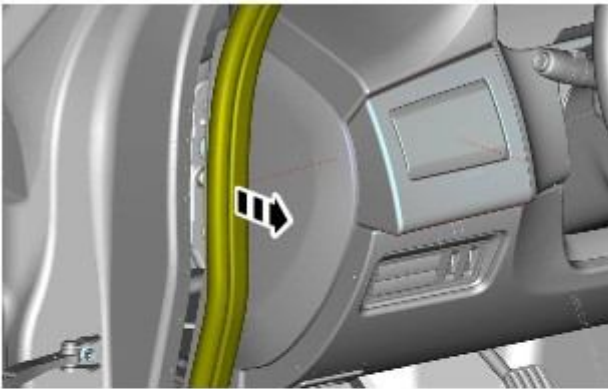
Removal and Installation

## Removal

 **CAUTION:** Do not manually open the registers. Failure to follow this instruction may result in damage to the internal components.

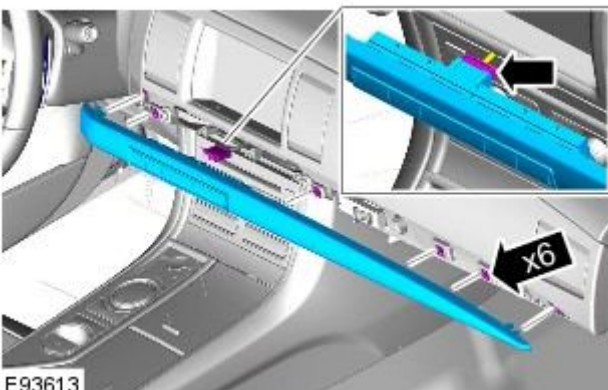
- NOTE: If the registers are set to 'Automatic' mode and one or more are disconnected during an ignition cycle, a vehicle battery reset may be required to reconnect the affected registers to the LIN BUS.
- NOTE: Removal steps in this procedure may contain installation details.

1.

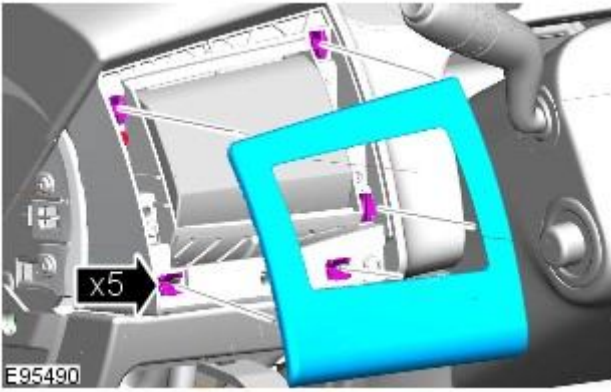


E95489

2.



E93613

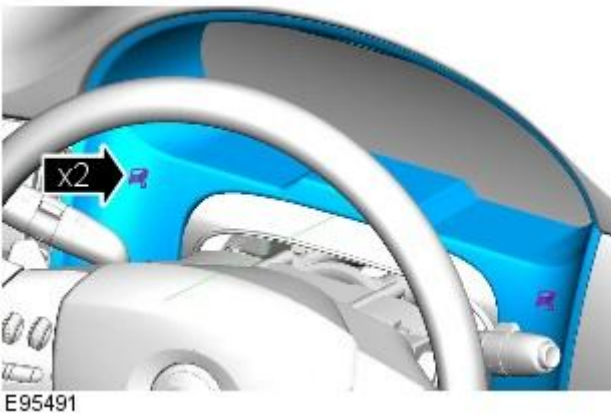


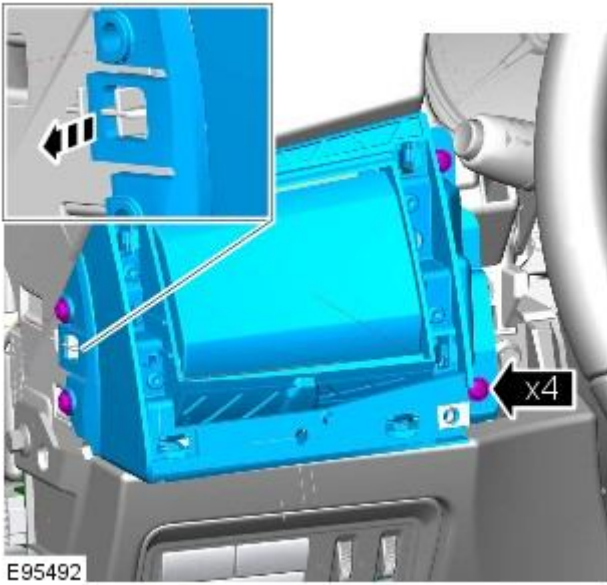
3.

4. Fully extend and lower the steering column for access.

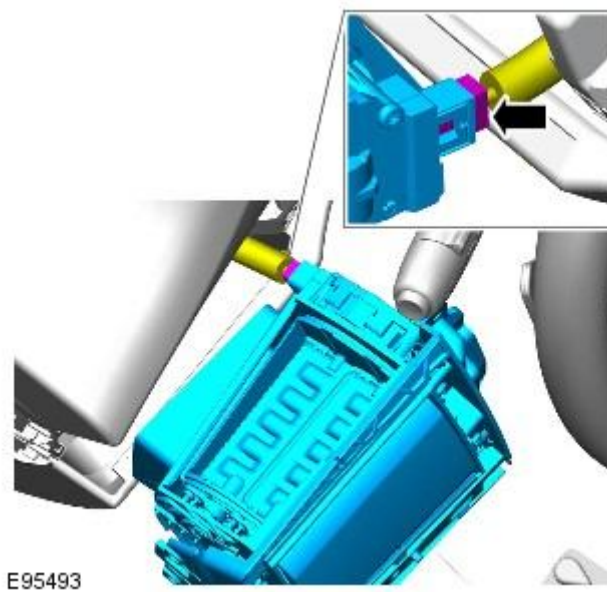


5.

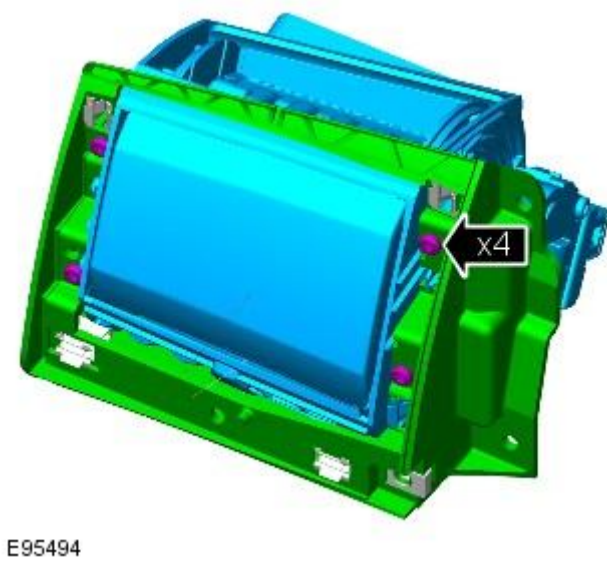




6.



7.



8. **8.** NOTE: Do not disassemble further if the component is removed for access only.

## Installation

1. To install, reverse the removal procedure.

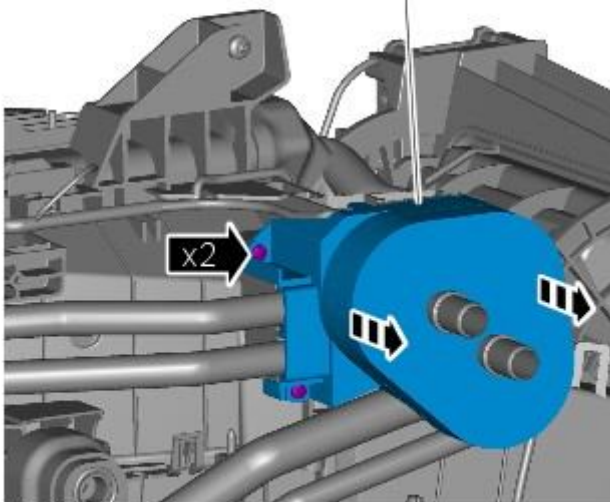
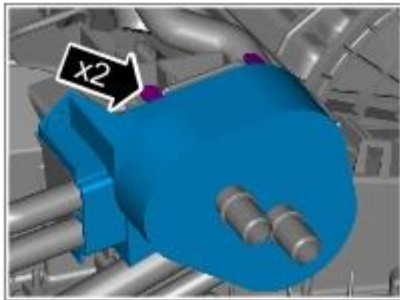
# Climate Control - Evaporator

Removal and Installation


## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Thermostatic Expansion Valve](#) (412-01 Climate Control, Removal and Installation).

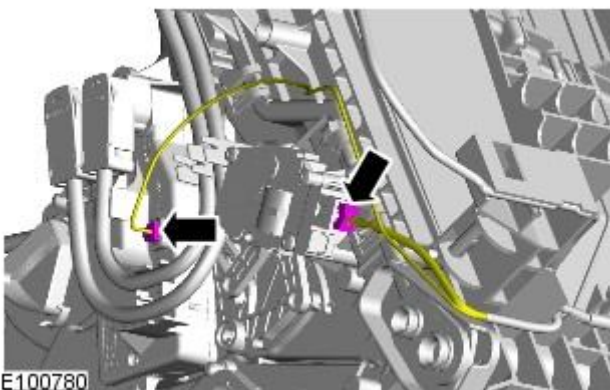


E100773

3.  CAUTION: Take extra care not to damage the clips or screw threads. Failure to follow this instruction may result in damage to the climate control assembly.

• NOTE: RHD illustration shown, LHD is similar.

Torque: 1.3 Nm

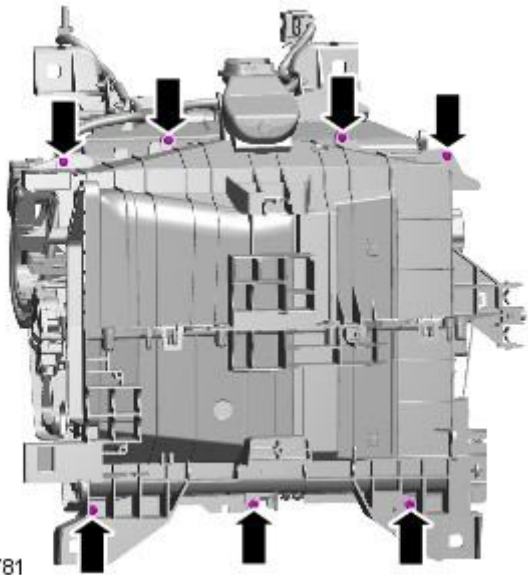


E100780

- 4.

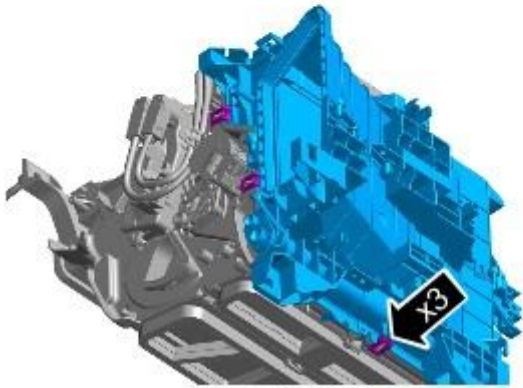
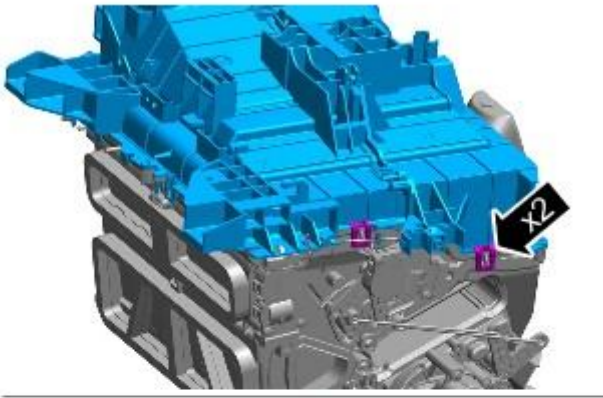


5. Torque: 1.3 Nm



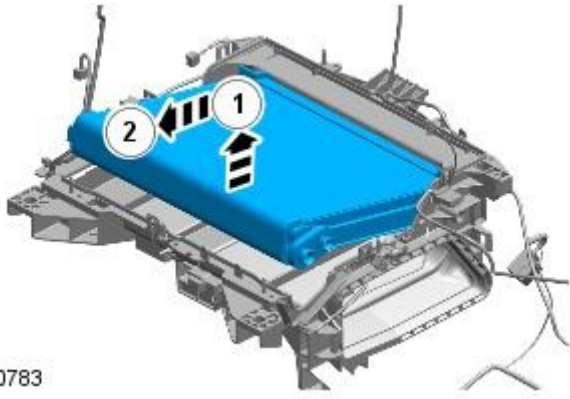
E100781

6.



E100782





E100783

## Installation

7.  **WARNING:** Only use moderate force when installing the sensor.

- **CAUTIONS:**

 Make sure the evaporator temperature sensor harness does not become trapped.

 Make sure that the sensor is correctly installed.

1. To install, reverse the removal procedure.

# Climate Control - Floor Console Register

Removal and Installation

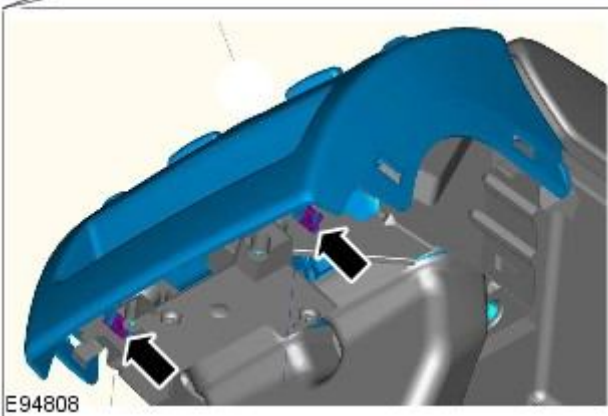
## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Remove both floor console side trim panels.

Refer to: [Floor Console Side Trim Panel](#) (501-12 Instrument Panel and Console, Removal and Installation).

- 2.



3. **3.** NOTE: Do not disassemble further if the component is removed for access only.



E94809

4. Remove the 2 clips.



E94810

## Installation

1. To install, reverse the removal procedure.

# Climate Control - Footwell Vent/Duct Blend Door Actuator


## Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Climate Control Assembly](#) (412-01 Climate Control, Removal and Installation).

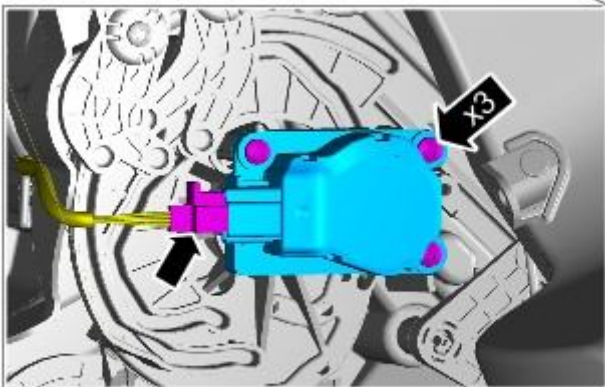
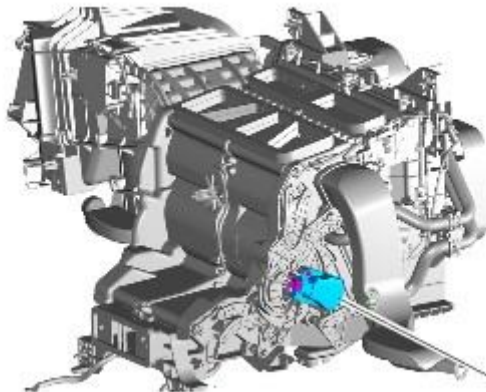
3. **3. CAUTIONS:**

 Take extra care not to damage the clips or screw threads. Failure to follow this instruction may result in damage to the climate control assembly.

 Make sure that the component is correctly located on the locating dowels.

- NOTE: RHD illustration shown, LHD is similar.

Torque: 1.3 Nm



E100700

### Installation

1. To install, reverse the removal procedure.

## Climate Control - Heater Core

Removal and Installation

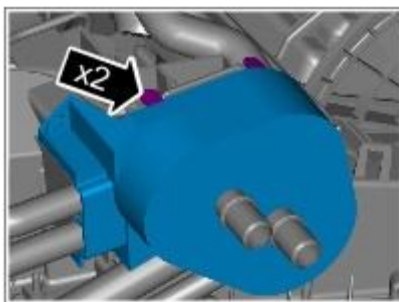
### Removal


- NOTE: Removal steps in this procedure may contain installation details.

All vehicles

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Heater Core and Evaporator Core Housing](#) (412-01 Climate Control, Removal and Installation).

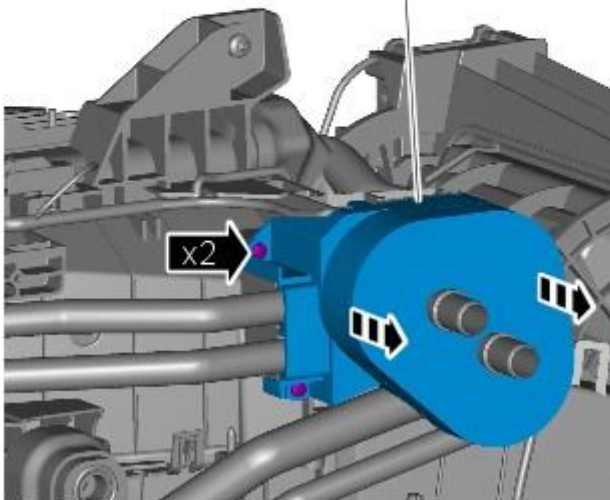
All vehicles



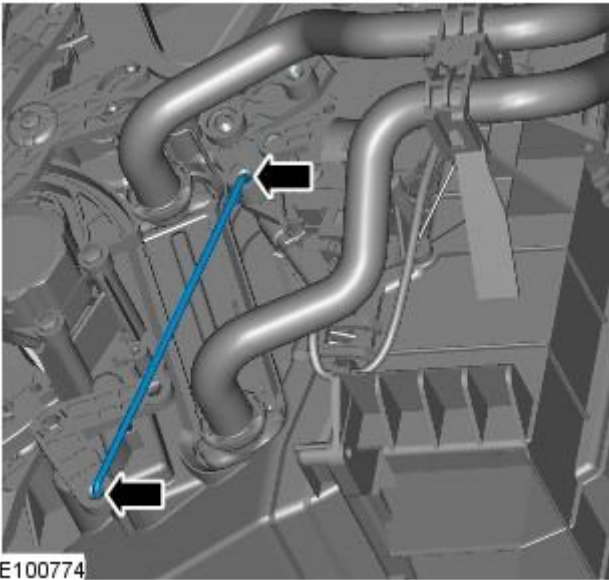
3.  CAUTION: Take extra care not to damage the clips or screw threads. Failure to follow this instruction may result in damage to the climate control assembly.

- NOTE: RHD illustration shown, LHD is similar.

Torque: 1.3 Nm



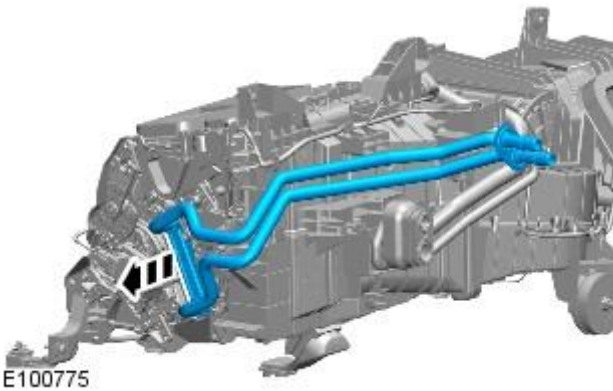
E100773



E100774

4.  CAUTION: Take extra care not to damage the component.

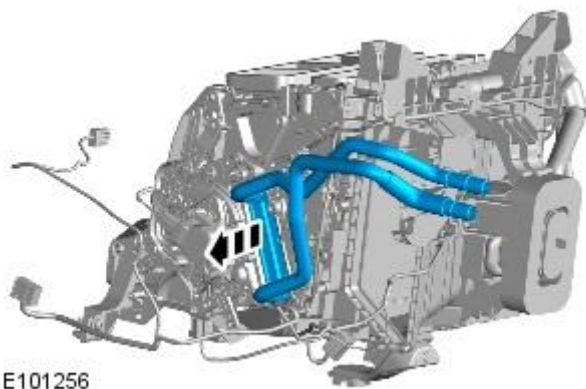
Right-hand drive vehicles



E100775

- 5.

Left-hand drive vehicles



E101256

- 6.

## Installation

1. To install, reverse the removal procedure.



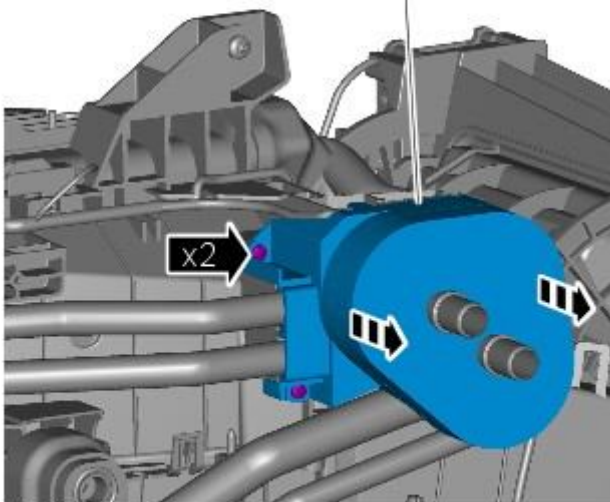
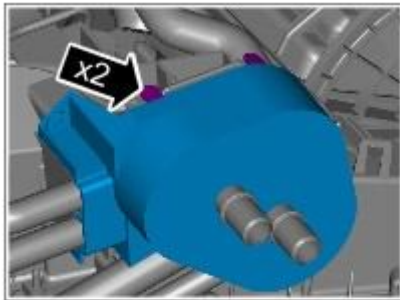
# Climate Control - Heater Core and Evaporator Core Housing

## Removal and Installation


### Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Climate Control Assembly](#) (412-01 Climate Control, Removal and Installation).



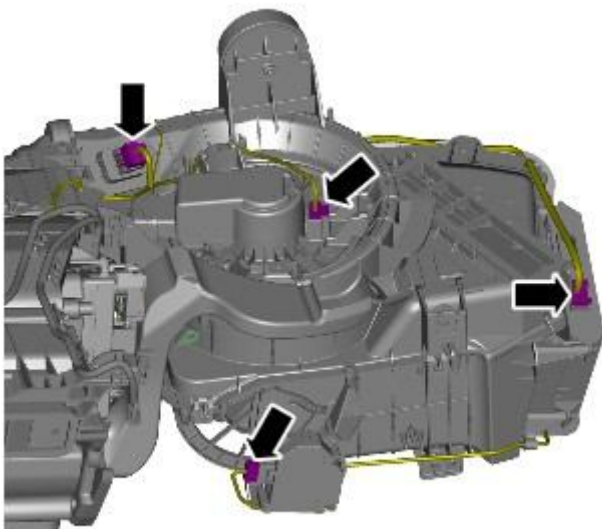
E100773

3.  CAUTION: Take extra care not to damage the clips or screw threads. Failure to follow this instruction may result in damage to the climate control assembly.

• NOTE: RHD illustration shown, LHD is similar.

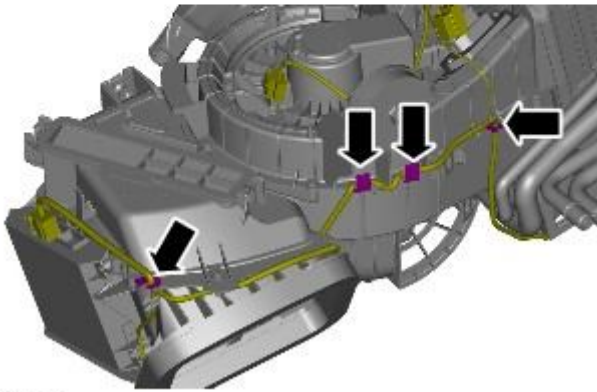
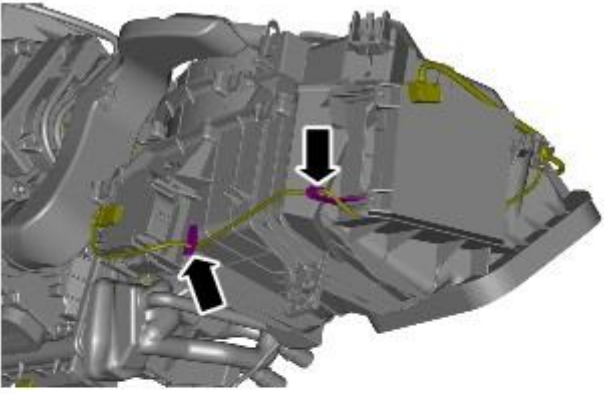
Torque: 1.3 Nm

- 4.



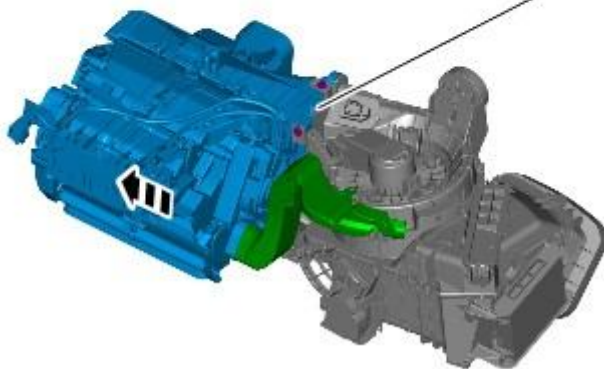
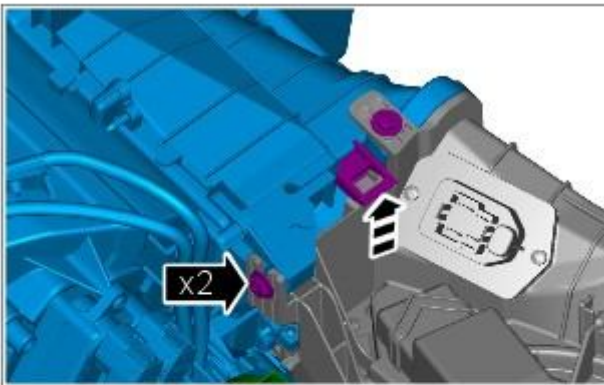
E100762

5.



E100821

6. *Torque: 2.4 Nm*



E100763

## Installation

1. To install, reverse the removal procedure.

# Climate Control - Instrument Panel Register Trim Panel

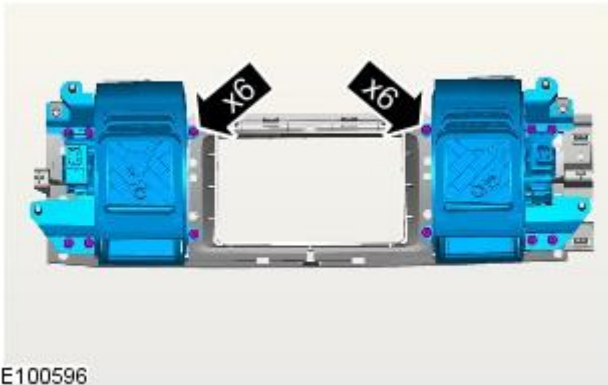
Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

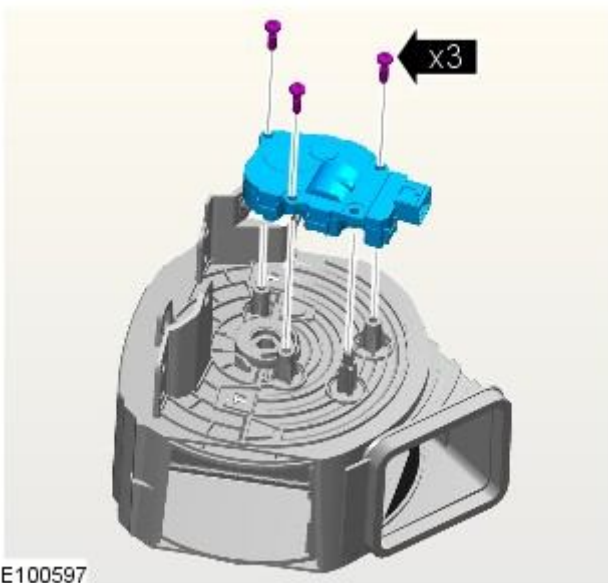
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Center Registers](#) (412-01 Climate Control, Removal and Installation).

3.

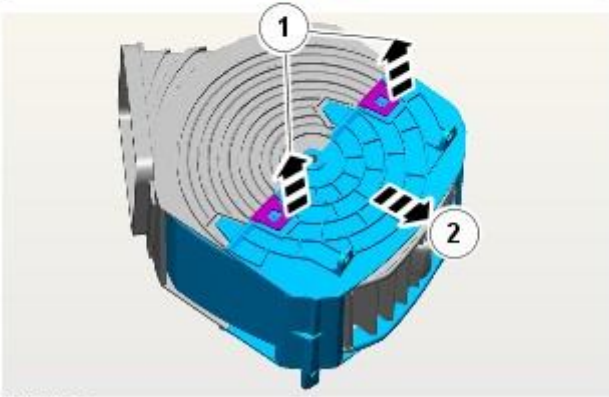
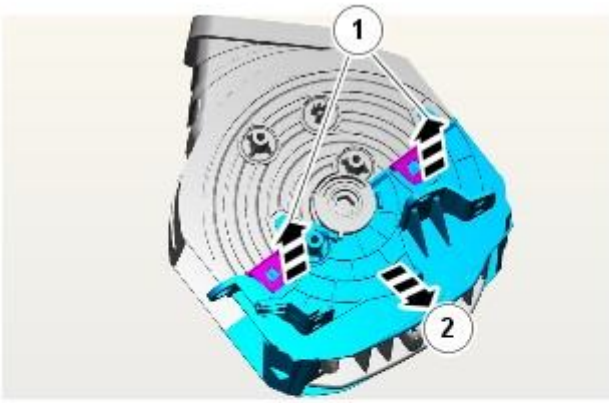


E100596

4.

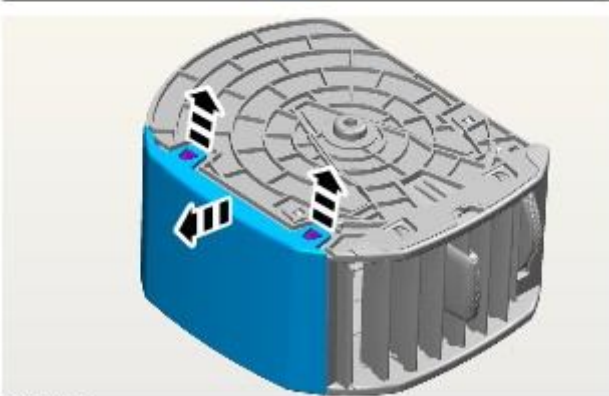
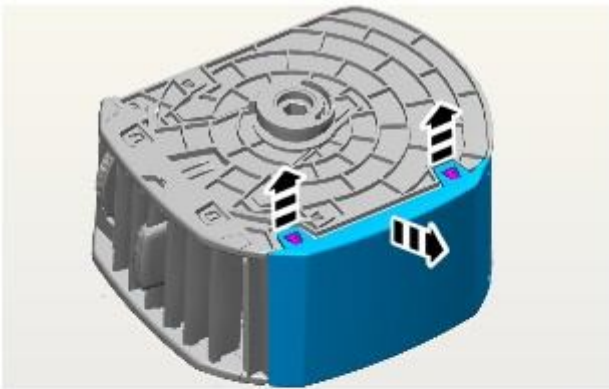


E100597



E100598

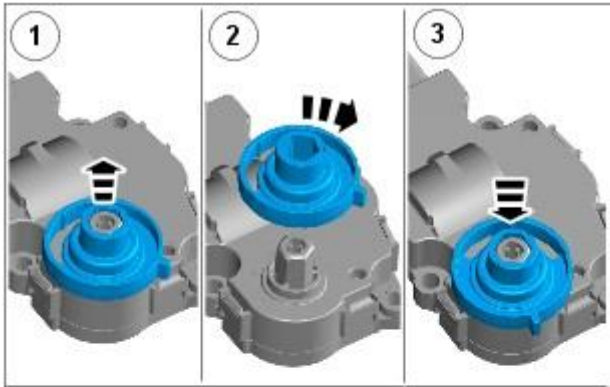
5.




E100599

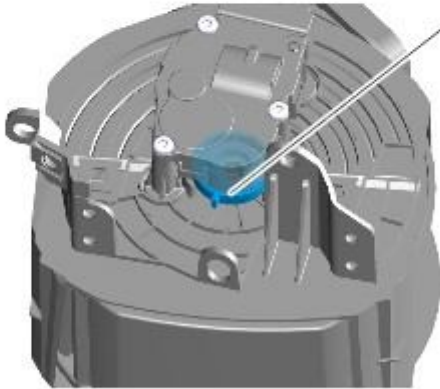
6.

## Installation



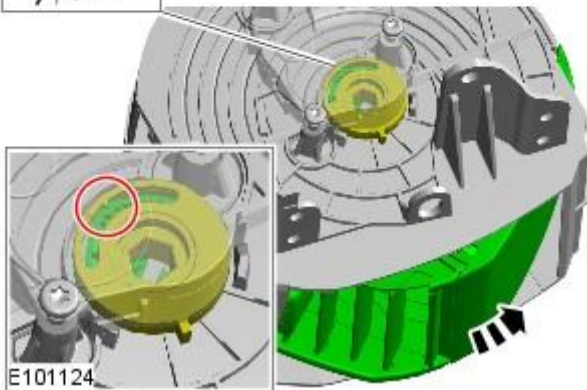
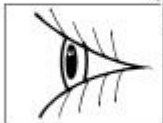
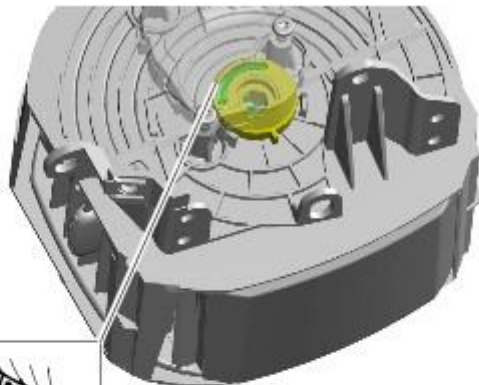
1.  **CAUTION:** Make sure that the clutch rib is located between the two ribs on the car rearward (front half), of the register housing to avoid damage on installation.

To install, reverse the removal procedure.



E100759

2.
  - Position the locating peg.



E101124



# Climate Control - In-Vehicle Temperature Sensor

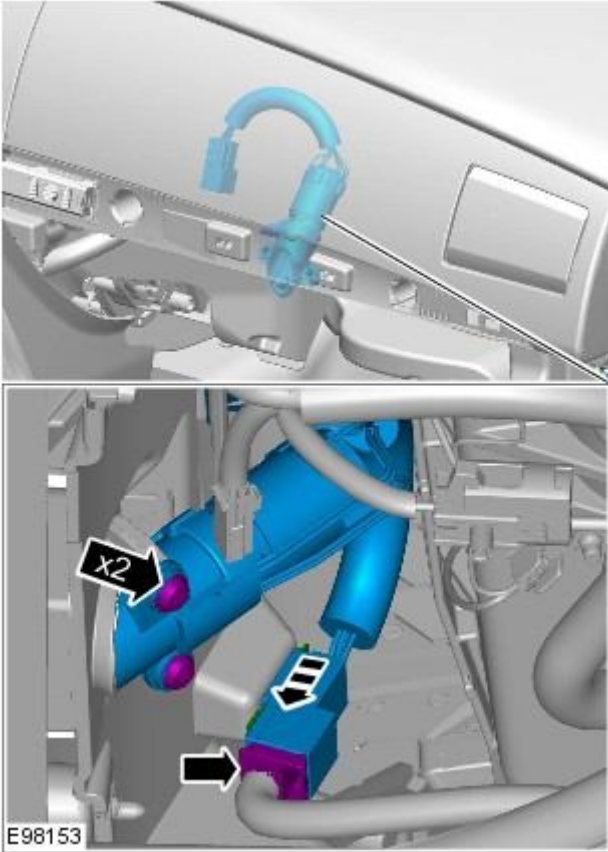
Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Glove Compartment](#) (501-12 Instrument Panel and Console, Removal and Installation).

2.



## Installation

1. To install, reverse the removal procedure.



# Climate Control - Passenger Side Register

Removal and Installation

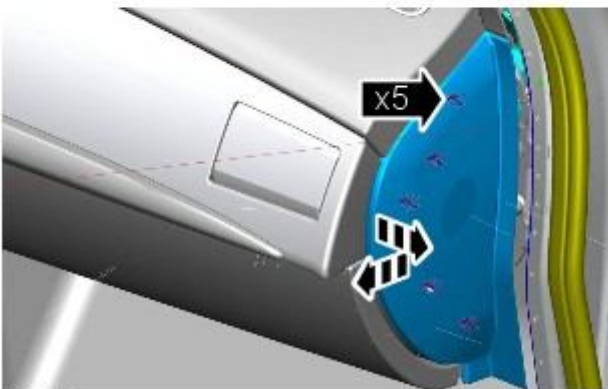
## Removal



**CAUTION:** Do not manually open the registers. Failure to follow this instruction may result in damage to the internal components.

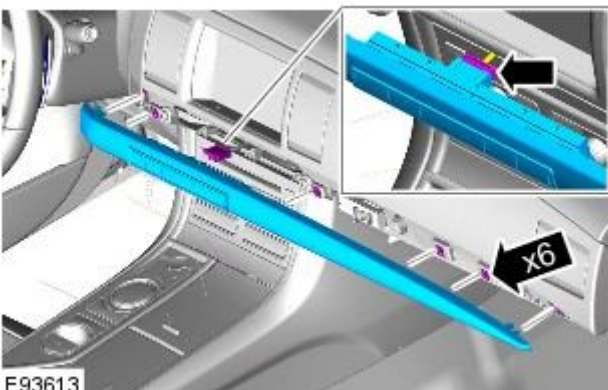
- NOTE: If the registers are set to 'Automatic' mode and one or more are disconnected during an ignition cycle, a vehicle battery reset may be required to reconnect the affected registers to the LIN BUS.
- NOTE: Removal steps in this procedure may contain installation details.

1.



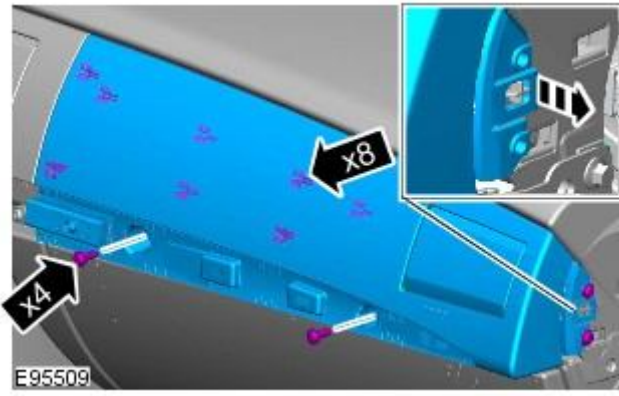
E95508

2.

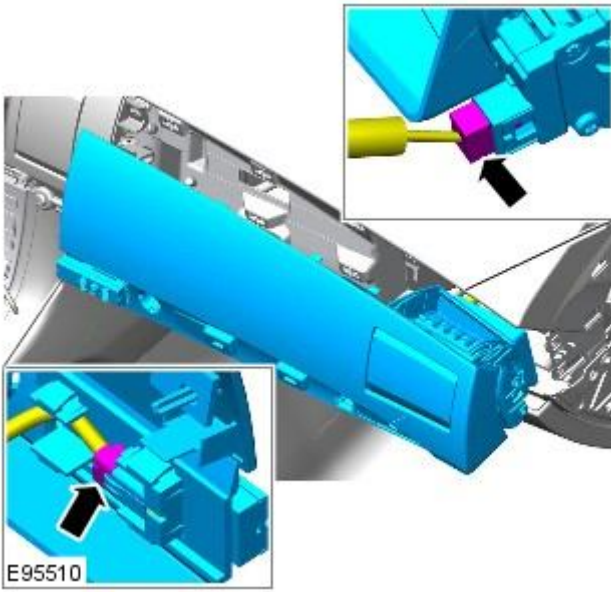


E93613

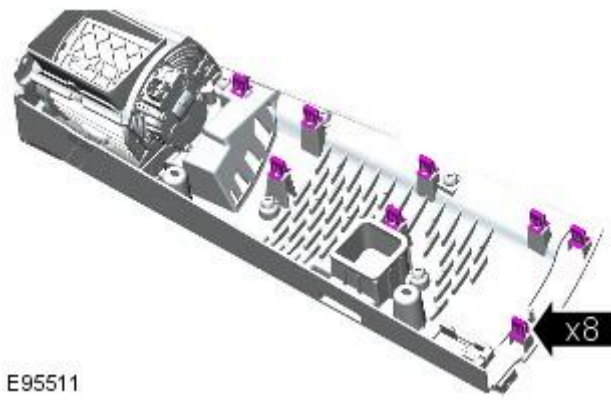
3.

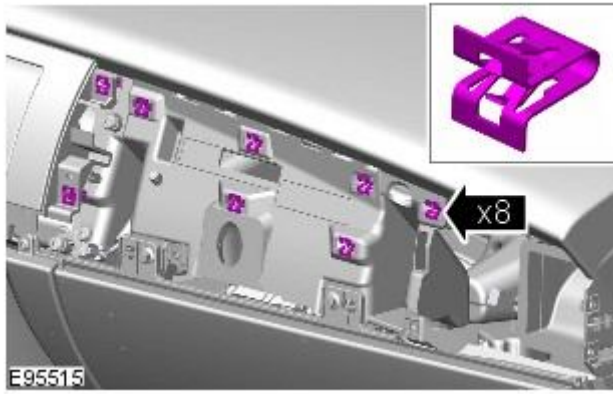


4.

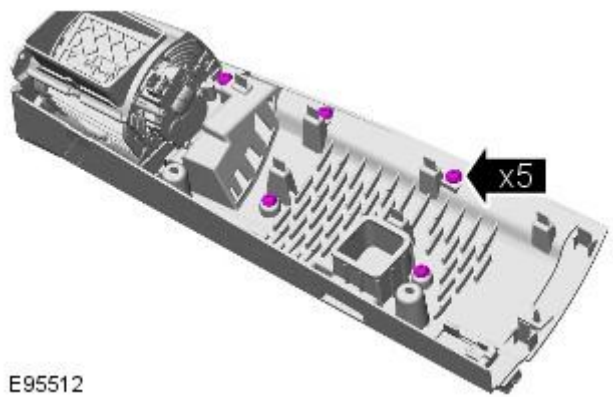


5.

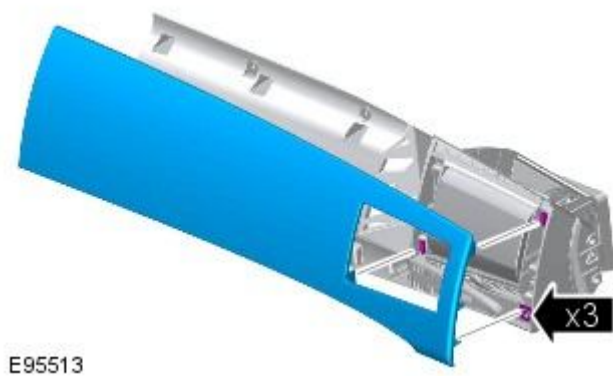




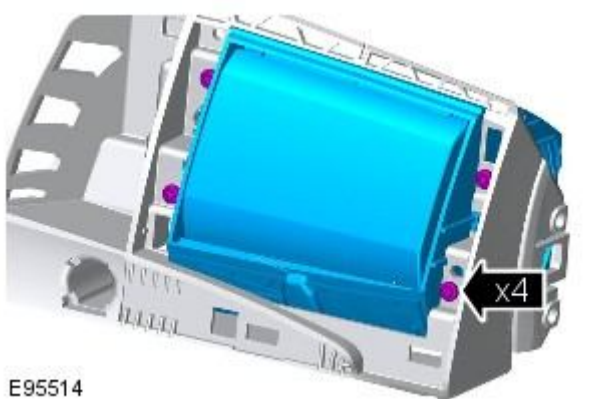
6. Install the clips into the instrument panel.



7. **7. NOTE:** Do not disassemble further if the component is removed for access only.



8. **8. NOTE:** When removing the component, some of the clips may remain attached. These clips should be removed and returned to their original positions in the passenger side register carrier.



9.

## Installation

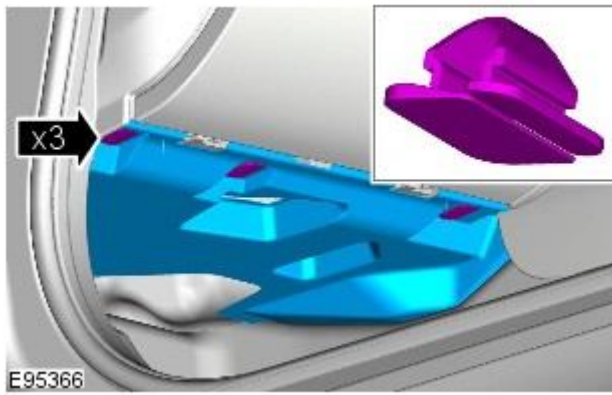
1. To install, reverse the removal procedure.

# Climate Control - Pollen Filter

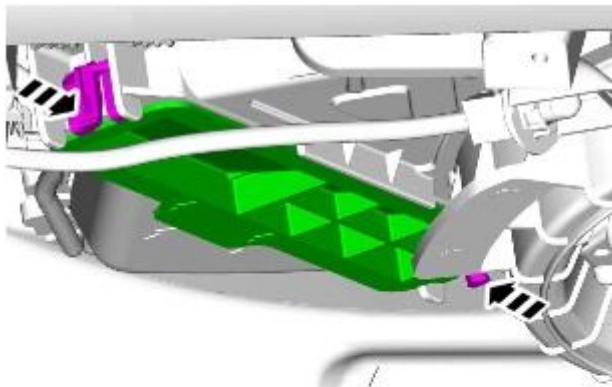
Removal and Installation

## Removal

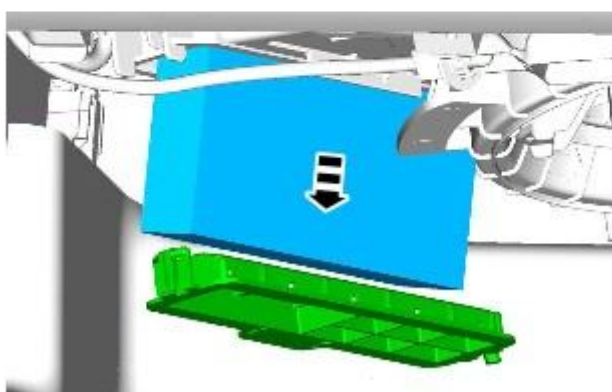
- NOTE: Removal steps in this procedure may contain installation details.



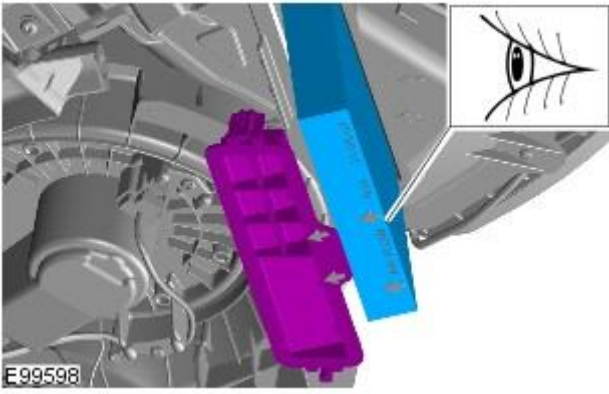
1.



2.



E95367



3.

## Installation

1. To install, reverse the removal procedure.

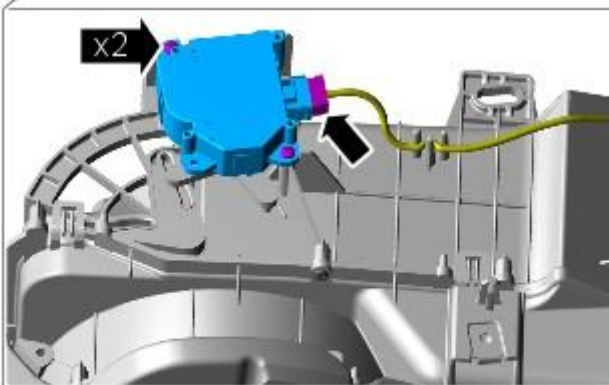
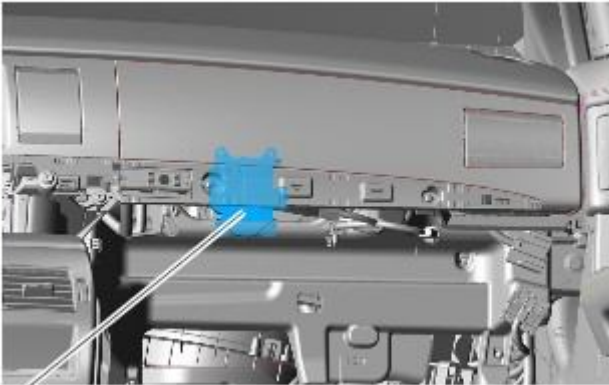
# Climate Control - Recirculation Blend Door Actuator

Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Glove Compartment](#) (501-12 Instrument Panel and Console, Removal and Installation).
3. **3.** NOTE: Make sure that the actuator is correctly aligned to the recirculation blend door arm.



E100075

## Installation

1. To install, reverse the removal procedure.



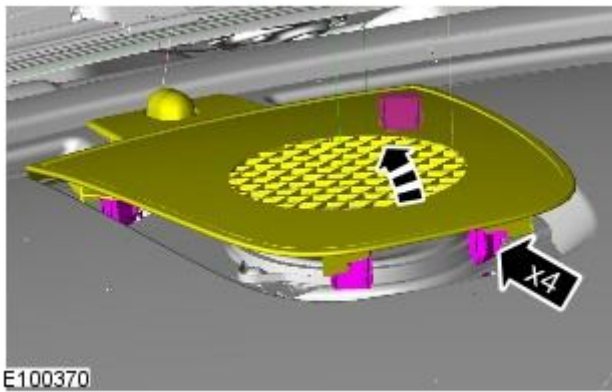
# Climate Control - Sunload Sensor

Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).



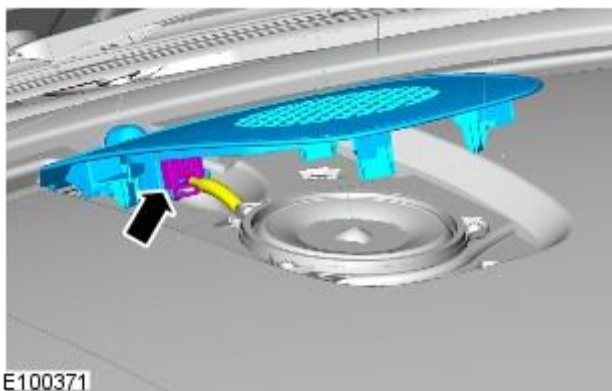
2. 2. CAUTIONS:



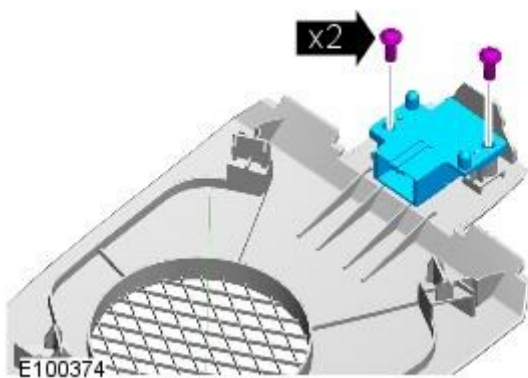
Protect the surrounding trim to avoid damage.




Make sure that the clips are correctly located.



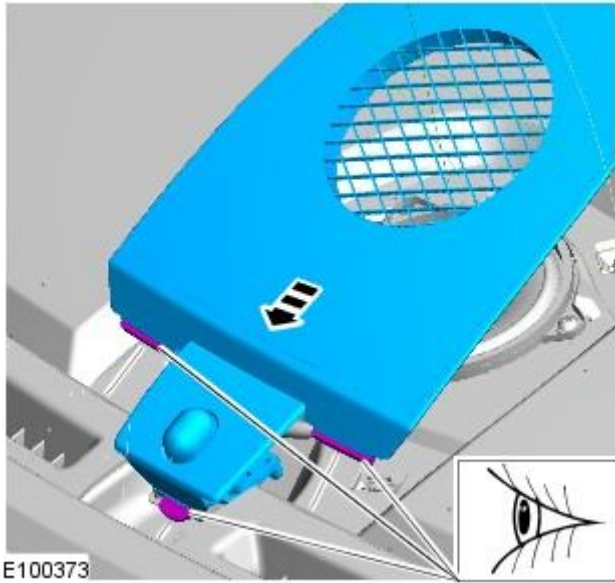
- 3.



4.  CAUTION: Make sure that the component is correctly located on the locating dowels.

*Torque: 2 Nm*

## Installation



E100373

1. To install, reverse the removal procedure.

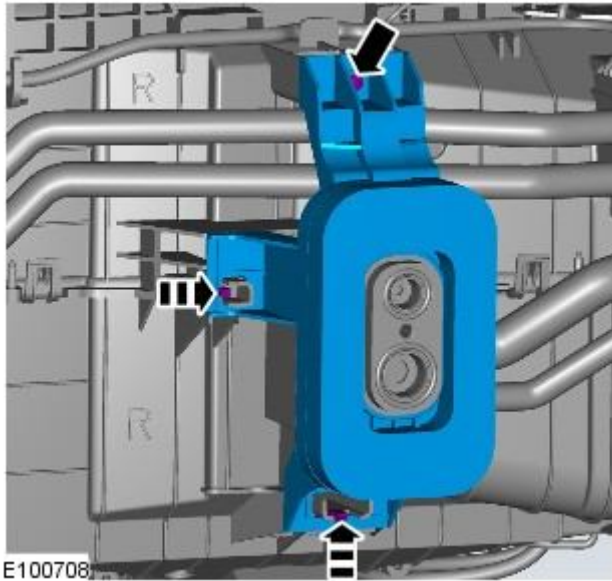
# Climate Control - Thermostatic Expansion Valve


## Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.

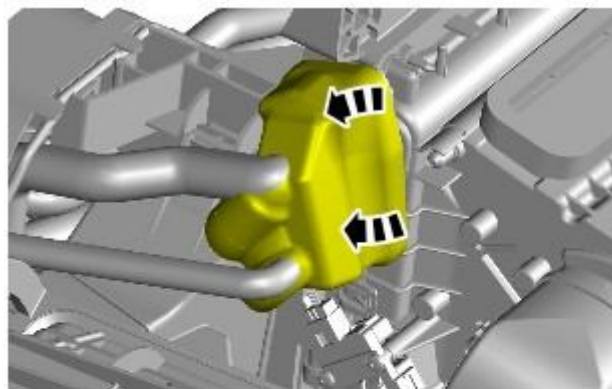
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Climate Control Assembly](#) (412-01 Climate Control, Removal and Installation).



3.  CAUTION: Take extra care not to damage the clips or screw threads. Failure to follow this instruction may result in damage to the climate control assembly.

- NOTE: RHD illustration shown, LHD is similar.

Torque: 1.3 Nm

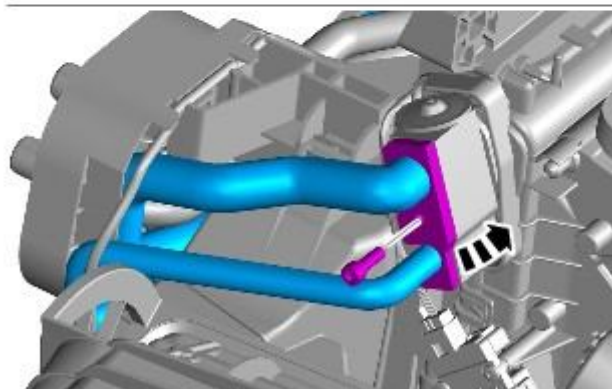


4. CAUTIONS:

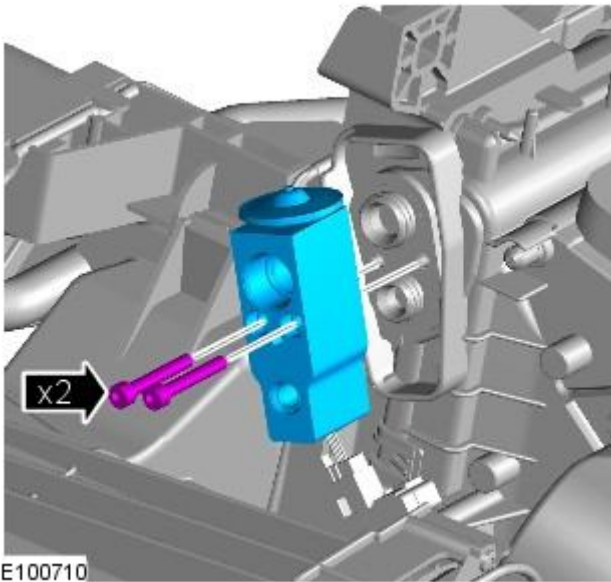
-  Take care not to damage the O-ring seals during installation.

-  A new O-ring seal is to be installed.

Torque: 5.3 Nm



E100709



5. **5. CAUTIONS:**

 Take care not to damage the O-ring seals during installation.

 A new O-ring seal is to be installed.

*Torque:* 3.5 Nm

## Installation

1. To install, reverse the removal procedure.

**Air Conditioning -****Torque Specifications**

Description	Nm	lb-ft	lb-in
A/C compressor retaining bolts	25	18	-
A/C compressor manifold and tube retaining bolt	9	-	80
A/C condenser core retaining studs	5	-	48
A/C condenser core supply and return lines retaining nuts	8	-	71
Power steering oil cooler retaining nuts	7	-	62
A/C desiccant bag retaining screw (vehicles fitted with petrol engines)	22	16	-
A/C desiccant bag retaining screw (vehicles fitted with diesel engines)	4	-	37
A/C pressure cutoff switch	8	-	71

## **Air Conditioning - Air Conditioning**

Diagnosis and Testing

For additional information.

REFER to: [Climate Control System](#) (412-00 Climate Control System - General Information, Diagnosis and Testing).



# Air Conditioning - Air Conditioning (A/C) Compressor 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Removal and Installation

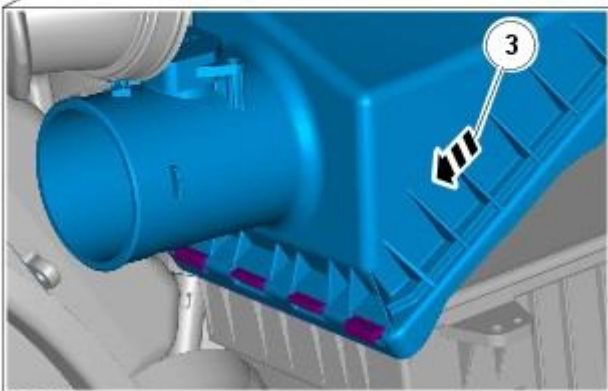
## Removal

• NOTE: Removal steps may contain installation details.

1. For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
3. NOTE: Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

4.



E96195

5.

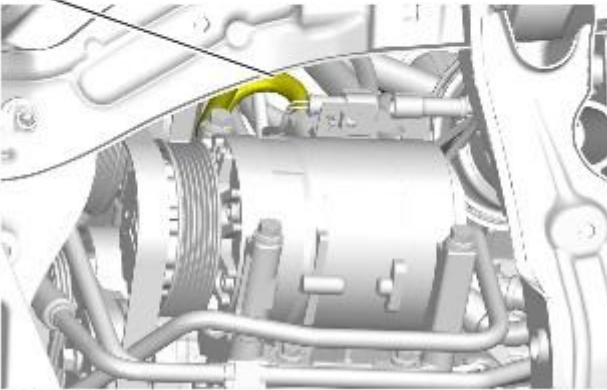
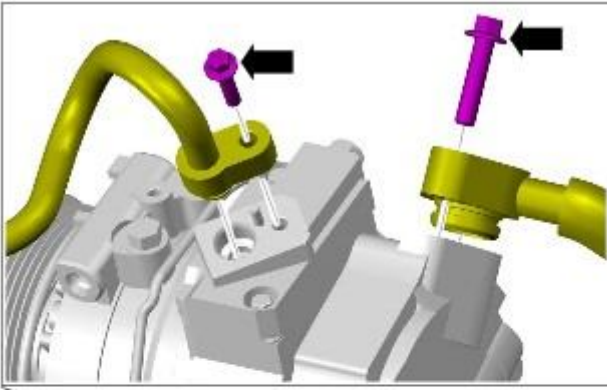


E97788

6. For additional information, refer to: [Engine Mount LH](#) (303-01A Engine - 4.2L NA V8 - AJV8, In-vehicle Repair).

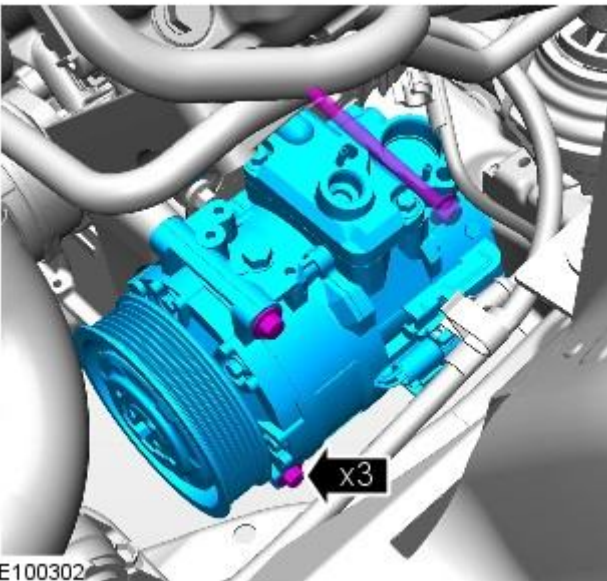
7. NOTE: Make sure that all openings are sealed. Use new blanking caps.

TORQUE: 9 Nm



E97758

8. TORQUE: 25 Nm



E100302

## Installation

1. To install, reverse the removal procedure.

## Air Conditioning - Condenser Core4.2L NA V8 - AJV8

Removal and Installation

### Removal

• NOTE: Removal steps in this procedure may contain installation details.

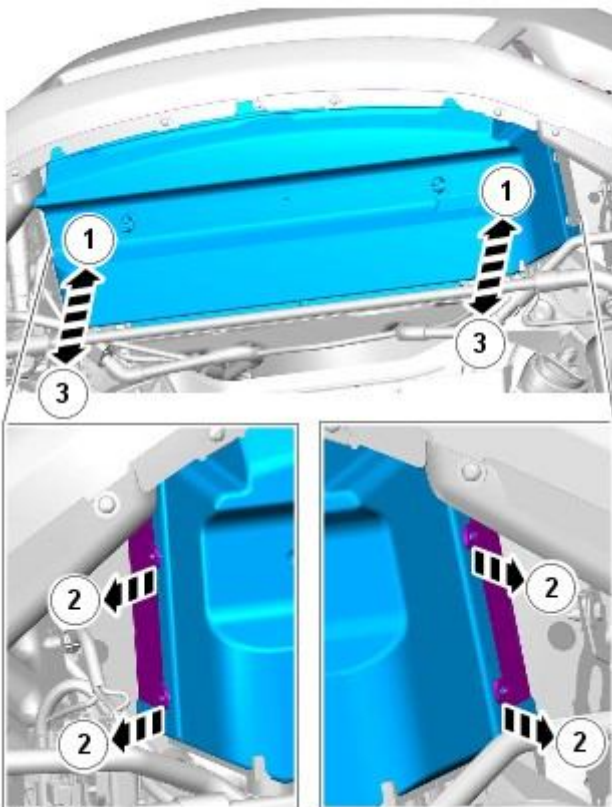
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

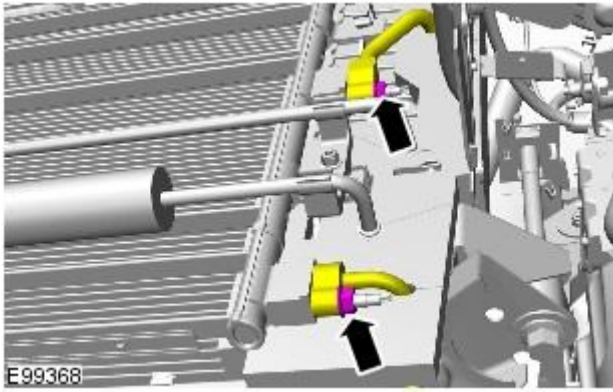
Raise and support the vehicle.

4. Refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

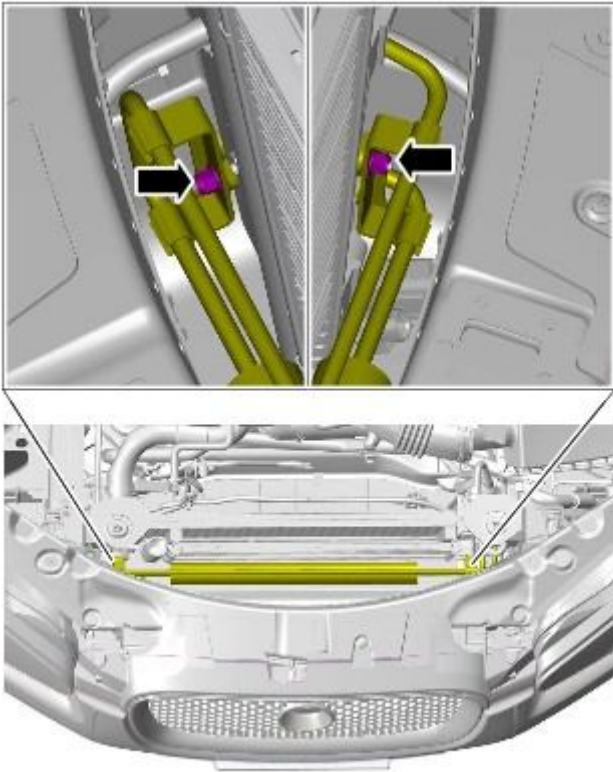
5. **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.



E97870



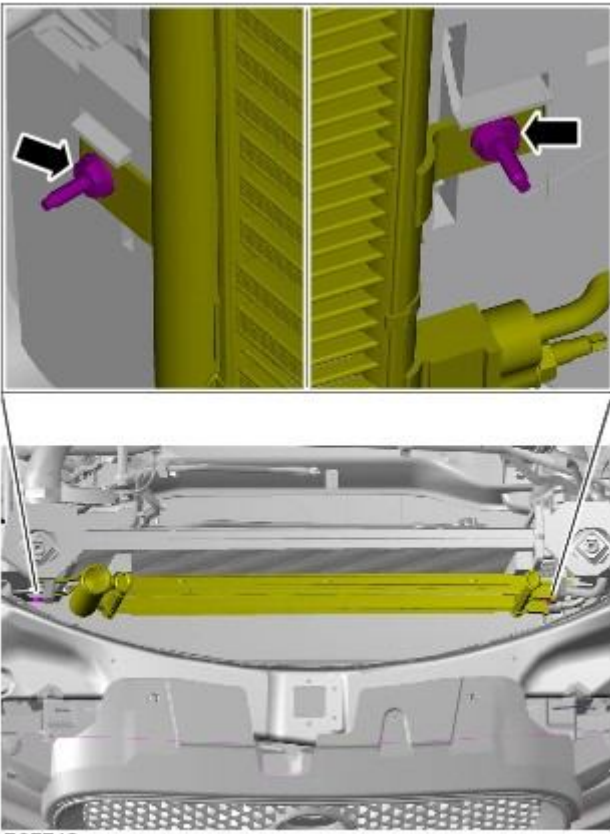
6. Torque: 20 Nm



7. Torque: 10 Nm

E97747

8. Torque: 10 Nm



## Installation

1. To install, reverse the removal procedure.



## Air Conditioning - Condenser Core4.2L SC V8 - AJV8

Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.

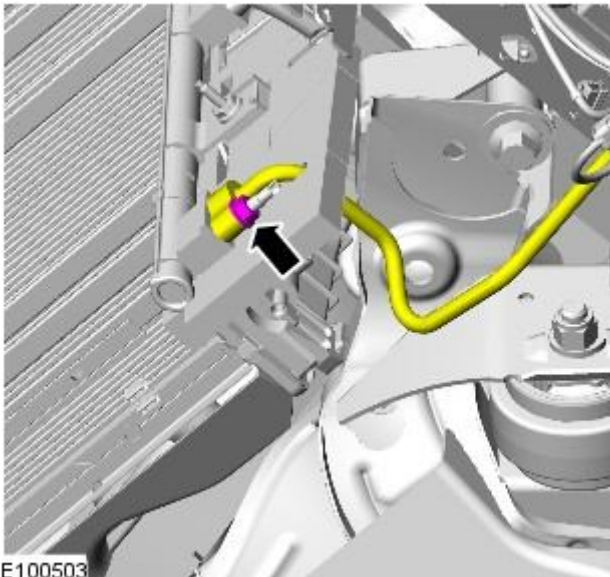
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

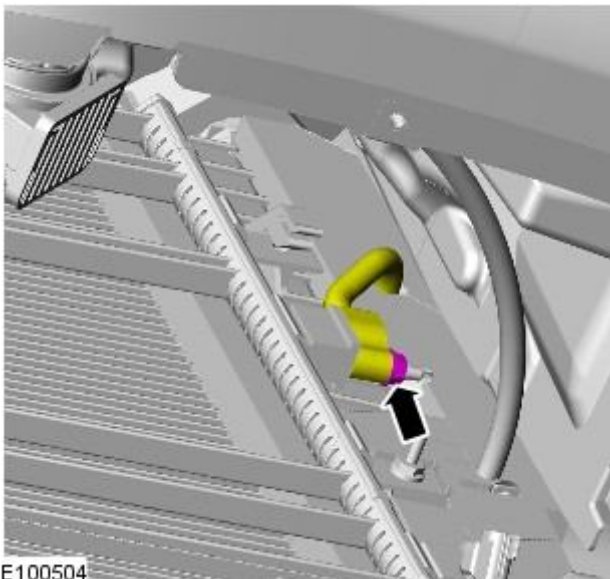
2. Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

3. Refer to: [Radiator](#) (303-03B Supercharger Cooling - 4.2L SC V8 - AJV8, Removal and Installation).

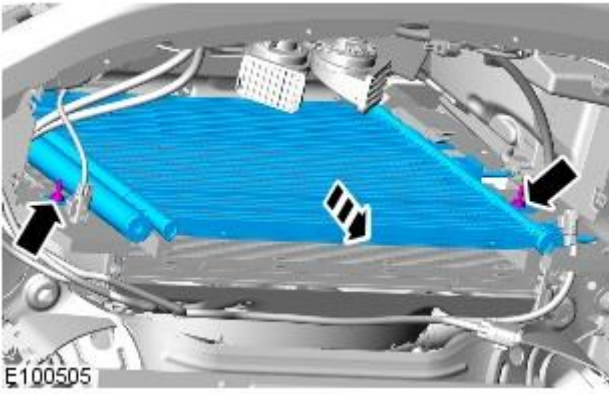
4. Torque: 20 Nm



5. Torque: 20 Nm







6.  CAUTION: Protect the A/C condenser.

*Torque:* 10 Nm

## Installation

1. To install, reverse the removal procedure.

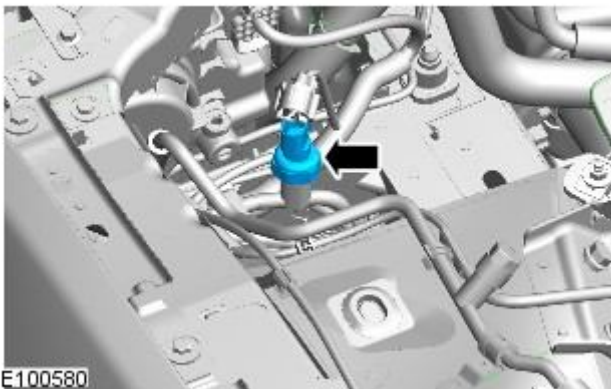
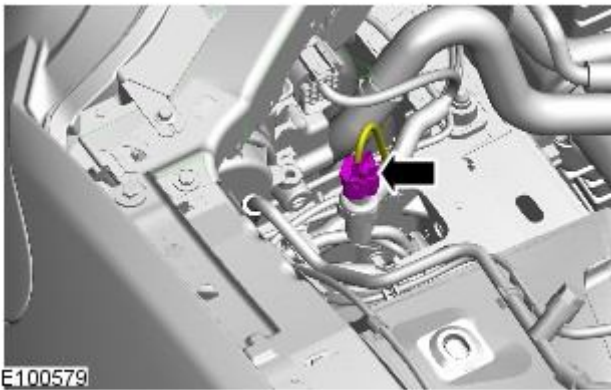
## Air Conditioning - Pressure Cutoff Switch


Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
2. For additional information, refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - 4.2L NA V8 - AJV8, Removal and Installation).
- 3.



4.  CAUTION: Make sure the air conditioning (A/C) hose does not turn when removing the low pressure switch.

TORQUE: 8 Nm

### Installation

1. To install, reverse the removal procedure.

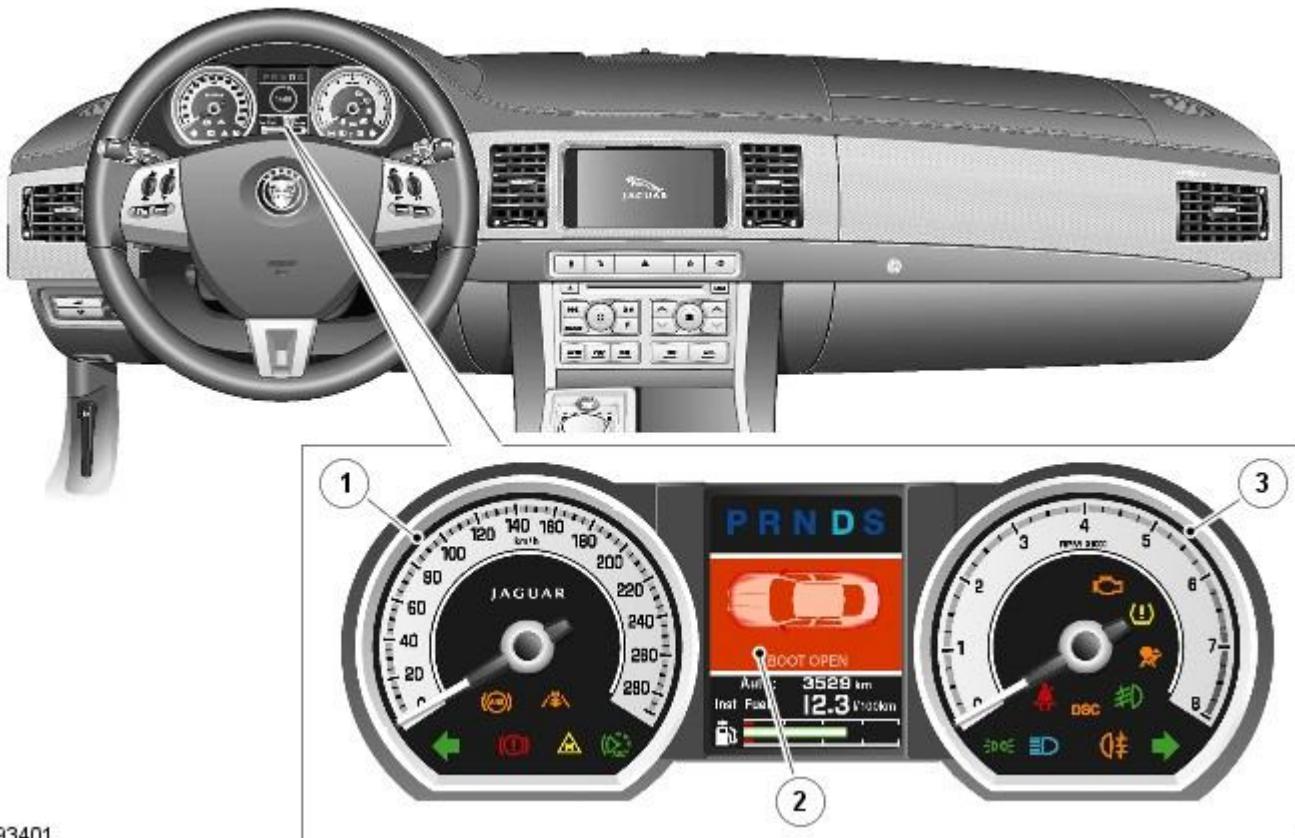
**Instrument Cluster -**

Description	Specification
Illumination bulb.	3.0 Watt

# Instrument Cluster - Instrument Cluster - Component Location

Description and Operation

COMPONENT LOCATION



E93401

## ItemDescription

- |   |                |
|---|----------------|
| 1 | Speedometer    |
| 2 | Message Center |
| 3 | Tachometer     |

# Instrument Cluster - Instrument Cluster - Overview

Description and Operation

## OVERVIEW

The primary task of the instrument cluster is to display current vehicle status through a series of analogue gauges, indicator lamps, and a [LCD \(liquid crystal display\)](#) message center. In addition to this, the instrument cluster:

- Acts as a gateway between the medium speed and high speed [CAN \(controller area network\)](#) bus networks
- Is connected by the [LIN \(local interconnect network\)](#) bus to the start control unit and the steering wheel clockspring
- Controls operation of the steering column adjust feature  
Refer to: [Steering Column](#) (211-04 Steering Column, Description and Operation).
- Acts as an interface for the passive anti-theft system.  
Refer to: [Anti-Theft - Active](#) (419-01A Anti-Theft - Active, Description and Operation).

Two analogue gauges are located in the instrument cluster; the speedometer and the tachometer. The speedometer is located on the [LH \(left-hand\)](#) side of the instrument cluster. The tachometer is located on the [RH \(right-hand\)](#) side of the instrument cluster

and displays engine speeds up to 7000 Revolutions Per Minute (RPM) for the supercharged engine, 8000 RPM for the naturally aspirated engines and 6000 RPM for diesel variants.

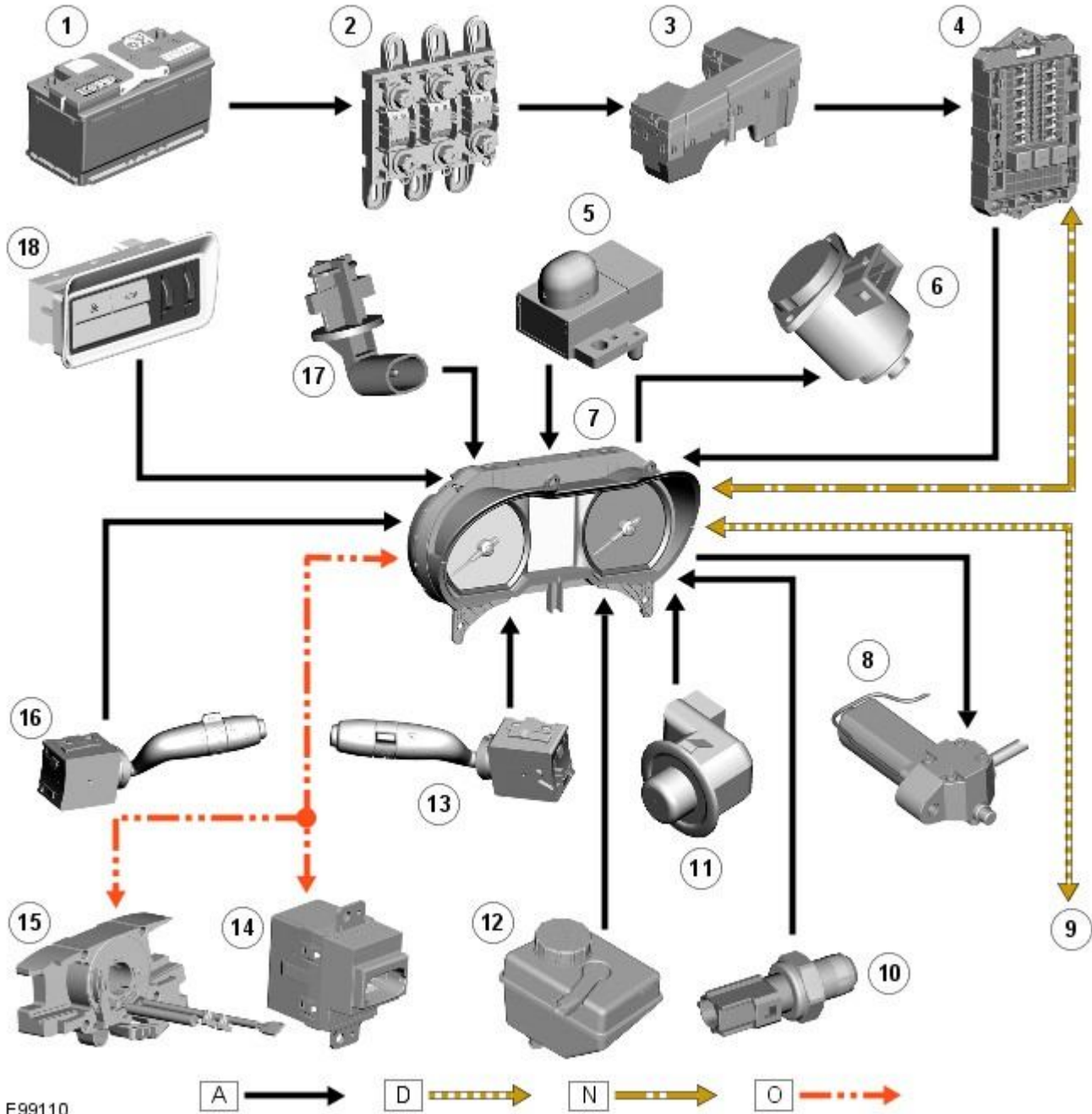
The message center is a [LCD](#) located in a central position in the cluster. The message center displays system status information including fuel quantity remaining.

# Instrument Cluster - Instrument Cluster - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **D** = High speed CAN (controller area network) bus; **N** = Medium speed CAN bus; **O** = LIN (local interconnect network) bus



**ItemDescription**

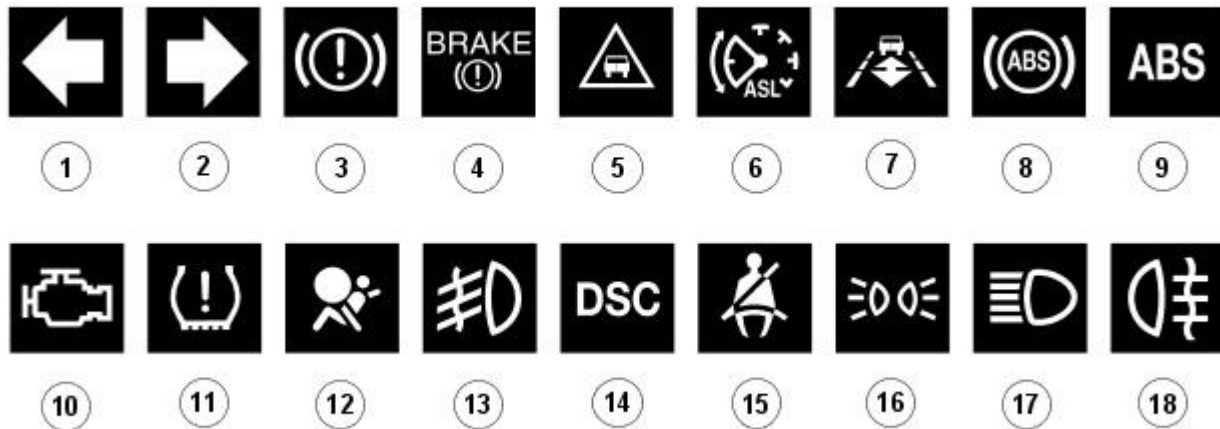
1	Battery
2	BJB (battery junction box)
3	EJB (engine junction box)
4	CJB (central junction box)
5	Sun load sensor (alarm LED (light emitting diode))
6	Servotronic valve
7	Instrument cluster
8	Steering column motor
9	High speed CAN bus connection to other vehicle systems
10	Engine oil pressure switch



11	Steering column adjustment switch
12	Brake fluid level switch
13	LH (left-hand) steering column multifunction switch
14	Start control module
15	Clockspring
16	RH (right-hand) steering column multifunction switch
17	Engine coolant level sensor
18	Auxiliary lighting switch

## System Operation

### WARNING INDICATOR FUNCTIONALITY



E99113

#### ItemDescription

1	LH turn signal
2	RH turn signal
3	Brake warning
4	Brake warning (NAS)
5	Forward alert
6	Automatic Speed Limiter (ASL)
7	Adaptive speed control
8	ABS (anti-lock brake system) warning
9	ABS warning (NAS)
10	Malfunction Indicator Lamp (MIL)
11	Tire Pressure Monitoring System (TPMS)
12	Airbag warning
13	Front fog lamps
14	Dynamic Stability Control (DSC) warning
15	Seat belt warning
16	Side lamps
17	High beam
18	Rear fog lamps

The functionality for each of the above warning indicators is described in the following sections:

#### 1 and 2. Turn Signal Indicators

The turn signal indicators are controlled by the [CJB](#) on receipt of medium speed [CAN](#) bus signals from the instrument cluster.

The instrument cluster outputs a voltage to the turn signal indicator switch. The switch contains resistors of different values. When the switch is operated in either the [LH](#) or [RH](#) direction, the voltage is passed to a ground connection in the instrument cluster which detects the reduced voltage supplied via the resistors. When the turn signal indicator switch is operated in the [LH](#) or [RH](#) direction, the instrument cluster detects the ground voltage and determines whether a [LH](#) or [RH](#) selection is made.

The instrument cluster transmits a medium speed [CAN](#) message to the [CJB](#) for operation of the applicable turn signal

indicators. The message can contain a number of states for each possible switch position and also an out of range low and high state for circuit faults and an initial value for the switch neutral position. The turn signal indicators are not subject to the 3 second indicator check when the ignition is switched on.

The **RJB (rear junction box)** software controls the flash rate of the warning indicator which sends 'ON' and 'OFF' signals to the instrument cluster which flashes the indicators in a green color. During normal operation, the warning indicator flashes slowly, accompanied simultaneously by a sound from the instrument cluster sounder. If a fault exists, the **RJB** transmits a message to the instrument cluster which responds by displaying an appropriate message in the message center.

The hazard warning indicators are controlled by the **CJB** on receipt of a completed ground path from the hazard warning indicator switch. The **CJB** outputs a medium speed **CAN** message to the instrument cluster which operates both the **LH** and **RH** turn signal indicators simultaneously. The hazard warning indicators can operate with the ignition switched off, therefore the **CAN** message from the **CJB** will also carry a 'wake-up' message for the instrument cluster.

### 3. Brake Warning Indicator

This warning indicator is displayed in a red or amber color (dependant on market) as a brake symbol in all markets except United States of America (USA) which have the word 'BRAKE' in place of the symbol. The indicator is controlled by high speed **CAN** messages from the **ABS** module and the parking brake control module. The indicator is illuminated in a red color for a 3 second indicator check when the ignition is switched on.

The instrument cluster monitors the fluid level in the brake fluid reservoir using a hardwired level switch. If the fluid level falls to below a determined level, the switch contact is broken and the **ABS** module detects the low fluid level condition. The instrument cluster illuminates the warning indicator and simultaneously displays a 'BRAKE FLUID LOW' message in the message center.

- **NOTE:** If both the brake warning indicator and the **ABS** warning indicator illuminate simultaneously, a major fault in the brake system will have occurred.

The warning indicator also displays parking brake status. When the parking brake is applied, the warning indicator will be illuminated by the instrument cluster and, if the vehicle is moving, the message 'PARK BRAKE APPLIED' will be also displayed in the message center in response to a **CAN** message from the parking brake control module.

If a condition exists where the parking brake cannot be applied, the parking brake control module issues a **CAN** message to the instrument cluster which flashes the warning lamp on and off and is accompanied with a message 'CANNOT APPLY PARK BRAKE'. If a fault occurs in the parking brake system, the parking brake control module issues a **CAN** message to the instrument cluster which illuminates the warning indicator and displays the message 'PARK BRAKE FAULT' in the message center.

### 4. Forward Alert Indicator

The forward alert system uses the components of the adaptive speed control system to alert the driver of the presence of a vehicle ahead. The system can be turned on and off using a switch located in the auxiliary lighting switch when the adaptive speed control system is off. The indicator is illuminated in an amber color for a 3 second indicator check when the ignition is switched on.

The forward alert system is controlled by the adaptive speed control module. When the switch is pressed, the forward alert system is activated and the adaptive speed control module issues a forward alert active message on the high speed **CAN** bus to the instrument cluster. The forward alert icon in the instrument cluster will illuminate in an amber color and a 'FORWARD ALERT' message will be displayed in the message center. When the button is pressed a second time, the module issues a forward alert off **CAN** message. The forward alert system will be deactivated, the forward alert icon will go off and a message 'FORWARD ALERT OFF' will be displayed in the message center.

### 5. Automatic Speed Limiter (ASL) Indicator

The ASL is controlled by the **ECM (engine control module)**. An ASL switch is located in the floor console, adjacent to the gear selector lever. When the ASL switch is pressed, this is sensed by the **ECM** which issues a high speed **CAN** message to the instrument cluster. The instrument cluster illuminates the ASL warning indicator in an amber color to show the driver that ASL is active. The driver sets the required speed using the speed control SET +/- switches on the steering wheel. The selected speed is shown by the message 'LIMITER SET XXX MPH / K/MH' in the message center. The indicator is illuminated in an amber color for a 3 second indicator check when the ignition is switched on. ASL can be deselected by pressing the ASL switch, by depressing the throttle pedal initiating kick-down or by pressing the 'cancel' switch on the steering wheel. The ASL indicator will go off and the message center will display the message 'limiter cancelled' for 4 seconds. If a fault occurs in the ASL system, the **ECM** will send a message to the instrument cluster to illuminate the ASL indicator and display the message 'LIMITER NOT AVAILABLE'.

### 6. Adaptive Speed Control Indicator

The adaptive speed control system is controlled by the adaptive speed control module. Operation of the SET +/- switches on the steering wheel will activate the system. Operation of the switches is detected by the adaptive speed control module. The module issues a high speed **CAN** message to the instrument cluster which illuminates the adaptive speed control indicator, when the system is in 'follow mode', in an amber color and displays a 'SETSPEED XXX MPH / KM/H' message in the message center. The indicator is illuminated in an amber color for a 3 second indicator check when the ignition is switched on.

### 7. Anti-lock Braking System (ABS) Warning Indicator

The **ABS** warning indicator is controlled by the **ABS** module. If a fault in the **ABS** system is detected by the **ABS** module, the module issues a high speed **CAN** message to the instrument cluster to illuminate the **ABS** warning indicator in an amber color and display the message 'ABS FAULT' in the instrument cluster. The indicator is illuminated in an amber color for a 3 second indicator check when the ignition is switched on. If a fault is present when the ignition is on, the bulb will remain illuminated after the 3 second indicator check period.

- **NOTE:** The 'ABS FAULT' message is not displayed in NAS markets).

- **NOTE:** If both the **ABS** warning indicator and the brake warning indicator illuminate simultaneously, a major fault in the brake system will have occurred.

On NAS vehicles, the [ABS](#) warning indicator is also used for parking brake operation. The NAS warning indicator does not have 'ABS' on the icon and will function as described previously for the parking brake operation of the brake warning indicator.

### 8. Engine Malfunction Indicator Lamp (MIL)

The MIL warning indicator is controlled by the [ECM](#) and illuminated by the instrument cluster on receipt of a message on the high speed [CAN](#) bus from the [ECM](#). The indicator is illuminated in an amber color for a 3 second indicator check when the ignition is switched on.

If the MIL remains illuminated after the engine is started or illuminates when driving, a fault is present and must be investigated at the earliest opportunity. Illumination of the MIL warning indicator alerts the driver to an [OBD \(on-board diagnostic\)](#) fault which will cause excessive emissions output. This may relate to either an engine management system fault or a transmission.

### 9. Tire Pressure Monitoring System (TPMS) Warning Indicator

The TPMS warning indicator is illuminated by the instrument cluster on receipt of a medium speed [CAN](#) message from the TPMS module. The indicator is illuminated in an amber color for a 3 second indicator check when the ignition is switched on.

If the indicator illuminates and is accompanied by the message 'TYRE PRESSURE SYSTEM FAULT' in the message center, then a TPMS fault has occurred. If the indicator illuminates and accompanied by a different message, then a low tire pressure has been detected, a spare wheel has been fitted or a TPMS sensor has failed.

### 10. Airbag Warning Indicator

The airbag warning indicator is controlled by the instrument cluster. The indicator is illuminated in an amber color for the 3 second indicator check when the ignition is switched on. The indicator remains illuminated after the 3 second period has expired until the instrument cluster receives a turn off message on the high speed [CAN](#) bus from the [RCM \(restraints control module\)](#).

### 11. Front Fog Lamp Indicator

The green colored front fog lamp indicator is controlled by the [CJB](#) and illuminated by the instrument cluster on receipt of a front fog lamp on message on the medium speed [CAN](#) bus from the [CJB](#). The indicator is illuminated for as long as the front fog lamps are active. The front fog lamp indicator is not subject to the 3 second indicator check when the ignition is switched on.

### 12. Dynamic Stability Control (DSC) Indicator

The DSC warning lamp is controlled by the [ABS](#) module and illuminated by the instrument cluster in response to messages received on the high speed [CAN](#) bus. The indicator is illuminated in an amber color for the 3 second indicator check when the ignition is switched on. The DSC warning indicator, are permanently illuminated in an amber color if the instrument cluster receives a high speed [CAN](#) message from the [ABS](#) module relating to one of the following faults:

- Traction control fault
- Yaw control fault
- Engine drag torque control fault
- Panic Brake Assist (PBA) fault
- Signal missing relating to either traction control active, yaw control active or DSC switch input.

The above faults will also generate an applicable DSC and ABS warning message in the message center. The DSC warning indicator will flash at 2 Hz for if the traction control or yaw control is active when the DSC system is enabled. If the DSC system is switched off, the warning indicator will be permanently illuminated until the DSC system is subsequently re-activated.

### 13. Safety Belt Warning Indicator

The safety belt warning indicator operates for both the driver and passenger safety belts. The warning indicator is controlled by the [RCM](#) and illuminated by the instrument cluster on receipt of high speed [CAN](#) bus messages. The safety belt warning indicator is not subject to the 3 second indicator check when the ignition is switched on.

The operation of the passenger seat buckle switch is as described below with the exception that the instrument cluster must receive a hardwired signal from the belt minder control module to indicate that a passenger is occupying the seat.

The safety belt warning indicator is subject to a timer. The warning indicator is activated when the following conditions exist:

- Ignition is switched on
- One of the front seat belts is unbuckled
- USA market only - 75 seconds has elapsed after ignition on mode is selected
- Vehicle is not in reverse gear
- Vehicle speed is more than 8 km/h (5 mph).

Once the above parameters are met, the instrument cluster flashes the warning indicator at 2 Hz for 10 seconds accompanied by a simultaneous chime. After 10 seconds the chime ceases and the warning indicator is permanently illuminated for 20 seconds. This sequence is repeated every 30 seconds until one of the following events occurs:

- 300 seconds has elapsed
- The safety belt of the occupied front seats is fastened
- The ignition is switched to off mode
- The vehicle speed decreases to below 5 km/h (3 mph).

• **NOTE:** On USA market vehicles, the warning indicator is not permanently illuminated.

The safety belt minder function cannot be disabled. The seat belt minder function can be disabled. Refer to: [Safety Belt System](#) (501-20A Safety Belt System, Description and Operation).

## 14. Side Lamp Indicator

The instrument cluster controls the green colored side lamp indicator on receipt of a side lamp status message on the medium speed [CAN](#) bus from the [CJB](#) and the auxiliary junction box. The lighting switch on the [LH](#) steering column multifunction switch is connected to the instrument cluster. Selections using this switch are detected by the cluster which requests the side or headlamp operation via a message to the [CJB](#) and the [RJB](#). The [CJB](#) and the [RJB](#) responds with a side lamp active message and the cluster illuminates the side lamp indicator. The side lamp indicator is not subject to the 3 second indicator check when the ignition is switched on.

## 15. High Beam Indicator

The instrument cluster controls the blue colored high beam indicator on receipt of a high beam status message on the medium speed [CAN](#) bus from the [CJB](#). The lighting switch on the [LH](#) steering column multifunction switch is connected to the instrument cluster. High beam or flash selections using this switch are detected by the cluster which requests the light operation via a [CAN](#) message to the [CJB](#). The [CJB](#) responds with a high beam active message and the cluster illuminates the high beam indicator. The high beam indicator is not subject to the 3 second indicator check when the ignition is switched on.

## 16. Rear Fog Lamp Indicator

The amber colored rear fog lamp indicator is controlled by the auxiliary junction box and illuminated by the instrument cluster on receipt of a rear fog lamp on message on the medium speed [CAN](#) bus from the [RJB](#). The indicator is illuminated for as long as the rear fog lamps are active. The rear fog lamp indicator is not subject to the 3 second indicator check when the ignition is switched on.

## SPEEDOMETER

The speedometer is driven by high speed [CAN](#) signals transmitted by the [ABS](#) module. The wheel speeds are measured by sensors reading the rotational speed of the rear wheels from toothed targets on the hubs. An average of the two wheel speeds are passed from the sensors to the [ABS](#) module in the form of pulsed signals. The [ABS](#) module converts these signals into a speed output on the high speed [CAN](#) to the instrument cluster. The same speed outputs from the wheel speed sensors are also used to calculate the distance the vehicle has travelled.

## TACHOMETER

The tachometer is driven by an engine speed signal transmitted on the high speed [CAN](#) from the [ECM](#). The signal is derived from the [CKP \(crankshaft position\)](#) sensor. The signal is received by the instrument cluster microprocessor and the output from the microprocessor drives the tachometer.

## FUEL GAGE

The fuel gage is controlled by [CAN](#) messages from the [RJB](#). The [RJB](#) reads the values output by the fuel level sensors every 131 ms and transmits a fuel tank contents value, corrected for battery voltage, in a [CAN](#) message to the instrument cluster. A fuel pump symbol is displayed to the left of the linear gage. An arrow above the symbol shows the driver on which side of the vehicle the fuel filler cap is located. Above the linear fuel gage, is a [LCD \(liquid crystal display\)](#) area which displays odometer and trip readouts. When a trip computer function is selected, these are replaced by a trip computer display for the trip function selected.

## LIQUID CRYSTAL DISPLAY

In the area above and below the message center is a [LCD](#) display. The area below the message center displays a linear fuel gage, odometer, trip distance and trip computer readouts. The trip distance and trip computer information is derived from information supplied on the high speed [CAN](#) bus to the instrument cluster from the [ABS](#) module and the [ECM](#).

The area above the message center displays the transmission gear position information and speed control related information. The transmission information is supplied on the high speed [CAN](#) bus from the [TCM \(transmission control module\)](#).

- NOTE: There is no engine coolant temperature gage displayed. If the engine coolant temperature increases to above a predetermined threshold, a warning message is displayed in the message center. The message is sent from the [ECM](#) in a high speed [CAN](#) message to the instrument cluster.

## TRANSMISSION GEAR SELECTION POSITION

The gear position display shows JaguarDrive selector position or selected gear when using the Jaguar Sequential Shift. The gear selector module transmits a [CAN](#) message to the instrument cluster for gear selector lever position. The module also outputs a 'not in park' signal to the instrument cluster. The [TCM](#) transmits a high speed [CAN](#) message to the instrument cluster with data containing the selected gear when in Jaguar Sequential Shift mode.

## Component Description

### INSTRUMENT CLUSTER - WARNING INDICATOR LOCATIONS

- NOTE: Other market variants of instrument cluster are similar.

EUROPEAN MARKET - DIESEL INSTRUMENT CLUSTER

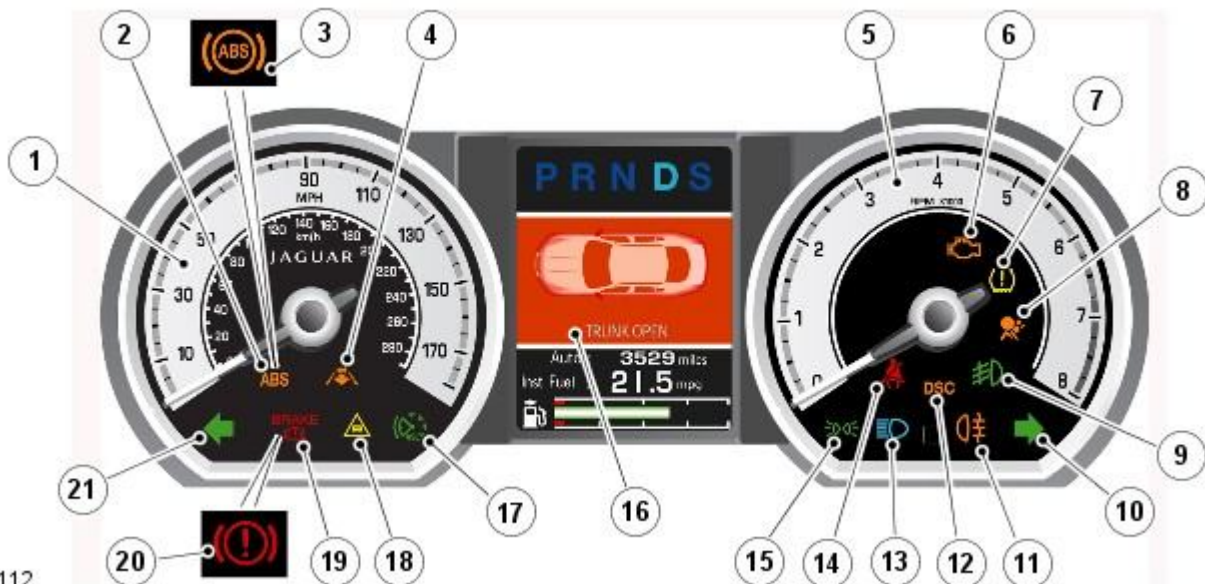


E99111

**ItemDescription**

1	Speedometer
2	<a href="#">ABS</a> indicator
3	Adaptive speed control indicator
4	Glow plug indicator
5	Malfunction Indicator Lamp (MIL)
6	Tire Pressure Monitoring System (TPMS) indicator
7	Airbag warning indicator
8	Front fog lamp indicator
9	Tachometer
10	<a href="#">RH</a> turn signal indicator
11	Rear fog lamp indicator
12	Dynamic Stability Control (DSC) indicator
13	High beam indicator
14	Side lamp indicator
15	Seat belt warning indicator
16	Message center
17	Automatic Speed Limiter (ASL) indicator
18	Forward alert indicator
19	Brake warning indicator
20	<a href="#">LH</a> turn signal indicator

NAS MARKET - V8 NORMALLY ASPIRATED INSTRUMENT CLUSTER



E99112



Item	Description
1	Speedometer
2	<a href="#">ABS</a> indicator (NAS)
3	<a href="#">ABS</a> indicator (ROW)
4	Adaptive speed control indicator
5	Tachometer
6	Malfunction Indicator Lamp (MIL)
7	Tire Pressure Monitoring System (TPMS) indicator
8	Airbag warning indicator
9	Front fog lamp indicator
10	<a href="#">RH</a> turn signal indicator
11	Rear fog lamp indicator
12	Dynamic Stability Control (DSC) indicator
13	High beam indicator
14	Seat belt warning indicator
15	Side lamp indicator
16	Message center
17	Automatic Speed Limiter (ASL) indicator
18	Forward alert indicator
19	Brake warning indicator (NAS)
20	Brake warning indicator (ROW)
21	<a href="#">LH</a> turn signal indicator

The warning indicators are located in various positions in the instrument cluster. The indicators can be split into two groups; instrument cluster controlled and externally controlled.

Instrument cluster controlled warning indicators are dependent on software logic within the instrument cluster for activation. The cluster software controls the indicator illumination check at ignition on (power mode 6).

Externally controlled indicators are supplied with current from another vehicle system control module or illuminated by the instrument cluster software on receipt of a bus message from another vehicle sub-system. The indicator illumination check at ignition on (powermode 6) is also controlled by the sub-system module for these indicators.

## MESSAGE CENTER

The message center is a [LCD](#) located in a central position in the cluster. The message center displays system status information.

Refer to: [Information and Message Center](#) (413-08 Information and Message Center, Description and Operation).

## ANALOGUE GAGES

### Speedometer

The analogue speedometer is located on the [LH](#) side of the instrument cluster and is available in 4 market variants:

- Major scale Miles Per Hour (MPH), minor scale kilometers per hour (km/h) (ROW)
- Major scale MPH, minor scale km/h (NAS)
- Major scale km/h, minor scale MPH
- Major scale km/h only.

### Tachometer

The analogue tachometer is located on the [RH](#) side of the instrument cluster. The tachometer has different Revolutions Per Minute (RPM) scales depending on the engine variant fitted to the vehicle as follows:

- 4.2L V8 Supercharged 7000 RPM
- 4.2L V8 Naturally aspirated 8000 RPM
- 3.0L V6 Naturally aspirated 8000 RPM
- 2.7 V6 Diesel 6000 RPM.

## ELECTRONIC GAGES

### Fuel Gage

The linear fuel gage has a colored bar which moves left or right depending on the tank contents. As the bar moves to the left the fuel tank contents displayed is decreasing. A warning message is displayed in the message center when the fuel tank contents fall to below the reserve level.

### Transmission Gear Position Display

The gear position display shows the JaguarDrive selector position or the selected gear when using the Jaguar Sequential Shift.

The applicable drive letter is highlighted to show that a selection has been made using the JaguarDrive selector.

When Jaguar Sequential Shift is selected, the letters change to numbers; 1 - 6, and the selected gear is highlighted to emphasize the selection to the driver.



# Instrument Cluster - Instrument Cluster

Diagnosis and Testing

## Principles of Operation

For a detailed description of the Instrument Cluster, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (413-01 Instrument Cluster)

[Instrument Cluster](#) (Description and Operation),  
[Instrument Cluster](#) (Description and Operation),  
 Instrument Cluster (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Fluid level(s)</li> <li>● Accessory installations</li> </ul>	<ul style="list-style-type: none"> <li>● Fuse(s)</li> <li>● Wiring harness</li> <li>● Electrical connector(s)</li> <li>● Instrument cluster</li> <li>● Central Junction Box (CJB)</li> <li>● Engine Junction Box (EJB)</li> <li>● Driver Door Module (DDM)</li> <li>● Engine Control Module (ECM)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

## Symptom Chart

The instrument cluster contains a self-diagnostic mode known as engineering test mode (ETM). This can be used to show the status of the instrument cluster inputs as well as a number of other useful features.

When in the ETM, the Message Centre displays internal data that can be cycled through. All functions except the message centre display will continue to operate normally unless otherwise noted.

This document is to be used in conjunction with the instrument cluster ETM (see relevant section within this document) and the Integrated Diagnostic System (IDS) facility; this does not supersede or replace the IDS facility.

Go directly to the 'Area of Concern/Symptom' that indicates the customer concern(s) and perform the actions described within the relevant section(s):

Area of Concern/Symptom	Diagnostic Ref. No.	Actions	Notes
Warning lights	A-1	Perform instrument cluster Self-Diagnostic Mode/ETM test 3.	When this test is ended the warning lamps currently required to be 'ON' will remain illuminated.
Multiple warning lights 'ON'	B-1	Check with IDS for DTCs related to identified vehicle system(s).	.
.	B-2	Check instrument cluster battery and ignition wiring - refer to circuit diagrams.	Specifically check continuity of Standard Corporate Protocol (SCP) and Controller Area Network (CAN) lines.
.	B-3	Check instrument cluster grounds.	.
.	B-4	Check fuses in battery junction box.	.
.	B-5	Check for harness traps in fascia.	.
.	B-6	Perform instrument cluster Self-Diagnostic Mode/ETM test 3.	Frost/ice warning illuminated in mixed red and amber; therefore colour differs from other warning lamps. When this test is ended, warning lamps currently required to be 'ON' will remain illuminated.
.	B-7	Check for open circuit/shorts in wiring to related warning lamp trigger (module, sensor, switch).	.
Specific warning lamp 'ON'	C-1	Check with IDS for DTCs related to identified vehicle system.	.
.	C-2	Check for open circuit/shorts in wiring related to warning lamp circuit (module, sensor, switch) where appropriate.	.

Area of Concern/Symptom	Diagnostic Ref. No.	Actions	Notes
.	C-3	Perform cluster Self-Diagnostic Mode/ETM test 3.	Frost/ice warning illuminated in mixed red and amber; therefore colour differs from other warning lamps. When this test is ended, warning lamps currently required to be 'ON' will remain illuminated.
.	C-4	Check the specific vehicle system indicated by the warning lamp illuminated?	What is the warning lamp telling me? Does this check out with the DTC logged by the system indicating the fault?
Fuel gauge operation	D-1	Perform Self-Diagnostic Mode/ETM test 21 to establish if fuel level input to cluster is out of range or invalid.	0 - 9 = short circuit; gauge will show empty. 10 - 254 = normal range. 255 = open circuit; gauge will show empty. --- = missing signal; gauge will show empty.
.	D-2	Check gauge function versus Self-Diagnostic Mode/ETM test 21.	0 = empty, 254 = full. 255 = invalid; gauge will show empty.
.	D-3	Check for open circuit/shorts in wiring between the Fuel Delivery Module, Jet Pump Module and Rear Electronic Module (REM).	
Fuel gauge reading	E-1	Check gauge position versus Self-Diagnostic Mode/ETM test 21.	0 = empty to 254 = full (255 invalid; gauge will show empty). Other values percentage of above range e.g. 127 = half.
.	E-2	Calculate percentage fuel level from figure obtained from Self-Diagnostic Mode/ETM test 21 and compare to IDS vehicle fuel percentage test.	Self-Diagnostic Mode fuel level percentage can be calculated as follows: Value from Self-Diagnostic Mode test 26 ÷ 254 x 100 = % shown on gauge.
.	E-3	Monitor value of Self-Diagnostic Mode test/ETM test 21 (during test drive) to establish if input drops out of range.	0 - 9 = short circuit; gauge will show empty. 10 - 254 = normal range. 255 = open circuit; gauge will show empty. --- = missing signal; gauge will show empty.
.	E-4	Monitor 'FUEL LEVEL' in IDS data logger (during test drive) to correlate gauge position to vehicle reported fuel level.	Gauge function is damped so will not follow rapidly changing Fuel Delivery Module values.
Speedometer operation	H-1	Monitor Self-Diagnostic Mode/ETM test 19 (during test drive) check to establish if vehicle speed input to cluster is out of range or invalid.	Display speed input in 1/10 mile/h, no decimal point shown, and is compensated for tire size etc. Displays ---- or INV if message is not received or if received data is invalid.
Speedometer reading	I-1	During test drive compare speedometer position to Self-Diagnostic Mode/ETM test 19, displayed value.	Self-Diagnostic Mode displayed speed figure will be approx 3% higher than speed indicated by speedometer. Allowed tolerance - minus nothing/+ 10% + 2.5 mile/h.
.	I-2	Monitor Self-Diagnostic Mode/ETM test 19 (during test drive) to establish if vehicle speed input to cluster drops out of range or is invalid.	Displays ---- if message is not received or if received data is invalid for two seconds or more.
.	I-3	Check that installed wheels and tires are standard Jaguar fitment. Confirm wheel size in IDS, 'ADD REMOVE ACCESSORY' section.	Non standard wheels and tires may lead to speed indication inaccuracies. Incorrectly set wheel size will result in speed indication inaccuracies. Trip and odometer distance accumulation will also be incorrect.
Tachometer operation	J-1	Perform Self-Diagnostic Mode/ETM test 20 to establish if vehicle rpm input to cluster out of range or invalid.	Displays ---- or INV if message is not received or if received data is invalid.
Tachometer reading	K-1	Check tachometer position versus Self-Diagnostic Mode/ETM test 20, displayed value.	Tachometer accuracy +/- 100 rpm.
.	K-2	Monitor 'ENGINE RPM' in IDS data logger at constant engine rpm to compare tachometer indicated engine rpm to engine rpm reported by Engine Control Module (ECM).	Tachometer accuracy +/- 100 rpm.
.	K-3	Monitor Self-Diagnostic Mode test/ETM test 20, (during test drive) to establish if input to cluster drops out of range or is invalid.	Displays ---- or INV if message is not received or if received data is invalid.
Gauge judder	L-1	Perform Self-Diagnostic Mode test/ETM test 2, to prove out smooth gauge operation.	
Gauge noise	M-1	Perform vehicle road test. Gauges should not be audible during operation in drive cycle.	
.	M-2	Benchmark noise against non-complaint vehicle.	
Trip (fuel) computer	N-1	Check for consistent display (during test drive) of valid 'Rolling Odometer' count in Self-Diagnostic Mode/ETM test 24.	Displays ----, INV or 255 if message is not received, or if received data is invalid.
.	N-2	Check that installed wheels and tires are standard Jaguar fit. Confirm fitted wheel size in IDS, 'ADD REMOVE ACCESSORY' section.	Non standard wheels and tires or incorrectly set wheel size may lead to Odometer increment inaccuracies. This will impact the distance accumulators, which in turn affects the rolling average, fuel economy and range

Area of Concern/Symptom	Diagnostic Ref. No.	Actions	Notes
			values. Trip distance accumulation will also be incorrect.
	N-3	Consider noting odometer value and resetting fuel computer system. Advise customer to conduct brim-to-brim fuel tank test. Use collected information to determine if system accurate.	
Column adjust	O-1	Check with IDS for DTCs related to powered column system.	
	O-2	Check cluster battery supply voltage and ground resistance. Check for loose connections.	
	O-3	Check power column motors supply voltage.	
	O-4	Check power column switch for physical damage.	
Passive Anti-Theft System (PATS) indicator	P-1	Check for three second prove out when vehicle start button is pressed.	
	P-2	Check for loose connections/wiring continuity.	
	P-3	Check ignition switch for physical damage.	
Cluster illumination	Q-1	Check for loose connections/wiring continuity.	
	Q-2	Check dimmer switch operation.	
Cluster backlight operation	R-1	Is the backlight on other components inoperative.	
	R-2	Check dimmer switch operation.	
	R-3	Check for loose connections/wiring continuity.	
Chime/tone operation	S-1	Check vehicle configuration.	
	S-2	Utilize lights ON, ignition OFF, door open warning to verify chime operation.	
	S-3	Check appropriate sensing circuit.	
Continuous chime/tone	T-1	Check appropriate sensing circuit.	
Unexpected chime operation	U-1	Check vehicle configuration.	
Message centre display illumination	V-1	Is the backlight 'ON' and other components dim?	
	V-2	Does the lighting level of other components change when dimmer adjusted?	
Message centre display issue	W-1	Perform Self-Diagnostic Mode test/ETM tests 5 to 9, to prove out LCD display function.	
Message centre missing lines	X-1	Perform Self-Diagnostic Mode test/ETM tests 5 to 9, to prove out LCD display function.	
Message centre incorrect message	Y-1	What is the message?	
	Y-2	Check for open circuit/shorts in wiring to related warning light trigger (module, sensor, switch).	
Cluster/connectivity	Z-1	Check cluster battery and ignition wiring.	
	Z-2	Check cluster grounds.	
	Z-3	Disconnect/reconnect cluster.	
	Z-4	Attempt to enter Self-Diagnostic Mode/ETM to prove cluster response to inputs.	
No crank	AA-1	Check with IDS for presence of related DTCs.	
	AA-2	Is there a Passive Anti-Theft System (PATS) flash code?	
	AA-3	Does the vehicle crank with the other passive key?	
	AA-4	Ensure only one key is in the vehicle, try both keys in the Starter Control Unit (SCU).	If this test starts the vehicle this tends to indicate an issue with the keyless vehicle module.
	AA-5	Tried new key?	
	AA-6	Check battery voltage.	
	AA-7	Diagnose non-start condition with IDS.	
	AA-8	Attempt PATS key erase and re-learn.	Ensure keys are erased from current cluster if replacing cluster.
Crank but no-start	AB-1	Diagnose non-start condition with IDS.	Not usually caused by cluster issue.
Incorrect configuration	AC-1	Attempt to configure cluster.	

Area of Concern/Symptom	Diagnostic Ref. No.	Actions	Notes
	AC-2	Ensure battery voltage is maintained above 12.5 volts if cluster re-configured.	

1. If the cause is not visually evident, verify the symptom and refer to the Self-Diagnostic Mode

## Self-Diagnostic Mode

To place the cluster in engineering test mode (ETM) carry out the following steps

1. Press and hold the stalk trip cycle button, for more than five seconds but less than eight seconds, whilst briefly pressing the vehicle START button. There is no initial display indication that the instrument cluster has entered ETM. If ETM has successfully been entered then 'ENGINEERING TEST MODE' will be displayed in the Message Centre when the stalk trip button is released .
- 2.To navigate forward through the instrument cluster Self-Diagnostic Mode tests, press the stalk trip cycle button.
3. Each push of the stalk trip cycle button will advance one step through the ETM sequence. It is not possible to move backward through the test sequence.
- 4.To exit the Self-Diagnostic Mode press and hold the stalk trip cycle button for more than three seconds.
- 5.The Self-Diagnostic Mode is also deactivated when the ignition switch is turned to the 'OFF' position or low battery voltage is detected.
- 6.If the Self-Diagnostic Mode cannot be accessed repeat the above paying particular care to the sequence timing.
- 7.The ETM text is not language configurable and will be displayed in English.

ETM Test/no.	Message Center Display	Gauge/Indicator/Display Tested.	Range	Description
1 - Self-diagnostic entry.	ENGINEERING TEST MODE.		Not Applicable (N/A).	Establishes Self - Diagnostic mode.
2 - Gauge sweep.	GAUGE SWEEP.	Tachometer and speedometer. Gauges display current values after test.	(N/A).	All gauges go through a full up and down pointer sweep smoothness check.
3- Warning lamp LED's.	TELL TALE TEST.	All internally controlled lamps/LED's regardless of software configuration.	(N/A).	Illuminates all the LED warning indicators that are controlled by the instrument cluster. When this test is exited current vehicle warning lamps will remain illuminated.
4 - Version information.	PROGRAM VERSION. <ul style="list-style-type: none"> <li>● ROM: XXXX</li> <li>● NVM: XXXX</li> <li>● REV: XXXX</li> <li>● DATE: XXXX</li> </ul>	Software Read only memory (ROM) and Non volatile memory (NVM) version and date.	(N/A).	Display's the instrument cluster ROM and NVM level version and date or indication of ROM checksum fault.
5 - Message Center display.	LCD display in WHITE.	Message center LCD display.	(N/A).	Activates all pixels of LCD display in White.
6 - Message Center display.	LCD display in DARK GREY.	Message center LCD display.	(N/A).	Activates all pixels of LCD display in Dark Grey.
7 - Message Center display.	LCD display in LIGHT GREY.	Message center LCD display.	(N/A).	Activates all pixels of LCD display in Light Grey.
8 - Message Center display.	LCD display in four bands black to white, top to bottom.	Message center LCD display.	(N/A).	Activates all pixels of LCD in four bands from black to white, from top to bottom.
9 - Message Center display.	LCD display in four bands dark to light left to right.	Message center LCD display.	(N/A).	Activates all pixels of LCD in four bands from dark to light, from left to right.
10 - Digital I/O.	DIGITAL I/O. <ul style="list-style-type: none"> <li>● A: XXXX E: XXXX</li> <li>● B: XXXX F: XXXX</li> <li>● C: XXXX G: XXXX</li> <li>● D: XXXX H: XXXX</li> </ul>	Cluster configuration settings.	(N/A).	Display Hex coding of cluster configuration settings ports A to H. Not defined for diagnostic purpose.
11 - Analogue Inputs.	ANALOG INPUTS. <ul style="list-style-type: none"> <li>● #: RAW - RATIO</li> <li>● 0:XXX - XXXX</li> <li>● 1:XXX - XXXX</li> <li>● 2:XXX - XXXX</li> <li>● 3.XXX - XXXX</li> </ul>	Cluster inputs.	TDB.	Displays Hex coding of inputs 0 - 3. <ul style="list-style-type: none"> <li>● 0 - Main beam / FTP</li> <li>● 1 - Master light switch</li> <li>● 2 - Power column joystick switch</li> <li>● 3 - DI / Hazard</li> </ul>

ETM Test/no.	Message Center Display	Gauge/Indicator/Display Tested.	Range	Description
12 - Analogue Inputs.	ANALOG INPUTS. <ul style="list-style-type: none"> <li>● #: RAW - RATIO</li> <li>● 4:XXX - XXXX</li> <li>● 5:XXX - XXXX</li> <li>● 6:XXX - XXXX</li> <li>● 7.XXX - XXXX</li> </ul>	Cluster inputs.	TDB.	Displays Hex coding of inputs 4 - 7. <ul style="list-style-type: none"> <li>● 4 - Auto lamp sensor</li> <li>● 5 - battery in</li> <li>● 6 - Pedal position</li> <li>● 7 - Display temperature</li> </ul>
13 - Analogue Inputs.	ANALOG INPUTS. <ul style="list-style-type: none"> <li>● #: RAW - RATIO</li> <li>● 8:XXX - XXXX</li> <li>● 9:XXX - XXXX</li> <li>● 10:XXX - XXXX</li> <li>● 11.XXX - XXXX</li> </ul>	Cluster inputs.	TDB.	Displays Hex coding of inputs 8 - 11. <ul style="list-style-type: none"> <li>● 8 - Power column Rake position</li> <li>● 9 - Power column Reach position</li> <li>● 10 - Auxiliary switch</li> <li>● 11 - Power column mode switch</li> </ul>
14 - Analogue Inputs.	ANALOG INPUTS. <ul style="list-style-type: none"> <li>● #: RAW - RATIO</li> <li>● 12:XXX - XXXX</li> <li>● 13:XXX - XXXX</li> <li>● 14:XXX - XXXX</li> <li>● 15.XXX - XXXX</li> </ul>	Cluster inputs.	TDB.	Displays Hex coding of inputs 12 - 15. <ul style="list-style-type: none"> <li>● 12 - Not used</li> <li>● 13 -Airbag LED monitor</li> <li>● 14 - Battery voltage</li> <li>● 15 - Low brake fluid</li> </ul>
15- Analogue Inputs.	ANALOG INPUTS. <ul style="list-style-type: none"> <li>● #: RAW - RATIO</li> <li>● 16:XXX - XXXX</li> <li>● 17:XXX - XXXX</li> <li>● 18:XXX - XXXX</li> <li>● 19.XXX - XXXX</li> </ul>	Cluster inputs.	TDB.	Displays Hex coding of inputs 16- 19. <ul style="list-style-type: none"> <li>● 16 - Fog light switch</li> <li>● 17 - Flick wipe switch</li> <li>● 18 - Int. wipe switch</li> <li>● 19 - Exit delay switch</li> </ul>
16 - Analogue Inputs.	ANALOG INPUTS. <ul style="list-style-type: none"> <li>● #: RAW - Ratio</li> <li>● 20:XXX - XXXX</li> <li>● 21:XXX - XXXX</li> <li>● 22:XXX - XXXX</li> <li>● 23.XXX - XXXX</li> </ul>	Cluster inputs.	TDB.	Displays Hex coding of inputs 20 - 23. <ul style="list-style-type: none"> <li>● 20 - Wash wipe switch</li> <li>● 21 - Trip cycle switch</li> <li>● 22 - dimmer level</li> <li>● 23 - Master wipe switch</li> </ul>
17 - Analogue Inputs.	ANALOG INPUTS. <ul style="list-style-type: none"> <li>● #: RAW- Ratio</li> <li>● 24:XXX - XXXX</li> <li>● 25:XXX - XXXX</li> <li>● 26:XXX - XXXX</li> <li>● 27.XXX - XXXX</li> </ul>	Cluster inputs.	TDB.	Displays Hex coding of inputs 24 - 27. <ul style="list-style-type: none"> <li>● 24 - Brake pad wear</li> <li>● 25 - Passenger seat belt</li> <li>● 26 - Not used</li> <li>● 27 - On-board temp ref</li> </ul>
18 - Analogue Inputs.	<ul style="list-style-type: none"> <li>● ANALOG INPUTS.</li> <li>● #: RAW - Ratio</li> <li>● 28:XXX - XXXX</li> <li>● 29:XXX - XXXX</li> <li>● 30:XXX - XXXX</li> <li>● 31.XXX - XXXX</li> </ul>	Cluster inputs.	TDB.	Displays Hex coding of inputs 28 - 31. <ul style="list-style-type: none"> <li>● 28 - On-board temp</li> <li>● 29 - Not used</li> <li>● 30 - Not used</li> <li>● 31 - Not used</li> </ul>
19 - Speedometer.	SPEEDOMETER. <ul style="list-style-type: none"> <li>● RAW:</li> <li>● MPH:</li> <li>● KMH:</li> <li>● DRIVER:</li> </ul>	Speedometer inputs.	.	<ul style="list-style-type: none"> <li>● Displays present .</li> <li>● Speedometer inputs values;</li> <li>● Speedometer will indicate present road speed.</li> </ul>
20 - Tachometer.	TACHOMETER. <ul style="list-style-type: none"> <li>● RAW:</li> <li>● ACTUAL:</li> <li>● DRIVER:</li> </ul>	Tachometer inputs.	.	Displays present received Tachometer input values, tachometer will indicate present engine RPM.
21 - Fuel system.	FUEL SYSTEM. <ul style="list-style-type: none"> <li>● (A) (B)</li> <li>● RAW: X X</li> <li>● FILT: X X</li> </ul>	Fuel indication system.	.	Displays present received fuel level A/D inputs in decimal, fuel gauge will indicate present filtered level.

ETM Test/no.	Message Center Display	Gauge/Indicator/Display Tested.	Range	Description
	<ul style="list-style-type: none"> <li>● PERCENT: X X</li> </ul>			
22 - Battery voltage.	BATTERY VOLTAGE. <ul style="list-style-type: none"> <li>● LOCAL:</li> <li>● VEHICLE:</li> <li>● RAW:</li> <li>● A/D:</li> </ul>	Battery voltage.	.	Displays present received battery input voltage values. If message not received or invalid display will be ' _ _ _ '.
23 - Rolling counts.	ROLLING COUNTS. <ul style="list-style-type: none"> <li>● ODO:</li> <li>● FUEL:</li> </ul>	Odometer and fuel gauge.	0 - 255.	Displays present received odometer and fuel level input values in decimal, value is a rolling count. If either message not received or invalid respective display will be ' _ _ _ '.
24 - VAPS.	VAPS. <ul style="list-style-type: none"> <li>● CURRENT:</li> <li>● COMMAND:</li> <li>● STATUS:</li> </ul>	Variable assistance power steering (VAPS) status.	.	CURRENT is displayed in mA. COMMAND is last command sent to VAPS chip. STATUS is last status returned from VAPS chip.
25 - Module status.	MODULE STATUS. <ul style="list-style-type: none"> <li>● IGN</li> <li>● DSC</li> <li>● ACC</li> <li>● ADCM</li> </ul>	Provides status of; Ignition (IGN), Dynamic Stability Control (DSC), Adaptive Cruise Control (ACC) and Adaptive damping control module (ADCM) modules.	<ul style="list-style-type: none"> <li>● CONNECTED</li> <li>● WAITING</li> <li>● MISSING</li> <li>● FAULTY.</li> </ul>	<ul style="list-style-type: none"> <li>● Communication (Coms) ok</li> <li>● Coms not received, not an issue</li> <li>● Coms never received</li> <li>● Coms error .</li> </ul>
26 - Module status.	MODULE STATUS. <ul style="list-style-type: none"> <li>● EPB</li> <li>● PIE</li> <li>● RCM</li> <li>● TCM</li> </ul>	Provides status of; Electronic park brake (EPB), Pedestrian Impact ECU (PIE), Restraints control module (RCM) and Traction control module (TCM), modules..	<ul style="list-style-type: none"> <li>● CONNECTED</li> <li>● WAITING</li> <li>● MISSING</li> <li>● FAULTY.</li> </ul>	<ul style="list-style-type: none"> <li>● Communication (Coms) ok</li> <li>● Coms not received, not an issue</li> <li>● Coms never received</li> <li>● Coms error .</li> </ul>
27 - Module status.	MODULE STATUS. <ul style="list-style-type: none"> <li>● ECM</li> <li>● RCC</li> <li>● DDC</li> <li>● PDC</li> </ul>	Provides status of; Engine control module (ECM), Rear Climate Control (RCC), Driver Door Control (DDC) and Passenger Door Control (PDC) modules..	<ul style="list-style-type: none"> <li>● CONNECTED</li> <li>● WAITING</li> <li>● MISSING</li> <li>● FAULTY.</li> </ul>	<ul style="list-style-type: none"> <li>● Communication (Coms) ok</li> <li>● Coms not received, not an issue</li> <li>● Coms never received</li> <li>● Coms error .</li> </ul>
28 - Module status.	MODULE STATUS. <ul style="list-style-type: none"> <li>● KVM</li> <li>● DSM</li> <li>● ICM</li> <li>● ICP</li> </ul>	Provides status of; Keyless vehicle module (KVM), Drivers seat module (DSM), Infotainment control module (ICM) and Integrated control panel (ICP) modules..	<ul style="list-style-type: none"> <li>● CONNECTED</li> <li>● WAITING</li> <li>● MISSING</li> <li>● FAULTY.</li> </ul>	<ul style="list-style-type: none"> <li>● Communication (Coms) ok</li> <li>● Coms not received, not an issue</li> <li>● Coms never received</li> <li>● Coms error .</li> </ul>
29 - Module status.	MODULE STATUS. <ul style="list-style-type: none"> <li>● FSJB</li> <li>● RSJB</li> <li>● TPMS</li> <li>● AFLS</li> </ul>	Provides status of; Front smart junction box (FSJB), Rear smart junction box (RSJB), Tyre pressure monitoring system (TPMS) and Adaptive front lighting system (AFLS) modules.	<ul style="list-style-type: none"> <li>● CONNECTED</li> <li>● WAITING</li> <li>● MISSING</li> <li>● FAULTY.</li> </ul>	<ul style="list-style-type: none"> <li>● Communication (Coms) ok</li> <li>● Coms not received, not an issue</li> <li>● Coms never received</li> <li>● Coms error .</li> </ul>
30 - Module status.	MODULE STATUS. <ul style="list-style-type: none"> <li>● PATS</li> <li>● BSM</li> <li>● GSM</li> <li>● SCU</li> </ul>	Provides status of; Passive anti-theft system (PATS), Blind Spot Monitoring (BSM), Gear shift module (GSM) and Starter Control Unit (SCU) modules.	<ul style="list-style-type: none"> <li>● CONNECTED</li> <li>● WAITING</li> <li>● MISSING</li> <li>● FAULTY.</li> </ul>	<ul style="list-style-type: none"> <li>● Communication (Coms) ok</li> <li>● Coms not received, not an issue</li> <li>● Coms never received</li> <li>● Coms error .</li> </ul>
31- Back to test 2.	GAUGE SWEEP.	Tachometer and speedometer.	N/A.	Repeats display cycle from test 2.

1. 1. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• **NOTE:** If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• **NOTE:** Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).



• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B100811	Wiper Mode Switch	<ul style="list-style-type: none"> <li>Master wiper switch circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check master wiper switch circuit for short to ground
B100815	Wiper Mode Switch	<ul style="list-style-type: none"> <li>Master wiper switch circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check master wiper switch circuit for short to power, open circuit
B100951	Ignition Authorisation	<ul style="list-style-type: none"> <li>Instrument cluster power and ground supply circuits - short, open circuit</li> <li>Target SID synchronization error following re-programming</li> <li>CAN fault</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check instrument cluster power and ground supply circuits for short, open circuit. Perform the Immobilisation application from the Set-up menu using the manufacturer approved diagnostic system. Check CAN communications between instrument cluster and tester
B100962	Ignition Authorisation	<ul style="list-style-type: none"> <li>LS CAN fault</li> <li>CJB ignition, power and ground supply circuits - short, open circuit</li> <li>Instrument cluster power and ground supply circuits - short, open circuit</li> <li>Incorrect CJB or instrument cluster installed</li> <li>Target SID synchronization error following re-programming</li> <li>Noise/EMC related error</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check CAN communications between CJB and instrument cluster. Refer to the electrical circuit diagrams and check CJB ignition, power and ground supply circuits for short, open circuit and instrument cluster power and ground supply circuits for short, open circuit. Check correct CJB and instrument cluster installed. Perform the Immobilisation application from the Set-up menu using the manufacturer approved diagnostic system. Check CAN network for interference/EMC related issues
B100987	Ignition Authorisation	<ul style="list-style-type: none"> <li>CJB ignition, power and ground supply circuits - short, open circuit</li> <li>LS CAN fault</li> <li>Instrument cluster power and ground supply circuits - short, open circuit</li> <li>Low battery voltage &lt;9 volts</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CJB ignition, power and ground supply circuits for short, open circuit and instrument cluster power and ground supply circuits for short, open circuit. Check CAN communications between CJB and instrument cluster. Check battery is in serviceable condition and fully charged
B100A62	Fuel Pump Authorisation	<ul style="list-style-type: none"> <li>LS CAN fault</li> <li>RJB power and ground supply circuits - short, open circuit</li> <li>Instrument cluster power and ground supply circuits - short, open circuit</li> <li>Incorrect RJB or instrument cluster installed</li> <li>Target SID synchronization error following re-programming</li> <li>Noise/EMC related error</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check CAN communications between RJB and instrument cluster. Refer to the electrical circuit diagrams and check RJB power and ground supply circuits for short, open circuit and instrument cluster power and ground supply circuits for short, open circuit. Check correct RJB and instrument cluster installed. Perform the Immobilisation application from the Set-up menu using the manufacturer approved diagnostic system. Check CAN network for interference/EMC related issues
B100A64	Fuel Pump Authorisation	<ul style="list-style-type: none"> <li>Target SID synchronization error following re-programming</li> <li>RJB power and ground supply circuits - short, open circuit</li> <li>LS CAN fault</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Perform the Immobilisation application from the Set-up menu using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check RJB power and ground supply circuits for short, open circuit. Check CAN communications between RJB and instrument cluster
B100A87	Fuel Pump Authorisation	<ul style="list-style-type: none"> <li>RJB power and ground supply circuits - short, open circuit</li> <li>LS CAN fault</li> <li>Instrument cluster power and ground supply circuits - short, open circuit</li> <li>Low battery voltage &lt;9 volts</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check RJB power and ground supply circuits for short, open circuit and instrument cluster power and ground supply circuits for short, open circuit. Check CAN communications between RJB and instrument cluster. Check battery is in serviceable condition and fully charged
B100B67	Column Lock Ground Authorisation	<ul style="list-style-type: none"> <li>Algorithm based failure-signal is incorrect after the event</li> <li>Instrument cluster power and ground supply circuits - short, open circuit</li> <li>LS CAN fault</li> <li>RJB power and ground supply</li> </ul>	If a non start issue has not been identified, clear the DTC and check vehicle starts correctly. If a non start issue has been identified run the manufacturers approved diagnostic system Start Authorisation Application. Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check RJB power and

DTC	Description	Possible Cause	Action
		<ul style="list-style-type: none"> <li>circuits - short, open circuit</li> <li>● Vehicle speed present when attempting to power ESCL</li> <li>● Engine speed present when attempting to power ESCL</li> <li>● PowerMode status &gt; 4 when attempting to perform lock action</li> </ul>	ground supply circuits for short, open circuit and instrument cluster power and ground supply circuits for short, open circuit. Check CAN communications between RJB and instrument cluster. Check for invalid vehicle speed signal from ABS/instrument cluster gateway. Check for invalid engine speed signal from ECM/instrument cluster gateway. Check for invalid signal from CJB
B100B87	Column Lock Ground Authorisation	<ul style="list-style-type: none"> <li>● Instrument cluster power and ground supply circuits - short, open circuit</li> <li>● LS CAN fault</li> <li>● RJB power and ground supply circuits - short, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check RJB power and ground supply circuits for short, open circuit and instrument cluster power and ground supply circuits for short, open circuit. Check CAN communications between RJB and instrument cluster
B100C67	Column Lock Supply Authorisation	<ul style="list-style-type: none"> <li>● Instrument cluster power and ground supply circuits - short, open circuit</li> <li>● LS CAN fault</li> <li>● CJB power and ground supply circuits - short, open circuit</li> <li>● Vehicle speed present when attempting to power ESCL</li> <li>● Engine speed present when attempting to power ESCL</li> <li>● PowerMode status &gt; 4 when attempting to perform lock action</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CJB power and ground supply circuits for short, open circuit and instrument cluster power and ground supply circuits for short, open circuit. Check CAN communications between CJB and instrument cluster. Check for invalid vehicle speed signal from ABS/instrument cluster gateway. Check for invalid engine speed signal from ECM/instrument cluster gateway. Check for invalid signal from CJB
B100C87	Column Lock Supply Authorisation	<ul style="list-style-type: none"> <li>● Instrument cluster power and ground supply circuits - short, open circuit</li> <li>● LS CAN fault</li> <li>● CJB power and ground supply circuits - short, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CJB power and ground supply circuits for short, open circuit and instrument cluster power and ground supply circuits for short, open circuit. Check CAN communications between CJB and instrument cluster
B100D62	Column Lock Authorisation	<ul style="list-style-type: none"> <li>● CAN fault</li> <li>● ESCL power and ground supply circuits - short, open circuit</li> <li>● Instrument cluster power and ground supply circuits - short, open circuit</li> <li>● Incorrect ESCL or instrument cluster installed</li> <li>● Target SID synchronization error following re-programming</li> <li>● Noise/EMC related error</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check CAN communication between Electronic Steering Column Lock and instrument cluster. Refer to the electrical circuit diagrams and check Electronic Steering Column Lock power and ground supply circuits for short, open circuit and Instrument cluster power and ground supply circuits for short, open circuit. Check correct Electronic Steering Column Lock and instrument cluster installed. Perform the Immobilisation application from the Set-up menu using the manufacturer approved diagnostic system. Check CAN network for interference/EMC related issues
B100D64	Column Lock Authorisation	<ul style="list-style-type: none"> <li>● Algorithm based failure-signal plausibility failure</li> <li>● CAN fault</li> <li>● ESCL power and ground supply circuits - short, open circuit</li> <li>● Instrument cluster power and ground supply circuits - short, open circuit</li> </ul>	If the customer has not reported a non start issue, clear the DTC and check vehicle starts correctly. If a non start issue has been reported run the manufacturers approved diagnostic system Start Authorisation Application and follow the actions required for this DTC. Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check CAN communication between Electronic Steering Column Lock and instrument cluster (check transmission out speed, vehicle speed, engine speed, gear position and powermode signals to Electronic Steering Column Lock). Refer to the electrical circuit diagrams and check Electronic Steering Column Lock power and ground supply circuits for short, open circuit and Instrument cluster power and ground supply circuits for short, open circuit.
B100D87	Column Lock Authorisation	<ul style="list-style-type: none"> <li>● CAN fault</li> <li>● ESCL power and ground supply circuits - short, open circuit</li> <li>● Instrument cluster power and ground supply circuits - short, open circuit</li> <li>● Low voltage at ESCL &lt; 8 volts</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check CAN communication between Electronic Steering Column Lock and instrument cluster. Refer to the electrical circuit diagrams and check Electronic Steering Column Lock power and ground supply circuits for short, open circuit and Instrument cluster power and ground supply circuits for short, open circuit. Check power supply circuit to Electronic Steering Column Lock for short, open circuit
B100D96	Column Lock Authorisation	<ul style="list-style-type: none"> <li>● CAN fault</li> <li>● ESCL power and ground supply circuits - short, open circuit</li> <li>● Instrument cluster power and ground supply circuits - short, open circuit</li> <li>● Low temperature &lt; -30°</li> <li>● Low voltage at ESCL &lt; 8 volts</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check CAN communication between Electronic Steering Column Lock and instrument cluster. Refer to the electrical circuit diagrams and check Electronic Steering Column Lock power and ground supply circuits for short, open circuit and Instrument cluster power and ground supply circuits for short, open circuit. Check power supply


DTC	Description	Possible Cause	Action
		<ul style="list-style-type: none"> <li>● Restricted bolt movement</li> </ul>	circuit to Electronic Steering Column Lock for short, open circuit. Check steering wheel/column is not torqued up
B102487	Start Control Unit	<ul style="list-style-type: none"> <li>● Smart card docking station failure - slave node not responding</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check the smart card docking station LIN circuit for short, open circuit. Suspect the smart card docking station, check and install a new docking station as required, refer to the new module/component installation note at the top of the DTC Index
B104611	Front Fog Lamp Control Switch	<ul style="list-style-type: none"> <li>● Fog lamp switch circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check fog lamp switch circuit for short to ground
B104615	Front Fog Lamp Control Switch	<ul style="list-style-type: none"> <li>● Fog lamp switch circuit - short to power, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check fog lamp switch circuit for short to power, open circuit
B104811	Brake Fluid Level Switch	<ul style="list-style-type: none"> <li>● Brake fluid level switch circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check brake fluid level switch circuit for short to ground
B10A011	Wiper/ Washer Switch	<ul style="list-style-type: none"> <li>● Wash/wipe circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check wash/wipe circuit for short to ground
B10A015	Wiper/ Washer Switch	<ul style="list-style-type: none"> <li>● Wash/wipe circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check wash/wipe circuit for short to power, open circuit
B10A611	Main Light Switch	<ul style="list-style-type: none"> <li>● Master lighting switch circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check master lighting switch circuit for short to ground
B10A615	Main Light Switch	<ul style="list-style-type: none"> <li>● Master lighting switch circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check master lighting switch circuit for short to power, open circuit
B112B87	Steering Wheel Module	<ul style="list-style-type: none"> <li>● Steering wheel module failure - slave node not responding</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check the clockspring LIN circuit for short, open circuit. Suspect the clockspring, check and install a new clockspring as required, refer to the new module/component installation note at the top of the DTC Index
B115C7A	Transfer Fuel Pump	<ul style="list-style-type: none"> <li>● Fuel pump system fault</li> </ul>	Check for fuel system jet pump or jet pump fuel level sensor fault
B1A8515	Ambient Light Sensor	<ul style="list-style-type: none"> <li>● Autolamp sensor circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check autolamp sensor circuit for short to power, open circuit
B1B0100	Key Transponder	<ul style="list-style-type: none"> <li>● Operator only cycles one key</li> <li>● During transponder key programming the instrument cluster, smartcard docking station or key loses power/circuit failure</li> <li>● Faulty key during key programming</li> <li>● Unable to program transponder key due to noise/EMC related error</li> </ul>	Ensure all keys to be programmed are available. Refer to electrical circuit diagrams and check power and ground supply circuits to all relevant modules. Replace faulty key and repeat key programming. Check CAN network for interference/EMC related issues
B1B0105	Key Transponder	<ul style="list-style-type: none"> <li>● Error following SCU replacement</li> <li>● Smartcard docking station power and ground supply circuits - short, open circuit</li> <li>● LIN fault</li> <li>● Instrument cluster power and ground supply circuits - short, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Perform the Immobilisation application from the Set-up menu using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check smartcard docking station power and ground supply circuits for short, open circuit and instrument cluster power and ground supply circuits for short, open circuit. Check LIN communications between smartcard docking station and instrument cluster
B1B0151	Key Transponder	<ul style="list-style-type: none"> <li>● LIN fault</li> <li>● Instrument cluster power and ground supply circuits - short, open circuit</li> <li>● Key fault</li> <li>● Smartcard docking station power and ground supply circuits - short, open circuit</li> <li>● Attempted to program a non default key</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check LIN communications between smartcard docking station and instrument cluster. Refer to the electrical circuit diagrams and check smartcard docking station power and ground supply circuits for short, open circuit and instrument cluster power and ground supply circuits for short, open circuit. Confirm transponder key operation. Ensure new keys are from a known source

DTC	Description	Possible Cause	Action
B1B0155	Key Transponder	<ul style="list-style-type: none"> <li>● Un-programmed key inserted in SCU2</li> <li>● A non default key inserted during key programming</li> </ul>	Confirm the correct keys are used
B1B0162	Key Transponder	<ul style="list-style-type: none"> <li>● Instrument cluster power and ground supply circuits - short, open circuit</li> <li>● Smartcard docking station power and ground supply circuits - short, open circuit</li> <li>● Incorrect instrument cluster or smartcard docking station installed</li> <li>● Error during or following the Write Target SID routine</li> <li>● Noise/EMC related error</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check smartcard docking station power and ground supply circuits for short, open circuit and instrument cluster power and ground supply circuits for short, open circuit. Check correct instrument cluster and smartcard docking station are installed. Perform the Immobilisation application from the Set-Up menu using the manufacturer approved diagnostic system. Check CAN network for interference/EMC related issues
B1B0164	Key Transponder	<ul style="list-style-type: none"> <li>● LIN fault</li> <li>● Instrument cluster power and ground supply circuits - short, open circuit</li> <li>● Transponder key fault</li> <li>● Smartcard docking station power and ground supply circuits - short, open circuit</li> <li>● Error occurred during transponder key programming</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check LIN communications between smartcard docking station and instrument cluster. Refer to the electrical circuit diagrams and check smartcard docking station power and ground supply circuits for short, open circuit and instrument cluster power and ground supply circuits for short, open circuit. Confirm transponder key operation. Repeat transponder key programming
B1B0167	Key Transponder	<ul style="list-style-type: none"> <li>● LIN fault</li> <li>● Instrument cluster power and ground supply circuits - short, open circuit</li> <li>● Transponder key fault</li> <li>● Smartcard docking station power and ground supply circuits - short, open circuit</li> <li>● Another key in close proximity</li> <li>● Instrument cluster in incorrect programming state</li> <li>● Attempted to program a non default key</li> <li>● Instrument cluster Cold init whilst in Ignition On state, without key being present in the SCU</li> <li>● Race condition caused by closing driver door and pressing the start button within a small time window</li> <li>● Passive Key search function from last door closed and key inserted in the SCU</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check LIN communications between smartcard docking station and instrument cluster. Refer to the electrical circuit diagrams and check smartcard docking station power and ground supply circuits for short, open circuit and instrument cluster power and ground supply circuits for short, open circuit. Confirm transponder key operation. Confirm single key operation. Ensure instrument cluster in correct mode i.e. Auto Enable, Key erase etc. Ensure new keys are from a known source. Check for intermittent power and ground to instrument cluster. Design condition - advise customer of starting sequence. Design condition - determine customer transponder key usage
B1B0187	Key Transponder	<ul style="list-style-type: none"> <li>● LIN fault</li> <li>● Instrument cluster power and ground supply circuits - short, open circuit</li> <li>● Smartcard docking station power and ground supply circuits - short, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check LIN communications between smartcard docking station and instrument cluster. Refer to the electrical circuit diagrams and check smartcard docking station power and ground supply circuits for short, open circuit and instrument cluster power and ground supply circuits for short, open circuit
B1B3305	Target I.D. Transfer	<ul style="list-style-type: none"> <li>● CAN fault</li> <li>● ECM ignition, power and ground supply circuits - short, open circuit</li> <li>● Instrument cluster power and ground supply circuits - short, open circuit</li> <li>● ECM or instrument cluster incorrectly configured</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check CAN communications between ECM and instrument cluster. Refer to electrical circuit diagrams and check ECM ignition, power and ground supply circuits for short, open circuit and instrument cluster power and ground supply circuits for short, open circuit. Perform the Immobilisation application from the Set-up menu using the manufacturer approved diagnostic system
B1B3362	Target I.D. Transfer	<ul style="list-style-type: none"> <li>● CAN fault</li> <li>● ECM ignition, power and ground supply circuits - short, open circuit</li> <li>● Instrument cluster power and ground supply circuits - short, open circuit</li> <li>● Incorrect ECM or instrument cluster installed</li> <li>● Synchronisation error following re-programming</li> <li>● Noise/EMC related error</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check CAN communications between ECM and instrument cluster. Refer to electrical circuit diagrams and check ECM ignition, power and ground supply circuits for short, open circuit and instrument cluster power and ground supply circuits for short, open circuit. Check correct ECM and instrument cluster installed. Perform the Immobilisation application from the Set-up menu using the manufacturer approved diagnostic system. Check CAN network for interference/EMC related issues

# Instrument Cluster - Instrument Cluster

Removal and Installation

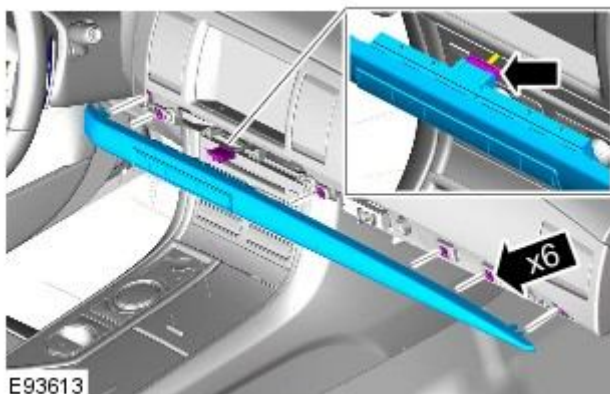
## Removal

 **CAUTION:** If a new instrument cluster is to be installed, the diagnostic tool must be connected prior to removal, the data must then be downloaded from it and the keys (remote control handsets) set into default mode. Failure to follow this instruction will result in permanent damage to the keys.

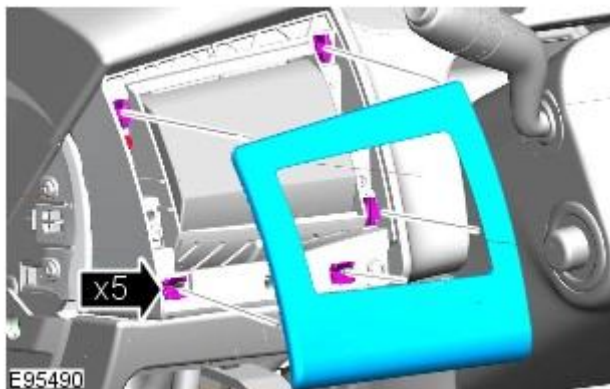
- NOTE: If a new instrument cluster is to be installed, make sure that all keys (remote control handsets) are present.
- NOTE: Removal steps in this procedure may contain installation details.

1. Fully extend and lower the steering column for access.
2. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

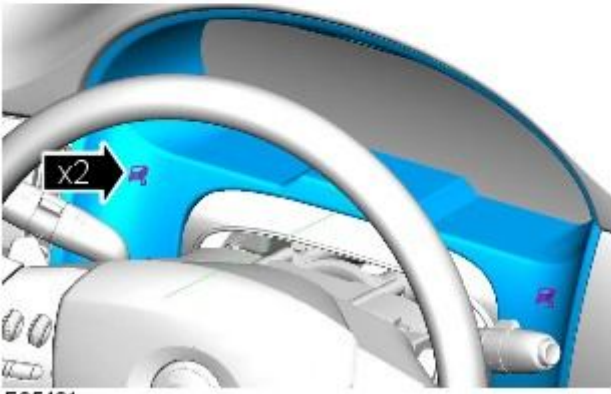
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4.

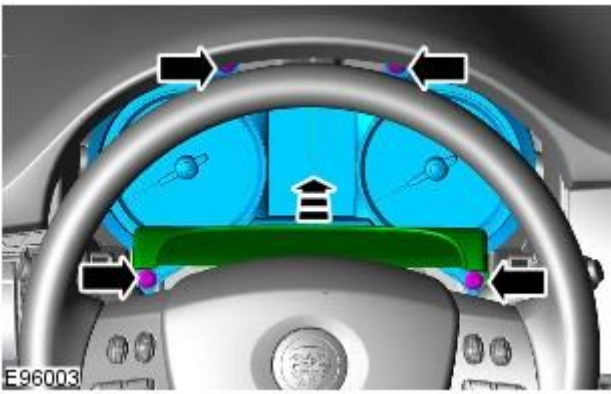


5.



E95491

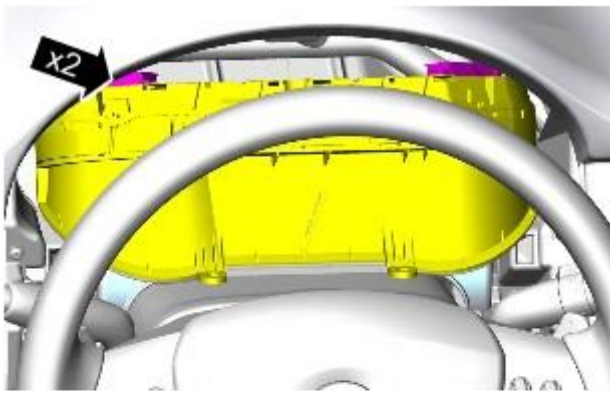
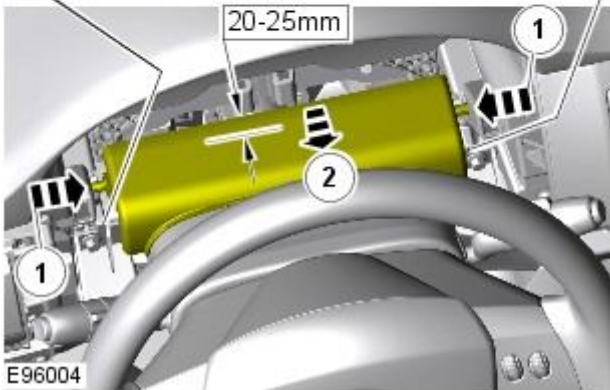
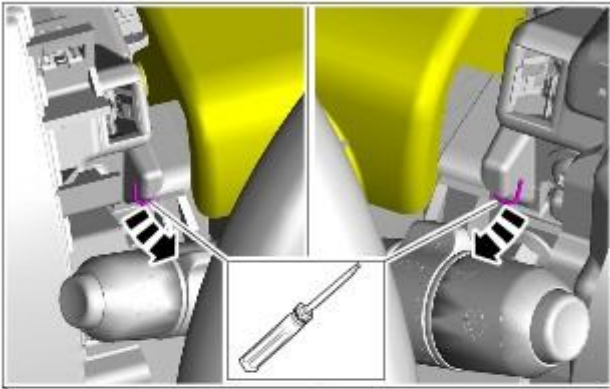
6.




E96003



7.



E96005

8.  CAUTION: Take extra care not to damage the instrument cluster face.

## Installation

1. To install, reverse the removal procedure.
2. Configure the instrument cluster and ignition keys using the diagnostic tool.

**Horn -**

Description	Nm	lb-ft	lb-in
Vehicle horn retaining bolt	25	18	-

## Horn - Horn

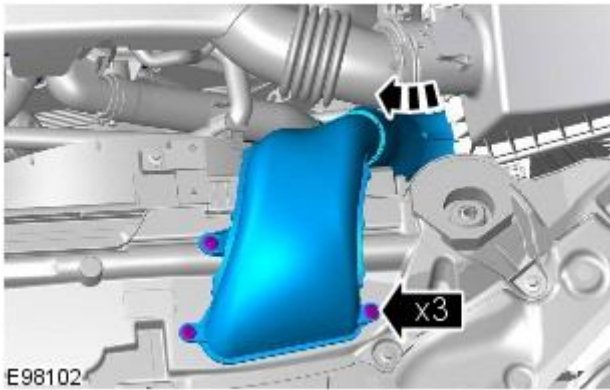
### Removal and Installation

#### Removal

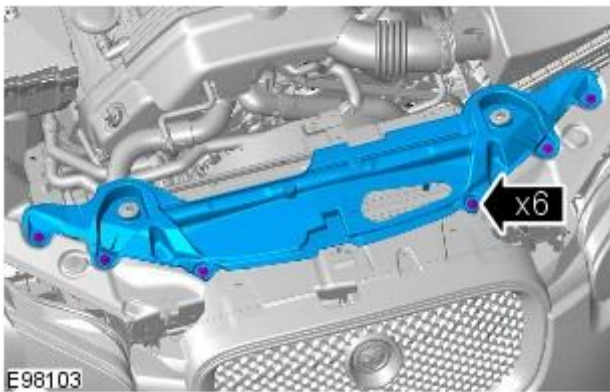
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

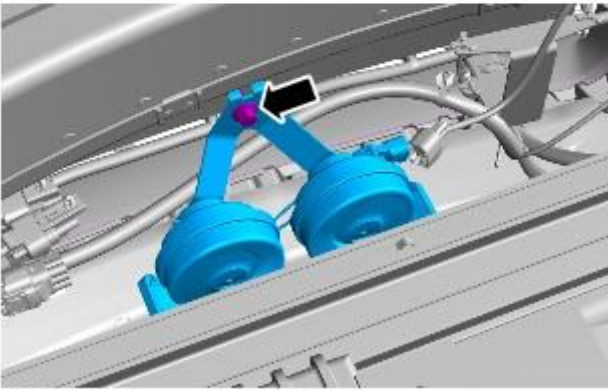
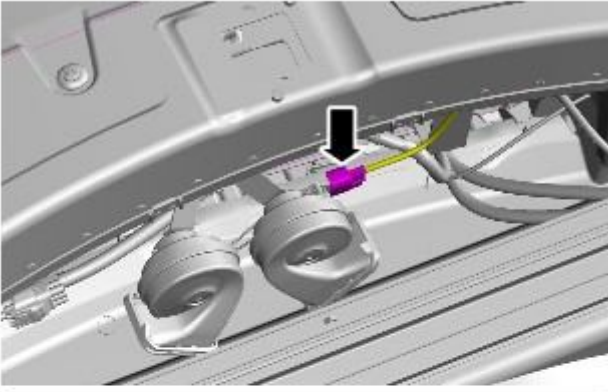
2. Torque: 7 Nm



3. Torque: 7 Nm



4. Torque: 25 Nm



E99894

## Installation

1. To install, reverse the removal procedure.

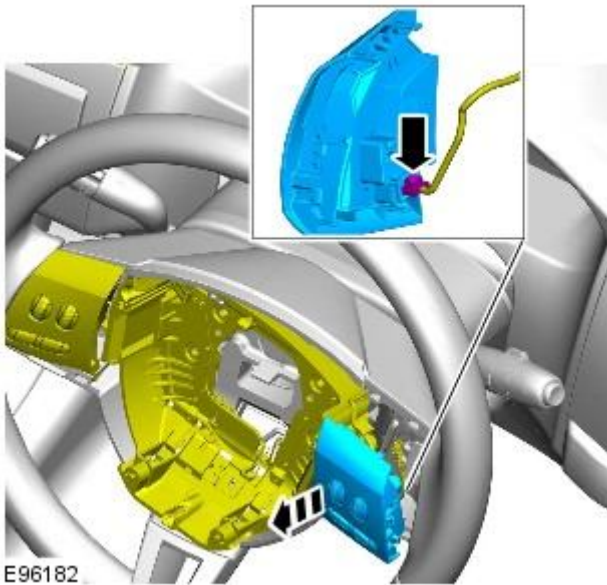
## Horn - Horn Switch

Removal and Installation

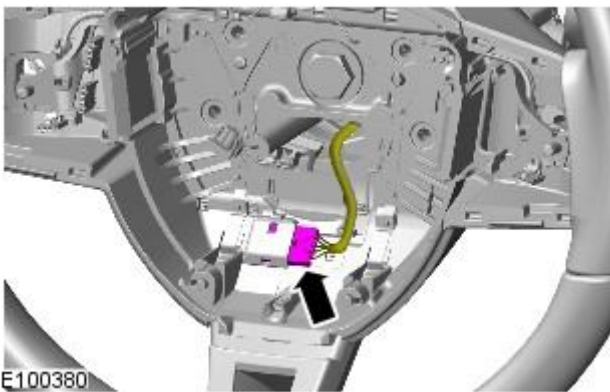
### Removal

1. Refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).
2. Refer to: [Steering Wheel Audio Controls](#) (415-01 Information and Entertainment System, Removal and Installation).

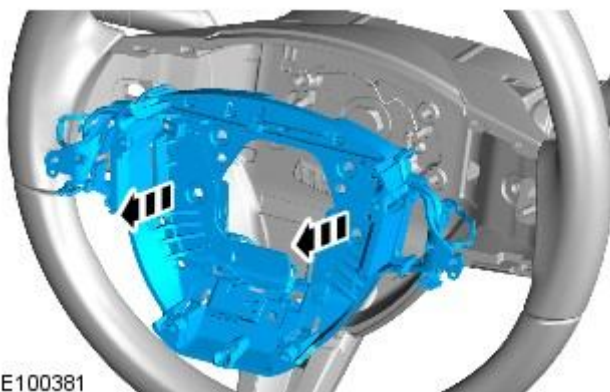
3.



4.



5.



### Installation

1. To install, reverse the removal procedure.

# Information and Message Center - Information and Message Center - Component Location

Description and Operation

## COMPONENT LOCATION



E93390

### ItemDescription

- 1 Message center



# Information and Message Center - Information and Message Center -

## Overview

Description and Operation

### OVERVIEW

The message center is a [LCD \(liquid crystal display\)](#) located in a central position in the instrument cluster. The message center receives [CAN \(controller area network\)](#) bus, [LIN \(local interconnect network\)](#) bus, and hardwired signals from other vehicle system control modules to display current vehicle status information. Depending on message importance, the message center will be backlit in white, amber or red.

The message center will display:

- Fuel level
- Trip computer information
- Gear selected
- Speed control information
- Vehicle map
- Clock
- Turn by turn satellite navigation
- Voice control text
- JaguarDrive Control system messages.

Operation of the message center is controlled by software within the instrument cluster.  
Refer to: [Instrument Cluster](#) (413-01 Instrument Cluster, Description and Operation).

# Information and Message Center - Information and Message Center - System Operation and Component Description

Description and Operation

## System Operation

### SERVICE INTERVAL INDICATOR - DIESEL MODELS ONLY

If the vehicle is within 3,200 kilometers (1,988 miles) of a service, the message center will display 'SERVICE REQUIRED IN XXXX km or MILES'. The display reduces the 'service required in' readout by increments every 50 kilometers (30 miles). If this distance drops below 1 km (0.6 miles), the message center will display 'SERVICE REQUIRED'.

These messages are displayed every time the vehicle enters power mode 6, for 4 seconds after the instrument cluster bulb check routine has finished.

• **NOTE:** The message center will display distance to next service in miles on an instrument cluster fitted with a Miles Per Hour (MPH) speedometer unless the driver has changed the display units on the Touch Screen Display (TSD).

#### Reset Procedure

To re-set the service interval indicator, the following process switch presses must each be carried out within 3 seconds:

- With the vehicle in power mode 0, (ignition off) press and hold the rear fog lamp switch
- Allow the vehicle to enter power mode 6 (Press the start button without a foot on the brake)
- Immediately release the rear fog lamp switch
- Press and hold the trip computer cycle switch
- Press and hold the rear fog lamp switch
- Continue to hold the trip computer and rear fog lamp switches
- If the process has been successful, the message center will display 'RESETTING SERVICE MODE' and then display 'SERVICE MODE RESET' after 10 seconds
- Release both switches and return the vehicle ignition to off, power mode 0.

## Component Description

### MESSAGE CENTER

The message center [LCD \(liquid crystal display\)](#) display has a viewable area of 126 pixels horizontal and 174 pixels vertical. It is divided into six information display zones as follows, starting from the top:

- Set speed
- Transmission position
- Warning /message display
- JaguarDrive Optimization icon
- Odometer/Trip computer information
- Fuel level.

The message center is active at all times when the ignition is on and can also be active when the ignition is off, dependant on the information to be displayed. The message center [LCD](#) illumination is controlled by the sun load light sensor located on the instrument panel. In bright conditions, the illumination is set to maximum brightness. As the ambient light levels drop, the illumination dims. When the lights are switched on or activated by the 'AUTO' function, the illumination operates in the same way until a defined ambient light threshold is reached, at this point the setting of the panel illumination dimmer in the auxiliary light switch will control the brightness.

If more than one message is active, each message is displayed for 4 seconds in the order of priority. Once all messages have been displayed, they are again displayed in turn for 2 seconds each. Warning messages can be displayed when the ignition is in accessory power mode 4 which is the initial ignition state when a door is opened.

#### Message Priority

Messages are assigned priorities which are defined by the effect on driving safety and functional ability of the vehicle. When new messages are displayed they may be accompanied by a chime from the instrument cluster sounder. A new message will be displayed immediately, providing the currently displayed message (if there is one) has been displayed for at least 4 seconds. A warning indicator will be activated simultaneously with the message being displayed. If more than one fault warning message is being displayed, the messages will cycle, in priority order, with each message being displayed for 2 seconds.

### INFORMATION DISPLAY

The transmission display is located in the upper section of the [LCD](#). The transmission position information is sent from the [TCM \(transmission control module\)](#) in a high speed [CAN \(controller area network\)](#) message to the instrument cluster. The transmission has three modes of operation:

- Conventional automatic operation (JaguarDrive selector in 'D' position)
- Sport automatic operation (JaguarDrive selector in 'S' position)
- Manual gear operation - Jaguar Sequential Shift.

The following table shows the JaguarDrive selector position and the highlighted indication displayed in the transmission display.

JaguarDrive Selector Position	Transmission Display
(P) Park	P
(R) Reverse	R

Jaguar Drive Selector Position	Transmission Display
(N) Neutral	N
(D) Drive	D
(S) Sport	S

The following table shows the Jaguar Sequential Shift display. Selections are made using the steering wheel mounted paddle switches.

Jaguar Sequential Shift Gear Selection	Transmission Display
First	1
Second	2
Third	3
Fourth	4
Fifth	5
Sixth	6

The transmission may inhibit a requested up or down shift if the requested gear is outside the normal engine speed operating range. If this occurs, the transmission display will briefly display the gear requested by the driver but will then change to display the actual gear selection.

### Speed Control and Set Speed Displays

The following table shows the possible messages which can be displayed, other visual or audible warnings and a description of the message.

Message	Other Warnings	Reason	Action
OVERLIMIT XXX MPH (km/h)	<ul style="list-style-type: none"> <li>Amber ASL warning indicator illuminated at +4.8 km/h (+3 mph) above limit</li> <li>Amber ASL warning indicator flashing at +24 km/h (+15 mph) above limit</li> <li>Amber ASL warning indicator flashing and chime emitted at +24 km/h (+15 mph) for a certain time period</li> </ul>	Displayed when vehicle speed exceeds the ASL set speed	Reduce vehicle speed to ASL set limit
LIMITER CANCELLED	None	Displayed for 4 seconds when driver deselects ASL	None
LIMITER SET XXX MPH (km/h)	None	Displays new speed setting for the ASL	None
LIMITER STANDBY	None	Displayed when ASL is activated and speed control is selected	None
LIMITER NOT AVAILABLE	None	Displayed when <a href="#">ECM (engine control module)</a> has detected a fault	Use an approved Jaguar Diagnostic System to diagnose fault
TOO FAST TO RESUME	None	Displayed when 'Resume' switch is pressed but vehicle speed is 30 km/h (18 mph) above the set speed.	Reduce vehicle speed to set speed then press 'Resume' switch.
CRUISE CANCELLED	None	Driver has cancelled speed control or the brake pedal has been pressed.	None
CRUISE OVERRIDE	None	Driver has pressed the accelerator pedal, overriding the speed control system. Message will go off when accelerator pedal is released and speed control is active.	<b>WARNING: Adaptive cruise braking will be disabled when this message is displayed.</b>
GAP 1 / 2 / 3 / 4	None	Displays the current set or default adaptive speed control distance. Displayed along with a vehicle graphic in the <a href="#">LCD</a> . Chevrons (>) denote gap figure selected.	If required, adjust distance using the steering wheel switches.
SETSPEED XXX MPH (km/h)	None	Displays the new speed input for the speed control	None
DRIVER INTERVENE	None	Immediate action required by the driver to apply the brakes if required.	<ul style="list-style-type: none"> <li>Apply brakes if required.</li> <li>May also be displayed if speed control system loses <a href="#">CAN</a> messages when active.</li> </ul>
CRUISE NOT AVAILABLE	None	Speed control cannot be engaged.	A fault has occurred in the speed control system. Diagnose fault using an approved Jaguar Diagnostic System.
RADAR SENSOR BLOCKED	None	The adaptive speed control radar sensor has become dirty or obstructed.	Remove obstruction or clean the radar sensor.
FORWARD ALERT OFF	None	Forward alert has been switched off. No warning will be given for objects in the vehicles forward direction.	None

Message	Other Warnings	Reason	Action
FORWARD ALERT	None	Forward alert has been switched on or the gap settings have changed.	None

**Warning/Message Display**

Warning and information messages are displayed in the central area of the [LCD](#). When no messages are required, an analogue clock is present on the display. The message display language can be changed by the driver using a selection menu on the Touch Screen Display (TSD). The following table shows the possible messages which can be displayed, other visual or audible warnings and a description of the message.

Message	Other Warnings	Reason	Action
DSC ON	DSC warning indicator flashes for a short time.	Displayed for a short time when the DSC switch is operated to activate the DSC system.	None
DSC OFF	DSC warning indicator illuminated.	Displayed for a short time when the DSC switch is operated to de-activate the DSC system.	None
TRAC DSC	DSC warning indicator illuminated.	Displayed for a short time when the DSC switch is operated to activate the TRAC DSC system.	None
DSC NOT AVAILABLE	DSC warning indicator illuminated.	A fault is present in the DSC system.	A fault has occurred in the DSC system. Interrogate <a href="#">ABS (anti-lock brake system)</a> module for faults and diagnose fault using an approved Jaguar Diagnostic System.
BRAKE FLUID LOW	<ul style="list-style-type: none"> <li>● Brake warning indicator illuminated.</li> <li>● Red warning triangle illuminated in <a href="#">LCD</a>.</li> </ul>	Brake fluid level has become low and activated low level switch.	Investigate fluid loss and check brake system for leaks. Repair system as required and replenish brake fluid reservoir.
ABS FAULT	<ul style="list-style-type: none"> <li>● <a href="#">ABS</a> warning indicator illuminated.</li> <li>● Amber warning triangle illuminated in <a href="#">LCD</a>.</li> </ul>	A fault is present in the <a href="#">ABS</a> system. Braking system will operate but <a href="#">ABS</a> will not be available.	A fault has occurred in the <a href="#">ABS</a> system. Interrogate <a href="#">ABS</a> module for faults and diagnose fault using an approved Jaguar Diagnostic System.
BRAKE ASSIST FAULT	Amber warning triangle illuminated in <a href="#">LCD</a> .	A fault is present in the braking system preventing brake assist operation. Braking system will operate but brake assist will not be available and increased effort on the brake pedal may be required.	A fault has occurred in the brake assist system. Interrogate <a href="#">ABS</a> module for faults and diagnose fault using an approved Jaguar Diagnostic System.
EBD FAULT	Red warning triangle illuminated in <a href="#">LCD</a> .	A fault is present in the braking system preventing EBD operation. Braking system will operate but EBD will not be available.	A fault has occurred in the EBD system. Interrogate <a href="#">ABS</a> module for faults and diagnose fault using an approved Jaguar Diagnostic System.
CATS SYSTEM FAULT	Amber warning triangle illuminated in <a href="#">LCD</a> .	A fault is present in the Computer Active Technology Suspension (CATS). Suspension will default to the 'hard' setting.	A fault has occurred in the CATS system. Interrogate the CATS module for faults and diagnose using an approved Jaguar Diagnostic System.
PARK BRAKE APPLIED	None	Parking brake has been applied when the vehicle moving at a speed 5 km/h (3 mph) or above.	None
PARK BRAKE FAULT	<ul style="list-style-type: none"> <li>● Brake warning indicator illuminated.</li> <li>● Red warning triangle illuminated in <a href="#">LCD</a>.</li> </ul>	A fault is present in the parking brake system.	A fault has occurred in the parking brake system. Interrogate the parking brake module for faults and diagnose using an approved Jaguar Diagnostic System.
APPLY FOOT AND PARK BRAKE	Amber warning triangle illuminated in <a href="#">LCD</a> .	The battery has been disconnected or power supply interrupted to the parking brake module.	Apply foot brake and parking brake to reset the parking brake module.
CANNOT APPLY PARK BRAKE	<ul style="list-style-type: none"> <li>● Brake warning indicator flashing.</li> <li>● Red warning triangle illuminated in <a href="#">LCD</a>.</li> <li>● <b>NOTE: In certain markets the brake warning indicator does not flash.</b></li> </ul>	A fault is present in the parking brake system and the parking brake cannot be applied.	A fault has occurred in the parking brake system. Interrogate the parking brake module for faults and diagnose using an approved Jaguar Diagnostic System.
<b>Odometer Display</b> The odometer displays the total distance which wheel speed signals from the ABS module. The odometer can show 6 characters and distances up to 999,999 miles or kilometers. The total distance travelled is stored in a <a href="#">EEPROM (electrically programmable read only memory)</a> and the <a href="#">RAM (random access memory)</a> . This ensures that the total distance is not lost if the battery is disconnected.	<ul style="list-style-type: none"> <li>● Tire Pressure Monitoring System (TPMS) warning indicator illuminated.</li> <li>● Vehicle graphic illuminated.</li> </ul>	A tire pressure has decreased to below the warning threshold.	Check tires for punctures and re-inflate to correct pressures. Calculated by the instrument cluster using

The odometer value is passed to other vehicle system modules on the medium speed and high speed [CAN](#) bus. This is used to record the total vehicle mileage for diagnostic purposes and when storing [DTC \(diagnostic trouble code\)](#)'s.

### **Trip computer Information Display**

The instrument cluster contains software which controls the trip computer. The computer allows the driver to access information for current fuel usage, current journey length, average speed and estimated vehicle range of fuel remaining.

The information is calculated from [CAN](#) messages from other vehicle systems, for example wheel speed signals from the [ABS](#) module and fuel injector operating data from the [ECM](#).

A 'Trip' button is located on the end of the [LH \(left-hand\)](#) multifunction switch and allows the driver to access, in sequence, the available trip information by repeatedly pressing the button. The trip information is displayed in the following order:

- Trip distance – The trip distance since the last reset is displayed
- Average speed – The average speed since the last reset is displayed
- Average fuel consumption – The average fuel consumption since the last reset is displayed
- Range – The range is displayed showing the distance which can be travelled until the fuel gage reads empty. If the range display shows dashes (-), this indicates a failure with one or both of the fuel level sensors.

The trip computer has three independent memories; A, B and Auto. Memories A and B can be set independently. The Auto memory is reset after each ignition cycle and therefore only contains information relating the current journey.

The trip information can also be accessed from the TSD located in the center console. The TSD allows the same information available with the trip button on the multifunction switch to be displayed on the TSD, with the addition of the option to reset the values in the A and B memories.

If the battery is disconnected, all trip data in memories A, B and Auto are erased.

### **Fuel Level Display**

The fuel level display is a linear [LCD](#) display to show the usable fuel tank contents. The level display is active at all times when the ignition is on. Low fuel level is displayed as a LOW FUEL LEVEL message and an amber warning triangle in the message center.

The fuel level is obtained by fuel level sensors in the fuel tank. These are monitored by the [RJB](#) software and their output resistance values, corresponding fuel quantity, are transmitted to the instrument cluster on the medium speed [CAN](#) bus. The instrument cluster uses the two level sensor signals to calculate the fuel tank contents. This calculation takes into account fuel movement in the tank to display a steady fuel quantity in the [LCD](#).

The fuel level information is transmitted on the medium speed and high speed [CAN](#) bus for use by other vehicle system modules.

### **AUDIBLE WARNINGS**

The instrument cluster can generate audible warnings to alert the driver to a displayed message and change of vehicle operating condition. The audible warning is generated by a sounder located within the instrument cluster. The audible warnings can be generated for the warnings below and are listed in order of priority, with the first being the highest priority:

- Seatbelt reminder
- EPB (High Pitch)
- ACC Driver Intervene 1
- Airbag fault
- Key in ignition switch
- ASL overspeed
- ACC Driver Intervene 2
- EPB (Low Pitch)
- Vehicle armed (entry delay)
- JaguarDrive selector not in park
- Valet mode
- Lights on reminder
- Hood operation
- Passive Entry / Passive Start (PEPS)
- Memory set
- Turn signal indicators
- Seat Belt Minder.

The audible warnings can take the form of a single chime, a number of chimes or a continuous chime. The audible warnings are initiated by a CAN message request from the requesting sub-system control module or by the instrument cluster software.

# Information and Message Center - Information and Message Center

Diagnosis and Testing

For additional information.

REFER to: [Instrument Cluster](#) (413-01 Instrument Cluster, Diagnosis and Testing).



# Warning Devices - Warning Devices

Diagnosis and Testing

## Principles of Operation

For a detailed description of the Blindspot Monitoring system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (413-09)

Blind Spot Monitoring System (Description and Operation),  
Blind Spot Monitoring System (Description and Operation),  
Blind Spot Monitoring System (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

• **NOTE:** Particular attention should be paid to the following items where DTCs may not be logged:

- Check for contamination (e.g. dirt, grime, frosting, ice) around the blindspot monitoring sensors and clear.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>• Exterior rear view mirror glass</li> <li>• Mud or sleet contamination around rear bumper area</li> <li>• Blindspot Monitoring Modules</li> </ul>	<ul style="list-style-type: none"> <li>• Fuse(s)</li> <li>• Relay(s)</li> <li>• Wiring Harness</li> <li>• Electrical connector(s)</li> <li>• Blindspot Monitoring Modules</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
<ul style="list-style-type: none"> <li>• The instrument cluster displays 'BSM System Fault'</li> <li>• DTC B11C915 is logged within the left hand Blind Spot Monitoring module</li> <li>• The Left Alert icon is constantly illuminated</li> </ul>	<ul style="list-style-type: none"> <li>• Left driver display alert LED circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check left driver display alert LED circuit for short to power
<ul style="list-style-type: none"> <li>• The instrument cluster displays 'BSM System Fault'</li> <li>• DTC B11C915 is logged within the left hand Blind Spot Monitoring module</li> <li>• No short to power or open circuit fault on the driver display status LED circuit</li> </ul>	<ul style="list-style-type: none"> <li>• Left mirror ground circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check the left mirror ground circuit for open circuit
<ul style="list-style-type: none"> <li>• The instrument cluster displays 'BSM System Fault'</li> <li>• DTC B11C915 is logged within the right hand Blind Spot Monitoring module</li> <li>• No short to power or open circuit fault on the driver display status LED circuit</li> </ul>	<ul style="list-style-type: none"> <li>• Right mirror ground circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check the right mirror ground circuit for open circuit
<ul style="list-style-type: none"> <li>• The instrument cluster displays 'BSM System Fault'</li> <li>• DTC U023200 is logged within the right hand</li> </ul>	<ul style="list-style-type: none"> <li>• Left driver display status LED circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check left driver display status LED circuit for short to ground. Clear DTC and re-test. If DTC remains suspect the left hand Blindspot Monitoring module. Check and install a new left hand Blindspot Monitoring module only, refer to the new module/component installation note at the

Symptom	Possible Cause	Action
Blind Spot Monitoring module <ul style="list-style-type: none"> <li>The left driver display status LED does not illuminate when the vehicle is stationary, in Park and the ignition is on</li> </ul>	<ul style="list-style-type: none"> <li>Suspect left hand module failure</li> </ul>	top of the DTC Index
<ul style="list-style-type: none"> <li>The instrument cluster displays 'BSM System Fault'</li> <li>DTC U023200 is logged within the right hand Blind Spot Monitoring module</li> <li>When the system is powered up the left driver display alert LED does not illuminate during the bulb self-checks</li> </ul>	<ul style="list-style-type: none"> <li>Left driver display alert LED - short to ground, open circuit</li> <li>Suspect left hand module failure</li> </ul>	Refer to the electrical circuit diagrams and check left driver display alert LED circuit for short to ground, open circuit. Clear DTC and re-test. If DTC remains suspect the left hand Blindspot Monitoring module. Check and install a new left hand Blindspot Monitoring module only, refer to the new module/component installation note at the top of the DTC Index
<ul style="list-style-type: none"> <li>The instrument cluster displays 'BSM System Fault'</li> <li>DTC U023300 is logged within the left hand Blind Spot Monitoring module</li> <li>The right driver display status LED is constantly illuminated</li> </ul>	<ul style="list-style-type: none"> <li>Right driver display status LED - short to power</li> <li>Suspect right hand module failure</li> </ul>	Refer to the electrical circuit diagrams and check right driver display status LED circuit for short to power. Clear DTC and re-test. If DTC remains suspect the right hand Blindspot Monitoring module. Check and install a new right hand Blindspot Monitoring module only, refer to the new module/component installation note at the top of the DTC Index
<ul style="list-style-type: none"> <li>The instrument cluster displays 'BSM System Fault'</li> <li>DTC U023300 is logged within the left hand Blind Spot Monitoring module</li> <li>When the system is powered up the right driver display status LED does not illuminate during the bulb self-checks</li> </ul>	<ul style="list-style-type: none"> <li>Right driver display status LED - open circuit</li> <li>Suspect right hand module failure</li> </ul>	Refer to the electrical circuit diagrams and check right driver display status LED circuit for open circuit. Clear DTC and re-test. If DTC remains suspect the right hand Blindspot Monitoring module. Check and install a new right hand Blindspot Monitoring module only, refer to the new module/component installation note at the top of the DTC Index
<ul style="list-style-type: none"> <li>The instrument cluster displays 'BSM System Fault'</li> <li>DTC U023300 is logged within the left hand Blind Spot Monitoring module</li> <li>When the system is powered up both the right driver display LEDs do not illuminate during the bulb self-checks</li> </ul>	<ul style="list-style-type: none"> <li>Right mirror ground circuit - open circuit</li> <li>Suspect right hand module failure</li> </ul>	Refer to the electrical circuit diagrams and check the right mirror ground circuit for open circuit. Clear DTC and re-test. If DTC remains suspect the left hand Blindspot Monitoring module. Check and install a new left hand Blindspot Monitoring module only, refer to the new module/component installation note at the top of the DTC Index

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• **NOTE:** If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• **NOTE:** Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• **NOTE:** When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• **NOTE:** Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• **NOTE:** If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

• **NOTE:** When carrying out repair/diagnosis of the system, on removal of the front or rear bumper inspect the sensor

connectors to ensure they were correctly latched and check fly leads for signs of chaffing or trapped wires.

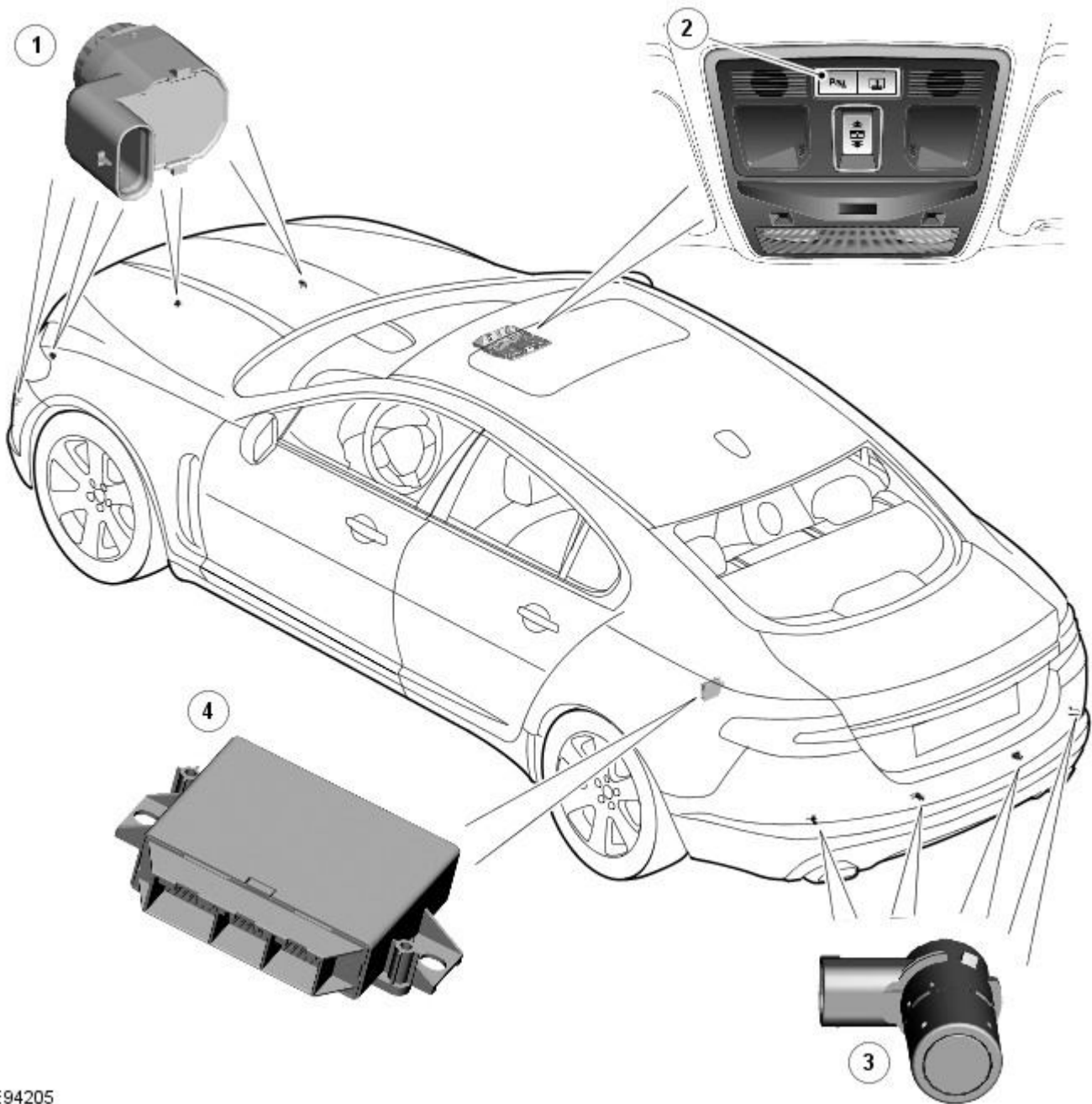
DTC	Description	Possible Cause	Action
B11C911	Driver Display Status LED	<ul style="list-style-type: none"> <li>Driver Display Status LED circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check driver display status LED circuit for short to ground
B11C915	Driver Display Status LED	<ul style="list-style-type: none"> <li>Driver Display Status LED circuit - short to power, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check driver display status LED circuit for short to power, open circuit
B11D611	Driver Display Alert LED	<ul style="list-style-type: none"> <li>Driver Display Alert LED circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check driver display alert LED circuit for short to ground
B11D615	Driver Display Alert LED	<ul style="list-style-type: none"> <li>Driver Display Alert LED circuit - short to power, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check driver display alert LED circuit for short to power, open circuit
U001000	Medium Speed CAN Communication Bus	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check MS CAN bus state, carry out CAN network integrity tests using the manufacturer approved diagnostic system
U014000	Lost Communication With Body Control Module	<ul style="list-style-type: none"> <li>Lost communication with CJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check CJB for related DTCs and correct function, refer to the relevant DTC Index
U014200	Lost Communication With Body Control Module "B"	<ul style="list-style-type: none"> <li>Lost communication with RJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check RJB for related DTCs and correct function, refer to the relevant DTC Index
U014600	Lost Communication With Gateway "A"	<ul style="list-style-type: none"> <li>Lost communication with information and entertainment module</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check information and entertainment module for related DTCs and correct function, refer to the relevant DTC Index
U015500	Lost Communication With Instrument Panel Cluster (IPC) Control Module	<ul style="list-style-type: none"> <li>Lost communication with instrument cluster</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check instrument cluster for related DTCs and correct function, refer to the relevant DTC Index
U023200	Lost Communication With Side Obstacle Detection Control Module - Left	<ul style="list-style-type: none"> <li>Lost communication with left hand Blindspot Monitoring module</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check left hand Blindspot Monitoring module for DTCs and correct function. Refer to electrical circuit diagrams and check CAN network between left hand and right hand Blindspot Monitoring modules. Clear DTC and re-test. If DTC remains, check and install a new left hand Blindspot Monitoring module only, refer to the new module/component installation note at the top of the DTC Index
U023300	Lost Communication With Side Obstacle Detection Control Module - Right	<ul style="list-style-type: none"> <li>Lost communication with right hand Blindspot Monitoring module</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check right hand Blindspot Monitoring module for DTCs and correct function. Refer to electrical circuit diagrams and check CAN network between left hand and right hand Blindspot Monitoring modules. Clear DTC and re-test. If DTC remains, check and install a new right hand Blindspot Monitoring module only, refer to the new module/component installation note at the top of the DTC Index
U030000	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>RJB car configuration data is not compatible with the Blindspot Monitoring module</li> </ul>	Check RJB for related DTCs and refer to the relevant DTC Index. Clear DTCs and re-test. If DTC still logged, re-configure the RJB using the manufacturer approved diagnostic system. Clear DTCs and re-test. If DTC still logged, re-configure the Blindspot Monitoring module using the manufacturer approved diagnostic system. Clear DTC and re-test, if still logged suspect the Blindspot Monitoring module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U041568	Invalid Data Received From Anti-Lock Brake System Control Module	<ul style="list-style-type: none"> <li>Event information</li> </ul>	Check ABS module for related DTCs and correct function, refer to the relevant DTC Index
U042268	Invalid Data Received From Body Control Module	<ul style="list-style-type: none"> <li>Event information</li> </ul>	Check CJB for related DTCs and correct function, refer to the relevant DTC Index
U042368	Invalid Data Received From Instrument Panel Control Module	<ul style="list-style-type: none"> <li>Event information</li> </ul>	Check instrument cluster for related DTCs and correct function, refer to the relevant DTC Index
U210000	Initial Configuration Not Complete	<ul style="list-style-type: none"> <li>No configuration has been previously set</li> </ul>	Check RJB for related DTCs and refer to the relevant DTC Index

<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
U210100	Control Module Configuration Incompatible	<ul style="list-style-type: none"> <li>Data sent from RJB is invalid</li> </ul>	Check RJB for related DTCs and refer to the relevant DTC Index. Check/amend Car Configuration File using the manufacturer approved diagnostic system
U300044	Control Module	<ul style="list-style-type: none"> <li>Data memory failure</li> </ul>	Cycle the ignition and check if the DTC is still logged. If DTC remains suspect the module, refer to the new module/component installation note at the top of the DTC Index
U300047	Control Module	<ul style="list-style-type: none"> <li>Watchdog/safety Micro controller failure</li> </ul>	Cycle the ignition and check if the DTC is still logged. If DTC remains suspect the module, refer to the new module/component installation note at the top of the DTC Index
U300049	Control Module	<ul style="list-style-type: none"> <li>Internal electronic failure</li> </ul>	Cycle the ignition and check if the DTC is still logged. If DTC remains suspect the module, refer to the new module/component installation note at the top of the DTC Index
U300281	Vehicle Identification Number	<ul style="list-style-type: none"> <li>Vehicle/component mis-match. Corrupt VIN data being transmitted, suspect module previously installed to other vehicle</li> </ul>	Check RJB has not been previously installed to other vehicle. Install original/new module as required, refer to the new module/component installation note at the top of the DTC Index. Check RJB for DTCs and refer to the relevant DTC Index
U300362	Battery Voltage	<ul style="list-style-type: none"> <li>Mis-match in battery voltage, of 2 volts or more, between Blindspot Monitoring module and RJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

# Parking Aid - Parking Aid - Component Location

Description and Operation

## COMPONENT LOCATION - PARKING AID

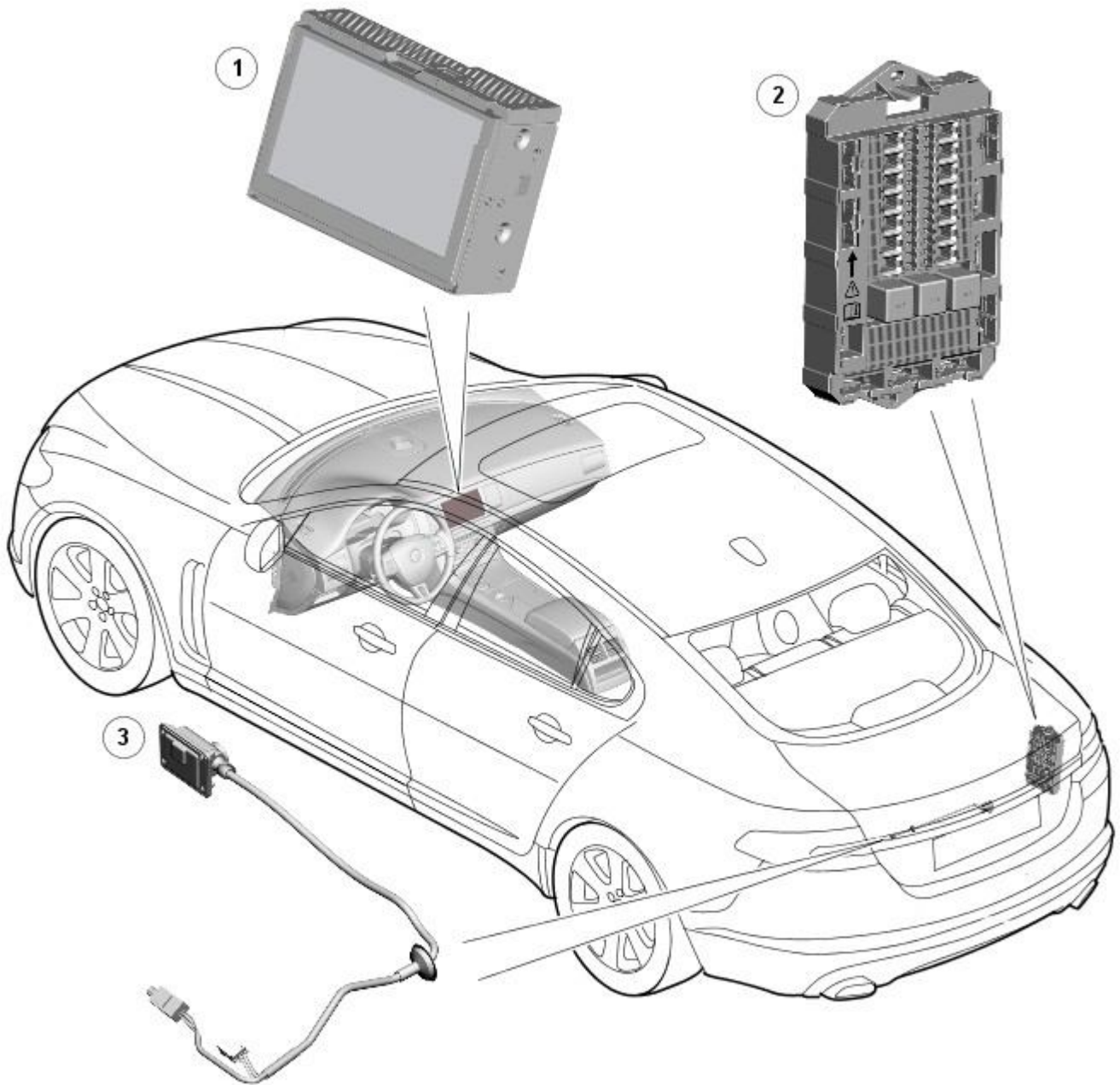


E94205

### ItemDescription

1	Front parking aid sensors (4 off)
2	Parking aid switch
3	Rear parking aid sensors (4 off)
4	Parking aid module

## COMPONENT LOCATION - PARKING AID CAMERA



E94206

**ItemDescription**

- |   |   |
|---|---|
| 1 | Touch Screen Display (TSD)              |
| 2 | <a href="#">RJB (rear junction box)</a> |
| 3 | Parking aid camera                      |



# Parking Aid - Parking Aid - Overview

Description and Operation

## OVERVIEW

The parking aid system provides an audible warning to the driver when any obstacles are in the path of the vehicle during a forward (if front sensors are fitted) or reversing manoeuvre. The purpose of the system is to assist the driver when parking or manoeuvring in a restricted space. It is not designed as a crash avoidance system or a replacement for visual interpretation by the driver.

All vehicles are fitted with rear parking aid sensors. Higher specification vehicles may also be fitted with front parking aid sensors.

A roof console mounted parking aid switch allows the driver to deactivate the parking aid system if operation is not required.

- **NOTE:** The switch is only fitted to vehicles with front parking aid sensors.

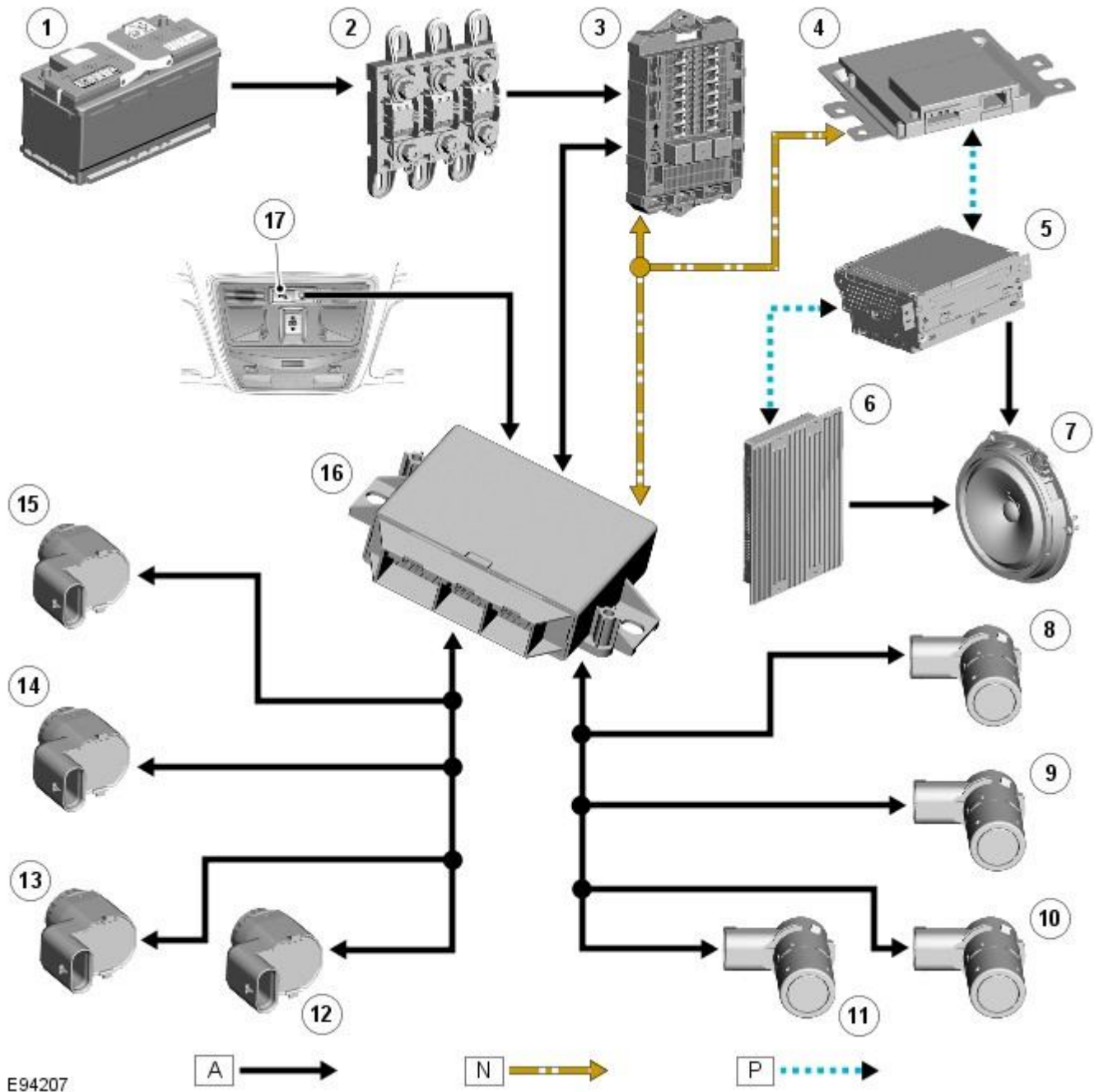
A parking aid camera is a standard fitment on some models and optional on others. The parking aid camera supplements the information provided by the parking aid system by providing the driver with a visual display of the area directly behind the vehicle.

# Parking Aid - Parking Aid - System Operation and Component Description

Description and Operation

## Control Diagram

CONTROL DIAGRAM - PARKING AID



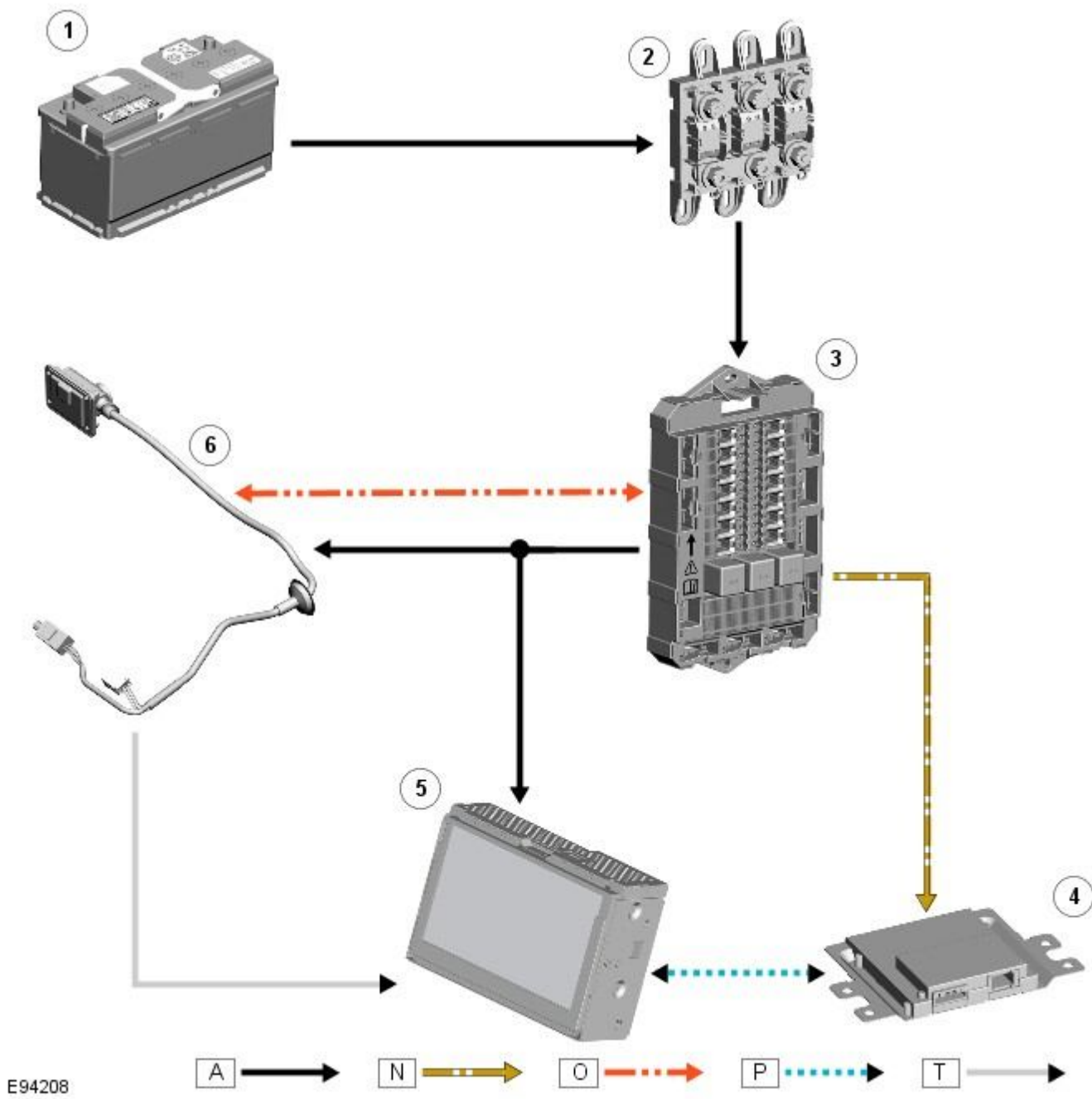
### ItemDescription

NOTE: **A** = Hardwired; **N** = Medium speed CAN bus; **P** = MOST ring

1	Battery
2	<a href="#">BJB (battery junction box)</a>
3	<a href="#">RJB (rear junction box)</a>
4	Entertainment system control module
5	Integrated audio module
6	Audio system amplifier
7	Audio system speakers
8	<a href="#">RH (right-hand) outer rear sensor</a>
9	<a href="#">RH (right-hand) inner rear sensor</a>
10	<a href="#">LH (left-hand) inner rear sensor</a>
11	<a href="#">LH (left-hand) outer rear sensor</a>

12	<a href="#">LH</a> outer front sensor
13	<a href="#">LH</a> inner front sensor
14	<a href="#">RH</a> inner front sensor
15	<a href="#">RH</a> outer front sensor
16	Parking aid module
17	Parking aid switch

CONTROL DIAGRAM - PARKING AID CAMERA



ItemDescription

NOTE: **A** = Hardwired; **N** = Medium speed CAN bus; **O** = LIN bus; **P** = MOST ring; **T** = Co-axial cable

1	Battery
2	<a href="#">BJB</a>
3	<a href="#">RJB</a>
4	Entertainment system control module
5	Touch Screen Display (TSD)
6	Parking aid camera

System Operation

PARKING AID

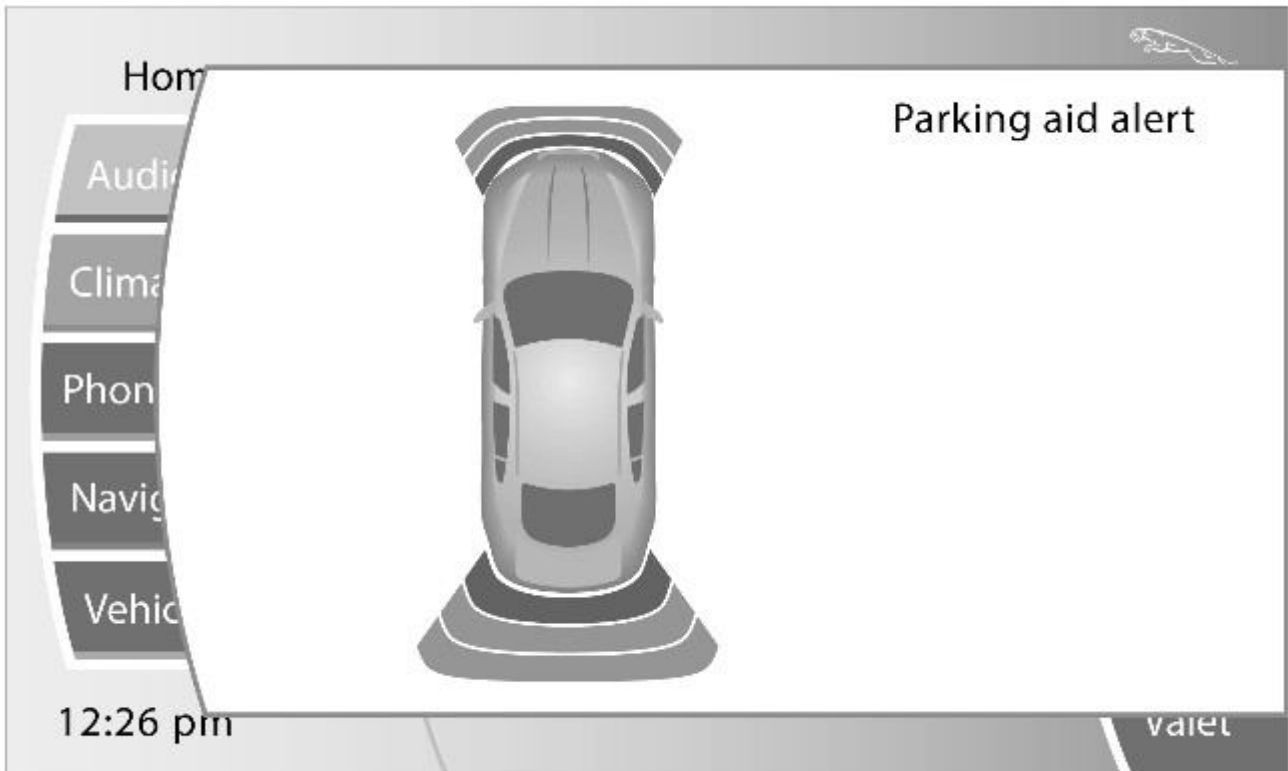
The parking aid module receives and ignition power mode 6 supply from the [RJB](#).

The parking aid module is connected to the entertainment system control module by the medium speed [CAN \(controller area network\)](#) bus and the Media Orientated System Transport (MOST). The entertainment system is used by the parking aid system to provide the driver with an audible warning. If an obstacle is sensed by the rear parking aid sensors, the rear audio system speakers will sound. If an obstacle is sensed by the front parking aid sensors (if fitted), the front audio system speakers will sound.

The parking aid system operates using ultrasonic signals which are transmitted by the sensors. The reflected echo from this output is received by the sensors and used by the parking aid module to calculate the distance from an object.

When the parking aid module activates the system, the switch [LED \(light emitting diode\)](#) is illuminated to indicate that the system is operating. The parking aid module then processes signals received from the sensors to determine if there is an object within the detection range of the sensors. A parking aid screen is automatically displayed in the Touch Screen Display. If the vehicle has a parking aid camera fitted, the camera display is automatically displayed in the TSD in preference to the parking aid alert display. To view the parking aid sensor display, a single touch of the TSD screen will remove the camera image display and show the parking aid alert display.

#### Parking Aid Alert Display



E99384

In the combined mode, the sensors emit a series of ultrasonic impulses and then switch to receiver mode to receive the echo reflected by an obstacle within the detection range. The received echo signals are amplified and converted from an analogue signal to a digital signal by the sensor. The digital signal is passed to the parking aid module and compared with pre-programmed data stored in an [EEPROM \(electrically erasable programmable read only memory\)](#) within the module. The module receives this data via the signal line from the sensor and calculates the distance from the object using the elapsed time between the transmitted and received impulse. The duration of the impulse duration is determined by the module, with the sensor controlling the frequency of the impulse output.

In receiver mode, the sensor receives impulses that were emitted by adjacent sensors. The module uses this information to precisely determine the position and distance of the object.

If no objects are detected there are no further warning tones. If an object is detected, repeated audible tones are emitted from either the front or rear audio speakers as appropriate. The time delay between the tones decreases as the distance between the object and the vehicle decreases, until at approximately 250 mm (10 inches), the audible tone becomes continuous.

If, after the initial detection of an object, there is no decrease in distance between the object and the vehicle, the audible warning tones remain constant if the object is detected by a central sensor or stops after 3 seconds if the object is detected by a corner sensor.

The audible tones will stop if the vehicle is moved out of reverse gear. The module continues to monitor the distance and will resume the warning tones if a decrease in distance is detected.

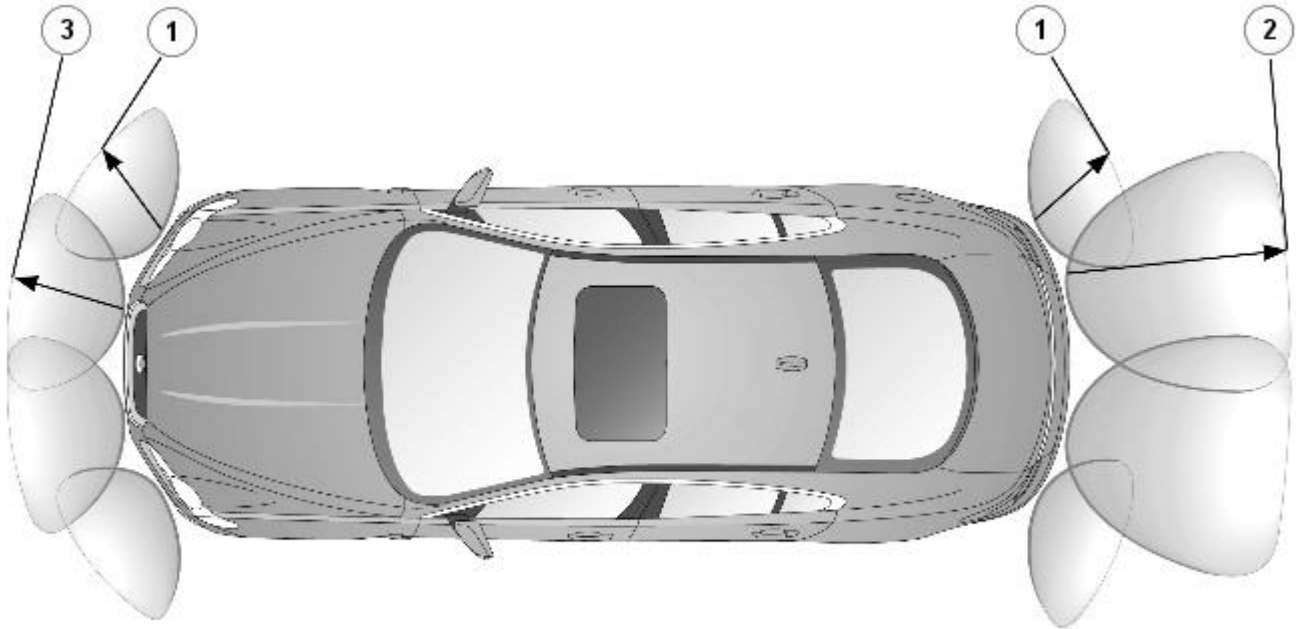
The volume output of the parking aid audible tones can be adjusted by selecting the 'Vehicle Settings' menu and selecting 'Parking' from the menu on the TSD. The volume can be adjusted using the + or - selections on the TSD.

System operation is cancelled when the parking aid switch is pressed or the ignition is switched off. System operation is also cancelled if the vehicle travels more than 50 m (164 ft) or the vehicle forward speed exceeds 30 km/h (19 mph).

The system can detect when a trailer is connected to the vehicle by a message output on the medium speed [CAN](#) bus from the trailer module. When the parking aid module detects that a trailer is connected to the vehicle, the rear sensors are disabled to prevent constant warnings due to the close proximity of the trailer.

The parking aid module also incorporates software that compensates for the effects of frost, ice or rain on the sensors. Ice compensation occurs if the ambient temperature, received on a medium speed [CAN](#) bus message from the instrument cluster, is less than 6°C (43°F).

**Distance Calculation**



E99385

**ItemDescription**

1	600 mm (24 inches)
2	1800 mm (71 inches)
3	800 mm (31 inches)

An intermittent warning tone is emitted once the object is within the detection range for the particular sensor. When the object is 250 mm (10 inches) from the sensor, the tone changes to a continuous tone.

The maximum detection range for the front sensors is 800 mm (31 inches) for the central sensors and 600 mm (23.5 inches) for the corner sensors.

The maximum detection range for the rear sensors is 1800 mm (70 inches) for the central sensors and 600 mm (23.5 inches) for the corner sensors.

**PARKING AID CAMERA**

The parking aid camera receives an ignition power mode 6 power supply from the [RJB](#). It also has a [LIN \(local interconnect network\)](#) bus connection from the [RJB](#) which is not used at the moment but installed for a later enhancement of the parking aid camera.

A shielded co-axial cable connection between the camera and the Touch Screen Display (TSD) is used for the video image transmission.

The camera receives power at all times when the ignition is in power mode 6. When reverse gear is selected, the [RJB](#) transmits a reverse selected signal on the medium speed [CAN](#) bus message to the entertainment system control module. This message is transferred on the MOST to the TSD which displays the parking aid camera video input from the camera in preference to the parking aid alert screen.

If the driver does not require the camera image in the TSD, a single touch on the screen will revert the display to the parking aid alert screen. The camera view can be reselected by pressing the 'Rear Camera' softkey on the TSD.

When reverse gear is deselected, the camera image remains on the TSD for 10 seconds after the transmission has been put into drive 'D'. This is to prevent the TSD switching between screens if the vehicle is being manoeuvred into a parking space. If the vehicle forward speed exceeds 16 km/h (10 mph) within the 10 second period, the camera image is removed from the TSD.

If the TSD display is switched off, the camera image will be automatically displayed when reverse gear is selected. When

reverse gear is deselected and the 10 second period has expired, the TSD will revert back to its switched off state.

## Component Description

### PARKING AID

Two levels of parking aid system can be fitted; a rear only system or a front and rear system.

The parking aid system provides an audible warning to the driver when any obstacles are in the path of the vehicle during forward (if front sensors are fitted) or reverse parking manoeuvres. The system consists of four ultrasonic sensors in each bumper, a parking aid module and a parking aid switch.

At low speeds, the parking aid module uses the ultrasonic sensors to monitor the area around the front and rear bumpers. If an object is detected within a monitored area, the module then outputs a warning using the audio system speakers. The sensors can detect solid objects such as posts, walls and other vehicles and can also detect less solid objects such as a wire mesh fence. Objects very close to the ground may not be detected, but because of their low height may not cause damage to the vehicle.

The parking aid system comprises the following components:

- Parking aid module
- Parking aid switch
- Eight parking aid sensors.

The parking aid module communicates via the medium speed [CAN](#) bus with the audio system via the integrated audio module. The audio system then outputs the applicable warning tones from the front or rear speakers when an object is detected. The medium speed [CAN](#) bus is also used to collect vehicle data from other vehicle systems.

#### Parking Aid Module

The parking aid module is located on the [LH](#) side of the luggage compartment.

The parking aid module has three connectors which provide for power, ground and [CAN](#) bus connections, front parking aid sensors and rear parking aid sensors. The medium speed [CAN](#) bus connections provide for the receipt of the following information from other systems:

- [ABS \(anti-lock brake system\)](#) module - Road speed signal
- [TCM \(transmission control module\)](#) - Reverse gear engaged signal
- Trailer module - Trailer attached to vehicle
- Instrument cluster - Ambient temperature signal.

The module also outputs messages on the medium speed [CAN](#) bus which are received by the integrated audio module. The integrated audio module processes these messages and converts them into Media Orientated System Transport (MOST) signals which are passed to the audio system power amplifier. These signals are then used by the power amplifier to emit the applicable warning tones from the front or rear audio speakers when an object is detected by the front or rear parking aid sensors. A warning tone can also be emitted to alert the driver to a fault in the parking aid system.

The parking aid module performs self check routines and when the system is active checks the sensor wiring for short or open circuits. If a fault is detected a code is stored in a memory in the module and if necessary either the front and/or rear sensors can be disabled. The driver is made aware of any fault condition by the parking aid switch [LED](#) flashing and a continuous warning tone being emitted for 3 seconds, in place of the normal short tones when the system is functioning normally. Fault codes can be read using an approved Jaguar diagnostic system via the diagnostic socket.

#### Parking Aid Sensors

Four ultrasonic sensors are located in the front and rear bumpers. Each sensor comprises a sensor and a bumper insert. The insert ensures that each sensor is correctly orientated in relation to its location in the bumper.

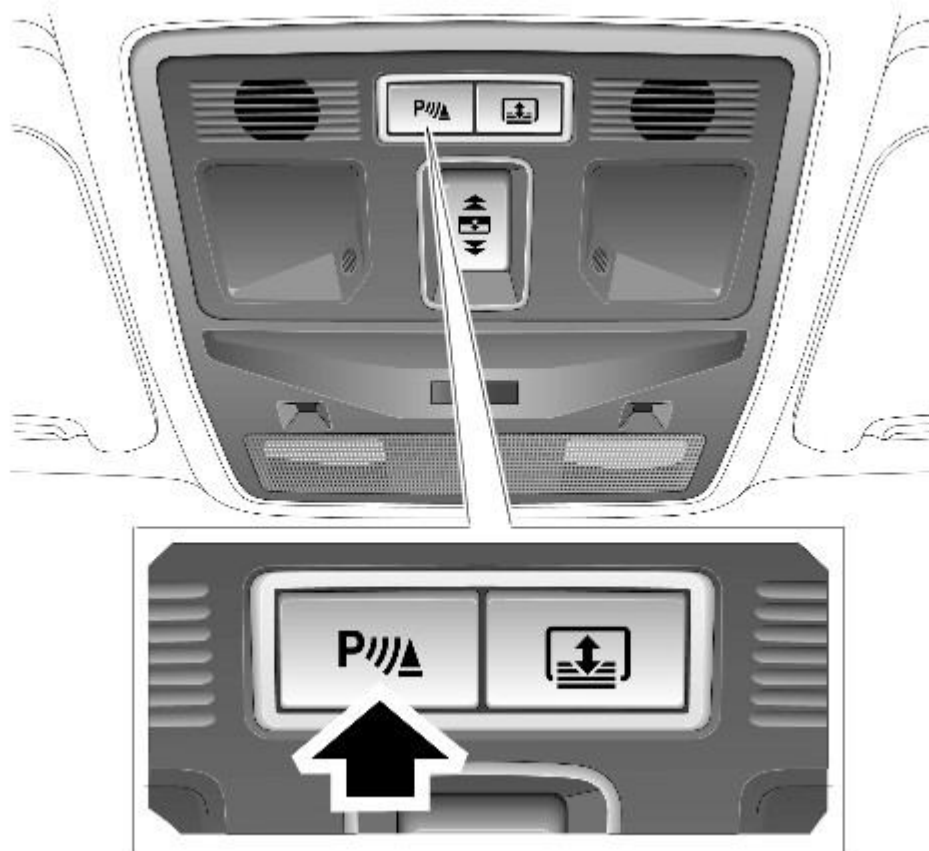
Each sensor has a three pin connector which mates with a bumper harness, which in turn is connected to the main body harness. Three pins provide for power supply, ground and signal lines to and from the parking aid module.

Each sensor comprises a plastic housing which contains a piezo electric disc. The disc resonates at a frequency of 34.8kHz, producing the ultrasonic output. The disc also receives the reflected echo signal from any objects within range.

The parking aid module controls the operation of each sensor using a digital output on the signal line. The module controls the sensor in one of two modes; combined transmitter and receiver mode or receiver mode only.

#### Parking Aid Switch





E99386

The parking aid switch is located in the instrument panel switch pack, above the touch screen. The switch is the [LH](#) switch with an integral [LED](#).

The switch is a non-latching push switch which allows the driver to select the parking aid system on or off. When pressed, the switch momentarily connects a ground to the parking aid module.

The [LED](#) indicates when the parking aid system is active. The [LED](#) is controlled by the parking aid module. The switch allows the driver to disable the parking aid system when reverse gear is selected or to activate the parking sensors when not in reverse gear.

If a fault exists in the parking aid system, the [LED](#) flashes continuously when reverse gear is selected or the driver selects the parking sensors on, using the switch.

## **PARKING AID CAMERA**

The parking aid camera is located on a bracket which is attached to the luggage compartment lid finisher.

The camera is connected to the vehicle harness by one 3 pin connector for the power, ground and [LIN](#) bus and a second connector for the video co-axial cable.

the camera produces color images to an analogue NTSC format, with a resolution of 640 x 480 pixels and an aspect ratio of 4:3.

The image captured by the camera is mirrored to give the driver a true representation of the rear view on the TSD.

# Parking Aid - Parking Aid

Diagnosis and Testing

## Principle of Operation

For a detailed description of the parking aid system, refer to the relevant Description and Operation section in the workshop manual. REFER to: (413-13 Parking Aid)

[Parking Aid](#) (Description and Operation),  
[Parking Aid](#) (Description and Operation),  
[Parking Aid](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage.

• **NOTE:** Particular attention should be paid to the following items where DTCs may not be logged:

- Check for contamination (e.g. dirt, grime, frosting, ice) around the parking aid sensors, if so refer to the parking aid section in the vehicle handbook.
- Check for the correct installation and alignment of the sensors to the bumper.
- Spurious detection of the ground may occur during front system operation on an up-slope, or down slope.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Sensor installation, alignment</li> <li>● Sensor contamination</li> </ul>	<ul style="list-style-type: none"> <li>● Fuse(s)</li> <li>● Relay(s)</li> <li>● Wiring Harness</li> <li>● Electrical connector(s)</li> <li>● Front parking aid sensor(s) and holders</li> <li>● Rear parking aid sensor(s) and holders</li> <li>● Audio system</li> <li>● Parking aid switch and LED</li> <li>● Parking aid module</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• **NOTE:** If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• **NOTE:** Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• **NOTE:** When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• **NOTE:** Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• **NOTE:** If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

• **NOTE:** When carrying out repair/diagnosis of the system, on removal of the front or rear bumper inspect the sensor connectors to ensure they were correctly latched and check fly leads for signs of chaffing or trapped wires.

DTC	Description	Possible Cause	Action
B1B3601	Front right outer sensor	<ul style="list-style-type: none"> <li>● Front right outer sensor signal circuit short to ground, open circuit</li> <li>● Front right outer</li> </ul>	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
		sensor power supply circuit - open circuit	
B1B3612	Front right outer sensor	<ul style="list-style-type: none"> <li>● Front right outer sensor signal circuit short to power</li> </ul>	Refer to electrical circuit diagrams and check front right outer sensor signal circuit for short to power
B1B3696	Front right outer sensor	<ul style="list-style-type: none"> <li>● Front right outer sensor ground circuit - open circuit</li> <li>● Front right outer sensor internal failure</li> </ul>	Refer to electrical circuit diagrams and check front right outer sensor ground circuit for open circuit. Check and install new sensor as required
B1B3801	Front right inner sensor	<ul style="list-style-type: none"> <li>● Front right inner sensor signal circuit short to ground, open circuit</li> <li>● Front right inner sensor power supply circuit - open circuit</li> </ul>	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B3812	Front right inner sensor	<ul style="list-style-type: none"> <li>● Front right inner sensor signal circuit short to power</li> </ul>	Refer to electrical circuit diagrams and check front right inner sensor signal circuit for short to power
B1B3896	Front right inner sensor	<ul style="list-style-type: none"> <li>● Front right inner sensor ground circuit - open circuit</li> <li>● Front right inner sensor internal failure</li> </ul>	Refer to electrical circuit diagrams and check front right inner sensor ground circuit for open circuit. Check and install new sensor as required
B1B4001	Front left outer sensor	<ul style="list-style-type: none"> <li>● Front left outer sensor signal circuit short to ground, open circuit</li> <li>● Front left outer sensor power supply circuit - open circuit</li> </ul>	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B4012	Front left outer sensor	<ul style="list-style-type: none"> <li>● Front left outer sensor signal circuit short to power</li> </ul>	Refer to electrical circuit diagrams and check front left outer sensor signal circuit for short to power
B1B4096	Front left outer sensor	<ul style="list-style-type: none"> <li>● Front left outer sensor ground circuit - open circuit</li> <li>● Front left outer sensor internal failure</li> </ul>	Refer to electrical circuit diagrams and check front left outer sensor ground circuit for open circuit. Check and install new sensor as required
B1B4201	Front left inner sensor	<ul style="list-style-type: none"> <li>● Front left inner sensor signal circuit short to ground, open circuit</li> <li>● Front left inner sensor power supply circuit - open circuit</li> </ul>	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B4212	Front left inner sensor	<ul style="list-style-type: none"> <li>● Front left inner sensor signal circuit short to power</li> </ul>	Refer to electrical circuit diagrams and check front left inner sensor signal circuit for short to power
B1B4296	Front left inner sensor	<ul style="list-style-type: none"> <li>● Front left inner sensor ground circuit - open circuit</li> <li>● Front left inner sensor internal failure</li> </ul>	Refer to electrical circuit diagrams and check front left inner sensor ground circuit for open circuit. Check and install new sensor as required
B1B4401	Rear right outer sensor	<ul style="list-style-type: none"> <li>● Rear right outer sensor signal circuit short to ground, open circuit</li> <li>● Rear right outer sensor power supply circuit - open circuit</li> </ul>	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B4412	Rear right outer sensor	<ul style="list-style-type: none"> <li>● Rear right outer sensor signal circuit short to power</li> </ul>	Refer to electrical circuit diagrams and check rear right outer sensor signal circuit for short to power

DTC	Description	Possible Cause	Action
B1B4496	Rear right outer sensor	<ul style="list-style-type: none"> <li>● Rear right outer sensor ground circuit - open circuit</li> <li>● Rear right outer sensor internal failure</li> </ul>	Refer to electrical circuit diagrams and check rear right outer sensor ground circuit for open circuit. Check and install new sensor as required
B1B4601	Rear right inner sensor	<ul style="list-style-type: none"> <li>● Rear right inner sensor signal circuit - short to ground, open circuit</li> <li>● Rear right inner sensor power supply circuit - open circuit</li> </ul>	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B4612	Rear right inner sensor	<ul style="list-style-type: none"> <li>● Rear right inner sensor signal circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and check rear right inner sensor signal circuit for short to power
B1B4696	Rear right inner sensor	<ul style="list-style-type: none"> <li>● Rear right inner sensor ground circuit - open circuit</li> <li>● Rear right inner sensor internal failure</li> </ul>	Refer to electrical circuit diagrams and check rear right inner sensor ground circuit for open circuit. Check and install new sensor as required
B1B4801	Rear left outer sensor	<ul style="list-style-type: none"> <li>● Rear left outer sensor signal circuit - short to ground, open circuit</li> <li>● Rear left outer sensor power supply circuit - open circuit</li> </ul>	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B4812	Rear left outer sensor	<ul style="list-style-type: none"> <li>● Rear left outer sensor signal circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and check rear left outer sensor signal circuit for short to power
B1B4896	Rear left outer sensor	<ul style="list-style-type: none"> <li>● Rear left outer sensor ground circuit - open circuit</li> <li>● Rear left outer sensor internal failure</li> </ul>	Refer to electrical circuit diagrams and check rear left outer sensor ground circuit for open circuit. Check and install new sensor as required
B1B5001	Rear left inner sensor	<ul style="list-style-type: none"> <li>● Rear left inner sensor signal circuit - short to ground, open circuit</li> <li>● Rear left inner sensor power supply circuit - open circuit</li> </ul>	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B5012	Rear left inner sensor	<ul style="list-style-type: none"> <li>● Rear left inner sensor signal circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and check rear left inner sensor signal circuit for short to power
B1B5096	Rear left inner sensor	<ul style="list-style-type: none"> <li>● Rear left inner sensor ground circuit - open circuit</li> <li>● Rear left inner sensor internal failure</li> </ul>	Refer to electrical circuit diagrams and check rear left inner sensor ground circuit for open circuit. Check and install new sensor as required
B1B5411	Parking aid status LED	<ul style="list-style-type: none"> <li>● Parking aid status LED - short to ground (detected if driven only)</li> </ul>	Refer to the electrical circuit diagrams and test status LED circuit for short to ground
B1B5412	Parking aid status LED	<ul style="list-style-type: none"> <li>● Parking aid status LED - short to power (detected if not driven only)</li> </ul>	Refer to the electrical circuit diagrams and test status LED circuit for short to power
B1B5711	Front sensors power supply circuit	<ul style="list-style-type: none"> <li>● Front sensors power supply circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test front sensor power supply circuit for short to ground
B1B5811	Rear sensors power supply circuit	<ul style="list-style-type: none"> <li>● Rear sensors power supply circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test rear sensor power supply circuit for short to ground

DTC	Description	Possible Cause	Action
B1C3073	Disable switch	<ul style="list-style-type: none"> <li>● Disable switch stuck closed</li> <li>● Disable switch circuit - short circuit</li> </ul>	Refer to electrical circuit diagrams and check disable switch and circuit for short circuit
U001000	Medium speed CAN communication Bus	<ul style="list-style-type: none"> <li>● Medium speed CAN communication Bus</li> </ul>	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014000	Lost communication with CJB	<ul style="list-style-type: none"> <li>● Logged when subscribed CAN message missing from CJB</li> </ul>	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014200	Lost Communication With Body Control Module 'B'	<ul style="list-style-type: none"> <li>● Logged when subscribed CAN message missing from RJB</li> </ul>	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check RJB for related DTCs and refer to relevant DTC Index
U015500	Lost Communication With Instrument Panel Cluster (IPC) Control Module	<ul style="list-style-type: none"> <li>● Logged when subscribed CAN message missing from Instrument Cluster</li> </ul>	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check Instrument Cluster for related DTCs and refer to relevant DTC Index
U030000	Internal control module software incompatibility	<ul style="list-style-type: none"> <li>● RJB car configuration data is not compatible with the parking aid module</li> </ul>	Check RJB for related DTCs and refer to the relevant DTC Index. Clear DTCs and re-test. If DTC still logged, re-configure the RJB using the manufacturer approved diagnostic system. Clear DTCs and re-test. If DTC still logged, re-configure the parking aid module using the manufacturer approved diagnostic system. Clear DTC and re-test, if still logged suspect the parking aid module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U042200	Invalid data received from CJB	<ul style="list-style-type: none"> <li>● Logged when subscribed CAN message invalid from CJB</li> </ul>	Check CJB for related DTCs and refer to relevant DTC Index
U042300	Invalid Data Received From Instrument Panel Control Module	<ul style="list-style-type: none"> <li>● Logged when subscribed CAN message invalid data from Instrument Cluster</li> </ul>	Check Instrument Cluster for related DTCs and refer to relevant DTC Index
U044300	Invalid Data Received From Body Control Module "B"	<ul style="list-style-type: none"> <li>● Logged when subscribed CAN message invalid data from RJB</li> </ul>	Check RJB for related DTCs and refer to the relevant DTC Index
U210000	Initial configuration not complete	<ul style="list-style-type: none"> <li>● No configuration has been previously set</li> </ul>	Check RJB for related DTCs and refer to the relevant DTC Index
U210100	Control module configuration incompatible	<ul style="list-style-type: none"> <li>● Data sent from RJB is invalid</li> </ul>	Check RJB for related DTCs and refer to the relevant DTC Index
U300049	Control module	<ul style="list-style-type: none"> <li>● Internal control module failure</li> </ul>	Install a new Parking Aid module as required, refer to the new module/component installation note at the top of the DTC Index
U300281	Vehicle Identification Number	<ul style="list-style-type: none"> <li>● Invalid VIN data received</li> </ul>	Check RJB for related DTCs and refer to the relevant DTC Index. Check RJB/parking aid module has not been previously installed to other vehicle
U300316	Battery voltage	<ul style="list-style-type: none"> <li>● Circuit voltage below threshold</li> </ul>	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300317	Battery voltage	<ul style="list-style-type: none"> <li>● Circuit voltage above threshold</li> </ul>	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300362	Battery voltage	<ul style="list-style-type: none"> <li>● Mis-match in battery voltage, of 2 volts or more, between parking aid module and RJB</li> </ul>	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

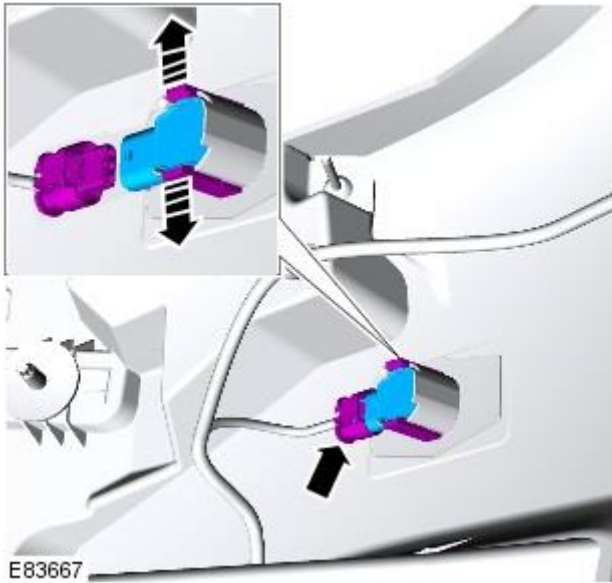
## Parking Aid - Front Inner Parking Aid Sensor

Removal and Installation

### Removal

1. Refer to: [Front Bumper Cover](#) (501-19 Bumpers, Removal and Installation).

2.



### Installation

1.  CAUTION: If a new sensor is installed, only the front face must be painted. Failure to follow this instruction may result in the component malfunctioning.

To install, reverse the removal procedure.



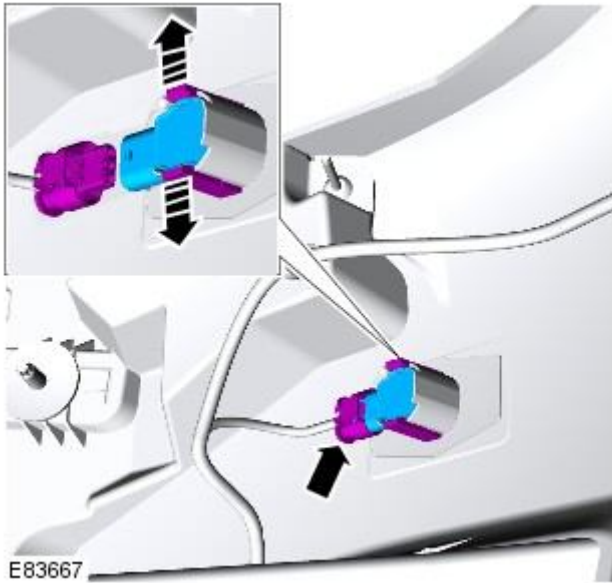
## Parking Aid - Front Outer Parking Aid Sensor

Removal and Installation

### Removal

1. Refer to: [Front Bumper Cover](#) (501-19 Bumpers, Removal and Installation).

2.



### Installation

1.  CAUTION: If a new sensor is installed, only the front face must be painted. Failure to follow this instruction may result in the component malfunctioning.

To install, reverse the removal procedure.

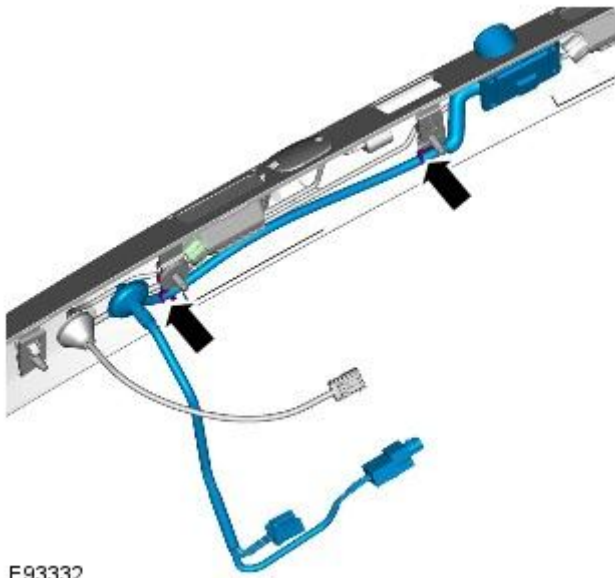
## Parking Aid - Parking Aid Camera

Removal and Installation

### Removal

1. Refer to: [Luggage Compartment Lid Moulding](#) (501-08 Exterior Trim and Ornamentation, Removal and Installation).

2.



### Installation

1. To install, reverse the removal procedure.

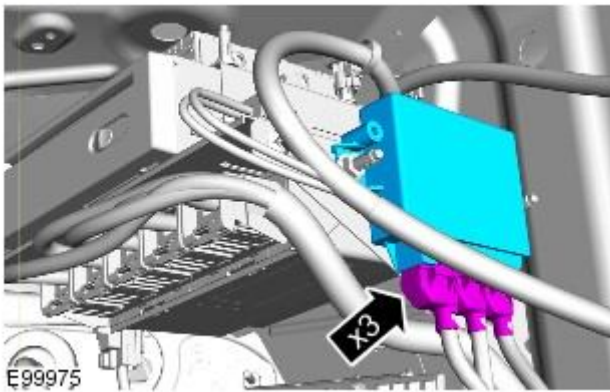
## Parking Aid - Parking Aid Module

Removal and Installation

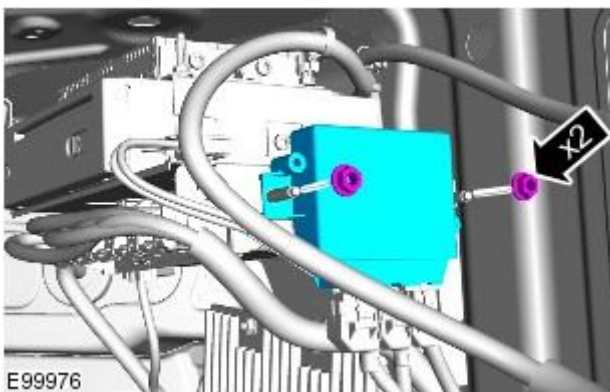
### Removal

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Loadspace Trim Panel LH](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.



4.



### Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Jaguar approved diagnostic equipment.

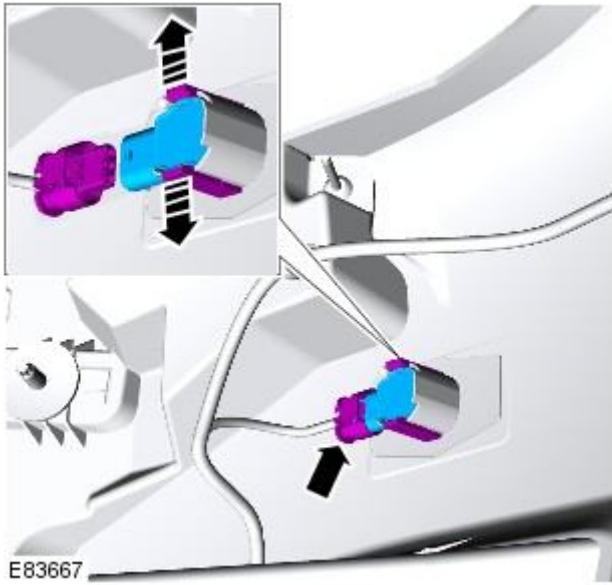
## Parking Aid - Rear Parking Aid Sensor

Removal and Installation

### Removal

1. Refer to: [Rear Bumper Cover](#) (501-19 Bumpers, Removal and Installation).

2.



### Installation

1. To install, reverse the removal procedure.

# Charging System - General Information - Charging System

Diagnosis and Testing

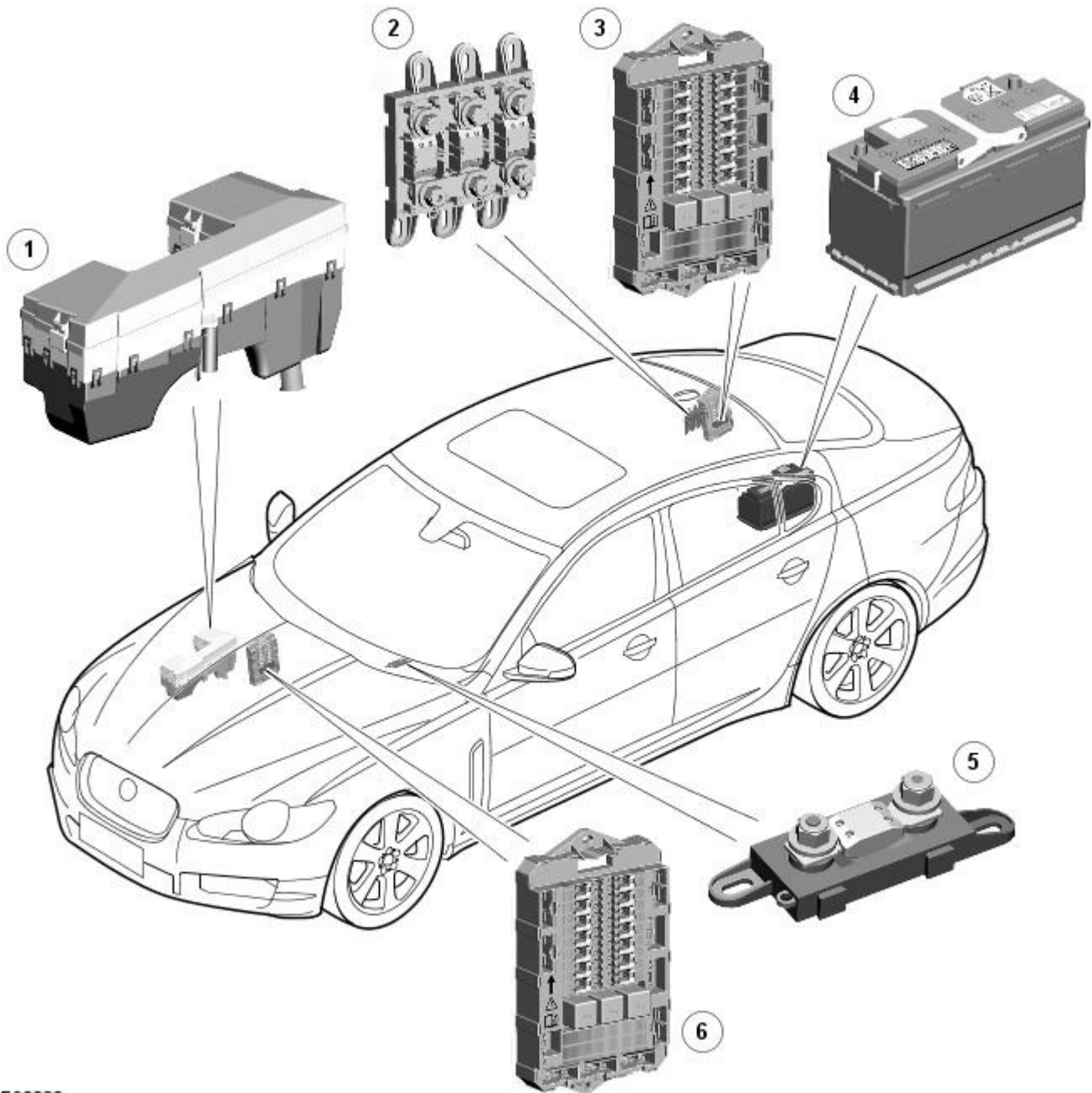
For additional information.

REFER to: [Battery](#) (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

# Battery, Mounting and Cables - Battery and Cables - Component Location

Description and Operation

COMPONENT LOCATION



E93323

## ItemDescription

1	<a href="#">EJB (engine junction box)</a>
2	<a href="#">BJB (battery junction box)</a>
3	<a href="#">RJB (rear junction box)</a>
4	Battery
5	Electric booster heater megafuse
6	<a href="#">CJB (central junction box)</a>



# Battery, Mounting and Cables - Battery and Cables - Overview

Description and Operation

## OVERVIEW

Mounted on the battery negative terminal is a battery monitoring system module. The battery monitoring system module is integral with the battery negative cable and is controlled by the [ECM \(engine control module\)](#).



**CAUTION:** To avoid damaging the battery monitoring system module, always use a suitable body ground point rather than the battery negative terminal when connecting a slave power supply to the vehicle.

If a new battery is fitted to the vehicle, the battery monitoring system module will require re-calibrating using the Jaguar approved diagnostic system.

Fitted on the battery positive terminal is a transit relay. The transit relay must be removed from the vehicle during the Pre-Delivery Inspection (PDI). For additional information, refer to the PDI Manual.

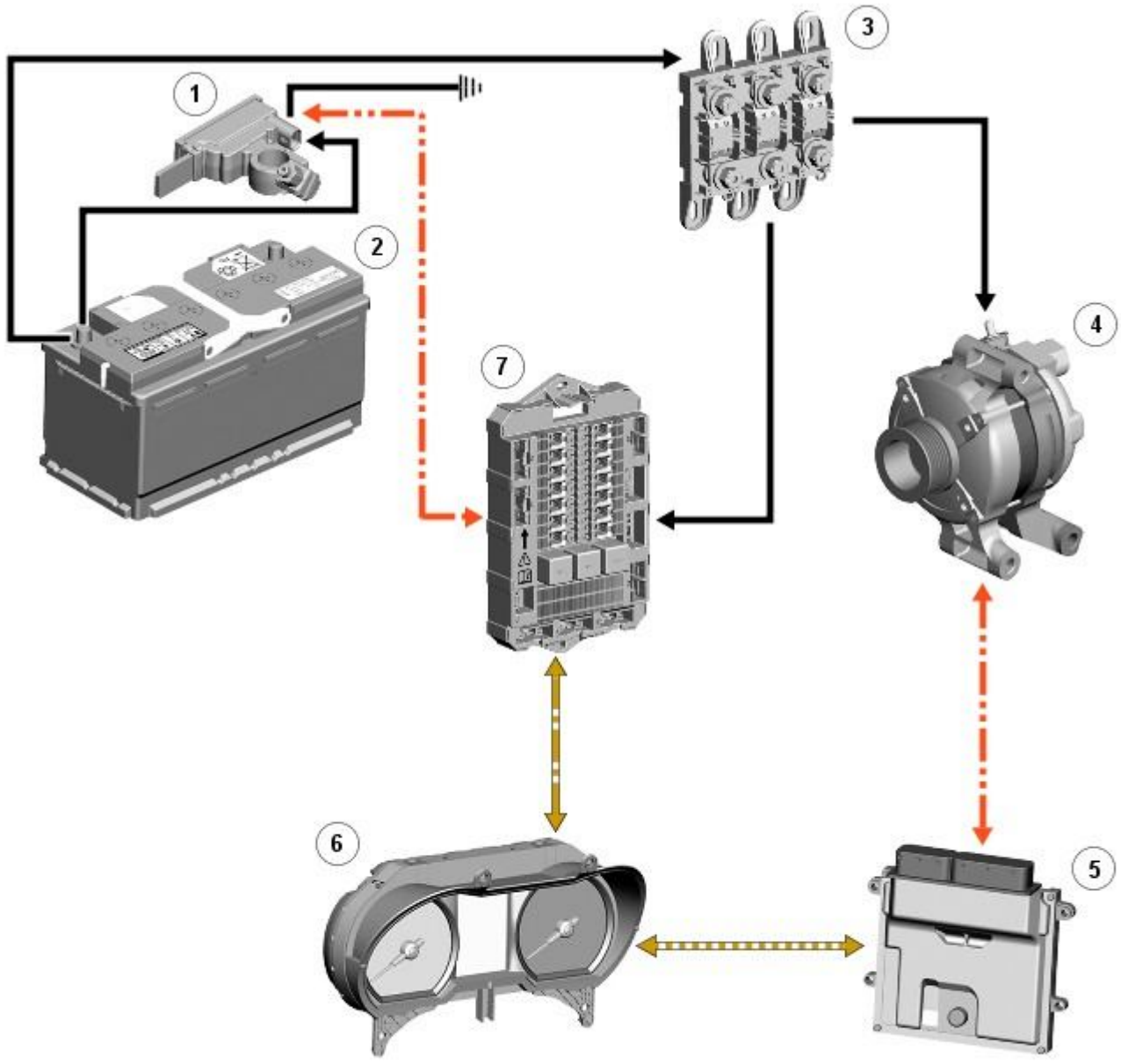
The vehicle battery provides power to the [BJB \(battery junction box\)](#). The [BJB](#) contains 3 megafuses, delivering power to the [RJB \(rear junction box\)](#), the [CJB \(central junction box\)](#) and the [EJB \(engine junction box\)](#). In addition to containing fuses and relays, the [RJB](#) and [RJB](#) contain software to control a number of vehicle systems. These functions are covered in the appropriate sections of this manual.

# Battery, Mounting and Cables - Battery and Cables - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **D** = High speed CAN bus; **N** = Medium speed CAN bus; **O** = LIN bus



E96985



### ItemDescription

1	Battery monitoring system module
2	Battery
3	BJB (battery junction box)
4	Generator/regulator
5	ECM (engine control module)
6	Instrument cluster
7	RJB (rear junction box)

## System Operation

### BATTERY MONITORING SYSTEM

Periodically the battery monitoring system module will instigate a self-calibration routine. To self calibrate, the battery monitoring system first charges the battery to its full condition.

• **NOTE:** If the vehicle is only driven for short periods the charging process could take a number of days to complete.

Once the battery is fully charged, the battery monitoring system will discharge the battery to approximately 75% of its full state of charge, but never lower than 12.2 V. The time taken to complete this part of the routine is dependent on the electrical load on the vehicle.

When the second part of the routine has been successfully completed, the battery monitoring system will return the battery to its optimum level of charge. The optimum level of charge will be between 12.6 V and 15 V, depending on battery condition, temperature and loading.

The battery monitoring system module also monitors the battery condition with the engine switched off. If a low voltage condition is detected the module can request the infotainment system is switched off to protect battery voltage. Once the infotainment system has been switched off, the vehicle must be run for at least 5 minutes to charge the battery before the infotainment system can be operated with the engine switched off.

## Component Description

### BATTERY

The battery is located under the floor in the **RH (right-hand)** side of the luggage compartment.

On new vehicles the battery positive terminal is fitted with a transit relay. The transit relay must be removed using the correct process detailed in the PDI manual.

The battery negative terminal is fitted with a battery monitoring system module. The module is integral with the battery negative cable and communicates with the **RJB** via a **LIN (local interconnect network)** bus connection. The battery condition information is passed to the **ECM** which controls the generator output accordingly.



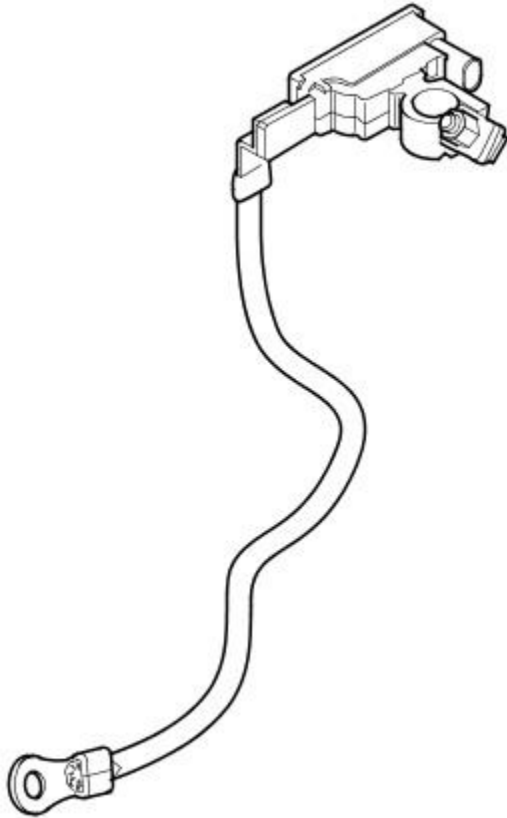
**CAUTION:** To avoid damage to the battery monitoring system module, always use a suitable body ground point rather than the battery negative terminal when connecting a slave power supply. The recommended ground point is the spare wheel securing bracket in the luggage compartment.

Failure to use the recommended ground point will lead to the setting of a **DTC (diagnostic trouble code)**. Incorrect information of battery condition will be retained by the battery monitoring system module due to the unmonitored current flow into the battery. The system will however, recognize and compensate for the change in battery status after a period of time.

If a new battery is fitted, the battery monitoring system module will require re-calibration using a Jaguar approved diagnostic system. Replacement of the battery monitoring system module requires no action as the module will re-calibrate automatically.

### BATTERY MONITORING SYSTEM

Battery Monitoring System Module



E98130

The battery monitoring system module measures battery current and voltage, which it communicates to the [RJB](#) over a [LIN](#) bus connection. The [RJB](#) transmits the battery information to the instrument cluster over the medium speed [CAN](#) ([controller area network](#)) bus. The instrument cluster acts as a gateway between the medium and high speed CAN bus networks, and transmits the battery condition information to the [ECM](#) over the high speed [CAN](#) bus. Based on the information received from the battery monitoring system module, the [ECM](#) will control the output from the generator and request the switching off of electrical loads if necessary. For additional information, refer to: For additional information, refer to:

Generator (414-02A, Description and Operation),  
Generator (414-02B, Description and Operation),  
[Generator](#) (414-02 Generator and Regulator - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).



**CAUTION:** Due to the self-calibration routine, it is recommended that all power supply diagnostic testing is carried out using the Jaguar approved diagnostic system rather than a digital multimeter

The battery monitoring system module is able to generate [DTC](#)'s to help diagnose battery or generator power supply issues. These [DTC](#)'s can be read using the Jaguar approved diagnostic system. The Jaguar approved diagnostic system can also be used to implement a battery and generator self test routine. For additional information, refer to the Diagnosis and Testing section of the workshop manual.

If a fault is detected, the [ECM](#) will override the battery monitoring system module.

The battery monitoring system module [DTC](#)'s can be used to help diagnose battery or generator power supply faults. The [DTC](#)'s are stored in both the [RJB](#) and the [ECM](#). The Jaguar approved diagnostic system has a process for an automated power supply diagnostic procedure. The procedure provides a menu driven process to locate a fault in a logical sequence. The procedure uses the capability of the battery monitoring system and generator [LIN](#) bus controlled functions to provide current flow information and will detect if the battery monitoring system or generator are functioning correctly.

# Battery, Mounting and Cables - Battery

Diagnosis and Testing

## Principles of Operation

For a detailed description of the Battery, Mounting and Cables and charging system, refer to the relevant Description and Operation sections in the Workshop Manual. REFER to:

[Battery and Cables](#) (414-01 Battery, Mounting and Cables, Description and Operation),  
[Battery and Cables](#) (414-01 Battery, Mounting and Cables, Description and Operation),  
[Battery and Cables](#) (414-01 Battery, Mounting and Cables, Description and Operation),  
 Generator (414-02 Generator and Regulator - 2.7L Diesel, Description and Operation),  
 Generator (414-02 Generator and Regulator - 2.7L Diesel, Description and Operation),  
 Generator (414-02 Generator and Regulator - 2.7L Diesel, Description and Operation),  
 Generator (414-02 Generator and Regulator - 3.0L, Description and Operation),  
 Generator (414-02 Generator and Regulator - 3.0L, Description and Operation),  
 Generator (414-02 Generator and Regulator - 3.0L, Description and Operation),  
[Generator](#) (414-02 Generator and Regulator - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation),  
[Generator](#) (414-02 Generator and Regulator - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation),  
[Generator](#) (414-02 Generator and Regulator - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Front End Accessory Drive (FEAD) belt condition/tension</li> <li>● Generator drive pulley</li> </ul>	<ul style="list-style-type: none"> <li>● Electrical connectors/pins</li> <li>● Wiring harnesses</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## Symptom Chart

Symptom	Possible Cause	Action
Battery discharged	<ul style="list-style-type: none"> <li>● Charging/monitoring circuit fault</li> <li>● Battery monitoring system failure</li> <li>● Generator failure</li> <li>● Battery failure</li> <li>● Quiescent current high</li> </ul>	Carry out automated diagnostic routine using manufacturer approved diagnostic system
Generator not charging	<ul style="list-style-type: none"> <li>● Charging/monitoring circuit fault</li> <li>● Generator failure</li> <li>● Pulley loose/failure</li> </ul>	Carry out automated diagnostic routine using manufacturer approved diagnostic system

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

- NOTE: If a module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).
- NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.
- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may

be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B11D949	Vehicle Battery	<ul style="list-style-type: none"> <li>● Internal electronic failure. The battery monitoring module has detected an internal circuit failure</li> <li>● Incorrect battery type or size installed</li> <li>● High quiescent current</li> <li>● A temporary battery state estimation error. The battery state estimation is performed by the battery monitoring system BMS</li> <li>● Battery failure, worn out</li> <li>● Battery damaged</li> </ul>	Check vehicle has correct battery type and size installed. Install new as required. Using manufacturer approved diagnostic system verify vehicle quiescent current draw levels are correct using power supply diagnostic function. Rectify as required. Using the Midtronics battery tester and battery care manual check the battery is serviceable. Install new as required. The BMS will correct a temporary battery state estimation error within a reasonable adaption time. The adaption time is dependant upon the driving time of the vehicle and may take a number of weeks.
B11DB01	Battery Monitoring Module	<ul style="list-style-type: none"> <li>● Battery monitoring system hardware fault</li> </ul>	Disconnect vehicle battery, re-connect after 60 seconds, clear DTC and retest. If DTC remains install a new battery monitoring module
B11DB87	Battery Monitoring Module	<ul style="list-style-type: none"> <li>● Battery monitoring module connector dis-connected/poor connection</li> <li>● Battery monitoring module to RJB LIN circuit - open circuit</li> <li>● Battery monitoring module to battery positive monitor circuit - open circuit</li> <li>● Battery monitoring module/RJB failure</li> </ul>	If additional DTCs B108783, B108786, B108787 are logged, suspect the RJB. Check and install a new RJB as required, refer to the new module/component installation note at the top of the DTC Index. If additional DTCs B108783, B108786, B108787 are NOT logged, check for good/clean contact at battery monitoring module connector, refer to electrical circuit diagrams and check battery monitoring module to RJB LIN circuit and battery monitoring module to battery positive monitor circuit for open circuit. Clear DTC and repeat automated diagnostic procedure using manufacturer approved diagnostic system. If DTC remains suspect the battery monitoring module, check and install a new battery monitoring module as required, refer to the new module/component installation note at the top of the DTC Index
P062001	Generator Control Circuit	<ul style="list-style-type: none"> <li>● Generator B+ or battery terminal disconnected/poor connection</li> <li>● Charging circuit - short, open circuit</li> <li>● Generator failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for good/clean contact at generator B+ and battery terminal connectors. Refer to the electrical circuit diagrams and check charging circuit for short, open circuit. Clear DTC and repeat automated diagnostic procedure using the manufacturer approved diagnostic system. If DTC remains suspect the generator, check and install a new generator as required, refer to the new module/component installation note at the top of the DTC Index
P065B16	Generator Control Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Charging circuit - short, open circuit</li> <li>● Quiescent current high</li> <li>● Battery damaged/worn out</li> <li>● Generator failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check charging circuit for short, open circuit. Clear DTC and repeat automated diagnostic procedure using the manufacturer approved diagnostic system. If DTC remains check battery is in fully charged and serviceable condition using the Midtronics battery tester and battery care manual. If ok suspect the generator, check and install a new generator as required, refer to the new module/component installation note at the top of the DTC Index
P065B17	Generator Control Circuit Range/Performance	<ul style="list-style-type: none"> <li>● Charging circuit - short, open circuit</li> <li>● Generator/ECM failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check ECM for over charging related DTCs and refer to the relevant DTC Index. Clear DTC and re-test, if DTC remains suspect the generator. Check and install a new generator as required, refer to the new module/component installation note at the top of the DTC Index
P065C00	Generator Mechanical Performance	<ul style="list-style-type: none"> <li>● Poor FEAD belt tension</li> <li>● Generator pulley loose/failure</li> <li>● Generator failure</li> </ul>	Check FEAD belt condition/contamination and for correct tension. Check generator pulley for failure. Clear DTC and repeat automated diagnostic procedure using manufacturer approved diagnostic system. If DTC remains check and install a new generator as required, refer to the new module/component installation note at the top of the DTC Index
POA1A87	Generator Control Module	<ul style="list-style-type: none"> <li>● Generator to ECM LIN circuit - open circuit</li> <li>● Generator/ECM failure</li> </ul>	Check for good/clean contact at generator and ECM LIN circuit connectors/pins. Refer to the electrical circuit diagrams and check generator to ECM LIN circuit for open circuit. Check for ECM hardware DTCs and refer to relevant DTC Index. Clear DTCs and repeat automated diagnostic procedure using the manufacturer approved diagnostic system. If DTC remains check and install a new generator/ECM as required, refer to the new module/component installation note at the top of the DTC Index



<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
P0A3B68	Generator Over Temperature	<ul style="list-style-type: none"><li>● Generator wiring/connectors heat damaged</li><li>● Generator failure</li></ul>	Check the generator wiring and connectors for heat damage. Clear the DTC and repeat the automated diagnostic procedure using the manufacturer approved diagnostic system. If DTC remains check and install a new generator as required, refer to the new module/component installation note at the top of the DTC Index

# Battery, Mounting and Cables - Battery Disconnect and Connect

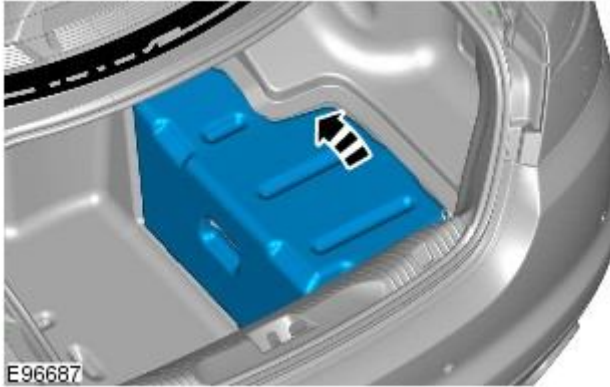
General Procedures

## Disconnect

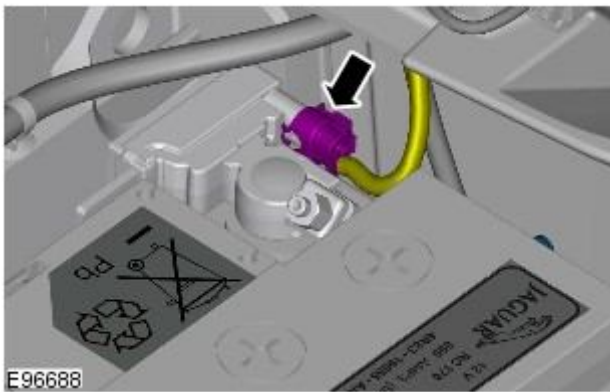


**WARNING:** Refer to: [Battery and Battery Charging Health and Safety Precautions](#) (100-00 General Information, Description and Operation).

1. Obtain and record the audio unit preset radio frequencies.



2. **NOTE:** Where fitted.

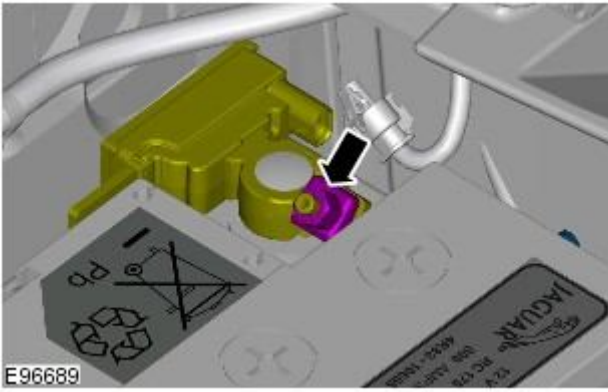


3. **CAUTION:** Take extra care not to damage the wiring harness.

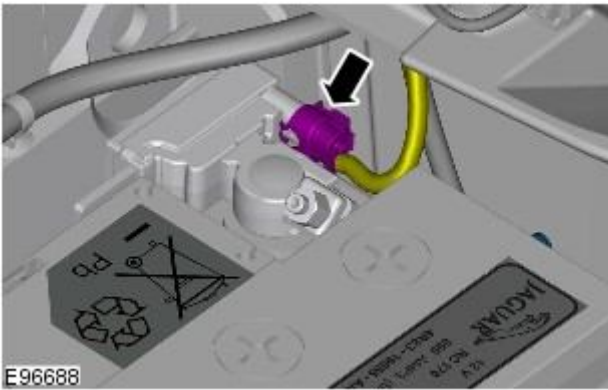


- 4.

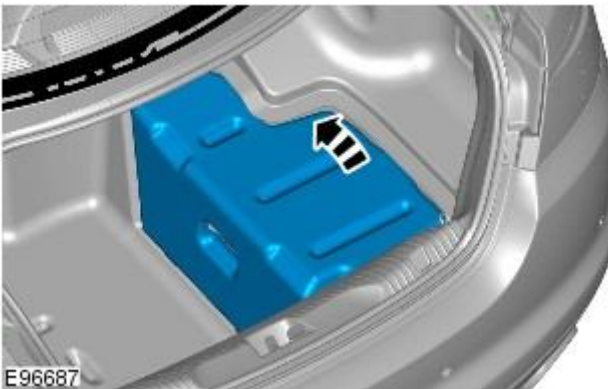
## Connect



1. Torque: 6 Nm



2.



3. **3.** NOTE: Where fitted.

4. **4.** NOTE: This step is only necessary when installing a new component.

Using the Jaguar approved diagnostic equipment, reset the battery monitoring system.

5. Refer to: [Door Window Motor Initialization](#) (501-11 Glass, Frames and Mechanisms, General Procedures).

6. Enter the audio unit preset radio frequencies.

7. Reset the clock to the correct time.

8. Start the engine and allow to idle until the engine reaches normal operating temperature.

9. Switch the engine off.

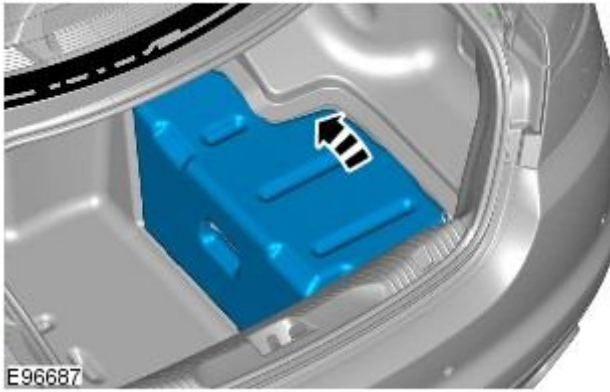
# Battery, Mounting and Cables - Battery

Removal and Installation

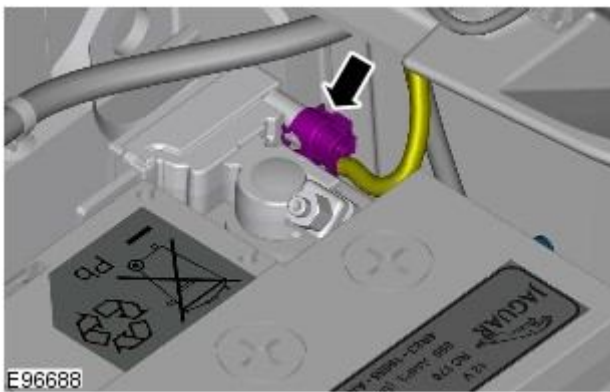
## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Obtain and record the audio unit preset radio frequencies.



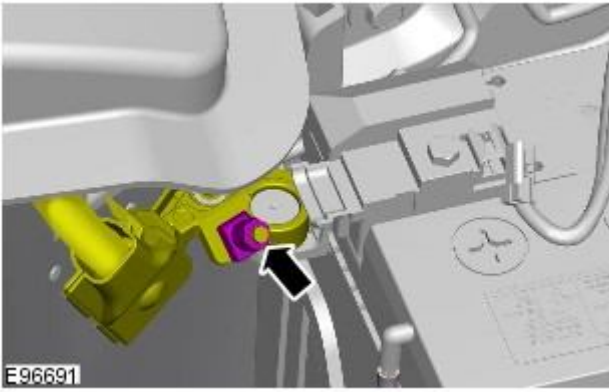
2. **NOTE:** Where fitted.



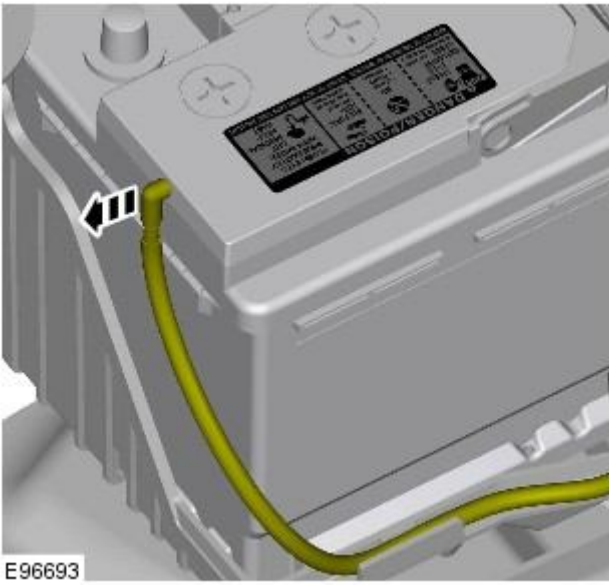
3.



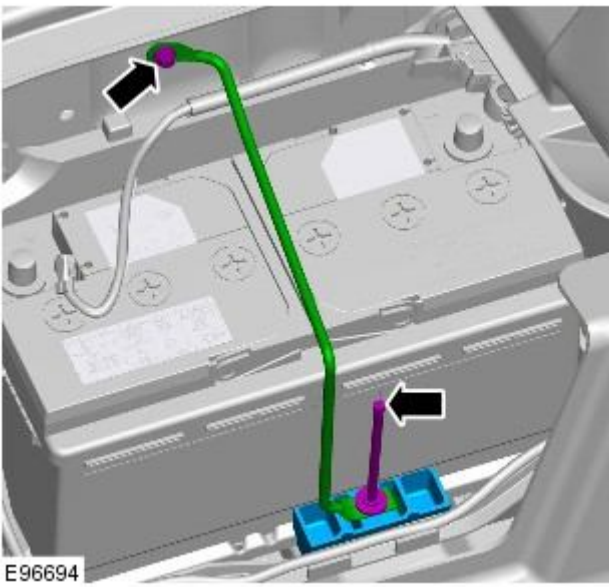
4. Torque: 6 Nm



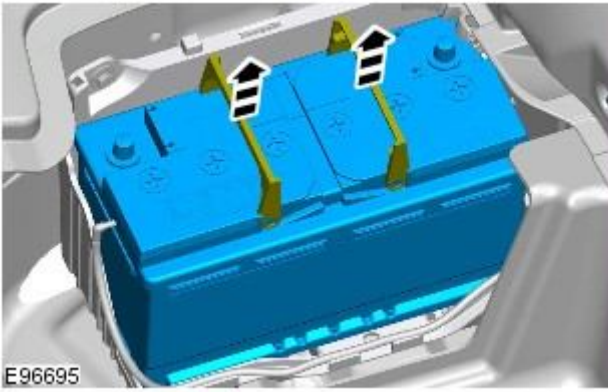
5. Torque: 6 Nm



6.



7. Torque: 13 Nm



8.

## Installation

1. To install, reverse the removal procedure.
2. **NOTE:** This step is only necessary when installing a new component.  
Using the Jaguar approved diagnostic equipment, reset the battery monitoring system.
3. Refer to: [Door Window Motor Initialization](#) (501-11 Glass, Frames and Mechanisms, General Procedures).
4. Enter the audio unit preset radio frequencies.
5. Reset the clock to the correct time.
6. Start the engine and allow to idle until the engine reaches normal operating temperature.
7. Switch the engine off.

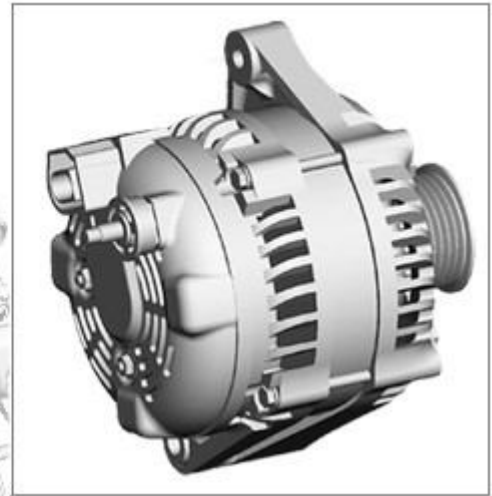
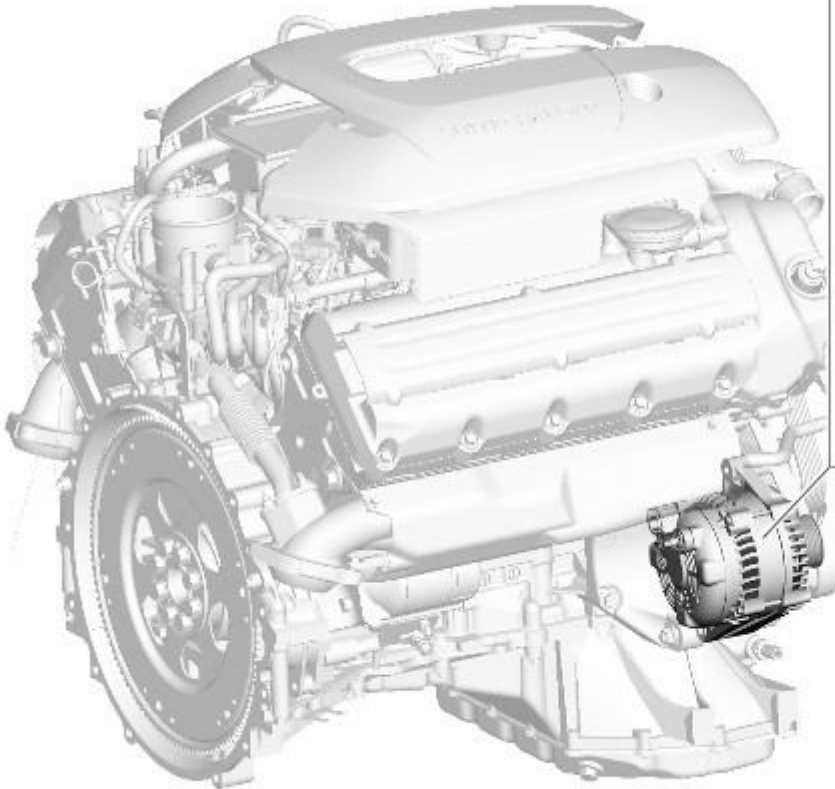


## Generator and Regulator - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Generator - Component Location

Description and Operation

- NOTE: Generator on vehicles with supercharger shown, generator on vehicles without supercharger is the same.

Component Location



E93663

## **Generator and Regulator - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Generator - Overview**

Description and Operation

### **Overview**

On 4.2L vehicles (naturally aspirated and supercharged), the charging system consists of a 130 A output generator and regulator assembly. The generator and regulator assembly generates electrical power for the vehicle electrical system and maintains the battery in a charged state.

When the engine is running the generator produces an alternating current, which is converted to a direct current internally. The output from the generator is controlled by the voltage regulator (located inside the generator) and then supplied to the battery through the main battery positive cable.

The generator is mounted on the front right side of the engine and driven at approximately 3 times engine speed by the accessory drive belt.

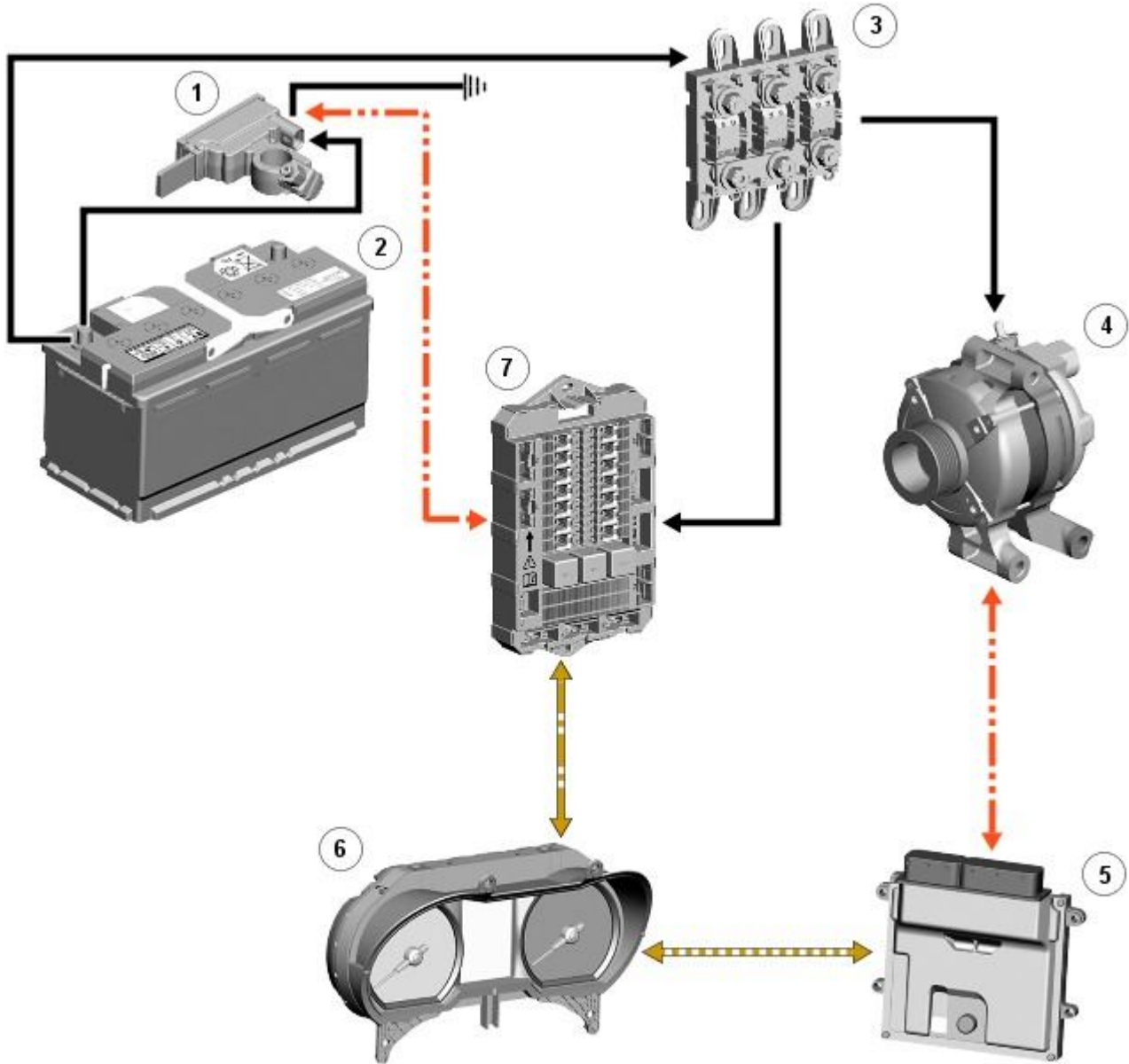
Refer to: Accessory Drive (303-05C, Description and Operation).

# Generator and Regulator - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Generator - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **D** = High speed CAN (controller area network) bus; **N** = Medium speed CAN bus; **O** = LIN (local interconnect network) bus.



E96985



### ItemDescription

1	Battery monitoring system module
2	Battery
3	BJB (battery junction box)
4	Generator and regulator
5	ECM (engine control module)
6	Instrument cluster
7	RJB (rear junction box)

## System Operation

### General

The output voltage required from the generator and regulator is calculated by the battery monitoring system. Refer to: [Battery and Cables](#) (414-01 Battery, Mounting and Cables, Description and Operation).

The battery monitoring system signals the calculated voltage to the [ECM](#) via the [RJB](#) and the instrument cluster. The [ECM](#) then transmits the calculated voltage to the generator and regulator on the [LIN](#) bus connection.

The [ECM](#) will over-ride the voltage value requested by the battery monitoring system if it detects a fault in the generator and regulator. The [ECM](#) also signals the instrument cluster to display a warning message if it detects a fault with the generator and regulator. Refer to: [Instrument Cluster](#) (413-01 Instrument Cluster, Description and Operation).

## Component Description

### Generator and Regulator

The regulator provides a controlled variable voltage output from the generator. Two electrical terminals are provided on the outer casing of the generator. One terminal supplies the [DC \(direct current\)](#) voltage output from the generator to the battery positive terminal. The second terminal provides the [LIN](#) bus connection between the regulator and the [ECM](#).

# **Generator and Regulator - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Generator**

Diagnosis and Testing

For additional information.

REFER to: [Battery](#) (414-01 Battery, Mounting and Cables, Diagnosis and Testing).


# Generator and Regulator - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Generator 4.2L NA V8 - AJV8

Removal and Installation

Special Tool(s)	
 303-703 E95037	Accessory belt tensioner 303-703

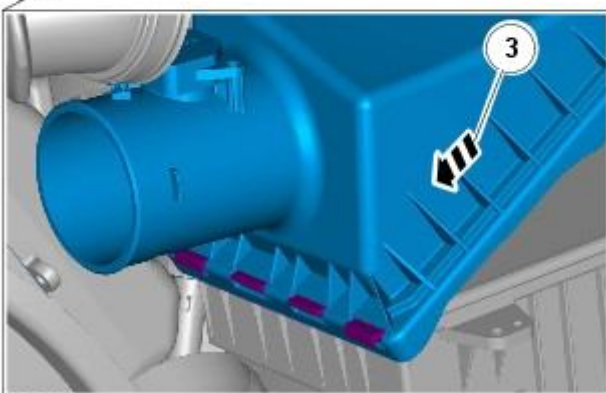
## Removal

1. Disconnect the battery ground cable.
2. Remove the engine cover.  
For additional information, refer to: [Engine Cover - 4.2L NA V8 - AJV8](#) (501-05 Interior Trim and Ornammentation, Removal and Installation).

3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

4. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02, Removal and Installation).
5. Remove the air cleaner outlet pipe.
6. Remove the air cleaner housing cover.

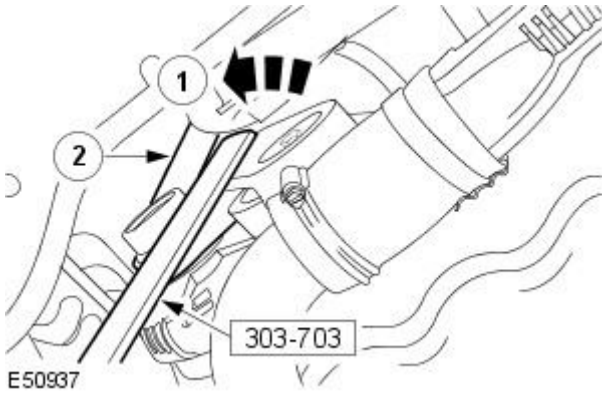


E96195

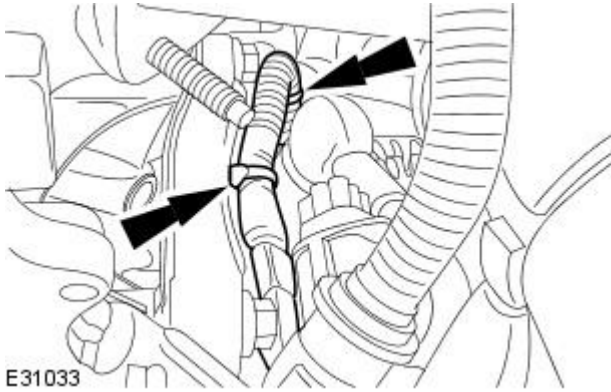


7. Release the accessory drive belt.

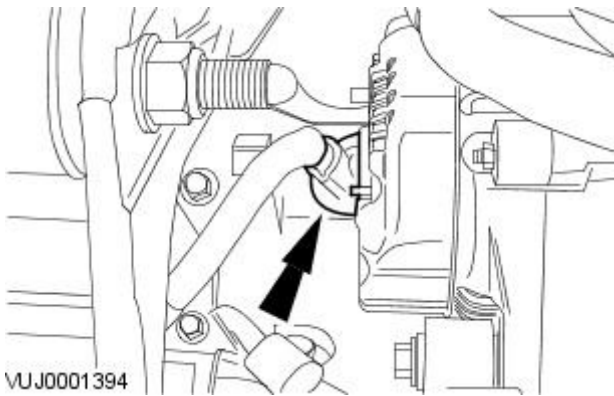
- Using the special tool 303-703, rotate the accessory drive belt tensioner counter-clockwise.



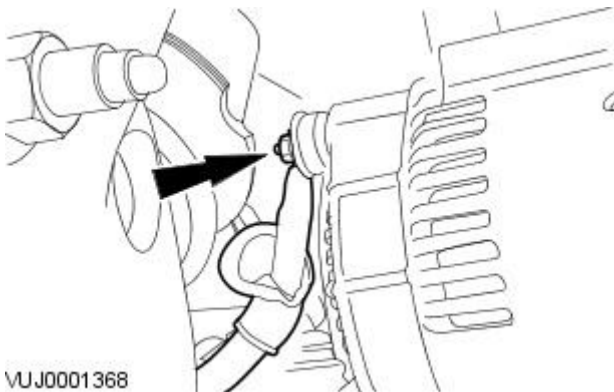
8. Detach the wiring harness.



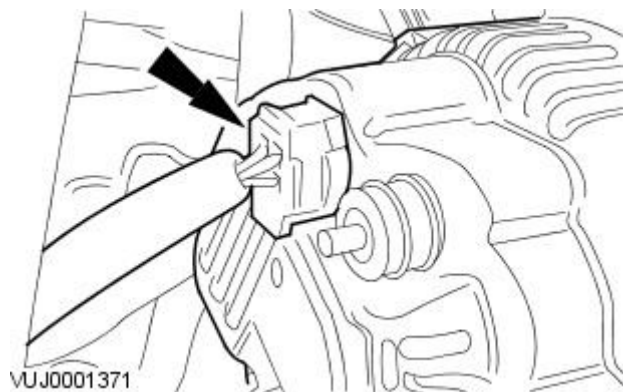
9. Release the battery positive cable protective cover.



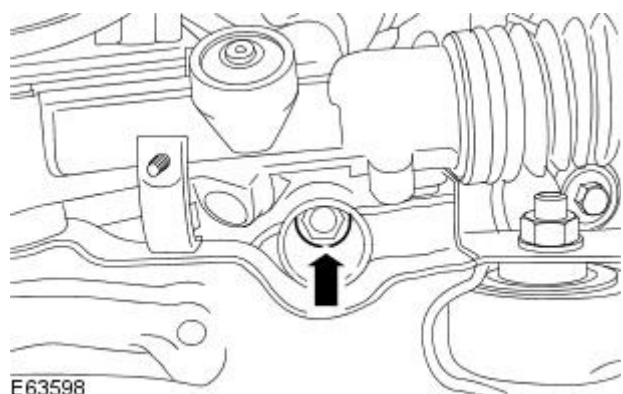
10. Disconnect the battery positive cable from the generator.



11. Disconnect the generator electrical connector.

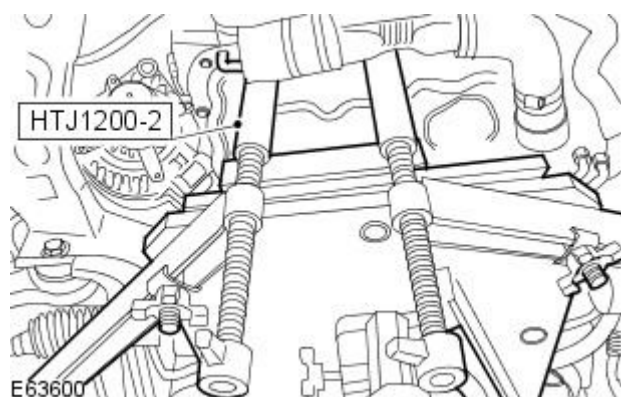


12. Remove the right-hand engine mounting retaining nut.

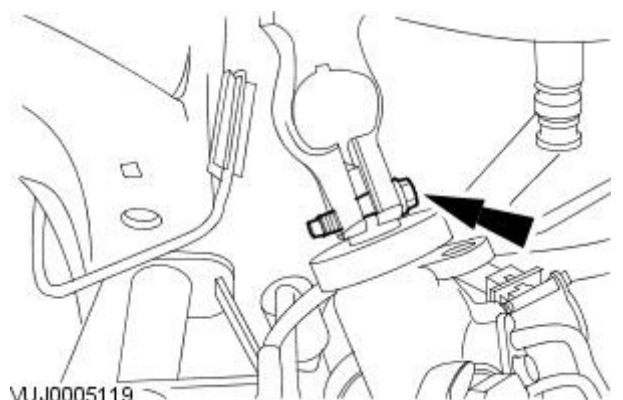


13. Using a suitable hydraulic jack, raise and support the engine.

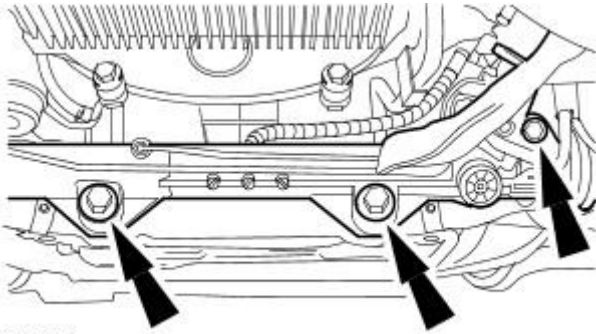
- Make sure the engine mounting is raised no more than 25 mm (0.984 ").



14. Remove the steering gear shaft pinch bolt.

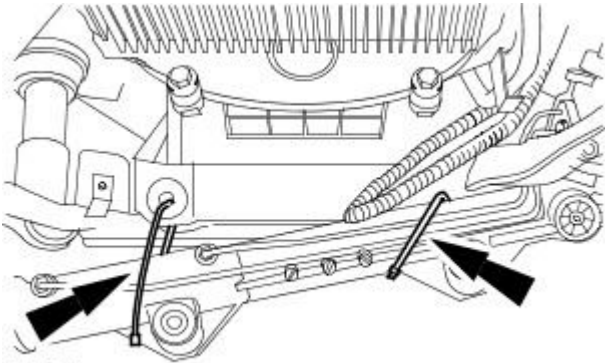


15. Remove the retaining bolts.



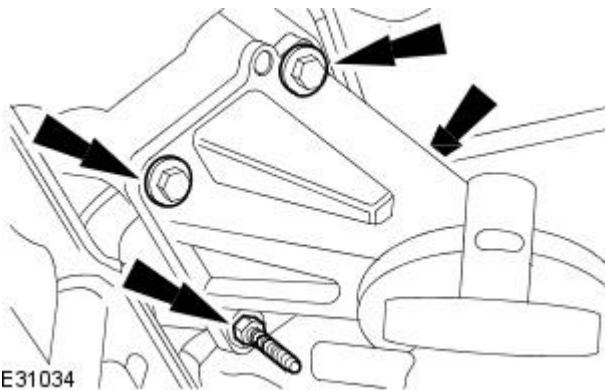
E31036

16. Support and release the power steering rack.



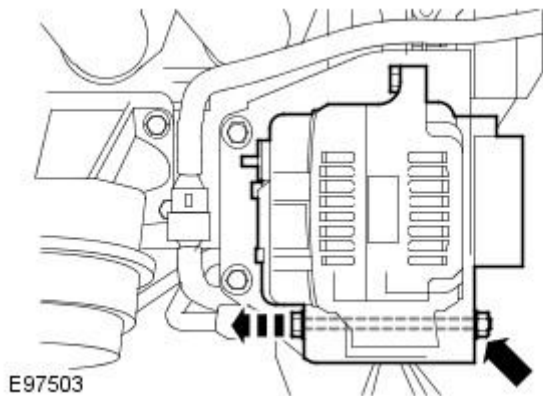
E 31035

17. Remove the engine mounting and bracket assembly.



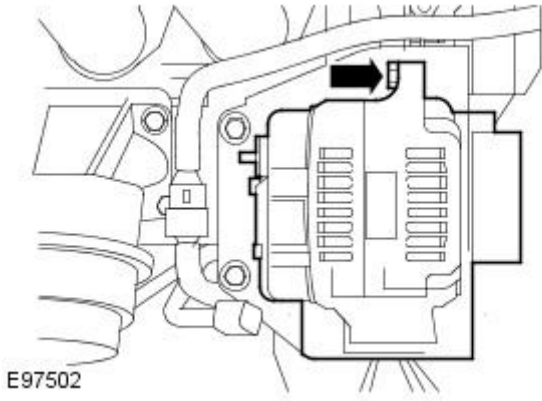
E31034

18. Remove the nut and bolt.



E97503

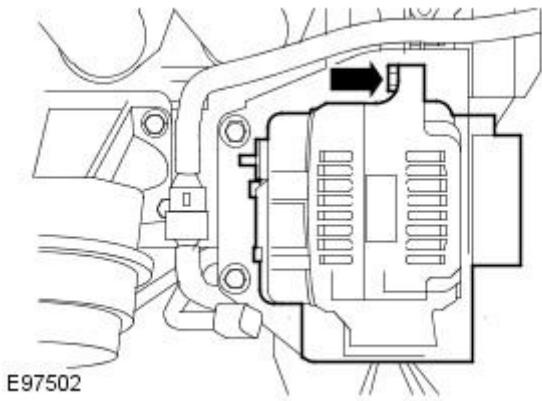
19. Remove the generator.



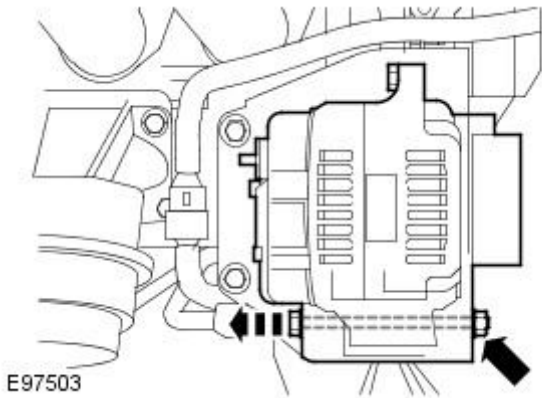
### Installation

1. To install, reverse the removal procedure.

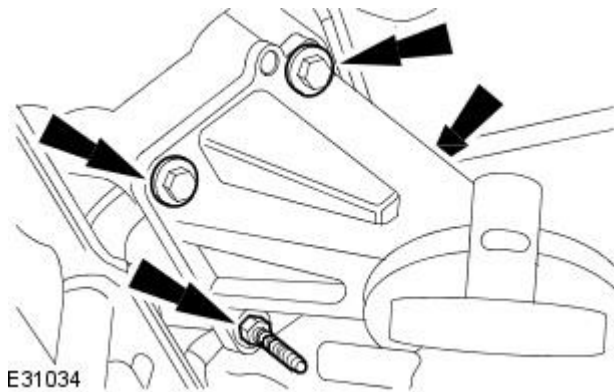
- Tighten to 21 Nm.



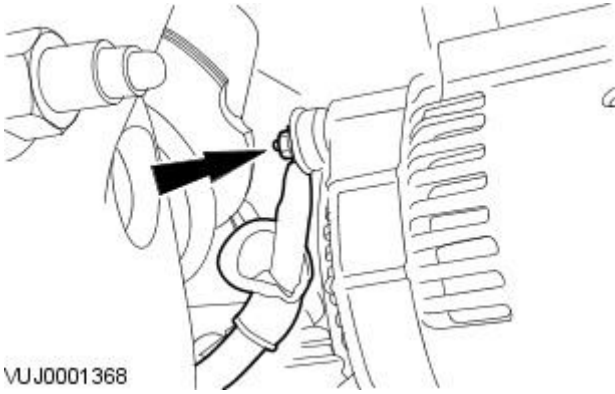
2. Tighten to 40 Nm.



3. Tighten to 25 Nm.

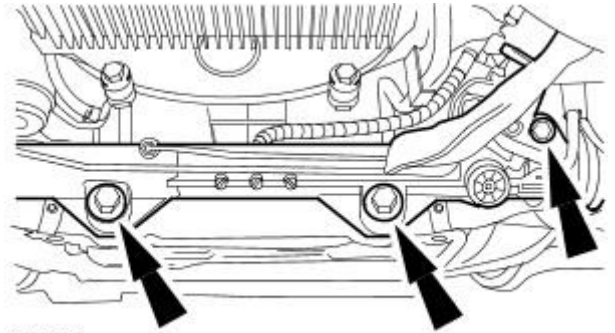


4. Tighten to 12 Nm.



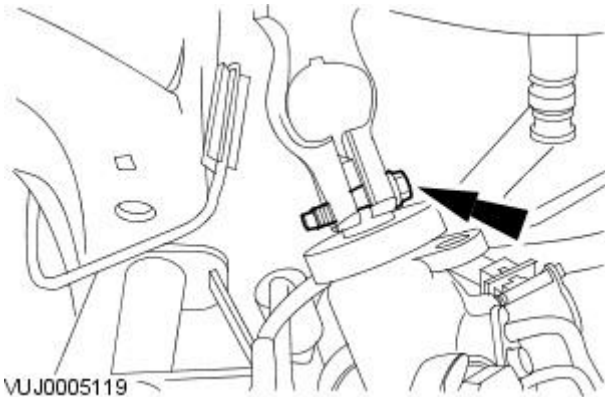
VUJ0001368

5. Tighten to 100 Nm.



E31036

6. Tighten to 35 Nm.




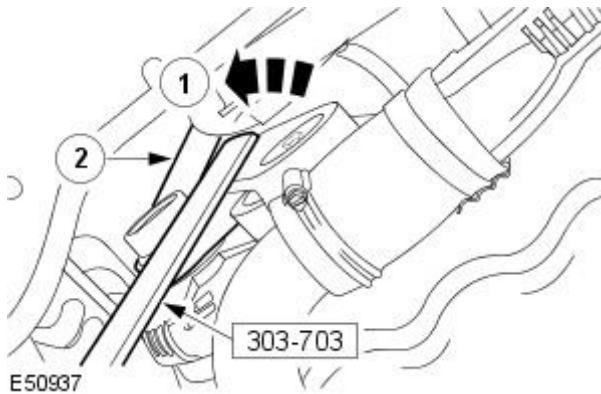
VUJ0005119

# Generator and Regulator - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 - Generator 4.2L SC V8 - AJV8

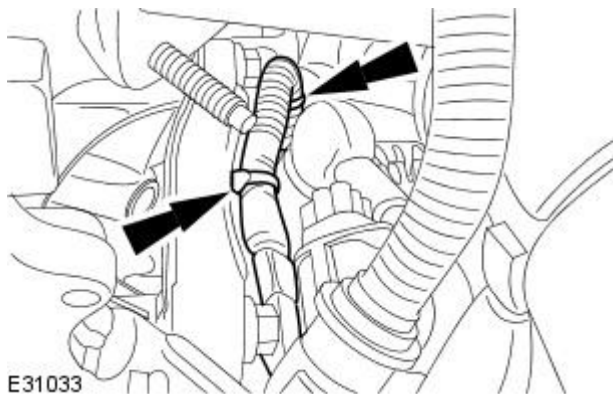
Removal and Installation

## Removal

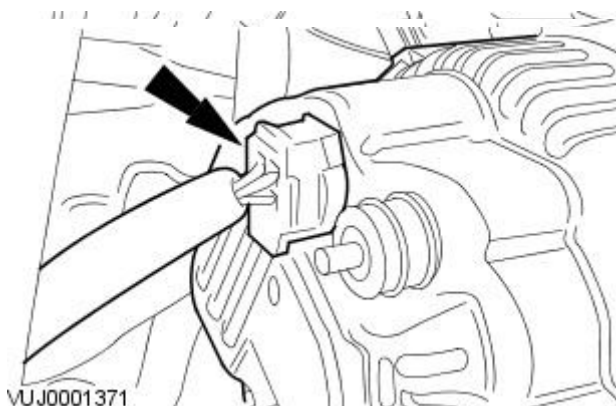
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the air deflector.  
For additional information, refer to: Air Deflector (501-02, Removal and Installation).
4. Remove the air cleaner outlet pipe.  
For additional information, refer to: Air Cleaner Outlet Pipe (303-12, Removal and Installation).
5. Remove the supercharger belt.  
For additional information, refer to: [Supercharger Belt](#) (303-05B Accessory Drive - 4.2L SC V8 - AJV8, Removal and Installation).
6. Release the accessory drive belt.
  - Using the special tool, rotate the accessory drive belt tensioner counter-clockwise.



7. Detach the wiring harness.

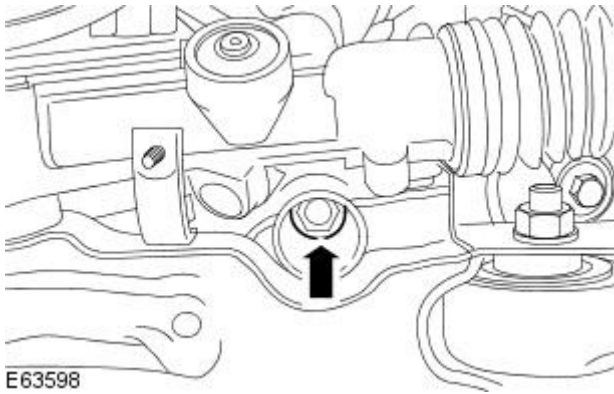


8. Release the battery positive cable protective cover.
9. Disconnect the battery positive cable from the generator.
10. Disconnect the generator electrical connector.



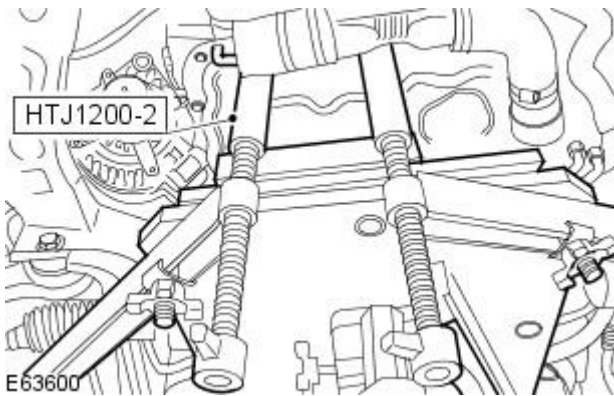


11. Remove the right-hand engine mounting retaining nut.

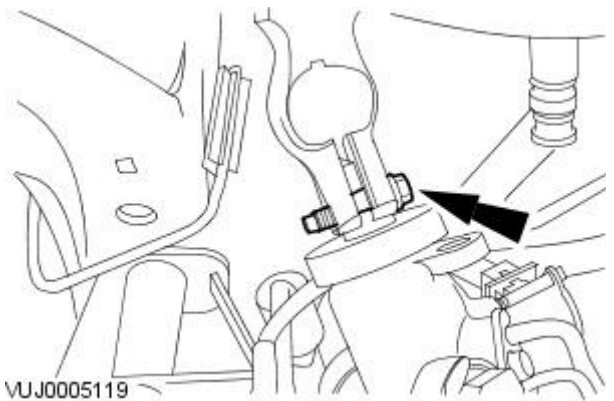


12. Using a suitable hydraulic jack, raise and support the engine.

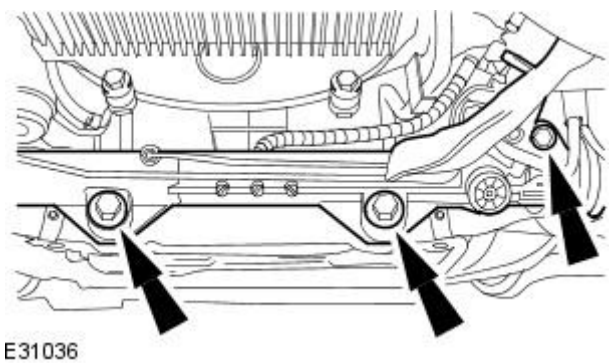
- Make sure the engine mounting is raised no more than 25 mm (0.984 ").



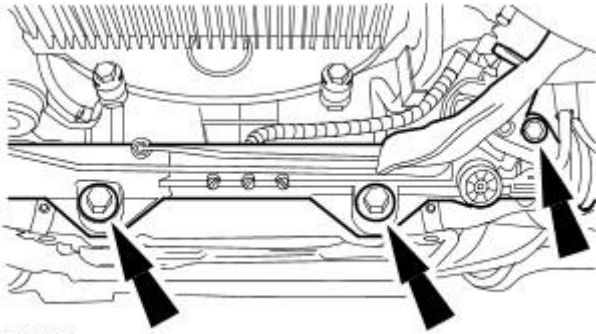
13. Remove the steering gear shaft pinch bolt.



14. Remove the retaining bolts.

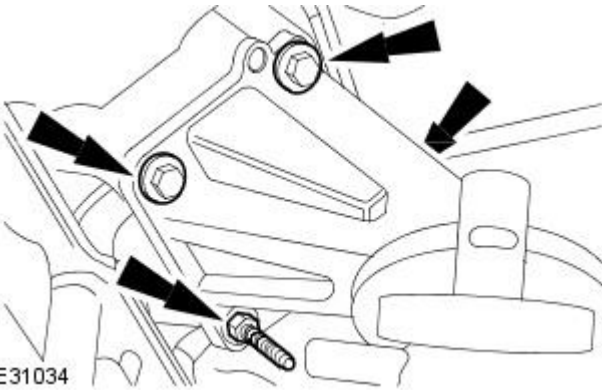


15. Release the steering gear.



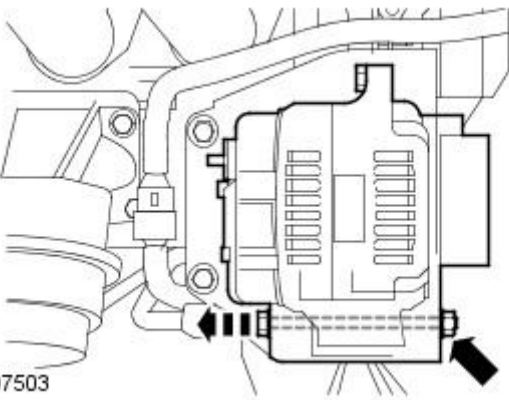
E31036

16. Remove the engine mounting and bracket assembly.



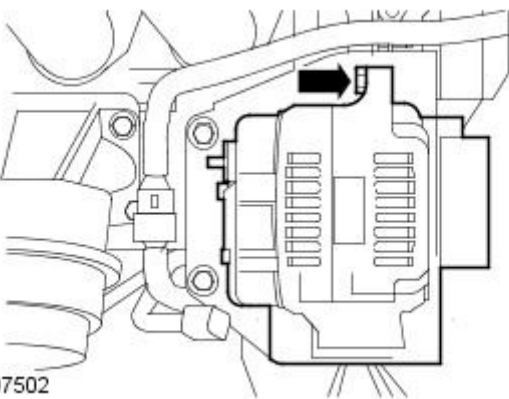
E31034

17. Remove the nut and bolt.



E97503

18. Remove the generator.



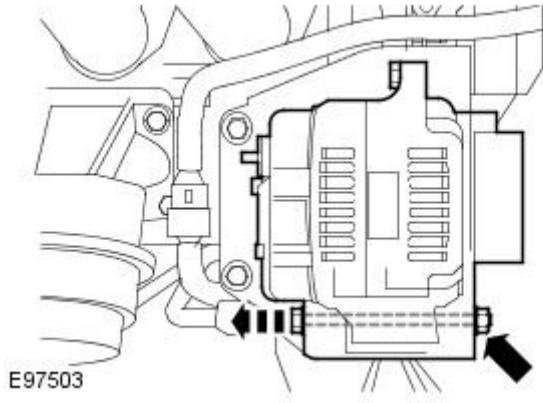
E97502

## Installation

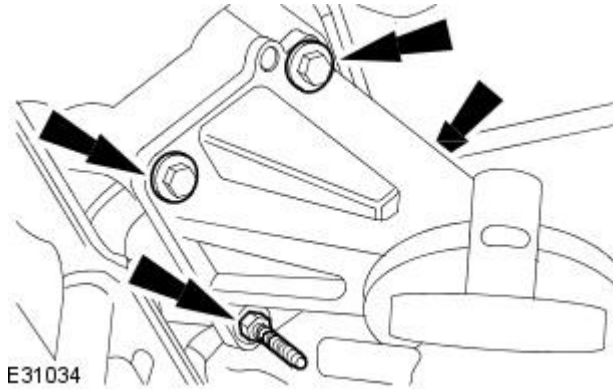
1. To install, reverse the removal procedure.

- Tighten to 21 Nm.

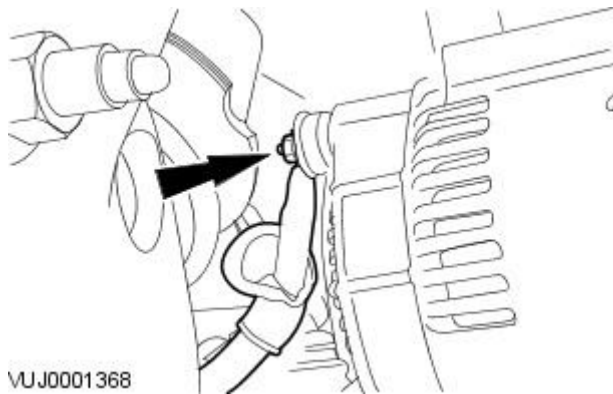
2. Tighten to 40 Nm.



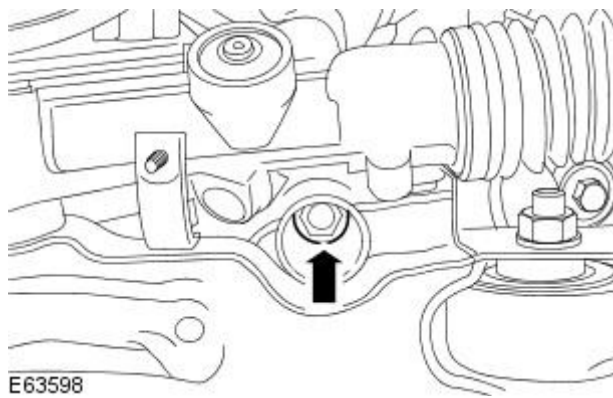
3. Tighten to 25 Nm.



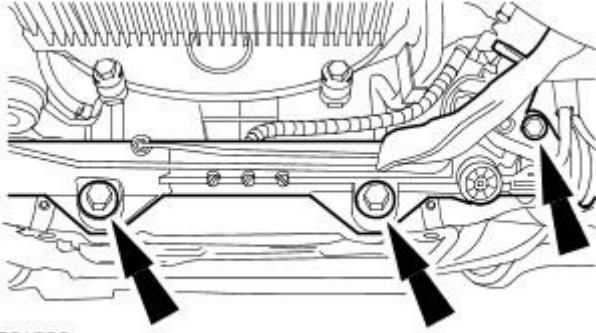
4. Tighten to 12 Nm.



5. Tighten to 63 Nm.

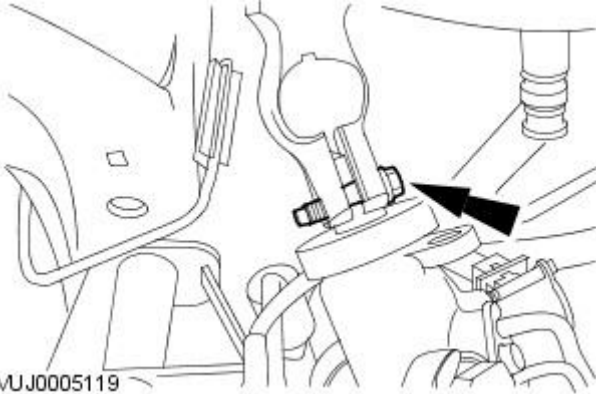


6. Tighten to 100 Nm.



E31036

7. Tighten to 35 Nm.



VUJ0005119

# Information and Entertainment System - General Information - Information and Entertainment System

Diagnosis and Testing

## Principle of Operation

For a detailed description of the Information and Entertainment System, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (415-01 Information and Entertainment System)

[Audio System](#) (Description and Operation),  
[Audio System](#) (Description and Operation),  
[Audio System](#) (Description and Operation),  
[Speakers](#) (Description and Operation),  
[Speakers](#) (Description and Operation),  
[Speakers](#) (Description and Operation),  
[Video System](#) (Description and Operation),  
[Video System](#) (Description and Operation),  
[Video System](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Information and entertainment module</li> <li>● Audio amplifier module</li> <li>● Integrated audio module</li> <li>● Portable audio interface module</li> <li>● Digital audio broadcast module</li> <li>● Integrated control panel</li> <li>● Touch screen display</li> <li>● Satellite radio module</li> <li>● Television module</li> <li>● Navigation system module</li> <li>● Telephone module</li> <li>● Compact disc player jammed, not loading</li> <li>● Scratched/dirty compact discs</li> <li>● Speakers</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Loose or corroded connector(s)</li> <li>● Information and entertainment module</li> <li>● Audio amplifier module</li> <li>● Integrated audio module</li> <li>● Portable audio interface module</li> <li>● Digital audio broadcast module</li> <li>● Integrated control panel</li> <li>● Touch screen display</li> <li>● Satellite radio module</li> <li>● Television module</li> <li>● Navigation system module</li> <li>● Telephone module</li> <li>● Speakers</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

## DTC Index

### Information and Entertainment Module



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

- NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).
- NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.
- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1A5949	Sensor 5 Volt Supply	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Suspect the information and entertainment module.

DTC	Description	Possible Cause	Action
			Check and install a new information and entertainment control module as required, refer to the new module/component installation note at the top of the DTC Index
U001000	Medium Speed CAN Communication Bus	<ul style="list-style-type: none"> <li>● General failure. No sub type information</li> </ul>	Clear DTC and re-test, if DTC remains check CAN network and harness integrity
U01564A	Lost Communication With Information Center "A"	<ul style="list-style-type: none"> <li>● Incorrect node installed</li> </ul>	Suspect incorrect instrument cluster installed, check and install correct/new instrument cluster as required, refer to the new module/component installation note at the top of the DTC Index
U015900	Lost Communication With Parking Assist Control Module "A"	<ul style="list-style-type: none"> <li>● General failure. No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check parking aid module for related DTCs and refer to the relevant DTC Index
U016300	Lost Communication With Navigation Control Module	<ul style="list-style-type: none"> <li>● General failure. No sub type information</li> </ul>	Check navigation module for related DTCs and refer to the relevant DTC Index
U01634A	Lost Communication With Navigation Control Module	<ul style="list-style-type: none"> <li>● Incorrect node installed</li> </ul>	Suspect incorrect navigation module installed, check and install correct/new module as required, refer to the new module/component installation note at the top of the DTC Index
U018400	Lost Communication With Radio	<ul style="list-style-type: none"> <li>● General failure. No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check integrated audio module for related DTCs and refer to the relevant DTC Index
U01844A	Lost Communication With Radio	<ul style="list-style-type: none"> <li>● Incorrect node installed</li> </ul>	Suspect incorrect integrated audio module installed, check and install correct/new module as required, refer to the new module/component installation note at the top of the DTC Index
U018600	Lost Communication with Audio Amplifier "A"	<ul style="list-style-type: none"> <li>● General failure. No sub type information</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Check audio amplifier for related DTCs and refer to the relevant DTC Index
U01864A	Lost Communication with Audio Amplifier "A"	<ul style="list-style-type: none"> <li>● Incorrect node installed</li> </ul>	Suspect incorrect audio amplifier installed, check and install correct/new audio amplifier as required, refer to the new module/component installation note at the top of the DTC Index
U019100	Lost Communication With Television	<ul style="list-style-type: none"> <li>● General failure. No sub type information</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Check television tuner for related DTCs and refer to the relevant DTC Index
U01914A	Lost Communication With Television	<ul style="list-style-type: none"> <li>● Incorrect node installed</li> </ul>	Suspect incorrect television tuner module installed, check and install correct/new module as required, refer to the new module/component installation note at the top of the DTC Index
U019300	Lost Communication With "Digital Audio Control Module A"	<ul style="list-style-type: none"> <li>● General failure. No sub type information</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Check SDARS module for related DTCs and refer to the relevant DTC Index
U01934A	Lost Communication With "Digital Audio Control Module A"	<ul style="list-style-type: none"> <li>● Incorrect node installed</li> </ul>	Suspect incorrect DAB/SDARS module installed, check and install correct/new module as required, refer to the new module/component installation note at the top of the DTC Index
U019700	Lost Communication With Telephone Control Module	<ul style="list-style-type: none"> <li>● General failure. No sub type information</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Check telephone module for related DTCs and refer to the relevant DTC Index
U01974A	Lost Communication With Telephone Control Module	<ul style="list-style-type: none"> <li>● Incorrect node installed</li> </ul>	Suspect incorrect telephone module installed, check and install correct/new module as required, refer to the new module/component installation note at the top of the DTC Index
U025700	Lost Communication With Front Controls/Display Interface Module	<ul style="list-style-type: none"> <li>● General failure. No sub type information</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Check touch screen display for related DTCs and refer to the relevant DTC Index
U02574A	Lost Communication With Front Controls/Display Interface Module	<ul style="list-style-type: none"> <li>● Incorrect node installed</li> </ul>	Suspect incorrect touch screen display installed, check and install correct/new touch screen display as required, refer to the new module/component installation note at the top of the DTC Index
U030051	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>● System programme failure. Not programmed</li> </ul>	Re-configure the information and entertainment module using the manufacturer approved diagnostic system
U1A1587	Incomplete MOST Ring Reported By ICM	<ul style="list-style-type: none"> <li>● Missing message</li> </ul>	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U1A2400	MOST Ring Complete No Communication	<ul style="list-style-type: none"> <li>● General failure. No sub type information</li> </ul>	Carry out MOST network integrity tests, using the manufacturer approved diagnostic system. Alternatively refer to the MOST network pinpoint tests. REFER to: <a href="#">Communications Network</a> (418-00 Module Communications Network, Diagnosis and Testing).



DTC	Description	Possible Cause	Action
U210100	Control Module Configuration Incompatible	<ul style="list-style-type: none"> <li>General failure. No sub type information</li> </ul>	Re-configure the information and entertainment module using the manufacturer approved diagnostic system, clear DTC and re-test. If DTC remains, check and amend the Car Configuration File using the manufacturer approved diagnostic system
U300055	Control Module	<ul style="list-style-type: none"> <li>Not configured</li> </ul>	Re-configure the information and entertainment module using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the information and entertainment module, refer to the new module/component installation note at the top of the DTC Index
U300087	Control Module	<ul style="list-style-type: none"> <li>Missing message</li> </ul>	Clear DTC and re-test, if DTC remains check the RJB for related DTCs and refer to the relevant DTC Index
U300281	Vehicle Identification Number	<ul style="list-style-type: none"> <li>Vehicle/component mis-match. Corrupt VIN data being transmitted, suspect module previously installed to other vehicle</li> </ul>	Check and install original/new information and entertainment module as required, refer to the new module/component installation note at the top of the DTC Index

## Audio Amplifier Module



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• **NOTE:** If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• **NOTE:** Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• **NOTE:** When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• **NOTE:** If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1A0111	Speaker #1	<ul style="list-style-type: none"> <li>Front left tweeter or mid-range speaker circuit - short to ground</li> </ul>	Refer to electrical circuit diagrams and check front left tweeter speaker circuit for short to ground
B1A0112	Speaker #1	<ul style="list-style-type: none"> <li>Front left tweeter or mid-range speaker circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and check front left tweeter speaker circuit for short to power
B1A0113	Speaker #1	<ul style="list-style-type: none"> <li>Front left tweeter or mid-range speaker circuit - open circuit</li> </ul>	Refer to electrical circuit diagrams and check front left tweeter speaker circuit for open circuit
B1A011A	Speaker #1	<ul style="list-style-type: none"> <li>Front left tweeter or mid-range speaker circuit - resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A0149	Speaker #1	<ul style="list-style-type: none"> <li>Internal electronic failure</li> </ul>	Suspect the audio amplifier module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B1A0211	Speaker #2	<ul style="list-style-type: none"> <li>Front right tweeter or mid-range speaker circuit - short to ground</li> </ul>	Refer to electrical circuit diagrams and check front right tweeter speaker circuit for short to ground
B1A0212	Speaker #2	<ul style="list-style-type: none"> <li>Front right tweeter or mid-range speaker circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and check front right tweeter speaker circuit for short to power
B1A0213	Speaker #2	<ul style="list-style-type: none"> <li>Front right tweeter or mid-range speaker circuit - open circuit</li> </ul>	Refer to electrical circuit diagrams and check front right tweeter speaker circuit for open circuit
B1A021A	Speaker #2	<ul style="list-style-type: none"> <li>Front right tweeter or mid-range speaker circuit - resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
B1A0249	Speaker #2	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Suspect the audio amplifier module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B1A0311	Speaker #3	<ul style="list-style-type: none"> <li>● Front left woofer speaker circuit - short to ground</li> </ul>	Refer to electrical circuit diagrams and check front left woofer speaker circuit for short to ground
B1A0312	Speaker #3	<ul style="list-style-type: none"> <li>● Front left woofer speaker circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and check front left woofer speaker circuit for short to power
B1A0313	Speaker #3	<ul style="list-style-type: none"> <li>● Front left woofer speaker circuit - open circuit</li> </ul>	Refer to electrical circuit diagrams and check front left woofer speaker circuit for open circuit
B1A031A	Speaker #3	<ul style="list-style-type: none"> <li>● Front left woofer speaker circuit - resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A0349	Speaker #3	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Suspect the audio amplifier module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B1A0411	Speaker #4	<ul style="list-style-type: none"> <li>● Front right woofer speaker circuit - short to ground</li> </ul>	Refer to electrical circuit diagrams and check front right woofer speaker circuit for short to ground
B1A0412	Speaker #4	<ul style="list-style-type: none"> <li>● Front right woofer speaker circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and check front right woofer speaker circuit for short to power
B1A0413	Speaker #4	<ul style="list-style-type: none"> <li>● Front right woofer speaker circuit - open circuit</li> </ul>	Refer to electrical circuit diagrams and check front right woofer speaker circuit for open circuit
B1A041A	Speaker #4	<ul style="list-style-type: none"> <li>● Front right woofer speaker circuit - resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A0449	Speaker #4	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Suspect the audio amplifier module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B1A0511	Speaker #5	<ul style="list-style-type: none"> <li>● Rear left speaker circuit - short to ground</li> </ul>	Refer to electrical circuit diagrams and check rear left speaker circuit for short to ground
B1A0512	Speaker #5	<ul style="list-style-type: none"> <li>● Rear left speaker circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and check rear left speaker circuit for short to power
B1A0513	Speaker #5	<ul style="list-style-type: none"> <li>● Rear left speaker circuit - open circuit</li> </ul>	Refer to electrical circuit diagrams and check rear left speaker circuit for open circuit
B1A051A	Speaker #5	<ul style="list-style-type: none"> <li>● Rear left speaker circuit - resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A0549	Speaker #5	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Suspect the audio amplifier module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B1A0611	Speaker #6	<ul style="list-style-type: none"> <li>● Rear right speaker circuit - short to ground</li> </ul>	Refer to electrical circuit diagrams and check rear right speaker circuit for short to ground
B1A0612	Speaker #6	<ul style="list-style-type: none"> <li>● Rear right speaker circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and check rear right speaker circuit for short to power
B1A0613	Speaker #6	<ul style="list-style-type: none"> <li>● Rear right speaker circuit - open circuit</li> </ul>	Refer to electrical circuit diagrams and check rear right speaker circuit for open circuit
B1A061A	Speaker #6	<ul style="list-style-type: none"> <li>● Rear right speaker circuit - resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A0649	Speaker #6	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Suspect the audio amplifier module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B1A0711	Speaker #7	<ul style="list-style-type: none"> <li>● Rear left surround speaker circuit - short to ground</li> </ul>	Refer to electrical circuit diagrams and check rear left surround speaker circuit for short to ground
B1A0712	Speaker #7	<ul style="list-style-type: none"> <li>● Rear left surround speaker circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and check rear left surround speaker circuit for short to power

<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
B1A0713	Speaker #7	<ul style="list-style-type: none"> <li>● Rear left surround speaker circuit - open circuit</li> </ul>	Refer to electrical circuit diagrams and check rear left surround speaker circuit for open circuit
B1A071A	Speaker #7	<ul style="list-style-type: none"> <li>● Rear left surround speaker circuit - resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A0749	Speaker #7	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Suspect the audio amplifier module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B1A0811	Speaker #8	<ul style="list-style-type: none"> <li>● Rear right surround speaker circuit - short to ground</li> </ul>	Refer to electrical circuit diagrams and check rear right surround speaker circuit for short to ground
B1A0812	Speaker #8	<ul style="list-style-type: none"> <li>● Rear right surround speaker circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and check rear right surround speaker circuit for short to power
B1A0813	Speaker #8	<ul style="list-style-type: none"> <li>● Rear right surround speaker circuit - open circuit</li> </ul>	Refer to electrical circuit diagrams and check rear right surround speaker circuit for open circuit
B1A081A	Speaker #8	<ul style="list-style-type: none"> <li>● Rear right surround speaker circuit - resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A0849	Speaker #8	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Suspect the audio amplifier module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B1A0911	Speaker #9	<ul style="list-style-type: none"> <li>● Center speaker circuit - short to ground</li> </ul>	Refer to electrical circuit diagrams and check center speaker circuit circuit for short to ground
B1A0912	Speaker #9	<ul style="list-style-type: none"> <li>● Center speaker circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and check center speaker circuit for short to power
B1A0913	Speaker #9	<ul style="list-style-type: none"> <li>● Center speaker circuit - open circuit</li> </ul>	Refer to electrical circuit diagrams and check center speaker circuit for open circuit
B1A091A	Speaker #9	<ul style="list-style-type: none"> <li>● Center speaker circuit - resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A0949	Speaker #9	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Suspect the audio amplifier module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B1A1011	Speaker #10	<ul style="list-style-type: none"> <li>● Left subwoofer speaker circuit - short to ground</li> </ul>	Refer to electrical circuit diagrams and check left subwoofer speaker circuit for short to ground
B1A1012	Speaker #10	<ul style="list-style-type: none"> <li>● Left subwoofer speaker circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and check left subwoofer speaker circuit for short to power
B1A1013	Speaker #10	<ul style="list-style-type: none"> <li>● Left subwoofer speaker circuit - open circuit</li> </ul>	Refer to electrical circuit diagrams and check left subwoofer speaker circuit for open circuit
B1A101A	Speaker #10	<ul style="list-style-type: none"> <li>● Left subwoofer speaker circuit - resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A1049	Speaker #10	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Suspect the audio amplifier module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B1A1111	Speaker #11	<ul style="list-style-type: none"> <li>● Right subwoofer speaker circuit - short to ground</li> </ul>	Refer to electrical circuit diagrams and check right subwoofer speaker circuit for short to ground
B1A1112	Speaker #11	<ul style="list-style-type: none"> <li>● Right subwoofer speaker circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and check right subwoofer speaker circuit for short to power
B1A1113	Speaker #11	<ul style="list-style-type: none"> <li>● Right subwoofer speaker circuit - open circuit</li> </ul>	Refer to electrical circuit diagrams and check right subwoofer speaker circuit for open circuit
B1A111A	Speaker #11	<ul style="list-style-type: none"> <li>● Right subwoofer speaker circuit - resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
B1A1149	Speaker #11	<ul style="list-style-type: none"> <li>Internal electronic failure</li> </ul>	Suspect the audio amplifier module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U200398	Fibre Optic Communication Bus	<ul style="list-style-type: none"> <li>Component or system over temperature</li> </ul>	Clear DTC and allow system to cool, monitor for re-occurrence of DTC
U300005	Control module - system programming failures	<ul style="list-style-type: none"> <li>Software incompatibility</li> <li>The version of the Local Configuration file does not match that expected</li> </ul>	Re-configure the audio amplifier as an existing control module, using the manufacturer approved diagnostic system
U300042	Control module - general memory failure	<ul style="list-style-type: none"> <li>General memory failure</li> </ul>	Re-configure the audio amplifier as an existing control module, using the manufacturer approved diagnostic system. Clear DTC, cycle ignition and read DTCs. If DTC returns, suspect audio amplifier module and install a new module. Refer to the new module/component installation note at the top of the DTC Index
U300044	Control module - data memory failure	<ul style="list-style-type: none"> <li>Data memory failure</li> </ul>	Re-configure the audio amplifier as an existing control module, using the manufacturer approved diagnostic system. Clear DTC, cycle ignition and read DTCs. If DTC returns, suspect audio amplifier module and install a new module. Refer to the new module/component installation note at the top of the DTC Index
U300055	Control Module	<ul style="list-style-type: none"> <li>Incorrect car configuration data received</li> </ul>	Check/up-date Car Configuration File using the manufacturer approved diagnostic system
U300087	Control Module	<ul style="list-style-type: none"> <li>Missing message</li> </ul>	Check CJB for DTCs and refer to DTC Index. Check information and entertainment module for Car Configuration File and MOST network DTCs and refer to relevant DTC Index. Carry out MOST/CAN network tests using the manufacturer approved diagnostic system
U300316	Battery Voltage	<ul style="list-style-type: none"> <li>Circuit voltage below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300317	Battery Voltage	<ul style="list-style-type: none"> <li>Circuit voltage above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

## Integrated Audio Module



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• **NOTE:** If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• **NOTE:** Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• **NOTE:** When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• **NOTE:** If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1B6915	12 Volt supply circuit	<ul style="list-style-type: none"> <li>Antenna power supply circuit - short to battery, high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B6911	12 Volt supply circuit	<ul style="list-style-type: none"> <li>Antenna power supply circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. to the electrical circuit diagrams and test the antenna power supply circuit for short to ground
B1D1916	Compact Disc Unit	<ul style="list-style-type: none"> <li>Circuit voltage below threshold</li> </ul>	Suspect the integrated audio module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B1D1977	Compact Disc Unit	<ul style="list-style-type: none"> <li>Commanded position not reachable</li> </ul>	Suspect the integrated audio module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index

DTC	Description	Possible Cause	Action
B1D1993	Compact Disc Unit	<ul style="list-style-type: none"> <li>No operation</li> </ul>	Suspect the integrated audio module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B1A0111	Speaker #1	<ul style="list-style-type: none"> <li>Front driver speaker circuits - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test front driver speaker circuits for short to ground
B1A0112	Speaker #1	<ul style="list-style-type: none"> <li>Front driver speaker circuits - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test front driver speaker circuits for short to power
B1A011A	Speaker #1	<ul style="list-style-type: none"> <li>Front driver speaker circuits - resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A011B	Speaker #1	<ul style="list-style-type: none"> <li>Front driver speaker circuits - resistance above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A011C	Speaker #1	<ul style="list-style-type: none"> <li>Front driver speaker circuits - voltage out of range. Power IC failure internal to the integrated audio</li> </ul>	Suspect the integrated audio module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B1A0211	Speaker #2	<ul style="list-style-type: none"> <li>Front passenger speaker circuits - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test front passenger speaker circuits for short to ground
B1A0212	Speaker #2	<ul style="list-style-type: none"> <li>Front passenger speaker circuits - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test front passenger speaker circuits for short to power
B1A021A	Speaker #2	<ul style="list-style-type: none"> <li>Front passenger speaker circuits - resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A021B	Speaker #2	<ul style="list-style-type: none"> <li>Front passenger speaker circuits - resistance above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A021C	Speaker #2	<ul style="list-style-type: none"> <li>Front passenger speaker circuits - voltage out of range. Power IC failure internal to the integrated audio</li> </ul>	Suspect the integrated audio module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B1A0311	Speaker #3	<ul style="list-style-type: none"> <li>Rear left speaker circuits - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test rear left speaker circuits for short to ground
B1A0312	Speaker #3	<ul style="list-style-type: none"> <li>Rear left speaker circuits - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test rear left speaker circuits for short to power
B1A031A	Speaker #3	<ul style="list-style-type: none"> <li>Rear left speaker circuits - resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A031B	Speaker #3	<ul style="list-style-type: none"> <li>Rear left speaker circuits - resistance above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A031C	Speaker #3	<ul style="list-style-type: none"> <li>Rear left speaker circuits - voltage out of range. Power IC failure internal to the integrated audio</li> </ul>	Suspect the integrated audio module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B1A0411	Speaker #4	<ul style="list-style-type: none"> <li>Rear right speaker circuits - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test rear right speaker circuits for short to ground
B1A0412	Speaker #4	<ul style="list-style-type: none"> <li>Rear right speaker circuits - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test rear right speaker circuits for short to power
B1A041A	Speaker #4	<ul style="list-style-type: none"> <li>Rear right speaker circuits - resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A0413	Speaker #4	<ul style="list-style-type: none"> <li>Rear right speaker circuits - resistance above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A041C	Speaker #4	<ul style="list-style-type: none"> <li>Rear right speaker circuits - voltage out of range. Power IC failure internal to the integrated audio</li> </ul>	Suspect the integrated audio module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index

DTC	Description	Possible Cause	Action
B1A5613	Antenna	<ul style="list-style-type: none"> <li>● Antenna circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check antenna circuit for open circuit
B1D7811	Auxiliary Input	<ul style="list-style-type: none"> <li>● Auxiliary input circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test Auxiliary input circuits for short to ground
B1D7812	Auxiliary Input	<ul style="list-style-type: none"> <li>● Auxiliary input circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test Auxiliary input circuits for short to power
B1D7813	Auxiliary Input	<ul style="list-style-type: none"> <li>● Auxiliary input circuit - high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test Auxiliary input circuits for high resistance
B1D7911	Microphone Input	<ul style="list-style-type: none"> <li>● Microphone input circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test microphone input circuits for short to ground
B1D7912	Microphone Input	<ul style="list-style-type: none"> <li>● Microphone input circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test microphone input circuits for short to power
B1D7913	Microphone Input	<ul style="list-style-type: none"> <li>● Microphone input circuit - high resistance</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test microphone input circuits for high resistance
B113411	Phone Input	<ul style="list-style-type: none"> <li>● Phone input circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test phone input circuits for short to ground
B113412	Phone Input	<ul style="list-style-type: none"> <li>● Phone input circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and test phone input circuits for short to power
B113413	Phone Input	<ul style="list-style-type: none"> <li>● Phone input circuit - high resistance</li> </ul>	Refer to the electrical circuit diagrams and test phone input circuits for high resistance
U210000	Initial Configuration Not Complete	<ul style="list-style-type: none"> <li>● Car configuration data not received</li> </ul>	Check RJB for related DTCs and refer to the relevant DTC Index
U210100	Control Module Configuration Incompatible	<ul style="list-style-type: none"> <li>● Incorrect car configuration data received</li> </ul>	Check RJB for related DTCs and refer to the relevant DTC Index. Check/amend Car Configuration File using the manufacturer approved diagnostic system
U300049	Control Module	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Suspect the integrated audio module, install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300055	Control Module	<ul style="list-style-type: none"> <li>● Incorrect car configuration data received</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the integrated audio module, refer to the new module/component installation note at the top of the DTC Index
U300087	Control Module	<ul style="list-style-type: none"> <li>● Missing message</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. Check integrated audio module for DTCs and refer to the DTC Index. Check CAN network integrity using the manufacturer approved diagnostic system
U300098	Control Module	<ul style="list-style-type: none"> <li>● Component or system over temperature</li> </ul>	Check for additional DTCs and refer to DTC Index. Clear DTC and re-test/monitor condition
U300362	Battery Voltage	<ul style="list-style-type: none"> <li>● Mis-match in battery voltage, of 2 volts or more, between integrated audio module and RJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

### Portable Audio Interface Module



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
U300044	Control Module	<ul style="list-style-type: none"> <li>Module internal failure</li> </ul>	Suspect the portable audio interface module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300045	Control Module	<ul style="list-style-type: none"> <li>Module internal failure</li> </ul>	Suspect the portable audio interface module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300055	Control Module	<ul style="list-style-type: none"> <li>Module configuration/programming failure</li> </ul>	Re-program the portable audio interface module, clear DTC and re-test. If DTC remains carry out MOST tests and test USB cable for open, short circuit, clear DTC and re-test. If DTC remains suspect the portable audio interface module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300362	Battery Voltage	<ul style="list-style-type: none"> <li>Mis-match in battery voltage, of 2 volts or more, between portable audio interface module and RJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

### Digital Audio Broadcast Module



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B11A411	L-Band Antenna	DAB L-Band antenna circuit - short to ground	If DTCs: B11A411, B11A511, U300044, U30004A, U300098, U300362 have logged at the same time with invalid snapshot data carry out a DTC clear and re-read to ensure the DTCs have not re-logged. If the DTC B11A411 does relog (without the other DTCs) carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check DAB L-Band antenna circuit for short to ground
B11A415	L-Band Antenna	DAB L-Band antenna circuit - short to power, open circuit	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check DAB L-Band antenna circuit for short to power, open circuit
B11A511	Band 3 Antenna	DAB Band 3 antenna circuit - short to ground	If DTCs: B11A411, B11A511, U300044, U30004A, U300098, U300362 have logged at the same time with invalid snapshot data carry out a DTC clear and re-read to ensure the DTCs have not re-logged. If the DTC B11A511 does relog (without the other DTCs) carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check DAB Band 3 antenna circuit for short to ground
B11A515	Band 3 Antenna	DAB Band 3 antenna circuit - short to power, open circuit	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check DAB Band 3 antenna circuit for short to power, open circuit
U300004	Control Module	System internal failure	Clear the DTC and perform a system function check. If the DTC relogs and the system do not function correctly suspect the digital audio broadcast module. Check and install a new module as required
U300044	Control Module data memory failure	System internal failure	If DTCs: B11A411, B11A511, U300044, U30004A, U300098, U300362 have logged at the same time with invalid snapshot data carry out a DTC clear and re-read to ensure the DTCs have not re-logged.
U30004A	Control Module	Incorrect component installed	If the DTCs: B11A411, B11A511, U300044, U30004A, U300098, U300362 have logged at the same time with invalid snapshot data carry out a DTC clear and re-read to ensure the DTCs have not re-logged. If the DTC does re-log check/up-date Car Configuration File using manufacturer approved diagnostic system
U300055	Control Module	Incorrect Car Configuration File data received	Check/up-date Car Configuration File using manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
U300087	Control Module	Missing message	Check RJB for related DTCs and refer to relevant DTC Index. Check information and entertainment module for Car Configuration File and MOST network DTCs and refer to relevant DTC Index. Carry out MOST/CAN network tests using the manufacturer approved diagnostic system
U300098	Control Module	Component or system over temperature	If DTCs: B11A411, B11A511, U300044, U30004A, U300098, U300362 have logged at the same time with invalid snapshot data carry out a DTC clear and re-read to ensure the DTCs have not re-logged.
U300362	Battery Voltage	Mis-match in battery voltage, of 2 volts or more, between digital audio broadcast module and RJB	If DTCs: B11A411, B11A511, U300044, U30004A, U300098, U300362 have logged at the same time with invalid snapshot data carry out a DTC clear and re-read to ensure the DTCs have not re-logged. If only DTC U300362 is logged carry out any pinpoint tests associated with this DTC, check power supply circuits to Digital Audio Broadcast module and Rear Junction Box.

### Integrated Control Panel



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B101223	Heated Windshield Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B101323	Heater Rear Defog Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B101423	Recirculation Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B101523	Screen On/Off Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B101623	Status Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B101723	Left Temperature Decrease Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B101823	Right Temperature Decrease Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B101923	Left Temperature Increase Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B101A23	Right Temperature Increase Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required

DTC	Description	Possible Cause	Action
B101B23	Defrost Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B101C23	Seek Up Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B101D23	Seek Down Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B101E23	Air Conditioning Mode Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B101F23	Eject Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B102023	Load Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B102123	Source Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B102223	Audio On/Off Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B11A923	Tone Button	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
B121F23	Climate Switch	<ul style="list-style-type: none"> <li>● Button stuck down/jammed</li> <li>● Integrated control panel failure</li> </ul>	Check for stuck down/jammed button. Check and install a new integrated control panel as required
U001088	Medium Speed CAN Communication Bus	<ul style="list-style-type: none"> <li>● Bus off</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014000	Lost Communication With Body Control Module	<ul style="list-style-type: none"> <li>● Missing message from CJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014200	Lost Communication With Body Control Module "B"	<ul style="list-style-type: none"> <li>● Missing message from RJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U015500	Lost Communication With Instrument Panel Cluster (IPC) Control Module	<ul style="list-style-type: none"> <li>● Missing message from instrument cluster</li> </ul>	Carry out any pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
U015600	Lost Communication With Information Center "A"	<ul style="list-style-type: none"> <li>● Missing message from information and entertainment control module</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030000	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>● Invalid car configuration data received</li> </ul>	Re-configure the integrated control panel as new. Clear DTC and re-test, if DTC remains suspect the integrated control panel. Check and install a new integrated control panel as required, refer to the new module/component installation note at the top of the DTC Index
U300041	Control Module	<ul style="list-style-type: none"> <li>● Checksum error, internal module failure</li> </ul>	Suspect the integrated control panel, check and install a new integrated control panel as required, refer to the new module/component installation note at the top of the DTC Index

### Touch Screen Display (TSD)



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• **NOTE:** If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the

Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

- NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

- NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B100E25	Video Input 'A'	<ul style="list-style-type: none"> <li>• ODST Only - TV video synch mis-match</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B100F25	Video Input 'B'	<ul style="list-style-type: none"> <li>• ODST Only - Reverse Camera video synch mis-match</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U1A0101	Communication Link	<ul style="list-style-type: none"> <li>• ODST Only - cable from navigation module not correctly installed</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check electrical harness from navigation module is correctly installed
U1A0115	Communication Link	<ul style="list-style-type: none"> <li>• TSD to navigation module circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check TSD to navigation module circuit for short to power, open circuit
U1A4B48	Control Module Processor B	<ul style="list-style-type: none"> <li>• Supervision software failure</li> </ul>	Re-configure the TSD using the manufacturer approved diagnostic system
U300044	Control Module	<ul style="list-style-type: none"> <li>• EEPROM, External RAM access failure</li> </ul>	Suspect the TSD, check and install a new TSD as required, refer to the new module/component installation note at the top of the DTC Index
U300048	Control Module	<ul style="list-style-type: none"> <li>• Supervision software failure</li> </ul>	Re-configure the TSD using the manufacturer approved diagnostic system
U30004B	Control Module	<ul style="list-style-type: none"> <li>• Touch panel backlight - high temperature detected</li> </ul>	Allow the system to cool, clear the DTC and check/monitor system for re-occurrence. If DTC re-occurs suspect the TSD. Check and install a new TSD as required, refer to the new module/component installation note at the top of the DTC Index
U300055	Control Module	<ul style="list-style-type: none"> <li>• Incorrect Car Configuration Parameters received</li> </ul>	Check/amend Car Configuration File using the manufacturer approved diagnostic system
U300087	Control Module	<ul style="list-style-type: none"> <li>• Car Configuration File not received</li> </ul>	Check RJB for related DTCs and refer to relevant DTC Index. Check CAN and MOST networks, carry out the CAN and MOST network tests using the manufacturer approved diagnostic system
U300098	Control Module	<ul style="list-style-type: none"> <li>• TSD internal temperature over limit</li> </ul>	Allow the system to cool, clear the DTC and check/monitor system for re-occurrence. If DTC re-occurs suspect the TSD. Check and install a new TSD as required, refer to the new module/component installation note at the top of the DTC Index
U300316	Battery Voltage	<ul style="list-style-type: none"> <li>• Circuit voltage below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300317	Battery Voltage	<ul style="list-style-type: none"> <li>• Circuit voltage above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

## Satellite Radio Module



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

- NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

- NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

- NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1A8911	Satellite Antenna	<ul style="list-style-type: none"> <li>Satellite antenna circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check satellite antenna circuit for short to ground
B1A8912	Satellite Antenna	<ul style="list-style-type: none"> <li>Satellite antenna circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check satellite antenna circuit for short to power
B1A8913	Satellite Antenna	<ul style="list-style-type: none"> <li>Satellite antenna circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check satellite antenna circuit for open circuit
U300004	Control Module	<ul style="list-style-type: none"> <li>System internal failure</li> </ul>	Suspect the satellite radio module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U30004A	Control Module	<ul style="list-style-type: none"> <li>Incorrect component installed</li> </ul>	Suspect the satellite radio module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300055	Control Module	<ul style="list-style-type: none"> <li>Vehicle not configured for satellite radio system</li> </ul>	Check/amend the Car Configuration File using the manufacturer approved diagnostic system
U300087	Control Module	<ul style="list-style-type: none"> <li>Missing message</li> </ul>	Suspect the satellite radio module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300098	Control Module	<ul style="list-style-type: none"> <li>Component or system over temperature</li> </ul>	Clear DTC and re-test. Check/monitor condition for re-occurrence
U300362	Battery Voltage	<ul style="list-style-type: none"> <li>Mis-match in battery voltage, of 2 volts or more, between satellite radio module and RJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

### Television Module



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1A5611	Antenna	<ul style="list-style-type: none"> <li>Antenna circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check antenna circuit for short to ground
B1A5612	Antenna	<ul style="list-style-type: none"> <li>Antenna circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check antenna circuit for short to power
B1A5613	Antenna	<ul style="list-style-type: none"> <li>Antenna circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check antenna circuit for open circuit
B1D5511	Antenna#2	<ul style="list-style-type: none"> <li>Antenna#2 circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check antenna#2 circuit for short to ground
B1D5512	Antenna#2	<ul style="list-style-type: none"> <li>Antenna#2 circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check antenna#2 circuit for short to power
B1D5513	Antenna#2	<ul style="list-style-type: none"> <li>Antenna#2 circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check antenna#2 circuit for open circuit
B1D5611	Antenna #3 Circuit	<ul style="list-style-type: none"> <li>Antenna#3 circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check antenna#3 circuit for short to ground
B1D5612	Antenna #3 Circuit	<ul style="list-style-type: none"> <li>Antenna#3 circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check antenna#3 circuit for short to power
B1D5613	Antenna #3 Circuit	<ul style="list-style-type: none"> <li>Antenna#3 circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check antenna#3 circuit for open circuit

<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
B1D5711	Antenna #4 Circuit	<ul style="list-style-type: none"> <li>● Antenna#4 circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check antenna#4 circuit for short to ground
B1D5712	Antenna #4 Circuit	<ul style="list-style-type: none"> <li>● Antenna#4 circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check antenna#4 circuit for short to power
B1D5713	Antenna #4 Circuit	<ul style="list-style-type: none"> <li>● Antenna#4 circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check antenna#4 circuit for open circuit
B1D5811	Television Output	<ul style="list-style-type: none"> <li>● Television output circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check television output circuit for short to ground
B1D5812	Television Output	<ul style="list-style-type: none"> <li>● Television output circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check television output circuit for short to power
B1D5813	Television Output	<ul style="list-style-type: none"> <li>● Television output circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check television output circuit for open circuit
U300049	Control Module	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Suspect the television module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300316	Battery Voltage	<ul style="list-style-type: none"> <li>● Circuit voltage below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300317	Battery Voltage	<ul style="list-style-type: none"> <li>● Circuit voltage above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system



# Information and Entertainment System - General Information - Cellular Phone

Diagnosis and Testing

## Principle of Operation

For a detailed description of the Cellular Phone System, refer to the relevant Description and Operation sections in the workshop manual.

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Microphone</li> <li>● Bluetooth antenna</li> </ul>	<ul style="list-style-type: none"> <li>● Electrical connectors</li> <li>● Wiring harness for damage or corrosion</li> <li>● Fuses</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

## Symptom Chart

Symptom	Action
Unable to pair	<ul style="list-style-type: none"> <li>● GO to Pinpoint Test <a href="#">A.</a></li> </ul>
Not Auto Connecting	<ul style="list-style-type: none"> <li>● GO to Pinpoint Test <a href="#">B.</a></li> </ul>
No Audio to 3rd Party	<ul style="list-style-type: none"> <li>● GO to Pinpoint Test <a href="#">C.</a></li> </ul>
No Audio from 3rd Party	<ul style="list-style-type: none"> <li>● GO to Pinpoint Test <a href="#">D.</a></li> </ul>
No Audio	<ul style="list-style-type: none"> <li>● GO to Pinpoint Test <a href="#">E.</a></li> </ul>

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1A5613	Antenna	<ul style="list-style-type: none"> <li>● Bluetooth antenna circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check blue tooth antenna circuit for open circuit
B1D7984	Microphone Input	<ul style="list-style-type: none"> <li>● Signal amplitude &lt; minimum</li> </ul>	Refer to the electrical circuit diagrams and test microphone input circuit for short/open circuit. Check integrated audio module for related DTCs and refer to relevant DTC Index
U1A0088	Private Communication Network	<ul style="list-style-type: none"> <li>● Bluetooth phone module internal communications failure</li> </ul>	Suspect the module. Check and install a new telephone module as required, refer to the new module/component installation note at the top of the DTC Index

DTC	Description	Possible Cause	Action
U210000	Initial Configuration Not Complete	<ul style="list-style-type: none"> <li>Initial configuration not complete</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. If DTC remains, carry out CAN network integrity tests using the manufacturer approved diagnostic system
U210100	Control Module Configuration Incompatible	<ul style="list-style-type: none"> <li>Configuration incompatible</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. If DTC remains, suspect the telephone module. Check and install a new telephone module as required, refer to the new module/component installation note at the top of the DTC Index
U300044	Control Module	<ul style="list-style-type: none"> <li>Data memory failure</li> </ul>	Re-configure the telephone module. If the DTC remains, suspect the telephone module. Check and install a new telephone module as required, refer to the new module/component installation note at the top of the DTC Index
U300045	Control Module	<ul style="list-style-type: none"> <li>Program memory failure</li> </ul>	Re-configure the telephone module. If the DTC remains, suspect the telephone module. Check and install a new telephone module as required, refer to the new module/component installation note at the top of the DTC Index
U300055	Control Module	<ul style="list-style-type: none"> <li>Incorrect car configuration data received</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the telephone module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300098	Control Module	<ul style="list-style-type: none"> <li>Component or system over temperature</li> </ul>	Check for additional DTCs and refer to DTC Index. Clear DTC and re-test/monitor condition for re-occurrence
U300362	Battery Voltage	<ul style="list-style-type: none"> <li>Mis-match in battery voltage, of 2 volts or more, between telephone module and RJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

## Pinpoint Tests

PINPOINT TEST A : UNABLE TO PAIR	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>A1: 'NO PHONE FITTED' DISPLAY</b>	
<ul style="list-style-type: none"> <li>NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the bluetooth function is activated and the telephone handset is placed within the vehicle cabin area.</li> </ul>	
	1 Carry out checks to determine if 'No Phone Fitted' is shown on vehicle display.
	Is 'No Phone Fitted' displayed? <b>Yes</b> <a href="#">GO to A2.</a> <b>No</b> Locate the connected telephone and if not Customer telephone, disconnect from the system.
<b>A2: TELEPHONE BLUETOOTH DEVICE SEARCH</b>	
	1 Carry out Bluetooth device search using Customer handset.
	Is 'Jaguar' identified in Bluetooth device list? <b>Yes</b> Select device from list, then continue with diagnosis. <a href="#">GO to A3.</a> <b>No</b> Carry out further Bluetooth device search, to a maximum of 4 times, waiting approximately 20 seconds between searches. If 'Jaguar' still not identified in Bluetooth device list, set ignition status to OFF, wait approximately 30 seconds and set ignition status to ON. Carry out further Bluetooth device search, to a maximum of 4 times, waiting approximately 20 seconds between searches. If 'Jaguar' still not identified in Bluetooth device list, contact your local in market support for further assistance.
<b>A3: TELEPHONE HANDSET ERROR</b>	
	1 Check for any error shown on the telephone handset when 'Jaguar' is selected from the Bluetooth device list.
	Was an error immediately shown on the telephone handset? <b>Yes</b> Wait approximately 10 seconds then re-attempt selection, to a maximum of 4 times, waiting approximately 10 seconds between each attempt. If error still being displayed, contact your local in market support for assistance. <b>No</b> Enter PIN '1313' then continue with diagnosis. <a href="#">GO to A4.</a>
<b>A4: PIN ENTRY STATUS</b>	
	1 Check for successful PIN entry.
	Was PIN entry successful? <b>Yes</b> <a href="#">GO to A5.</a> <b>No</b> Wait approximately 10 seconds then re-attempt PIN entry, to a maximum of 4 times, waiting approximately 10 seconds between each attempt. If PIN entry is still un-successful, contact your local in market support for assistance.
<b>A5: 'NO PHONE FITTED' DISPLAY</b>	

	<b>1</b> Carry out checks to determine if 'No Phone Fitted' is still shown on vehicle display.
Is 'No Phone Fitted' still displayed?	<p><b>Yes</b></p> <p>From the telephone handset, select the connect option for the 'Land Rover' device identified in the Bluetooth device list. If 'No Phone Fitted' is still displayed, suspect a telephone handset fault. Carry out Pinpoint test again using known good telephone handset.</p> <p><b>No</b></p> <p>The telephone is paired and connected to the system. No further action is required for this symptom.</p>

## PINPOINT TEST B : NOT AUTOMATICALLY CONNECTING

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>B1: BLUETOOTH MODULE PAIRED DEVICE LIST</b>	
<p>• NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the bluetooth and auto connect functions are activated and the telephone handset is placed within the vehicle cabin area.</p>	
	<b>1</b> Carry out checks to determine if the Customer telephone is shown in the Bluetooth Module paired device list.
Is the Customer telephone in the Bluetooth Module paired device list?	<p><b>Yes</b></p> <p><a href="#">GO to B2.</a></p> <p><b>No</b></p> <p>Carry out Unable to Pair Pinpoint Test. <a href="#">GO to A.</a></p>
<b>B2: CUSTOMER HANDSET PAIRED DEVICE LIST</b>	
	<b>1</b> Carry out checks to determine if the Bluetooth Module is shown in the Customer telephone paired device list.
Is the Bluetooth Module in the Customer telephone paired device list?	<p><b>Yes</b></p> <p><a href="#">GO to B3.</a></p> <p><b>No</b></p> <p>Carry out Unable to Pair Pinpoint Test. <a href="#">GO to A.</a></p>
<b>B3: CUSTOMER TELEPHONE IN POSITION 1</b>	
	<b>1</b> Carry out checks to determine if the Customer telephone is in position 1 in the Bluetooth Module paired device list.
Is the Customer telephone in position 1?	<p><b>Yes</b></p> <p><a href="#">GO to B4.</a></p> <p><b>No</b></p> <p>Advise Customer that auto connection will only be attempted with the device that is shown in position 1 in Bluetooth Module paired device list.</p>
<b>B4: CHECK FOR DTC B1A56-13</b>	
	<b>1</b> Using Manufacturer approved diagnostic system, check for DTC B1A56-13.
Is DTC B1A56-13 logged?	<p><b>Yes</b></p> <p>Carry out remedial actions as outlined in DTC Index. If symptom remains, contact your local in market support for assistance.</p> <p><b>No</b></p> <p><a href="#">GO to B5.</a></p>
<b>B5: BLUETOOTH CONNECTION</b>	
	<b>1</b> Carry out checks to determine if Bluetooth connection icon is shown on Customer Bluetooth telephone screen but shows 'No Phone Fitted' on vehicle screen.
Is Bluetooth connection icon shown on the Customer handset but 'No Phone Fitted' displayed on vehicle screen?	<p><b>Yes</b></p> <p><a href="#">GO to B9.</a></p> <p><b>No</b></p> <p><a href="#">GO to B6.</a></p>
<b>B6: 'LAND ROVER' AUTHORISATION</b>	
<p>• NOTE: Some handsets may require operator intervention to manually authorise connection.</p>	
	<b>1</b> Carry out checks to determine if 'Land Rover' is authorised in the Customer Bluetooth telephone device list menu.
Is 'Land Rover' authorised in the Customer Bluetooth telephone device list menu?	<p><b>Yes</b></p> <p><a href="#">GO to B7.</a></p> <p><b>No</b></p> <p>Advise customer that 'Land Rover' needs to be authorised in the Customer Bluetooth telephone device list menu, or operator intervention may be required to manually authorise connection.</p>
<b>B7: SEARCH FOR DEVICES SCREEN</b>	
	<b>1</b> Select the search for devices button on the vehicle display.
Does pressing the search for devices button bring up the searching screen on the vehicle display?	<p><b>Yes</b></p> <p>Contact your local in market support for assistance.</p> <p><b>No</b></p> <p><a href="#">GO to B8.</a></p>
<b>B8: CYCLE IGNITION AND CHECK SEARCH FOR DEVICES SCREEN</b>	
	<b>1</b> Lock vehicle (wait 60s) before unlocking and turning Ignition status back to ON.
Does pressing the search for devices button bring up the searching screen on the vehicle display?	<p><b>Yes</b></p> <p>No further action required for this Symptom. Possible intermittent fault.</p> <p><b>No</b></p> <p>Contact your local in market support for assistance.</p>

<b>B9: PAIRED DEVICE</b>	
	<p>1 Check Customer telephone paired device list to establish which device the Customer telephone is connected to.</p>
	<p>Is the Customer telephone connected to the vehicle?</p> <p><b>Yes</b> Lock vehicle (wait 60s) before unlocking and turning Ignition status back to ON. If Not Automatically Connecting, contact you local in market support for assistance.</p> <p><b>No</b> Using the Customer telephone controls, disconnect from the currently connected device and delete from paired device list. Lock vehicle (wait for 60s) before unlocking and turning Ignition status to ON. If Not Automatically Connecting, contact your local in market support for assistance.</p>

<b>PINPOINT TEST C : NO AUDIO TO THIRD PARTY</b>	
<b>TEST CONDITIONS</b>	<b>DETAILS/RESULTS/ACTIONS</b>
<b>C1: MICROPHONE DIAGNOSTIC TROUBLE CODES (DTCS)</b>	
<p>• NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the telephone is placed within the vehicle cabin area and is connected to the vehicle via bluetooth.</p>	
	<p>1 Using the Manufacturer approved diagnostic system, check for any logged microphone DTCs in Audio Front Control module.</p>
	<p>Is DTC B1D79-01 logged?</p> <p><b>Yes</b> Carry out diagnosis of electrical failure as advised in Action column of DTC Index.</p> <p><b>No</b> Contact your local in market support for assistance.</p>

<b>PINPOINT TEST D : NO AUDIO FROM THIRD PARTY</b>	
<b>TEST CONDITIONS</b>	<b>DETAILS/RESULTS/ACTIONS</b>
<b>D1: 'IN CALL' DISPLAY</b>	
<p>• NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the telephone is placed within the vehicle cabin area and is connected to the vehicle via bluetooth.</p>	
	<p>1 Carry out checks to determine if 'In Call' is shown on the vehicle display.</p>
	<p>Is vehicle display showing 'In Call'?</p> <p><b>Yes</b> Contact your local in market support for assistance.</p> <p><b>No</b> Call has ended. No further action is required for this symptom.</p>

<b>PINPOINT TEST E : NO AUDIO</b>	
<b>TEST CONDITIONS</b>	<b>DETAILS/RESULTS/ACTIONS</b>
<b>E1: AUDIO FROM THIRD PARTY</b>	
<p>• NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the telephone is placed within the vehicle cabin area and is connected to the vehicle via bluetooth.</p>	
	<p>1 Establish from Customer feedback/symptom if there is Audio from the Third Party.</p>
	<p>Is there Audio from the Third Party?</p> <p><b>Yes</b> <a href="#">GO to E2.</a></p> <p><b>No</b> Refer to the 'No Audio From Third Party' Pinpoint test. <a href="#">GO to D.</a></p>
<b>E2: AUDIO TO THIRD PARTY</b>	
	<p>1 Establish from Customer feedback/symptom if there is Audio to the Third Party.</p>
	<p>Is there Audio to the Third Party?</p> <p><b>Yes</b> <a href="#">GO to E3.</a></p> <p><b>No</b> Refer to the 'No Audio To Third Party' Pinpoint test. <a href="#">GO to C.</a></p>
<b>E3: CD OR RADIO AUDIO</b>	
	<p>1 Establish from Customer feedback/symptom if there is Audio from the CD or Radio.</p>
	<p>Is there Audio from the CD or Radio?</p> <p><b>Yes</b> <a href="#">GO to E4.</a></p> <p><b>No</b> Suspect MOST ring fault, refer to electrical circuit diagrams and check/rectify MOST ring as necessary.</p>
<b>E4: TELEPHONE HANDSET AUDIO</b>	
	<p>1 Establish from Customer feedback/symptom if there is Audio from the telephone handset.</p>
	<p>Is there Audio from the telephone handset?</p> <p><b>Yes</b> Ensure vehicle is parked. Disconnect and reconnect handset. If issue not resolved, contact your local in market support for assistance.</p> <p><b>No</b> Contact your local in market support for assistance.</p>

# Information and Entertainment System - General Information - Navigation System

Diagnosis and Testing

## Principle of Operation

For a detailed description of the Navigation System, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (415-01 Information and Entertainment System)

[Navigation System](#) (Description and Operation),  
[Navigation System](#) (Description and Operation),  
[Navigation System](#) (Description and Operation),  
[Video System](#) (Description and Operation),  
[Video System](#) (Description and Operation),  
[Video System](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Information and entertainment module</li> <li>● Audio amplifier module</li> <li>● Integrated audio module</li> <li>● Portable audio interface module</li> <li>● Digital audio broadcast module</li> <li>● Integrated control panel</li> <li>● Touch screen display</li> <li>● Satellite radio module</li> <li>● Television module</li> <li>● Navigation system module</li> <li>● Telephone module</li> <li>● Compact disc player jammed, not loading</li> <li>● Scratched/dirty compact discs</li> <li>● Speakers</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Loose or corroded connector(s)</li> <li>● Information and entertainment module</li> <li>● Audio amplifier module</li> <li>● Integrated audio module</li> <li>● Portable audio interface module</li> <li>● Digital audio broadcast module</li> <li>● Integrated control panel</li> <li>● Touch screen display</li> <li>● Satellite radio module</li> <li>● Television module</li> <li>● Navigation system module</li> <li>● Telephone module</li> <li>● Speakers</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

## DTC Index

### Navigation System Module



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1A8911	Satellite Antenna	<ul style="list-style-type: none"> <li>● Satellite antenna circuit - short to ground</li> </ul>	Check satellite antenna connections. Refer to the electrical circuit diagrams and check satellite antenna circuit for short to ground

DTC	Description	Possible Cause	Action
B1A8913	Satellite Antenna	<ul style="list-style-type: none"> <li>Satellite antenna circuit - open circuit</li> </ul>	Check satellite antenna connections. Refer to the electrical circuit diagrams and check satellite antenna circuit for open circuit
B1A891B	Satellite Antenna	<ul style="list-style-type: none"> <li>Satellite antenna - circuit resistance above threshold</li> </ul>	Suspect navigation module. Check and install a new navigation system module as required, refer to the new module/component installation note at the top of the DTC Index
B1D5514	Antenna #2	<ul style="list-style-type: none"> <li>TMC/VICS FM antenna circuit - open circuit</li> </ul>	Check TMC/VICS FM antenna connections. Refer to the electrical circuit diagrams and check TMC/VICS FM antenna circuit for open circuit
B1D5614	Antenna #3 Circuit	<ul style="list-style-type: none"> <li>VICS antenna circuit - open circuit</li> </ul>	Check VICS antenna connections. Refer to the electrical circuit diagrams and check VICS antenna circuit for open circuit
U200531	Vehicle Speed	<ul style="list-style-type: none"> <li>Missing vehicle speed message</li> </ul>	Check ABS module and Instrument Cluster for speed related DTCs and refer to relevant DTC Index
U300049	Control Module	<ul style="list-style-type: none"> <li>Internal electronic failure</li> </ul>	Suspect the navigation module. Check and install a new navigation system module as required, refer to the new module/component installation note at the top of the DTC Index
U300055	Control Module	<ul style="list-style-type: none"> <li>Incorrect car configuration data received</li> </ul>	Using the manufacturer approved diagnostic system check/amend the Car Configuration File parameter in block 2, byte 127 to match vehicle market/specification. If the DTC remains check navigation system module part number and ensure the correct component is installed to vehicle market/specification
U300087	Control Module	<ul style="list-style-type: none"> <li>Missing message</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. Check navigation module for DTCs and refer to the DTC Index. Check CAN network integrity using the manufacturer approved diagnostic system
U300098	Control Module	<ul style="list-style-type: none"> <li>Component or system over temperature</li> </ul>	Check for additional DTCs and refer to DTC Index. Clear DTC and re-test/monitor condition for re-occurrence
U300317	Battery Voltage	<ul style="list-style-type: none"> <li>Circuit voltage above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300362	Battery Voltage	<ul style="list-style-type: none"> <li>Mis-match in battery voltage, of 2 volts or more, between navigation module and RJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

### Touch Screen Display (TSD)



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B100E25	Video Input 'A'	<ul style="list-style-type: none"> <li>ODST Only - TV video synch mis-match</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B100F25	Video Input 'B'	<ul style="list-style-type: none"> <li>ODST Only - Reverse Camera video synch mis-match</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U1A0101	Communication Link	<ul style="list-style-type: none"> <li>ODST Only - cable from navigation module not correctly installed</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check electrical harness from navigation module is correctly installed
U1A0115	Communication Link	<ul style="list-style-type: none"> <li>TSD to navigation module circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check TSD to navigation module circuit for short to power, open circuit
U1A4B48	Control Module Processor B	<ul style="list-style-type: none"> <li>Supervision software failure</li> </ul>	Re-configure the TSD using the manufacturer approved diagnostic system



<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
U300044	Control Module	<ul style="list-style-type: none"> <li>● EEPROM, External RAM access failure</li> </ul>	Suspect the TSD, check and install a new TSD as required, refer to the new module/component installation note at the top of the DTC Index
U300048	Control Module	<ul style="list-style-type: none"> <li>● Supervision software failure</li> </ul>	Re-configure the TSD using the manufacturer approved diagnostic system
U30004B	Control Module	<ul style="list-style-type: none"> <li>● Touch panel backlight - high temperature detected</li> </ul>	Allow the system to cool, clear the DTC and check/monitor system for re-occurrence. If DTC re-occurs suspect the TSD. Check and install a new TSD as required, refer to the new module/component installation note at the top of the DTC Index
U300055	Control Module	<ul style="list-style-type: none"> <li>● Incorrect Car Configuration Parameters received</li> </ul>	Check/amend the Car Configuration File using the manufacturer approved diagnostic system
U300087	Control Module	<ul style="list-style-type: none"> <li>● Car Configuration File not received</li> </ul>	Check RJB for related DTCs and refer to relevant DTC Index. Check CAN and MOST networks, carry out the CAN and MOST network tests using the manufacturer approved diagnostic system
U300098	Control Module	<ul style="list-style-type: none"> <li>● TSD internal temperature over limit</li> </ul>	Allow the system to cool, clear the DTC and check/monitor system for re-occurrence. If DTC re-occurs suspect the TSD. Check and install a new TSD as required, refer to the new module/component installation note at the top of the DTC Index
U300316	Battery Voltage	<ul style="list-style-type: none"> <li>● Circuit voltage below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300317	Battery Voltage	<ul style="list-style-type: none"> <li>● Circuit voltage above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

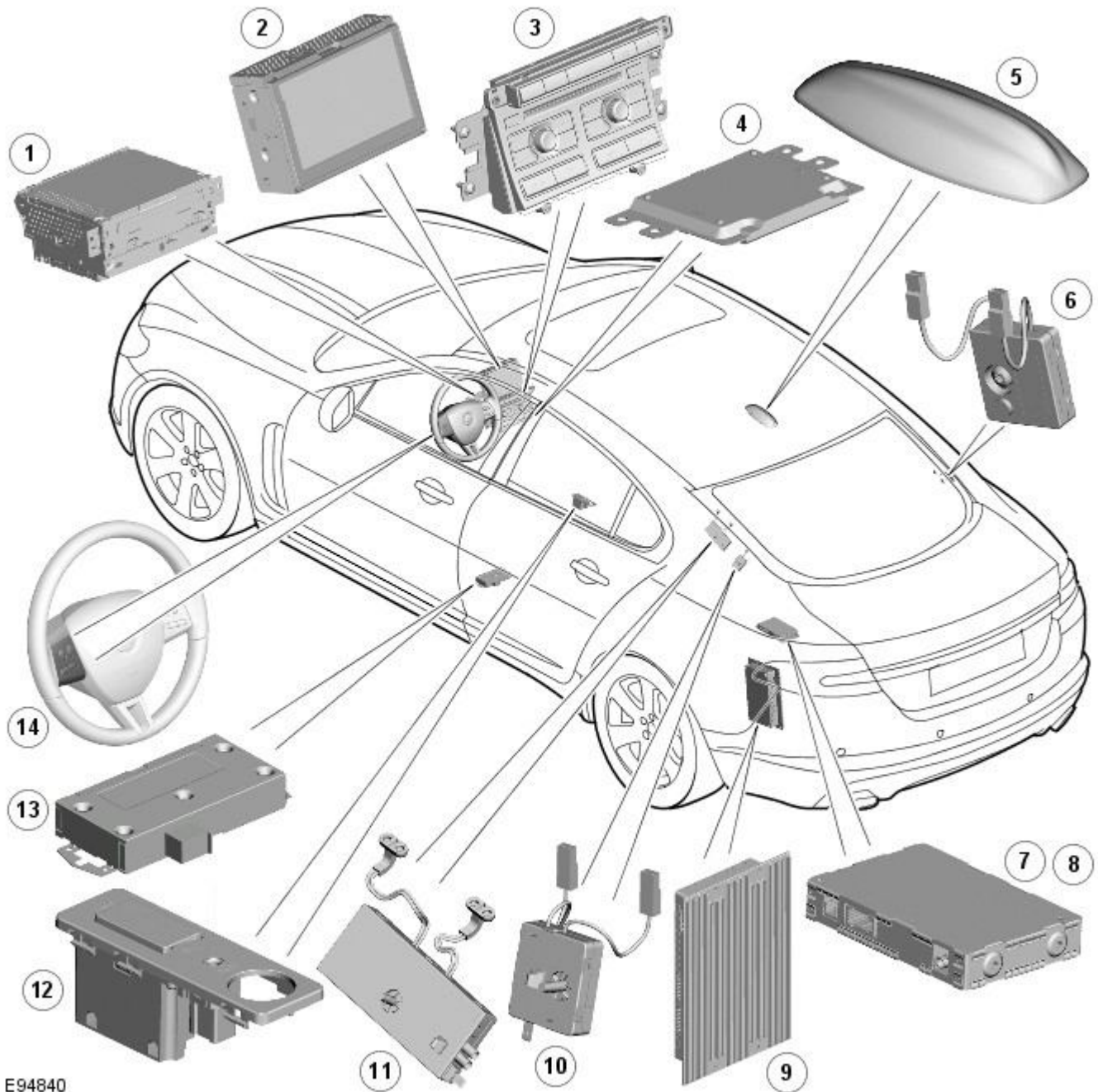
**Information and Entertainment System -**

Description	Nm	lb-ft	lb-in
Audio antenna unit to "D" pillar retaining bolts	9	-	80
Digital Radio antenna pod retaining nuts	5	-	48
Amplifier retaining nuts	7	-	62
Information and entertainment display retaining bolts	2	-	17
Information and entertainment display mounting bracket to Information and entertainment display retaining bolts	3	-	26
Information and entertainment module retaining bolts	3	-	26
Instrument panel speaker retaining screws	2	-	18
Steering wheel audio control switch retaining screws	3	-	26
Subwoofer amplifier retaining nuts	7	-	62
Subwoofer speaker retaining bolts	6	-	53

# Information and Entertainment System - Audio System - Component

## Location

Description and Operation



E94840

### ItemDescription

1	IAM (integrated audio module)
2	Touch-screen
3	ICP (integrated control panel)
4	ICM (information control module)
5	Roof pod antenna module (DAB band L and satellite radio receiver antennas)
6	RF filter
7	DAB (digital audio broadcasting) radio receiver (Optional - Europe only)
8	Satellite radio digital receiver (Optional - NAS only)
9	Power amplifier (Not fitted to the Jaguar Sound System)
10	RF filter
11	Diversity antenna module (AM/FM and DAB band III antennas)
12	Portable audio interface console (Optional)
13	Portable audio module (Optional)
14	Steering wheel remote audio controls

# Information and Entertainment System - Audio System - Overview

Description and Operation

## OVERVIEW

The audio system is available in three versions.

- Jaguar Sound System
- Jaguar 320W Premium Sound System
- Bowers & Wilkins 440W Surround Sound System

The audio systems are instrument panel mounted and combine the radio tuner with a slot loading single or 6 disc [CD \(compact disc\)](#) player. All units have AM/FM diversity reception, through the diversity antenna module, which receives signals from antennas located in the heated rear window. The audio systems have various levels of user control through the Touch-screen, ICP (integrated control panel) and steering wheel control panel. The Jaguar Sound System (base audio unit) with single [CD](#) player is only compatible with standard [CD](#)'s. All other versions of [CD](#) player are compatible with standard [CD](#)s and [CD](#)s with MP3 or WMA (windows media audio) files.

A portable audio module allows for the connection of a range of portable audio devices to the car's audio system. The portable audio module is controlled through the IAM (integrated audio module) and Touch-screen with play back through the car's speaker system. The introduction of this system allows the user to import their personal portable media player to interface with the car, including iPod and other MP3 players, or USB mass storage devices such as memory sticks. MP3 players can also be controlled through the Touch-screen if they are configured as mass storage devices. Details of how to do this will be contained in the manufacturers instructions.

The chosen audio device can be plugged into the car using an interface panel located in the floor console between the front seats. The interface includes a 3.5mm auxiliary jack-plug socket, a 12-volt power supply, a dedicated iPod connector with charging function, plus a USB2 connector which allows connectivity for a wide variety of USB devices. The USB port also provides a charging function although it **does not** support a USB hub. The maximum charging current supplied is 500ma. The user can connect an iPod and USB device at the same time, changing the source via the Touch-screen. The non selected source will still charge.

The Jaguar Sound System is the basic audio system which comprises of an IAM (integrated audio module) with no external amplifier and 8 speakers.

The Jaguar 320W Premium Sound System has the addition of an AUD 8 power amplifier and a 9 speaker system.

The Bowers & Wilkins 440w Surround Sound System additions include an AUD 12 power amplifier, a Dolby Pro-Logic 2 7.1 Surround Sound System, and 14 speakers.

DAB (digital audio broadcasting) is available for most European markets and gives access to digital radio channels for better sound quality and enhanced functionality depending on local service availability. The DAB (digital audio broadcasting) module is located in the luggage compartment. The system receives reception signals from the following sources to ensure optimum signal strength.

- DAB band L antenna located in the roof pod antenna module
- DAB band III antenna located in the heated rear window.

For NAS vehicles the digital format adopted is satellite radio which specifically links to the Sirius network. The system operates in the S-band frequency range, and as a result of the use of satellite transmission, has the ability to provide [CD](#) quality audio broadcasts over very large areas (typically continents). The satellite radio receiver is located in the luggage compartment. The system receives reception signals from the satellite radio antenna located in the roof pod module.

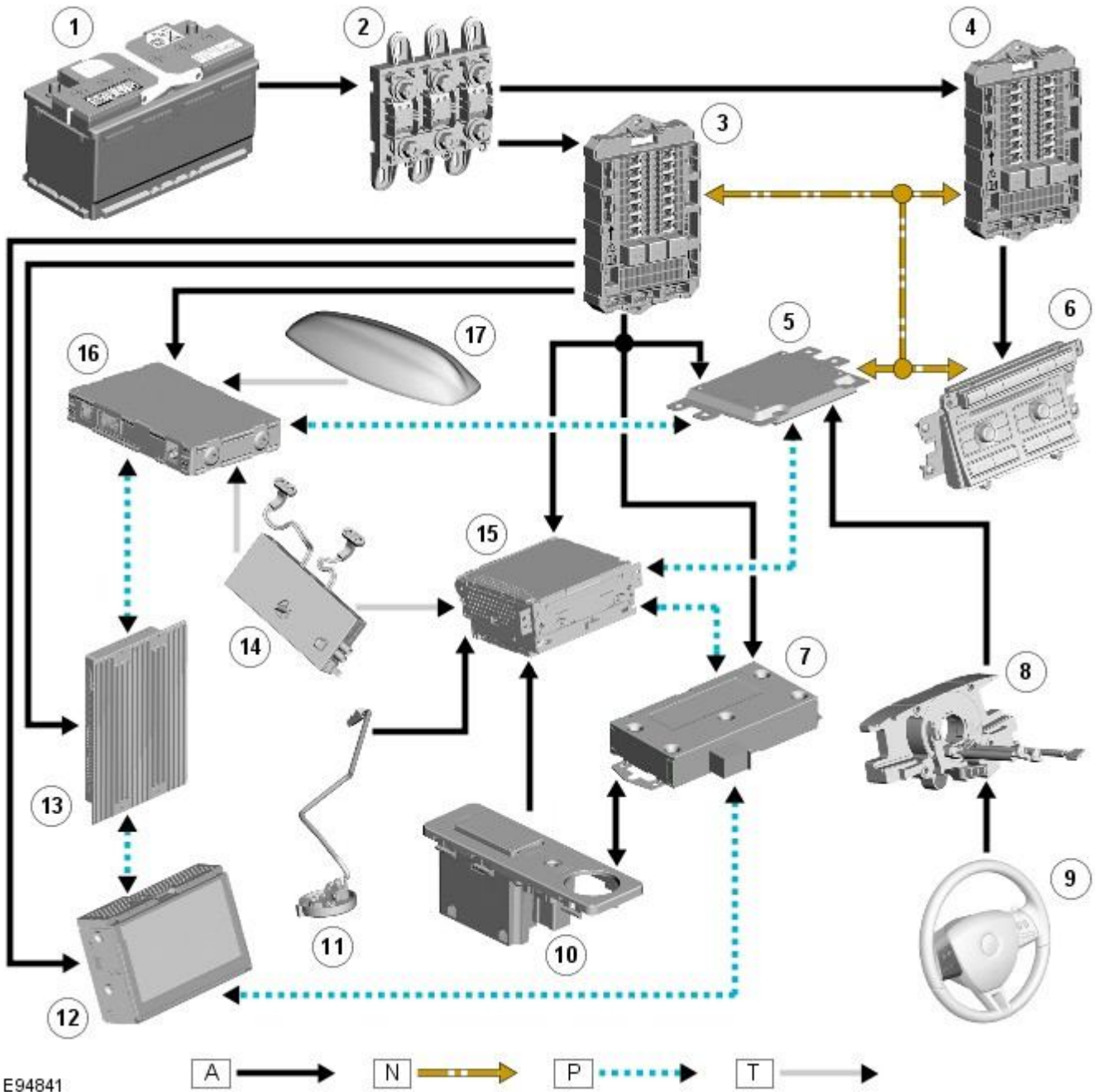
Primary user control of the audio system is via the ICP (integrated control panel) and the Touch-screen which are located in the center of the instrument panel. Control signals from the ICP (integrated control panel) are relayed on the medium speed [CAN \(controller area network\)](#) bus to the ICM (information control module). The ICM (information control module) relays the control signals to the rest of the audio system on the MOST (media oriented systems transport) ring. The ICM (information control module) is the timing master for the MOST (media oriented systems transport) ring and also hosts a gateway function between the medium speed [CAN](#) bus and the MOST (media oriented systems transport) ring. Audio output signals on the Jaguar 320W Premium Sound System and Bowers & Wilkins 440W Surround Sound System are sent on the MOST (media oriented systems transport) ring from the IAM (integrated audio module) to the power amplifier for speaker output.

# Information and Entertainment System - Audio System - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: A = Hardwired; N = Medium Speed CAN (controller area network) bus; O = LIN bus; P = MOST ring; T = Coaxial

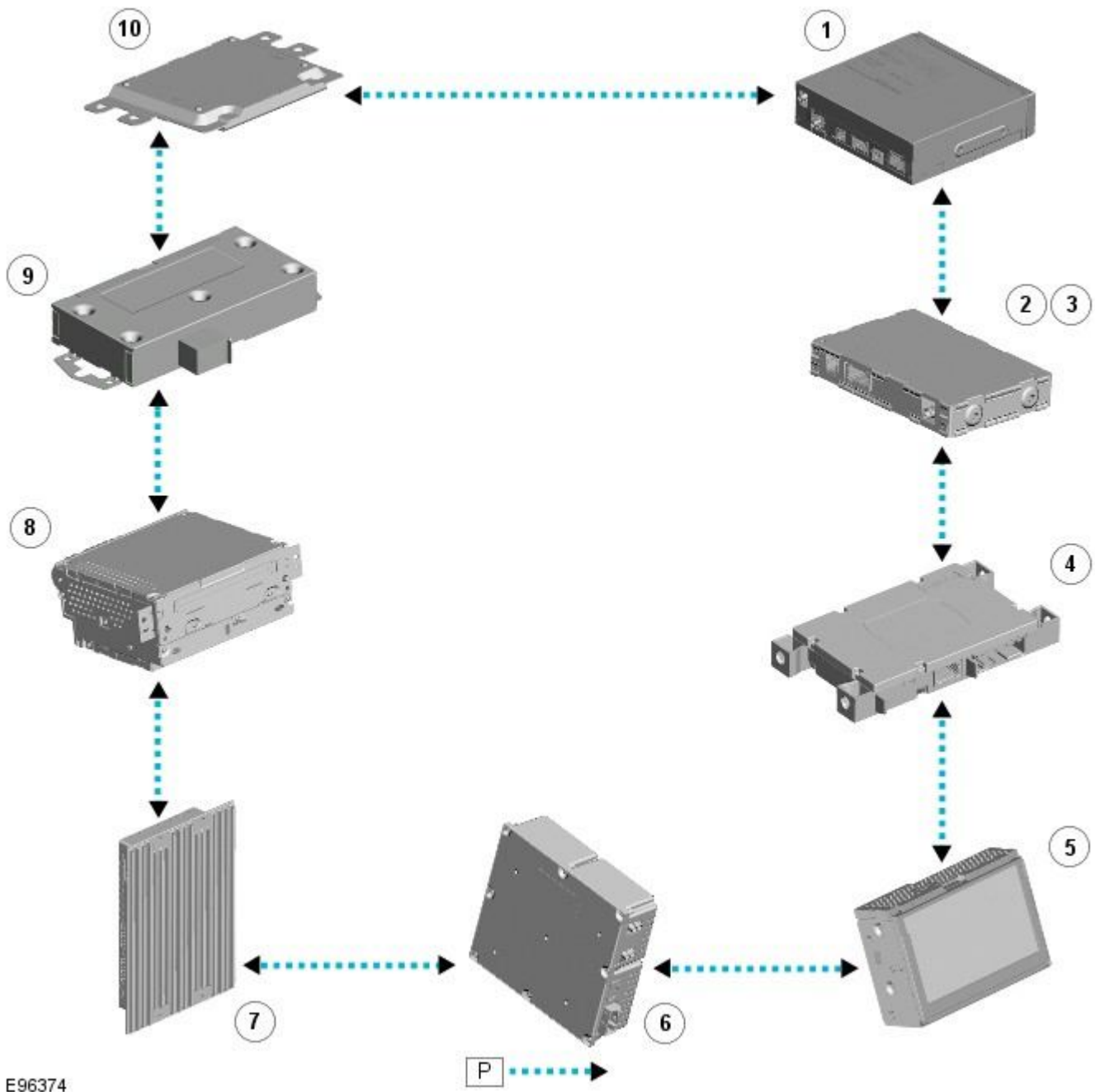


E94841

**ItemDescription**

1	Battery
2	BJB (battery junction box)
3	RJB (rear junction box)
4	CJB (central junction box)
5	ICM (information control module)
6	ICP (integrated control panel)
7	Portable audio module
8	Clock spring
9	Steering wheel remote audio controls
10	Portable audio interface panel
11	Microphone

12	Touch-screen
13	Power amplifier
14	Diversity antenna module
15	IAM (integrated audio module)
16	DAB receiver/Satellite Radio receiver (Note: There is no co-axial link from the diversity antenna module to the satellite radio receiver)
17	Roof pod



E96374

**ItemDescription**

1	Navigation computer (Optional)
2	DAB (digital audio broadcasting) radio receiver (Optional - Europe only)
3	Satellite Radio digital receiver (Optional - NAS only)
4	Telephone control module (Optional)
5	Touch-screen
6	TV tuner (Optional)
7	Power amplifier (Not fitted to the Jaguar Sound System)
8	IAM (integrated audio module)
9	Portable audio module (Optional)
10	ICM (information control module)

**System Operation**



## AUDIO SYSTEM OPERATION

The components of the audio/infotainment system are all connected on the MOST (media orientated systems transport) ring. The MOST (media orientated systems transport) ring is a fibre optic communications bus for multimedia applications. Audio and control information is passed around the MOST (media orientated systems transport) ring and can be picked up by any of the systems units. For example, radio station tuning/selection input by the vehicle user into the Touch-screen is sent along the MOST (media orientated systems transport) ring and collected by the IAM (integrated audio module) which then selects the requested radio station.

MOST (media orientated systems transport) technology uses a plastic optical fibre which forms a network connecting the audio and multimedia system components. Each component in the ring is connected to the plastic optical fibre through a device known as a FOT (fibre optical transceiver). Each FOT (fibre optical transceiver) has two optical connections; one connection is sensitive to light and is the input, the second connection forms the light source and is the output. The system operates by connecting the output from one FOT (fibre optical transceiver) to the input of another FOT (fibre optical transceiver).

The light signals are sent in one direction only and are formed in the following way:

- Electrical signals are converted into an electrical current
- The current then drives an [LED \(light emitting diode\)](#) in the FOT (fibre optical transceiver) to produce a high intensity red light
- The [LED](#) transmits the light through a fibre optic cable
- A photo diode in the FOT (fibre optical transceiver) at the opposite end of the fibre optic cable detects the light.

The following components may be connected to the MOST ring dependant on the vehicle equipment level:

- IAM (integrated audio module)
- Touch-screen
- ICM (information control module)
- DAB (digital audio broadcasting) radio receiver (Optional - Europe only)
- Satellite radio digital receiver (Optional - NAS only)
- Power amplifier (Not fitted to the Jaguar Sound System)
- Portable audio module (Optional)
- Telephone control module (Optional)
- Navigation computer (Optional)
- TV tuner (Optional)

• **NOTE:** Do not view the red light directly

MOST is a synchronous network. A timing master supplies the clock information and all other devices on the network synchronize their operation to this clock. The timing master for the MOST (media orientated systems transport) network on this vehicle is the ICM (information control module). This unit also controls and manages the MOST (media orientated systems transport) ring and the system components.

An Optical Bus tester is used in conjunction with the Jaguar diagnostic system to diagnose the MOST (media orientated systems transport) system. The Optical Bus tester emits a visible, high intensity red light which can be connected into the ring at any point to test the ring integrity. Disconnecting a MOST (media orientated systems transport) connector will reveal if the high intensity red light is visible.

If a break occurs in the MOST (media orientated systems transport) ring fault codes are stored in the ICM (information control module) which can be retrieved using the Jaguar diagnostic system equipment.

With reference to the audio system information and signal transfer the instrument cluster is the gateway between the high and medium speed [CAN](#) bus communication protocols. The ICM (information control module) is the gateway between medium speed [CAN](#) and the MOST (media orientated systems transport) systems.

A typical example of information transfer is vehicle speed information from the [ABS \(anti-lock brake system\)](#) module used to control the automatic volume control function. The vehicle speed information from the [ABS](#) module is sent on the high speed [CAN](#) network and collected by the instrument panel gateway. The signal is passed to the medium speed [CAN](#) network and onto the ICM (information control module) gateway. The ICM (information control module) calculates the volume adjustment required. The corrected audio volume level signal is sent on the MOST (media orientated systems transport) network to the IAM (integrated audio module) or Power amplifier (dependant on vehicle equipment level) for output to the speaker system.

## AUDIO SYSTEM GATEWAY FUNCTIONS

With reference to the audio system information and signal transfer the instrument cluster is the gateway between the high and medium speed [CAN](#) bus communication protocols. The ICM is the gateway between medium speed [CAN](#) and the MOST systems.

A typical example of information transfer is vehicle speed information from the [ABS \(anti-lock brake system\)](#) module used to control the automatic volume control function. The vehicle speed information from the [ABS](#) module is sent on the high speed [CAN](#) network and collected by the instrument panel gateway. The signal is passed to the medium speed [CAN](#) network and onto the ICM gateway. The ICM calculates the volume adjustment required. The corrected audio volume level signal is sent on the MOST network to the IAM or Power amplifier (dependant on vehicle equipment level) for output to the speaker system.

## AUDIO SYSTEM USER CONTROLS

Touch-Screen



E96378

**ItemDescription**

1	Touch-screen
2	Home menu button
3	Touch-screen on/off button

The Touch-screen forms the basis of the audio system. It communicates with the rest of the audio/infotainment system on the MOST ring and allows control of the audio system and other infotainment systems from a single point.

The Touch-screen communicates with the IAM on the MOST ring and provides the primary user interface and display of the audio system controls. No configuration procedure is required if the touch-screen is replaced.

Calibration of the Touch-screen using the Jaguar approved diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

The touch-screen provides user control of the following systems:

System	Functions
Audio	Radio display AM/FM or DAB, auxiliary and portable audio, digital TV or <a href="#">CD (compact disc)</a>
Climate control	Air conditioning, distribution, seats, heated steering wheel, automatic air recirculation
Telephone	Digit dialer, phone book, last ten calls (made, received, missed)
Navigation	Destination, stored locations, navigation setup, route options
Vehicle	Security, parking, valet mode, trip computer, clock, brightness, contrast, system settings, vehicle settings, display settings

Integrated Control Panel



E96379

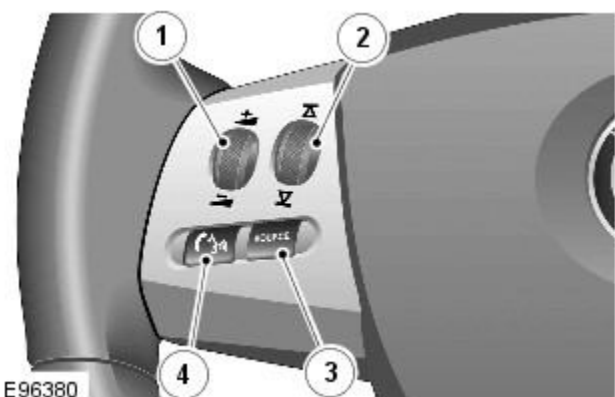
**ItemDescription**

1	Touch-screen
2	<a href="#">CD</a> load
3	<a href="#">CD</a> load and eject slot
4	Seek up
5	Settings button
6	Audio system on/off and volume control
7	Audio source
8	Seek down
9	Eject

The ICP duplicates many of the touch-screen audio user control features. Any volume setting made whilst in audio, TV, phone, navigation or voice activation mode will be memorized for that system. The ICP communicates with the ICM on the medium speed [CAN](#). The ICM converts control/command signals from the ICP and then distributes the information onto the MOST system to the audio system and other information and entertainment systems.

No configuration procedure is required if the ICP is replaced. There is no option to calibrate the ICP using the Jaguar approved diagnostic equipment.

**Steering Wheel Controls**



E96380

**ItemDescription**

1	Volume adjustment
2	Change pre-set radio stations or <a href="#">CD</a> tracks

3 Select audio source

4 Audio mute control/JaguarVoice control

Additional control of the audio system is available in the form of steering wheel mounted switches which are located on the left hand side of the steering wheel. The four switches provide for volume adjustment, change pre-set radio stations or [CD](#) tracks, select audio source and finally audio mute control. The mute control is also used for JaguarVoice control.

The steering wheel audio control switches are hardwired through the clock spring to the ICM. The ICM processes the analogue signals from the switches into digital signals. The digital signals are then passed from the ICM onto the MOST system to control the requested audio functions.

AVC (automatic volume control) controls the audio volume in relation to vehicle speed. As vehicle speed increases the audio level is adjusted to compensate for extra road and vehicle noise. There are three settings for AVC:

- Low
- Medium
- High

Setting of the AVC level is made using the audio controls. The default setting is medium.

The vehicle speed signal is used to enable the ICM to calculate the volume adjustment required. The vehicle speed signal is received over the [CAN](#). The signal is an average of the four wheel speed sensor signals. Should an invalid speed signal be received the AVC will not alter the output volume.

## Component Description

### INTEGRATED AUDIO MODULE



E96375

The IAM is located in the center console behind the ICP faceplate, and combines the radio tuner and [CD](#) player. The head unit controls which of the two sources is routed to the speakers. All tuner versions have AM/FM reception. Each audio system features auto-store, with a press and hold function to store selected channels as pre-sets. The standard search facility finds the nine strongest channels currently available, while search and manual tuning allow channels to be stored as above.

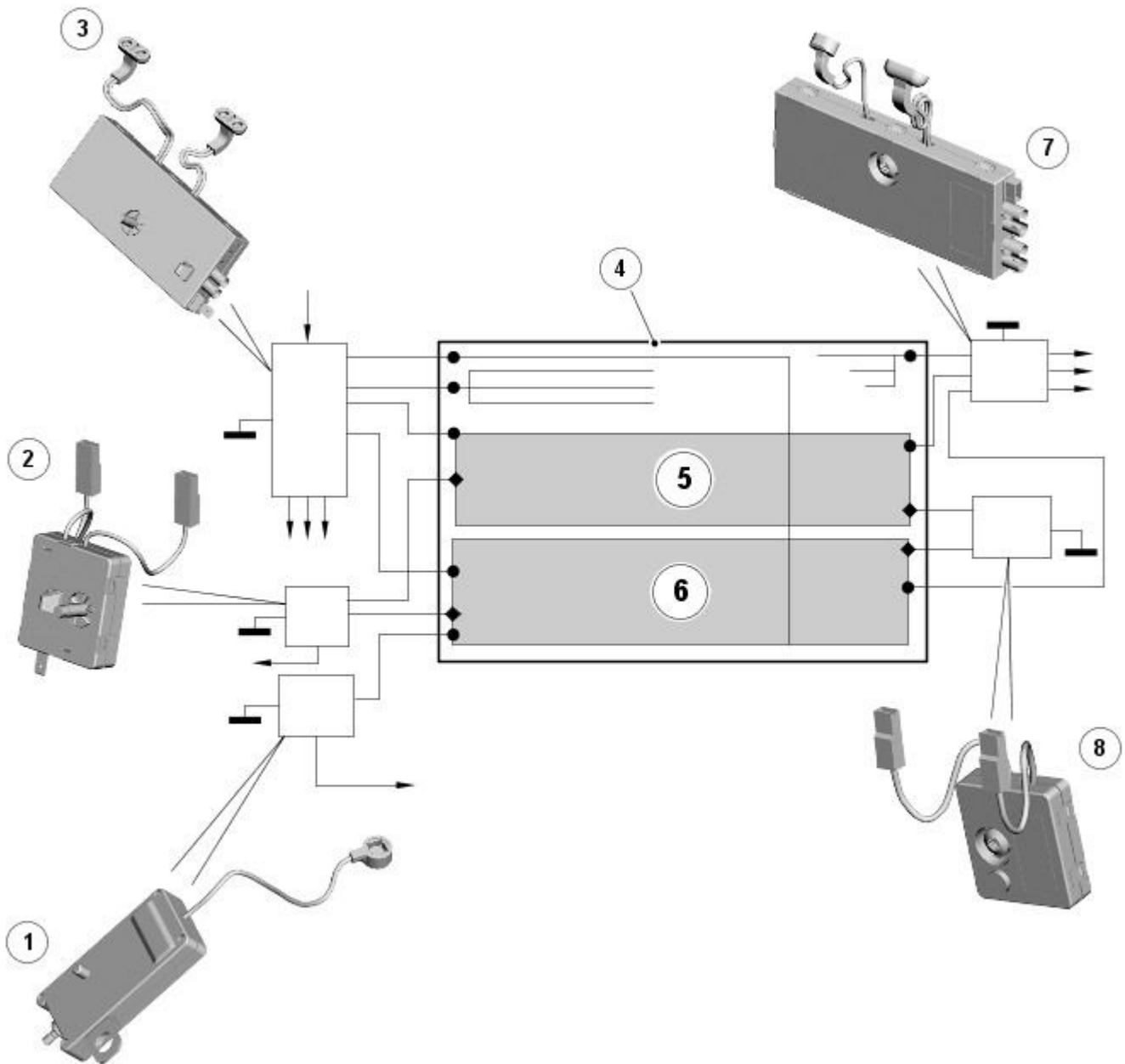
The Jaguar Sound System IAM uses an internal amplifier which directly drives the system speakers. The Jaguar 320W Premium Sound System and Bowers & Wilkins 440W Surround Sound System differs from the Jaguar Sound System with the addition of an external amplifier. Audio output signals from the IAM are sent on the MOST system to the external amplifier which drives the system speakers.

Depending on audio specification the slot-loading [CD](#) unit is either a single-disc type or six-disc auto-changer. The system automatically detects the [CD](#) format of the source (standard [CD](#), MP3 or WMA files) and offers a full range of options, presenting folders on the touch-screen, listed by albums and tracks, to browse as on a PC. Both versions have mix and repeat functions and the six-disc version displays disc names.

The IAM communicates on the MOST system with the rest of the audio system. If the IAM is replaced it must be configured as a new module using the Jaguar approved diagnostic equipment.

Calibration of the IAM using the Jaguar approved diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

### Audio Antennas



E96376

**ItemDescription**

1	Single TV antenna module
2	RF filter
3	Diversity antenna module
4	Heated rear window
5	Heated rear window upper section
6	Heated rear window lower section
7	Triple TV antenna module
8	RF filter

The diversity antenna module, located on the left hand side of the heated rear window, receives signals from four antennas located in the heated rear window, where one antenna is dedicated as an AM antenna.

The diversity tuning system ensures that the strongest signals are used by the radio system to ensure the best possible FM reception. Using the three remaining receiving antennas serves to eliminate multipath signal distortion. Typically, the signal from the antenna with the least noise is chosen, and the other antennas are ignored.

The diversity antenna module is an interface between the antenna aerials in the heated rear window and audio system modules/tuners. It provides antenna signals to the AM/FM tuner in the IAM, to the DAB receiver and to the VICS (vehicle information and communication systems) or TMC (traffic message channel) in the navigation computer.

There are three different types of diversity antenna module fitted depending on the vehicle market and infotainment equipment specification:

- AM/FM with one co-axial output

- AM/FM and VICS/TMC with two co-axial outputs
- AM/FM, VICS/TMC and DAB band III with three co-axial outputs

The diversity antenna module receives a power supply from the IAM.

Vehicle or other component generated electromagnetic interference may cause unwanted disturbances in the radio and TV reception signals. The disturbance may interrupt, obstruct, or otherwise degrade or limit the effective performance of the circuit. It frequently affects the reception of AM radio in urban areas and can also affect FM radio and television reception, although to a lesser extent.

The RF filters, which act as RF isolators, are located on both sides of the heated rear window and are used to reduce the electromagnetic interference. The left hand side RF filter is connected across the heated rear window power supply and used to separate the DC (direct current) interference from the RF signals. The right hand side RF filter is used in conjunction with the TV antenna module (if fitted). If the TV system is not fitted the filter is linked directly to ground.

## INFORMATION CONTROL MODULE



E96377

The ICM is located beneath the IAM in the center console. The unit performs a range of infotainment and some climate-control functions.

The ICM, which is the timing master of the MOST system; supplies clock information to all other devices on the network which synchronize their operation to this clock.

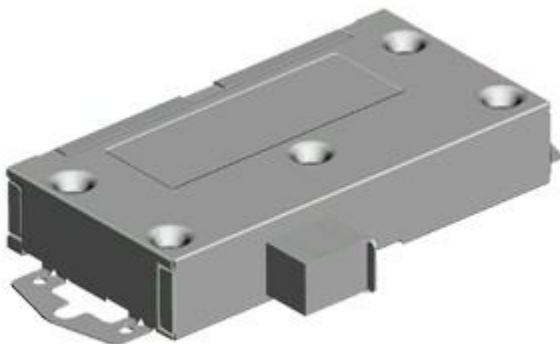
The unit also controls and manages the MOST ring and provides the allocations of channels, system power management, functionality and co-ordination of the other system components.

The system becomes operational when the vehicle is unlocked and a 'wake up' signal is received by the ICM on the medium speed [CAN](#). The ICM 'wakes up' all the control modules on the MOST system ready for immediate operation by the vehicle user.

If the ICM is replaced it must be configured as a new module using the Jaguar approved diagnostic equipment.

Calibration of the ICM using the Jaguar approved diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

## PORTABLE AUDIO MODULE

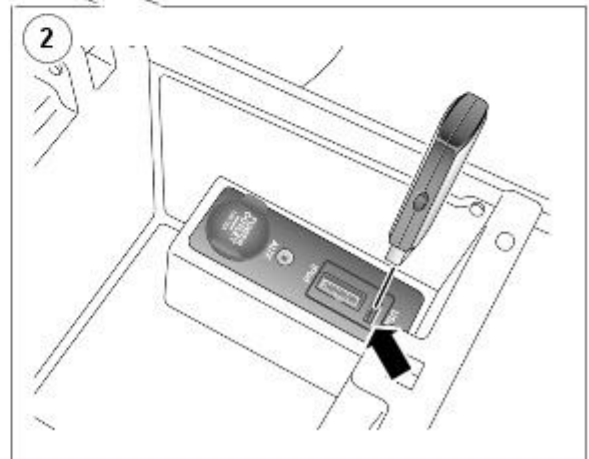
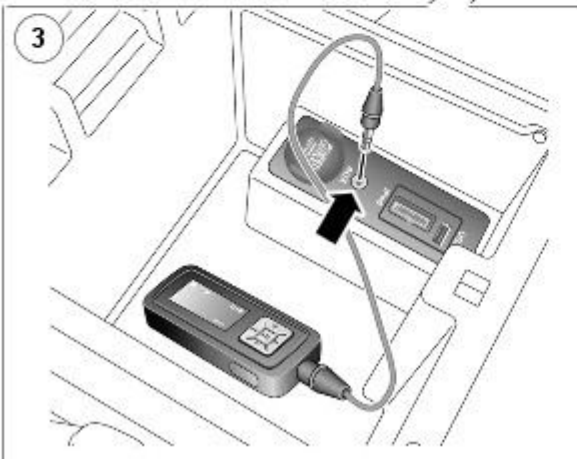
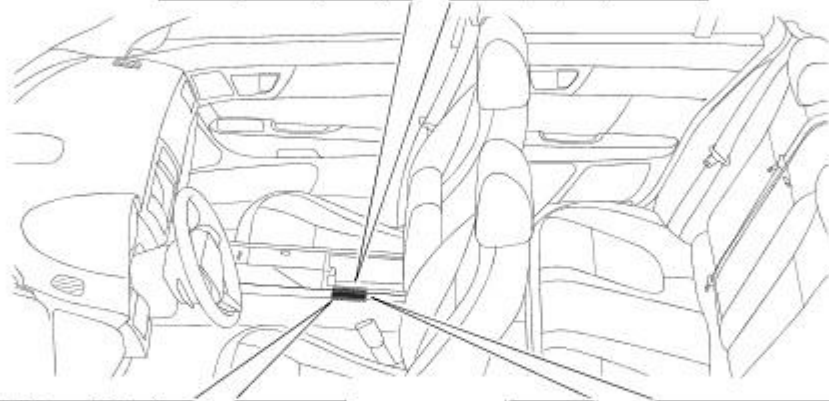
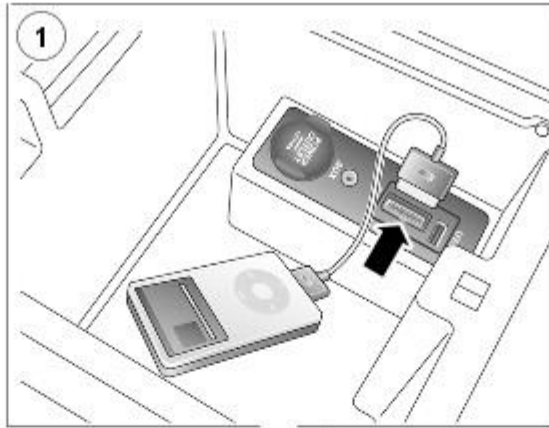


E96381

The portable audio module, located under the left hand front seat, allows for the connection, control and playback of a range of portable audio devices through the car's audio system.

No configuration procedure is required if the portable audio module is replaced. Calibration of the portable audio module using the Jaguar approved diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.





E96382

#### ItemDescription

- |   |                      |
|---|----------------------|
| 1 | iPod connection      |
| 2 | USB connection       |
| 3 | Auxiliary connection |

The chosen audio device is plugged into the car using the interface panel located in the center console between the front seats. Vehicles with the optional iPod function are supplied with a bespoke iPod lead in the vehicle delivery pack .

A menu option is available through the Touch-screen audio section when selecting a portable audio device for operation through the vehicle audio system.

After the connection of an iPod or USB mass storage device the Touch-screen is used to operate and search the connected device. Due to safety regulations, the normal control interfaces of either the iPod or USB device are disabled when it is plugged into the interface panel.

• NOTE: Some MP3 players have their own file system that is not supported by this system. To use the MP3 player it must be set to USB Removable Device or Mass Storage Device mode. The manufacturer's information should include details of this procedure. Only music that has been added to the device in this mode can be played via the vehicle's portable audio system.

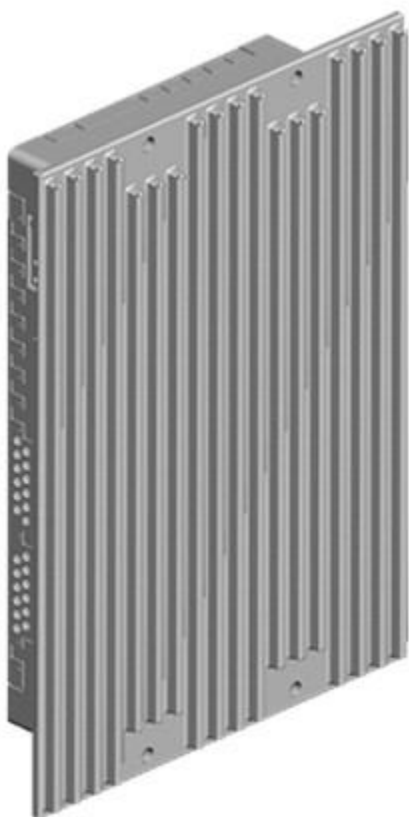
Conversely, connection of any devices through the auxiliary connection cannot be controlled through the touch-screen and are controlled through the device itself.

• NOTE: The system will support devices with a storage capacity up to 256 GB which is approximately 65,000 audio tracks.

The wiring link harness between the portable audio module and interface panel consists of hardwired and digital connections for data and signal exchange. The MOST carries the communication signals and information between the portable audio module to the IAM and touch-screen. Audio output to the speaker system is controlled by the IAM or power

amplifier depending on the audio system specification.

## POWER AMPLIFIER



E96383

The audio system has three amplification options dependant on the audio system specification:

- IAM internal amplifier
- Alpine AUD 8
- Alpine AUD 12

The power amplifier is located in the left hand side of the luggage compartment and is connected to the audio system via the MOST bus. Speaker connections are hardwired.

If the power amplifier is replaced it must be configured as a new module using the Jaguar diagnostic equipment.

Calibration of the power amplifier using the Jaguar approved diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

## DIGITAL AUDIO BROADCASTING

DAB is a digital radio network designed to provide reliable, multi-service broadcasting for reception by mobile, portable and fixed receivers.

DAB provides a clear signal with minimal interference, hiss or fading. After a channel (or station) has been tuned and stored, it does not need retuning.

• **NOTE:** Radio signals travel in a straight line so large obstacles, such as tall buildings, can shield the vehicle from the signal causing temporary loss of reception (known as dead spots).

Digital radio is transmitted from regional terrestrial transmitters. Some local digital radio channels are not available outside the range of a transmitter. To receive new local channels during vehicle movement around a country, the auto-tune function is used to build new channel lists.

• **NOTE:** When the vehicle DAB radio is first used the system will not receive any digital stations until the auto-tune function has been completed.

Digital radio channels are organized into groups called ensembles (also known as multiplexes). Some individual channels may also provide a number of subchannels. For example, if several sports events are being held simultaneously, the channel may temporarily choose to broadcast each different event on a separate subchannel.

DAB is broadcast across Europe, Canada and parts of Asia. System transmission is via a terrestrial network, on two separate broadcasting bands:

- DAB band-L
- DAB band III

The DAB system requires additional components to be added to the audio system. DAB antennas and a receiver are fitted to allow reception of the service.

Operation of the DAB system is the same as the radio operation with selections made through the touch-screen and ICP to access and navigate the system functions.

The DAB receiver is a dedicated tuner which is controlled by the ICM on the MOST ring. The receiver processes the signals from the DAB antennas. Information is transmitted on the MOST ring and processed by the ICM. The processed information is sent out to the power amplifier or IAM (with internal amplifier) and broadcast through the speaker system.

No configuration procedure is required if the DAB receiver is replaced. Calibration of the DAB receiver using the Jaguar approved diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

#### Digital Audio Broadcasting Antennas



E96385

#### ItemDescription

1	Roof pod
2	Diversity antenna module

The DAB band III antenna is located in the heated rear window and is part of the diversity antenna module circuit. The two antenna circuits each have a co-axial connection to the DAB module.

DAB signals are transmitted on either DAB band III (174 - 240 MHz) or DAB band-L (1452 - 1492 MHz). Some countries may only use the band III signals, while others may only use the band-L signals. Some countries use both frequency ranges within the same geographical area. The type of DAB signal received depends on the vehicle market location.

The DAB antennas are designed with 50 ohm output impedance. The DAB receiver is fitted with 50 ohm fakra II connectors to ensure compatibility with the antenna. For optimum performance 50 ohm low loss coaxial cable is used between the antenna and receiver.

## SATELLITE RADIO (NAS VEHICLES ONLY)



E96386

The digital radio format adopted for NAS vehicles is satellite radio. Satellite service providers transmit a signal from their up-link facility (which is the original point of transmission of data, voice or other information through an antenna system) to a satellite where the signal is then down linked to both the terrestrial repeater network and the individual satellite car radios. The radio switches between the satellite signal and the repeater network signal depending on the strength of the signal at any given time.

The Sirius satellite system comprises:

- Satellites
- Ground repeaters
- Up-link ground stations
- Radio receiver systems

The Sirius satellite radio system uses three satellites on an inclined elliptical orbit. This ensures that each satellite spends approximately 16 hours a day over the continent of the USA, with at least one satellite over the country at any one time.

The satellites beam their signals down to the ground where the signal is picked up by receivers or is transmitted to repeater stations to cover built up areas where the signal is obscured. The satellite service comprises over 100 channels of digital entertainment which is provided by subscription requiring a monthly payment.

Operation of the satellite radio system is the same as the radio operations with selections made through the Touch-screen and ICP to access and navigate the system functions.

The satellite radio receiver is a dedicated tuner which is controlled by the ICM on the MOST ring. The receiver filters the signals from the satellite radio antenna. Information is transmitted on the MOST ring and processed by the ICM. The processed information is sent out to the power amplifier or IAM (with internal amplifier) and broadcast through the speaker system.

No configuration procedure is required if the satellite radio receiver is replaced. Calibration of the satellite radio receiver using the Jaguar approved diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

#### Satellite Radio Antenna



E96387

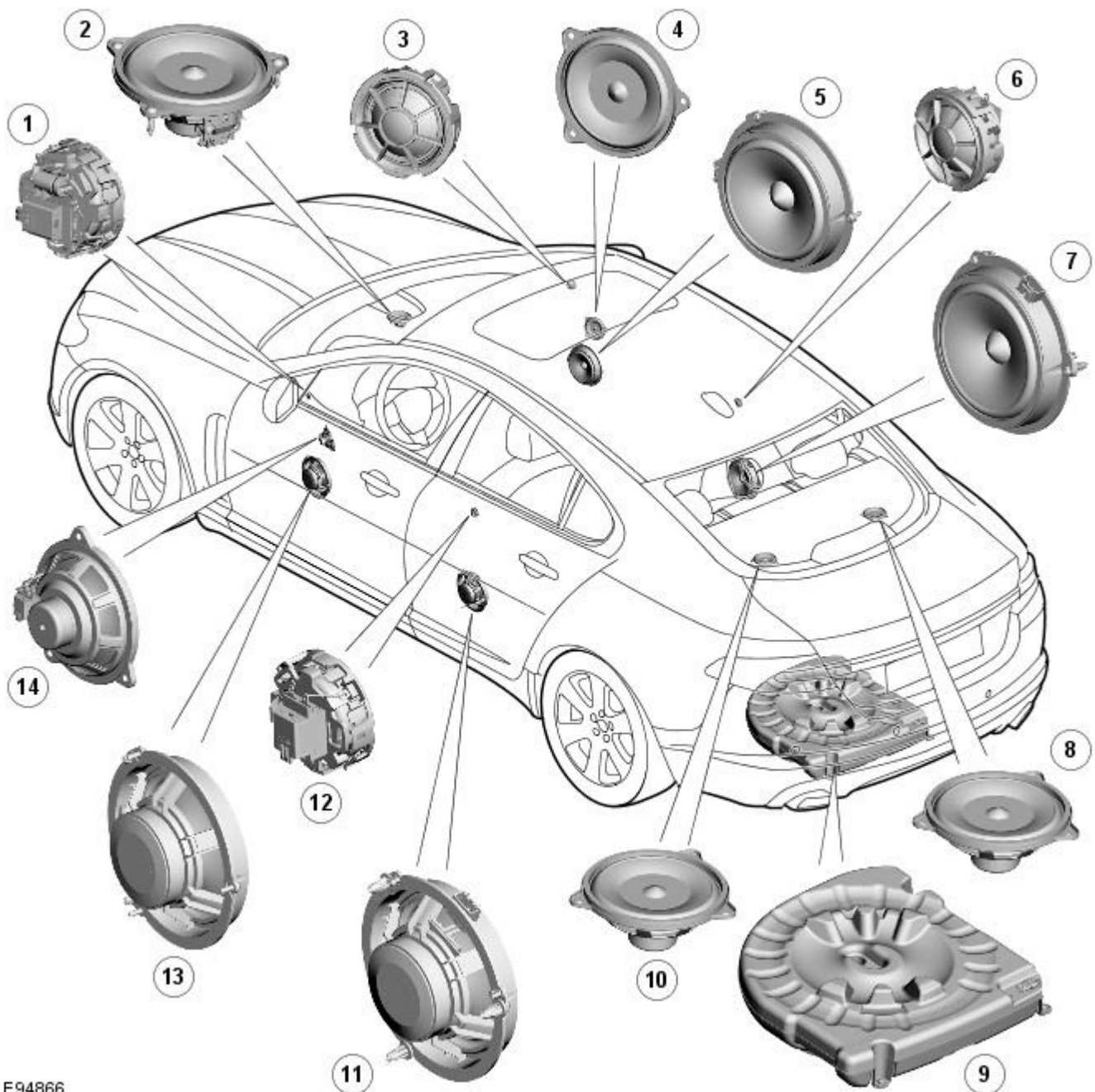
The satellite radio antenna is located in the roof pod and is shared with the navigation system [GPS \(global positioning system\)](#) antenna where fitted. The roof pod is located externally in a central position towards the rear of the roof.

Similar to the DAB system the satellite radio antenna is designed with 50 ohm output impedance. The satellite radio receiver is fitted with 50 ohm fakra II connectors to ensure compatibility with the antenna. For optimum performance 50 ohm low loss coaxial cable is used between the antenna and receiver.

The antenna is designed to receive one of two signals, using the strongest signal with the least distortion to process for audio output. For example, if the vehicle drives into a tunnel, the signal received will change from a satellite signal to a repeater station signal maintaining the strongest signal.

# Information and Entertainment System - Speakers - Component Location

Description and Operation



E94866

## ItemDescription

1	<a href="#">LH (left-hand)</a> front tweeter speaker (All models)
2	Front center speaker (Bowers & Wilkins 440W Surround Sound System only)
3	<a href="#">RH (right-hand)</a> front tweeter speaker (All models)
4	<a href="#">RH</a> front mid-range speaker (Bowers & Wilkins 440W Surround Sound System only)
5	<a href="#">RH</a> front mid-bass speaker (All models)
6	<a href="#">RH</a> rear tweeter speaker (All models)
7	<a href="#">RH</a> rear mid-bass speaker (All models)
8	<a href="#">RH</a> rear full range speaker (Bowers & Wilkins 440W Surround Sound System only)
9	Subwoofer enclosure (Not fitted to Jaguar Sound System)
10	<a href="#">LH</a> rear full range speaker (Bowers & Wilkins 440W Surround Sound System only)
11	<a href="#">LH</a> rear mid-bass speaker (All models)
12	<a href="#">LH</a> rear tweeter speaker (All models)
13	<a href="#">LH</a> front mid-bass speaker (All models)
14	<a href="#">LH</a> front mid-range speaker (Bowers & Wilkins 440W Surround Sound System only)

# Information and Entertainment System - Speakers - Overview

Description and Operation

## Overview

The vehicle has three levels of audio system available:

- Jaguar Sound System
- Jaguar Premium Sound System
- Bowers & Wilkins Surround Sound System

The Jaguar Sound System has 8 speakers, comprising an identical mid-bass and tweeter combination in each door. All speaker domes in this system are of standard textile construction. The speakers are driven directly by the IAM (integrated audio module) internal amplifier.

The Jaguar 320W Premium Sound System has 9 speakers including mid-bass and tweeters in the doors, adding a sub-woofer in the spare wheel well. The speakers are driven by an Alpine AUD 8 amplifier located in the [LH \(left-hand\)](#) side of the luggage compartment.

The Bowers & Wilkins 440W Surround Sound System uses an Alpine AUD 12 amplifier, a Dolby Pro-Logic 2 7.1 Surround Sound System and has 14 speakers. This layout adds a mid-range speaker to each front door while retaining a mid-bass and tweeter in each rear door. It also adds an instrument panel center speaker, 2 surround-effect speakers in the rear parcel shelf, and has the luggage compartment-mounted sub-woofer as the Jaguar 320W Premium Sound System. The speakers are driven by an AUD 12 power amplifier located in the luggage compartment.

The main speakers on the Jaguar 320W Premium Sound System and the Bowers & Wilkins 440W Surround Sound System are identified by the bright yellow Kevlar constructed domes which are visible through the speaker grilles. The tweeter speaker domes are an aluminum construction. The sub-woofer speakers are a textile dome construction.



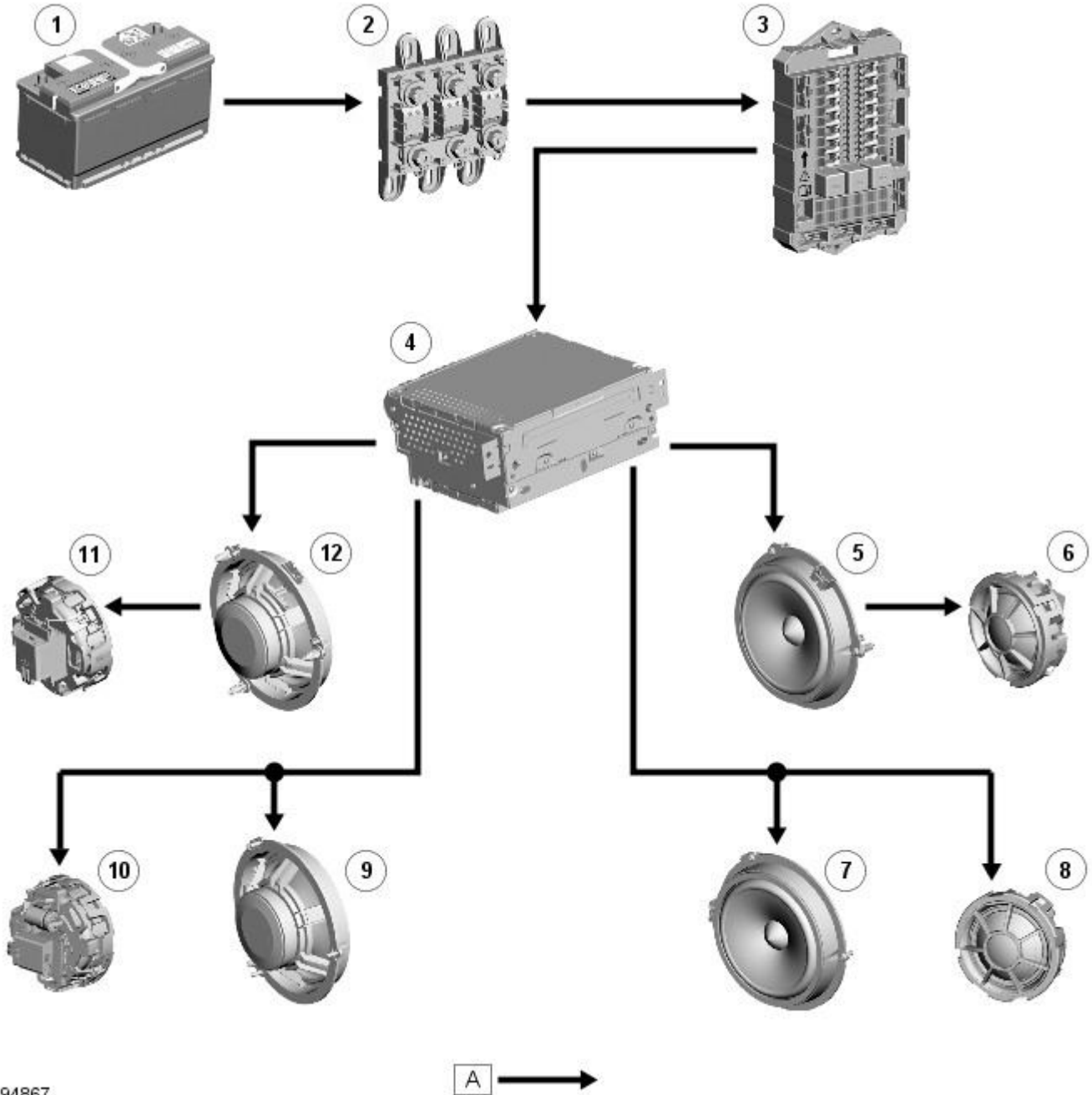
# Information and Entertainment System - Speakers - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: A = Hardwired

CONTROL DIAGRAM - JAGUAR SOUND SYSTEM



E94867

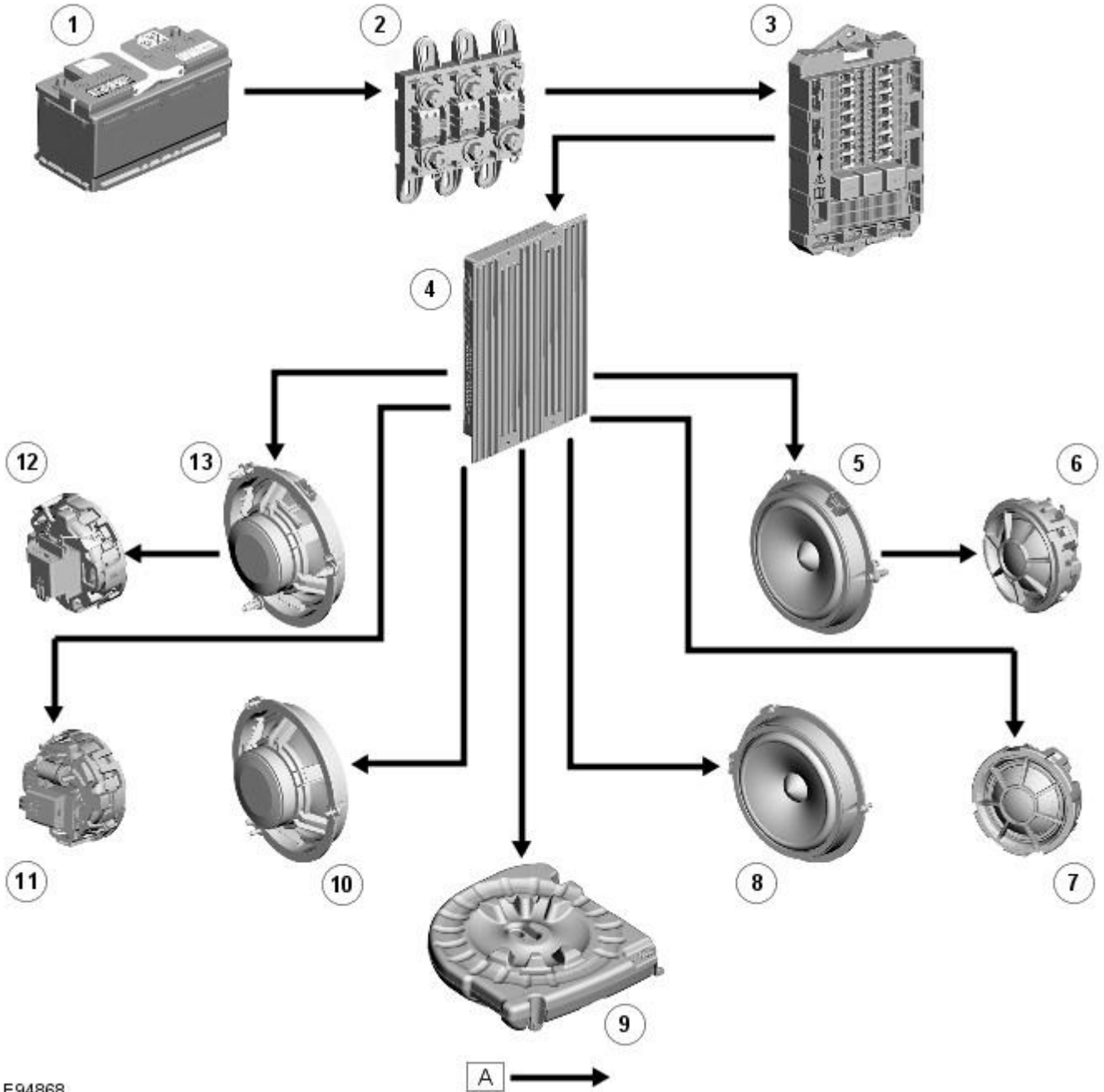
### ItemDescription

1	Battery
2	<a href="#">BJB (battery junction box)</a>
3	<a href="#">RJB (rear junction box)</a>
4	IAM (integrated audio module)
5	<a href="#">RH (right-hand) rear mid-bass speaker</a>
6	<a href="#">RH</a> rear tweeter speaker
7	<a href="#">RH</a> front mid-bass speaker
8	<a href="#">RH</a> front tweeter speaker
9	<a href="#">LH (left-hand) front mid-bass speaker</a>
10	<a href="#">LH</a> front tweeter speaker

11 [LH](#) rear tweeter speaker

12 [LH](#) rear mid-bass speaker

CONTROL DIAGRAM - JAGUAR 320W PREMIUM SOUND SYSTEM

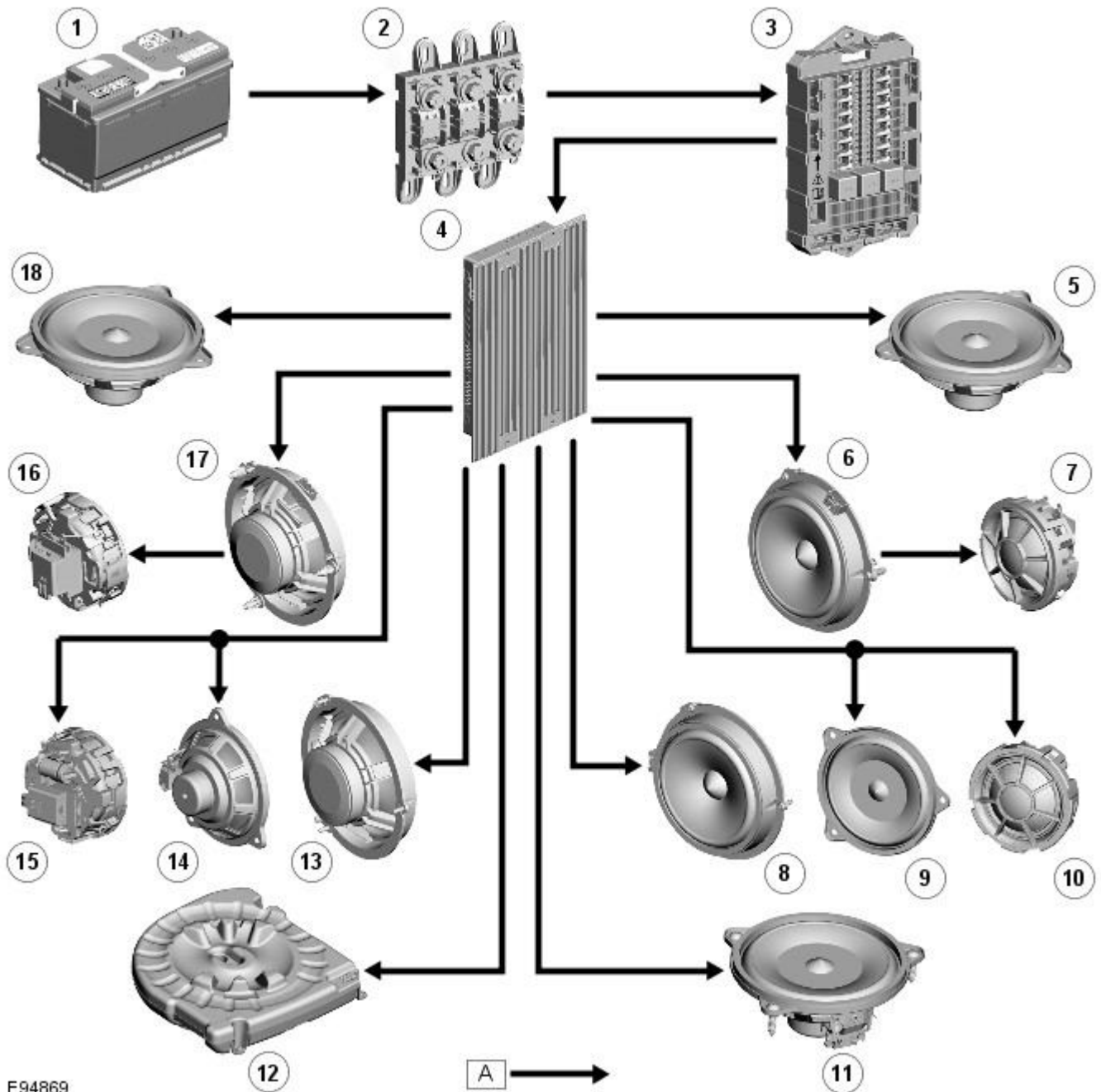


E94868

ItemDescription

1	Battery
2	<a href="#">BJB</a>
3	<a href="#">RJB</a>
4	Power amplifier
5	<a href="#">RH</a> rear mid-bass speaker
6	<a href="#">RH</a> rear tweeter speaker
7	<a href="#">RH</a> front tweeter speaker
8	<a href="#">RH</a> front mid-bass speaker
9	Subwoofer enclosure
10	<a href="#">LH</a> front mid-bass speaker
11	<a href="#">LH</a> front tweeter speaker
12	<a href="#">LH</a> rear tweeter speaker
13	<a href="#">LH</a> rear mid-bass speaker

CONTROL DIAGRAM - BOWERS & WILKINS 440W SURROUND SOUND SYSTEM



E94869

**ItemDescription**

1	Battery
2	<a href="#">BJB</a>
3	<a href="#">RJB</a>
4	Power amplifier
5	<a href="#">RH</a> rear full range speaker
6	<a href="#">RH</a> rear mid-bass speaker
7	<a href="#">RH</a> rear tweeter speaker
8	<a href="#">RH</a> front mid-bass speaker
9	<a href="#">RH</a> front mid-range speaker
10	<a href="#">RH</a> front tweeter speaker
11	Front center speaker
12	Subwoofer enclosure
13	<a href="#">LH</a> front mid-bass speaker
14	<a href="#">LH</a> front mid-range speaker
15	<a href="#">LH</a> front tweeter speaker
16	<a href="#">LH</a> rear tweeter speaker
17	<a href="#">LH</a> rear mid-bass speaker
18	<a href="#">LH</a> rear full range speaker

## System Operation

The Jaguar Sound System has 8 speakers, comprising an identical mid-bass and tweeter combination in each door. All speaker domes in this system are of standard textile construction. The speakers are driven directly by the IAM (integrated audio module) internal amplifier.

The Jaguar 320W Premium Sound System has 9 speakers including mid-bass and tweeters in the doors, adding a sub-woofer in the spare wheel well. The speakers are driven by an Alpine AUD 8 amplifier located in the [LH](#) side of the luggage compartment.

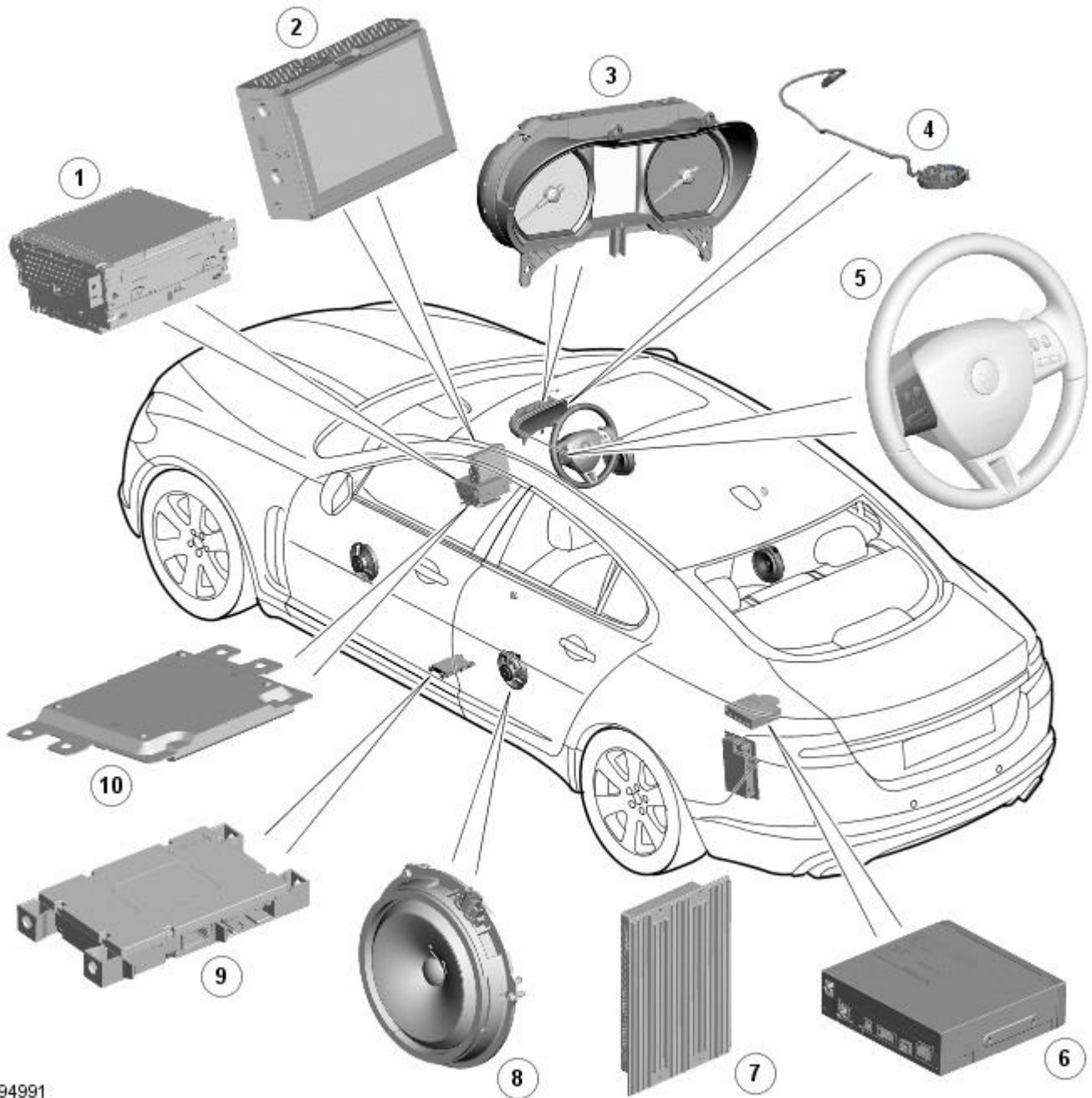
The Bowers & Wilkins 440W Surround Sound System uses an Alpine AUD 12 amplifier, a Dolby Pro-Logic 2 7.1 Surround Sound System and has 14 speakers. This layout adds a mid-range speaker to each front door while retaining a mid-bass and tweeter in each rear door. It also adds an instrument panel center speaker, 2 surround-effect speakers in the rear parcel shelf, and has the luggage compartment-mounted sub-woofer as the Jaguar 320W Premium Sound System. The speakers are driven by an AUD 12 power amplifier located in the luggage compartment.

The main speakers on the Jaguar 320W Premium Sound System and the Bowers & Wilkins 440W Surround Sound System are identified by the bright yellow Kevlar constructed domes which are visible through the speaker grilles. The tweeter speaker domes are an aluminum construction. The sub-woofer speakers are a textile dome construction.

# Information and Entertainment System - Cellular Phone - Component

## Location

Description and Operation



E94991

### ItemDescription

1	IAM (integrated audio module)
2	Touch-screen
3	Instrument cluster
4	Microphone
5	Steering wheel controls
6	Navigation Computer
7	Power amplifier
8	Speakers
9	Telephone control module
10	ICM (information control module)

# Information and Entertainment System - Cellular Phone - Overview

Description and Operation

Authoring Template

## OVERVIEW

The cellular phone system uses the customers own Bluetooth® capable handset in conjunction with the vehicle information and entertainment system. The telephone control module is located under the left-hand front seat, and has a Bluetooth® antenna integrated into the unit. Telephone handsets must be paired with the telephone control module, requiring input of a PIN (personal identification number) before they can be used with the vehicle system. Once paired, any phone can be docked to the car without re-entering a PIN (personal identification number). In addition to this, the last connected device will dock automatically the next time it is placed in the vehicle and the ignition is in power mode (ignition on).

The system has the ability to pair and dock telephone handsets from the telephones themselves. By supplying a fixed PIN (personal identification number), a user will be able to use their telephone or other telephone related Bluetooth® device and pair with it without using the touch screen. This enables devices such as Blackberry's and other secure PDA's (personal digital assistants) to pair and dock with the vehicle system.

Up to 5 telephone handsets can be paired with the vehicle, but only 1 telephone can be used at a time. The Touch-screen displays phone functionality, including dialing, and (if compatible) the handset's phone book. The Touch-screen also displays the phone's signal strength and battery meter (if supported by the phone). These functions allow the user to view the displays on the Touch-screen and not have to use the handset.

• **NOTE:** There is no physical connection (cradle) between the phone handset and the telephone control module. Communications between the 2 components are purely Bluetooth®. This can limit the available functions dependant on the handset used.

The system allows the driver to make, receive and end phone calls using the Touch-screen, steering wheel switches and voice recognition system (if fitted).

Phone dialing is achieved using one of the following methods:

- Dialing a number using the Touch-screen keypad
- Selecting a number from the handsets (automatically or manually downloaded) phonebook on the Touch-screen
- Selecting a number from the handsets (automatically or manually downloaded) phonebook in the instrument cluster message center
- Selecting from the handsets (downloaded) call register, typically the last 10 calls made, received and missed

The telephone control module is connected to the information and entertainment system on the MOST (media oriented systems transport) ring. This allows audio and control signals to be routed to and from the telephone control module.

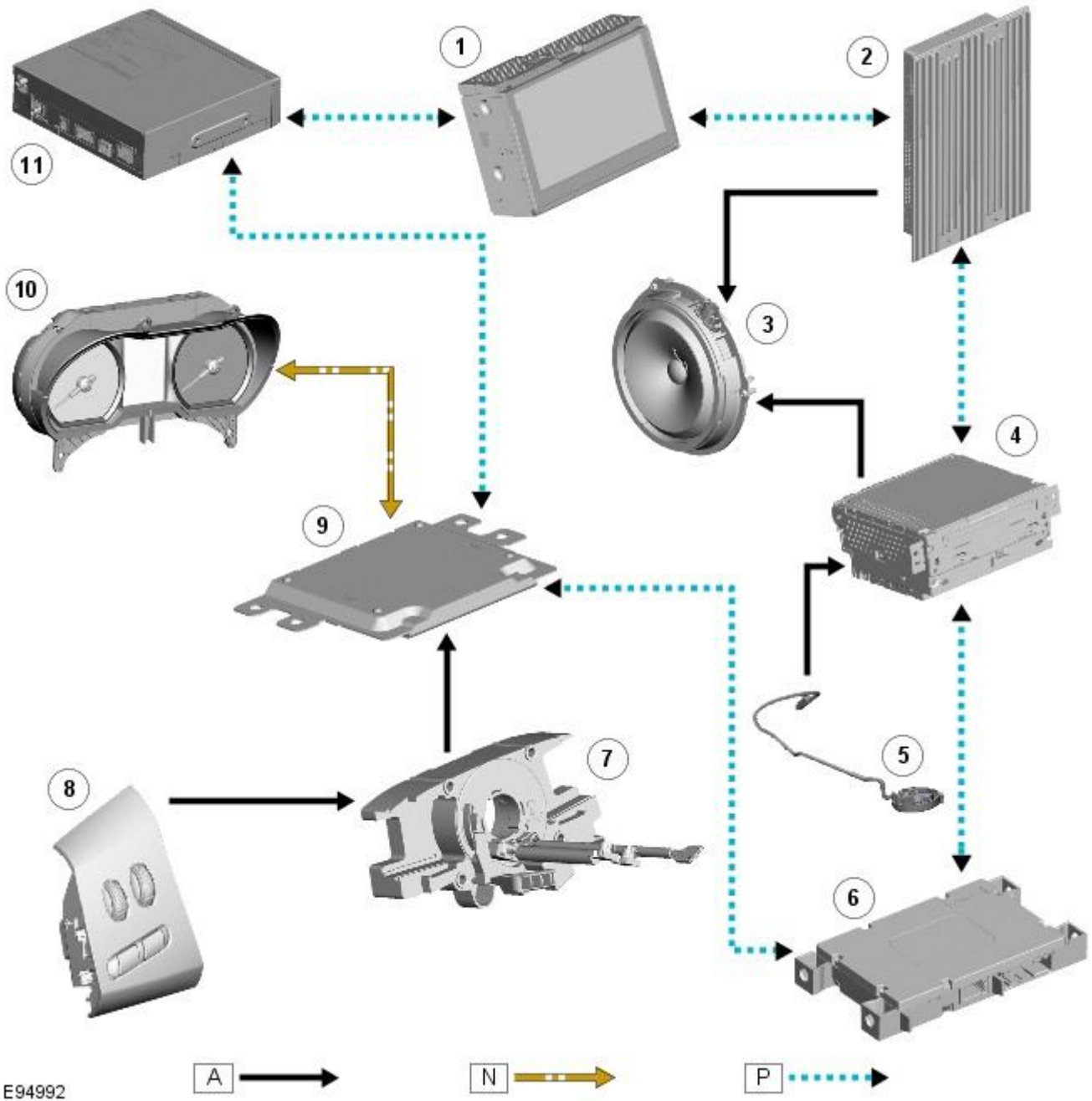


# Information and Entertainment System - Cellular Phone - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: A = Hardwired; N = Medium Speed CAN (controller area network) bus; O = LIN bus; P = MOST ring



E94992

**ItemDescription**

1	Touch-screen
2	Power amplifier
3	Speakers
4	IAM (integrated audio module)
5	Microphone
6	Telephone control module
7	Clock spring
8	Steering wheel controls
9	ICM (information control module)
10	Instrument cluster
11	Navigation computer

## System Operation

### PRINCIPLES OF OPERATION

Primary user control of the phone system is via the Touch-screen and JaguarVoice control switch. Selection of 'phone/comms' on the Touch-screen home menu sends a control signal to the telephone control unit on the MOST (media orientated systems transport) ring, opening the phone submenu options.

When making an outgoing phone call using the JaguarVoice function the ICM (information control module) processes the analogue signal from the switch into a digital signal. The digital signal is passed from the ICM (information control module) onto the MOST (media orientated systems transport) system to the JaguarVoice control unit which is integral with the navigation computer.

The navigation computer sends an instruction via MOST (media orientated systems transport) to the IAM (integrated audio module) to turn on the microphone facility.

The voice command signals are relayed from the IAM (integrated audio module) via the MOST (media orientated systems transport) ring to the navigation computer for processing.

The processed voice command is relayed on the MOST (media orientated systems transport) ring from the navigation computer to the phone control module.

Speech output information is transferred from the phone control module via the Bluetooth® connection to the cell phone.

Incoming calls are received from the Bluetooth® phone by the phone control module. The information is processed by the phone control module and transferred on the MOST (media orientated systems transport) ring to the power amplifier or IAM (integrated audio module) for audio output through the vehicle's audio speaker system.

A number of responses by the telephone and voice systems are reinforced by messages appearing in the instrument cluster message center display. Information is relayed to the message center from the phone control module and navigation computer on the MOST (media orientated systems transport) ring to the ICM (information control module).

The ICM (information control module) is the gateway from the MOST (media orientated systems transport) ring to the medium speed CAN. The ICM (information control module) transfers the message center information onto the medium speed CAN which is received and processed for display on the instrument cluster message center.

Users can pair & dock their handset using their phone or the touch screen. If there is no phone already docked with the system, a user can use their phone to search for Bluetooth Devices. If the vehicles Bluetooth system has been successfully discovered, the phone will display "Jaguar" as a device to pair & connect to. Using this method requires the user to enter the Jaguar PIN of 1313. Alternatively, after accessing the phone menu from the Touch-screen home menu, selecting 'Search New' searches for the Bluetooth® enabled handsets within range, displays their identities on screen, and allows the user to pair and dock the phone ready for use, using a random four-digit security code displayed on screen. The system will normally try to dock (automatically) to the last phone docked, but if a different Bluetooth® enabled phone enters the car it will become available on the screen's list of handsets once the search has been completed.

Once a phone is paired and docked a digit dial screen is displayed, including phonebook options. With a Bluetooth® compatible handset and software version there is the option, through the settings menu, to automatically download the contents of the handset's phonebook to the vehicle system. Because there is no industry standard for arranging the phonebook, the downloaded lists from individual handsets may vary.

Cell phone handset manufacturers continually update hardware and software to standard specifications laid down by the Bluetooth® Special Interest Group (SIG), which defined how Bluetooth® would work in an automotive environment. However, because different makes and models may use different software, not all handsets are fully compatible with Jaguar, but through testing individual handset models Jaguar has produced a list of compatible handsets and the appropriate software version for Jaguar Bluetooth® connectivity. Referral to the list also describes how to check the software version of each individual cell phone manufacturer. This list must be consulted by users, sales & service teams to confirm whether customer's handsets are compatible or not.

Jaguar is continually validating compatible handset and software combinations. The most up-to-date compatibility list will always be available on-line from Jaguar.

• **NOTE:** To achieve full Bluetooth® handset functionality it is crucial that the phone software level matches the version detailed in the list of compatible handsets.

The upgraded hands free profile of this system allows the display of the network signal strength, network operator and phone battery level indication on the vehicle display. Also, if applicable, the phone handset will show a "car" or "headset" symbol to indicate it is in handsfree profile.

### BLUETOOTH®

Bluetooth® is a short-range RF (radio frequency) technology that operates at 2.4 GHz and is capable of transmitting voice and data wirelessly. The effective range of Bluetooth® devices is 32 feet (10 meters) with a data transfer rate of 1 Mbps.

Bluetooth® is essentially a wireless connection which operates with the user's own mobile handset, does not have to be fixed into the car and is designed to function without an external aerial. The handset can be located anywhere within the cabin, even in a bag, or jacket pocket. It could work from the luggage compartment, although the signal could be compromised. The handset can be charged from the 12 volt power socket or USB (if supported) while in use.

## Component Description

### Touch-Screen

The Touch-screen communicates with the telephone control module on the MOST (media orientated systems transport) ring and provides the primary user interface and display of the phone system.



E96378

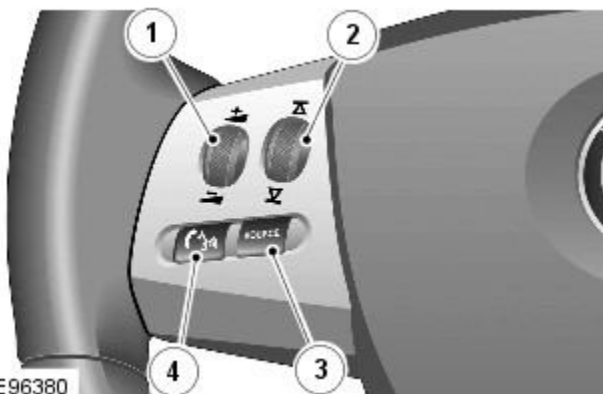
**ItemDescription**

1	Touch-screen
2	Touch-screen on/off button
3	Home menu button

The following functions are available on the phone menu:

- Digit dial
- Phone book
- Last ten calls (made, received, missed)
- Voicemail

**Steering Wheel Controls**



E96380

**ItemDescription**

1	Volume adjustment
2	Scroll up/down to next/previous memory location.
3	Audio source (Long press for instrument cluster message center phonebook access)
4	JaguarVoice button. Briefly press to initiate or end a call. This is also used for voice control functions

Additional control of the phone system is available in the form of steering wheel mounted switches which are located on the left hand side of the steering wheel. The switches provide for volume adjustment, scroll up/down to next/previous memory location, instrument cluster message center phonebook access and finally JaguarVoice/call control.

The steering wheel control switches are hardwired through the clock spring to the ICM (information control module). The ICM (information control module) processes the analogue signals from the switches into digital signals. The digital signals are then passed from the ICM (information control module) onto the MOST (media orientated systems transport) system for control unit processing and operation of the requested functions.

**JaguarVoice**

JaguarVoice enables activation of several voice activated functions of the infotainment and climate control systems without the need to touch any controls manually. The following systems include JaguarVoice functionality;

- Navigation system
- Phone system
- Climate control system
- Vehicle display system

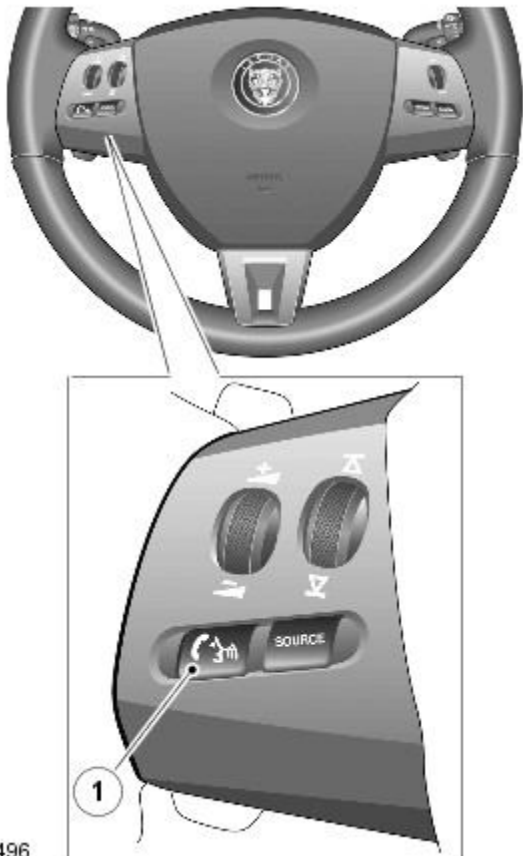
- Vehicle notepad

The 'notepad' facility allows voice notes to be recorded. Nametags for phone dialing and navigation locations allow the system to be personalized and there is a help and tutorial function to provide advice on using the system.

The system allows the vehicle user to concentrate fully on driving the vehicle, without any need to divert their eyes from the road ahead in order to check information read outs on the vehicle instrument panel information units. The voice control system also feeds back audible information to the vehicle user.

JaguarVoice is a key component of the phone system, allowing hands free control and use of the Bluetooth® enabled phone.

The system is controlled by the voice button on the left hand side of the steering wheel. Voice commands are picked by the dedicated microphone. When giving a voice command audible feedback will be heard through the vehicle's audio speakers. Received call voice/speech is also broadcast on the vehicle audio speaker system. All speakers are used for voice/speech output with the exception of the front center speaker (only fitted on the Bowers & Wilkins 440W Surround Sound System) due to echo return picked up by the microphone.



E96496

**ItemDescription**

1 JaguarVoice button

Efficient operation of JaguarVoice is reliant on the user understanding some of the following basic operating conditions;

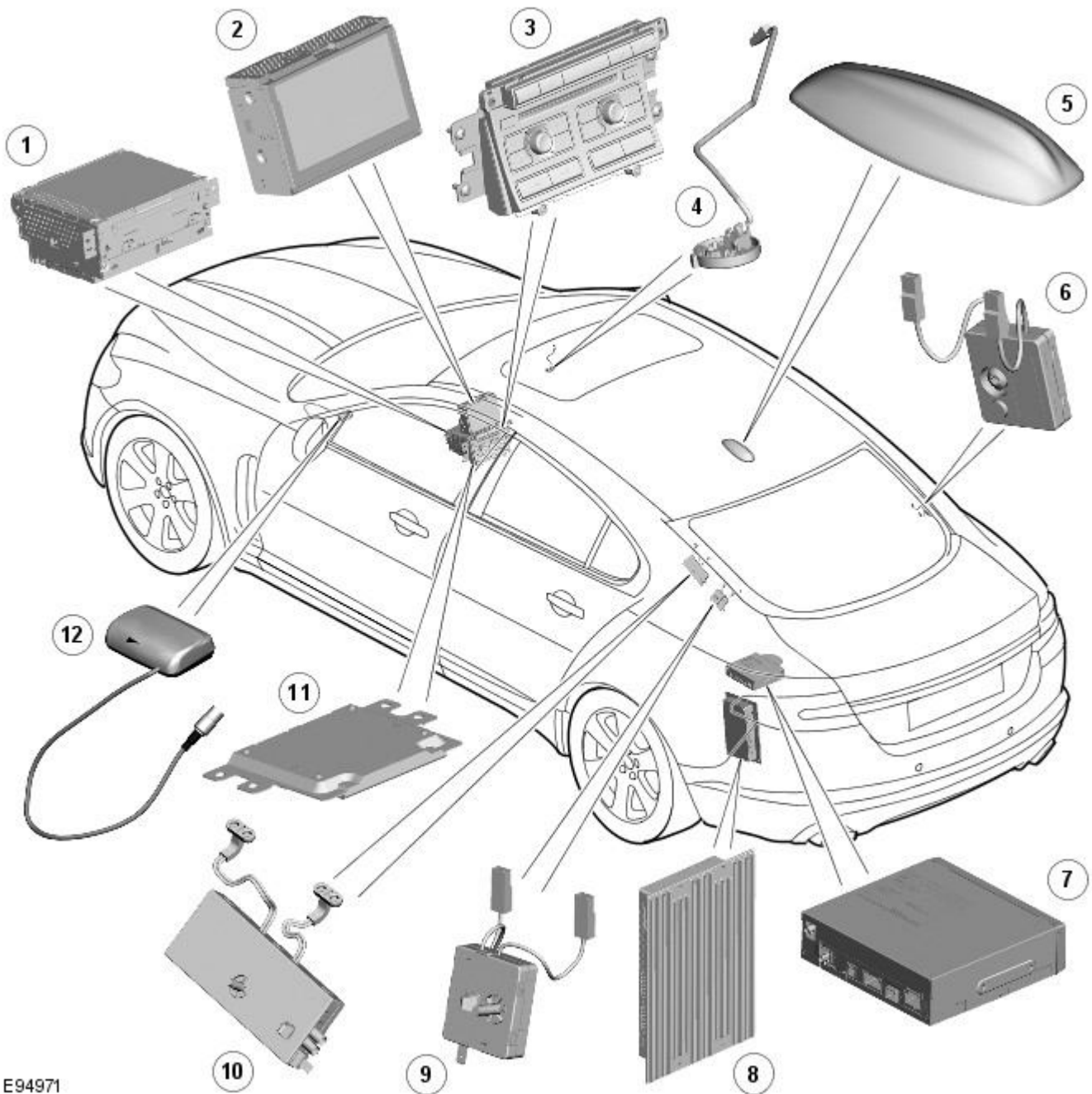
- Face forwards, sitting in a normal driving position
- After pressing the voice button, always wait for the end of the audible tone before speaking.
- Speak naturally, as if you were talking to a passenger or on the phone without pausing between words
- When the system asks for more information, always wait for the end of the tone before responding
- Always say numbers correctly
- Excessive noise, for example while driving with windows open, may cause voice command mis-recognition. If it is too noisy to use the phone, it is likely that voice commands will not be recognized

Most accents are understood without difficulty, but if the system does not recognize the command it will respond "SORRY" and allow two more attempts to say the command.

Voice feedback is given in the same language as the command recognition. It is possible to change the language of the speech control system.

# Information and Entertainment System - Navigation System - Component Location

Description and Operation



E94971

## ItemDescription

1	IAM (integrated audio module)
2	Touch-screen
3	ICP (integrated control panel)
4	Microphone
5	Roof pod antenna module (GPS antenna)
6	RF filter
7	Navigation computer
8	Power amplifier
9	RF filter
10	Diversity antenna module (VICS/TMC antenna)
11	ICM (information control module)
12	VICS (vehicle information and communication system) beacon antenna - Japan only

# Information and Entertainment System - Navigation System - Overview

Description and Operation

Authoring Template

## OVERVIEW

The navigation system provides audible and visual route guidance information to enable the driver to reach a desired destination. The system allows the driver to choose the desired route using minor or major roads and will present 3 routes to the driver based on user preferences. Directions to hospitals, museums, monuments and hotels are also available. The navigation computer uses map information stored on a DVD (digital versatile disc) to determine the best route for the journey and provide the driver with details of directions and approaching junctions.

The navigation system has various levels of user control through the Touch-screen and JaguarVoice system. System volume adjustment can be made using the ICP (integrated control panel), Touch-screen and steering wheel controls.

There are 3 navigation system variants specific to various markets. On all systems the GPS (global positioning system) signal is received by the GPS (global positioning system) antenna located in the roof pod antenna module.

The European navigation system includes the TMC (traffic messaging channel) function, which receives traffic information from an FM antenna integrated into the heated rear window. On a pre-selected route the system will offer re-routing options depending on traffic conditions.

The Japanese navigation system includes the VICS (vehicle information and communication systems) function. The VICS (vehicle information and communication systems) supplies information to enable the navigation computer to re-route the navigation guidance or to inform the vehicle driver of traffic conditions in the vehicles vicinity. Information is provided to the system through an FM antenna integrated into the heated rear window and a VICS beacon located in the LH upper side of the instrument panel.

The NAS (North American specification) variant does not include any additional traffic information systems.

The navigation system is primarily controlled from the Touch-screen which is located in the center of the instrument panel. Control signals from the Touch-screen are sent on the MOST (media oriented systems transport) ring to the navigation computer. The navigation computer uses a dedicated GVIF (gigabit video interface) bus to transmit video signals to the Touch-screen.

Depending upon the audio system version fitted the navigation audio output signals are sent on the MOST (media oriented systems transport) ring to the IAM (integrated audio module) or the power amplifier for speaker output.

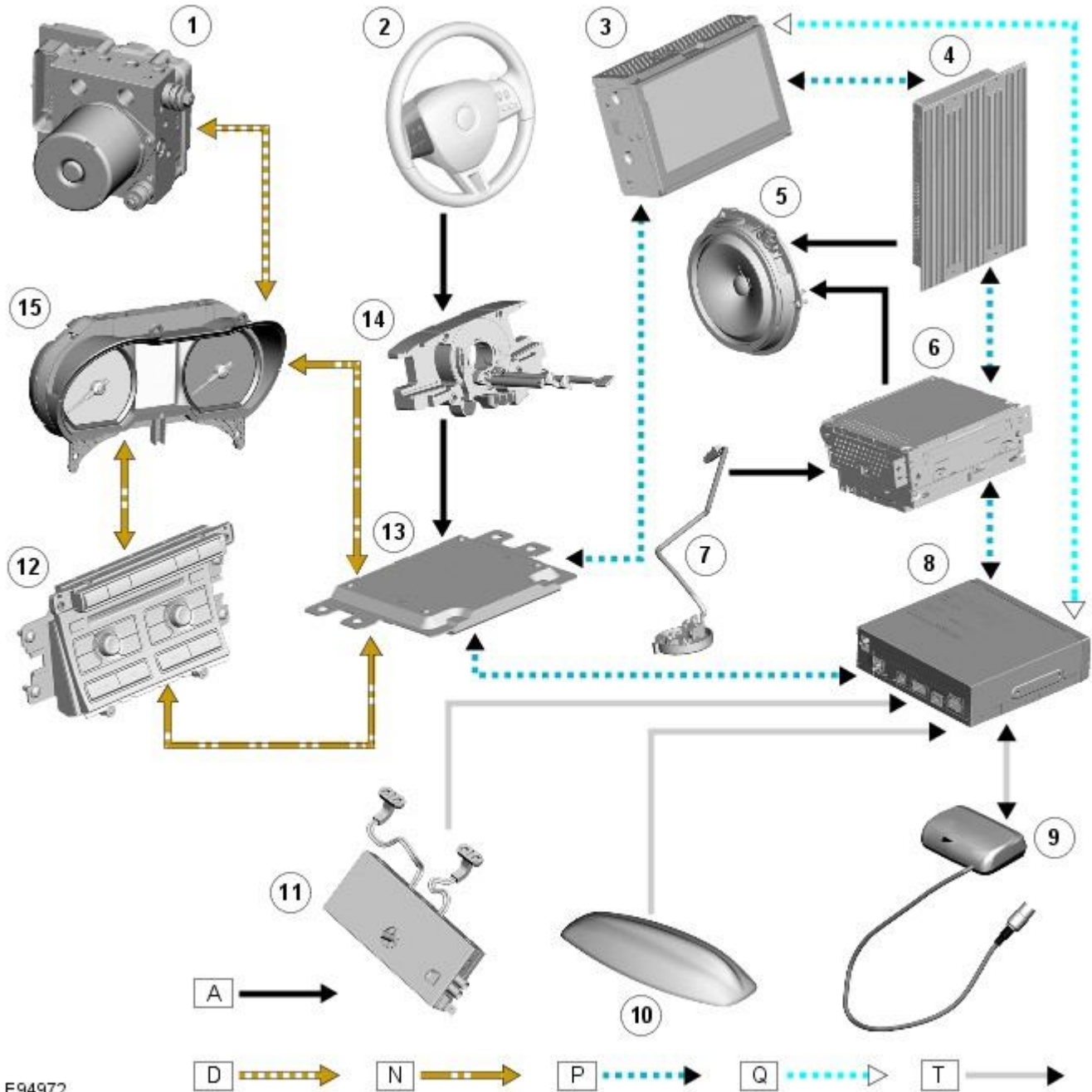


# Information and Entertainment System - Navigation System - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: A = Hardwired; D = High Speed CAN bus; N = Medium Speed CAN bus; O = LIN bus; P = MOST ring; Q = GVIF; T = CoAxial



E94972

### ItemDescription

1	ABS (anti-lock brake system) module
2	Steering wheel remote audio controls
3	Touch-screen
4	Power amplifier
5	Speakers
6	IAM (integrated audio module)
7	Microphone
8	Navigation computer
9	VICS (vehicle information and communication system) beacon antenna - Japan only
10	Roof pod antenna module (GPS (global positioning system) antenna)

11	Diversity antenna module (VICS/TMC antenna)
12	ICP (integrated control panel)
13	ICM (information control module)
14	Clock spring
15	Instrument cluster

## System Operation

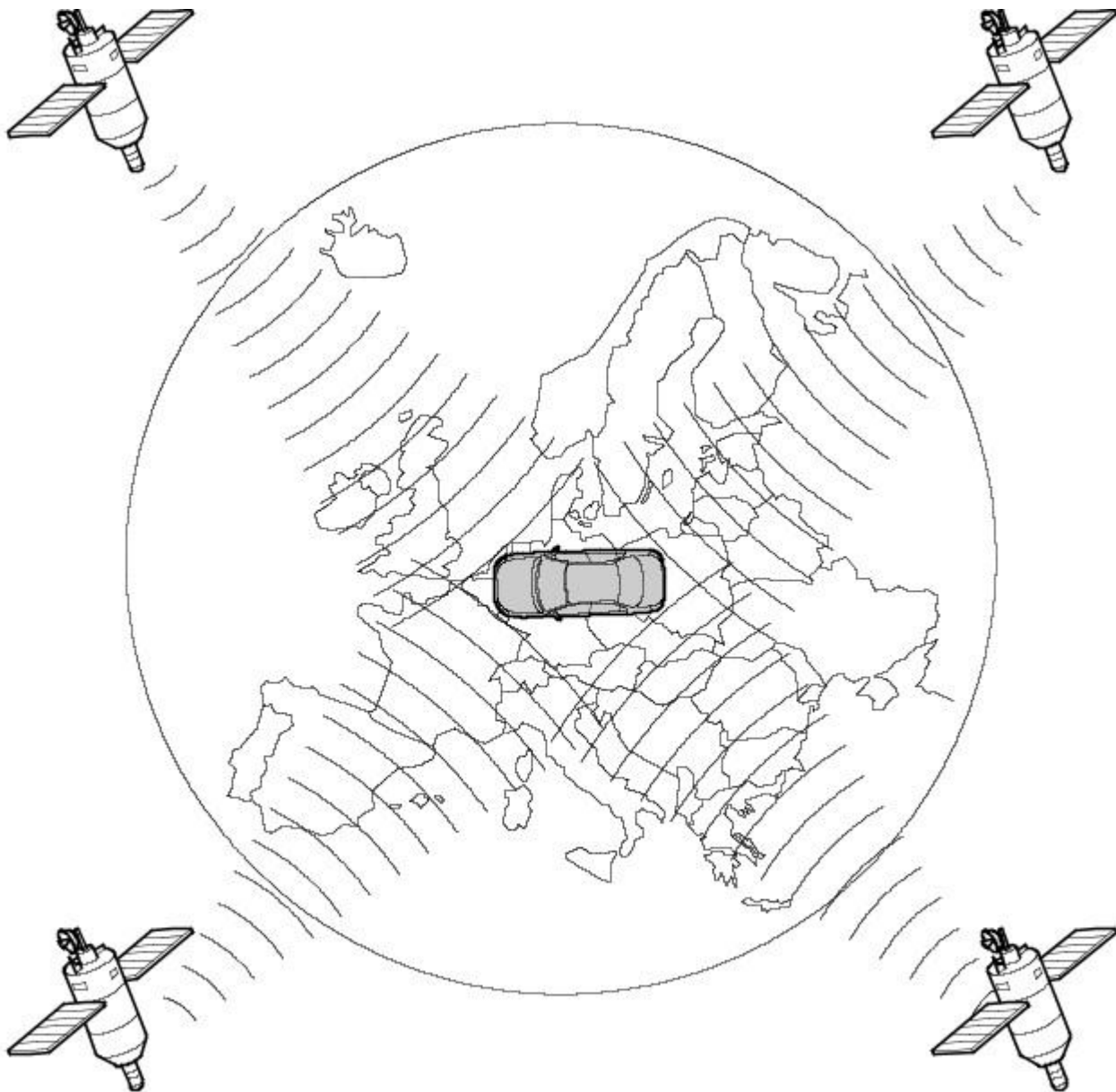
Authoring Template

### INTRODUCTION TO THE GLOBAL POSITIONING SYSTEM

The system used to calculate the current position of the vehicle is called the [GPS](#). The system utilizes satellites which are owned by the United States Department of Defense. A total of 24 satellites circular orbit the earth every 12 hours at a height of 20,000 km (12500 miles), and between 5 and 11 of these satellites can be seen from a single point at any given time. The orbits are tilted to the earth's equator by 55 degrees to ensure coverage of polar regions. Each satellite transmits radio signals to provide information about the satellite position i.e. latitude, longitude, altitude, almanac data and an accurate time signal generated by an on-board atomic clock. Each satellite contains four atomic clocks.

The vehicle needs to receive data from at least four different satellites to give a three dimensional fix on its current position.

As the vehicle moves, this information is continually being updated. The computer determines which satellites are 'visible' to the system and their current position and relationship to each other. Using this information the computer can account for positional deviations of the satellites and compensate to enhance the accuracy of the navigation system.



E51822

The [GPS](#) signal is also known as the PPS (precision positioning signal).

PPS (precision positioning signal) predictable accuracy is:

- 22 meters horizontal accuracy
- 27.7 meters vertical accuracy
- 200 nanoseconds time accuracy

The navigation system receives [GPS](#) information via the [GPS](#) antenna. The [GPS](#) signals are used by the navigation computer to calculate the vehicles position. Once the driver has input a desired destination the navigation computer can calculate a route, based on the driver's pre-determined preferences or the default settings in the navigation computer.

The navigation system is accessed from the Touch-screen home menu.

Navigation is initiated by the driver inputting a destination. This can be achieved by:

- Entering an address using the Touch-screen
- Entering a post code
- Choosing a previous destination
- Choosing a point of interest from the map disc database
- Choosing the home location
- Choosing a memory stored location

The driver is then guided to the destination by a scrolling map display and voice guidance. The display can be varied by scale and display type.

In addition to the standard navigation system there are two market dependant systems that supply extra information to the navigation system and the driver. These are:

- TMC (traffic message channel) (Europe only)
- VICS (vehicle information and communication system) (Japan only)

The TMC (traffic message channel) is a function of the [FM \(frequency modulation\)RDS \(radio data system\)](#). The system broadcasts real-time traffic and weather information. Data messages are received and decoded by the TMC (traffic message channel) integral receiver and processed by the navigation computer. TMC (traffic message channel) messages can be filtered by the navigation computer so that only those relevant to the current journey are displayed, allowing the navigation system to offer dynamic route guidance - alerting the driver of a problem on the planned route and calculating an alternative route to avoid the incident. All TMC (traffic message channel) events on the map can be viewed not just the ones on the calculated route.

TMC (traffic message channel) traffic information systems conform to a global standard that has been adopted by traffic data gatherers, information service providers, broadcasters and vehicle/receiver manufacturers.

All TMC (traffic message channel) receivers use the same list of event codes, while the location database (on the map disc) contains both a country-specific set of location codes for the strategic European road network.

TMC (traffic message channel) traffic data is currently broadcast in many European countries.

The VICS (vehicle information and communication system) is broadcast in the Japanese market.

The VICS (vehicle information and communication system) supplies information to enable the navigation computer to re-route the navigation guidance or to inform the vehicle driver of traffic conditions in the vehicles vicinity. Information is provided to the system through 3 routes:

- RF (radio frequency) transmission
- Infra-red transmission
- [FM](#) multiplex transmissions

The RF (radio frequency) transmissions are generally transmitted from road side beacons mainly on expressways. The information transmitted is as follows:

- Traffic congestion
- Travel time to next intersection
- Traffic conditions in surrounding areas and expressway turn offs
- Traffic accidents
- Speed limits
- Lane regulations
- Tire change
- Parking availability at expressway service areas and parking areas

Infra-Red transmissions are transmitted from road side beacons on major trunk roads. The information transmitted is:

- Traffic congestion and travel time
- Traffic accidents
- Breakdowns
- Road works restrictions
- Parking availability

[FM](#) transmissions are broadcast as part of the [FM](#) multiplex broadcasting system from NHK [FM](#) stations. Information transmitted is:

- Traffic congestion and travel time for wide areas
- Traffic accidents, road works, speed limits and lane restrictions for a wide area
- Parking availability information

The traffic data is split from the normal [FM](#) transmissions by the diversity antenna module.

Selection of 'Navigation' on the Touch-screen home menu and subsequent sub-menu selection sends a control request signal to the navigation computer on the MOST (media orientated systems transport) ring. The requested control information is processed by the navigation computer.

If voice guidance is operational the voice signal information is relayed from the navigation computer on the MOST (media orientated systems transport) ring to either the IAM (integrated audio unit) or Power Amplifier, dependant on equipment level, for output on the speaker system. The navigation audio output is through the front speakers whilst the background audio, for example radio or [CD \(compact disc\)](#), is played at a reduced volume on the rear speakers.

The [GPS](#) signal is available to the navigation system at all times when the vehicle ignition is switched on.

Navigation user voice commands are made using the JaguarVoice system. The ICM (information control module) processes the analogue signal from the JaguarVoice switch into a digital signal. The digital signal is passed from the ICM (information control module) onto the MOST (media orientated systems transport) system to the JaguarVoice control unit which is integral with the navigation computer.

The navigation computer sends an instruction via the MOST (media orientated systems transport) ring to the IAM (integrated audio module) to turn on the microphone facility.

The microphone is hardwired to the IAM (integrated audio module). The spoken voice command signals are relayed from the IAM (integrated audio module) via the MOST (media orientated systems transport) ring to the navigation computer for processing.

The processed voice command is relayed from the navigation computer to the Touch-screen.

Traffic data from TMC (traffic message channel) or VICS (vehicle information and communication system) is processed by the navigation computer, distributed to the Touch-screen with any supporting voice instruction relayed through the MOST (media orientated systems transport) ring to either the IAM (integrated audio unit) or Power Amplifier, dependant on equipment level, for output on the speaker system.

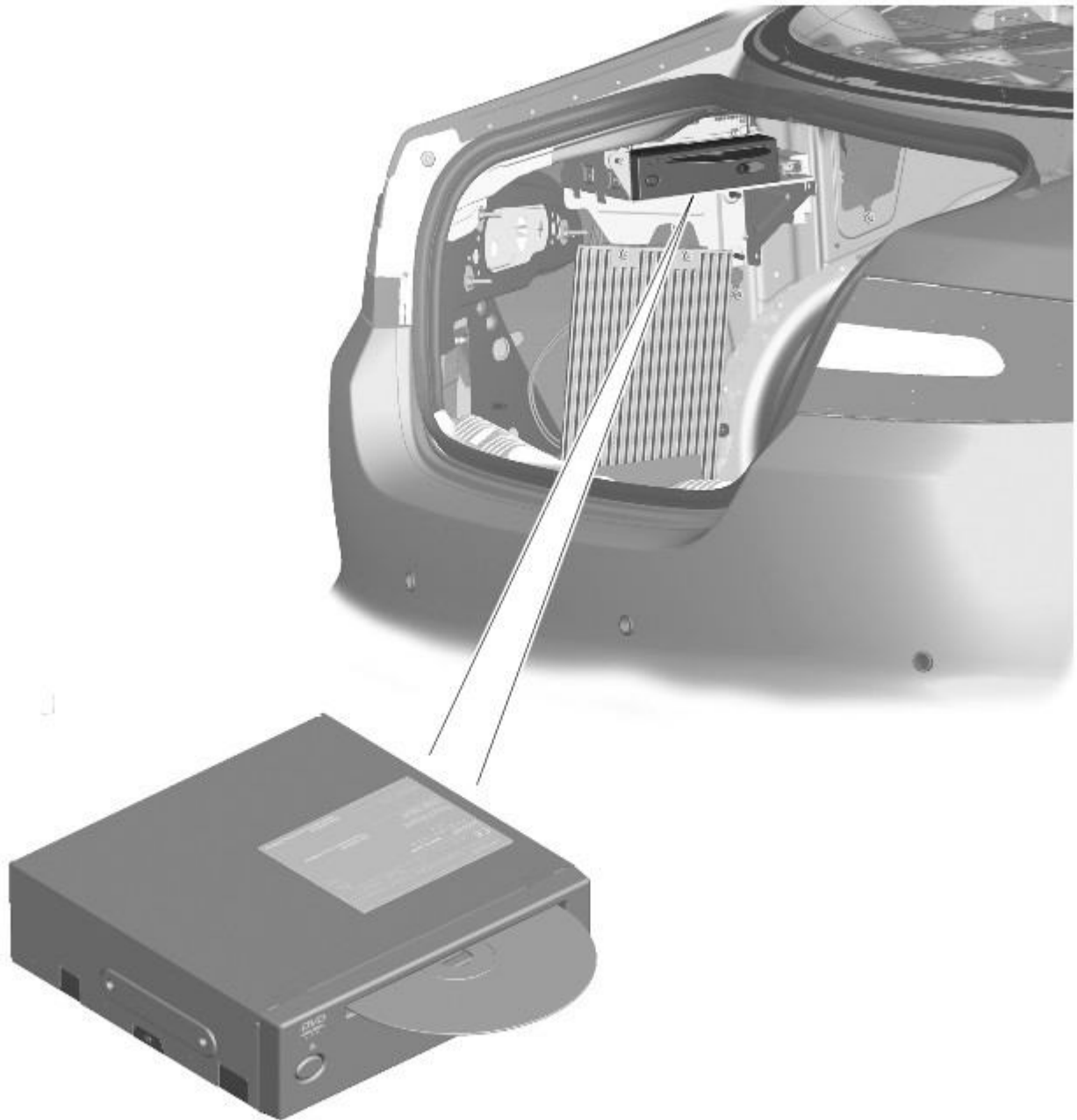
A number of actions, when using the navigation voice system, are reinforced by messages appearing in the instrument cluster message center display. Information is relayed to the message center from the navigation computer on the MOST (media orientated systems transport) ring to the ICM (information control module).

The ICM (information control module) is the gateway from the MOST (media orientated systems transport) ring to the medium speed [CAN \(controller area network\)](#). The ICM (information control module) transfers the message center information onto the medium speed [CAN](#) which is received and processed for display on the instrument cluster message center.

## Component Description

### NAVIGATION COMPUTER

The navigation computer is located in the left hand side of the luggage compartment.



E96571

The navigation computer incorporates the following:

- [GPS](#) receiver
- VICS (vehicle information and communication system) receiver (Japan only)
- TMC (traffic message channel) receiver (Europe only)
- JaguarVoice control module

The navigation computer contains a solid state piezo gyro which measures the motion of the vehicle around its vertical axis. The gyro operates on the principle known as the coriolis force. The coriolis force is the force that appears to accelerate a body moving away from its rotational axis against the direction of rotation of the axis.

Using inputs from the [ABS](#) module, the [GPS](#) antenna and the gyro sensor, the computer calculates the vehicle's current position, direction and speed.

The navigation computer houses the [DVD \(digital versatile disc\)](#) drive. The drive is used to read map data from region specific [DVD](#)'s. The number of [DVD](#)'s issued per region varies depending on the amount of information available. The regions are as follows:

- Europe (2 versions, Western Europe and Whole of Europe)
- NAS (North American specification)
- Japan, Middle East, Australia and South Africa

A button, located adjacent to the [DVD](#) slot, is provided to eject the [DVD](#) from the unit. Prior to ejecting the disc the slot protection has to be slid to the side. If the ignition is on, or the entertainment system is in 1-hour mode, one press of the button will eject the [DVD](#).

The navigation computer uses non-volatile memory to store settings and configuration information when it is powered down. This process takes place just before the computer turns off.

No configuration procedure is required if the navigation computer is replaced. There is no option to calibrate the navigation computer using the Jaguar approved diagnostic equipment; however in some regions a software download, contained in the [DVD](#) disc, is required before the navigation system becomes operational.

## MICROPHONE



E96495

A single microphone is used for hands-free operation using the JaguarVoice system. The microphone has an integrated noise suppression system for hands-free use. The microphone is a standard directional type and is located in the front roof overhead console. The microphone is hardwired to the IAM (integrated audio module). When replacing the microphone extra care must be taken to make sure it is fitted into its securing clips for correct positioning and orientation.

## GPS Antenna



E96387

The [GPS](#) antenna passes signals from the [GPS](#) satellites to the navigation computer for processing. The antenna is located in the roof pod and is shared with the DAB (digital audio broadcasting) band L antenna or satellite radio antenna where fitted. The roof pod is located externally in a central position towards the rear of the roof.

The [GPS](#) antenna is designed with 50 ohm output impedance. The navigation computer is fitted with 50 ohm fakra II connectors to ensure compatibility with the antenna. For optimum performance 50 ohm low loss coaxial cable is used between the antenna and navigation computer.

It is possible for the [GPS](#) antenna to lose the signal from the [GPS](#) satellites;

- In hilly or tree lined areas
- Built up areas with tall buildings
- In multi storey car parks
- In garages
- In tunnels
- On bridges
- During heavy rain or thunderstorms

When the signal is lost the navigation computer will continue to give guidance using memory mapped data from the [DVD](#) map until the signal is restored.

## TMC/VICS FM Antenna

Data messages for both TMC (traffic message channel) and VICS (vehicle information and communication system) are received through the [FM](#) antennas and diversity antenna module located in the heated rear window.

## VICS Beacon Antenna (Japan Only)

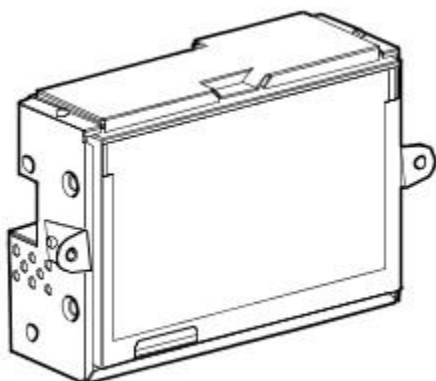




E96572

The VICs (vehicle information and communication system) beacon antenna receives infra red and RF (radio frequency) traffic data signals from road side transmitters. The antenna is connected to the navigation computer which incorporates a VICs (vehicle information and communication system) receiver.

### Touch Screen Display



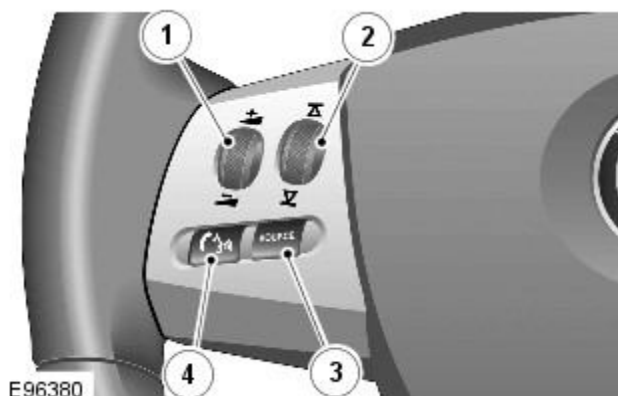
E73867

The Touch-screen is the control interface for the following vehicle systems;

System	Functions
Audio	Radio display AM/FM or DAB (digital audio broadcast), auxiliary and portable audio, digital TV or CD
Climate control	Air conditioning, distribution, seats, heated steering wheel, automatic air recirculation
Telephone	Digit dialer, phone book, last ten calls (made, received, missed)
Navigation	Destination, stored locations, navigation setup, route options
Vehicle	Security, parking, valet mode, trip computer, clock, brightness, contrast, system settings, vehicle settings, display settings

The screen is a touch sensitive 7 inch LCD (liquid crystal display) VGA screen containing 800 x 480 pixels in a 15:9 format. The screen processes its own video for system operation but receives the navigation graphics from the navigation computer.

### Steering Wheel Controls



E96380

#### ItemDescription

1	Volume adjustment
2	Scroll wheel (No navigation functionality)
3	Audio source (No navigation functionality)

#### 4 JaguarVoice control

Additional control of the navigation system is available in the form of steering wheel mounted switches which are located on the left hand side of the steering wheel. 2 switches are used for navigation functions;

- Volume adjustment
- JaguarVoice control

JaguarVoice enables operation of several voice activated functions of the infotainment and climate control systems without the need to touch any controls manually. The following systems include JaguarVoice functionality;

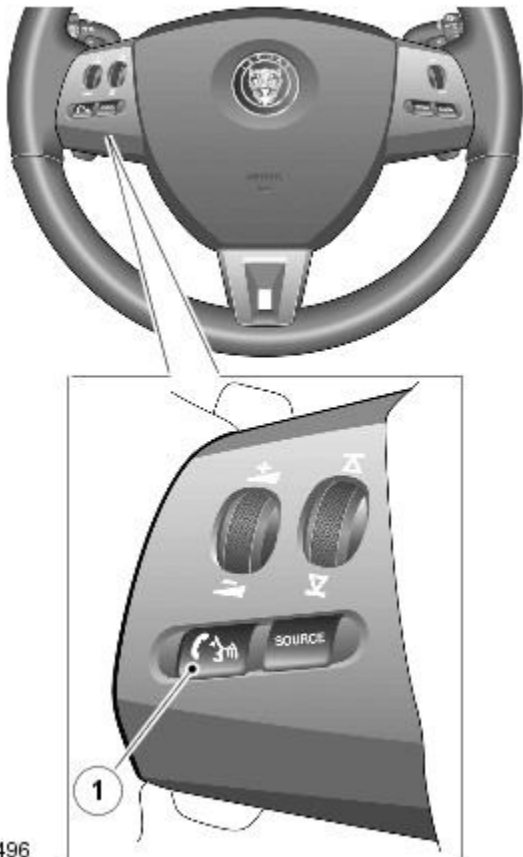
- Navigation system
- Phone system
- Climate control system
- Vehicle display system
- Vehicle notepad

The 'notepad' facility allows voice notes to be recorded. Nametags for phone dialing and navigation locations allow the system to be personalized and there is a help and tutorial function to provide advice on using the system.

The system allows the vehicle user to concentrate fully on driving the vehicle, without any need to divert their eyes from the road ahead in order to check information read outs on the vehicle instrument panel information units. The voice control system also feeds back audible information to the vehicle user.

JaguarVoice is a key component of the navigation system, allowing hands free control when issuing navigation commands.

The system is controlled by the voice button on the left hand side of the steering wheel. Voice commands are picked up by a dedicated microphone. When giving a voice command audible feedback will be heard through the vehicle's audio speakers.



E96496

#### ItemDescription

- 1 JaguarVoice button

Efficient operation of JaguarVoice is reliant on the user understanding some of the following basic operating conditions;

- Face forwards, sitting in a normal driving position
- After pressing the voice button, always wait for the end of the tone before speaking.
- Speak naturally, as if you were talking to a passenger or on the phone without pausing between words
- When the system asks for more information, always wait for the end of the tone before responding
- Always say numbers correctly
- Excessive noise, for example while driving with windows open, may cause voice command mis-recognition. For example if it is too noisy to use the phone, it is likely that voice commands will not be recognized.

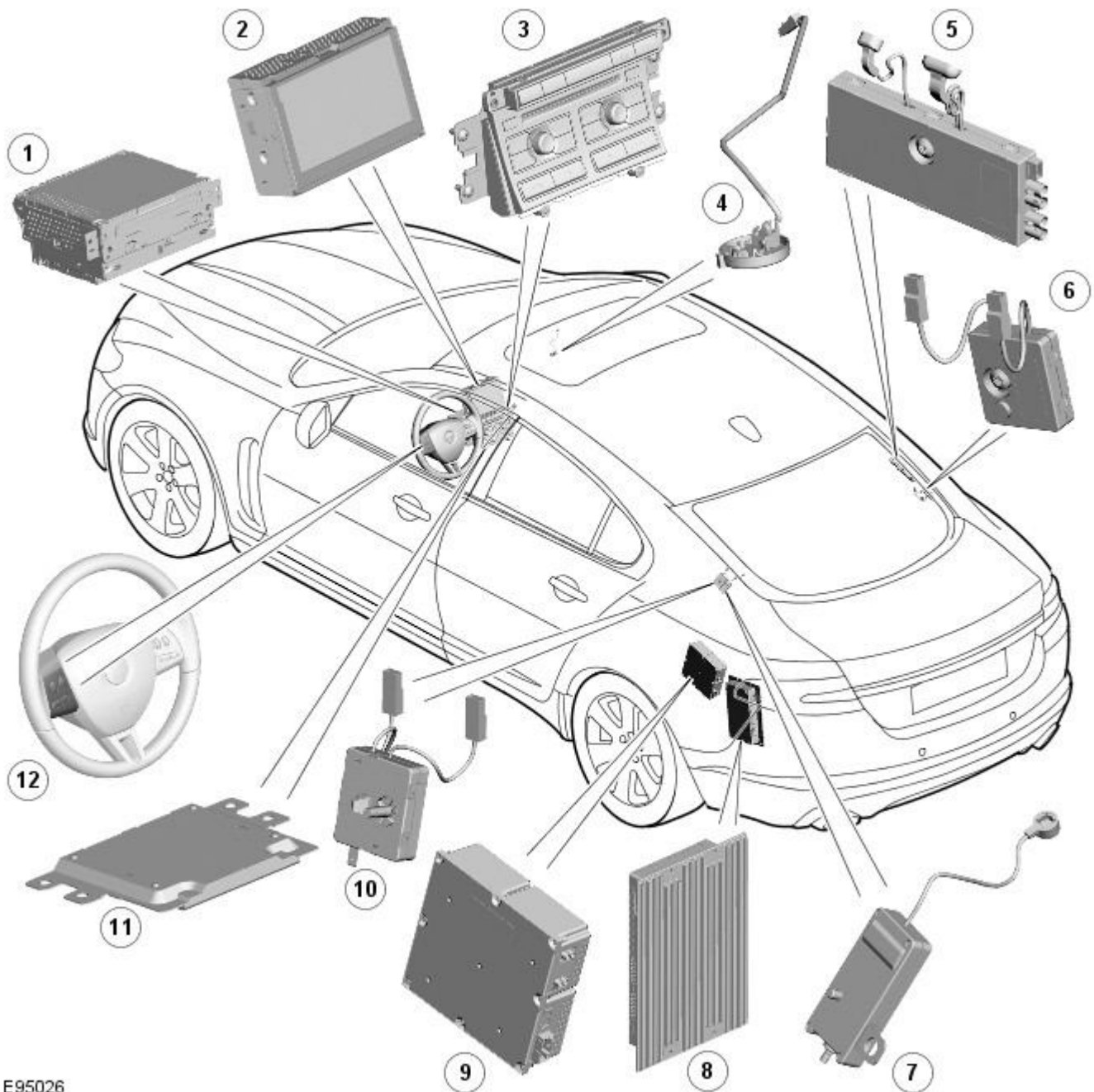
Most accents are understood without difficulty, but if the system does not recognize the command it will respond "SORRY" and allow two more attempts to say the command.

Voice feedback is given in the same language as the command recognition. It is possible to change the language of the speech control system.

# Information and Entertainment System - Video System - Component

## Location

Description and Operation



E95026

### ItemDescription

1	IAM (integrated audio module)
2	Touch-screen
3	ICP (integrated control panel)
4	Microphone
5	Triple TV (television) antenna module
6	RF filter
7	Single TV (television) antenna module
8	Power amplifier
9	TV (television) tuner
10	RF filter
11	ICM (information control module)
12	Steering wheel remote controls

# Information and Entertainment System - Video System - Overview

Description and Operation

## OVERVIEW

The Television system combines digital and analogue reception. The digital element is similar to the home based freeview system, and displays information such as current channel detail. The Japanese market uses the analogue signal as the digital format is not compatible.

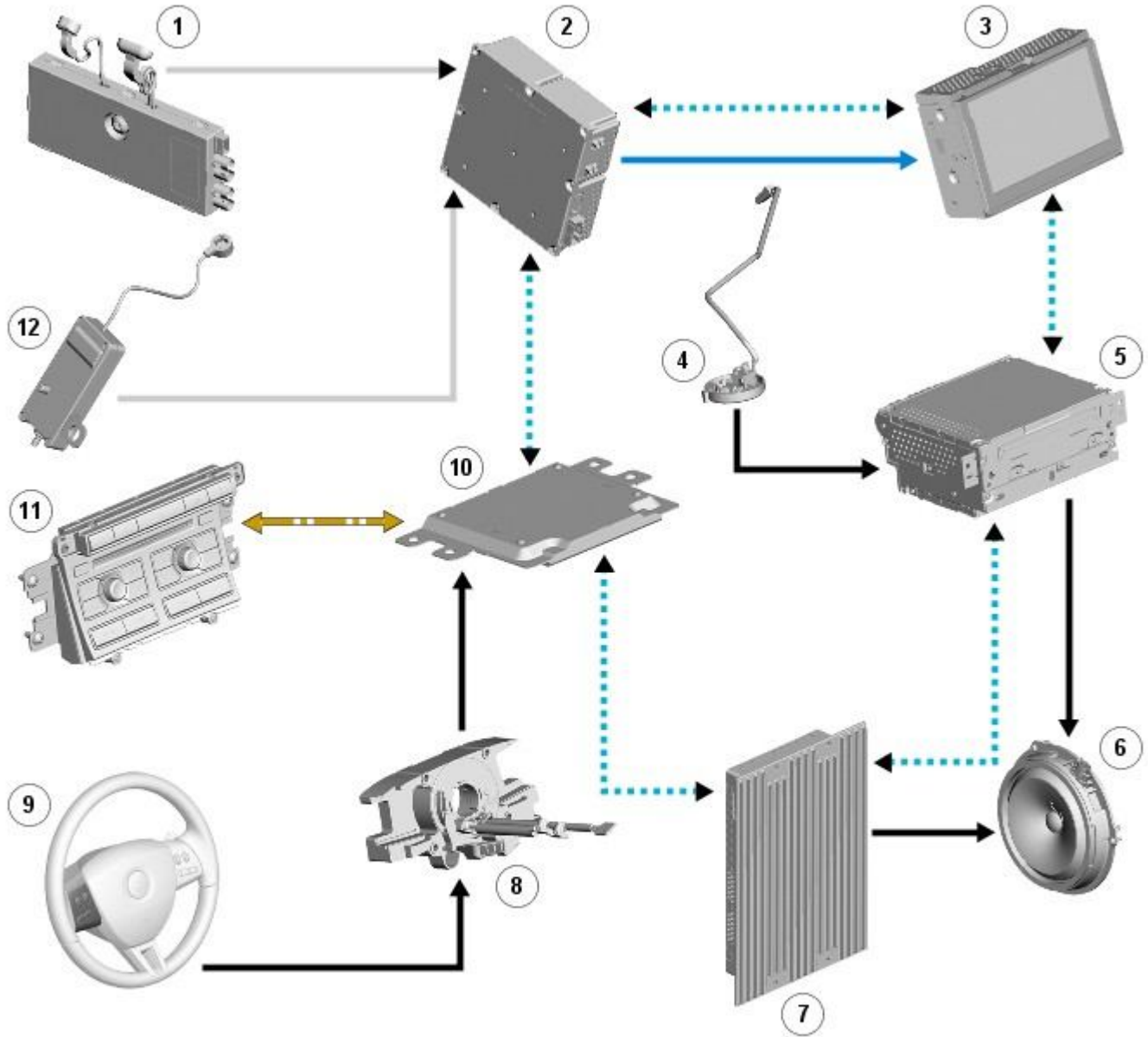
For legal reasons, the Touch-screen Television image can only be displayed when the vehicle is at rest, however the system is configured not to constantly switch on and off in stop-start traffic. It is possible to listen to Television sound as the vehicle is moving.

# Information and Entertainment System - Video System - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: A = Hardwired; N = Medium Speed CAN (controller area network) bus; O = LIN bus; P = MOST ring; T = CoAxial; I = Composite video signal



E95027



### ItemDescription

1	Triple TV (television) antenna module
2	TV (television) tuner
3	Touch-screen
4	Microphone
5	IAM (integrated audio module)
6	Speakers
7	Power amplifier
8	Clock spring
9	Steering wheel remote controls
10	ICM (information control module)

11 ICP (integrated control panel)
12 Single TV (television) antenna module

## System Operation

The Television system has various levels of user control through the Touch-screen, ICP (integrated control panel) and steering wheel control panel. The system includes nine analogue and nine digital channel pre-sets. As with the audio system, the user can search up or down and store by a long press of the selected channel button. The system offers a choice of screen aspect ratios similar to a typical domestic receiver, giving options between the standard 4:3 format, wide screen 16:9 format and zoom to fill the screen.

To provide the strongest possible signal the Television tuner receives signals from 4 antenna sources located in the heated rear window. Unlike domestic systems this system gives a more progressive picture loss if the signal is lost. The signal loss is indicated to the user by a 'loss of reception' screen message.

The Television system is primarily controlled from the Touch-screen and the ICP (integrated control panel) which are located in the center of the instrument panel. Control signals from the Touch-screen display are sent on the MOST (media oriented systems transport) ring to the Television tuner. The Television tuner uses a dedicated CVBS (composite video signal) bus to transmit video signals to the Touch-screen.

Control signals from the ICP (Integrated control panel) are relayed on the medium speed CAN bus to the ICM (information control module). The ICM (information control module) relays the control signals to the Television tuner on the MOST (media oriented systems transport) ring. The ICM (information control module) is the timing master for the MOST (media oriented systems transport) ring and also hosts a gateway function between the medium speed CAN bus and the MOST (media oriented systems transport) ring.

Depending upon the audio system version fitted the Television tuner audio output signals are sent on the MOST (media oriented systems transport) ring to the IAM (integrated audio module) or the power amplifier for speaker output.

## Component Description

### TELEVISION TUNER



E96676

The television tuner is a DVB-T (digital video broadcasting - terrestrial) receiver and consists of a 'front end' which is made up of a tuner and a demodulator. Following pre-filtering, the tuner converts the signal from the antenna to an intermediate frequency. In the demodulator, the signal is first converted to a basic frequency, so that a signal from a transponder can be forwarded to the MPEG decoder as a transport stream. The transport stream usually contains several television channels along with relevant auxiliary services such as teletext, subtitles and electronic program guides.

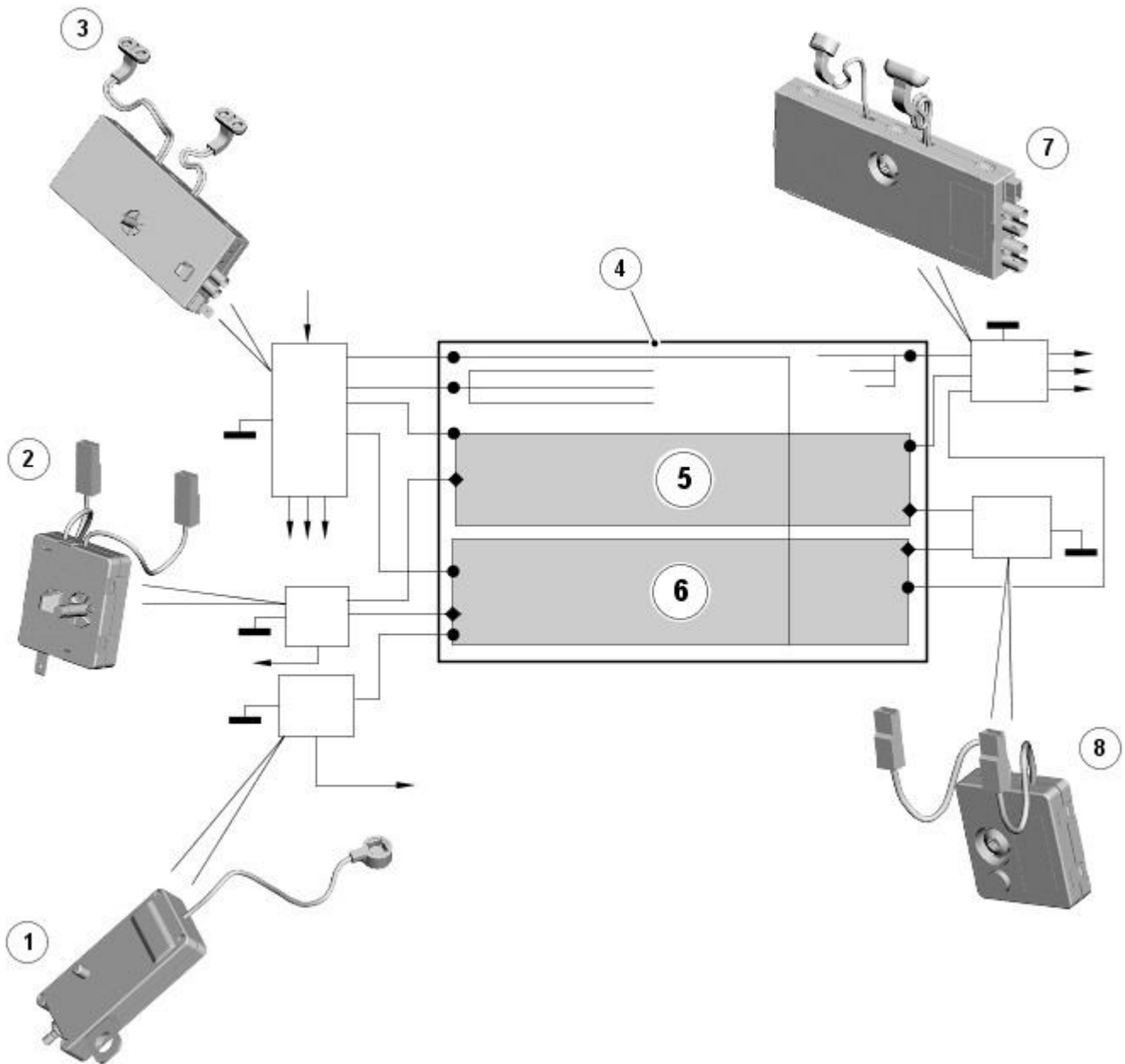
- **NOTE:** Not all digital features such as text and programme listings are currently available.

Control signals from the Touch-screen display are sent on the MOST (media oriented systems transport) ring to the television tuner. The television tuner uses the dedicated CVBS (composite video signal) bus to transmit its video signals to the Touch-screen. The CVBS (composite video signal) system utilizes a single wire transmission system and is limited in bandwidth to less than 6MHz.

No configuration procedure is required if the television tuner is replaced. Calibration of the television tuner using the Jaguar approved diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

### Television Antennas





E96376

**ItemDescription**

1	Single TV (television) antenna module
2	RF filter
3	Diversity antenna module
4	Heated rear window
5	Heated rear window upper section
6	Heated rear window lower section
7	Triple TV (television) antenna module
8	RF filter

The television tuner receives digital and analogue television signals through 4 antennas located in the heated rear window. 3 of the antennas are connected to the triple antenna amplifier/module located on the **RH (right-hand)** side of the heated rear window. A fourth antenna is connected to the single antenna amplifier/module located on the **LH (left-hand)** side of the heated rear window.

The combination of signals from several antennas is known as 'diversity' reception. For example using two or more antennas can reduce the signal error rate by 50%, which is of critical importance for mobile receivers.

Vehicle or other component generated electromagnetic interference may cause unwanted disturbance in the television reception signals. The disturbance may interrupt, obstruct, or otherwise degrade or limit the effective performance of the circuit.

Double coil RF (radio frequency) filters, which act as RF (radio frequency) isolators, are located on both sides of the heated rear window and are used to reduce any electromagnetic interference. The **LH** side RF (radio frequency) filter is connected across the heated rear window power supply and used to separate the DC (direct current) interference from the RF (radio

frequency) signals. The positive filter is present on all vehicle types and markets.

The right hand side double coil RF (radio frequency) filter is only used in conjunction with the television antenna modules and is connected across the heated rear window ground circuit. If a television system is not fitted a filter is used which is linked directly to ground.

### Touch-Screen



E96378

#### ItemDescription

1	Touch-screen
2	Touch-screen on/off button
3	Home menu button

The Touch-screen is the primary user interface for the television system. From the 'Home' screen menu television is a sub-menu of 'Audio'. The Touch-screen communicates with the television tuner. Video signals to the Touch-screen are transmitted from the television tuner.

### Integrated Control Panel



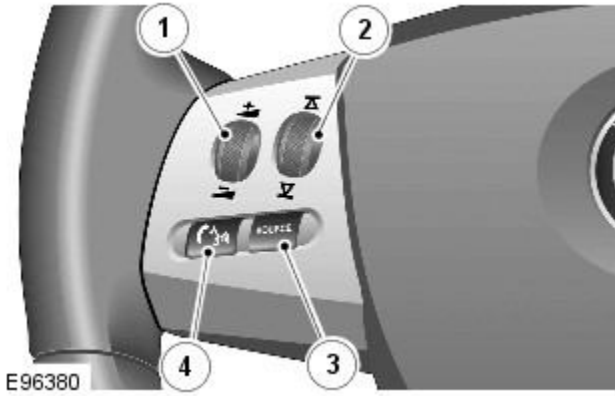
E96677

#### ItemDescription

1	Touch-screen
2	Seek up button
3	Settings button
4	On/off and volume control
5	Source button
6	Seek down button

The ICP (integrated control panel) duplicates many of the Touch-screen television user control features. The ICP (integrated control panel) communicates with the television system through the medium speed [CAN](#) and MOST (media orientated systems transport) bus systems.

### Steering Wheel Controls



#### ItemDescription

1	Volume adjustment
2	Change pre-set TV (television) stations
3	Select source
4	Audio mute control/JaguarVoice control

Additional control of the television system is available in the form of steering wheel mounted switches which are located on the left hand side of the steering wheel. The 4 switches provide for volume adjustment, change pre-set television stations, select media source and finally audio mute control. The mute control is also used for JaguarVoice control.

# Information and Entertainment System - Information and Entertainment System

Diagnosis and Testing

For additional information. REFER to: (415-00 Information and Entertainment System - General Information)

[Information and Entertainment System](#) (Diagnosis and Testing),

[Cellular Phone](#) (Diagnosis and Testing),

[Navigation System](#) (Diagnosis and Testing).

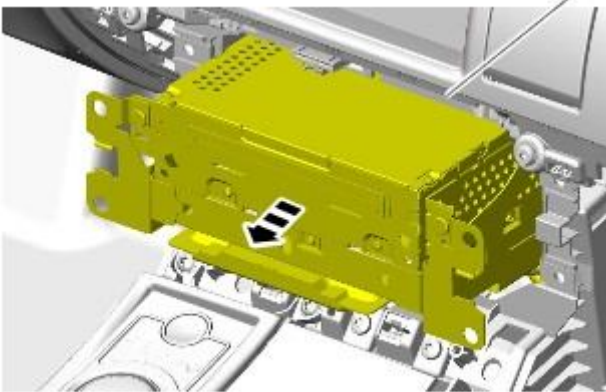
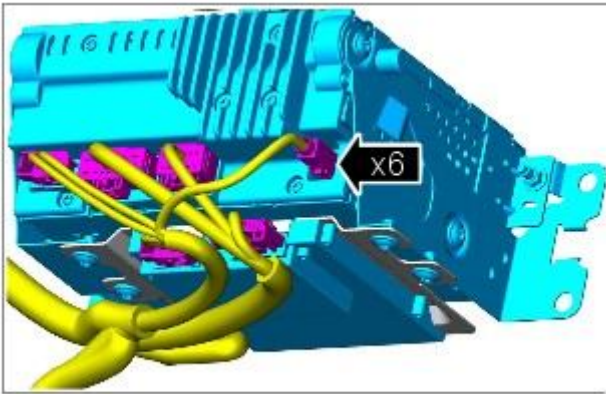
# Information and Entertainment System - Audio Unit

Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Audio and Climate Control Assembly](#) (415-01 Information and Entertainment System, Removal and Installation).



E95329

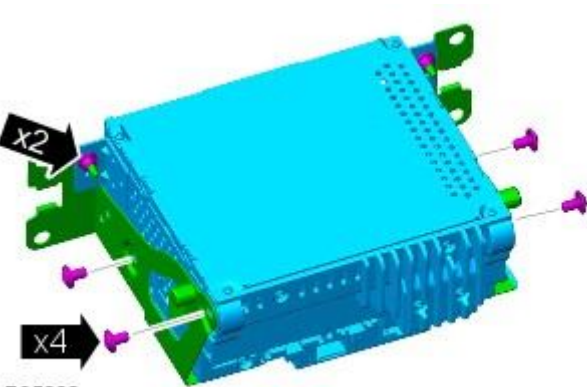
3. **3. CAUTIONS:**



Protect the surrounding trim to avoid damage.



Cover fiber optic cable connectors to minimize dust ingress and avoid bending the cables in a radius of less than 30 mm.



E95330

4. **4. NOTE:** Do not disassemble further if the component is removed for access only.

*Torque:*

Retaining screws 3 Nm

Retaining nuts 5 Nm

## Installation

1. **1. NOTE:** New units must be configured using the Programmable Module Installation Routine in the diagnostic tool.

To install, reverse the removal procedure.

# Information and Entertainment System - Audio Unit Antenna Amplifier

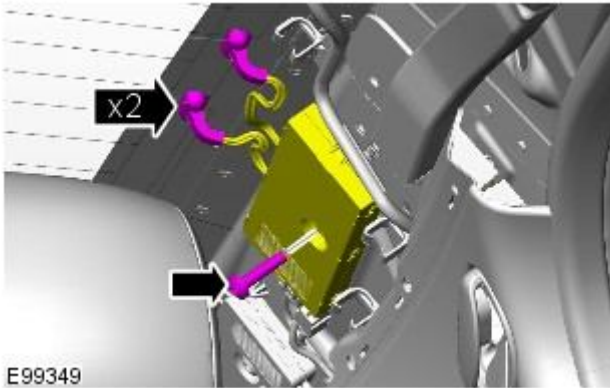
Removal and Installation

## Removal

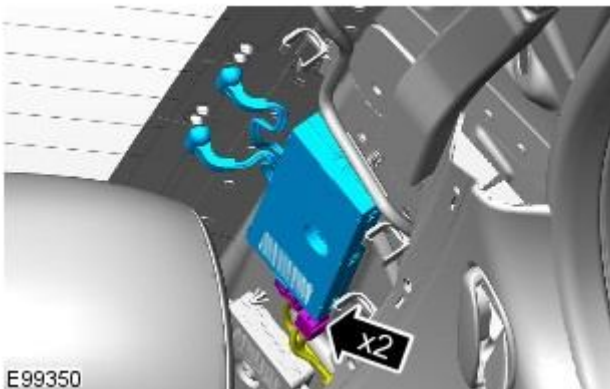
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [C-Pillar Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Torque: 10 Nm



4.



## Installation

1. To install, reverse the removal procedure.



# Information and Entertainment System - Audio and Climate Control

## Assembly

Removal and Installation

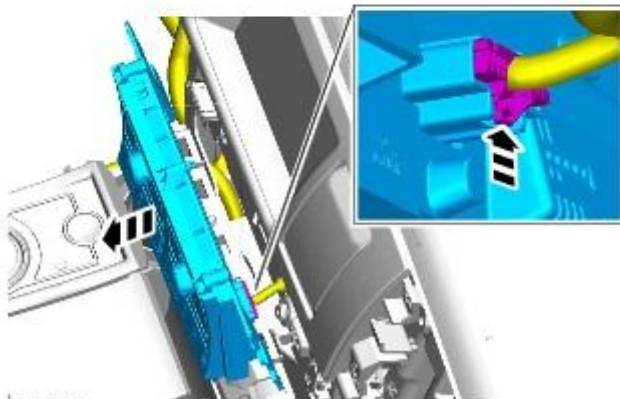
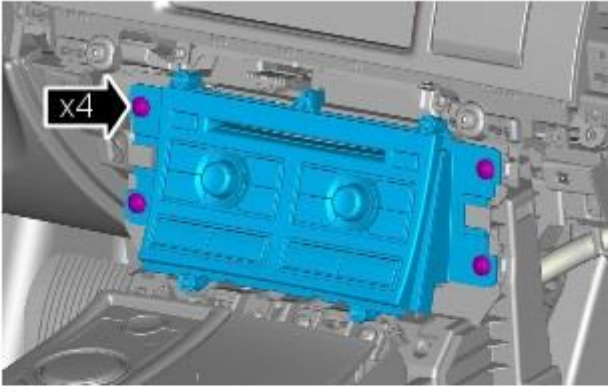
### Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove both floor console side trim panels.

Refer to: [Floor Console Side Trim Panel](#) (501-12 Instrument Panel and Console, Removal and Installation).

2. Torque: 4 Nm



E95125

### Installation

1. To install, reverse the removal procedure.

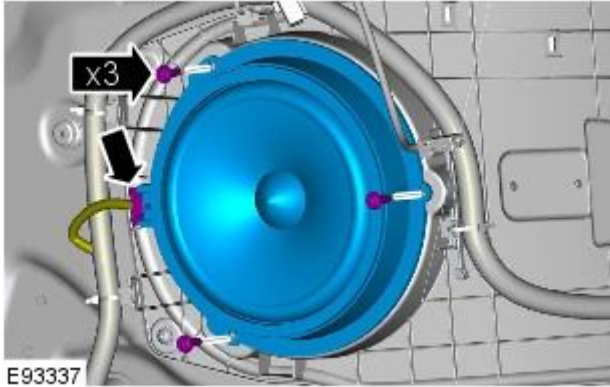
# Information and Entertainment System - Front Door Speaker

Removal and Installation

## Removal

1. Refer to: Front Door Trim Panel (501-05, Removal and Installation).

2.



## Installation

1. To install, reverse the removal procedure.

# Information and Entertainment System - Information and Entertainment Display

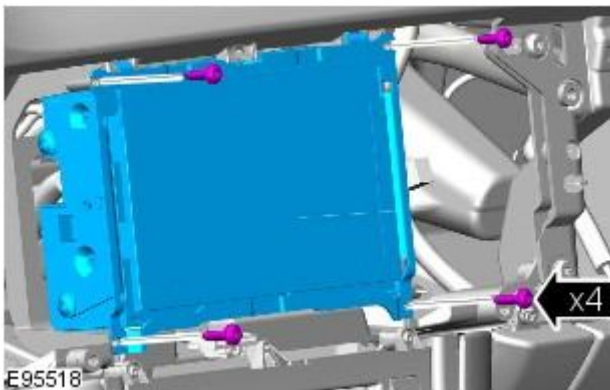
Removal and Installation


## Removal

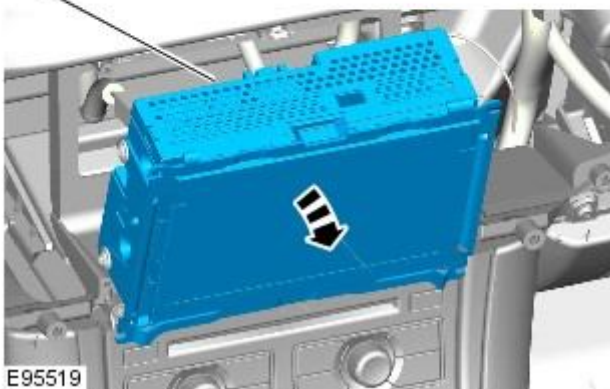
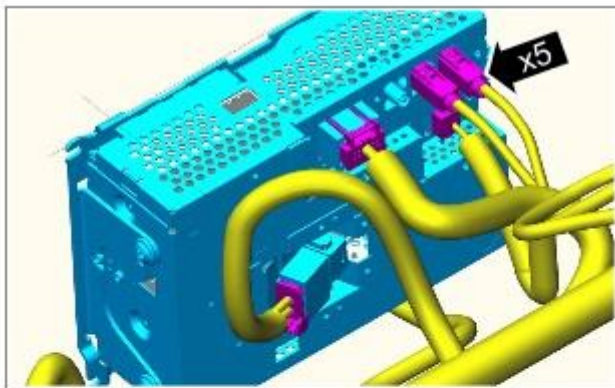
• NOTE: Removal steps in this procedure may contain installation details.

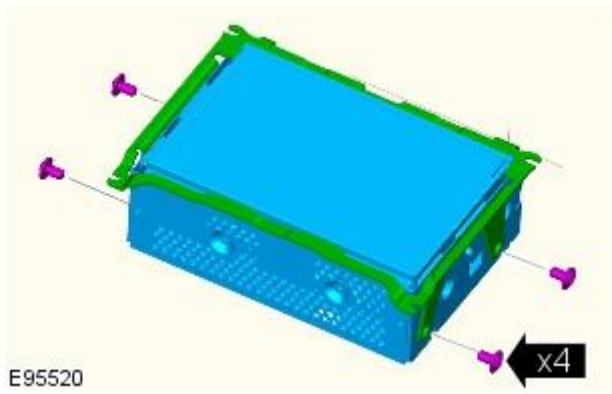
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Center Registers](#) (412-01 Climate Control, Removal and Installation).

3. Torque: 2 Nm



4.  CAUTION: Cover fiber optic cable connectors to minimize dust ingress and avoid bending the cables in a radius of less than 30 mm.





5. **NOTE:** Do not disassemble further if the component is removed for access only.

*Torque:* 3 Nm

## Installation

1. To install, reverse the removal procedure.

# Information and Entertainment System - Information and Entertainment Module

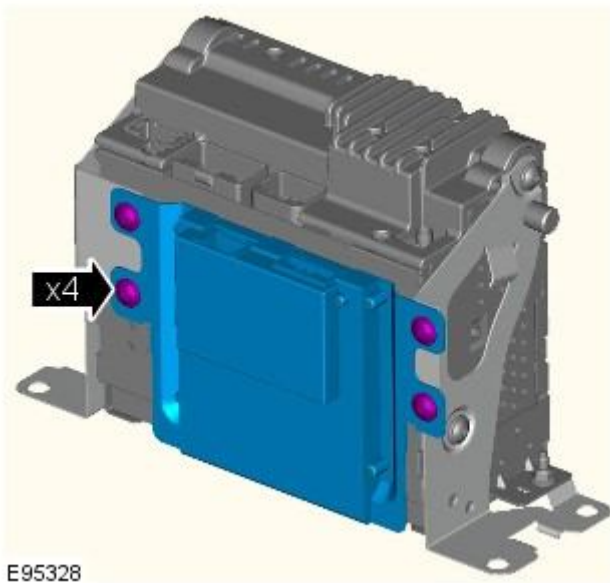
Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Audio Unit](#) (415-01 Information and Entertainment System, Removal and Installation).

3. Torque: 3 Nm



## Installation

1. NOTE: New units must be configured using the Programmable Module Installation Routine in the diagnostic tool.

To install, reverse the removal procedure.

# Information and Entertainment System - Instrument Panel Speaker

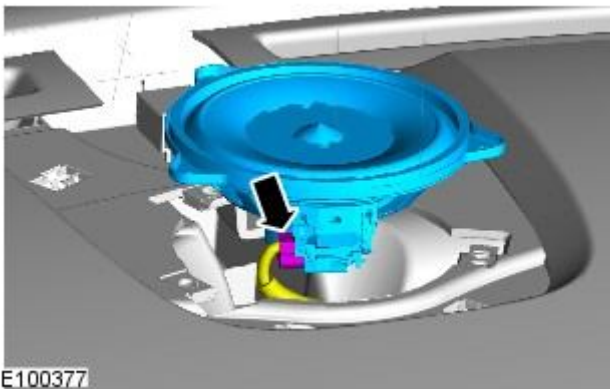
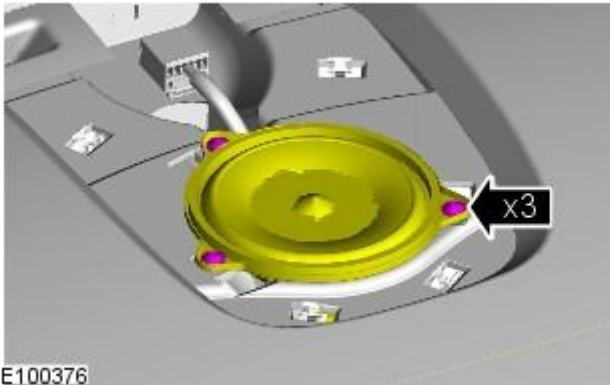
Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Instrument Panel Speaker Grille](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Torque: 2 Nm



4.

## Installation

1. To install, reverse the removal procedure.



# Information and Entertainment System - Rear Door Speaker

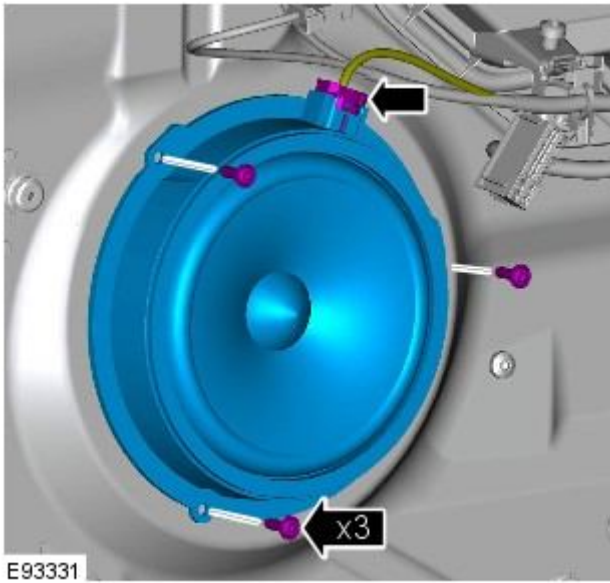
Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Rear Door Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



## Installation

1. To install, reverse the removal procedure.

# Information and Entertainment System - Steering Wheel Audio Controls

Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Make the SRS system safe.

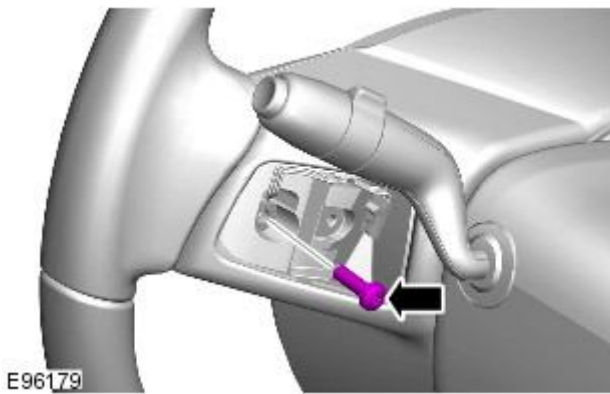
Refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).

2. Refer to: [Driver Air Bag Module](#) (501-20B Supplemental Restraint System, Removal and Installation).

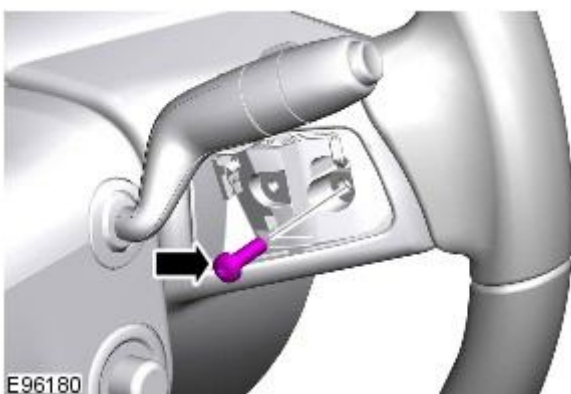
3. Refer to: [Upshift Paddle Switch](#) (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation).

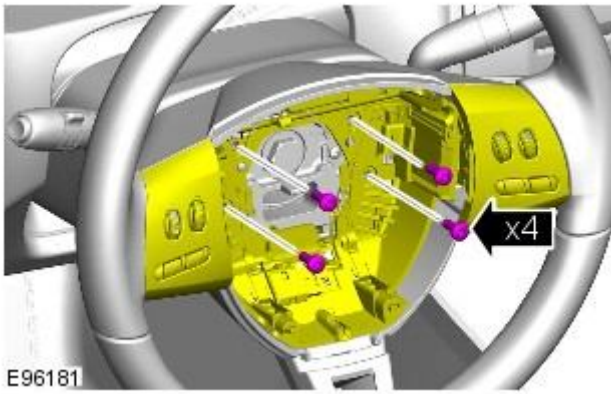
4. Refer to: [Downshift Paddle Switch](#) (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation).

5. Torque: 3 Nm

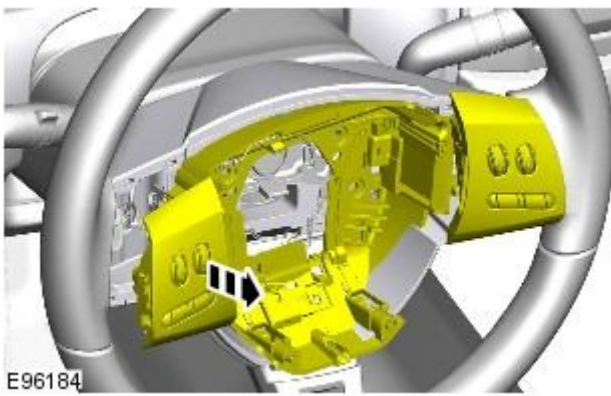


6. Torque: 3 Nm

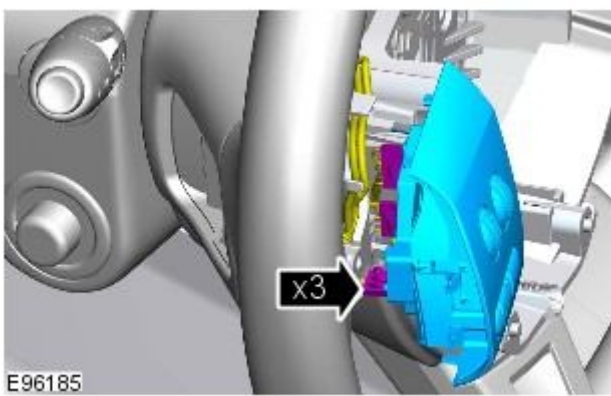




7. Torque: 6 Nm



8.



9.

## Installation

1. To install, reverse the removal procedure.

# Information and Entertainment System - Subwoofer Amplifier

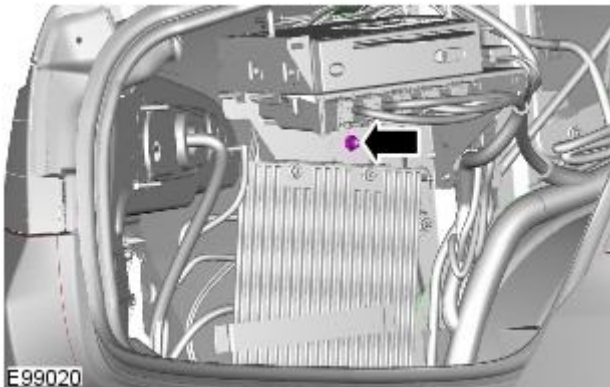
Removal and Installation

## Removal

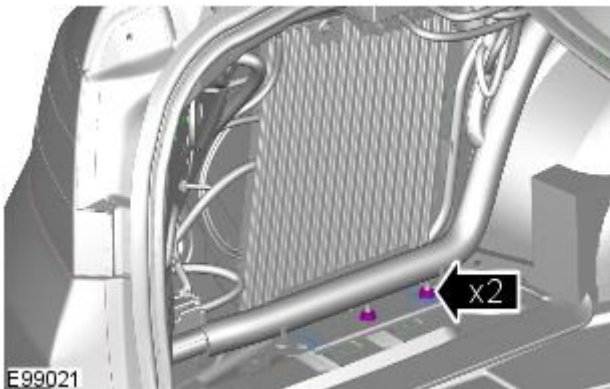
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Loadspace Trim Panel LH](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Torque: 7 Nm



4. Torque: 7 Nm



5. 6. NOTE: Do not disassemble further if the component is removed for access only.

Torque: 7 Nm

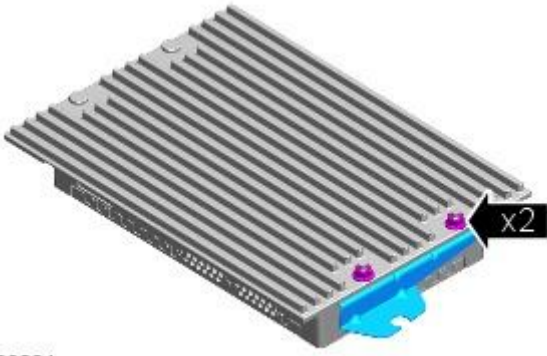


E99023



E99022

7. Torque: 7 Nm



E99024

## Installation

1. To install, reverse the removal procedure.

# Information and Entertainment System - Subwoofer Speaker

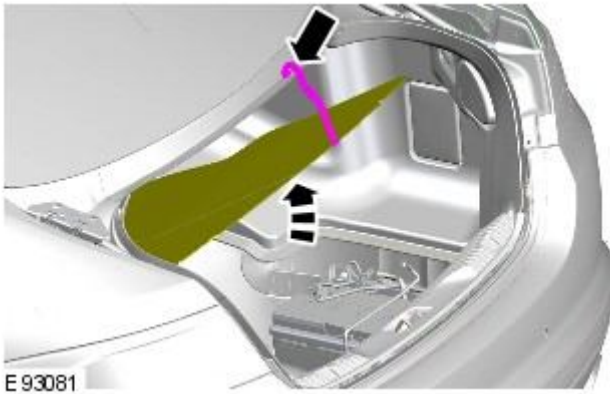
Removal and Installation

## Removal

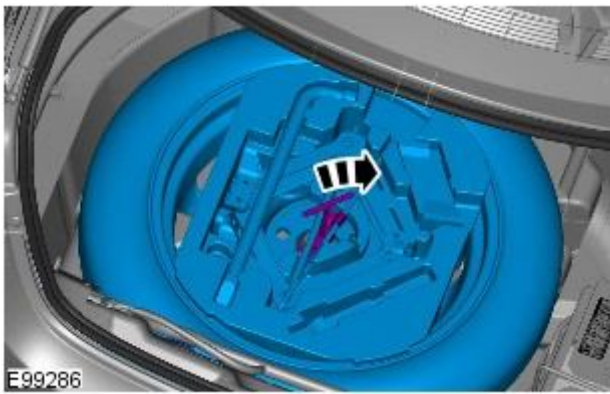
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

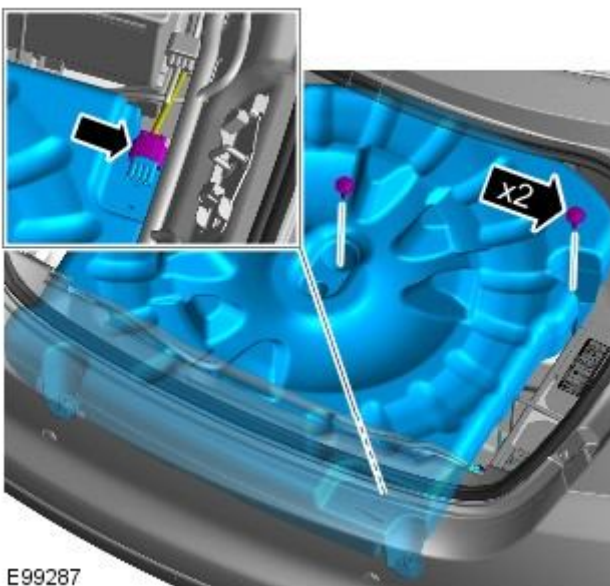
2.



3. Torque: 6 Nm



4. Torque: 6 Nm



## Installation

1. To install, reverse the removal procedure.



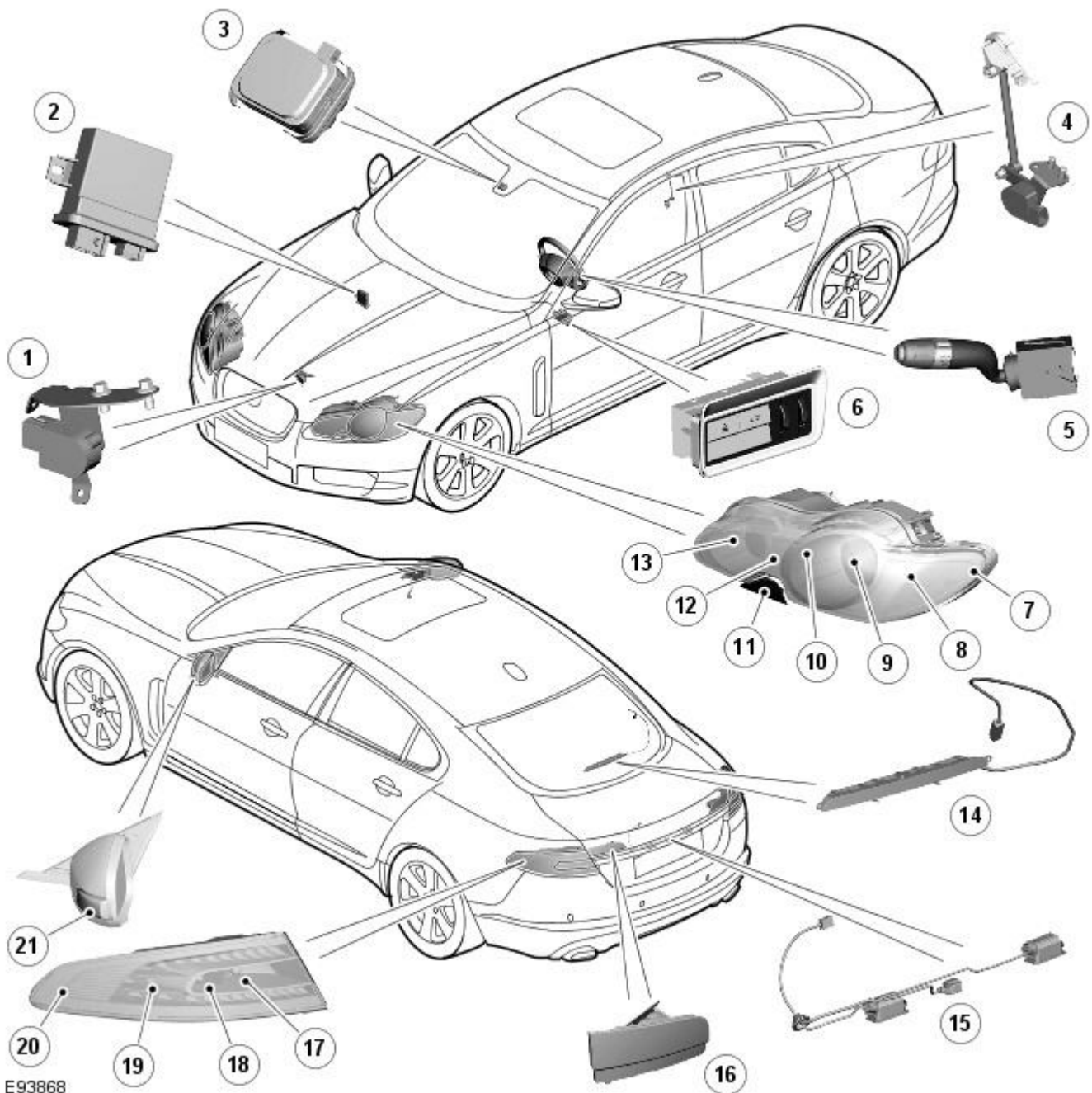
## Exterior Lighting -

### General Specifications

Item	Specification
Low beam headlamp bulb - Vehicles with conventional headlamps - non Federal	H7
Low beam headlamp bulb - Vehicles with conventional headlamps - Federal	H11
Low beam headlamp bulb - Vehicles with xenon headlamps	D1S
High beam headlamp bulb	H7
Cornering lamp bulb	H8
Side repeater lamp bulb	WY5W
Side marker lamp bulb - Federal	W5W
Front turn signal lamp bulb - non Federal	PY21W
Front turn signal lamp bulb - Federal	3457 AK
Rear turn signal lamp bulb	PY19W
Front side/parking lamp bulb	W5W halogen cool blue
Reversing lamp bulb	PS19W

# Exterior Lighting - Exterior Lighting - Component Location

Description and Operation



E93868

## ItemDescription

1	Front height sensor
2	Headlamp leveling module
3	Rain/light sensor
4	Rear height sensor
5	Light switch - LH (left-hand) steering column multifunction switch
6	Auxiliary lighting switch
7	Side marker lamp (NAS only) (2 off)
8	Front turn signal indicator (2 off)
9	Halogen or xenon headlamp projector module (2 off)
10	Cornering/Static bending lamp (where fitted) (2 off)
11	Headlamp telescopic power washer (2 off)
12	Front side lamp (2 off)
13	High beam only halogen lamp (2 off)
14	High Mounted Stop Lamp (HMSL) LED (light emitting diode)'s

15	License plate lamps (2 off)
16	Rear fog lamp (2 off)
17	Rear turn signal indicator (2 off)
18	Reverse lamp (2 off)
19	Side lamp/stop lamp <a href="#">LED's</a> (2 off)
20	Side marker <a href="#">LED's</a> (All markets) (2 off)
21	Side repeater lamp (2 off)

# Exterior Lighting - Exterior Lighting - Overview

Description and Operation

## OVERVIEW

The lighting systems are controlled by the [EJB \(engine junction box\)](#), [RJB \(rear junction box\)](#) and the [CJB \(central junction box\)](#). The two boxes contain fuses, relays and microprocessors to control the power supply and functionality of the lighting systems.

Driver lighting selections using the [LH \(left-hand\)](#) steering column multifunction switch or the auxiliary lighting switch are passed to the [CJB](#) via the instrument cluster.

The lighting system has an 'auto' lights function which is controlled by the [CJB](#) on receipt of signals from the rain/light sensor located at the top of the windscreen. The exterior lights are turned on or off in response to ambient light signals from the rain/light sensor on a [LIN \(local interconnect network\)](#) bus connection to the [CJB](#). The auto lights can also be activated when the windshield wipers are activated by signals from the rain sensor, which is located at the top of the windshield or when the driver activates the wipers in the fast wipe position.

Two levels of headlamp specification are available; halogen or xenon. In certain markets the headlamps feature a cornering lamp or a static bending lamp which illuminates the area at the side of the vehicle when turning into driveways for example. North American Specification (NAS) vehicles have a side marker lamp installed in the headlamp assembly. Replacement of any of the headlamp bulbs requires removal of the headlamp assembly.

The tail lamp comprises two separate lamp assemblies. The turn signal indicator, side and stop lamps and reverse lamps are located in each rear fender tail lamp assembly. The rear fog lamps are located in separate units attached to the luggage compartment lid. A side marker lamp is fitted to the rear fender tail lamp assembly and is fitted in all markets.

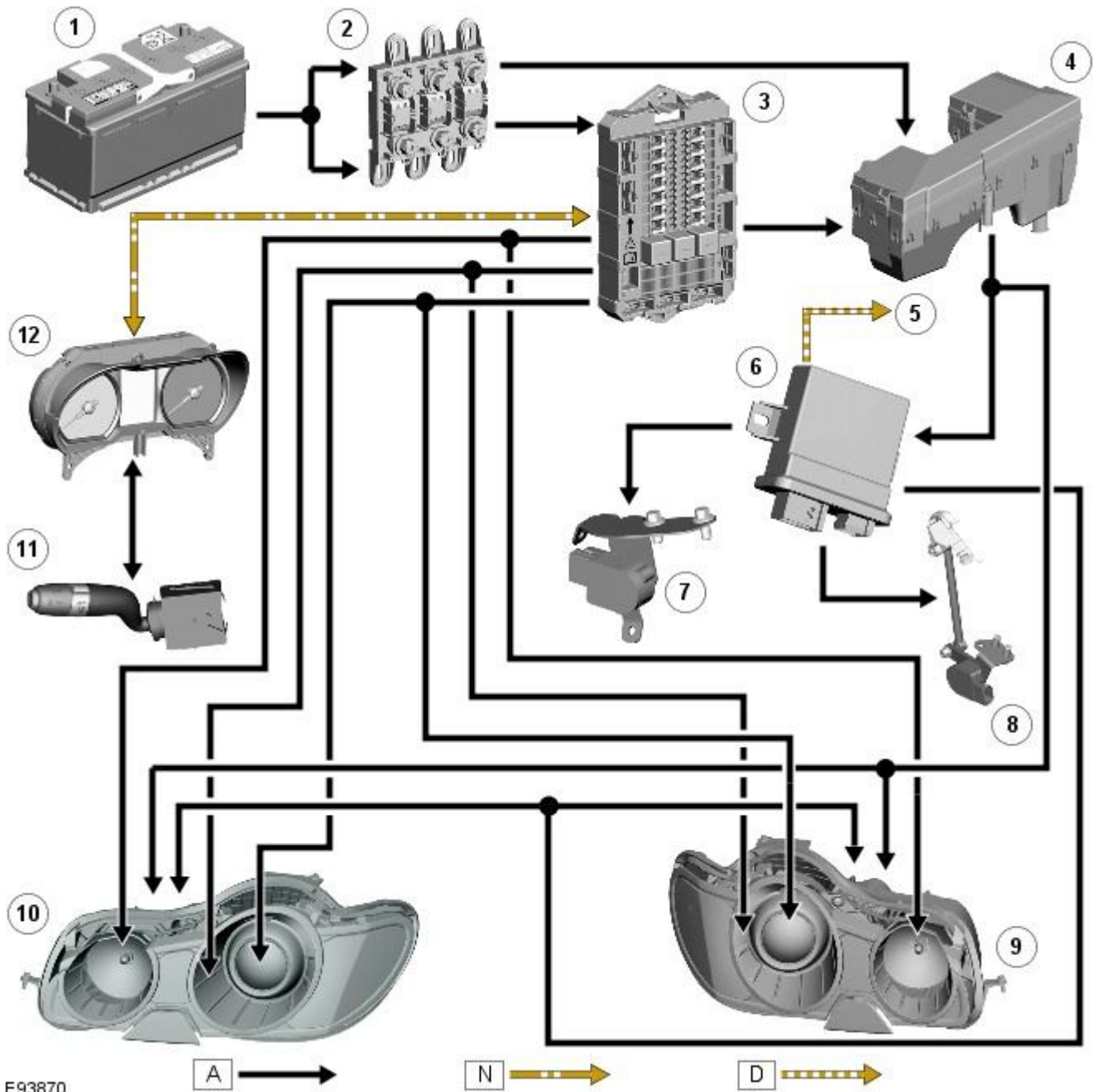
Two systems of headlamp leveling are available; manual leveling which is only available on halogen headlamps and static dynamic leveling which is available on xenon headlamps. The manual system uses a thumbwheel rheostat to adjust the vertical alignment of the headlamps to compensate for differing vehicle loading. The static dynamic system uses height sensors fitted to the front and rear suspension and a headlamp leveling module which periodically monitors the vehicle attitude and adjusts the headlamp vertical alignment accordingly.

# Exterior Lighting - Exterior Lighting - System Operation and Component Description

Description and Operation

## Control Diagram

XENON HEADLAMPS - CONTROL DIAGRAM



E93870

### ItemDescription

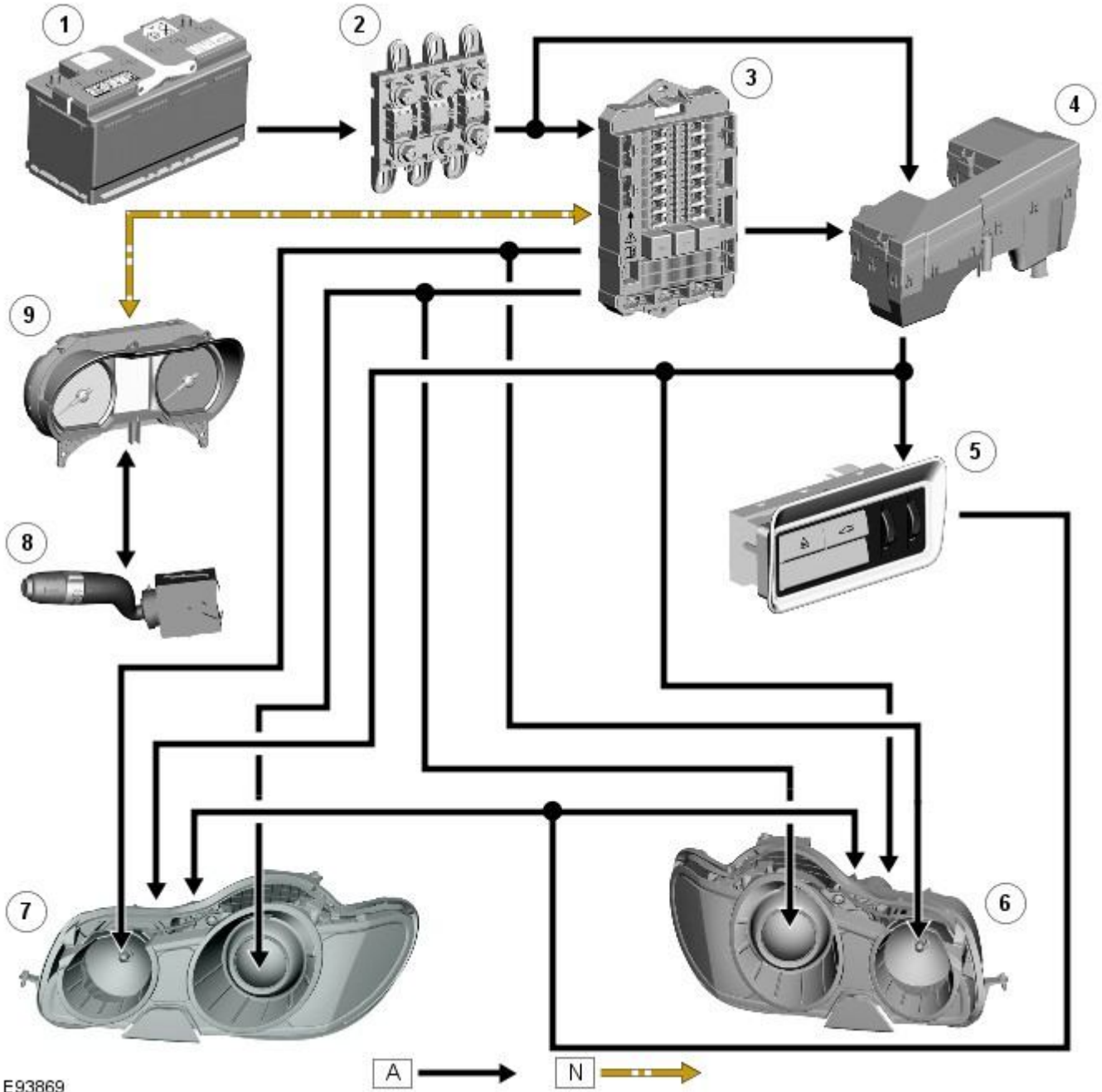
**A** = Hardwired; **D** = High speed CAN bus; **N** = Medium speed CAN bus

1	Battery
2	BJB (battery junction box)
3	CJB (central junction box)
4	EJB (engine junction box)
5	Medium speed CAN (controller area network) bus to other vehicle systems
6	Headlamp leveling module
7	Front height sensor
8	Rear height sensor
9	RH (right-hand) headlamp assembly
10	LH (left-hand) headlamp assembly

11 Lighting control switch - [LH](#) steering column multifunction switch

12 Instrument cluster

HALOGEN HEADLAMPS - CONTROL DIAGRAM



E93869

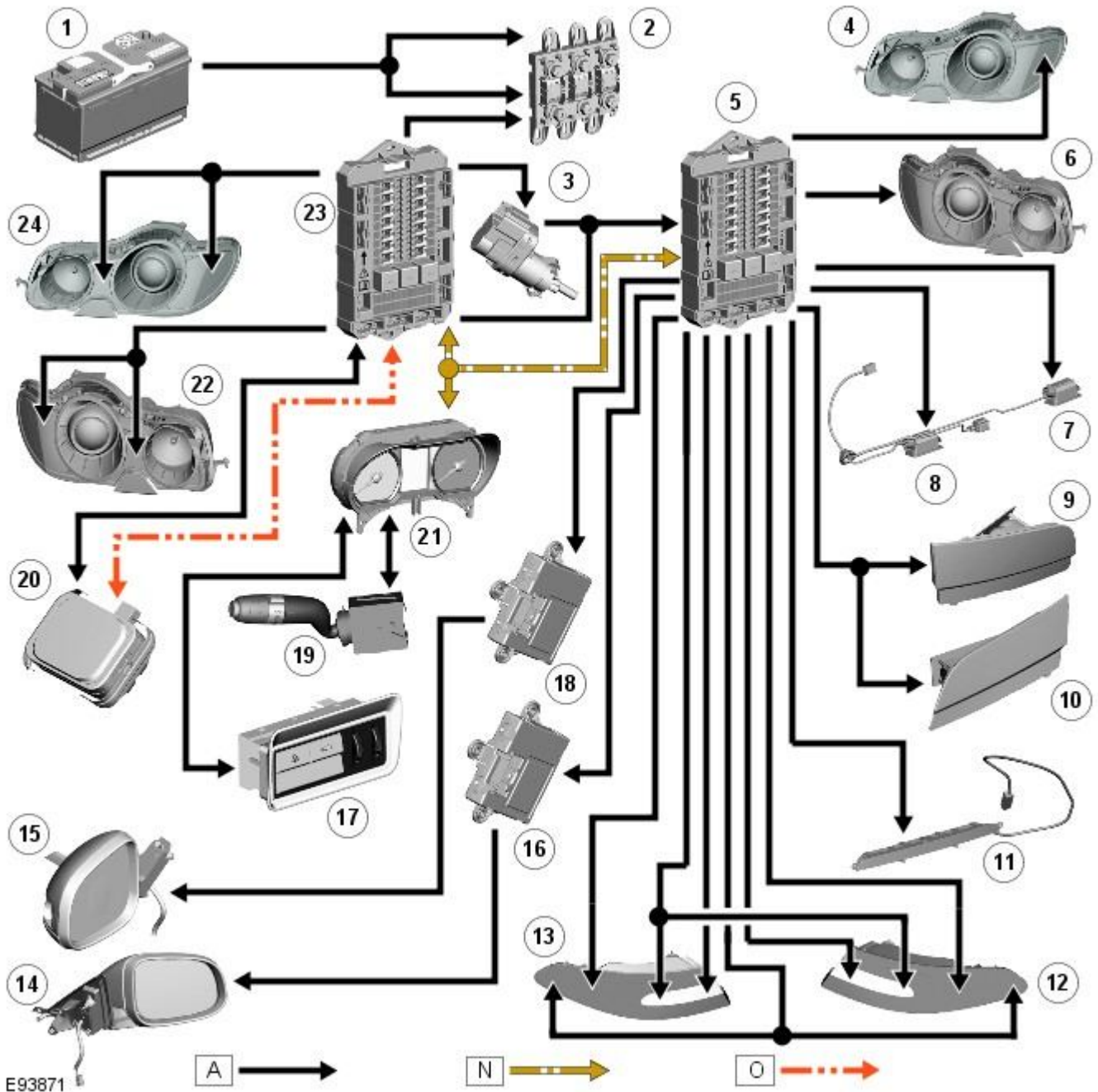
ItemDescription

A = Hardwired; N = Medium speed CAN bus

1	Battery
2	<a href="#">BJB</a>
3	<a href="#">CJB</a>
4	<a href="#">EJB</a>
5	Auxiliary lighting switch
6	<a href="#">RH</a> headlamp assembly
7	<a href="#">LH</a> headlamp assembly
8	Lighting control switch - <a href="#">LH</a> steering column multifunction switch
9	Instrument cluster

SIDE LAMPS/TURN SIGNAL INDICATORS/FOG LAMPS - CONTROL DIAGRAM





#### ItemDescription

A = Hardwired; N = Medium speed CAN bus; O = LIN bus

1	Battery
2	<a href="#">BJB</a> - Megafuse
3	Stop lamp switch
4	<a href="#">LH</a> turn signal indicator
5	<a href="#">RJB</a> (rear junction box)
6	<a href="#">RH</a> turn signal indicator
7	<a href="#">RH</a> licence plate lamp
8	<a href="#">LH</a> licence plate lamp
9	<a href="#">LH</a> fog lamp
10	<a href="#">RH</a> fog lamp
11	High mounted stop lamp
12	<a href="#">RH</a> tail lamp assembly
13	<a href="#">LH</a> tail lamp assembly
14	<a href="#">RH</a> door mirror side repeater
15	<a href="#">LH</a> door mirror side repeater
16	<a href="#">RH</a> front door module
17	Auxiliary lighting switch

18	<a href="#">LH</a> front door module
19	Lighting control switch - <a href="#">LH</a> steering column multifunction switch
20	Rain/light sensor
21	Instrument cluster
22	<a href="#">RH</a> headlamp assembly - side lamp and side marker lamp (if fitted)
23	<a href="#">CJB</a>
24	<a href="#">LH</a> headlamp assembly - side lamp and side marker lamp (if fitted)

## System Operation

### CENTRAL JUNCTION BOX (CJB) AND REAR JUNCTION BOX (RJB)

The [CJB](#) is an integrated unit which controls body functions and power distribution. The [CJB](#) is located on the [RH](#) 'A' pillar.

The [RJB](#) also controls body functions and power distribution and is located in the [RH](#) side of the luggage compartment.

#### Central Junction Box

The [CJB](#) receives inputs from the following switches via the instrument cluster and the medium speed [CAN](#) bus:

- [LH](#) Steering column multifunction switch
  - Side lamp position
  - Headlamp position
  - Automatic (AUTO) position
  - Timer delay positions
  - Turn signal indicators
  - Headlamp flash and main beam positions.

The [CJB](#) receives direct inputs from the following components:

- Stop lamp switch
- Rain/light sensor.

The [CJB](#) provides power supplies to the following lamps:

- [LH](#) and [RH](#) front side lamps
- [LH](#) and [RH](#) front side marker lamps (if fitted)
- [LH](#) and [RH](#) static bending lamp (if fitted)
- [LH](#) and [RH](#) low beam headlamp
- [LH](#) and [RH](#) high beam headlamp.

#### Rear Junction Box

The [RJB](#) provides power supplies to the following lamps:

- [LH](#) and [RH](#) tail lamps
- [LH](#) and [RH](#) stop lamps
- [LH](#) and [RH](#) front turn signal indicators
- [LH](#) and [RH](#) rear turn signal indicators
- [LH](#) and [RH](#) licence plate lamps
- [LH](#) and [RH](#) side marker lamps
- High mounted stop lamp
- Rear fog lamps
- Reverse lamps.

The [RJB](#) also provides a power supply to the [LH](#) and [RH](#) door modules. The door modules use the power supply to activate the turn signal indicator side repeater lamps located in the door mirrors, on receipt of a medium speed [CAN](#) bus message from the [RJB](#).

#### Circuit Protection

The [CJB](#) and the [RJB](#) provide circuit protection for their respective lighting circuits. The exterior lighting circuits are protected by Field Effect Transistors (FET's). The FET's can detect overloads and short circuits and respond to heat generated by increased current flow caused by a short circuit.

On a normal conventionally protected circuit this would cause a fuse to blow. The FET's respond to the heat increase and disconnect the power supply to the affected circuit. When the fault is rectified or the FET has cooled, the FET will reset and operate the circuit normally. If the fault persists the FET will cycle, disconnecting and reconnecting the power supply.

The [CJB](#) and the [RJB](#) store fault codes which can be retrieved using a Jaguar approved diagnostic system. The fault code will identify that there is a fault on a particular output circuit which will assist with fault diagnosis and detection.

#### Alarm Indications

The exterior lighting system is used for alarm arm and disarm requests to show alarm system status.

When the driver locks and arms the vehicle, a visual indication of a successful lock and arm request is displayed to the driver by a single flash of the hazard flashers. If the vehicle is superlocked, then the hazard flashers will flash a second time (200 ms off and 200 ms on) to confirm the superlock request.

If the alarm is activated, the hazard flashers are operated for 10, 30 second cycles of 200 ms on and 200 ms off, with a 10 second delay between each cycle.

• NOTE: On North American Specification (NAS) vehicles, the delay between the cycle when the alarm is activated is 60 seconds.

### Lights on Warning

When the ignition is in the off power mode 0 or accessory power mode 4 and the lighting control switch is in the side lamp or headlamp position, a warning chime will sound if the driver's door is opened. This indicates to the driver that the exterior lights have been left switched on.

The chime is generated from the instrument cluster sounder on receipt of a lights on signal, a driver's door open signal and an ignition off power mode 0 or accessory power mode 4 signal via a medium speed [CAN](#) bus signal from the [CJB](#).

### Headlamp Timer

The [RJB](#) controls the headlamp timer function which allows the headlamps to remain on for a period of time after leaving the vehicle. This is a driver convenience feature which illuminates the driveway after leaving the vehicle.

To operate the timer function the lighting control switch must be in one of the three headlamp timer positions when the ignition status is changed from ignition on power mode 6 to the off power mode 0. The timer function will then be initiated and the low beam headlamps will be illuminated for the selected timer period.

• NOTE: If the lighting switch is in the AUTO position, the headlamp timer will not function when the ignition is changed to off power mode 0.

When the lighting control switch is in the autolamp exit delay position, the lighting control switch reference voltage flows through 4 of the resistors. The returned signal voltage is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [RJB](#) that autolamps has been selected.

Depending on the selected exit delay position, the reference voltage to the autolamp exit delay switch is routed through 3, 2 or 1 resistors which is detected by the instrument cluster. The cluster outputs a message on the medium speed [CAN](#) bus to the [RJB](#) that autolamp exit delay period has been selected at 30, 60 or 120 seconds respectively.

### Crash Signal Activation

When a crash signal is transmitted from the [RCM \(restraints control module\)](#), the [RJB](#) activates the hazard flashers. The hazard flashers continue to operate until the ignition is in the off power mode 0 or accessory power mode 6. Once this ignition state has occurred, the [RCM](#) will cease to transmit the crash signal.

## LIGHTING CONTROL SWITCH

The instrument cluster outputs 2 reference voltages to the rotary lighting control switch; one feed being supplied to the light selection function of the switch and the second feed being supplied to the auto headlamp exit delay function. The switch position is determined by instrument cluster by the change in returned signal voltage which is routed through up to 4 resistors in series depending on the selection made.

OFF - When the lighting control switch is in the off position, the reference voltage flows through 1 of the resistors. The returned signal voltage is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) that no lighting selection is made. The reference voltage to the auto headlamp exit delay switch is routed through 4 resistors which is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) that auto headlamp or exit delay has not been selected.

SIDE LAMPS - When the lighting control switch is in the side lamp position, the reference voltage flows through 2 of the resistors. The returned signal voltage is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) to activate the side lamps. The reference voltage to the autolamp exit delay switch is routed through 4 resistors which is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) that auto headlamp or exit delay has not been selected.

HEADLAMPS - When the lighting control switch is in the headlamp position, the reference voltage flows through 3 of the resistors. The returned signal voltage is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) to activate the headlamps. The reference voltage to the auto headlamp exit delay switch is routed through 4 resistors which is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) that auto headlamp or exit delay has not been selected.

AUTOLAMPS - When the lighting control switch is in the auto headlamp position, the reference voltage flows through 4 of the resistors. The returned signal voltage is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) to activate the autolamp function. The reference voltage to the autolamp exit delay switch is routed through 4 resistors which is detected by the instrument cluster which outputs a message on the medium speed [CAN](#) bus to the [CJB](#) that auto headlamp has been selected.

## AUXILIARY LIGHTING SWITCH

### Headlamp Leveling Rotary Thumbwheel (Halogen headlamps only)

A power supply is passed to the headlamp leveling thumbwheel from the ignition relay in the [EJB](#). Depending on the position of the thumbwheel, the voltage passes through 1, 2 or 3 resistors connected in series. The voltage through the resistors is passed to the headlamp leveling motor controller in each headlamp. The received voltage is determined as a request for the appropriate level position and the controller powers the headlamp level motors to the applicable position for each headlamp.

### Rear Fog Lamp Switch

The instrument cluster supplies a reference voltage and return to the rear fog lamp switch. The fog lamp switch is a non-latching, momentary switch.

When the fog lamp switch is off the reference voltage is passed through a 1Kohm resistor. The voltage through the resistor is returned to the instrument cluster that determines that no request for fog lamp operation has been made.

When the driver presses the fog lamp switch, the reference voltage is passed through a 330 ohm resistor. The change in return voltage is sensed by the instrument cluster which determines fog lamp operation has been requested. The instrument cluster transmits a medium speed CAN bus signal to the RJB providing the lighting control switch is in the correct position. The RJB reacts to the message and provides a power supply to the 3 LED (light emitting diode)'s in each rear fog lamp. A fog lamp warning lamp in the instrument cluster will also be illuminated when the fog lamps are operating.

The RJB will only activate the rear fog lamps if the headlamps are selected on or are active with auto headlamp activation. When the headlamps are turned off the fog lamps are also turned off. When the headlamps are next switched on, the fog lamps will not be activated until the driver requests fog lamp operation.

- NOTE: The fog lamps do operate when DRL (daytime running lamps) are active.

## HEADLAMP LEVELING

### Manual Headlamp Leveling - Halogen headlamps only

A power supply is passed to the headlamp leveling motor in each headlamp from the ignition relay in the EJB. When a signal voltage is received from the headlamp leveling rotary thumbwheel, the headlamp leveling motor controller in each headlamp uses the power supply to operate the motors and move the headlamp to the requested position.

### Static Dynamic Headlamp Leveling - Xenon headlamps only

The headlamp leveling module receives a power supply from the ignition relay in the EJB. The same power supply is also supplied to the headlamp leveling motor in each headlamp assembly. The front and rear height sensors are connected to the headlamp leveling module and receive a power and ground from the module. Each sensor has a signal line to the headlamp leveling module to return height information to the module. The module uses the height signals from the sensors to calculate the vehicle attitude and supplies a signal to each motor to power the headlamp to the required position.

## Component Description

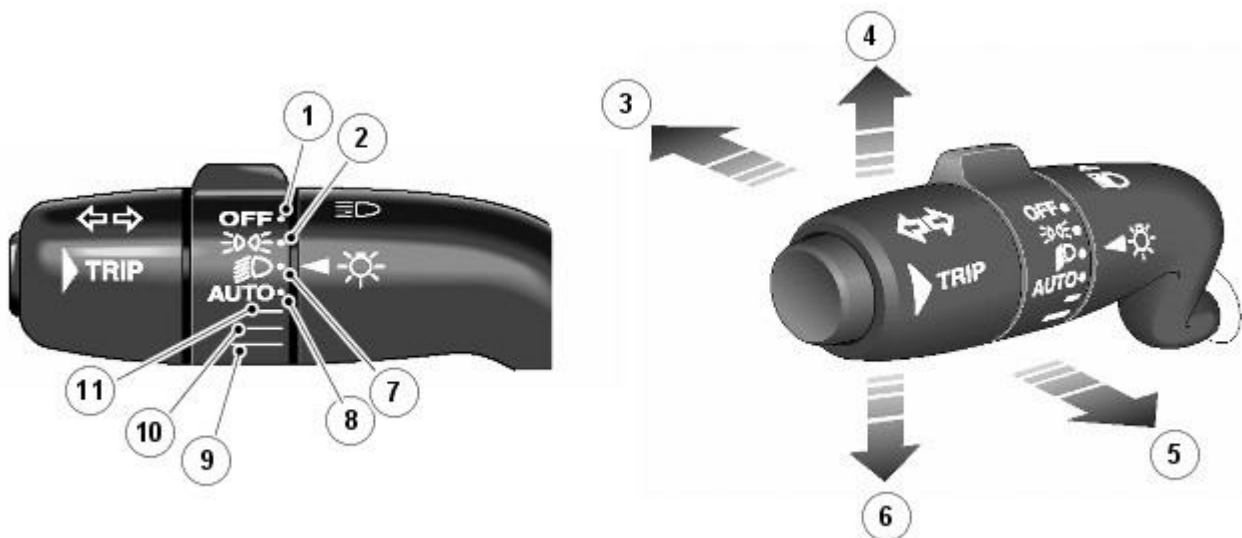
### EXTERIOR BULB TYPE/RATING

The following table shows the bulbs used for the exterior lighting system and their type and specification.

- NOTE: The tail lamps, side marker lamps, stop lamps, high mounted stop lamp and rear fog lamps are illuminated by LED's and are non-serviceable components.

Bulb	Type	Rating
Halogen headlamp - Projector module low/high beam - Not NAS	H7	55W
Halogen headlamp - Projector module low/high beam - NAS only	H11	60W
Xenon headlamp - Projector module low/high beam - All markets	D1S	35W
High beam only (halogen) - High/low beam (xenon) - All markets	H7	55W
Front side lamps - all markets	W5W Halogen cool blue (HCB)	5W
Front turn signal indicators - Not NAS	PY21W	21W
Front turn signal indicators - NAS only	3457AK	27W
Rear turn signal indicators - All markets	PSY19W	19W
Turn signal indicator side repeaters - All markets	WY5W	5W
Reverse lamps - All markets	PS19W	19W
Licence plate lamps - All markets	W5W	5W

### LIGHTING CONTROL SWITCH



E82943

#### ItemDescription

- |   |              |
|---|--------------|
| 1 | Off position |
|---|--------------|

2	Side lamp position
3	High beam position
4	RH turn signal indicator
5	Headlamp flash/high beam off position
6	LH turn signal indicator
7	Headlamp position
8	AUTO headlamp position
9	Headlamp timer 120 second delay position
10	Headlamp timer 60 second delay position
11	Headlamp timer 30 second timer delay position

The lighting control switch is located on the LH steering column multifunction switch. The lighting control switch is a rotary control with positions for the following lighting functions:

- Off
- Side lamps
- Headlamps
- AUTO headlamps
- Headlamp timer (3 time period selections).

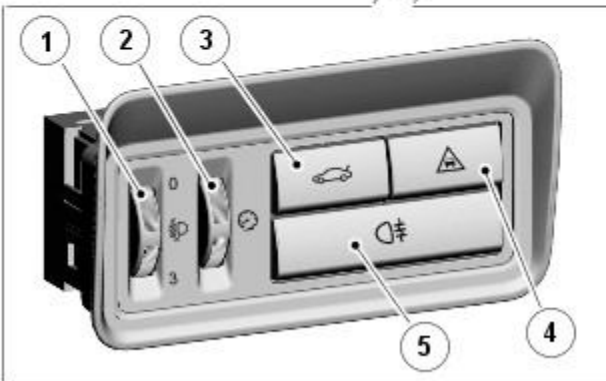
The LH steering column multifunction switch also provides for the following functions:

- Low beam headlamps
- High beam headlamps
- Headlamp flash
- LH and RH turn signal indicators
- Trip computer function button.  
Refer to: Information and Message Center (413-08 Information and Message Center, Description and Operation).

The switch has a turn signal indicator lane change function. If the switch is gently pushed to either turn signal indicator position and then released, the applicable turn signal indicators will flash 3 times and then will be automatically cancelled. If a turn signal indicator bulb fails, the green turn signal warning indicator in the instrument cluster will flash at twice the normal rate and the audible ticking from the instrument cluster sounder will also be at twice the normal rate.

### AUXILIARY LIGHTING SWITCH

- NOTE: RHD (right-hand drive) switch shown



E98399

#### ItemDescription

1	Headlamp leveling rotary thumbwheel (halogen headlamps only)
2	Instrument panel illumination dimmer thumbwheel
3	Luggage compartment lid release switch

4 Forward alert switch (if fitted)
------------------------------------

5 Rear fog lamp switch
------------------------

The auxiliary lighting switch is located in the instrument panel, adjacent to the steering column. The switch has a rear fog lamp switch and a rotary thumbwheel to adjust headlamp leveling on vehicles with halogen headlamps. The auxiliary lighting switch also has a forward alert switch (if fitted) and a rotary thumbwheel for instrument panel illumination dimming.

The rear fog lamp switch is a non-latching switch which provides a momentary signal to the instrument cluster. The fog lamps can only be activated if the ignition is in power mode 6 and the headlamp or auto headlamps are selected on. If the fog lamp switch is pressed when the fog lamps are operating, they will be switched off. If the lighting control switch is moved to the side lamp or off position or if the auto headlamps turns off the headlamps the rear fog lamps will be extinguished. If the headlamps are subsequently turned on the rear fog lamp operation will not be active and the rear fog lamp switch must be pressed to activate the lamps.

## **HEADLAMP ASSEMBLY**

Two types of headlamp are available; xenon or halogen. The headlamp is secured in the front of the vehicle with three bolts; one outboard bolt is screwed into the front upper cross member, one inboard bolt in the front upper body gusset and one bolt located at the rear of the headlamp assembly which locates in the front fender reinforcing panel. Bulb replacement requires the removal of the 3 bolts and the headlamp assembly.

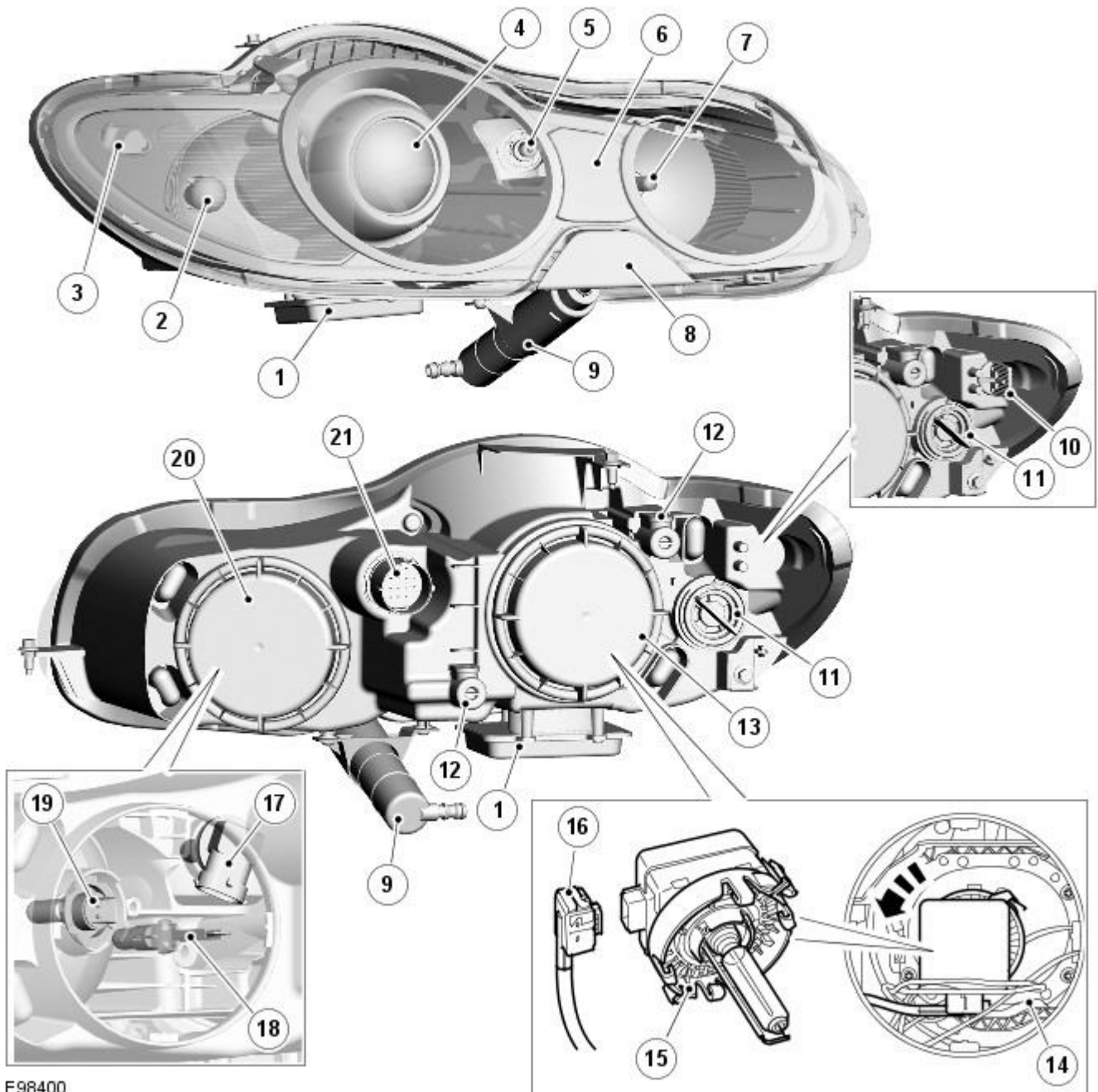
The rear of the headlamp has removable panels which allow access to the bulbs for replacement. A large cover can be rotated counter-clockwise for removal allows access the headlamp low beam halogen or xenon D1S bulb. Another large removable cover can be rotated for removal to provide access to the high beam bulb, side lamp bulb and cornering/static bending lamp bulb (if fitted).

The headlamps have 2 adjustment screws on the rear which allow for the manual setting of the vertical and horizontal alignment.

On NAS vehicles, the headlamp is regarded as 'Visual Optically Left' aiming. The adjustment screws must be turned equal amounts to maintain the correlation in the vertical axis only. There is no horizontal adjustment. Refer to the Service Repair Procedures manual for headlamp alignment data and procedures.

Each headlamp has an integral 16 pin connector which provides inputs and outputs for the various functions of the headlamp assembly.





E98400

**ItemDescription**

1	Xenon control module (not fitted on halogen low beam headlamps)
2	Turn signal indicator
3	Side marker lamp (NAS only)
4	Projector module - Low beam headlamp(Halogen) – Low/High beam headlamp (xenon)
5	Cornering/static bending lamp (if fitted)
6	Side lamp
7	High beam headlamp
8	Power wash jets trim cover
9	Headlamp powerwash
10	Side marker lamp bulb (NAS only)
11	Turn signal indicator bulb
12	Headlamp adjuster screw (2 off)
13	Cover - Low beam headlamp projector module bulb
14	Mounting collar
15	Xenon igniter unit and bulb
16	Xenon igniter electrical connector
17	Cornering/static bending lamp bulb (if fitted)
18	Side lamp bulb

19	High beam headlamp bulb
20	Cover - Side lamp, cornering/static bending lamp (if fitted) and high beam headlamp bulbs
21	Electrical connector

### Bi-Xenon Headlamp

The bi-xenon headlamp uses a projector lens, similar to the halogen headlamp. The projector module comprises an ellipsoidal lens and a reflector. The projector reflector collects the light produced by the halogen bulb and projects the light into a focal plane containing a shield. The contour of the shield is projected onto the road by the lens. A complex surface reflector is used for the halogen fill in high beam lamp. This type of reflector is divided into separate parabolic segments, with each segment having a different focal length. The low and high beam bulbs are quartz halogen H7, with a rating of 55W. The bulbs are retained in the headlamp unit with conventional wire retaining clips.

A tourist lever mechanism is located on the right hand side of the projector module. This mechanism moves a flap to blank off a portion of the beam spread to enable the vehicle to be driven in opposite drive hand markets without applying blanking decals to the headlamp lens. The beam is changed by removing the access cover at the rear of the lamp assembly and moving a small lever located near the bulb holder, at the side of the projector.

- **NOTE:** The tourist lever is not fitted to NAS vehicles.



**WARNING:** The Xenon system generates up to 30000 volts and contact with this voltage could lead to fatality. Make sure that the headlamps are switched off before working on the system.

The following safety precautions must be adhered to when working on the xenon low beam headlamp system:

- **DO NOT** attempt any procedures on the xenon headlamps when the lights are switched on.
- Handling of the D1S xenon bulb must be performed using suitable protective equipment; for example gloves and goggles. The glass part of the bulb must not be touched.
- Xenon bulbs must be disposed of as hazardous waste.
- Only operate the bulb in a mounted condition in the projector module installed in the headlamp.

The xenon headlamp is known as 'bi-xenon' because it operates as both a low and high beam headlamp unit. The xenon lamp, or High Intensity Discharge (HID) lamp as they are sometimes referred to, comprises an ellipsoidal lens with a solenoid controlled shutter to change the beam output from low to high beam.

- **NOTE:** If the lighting control switch is in the 'off' position, both the xenon lamp and the halogen high beam lamp will operate when the high beam 'flash' function is operated.

The xenon headlamp system is controlled by the [CJB](#) using a control module for each headlamp and an igniter. The control modules and the igniters provide the regulated power supply required to illuminate the bulbs through their start-up phases of operation.

The xenon headlamp is a self contained unit located within the headlamp assembly. The unit comprises a reflector, an adaptor ring, the lens, a shutter controller and the xenon bulb, which together forms an assembly known as the projector module. The reflector is curved and provides the mounting point for the xenon bulb. The bulb locates in a keyway to ensure the correct alignment in the reflector and is secured by a plastic mounting ring. The bulb is an integral component of the igniter and is electrically connected by a connector located in the igniter unit.

The shutter controller is a solenoid which operates the shutter mechanism via a lever. The shutter is used to change the beam projection from low beam to high beam and vice versa.

The xenon bulbs illuminate when an arc of electrical current is established between 2 electrodes within the bulb. The xenon gas sealed in the bulb reacts to the electrical excitation and the heat generated by the current flow to produce the characteristic blue/white light.

To operate at full efficiency, the xenon bulb goes through 3 full stages of operation before full output for continuous operation is achieved. The 3 phases are: start-up phase, warm-up phase and continuous phase.

In the start-up phase, the bulb requires an initial high voltage starting pulse of up to 30000 volts to establish the arc. This is produced by the igniter. The warm-up phase begins once the arc is established. The xenon control module regulates the supply to the bulb to 2.6A which gives a lamp output of 75W. During this phase, the xenon gas begins to illuminate brightly and the environment within the bulb stabilizes, ensuring a continual current flow between the electrodes. When the warm-up phase is complete, the xenon control module changes to continuous phase. The supply voltage to the bulb is reduced and the operating power required for continual operation is reduced to 35W. The process from start-up to continuous phase is completed in a very short time.

The xenon control modules (one per headlamp) receive an operating voltage from the [CJB](#) when the headlamps are switched on. The modules regulate the power supply required through the phases of start-up.

The igniters (one per headlamp) generate the initial high voltage required to establish the arc. The igniters have integral coils which generate high voltage pulses required for start-up. Once the xenon bulbs are operating, the igniters provide a closed circuit for the regulated power supply from the control modules.

### Halogen Low/high Beam Headlamp

The halogen low/high beam headlamp uses a projector lens, similar to the xenon headlamp. The projector module comprises an ellipsoidal lens and a reflector. The projector reflector collects the light produced by the halogen bulb and projects the light into a focal plane containing a shield. The contour of the shield is projected onto the road by the lens. The low/high beam bulbs are quartz halogen and are retained in the headlamp unit with conventional wire retaining clips.

A tourist lever mechanism is located on the right hand side of the projector module. This mechanism moves a flap to blank off a portion of the beam spread to enable the vehicle to be driven in opposite drive hand markets without applying blanking decals to the headlamp lens. The beam is changed by removing the access cover at the rear of the lamp assembly and moving a small lever located near the bulb holder, at the side of the projector.

### Halogen High Beam Headlamp - Xenon and Halogen

The xenon and halogen headlamps use a complex surface reflector for the halogen fill in high beam lamp only lighting unit, which is of the same design on both headlamp types. This type of reflector has the reflector divided into separate parabolic segments, with each segment having a different focal length.

The high beam headlamp bulbs are quartz halogen and are retained in the headlamp unit with conventional wire retaining clips.

### Cornering Lamps

- NOTE: The cornering lamps are not fitted to NAS vehicles.

The cornering lamps are an optional feature designed to illuminate the direction of travel when cornering at low speeds. The design of the lens projects a spread of light from the vehicle at approximately 45 degrees to the vehicle axis. The cornering lamp is incorporated into the headlamp assembly and shares the same housing as the low beam headlamp. The cornering lamp uses a 35W Halogen H8 bulb which is permanently located in an integral holder which is connected on the headlamp housing. The holder is located in an aperture in the headlamp housing and rotated to lock. The bulb is accessible via a removable cover on the base of the headlamp housing.

The cornering lamps are controlled by the [LH](#) steering column multifunction switch with the lighting control switch in the headlamp position and the ignition in power mode 6. The cornering lamps are supplied power via the ignition circuit to ensure that they do not function with the headlamp delay feature. The cornering lamps are deactivated if the vehicle speed exceeds 25 mph (40 km/h). Only one cornering lamp will illuminate at any one time. If the left hand turn signal indicators are selected on, the left hand cornering lamp will be illuminated and vice versa, providing the vehicle speed and lighting control switch positions are correct.

### Static Bending Lamps

- NOTE: The static bending lamps are not fitted to NAS vehicles.

The static bending lamps are designed to illuminate the direction of travel when cornering at low speeds. The static bending lamp functionality, which is controlled by the [CJB](#) and the headlamp leveling module, operates using inputs from the steering angle sensor and vehicle speed information from the [ABS \(anti-lock brake system\)](#) module. The static bending lamp is incorporated into the headlamp assembly and shares the same housing as the low beam headlamp. The design of the lens projects a spread of light from the vehicle at approximately 45 degrees to the vehicle axis. The static bending lamp uses a 35W Halogen H8 bulb which locates in a holder which is connected via wires to the main connector on the headlamp housing. The holder is located in an aperture in the headlamp housing and rotated to lock. The bulb is accessible via a removable cover at the rear of the headlamp housing.

The static bending lamps operate with a steering angle sensor [CAN](#) bus signal which is received by the [CJB](#). The [CJB](#) monitors this signal and vehicle speed and activates the static bending lamp bulb. When the operation parameters of the lamp are reached, the [CJB](#) fades the static bending lamp bulb on using a [PWM \(pulse width modulation\)](#) voltage over a period of approximately 2 seconds. When the lamp is switched off, the [CJB](#) fades the bulb off by decreasing the [PWM](#) voltage in a linear manner depending on steering angle and vehicle speed. The cornering lamps can only be active for a maximum of 3 minutes.

- NOTE: Static bending lamps only operate when the transmission is in DRIVE or in SPORT.

### Turn Signal Indicators

The turn signal indicator lamp is incorporated into the outer part of the headlamp assembly. The turn signal indicator lamp uses a PY21W bayonet orange colored bulb in ROW markets, a S8W 27/7W wedge bulb is used in NAS markets. The bulb is fitted into a holder which connects with contacts in the headlamp housing. The holder is fitted into an aperture in the headlamp housing and rotated to lock into position.

When active, the turn signal indicator lamps will flash at a frequency cycle of 380ms on and 380ms off. If a bulb fails, the remaining turn signal lamps bulbs continue to flash at normal speed. The turn signal indicators in the instrument cluster will flash at double speed to indicate the bulb failure to the driver.

### Side Lamps

The side lamp is located between the headlamp projector module and the high beam headlamp. The side lamp uses a W5W wedge fitting bulb which locates in a holder which connected via wires to the main connector on the headlamp housing. The holder is a push fit into a receptacle in the headlamp housing. The bulb is accessible by removal of the inner cover on the rear of the headlamp housing. Access to the bulb requires removal of the headlamp from the vehicle. The side lamps are operated by selecting side lamps or headlamps on the lighting control switch. The side lamps are functional at all times and are dependant on a particular ignition mode status. The side lamps will also be illuminated when the lighting control switch is in the AUTO position and a 'lights on' signal is received by the [CJB](#) from the rain/light sensor

### Side Marker Lamps (NAS only)

The side marker lamp is located in the outer part of the headlamp assembly. The side marker lamp uses a W5W wedge fitting bulb. The bulb is fitted into a holder which connects with contacts in the headlamp housing. The holder is fitted into an aperture which connects with contacts in the headlamp housing. The side marker lamp is active at all times when the side lamps are active.

## AUTOMATIC HEADLAMP OPERATION

The automatic headlamp function is a driver assistance system. The driver can override the system operation by selection of side lamp or headlamp on if the ambient light conditions require front and rear lighting to be active. The automatic headlamp system uses a light sensor and the [CJB](#), which are connected via a [LIN \(local interconnect network\)](#) bus to control the headlamp functionality. The light sensor is incorporated in the rain/light sensor located on the inside of the windshield, below the rear view mirror. The wiper system also uses the rain/light sensor for automatic wiper operation.

The light sensor measures the ambient light around the vehicle in a vertical direction and also the angular light level from the front of the vehicle. The rain/light sensor uses vehicle speed signals, wiper switch position and the park position of the front wipers to control the system. The automatic headlamp operation uses ambient light levels which are monitored by photodiode incorporated in the rain/light sensor. The rain/light sensor sends a lights on/off request to the [CJB](#) on the [LIN](#)

bus, which responds by switching on the low beam headlamps, front side lamps and rear tail lamps. The automatic headlamps are activated under the following conditions:

- Twilight
- Darkness
- Rain
- Snow
- Tunnels
- Underground or multistoried car parks.

Operation of the automatic headlamps requires the ignition to be in ignition mode 6, the lighting control switch to be in the 'AUTO' position and a lights on request signal from the light sensor. If the rain sensor signal activates the fast speed wipers, the low beam headlamps are activated, providing the lighting control switch is in the 'AUTO' position.

## HEADLAMP LEVELING

Headlamp leveling provides for the adjustment of the vertical aim of the headlamps. The leveling system is primarily required to minimise glare to other road users when a heavy load is in the rear of the vehicle. Two systems of headlamp leveling are available; manual and static dynamic.

### Manual Headlamp Leveling

The manual system uses a thumbwheel rheostat to adjust the vertical alignment of the headlamps to compensate for differing vehicle loading. The rotary thumbwheel is located on the auxiliary lighting switch, adjacent to the illumination dimmer thumbwheel. Three positions are available to adjust the headlamps to a position to prevent glare to other road users.

### Static Dynamic Headlamp Leveling

The static dynamic headlamp leveling system uses the following components:

- Front and rear vehicle height sensors
- Two headlamp leveling, vertical adjustment motors
- Headlamp leveling module
- Ignition in mode 6
- Vehicle speed information from [ABS](#) module.

The static dynamic system uses height sensors fitted to the front and rear suspension and a headlamp leveling module which periodically monitors the vehicle attitude and adjusts the headlamp vertical alignment accordingly.

Static dynamic headlamp leveling is controlled by a headlamp leveling module located in the lower instrument panel, behind the glovebox.

The height sensors are both located on the [RH](#) side of the vehicle. The front sensor is attached to the front suspension lower arm with a strap and to the front sub frame with a bracket and 2 bolts. The rear sensor is attached to the rear suspension upper control arm with a cable tied clip and to the rear sub frame with a bracket and 2 bolts. Each sensor has 3 connections to the headlamp leveling module; power, ground and signal.

## DAYTIME RUNNING LAMPS (DRL)

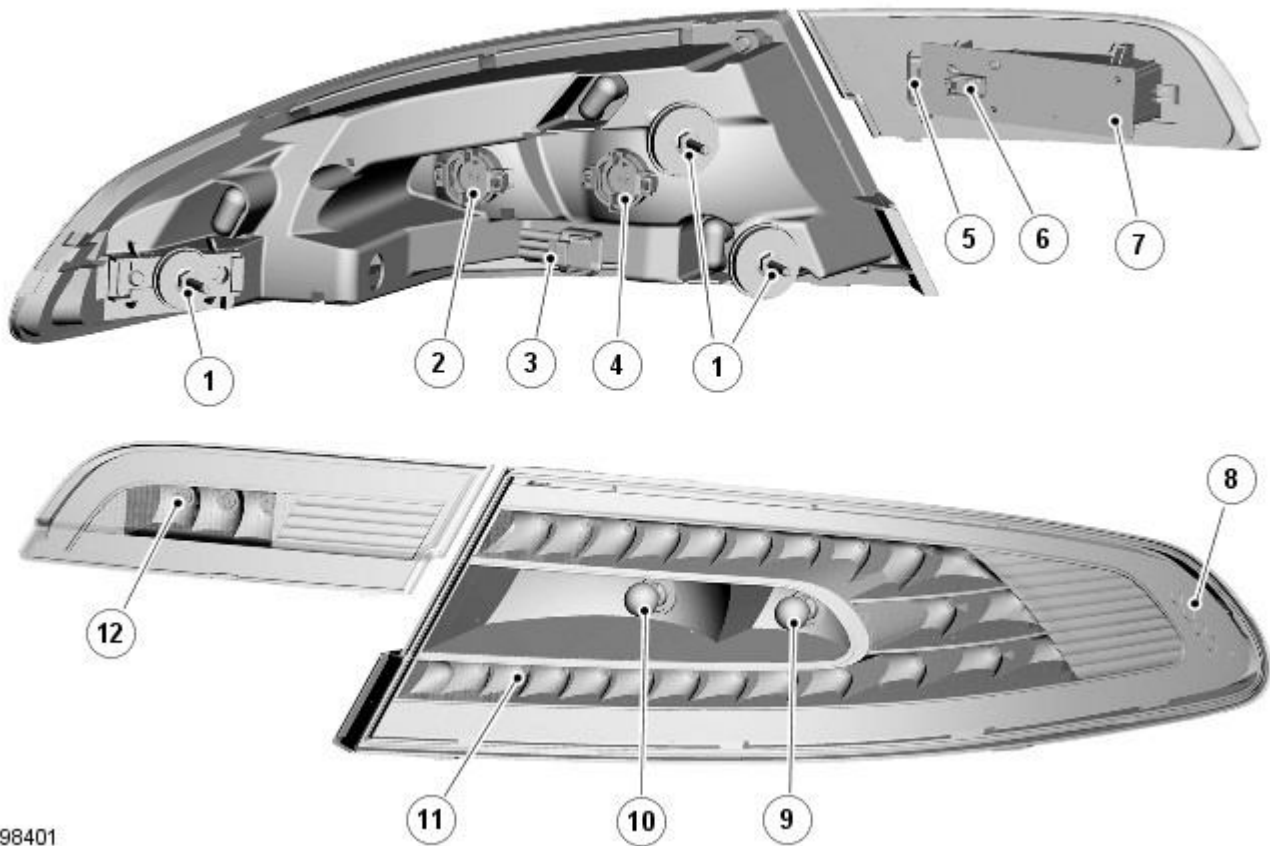
Refer to [DRL](#) section for details.

Refer to: [Daytime Running Lamps \(DRL\)](#) (417-04 Daytime Running Lamps (DRL), Description and Operation).

## REAR LAMP ASSEMBLY

The rear lamp assembly is a 2 piece unit, with one part located in the rear quarter panel and the second part attached to the luggage compartment lid. The outer rear lamp assembly is located in a recess in the vehicle body. The lamp is secured with 2 studs inboard studs on the lamp body which are secured to the vehicle body with 2 nuts. A third outboard stud and nut secures a clip to the vehicle body. To remove the lamp assembly, only the 2 inboard nuts require removal. The outboard nut retains a sliding clip in position on the vehicle body. To remove the rear lamp assembly, remove the 2 inboard nuts and slide the lamp rearwards to release the outboard clip.

The inner rear lamp is located in a recess in the luggage compartment lip and secured with a clip.



E98401

**ItemDescription**

1	Nut (3 off)
2	Reverse lamp bulb and holder
3	Rear lamp electrical connector
4	Turn signal indicator bulb and holder
5	Securing clip
6	Rear fog lamp electrical connector
7	Rear fog lamp LED's and Printed Circuit Board (PCB)
8	Side marker LED's (4 off - all markets)
9	Reverse lamp
10	Turn signal indicator lamp
11	Side lamp/stop lamp LED's (24 off)
12	Rear fog lamp LED's (3 off)

**Rear Stop and Side Lamp**

The turn signal indicator, side and stop lamps and reverse lamps are located in each outer rear lamp assembly. The side lamps and stop lamps use 24 LED's. The 24 LED's are illuminated at a higher intensity than the side lamp when the stop lamp switch is operated by pressing the brake pedal. A side marker lamp is fitted to the outer rear lamp assembly and is fitted in all markets. The side marker lamp also uses 4 LED's and are active at all times when the side lamps are selected on.

The stop lamps can also be activated by the adaptive speed control system. A signal from the adaptive speed control module is sent via the high speed CAN bus to the RJB which activates the stop lamps until an off message is received.

**Turn Signal Indicator**

The turn signal indicator lamp uses a Phillips Hypervision glass filament bulb. The bulb is located in a holder which has contacts which mate with contacts on lamp body. The holder locates in the lamp body and is rotated to lock.

If a bulb fails, the remaining turn signal indicator lamps continue to flash at the normal speed. The applicable turn signal indicator in the instrument cluster will flash at double speed to indicate the bulb failure to the driver.

**Reverse Lamp**

The reverse lamp also uses a Phillips Hypervision glass filament bulb. The bulb is located in a holder which has contacts which mate with contacts on lamp body. The holder locates in the lamp body and is rotated to lock.

The reverse lamps are activated on receipt of a reverse selected message sent on the medium speed CAN bus to the RJB.

**Rear Fog Lamp**

The rear fog lamps are located in separate units attached to the luggage compartment lid. The rear fog lamps each use 3

high intensity [LED](#)'s. The fog lamp located in a recess in the luggage compartment lid has a seal to prevent the ingress of water into the luggage compartment. The lamp is secured in the recess with a metal securing clip. The rear fog lamp is activated using a button located on the auxiliary lighting switch in the instrument panel.

## LICENCE PLATE LAMPS

Two licence plate lamps are located in the luggage compartment lid trim finisher. One is located adjacent to the emergency luggage compartment lid release key barrel cover and the other is adjacent to the rear view camera (if fitted). The licence plate lamps are active at all times when the side lamps are operating. Each lamp can be removed from the finisher by inserting a wide, flat screwdriver blade or similar tool in a slot between the lamp lens and the finisher and gently levering the lamp from the surround. The bulb is a push fit in a holder which in turn is a press fit in the lamp housing.

## HIGH MOUNTED STOP LAMP

The high mounted stop lamp is located at the bottom of the rear windshield. The lamp is secured to a bezel in the parcel shelf with 2 screws.

The high mounted stop lamp uses 12, red colored [LED](#)'s which illuminate through a clear lens. The high mounted stop lamp functionality is the same as that described for the stop lamps.

## TURN SIGNAL INDICATOR SIDE REPEATER LAMPS

The turn signal indicator side repeaters are located in each door mirror. On vehicles from 10MY the lamp is an [LED](#) unit which illuminates in an orange color. The [LED](#) unit is secured to the mirror bezel with 2 screws and is connected to the mirror wiring harness with a 2 pin connector.

The side repeaters have the same functionality and operate in conjunction with the front and rear turn signal indicators and the hazard warning flashers.

## HAZARD FLASHERS

The hazard flashers are activated by a non-latching switch located in the switch pack located in the center of the instrument panel. The hazard flashers operate at all times when selected and operate independent of the ignition mode.

When the hazard flashers are selected on by the driver, a ground path is momentarily completed to the [CJB](#) which activates the front and rear and side repeater turn signal indicators. A second press of the switch is sensed by the [CJB](#) and the hazard flasher are deactivated. When the hazard flashers are active, they override any request for turn signal indicator operation.

The hazard flashers can also be activated by a crash signal from the [RCM](#).

Refer to: [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) (501-20B Supplemental Restraint System, Description and Operation).



# Exterior Lighting - Headlamps

Diagnosis and Testing

## Principles of Operation

For a detailed description of the exterior lighting system, refer to the relevant Description and Operation section in the workshop manual. REFER to: (417-01 Exterior Lighting)

[Exterior Lighting](#) (Description and Operation),  
[Exterior Lighting](#) (Description and Operation),  
[Exterior Lighting](#) (Description and Operation).

## Safety Information

### • WARNINGS:



The Xenon Headlamp system generates up to 28,000 volts. Make sure that the headlamps are switched off before working on the system. Failure to follow this instruction may lead to fatality.



The following safety precautions must be followed when working on the Xenon Headlamp System:

- DO NOT attempt any procedures on the Xenon Headlamps or circuits when the system is energized.
- Handling of the xenon bulb must be performed using suitable protective equipment, e.g. gloves and goggles. The glass part of the bulb must not be touched.
- Only operate the lamp in a mounted condition in the reflector.
- All safety procedures and precautions must be followed to prevent personal injury.



**CAUTION:** Xenon bulbs must be disposed of as hazardous waste.

There are instructions on the correct procedures for Xenon Headlamp System repairs in the manual, refer to section 100-00 - General Information, Standard Workshop Practices of the workshop manual.

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage.

### Visual Inspection

Electrical
<ul style="list-style-type: none"> <li>● Headlamp Leveling Module (HLM)</li> <li>● Bulb(s)</li> <li>● Photocell(s)</li> <li>● Ballast</li> <li>● Wiring harness/electrical connectors</li> <li>● Fuse(s)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to DTC Index.

## Symptom Chart

Symptom	Possible Causes	Action
Low beam lamp(s) inoperative	<ul style="list-style-type: none"> <li>● Bulb failure</li> <li>● Fuse(s) blown</li> <li>● Circuit fault</li> <li>● Lighting control switch fault</li> </ul>	Check the bulb and fuse condition (see visual inspection). Check the headlamp circuits. Check the lighting control switch function. Check the left-hand steering column multifunction switch operation. Refer to the electrical guides. Check for DTCs indicating a headlamp or related circuit fault.
High beam lamp(s) inoperative	<ul style="list-style-type: none"> <li>● Left-hand steering column multifunction switch fault</li> </ul>	
Low beam lamp(s) dim	<ul style="list-style-type: none"> <li>● Incorrect bulb rating</li> <li>● Tourist lever set in the wrong position</li> <li>● Circuit fault</li> </ul>	Check the bulb condition and rating. Check the tourist lever is set correctly. Check the headlamp circuits. Check the lighting control switch function. Check the left-hand steering column multifunction switch function. Refer to the electrical guides.

Symptom	Possible Causes	Action
High beam lamp(s) dim	<ul style="list-style-type: none"> <li>● Lighting control switch fault</li> <li>● Left-hand steering column multifunction switch fault</li> </ul>	
Low beam lamp(s) stuck on	<ul style="list-style-type: none"> <li>● Circuit fault</li> <li>● Lighting control switch fault</li> <li>● Left-hand steering column multifunction switch fault</li> </ul>	Check the headlamp circuits. Check the lighting control switch function. Check the left-hand steering column multifunction switch operation. Check the headlamp timer function. Refer to the electrical guides. Check for DTCs indicating a headlamp circuit fault
High beam lamp(s) stuck on	<ul style="list-style-type: none"> <li>● Headlamp timer function fault</li> </ul>	
Headlamp low/high beam switching function inoperative	<ul style="list-style-type: none"> <li>● Circuit fault</li> <li>● Left-hand steering column multifunction switch fault</li> <li>● Xenon lamp shutter mechanism fault</li> </ul>	Check the headlamp circuits. Check the left-hand steering column multifunction switch operation. Check the xenon lamp shutter mechanism operation. Refer to the electrical guides. Check for DTCs indicating a headlamp circuit fault
Warning lamp(s) inoperative	<ul style="list-style-type: none"> <li>● Fuse(s) blown</li> <li>● Lighting control switch fault</li> <li>● Left-hand steering column multifunction switch inoperative</li> <li>● Circuit fault</li> <li>● Instrument cluster fault</li> </ul>	Check the fuse(s) (see visual inspection). Check the lighting control switch function. Check the left-hand steering column multifunction switch function. Check the warning lamp circuits. Refer to the electrical guides. Check for DTCs indicating an instrument cluster or CAN system fault.
Headlamp Wet - Internal	<ul style="list-style-type: none"> <li>● Condensation</li> <li>● Water Ingress</li> </ul>	Check for outstanding Technical Service Bulletins (TSBs) relating to 'Headlamp Internal Condensation'. Carry out the instructions in the service bulletin to determine if the fault is related to condensation or water ingress.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

• NOTE: Prior to installation/replacement of the Headlamp Assembly carry out all relevant internal visual and mechanical checks for correct cable location and termination including: checks for corroded, bent or backed out pins or terminals, incorrectly inserted connectors and harness damage due to chaffing or incorrect routing.

• NOTE: If the control module has been removed and reinstalled, carry out a DTC code clear, cycle the ignition state to off, then on. This will erase any DTCs that have been logged during the module installation procedure

### Headlamp Leveling Module (HLM)

DTC	Description	Possible Cause	Action
B1041-04	Leveling Control - System Internal Failures	<ul style="list-style-type: none"> <li>● Module internal failure</li> </ul>	Suspect Headlamp Leveling Module internal fault. Replace as required, refer to the new module/component installation note at the top of the DTC Index
B1041-54	Leveling Control - Missing calibration	<ul style="list-style-type: none"> <li>● Leveling sensor calibration routine not carried out</li> </ul>	<ul style="list-style-type: none"> <li>• NOTE: Sensor calibration routine must be carried out with the vehicle unladen.</li> </ul> <p>Calibrate the Headlamp Leveling sensors using the manufacturer approved diagnostic system, carry the out routine 'Headlamp Control Module System Calibration' from the 'Module programming and configuration - Setup and Configuration - Lighting'</p>

DTC	Description	Possible Cause	Action
B10AE-11	Headlamp Leveling Motor - Circuit short to ground	<ul style="list-style-type: none"> <li>Headlamp Leveling Motor Control circuit short to ground</li> </ul>	Refer to the electrical circuit diagrams and check the Headlamp Leveling Motor Control circuit for short to ground
B10AE-12	Headlamp Leveling Motor - Circuit short to battery	<ul style="list-style-type: none"> <li>Headlamp Leveling Motor Control circuit short to power</li> </ul>	Refer to the electrical circuit diagrams and check the Headlamp Leveling Motor Control circuit for short to power
B10AE-64	Headlamp Leveling Motor - Signal plausibility failure	<ul style="list-style-type: none"> <li>Signal plausibility failure voltage out of range</li> </ul>	Refer to the electrical circuit diagrams and check the Headlamp Leveling Motor circuits for failure. Disconnect one headlamp connector, clear DTC and re-test. If DTC cleared, suspect Headlamp Leveling Module or circuits to the disconnected side. If DTC remains, reconnect first headlamp and disconnect second, clear DTC and re-test. If DTC cleared, suspect Headlamp Leveling Module or circuits to the disconnected side. If DTC remains, suspect common circuits of the failure. Refer to the electrical circuit diagrams and check as required
B1A59-11	Sensor 5 Volt Supply - Circuit short to ground	<ul style="list-style-type: none"> <li>Headlamp Leveling sensor 5 volt supply circuit short to ground</li> </ul>	Refer to electrical circuit diagrams and check the Headlamp Leveling Sensor 5 volt supply circuit for short to ground
B1A59-12	Sensor 5 Volt Supply - General Electrical Failure	<ul style="list-style-type: none"> <li>Headlamp Leveling sensor 5 volt supply circuit short to power</li> </ul>	Refer to electrical circuit diagrams and check the Headlamp Leveling Sensor 5 volt supply circuit for short to power
C1A04-11	Right Front Height Sensor - Circuit short to ground	<ul style="list-style-type: none"> <li>Right Front Height Sensor circuit short to ground</li> </ul>	Refer to the electrical circuit diagrams, and check the Right Front Height Sensor circuit for short to ground
C1A04-15	Right Front Height Sensor - Circuit short to battery or open	<ul style="list-style-type: none"> <li>Right Front Height Sensor circuit short to power or open circuit</li> </ul>	Check the Right Front Height Sensor connector for security. Refer to the electrical circuit diagrams, and check Right Front Height Sensor circuit for short to power or open circuit
C1A04-64	Right Front Height Sensor - Signal plausibility failure	<ul style="list-style-type: none"> <li>Sensor (PWM) Signal out of range</li> </ul>	<ul style="list-style-type: none"> <li><b>NOTE: This DTC may be logged if the vehicles wheels have been raised from the floor</b></li> </ul> <p>Check the location, security and mechanical operation of the Height Sensor. Refer to the electrical circuit diagrams, and check Front Right Height Sensor signal circuit for fault</p>
C1A06-11	Right Rear Height Sensor - Circuit short to ground	<ul style="list-style-type: none"> <li>Right Rear Height Sensor circuit short to ground</li> </ul>	Refer to the electrical circuit diagrams, and check Right Rear Height Sensor circuit for short to ground
C1A06-15	Right Rear Height Sensor - Circuit short to battery or open	<ul style="list-style-type: none"> <li>Right Rear Height Sensor circuit short to power or open circuit</li> </ul>	Check the Right Rear Height Sensor connector for security. Refer to the electrical circuit diagrams, and check Right Rear Height Sensor circuit for short to power or open circuit
C1A06-64	Right Rear Height Sensor - Signal plausibility failure	<ul style="list-style-type: none"> <li>Sensor (PWM) Signal out of range</li> </ul>	<ul style="list-style-type: none"> <li><b>NOTE: This DTC may be logged if the vehicles wheels have been raised from the floor</b></li> </ul> <p>Check the location, security and mechanical operation of the Height Sensor. Refer to the electrical circuit diagrams, and check Right Rear Height Sensor signal circuit for fault</p>
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> <li>CAN Bus Off</li> <li>CAN Bus Circuit fault</li> </ul>	Carry out the CAN Network Integrity test using the manufacturer approved diagnostic system
U0100-00	Lost Communication With ECM/PCM "A" - No sub type information	<ul style="list-style-type: none"> <li>Lost communication with the Engine Control Module</li> <li>CAN network fault</li> </ul>	Check the Engine Control Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Headlamp Leveling Module and the Engine Control Module
U0101-00	Lost Communication with TCM - No sub type information	<ul style="list-style-type: none"> <li>Lost communication with the Transmission Control Module</li> <li>CAN network fault</li> </ul>	Check the Transmission Control Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Headlamp Leveling Module and the Transmission Control Module
U0121-00	Lost Communication With Anti-Lock Brake System (ABS) Control Module - No sub type information	<ul style="list-style-type: none"> <li>Lost communication with the Anti-lock Brake System Module</li> <li>CAN network fault</li> </ul>	Check the Anti-lock Brake System Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Headlamp Leveling Module and the Anti-lock Brake System Module
U0155-00	Lost Communication With Instrument Panel Cluster (IPC) Control Module - No sub type information	<ul style="list-style-type: none"> <li>Lost communication with the Instrument Panel Cluster (IPC) Control Module</li> <li>CAN network fault</li> </ul>	Check the Instrument Cluster for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Headlamp Leveling Module and the Instrument Cluster

DTC	Description	Possible Cause	Action
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> <li>Car Configuration File (CCF) information incompatible to Headlamp Leveling Module</li> </ul>	<ul style="list-style-type: none"> <li><b>NOTE: The Car Configuration File (CCF) parameters required are (Vehicle type)(Headlamp type)(Gearbox type) and (Dayrunning light)</b></li> </ul> <p>Check/amend the Car Configuration File (CCF) using the manufacturer approved diagnostic system. Confirm the latest Strategy and Calibration software is installed in the Headlamp Leveling Module, using the manufacturer approved diagnostic system update the Headlamp Leveling Module software as required. If DTC returns suspect an internal fault with the Headlamp Leveling Module check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index</p>
U0415-00	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - No sub type information	<ul style="list-style-type: none"> <li>Invalid data received from ABS module</li> </ul>	<ul style="list-style-type: none"> <li><b>NOTE: The steering wheel center (straight ahead) position is recalculated each ignition cycle</b></li> </ul> <p>Check the Anti-lock Brake System Module for related DTCs and refer to relevant DTC Index.</p>
U0443-00	Invalid Data Received From Body Control Module "B" - No sub type information	<ul style="list-style-type: none"> <li>Invalid signal from the Auxiliary Junction Box</li> <li>Auxiliary Junction Box fault</li> </ul>	Check the Auxiliary Junction Box for related DTCs and refer to the relevant DTC Index. Carry out the CAN Network Integrity test using the manufacturer approved diagnostic system
U2100-00	Initial Configuration Not Complete - No sub type information	<ul style="list-style-type: none"> <li>Car Configuration File (CCF) information not received completely</li> </ul>	<ul style="list-style-type: none"> <li><b>NOTE: The Car Configuration File (CCF) parameters required are (Vehicle type)(Headlamp type)(Gearbox type) and (Dayrunning light)</b></li> </ul> <p>Using the manufacturer approved diagnostic system, clear the stored DTC then cycle the Ignition State to off, wait 30 seconds, return the Ignition state to on and check for stored DTCs, if the DTC reoccurs check other modules for related stored DTCs. If no other modules have related DTCs confirm the security and condition of the Headlamp Leveling Module circuit connections. If no other DTCs are stored and the circuit is correct suspect an internal fault with the Headlamp Leveling Module check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index</p>
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> <li>Car Configuration File (CCF) information incompatible to Headlamp Leveling Module</li> </ul>	<ul style="list-style-type: none"> <li><b>NOTE: The Car Configuration File (CCF) parameters required are (Vehicle type)(Headlamp type)(Gearbox type) and (Dayrunning light)</b></li> </ul> <p>Re-configure the Car Configuration File (CCF) as required using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the Headlamp Leveling Module, refer to the new module installation note at the top of the DTC Index</p>
U3002-81	Vehicle Identification Number - Invalid serial data received	<ul style="list-style-type: none"> <li>The stored Vehicle Identification Number is not the same as the Central Broadcast Vehicle Identification Number</li> <li>The Headlamp Leveling Module has previously been installed to another vehicle</li> </ul>	Check the correct Headlamp Leveling Module is installed to vehicle specification. Refit original or replace the module as required. Refer to the new module/component installation note at the top of the DTC Index
U3003-16	Battery Voltage - Circuit voltage below threshold	<ul style="list-style-type: none"> <li>The power supply to the Module has been below 9 Volts for more than 1000 milliseconds</li> </ul>	Suspect Battery or Charging fault. Check the battery condition and state of charge. Check the vehicle charging system. Refer to the relevant workshop manual section. Clear the DTC, cycle ignition state to off then on, if DTC returns refer to the electrical circuit diagrams and check power and ground circuit to the Headlamp Leveling Module
U3003-17	Battery Voltage - Circuit voltage above threshold	<ul style="list-style-type: none"> <li>The power supply to the Module has been above 16 Volts for more than 1000 milliseconds</li> </ul>	Suspect Charging fault. Check the battery condition and state of charge. Check the vehicle charging system. Refer to the relevant workshop manual section
U3003-62	Battery Voltage - Signal compare failure	<ul style="list-style-type: none"> <li>Difference in battery voltage, of 2 volts or more, between the central broadcast voltage (via CAN Bus) and Headlamp Leveling Module</li> </ul>	Check other modules for related stored DTCs. Refer to the electrical circuit diagrams and check power and ground voltages at the Headlamp Leveling Module

## Exterior Lighting - Approach Lamp

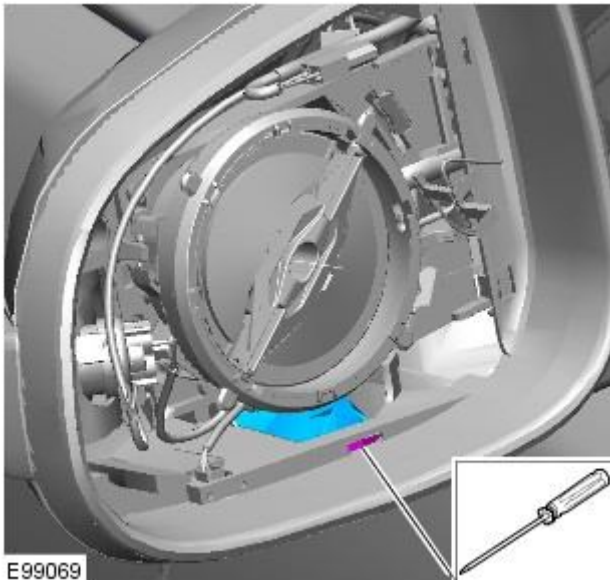
Removal and Installation

### Removal

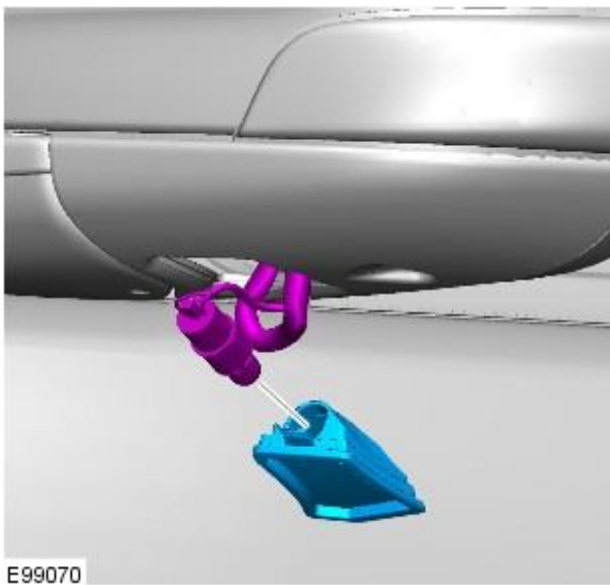
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Exterior Mirror Glass](#) (501-09 Rear View Mirrors, Removal and Installation).

2.



3.



### Installation

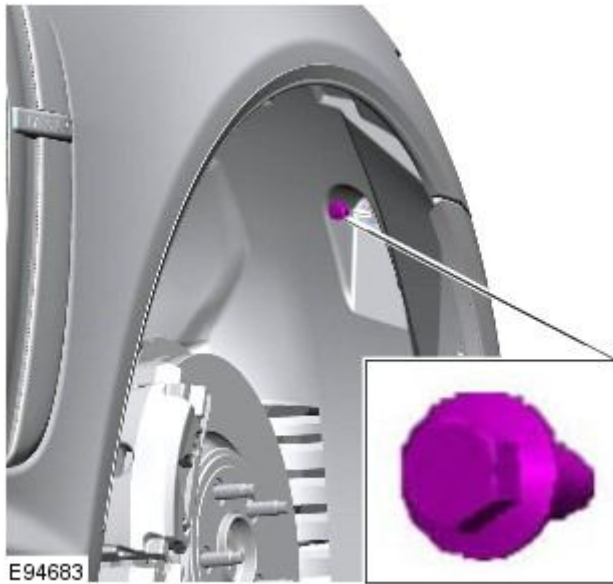
1. To install, reverse the removal procedure.

## Exterior Lighting - Headlamp Assembly

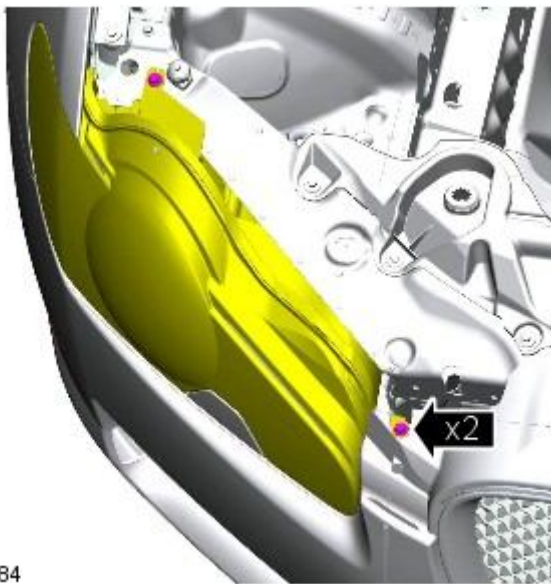
Removal and Installation

### Removal

- NOTE: RH illustration shown, LH is similar.

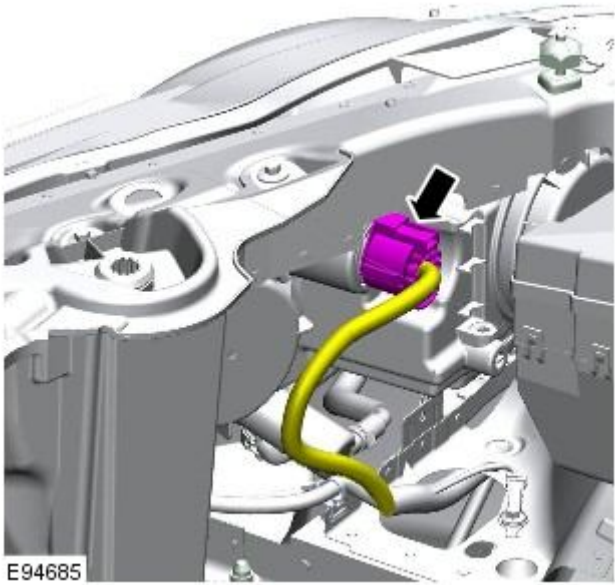


1. 1. NOTE: Turn the steering wheel to full LH lock.

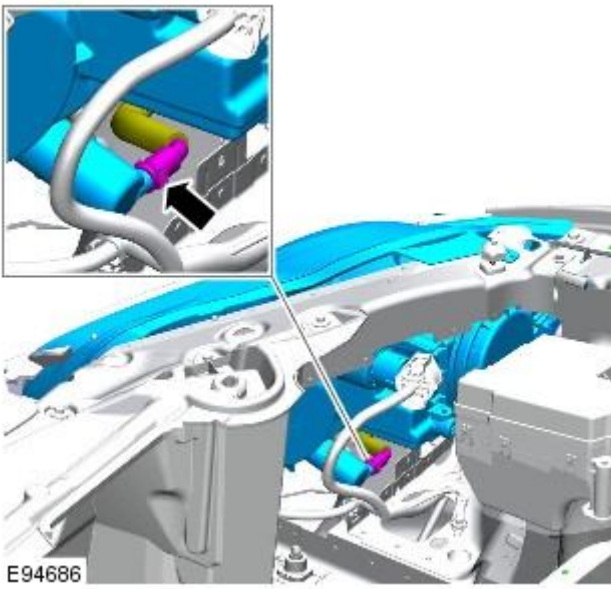


- 2.



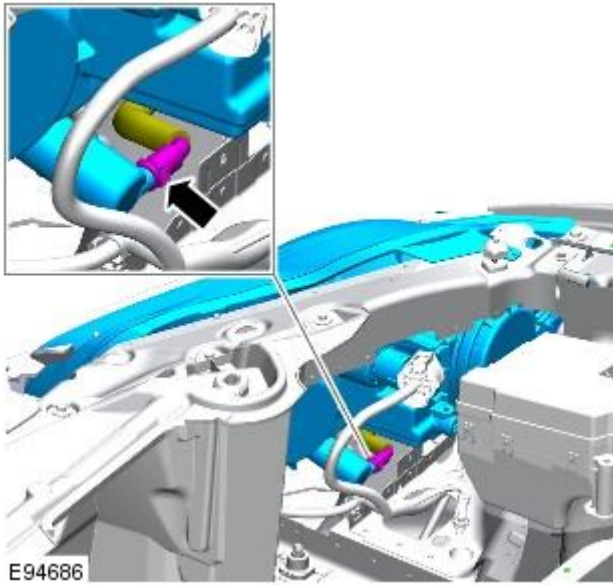


3.

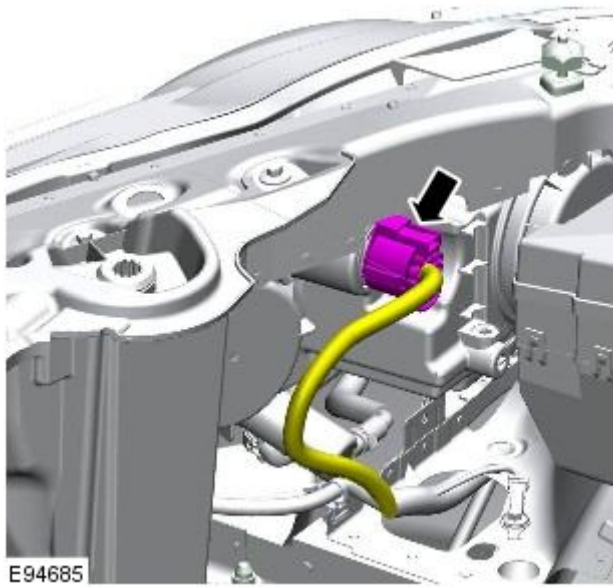


4.

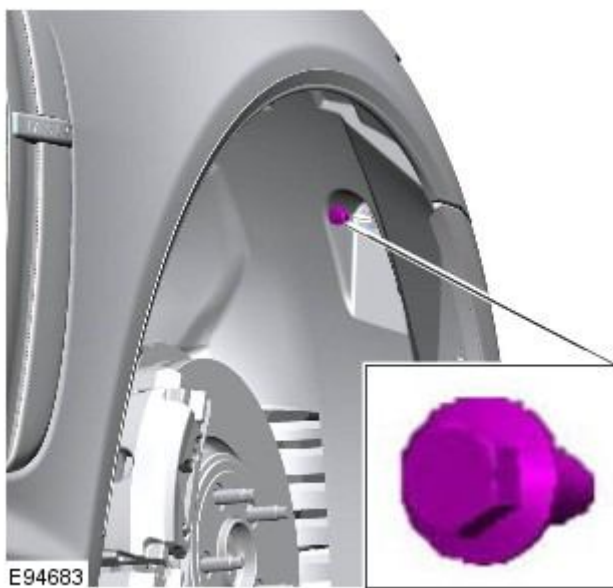
## Installation



1.

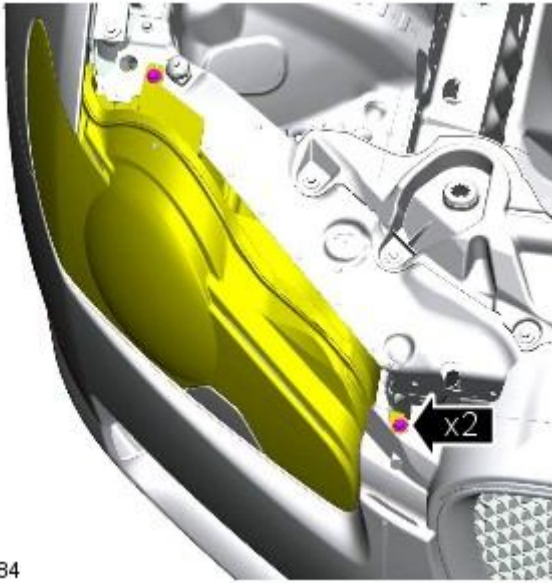


2.



3. Torque: 5 Nm

4. Torque: 5 Nm




E94684

# Exterior Lighting - Headlamp Leveling Front Sensor

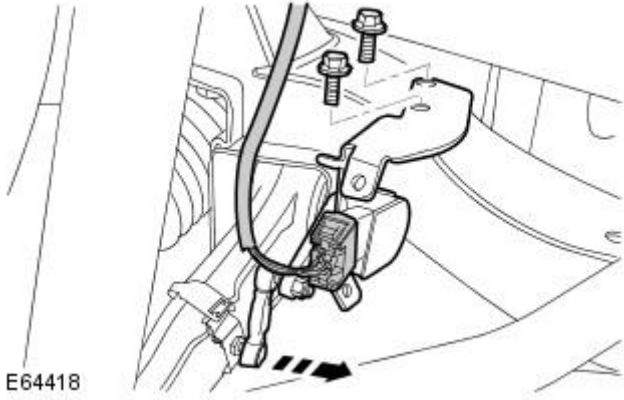
Removal and Installation

## Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the headlamp leveling sensor.
  - Disconnect the height sensor link.
  - Disconnect the electrical connector.
  - Remove the 2 bolts.



3. **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the height sensor link.

4. **NOTE:** Note the fitted position.

Remove the bracket.

- Remove the 2 Allen bolts.



## Installation

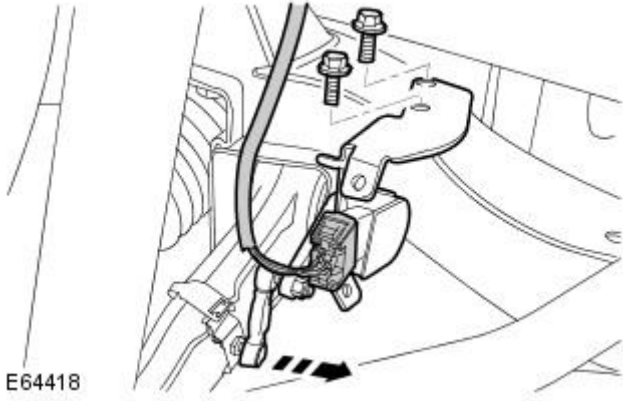
1. **NOTE:** Align to the position noted on removal.

Install the bracket.

- Tighten to 5 Nm.



2. Install the height sensor link.




**3. Install the headlamp leveling sensor.**

- Tighten to 25 Nm.
- Connect the electrical connector.
- Connect the height sensor link.

## Exterior Lighting - Headlamp Leveling Rear Sensor

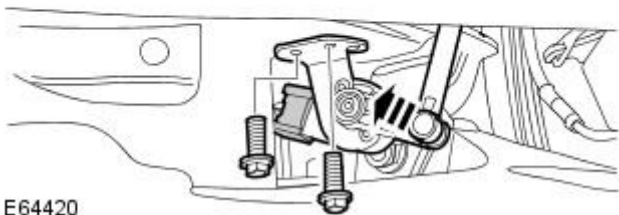
Removal and Installation

### Removal

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- Remove the headlamp leveling sensor.
  - Disconnect the height sensor link.
  - Release and disconnect the electrical connector.
  - Remove the 2 bolts.



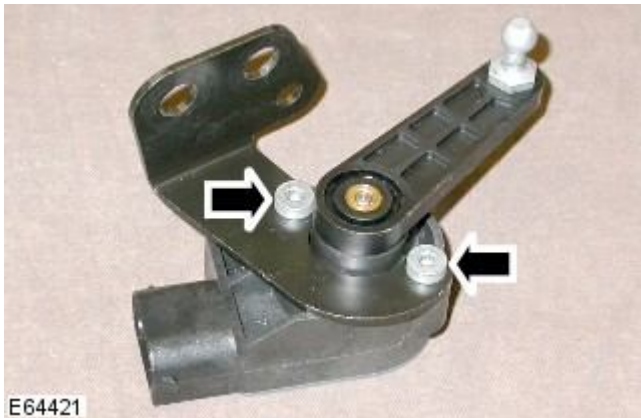
E64420

- NOTE:** Do not disassemble further if the component is removed for access only.

- **NOTE:** Note the fitted position.

Remove the bracket.

- Remove the 2 Allen bolts.



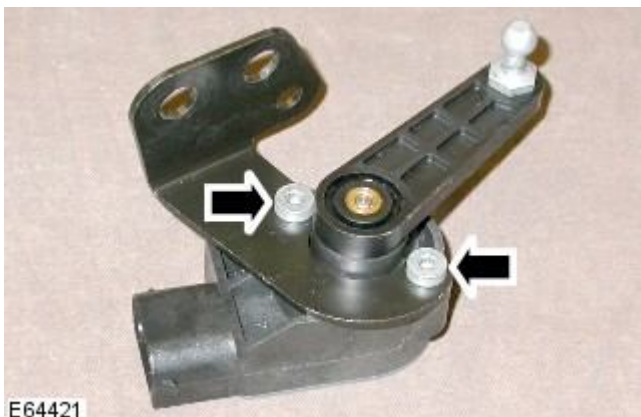
E64421

### Installation

- NOTE:** Align to the position noted on removal.

Install the bracket.

- Tighten to 5 Nm.



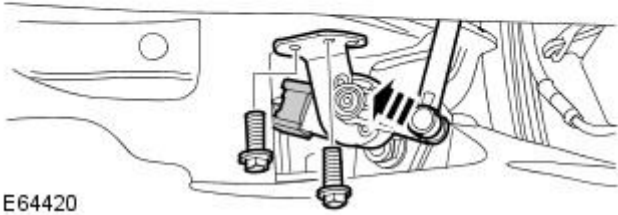
E64421





2. Install the headlamp leveling sensor.

- Tighten to 25 Nm
- Connect the electrical connector.
- Install the height sensor link.



E64420

## Exterior Lighting - High Mounted Stoplamp

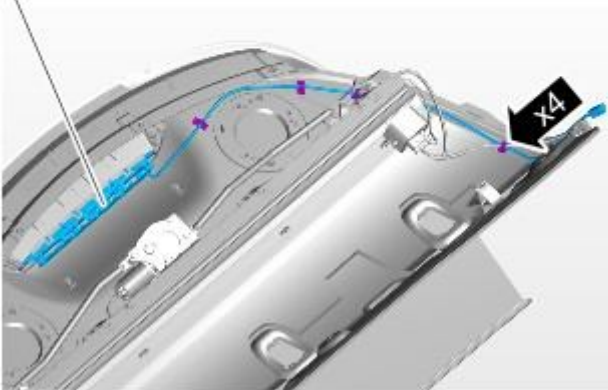
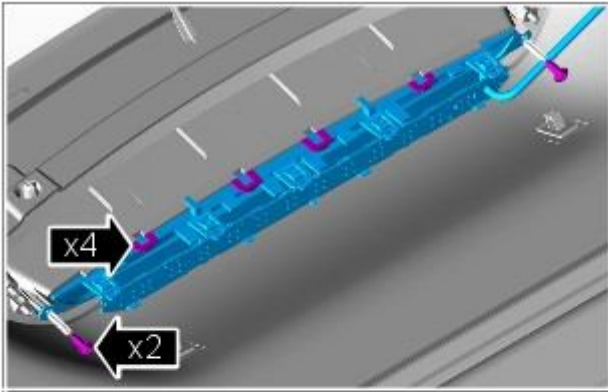
Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Parcel Shelf](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



E99046

### Installation

1. To install, reverse the removal procedure.

## Exterior Lighting - Rear Fog Lamp

Removal and Installation

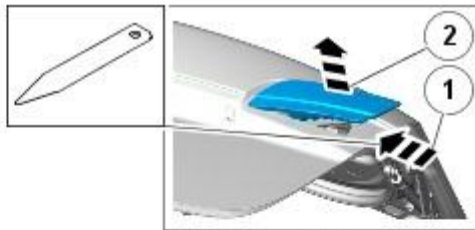
### General Equipment

Spatula

### Removal


- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Luggage Compartment Lid Moulding](#) (501-08 Exterior Trim and Ornamentation, Removal and Installation).

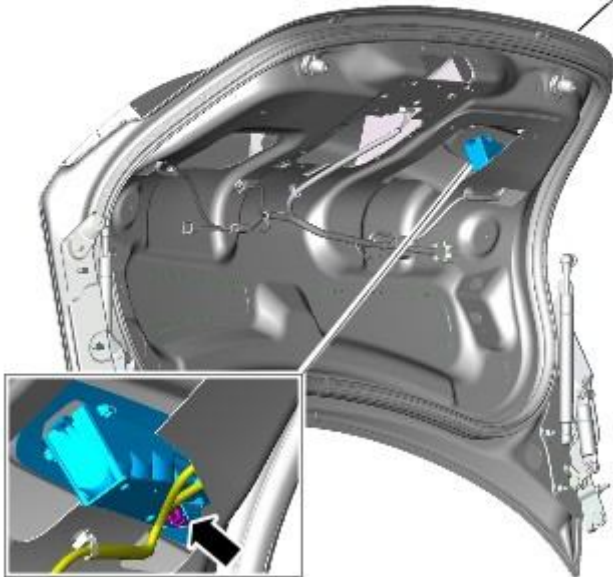


2. CAUTIONS:

 Protect the surrounding paintwork to avoid damage.

 Take extra care not to damage the edges of the component.

General Equipment: [Spatula](#)



E93231

### Installation

1. To install, reverse the removal procedure.

## Exterior Lighting - Rear Lamp Assembly

Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.

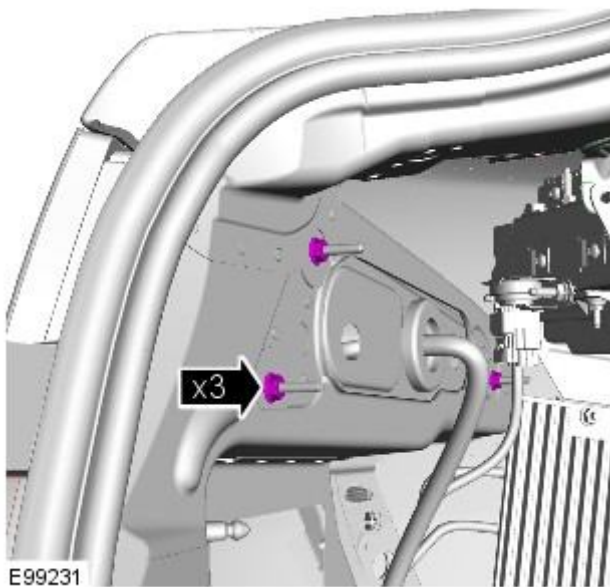
1. Refer to: [Loadspace Scuff Plate Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

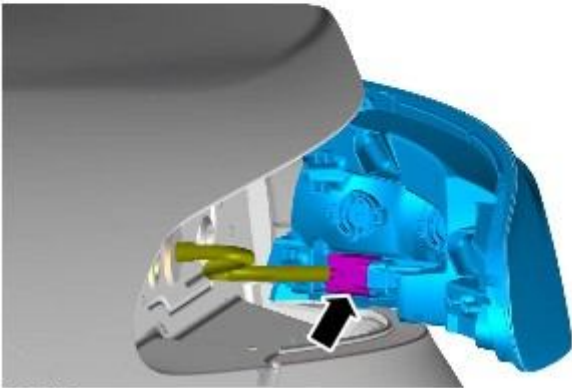
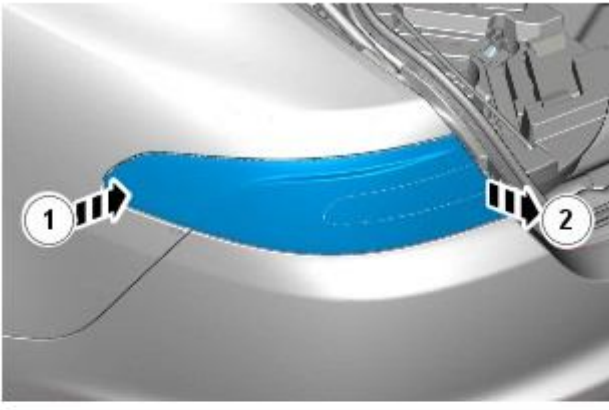
2. **2.** NOTE: LH illustration shown, RH is similar.




3. **3.** NOTE: LH illustration shown, RH is similar.

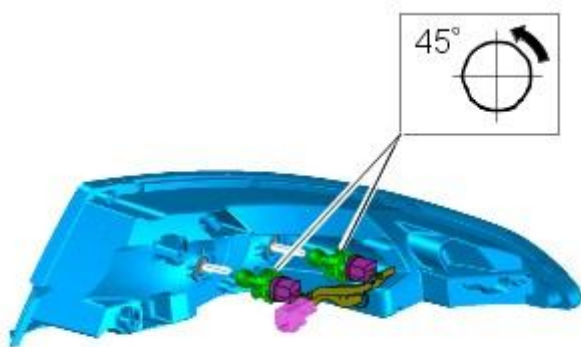
- Torque: 3 Nm





E93318

4.  CAUTION: Take extra care not to damage the edges of the component.



E93319

5. NOTE: Do not disassemble further if the component is removed for access only.

## Installation

1. To install, reverse the removal procedure.

## Exterior Lighting - Side Turn Signal Lamp

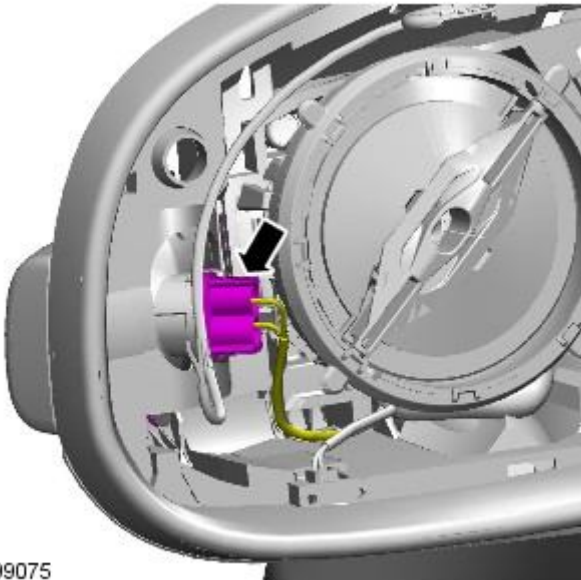
Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.

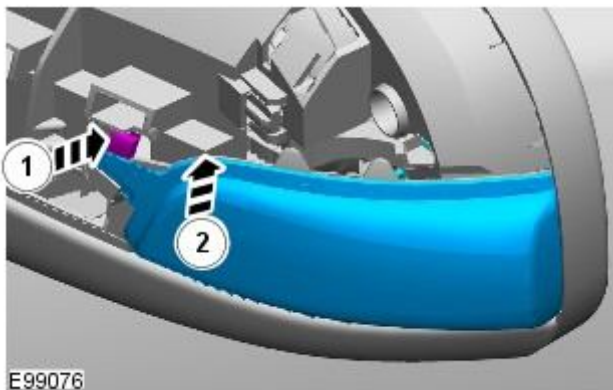
1. Refer to: [Exterior Mirror Cover](#) (501-09 Rear View Mirrors, Removal and Installation).

2.



E99075

3.



E99076

### Installation

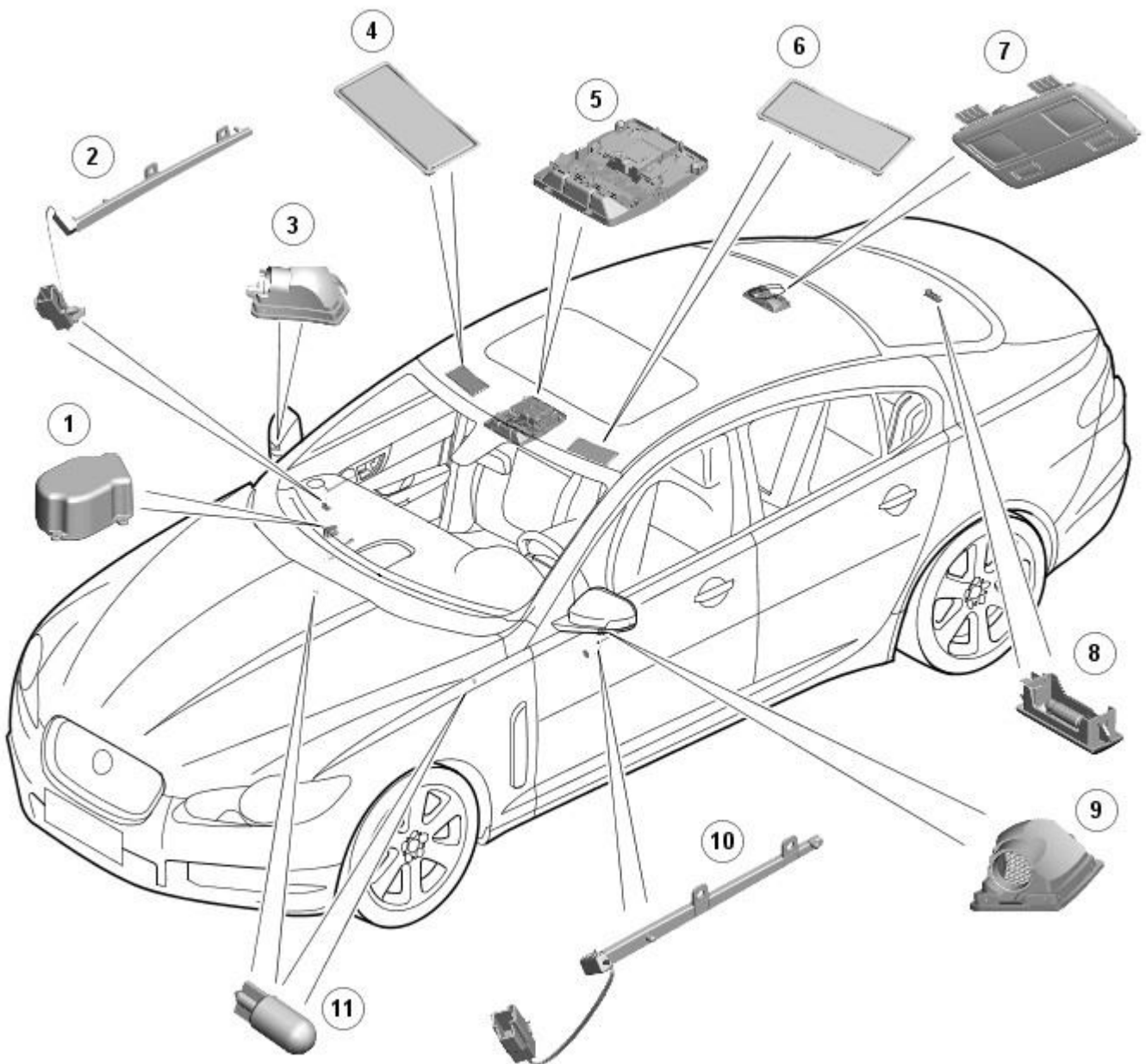
1. To install, reverse the removal procedure.



# Interior Lighting - Interior Lighting - Component Location

Description and Operation

## INTERIOR LIGHTING COMPONENT LOCATION



E93973

### ItemDescription

1	Glovebox lamp
2	Door casing <a href="#">LED (light emitting diode)</a> illumination
3	Approach lamp
4	Vanity mirror illumination
5	Overhead console
6	Vanity mirror illumination
7	Rear overhead console
8	Luggage compartment lamp
9	Approach lamp
10	Door casing <a href="#">LED</a> illumination
11	Footwell lamps

# Interior Lighting - Interior Lighting - Overview

Description and Operation

## OVERVIEW

Interior lighting is provided to enable the safe entry and departure from the vehicle for the driver and passengers in low ambient light conditions, without any manual switching of the lights.

- **NOTE:** The term interior lamps also includes the door mirror approach lamps.

The interior lamps are controlled by the [CJB \(central junction box\)](#) and the [RJB \(rear junction box\)](#) and have 2 modes of operation: manual and automatic. The front interior lamps in the front overhead console are operated using the 'JaguarSense' system. The system uses capacitive proximity sensor technology for the switch operation which is integral with the overhead console. The rear overhead console interior lamps have conventional switches.

In the manual mode the interior lamps can be switched on and off with the JaguarSense system. Positioning your hand adjacent to each lamp in the front overhead console will switch interior lamps on or off and completely disable the interior lamp system. In the automatic mode the interior lamp functionality is controlled by the [CJB](#) and the [RJB](#) and reacts to the vehicle being locked or unlocked and opening the vehicle doors.

In manual mode the interior lamps can be operated by placing your finger(s) close to, or touch, the surface of the appropriate lamp. The courtesy light and map reading lamps can be operated manually by the 'JaguarSense' system. When in automatic mode, the courtesy lamp functionality is also controlled by the [CJB](#) and the [RJB](#) and reacts to the vehicle being locked or unlocked and opening the vehicle doors. To deactivate or activate automatic illumination, touch the front courtesy lamp for approximately 2 seconds

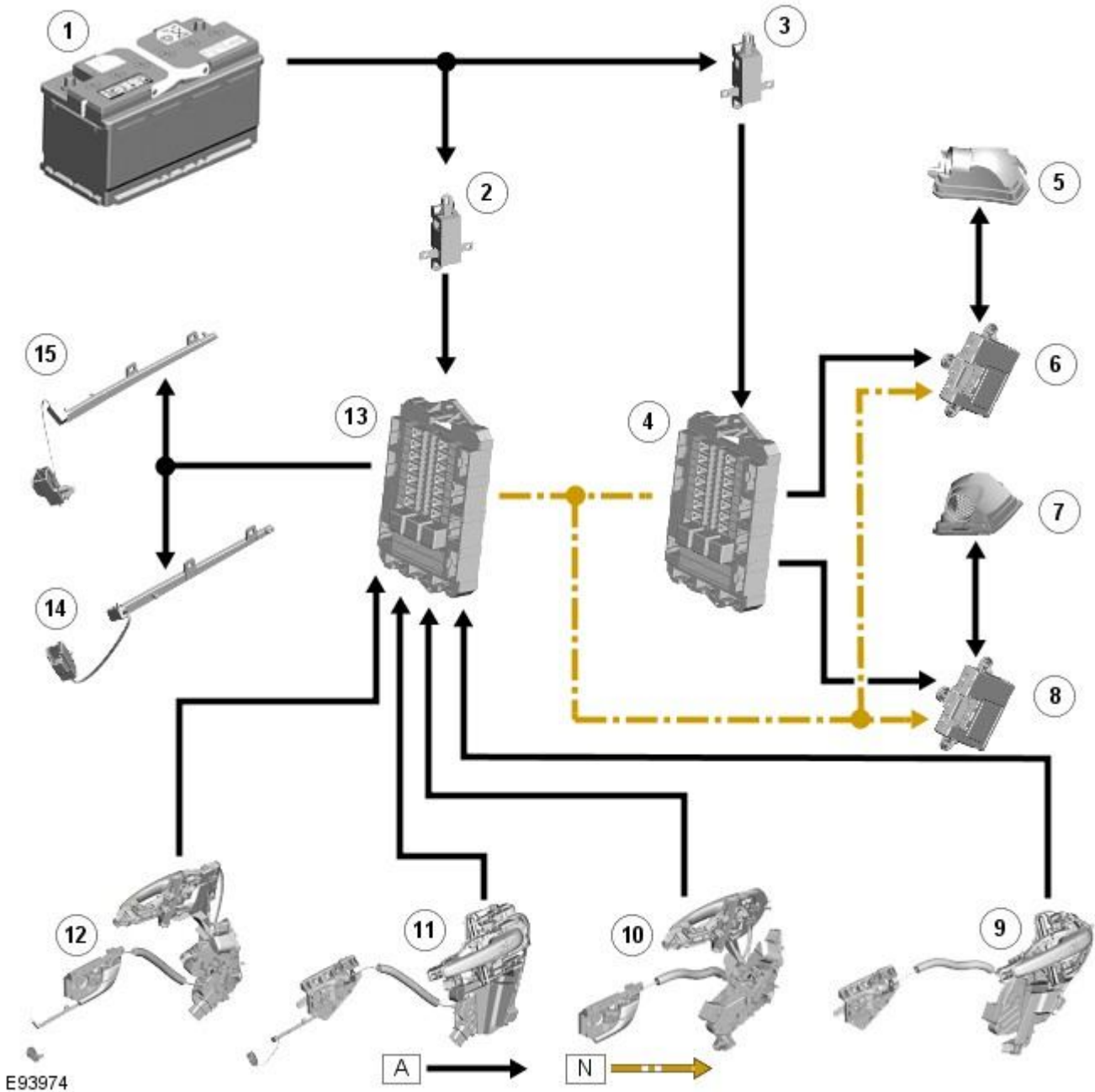
The driver's and passenger door approach lamps are controlled by the driver's door module and the passenger door module respectively and operate with the automatic mode. The door modules receive a power supply from the [RJB](#) and receive information to illuminate the approach lamps on the medium speed [CAN \(controller area network\)](#) bus from the [RJB](#) and the [CJB](#).

# Interior Lighting - Interior Lighting - System Operation and Component Description

Description and Operation

## Control Diagram

CONTROL DIAGRAM (SHEET 1 OF 2)



E93974

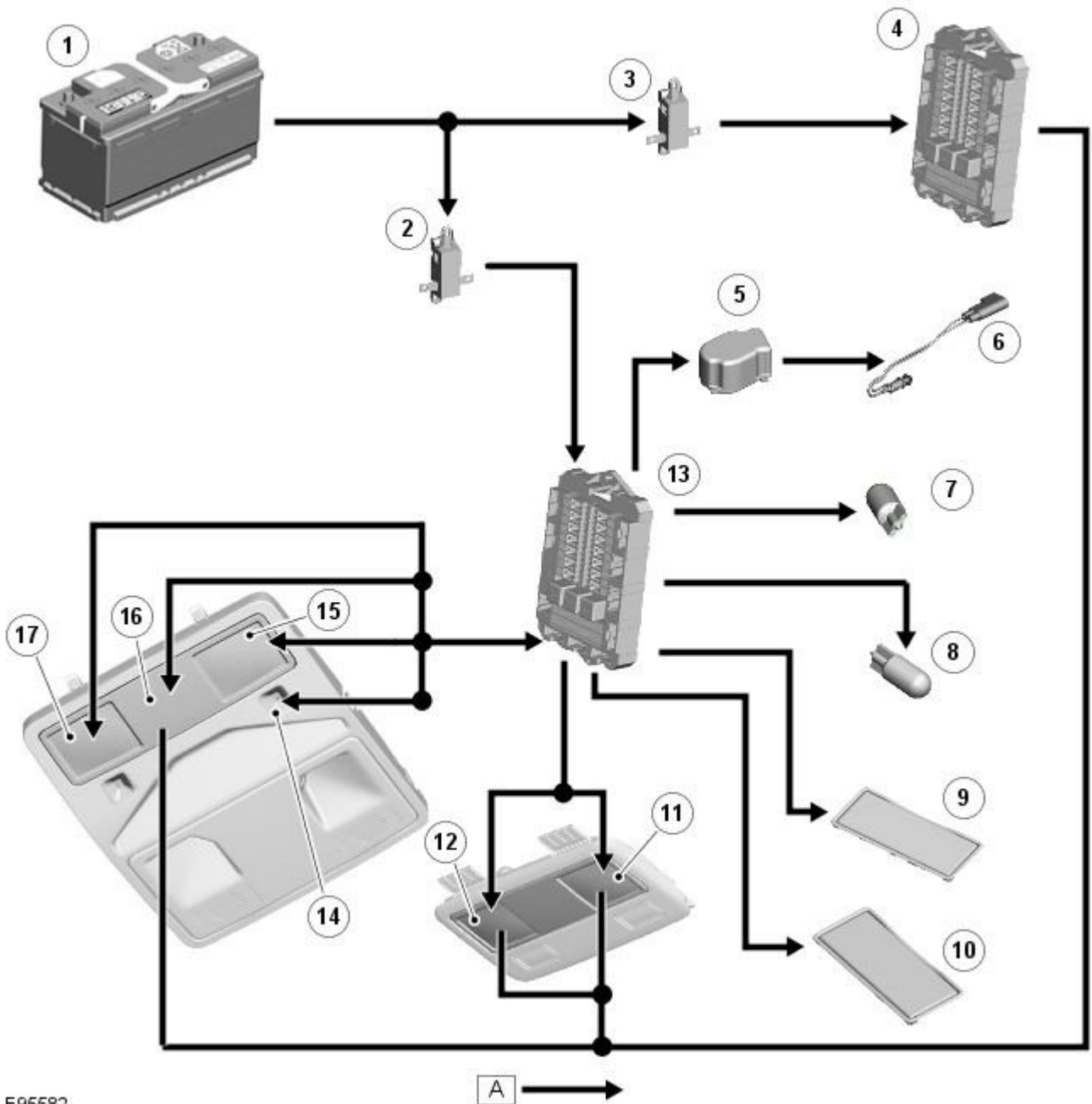
**ItemDescription**

A = Hardwired; N = Medium speed CAN Bus

1	Battery
2	BJB (battery junction box) - Megafuse
3	BJB - Megafuse
4	RJB (rear junction box)
5	Driver's door mirror approach lamp
6	Driver's door module
7	Passenger door mirror approach lamp
8	Passenger door module
9	LH (left-hand) rear door latch
10	RH (right-hand) rear door latch

- 11 [LH](#) front door latch
- 12 [RH](#) front door latch
- 13 [CJB](#) (central junction box)
- 14 [LH](#) front door handle [LED](#) (light emitting diode) illumination
- 15 [RH](#) front door handle [LED](#) illumination

CONTROL DIAGRAM (SHEET 2 OF 2)



E95582

**ItemDescription**

**A** = Hardwired

1	Battery
2	<a href="#">BJB</a> - Megafuse
3	<a href="#">BJB</a> - Megafuse
4	<a href="#">RJB</a>
5	Glovebox lamp
6	Glovebox lamp switch
7	<a href="#">LH</a> footwell lamp
8	<a href="#">RH</a> footwell lamp
9	<a href="#">LH</a> vanity mirror
10	<a href="#">RH</a> vanity mirror
11	<a href="#">LH</a> rear interior lamp

12	<a href="#">RH</a> rear interior lamp
13	<a href="#">CJB</a>
14	Ambience lighting <a href="#">LED's</a>
15	<a href="#">LH</a> map reading lamp
16	Courtesy lamp
17	<a href="#">RH</a> map reading lamp

## System Operation

### JUNCTION BOXES

#### Inputs

The [CJB](#) receives the following inputs which affect the operation of the interior lamps:

- Ignition mode
- Lock/unlock
- Luggage compartment lid latch switch
- Door latch switches.

#### Outputs

The [RJB](#) outputs the following for the interior lighting system:

- Luggage compartment lamp power supply
- Driver and passenger door module power supplies
- Fade on and off grounds for front and rear overhead console interior lamps and footwell lamps
- [PWM \(pulse width modulation\)](#) power output for the ambience lighting.

#### Interior Lamp Time-Out

The interior lamps are controlled by a timer within the [CJB](#) which allows a 60 second delay period for the lamps to remain active after the ignition mode has been changed to off power mode 0 or the vehicle has been unlocked. The interior lamp fade off is controlled by the [RJB](#) via a delayed power off relay in the [CJB](#). The following interior lamps are subject to the delay period:

- Front overhead console interior lamp
- Rear interior lamps
- Footwell lamps
- Door mirror approach lamps.

The timer delay is activated when the [CJB](#) receives one of the following signals:

- An unlock signal from the Smart Key via the keyless vehicle module.
- Ignition mode is changed from the crank power mode 9 or ignition power mode 6 to the accessory power mode 4 to the off power mode 0.

If a second occurrence of the above actions occurs within the timer period, the timer will be reset and the delay period timer will restart.

The timer delay is deactivated when the [CJB](#) receives one of the following signals:

- A lock signal from the Smart Key via the keyless vehicle module
- Ignition mode is changed from the off power mode 0 to the accessory power mode 4 or ignition power mode 6
- The [CJB](#) receives a door opened signal (even if that door is subsequently closed).

#### Battery Saver

The battery saver provides an automatic shut-off of the interior lamps after a period of 15 minutes in order to prevent excessive power drain on the battery.

When the ignition mode is changed from the ignition power mode 6 or accessory power mode 4 to the off power mode 0, the [CJB](#) starts a timer which de-energizes a delayed power off relay in the [CJB](#), removing the power supply to the interior lamps after a period of 15 minutes, switching off all or any interior lamps which have remained on for any reason.

Once the timer has expired and the lamps are off, any one of the following will 'wake up' the battery saver and the interior lamps will function again. The timer will be restarted as soon as an input is received by the [CJB](#) from one of the following:

- Ignition mode changed from off power mode 0 to accessory power mode 4, ignition power mode 6 or crank power mode 9.
- Any door, including the luggage compartment lid is opened
- An unlock request is received from the Smart Key via the keyless vehicle module
- Overhead console interior lamp is switched on via the JaguarSense function.

### INTERIOR LAMPS

When the interior lighting system switches the interior lamps on, the [CJB](#) ramps the lamps up to full power over a period of 1.3 seconds. When the system switches the lamps off, after the time-out period has expired, the [CJB](#) fades the lamps off over a period of 2.6 seconds.

The interior lighting system will illuminate the interior lamps when one of the following events occurs:

- The [CJB](#) receives an unlock signal from the Smart Key via the keyless vehicle module

- Any door is opened including the luggage compartment lid
- The ignition mode is changed from ignition power mode 6 or accessory power mode 4 to off power mode 0.

The interior lighting system will turn off the interior lamps when one of the following events occurs:

- Once the time-out timer delay has expired since the lamps were either activated or the last door is closed and the vehicle is not locked
- The ignition is in off power mode 0 and an external lock is requested (using either the door lock buttons or the Smart Key) with all doors closed
- The ignition mode is changed from the off power mode 0 or the accessory power mode 4 to the ignition power mode 6
- The last door is closed and the vehicle is externally locked, on receipt of an unlock request from the Smart Key or door handle operation detected when the time-out timer is still active.

## DELIVERY MODE

Delivery mode is set at the factory on vehicles to minimize battery drain. The mode enables the switching off of non-critical electrical components, including the interior lighting system. The delivery mode feature is cancelled by the dealer during the Pre-Delivery Inspection using an approved Jaguar diagnostic system.

## CRASH ILLUMINATION

When a crash signal is received from the [RCM \(restraints control module\)](#), the [CJB](#) activates the interior lamps once the vehicle speed has reduced to 5 km/h (3.1 mph). The hazard flashers are also activated and the doors are prevented from being locked. The lamps remain on until the crash signal is removed, they cannot be switched off using the JaguarSense feature. The crash signal is removed by completing one ignition on and off cycle.

### Component Description

## INTERIOR BULB TYPE/RATING

The following table shows the bulbs used for the interior lighting system and their type and specification.

• **NOTE:** The front overhead console and the front door ambience lighting is illuminated by [LED's](#) and are non-serviceable components.

Bulb	Type	Rating
Front overhead console - interior lamp	W6WX	6W
Front overhead console - <a href="#">LH/RH</a> map reading lamps	W6WX	6W
Rear interior lamps	W6WX	10W
Sunvisor lamps	TS1.3W	1.3W
<a href="#">LH/RH</a> footwell lamps	W5W	5W
Glovebox lamp	W5W	5W
<a href="#">LH/RH</a> door mirror approach lamps	W5W	5W
Luggage compartment lamp	S10W	10W

## JUNCTION BOXES

The [CJB](#) is an integrated unit located on the [RH](#) 'A' pillar, below the instrument panel. The [CJB](#) contains fuses, relays and number of microprocessors which control the power supply and functionality of the interior lighting system and other vehicle systems.

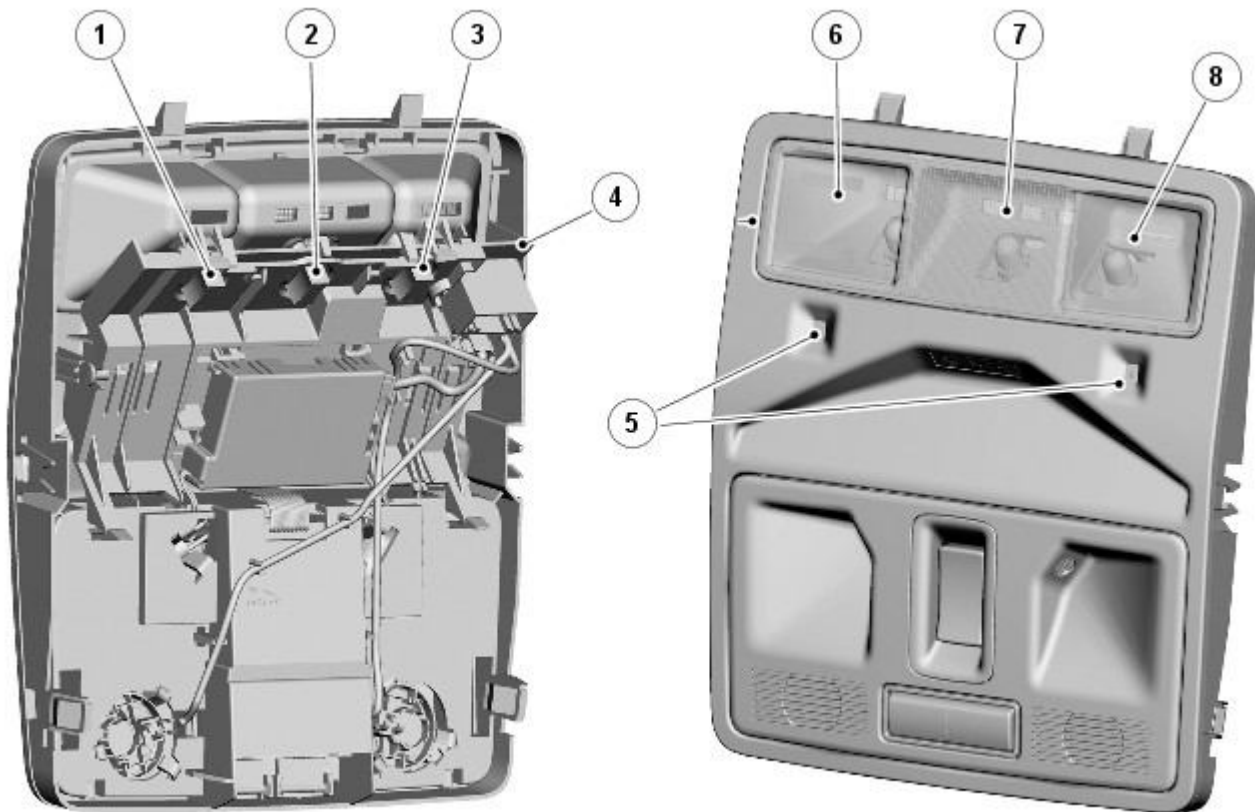
The [RJB](#) is located on the [RH](#) side of the luggage compartment. The [RJB](#) contains fuses, relays and microprocessors which in conjunction with the [CJB](#) control the interior lighting system and other vehicle systems.

### Circuit Protection

The [CJB](#) and the [RJB](#) provide circuit protection for all interior lamp circuits. The lamps are protected by fuses in the [CJB](#) and the [RJB](#).

## FRONT OVERHEAD CONSOLE





E98639

**ItemDescription**

1	<a href="#">LH</a> map reading lamp bulb
2	Interior lamp bulb
3	<a href="#">RH</a> map reading lamp bulb
4	Printed Circuit Board (PCB) - JaguarSense
5	Ambience lighting <a href="#">LED's</a>
6	<a href="#">RH</a> map reading lamp
7	Interior lamp
8	<a href="#">LH</a> map reading lamp

The overhead console is located near the windshield in the head lining. The console can be removed by carefully levering out the rear edge of the housing to release 2 spring clips, and then pulling the console rearwards to release 2 locating tabs. Removal of the console is required to replace any of the interior or map reading lamp bulbs.

The interior lamps and air bag off warning lamp in the front overhead console are common to all vehicles. The overhead console can also contain security system intrusion detection module and volumetric sensors, sunroof switch and a voice activation microphone depending on vehicle specification and market.

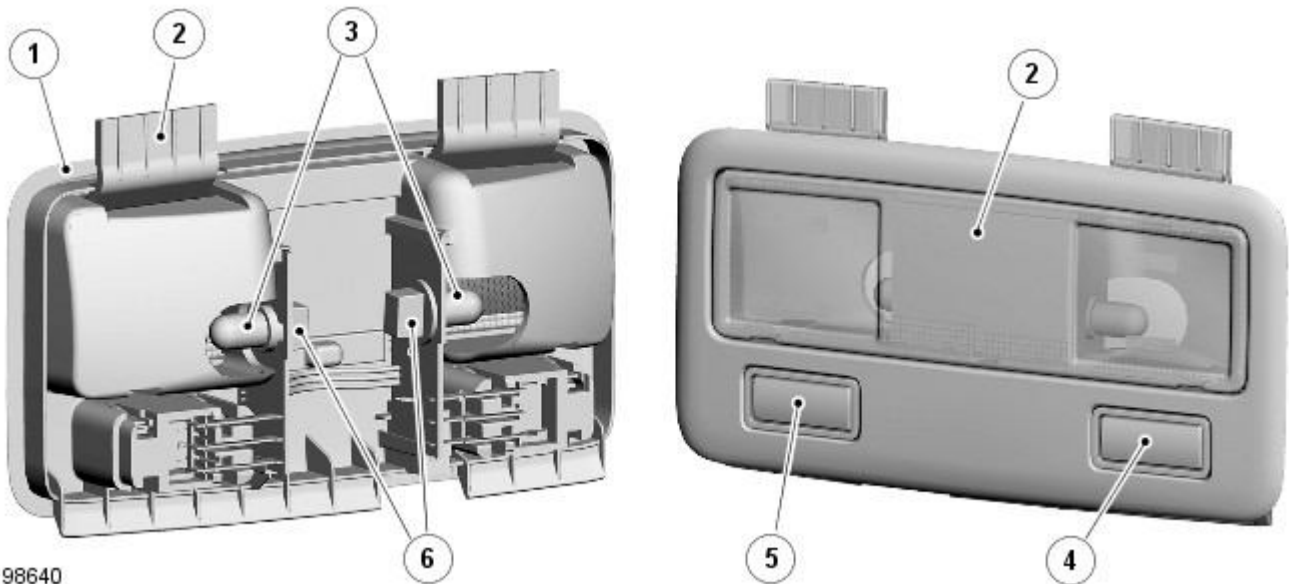
The interior lamp can operated manually using the JaguarSense feature to switch the lamp on and off. The lamp is also controlled as part of the automatic interior lighting system.

The map reading lamps only operate manually using the JaguarSense feature to activate the lamps.

The interior and map reading lamp bulbs are located in holders which locate in a PCB. The PCB also provides for the operation of the ambience lighting [LED's](#), the air bag off warning lamp and the JaguarSense proximity sensors which are integral with the PCB.

The overhead console also contains 2 [LED's](#) for the ambience lighting system. The ambience lighting is part of the lighting control switch functionality and is subject to the setting of the instrument panel illumination dimmer control in the auxiliary lighting switch. The ambience lighting provides very limited illumination of the instrument panel and floor console when the vehicle is being driven without affecting the driver's visibility.

**REAR OVERHEAD CONSOLE**



E98640

**ItemDescription**

1	Lamp body
2	Lamp lens
3	Interior lamp bulbs
4	LH lamp switch
5	RH lamp switch
6	Bulb holders

The rear overhead console is located in the head lining, at the rear of the vehicle. The console can be removed by carefully levering the lamp lens from the body. This releases 2 tabs which are integral with the lens allowing the body to be removed from the aperture in the head lining.

the lamp comprises the lamp body and lens and 2 separate lamps with 2 switches to operate each lamp individually.

The rear interior lamps can be operated manually using the 2 switches located on the lamp body. The lamp is also controlled as part of the automatic interior lighting system.

The bulbs are located in bulb holders which are located on a PCB connected to each switch. Removal of the rear overhead console is required to replace the bulbs.

**GLOVEBOX LAMP**

The glovebox lamp is located in the top of the glovebox housing in the instrument panel. The lamp is located in a cover on the outside, upper surface of the housing and projects the light into the top of the glovebox.

The lamp is operated by a switch located at the rear of the glovebox housing. The switch protrudes into the housing and is operated by the rear face of the glovebox lid tray when the glovebox is opened or closed.

The bulb is located in a holder which is fitted into the side of the glovebox lamp cover. Replacement of the bulb requires the removal of the glovebox housing.

The glovebox lamp is active at all times when the interior lamps are active and will illuminate only when the glovebox is opened.

**FOOTWELL LAMPS**

The footwell lamps are located under the instrument panel. Each lamp comprises a bulb and holder which is part of the instrument panel wiring harness. The bulb and holder is located in a hole in the front footwell air ducts. The footwell lamps are active at all times when the interior lamps are active.

**LUGGAGE COMPARTMENT LAMP**

The luggage compartment lamp is located in the luggage compartment trim, in a central position below the rear screen. The lamp comprises a molded lens and housing and two electrical contacts which locate the bulb.

The lamp is accessible by removing one end from the trim panel to gain access to the bulb. The lamp is active at all times when the interior lamps are active.

**VANITY MIRROR LAMPS**

Four vanity mirror lamps are fitted, two in each vanity mirror. The lamps are illuminated when the mirror cover is raised. The vanity mirror lamps operate at all times when the interior lamps are active.

The vanity mirrors use low voltage, 1.2W festoon type bulbs.

**DOOR MIRROR APPROACH LAMPS**

A door mirror approach lamp is located on the underside of each exterior door mirror.

The approach lamps are active at all times when the interior lamps are active.

# Interior Lighting - Interior Lighting

Diagnosis and Testing

## Principles of Operation

For a detailed description of the interior lighting system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (417-02 Interior Lighting)

[Interior Lighting](#) (Description and Operation),  
[Interior Lighting](#) (Description and Operation),  
[Interior Lighting](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. Verify the customer concern.
2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Bulbs</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses/relays (refer to electrical guide)</li> <li>● Wiring harness</li> <li>● Correct engagement of electrical connectors</li> <li>● Loose or corroded connections</li> </ul>

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• **NOTE:** If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• **NOTE:** Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• **NOTE:** When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• **NOTE:** If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B116511	Left Front Puddle Lamp Output	<ul style="list-style-type: none"> <li>● Left front puddle lamp control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test left front puddle lamp control circuit for short to ground
B116515	Left Front Puddle Lamp Output	<ul style="list-style-type: none"> <li>● Left front puddle lamp control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test left front puddle lamp control circuit for short to power, open circuit
B116611	Right Front Puddle Lamp Output	<ul style="list-style-type: none"> <li>● Right front puddle lamp control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test right front puddle lamp control circuit for short to ground
B116615	Right Front Puddle Lamp Output	<ul style="list-style-type: none"> <li>● Right front puddle lamp control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test right front puddle lamp control circuit for short to power, open circuit
B111E11	Boot/Trunk Lamps	<ul style="list-style-type: none"> <li>● Luggage compartment lamp control circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check luggage compartment lamp control circuit for short to ground

<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
B111E15	Boot/Trunk Lamps	<ul style="list-style-type: none"> <li>● Luggage compartment lamp control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check luggage compartment lamp control circuit for short to power, open circuit
B112412	Lamp Fade Control	<ul style="list-style-type: none"> <li>● Interior lamp fade control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check interior lamp fade control circuit for short to power
B113C12	Hazard Switch Illumination	<ul style="list-style-type: none"> <li>● Hazard switch illumination control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check hazard switch illumination control circuit for short to power
B1A8596	Ambient Light Sensor	<ul style="list-style-type: none"> <li>● Light sensor internal electronic failure</li> </ul>	Check and install a new sensor as required
U201012	Switch Illumination	<ul style="list-style-type: none"> <li>● Switch/interior illumination PWM supply circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check switch/interior illumination PWM supply circuit for short to power
U201014	Switch Illumination	<ul style="list-style-type: none"> <li>● Switch/interior illumination PWM supply circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check switch/interior illumination PWM supply circuit for short to ground, open circuit

# Daytime Running Lamps (DRL) - Daytime Running Lamps (DRL) - Overview

Description and Operation

## OVERVIEW

[DRL \(daytime running lamps\)](#) use the full intensity low beam headlamps which are permanently illuminated when the vehicle is being driven.

Two [DRL](#) systems are available depending on market requirements.

# Daytime Running Lamps (DRL) - Daytime Running Lamps (DRL) - System Operation and Component Description

Description and Operation

## System Operation

### CENTRAL JUNCTION BOX (CJB)

The [CJB](#) (central junction box) controls the operation of the [DRL](#) (daytime running lamps). The [DRL](#) are activated once the [CJB](#) detects an ignition on power mode 6 signal.

The [CJB](#) also monitors the lighting control switch and the auto lamps feature and overrides the [DRL](#) if required.

## Component Description

### DAYTIME RUNNING LAMPS - CANADA

The [DRL](#) for this market use full intensity low beam headlamps. The side marker lamps, tail lamps and license plate lamps will be on, but instrument cluster illumination will be off. [DRL](#) are active when the following parameters are met:

- PARK is not selected on the electronic transmission selector
- Electronic Parking Brake (EPB) is off
- Power mode 6 (ignition on) detected by the [CJB](#)
- The [CJB](#) receives an engine running signal
- The lighting control switch is in the off or side lamps position.

• NOTE: If the lighting control switch is moved to the headlamp position, [DRL](#) are deactivated and normal side lamp and headlamp functionality is operational.

• NOTE: When [DRL](#) are active, the headlamp flash function using the left hand steering column multifunction switch will operate normally.

The high beam headlamp function using the left hand steering column stalk switch will be deactivated. When the transmission is in PARK, [DRL](#) are turned off. This is to reduce battery discharge during long periods of engine idling in cold climate conditions. When the electronic transmission selector is moved from the PARK position, normal [DRL](#) functionality is restored.

### DAYTIME RUNNING LAMPS - DENMARK, HOLLAND, NORWAY, SWEDEN, FINLAND AND POLAND

• NOTE: DRL for Poland is on vehicles from 2008MY.

[DRL](#) for these markets use full intensity low beam headlamps. Side lamps and license plate lamps will be on, but instrument cluster illumination will be off. [DRL](#) are active when the following parameters are met:

- Power mode 6 (ignition on) detected by the [CJB](#)
- The [CJB](#) receives an engine running signal
- The lighting control switch is in the off position.

• NOTE: When [DRL](#) are active, the headlamp flash function using the left hand steering column multifunction switch will operate normally. The high beam headlamp function using the left hand steering column stalk switch will be deactivated.

If the lighting control switch is moved to the side lamp or headlamp positions, [DRL](#) are deactivated and normal side lamp and headlamp functionality is operational.

### AUTOMATIC HEADLAMPS

On vehicles fitted with the automatic headlamps feature, [DRL](#) are overridden if the lighting control switch is in the 'Auto' position and the [CJB](#) receives a signal from the rain/light sensor to activate the exterior lights.

When the [CJB](#) receives a signal to de-activate the automatic headlamps feature the [DRL](#) function is restored providing the parameters for [DRL](#) activation are met.



# Module Communications Network - Communications Network - Overview

Description and Operation

## OVERVIEW

A number of different types of communication network are incorporated into the vehicle wiring harnesses for the transmission of commands and information between control modules. The configuration installed on a particular vehicle depends on the model and equipment level.

- NOTE: The control diagrams shown later in this section are schematics reflecting communications networks fitted to LH (left-hand) vehicles only. For detailed layouts of the various communications networks fitted to LHD (left-hand drive) and RHD (right-hand drive) vehicles, refer to the Electrical Guide.

The communications networks available on the vehicle are shown in the table below.

Network	Baud Rate
LIN (local interconnect network) bus	9.6 kbits/s
Medium speed CAN (controller area network) bus	125 kbits/s
High speed CAN bus	500 kbits/s
Media Orientated System Transport (MOST) ring	24 mbits/s

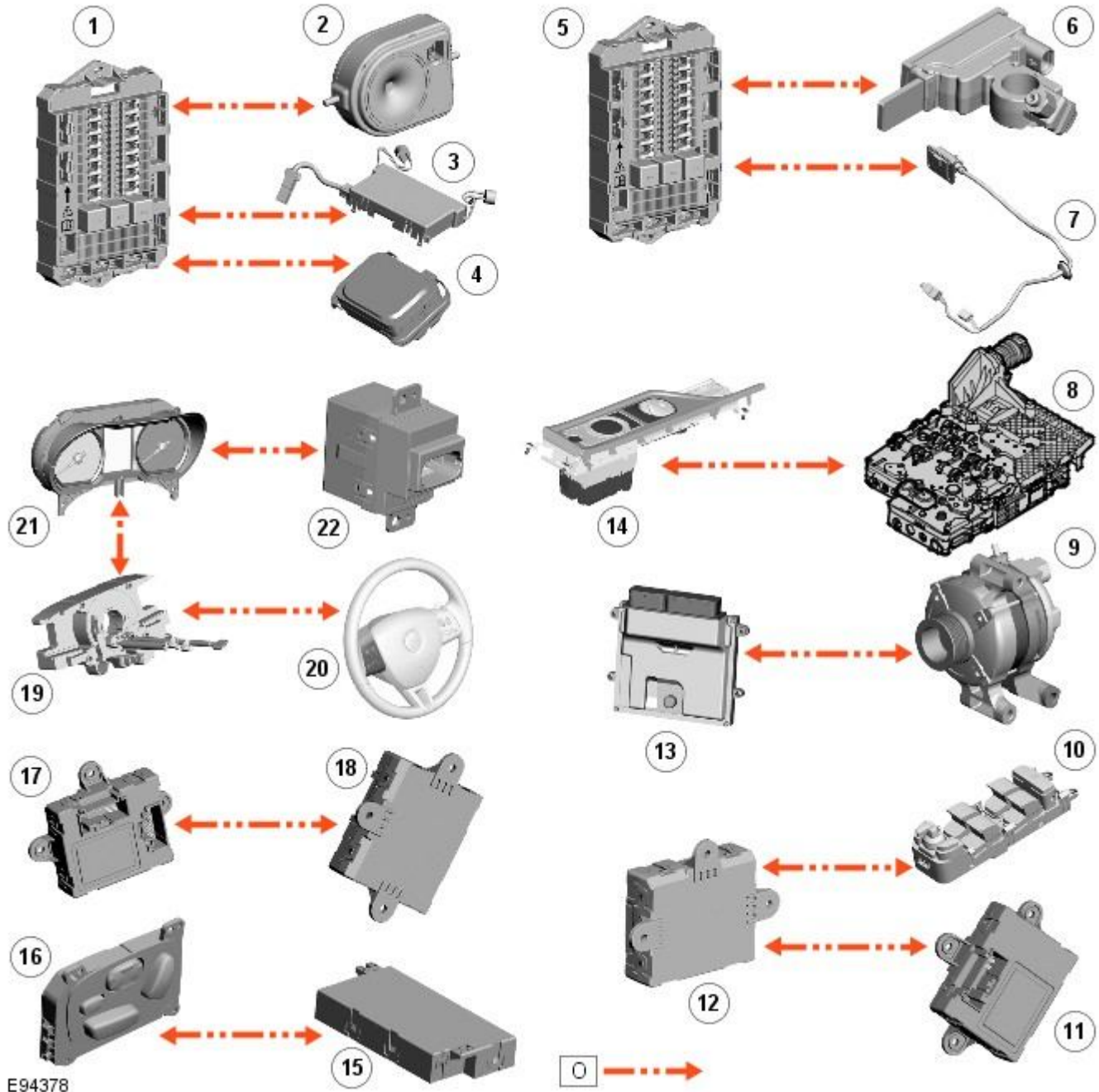
# Module Communications Network - Communications Network - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE:

CONTROL DIAGRAM - LIN BUS - SHEET 1 OF 2



E94378

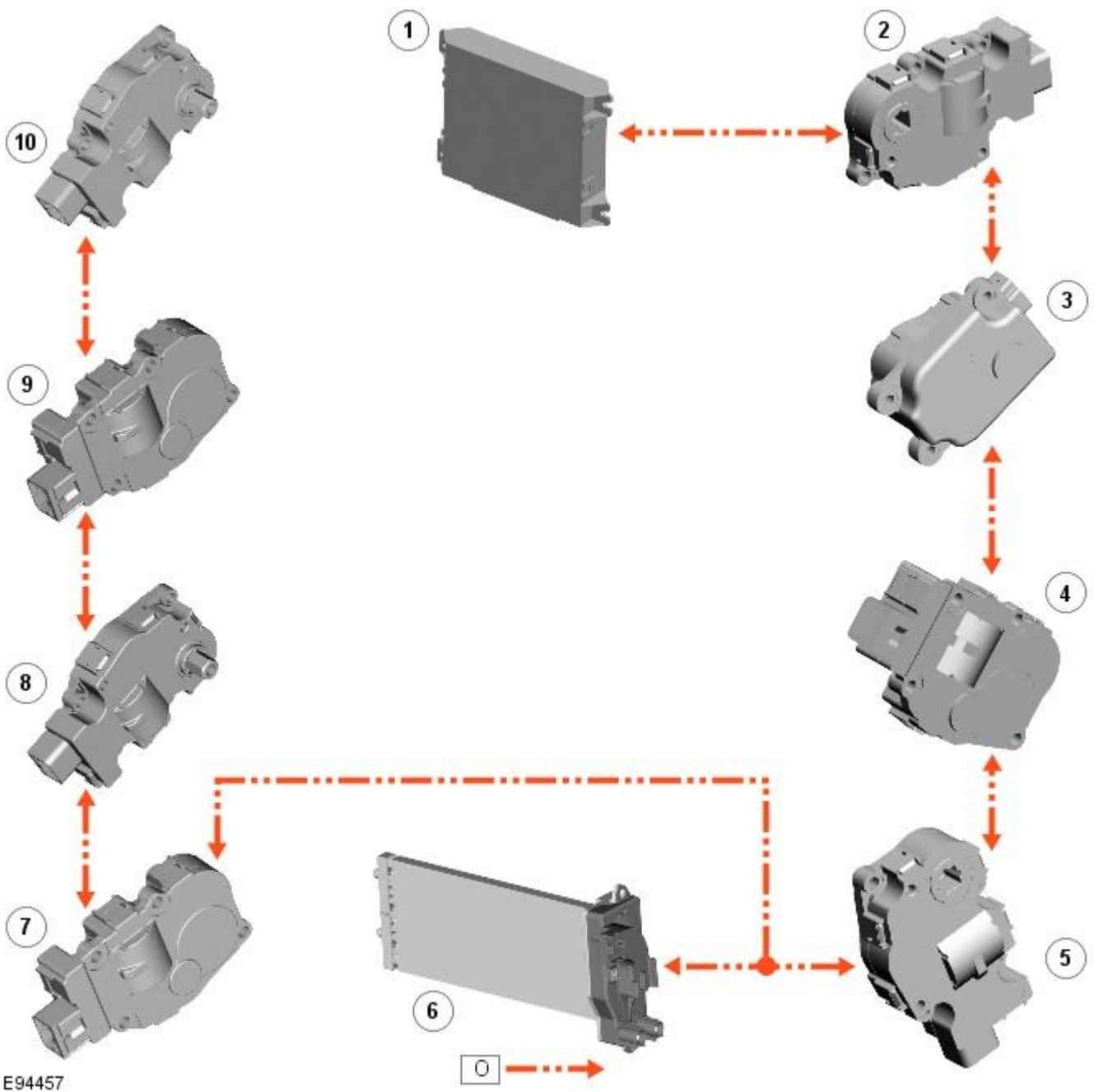
### ItemDescription

0 = LIN (local interconnect network) bus

1	CJB (central junction box)
2	Battery backed sounder
3	Intrusion detection module
4	Rain/Light sensor
5	RJB (rear junction box)
6	Battery monitoring system module
7	Rear view camera
8	TCM (transmission control module)
9	Generator

10	Driver's door switch pack
11	Rear door control module
12	Driver's door control module
13	ECM (engine control module)
14	Electronic transmission selector
15	Driver's seat module
16	Driver's seat switch pack
17	Rear door control module
18	Front passenger door control module
19	Clockspring
20	Audio and telephone steering wheel switches
21	Instrument cluster
22	Start control module

CONTROL DIAGRAM - LIN BUS - SHEET 2 OF 2

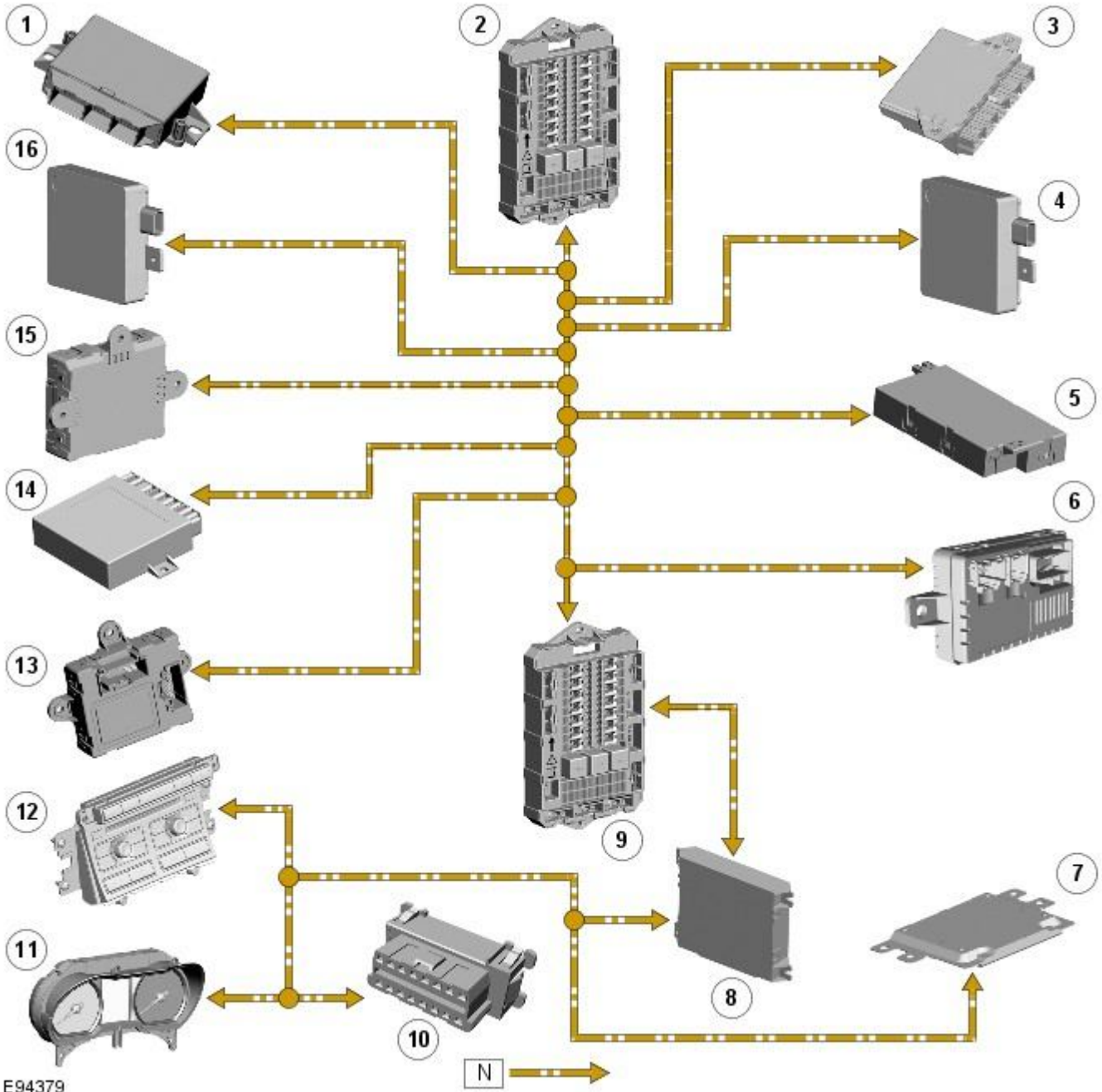


E94457

ItemDescription	
0	LIN bus
1	ATC (automatic temperature control) module
2	Stepper motor - Windshield defrost
3	Stepper motor - Face/feet distribution

4	Stepper motor - <a href="#">LH</a> (left-hand) temperature blend
5	Stepper motor - <a href="#">RH</a> (right-hand) temperature blend
6	Electric booster heater
7	Stepper motor - <a href="#">RH</a> outer face level vent
8	Stepper motor - <a href="#">RH</a> inner face level vent
9	Stepper motor - <a href="#">LH</a> inner face level vent
10	Stepper motor - <a href="#">LH</a> outer face level vent

CONTROL DIAGRAM - MEDIUM SPEED CAN BUS



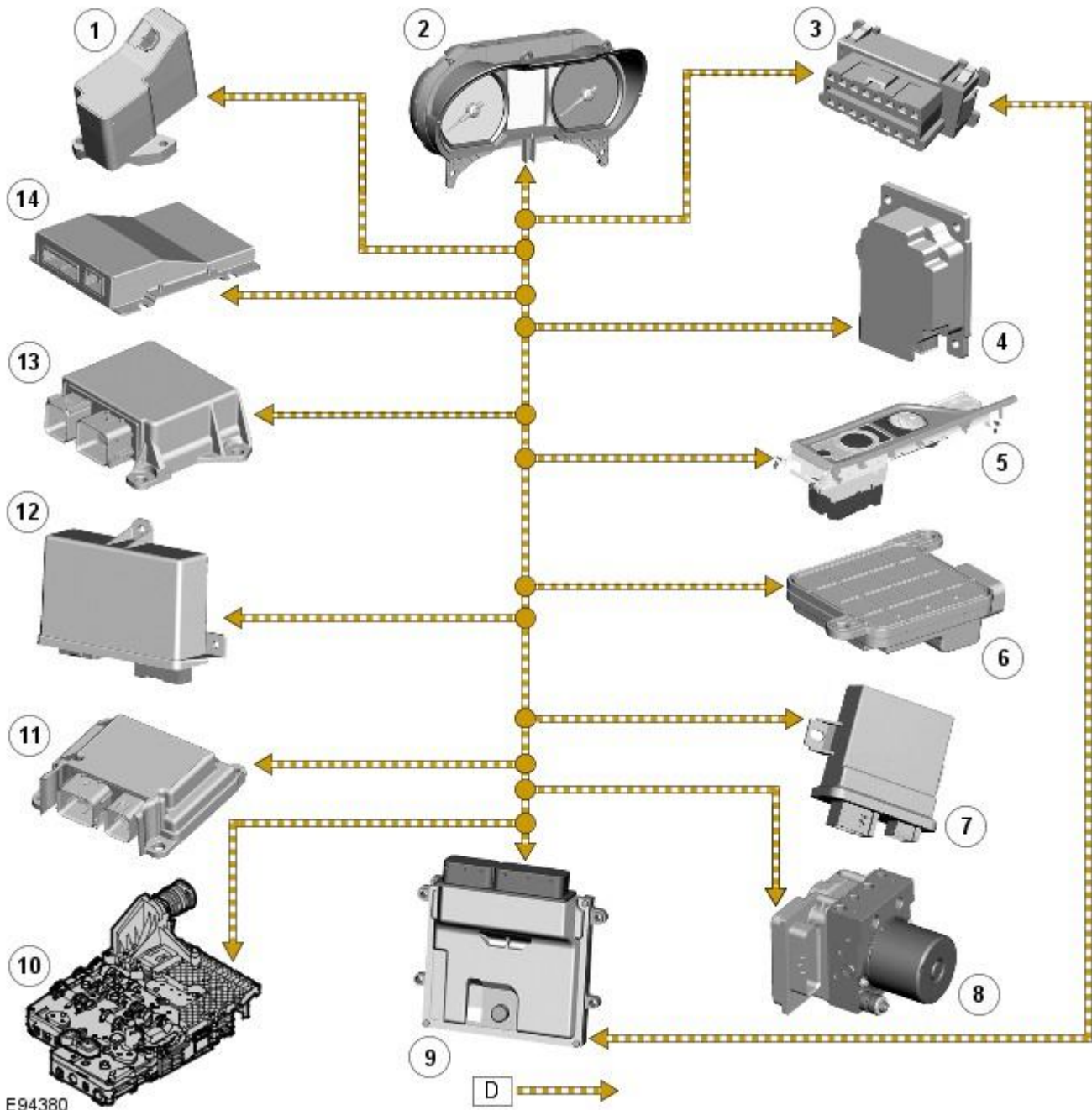
E94379

ItemDescription

	N = Medium speed <a href="#">CAN</a> (controller area network) bus
1	Parking aid module
2	<a href="#">RJB</a>
3	Keyless vehicle module
4	<a href="#">RH</a> blind spot monitoring module
5	Driver's seat module
6	Front seat climate control module
7	Information control module
8	<a href="#">ATC</a> module
9	<a href="#">CJB</a>

10	Diagnostic socket
11	Instrument cluster
12	Integrated control panel
13	Front passenger door control module
14	Tire Pressure Monitoring System (TPMS) module
15	Driver's door control module
16	<a href="#">LH</a> blind spot monitoring module

CONTROL DIAGRAM - HIGH SPEED CAN BUS



E94380

**ItemDescription**

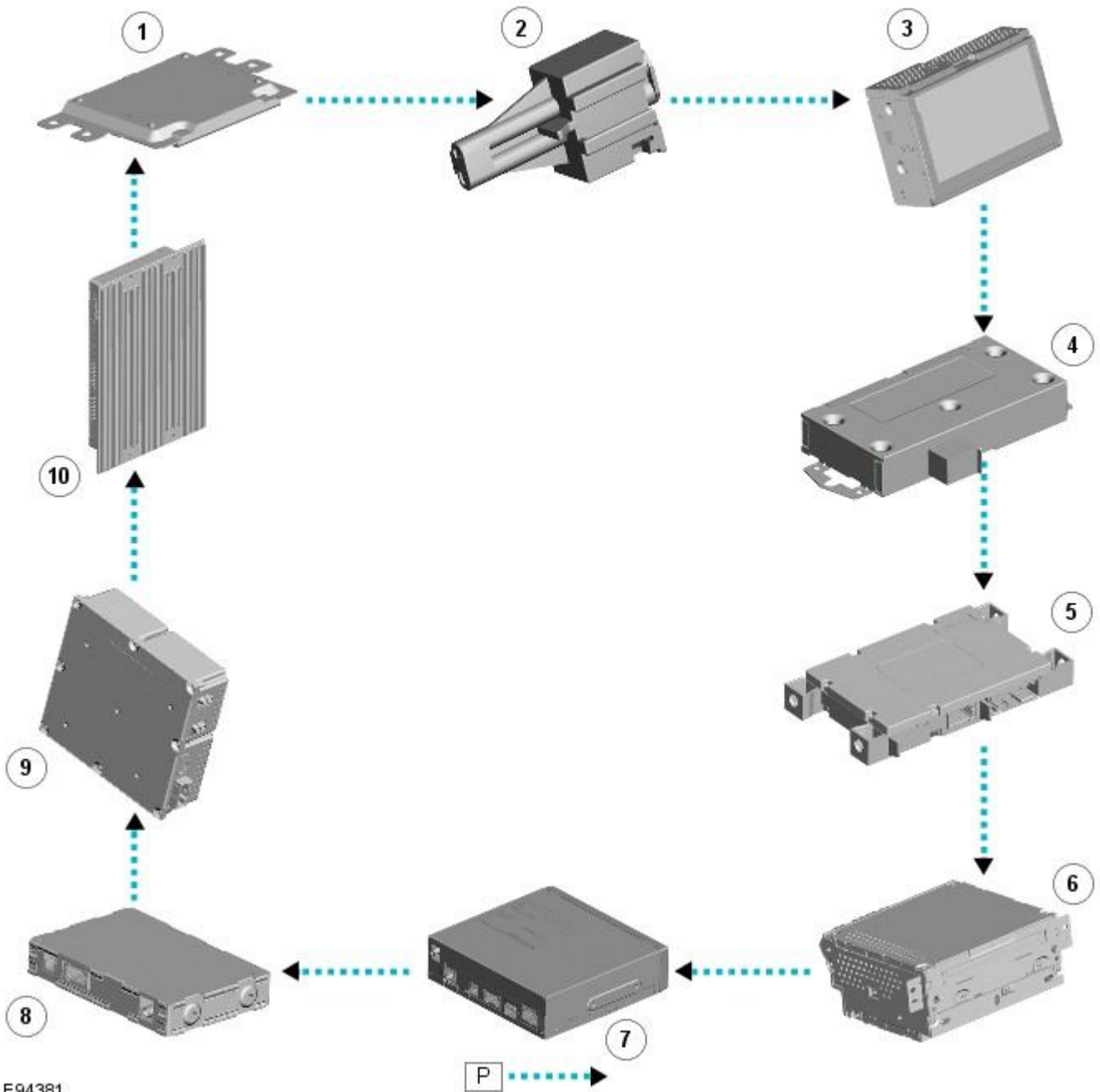
D = High speed [CAN](#) bus

1	Electric steering column lock
2	Instrument cluster
3	Diagnostic socket
4	Adaptive speed control module
5	Electronic transmission selector
6	Occupant classification system control module
7	Headlamp leveling module
8	<a href="#">ABS (anti-lock brake system)</a> module
9	<a href="#">ECM</a>



10	<a href="#">TCM</a>
11	Pedestrian protection system control module
12	Electric park brake module
13	<a href="#">RCM (restraints control module)</a>
14	Adaptive damping control module

CONTROL DIAGRAM - MOST RING



E94381

**ItemDescription**

P = MOST ring

1	Entertainment system control module
2	Software download socket
3	Touch Screen Display (TSD)
4	Portable audio interface
5	Bluetooth® telephone module
6	Integrated audio module
7	Multi-media module
8	DAB/SDARS receiver
9	Television (TV) tuner
10	Audio system amplifier



## **System Operation**

### **OPERATION**

Refer to the relevant system section for details of system operation.

## **Component Description**

### **DESCRIPTION**

Refer to the relevant system section for details of system description.

# Module Communications Network - Communications Network

Diagnosis and Testing

## Principles of Operation

For a detailed description of the Communications Network, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

Communications Network (418-00, Description and Operation),  
[Communications Network](#) (418-00 Module Communications Network, Description and Operation),  
[Communications Network](#) (418-00 Module Communications Network, Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Visual Inspection	Electrical
<ul style="list-style-type: none"> <li>● Fuses (refer to electrical guide)</li> <li>● Wiring harness</li> <li>● Correct engagement of electrical connectors</li> <li>● Loose or corroded connections</li> <li>● Routing of fibre optic harnesses</li> <li>● Correct engagement of optical connectors</li> <li>● Correct placement of optical connectors (ring order)</li> <li>● Correct assembly of optical connectors (backout, etc)</li> <li>● Damage to fibre (chafing, abrasion, kinking, cuts, etc)</li> </ul>	

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## CAN Network Integrity Checks

In the event that one or more control modules are not communicating on either the Medium Speed (MS) or High Speed (HS) CAN Buses, checks can be performed to confirm the integrity of the CAN harness.

The following information is applicable to HS and MS CAN Buses accessible via the J1962 diagnostic connector.

### Module Connections to the CAN Harness

Modules are connected to the CAN harness either in a 'loop' or 'spur' configuration. In the 'loop' type configuration the CAN harness loops into the module (via two connector pins) and then loops out of the module (via another two connector pins). In the 'spur' type configuration, a harness spur is spliced into the main 'backbone' of the CAN harness and the module is connected to the harness spur via two connector pins.

### CAN Harness Architecture

For a detailed description of the CAN Networks and architecture, refer to the relevant Description and Operation section in the Workshop Manual. REFER to:

Communications Network (418-00, Description and Operation),  
[Communications Network](#) (418-00 Module Communications Network, Description and Operation),  
[Communications Network](#) (418-00 Module Communications Network, Description and Operation).

### IDS Vehicle Integrity Test

If a control module is suspected of non-communication, the Network Integrity test application available on the manufacturer approved diagnostic system can be used to confirm if communication is possible between the control modules on the vehicle and the manufacturer approved diagnostic system (via the J1962 diagnostic connector). The results from the test can be used to determine if either a single module or multiple modules are failing to communicate.

### CAN Terminating Modules

If the Network Integrity test indicates that one or more module on one of the CAN networks (HS or MS) are failing to communicate, there are several checks that can be made. The first step is to identify if both of the CAN terminating modules on each individual CAN Bus are communicating. If both CAN terminating modules for each individual CAN Bus are communicating (identified via the Network Integrity test), then it can be confirmed that the main 'backbone' of the CAN harness is complete. The main 'backbone' of the CAN harness consists of all the modules connected to the CAN harness via a 'loop' configuration and also includes the two terminating modules.

Communication with both CAN terminating modules via the Network Integrity test confirms the physical integrity of the main 'backbone' of the CAN harness (and the harness spur to the J1962 diagnostic connector). This means that there is no requirement to check the resistance of the CAN Network. This is because the standard check for 60 ohms across the CAN

High and CAN Low lines will not provide any additional information regarding the physical condition of the CAN harness, beyond what has already been determined from the Network Integrity test.

#### Non-Communication of a Terminating Module

If a Network Integrity test reveals a terminating module is failing to communicate it can indicate a break in the main 'backbone' of the CAN harness. The first checks should always be to confirm the power and ground supplies to the non-communicating module are correct. Providing these are correct, the resistance between the CAN High and CAN Low lines at the J1962 connector can be checked to determine the integrity of the main 'backbone' of the CAN harness. After disconnecting the battery a reading of 120 ohms would indicate an open circuit in the main 'backbone' of the CAN harness. Alternatively, a reading of 60 ohms would indicate that there is no open circuit fault with the main 'backbone' of the CAN harness.

It is worth noting that even if one of the terminating modules is disconnected from the CAN harness, communications between the modules still connected may still be possible. Therefore communication between the manufacturer approved diagnostic system and the connected modules may also be possible.

#### Locating CAN Harness Open Circuits

In the case where multiple modules, including a terminating module, are failing to communicate, having first confirmed the power and ground supplies are correct, the approximate location of the open circuit can be identified from analysis of the Network Integrity test results and reference to the relevant CAN network circuit diagrams. For example, if an open circuit existed in a certain position on the CAN harness, any module positioned on the Network between the J1962 connector and the open circuit should return a response during the Network Integrity test. No responses would be returned from any modules past the open circuit fault in the Network.

#### CAN Harness 'Spur' Type Configuration Circuits

If, after the initial checks (Network Integrity test using the manufacturer approved diagnostic system, and power and ground supplies to the module have been checked and confirmed as correct), a module that is connected to the CAN harness via a 'spur' type configuration is suspected of not communicating, then the physical integrity of the CAN harness 'spur' can be checked.

This is most easily undertaken by individually checking the continuity of the CAN High and CAN Low lines between the non-communicating module connector (with the module disconnected) and the J1962 diagnostic connector.

#### 'Lost Communications' DTCs

As well as the methods described so far in this document, which can be used to determine the location of an open circuit in the CAN harness, 'Lost Communications' DTCs can also be used for this purpose.

For example, if a global DTC read were to be carried out, only DTCs stored in the modules that the manufacturer approved diagnostic system could communicate with would be displayed. If there were an open circuit fault in a certain position on the CAN harness, the modules that could display DTCs would all be prior to the open circuit on the Network, and these modules should display 'Lost Communications' DTCs with all the modules located on the Network past the open circuit fault.

- NOTE: Additional DTCs may also be logged along with the 'Lost Communications' DTCs.

## DTC Index

### Central Junction Box (CJB)



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

- NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).
- NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.
- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B00D511	Restraint System Passenger Disable Indicator	<ul style="list-style-type: none"> <li>● PAD lamp supply circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check PAD lamp supply circuit for short to ground
B00D512	Restraint System Passenger Disable Indicator	<ul style="list-style-type: none"> <li>● PAD lamp supply circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check PAD lamp supply circuit for short to power
B00D513	Restraint System Passenger Disable Indicator	<ul style="list-style-type: none"> <li>● PAD lamp supply circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check PAD lamp supply circuit for open circuit

DTC	Description	Possible Cause	Action
B100951	Ignition Authorisation	<ul style="list-style-type: none"> <li>Faulty instrument cluster</li> <li>Target SID re-synchronisation error following programming</li> <li>CAN fault</li> </ul>	Check ignition, power and ground supplies to CJB and instrument cluster. Re-synchronize ID by re-configuring the instrument cluster as a new module. Check CAN communications between instrument cluster and tester
B100962	Ignition Authorisation	<ul style="list-style-type: none"> <li>Low speed CAN fault</li> <li>CJB fault</li> <li>Instrument cluster fault</li> <li>Incorrect module installed (CJB/Instrument cluster)</li> <li>Target SID synchronisation error following re-programming</li> <li>Noise/EMC related error</li> </ul>	Check CAN communications between CJB and instrument cluster. Check ignition, power and ground supplies to CJB and instrument cluster. Confirm correct module is installed. Re-synchronise ID by re-configuring the instrument cluster as a new module. Check CAN network for interference/EMC related issues
B100963	Ignition Authorisation	<ul style="list-style-type: none"> <li>CJB fault</li> <li>Low speed CAN fault</li> <li>Instrument cluster fault</li> <li>Low battery voltage &lt;9V</li> </ul>	Check Power and Ground supplies to CJB and instrument cluster. Check CAN communications between CJB and instrument cluster. Check battery is in fully charged and serviceable condition, refer to the battery care manual
B100964	Ignition Authorisation	<ul style="list-style-type: none"> <li>CJB fault</li> <li>Low speed CAN fault</li> <li>Instrument cluster fault</li> </ul>	Check power and ground supplies to CJB and instrument cluster. Check CAN communications between CJB and instrument cluster
B102B67	Passive Key	<ul style="list-style-type: none"> <li>CJB fault</li> <li>Low speed CAN fault</li> <li>Remote Keyless Entry (RKE) module fault</li> <li>Write target SID synchronisation error following re-programming</li> </ul>	Check power and ground supplies to CJB and RKE module. Check CAN communications between CJB and RKE module. Re-synchronise ID by re-configuring the RKE module as a new module
B102B87	Passive Key	<ul style="list-style-type: none"> <li>CJB fault</li> <li>Low speed CAN fault</li> <li>RKE module fault</li> <li>Key fob battery low/battery contact issue</li> <li>Interference from other RF signal</li> <li>EMC/noise</li> <li>Receiver fault</li> <li>Receiver not programmed correctly</li> <li>Serial communications fault (between receiver and RKE module)</li> <li>Key fault</li> <li>Passive antenna fault</li> <li>Confirm placement of key within vehicle</li> </ul>	Check power and ground supplies to CJB, RKE module and receiver. Check CAN communications between CJB and instrument cluster. Check key fob battery. Confirm vehicle surroundings, move vehicle. Check CAN network for interference/EMC related issues. Disconnect battery, then re-connect - confirm operation by re-programming keys. Check serial circuit between receiver and RKE module. Confirm spare key works. Refer to the electrical circuit diagrams and test circuits to all 3 antennas. Check whereabouts of key
B108413	Boot/Trunk Motor Close Switch	<ul style="list-style-type: none"> <li>Trunk latch open signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check trunk latch open signal circuit for open circuit
B108783	LIN Bus "A"	<ul style="list-style-type: none"> <li>Checksum of the received LIN frame from battery backed sounder, roof header console, and/or rain/light sensor is incorrect</li> </ul>	Check operation of rain/light sensor by covering sensor or applying water to screen, install a new sensor as required
B108788	LIN Bus "A"	<ul style="list-style-type: none"> <li>Bus off. Battery backed sounder, roof header console, and/or rain/light sensor LIN circuit - short to ground, power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check battery backed sounder, roof header console, and rain/light sensor LIN circuit for short to ground, power
B108A11	Start Button	<ul style="list-style-type: none"> <li>Start/Stop switch analogue input circuits 1 or 2 - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check Start/Stop switch analogue input circuits 1 and 2 for short to ground
B108A12	Start Button	<ul style="list-style-type: none"> <li>Start/Stop switch analogue input circuits 1 or 2 - short to power</li> </ul>	Refer to the electrical circuit diagrams and check Start/Stop switch analogue input circuits 1 and 2 for short to power
B109512	Wiper On/Off Relay	<ul style="list-style-type: none"> <li>Wiper On/Off relay control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check wiper On/Off relay control circuit for short to power
B109514	Wiper On/Off Relay	<ul style="list-style-type: none"> <li>Wiper On/Off relay control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check wiper On/Off relay control circuit for short to ground, open circuit

DTC	Description	Possible Cause	Action
B109612	Wiper High/Low Relay	<ul style="list-style-type: none"> <li>Wiper Fast/Slow relay control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check wiper Fast/Slow relay control circuit for short to power
B109614	Wiper High/Low Relay	<ul style="list-style-type: none"> <li>Wiper Fast/Slow relay control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check wiper Fast/Slow relay control circuit for short to ground, open circuit
B109712	Heated Windshield Relay	<ul style="list-style-type: none"> <li>Heated windshield relay control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check heated windshield relay control circuit for short to power
B109714	Heated Windshield Relay	<ul style="list-style-type: none"> <li>Heated windshield relay control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check heated windshield relay control circuit for short to ground, open circuit
B10A612	Main Light Switch	<ul style="list-style-type: none"> <li>Master light switch signal from roof header console circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check master light switch signal from roof header console circuit for short to power
B10A623	Main Light Switch	<ul style="list-style-type: none"> <li>Master light switch signal from roof header console signal stuck low. Switch is read as ON for too long a time</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check master light switch signal from roof header console for short to ground
B10AD09	Rain Sensor	<ul style="list-style-type: none"> <li>Component failures</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the rain/light sensor, check and install a new sensor as required
B10AD11	Rain Sensor	<ul style="list-style-type: none"> <li>Rain/light sensor power circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check rain/light sensor power circuit for short to ground
B10AD96	Rain Sensor	<ul style="list-style-type: none"> <li>Component internal failure</li> </ul>	Suspect the rain/light sensor, check and install a new sensor as required
B10E511	PCM Wake-up Signal	<ul style="list-style-type: none"> <li>ECM wake-up signal circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check ECM wake-up signal circuit for short to ground
B10E512	PCM Wake-up Signal	<ul style="list-style-type: none"> <li>ECM wake-up signal circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check ECM wake-up signal circuit for short to power
B10E513	PCM Wake-up Signal	<ul style="list-style-type: none"> <li>ECM wake-up signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check ECM wake-up signal circuit for open circuit
B10F111	Key In Switch	<ul style="list-style-type: none"> <li>Keyless vehicle module, key IN status circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check keyless vehicle module, key IN status circuit for short to ground
B10F112	Key In Switch	<ul style="list-style-type: none"> <li>Keyless vehicle module, key IN status circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check keyless vehicle module, key IN status circuit for short to power
B10F113	Key In Switch	<ul style="list-style-type: none"> <li>Keyless vehicle module, key IN status circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check keyless vehicle module, key IN status circuit for open circuit
B10F211	Sunroof Control	<ul style="list-style-type: none"> <li>Sunroof enable signal circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check sunroof enable signal circuit for short to ground
B10F212	Sunroof Control	<ul style="list-style-type: none"> <li>Sunroof enable signal circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check sunroof enable signal circuit for short to power
B10F213	Sunroof Control	<ul style="list-style-type: none"> <li>Sunroof enable signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check sunroof enable signal circuit for open circuit
B10F311	Left Front Position Light	<ul style="list-style-type: none"> <li>Left front side lamps circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left front side lamps circuit for short to ground
B10F315	Left Front Position Light	<ul style="list-style-type: none"> <li>Left front side lamps circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left front side lamps circuit for short to power, open circuit
B10F411	Right Front Position Light	<ul style="list-style-type: none"> <li>Right front side lamps circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right front side lamps circuit for short to ground
B10F415	Right Front Position Light	<ul style="list-style-type: none"> <li>Right front side lamps circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right front side lamps circuit for short to power, open circuit

DTC	Description	Possible Cause	Action
B10F812	Accessory socket 'A' relay	<ul style="list-style-type: none"> <li>Accessory socket 'A' relay control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check accessory socket 'A' relay control circuit for short to power
B10F814	Accessory socket 'A' relay	<ul style="list-style-type: none"> <li>Accessory socket 'A' relay control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check accessory socket 'A' relay control circuit for short to ground, open circuit
B10F912	Accessory socket 'B' relay	<ul style="list-style-type: none"> <li>Front powerpoint, trailer tow connector, road pricing connector, sunblind power supply circuits - short to power</li> </ul>	Refer to the electrical circuit diagrams and check front powerpoint, trailer tow connector, road pricing connector, sunblind power supply circuits for short to power
B10F914	Accessory socket 'B' relay	<ul style="list-style-type: none"> <li>Front powerpoint, trailer tow connector, road pricing connector, sunblind power supply circuits - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check front powerpoint, trailer tow connector, road pricing connector, sunblind power supply circuits for short to ground, open circuit
B10F993	Accessory socket 'B' relay	<ul style="list-style-type: none"> <li>Front powerpoint, trailer tow connector, road pricing connector, sunblind power supply circuits - short to power, ground, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check front powerpoint, trailer tow connector, road pricing connector, sunblind power supply circuits for short to power, ground, open circuit
B10FA93	Delayed Power Off relay	<ul style="list-style-type: none"> <li>ADRC ECM, roof header console lamp, glove box lamp, RH/LH footwell lamps, JAG Sense glove box module, RH/LH sunvisor lamps, rear dome lamps switched power circuits - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ADRC ECM, roof header console lamp, glove box lamp, RH/LH footwell lamps, JAG Sense glove box module, RH/LH sunvisor lamps, rear dome lamps switched power circuits for short to power, open circuit
B10FF11	Ignition control	<ul style="list-style-type: none"> <li>ECM and FPDB ignition control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECM and FPDB ignition control circuit for short to ground
B10FF13	Ignition control	<ul style="list-style-type: none"> <li>ECM and FPDB ignition control circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECM and FPDB ignition control circuit for open circuit
B110011	O2 sensor heater relay	<ul style="list-style-type: none"> <li>FPDB O2 sensor heater relay control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check FPDB O2 sensor heater relay control circuit for short to ground
B113D12	Sunroof Global Open/Close Control	<ul style="list-style-type: none"> <li>Roof opening panel global open/close control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check roof opening panel global open/close control circuit for short to power
B113D14	Sunroof Global Open/Close Control	<ul style="list-style-type: none"> <li>Roof opening panel global open/close control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check roof opening panel global open/close control circuit for short to ground, open circuit
B114011	Engine Crank Authorisation	<ul style="list-style-type: none"> <li>Engine crank authorisation signal circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check engine crank authorisation signal circuit for short to ground
B114211	Ignition Status 1	<ul style="list-style-type: none"> <li>Ignition supply 1 circuits - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check all ignition supply 1 circuits for short to ground
B114311	Ignition Status 2	<ul style="list-style-type: none"> <li>Ignition supply 2 circuits - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check all ignition supply 2 circuits for short to ground
B114411	Heated Steering Wheel Supply	<ul style="list-style-type: none"> <li>Heated steering wheel supply circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check heated steering wheel supply circuit for short to ground
B114511	Glovebox Locking Motor	<ul style="list-style-type: none"> <li>Glovebox latch locking motor circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check glovebox latch locking motor circuit for short to ground
B114512	Glovebox Locking Motor	<ul style="list-style-type: none"> <li>Glovebox latch locking motor control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check glovebox latch locking motor control circuit for short to power



DTC	Description	Possible Cause	Action
B114513	Glovebox Locking Motor	<ul style="list-style-type: none"> <li>Glovebox latch locking motor control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check glovebox latch locking motor control circuit for open circuit
B114612	Passive sounder Supply	<ul style="list-style-type: none"> <li>Security passive sounder control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check security passive sounder control circuit for short to power
B114614	Passive sounder Supply	<ul style="list-style-type: none"> <li>Security passive sounder control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check security passive sounder control circuit for short to ground, open circuit
B115811	Front Passenger Seat Heater Sensor	<ul style="list-style-type: none"> <li>Front passenger seat heater sensor circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check front passenger seat heater sensor circuit for short to ground
B115813	Front Passenger Seat Heater Sensor	<ul style="list-style-type: none"> <li>Front passenger seat heater sensor circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check front passenger seat heater sensor circuit for open circuit
B115911	Driver Seat Heater Sensor	<ul style="list-style-type: none"> <li>Driver seat heater sensor circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat heater sensor circuit for short to ground
B115913	Driver Seat Heater Sensor	<ul style="list-style-type: none"> <li>Driver seat heater sensor circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat heater sensor circuit for open circuit
B115A11	Front Passenger Seat Heater	<ul style="list-style-type: none"> <li>Front passenger seat heater supply circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check front passenger seat heater supply circuit for short to ground
B115A15	Front Passenger Seat Heater	<ul style="list-style-type: none"> <li>Front passenger seat heater supply circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check front passenger seat heater supply circuit for short to power, open circuit
B115B11	Driver Seat Heater	<ul style="list-style-type: none"> <li>Driver seat heater supply circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat heater supply circuit for short to ground
B115B15	Driver Seat Heater	<ul style="list-style-type: none"> <li>Driver seat heater supply circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat heater supply circuit for short to power, open circuit
B117513	Driver Door Ajar Switch	<ul style="list-style-type: none"> <li>Driver door ajar switch signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check driver door ajar switch signal circuit for open circuit
B117613	Passenger Door Ajar Switch	<ul style="list-style-type: none"> <li>Passenger door ajar switch signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check passenger door ajar switch signal circuit for open circuit
B117712	Screenwash Level Switch	<ul style="list-style-type: none"> <li>Screenwash level switch signal circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check screenwash level switch signal circuit for short to power
B11C013	Driver Side Rear Door Ajar Switch	<ul style="list-style-type: none"> <li>Left rear door ajar switch signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check left rear door ajar switch signal circuit for open circuit
B11C113	Passenger Side Rear Door Ajar Switch	<ul style="list-style-type: none"> <li>Right rear door ajar switch signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check right rear door ajar switch signal circuit for open circuit
B122223	Master Lock/Unlock Switch	<ul style="list-style-type: none"> <li>Master lock or unlock switch digital input circuit - signal stuck low</li> </ul>	Refer to the electrical circuit diagrams and check master lock and unlock switch digital input circuits for short to ground, open circuit
B123711	Gear Shift Module Early Wake-up	<ul style="list-style-type: none"> <li>Transmission shift module wake-up control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check transmission shift module wake-up control circuit for short to ground
B123712	Gear Shift Module Early Wake-up	<ul style="list-style-type: none"> <li>Transmission shift module wake-up control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check transmission shift module wake-up control circuit for short to power
B123713	Gear Shift Module Early Wake-up	<ul style="list-style-type: none"> <li>Transmission shift module wake-up control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check transmission shift module wake-up control circuit for open circuit
B123E13	Crank Enable	<ul style="list-style-type: none"> <li>OK to crank signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check OK to crank signal circuit for open circuit
B1A8596	Ambient Light Sensor	<ul style="list-style-type: none"> <li>Light sensor internal electronic failure</li> </ul>	Check and install a new sensor as required

DTC	Description	Possible Cause	Action
B1C4513	Front Wiper Park Position Switch	<ul style="list-style-type: none"> <li>● Windshield wiper motor park switch signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check windshield wiper motor park switch signal circuit for open circuit
B1C4523	Front Wiper Park Position Switch	<ul style="list-style-type: none"> <li>● Signal stuck low</li> </ul>	Refer to the electrical circuit diagrams and check front wiper park position switch input circuit for short, open circuit
B1C7812	Powerwash Relay	<ul style="list-style-type: none"> <li>● Powerwash relay control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check powerwash relay control circuit for short to power
B1C7814	Powerwash Relay	<ul style="list-style-type: none"> <li>● Powerwash relay control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check powerwash relay control circuit for short to ground, open circuit
B1C7911	Front Washer Pump	<ul style="list-style-type: none"> <li>● Screenwash pump control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check screenwash pump control circuit for short to ground
B1C7913	Front Washer Pump	<ul style="list-style-type: none"> <li>● Screenwash pump control circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check screenwash pump control circuit for open circuit
B1C9812	Left Corner Lamp Circuit	<ul style="list-style-type: none"> <li>● Left front corner lamp control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check left front corner lamp control circuit for short to power
B1C9814	Left Corner Lamp Circuit	<ul style="list-style-type: none"> <li>● Left front corner lamp control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check left front corner lamp control circuit for short to ground, open circuit
B1C9912	Right Corner Lamp Circuit	<ul style="list-style-type: none"> <li>● Right front corner lamp control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check right front corner lamp control circuit for short to power
B1C9914	Right Corner Lamp Circuit	<ul style="list-style-type: none"> <li>● Right front corner lamp control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check right front corner lamp control circuit for short to ground, open circuit
B1D0011	Left Low Beam	<ul style="list-style-type: none"> <li>● Left dip beam control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left dip beam control circuit for short to ground
B1D0012	Left Low Beam	<ul style="list-style-type: none"> <li>● Left dip beam control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check left dip beam control circuit for short to power
B1D0013	Left Low Beam	<ul style="list-style-type: none"> <li>● Left dip beam control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check left dip beam control circuit for open circuit
B1D0111	Right Low Beam	<ul style="list-style-type: none"> <li>● Right dip beam control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right dip beam control circuit for short to ground
B1D0112	Right Low Beam	<ul style="list-style-type: none"> <li>● Right dip beam control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check right dip beam control circuit for short to power
B1D0113	Right Low Beam	<ul style="list-style-type: none"> <li>● Right dip beam control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check right dip beam control circuit for open circuit
B1D0211	Left High Beam Circuit	<ul style="list-style-type: none"> <li>● Left high beam control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check left high beam control circuit for short to ground
B1D0212	Left High Beam Circuit	<ul style="list-style-type: none"> <li>● Left high beam control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check left high beam control circuit for short to power
B1D0213	Left High Beam Circuit	<ul style="list-style-type: none"> <li>● Left high beam control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check left high beam control circuit for open circuit
B1D0311	Right High Beam Circuit	<ul style="list-style-type: none"> <li>● Right high beam control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check right high beam control circuit for short to ground
B1D0312	Right High Beam Circuit	<ul style="list-style-type: none"> <li>● Right high beam control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check right high beam control circuit for short to power
B1D0313	Right High Beam Circuit	<ul style="list-style-type: none"> <li>● Right high beam control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check right high beam control circuit for open circuit
B1D1711	Battery Backed Sounder	<ul style="list-style-type: none"> <li>● Battery backed sounder inclination sensor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check battery backed sounder inclination sensor control circuit for short to ground
B1D1811	Volumetric Sensor	<ul style="list-style-type: none"> <li>● Intrusion sensor module supply circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check intrusion sensor module supply circuit for short to ground

DTC	Description	Possible Cause	Action
B1D2711	Heater Coolant Pump	<ul style="list-style-type: none"> <li>Heater coolant pump control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check heater coolant pump control circuit for short to ground
B1D2713	Heater Coolant Pump	<ul style="list-style-type: none"> <li>Heater coolant pump control circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check heater coolant pump control circuit for open circuit
B1D9796	Tilt Sensor	<ul style="list-style-type: none"> <li>Component internal failure</li> </ul>	Suspect the battery backed sounder, check and install a new battery backed sounder as required
P057112	Brake Switch A Circuit	<ul style="list-style-type: none"> <li>Footbrake switch circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check footbrake switch circuit for short to power
P080111	Reverse Inhibit Control Circuit	<ul style="list-style-type: none"> <li>Electrochromic rear view mirror, reverse inhibit circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check electrochromic rear view mirror, reverse inhibit circuit for short to ground
P080112	Reverse Inhibit Control Circuit	<ul style="list-style-type: none"> <li>Electrochromic rear view mirror, reverse inhibit circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check electrochromic rear view mirror, reverse inhibit circuit for short to power
P080113	Reverse Inhibit Control Circuit	<ul style="list-style-type: none"> <li>Electrochromic rear view mirror, reverse inhibit circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check electrochromic rear view mirror, reverse inhibit circuit for open circuit
P085013	Park/Neutral Switch Input Circuit	<ul style="list-style-type: none"> <li>Park/Neutral signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check Park/Neutral signal circuit for open circuit
P162413	Anti-theft System	<ul style="list-style-type: none"> <li>RJB anti-theft signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check RJB anti-theft signal circuit for open circuit
P254F13	Engine Hood Switch Circuit/Open	<ul style="list-style-type: none"> <li>Hood ajar switch signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check hood ajar switch signal circuit for open circuit
U001988	Low Speed CAN Communication Bus	<ul style="list-style-type: none"> <li>Bus OFF</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U014200	Lost Communication With Body Control Module "B"	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U015500	Lost Communication With Instrument Panel Cluster (IPC) Control Module	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U015600	Lost Communication With Information Center "A"	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U016400	Lost Communication With HVAC Control Module	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U016800	Lost Communication With Vehicle Security Control Module	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Check power and ground supplies to vehicle security module
U019900	Lost Communication With "Door Control Module A"	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U020000	Lost Communication With "Door Control Module B"	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U021400	Lost Communication With Remote Function Actuation	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U023100	Lost Communication With Rain Sensing Module	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Check power and ground supplies to rain sensing module. LIN circuit fault
U030000	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Suspect the CJB. Check and install a new CJB as required, refer to the new module/component installation note at the top of the DTC Index
U100000	Solid State Driver Protection Active - Driver Disabled	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Check CJB for additional load related DTCs and refer to remedial actions for those DTCs

DTC	Description	Possible Cause	Action
U1A1449	CAN Initialisation Failure	<ul style="list-style-type: none"> <li>Internal electronic failure</li> </ul>	Suspect the CJB. Check and install a new CJB as required, refer to the new module/component installation note at the top of the DTC Index
U200813	Sensor Cluster	<ul style="list-style-type: none"> <li>Instrument cluster security signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check instrument cluster security signal circuit for open circuit
U201012	Switch Illumination	<ul style="list-style-type: none"> <li>Switch/interior illumination PWM supply circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check switch/interior illumination PWM supply circuit for short to power
U201014	Switch Illumination	<ul style="list-style-type: none"> <li>Switch/interior illumination PWM supply circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check switch/interior illumination PWM supply circuit for short to ground, open circuit
U210000	Initial Configuration Not Complete	<ul style="list-style-type: none"> <li>RJB configuration (parameters) failure</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system
U300049	Control Module	<ul style="list-style-type: none"> <li>Internal electronic failure</li> </ul>	Suspect the CJB. Check and install a new CJB as required, refer to the new module/component installation note at the top of the DTC Index
U300055	Control Module	<ul style="list-style-type: none"> <li>Not configured</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. Check the correct CJB is installed to vehicle market/specification. Install a new/correct CJB as required, refer to the new module/component installation note at the top of the DTC Index
U300087	Control Module	<ul style="list-style-type: none"> <li>Missing message</li> </ul>	Carry out CAN network integrity test using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CAN network between RJB and CJB for short, open circuit. Check RJB and then CJB for related DTCs and refer to the relevant DTC Index
U300281	Vehicle Identification Number	<ul style="list-style-type: none"> <li>Invalid serial data received</li> </ul>	Suspect the CJB has previously been installed to another vehicle. Check and install the original or a new CJB
U300317	Battery Voltage	<ul style="list-style-type: none"> <li>Circuit voltage above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U300362	Battery Voltage	<ul style="list-style-type: none"> <li>Mis-match in battery voltage, of 2 volts or more, between CJB and RJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.

### Rear Junction Box (RJB)



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Causes	Action
P046011	Fuel Level Sensor A Circuit	<ul style="list-style-type: none"> <li>Fuel level sensor A analogue input circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel level sensor A analogue input circuit for short to ground
P046015	Fuel Level Sensor A Circuit	<ul style="list-style-type: none"> <li>Fuel level sensor A analogue input circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel level sensor A analogue input circuit for short to power, open circuit
P057112	Brake Switch A Circuit	<ul style="list-style-type: none"> <li>Footbrake switch digital input signal circuits - short to power</li> </ul>	Refer to the electrical circuit diagrams and check footbrake switch digital input signal circuits for short to power
P123012	Fuel Pump Low Speed Malfunction (VLCM)	<ul style="list-style-type: none"> <li>High Side output not driven - Diagnosis feedback indicates output is short to power</li> </ul>	Refer to the electrical circuit diagrams and check fuel pump delivery module for short to power

DTC	Description	Possible Causes	Action
P123014	Fuel Pump Low Speed Malfunction (VLCM)	<ul style="list-style-type: none"> <li>High Side output not driven - Diagnosis feedback indicates output is short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check fuel pump delivery module for short to ground, open circuit
P123093	Fuel Pump Low Speed Malfunction (VLCM)	<ul style="list-style-type: none"> <li>High Side output not driven - Diagnosis feedback indicates output is at open load or short to power</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel pump delivery module for short to power, open circuit
P134611	Fuel Level Sensor B Circuit	<ul style="list-style-type: none"> <li>Fuel level sensor B analogue input circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel level sensor B analogue input circuit for short to ground
P134615	Fuel Level Sensor B Circuit	<ul style="list-style-type: none"> <li>Fuel level sensor B analogue input circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check fuel level sensor B analogue input circuit for short to power, open circuit
P162413	Anti-theft System	<ul style="list-style-type: none"> <li>Anti-theft signal circuit from CJB - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check anti-theft signal circuit from CJB for open circuit
C111A11	Right Stop Lamp	<ul style="list-style-type: none"> <li>Right stop lamp control circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right stop lamp control circuit for short to ground
C111A12	Right Stop Lamp	<ul style="list-style-type: none"> <li>Right stop lamp control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check right stop lamp control circuit for short to power
C111A13	Right Stop Lamp	<ul style="list-style-type: none"> <li>Right stop lamp control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check right stop lamp control circuit for open circuit
C111B11	Left Stop Lamp	<ul style="list-style-type: none"> <li>Left stop lamp control circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left stop lamp control circuit for short to ground
C111B13	Left Stop Lamp	<ul style="list-style-type: none"> <li>Left stop lamp control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check left stop lamp control circuit for open circuit
C112011	Reversing lamp	<ul style="list-style-type: none"> <li>Reverse lamp control circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check reverse lamp control circuit for short to ground
C112012	Reversing lamp	<ul style="list-style-type: none"> <li>Reverse lamp control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check reverse lamp control circuit for short to power
C112013	Reversing lamp	<ul style="list-style-type: none"> <li>Reverse lamp control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check reverse lamp control circuit for open circuit
B100A51	Fuel Pump Authorisation	<ul style="list-style-type: none"> <li>RJB fault</li> <li>Low speed CAN fault</li> <li>Instrument cluster fault</li> </ul>	Check power and ground supplies to RJB. Check CAN communications between RJB and instrument cluster. Check power and ground supplies to instrument cluster
B100A62	Fuel Pump Authorisation	<ul style="list-style-type: none"> <li>Low speed CAN fault</li> <li>RJB fault</li> <li>Instrument cluster fault</li> <li>Incorrect module installed (RJB/Instrument cluster)</li> <li>Write target SID synchronisation error following re-programming</li> <li>Noise/EMC related error</li> </ul>	Check CAN communications between RJB and instrument cluster. Check power and ground supplies to RJB and instrument cluster. Confirm correct module installed. Re-synchronise ID by re-configuring the RJB as a new module. Check CAN network for interference/EMC related issues
B100A63	Fuel Pump Authorisation	<ul style="list-style-type: none"> <li>RJB fault</li> <li>Low speed CAN fault</li> <li>Instrument cluster fault</li> <li>Low battery voltage &lt;9V</li> </ul>	Check power and ground supplies to RJB and instrument cluster. Check CAN communications between RJB and instrument cluster. Check battery is in fully charged and serviceable condition, refer to the battery care manual
B102612	Steering Column Lock	<ul style="list-style-type: none"> <li>Steering column lock ground circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check steering column lock ground circuit for short to power
B108783	LIN Bus "A"	<ul style="list-style-type: none"> <li>The checksum of the received LIN frame is incorrect</li> </ul>	Check the battery monitoring system and rear parking aid system for DTCs and refer to relevant DTC Index
B108786	LIN Bus "A"	<ul style="list-style-type: none"> <li>The header of the LIN message received is incorrect</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Check the battery monitoring system and rear parking aid system for DTCs and refer to relevant DTC Index

DTC	Description	Possible Causes	Action
B108788	LIN Bus "A"	<ul style="list-style-type: none"> <li>Battery monitoring system LIN circuit - short to ground, power</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check battery monitoring system LIN circuit for short to ground, power
B108A23	Start Button	<ul style="list-style-type: none"> <li>Start/Stop switch digital input signal circuit - stuck low</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check Start/Stop switch digital input signal circuit for short to ground
B10A111	Trailer Tow Detection	<ul style="list-style-type: none"> <li>Trailer tow detection digital input circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check trailer tow detection digital input circuit for short to ground
B10AF12	Blower Fan Relay	<ul style="list-style-type: none"> <li>High Side output not driven - Diagnosis feedback indicates output is short to power</li> </ul>	Refer to the electrical circuit diagrams and check blower motor supply circuit for short to power
B10AF14	Blower Fan Relay	<ul style="list-style-type: none"> <li>High Side output not driven - Diagnosis feedback indicates output is short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check blower motor supply circuit for short to ground, open circuit
B10AF93	Blower Fan Relay	<ul style="list-style-type: none"> <li>High Side output not driven - Diagnosis feedback indicates output is at open load or short to power</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check blower motor supply circuit for short to power, open circuit
B10DD11	Airbag Deployed	<ul style="list-style-type: none"> <li>Airbag deployed digital input signal circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check airbag deployed digital input signal circuit for short to ground
B10DD15	Airbag Deployed	<ul style="list-style-type: none"> <li>Airbag deployed digital input signal circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check airbag deployed digital input signal circuit for short to power, open circuit
B10DD38	Airbag Deployed	<ul style="list-style-type: none"> <li>Signal frequency incorrect</li> </ul>	Check the RCM for related DTCs and refer to the relevant DTC Index
B10DE11	Low Fuel Warning Switch	<ul style="list-style-type: none"> <li>Diesel run-dry switch analogue input circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check diesel run-dry switch analogue input circuit for short to ground
B10DE15	Low Fuel Warning Switch	<ul style="list-style-type: none"> <li>Diesel run-dry switch analogue input circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check diesel run-dry switch analogue input circuit for short to power, open circuit
B111211	Park Aid Ignition	<ul style="list-style-type: none"> <li>Parking aid ignition supply circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check parking aid ignition supply circuit for short to ground
B111212	Park Aid Ignition	<ul style="list-style-type: none"> <li>Parking aid ignition supply circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check parking aid ignition supply circuit for short to power
B111511	High Mounted Stop Lamp Control	<ul style="list-style-type: none"> <li>High mounted stop lamp control circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check high mounted stop lamp control circuit for short to ground
B111611	Left Tail Lamp	<ul style="list-style-type: none"> <li>Left hand tail lamp control circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left hand tail lamp control circuit for short to ground
B111711	Right Tail Lamp	<ul style="list-style-type: none"> <li>Right hand tail lamp control circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right hand tail lamp control circuit for short to ground
B111A11	Number Plate Lamps	<ul style="list-style-type: none"> <li>Right hand or left hand number plate lamp control circuits - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right hand and left hand number plate lamp control circuits for short to ground
B111A12	Number Plate Lamps	<ul style="list-style-type: none"> <li>Right hand or left hand number plate lamp control circuits - short to power</li> </ul>	Refer to the electrical circuit diagrams and check right hand and left hand number plate lamp control circuits for short to power



DTC	Description	Possible Causes	Action
B111A13	Number Plate Lamps	<ul style="list-style-type: none"> <li>Right hand or left hand number plate lamp control circuits - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check right hand and left hand number plate lamp control circuits for open circuit
B111D12	Boot/Trunk Motor Open	<ul style="list-style-type: none"> <li>Luggage compartment lid latch actuator control circuit - short to power</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check luggage compartment lid latch actuator control circuit for short to power
B111D14	Boot/Trunk Motor Open	<ul style="list-style-type: none"> <li>Luggage compartment lid latch actuator control circuit - short to ground, open circuit</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check luggage compartment lid latch actuator control circuit for short to ground, open circuit
B111E11	Boot/Trunk Lamps	<ul style="list-style-type: none"> <li>Luggage compartment lamp control circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check luggage compartment lamp control circuit for short to ground
B111E12	Boot/Trunk Lamps	<ul style="list-style-type: none"> <li>Luggage compartment lamp control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check luggage compartment lamp control circuit for short to power
B111E13	Boot/Trunk Lamps	<ul style="list-style-type: none"> <li>Luggage compartment lamp control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check luggage compartment lamp control circuit for open circuit
B112312	Restraints Ignition Relay	<ul style="list-style-type: none"> <li>High Side output not driven - diagnosis feedback indicates output is short to power</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check restraints ignition relay output for short to power
B112314	Restraints Ignition Relay	<ul style="list-style-type: none"> <li>High Side output not driven - diagnosis feedback indicates output is short to ground, open circuit</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check restraints ignition relay output for short to ground, open circuit
B112393	Restraints Ignition Relay	<ul style="list-style-type: none"> <li>High Side output not driven - diagnosis feedback indicates output is at open load or short to power</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check restraints ignition relay output for open load or short to power
B112411	Lamp Fade Control	<ul style="list-style-type: none"> <li>Interior lamp fade control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check interior lamp fade control circuit for short to ground
B112412	Lamp Fade Control	<ul style="list-style-type: none"> <li>Interior lamp fade control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check interior lamp fade control circuit for short to power
B113C12	Hazard Switch Illumination	<ul style="list-style-type: none"> <li>Hazard switch illumination control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check hazard switch illumination control circuit for short to power
B113C14	Hazard Switch Illumination	<ul style="list-style-type: none"> <li>Hazard switch illumination control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check hazard switch illumination control circuit for short to ground, open circuit
B113E12	External Boot/Trunk Release Switch	<ul style="list-style-type: none"> <li>External luggage compartment lid release switch digital input circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check external luggage compartment lid release switch digital input circuit for short to power
B113E23	External Boot/Trunk Release Switch	<ul style="list-style-type: none"> <li>External luggage compartment lid release switch digital input circuit - signal stuck low</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check external luggage compartment lid release switch digital input circuit for short to ground
B11D949	Vehicle Battery	<ul style="list-style-type: none"> <li>Vehicle battery damaged/worn out</li> </ul>	Check battery is in fully charged and serviceable condition using the Midtronics battery tester and the battery care manual
B11DB49	Battery Monitoring Module	<ul style="list-style-type: none"> <li>Internal electronic failure</li> </ul>	Suspect the battery monitoring module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B11DB87	Battery Monitoring Module	<ul style="list-style-type: none"> <li>Battery monitoring module connector dis-connected/poor connection</li> <li>Battery monitoring module to RJB LIN circuit - open circuit</li> <li>Battery monitoring module to battery</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. If additional DTCs B108783, B108786, B108787 are logged, suspect the RJB. Check and install a new RJB as required, refer to the new module/component installation note at the top of the DTC Index. If additional DTCs B108783, B108786, B108787 are NOT logged, check for good/clean contact at battery monitoring module connector, refer to electrical circuit diagrams and check battery monitoring module to RJB LIN

DTC	Description	Possible Causes	Action
		positive monitor circuit - open circuit ● Battery monitoring module/RJB failure	circuit and battery monitoring module to battery positive monitor circuit for open circuit. Clear DTC and repeat automated diagnostic procedure using manufacturer approved diagnostic system. If DTC remains suspect the battery monitoring module, check and install a new battery monitoring module as required, refer to the new module/component installation note at the top of the DTC Index
B123A11	Left Front Turn Indicator	● Left front turn signal lamp control circuit - short to ground	Refer to the electrical circuit diagrams and check left front turn signal lamp control circuit for short to ground
B123A12	Left Front Turn Indicator	● Left front turn signal lamp control circuit - short to power	Refer to the electrical circuit diagrams and check left front turn signal lamp control circuit for short to power
B123A13	Left Front Turn Indicator	● Left front turn signal lamp control circuit - open circuit	Refer to the electrical circuit diagrams and check left front turn signal lamp control circuit for open circuit
B123B11	Right Front Turn Indicator	● Right front turn signal lamp control circuit - short to ground	Refer to the electrical circuit diagrams and check right front turn signal lamp control circuit for short to ground
B123B12	Right Front Turn Indicator	● Right front turn signal lamp control circuit - short to power	Refer to the electrical circuit diagrams and check right front turn signal lamp control circuit for short to power
B123B13	Right Front Turn Indicator	● Right front turn signal lamp control circuit - open circuit	Refer to the electrical circuit diagrams and check right front turn signal lamp control circuit for open circuit
B124711	Left Rear Turn Indicator	● Left rear turn signal lamp control circuit - short to ground	Refer to the electrical circuit diagrams and check left rear turn signal lamp control circuit for short to ground
B124712	Left Rear Turn Indicator	● Left rear turn signal lamp control circuit - short to power	Refer to the electrical circuit diagrams and check left rear turn signal lamp control circuit for short to power
B124713	Left Rear Turn Indicator	● Left rear turn signal lamp control circuit - short to power, open circuit	Refer to the electrical circuit diagrams and check left rear turn signal lamp control circuit for open circuit
B124811	Right Rear Turn Indicator	● Right rear turn signal lamp control circuit - short to ground	Refer to the electrical circuit diagrams and check right rear turn signal lamp control circuit for short to ground
B124812	Right Rear Turn Indicator	● Right rear turn signal lamp control circuit - short to power	Refer to the electrical circuit diagrams and check right rear turn signal lamp control circuit for short to power
B124813	Right Rear Turn Indicator	● Right rear turn signal lamp control circuit - open circuit	Refer to the electrical circuit diagrams and check right rear turn signal lamp control circuit for open circuit
B126113	Fuel Flap/Door Release Switch	● Fuel filler flap digital input signal circuit - open circuit	Refer to the electrical circuit diagrams and check fuel filler flap digital input signal circuit for open circuit
B1A7911	Rear Fog Lamp	● Rear fog lamp control circuit - short to ground	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check rear fog lamp control circuit for short to ground
B1A7912	Rear Fog Lamp	● Rear fog lamp control circuit - short to power	Refer to the electrical circuit diagrams and check rear fog lamp control circuit for short to power
B1A7913	Rear Fog Lamp	● Rear fog lamp control circuit - open circuit	Refer to the electrical circuit diagrams and check rear fog lamp control circuit for open circuit
B1C5512	Horn Relay	● Horn control circuit - short to power	Refer to the electrical circuit diagrams and check horn control circuit for short to power
B1C5514	Horn Relay	● Horn control circuit - short to ground, open circuit	Refer to the electrical circuit diagrams and check horn control circuit for short to ground, open circuit
B1C8312	Rear Defog Relay	● High Side output not driven - diagnosis feedback indicates output is short to power	Refer to the electrical circuit diagrams and check heated rear window power supply circuit for short to power

DTC	Description	Possible Causes	Action
B1C8314	Rear Defog Relay	<ul style="list-style-type: none"> <li>High Side output not driven - diagnosis feedback indicates output is short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check heated rear window power supply circuit for short to ground, open circuit
B1C8393	Rear Defog Relay	<ul style="list-style-type: none"> <li>High Side output not driven - diagnosis feedback indicates output is at open load or short to power</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check heated rear window power supply circuit for open load and short to power
B1C9112	Fuel Flap/Door Lock Relay Coil Circuit	<ul style="list-style-type: none"> <li>Fuel filler flap locking motor control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check fuel filler flap locking motor control circuit for short to power
B1C9114	Fuel Flap/Door Lock Relay Coil Circuit	<ul style="list-style-type: none"> <li>Fuel filler flap locking motor control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check fuel filler flap locking motor control circuit for short to ground, open circuit
B1D3512	Hazard Switch	<ul style="list-style-type: none"> <li>Hazard warning lamp switch digital input circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check hazard warning lamp switch digital input circuit for short to power
B1D3523	Hazard Switch	<ul style="list-style-type: none"> <li>Hazard warning lamp switch digital input circuit - signal stuck low</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check hazard warning lamp switch digital input circuit for short to ground
U001988	Low Speed CAN Communication Bus	<ul style="list-style-type: none"> <li>Bus off</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U014000	Lost Communication With Body Control Module	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U015500	Lost Communication With Instrument Panel Cluster (IPC) Control Module	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U015900	Lost Communication With Parking Assist Control Module "A"	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U016400	Lost Communication With HVAC Control Module	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U021400	Lost Communication With Remote Function Actuation	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U030046	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>Calibration/parameter memory failure</li> </ul>	Suspect the RJB. Check and install a new RJB as required, refer to the new module/component installation note at the top of the DTC Index
U100000	Solid State Driver Protection Active -Driver Disabled	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U1A1449	CAN Initialisation Failure	<ul style="list-style-type: none"> <li>Internal electronic failure</li> </ul>	Suspect the RJB. Check and install a new RJB as required, refer to the new module/component installation note at the top of the DTC Index
U300049	Control Module	<ul style="list-style-type: none"> <li>Internal electronic failure</li> </ul>	Suspect the RJB. Check and install a new RJB as required, refer to the new module/component installation note at the top of the DTC Index
U300055	Control Module	<ul style="list-style-type: none"> <li>Not configured</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system

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# Module Communications Network - Central Junction Box (CJB)

Removal and Installation

## Removal

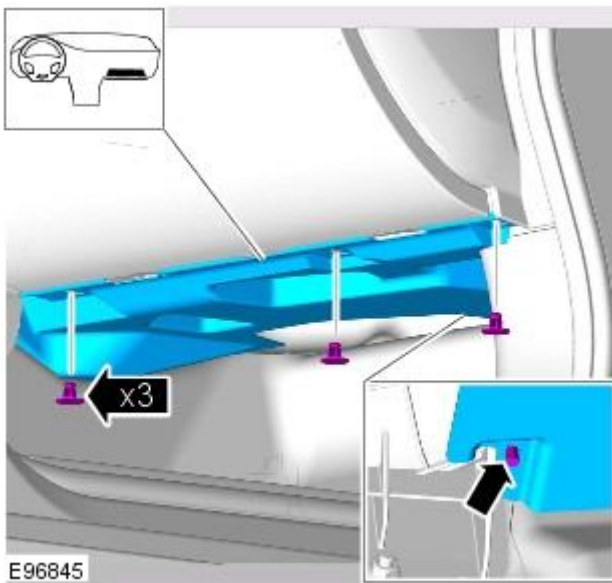
- NOTE: Removal steps in this procedure may contain installation details.

All vehicles

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Cowl Side Trim Panel](#) (501-05 Interior Trim and Ornementation, Removal and Installation).

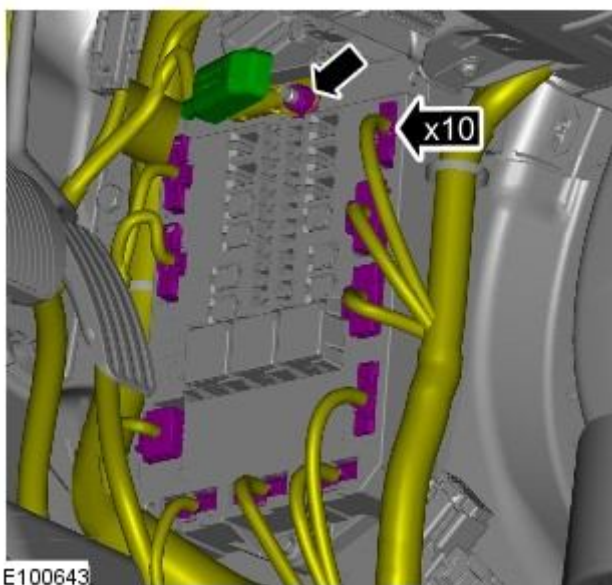
Left-hand drive vehicles

3.

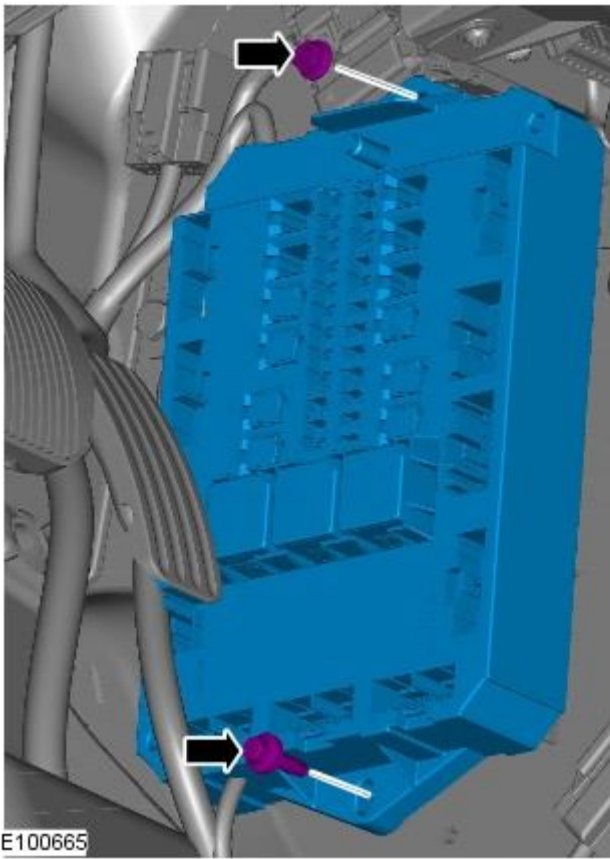


All vehicles

4.



5.



## Installation

1. To install, reverse the removal procedure.
2. Configure the CJB using the diagnostic tool.

# Wiring Harnesses - Wiring Harness

Description and Operation

## Introduction



**CAUTION:** Do **not** use any other heat shrink sleeve other than the approved glue lined heat shrink sleeve mentioned in the repair procedure.

The purpose of this document is to promote quick and efficient minor repair to harness connectors or cables using approved methods and the wiring harness repair kit. Repairs may only be made to cables and connectors which have been mechanically, **not electrically** damaged. It also applies where the whole extent of the damage can be clearly identified and rectified.

Care and neatness are essential requirements in making a perfect repair.

### Caution:

At the time of this first issue of the Harness Repair Guide, do not approve repairs to any of the following circuits:

- Any media orientated system transport network harnesses.
- Supplement restraint system (SRS) firing circuits (Air bags).
- Link lead assemblies, which are unique to safety critical circuits such as anti-lock brake system (ABS) and thermocouple circuits. An example of this is the ABS wheel speed sensors with moulded connectors.
- 4. Screened cables, leads and wiring harness(s).

**If any harness(s) with defective electrical connector terminals or wires from the above circuits are a concern, new components must be installed.**

## Repair Kit



**CAUTION:** Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

The wiring harness repair kit has been produced which comprises:

- Pre-terminated wiring harness(s) of different sizes and types
- Three sizes of butt splice connectors
- A selection of colored cable identification sleeves
- Two sizes of glue lined heat shrink sleeves
- Crimping pliers
- A wire cutter and insulation stripper
- An electrical connector terminal extraction handle and tips

A suitable heat source, for shrinking heat shrink sleeves will be required.

The pre-insulated diamond grip range of electrical connector terminals and in-line, butt splice connectors contained within the wiring harness repair kit are the **only** acceptable product for the repairs of wiring harnesses. The butt connectors not only grip the wire but also the insulation, making a very secure joint.

If an electrical connector terminal is not included in the wiring harness repair kit then approval for the repair is **NOT** given and in these circumstances a new wiring harness must be installed.

### Pre-Terminated Wiring Harness(s) and Butt Splice Connectors

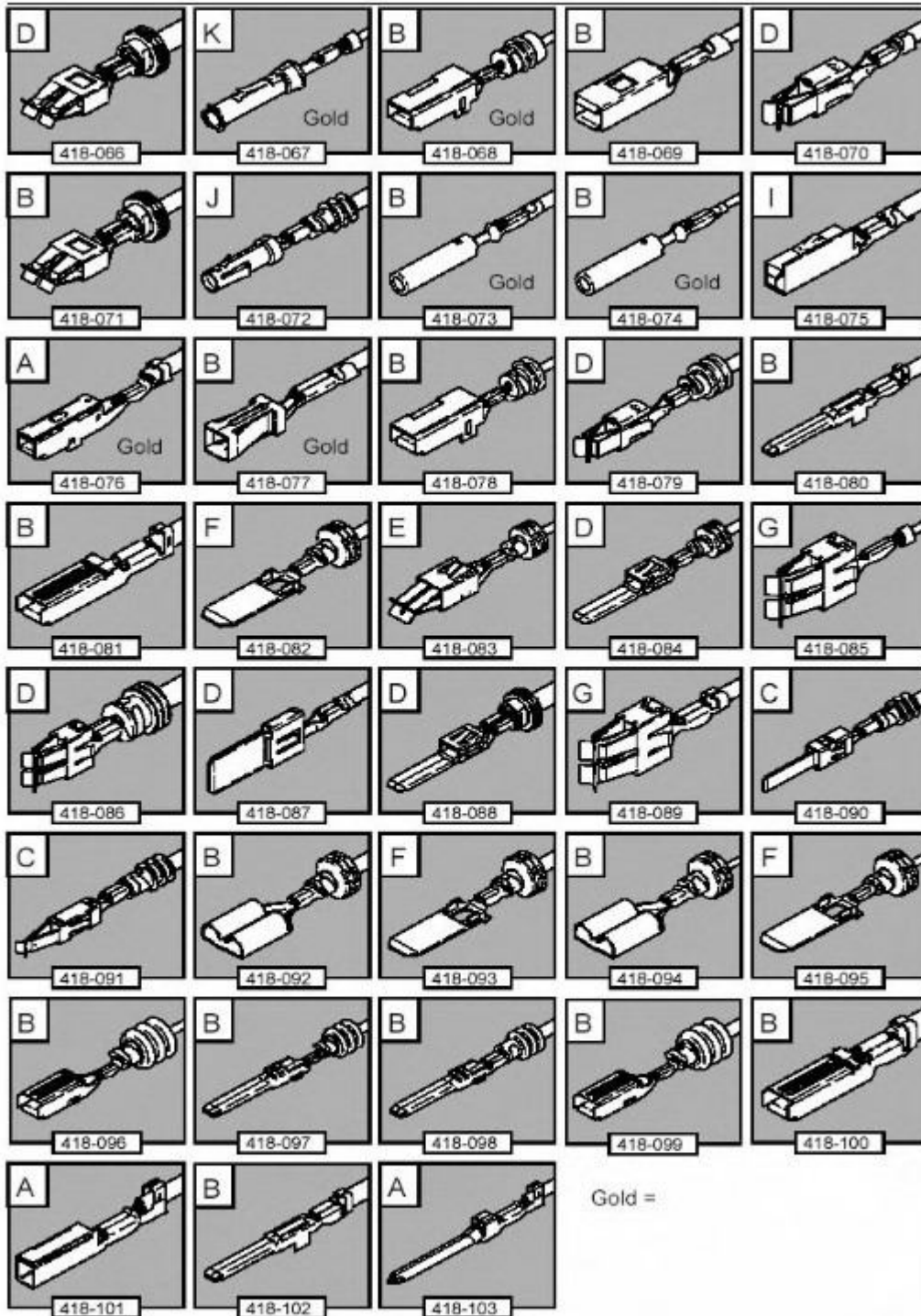
All pre-terminated wiring harness(s) and butt splice connectors in the wiring harness repair kit are contained in bags which can be resealed after use. Each bag is marked with the part number of the items stored within the bag. Each storage compartment in the wiring harness repair kit is identified with the corresponding part number. Make sure that pre-terminated wiring harness(s) and connectors are not mixed up it is advisable to only open one bag at a time and to reseat the bag securely before opening another bag. Also, replace the bag in its mating part number compartment within the case.

The pre-terminated wiring harness(s) are supplied with the insulation in one of three colors, red, blue or yellow. The colors do not apply to any particular circuit but to the harness wire size. See the Relationship Table in the Repair Method section.

Butt splice connectors are also supplied with red, blue or yellow coverings, which must be matched to the pre-terminated wiring harness insulation color.

Pre-Terminated Wiring Harness(s)





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The illustration shows:

- The pre-terminated wiring harness(s) which are included in the wiring harness repair kit
- The part number of the pre-terminated wiring harness
- The letter showing the extractor tip which must be used to remove this type of electrical connector terminal
- Those electrical connector terminals which are gold

Some of the pre-terminated wiring harness(s) have seals installed to the insulation for sealed connector applications. It is essential for prevention of moisture ingress that a sealed pre-terminated wiring harness must be used where a sealed terminal was removed.



**CAUTION:** Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the

glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

Two sizes of heat shrink sleeving are supplied in the wiring harness repair kit. Each heat shrink sleeve contains a sealant glue. These must be used when connecting wiring harness(s) or electrical connector terminal(s) at all times. The smaller diameter heat shrink sleeve is to be used with the red and blue butt splice connectors and the larger diameter sleeve with the yellow butt splice connectors.

For ease and speed, some of the pre-terminated wiring harness(s) may already have the insulation partly stripped at the splice end. If the repair requires insulation to be stripped from the cable, refer to the Relationship Table for the correct length of insulation to be stripped.

The Pre-Terminated Wiring Harness(s) illustration shows the electrical connector terminal type, the part number of the pre-terminated wiring harness and the letter of the extractor tip which must be used to extract the electrical connector terminal from the connector housing. Additionally, those electrical connector terminal(s) which are gold are identified, all others are therefore, tinned and not gold.

#### Wiring Harness Cable Identification Sleeves

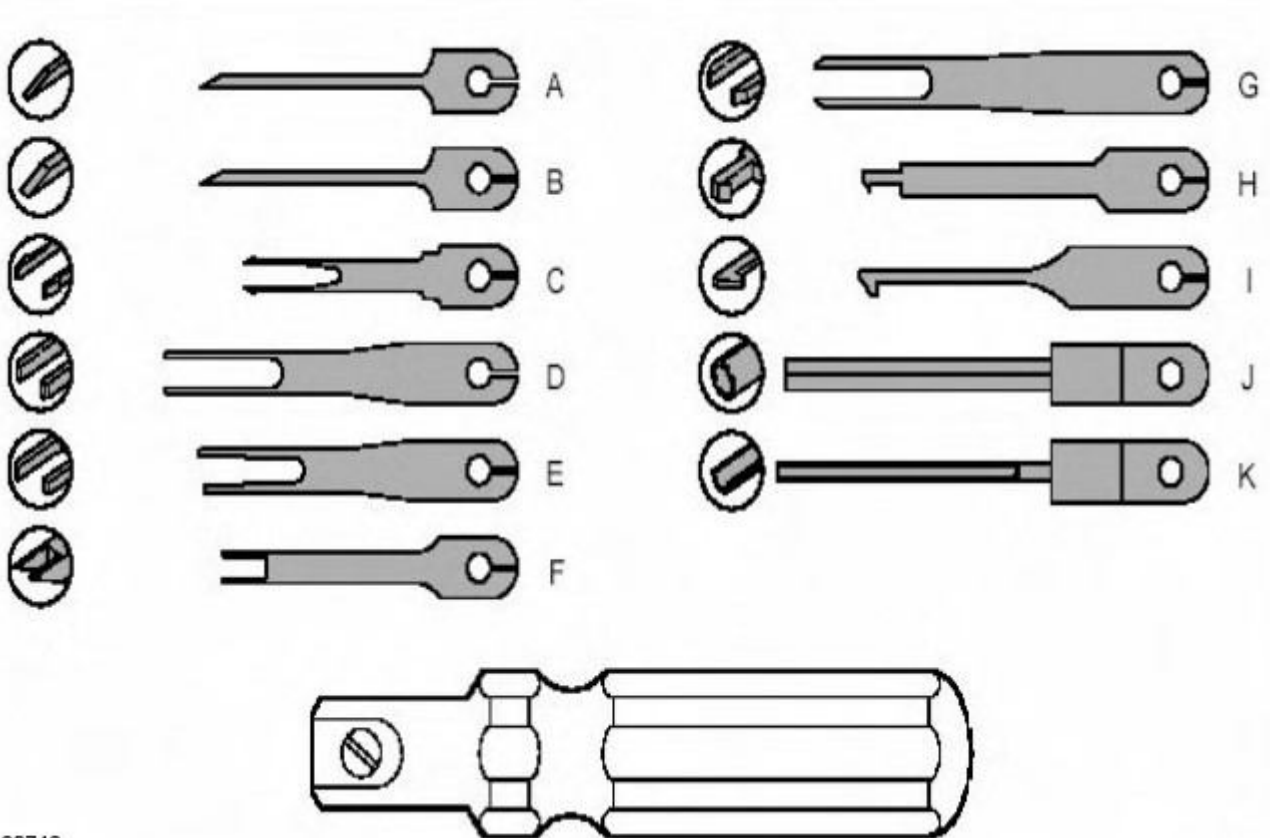
A selection of colored sleeves are contained in the wiring harness repair kit for maintaining the wiring harness cable identification on the pre-terminated wiring harness. Place the correct colored sleeve(s) over the pre-terminated wiring harness insulation as near to the electrical connector as possible with the main wiring harness cable color nearest to the electrical connector.

For example, if the original wiring harness cable color is pink with a black trace put the pink wiring harness cable identification sleeve on the pre-terminated wiring harness first followed by a black sleeve, and slide both along the wiring harness cable to the electrical connector terminal.

#### Extraction Handle and Tips

The extraction handle, in conjunction with the correct tip, is used to remove a terminal from an electrical connector. Each tip contained in the wiring harness repair kit is marked with an identification letter, A to K inclusive. Each tip has been specially designed to extract a particular type of electrical connector terminal. The use of any other tool is **not** recommended and is liable to cause damage to the electrical connector. The tip is fastened to the handle by a screw which holds the tip firmly yet allows it to be easily replaced.

#### Extraction Handle and Tips

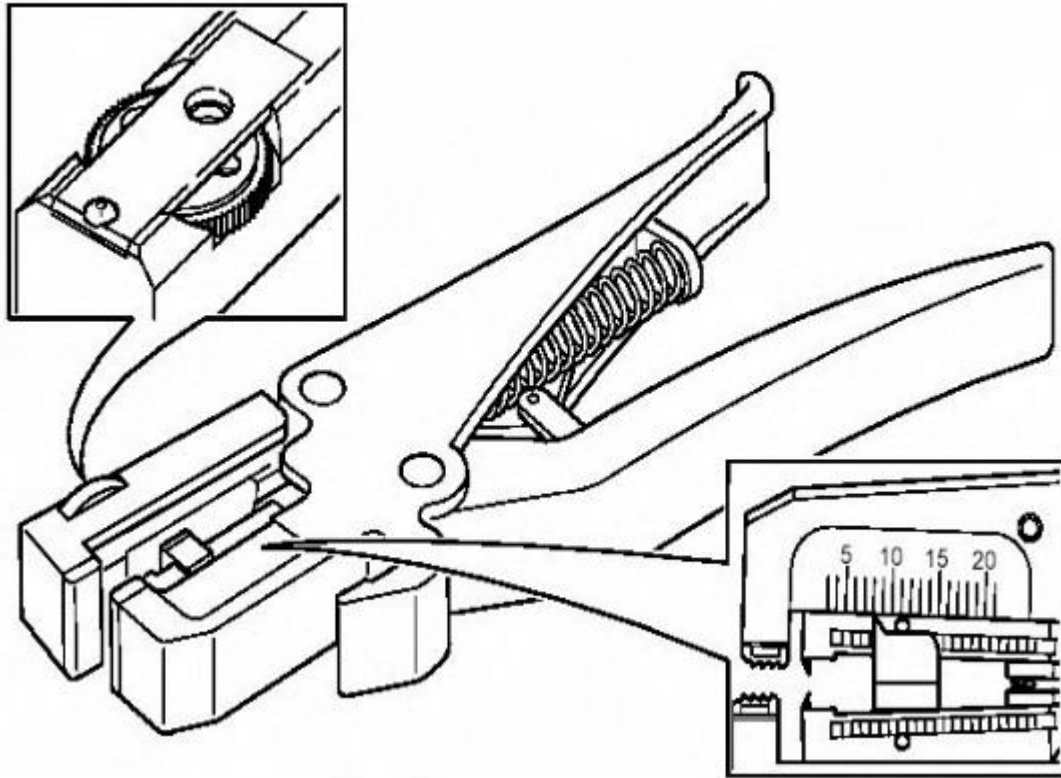


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#### Insulation Stripper

The moving jaw has an adjuster wheel which has a series of holes in it. Turning the wheel and placing the cable in the matching size hole will automatically adjust the jaw to the correct pressure. Note that some wiring harness(s) may have a harder insulation and slight adjustment of the wheel may be needed to make a clean strip but exercise care not to damage the wire.

#### Insulation Stripper

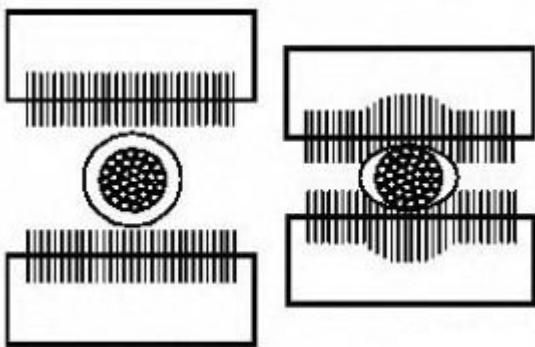


E130743

By pressing the outer edges of the wiring harness cable length stop together the adjuster can be slid up or down the jaw. This decreases or increases the length by which the wiring harness cable insulation will be stripped from the pre-terminated wiring harness or wiring harness wire. The adjuster has a position indicator to align with a graduated scale and this sets the correct length in millimetres, of insulation to be stripped. The amount of insulation to be stripped is shown in the Relationship Table.

The illustration shows the insulation stripper tool and a wiring harness correctly gripped in the jaws. A wire cutter is provided on the outer side of the fixed jaw.

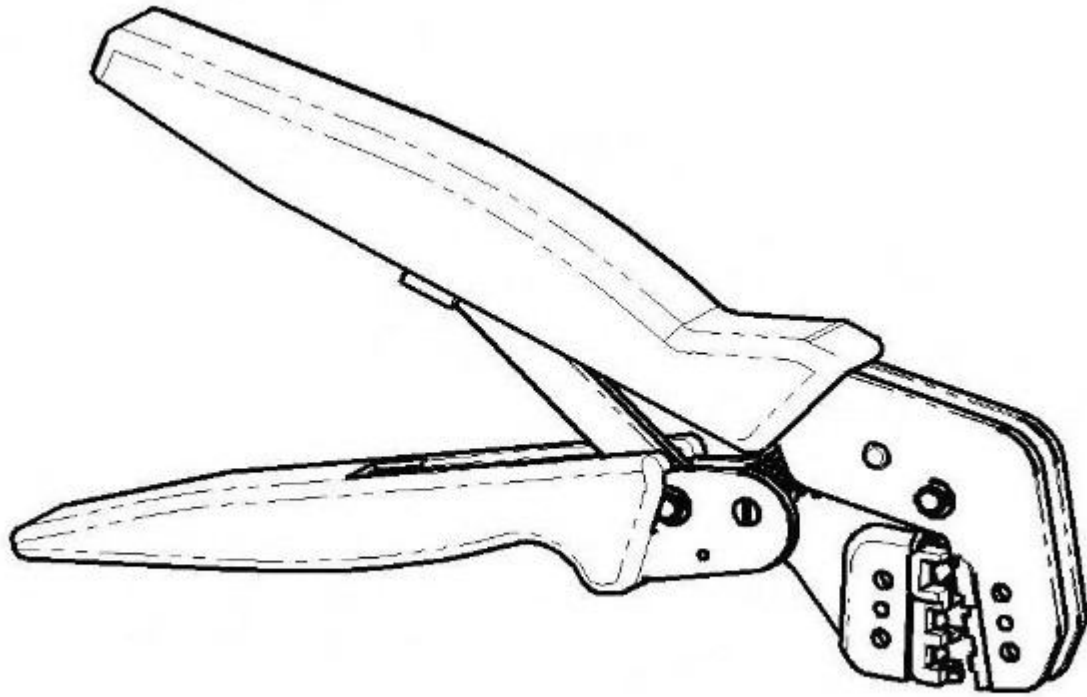
Cable Correctly Gripped in Stripper Blades



E130744

### Crimping Pliers

Crimping Pliers



E130745

The crimping pliers have a moving jaw and a stationary jaw, with three different sized crimping enclosures. Each of the enclosures is identified by a red, blue or yellow coloured dot which corresponds to the three colours of the pre-terminated wiring harness(s) and butt splice connector colors.

#### List of Parts

Description	Part Number	Quantity
Wiring Harness Repair Kit	418-S065	1
Pre-Terminated Wiring Harness(s)	418-066 to 418-103 inclusive	10 each
Glue Lined Heat Shrink Pack – small diameter	418-104	25 per pack
Glue Lined Heat Shrink Pack – larger diameter	418-105	10 per pack
Case Assembly Comprising – carry case, lid, inner lid, base, insert, trays foam spacers	418-106	1
Butt Splice Connector – Red	418-107	50 per pack
Butt Splice Connector – Blue	418-108	50 per pack
Butt Splice Connector – Yellow	418-109	20 per pack
Extraction Tool Handle	418-110	1
Extraction Tip Pack consists of 2 spare screws plus	418-S111	1
Tip A	418-118	1
Tip B	418-119	1
Tip C	418-120	1
Tip D	418-121	1
Tip E	418-122	1
Tip F	418-123	1
Tip G	418-124	1
Tip H	418-125	1
Tip I	418-126	1
Tip J	418-127	1
Tip K	418-128	1
Sleeve Identification Pack – for Red insulation	418-112	500
Sleeve Identification Pack – for Blue insulation	418-113	500
Sleeve Identification Pack – for Yellow insulation	418-114	500
Instruction Manual	JTP 593	1
Crimping Pliers	YRW500010	1
Wire Stripping Tool	418-117	1

Items can be ordered from:

SPX United Kingdom Limited

Ironstone Way

Brixworth

Northants

NN6 9UD

United Kingdom

Telephone: +44 (0) 1327 704461

Fax: +44 (0) 1327 706632

## Repair Methods



**CAUTION: Several different types and sizes of terminal may be found in a single electrical connector housing.**

It is necessary to identify:

- The conductor (wire) size of the affected wiring harness
- The electrical connector range from which the damaged wiring harness is to be removed
- The terminal type

Use of the approved diagnostic tool will greatly assist in the quick identification of electrical connectors and faulty pin terminal(s).

Reference can also be made to the vehicle Electrical Guides, held by Dealers, to identify wiring harness(s) and electrical connector(s).

By using the Relationship Table, the wiring harness conductor (wire) size can be related to a suitable pre-terminated wiring harness by the color of the insulation. Also, the correct length of insulation to be stripped from the wiring harness lead is identified.

### Relationship Table

CABLE RANGE	SPLICE	STRIP LENGTH
0.35 mm <sup>2</sup> to 1.50 mm <sup>2</sup>	RED	6.00 to 7.00 mm
1.00 mm <sup>2</sup> to 2.50 mm <sup>2</sup>	BLUE	6.00 to 7.00 mm
4.00 mm <sup>2</sup> to 6.00 mm <sup>2</sup>	YELLOW	9.00 to 9.50 mm

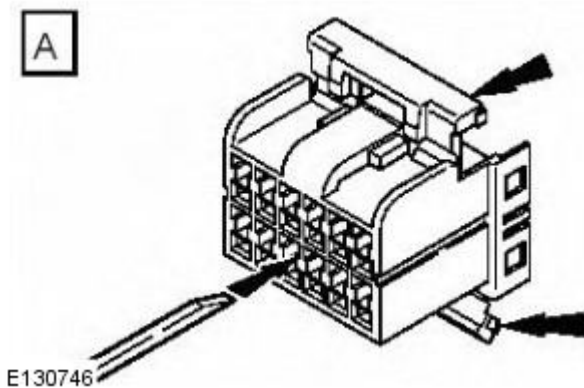
### Electrical Connector Terminal Extraction

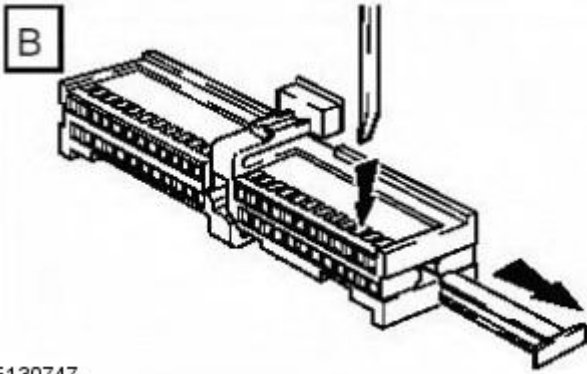
It must be noted that some electrical connector(s) have anti-backout devices which prevent the terminals from being removed from the electrical connector. Some examples of these are shown in following illustrations. The anti-backout device must be released before attempting to remove the terminal from the electrical connector. Some anti-backout devices require a special tip to release the device and these have been included in the kit. Most can be released by carefully using a suitable small screwdriver.

Various types of electrical connector have seals installed internally or externally to prevent moisture ingress. These normally do not have to be removed but make sure that they are installed when the electrical connectors are connected.

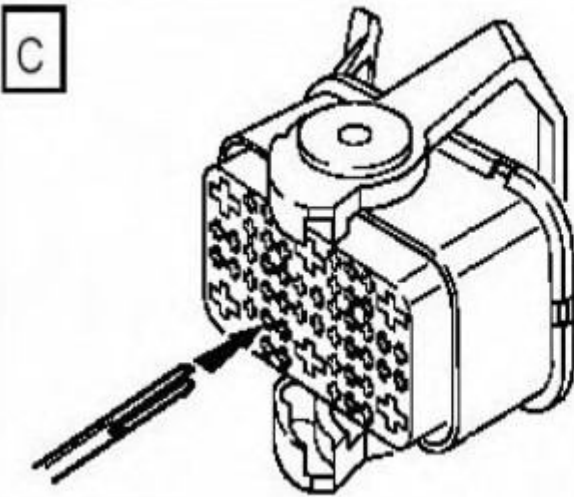
The illustrations show examples of each tip used on different types of electrical connector(s). There are a large number of different types of electrical connector used on vehicles therefore only one example using each tip is shown. Technicians experience and judgement will dictate which type of tip should be used for those electrical connector(s) which are not shown. Care should be exercised to avoid further damage when removing the terminals from the electrical connector.

- **NOTE: Examples of the extraction tips and anti-backout tips.**

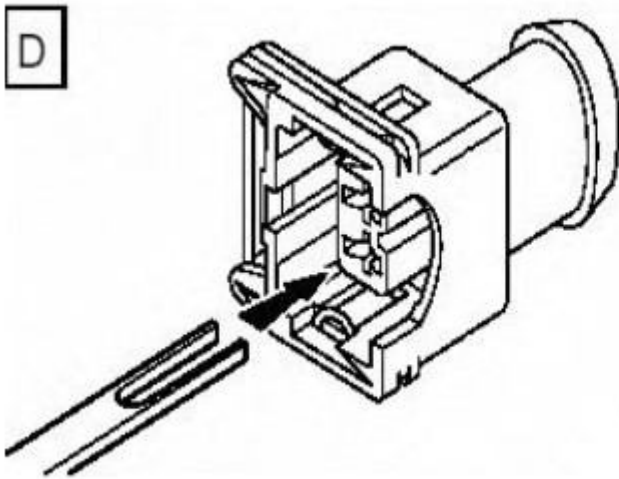
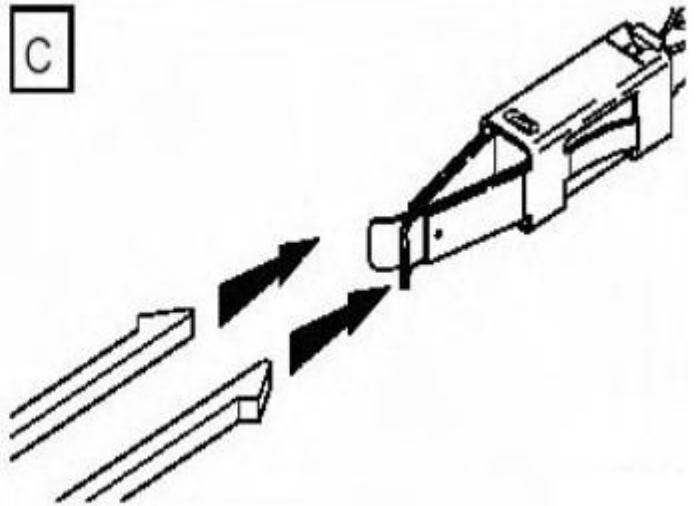




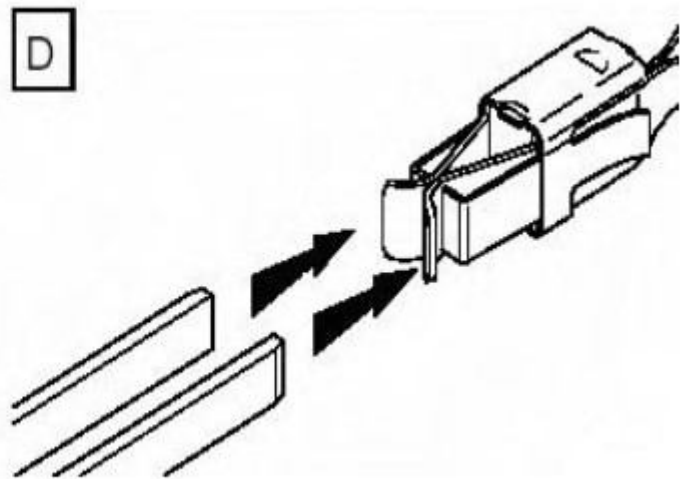
E130747



E130748

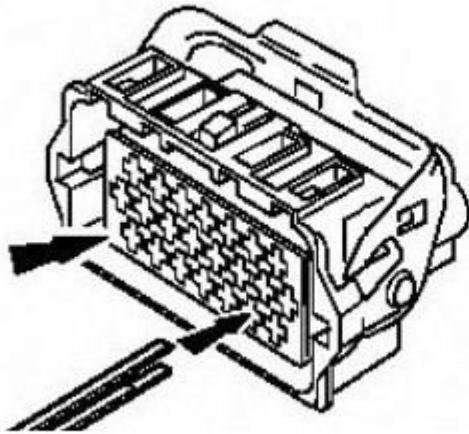


E130749

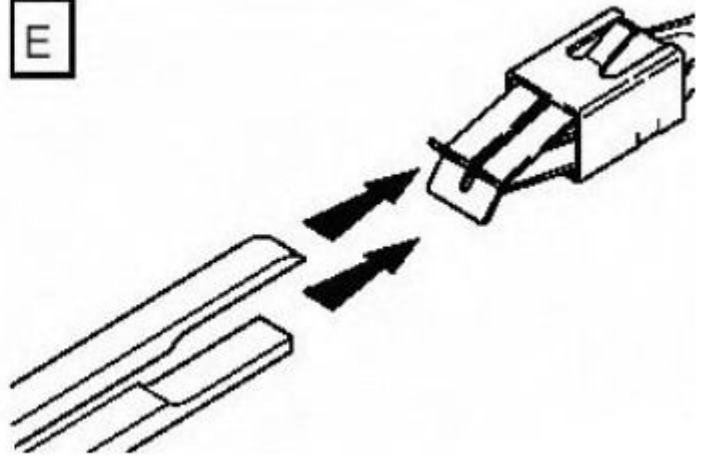




E

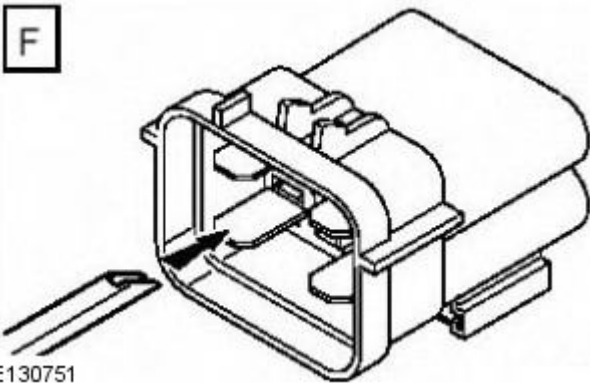


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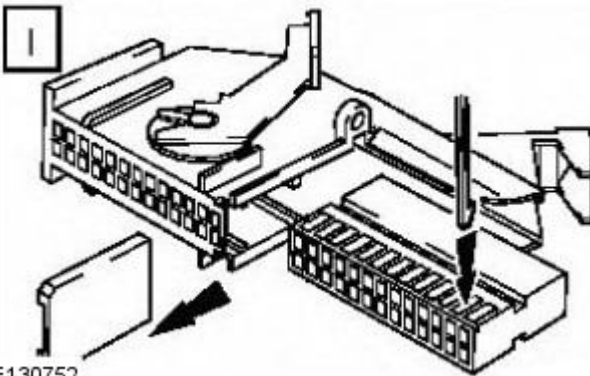
E130750

F

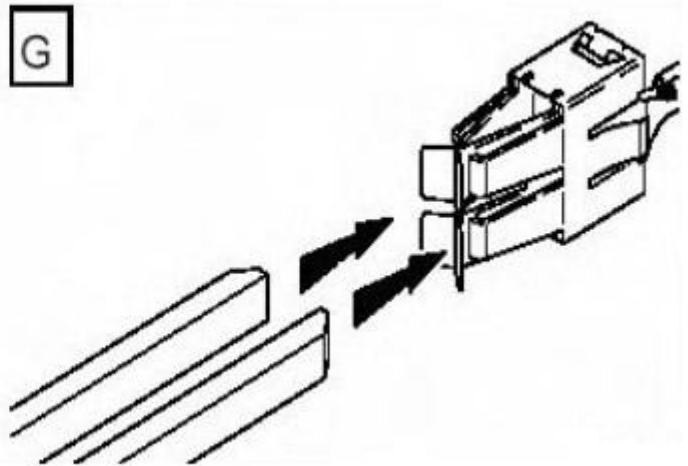
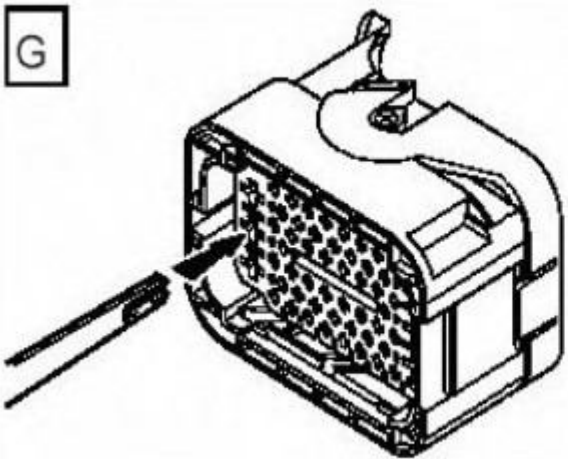


E130751

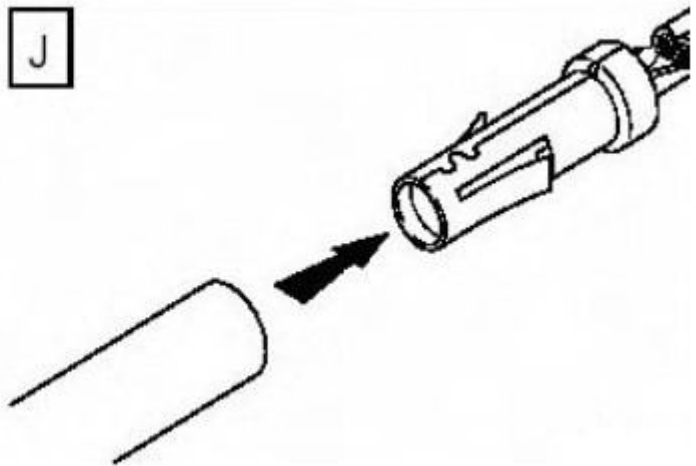
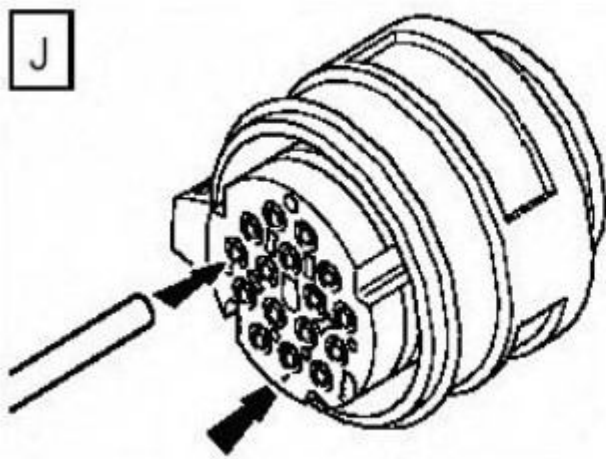
I



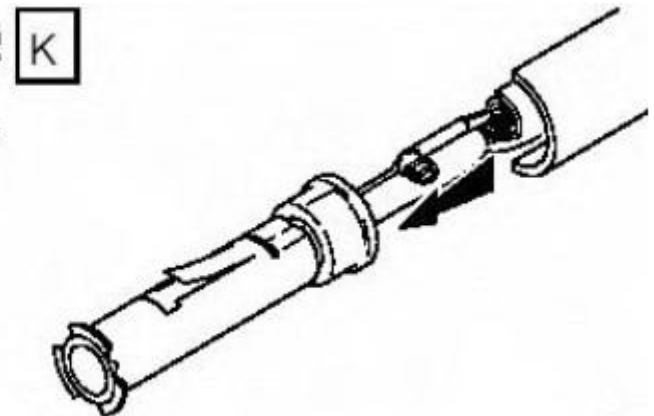
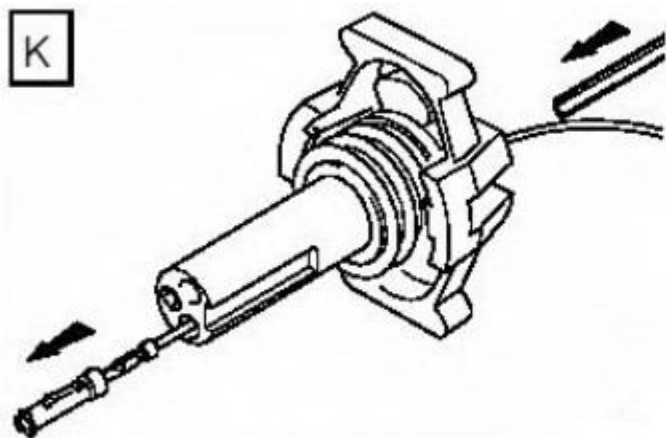
E130752



≡130753



≡130754



≡130755

• NOTE: The chart shows the electrical connector types, terminal pins/sockets, extractor tip and anti-backout tip.

Electrical connector terminal type	Pin or socket	Extractor tip	Anti-backout tip
Multilock 040 series	D	A	
Multilock 040 series	B	A	
Multilock 070 series	B	B	

Electrical connector terminal type	Pin or socket	Extractor tip	Anti-backout tip
Multilock 040 series	D	B	
Econoseal III 070 series	D	B	
Econoseal III 070 series	B	B	
Econoseal III 070 series	B	B	
Econoseal III J2	D	B	
Econoseal III 250 series	B	F	
Econoseal III 250 series	D	B	
Econoseal III 250 series	B	F	
Econoseal III 250 series	D	B	
Micro-timer II 1.5mm	D	C	
Micro-timer II 1.5mm	B	C	
Std power timer 4.8 flat	D	G	
Std power timer 5.8 flat	B	D	
Std power timer 5.8 flat	B	D	
Std power timer 2.8 flat	D	D	
Std power timer 4.8 flat	D	G	
Std power timer 5.8 flat	B	D	
Ford 2.8 flat	D	E	H
Multilock 070 series	D	B	
Multilock 070 series	B	B	
Junior power timer 2.8 flat	D	D	
Sumitomo TS90 connector	B	B	H
Modu IV gold plated	D	B	
Multilock 040 series gold plated	D	A	
Micro qualock	D	I	
EECV	D	B	
EECV	D	B	
Kostal dia 1.50 series	D	J	
AMP 6.3 flat	D	B	
Junior power timer 2.8 flat	D	D	
2.8 series	D	B	I
Sumitomo TS90 connector	D	B	H
Ducon 0.60 gold plated	D	K	
AMP 6.3 flat	D	D	
Econoseal III 250 series	B	F	

## Repair Procedure

### • CAUTIONS:



Do not use crimping pliers, insulation strippers, butt splice connectors, heat shrink sleeves or pre-terminated wiring harness(s) that are not supplied with the Jaguar wiring harness repair kit. Each part has been designed to be used only with the other parts in this wiring harness repair kit.



Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

It is not correct to make more than five repair joints on the wiring harness to any electrical connector and if more damage is found at the same electrical connector then a new wiring harness must be installed.

- Remove the faulty terminal from the electrical connector using the extractor tool and correct tip. Make sure that any anti-backout device is released before trying to remove the terminal.
- **CAUTION:** : A number of electrical connector terminals are gold plated or gold flashed. When defective, they must be installed with a gold pre-terminated wiring harness(s) from the wiring harness repair kit. It is not always easy to identify the female as gold but the male pins are visually easier, therefore always check both male and female terminals to identify those which are gold. Under no circumstances are gold and tin terminals to be mixed as this will lead to early failure of the electrical contact.
  - **NOTE:** Never use a harness lead with a smaller diameter than the original harness lead.


Select the correct size and type of pre-terminated wiring harness and butt splice connector from the wiring harness repair kit.

- Using the wire cutter on the stripping tool, cut the pre-terminated wiring harness and the harness cable to the required length.
- **NOTE:** See illustration: **Stripping Insulation**

From the Relationship Table, find the correct length of insulation to be stripped from the pre-terminated wiring harness and set the adjustable cable length stop to the correct length. Place the pre-terminated wiring harness in the wire stripper and remove the insulation.

- Put the cable identification sleeve(s) on to the wiring harness with the main cable colour nearest to the terminal.
- During this next step do not overtighten. Place the selected butt splice connector in the crimping tool, matching the aperture and the butt connector colours. Make sure that the window indentation in the butt connector is resting over the guide bar on the lower jaw. Partially close the grip until the butt connector is securely held in the aperture. This will give support to the butt connector while the pre-terminated wiring harness is inserted into it.
- **NOTE:** See illustration: **Splice Correctly Located**

Insert the pre-terminated wiring harness into the butt connector and make sure that the wire is against the wire stop. Close the grip firmly, crimping the lead to the butt connector. When the handles have been completely closed the butt connector will be freed from the tool as the handles are released. If the handles have not been completely closed then the jaws will hold the butt connector and it cannot be removed from the tool until the crimp is fully made by closing the handles completely.

- Make sure that the harness cable has been squarely cut and the correct length of insulation removed. If more than one splice is needed the butt connectors must be not be crimped to the wiring harness at the same distance from the connector. The splices must be staggered to prevent a bulk of splices in the same area of the wiring harness.
- It is preferable to cover the butt splice joint with heat shrink sleeve. This is desirable not essential, except where the electrical connector is a sealed electrical connector. Use the smaller diameter sleeve for red and blue pre-terminated wiring harness(s) and the large diameter sleeve for the yellow pre-terminated wiring harness(s). It is advisable to place the heat shrink over the completed joint but in some instances the sleeve will not pass over the terminal. Check, and if required, place the correct size sleeve onto the harness cable or pre-terminated wiring harness before crimping the butt splice to the wiring harness.
- Place the harness cable into the butt splice with the splice window over the guide bar. Make sure that the cable harness wire is against the stop in the butt splice, crimp the butt splice connector to the wiring harness.
- Gently pull the harness cables each side of the butt splice to make sure that a secure joint has been made.
-  **WARNING:** Do not use a naked flame in areas where fuel or oil have been spilt. Clean the area of residual oil and fuel and wait until the fuel spill has fully evaporated.

• CAUTIONS:



When using a heat source make sure that it is localised and causes no damage to surrounding materials.

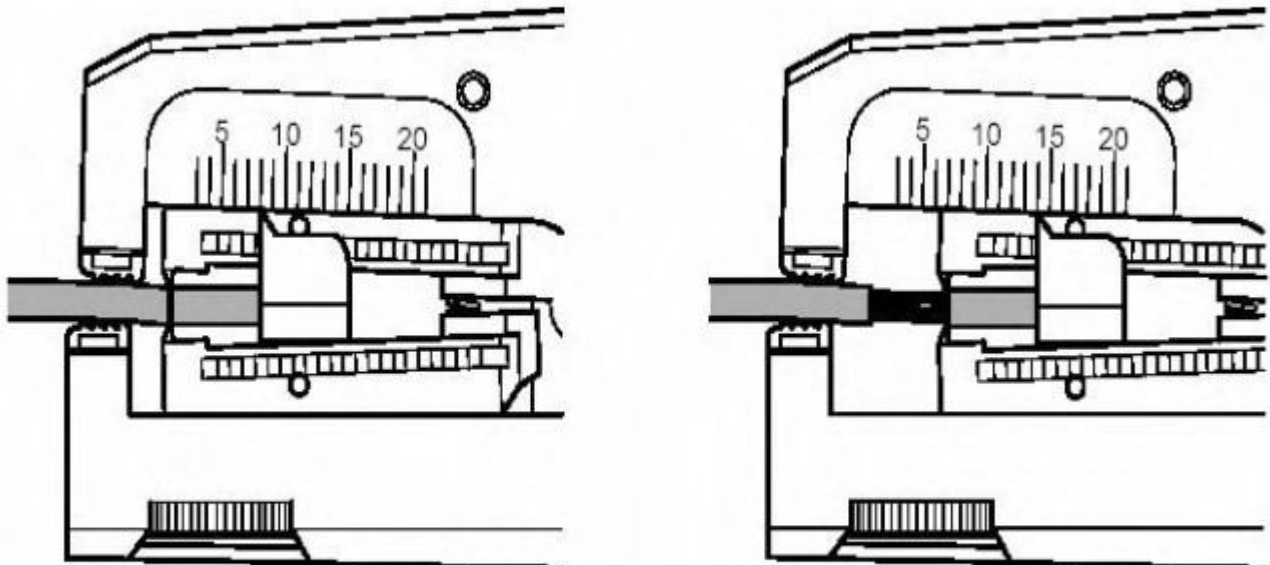


Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

Using a suitable heat source, shrink the sleeve over the butt splice.

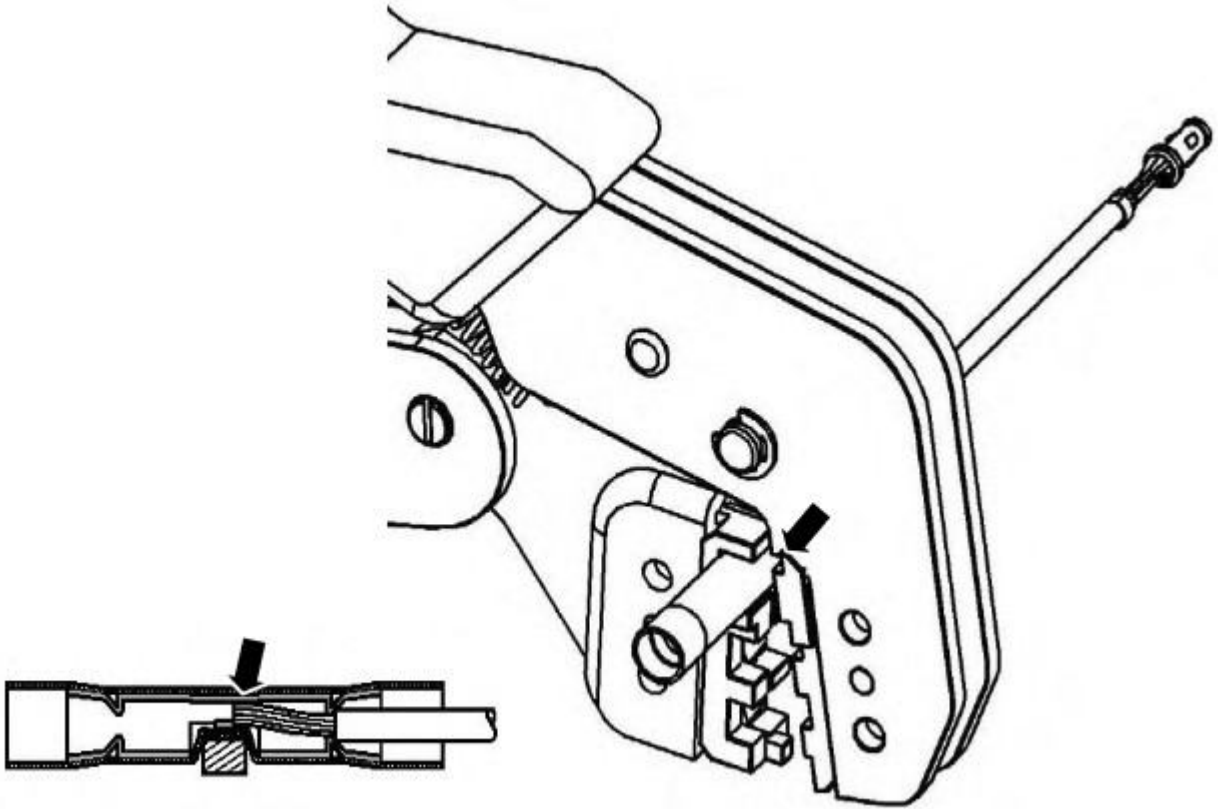
- If further pre-terminated wiring harness(s) are to be installed to the same electrical connector, make sure that the lead is cut at a different length to the previous joint. This makes sure that the splices will, where possible, be staggered on the wiring harness and prevent a bulk of splices in one area.
- When all of the splices have been made, fit the terminal(s) to the electrical connector, taking care that the terminals are correctly orientated.
- Install the wiring harness cover and secure with adhesive electrical tape. Do not cover the wiring harness right to the electrical connector as the terminals must have a little movement and not be firmly bound to the electrical connector or wiring harness. Make sure that the cable identification sleeve(s) are showing at the wiring harness electrical connector.

### Stripping Insulation



E130756

Splice Correctly Located



E130757

# Wiring Harnesses - Wiring Harness Repair

General Procedures


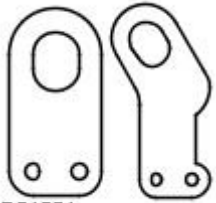

1. For additional information, refer to: [Wiring Harness](#) (418-02 Wiring Harnesses, Description and Operation).



# Wiring Harnesses - Engine Wiring Harness TDV6 2.7L Diesel

Removal and Installation

## Special Tool(s)

 <p>303-021</p>	<p>303-021 Engine support bracket</p>
 <p>E54554</p>	<p>303-1129 Engine Lifting Brackets</p>
 <p>303-703</p> <p>E95037</p>	<p>303-703 Wrench, Accessory Belt Tensioner</p>

## General Equipment

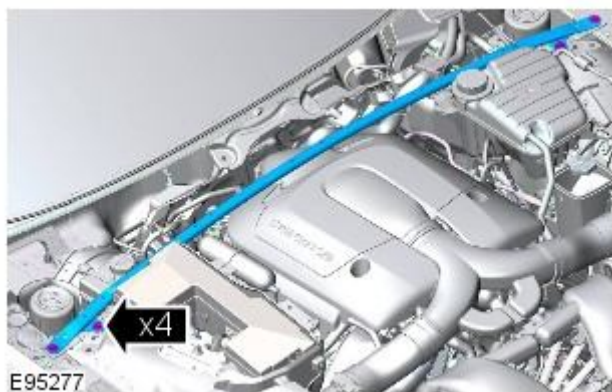
Powertrain Jack

## Removal

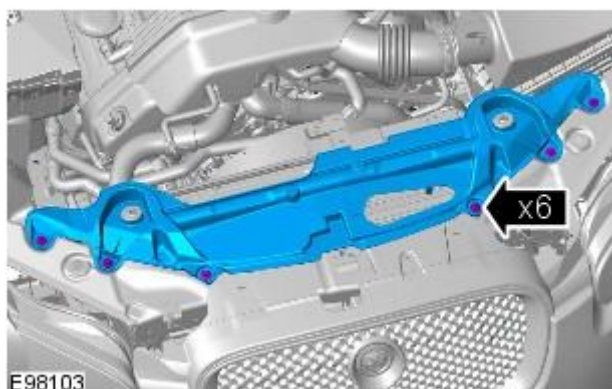
1. Refer to: [Specifications](#) (414-01 Battery, Mounting and Cables, Specifications).
2. Refer to: [Cowl Vent Screen](#) (501-02 Front End Body Panels, Removal and Installation).

3. **3.** NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

*Torque:* 25 Nm

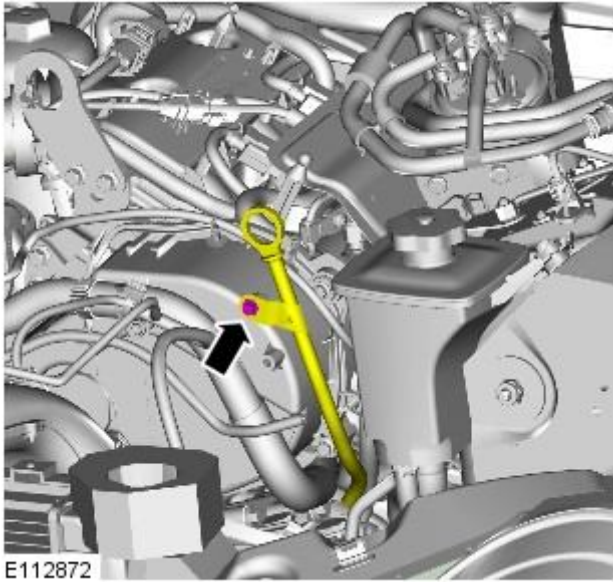


- 4.

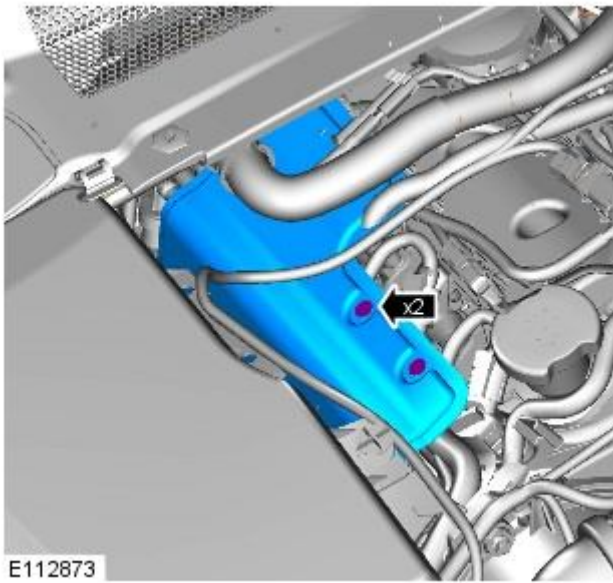


5. Refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel,

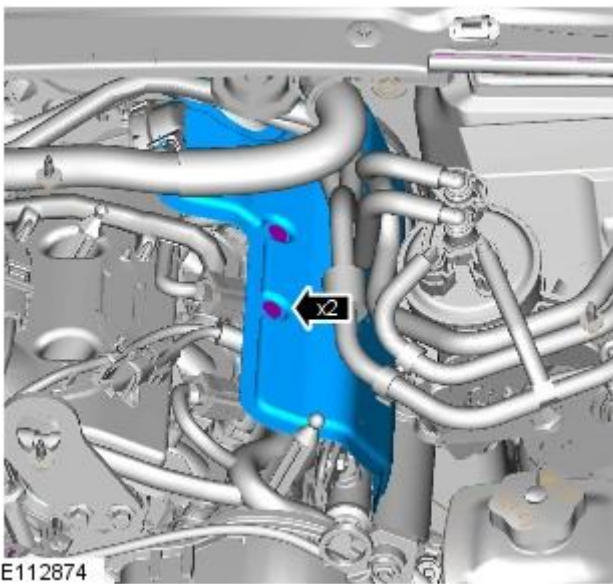
6. Torque: 4 Nm




7.



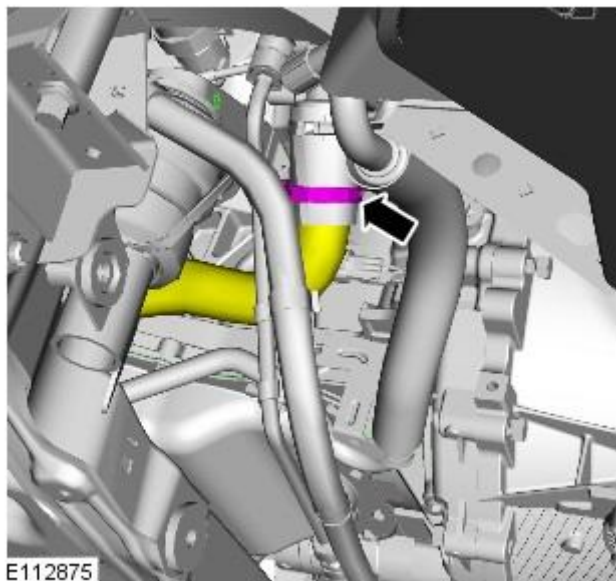
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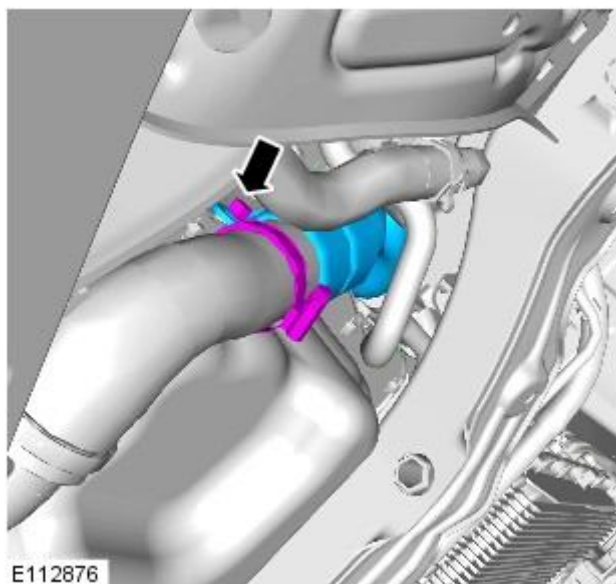
9. Refer to: [Exhaust Gas Recirculation \(EGR\) Valve Outlet Tube](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Removal and Installation).

10.  **WARNING:** Make sure to support the vehicle with axle stands.  
Raise and support the vehicle.

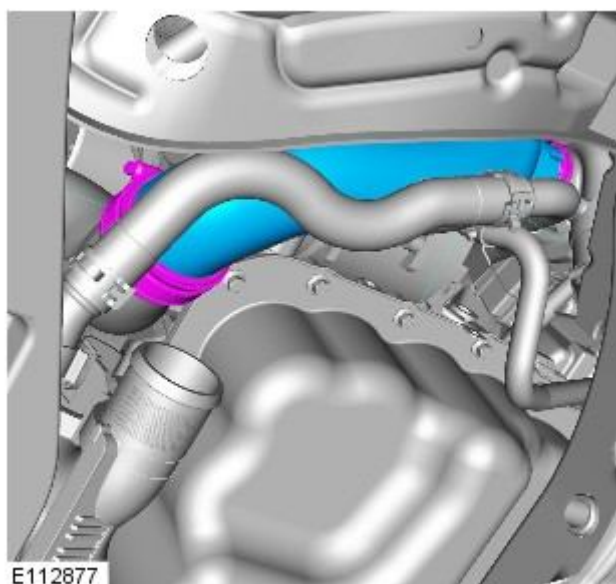
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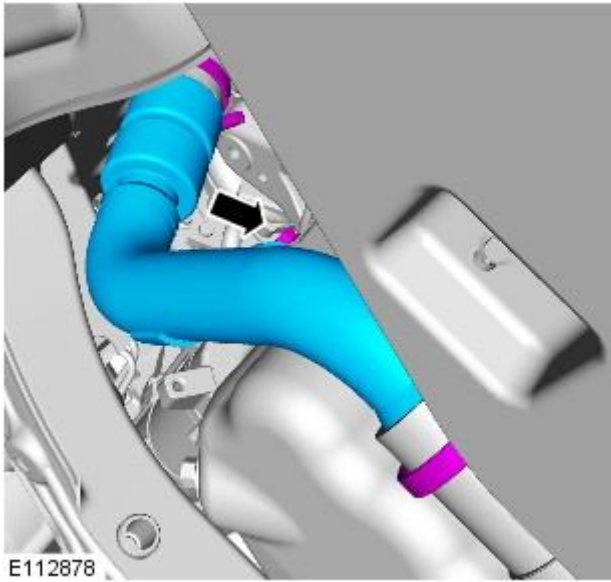
12. *Torque:* 10 Nm



13.

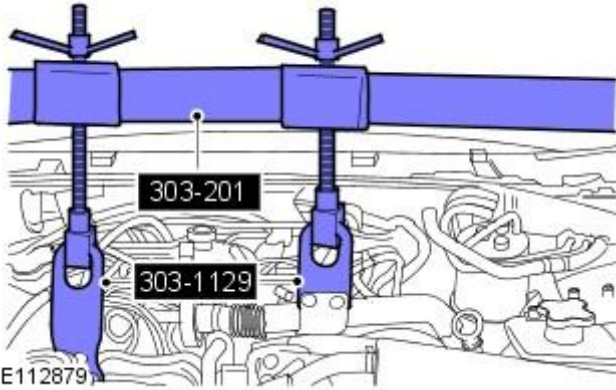


14. Torque: 22 Nm



E112878

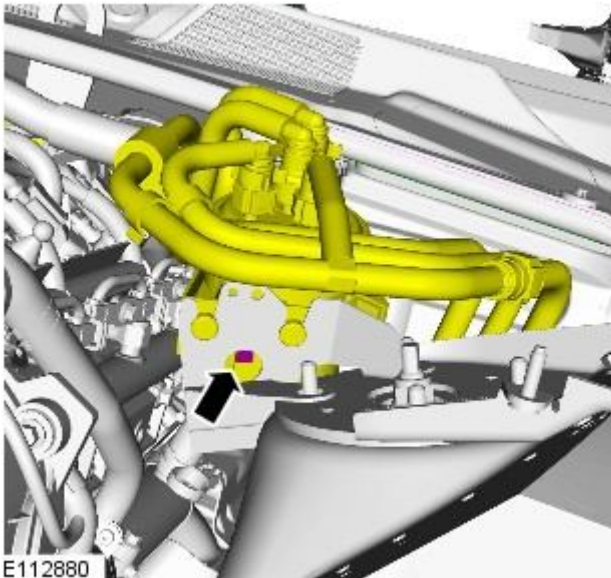
15. Lower the vehicle.



E112879

16. *Special Tool(s)*: [303-021](#), [303-1129](#)

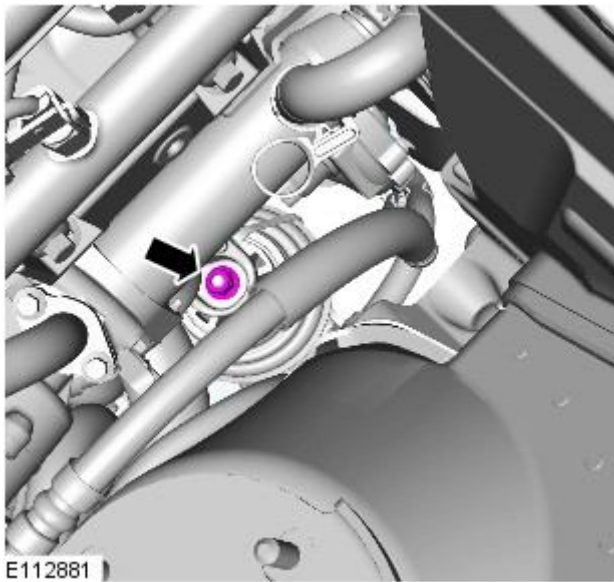
17.



E112880

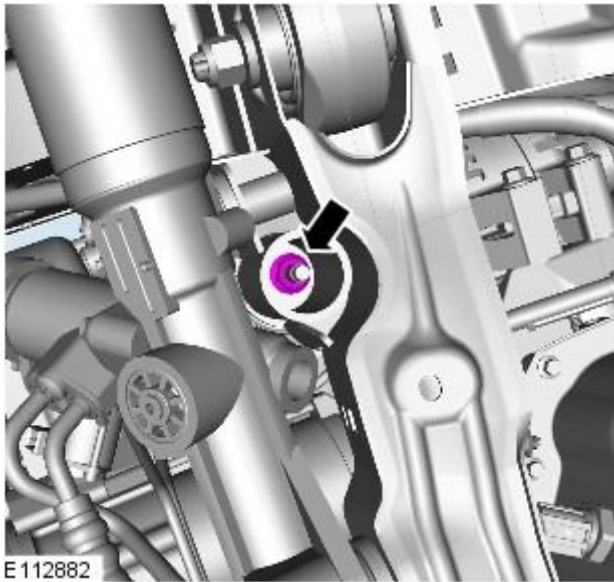


18. Torque: 47 Nm



19. Raise the vehicle.

20. Torque: 63 Nm

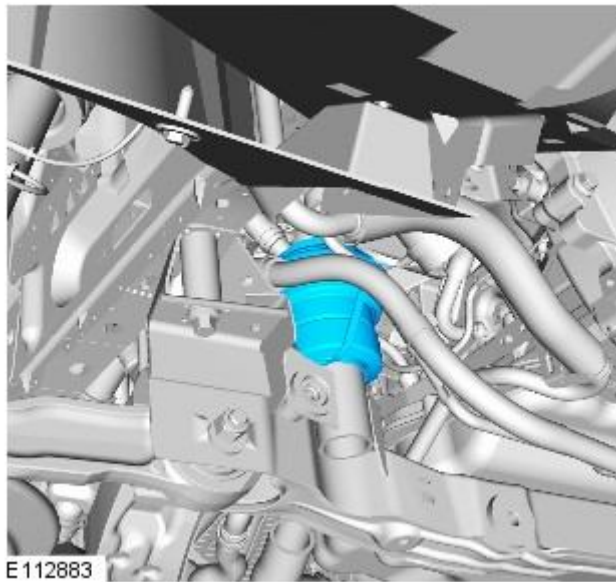


21. Raise the engine.

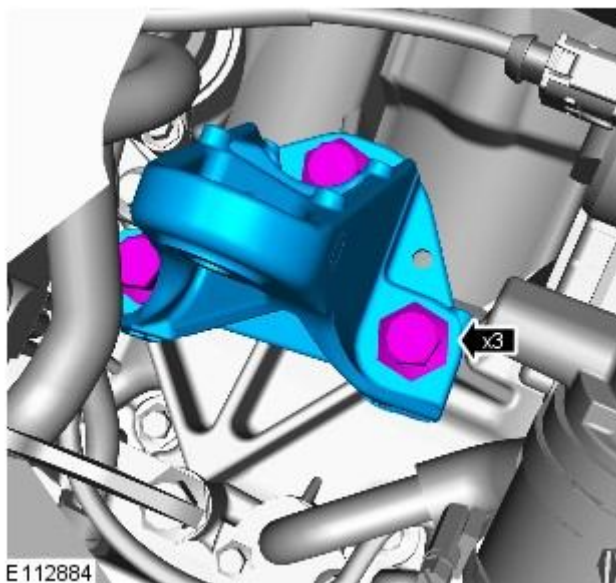
General Equipment: [Powertrain Jack](#)



22.




23. Torque: 110 Nm



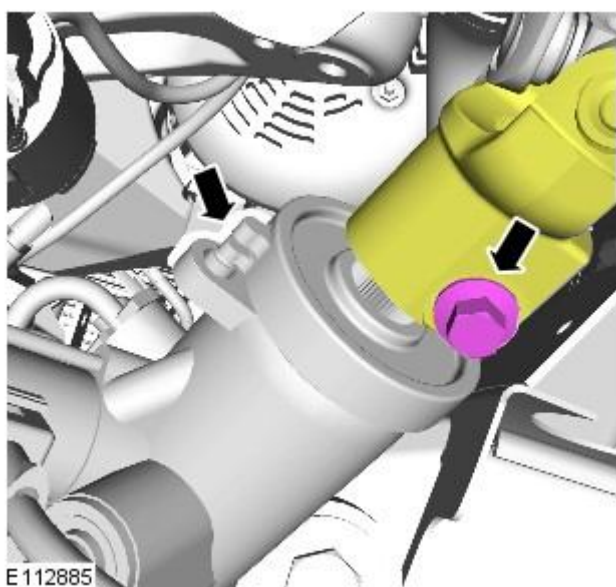
24. **24. CAUTIONS:**

 Make sure the alignment mark on the steering gear pinion seal protection cover is central to the steering gear pinion casting.

 Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

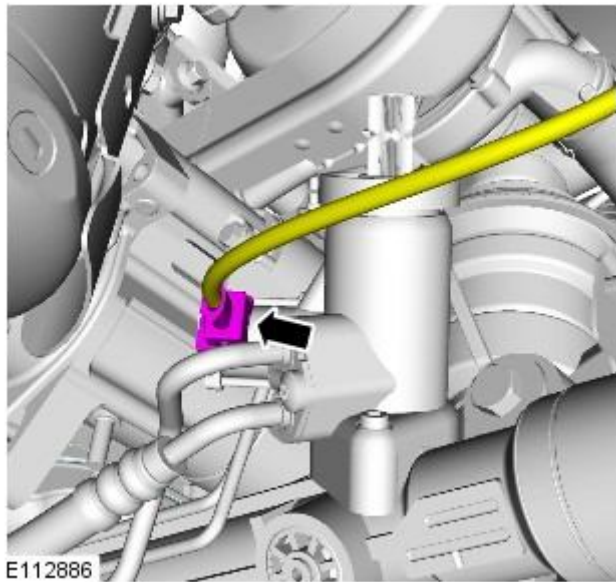
 Make sure that a new bolt is installed.

Torque: 35 Nm

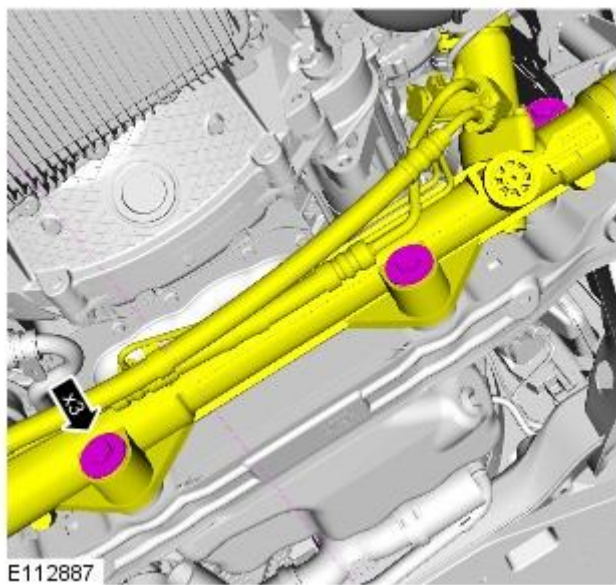




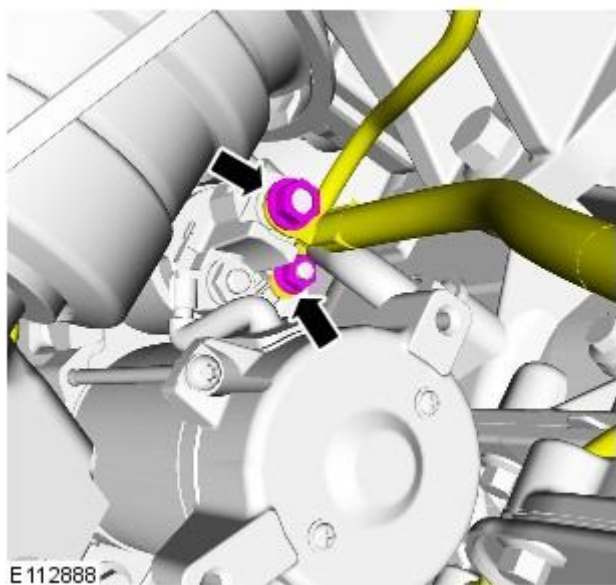
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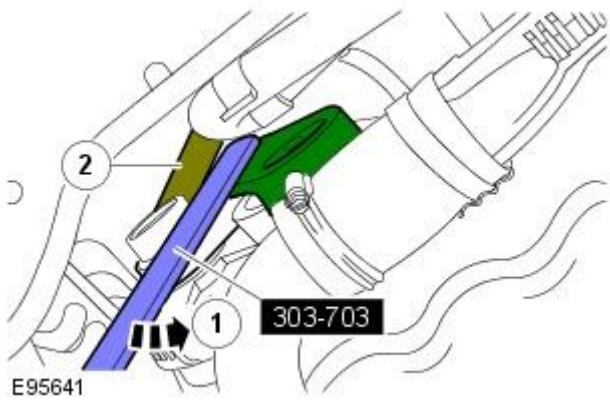
26. **26.**  CAUTION: Make sure to support the steering gear.  
*Torque: 100 Nm*



27.

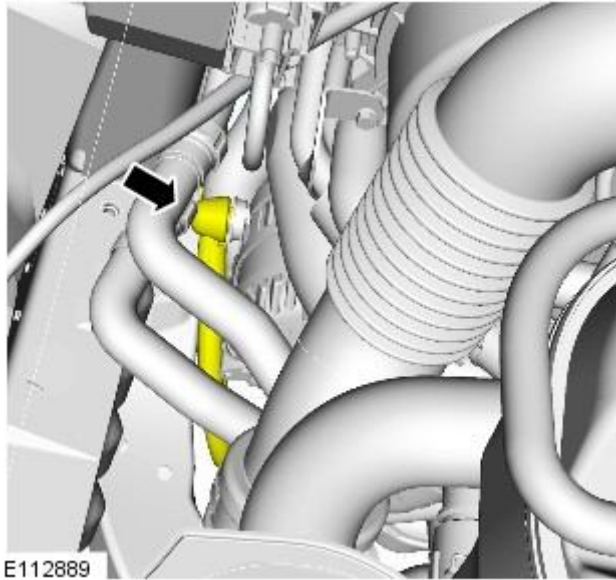


28. Special Tool(s): [303-703](#)



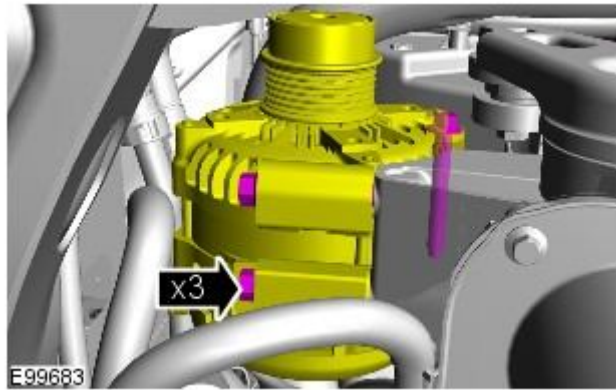
E95641

29. Torque: 12 Nm



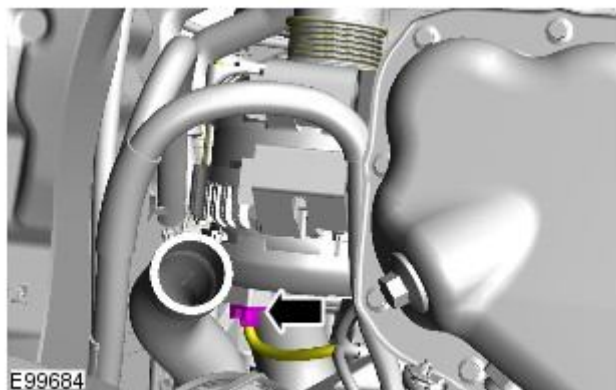
E112889

30. Torque: 47 Nm



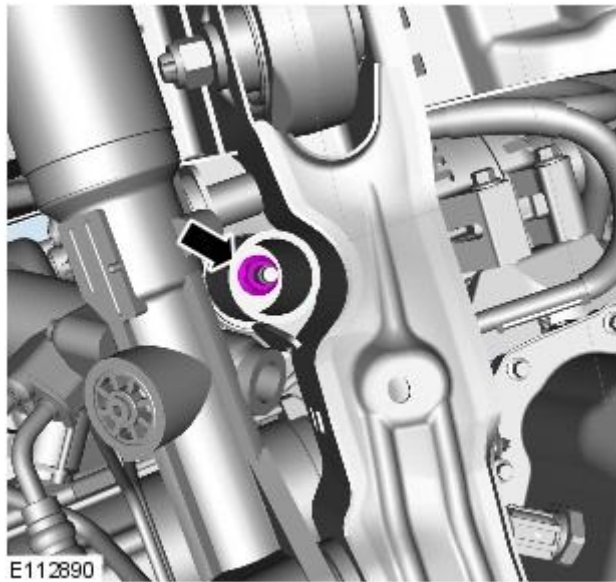
E99683

31.

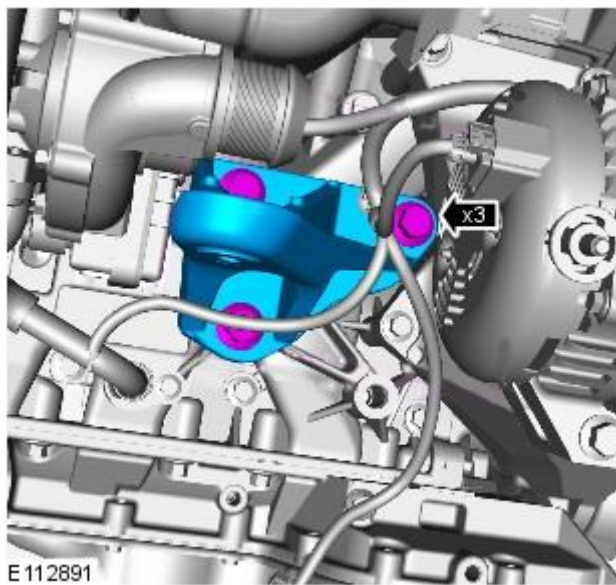


E99684

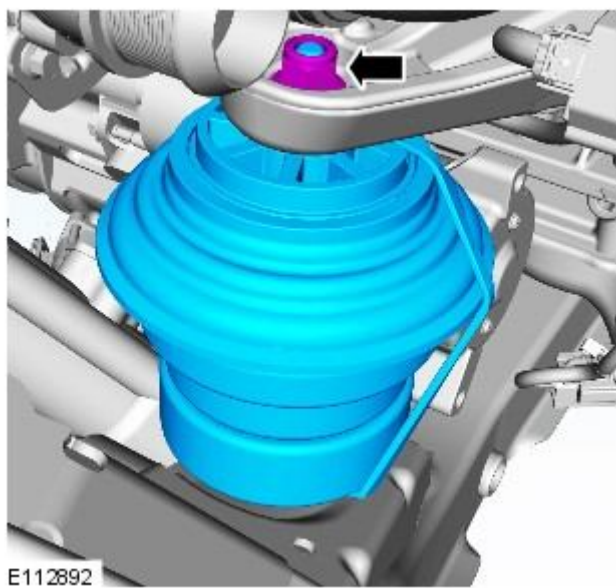
32. Torque: 63 Nm



33. **33.** NOTE: Component illustrated, removed for clarity.  
Torque: 110 Nm



34. Torque: 48 Nm



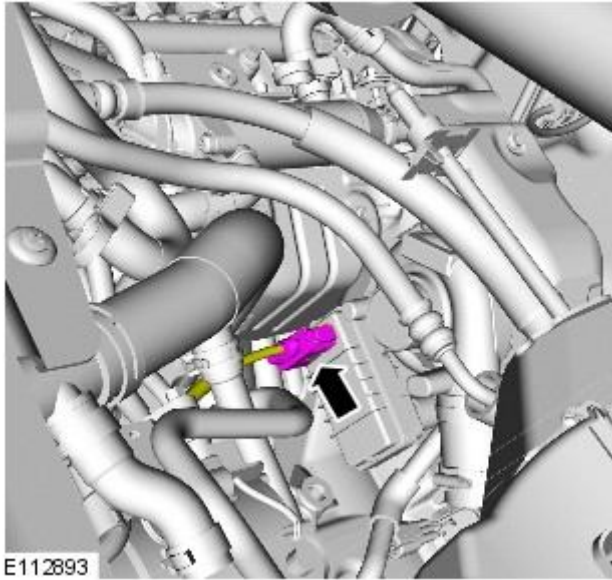


35. Lower the engine.

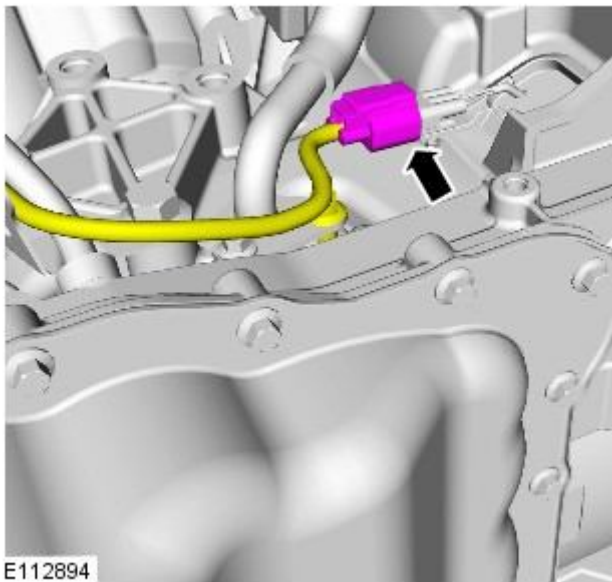
General Equipment: [Powertrain Jack](#)



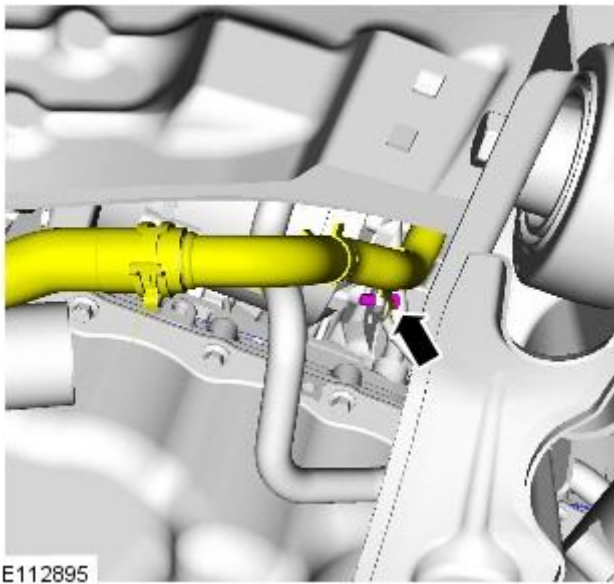
36.



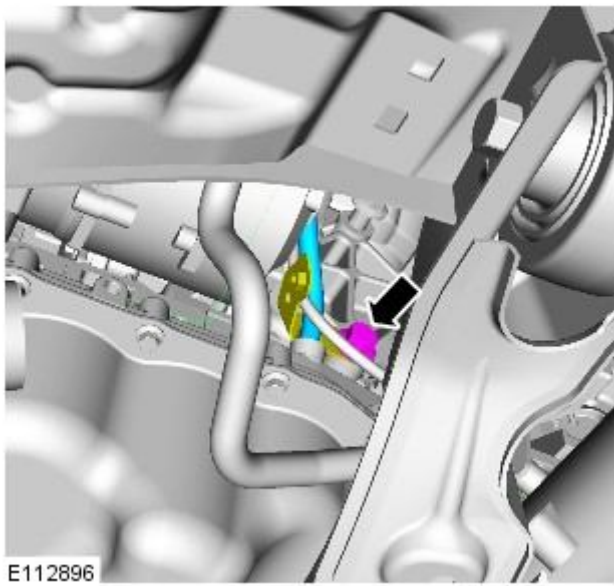
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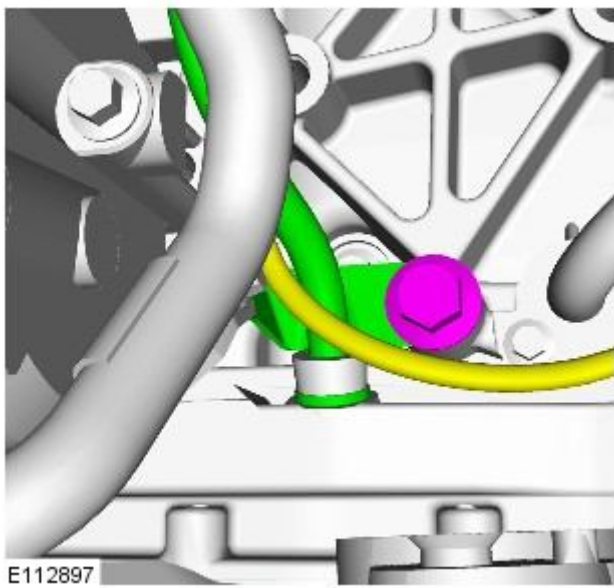
38. Torque: 10 Nm



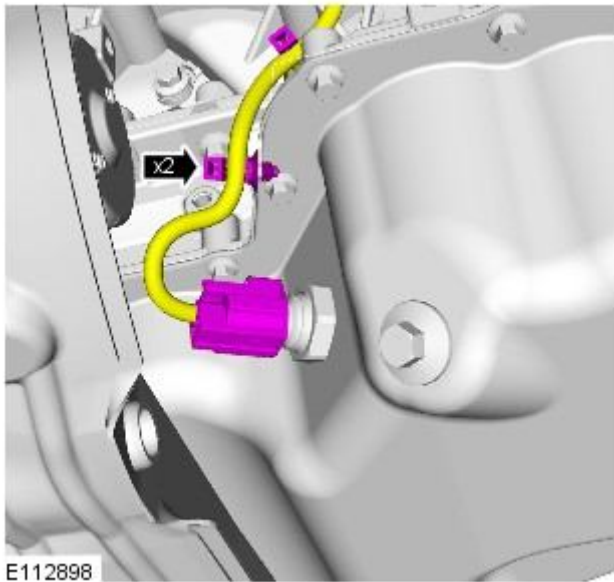
39. Torque: 25 Nm



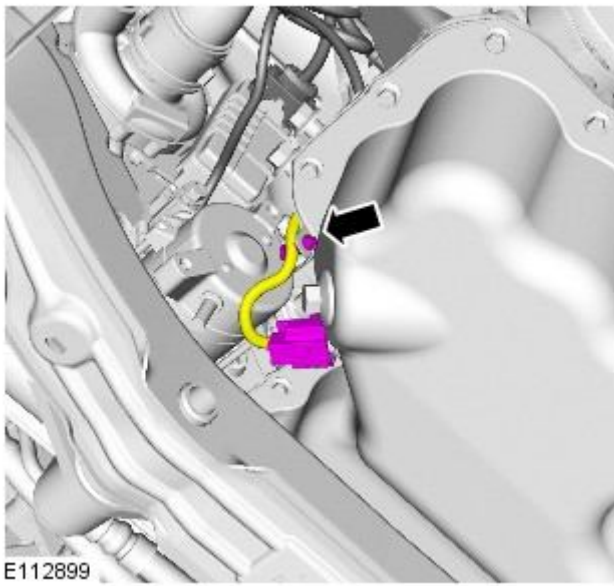
40.



41.

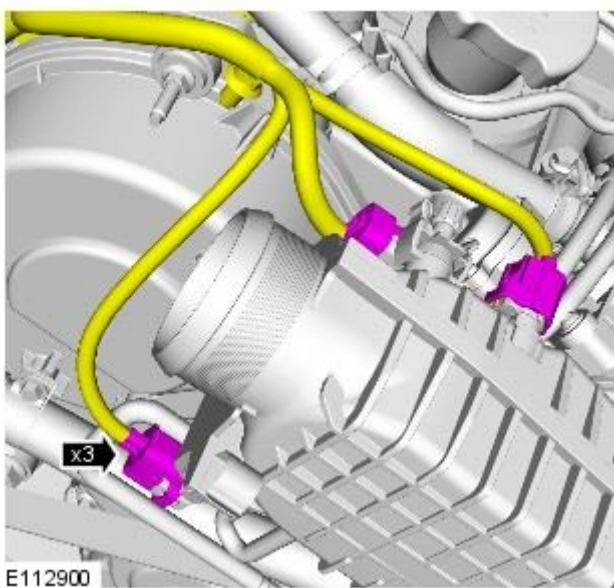


42.



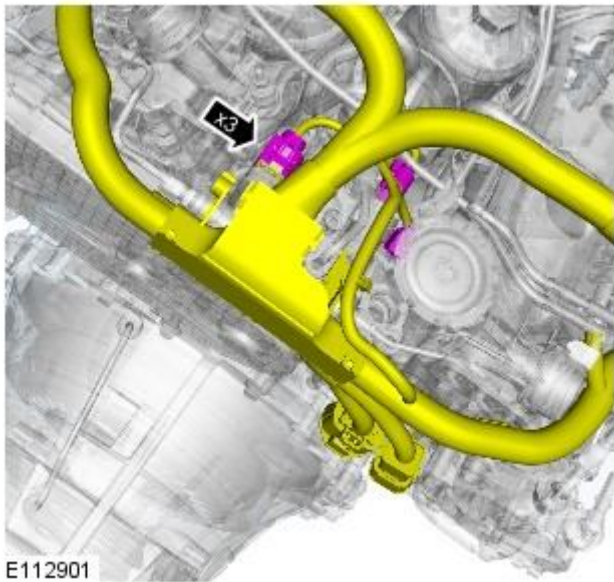
43. Lower the vehicle.

44.

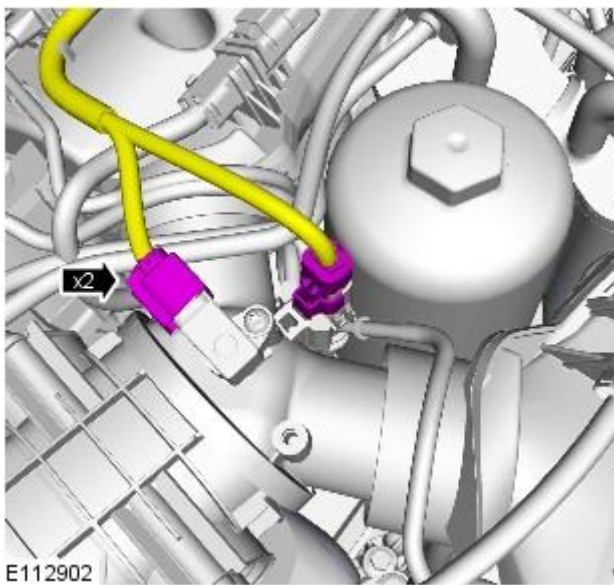




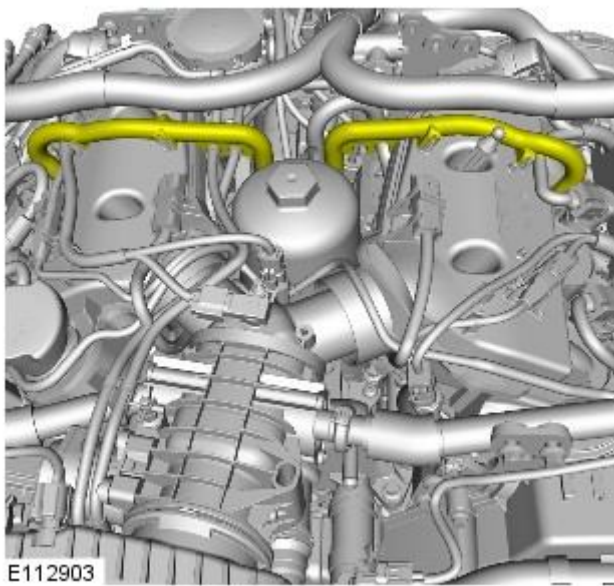
45.



46.

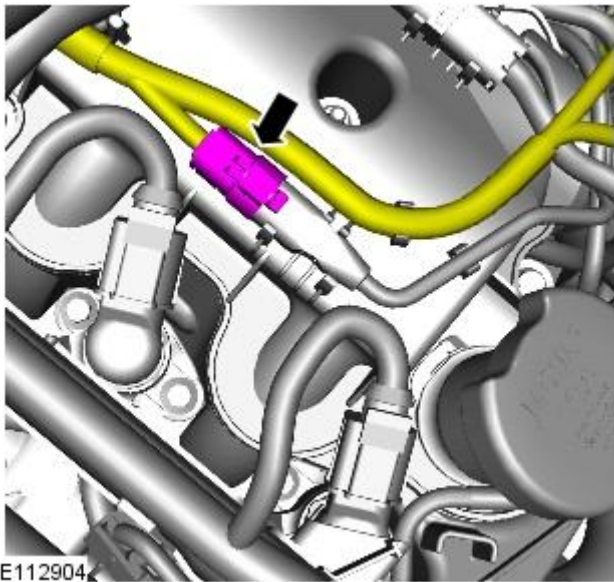


47.

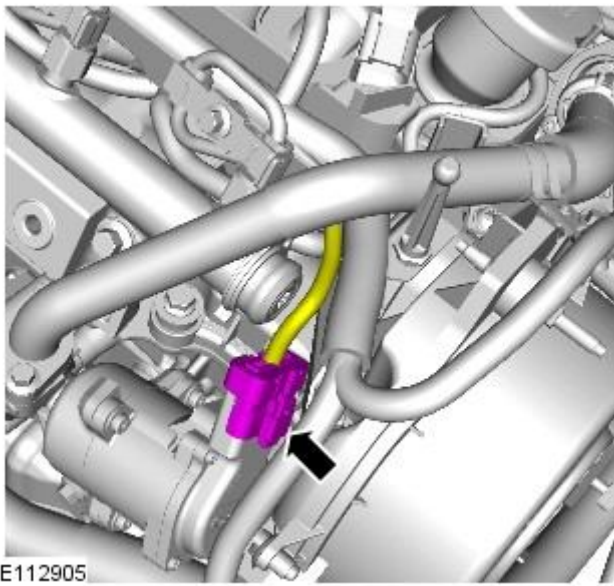


48. Release the engine wiring harness from below the vacuum hoses.

49.



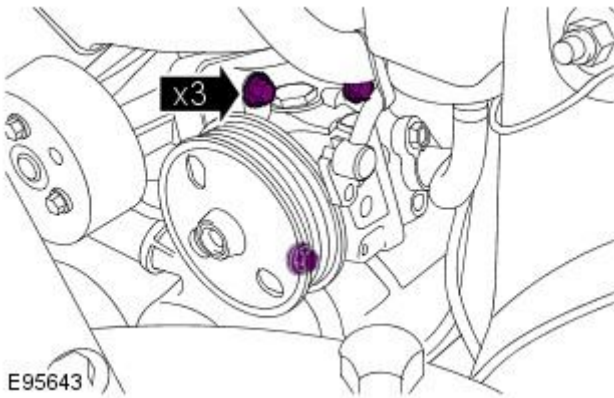
50.



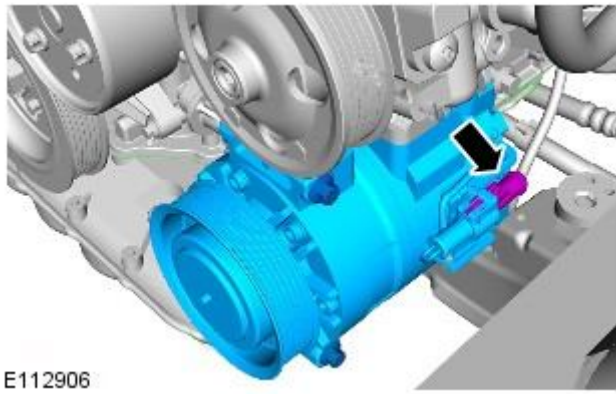
51. Release the engine wiring harness from the RH side of the engine.

52. Position the RH engine wiring harness on top of the engine.

53. *Torque:* 25 Nm

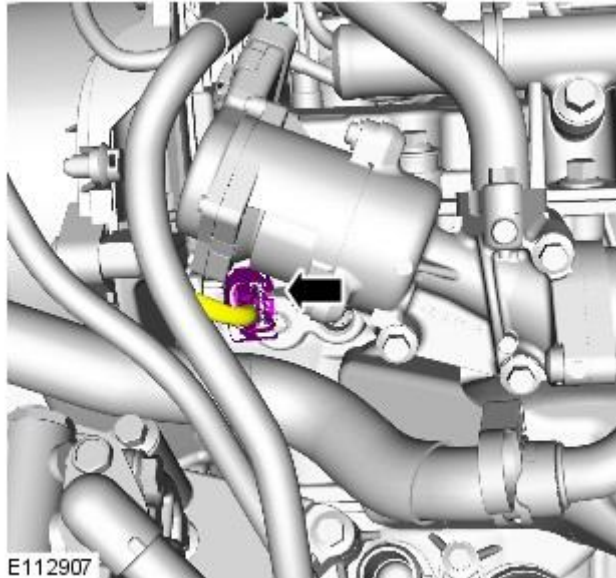


54.



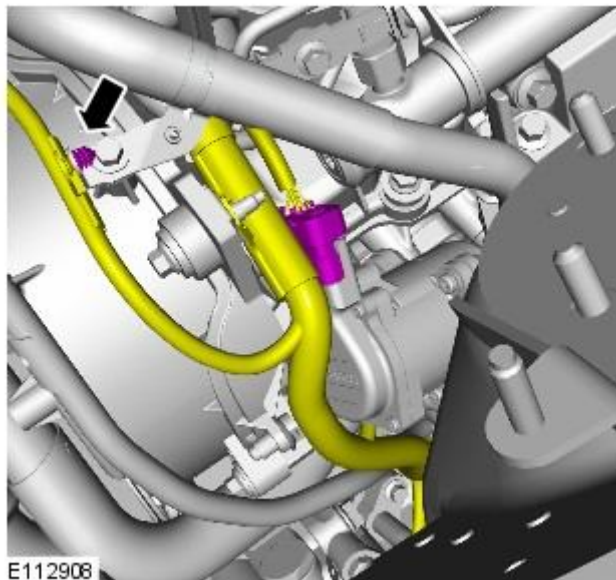
E112906

55.



E112907

56.

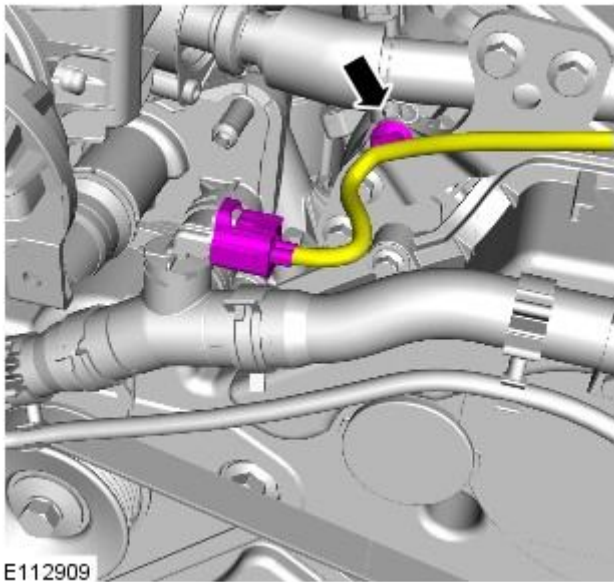


E112908

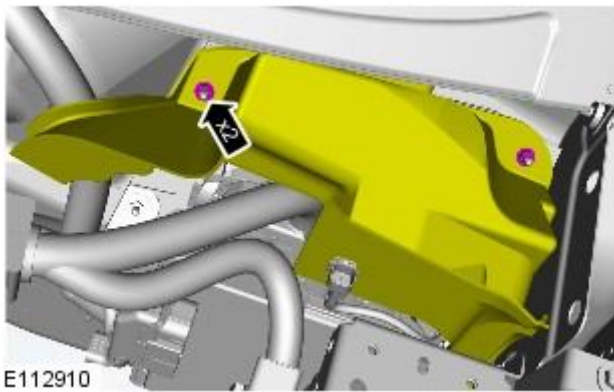
57. Release the engine wiring harness from the LH side of the engine.



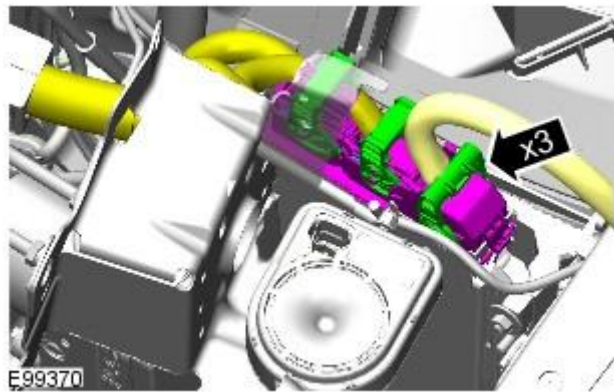
58.



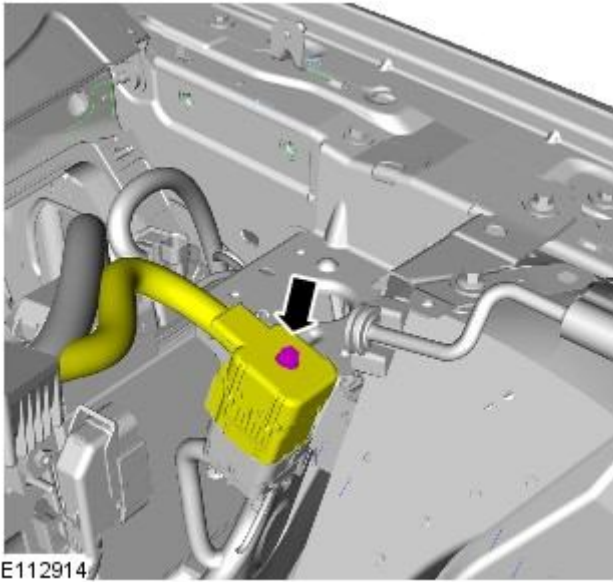
59. *Torque: 6 Nm*



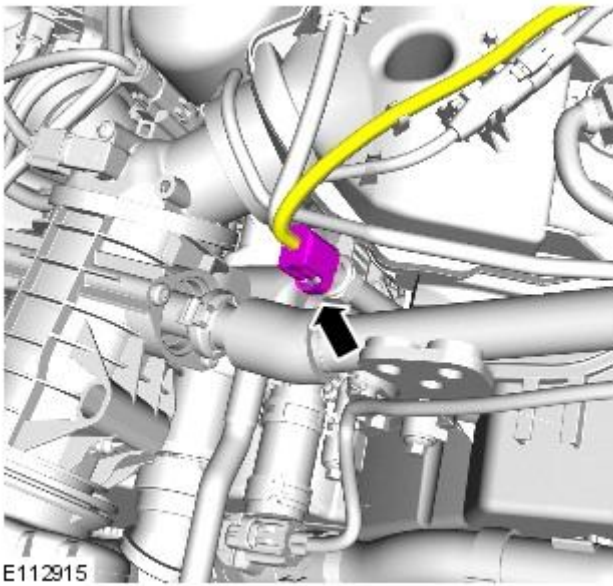
60.



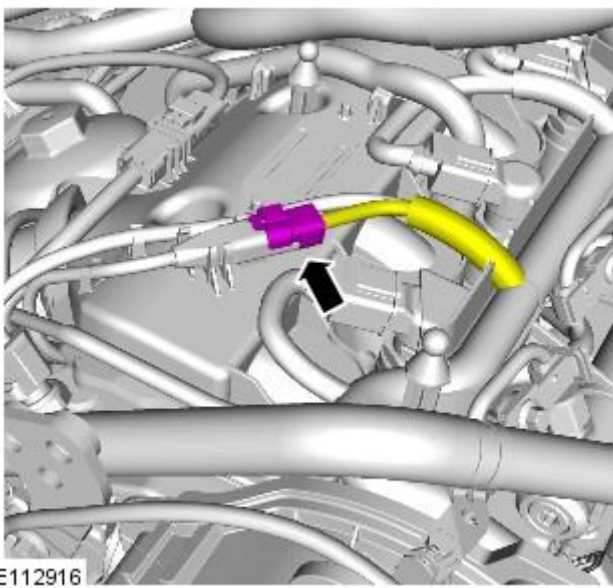
61. Torque: 10 Nm



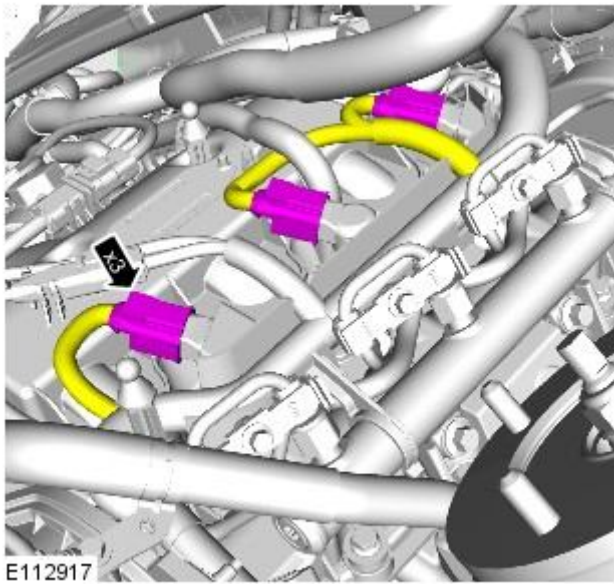
62.



63.



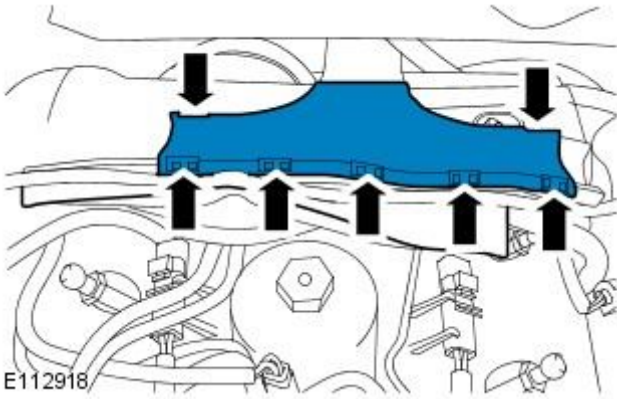
64.



E112917

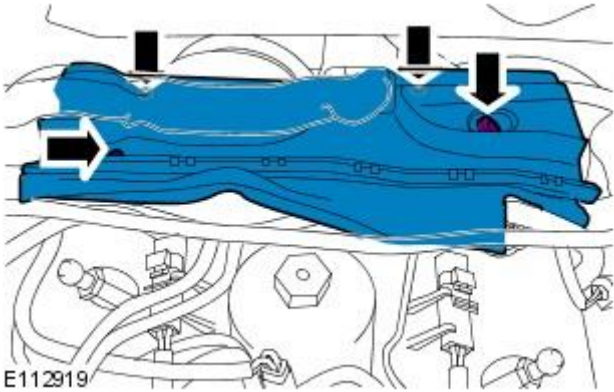
65. Release the engine wiring harness from beneath the fuel pipes.

66.



E112918

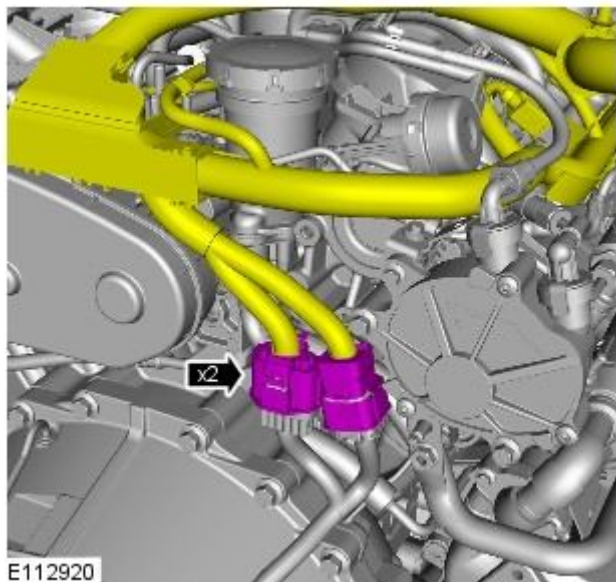
67. Torque: 10 Nm



E112919



68.



69. Remove the engine wiring harness.

## Installation

1. To install reverse the removal procedure.

# Wiring Harnesses - Luggage Compartment Lid Wiring Harness

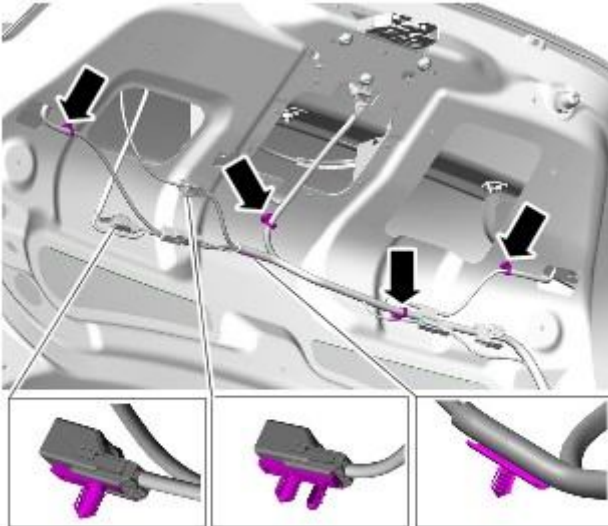
Removal and Installation

## Removal

1. Remove the luggage compartment lid trim panel.

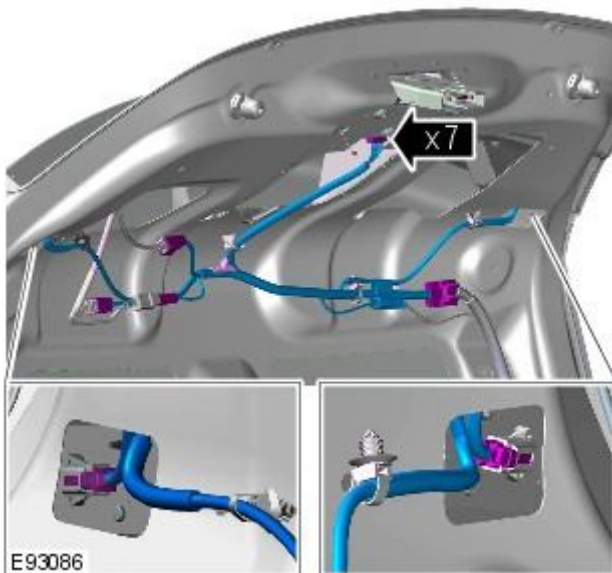
Refer to: [Luggage Compartment Lid Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

- 2.



E93085

- 3.



E93086

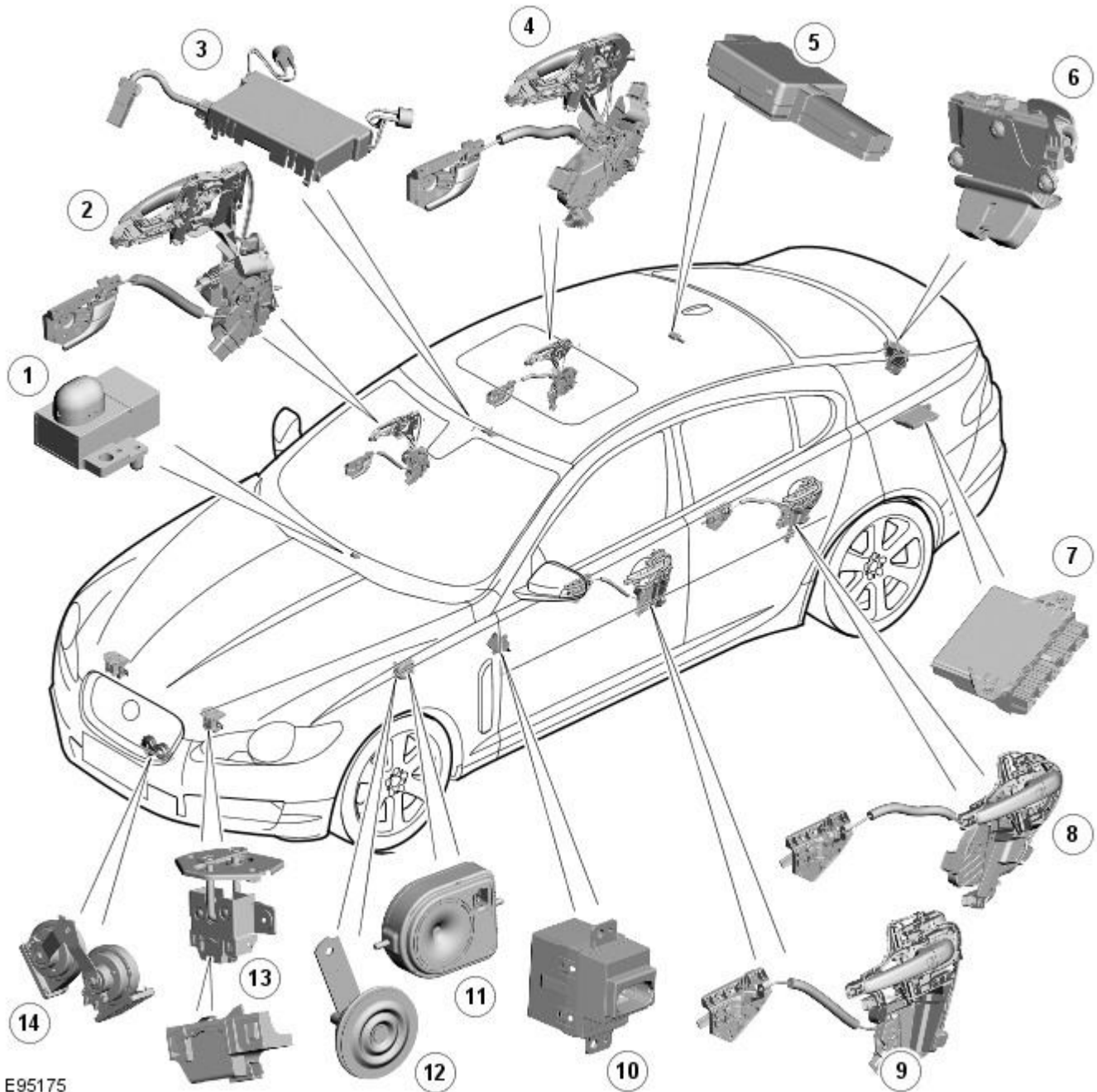
## Installation

1. To install, reverse the removal procedure.

# Anti-Theft - Active - Anti-Theft - Active - Component Location

Description and Operation

Component Location



E95175

## ItemDescription

1	Alarm indicator
2	Latch mechanism - front door
3	Intrusion detection module
4	Latch mechanism - rear door
5	Central locking Radio Frequency (RF) receiver
6	Luggage compartment lid latch mechanism
7	Keyless vehicle module
8	Latch mechanism - rear door
9	Latch mechanism - front door
10	Start control unit
11	Battery backed sounder
12	Passive sounder
13	Hood latch mechanism
14	Vehicle horn

# Anti-Theft - Active - Anti-Theft - Active - Overview

Description and Operation

## Overview

The active anti-theft system is available with three different levels of vehicle protection depending on market specification:

- Hinged panel sensing
- Hinged panel and intrusion sensing
- Hinged panel, intrusion and inclination sensing.

The **CJB (central junction box)** automatically arms and disarms the active anti-theft system when it functions the central locking system.

Refer to: [Handles, Locks, Latches and Entry Systems](#) (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

Depending on market specification two modes of protection are used: perimeter mode and volumetric mode.

### Perimeter mode

Perimeter mode, monitors the security of the hinged panels, which include:

- all doors,
- luggage compartment lid, and
- engine compartment lid.

When perimeter mode is active, the CJB monitors the panel ajar switches in the latch mechanisms of the hinged panels.

### Volumetric mode

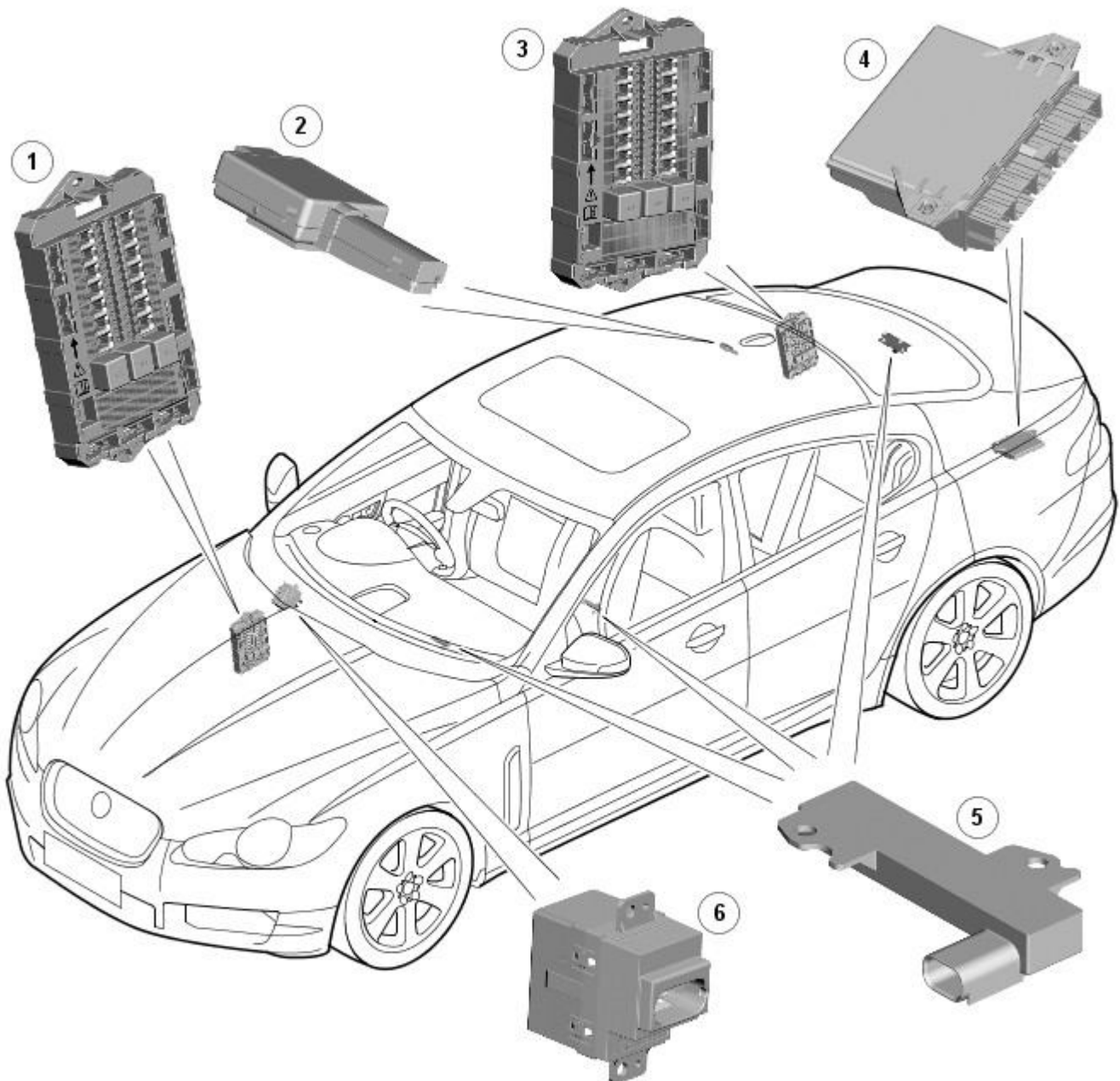
In volumetric mode the CJB monitors the interior of the vehicle for movement using an ultrasonic sound wave sensor.

If the battery backed sounder incorporates an inclination sensor the vehicle will also be monitored for unauthorised tilting; for example towing or jacking.

# Anti-Theft - Passive - Anti-Theft - Passive - Component Location

Description and Operation

Component Location



E94900

## ItemDescription

1	<a href="#">CJB (central junction box)</a>
2	Radio frequency receiver
3	<a href="#">RJB (rear junction box)</a>
4	Keyless vehicle module
5	Low frequency antennae (3 off)
6	Start control module

# Anti-Theft - Passive - Anti-Theft - Passive - Overview

Description and Operation

## Overview

The [PATS \(passive anti-theft system\)](#) prevents the vehicle's engine from being started by unauthorized persons.

Engine starting is prevented by inhibiting the fuel, engine (spark, injectors and crank) and ignition systems from operating.

This is achieved by using a uniquely coded Smart Key and an encoded data exchange between multiple control modules.

The system is automatic and requires no input from the driver.

The engine start system is initiated when the encoded data between the Smart Key and vehicle control modules is verified. The engine can then be started when the drive selector is in the 'Park' position, and the start/stop switch and the brake pedal are pressed simultaneously.

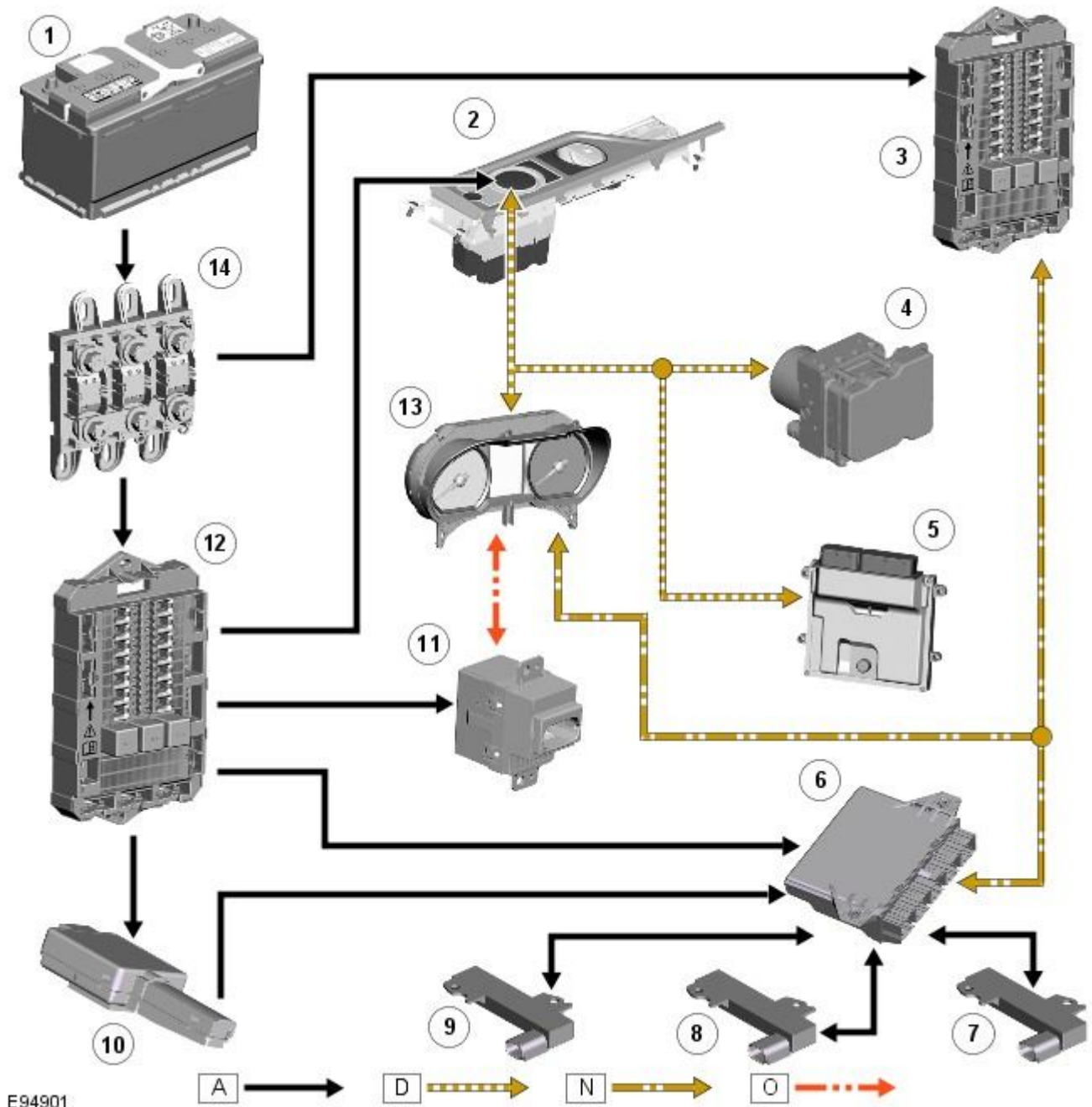


# Anti-Theft - Passive - Anti-Theft - Passive - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **D** = High speed CAN; **N** = Medium speed CAN; **O** = LIN bus



E94901

### ItemDescription

1	Battery
2	Drive selector
3	RJB (rear junction box)
4	ABS (anti-lock brake system)
5	ECM (engine control module)
6	Keyless vehicle module
7	Low frequency antenna - front
8	Low frequency antenna - center
9	Low frequency antenna - rear
10	Radio frequency receiver
11	Start control module

12	<a href="#">CJB (central junction box)</a>
13	Instrument cluster
14	Megafuse (250 amp)

## System Operation

The passive start function prevents the vehicle from being started by unauthorized persons. It does this by immobilizing the ignition, fuel and engine crank functions. The system is automatic and requires no input from the driver.

At the request of the [CJB](#), the keyless vehicle module prompts each of the Low Frequency (LF) antennae to output a signal. When the Smart Key is in the vehicle cabin, it detects the LF signals and responds with a Radio Frequency (RF) data-identification signal back to the keyless vehicle module via the RF receiver.

If the data received matches that stored in the keyless vehicle module it continues the passive start process by communicating a 'Smart Key valid' signal to the CJB via the medium speed [CAN \(controller area network\)](#) bus.

Once the CJB receives the authorization and confirms a response with an internal calculation, it passes the result to the instrument cluster on the medium speed CAN bus.

Before the instrument cluster sends a mobilization signal to the [ECM](#) it will exchange encrypted data with:

- The electric steering lock mechanism to authorize unlocking the steering column.
- The [RJB](#) to authorize fuel pump operation. Once the RJB receives the authorization and confirms the response with an internal calculation, it will enable the [FPDM \(fuel pump driver module\)](#).
- The CJB to authorize the ignition status. If the drive selector is in the park position and the driver presses the brake pedal and simultaneously presses the start/stop switch, the CJB interprets this as an engine crank request. Before the engine crank request is allowed, the CJB compares a brake pressure signal received from the [ABS](#) module. The brake pressure signal is compared to an internally stored threshold value within the CJB. If the signal is greater than the stored threshold value, a crank request signal is sent to the ECM on the high speed CAN bus.

Once these factors have been confirmed, and the vehicle is in 'Park', the engine can be started by pressing the brake pedal and the Stop/Start button simultaneously.

• **NOTE:** If the keyless vehicle module fails to locate the Smart Key, the message 'SMART KEY NOT FOUND PLEASE INSERT IN SLOT' will appear in the instrument cluster message center. When inserted the start control module will read the transponder within the Smart Key. If the transponder identification is valid, authorization will be transmitted to the instrument cluster on the [LIN \(local interconnect network\)](#) bus.

• **NOTE:** When the vehicle is delivered from the factory the passive start function is inhibited. In this condition the vehicle can only be started by placing the Smart Key in the start control module. The system should be switched on during the Pre-Delivery Inspection (PDI) using the Jaguar approved diagnostic system. For additional information, refer to the PDI Manual.

## Component Description

### Start Control Module

The start control module is used if the keyless vehicle module is unable to authorise the Smart Key.

If the keyless vehicle module is unable to identify the Smart Key, for example if the Smart Key battery voltage is low or there is local RF interference, the transponder within the Smart Key can be read in the conventional manner. The driver will be alerted to this by a chime and a message in the instrument cluster message center 'SMART KEY NOT FOUND PLEASE INSERT IN SLOT'.

Once inserted the start control module will read the transponder within the Smart Key. If the transponder identification is valid, authorization will be transmitted to the instrument cluster on the LIN bus.

• **NOTE:** Inserting the Smart Key into the start control module will not charge the Smart Key battery. The battery is non-chargeable and must be replaced if defective.

A message 'REMOVE SMART KEY' will be displayed if the Smart Key is still in the start control module and the driver's door is opened.

### Low Frequency Antenna

Three Low Frequency (LF) antennae for the passive start system are positioned in specific locations in the vehicle; refer to Component Location graphic.

• **NOTE:** On vehicles with the passive entry system, five additional antennae are used; one integrated into the rear bumper and one in each door handle assembly. These are only used by the passive entry system and have no function in the passive start system.

Refer to: [Anti-Theft - Active \(419-01A Anti-Theft - Active, Description and Operation\)](#).

The keyless vehicle module transmits an LF signal via the antennae which is received by the Smart Key. The Smart Key then responds by transmitting a Radio Frequency (RF) signal which is received by the RF receiver and passed to the keyless vehicle module for authorization.

### Keyless Vehicle Module

The keyless vehicle module controls signal transmissions to and from the Smart Key and provides authorization to allow the vehicle to be started. The module has a medium speed CAN connection to the CJB for authorizing vehicle starting.

### Radio Frequency Receiver

The Radio Frequency (RF) receiver transmission is received from the Smart Key to enable key identification.

## Anti-Theft - Passive - Anti-Theft - Passive

Diagnosis and Testing

### Principle of Operation

For a detailed description of the Anti-Theft - Passive system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (419-01B Anti-Theft - Passive)

[Anti-Theft - Passive](#) (Description and Operation),  
[Anti-Theft - Passive](#) (Description and Operation),  
[Anti-Theft - Passive](#) (Description and Operation).

### Inspection and Verification

#### Anti-theft - Passive

The best method to confirm the correct operation of the Passive Anti-Theft System (PATS) is to check the LED (located in the center of the instrument panel). The LED should illuminate solid for 3 seconds, when the ignition status is set to ON, and then extinguish. This validates all PATS functions (i.e. the key transponder matches a stored key code, the challenge/response sequence between the respective modules was successful resulting in the EMS being enabled).

Ignition fails to operate

Check that the smart key is located within the vehicle interior, and that it is the correct one for the vehicle.

Insert the smart key into the start control unit (located at out board side of driver instrument panel lower panel), this is an alternative method to allow Ignition On/Engine Start.



Check that the start button circuit to the CJB is not open circuit or short circuit to power.

Check that the Low Speed CAN network is not malfunctioning, i.e. open circuit or short circuit. This would mean that the remote keyless entry module, Central Junction Box (CJB) and instrument cluster would be unable to communicate.

Engine fails to crank

If a PATS fault is detected, the LED will flash for 60 seconds at 4Hz with a 50% duty cycle. At the end of this period, the LED will flash a 2 digit code; this code is repeated 10 times. The meaning of these fault codes along with the frequency of flashing is given in the accompanying table. As a general rule a fault code of 16 or less will cause the vehicle not to crank. Additionally, the manufacturer approved diagnostic system should be used to check the instrument cluster, CJB & ECM for Diagnostic Trouble Codes (DTCs).

One potential occurrence for failing to crank could be due to the P & N start switch (input to the ECM).

Check the Crank Request output from the CJB to ECM is not short circuit to ground or open circuit.

Check the Starter Relay circuit.

• **NOTE:** On petrol engine variants, due to Smart Start, both sides of Relay Coil are switched directly from ECM (If conditions correct). On diesel engine variants the low side only is switched directly from the ECM.

Check that the Steering Column Lock correctly operates and the steering wheel can turn freely.

Check that the High Speed CAN network is not malfunctioning, i.e. the CAN circuit is open or short circuit. This would mean that the instrument cluster and ECM would be unable to communicate resulting in no Challenge being performed to enable the ECM. This would be supported by LED Flash Code 24, see PATS Fault Code Table.

Also check the CAN network between the ABS module and the CJB. The CJB uses the CAN\_BrakePressureTMC signal to determine if the brake pedal has been pressed in order to allow an engine crank. The CJB uses a value of 0x05, if the CJB sees a value less than this, it will not enable the Crank Request Output.

Engine cranks but will not start

If the Engine is cranking it means that the ECM has passed the authorisation required with the Instrument Cluster. If this authorisation failed, the ECM would not engage the starter relay. This could be confirmed by verifying the PATS LED prove out (illuminated solid for 3 seconds) or by reading DTCs from the instrument cluster and ECM.

In this case, the fuel pump circuit should be verified. The Fuel Pump Delivery Module (FPDM), which is supplied via the RJB (authentication required with the instrument cluster) and controlled by the ECM, supplies the fuel pump.

In all cases of suspected non-start issues, the most logical failure modes should be eliminated first. i.e.

- Check all relevant supplies and grounds to the relevant modules listed herein.
- Note any unusual behaviour from other systems/functionality.
- Note any functions that are not operating as expected.

#### PATS Fault Codes

For the various PATS modes/faults listed in the table, the instrument cluster will store a DTC and indicate this to the customer during the detection period defined in the 'when logged' column, by illuminating the indicator as described for 60 seconds and then flashing the LED 10 times as appropriate. The indication will stop immediately the ignition status is set to OFF any time during the fault indication sequence. Up to 4 DTCs could be stored per key read sequence (1-10 read attempts). No DTCs will be stored until all retry attempts are complete. Only the highest priority fault code will be flashed.

To determine the fault code from the LED: The LED will flash initially ten times with 1.5 seconds between. The LED will remain OFF for 2.5 seconds then flash a number of times with 0.5 seconds between (the number of times the LED flashes represents the first digit of the code), the LED will remain OFF for 1.5 seconds then flash a number of times with 1.5 seconds between (the number of times the LED flashes represents the second digit of the code).

The PATS LED will be commanded on as shown under 'indication'. Normal PATS operations are complete within 400ms of the ignition switch transition from OFF to ON or START, worst case for ECM communication problems will be less than 2 seconds. If PATS is not complete during the 2 seconds the ECM will terminate PATS and await the next ignition ON or START event. PATS faults will be indicated via the LED as soon as possible and will terminate the LED prove out. At ignition OFF all previous flashing will cease and the perimeter anti-theft system will control the LED when the vehicle is locked and armed.

**PATS Fault Code Table**

Mode of Operation/Fault	When Logged	Ignition Status	DTC	LED Fault Code	Indication
Prove out	N/A	Transition from OFF to ON	N/A	N/A	3 Seconds of steady illumination
Perimeter Anti-theft Control	N/A	OFF - Vehicle locked and armed	N/A	N/A	Off or 0.5Hz flashing at 5% duty cycle $\pm$ 20% until Off
Start Control Unit already programmed	Key Insert	Any	B1B0105	N/A	No Indication
Start Control Unit status = invalid response	Key Insert	Any	B1B0167	N/A	No Indication
Start Control Unit programming error	Key Insert	Any	B1B0151	N/A	No Indication
Start Control Unit challenge response error	Key Insert	OFF	B1B0162	N/A	No Indication
Key Programming timer expired or Key Auth Timer expired	Key Insert	Any	B1B0187	N/A	No Indication
Transponder challenge response error	Key Insert	Any	B1B0164	N/A	No Indication
Transponder keys stored below minimum number required	B&A/Dealer	Any	B1B0100	N/A	No Indication
Transponder not programmed	B&A/Dealer	Any	B1B0155	N/A	No Indication
If the instrument cluster sends a 'theft' key status to the ECM or the ECM returns a status message containing the data 'Disabled/Theft', the instrument cluster will set this DTC	EMS CAN communication	OFF to ON	B1B3364	16	60 seconds of 4Hz flashing at 50% duty cycle followed by fault code 16 flashing 10 times
During manufacturing a Target ID is transferred from the ECM when requested by the instrument cluster. The instrument cluster stores this unique vehicle number in EEPROM. If this ID fails to store in EEPROM correctly, the instrument cluster will set this DTC	B&A/Dealer	OFF to ON	B1B3305	22	60 seconds of steady indication followed by fault code 22 flashing 10 times
If the status message received from the ECM contains the data challenge response error, the instrument cluster will set this DTC	Challenge/Response	OFF to ON	B1B3362	23	60 seconds of steady indication followed by fault code 23 flashing 10 times
After the instrument cluster has transmitted its first PATS idle message, it will start a 2 second timer running. If the PATS sequence does not complete (Cluster received the Enable msg) within this time period the instrument cluster will set this DTC	Idle message missing	OFF to ON	B1B3387	24	60 seconds of steady indication followed by fault code 24 flashing 10 times

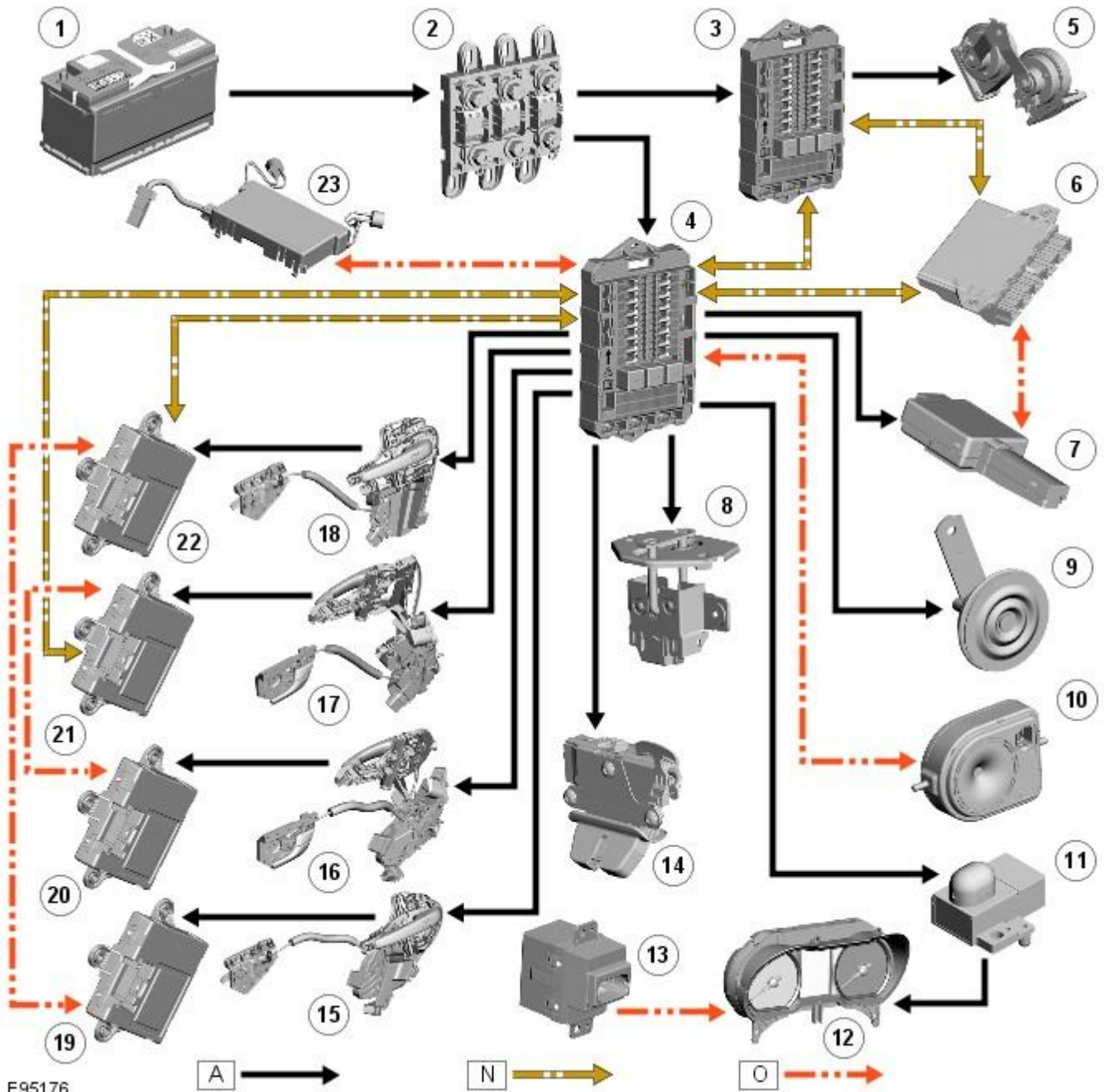
1. **1.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
2. **2.** If the cause is not visually evident, verify the symptom and refer to the manufacturer approved diagnostic system.

# Anti-Theft - Active - Anti-Theft - Active - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **N** = Medium speed CAN; **O** = LIN bus



E95176

### ItemDescription

1	Battery
2	Megafuse (250 amp)
3	RJB (rear junction box)
4	CJB (central junction box)
5	Vehicle horn
6	Keyless vehicle module
7	Central locking - Radio Frequency (RF) receiver
8	Engine compartment lid - latch mechanism
9	Passive sounder
10	Battery backed sounder
11	Alarm indicator



12	Instrument cluster
13	Start control unit
14	Luggage compartment lid - latch mechanism
15	Door latch mechanism - LH (left-hand) rear
16	Door latch mechanism - RH (right-hand) rear
17	Door latch mechanism - RH front
18	Door latch mechanism - LH front
19	Door module - LH rear
20	Door module - RH rear
21	Door module - RH front
22	Door module - LH front
23	Intrusion detection module

## System Operation

### Anti-Theft - Active

The active anti-theft system is available with three different levels of vehicle protection depending on market specification:

- Hinged panel sensing
- Hinged panel and intrusion sensing
- Hinged panel, intrusion and inclination sensing.

The system is controlled by software in the [CJB](#) and [RJB](#) and indicates a trigger condition:

- Visually, using the direction indicators, and
- Audibly, using the vehicle horn and either a passive or active sounder to indicate a trigger condition.

The passive sounder takes the form of an anti-theft disc horn located at the rear of the engine compartment on the [LH](#) side. The active sounder takes the form of a battery backed sounder located in the same position.

Depending on market specification, the battery backed sounder may be fitted with an inclination sensor. Both types of battery backed sounder are visually identical and can only be identified by their part number. Both are also intelligent units, and communicate to the CJB over a [LIN \(local interconnect network\)](#) bus connection.

Monitoring of the hinged panels is carried out using switches located in each door latch assembly, the engine-compartment-lid latch assembly, and the luggage-compartment-lid latch assembly. The condition of the switches is monitored by the CJB.

Monitoring of front door lock status is carried out using switches located in the door latch mechanisms. The condition of the switches is monitored by the front door modules and transmitted to the CJB over the medium speed [CAN \(controller area network\)](#) bus.

Monitoring of the cabin interior is carried out using an intrusion detection module mounted behind the roof console. The intrusion detection module comprises an ultrasonic sound wave sensor to determine if there is movement within the cabin.

Information from the intrusion detection module is communicated to the CJB over a LIN bus connection.

#### • CAUTIONS:



The intrusion detection module electrical connections, particularly those to the sensors mounted in the roof console, are very delicate and must be handled with care.



The intrusion detection module is an electro-statically sensitive part and should only be handled in an electro-statically controlled environment.

When armed, the active anti-theft system can be triggered in one of the following ways:

- A door ajar switch indicates a door has been opened.
- The engine compartment lid or luggage compartment lid ajar switches indicate that either has been opened.
- Either front door latch mechanism indicates a door has been unlocked.
- The emergency key blade is used to open either the LH front door or luggage compartment.
- The CJB or RJB are disconnected (this may result in only a partial trigger).
- An attempt is made to start the engine without a valid signal from the Smart Key.  
Refer to: [Anti-Theft - Passive](#) (419-01B Anti-Theft - Passive, Description and Operation).
- The battery backed sounder is disconnected (partial trigger only).
- The vehicle battery is disconnected on a vehicle fitted with a battery backed sounder (partial trigger only).
- The inclination sensor detects a change in vehicle attitude.
- The intrusion detection module detects movement within the cabin.

## Component Description

### Door Modules

The door modules provide the interface between the door latch-motors, the door latch-switches and the CJB. The door modules provide door switch status information and enable the door latch-motors on request from the CJB or the keyless

vehicle module.

## Keyless Vehicle Module

The keyless vehicle module interfaces with the Central locking, Radio Frequency (RF) receiver and collects RF signal information which is transmitted from the Smart Key. This information is translated into commands which are passed on the medium speed CAN bus to the:

- CJB,
- RJB,
- door modules, and
- instrument cluster.

The keyless vehicle module also monitors:

- 2 interior antennae,
- 1 luggage compartment antenna,
- a rear bumper antenna, and
- 4 door handle antennae if the passive entry system is fitted.

On vehicles with passive entry, the additional fast latch motors are controlled via the keyless vehicle module and the locking status is passed to the CJB on the medium speed CAN bus.

## Instrument Cluster

The instrument cluster controls the alarm indicator, and in conjunction with the [ECM \(engine control module\)](#), the engine immobilization. The ECM controls the engine crank and fuel functions and the instrument cluster processes the valid transponder information.

## Alarm Indicator

The alarm indicator is a [LED \(light emitting diode\)](#) located in the body of the sunload/light sensor. When the ignition is off the indicator gives a visual indication of the active anti-theft system to show if the alarm system is active or not active. Operation of the alarm indicator is controlled by the instrument cluster which varies the flash rate of the LED to indicate the system status of the alarm and the immobilization systems.

When the ignition is on, the indicator provides a visual indication of the status of the passive anti-theft (engine immobilization) system. If the immobilization system is operating correctly, the LED will be illuminated for 3 seconds at ignition on and then extinguish. If a fault exists in the immobilization system, the LED will be either permanently illuminated or flashing for 60 seconds. This indicates that a fault exists and fault code has been recorded. After the 60 second period the LED will flash at different frequencies which indicate the nature of the fault. Refer to: [Anti-Theft - Passive](#) (419-01B Anti-Theft - Passive, Description and Operation).

## Passive Anti-Theft Horn

The passive anti-theft horn is hardwired to the CJB which activates the horn when the alarm is triggered.

## Battery Backed Sounder

Operation of the battery backed sounder is controlled by the CJB on the LIN bus. The sounder is also connected with a permanent battery supply via the CJB. An integral, rechargeable battery powers the sounder if the battery power supply from the CJB is interrupted.

Dependant on vehicle, a incitation sensor is incorporated into the battery backed sounder, to monitor vehicle attitude, see Inclination Sensor.

## Inclination Sensor

The CJB monitors the inclination sensor and will activate the alarm system if the vehicle is being raised.

## Intrusion Detection Module

The intrusion detection module comprises an ultrasonic sound wave sensor which monitors the vehicle's interior.

The intrusion detection module is activated with volumetric mode which in turn is enabled when the vehicle is double locked. The vehicle can be locked and alarmed with the module de-activated if a pet is to be left in the vehicle for example by single-locking the active anti-theft system. The intrusion detection modules can also be de-activated by deselecting the 'Alarm Sensors' option in the 'Vehicle Settings' screen on the Touch Screen Display.

• **NOTE:** The Touch Screen method of de-activation of the intrusion detection module is only for one arm cycle, it will revert to active once the engine is next started.

When the volumetric mode is active and the vehicle battery voltage falls below 9 volts, the CJB will ignore any inputs from the intrusion detection module to prevent false alarm activation.

# Anti-Theft - Active - Anti-Theft - Active

Diagnosis and Testing

## Principles of Operation

For a detailed description of the anti-theft - active system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (419-01A Anti-Theft - Active)

[Anti-Theft - Active](#) (Description and Operation),  
[Anti-Theft - Active](#) (Description and Operation),  
[Anti-Theft - Active](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Door latch micro switches</li> <li>● Hood ajar switch</li> <li>● Passive anti-theft alarm horn (if installed)</li> <li>● Battery backed sounder (if installed) or battery backed sounder with tilt sensor (if installed)</li> <li>● Vehicle horns</li> </ul>	<ul style="list-style-type: none"> <li>● Fuse(s)</li> <li>● Electrical connector(s)</li> <li>● Wiring Harness</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

• NOTE: For Remote Keyless Entry system failures.  
 REFER to: [Remote Keyless Entry \(RKE\) Module](#) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B108783	LIN Bus "A"	<ul style="list-style-type: none"> <li>● Checksum of the received LIN frame from battery backed sounder, roof header console, and/or rain/light sensor is incorrect</li> </ul>	Check operation of rain/light sensor by covering sensor or applying water to screen, install a new sensor as required
B108788	LIN Bus "A"	<ul style="list-style-type: none"> <li>● Bus off. Battery backed sounder, roof header console, and/or rain/light sensor LIN circuit - short to ground, power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check battery backed sounder, roof header console, and rain/light sensor LIN circuit for short to ground, power

DTC	Description	Possible Cause	Action
B10EB11	Driver door double locking motor	<ul style="list-style-type: none"> <li>Driver door double locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test driver door double locking motor control circuit for short ground
B10EB15	Driver door double locking motor	<ul style="list-style-type: none"> <li>Driver door double locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver door double locking motor control circuit for short to power or open circuit
B10EC11	Passenger door double locking motor	<ul style="list-style-type: none"> <li>Passenger door double locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger door double locking motor control circuit for short ground
B10EC15	Passenger door double locking motor	<ul style="list-style-type: none"> <li>Passenger door double locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test passenger door double locking motor control circuit for short to power or open circuit
B10ED11	Rear door driver side double locking motor	<ul style="list-style-type: none"> <li>Rear door driver side double locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test rear door driver side double locking motor control circuit for short ground
B10ED15	Rear door driver side double locking motor	<ul style="list-style-type: none"> <li>Rear door driver side double locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test rear door driver side double locking motor control circuit for short power, open circuit
B10EE11	Rear door passenger side double locking motor	<ul style="list-style-type: none"> <li>Rear door passenger side double locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test rear door passenger side double locking motor control circuit for short ground
B10EE15	Rear door passenger side double locking motor	<ul style="list-style-type: none"> <li>Rear door passenger side double locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test rear door passenger side double locking motor control circuit for short power, open circuit
B10F111	Key In Switch	<ul style="list-style-type: none"> <li>Keyless vehicle module, key IN status circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check keyless vehicle module, key IN status circuit for short to ground
B10F112	Key In Switch	<ul style="list-style-type: none"> <li>Keyless vehicle module, key IN status circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check keyless vehicle module, key IN status circuit for short to power
B10F113	Key In Switch	<ul style="list-style-type: none"> <li>Keyless vehicle module, key IN status circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check keyless vehicle module, key IN status circuit for open circuit
B110811	Driver door central locking motor	<ul style="list-style-type: none"> <li>Driver door central locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test driver door central locking motor control circuit for short ground
B110815	Driver door central locking motor	<ul style="list-style-type: none"> <li>Driver door central locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver door central locking motor control circuit for short to power, open circuit
B110A11	Rear door driver side central locking motor	<ul style="list-style-type: none"> <li>Rear driver door central locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test rear driver door central locking motor control circuit for short ground
B110A15	Rear door driver side central locking motor	<ul style="list-style-type: none"> <li>Rear driver door central locking motor control circuit - short to power, open circuit</li> </ul>	Refer to the electrical circuit diagrams and test rear driver door central locking motor control circuit for short to power, open circuit
B117513	Driver Door Ajar Switch	<ul style="list-style-type: none"> <li>Driver door ajar switch signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check driver door ajar switch signal circuit for open circuit
B117613	Passenger Door Ajar Switch	<ul style="list-style-type: none"> <li>Passenger door ajar switch signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check passenger door ajar switch signal circuit for open circuit
B11C013	Driver Side Rear Door Ajar Switch	<ul style="list-style-type: none"> <li>Left rear door ajar switch signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check left rear door ajar switch signal circuit for open circuit
B11C113	Passenger Side Rear Door Ajar Switch	<ul style="list-style-type: none"> <li>Right rear door ajar switch signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check right rear door ajar switch signal circuit for open circuit
B122223	Master Lock/Unlock Switch	<ul style="list-style-type: none"> <li>Master lock or unlock switch digital input circuit - signal stuck low</li> </ul>	Refer to the electrical circuit diagrams and check master lock and unlock switch digital input circuits for short to ground, open circuit

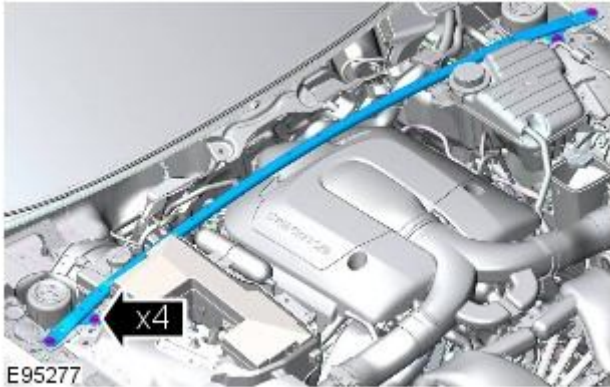
<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
B1D1711	Battery Backed Sounder	<ul style="list-style-type: none"> <li>● Battery backed sounder inclination sensor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check battery backed sounder inclination sensor control circuit for short to ground
B1D1811	Volumetric Sensor	<ul style="list-style-type: none"> <li>● Intrusion sensor module supply circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check intrusion sensor module supply circuit for short to ground
B1D9796	Tilt Sensor	<ul style="list-style-type: none"> <li>● Component internal failure</li> </ul>	Suspect the battery backed sounder, check and install a new battery backed sounder as required
P162413	Anti-theft System	<ul style="list-style-type: none"> <li>● RJB anti-theft signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check RJB anti-theft signal circuit for open circuit
P254F13	Engine Hood Switch Circuit/Open	<ul style="list-style-type: none"> <li>● Hood ajar switch signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check hood ajar switch signal circuit for open circuit

## Anti-Theft - Active - Anti-Theft Alarm Horn

Removal and Installation

### Removal

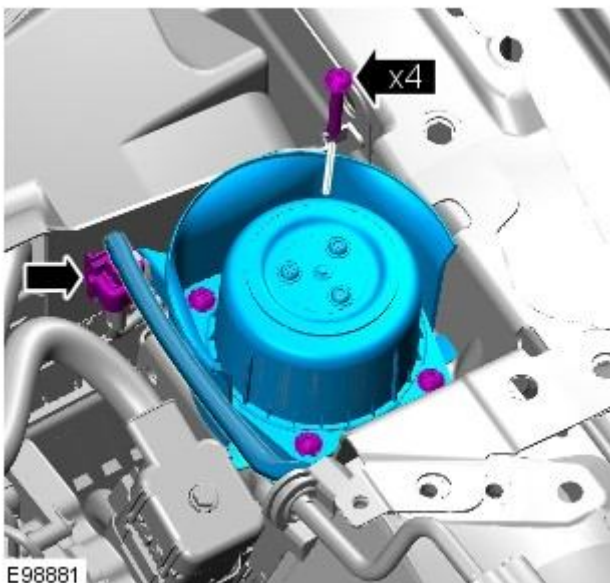
1. Remove the cowl vent screen.  
For additional information, refer to: [Cowl Vent Screen](#) (501-02 Front End Body Panels, Removal and Installation).
2. Remove the engine compartment brace.



3. Remove the secondary bulkhead LH panel.  
For additional information, refer to: [Secondary Bulkhead Panel LH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).

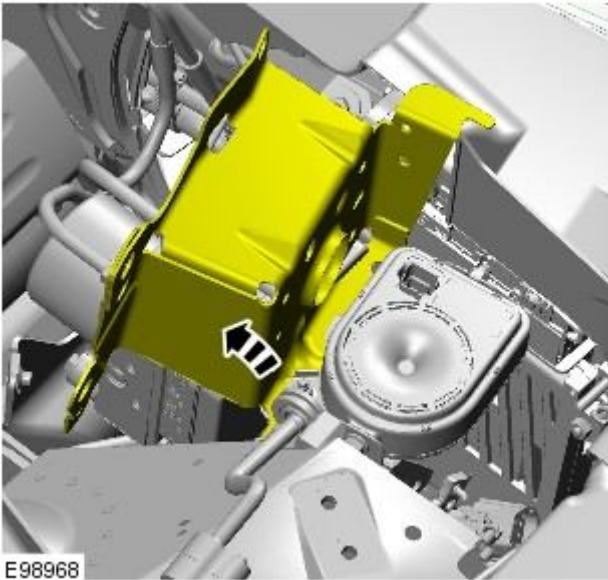
4. Remove the pedestrian protection actuator.

- Reposition the pedestrian protection hood actuator.

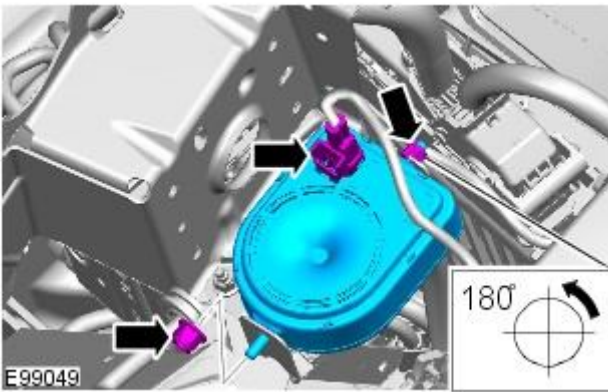




5. Release the pedestrian protection actuator bracket.



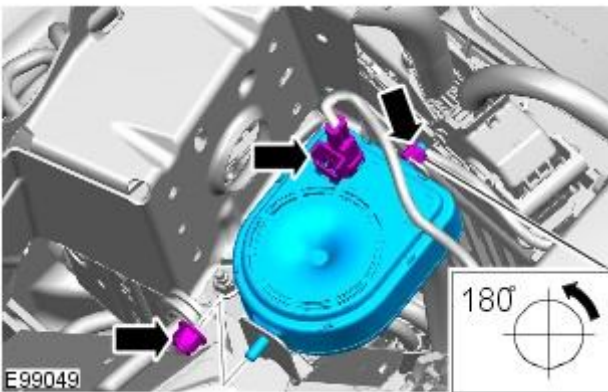
6. Remove the anti-theft alarm horn.



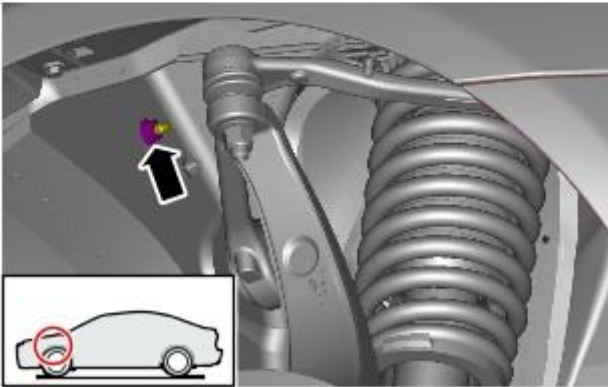
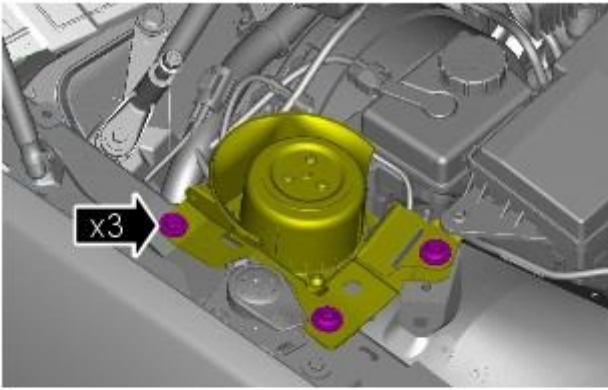
### Installation

1. Install is the reverse of removal.

- Tighten to 7 Nm.

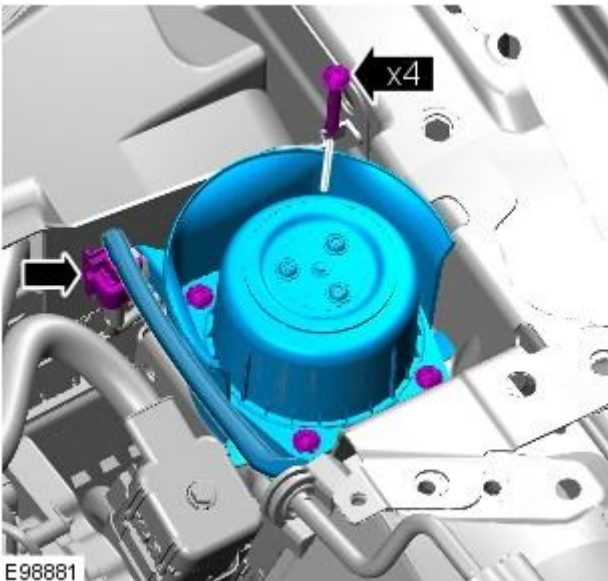


2. Tighten to 25 Nm.



E98989

3. Tighten to 8 Nm.



E98881

4. Tighten to 25 Nm.

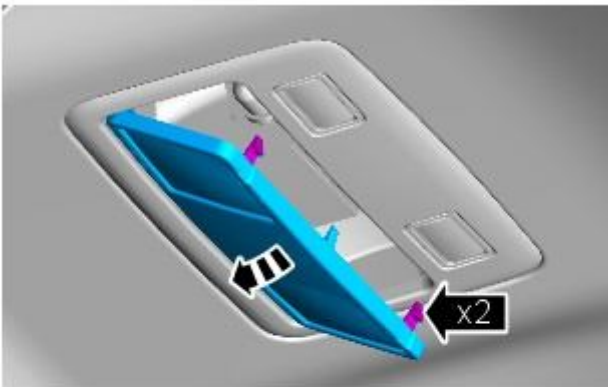


# Navigation System - Navigation System Antenna

Removal and Installation

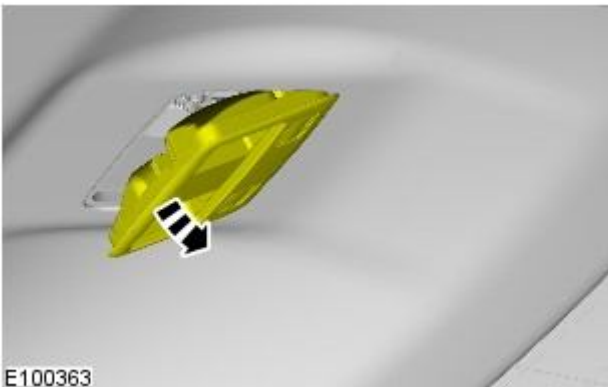
## Removal

1. Remove the interior lamp lens.




E99917

2. Release the interior lamp.



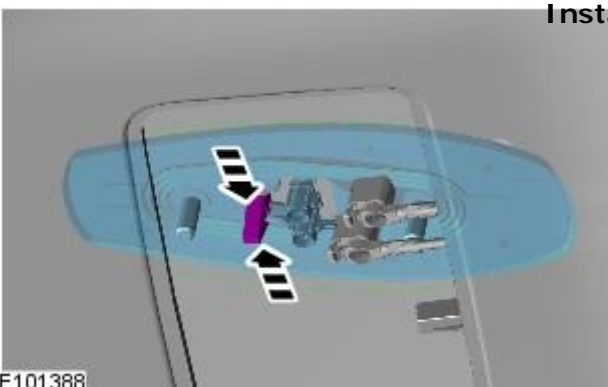
E100363

4. Remove the global positioning sensor (GPS) antenna.
3.  **CAUTION:** Make sure that the latch is pressed before disconnecting the electrical connector.

## Installation

Release and disconnect the 2 electrical connectors.

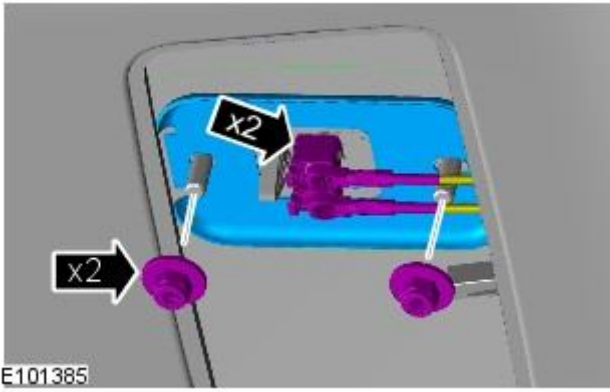
- Remove the 2 nuts.
- Remove the reinforcement plate.



E101388

1. To install, reverse the removal procedure.

- Tighten to 6 Nm.



## Navigation System - Navigation System Module

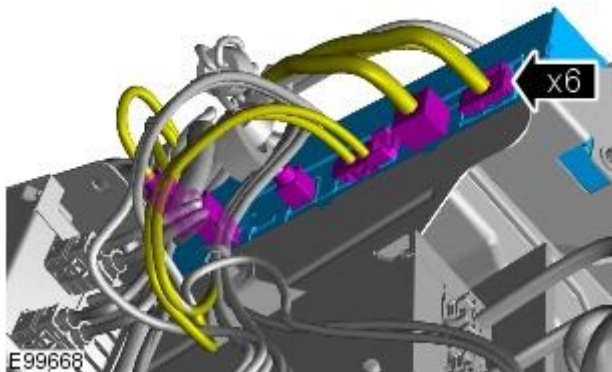
Removal and Installation

### Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the LH luggage compartment side trim panel.  
For additional information, refer to: [Loadspace Trim Panel LH](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Release the navigation system module.



4. Remove the navigation system module.



### Installation

1. Install is the reverse of removal.
2. Tighten to 10 Nm.



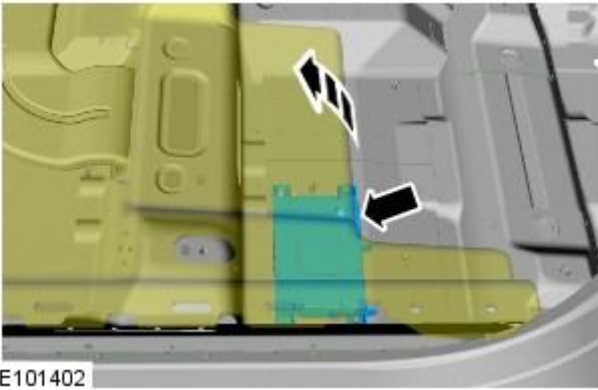


## Cellular Phone - Bluetooth Module

Removal and Installation

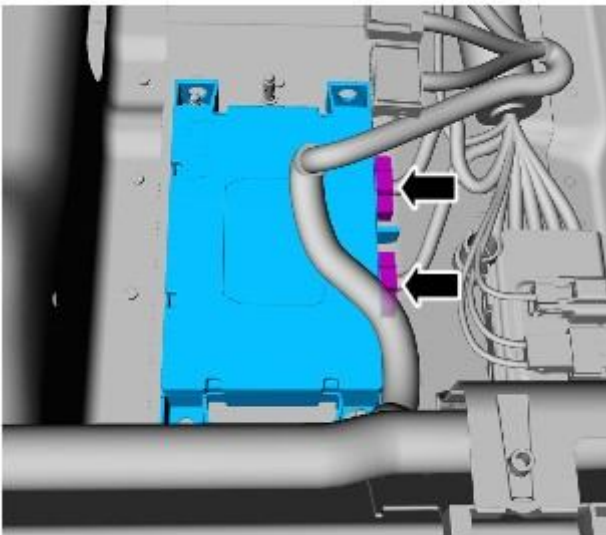
### Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the front seat.
3. Lift the carpet for access.



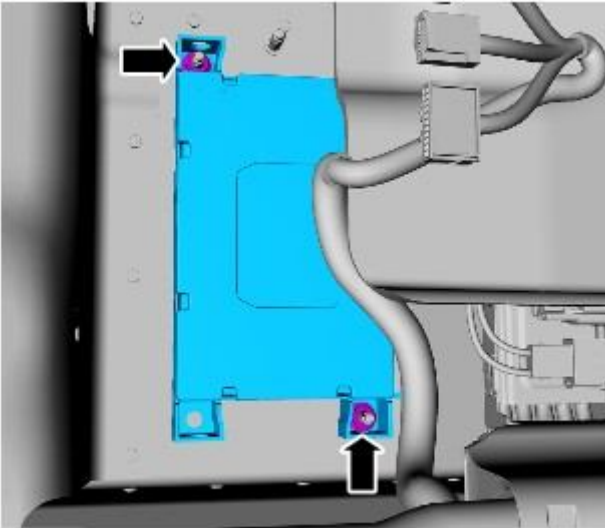
E101402

4. Disconnect the 2 electrical connectors.



E101404

5. Remove the bluetooth module.

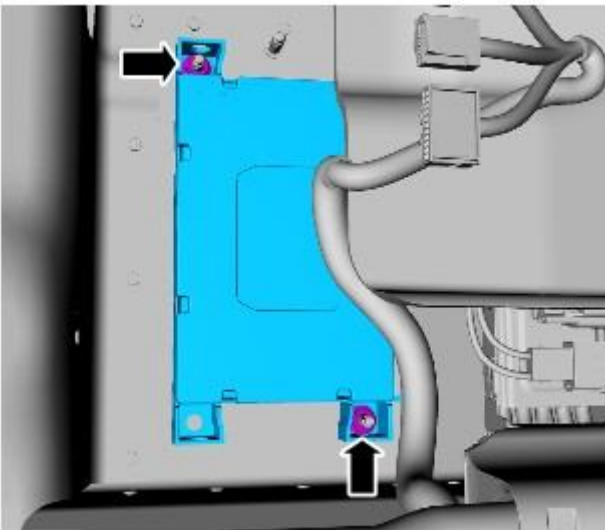


E101403

### Installation

1. Install is the reverse of removal.

- Tighten to 10 Nm.



E101403

## Multifunction Electronic Modules -

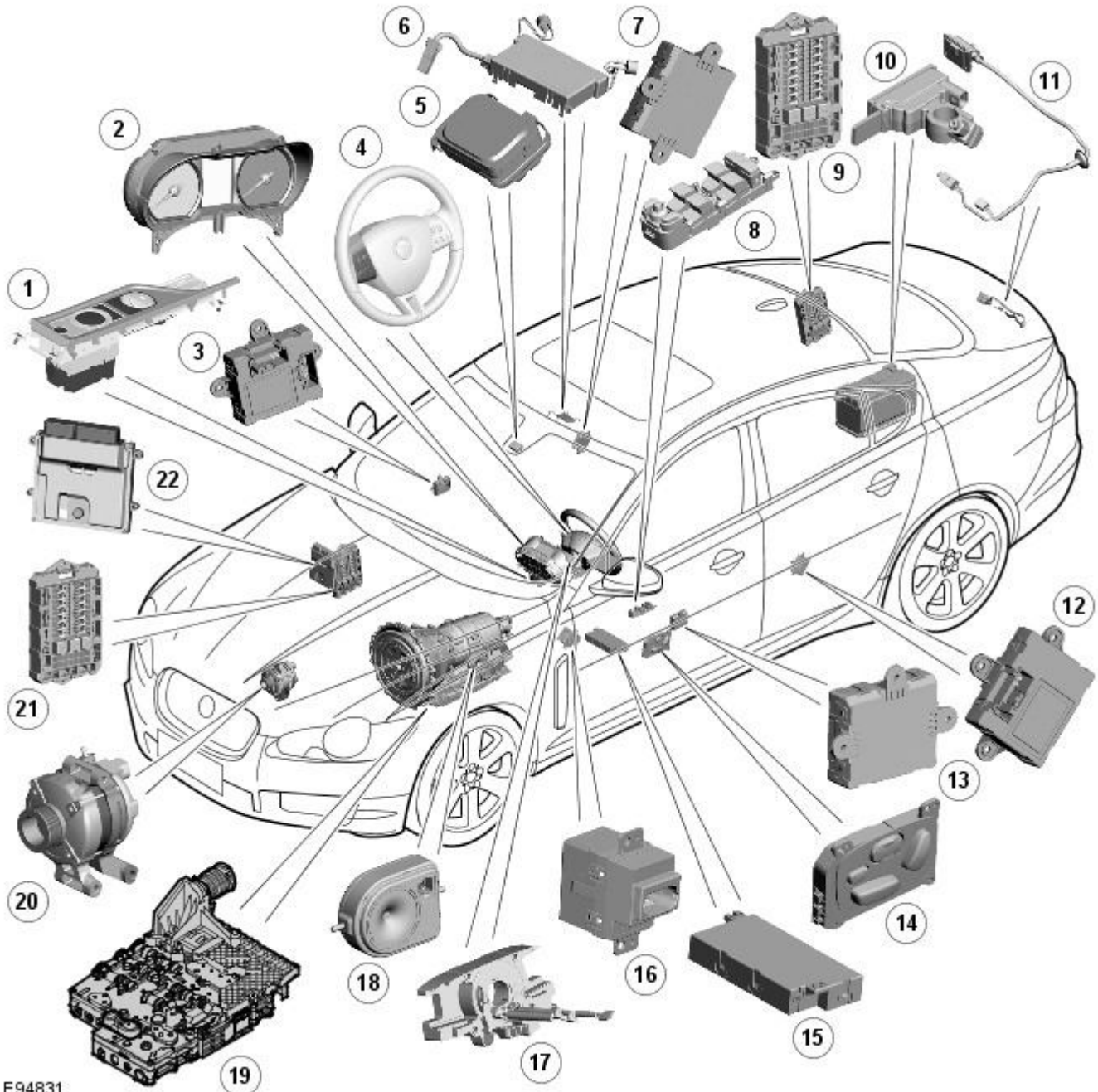
### Torque Specifications

Description	Nm	lb-ft	lb-in
Rear electronic module retaining bolts	10	7	89
Multifunction voice activated module retaining bolts	10	7	89
Front electronic module retaining bolts	10	7	89

# Multifunction Electronic Modules - Module Controlled Functions - Component Location

Description and Operation

COMPONENT LOCATION - LIN BUS (Sheet 1 of 2)



E94831

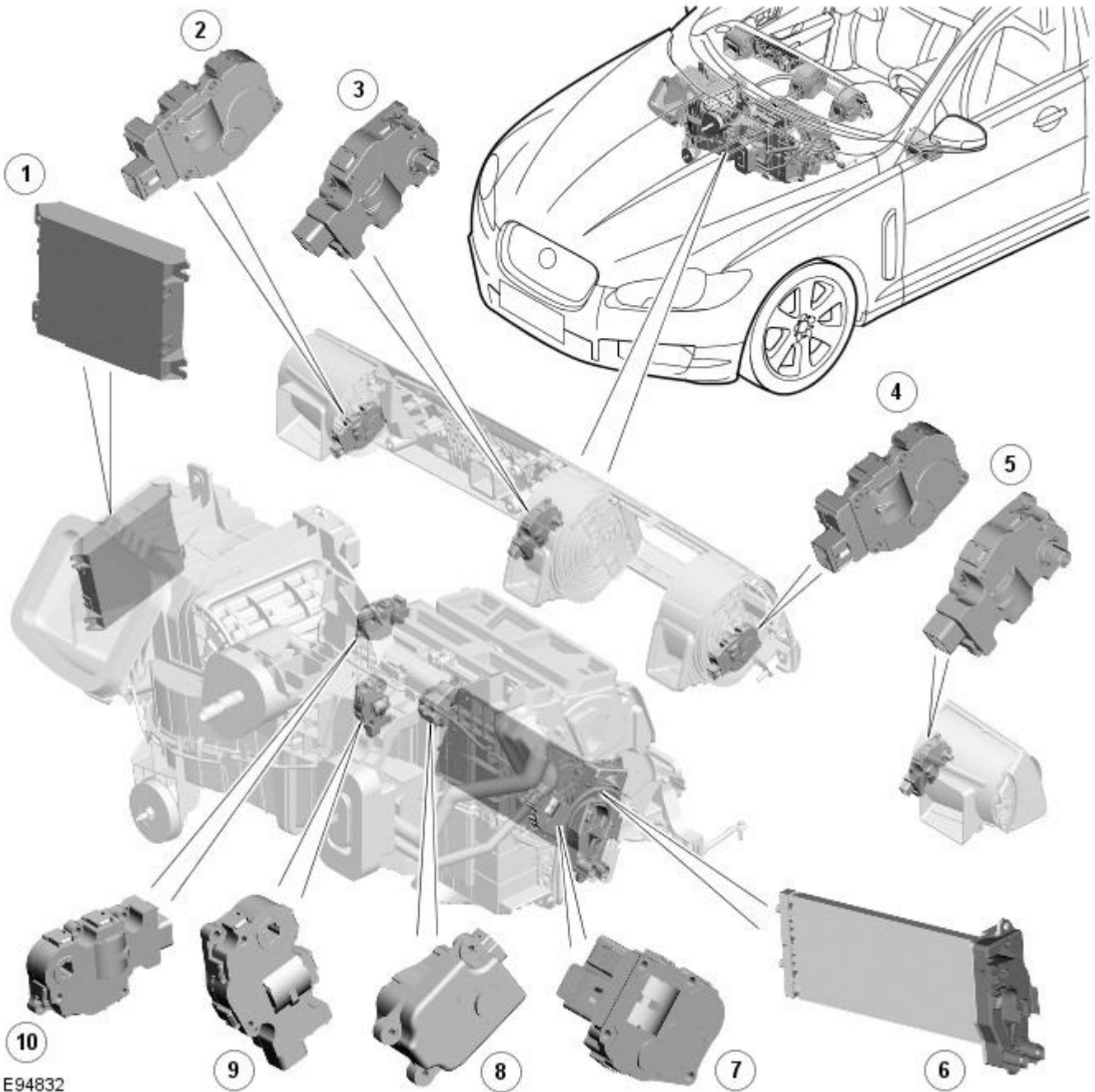
## ItemDescription

NOTE: LHD (left-hand drive) vehicle shown

1	Electronic transmission selector
2	Instrument cluster
3	Passenger door module
4	Steering wheel switches
5	Rain/light sensor
6	Intrusion detection module
7	Passenger side rear door module
8	Driver's door switches
9	RJB (rear junction box)
10	Battery monitoring system module
11	Rear view camera

12	Driver's side rear door module
13	Driver's door module
14	Driver's seat switches
15	Driver's seat module
16	Start control module
17	Clockspring
18	Battery backed sounder
19	TCM (transmission control module)
20	Generator
21	CJB (central junction box)
22	ECM (engine control module)

COMPONENT LOCATION - LIN BUS (Sheet 2 of 2)



**ItemDescription**

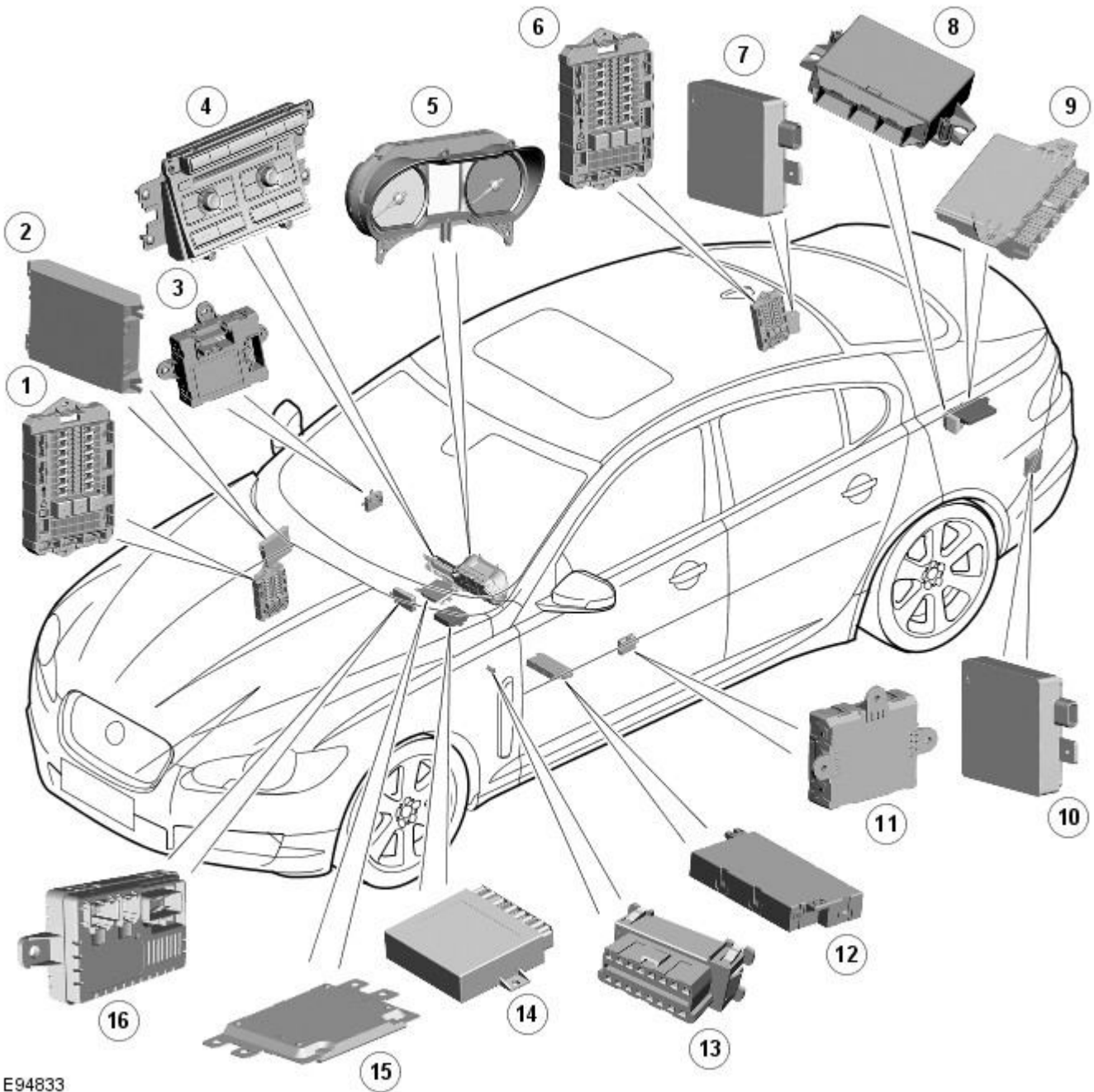
NOTE: [LHD](#) vehicle shown

1	<a href="#">ATC (automatic temperature control)</a> module
2	<a href="#">RH (right-hand)</a> outer face level vent
3	<a href="#">RH</a> inner face level vent
4	<a href="#">LH (left-hand)</a> inner face level vent
5	<a href="#">LH</a> outer face level vent



6	Electric booster heater
7	Stepper motor - LH temperature blend
8	Stepper motor - windshield defrost
9	Stepper motor - RH temperature blend
10	Stepper motor - face/feet

COMPONENT LOCATION - MEDIUM SPEED CAN BUS



E94833

**ItemDescription**

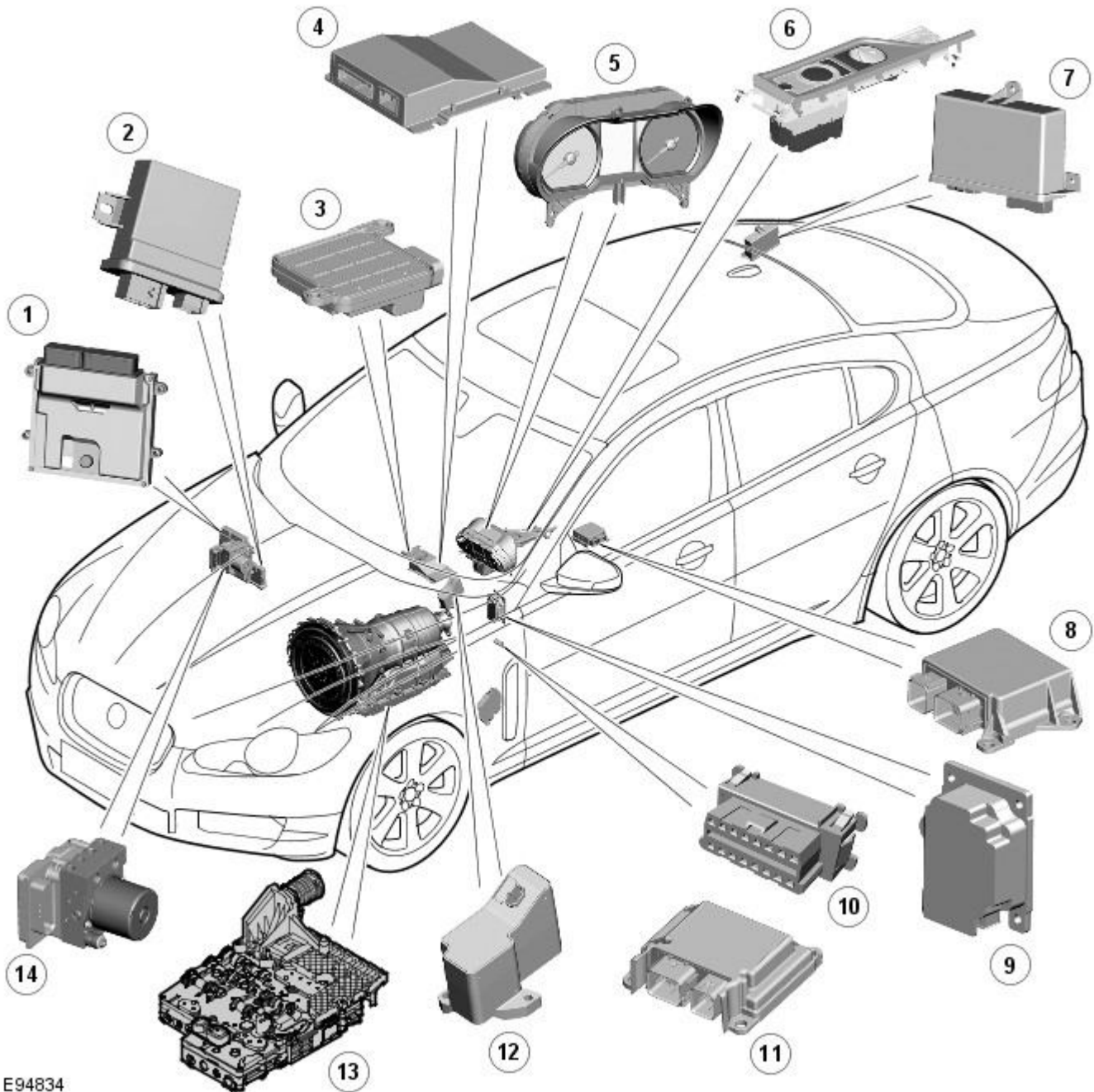
NOTE: [LHD](#) vehicle shown

1	<a href="#">CJB</a>
2	<a href="#">ATC</a> module
3	Passenger door module
4	Audio system control panel
5	Instrument cluster
6	<a href="#">RJB</a>
7	<a href="#">RH</a> blind spot monitoring module
8	Parking aid module
9	Keyless vehicle module
10	<a href="#">LH</a> blind spot monitoring module
11	Driver's door module



12	Driver's seat module
13	Diagnostic socket
14	Tire Pressure Monitoring System (TPMS) control module
15	Entertainment system control module
16	Climate seat module

COMPONENT LOCATION - HIGH SPEED CAN BUS



E94834

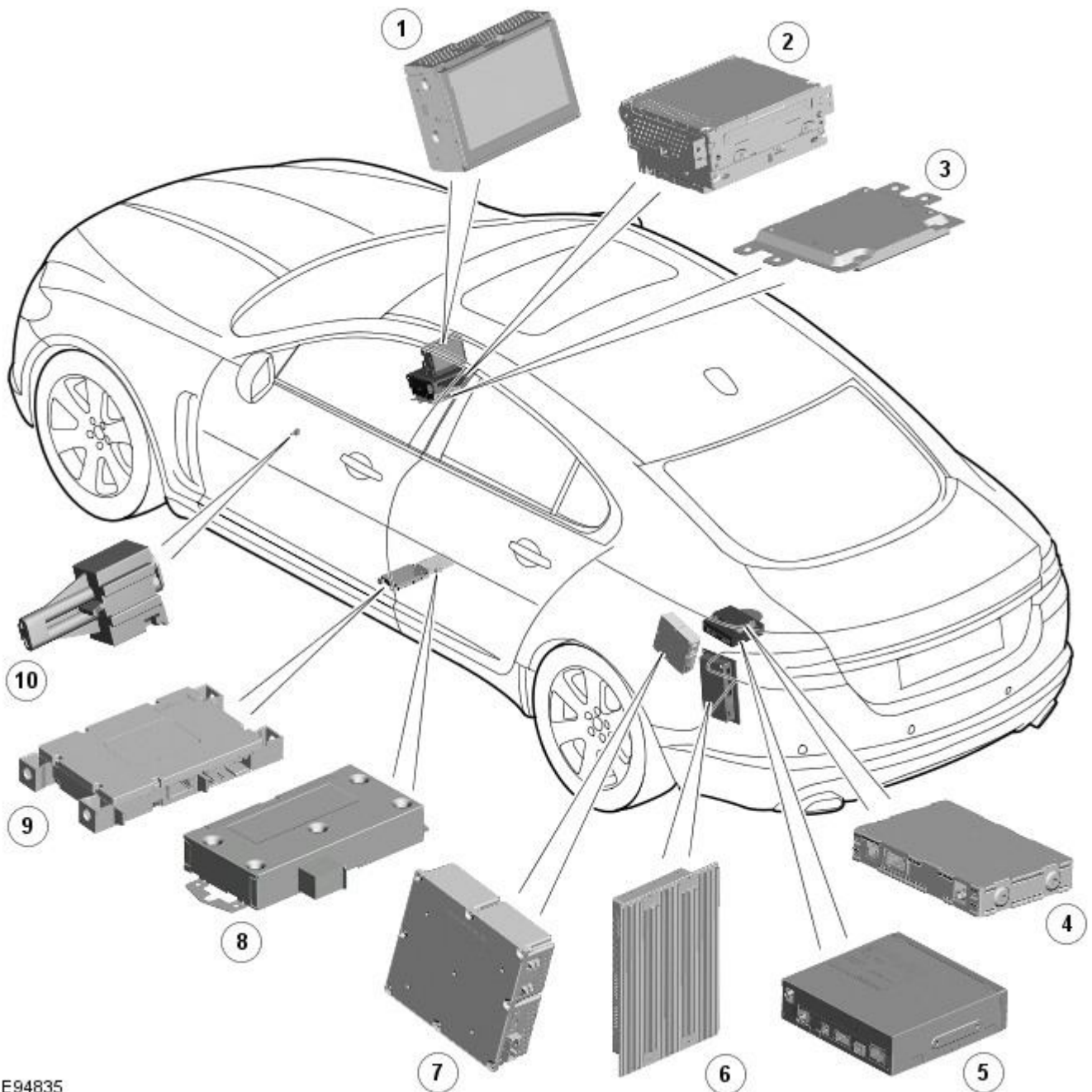
Item	Description
	NOTE: <a href="#">LHD</a> vehicle shown
1	<a href="#">ECM</a> - V8 shown
2	Headlamp leveling control module
3	Occupant classification system control module
4	Adaptive damping control module
5	Instrument cluster
6	Electronic transmission selector
7	Electronic Parking Brake (EPB) module
8	<a href="#">RCM (restraints control module)</a>
9	Adaptive speed control module
10	Diagnostic socket
11	Pedestrian protection control module

12 Electric steering column lock

13 [TCM](#)

14 [ABS \(anti-lock brake system\)](#) module

COMPONENT LOCATION - MOST



E94835

**ItemDescription**

NOTE: [LHD](#) vehicle shown

1 Touch Screen Display (TSD)

2 Integrated audio module

3 Entertainment system control module

4 Digital Audio Broadcast (DAB)/Satellite Digital Audio Radio System (SDARS)

5 Multimedia module

6 Audio system amplifier

7 Television (TV) tuner

8 Portable audio interface

9 Blue tooth phone module

10 Software download socket

# Multifunction Electronic Modules - Module Controlled Functions - Overview

Description and Operation

## OVERVIEW

The vehicle electrical system comprises a number of control modules which are interconnected via several network systems.

The following network systems are used on the vehicle:

- High speed CAN (controller area network) bus
- Medium speed CAN bus
- LIN (local interconnect network) bus
- K Bus
- Media Orientated Systems Transport (MOST) ring.

# Multifunction Electronic Modules - Module Controlled Functions - System Operation and Component Description

Description and Operation

## System Operation

### MODULE CONTROLLED FUNCTIONS

Refer to the relevant section for details of system operation.

### Component Description

### MODULES, SYSTEMS AND FUNCTION

The **CJB (central junction box)** is the 'gateway' for the network systems which allows information to be exchanged between networks.

The entertainment system components are connected on a fiber optic MOST ring. The MOST ring can send and receive information to/from the other network systems via a 'gateway' in the Integrated Control Module.

The following table shows each vehicle control module, the network system to which it is connected, its function and location in the vehicle.

Module	Network System	Function	Vehicle Location
Instrument cluster	High speed <a href="#">CAN (controller area network)</a> bus	Receives data from other vehicle systems to provide information to the driver. Also functions as the gateway for the bus systems.	Instrument panel.
Steering column	High speed <a href="#">CAN</a> bus	Controls the locking and unlocking of the steering column.	Upper steering column.
Diagnostic socket	High speed <a href="#">CAN</a> bus	Allows the transfer of vehicle information using a Jaguar approved diagnostic system or other diagnostic tool.	In the lower instrument panel on the driver's side, adjacent to the start control module.
<a href="#">RCM (restraints control module)</a>	High speed <a href="#">CAN</a> bus	Controls the deployment of the supplementary restraint components.	At rear of floor console.
<a href="#">TCM (transmission control module)</a>	High speed <a href="#">CAN</a> bus	Controls automatic transmission operation.	Inside the transmission and accessible via the fluid pan.
<a href="#">ECM (engine control module)</a>	High speed <a href="#">CAN</a> bus	Controls engine management and fuel system operation.	Rear of the engine compartment on the bulkhead.
<a href="#">ABS (anti-lock brake system)</a>	High speed <a href="#">CAN</a> bus	Controls all aspects of the braking system	Rear of the engine compartment on the bulkhead.
Headlamp leveling module	High speed <a href="#">CAN</a> bus	Controls the static dynamic headlamp leveling function.	In the lower instrument panel, behind the glovebox.
Occupant classification system control module (NAS only)	High speed <a href="#">CAN</a> bus	Detects when a passenger is in the front passenger seat and can determine their size and weight.	Below the front passenger seat.
Adaptive damping control module	High speed <a href="#">CAN</a> bus	Controls the adjustment of the dampers.	Below the front passenger seat.
Electronic Parking Brake (EPB) module	High speed <a href="#">CAN</a> bus	Controls the application and release of the electronic parking brake.	In the luggage compartment, above the <a href="#">RH (right-hand)</a> wheel arch.
Pedestrian protection module	High speed <a href="#">CAN</a> bus	Controls and monitors the pedestrian protection system.	<a href="#">LH (left-hand)</a> 'A' pillar.
Adaptive speed control module	High speed <a href="#">CAN</a> bus	Controls the vehicle's road speed in relation to other vehicles when in speed control mode.	Behind the instrument panel on the driver's side.
Electronic transmission selector	High speed <a href="#">CAN</a> bus	Allows the driver to electronically select the required automatic transmission mode. Transmits driver selections to the <a href="#">TCM</a> .	In the floor console.
Jaguar Drive control module	High speed <a href="#">CAN</a> bus	Controls the Jaguar Drive function and communicates with other system modules.	Integral with the electronic transmission selector software in the floor console.
<a href="#">CJB</a>	Medium speed <a href="#">CAN</a> bus	Controls body functions and power distribution.	On <a href="#">RH</a> 'A' pillar.
Diagnostic socket	Medium speed <a href="#">CAN</a> bus	Allows the transfer of vehicle information using a Jaguar approved diagnostic system or other diagnostic tool.	In the lower instrument panel on the driver's side, adjacent to the start control module.
Passenger door module	Medium speed <a href="#">CAN</a> bus	Controls window and locking functions.	In the front passenger door.
Parking aid module	Medium speed <a href="#">CAN</a> bus	Controls the parking aid system.	In the <a href="#">LH</a> side of the luggage compartment, adjacent to the keyless vehicle module.
Driver's seat module	Medium speed <a href="#">CAN</a> bus	Controls driver's seat positioning and also memory functions of other personalized functions.	Below the driver's seat.

Module	Network System	Function	Vehicle Location
Instrument cluster	Medium speed <a href="#">CAN</a> bus	Receives data from other systems to provide driver information.	In the instrument panel.
Driver's door module	Medium speed <a href="#">CAN</a> bus	Controls window and locking functions.	In the driver's door.
<a href="#">ATC</a> (automatic temperature control) module	Medium speed <a href="#">CAN</a> bus	Contains controls for the heating and air conditioning systems.	On the end of the air conditioning evaporator and blower assembly.
Information control module	Medium speed <a href="#">CAN</a> bus	Contains controls for the entertainment systems.	In the instrument panel below the integrated control panel.
Integrated control panel	Medium speed <a href="#">CAN</a> bus	Contains controls for the entertainment systems and gateway between audio system and other vehicle systems.	In the instrument panel.
Front seat climate control module	Medium speed <a href="#">CAN</a> bus	Controls the temperature requirements of the driver and passenger front seats.	Below the <a href="#">RH</a> front seat.
<a href="#">LH</a> blind spot monitoring module	Medium speed <a href="#">CAN</a> bus	Controls the operating parameters of the system and provides driver indications and fault monitoring.	Behind the outer part of the rear bumper, rearward of the rear wheel.
<a href="#">RH</a> blind spot monitoring module	Medium speed <a href="#">CAN</a> bus	Controls the operating parameters of the system and provides driver indications and fault monitoring.	Behind the outer part of the rear bumper, rearward of the rear wheel.
Keyless vehicle module	Medium speed <a href="#">CAN</a> bus	Allows the vehicle to be opened and closed without the use of a key.	In the <a href="#">LH</a> side of the luggage compartment, adjacent to the parking aid module.
<a href="#">RJB</a> (rear junction box)	Medium speed <a href="#">CAN</a> bus	Controls body functions and power distribution.	<a href="#">RH</a> of luggage compartment.
Tire pressure monitoring control module	Medium speed <a href="#">CAN</a> bus	Monitors the vehicle tires to warn of deflation.	Below the rear of the floor console.
<a href="#">TCM</a>	K Bus	Data transfer between <a href="#">TCM</a> and diagnostic socket. <b>NOTE:</b> Only fitted to early build vehicles.	Inside the transmission and accessible by removal of the fluid pan.
Driver's side rear door module	<a href="#">LIN</a> (local interconnect network)	Controls window and locking operation.	In the driver's side rear door.
Passenger side rear door module	<a href="#">LIN</a>	Controls window and locking operation.	In the passenger side rear door.
Driver's door module	<a href="#">LIN</a>	Memory/adjustment functions for seat, steering column and mirrors and door security functions.	In the driver's door.
Passenger front door module	<a href="#">LIN</a>	Memory/adjustment functions for seat, steering column and mirrors and door security functions.	In the passenger door.
Driver's door switches	<a href="#">LIN</a>	Transmit driver selections to the driver's door module.	In the driver's door panel.
<a href="#">ECM</a>	<a href="#">LIN</a>	Receives a load signal from the generator.	In the engine compartment on the bulkhead.
Generator	<a href="#">LIN</a>	Provide load signal to the <a href="#">ECM</a> .	On the <a href="#">LH</a> side at the front of the engine.
Driver's seat module	<a href="#">LIN</a>	Control position of driver's seat.	Below the driver's seat on the floor pan.
Driver's seat switches	<a href="#">LIN</a>	Provide driver selection inputs to the driver's seat module.	On the outside of the trim panel on the driver's seat.
Air quality sensor	<a href="#">LIN</a>	Measures quality of air entering the vehicle interior.	At the front of the vehicle, behind the air intake grill.
Windshield (defrost) stepper motor	<a href="#">LIN</a>	Moves flaps within the heater assembly to direct air flow to the windshield.	On the heater assembly.
Face/feet stepper motor	<a href="#">LIN</a>	Moves flaps within the heater assembly to direct air flow to instrument panel vents and/or footwell.	On the heater assembly.
<a href="#">LH</a> temperature blend stepper motor	<a href="#">LIN</a>	Moves flaps within the heater assembly to control temperature in <a href="#">LH</a> side footwell.	On the heater assembly.
<a href="#">RH</a> temperature blend stepper motor	<a href="#">LIN</a>	Moves flaps within the heater assembly to direct air flow to <a href="#">RH</a> side footwell.	On the heater assembly.
Electric booster heater	<a href="#">LIN</a>	Controls operation of the electric booster heater.	Inside the heater assembly.
<a href="#">LH</a> outer face level vent	<a href="#">LIN</a>	Controls the operation of the face level vent stepper motor.	In the instrument panel.
<a href="#">LH</a> inner face level vent	<a href="#">LIN</a>	Controls the operation of the face level vent stepper motor.	In the instrument panel.
<a href="#">RH</a> inner face level vent	<a href="#">LIN</a>	Controls operation of the face level vent stepper motor.	In the instrument panel.
<a href="#">RH</a> outer face level vent	<a href="#">LIN</a>	Controls operation of the face level vent stepper motor.	In the instrument panel.
<a href="#">ATC</a> module	<a href="#">LIN</a>	Controls operation of the climate system functions.	In the instrument panel.
Steering wheel audio switches	<a href="#">LIN</a>	Converts analogue signals from steering wheel switches into digital messages.	On the steering wheel.
Steering wheel clockspring	<a href="#">LIN</a>	Passes digital messages from the steering wheel audio switches to the instrument cluster.	Behind the steering wheel, on the upper steering column.
Instrument cluster	<a href="#">LIN</a>	Receives digital signals from other vehicle systems.	On the driver's side of the instrument panel.



Module	Network System	Function	Vehicle Location
Battery backed sounder	<a href="#">LIN</a>	Activated by <a href="#">CJB</a> when alarm trigger is received.	In the <a href="#">LH</a> side of the engine compartment, near the bulkhead.
<a href="#">CJB</a>	<a href="#">LIN</a>	Controls body functions and power distribution.	On the <a href="#">RH</a> 'A' pillar.
<a href="#">RJB</a>	<a href="#">LIN</a>	Controls body functions and power distribution.	On the <a href="#">RH</a> of the luggage compartment.
Battery monitoring system module	<a href="#">LIN</a>	Monitors the condition and charge of the vehicle battery.	On the vehicle battery positive terminal in the luggage compartment.
Intrusion detection module	<a href="#">LIN</a>	Detects movement in the vehicle interior and activates the anti-theft system.	In the front overhead console.
Rain/light sensor	<a href="#">LIN</a>	Detects ambient light levels and moisture on the windscreen for operation of the automatic headlamps and wiper systems.	On the inside of the windshield behind the interior rear view mirror.
Start control module	<a href="#">LIN</a>	Used to identify the Smart Key - component of the keyless start system.	In the lower instrument panel on the driver's side.
Rear view camera	<a href="#">LIN</a>	Passes digital images data from the rear view camera to the <a href="#">RJB</a>	In the luggage compartment lid trim finisher.
Driver's window switch	<a href="#">LIN</a>	Controls operation of the driver's window.	In the driver's door trim panel.
Electronic transmission selector	<a href="#">LIN</a>	Sends selector position to the <a href="#">TCM</a> .	In the floor console.
<a href="#">TCM</a>	<a href="#">LIN</a>	Receives selector position information to control the transmission.	Inside the transmission and accessible by removal of the fluid pan.
Information control module	Media Oriented System Transport (MOST)	Contains controls for the entertainment system and gateway between audio system and other vehicle systems.	In the instrument panel below the integrated control panel.
Integrated control panel	MOST	Contains controls for the entertainment system.	In the instrument panel.
Digital Audio Broadcast (DAB) receiver (SDARS NAS only)	MOST	Receives digital radio broadcasts.	In the <a href="#">LH</a> side of the luggage compartment, above the keyless vehicle module.
Bluetooth® phone module	MOST	Controls operation of the Bluetooth® phone system.	Below the <a href="#">LH</a> front seat, adjacent to the portable audio module.
Amplifier/tuner	MOST	Provides amplification for the entertainment systems and reception of radio RF broadcasts.	In the <a href="#">LH</a> side of the luggage compartment.
Navigation computer	MOST	Reads map data from a <a href="#">DVD (digital versatile disc)</a> to calculate and display visual route guidance information via the TSD and audible guidance via the amplifier to the driver.	In the <a href="#">LH</a> side of the luggage compartment.
Touch Screen Display (TSD)	MOST	Provides the driver interface to the entertainment, navigation and driver personalization functions.	In the center of the instrument panel.
TV tuner	MOST	Controls the reception of television signals and audio/visual inputs.	In the <a href="#">LH</a> side of the luggage compartment.
Portable Audio Module	MOST	Controls the auxiliary inputs for additional audio inputs via the portable audio interface.	Below the <a href="#">LH</a> front seat, adjacent to the Bluetooth® phone module.
MOST diagnostic connector	MOST	Allows for diagnostic fault detection of the MOST ring.	Below the air ducting in the floor console.

Refer to Communications Network section for further details.

Refer to: [Communications Network](#) (418-00 Module Communications Network, Description and Operation).



# Multifunction Electronic Modules - Driver Door Module (DDM)

Diagnosis and Testing

## Description and Operation

For a detailed description of the multifunction electronic control modules, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (419-10 Multifunction Electronic Modules)

[Module Controlled Functions](#) (Description and Operation),  
[Module Controlled Functions](#) (Description and Operation),  
[Module Controlled Functions](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Electrical
<ul style="list-style-type: none"> <li>● Fuse(s)</li> <li>● Electrical connector(s)</li> <li>● Wiring Harness</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B10EB11	Driver door double locking motor	<ul style="list-style-type: none"> <li>● Driver door double locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test driver door double locking motor control circuit for short ground
B10EB15	Driver door double locking motor	<ul style="list-style-type: none"> <li>● Driver door double locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver door double locking motor control circuit for short to power or open circuit
B10EC11	Passenger door double locking motor	<ul style="list-style-type: none"> <li>● Passenger door double locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger door double locking motor control circuit for short ground
B10EC15	Passenger door double locking motor	<ul style="list-style-type: none"> <li>● Passenger door double locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test passenger door double locking motor control circuit for short to power or open circuit

DTC	Description	Possible Cause	Action
B10ED11	Rear door driver side double locking motor	<ul style="list-style-type: none"> <li>Rear door driver side double locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test rear door driver side double locking motor control circuit for short ground
B10ED15	Rear door driver side double locking motor	<ul style="list-style-type: none"> <li>Rear door driver side double locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test rear door driver side double locking motor control circuit for short power, open circuit
B10EE11	Rear door passenger side double locking motor	<ul style="list-style-type: none"> <li>Rear door passenger side double locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test rear door passenger side double locking motor control circuit for short ground
B10EE15	Rear door passenger side double locking motor	<ul style="list-style-type: none"> <li>Rear door passenger side double locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test rear door passenger side double locking motor control circuit for short power, open circuit
B110811	Driver door central locking motor	<ul style="list-style-type: none"> <li>Driver door central locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test driver door central locking motor control circuit for short ground
B110815	Driver door central locking motor	<ul style="list-style-type: none"> <li>Driver door central locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver door central locking motor control circuit for short to power, open circuit
B110A11	Rear door driver side central locking motor	<ul style="list-style-type: none"> <li>Rear driver door central locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test rear driver door central locking motor control circuit for short ground
B110A15	Rear door driver side central locking motor	<ul style="list-style-type: none"> <li>Rear driver door central locking motor control circuit - short to power, open circuit</li> </ul>	Refer to the electrical circuit diagrams and test rear driver door central locking motor control circuit for short to power, open circuit
B116311	Left Mirror Heater Output	<ul style="list-style-type: none"> <li>Left mirror heater control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test left mirror heater control circuit for short to ground
B116315	Left Mirror Heater Output	<ul style="list-style-type: none"> <li>Left mirror heater control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test left mirror heater control circuit for short to power, open circuit
B116411	Right Mirror Heater Output	<ul style="list-style-type: none"> <li>Right mirror heater control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test right mirror heater control circuit for short to ground
B116415	Right Mirror Heater Output	<ul style="list-style-type: none"> <li>Right mirror heater control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test right mirror heater control circuit for short to power, open circuit
B116511	Left Front Puddle Lamp Output	<ul style="list-style-type: none"> <li>Left front puddle lamp control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test left front puddle lamp control circuit for short to ground
B116515	Left Front Puddle Lamp Output	<ul style="list-style-type: none"> <li>Left front puddle lamp control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test left front puddle lamp control circuit for short to power, open circuit
B116611	Right Front Puddle Lamp Output	<ul style="list-style-type: none"> <li>Right front puddle lamp control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test right front puddle lamp control circuit for short to ground
B116615	Right Front Puddle Lamp Output	<ul style="list-style-type: none"> <li>Right front puddle lamp control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test right front puddle lamp control circuit for short to power, open circuit
B117C07	Rear Power Window Up	<ul style="list-style-type: none"> <li>Mechanical failure</li> </ul>	Check rear window mechanism for mechanical failure
B117C72	Rear Power Window Up	<ul style="list-style-type: none"> <li>Actuator stuck open</li> </ul>	Suspect the rear door module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B117C73	Rear Power Window Up	<ul style="list-style-type: none"> <li>Actuator stuck closed</li> </ul>	Suspect the rear door module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B117C92	Rear Power Window Up	<ul style="list-style-type: none"> <li>Performance or incorrect operation</li> </ul>	Refer to the electrical circuit diagrams and check rear door module power and ground supplies

DTC	Description	Possible Cause	Action
B117D72	Rear Power Window Down	<ul style="list-style-type: none"> <li>Actuator stuck open</li> </ul>	Suspect the rear door module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B117D73	Rear Power Window Down	<ul style="list-style-type: none"> <li>Actuator stuck closed</li> </ul>	Suspect the rear door module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B117E07	Front Power Window Up	<ul style="list-style-type: none"> <li>Mechanical failure</li> </ul>	Check front window mechanism for mechanical failure
B117E72	Front Power Window Up	<ul style="list-style-type: none"> <li>Actuator stuck open</li> </ul>	Suspect the DDM. Check and install a new DDM as required, refer to the new module/component installation note at the top of the DTC Index
B117E73	Front Power Window Up	<ul style="list-style-type: none"> <li>Actuator stuck closed</li> </ul>	Suspect the DDM. Check and install a new DDM as required, refer to the new module/component installation note at the top of the DTC Index
B117F72	Front Power Window Down	<ul style="list-style-type: none"> <li>Actuator stuck open</li> </ul>	Suspect the DDM. Check and install a new DDM as required, refer to the new module/component installation note at the top of the DTC Index
B117F73	Front Power Window Down	<ul style="list-style-type: none"> <li>Actuator stuck closed</li> </ul>	Suspect the DDM. Check and install a new DDM as required, refer to the new module/component installation note at the top of the DTC Index
B118929	Front Window Position Sensor	<ul style="list-style-type: none"> <li>Front window hall position sensor - signal invalid</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B118A29	Rear Window Position Sensor	<ul style="list-style-type: none"> <li>Rear window hall position sensor - signal invalid</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B11D183	LIN Bus Circuit "C"	<ul style="list-style-type: none"> <li>Value of signal protection calculation incorrect</li> </ul>	Suspect driver switchpack. Check and install a new driver switchpack as required, refer to the new module/component installation note at the top of the DTC Index
B11D186	LIN Bus Circuit "C"	Signal invalid	Suspect driver switchpack. Check and install a new driver switchpack as required, refer to the new module/component installation note at the top of the DTC Index
B11D187	LIN Bus Circuit "C"	Missing message	Suspect driver switchpack. Check and install a new driver switchpack as required, refer to the new module/component installation note at the top of the DTC Index
B11F611	Driver Folding Mirror Motor	<ul style="list-style-type: none"> <li>Driver folding mirror motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check driver folding mirror motor control circuit for short to ground
B11F615	Driver Folding Mirror Motor	<ul style="list-style-type: none"> <li>Driver folding mirror motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver folding mirror motor control circuit for short to power, open circuit
B1A9883	LIN Bus Circuit #1	<ul style="list-style-type: none"> <li>Value of signal protection calculation incorrect</li> </ul>	Refer to the electrical circuit diagrams and check LIN circuit between DDM and rear door module for short/open circuits
B1A9886	LIN Bus Circuit #1	<ul style="list-style-type: none"> <li>Signal invalid</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check LIN circuit between DDM and rear door module for short/open circuits
B1A9887	LIN Bus Circuit #1	<ul style="list-style-type: none"> <li>Missing message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check LIN circuit between DDM and rear door module for short/open circuits
B1C0911	Driver Left/Right Mirror Motor Circuit	<ul style="list-style-type: none"> <li>Driver left/right mirror motor control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver left/right mirror motor control circuit for short to ground
B1C0915	Driver Left/Right Mirror Motor Circuit	<ul style="list-style-type: none"> <li>Driver left/right mirror motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver left/right mirror motor control circuit for short to power, open circuit
B1C1011	Driver Up/Down Mirror Motor Circuit	<ul style="list-style-type: none"> <li>Driver up/down mirror motor control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver up/down mirror motor control circuit for short to ground
B1C1015	Driver Up/Down Mirror Motor Circuit	<ul style="list-style-type: none"> <li>Driver up/down mirror motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver up/down mirror motor control circuit for short to power, open circuit

DTC	Description	Possible Cause	Action
B1C1311	Driver Up/Down Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> <li>Driver up/down mirror motor feedback circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test driver up/down mirror motor feedback circuit for short to ground
B1C1315	Driver Up/Down Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> <li>Driver up/down mirror motor feedback circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver up/down mirror motor feedback circuit for short to power, open circuit
B1C1411	Driver Left/Right Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> <li>Driver left/right mirror motor feedback circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test driver left/right mirror motor feedback circuit for short to ground
B1C1415	Driver Left/Right Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> <li>Driver left/right mirror motor feedback circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver left/right mirror motor feedback circuit for short to power, open circuit
B1D0611	Left Turn Indicator	<ul style="list-style-type: none"> <li>Left side turn indicator repeater lamp circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check left side turn indicator repeater lamp circuit for short to ground
B1D0615	Left Turn Indicator	<ul style="list-style-type: none"> <li>Left side turn indicator repeater lamp circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left side turn indicator repeater lamp circuit for short to power, open circuit
B1D0711	Right Turn Indicator	<ul style="list-style-type: none"> <li>Right side turn indicator repeater lamp circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check right side turn indicator repeater lamp circuit for short to ground
B1D0715	Right Turn Indicator	<ul style="list-style-type: none"> <li>Right side turn indicator repeater lamp circuit - short to power, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check right side turn indicator repeater lamp circuit for short to power, open circuit
C1B1411	Sensor Supply #1	<ul style="list-style-type: none"> <li>Window position hall sensors supply circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test window position hall sensors supply circuit for short to ground
C1B1415	Sensor Supply #1	<ul style="list-style-type: none"> <li>Window position hall sensors supply circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test window position hall sensors supply circuit for short to power, open circuit
C1B1511	Sensor Supply #2	<ul style="list-style-type: none"> <li>Hall sensor supply circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test window position hall sensors supply circuit for short to ground
C1B1515	Sensor Supply #2	<ul style="list-style-type: none"> <li>Hall sensor supply circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test window position hall sensors supply circuit for short to power, open circuit
U001000	Medium Speed CAN Communication Bus	<ul style="list-style-type: none"> <li>Bus off</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014000	Lost Communication With Body Control Module	<ul style="list-style-type: none"> <li>Missing message from CJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U020800	Lost Communication With Seat Control Module "A"	<ul style="list-style-type: none"> <li>Missing message from driver seat module</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030000	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>Invalid configuration message is received</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC remains suspect the DDM. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U200224	Switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Clear DTC and re-test. If DTC remains, suspect the passenger side window switch. Check and install a new passenger side window switch
U200424	Auxiliary Switch Pack	<ul style="list-style-type: none"> <li>Left or right rear door local switch - signal stuck high</li> </ul>	Check for stuck rear window switch. Refer to the electrical circuit diagrams and check left or right rear door local switch circuit for short circuit
U201011	Switch illumination	<ul style="list-style-type: none"> <li>Rear window switch illumination circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check rear window switch illumination circuit for short to ground
U201208	Car Configuration Parameter(s)	<ul style="list-style-type: none"> <li>Bus signal/message failures</li> </ul>	Cycle the ignition status and re-test. If DTC remains, re-configure the RJB using the manufacturer approved diagnostic system
U201324	Switch Pack	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Clear DTC and re-test. If DTC remains, install a new driver door switch pack
U201444	Control Module Hardware	<ul style="list-style-type: none"> <li>Data memory failure</li> </ul>	Suspect the DDM. Check and install a new DDM as required, refer to the new module/component installation note at the top of the DTC Index

<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
U210000	Initial Configuration Not Complete	<ul style="list-style-type: none"> <li>● No sub type information</li> </ul>	Re-configure the DDM using the manufacturer approved diagnostic system
U300049	Control Module	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Suspect the DDM. Check and install a new DDM as required, refer to the new module/component installation note at the top of the DTC Index
U300255	Vehicle Identification Number	<ul style="list-style-type: none"> <li>● Not configured</li> </ul>	Re-configure the DDM as new using the manufacturer approved diagnostic system and re-test. If DTC remains install a new module, refer to the new module/component installation note at the top of the DTC Index
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> <li>● Vehicle/component mis-match. Corrupt VIN data being transmitted, module previously installed to other vehicle</li> </ul>	Check and install correct/new module as required, refer to the new module/component installation note at the top of the DTC Index
U300362	Battery voltage	<ul style="list-style-type: none"> <li>● Mis-match in battery voltage, of 2 volts or more, between DDM and RJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

# Multifunction Electronic Modules - Remote Keyless Entry (RKE) Module

Diagnosis and Testing

## Principles of Operation

For a detailed description of the Remote Keyless Entry system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (419-10 Multifunction Electronic Modules)

[Module Controlled Functions](#) (Description and Operation),  
[Module Controlled Functions](#) (Description and Operation),  
[Module Controlled Functions](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. Verify the customer concern.
2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Misaligned door(s), hood or luggage compartment lid</li> <li>● Door latch(s)</li> <li>● Actuating rod(s)</li> <li>● Exterior door handle(s)</li> <li>● Interior door handle(s)</li> <li>● Door lock cylinder</li> <li>● Cable(s)</li> <li>● Luggage compartment lid exterior release switch</li> </ul>	<ul style="list-style-type: none"> <li>● Fuse(s)</li> <li>● Wiring harness</li> <li>● Electrical connector(s)</li> <li>● Door lock actuator(s)</li> <li>● Remote transmitter batteries</li> <li>● Vehicle battery</li> <li>● Remote transmitter</li> <li>● Door lock switch(s)</li> </ul>

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

- NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).
- NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.
- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.
- NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B102B00	Passive Key	<ul style="list-style-type: none"> <li>● Response Error - general failure</li> </ul>	Using the manufacturer approved diagnostic system, clear all passive keys, re-learn all passive keys
B10C100	Left Front Unlock Pull Switch	<ul style="list-style-type: none"> <li>● No subtype information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10C124	Left Front Unlock Pull Switch	<ul style="list-style-type: none"> <li>● Signal stuck high - button stuck in active position</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for stuck left front unlock switch. Refer to the electrical circuit diagrams and check left front unlock switch circuit for short to ground
B10C200	Left Rear Unlock Pull Switch	<ul style="list-style-type: none"> <li>● No subtype information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system



DTC	Description	Possible Cause	Action
B10C224	Left Rear Unlock Pull Switch	<ul style="list-style-type: none"> <li>Signal stuck high - button stuck in active position</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for stuck left rear unlock switch. Refer to the electrical circuit diagrams and check left rear unlock switch circuit for short to ground
B10C300	Right Front Unlock Pull Switch	<ul style="list-style-type: none"> <li>No subtype information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10C324	Right Front Unlock Pull Switch	<ul style="list-style-type: none"> <li>Signal stuck high - button stuck in active position</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for stuck right front unlock switch. Refer to the electrical circuit diagrams and check right front unlock switch circuit for short to ground
B10C400	Right Rear Unlock Pull Switch	<ul style="list-style-type: none"> <li>No subtype information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10C424	Right Rear Unlock Pull Switch	<ul style="list-style-type: none"> <li>Signal stuck high - button stuck in active position</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for stuck right rear unlock switch. Refer to the electrical circuit diagrams and check right front unlock switch circuit for short to ground
B10C524	Trunk Unlock Pull Switch	<ul style="list-style-type: none"> <li>Signal stuck high - button stuck in active position</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for stuck luggage compartment lid unlock switch. Refer to the electrical circuit diagrams and check luggage compartment lid unlock switch circuit for short to ground
B10C61F	Exterior Trunk Antenna	<ul style="list-style-type: none"> <li>Circuit intermittent - general electrical error</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check exterior luggage compartment antenna circuits for short to ground, power, open circuit
B10C71F	Interior Trunk Antenna	<ul style="list-style-type: none"> <li>Circuit intermittent - general electrical error</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check interior luggage compartment antenna circuits for short to ground, power, open circuit
B10C81F	Interior Center Antenna	<ul style="list-style-type: none"> <li>Circuit intermittent - general electrical error</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check interior center antenna circuits for short to ground, power, open circuit
B10C91F	Interior Front Antenna	<ul style="list-style-type: none"> <li>Circuit intermittent - general electrical error</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check interior front antenna circuits for short to ground, power, open circuit
B10CA1F	Left Rear Door Handle Antenna	<ul style="list-style-type: none"> <li>Circuit intermittent - general electrical error</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left rear door handle antenna circuits for short to ground, power, open circuit
B10CB1F	Right Rear Door Handle Antenna	<ul style="list-style-type: none"> <li>Circuit intermittent - general electrical error</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right rear door handle antenna circuits for short to ground, power, open circuit
B10CC24	Left Front Latch Clutch Switch	<ul style="list-style-type: none"> <li>Signal stuck high - button stuck in active position</li> </ul>	Check for stuck left front door latch clutch switch. Refer to the electrical circuit diagrams and check left front door latch clutch switch circuit for short to ground
B10CD24	Left Rear Latch Clutch Switch	<ul style="list-style-type: none"> <li>Signal stuck high - button stuck in active position</li> </ul>	Check for stuck left rear door latch clutch switch. Refer to the electrical circuit diagrams and check left rear door latch clutch switch circuit for short to ground
B10CE24	Right Front Latch Clutch Switch	<ul style="list-style-type: none"> <li>Signal stuck high - button stuck in active position</li> </ul>	Check for stuck right front door latch clutch switch. Refer to the electrical circuit diagrams and check right front door latch clutch switch circuit for short to ground
B10CF24	Right Rear Latch Clutch Switch	<ul style="list-style-type: none"> <li>Signal stuck high - button stuck in active position</li> </ul>	Check for stuck right rear door latch clutch switch. Refer to the electrical circuit diagrams and check right rear door latch clutch switch circuit for short to ground
B10D124	Left Front Lock Button	<ul style="list-style-type: none"> <li>Signal stuck high - button stuck in active position</li> </ul>	Check for stuck left front door handle lock switch. Refer to the electrical circuit diagrams and check left front door handle lock switch circuit for short to ground
B10D224	Left Rear Lock Button	<ul style="list-style-type: none"> <li>Signal stuck high - button stuck in active position</li> </ul>	Check for stuck left rear door handle lock switch. Refer to the electrical circuit diagrams and check left rear door handle lock switch circuit for short to ground
B10D324	Right Front Lock Button	<ul style="list-style-type: none"> <li>Signal stuck high - button stuck in active position</li> </ul>	Check for stuck right front door handle lock switch. Refer to the electrical circuit diagrams and check right front door handle lock switch circuit for short to ground
B10D424	Right Rear Lock Button	<ul style="list-style-type: none"> <li>Signal stuck high - button stuck in active position</li> </ul>	Check for stuck right rear door handle lock switch. Refer to the electrical circuit diagrams and check left front door handle lock switch circuit for short to ground

DTC	Description	Possible Cause	Action
U001000	Medium Speed CAN Communication Bus	<ul style="list-style-type: none"> <li>No subtype information</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Carry out CAN network integrity test using the manufacturer approved diagnostic system
U014000	Lost Communication With Body Control Module	<ul style="list-style-type: none"> <li>Missing message from CJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Carry out CAN network integrity test using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies to CJB
U014200	Lost Communication With Body Control Module "B"	<ul style="list-style-type: none"> <li>Missing message from RJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Carry out CAN network integrity test using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies to RJB
U015500	Lost Communication With Instrument Panel Cluster (IPC) Control Module	<ul style="list-style-type: none"> <li>Missing message from instrument cluster</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Carry out CAN network integrity test using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies to instrument cluster
U030000	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>Invalid configuration message is received</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the remote keyless entry module, refer to the new module installation note at the top of the DTC Index
U201F00	External Receiver	<ul style="list-style-type: none"> <li>No subtype information - communication error</li> </ul>	Suspect the RF receiver, check and install a new RF receiver as required, refer to the new module/component installation note at top of DTC Index
U201F13	External Receiver	<ul style="list-style-type: none"> <li>Line open</li> </ul>	Refer to the electrical circuit diagrams and test RF receiver communication circuit to remote keyless entry module for short to ground or open circuit
U201F87	External Receiver	<ul style="list-style-type: none"> <li>Transmission error</li> </ul>	Refer to the electrical circuit diagrams and check the data line between the RF receiver and the remote keyless entry module for short, open circuit. Suspect the RF receiver or remote keyless entry module, check and install a new RF receiver or remote keyless entry module as required, refer to the new module/component installation note at top of DTC Index
U210000	Initial Configuration Not Complete	<ul style="list-style-type: none"> <li>No subtype information</li> </ul>	Configure the Remote Keyless Entry module using the manufacturer approved diagnostic system
U210100	Control Module Configuration Incompatible	<ul style="list-style-type: none"> <li>No subtype information</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system
U300049	Control Module	<ul style="list-style-type: none"> <li>Internal electronic failure</li> </ul>	Install a new remote keyless entry module, refer to the new module installation note at the top of the DTC Index
U300281	Vehicle Identification Number	<ul style="list-style-type: none"> <li>Vehicle/component mis-match. Module previously installed to other vehicle</li> </ul>	Install correct/new module to vehicle specification, refer to the new module/component installation note at the top of the DTC Index
U300362	Battery Voltage	<ul style="list-style-type: none"> <li>Mis-match in battery voltage, of 2 volts or more, between remote keyless entry module and RJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

# Multifunction Electronic Modules - Passenger Door Module (PDM)

Diagnosis and Testing

## Description and Operation

For a detailed description of the multifunction electronic control modules, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (419-10 Multifunction Electronic Modules)

[Module Controlled Functions](#) (Description and Operation),  
[Module Controlled Functions](#) (Description and Operation),  
[Module Controlled Functions](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Electrical
<ul style="list-style-type: none"> <li>● Fuse(s)</li> <li>● Electrical connector(s)</li> <li>● Wiring Harness</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B10EB11	Driver door double locking motor	<ul style="list-style-type: none"> <li>● Driver door double locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test driver door double locking motor control circuit for short ground
B10EB15	Driver door double locking motor	<ul style="list-style-type: none"> <li>● Driver door double locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver door double locking motor control circuit for short to power or open circuit
B10EC11	Passenger door double locking motor	<ul style="list-style-type: none"> <li>● Passenger door double locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger door double locking motor control circuit for short ground
B10EC15	Passenger door double locking motor	<ul style="list-style-type: none"> <li>● Passenger door double locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test passenger door double locking motor control circuit for short to power or open circuit

DTC	Description	Possible Cause	Action
B10ED11	Rear door driver side double locking motor	<ul style="list-style-type: none"> <li>Rear door driver side double locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test rear door driver side double locking motor control circuit for short ground
B10ED15	Rear door driver side double locking motor	<ul style="list-style-type: none"> <li>Rear door driver side double locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test rear door driver side double locking motor control circuit for short power, open circuit
B10EE11	Rear door passenger side double locking motor	<ul style="list-style-type: none"> <li>Rear door passenger side double locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test rear door passenger side double locking motor control circuit for short ground
B10EE15	Rear door passenger side double locking motor	<ul style="list-style-type: none"> <li>Rear door passenger side double locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test rear door passenger side double locking motor control circuit for short power, open circuit
B110911	Passenger door central locking motor	<ul style="list-style-type: none"> <li>Passenger door central locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger door central locking motor control circuit for short ground
B110915	Passenger door central locking motor	<ul style="list-style-type: none"> <li>Passenger door central locking motor control circuit - short to power, open circuit</li> </ul>	Refer to the electrical circuit diagrams and test passenger door central locking motor control circuit for short to power, open circuit
B110B11	Rear door passenger side central locking motor	<ul style="list-style-type: none"> <li>Rear passenger door central locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test rear passenger door central locking motor control circuit for short ground
B110B15	Rear door passenger side central locking motor	<ul style="list-style-type: none"> <li>Rear passenger door central locking motor control circuit - short to power, open circuit</li> </ul>	Refer to the electrical circuit diagrams and test rear passenger door central locking motor control circuit for short to power, open circuit
B116311	Left Mirror Heater Output	<ul style="list-style-type: none"> <li>Left mirror heater control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test left mirror heater control circuit for short to ground
B116315	Left Mirror Heater Output	<ul style="list-style-type: none"> <li>Left mirror heater control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test left mirror heater control circuit for short to power, open circuit
B116411	Right Mirror Heater Output	<ul style="list-style-type: none"> <li>Right mirror heater control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test right mirror heater control circuit for short to ground
B116415	Right Mirror Heater Output	<ul style="list-style-type: none"> <li>Right mirror heater control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test right mirror heater control circuit for short to power, open circuit
B116511	Left Front Puddle Lamp Output	<ul style="list-style-type: none"> <li>Left front puddle lamp control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test left front puddle lamp control circuit for short to ground
B116515	Left Front Puddle Lamp Output	<ul style="list-style-type: none"> <li>Left front puddle lamp control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test left front puddle lamp control circuit for short to power, open circuit
B116611	Right Front Puddle Lamp Output	<ul style="list-style-type: none"> <li>Right front puddle lamp control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test right front puddle lamp control circuit for short to ground
B116615	Right Front Puddle Lamp Output	<ul style="list-style-type: none"> <li>Right front puddle lamp control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test right front puddle lamp control circuit for short to power, open circuit
B117C07	Rear Power Window Up	<ul style="list-style-type: none"> <li>Mechanical failure</li> </ul>	Check rear window mechanism for mechanical failure
B117C72	Rear Power Window Up	<ul style="list-style-type: none"> <li>Actuator stuck open</li> </ul>	Suspect the rear door module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B117C73	Rear Power Window Up	<ul style="list-style-type: none"> <li>Actuator stuck closed</li> </ul>	Suspect the rear door module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B117C92	Rear Power Window Up	<ul style="list-style-type: none"> <li>Performance or incorrect operation</li> </ul>	Refer to the electrical circuit diagrams and check rear door module power and ground supplies

DTC	Description	Possible Cause	Action
B117D72	Rear Power Window Down	<ul style="list-style-type: none"> <li>Actuator stuck open</li> </ul>	Suspect the rear door module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B117D73	Rear Power Window Down	<ul style="list-style-type: none"> <li>Actuator stuck closed</li> </ul>	Suspect the rear door module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B117E07	Front Power Window Up	<ul style="list-style-type: none"> <li>Mechanical failure</li> </ul>	Check the front window mechanism for mechanical failure
B117E72	Front Power Window Up	<ul style="list-style-type: none"> <li>Actuator stuck open</li> </ul>	Suspect the PDM. Check and install a new PDM as required, refer to the new module/component installation note at the top of the DTC Index
B117E73	Front Power Window Up	<ul style="list-style-type: none"> <li>Actuator stuck closed</li> </ul>	Suspect the PDM. Check and install a new PDM as required, refer to the new module/component installation note at the top of the DTC Index
B117F72	Front Power Window Down	<ul style="list-style-type: none"> <li>Actuator stuck open</li> </ul>	Suspect the PDM. Check and install a new PDM as required, refer to the new module/component installation note at the top of the DTC Index
B117F73	Front Power Window Down	<ul style="list-style-type: none"> <li>Actuator stuck closed</li> </ul>	Suspect the PDM. Check and install a new PDM as required, refer to the new module/component installation note at the top of the DTC Index
B118929	Front Window Position Sensor	<ul style="list-style-type: none"> <li>Front window hall position sensor - signal invalid</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B118A29	Rear Window Position Sensor	<ul style="list-style-type: none"> <li>Rear window hall position sensor - signal invalid</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B11D183	LIN Bus Circuit "C"	<ul style="list-style-type: none"> <li>Value of signal protection calculation incorrect</li> </ul>	Suspect driver switchpack. Check and install a new driver switchpack as required, refer to the new module/component installation note at the top of the DTC Index
B11D186	LIN Bus Circuit "C"	Signal invalid	Suspect driver switchpack. Check and install a new driver switchpack as required, refer to the new module/component installation note at the top of the DTC Index
B11D187	LIN Bus Circuit "C"	Missing message	Suspect driver switchpack. Check and install a new driver switchpack as required, refer to the new module/component installation note at the top of the DTC Index
B11F711	Passenger Folding Mirror Motor	<ul style="list-style-type: none"> <li>Passenger folding mirror motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check passenger folding mirror motor control circuit for short to ground
B11F715	Passenger Folding Mirror Motor	<ul style="list-style-type: none"> <li>Passenger folding mirror motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check passenger folding mirror motor control circuit for short to power, open circuit
B1A9883	LIN Bus Circuit #1	<ul style="list-style-type: none"> <li>Value of signal protection calculation incorrect</li> </ul>	Refer to the electrical circuit diagrams and check LIN circuit between DDM and rear door module for short/open circuits
B1A9886	LIN Bus Circuit #1	<ul style="list-style-type: none"> <li>Signal invalid</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check LIN circuit between DDM and rear door module for short/open circuits
B1A9887	LIN Bus Circuit #1	<ul style="list-style-type: none"> <li>Missing message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check LIN circuit between DDM and rear door module for short/open circuits
B1C1111	Passenger Left/Right Mirror Motor Circuit	<ul style="list-style-type: none"> <li>Passenger left/right mirror motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger left/right mirror motor control circuit for short to ground
B1C1115	Passenger Left/Right Mirror Motor Circuit	<ul style="list-style-type: none"> <li>Passenger left/right mirror motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test passenger left/right mirror motor control circuit for short to power, open circuit
B1C1211	Passenger Up/Down Mirror Motor Circuit	<ul style="list-style-type: none"> <li>Passenger up/down mirror motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger up/down mirror motor control circuit for short to ground
B1C1215	Passenger Up/Down Mirror Motor Circuit	<ul style="list-style-type: none"> <li>Passenger up/down mirror motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test passenger up/down mirror motor control circuit for short to power, open circuit

DTC	Description	Possible Cause	Action
B1C1511	Passenger Up/Down Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> <li>Passenger up/down mirror motor feedback circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger up/down mirror motor feedback circuit for short to ground
B1C1515	Passenger Up/Down Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> <li>Passenger up/down mirror motor feedback circuit - short to power, open circuit</li> </ul>	Refer to the electrical circuit diagrams and test passenger up/down mirror motor feedback circuit for short to power, open circuit
B1C1611	Passenger Left/Right Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> <li>Passenger left/right mirror motor feedback circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger left/right mirror motor feedback circuit for short to ground
B1C1615	Passenger Left/Right Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> <li>Passenger left/right mirror motor feedback circuit - short to power, open circuit</li> </ul>	Refer to the electrical circuit diagrams and test passenger left/right mirror motor feedback circuit for short to power, open circuit
B1D0611	Left Turn Indicator	<ul style="list-style-type: none"> <li>Left side turn indicator repeater lamp circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check left side turn indicator repeater lamp circuit for short to ground
B1D0615	Left Turn Indicator	<ul style="list-style-type: none"> <li>Left side turn indicator repeater lamp circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left side turn indicator repeater lamp circuit for short to power, open circuit
B1D0711	Right Turn Indicator	<ul style="list-style-type: none"> <li>Right side turn indicator repeater lamp circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check right side turn indicator repeater lamp circuit for short to ground
B1D0715	Right Turn Indicator	<ul style="list-style-type: none"> <li>Right side turn indicator repeater lamp circuit - short to power, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check right side turn indicator repeater lamp circuit for short to power, open circuit
C1B1411	Sensor Supply #1	<ul style="list-style-type: none"> <li>Front window position hall sensor supply circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test front window position hall sensor supply circuit for short to ground
C1B1415	Sensor Supply #1	<ul style="list-style-type: none"> <li>Front window position hall sensor supply circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test front window position hall sensor supply circuit for short to power, open circuit
C1B1511	Sensor Supply #2	<ul style="list-style-type: none"> <li>Hall sensor supply circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test window position hall sensors supply circuit for short to ground
C1B1515	Sensor Supply #2	<ul style="list-style-type: none"> <li>Hall sensor supply circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test window position hall sensors supply circuit for short to power, open circuit
U001000	Medium Speed CAN Communication Bus	<ul style="list-style-type: none"> <li>Bus off</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014000	Lost Communication With Body Control Module	<ul style="list-style-type: none"> <li>Missing message from CJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U020800	Lost Communication With Seat Control Module "A"	<ul style="list-style-type: none"> <li>Missing message from driver seat module</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030000	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>Invalid configuration message is received</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC remains suspect the PDM. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U200224	Switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Clear DTC and re-test. If DTC remains, suspect the passenger side window switch. Check and install a new passenger side window switch
U200424	Auxiliary Switch Pack	<ul style="list-style-type: none"> <li>Left or right rear door local switch - signal stuck high</li> </ul>	Check for stuck rear window switch. Refer to the electrical circuit diagrams and check left or right rear door local switch circuit for short circuit
U201011	Switch illumination	<ul style="list-style-type: none"> <li>Rear window switch illumination circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check rear window switch illumination circuit for short to ground
U201208	Car Configuration Parameter(s)	<ul style="list-style-type: none"> <li>Bus signal/message failures</li> </ul>	Cycle the ignition status and re-test. If DTC remains, re-configure the RJB using the manufacturer approved diagnostic system
U201324	Switch Pack	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Clear DTC and re-test. If DTC remains, install a new driver door switch pack
U201444	Control Module Hardware	<ul style="list-style-type: none"> <li>Data memory failure</li> </ul>	Suspect the PDM. Check and install a new PDM as required, refer to the new module/component installation note at the top of the DTC Index
U210000	Initial Configuration Not Complete	<ul style="list-style-type: none"> <li>No sub type information</li> </ul>	Re-configure the PDM using the manufacturer approved diagnostic system



<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
U300049	Control Module	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Suspect the PDM. Check and install a new PDM as required, refer to the new module/component installation note at the top of the DTC Index
U300255	Vehicle Identification Number	<ul style="list-style-type: none"> <li>● Not configured</li> </ul>	Re-configure the PDM as new using the manufacturer approved diagnostic system and re-test. If DTC remains install a new module, refer to the new module/component installation note at the top of the DTC Index
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> <li>● Vehicle/component mis-match. Corrupt VIN data being transmitted, module previously installed to other vehicle</li> </ul>	Check and install correct/new module as required, refer to the new module/component installation note at the top of the DTC Index
U300362	Battery voltage	<ul style="list-style-type: none"> <li>● Mis-match in battery voltage, of 2 volts or more, between PDM and RJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

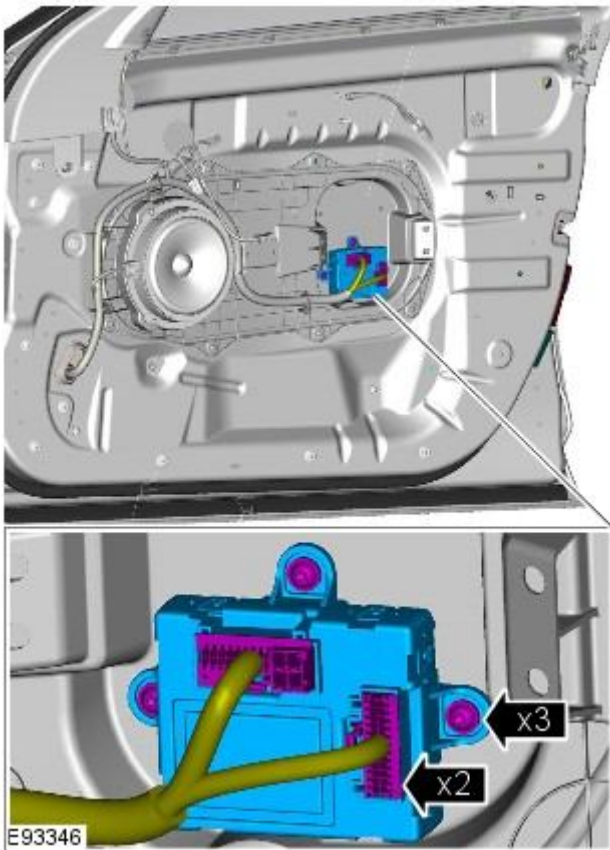
# Multifunction Electronic Modules - Driver Door Module (DDM)

## Removal and Installation

### Removal

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Front Door Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.



### Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Jaguar approved diagnostic equipment.

# Multifunction Electronic Modules - Driver Seat Module (DSM)

Removal and Installation

## Removal

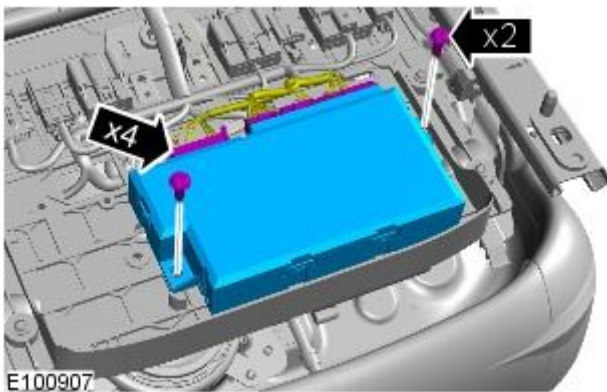
• NOTE: Removal steps in this procedure may contain installation details.

1. Make the air bag supplemental restraint system (SRS) safe.

Refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).

2. Refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).

3.



## Installation

1. To install, reverse the removal procedure.

2. If a new component has been installed, configure using Jaguar approved diagnostic equipment.

# Multifunction Electronic Modules - Passenger Door Module (PDM)

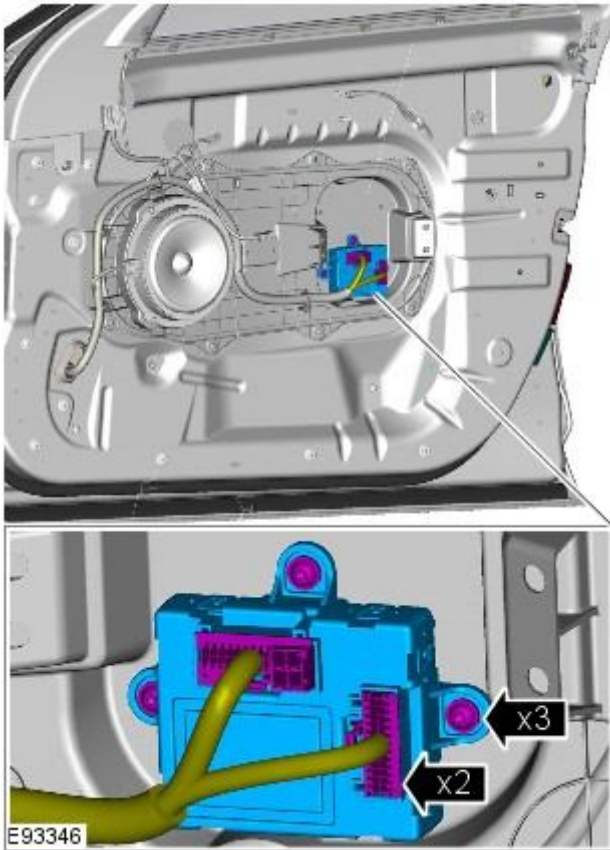
## Removal and Installation

### Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Front Door Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.



### Installation

1. To install, reverse the removal procedure.

## Multifunction Electronic Modules - Rear Door Module (RDM)

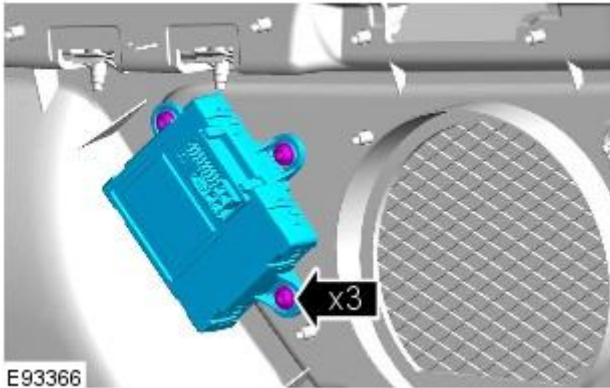
Removal and Installation

### Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Rear Door Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Torque: 1.5 Nm



### Installation

1. To install, reverse the removal procedure.

**Front End Body Panels -**

<b>Description</b>	<b>Nm</b>	<b>lb-ft</b>	<b>lb-in</b>
Air deflector retaining nuts	7	-	62
Air deflector retaining bolts	7	-	62
Engine rear undershield retaining bolts	7	-	62
Secondary bulkhead left-hand panel retaining bolts	5	-	44
Secondary bulkhead right-hand panel retaining bolts	5	-	44



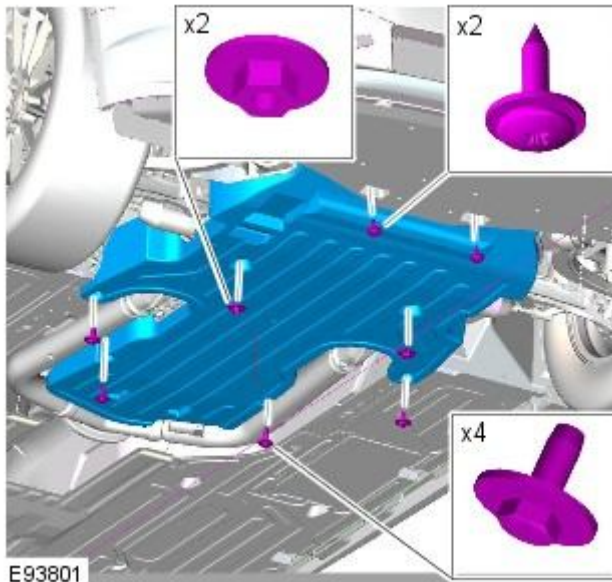
## Front End Body Panels - Air Deflector

Removal and Installation

### Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.



2. **NOTE:** Note the fitted position of the washers.

*Torque:* 7 Nm

### Installation

1. To install, reverse the removal procedure.

## Front End Body Panels - Cowl Vent Screen

Removal and Installation

### Removal

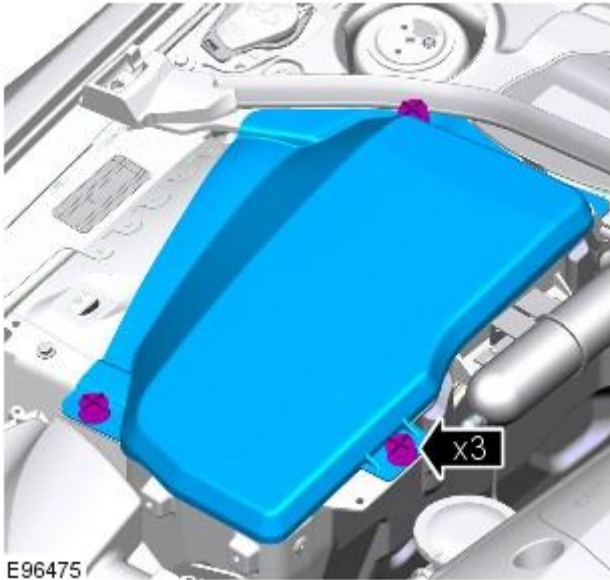


**CAUTION:** Always protect paintwork and glass when removing exterior components.

- **NOTE:** Removal steps in this procedure may contain installation details.

1. For additional information, refer to: Windshield Wiper Pivot Arm (501-16, Removal and Installation).

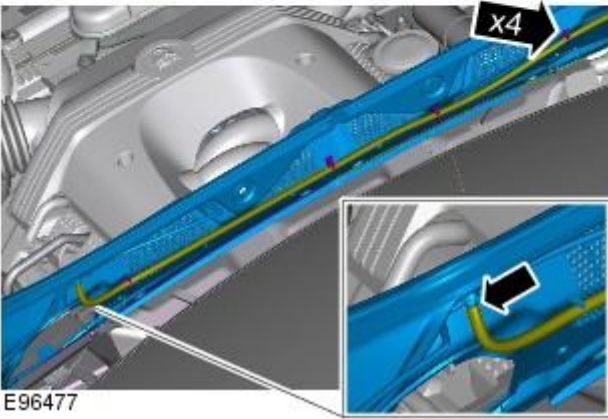
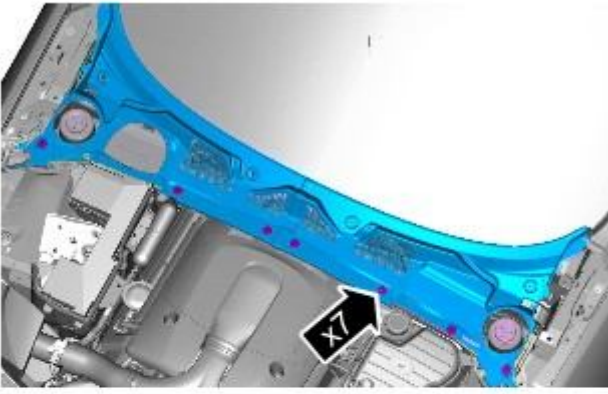
2.



3.



4.



E96477

5.



E96478

## Installation

1. To install, reverse the removal procedure.

## Front End Body Panels - Engine Rear Undershield

Removal and Installation

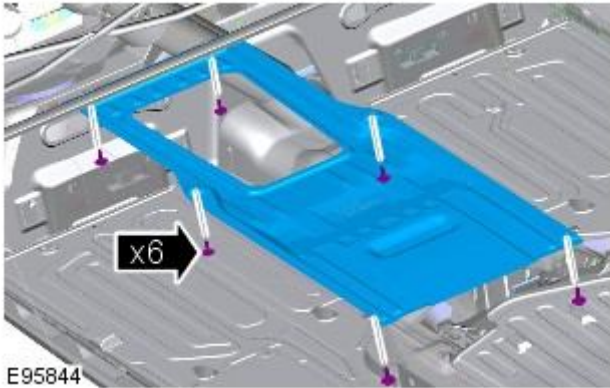
### Removal

- NOTE: Removal steps in this procedure may contain installation details.

1.  WARNING: Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Torque: 7 Nm



### Installation

1. To install, reverse the removal procedure.

## Front End Body Panels - Fender Splash Shield

Removal and Installation

### Removal

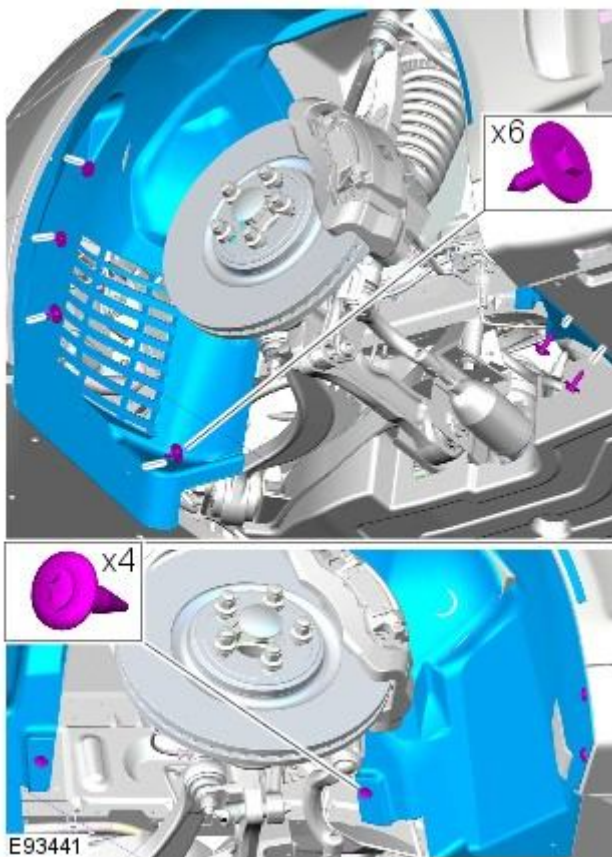
- NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

3.




### Installation

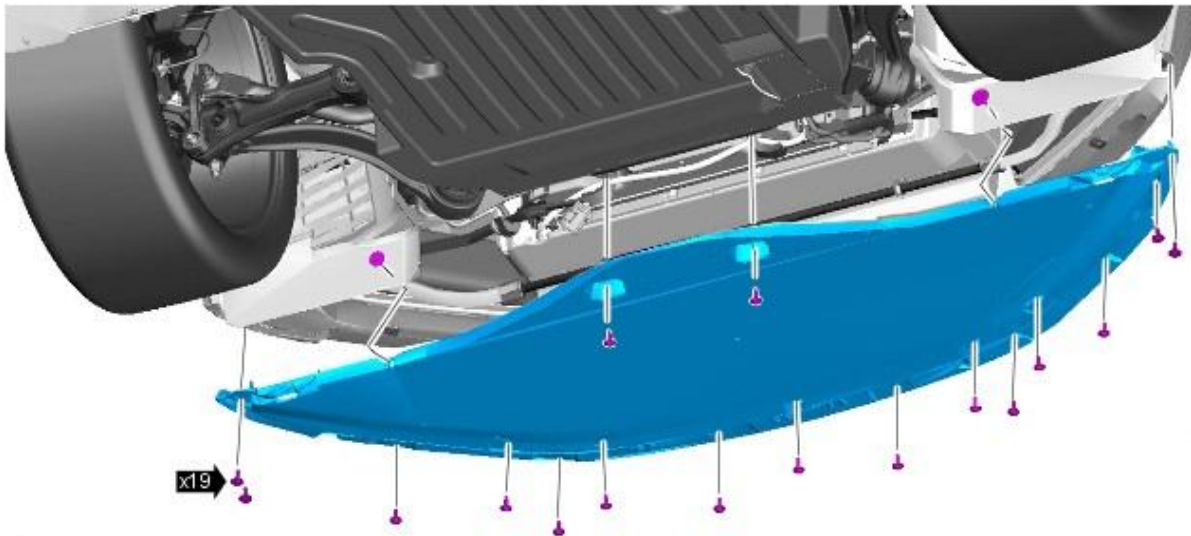
1. To install, reverse the removal procedure.

## Front End Body Panels - Radiator Splash Shield

Removal and Installation

### Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands. Raise and support the vehicle.



E93528

### Installation

1. To install, reverse the removal procedure.

2.

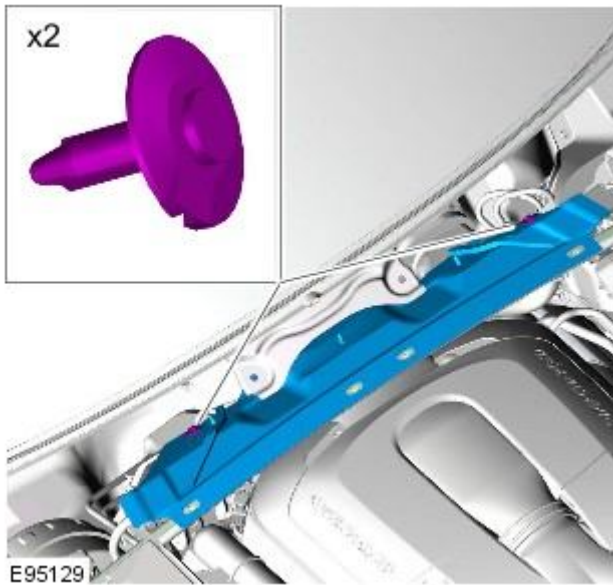


## Front End Body Panels - Secondary Bulkhead Center Panel

Removal and Installation

### Removal

1. Refer to: [Cowl Vent Screen](#) (501-02 Front End Body Panels, Removal and Installation).



2.



3. **3.** NOTE: Do not disassemble further if the component is removed for access only.

### Installation

1. To install, reverse the removal procedure.

# Front End Body Panels - Secondary Bulkhead Panel LH2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

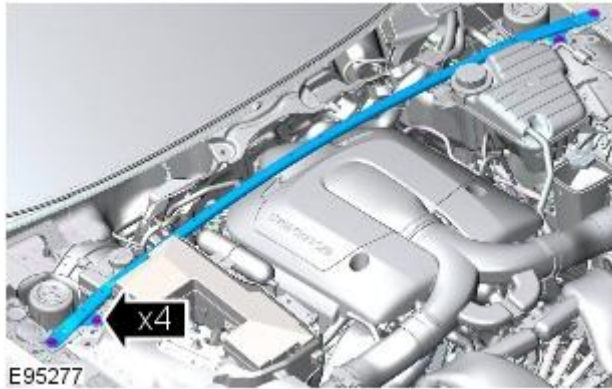
Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

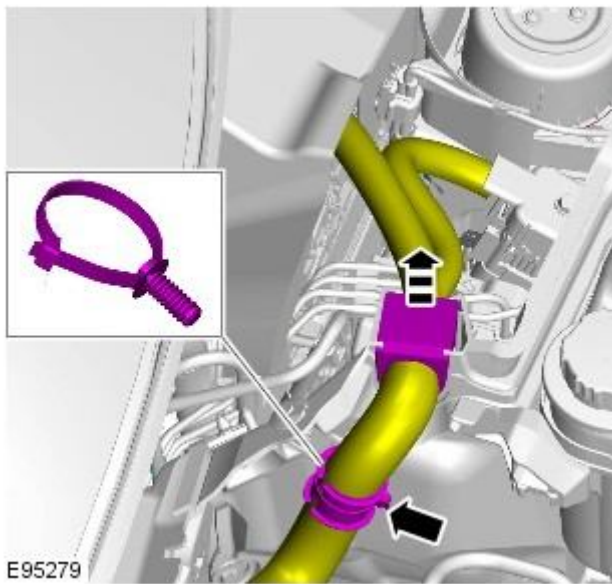
All vehicles

1. Refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).



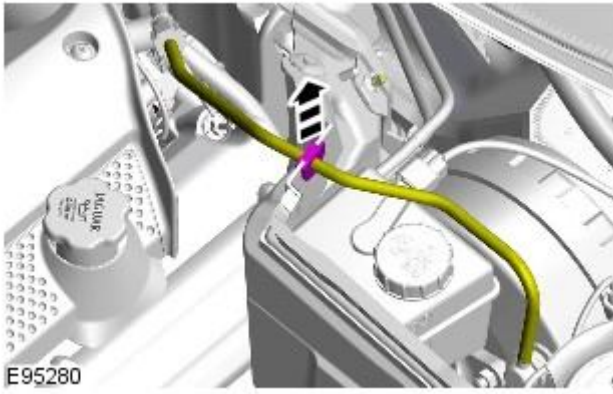
2.
  - Torque: 25 Nm

Right-hand drive vehicles



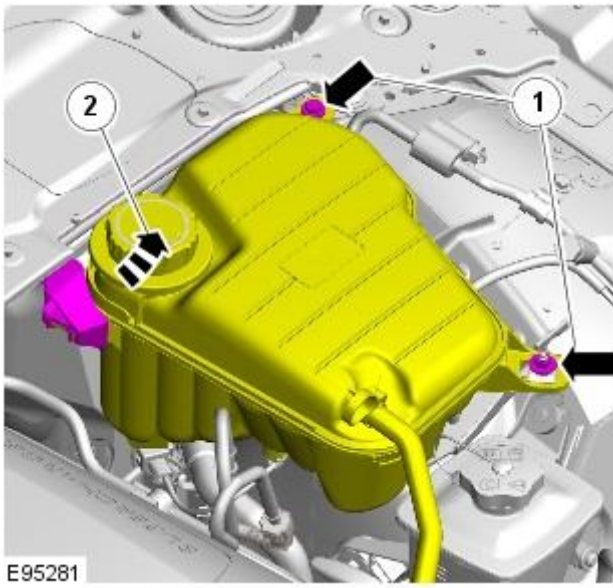
- 3.

Left-hand drive vehicles



4.

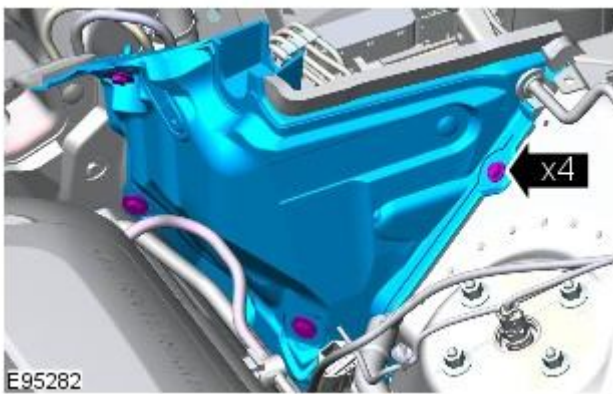
Vehicles with supercharger



5.

- Torque: 7 Nm

All vehicles



6.

- Torque: 5 Nm



E95283

7. **7. NOTE:** Do not disassemble further if the component is removed for access only.

## Installation

1. To install, reverse the removal procedure.

# Front End Body Panels - Secondary Bulkhead Panel RH2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Removal and Installation

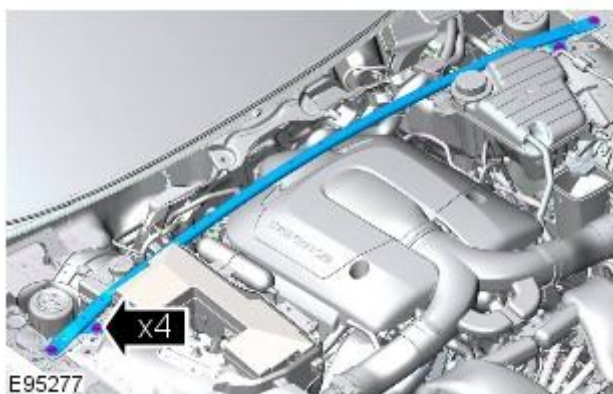
## Removal

- NOTE: Removal steps in this procedure may contain installation details.

All vehicles

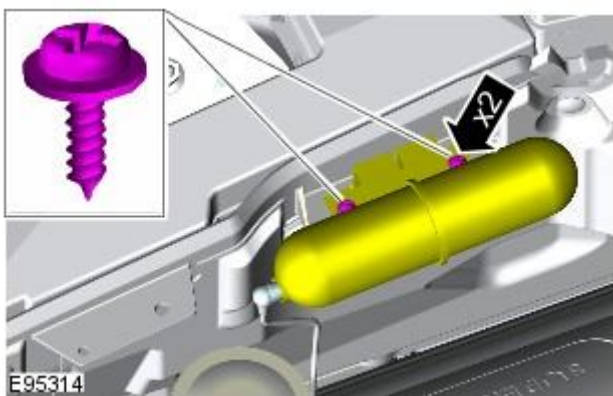
1. Refer to: [Cowl Vent Screen](#) (501-02 Front End Body Panels, Removal and Installation).
2. Refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).

3. Torque: 25 Nm



Vehicles with petrol engine

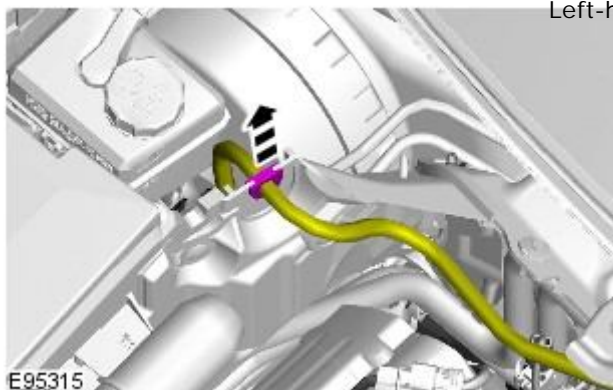
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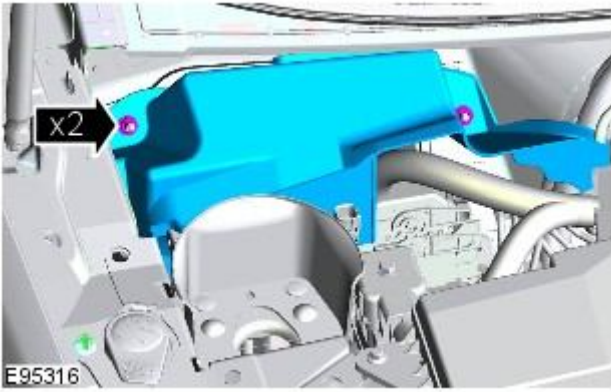
Right-hand drive vehicles

5.

Left-hand drive vehicles

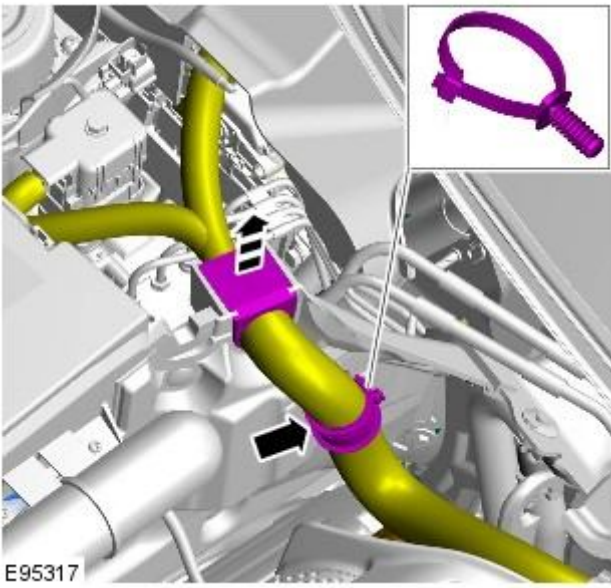






6.

Left-hand drive vehicles

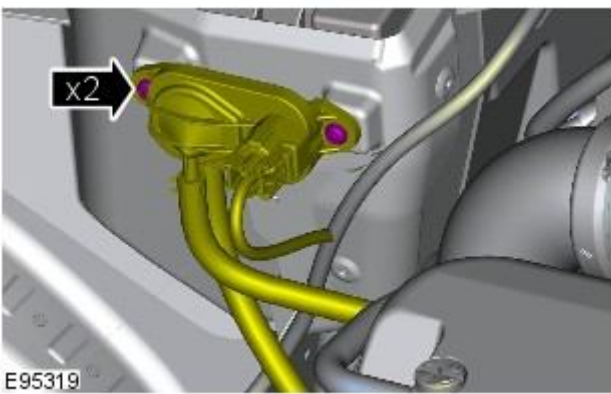


7.

Vehicles with supercharger

8. Refer to: Air Cleaner RH (303-12 Intake Air Distribution and Filtering - 4.2L, Vehicles With: Supercharger, Removal and Installation).

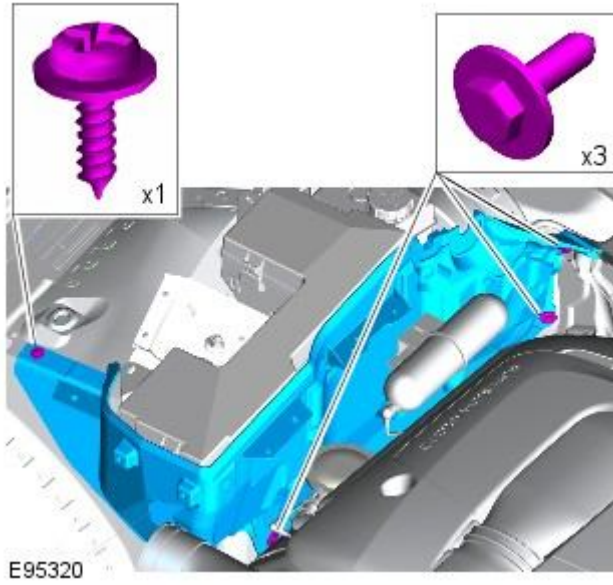
Vehicles with diesel engine



9.

All vehicles





10.

## Installation

1. To install, reverse the removal procedure.

## Body Closures - Front Door

Removal and Installation

### Removal

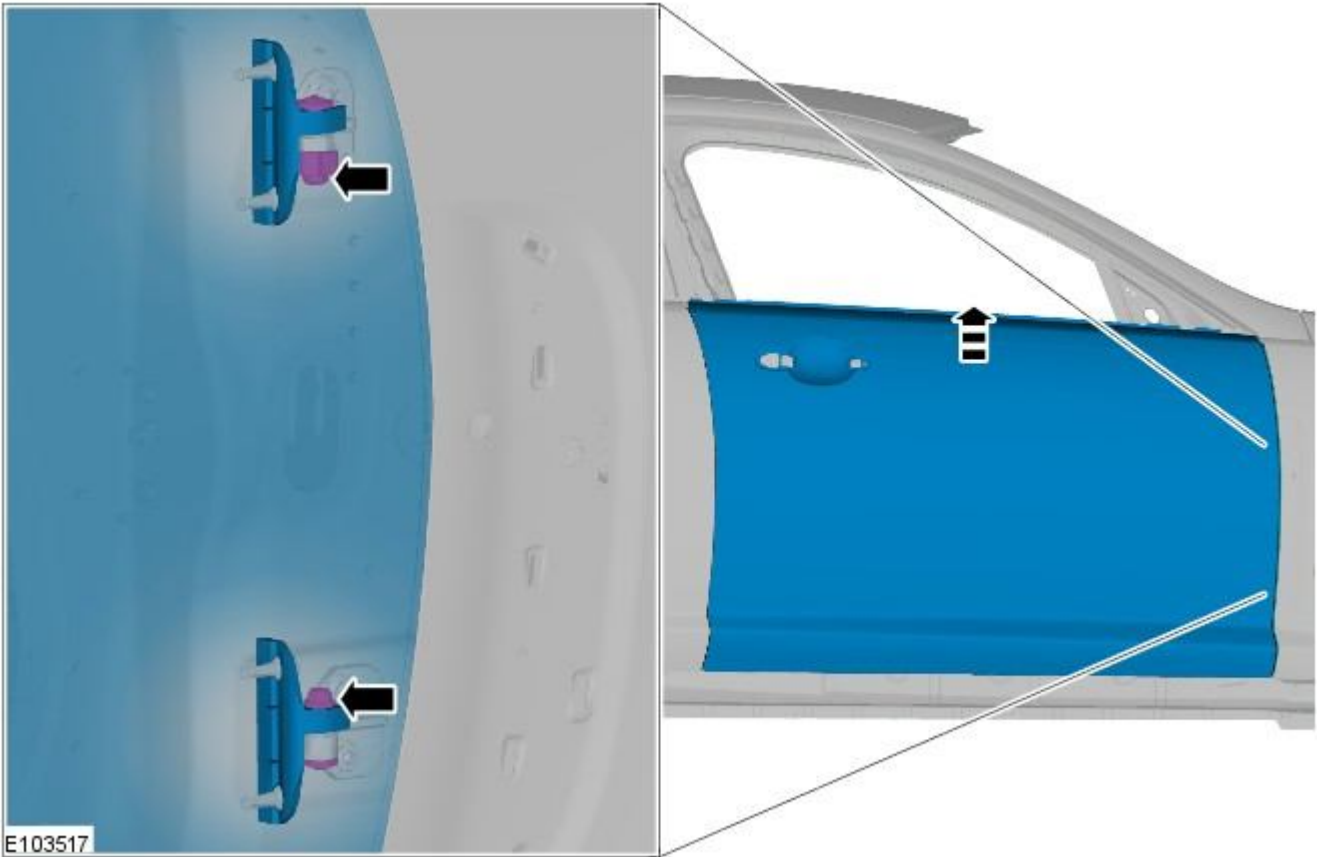
1. NOTE: The front door is manufactured from mild steel, it contains a side impact reinforcement manufactured from boron steel.

The front door is serviced as a separate bolt-on panel.



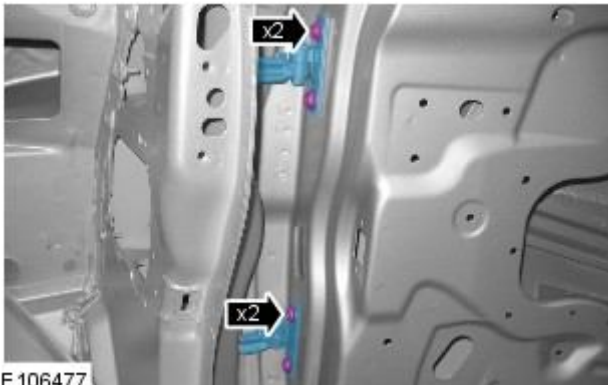
E 106476

2. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) /  
[Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) /  
[Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) /  
[Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
3. NOTE: If the procedure includes removal of the front door components, the battery can remain connected to aid their removal and disconnected afterwards.
- Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
4. NOTE: For new front door installation, this step may be carried out later in the removal procedure.
- Disconnect the front door wiring harness, accessed behind the grommet on the A-pillar.
5. NOTE: For new front door installation, this step may be carried out later in the removal procedure.
- Release the front door check strap from the body.
6. NOTE: This step is for removing the fully trimmed front door for access only, for installing a new front door, continue to removal step 7.
- Remove the front door upper and lower hinge pivot bolts and lift the front door to remove.



E103517

7. Remove the front door window regulator and motor.  
For additional information, refer to: [Front Door Window Regulator and Motor](#) (501-11 Glass, Frames and Mechanisms, Removal and Installation).
8. Remove the exterior mirror.  
For additional information, refer to: [Exterior Mirror](#) (501-09 Rear View Mirrors, Removal and Installation).
9. Remove the front door latch.  
For additional information, refer to: [Front Door Latch](#) (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
10. Remove the front door outer window frame mouldings.
11. Remove the front door weatherstrips.
12. Remove the front door wiring harness.
13. Remove the front door impact absorbers.
14. Remove the front door check strap.
15. Remove the front door glass run felt.
16. Remove any miscellaneous front door clips, grommets and blanking covers.
17. NOTE: If new hinges are being installed, install the complete hinges to the A-pillar. To align the hinges at the A-pillar it will be necessary to remove the front fender.



E 106477

Remove the upper and lower front door hinge fixing bolts and remove the front door.

## Installation

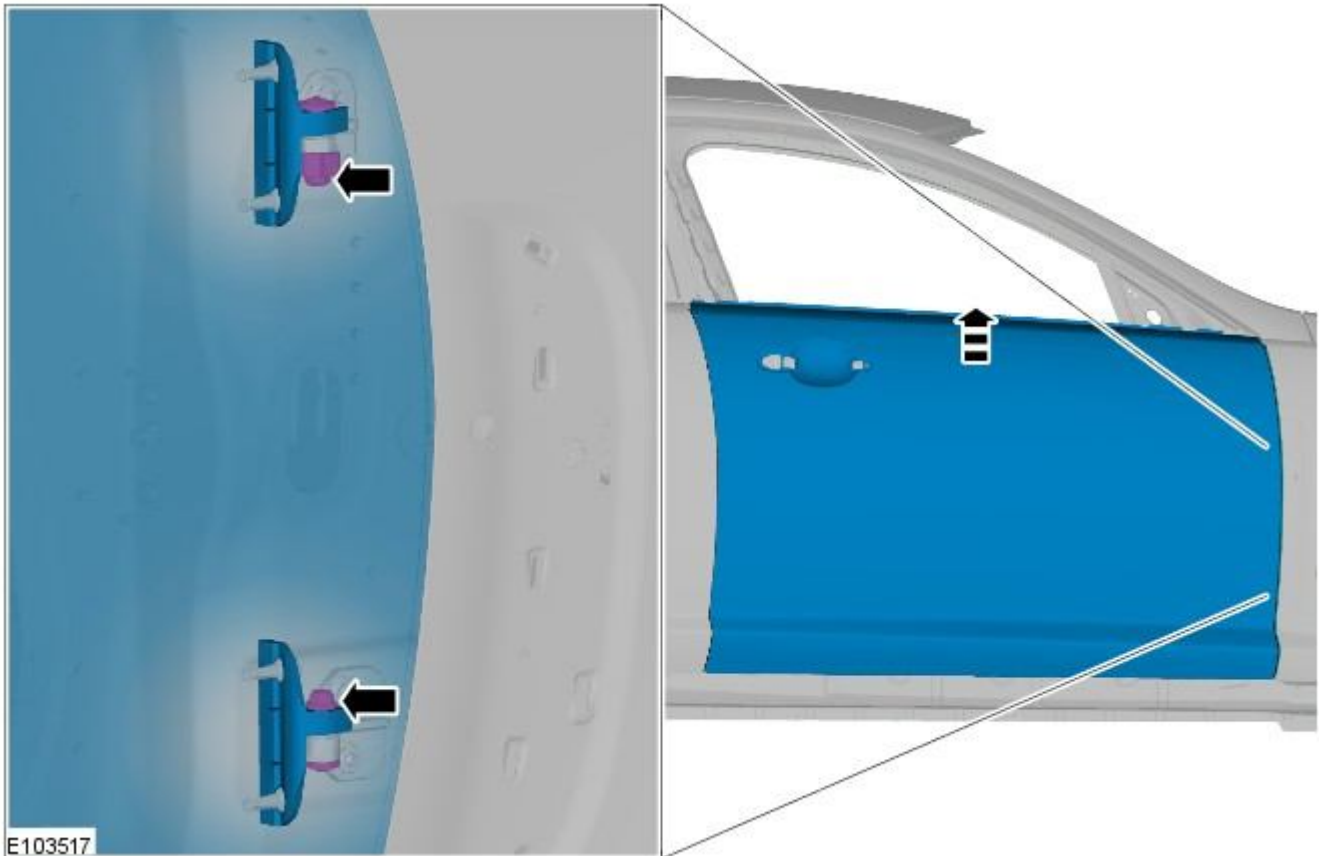
1. NOTE: If the front door has been removed for access only, it can be installed back on to its upper and lower hinge pivots and secured with the upper and lower hinge pivot bolts.

Offer up the front door and loosely install the front door hinge bolts.

2. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

3. Tighten the front door hinge bolts to 30 Nm.

4. When correctly aligned and with the front door hinge bolts tightened, the new front door can be removed at its upper and lower hinge pivot bolts for refinishing.



5. NOTE: Install the front door upper frame weatherstrip prior to installing the front door.

The installation of associated panels and components is the reversal of removal procedure.

- Tighten the front door upper and lower hinge pivot bolts to 30 Nm.

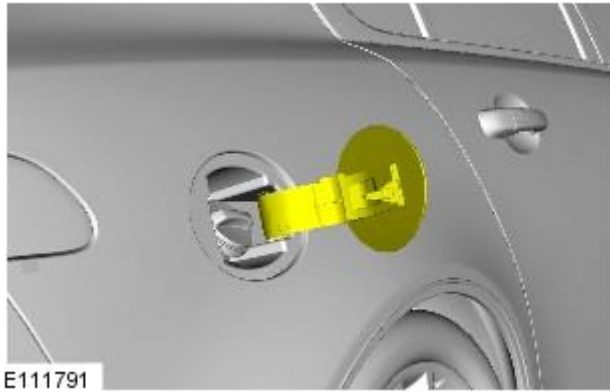
## Body Closures - Fuel Filler Door

Removal and Installation

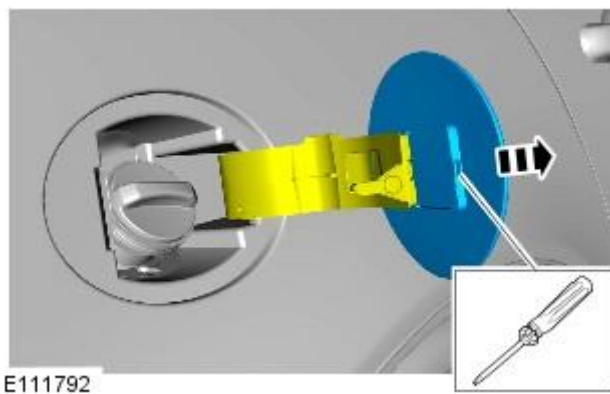
### Removal


 **CAUTION:** Do not align the bowl using the hinge arm.

- **NOTE:** Removal steps in this procedure may contain installation details.



1.



2.  **CAUTION:** Protect the surrounding paintwork to avoid damage.

- Release the clip.

### Installation

1. To install, reverse the removal procedure.


## Body Closures - Fuel Filler Door Assembly

Removal and Installation

### Removal

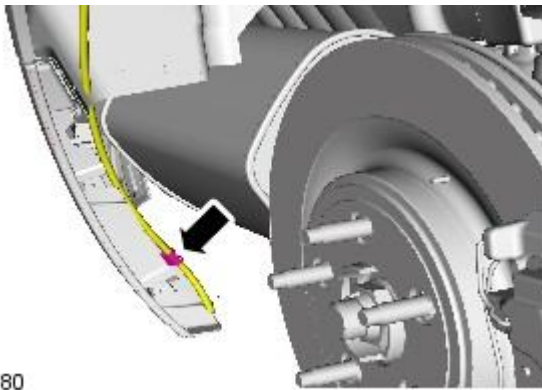
 **CAUTION:** Do not align the bowl using the hinge arm.

- **NOTE:** Removal steps in this procedure may contain installation details.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

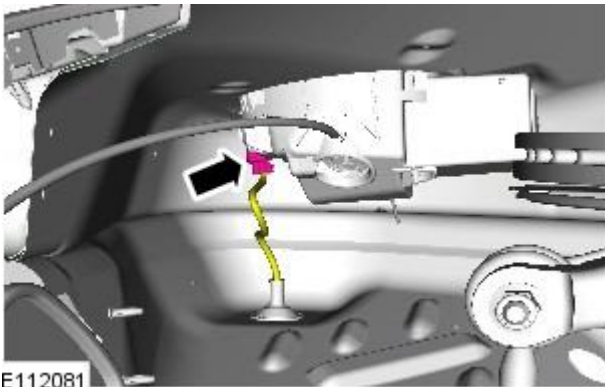
Raise and support the vehicle.

2. Refer to: Fuel Tank Filler Pipe (310-01, Removal and Installation).



E112080

3.

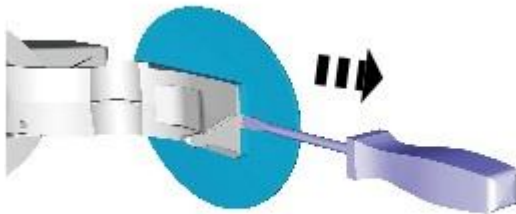
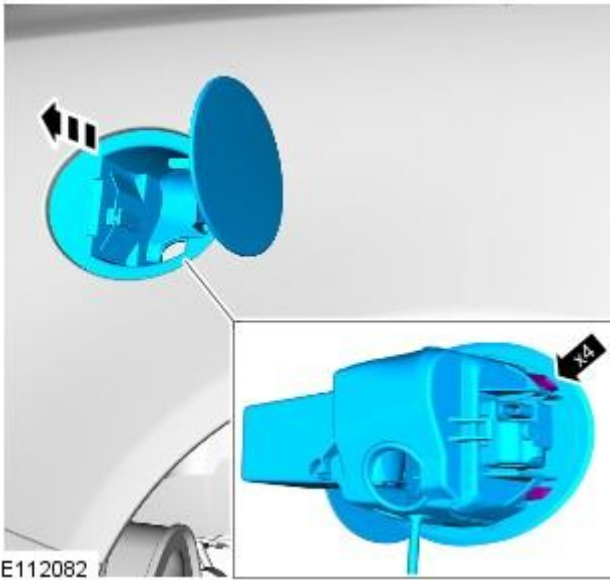



E112081

4.



5.



6.  CAUTION: Protect the surrounding paintwork to avoid damage.
- NOTE: Do not disassemble further if the component is removed for access only.
  - Release the clip.

E112083

## Installation

1. To install, reverse the removal procedure.

## Body Closures - Luggage Compartment Lid

Removal and Installation

### Removal

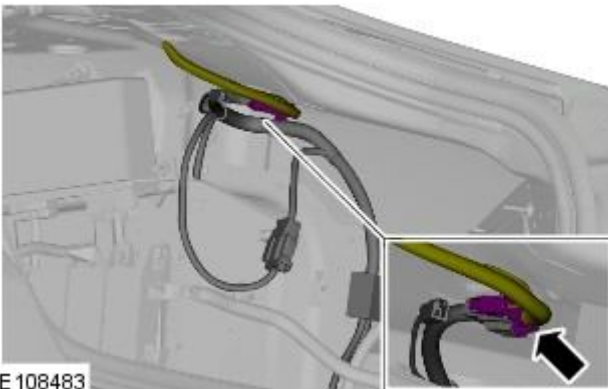
1. NOTE: The luggage compartment lid is manufactured from mild steel.

The luggage compartment lid is serviced as a separate bolt-on panel, less its hinges.



E 103477

2. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
3. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
4. Remove the loadspace trim panel RH.  
For additional information, refer to: [Loadspace Trim Panel RH](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
5. Disconnect the luggage compartment lid wiring harness.



E 108483

6. NOTE: This step requires the aid of another technician.

Remove the luggage compartment lid.



**7. NOTE:** Do not disassemble further if the component is removed for access only.

Remove the luggage compartment lid moulding.  
For additional information, refer to: [Luggage Compartment Lid Moulding](#) (501-08 Exterior Trim and Ornammentation, Removal and Installation).

- 8.** Remove the luggage compartment lid latch actuator.  
For additional information, refer to: [Luggage Compartment Lid Latch Actuator](#) (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
- 9.** Remove both rear fog lamps.  
For additional information, refer to: [Rear Fog Lamp](#) (417-01 Exterior Lighting, Removal and Installation).
- 10.** Remove both luggage compartment lid buffers.
- 11.** Remove the luggage compartment lid wiring harness.  
For additional information, refer to: [Luggage Compartment Lid Wiring Harness](#) (418-02 Wiring Harnesses, Removal and Installation).
- 12. NOTE:** Where it is not practical to re-use the luggage compartment lid badges, they should be renewed, therefore removal is not required.

Remove the luggage compartment lid badges.

## Installation

- 1. NOTE:** This step requires the aid of another technician.

Offer up the panel and loosely install the luggage compartment lid hinge retaining nuts.



E103478

2. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.
3. Tighten the luggage compartment lid hinge retaining nuts to 25 Nm.
4. The installation of associated panels and components is the reversal of removal procedure.

## Body Closures - Rear Door

Removal and Installation

### Removal

1. NOTE: The rear door is manufactured from mild steel, it contains a side impact reinforcement manufactured from boron steel.

The rear door is serviced as a separate bolt-on panel.



E 106478

2. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) /  
[Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) /  
[Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) /  
[Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

3. NOTE: If the procedure includes removal of the rear door components, the battery can remain connected to aid their removal and disconnected afterwards.

Disconnect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

4. NOTE: For new rear door installation, this step may be carried out later in the removal procedure.

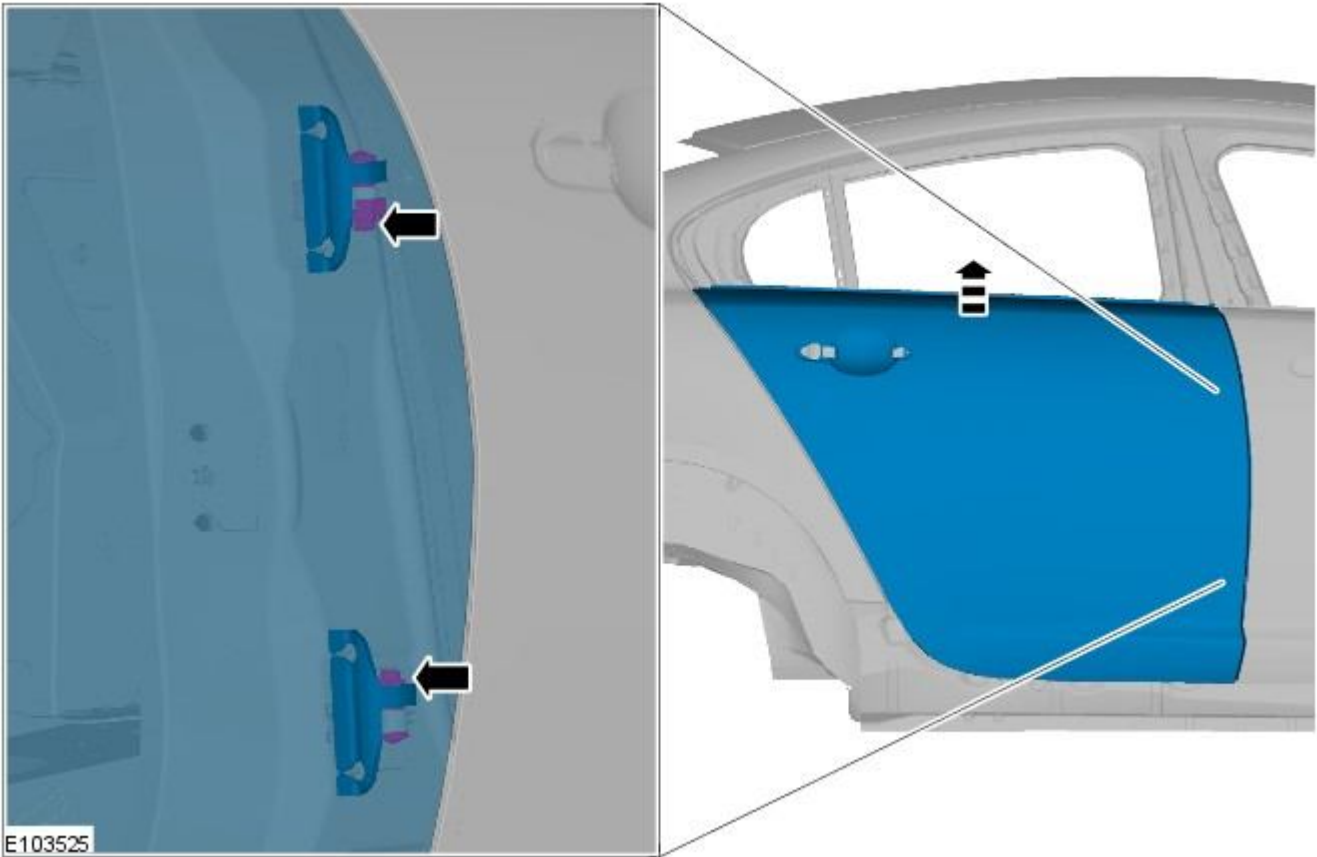
Disconnect the rear door wiring harness, accessed behind the grommet on the B-pillar.

5. NOTE: For new rear door installation, this step may be carried out later in the removal procedure.

Release the rear door check strap from the body.

6. NOTE: This step is for removing the fully trimmed rear door for access only, for installing a new front door, continue to removal step 7.

Remove the rear door upper and lower hinge pivot bolts and lift the rear door to remove.



7. Remove the rear door fixed window glass.  
For additional information, refer to: [Rear Door Fixed Window Glass](#) (501-11 Glass, Frames and Mechanisms, Removal and Installation).
8. Remove the rear door latch.  
For additional information, refer to: [Rear Door Latch](#) (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
9. Remove the rear door outer window frame mouldings.
10. Remove the rear door weatherstrips.
11. Remove the rear door wiring harness.
12. Remove the rear door impact absorbers.
13. Remove the rear door check strap.
14. Remove the rear door glass run felt.
15. Remove any miscellaneous rear door clips, grommets and blanking covers.

**16. NOTE:** If new hinges are being fitted, install the complete hinges to the B-pillar.

Remove the upper and lower rear door hinge bolts and remove the rear door.



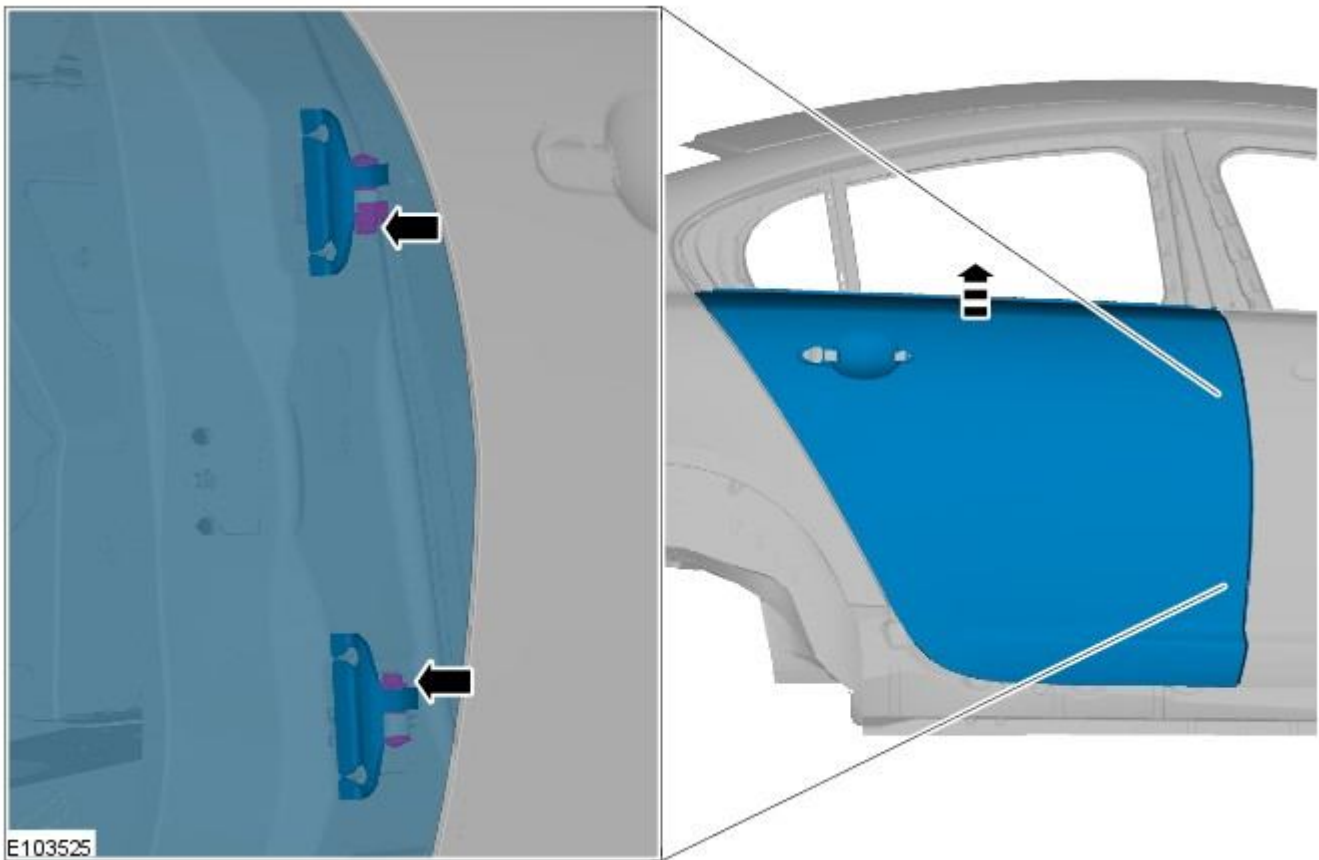
## Installation

1. NOTE: If the rear door has been removed for access only, it can be installed back on to its upper and lower hinge pivots and secured with the upper and lower hinge pivot bolts.



Offer up the rear door and loosely install the rear door hinge bolts.

2. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.
3. Tighten the rear door hinge bolts to 30 Nm.
4. When correctly aligned and with the rear door hinge bolts tightened, the new rear door can be removed at its upper and lower hinge pivot bolts for refinishing.



5. The installation of associated panels and components is the reversal of removal procedure.

- Tighten the rear door upper and lower hinge pivot bolts to 30 Nm.

**Interior Trim and Ornamentation -**

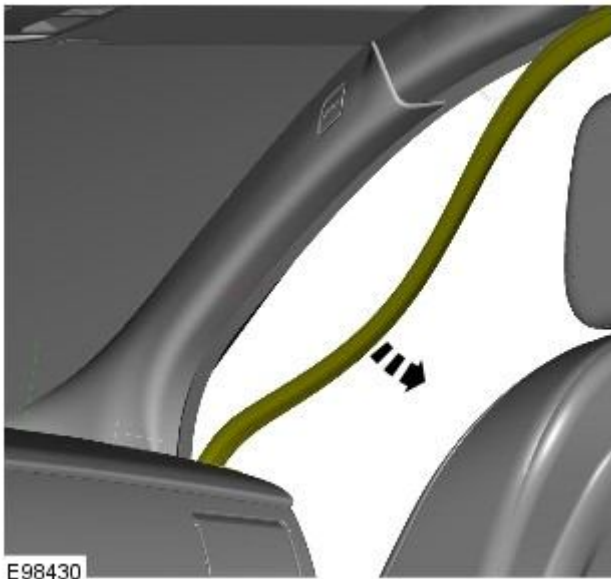
Description	Nm	lb-ft	lb-in
Front Safety belt shoulder height adjuster retaining bolt	25	19	-
Rear safety belt lower retaining bolt	40	30	-

# Interior Trim and Ornamentation - A-Pillar Trim Panel

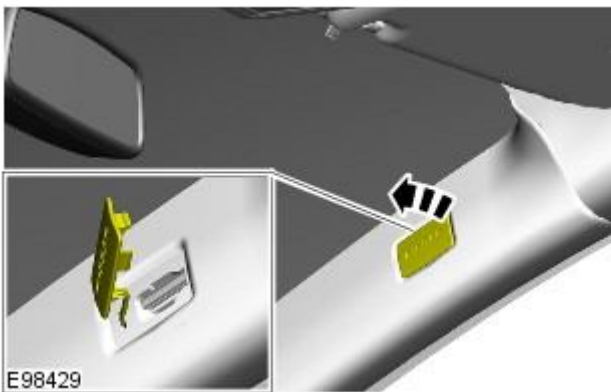
Removal and Installation

## Removal

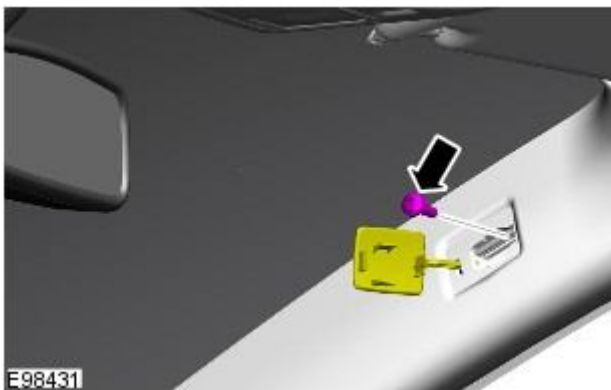
- NOTE: Removal steps in this procedure may contain installation details.



1.



2.



3. Torque: 6 Nm



4.

## Installation

1. To install, reverse the removal procedure.

# Interior Trim and Ornamentation - B-Pillar Lower Trim Panel

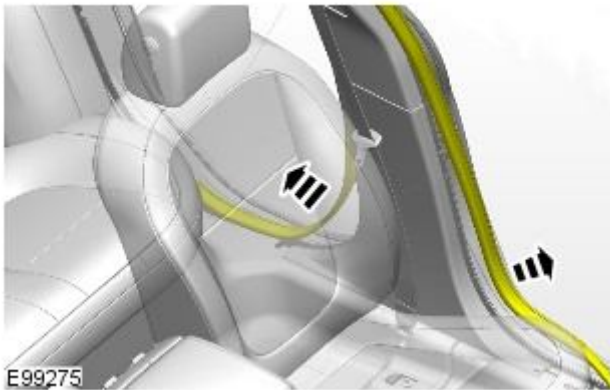
Removal and Installation


## Removal

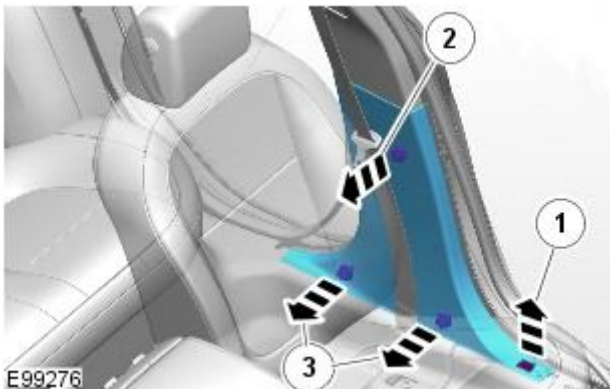
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Front Scuff Plate Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Refer to: [Rear Scuff Plate Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.



4.  CAUTION: Make sure that the clips are correctly located.



## Installation

1. To install, reverse the removal procedure.

# Interior Trim and Ornamentation - B-Pillar Upper Trim Panel

Removal and Installation

## Removal

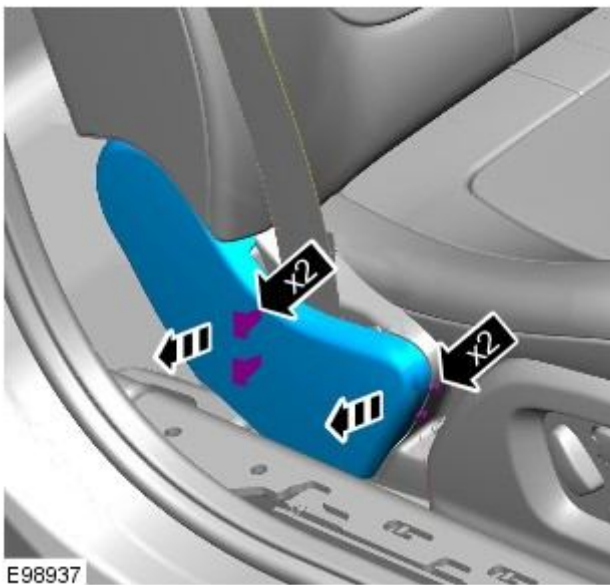
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [B-Pillar Lower Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

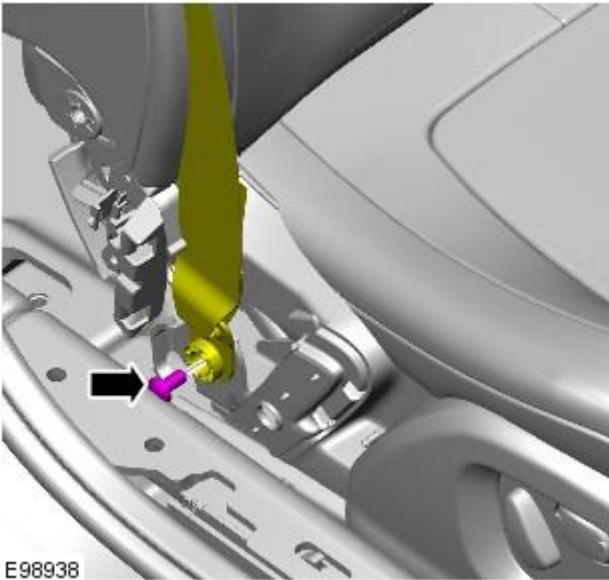
2.



3.

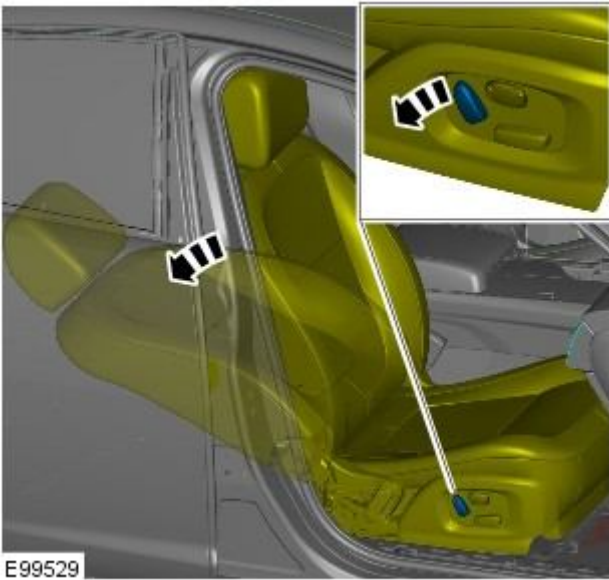






E98938

4. Torque: 40 Nm



E99529

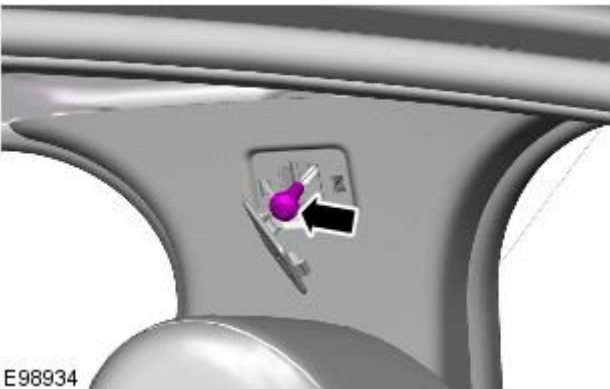
5.

6.

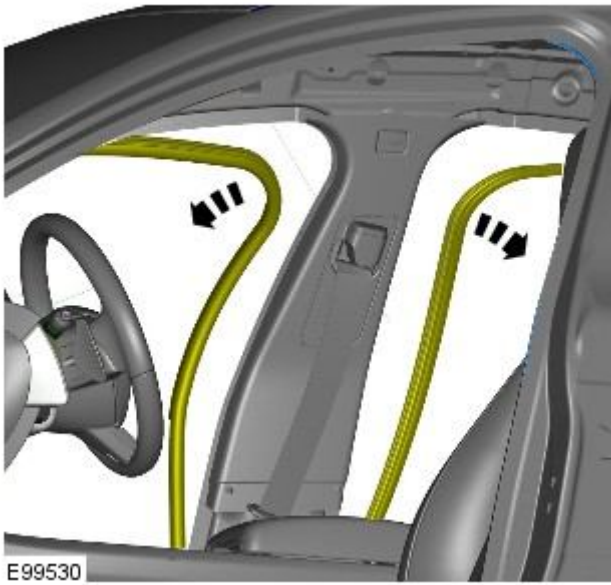


E98933

7. Torque: 6 Nm



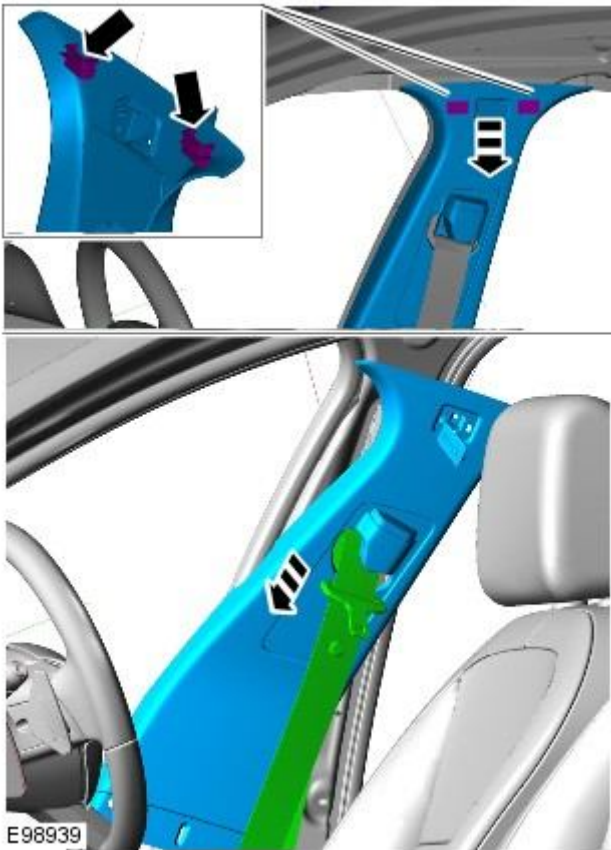
E98934





8.

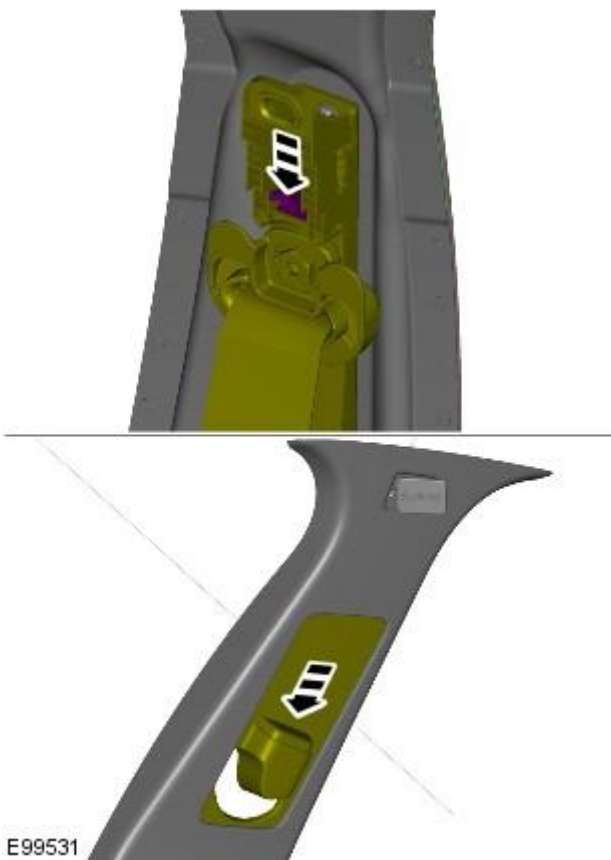



9.



10. **10.**  **WARNING:** Failure to follow this instruction may cause damage to the vehicle.

 **CAUTION:** Make sure the locating dowels are installed correctly.



11. **11.**  **CAUTION:** Make sure that these components are installed to the noted removal position.

## Installation

1. To install, reverse the removal procedure.

# Interior Trim and Ornamentation - C-Pillar Lower Trim Panel

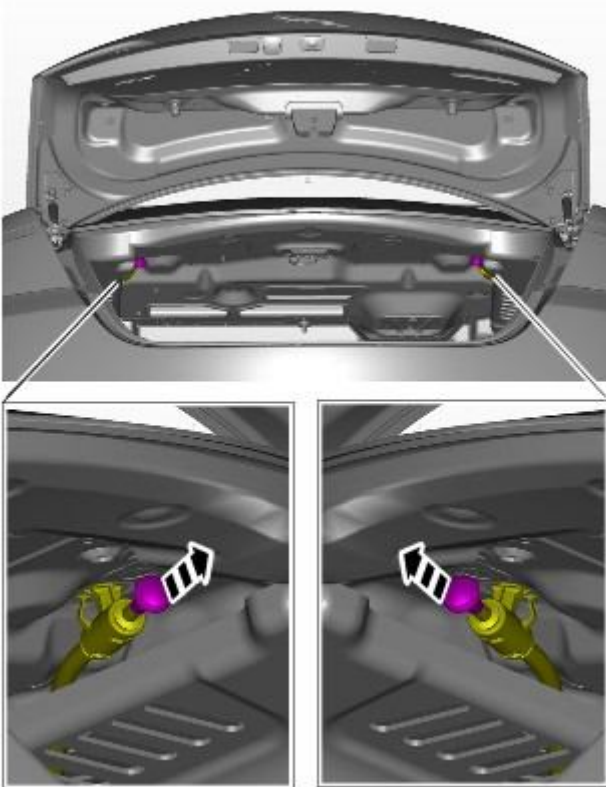
Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [C-Pillar Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



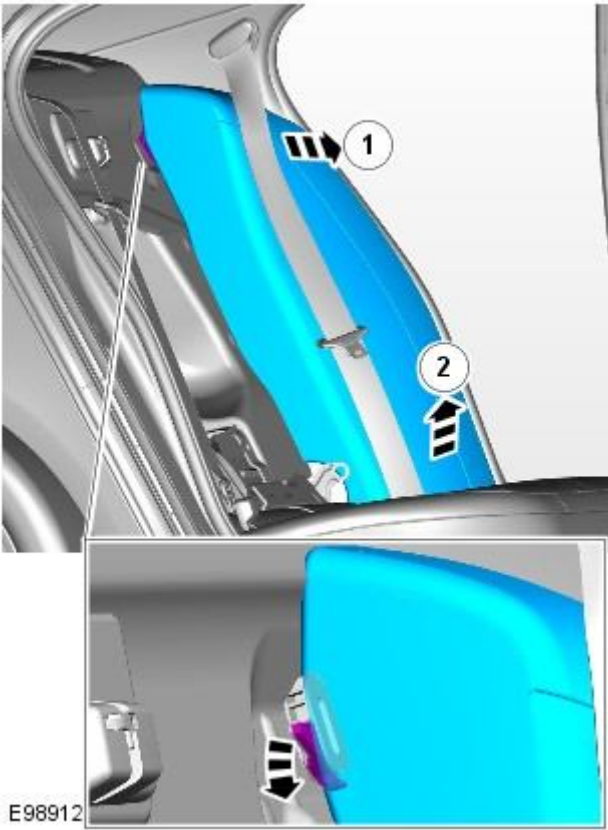
E98909

3.

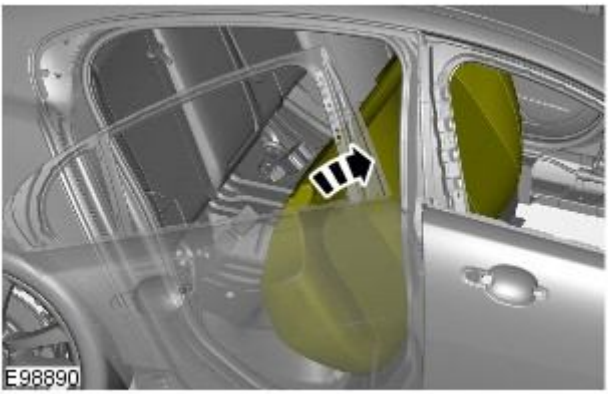


E98911

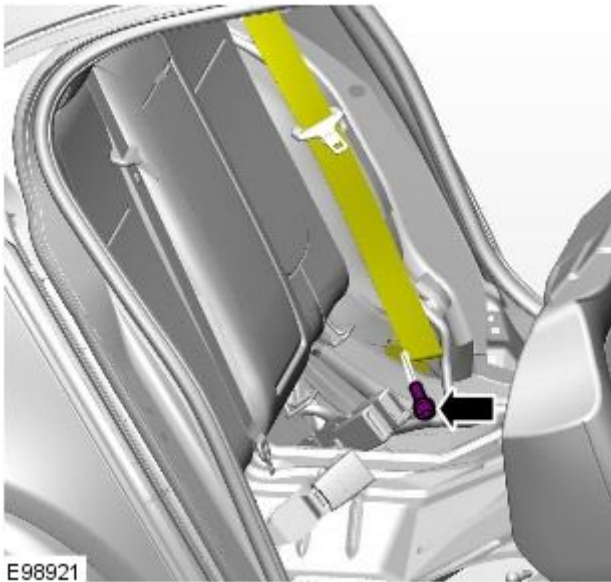
4.



5.








6. Torque: 40 Nm

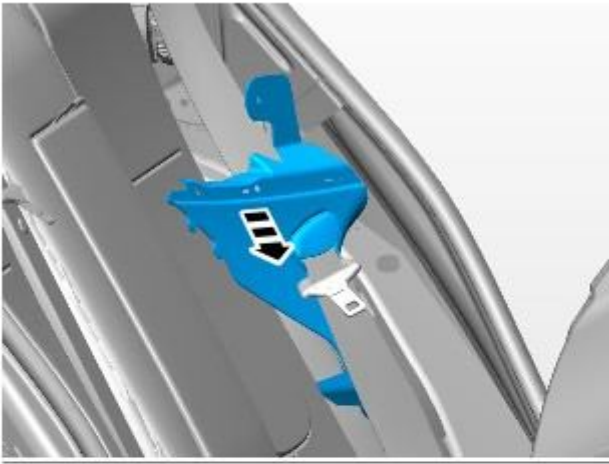



7. **7. CAUTIONS:**

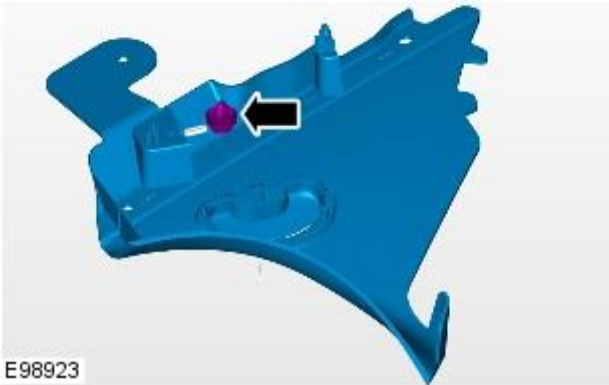
 Note the fitted position of the component prior to removal.

 Make sure that these components are installed to the noted removal position.

Torque: 9 Nm



8.  CAUTION: Make sure the locating dowels are installed correctly.



E98923

## Installation

1. To install, reverse the removal procedure.

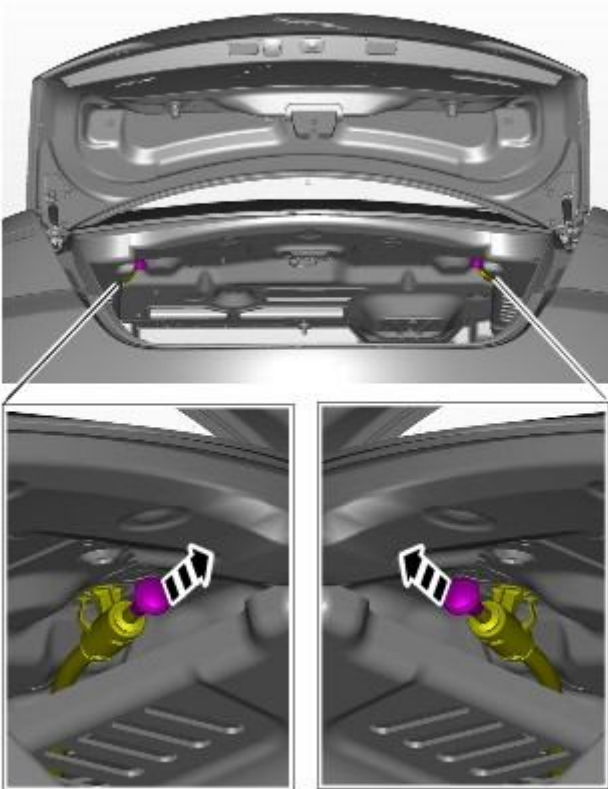
# Interior Trim and Ornamentation - C-Pillar Trim Panel

Removal and Installation

## Removal

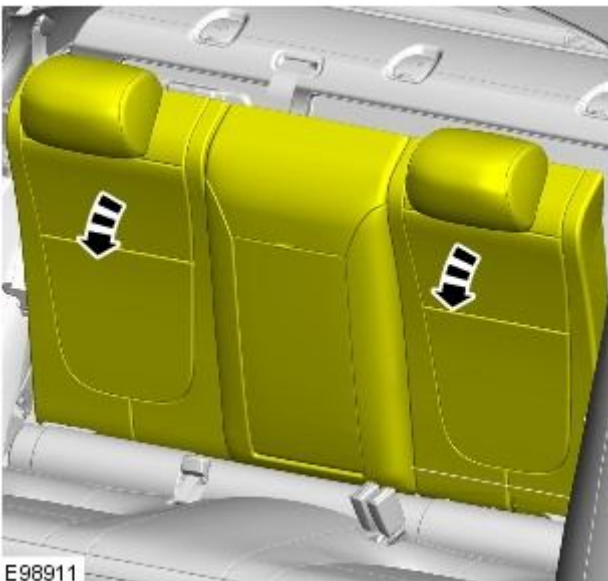
- NOTE: Removal steps in this procedure may contain installation details.

1.

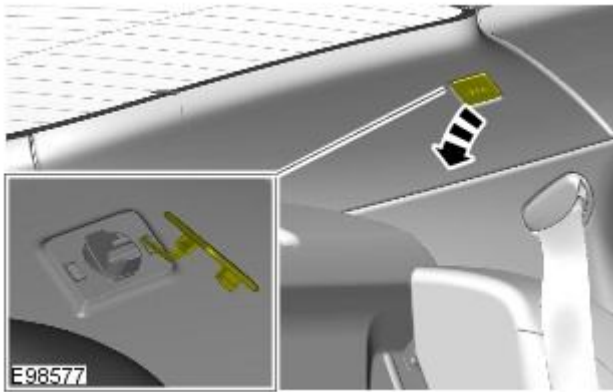


E98909

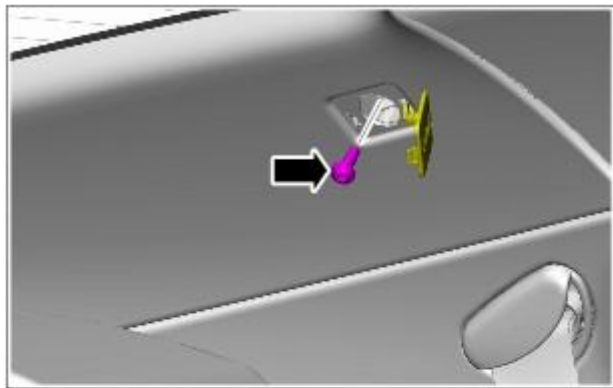
2.




E98911



3.

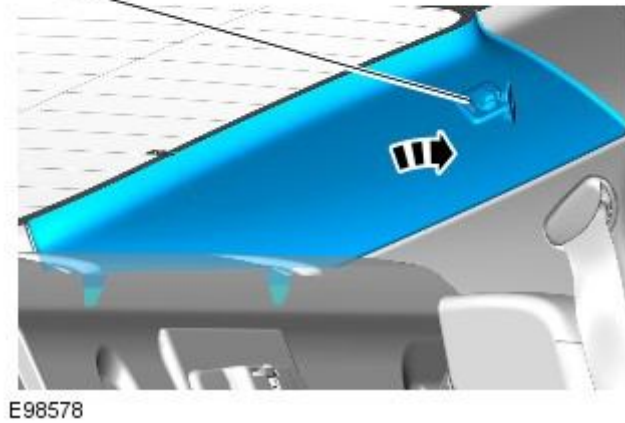


4. 4. CAUTIONS:

 Make sure the locating dowels are installed correctly.

 Make sure that the clips are correctly located.

*Torque: 6 Nm*



## Installation

1. To install, reverse the removal procedure.

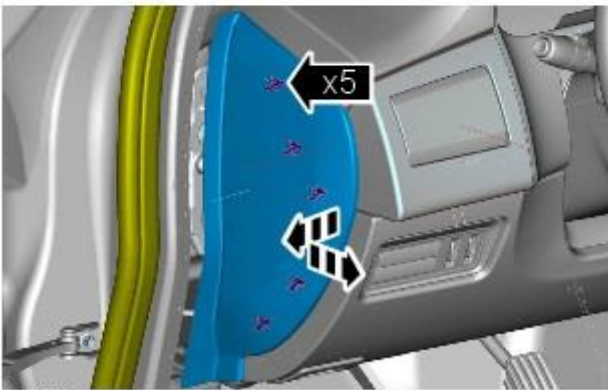
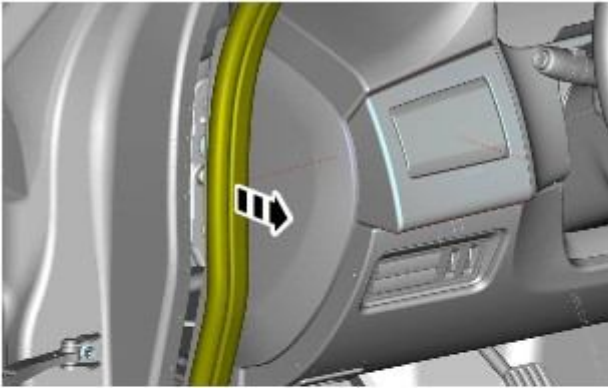
## Interior Trim and Ornamentation - Cowl Side Trim Panel

Removal and Installation

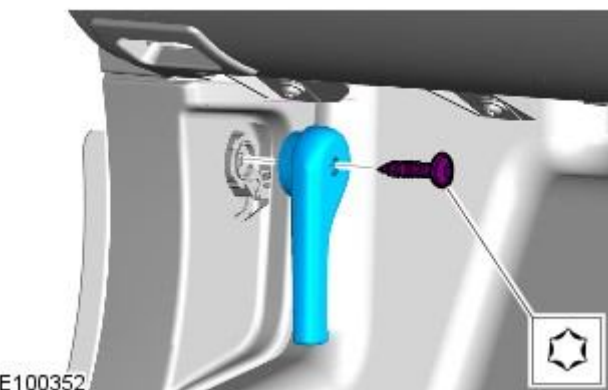
### Removal

1. Refer to: [Front Scuff Plate Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. **2. NOTE:** Left-hand shown, right-hand similar.

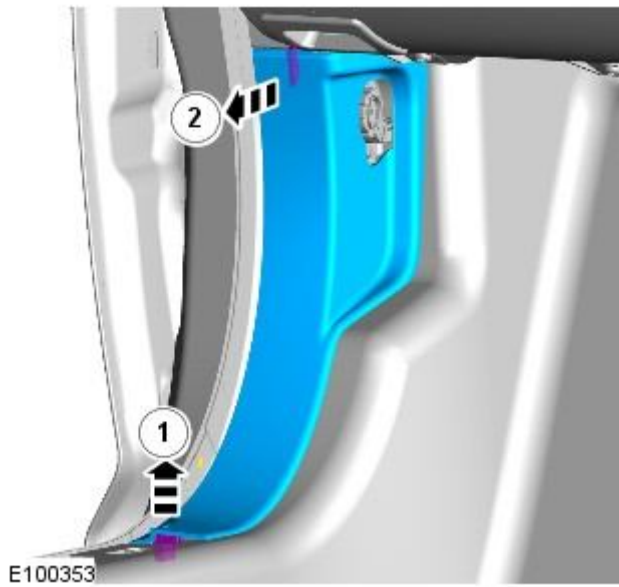


E95489



E100352

3.
  - LH side only: Remove the hood release lever.



4. **4.** NOTE: Left-hand shown, right-hand similar.

## Installation

1. To install, reverse the removal procedure.

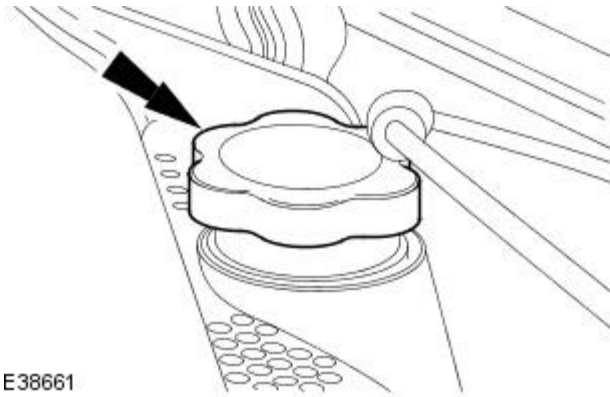


# Interior Trim and Ornamentation - Engine Cover 4.2L NA V8 - AJV8

Removal and Installation

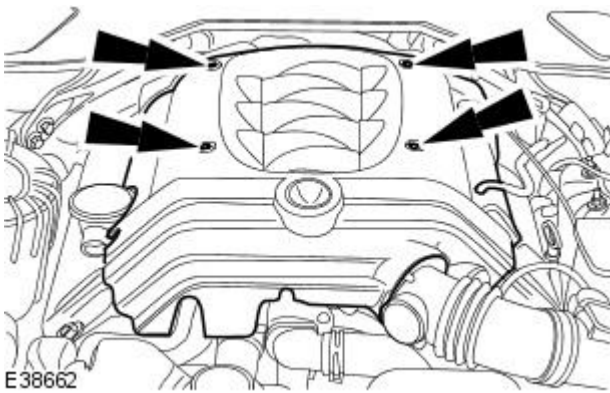
## Removal

1. Remove the oil filler cap.



E38661

2. Remove the engine cover.



E38662

## Installation

1.  **CAUTION:** Correct installation of the oil filler cap can be obtained by tightening the cap until an audible click is heard.

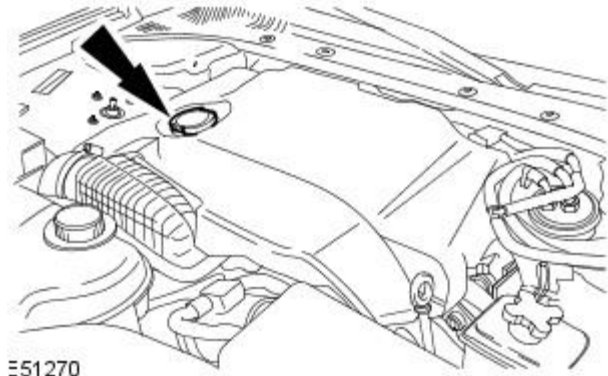
To install, reverse the removal procedure.

# Interior Trim and Ornamentation - Engine CoverTDV6 2.7L Diesel

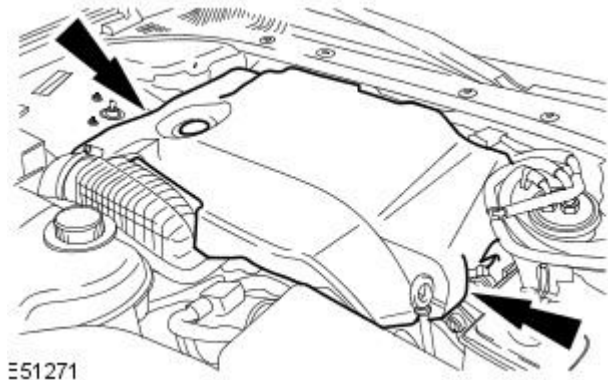
Removal and Installation

## Removal


1. Remove the oil filler cap.



2. Remove the engine cover.



## Installation

1.  **CAUTION:** Correct installation of the oil filler cap can be obtained by tightening the cap until an audible click is heard.

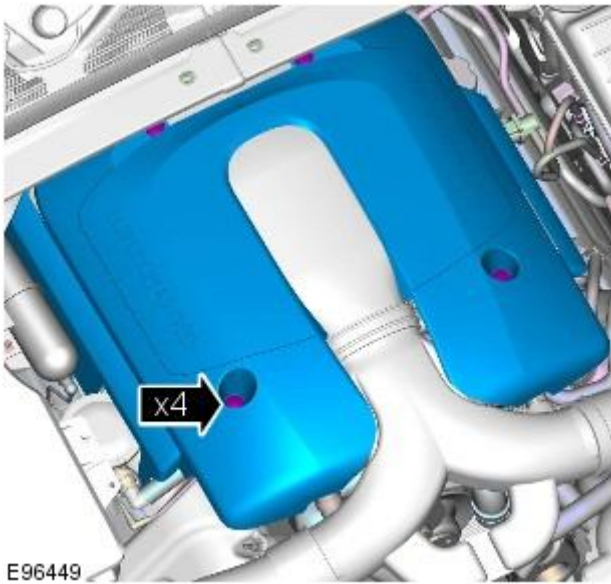
To install, reverse the removal procedure.

## Interior Trim and Ornamentation - Engine Cover 4.2L SC V8 - AJV8

Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.



1.

- Release the clips.

### Installation

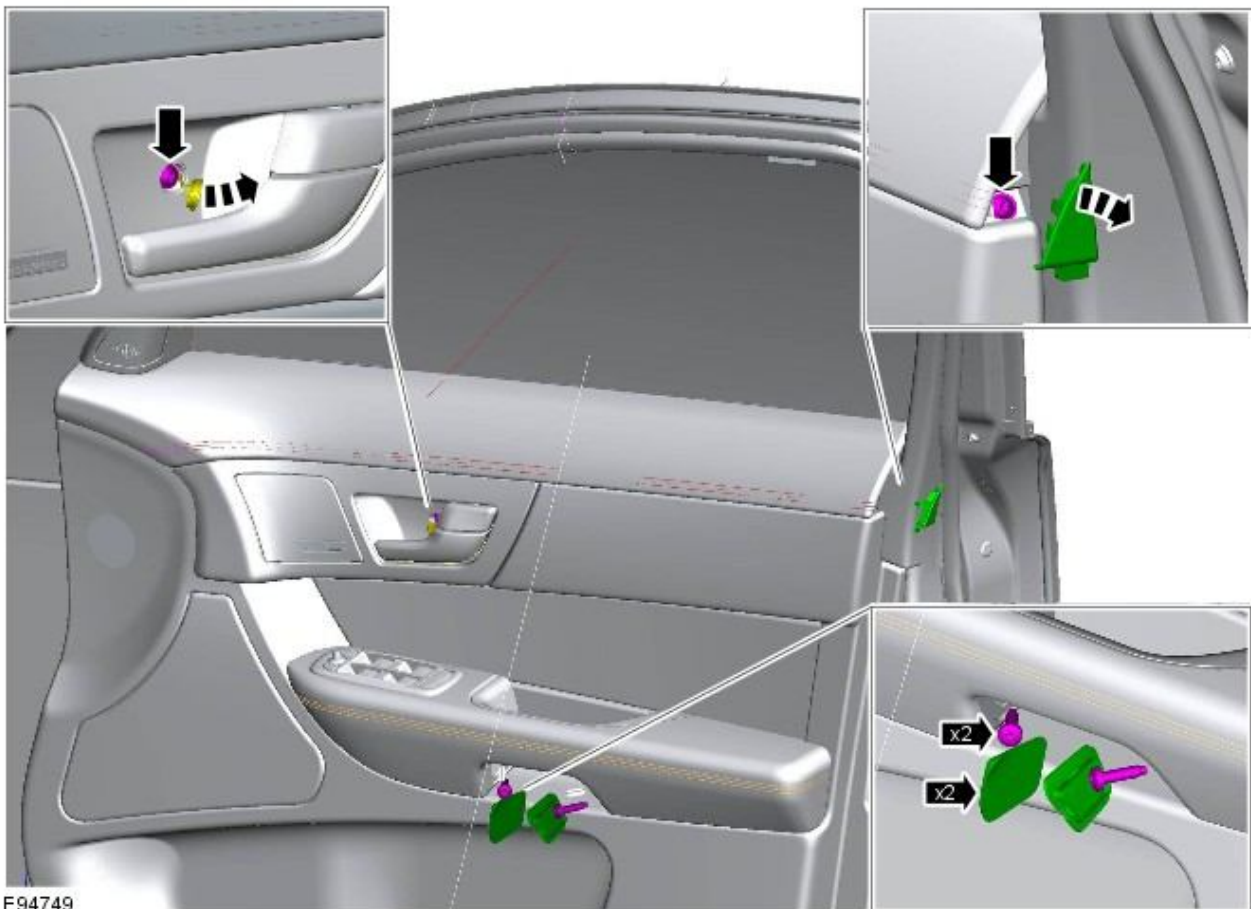
1. To install, reverse the removal procedure.

# Interior Trim and Ornamentation - Front Door Trim Panel

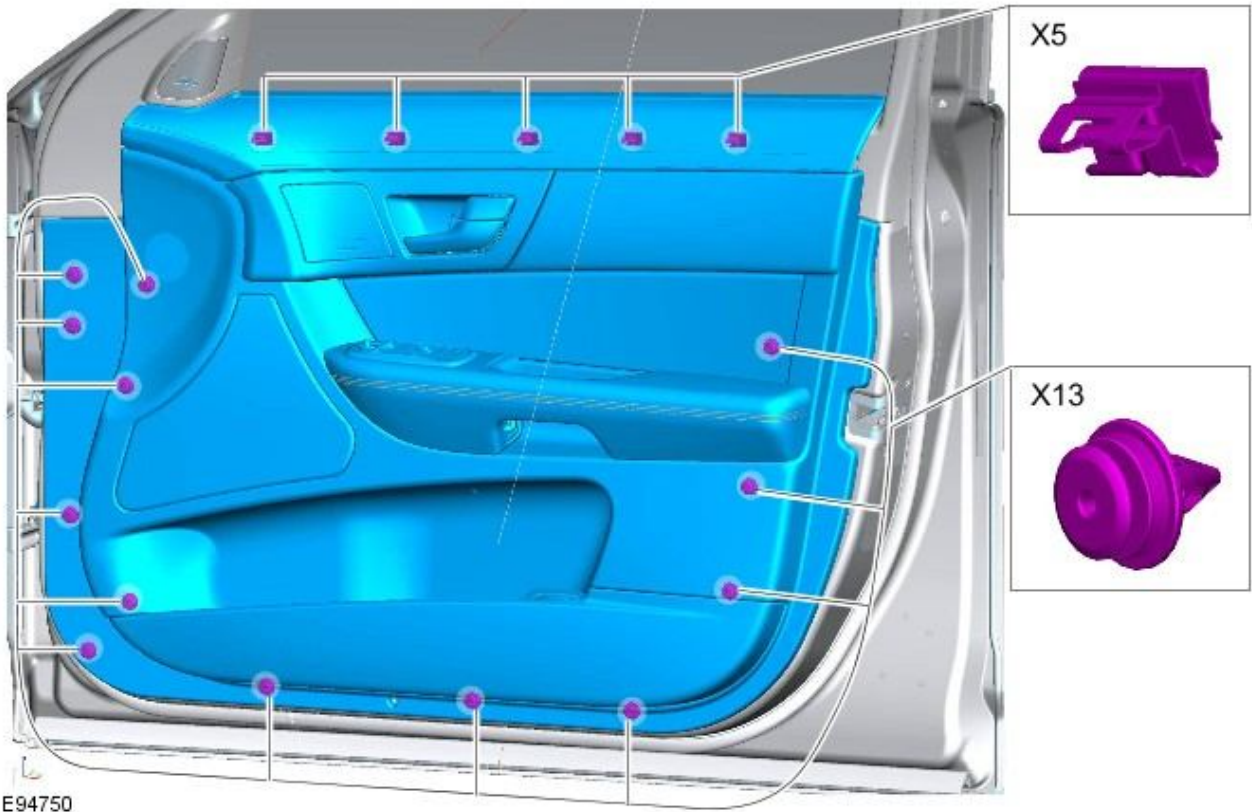
Removal and Installation

## Removal

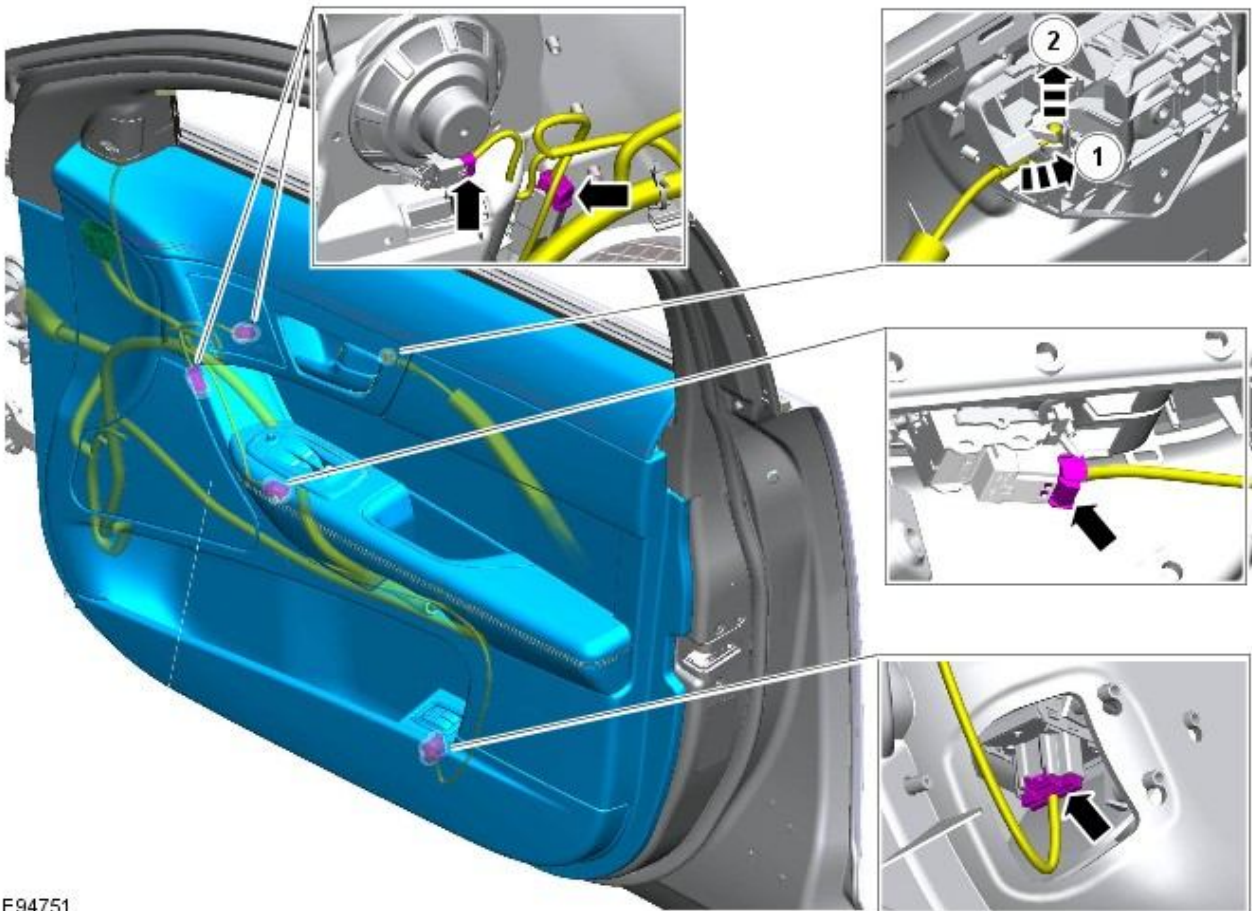
- NOTE: Removal steps in this procedure may contain installation details.



E94749

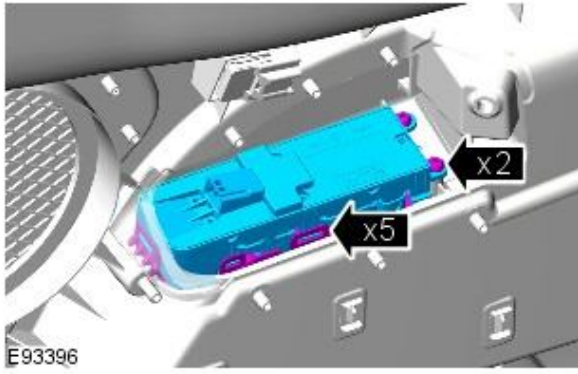


E94750

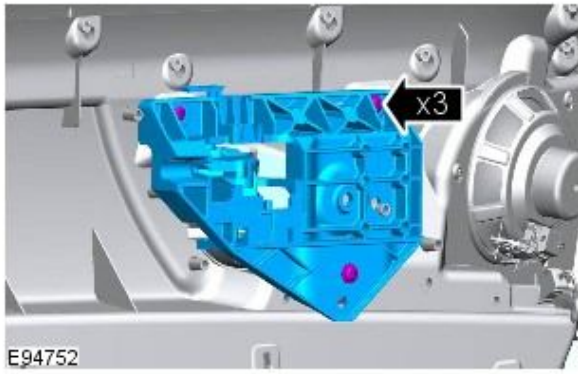


E94751

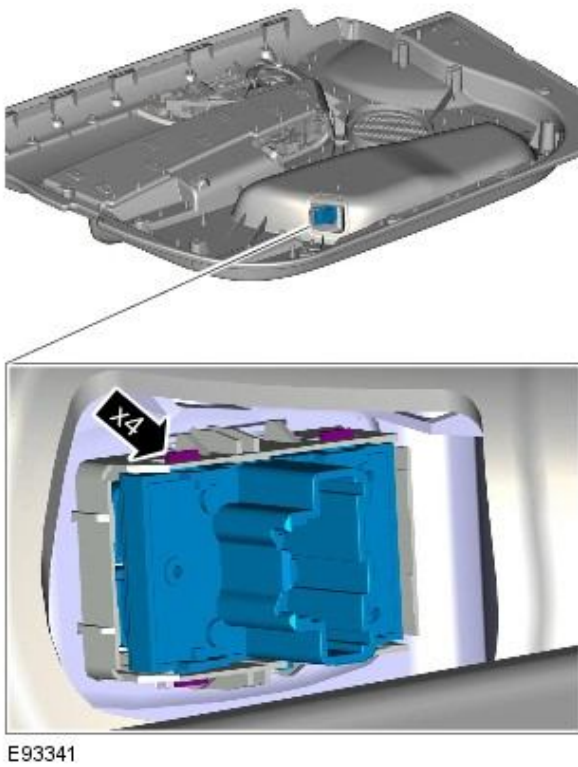




4. **4. NOTE:** Do not disassemble further if the component is removed for access only.

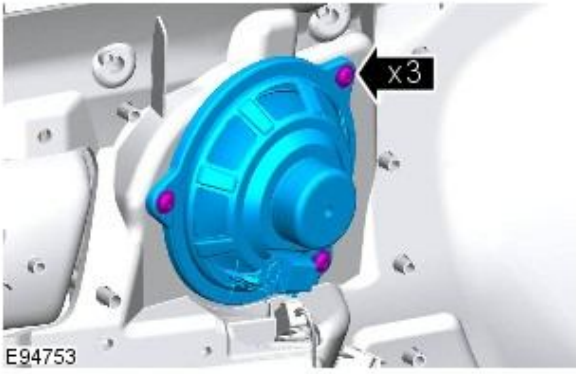


5.

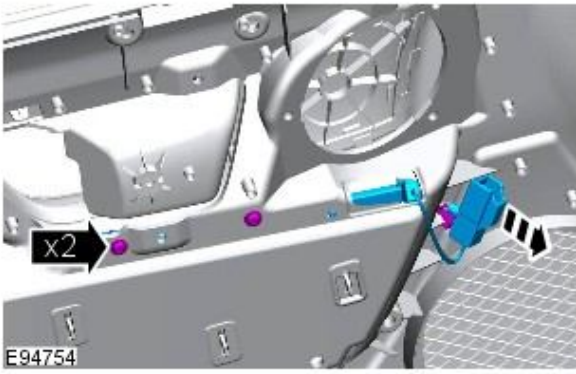


6.





7.



8.

## Installation

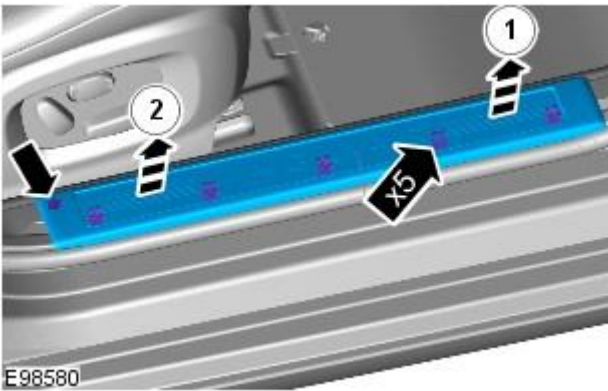
1. To install, reverse the removal procedure.


## Interior Trim and Ornamentation - Front Scuff Plate Trim Panel

Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.



1.  CAUTION: Make sure that the component is correctly located on the locating dowels.

### Installation

1. To install, reverse the removal procedure.

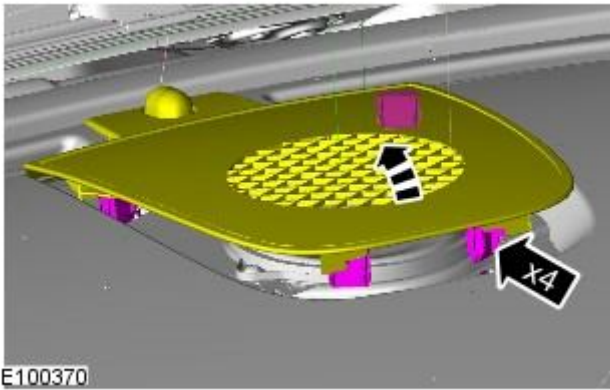
# Interior Trim and Ornamentation - Instrument Panel Speaker Grille

Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).



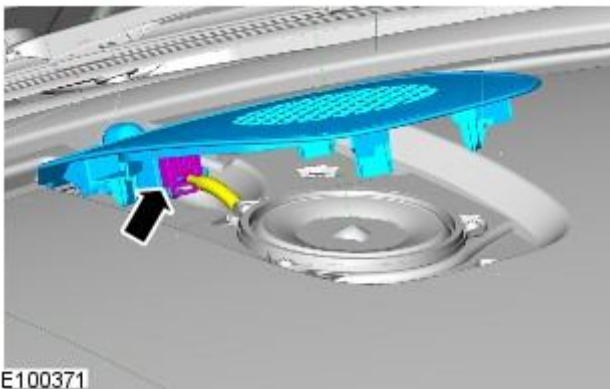
2. CAUTIONS:



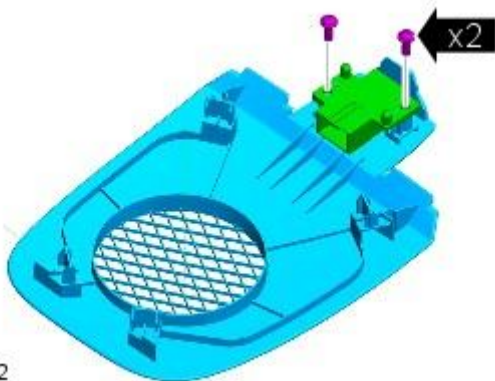
Protect the surrounding trim to avoid damage.



Make sure that the clips are correctly located.



- 3.

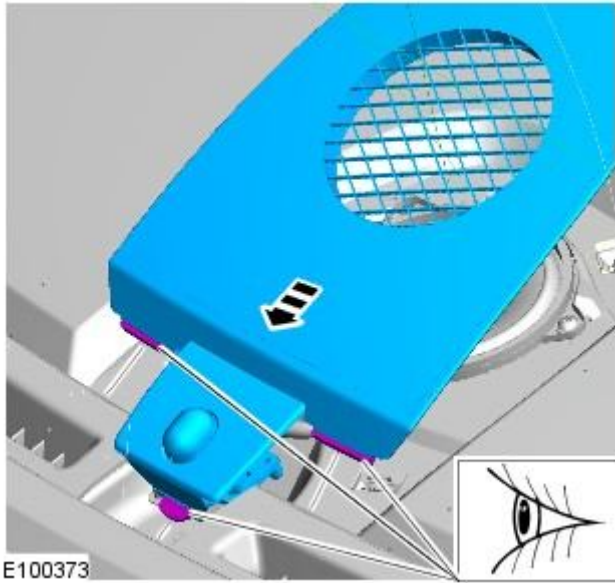


4. CAUTION: Make sure that the component is correctly located on the locating dowels.

- NOTE: Do not disassemble further if the component is removed for access only.

Torque: 2 Nm

## Installation



E100373

1. To install, reverse the removal procedure.

# Interior Trim and Ornamentation - Headliner

Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Interior Rear View Mirror](#) (501-09 Rear View Mirrors, Removal and Installation).
3. Refer to: [Overhead Console](#) (501-12 Instrument Panel and Console, Removal and Installation).

4.
  - Remove both sun visors.

Refer to: [Sun Visor](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

5.
  - Remove both A-pillar trim panels.

Refer to: [A-Pillar Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

6.
  - Remove both B-pillar upper trim panels.

Refer to: [B-Pillar Upper Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

7.
  - Remove both C-pillar trim panels.

Refer to: [C-Pillar Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

8.
  - Remove both front seats.

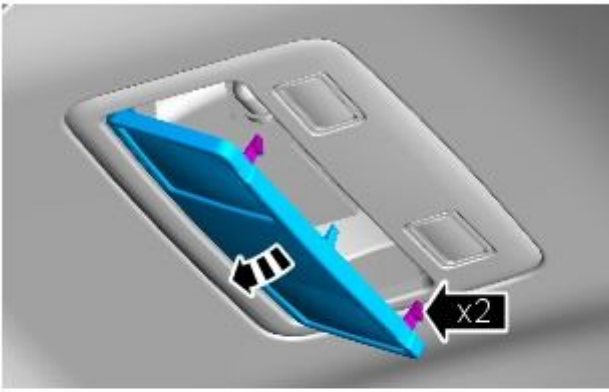
Refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).

9. Refer to: [Rear Seat Cushion](#) (501-10 Seating, Removal and Installation).

10. Torque: 2 Nm

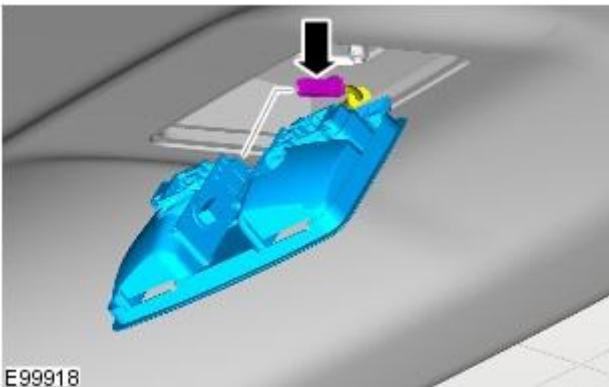


11.



E99917

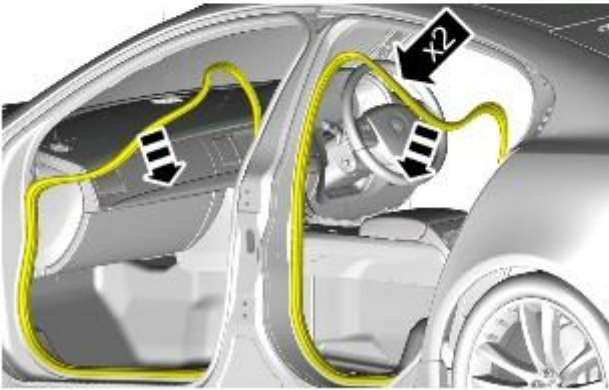
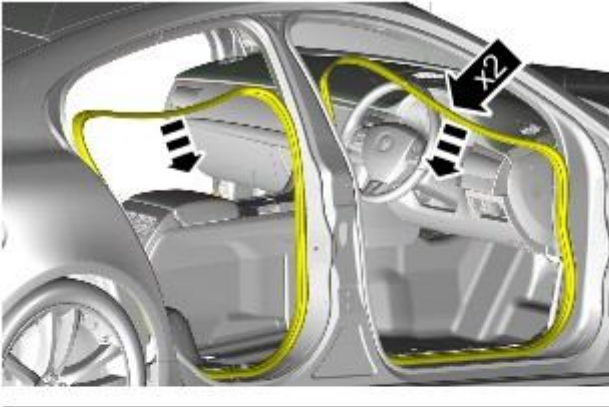
12.



E99918

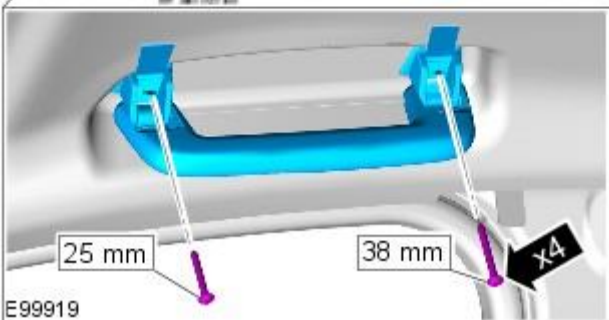
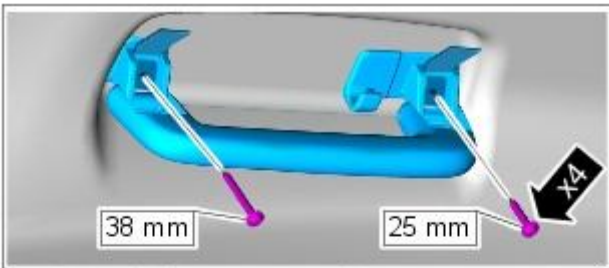


13.



E100343

Vehicles with roof opening panel



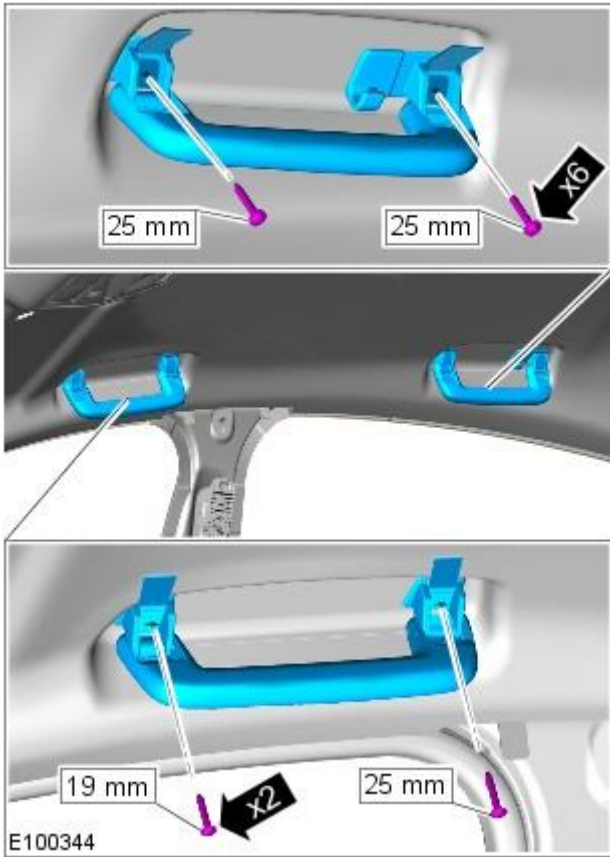
E99919

14. **14.** NOTE: Note the different lengths of screws.

• NOTE: Make sure that the component is installed to the position noted on removal.

Torque: 2 Nm

Vehicles without roof opening panel



15. **15.** NOTE: Note the different lengths of screws.

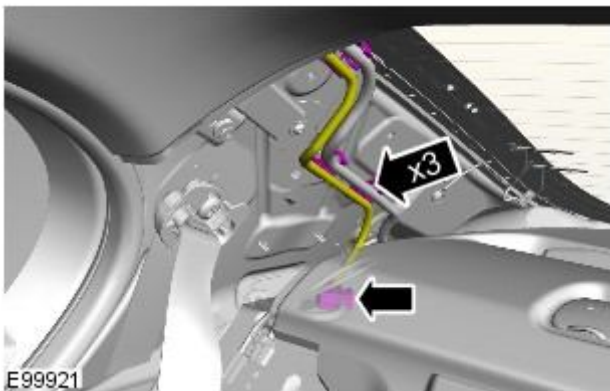
- NOTE: Make sure that the component is installed to the position noted on removal.

Torque: 2 Nm

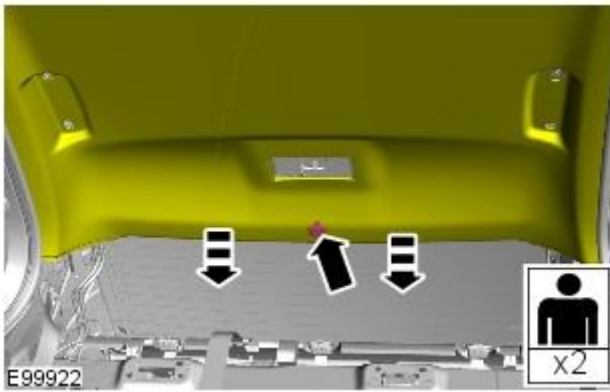
All vehicles



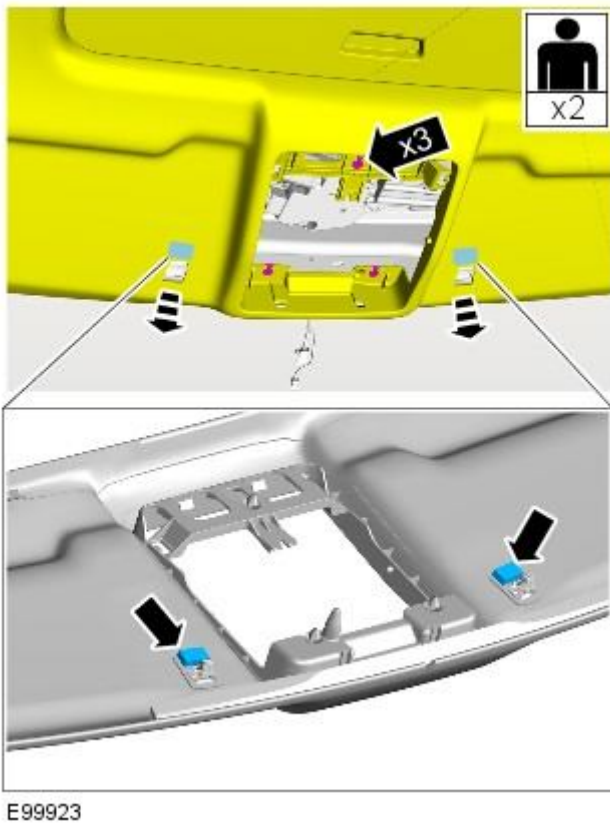
16.




17.




18. **18.**  **WARNING:** This step requires the aid of another technician.



19. **19.**  **WARNING:** This step requires the aid of another technician.


• **CAUTIONS:**

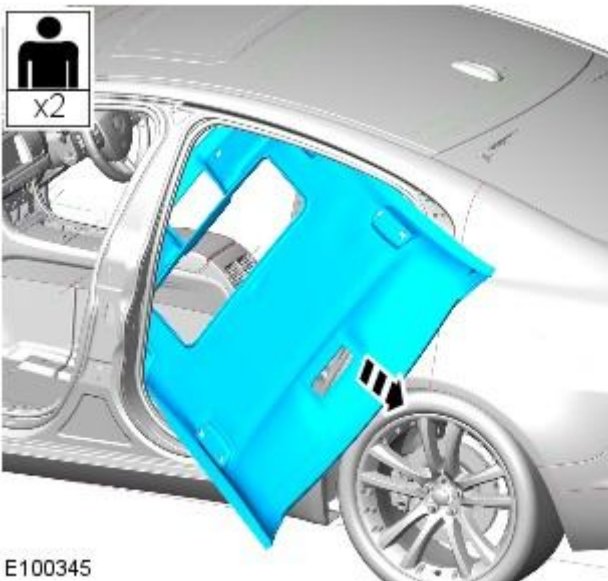
 Note the fitted position of the component prior to removal.

 Make sure that these components are installed to the noted removal position.




E99924

20.  **CAUTION:** Note the fitted position of the component prior to removal.
  - **NOTE:** Make sure that the component is installed to the position noted on removal.



E100345

21.  **WARNING:** This step requires the aid of another technician.

## Installation

1. To install, reverse the removal procedure.

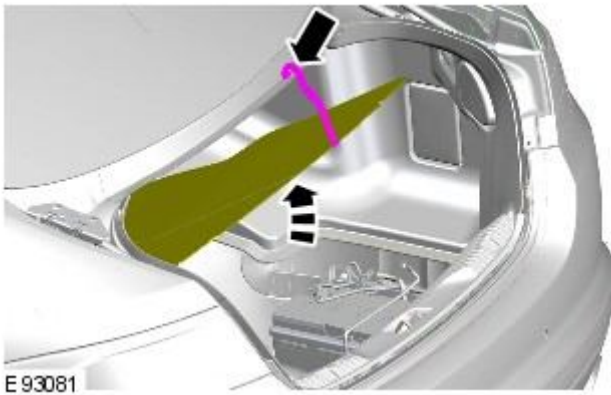
# Interior Trim and Ornamentation - Loadspace Scuff Plate Trim Panel

Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1.



2.



## Installation

1. To install, reverse the removal procedure.

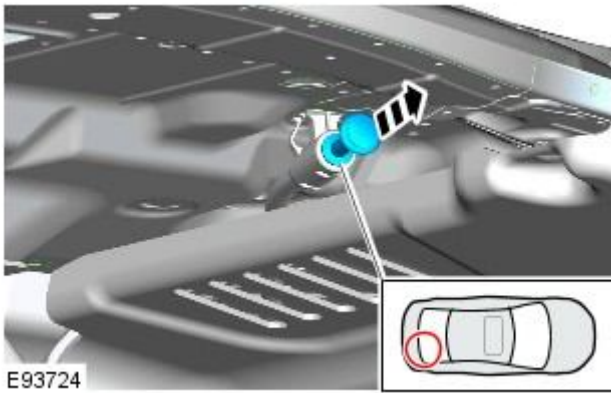


# Interior Trim and Ornamentation - Loadspace Trim Panel

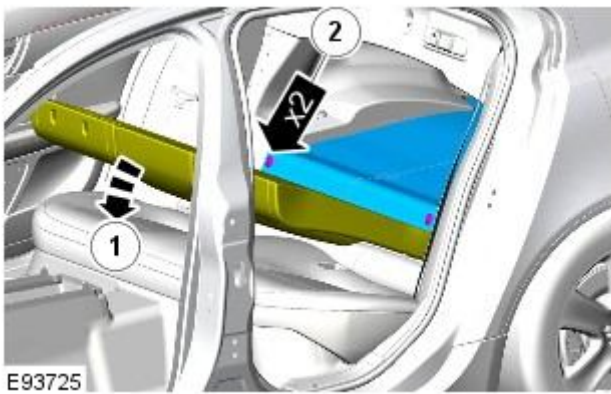
Removal and Installation

## Removal

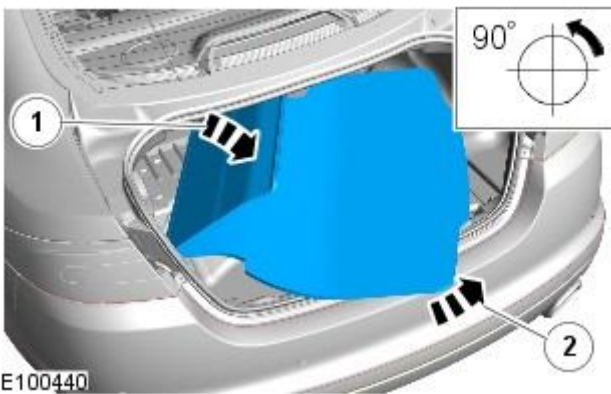
- NOTE: Removal steps in this procedure may contain installation details.



1.
  - Repeat the above procedure for the other side.



- 2.



- 3.

## Installation

1. To install, reverse the removal procedure.



# Interior Trim and Ornamentation - Loadspace Trim Panel LH

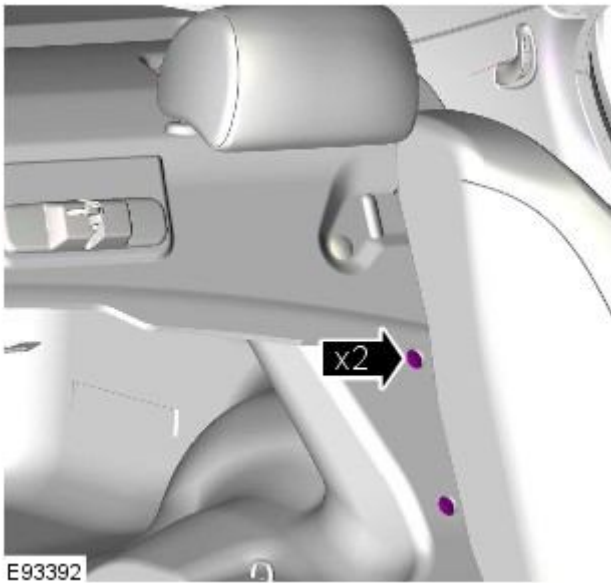
Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Loadspace Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Refer to: [Loadspace Scuff Plate Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.



4.



## Installation

1. To install, reverse the removal procedure.

# Interior Trim and Ornamentation - Loadspace Trim Panel RH

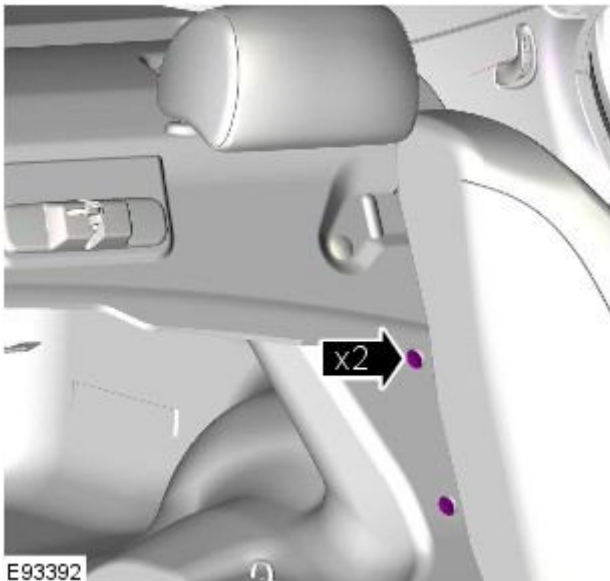
Removal and Installation

## Removal

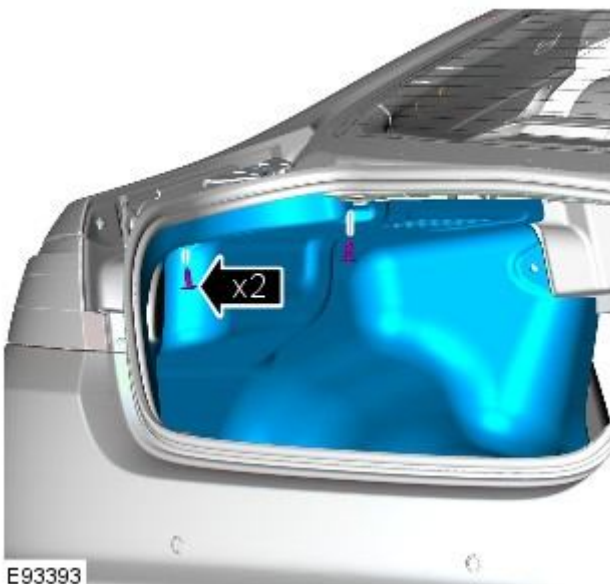
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Loadspace Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Refer to: [Loadspace Scuff Plate Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.



4. 4. NOTE: LH illustration shown, RH is similar.



## Installation

1. To install, reverse the removal procedure.

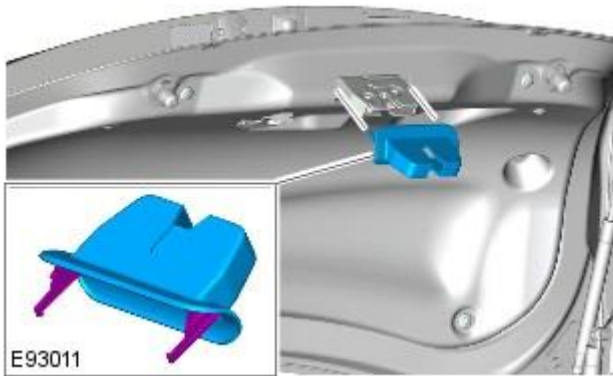
# Interior Trim and Ornamentation - Luggage Compartment Lid Trim Panel

Removal and Installation

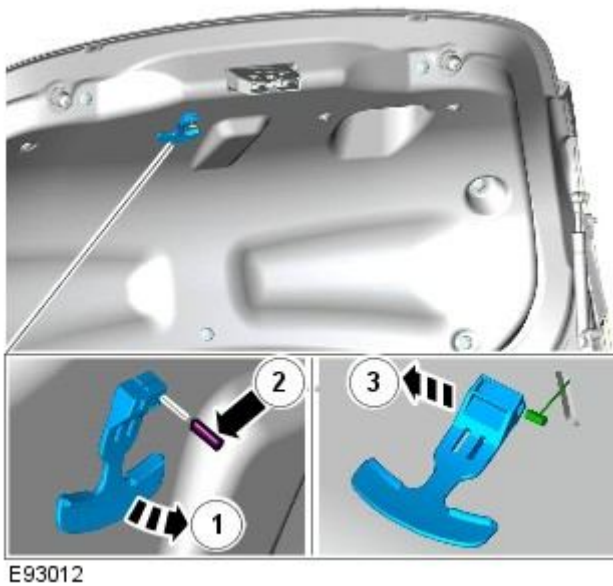
## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1.



2.



3.



## Installation

1. To install, reverse the removal procedure.

## Interior Trim and Ornamentation - Parcel Shelf

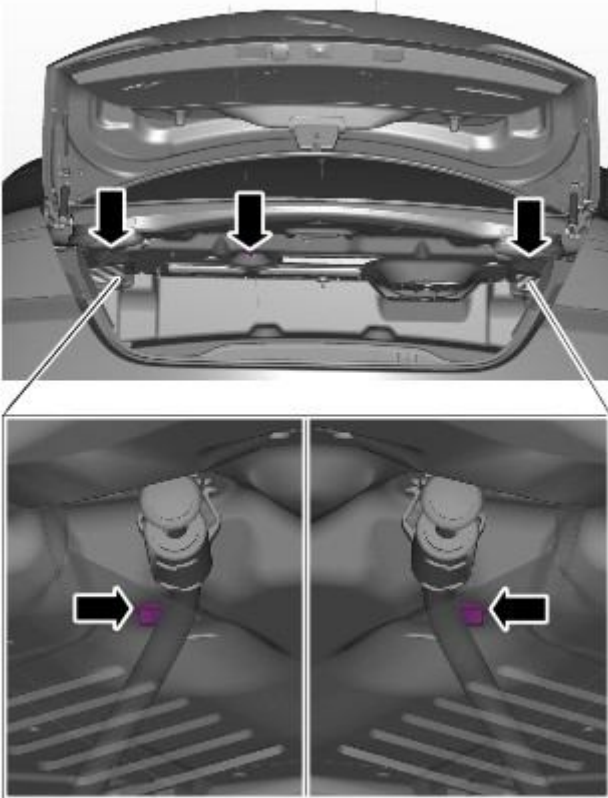
Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.

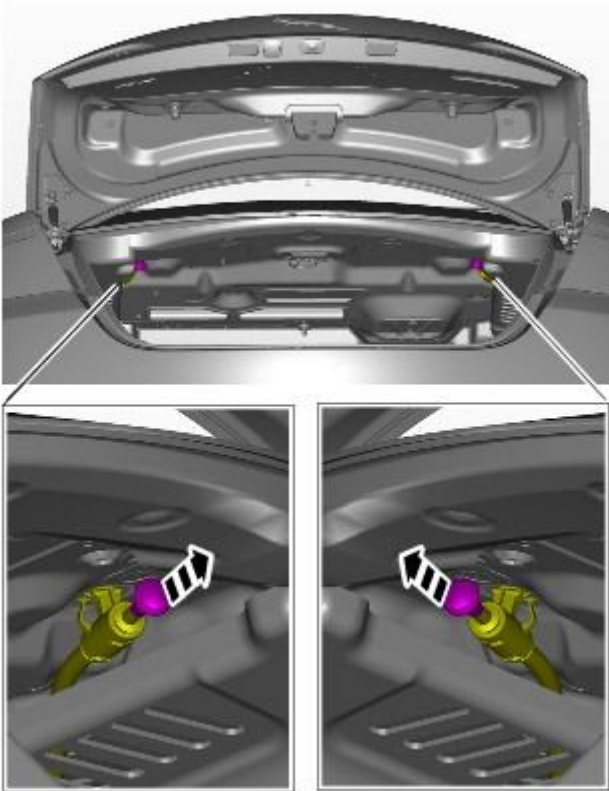
1. Refer to: [C-Pillar Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. Torque: 12 Nm



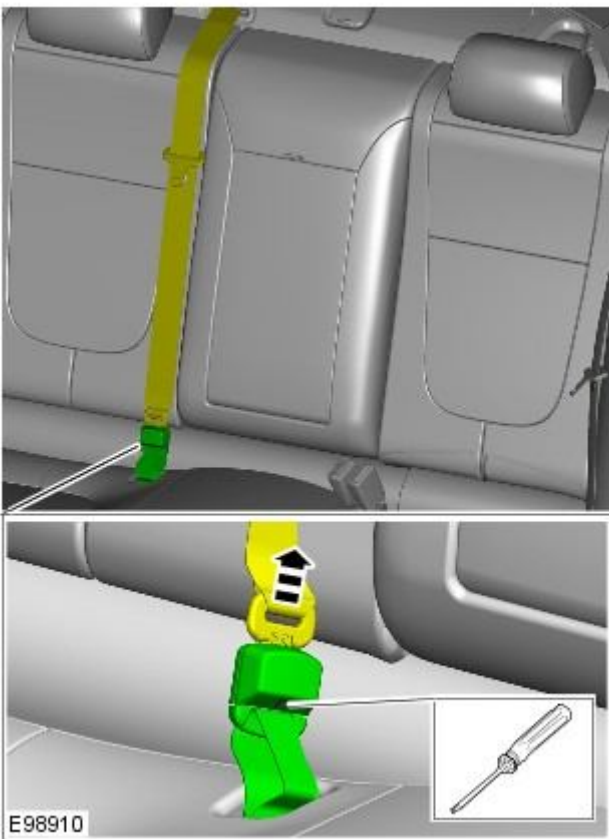
E98908

3.

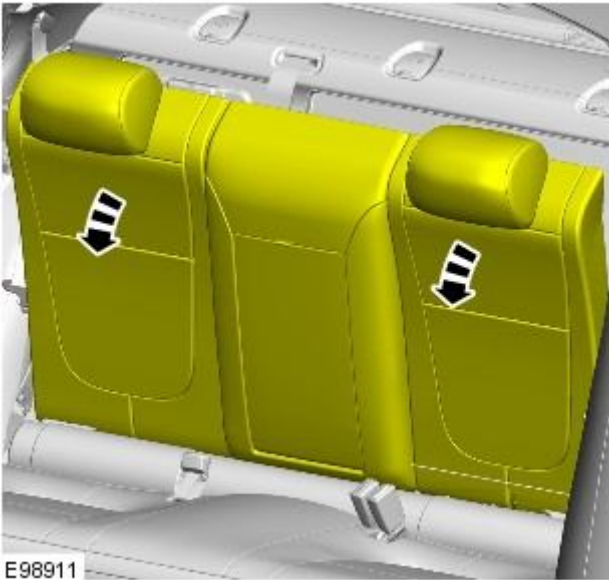


E98909

4.

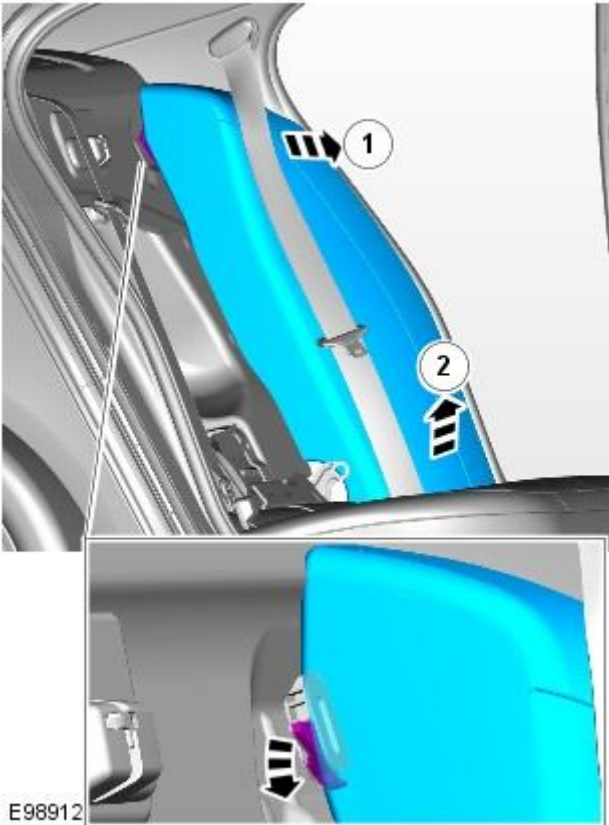


E98910



E98911

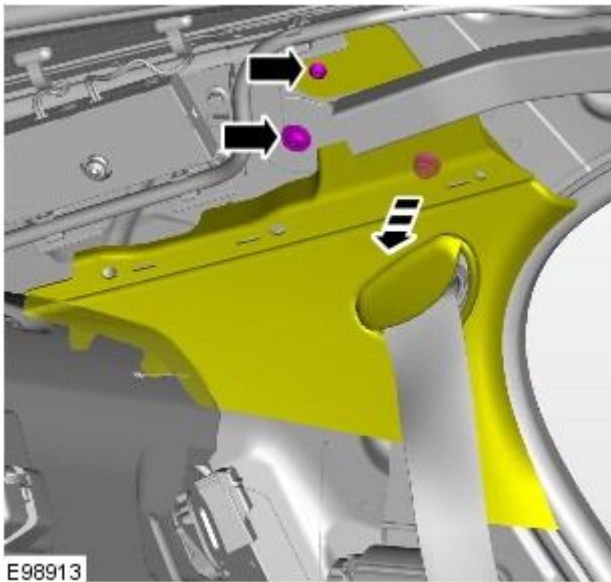
5.



E98912

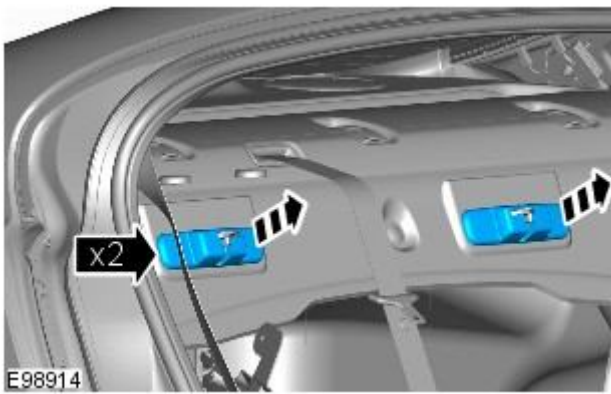
6. **6.** NOTE: The procedure must be carried out on both sides of the seat.





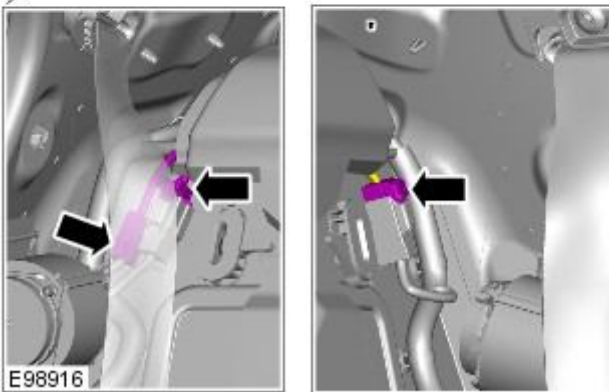
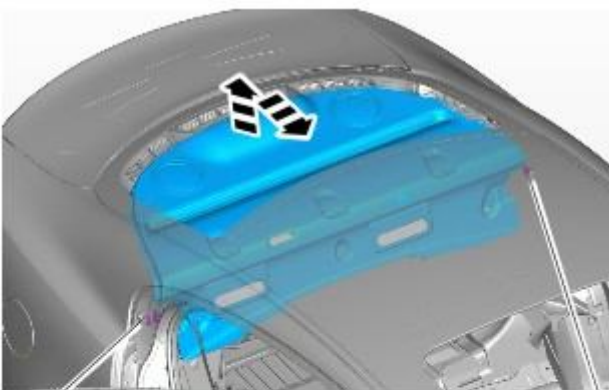
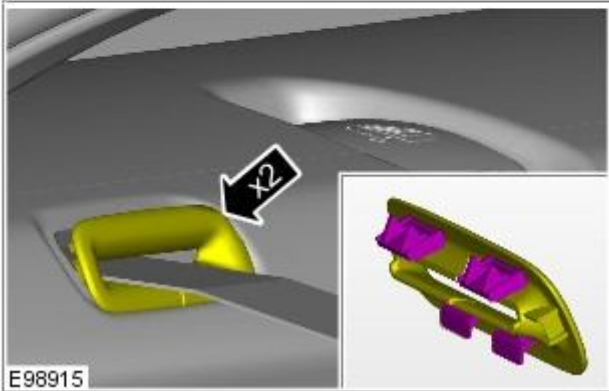
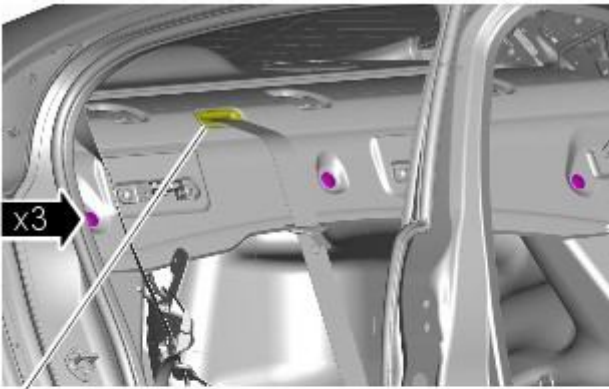
7. **7.** NOTE: The procedure must be carried out on both sides of the seat.

Torque: 6 Nm

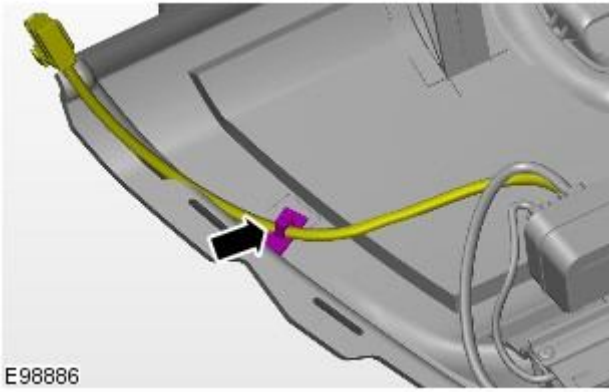


8.

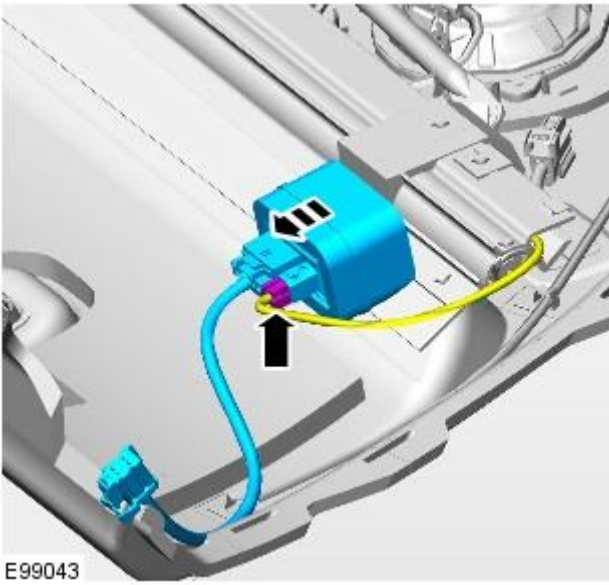
9.



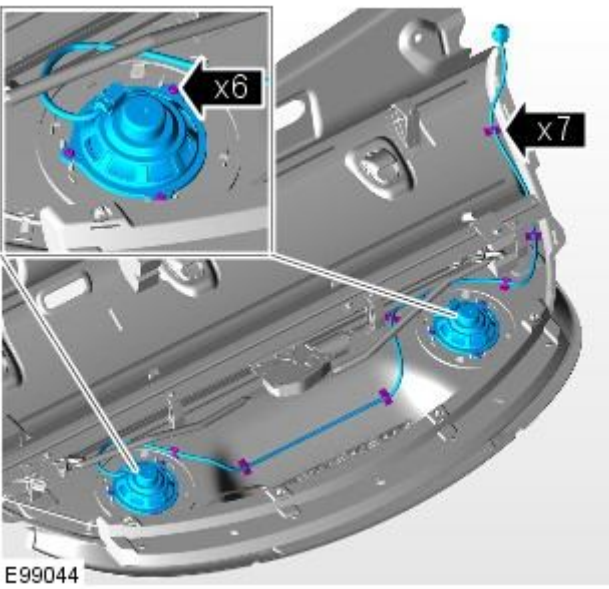
10. **10.** NOTE: On installation, use a suitable tool to make sure that the parcel shelf is located underneath the rear window blind.



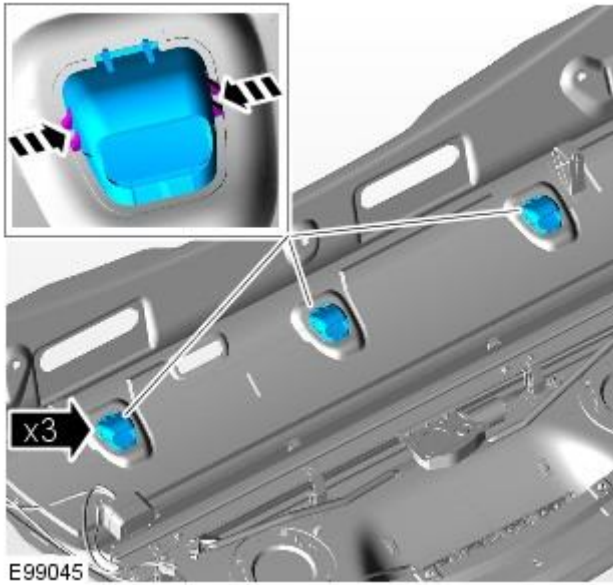
11. **11.** NOTE: Do not disassemble further if the component is removed for access only.



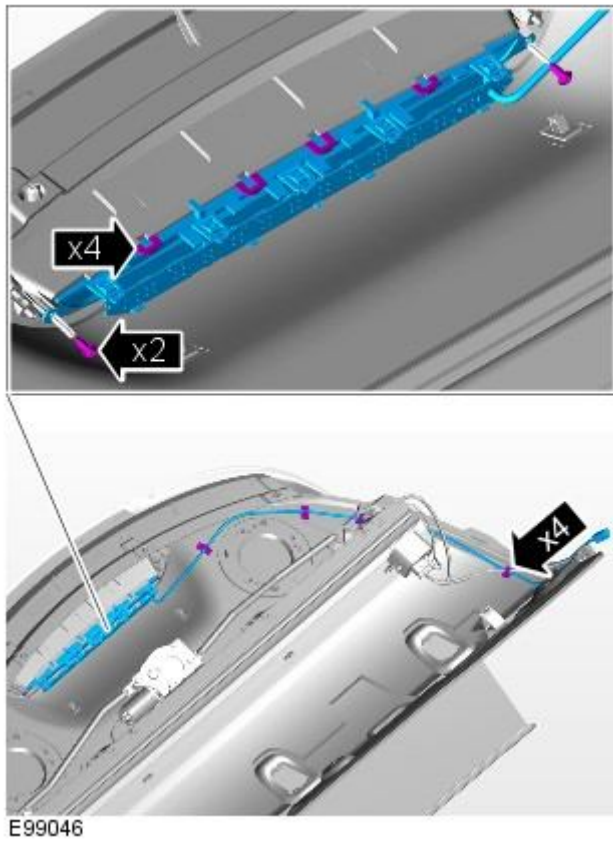
12.



13.

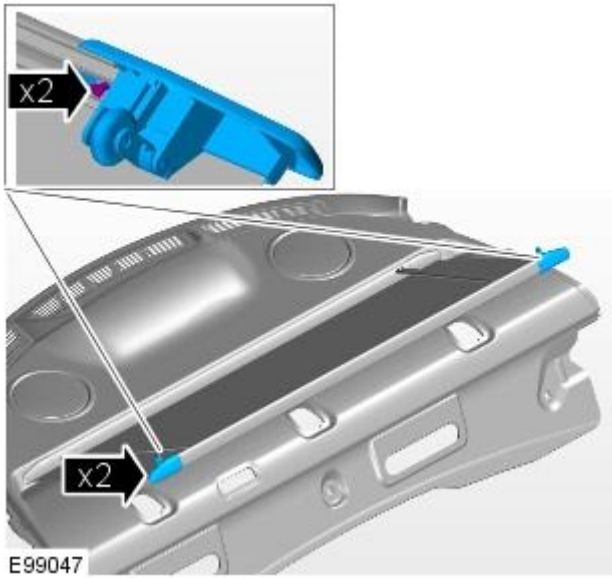


14.



15.

16.



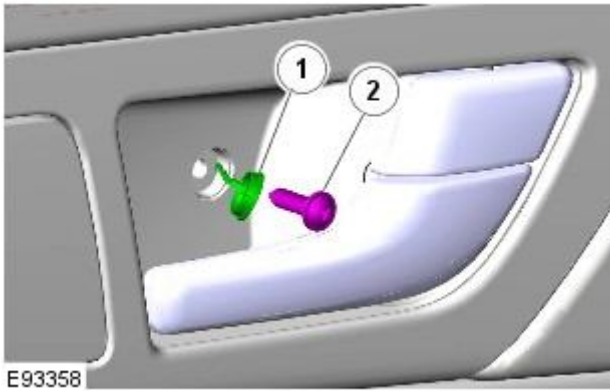
## Installation

1. To install, reverse the removal procedure.

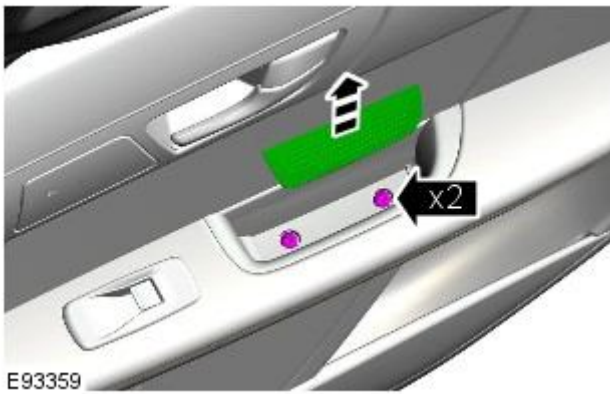
# Interior Trim and Ornamentation - Rear Door Trim Panel

Removal and Installation

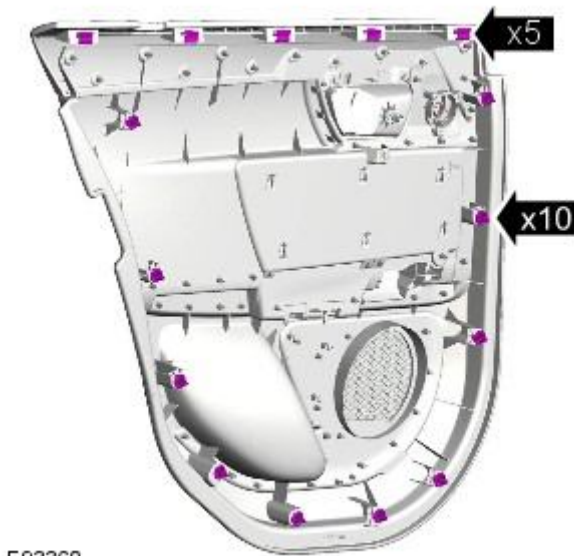
## Removal



1.



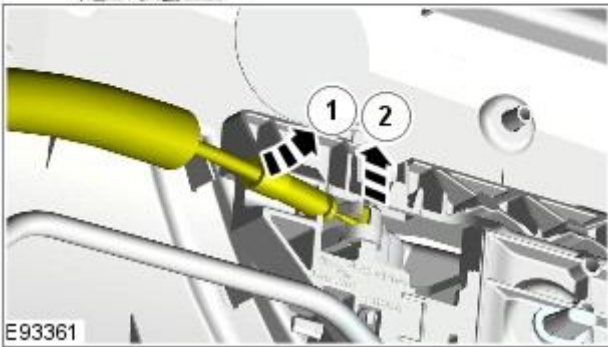
2.



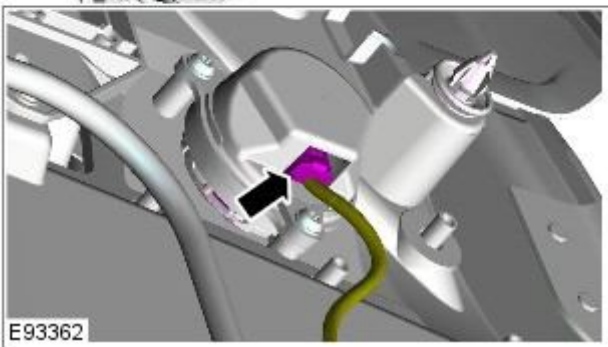
3.



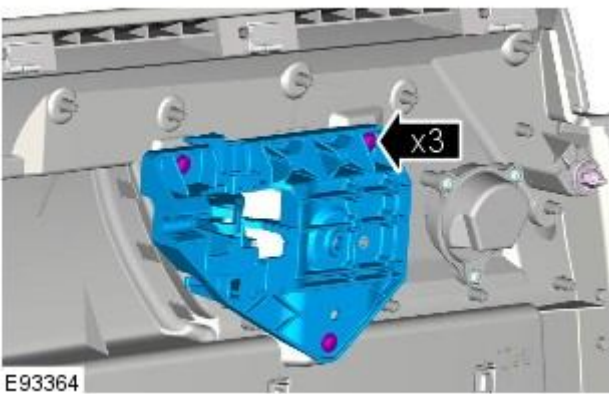
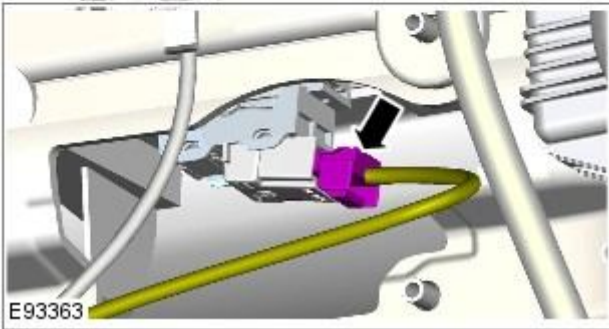
4.



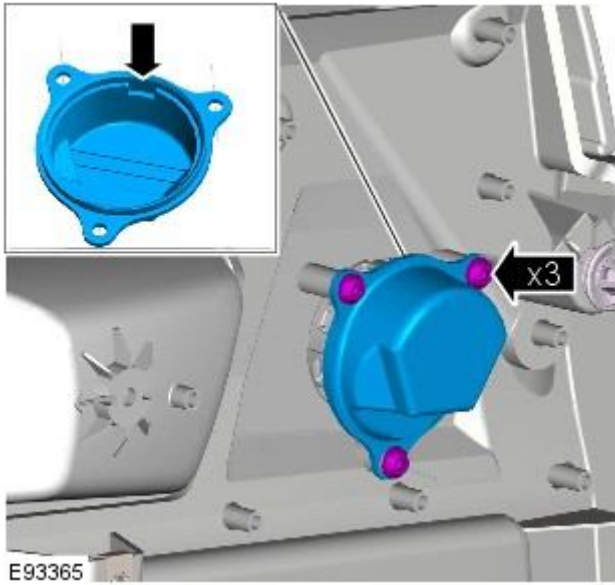
5.



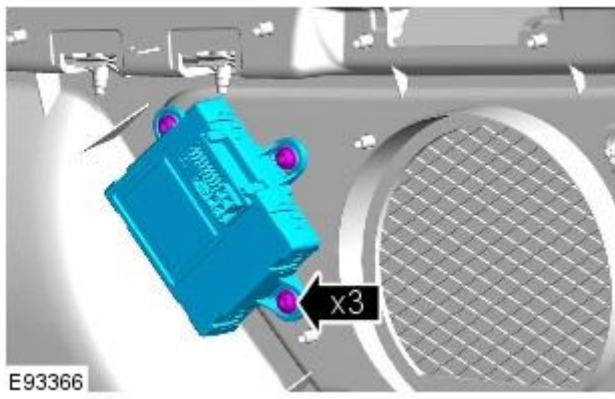
6.



7. **7. NOTE:** Do not disassemble further if the component is removed for access only.

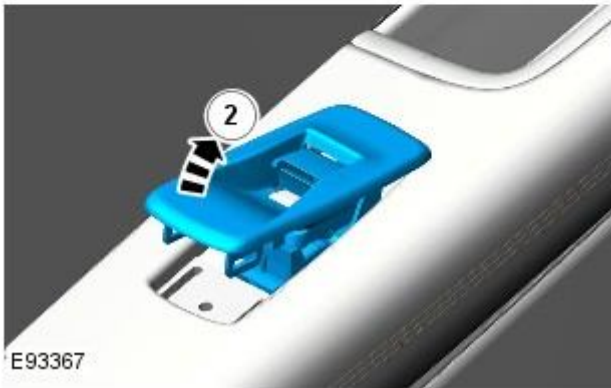
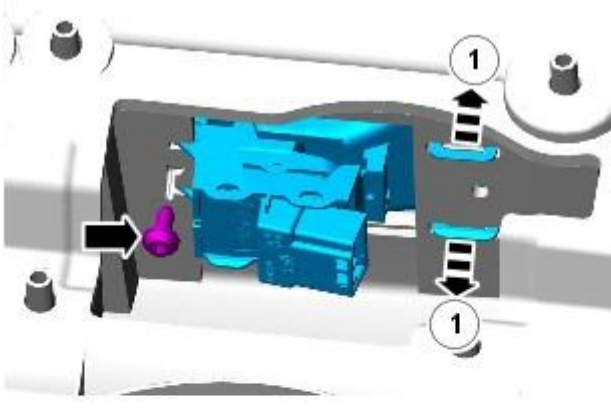


8.



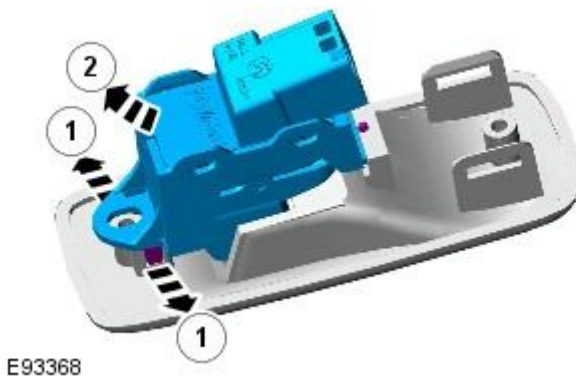
9.

10.



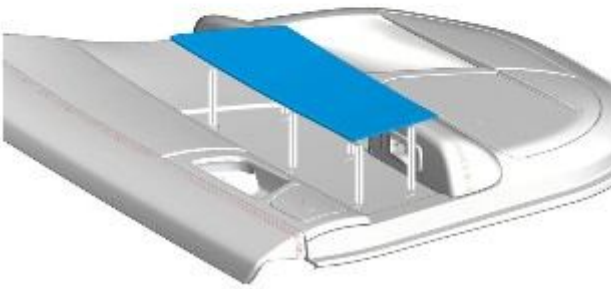
E93367

11.



E93368

12.



E93422

13.



E93369

## Installation

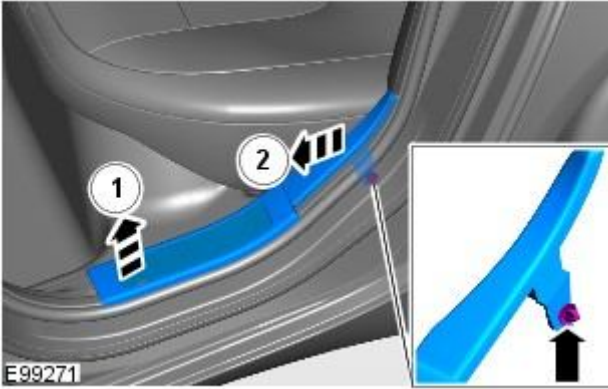
1. To install, reverse the removal procedure.

# Interior Trim and Ornamentation - Rear Scuff Plate Trim Panel

Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.



1.  CAUTION: Make sure that the clips are correctly located.

## Installation

1. To install, reverse the removal procedure.



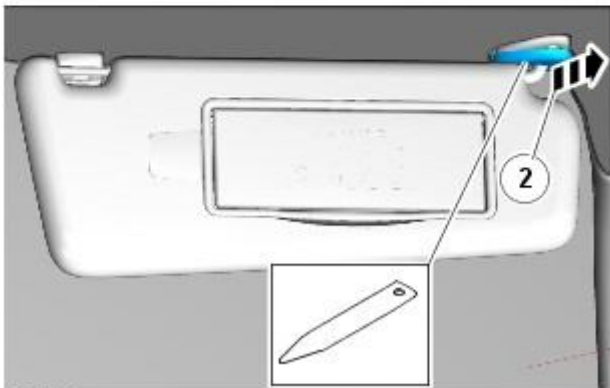
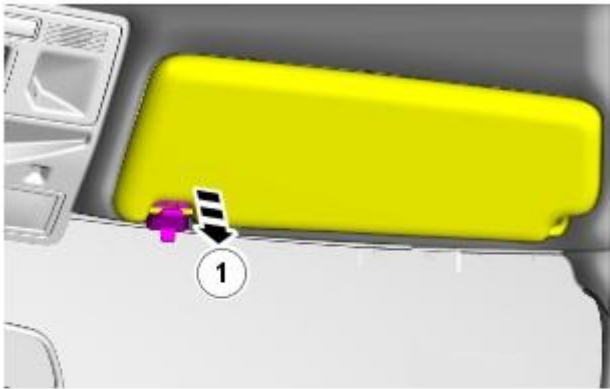
# Interior Trim and Ornamentation - Sun Visor

Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1.  CAUTION: Take extra care not to damage the edges of the component.



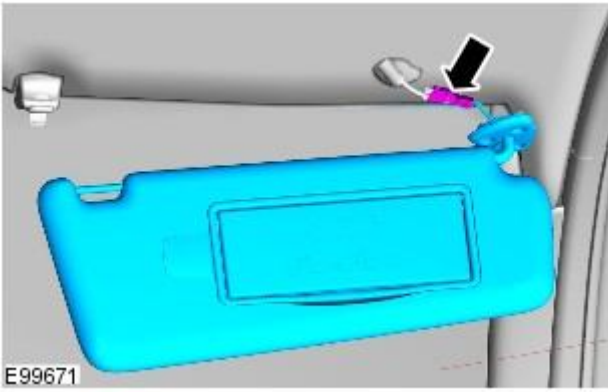
E99669

2. TORQUE: 2 Nm



E99670

3.



### Installation

1. To install, reverse the removal procedure.

**Exterior Trim and Ornamentation -**

Description	Nm	lb-ft	lb-in
Luggage compartment lid moulding retaining nuts	3	-	26

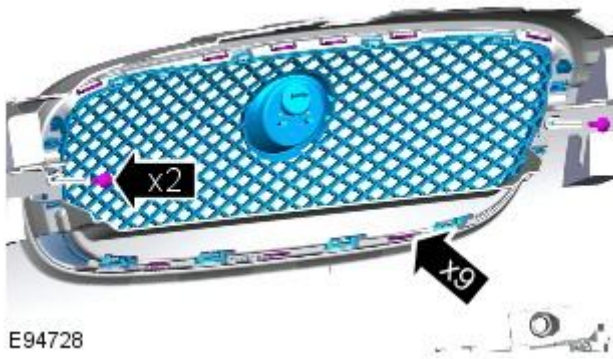
# Exterior Trim and Ornamentation - Radiator Grille

Removal and Installation

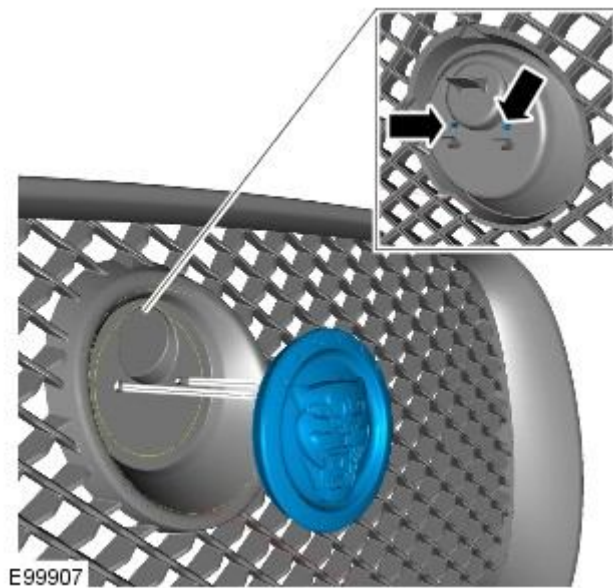
## Removal

1. Refer to: [Front Bumper Cover](#) (501-19 Bumpers, Removal and Installation).

2.



3. **3. NOTE:** Note the fitted position of the locating pegs.



## Installation

1. To install, reverse the removal procedure.

# Exterior Trim and Ornamentation - Luggage Compartment Lid Moulding

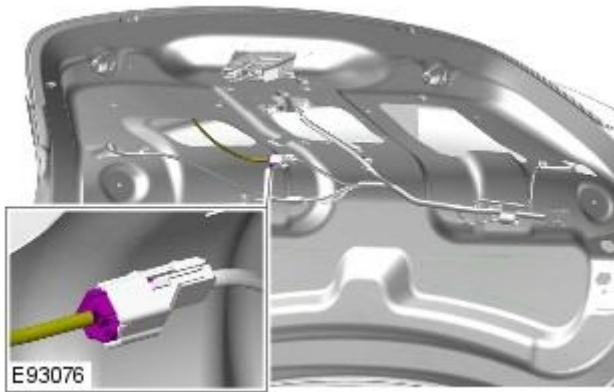
Removal and Installation

## Removal

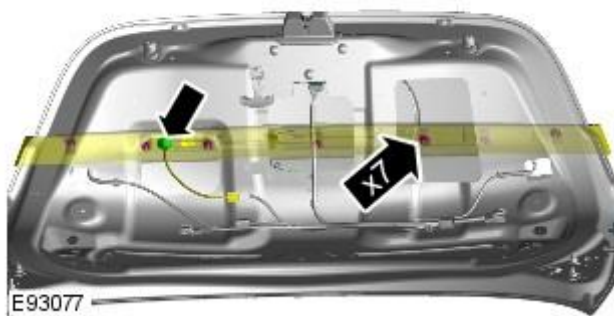
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Luggage Compartment Lid Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



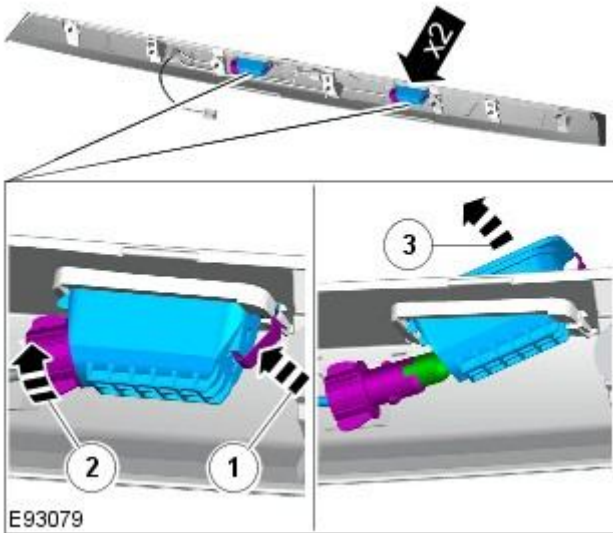
3. Torque: 3 Nm



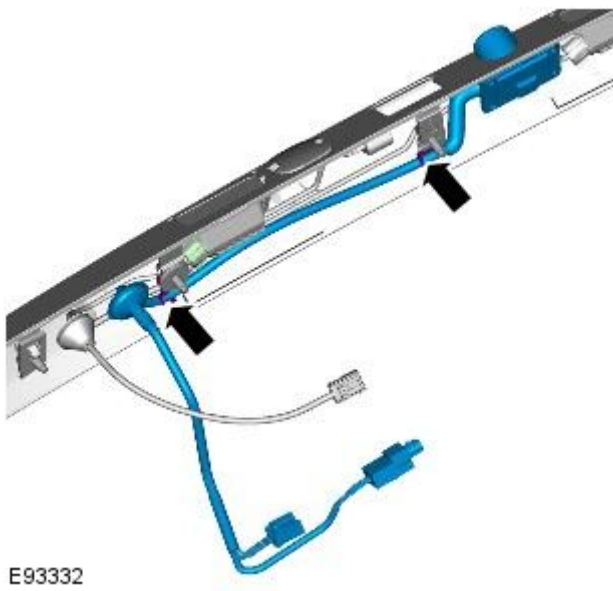
4.



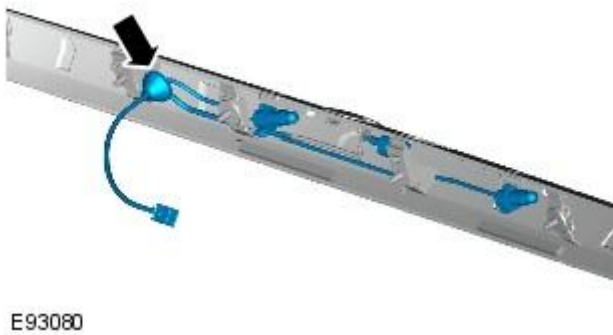
5. NOTE: Do not disassemble further if the component is removed for access only.



- 6.



- 7.



## Installation

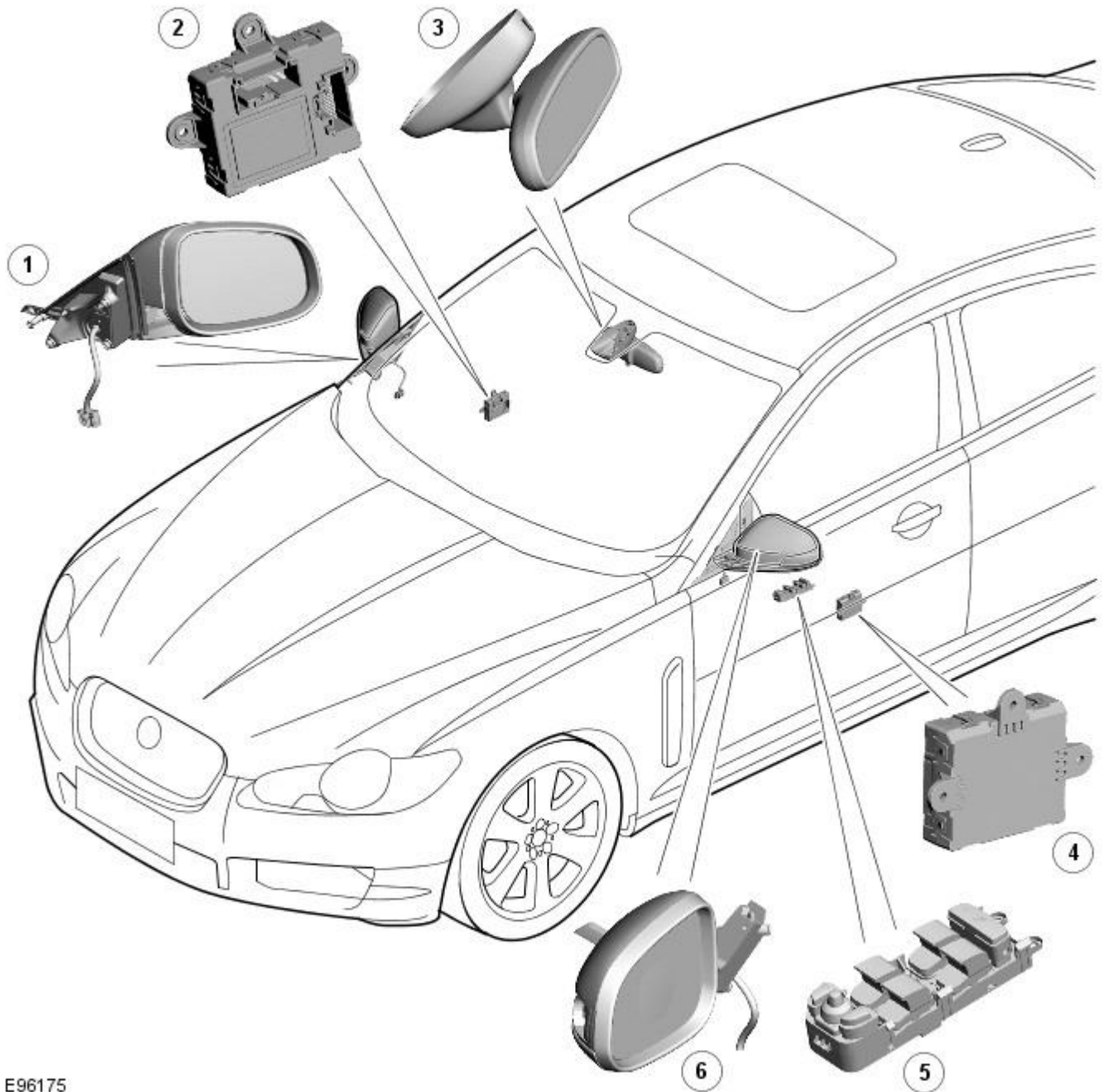
1. To install, reverse the removal procedure.



## Rear View Mirrors - Rear View Mirrors - Component Location

Description and Operation

• NOTE: LHD (left-hand drive) shown RHD (right-hand drive) similar



E96175

### ItemDescription

1	Passenger door mirror
2	Passenger door control module
3	Interior mirror
4	Drivers door control module
5	Mirror control switch
6	Drivers door mirror

# Rear View Mirrors - Rear View Mirrors - Overview

Description and Operation

## Overview

The exterior mirrors incorporate the following:

- Blind spot monitoring indicator
- Auto dimming function
- Turn signal indicators
- Approach lamps
- Exterior temperature sensor
- Heated mirror function
- Reverse dipping function

Movement of the door mirrors is controlled from a switch pack located on the drivers door. The switch pack contains 2 non-latching mirror select buttons labeled 'L' and 'R' and a 4-way mirror movement switch. Door mirror movement commands are transmitted to the driver's door module over the [LIN \(local interconnect network\)](#) bus. The drivers door module transmits any mirror movement commands to the passenger door module over the medium speed [CAN \(controller area network\)](#) bus.

Movement of the door mirrors is carried out by the respective door module. The door modules provide supply and ground paths to the mirror motors and monitor mirror position via potentiometers located in the mirror housings.

Both exterior door mirrors and the interior mirror feature an auto dimming function. The interior rear view mirror contains one forward and one rearward facing light sensor. The light sensors control the auto dimming feature of the interior mirror to reduce glare from the headlights of following vehicles.

When auto-dimming of the interior mirror is required, a supply is provided by the interior mirror to both door mirrors to initiate the door mirror auto-dimming sequence.

Blind spot monitoring function alerts the driver to a vehicle located in the vehicle blind spot. A warning indicator is located in each exterior mirror towards the outer edge.

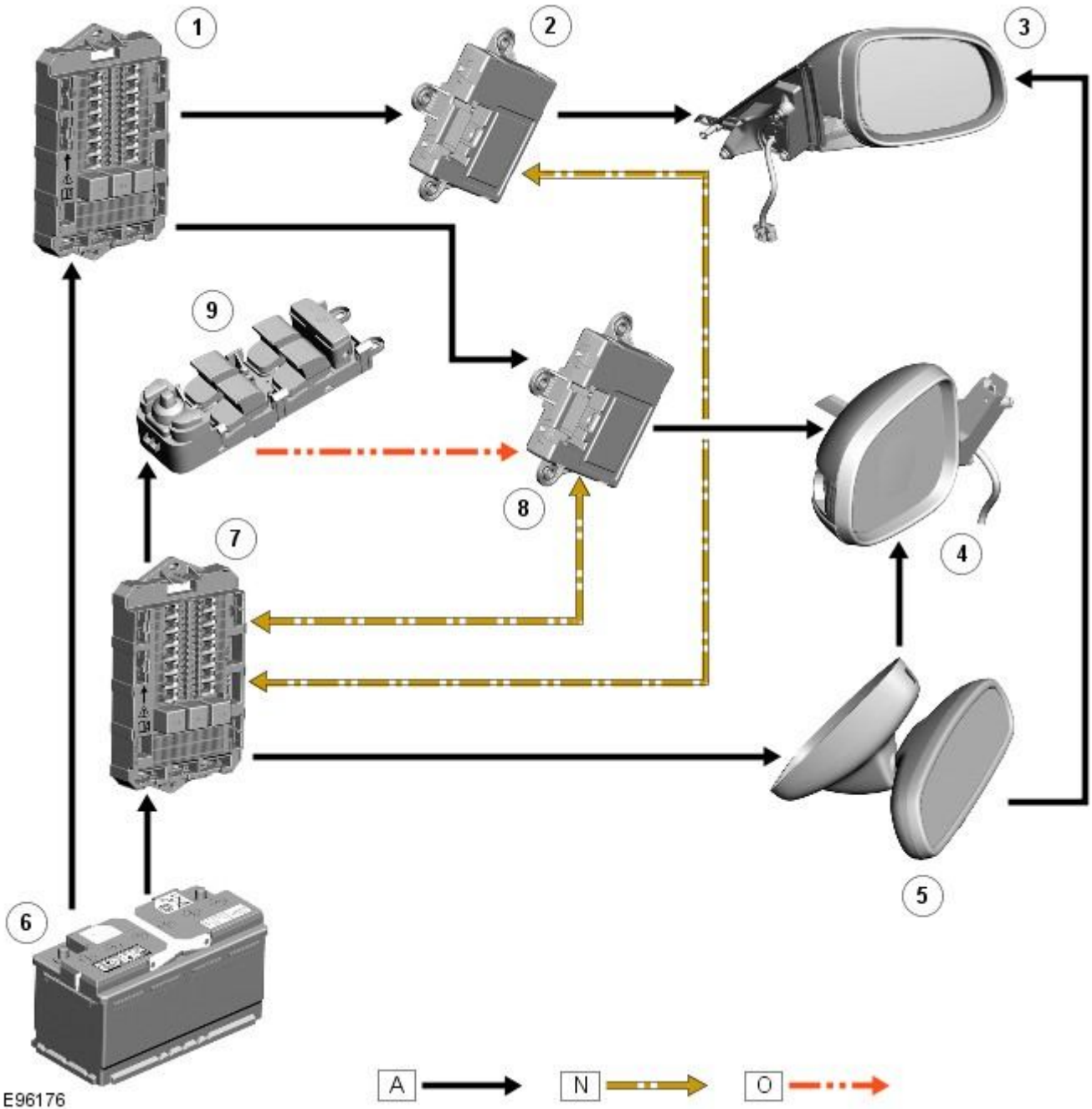
Refer to: Blind Spot Monitoring System (413-09, Description and Operation).

# Rear View Mirrors - Rear View Mirrors - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: A = Hardwired, N = Medium speed CAN (controller area network) bus, O = LIN (local interconnect network) bus



E96176

### ItemDescription

1	RJB (rear junction box)
2	RH (right-hand) door module
3	RH door mirror
4	LH (left-hand) side door mirror
5	Interior mirror
6	Battery
7	CJB (central junction box)
8	LH door module
9	Exterior mirror control switches

## System Operation

The rear view mirrors comprise an interior mirror mounted to the windshield, and an exterior mirror mounted on each front door cheater. The types of mirrors and associated operating functions installed depend on the specification and trim level of the vehicle.

## Interior Mirrors

The interior rear view mirror is provided as a manual dimming or an electrically operated automatic dimming type.

The manual dimming mirror comprises a prismatic glass housed within a surrounding case that is attached with a ball joint connector to the mirror stem. Manual dimming of the mirror is achieved using the lever mounted on the underside of the mirror body. Operating the lever will tilt the mirror head from the 'day' position to the 'night' position.

The automatic dimming mirror comprises an electro-chromatic glass housed within a surrounding case that is attached with a ball joint connector to the mirror stem. The mirror stem incorporates an 8-pin electrical connector that is connected to the roof panel wiring harness. The wiring harness provides hardwired and a [LIN](#) connection to the [CJB](#).

Light sensors are mounted on the front and rear of the mirror surround case. The sensors control the automatic dimming feature to reduce glare from the headlights of following vehicles.

The automatic dimming function is permanently active when the ignition is in power mode 4 (Accessory) and power mode 6 (Ignition). The forward facing light sensor monitors the ambient light level at the front of the vehicle; the rearward facing light sensor monitors the light level coming from the rear of the vehicle. When light from the rear of the vehicle exceeds the ambient light level from the front of the vehicle, the automatic dimming circuit darkens the interior mirror surface.

Automatic dimming is inhibited when reverse gear is selected to provide the driver with maximum vision. On vehicles with automatic transmission, the reverse gear signal is provided by the [TCM \(transmission control module\)](#) via the high speed [CAN](#) bus to the [CJB](#). The [CJB](#) then provides a power feed to the mirror. On vehicles with manual transmission, the reverse gear signal is provided by a transmission switch that is hardwired to the [CJB](#).

## Exterior Mirrors

Electrically operated and heated exterior mirrors are installed as standard. Depending on the specification and trim level of the vehicle, the following options are available:

- Power fold (switch pack operated feature) and auto fold (remote handset operated feature)
- Memory recall
- Reverse gear mirror dip
- Mirror heating
- Exterior mirror lamps.

The power fold/auto fold feature is available only when power fold mirrors are installed to the vehicle.

The mirrors can be configured to automatically fold when the vehicle is locked and unfold when unlocked. This feature can be enabled or disabled via the Vehicle settings area of the touch screen:

- Select 'Vehicle' from the touch screen Home menu.
- The Security menu is displayed as the default. Scroll down through the menu until the desired Mirror fold back is displayed.
- Select 'On' or 'Off' as appropriate.

The auto fold and reverse gear mirror dip functions are not customer configurable, but may be enabled or disabled by the dealer using the Jaguar approved diagnostic system. The diagnostic system enables or disables either or both functions by setting the [EEPROM \(electrically erasable programmable read only memory\)](#) contained within the instrument cluster.

The [LH](#) door mirror incorporates an ambient air temperature sensor that is hardwired to the [ECM \(engine control module\)](#). The [ECM](#) is connected to the [CJB](#) and other control modules via the high speed [CAN](#) bus. The sensor provides information to the [ECM](#) that is then transmitted on the medium speed [CAN](#) bus for use by other control modules. On vehicles installed with a high-line instrument cluster, the [CJB](#) transmits the temperature signal to the instrument cluster that provides a display of the ambient temperature to the driver.

The exterior mirror lamps are controlled by the interior lighting function.

The door mirrors are controlled using a switch pack located on the driver's door. The switch pack contains 2 non-latching mirror select switches labeled 'L' and 'R' and a 4-way directional joystick. The switch pack is connected to the driver door control module via the [LIN](#) bus. The driver and front passenger door control modules are connected via the medium speed [CAN](#) bus. A hardwired connection between each door control module and the corresponding door mirror, provides the supply and ground paths for the mirror motors.

Each exterior door mirror incorporates 2 motors to control horizontal (left/right) and vertical (up/down) adjustments.

On vehicles installed with a driver's power operated memory seat and memory exterior mirrors, a potentiometer is incorporated within each mirror motor and is used to provide information regarding the actual motor positions. The current position and memory positions of each door mirror motor are maintained and stored within the corresponding door control module.

The memory exterior mirror positions are also monitored and stored within door control module memory when the reverse gear mirror dip function is used.

When reverse gear is selected, the door control modules store the current mirror positions and will then dip both the driver and passenger mirror glass to a default dip position. While reverse gear is selected it is possible to store a preferred dipped mirror position by adjusting the driver/passenger mirror glass to the desired position via the mirror switch pack. When the desired position is achieved using the switches, the new dip positions will be automatically stored by the door control modules when reverse gear is de-selected. Therefore when reverse gear is re-selected, the dip position recalled by the door control modules will be the new reverse gear mirror dip stored position. When reverse gear is deselected the mirror glass will automatically move to the previous stored position prior to reverse gear selection.

Reverse gear mirror dip is only available when memory mirrors are installed, and reverse gear mirror dip is enabled within the instrument cluster.

If the driver selects a memory recall function using the memory seat switch pack, the driver's memory seat and exterior memory mirrors are moved to a stored memory position.

Exterior mirrors with the power fold/auto fold feature incorporate a motor located in the hinge of each exterior mirror arm. Operation of the power fold feature is achieved using the exterior mirror switch pack. Operation of the auto fold feature is achieved using the remote handset.

The power fold function is active when the ignition is in power mode 6 (Ignition).

Both exterior mirrors will power fold when the mirror switch pack 'L' and 'R' switches are pressed together. Pressing the switches again will unfold the mirrors.

When the instrument cluster is configured for the auto fold feature, the mirrors will fold in when the remote handset lock button is pressed. The mirrors will unfold when the vehicle is unlocked using the remote handset unlock button.

• **NOTE:** If the mirrors are folded in using the mirror switch pack (power fold) and the vehicle is then locked, subsequent unlocking of the vehicle will not unfold the mirrors.

When the remote handset unlock button is operated, the [CJB](#) recognizes the remote handset for that vehicle and acknowledges the request. The door control modules are connected directly to the [AJB \(auxiliary junction box\)](#) for power supply to the exterior mirror folding motors.

When the vehicle is locked the door control modules reverse the polarity of the mirror fold motor, power and ground connections to operate the mirrors in the opposite direction.

Exterior mirror heating is provided with heater elements bonded to the back of the mirror glass. Power supply for the mirror heating elements is provided by the corresponding driver or passenger door control module via the [RJB](#). The door control modules receive a power supply from the [RJB](#), and are both connected on the medium speed [CAN](#) bus to the [ATC \(automatic temperature control\)](#) module. A ground terminal from each door control module completes the circuit. The [ATC](#) module automatically controls the mirror heating function whenever the ignition is in power mode 4 (Accessory) and power mode 6 (Ignition).

Operation of the exterior mirror heaters is fully automatic and not controllable by the driver. Exterior mirror heater operation is determined by ambient air temperature and windshield wiper status. When ambient air temperature reaches a pre-determined level, the [ATC](#) module broadcasts an exterior mirror heating request to the door modules over the medium speed [CAN](#) bus. On receipt of this message, the door modules provide feed and ground connections to both exterior mirror heater elements.

The mirror heating is controlled in two phases, the initial heating phase and a second [PWM \(pulse width modulation\)](#) controlled phase. In the first phase the heater elements in the mirrors are permanently powered for a pre-determined length of time. This length of time varies with the ambient temperature. During the second [PWM](#) phase, the heater elements are turned on and off every 30 seconds. The amount of time the exterior mirror heaters are operational increases if the windshield wipers are switched on. This ensures the mirrors remain mist free in damp and wet conditions, where there is an increased risk of misting.

# Rear View Mirrors - Rear View Mirrors

Diagnosis and Testing

## Principles of Operation

For a detailed description of the rear view mirrors and systems, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (501-09 Rear View Mirrors)

[Rear View Mirrors](#) (Description and Operation),  
[Rear View Mirrors](#) (Description and Operation),  
[Rear View Mirrors](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Exterior rear view mirror glass</li> </ul>	<ul style="list-style-type: none"> <li>● Fuse(s)</li> <li>● Relay(s)</li> <li>● Wiring Harness</li> <li>● Electrical connector(s)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• **NOTE:** If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• **NOTE:** Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• **NOTE:** When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• **NOTE:** Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• **NOTE:** If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

• **NOTE:** When carrying out repair/diagnosis of the system, on removal of the front or rear bumper inspect the sensor connectors to ensure they were correctly latched and check fly leads for signs of chaffing or trapped wires.

DTC	Description	Possible Cause	Action
B116311	Left Mirror Heater Output	<ul style="list-style-type: none"> <li>● Left mirror heater control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test left mirror heater control circuit for short to ground
B116315	Left Mirror Heater Output	<ul style="list-style-type: none"> <li>● Left mirror heater control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test left mirror heater control circuit for short to power, open circuit
B116411	Right Mirror Heater Output	<ul style="list-style-type: none"> <li>● Right mirror heater control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test right mirror heater control circuit for short to ground
B116415	Right Mirror Heater Output	<ul style="list-style-type: none"> <li>● Right mirror heater control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test right mirror heater control circuit for short to power, open circuit



DTC	Description	Possible Cause	Action
B11F711	Passenger Folding Mirror Motor	<ul style="list-style-type: none"> <li>Passenger folding mirror motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check passenger folding mirror motor control circuit for short to ground
B11F715	Passenger Folding Mirror Motor	<ul style="list-style-type: none"> <li>Passenger folding mirror motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check passenger folding mirror motor control circuit for short to power, open circuit
B1C0911	Driver Left/Right Mirror Motor Circuit	<ul style="list-style-type: none"> <li>Driver left/right mirror motor control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver left/right mirror motor control circuit for short to ground
B1C0915	Driver Left/Right Mirror Motor Circuit	<ul style="list-style-type: none"> <li>Driver left/right mirror motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver left/right mirror motor control circuit for short to power, open circuit
B1C1011	Driver Up/Down Mirror Motor Circuit	<ul style="list-style-type: none"> <li>Driver up/down mirror motor control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver up/down mirror motor control circuit for short to ground
B1C1015	Driver Up/Down Mirror Motor Circuit	<ul style="list-style-type: none"> <li>Driver up/down mirror motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver up/down mirror motor control circuit for short to power, open circuit
B1C1111	Passenger Left/Right Mirror Motor Circuit	<ul style="list-style-type: none"> <li>Passenger left/right mirror motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger left/right mirror motor control circuit for short to ground
B1C1115	Passenger Left/Right Mirror Motor Circuit	<ul style="list-style-type: none"> <li>Passenger left/right mirror motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test passenger left/right mirror motor control circuit for short to power, open circuit
B1C1211	Passenger Up/Down Mirror Motor Circuit	<ul style="list-style-type: none"> <li>Passenger up/down mirror motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger up/down mirror motor control circuit for short to ground
B1C1215	Passenger Up/Down Mirror Motor Circuit	<ul style="list-style-type: none"> <li>Passenger up/down mirror motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test passenger up/down mirror motor control circuit for short to power, open circuit
B1C1311	Driver Up/Down Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> <li>Driver up/down mirror motor feedback circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test driver up/down mirror motor feedback circuit for short to ground
B1C1315	Driver Up/Down Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> <li>Driver up/down mirror motor feedback circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver up/down mirror motor feedback circuit for short to power, open circuit
B1C1411	Driver Left/Right Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> <li>Driver left/right mirror motor feedback circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test driver left/right mirror motor feedback circuit for short to ground
B1C1415	Driver Left/Right Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> <li>Driver left/right mirror motor feedback circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver left/right mirror motor feedback circuit for short to power, open circuit
B1C1511	Passenger Up/Down Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> <li>Passenger up/down mirror motor feedback circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger up/down mirror motor feedback circuit for short to ground
B1C1515	Passenger Up/Down Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> <li>Passenger up/down mirror motor feedback circuit - short to power, open circuit</li> </ul>	Refer to the electrical circuit diagrams and test passenger up/down mirror motor feedback circuit for short to power, open circuit
B1C1611	Passenger Left/Right Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> <li>Passenger left/right mirror motor feedback circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger left/right mirror motor feedback circuit for short to ground
B1C1615	Passenger Left/Right Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> <li>Passenger left/right mirror motor feedback circuit - short to power, open circuit</li> </ul>	Refer to the electrical circuit diagrams and test passenger left/right mirror motor feedback circuit for short to power, open circuit

## Rear View Mirrors - Exterior Mirror

Removal and Installation

### Removal

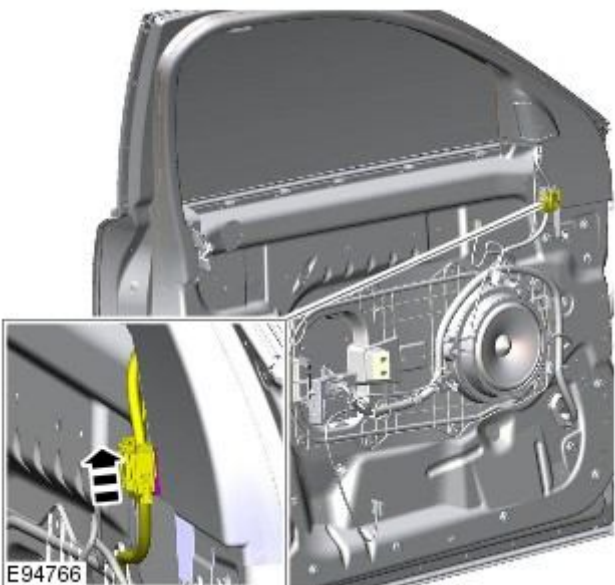
1. **1.** NOTE: Left-hand shown, right-hand similar.



E94765

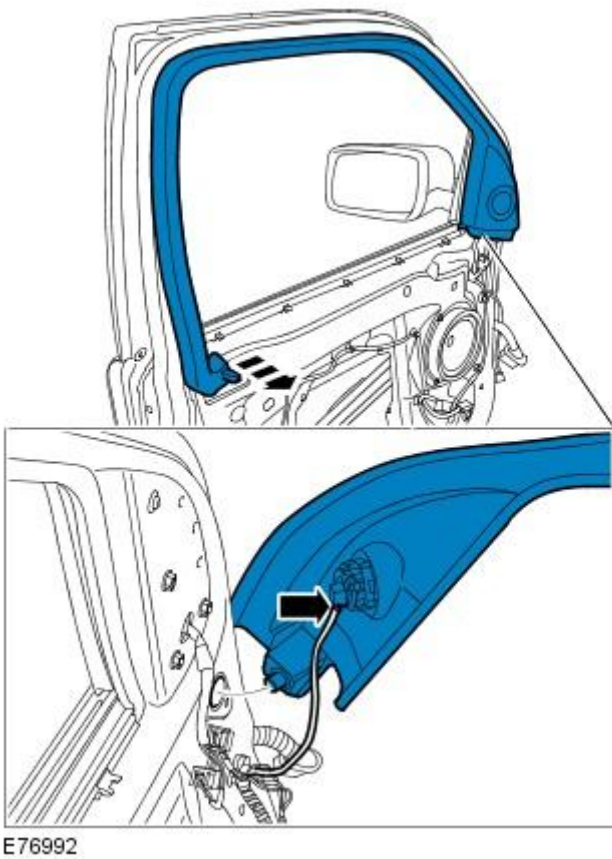
2. Refer to: Front Door Trim Panel (501-05, Removal and Installation).

3. **3.** NOTE: Left-hand shown, right-hand similar.



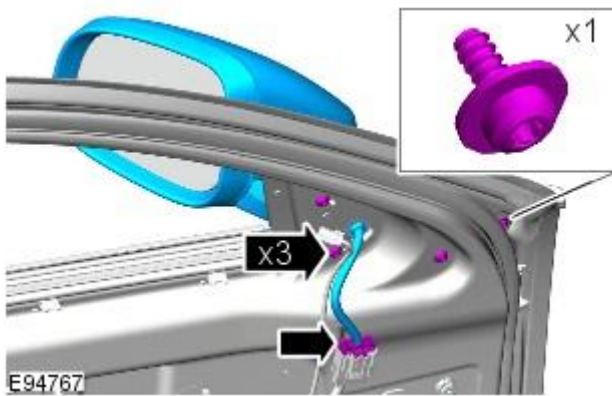
E94766

4. **4.** NOTE: Left-hand shown, right-hand similar.



0

5. **5.** NOTE: Left-hand shown, right-hand similar.



## Installation

1. To install, reverse the removal procedure.

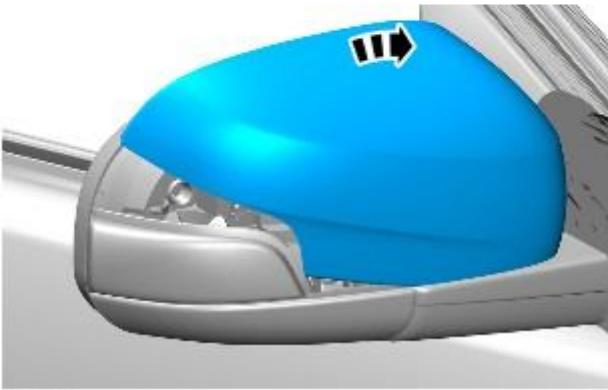
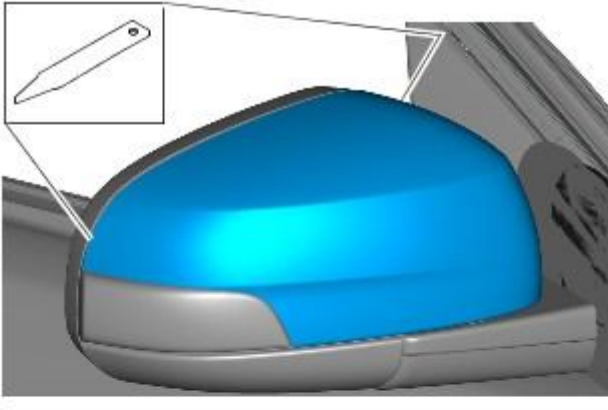
## Rear View Mirrors - Exterior Mirror Cover

Removal and Installation

### Removal

1. Refer to: [Exterior Mirror Glass](#) (501-09 Rear View Mirrors, Removal and Installation).

2. **NOTE:** Note the fitted position of the locating pegs.



E99882

### Installation

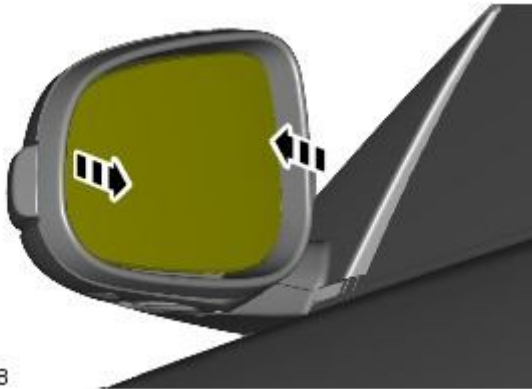
1. To install, reverse the removal procedure.

## Rear View Mirrors - Exterior Mirror Glass

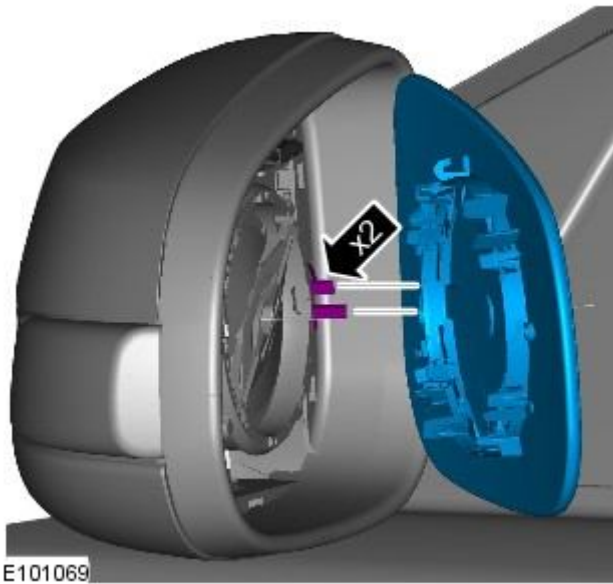
Removal and Installation

### Removal

1.



2.



### Installation

1. **NOTE:** Note the fitted position of the locating pegs.  
To install, reverse the removal procedure.

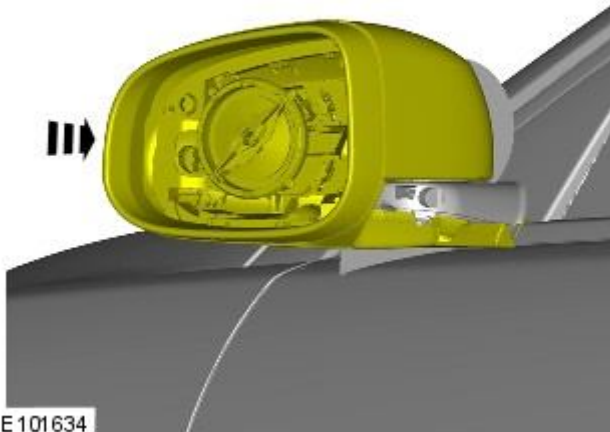
## Rear View Mirrors - Exterior Mirror Motor

Removal and Installation

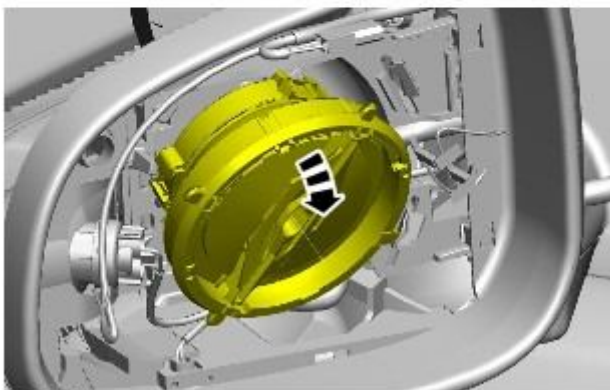
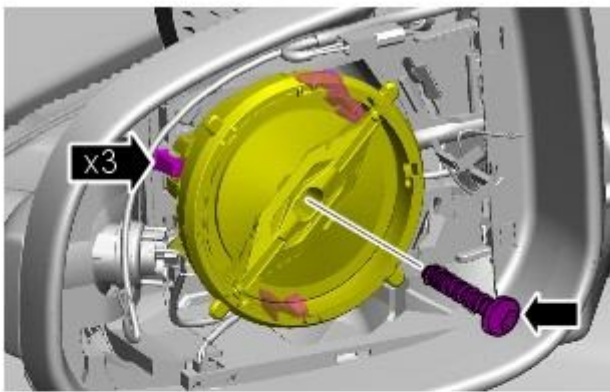
### Removal

1. Refer to: [Exterior Mirror Glass](#) (501-09 Rear View Mirrors, Removal and Installation).

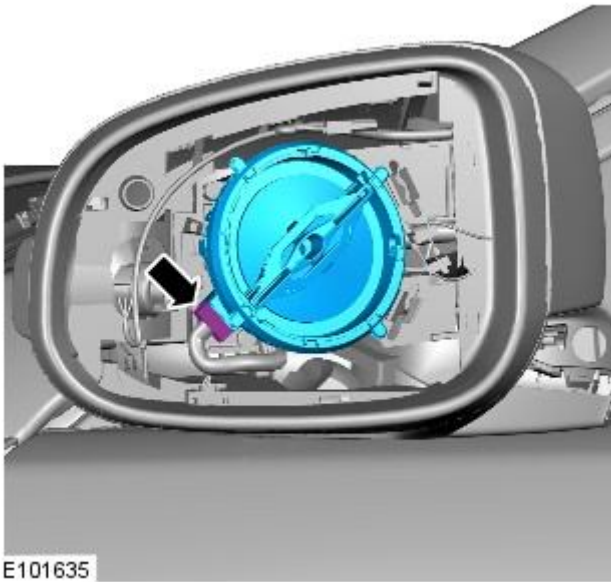
2.



3.







4. **NOTE:** Note the fitted position of the locating pegs.

## Installation

1. To install, reverse the removal procedure.

## Rear View Mirrors - Interior Rear View Mirror

Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.

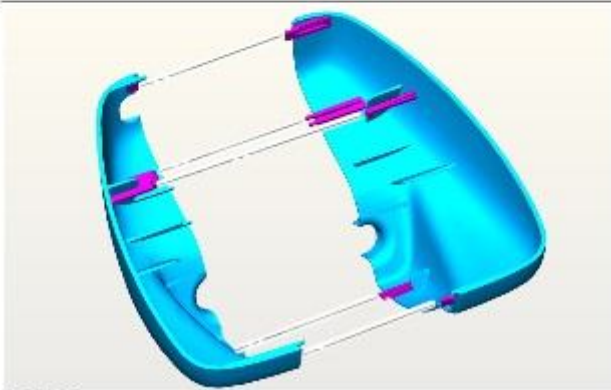
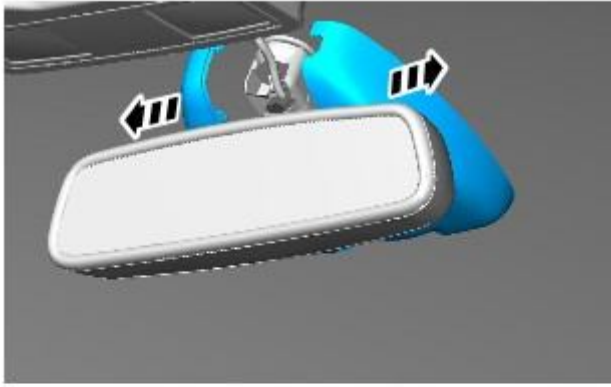
1. 1. CAUTIONS:



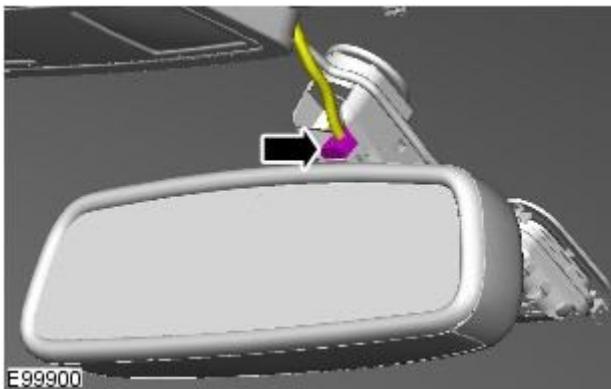
Take extra care not to damage the clips.



Protect the surrounding trim to avoid damage.

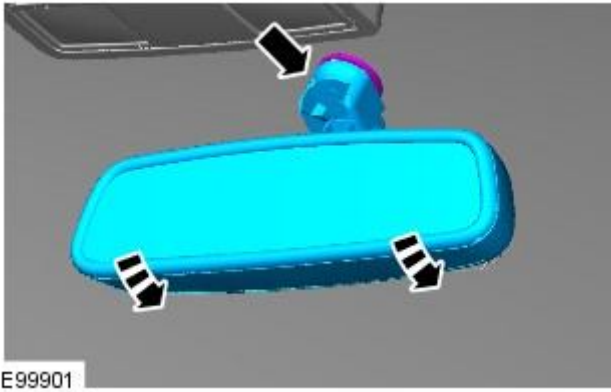


E99899



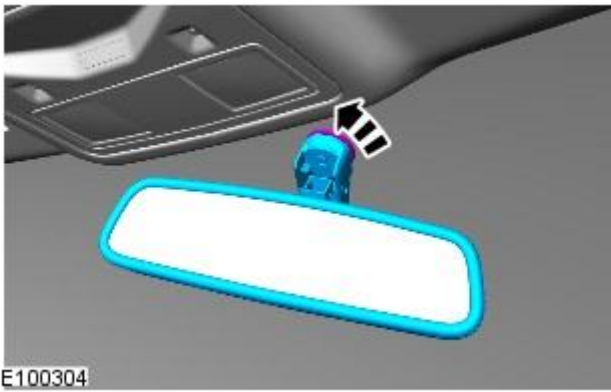
E99900

2.



3.

## Installation



1. To install, reverse the removal procedure.

## Seating -

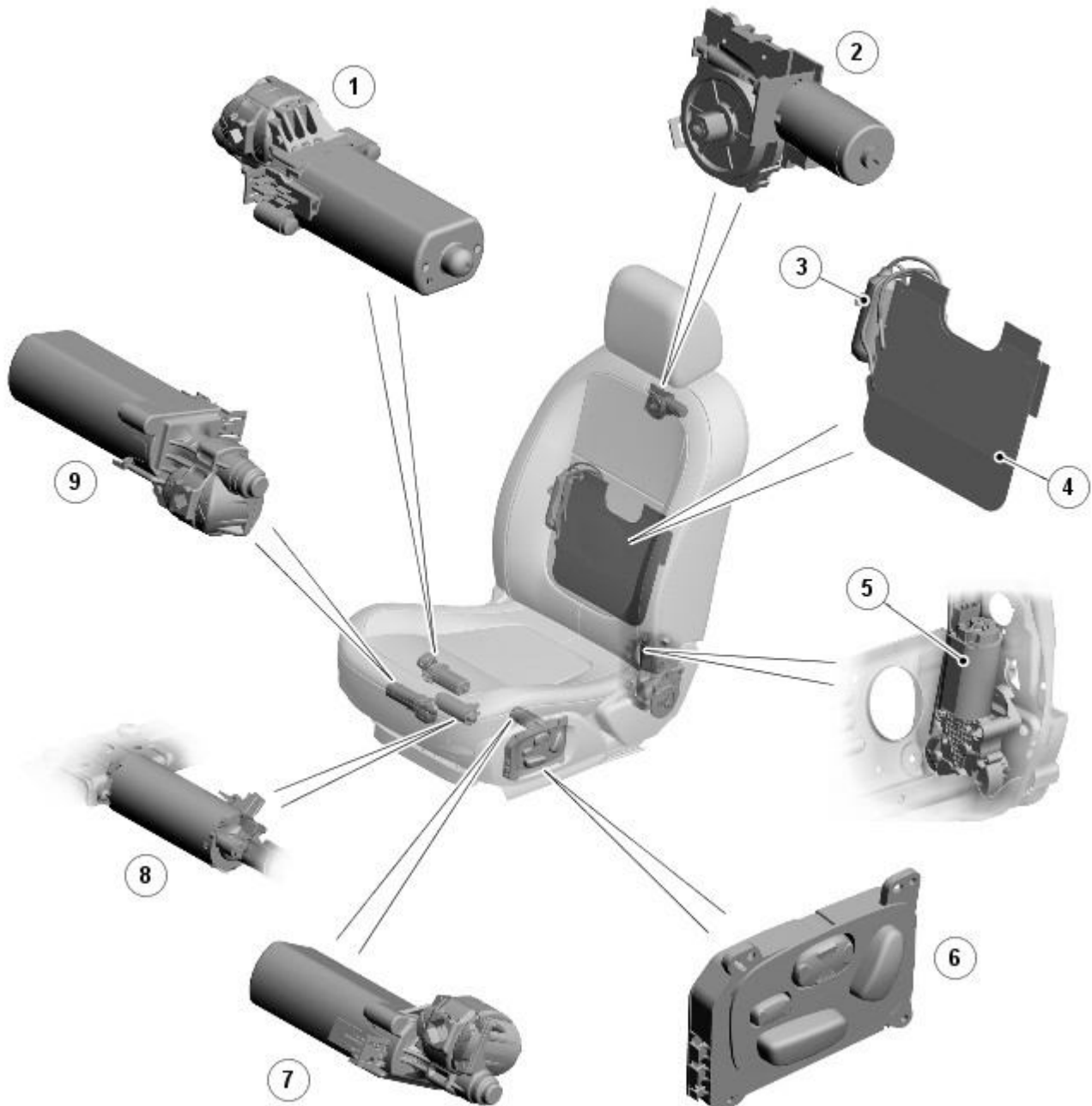
### Torque Specifications

Description	Nm	lb-ft	lb-in
Front seat backrest retaining bolts	35	26	-
Front seat safety belt anchor retaining bolts	40	30	-
Front seat retaining bolts	47	35	-
Front safety belt buckle retaining bolt	40	30	-
Rear seat backrest retaining bolts	17	13	-
Side air bag module retaining nuts	7	-	62

## Seating - Seats - Component Location

Description and Operation

COMPONENT LOCATION - MOVEMENT



E94653

### ItemDescription

Note: 16-way LH (left-hand) driver's seat shown.

1	Seat height motor
2	Head restraint motor
3	Lumbar support motor
4	Lumbar support air cells
5	Seat squab recline motor
6	Seat switch pack
7	Seat slide motor
8	Seat cushion tilt motor
9	Seat cushion extension motor

COMPONENT LOCATION - TEMPERATURE - HEATED SEATS - SHEET 1 OF 2



E95062

**ItemDescription**

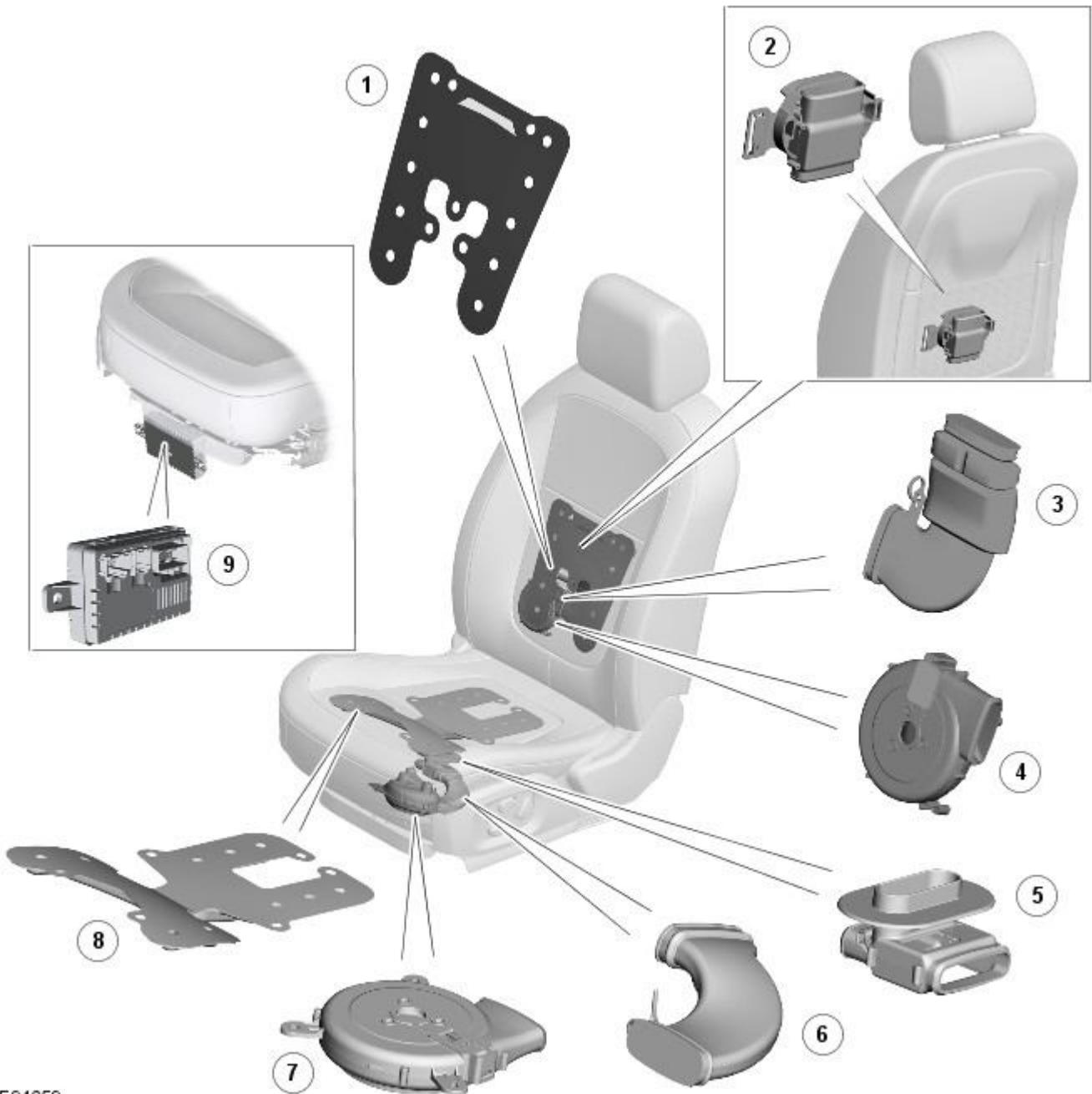
Note: Heated front seat shown

1 Squab heater element

2 Cushion heater element

COMPONENT LOCATION - TEMPERATURE - CLIMATE SEATS - SHEET 2 OF 2





E94659

**ItemDescription**

Note: Heated and cooled front seat shown

1	Squab liner
2	Squab climate module
3	Squab inlet duct
4	Squab blower
5	Cushion climate module
6	Cushion inlet duct
7	Cushion blower
8	Cushion liner
9	Front seat climate control module

## Seating - Seats - Overview

Description and Operation

### OVERVIEW

A number of front seating options are available. An 8-way electrically adjustable driver's seat is complemented by an 8-way electrically adjustable passenger seat. A 10-way electrically adjustable driver's seat is complemented by an 10-way electrically adjustable front passenger seat. A 16-way electrically adjustable driver's seat is complemented by a 12-way electrically adjustable front passenger seat.

On non-memory seats, the operation of the seats is controlled directly from the driver's seat switchpack. On memory seats, the operation of the seat motors is controlled by a seat control module which is located on the underside of the driver's seat frame.

The driver's seat is fitted with a seat position sensor which is located on the seat rail. The sensor is used by the [RCM \(restraints control module\)](#) to determine the seat position and adjust the inflation time of the airbag deployment accordingly.

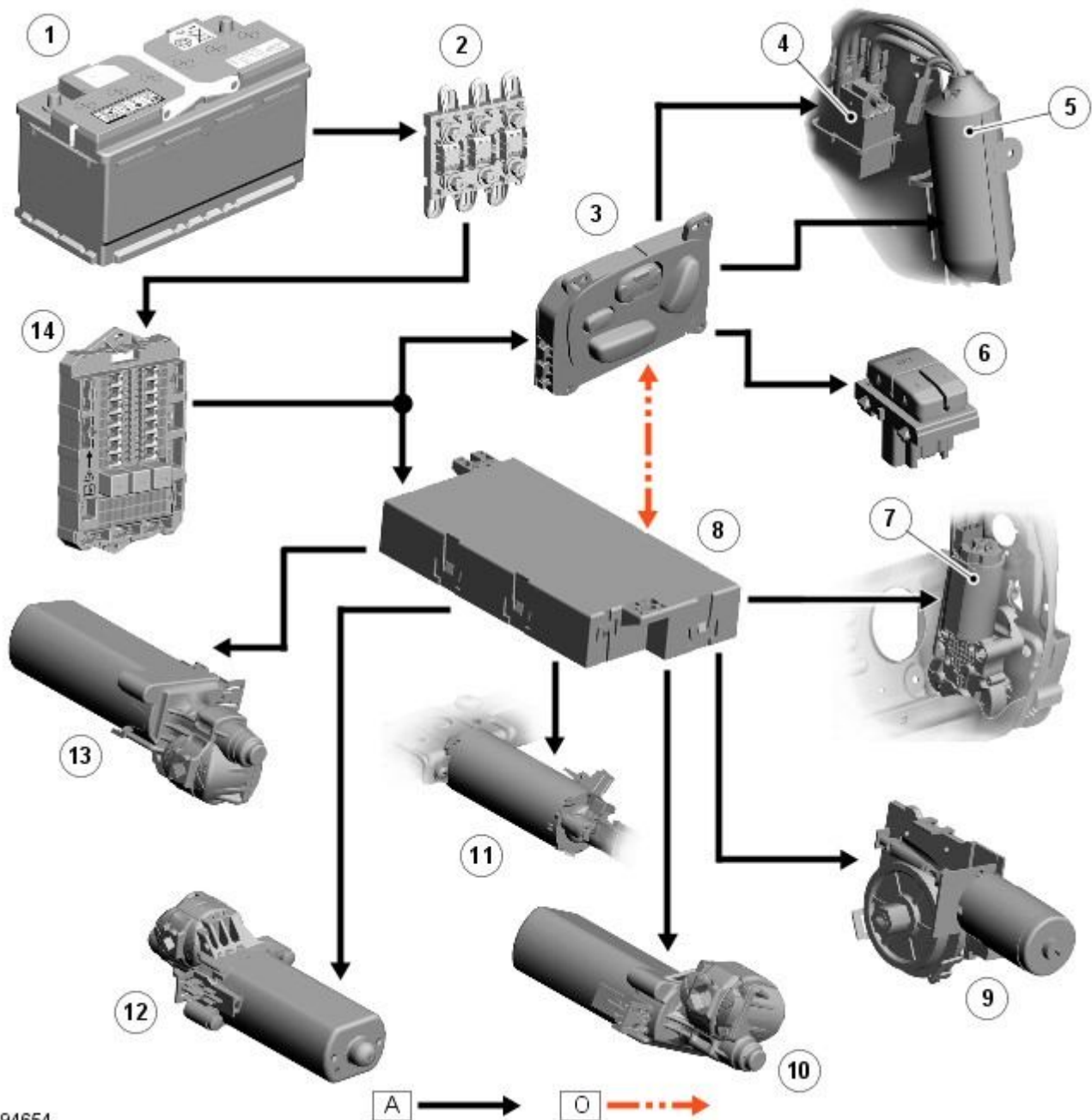
Refer to: [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) (501-20B Supplemental Restraint System, Description and Operation).

# Seating - Seats - System Operation and Component Description

Description and Operation

## Control Diagram

CONTROL DIAGRAM - MOVEMENT - MEMORY SEATS



E94654

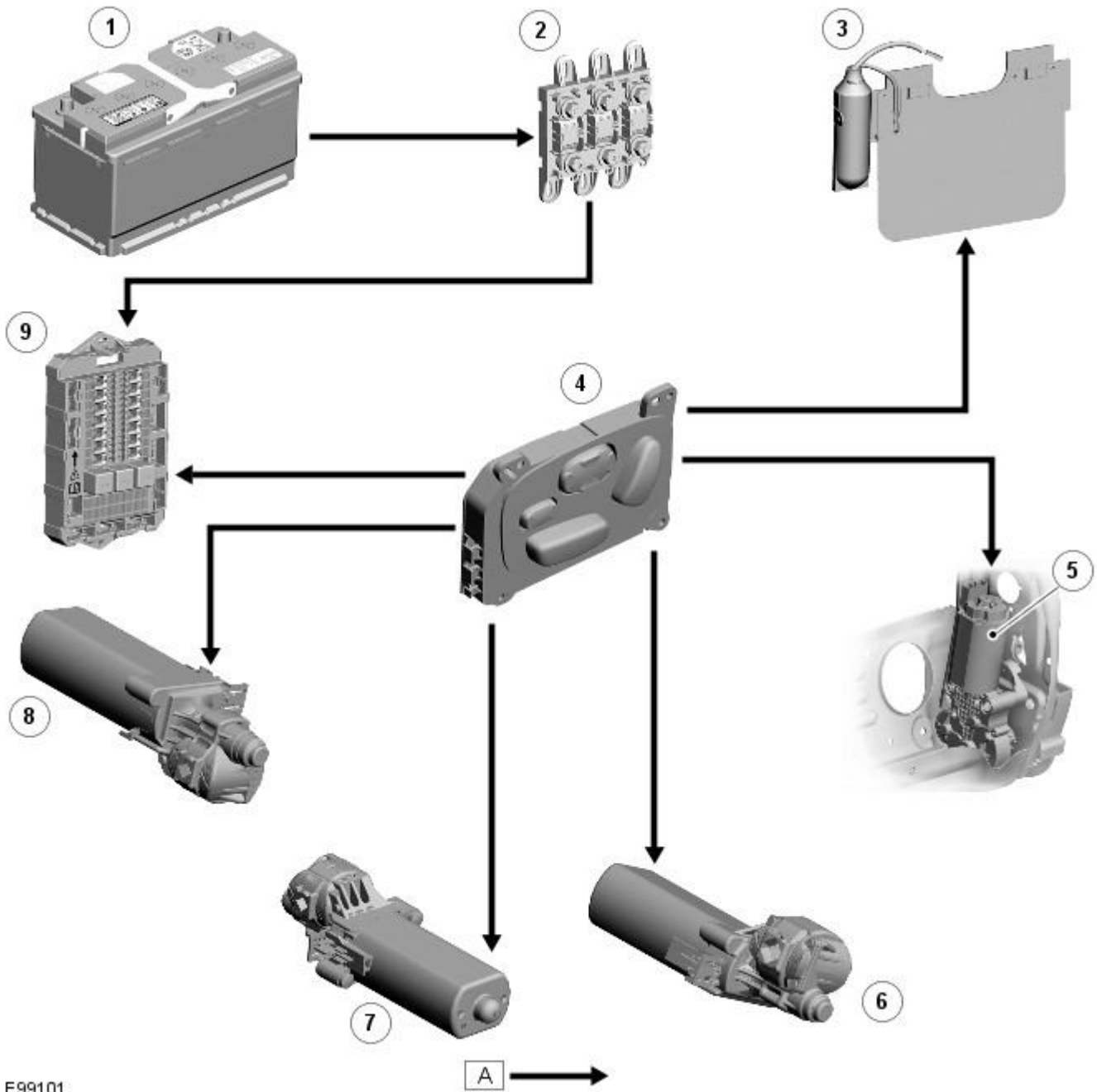
### ItemDescription

Note: **A** = Hardwired; **O** = LIN (local interconnect network)

1	Battery
2	BJB (battery junction box)
3	Seat switch pack
4	Lumbar support solenoids
5	Lumbar support motor
6	Seat memory switches
7	Squab recline motor
8	Driver's seat module
9	Head restraint motor
10	Cushion tilt motor
11	Cushion extension motor

- 12 Seat slide motor
- 13 Seat height motor
- 14 [CJB \(central junction box\)](#)

CONTROL DIAGRAM - MOVEMENT - NON-MEMORY SEATS



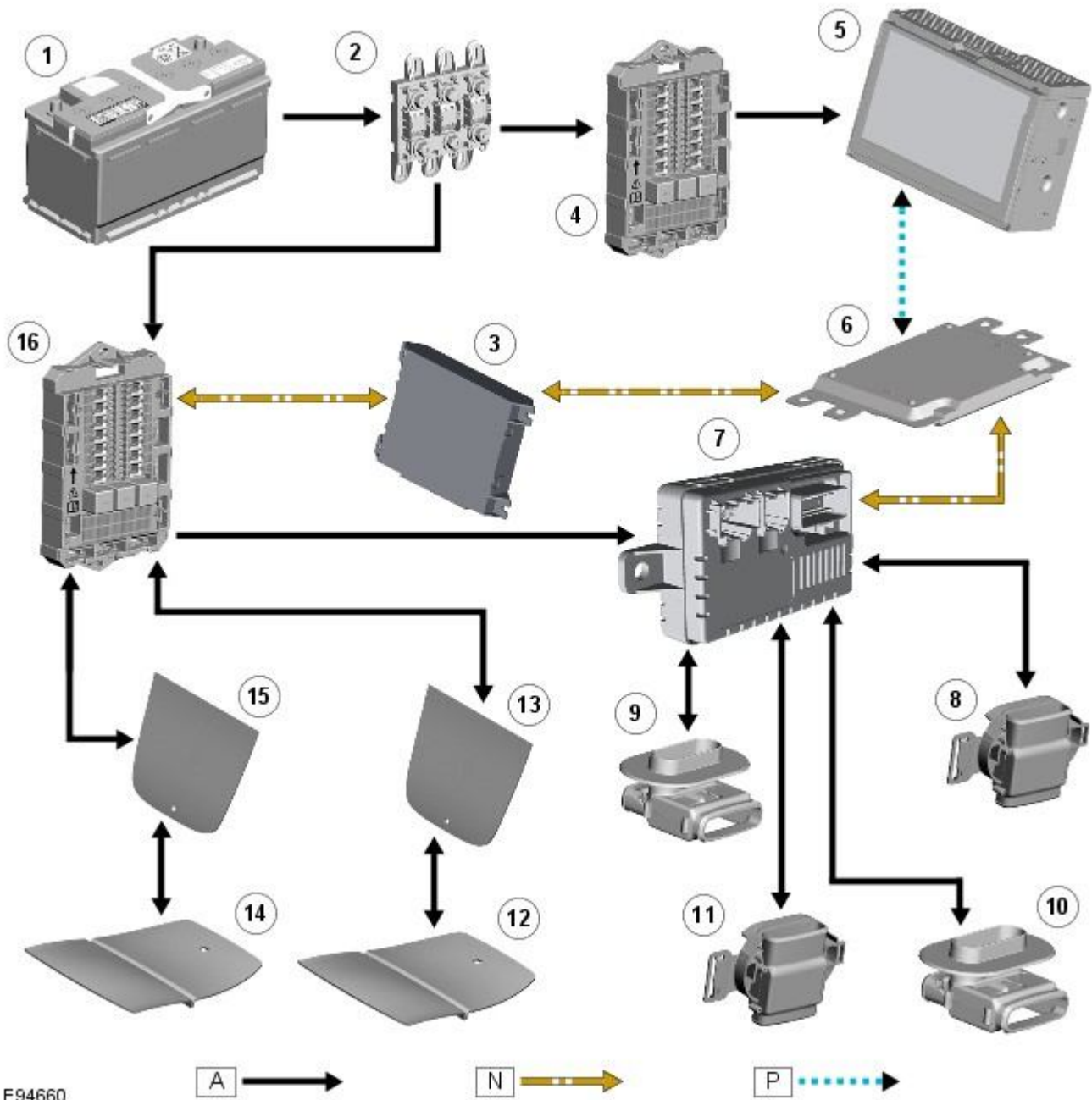
E99101

**ItemDescription**

Note: A = Hardwired

1	Battery
2	<a href="#">BJB</a>
3	2-way Lumbar support
4	Seat switch pack
5	Squab recline motor
6	Cushion tilt motor
7	Seat slide motor
8	Seat height motor
9	<a href="#">CJB</a>

CONTROL DIAGRAM - TEMPERATURE



E94660

A

N

P

**ItemDescription**

Note: **A** = Hardwired; **N** = Medium speed CAN (controller area network) bus; **P** = MOST ring

1	Battery
2	<a href="#">BJB</a>
3	<a href="#">ATC (automatic temperature control)</a> module
4	<a href="#">RJB (rear junction box)</a>
5	Touch Screen Display (TSD)
6	Information and Entertainment module
7	Front seat climate control module
8	Passenger seat squab climate module
9	Drivers seat cushion climate module
10	Passenger seat cushion climate module
11	Drivers seat squab climate module
12	Passenger seat cushion heater element
13	Passenger seat squab heater element
14	Drivers seat cushion heater element
15	Drivers seat squab heater element
16	<a href="#">CJB</a>

# System Operation

## HEATED SEATS - OPERATION

### Heated Front Seats

The TSD receives a fused power supply from the [RJB](#). One of the 3 seat heat temperature selections made by the driver or passenger using the TSD soft keys are passed from the TSD on the MOST ring to the Information and Entertainment module. The information and entertainment module processes the information and transmits the request on the medium speed [CAN](#) bus to the [ATC](#) module.

The cushion heaters have a thermal sensor which supplies a feed back signal back to the [CJB](#). The squab heater elements do not have a thermal sensor and are maintained at the same temperature as the seat cushion elements.

The [ATC](#) module reacts to the driver request information received from the information and entertainment module and requests the [CJB](#) to activate the seat heaters. The [CJB](#) measures the returned temperature signals from the thermal sensors and relays the temperature signals back to the [ATC](#) module. The [ATC](#) module then uses the measured seat element temperatures to provide closed-loop control of the heater elements to maintain the temperature at one the 3 heat ranges selected.

- **NOTE:** To prevent excessive battery discharge, the heated front seats will only operate when the engine is running.

### Heated and Cooled Front Seats

The TSD receives a fused power supply from the [RJB](#). Selections made by the driver using the TSD soft keys are passed from the TSD on the MOST ring to the Information and Entertainment module. The information and entertainment module processes the information and transmits the request on the medium speed [CAN](#) bus to the front seat climate control module. The front seat climate control module is located beneath the **RH (right-hand)** front seat, on the floor cross member.

The front seat climate control module receives its power supplies from the [CJB](#). Heating and cooling requests are generated using the soft buttons on the TSD. These requests are transmitted to the information and entertainment module over the MOST ring. The Information and Entertainment module forwards these requests to the front seat climate control module over the medium speed [CAN](#) bus.

The front seat climate control module supplies power to the two climate modules in each seat. The temperature sensor in each climate module is monitored by the front seat climate control module which uses the temperature information to control the Peltier cells accordingly and also the blower fans to distribute the heated or cooled air.

- **NOTE:** To prevent excessive battery discharge, the heated and cooled front seats will only operate when the engine is running.

### Electric Driver's Seat Adjustment - Non-Memory Seats

The [CJB](#) supplies 3 power supplies to the driver's seat switchpack. The fused supplies provide power for the seat height and squab recline, the seat slide and seat tilt and the lumbar adjustment respectively. The [CJB](#) only provides the power to the driver's seat switch pack when the ignition is on (power mode 6).

For the seat movement motors, when the applicable switch is operated, the power is supplied to the applicable side of the motor and the ground path is completed to operate the motor in the required direction. To move the motor in the opposite direction the polarity is reversed.

For the lumbar adjustment, when the switch is operated in the inflate position, power is supplied to the pump motor to inflate the lumbar support. When the switch is operated in the opposite direction, the power energizes a solenoid which in turn opens a valve to deflate the lumbar support.

### Electric Passenger Seat Adjustment ( 8, 10 and 12 way)

The [CJB](#) supplies 3 power supplies to the passenger seat switchpack. The fused supplies provide power for the seat height and squab recline, the seat slide and seat tilt and the head restraint and lumbar adjustment respectively. The [CJB](#) only provides the power to the passenger seat switch pack when the ignition is on (power mode 6).

For the seat movement and head restraint motors, when the applicable switch is operated, the power is supplied to the applicable side of the motor and the ground path is completed to operate the motor in the required direction. To move the motor in the opposite direction the polarity is reversed.

For the lumbar adjustment, when the switch is operated in the inflate position, power is supplied to the pump motor to inflate the lumbar support. When the switch is operated in the opposite direction, the power energizes a solenoid which in turn opens a valve to deflate the lumbar support.

### Electric Driver's Seat Adjustment - Memory Seats (10 and 16 way)

The [CJB](#) supplies 3 power supplies to the driver's seat module and one supply to the driver's seat switch pack. The fused supplies provide power for the movement motors in addition to the driver's seat switch pack. Power is only supplied to the driver's seat module and the driver's seat switch pack when the ignition is on (power mode 6).

The driver's seat switch pack is connected to the driver's seat module by a [LIN](#) bus for the seat movement switches. Any selection for seat movement generates a message which is passed via the [LIN](#) to the driver's seat module. The seat module processes the request and operates the applicable seat function as required using the power supplies from the [CJB](#).

Each seat motor contains a Hall position sensor. The sensor sends a feedback signal to the driver's seat module. The signal is used for memory store and memory recall functions.

The lumbar adjustment switch on the driver's seat switch pack is wired direct to the lumbar pump and solenoids. The switch, when moved to the inflate position for either the upper or lower inflatable cushion cell, provides a power supply to the lumbar pump and simultaneously activates the applicable inflate solenoid valve. When the switch is released the pump



stops and the solenoid valve closes trapping the air in the inflatable cushion. When the switch is moved to the deflate position for either the upper or lower inflatable cushion cell, power is supplied to the applicable deflate solenoid valve which opens to allow the air in the cushion to escape. When the switch is released, the valve is closed and the remaining air in the cushion is retained.

## Component Description

### FRONT SEATS - DESCRIPTION

The table below highlights the features available for each seating option.

Seat Type	Non-Heated	Heated	Heated and Cooled	Lumbar Support	Memory
8-way	Yes	Optional	No	2-way	No
10-way	Yes	Optional	Optional	2-way	Optional (Driver's seat only)
12-way	No	No	Yes	4-way	No
16-way	No	No	Yes	4-way	Yes (Driver's seat only)

#### Seat Heating

The 3-stage heated front seats feature 2 heater elements located in the seat cushion and a single heater element located in the seat squab. Operation of the heated front seats is controlled by the [ATC](#) module via the TSD, information and entertainment control module and the [CJB](#) module on vehicles with heated seats. On vehicles with heated and cooled seats the operation is controlled by the TSD, information and entertainment control module and the front seat climate control module.

The heated and cooled front seats each contain 2 climate modules; one in the cushion, one in the squab. The climate modules contain 'Peltier' cells which are able to deliver heating and cooling based on a voltage provided by the front seat climate control module. Each climate module also contains a fan, which blows air over the Peltier cells to distribute heated or cooled air via liners in the seat cushion and squab. The fan is also controlled by the front seat climate control module. The TSD allows the driver and passenger to select 3 ranges of heated or cooled ventilation; off, minimum and intermediate. Also, using the selections on the TSD, the driver and passenger can select between full seat ventilation or squab backrest ventilation only.

Vehicles fitted with the 3-stage heated front seat option also feature a heated steering wheel. Refer to: [Steering Column Switches](#) (211-05 Steering Column Switches, Description and Operation).

### Electric Seat Adjustment

#### Lumbar Support

On 8, 10 and 12 way seats, a 2 way lumbar support is provided which allows the lumbar inflatable cushion to be inflated or deflated as required. On 16 way seats, a 4 way lumbar support is fitted which comprises two separate cushion cells. The upper and lower cells can be inflated or deflated individually allowing greater comfort adjustment for the driver and passenger.

The lumbar support comprises an inflatable cushion located in the seat squab, a pump and solenoids. The pump is activated when the applicable seat switch is moved to the inflate position, inflating the cell(s) in the inflatable cushion. On 8 and 10 way seats, a single solenoid operated valve allows the inflatable cushion to be deflated. On 12 and 16 way seats, 4 solenoid valves control the inflation and deflation of the upper and lower inflatable cushion cells, allowing each cell to be adjusted individually.

#### Seat Motors

The head restraint motor is located in the upper section of each seat squab and is accessible by removal of the seat back. The motor moves a cradle which is driven in a vertical motion by a rack and pinion arrangement. The cradle has the two head restraint stems attached to it and therefore raises and lowers the head restraint as the motor moves the cradle. The motor contains a Hall sensor which supplies positional information to the driver's seat module.

The seat slide motor is an integral component of the seat frame. The motor drives on a gear on a worm drive lead screw which is integral with the floor rail. The lead screw has a stop at each end to limit the fore and aft seat movement.

The tilt motor is located below the seat. The tilt motor drives a gear on a lead screw to raise the front of the seat cushion. The motor contains a Hall sensor which supplies positional information to the driver's seat module.

The cushion extend motor is located below the seat. The motor drives a gear on a lead screw which extends or retracts the front of the seat cushion. The motor contains a Hall sensor which supplies positional information to the driver's seat module.

The height motor is located below the seat. The height motor drives a gear on a lead screw. The lead screw moves a lever mechanism which raises or lowers the seat cushion. The motor contains a Hall sensor which supplies positional information to the driver's seat module.

The squab recline motor is located in the seat back rest. The recline motor rotates a shaft which is connected the seat squab frame and raises or lowers the back rest position. The motor contains a Hall sensor which supplies positional information to the driver's seat module.

### DRIVER'S SEAT MODULE

A memory store switch is located in the lower part of the driver's door. The switch communicates with the driver's seat module via the [LIN](#) bus in the driver's seat switch pack. The memory store switch has two buttons; 1 and 2 to allow two separate memory positions to be stored and 'set' button with integral [LED \(light emitting diode\)](#). The seat, door mirror and steering column motors have position sensors which provide feedback to driver's seat module.

Once the driver's seat, steering column and exterior mirrors have been adjusted, the vehicle is able to memorize these settings for future use by using the following procedure:

- Push the memory 'SET' button, the [LED](#) in the switch will illuminate
- Press the memory button 1 or 2 to memorize the current settings. The [LED](#) will extinguish, and a chime will sound to confirm that the settings have been memorized. If the ignition is on, power mode 6, the message center will display a confirmation message.

The positions can be recalled by pressing the applicable button 1 or 2.

### **Stall Detection**

Seat, steering column and mirror motors are deemed to have stalled if there is no change in the inputs that are received from the corresponding feedback sensors for 200 ms (seat).

If a stall condition is detected then the drive to that motor is cancelled for the remainder of that memory operation (memory recall) or until the switch is re-selected (manual movement).

If the motor movement has stopped due to loss of sensor feedback, either stall or sensor failure, then that motor may be activated again, to move past the stall position, by re-selecting the appropriate switch and pressing for longer than 2 seconds. This allows control of the motor to be maintained if sensor feedback is lost.

Upon re-selection of movement, if sensor pulses are detected then the motor will continue to be driven until the switch is released or another stall condition is detected. If sensor feedback is not detected then the motor is only driven for 0.5 second and then stops until the switch is released and then pressed again, when a further 0.5 second of activation is permitted, and so on, this is known as inch mode.

For all seat motor manual movements, whenever a motor is driven and a stall occurs, the memory control module records the position at which the stall occurred. If movement occurs beyond a stall position, then that position is erased from the control modules memory. This will always allow movement past a previously recorded stall position once movement has been registered beyond that position. This is the case for both manual and memory movement.

### **Initialization**

When a replacement driver's seat module is fitted, it should be calibrated a Jaguar approved diagnostic system so that the module can learn the seats absolute position.

### **Battery Monitor**

If the battery voltage drops below 10.5 Volts, then the driver's seat module ignores all requests for a memory recall until the battery voltage has reached 11.5 Volts. This will conserve as much power in the vehicle battery as possible to enable engine cranking.

## **REAR SEATS - DESCRIPTION**

The rear seat features a single piece cushion and a 60/40 split squab. Two latches are secured to the rear bulkhead by a pair of M8 bolts to retain the seat squabs in the upright position. The latches can be released to fold down the individual cushions by pulling a cable release located below the rear window parcel shelf in the luggage compartment.

ISOFIX fastening points are attached to the vehicle floor to provide secure fastening for compatible child seats.

A centrally mounted center arm rest can be folded down from the 60% squab. The arm rest contains two drinks holders.

## Seating - Seats

Diagnosis and Testing

### Principle of Operation

For a detailed description of the seats and seat operation, refer to the relevant Description and Operation section in the workshop manual. REFER to: (501-10 Seating)

[Seats](#) (Description and Operation),  
[Seats](#) (Description and Operation),  
[Seats](#) (Description and Operation).

### Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

• **NOTE:** Prior to carrying out any diagnosis, ensure the vehicle battery is in a good serviceable condition, refer to the battery care manual.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of damage and system integrity.

#### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Security, condition and correct installation of seat components and fixings</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses</li> <li>● Harnesses for damage/corrosion</li> <li>● Electrical connectors</li> <li>● Damaged/corroded pins</li> </ul>

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the concern and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

### Symptom Chart

Symptom	Possible Cause	Action
No seat movement from switch pack (including no memory recall)	<ul style="list-style-type: none"> <li>● Seat module has gone into sleep mode</li> <li>● Seat switch pack LIN, power or ground circuit - open circuit</li> <li>● Seat switch pack LIN circuit - short to power, ground</li> </ul>	Set ignition ON. Re-check seat function from switch pack. Check for DTC B1A9887 and refer to DTC Index. Check for DTC B1A9888 and refer to DTC Index
No seat movement or lumbar movement from switch pack (including no memory recall)	<ul style="list-style-type: none"> <li>● <b>NOTE: Seat module does not control the seat lumbar function</b></li> <li>● Seat switch pack power or ground supply circuits - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check seat switch pack power and ground supply circuits for open circuit
Seat movement and lumbar movement from switch pack is ok, however, no recall from memory switch pack	<ul style="list-style-type: none"> <li>● Seat switch pack to memory switch pack circuits - short, open circuit</li> </ul>	<ul style="list-style-type: none"> <li>● <b>NOTE: Memory switch pack is separate switch hardwired to seat adjust switch</b></li> </ul> Refer to the electrical circuit diagrams and check seat switch pack to memory switch pack circuits for short, open circuit
Seat movement and memory recall works correctly however seat lumbar is not working correctly	<ul style="list-style-type: none"> <li>● <b>NOTE: Seat module does not control the seat lumbar function</b></li> <li>● Seat movement switch to lumbar circuits - short, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check seat movement switch to lumbar circuits for short, open circuit

Symptom	Possible Cause	Action
Seat movement from switch pack occurs in delayed inch mode (seat axis moves short distance when switch pressed for longer than 2 seconds and then stops). This behaviour could occur on any seat axis (slide, height, squab, tilt, headrest or cushion) when requested	<ul style="list-style-type: none"> <li>Motor Hall sensor on affected axis is not connected or not receiving expected signals</li> </ul>	Check for DTCs, B1B8731, B1B9131, B1B8931, B1B9331, B106331, B106431. If present then check Hall sensor feedback circuits between seat motor and seat module and also check Hall sensor ground circuits for affected axis. These DTCs are only logged if the axis is attempted to be moved in both directions. When hall sensor connection issue fixed press switch on affected axis for longer than 2 seconds. By keeping the switch pressed the axis movement should now operate for the duration of switch-press. Re-calibrate affected seat
Seat movement from switch pack occurs in inch mode. When seat axis movement is requested from the seat switch pack the requested seat axis moves a short distance then stops (does not include lumbar). This behaviour will occur on ALL seat axis (slide, height, squab, tilt headrest and cushion) when requested. MS CAN communication not possible	<ul style="list-style-type: none"> <li>MS CAN fault</li> </ul>	Carry out CAN network integrity test using manufacturer approved diagnostic system
Seat movement from switch pack occurs in inch mode. When seat axis movement is requested from the seat switch pack the requested seat axis moves a short distance then stops (does not include lumbar). This behaviour will occur on ALL seat axis (slide, height, squab, tilt headrest and cushion) when requested. MS CAN communication not possible	<ul style="list-style-type: none"> <li>Seat module is disconnected from the CAN Bus</li> </ul>	Check for Instrument Cluster DTC U020800 'Lost Communication With Seat Module'. If this DTC is present, refer to the electrical circuit diagrams and check seat module power and ground supplies for short, open circuit. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
Seat movement from switch pack occurs in inch mode. When seat axis movement is requested from the seat switch pack the requested seat axis moves a short distance then stops (does not include lumbar). This behaviour will occur on ALL seat axis (slide, height, squab, tilt headrest and cushion) when requested. MS CAN communication not possible	<ul style="list-style-type: none"> <li>Instrument cluster is disconnected from the CAN Bus</li> </ul>	Check for seat module DTC U015500 'Lost Communication With Instrument Cluster'. If this DTC is present, refer to the electrical circuit diagrams and check instrument cluster power and ground supplies for short, open circuit. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
Seat movement from switch pack occurs in inch mode. When seat axis movement is requested from the seat switch pack the requested seat axis moves a short distance then stops (does not include lumbar). This behaviour will occur on ALL seat axis (slide, height, squab, tilt headrest and cushion) when requested. MS CAN communication not possible	<ul style="list-style-type: none"> <li>Driver Door Module is disconnected from the CAN Bus</li> </ul>	Check for seat module DTC U019900 'Lost Communication With Driver Door Module'. If this DTC is present, refer to the electrical circuit diagrams and check driver door module power and ground supplies for short, open circuit. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
Seat movement from switch pack occurs in inch mode. When seat axis movement is requested from the seat switch pack the requested seat axis moves a short distance then stops (does not include lumbar). This behaviour will occur on ALL seat axis (slide, height, squab, tilt headrest and cushion) when requested. MS CAN communication not possible	<ul style="list-style-type: none"> <li>Rear Junction Box (RJB) is disconnected from the CAN Bus</li> </ul>	Check for seat module DTC U014200 'Lost Communication With RJB'. If this DTC is present, refer to the electrical circuit diagrams and check RJB power and ground supplies for short, open circuit. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
Seat movement from switch pack occurs in inch mode. When seat axis movement is requested from the seat switch pack the requested seat axis moves a short distance then stops (does not include lumbar). This behaviour will occur on ALL seat axis (slide, height, squab, tilt headrest and cushion) when requested. MS CAN communication not possible	<ul style="list-style-type: none"> <li>Central Junction Box (CJB) is disconnected from the CAN Bus</li> </ul>	Refer to the electrical circuit diagrams and check CJB power and ground supplies for short, open circuit. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
<p>• NOTE: Electric passenger seat can always be activated – there is no passenger seat module installed to this vehicle</p> <p>Seat module does not go to sleep. Seat movement is always active from driver seat switch pack</p>	<ul style="list-style-type: none"> <li>Seat module is in manufacturing mode</li> </ul>	<p>• NOTE: A new module is NOT required to be installed, only the module replacement routine needs to be performed. This will set the PID required to disable manufacturing mode</p> <p>Seat module needs to be configured for customer mode. Check for DTC U1A4C68 'Build/End of Line mode Active'. If this DTC is present then configure for customer mode by running 'New Seat Module Replacement' application for the affected seat using the manufacturer approved diagnostic system</p>

Symptom	Possible Cause	Action
Front seat fore/aft movement not functioning	<ul style="list-style-type: none"> <li>Carry out the pinpoint test associated to this Symptom</li> </ul>	GO to Pinpoint Test <a href="#">A.</a>
Front seat excessive fore/aft free play	<ul style="list-style-type: none"> <li>Carry out the pinpoint test associated to this Symptom</li> </ul>	GO to Pinpoint Test <a href="#">B.</a>
Front seat fore/aft movement noisy	<ul style="list-style-type: none"> <li>Carry out the pinpoint test associated to this Symptom</li> </ul>	GO to Pinpoint Test <a href="#">C.</a>
Front seat height, tilt and/or seat extension motor movement not functioning	<ul style="list-style-type: none"> <li>Carry out the pinpoint test associated to this Symptom</li> </ul>	GO to Pinpoint Test <a href="#">D.</a>
Front seat height, tilt and/or extension movement noisy	<ul style="list-style-type: none"> <li>Carry out the pinpoint test associated to this Symptom</li> </ul>	GO to Pinpoint Test <a href="#">E.</a>
Heating And Cooling - Inoperative	<ul style="list-style-type: none"> <li>Carry out the pinpoint test associated to this Symptom</li> </ul>	GO to Pinpoint Test <a href="#">E.</a>
Heating And Cooling - Noisy Operation	<ul style="list-style-type: none"> <li>Carry out the pinpoint test associated to this Symptom</li> </ul>	GO to Pinpoint Test <a href="#">G.</a>
Heating And Cooling - Poor Heat Or Cool Efficiency	<ul style="list-style-type: none"> <li>Carry out the pinpoint test associated to this Symptom</li> </ul>	GO to Pinpoint Test <a href="#">H.</a>
Heating And Cooling - Heat Or Cool Operation Slow	<ul style="list-style-type: none"> <li>Carry out the pinpoint test associated to this Symptom</li> </ul>	GO to Pinpoint Test <a href="#">I.</a>
Heating And Cooling - Intermittent Operation	<ul style="list-style-type: none"> <li>Carry out the pinpoint test associated to this Symptom</li> </ul>	GO to Pinpoint Test <a href="#">J.</a>

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

### Driver Seat Module

DTC	Description	Possible Cause	Action
B105F11	Seat Cushion Extension Motor Output	<ul style="list-style-type: none"> <li>Driver seat cushion extension motor circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat cushion extension motor circuit for short to ground

DTC	Description	Possible Cause	Action
B105F15	Seat Cushion Extension Motor Output	<ul style="list-style-type: none"> <li>Driver seat cushion extension motor circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat cushion extension motor circuit for short to power, open circuit
B106011	Seat Headrest Motor Output	<ul style="list-style-type: none"> <li>Driver seat headrest motor circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat headrest motor circuit for short to ground
B106015	Seat Headrest Motor Output	<ul style="list-style-type: none"> <li>Driver seat headrest motor circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat headrest motor circuit for short to power, open circuit
B106331	Seat Cushion Extension Motor Speed/Position Sensor	<ul style="list-style-type: none"> <li>Driver seat cushion extension motor speed/position sensor circuit - short to ground, power, open circuit</li> <li>Sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat cushion extension motor speed/position sensor circuit for short to ground, power, open circuit. Check and install a new sensor as required
B106431	Seat Headrest Motor Speed/Position Sensor	<ul style="list-style-type: none"> <li>Driver seat headrest motor speed/position sensor circuit - short to ground, power, open circuit</li> <li>Sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat headrest motor speed/position sensor circuit for short to ground, power, open circuit. Check and install a new sensor as required
B106524	Cushion extend switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Check for a stuck switch. Refer to the electrical circuit diagrams and check driver seat switch pack to seat module LIN circuit for short, open circuit and cushion extend circuit for short to ground
B106624	Cushion retract switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Check for a stuck switch. Refer to the electrical circuit diagrams and check driver seat switch pack to seat module LIN circuit for short, open circuit and cushion retract circuit for short to ground
B106D24	Headrest up switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Check for a stuck switch. Refer to the electrical circuit diagrams and check driver seat switch pack to seat module LIN circuit for short, open circuit and headrest up circuit for short to ground
B106E24	Headrest down switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Check for a stuck switch. Refer to the electrical circuit diagrams and check driver seat switch pack to seat module LIN circuit for short, open circuit and headrest down circuit for short to ground
B1A9883	LIN Bus Circuit #1	<ul style="list-style-type: none"> <li>Value of signal protection calculation incorrect</li> </ul>	Check LIN network for interference/EMC related issues
B1A9886	LIN Bus Circuit #1	<ul style="list-style-type: none"> <li>LIN bus Header error</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check LIN network for interference/EMC related issues
B1A9887	LIN Bus Circuit #1	<ul style="list-style-type: none"> <li>Slave node communication missing. LIN bus circuit - short to ground, power, open circuit (ECU Types 7 &amp; 8)</li> </ul>	Refer to electrical circuit diagrams and test LIN Bus between seat switch pack and control module for short to ground, power, open circuit, check power and ground supplies to switch pack
B1A9888	LIN Bus Circuit #1	<ul style="list-style-type: none"> <li>Bus off</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and test LIN Bus between seat switch pack and control module for short to ground or power
B1B8611	Seat Height Motor Relay	<ul style="list-style-type: none"> <li>Driver seat parallel height motor circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat parallel height motor circuit for short to ground
B1B8615	Seat Height Motor Relay	<ul style="list-style-type: none"> <li>Driver seat parallel height motor circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat parallel height motor circuit for short to power, open circuit
B1B8731	Seat Height Motor Speed/Position Sensor	<ul style="list-style-type: none"> <li>Driver seat parallel height motor speed/position sensor circuit - short to ground, power, open circuit</li> <li>Sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat parallel height motor speed/position sensor circuit for short to ground, power, open circuit. Check and install a new sensor as required
B1B8811	Seat Slide Motor Relay	<ul style="list-style-type: none"> <li>Driver seat slide motor circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat slide motor circuit for short to



DTC	Description	Possible Cause	Action
			ground
B1B8815	Seat Slide Motor Relay	<ul style="list-style-type: none"> <li>Driver seat slide motor circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat slide motor circuit for short to power, open circuit
B1B8931	Seat Slide Motor Speed/Position Sensor	<ul style="list-style-type: none"> <li>Driver seat slide motor speed/position sensor circuit - short to ground, power, open circuit</li> <li>Sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat slide motor speed/position sensor circuit for short to ground, power, open circuit. Check and install a new sensor as required
B1B9011	Seat Tilt Motor Relay	<ul style="list-style-type: none"> <li>Driver seat tilt motor circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat tilt motor circuit for short to ground
B1B9015	Seat Tilt Motor Relay	<ul style="list-style-type: none"> <li>Driver seat tilt motor circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat tilt motor circuit for short to power, open circuit
B1B9131	Seat Tilt Motor Speed/Position Sensor	<ul style="list-style-type: none"> <li>Driver seat tilt motor speed/position sensor circuit - short to ground, power, open circuit</li> <li>Sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat tilt motor speed/position sensor circuit for short to ground, power, open circuit. Check and install a new sensor as required
B1B9211	Seat Recline Motor Relay	<ul style="list-style-type: none"> <li>Driver seat recline motor circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat recline motor circuit for short to ground
B1B9215	Seat Recline Motor Relay	<ul style="list-style-type: none"> <li>Driver seat recline motor circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat recline motor circuit for short to power, open circuit
B1B9331	Seat Recline Motor Speed/Position Sensor	<ul style="list-style-type: none"> <li>Driver seat recline motor speed/position sensor circuit - short to ground, power, open circuit</li> <li>Sensor failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check driver seat recline motor speed/position sensor circuit for short to ground, power, open circuit. Check and install a new sensor as required
B1B9424	Seat Height Up Switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Check for a stuck switch. Refer to the electrical circuit diagrams and check driver seat switch pack to seat module LIN circuit for short, open circuit and seat height up circuit for short to ground
B1B9524	Seat Height Down Switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Check for a stuck switch. Refer to the electrical circuit diagrams and check driver seat switch pack to seat module LIN circuit for short, open circuit and seat height down circuit for short to ground
B1B9624	Seat Slide Forward Switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Check for a stuck switch. Refer to the electrical circuit diagrams and check driver seat switch pack to seat module LIN circuit for short, open circuit and seat slide forward circuit for short to ground
B1B9724	Seat Slide Backward Switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Check for a stuck switch. Refer to the electrical circuit diagrams and check driver seat switch pack to seat module LIN circuit for short, open circuit and seat slide backward circuit for short to ground
B1B9824	Seat Tilt Up Switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Check for a stuck switch. Refer to the electrical circuit diagrams and check driver seat switch pack to seat module LIN circuit for short, open circuit and seat tilt up circuit for short to ground
B1B9924	Seat Tilt Down Switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Check for a stuck switch. Refer to the electrical circuit diagrams and check driver seat switch pack to seat module LIN circuit for short, open circuit and seat tilt down circuit for short to ground
B1C0024	Seat Recline Up Switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Check for a stuck switch. Refer to the electrical circuit diagrams and check driver seat switch pack to seat module LIN circuit for short, open circuit and seat recline up circuit for short to ground
B1C0124	Seat Recline Down Switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Check for a stuck switch. Refer to the electrical circuit diagrams and check driver seat switch pack to seat module LIN circuit for short, open circuit and check seat recline down circuit for short to ground
B1C0224	Memory Store Switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Check for a stuck switch. Refer to the electrical circuit diagrams and check driver seat switch pack to seat module LIN circuit for short, open circuit
B1C0324	Memory #1 Switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Check for a stuck switch. Refer to the electrical circuit diagrams and check driver seat switch pack to seat module LIN circuit for short, open circuit

DTC	Description	Possible Cause	Action
B1C0424	Memory #2 Switch	<ul style="list-style-type: none"> <li>● Signal stuck high</li> </ul>	Check for a stuck switch. Refer to the electrical circuit diagrams and check driver seat switch pack to seat module LIN circuit for short, open circuit
B1C0524	Memory #3 Switch	<ul style="list-style-type: none"> <li>● Signal stuck high</li> </ul>	Check for a stuck switch. Refer to the electrical circuit diagrams and check driver seat switch pack to seat module LIN circuit for short, open circuit
U001088	Medium speed Can communication Bus	<ul style="list-style-type: none"> <li>● Bus off</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CAN network to climate controlled seat module for short, open circuit
U014000	Lost communication with CJB	<ul style="list-style-type: none"> <li>● Lost communication with CJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check CJB for related DTCs and refer to the relevant DTC Index
U014200	Lost communication with RJB	<ul style="list-style-type: none"> <li>● Lost communication with RJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check RJB for related DTCs and refer to the relevant DTC Index
U015500	Lost communications with instrument cluster	<ul style="list-style-type: none"> <li>● Lost communications with instrument cluster</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CAN network to climate controlled seat module and instrument cluster for short, open circuit
U019900	Lost communication with Driver Door Module (DDM)	<ul style="list-style-type: none"> <li>● Lost communication with DDM</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030000	Internal control module software incompatibility	<ul style="list-style-type: none"> <li>● Invalid configuration message is received</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the DSM/PSM, refer to the new module installation note at the top of the DTC Index
U1A1449	CAN Initialisation failure	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Install a new DSM, refer to the new module installation note at the top of the DTC Index
U1A4C68	Build/end of line mode active	<ul style="list-style-type: none"> <li>● Manufacturing mode has not been removed</li> </ul>	Place DSM in to customer mode using manufacturer approved diagnostic system
U300049	Control module	<ul style="list-style-type: none"> <li>● Internal electronic failure</li> </ul>	Install a new DSM, refer to the new module installation note at the top of the DTC Index
U300055	Stored vehicle configuration data does not match	<ul style="list-style-type: none"> <li>● Incorrect car configuration data received</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the DSM, refer to the new module installation note at the top of the DTC Index
U300087	Control Module	<ul style="list-style-type: none"> <li>● Missing message</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system. Check DSM for DTCs and refer to the DTC Index. Check CAN network integrity using the manufacturer approved diagnostic system
U300146	Control module improper shutdown	<ul style="list-style-type: none"> <li>● Calibration/parameter memory failure</li> </ul>	Check for DTCs that could indicate power failure to the module and refer to the DTC Index
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> <li>● Vehicle/component mis-match. Corrupt VIN data being transmitted, module previously installed to other vehicle</li> </ul>	Install original module, check for DTCs and refer to relevant DTC Index
U300316	Battery Voltage	<ul style="list-style-type: none"> <li>● Circuit voltage below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300317	Battery Voltage	<ul style="list-style-type: none"> <li>● Circuit voltage above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.




• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.


• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

#### Climate Controlled Seat Module



DTC	Description	Possible Cause	Action
B10B913	Blower Control	<ul style="list-style-type: none"> <li>● Left blower control circuit - open circuit</li> <li>● Left blower motor - open circuit</li> <li>● Climate controlled seat module failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left blower control circuit for open circuit. Check and install new left blower motor, climate controlled seat module as required, refer to the new module/component installation note at the top of the DTC Index
B10B94B	Blower Control	<ul style="list-style-type: none"> <li>● Mechanical restriction within the left blower motor housing</li> <li>● Left blower control circuit - short to ground</li> <li>● Left blower motor - short to ground</li> <li>● Climate controlled seat module failure</li> </ul>	Check for mechanical restriction within the left blower motor housing. Refer to the electrical circuit diagrams and check left blower control circuit for short to ground. Check and install new left blower motor, climate controlled seat module as required, refer to the new module/component installation note at the top of the DTC Index
B115713	Blower Control "B"	<ul style="list-style-type: none"> <li>● Right blower control circuit - open circuit</li> <li>● Right blower motor - open circuit</li> <li>● Climate controlled seat module failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right blower control circuit for open circuit. Check and install new right blower motor, climate controlled seat module as required, refer to the new module/component installation note at the top of the DTC Index
B11574B	Blower Control "B"	<ul style="list-style-type: none"> <li>● Mechanical restriction within the right blower motor housing</li> <li>● Right blower control circuit - short to ground</li> <li>● Right blower motor - short to ground</li> <li>● Climate controlled seat module failure</li> </ul>	Check for mechanical restriction within the right blower motor housing. Refer to the electrical circuit diagrams and check right blower control circuit for short to ground. Check and install new right blower motor, climate controlled seat module as required, refer to the new module/component installation note at the top of the DTC Index
B120E13	Right Thermal Electric Device Control	<ul style="list-style-type: none"> <li>● Right seatback/cushion thermal electric device control circuits - open circuit</li> <li>● Thermal electric device failure</li> <li>● Climate controlled seat module failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right seatback/cushion thermal electric device control circuits for open circuit. Check and install new thermal electric device/climate controlled seat module as required, refer to the new module/component installation note at the top of the DTC Index
B120E19	Right Thermal Electric Device Control	<ul style="list-style-type: none"> <li>● Right seatback/cushion thermal electric device control circuits - short to ground</li> <li>● Thermal electric device failure</li> <li>● Climate controlled seat module failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right seatback/cushion thermal electric device control circuits for short to ground. Check and install new thermal electric device/climate controlled seat module as required, refer to the new module/component installation note at the top of the DTC Index
B120E4B	Right Thermal Electric Device Control	<ul style="list-style-type: none"> <li>● Right seatback/cushion thermal electric device control circuits - short to ground</li> <li>● Blocked thermal electric device duct (restriction in airflow)</li> <li>● Thermal electric device failure</li> <li>● Climate controlled seat module failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for restriction in thermal electric device duct. Refer to the electrical circuit diagrams and check right seatback/cushion thermal electric device control circuits for short to ground. Check and install new thermal electric device/climate controlled seat module as required, refer to the new module/component installation note at the top of the DTC Index
B122413	Left Thermal Electric Device Control	<ul style="list-style-type: none"> <li>● Left seatback/cushion thermal electric device control circuits - open circuit</li> <li>● Thermal electric device failure</li> <li>● Climate controlled seat module failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left seatback/cushion thermal electric device control circuits for open circuit. Check and install new thermal electric device/climate controlled seat module as required, refer to the new module/component installation note at the top of the DTC Index
B122419	Left Thermal Electric Device Control	<ul style="list-style-type: none"> <li>● Left seatback/cushion thermal electric device control circuits - short to ground</li> <li>● Thermal electric device failure</li> <li>● Climate controlled seat module failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left seatback/cushion thermal electric device control circuits for short to ground. Check and install new thermal electric device/climate controlled seat module as required, refer to the new module/component installation note at the top of the DTC Index

DTC	Description	Possible Cause	Action
		module failure	Index
B12244B	Left Thermal Electric Device Control	<ul style="list-style-type: none"> <li>Left seatback/cushion thermal electric device control circuits - short to ground</li> <li>Blocked thermal electric device duct (restriction in airflow)</li> <li>Thermal electric device failure</li> <li>Climate controlled seat module failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check for restriction in thermal electric device duct. Refer to the electrical circuit diagrams and check left seatback/cushion thermal electric device control circuits for short to ground. Check and install new thermal electric device/climate controlled seat module as required, refer to the new module/component installation note at the top of the DTC Index
B122A11	Right Seat Cushion Blower Speed Sensor	<ul style="list-style-type: none"> <li>Right seat cushion blower speed sensor circuit - short to ground</li> <li>Internal motor failure</li> <li>Climate controlled seat module failure</li> </ul>	Refer to the electrical circuit diagrams and check right seat cushion blower speed sensor circuit for short to ground. Check and install a new motor/module as required, refer to the new module/component installation note at the top of the DTC Index
B122A12	Right Seat Cushion Blower Speed Sensor	<ul style="list-style-type: none"> <li>Right seat cushion blower speed sensor circuit - short to power</li> <li>Internal motor failure</li> <li>Climate controlled seat module failure</li> </ul>	Refer to the electrical circuit diagrams and check right seat cushion blower speed sensor circuit for short to power. Check and install a new motor/module as required, refer to the new module/component installation note at the top of the DTC Index
B122B11	Right Seat Back Blower Speed Sensor	<ul style="list-style-type: none"> <li>Right seatback blower speed sensor circuit - short to ground</li> <li>Internal motor failure</li> <li>Climate controlled seat module failure</li> </ul>	Refer to the electrical circuit diagrams and check right seatback blower speed sensor circuit for short to ground. Check and install a new motor/module as required, refer to the new module/component installation note at the top of the DTC Index
B122B12	Right Seat Back Blower Speed Sensor	<ul style="list-style-type: none"> <li>Right seatback blower speed sensor circuit - short to power</li> <li>Internal motor failure</li> <li>Climate controlled seat module failure</li> </ul>	Refer to the electrical circuit diagrams and check right seatback blower speed sensor circuit for short to power. Check and install a new motor/module as required, refer to the new module/component installation note at the top of the DTC Index
B122C11	Left Seat Cushion Blower Speed Sensor	<ul style="list-style-type: none"> <li>Left seat cushion blower speed sensor circuit - short to ground</li> <li>Internal motor failure</li> <li>Climate controlled seat module failure</li> </ul>	Refer to the electrical circuit diagrams and check left seat cushion blower speed sensor circuit for short to ground. Check and install a new motor/module as required, refer to the new module/component installation note at the top of the DTC Index
B122C12	Left Seat Cushion Blower Speed Sensor	<ul style="list-style-type: none"> <li>Left seat cushion blower speed sensor circuit - short to power</li> <li>Internal motor failure</li> <li>Climate controlled seat module failure</li> </ul>	Refer to the electrical circuit diagrams and check left seat cushion blower speed sensor circuit for short to power. Check and install a new motor/module as required, refer to the new module/component installation note at the top of the DTC Index
B122D11	Left Seat Back Blower Speed Sensor	<ul style="list-style-type: none"> <li>Left seatback blower speed sensor circuit - short to ground</li> <li>Internal motor failure</li> <li>Climate controlled seat module failure</li> </ul>	Refer to the electrical circuit diagrams and check left seatback blower speed sensor circuit for short to ground. Check and install a new motor/module as required, refer to the new module/component installation note at the top of the DTC Index
B122D12	Left Seat Back Blower Speed Sensor	<ul style="list-style-type: none"> <li>Left seatback blower speed sensor circuit - short to power</li> <li>Internal motor failure</li> <li>Climate controlled seat module failure</li> </ul>	Refer to the electrical circuit diagrams and check left seatback blower speed sensor circuit for short to power. Check and install a new motor/module as required, refer to the new module/component installation note at the top of the DTC Index
B122E13	Right Seat Cushion	<ul style="list-style-type: none"> <li>Right seat cushion temperature sensor circuit - open circuit</li> <li>Temperature sensor failure</li> <li>Climate controlled seat module failure</li> </ul>	Refer to the electrical circuit diagrams and check right seat cushion temperature sensor circuit for open circuit. Check and install a new sensor/module as required, refer to the new module/component installation note at the top of the DTC Index
B122E98	Right Seat Cushion	<ul style="list-style-type: none"> <li>Blockage in the right seat cushion thermal electric device fan exhaust vent</li> </ul>	Check/remove any blockage/restriction from the right seat cushion thermal electric device fan exhaust vent
<b>PINPOINT TESTS</b>			
		<ul style="list-style-type: none"> <li>Right seat cushion thermal electric device fan movement restricted</li> </ul>	
<b>PINPOINT TEST A : FRONT SEAT FOLD/UP MOVEMENT NOT FUNCTIONING</b>			



TEST CONDITIONS	DETAILS/RESULTS/ACTIONS				
<b>A1: CHECK FOR FRONT SEAT FORWARD-REARWARD SEAT MOTOR OPERATION</b>					
	 <b>WARNING:</b> Before work is carried out, make the air bag supplemental restraint system safe. For additional information, refer to Standard Workshop Practices section of workshop manual.				
	<ol style="list-style-type: none"> <li>Set ignition status to 'ON'.</li> <li>From the switch pack, operate the front seat forward-rearward seat motor switch and listen for evidence of the motor operating.</li> </ol>				
	Does the motor operate? <b>Yes</b> <a href="#">GO to A2.</a> <b>No</b> <a href="#">GO to A3.</a>				
<b>A2: CHECK FRONT SEAT FORWARD-REARWARD SEAT MOTOR DRIVE BAR</b>					
	<ol style="list-style-type: none"> <li>Check front seat drive bar for correct installation and condition</li> </ol>				
	Is the front seat drive bar correctly installed and in a serviceable condition? <b>Yes</b> Re-check for correct front seat forward-rearward movement. Remove seat to allow for further investigation if required. <b>No</b> Correctly install front seat forward-rearward seat motor drive bar, or replace if required.				
<b>A3: CHECK FRONT SEAT FORWARD-REARWARD SEAT MOTOR</b>					
	 <b>WARNING:</b> When carrying out the following steps, stand clear of all moving parts and ensure link harness is routed accordingly.				
	<ol style="list-style-type: none"> <li>Set ignition status to 'OFF'.</li> <li>Disconnect front seat forward-rearward seat motor connector.</li> </ol>				
	<ul style="list-style-type: none"> <li><b>NOTE:</b> It may be that the seat has been driven to the limit of travel along the relevant axis, and when the link harness is connected, the seat will remain in the same position. If this is the case, a jolt may be felt from the motor. To confirm the motor operation, swap the link harness to alternate motor pin connections and the seat should travel in the opposite direction.</li> </ul>				
	<ol style="list-style-type: none"> <li>Using a locally made fused link harness and power supply, connect power and ground to forward-rearward seat motor.</li> </ol> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: center;">Battery positive terminal</th> <th style="width: 50%; text-align: center;">Battery negative terminal</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">forward-rearward seat motor pin 1</td> <td style="text-align: center;">forward-rearward seat motor pin 2</td> </tr> </tbody> </table>	Battery positive terminal	Battery negative terminal	forward-rearward seat motor pin 1	forward-rearward seat motor pin 2
Battery positive terminal	Battery negative terminal				
forward-rearward seat motor pin 1	forward-rearward seat motor pin 2				
	Does the motor operate? <b>Yes</b> Using manufacturer approved diagnostic system, check for related Diagnostic Trouble Codes (DTCs) and carry out the repair operations specified. Alternatively, refer to the electrical circuit diagrams and check front seat forward-rearward seat motor circuits. <b>No</b> Replace front seat forward-rearward seat motor. Refer to relevant section of workshop manual.				
<b>PINPOINT TEST B : FRONT SEAT EXCESSIVE FORWARD-REARWARD FREE PLAY</b>					
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS				
<b>B1: CHECK FRONT SEAT FOR EXCESSIVE FORWARD-REARWARD FREE PLAY</b>					
	 <b>WARNING:</b> Before work is carried out, make the air bag supplemental restraint system safe. For additional information, refer to Standard Workshop Practices section of workshop manual.				
	<ol style="list-style-type: none"> <li>Check all accessible front seat frame fixings are installed and to the correct torque.</li> </ol>				
	Are all accessible front seat frame fixings installed and to the correct torque? <b>Yes</b> <a href="#">GO to B2.</a> <b>No</b> Install and tighten all accessible front seat frame fixings to correct torque and re-check for excessive free play.				
<b>B2: COMPARE THE FRONT SEAT FORWARD-REARWARD FREE PLAY AGAINST A SIMILAR SEAT</b>					
	<ol style="list-style-type: none"> <li>Compare the front seat forward-rearward free play against a similar seat.</li> </ol>				
	Is the front seat forward-rearward free play excessive when compared to a similar seat? <b>Yes</b> <a href="#">GO to B3.</a> <b>No</b> The front seat frame is operating correctly. Submit Electronic Product Quality Report (EPQR) with any further query.				
<b>B3: CHECK REMAINING FRONT SEAT FRAME FIXINGS</b>					
	<ol style="list-style-type: none"> <li>Remove front seat and/or any seat covers/trim to allow access to check remaining front seat frame fixings are all installed and to the correct torque.</li> </ol>				
	Are all remaining front seat frame fixings installed and to the correct torque? <b>Yes</b> Replace front seat frame. Refer to the relevant section of the workshop manual. <b>No</b> Install and tighten all remaining front seat frame fixings to correct torque and re-check for excessive free play.				
<b>PINPOINT TEST C : FRONT SEAT FORWARD-REARWARD MOVEMENT NOISY</b>					

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>C1: COMPARE FRONT SEAT FORWARD-REARWARD MOVEMENT NOISE TO OTHER FRONT SEAT</b>	
	 <b>WARNING:</b> Before work is carried out, make the air bag supplemental restraint system safe. For additional information, refer to Standard Workshop Practices section of workshop manual.
	<ol style="list-style-type: none"> <li>1 Compare the front seat forward-rearward movement noise to other front seat.</li> </ol>
	Is the front seat forward-rearward movement noise excessive when compared to other front seat? <b>Yes</b> <a href="#">GO to C2.</a> <b>No</b> <a href="#">GO to C3.</a>
<b>C2: COMPARE FRONT SEAT FORWARD-REARWARD MOVEMENT NOISE TO FRONT SEAT IN OTHER VEHICLE</b>	
	<ol style="list-style-type: none"> <li>1 Compare the front seat forward-rearward movement noise to front seat in other vehicle.</li> </ol>
	Is the front seat forward-rearward movement noise excessive when compared to front seat in other vehicle? <b>Yes</b> <a href="#">GO to C3.</a> <b>No</b> The front seat frame is operating correctly. Submit Electronic Product Quality Report (EPQR) with any further query.
<b>C3: CHECK FOR DEBRIS OBSTRUCTING SEAT MOVEMENT</b>	
	<ol style="list-style-type: none"> <li>1 Check for debris obstructing seat movement.</li> </ol>
	Is the front seat forward-rearward movement obstructed by debris? <b>Yes</b> Remove obstruction and re-check for noisy forward-rearward seat movement. <b>No</b> <a href="#">GO to C4.</a>
<b>C4: RE-ALIGN FRONT SEAT FRAME</b>	
	<ol style="list-style-type: none"> <li>1 Loosen front seat frame fixings.</li> <li>2 Set ignition status to 'ON'.</li> <li>3 Using the front seat switch pack drive the front seat fully forward then fully rearward.</li> <li>4 Tighten front seat frame fixings to the correct torque.</li> <li>5 Re-check for noisy seat movement.</li> </ol>
	Is the front seat forward-rearward movement still noisy? <b>Yes</b> <a href="#">GO to C5.</a> <b>No</b> The front seat frame is now operating correctly.
<b>C5: CHECK FRONT SEAT FORWARD-REARWARD SEAT MOTOR DRIVE BAR</b>	
	<ol style="list-style-type: none"> <li>1 Check front seat drive bar for correct installation and condition.</li> </ol>
	Is the front seat drive bar correctly installed and in a serviceable condition? <b>Yes</b> Replace front seat forward-rearward seat motor. Refer to relevant section of workshop manual. <b>No</b> Correctly install front seat forward-rearward seat motor drive bar, or replace if required.

**PINPOINT TEST D : FRONT SEAT HEIGHT, TILT AND/OR SEAT EXTENSION MOTOR MOVEMENT NOT FUNCTIONING**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS				
<b>D1: CHECK FRONT SEAT HEIGHT, TILT OR EXTENSION MOTOR</b>					
<ul style="list-style-type: none"> <li>• <b>WARNINGS:</b></li> </ul>					
	 Before work is carried out, make the air bag supplemental restraint system safe. For additional information, refer to Standard Workshop Practices section of workshop manual.				
	 When carrying out the following steps, stand clear of all moving parts and ensure link harness is routed accordingly.				
	<ol style="list-style-type: none"> <li>1 Set ignition status to 'OFF'.</li> <li>2 Disconnect front seat height, tilt or extension motor connector.</li> </ol>				
	<ul style="list-style-type: none"> <li>• <b>NOTE:</b> It may be that the seat has been driven to the limit of travel along the relevant axis, and when the link harness is connected, the seat will remain in the same position. If this is the case, a jolt may be felt from the motor. To confirm the motor operation, swap the link harness to alternate motor pin connections and the seat should travel in the opposite direction.</li> </ul>				
	<ol style="list-style-type: none"> <li>3 Using a locally made fused link harness and power supply, connect power and ground to relevant motor.</li> </ol>				
	<table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 50%; text-align: center;">Battery positive terminal</th> <th style="width: 50%; text-align: center;">Battery negative terminal</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">motor pin 1</td> <td style="text-align: center;">motor pin 2</td> </tr> </tbody> </table>	Battery positive terminal	Battery negative terminal	motor pin 1	motor pin 2
Battery positive terminal	Battery negative terminal				
motor pin 1	motor pin 2				
	Does the motor operate? <b>Yes</b> Using manufacturer approved diagnostic system, check for related Diagnostic Trouble Codes (DTCs) and carry out the repair operations specified. Alternatively, refer to the electrical circuit diagrams and check relevant motor circuits. <b>No</b> Replace the relevant motor. Refer to relevant section of workshop manual.				



<b>PINPOINT TEST E : FRONT SEAT HEIGHT, TILT AND/OR EXTENSION MOVEMENT NOISY</b>	
<b>TEST CONDITIONS</b>	<b>DETAILS/RESULTS/ACTIONS</b>
<b>E1: COMPARE THE HEIGHT, TILT OR EXTENSION MOVEMENT NOISE WITH THE OTHER FRONT SEAT</b>	
	 <b>WARNING:</b> Before work is carried out, make the air bag supplemental restraint system safe. For additional information, refer to Standard Workshop Practices section of workshop manual.
	<b>1</b> Compare the front seat movement noise to other front seat.
	Is the front seat height, tilt or extension movement noise excessive when compared to other front seat? <b>Yes</b> <a href="#">GO to E2.</a> <b>No</b> <a href="#">GO to E3.</a>
<b>E2: COMPARE FRONT SEAT HEIGHT, TILT OR EXTENSION MOVEMENT NOISE TO FRONT SEAT IN OTHER VEHICLE</b>	
	<b>1</b> Compare the front seat height, tilt or extension movement noise to front seat in other vehicle.
	Is the front seat height, tilt or extension movement noise excessive when compared to front seat in other vehicle? <b>Yes</b> <a href="#">GO to E3.</a> <b>No</b> The front seat frame is operating correctly. Submit Electronic Product Quality Report (EPQR) with any further query.
<b>E3: CHECK FOR DEBRIS OBSTRUCTING SEAT MOVEMENT</b>	
	<b>1</b> Check for debris obstructing seat movement.
	Is the front seat height, tilt or extension movement obstructed by debris? <b>Yes</b> Remove obstruction and re-check for noisy height, tilt or extension seat movement. If still noisy GO to Pinpoint Test ??. <b>No</b> <a href="#">GO to E4.</a>
<b>E4: CHECK FOR HEIGHT, TILT OR EXTENSION MOVEMENT MECHANISM LUBRICATION</b>	
	<b>1</b> Check and apply manufacturer approved lubrication to seat height, tilt or extension movement mechanism and re-test for noise.
	Is the front seat height, tilt or extension noise still apparent? <b>Yes</b> Replace the relevant motor. Refer to relevant section of workshop manual. <b>No</b> The front seat height, tilt or extension motor is operating correctly.
<b>PINPOINT TEST F : HEATER AND COOLING - INOPERATIVE</b>	
<b>TEST CONDITIONS</b>	<b>DETAILS/RESULTS/ACTIONS</b>
<b>F1: CHECK FOR STORED DTC</b>	
	<b>1</b> Check the Climate Controlled Seat Module for stored DTC's.
	Are there any stored DTC's? <b>Yes</b> For information on stored DTC's refer to the information in the Climate Controlled Seat Module DTC index. <b>No</b> <a href="#">GO to F2.</a>
<b>F2: DRIVER OR FRONT PASSENGER SEAT BACKREST CLIMATE ASSEMBLY - FUNCTIONALITY CHECK</b>	
	 <b>WARNING:</b> Before work is carried out, make the air bag supplemental restraint system safe. For additional information, refer to Standard Workshop Practices section of workshop manual.
	<ul style="list-style-type: none"> <li>• <b>NOTE:</b> The Climate Controlled Seat's (heat and cool) function will only operate when the vehicle's engine is running.</li> <li>• <b>NOTE:</b> If a fault is identified and repaired, check for correct operation of the driver and front-passenger climate controlled seat (heat and cool) functions.</li> </ul>
	<b>1</b> Check the heat and cool function of the backrest.
	Does the backrest heat and cool function operate correctly? <b>Yes</b> <a href="#">GO to F3.</a> <b>No</b> <a href="#">GO to F5.</a>
<b>F3: DRIVER OR FRONT PASSENGER SEAT CUSHION CLIMATE ASSEMBLY - FUNCTIONALITY CHECK</b>	
	<b>1</b> Check the heat and cool function at the cushion.
	Does the cushion heat and cool function operate correctly? <b>Yes</b> If there are no faults evident, verify the customer concern. <b>No</b> <a href="#">GO to F4.</a>
<b>F4: CUSHION BELLOWS</b>	
	<b>1</b> Check the condition of the bellows.
	Are the bellows obstructed, have they collapsed? <b>Yes</b> Remove the obstruction or replace collapsed bellows. <b>No</b> Suspect an internal fault with the Seat Climate Assembly. Replace as required, refer to the Warranty Policy and Procedures manual (section B1.2). Prior to installing a new component.
<b>F5: BACKREST BELLOWS DUCT</b>	

	<b>1</b> Check the security of the bellows duct.
	Is the bellows duct correctly installed? <b>Yes</b> <a href="#">GO to F6.</a> <b>No</b> Securely reconnect the bellows duct.

#### F6: BACKREST BELLOWS

	<b>1</b> Check the security of the bellows.
	Are the bellows obstructed, have they collapsed? <b>Yes</b> Remove the obstruction or replace collapsed bellows. <b>No</b> Suspect an internal fault with the Seat Climate Assembly. Replace as required, refer to the Warranty Policy and Procedures manual (section B1.2). Prior to installing a new component. Follow the link below to check operation of the Driver or Front Passenger Seat Cushion Climate Assembly. <a href="#">GO to F2.</a>


#### PINPOINT TEST G : HEATING AND COOLING - NOISY OPERATION

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
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#### G1: CHECK FOR STORED DTC

	<b>1</b> Check the Climate Controlled Seat Module for stored DTC's.
	Are there any stored DTC's? <b>Yes</b> For information on stored DTC's refer to the information in the Climate Controlled Seat Module DTC index. <b>No</b> <a href="#">GO to G2.</a>

#### G2: DRIVER OR FRONT PASSENGER SEAT BACKREST CLIMATE ASSEMBLY - NOISE

 <b>WARNING:</b> Before work is carried out, make the air bag supplemental restraint system safe. For additional information, refer to Standard Workshop Practices section of workshop manual.	
<ul style="list-style-type: none"> <li>• <b>NOTE:</b> The Climate Controlled Seat's (heat and cool) function will only operate when the vehicle's engine is running.</li> <li>• <b>NOTE:</b> If a fault is identified and repaired, check for correct operation of the driver and front-passenger climate controlled seat (heat and cool) functions.</li> </ul>	

	<b>1</b> There is a known issue which effects a limited number of vehicles where under acceleration of the vehicle the occupant of seat can deform the suspension mat (snake wire) which then presses on the casing of the seat backrest climate assembly, this causes the casing to distort and the noise issue to occur. If contact has occurred there will be a witness mark on the casing. Carry out visual inspection of the seat backrest climate assembly that has been identified as noisy by the customer.
	Is there a witness mark on the casing? <b>Yes</b> Contact the local in market support for further information. <b>No</b> <a href="#">GO to G3.</a>

#### G3: DRIVER OR FRONT PASSENGER SEAT CLIMATE ASSEMBLY - NOISE 2

	<b>1</b> Operate the heat and cool function of the seat. Listen for a 'WAH WAH' noise (the fan speeds up and slows down repeatedly).
	Does the fan speeds up and slow down repeatedly? <b>Yes</b> Confirm the latest Strategy and Calibration software is installed, using the manufacturer approved diagnostic system carry out the new Climate Controlled Seat Module application and update the Climate Controlled Seat Module software if required. If the noise is still evident after software update follow link below. <a href="#">GO to G4.</a> <b>No</b> <a href="#">GO to G4.</a>

#### G4: DRIVER OR FRONT PASSENGER SEAT BACKREST CLIMATE ASSEMBLY - NOISE LEVEL COMPARISON

	<b>1</b> Compare the noise level of the suspect climate seat assembly to another climate seat assembly.
	Is the noise level equal between the two seats? <b>Yes</b> The noise level is standard and comparable to the design intent. <b>No</b> Suspect an internal fault with the Seat Climate Assembly. Replace as required, refer to the Warranty Policy and Procedures manual (section B1.2). Prior to installing a new component.


#### PINPOINT TEST H : HEATING AND COOLING - POOR HEAT OR COOL EFFICIENCY

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
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#### H1: CHECK FOR STORED DTC


	<b>1</b> Check the Climate Controlled Seat Module for stored DTC's.
	Are there any stored DTC's? <b>Yes</b> For information on stored DTC's refer to the information in the Climate Controlled Seat Module DTC index. <b>No</b> <a href="#">GO to H2.</a>

#### H2: DRIVER OR FRONT PASSENGER SEAT BACKREST CLIMATE ASSEMBLY - FUNCTIONALITY CHECK

 <b>WARNING:</b> Before work is carried out, make the air bag supplemental restraint system safe. For additional information, refer to Standard Workshop Practices section of workshop manual.	
<ul style="list-style-type: none"> <li>• <b>NOTE:</b> The Climate Controlled Seat's (heat and cool) function will only operate when the vehicle's engine is running.</li> </ul>	


<p>• NOTE: If a fault is identified and repaired, check for correct operation of the driver and front-passenger climate controlled seat (heat and cool) functions.</p>	
	<p>1 Check the heat and cool function of the backrest.</p>
	<p>Does the backrest heat and cool function operate correctly?  <b>Yes</b>  <a href="#">GO to H3.</a>  <b>No</b>  <a href="#">GO to H5.</a></p>
<b>H3: DRIVER OR FRONT PASSENGER SEAT CUSHION CLIMATE ASSEMBLY - FUNCTIONALITY CHECK</b>	
	<p>1 Check the heat and cool function at the cushion.</p>
	<p>Does the cushion heat and cool function operate correctly?  <b>Yes</b>          If there are no faults evident, verify the customer concern.  <b>No</b>  <a href="#">GO to H4.</a></p>
<b>H4: CUSHION BELLOWS</b>	
	<p>1 Check the condition of the bellows.</p>
	<p>Are the bellows obstructed, have they collapsed?  <b>Yes</b>          Remove the obstruction or replace collapsed bellows.  <b>No</b>  <a href="#">GO to H7.</a></p>
<b>H5: BACKREST BELLOWS DUCT</b>	
	<p>1 Check the security of the bellows duct.</p>
	<p>Is the bellows duct correctly installed?  <b>Yes</b>  <a href="#">GO to H6.</a>  <b>No</b>          Securely reconnect the bellows duct.</p>
<b>H6: BACKREST BELLOWS</b>	
	<p>1 Check the security of the bellows.</p>
	<p>Are the bellows obstructed, have they collapsed?  <b>Yes</b>          Remove the obstruction or replace collapsed bellows.  <b>No</b>          Suspect an internal fault with the Seat Climate Assembly. Replace as required, refer to the Warranty Policy and Procedures manual (section B1.2). Prior to installing a new component. Follow the link below to check operation of the Driver or Front Passenger Seat Cushion Climate Assembly.<a href="#">GO to H2.</a></p>
<b>H7: DRIVER OR FRONT PASSENGER SEAT BACKREST CLIMATE ASSEMBLY - EFFICIENCY COMPARISON</b>	
	<p>1 Compare the efficiency of the suspect climate seat assembly to another climate seat assembly.</p>
	<p>Is the efficiency equal between the two seats?  <b>Yes</b>          The efficiency is standard and comparable to the design intent.  <b>No</b>          Suspect an internal fault with the Seat Climate Assembly. Replace as required, refer to the Warranty Policy and Procedures manual (section B1.2). Prior to installing a new component.</p>

**PINPOINT TEST I : HEATING AND COOLING - HEAT OR COOL OPERATION SLOW**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>I1: CHECK FOR STORED DTC</b>	
	<p>1 Check the Climate Controlled Seat Module for stored DTC's.</p>
	<p>Are there any stored DTC's?  <b>Yes</b>          For information on stored DTC's refer to the information in the Climate Controlled Seat Module DTC index.  <b>No</b>  <a href="#">GO to I2.</a></p>
<b>I2: DRIVER OR FRONT PASSENGER SEAT BACKREST CLIMATE ASSEMBLY - FUNCTIONALITY CHECK</b>	
<p> <b>WARNING:</b> Before work is carried out, make the air bag supplemental restraint system safe. For additional information, refer to Standard Workshop Practices section of workshop manual.</p> <p>• NOTE: The Climate Controlled Seat's (heat and cool) function will only operate when the vehicle's engine is running.</p> <p>• NOTE: If a fault is identified and repaired, check for correct operation of the driver and front-passenger climate controlled seat (heat and cool) functions.</p>	
	<p>1 Check the heat and cool function of the backrest?</p>
	<p>Does the backrest heat and cool function operate correctly?  <b>Yes</b>  <a href="#">GO to I3.</a>  <b>No</b>  <a href="#">GO to I5.</a></p>
<b>I3: DRIVER OR FRONT PASSENGER SEAT CUSHION CLIMATE ASSEMBLY - FUNCTIONALITY CHECK</b>	
	<p>1 Check the heat and cool function at the cushion.</p>
	<p>Does the cushion heat and cool function operate correctly?  <b>Yes</b>          If there are no faults evident, verify the customer concern.  <b>No</b>  <a href="#">GO to I4.</a></p>
<b>I4: CUSHION BELLOWS</b>	
	<p>1 Check the condition of the bellows.</p>

	<p>Are the bellows obstructed, have they collapsed?</p> <p><b>Yes</b> Remove the obstruction or replace collapsed bellows.</p> <p><b>No</b> <a href="#">GO to I7.</a></p>
<b>I5: BACKREST BELLOWS DUCT</b>	
	<p><b>1</b> Check the security of the bellows duct.</p>
	<p>Is the bellows duct correctly installed?</p> <p><b>Yes</b> <a href="#">GO to I6.</a></p> <p><b>No</b> Securely reconnect the bellows duct.</p>
<b>I6: BACKREST BELLOWS</b>	
	<p><b>1</b> Check the security of the bellows.</p>
	<p>Are the bellows obstructed, have they collapsed?</p> <p><b>Yes</b> Remove the obstruction or replace collapsed bellows.</p> <p><b>No</b> Suspect an internal fault with the Seat Climate Assembly. Replace as required, refer to the Warranty Policy and Procedures manual (section B1.2). Prior to installing a new component. Follow the link below to check operation of the Driver or Front Passenger Seat Cushion Climate Assembly. <a href="#">GO to I2.</a></p>
<b>I7: DRIVER OR FRONT PASSENGER SEAT BACKREST CLIMATE ASSEMBLY - OPERATION COMPARISON</b>	
	<p><b>1</b> Compare the operation of the suspect climate seat assembly to another climate seat assembly.</p>
	<p>Is the operation equal between the two seats?</p> <p><b>Yes</b> The operation is standard and comparable to the design intent.</p> <p><b>No</b> Suspect an internal fault with the Seat Climate Assembly. Replace as required, refer to the Warranty Policy and Procedures manual (section B1.2). Prior to installing a new component.</p>

**PINPOINT TEST J : HEATING AND COOLING - INTERMITTENT OPERATION**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>J1: CHECK FOR STORED DTC</b>	
	<p><b>1</b> Check the Climate Controlled Seat Module for stored DTC's.</p>
	<p>Are there any stored DTC's?</p> <p><b>Yes</b> For information on stored DTC's refer to the information in the Climate Controlled Seat Module DTC index.</p> <p><b>No</b> <a href="#">GO to J2.</a></p>
<b>J2: CABLE CONNECTION CHECK</b>	
<p> <b>WARNING:</b> Before work is carried out, make the air bag supplemental restraint system safe. For additional information, refer to Standard Workshop Practices section of workshop manual.</p> <p>• <b>NOTE:</b> The Climate Controlled Seat's (heat and cool) function will only operate when the vehicle's engine is running.</p> <p>• <b>NOTE:</b> If a fault is identified and repaired, check for correct operation of the driver and front-passenger climate controlled seat (heat and cool) functions.</p>	
	<p><b>1</b> Identify from customer concern or stored DTC's which Seat Climate Assembly is operating intermittently and confirm the harness connector is fully connected.</p>
	<p>Is the harness connector is fully connected?</p> <p><b>Yes</b> Suspect an internal fault with the Seat Climate Assembly. Replace as required, refer to the Warranty Policy and Procedures manual (section B1.2). Prior to installing a new component.</p> <p><b>No</b> Disconnect the harness connector, inspect connector and terminals for damage. Repair or replace if required. Reconnect connector and check operation.</p>

## Seating - Front Seat

### Removal and Installation

#### Removal

1. Make the air bag supplemental restraint system (SRS) safe. For additional information, refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).

2. NOTE: Right-hand shown, left-hand similar.

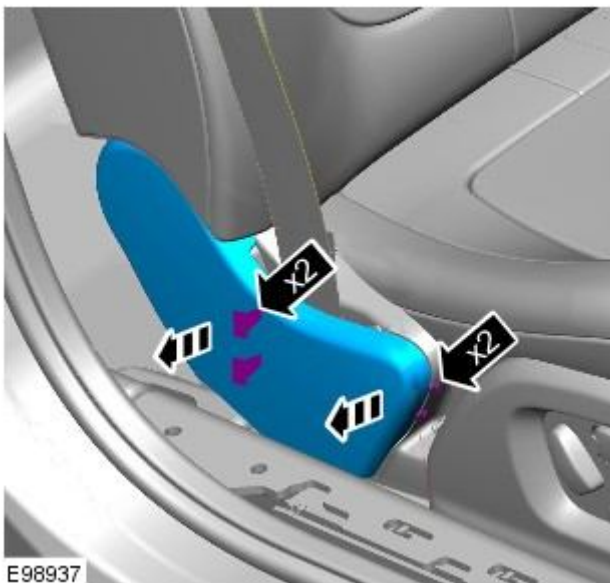


Position the front seat fully forwards.

- Lower the front seat head restraint to the fully lowered position.

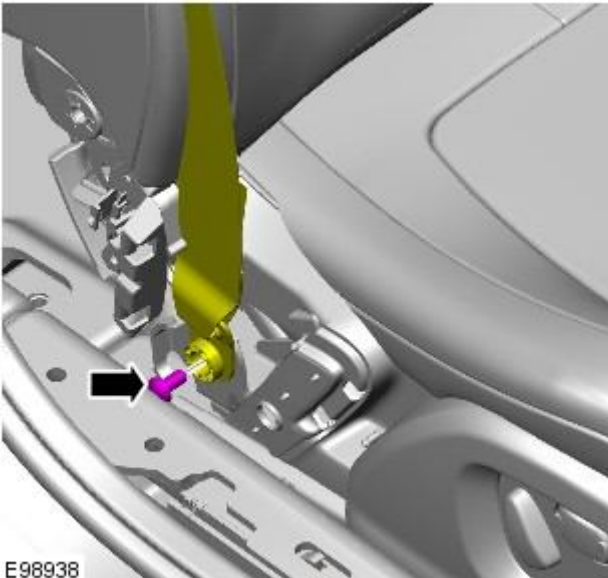
3. NOTE: Right-hand shown, left-hand similar.

Remove the safety belt lower anchor trim panel.



4. NOTE: Right-hand shown, left-hand similar.

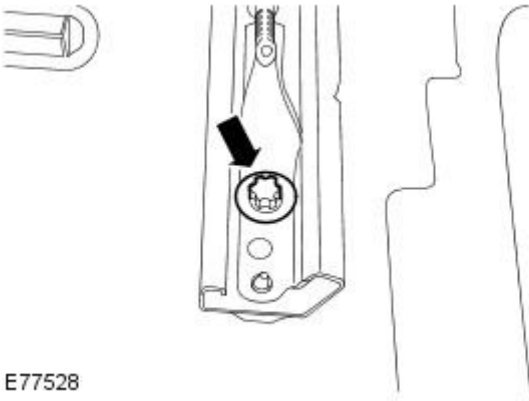
Release the safety belt lower anchor from the front seat.



5. NOTE: Left-hand shown, right-hand similar.

• NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

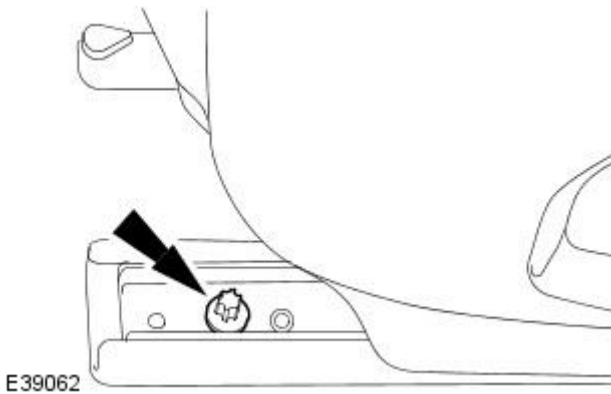
Remove the 2 rear bolts from the front seat.



6. Position the front seat fully rearwards.

7. NOTE: Left-hand shown, right-hand similar.

Remove the 2 front bolts from the front seat.



8. Reposition the front seat to the central position.

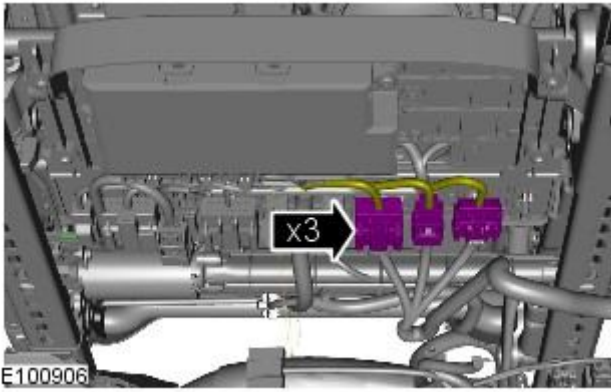
9. Disconnect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).



10. Disconnect the front seat harness electrical connectors.

- Tilt the front seat rearwards to aid disconnecting the front seat electrical connectors.



11. NOTE: Make sure no damage is caused to the vehicle trim when removing the front seat.

- NOTE: Left-hand shown, right-hand similar.

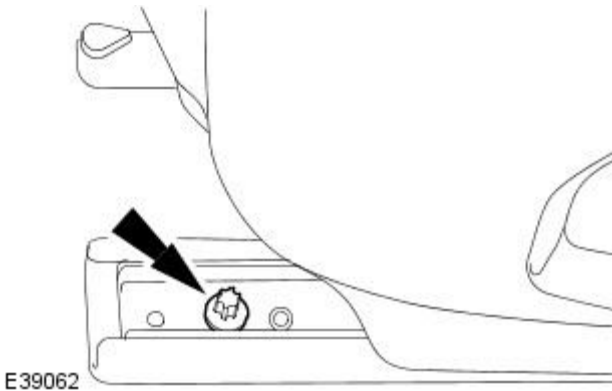
Remove the front seat.



## Installation

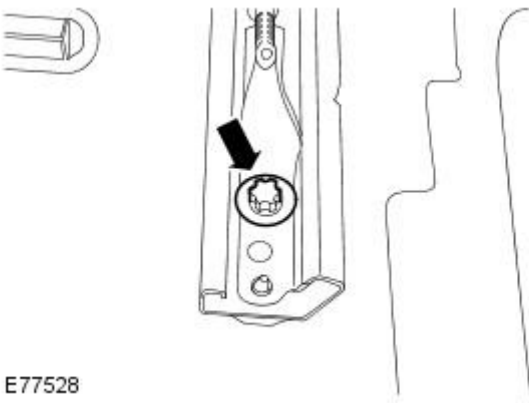
1. To install, reverse the removal procedure.

- TORQUE: 47 Nm



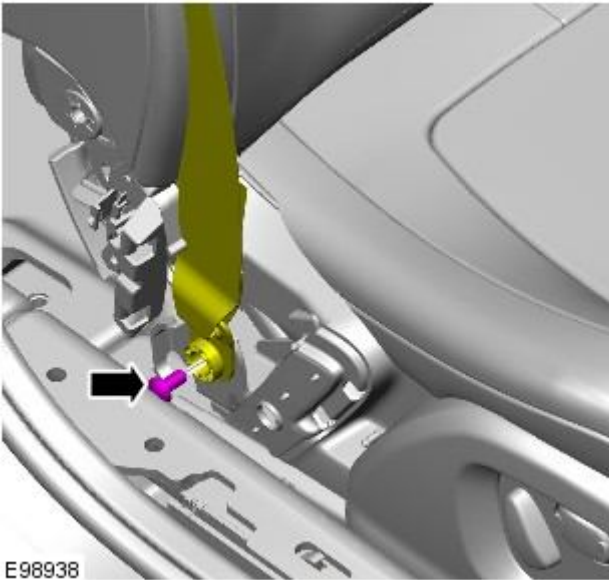
2. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

TORQUE: 47 Nm



3. NOTE: Right-hand shown, left-hand similar.

TORQUE: 40 Nm



E98938

## Seating - Front Seat Backrest

Removal and Installation

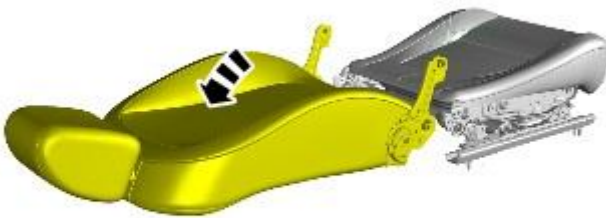
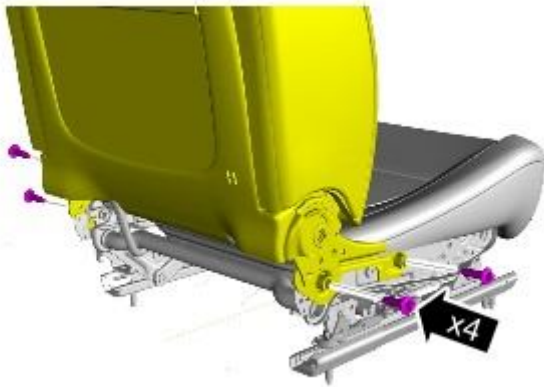
### Removal

1. Make the air bag supplemental restraint system (SRS) safe.  
For additional information, refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).
2. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
3. Remove the front seat.  
For additional information, refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).

4.  **WARNING:** This step requires the aid of another technician.

 **CAUTION:** Take extra care when handling the component.

Remove the front seat backrest assembly.



E101228

5. Remove the front seat backrest cover.  
For additional information, refer to: [Front Seat Backrest Cover](#) (501-10 Seating, Removal and Installation).

6. Remove the backrest halo panel.

- Release the 5 wiring harness clips.

7. **NOTE:** Do not disassemble further if the component is removed for access only.

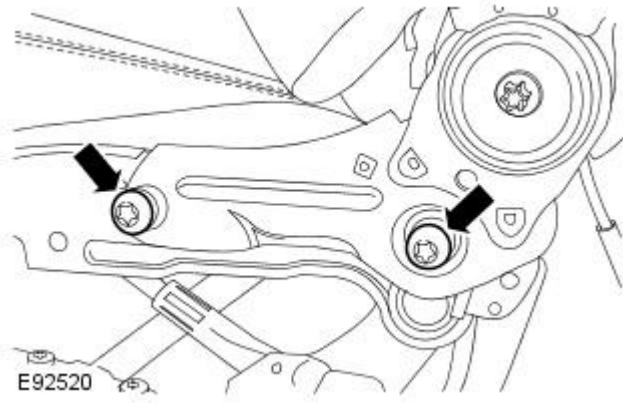
Remove the front seat recliner motor.

For additional information, refer to: [Front Seat Recliner Motor](#) (501-10 Seating, Removal and Installation).

8. Remove the lumbar assembly.  
For additional information, refer to: Lumbar Assembly (501-10, Removal and Installation).

9. Remove the front seat head restraint motor.  
For additional information, refer to: Front Seat Head Restraint Motor (501-10, Removal and Installation).

### Installation



1. To install, reverse the removal procedure.

- TORQUE: 35 Nm

2. If a new component has been installed, configure using Jaguar approved diagnostic equipment.

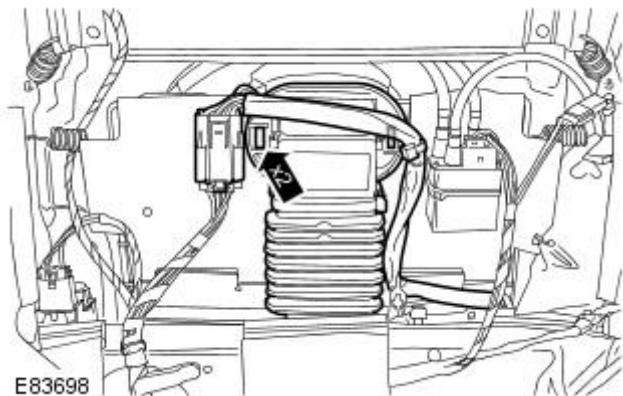
## Seating - Front Seat Backrest Cover

Removal and Installation

### Removal

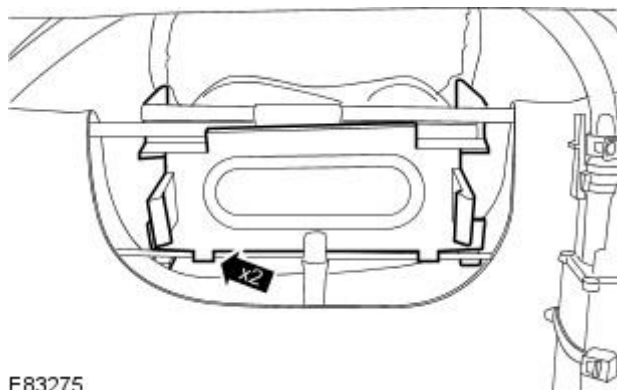
1. Make the air bag supplemental restraint system (SRS) safe.  
For additional information, refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).
2. Remove the front seat.  
For additional information, refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).
3. Remove the side air bag module.  
For additional information, refer to: [Side Air Bag Module](#) (501-20B Supplemental Restraint System, Removal and Installation).
4. **NOTE: If equipped.**

Reposition the front seat backrest thermo-electric device.



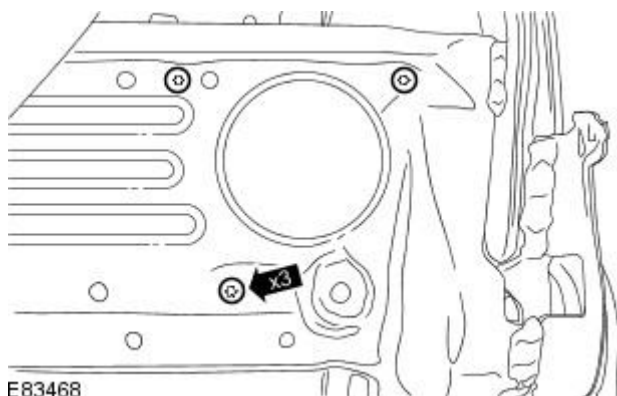
5. **NOTE: If equipped.**

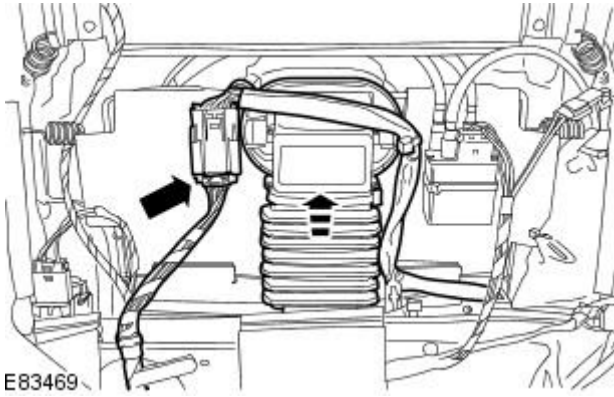
Release the front seat backrest thermo-electric device duct



6. **NOTE: If equipped.**

Remove the front seat backrest thermo-electric device retaining screws.





E83469

**7. NOTE: If equipped.**

Remove the front seat backrest thermo-electric device.

- Disconnect the electrical connector.

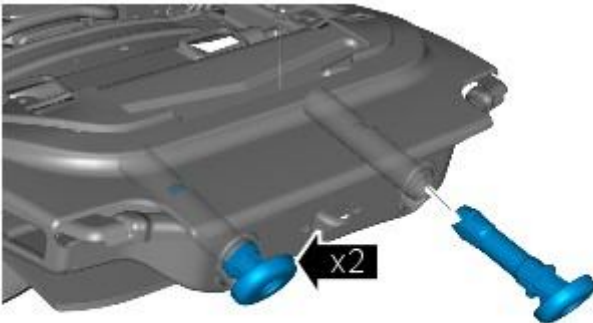
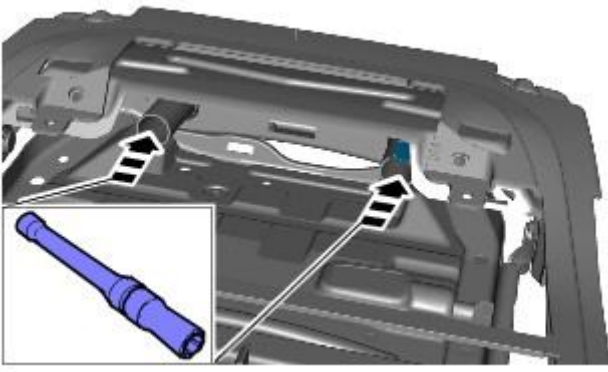
**8. Remove the front seat head restraint.**

**9. Remove the front seat head restraint motor.**

For additional information, refer to: Front Seat Head Restraint Motor (501-10, Removal and Installation).

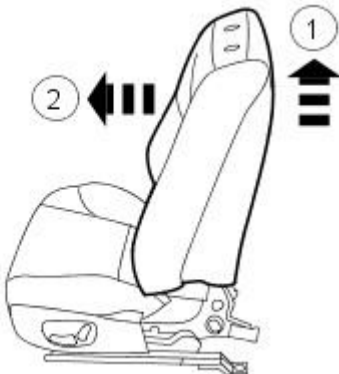
**10. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.**

Using a suitable tool, remove the front seat head restraint guide sleeves.



E101146

**11. Remove the front seat backrest cushion and cover from the front seat frame.**

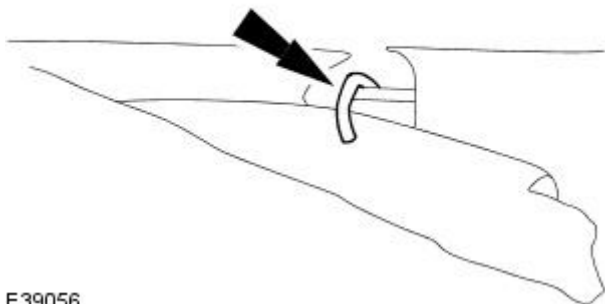


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12. Remove and discard the hog rings.

- Remove the 22 hog rings.



E39056

13. Remove the front seat backrest cover.

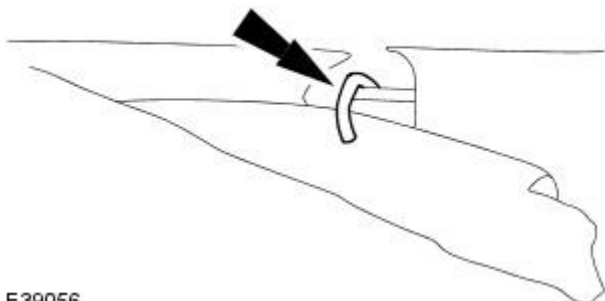


E39246

## Installation

1. NOTE: Make sure that new hog rings are installed.

- NOTE: Use hog ring pliers to close the hog rings. Do not use any other tool. The hog rings must be closed to overlap as illustrated.



E39056

To install, reverse the removal procedure.

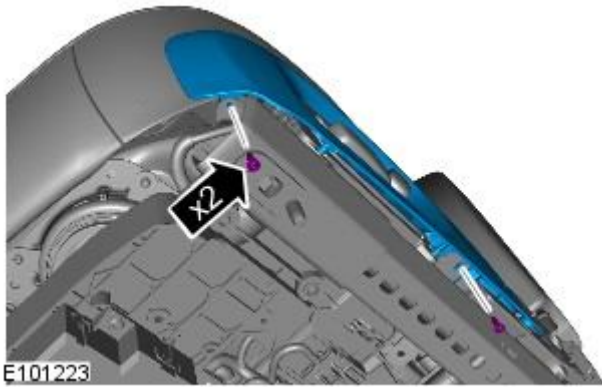
## Seating - Front Seat Cushion Cover

Removal and Installation

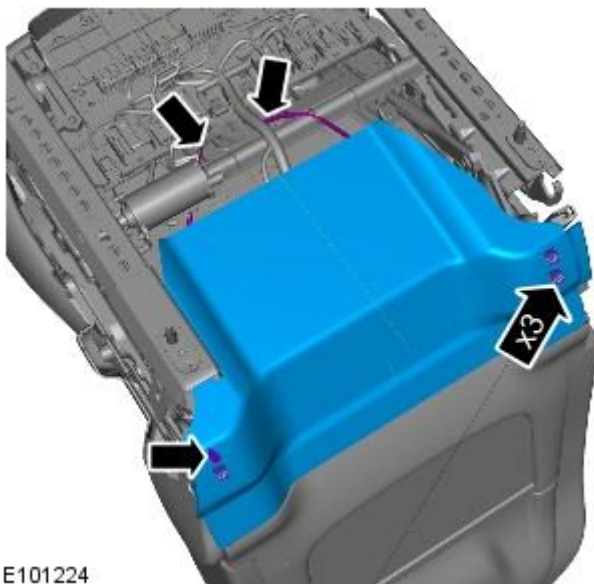
### Removal

1. Refer to: [Front Safety Belt Buckle](#) (501-20A Safety Belt System, Removal and Installation).

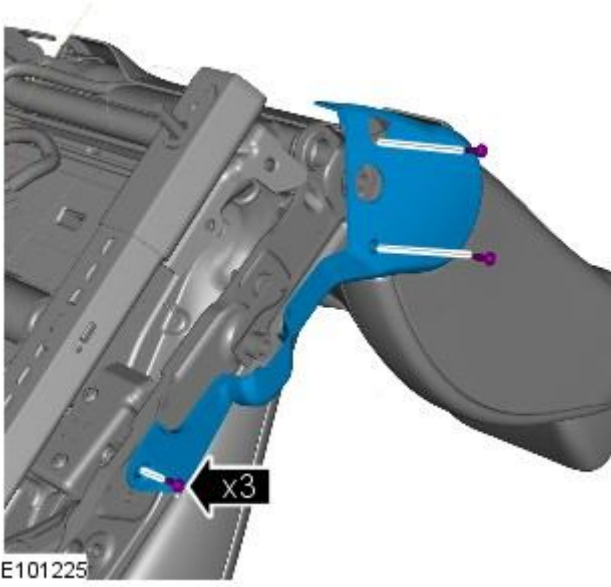
2.



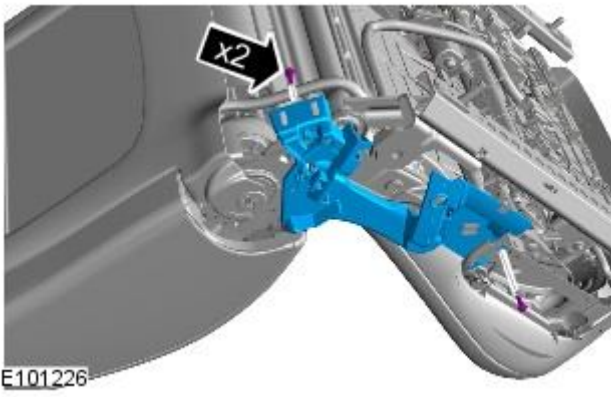
3.



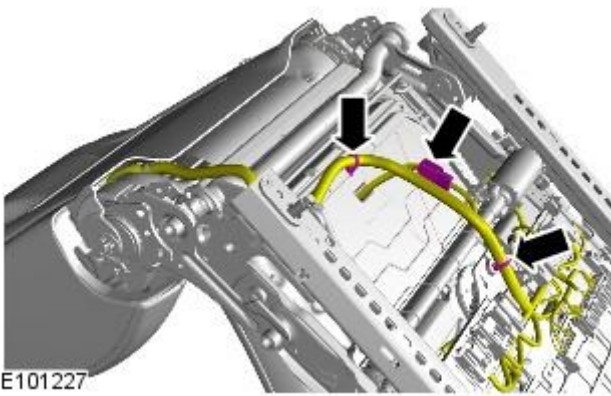
4.

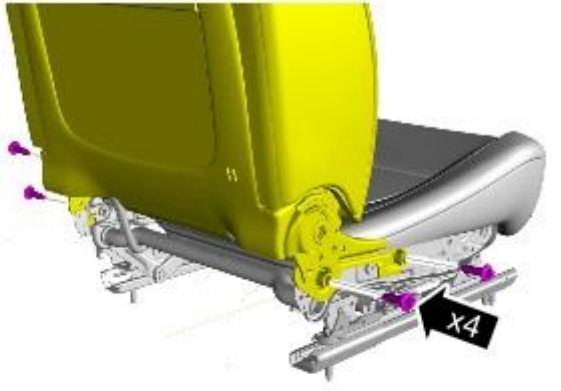



5.




6.





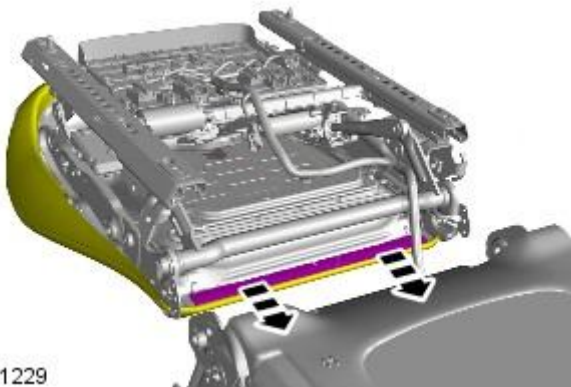
7.  **WARNING:** This step requires the aid of another technician.

 **CAUTION:** Take extra care when handling the component.

*Torque:* 35 Nm

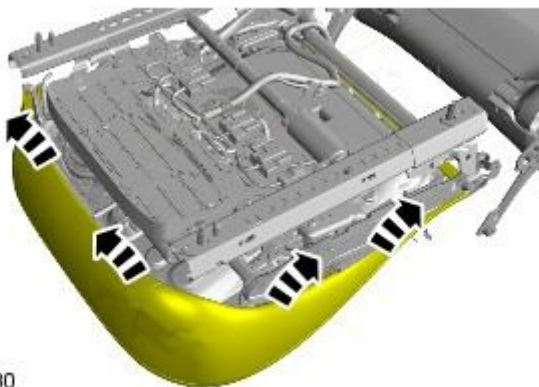


E101228



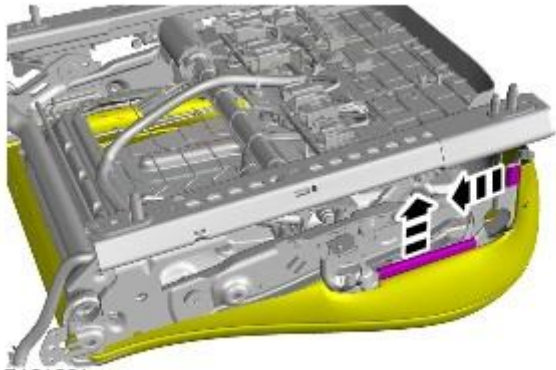
E101229

- 8.



E101230

- 9.



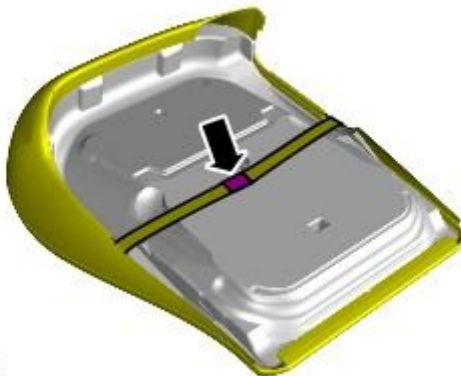
E101231

10.



E101232

11.



E101233

12.

13. **13.** NOTE: Make sure that new hog rings are installed.



E101234

## Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Jaguar approved diagnostic equipment.



## Seating - Front Seat Track Motor

Removal and Installation

### Removal

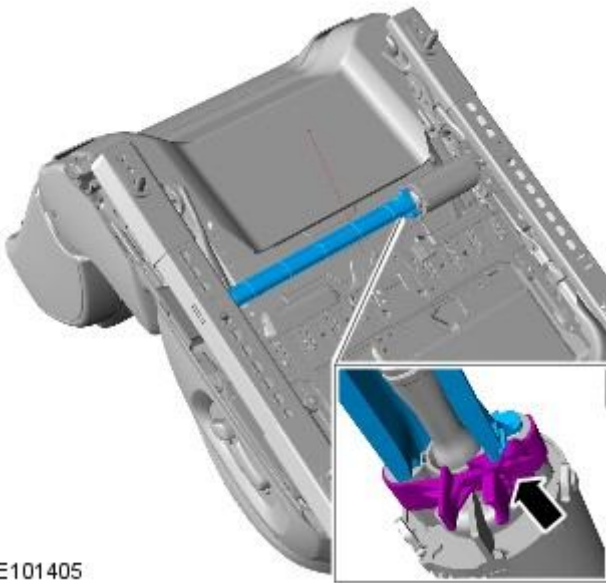
1. Make the air bag supplemental restraint system (SRS) safe.

Refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).

2. Remove the front seat.

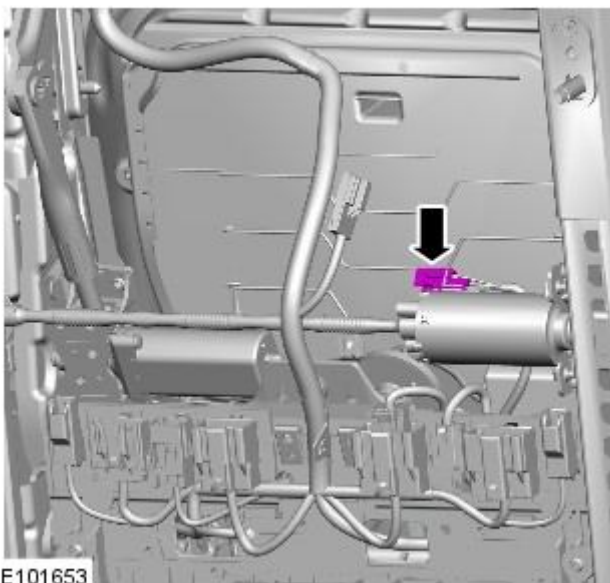
Refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).

- 3.

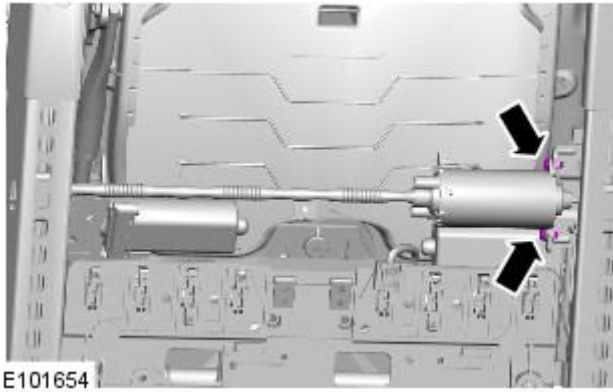


E101405

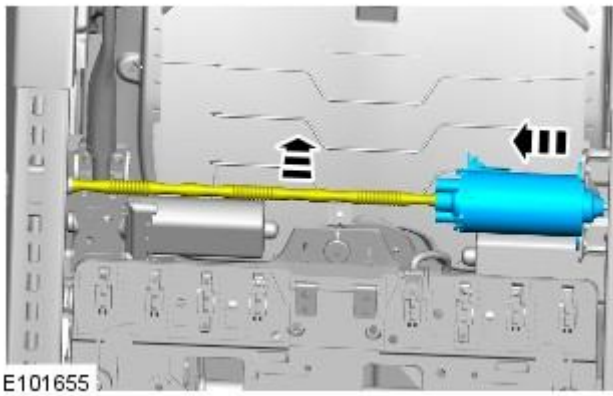
- 4.



E101653



5.



6.

## Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Jaguar approved diagnostic equipment.

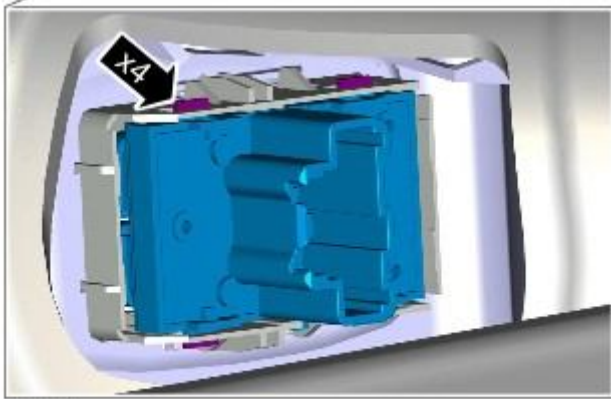
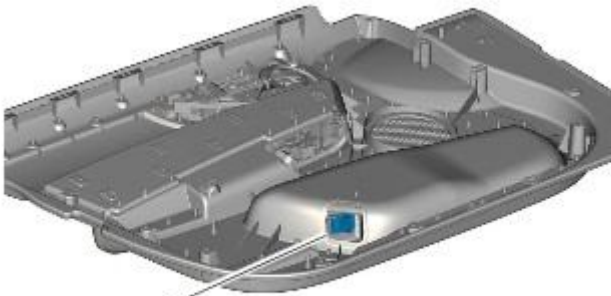
## Seating - Memory Seat Position Switch

Removal and Installation

### Removal

1. Refer to: Front Door Trim Panel (501-05, Removal and Installation).

2.



E93341

### Installation

1. To install, reverse the removal procedure.

## Seating - Seat Base

### Removal and Installation

#### Removal

- WARNINGS:



To avoid accidental deployment, the restraints control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.



Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.



To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.



To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.



To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.



Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.



Painting over the driver air bag module trim cover or instrument panel could lead to deterioration of the trim cover and air bags. Do not for any reason attempt to paint discolored or damaged air bag module trim covers or instrument panel. Install a new component. Failure to follow this instruction may result in personal injury.

- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

- NOTE: Removal steps in this procedure may contain installation details.

1. Make the air bag supplemental restraint system (SRS) safe.

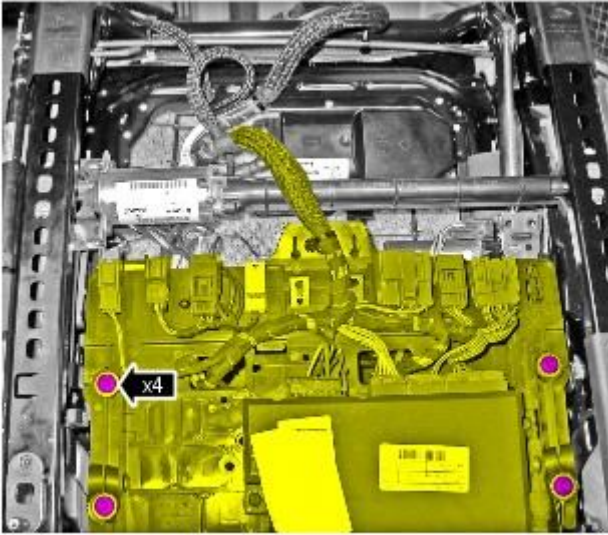
Refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).

2. Refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).

3. Refer to: [Front Safety Belt Buckle](#) (501-20A Safety Belt System, Removal and Installation).

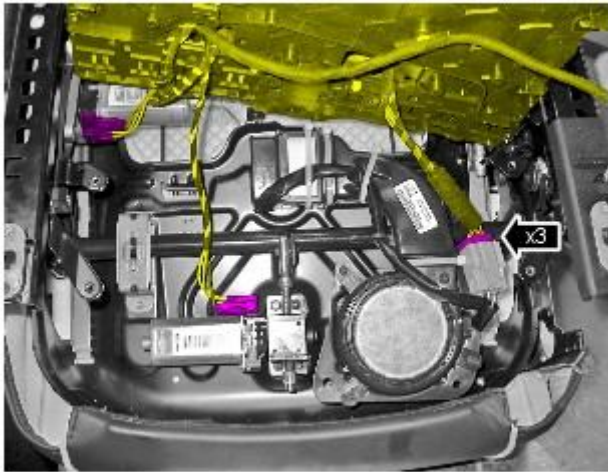
4. Refer to: [Front Seat Cushion Cover](#) (501-10 Seating, Removal and Installation).

5.



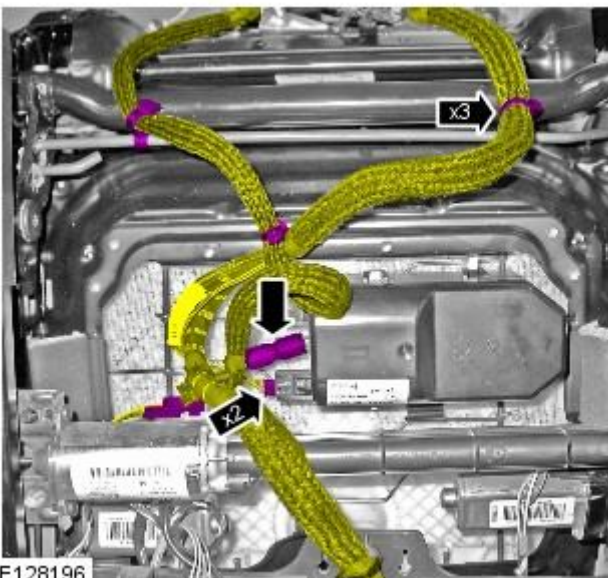
E128198

6.

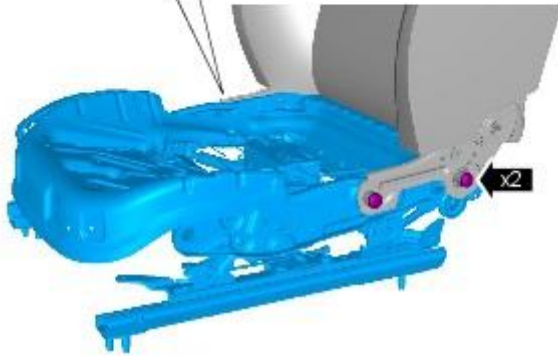
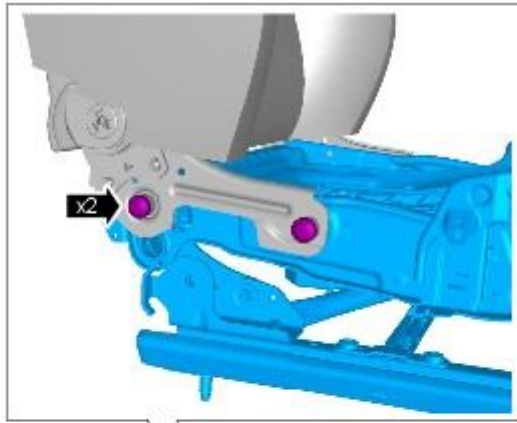


E128197

7.



E128196



E128209

## Installation

8.  **CAUTION:** Make sure that new bolts are installed.

*Torque:* 35 Nm

1. To install, reverse the removal procedure.

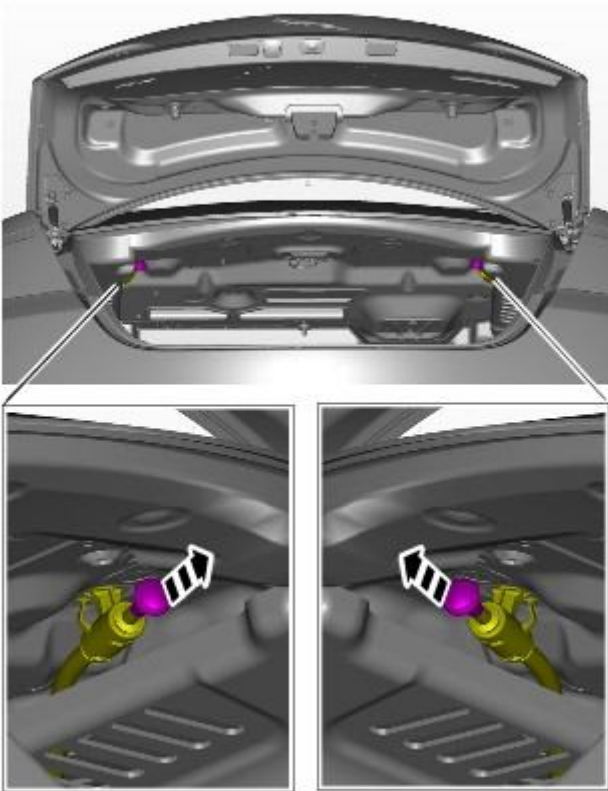


## Seating - Rear Seat Backrest Cover

Removal and Installation

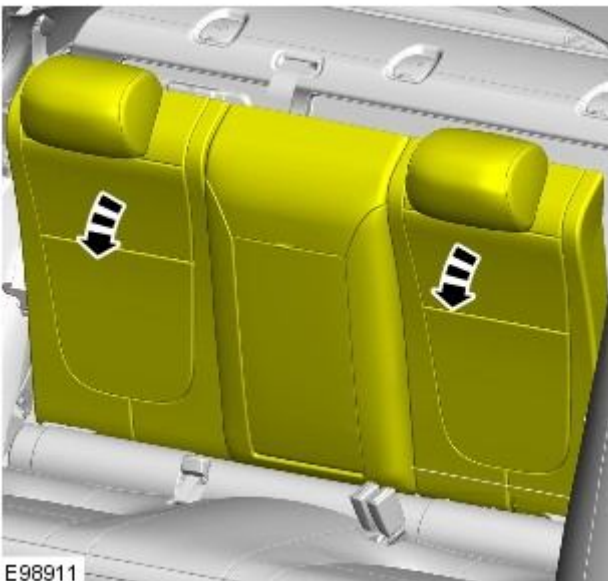
### Removal

1. Remove the rear seat cushion.  
For additional information, refer to: [Rear Seat Cushion](#) (501-10 Seating, Removal and Installation).
2. Release both the rear seat back rest catches.



E98909

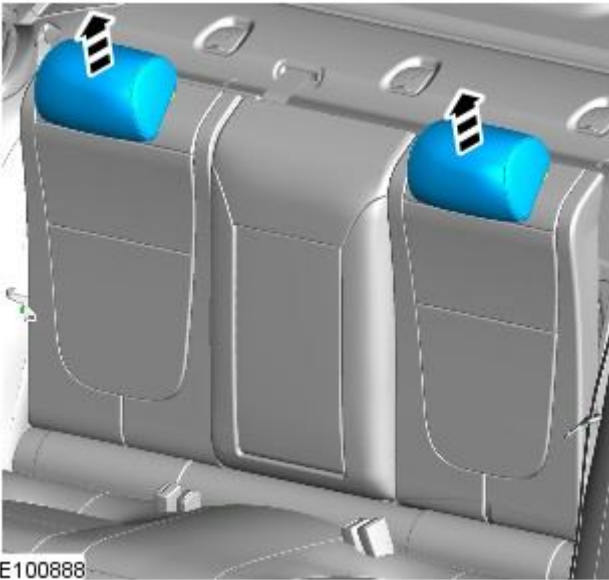
3. Fold down the rear seat backrest.



E98911

4. Remove the rear seat head restraint(s).

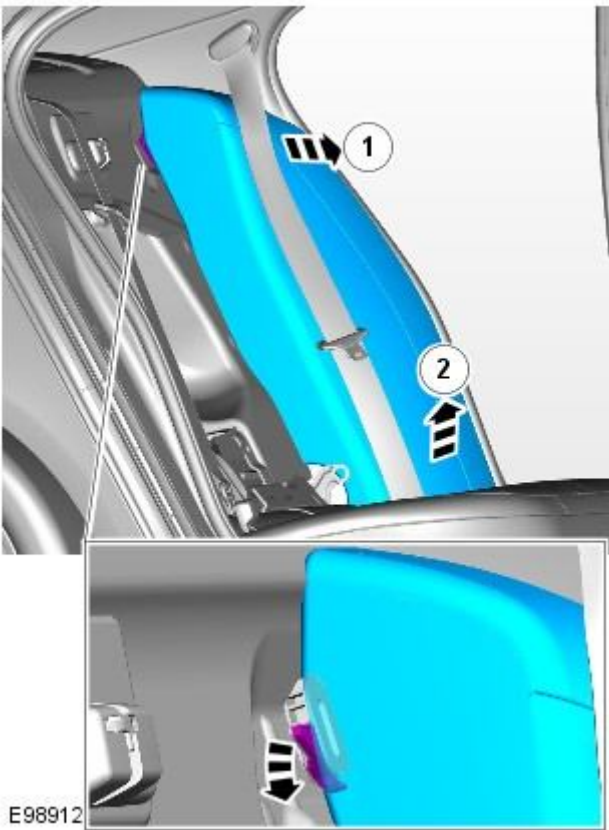
- Lower both rear seats.




5. NOTE: The procedure must be carried out on both sides of the seat.

- NOTE: Left-hand shown, right-hand similar.

Remove both rear seat bolsters.

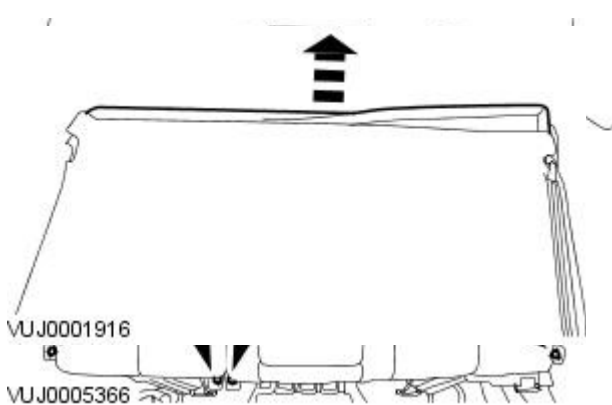


7. Release the backrest cover.

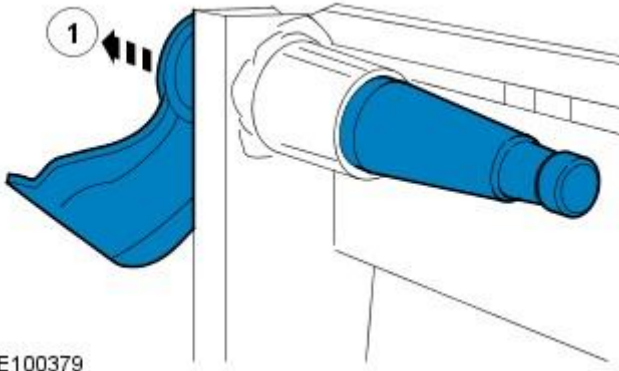
6.  CAUTION: Make sure no damage is caused to the vehicle trim when releasing the rear seat.

With assistance, remove the rear seat backrest.

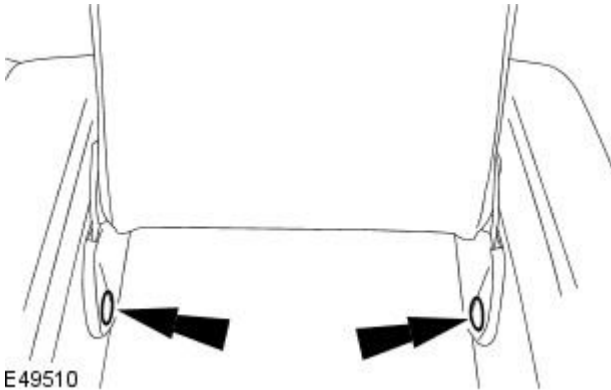
- Both rear seat backrests need to be in an upright position but not latched for access to retaining bolts.



8. Remove the rear seat backrest hinge(s).

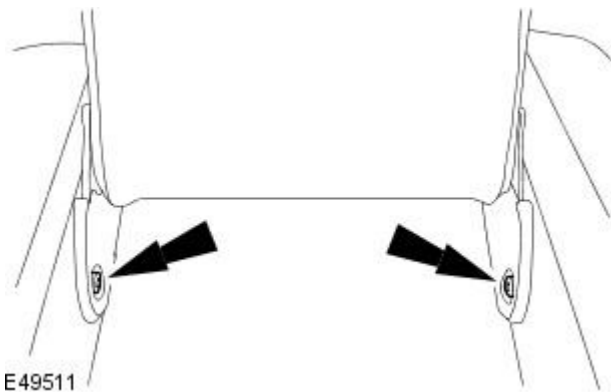



9. Remove the rear armrest retaining screw covers.



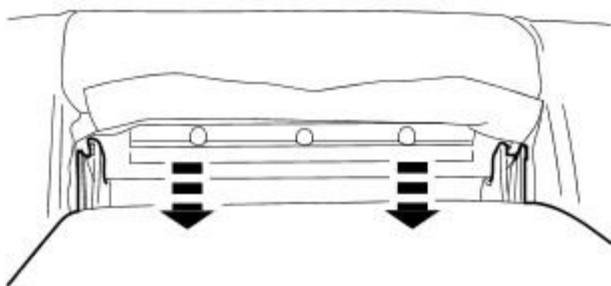
10. Remove the rear armrest retaining screws.

- Remove the 2 Torx screws.



11.  CAUTION: Make sure no damage is caused to the seat trim when removing the seat armrest.

Remove the rear seat armrest.



12. Release the rear seat backrest cover from the armrest aperture.

- Release the 3 plastic retaining strips from the securing clips.

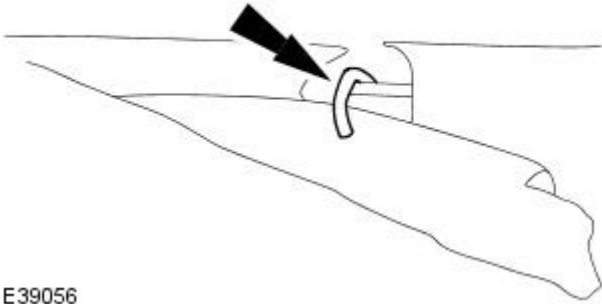
13. Remove the cappings from the rear head restraint retaining posts.

- Release the rear backrest cover over the head restraint posts.

**14.** Remove the rear seat backrest cushion and cover from the rear seat backrest.

**15.** Remove and discard the hog rings.

- Remove the 36 hog rings securing the rear 60% seat backrest cover to the backrest seat cushion.
- Remove the 26 hog rings securing the rear 40% seat backrest cover to the backrest seat cushion.



E39056

**16.** Remove the rear seat backrest cover.

### Installation

**1.** NOTE: Make sure that new hog rings are installed.

- NOTE: Use hog ring pliers to close the hog rings. Do not use any other tool. The hog rings must be closed to overlap as illustrated.

To install, reverse the removal procedure.

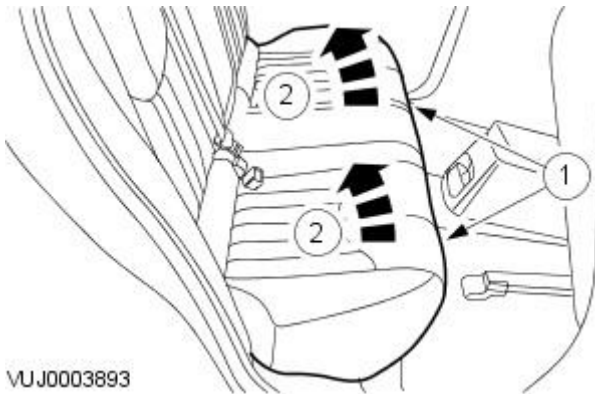
## Seating - Rear Seat Cushion

Removal and Installation

### Removal

1. Detach the rear seat cushion.

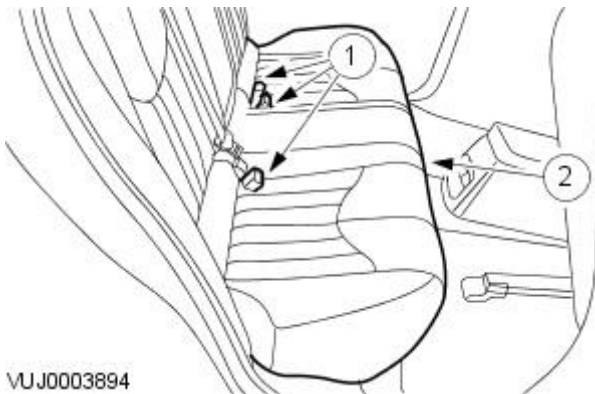
- Release the rear seat cushion retaining clips.
- Detach the rear seat cushion.



VUJ0003893

2. Remove the rear seat cushion.

- Guide the safety belt buckles through the rear seat cushion aperture.
- Remove the rear seat cushion.



VUJ0003894

### Installation

1. To install, reverse the removal procedure.

## Seating - Front Seat Height Adjustment Motor

Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Make the air bag supplemental restraint system (SRS) safe.

Refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).

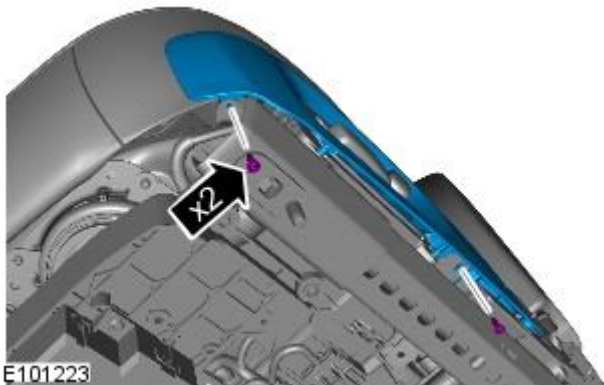
2. Disconnect the battery ground cable.

Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

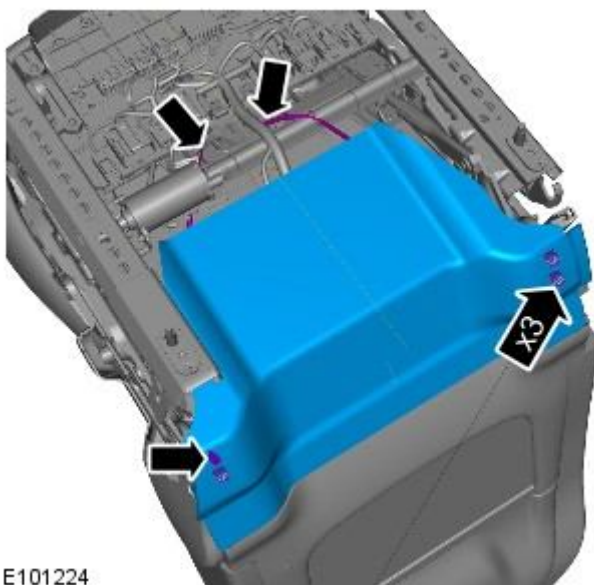
3. Remove the front seat.

Refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).

- 4.

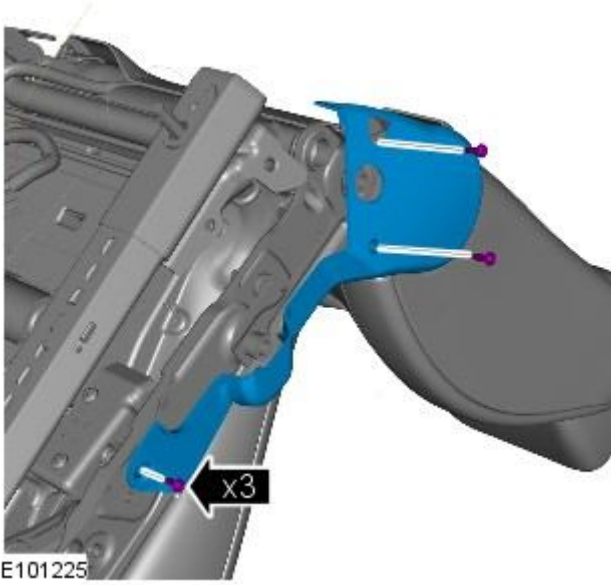


- 5.

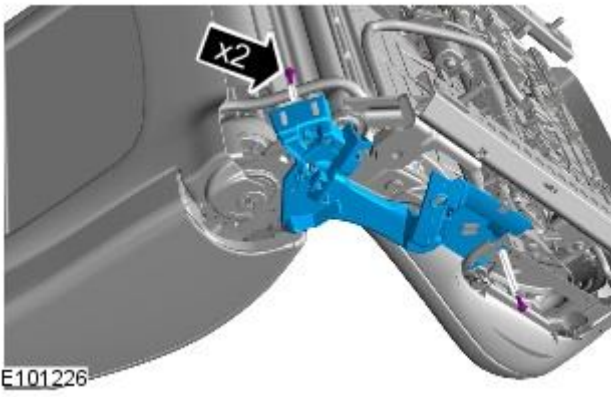




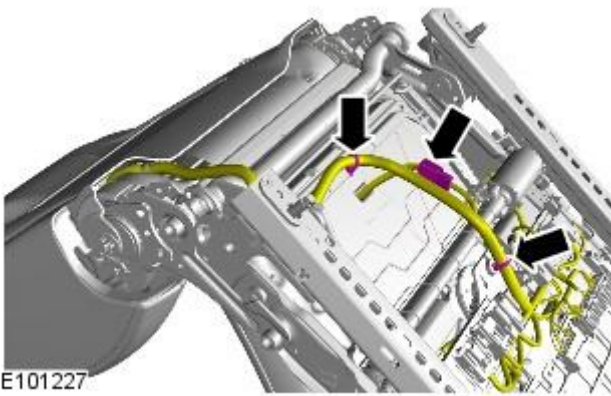
6.

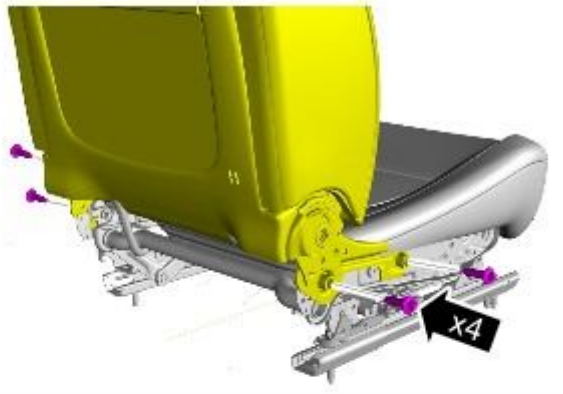



7.



8.

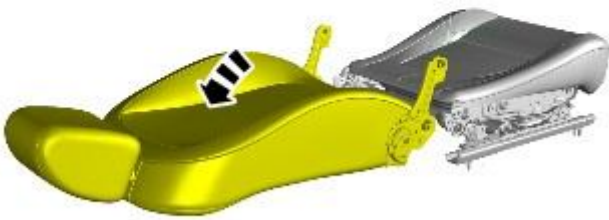




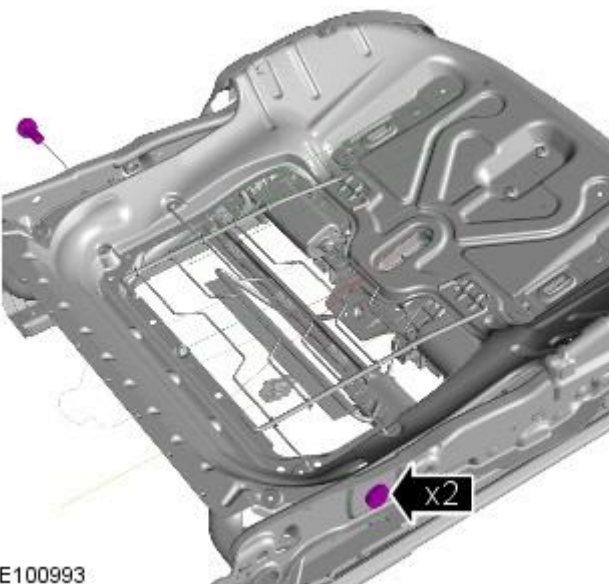
9.  **WARNING:** This step requires the aid of another technician.

 **CAUTION:** Take extra care when handling the component.

*Torque:* 35 Nm



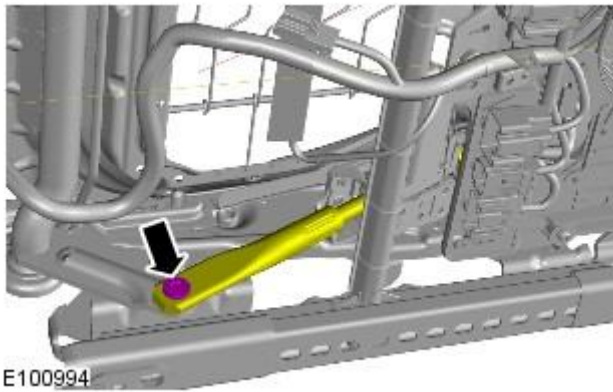
E101228



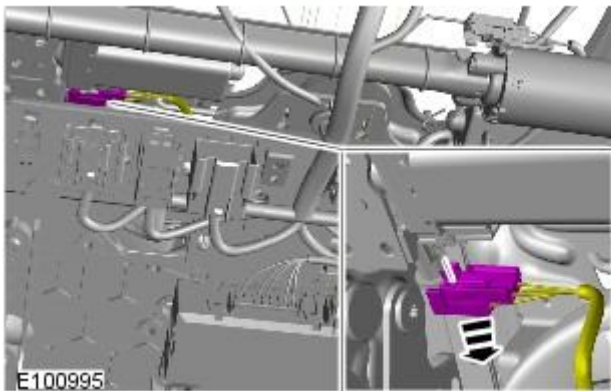
10. **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

*Torque:* 35 Nm

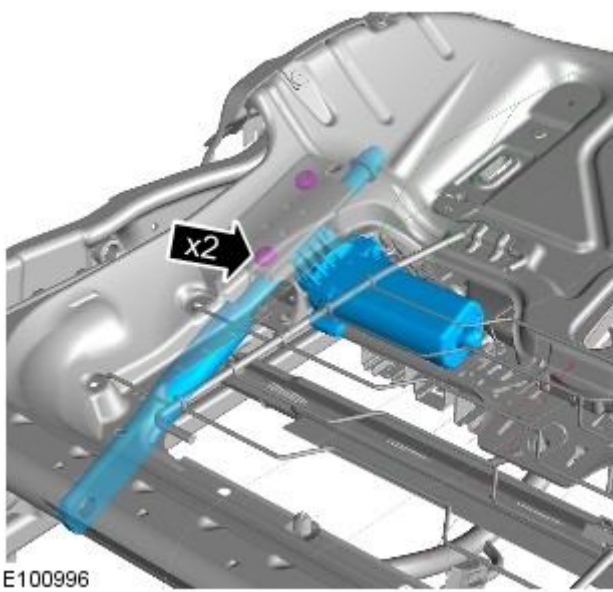
E100993



11. **11.** NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



12. **12.** NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



13. **13.** NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

## Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Jaguar approved diagnostic equipment.

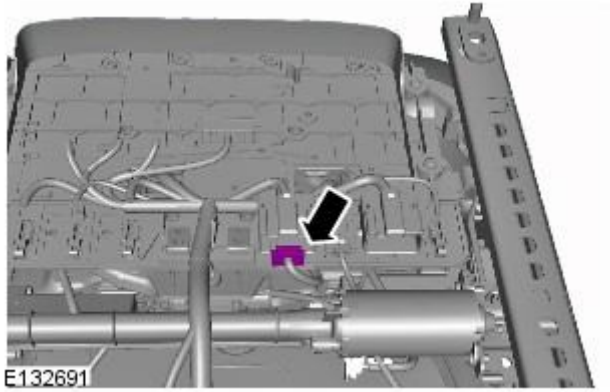
# Seating - Front Seat Control Switch

Removal and Installation

## Removal

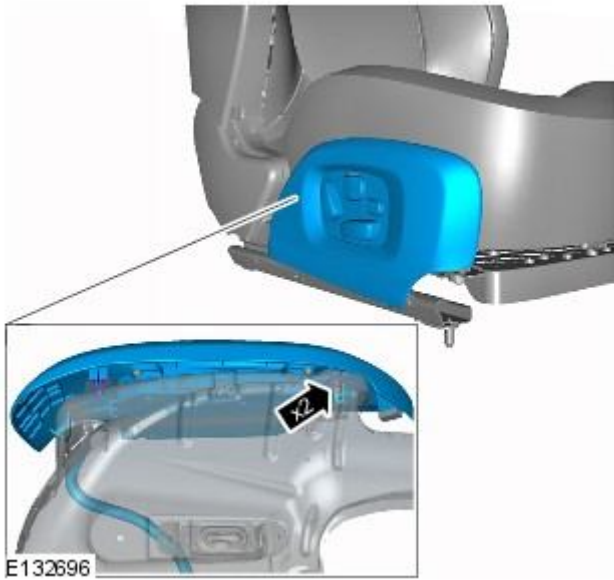
1. Refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).

2.

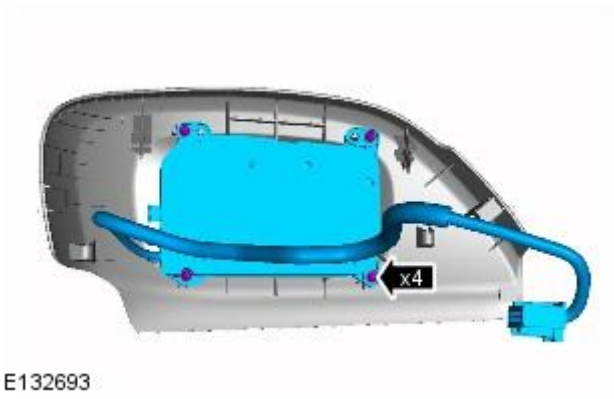


3.



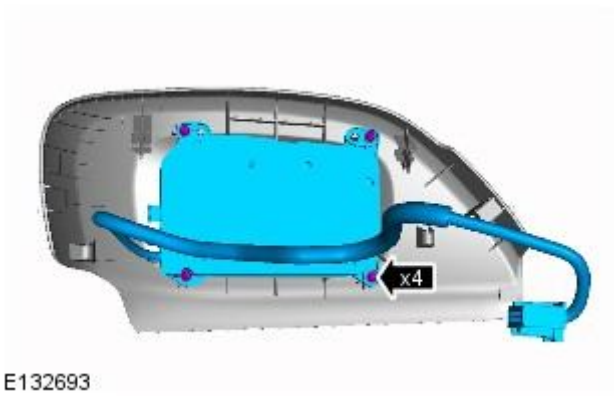


4.
  - Remove and discard the retaining clips.

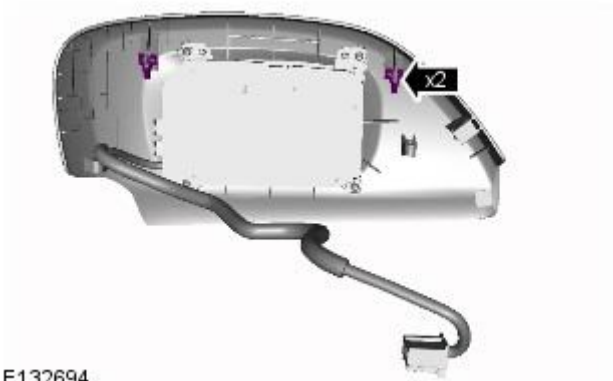


- 5.

## Installation

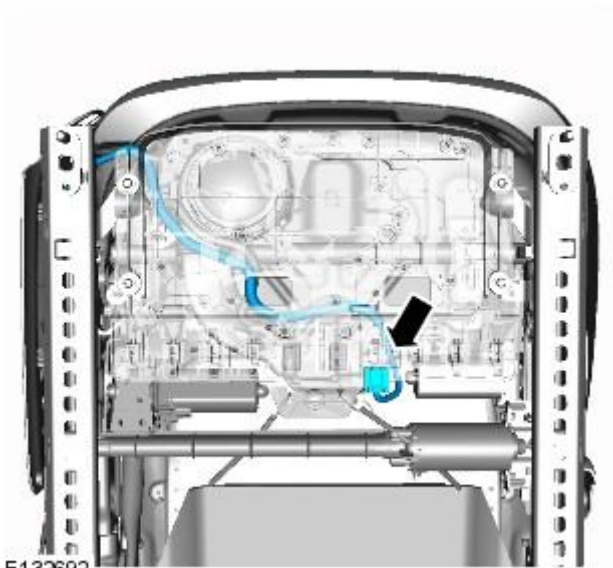


- 1.



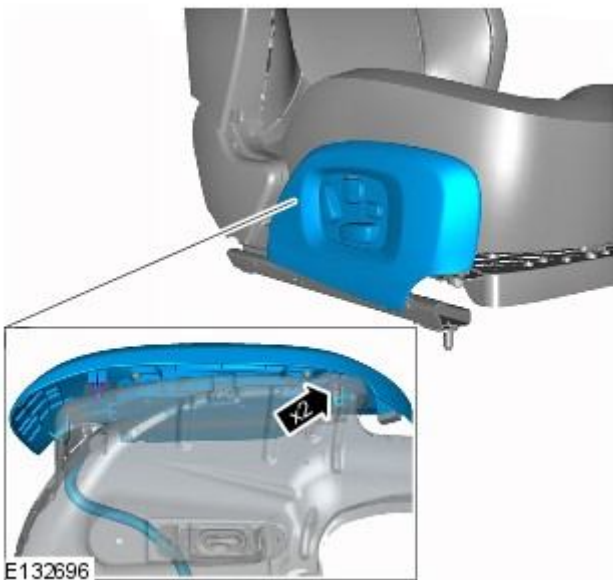
E132694

2. Install new clips.



E132692

3.



E132696

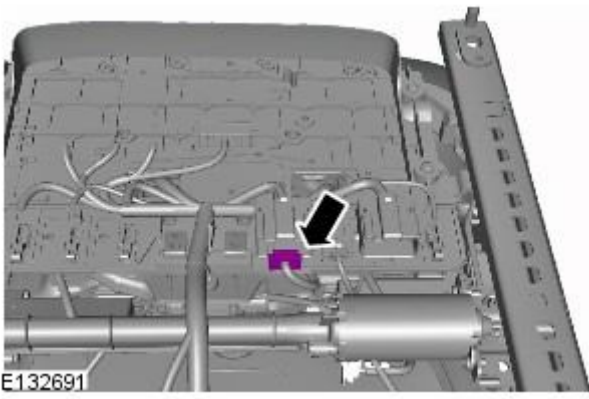
4.



5.



6.



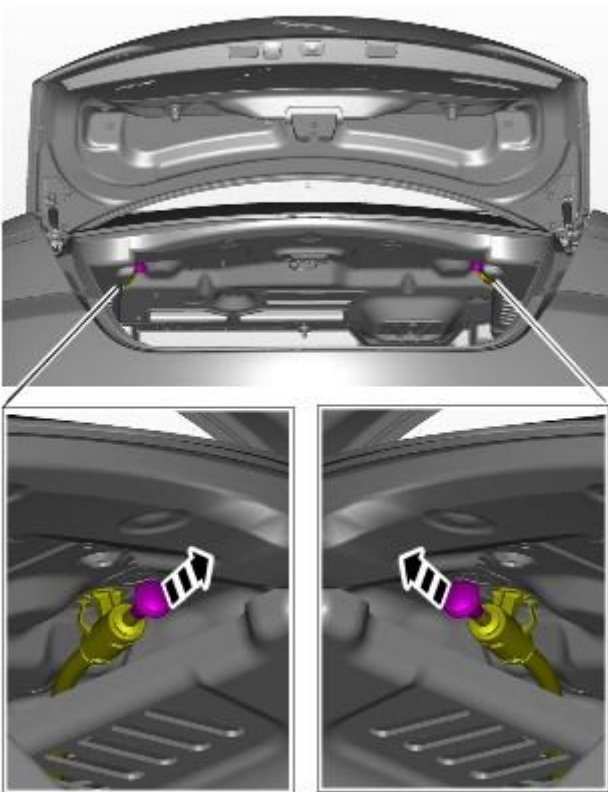
7. Refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).

## Seating - Rear Seat Bolster

Removal and Installation

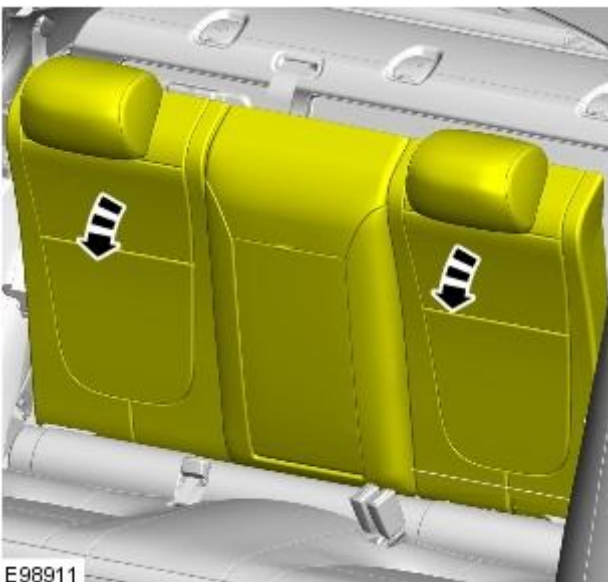
### Removal

1.



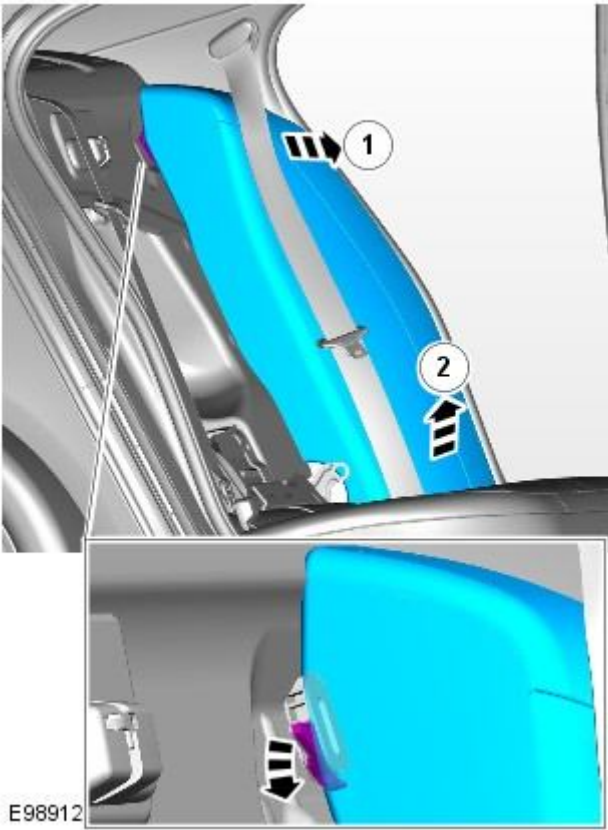
E98909

2.



E98911

3.



## Installation

1. To install, reverse the removal procedure.

## Glass, Frames and Mechanisms -

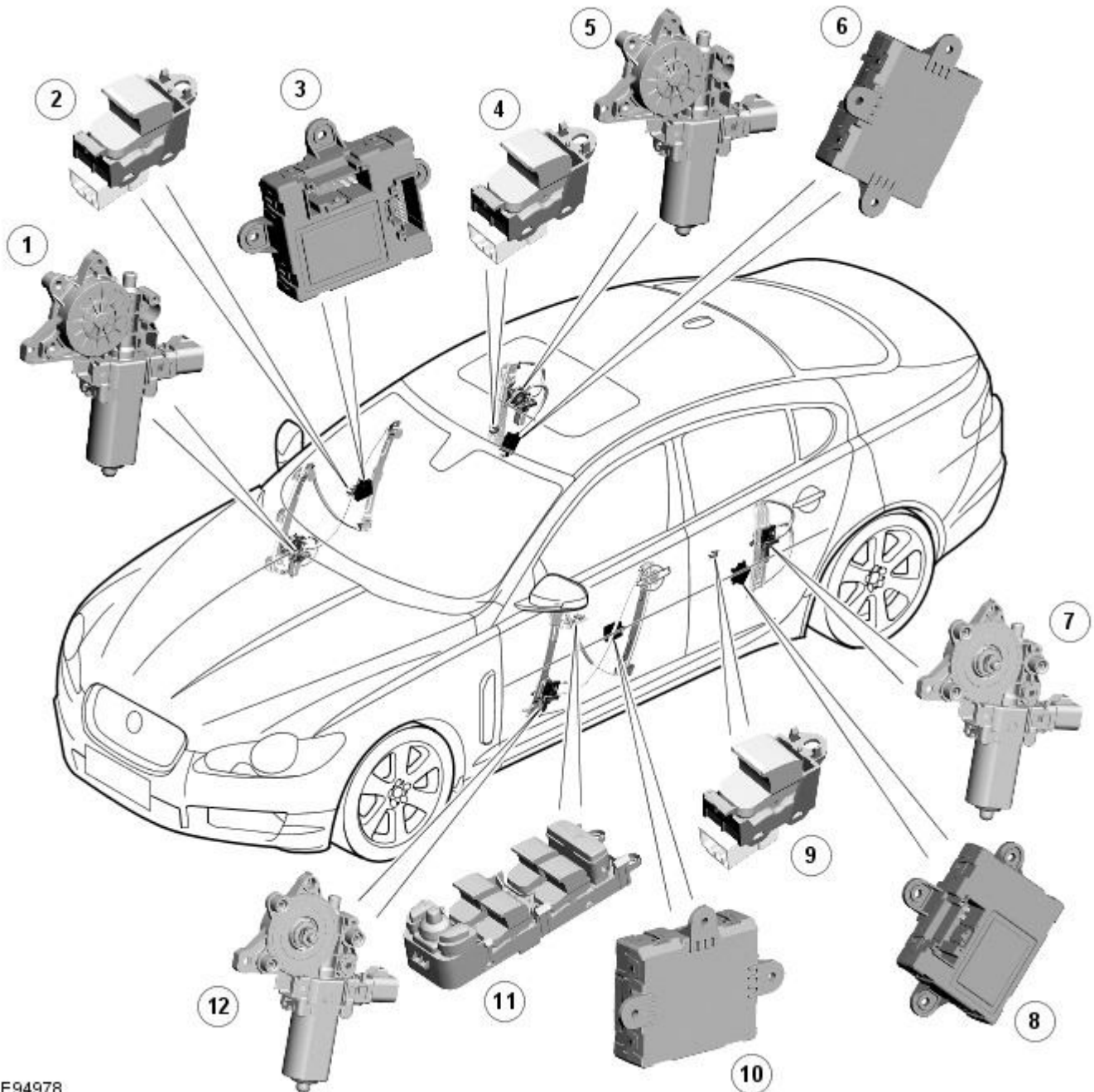
### Torque Specifications

Description	Nm	lb-ft	lb-in
Front door window glass regulator retaining screws to BIW	7	-	62
Front door window glass regulator motor retaining screw to panel	2	-	18
Rear door window glass regulator retaining screws to BIW	7	-	62
Rear door window glass regulator motor retaining screw to panel	2	-	18
Rear door glass run retaining nuts	4	-	35

# Glass, Frames and Mechanisms - Glass, Frames and Mechanisms - Component Location

Description and Operation

Component Location



E94978

## ItemDescription

1	Window regulator motor – front passenger
2	Window control switch - front passenger
3	Door module – front passenger
4	Window control switch – RH (right-hand) rear passenger
5	Window regulator motor – RH rear passenger
6	Door module – RH rear passenger
7	Window regulator motor – LH (left-hand) rear passenger
8	Door module – LH rear passenger
9	Window control switch – LH rear passenger
10	Door module – driver's door
11	Window control switches - driver's door
12	Window regulator motor – driver's door

# Glass, Frames and Mechanisms - Glass, Frames and Mechanisms - Overview

Description and Operation

## Overview

The windshield is manufactured from laminated green-tinted glass with two variants of windshield being available: standard and heated.

The rear window is manufactured from toughened green-tinted glass. The heated rear window grid-wire and antennas are incorporated in the rear window. There are two variants of rear window dependant on the TV antenna specification.

The door windows are manufactured from green-tinted toughened glass. The driver and passenger windows are electrically operated; the rear glass sections in the rear doors are fixed units. Door windows can be operated individually, or by the driver's window control switch. An anti-trap function is included that stops the window's travel when an obstacle is detected in the in the window's path.

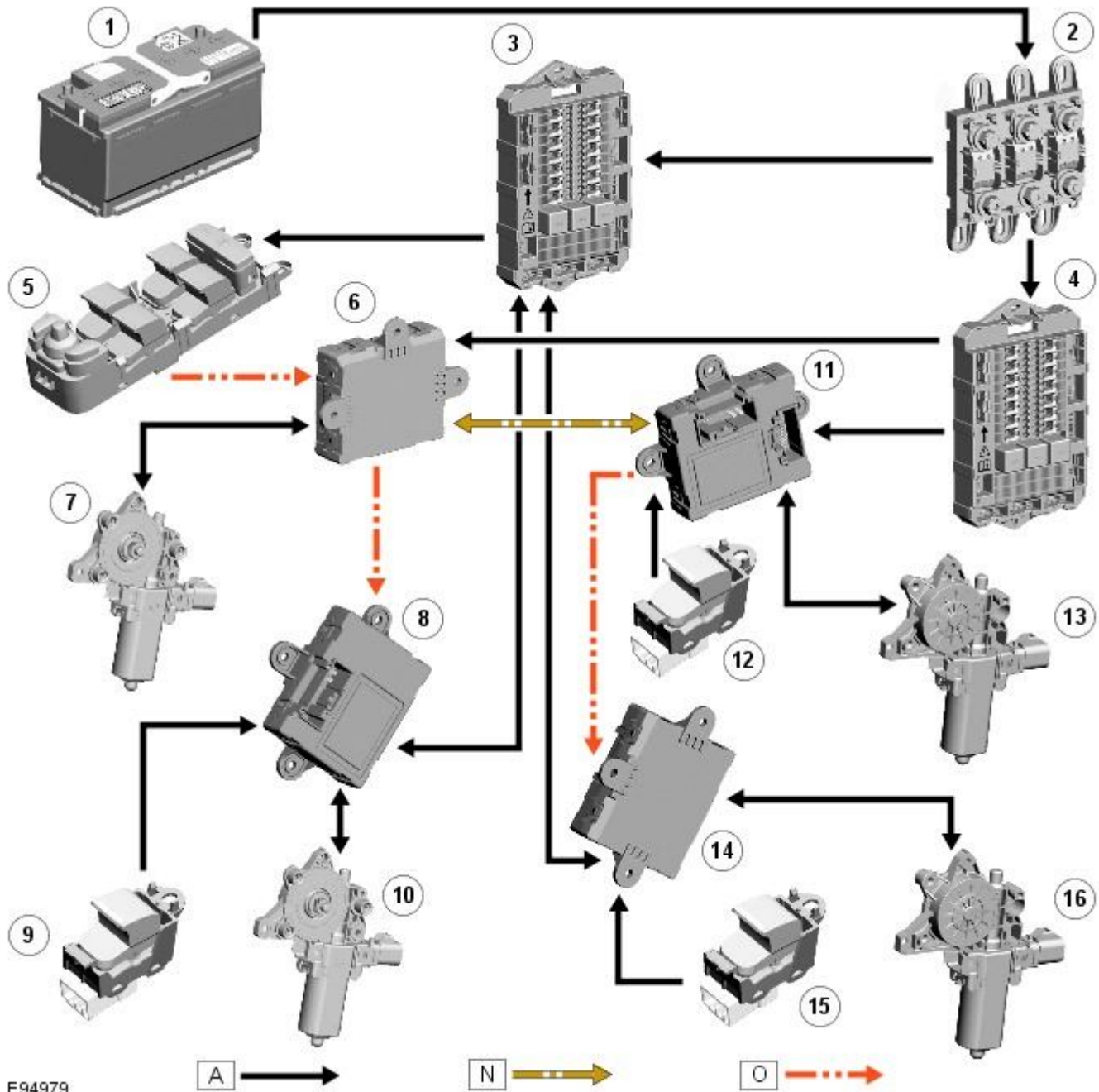


# Glass, Frames and Mechanisms - Glass, Frames and Mechanisms - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **N** = Medium speed CAN; **O** = LIN bus



E94979

### ItemDescription

1	Battery
2	Megafuse (250 amp)
3	CJB (central junction box)
4	RJB (rear junction box)
5	Window control switches - driver's door
6	Door module – driver's door
7	Window regulator motor – driver's door
8	Door module – LH (left-hand) rear passenger
9	Window control switch - LH rear passenger
10	Window regulator motor – LH rear passenger
11	Door module – front passenger

12	Window control switches - front passenger
13	Window regulator motor – front passenger
14	Door module – RH (right-hand) rear passenger
15	Window control switch - RH rear passenger
16	Window regulator motor – RH rear passenger

## System Operation

### Door Windows

All windows can be operated individually, or by the driver's window control switch. The operation of the windows is proportional to the switch activation. The driver window can be controlled by 'one touch' in an upward or downward direction. When the 'one touch' operation is activated in the upwards direction an anti-trap sensor is automatically checked prior to the window closing. If the anti-trap sensor is inoperative the window will not close. When the anti-trap sensor detects an obstacle in the window's path, the upward travel of the window will automatically cease. Downward travel of the window will begin and then stop when a preset time has elapsed.

Electric window operation is enabled while the ignition is in power mode 4 and 6. When the switches in the driver's door are used to operate the passenger windows, the driver's door module outputs a related message on the LIN (local interconnect network) bus and medium speed CAN (controller area network) bus. The passenger door module responds to the message by operating the appropriate window. When the child lock is engaged, the rear door modules ignore inputs from the rear window switches.

#### End of travel shut off

End of travel shut-off for the window motors is determined by monitoring the current draw of the motors. Each time it switches on a window motor, the door module measures the window motor current for a preset time. The maximum value measured within that time is stored as the switch-on current. When the window motor current next exceeds the switch-on current, the door module assumes the window has reached the end of its travel and switches off the power supply to the window motor even if a window switch is still being activated.

#### Anti-trap

The anti-trap function is enabled for window closing in both the inching and one-shot modes. If the anti-trap feature is activated while a window is closing, the window motor is reversed for a preset period.

A Hall sensor, located in the window regulator motor, monitors the speed of the motor and if the speed decreases below a set threshold, indicating an obstruction, the power feed to the motor is reversed so the window goes back down for preset time.

In an emergency the anti-trap function can be overridden by holding the window switch in the one-shot closed position.

After the battery has been disconnected it is necessary to initialize the door window motors to be able to operate the one-shot up function.

## Component Description

### Windshield

The windshield, manufactured from 5mm laminated green-tinted glass is positioned to the vehicle's body by two locator pins, one in each top corner of the windshield. This allows for centralizing movement of the windshield across the car upon fitment. The base of the windshield carries a leaf-screen retainer. The windshield is bonded and sealed to the vehicle body aperture using Polyurethane (PU) adhesive. The windshield finisher is a three-sided extruded flip, taped onto the inner surface of the glass; this helps to centralize the glass in the aperture.

Two variants of windshield are available:

- standard, and
- heated.

Refer to: [Control Components](#) (412-01 Climate Control, Description and Operation).

### Interior Mirror and Rain Sensor

The interior mirror and rain sensor mounting positions are located at the top of the windshield.  
Refer to: [Wipers and Washers](#) (501-16 Wipers and Washers, Description and Operation).

### Rear Window

The rear window, manufactured from toughened 4mm green-tinted glass, is positioned to the vehicle's body by two locator pins, one in each top corner of the windshield. This allows for the centralizing movement of the windshield across the car upon fitment. The window is bonded and sealed to the vehicle body aperture using PU adhesive. The window finisher is a three-sided extruded flip, taped onto the inner surface of the glass; this helps to centralize the glass in the aperture.

The heated rear window grid wire and antennas are incorporated in the rear window. There are two derivatives of rear window dependant on the TV antenna specification.

Refer to: [Video System](#) (415-01 Information and Entertainment System, Description and Operation).

### Door Windows

The door windows are manufactured from 4.85mm green-tinted toughened glass. The driver and passenger windows are electrically operated, and are raised and lowered by a cable mechanism; the rear glass sections in the rear doors are fixed units.

All windows can be operated individually, or by the driver's window control switch. The operation of the windows is proportional to the switch activation. The driver window can be controlled by 'one touch' in an upward or downward direction. When the 'one touch' operation is activated in the upwards direction an anti-trap sensor is automatically checked prior to the window closing. If the anti-trap sensor is inoperative the window will not close. When the anti-trap sensor detects an obstacle in the window's path, the upward travel of the window will automatically cease. Downward travel of the window will begin and then stop when a preset time has elapsed.

# Glass, Frames and Mechanisms - Glass, Frames and Mechanisms

Diagnosis and Testing

## Principle of Operation

For a detailed description of the Glass, Frames and Mechanisms, refer to the relevant Description and Operation section in the workshop manual. REFER to: (501-11 Glass, Frames and Mechanisms)

[Glass, Frames and Mechanisms](#) (Description and Operation),  
[Glass, Frames and Mechanisms](#) (Description and Operation),  
[Glass, Frames and Mechanisms](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern by operating the system.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Window glass</li> <li>● Window regulator</li> </ul>	<ul style="list-style-type: none"> <li>● Fuse(s)</li> <li>● Window motor</li> <li>● Loose or corroded electrical connector(s)</li> <li>● Switch</li> <li>● Circuit(s)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the concern is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

- NOTE: If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.
- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).
- NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.
- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.
- NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B109712	Heated Windshield Relay	<ul style="list-style-type: none"> <li>● Heated windshield relay control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check heated windshield relay control circuit for short to power
B109714	Heated Windshield Relay	<ul style="list-style-type: none"> <li>● Heated windshield relay control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check heated windshield relay control circuit for short to ground, open circuit
B117C07	Rear Power Window Up	<ul style="list-style-type: none"> <li>● Mechanical failure</li> </ul>	Check rear window mechanism for mechanical failure
B117C72	Rear Power Window Up	<ul style="list-style-type: none"> <li>● Actuator stuck open</li> </ul>	Suspect the rear door module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B117C73	Rear Power Window Up	<ul style="list-style-type: none"> <li>● Actuator stuck closed</li> </ul>	Suspect the rear door module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B117C92	Rear Power Window Up	<ul style="list-style-type: none"> <li>● Performance or incorrect operation</li> </ul>	Refer to the electrical circuit diagrams and check rear door module power and ground supplies

<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
B117D72	Rear Power Window Down	<ul style="list-style-type: none"> <li>● Actuator stuck open</li> </ul>	Suspect the rear door module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B117D73	Rear Power Window Down	<ul style="list-style-type: none"> <li>● Actuator stuck closed</li> </ul>	Suspect the rear door module. Check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
B117E07	Front Power Window Up	<ul style="list-style-type: none"> <li>● Mechanical failure</li> </ul>	Check front window mechanism for mechanical failure
B117E72	Front Power Window Up	<ul style="list-style-type: none"> <li>● Actuator stuck open</li> </ul>	Suspect the DDM. Check and install a new DDM as required, refer to the new module/component installation note at the top of the DTC Index
B117E73	Front Power Window Up	<ul style="list-style-type: none"> <li>● Actuator stuck closed</li> </ul>	Suspect the DDM. Check and install a new DDM as required, refer to the new module/component installation note at the top of the DTC Index
B117F72	Front Power Window Down	<ul style="list-style-type: none"> <li>● Actuator stuck open</li> </ul>	Suspect the DDM. Check and install a new DDM as required, refer to the new module/component installation note at the top of the DTC Index
B117F73	Front Power Window Down	<ul style="list-style-type: none"> <li>● Actuator stuck closed</li> </ul>	Suspect the DDM. Check and install a new DDM as required, refer to the new module/component installation note at the top of the DTC Index
B118929	Front Window Position Sensor	<ul style="list-style-type: none"> <li>● Front window hall position sensor - signal invalid</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B118A29	Rear Window Position Sensor	<ul style="list-style-type: none"> <li>● Rear window hall position sensor - signal invalid</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

## Glass, Frames and Mechanisms - Door Window Motor Initialization

### General Procedures

**1. NOTE:** After the battery has been disconnected it is necessary to initialize each door window motor separately to operate the "one-touch" up function.

Operate the window control switch until the door window glass is in the fully closed position, continue to operate the window control switch for a further two seconds.

**2.** Release the window control switch.

**3.** Operate the window control switch in the closed position and continue to operate the window control switch for a further two seconds.

**4.** Operate the window control switch until the door window glass is in the fully open position ("one-touch" down).

**5. NOTE:** If the door window motor initialization has been completed correctly, when the window control switch is operated, the door window glass should move to the fully closed position ("one-touch" up) automatically.

• **NOTE:** If the door window glass does not fully close automatically ("one-touch" up), repeat the complete procedure.

Operate the window control switch once to the close position.

**6.** Repeat the door window motor initialization for each door window motor.

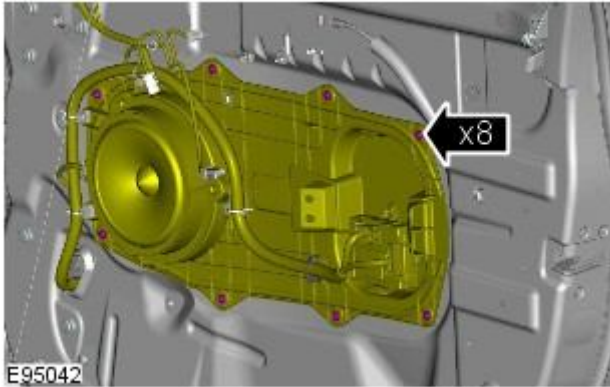


# Glass, Frames and Mechanisms - Door Window Regulator Motor

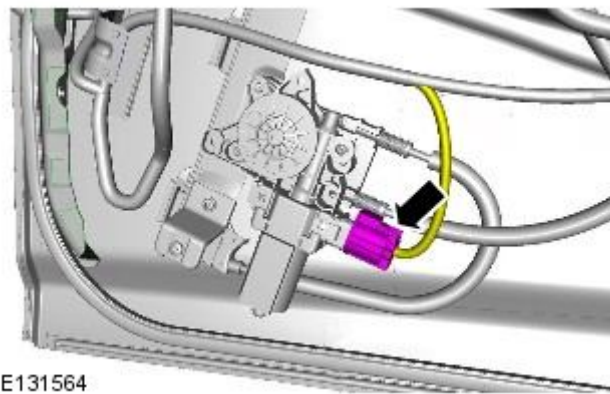
Removal and Installation

## Removal

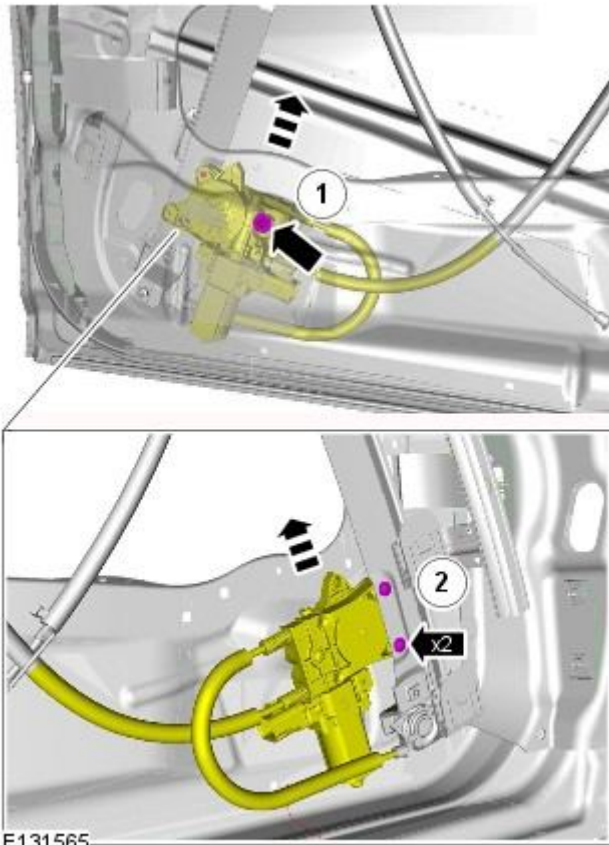
1. Refer to: [Front Door Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).



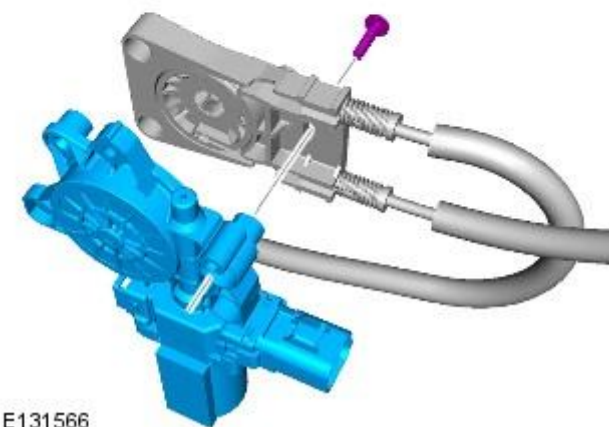
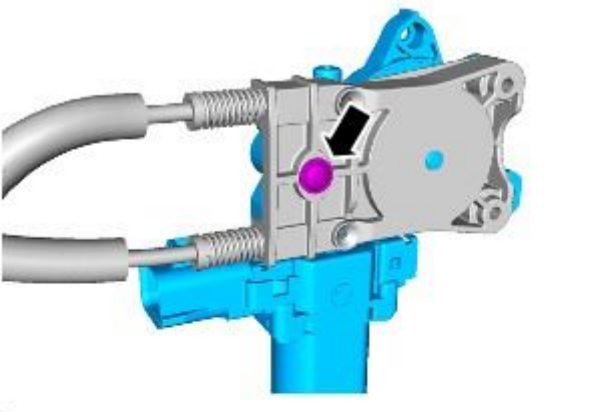
2. **2.** NOTE: Right-hand shown, left-hand similar.



3. **3.** NOTE: Components removed for clarity.



E131565

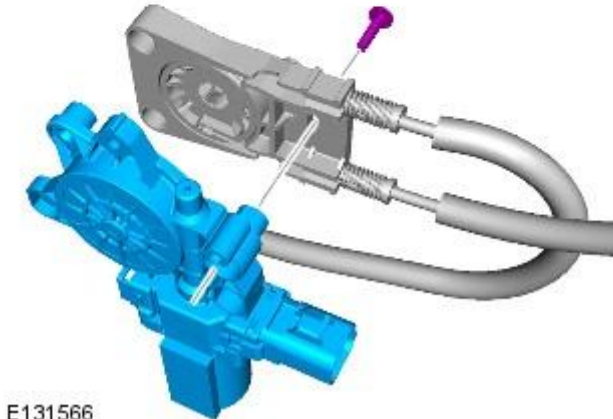
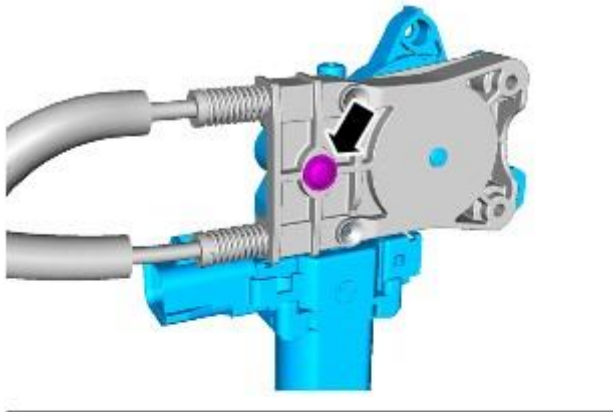


E131566

4. **4. NOTE:** Make sure the door window glass is in the fully closed position.
  - **NOTE:** Components removed for clarity.
    - Apply suitable adhesive tape to the door window glass and over the door frame, to prevent the door window glass from damage.

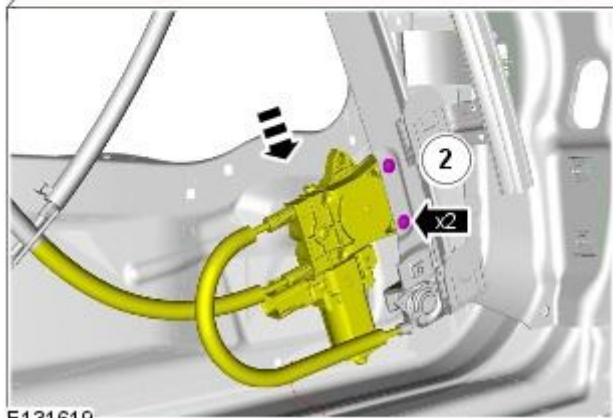
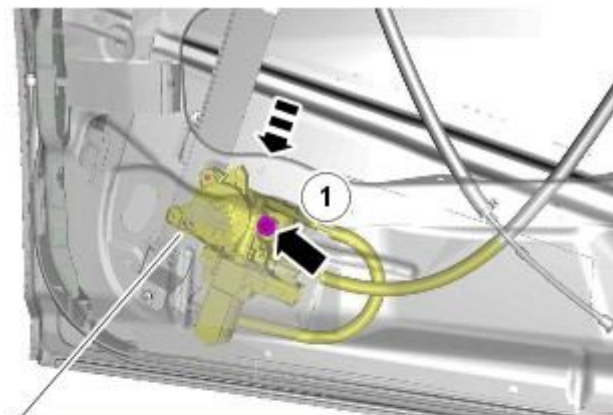
5. **5. ⚠ CAUTION:** Make sure the drum remains in position. Use a suitable flat blade screwdriver to secure the drum while separating the motor.

## Installation



E131566

1.
  - Torque: 5 Nm



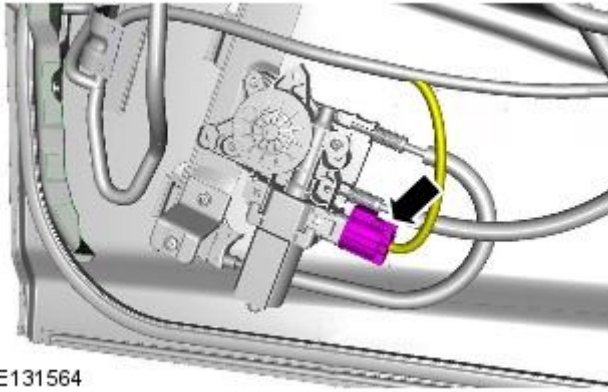
E131619

2. **2. CAUTIONS:**

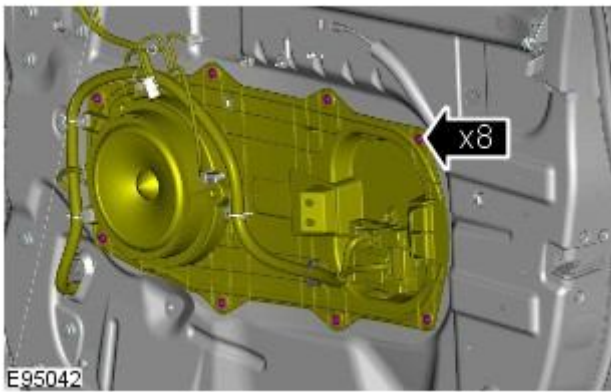
 Install all the bolts finger tight before final tightening.

 Care must be taken not to damage the outer door panel.

- Install the retaining bolt 1 to the witness mark on the body.
- Torque:
  - 1 1.9 Nm
  - 2 5 Nm



3. **3.** NOTE: Components removed for clarity.



4. **4.** NOTE: Right-hand shown, left-hand similar.

- Torque: 1.5 Nm

5. Refer to: [Front Door Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

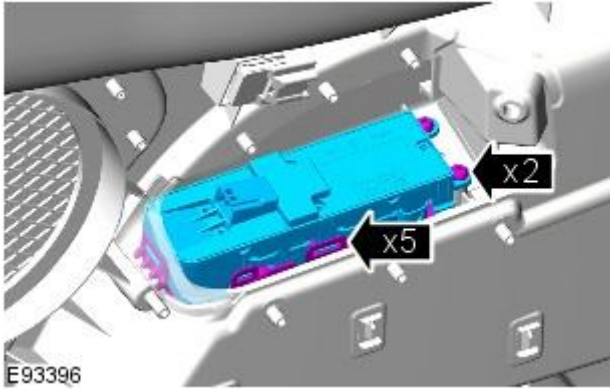
# Glass, Frames and Mechanisms - Driver Door Window Control Switch

Removal and Installation

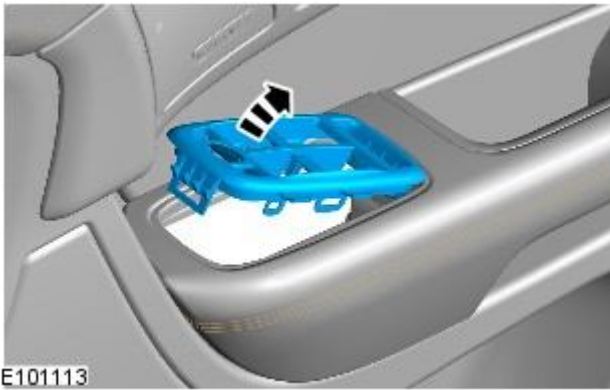
## Removal

1. For additional information, refer to: [Front Door Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



3.



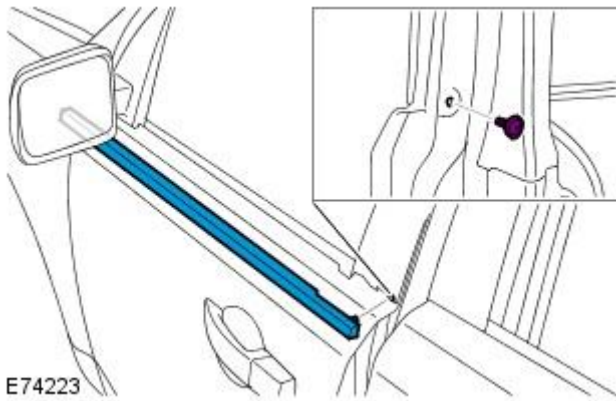
## Installation

1. To install, reverse the removal procedure.

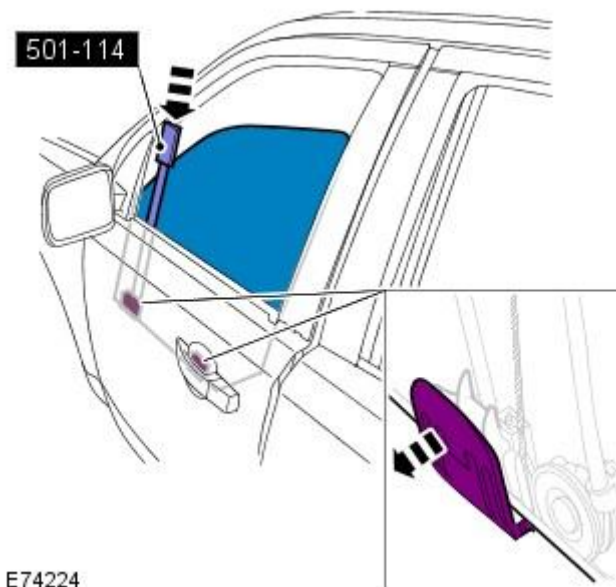
# Glass, Frames and Mechanisms - Front Door Window Glass

Removal and Installation

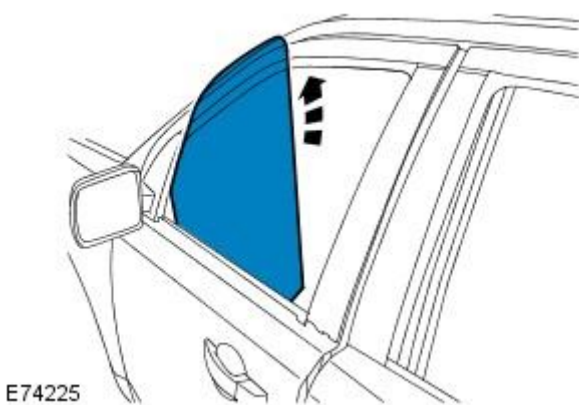
## Removal



1.



2.



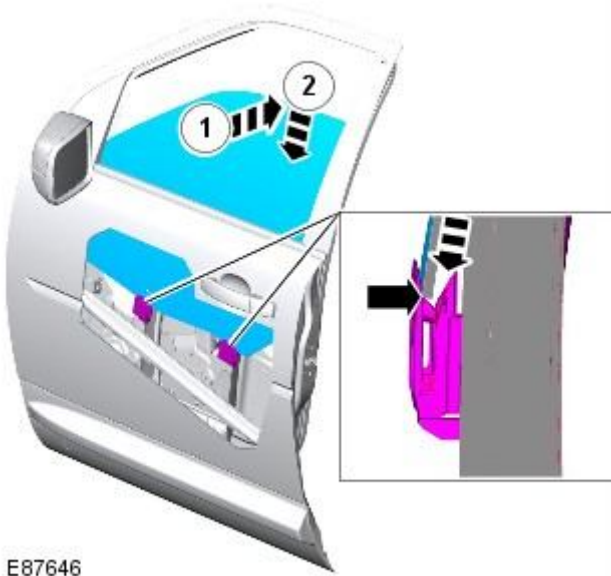
3.

## Installation

1. To install, reverse the removal procedure.




2.



E87646

# Glass, Frames and Mechanisms - Front Door Window Regulator and Motor

Removal and Installation

Special Tool(s)	
 501-114 E54200	Door glass release lever 501-114

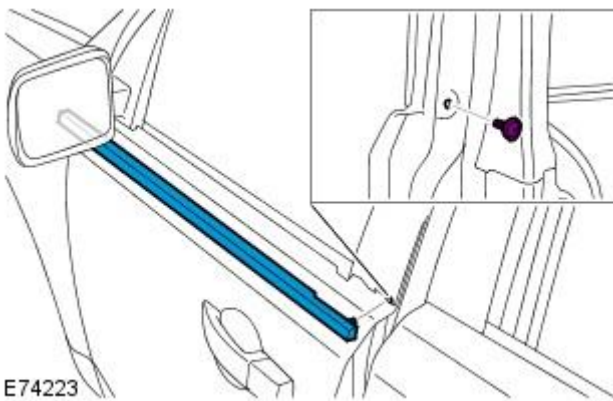
## Removal

1. NOTE: Left-hand shown, right-hand similar.

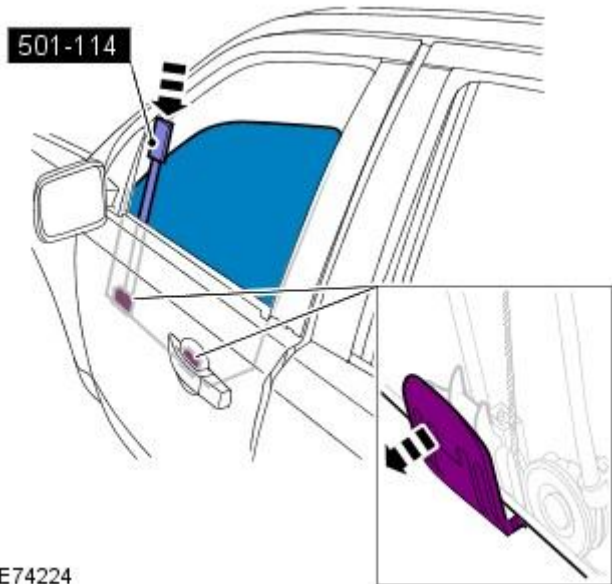


E94765


2. NOTE: Left-hand shown, right-hand similar.



E74223

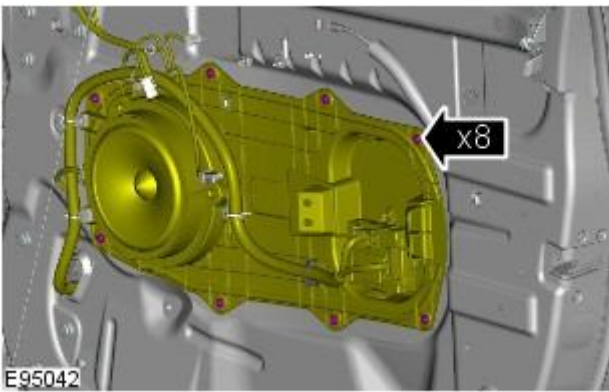


E74224

3.  **WARNING:** Do not allow the glass to drop.

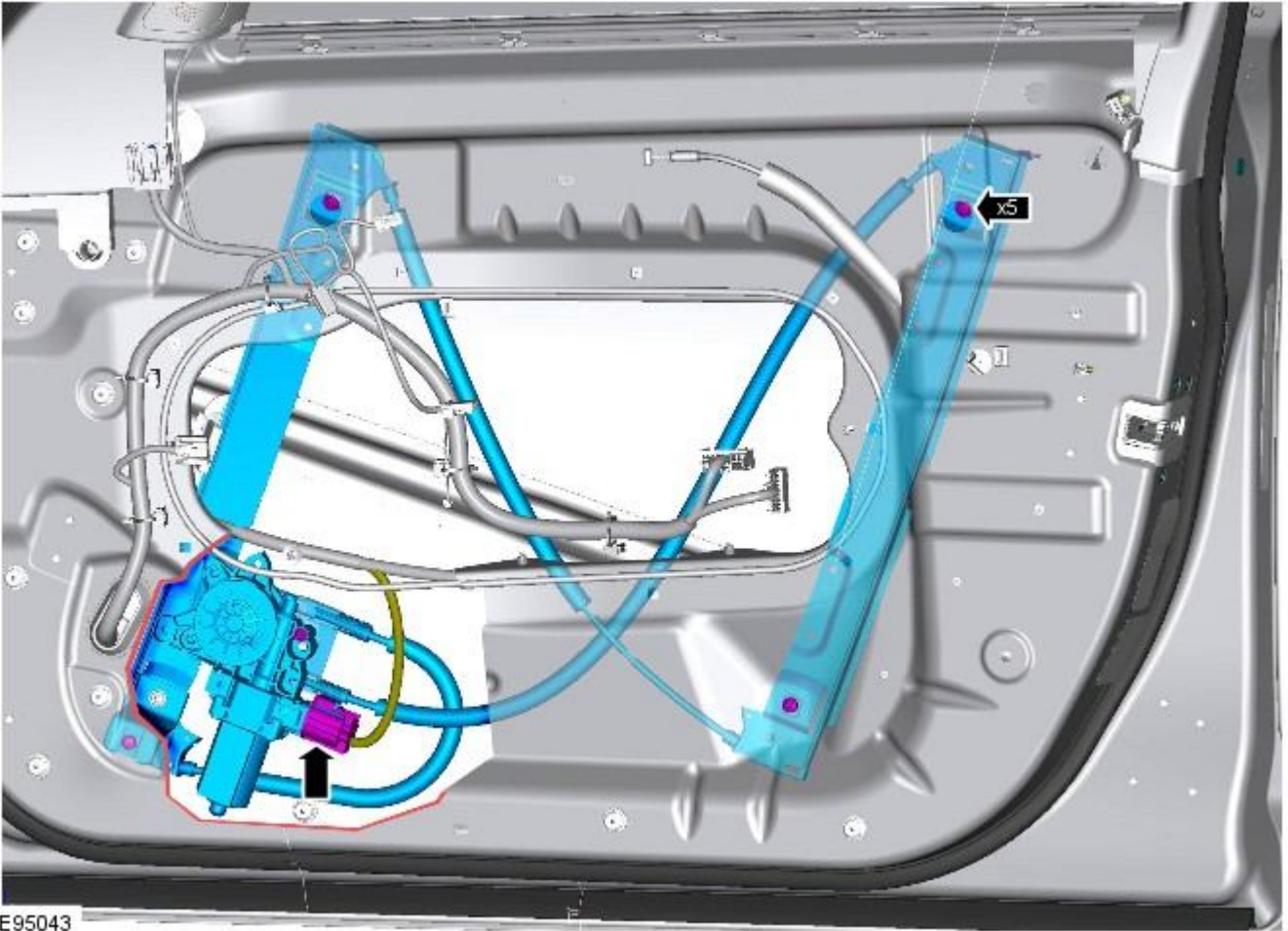
  - **NOTE:** Left-hand shown, right-hand similar.

4. For additional information, refer to: [Front Door Trim Panel \(501-05 Interior Trim and Ornamentation, Removal and Installation\)](#).
5. **NOTE:** Right-hand shown, left-hand similar.



E95042

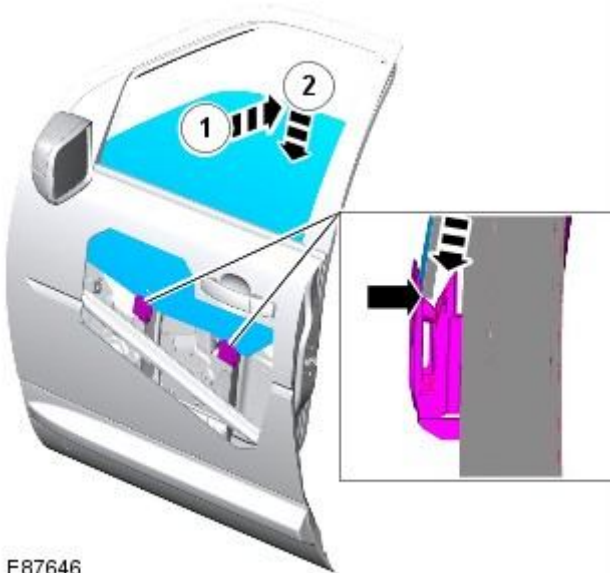
6.
  - **TORQUE:** 7 Nm



E95043

### Installation

1. To install, reverse the removal procedure.



E87646

## Glass, Frames and Mechanisms - Rear Door Fixed Window Glass

Removal and Installation

### Removal

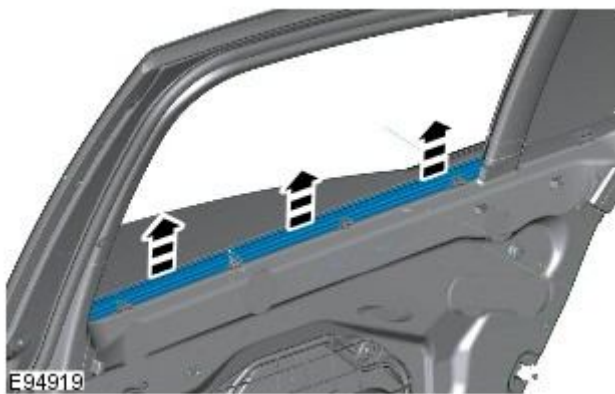
1. Lower the rear door window glass.



2. Remove the rear door trim panel.

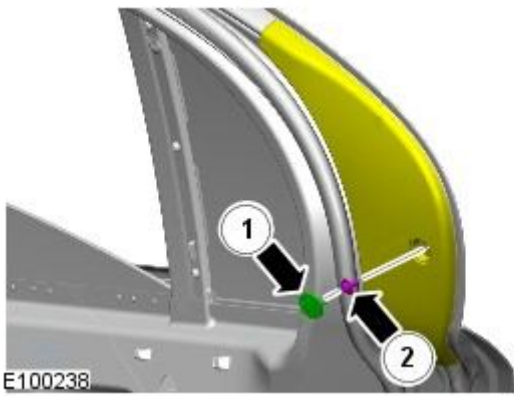
Refer to: [Rear Door Trim Panel](#) (501-05 Interior Trim and Ornementation, Removal and Installation).

- 3.

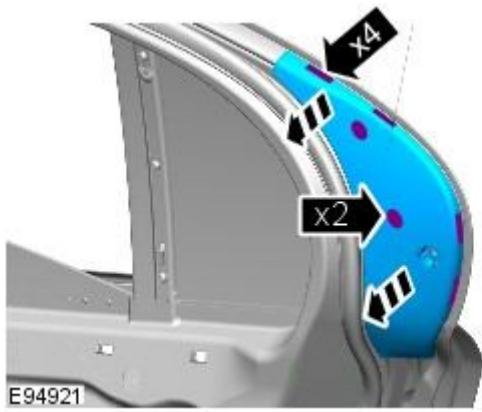




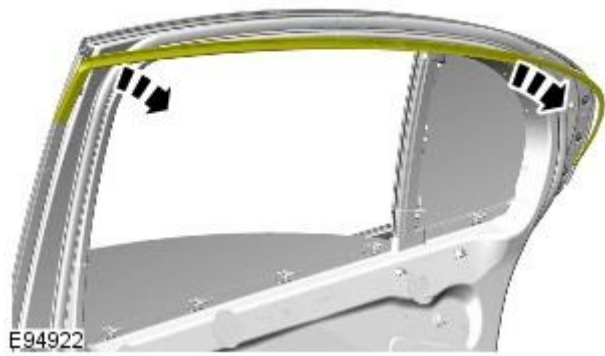
4.



5.



6.



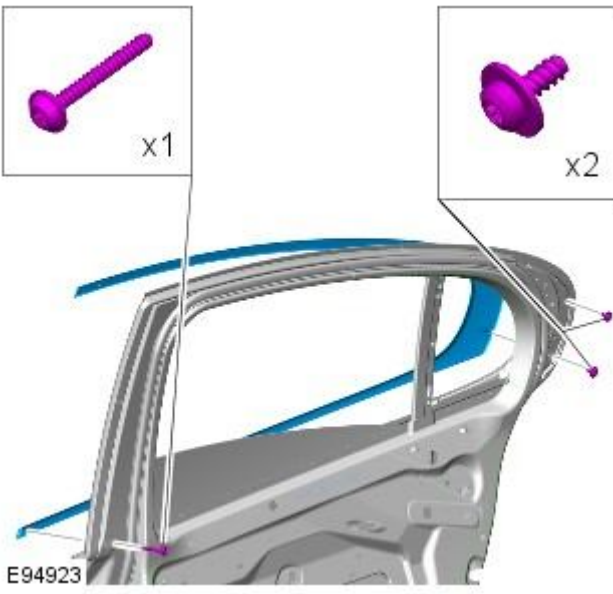
7.

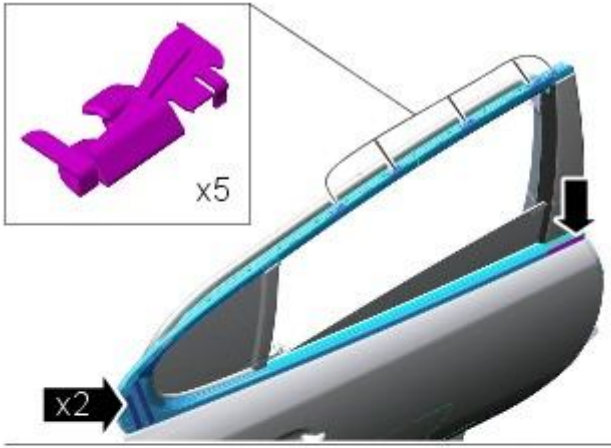



8.



9.

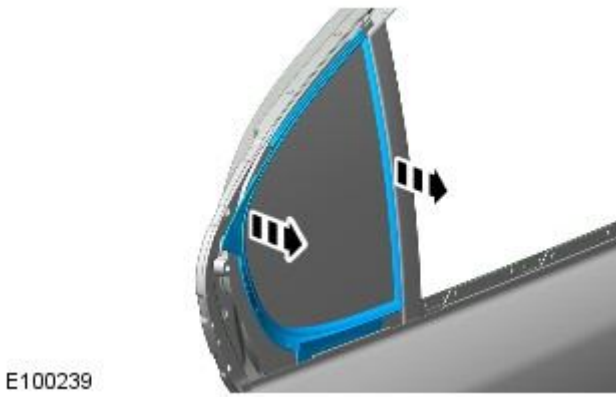




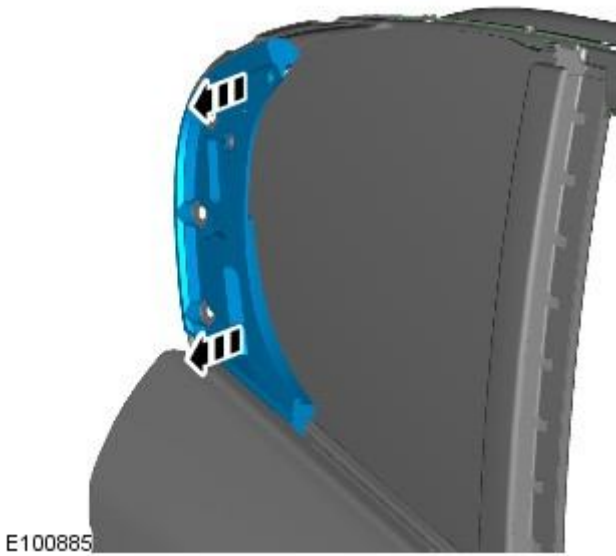
10. **10.**  CAUTION: Note the fitted position of the component prior to removal.



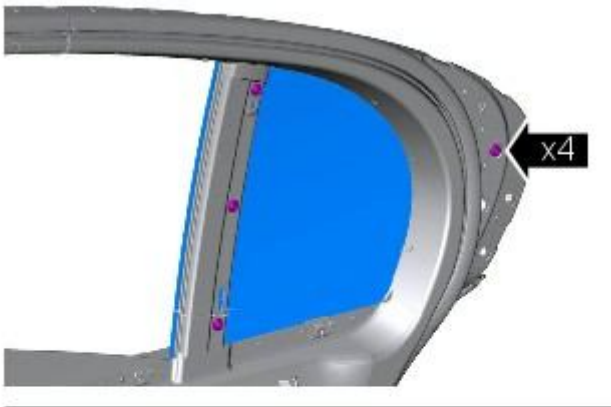
- 11.



12.



13.



## Installation

1. To install, reverse the removal procedure.
2. Tighten the Torx screws securing the fixed window glass after alignment of the bright external trim.

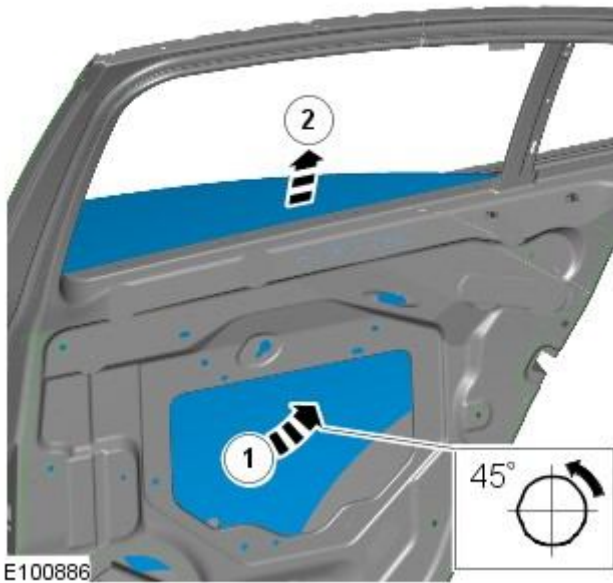
## Glass, Frames and Mechanisms - Rear Door Window Glass

Removal and Installation

### Removal

1. Refer to: [Rear Door Fixed Window Glass](#) (501-11 Glass, Frames and Mechanisms, Removal and Installation).
2. Refer to: [Rear Door Window Regulator and Motor](#) (501-11 Glass, Frames and Mechanisms, Removal and Installation).

3.



### Installation

1. To install, reverse the removal procedure.

# Glass, Frames and Mechanisms - Rear Door Window Regulator and Motor

Removal and Installation

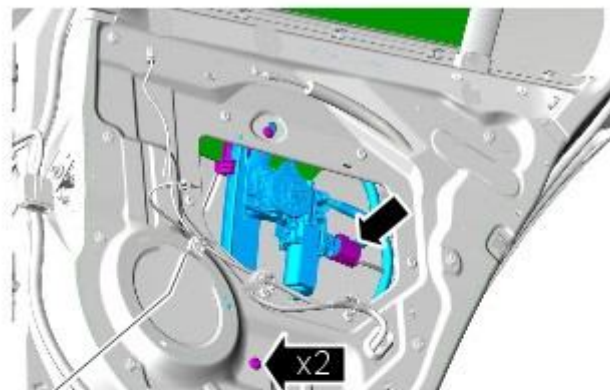
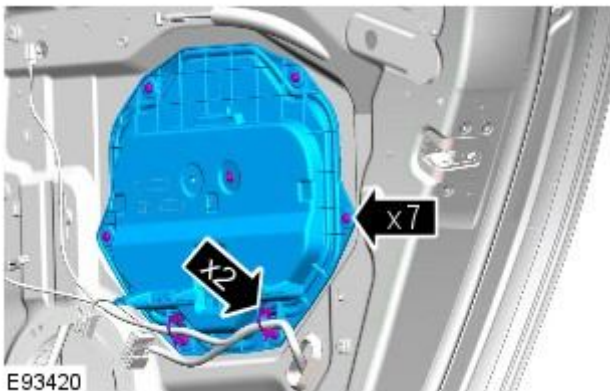
## Removal


- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the rear door speaker.

Refer to: [Rear Door Speaker](#) (415-01 Information and Entertainment System, Removal and Installation).

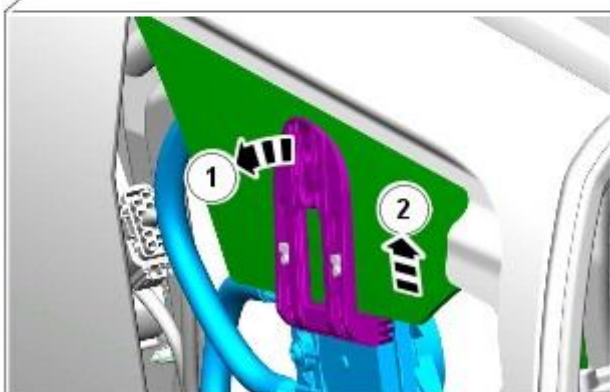
- 2.



3.  **WARNING:** Do not allow the glass to drop.

- NOTE: The door glass should be lowered by approximately one third.

Torque: 7 Nm



## Installation

1. To install, reverse the removal procedure.

# Glass, Frames and Mechanisms - Rear Window Glass

Removal and Installation

## Removal

• CAUTIONS:



Always protect paintwork and glass when removing exterior components.



Always protect the interior components when removing body glass.



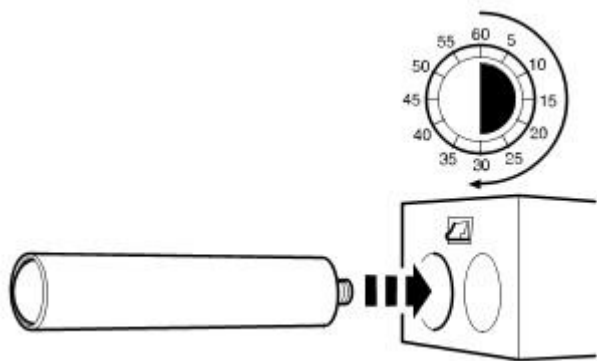
Lay the glass on felt covered supports. Do not stand on edge as this can cause chips which subsequently develop into cracks.

• NOTE: The following equipment is required: I Cutting wire and handles I Kent knife I Glazing knife I Windshield replacement kit I Sealant applicator gun I Suction cups I A felt covered table or stand to support glass

1. Refer to: [C-Pillar Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

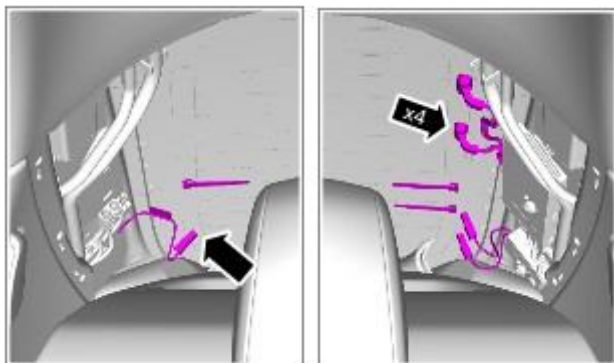
2.

- Remove the polyurethane (PU) adhesive cap and heat the PU adhesive for a minimum of 30 minutes.



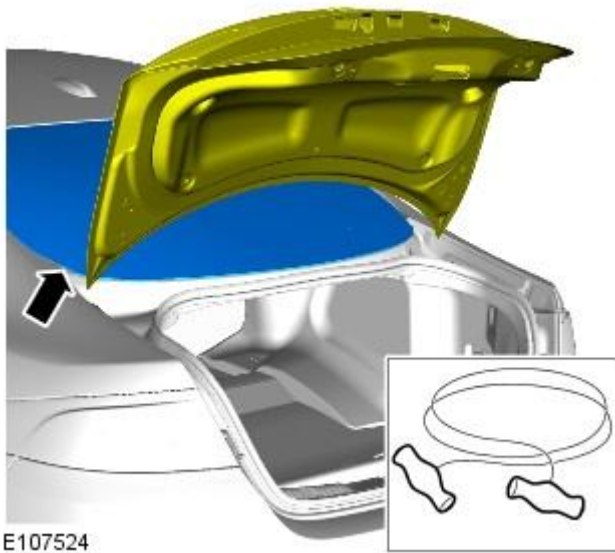
TIE0022871

3.



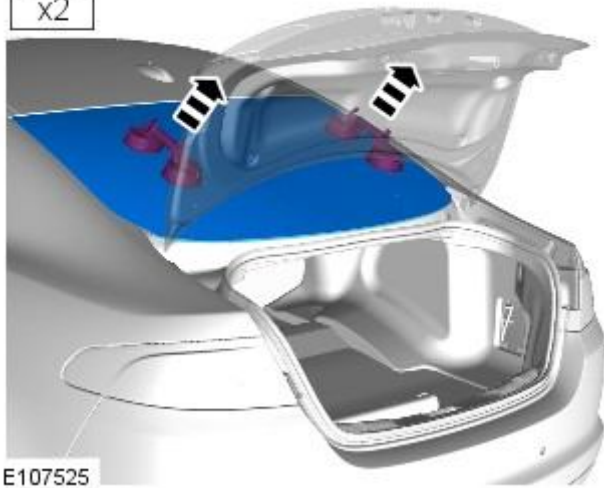
E107523





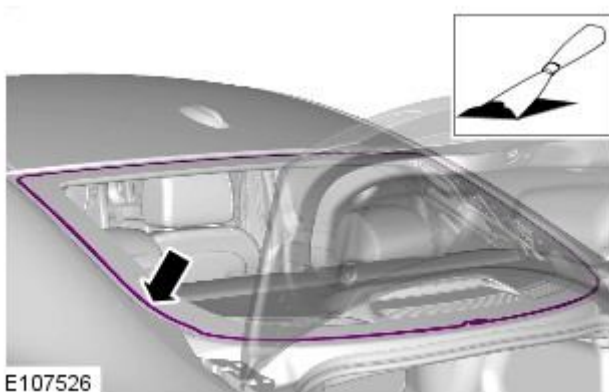
4. 4. CAUTIONS:

- ⚠ Protect the surrounding components.
- ⚠ Protect the surrounding paintwork to avoid damage.

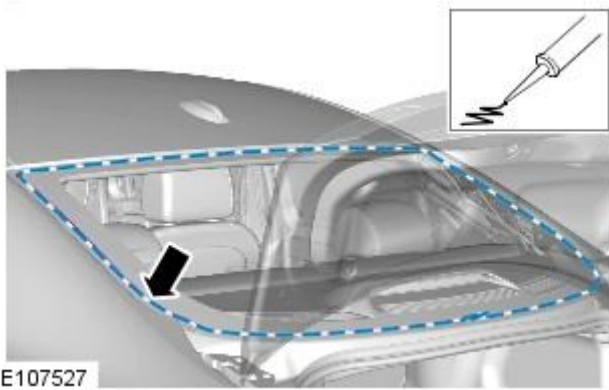



5. ⚠ **WARNING:** This step requires the aid of another technician.

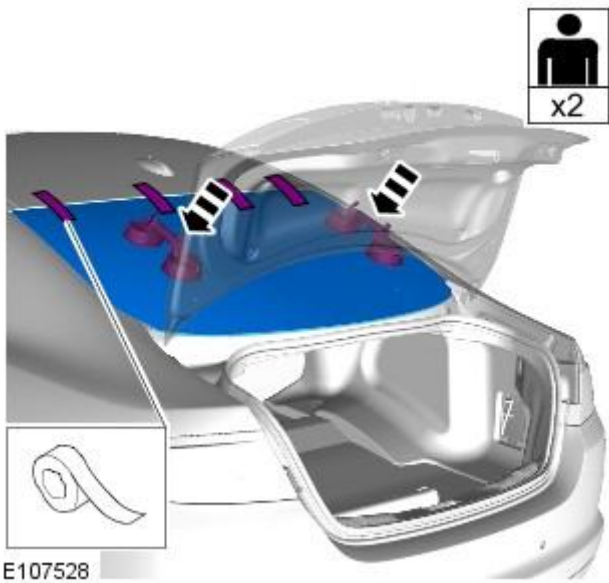
**Installation**



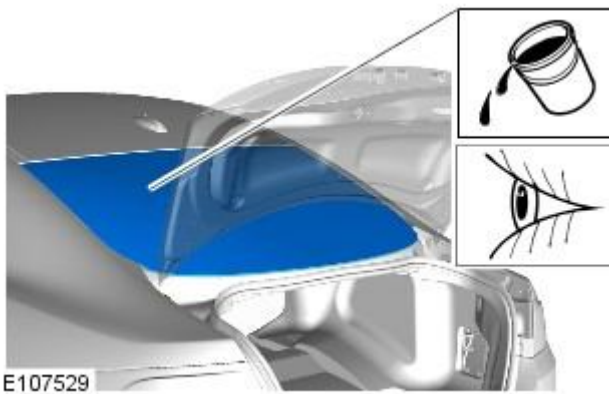
1. ⚠ **CAUTION:** Make sure that the mating faces are clean and free of foreign material.
- Prepare the window glass, window glass flange and trimmed PU adhesive in accordance with the instructions included with the PU adhesive kit.




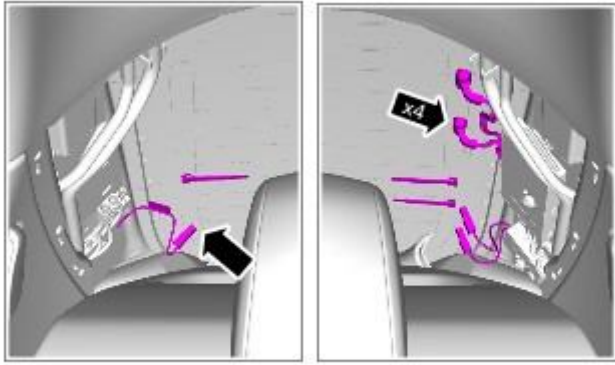
2.  **CAUTION:** Touching the adhesive surface will impair rebonding.
  - **NOTE:** Install new spacers.



3.



4.  **CAUTION:** Make sure that no excess sealant residue is evident.
  - If water is used as a means for the leak check, then allow sealant to dry before testing.
  - Spray water around the windshield glass, mark any area that leaks. Dry the windshield glass and sealant before applying additional sealant.



E107523

5.

6. Refer to: [C-Pillar Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

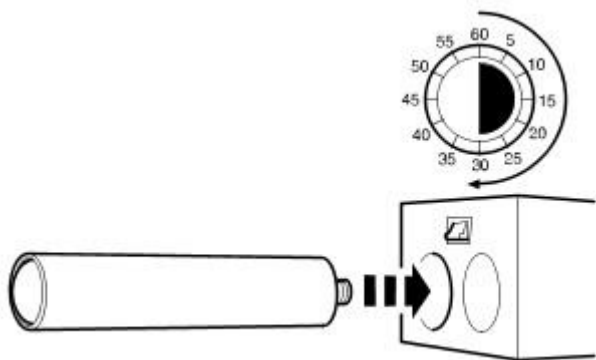
# Glass, Frames and Mechanisms - Windshield Glass

## Removal and Installation

### Removal

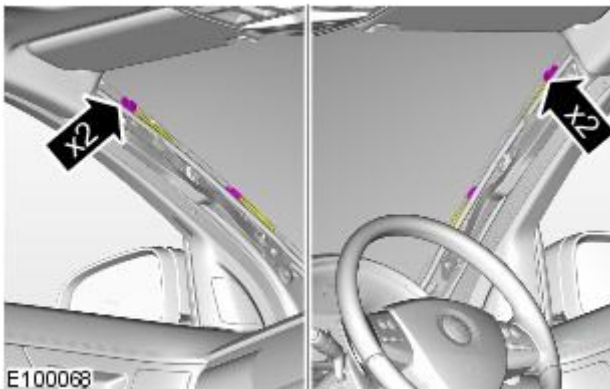
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Cowl Vent Screen](#) (501-02 Front End Body Panels, Removal and Installation).
2. Refer to: [A-Pillar Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Refer to: [Rain Sensor](#) (501-16 Wipers and Washers, Removal and Installation).



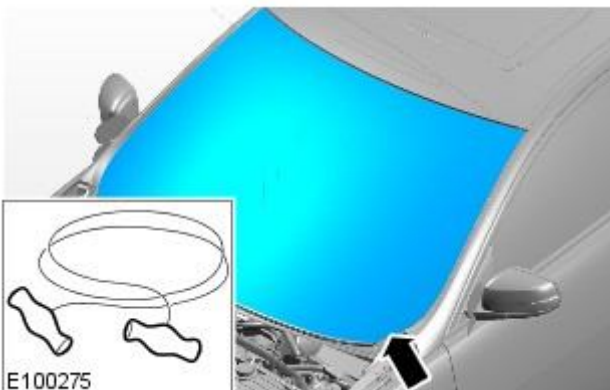
TIE0022871

4.
  - Remove the polyurethane (PU) adhesive cap and heat the PU adhesive for a minimum of 30 minutes.



E100068

- 5.



E100275

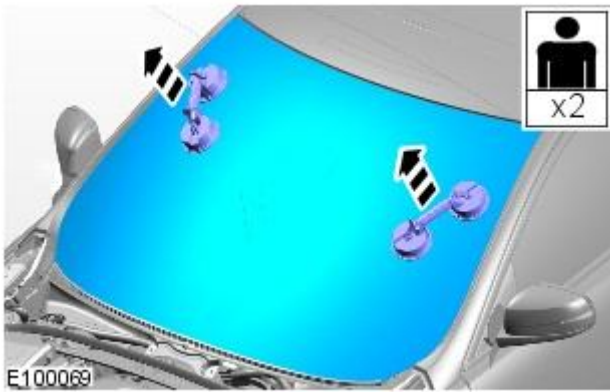
6. **CAUTIONS:**



Protect the surrounding components.

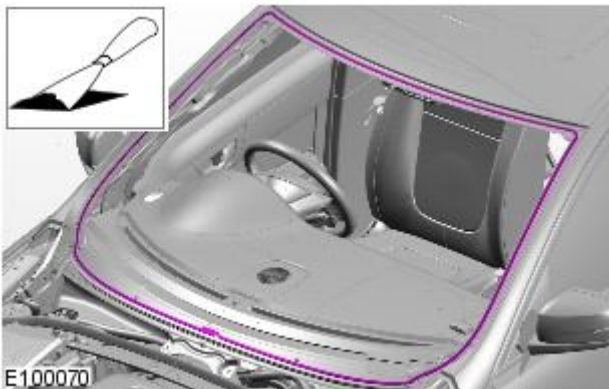



Protect the surrounding paintwork to avoid damage.

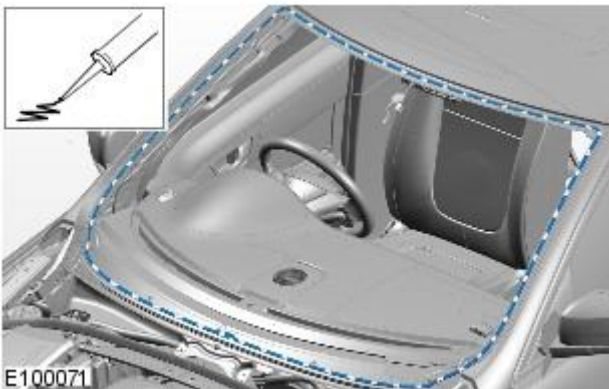


7.  **WARNING:** This step requires the aid of another technician.

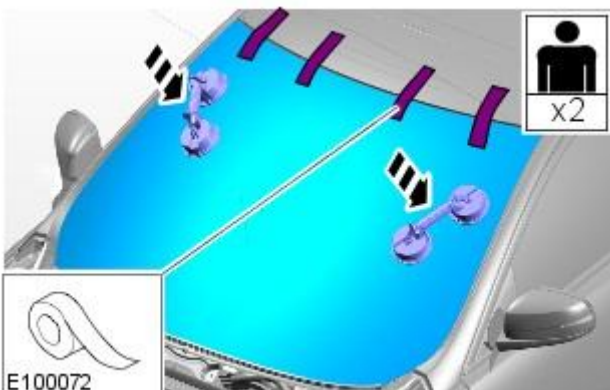
## Installation



1.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.
- Prepare the window glass, window glass flange and trimmed PU adhesive in accordance with the instructions included with the PU adhesive kit.




2.  **CAUTION:** Touching the adhesive surface will impair rebonding.



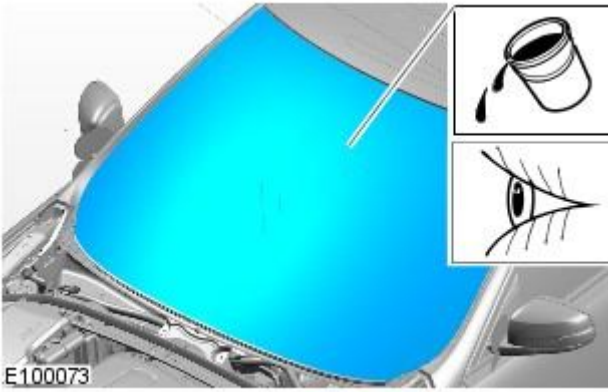
3.  **WARNING:** This step requires the aid of another technician.


• **CAUTIONS:**

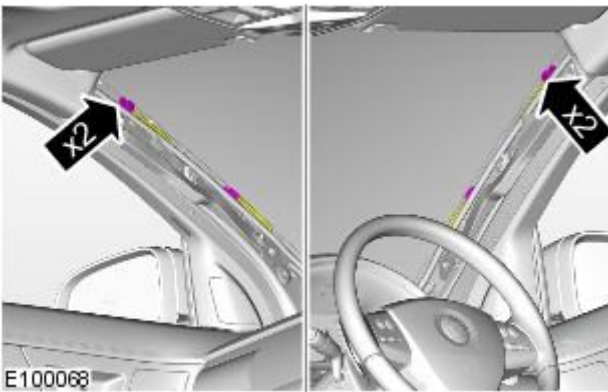
 Make sure that the component is correctly located on the locating dowels.

 Make sure that equal pressure is applied to the full length of the component.

- If the ambient temperature falls below 10 degrees C, apply warm air (25 degrees C) continuously for 15 minutes.



4.  **CAUTION:** Make sure that no excess sealant residue is evident.
- If water is used as a means for the leak check, then allow sealant to dry before testing.
  - Spray water around the windshield glass, mark any area that leaks. Dry the windshield glass and sealant before applying additional sealant.



5.

6. Refer to: [Rain Sensor](#) (501-16 Wipers and Washers, Removal and Installation).
7. Refer to: [A-Pillar Trim Panel](#) (501-05 Interior Trim and Ornementation, Removal and Installation).
8. Refer to: [Cowl Vent Screen](#) (501-02 Front End Body Panels, Removal and Installation).



## Instrument Panel and Console -

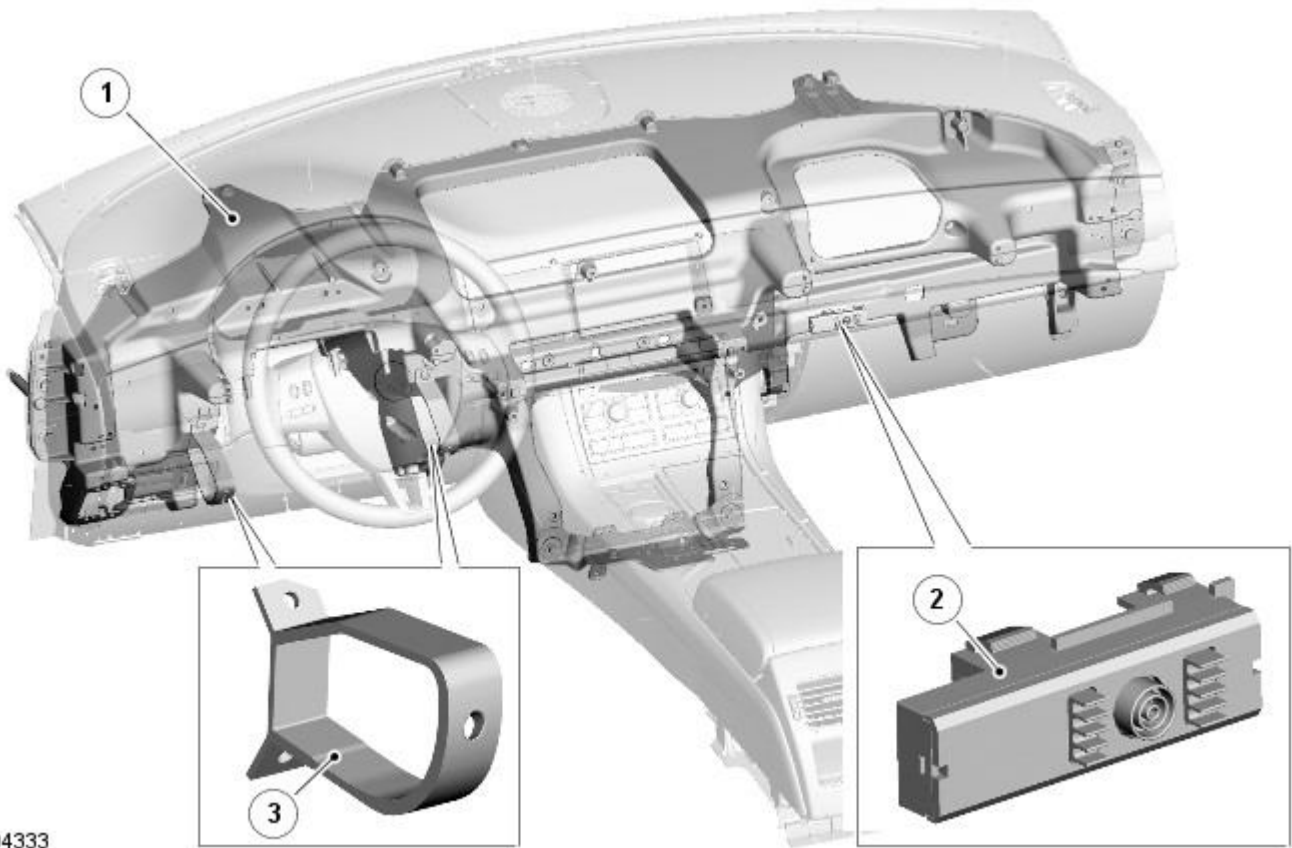
### Torque Specifications

Description	Nm	lb-ft	lb-in
Instrument panel retaining bolts	20	15	-
Floor console retaining nuts	5	-	44
Instrument panel support brackets retaining bolts	9	-	80
Instrument panel support brackets retaining nuts	9	-	80

# Instrument Panel and Console - Instrument Panel - Component Location

Description and Operation

COMPONENT LOCATION



E94333

**ItemDescription**

- |   |                                   |
|---|-----------------------------------|
| 1 | Cross car beam                    |
| 2 | JaguarSense glovebox module       |
| 3 | Energy absorbing brackets (2 off) |

# Instrument Panel and Console - Instrument Panel - Overview

Description and Operation

## OVERVIEW

The instrument panel incorporates a magnesium cross car beam. North American Specification (NAS) vehicles also feature a pair of energy absorbing brackets. The energy absorbing brackets are mounted behind the driver's side of the instrument panel. Each is secured to the cross car beam by 2 screws.

The cross car beam acts as a support and provides mounting points for the instrument panel top pad. The instrument panel top pad supports various other system components. These include ducting, vents and registers for the climate control system and the passenger airbag. For additional information, refer to:

[Air Distribution and Filtering](#) (412-01 Climate Control, Description and Operation),

[Safety Belt System](#) (501-20A Safety Belt System, Description and Operation),

[Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) (501-20B Supplemental Restraint System, Description and Operation),

[Pedestrian Protection System](#) (501-20C Pedestrian Protection System, Description and Operation).

# Instrument Panel and Console - Instrument Panel - System Operation and Component Description

Description and Operation

## System Operation

### JAGUARSENSE OPERATION

JaguarSense uses a capacitive proximity sensor which operates along similar lines to a capacitor. The sensor comprises a single capacitor conductor plate. The second capacitor conductor plate is the operators hand, known as the target. The capacitor dielectric is the air gap between the sensor conductor plate and the target.

As the target approaches the proximity sensor, current flow through the conductor plate increases. Circuitry within the sensor module detects the rise in current flow and provides a signal output to the relevant control module. Both the glove box and interior lamp JaguarSense systems are controlled by the [CJB \(central junction box\)](#).

The glove box proximity sensor is also inhibited if the anti-theft alarm system is armed and if valet mode is selected using the Touch Screen Display (TSD).

## Component Description

### JAGUARSENSE DESCRIPTION

The conventional glove box release and overhead console lamp switches have been replaced with capacitive proximity sensors. This feature is known as 'JaguarSense'. The glove box proximity sensor takes the form of a roundel located above the inboard end of the glove box. The interior lamp assembly contains 3 capacitive proximity sensors located behind the lamp lense.

The glove box proximity sensor module also incorporates 2 anti-wipe sensors. The anti-wipe sensors are located on either side of the proximity sensor and can detect a wiping movement along the instrument panel veneer. When this movement is detected the proximity sensor is temporarily inhibited.

# Instrument Panel and Console - Floor Console

## Removal and Installation

### Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Floor Console Cup Holder](#) (501-12 Instrument Panel and Console, Removal and Installation).

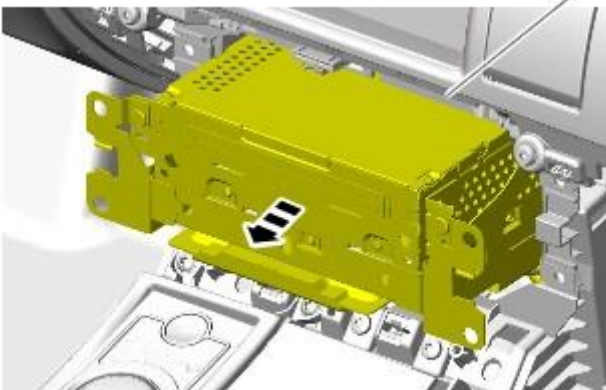
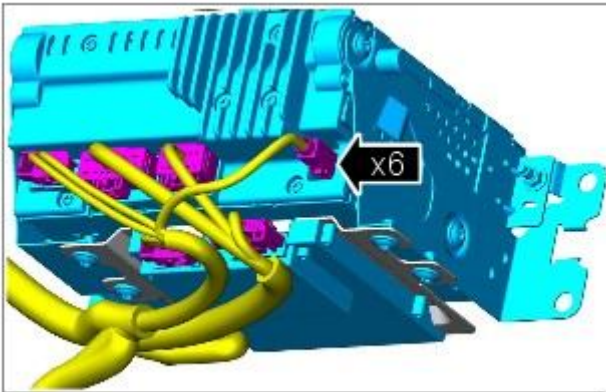
### 3. CAUTIONS:



Protect the surrounding trim to avoid damage.



Cover fiber optic cable connectors to minimize dust ingress and avoid bending the cables in a radius of less than 30 mm.

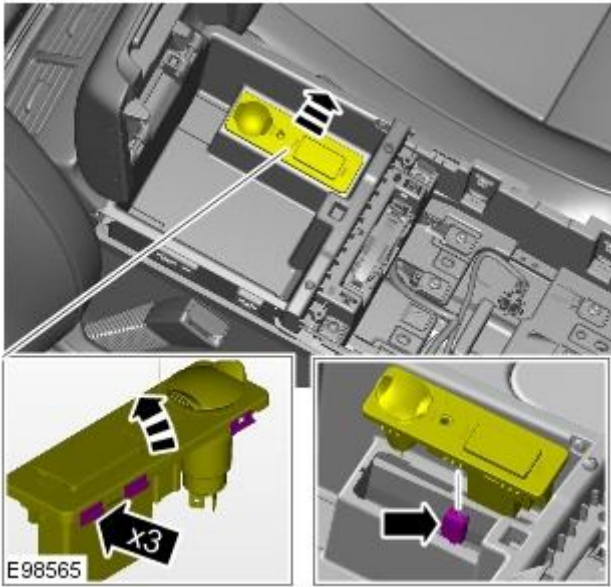


E95329

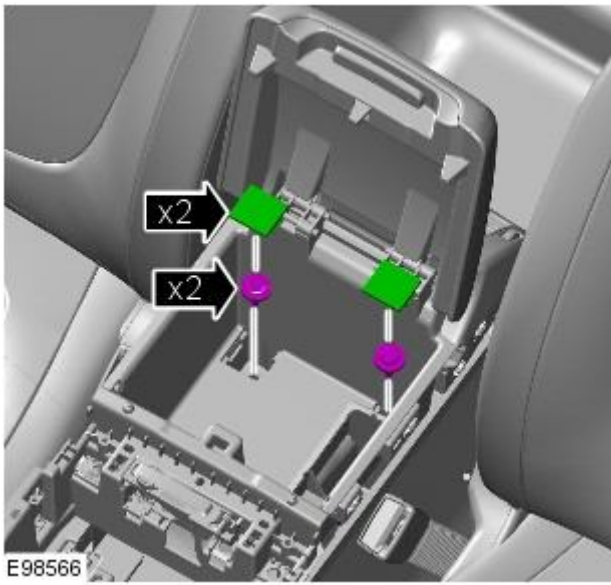
### 4. Torque: 9 Nm



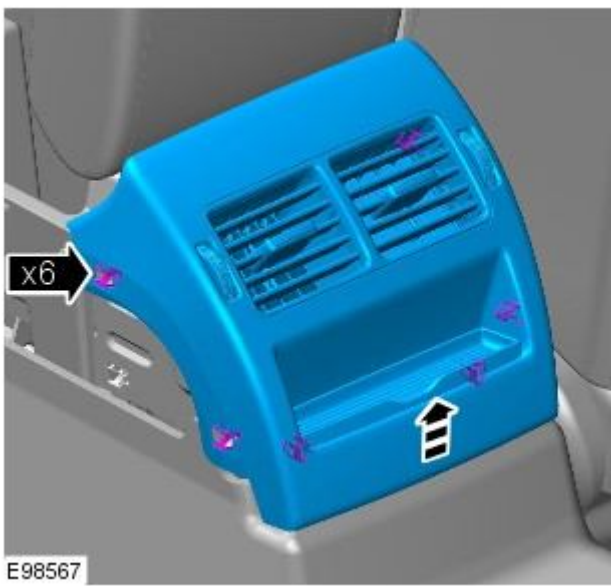
E98564



5.

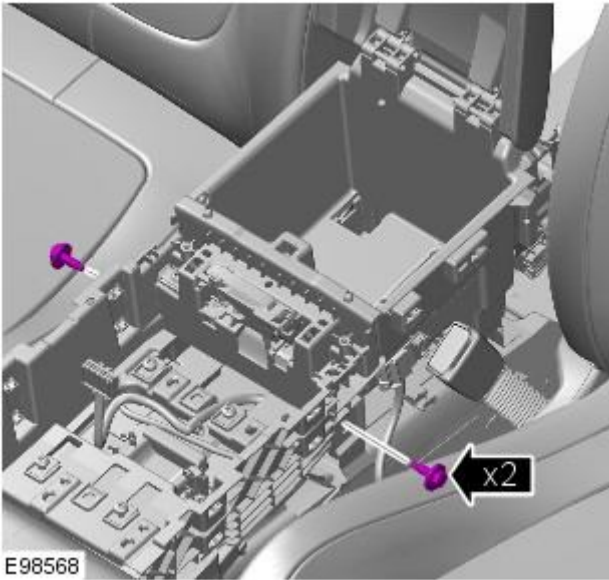


6. Torque: 6 Nm

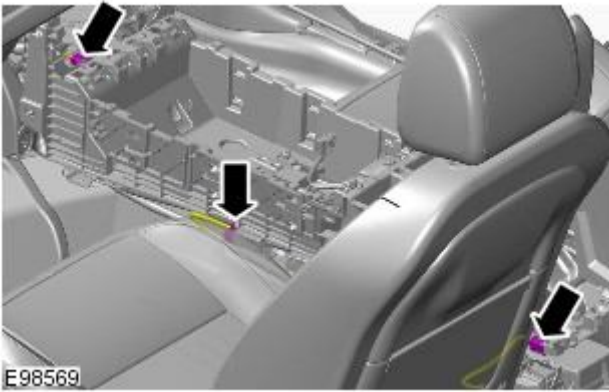


7.



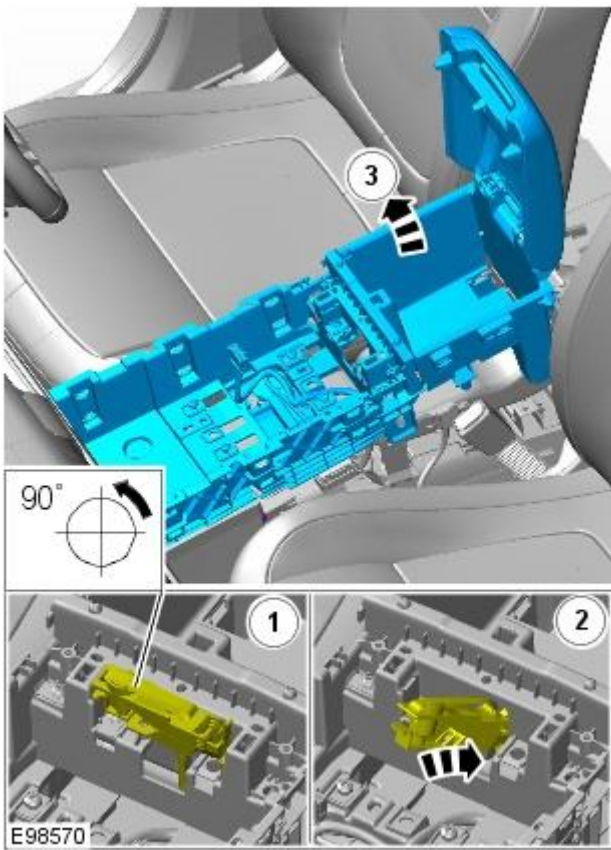


8. Torque: 6 Nm



9.

10.



## Installation

1. To install, reverse the removal procedure.

# Instrument Panel and Console - Floor Console Cup Holder

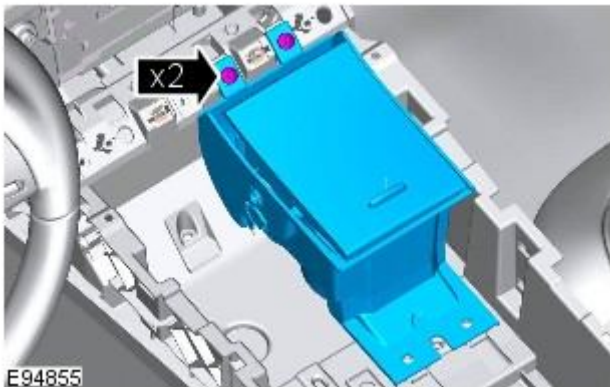
Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

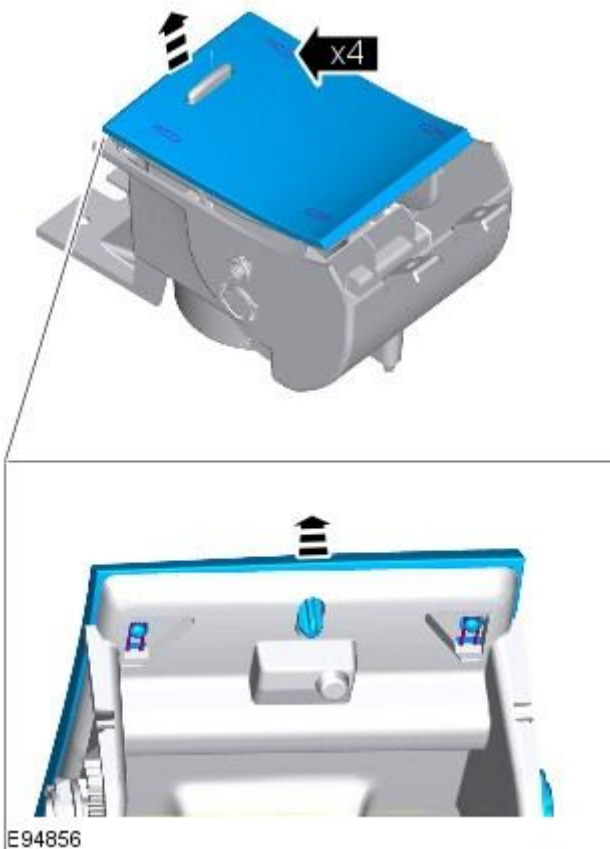
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Floor Console Double Cup Holder](#) (501-12 Instrument Panel and Console, Removal and Installation).

3.



4.  CAUTION: Take extra care not to damage the component.

- NOTE: Do not disassemble further if the component is removed for access only.



## Installation

1. NOTE: Make sure that the veneer trim panel is correctly installed and secured.

To install, reverse the removal procedure.

# Instrument Panel and Console - Floor Console Double Cup Holder

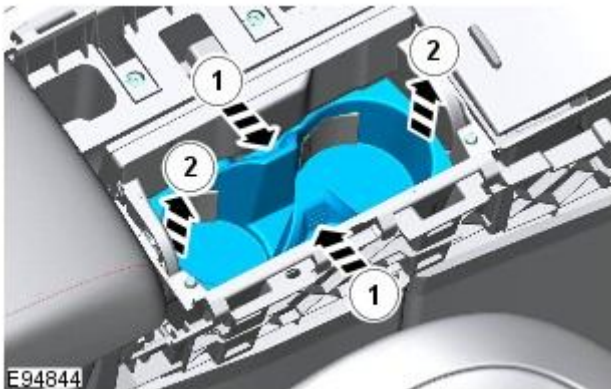
Removal and Installation

## Removal

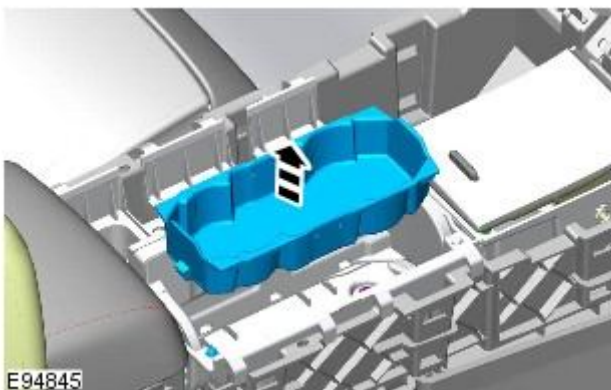
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Transmission Control Switch \(TCS\)](#) (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation).

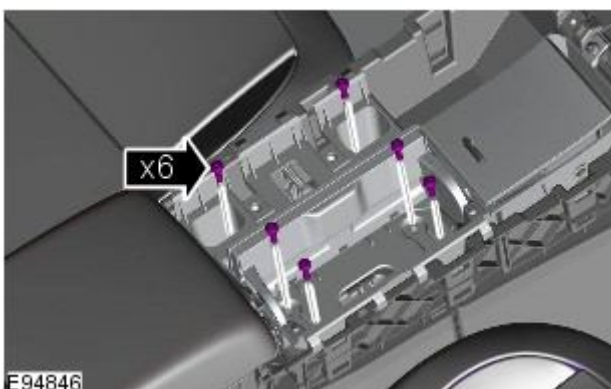
3.



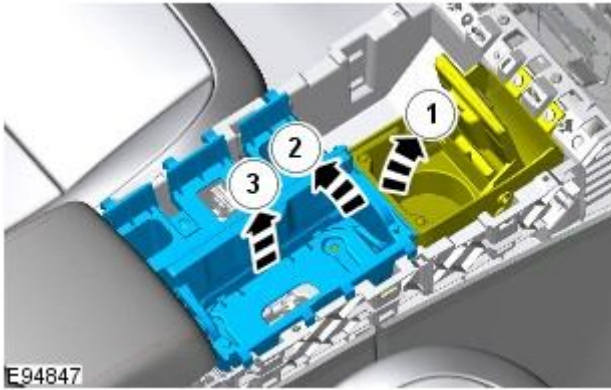
4.



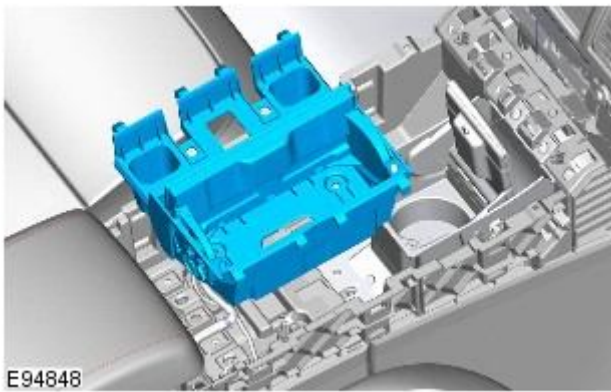
5.



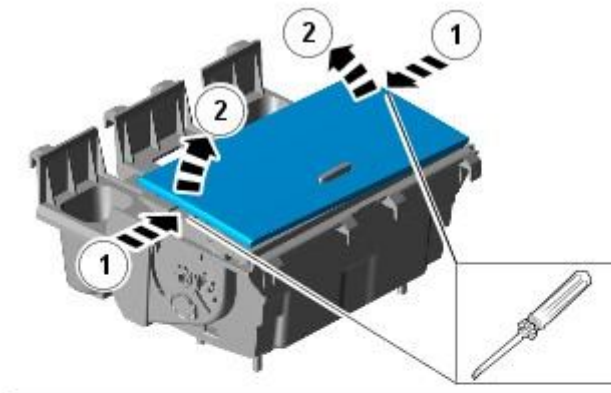
6. Open the floor console single cup holder.



7. Carefully release the front edge of the floor console double cup holder from under the rear edge of the floor console single cup holder.

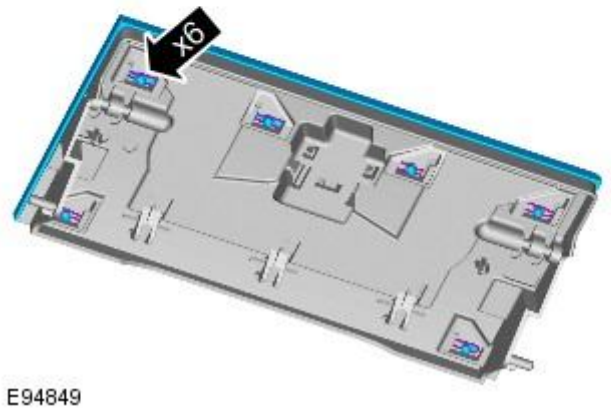


- 8.



9. **⚠ CAUTION:** Take extra care not to damage the component.
  - NOTE: Do not disassemble further if the component is removed for access only.

2



E94849

## Installation

1. **1.** NOTE: Make sure that the veneer trim panel is correctly installed and secured.

To install, reverse the removal procedure.



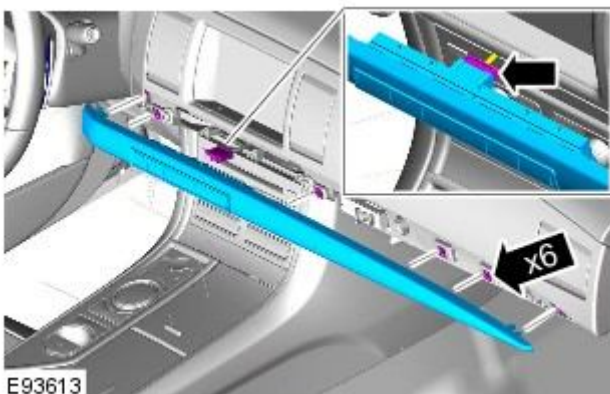
# Instrument Panel and Console - Floor Console Side Trim Panel

Removal and Installation

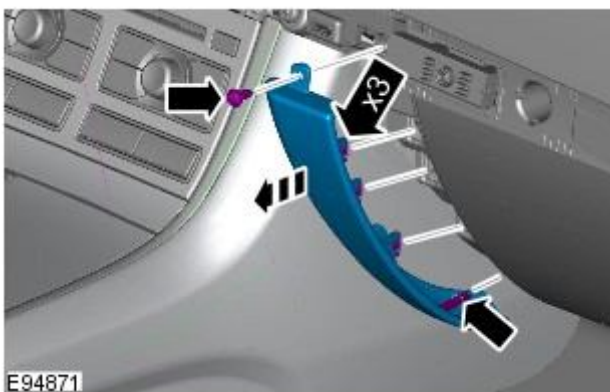
## Removal

- NOTE: LHD right-hand floor console side trim panel shown, LHD left-hand and both RHD floor console side trim panels are similar.
- NOTE: Removal steps in this procedure may contain installation details.

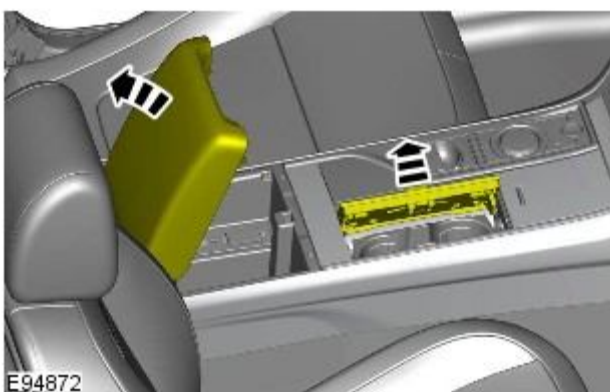
1. Recline the front seats and move to the rear most position.



2. NOTE: When removing the component, some of the clips may remain attached. These clips should be removed and returned to their original positions in the instrument panel.

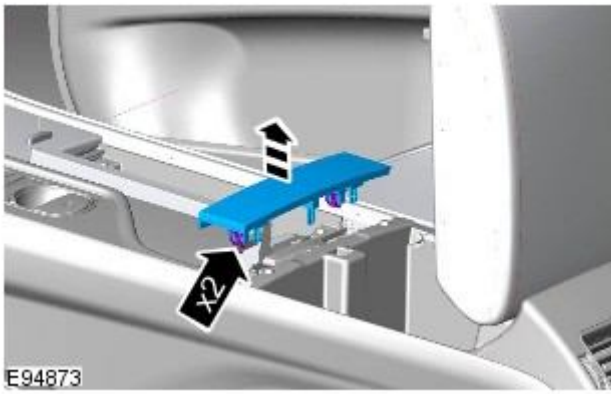


3.

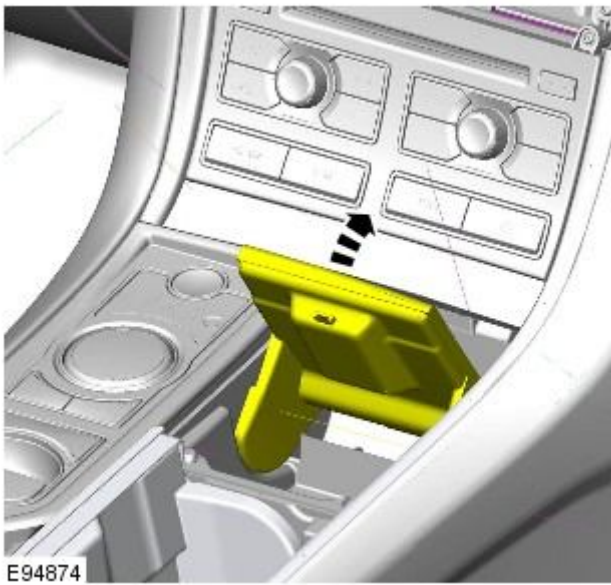


4.

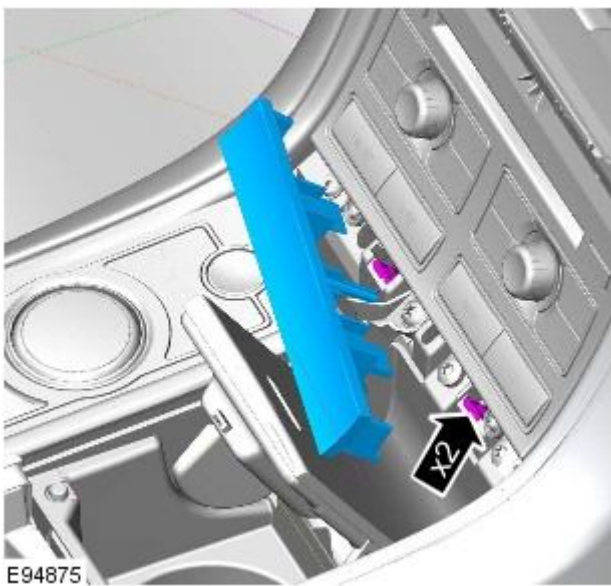




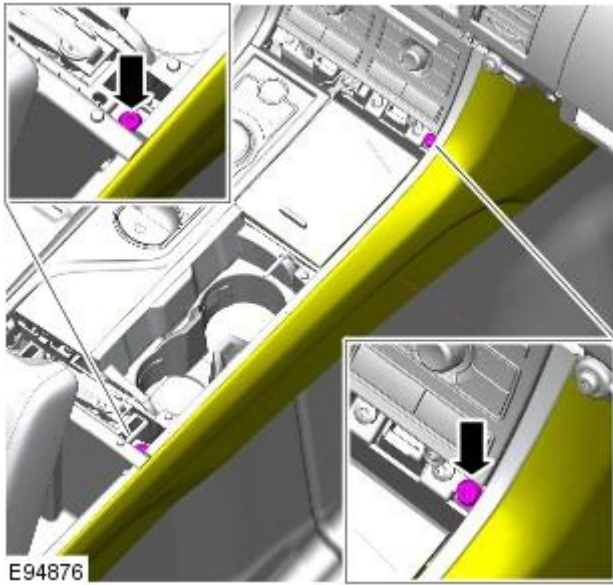
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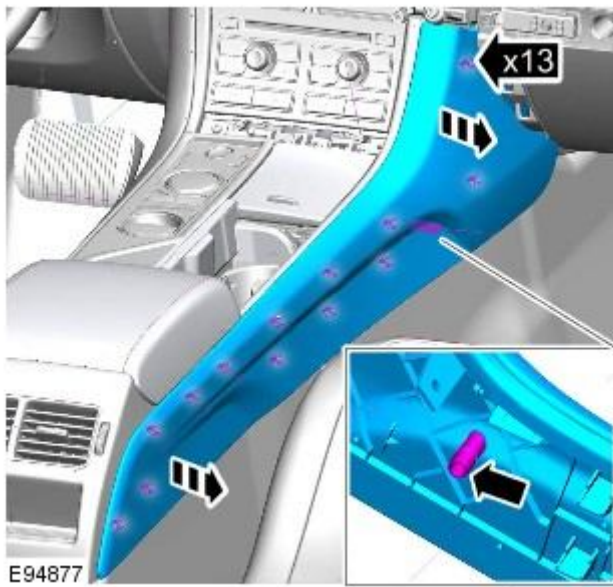
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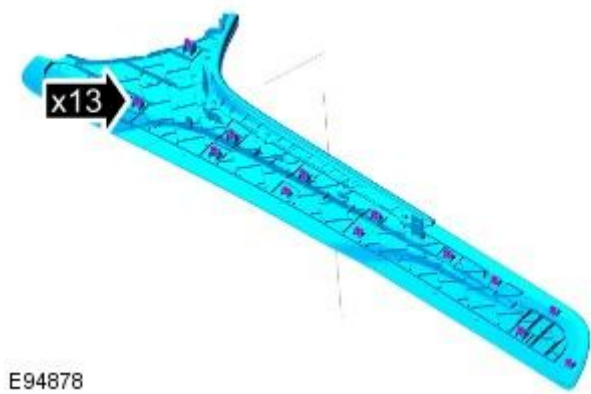
7. **7. NOTE:** When removing the component, some of the clips may remain attached. These clips should be removed and returned to their original positions in the center console.



8.

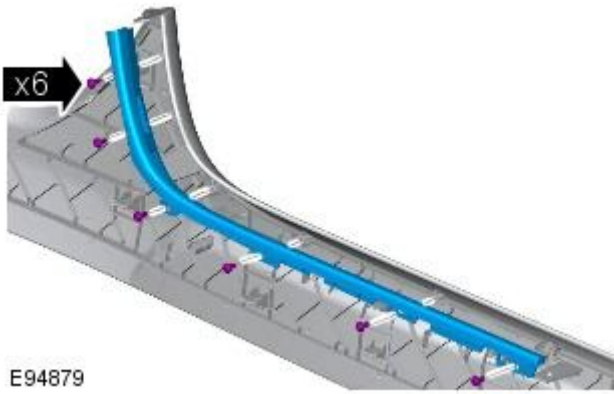


9.



10. **10.** NOTE: Do not disassemble further if the component is removed for access only.

11.



## Installation

1. **NOTE:** Make sure that the veneer trim panel is correctly installed and secured.

To install, reverse the removal procedure.

# Instrument Panel and Console - Glove Compartment

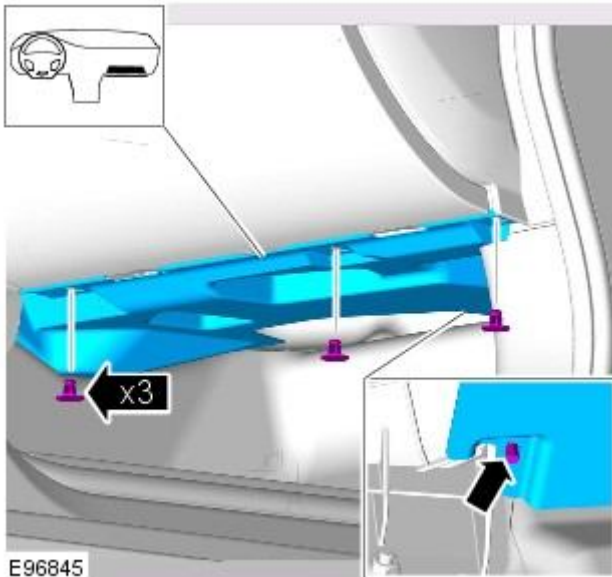
Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Passenger Side Register](#) (412-01 Climate Control, Removal and Installation).

2.

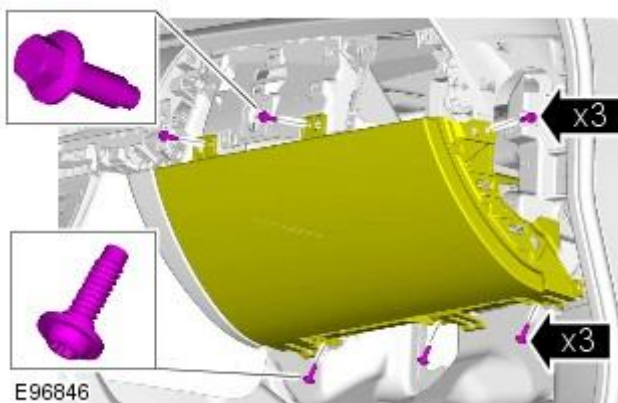


3.  CAUTION: Fixings must be started by hand to avoid damaging threads.

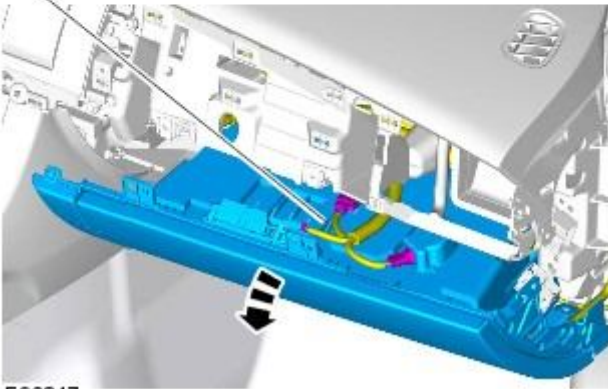
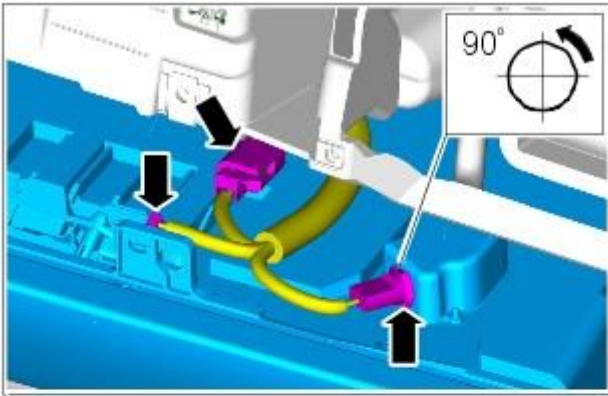
- Upper 3 bolts.

- Torque: 2.5 Nm
- Lower 3 bolts.

Torque: 9 Nm

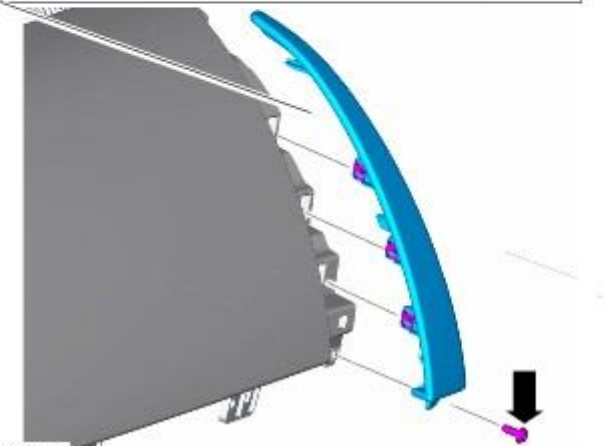
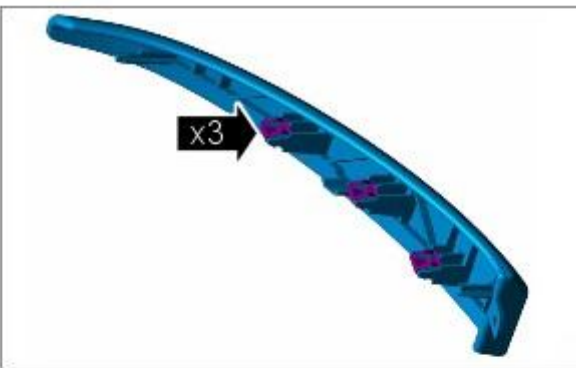


4.



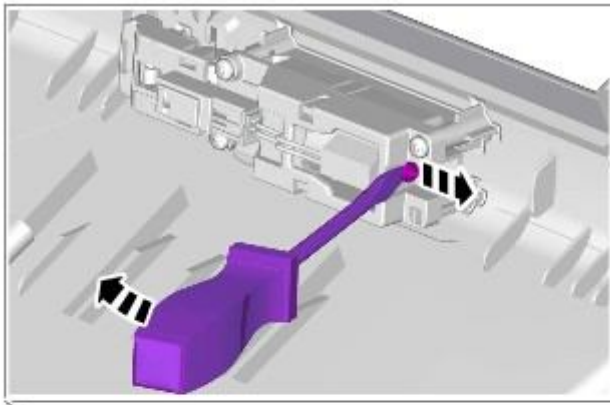
E96847

5. **5. NOTE:** Do not disassemble further if the component is removed for access only.

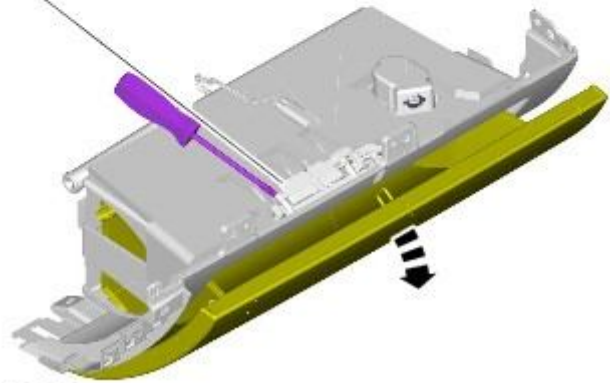


E96848

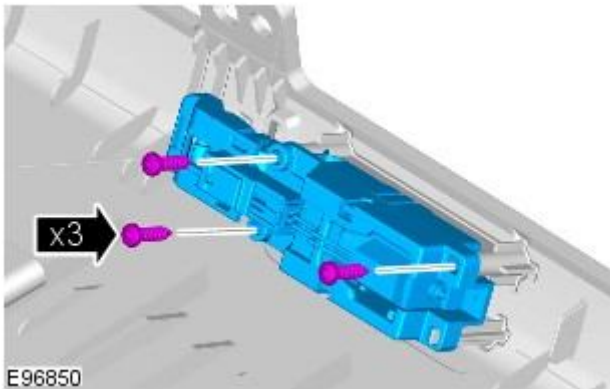




6. Using a screwdriver, carefully release the latch and open the glove compartment.

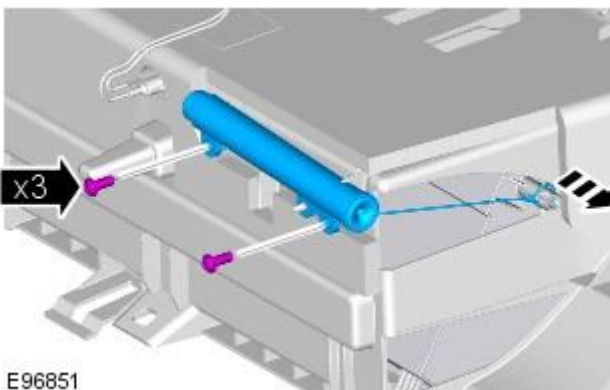


E96849



- 7.

E96850



- 8.

E96851

## Installation

1. To install, reverse the removal procedure.



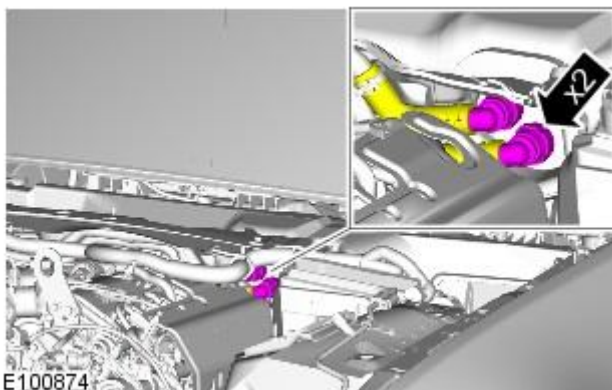
# Instrument Panel and Console - Instrument Panel Console


Removal and Installation

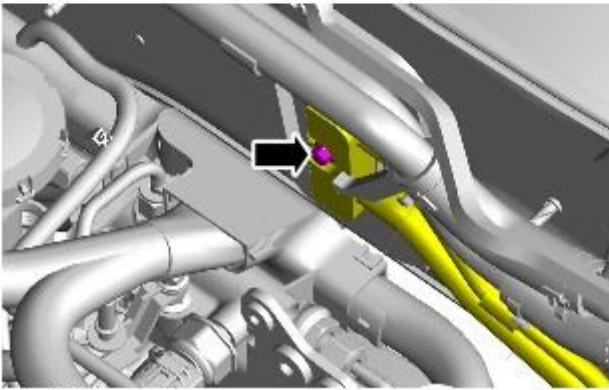
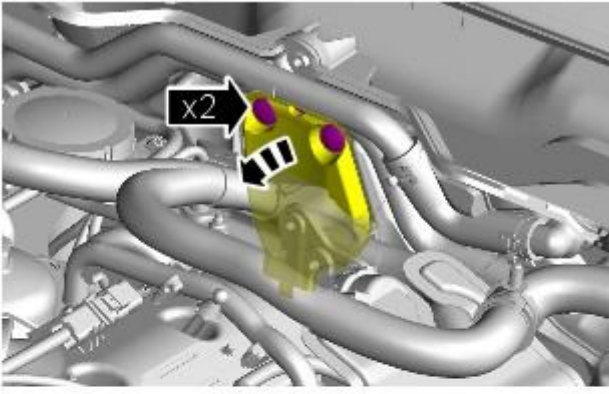
## Removal

• NOTE: Removal steps in this procedure may contain installation details.


1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03A, General Procedures).
3. Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
4. Refer to: [Secondary Bulkhead Center Panel](#) (501-02 Front End Body Panels, Removal and Installation).
5. Refer to: [Floor Console](#) (501-12 Instrument Panel and Console, Removal and Installation).
6. Refer to: [Glove Compartment](#) (501-12 Instrument Panel and Console, Removal and Installation).
7. Refer to: [Instrument Panel Lower Trim Panel](#) (501-12 Instrument Panel and Console, Removal and Installation).
8. Refer to: [A-Pillar Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
9. Refer to: [Cowl Side Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
10. Refer to: [Steering Wheel](#) (211-04 Steering Column, Removal and Installation).



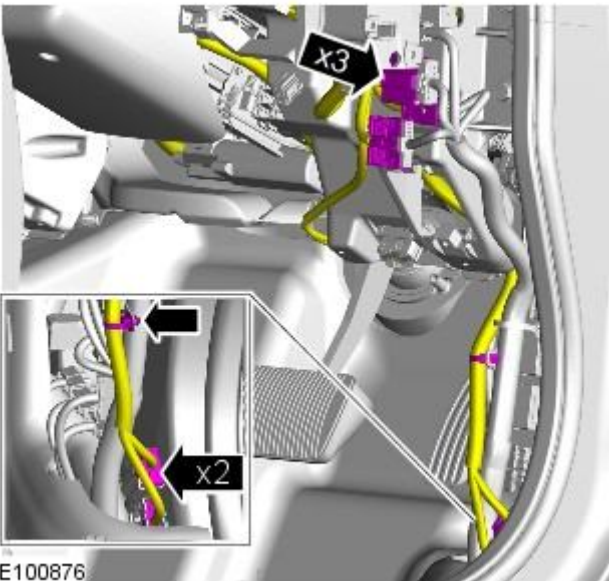
11.  CAUTION: Be prepared to collect escaping coolant.



E100875

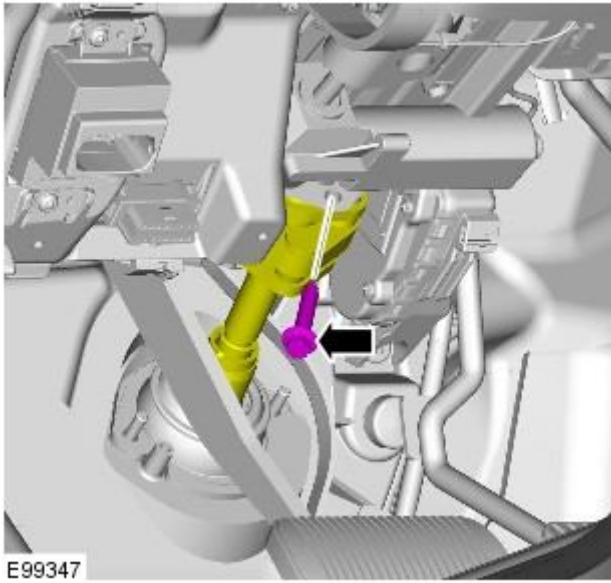
12.  CAUTION: Take care not to damage the O-ring seals during installation.

Torque: 9 Nm



E100876

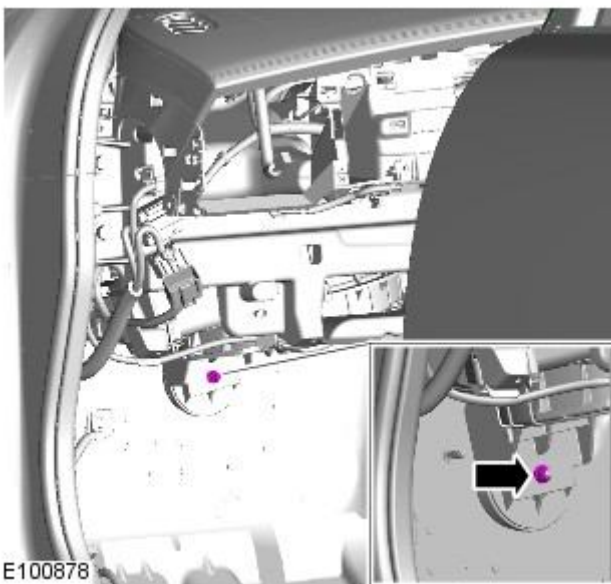
- 13.



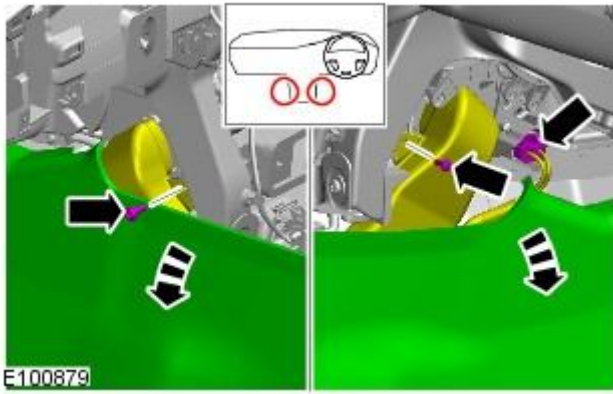
14. Torque: 30 Nm



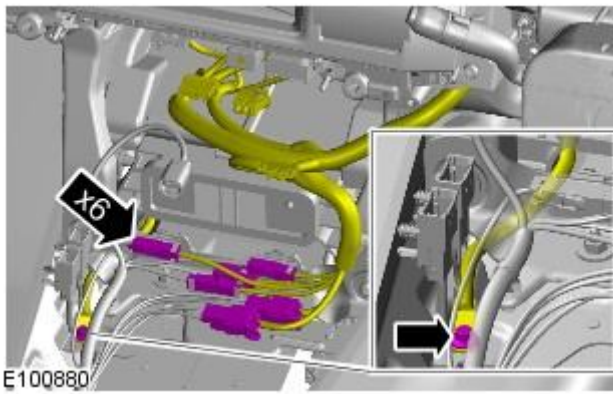
15.



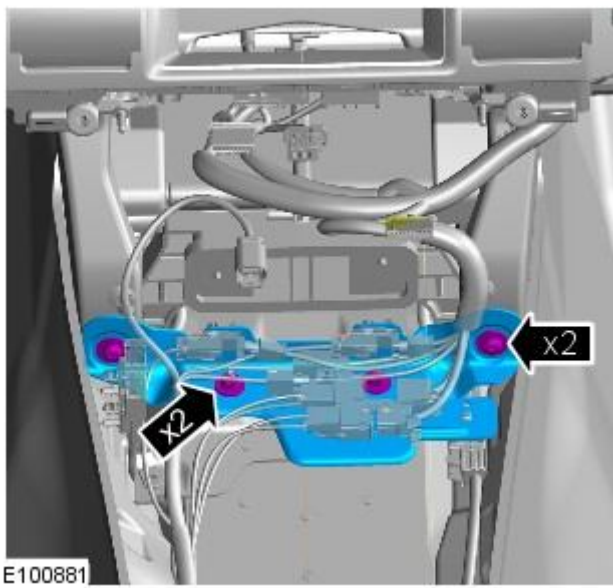
16. Torque: 4 Nm



17.



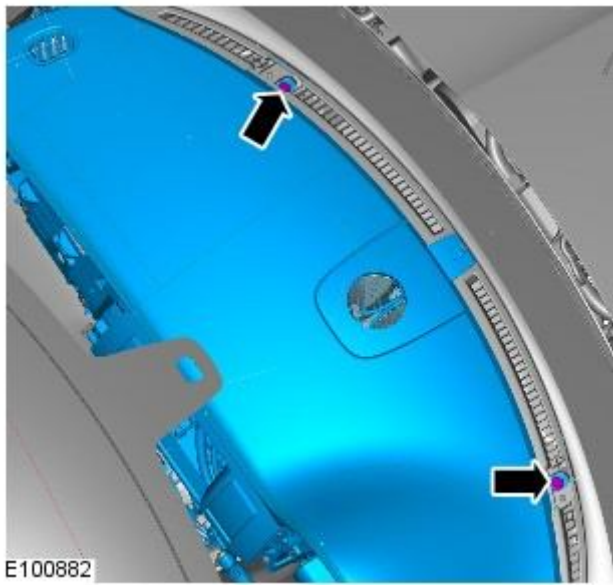
18. Torque: 12 Nm



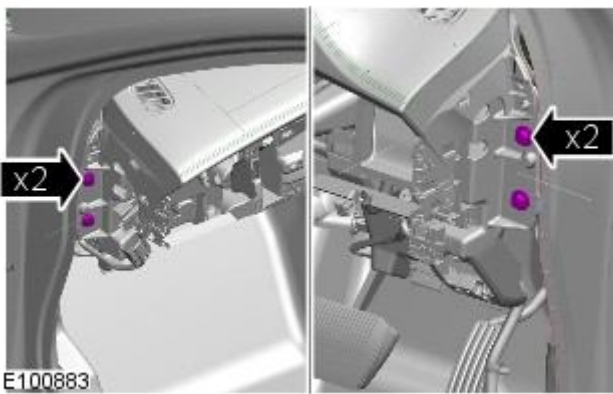
19. Torque: 9 Nm



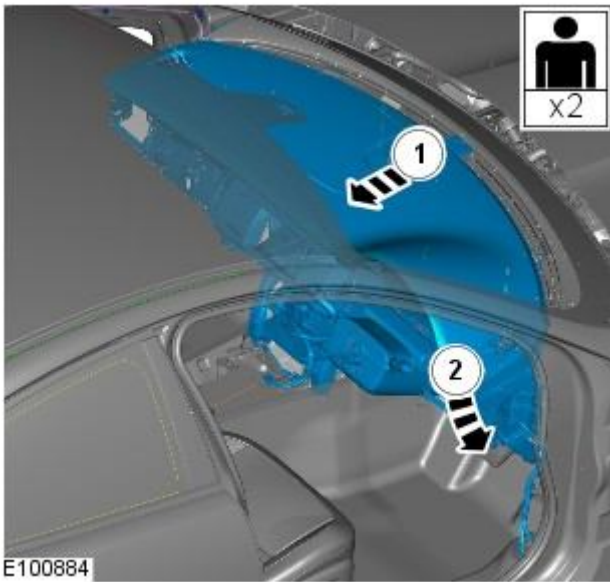
20.



21. Torque: 20 Nm



22. Torque: 20 Nm



23. **23. CAUTIONS:**



Be prepared to collect escaping coolant.



Protect the surrounding paintwork to avoid damage.



Protect the surrounding trim to avoid damage.

## Installation

1. To install, reverse the removal procedure.

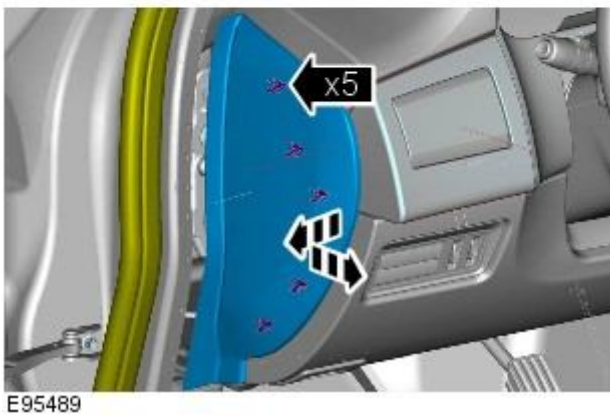
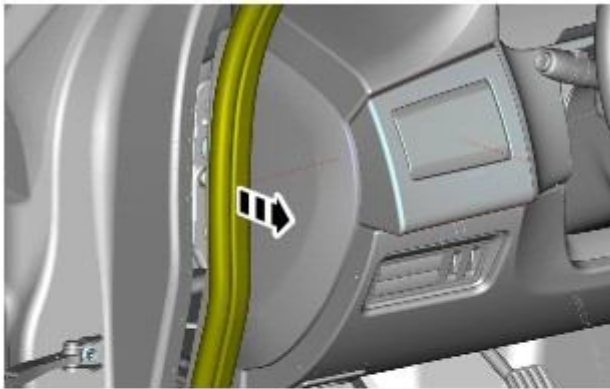
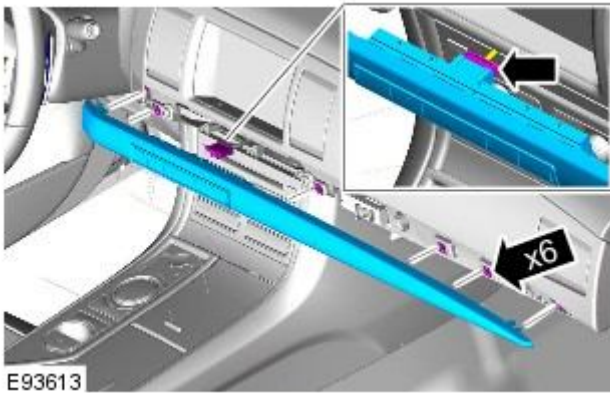


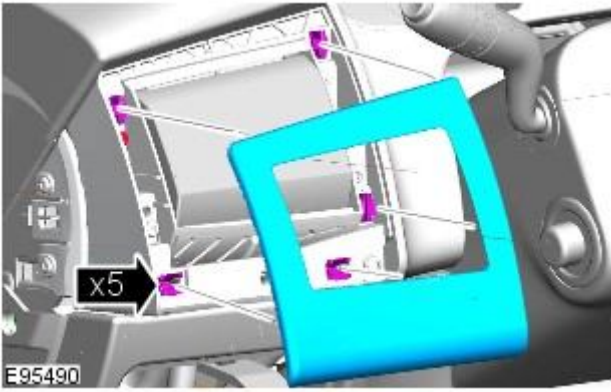
# Instrument Panel and Console - Instrument Panel Lower Trim Panel

Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.



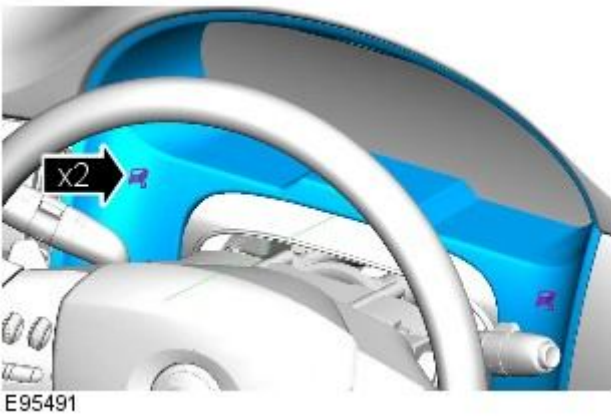


3.

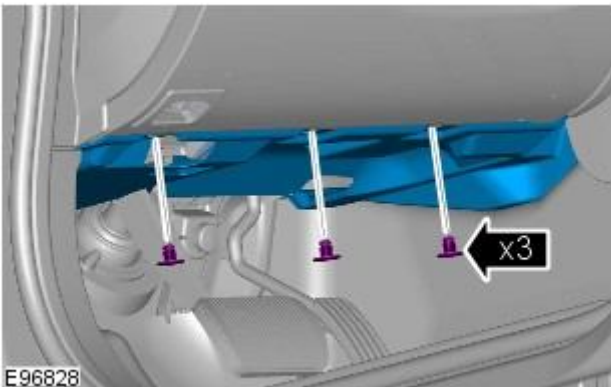
4. Fully extend and lower the steering column for access.



5.

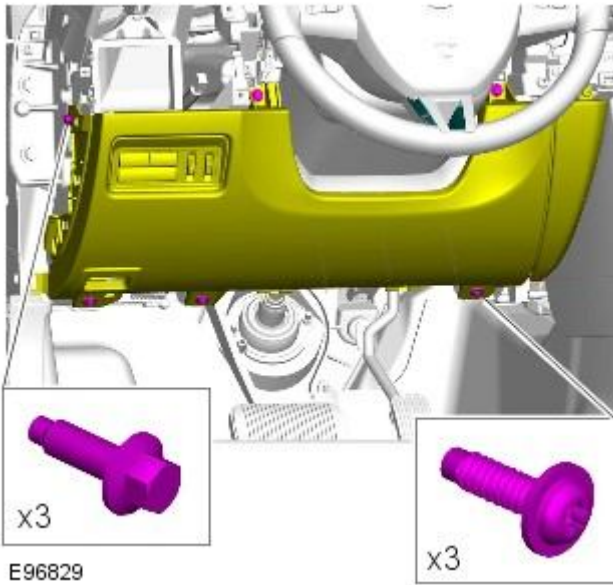



E95491



E96828

6.



7.  CAUTION: Fixings must be started by hand to avoid damaging threads.

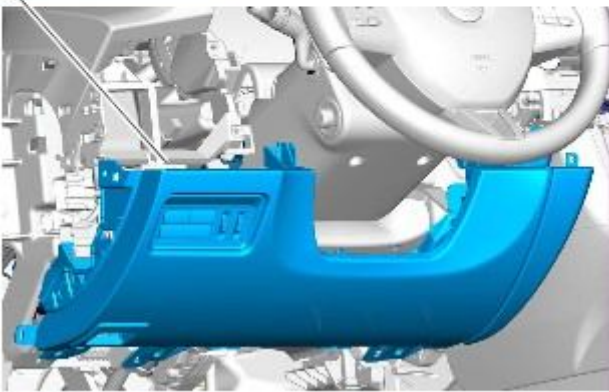
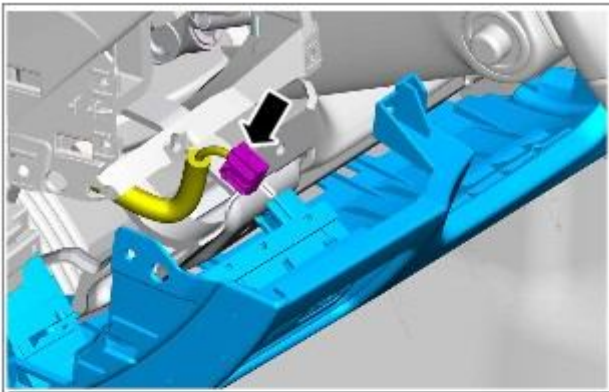
- Upper 3 bolts.

*Torque: 2.5 Nm*

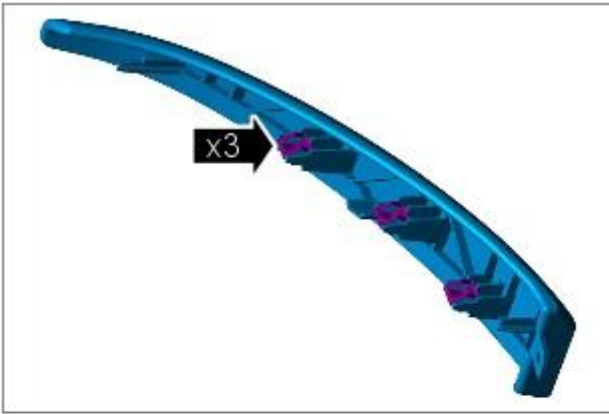
- Lower 3 bolts.

*Torque: 9 Nm*

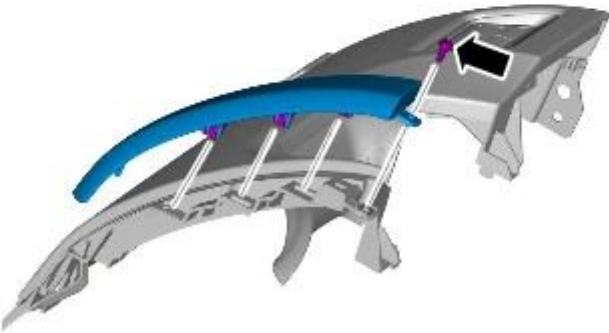
8.



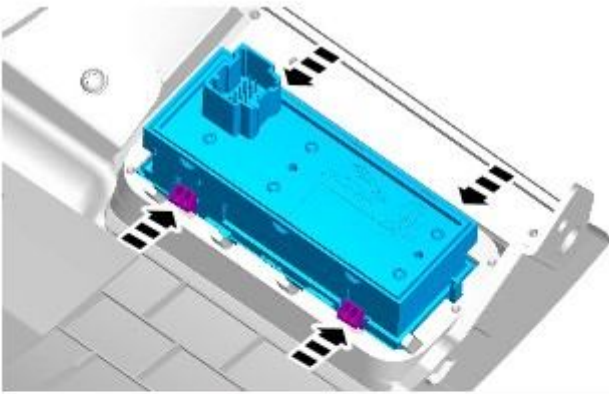
E96830



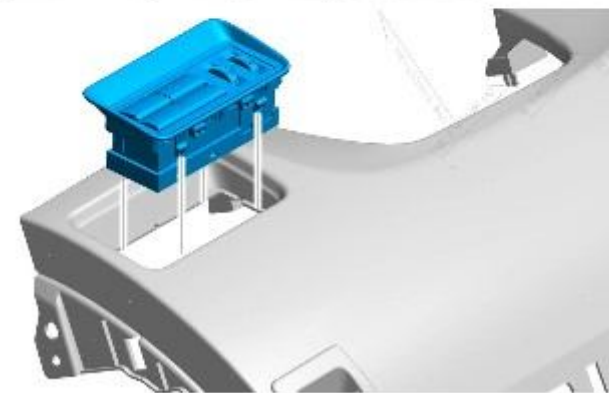
9. **9.** NOTE: Do not disassemble further if the component is removed for access only.



E96831



10.



E96832

11.



E96833

## Installation

1. To install, reverse the removal procedure.

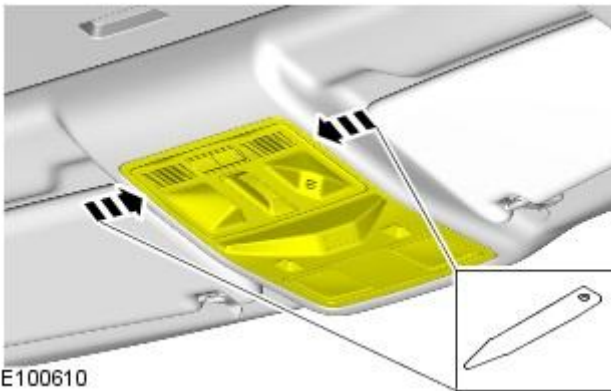



# Instrument Panel and Console - Overhead Console

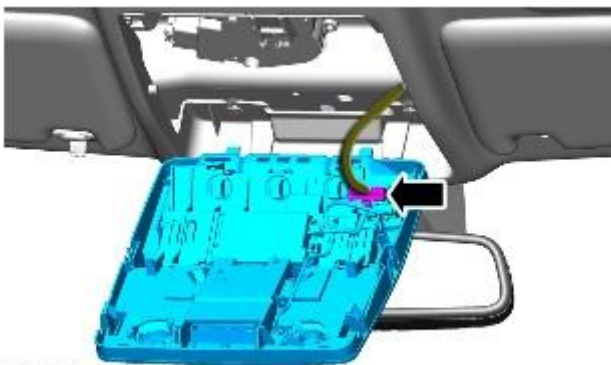
Removal and Installation

## Removal

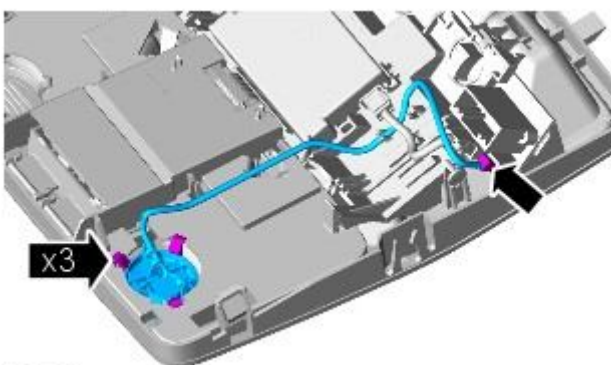
- NOTE: Removal steps in this procedure may contain installation details.



1.  CAUTION: Take extra care not to damage the edges of the component.

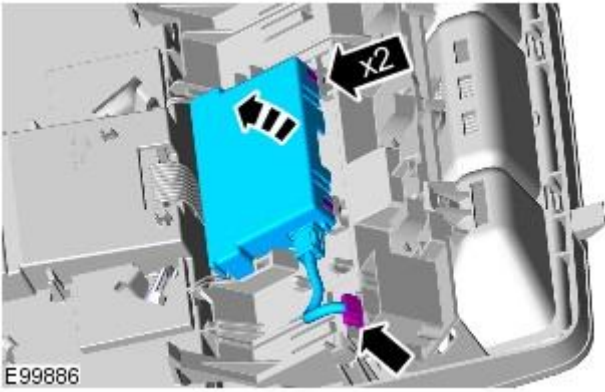



- 2.

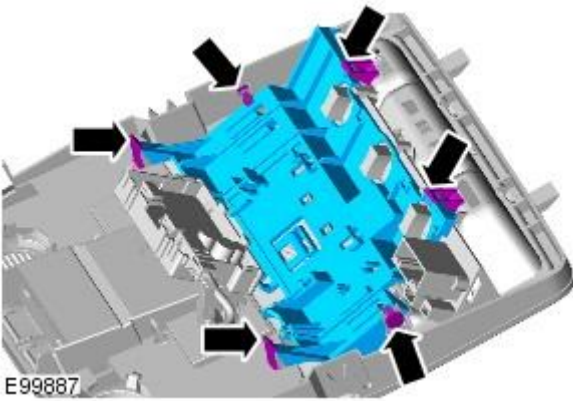


3. 3. NOTE: Do not disassemble further if the component is removed for access only.

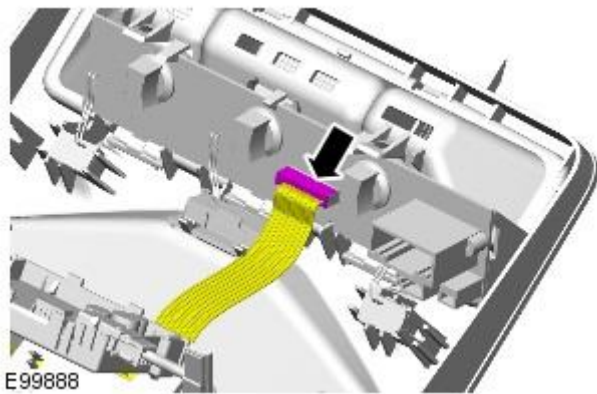




4.  CAUTION: Take extra care not to damage the wiring harnesses.
  - Take precautions to avoid any electrostatic charging, which could damage this component.

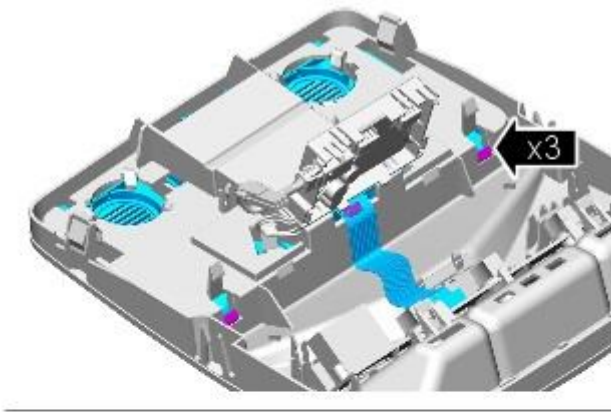


5.



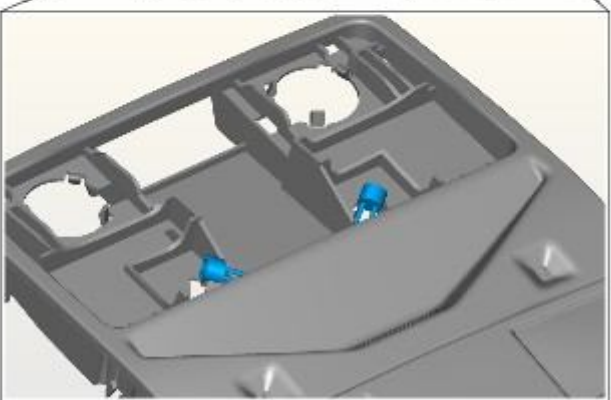
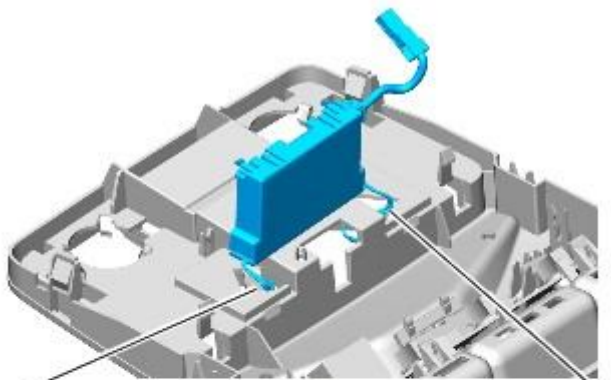
6.  CAUTION: Take extra care not to damage the wiring harnesses.

7.



E99889

8.

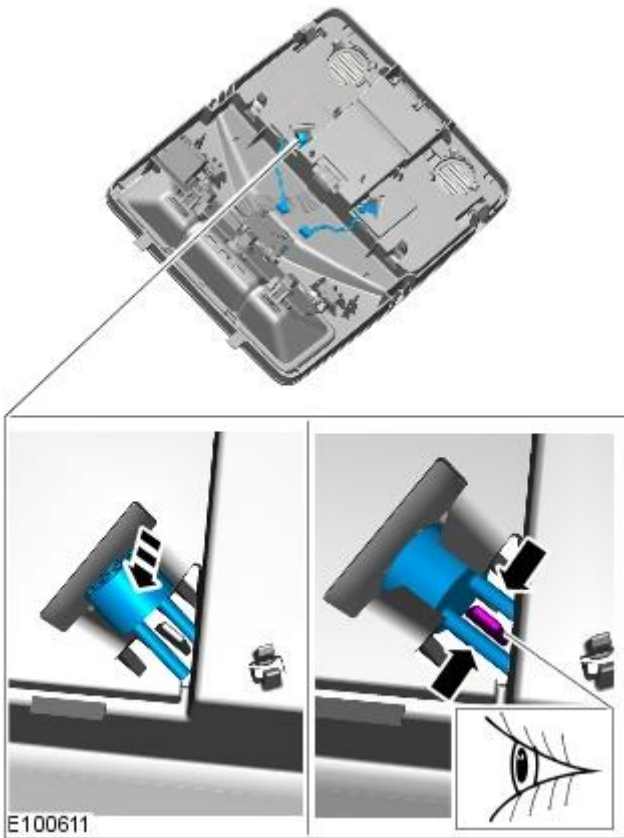


E99890

## Installation

1.  CAUTION: Take extra care not to damage the wiring harnesses.

To install, reverse the removal procedure.



## Handles, Locks, Latches and Entry Systems -

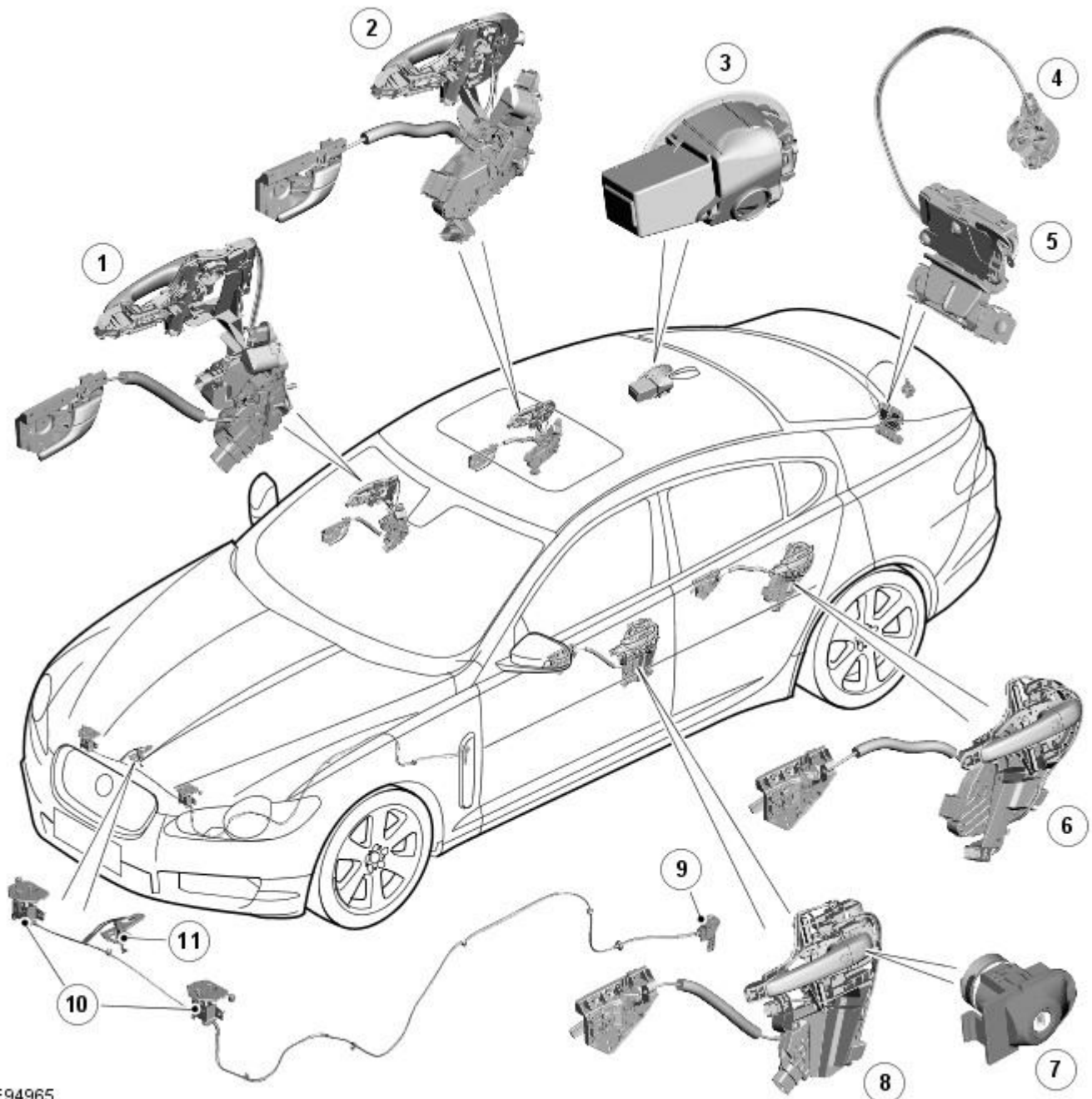
### Torque Specifications

Description	Nm	lb-ft	lb-in
Front and rear door latch retaining screw	7	-	62
Front and Rear exterior door handle / Door lock captive retaining screw	4	-	36
Front and Rear Exterior Door handle separate retaining screw	3	-	28
Front and Rear Door striker retaining screw	25	18	-
Interior Door handle retaining Screw	1.3	-	11.5
Hood latch Retaining screw	10	8	-
Hood Striker Retaining screw	22	17	-
Trunk Latch Retaining screw	20	15	-
Trunk Striker Retaining screw	22	17	-
Trunk Lock Retaining screw	3	-	28

# Handles, Locks, Latches and Entry Systems - Handles, Locks, Latches and Entry Systems - Component Location

Description and Operation

Locks and Latches



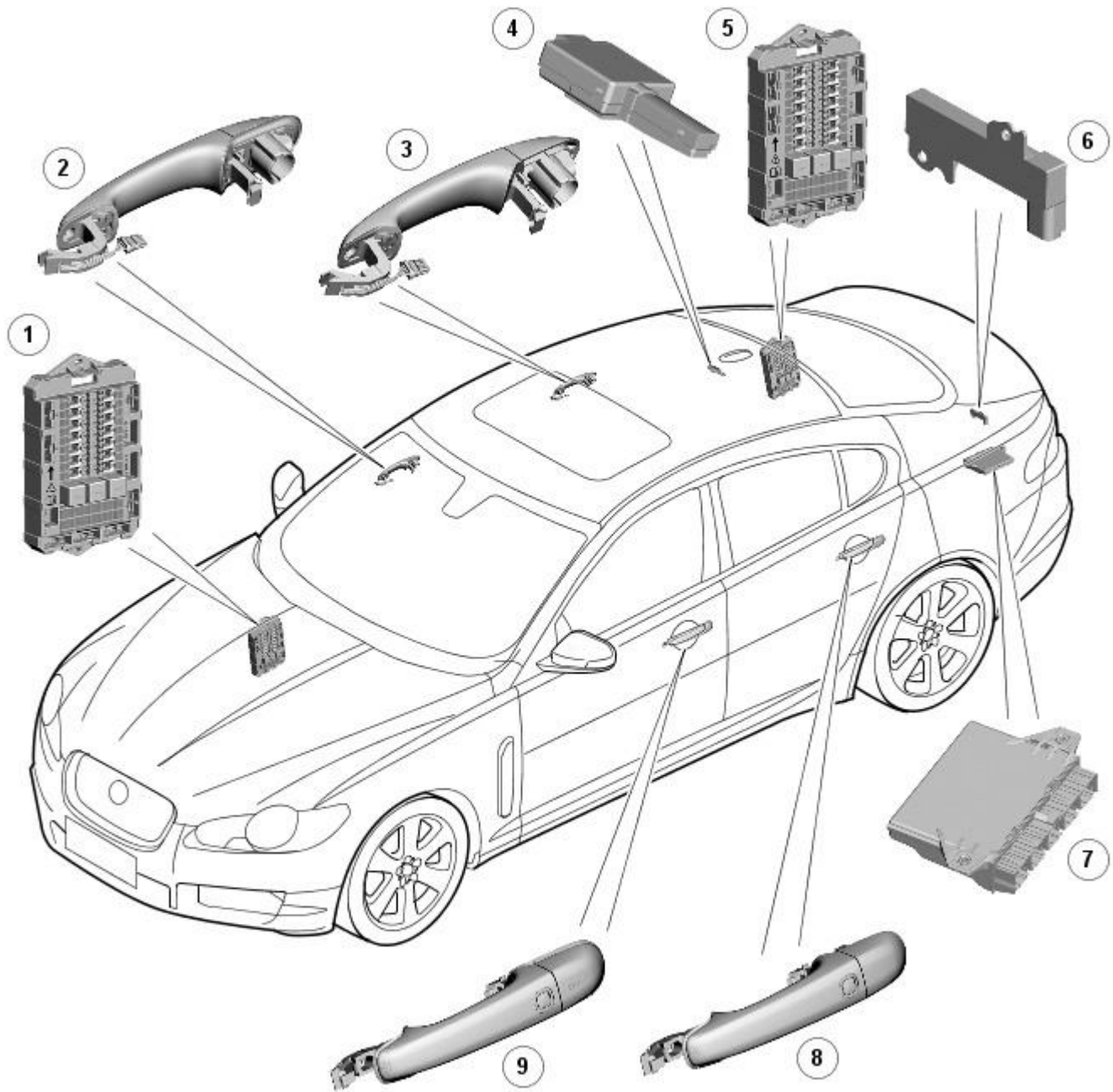
E94965

## ItemDescription

1	RH (right-hand) front door handles, latch and motor
2	RH rear door handles, latch and motor
3	Fuel filler door and motor
4	Luggage compartment emergency key barrel
5	Luggage compartment latch and motor
6	LH (left-hand) rear door handles, latch and motor
7	Door emergency key barrel - LH front door only
8	LH front door handles, latch and motor
9	Engine-compartment-lid release-lever and cable
10	Engine-compartment-lid striker
11	Engine-compartment-lid safety hook and guide

Central Locking and Keyless Vehicle Locking





E94967

**ItemDescription**

1	<a href="#">CJB (central junction box)</a>
2	Keyless vehicle, RH front door antenna * – integral to the handle
3	Keyless vehicle, RH rear door antenna * – integral to the handle
4	Central locking radio frequency receiver
5	<a href="#">RJB (rear junction box)</a>
6	Keyless vehicle, luggage compartment antenna *
7	Keyless vehicle module
8	Keyless vehicle, LH rear door antenna * – integral to the handle
9	Keyless vehicle, LH front door antenna * – integral to the handle
<b>Comments:</b>	
(* Only with passive entry option fitted)	



# Handles, Locks, Latches and Entry Systems - Handles, Locks, Latches and Entry Systems - Overview

## Description and Operation

The hinged panels are secured with latches and strikers. A remotely operated central locking system controls the locking and unlocking of the door and luggage compartment latches. A radio frequency Smart Key allows the vehicle to be locked and unlocked by pressing the appropriate handset buttons. Two levels of central locking system are available:

- remote central locking, and an
- optional passive entry system.

The remote central locking system, provides locking and unlocking of the vehicle from inside and outside of the vehicle. The system is operated using buttons on the Smart Key, which transmits radio frequency signals to the central locking radio frequency receiver.

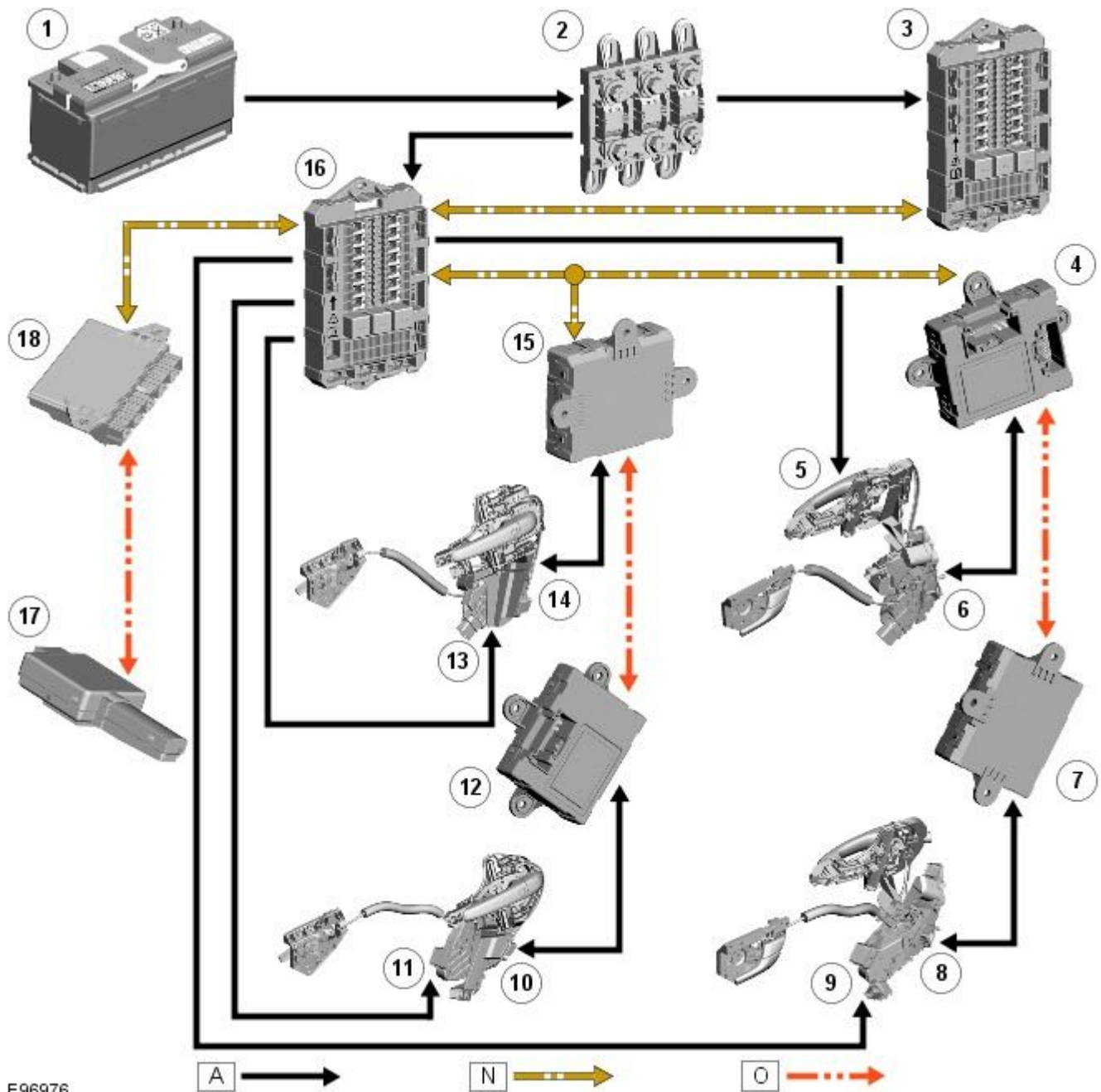
On vehicles fitted with the optional passive entry system, the vehicle can be unlocked without the use of a key or pressing buttons on the Smart Key. The Smart Key operates the passive entry system.

# Handles, Locks, Latches and Entry Systems - Handles, Locks, Latches and Entry Systems - System Operation and Component Description

Description and Operation

## Control Diagram

Central Locking



E96976

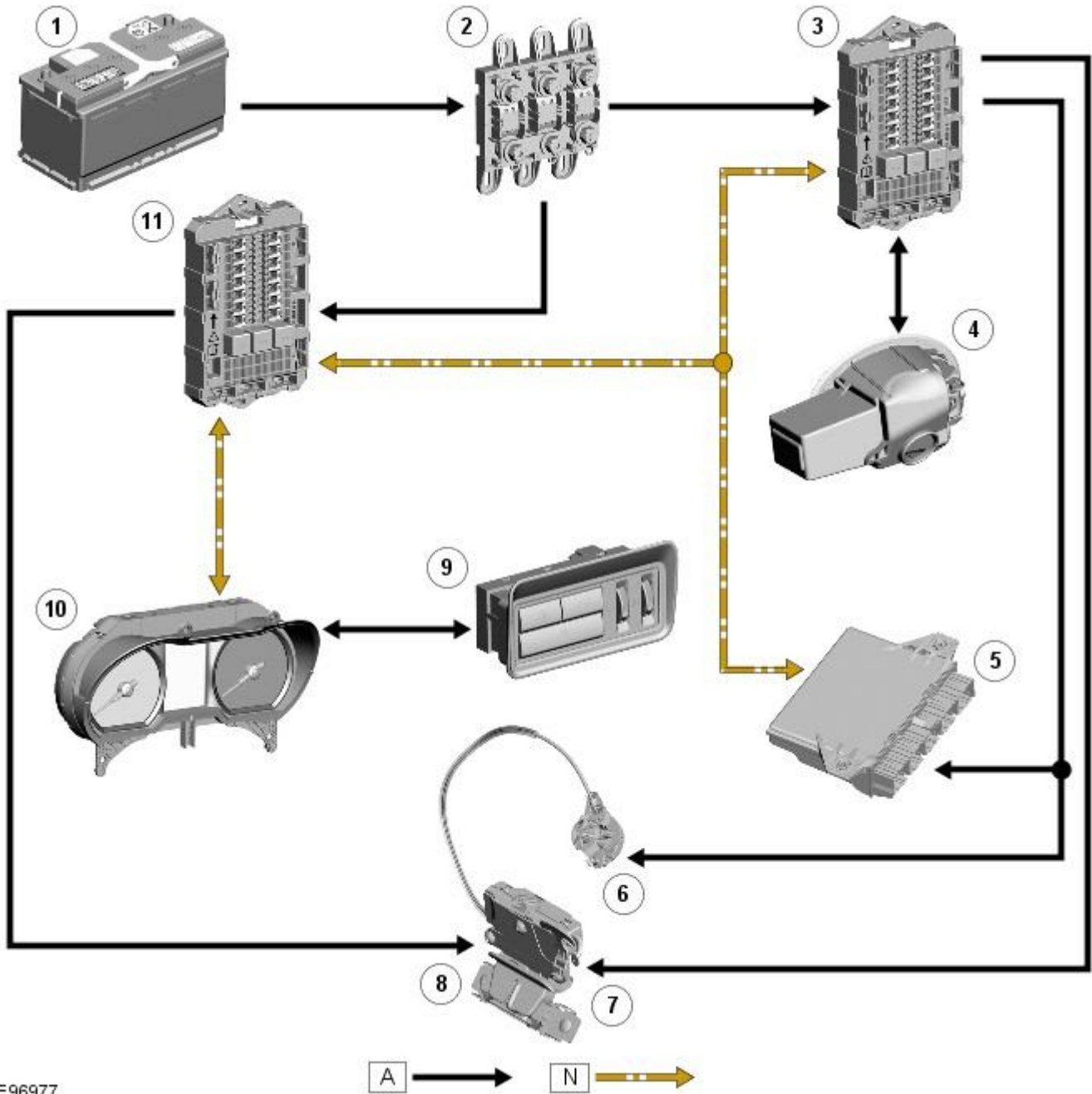
### ItemDescription

Note: **A** = Hardwired; **N** = Medium speed CAN (controller area network); **O** = LIN (local interconnect network) bus

1	Battery
2	Megafuse (250 A)
3	RJB (rear junction box)
4	Door module - front passenger
5	Door ajar switch - front passenger
6	Door latch - front passenger
7	Door module - RH (right-hand) rear passenger
8	Door latch - RH rear passenger
9	Door ajar switch - RH rear passenger
10	Door latch - LH (left-hand) rear passenger

11	Door ajar switch - LH rear passenger
12	Door module - LH rear passenger
13	Door ajar switch - driver door
14	Door latch - driver door
15	Door module - driver door
16	<a href="#">CJB (central junction box)</a>
17	Central-locking radio-frequency receiver
18	Keyless vehicle module

Luggage Compartment Lid and Fuel Filler Door Locking



E96977

**ItemDescription**

Note: **A** = Hardwired; **N** = Medium speed CAN

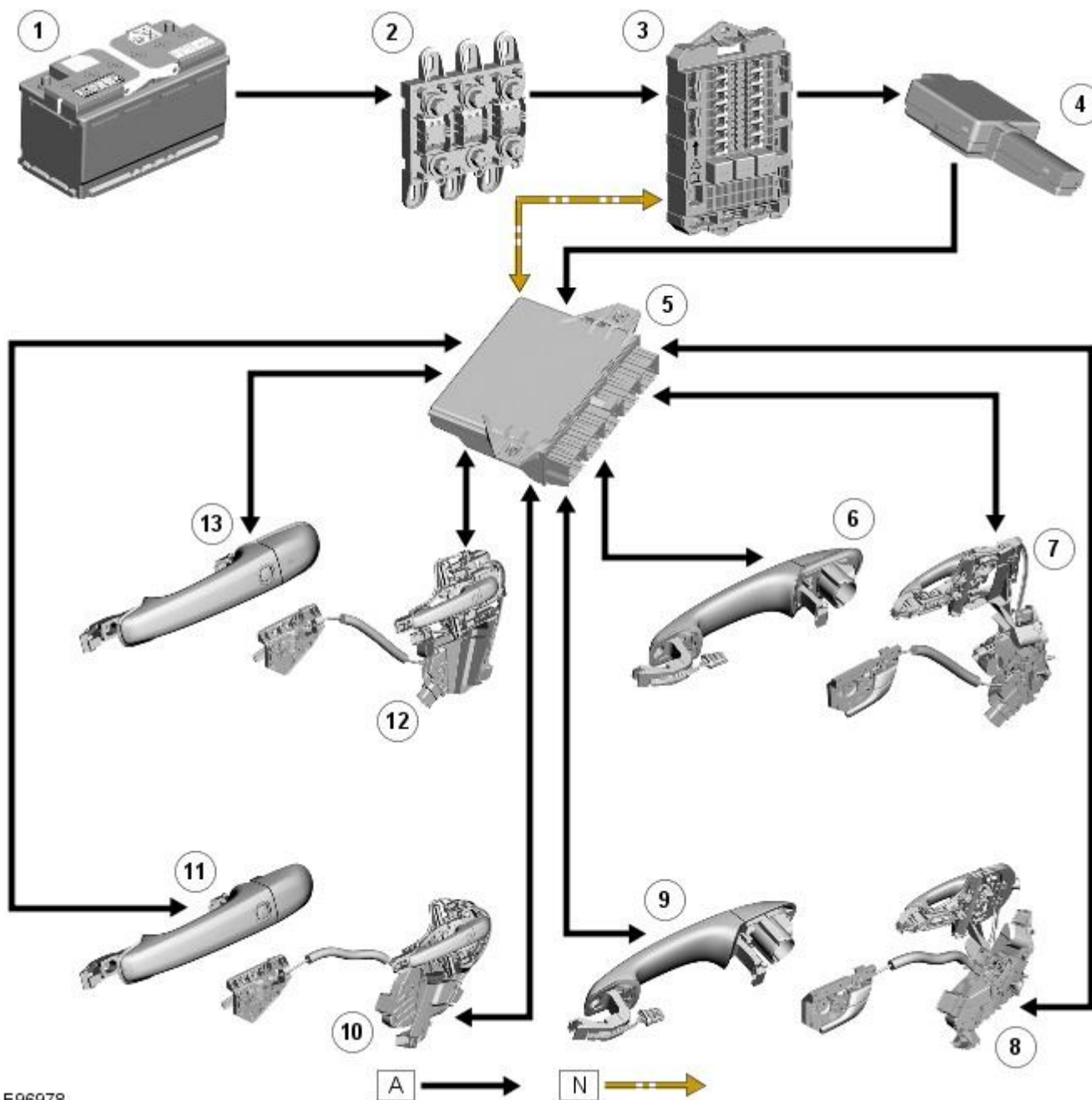
1	Battery
2	Megafuse (250 A)
3	<a href="#">RJB</a>
4	Locking motor - fuel door
5	Keyless vehicle module
6	Emergency key barrel - luggage compartment
7	Release latch - luggage compartment lid
8	Ajar switch - luggage compartment lid

9 Fascia switch - luggage compartment lid

10 Instrument cluster

11 [CJB](#)

### Passive Entry System



E96978

### ItemDescription

Note: **A** = Hardwired; **N** = Medium speed CAN

1	Battery
2	Megafuse (250 A)
3	<a href="#">CJB</a>
4	Radio frequency receiver
5	Keyless vehicle module
6	Door handle, lock/unlock switch and antenna - front passenger
7	Door latch, fast latch - front passenger
8	Door latch, fast latch - <a href="#">RH</a> rear passenger
9	Door handle, lock/unlock switch and antenna - RH rear passenger
10	Door latch, fast latch - LH rear passenger
11	Door handle, lock/unlock switch and antenna - LH rear passenger
12	Door latch, fast latch - driver door
13	Door handle, lock/unlock switch and antenna - driver door

## System Operation

The hinged panels are secured with latches and strikers. A remotely operated central locking system controls the locking and unlocking of the door and luggage compartment latches. A radio frequency Smart Key allows the vehicle to be locked and unlocked by pressing the appropriate handset buttons. Two levels of central locking system are available: remote central locking and an optional passive entry system.

The passive entry and associated passive start system allows the driver to unlock and start the vehicle without using a vehicle key in a door-lock or ignition switch. The passive entry system is an optional fitment while the passive start system is a standard fitment on all vehicles. The passive start system is combined with the passive anti-theft immobilization system.

Refer to: [Anti-Theft - Passive](#) (419-01B Anti-Theft - Passive, Description and Operation).

Emergency access to the vehicle is provided by two concealed key barrels: one located in the front left-hand door handle and one located on the underside of the luggage compartment lid finisher. An emergency, removable key blade is fitted into the Smart Key.

Operation of either key barrel unlocks the vehicle but does not disarm the alarm system. The key barrels in the door and luggage compartment lid are concealed by a plastic cover which can be removed by inserting the blade of the emergency key into a slot in the cover.

Locking and unlocking conditions using the emergency key in the door key barrel:

- If the alarm is not armed the vehicle can be centrally unlocked.
- If the alarm is armed the door only can be opened and the alarm will be triggered.
- The vehicle cannot be double locked or the alarm system armed using the emergency key.

The vehicle can be centrally locked and unlocked from inside using the interior handle release levers on the front doors only. Central locking and unlocking can also be performed using lock and unlock buttons on the vehicle's fascia. The driver can select locking options, single point entry or drive away locking for example, from a menu available on the touch screen.

### Central Locking – Radio Frequency Remote System

The radio frequency central locking system, provides locking and unlocking of the vehicle from inside and outside of the vehicle. The system is operated using buttons on the Smart Key, which transmits radio frequency signals to the central locking radio frequency receiver.

The system provides additional security by double-locking the doors from outside the vehicle if the lock button, on the Smart Key, is pressed twice within 3 seconds; this function is not applicable in North American Specification (NAS) and Japanese markets.

Additional buttons on the Smart Key provide for the convenience operation of the luggage compartment lid release, headlamp delay and panic alarm functions. A global open or close feature is also available in certain markets using the lock/unlock buttons.

### Passive Entry

On vehicles fitted with the optional passive entry system, the vehicle can be unlocked without the use of a key blade or pressing buttons on the Smart Key. The Smart Key operates the passive entry system in addition to the passive start system.

Refer to: [Anti-Theft - Passive](#) (419-01B Anti-Theft - Passive, Description and Operation).

The passive entry system is controlled by the keyless vehicle module and five low frequency antennas. One antenna located in each door handle and one antenna located behind the rear bumper cover.

When a vehicle door handle is pulled to the first five-percent of its travel and the Smart Key is within one meter of the handle; the Smart Key receives the low-frequency signal transmitted from the keyless vehicle module. The Smart Key responds with a radio frequency transmission of its authorization code. The radio frequency signal is received by the central locking radio-frequency receiver and passed to the keyless vehicle module which checks and approves the code as valid. Once the handle is pulled to eighty percent of its travel the keyless vehicle module then drives the fast latch directly to allow the door to be opened. The keyless vehicle module also transmits an unlock request to the [CJB](#). The CJB then passes an unlock request to the door modules.

Locking of the vehicle is performed by pressing one of the buttons located on each exterior door handle, with the Smart Key within a one meter range of the vehicle. When the door handle button is pressed, the keyless vehicle module transmits a low-frequency signal via the low-frequency handle antenna to the Smart Key. The Smart Key transmits a radio frequency signal which is verified by the keyless vehicle module and allows the doors to be locked or double locked and the alarm system to be armed.

To double lock the vehicle, the button on the exterior door handle must be pressed twice within three seconds, with the Smart Key within one meter range of the vehicle.

If a door, engine-compartment lid or the luggage compartment lid is ajar when an attempt to lock the vehicle is made, an error tone is emitted and no locking action will occur.

Refer to: [Anti-Theft - Active](#) (419-01A Anti-Theft - Active, Description and Operation).

## Component Description

### Engine Compartment Lid Latches

Two engine-compartment lid latches are located on the front crossmember. An engine-compartment lid release lever is located below the instrument panel on the left-hand 'A' pillar and is connected with a cable to the latches. An engine-compartment lid ajar switch is integrated in the engine-compartment lid latch.

## Door Latches

The door latches are located at the rear of each door and engage with a striker on the adjacent pillar. Each door latch motor assembly contains micro-switches for lock, unlock and door ajar. Motors provide for the central door locking and the double locking feature. The electrical control for the door latch components is provided by the CJB and RJB via the driver's and passenger door modules.

The interior door handles are connected by a cable to the latch release mechanisms. The interior door handles also incorporate a locking facility to allow the doors to be locked from inside the vehicle when all the doors are closed. If a door is ajar the locking feature is inhibited.

## Luggage Compartment Lid Latch

The luggage compartment latch is attached to the bottom of the lid. The latch can be released electrically by pressing the interior release button located on the outboard side of driver's lower knee bolster; a release button is also provided on the Smart Key. There is also a release switch on the underside of the luggage compartment lid finisher.

On NAS vehicles an emergency release cable is attached to the latch. This allows the latch to be manually opened by pulling a handle located in the luggage compartment lid interior trim.

## Fuel Filler Door

The fuel filler door is electrically locked by a motor located on the fuel door housing. The fuel door is locked when the vehicle is locked and alarmed. The fuel door can be opened when the vehicle is unlocked or locked:

- via an interior handle,
- via drive-a-way locking,
- via the lock switch on the fascia,
- via the external door key barrel.



# Handles, Locks, Latches and Entry Systems - Locks, Latches and Entry Systems

Diagnosis and Testing

## Description and Operation

For a detailed description of the handles, locks, latches and entry systems, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (501-14 Handles, Locks, Latches and Entry Systems)

[Handles, Locks, Latches and Entry Systems](#) (Description and Operation),  
[Handles, Locks, Latches and Entry Systems](#) (Description and Operation),  
[Handles, Locks, Latches and Entry Systems](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. Verify the customer concern.

• NOTE: For remote keyless entry issues, REFER to: [Remote Keyless Entry \(RKE\) Module](#) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Misaligned door(s), hood or luggage compartment lid</li> <li>● Door latch(s)</li> <li>● Actuating rod(s)</li> <li>● Exterior door handle(s)</li> <li>● Interior door handle(s)</li> <li>● Door lock cylinder</li> <li>● Cable(s)</li> <li>● Luggage compartment lid exterior release switch</li> </ul>	<ul style="list-style-type: none"> <li>● Fuse(s)</li> <li>● Wiring harness</li> <li>● Electrical connector(s)</li> <li>● Door lock actuator(s)</li> <li>● Remote transmitter batteries</li> <li>● Vehicle battery</li> <li>● Remote transmitter</li> <li>● Door lock switch(s)</li> </ul>

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B108413	Boot/Trunk Motor Close Switch	<ul style="list-style-type: none"> <li>● Trunk latch open signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check trunk latch open signal circuit for open circuit
B10EB11	Driver door double locking motor	<ul style="list-style-type: none"> <li>● Driver door double locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test driver door double locking motor control circuit for short ground
B10EB15	Driver door double locking motor	<ul style="list-style-type: none"> <li>● Driver door double locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver door double locking motor control circuit for short to power or

DTC	Description	Possible Cause	Action
			open circuit
B10EC11	Passenger door double locking motor	<ul style="list-style-type: none"> <li>Passenger door double locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger door double locking motor control circuit for short ground
B10EC15	Passenger door double locking motor	<ul style="list-style-type: none"> <li>Passenger door double locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test passenger door double locking motor control circuit for short to power or open circuit
B10ED11	Rear door driver side double locking motor	<ul style="list-style-type: none"> <li>Rear door driver side double locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test rear door driver side double locking motor control circuit for short ground
B10ED15	Rear door driver side double locking motor	<ul style="list-style-type: none"> <li>Rear door driver side double locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test rear door driver side double locking motor control circuit for short power, open circuit
B10EE11	Rear door passenger side double locking motor	<ul style="list-style-type: none"> <li>Rear door passenger side double locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test rear door passenger side double locking motor control circuit for short ground
B10EE15	Rear door passenger side double locking motor	<ul style="list-style-type: none"> <li>Rear door passenger side double locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test rear door passenger side double locking motor control circuit for short power, open circuit
B110811	Driver door central locking motor	<ul style="list-style-type: none"> <li>Driver door central locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test driver door central locking motor control circuit for short ground
B110815	Driver door central locking motor	<ul style="list-style-type: none"> <li>Driver door central locking motor control circuit - short to power, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test driver door central locking motor control circuit for short to power, open circuit
B110A11	Rear door driver side central locking motor	<ul style="list-style-type: none"> <li>Rear driver door central locking motor control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test rear driver door central locking motor control circuit for short ground
B110A15	Rear door driver side central locking motor	<ul style="list-style-type: none"> <li>Rear driver door central locking motor control circuit - short to power, open circuit</li> </ul>	Refer to the electrical circuit diagrams and test rear driver door central locking motor control circuit for short to power, open circuit
B114511	Glovebox Locking Motor	<ul style="list-style-type: none"> <li>Glovebox latch locking motor control circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check glovebox latch locking motor circuit for short to ground
B114512	Glovebox Locking Motor	<ul style="list-style-type: none"> <li>Glovebox latch locking motor control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check glovebox latch locking motor control circuit for short to power
B114513	Glovebox Locking Motor	<ul style="list-style-type: none"> <li>Glovebox latch locking motor control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check glovebox latch locking motor control circuit for open circuit
B117513	Driver Door Ajar Switch	<ul style="list-style-type: none"> <li>Driver door ajar switch signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check driver door ajar switch signal circuit for open circuit
B117613	Passenger Door Ajar Switch	<ul style="list-style-type: none"> <li>Passenger door ajar switch signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check passenger door ajar switch signal circuit for open circuit
B11C013	Driver Side Rear Door Ajar Switch	<ul style="list-style-type: none"> <li>Left rear door ajar switch signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check left rear door ajar switch signal circuit for open circuit
B11C113	Passenger Side Rear Door Ajar Switch	<ul style="list-style-type: none"> <li>Right rear door ajar switch signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check right rear door ajar switch signal circuit for open circuit
B122223	Master Lock/Unlock Switch	<ul style="list-style-type: none"> <li>Master lock or unlock switch digital input circuit - signal stuck low</li> </ul>	Refer to the electrical circuit diagrams and check master lock and unlock switch digital input circuits for short to ground, open circuit
B111D12	Boot/Trunk Motor Open	<ul style="list-style-type: none"> <li>Luggage compartment lid latch actuator control circuit - short to power</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check luggage compartment lid latch actuator control circuit for short to power
B111D14	Boot/Trunk Motor Open	<ul style="list-style-type: none"> <li>Luggage compartment lid latch actuator control circuit - short to ground, open circuit</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check luggage compartment lid latch actuator control circuit for short to ground, open circuit

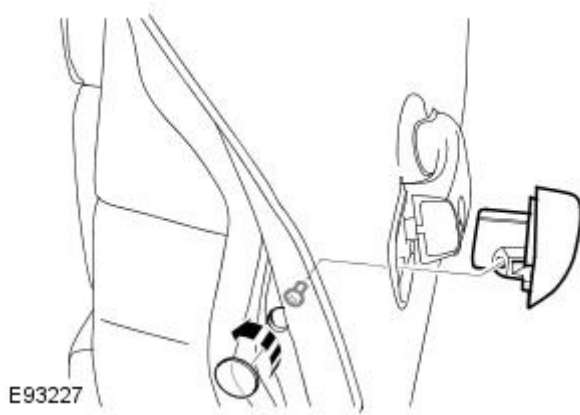
<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
B111E11	Boot/Trunk Lamps	<ul style="list-style-type: none"> <li>Luggage compartment lamp control circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check luggage compartment lamp control circuit for short to ground
B111E12	Boot/Trunk Lamps	<ul style="list-style-type: none"> <li>Luggage compartment lamp control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check luggage compartment lamp control circuit for short to power
B111E13	Boot/Trunk Lamps	<ul style="list-style-type: none"> <li>Luggage compartment lamp control circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check luggage compartment lamp control circuit for open circuit
B113E12	External Boot/Trunk Release Switch	<ul style="list-style-type: none"> <li>External luggage compartment lid release switch digital input circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check external luggage compartment lid release switch digital input circuit for short to power
B113E23	External Boot/Trunk Release Switch	<ul style="list-style-type: none"> <li>External luggage compartment lid release switch digital input circuit - signal stuck low</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check external luggage compartment lid release switch digital input circuit for short to ground
B126113	Fuel Flap/Door Release Switch	<ul style="list-style-type: none"> <li>Fuel filler flap digital input signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check fuel filler flap digital input signal circuit for open circuit
B1C9112	Fuel Flap/Door Lock Relay Coil Circuit	<ul style="list-style-type: none"> <li>Fuel filler flap locking motor control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check fuel filler flap locking motor control circuit for short to power
B1C9114	Fuel Flap/Door Lock Relay Coil Circuit	<ul style="list-style-type: none"> <li>Fuel filler flap locking motor control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check fuel filler flap locking motor control circuit for short to ground, open circuit
U200224	Switch	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Clear DTC and re-test. If DTC remains, suspect the passenger side window switch. Check and install a new passenger side window switch
U200424	Auxiliary Switch Pack	<ul style="list-style-type: none"> <li>Left or right rear door local switch - signal stuck high</li> </ul>	Check for stuck rear window switch. Refer to the electrical circuit diagrams and check left or right rear door local switch circuit for short circuit
U201011	Switch illumination	<ul style="list-style-type: none"> <li>Rear window switch illumination circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check rear window switch illumination circuit for short to ground
U201324	Switch Pack	<ul style="list-style-type: none"> <li>Signal stuck high</li> </ul>	Clear DTC and re-test. If DTC remains, install a new driver door switch pack

# Handles, Locks, Latches and Entry Systems - Exterior Front Door Handle

Removal and Installation

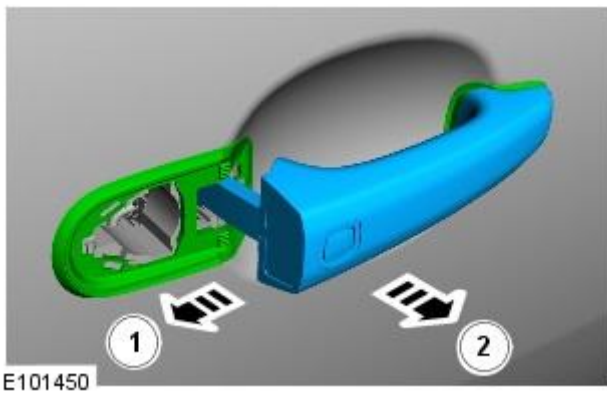
## Removal

- NOTE: Removal steps in this procedure may contain installation details.

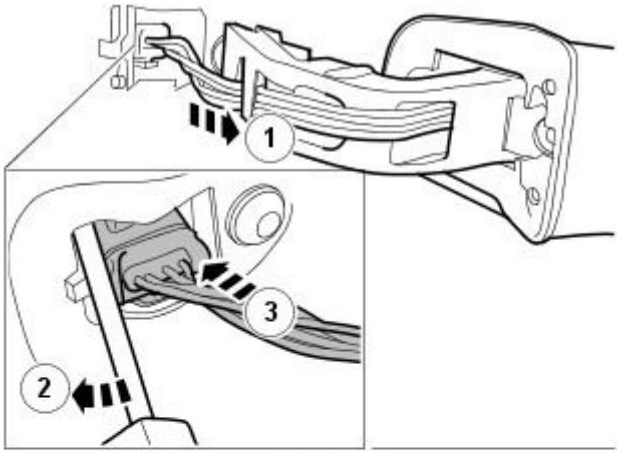



1. NOTE: Remove the screw sufficiently, only to release the component.

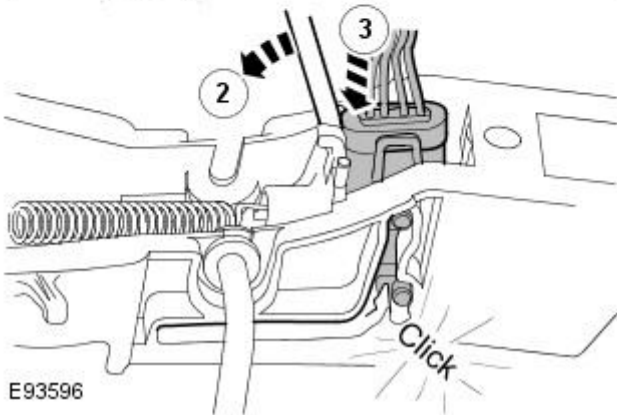
Torque: 4 Nm



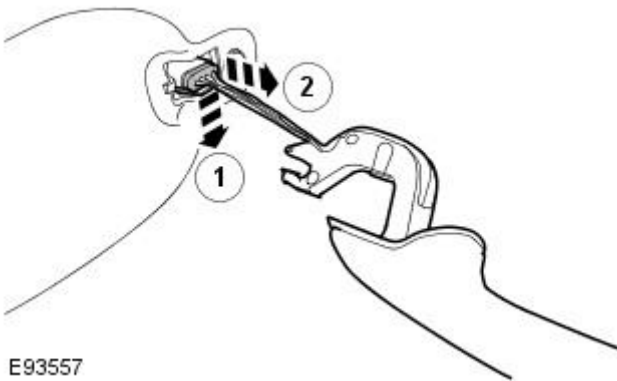
2. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



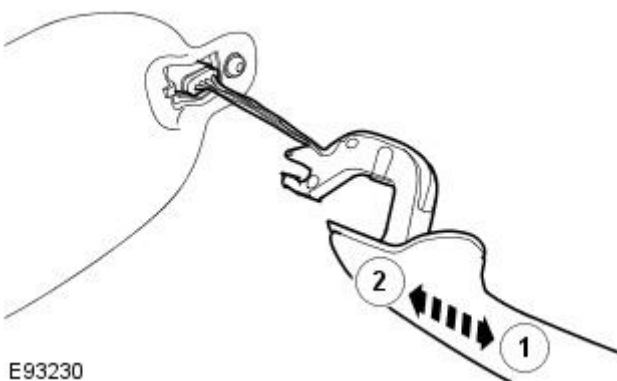
3.  **CAUTION:** Take extra care not to damage the wiring harnesses.
  - **NOTE:** Secure the connection in the service position.




4.



## Installation



1.  **CAUTION:** Make sure that the wiring harnesses are correctly located.

To install, reverse the removal procedure.

# Handles, Locks, Latches and Entry Systems - Exterior Luggage

## Compartment Lid Release Switch

Removal and Installation

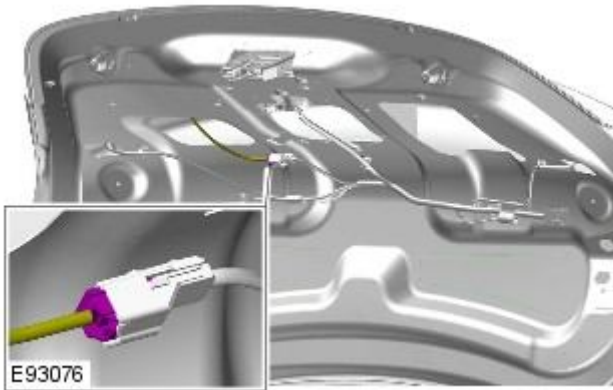
### Removal

All vehicles

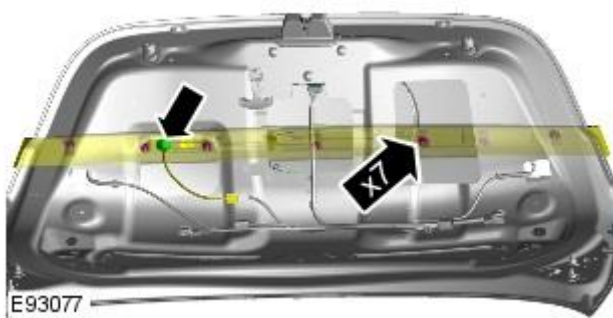
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Luggage Compartment Lid Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



3. Torque: 3 Nm

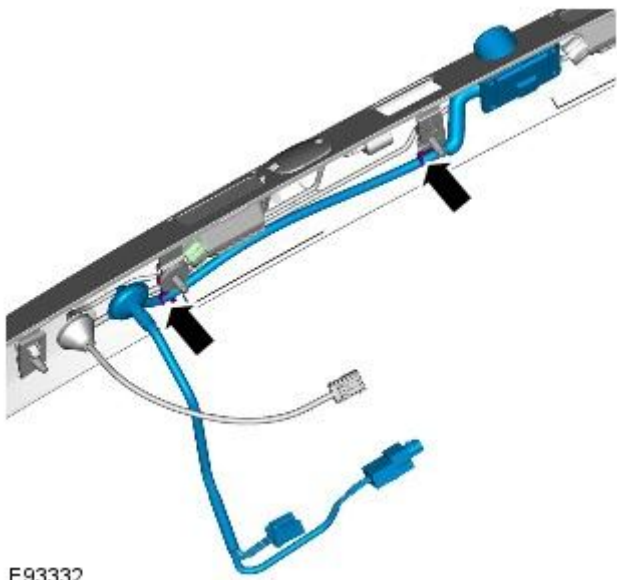


4.



Vehicles with parking aid

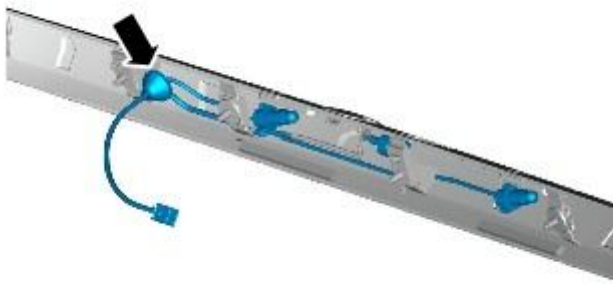




E93332

5.

All vehicles



E93080

6.

## Installation

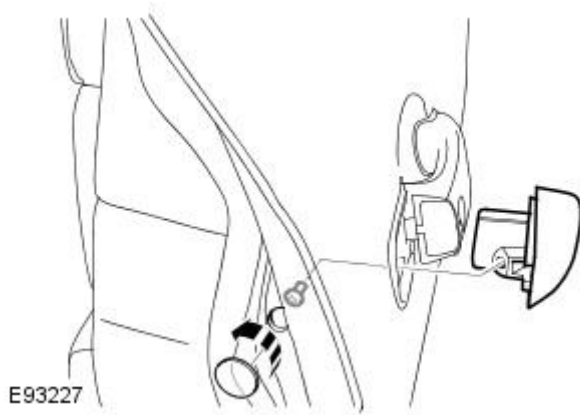
1. To install, reverse the removal procedure.

# Handles, Locks, Latches and Entry Systems - Exterior Rear Door Handle

Removal and Installation

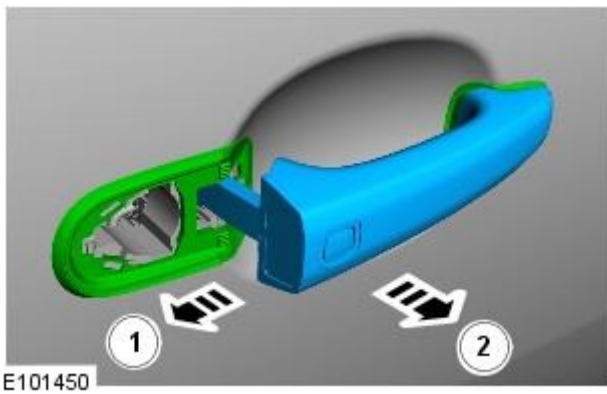
## Removal

- NOTE: Removal steps in this procedure may contain installation details.

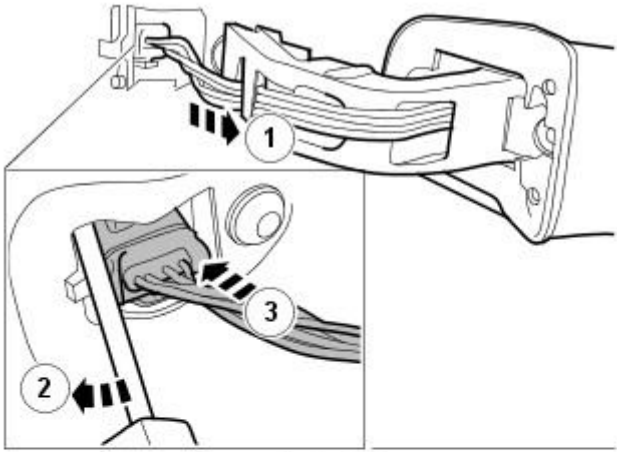



1. **1.** NOTE: Remove the screw sufficiently, only to release the component.

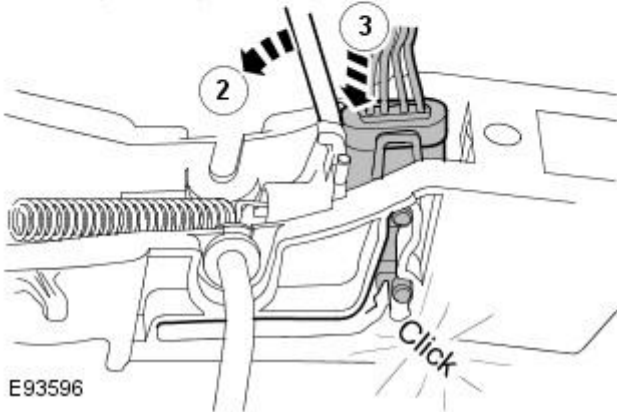
*Torque:* 4 Nm



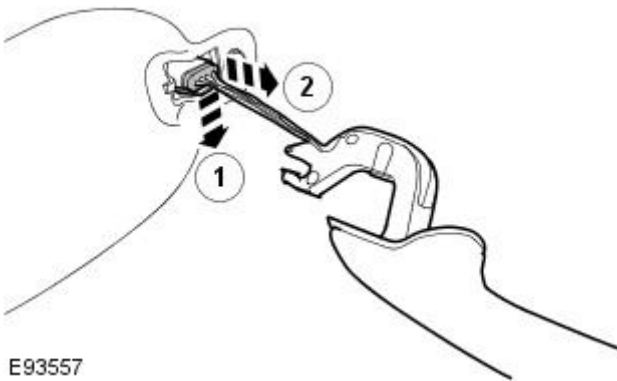
2. **2.** NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



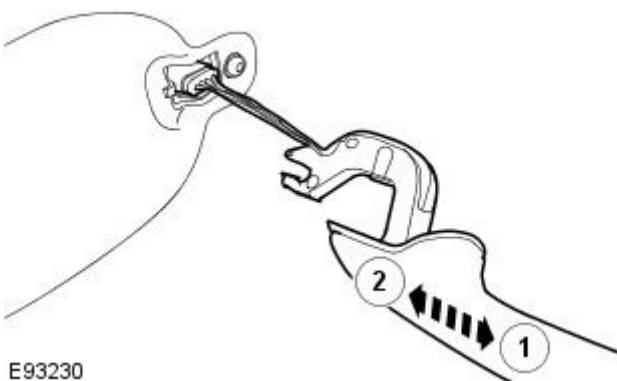
3.  **CAUTION:** Take extra care not to damage the wiring harnesses.
  - **NOTE:** Secure the connection in the service position.



4.



## Installation




1.  **CAUTION:** Make sure that the wiring harnesses are correctly located.

To install, reverse the removal procedure.

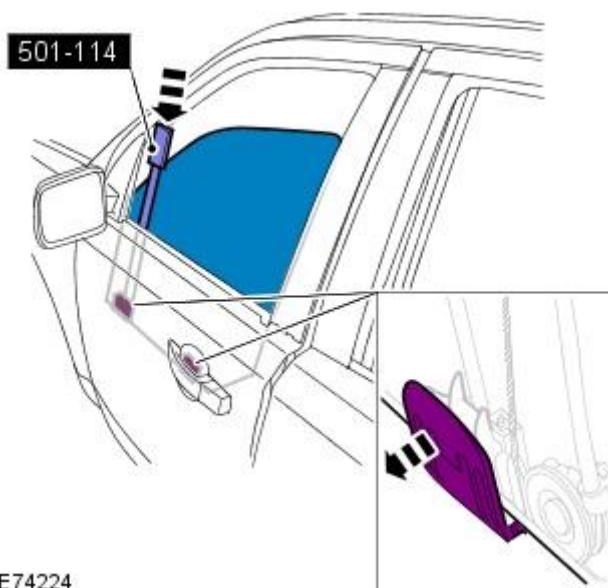
# Handles, Locks, Latches and Entry Systems - Front Door Latch


Removal and Installation

## Special Tool(s)

 <p>501-114 E54200</p>	<p>501-114 Release Lever, Door Glass</p>
---	--

## Removal



1.  **WARNING:** Do not allow the glass to drop.
  - **NOTE:** Left-hand shown, right-hand similar.
  - **NOTE:** The door glass should be lowered by approximately one third.

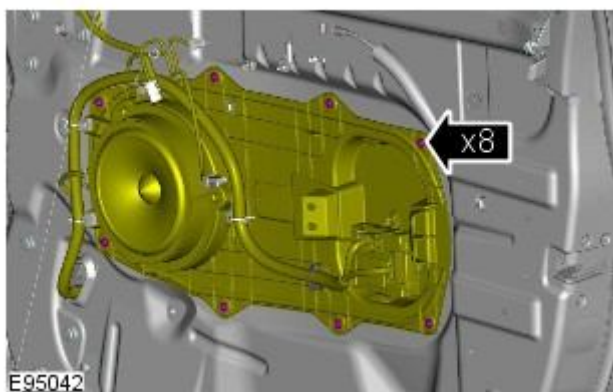
*Special Tool(s):* [501-114](#)

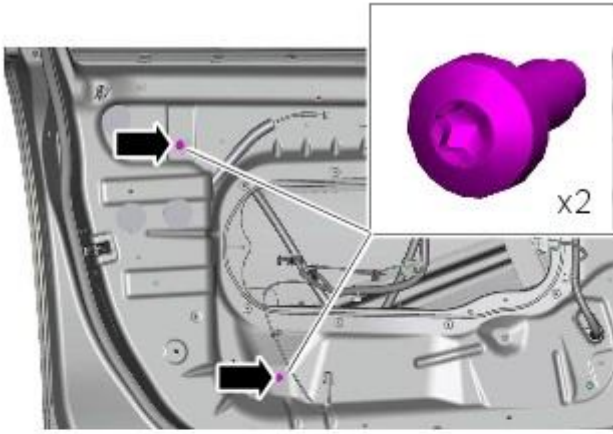
2. **2.** **NOTE:** Left-hand shown, right-hand similar.

Refer to: [Exterior Front Door Handle](#) (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

3. Refer to: [Front Door Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

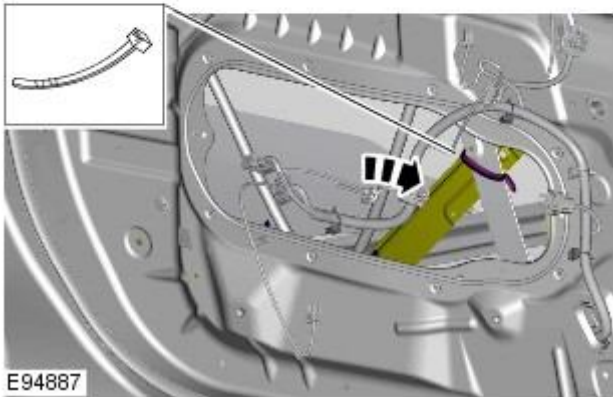
4. **4.** **NOTE:** Right-hand shown, left-hand similar.





5. **5.** NOTE: Left-hand shown, right-hand similar.

*Torque: 7 Nm*

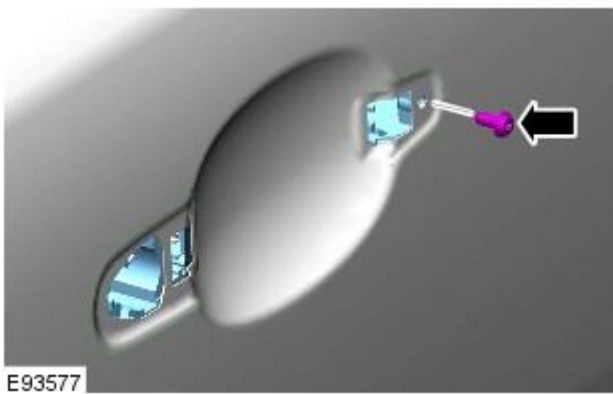


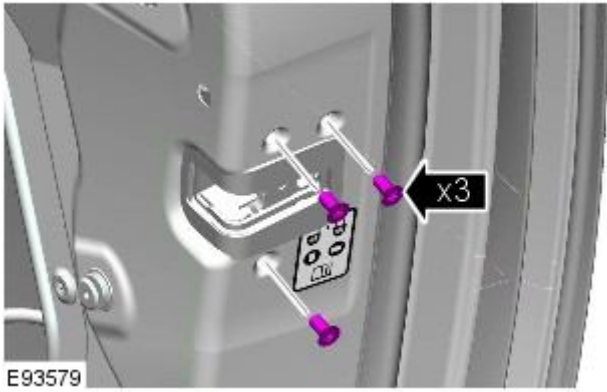
6. **6.** NOTE: Left-hand shown, right-hand similar.



7. **7.** NOTE: Right-hand shown, left-hand similar.

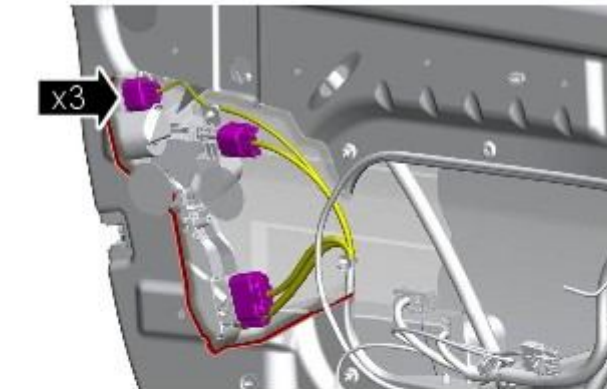
*Torque: 3 Nm*





8. **8.** NOTE: Right-hand shown, left-hand similar.

*Torque: 7 Nm*

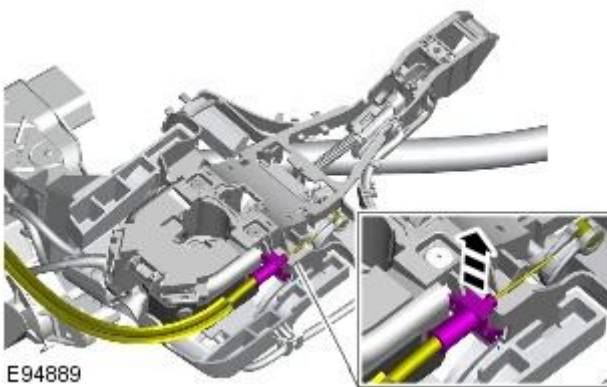


9. **9.** NOTE: Left-hand shown, right-hand similar.

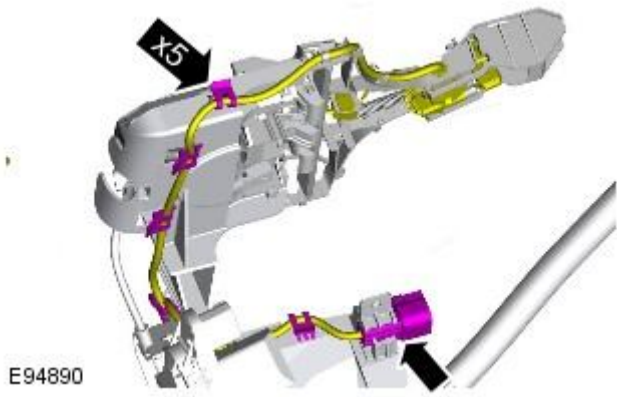


E94888

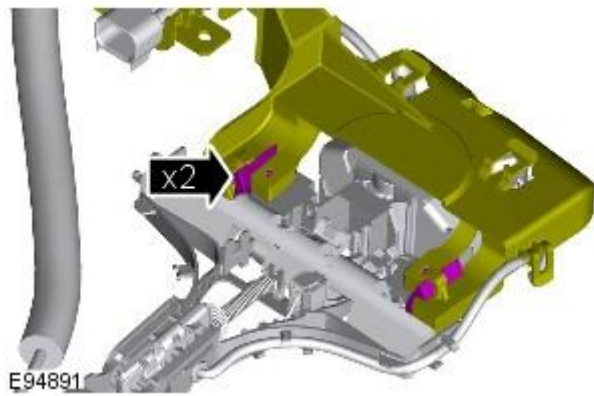
10. **10.** NOTE: Do not disassemble further if the component is removed for access only.



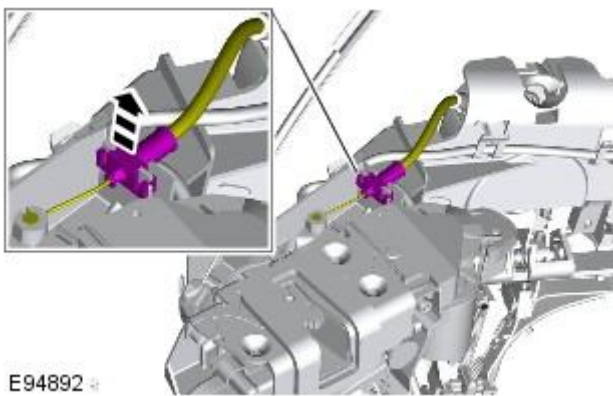




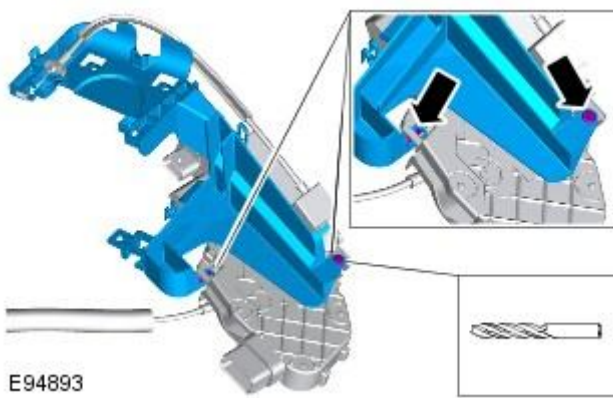
11. **11.** NOTE: Note the position of the wiring harness.



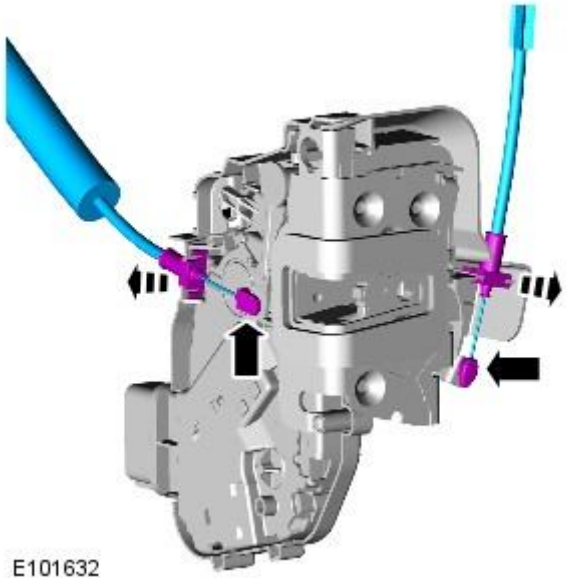
12. **12.** NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



13.



14.



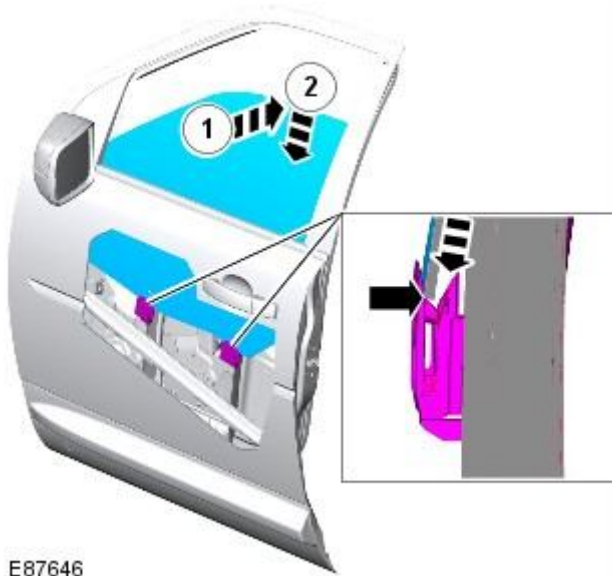
E101632

15.

## Installation

1. To install, reverse the removal procedure.

2.



E87646

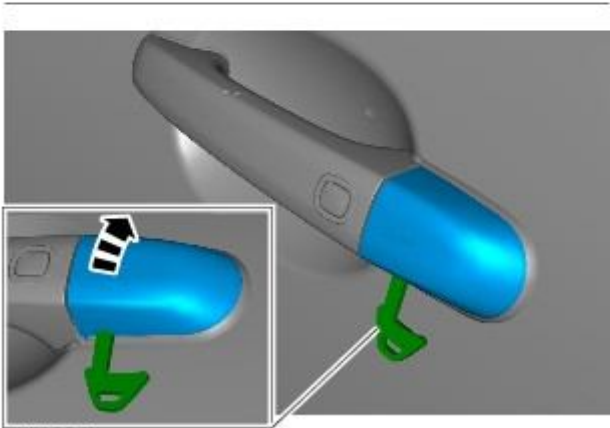
# Handles, Locks, Latches and Entry Systems - Front Door Lock Cylinder

Removal and Installation

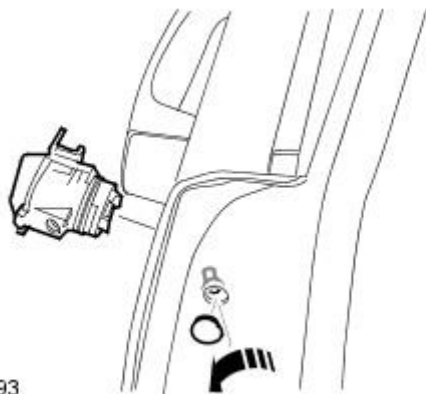
## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1.



E101264

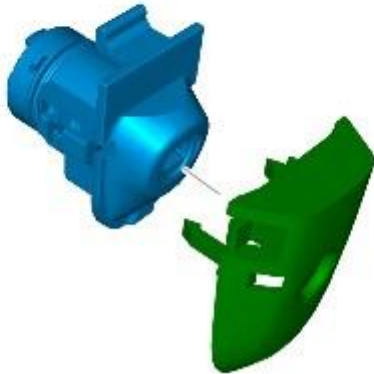
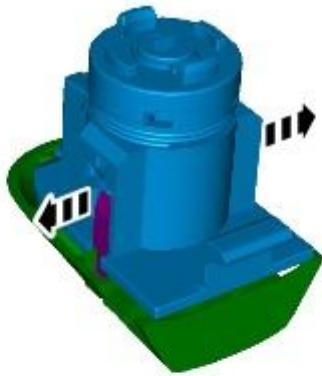


E56293

2. 2. NOTE: Remove the screw sufficiently, only to release the component.

*Torque: 4 Nm*

3. **3.** NOTE: Do not disassemble further if the component is removed for access only.



E101265

## Installation

1. To install, reverse the removal procedure.

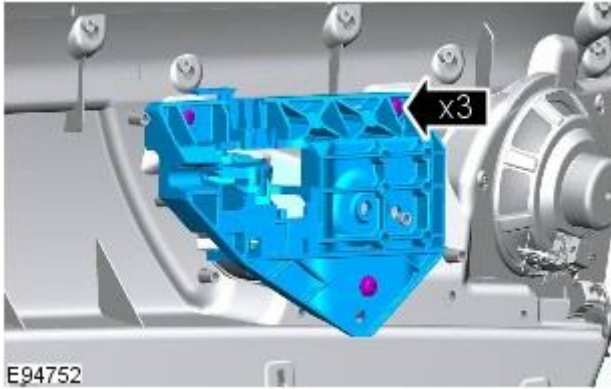
# Handles, Locks, Latches and Entry Systems - Interior Front Door Handle

Removal and Installation

## Removal

1. Refer to: [Front Door Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



## Installation

1. To install, reverse the removal procedure.

# Handles, Locks, Latches and Entry Systems - Luggage Compartment Lid

## Latch Actuator

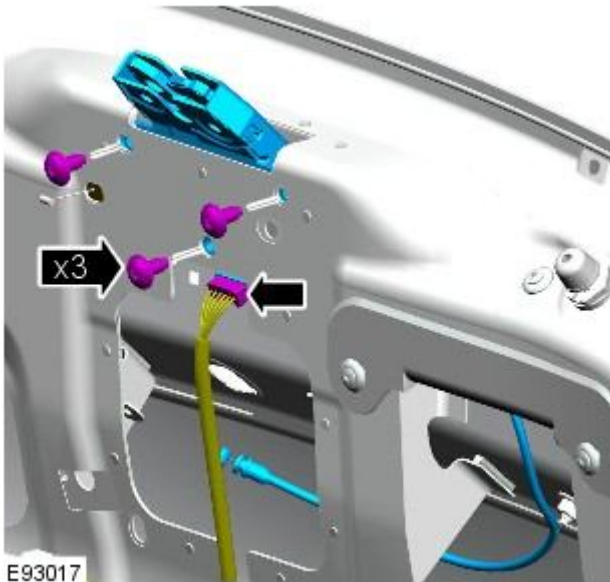
Removal and Installation

### Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Luggage Compartment Lid Lock Cylinder](#) (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

2. Torque: 20 Nm



### Installation

1. To install, reverse the removal procedure.



# Handles, Locks, Latches and Entry Systems - Luggage Compartment Lid

## Lock Cylinder

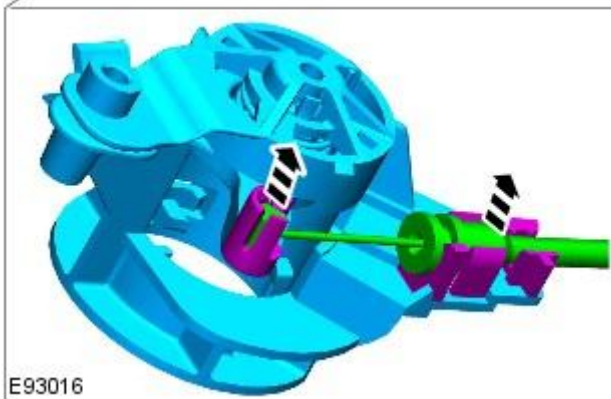
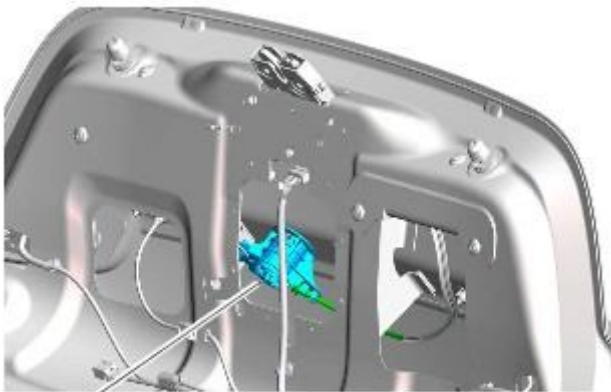
Removal and Installation

### Removal

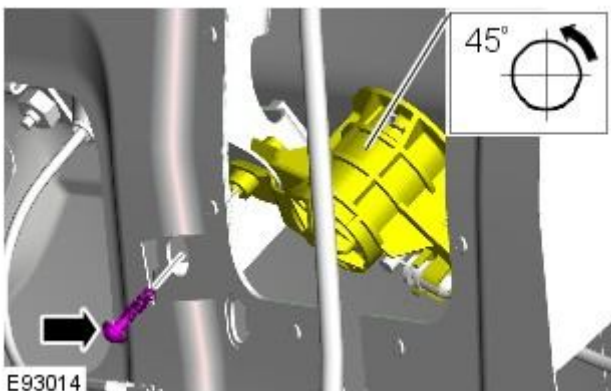
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Luggage Compartment Lid Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

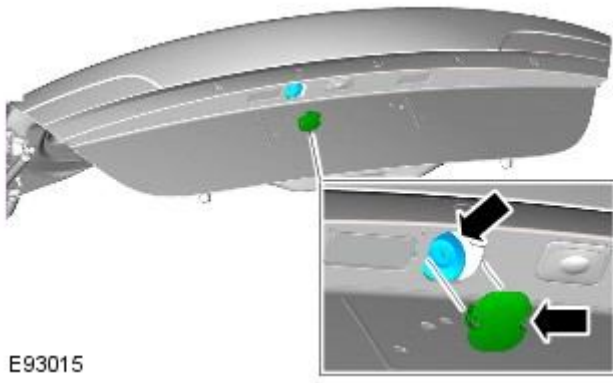
2.



3. Torque: 3.2 Nm



4.



E93015

## Installation

1. To install, reverse the removal procedure.

# Handles, Locks, Latches and Entry Systems - Rear Door Latch

Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

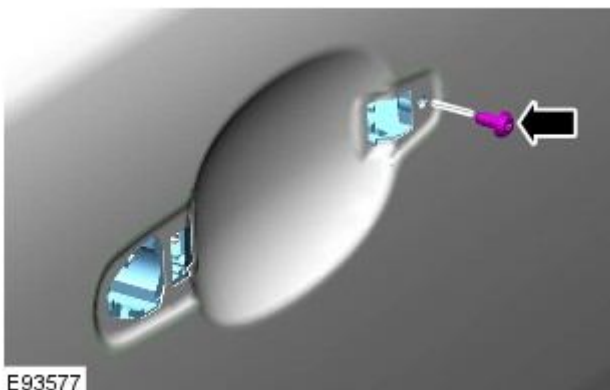
1. Remove the rear door window regulator and motor.

Refer to: [Rear Door Window Regulator and Motor](#) (501-11 Glass, Frames and Mechanisms, Removal and Installation).

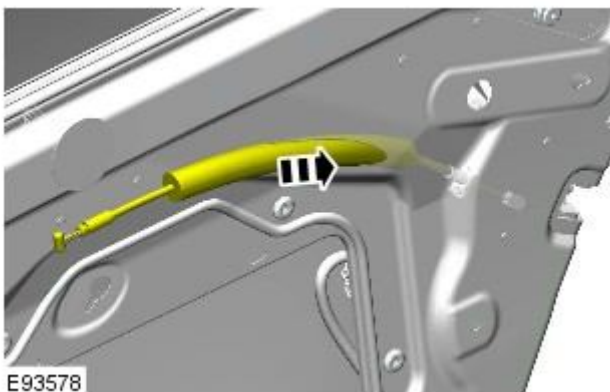
2. Remove the rear door exterior handle.

Refer to: [Exterior Rear Door Handle](#) (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

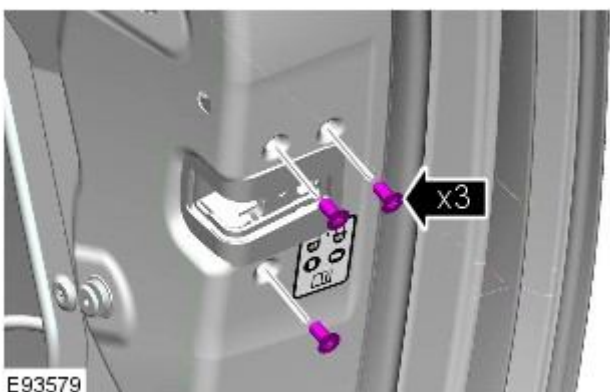
3. Torque: 3 Nm

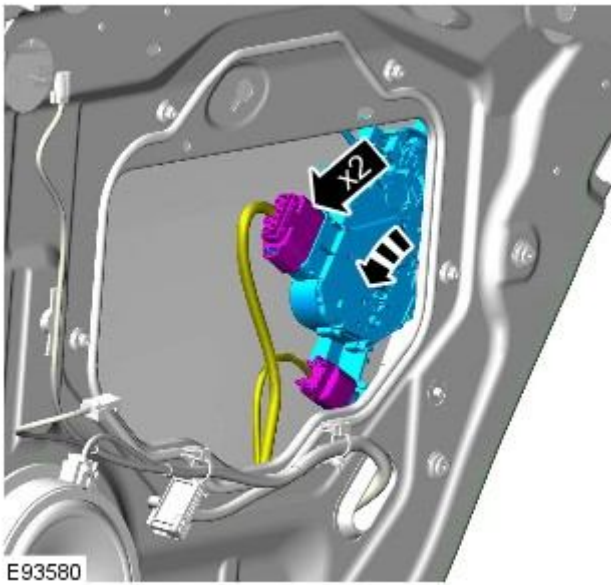


- 4.

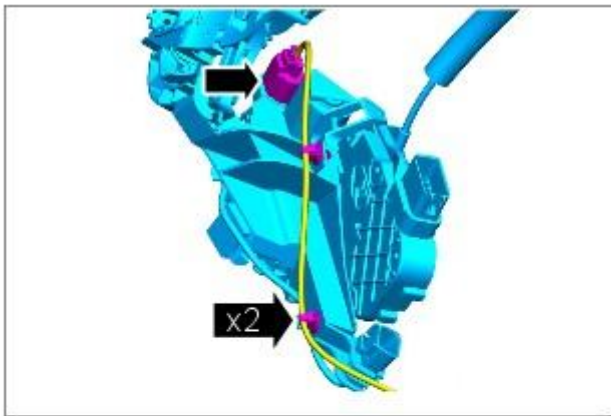


5. Torque: 7 Nm

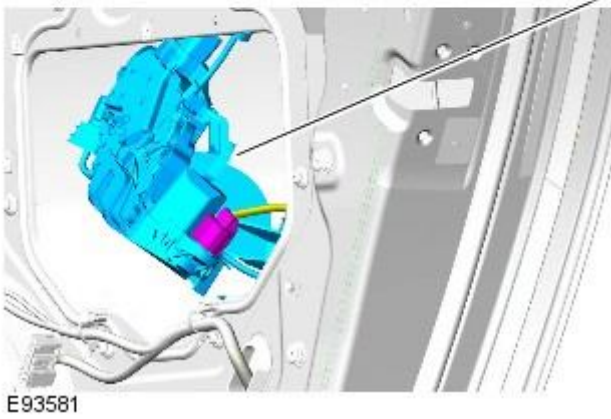




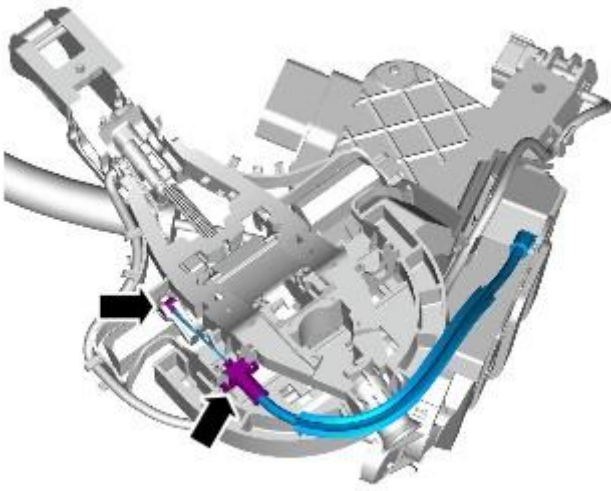
6.



7.  CAUTION: Note of the routing of the wiring harnesses.

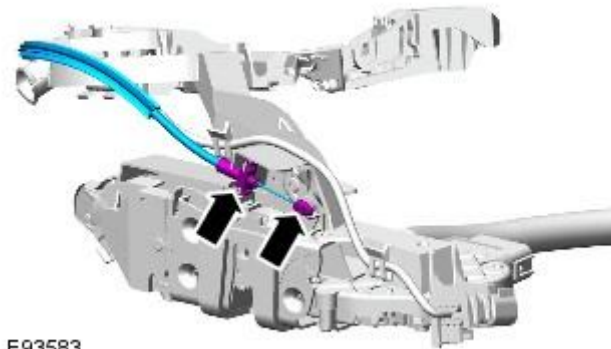


8. **8.** NOTE: Do not disassemble further if the component is removed for access only.



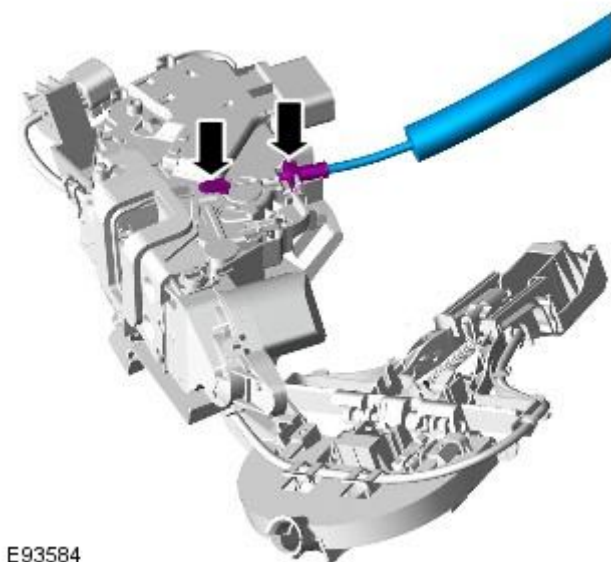
E93582

9.

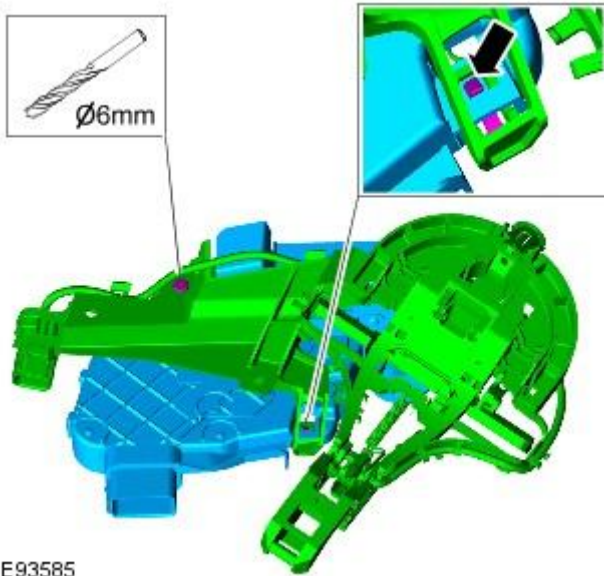


E93583

10.

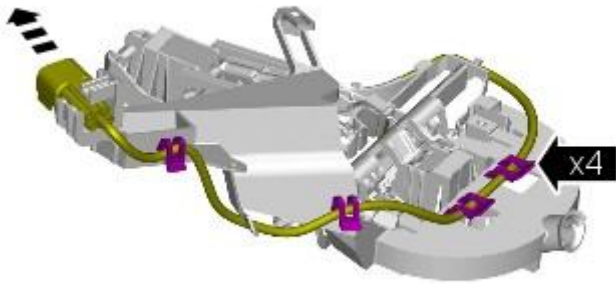


E93584



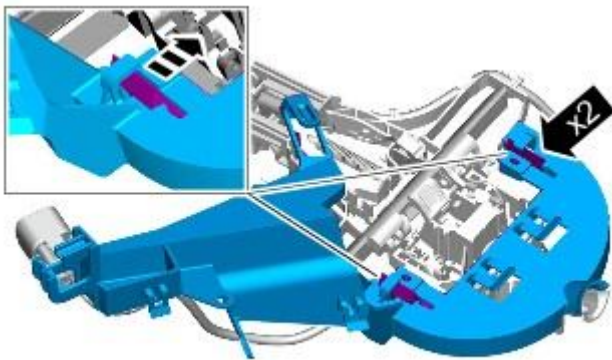
E93585

11.
  - Drill out the rivet.
  - Release the clip.



E93586


12.  CAUTION: Note of the routing of the wiring harnesses.



E93587

- 13.

## Installation

1.  CAUTION: Make sure that the wiring harnesses are correctly located.

To install, reverse the removal procedure.



## Wipers and Washers -

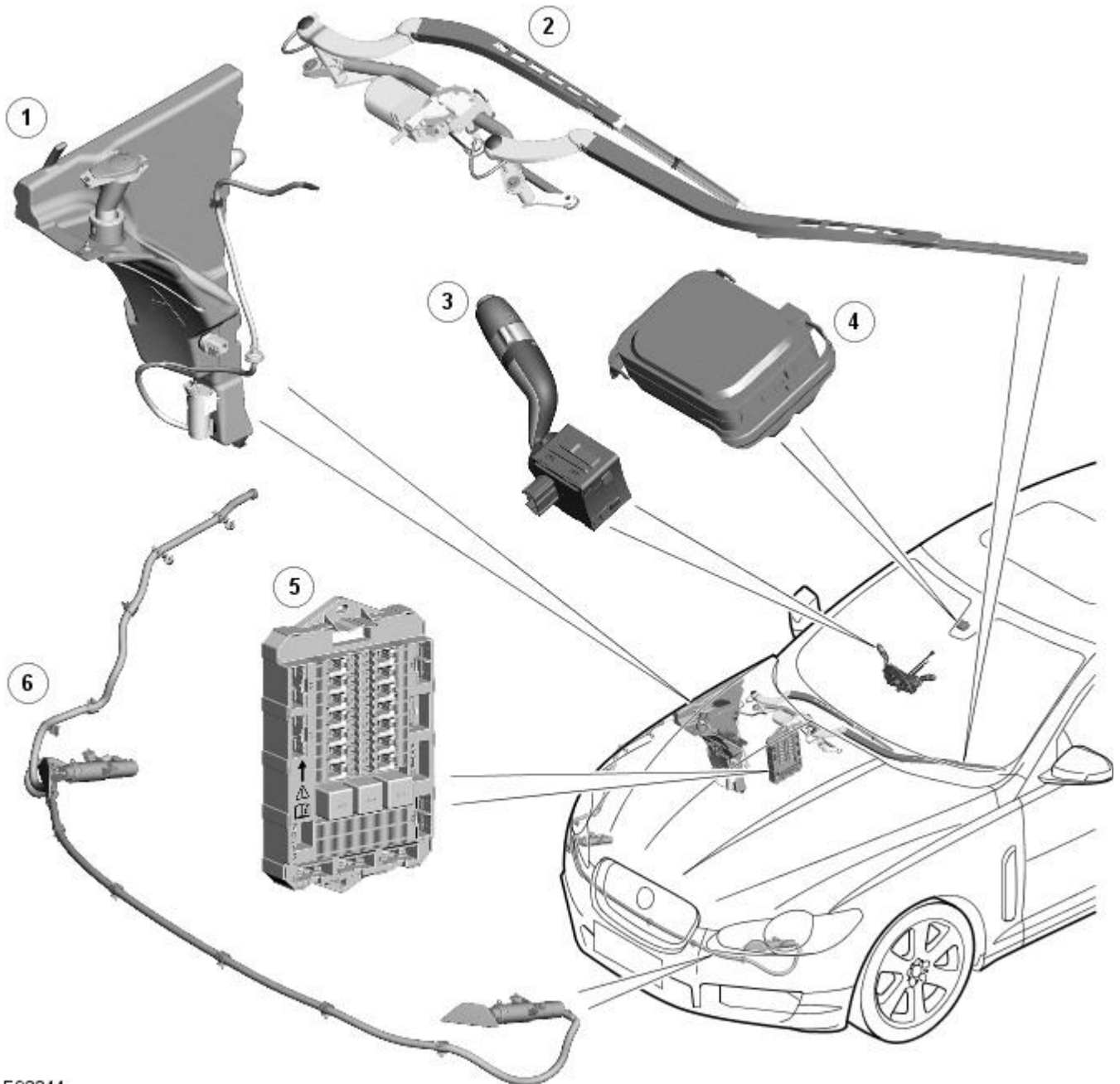
### Torque Specifications

Description	Nm	lb-ft	lb-in
Wiper arm retaining nuts	22	16.2	194.7
Wiper linkage bolts / screws	11	8.1	97.4

# Wipers and Washers - Wipers and Washers - Component Location

Description and Operation

COMPONENT LOCATION



E93344

## ItemDescription

1	Washer reservoir
2	Wiper motor and linkage assembly
3	Wiper/washer switch - RH (right-hand) steering column multifunction switch
4	Rain/light sensor
5	CJB (central junction box)
6	Headlamp washer jets (2 off)

# Wipers and Washers - Wipers and Washers - Overview

Description and Operation

## OVERVIEW

The wipers and washers comprise a windshield wiper system with a conventional wiper linkage and 2 wiper blades and a windshield washer with jets located on the wiper arms. A headlamp powerwash is available on certain models.

The front wipers have 4 operational states:

- Flick wipe
- Auto
- Slow wipe
- Fast wipe.

Operation of the windshield wipers and washers and the headlamp powerwash is controlled by the [CJB \(central junction box\)](#) in response to driver inputs and signals from the rain/light sensor. The instrument cluster monitors the condition of the wiper/washer control switch and transmits driver requests to the [CJB](#) over the medium speed [CAN \(controller area network\)](#) bus.

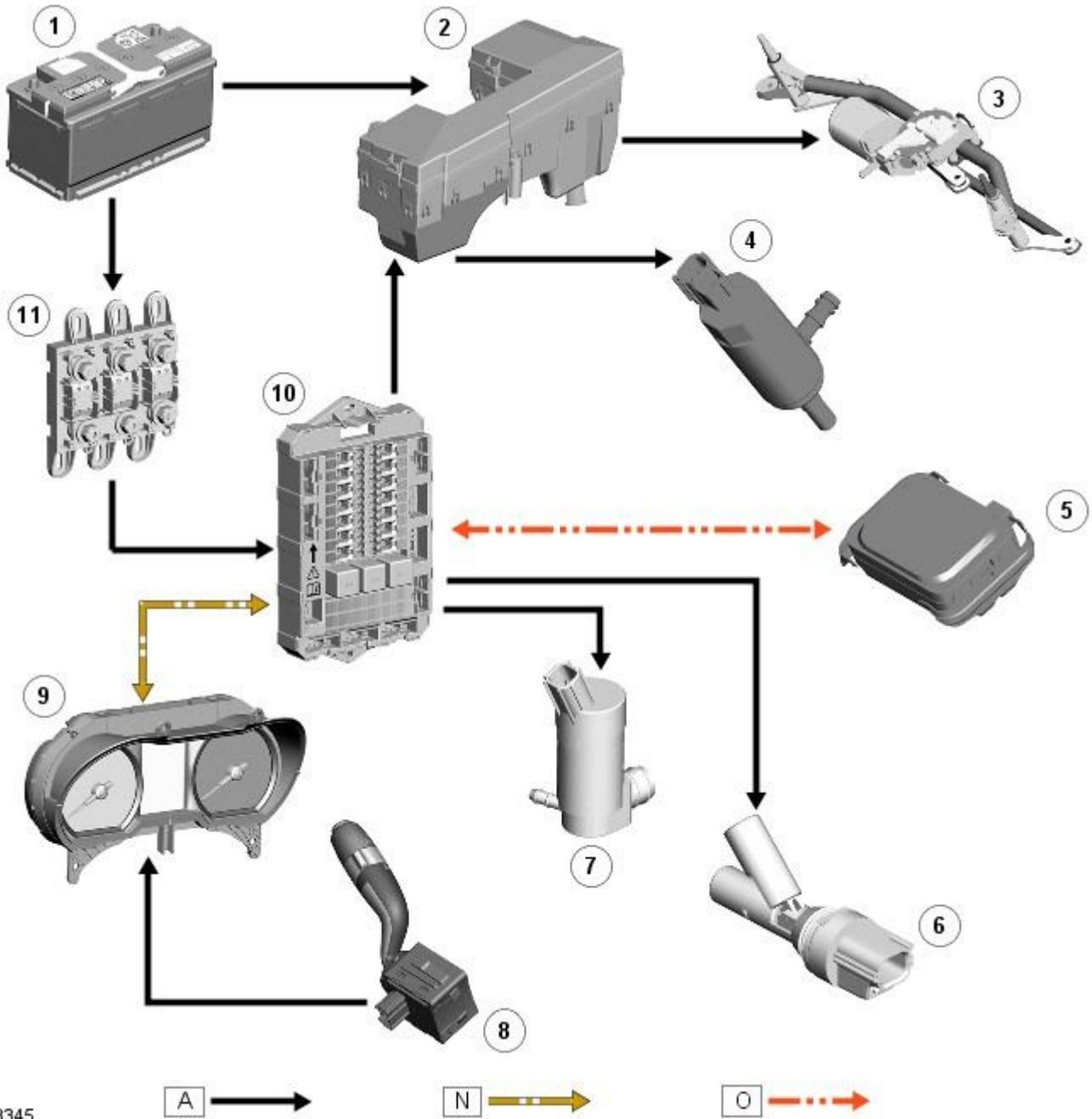
The 'Auto' function requires an input from the rain sensor. The rain sensor is mounted on the inner surface of the windshield and transmits an infra-red signal to determine the amount of water on the outer surface of the windshield. A value is then transmitted to the [CJB](#) over the [LIN \(local interconnect network\)](#) bus.

# Wipers and Washers - Wipers and Washers - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: **A** = Hardwired; **N** = Medium speed CAN (controller area network) bus; **O** = LIN (local interconnect network) bus



E93345

### ItemDescription

1	Battery
2	EJB (engine junction box)
3	Wiper motor
4	Headlamp washer pump
5	Rain/Light sensor
6	Washer reservoir fluid level switch
7	Windshield washer pump
8	Wiper/Washer switch - RH (right-hand) steering column multifunction switch
9	Instrument cluster
10	CJB (central junction box)
11	BJB (battery junction box)

## System Operation

### WINDSHIELD WIPERS

Operation of the wipers and washers is controlled by the [CJB](#) in response to driver inputs from the wiper control switch and signals from the rain/light sensor. The instrument cluster monitors the condition of the wiper/washer control switch and transmits driver requests to the [CJB](#) over the medium speed [CAN](#) bus.

The wiper control switch is connected via hardwired connections to the instrument cluster. The instrument cluster outputs on 4 wires a reference voltage to the wash/wipe switch, the auto wiper switch, the wiper switch and the flick wipe switch. All the switches are connected to the instrument cluster on a common ground. Each switch function is connected to ground via a resistor or series of resistors and the instrument cluster monitors the ground signal and determines which function has been selected. The instrument cluster then outputs the appropriate message on the medium speed [CAN](#) bus to the [CJB](#) which responds to the requested wiper function. The [CJB](#) then activates the appropriate function either directly or via relays in the [EJB](#) for the wipers and headlamp powerwashers.

#### Speed Dependent Mode

When the wipers are operating, a vehicle speed signal received by the [CJB](#) on the high speed [CAN](#) bus is used to operate a speed dependent mode. If the wipers are in fast wipe and the vehicle speed decreases to below 2 km/h (1.2 mph), the wipers will reduce to the normal wipe speed. When the vehicle speed increases to above 8 km/h (5 mph) the fast wiper speed selection is restored. If slow speed is selected and the vehicle speed drops below 2km/h (1.2 mph), the wipers will operate in the intermittent mode. When the vehicle speed increases to above 8 km/h (5 mph) the slow wiper speed selection is restored – this feature is configurable by the dealer using the approved Jaguar diagnostic system.

#### Wiper Motor

The wiper motor is controlled by the [CJB](#). The [CJB](#) is connected to a wiper motor normal/fast relay in the [EJB](#) on 2 wires. The [CJB](#) is also connected to a wiper run/park relay, also located in the [EJB](#).

Driver requests are received by the [CJB](#) which energizes the wiper motor normal/fast relay in the appropriate mode (normal or fast wipe) and also energizes the run/park relay in the run mode by providing a ground for the relay coils. When wiper operation is deselected by the driver, the [CJB](#) monitors a park switch which is integral with the wiper motor. On receipt of a signal from the park switch, the [CJB](#) de-energises the run/park relay, removing the power supply through the normal/fast relay, stopping the wipers in the park position on the windshield.

The wiper motor is a **DC (direct current)** motor which drives a gear wheel via a worm drive attached to the motor spindle. The motor has 3 sets of brushes with one brush connected to ground. When the normal/fast relay is energized in the normal position, a power feed is supplied to the brush directly opposite the ground brush and operates the motor at slow speed. When the relay is energized in the fast position, a power feed is connected to the second motor brush, which is offset from the ground brush and operates the motor at the fast speed. With power supplied through the offset brush, the current flows through fewer motor coil windings. This results in a lower resistance to current flow to the ground brush and produces a higher motor rotational speed.

### WINDSHIELD WASHERS

The windshield washers are controlled by the [CJB](#). A driver request for washer operation, via the wiper control switch, is passed to the instrument cluster on the [LIN](#) bus. The instrument cluster passes the message to the [CJB](#) on the medium speed [CAN](#) bus.

The [CJB](#) energizes the windshield washer pump during the up stroke of the first 2 wash/wipe cycles. This ensures that wiper fluid is pushed to the sides of the windshield and eliminates the trail of fluid which can occur if the fluid is pushed to the bottom of the windshield. The wipers will continue for 3 more cycles, followed after a delay of 4 seconds, by a single dry wipe.

- **NOTE:** The dry wipe feature is configurable using an approved Jaguar diagnostic system.

The operation of the washer pump on the wiper up stroke only is configurable using an approved Jaguar diagnostic system.

The washer button can be pressed and held and the wipers will operate continuously for up to 10 seconds. After this period when the button is released, the wipers will continue for 3 more cycles, followed after a delay, by a single dry wipe. After this period washing will be inhibited, the wipers will continue for 3 more cycles, followed after a delay, by a single dry wipe. Reactivating the switch will recommence the wash/wipe cycle.

### RESERVOIR LEVEL SWITCH

The level switch is connected directly to the [CJB](#). The switch is operated by a float which closes contacts within the switch when the fluid level falls to below the switch level. When the contacts are closed a ground path is completed from the [CJB](#) through the switch. This is sensed by the [CJB](#) which issues a message to the instrument cluster which displays a low fluid level warning.

### HEADLAMP POWERWASHERS

The headlamp powerwash is activated when the driver requests windshield washer operation. The [CJB](#) receives the driver request via a [CAN](#) bus message from the instrument cluster. The [CJB](#) then checks for an exterior lights active signal and that a low washer fluid level signal is not present.

The [CJB](#) outputs a control voltage to a headlamp powerwash pump relay located in the [EJB](#). The relay is energized by the [CJB](#) for a pre-determined period to allow the headlamp telescopic washers to operate.

The [CJB](#) monitors the driver washer requests and only operates the headlamp powerwash on every fourth request for windshield washer operation, provided that 10 minutes have elapsed since the last headlamp powerwash operation. The powerwash sequence is reset when the headlamps or the ignition is switched off.

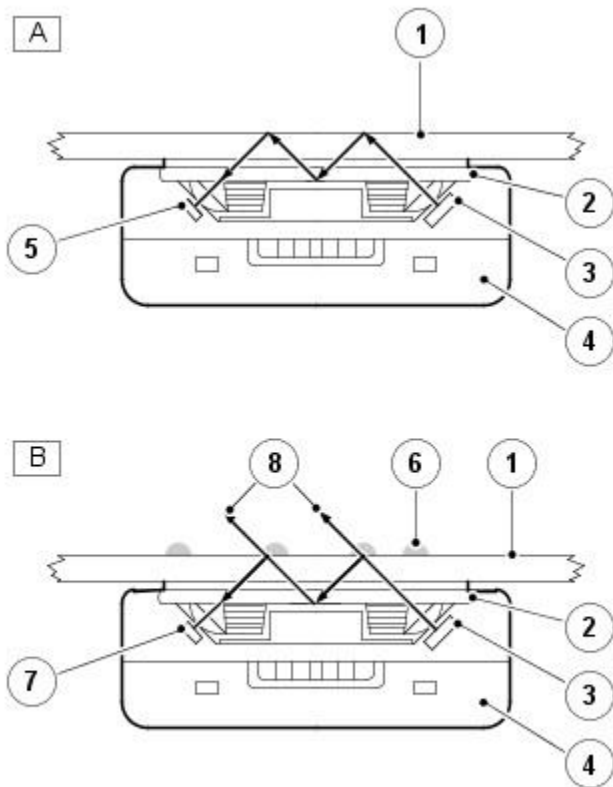
- **NOTE:** If a low fluid reservoir level is present the [CJB](#) prohibits headlamp powerwash.

## RAIN/LIGHT SENSOR

On receiving a request for automatic windshield wiper operation, the [CJB](#) interprets [LIN](#) bus messages received from the rain sensor. The rain sensor provides [LIN](#) bus messages with values ranging from 0 to 7.

A signal value of 0 is interpreted by the [CJB](#) as the windshield is dry. A signal value from 1 to 5 is interpreted by the [CJB](#) as a small amount of water hitting the windshield. In this instance, the [CJB](#) initiates a slow wipe. A signal value of 7 is interpreted by the [CJB](#) as a large amount of water hitting the windshield. In this instance, the [CJB](#) initiates a fast wipe.

- NOTE: The [CJB](#) will only change a fast wipe routine to a slow wipe routine if the rain sensor value is lower than 7.
- NOTE: **A** = Clean and dry windshield; **B** = Wet and dirty windshield



E43326

### ItemDescription

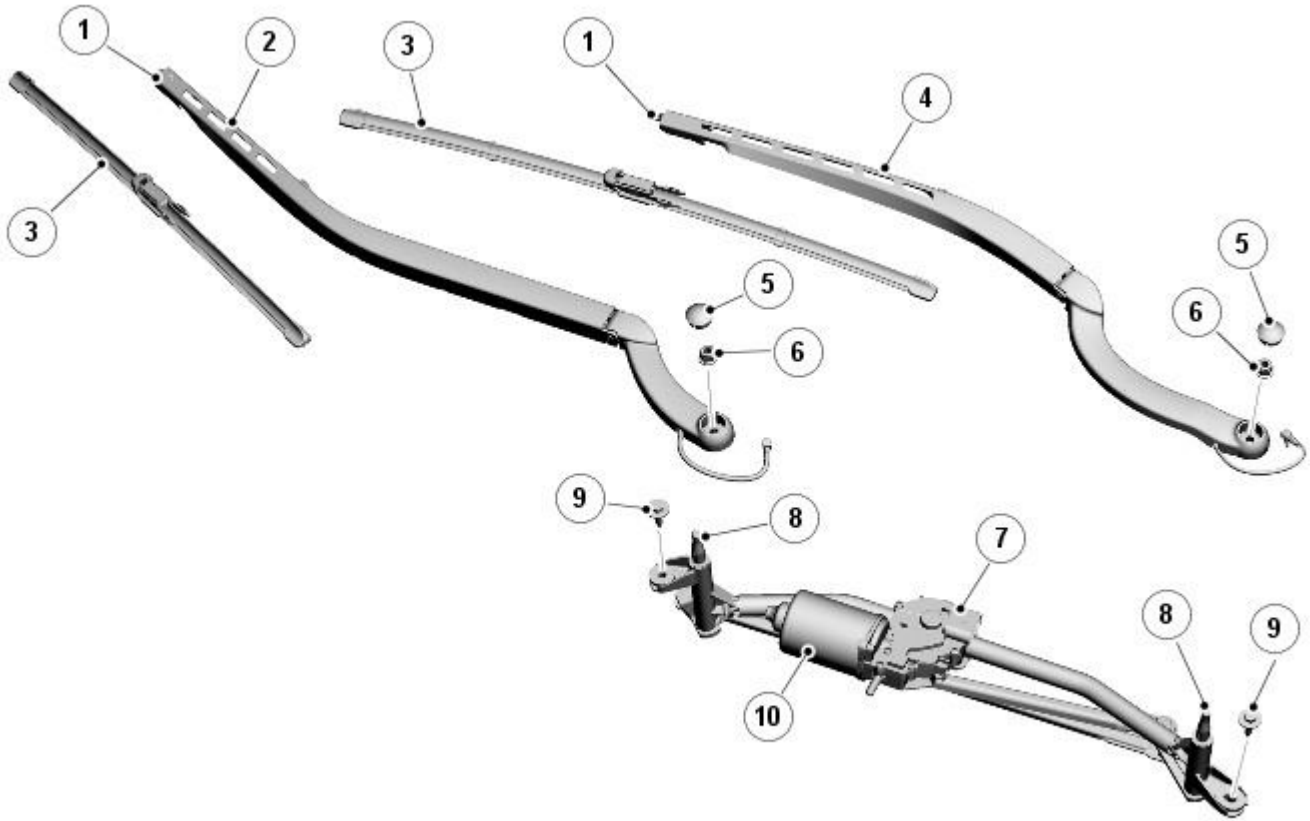
1	Windshield outer surface
2	Optical element
3	Transmitter diodes (100% light transmitted)
4	Rain sensor
5	Receiver diodes (100% light received)
6	Water droplets/film
7	Receiver diodes (less than 100% light received)
8	Lost light

### Component Description

## WINDSHIELD WIPER MOTOR AND LINKAGE

- NOTE: LHD (left-hand drive) wiper linkage shown





E96944

**ItemDescription**

1	Quick release wiper blade attachment
2	<a href="#">RH</a> wiper arm
3	Wiper blade (2 off)
4	<a href="#">LH (left-hand)</a> wiper arm
5	Wiper arm cap (2 off)
6	Nut (2 off)
7	Wiper linkage location hole (hidden)
8	Pivot housing (2 off)
9	Screw and washer (2 off)
10	Wiper motor

The wiper linkage and motor assembly differs between [LHD](#) and [RHD \(right-hand drive\)](#) models. The wiper linkage and motor assembly is not available as separate service components. If the wiper linkage and motor assembly is replaced, it is important that alignment is made to marks on the windshield and the fixings are tightened in the correct order.

The wiper linkage and motor assembly is attached to the vehicle body with screws and washers at each end. The screws are located in rubber bushes in the linkage assembly which isolate the linkage from the vehicle body. A rubber grommet is located behind the motor and engages on a spigot on the vehicle body to locate the linkage.

The linkage assembly comprises a main tube with a pivot housing located at each end. The motor assembly is attached to the tube by a clamp plate and 4 screws. The motor output shaft is fitted with a crank. A link rod is connected to the motor crank and is connected at the opposite end to the [LH](#) pivot housing via a crank. The [LH](#) pivot housing crank is fitted with a second link rod which is connected directly to the crank on the [RH](#) pivot housing.

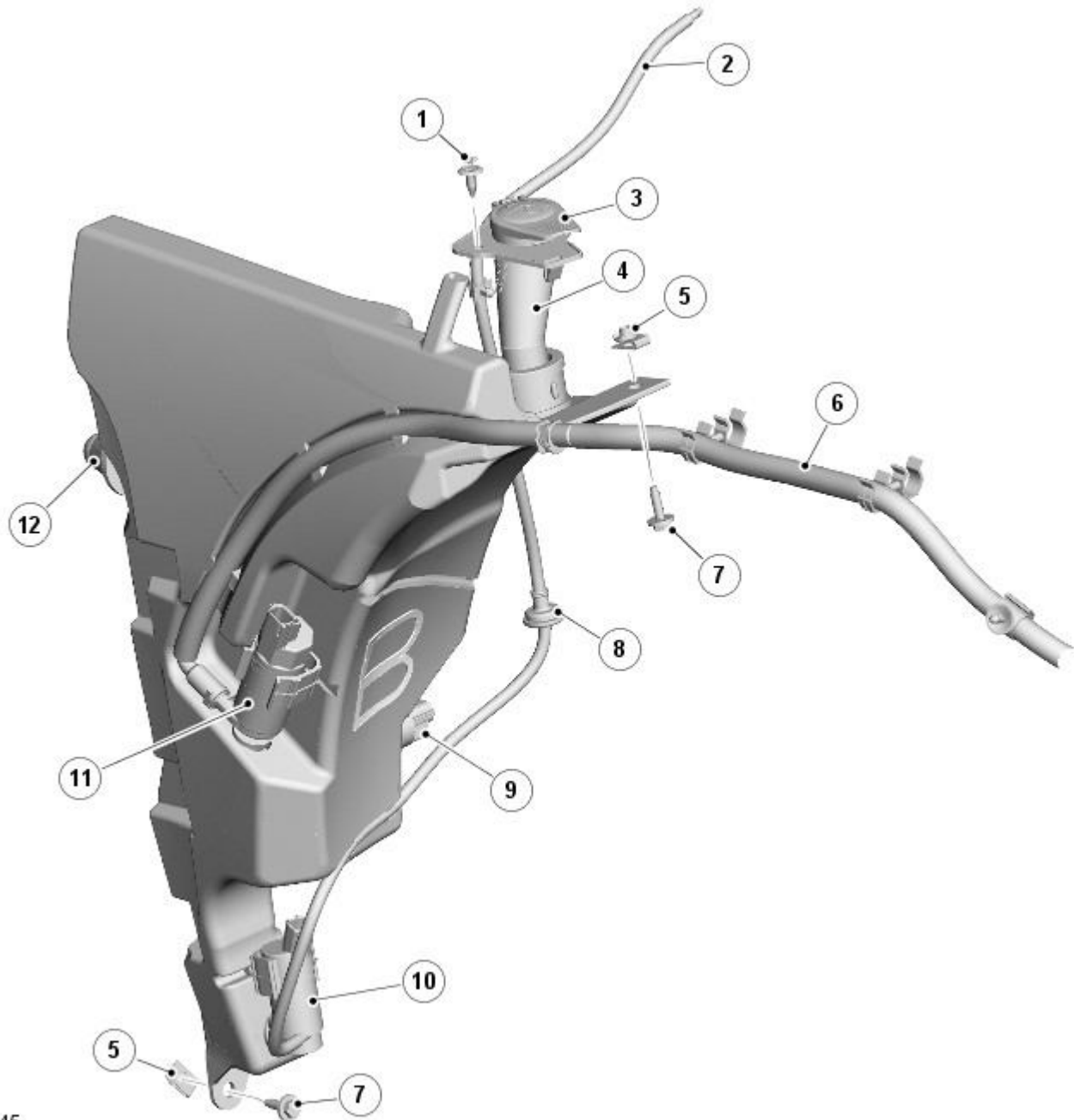
The motor crank converts rotary motion from the motor output shaft into linear movement of the link rods. The cranks connected to each pivot housing, convert the linear motion of the link rods back to rotary motion of the pivot housings. This rotary motion is passed to the wiper arms and blades causing the blades to wipe an arc across the windshield.

Each wiper arm is located on a taper spline on the respective pivot housing. A nut is screwed on the end of the pivot housing shaft and positively secures the wiper arm on the taper spline.

The wiper blades are attached to the wiper arms with a quick release fittings. The blades are of the flat blade type. These blades have an integral spring along their full length which curves the blade to match the windshield and provides even blade to windshield contact pressure along the entire length of the blade.

**WASHER RESERVOIR**

- NOTE: Type 'B' washer reservoir shown



E96945

**ItemDescription**

1	Scrivet
2	Windshield washer feed pipe to washer jets
3	Reservoir cap
4	Reservoir filler neck
5	Captive nut (2 off)
6	Headlamp powerwash feed pipe to telescopic washer jets
7	Screw and washer (2 off)
8	Grommet
9	Washer fluid level sensor
10	Windshield washer pump
11	Headlamp washer pump
12	Location spigot

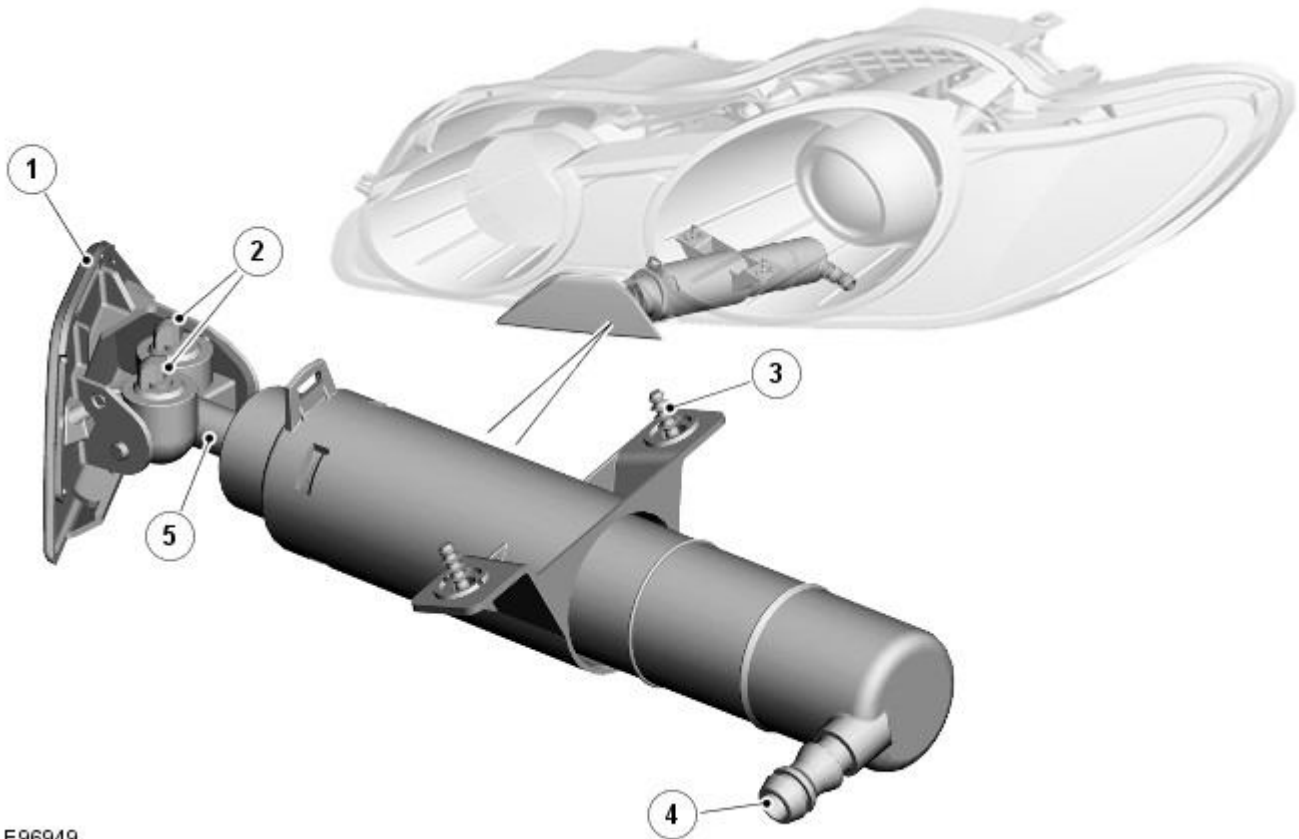
The washer reservoir is located in the [RH](#) wheel arch. The reservoir is a plastic moulding and is secured in the wheel arch with 2 screws and washers and a scrivet. A level sensor is located in the reservoir and is connected to the [CJB](#). The reservoir is fitted with a washer pump which supplies pressurized washer fluid to the windshield washer jets mounted on the wiper arms.

A vehicle fitted with optional headlamp washers is fitted with a larger reservoir and an additional pump for the headlamp washers. The larger reservoir is identifiable by a letter 'B' moulded on the casing and has a capacity of 5.5 liters. Reservoirs moulded with the letter 'A' are for use on vehicles with windshield washers only and have a capacity of 4.4 liters.

A filler cap is located at the top of the reservoir and is accessible from the engine compartment.

The pumps are located in rubber sealing grommets in holes in the reservoir and secured with clips. The pump fluid hoses have quick release connectors which mate with the pumps. The fluid level sensor is a push fit into a sealing grommet in one side of the reservoir body.

### HEADLAMP POWERWASHERS (if fitted)



E96949

#### ItemDescription

1	Powerwash trim cap
2	Washer jets
3	Self-tapping screws (2 off)
4	Pressure feed from powerwash pump
5	Telescopic arm

On vehicles with headlamp powerwash, each headlamp assembly is fitted with a headlamp powerwasher. The powerwasher is located on the underside of the headlamp assembly. The powerwasher is located in a clip at the front of the headlamp and secured with 2 self tapping screws to the headlamp body.

The powerwasher is a telescopic unit which extends forwards from the headlamp assembly under washer fluid pressure supplied by the headlamp powerwash pump. When the pump pressure decreases the powerwasher is automatically retracted back into the housing. The outer end of the powerwasher is fitted with a trim which blends the powerwasher into the headlamp when it is not operating. The powerwasher has two washer jets which direct washer fluid under high pressure onto the headlamp lens when the powerwasher is extended.

### RAIN/LIGHT SENSOR



#### E84141

The rain/light sensor is located at the upper edge of the windshield, behind the interior rear view mirror. Contact between the rain sensor and windscreen is provided via a silicon pad which is compressed during the assembly process by two locking retaining clips either side of the sensor.

The rain/light sensor unit attaches to the windshield via two clips, which latch onto formed tags on the windshield bracket.

The sensor provides information to the [CJB](#) for the optimum wiper operation for the prevailing conditions to maintain the shield in a clear condition at all times. The rain/light sensor is an optical unit, which operates on an infrared waveband. The sensor uses the principle of the laws of reflection on interfacing surfaces between materials with differing refraction properties.

The rain/light sensor is connected to the [CJB](#) via a [LIN](#) bus. The sensor also receives a hardwired power and ground from the [CJB](#). The 'auto' wipers are activated when the column stalk is moved to position 1 (first position from off in the upward direction). The sensitivity of the sensor can be adjusted by rotating the sensitivity collar on the wiper column stalk in the clockwise or counterclockwise direction. Clockwise rotation will decrease sensitivity, while counterclockwise adjustment will increase sensitivity. An increase in sensitivity adjustment results in a single wipe of the front wiper motor.

• **NOTE:** The rain sensor also contains a light sensor. The light sensor is used to control operation of the automatic headlamps function.

Refer to: [Exterior Lighting \(417-01 Exterior Lighting, Description and Operation\)](#).

### WIPER CONTROL SWITCH

The wiper control switch is located on the [RH](#) steering column multifunction switch. The switch allows selection of the following functions:

- Slow wipe
- Fast wipe
- Auto
- Flick wipe
- Windshield wash and headlamp powerwash (if fitted).

All wiper functions are connected to the instrument cluster by a resistor or series of resistors within the switch. The instrument cluster uses the returned current to determine the selected function.

### WIPER SERVICE POSITION

The wiper service position allows the wipers to be parked in a position to allow easy access to the wiper blades for replacement. The service position is initiated by pulling the [RH](#) steering column multifunction switch towards the steering wheel and pressing the start/stop button to switch on the ignition. The wipers will move and stop in a vertical position on the windshield. The [RH](#) steering column multifunction switch can be released and the ignition switched off. The service position is terminated at the next ignition on cycle and the wipers return to their normal park position.

# Wipers and Washers - Wipers and Washers

Diagnosis and Testing

## Principle of Operation

For a detailed description of the wipers and washers, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (501-16 Wipers and Washers)

[Wipers and Washers](#) (Description and Operation),  
[Wipers and Washers](#) (Description and Operation),  
[Wipers and Washers](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Wiper blade(s)</li> <li>● Wiper pivot arm shaft</li> <li>● Washer reservoir</li> <li>● Hose(s)</li> <li>● Washer jet(s)</li> </ul>	<ul style="list-style-type: none"> <li>● Fuse(s)</li> <li>● Wiring harness</li> <li>● Electrical connector(s)</li> <li>● Washer pump(s)</li> <li>● Wiper motor</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

- NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).
- NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.
- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.
- NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B109512	Wiper On/Off Relay	<ul style="list-style-type: none"> <li>● Wiper On/Off relay control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check wiper On/Off relay control circuit for short to power
B109514	Wiper On/Off Relay	<ul style="list-style-type: none"> <li>● Wiper On/Off relay control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check wiper On/Off relay control circuit for short to ground, open circuit
B109612	Wiper High/Low Relay	<ul style="list-style-type: none"> <li>● Wiper Fast/Slow relay control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check wiper Fast/Slow relay control circuit for short to power
B109614	Wiper High/Low Relay	<ul style="list-style-type: none"> <li>● Wiper Fast/Slow relay control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check wiper Fast/Slow relay control circuit for short to ground, open circuit
B10AD09	Rain Sensor	<ul style="list-style-type: none"> <li>● Component failures</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Suspect the rain/light sensor, check and install a new sensor as required

<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
B10AD11	Rain Sensor	<ul style="list-style-type: none"> <li>● Rain/light sensor power circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check rain/light sensor power circuit for short to ground
B10AD96	Rain Sensor	<ul style="list-style-type: none"> <li>● Component internal failure</li> </ul>	Suspect the rain/light sensor, check and install a new sensor as required
B117712	Screenwash Level Switch	<ul style="list-style-type: none"> <li>● Screenwash level switch signal circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check screenwash level switch signal circuit for short to power
B1C4513	Front Wiper Park Position Switch	<ul style="list-style-type: none"> <li>● Windshield wiper motor park switch signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check windshield wiper motor park switch signal circuit for open circuit
B1C4523	Front Wiper Park Position Switch	<ul style="list-style-type: none"> <li>● Signal stuck low</li> </ul>	Refer to the electrical circuit diagrams and check front wiper park position switch input circuit for short, open circuit
B1C7812	Powerwash Relay	<ul style="list-style-type: none"> <li>● Powerwash relay control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check powerwash relay control circuit for short to power
B1C7814	Powerwash Relay	<ul style="list-style-type: none"> <li>● Powerwash relay control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check powerwash relay control circuit for short to ground, open circuit
B1C7911	Front Washer Pump	<ul style="list-style-type: none"> <li>● Screenwash pump control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check screenwash pump control circuit for short to ground
B1C7913	Front Washer Pump	<ul style="list-style-type: none"> <li>● Screenwash pump control circuit - open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check screenwash pump control circuit for open circuit



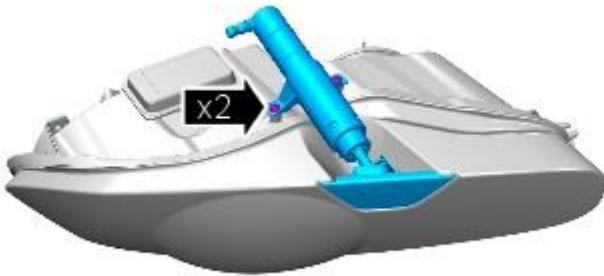
## Wipers and Washers - Headlamp Washer Jet

Removal and Installation

### Removal

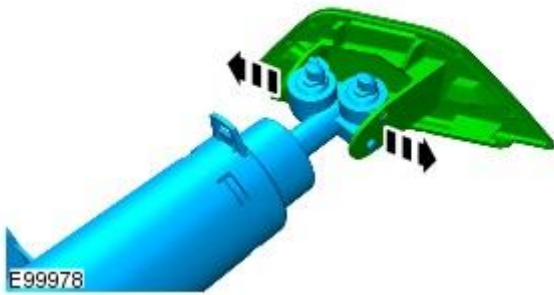
1. Refer to: [Headlamp Assembly](#) (417-01 Exterior Lighting, Removal and Installation).

2. **2.** NOTE: Left-hand shown, right-hand similar.



E99977

3. **3.** NOTE: Left-hand shown, right-hand similar.



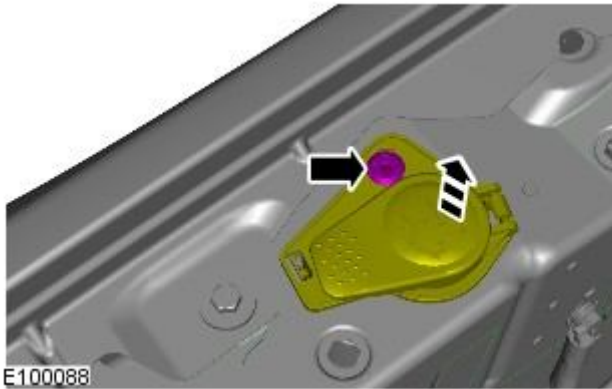
### Installation

1. To install, reverse the removal procedure.

# Wipers and Washers - Headlamp Washer Pump

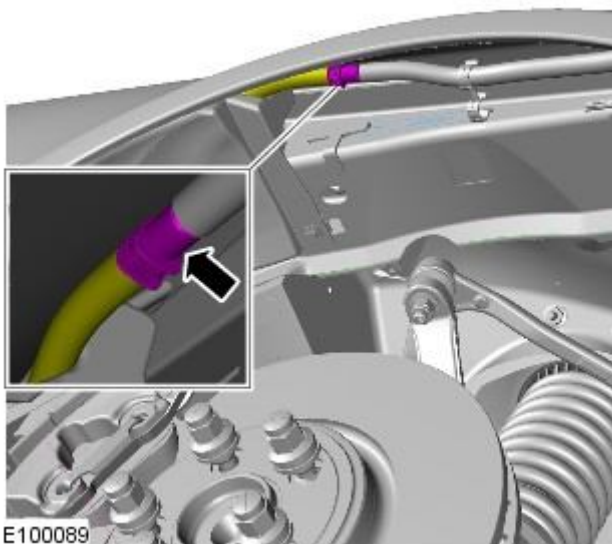
Removal and Installation


## Removal

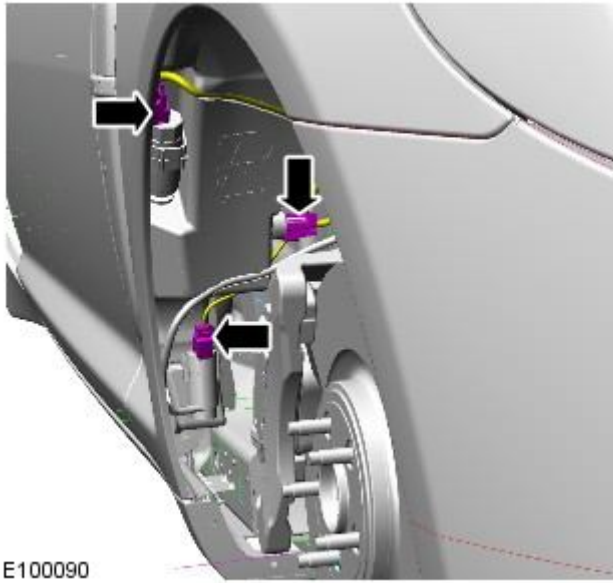


1.

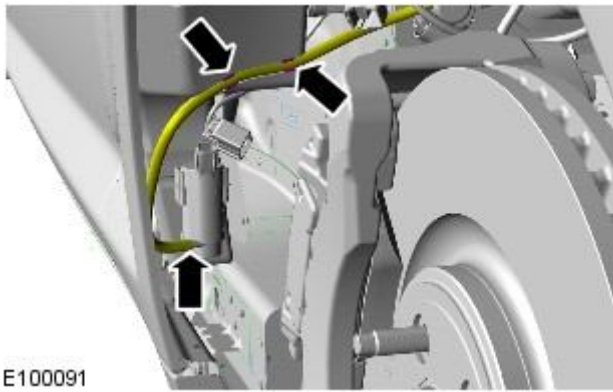
2. Refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).




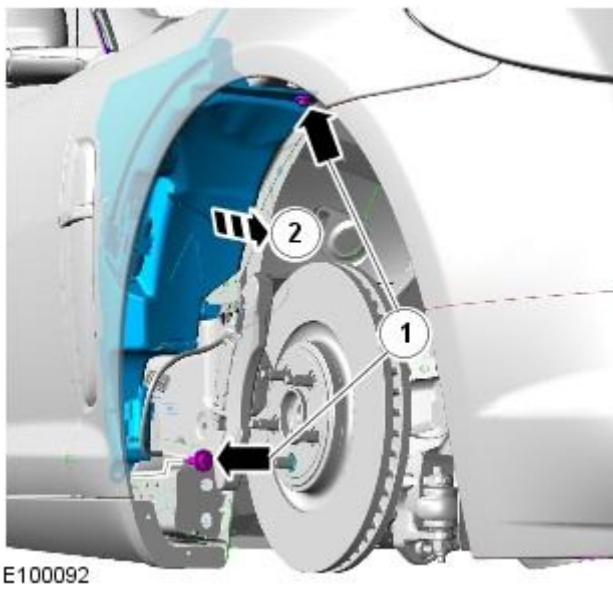
3.  **CAUTION:** Be prepared to collect escaping fluids.



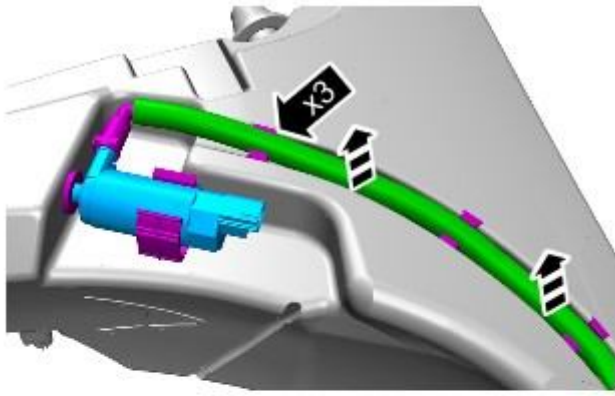
4.



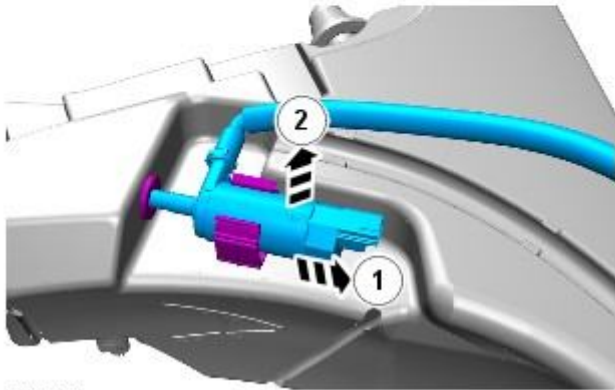
5.  CAUTION: Be prepared to collect escaping fluids.



6.




7.  CAUTION: Take extra care not to damage the seal.



E100151

## Installation

1.  CAUTION: The seals are to be reused unless damaged.  
To install, reverse the removal procedure.

# Wipers and Washers - Rain Sensor

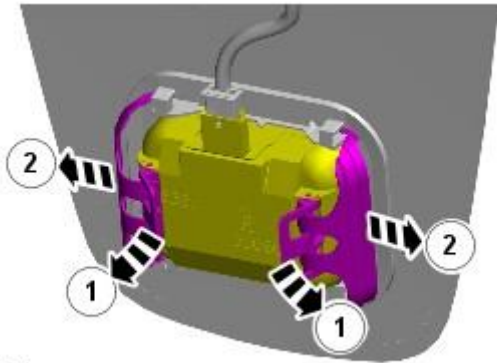
Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

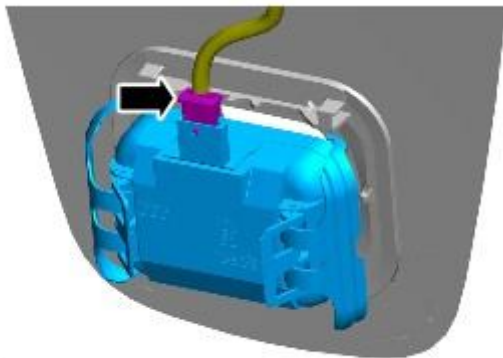
1. Refer to: [Interior Rear View Mirror](#) (501-09 Rear View Mirrors, Removal and Installation).

2.



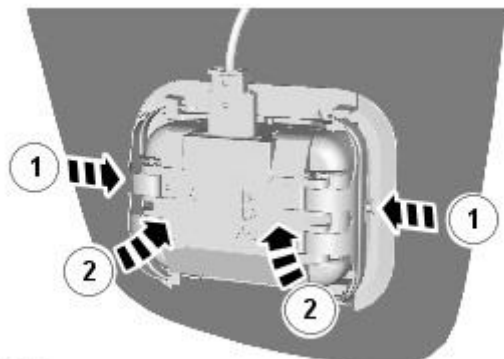
E99897

3.



E99898

## Installation



E115433

1. **1. CAUTIONS:**

 Make sure that the component is secured in the retainer.

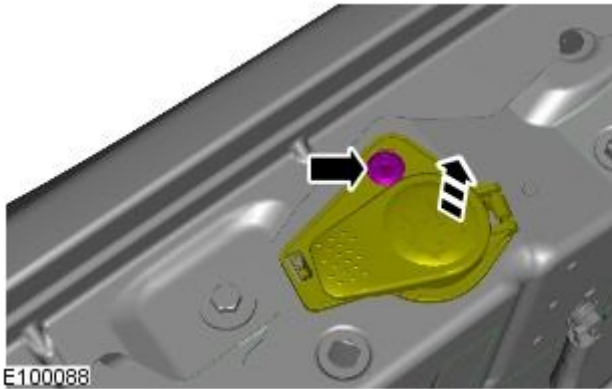
 Make sure that the clips are correctly located.

To install, reverse the removal procedure.

# Wipers and Washers - Windshield Washer Reservoir

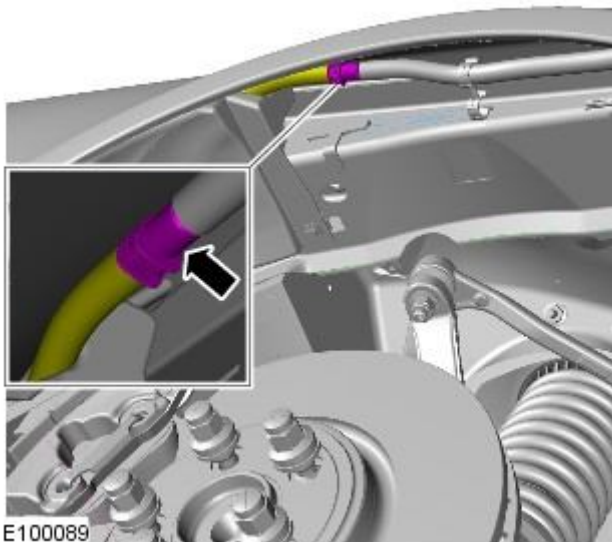
Removal and Installation


## Removal



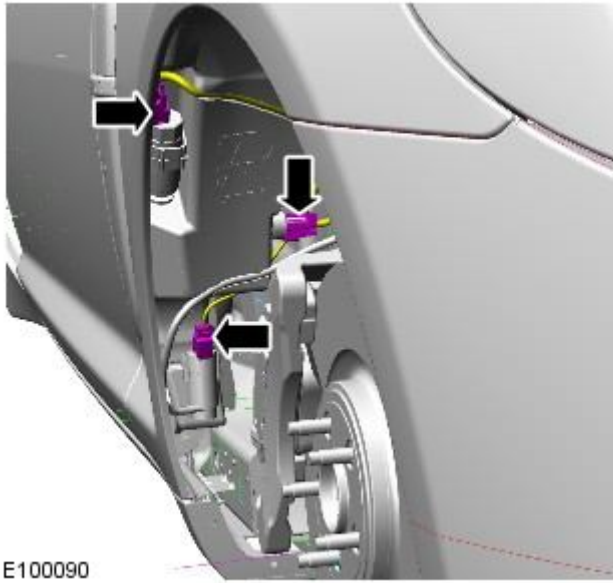
1.

2. Refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

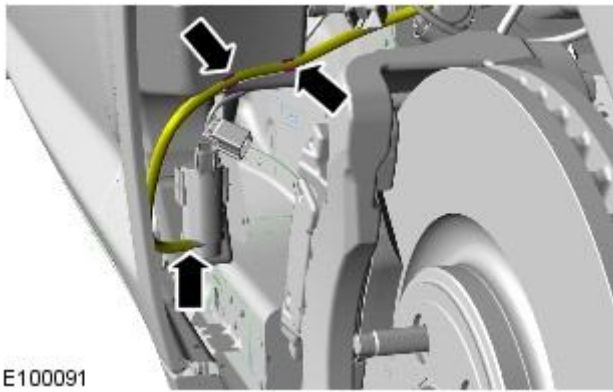



3.  **CAUTION:** Be prepared to collect escaping fluids.

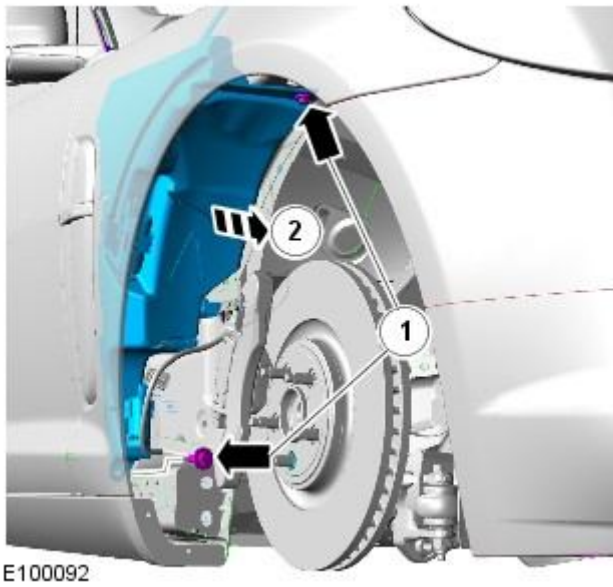




4.

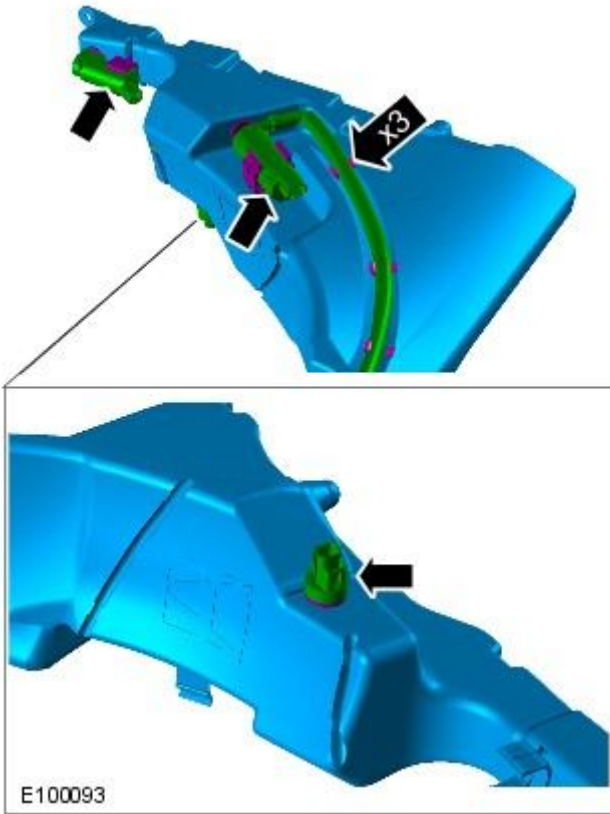


5.  CAUTION: Be prepared to collect escaping fluids.




6.

7.



## Installation

1.  CAUTION: The seals are to be reused unless damaged.  
To install, reverse the removal procedure.

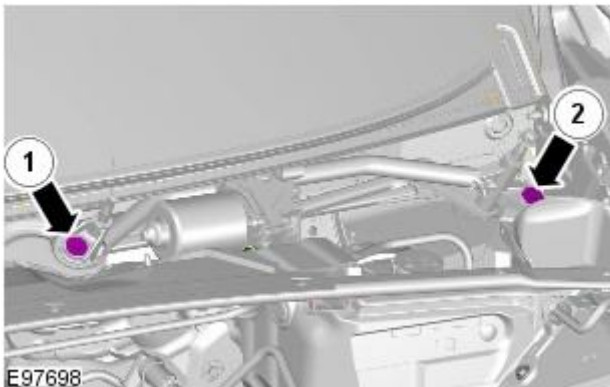
# Wipers and Washers - Windshield Wiper Motor

Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

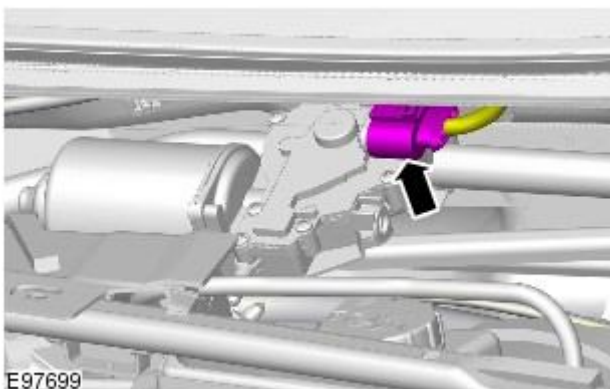
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Cowl Vent Screen](#) (501-02 Front End Body Panels, Removal and Installation).



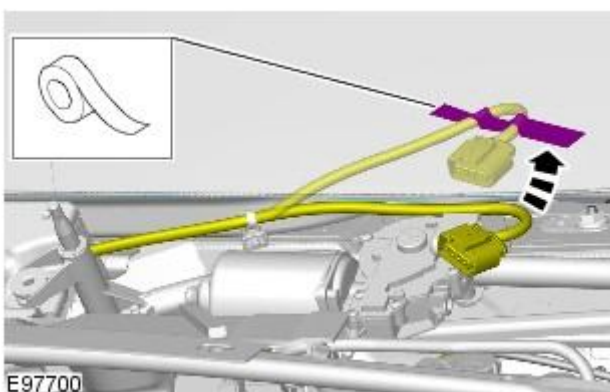
3.  CAUTION: Tighten the bolts in the sequence shown.

• NOTE: LHD illustration shown, RHD is similar.

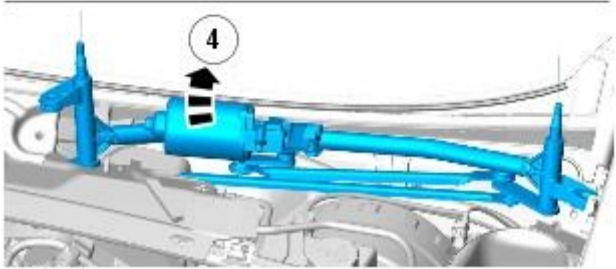
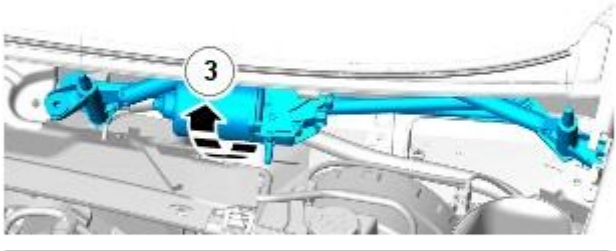
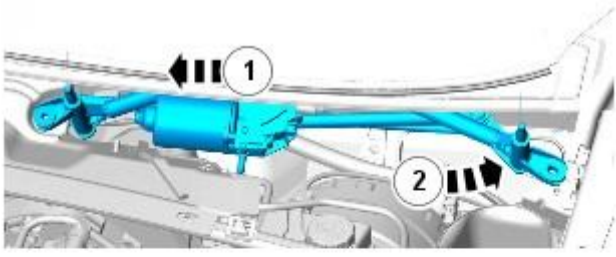
Torque: 12 Nm




4. 4. NOTE: LHD illustration shown, RHD is similar.



5. 5. NOTE: LHD illustration shown, RHD is similar.



E97701

6.  CAUTION: Make sure that the component is correctly located on the locating dowels.
  - NOTE: LHD illustration shown, RHD is similar.

## Installation

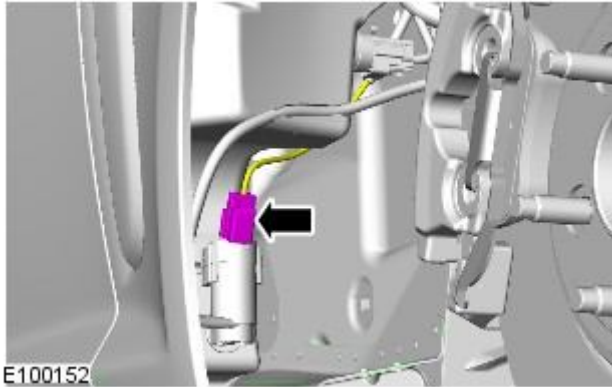
1. To install, reverse the removal procedure.

# Wipers and Washers - Windshield Washer Pump

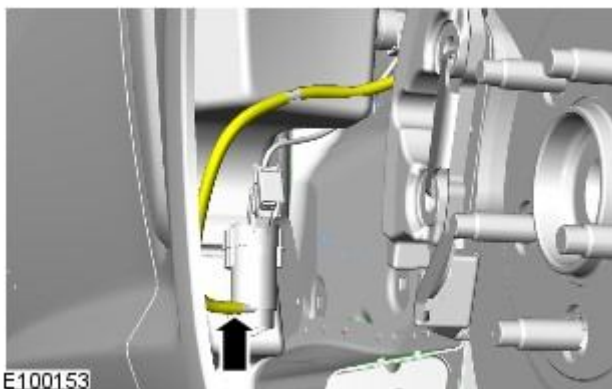
Removal and Installation


## Removal

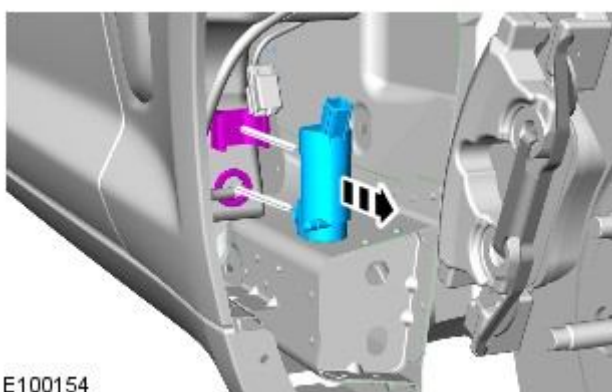
1. Refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).



2.




3.  CAUTION: Be prepared to collect escaping fluids.



4.  CAUTION: Take extra care not to damage the seal.

## Installation

1.  CAUTION: The seal is to be reused unless damaged.  
To install, reverse the removal procedure.

## Roof Opening Panel -

### Torque Specifications

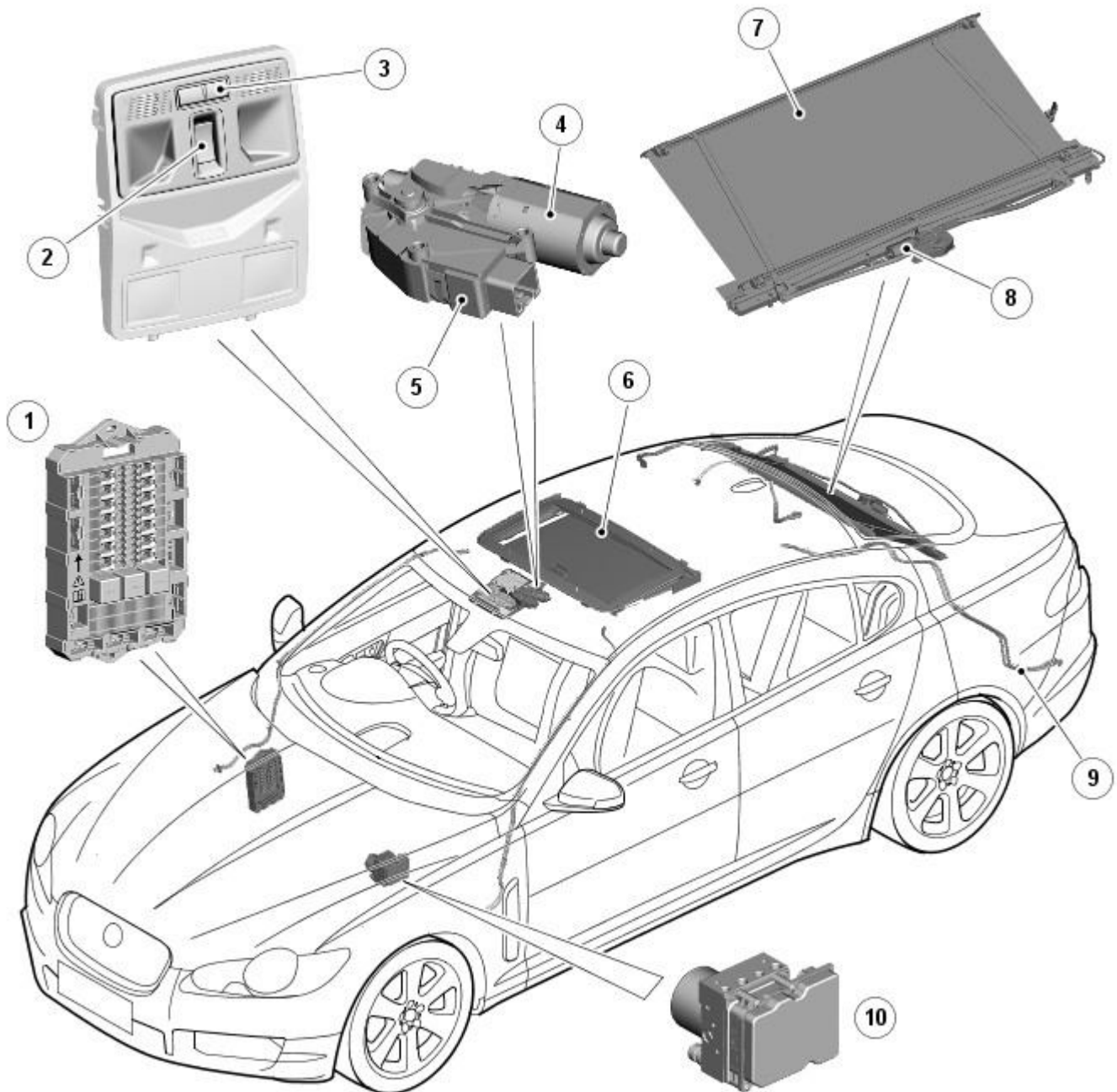
Description	Nm	lb-ft	lb-in
Roof opening panel frame retaining bolts	9	—	80
Roof opening panel motor retaining bolts	4	—	35
Roof opening panel glass retaining screws	4	—	35



# Roof Opening Panel - Roof Opening Panel - Component Location

Description and Operation

Component Location



E94547

## ItemDescription

1	<a href="#">CJB (central junction box)</a>
2	Roof opening panel, rocker switch
3	Rear window sunblind, switch
4	Roof opening panel, motor
5	Roof opening panel, control module
6	Roof opening panel
7	Rear window sunblind
8	Rear window sunblind, motor assembly
9	Drain tubes (4 off)
10	<a href="#">ABS (anti-lock brake system) module</a>

# Roof Opening Panel - Roof Opening Panel - Overview

Description and Operation

## Overview

The roof opening panel is operated through a two-way rocker switch located in the roof console. A motor, attached to the front of the roof-opening-panel frame, drives the glass panel to the tilt, open or closed positions using a pair of steel cables.

### Tilt

With the roof opening panel closed, a press and release on the front of the rocker switch, tilts the rear of the panel upwards. If the switch is pressed again before the full tilt position is reached, the panel stops at the chosen position.

### Fully open

With the roof opening panel closed, a press and release on the rear of the rocker switch, moves the panel to the fully open position automatically. It can be stopped at any point by pressing the button again.

### Close

- From the fully open position, press and release the front of the switch. The panel will return to the closed position automatically.
- From the tilted position, press and release the rear of the switch. The panel will return to the closed position automatically.

### Anti-trap

The roof opening panel has an 'anti-trap' function which prevents the panel from closing if an obstruction is sensed. When an obstruction is sensed, the motor will automatically retract the panel as far as possible. When the obstruction is removed, the panel can be closed by the normal method.

## Roof opening sunblind

A sunblind integrated into the roof-opening-panel frame, is operated manually and can be opened or closed when the roof opening panel is in either the tilted or closed position. When the roof opening panel opens (slides rearwards) the sunblind automatically slides rearwards and cannot be pulled forward until the roof opening panel is in a forward position.

## Rear window sunblind

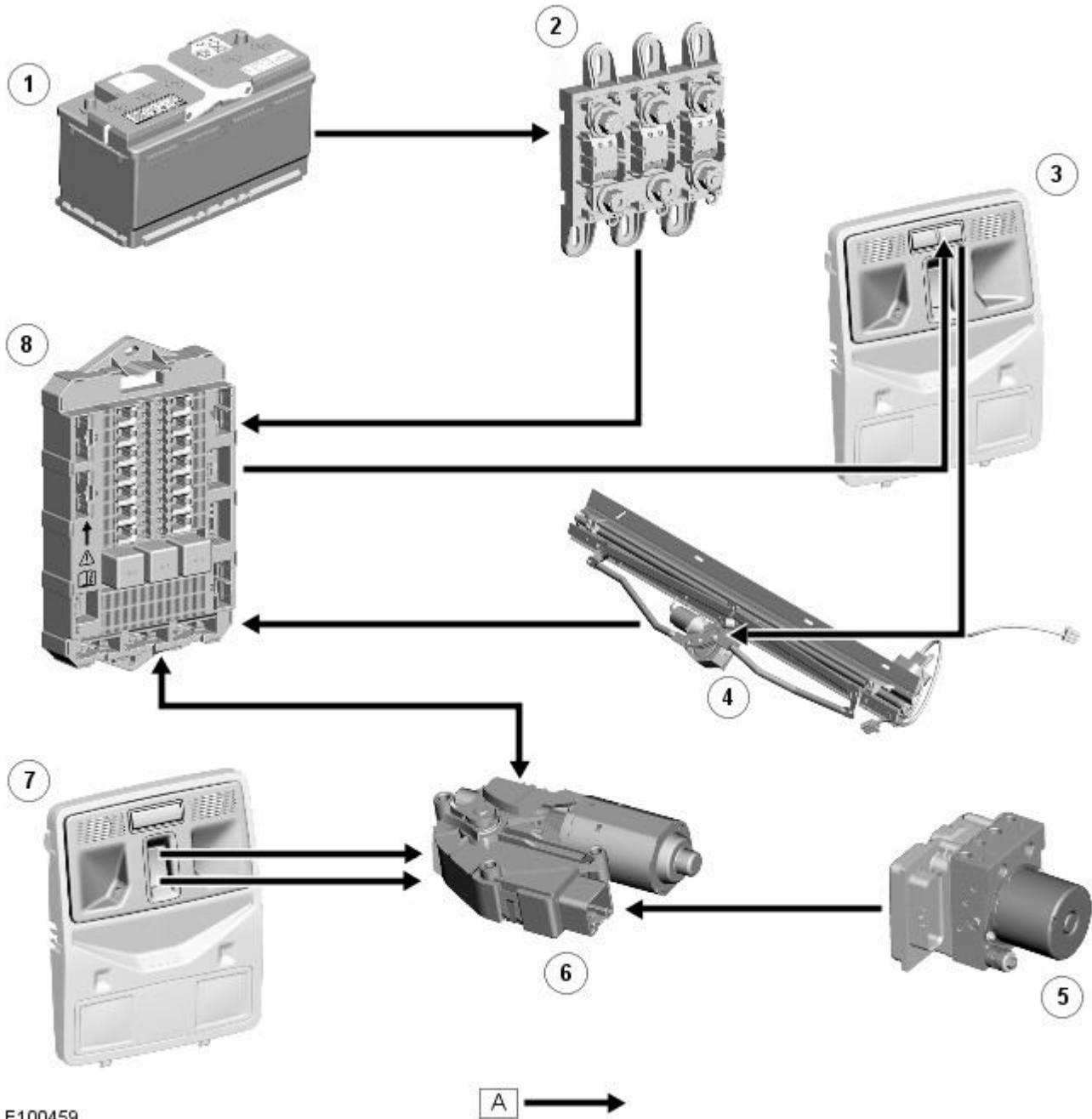
The rear window sunblind is operated through a switch in the roof console.

# Roof Opening Panel - Roof Opening Panel - System Operation and Component Description

Description and Operation

## Control Diagram

• NOTE: A = Hardwired



E100459

### ItemDescription

1	Battery
2	Megafuse (250 A)
3	Rear window sunblind, switch
4	Rear window sunblind, motor
5	ABS (anti-lock brake system) module
6	Roof opening panel, control module
7	Roof opening panel, rocker switch
8	CJB (central junction box)

## System Operation

### Roof opening panel

Operation of the roof opening panel is controlled by the roof opening panel control module, which is integral with the motor. The control module receives inputs from the CJB, which provides an 'open' or 'close' signal for remote handset operation, and an 'enable' signal when the vehicle enters power mode 6.

The control module also receives a vehicle speed signal from the ABS module. The vehicle speed signal is used by the control module to calibrate the anti-trap feature.

If the battery is disconnected, or the power supply is interrupted while the roof opening panel is in a partially open position, the motor and control module will need to be calibrated to restore full functionality. To recalibrate:

- Switch ignition on.
- Press the front of the switch, so the roof opening panel is in the tilt position, and then release the switch.
- Press the front of the switch and hold for thirty seconds.
- After thirty seconds the roof opening panel will begin to move. Keep the front of the switch pressed until the roof opening panel has fully opened and then closed.
- Once the open/close cycle has completed and the roof opening panel has stopped moving, release the switch.
- The roof opening panel can now be operated as normal.

Drain hoses are connected to the front and rear corners of the roof opening panel frame. The drain hoses are located inside of the cabin on the 'A' and 'D' post pillars to allow water, which has collected in the frame, to escape. One-way valves fitted to the end of each drain hose, prevent the ingress of dirt and moisture.

## **Rear window sunblind**

The powered rear window sunblind is operated through a switch in the roof console. Power to the sunblind motor is provided by a pair of relays located in the CJB when the vehicle enters power mode 4. The sunblind motor is located beneath the rear parcel shelf and is supplied as a sealed unit with the sunblind mechanism.

If the battery is disconnected or a replacement sunblind is fitted, the motor will require re-calibrating. To re-calibrate the motor the sunblind should be powered through two-full cycles of movement.

## **Component Description**

### **Roof opening panel, motor**

The roof opening panel motor has a worm drive which drives a gear in the cast housing attached to the end of the motor. The gear has a small pinion gear attached to the outer part of its spindle. The pinion engages with two cables to form a rack and pinion drive. Rotation of the motor turns the pinion which in turn drives the cables in the required direction.

The two cables are attached either side of the pinion. One end of each cable is attached to the guide; the opposite end of each cable is held in position on the pinion by a metal insert in the frame. The cables run in channels, in the panel frame to the guides. As the panel is closed the cables are pushed through channels in the front of the frame. The displaced cable is guided into a further two channels in the frame, which protect the cable and prevent it from snagging. The cables manufactured from rigid spring steel can pull as well as push the panel along the guides.

The motor contains a micro-switch and Hall effect sensor. Signals received from these components enable the control module to calculate the exact position of the roof opening panel. The Hall effect sensor is also responsible for the operation of the anti-trap function.

If the anti-trap feature is activated while the roof opening panel is closing, the panel is reversed for 200mm or as far as possible. The Hall effect sensor, located in the motor, monitors the speed of the motor and if the speed decreases below a set threshold, indicating an obstruction, the power feed to the motor is reversed so the panel goes back. In an emergency the anti-trap function can be overridden by holding the switch in the closed position.

### **Roof opening panel, control module**

The roof opening panel control module is integrated within the motor. The control module receives inputs from the CJB, which provides an 'open' or 'close' signal for remote handset operation, and an 'enable' signal when the vehicle enters power mode 6.

The control module also contains the algorithm for the anti-trap system and receives a vehicle speed signal from the ABS module. The vehicle speed signal is used by the control module to calibrate the anti-trap feature.

# Roof Opening Panel - Roof Opening Panel

Diagnosis and Testing

## Principle of Operation

For a detailed description of the roof opening panel, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (501-17 Roof Opening Panel)

[Roof Opening Panel](#) (Description and Operation),  
[Roof Opening Panel](#) (Description and Operation),  
[Roof Opening Panel](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Roof opening panel</li> <li>● Helixed drive cables</li> <li>● Switch</li> <li>● Control unit/motor</li> </ul>	<ul style="list-style-type: none"> <li>● Fuses/relays (refer to electrical guide)</li> <li>● Wiring harness</li> <li>● Correct engagement of electrical connectors</li> <li>● Loose or corroded connections</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• **NOTE:** If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• **NOTE:** Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• **NOTE:** When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

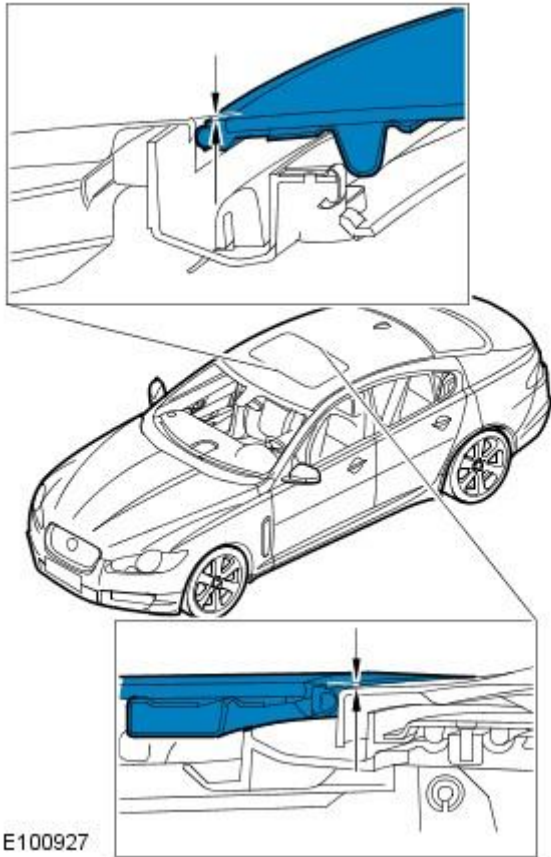
• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• **NOTE:** If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B10F211	Sunroof Control	<ul style="list-style-type: none"> <li>● Sunroof enable signal circuit - short to ground</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check sunroof enable signal circuit for short to ground
B10F212	Sunroof Control	<ul style="list-style-type: none"> <li>● Sunroof enable signal circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check sunroof enable signal circuit for short to power
B10F213	Sunroof Control	<ul style="list-style-type: none"> <li>● Sunroof enable signal circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check sunroof enable signal circuit for open circuit
B113D12	Sunroof Global Open/Close Control	<ul style="list-style-type: none"> <li>● Roof opening panel global open/close control circuit - short to power</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check roof opening panel global open/close control circuit for short to power
B113D14	Sunroof Global Open/Close Control	<ul style="list-style-type: none"> <li>● Roof opening panel global open/close control circuit - short to ground, open circuit</li> </ul>	Refer to the electrical circuit diagrams and check roof opening panel global open/close control circuit for short to ground, open circuit

## Roof Opening Panel - Roof Opening Panel Alignment

General Procedures

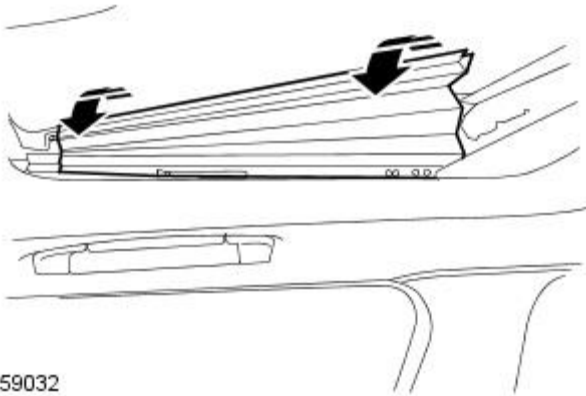


E100927

1. With the roof opening panel closed, check the alignment of the glass to the roof panel. The glass should be central in its aperture. Profile of sunroof to body should be flush or up to 1.0 mm (0.40") low all round.

2. Open the roof opening panel blind.

3. Release the cover.
  - Repeat the above procedure for the other side.



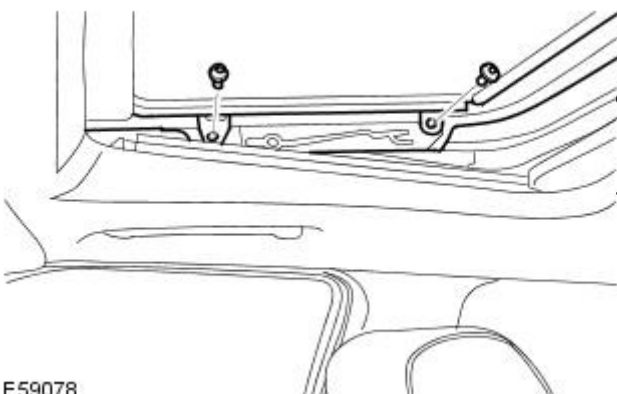
E59032

5. 4. Loosen the 4 roof opening panel Torx screws.

- TORQUE: 4 Nm

6. Install the cover.
  - Repeat the above procedure for the other side.

7. Close the roof opening panel blind.



E59078



# Roof Opening Panel - Motor Synchronization

## General Procedures

### 1. NOTE: If a new component is installed.

Press and hold the front of the switch, hold down until the roof opening panel has completed a full open/close cycle.

- The roof opening panel is now synchronized.

### 2. NOTE: If the removed component is re-installed.

Press and hold the the front of the switch, the roof opening panel will move to the tilt position. Release the switch then press and hold the front of the switch, then the roof opening panel will move slightly more after 20 seconds.

- The roof opening panel is now un-synchronized.

### 3. NOTE: If the removed component is re-installed.

Press and hold the front of the switch, hold down until the roof opening panel has completed a full open/close cycle.

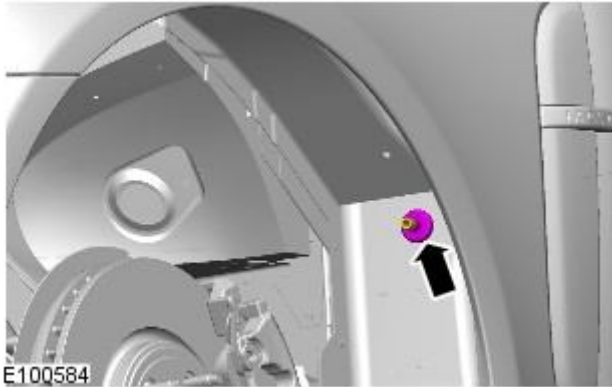
- This action must be done within 2-3 seconds of the last action.
- The roof opening panel is now synchronized.

# Roof Opening Panel - Roof Opening Panel Front Drain Hose

Removal and Installation

## Removal

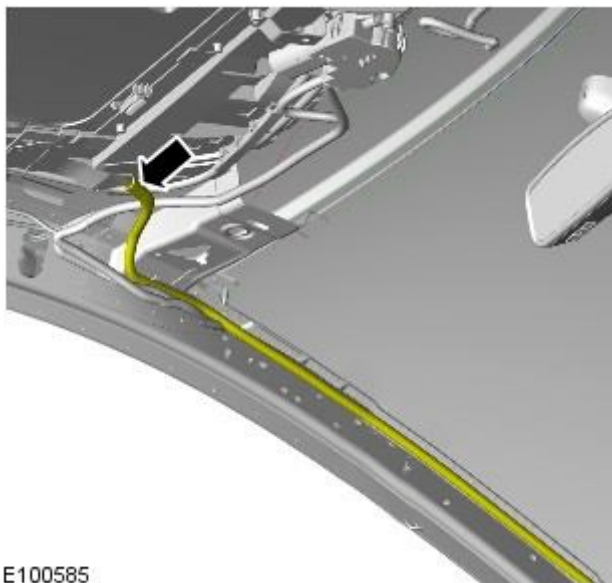
1. Refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).



2.

3. Refer to: [Cowl Side Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

4. Refer to: [Headliner](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).



5.



6.

## Installation

1. To install, reverse the removal procedure.

## Roof Opening Panel - Roof Opening Panel Frame

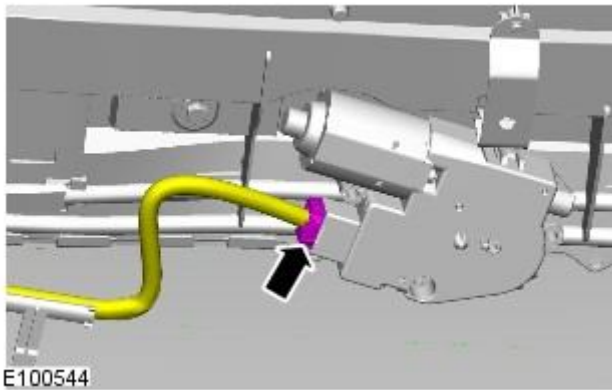
Removal and Installation

### Removal

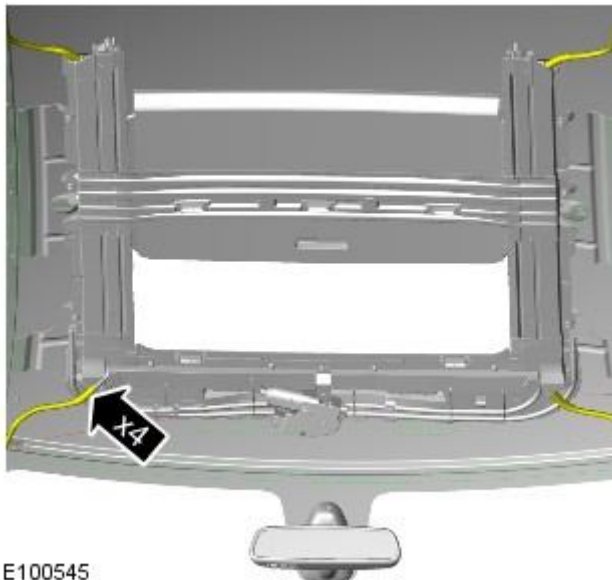
• NOTE: Removal steps in this procedure may contain installation details.

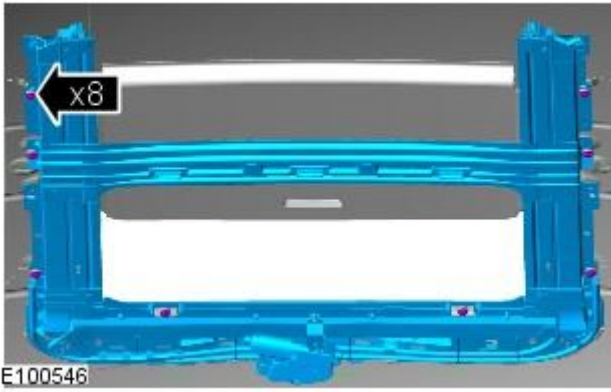
1. Refer to: [Motor Synchronization](#) (501-17 Roof Opening Panel, General Procedures).
2. Refer to: [Headliner](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Refer to: [Roof Opening Panel Glass](#) (501-17 Roof Opening Panel, Removal and Installation).


4.



5.

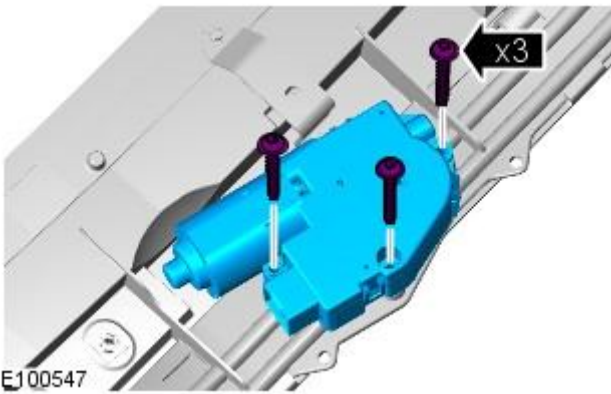




6.  **WARNING:** This step requires the aid of another technician.

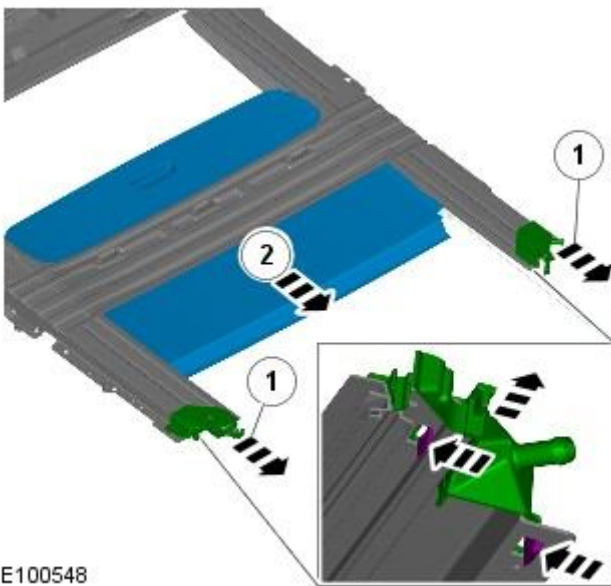
- **NOTE:** Note the fitted position of the spacers.

*Torque:* 8 Nm



7. **NOTE:** Do not disassemble further if the component is removed for access only.

*Torque:* 4 Nm




- 8.

9.



E100549

## Installation

1.  CAUTION: Make sure that the component is correctly located on the locating dowels.

- NOTE: Replace the spacers to the fitted position.

To install, reverse the removal procedure.



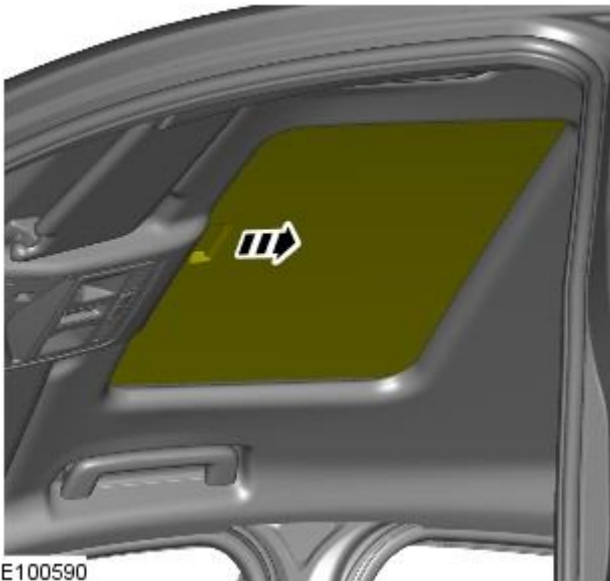
# Roof Opening Panel - Roof Opening Panel Glass

Removal and Installation

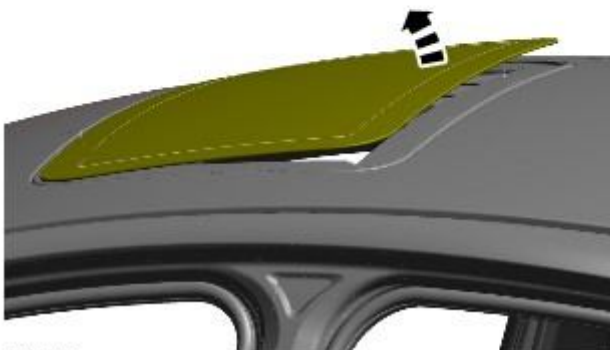
## Removal

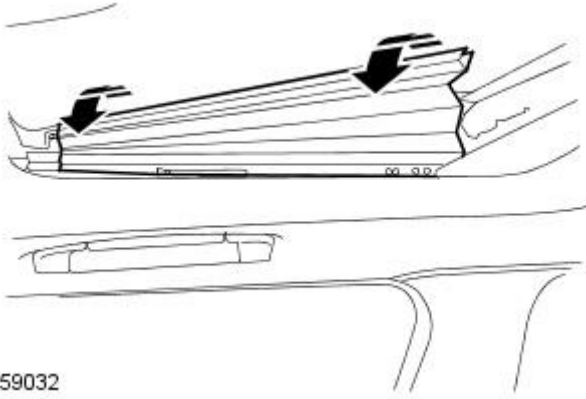
- NOTE: Removal steps in this procedure may contain installation details.

1.



2.

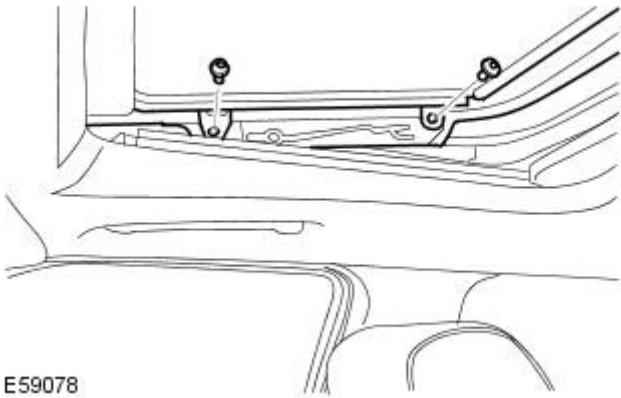




E59032

3. **3.** NOTE: Right-hand shown, left-hand similar.

- Repeat procedure for the other side.



E59078

4. **4.** NOTE: Right-hand shown, left-hand similar.

*Torque: 4 Nm*

## Installation

1. To install, reverse the removal procedure.

## Roof Opening Panel - Roof Opening Panel Motor

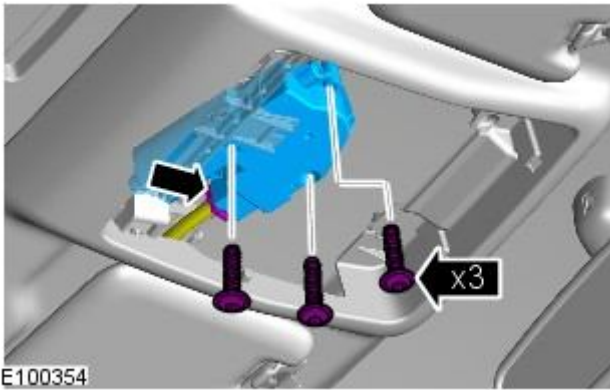
Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Overhead Console](#) (501-12 Instrument Panel and Console, Removal and Installation).

2. Torque: 4 Nm



### Installation

1. To install, reverse the removal procedure.

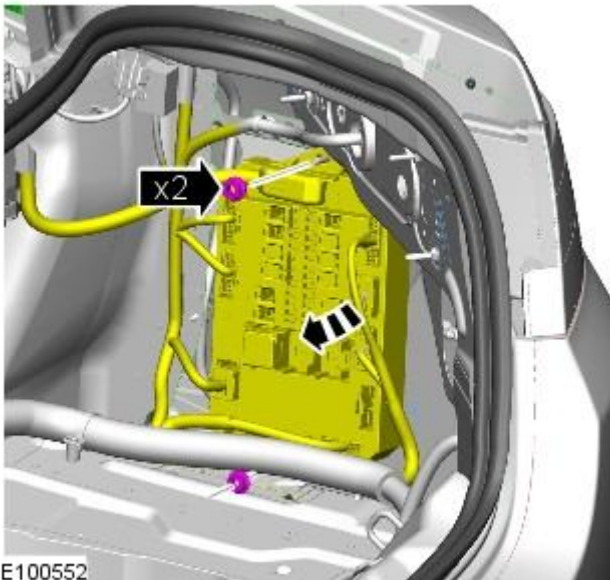
## Roof Opening Panel - Roof Opening Panel Rear Drain Hose

Removal and Installation

### Removal

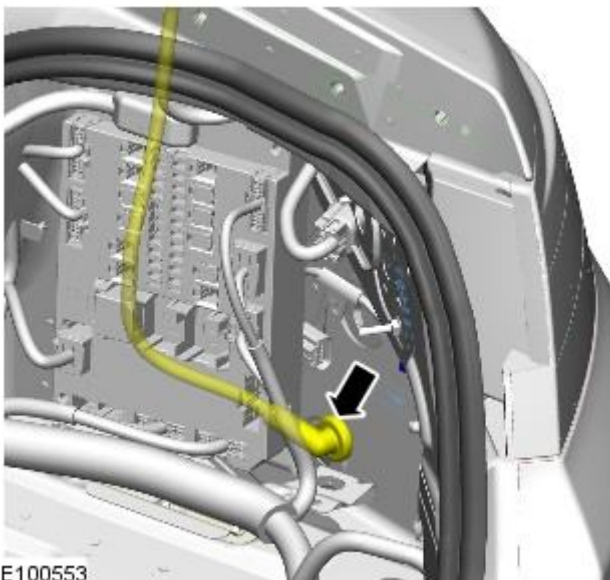
1. Refer to: [Loadspace Trim Panel RH](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Refer to: [Headliner](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. **3.** NOTE: RH side only.

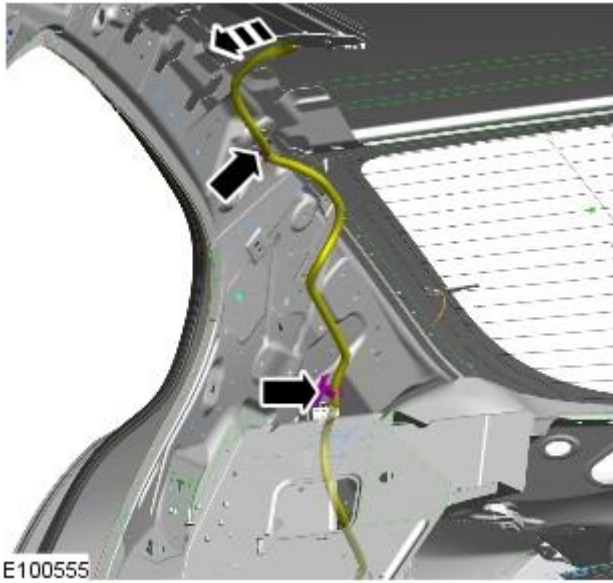


E100552

4. **4.** NOTE: RH illustration shown, LH is similar.



E100553



5. **5.** NOTE: RH illustration shown, LH is similar.



6. **6.** NOTE: RH illustration shown, LH is similar.

## Installation

1. To install, reverse the removal procedure.

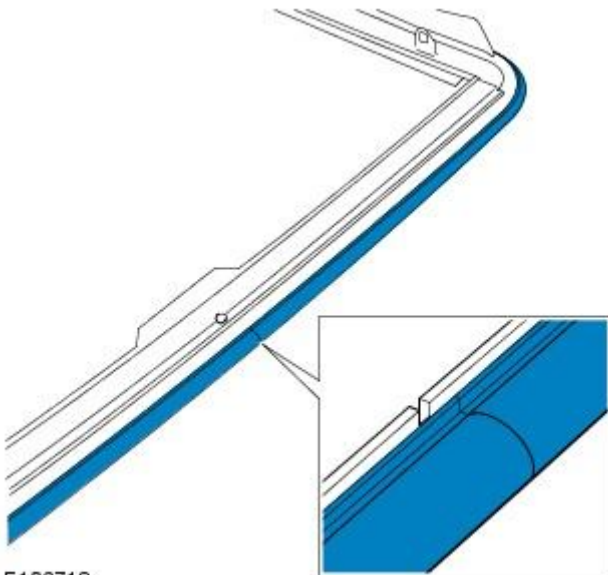
## Roof Opening Panel - Roof Opening Panel Weatherstrip

Removal and Installation

### Removal

1. Refer to: [Roof Opening Panel Glass](#) (501-17 Roof Opening Panel, Removal and Installation).

2. **NOTE:** Make sure that this component is installed to the noted removal position.



### Installation

1. To install, reverse the removal procedure.



**Bumpers -**

<b>Description</b>	<b>Nm</b>	<b>lb-ft</b>	<b>lb-in</b>
Radiator splash shield outer retaining bolts	3	-	26
Radiator splash shield inner retaining bolts	7	-	62
Radiator splash shield inner retaining screws	2	-	18
Front bumper cover retaining bolts	2	-	18
Rear bumper cover retaining bolts	7	-	62
Rear bumper retaining bolts	25	18	-

# Bumpers - Front Bumper Cover

Removal and Installation

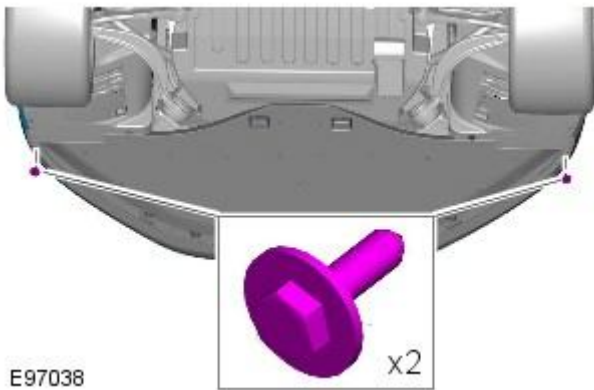
## Removal

- NOTE: Removal steps in this procedure may contain installation details.

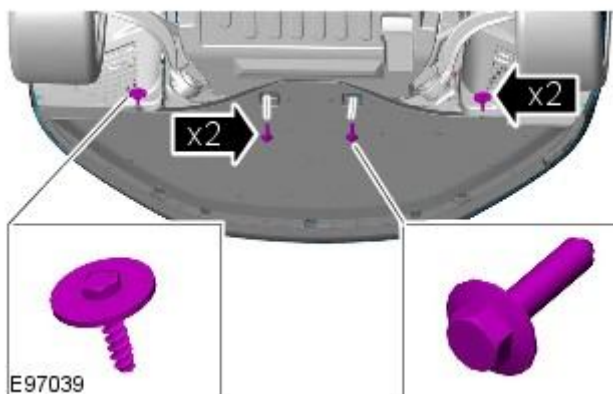
1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

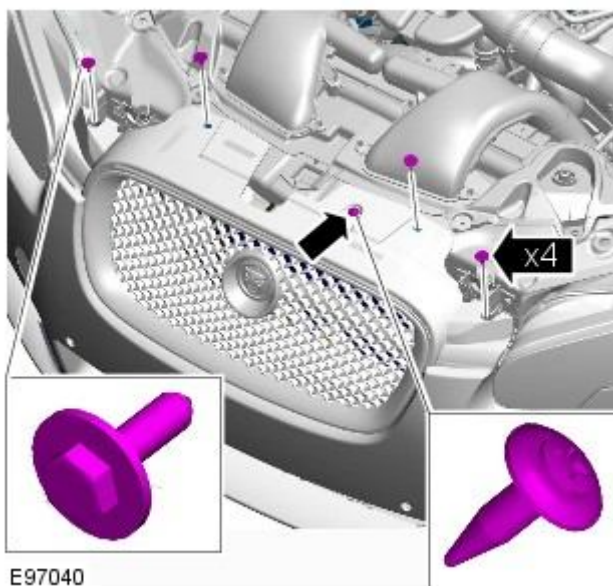
2. Torque: 3 Nm



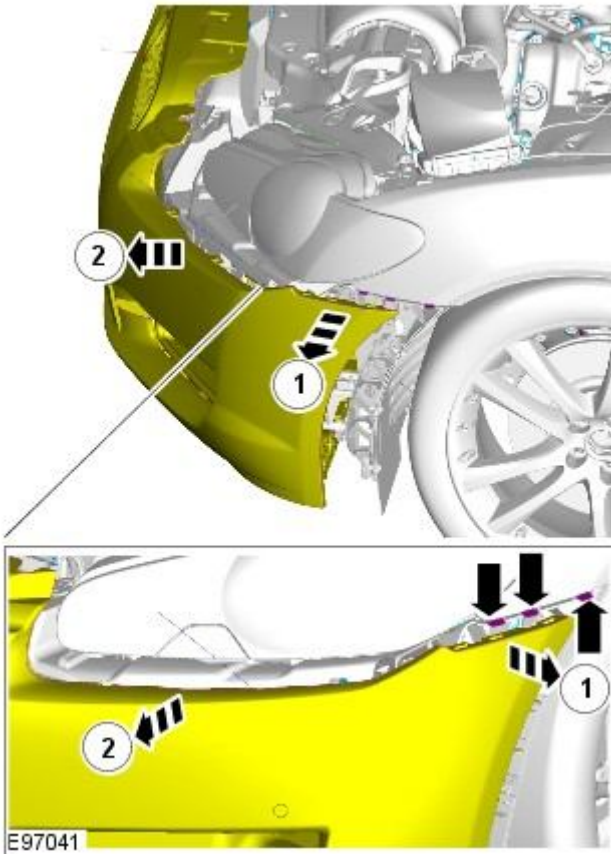
3. Torque:  
Retaining screws 2 Nm  
Retaining bolts 7 Nm



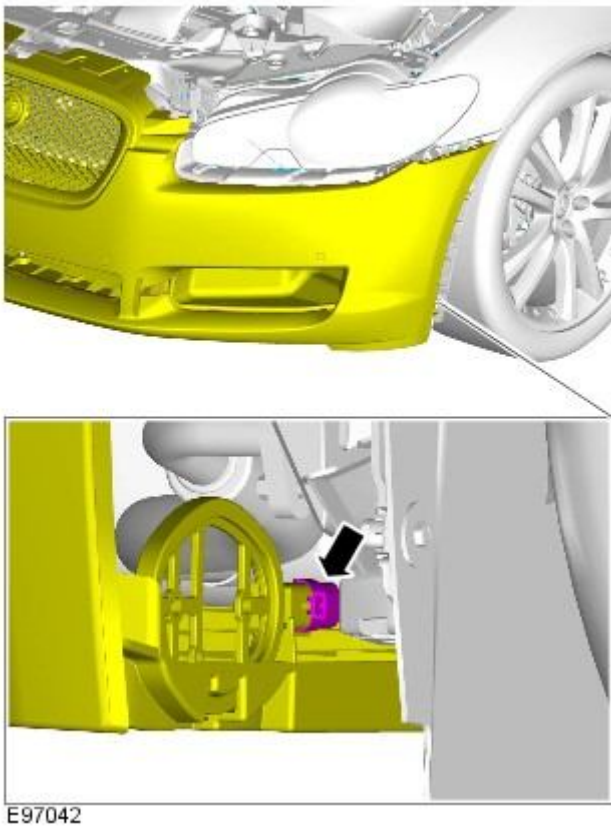
4. Torque: 2 Nm

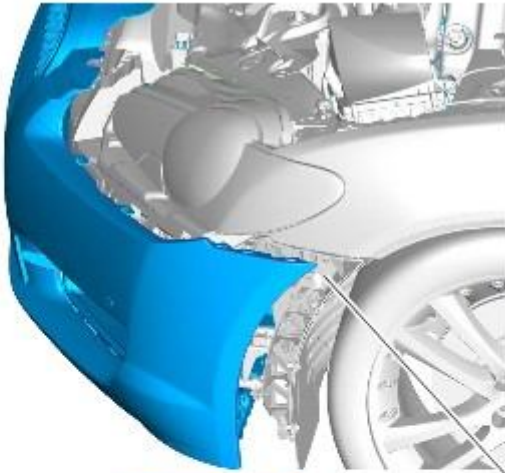


5. **5. NOTE:** This step requires the aid of another technician.

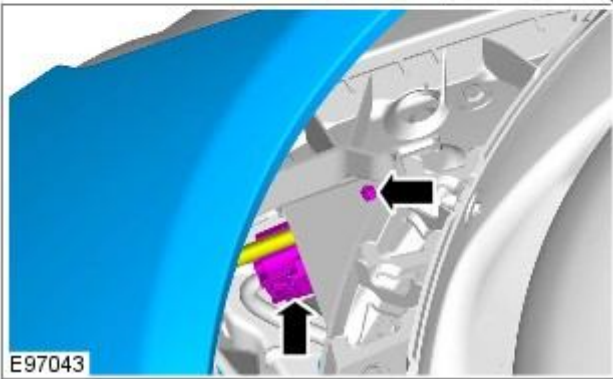


6. **6. NOTE:** On both sides.





7. **7. NOTE:** This step requires the aid of another technician.



## Installation

1. To install, reverse the removal procedure

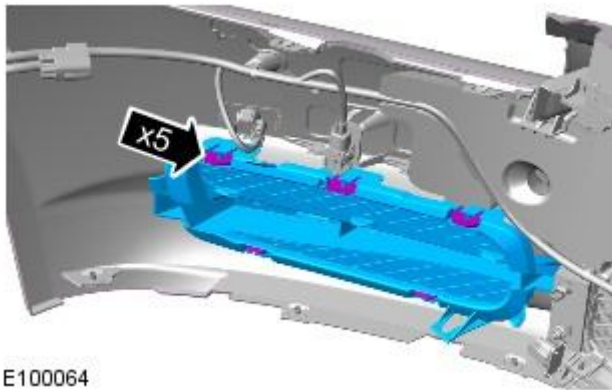
## Bumpers - Front Bumper Cover Insert

Removal and Installation

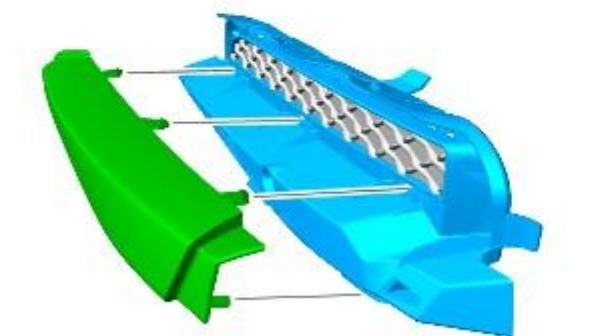
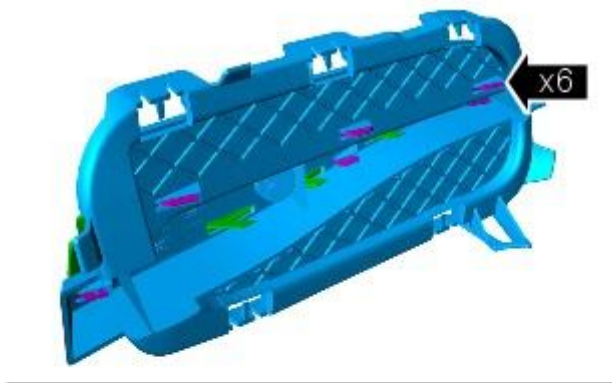
### Removal

1. Refer to: [Front Bumper Cover](#) (501-19 Bumpers, Removal and Installation).

2.



3. **3. NOTE:** Do not disassemble further if the component is removed for access only.



E100065

### Installation

1. To install, reverse the removal procedure.

## Bumpers - Rear Bumper Cover

Removal and Installation

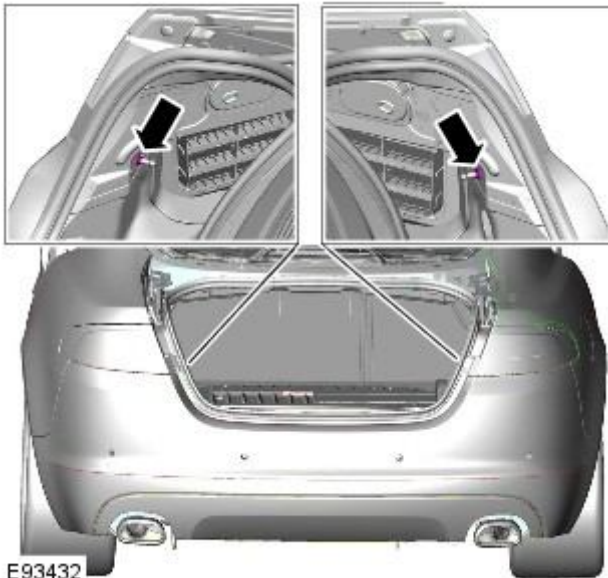
### Removal

- NOTE: Removal steps may contain installation details.

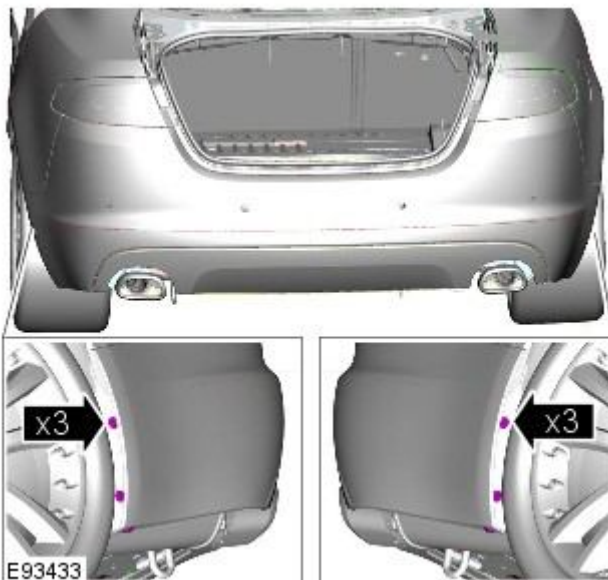
1. Remove the rear lamp assemblies.

Refer to: [Rear Lamp Assembly](#) (417-01 Exterior Lighting, Removal and Installation).

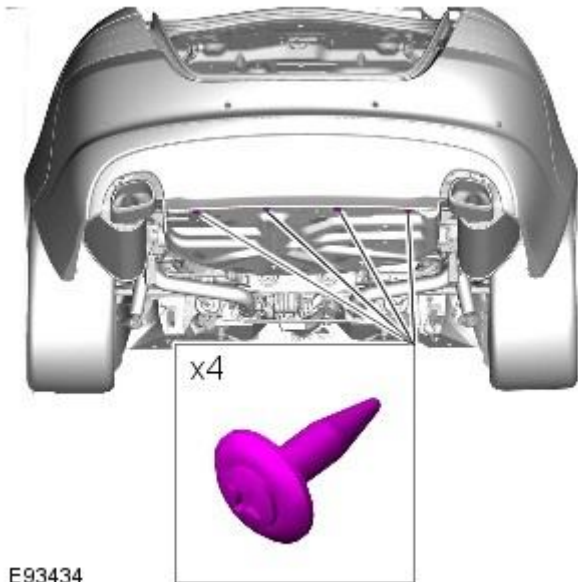
2. Torque: 7 Nm



- 3.







E93434

4.



E93435

5.

## Installation

1. To install, reverse the removal procedure.

## Bumpers - Rear Bumper

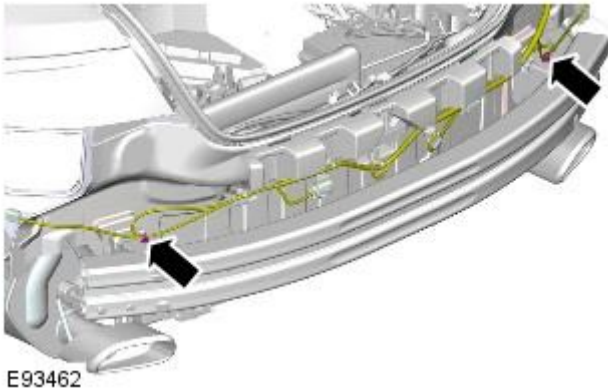
Removal and Installation

### Removal

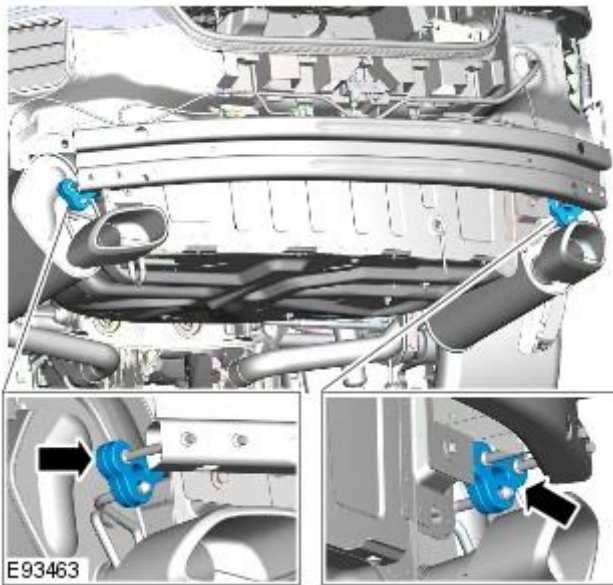
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Rear Bumper Cover](#) (501-19 Bumpers, Removal and Installation).

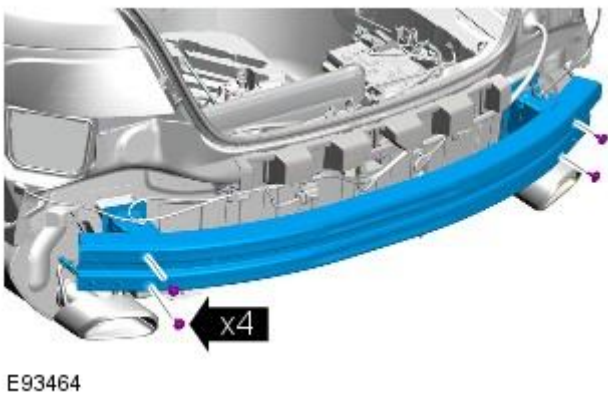
2.



3.



4. Torque: 25 Nm



### Installation

1. To install, reverse the removal procedure.

## Safety Belt System -

### Torque Specifications

Description	Nm	lb-ft	lb-in
Front safety belt retractor to seat track retaining bolt	40	30	-
Front safety belt retractor retaining bolt	40	30	-
Front safety belt D loop retaining bolt	40	30	-
Front safety belt buckle retaining bolt	40	30	-
Front safety belt shoulder height adjuster retaining bolts	25	18	-
Rear centre safety belt retractor retaining bolts	40	30	-
Rear safety belt long end retaining bolts	40	30	-
Rear safety belt D loop retaining bolt	40	30	-
Rear safety belt long end retaining bolt	40	30	-
Rear safety belt buckle retaining bolts	40	30	-

# Safety Belt System - Safety Belt System - Component Location

Description and Operation

• NOTE: Authoring Template



E93457

## ItemDescription

1	Belt tension sensor - if fitted
2	<a href="#">RH (right-hand)</a> front safety belt retractor
3	<a href="#">RH</a> front safety belt
4	<a href="#">RH</a> rear safety belt
5	<a href="#">RH</a> rear safety belt retractor
6	Child seat tethers (3 off)
7	Center rear safety belt retractor
8	<a href="#">LH (left-hand)</a> rear safety belt retractor
9	<a href="#">LH</a> rear safety belt buckle
10	<a href="#">RH</a> rear and center safety belt buckles
11	<a href="#">LH</a> front safety belt
12	<a href="#">LH</a> front safety belt retractor
13	<a href="#">LH</a> front safety belt buckle and pre-tensioner
14	<a href="#">RH</a> front safety belt buckle and pre-tensioner

# Safety Belt System - Safety Belt System - Overview

Description and Operation

Authoring Template

## OVERVIEW

A three point safety belt is fitted to all seating positions. Each safety belt retractor incorporates an emergency locking feature. The emergency locking retractor incorporates 2 mechanical inertia devices. One inertia device activates if the safety belt is subjected to a sharp pull. The second inertia device activates if the vehicle is subject to a sudden deceleration or is on a severe incline.

North American Specification (NAS) safety belt retractors also include an automatic locking feature. The Automatic Locking Retractor (ALR) is fitted to all passenger seating positions and allows the safety belt to be tensioned to aid the safe fitment of child or booster seats. For additional information, refer to the Owners Handbook.

NAS vehicles are also fitted with a belt tension sensor on the front passenger seat. The belt tension sensor is incorporated into the seat belt lower anchorage and is attached to the seat frame by an M10 Torx head bolt. The belt tension sensor forms part of the [SRS \(supplemental restraint system\)](#) occupancy detection and classification feature.

The center rear safety belt features a mini-buckle lower anchorage. The mini-buckle is disengaged by inserting a suitable tool into the small aperture on the front face of the housing.

To aid the fitment of child seats, 3 tethers are located on the rear parcel shelf. Each tether is attached to the parcel shelf with an M10 Torx head bolt.

A safety belt warning indicator is located in the instrument cluster to remind front seat passengers to fasten their safety belts. The warning indicator will illuminate if the safety belt of an occupied front seat is not fastened. Refer to: Instrument Cluster (413-01, Description and Operation).

# Safety Belt System - Safety Belt System - System Operation and Component Description

Description and Operation

## System Operation

Refer to: [Safety Belt System](#) (501-20A Safety Belt System, Description and Operation).



# Safety Belt System - Safety Belt System

Diagnosis and Testing

## Principle of Operation

For a detailed description of the safety belt system, refer to the relevant Description and Operation section in the workshop manual. REFER to: (501-20A Safety Belt System)

[Safety Belt System](#) (Description and Operation),  
[Safety Belt System](#) (Description and Operation),  
[Safety Belt System](#) (Description and Operation).

## Inspection and Verification

1. Verify the customer concern by operating the safety belt.
2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>Loose webbing</li> <li>Damaged/frayed webbing</li> <li>Safety belt retractor</li> </ul>	<ul style="list-style-type: none"> <li>Warning indicator bulb</li> </ul>

3. If the fault is not visually evident determine the symptom(s) and proceed to the Symptom Chart.

## Symptom Chart

Symptom	Possible Causes	Action
Normal Mode - Occupant Restraint System inoperative	<ul style="list-style-type: none"> <li>Broken tooth on retractor sensor gear</li> <li>Loose webbing</li> </ul>	REFER to the Component Tests in this section
Automatic Locking Retraction System (ALR) Inoperative	<ul style="list-style-type: none"> <li>Broken tooth on retractor sensor gear</li> <li>Loose webbing</li> </ul>	REFER to the Component Tests in this section
Seatbelt - Jammed	<ul style="list-style-type: none"> <li>(ALR) automatic locking retractor in use (normal operation)</li> <li>Twist in webbing</li> <li>Webbing guide incorrect location</li> <li>Foreign object in webbing route</li> <li>Safety belt reel is incorrectly installed</li> </ul>	GO to Pinpoint Test <a href="#">A.</a>
Seatbelt - Not retracting	<ul style="list-style-type: none"> <li>(ALR) automatic locking retractor in use (normal operation)</li> <li>Twist in webbing</li> <li>Webbing guide incorrect location</li> <li>Foreign object in webbing route</li> <li>Safety belt reel is incorrectly installed</li> </ul>	GO to Pinpoint Test <a href="#">A.</a>
Seatbelt - Not working	<ul style="list-style-type: none"> <li>(ALR) automatic locking retractor in use (normal operation)</li> <li>Twist in webbing</li> <li>Webbing guide incorrect location</li> <li>Foreign object in webbing route</li> <li>Safety belt reel is incorrectly installed</li> </ul>	GO to Pinpoint Test <a href="#">A.</a>
Seatbelt - Slow retraction	<ul style="list-style-type: none"> <li>(ALR) automatic locking retractor in use (normal operation)</li> <li>Twist in webbing</li> <li>Webbing guide incorrect location</li> <li>Foreign object in webbing route</li> <li>Safety belt reel is incorrectly installed</li> </ul>	GO to Pinpoint Test <a href="#">A.</a>
Seatbelt - Binding	<ul style="list-style-type: none"> <li>(ALR) automatic locking retractor in use (normal operation)</li> <li>Twist in webbing</li> <li>Webbing guide incorrect location</li> <li>Foreign object in webbing route</li> <li>Safety belt reel is incorrectly installed</li> </ul>	GO to Pinpoint Test <a href="#">A.</a>
Seatbelt - Inoperative	<ul style="list-style-type: none"> <li>(ALR) automatic locking retractor in use (normal operation)</li> <li>Twist in webbing</li> <li>Webbing guide incorrect location</li> <li>Foreign object in webbing route</li> <li>Safety belt reel is incorrectly installed</li> </ul>	GO to Pinpoint Test <a href="#">A.</a>

Symptom	Possible Causes	Action
Seatbelt - Intermittent	<ul style="list-style-type: none"> <li>● (ALR) automatic locking retractor in use (normal operation)</li> <li>● Twist in webbing</li> <li>● Webbing guide incorrect location</li> <li>● Foreign object in webbing route</li> <li>● Safety belt reel is incorrectly installed</li> </ul>	GO to Pinpoint Test <a href="#">A.</a>
Seatbelt - Jamming	<ul style="list-style-type: none"> <li>● (ALR) automatic locking retractor in use (normal operation)</li> <li>● Twist in webbing</li> <li>● Webbing guide incorrect location</li> <li>● Foreign object in webbing route</li> <li>● Safety belt reel is incorrectly installed</li> </ul>	GO to Pinpoint Test <a href="#">A.</a>

## Component Tests

### Poor Retraction



**WARNING:** In the event of an accident in which the air bags have been deployed, the front safety belts that were in use, and the rear safety belts whether in use or not, at the time of the accident must be removed and NEW safety belts MUST be installed. Failure to follow this instruction may result in personal injury and component failure.

If a safety belt does not retract correctly, check that the anchor covers and trim bezels are correctly installed and not rubbing against the safety belt webbing. Where necessary, check the safety belt webbing is not rubbing at one end of the retractor cover slot and if so, correct by loosening the retaining bolt, aligning the retractor to centralize the safety belt webbing and re-tighten the bolt.

The vehicle is equipped with two front and three rear inertia reel safety belts. These safety belts are "dual sensitive" which means that they have:

- a vehicle motion sensor, which locks the safety belt webbing under braking, cornering, on steep hills and in adverse camber conditions
- a webbing motion sensor, which locks when the safety belt webbing is quickly extracted

Both systems should be fully operational and can be checked by the tests below:

### Vehicle Motion Sensor Test

Either of the following two procedures may be used to check correct operation of the vehicle motion sensor. Both methods require two people but note that people of larger than average build should not be asked to conduct these tests. This is to avoid the possibility of a fully unrolled safety belt webbing being mistaken for a correctly locked safety belt retractor.

Test Method 1 (braking)



**WARNING:** It is important that during this test, the wearer allows the safety belt to provide the restraint, the wearer should not attempt to anticipate the sudden deceleration and the driver should not brace themselves against the steering wheel. However, both the driver and the passenger must prepare themselves for the possibility that the safety belt will not lock. The passenger should hold their hands in front of him, just clear of the instrument panel or front seat backrest. Depending on which belt is being tested. Failure to follow these procedures may result in personal injury.

- Select for this test, a quiet or private stretch of road. Make sure that the road is clear and that full visibility is maintained at all times
- Both driver and passenger should adopt a normal, comfortable seating position. Both occupants should wear the safety belts and the safety belt webbing must be correctly adjusted, with no slack
- Proceed at a speed of approximately 10 km/h (6 miles/hour), do not exceed 10 km/h (6 miles/hour) for this test
- When safe to do so, apply the foot brake sharply to stop the vehicle. If the vehicle motion sensitive lock mechanism is operating correctly, the safety belt webbing will lock and restrain the wearer
- Conduct the test twice in each front and rear passenger seat position
- Any safety belt retractor which does not restrain the wearer during this test must not be used. A NEW safety belt must be installed

Test Method 2 (turning circle)

This method requires a flat open area of private road, sufficient for the vehicle to be driven safely in a continuous circle on full lock.

- The driver should wear the safety belt provided and the belt webbing must be correctly adjusted, with no slack
- The passenger should occupy a rear seat with the safety belt correctly adjusted
- Start the engine and, with the steering on full right-hand lock, drive the vehicle in a continuous circle at 16 km/h (10 miles/hour), do not exceed 16 km/h (10 miles/hour)
- When the speed is stable, the passenger should attempt to slowly extract the safety belt webbing from each safety belt retractor in turn. If the vehicle motion sensitive lock mechanism is operating correctly, it will not be possible to extract the webbing
- Any safety belt retractor from which it is possible to extract the webbing during this test must not be used. A NEW safety belt must be installed

### Safety Belt Webbing Sensor Test

With the vehicle stationary and on level ground take firm hold of the safety belt webbing (on the tongue side of the upper safety belt anchor) and pull out quickly. The retractor should lock within 0.25 metre (10 inches), preventing further webbing pullout. Any safety belt retractor from which it is possible to extract further webbing must not be used. A NEW

safety belt must be installed.

## Service Installation of Safety Belts

It is possible that the safety belt assemblies installed in service may have been damaged during handling or installation to the vehicle. The damage is contained within the inner workings of the retractor and is therefore, not visible. However, the damage usually causes the retractor to stick or jam. The damage can only occur before installation is completed and is usually in one of the following ways:

- The safety belt webbing is allowed to retract onto the spindle until it jams the locking mechanism in a way that cannot occur when the safety belt is installed in the car. The safety belt webbing prevents the correct locking action and if the safety belt webbing is snatched or jerked out of the retractor, the loads are not taken on this high strength locking mechanism
- The webbing is snatched loaded by attempted fast extraction or manual testing with the safety belt held in the hand. This can result in deceleration which are much higher than those occurring in accident situations and there is a risk of damage to the mechanism

When handling safety belt assemblies, adopt the following procedures:



**WARNING:** If the following procedures are not successful, reject the safety belt assembly. Do not try to jerk or snatch the webbing out of the retractor as this may cause damage. Failure to follow these procedures may cause damage or personal injury.

- If the safety belt webbing retracts and will not extract under low webbing tension, install the retractor onto its mounting in the car, which will set it at its correct angle, and the safety belt webbing should extract easily
- If it does not, feed 5-10 mm (3/16 - 3/8 inch) more safety belt webbing onto the spindle (rotate the spindle using finger pressure if necessary) and the safety belt webbing should then extract

## Pinpoint Test

PINPOINT TEST A : DIAGNOSTIC GUIDE FOR THE SECOND AND THIRD ROW SAFETY BELTS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>A1: SAFETY BELT</b>	
• NOTE: During normal conditions the (ALR) automatic locking retractor can operate giving the impression of a jammed safety belt this can be overcome by drawing 20mm of webbing from the belt reel with moderate force, the belt reel should then operate correctly. Check the operation, if the webbing moves freely then retracts correctly no further action required, do not replace safety belt.	
	1 Visually inspect the condition of the safety belt.
	Is the safety belt fully retracted? <b>Yes</b> The safety belt is fully retracted, no slack in the webbing. <a href="#">GO to A2.</a> <b>No</b> Not fully retracted, the webbing is slack. <a href="#">GO to A3.</a>
<b>A2: REQUIRED FORCE</b>	
	1 Draw the webbing from the safety belt reel with moderate force then release the webbing. Carry out this operation twice.
	Does the webbing move freely then retract correctly? <b>Yes</b> No further action required, do not replace safety belt. <b>No</b> <a href="#">GO to A3.</a>
<b>A3: WEBBING SLACK - NOT FULLY RETRACTED</b>	
	1 Remove any trim panels to expose the D loop (anchor point) and safety belt reel. Check the webbing is not trapped or twisted.
	Does the webbing move freely then retract correctly? <b>Yes</b> While refitting the trim panels, ensure there are no obstruction and the webbing does not catch or rub. Check the operation, if the webbing moves freely then retracts correctly no further action required, do not replace safety belt. <b>No</b> <a href="#">GO to A4.</a>
<b>A4: TRAPPED OR TWISTED SAFETY BELT WEBBING</b>	
	1 If the webbing is twisted due to a fold passing through the anchor point (do not remove the safety belt reel) feed the twist back through the anchor point to remove. If the webbing is trapped, release and inspect for damage, if the webbing is damaged replace the safety belt.
	Does the webbing move freely then retract correctly? <b>Yes</b> If the webbing moves freely then retracts correctly no further action required, do not replace safety belt. While refitting the trim panels, ensure there are no obstruction and the webbing does not catch or rub. <b>No</b> <a href="#">GO to A5.</a>
<b>A5: SAFETY BELT WEBBING GUIDE LOCATION</b>	
• NOTE: The safety belt reel has a guide installed that can cause the safety belt reel to operate poorly if incorrectly located.	
	1 Visually and manually inspect the safety belt reel webbing guide for location and installation.
	Is the safety belt reel webbing guide for location and installation correct and secure? <b>Yes</b> <a href="#">GO to A6.</a> <b>No</b>

Refit the safety belt reel webbing guide ensure the fixing lug is properly located in the retractor frame. When correct draw the full length of the webbing from the reel then allow the belt to retract, the webbing will now be central on the spindle. Check the operation, if the webbing moves freely then retracts correctly, no further action required, do not replace safety belt. While replacing the trim panels, ensure there are no obstruction and the webbing does not catch or rub.

**A6: SAFETY BELT REEL LOCATION**

• **NOTE:** [Incorrect installation / location of the safety belt reel can affect operation.](#)

<b>1</b>	Confirm that the safety belt reel is correctly installed, check for correct location of both anti rotational pins if present.
----------	---

Is the safety belt reel is correctly installed?

**Yes**

Check the operation, if the webbing moves freely then retracts correctly, no further action required, do not replace safety belt. While replacing the trim panels, ensure there are no obstruction and the webbing does not catch or rub.

**No**

Correctly install the safety belt reel ensuring correct location of both anti rotational pins if present. Check the operation, if the webbing moves freely then retracts correctly, no further action required, do not replace safety belt. While replacing the trim panels, ensure there are no obstruction and the webbing does not catch or rub.

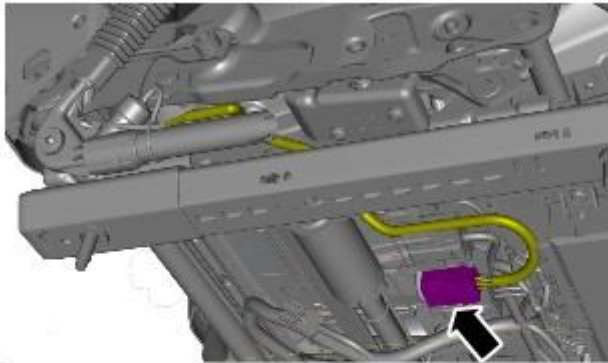
# Safety Belt System - Front Safety Belt Buckle

## Removal and Installation

### Removal

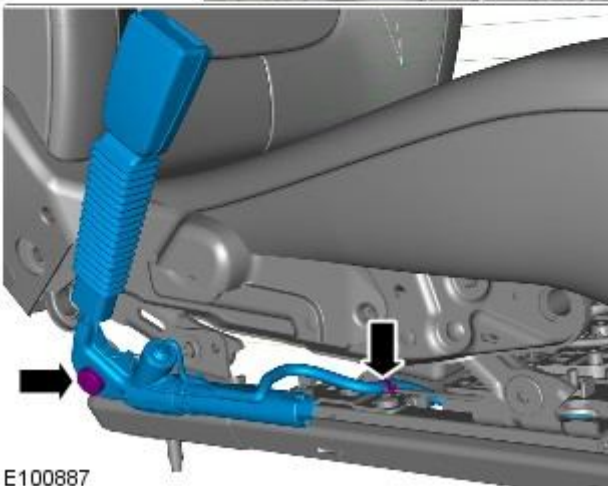
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).
2. Refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).




3.  CAUTION: Discard the bolt.

*Torque: 35 Nm*



E100887

### Installation

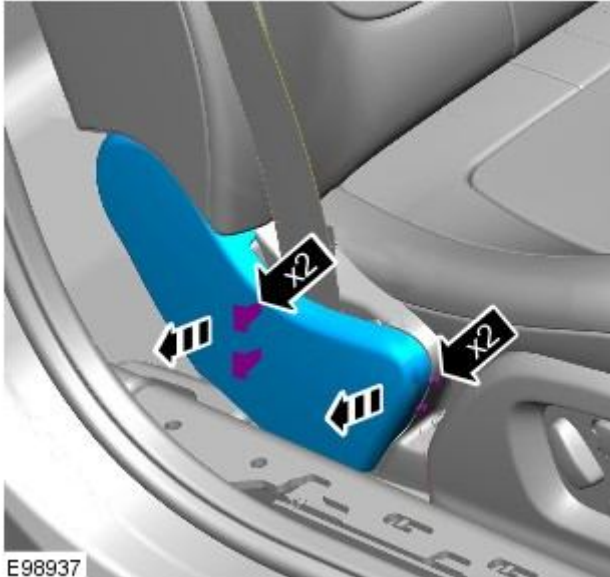
1.  CAUTION: Make sure that a new bolt is installed.  
To install, reverse the removal procedure.

## Safety Belt System - Front Safety Belt Retractor

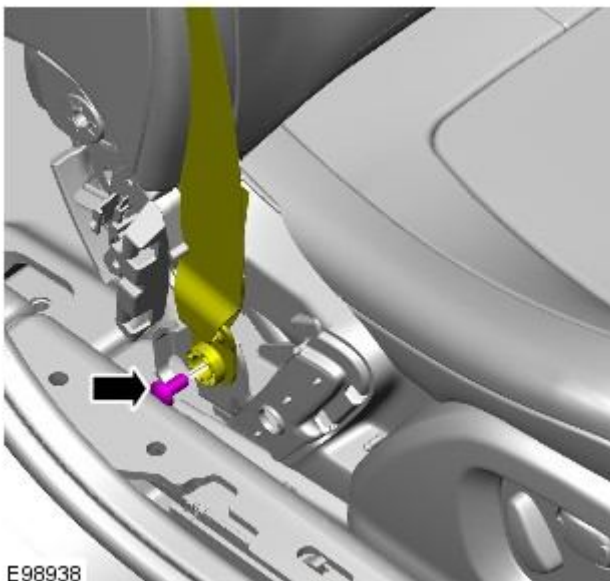
Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.



1. 1. NOTE: Right-hand shown, left-hand similar.

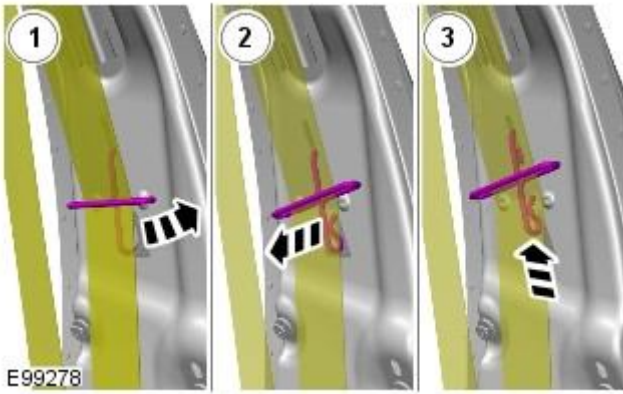


2. 2. NOTE: Right-hand shown, left-hand similar.

*Torque:* 40 Nm

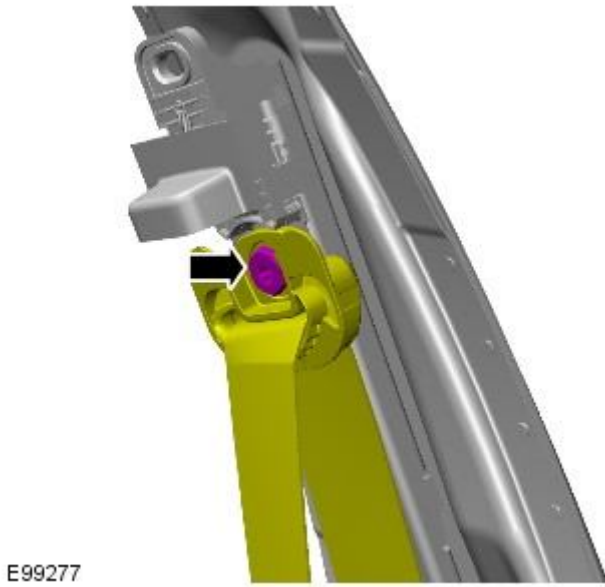
3. Refer to: [B-Pillar Upper Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).



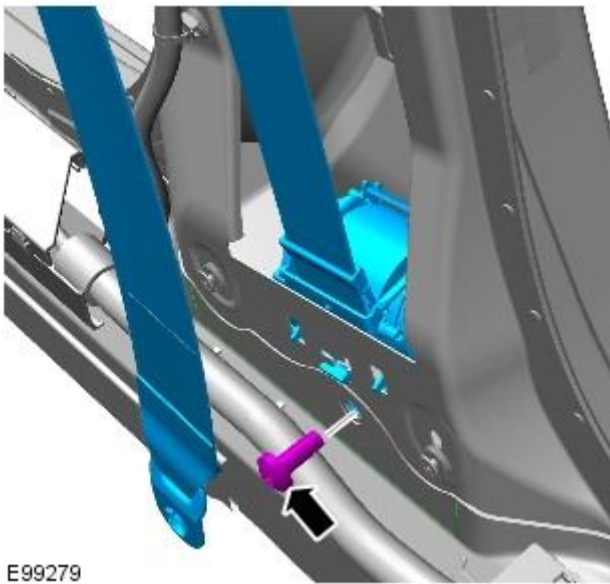


4.


5. Torque: 40 Nm



6. Torque: 40 Nm



## Installation

1.  CAUTION: Fixings must be started by hand to avoid damaging threads.  
To install, reverse the removal procedure.

# Safety Belt System - Rear Center Safety Belt Retractor

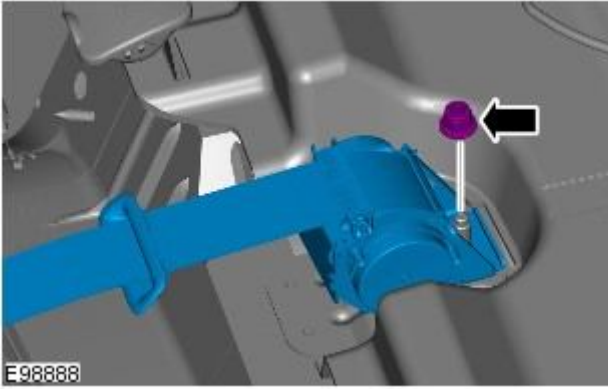
Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Parcel Shelf](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. Torque: 40 Nm



## Installation

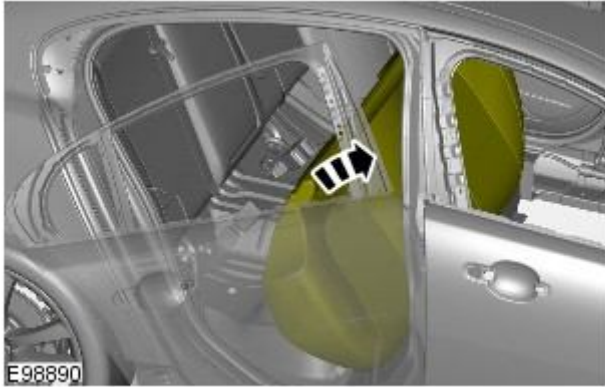
1. To install, reverse the removal procedure.

## Safety Belt System - Rear Safety Belt Buckle

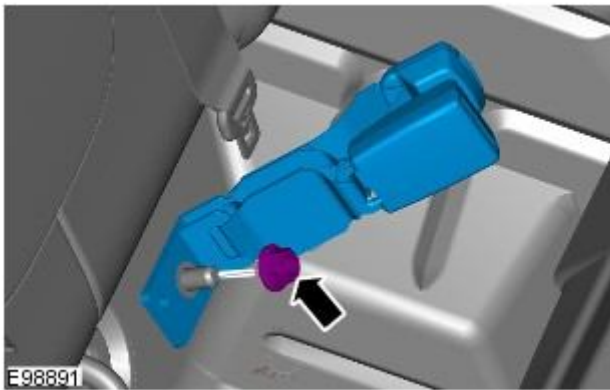
Removal and Installation

### Removal

- NOTE: Removal steps in this procedure may contain installation details.



1.



2. Torque: 40 Nm

### Installation

1. To install, reverse the removal procedure.

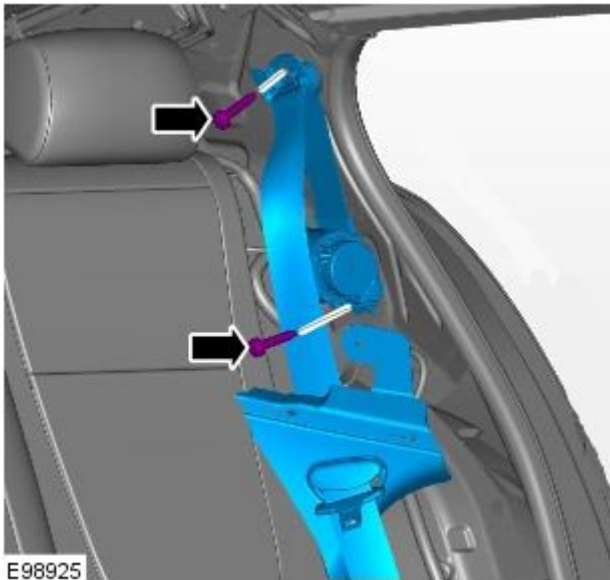
# Safety Belt System - Rear Safety Belt Retractor

Removal and Installation

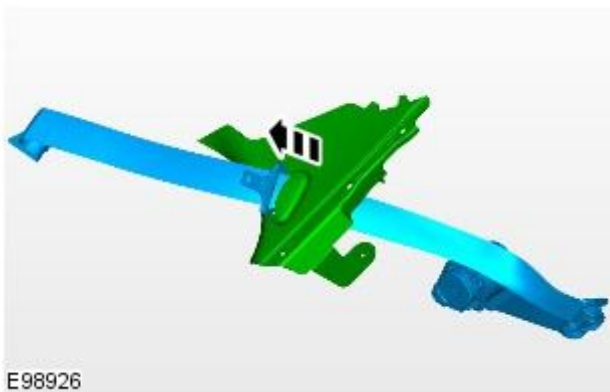
## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [C-Pillar Lower Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).



2. Torque: 40 Nm



- 3.

## Installation

1. To install, reverse the removal procedure.

# Safety Belt System - Safety Belt Shoulder Height Adjuster

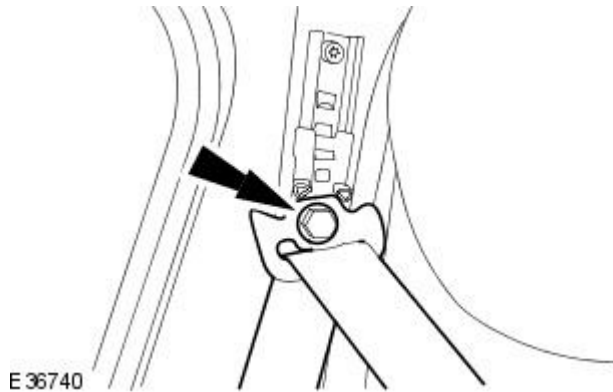
Removal and Installation

## Removal

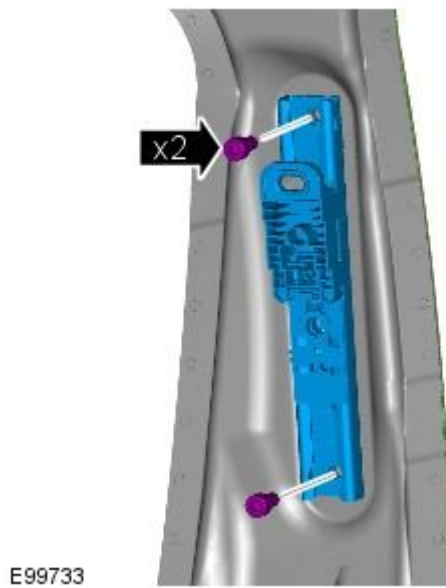
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [B-Pillar Upper Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. Torque: 40 Nm



3. Torque: 25 Nm



## Installation

1. To install, reverse the removal procedure.

## Supplemental Restraint System -

### Torque Specifications

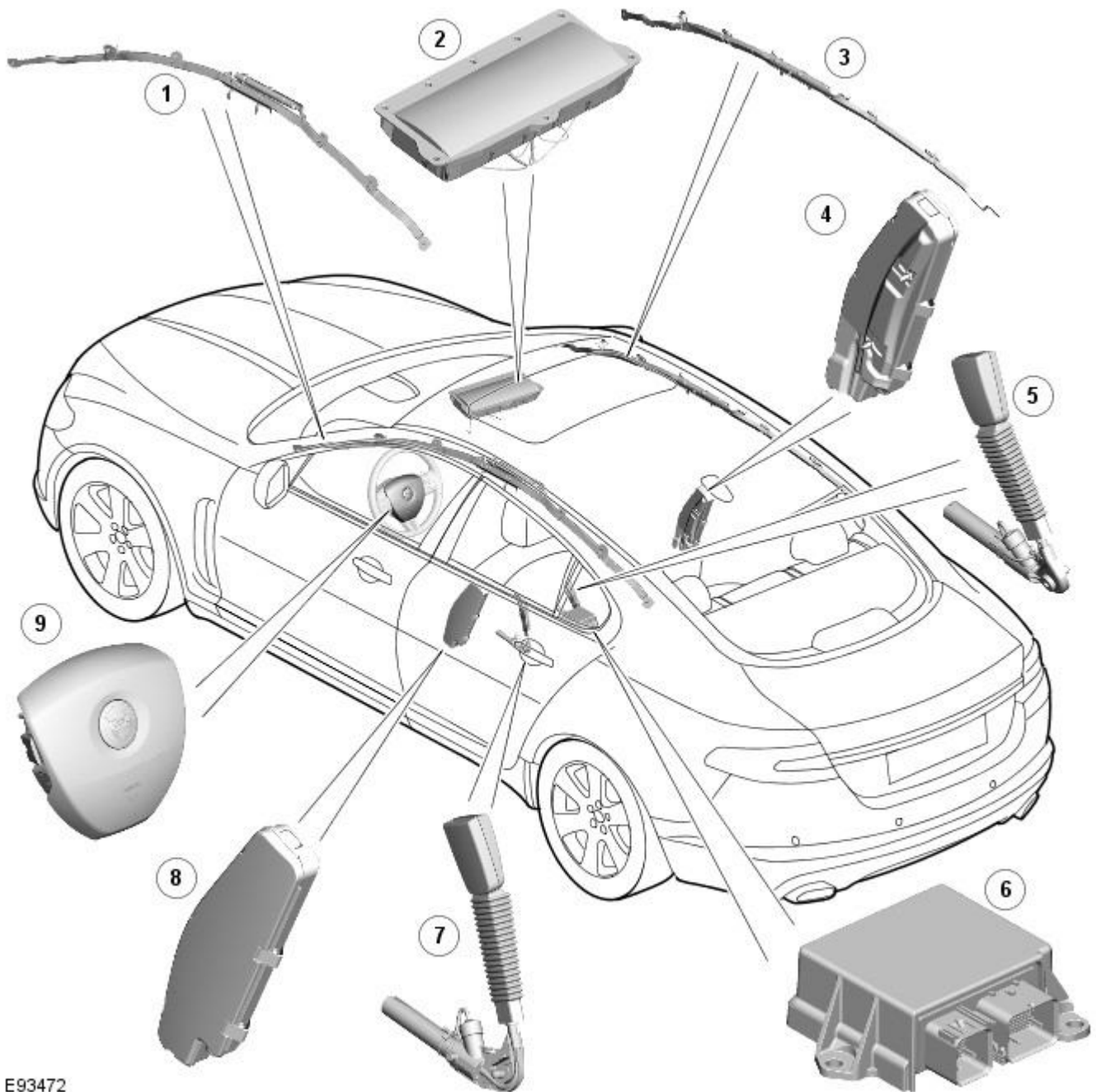
Description	Nm	Lb/Ft	Lb/In
Passenger air bag module retaining nuts	6	-	55
Passenger air bag earth lead retaining bolt	9	-	80
Restraints control module (RCM) retaining nuts	10	-	89
Side air curtain module inflator retaining bolts	9	-	80
Side air curtain module tether straps retaining bolts	9	-	80
Side air bag module retaining nuts	7	-	62
Side impact sensor retaining bolt	10	-	89
Front crash sensor retaining bolt	10	-	89
Clock spring retaining screws	5	-	44



# Supplemental Restraint System - Air Bag and Safety Belt Pretensioner

## Supplemental Restraint System (SRS) - Component Location

Description and Operation



E93472

### ItemDescription

1	LH (left-hand) curtain airbag
2	Front passenger airbag
3	RH (right-hand) curtain airbag
4	Passenger thorax airbag
5	Driver's seat safety belt pretensioner
6	RCM (restraints control module)
7	Front passenger seat safety belt pretensioner
8	Drivers thorax airbag
9	Driver's airbag



E93493

**ItemDescription**

1	Occupant classification system pressure pad
2	Safety belt tension sensor
3	Occupant detection system pad
4	Drivers seat position sensor
5	Occupant classification system control module
6	<a href="#">RH</a> side impact sensor
7	<a href="#">RH</a> rear impact sensor
8	<a href="#">LH</a> rear impact sensor
9	<a href="#">LH</a> side impact sensor
10	Occupant detection system <a href="#">LED (light emitting diode)</a>
11	Instrument cluster
12	<a href="#">LH</a> front impact sensor
13	<a href="#">RH</a> front impact sensor

# Supplemental Restraint System - Air Bag and Safety Belt Pretensioner

## Supplemental Restraint System (SRS) - Overview

Description and Operation

### OVERVIEW



**WARNING:** All pyrotechnic devices are dangerous. Before performing any procedures on any pyrotechnic device, read all information contained within the Standard Workshop Practices section of this manual. Refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).

The [SRS \(supplemental restraint system\)](#) provides additional protection for the vehicle occupants in certain impact conditions. The system is controlled by the [RCM \(restraints control module\)](#), which is mounted beneath the floor console. The system includes twin stage drivers and front passenger airbags.

The [RCM](#) receives inputs from various sensors around the vehicle and determines which, if any, airbags should be deployed.

The [SRS](#) features an occupant detection system. The occupant detection system comprises a mat fitted inside the front passenger seat. By monitoring the condition of the mat, the [RCM](#) can determine if the front passenger seat is occupied. It uses this information to determine which airbags to deploy in the event of an impact. This information is also used to illuminate the safety belt instrument cluster warning lamp if the front passenger seat is occupied and the safety belt is not engaged.

North American Specification (NAS) vehicles also feature an occupant classification system. The occupant classification system comprises a control module, pressure pad and safety belt tension sensor. The system can determine the size and weight of the front seat passenger. This information is transmitted to the [RCM](#) over the high speed [CAN \(controller area network\)](#) bus. The [RCM](#) uses this information to help determine which airbags to deploy in the event of an impact.

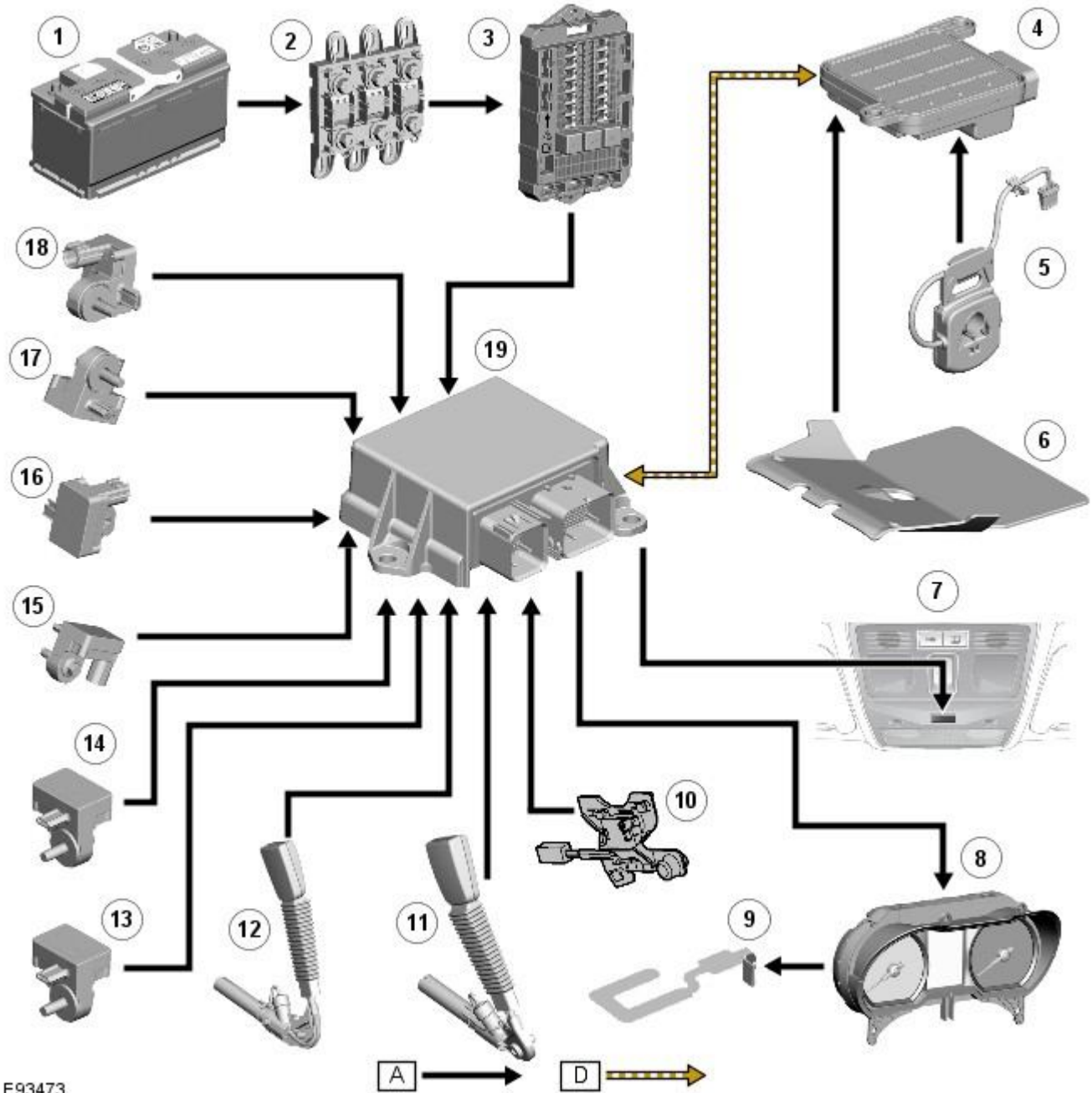
# Supplemental Restraint System - Air Bag and Safety Belt Pretensioner

## Supplemental Restraint System (SRS) - System Operation and Component Description

Description and Operation

### Control Diagram

• NOTE: **A** = Hardwired; **D** = High speed CAN (controller area network) bus

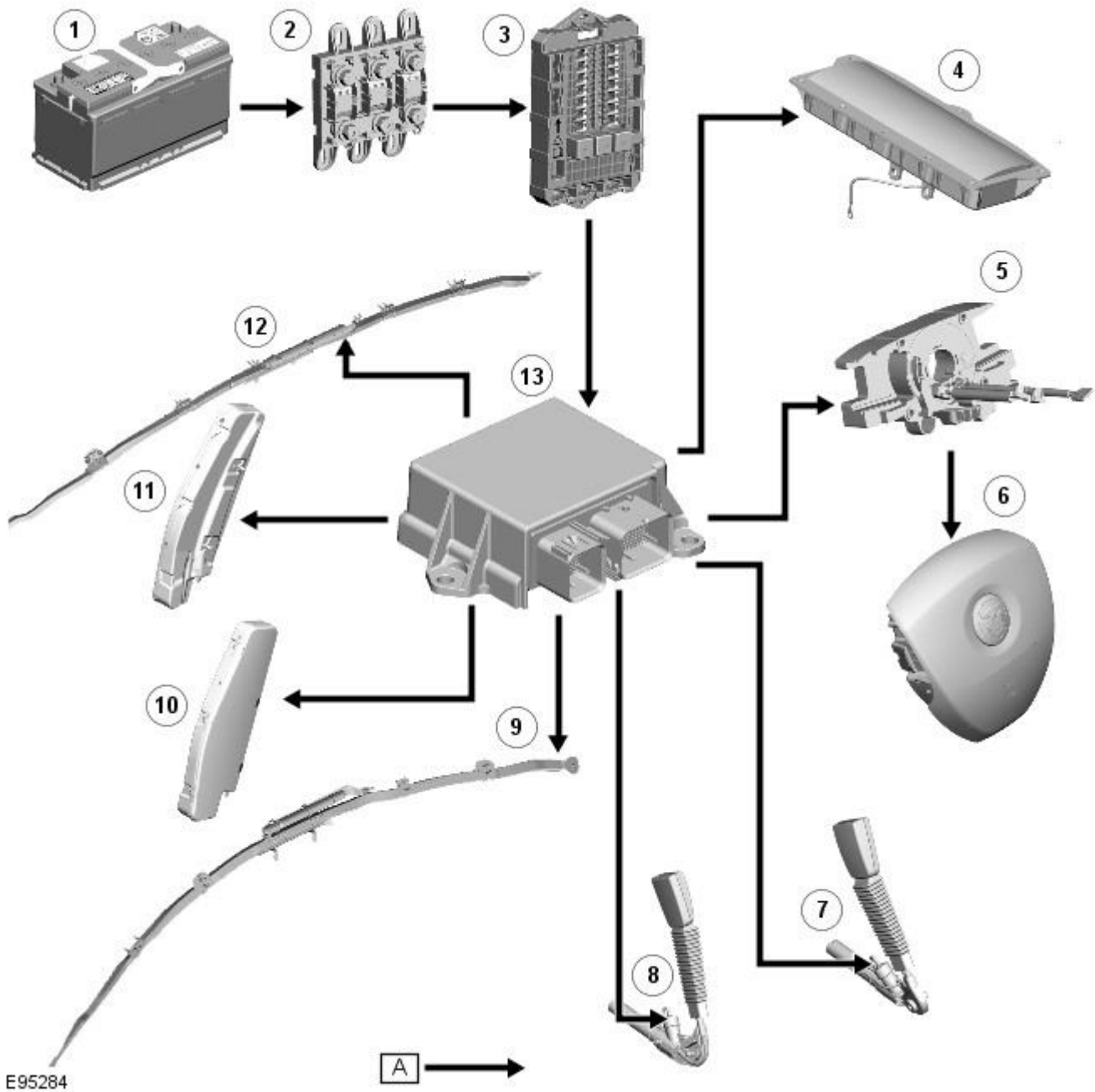


E93473

#### ItemDescription

1	descriptionBJB (battery junction box)
2	<a href="#">BJB</a>
3	<a href="#">RJB (rear junction box)</a>
4	Occupant classification system control module
5	Safety belt tension sensor
6	Occupant classification system pressure pad
7	Occupant detection system <a href="#">LED (light emitting diode)</a>
8	Instrument cluster
9	Occupant detection system pad
10	Driver's seat position sensor

11	Front passenger seat safety belt pretensioner
12	Driver's seat safety belt pretensioner
13	LH (left-hand) front impact sensor
14	RH (right-hand) front impact sensor
15	RH rear impact sensor
16	RH side impact sensor
17	LH rear impact sensor
18	LH side impact sensor
19	RCM (restraints control module)



**ItemDescription**

1	Battery
2	<a href="#">BJB</a>
3	<a href="#">RJB</a>
4	Front passenger airbag
5	Clockspring
6	Driver's airbag
7	Front passenger seat safety belt switch
8	Driver's seat safety belt switch
9	<a href="#">LH</a> curtain airbag



10	Driver's seat thorax airbag
11	Front passenger seat thorax airbag
12	<a href="#">RH</a> curtain airbag
13	<a href="#">RCM</a>

## System Operation

### System Operation

In a collision, the sudden deceleration or acceleration is measured by the impact sensors and the accelerometers in the restraints control module. The restraints control module evaluates the readings to determine the impact point on the vehicle and whether the deceleration/acceleration readings exceed the limits for firing any of the air bags, pretensioners, and battery disconnect unit. During a collision, the restraints control module only fires the air bags and pretensioners if the safing function confirms that the data from the impact sensor(s) indicates an impact limit has been exceeded.

The restraints control module incorporates the following impact thresholds to cater for different accident scenarios:

- Front impact, pretensioners
- Front impact, driver and passenger air bags stage 1, belt unfastened
- Front impact, driver and passenger air bags stage 1, belt fastened
- Front impact, driver and passenger air bags stage 2, belt unfastened
- Front impact, driver and passenger air bags stage 2, belt fastened
- Rear impact
- Driver side impact
- Passenger side impact.

The front impact thresholds increase in severity from pretensioners, through to driver and passenger air bag stage 2, belt fastened.

### Firing Strategies

The safety belt pretensioners are fired when the pretensioner impact limit is exceeded. The [RCM](#) only fires the pretensioners if the related safety belt is fastened.

The driver and passenger air bags are only fired in a frontal impact. If an impact exceeds a stage 1 limit, but is less than the corresponding stage 2 limit, only one inflator in each air bag is fired (stage 2 is still fired for disposal after a delay of 100ms). If an impact exceeds the stage 2 limit, the two inflators in each air bag are fired simultaneously.

The passenger air bag is disabled unless the front passenger seat is occupied by a large person (NAS only), or the passenger air bag deactivation switch is on (all except NAS & AUS).

The stage 2 inflator of the driver air bag is disabled if the driver seat is forward of the switching point of the seat position sensor.

If there is a fault with a safety belt buckle sensor, the [RCM](#) assumes the related safety belt is fastened for the pretensioner firing strategy and unfastened for the driver and passenger air bag firing strategies. If there is a fault with the occupant classification sensor, the [RCM](#) disables the passenger air bag. If there is a fault with the passenger air bag deactivation switch, the [RCM](#) disables the passenger air bag.

If a side impact limit is exceeded, the [RCM](#) fires the side air bag and the side head air bag on that side of the vehicle. If the side impact limit on the front passenger side of the vehicle is exceeded, the [RCM](#) also evaluates the input from the occupant classification sensor, and fires the side air bag only if the front passenger seat is occupied by a large person (NAS only).

If multiple impacts occur during a crash event, after responding to the primary impact the [RCM](#) will output the appropriate fire signals in response to any further impacts if unfired units are available.

#### Front and Rear Impact Firing Strategy (All Except NAS)

Safety Belt Status		Strategy		
Driver	Passenger	Applicable Pretensioner	Driver Air Bag	Passenger Air Bag
Fastened	-	Fired at pretensioner threshold	Fired at belt fastened threshold	-
Unfastened	-	Not fired	Fired at belt unfastened threshold	-
-	Fastened	Fired at pretensioner threshold	-	Fired at belt fastened threshold
-	Unfastened	Not fired	-	Fired at belt unfastened threshold

#### Front and Rear Impact Firing Strategy (NAS Only)

Safety Belt Status		Passenger Seat Status	Strategy		
Driver	Passenger		Applicable Pretensioner	Driver Air Bag	Passenger Air Bag
Fastened	-	-	Fired at pretensioner threshold	Fired at belt fastened threshold	-
Unfastened	-	-	Not fired	Fired at belt unfastened threshold	-
-	Fastened	Occupied allow	Fired at pretensioner threshold	-	Fired at belt fastened threshold
-	Fastened	Unoccupied inhibit/empty	Fired at pretensioner threshold	-	Not fired
-	Unfastened	Occupied allow	Not fired	-	Fired at belt unfastened threshold
-	Unfastened	Unoccupied inhibit/empty	Not fired	-	Not fired

The battery disconnect unit is fired:



- At driver and passenger air bag belt fastened threshold in a frontal impact
- At the driver and passenger side impact threshold in a side impact
- At the rear impact threshold in a rear impact.

## Crash Signal

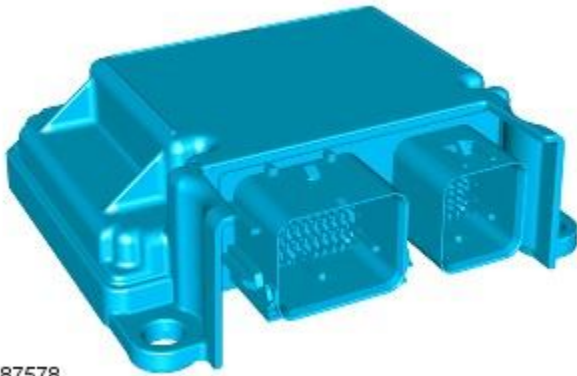
When the [RCM](#) outputs any of the fire signals it also outputs a crash signal to the [RJB](#) and the [ECM \(engine control module\)](#) on the High speed [CAN](#). The crash signal is also hardwired to the [ECM](#) and the [RJB](#). The instrument cluster picks up the crash signal from the High speed [CAN](#) and gateways it to the [LCM \(lighting control module\)](#). On receipt of the crash signal, the [RJB](#) goes into a crash mode and the [ECM](#) cuts the power supply to the fuel pump relay. In the crash mode, the [RJB](#):

- Activates all of the unlock signals of the vehicle locking system, even if the vehicle is already unlocked.
- Ignores all locking/superlocking inputs until it receives an unlock input, when it returns the locking system to normal operation.
- Activates the interior lamps. The interior lamps remain on permanently until they are manually switched off at the lamp unit, or the [RJB](#) crash mode is switched off and they return to normal operation.
- Disables the rear window child lock input until the crash mode is switched off.
- Sends a crash message to the [LCM](#), to activate the hazard flashers. The hazard flashers remain on until cancelled by the hazard warning switch or the crash mode is switched off.

The [RJB](#) crash mode is switched off by a valid locking and unlocking cycle of the locking system.

## Component Description

### Restraints Control Module



E87578

The [RCM](#) is installed on the top of the transmission tunnel, in line with the B pillars, and controls operation of the [SRS \(supplemental restraint system\)](#). The main functions of the [RCM](#) include:

- Crash detection and recording
- Air bag and pre-tensioner firing
- Self test and system monitoring, with status indication via the air bag warning lamp and non volatile storage of fault information.

The [RCM](#) determines which elements of the [SRS](#) are to be deployed by using two internal areas:

- Crash severity evaluation
- Deployment handler.

Crash severity evaluation evaluates crash severity by using data from the [RCM](#) internal accelerometer, the front crash sensor and the safety belt buckle sensor. Based on this data, the [RCM](#) decides which level of air bag module deployment is required and forwards the information to the second area, the deployment handler.

The deployment handler evaluates the status of the seat track position sensor and safety belt buckle sensors before a decision is made about which restraints should finally be deployed.

Data from the side crash sensors is used by the [RCM](#) in conjunction with acceleration data from the [RCM](#) internal accelerometer to make a deployment decision. The [RCM](#) processes the acceleration data and subject to an impact being of high enough severity, decides whether the side air bag module should be deployed.

On board testing of the air bag modules, front safety belt pretensioner firing circuits, warning indicator circuits and module status (the crash and side impact sensors perform basic self-tests) is performed by the [RCM](#) together with the storing of fault codes.

The [RCM](#) drives the [SRS](#) indicator on the instrument pack via a [CAN](#) signal. If the warning lamp fails, a fault code is recorded and a warning tone is sounded in place of the lamp if a further fault occurs. It also provides a temporary back-up power supply to operate the air bag modules in the event that in crash conditions, the battery supply is lost. In the event of a crash, it records certain data which can be accessed via the diagnostic connector.

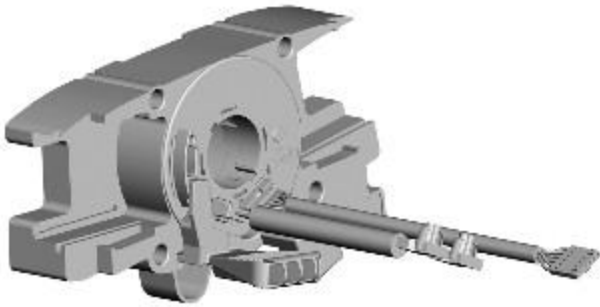
A safing sensor in the [RCM](#) provides confirmation of an impact to verify if air bag and pretensioner activation is necessary. A roll-over sensor monitors the lateral attitude of the vehicle. Various firing strategies are employed by the [RCM](#) to ensure that during an accident only the appropriate air bags and pretensioners are fired. The firing strategy used also depends on the inputs from the safety belt switches and the occupant monitoring system.

An energy reserve in the [RCM](#) ensures there is always a minimum of 150 milliseconds of stored energy available if the power supply from the ignition switch is disrupted during a crash. The stored energy is sufficient to produce firing signals

for the driver air bag, the passenger air bag and the safety belt pretensioners.

When the ignition is switched on the [RCM](#) performs a self test and then performs cyclical monitoring of the system. If a fault is detected the [RCM](#) stores a related fault code and illuminates the air bag warning indicator. The faults can be retrieved by the recommended Jaguar diagnostic tool over the [CAN](#) bus. If a fault that could cause a false fire signal is detected, the [RCM](#) disables the respective firing circuit, and keeps it disabled during a crash event.

## Clock Spring



E98177

The clockspring is installed on the steering column to provide the electrical interface between the fixed wiring harness of the steering column and the components that rotate with the steering wheel, i.e. the driver air bag, the horn and the steering wheel switch packs.

The clockspring consists of a plastic cassette which incorporates an outer cover fixed to the steering column and an inner rotor which turns with the steering wheel. Four securing lugs attach the cover to the multifunction switch on the steering column. The rotor is keyed to the steering wheel by a drive peg. A lug on the underside of the rotor operates the self-cancelling feature of the turn signal indicator switch. A ribbon lead, threaded on rollers in the rotor, links two connectors on the cover to two connectors on the rotor. Link leads for the driver air bag are installed in one of the connectors on the rotor.

To prevent damage to the ribbon lead, both the steering and the clockspring must be centralized when removing and installing the clockspring or the steering wheel. The clockspring is centralized when the drive peg is at six o'clock and 50 - 100% of a yellow wheel is visible in the viewing window.

Replacement clocksprings are fitted with a stopper, which locks the cover to the rotor, in the central position. The stopper must be broken off when the replacement clockspring is installed.

## Drivers Airbag Module



E98175

The driver air bag module is controlled by the [RCM](#) which chooses between single or dual stage deployment, depending on the occupant position and the crash severity. To reduce the risk of an air bag module induced injury to a driver that is positioned close to the steering wheel, the air bag module deploys radially. It has a non-azide propellant that reduces particulates and effluents. It consists of a two stage inflator with separate chambers for the two inflation stages, each being independently activated by the [RCM](#). It has two electrical connectors that are color coded and mechanically keyed to the respective connector on the inflator.

## Passenger Airbag Module



E98176

The passenger airbag module is controlled by the [RCM](#) which chooses between single or dual stage deployment, depending on the occupant status and the crash severity. It consists of a two stage inflator with two air bag electrical connectors to accommodate the two stage inflation.

The heated gas inflator consists of a high-pressure mix of clean air and hydrogen gas, triggered by two separate ignition squibs. It produces a controlled generation of clean gas to rapidly fill the air bag. It is classified as a stored flammable gas (not as an explosive) and as such, has less restrictive storage and transportation requirements. It produces a very clean burn and almost no particulates and is almost free of any toxins, making disposal or recycling much easier.

## Head Airbag



E98180

Side air curtains protect against head injuries in a side impact, while also helping to ensure unrestrained occupants are not ejected through open or broken windows during a rollover event.

A single inflator mounted behind the rear seat unfurls the curtain and fills five separate chambers to provide head protection cushions for occupants in side-impact and roll-over events. Steel ramps guarantee the curtain does not snag on the interior trim as it unfurls, while tethers at the front and rear of the curtain ensure the curtain is held taut.

The side air curtain deflation characteristics are deliberately slow to ensure it remains inflated throughout the duration of a vehicle rollover event.

## Side Airbag Module



E98181

A side air bag is attached to the outside of each front seat backrest frame, under the backrest cover.

The side air bags are handed, and each consist of a molded plastic case which contains the folded air bag and the inflator. A cable connects the igniter of the inflator to a connector in the main seat harness connector block located under the front edge of the seat cushion.

When the air bag deploys it forces the front edge of the molded plastic case apart and splits open the backrest cover.

The side air bags use compressed argon as the inflation medium. The inflated volume of each side air bag is 12 liters (0.42 ft<sup>3</sup>).

## Impact Sensors



E98182

Impact sensors are installed in the front and both sides of the vehicle. The use of multiple impact sensors provides shorter air bag trigger times, through faster detection of lateral and longitudinal acceleration, and improves detection accuracy.

There are two front impact sensors, attached to the headlamp surround panel below the headlamps.

There are four side impact sensors located in the passenger compartment, as follows:

- One attached to the base of each B/C pillar
- One attached to the base of each D pillar.

Each impact sensor incorporates an accelerometer and a microchip powered by a feed from the [RCM](#). The power feed also provides the interface connection through which the side impact sensor communicates with the [RCM](#) using serial data messages. Acceleration is evaluated by the microchip and transmitted to the restraints control module, which then makes the decision on whether or not to activate the air bags and pretensioners.

When the ignition is switched on the [RCM](#) supplies power to the impact sensors, which perform a self test. After

satisfactory self tests the impact sensors continually output 'digital acceleration' messages to the restraints control module. If a fault is detected the relevant impact sensor sends a fault message, instead of the digital acceleration message, to the restraints control module. The [RCM](#) then stores a related fault code and illuminates the air bag warning indicator. Faults can be retrieved by the Jaguar approved diagnostic system from the [RCM](#) via the high speed [CAN](#) bus connection.

## Seat Position Sensor

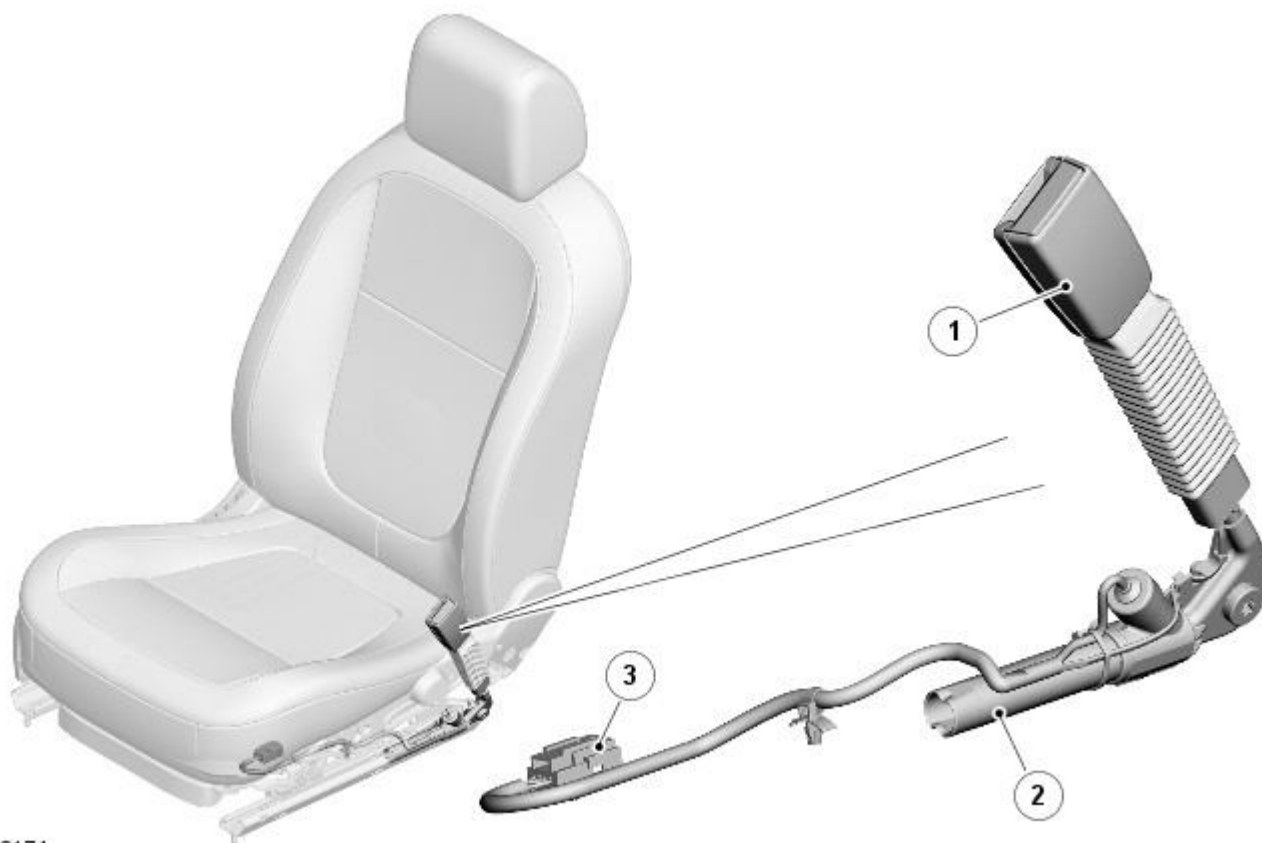
The seat position sensor allows the [RCM](#) to detect when the driver seat is forward of a given point on the seat track. The seat position sensor consists of a Hall effect sensor attached to the driver seat frame. While the ignition is on, the [RCM](#) supplies the sensor with power, and monitors the return current. When the seat frame moves forwards, the sensor moves over the edge of the seat track, which changes the reluctance of the sensor. The change of current is detected by the [RCM](#) and used as a switching point. The switching point is when the center of the sensor is  $3 \pm 4$  mm from the leading edge of the seat track.

When the driver seat is forward of the switching point, the [RCM](#) increases the time delay between firing the two stages of the inflator in the driver air bag. When the driver seat is rearward of the switching point, the [RCM](#) uses the normal time delay between firing the two stages.

## Safety Belt Sensor

A safety belt switch is installed in the buckle of each front safety belt to provide the [RCM](#) with a status signal of the related safety belt(s). When the safety belt is unfastened the switch outputs a low current to the [RCM](#). When the safety belt is fastened the switch outputs a high current to the [RCM](#).

## Pretensioners



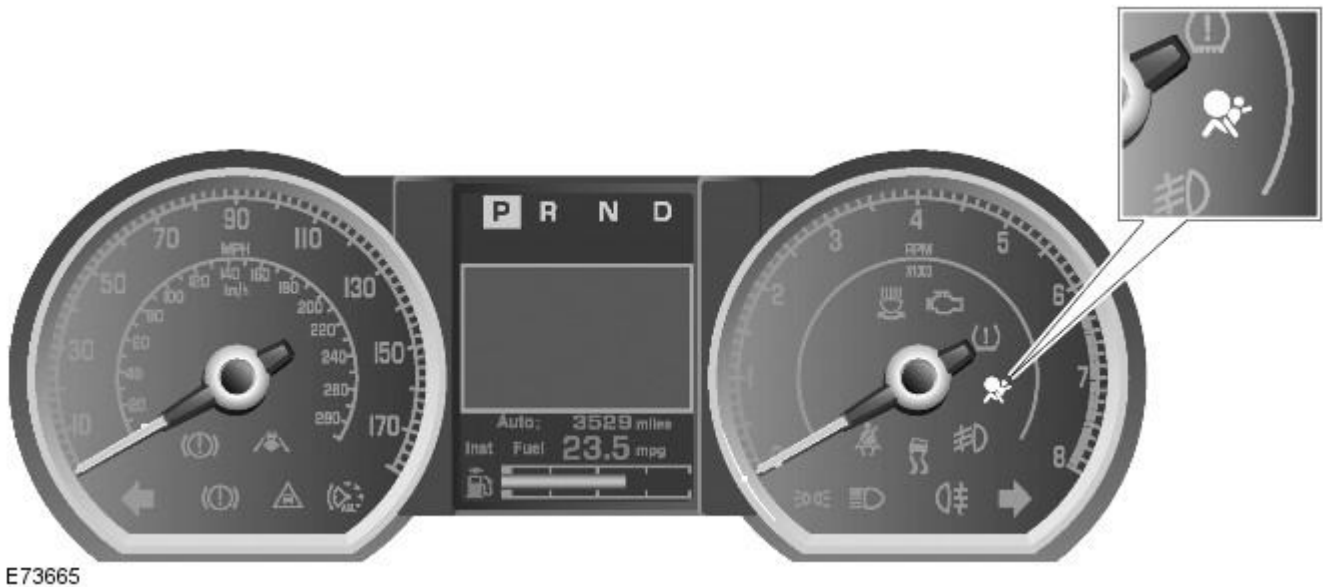
E98174

The pretensioners are used to tighten the front safety belts during a collision to ensure the occupants are securely held in their seats. A pretensioner is integrated into each front safety belt buckle and attached to a bracket on the inboard side of the seat.

Each pretensioner has a tube containing propellant and a piston. The piston is attached to a steel cable, the opposite end of which is attached to the safety belt buckle. A squib in the base of the tube provides an ignition source when triggered by a fire signal from the [RCM](#).

On receipt of a fire signal from the [RCM](#), the squib ignites the propellant. The propellant produces nitrogen gas that rapidly expands to drive the piston along the tube, pulling the cable and drawing the buckle downwards.

## Airbag Warning Indicator



E73665

The air bag warning indicator consists of a red [LED](#) behind a [SRS](#) graphic in the instrument cluster.

Operation of the air bag warning indicator is controlled by a high speed [CAN](#) bus message from the [RCM](#) to the instrument cluster. The [RCM](#) sends the signal to illuminate the air bag warning indicator if a fault is detected, and for approximately 6 seconds during the bulb check at the beginning of each ignition cycle.

## Occupant Monitoring

There are two types of occupant monitoring:

- In all markets except NAS & Australia, vehicles have an occupant detection sensor
- In NAS markets, vehicles have an occupant classification system

For markets which have an occupant detection sensor, this has no interface with the restraints system and only provides the belt reminder function.

For markets that have an occupant classification system, this provides the [RCM](#) with the occupancy status of the front passenger seat. The restraints control module uses this and the seat buckle status in the evaluation of the firing strategy for the passenger front air bag, side air bag, and pretensioner.

## Safety Belt Sensors

The buckle of each front safety belt incorporates a Hall effect sensor that provides a safety belt status signal to the [RCM](#). The [RCM](#) broadcasts the status of the two front safety belts on the high speed [CAN](#) bus for use by the instrument cluster. In the event of a front impact the [RCM](#) will deploy the pretensioners provided the safety belt buckles are fastened. The safety belt buckle pretensioners have a lower deployment threshold than that required by the air bags. Hence it is possible during a minor collision, which exceeds the deployment threshold, that only the safety belt buckle pretensioners will deploy.

## Passenger Airbag Deactivation Indicator

Passenger Airbag Deactivation Warning Lamp





E98223

The passenger air bag deactivation indicator is installed on the center switch pack of the instrument panel. When appropriate, the indicator illuminates to advise front seat occupants that the passenger air bag is disabled. Operation of the indicator is controlled by the RCM (restraints control module) . The [RCM](#) illuminates the indicator when:

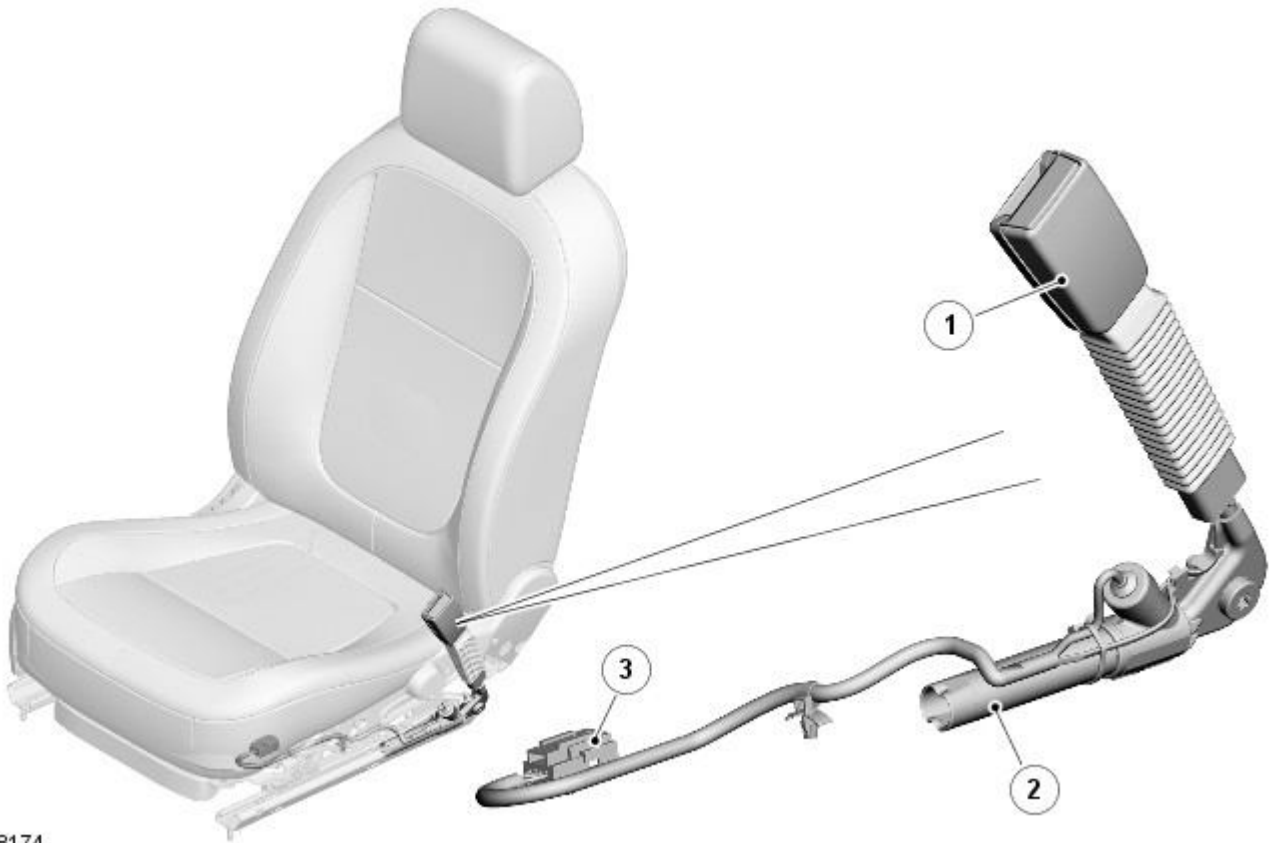
- There is a fault with the passenger air bag firing circuit(s).
- The passenger air bag is deactivated with the passenger air bag deactivation switch (where fitted).
- Required by passenger seat occupant monitoring (see below).

### **Passenger Airbag Deactivation Switch (All Except NAS)**

The passenger air bag deactivation switch provides a method of manually disabling the passenger air bag. The switch is installed in the front passenger end of the instrument panel and operated by the ignition key.

When the passenger air bag deactivation switch is operated, it changes a ground connection between two pins in the connectors of the [RCM](#) . When the passenger air bag deactivation switch is selected to OFF, the [RCM](#) disables the passenger air bag and, if the front passenger seat is occupied, illuminates the passenger air bag deactivation indicator.

### **Occupant Detection System**



E98174

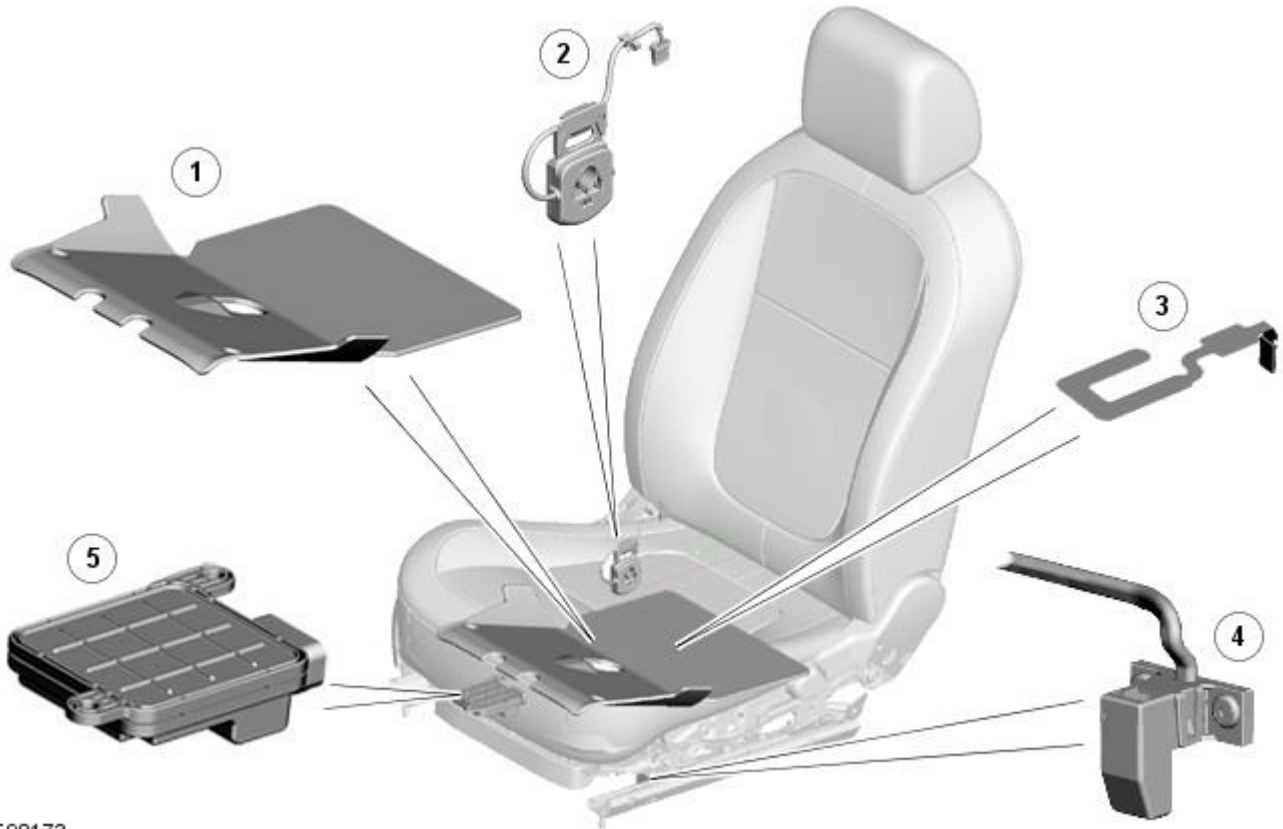
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For markets which have an occupant detection sensor, this has no interface with the restraints system and only provides the belt reminder function.

For markets that have an occupant classification system, this provides the [RCM](#) with the occupancy status of the front passenger seat. The [RCM](#) uses this and the seat buckle status in the evaluation of the firing strategy for the passenger front air bag, side air bag, and pretensioner.

### **Occupant Classification System**



E98173

The occupant classification system can determine if the front passenger seat is unoccupied, occupied by a small person, or occupied by a large person. The occupant classification system consists of:

- A pressure pad, installed under the cushion of the front passenger seat, which is connected to a pressure sensor
- A safety belt tension sensor, integrated into the anchor point of the front passenger safety belt
- An occupant classification module, installed under the front passenger seat.

The pressure pad is a silicone filled bladder. Any load on the pressure pad is detected by the pressure sensor.

The safety belt tension sensor is a strain gauge that measures the load applied by the safety belt anchor to the anchor bolt. The sensor is located in the lower safety belt anchor point.

## SAFETY BELT TENSION SENSOR



E98178

The occupant classification module supplies a reference voltage to the pressure sensor and the safety belt tension sensor and, from the returned signals, measures the loads acting on the pressure pad and the safety belt tension sensor. The load measurement from the safety belt tension sensor is used to produce a correction factor for the load measurement from the pressure pad. The tightness of the safety belt affects the load acting on the pressure pad, so without the correction factor the occupant classification module cannot derive an accurate occupancy status.

The occupant classification module translates the load readings into a seat occupancy status and transmits the result to the [RCM](#), on a dedicated high speed [CAN](#) bus link. The occupant classification module incorporates two load limits for the seat cushion: When the load exceeds the lower limit, but is less than the upper limit, the occupant is classified as small; when the upper limit is exceeded, the occupant is classified as large.

# Supplemental Restraint System - Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

Diagnosis and Testing

## Principle of Operation

For a detailed description of the supplemental restraints system and operation, refer to the relevant Description and Operation section in the workshop manual. REFER to: (501-20B Supplemental Restraint System)

[Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) (Description and Operation),  
[Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) (Description and Operation),  
[Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) (Description and Operation).

## Inspection and Verification



**WARNING:** TO AVOID ACCIDENTAL DEPLOYMENT AND POSSIBLE PERSONAL INJURY, THE BACKUP POWER SUPPLY MUST BE DEPLETED BEFORE REPAIRING OR REPLACING ANY AIR BAG SUPPLEMENTAL RESTRAINT SYSTEM (SRS) COMPONENTS. TO DEplete THE BACKUP POWER SUPPLY ENERGY, DISCONNECT THE BATTERY GROUND CABLE AND WAIT ONE MINUTE. FAILURE TO FOLLOW THIS INSTRUCTION MAY RESULT IN PERSONAL INJURY.



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

• NOTE: Given the legal implications of a restraints system failure, harness repairs to Air Bag module circuits are not acceptable. Where the text refers to "REPAIR the circuit", this will normally mean the replacement of a harness.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Electrical
<ul style="list-style-type: none"> <li>● Battery condition, state of charge</li> <li>● Make sure all electrical connector(s) are engaged correctly on the air bag circuits</li> <li>● Wiring harness</li> <li>● Air bag module(s)</li> <li>● Make sure the restraints control module (RCM) is correctly installed</li> <li>● Fuse(s)</li> <li>● Sensor(s)</li> <li>● Pretensioner(s)</li> <li>● Warning lamp bulb(s)</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index

### Restraints Control Module



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B0001-09	Driver Frontal Stage 1 Deployment Control -	<ul style="list-style-type: none"> <li>● Driver front stage 1 air bag - internal driver failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved

DTC	Description	Possible Cause	Action
	Component Failures		diagnostic system
B0001-11	Driver Frontal Stage 1 Deployment Control - Circuit short to ground	<ul style="list-style-type: none"> <li>● Driver front stage 1 air bag circuit - short to ground</li> </ul>	Refer to electrical circuit diagrams and test driver front stage 1 air bag circuit for short to ground
B0001-12	Driver Frontal Stage 1 Deployment Control - Circuit short to battery	<ul style="list-style-type: none"> <li>● Driver front stage 1 air bag circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and test driver front stage 1 air bag circuit for short to power
B0001-1A	Driver Frontal Stage 1 Deployment Control - Circuit resistance below threshold	<ul style="list-style-type: none"> <li>● Circuit resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0001-1B	Driver Frontal Stage 1 Deployment Control - Circuit resistance above threshold	<ul style="list-style-type: none"> <li>● Circuit resistance above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0001-1C	Driver Frontal Stage 1 Deployment Control - Circuit voltage out of range	<ul style="list-style-type: none"> <li>● Driver front stage 1 air bag circuit - high resistance</li> </ul>	Refer to electrical circuit diagrams and test driver front stage 1 air bag circuit for high resistance
B0001-56	Driver Frontal Stage 1 Deployment Control - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>● Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B0001-95	Driver Frontal Stage 1 Deployment Control - Incorrect assembly	<ul style="list-style-type: none"> <li>● Crosscoupling with other firing loop</li> </ul>	Refer to electrical circuit diagrams and test driver front stage 1 air bag circuit for crosscoupling with other firing loop
B0002-09	Driver Frontal Stage 2 Deployment Control - Component Failures	<ul style="list-style-type: none"> <li>● Driver front stage 2 air bag - internal driver failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0002-11	Driver Frontal Stage 2 Deployment Control - Circuit short to ground	<ul style="list-style-type: none"> <li>● Driver front stage 2 air bag circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test driver front stage 2 air bag circuit for short to ground
B0002-12	Driver Frontal Stage 2 Deployment Control - Circuit short to battery	<ul style="list-style-type: none"> <li>● Driver front stage 2 air bag circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and test driver front stage 2 air bag circuit for short to power
B0002-1A	Driver Frontal Stage 2 Deployment Control - Circuit resistance below threshold	<ul style="list-style-type: none"> <li>● Circuit resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0002-1B	Driver Frontal Stage 2 Deployment Control - Circuit resistance above threshold	<ul style="list-style-type: none"> <li>● Circuit resistance above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0002-1C	Driver Frontal Stage 2 Deployment Control - Circuit voltage out of range	<ul style="list-style-type: none"> <li>● Driver front stage 2 air bag circuit - high resistance</li> </ul>	Refer to electrical circuit diagrams and test driver front stage 2 air bag circuit for high resistance
B0002-56	Driver Frontal Stage 2 Deployment Control - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>● Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B0002-95	Driver Frontal Stage 2 Deployment Control - incorrect assembly	<ul style="list-style-type: none"> <li>● Crosscoupling with other firing loop</li> </ul>	Refer to electrical circuit diagrams and test driver front stage 2 air bag circuit for crosscoupling with other firing loop
B0010-09	Passenger Frontal Stage 1 Deployment Control - Component Failures	<ul style="list-style-type: none"> <li>● Passenger front stage 1 air bag - internal driver failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0010-11	Passenger Frontal Stage 1 Deployment Control - Circuit short to ground	<ul style="list-style-type: none"> <li>● Passenger front stage 1 air bag circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger front stage 1 air bag circuit for short to ground
B0010-12	Passenger Frontal Stage 1 Deployment Control - Circuit short to battery	<ul style="list-style-type: none"> <li>● Passenger front stage 1 air bag circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and test passenger front stage 1 air bag circuit for short to power
B0010-1A	Passenger Frontal Stage 1 Deployment Control - Circuit resistance below threshold	<ul style="list-style-type: none"> <li>● Circuit resistance below threshold</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0010-1B	Passenger Frontal Stage 1 Deployment Control - Circuit resistance above threshold	<ul style="list-style-type: none"> <li>● Circuit resistance above threshold</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0010-1C	Passenger Frontal Stage 1 Deployment Control - Circuit voltage out of range	<ul style="list-style-type: none"> <li>● Passenger front stage 1 air bag circuit - high resistance</li> </ul>	Refer to electrical circuit diagrams and test passenger front stage 1 air bag circuit for high resistance
B0010-56	Passenger Frontal Stage 1 Deployment Control - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>● Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B0010-95	Passenger Frontal Stage 1 Deployment Control - Incorrect assembly	<ul style="list-style-type: none"> <li>● Crosscoupling with other firing loop</li> </ul>	Refer to electrical circuit diagrams and test passenger front stage 1 air bag circuit for crosscoupling with other firing loop

DTC	Description	Possible Cause	Action
B0011-09	Passenger Frontal Stage 2 Deployment Control - Component Failures	<ul style="list-style-type: none"> <li>Passenger front stage 2 air bag - internal driver failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0011-11	Passenger Frontal Stage 2 Deployment Control - Circuit short to ground	<ul style="list-style-type: none"> <li>Passenger front stage 2 air bag circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger front stage 2 air bag circuit for short to ground
B0011-12	Passenger Frontal Stage 2 Deployment Control - Circuit short to battery	<ul style="list-style-type: none"> <li>Passenger front stage 2 air bag circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and test passenger front stage 2 air bag circuit for short to power
B0011-1A	Passenger Frontal Stage 2 Deployment Control - Circuit resistance below threshold	<ul style="list-style-type: none"> <li>Circuit resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0011-1B	Passenger Frontal Stage 2 Deployment Control - Circuit resistance above threshold	<ul style="list-style-type: none"> <li>Circuit resistance above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0011-1C	Passenger Frontal Stage 2 Deployment Control - Circuit voltage out of range	<ul style="list-style-type: none"> <li>Passenger front stage 2 air bag circuit - high resistance</li> </ul>	Refer to electrical circuit diagrams and test passenger front stage 2 air bag circuit for high resistance
B0011-56	Passenger Frontal Stage 2 Deployment Control - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B0011-95	Passenger Frontal Stage 2 Deployment Control - Incorrect assembly	<ul style="list-style-type: none"> <li>Crosscoupling with other firing loop</li> </ul>	Refer to electrical circuit diagrams and test passenger front stage 2 air bag circuit for crosscoupling with other firing loop
B0020-09	Left Side Air Bag Deployment Control - Component Failures	<ul style="list-style-type: none"> <li>Left side air bag circuit - internal driver failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0020-11	Left Side Air Bag Deployment Control - Circuit short to ground	<ul style="list-style-type: none"> <li>Left side air bag circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test left side air bag circuit for short to ground
B0020-12	Left Side Air Bag Deployment Control - Circuit short to battery	<ul style="list-style-type: none"> <li>Left side air bag circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and test left side air bag circuit for short to power
B0020-1A	Left Side Air Bag Deployment Control - Circuit resistance below threshold	<ul style="list-style-type: none"> <li>Circuit resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0020-1B	Left Side Air Bag Deployment Control - Circuit resistance above threshold	<ul style="list-style-type: none"> <li>Circuit resistance above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0020-1C	Left Side Air Bag Deployment Control - Circuit voltage out of range	<ul style="list-style-type: none"> <li>Left side air bag circuit - high resistance</li> </ul>	Refer to electrical circuit diagrams and test left side air bag circuit for high resistance
B0020-56	Left Side Air Bag Deployment Control - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B0020-95	Left Side Air Bag Deployment Control - Incorrect assembly	<ul style="list-style-type: none"> <li>Crosscoupling with other firing loop</li> </ul>	Refer to electrical circuit diagrams and test left side air bag circuit for crosscoupling with other firing loop
B0028-09	Right Side Air Bag Deployment Control - Component Failures	<ul style="list-style-type: none"> <li>Right side air bag circuit - internal driver failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0028-11	Right Side Air Bag Deployment Control - Circuit short to ground	<ul style="list-style-type: none"> <li>Right side air bag circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test right side air bag circuit for short to ground
B0028-12	Right Side Air Bag Deployment Control - Circuit short to battery	<ul style="list-style-type: none"> <li>Right side air bag circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and test right side air bag circuit for short to power
B0028-1A	Right Side Air Bag Deployment Control - Circuit resistance below threshold	<ul style="list-style-type: none"> <li>Circuit resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0028-1B	Right Side Air Bag Deployment Control - Circuit resistance above threshold	<ul style="list-style-type: none"> <li>Circuit resistance above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0028-1C	Right Side Air Bag Deployment Control - Circuit voltage out of range	<ul style="list-style-type: none"> <li>Right side air bag circuit - high resistance</li> </ul>	Refer to electrical circuit diagrams and test right side air bag circuit for high resistance
B0028-56	Right Side Air Bag Deployment Control - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B0028-95	Right Side Air Bag Deployment Control - Incorrect assembly	<ul style="list-style-type: none"> <li>Crosscoupling with other firing loop</li> </ul>	Refer to electrical circuit diagrams and test right side air bag circuit for crosscoupling with other firing loop



DTC	Description	Possible Cause	Action
B0029-09	Right Curtain Deployment Control 1 - Component Failures	<ul style="list-style-type: none"> <li>Right curtain deployment control 1 circuit - internal driver failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0029-11	Right Curtain Deployment Control 1 - Circuit short to ground	<ul style="list-style-type: none"> <li>Right curtain deployment control 1 circuit - short to ground</li> </ul>	Refer to electrical circuit diagrams and check right curtain deployment control 1 circuit for short to ground
B0029-12	Right Curtain Deployment Control 1 - Circuit short to battery	<ul style="list-style-type: none"> <li>Right curtain deployment control 1 circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and check right curtain deployment control 1 circuit for short to power
B0029-1A	Right Curtain Deployment Control 1 - Circuit resistance below threshold	<ul style="list-style-type: none"> <li>Circuit resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0029-1B	Right Curtain Deployment Control 1 - Circuit resistance above threshold	<ul style="list-style-type: none"> <li>Circuit resistance above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0029-1C	Right Curtain Deployment Control 1 - Circuit voltage out of range	<ul style="list-style-type: none"> <li>Right curtain deployment control 1 circuit - high resistance</li> </ul>	Refer to electrical circuit diagrams and test right curtain deployment control 1 circuit for high resistance
B0029-56	Right Curtain Deployment Control 1 - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B0029-95	Right Curtain Deployment Control 1 - Incorrect assembly	<ul style="list-style-type: none"> <li>Crosscoupling with other firing loop</li> </ul>	Refer to electrical circuit diagrams and test right curtain deployment control 1 circuit for crosscoupling with other firing loop
B0050-11	Driver Safety Belt Sensor - Circuit short to ground	<ul style="list-style-type: none"> <li>Driver safety belt sensor circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test driver safety belt sensor circuit for short to ground
B0050-12	Driver Safety Belt Sensor - Circuit short to battery	<ul style="list-style-type: none"> <li>Driver safety belt sensor circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and test driver safety belt sensor circuit for short to power
B0050-13	Driver Safety Belt Sensor - Circuit open	<ul style="list-style-type: none"> <li>Driver safety belt sensor circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and test driver safety belt sensor circuit for open circuit
B0050-1E	Driver Safety Belt Sensor - Circuit resistance out of range	<ul style="list-style-type: none"> <li>Driver safety belt sensor circuit - resistance out of range</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0050-56	Driver Safety Belt Sensor - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B0052-11	Passenger Safety Belt Sensor - Circuit short to ground	<ul style="list-style-type: none"> <li>Passenger safety belt sensor circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger safety belt sensor circuit for short to ground
B0052-12	Passenger Safety Belt Sensor - Circuit short to battery	<ul style="list-style-type: none"> <li>Passenger safety belt sensor circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and test passenger safety belt sensor circuit for short to power
B0052-13	Passenger Safety Belt Sensor - Circuit open	<ul style="list-style-type: none"> <li>Passenger safety belt sensor circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and test passenger safety belt sensor circuit for open circuit
B0052-1E	Passenger Safety Belt Sensor - Circuit resistance out of range	<ul style="list-style-type: none"> <li>Passenger safety belt sensor circuit - resistance out of range</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0052-56	Passenger Safety Belt Sensor - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B0091-08	Left Side Restraints Sensor 1 - Bus Signal / Message Failures	<ul style="list-style-type: none"> <li>(Side Impact LH Side Front Sensor) Left side 'B' pillar impact sensor - Bus Signal/Message Failures</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0091-13	Left Side Restraints Sensor 1 - Circuit open	<ul style="list-style-type: none"> <li>(Side Impact LH Side Front Sensor) Left side 'B' pillar impact sensor circuit - open circuit</li> </ul>	Refer to electrical circuit diagrams and check left side 'B' pillar impact sensor circuit for open circuit
B0091-1C	Left Side Restraints Sensor 1 - Circuit voltage out of range	<ul style="list-style-type: none"> <li>(Side Impact LH Side Front Sensor) Left side 'B' pillar impact sensor circuit - voltage out of range</li> </ul>	Refer to electrical circuit diagrams and check left side 'B' pillar impact sensor circuit for short circuit
B0091-49	Left Side Restraints Sensor 1 - Internal electronic failure	<ul style="list-style-type: none"> <li>(Side Impact LH Side Front Sensor) Left side 'B' pillar impact sensor circuit - Internal electronic failure</li> </ul>	Suspect the Side Impact LH Side Front Sensor, check and install a new Side Impact LH Side Front Sensor as required, refer to the new module/component installation note at the top of the DTC Index

DTC	Description	Possible Cause	Action
B0091-56	Left Side Restraints Sensor 1 - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>(Side Impact LH Side Front Sensor) Left side 'B' pillar impact sensor - Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B0092-08	Left Side Restraints Sensor 2 - Bus Signal / Message Failures	<ul style="list-style-type: none"> <li>(Side Impact LH Side Rear Sensor) Left side 'C' pillar impact sensor - Bus Signal/Message Failures</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0092-13	Left Side Restraints Sensor 2 - Circuit open	<ul style="list-style-type: none"> <li>(Side Impact LH Side Rear Sensor) Left side 'C' pillar impact sensor circuit - open circuit</li> </ul>	Refer to electrical circuit diagrams and check left side 'C' pillar impact sensor circuit for open circuit
B0092-1C	Left Side Restraints Sensor 2 - Circuit voltage out of range	<ul style="list-style-type: none"> <li>(Side Impact LH Side Rear Sensor) Left side 'C' pillar impact sensor circuit - voltage out of range</li> </ul>	Refer to electrical circuit diagrams and check left side 'C' pillar impact sensor circuit for short circuit
B0092-49	Left Side Restraints Sensor 2 - Internal electronic failure	<ul style="list-style-type: none"> <li>(Side Impact LH Side Rear Sensor) Left side 'C' pillar impact sensor circuit - Internal electronic failure</li> </ul>	Suspect the Side Impact LH Side Rear Sensor, check and install a new Side Impact LH Side Rear Sensor as required, refer to the new module/component installation note at the top of the DTC Index
B0092-56	Left Side Restraints Sensor 2 - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>(Side Impact LH Side Rear Sensor) Left side 'C' pillar impact sensor - Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B0096-08	Right Side Restraints Sensor 1 - Bus Signal / Message Failures	<ul style="list-style-type: none"> <li>(Side Impact RH Side Front Sensor) Right side 'B' pillar impact sensor - Bus Signal/Message Failures</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0096-13	Right Side Restraints Sensor 1 - Circuit open	<ul style="list-style-type: none"> <li>(Side Impact RH Side Front Sensor) Right side 'B' pillar impact sensor circuit - open circuit</li> </ul>	Refer to electrical circuit diagrams and check right side 'B' pillar impact sensor circuit for open circuit
B0096-1C	Right Side Restraints Sensor 1 - Circuit voltage out of range	<ul style="list-style-type: none"> <li>(Side Impact RH Side Front Sensor) Right side 'B' pillar impact sensor circuit - voltage out of range</li> </ul>	Refer to electrical circuit diagrams and check right side 'B' pillar impact sensor circuit for short circuit
B0096-49	Right Side Restraints Sensor 1 - Internal electronic failure	<ul style="list-style-type: none"> <li>(Side Impact RH Side Front Sensor) Right side 'B' pillar impact sensor circuit - Internal electronic failure</li> </ul>	Suspect the Side Impact RH Side Front Sensor, check and install a new Side Impact RH Side Front Sensor as required, refer to the new module/component installation note at the top of the DTC Index
B0096-56	Right Side Restraints Sensor 1 - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>(Side Impact RH Side Front Sensor) Right side 'B' pillar impact sensor - Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B0097-08	Right Side Restraints Sensor 2 - Bus Signal / Message Failures	<ul style="list-style-type: none"> <li>(Side Impact RH Side Rear Sensor) Right side 'C' pillar impact sensor - Bus Signal/Message Failures</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B0097-13	Right Side Restraints Sensor 2 - Circuit open	<ul style="list-style-type: none"> <li>(Side Impact RH Side Rear Sensor) Right side 'C' pillar impact sensor circuit - open circuit</li> </ul>	Refer to electrical circuit diagrams and check right side 'C' pillar impact sensor circuit for open circuit
B0097-1C	Right Side Restraints Sensor 2 - Circuit voltage out of range	<ul style="list-style-type: none"> <li>(Side Impact RH Side Rear Sensor) Right side 'C' pillar impact sensor circuit - voltage out of range</li> </ul>	Refer to electrical circuit diagrams and check right side 'C' pillar impact sensor circuit for short circuit
B0097-49	Right Side Restraints Sensor 2 - Internal electronic failure	<ul style="list-style-type: none"> <li>(Side Impact RH Side Rear Sensor) Right side 'C' pillar impact sensor circuit - Internal electronic failure</li> </ul>	Suspect the Side Impact RH Side Rear Sensor, check and install a new Side Impact RH Side Rear Sensor as required, refer to the new module/component installation note at the top of the DTC Index
B0097-56	Right Side Restraints Sensor 2 - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>(Side Impact RH Side Rear Sensor) Right side 'C' pillar impact sensor - Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B00A0-04	Occupant Classification System - System Internal Failures	<ul style="list-style-type: none"> <li>Internal module failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
B00A0-08	Occupant Classification System - System Internal Failures	<ul style="list-style-type: none"> <li>● CAN message failure from OCS</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B00A0-56	Occupant Classification System - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>● Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B00B5-11	Driver Seat Track Position Restraints Sensor - Circuit short to ground	<ul style="list-style-type: none"> <li>● Driver seat position sensor circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test driver seat position sensor circuit for short to ground
B00B5-12	Driver Seat Track Position Restraints Sensor - Circuit short to battery	<ul style="list-style-type: none"> <li>● Driver seat position sensor circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and test driver seat position sensor circuit for short to power
B00B5-13	Driver Seat Track Position Restraints Sensor - Circuit open	<ul style="list-style-type: none"> <li>● Driver seat position sensor circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and test driver seat position sensor circuit for open circuit
B00B5-1E	Driver Seat Track Position Restraints Sensor - Circuit resistance out of range	<ul style="list-style-type: none"> <li>● Driver seat position sensor circuit - resistance out of range</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B00B5-56	Driver Seat Track Position Restraints Sensor - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>● Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B00C5-11	Passenger Seat Track Position Restraints Sensor - Circuit short to ground	<ul style="list-style-type: none"> <li>● Passenger seat position sensor circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test passenger seat position sensor circuit for short to ground
B00C5-12	Passenger Seat Track Position Restraints Sensor - Circuit short to battery	<ul style="list-style-type: none"> <li>● Passenger seat position sensor circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and test passenger seat position sensor circuit for short to power
B00C5-13	Passenger Seat Track Position Restraints Sensor - Circuit open	<ul style="list-style-type: none"> <li>● Passenger seat position sensor circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and test passenger seat position sensor circuit for open circuit
B00C5-1E	Passenger Seat Track Position Restraints Sensor - Circuit resistance out of range	<ul style="list-style-type: none"> <li>● Passenger seat position sensor circuit - resistance out of range</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B00C5-56	Passenger Seat Track Position Restraints Sensor - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>● Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B00D2-01	Restraint System Malfunction Indicator 1 - General Electrical Failure	<ul style="list-style-type: none"> <li>● Warning lamp fault was transmitted through CAN from instrument cluster</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B00D5-11	Restraint System Passenger Disable Indicator - Circuit short to ground	<ul style="list-style-type: none"> <li>● Passenger Air bag De-activation (PAD) lamp circuit - short to ground</li> </ul>	Refer to electrical circuit diagrams and test Passenger Air bag De-activation (PAD) lamp circuit for short to ground
B00D5-12	Restraint System Passenger Disable Indicator - Circuit short to battery	<ul style="list-style-type: none"> <li>● Passenger Air bag De-activation (PAD) lamp circuit - short to power</li> </ul>	Refer to electrical circuit diagrams and test Passenger Air bag De-activation (PAD) lamp circuit for short to power
B00D5-13	Restraint System Passenger Disable Indicator - Circuit open	<ul style="list-style-type: none"> <li>● Passenger Air bag De-activation (PAD) lamp circuit - open circuit</li> </ul>	Refer to electrical circuit diagrams and test Passenger Air bag De-activation (PAD) lamp circuit for open circuit
B00D5-56	Restraint System Passenger Disable Indicator - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>● Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B1193-00	Crash Event Storage Full and Locked - No sub type information	<ul style="list-style-type: none"> <li>● Crash data memory full</li> </ul>	Suspect the RCM, check and install a new RCM as required, refer to the new module/component installation note at the top of the DTC Index
B1194-08	Driver Side Frontal Acceleration Sensor - Bus Signal / Message Failures	<ul style="list-style-type: none"> <li>● Bus Signal/Message Failures</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1194-13	Driver Side Frontal Acceleration Sensor - Circuit open	<ul style="list-style-type: none"> <li>● Driver front impact sensor circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check driver front impact sensor circuit for open circuit
B1194-1C	Driver Side Frontal Acceleration Sensor - Circuit voltage out of range	<ul style="list-style-type: none"> <li>● Driver front impact sensor circuit - circuit voltage out of range</li> </ul>	Refer to the electrical circuit diagrams and check driver front impact sensor circuit for short circuit
B1194-49	Driver Side Frontal Acceleration Sensor - Internal electronic failure	<ul style="list-style-type: none"> <li>● Driver front impact sensor circuit - Internal electronic failure</li> </ul>	Suspect the Driver front impact sensor, check and install a new Driver front impact sensor as required, refer to the new module/component installation note at the top of the DTC Index
B1194-56	Driver Side Frontal Acceleration Sensor - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>● Driver front impact sensor circuit - Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
B1195-08	Passenger Side Frontal Acceleration Sensor - Bus Signal / Message Failures	<ul style="list-style-type: none"> <li>Passenger front impact sensor circuit - Bus Signal/Message Failures</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1195-13	Passenger Side Frontal Acceleration Sensor - Circuit open	<ul style="list-style-type: none"> <li>Passenger front impact sensor circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check passenger front impact sensor circuit for open circuit
B11951-C	Passenger Side Frontal Acceleration Sensor - Circuit voltage out of range	<ul style="list-style-type: none"> <li>Passenger front impact sensor circuit - circuit voltage out of range</li> </ul>	Refer to the electrical circuit diagrams and check passenger front impact sensor circuit for short circuit
B1195-49	Passenger Side Frontal Acceleration Sensor - Internal electronic failure	<ul style="list-style-type: none"> <li>Passenger front impact sensor circuit - Internal electronic failure</li> </ul>	Suspect the Passenger front impact sensor, check and install a new Passenger front impact sensor, as required, refer to the new module/component installation note at the top of the DTC Index
B1195-56	Passenger Side Frontal Acceleration Sensor - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>Passenger front impact sensor circuit - Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B1212-09	Driver Safetybelt Buckle Pretensioner Deployment Control - Component Failures	<ul style="list-style-type: none"> <li>Driver safetybelt buckle pretensioner deployment control - internal driver failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1212-11	Driver Safetybelt Buckle Pretensioner Deployment Control - Circuit short to ground	<ul style="list-style-type: none"> <li>Driver safetybelt buckle pretensioner deployment control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check driver safetybelt buckle pretensioner deployment control circuit for short to ground
B1212-12	Driver Safetybelt Buckle Pretensioner Deployment Control - Circuit short to battery	<ul style="list-style-type: none"> <li>Driver safetybelt buckle pretensioner deployment control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check driver safetybelt buckle pretensioner deployment control circuit for short to power
B1212-1A	Driver Safetybelt Buckle Pretensioner Deployment Control - Circuit resistance below threshold	<ul style="list-style-type: none"> <li>Driver safetybelt buckle pretensioner deployment control circuit - circuit resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1212-1B	Driver Safetybelt Buckle Pretensioner Deployment Control - Circuit resistance above threshold	<ul style="list-style-type: none"> <li>Driver safetybelt buckle pretensioner deployment control circuit - circuit resistance above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1212-1C	Driver Safetybelt Buckle Pretensioner Deployment Control - Circuit voltage out of range	<ul style="list-style-type: none"> <li>Driver safetybelt buckle pretensioner deployment control circuit - circuit voltage out of range</li> </ul>	Refer to the electrical circuit diagrams and check driver safetybelt buckle pretensioner deployment control circuit for short circuit
B1212-56	Driver Safetybelt Buckle Pretensioner Deployment Control - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B1212-95	Driver Safetybelt Buckle Pretensioner Deployment Control - Incorrect assembly	<ul style="list-style-type: none"> <li>Driver safetybelt buckle pretensioner deployment control circuit - crosscoupling with other firing loop</li> </ul>	Refer to the electrical circuit diagrams and check driver safetybelt buckle pretensioner deployment control circuit for crosscoupling with other firing loop
B1213-09	Passenger Safetybelt Buckle Pretensioner Deployment Control - Component Failures	<ul style="list-style-type: none"> <li>Passenger safetybelt buckle pretensioner deployment control - internal driver failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1213-11	Passenger Safetybelt Buckle Pretensioner Deployment Control - Circuit short to ground	<ul style="list-style-type: none"> <li>Passenger safetybelt buckle pretensioner deployment control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check passenger safetybelt buckle pretensioner deployment control circuit for short to ground
B1213-12	Passenger Safetybelt Buckle Pretensioner Deployment Control - Circuit short to battery	<ul style="list-style-type: none"> <li>Passenger safetybelt buckle pretensioner deployment control circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check passenger safetybelt buckle pretensioner deployment control circuit for short to power
B1213-1A	Passenger Safetybelt Buckle Pretensioner Deployment Control - Circuit resistance below threshold	<ul style="list-style-type: none"> <li>Passenger safetybelt buckle pretensioner deployment control circuit - circuit resistance below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1213-1B	Passenger Safetybelt Buckle Pretensioner Deployment Control - circuit resistance above threshold	<ul style="list-style-type: none"> <li>Passenger safetybelt buckle pretensioner deployment control circuit - circuit resistance above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1213-1C	Passenger Safetybelt Buckle Pretensioner Deployment Control - Circuit voltage out of range	<ul style="list-style-type: none"> <li>Passenger safetybelt buckle pretensioner deployment control circuit - circuit voltage out of range</li> </ul>	Refer to the electrical circuit diagrams and check passenger safetybelt buckle pretensioner deployment control circuit for short circuit

DTC	Description	Possible Cause	Action
B1213-56	Passenger Safetybelt Buckle Pretensioner Deployment Control - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
B1213-95	Passenger Safetybelt Buckle Pretensioner Deployment Control - Incorrect assembly	<ul style="list-style-type: none"> <li>Passenger safetybelt buckle pretensioner deployment control circuit - crosscoupling with other firing loop</li> </ul>	Refer to the electrical circuit diagrams and check passenger safetybelt buckle pretensioner deployment control circuit for crosscoupling with other firing loop
B1A55-12	Crash Record Output - Circuit short to battery	<ul style="list-style-type: none"> <li>Air bag deployed signal circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check air bag deployed signal circuit for short to power
B1A55-14	Crash Record Output - Circuit short to ground or open	<ul style="list-style-type: none"> <li>Air bag deployed signal circuit - short to ground, open circuit</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A55-49	Crash Record Output - Internal electronic failure	<ul style="list-style-type: none"> <li>Internal electronic failure</li> </ul>	Suspect the RCM, check and install a new RCM as required, refer to the new module/component installation note at the top of the DTC Index
B1D75-11	Passenger Air bag Cutoff Disable Switch - Circuit short to ground	<ul style="list-style-type: none"> <li>Passenger air bag cut-off switch circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and check passenger air bag cut-off switch circuit for short to ground
B1D75-12	Passenger Air bag Cutoff Disable Switch - Circuit short to battery	<ul style="list-style-type: none"> <li>Passenger air bag cut-off switch circuit - short to power</li> </ul>	Refer to the electrical circuit diagrams and check passenger air bag cut-off switch circuit for short to power
B1D75-13	Passenger Air bag Cutoff Disable Switch - Circuit open	<ul style="list-style-type: none"> <li>Passenger air bag cut-off switch circuit - open circuit</li> </ul>	Refer to the electrical circuit diagrams and check passenger air bag cut-off switch circuit for open circuit
B1D75-1E	Passenger Air bag Cutoff Disable Switch - Circuit resistance out of range	<ul style="list-style-type: none"> <li>Passenger air bag cut-off switch circuit - circuit resistance out of range</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1D75-56	Passenger Air bag Cutoff Disable Switch - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>Incompatible configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
U0100-00	Lost Communication With ECM - No sub type information	<ul style="list-style-type: none"> <li>Missing message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0121-00	Lost Communication With Anti-Lock Brake System (ABS) Control Module - No sub type information	<ul style="list-style-type: none"> <li>Missing CAN message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0154-00	Lost Communication With Restraints Occupant Classification System Module - No sub type information	<ul style="list-style-type: none"> <li>Missing CAN message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0155-00	Lost Communication With Instrument Panel Cluster (IPC) Control Module - No sub type information	<ul style="list-style-type: none"> <li>Missing CAN message</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> <li>Mis-match between vehicle and RCM software levels</li> </ul>	Re-configure the RCM with the latest level software using the manufacturer approved diagnostic system
U201A-46	Control Module Main Calibration Data - Calibration / parameter memory failure	<ul style="list-style-type: none"> <li>Calibration parameter failure</li> </ul>	Re-configure the RCM with the latest level software using the manufacturer approved diagnostic system
U2100-00	Initial Configuration Not Complete - No sub type information	<ul style="list-style-type: none"> <li>New module configuration application not carried out after installing new module</li> </ul>	Carry out new module configuration application using the manufacturer approved diagnostic system
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> <li>Incorrect OCS installed</li> </ul>	Check and install correct OCS as required, refer to the new module/component installation note at the top of the DTC Index
U3000-04	Control Module - System Internal Failures	<ul style="list-style-type: none"> <li>System internal failures</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U3000-09	Control Module - Component Failures	<ul style="list-style-type: none"> <li>Component failures</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U3000-42	Control Module - General memory failure	<ul style="list-style-type: none"> <li>general memory failure</li> </ul>	Suspect RCM, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U3000-47	Control Module - Watchdog / safety MicroController failure	<ul style="list-style-type: none"> <li>watchdog / safety MicroController failure</li> </ul>	Suspect RCM, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U3000-55	Control Module - Not configured	<ul style="list-style-type: none"> <li>Invalid data received from instrument cluster</li> </ul>	Check and up-date RCM software to latest level. Check instrument cluster for related DTCs and refer to the relevant DTC Index

DTC	Description	Possible Cause	Action
U3000-56	Control Module - Invalid / incomplete configuration	<ul style="list-style-type: none"> <li>Invalid/incomplete configuration</li> </ul>	Re-configure the RCM using the manufacturer approved diagnostic system
U3003-16	Battery Voltage - Circuit voltage below threshold	<ul style="list-style-type: none"> <li>Circuit voltage below threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U3003-17	Battery Voltage - Circuit voltage above threshold	<ul style="list-style-type: none"> <li>Circuit voltage above threshold</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U3003-62	Battery Voltage - Signal compare failure	<ul style="list-style-type: none"> <li>Mis-match in battery voltage, of 2 volts or more, between RCM and RJB</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

### Occupant Classification System (OCS)



**CAUTION:** When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B119353	Crash Event Storage Full and Locked	<ul style="list-style-type: none"> <li>Crash event occurred</li> </ul>	Clear DTC and re-test
B1A5401	Occupant Belt Tension Sensor	<ul style="list-style-type: none"> <li>General electrical failure</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B1A5402	Occupant Belt Tension Sensor	<ul style="list-style-type: none"> <li>General signal failure</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check OCS tension and pressure sensor circuits for short to each other
B1A5411	Occupant Belt Tension Sensor	<ul style="list-style-type: none"> <li>OCS tension sensor voltage reference or signal circuit - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check OCS tension sensor voltage reference and signal circuits for short to ground
B1A5412	Occupant Belt Tension Sensor	<ul style="list-style-type: none"> <li>OCS tension sensor voltage reference or signal circuit - short to power</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check OCS tension sensor voltage reference and signal circuits for short to power
B1A5413	Occupant Belt Tension Sensor	<ul style="list-style-type: none"> <li>OCS tension sensor voltage reference or signal circuit - open circuit</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check OCS tension sensor voltage reference and signal circuits for open circuit
B1A6202	Pressure Sensor	<ul style="list-style-type: none"> <li>General signal failure</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check OCS tension and pressure sensor circuits for short to each other
B1A6211	Pressure Sensor	<ul style="list-style-type: none"> <li>OCS pressure sensor voltage reference or signal circuits - short to ground</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check OCS pressure sensor voltage reference and signal circuits for short to ground
B1A6212	Pressure Sensor	<ul style="list-style-type: none"> <li>OCS pressure sensor voltage reference, ground or signal circuits - short to power</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check OCS pressure sensor voltage reference, ground and signal circuits for short to power
B1A627A	Pressure Sensor	<ul style="list-style-type: none"> <li>Fluid leak or seal failure - pressure sensor internal failure</li> </ul>	Install a new OCS module as required, refer to the new module/component installation note at the top of the DTC Index




<b>DTC</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Action</b>
B1A627B	Pressure Sensor	<ul style="list-style-type: none"> <li>● Low fluid level - bladder damaged</li> </ul>	Install a new bladder, refer to the new module/component installation note at the top of the DTC Index
U000100	High Speed CAN Communication Bus	<ul style="list-style-type: none"> <li>● Bus OFF</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CAN network for short, open circuit. Carry out the CAN network integrity test using the manufacturer approved diagnostic system
U015100	Lost Communication With Restraints Control Module	<ul style="list-style-type: none"> <li>● No sub type information</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check power and ground supplies to RCM. Carry out CAN network integrity test using the manufacturer approved diagnostic system
U030000	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>● Master car configuration file ID does not correspond</li> </ul>	Check correct OCS module is installed for vehicle specification. Check RJB for related DTCs and refer to relevant DTC Index
U300004	Control Module	<ul style="list-style-type: none"> <li>● OCS module internal electronic failure</li> </ul>	Suspect the OCS module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300051	Control Module	<ul style="list-style-type: none"> <li>● ECU has not been programmed with a valid application</li> </ul>	Suspect the OCS module, check and install a new module as required, refer to the new module/component installation note at the top of the DTC Index
U300054	Control Module	<ul style="list-style-type: none"> <li>● This DTC is set if a 'Calibrate OCS Empty Seat Offset' routine is requested and fails due to one of the pre-conditions to execute the routine</li> </ul>	Check the following criteria have all been achieved: Ignition status set to RUN/START. Verify seat is always empty after power-up before re-zero is requested. The OCS has gone through the seat assembly plant calibration. No collision event received from the RCM during the current ignition cycle. No faults present in the current ignition cycle. The trigger message for calibrate empty seat offset has been received from the diagnostic tool. OCS has enough time to begin classification. Temperature is between 6C (42F) and 36C (97F)
U300316	Battery Voltage	<ul style="list-style-type: none"> <li>● Circuit voltage below threshold</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Check battery is in fully charged and serviceable condition. Check integrity of charging system
U300317	Battery Voltage	<ul style="list-style-type: none"> <li>● Circuit voltage above threshold</li> </ul>	Carry out any pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Check battery is in fully charged and serviceable condition. Check integrity of charging system

# Supplemental Restraint System - Air Bag Disposal

General Procedures

## Deployed Air Bag


-  **WARNING:** Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

Deployed air bag modules are to be disposed of as special waste and must comply with local environmental requirements, if in doubt, contact Authority for disposal requirements.

- NOTE:** The storage, transportation, disposal, and/or recycling of air bag module components must be carried out in accordance with all applicable federal, state and local regulations including, but not limited to, those governing building and fire codes, environmental protection, occupational health and safety, and transportation.

Modules removed and deployed by Jaguar service are to be returned to the importer for disposal.

## Undeployed Air Bag — Inoperative

-  **WARNING:** Carry a live air bag module with the air bag and trim cover or deployment door pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment. Failure to follow this instruction may result in personal injury.


- NOTE:** All inoperative air bag modules have been placed on the Mandatory Return List. All discolored or damaged air bag modules must be treated the same as any inoperative live air bag being returned. Failure to follow this instruction may result in personal injury.


Remove the inoperative driver air bag module or passenger air bag module. For additional information [Driver Air Bag Module](#) or [Passenger Air Bag Module](#) in this section.


## Undeployed Air Bag — Scrapped Vehicle


### Remote Deployment

- WARNINGS:**

 Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

 Carry a live air bag module with the air bag and trim cover or deployment door pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment. Failure to follow this instruction may result in personal injury.


 Remote deployment is to be carried out outdoors with all personnel at least 6.1 meters (20 feet) away to ensure personal safety. Due to the loud report which occurs when the air bag is deployed, hearing protection is required. Failure to follow this instruction may result in personal injury.

 Do not place the driver or passenger air bag module with the trim cover or deployment door facing down, as the forces of the deploying air bag can cause it to ricochet and cause personal injury. Failure to follow this instruction may result in personal injury.


Equipment required: Universal deployment tool-Part N° 418-135 and 12V Battery.

- The deployment procedure should be carried out outdoors away from other personnel.

3. Remove any loose debris from around air bag. Make sure that no flammable liquids are present.
4. Disconnect the battery ground and positive cables.
5. Disconnect the relevant air bag module electrical connector.
6. Connect the appropriate adaptor lead to the restraint device.
7. Connect the deployment lead to the adaptor lead. Pass wire of the deployment tool through window, close all doors, leave window with lead for deployment tool open.

8.  **WARNING:** Before proceeding, make sure precautions have been taken to warn personnel of a possible loud noise upon activation. Do not allow anybody to approach closer to restraint device than six meters. Failure to follow this instruction may result in personal injury.

Move as far from restraint device as possible and connect the tool clips to a 12V vehicle battery.


9.  **WARNING:** Do not handle the deployed device immediately after activation - it may be hot. Allow the unit to cool for at least 20 minutes. Cooling modules should be continuously monitored to make sure heat does not create a fire with spilled liquids or other debris. Failure to follow this instruction may result in personal injury.


Deploy the module by depressing both switches on the tool. If activation does not occur, disconnect battery from tool and seek advice from Jaguar Engineering and wait for further instructions.

10. Repeat procedure for all air bags in vehicle.
11. The vehicle is now to be scrapped in the normal manner with modules installed.

## Disposal of live air bag modules for all air bags, using tyres


1. Equipment required: Deployment tool 418-S135, Battery (12V), Safety goggles to BS2092 grade 2, Rubber gloves to PrEN 374 class 2, Ear protectors that have been measured to BS.EN 24869, Particulate respirator to EN 149 grade FFP2S
2. The deployment procedure should be carried out outdoors, away from other personnel.
3. Stack four scrap tyres, securing together with heavy gauge wire or cable. while disconnected from any electrical power source, connect deployment harness and place air bag adaptor portion under tyre stack, ready for connection to air bag.

4.  **WARNING:** Power must not be connected during this step. Failure to follow this instruction may result in personal injury.


 **CAUTION:** Make sure the connector is not in contact with the inflator or it will be damaged during the test.

Connect air bag to air bag connector, make sure the locking sleeve is fully engaged. position the air bag with the cover facing upwards.

5. Make sure battery connections of deployment harness are ten meters away from the tyre stack
6. Remove any loose from around the air bag . Make sure that no flammable liquids are present.

7.  **WARNING:** Before proceeding, make sure precautions have been taken to warn personnel of a possible loud noise upon activation. Do not allow anybody to approach closer to restraint device than six meters. Failure to follow this instruction may result in personal injury.

Move as far from restraint device as possible and connect the tool clips to a 12V vehicle battery.

8.  **WARNING:** Do not handle the deployed device immediately after activation - it may be hot. Allow the unit to cool for at least 20 minutes. Cooling modules should be continuously monitored to make sure heat does not create a fire with spilled liquids or other debris. Failure to follow this

instruction may result in personal injury.

Deploy the module by depressing both switches on the tool. If activation does not occur, disconnect battery from tool and seek advise from Jaguar Engineering and wait for further instructions.

9. Allow the air bag to cool for at least 20 minutes. Cooling modules should be continuously monitored to make sure heat generated a fire with spilled liquids or other debris.
10. Remove the air bag from the tyre stack and seal in a plastic bag, ready for disposal.
11. In the event of any problems or queries arising from this procedure, contact Jaguar Engineering.

# Supplemental Restraint System - B-Pillar Side Impact Sensor


Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

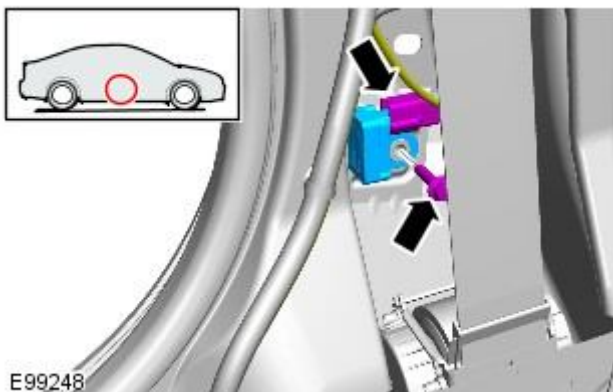
1. Make the air bag supplemental restraint system (SRS) safe.

Refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).

2.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any air bag supplementary restraints system (SRS) components. To deplete the backup power supply energy, disconnect the battery ground cable and wait for one minute. Failure to follow this instruction may result in personal injury.

Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

3. Refer to: [B-Pillar Lower Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).



4. Torque: 12 Nm

## Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Jaguar approved diagnostic equipment.

# Supplemental Restraint System - Clockspring

Removal and Installation

## Special Tool(s)

 <p>E43628</p>	<p>211-326 Locking Tool, Clockspring</p>
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## Removal

### • WARNINGS:



Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module.



Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment. Failure to follow this instruction may result in personal injury.



Do not set a live air bag module down with the trim cover face down. Failure to follow this instruction may result in personal injury.



After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards. Failure to follow this instruction may result in personal injury.



Never probe the connectors on the air bag module. Doing so may result in air bag deployment, which may result in personal injury. Failure to follow this instruction may result in personal injury.



Air bag modules with discolored or damaged trim covers must be replaced, not repainted.



Vehicle sensor orientation is critical for correct system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) is involved in a collision, inspect the sensor mounting bracket and wiring pigtail for deformation. If damaged, replace the sensor whether or not the air bag is deployed.



To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any air bag supplemental restraint system (SRS) components. To deplete the backup power supply energy, disconnect the battery ground cable and wait one minute. Failure to follow this instruction may result in personal injury.



**CAUTION:** Make sure the wheels are in the straight-ahead position. Failure to follow this instruction may result in damage to the component.

### • NOTE: Removal steps in this procedure may contain installation details.

1. Make the SRS system safe.

Refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).

2. **CAUTIONS:**



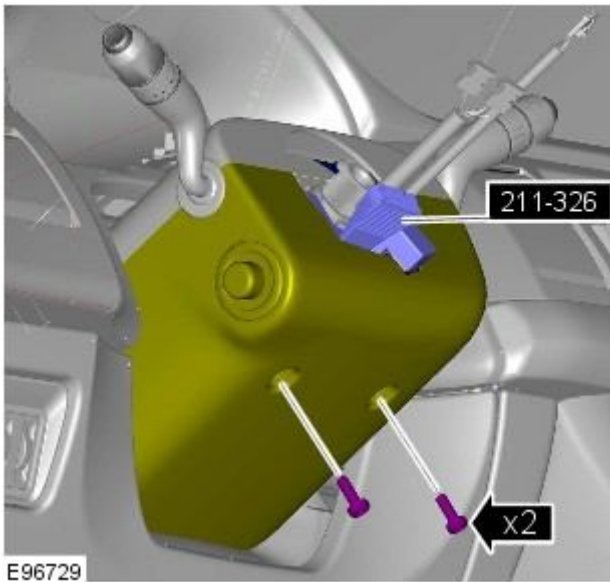
Make sure that special tool 211-326 is installed to the clockspring.




Make sure that the road wheels are in the straight ahead position, failure to follow this instruction may result in damage to the vehicle.

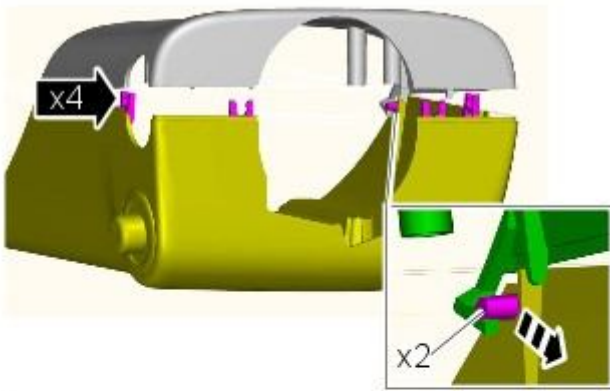
Refer to: [Steering Wheel](#) (211-04 Steering Column, Removal and Installation).



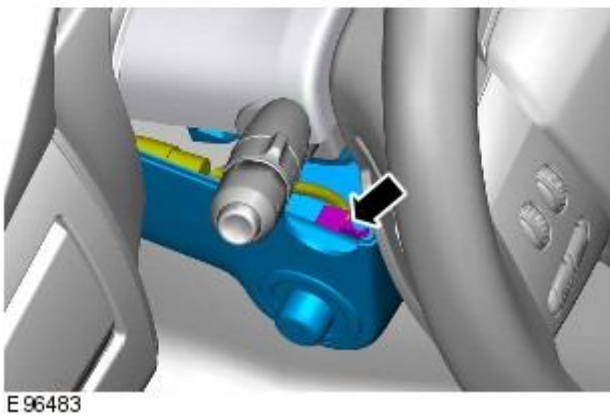


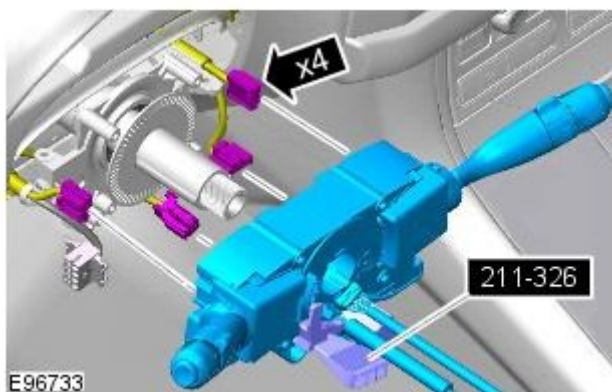
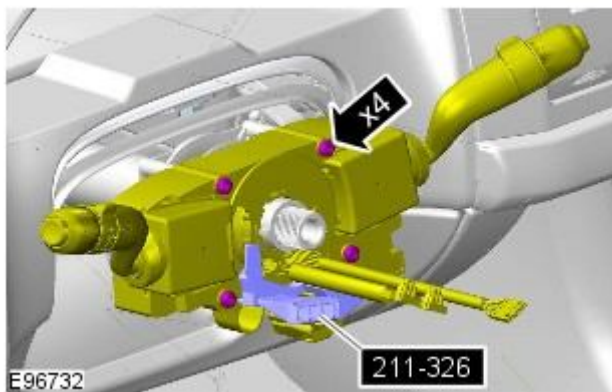
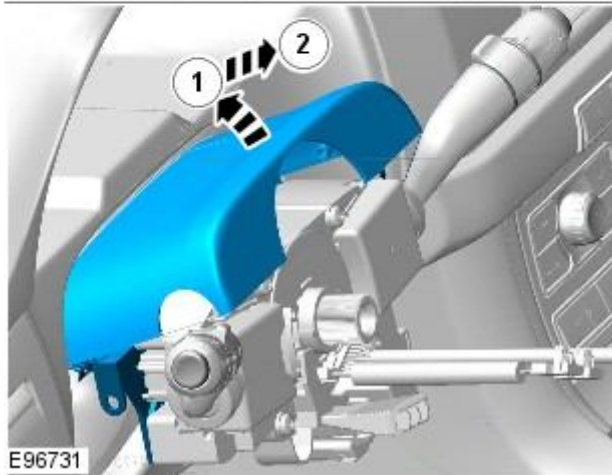
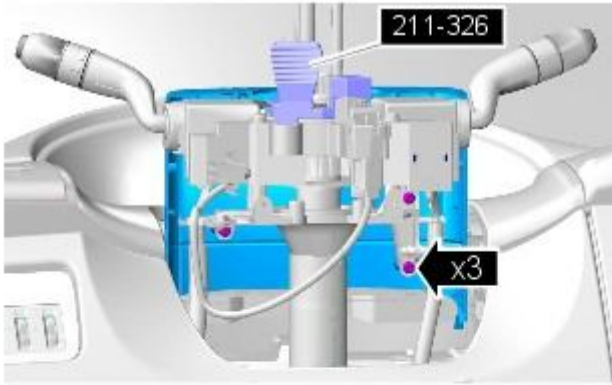
3.  CAUTION: Failing to install the special tool to the clockspring may result in damage to the vehicle.

Special Tool(s): [211-326](#)




- 4.




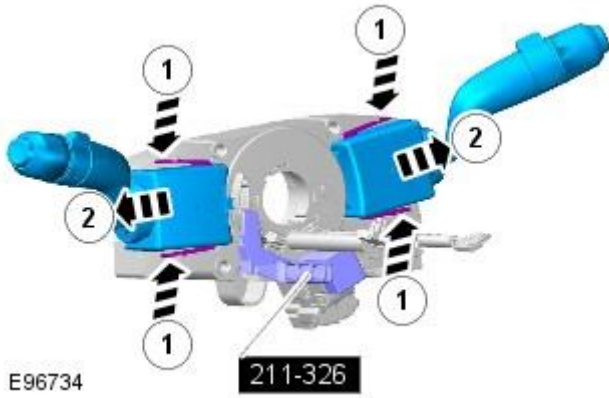


5.

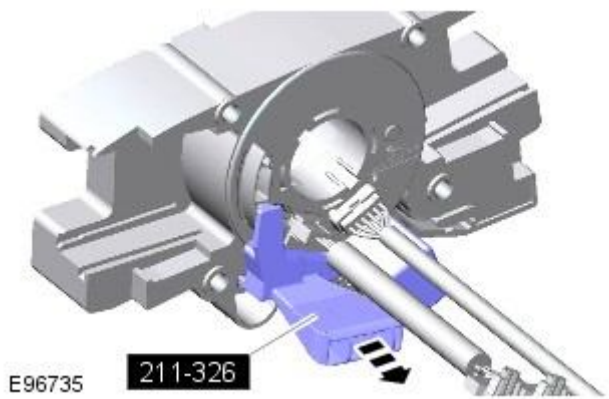
6.  CAUTION: Failing to install the special tool to the clockspring may result in damage to the vehicle.

*Torque: 6 Nm*

7.  CAUTION: Make sure no damage is occurred to the electrical connectors. Failure to follow this instruction may result in damage to the vehicle.

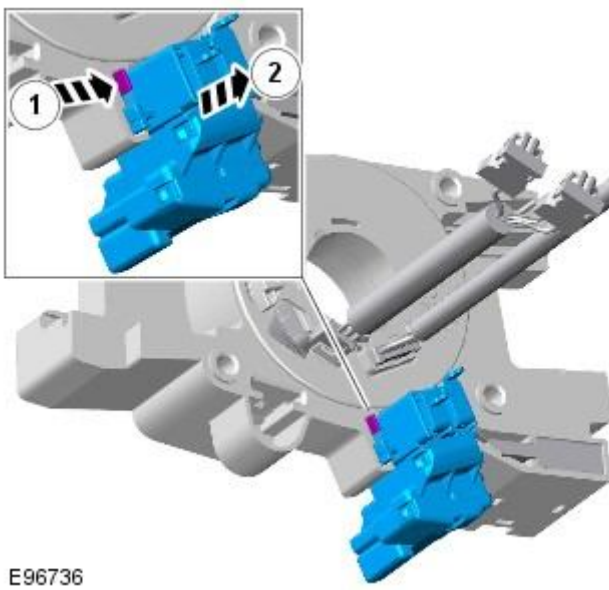


8. **8.** NOTE: Do not disassemble further if the component is removed for access only.



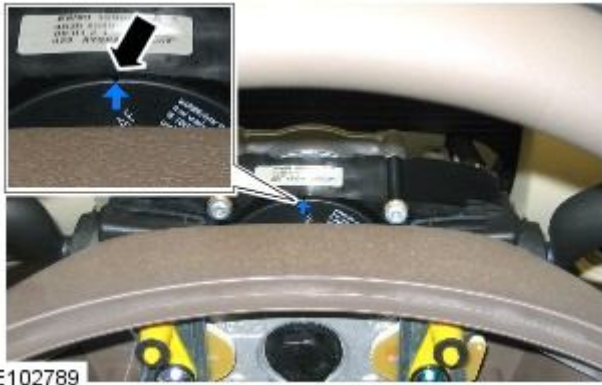
9. Remove the special tool from the clockspring.

*Special Tool(s):* [211-326](#)





- 10.


## Installation



1. 1. CAUTIONS:

 Make sure that special tool 211-326 is installed to the clockspring.

 Make sure that the arrow on the cassette is centered and pointing vertically (**make sure that the steering wheel has remained in the 12 o'clock position and that it has not been turned by +/- 360 degrees**) prior to the steering wheel installation. On removal of the special tool, keep the clockspring cables taugted to prevent the cassette moving from the set position. Failure to follow this instruction may result in damage to the component.

 Make sure that the road wheels are in the straight ahead position, failure to follow this instruction may result in damage to the vehicle.

To install, reverse the removal procedure.

# Supplemental Restraint System - C-Pillar Side Impact Sensor


Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Make the air bag supplemental restraint system (SRS) safe.

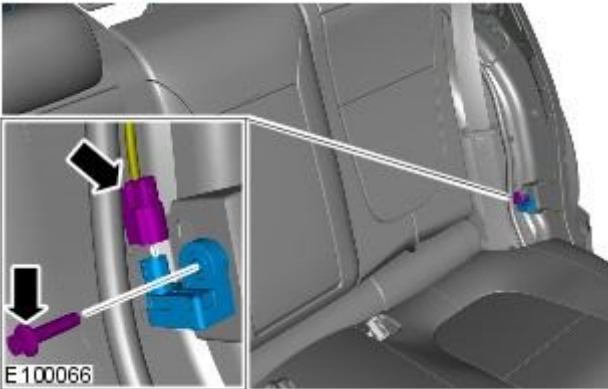
Refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).

2.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any air bag supplementary restraints system (SRS) components. To deplete the backup power supply energy, disconnect the battery ground cable and wait for one minute. Failure to follow this instruction may result in personal injury.

Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

3. Refer to: [Rear Seat Bolster](#) (501-10 Seating, Removal and Installation).

4. Torque: 12 Nm



## Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Jaguar approved diagnostic equipment.

# Supplemental Restraint System - Crash Sensor


Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

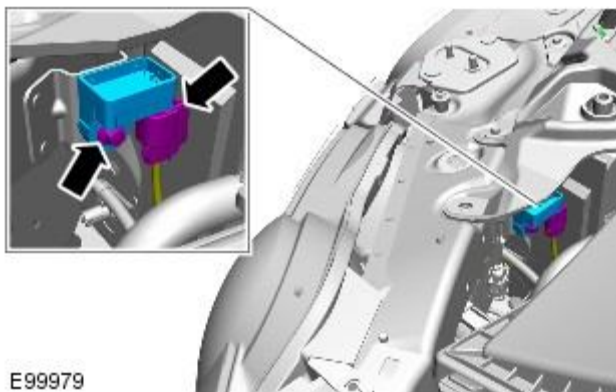
1. Make the air bag supplemental restraint system (SRS) safe.

Refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).

2.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any air bag supplementary restraints system (SRS) components. To deplete the backup power supply energy, disconnect the battery ground cable and wait for one minute. Failure to follow this instruction may result in personal injury.

Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

3. Torque: 10 Nm



## Installation

1. Install is the reverse of removal.
2. If a new component has been installed, configure using Jaguar approved diagnostic equipment.



# Supplemental Restraint System - Driver Air Bag Module

Removal and Installation

## Special Tool(s)

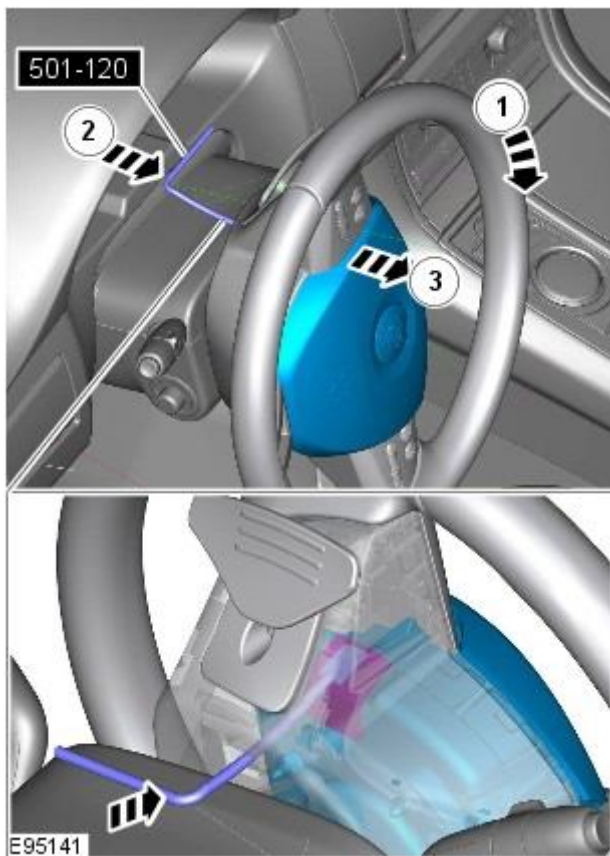


## Removal

 **WARNING:** Refer to: Supplemental Restraint System (SRS) Health and Safety Precautions (100-00, Description and Operation).

• **NOTE:** Removal steps in this procedure may contain installation details.

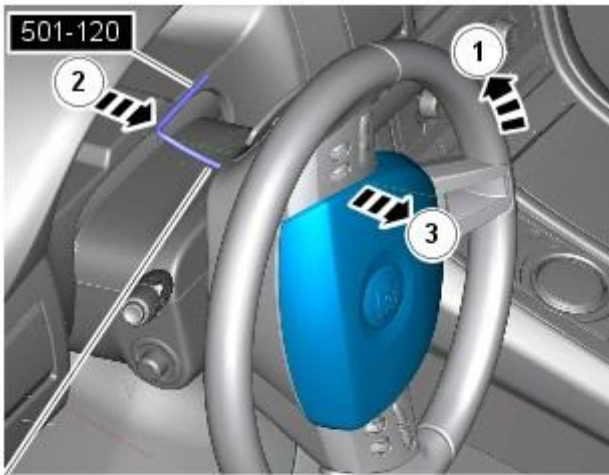
1. Refer to: Battery Disconnect and Connect (414-01, General Procedures).



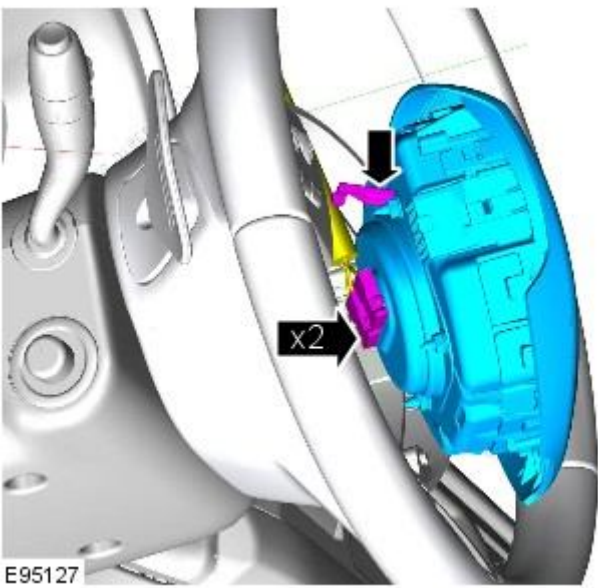
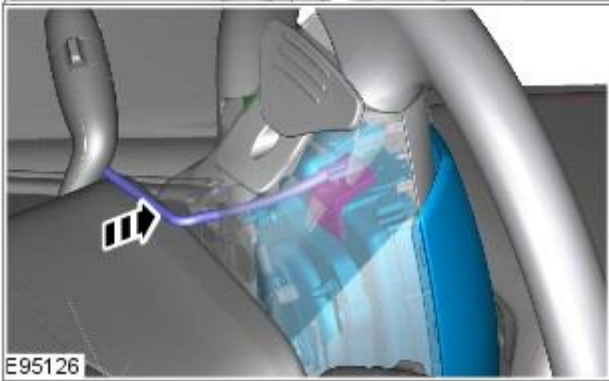
2. **NOTE:** Gentle pressure applied to the air bag towards the instrument panel aids release.

• **NOTE:** Driver air bag module installation can be confirmed by hearing 2 audible clicks, 1 for each clip.

*Special Tool(s):* [501-120](#)



3.



4.

## Installation

1. To install, reverse the removal procedure.

# Supplemental Restraint System - Front Door Side Impact Sensor

Removal and Installation

## Removal

- WARNINGS:



To avoid accidental deployment, the restraints control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.



Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.



To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.



To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.



To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.



Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.




Painting over the driver air bag module trim cover or instrument panel could lead to deterioration of the trim cover and air bags. Do not for any reason attempt to paint discolored or damaged air bag module trim covers or instrument panel. Install a new component. Failure to follow this instruction may result in personal injury.

- NOTE: Removal steps in this procedure may contain installation details.

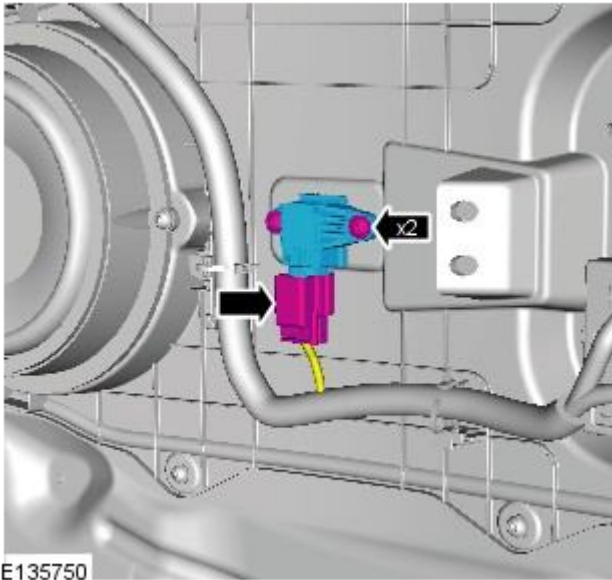
1. Make the air bag supplemental restraint system (SRS) safe.

Refer to: [Supplemental Restraint System \(SRS\) Health and Safety Precautions](#) (100-00 General Information, Description and Operation).

2.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any air bag supplementary restraints system (SRS) components. To deplete the backup power supply energy, disconnect the battery ground cable and wait for one minute. Failure to follow this instruction may result in personal injury.

Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

3. Refer to: [Front Door Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).



4. Torque: 1.7 Nm

## Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Jaguar approved diagnostic equipment.

# Supplemental Restraint System - Occupant Classification Sensor

## Removal and Installation

### Removal

- WARNINGS:



To avoid accidental deployment, the restraints control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.



Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.



To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.



To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.



To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.



Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.



Painting over the driver air bag module trim cover or instrument panel could lead to deterioration of the trim cover and air bags. Do not for any reason attempt to paint discoloured or damaged air bag module trim covers or instrument panel. Install a new component. Failure to follow this instruction may result in personal injury.

- CAUTIONS:



The front passenger seat occupant classification sensor is available only as a service kit. No attempt should be made to replace individual components. Failure to follow this instruction may result in personal injury.



Check for correct operation of the front seat after completion of the procedure to make sure that the wiring harness has not become trapped or stretched.

- NOTE: Note the routing of the seat harness.

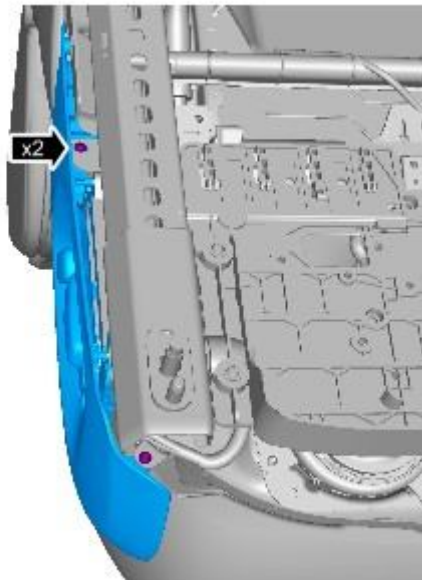
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Make the air bag supplemental restraint system (SRS) safe.

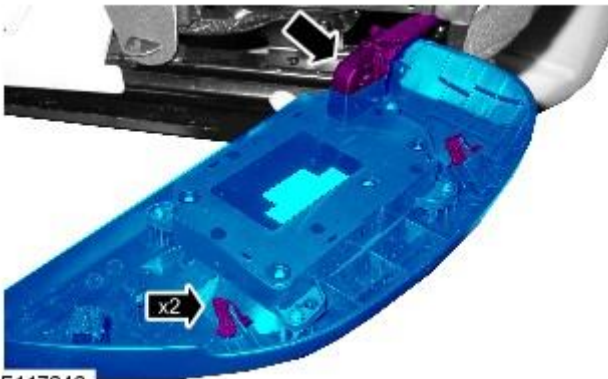
Refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).

2. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

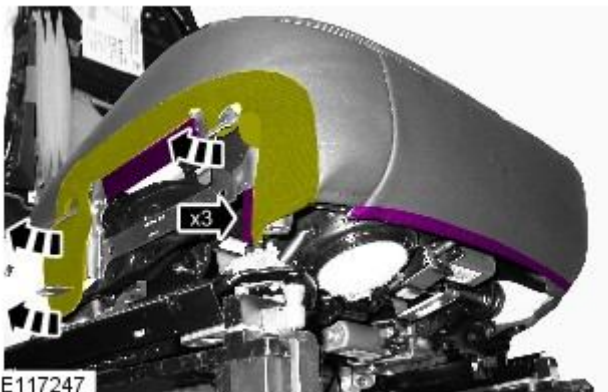
3. Refer to: [Front Seat Backrest Cover](#) (501-10 Seating, Removal and Installation).



E117245



E117246



E117247

4.

5. **NOTE:** An audible click is heard when the clips are fully latched.
- **NOTE:** Make sure the electrical connector is securely connected.

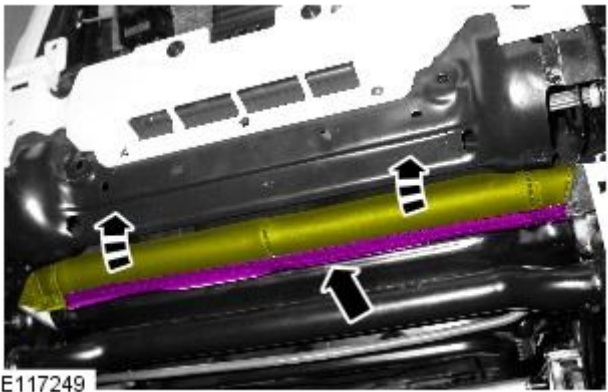
6.





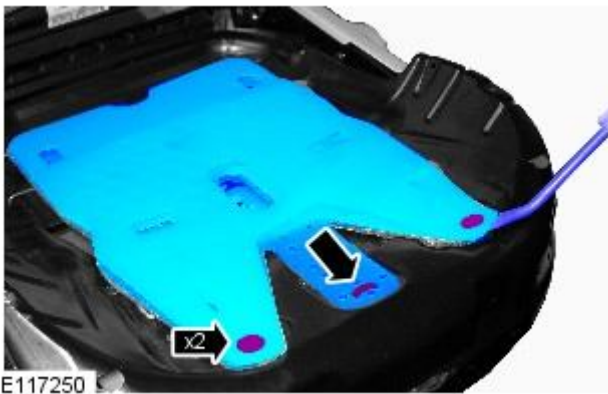
E117248

7.



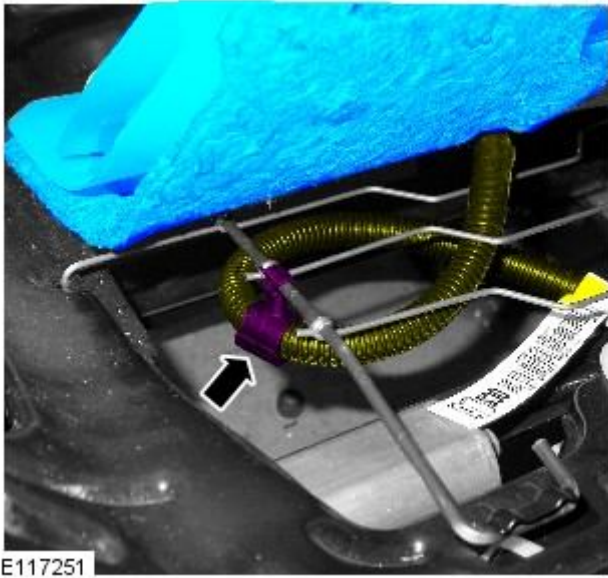
E117249

8.



E117250

9.



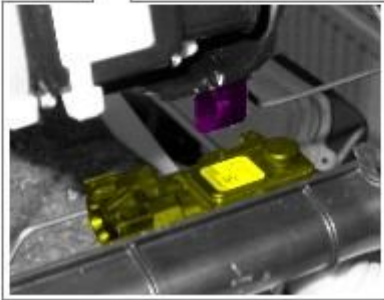
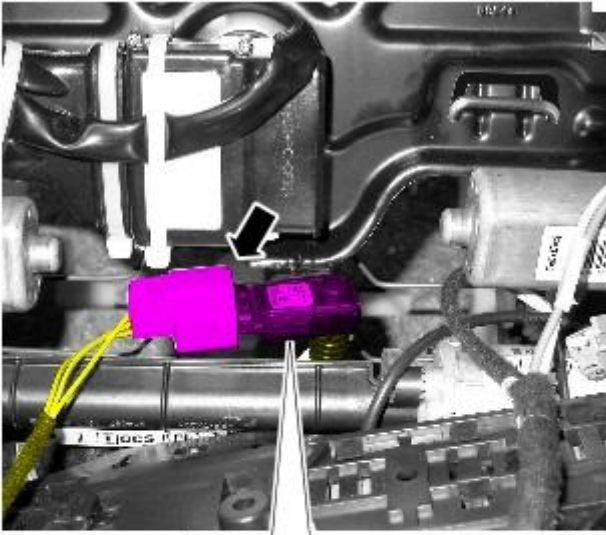
E117251

10. **10.** NOTE: Note the position of the wiring harnesses to aid installation.



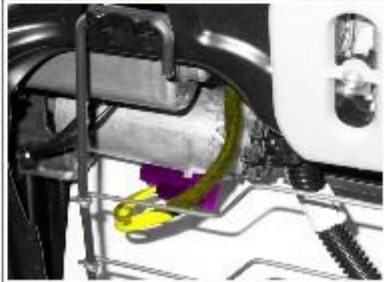
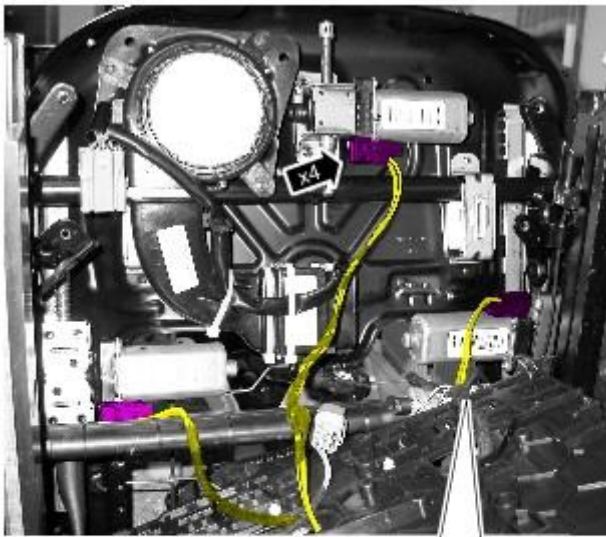
E117252

11.



E117253

12. **12.**  CAUTION: Take extra care not to damage the clips.



E117254

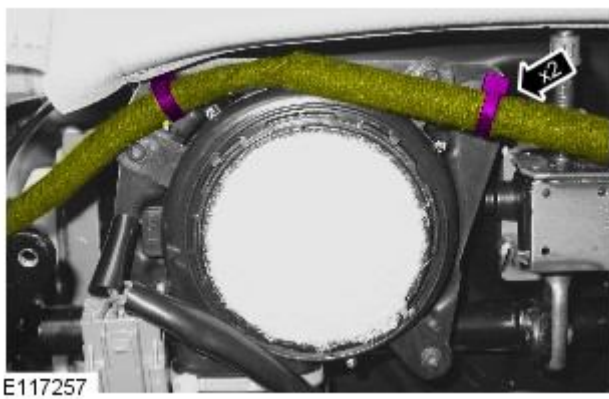
13. **13.** NOTE: Note the position of the wiring harnesses to aid installation.



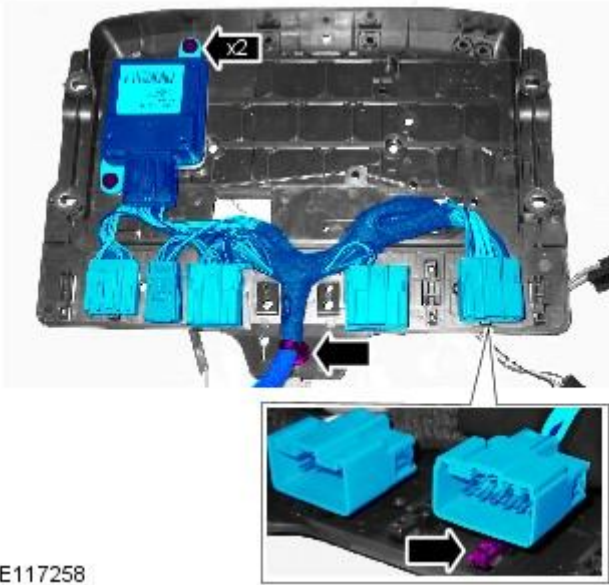
14.



15.



16.



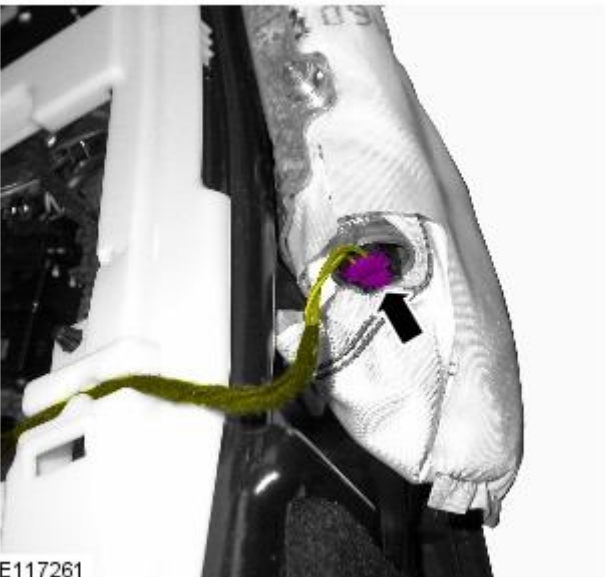
E117258

17.




E117260

18.

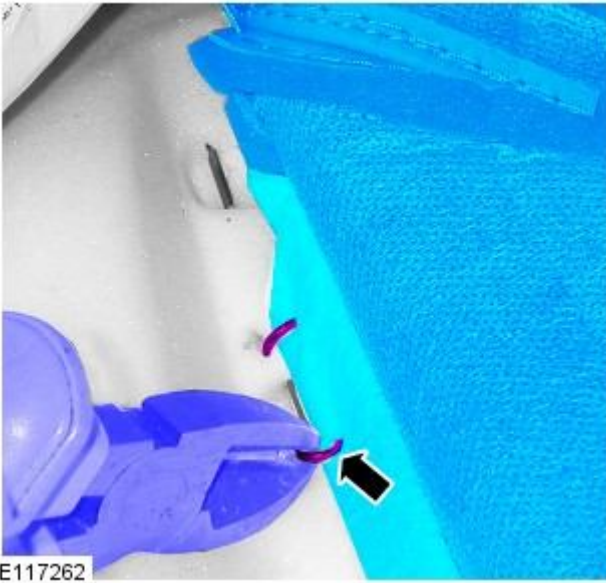


E117261

19.  **WARNING:** Do not probe supplemental restraint system (SRS) electrical connectors.




20.

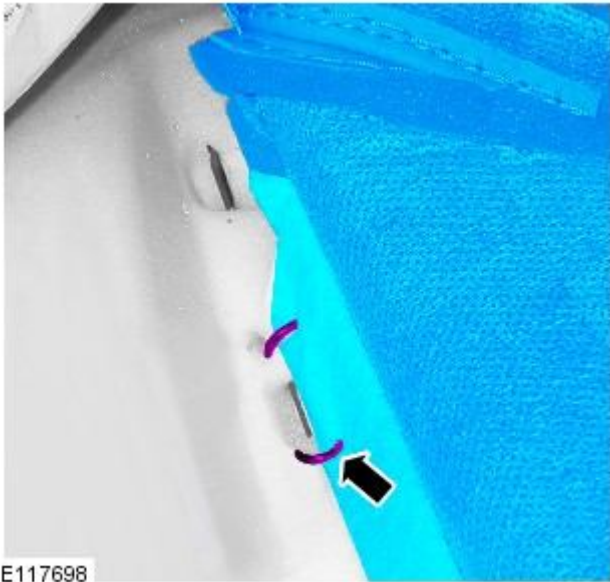


## Installation

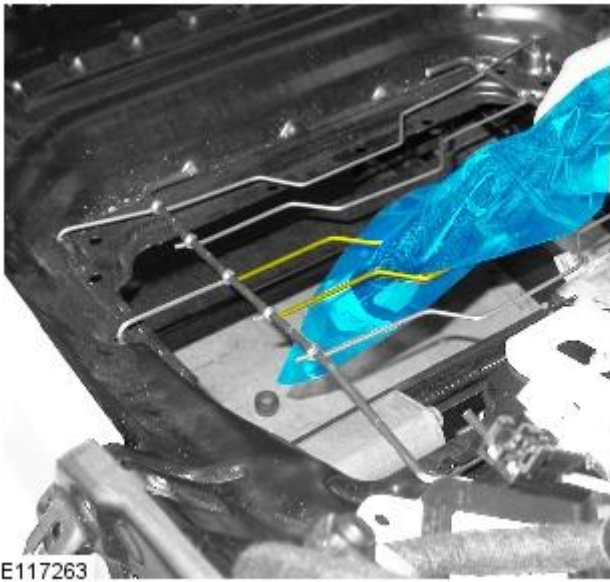


1.  CAUTION: The front passenger seat occupant classification sensor is available only as a service kit. No attempt should be made to replace individual components. Failure to follow this instruction may result in personal injury.





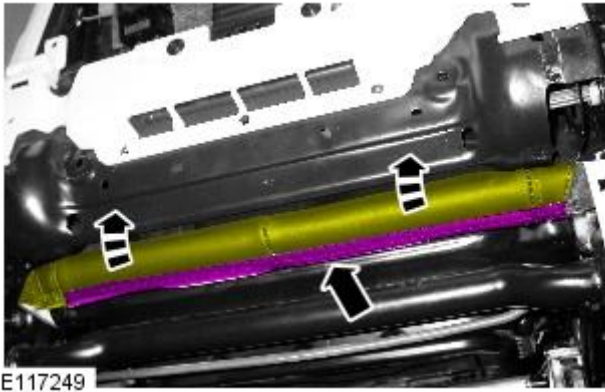
2. **2.** NOTE: Make sure that new hog rings are installed.
  - NOTE: Use hog ring pliers to close the hog rings. Do not use any other tool. The hog rings must be closed to overlap as illustrated.



3.

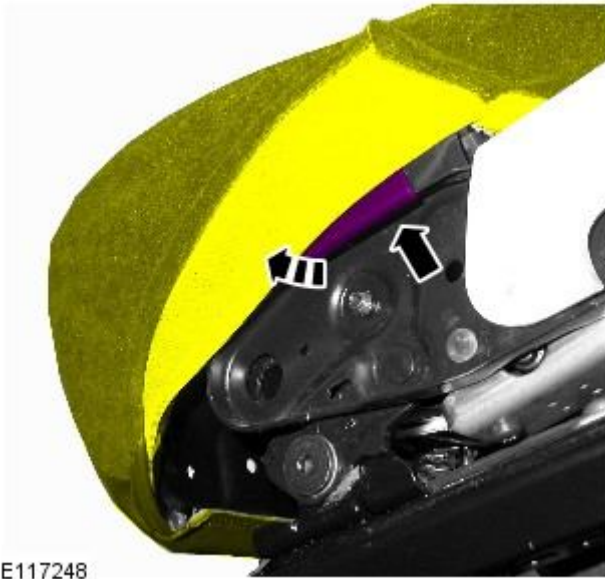


4.



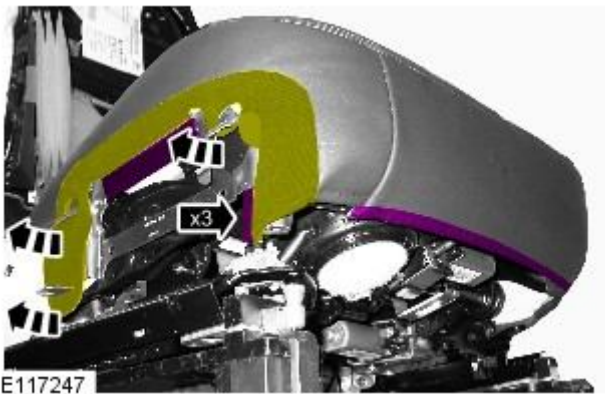
E117249

5.



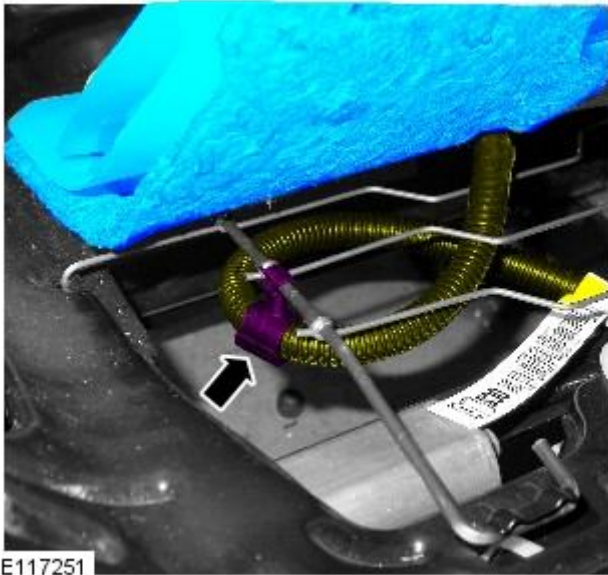
E117248

6.

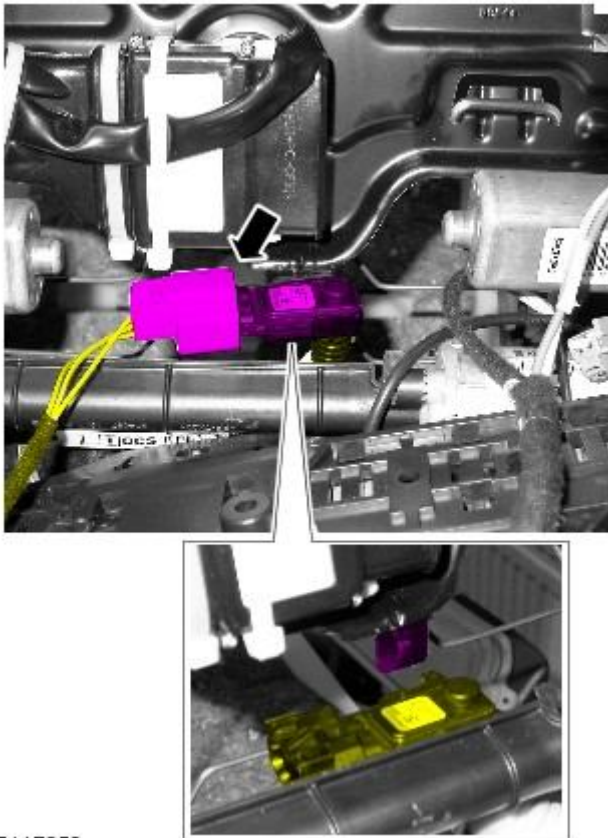


E117247

7.

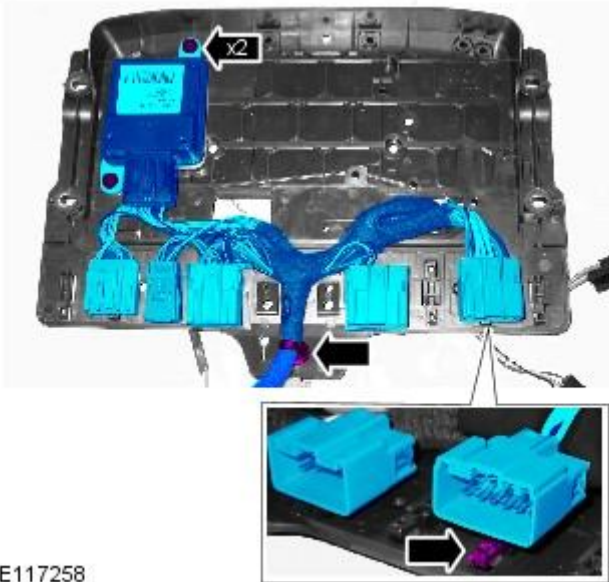


8. **8.** NOTE: Make sure that the harness is routed to the position noted on removal.



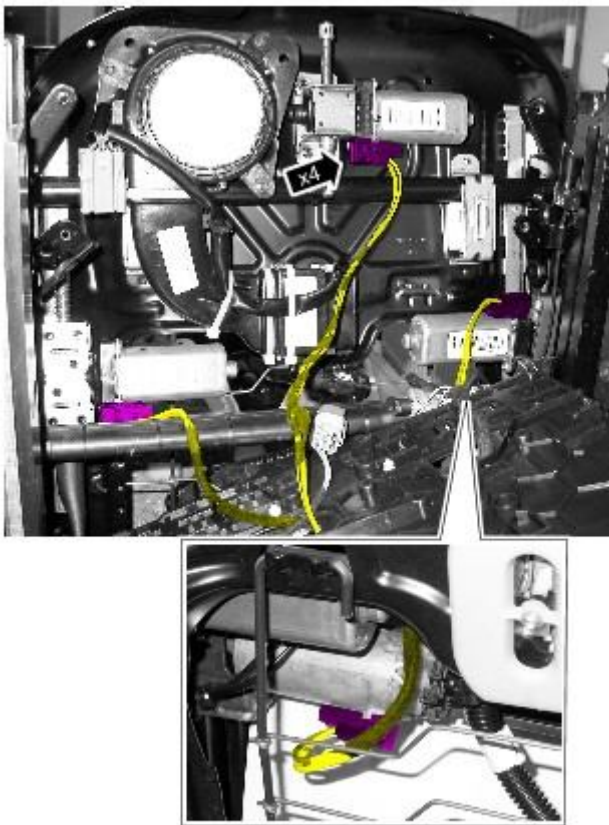
9.

E117253



E117258

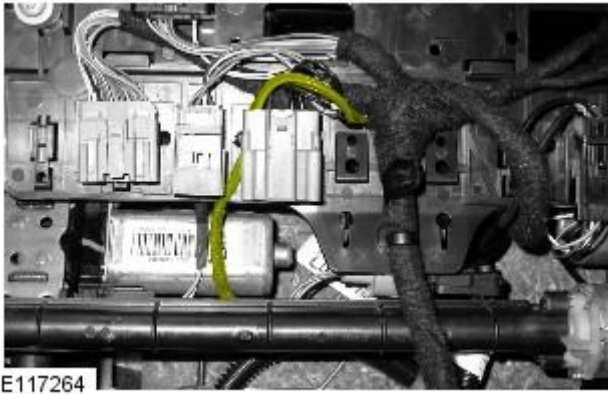
10. Torque: 4 Nm




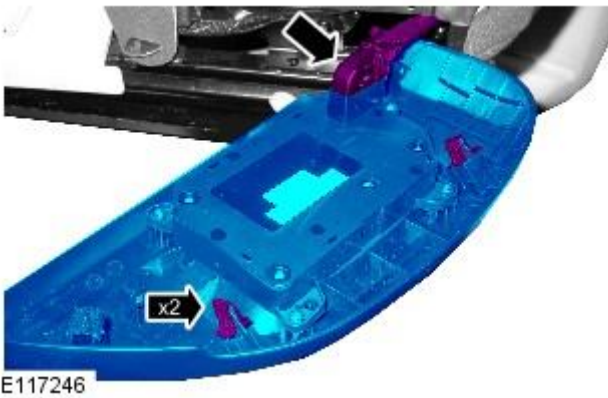
E117254

11. **11.** NOTE: Make sure that the harness is routed to the position noted on removal.

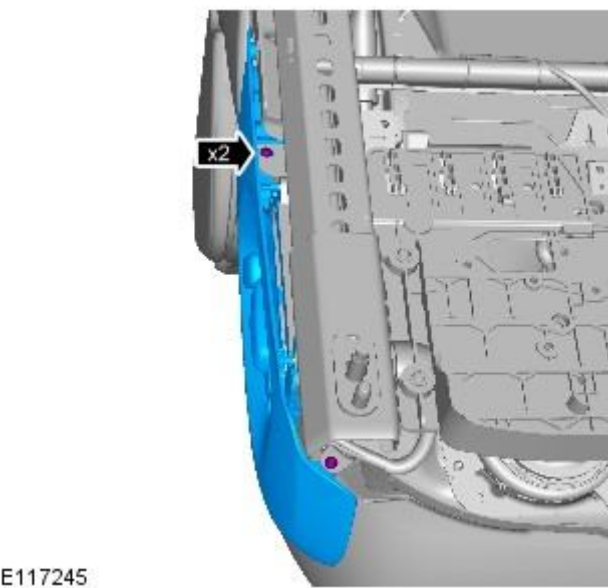




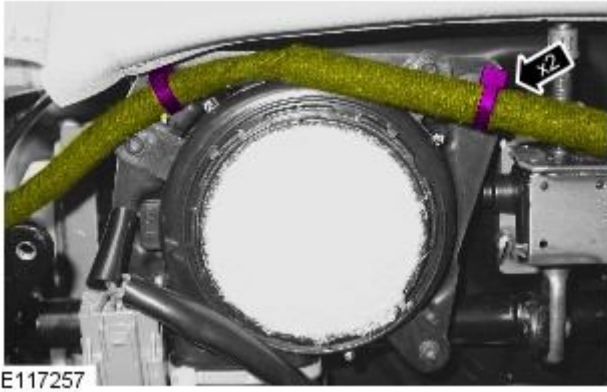
12. **12.**  **CAUTION:** Make sure that the wiring harness is routed above the drive bar as shown, to avoid damage to the wiring harness during movement of the front seat.



13. **13.** **NOTE:** An audible click is heard when the clips are fully latched.
- **NOTE:** Make sure the electrical connector is securely connected.

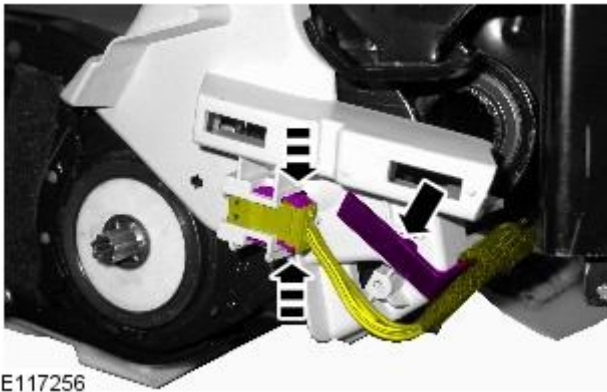


14. *Torque:* 1.3 Nm



E117257

15.



E117256

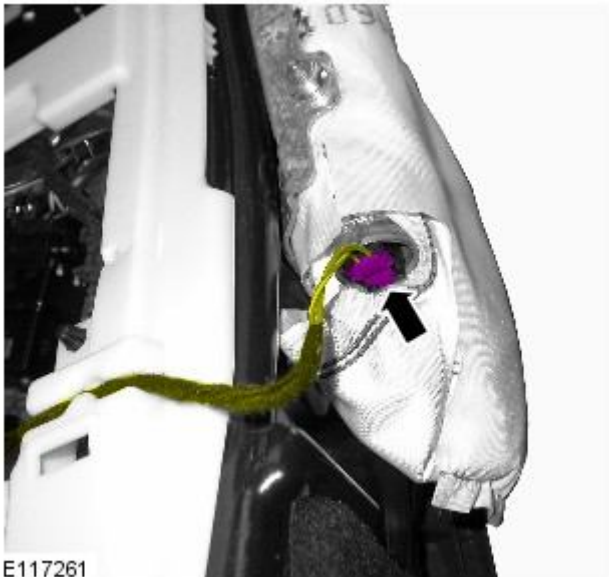
16.




E117252

17. Torque: 9 Nm

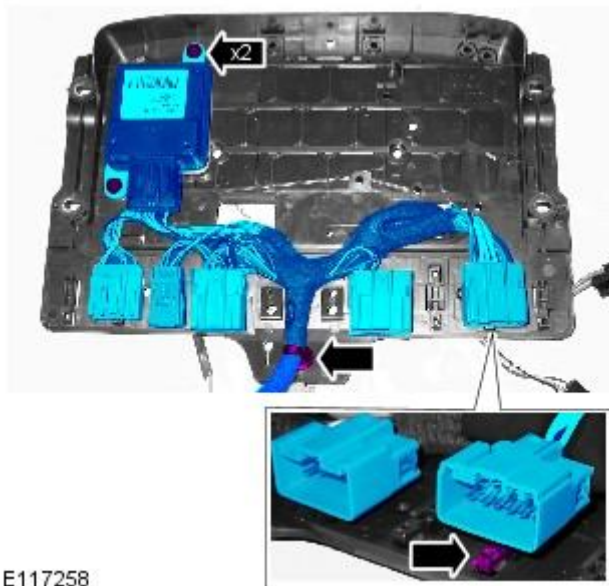




18.  **WARNING:** Do not probe supplemental restraint system (SRS) electrical connectors.



19.



20.

21. Refer to: [Front Seat Backrest Cover](#) (501-10 Seating, Removal and Installation).
22. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

# Supplemental Restraint System - Passenger Air Bag Module

Removal and Installation

## Special Tool(s)

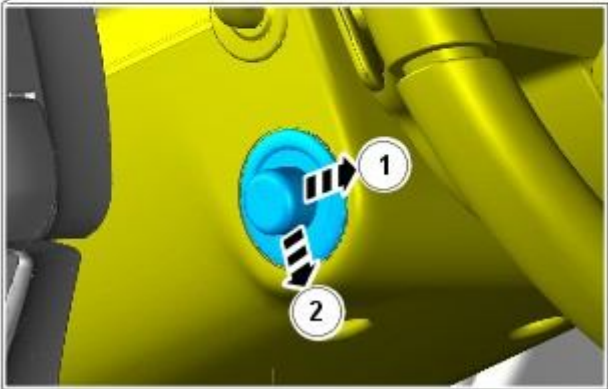
 E43628	211-326 Locking Tool, Clockspring
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## Removal

- NOTE: Removal steps in this procedure may contain installation details.

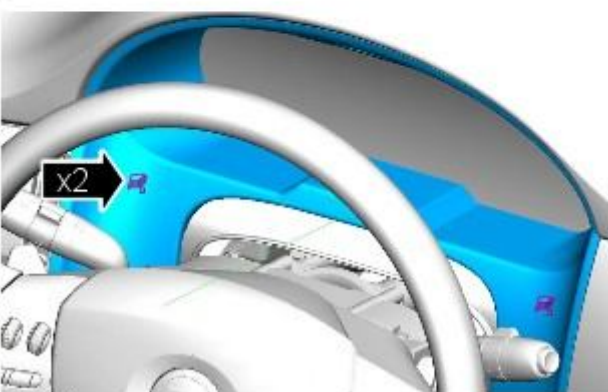
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Steering Wheel](#) (211-04 Steering Column, Removal and Installation).
3. Refer to: [Driver Side Register](#) (412-01 Climate Control, Removal and Installation).
4. Refer to: [Information and Entertainment Display](#) (415-01 Information and Entertainment System, Removal and Installation).
5. Refer to: [Instrument Panel Speaker](#) (415-01 Information and Entertainment System, Removal and Installation).
6. Refer to: [A-Pillar Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
7. Refer to: [Audio and Climate Control Assembly](#) (415-01 Information and Entertainment System, Removal and Installation).

8.

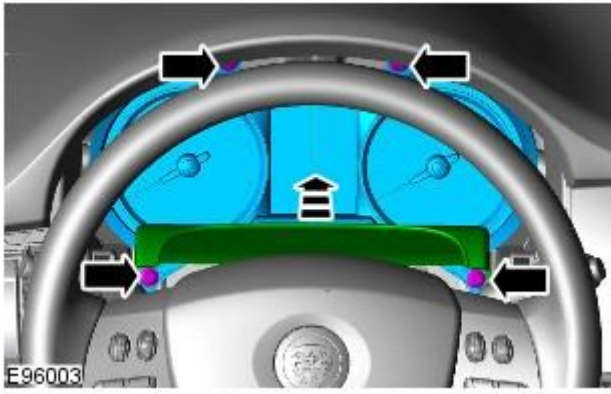


E100689

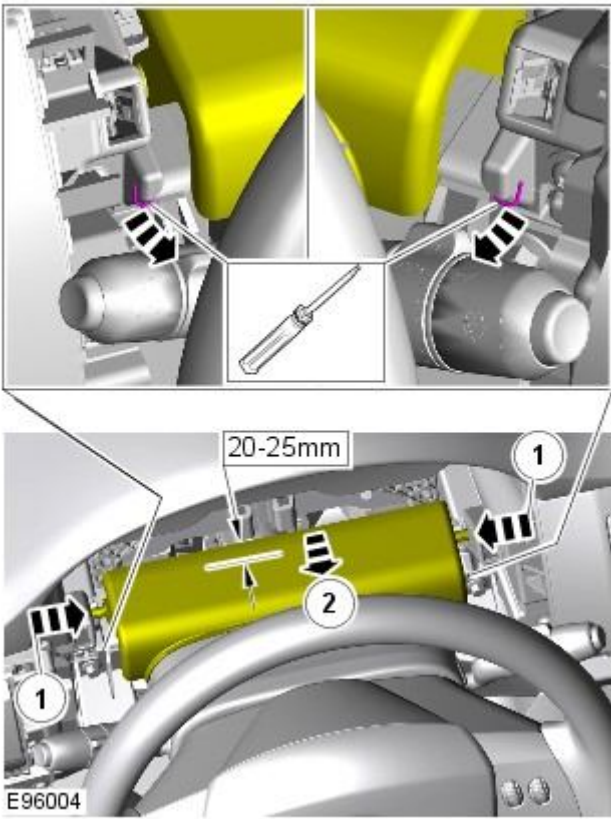
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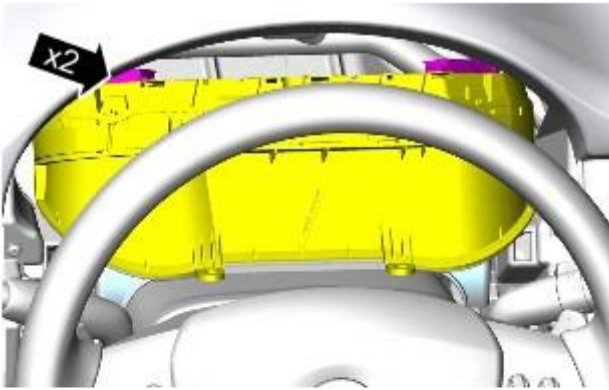
E95491




10.

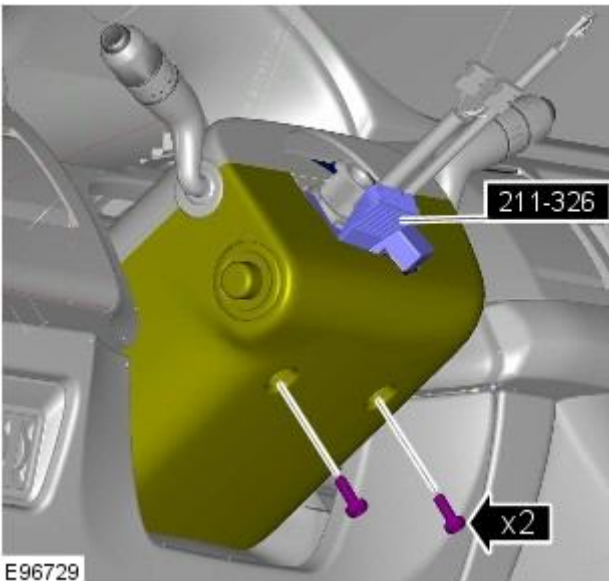


11.



E96005

12.  CAUTION: Take extra care not to damage the instrument cluster face.

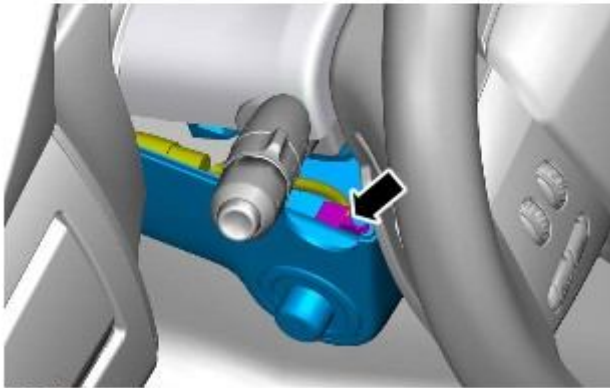
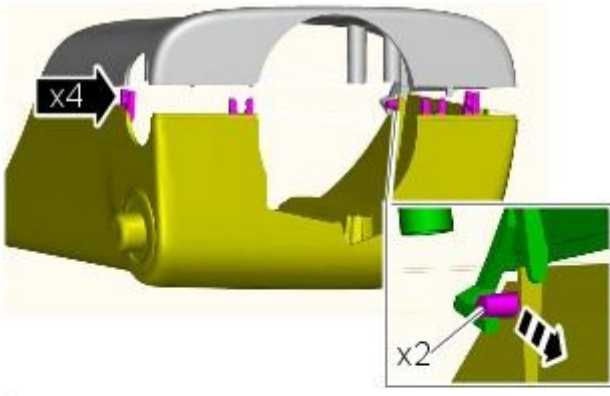


E96729

13. *Special Tool(s):* [211-326](#)

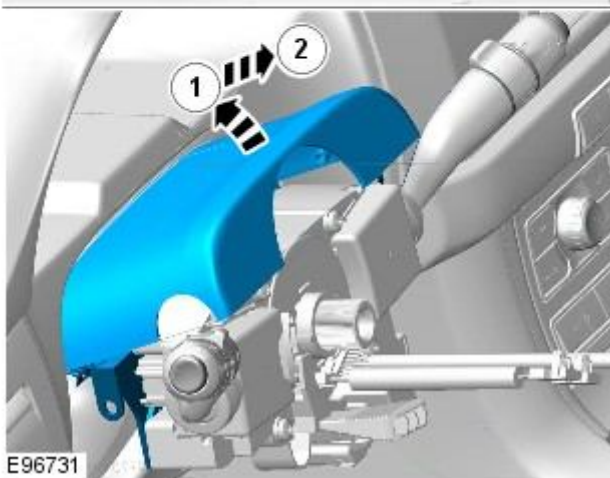
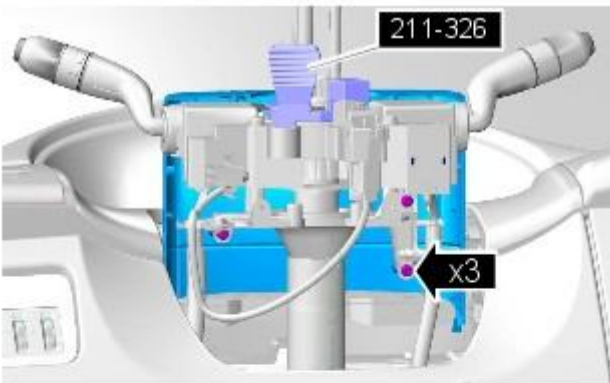


14.



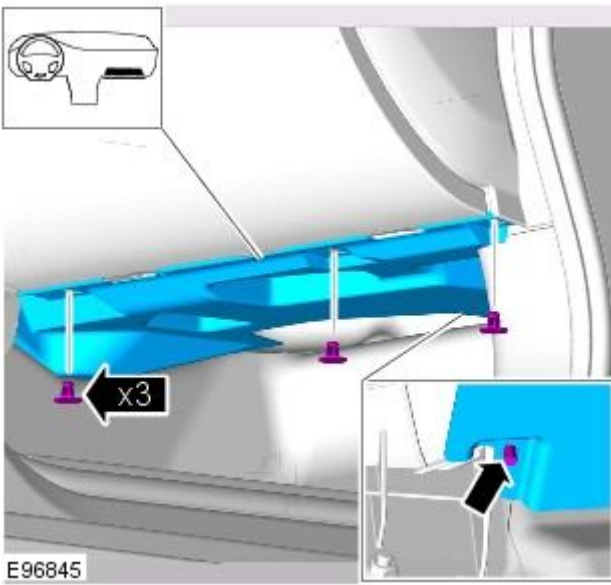
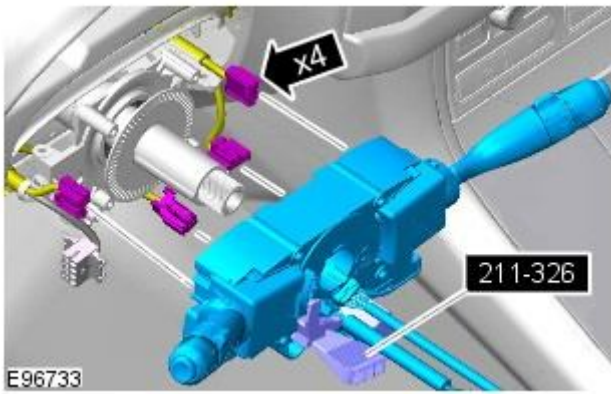
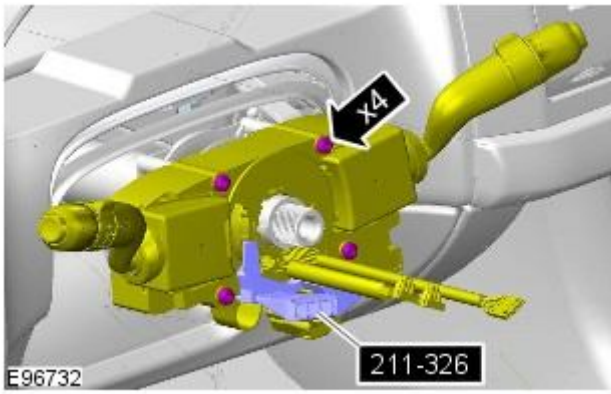
E 96483

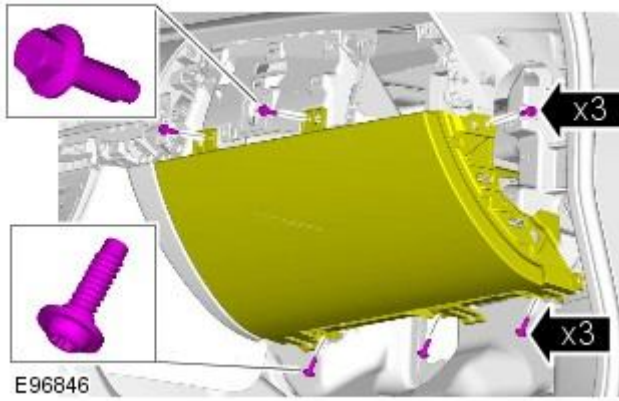
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E96731

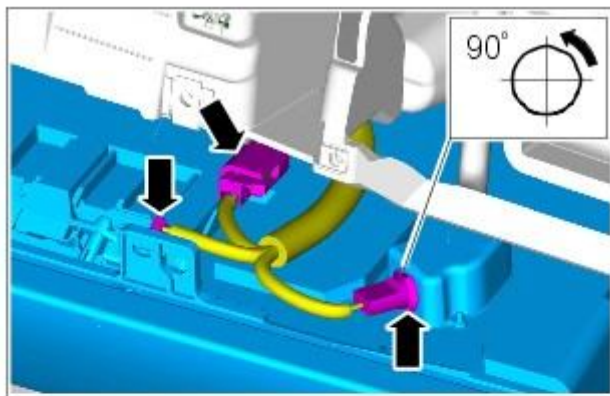




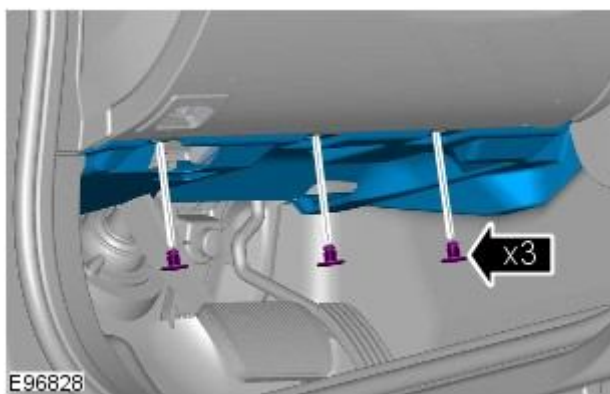
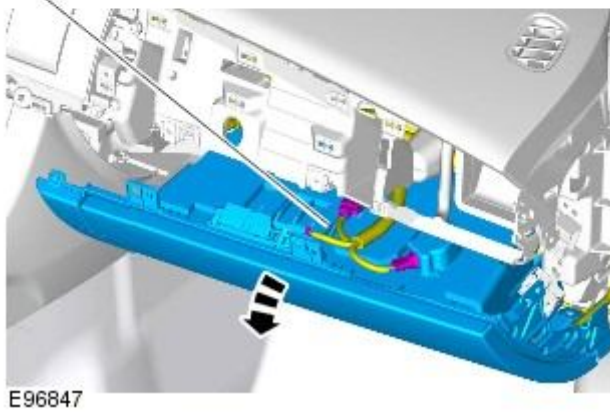


19. **19.**  **CAUTION:** Fixings must be started by hand to avoid damaging threads.

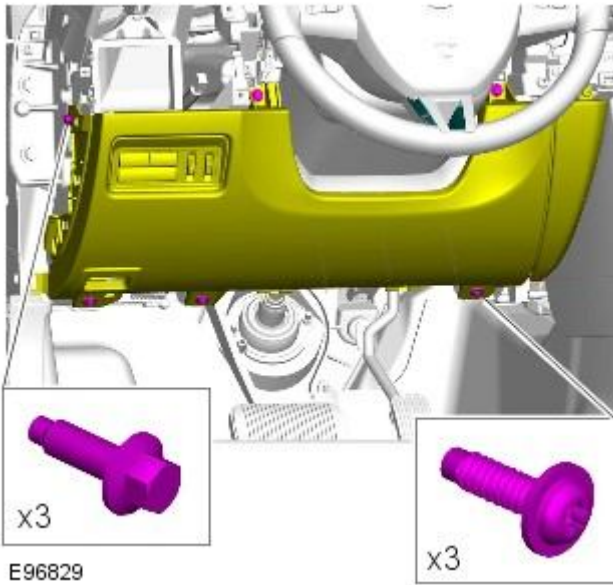
*Torque:*  
M8 2.5 Nm  
T27 9 Nm



- 20.



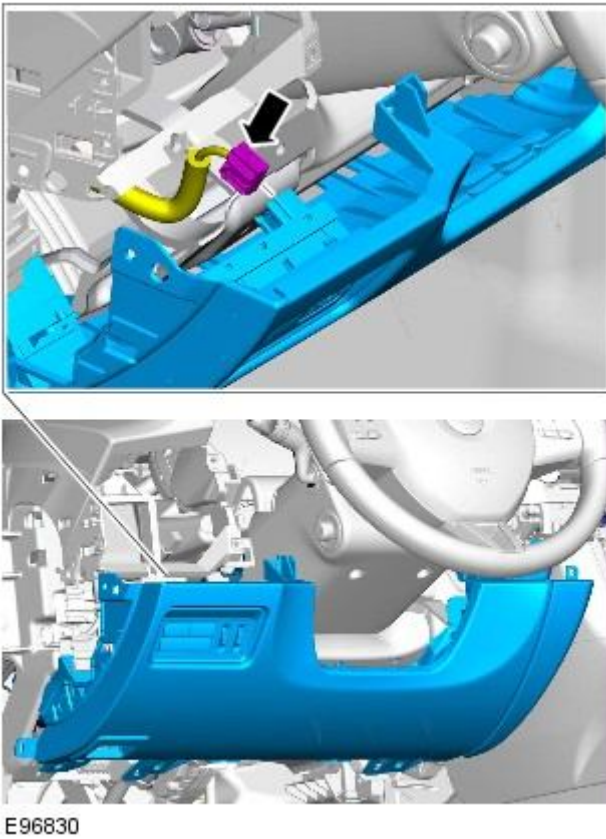
- 21.



22.  CAUTION: Fixings must be started by hand to avoid damaging threads.

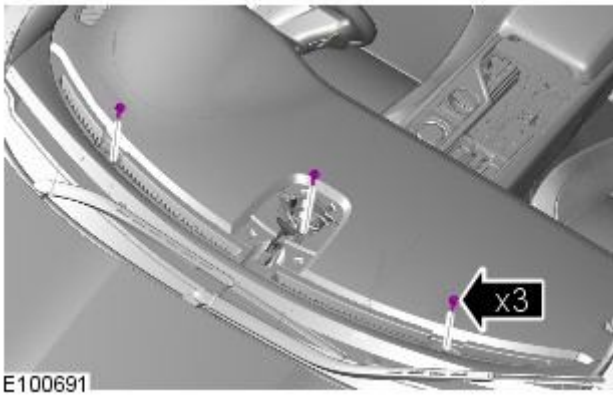
Torque:  
M8 2.5 Nm  
T27 9 Nm

- 23.

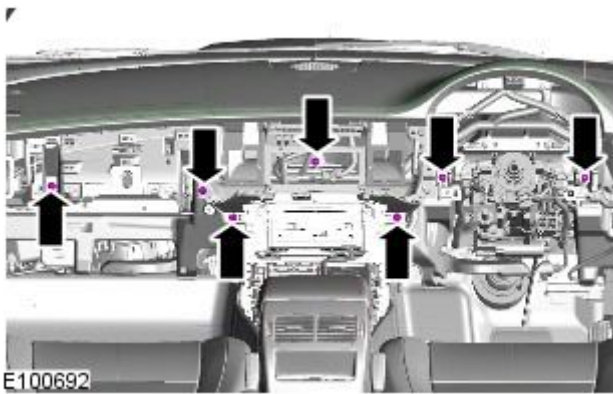




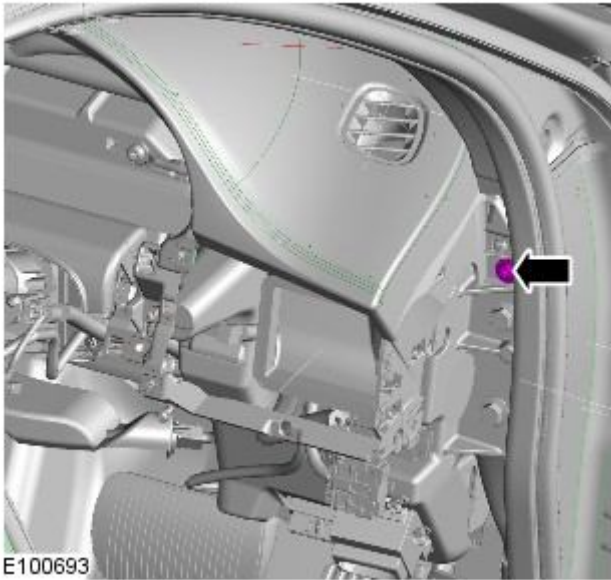
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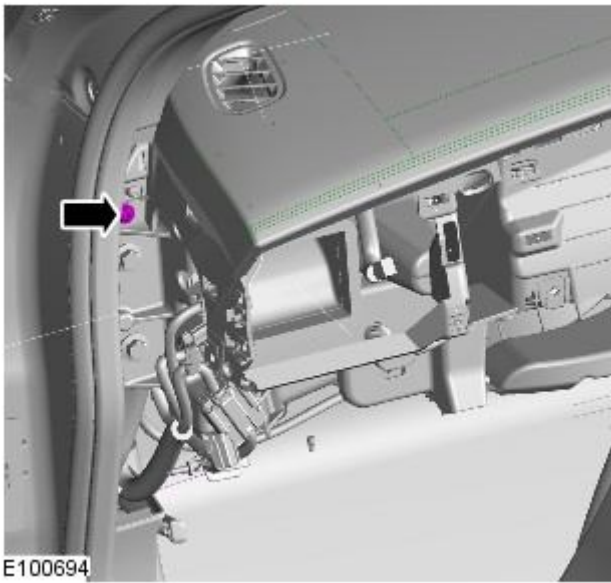
25. Torque: 20 Nm



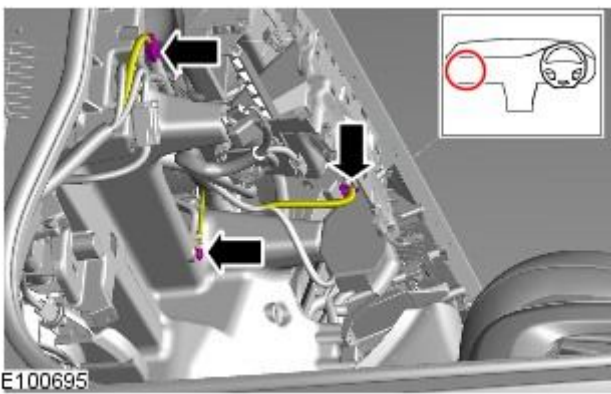
26. Torque: 20 Nm



27. Torque: 20 Nm



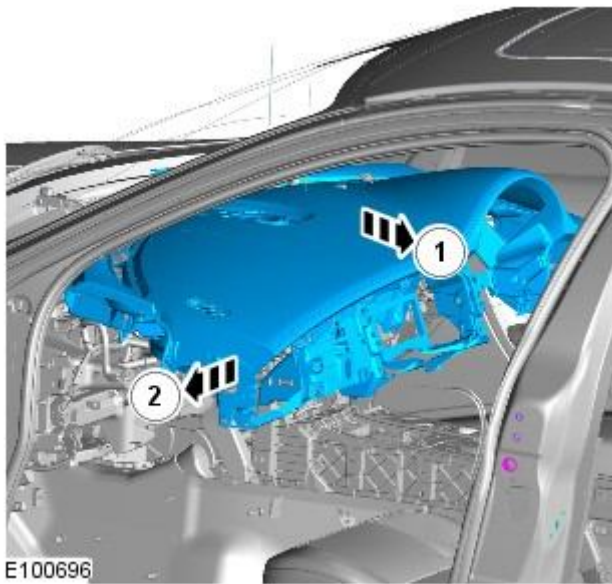
28. Torque: 20 Nm



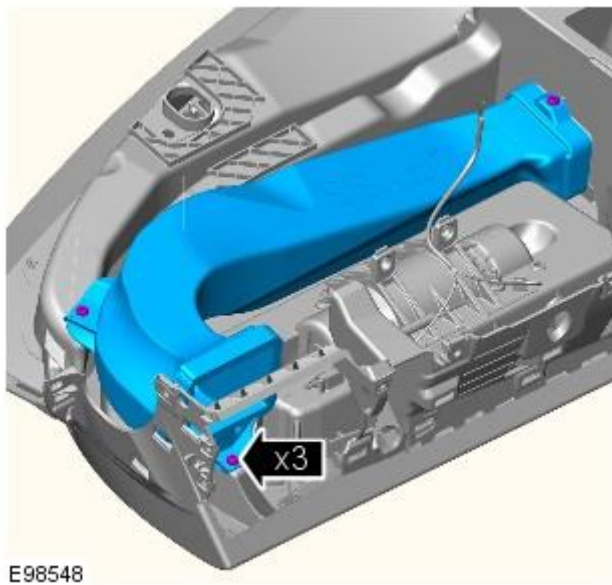
29.



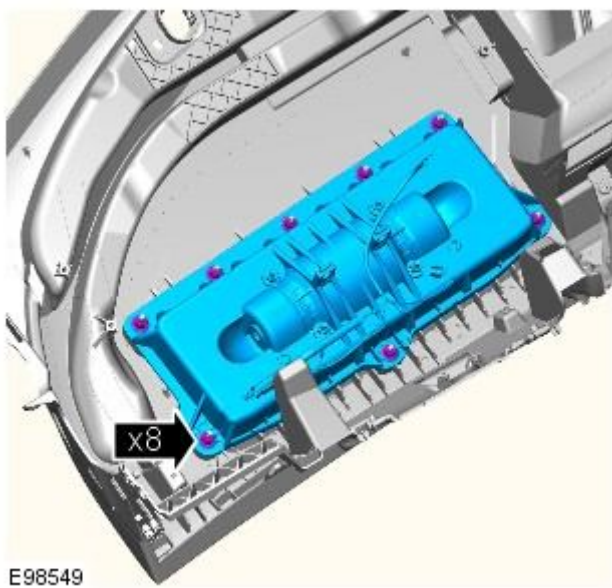
30.



31.



32. Torque: 6 Nm



## Installation

1. To install, reverse the removal procedure.



# Supplemental Restraint System - Restraints Control Module (RCM)


Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Make the air bag supplemental restraint system (SRS) safe.

Refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).

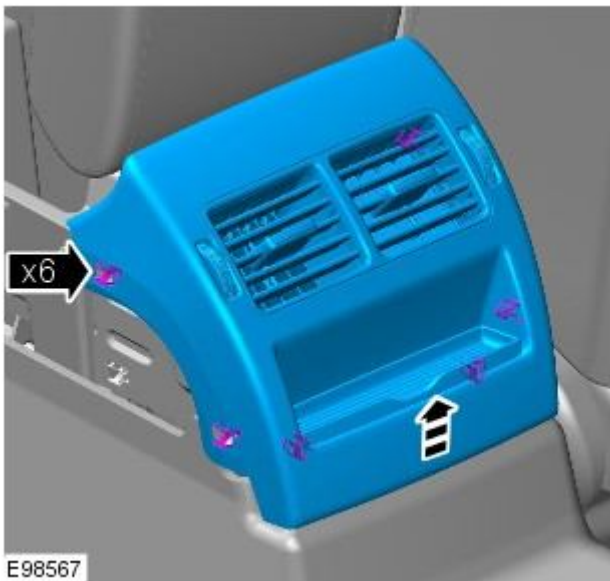
2.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any air bag supplementary restraints system (SRS) components. To deplete the backup power supply energy, disconnect the battery ground cable and wait for one minute. Failure to follow this instruction may result in personal injury.

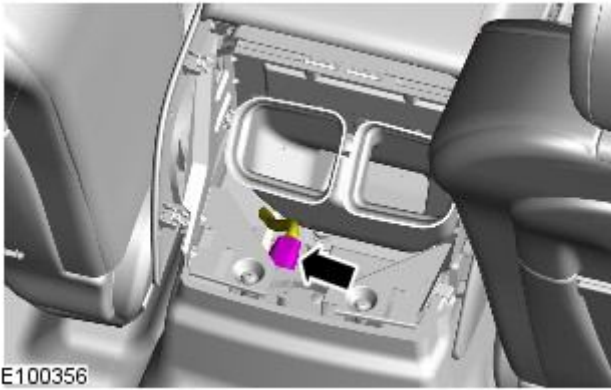
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

- 3.

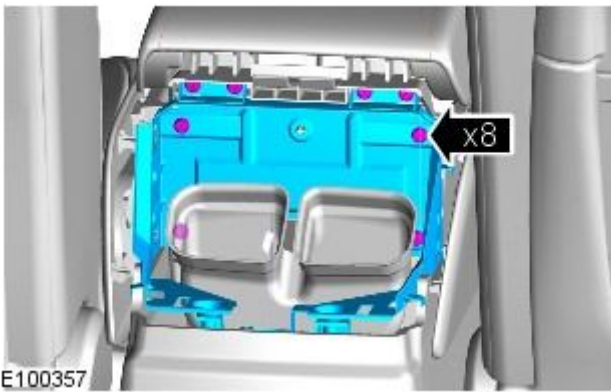


- 4.

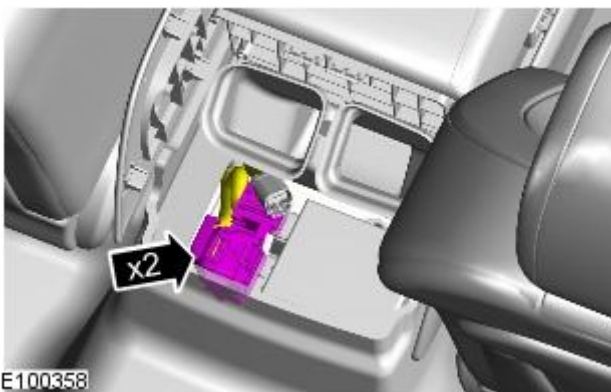




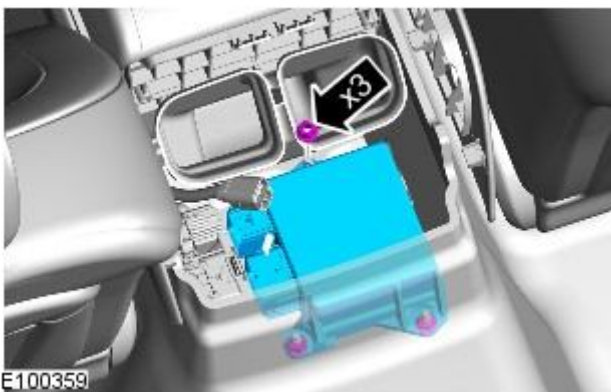
5.



6. Torque: 6 Nm



7.



8. **8.** NOTE: If the SRS component is to be replaced, the bar code of the new unit must be recorded.

- NOTE: The RCM will record and store impact data. The module must be replaced when three records are noted.

Torque: 10 Nm

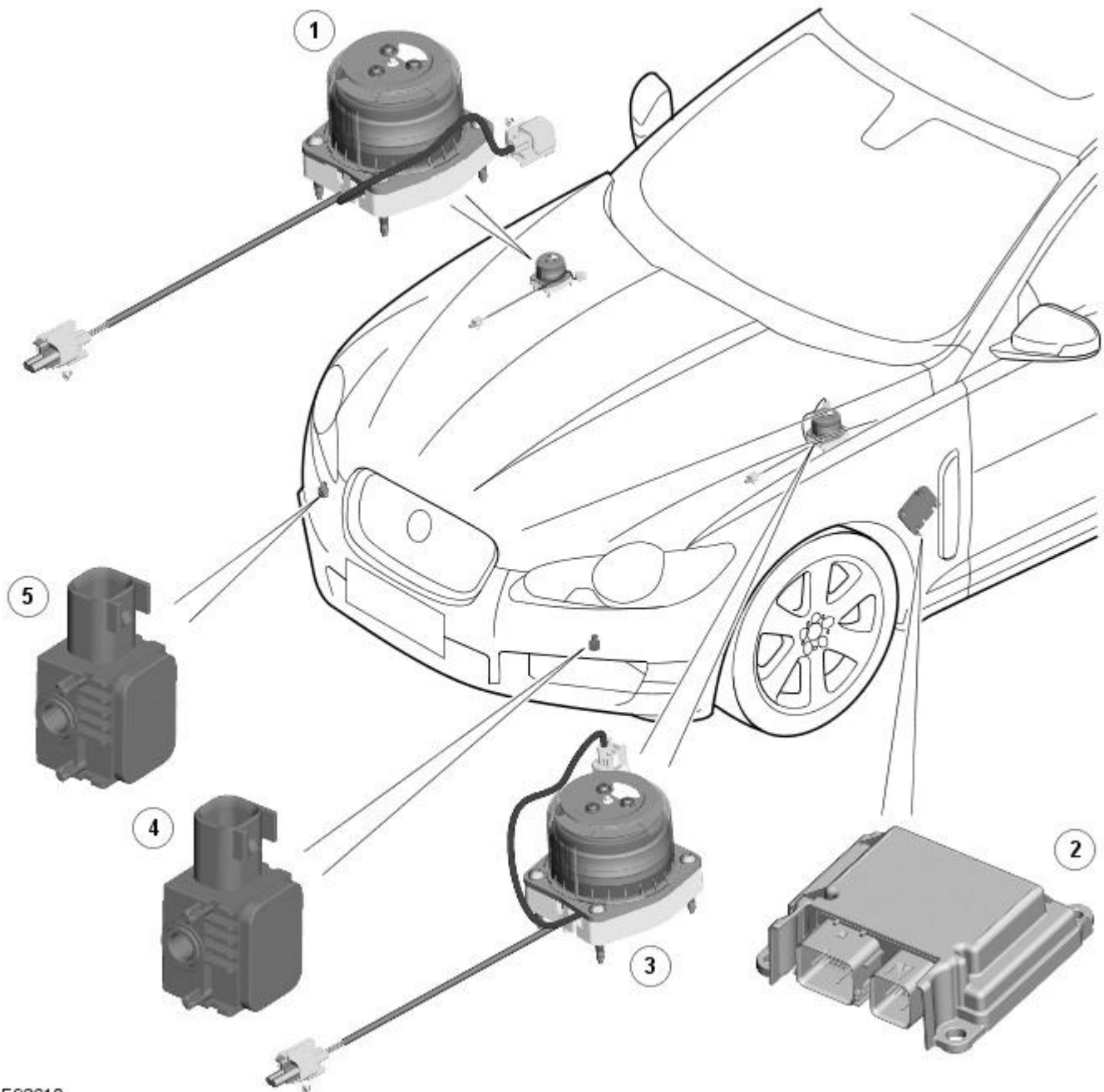
## Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Jaguar approved diagnostic equipment.

# Pedestrian Protection System - Pedestrian Protection System

Description and Operation

## COMPONENT LOCATION



E93610

Item	Part Number	Description
1	-	right-hand (RH) hood actuator
2	-	Pedestrian protection system control module
3	-	left-hand (LH) hood actuator
4	-	LH accelerometer
5	-	RH accelerometer

## OVERVIEW

The pedestrian protection system is designed to mitigate injuries in a pedestrian collision with the vehicle. It does this by utilizing a pair of pyrotechnic actuators to lift the hood away from the engine, creating a cushioned impact between the pedestrian and the vehicle.

The pedestrian protection system also includes passive protection integrated into the bumper system and bonnet structure.



**WARNING:** Do not fit any non-Jaguar approved accessories to the vehicle.

- NOTE: The pedestrian protection system operates independently from the supplemental restraint system (SRS).

The pedestrian protection system is operational when the vehicle is traveling at speeds between approximately 20 km/h (12.4 mph) and 45 km/h (28 mph). A vehicle speed signal is received by the pedestrian protection system control module over the high speed controller area network (CAN) bus.

The system is able to determine if contact is made with a pedestrian or another object, such as a traffic cone, using signals from accelerometers mounted behind the front bumper. When the system determines contact is made with a pedestrian it fires the actuators to lift the rear of the hood approximately 130 mm within 35 ms of the 'fire' signal.

When an impact condition is registered, the pedestrian protection system control module outputs an impact signal on the high speed CAN bus. This signal is used by the rear junction box (RJB) to initiate the hazard warning lamps. If this occurs, the hazard warning lamp switch is disabled for the remainder of the current ignition cycle.

**WARNING:** If any damage is caused to the front of the vehicle, be it cosmetic or structural, repairs must be carried out in line with the processes contained in the workshop manual. Failure to carry out the correct repair process could compromise operation of the pedestrian protection system. Refer to GTR for the latest information.

If the pedestrian protection system control module detects a fault with the system, it outputs a message on the high speed CAN bus to the instrument cluster message center. On receipt of this, the message center will display the message 'CHECK PEDESTRIAN SYSTEM'.

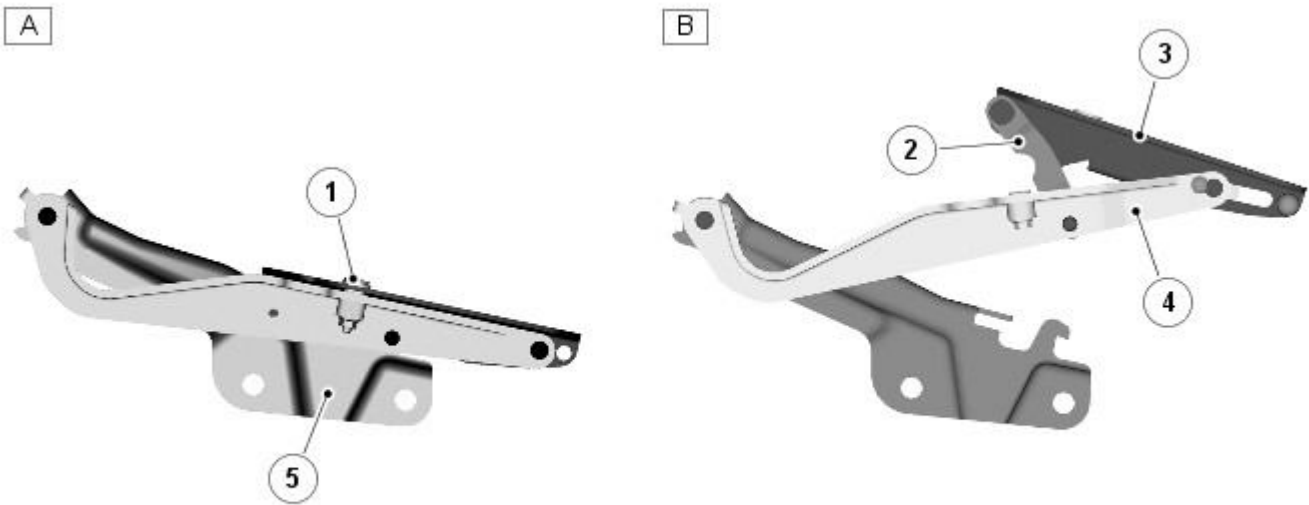
**CAUTION:** The vehicle must be left for 1 minute after disconnecting the battery before any work can be carried out on the pedestrian protection system.

The pedestrian protection system control module also stores the vehicle identification number (VIN). If a new control module is fitted to the vehicle the Jaguar approved diagnostic tool must be used to program the unit with the vehicles VIN.

When the vehicle is delivered from the factory the pedestrian protection system is in a 'safe' plant mode. Normal operating mode should be activated using the Jaguar approved diagnostic tool during the Pre-Delivery Inspection (PDI) prior to delivery to the customer. For additional information, refer to the PDI manual.

### Hood Hinges

- NOTE: **A** = Non-deployed hinge; **B** = Deployed hinge



E95115

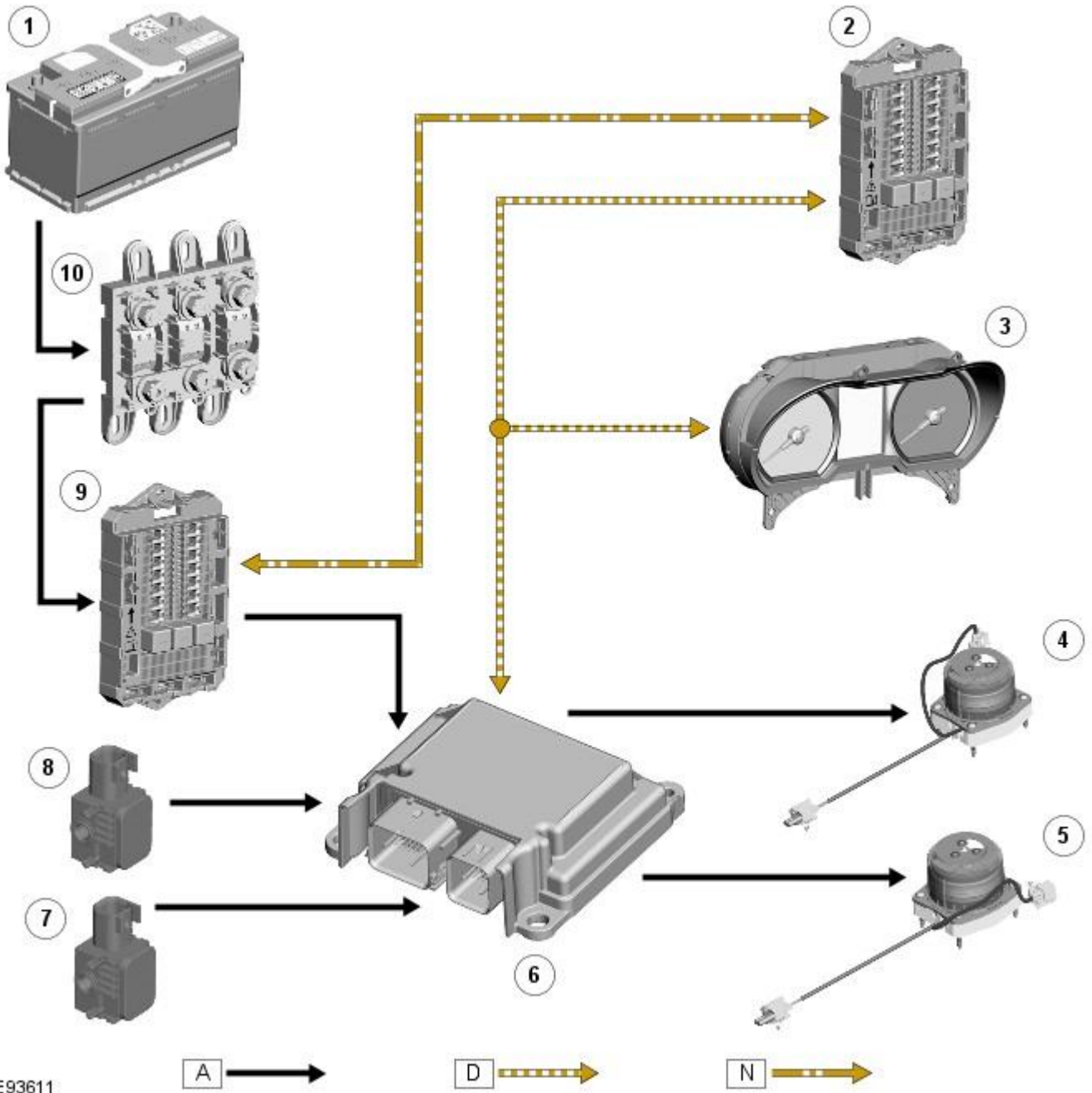
Item	Part Number	Description
1	-	Firing pin
2	-	Stabilizing link
3	-	Hood leaf
4	-	Intermediate leaf
5	-	Body leaf

The hinge system incorporates a number of leaves. This includes a leaf attached to the body, an intermediate leaf and a leaf attached to the hood. During normal operation the hinge opens and closes using the hood and intermediate leaves. These are attached together by a firing pin. When the actuators are fired the firing pins fail. This allows the hood and intermediate leaves to separate and deploy the hood upwards. When the hood deploys the hood latches act as temporary hinges.

- NOTE: The hinges deform during the deployment process and will need to be replaced.

### CONTROL DIAGRAM

- NOTE: **A** = Hardwired; **D** = High speed CAN bus; **N** = Medium speed CAN bus



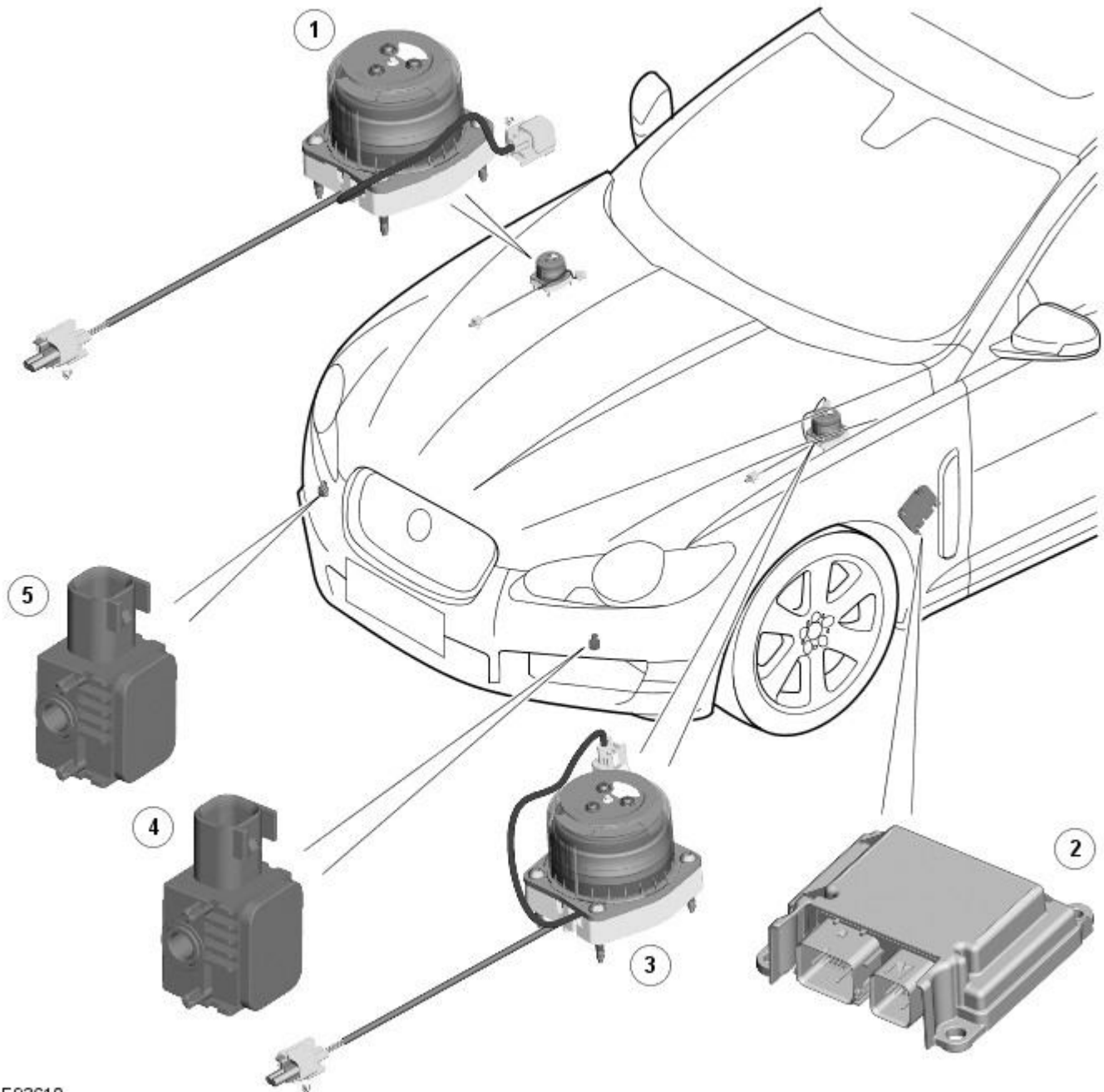
E93611

Item	Part Number	Description
1	-	Battery
2	-	central junction box (CJB)
3	-	Instrument cluster
4	-	LH hood actuator
5	-	RH hood actuator
6	-	Pedestrian protection system control module
7	-	RH accelerometer
8	-	LH accelerometer
9	-	RJB
10	-	battery junction box (BJB)



# Pedestrian Protection System - Pedestrian Protection System - Component Location

Description and Operation



E93610

## ItemDescription

1	<a href="#">RH (right-hand)</a> hood actuator
2	Pedestrian protection system control module
3	<a href="#">LH (left-hand)</a> hood actuator
4	<a href="#">LH</a> accelerometer
5	<a href="#">RH</a> accelerometer



# Pedestrian Protection System - Pedestrian Protection System - Overview

Description and Operation

## OVERVIEW



**WARNING:** All pyrotechnic devices are dangerous. Before performing any procedures on any pyrotechnic device, read all information contained within the [Standard Workshop Practices](#) section of this manual.  
Refer to: [Standard Workshop Practices](#) (100-00 General Information, Description and Operation).

The pedestrian protection system is designed to mitigate injuries in a pedestrian collision with the vehicle. It does this by utilizing a pair of pyrotechnic actuators to lift the hood away from the engine, creating a cushioned impact between the pedestrian and the vehicle.

The pedestrian protection system also includes passive protection integrated into the bumper system and bonnet structure.



**WARNING:** Do not fit any non-Jaguar approved accessories to the vehicle.

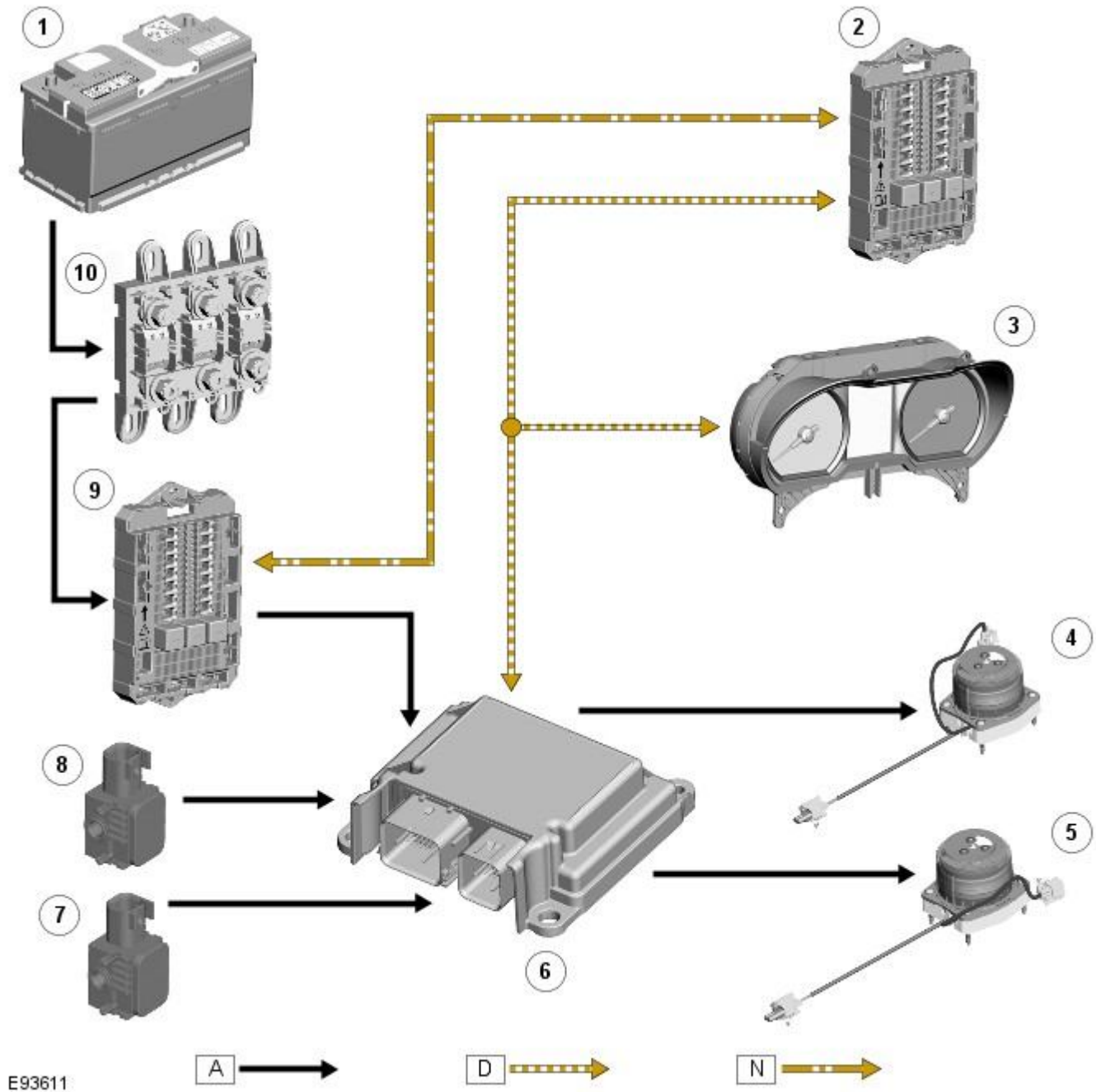
- **NOTE:** The pedestrian protection system operates independently from the [SRS \(supplemental restraint system\)](#).

# Pedestrian Protection System - Pedestrian Protection System - System Operation and Component Description

Description and Operation

## Control Diagram

- NOTE: A = Hardwired; D = High speed CAN (controller area network) bus; N = Medium speed CAN bus



E93611

### ItemDescription

1	Battery
2	CJB (central junction box)
3	Instrument cluster
4	LH (left-hand) hood actuator
5	RH (right-hand) hood actuator
6	Pedestrian protection system control module
7	RH accelerometer
8	LH accelerometer
9	RJB (rear junction box)
10	BJB (battery junction box)

## System Operation

The pedestrian protection system is operational when the vehicle is traveling at speeds between approximately 20 km/h (12.4 mph) and 45 km/h (28 mph). A vehicle speed signal is received by the pedestrian protection system control module over the high speed [CAN](#) bus.

The system is able to determine if contact is made with a pedestrian or another object, such as a traffic cone, using signals from accelerometers mounted behind the front bumper. When the system determines contact is made with a pedestrian it fires the actuators to lift the rear of the hood approximately 130 mm within 35 ms of the 'fire' signal.

When an impact condition is registered, the pedestrian protection system control module outputs an impact signal on the high speed [CAN](#) bus. This signal is used by the [RJB](#) to initiate the hazard warning lamps. If this occurs, the hazard warning lamp switch is disabled for the remainder of the current ignition cycle.

If the pedestrian protection system control module detects a fault with the system, it outputs a message on the high speed [CAN](#) bus to the instrument cluster message center. On receipt of this, the message center will display the message 'CHECK PEDESTRIAN SYSTEM'.

The pedestrian protection system control module also stores the [VIN \(vehicle identification number\)](#). If a new control module is fitted to the vehicle the Jaguar approved diagnostic tool must be used to program the unit with the vehicles [VIN](#).

When the vehicle is delivered from the factory the pedestrian protection system is in a 'safe' plant mode. Normal operating mode should be activated using the Jaguar approved diagnostic tool during the Pre-Delivery Inspection (PDI) prior to delivery to the customer. For additional information, refer to the PDI manual.

If any damage is caused to the front of the vehicle, be it cosmetic or structural, repairs must be carried out in line with the processes contained in the workshop manual. Failure to carry out the correct repair process could compromise operation of the pedestrian protection system. Refer to GTR for the latest information.

The vehicle must be left for 1 minute after disconnecting the battery before any work can be carried out on the pedestrian protection system.

### Failure Mode Detection

In service, if any fault is detected, or any part of the system is recognized as not being present, the message center displays the warning 'Check Pedestrian System'.

The bonnet deployment actuators are non-serviceable components, and if they must be replaced due to a fault, or due to having been deployed, or following any other accident, their barcode labels must be read and recorded in the service database against the vehicle VIN for security purposes.

After deployment of the pedestrian protection system, the vehicle must be stopped as soon as it is safe to do so. The hazard warning lamps will be activated and can only be switched off by pressing the engine START/STOP button to turn the engine off and on again. A warning message 'CHECK PEDESTRIAN SYSTEM' will appear on the message center and the vehicle should be transported to the nearest dealer/authorised repairer. The vehicle must not be driven when the bonnet has been deployed.

• **NOTE:** If the warning message 'CHECK PEDESTRIAN SYSTEM' appears in the message center when the bonnet has not been deployed, the vehicle should be taken to the nearest dealer/authorised repairer immediately. It can be driven.

If any significant damage occurs to the front bumper it should be inspected by a dealer/authorised repairer as soon as possible.

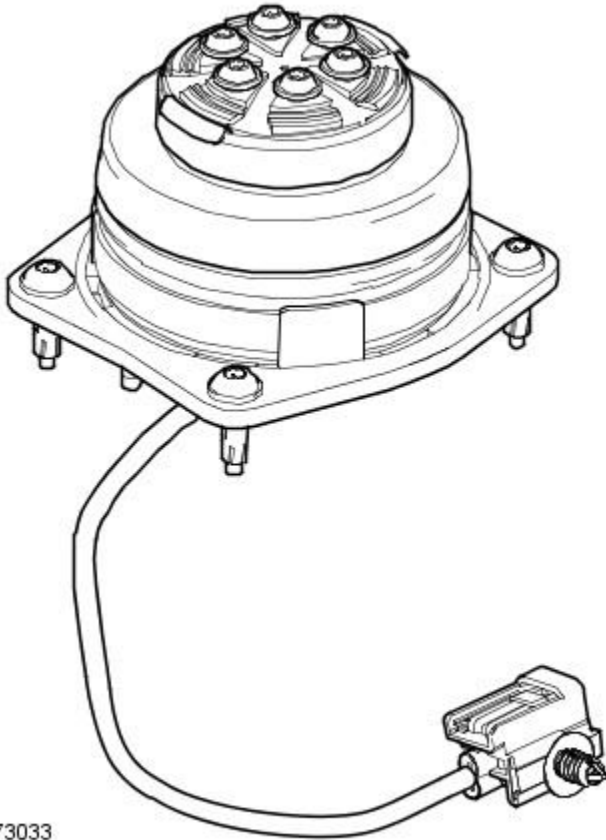
## Component Description

### CONTROL MODULE

The control module is mounted below the hood release lever behind the side trim in the left hand front footwell.

The deployment signal is received from the pedestrian protection system control module. The second-generation system adopted for XF is all-new to Jaguar and, although similar, differs from that introduced on XK by having an accelerometer-based sensing system rather than a contact-sensing system. The accelerometer-based system is supplied by Bosch. Mounted very close to the skin of the bumper, it examines the characteristics of vibration waves caused by impact. Its response time is quicker, because it does not rely on the front of the bumper being loaded. It uses the 'saved' time to make more complex decisions, and so has fewer error states. The speed of vehicle and the length of the bonnet define the time available to get the bonnet into its deployed and stabilized position. It is possible, therefore, to create a time-line counting back from the predicted moment of head impact to the time when the deployment signals need to be sent. That in turn defines a time from first contact to decision time.

### HOOD ACTUATORS



E73033

The hood actuators are pyrotechnic air bags. The hood actuators are located just forward of the hood latches on either side of the hood. The actuators comprise a pyrotechnic device to raise the hood, a secondary hood latch mechanism and a tether sleeve. Once fired a locking device mounted on top of the actuator couples with the secondary hood latch before the airbag inflates to raise the hood. This ensures that the hood can only deploy to a pre-determined height (approximately 130 mm). As the hood actuator is fired two prongs located in the secondary latch housing are moved out of their retaining clamp. The prongs are spring loaded to grip the secondary hood latch striker securing it to the actuator tether cone. Hood Actuator and Secondary Latch.

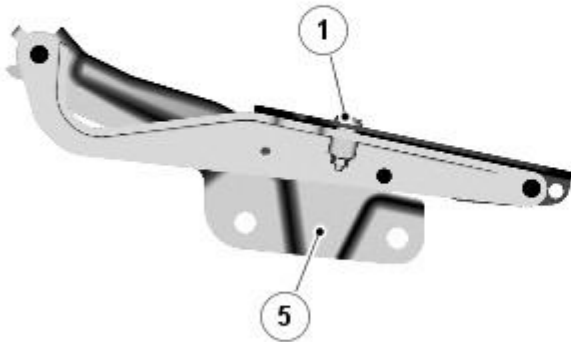
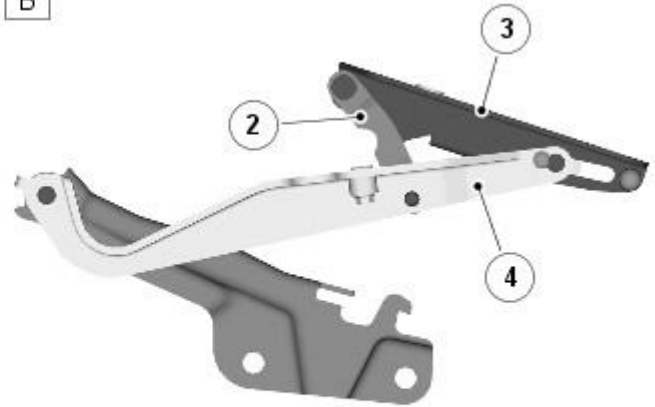
They are mounted to brackets in the secondary bulkhead and interface to reinforced areas on the lower surface of the bonnet.

### **Engine Compartment Lid**

The two-piece engine compartment lid is in aluminum and the inner panel has a hexagonal panel structure, which allows energy from a pedestrian head impact to be absorbed effectively across the full area of the bonnet. It also has sufficient strength in the rear cross-beam to accept the forces from the actuators and maintain a stable condition.

When deployed, front bonnet latch acts as the pivot point and the rear hinges allow a controlled degree of upward movement before retaining the bonnet at the end of its deployment, thus limiting its total upward travel and stabilizing its position.

- NOTE: A = Non-deployed hinge; B = Deployed hinge

**A****B**

E95115

**ItemDescription**

1	Firing pin
2	Stabilizing link
3	Engine compartment lid leaf
4	Intermediate leaf
5	Body leaf

The hinge system incorporates a number of leaves. This includes a leaf attached to the body, an intermediate leaf and a leaf attached to the hood. During normal operation the hinge opens and closes using the hood and intermediate leaves. These are attached together by a firing pin. When the actuators are fired the firing pins fail. This allows the hood and intermediate leaves to separate and deploy the hood upwards. When the hood deploys the hood latches act as temporary hinges.

- **NOTE:** The hinges deform during the deployment process and will need to be replaced.

# Pedestrian Protection System - Pedestrian Protection System

Diagnosis and Testing

## Principles of Operation

For a detailed description of the pedestrian protection system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (501-20C Pedestrian Protection System)

[Pedestrian Protection System](#) (Description and Operation),  
[Pedestrian Protection System](#) (Description and Operation),  
[Pedestrian Protection System](#) (Description and Operation).

## Inspection and Verification



**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. 1. Verify the customer concern.
2. 2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Damaged, loose, or missing fixings or components</li> </ul>	<ul style="list-style-type: none"> <li>● Ensure dummy electrical connector is installed to the Pedestrian Protection module</li> <li>● Blown fuse(s)</li> <li>● Damaged, loose or corroded connectors</li> <li>● Wiring harness</li> <li>● Damaged Pedestrian Protection module</li> </ul>

3. 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. 4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

## DTC Index

### • CAUTIONS:



Prior to carrying out any pinpoint tests on the pedestrian protection system the back-up power supply must be depleted. Disconnect the battery and wait two minutes for the back-up power supply to deplete.



When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B100111	Right Hood Deployment Control	<ul style="list-style-type: none"> <li>● Right hood deployment control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test right hood deployment control circuit for short to ground
B100112	Right Hood Deployment Control	<ul style="list-style-type: none"> <li>● Right hood deployment control circuit - short to power</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test right hood deployment control circuit for short to power



DTC	Description	Possible Cause	Action
B100119	Right Hood Deployment Control	<ul style="list-style-type: none"> <li>Right hood deployment control circuit - circuit current above threshold</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test right hood deployment control circuit for cross-coupling with another deployable device
B10011A	Right Hood Deployment Control	<ul style="list-style-type: none"> <li>Right hood deployment control circuit - circuit resistance below threshold</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test right hood deployment control circuit for short between both lines
B10011B	Right Hood Deployment Control	<ul style="list-style-type: none"> <li>Right hood deployment control circuit - circuit resistance above threshold</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test right hood deployment control circuit for open circuit
B100195	Right Hood Deployment Control	<ul style="list-style-type: none"> <li>Incorrect assembly</li> </ul>	Re-configure the pedestrian protection system module using the manufacturer approved diagnostic system
B100311	Left Hood Deployment Control	<ul style="list-style-type: none"> <li>Left hood deployment control circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test left hood deployment control circuit for short to ground
B100312	Left Hood Deployment Control	<ul style="list-style-type: none"> <li>Left hood deployment control circuit - short to power</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test left hood deployment control circuit for short to power
B100319	Left Hood Deployment Control	<ul style="list-style-type: none"> <li>Left hood deployment control circuit - circuit current above threshold</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test left hood deployment control circuit for cross-coupling with another deployable device
B10031A	Left Hood Deployment Control	<ul style="list-style-type: none"> <li>Left hood deployment control circuit - circuit resistance below threshold</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test left hood deployment control circuit for short between both lines
B10031B	Left Hood Deployment Control	<ul style="list-style-type: none"> <li>Left hood deployment control circuit - circuit resistance above threshold</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test left hood deployment control circuit for open circuit
B100395	Left Hood Deployment Control	<ul style="list-style-type: none"> <li>Incorrect assembly</li> </ul>	Re-configure the pedestrian protection system module using the manufacturer approved diagnostic system
B100411	Right Frontal Impact Classification Sensor	<ul style="list-style-type: none"> <li>Right frontal impact classification sensor circuit - short to ground</li> </ul>	Refer to electrical circuit diagrams and test right frontal impact classification sensor circuit for short to ground
B100412	Right Frontal Impact Classification Sensor	<ul style="list-style-type: none"> <li>Right frontal impact classification sensor circuit - short to power</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and test right frontal impact classification sensor circuit for short to power
B100419	Right Frontal Impact Classification Sensor	<ul style="list-style-type: none"> <li>Right frontal impact classification sensor circuit - circuit current above threshold</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test right frontal impact classification sensor circuit for cross-coupling with another sensor
B10044A	Right Frontal Impact Classification Sensor	<ul style="list-style-type: none"> <li>Incorrect component installed</li> </ul>	Install the correct right frontal impact classification sensor
B100487	Right Frontal Impact Classification Sensor	<ul style="list-style-type: none"> <li>Missing message</li> </ul>	Refer to the electrical circuit diagrams and test the right frontal impact classification sensor circuit for open circuit of at least one line or sensor disconnected
B100495	Right Frontal Impact Classification Sensor	<ul style="list-style-type: none"> <li>Incorrect assembly</li> </ul>	Re-configure the pedestrian protection system module using the manufacturer approved diagnostic system
B100496	Right Frontal Impact Classification Sensor	<ul style="list-style-type: none"> <li>Component internal failure</li> </ul>	Install a new right frontal impact classification sensor
B100511	Left Frontal Impact Classification Sensor	<ul style="list-style-type: none"> <li>Left frontal impact classification sensor circuit - short to ground</li> </ul>	Refer to the electrical circuit diagrams and test left frontal impact classification sensor circuit for short to ground
B100512	Left Frontal Impact Classification Sensor	<ul style="list-style-type: none"> <li>Left frontal impact classification sensor circuit - short to power</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test left frontal impact classification sensor circuit for short to power
B100519	Left Frontal Impact Classification Sensor	<ul style="list-style-type: none"> <li>Left frontal impact classification sensor circuit - circuit current above threshold</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test left frontal impact classification sensor circuit for cross-coupling with another sensor

DTC	Description	Possible Cause	Action
B10054A	Left Frontal Impact Classification Sensor	<ul style="list-style-type: none"> <li>Incorrect component installed</li> </ul>	Install the correct left frontal impact classification sensor
B100587	Left Frontal Impact Classification Sensor	<ul style="list-style-type: none"> <li>Missing message</li> </ul>	Refer to the electrical circuit diagrams and test the left frontal impact classification sensor circuit for open circuit of at least one line or sensor disconnected
B100595	Left Frontal Impact Classification Sensor	<ul style="list-style-type: none"> <li>Incorrect assembly</li> </ul>	Re-configure the pedestrian protection system module using the manufacturer approved diagnostic system
B100596	Left Frontal Impact Classification Sensor	<ul style="list-style-type: none"> <li>Component internal failure</li> </ul>	Install a new left frontal impact classification sensor
B119368	Crash Event Storage Full and Locked	<ul style="list-style-type: none"> <li>Event information - module crash recorder has stored 3 (or more) deployment events</li> </ul>	Install a new module, refer to the new module/component installation note at the top of the DTC Index
B11D868	Restraint Event Notification	<ul style="list-style-type: none"> <li>Event information - Left and right hood deployed</li> </ul>	System has deployed, install a new module, refer to the new module/component installation note at the top of the DTC Index
B11F468	Minor Impact Counter Exceeded	<ul style="list-style-type: none"> <li>Event information - near-crash counter has reached maximum (254 events)</li> </ul>	Install a new module, refer to the new module/component installation note at the top of the DTC Index
B120D66	Frontal Damage Check Required	<ul style="list-style-type: none"> <li>signal has too many transitions/events</li> </ul>	Check front of vehicle for crash damage and re-set near crash counter using manufacturer approved diagnostic system via set-up applications
P007129	Ambient Air Temperature Sensor Range/Performance	<ul style="list-style-type: none"> <li>Signal invalid - ambient air temperature over CAN has invalid value</li> </ul>	Check ECM for related DTCs and refer to the relevant DTC Index
P193429	Vehicle Speed Signal	<ul style="list-style-type: none"> <li>Signal invalid - vehicle speed over CAN has invalid value</li> </ul>	Check ABS module for related DTCs and refer to the relevant DTC Index
U000188	High Speed CAN Communication Bus	<ul style="list-style-type: none"> <li>Bus off</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U010000	Lost Communication With ECM/PCM "A"	<ul style="list-style-type: none"> <li>Missing CAN-temperature signal (from Petrol Engine Control Module, ECM)</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check ECM for related DTCs and refer to relevant DTC Index
U012100	Lost Communication With Anti-Lock Brake System (ABS) Control Module	<ul style="list-style-type: none"> <li>Missing CAN-speed signal (from DSC/Traction control module)</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check ABS module for related DTCs and refer to the relevant DTC Index
U014200	Lost Communication With Body Control Module "B"	<ul style="list-style-type: none"> <li>Missing CAN-signal master config id from RJB (signal is not on CAN bus)</li> </ul>	Check RJB for related DTCs and refer to the relevant DTC Index
U015500	Lost Communication With Instrument Panel Cluster (IPC) Control Module	<ul style="list-style-type: none"> <li>Missing CAN-signal from instrument cluster: Vehicle Info Parameters</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check instrument cluster for related DTCs and refer to the relevant DTC Index
U030000	Internal Control Module Software Incompatibility	<ul style="list-style-type: none"> <li>Incorrect or non Masterconfig ID received, ECU is in expulsion state</li> </ul>	Check RJB for related DTCs and refer to the relevant DTC Index
U210000	Initial Configuration Not Complete	<ul style="list-style-type: none"> <li>Module is in plant mode</li> </ul>	Set pedestrian protection system module into customer mode using the manufacturer approved diagnostic system
U21014A	Control Module Configuration Incompatible	<ul style="list-style-type: none"> <li>Incorrect component installed - invalid VIN received (federal market)</li> </ul>	Remove pedestrian protection system module from federal specification vehicle
U300049	Control Module	<ul style="list-style-type: none"> <li>Internal electronic failure</li> </ul>	Install a new module, refer to the new module/component installation note at the top of the DTC Index
U300281	Vehicle Identification Number	<ul style="list-style-type: none"> <li>Invalid serial data received - mis-match between stored VIN (ECU) and broadcasted VIN (from RJB)</li> </ul>	If new pedestrian protection system module has been installed, run the new module application using the manufacturer approved diagnostic system. If new pedestrian protection system module has NOT been installed, suspect pedestrian protection system module previously installed to other vehicle. Check and install correct/new module as required, refer to the new module/component installation note at the top of the DTC Index
U300316	Battery Voltage	<ul style="list-style-type: none"> <li>Circuit voltage below threshold</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300317	Battery Voltage	<ul style="list-style-type: none"> <li>Circuit voltage above threshold</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
U300362	Battery Voltage	<ul style="list-style-type: none"> <li>● Mis-match in battery voltage, of 2 volts or more, between pedestrian protection system module and RJB</li> </ul>	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300813	Control Module Ground "A"	<ul style="list-style-type: none"> <li>● Poor ground connection to module casing</li> </ul>	Refer to the electrical circuit diagrams and check module case grounds for open circuit, high resistance

# Pedestrian Protection System - Pedestrian Impact Sensor

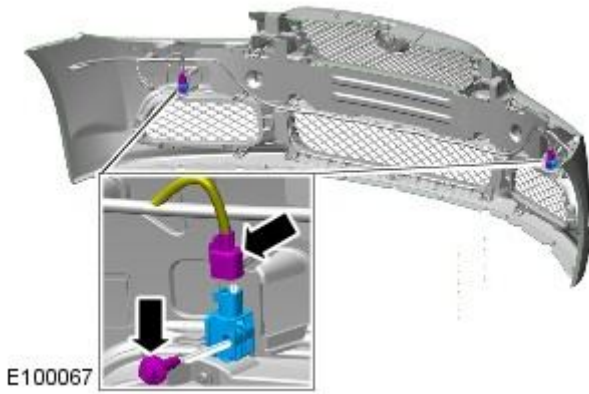
Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Front Bumper Cover](#) (501-19 Bumpers, Removal and Installation).

2. Torque: 3 Nm



## Installation

1. To install, reverse the removal procedure.

# Pedestrian Protection System - Pedestrian Protection Hood Actuator LH

Removal and Installation

## Removal

- NOTE: Removal steps in this procedure may contain installation details.

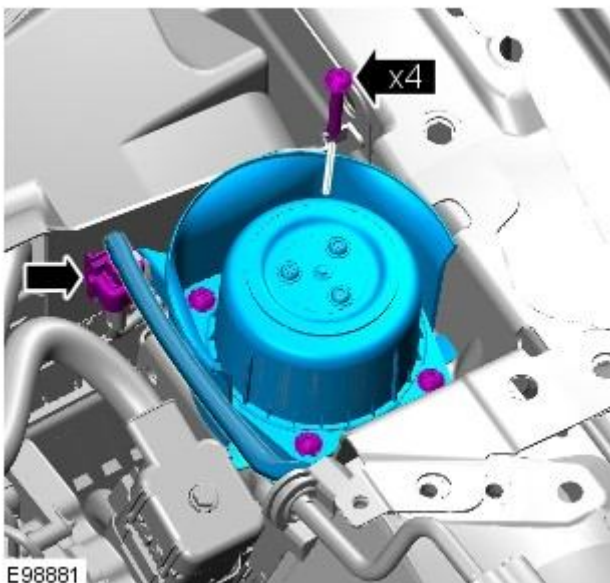
1. Disconnect the battery ground cable.

Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2. Remove the cowl vent screen.

Refer to: [Cowl Vent Screen](#) (501-02 Front End Body Panels, Removal and Installation).

3. Torque: 8 Nm



## Installation

1. Install is the reverse of removal.

# Pedestrian Protection System - Pedestrian Protection Hood Actuator RH

Removal and Installation

## Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

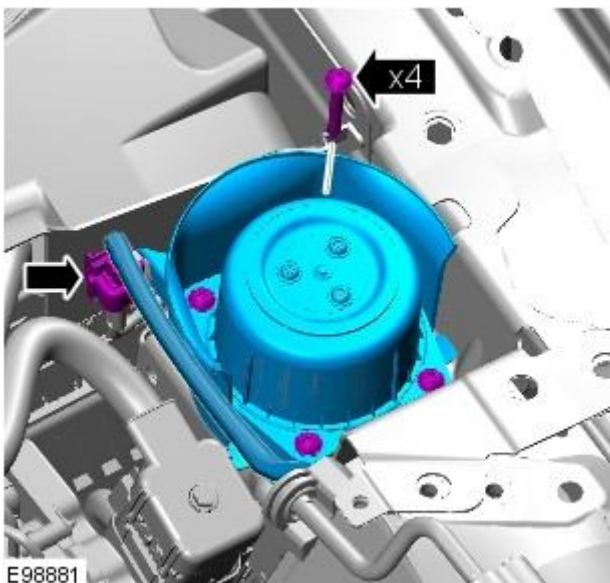
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2. Remove the cowl vent screen.

Refer to: [Cowl Vent Screen](#) (501-02 Front End Body Panels, Removal and Installation).

3. **3.** NOTE: Left-hand shown, right-hand similar.

*Torque: 8 Nm*



## Installation

1. Install is the reverse of removal.



# Pedestrian Protection System - Pedestrian Protection Module

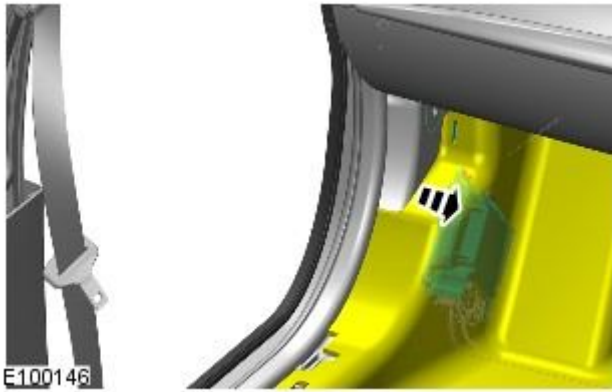
## Removal and Installation

### Removal

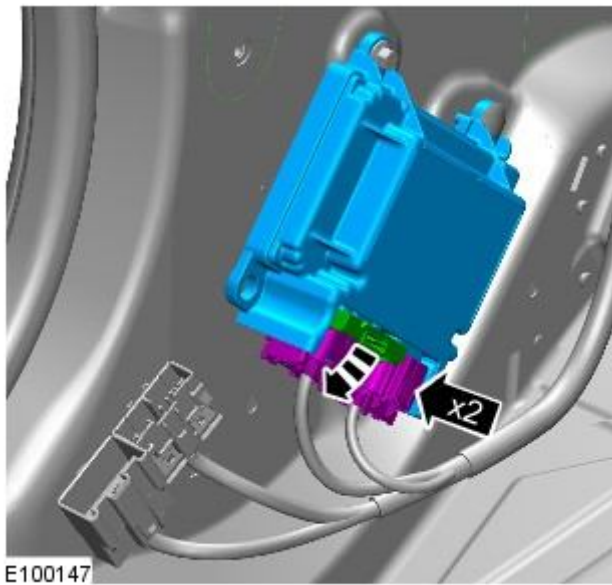
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

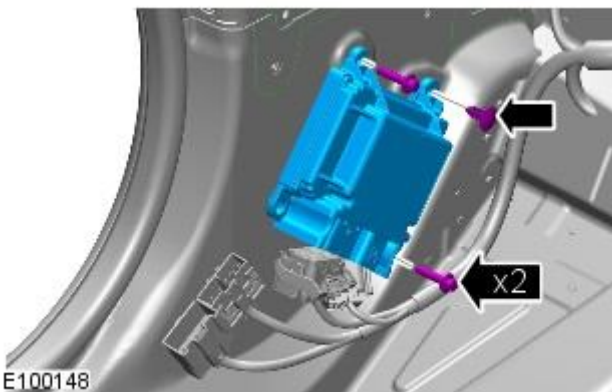
2.



3.



4. Torque: 10 Nm



### Installation

1. To install, reverse the removal procedure.

# Body Repairs - General Information - Body Repairs

Description and Operation

## General Information

### Introduction

The body plays a significant role in the increasing trend of ever more rapidly changing model variants. The different customer groups are strongly influenced by the design and shape of the body. At the same time the stability of the body plays the most important part in ensuring passenger and driver safety. Lightweight construction, alternative materials, composite materials, plastics and appropriate joining processes are all design features that characterise modern Jaguar vehicle bodies.

In terms of manufacturing technology, modern safety cell bodies can be produced almost without any problems. Jaguar guarantee high quality standards by ensuring that mechanical strength properties are tried and tested in numerous computer simulations, crash tests, by testing materials and by employing sophisticated manufacturing technologies. In the event of repairs it is vital that the production quality standards are upheld. This requires a well-equipped workshop, and places particular emphasis on the qualifications of the workshop technicians. Up-to-date knowledge of current manufacturing technologies and continuous training on new repair methods and techniques are vital for high-quality body repairs. The model-specific repair manuals and the general repair techniques provide valuable support when undertaking body repairs.

Always follow the repair instructions published in this manual. Failure to observe this instruction can result in serious impairment of vehicle safety. All specified safety requirements must be met after the work has been carried out.

### Vehicle design

#### The body

The XF adopts the latest generation steels, especially in the upper body – including high carbon steels, dual-phase, hot-formed boron steels, and bake-hardened steels to form a vertical safety ‘ring’ around the occupant cell. As well as combining strength with lightness, these steels improve corrosion resistance, by making best use of zinc and improving e-coat paint flow – and new thinking means that in spite of their strength, the XF’s A and B-pillars are impressively slim, to the benefit of both visibility and accessibility. Similarly, the lower sills are the first component on any Jaguar to use incredibly strong, dual-phase DP600 steel.

The safety of the driver and the passengers is paramount for every body design. There are two key safety aspects in the body:

- Safety passenger cell
- Crumple zones

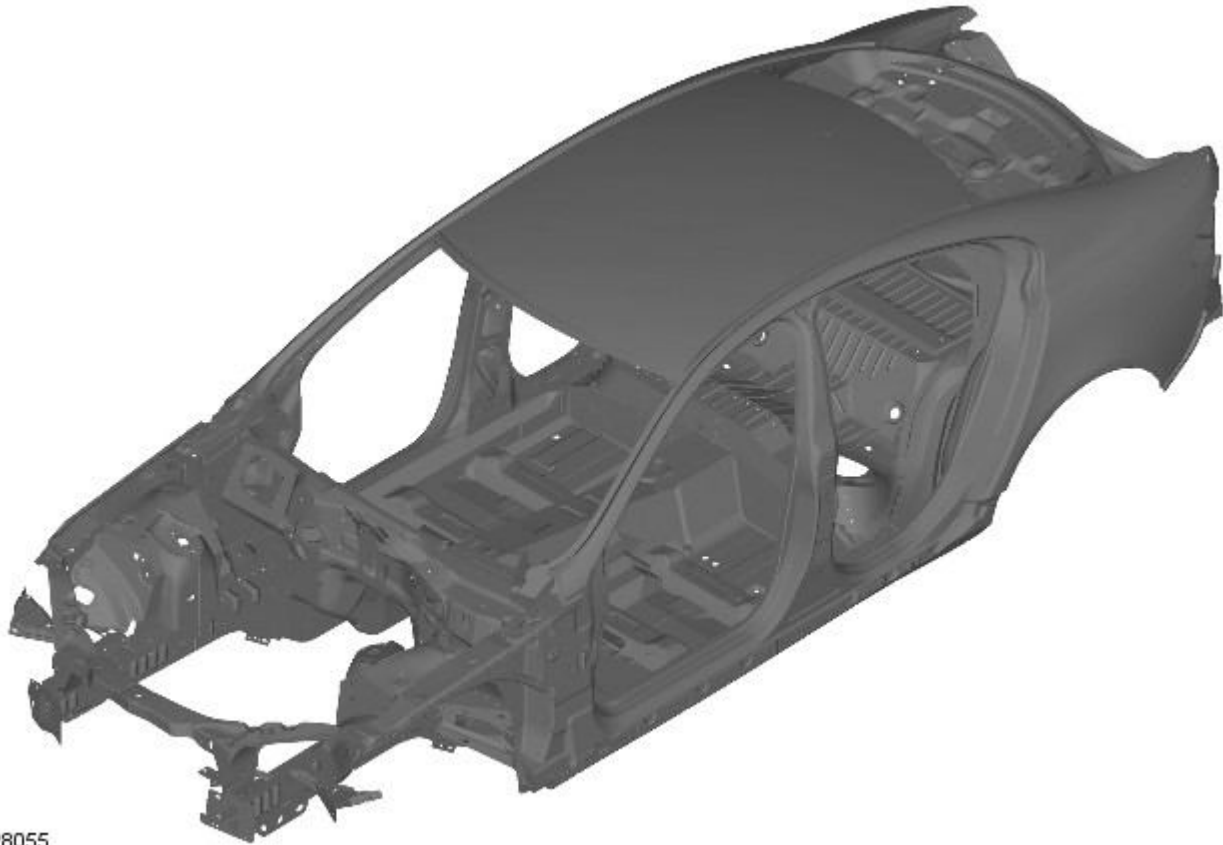
Safety passenger cell

- Stable pillars, rocker panel and door profiles.
- Side impact protection in the doors.
- Doors are designed to open even in the event of extreme deformation.

Crumple zone

- Dynamic absorption of deforming forces.
- Protection of the passenger cell.

### Vehicle Design



E128055

Item	Part Number	Description
1		Bodyshell

### High Strength Steels

Most modern vehicles are constructed from a number of different steels, partly to obtain an optimised body (collision, safety, rigidity, fuel economy, etc).

Steels are divided into several groups according to their tensile and yield strength, that is to say the force necessary to bring about plastic deformation of the material.

#### Yield Summary

Yield is the strength at which the metal changes from elastic to plastic in behaviour, the point of no return.

#### Tensile Summary

Tensile strength is the breaking strength of a material when subjected to a tensile (stretching) force, the point of no return.

Dual Phase (DP) steel falls into both the very high strength steel (VHSS) and extra high strength steel (EHSS) classifications, dependant on grade of DP.

Steel Type	Yield Strength
Mild steel (MS)	Maximum yield point up to 180 MPa
High strength steel (HSS)	Steel with a yield point up to 280 MPa
VHSS	Steel with a yield point up to 380 MPa
EHSS	Steel with a yield point up to 800 MPa
Ultra high strength steel (UHSS)	Steel with a yield point greater than 800 MPa

#### Welding Ultra High Strength Steel

UHSS requires welding equipment which can achieve the following equipment settings.

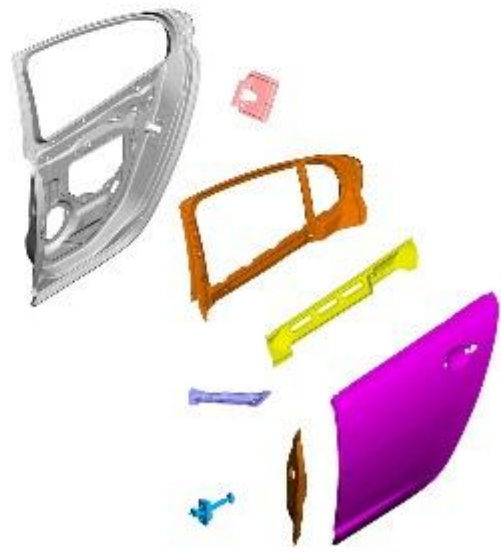
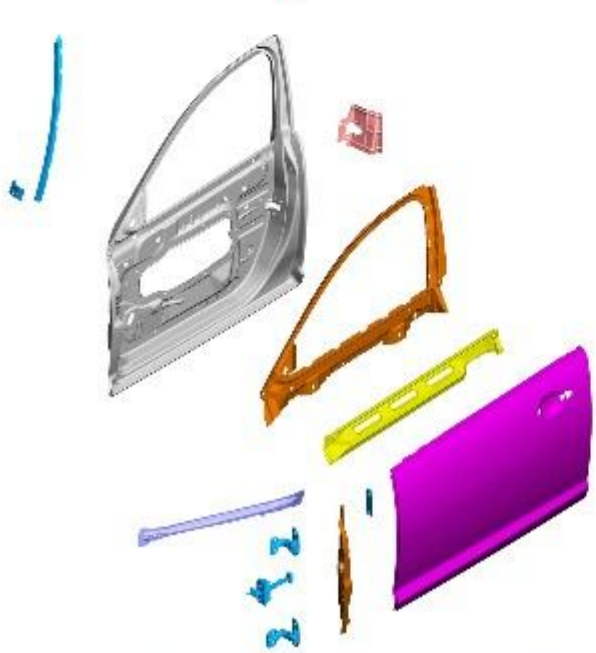
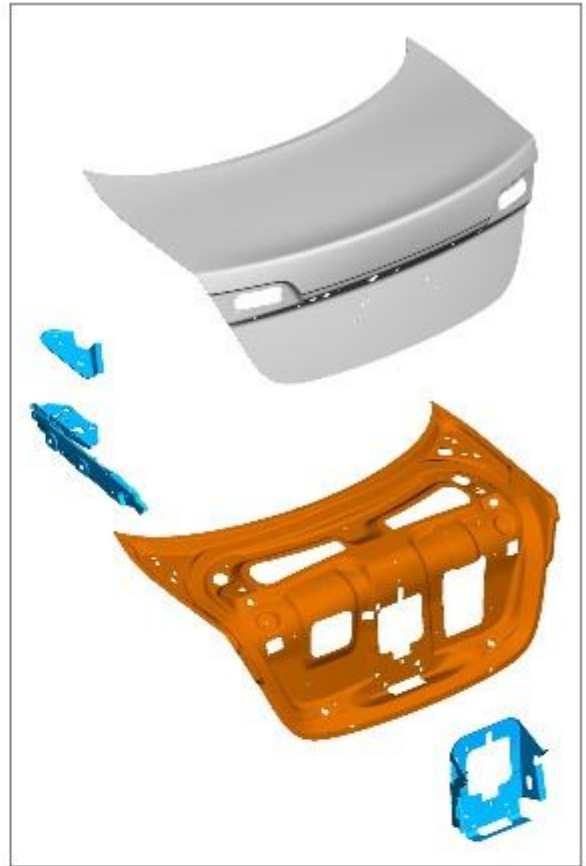
#### Spot Welding

Information to follow.

#### MIG Brazing

When mig-brazing use the following type of welder meeting the specifications shown: Fronius Trans Plus Synergic 2700 4 R/Z/AL MIG Welder, with CuSi3 (DIN 1733) 1.0mm filler wire with setting parameters 4, which is 92 Amps, Wire feed 4.6 m/min. Shielding gas L1 = pure Argon (DIN 439).

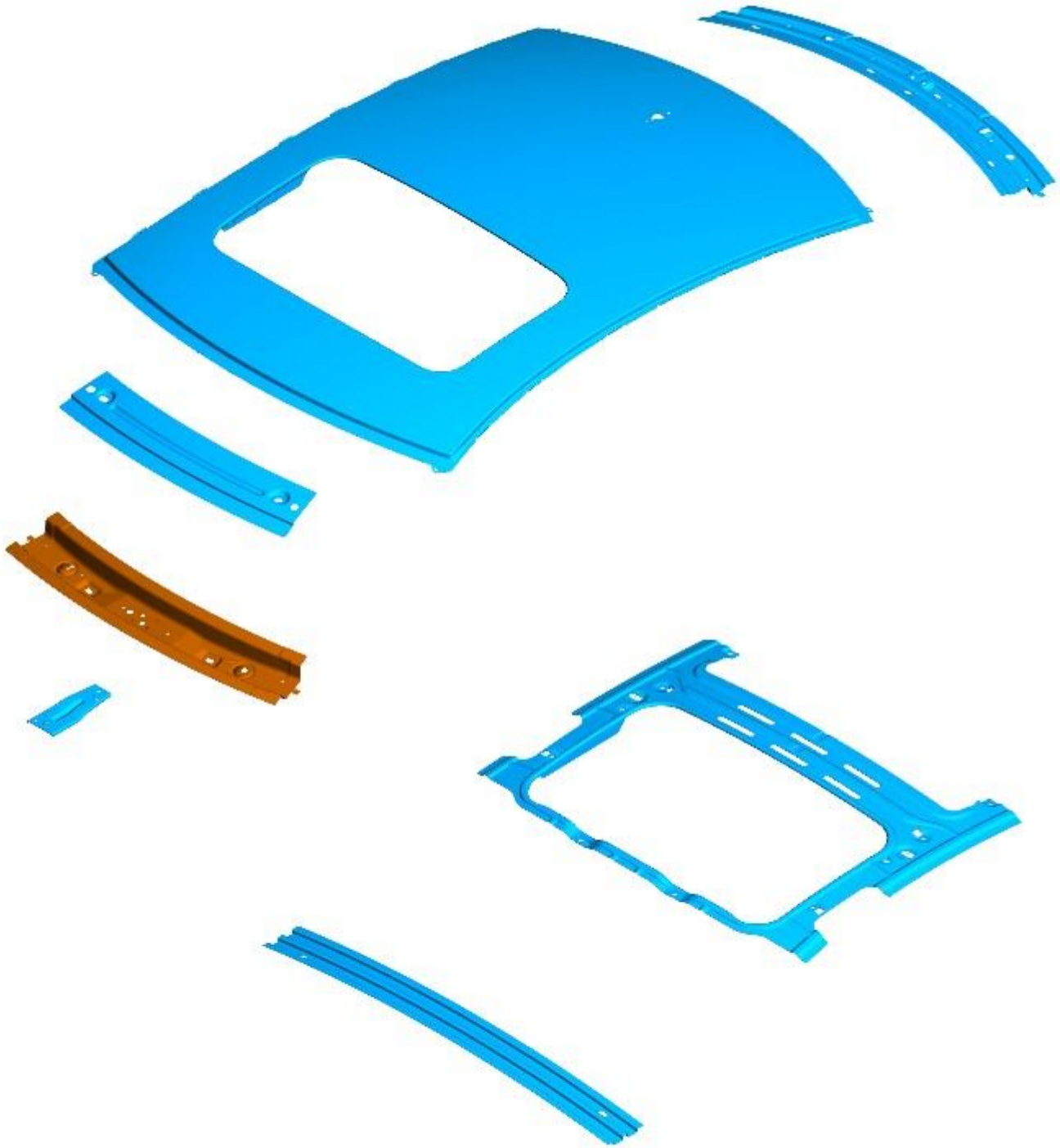
Steels used in body structure - Body closures



E128480      MS1+Z      MS2+Z      MS3+Z      MS4+Z      BH180+Z      BH220+Z  
 IF220+Z      BORON      5754NG+ALPT+ALS      S182+ALL      6111T4+ALL

Item	Type of Steel
MS1+Z	Mild steel with zinc
IF220+Z	Interstitial free steel - 220 MPa with zinc
MS2+Z	Mild steel with zinc
Boron	Boron steel
MS3+Z	Mild steel with zinc
5754NG+ALPT+ALS	5000 Series aluminium alloy
MS4+Z	Mild steel with zinc
S182+ALL	5000 Series aluminium alloy
BH180+Z	Bake hardened steel - 180 MPa with zinc
6111 T4+ALL	6000 Series aluminium alloy
BH220+Z	Bake hardened steel - 220 MPa with zinc

Steels used in body structure - Roof panels



MS1-4 BH300

E128477

Item	Type of Steel
MS1-4	Mild steel
BH300	Bake hardened steel - 300 MPa

Steels used in body structure - Front end panels





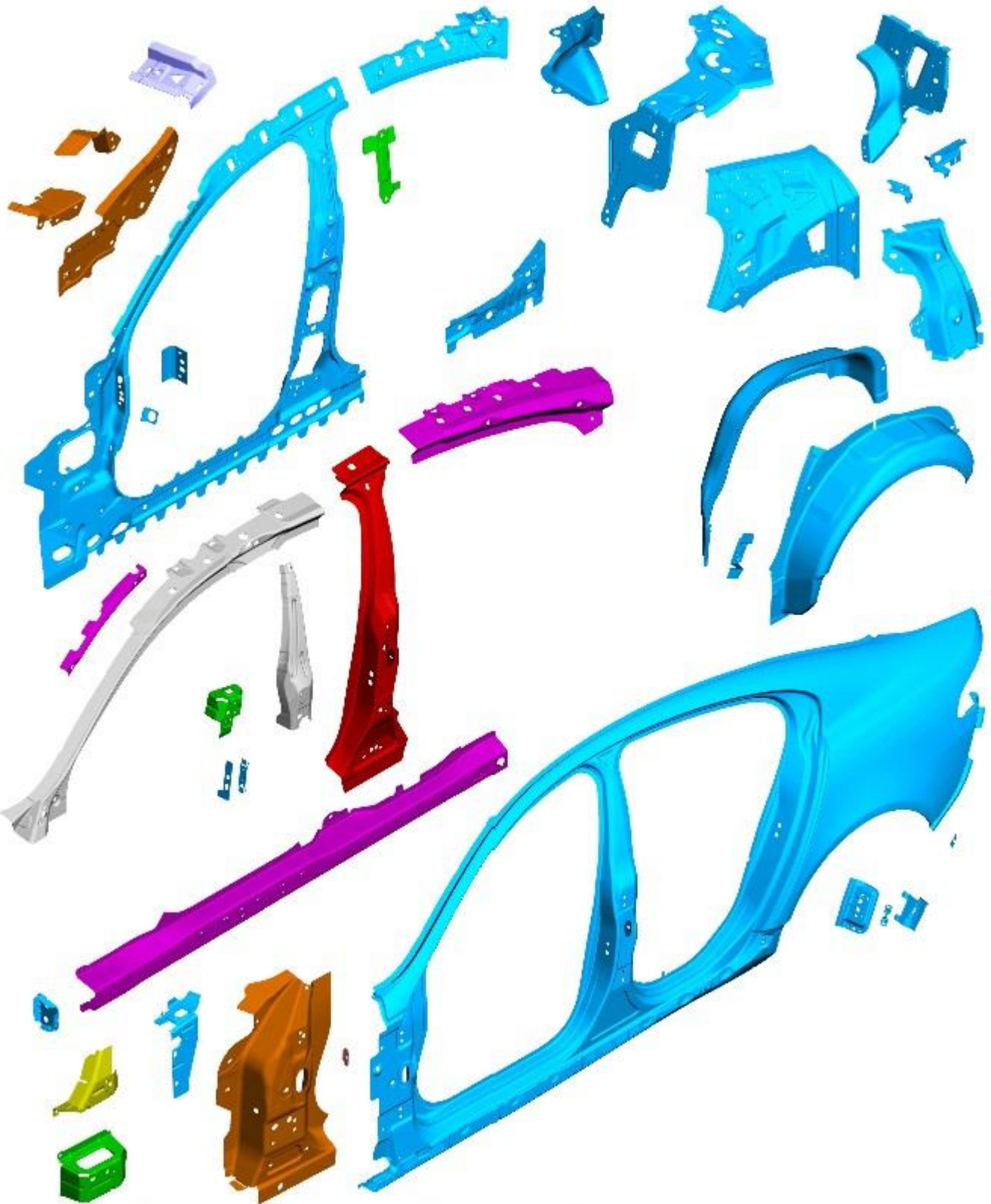
E128475

■ MS1+4    
 ■ HSLA340    
 ■ HSLA350    
 ■ HI ST BAR

Item	Type of Steel
MS1+4	Mild steel
HSLA340	High strength low alloy steel - 340 MPa
HSLA350	High strength low alloy steel - 350 MPa
HI ST BAR	High strength steel bar

Steels used in body structure - Side panels



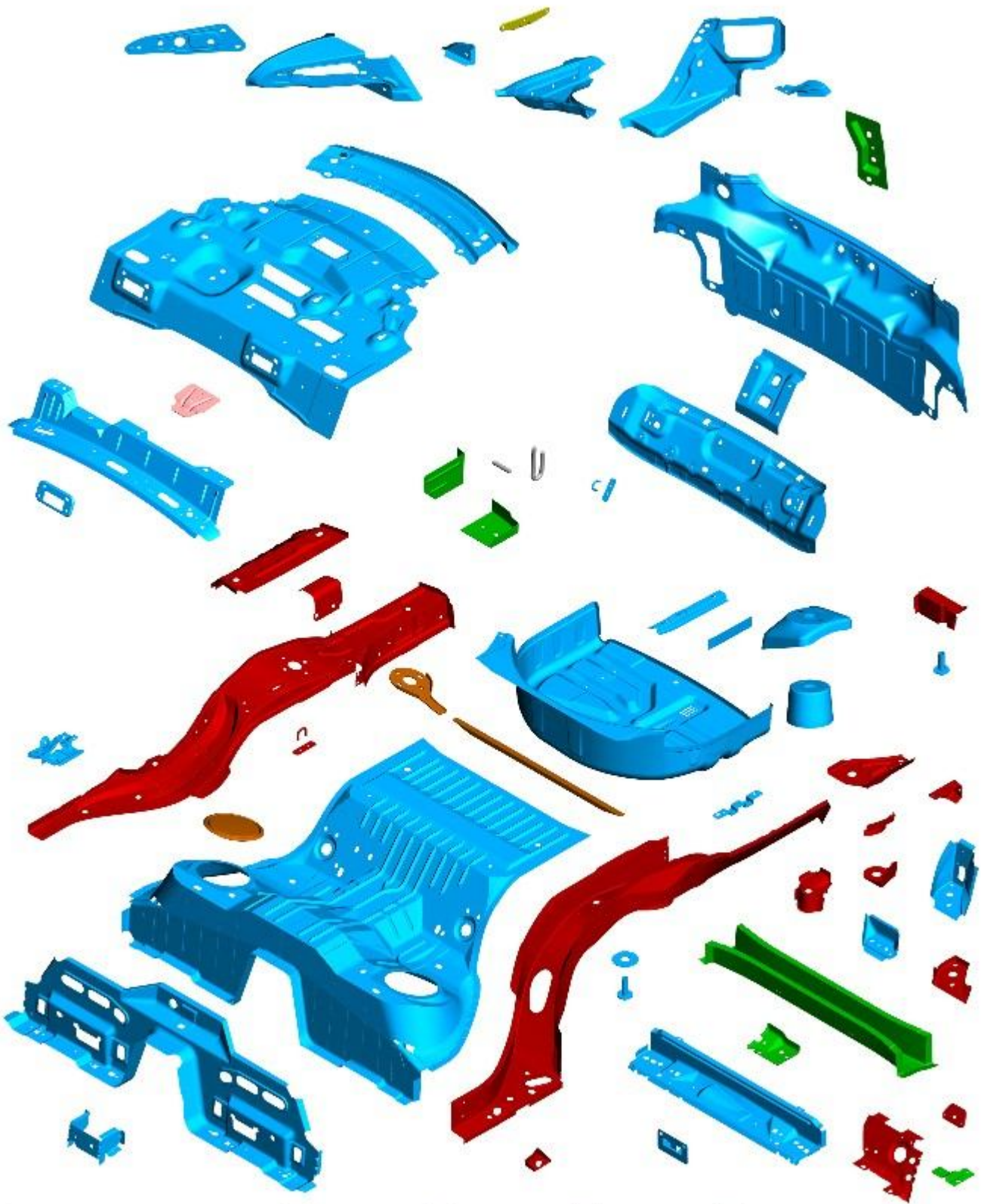


E128478

 MS1-4	 HSLA300	 HSLA340	 HSLA380	 BH220
 BH300	 DP450	 DP600	 BORON	

Item	Type of Steel
MS1-4	Mild steel
BH300	Bake hardened steel - 300 MPa
HSLA300	High strength low alloy steel - 300 MPa
DP450	Dual phase steel - 600 MPa
HSLA340	High strength low alloy steel - 340 MPa
DP600	Dual phase steel - 600 MPa
HSLA380	High strength low alloy steel - 380 MPa
Boron	Boron
BH220	Bake hardened steel - 220 MPa

Steels used in body structure - Rear end panels



E128479

 MS1-4	 HSLA300	 HSLA340	 HSLA350
 HSLA380	 HI ST BAR	 OTHER	

Item	Type of Steel
MS1-4	Mild steel
HSLA380	High strength low alloy steel - 380 MPa
HSLA300	High strength low alloy steel - 300 MPa
HI ST BAR	High strength steel bar
HSLA340	High strength low alloy steel - 340 MPa
Other	Other
HSLA350	High strength low alloy steel - 350 MPa

Steels used in body structure - Floor panels





E128476

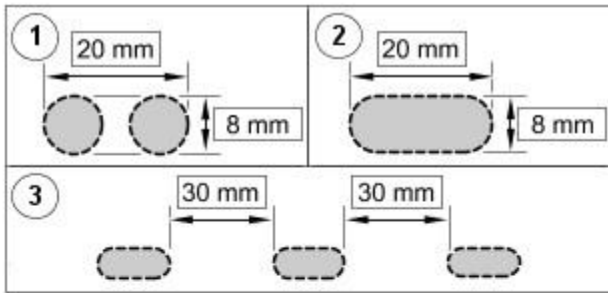
 MS1-4	 HSLA340	 HSLA350
 HSLA380	 BH260	 OTHER

Item	Type of Steel
MS1-4	Mild steel
HSLA380	High strength low alloy steel - 380 MPa
HSLA340	High strength low alloy steel - 340 MPa
BH260	Bake hardened steel - 260 MPa
HSLA350	High strength low alloy steel - 350 MPa
Other	Other

• NOTE: When installing the A-pillar outer panel, the rocker panel and B-pillar outer panel, or the roof panel, they must be slot brazed where they adjoin the A-pillar reinforcement upper.

• NOTE: The size of the slots are to be 20mm x 8mm and 30mm apart. Slots should be installed in accordance with this spacing. Where this is not possible, due to the indents in the panel, the slot should be made in the location of the original spot weld.

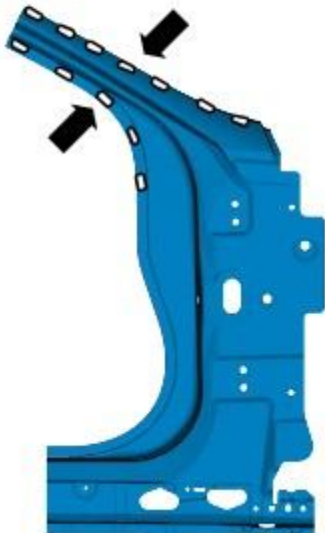
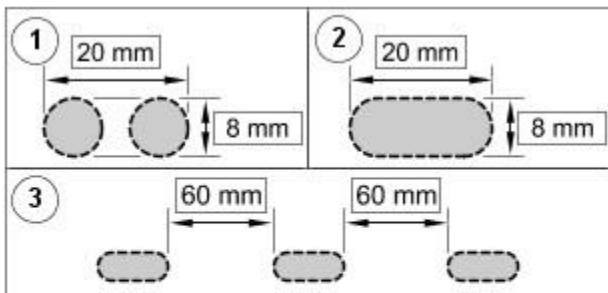
Rocker panel and b-pillar outer panel



E104791

Item	Description
1	Drill 2 x 8mm holes to form basis of slot
2	Mill out to form 20mm x 8mm slot
3	Slots spaced at 30mm intervals

A-pillar outer panel

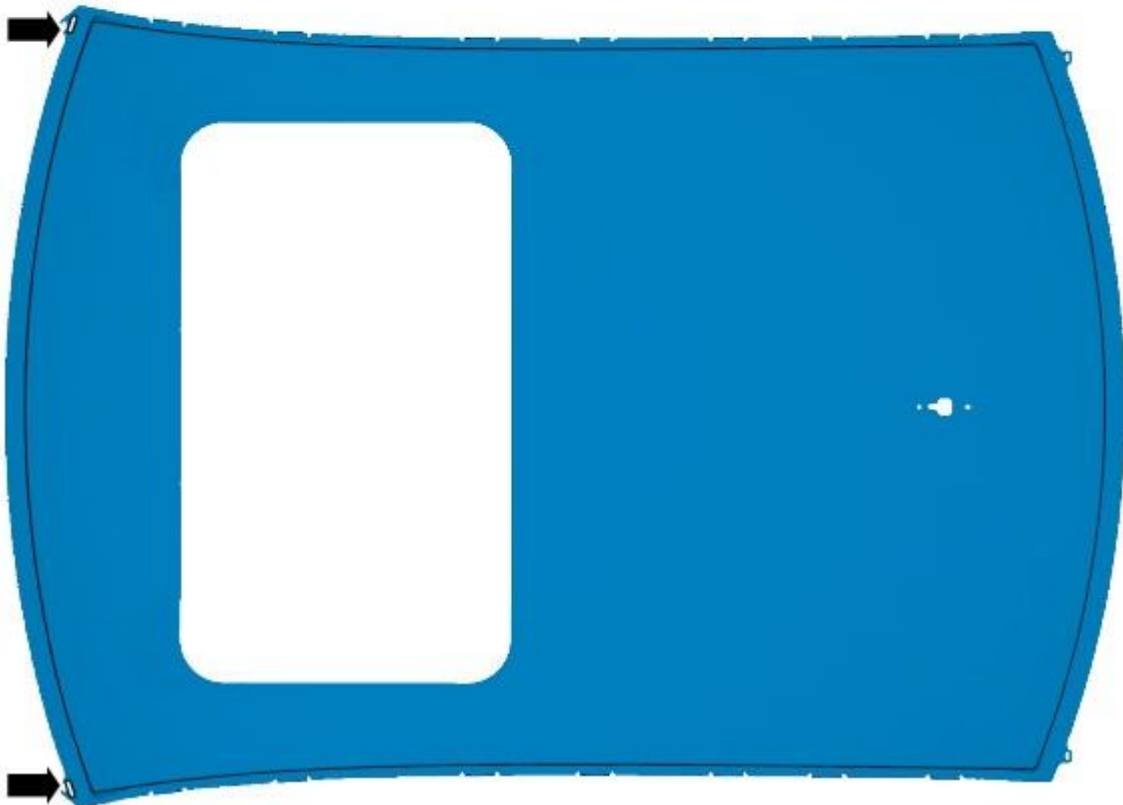
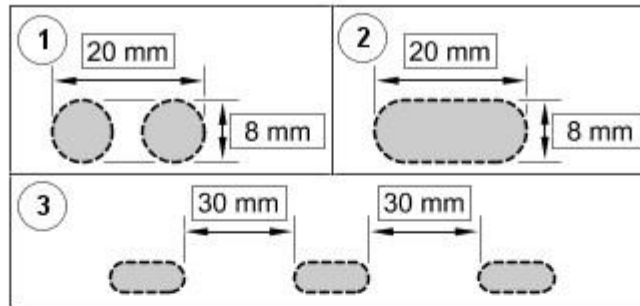


E108460

Item	Description
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Item	Description
1	Drill 2 x 8mm holes to form basis of slot
2	Mill out to form 20mm x 8mm slot
3	Slots spaced at 30mm intervals

Roof panel



E102826

Item	Description
1	Drill 2 x 8mm holes to form basis of slot
2	Mill out to form 20mm x 8mm slot
3	Slots spaced at 30mm intervals

• NOTE: Mig brazing is carried out at a temperature of 650°C to 950°C. To avoid degradation of the ultra high strength steel material properties, the temperature must be below 950°C.

Mig braze the slot(s) using a Fronius Trans Plus Synergic 2700 4 R/Z/AL MIG Welder, with CuSi3 (DIN 1733) 1.0mm filler wire with setting parameters 4, which is 92 Amps, Wire feed 4.6 m/min. Shielding gas L1 = pure Argon (DIN 439).

Dress the surface of the weld cap (brazed slot) with 60/80 grit belt sanders.

### Accident damage and diagnosis

General notes

- Exact diagnosis of the extent of the damage enables proper repair planning.
- All body repairs must be carried out in accordance with the guidelines in this Body Repair Manual.
- The stability and strength properties of the body must be taken into account during body repairs. The body has exact defined deformation patterns that must not be affected by any repair work.
- For instance, the crumple zones absorb the bulk of the impact energy. If any unprofessional repair techniques or

methods are used in these areas then this can pose a fundamental threat to vehicle safety.

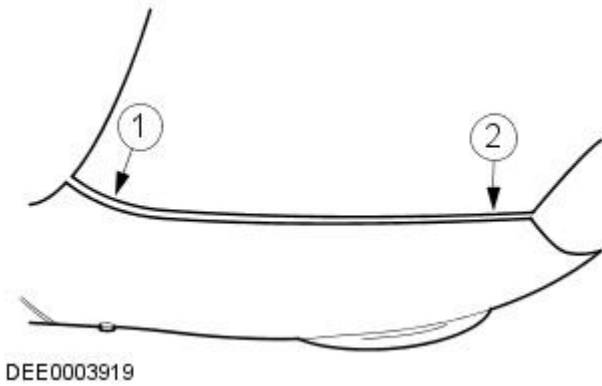
#### Hidden damage

- As well as looking at external indicators like flaked off paint, it is vital to check for hidden body damage or deformation that is not visible from the outside. Large attached parts like bumpers and inner fenders often need to be removed to allow accurate assessment of damage to underlying body parts.

#### Gap dimensions

Gap dimensions offer another alternative for diagnosis by visual inspection. If any changes or misaligned edges are apparent, then this usually indicates that the dimensions of the affected part are incorrect.

#### Changes in gap dimension



Item	Part Number	Description
1	-	Gap too wide
2	-	Gap too small

#### Impact effects on the body

• NOTE: Vehicle components like drive shafts and trailer attachments transfer forces. If a vehicle is subjected to a rear impact then all connected body parts and mechanical components (e.g. transmission mountings) should be thoroughly checked. Electronic components should be checked to make sure that they still operate correctly.

Furthermore it is possible to deduce the overall extent of damage from the direction and magnitude of the impact forces. This does however require extensive body-specific knowledge.

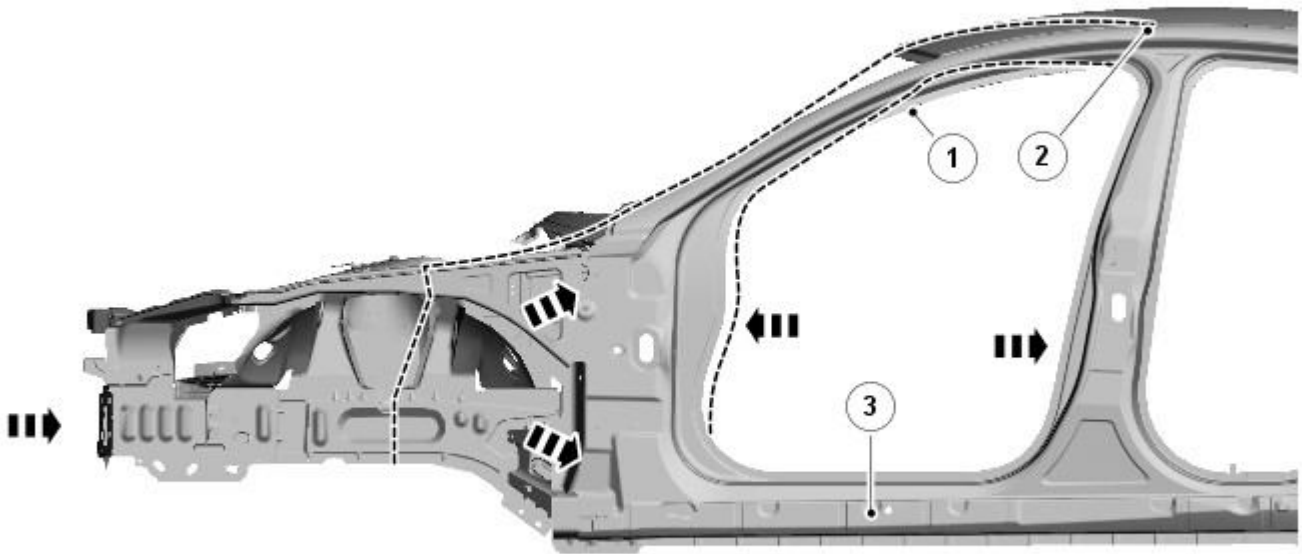
If, for instance, an impact occurs at the front left-hand side member, then the right-hand side member is usually also affected as a result of the rigid body-shell design (crossmember). Often the length of this side member will not have changed, but because of the rigid body-shell design it may have moved from its original position (often only by a very small amount). If any deviations are present this can usually be detected by checking the gap dimensions between door and fender or by checking for changes in dimension.

In the case of more severe impacts, the front part of the body cannot absorb all of the impact energy, and the passenger cell is also deformed. Here the impact energy is transferred via the side member to the A-pillar (see diagram). This results in deformations in the area of the roof and the door rocker panel.

The body reacts quite differently to side impacts where there is hardly any crumple zone. As the passenger cell is extremely stable, there are comparatively few local deformations at the site of the impact. However, the impact forces are transferred to the entire vehicle floor, which often results in so-called "banana damage", where the vehicle is bent into a banana shape.

Impact energy is transferred via the side member to the A-pillar





E128762

Item	Part Number	Description
1	-	Deformation area - roof rail
2	-	Deformation area - roof
3	-	Deformation area - door rocker panel

### Body measurements

#### Measuring options

- Comparison measurements can also be made on the outside of the body. Depending on the damage, comparison measurements and diagonal measurements can be carried out using compass, telescopic rod, tape measure or ruler.
- **NOTE:** The same reference points must be chosen on both sides when checking for changed dimensions (e.g. bores, edges, beads/swage lines etc).

All of the important external body dimensions are listed in Tolerance Checks.

For additional information, refer to: [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

- Measurements with a measuring/straightening jig.
- A measuring/straightening jig is required for accurate measurements of the body. The measuring systems are categorised by their means of operation:
  - Mechanical measuring system.
  - Optical measuring system.

Quick and accurate measuring results can be obtained using computerised measuring systems.

A minimum of three intact measuring points on the body are required for measurements of length, width and height dimensions.

In some cases this may mean making the measuring points accessible. All of these measuring systems can be used to make body measurements, provided all the equipment is available.

### Planning a repair

The following decisions have to be made before the repairs are started:

- Does the vehicle need to be put on a straightening jig, or can it be straightened by other means?
- Does the body need to be measured?
- Do aggregates like engine or axles need to be removed?
- **NOTE:** It is preferable to repair body parts rather than to renew them, as this keeps the complete body-shell intact.
  - Which body parts need to be renewed?
  - Which body parts can be repaired?

### Obtaining spare parts

The availability of spare parts often determines how easily the body repairs can be carried out. The following procedure is recommended:

- Obtain all the data for the vehicle, including type, vehicle identification number, trim code, engine identification letters, initial registration etc.
- Establish all of the metal parts that need to be renewed.
- Establish all of the attached parts that need to be renewed, including small parts like rivets, clips etc.

## Straightening repairs



**WARNING:** The use of heat when pulling to straighten body panels, (such as side members), is not recommended. Longitudinal pulling, (hot or cold), is also not recommended. A small amount of side to side pull is permissible, (cold).

When any type of pulling or straightening operation is performed it is important to observe for any movement in adjacent panels.

A panel must retain its strength and integrity, if there is any doubt the panel must be renewed.

Straightening repairs are often required to restore the body to its original shape after an accident. This can be done with:

- Alignment jigs.
- Universal straightening and measuring jigs.
- Welding jig system.

The following points must be followed to Make sure that the repairs are carried out professionally and that all the dimensions are correct after the repairs have been carried out.

- Structure:
  - The repair sequence depends on the individual repair plan (taking any necessary disassembly work into account).
  - Clean the attachment areas.
  - Anchor the vehicle free of stress on the relevant system.
  - Support the aggregates to take strain off the body.
  - Decide on at least three measuring/mounting points that are undamaged and as far apart as possible (for basic adjustment).
  - Check the dimensions of the measuring/mounting points.

- Straightening:

- - **NOTE:** Check dimensions and gaps continuously during straightening.

A body is always straightened in the opposite direction to that of the impact. Always carry out straightening repairs with the complete body shell assembled (do not cut out any parts beforehand). Carry out the straightening work in several stages. This prevents the risk of over stretching or of welded joints tearing out. During the individual straightening steps, relieve tension by striking with an aluminium hammer while the part is subjected to a tensile load (in the area of pre-determined folding points, dents, welded joints etc.).

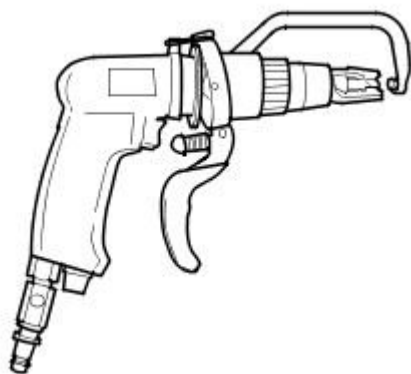
- Special features:

- Ultra high strength steel cannot be straightened due to its brittleness and must always be replaced.

## Cutting out body parts

Depending on how the parts are joined/connected, different tools are suitable for cutting/separating body parts.

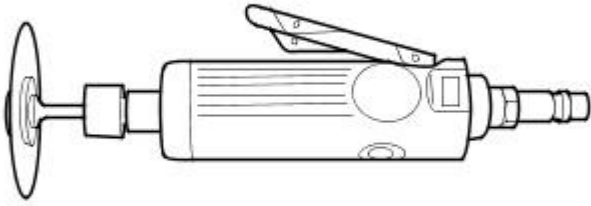
Spot-weld mill



DEE0003924

- **NOTE:** All other parts like interior equipment, window glass etc. must be protected against flying sparks.
- **NOTE:** Make sure that the milling depth is set correctly to prevent the remaining flange from being weakened.

Rod sander

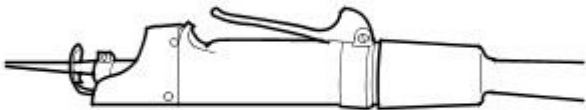


DEE0003925

- NOTE: Wear protective clothing. Protect any vulnerable body or glass areas against flying sparks. Remove explosive materials from the vicinity.

Any spot welds that are inaccessible for the spot-weld mill (diameter > 8 mm) should be ground out using a rod sander. The same applies to MIG spot welds or seams.

Short stroke saw

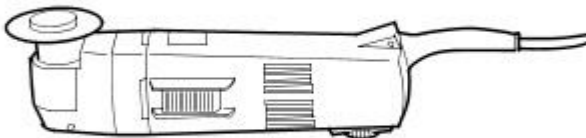


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- NOTE: Underlying metal parts, wiring harnesses, hoses etc. must not be damaged - remove them beforehand if necessary.

Body saws are particularly versatile and are therefore very suitable for making severance cuts on body parts.

Reciprocating saw

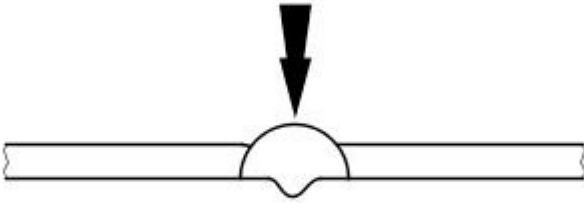


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In addition to the short stroke saw, the reciprocating saw can be used. With this, it is possible to make narrow and straight cuts to an exact depth.

### Carrying out the repairs

Butt joint



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• NOTE: The severance cut should always be kept as short as possible on sectional replacement. Only cut at the severance lines shown in the repair chapters.

Do not make any cuts near reinforcements or pre-determined folding lines.

- Prepare parts remaining on the vehicle/new parts.
  - Reshape the adjoining surface of any dented body parts that are to remain on the vehicle using a hammer and a counterhold (Make sure that the old part matches the shape of the new part). Grind off left over spot welds or seams with an angle grinder.
  - Cut the new parts to shape.
  - If necessary punch or drill holes for mig plug welding.
  -
- NOTE: Do not use a welding torch to remove paint residue (the heat could cause the metal to deform).

Grind all joining flanges to bare metal on both sides. Do not use an angle grinder for this purpose (this could weaken the metal and damage the zinc layer). Suitable tools: rotating wire brush, belt sander or plastic disc.

- Apply welding primer liberally to all weld flanges.
- The primer must be well stirred before use.

• NOTE: When using aerosols, take care not to contaminate adjacent parts with spray mist.

Fit the new part.

- It must be Make sured that the new part fits exactly to the specified dimensions. Suitable equipment:
  - Alignment jig.
  - Universal measuring system.
  - Jig system.
  - Ruler or tape measure.
  - Compass.
  - Frame dimensions can be found in the model-specific repair manuals.
- • NOTE: Any attached body parts that require accurate alignment and fitting must be incorporated in this step; for instance bumpers, seals, headlamps, rear lamps and lock assembly components. If this is not done carefully it may result in water leaks, wind noises and substantial follow-on work.

Make sure that edges line up with adjacent parts and check that gaps are consistent (compare left and right-hand sides). Make sure that the shape of the vehicle is retained.

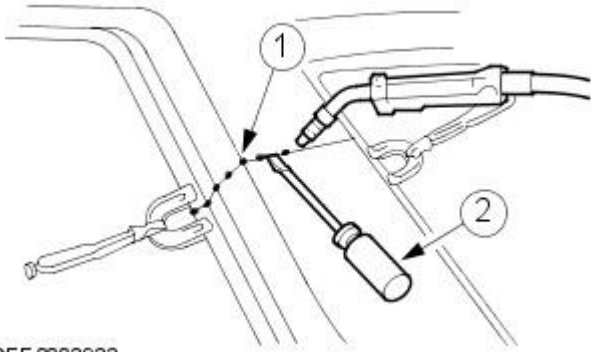
Secure the new part

- • NOTE: The need for subsequent follow-on work can be significantly reduced if aligning and tack-welding are carried out with due care.

Depending on accessibility the following methods for securing are available:

- Grip pliers (set of).
- Screw clamp (set of).
- Self-tapping screws.
- Tack welds.
- Use a staking tool or a screwdriver to Make sure that the edges of sectional replacements of profiled parts line up. The edge is then tack welded to Make sure that it lines up.

Aligning and tack weld

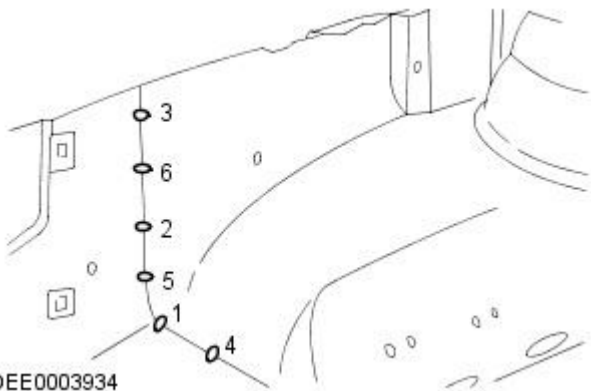


DEE0003933

Item	Part Number	Description
1	-	Tack welds
2	-	Using a screwdriver to align

- Longer joints are usually tack welded to prevent the panel from warping. It is important to carry out the tack welds in the correct sequence (see diagram).
- Weld in the new part following the instructions in the repair manual.

Correct tack welding sequence



DEE0003934

Follow on repairs/corrosion protection

- This step basically covers the following work:
  - Grinding welded seams.
  - Priming any bare metal.
  - Sealing welded seams.
  - Applying underbody protection.
  - Sticking damping matting in place.
  - Filling cavities with cavity wax.
  -
- **NOTE:** See corrosion protection section for cavity wax application areas.

Cavity wax (after painting).

## Panel Beating

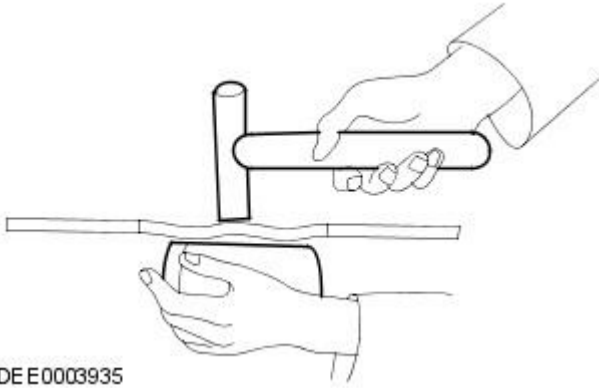
Fundamentals of panel beating

- Before carrying out any sectional replacements or complete replacements of body panels, always check carefully whether the damaged panel(s) can be rectified by panel beating.
- Panel beating is usually the easiest and most economical method of repairing a damaged panel.

Examples of applications of different panel beating techniques:

- Aluminium hammer and mallet.
  - Advantage: Low risk of over-stretching the panel.
  - Used for repairs of small dents on panels that are accessible from both sides.
  - These two panel beating tools are usually used for "finishing repairs".

Fine straightening with an aluminium hammer and a universal dolly



DE E0003935

- Sliding hammer
  - If the damaged panel is only accessible from the outside, use a sliding hammer to pull it back into shape. The discs or studs needed to mount the sliding hammer are welded onto the bare surface. Dents in the panel can be flattened out using controlled application of the sliding hammer.

## Heat-treatment of panels

- It is usually inevitable that some parts of the body panels show excess material as a result of mechanical strain. If there are any areas of excess material this will cause localised instabilities due to differences in tension. These localised instabilities can be stabilised by applying heat-treatment techniques.
- • NOTE: This does not apply to high-strength low alloy steel, ultra high strength steel and aluminium.

Rule: Flattening panels by heat-treatment reduces the amount of excess material by more than they were originally stretched.

Different heat-treatment techniques.

- NOTE: Different heat-treatment techniques are used depending on the amount of excess material.

- Flattening using a flame.
  - A welding torch is used if the material excess extends over a larger area (torch size 0.5 - 1.0 mm). Use a soft flame.
  - The surface of the metal is briefly spot-heated and then immediately cooled with a wet sponge.
  - Requirement: Ability to handle a welding torch safely and knowledge of annealing colours of steel.
  - Advantage: No damage to the surface of the metal.
- Flattening using a flame, supported by hammer and counterhold.
  - 
  - NOTE: The flattening effect is increased by speeding up the heating and cooling stages.

If the material excess is concentrated, then the flattening effect can be increased after heating by carefully using an aluminium or wooden hammer.

- Requirement: Ability to recognise material tension by feeling the surface that is to be flattened.
- Flattening using a carbon electrode.
  - If panel areas are only accessible from one side, or the panel is only slightly destabilised, then the preferred method is flattening using a carbon electrode.
  - Requirement: Bare metal surface.
  - Disadvantage: Scarring and hardening of the surface.
- Flattening using a copper electrode.
  - Small, sharp dents that face outwards can be worked on with a copper electrode.
- Flattening using a flame and body files.
  -

• NOTE: When applied correctly, this method can be used with all the attached parts still in place (roof headlining, wiring harnesses etc.).

Small, soft dents (only slight stretching): Working at the edges of the dent in an inward spiral pattern, the dent is heated with an oxyacetylene torch (torch size 1 - 2 mm, excess gas flame) to approx. 250° C.

- Working rapidly with a body file extracts heat from the edge area until the dent is flattened. Preferably alternate between two files. This increases the amount of heat that can be extracted.

## Safety measures

- The electronic control modules (ECM) fitted to vehicles make it advisable to follow suitable precautions prior to carrying out welding repair operations. Harsh conditions of heat and vibration may be generated during these operations which could cause damage to the modules. In particular, it is essential to follow the appropriate precautions when disconnecting or removing the airbag RCM.
- Do not allow electronic modules or lines to come into contact with the ground connection or the welding electrode.
- Seat belt anchorages are a safety critical. When making repairs in these areas, it is essential to follow design specifications. Note that extra strength low alloy steel may be used for seat belt anchorages. Where possible, the original production assembly should be used, complete with its seat belt anchorages, or the cut line should be so arranged that the original seat belt anchorage is not disturbed.
- All welds within 250mm (9.842) of seat belt anchorages must be carefully checked for weld quality, including spacing of spot welds.
- Remove the battery before carrying out welding work in its vicinity.
- Utmost care must be taken when welding near the fuel tank or other components that contain fuel. If the tank filler neck or a fuel line must be detached to allow access for welding work, then the fuel tank must be drained and removed.
- Never weld, on components of a filled air conditioning system. The same applies if there is a risk of the air conditioning system heating up.



- Connect the ground connection of the electrical welder directly to the part that is to be welded. Make sure that there are no electrically insulating parts between the ground connection and the welding point.
- Adjacent vehicle parts and adjacent vehicles must be shielded against flying sparks and heat.

## Pedestrian protection system

The pedestrian protection system is designed to mitigate injuries in a pedestrian collision with the vehicle. It does this by utilizing a pair of pyrotechnic actuators to lift the hood away from the engine, creating a cushioned impact between the pedestrian and the vehicle. It is essential that any repair or replacement operations do not affect the safe working of the system.

For additional information, refer to: [Pedestrian Protection System](#) (501-20C Pedestrian Protection System, Description and Operation).

## Resistance spot welding

Where resistance spot welds have been used in production, they must be reproduced with new spot welds in replacement where possible. All such reproduction spot welds should be spaced 25 to 30mm apart.

Setting up the equipment and co-ordinating the welding parameters.

- Equipment:
  - Follow the equipment manufacturer's instructions for the equipment settings.
  - Select the correct electrode arms (as short as possible).
  - Align the electrode arms and tips exactly.
  - Electrode tips should be convex (rough shaping with a file, fine shaping with a sanding block).
- Body:
  - Make sure that the flanges to be joined lie perfectly flat to one another.
  - Prepare a bare metal joint surface (inside and outside).
- Notes on technique/method:
  - Carry out a test weld on a sample piece of the material coated in welding paste.
  - If any metal parts are located between the electrode arms then there will be a loss of induction and therefore power (adjust current setting).
  - The power needs to be adjusted for high-strength low alloy steel.
  - Repeated welding on old welding points often leads to poor quality welds.
  - Keep the electrode tips as near as possible to an angle of 90° to the contact surface.
  - Keep the pressure on the electrodes for a short period after finishing the weld.
  - The electrodes work best if their shape is convex. Clean the contact surface of the electrodes regularly.

## Resistance spot welding panels where the total thickness is 3 mm or more

For all repairs to modern Jaguar vehicles, spot-welding equipment should be suitable for reliable welding of zinc-plated, high-strength and high-tensile steels in three or more layers, up to 5 mm total thickness. If these requirements are not fulfilled, plug welding must be used for safety reasons. The electrical specifications (current, resistance, heat) of the spot-welding equipment have different validity, depending upon the type of equipment. Therefore, it is essential that the manufacturer's instructions are observed with regard to the actual welding performance.

## MIG/MAG welding

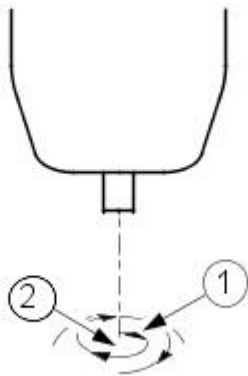
Setting up the equipment and co-ordinating the welding parameters.

- Any joints that are MIG/MAG welded in production must also be MIG/MAG welded during repairs. Also during repairs, some resistance spot welds need to be replaced by plug welds.
- If access is difficult, or if a suitably powerful spot welder (see above) for total panel thicknesses of 3 mm or more is not available, resistance spot welding must be partially replaced by plug welding during repairs. In this case, the increased time needed and the correspondingly more demanding corrosion protection requirements, must be taken into account.
- Welding repairs can only be carried out properly if the equipment is set up correctly and all the welding parameters are co-ordinated.
- Equipment:
  - Set up the equipment as directed by the manufacturer.
  - The hoses must be untwisted.
  - The core must be free of abraded rod particles.
  - The gas and current nozzles must be free of slag and scale residue.
  - Pay attention to the quality of the welding rod and the throughput of gas.
- Body:
  - Make sure that the joint surface is perfect.
  - Prepare a bare metal joint surface.
  - Maintain the correct gaps (formation of roots).
- Notes on technique/method:
  - 
  - NOTE: The increased application of heat during MIG welding destroys the welding primer/zinc layer over a much larger area than during resistance spot welding, as a result of which much more care needs to be taken when applying anti-corrosion protection afterwards.
  - NOTE: A test weld should always be carried out to make sure that the welded joint is not just a surface connection.

Attach the ground cable right next to the welding point (Make sure that good contact is made).

- During plug welding start welding on the lower panel to Make sure adequate penetration.

Plug welding



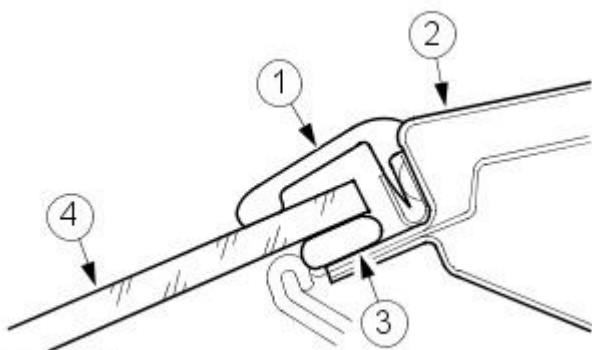
DEE0003936

Item	Part Number	Description
1	-	Welding direction: circular pattern working from the inside outwards
2	-	Welding starting point: centre of hole on lower panel

### Bonded glazing

- - The windscreen, side and rear windows are bonded directly onto the window frames on the body and liftgate.
- The windows are bonded primarily for reasons of adhesive strength. Bonded glazing provides additional torsional stiffness to the body.

Adhesive bonding of bonded windows



DEE0003938

Item	Part Number	Description
1	-	Rubber strip
2	-	Window frame
3	-	Adhesive
4	-	Window glass

### Removing and installing bonded windows

Safety measures

- The following safety measures must always be followed to prevent personal injury:
  - Wear protective gloves and arm protection.
  - Wear protective goggles.

Preparations

- Before cutting out a bonded window, undo and remove any attached parts in the cutting area that are at risk, e.g. trim panels and decorative strips, as well as all electrical connections.
- Mask any painted areas that are adjacent to the window.
- Cut off any surplus adhesive, as this makes it easier to cut out the window.
- Secure vertical windows against dropping out.

Cutting out the window

- Cut into the adhesive bead at easily accessible points using the cutting tool.
- Carefully guide the cutting tool around the window, cutting through the adhesive bead.
- Avoid touching the window frame and the body flange.
- Use cup suction tools to lift the cut-out window out of the window aperture.

General preparations for bonding

- Follow the manufacturer's instructions.
- Cut back the remaining adhesive bead on the metal flange to a residual height of about 1mm. Do not touch or clean the cut surface afterwards.
- Carefully rectify any paint damage (apply primer and top coat).
- Renew the window stops as necessary.

Bonding the window glass

- Apply an even bead of adhesive to the window or to the body flange.
- Insert the window glass into the window aperture and centre it (2 technicians required).
- Check the gaps.
- • NOTE: Open the windows and doors while the window is left to dry and do not move the vehicle (slamming doors creates excess pressure which could cause the window to become loose).

Use adhesive tape to prevent the window from falling out or slipping.

#### Finishing operations

- Reconnect all electrical connections and check that the components operate correctly.
- Install the attached parts and check that the fit is accurate and secure.
  - Carry out a visual inspection to Make sure that the gaps and joints are even.
- Thoroughly clean the window glass.

#### Protective equipment and safety at work

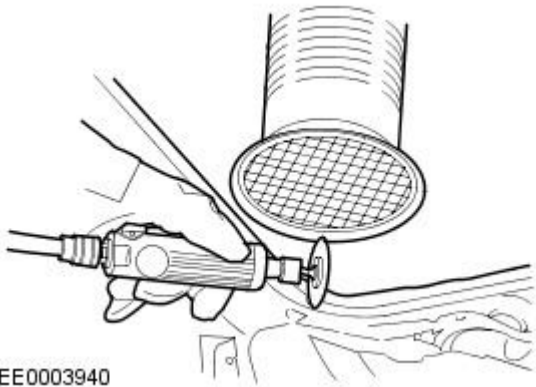
- Various safety measures and legal requirements must be met when carrying out repairs. All regulations relating to health and safety at work must be followed.

#### Welding safety precautions

- The following safety precautions must be observed to prevent the risk of personal injury:
  - Protective overalls
  - Safety hood (face protection).
  - Welding shield.
  - Safety gloves.
  - Safety shoes.
  - Extraction unit for welding fumes.
- Welding should always be carried out in well ventilated areas. A fire extinguisher must also always be within reach.

#### General body repair safety measures

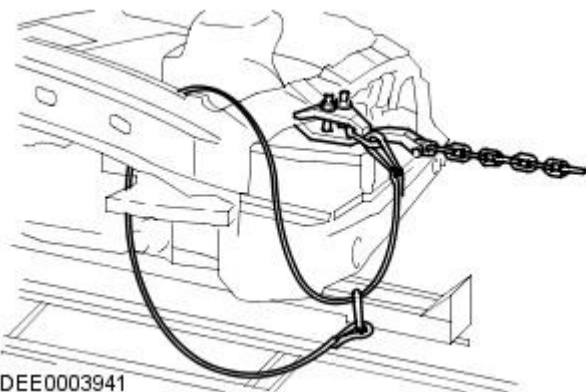
##### Extraction unit



DEE0003940

- Sealing compound, underbody protection etc. must not be burned off with a naked flame. This would produce toxic gases. If for instance PVC is burned, then gases containing hydrochloric acid are produced. For this reason a suitable extraction unit should always be used when performing grinding, welding or soldering work.
- Always Make sure good ventilation when working with materials that contain solvents, wear breathing equipment and use an extraction unit.
- Ear defenders should always be worn when cutting, grinding or straightening metal, as the noise levels can reach or even exceed 85 - 90 dB(A).
- Take care not to look directly into any laser measuring systems, for instance used to measure the under body.
- When removing components from a vehicle mounted on a lifting ramp, watch out for a shift in its centre-of-gravity. When first placing the vehicle on the ramp, take into account that it may need to be secured against tipping over.
- Chains and chain clamps must be secured with safety ropes during straightening work.

##### Safety rope



DEE0003941

# Body Repairs - Corrosion Protection - Corrosion Protection

Description and Operation

## General

The corrosion protection provided in production must be carefully maintained and/or reproduced during and after body repair work. It is only then that the long-term warranty against penetrative corrosion damage can be assured.

Only Jaguar original bodywork components and Jaguar approved repair materials, (sealer, paint etc.), are to be used for bodywork repairs.

Jaguar Original Parts



E117239

All Jaguar bodywork components have a cathodic base coating. Individual bodywork components are zinc plated on one or both sides, (in different areas depending on vehicle model).

Together with elastic paint coating, this guarantees an optimum, highly resistant protection against corrosion caused by the impact of small objects such as gravel.

• **NOTE:** If possible, the individual protective layers, (zinc, cathodic base coat), on Jaguar bodywork components must not be damaged or destroyed by sanding or other mechanical operations.

If hairline cracks at "bodywork connection areas" appear after reshaping work, (e.g. at door hinges), it must be ensured that the corrosion protection provided in production is recreated. The complete paint covering must be re-created if necessary. The same applies to reshaping work on heavily profiled bodywork components, (e.g. floor pan). Renew or touch-up the paint coating, sealing beads and underbody protection as necessary.

After repair, any interior surfaces which are no longer visible or accessible must be primed before cavity wax is applied. To be certain of an even coating on inner surfaces, careful application of spray, (twice, with drying time in-between), must be carried out throughout the whole cavity.

If bodywork panels are strongly heated during repair work, this will invariably result in damage to or even destruction of the applied corrosion protection material. The effectiveness of the cavity protection material is reduced if heating occurs. Reworking of the affected areas is therefore vital.

Welded areas should be made good before corrosion protection is applied.

The corrosion protection measures to be taken when bodywork components are renewed are described on the following pages.

## Corrosion Protection of New Components

All new components must be inspected for transport or storage damage such as scratches or dents. The following operations may be necessary, depending on the extent of damage:

### Undamaged New Component

- Do not grind the cathodic primer.
- Thoroughly clean with silicone remover and rub dry.

### Slightly Damaged New Component

- Sand out scratches.
- Finely sand the surrounding surface.
- Thoroughly clean with silicone remover and rub dry.
- Apply corrosion protection primer to bare areas.

### Damaged New Components (bumps and dents)

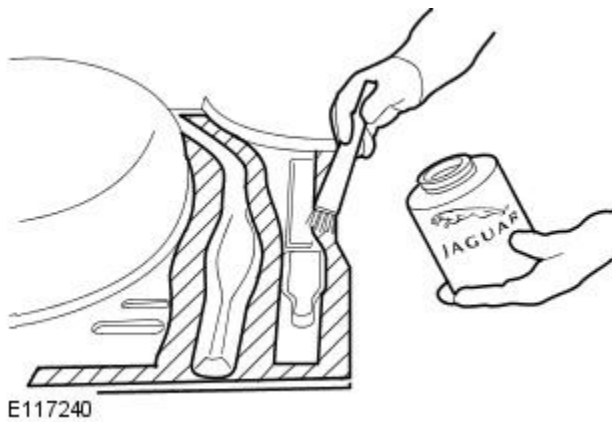
- Beat out the dented area and sand down to bare metal.
- Apply polyester filler (only onto bare metal).
- Apply filler.
- Lightly sand the whole component.
- Thoroughly clean with silicone remover and rub dry.
- Apply corrosion protection primer to bare areas.

The clinched flanges on the hood, doors, tailgate and liftgate must be sealed with clinched flange sealer, if this is not already applied.

## Weld Components

Use a stripping disc to remove the cathodic primer on the inside and outside of the area to be welded. The stripped area should be kept as small as possible, retaining as much of the cathodic primer as possible, taking care not to damage the zinc coating.

Apply Welding Primer



- NOTE: The welding primer must be stirred well or shaken before application.

Clean the repair area thoroughly, (silicone remover).

Apply welding primer evenly to all weld flanges, (old and new components).

- NOTE: The welding primer must be allowed to dry before welding is carried out.

All weld beads must be ground down after all welding is completed, taking care not to weaken the material.

Any unevenness at the joint must be made good.

If necessary, spot weld missing weld studs into position.

The vehicle must be completely cleaned of sanding dust and metal swarf because of the danger of corrosion.

Clean and prime all internal areas and those to be sealed.

- NOTE: The primer must be dry before sealing mastic or underbody protection is applied. Do not use thinners when applying sealing mastic, (the mastic will not dry).

## Partial Renewal

The procedure to follow when partially renewing components is the same as described in the section "Welded Components".

The main difference when components are partially, rather than completely renewed, concerns the preparation of butt or lap joints.

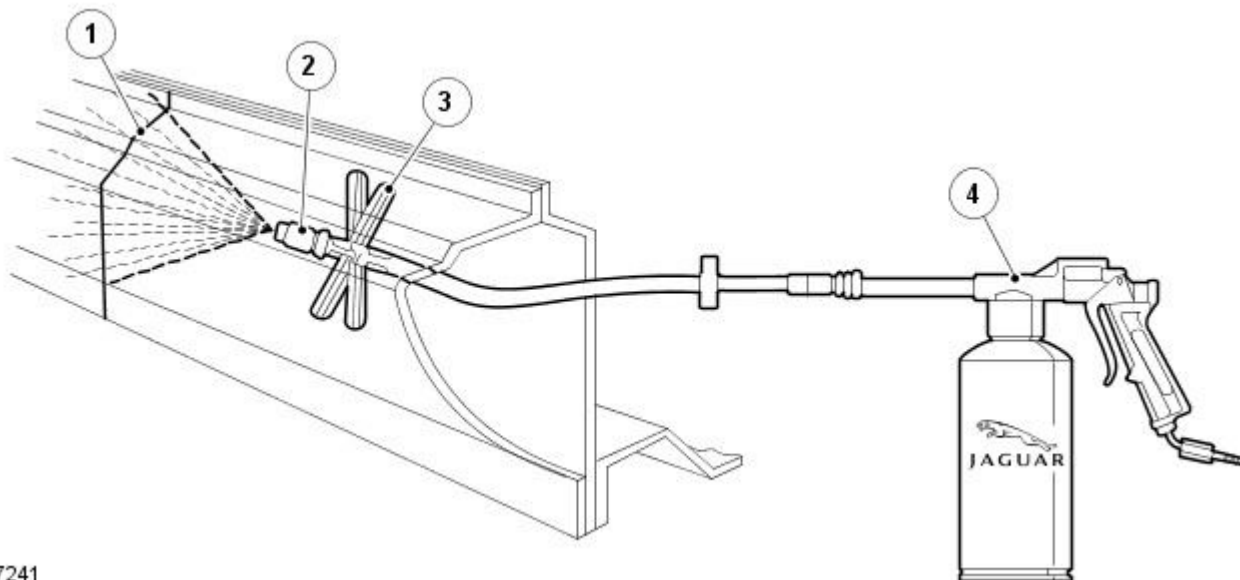
- When bodywork components are cut through, attention must be paid to the adequate removal of the paint and zinc coatings on inner areas. This specially applies to areas which are difficult to access internally.
- It is important for the weld quality that the inner area is bare metal. Zinc and paint residues in the weld area burn and cause serious hole formation during welding.
- If the zinc layer and the paint coating are not removed, the zinc and paint will burn during welding. The soot produced prevents satisfactory cavity protection.

## Procedure

- The paint layer must be removed for a width of 30 mm from the line of the weld using a rotating tress wire brush.
- This operation must be carried out on both the new and the old parts of the bodywork.
- Depending on the bodywork component, a 10 mm width of the underlying zinc layer must also be removed along the weld line.

- NOTE: A flat scraper or a wire brush can be used instead of the rotating brush if the cavity is small. Do not use an angle grinder, which would weaken the structure.

Application of Cavity Wax Protection on a Rocker Panel After Partial Repair



E117241

Item	Part Number	Description
1	-	Weld bead
2	-	Spray head
3	-	Distance maintainer
4	-	Spray gun

**Classification of the different corrosion protection measures for dent removal**

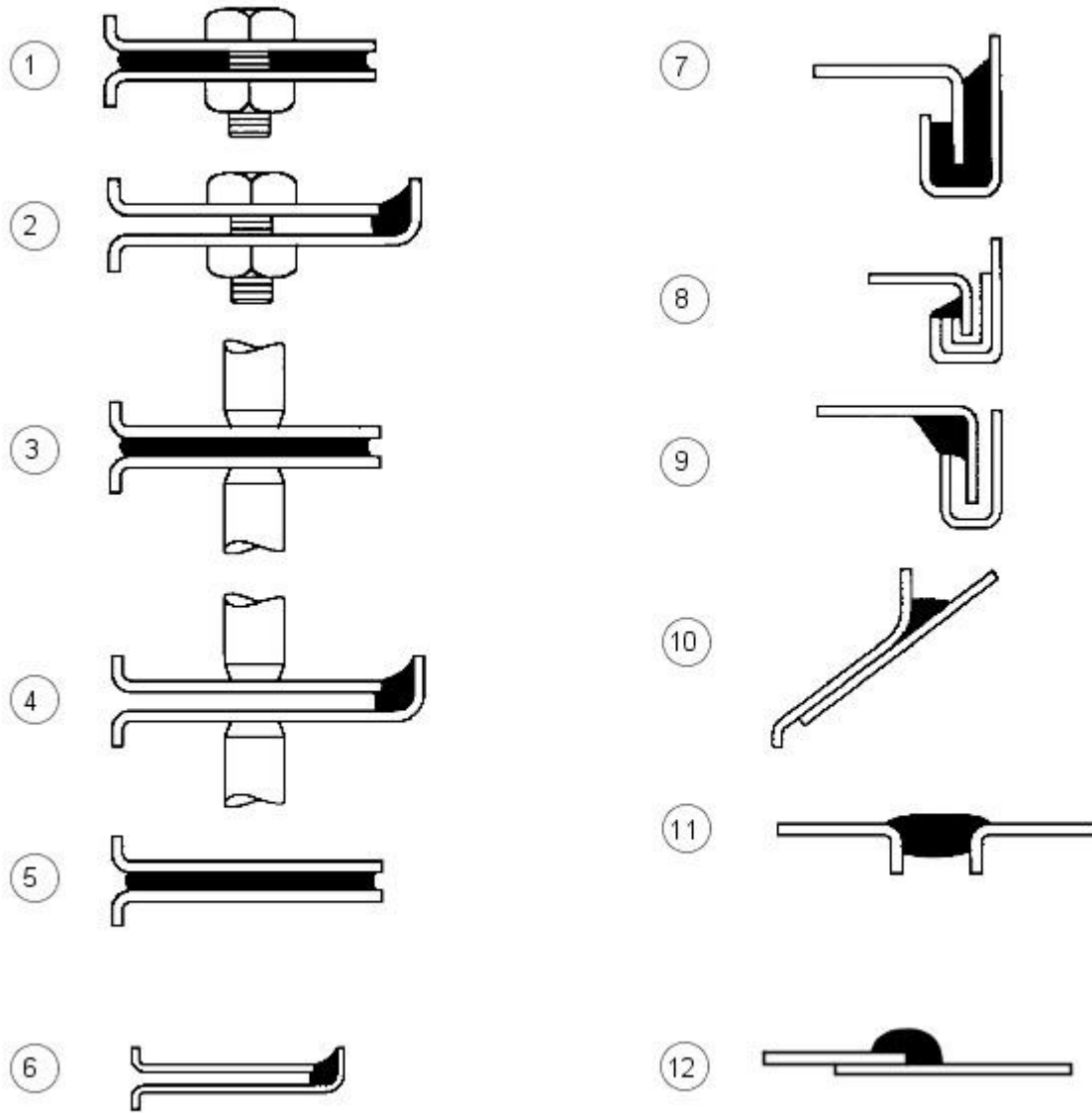
Corrosion Protection Method	Exterior Surfaces	Accessible Inner Surfaces	Inaccessible Inner Surfaces
Painting	X	X	
Cavity protection			X

**Classification of Different Corrosion Protection Measures for Installation of New Components**

Corrosion Protection Method	Weld Flanges Before Welding in Place (contact surfaces)	All Bare Sanded Areas	Weld Flange Area Accessible	Weld Flange Area Not Accessible
Welding primer	X			
Painting		X	X	
Clinched flange protection			X	
Cavity protection				X

**Body Sealing Materials**





E56018

Item	Part Number	Description
1	-	Between Panels - Bolted
2	-	Panel Edge Bolted
3	-	Between Panels - spot welded
4	-	Panel edges - spot welded
5	-	Between panels - bonded
6	-	Panel edges - bonded
7	-	Clinch joints - type A
8	-	Clinch joints - type B
9	-	Clinch joints - type C
10	-	Gaps between panels - type A
11	-	Gaps between panels - type B
12	-	Lap joint

**Approved Service Materials For Repair**

Description - Usage	Supplier	Product Number
<b>Sealing</b>	-	-
Polyurethane cartridge extruded seam sealer - grey - <b>this is not a weld through product</b>	3M	08684
Polyurethane cartridge extruded seam sealer - white - <b>this is not a weld through product</b>	3M	08689
Polyurethane cartridge extruded seam sealer - black - <b>this is not a weld through product</b>	3M	08694
Polyurethane sachet 310ml - grey - <b>this is not a weld through product</b>	3M	08782
Polyurethane sachet 310ml - white - <b>this is not a weld through product</b>	3M	08787
Polyurethane sachet 310ml - black - <b>this is not a weld through product</b>	3M	08789
Polyurethane sachet 600ml - grey - <b>this is not a weld through product</b>	3M	08783
Polyurethane sachet 600ml - white - <b>this is not a weld through product</b>	3M	08788

Description - Usage	Supplier	Product Number
Polyurethane sachet 600ml - black - <b>this is not a weld through product</b>	3M	08793
Sprayable seam sealer 2K polyurethane 150ml - grey	3M	08823
Sprayable seam sealer 2K polyurethane 250ml - grey	3M	08800
Sprayable seam sealer MS polymer grey	3M	08851
Super seam sealer can - grey	3M	08537
Super seam sealer - brush	3M	08540
Butyl cartridge highly flexible for joints greater than 3mm - grey	3M	08645
Terostat 9100 (1K PUR) adhesive sealant	Teroson	153.65B
Terostat 9100 (1K PUR) adhesive sealant	Teroson	112.72C
Terostat 9100 (1K PUR) adhesive sealant	Teroson	129.19S
Terostat 9200 (1K PUR) adhesive sealant - black	Teroson	120.20Q
Terostat 9200 (1K PUR) adhesive sealant - black	Teroson	120.25W
Terolan light vehicle body sealant	Teroson	128.60D
Terostat 9320 sprayable seam sealant - grey	Teroson	139.15A
Terostat 9320 sprayable seam sealant - black	Teroson	139.16B
Terostat 9320 sprayable seam sealant - ochre	Teroson	139.17C
Terolan special sealant brushable	Teroson	179.70H
Terostat II sprayable sealant band	Teroson	193.00D
Terostat VII round profile plastic sealing band	Teroson	112.46Z
Terostat IX putty	Teroson	157.86J
<b>MS Polymer Sealing</b>	-	-
MS Polymer caulkable sealer - white	3M	0855
Terostat 9120 (MS Polymer) adhesive sealant - white	Teroson	102.78X
Terostat 9120 (MS Polymer) adhesive sealant - black	Teroson	113.23H
Terostat 9120 (MS Polymer) adhesive sealant - black	Teroson	104.41R
<b>Seam Sealing Light</b>	-	-
Drip Chek clear	3M	08401
Drip Chek heavy	3M	08531
<b>Silicone Sealant</b>	-	-
Terostat 9140 silicone sealant - transparent	Teroson	140.08B
Terostat 9140 silicone sealant - black	Teroson	140.04X
<b>Body Caulking</b>	-	-
Body caulking	3M	08568
<b>Structural Adhesive</b>	-	-
Two component epoxy adhesive	3M	08122
Manual applicator gun	3M	08190
<b>Panel Bonding Adhesive</b>	-	-
Panel bonding adhesive + (nozzle 08193)	3M	08115
Requires manual applicator gun + nozzle	3M	08117
<b>Tape and Film</b>	-	-
Acrylic tape PT1100 double sided - 6mm x 40m	3M	80318
Acrylic tape PT1100 double sided -9mm x 20m	3M	80319
Acrylic tape PT1100 double sided 12mm x 20m	3M	80320
Acrylic tape PT1100 double sided 19mm x 20m	3M	80322
Acrylic tape PT1100 double sided 25mm x 20m	3M	80323
Polyolefin adhesion promoter	3M	05917
Abrasion resistance film	3M	08210
Abrasion resistance film	3M	08219
<b>Sealing Tape and Primer</b>	-	-
Terotape seam sealing tape 8mm x 6mm	Teroson	8164590
Terotape seam sealing tape 10mm x 16mm	Teroson	8164600
Terotape primer 420ml	Teroson	8164610
<b>Cavity Wax</b>	-	-
Body shultz coatings - black - 1L can	3M	08861
Body shultz coatings - black - 500ml aerosol	3M	08877
Inner cavity wax aerosol (transparent)	3M	08909
Inner cavity wax aerosol (amber)	3M	08901
Inner cavity wax 1L can (amber)	3M	08911
Inner cavity wax 1L can (transparent)	3M	08919
Inner cavity wax 10L drum (amber)	3M	08921
Inner cavity wax 10L drum (transparent)	3M	08929
Terotex HV 200 extra spray - 1L can	Teroson	176.48
Terotex HV 200 extra spray - 10L tin	Teroson	179.40A
Terotex HV 200 extra spray - 60L barrel	Teroson	170.96J
Terotex HV 400 1L can	Teroson	169.65Q
Terotex HV 400 10L tin	Teroson	169.76C
Terotex HV 400 60L barrel	Teroson	169.85M
Teroson cavity spray 500ml aerosol	Teroson	155.71A
<b>Underbody Wax</b>	-	-
Terotex wax black 1L can	Teroson	114.59F
Protective wax	Teroson	122.73Q
<b>Underbody Coating</b>	-	-
Bodyguard stonechip coating (textured) can - black	3M	08868
Bodyguard stonechip coating (textured) can - white	3M	08878
Bodyguard stonechip coating (textured) can - grey	3M	08879

Description - Usage	Supplier	Product Number
Bodyguard stonechip coating (flat) can - black	3M	08158
Bodyguard stonechip coating (flat) can - grey	3M	08159
Anti chip coating smooth - grey	3M	08886
Terotex record black 1L can	Teroson	122.48N
Terotex record light 1L can	Teroson	165.53S
Terotex anti chip compound light (UBC) 1L can	Teroson	191.08V
Terotex anti chip compound black (UBC) 1L can	Teroson	191.32V
<b>Trim Adhesive</b>	-	-
Auto adhesive - aerosol - clear (trim)	3M	08080
Auto adhesive - brushable - clear (trim)	3M	08150
Contact adhesive - aerosol - amber	3M	08090
<b>Corrosion Protection</b>	-	-
Zinc spray	3M	09113
Zinc spray	Teroson	158.18T
<b>Anti Corrosive Agent</b>	-	-
Terotex HV 350 1L can	Teroson	141.78L
Terotex HV 350 10L can	Teroson	160.02T
Terotex HV 350 60L barrel	Teroson	160.01S
<b>Sound Deadening</b>	-	-
Sound deadening sheets	3M	08840
Terodem SP 100 alu	Teroson	190.33
Terodem SP 200	Teroson	190.55M
Terodem SP 300 50 x 50	Teroson	145.28R
Terodem SP 300 100 x 50	Teroson	134.29X
<b>Flexible Part Repair</b>	-	-
Flexible part repair material (FPRM)	3M	05900
<b>Adhesives / Thread Locking</b>	-	-
Lock N Seal 243 thread locking	Loctite	13701
Lock N Seal 243 thread locking	Loctite	14131
Lock N Seal 243 thread locking	Loctite	25684
Stud N Bearing fit 271	Loctite	13704
Stud N Bearing fit 271	Loctite	14130
Stud N Bearing fit 271	Loctite	25685
Pipe sealant 577	Loctite	16604
Pipe sealant 577	Loctite	25689
Pipe sealant 55	Loctite	31899
<b>Gasket</b>	-	-
Multi gasket	Loctite	25688
Silicone copper	Loctite	19245
Silicone copper	Loctite	82046
Silicone 596 black	Loctite	19242
Silicone 596 black	Loctite	59875
3020 gasket adhesive	Loctite	31458
<b>NVH Baffle</b>	-	-
Sikabaffle 278	SIKA	

### Approved Service Material Supplier - Contact Details

3M

- 3M United Kingdom PLC
- 3M Centre
- Cain Road
- Bracknell
- Berkshire
- RG12 8HT
- Telephone (01344) 858000
- www.3m.com

Cooper Pegler

- Burgess Hill
- Sussex
- RH 15 9LA
- Telephone (014446) 42526

Sika Ltd

- Watchmead
- Welwyn Garden City
- Hertfordshire
- AL7 1BQ
- Telephone (01707) 394444
- www.sika.co.uk

SATA Spray Equipment

- Minden Industrial equipment
- 16 Greyfriars Road
- Moreton Hall

- Bury St Edmunds
- Suffolk
- IP32 7DX
- Telephone (01284) 760791
- www.sata.com

Henkel Loctite Adhesives Limited

- Technologies House
- Wood Lane End
- Hemel Hempstead
- Hertfordshire
- HP2 4RQ
- Telephone (01442) 278000
- www.loctite.co.uk

Teroson

- Henkel Ltd
- Apollo Court
- 2 Bishops Square Business Park
- Hatfield
- Hertfordshire
- AL10 9EY
- Telephone (01707) 635000
- www.henkel.co.uk

## Underbody sealer

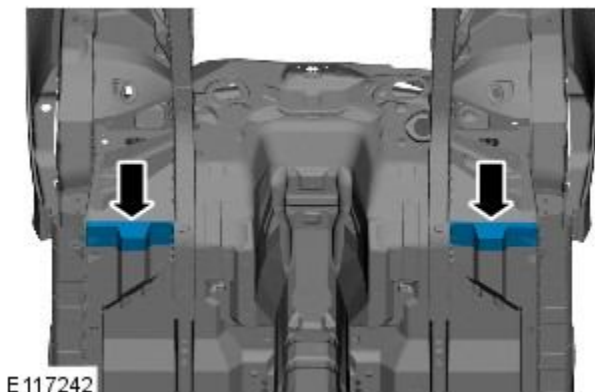
Under floor areas and the front part of the spare wheel well are treated with a plastisol PVC underbody sealer. This material is not suitable for re-treatment. When repairing areas of underbody sealer, strip the factory-applied underbody sealer back to a suitable break point. Ensure that a clean metal surface is exposed and that the edge of the existing adheres soundly to the panel.

Apply new underbody sealer between primer and surface paint operations. Apply seam sealer as necessary before application of underbody sealer. Ensure that blanking plugs and grommets in the floor pan (except those used for wax injection) are fitted before underbody sealer application. Refit any heat-fusible plugs which have been disturbed in repair with the aid of a hot air blower, or replace with rubber grommets

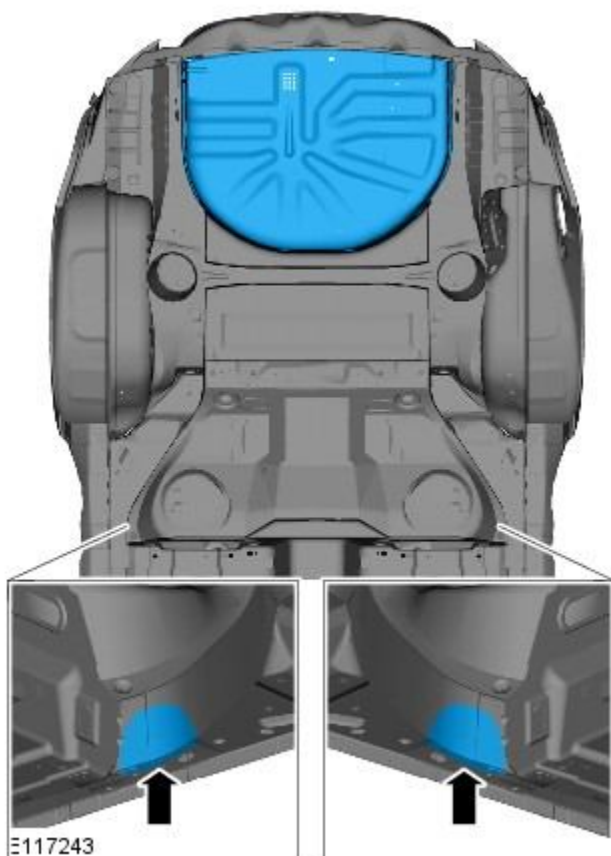


**CAUTION:** Ensure that suspension units, wheels, tires, power unit, drive shafts, exhaust and brakes, (including all mounting points), are shielded prior to application of fresh underbody sealer.

Area of Underbody Sealer Application - Floor Pan (Front)



Area of Underbody Sealer Application - Spare Wheel Well and Rear Side Member



### Precautions During Body Repairs and Handling

Take care when handling the vehicle in the workshop. Underbody sealers, seam sealers, underbody wax and body panels may be damaged if the vehicle is carelessly lifted.

### Proprietary Anti-corrosion Treatments

The application of proprietary anti corrosion treatments in addition to the factory-applied treatment could invalidate the corrosion warranty and should be discouraged. This does not apply to approved, compatible, preservative waxes which may be applied on top of existing coatings.

### Fitting Approved Accessories

When fitting accessories ensure that the vehicle corrosion protection is not affected, either by breaking the protective coating or by introducing a moisture trap.

Do not screw self-tapping screws directly into body panels. Fit suitable plastic inserts to the panel beforehand. Always ensure that the edges of holes drilled into panels, chassis members and other body parts are protected with a suitable zinc rich or acid etch primer, and follow with a protective wax coating brushed onto the surrounding area.

Do not attach painted metal surfaces of any accessory directly to the vehicle's bodywork unless suitably protected. Where metal surfaces are bolted together always interpose a suitable interface material such as weldable zinc rich primer, extruded strip, or zinc tape.

### Steam Cleaning

Due to the high pressure/temperature generated by steam cleaning equipment, there is a risk that certain adhesives and corrosion prevention material may become softened or liquified.

Take care not to allow the steam jet to dwell on one area, and keep the nozzle at least 300mm from the panel surface.



**CAUTION:** Do not remove wax or lacquer from underbody areas during repairs.

### Inspection During Maintenance Servicing

It is a requirement of the corrosion warranty that the vehicle is inspected for corrosion by a Jaguar Authorised Repairer during a routine service, to ensure that the factory-applied protection remains effective.

Rectify any bodywork damage or evidence of corrosion found during inspection as soon as is practicable, both to minimise the extent of the damage and to ensure the long term effectiveness of the factory-applied corrosion prevention treatment.

### Underbody Protection Repairs

Whenever body repairs have been carried out, ensure that full sealing and corrosion protection treatments are reinstated. This applies both to the damaged areas and also to areas where protection has been indirectly impaired, as a result either of accident damage or repair operations.

Remove corrosion protection from the damaged areas before straightening or panel beating. This applies in particular to panels coated with wax, PVC underbody sealer, sound deadening pads etc.



**CAUTION:** Do not use oxy-acetylene to remove corrosion prevention material. Large volumes of fumes and gases are liberated by these materials when they burn.

The most common method of removal is by means of a hot air blower with an integral scraper. High temperatures can be generated with this equipment which may cause fumes. Take care during its use.

### **Structural Adhesive**



**CAUTION:** When separating a joint with metal to metal adhesive, it is important to avoid distortion. Heat gradually until the bond weakens sufficiently to permit panel separation - do not apply excessive heat.

- **NOTE:** When spot welding through metal to metal adhesive, take particular care to adjust the equipment setting to ensure a suitable weld.

Metal to metal adhesive is applied to critical joint areas during factory assembly. The material used is a high temperature, heat cured, nitrile phenolic which serves to bond two metal surfaces and also to seal the joint against ingress of dust, moisture and fumes. This material is not suitable for service use and, during repair, should be substituted by an approved structural adhesive. For panel specific information and to identify the areas of structural adhesive application in repair, refer to the relevant sheet metal removal and installation procedure.

### **Expanding Foam Acoustic Seals**

Expanding foam acoustic seals are used in various closed-sections of the body to improve vehicle refinement. The seals are installed during the vehicle body manufacture and expand during the paint process up to ten times original size, thus locking them into position. They are located such that they prevent noise accentuation along a section and reflect air borne noise away from the cabin.

The seals have spilt functionality depending on location. The seals located at the base of the body pillars have a primary function of preventing water ingress when wading. Their secondary function is to prevent noise and dust ingress.

The seal around the fuel filler has a primary function of preventing both fuel and water ingress. With a secondary function of preventing noise and dust ingress.

The remaining seals primary function is to prevent noise accentuation along a section and reflect air borne noise away from the cabin.

Another advantage of the seals is that they marginally increase the overall stiffness of the body and its structural performance in case of a crash.

The seals are manufactured from an expandible polymer.

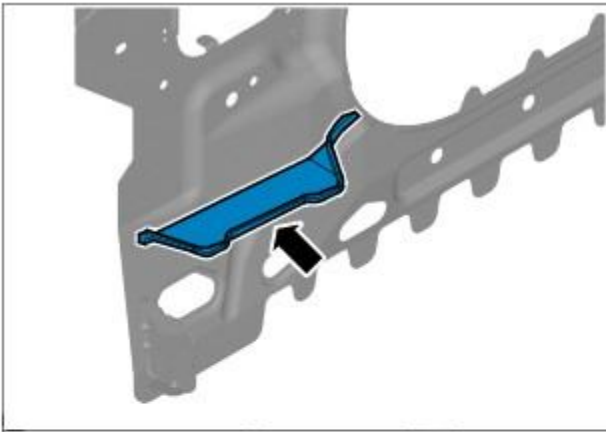
### **Replacing Expanding Foam Acoustic Seals**

As paint oven temperatures used in a repair workshop are significantly lower than those that are used during manufacture of the vehicle, (the temperatures are not sufficient to expand the foam), a different process is required to replicate the foam in repair.

If a repair disturbs the expanding foam acoustic seal it must be reinstated. If access allows, (whether a new seal is fitted or the original is reused), acoustic foam should be injected after paint refinishing. If access is not possible, or it is not practical to apply expanding foam due to the nature of the repair, a suitable flexible PU sealer should be applied around the seal and the corresponding body panel/s prior to assembly. In all cases the application of foam / sealer should form a seal between the expanding foam acoustic seal and any adjacent panelwork.

Expanding Foam Acoustic Seals - A-pillar, (Inner panel)





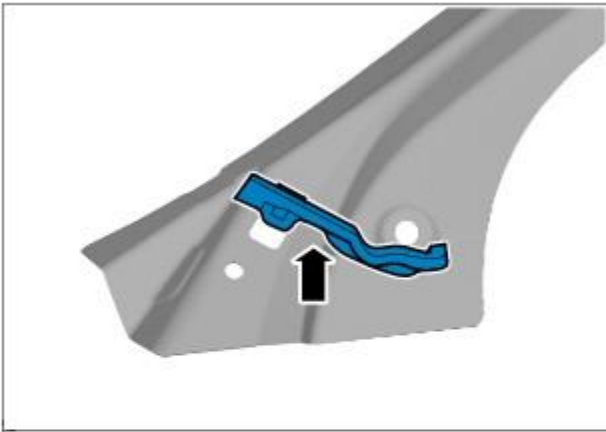
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Expanding Foam Acoustic Seals - A-pillar, (reinforcement)



E115026

Expanding Foam Acoustic Seals - A-pillar, (upper)



E115027

Expanding Foam Acoustic Seals - B-pillar, (reinforcement)



E115028

Expanding Foam Acoustic Seals - Quarter Panel, (fuel filler)



E115031

Expanding Foam Acoustic Seals - Quarter Panel, (inner reinforcement)



E115031

Expanding Foam Acoustic Seals - Quarter Panel, (fuel filler)



E115031

Expanding Foam Acoustic Seals - Quarter Panel, (fuel filler)



E115031

### Seam Sealer

A heat cured, PVC based sealant is applied to specific joint seams during factory assembly. This material is not suitable for service use and during repair and should be substituted by an approved seam sealer.

• **NOTE:** Where seams are inaccessible following the reassembly or fitting of components, ensure that a paste-type seam sealer is applied to such seams. Certain seams also become inaccessible after the completion of panel repairs. In such instances apply seam sealer and paint before final assembly.

Apply seam sealers after the application of primer and before the application of top coat. The sealer must form a continuous bead, with the profile of the bead dependent on the type of seam. If the seam sealer is applied with a brush take particular care to maintain the required coverage of the seam.

Ensure that all accessible repair seams are sealed following a repair. Damage to a vehicle often flexes areas of the body remote from the impact. As a result the seam sealer in these areas may be disturbed by subsequent straightening and repair operations. Check all seams in the vicinity of the area undergoing repair for evidence of cracked seam sealer, then clean out as required and apply fresh seam sealer using the following procedure:

- Clean the affected seam and re-treat any exposed metal areas with a suitable etch phosphate primer.
- Treat affected area with an etch-acid primer.
- Apply appropriate seam sealer as necessary.
- apply appropriate colour coat (and under body sealer as applicable).

Provided access is adequate, apply seam sealer to both sides of a repair joint. Where access is limited to one side only, (e.g. box section), treat the affected box member with cavity wax.

### Cavity Wax

After repairs, always re-treat these areas with an approved cavity wax. In addition, treat all interior surfaces which have been disturbed during repairs whether they have been treated in production or not. This includes all box members, cavities and door interiors.

Before wax injection, ensure that the cavity to be treated is free from any contamination or foreign matter. Where necessary, clear out any debris.

Ensure that cavity wax is applied after the final paint process and before refitting any trim components.

During application ensure that the wax covers all flanges and seam areas and that it is adequately applied to all repaired areas of both new and existing panels.

It should be noted that new panel assemblies and complete body shells are supplied without wax injection treatment. Ensure that such treatment is carried out after repairs.

Effective cavity wax protection is vital. Always observe the following points:

- Complete all paint refinish operations before wax application.
- Check the spray pattern of injection equipment.
- Mask all areas not to be waxed.
- Remove body fixings, such as seat belt retractors, if contamination is at all likely.
- Move door glasses to fully closed position before treating door interiors.
- Treat body areas normally covered by trim before refitting items.
- Check that body and door drain holes are clear after the protective wax has dried.
- Keep all equipment clean, especially wax injection nozzles.

# Body Repairs - Water Leaks - Water Leaks

Description and Operation

## General

- If water leaks occur after bodywork repairs, the cause can be established using the checks described below. A systematic and logical procedure is required to locate water leaks. Before beginning extensive checks, a thorough visual inspection must be carried out.
- Visual Inspection
  - The following characteristics may indicate existing leaks:
  - Check the clearance and accurate fit of ancillary components such as the hood, tailgate, liftgate, doors, and so on.
  - Check for correct fit and possible damage to sealing elements such as blanking plugs, rubber door seals, and so on.
  - Check water drain holes for unhindered flow.
- Various tests can be used to provide further information on possible leaks:
  - Water test
  - Washer test
  - Road test
  - Chalk (powder) test

## Practical execution of tests and checks

### Water test

- **NOTE:** Never aim a jet of water directly at a rubber seal.
- Carry out the water test with a second person present (in the passenger compartment).
- Use variable washer nozzles (concentrated water jet to fine spray mist).
- Start in the lower section and spray the whole area, working upwards in stages.

### Washer test

- Further tests can be carried out in the washer system.
- Some leaks originate here, or only occur here.
- The relevant passenger compartment should be checked using a torch during the wash procedure.

### Road test

- If no leaks are located during the tests above, road tests should be carried out on wet roads.
- Road tests under various conditions:
  - At various speeds.
  - On various road surfaces (asphalt to cobbles).
  - With loaded or unloaded vehicle.
  - Driving through puddles (splash water).

### Chalk test (powder test)

- In this test, the clamping load and the bearing surface of the seal are checked.
- Performing the test:
  - Dust the door seal with powder or coat with chalk.
  - Coat the bearing surface of the seal with a thin film of Vaseline.
  - Slowly close the door and open it again.
  - Check the width and continuity of the imprint on the door seal.

### Other test equipment

- Other equipment such as stethoscopes, UV lamps, special mirrors or ultrasound measuring instruments can be used to locate leaks.

## Rectifying the leak using recommended tools, auxiliary equipment and materials

- Tools and auxiliary equipment:
  - Dry, absorbent cloths
  - Variable washer nozzle
  - Torch, fluorescent tube
  - Mirror
  - Compressed air
  - Seal lip installer
  - Wet/dry vacuum cleaner
  - Sealing compound compressor
  - Remover for interior trim
  - Cutter blade or pocket knife
  - Wedge (wood or plastic)
  - Hot air blower
  - Special mirror for concealed leaks
  - Air flow checker
  - Sealing compound (tape and plastic compound)
  - Multi-purpose sticker
  - Clinched flange sealer
  - Window sealing compound
  - Water shield (PVC)
  - Double-sided adhesive tape for water shield

- Methylated spirit (available from trade outlets)
- PU adhesive
- Silicone remover
- Tar remover

### **Water leaks according to mileage or running time**

Increasing mileage has an effect on the problem of leaks in a vehicle. Possible influencing factors are:

- Servicing and maintenance of seals:
  - No maintenance, lack of maintenance or incorrect maintenance
  - Using an incorrect agent
- Damaged seals:
  - As a result of aging, wear or incorrect handling/assembly.
- Heavy soiling of the vehicle:
  - Heavy soiling of a vehicle can seriously impair the function of water drainage channels in particular, and also of rubber seals.
- Age-related factors:
  - Environmental factors
  - UV radiation
  - Extreme climatic conditions
- Corrosion can have a serious impact on bodywork, in particular as a result of:
  - Lightly or heavily rusted seal carriers
  - Rusted body seal welds
  - Perforation corrosion

### **Water leaks after body repairs**

If a vehicle develops a leak after body repairs, the following points must be taken into consideration in particular:

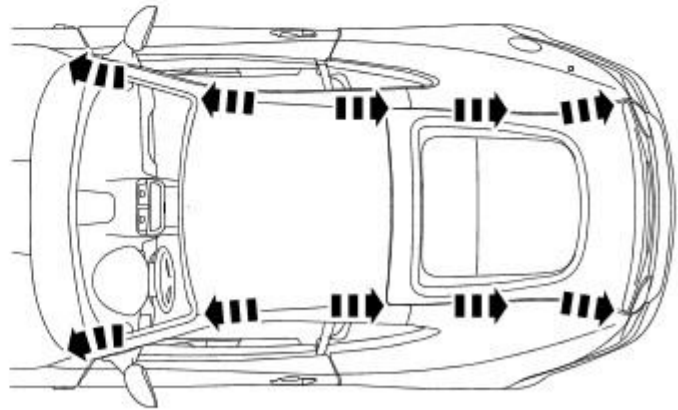
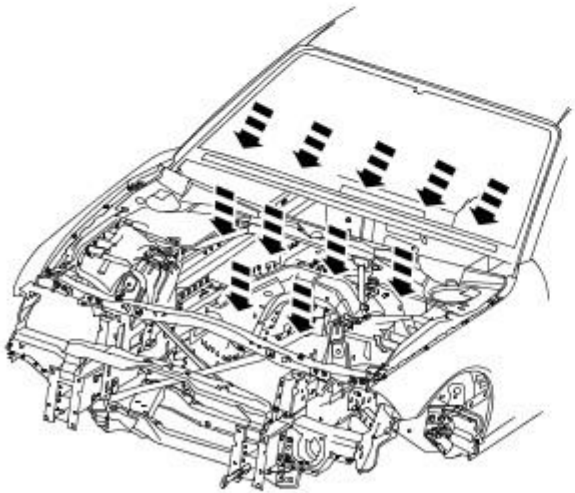
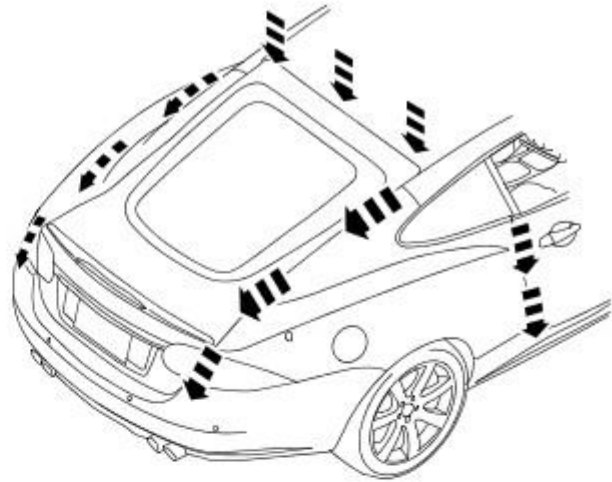
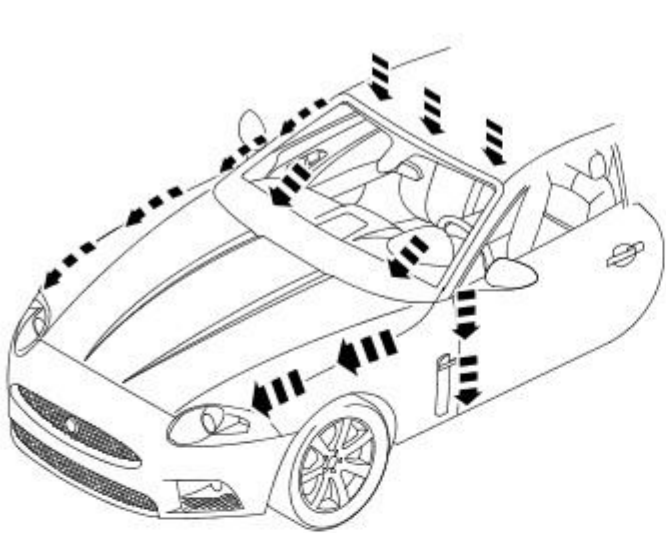
- The correct seating of ancillary components and their seals must be checked.
- The correct alignment of doors/tailgate and liftgate must be checked. The associated seals must not be damaged and must be installed correctly.
- Check that panel seams are correctly sealed.
- The correct seating of rubber grommets must be checked.
- Directly-glazed windows must have correct and complete bonding.

### **Water drainage system**

If a vehicle develops water leaks, then areas into which water is routed or drained should be checked first.

Water drainage system (illustration for reference only)





E102719

Item	Part Number	Description
1	-	Water drainage, front
2	-	Water drainage, side and rear
3	-	Roof drainage
4	-	Engine compartment drainage

### Water leaks, diagnosis and corrective action: Front passenger compartment

#### Windscreen

- Diagnosis:
  - Ingress of water into A-pillar area or instrument cluster area and rocker panel area.
- Cause:
  - Breaks in adhesive beads
- Corrective action:
  - The breaks in adhesive beads can be located from inside by using compressed air. The leak can be identified from outside by the escaping air.
  - The second test method is by means of a water test. The outer trims must be raised carefully using a plastic wedge. The leak should be located from inside by a second assistant.

#### Side windows

In the case of side windows, the same problems can arise as for a windscreen. The same corrective actions must therefore be used.

#### Door seal

- Diagnosis:
  - Water ingress in the lower part of the interior door trim or in the rocker panel area.

- Cause:
  - The water shield fitted behind the interior door trim exists to drain off water that has entered the door via the drainage holes, either downwards or outwards. If the water shield seal is damaged or has been fitted incorrectly, then water can get into the passenger compartment.
  - In addition to this, the drainage holes can become clogged with leaves, dirt or excess cavity protection agents. Water gathers in the door and ingresses into the passenger compartment.
  - Check water shield for damage or correct fitting.
  - If the water shield needs to be re-bonded, then approved seam sealer should be used.
  - Before the water shield is installed, the drainage holes must be checked for unhindered flow.

## Door seals

- Diagnosis:
  - Ingress of water into the rocker panel area
- Cause:
  - Insufficient clamping load between seal and door.
- Corrective action:
  - Check clamping load:
    - The easiest way to check the clamping load of a seal to the respective bearing surface is by means of a paper strip test. This consists of trapping strips of paper at various points between the door and the seal, and fully closing the door. If it is possible to pull out the paper with no great resistance, then the clamping load is too low.
    - 
    - NOTE: When adjusting the clamping load, the profile alignment of the relevant components must always be taken into consideration.

Adjust the clamping load:

- The clamping load is normally adjusted using the striker. When doing so, the edge alignment from the door to the side panel, or from the front door to the rear door must be taken into account.
- Another setting method is to realign the panel flange for the seal mounting. The clamping load is increased by moving the flange towards the door.
- 
- NOTE: Do not realign the flange too far in the direction of the door, as this can reduce the bearing surface of the seal to the door.

Check the bearing surface:

- Apply chalk evenly to the surface of the seal. Evenly coat the bearing surface of the door with Vaseline.
- Close the door fully, the lock must engage. Open the door. The imprint of the chalk (bearing surface) can be identified in the film of Vaseline.
- The bearing surface should be at least 5mm across at all points.

- Other causes:
  - The door seal must completely seal the door where it meets the bodywork.
  - Water can ingress directly or indirectly into the interior of the vehicle if the seal is damaged at any point.
- Corrective action:
  - A damaged or worn door seal must always be renewed in full.
  - When renewing the seal, the following must be taken into account:
    - Always fit the seal first in the area of the narrow radii (corner points).
    - Next, secure the seal to the flange evenly by tapping lightly with a rubber hammer. The installed seal must not be kinked at any point.

• NOTE: The prescribed length of a seal must not be shortened.

- Other cause:
  - The door seal is attached to the welded flange all the way round. If this welded flange is uneven or damaged at any point (usually in areas with small radii) then this point could be subject to leaks.
  - A stretched seal carrier can also cause a leak.
  - In both cases, water gets into the vehicle interior under the seal carrier.
- Corrective action:
  - Align the deformed welded flange using a hammer and anvil block, prevent and, if necessary, repair any paint damage.

## Sliding roof/tilting roof

- Diagnosis:
  - Ingress of water at sliding roof aperture
- Cause:
  - The sliding roof/tilting roof is installed in a water trap. The water drains off via the water trap, water drain holes and drain hoses. The drain hoses lead downwards on both sides via the A-pillar and B-pillar.
  - The drain holes or drain hoses can become clogged with leaves, dirt, underbody protection and so on.
- Corrective action:
  - 
  - NOTE: In the case of a sliding or tilting roof, the external rubber seal and the lock actuator or latch mechanism must be checked first of all.

Check the water trap for leaks.

- Check the drain hoses for leaks and for correct connection to the water trap.
- Check the drainage system for unhindered flow, and blow out with compressed air if necessary.
- Check the external seal and the correct adjustment of the sliding roof.

## Liftgate

- Diagnosis:
  - Ingress of water into rear headlining area and luggage area.
- Cause:
  - The leak problems of the tailgate and liftgate correspond to those of the doors.

- In addition to this, the area to be sealed is much bigger. The routing holes for cables and hoses must also be sealed.
- The rubber grommets for the routing holes must be checked for damage and correct seating (fully unhooked).
- The mounting points of the liftgate hinges may leak.
- Corrective action:
  - Check the rubber grommets and renew if necessary.
  - Check the hinge mounting points, and re-seal with sealing compound if necessary.

#### **Forced air extraction**

- Diagnosis:
  - Ingress of water into side luggage compartment area
- Cause:
  - The forced air extraction for the vehicle interior is located in the quarter panel lower extension.
  - The rubber flap of the forced air extraction must be able to move freely.
- Corrective action:
  - Remove the forced air extraction.
  - Check the seal area between the bodywork and housing, as well as the rubber flap.
  - Renew seal if necessary.

#### **Rear window**

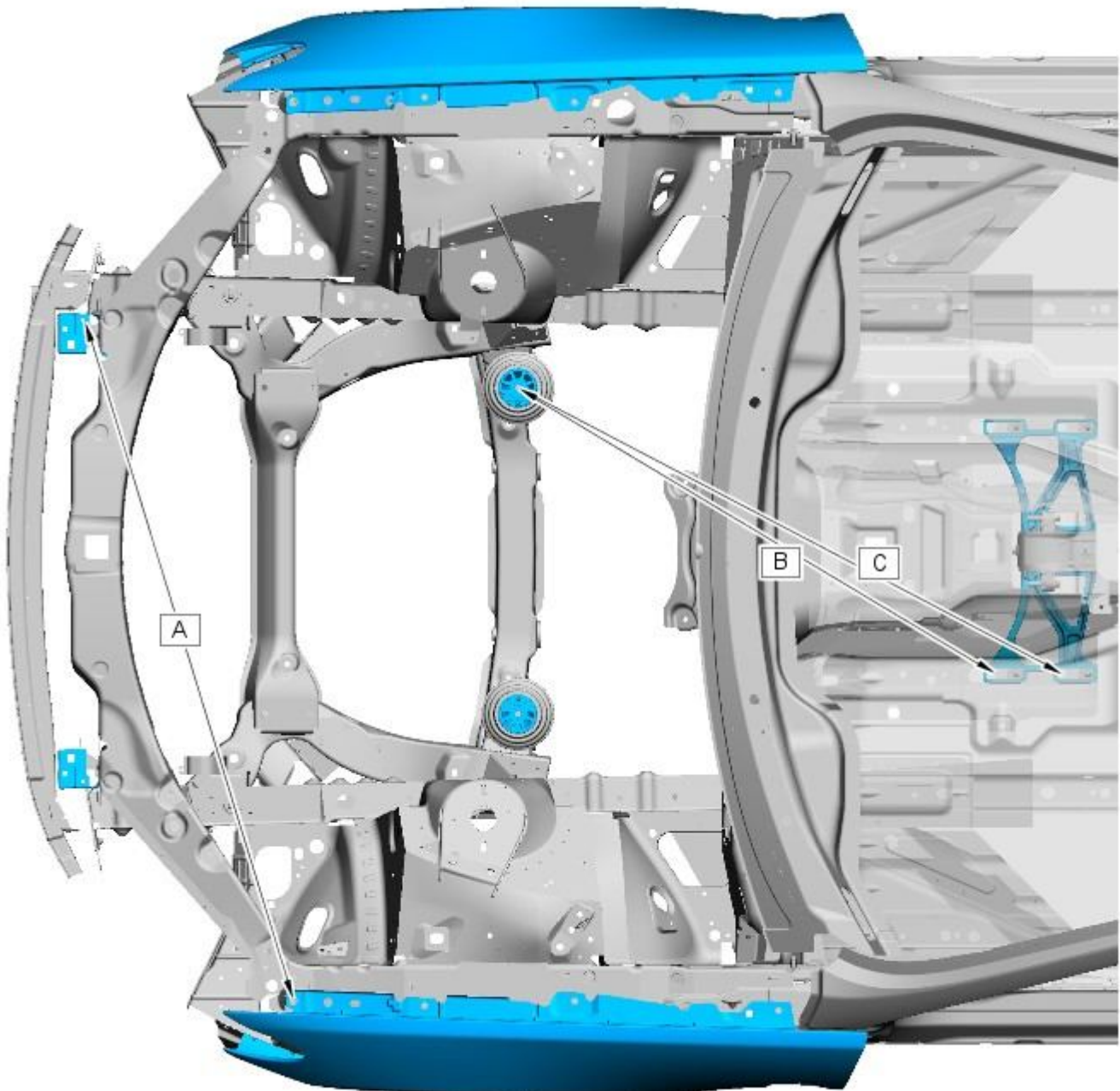
- Diagnosis:
  - Ingress of water into the luggage compartment area
- Cause:
  - Rear window leaking.
  - Check for leak in the same way as for leaking windscreen.

# Body Repairs - Vehicle Specific Information and Tolerance Checks - Body and Frame

Description and Operation

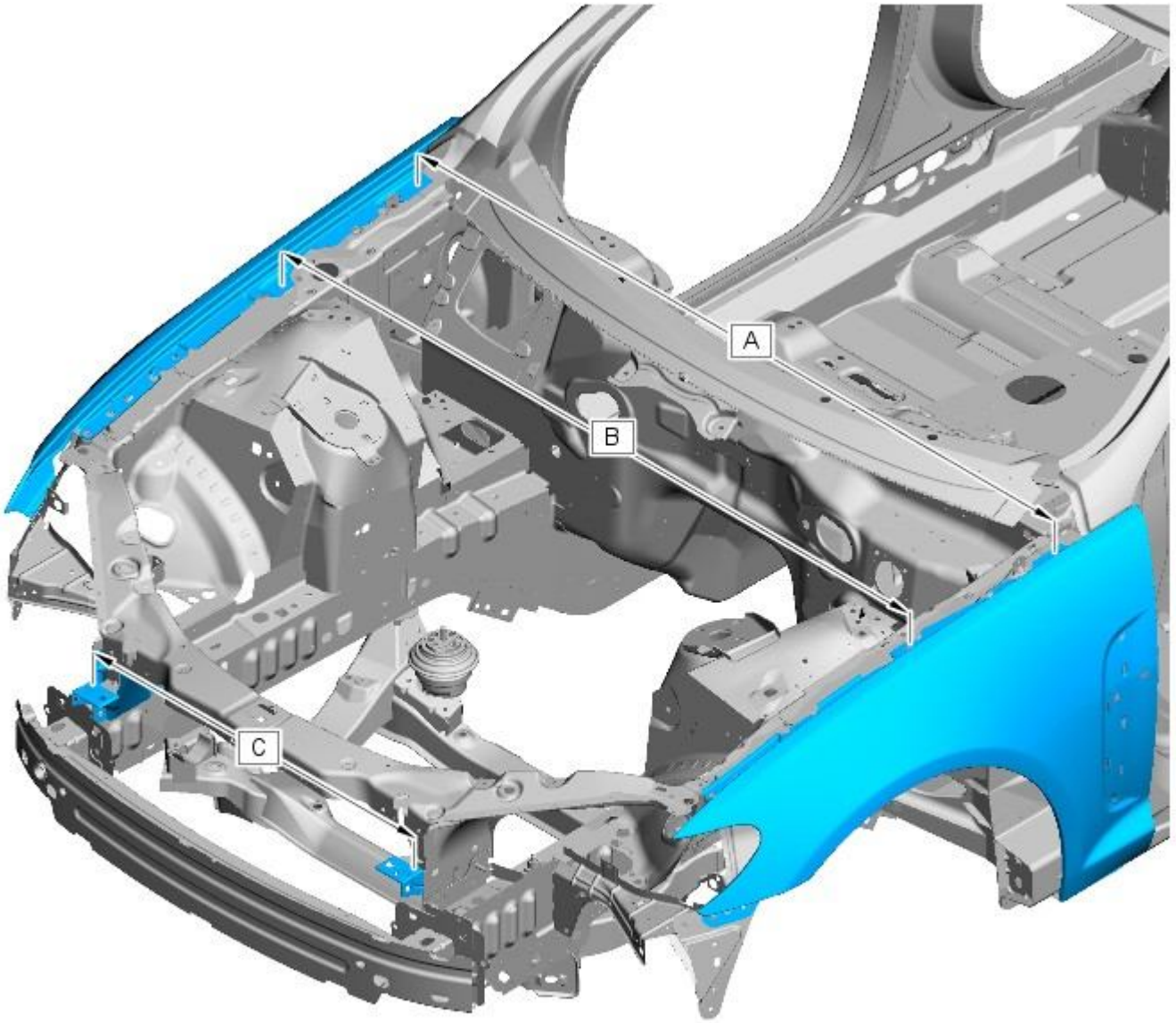
## Front End Body Dimensions

- NOTE: All dimensions shown are in millimetres (mm).
- NOTE: Dimensions shown to holes, are always taken from/to the hole centre. They are also always to the body panel surface, not to the top of bolts or components.



E128816

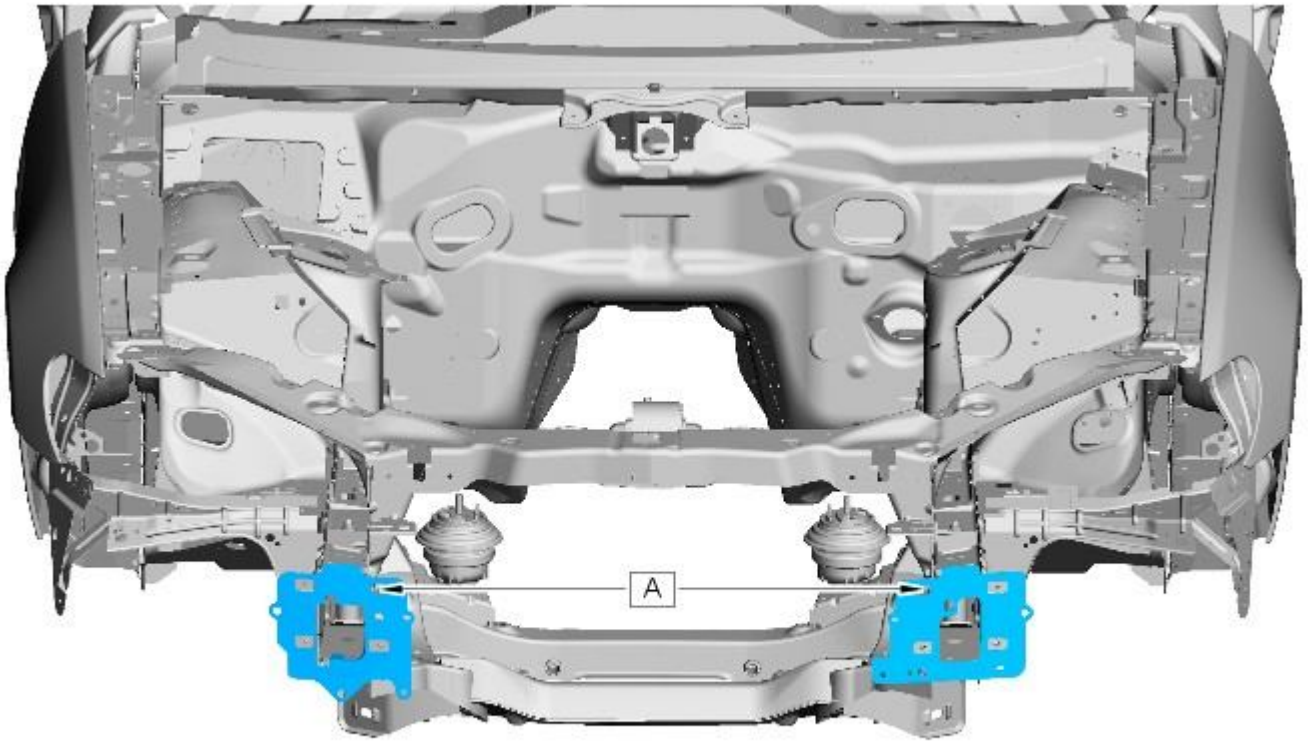
Item	From	To	Dimension
A	Headlamp RH inboard fixing hole	Front fender LH forward fixing hole	510.5
B	Transmission LH mounting, forward stud	Engine RH mounting, forward fixing hole	987.2
C	Transmission LH mounting, rear stud	Engine RH mounting, forward fixing hole	1091



E128817

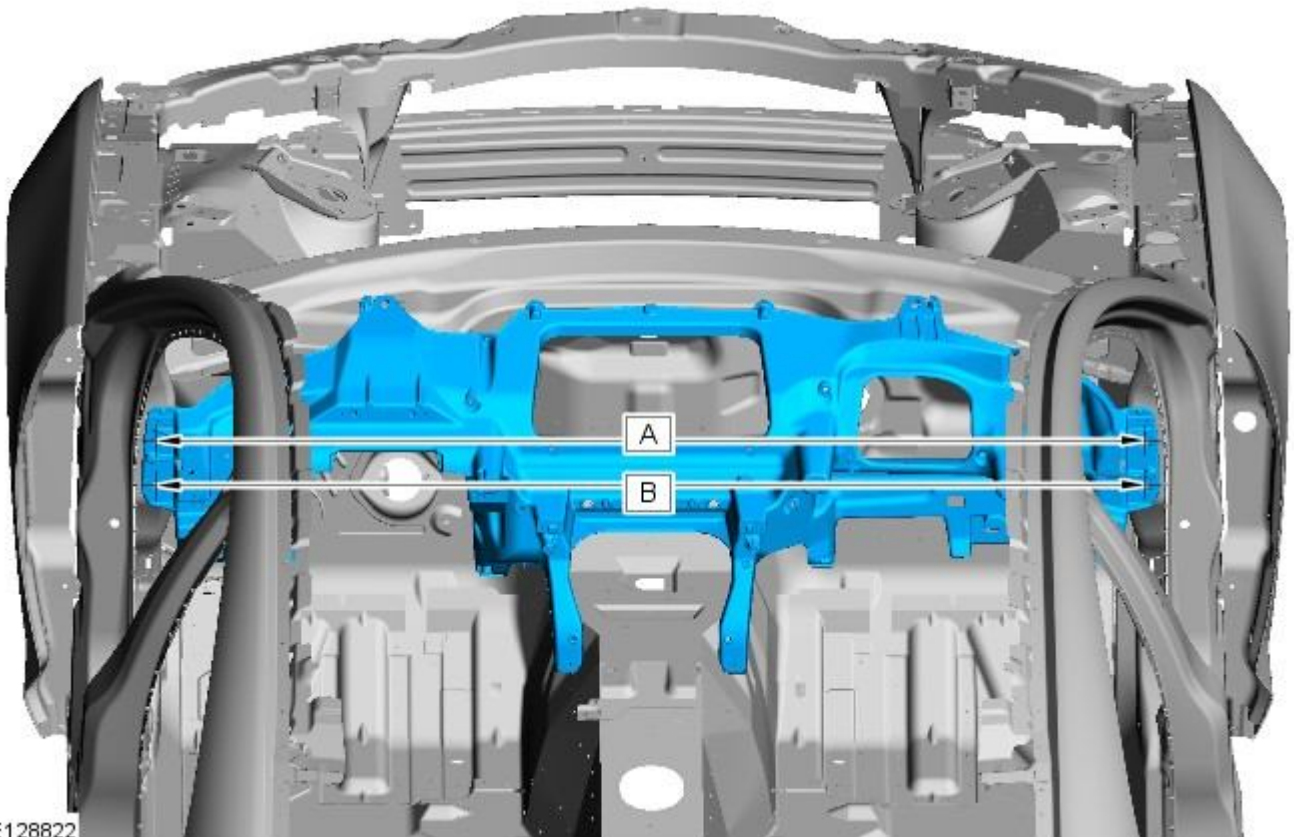
Item	From	To	Dimension
A	Front fender RH, rear fixing hole	Front fender LH, rear fixing hole	1549.6
B	Front fender RH, centre fixing hole	Front fender LH, centre fixing hole	1518.1
C	RH Headlamp top inboard fixing hole	LH Headlamp top inboard fixing hole	771





E128818

Item	From	To	Dimension
A	Front bumper RH top inboard fixing hole	Front bumper LH top inboard fixing hole	770.9

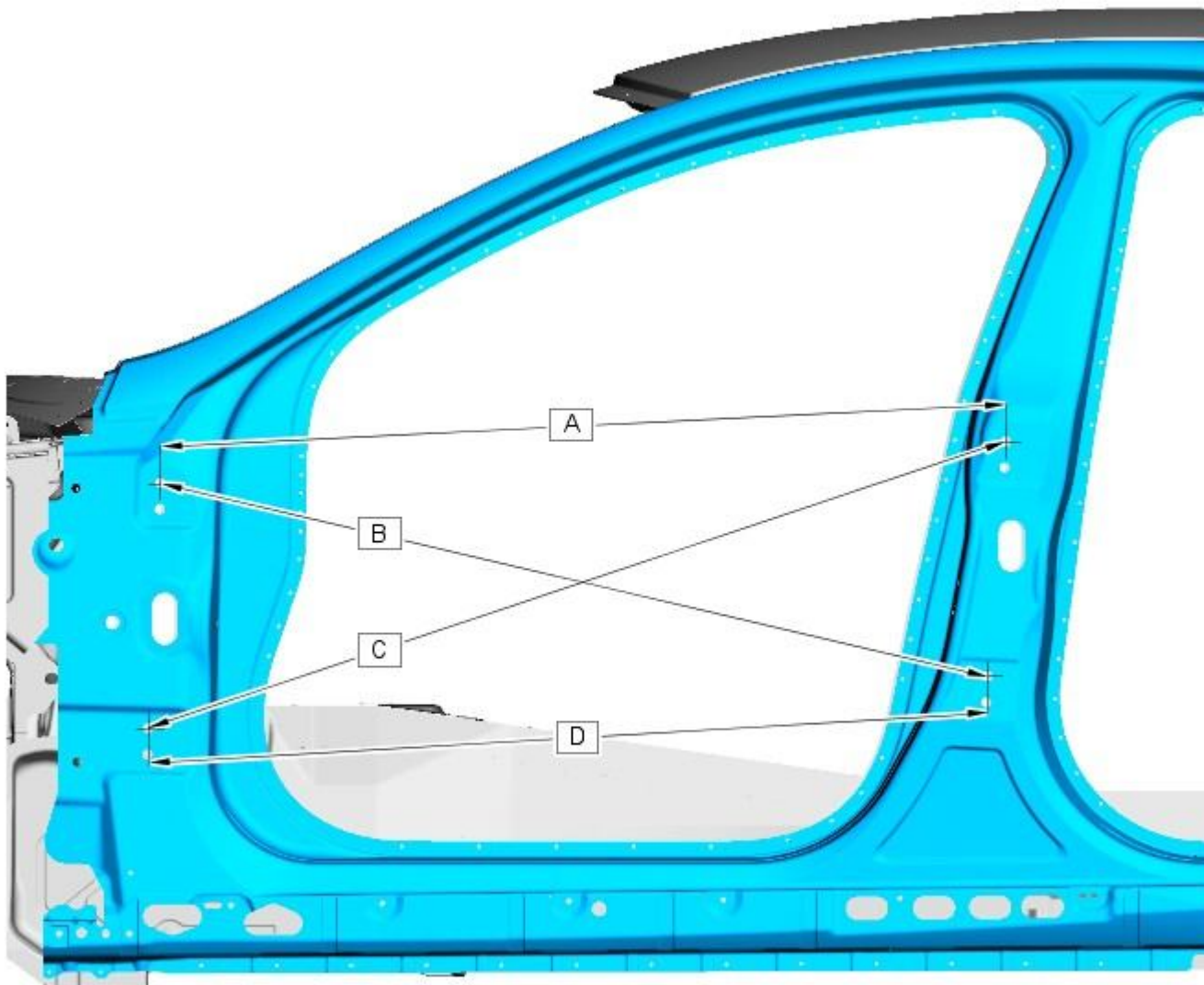


E128822

Item	From	To	Dimension
A	Instrument panel carrier RH top fixing hole	Instrument panel carrier LH top fixing hole	1416
B	Instrument panel carrier RH bottom fixing hole	Instrument panel carrier LH bottom fixing hole	1416

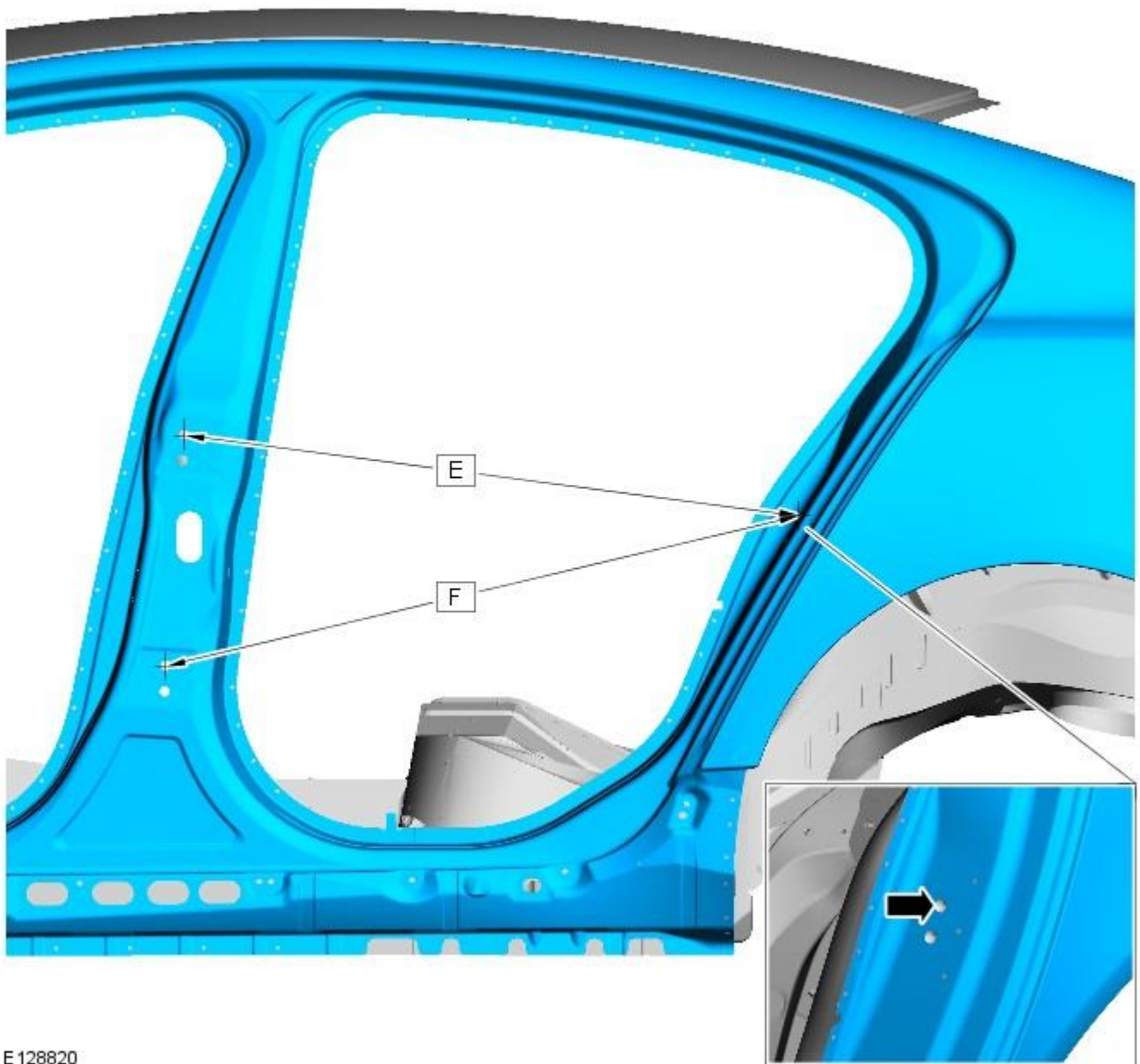
### Side Panel Dimensions





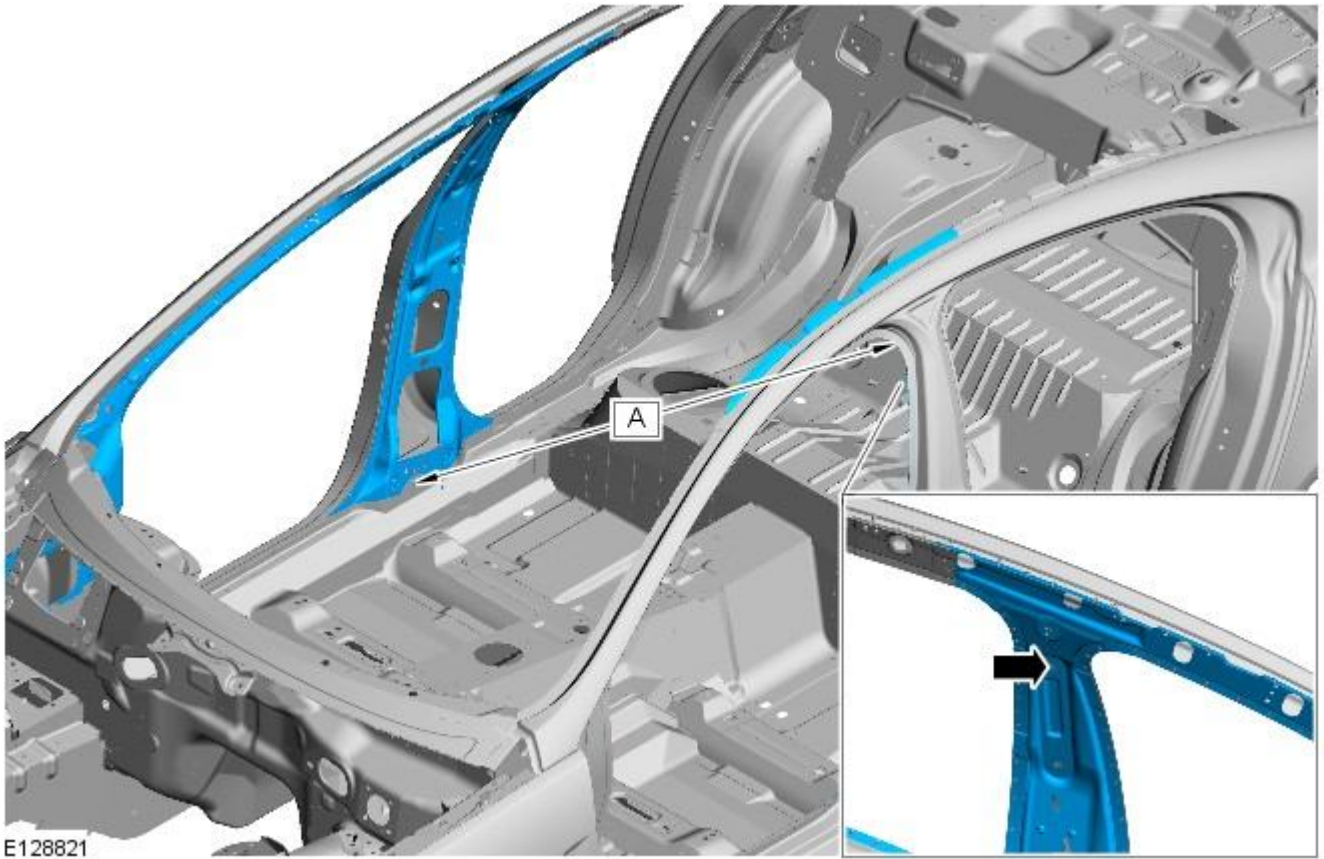
E128819

Item	From	To	Dimension
A	Front door top hinge, top fixing hole	Rear door top hinge, top fixing hole	1129.4
B	Front door top hinge, top fixing hole	Rear door bottom hinge, top fixing hole	1133.8
C	Front door bottom hinge, top fixing hole	Rear door top hinge, top fixing hole	1206.7
D	Front door bottom hinge, top fixing hole	Rear door bottom hinge, top fixing hole	1122.4



E128820

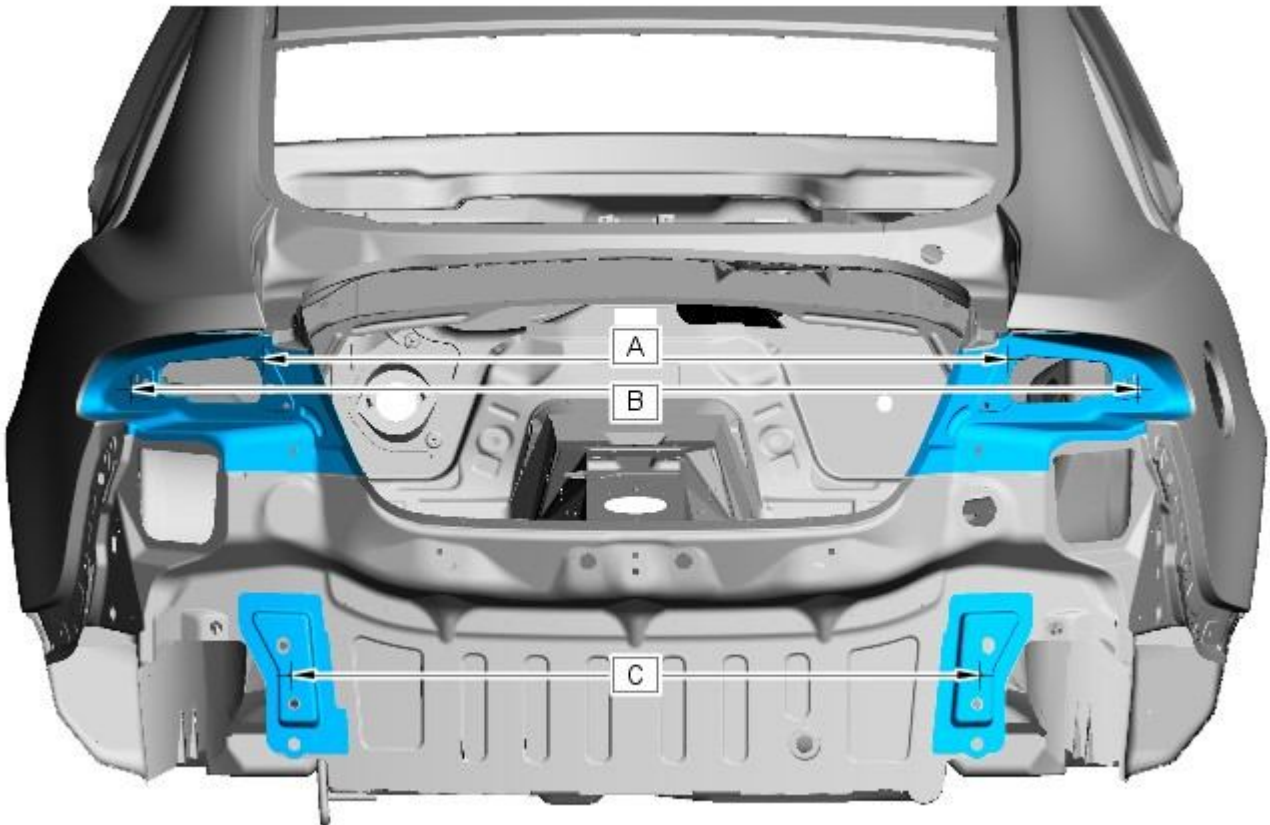
Item	From	To	Dimension
E	Rear door top hinge, top fixing hole	Rear door striker, top fixing hole	844.4
F	Rear door bottom hinge, top fixing hole	Rear door striker, top fixing hole	884.7



E128821

Item	From	To	Dimension
A	Front seat belt retractor fixing hole	Front seat belt anchorage fixing hole	1684.37

### Rear End Body Dimensions



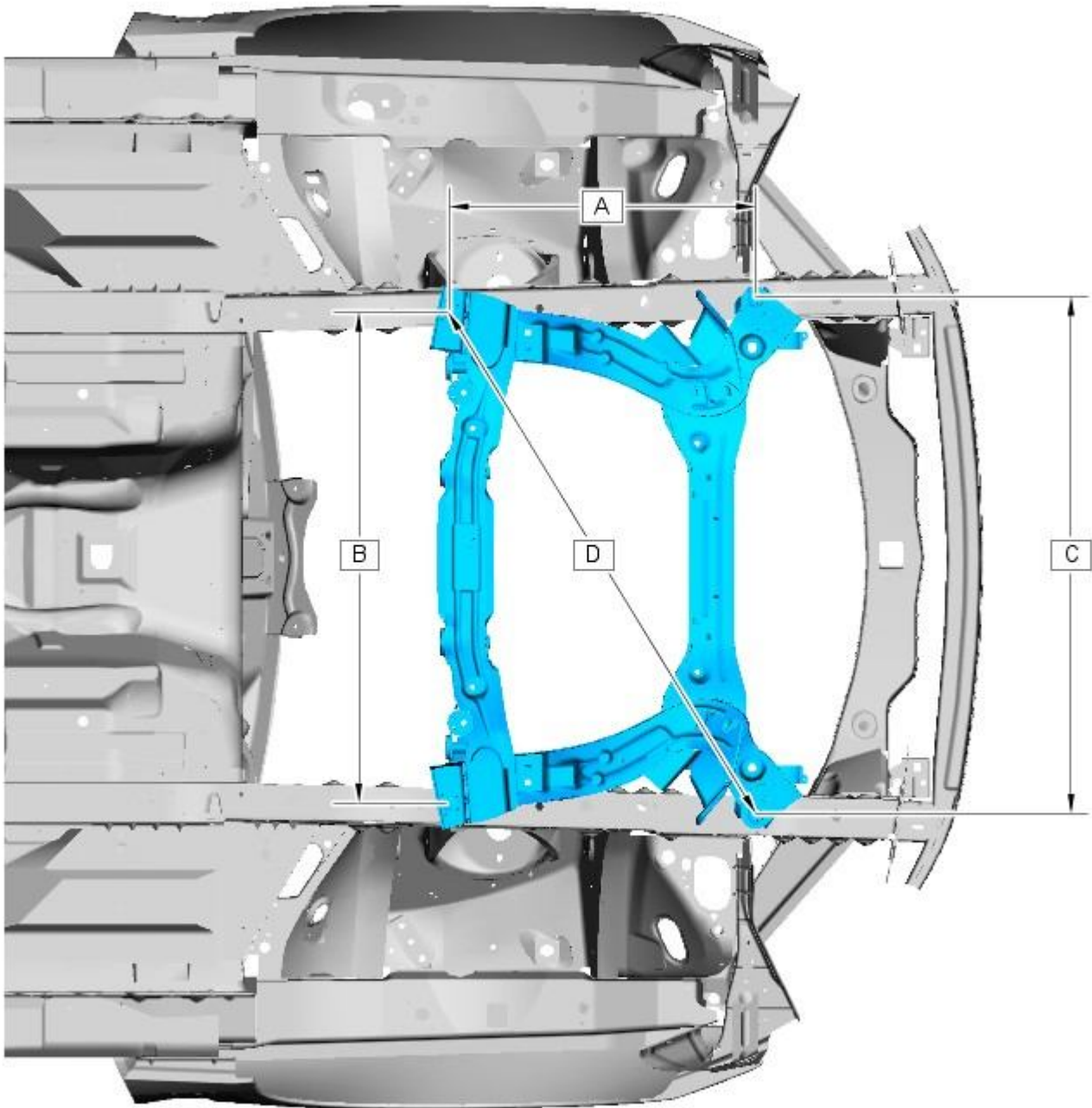
E128823

Item	From	To	Dimension
A	RH Rear lamp location hole	LH Rear lamp location hole	1501.8
B	RH Rear lamp top fixing hole	LH Rear lamp top fixing hole	1109.6



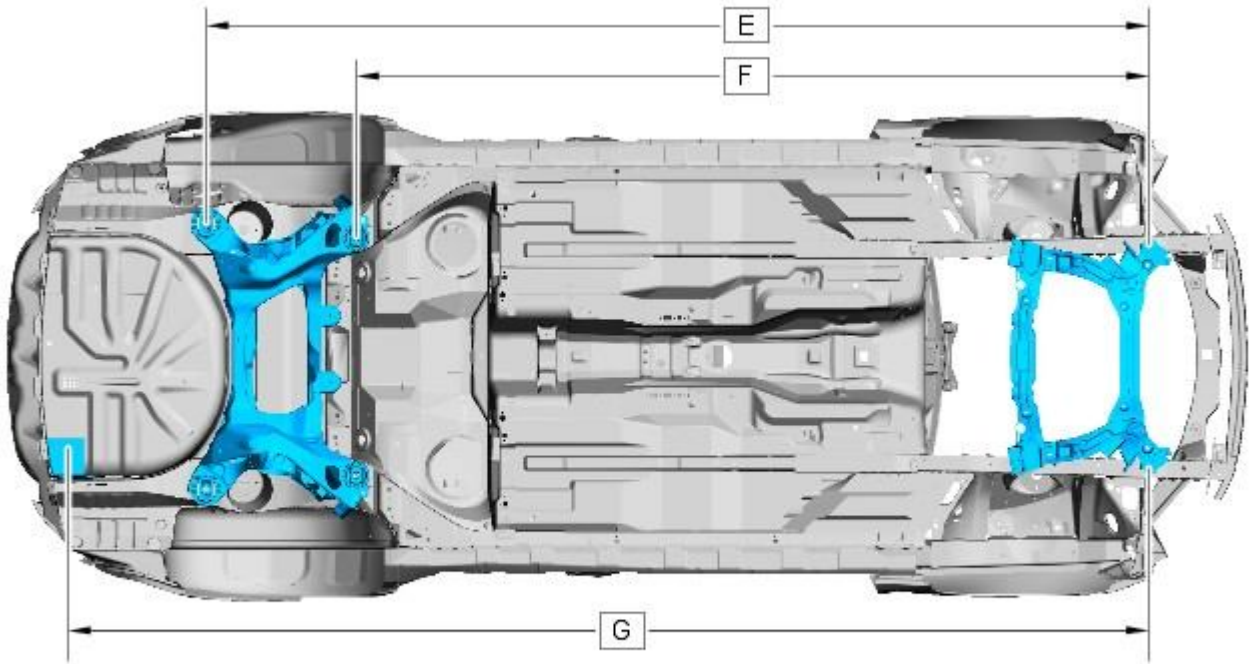
Item	From	To	Dimension
C	Rear bumper RH outboard top fixing stud	Rear bumper LH outboard top fixing stud	1024.7

### Under Body Dimensions



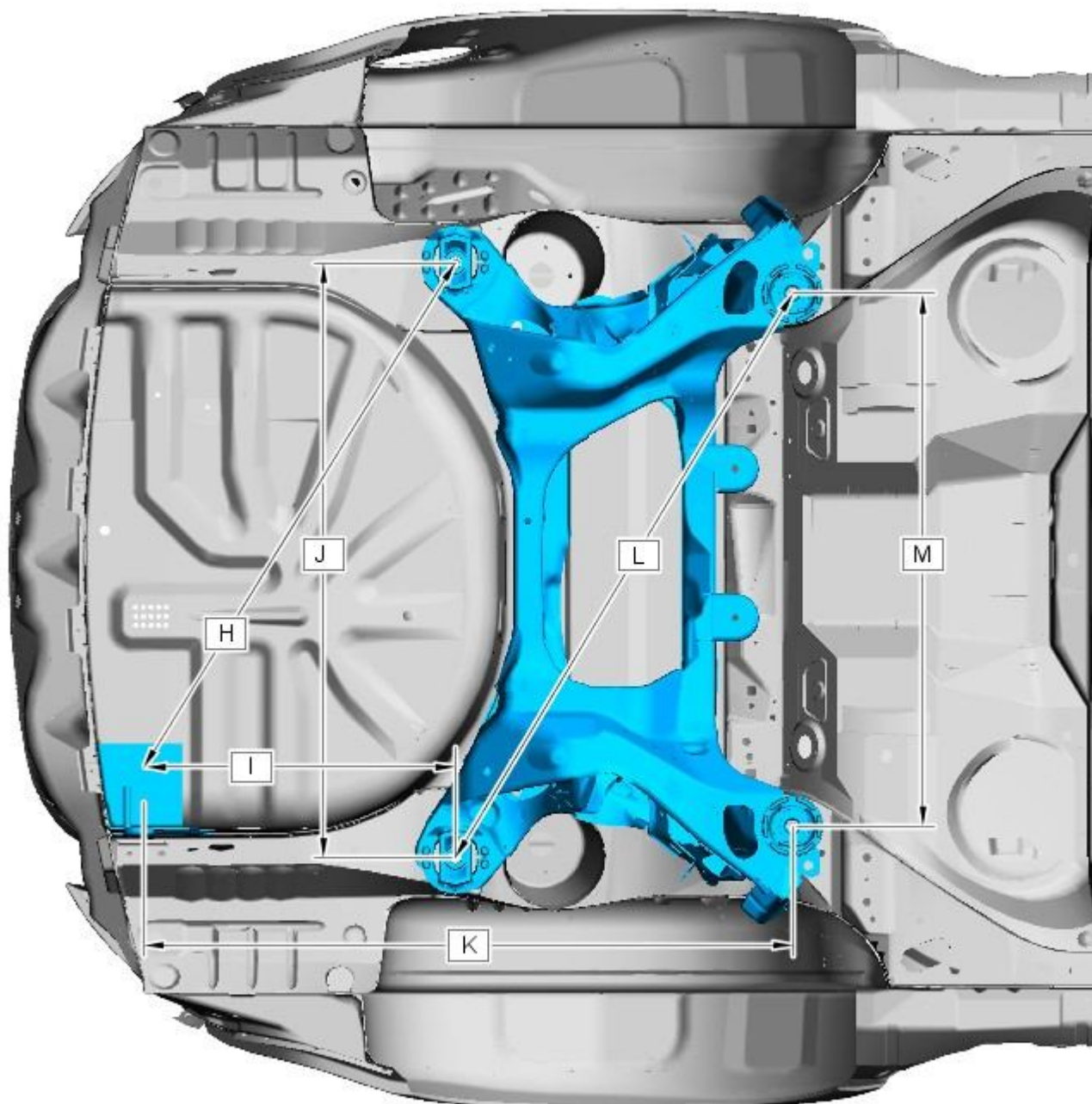
E128824

Item	From	To	Dimension
A	Front subframe front fixing hole	Front subframe rear fixing hole	510.5
B	Front subframe RH rear fixing hole	Front subframe LH rear fixing hole	821
C	Front subframe RH front fixing hole	Front subframe LH front fixing hole	860
D	Front subframe front fixing hole	Front subframe rear fixing hole	983.4



E128825

Item	From	To	Dimension
E	Front subframe front fixing hole	Rear subframe rear fixing hole	3608.5
F	Front subframe front fixing hole	Rear subframe front fixing hole	3035.8
G	Front subframe front fixing hole	Rear towing eye rear fixing hole	4138.1



E128826

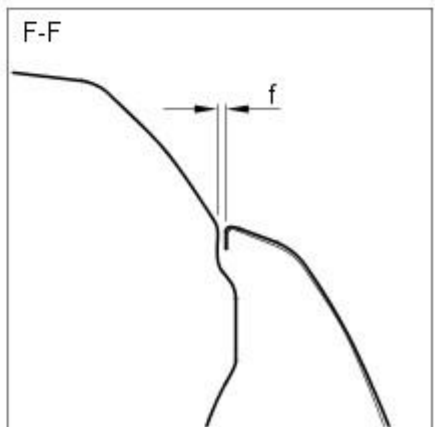
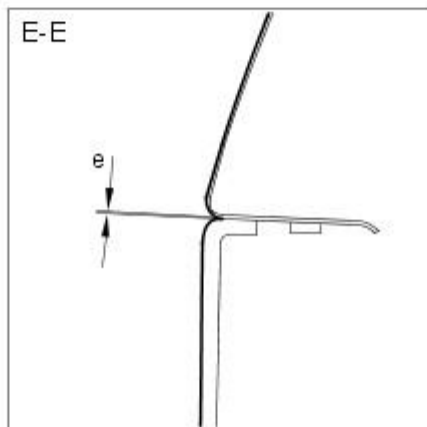
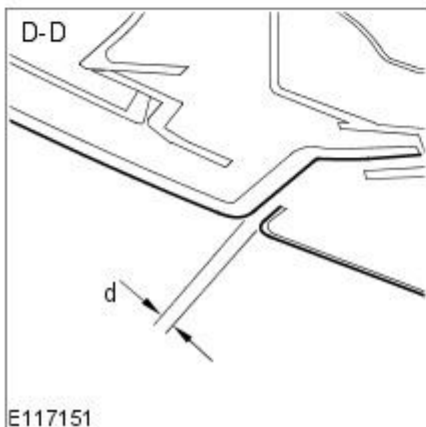
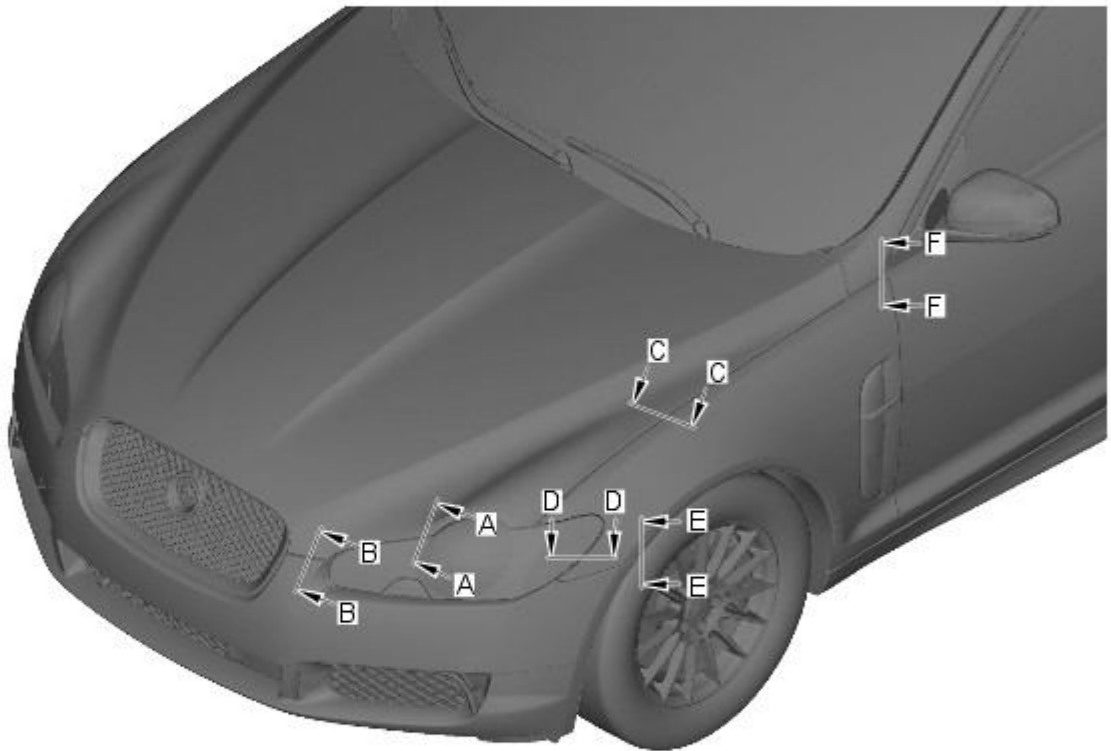
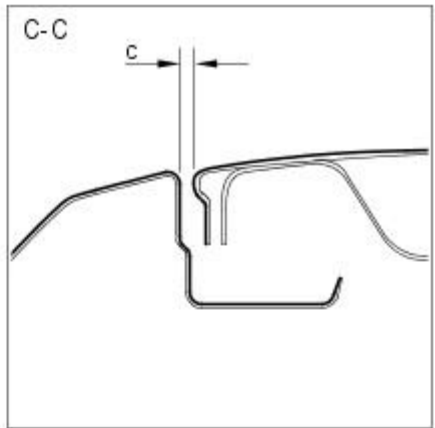
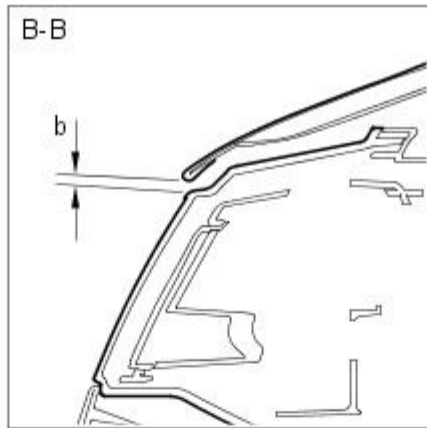
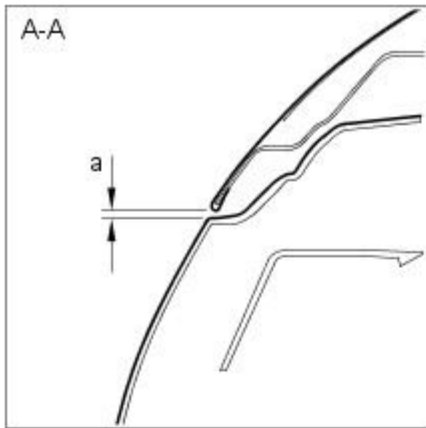
Item	From	To	Dimension
H	Rear subframe LH rear fixing hole	Rear towing eye rear fixing hole	1011.8
I	Rear subframe RH rear fixing hole	Rear towing eye rear fixing hole	560.8
J	Front subframe front fixing hole	Rear towing eye rear fixing hole	1015.3
K	Rear subframe front fixing hole	Rear towing eye rear fixing hole	1103.6
L	Rear subframe RH rear fixing hole	Rear subframe LH front fixing hole	1139
M	Rear subframe RH front fixing hole	Rear subframe LH front fixing hole	908.9

### Gap and Profile measurements

The following information is to be used as a guide to assist the technician in installing exterior body panels and trim items so as to achieve a correctly aligned and cosmetically acceptable vehicle.

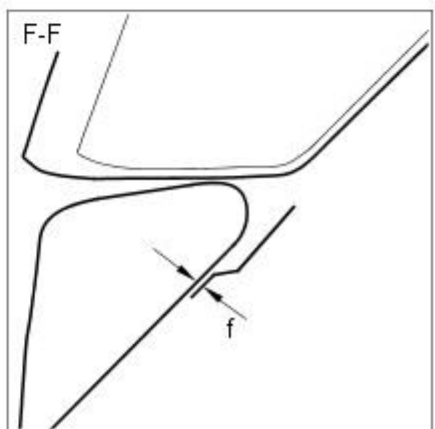
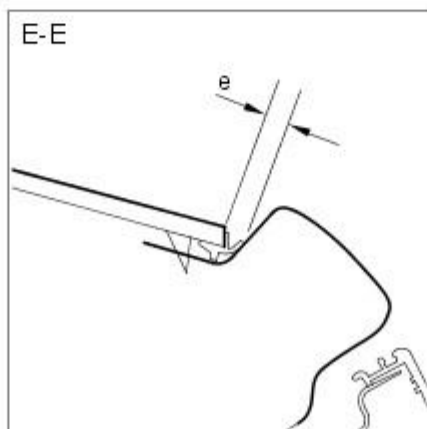
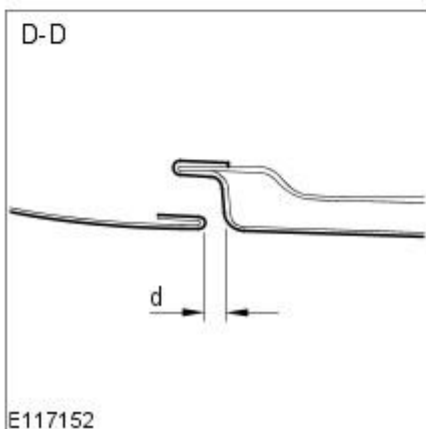
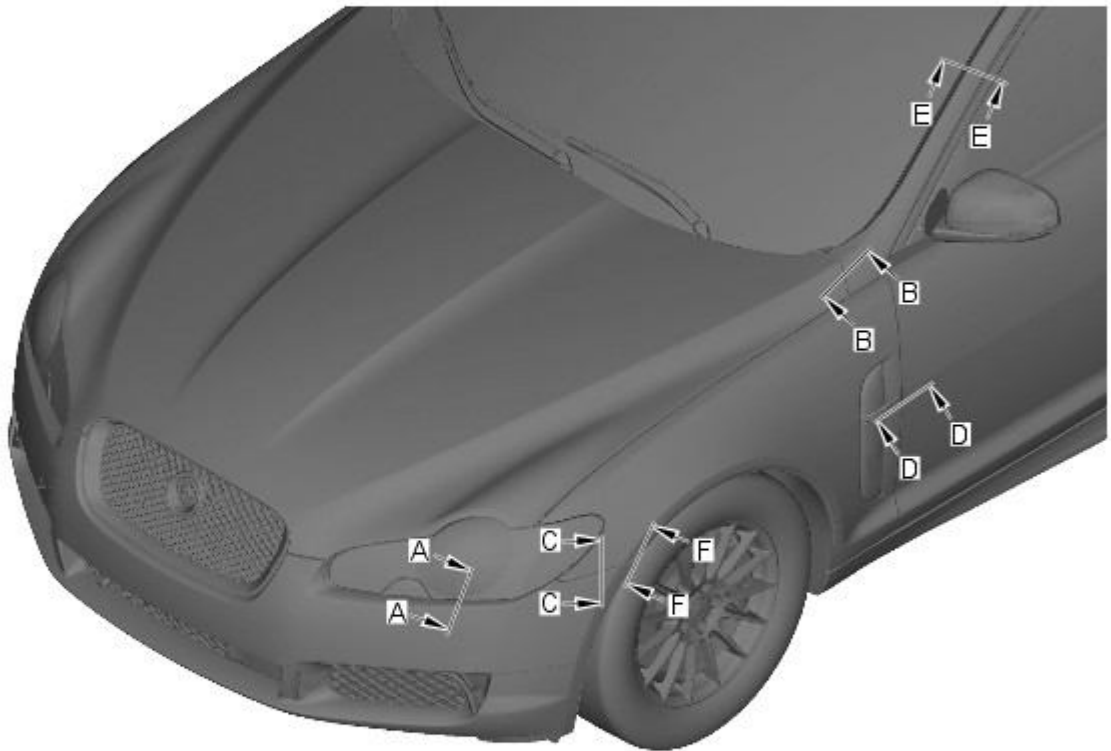
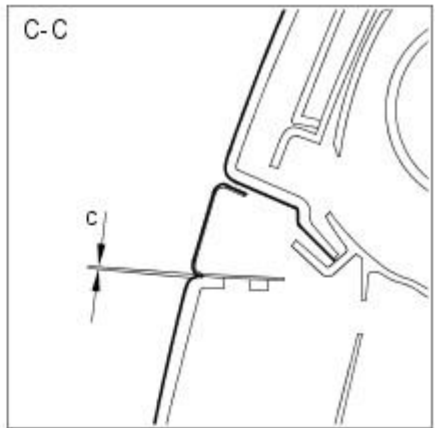
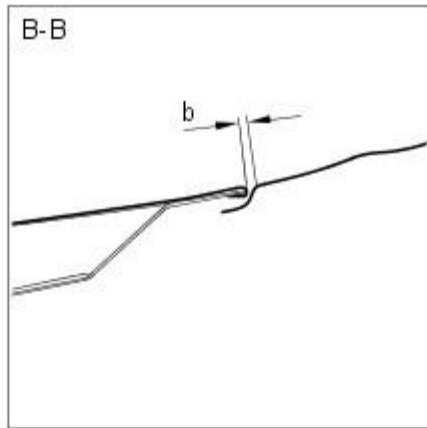
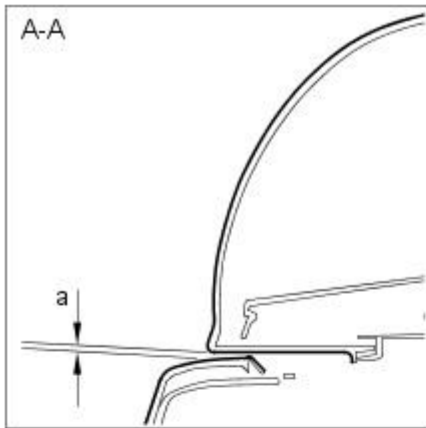
- NOTE: All dimensions shown are in millimetres, (mm).





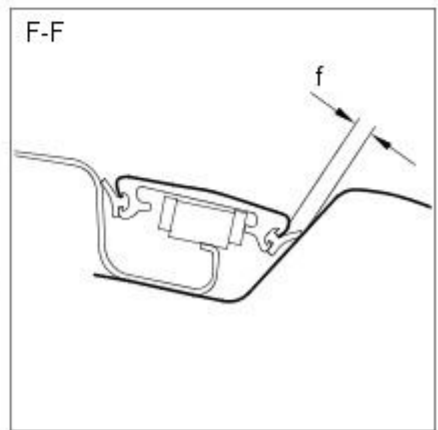
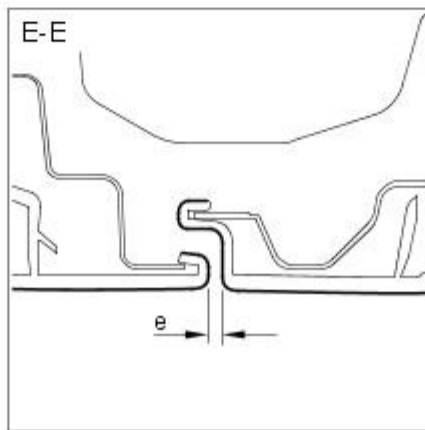
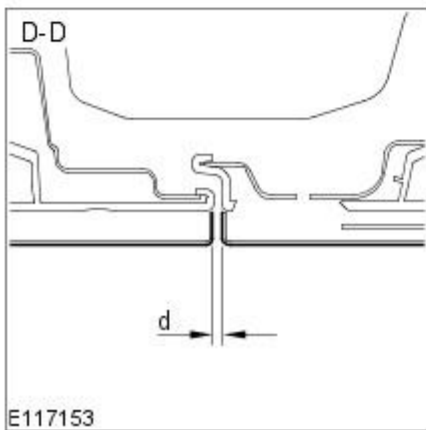
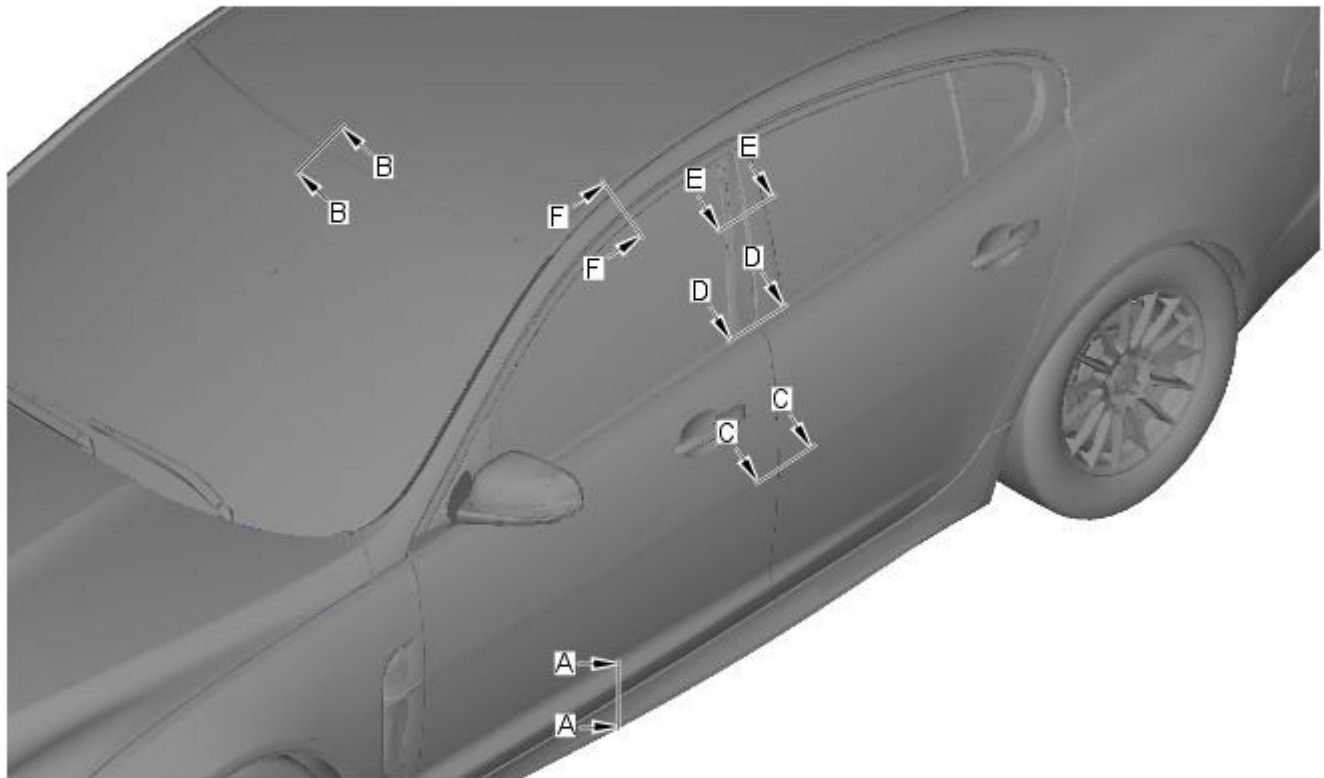
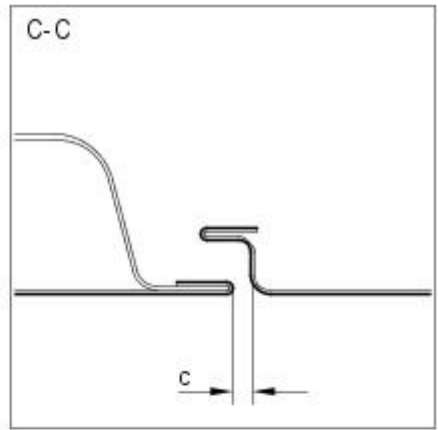
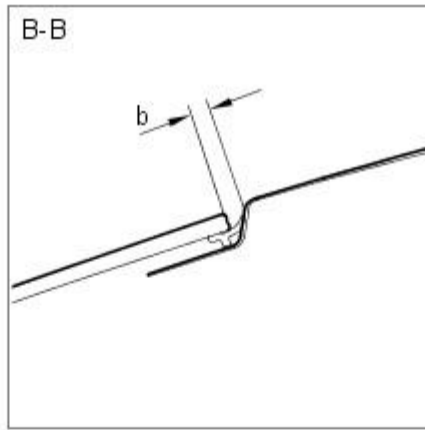
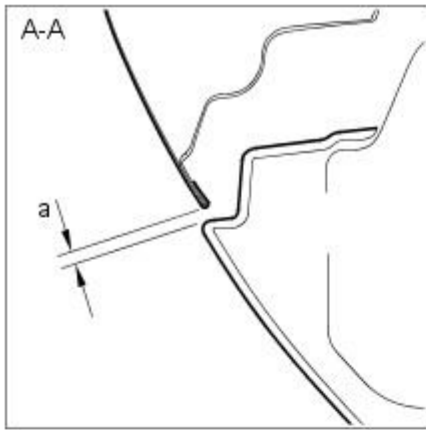
E117151

Section	Description	Gap	Profile
A-A	Hood to front bumper cover	$4.0 \pm 2.0$	N/A
B-B	Hood to headlamp	$4.0 \pm 2.0$	$2.0 \pm 2.0$
C-C	Hood to front fender	$3.5 \pm 1.0$	$0.5 \pm 0.5$
D-D	Front fender to headlamp	$2.0 \pm 1.0$	N/A
E-E	Front fender to front bumper cover	$0.0 \pm 0.5$	$0.5 \pm 0.7$



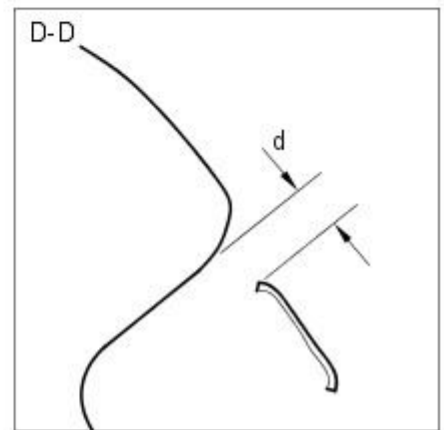
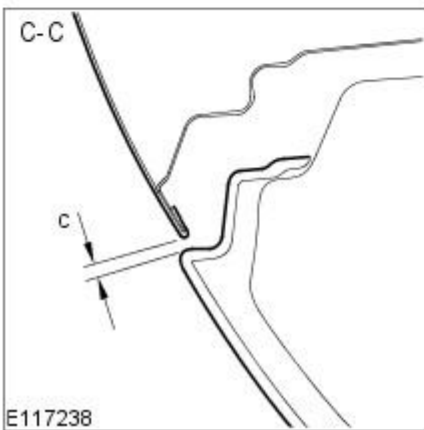
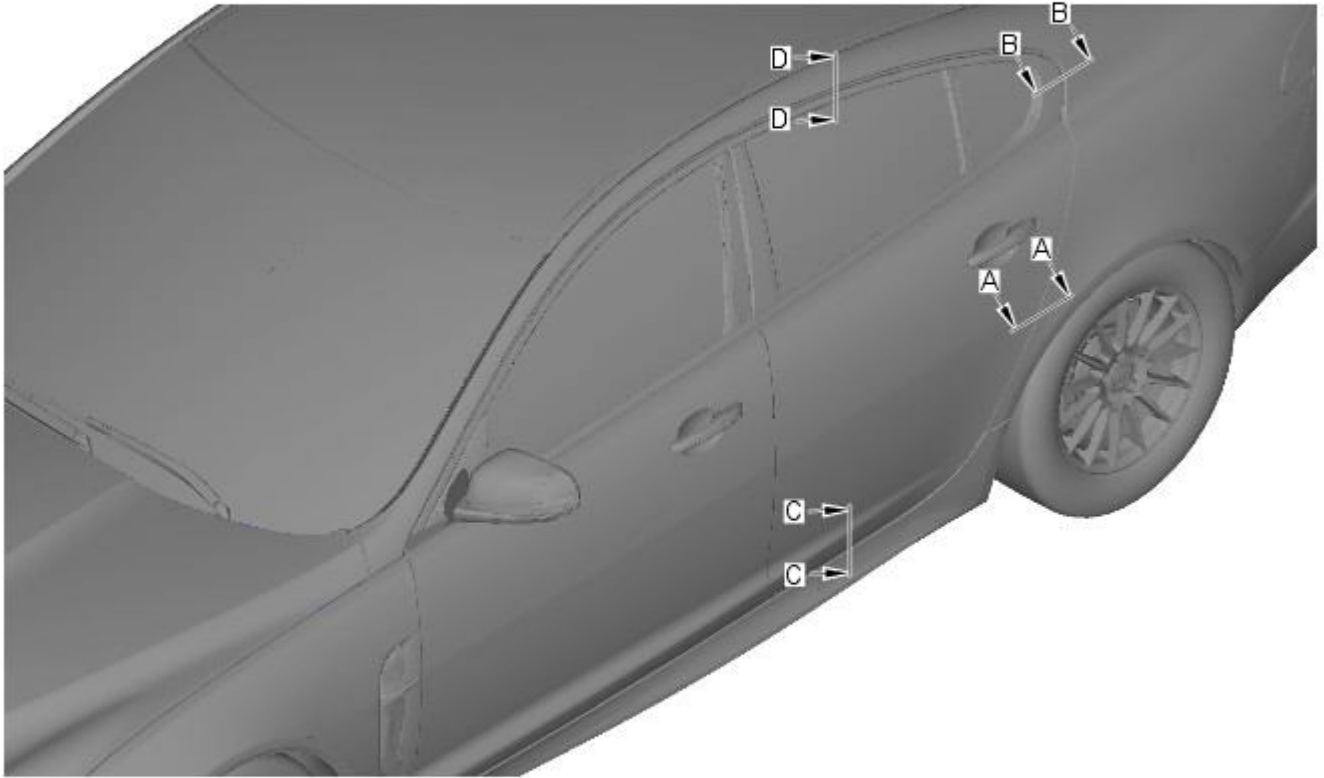
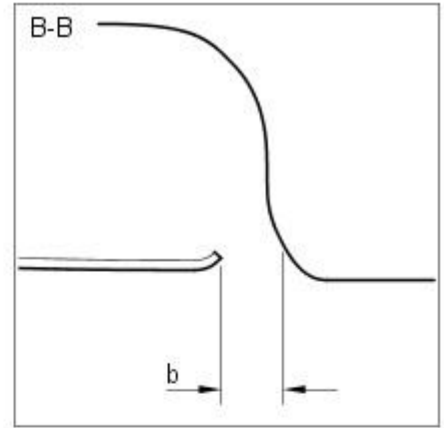
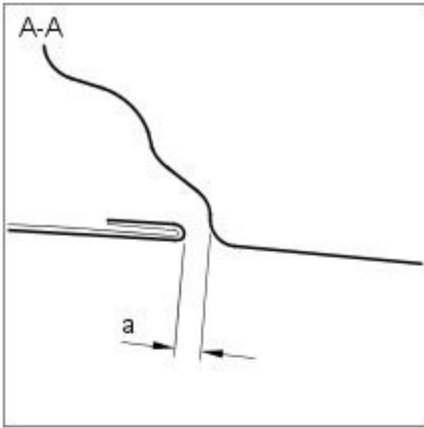
E117152

Section	Description	Gap	Profile
A-A	Front bumper cover to headlamp	$3.0 \pm 2.0$	N/A
B-B	A-pillar to hood	$3.0 \pm 1.3$	$-1.0 \pm 0.9$
C-C	Front fender to front bumper cover	$0.0 \pm 0.5$	$0.5 \pm 0.7$
D-D	Front door to front fender	$3.65 \pm 1.0$	$-0.5 \pm 1.0$
E-E	A-pillar to windshield	$4.0 \pm 1.0$	N/A
F-F	Front bumper cover to front fender (inner sweep)	N/A	$0.5 \pm 1.3$

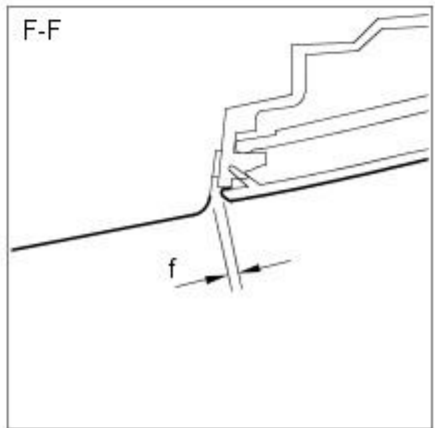
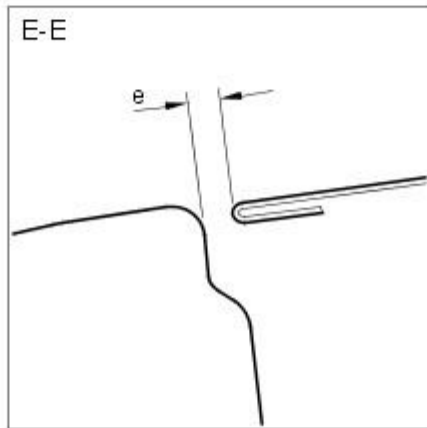
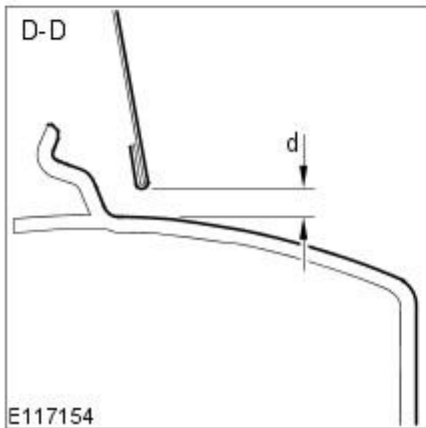
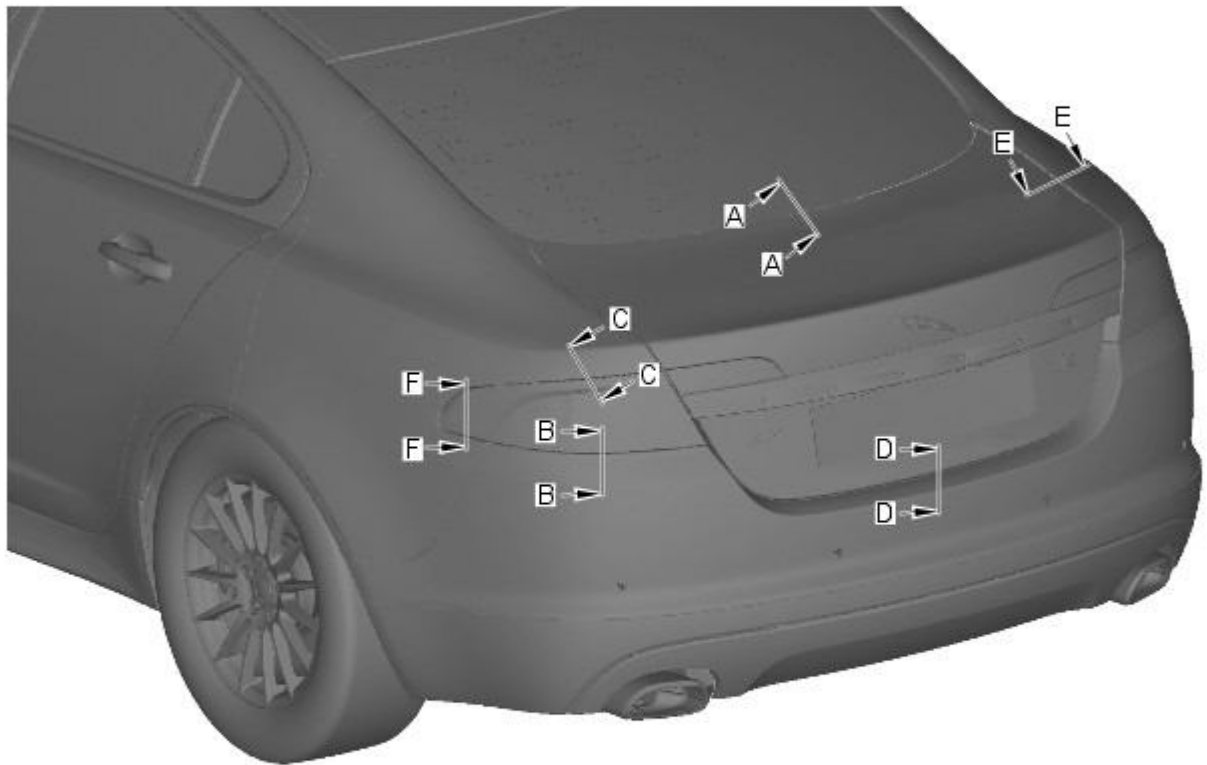
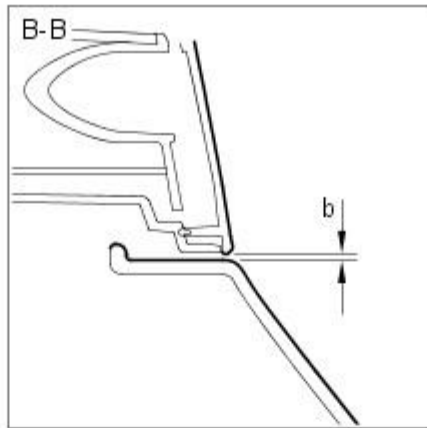
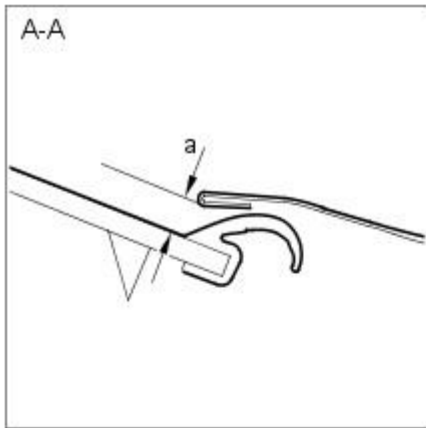


E117153

Section	Description	Gap	Profile
A-A	Rocker panel finisher to front door	$4.0 \pm 1.5$	N/A
B-B	Windshield to roof panel	$4.0 \pm 1.1$	N/A
C-C	Front door to rear door	$3.65 \pm 1.0$	$-0.5 \pm 1.0$
D-D	Front door to rear door at waist	$3.65 \pm 1.0$	$0.0 \pm 1.0$
E-E	Front door to rear door upper	$3.65 \pm 1.0$	$0.0 \pm 1.0$
F-F	Front door to roof	$11.7 \pm 1.6$	N/A



Section	Description	Gap	Profile
A-A	Rear door to quarter panel	$3.65 \pm 1.0$	$0.00 \pm 1.0$
B-B	Rear door to quarter panel upper	$7.9 \pm 1.5$	N/A
C-C	Rocker panel finisher to rear door	$4.0 \pm 1.5$	N/A
D-D	Rear door to roof panel	$7.9 \pm 1.5$	N/A



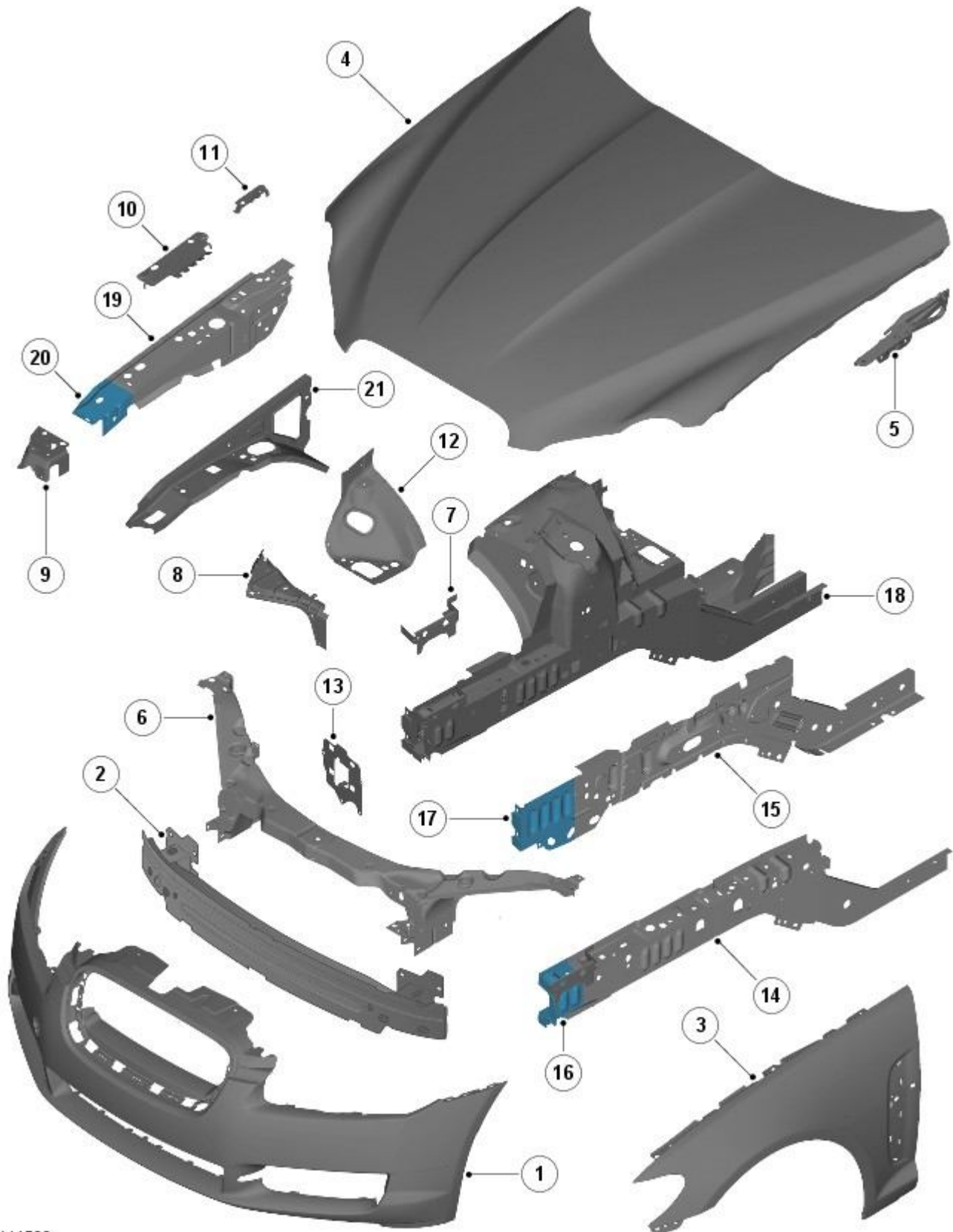
E117154

Section	Description	Gap	Profile
A-A	Luggage compartment lid to rear window glass	$6.0 \pm 1.5$	N/A
B-B	Rear lamp to rear bumper cover	$2.0 \pm 0.9$	$-2.0 \pm 1.5$
C-C	Rear lamp to rear quarter upper	$2.0 \pm 0.9$	$-2.0 \pm 1.5$
D-D	Luggage compartment lid to rear bumper cover	$6.0 \pm 1.7$	N/A
E-E	Luggage compartment lid to quarter panel	$3.5 \pm 1.1$	$0.5 \pm 0.5$
F-F	Rear lamp to rear bumper cover	$2.0 \pm 0.8$	$-2.0 \pm 1.8$

# Front End Sheet Metal Repairs - Front End Sheet Metal

Description and Operation

Front end service panels



E114566

• NOTE: The illustration may indicate either hand of the service panel, the opposite hand will be similar.

Item	Description
1	Front bumper cover
2	Front bumper
3	Front fender



Item	Description
4	Hood
5	Hood hinge
6	Hood latch panel
7	Hood latch panel mounting bracket
8	Front fender support bracket
9	Fender apron panel front extension
10	Fender mounting plate
11	Hood strut mounting bracket
12	Front wheelhouse section
13	Front bumper mounting
14	Front side member
15	Front side member section
16	Front side member closing panel
17	Front side member closing panel section
18	Front side member & suspension top mount assembly
19	Fender apron panel
20	Fender apron panel front section
21	Fender apron panel closing panel

### Time schedules, front end

The following information shows the total time taken to replace single panels and complete assemblies. This time includes removal of Mechanical, Electrical and Trim, (MET), items, plus paint times based on Metallic Clear Over Base Paint, (blends to adjacent panels are not included).

The times shown were generated by Thatcham, (the Motor Insurance Repair Research Centre), and are to be used as a guide only.

#### Single panel times

Panel Description	Hours
Hood	7.4
Front bumper cover	7.8
Front fender L/H	8.9
Front Fender R/H	9.1
Hood latch panel	6.6
Instrument panel console remove and install	5.3
Engine and suspension assembly remove and install	9.3

#### Combination panel replacement times

The following panel combination times show the total time to remove/install body panels, MET items and paint times based on Metallic Clear Over Base Paint process, (blends to adjacent panels are not included).

#### Combination panel times

Panel Description	Hours
Hood	
Hood hinge L/H and R/H	
Front bumper cover	
Front bumper	
Front fender	
Hood latch panel	
Hood latch panel mounting bracket	
Front fender support bracket	
<b>Total Time</b>	<b>L/H 23.5 R/H 23.6</b>

#### Combination panel times

Panel Description	Hours
Hood	
Hood hinge L/H and R/H	
Front bumper cover	
Front bumper	
Front fender L/H and R/H	
Hood latch panel	
Hood latch panel mounting bracket L/H and R/H	
Front fender support bracket L/H and R/H	
<b>Total Time</b>	<b>26.8</b>

#### Combination panel times

Panel Description	Hours
Hood	
Hood hinge L/H and R/H	
Front bumper cover	
Front bumper	
Front fender	
Hood latch panel	
Front fender support bracket	
Fender apron panel	
Fender apron panel closing panel	

Panel Description	Hours
Front side member & suspension top mount assembly	
Fender mounting plate	
Front fender lower mounting	
Engine and suspension assembly remove and install	
Instrument panel console remove and install	
<b>Total Time</b>	L/H 44.3 R/H 44.5

**Combination panel times**

Panel Description	Hours
Hood	
Hood hinge L/H and R/H	
Front bumper cover	
Front bumper	
Front fender L/H and R/H	
Hood latch panel	
Front fender support bracket L/H and R/H	
Fender apron panel L/H and R/H	
Fender apron panel closing panel L/H and R/H	
Front side member & suspension top mount assembly L/H and R/H	
Fender mounting plate L/H and R/H	
Front fender lower mounting L/H and R/H	
Engine and suspension assembly remove and install	
Instrument panel console remove and install	
<b>Total Time</b>	57.6

**Combination panel times**

Panel Description	Hours
Hood	
Hood hinge L/H and R/H	
Front bumper cover	
Front bumper	
Front fender	
Hood latch panel	
Front fender support bracket	
Front bumper mounting	
Front side member section	
Front side member closing panel section	
<b>Total Time</b>	

**Combination panel times**

Panel Description	Hours
Hood	
Hood hinge L/H and R/H	
Front bumper cover	
Front bumper	
Front fender	
Hood latch panel	
Front fender support bracket	
Front fender support bracket mounting	
Front fender lower mounting	
Front bumper mounting	
Front side member	
Front side member closing panel	
Front wheelhouse section	
Engine and suspension assembly remove and install	
<b>Total Time</b>	L/H 37.6 R/H 37.4

# Front End Sheet Metal Repairs - Fender Apron Closing Panel Front Section

Removal and Installation

## Removal

1. NOTE: The fender apron closing panel front section is manufactured from mild steel.

The fender apron closing panel front section is cut from the fender apron panel closing service panel.



E 107765

2. The fender apron closing panel front section is replaced in conjunction with:

- Front bumper cover
- Hood
- Front fender
- Hood latch panel
- Fender apron panel front extension
- Fender apron panel front section

3. For additional information relating to this repair procedure please see the following:

For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) /

[Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) /

[Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) /

[Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

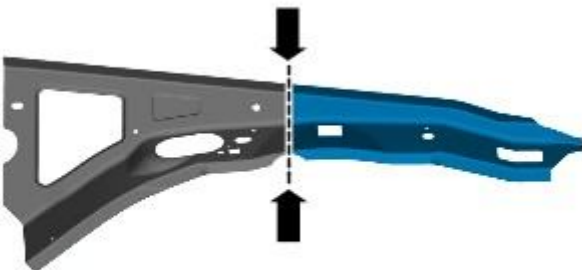
4. Remove the fender apron panel front section.

For additional information, refer to: [Fender Apron Panel Front Section](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).


5. Disconnect the generator electrical connectors.

6. NOTE: Make sure the section is cut to cater for the extent of damage and to allow a minimum 50mm staggered joint with the fender apron panel front section.

Cut the front section from the fender apron panel closing service panel.



E 107766

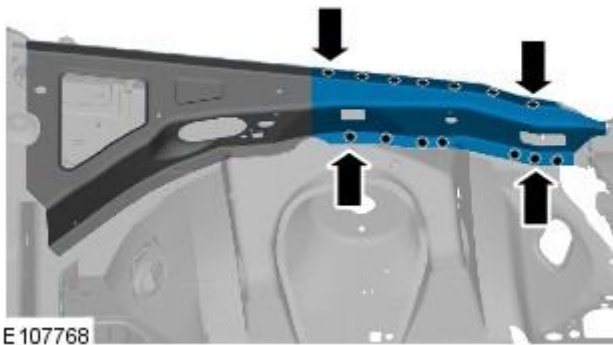
7.  CAUTION: Care should be taken not to cut through into adjacent panels.

Using the new panel for reference and allowing for an overlap, cut the old panel at the points indicated.




8. NOTE: To avoid unnecessary MAG plug welding on installation, spot welds must be drilled from underneath where this is possible.

Drill out the spot welds.



9. Separate the joints and remove the old panel.

## Installation

1.  CAUTION: Care should be taken not to cut through into adjacent panels.

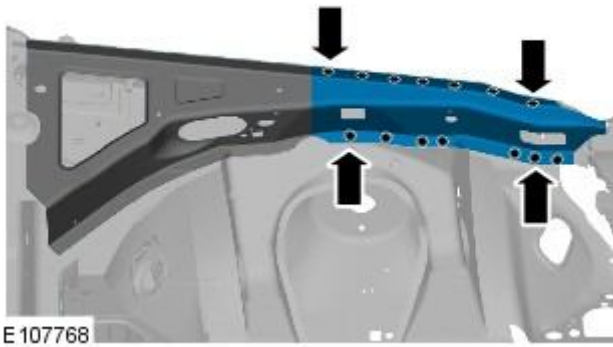
Offer up, align and clamp the new panel into position, overlapping the old panel remnant. Cut through the new panel, partially cutting the old panel, at the points where the MAG butt joint is to be made.



2. Remove the new panel.
3. Cut and remove the old panel remnants.
4. Prepare the old and new panel joint surfaces.
5. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.
6. Tack weld the butt joint.

**7. NOTE:** Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original.

Spot weld.



**8.** Dress the tack welds.

**9.** MAG weld the butt joint.



**10.** Dress all welded joints.

**11.** The installation of associated panels and components is the reversal of removal procedure.

# Front End Sheet Metal Repairs - Fender Apron Panel

Removal and Installation

## Removal

1. NOTE: The fender apron panel is manufactured from mild steel.

The fender apron panel is serviced as a separate weld-on panel.



E 107734

2. The fender apron panel is replaced in conjunction with:

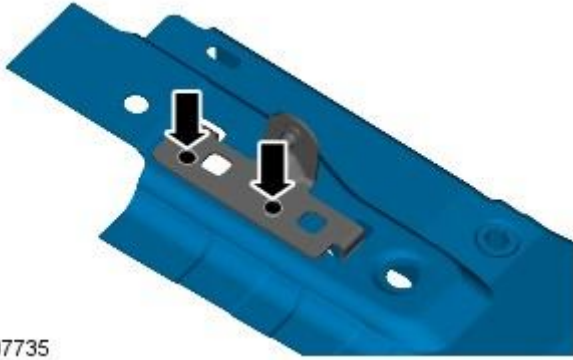
- Front bumper cover
- Front fender
- Fender apron panel closing panel
- Hood
- Hood hinge
- Hood strut mounting bracket
- Fender mounting plate

3. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove the hood.  
For additional information, refer to: Hood (501-02, Removal and Installation).
5. Remove the hood hinge.
6. Remove the fender apron panel closing panel.  
For additional information, refer to: [Fender Apron Panel Closing Panel](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).
7. Disconnect the generator electrical connectors.
8. Remove the windshield wiper motor and linkage.  
For additional information, refer to: [Windshield Wiper Motor](#) (501-16 Wipers and Washers, Removal and Installation).
9. Remove the ECM (engine control module).  
For additional information, refer to: Engine Control Module (ECM) (303-14A, Removal and Installation) / Engine Control Module (ECM) (303-14B, Removal and Installation) / [Engine Control Module \(ECM\)](#) (303-14 Electronic Engine Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).



**10. NOTE:** If the hood strut mounting bracket is to be replaced, it is not necessary to remove it.

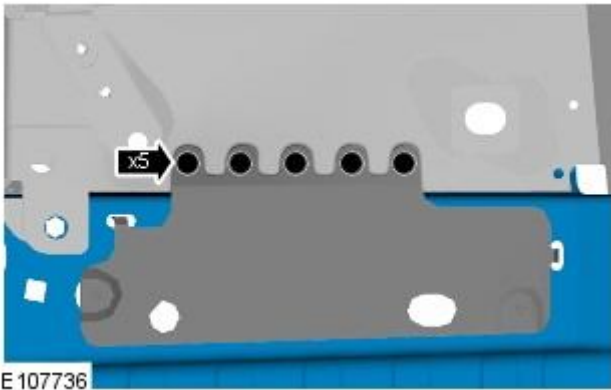
Drill out the spot welds to remove the hood strut mounting bracket.



E 107735

**11. NOTE:** If the fender mounting plate is damaged it is not necessary to remove it from the fender apron panel.

Drill out the spot welds to release the fender mounting plate.



E 107736

**12. NOTE:** If the fender mounting plate is undamaged it can be reused by releasing it from the fender apron panel, leaving it attached to the suspension top mount. Drill out from underneath to allow spot welds to be used in installation.

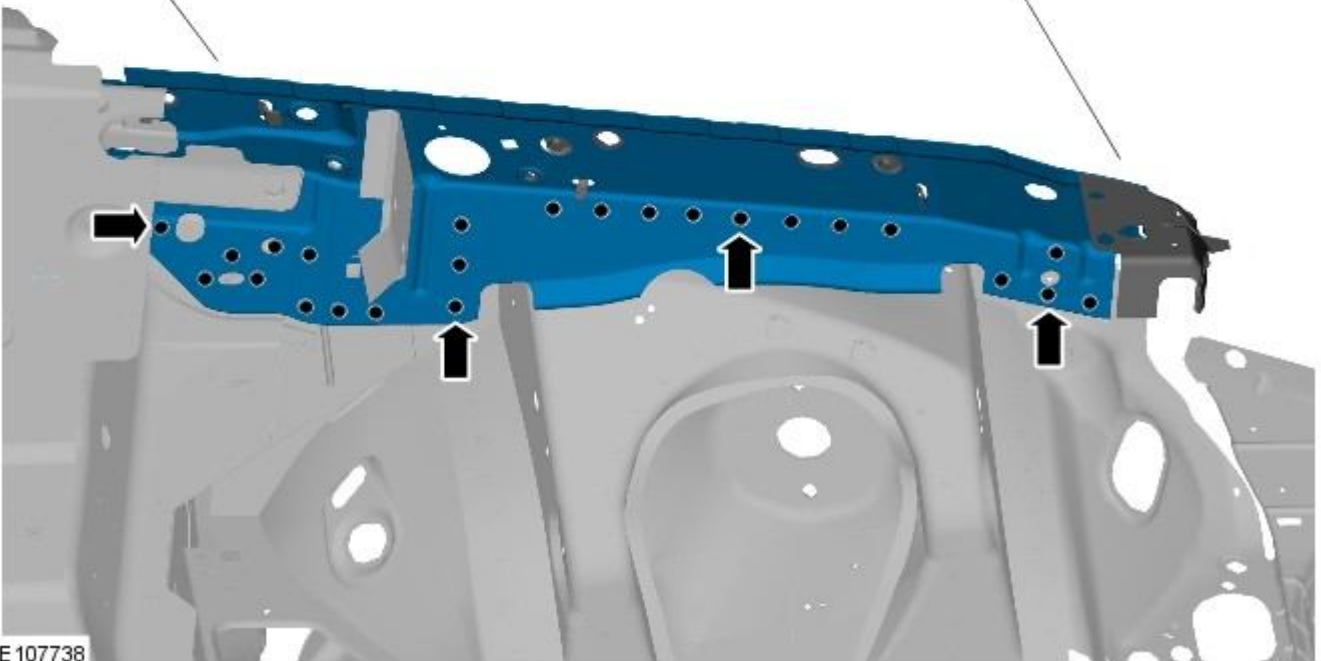
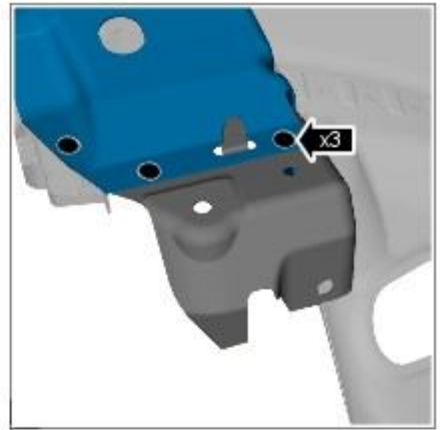
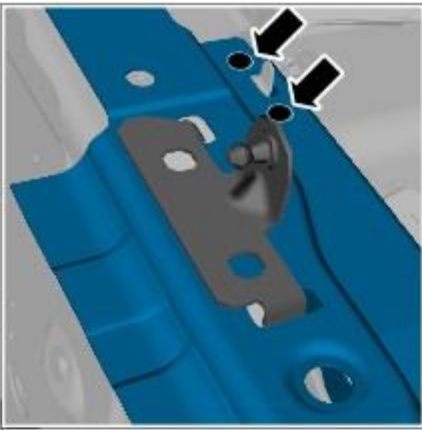
Drill out the spot welds, from underneath, to release the fender mounting plate.



E 107737

**13. NOTE:** Use a belt sander where there is no access to drill.

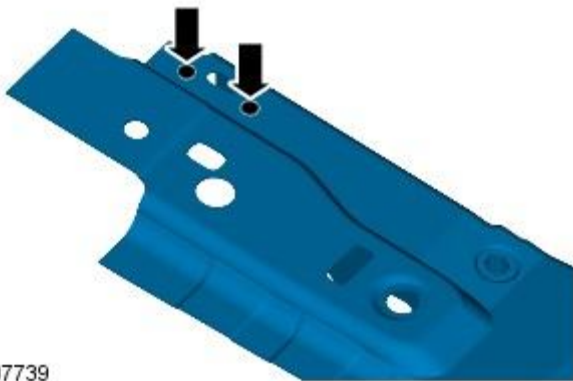
Drill out the spot welds.



14. Separate the joints and remove the old panel.

### Installation

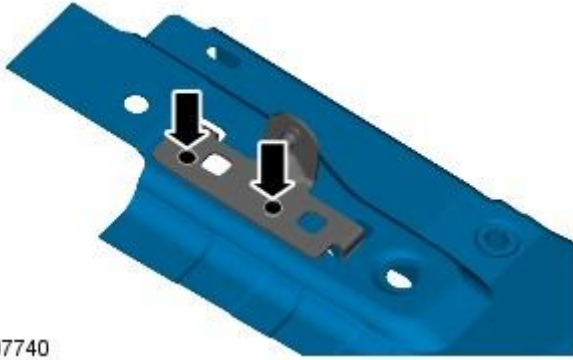
1. Drill holes in the new panel ready for MAG plug welding.



2. Prepare the old and new panel joint surfaces.

**3. NOTE:** If the hood strut mounting bracket is to be replaced, it must be spot welded to the fender apron panel prior to installation. If it is to be reused it should be MAG plug welded to the fender apron panel after installation.

Install the new hood strut mounting bracket.

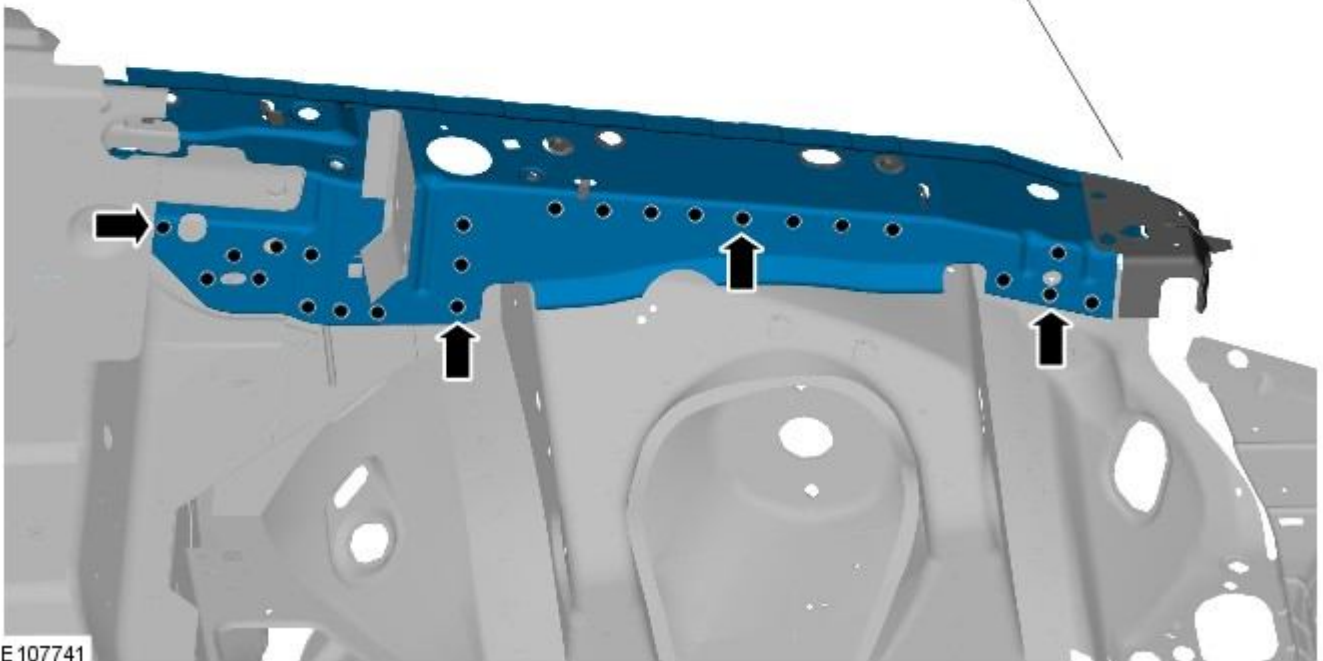
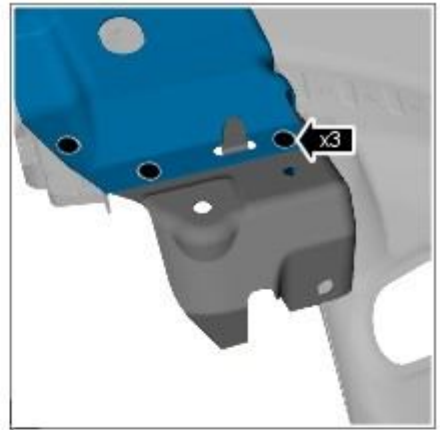


E 107740

**4.** Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

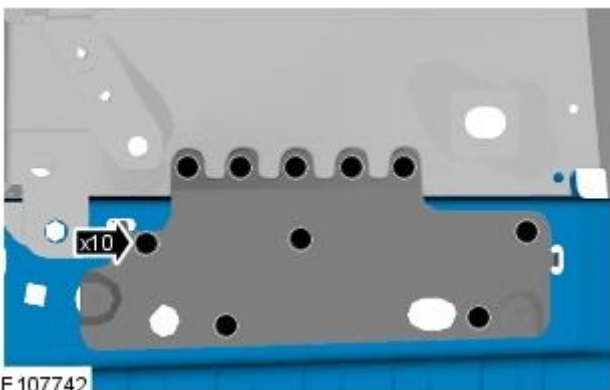
**5. NOTE:** Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original.

Spot weld.

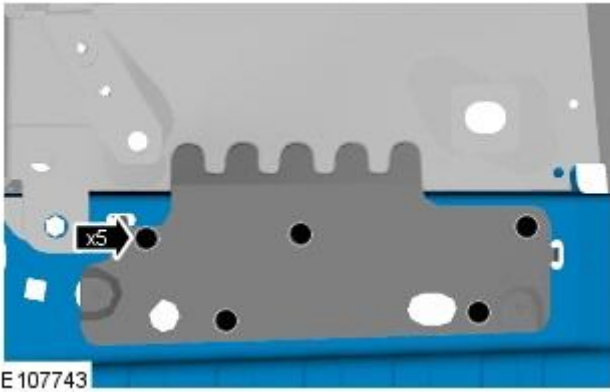


6. Offer up, align and clamp the new fender mounting plate into position, if correct, proceed to next step, if not rectify and recheck before proceeding.

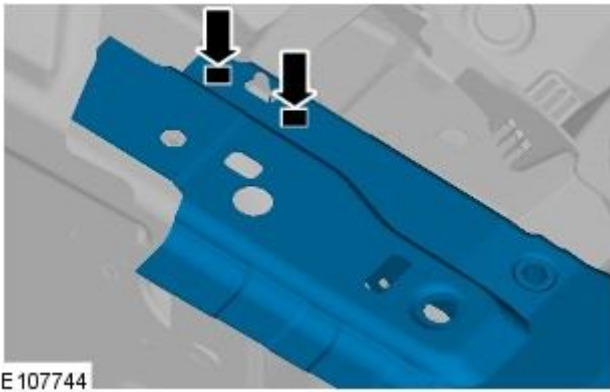
7. Spot weld the new fender mounting plate into position.



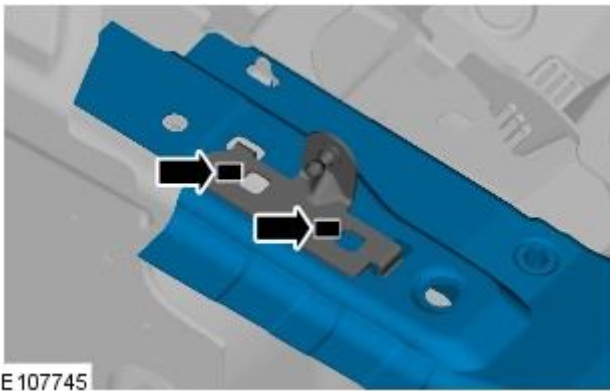
8. If the original fender mounting plate is being reused, spot weld as indicated.



9. MAG Plug weld.



10. Offer up, align and clamp the hood strut mounting bracket into position and MAG plug weld.



11. Dress all welded joints.

12. The installation of associated panels and components is the reversal of removal procedure.

- Tighten the hood hinge to 25 Nm.

# Front End Sheet Metal Repairs - Fender Apron Panel Closing Panel

Removal and Installation

## Removal

1. **NOTE:** The fender apron panel closing panel is manufactured from mild steel.

The fender apron panel closing panel is serviced as a separate weld-on panel.



E107771

2. The fender apron panel closing panel is replaced in conjunction with:
  - Front bumper cover
  - Front fender
3. For additional information relating to this repair procedure please see the following:  
 For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove the front fender.  
 For additional information, refer to: [Front Fender](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).
5. Disconnect the generator electrical connectors.
6. Remove the pedestrian protection hood actuator.  
 For additional information, refer to: [Pedestrian Protection Hood Actuator LH](#) (501-20C Pedestrian Protection System, Removal and Installation) / [Pedestrian Protection Hood Actuator RH](#) (501-20C Pedestrian Protection System, Removal and Installation).
7. Remove the secondary bulkhead panel.  
 For additional information, refer to: [Secondary Bulkhead Panel LH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation) / [Secondary Bulkhead Panel RH - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (501-02 Front End Body Panels, Removal and Installation).
8. Remove the pedestrian protection actuator bracket.
9. Release and position the fuse box to one side.
10. Release and position the wiring harness to one side.



11. NOTE: Spot welds must be drilled from underneath, this will make sure the new panel can be spot welded on installation. Use a belt sander where there is no access to drill.

Drill out the spot welds.



E 107772

12. Separate the joints and remove the old panel.

### Installation

1. Drill holes in the new panel ready for MAG plug welding.



E 107773

2. Prepare the old and new panel joint surfaces.

3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

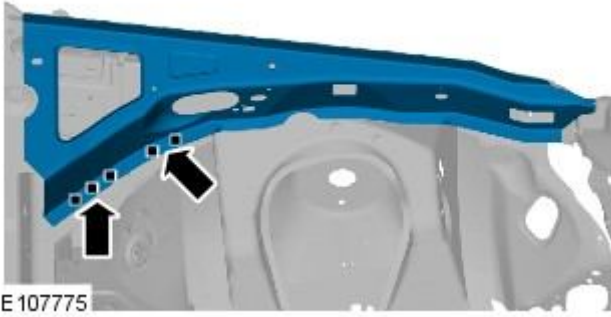
4. NOTE: Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original.

Spot weld.



E 107774

5. MAG Plug weld.



6. Dress all welded joints.

7. The installation of associated panels and components is the reversal of removal procedure.

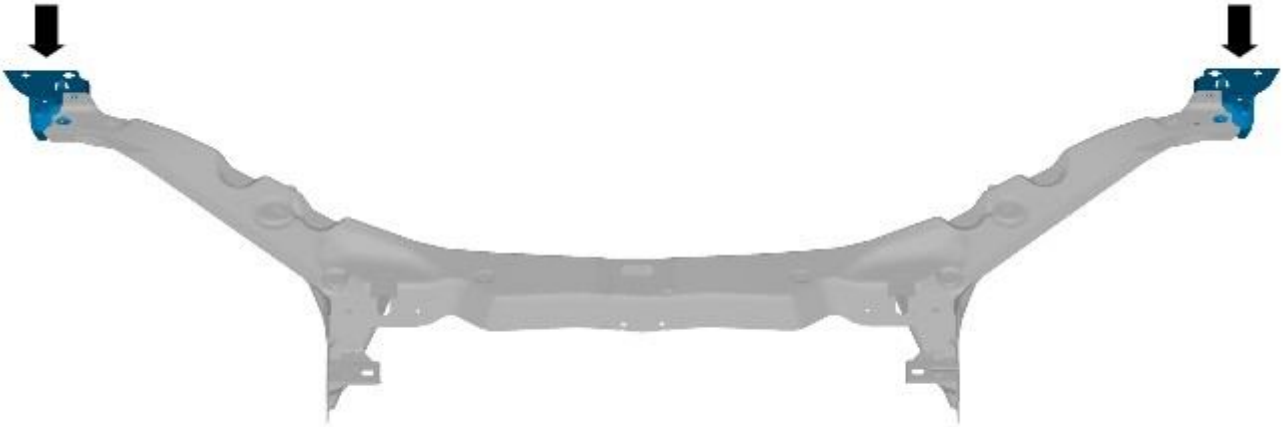
# Front End Sheet Metal Repairs - Fender Apron Panel Front Extension

Removal and Installation

## Removal

1. **NOTE:** The fender apron panel front extensions are manufactured from mild steel.

The right-hand and left-hand fender apron panel front extensions are serviced bolted on the hood latch panel. On the vehicle they are welded to the fender apron panels and inner wheelhouse.



E 103204

2. The fender apron panel front extension is replaced in conjunction with:

1. Front bumper cover
2. Front bumper
3. Hood latch panel
4. Front fender

3. For additional information relating to this repair procedure please see the following:

For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) /

[Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) /

[Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) /

[Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

4. Remove the hood latch panel.

For additional information, refer to: [Hood Latch Panel](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).

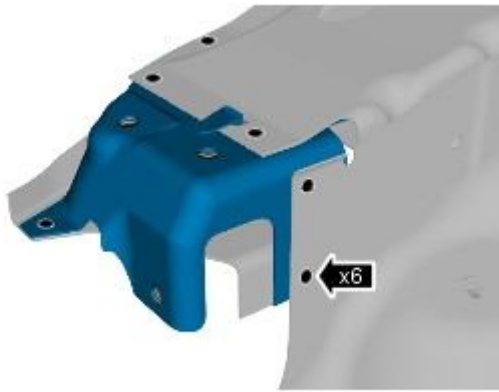
5. Remove the front fender.

For additional information, refer to: [Front Fender](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).

6. Disconnect the generator electrical connectors.

7. If the left-hand fender apron panel front extension is to be repaired, remove the air conditioning (A/C) pipe.

8. Drill out the spot welds.



E 103205

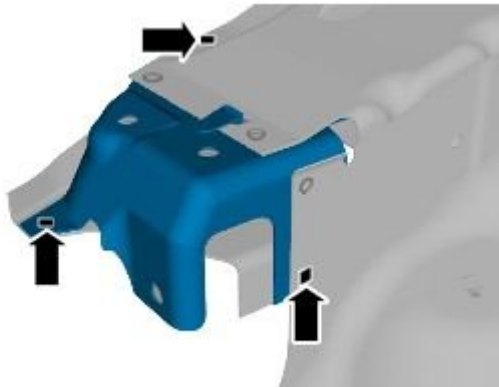
9. Separate the joints and remove the old panel.

### Installation

1. NOTE: If only one new fender apron panel front extension is to be fitted, remove the other side from the service panel and discard.

Offer up the new hood latch service panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

2. With the new panel offered up and aligned, drill 3 holes, in the areas indicated, ready for MAG plug welding.



E 104699

3. Remove the new hood latch service panel.

4. Prepare the old and new panel joint surfaces.

5. Offer up the new hood latch service panel, align and clamp into position.

6. MAG Plug weld.



E 103206

7. Remove the hood latch panel in readiness for the paint refinishing process.

8. Dress all welded joints.

9. The installation of associated panels and components is the reversal of removal procedure.



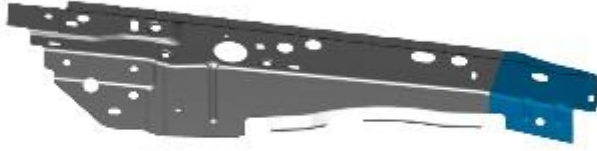
# Front End Sheet Metal Repairs - Fender Apron Panel Front Section

Removal and Installation

## Removal

1. NOTE: The fender apron panel front section is manufactured from mild steel.

The fender apron panel front section is cut from the fender apron service panel.



E107776

2. The fender apron panel front section is replaced in conjunction with:

- Front bumper cover
- Hood
- Front fender
- Hood latch panel
- Fender apron panel front extension
- Fender apron closing panel front section

3. For additional information relating to this repair procedure please see the following:

For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) /

[Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) /

[Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) /

[Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

4. NOTE: Make sure the fender apron closing panel front section is cut to allow a minimum 50mm staggered joint with the fender apron panel front section.

Remove the fender apron closing panel front section.

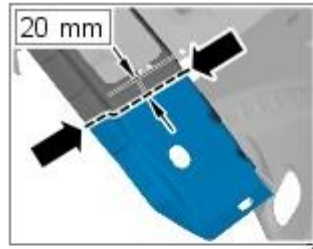
For additional information, refer to: [Fender Apron Closing Panel Front Section](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).

5. Disconnect the generator electrical connectors.



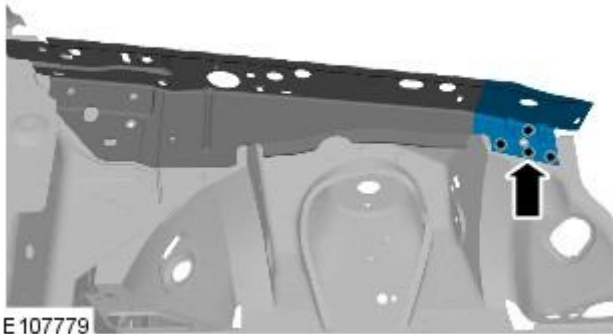
6. NOTE: The section is cut as indicated to allow access to dress the MAG butt weld.

Cut the old panel at the point indicated.



E 107778

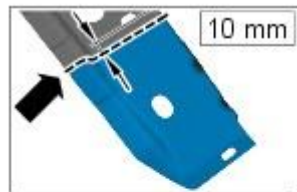
7. Drill out spot welds.



E 107779

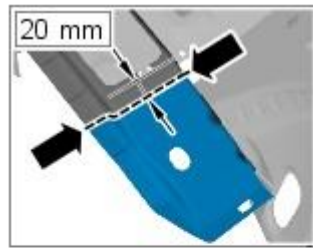
8. Separate the joints and remove the old panel.

9. Cut the new front section from the fender apron panel service panel at the point indicated.

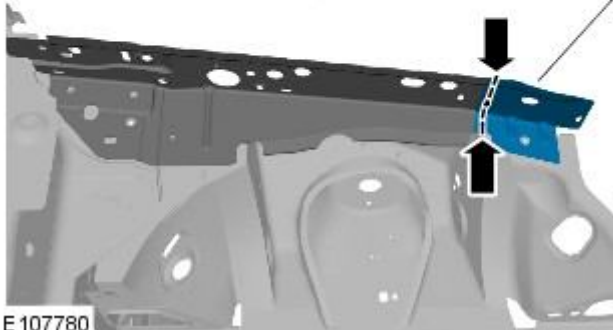


E 107777

## Installation



1. Offer up, align and clamp the new panel into position overlapping the old panel remnant. Cut along the edge of the old panel, through the new panel where the MAG butt joint is to be made.

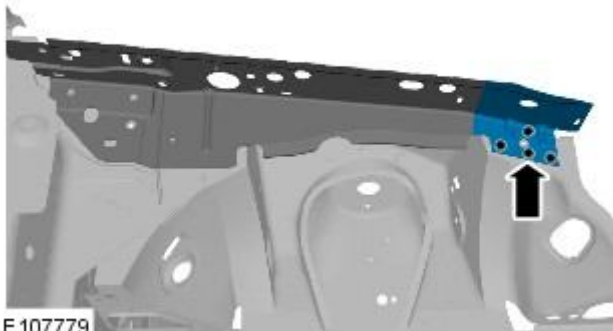


E 107780

2. Remove the new panel.
3. Prepare the old and new panel joint surfaces.
4. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.
5. Tack weld the butt joint.

6. NOTE: Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original.

Spot weld.



E 107779

7. Dress the tack welds.
8. MAG weld the butt joint.



E 107781

9. Dress all welded joints.
10. The installation of associated panels and components is the reversal of removal procedure.

# Front End Sheet Metal Repairs - Front Bumper Mounting

Removal and Installation

## Removal

1. NOTE: The front bumper mounting is manufactured from High Strength Low Alloy steel, 350MPa, (HSLA350).

The front bumper mounting is serviced as a separate weld-on panel, it is also serviced on the front side member & suspension top mount assembly.



E 108360

2. The front bumper mounting is replaced in conjunction with:

- Front bumper cover
- Front bumper
- Hood latch panel

3. For additional information relating to this repair procedure please see the following:

For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) /

[Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) /

[Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) /

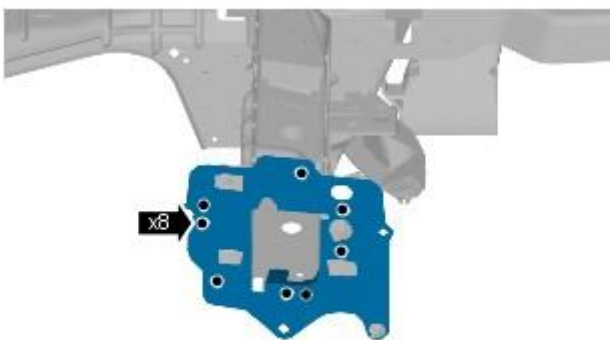
[Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

4. Remove the hood latch panel.

For additional information, refer to: [Hood Latch Panel](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).

5. Disconnect the generator electrical connectors.

6. Drill out the spot welds.



E 108361

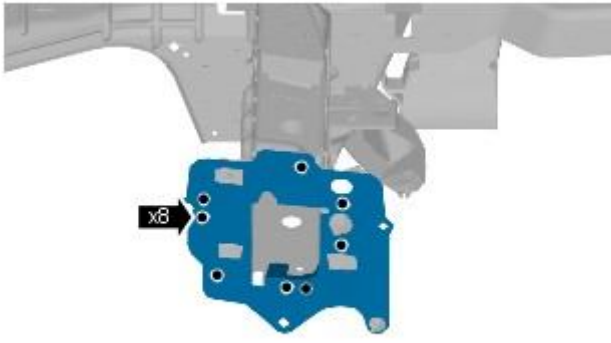
7. Separate the joints and remove the old panel.

## Installation

1. NOTE: Remove the caged nuts for the front bumper fixings, to allow for preparation.

Prepare the old and new panel joint surfaces.

2. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.



**3. NOTE:** Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original.

Spot weld.

E 108361

**4.** Dress all welded joints.

**5.** The installation of associated panels and components is the reversal of removal procedure.

# Front End Sheet Metal Repairs - Front Fender

Removal and Installation

## Removal

1. NOTE: The front fender is manufactured from mild steel.

The front fender is serviced as a separate bolt-on panel.

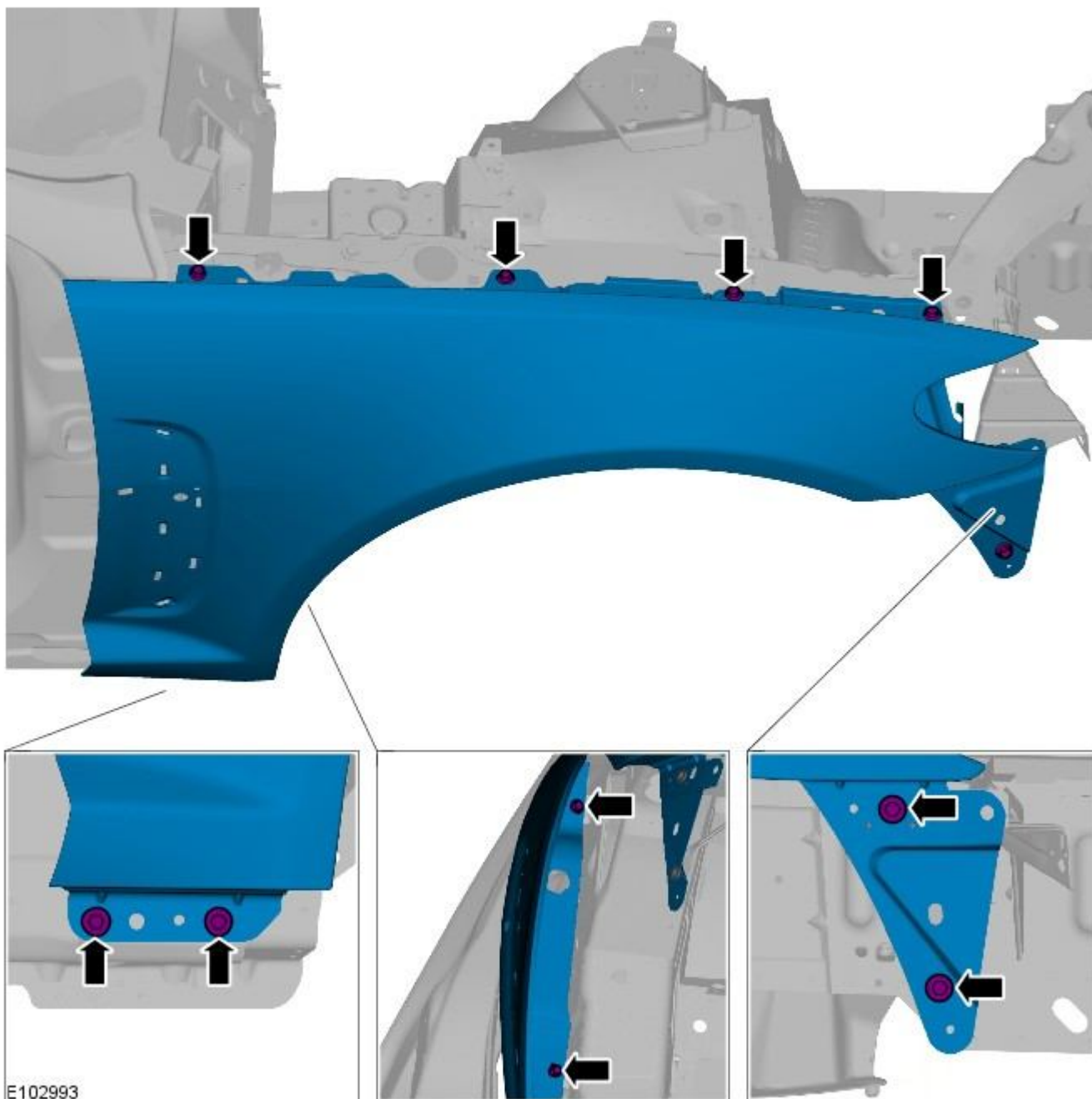


E102992

2. The front fender is replaced in conjunction with:

1. Front bumper cover

3. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) /  
[Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) /  
[Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) /  
[Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
5. Remove the front bumper cover.  
For additional information, refer to: [Front Bumper Cover](#) (501-19 Bumpers, Removal and Installation).
6. Remove the fender splash shield.  
For additional information, refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).
7. If the right-hand front fender is to be repaired, remove the windshield washer reservoir.  
For additional information, refer to: [Windshield Washer Reservoir](#) (501-16 Wipers and Washers, Removal and Installation).
8. Remove the headlamp assembly.  
For additional information, refer to: [Headlamp Assembly](#) (417-01 Exterior Lighting, Removal and Installation).
9. Remove the rocker panel outer moulding.
10. Remove the front fender.



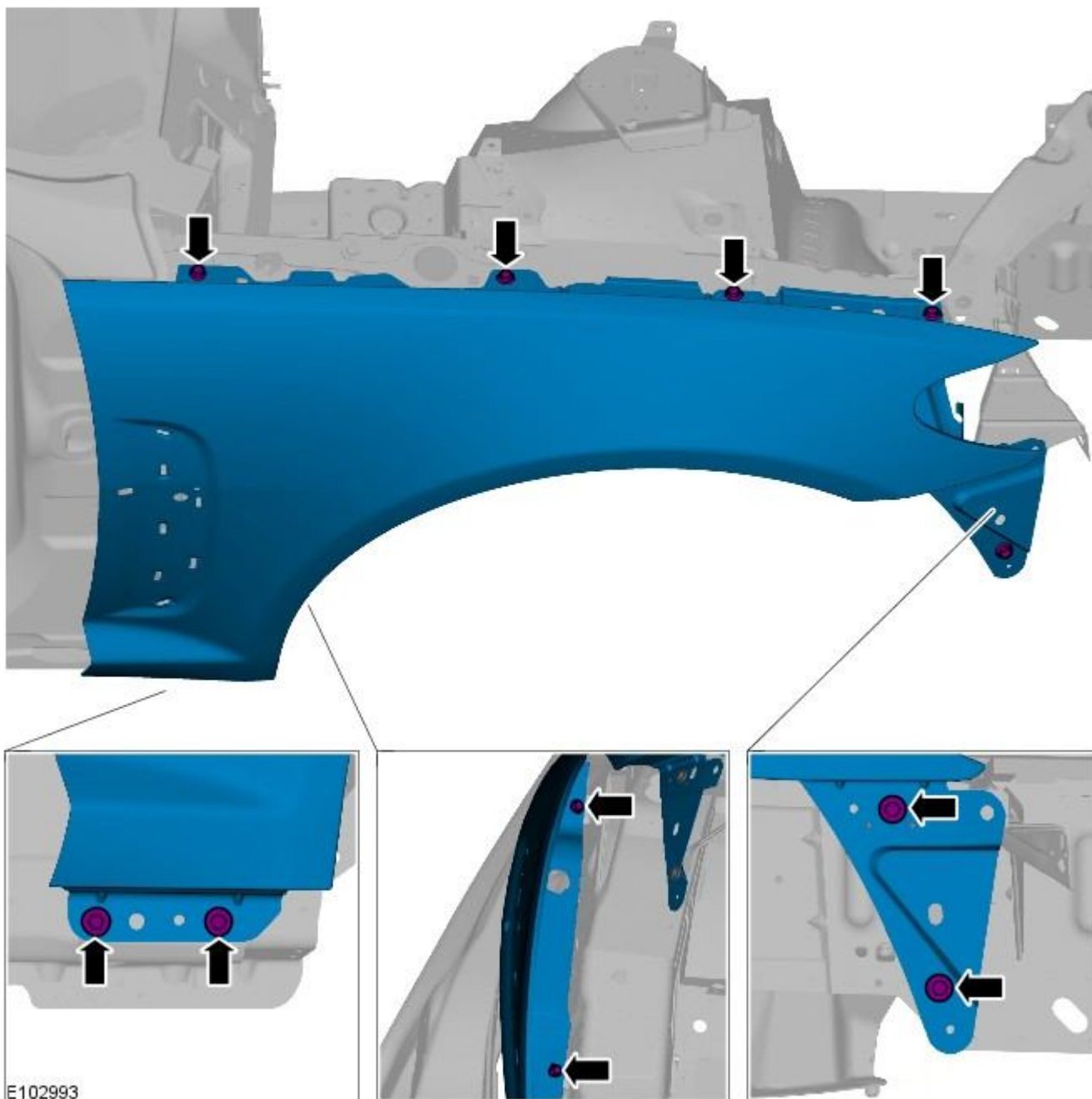
**11. NOTE:** Do not disassemble further if the component is removed for access only.

Remove the front fender moulding.

### Installation

1. Offer up the new panel. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.
2. Install the front fender.
  - Tighten to 10 Nm.





3. The installation of associated panels and components is the reversal of removal procedure.

# Front End Sheet Metal Repairs - Front Fender Support Bracket

Removal and Installation

## Removal

1. NOTE: The front fender support bracket is manufactured from mild steel.

The front fender support bracket is serviced as a separate weld-on panel.

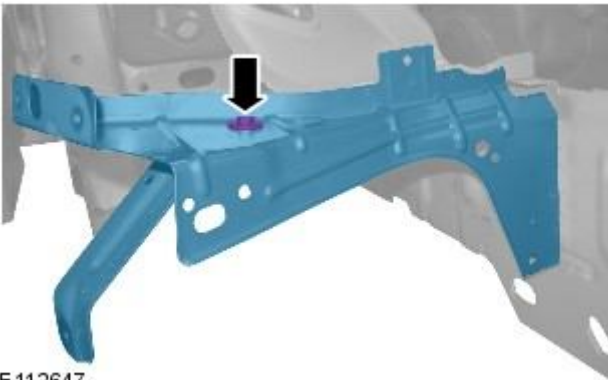


E 112646

2. The front fender support bracket is replaced in conjunction with:
  - Front bumper cover
  - Front fender
  - Hood latch panel
3. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove the hood latch panel.  
For additional information, refer to: [Hood Latch Panel](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).
5. Disconnect the generator electrical connectors.
6. If the left-hand front fender support bracket is to be repaired, remove the air conditioning (A/C) pipe.
7. Release and position the front fender support bracket wiring harness to one side.

8. NOTE: If the front fender lower mounting is undamaged it should be retained for reuse.

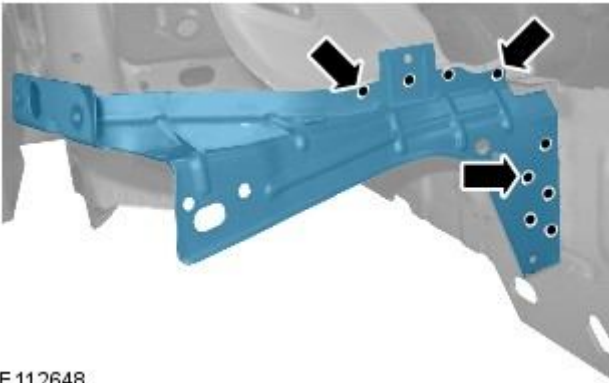
Remove the front fender lower mounting retaining bolt.



E 112647

9. NOTE: Use a belt sander where there is no access to drill.

Drill out the spot welds.



E 112648

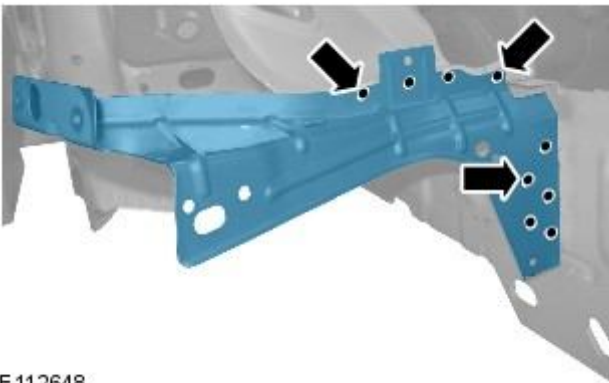
10. Separate the joints and remove the old panel.

## Installation

1. Prepare the old and new panel joint surfaces.
2. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

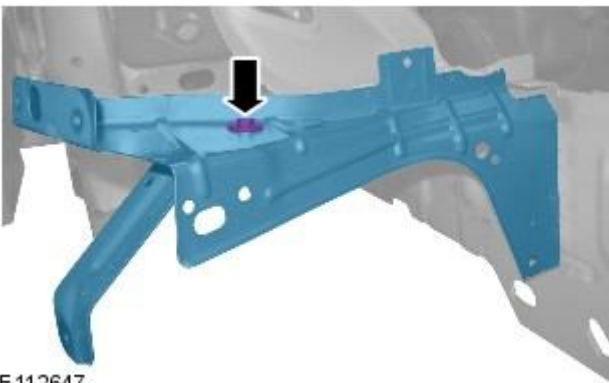
3. NOTE: Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible spot welds should be installed adjacent to the original.

Spot weld.



E 112648

4. Offer up the front fender lower mounting and loosely install its fixing bolt. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.



E 112647

5. Tighten the front fender lower mounting fixing bolt.

- Tighten to 10 Nm.

6. Dress all welded joints.

7. The installation of associated panels and components is the reversal of removal procedure.

# Front End Sheet Metal Repairs - Front Side Member

Removal and Installation

## Removal

1. NOTE: The front side member is manufactured from High Strength Low Alloy Steel, 350MPa, (HSLA350).

The front side member is serviced as a separate weld-on panel, which includes the hood latch panel mounting bracket. This method is to install a "long" section of the service panel.



E111823

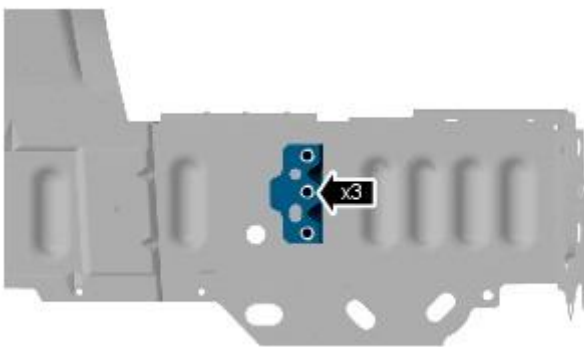
2. In this procedure, make sure that the vehicle is correctly aligned, it must be placed on an approved alignment jig.
3. The front side member is replaced in conjunction with:
  - Front bumper cover
  - Front bumper
  - Front bumper mounting
  - Hood
  - Hood latch panel
  - Front fender support bracket
  - Front fender support bracket mounting
  - Front wheelhouse section
  - Front side member closing panel
  - Engine, transmission / transaxle, front subframe and front suspension, as an assembly
4. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
5. Remove the hood.  
For additional information, refer to: Hood (501-02, Removal and Installation).
6. Remove the front wheelhouse section.  
For additional information, refer to: [Front Wheelhouse Section](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).
7. Remove the engine, transmission / transaxle, front subframe and front suspension, as an assembly.  
For additional information, refer to: Engine (303-01A, Removal) / Engine (303-01C, Removal) / [Engine](#) (303-01A Engine - 4.2L NA V8 - AJV8, Removal) / [Engine](#) (303-01B Engine - 4.2L SC V8 - AJV8, Removal) / Transmission - 2.7L Diesel (307-01, Removal) / Transmission - 3.0L Diesel (307-01, Removal) / Transmission - 3.0L (307-01, Removal) / [Transmission - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal) /

Transmission - 5.0L (307-01, Removal) / [Front Shock Absorber](#) (204-01 Front Suspension, Removal and Installation) / Front Subframe - 2.7L Diesel (502-00, Removal and Installation) / Front Subframe - 3.0L (502-00, Removal and Installation) / [Front Subframe - 4.2L NA V8 - AJV8](#) (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation) / [Front Subframe - 4.2L SC V8 - AJV8](#) (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

8. Remove the pedestrian protection hood actuator.  
For additional information, refer to: [Pedestrian Protection Hood Actuator LH](#) (501-20C Pedestrian Protection System, Removal and Installation) / [Pedestrian Protection Hood Actuator RH](#) (501-20C Pedestrian Protection System, Removal and Installation).
9. If the drivers side front side member and suspension top mount is to be repaired, remove the brake master cylinder and reservoir.  
For additional information, refer to: [Brake Master Cylinder](#) (206-06 Hydraulic Brake Actuation, Removal and Installation) / [Brake Fluid Reservoir](#) (206-06 Hydraulic Brake Actuation, Removal and Installation).
10. If the left-hand front side member and suspension top mount assembly is to be repaired, remove the fuel supply and return lines.
11. Release and position the front side member wiring harness to one side.
12. Remove any remaining miscellaneous components from the repair area.

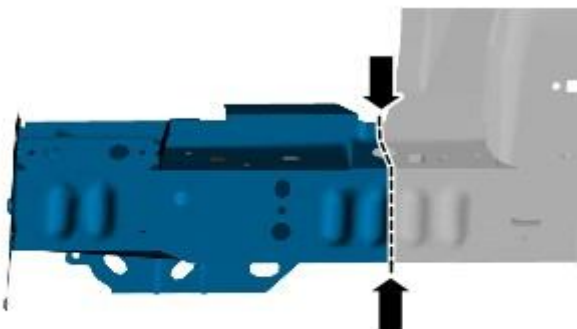
**13. NOTE:** Retain the front fender support bracket mounting if it is to be reused. If the front fender support bracket mounting is to be renewed, it is not necessary to remove or retain it.

Drill out the spot welds to remove the front fender support bracket mounting.

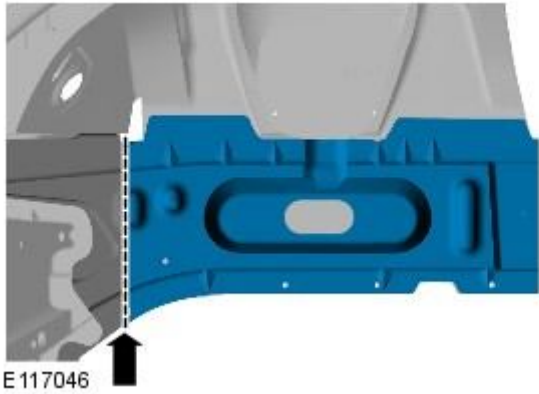



E117044

14. Remove the bulk of the damaged panels by cutting through the front side member and the front side member closing panel as indicated.



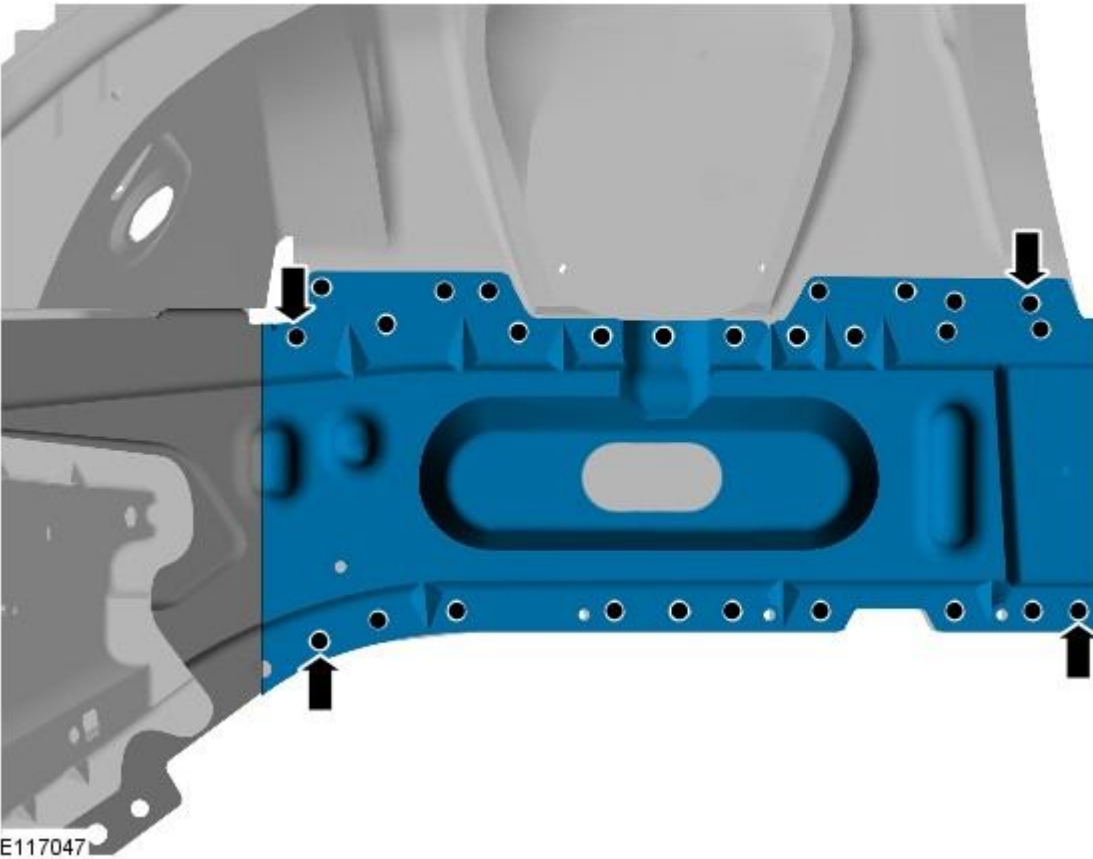
E117045



15.  CAUTION: Care should be taken not to cut through into the front side member or its inner lower reinforcement.

Cut the front side member closing panel as indicated.

16. Drill out the spot welds from the front side member closing panel as indicated.

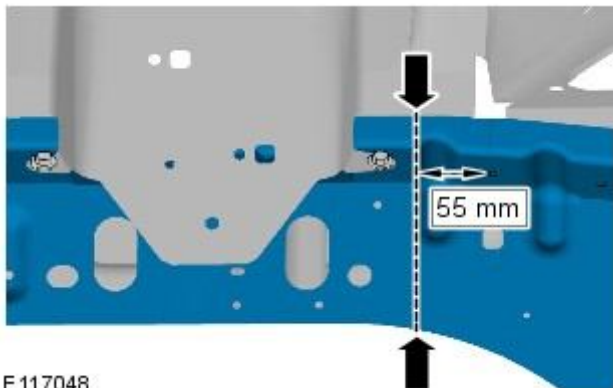


17. NOTE: Retain the front side member closing panel remnant as it will be used as a template.

Separate the joints and remove the front side member closing panel remnant.

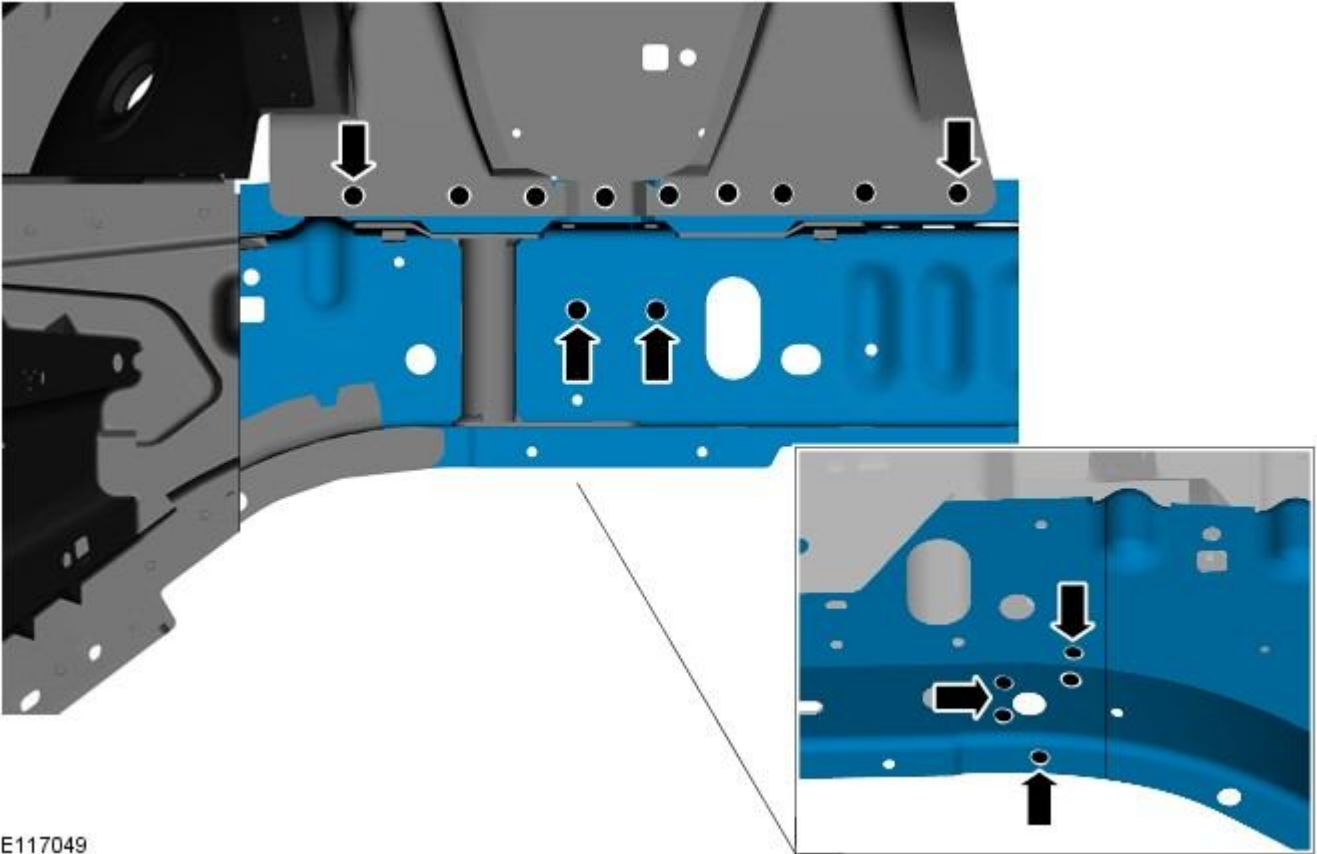
18. NOTE: Care should be taken not to cut through into the front side member inner lower reinforcement.

19. NOTE: Where possible, spot welds must be drilled out as indicated, to allow the new panel to be spot welded on installation. Mark out the position where the front side member MAG butt joint is to be made and cut through the panel at this point as indicated.



E117048

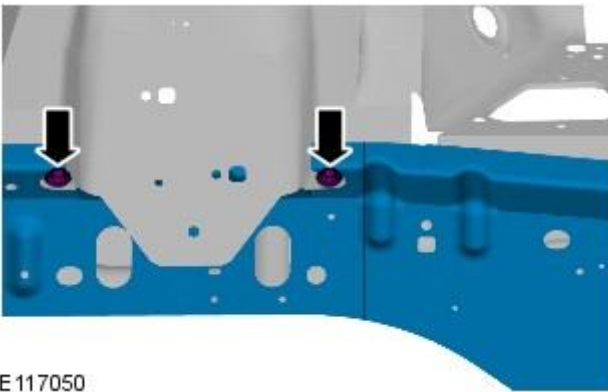




E117049

20. NOTE: Retain the bolts for refitment on installation.

Remove the retaining bolts as indicated.



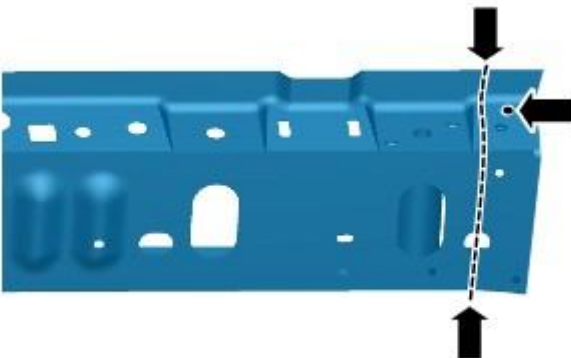
E117050

21. NOTE: Retain the front side member remnant as it will be used as a template.

Separate the joints and remove the front side member remnant.

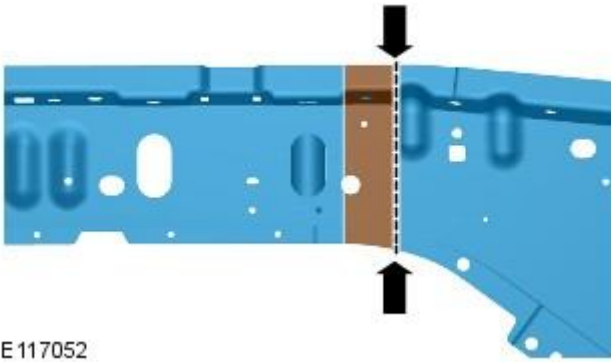
### Installation

1. Drill out one spot weld, separate and cut a template from the rear of the front side member remnant as indicated.



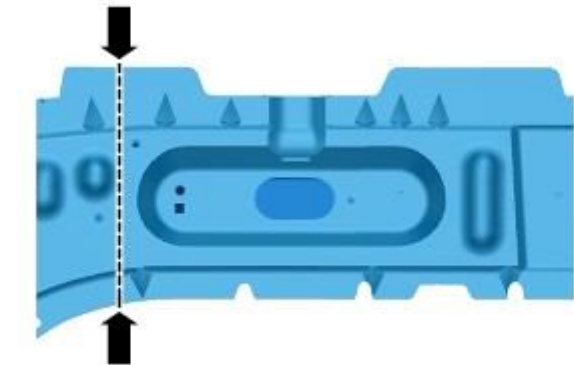
E117051

2. NOTE: Dress the panel joint surfaces of the template to allow a good fit.



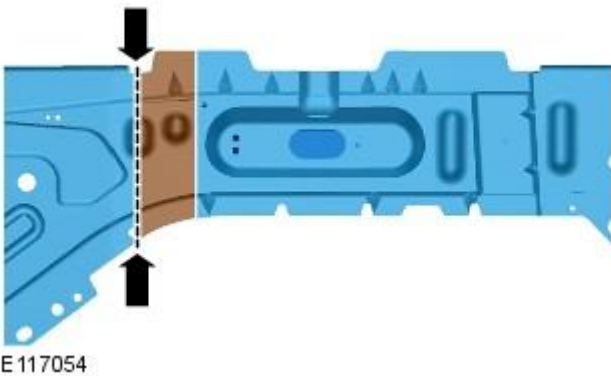
Offer up, align and clamp the template into position on the new side member service panel. Cut along the edge of the template, through the new panel, as indicated, where the MAG butt joint is to be made.

3. Cut a template from the rear of the front side member closing panel remnant as indicated.



4. NOTE: Dress the panel joint surfaces of the template to allow a good fit.

Offer up, align and clamp the front side member closing panel remnant into position on the new side member closing panel service panel. Cut along the edge of the template, through the new panel, as indicated, where the MAG butt joint is to be made.

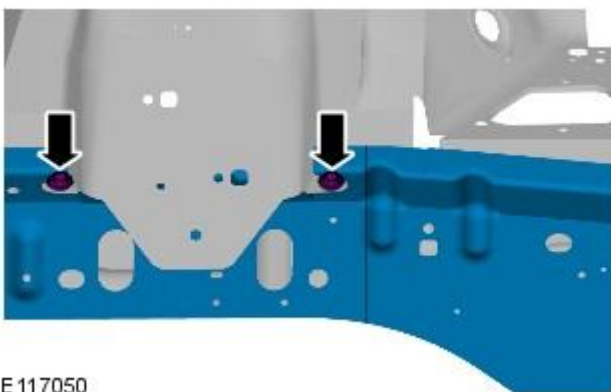


5. Prepare the panel joint surfaces of the old and new front side member.

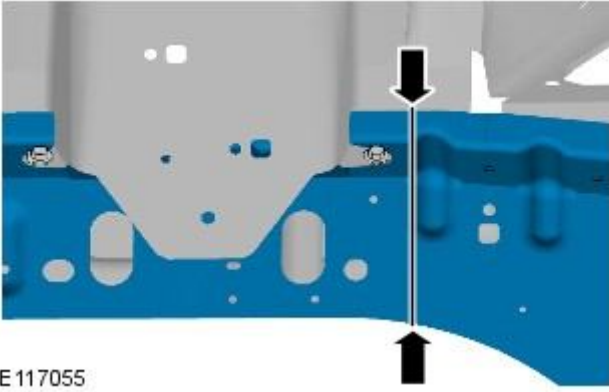
6. Offer up the new front side member and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

7. Install the retaining bolts.

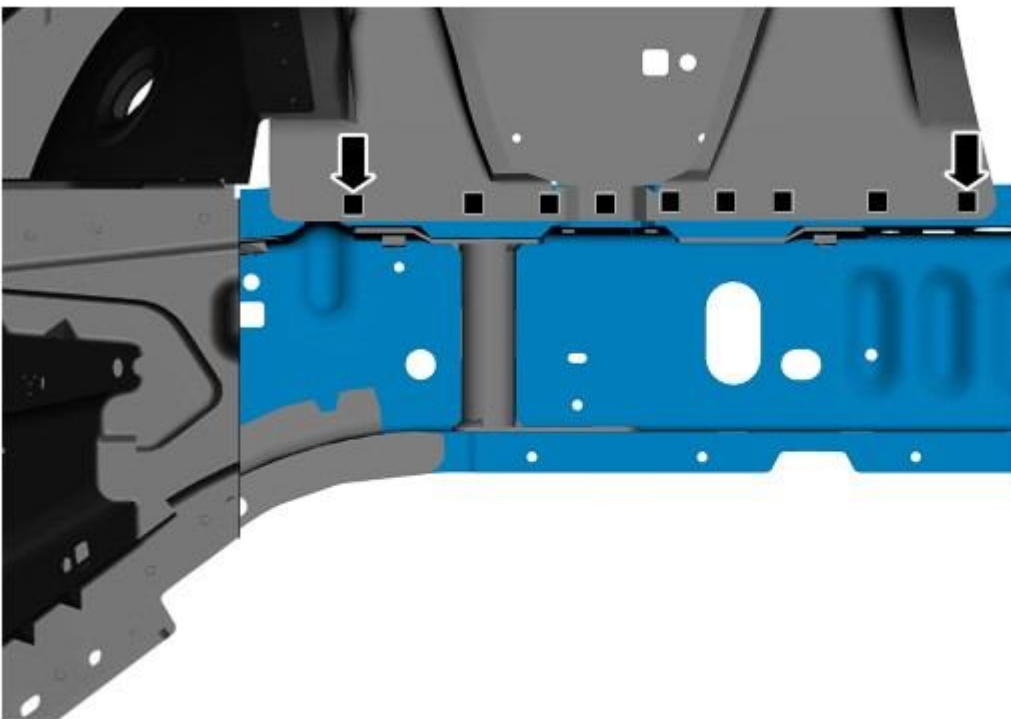
- Tighten to XXNm.



8. Tack MAG weld the front side member butt joint.
9. Dress the front side member MAG tack welds.
10. MAG weld the front side member butt joint.

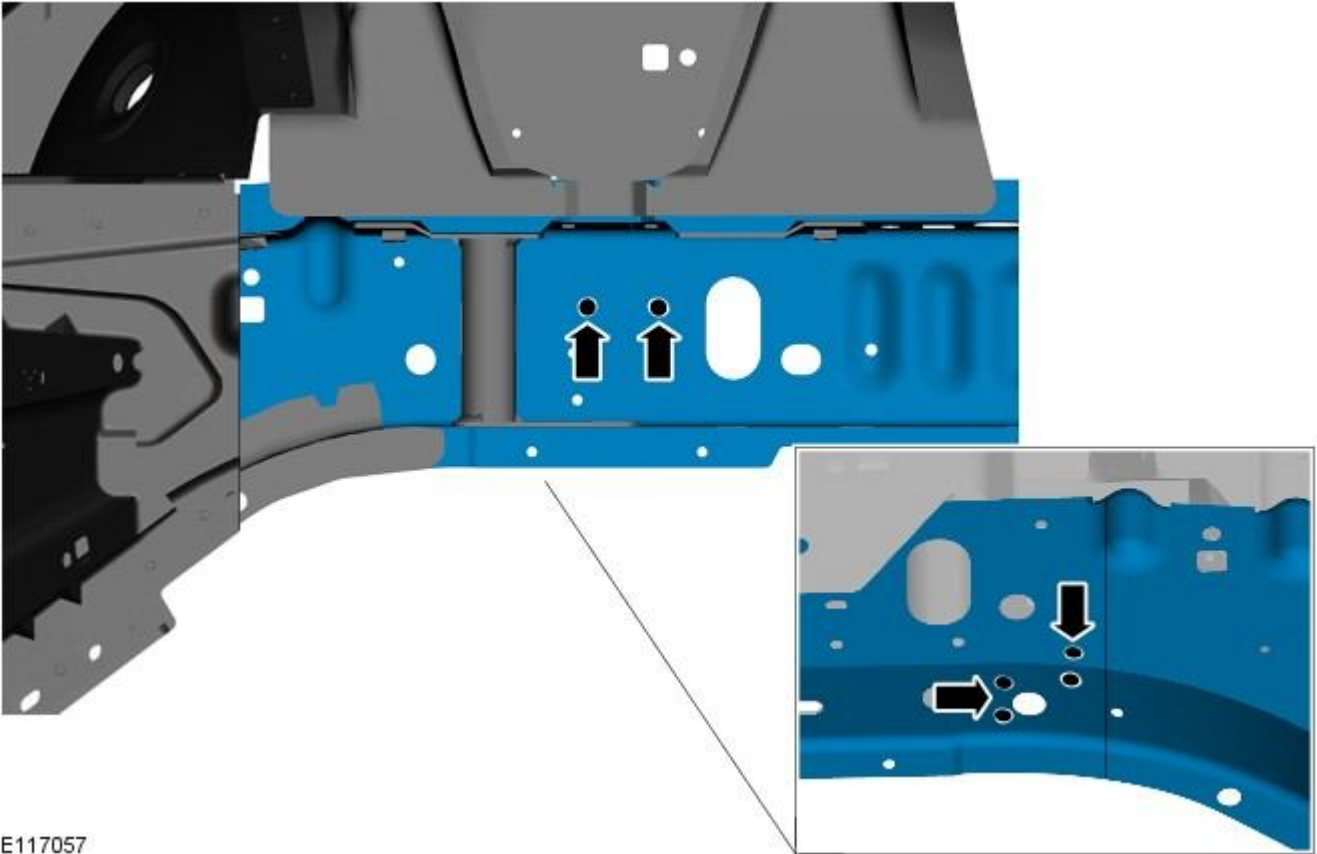


11. MAG plug weld.



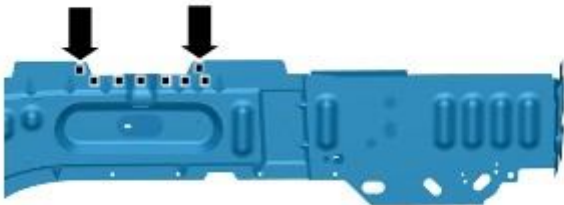
12. NOTE: Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original. Where there is adhesive in the original joint, spot welds should be installed through the original.

Spot weld.



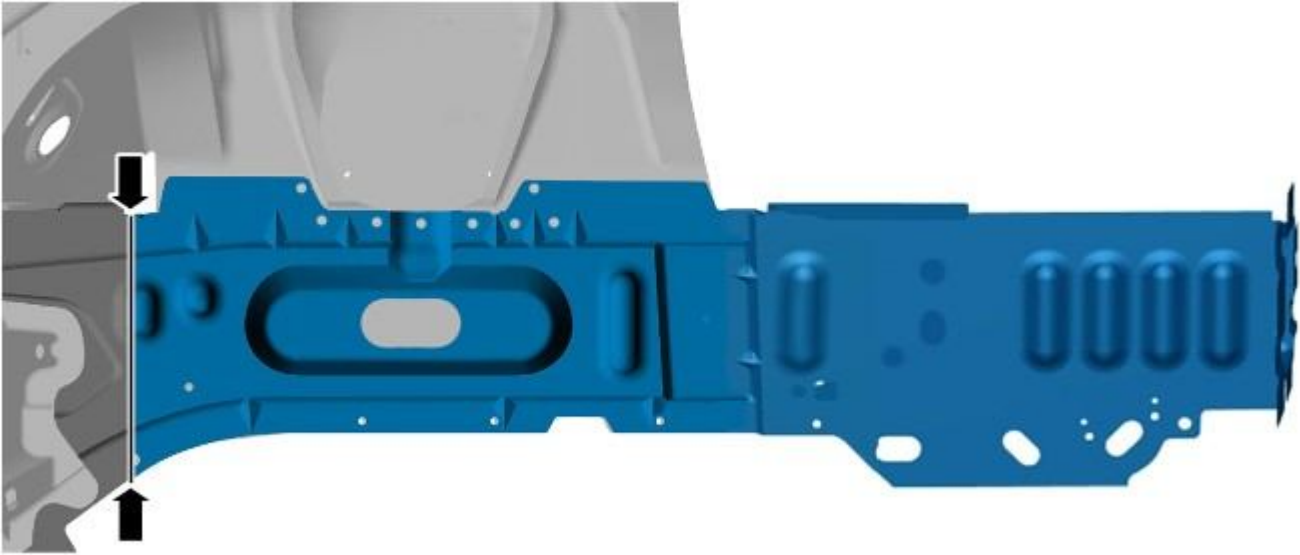
E117057

13. Dress all welded joints.
14. Apply a zinc rich primer to any bare metal surfaces at this stage.
15. Drill holes in the new side member closing panel ready for MAG plug welding.



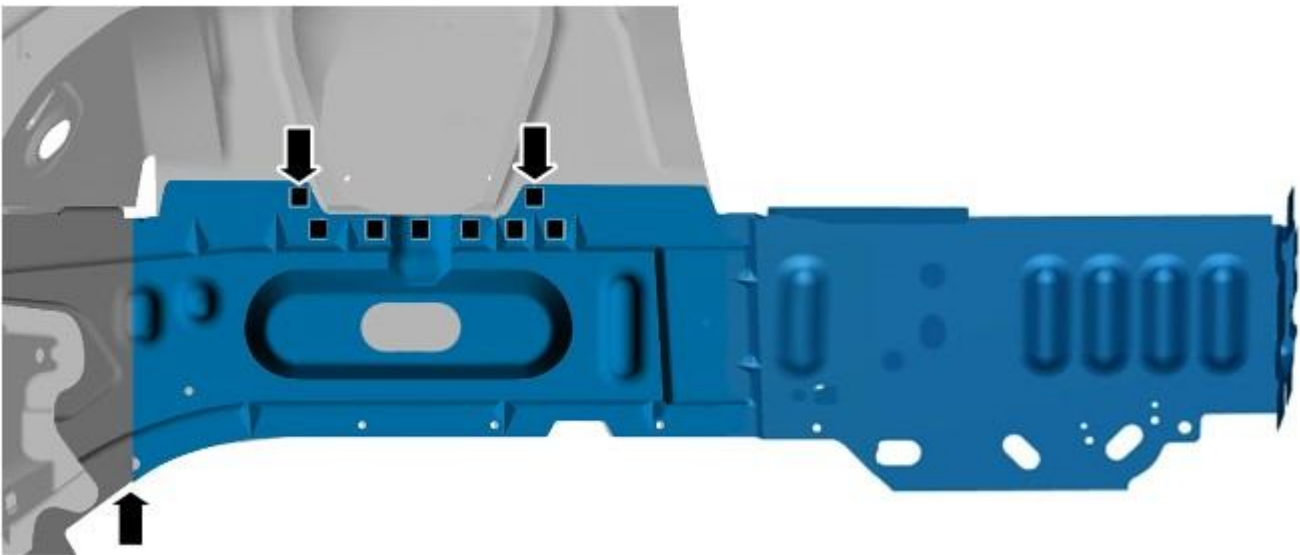
E117058

16. Prepare the panel joint surfaces of the old and new front side member closing panel.
17. Offer up the new front side member closing panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.
18. Tack MAG weld the front side member closing panel butt joint.
19. Dress the front side member closing panel MAG tack welds.
20. MAG weld the front side member closing panel butt joint.



E 117059

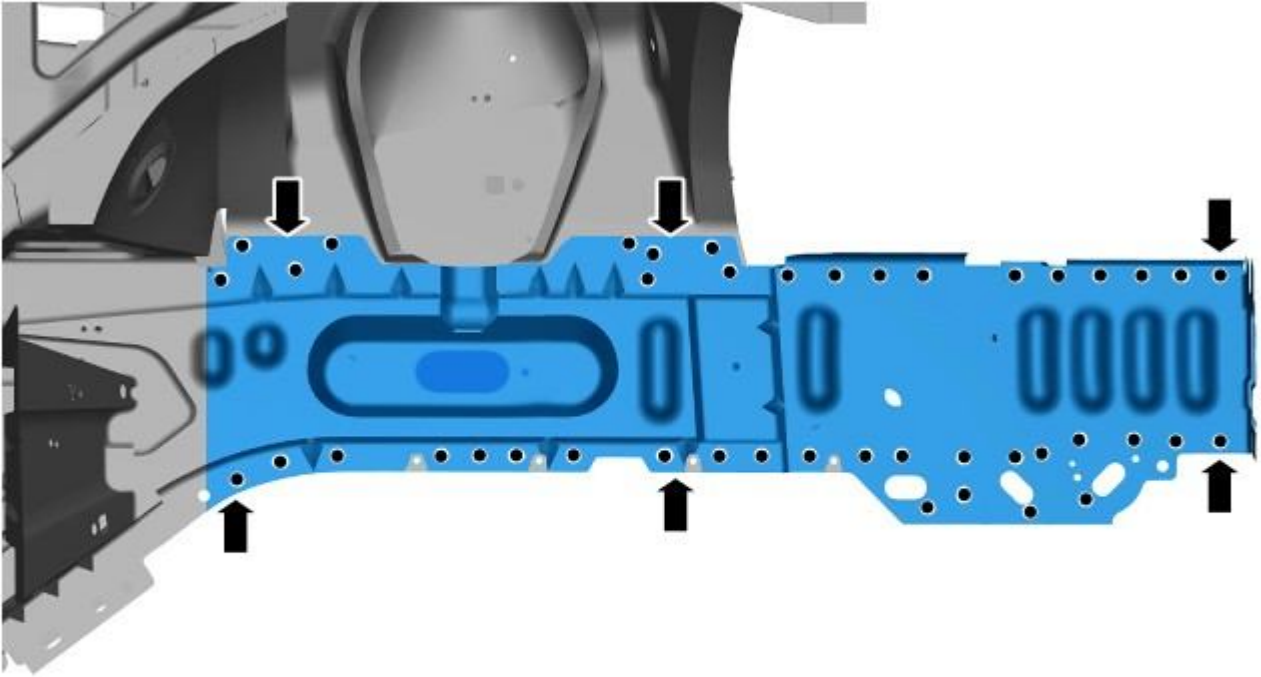
21. MAG plug weld.



E 117060

22. NOTE: Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original. Where there is adhesive in the original joint, spot welds should be installed through the original.

Spot weld.



E117061

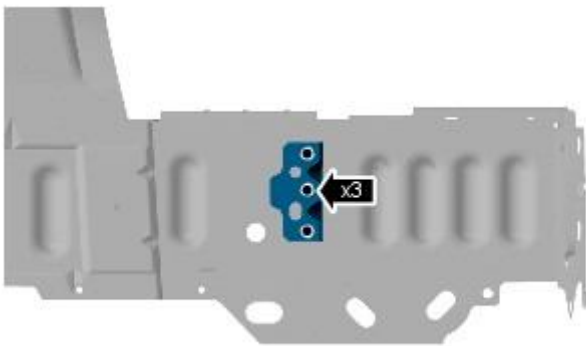
23. Dress all welded joints.

24. **NOTE:** If a new front fender support bracket mounting is to be installed, drill 3 holes ready for MAG plug welding.

Prepare the panel joint surfaces of the front fender support bracket mounting and the front side member closing panel.

25. Offer up the front fender support bracket mounting and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

26. MAG plug weld.



E117044

27. Dress the MAG plug welds.

28. Install the front bumper mounting.

For additional information, refer to: [Front Bumper Mounting](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).

29. Make sure any remaining areas of bare metal created during this procedure are treated with a zinc primer prior to the installation of outer panels.

30. The installation of associated panels and components is the reversal of removal procedure.



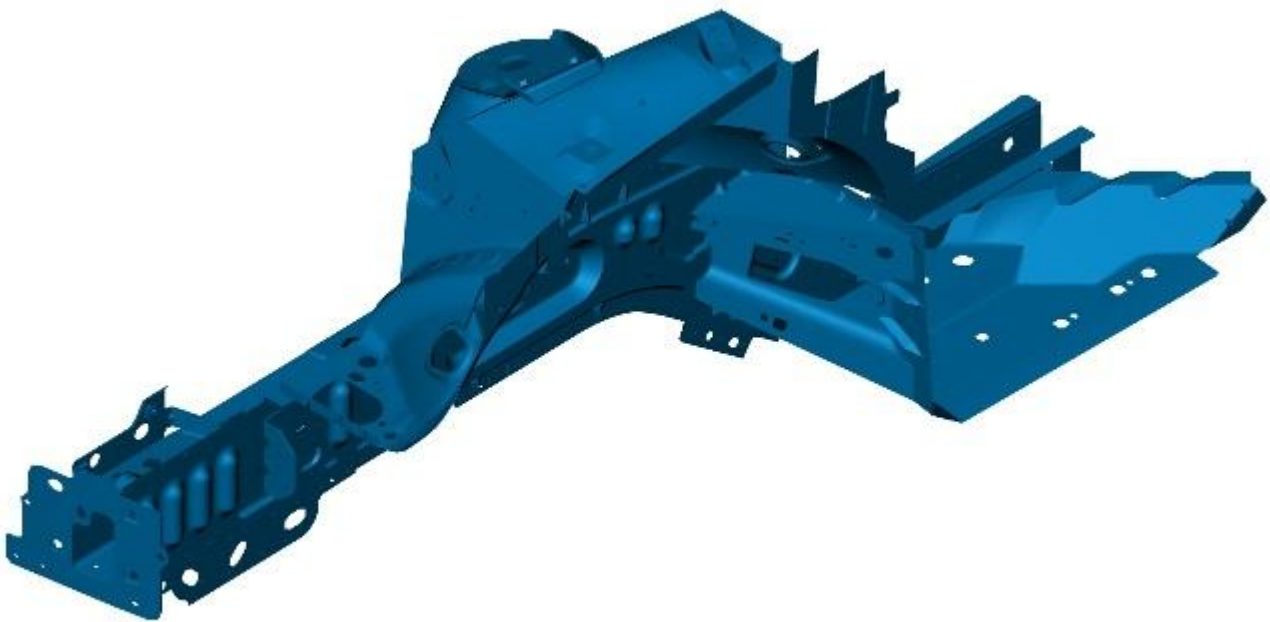
# Front End Sheet Metal Repairs - Front Side Member and Suspension Top Mount Assembly

Removal and Installation

## Removal

1. **NOTE:** The front side member and suspension top mount assembly is, an assembly of panels, manufactured from High Strength Low Alloy Steel, 350MPa, (HSLA350) and mild steel.

The front side member and suspension top mount assembly is serviced as a separate weld-on panel. The assembly includes, the front bumper mounting, hood latch support panel, front side member, front side member closing panel, front wheelhouse section, front fender support bracket mounting, suspension top mount and the inner apron and wheelhouse panels



E112841

2. In this procedure, to make sure that the vehicle is correctly aligned, it must be placed on an approved alignment jig.

3. The front side member and suspension top mount assembly is replaced in conjunction with:

- Front bumper cover
- Front bumper
- Front fender
- Hood
- Hood hinge
- Hood latch panel
- Front fender support bracket
- Fender apron panel front extension
- Fender apron panel closing panel
- Fender apron panel
- Hood strut mounting bracket

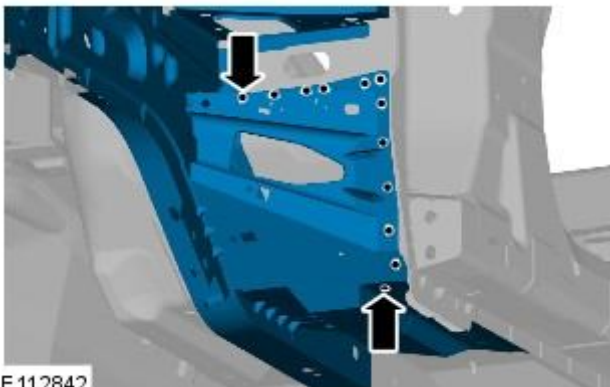
- Fender mounting plate
  - Instrument panel console
  - Engine, transmission / transaxle, front subframe and front suspension, as an assembly
4. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
  5. Remove the fender apron panel front extension.  
For additional information, refer to: [Fender Apron Panel Front Extension](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).
  6. Remove the front fender support bracket.  
For additional information, refer to: [Front Fender Support Bracket](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).
  7. Remove the fender apron panel.  
For additional information, refer to: [Fender Apron Panel](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).
  8. Remove the engine, transmission / transaxle, front subframe and front suspension, as an assembly.  
For additional information, refer to: [Engine](#) (303-01A, Removal) / [Engine](#) (303-01C, Removal) / [Engine](#) (303-01A Engine - 4.2L NA V8 - AJV8, Removal) / [Engine](#) (303-01B Engine - 4.2L SC V8 - AJV8, Removal) / [Transmission](#) - 2.7L Diesel (307-01, Removal) / [Transmission](#) - 3.0L Diesel (307-01, Removal) / [Transmission](#) - 3.0L (307-01, Removal) / [Transmission - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8](#) (307-01 Automatic Transmission/Transaxle - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal) / [Transmission](#) - 5.0L (307-01, Removal) / [Front Shock Absorber](#) (204-01 Front Suspension, Removal and Installation) / [Front Subframe](#) - 2.7L Diesel (502-00, Removal and Installation) / [Front Subframe](#) - 3.0L (502-00, Removal and Installation) / [Front Subframe - 4.2L NA V8 - AJV8](#) (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation) / [Front Subframe - 4.2L SC V8 - AJV8](#) (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
  9. Remove the pedestrian protection hood actuator.  
For additional information, refer to: [Pedestrian Protection Hood Actuator LH](#) (501-20C Pedestrian Protection System, Removal and Installation) / [Pedestrian Protection Hood Actuator RH](#) (501-20C Pedestrian Protection System, Removal and Installation).
  10. If the drivers side front side member and suspension top mount is to be repaired, remove the brake master cylinder and reservoir.  
For additional information, refer to: [Brake Master Cylinder](#) (206-06 Hydraulic Brake Actuation, Removal and Installation) / [Brake Fluid Reservoir](#) (206-06 Hydraulic Brake Actuation, Removal and Installation).
  11. If the drivers side front side member and suspension top mount is to be repaired, remove the brake booster.  
For additional information, refer to: [Brake Booster](#) (206-07 Power Brake Actuation, Removal and Installation).
  12. Remove the left-hand and right-hand front seats.  
For additional information, refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).
  13. Remove the heater core and evaporator core housing.  
For additional information, refer to: [Heater Core and Evaporator Core Housing](#) (412-01 Climate Control, Removal and Installation).
  14. Remove the front safety belt retractor.

For additional information, refer to: [Front Safety Belt Retractor](#) (501-20A Safety Belt System, Removal and Installation).

15. Remove the B-pillar side impact sensor.  
For additional information, refer to: [B-Pillar Side Impact Sensor](#) (501-20B Supplemental Restraint System, Removal and Installation).
16. Remove the left-hand and right-hand front floor covering.
17. Remove the rear floor covering.
18. If the left-hand front side member and suspension top mount assembly is to be repaired, remove the left-hand rear foot well duct.
19. If the right-hand front side member and suspension top mount assembly is to be repaired, remove the right-hand rear foot well duct.
20. If the drivers side front side member and suspension top mount is being repaired, remove the pedal box.
21. Release and position the insulating material at the inner bulkhead to one side.
22. Release and position the inner bulkhead and floor panel wiring harness to one side.
23. Drain the fuel tank.  
For additional information, refer to: [Fuel Tank Draining](#) (310-00 Fuel System - General Information, General Procedures).
24. If the left-hand front side member and suspension top mount assembly is to be repaired, remove the left-hand under shield.
25. If the right-hand front side member and suspension top mount assembly is to be repaired, remove the right-hand under shield.
26. If the left-hand front side member and suspension top mount assembly is to be repaired, remove the fuel supply and return pipes.
27. For diesel engine vehicles only, if the left-hand front side member and suspension top mount assembly is to be repaired, remove the fuel cooler.
28. If the right-hand front side member and suspension top mount assembly is to be repaired, release and position the underfloor wiring harness to one side.
29. If the right-hand front side member and suspension top mount assembly is to be repaired, remove the front to rear brake pipes.
30. Remove the exhaust heat shields.
31. Release and position the front side member and suspension top mount wiring harness to one side.
32. Remove any remaining miscellaneous components from the repair area as necessary.

**33. NOTE:** Remove the sealer to expose the spot welds.

Drill out the spot welds as indicated.

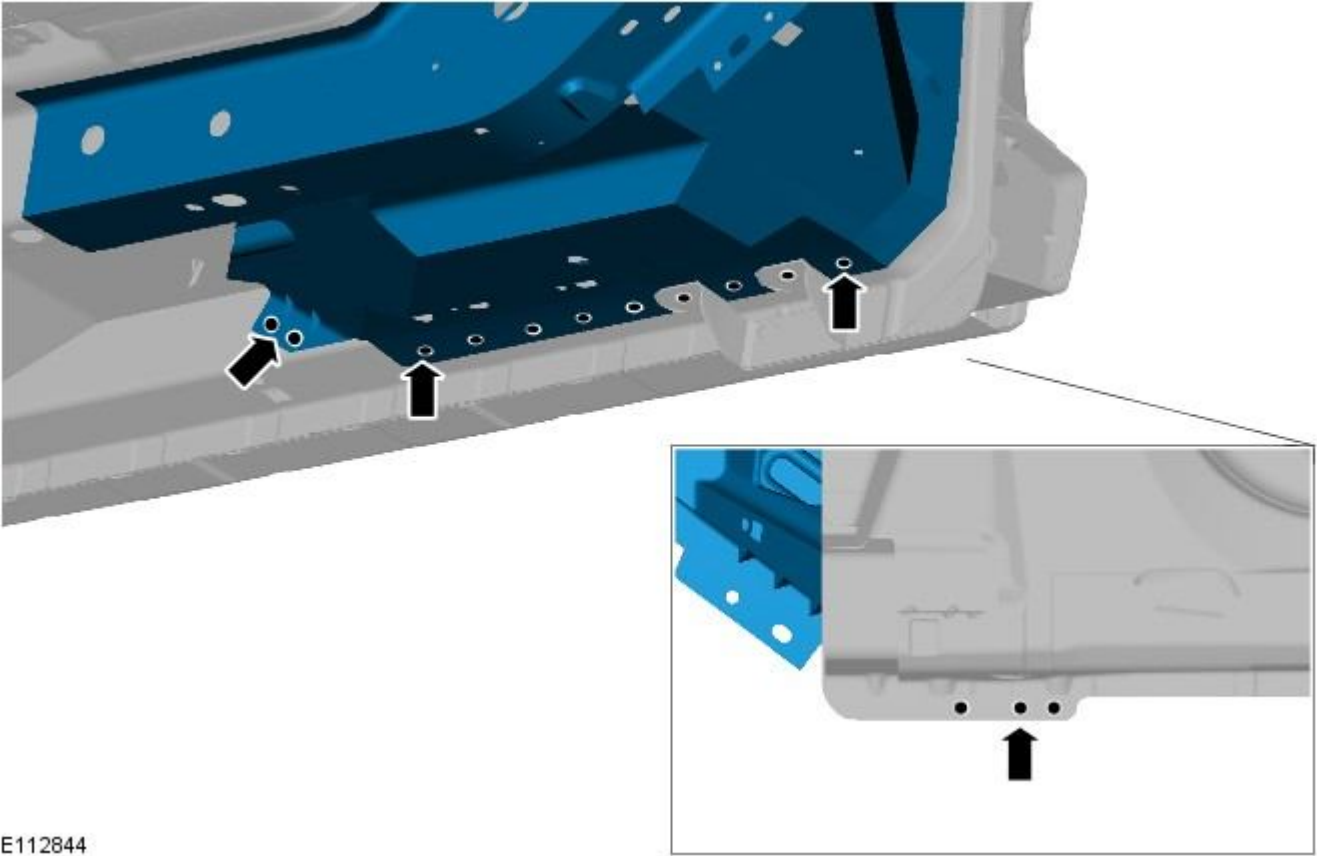


E 112842

**34. NOTE:** Remove the sealer to expose the spot welds.

• NOTE: Use a belt sander where there is no access to drill. The three spot welds at the rocker panel should be drilled from outside and right through, to allow MAG plug welding on installation

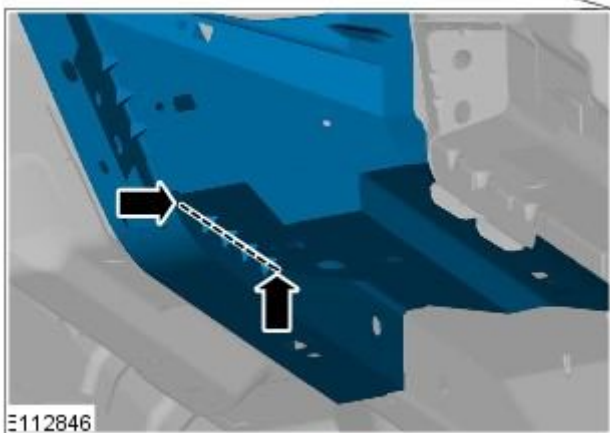
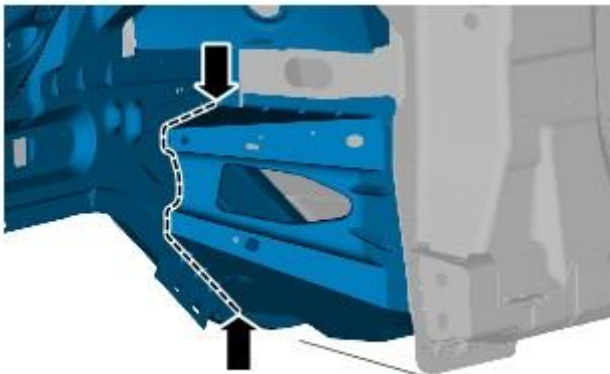
Drill out the spot welds as indicated.



E112844

**35. NOTE:** The removal of the bulkhead reinforcement is required to gain access to drill out two spot welds.

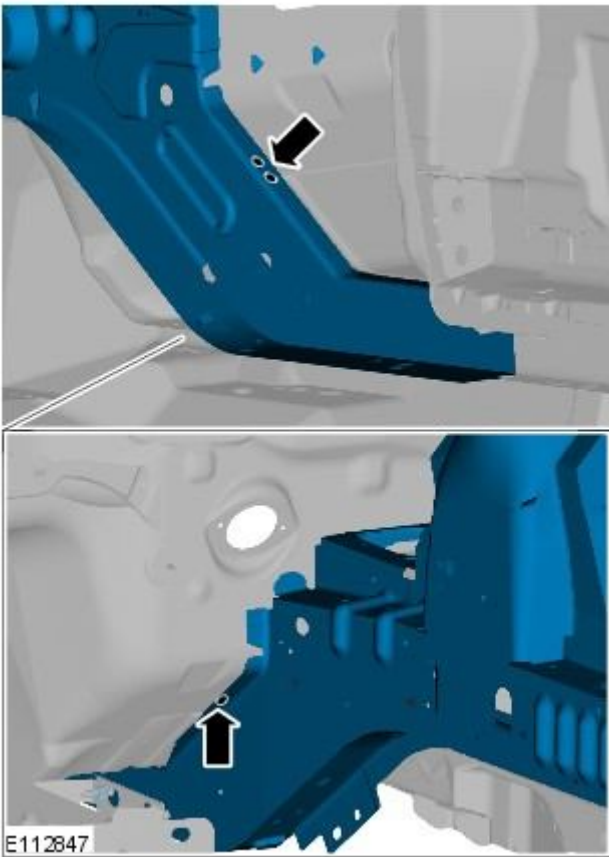
Remove the bulkhead reinforcement panel, by performing a saw cut at the points as indicated.



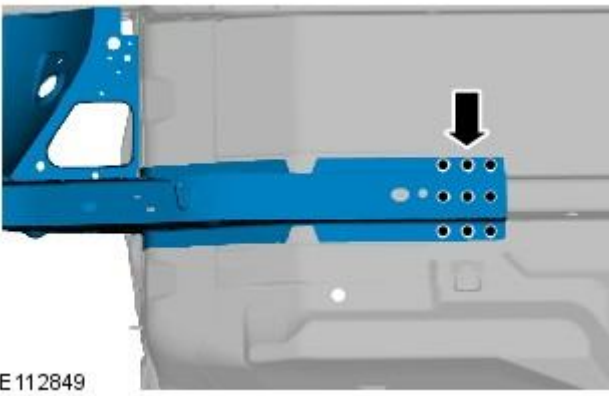
E112846

**36.** Separate the joints and remove the bulkhead reinforcement panel.

37. Drill out the spot welds as indicated.

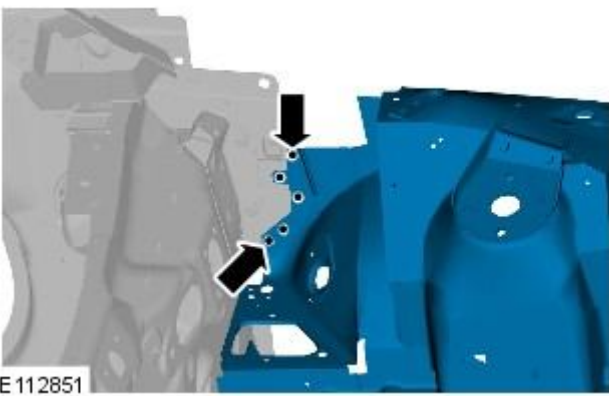


38. Drill out the spot welds as indicated.



39. NOTE: The spot welds indicated should be drilled from inside the engine compartment, to allow spot welding on installation.

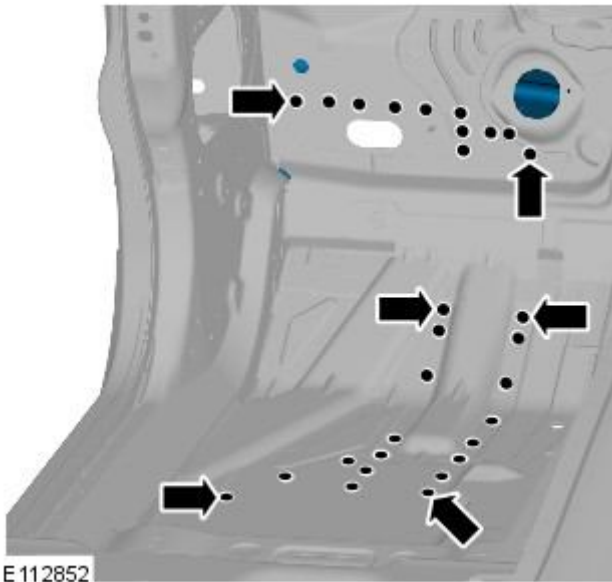
Drill out the spot welds as indicated.



40. NOTE: Remove the NVH (noise, vibration and harshness) sound deadening material to expose the spot welds.

• NOTE: The spot welds indicated should be drilled from inside and right through, to allow MAG plug welding on installation.

Drill out the spot welds as indicated.



41.  CAUTION: This step requires the aid of another technician as the removed panel will be heavy.

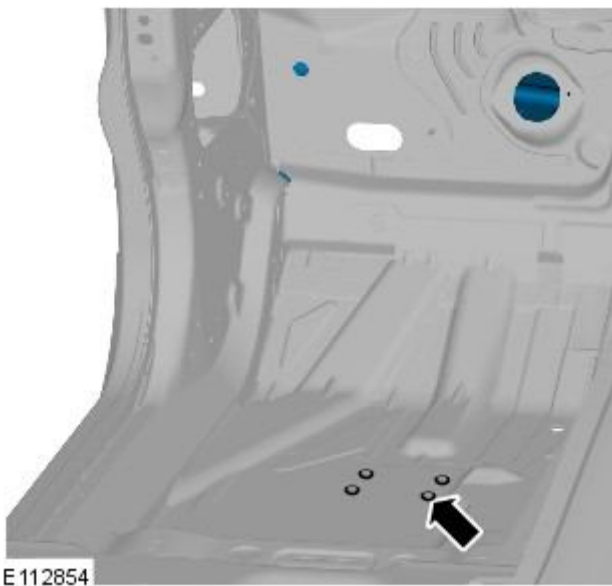
Separate the joints and remove the old panel.

### Installation

1. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

2. NOTE: To avoid overlapping MAG plug welds, the original removal holes must be marked so that they can be avoided when drilling the adjacent MAG plug holes.

Mark the position of the drilled holes as indicated, on the new panel.

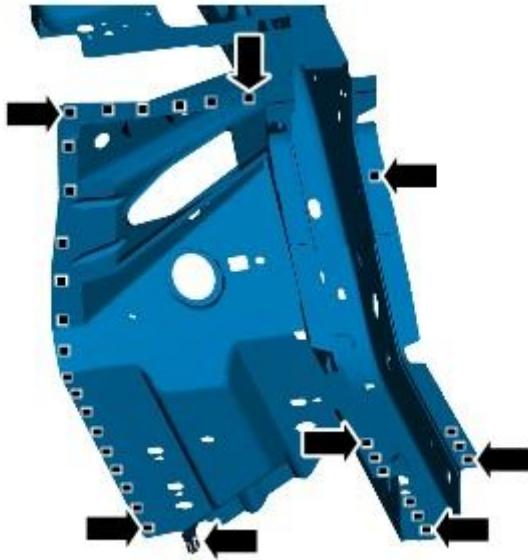


3. Remove the new panel.



4. NOTE: Holes should be drilled avoiding the areas previously marked.

Drill holes in the new panel ready for MAG plug welding.

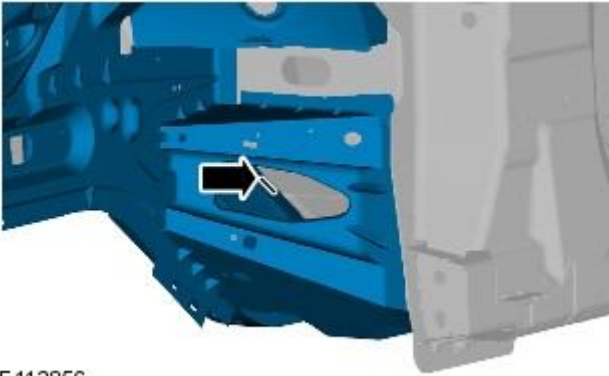


E 112855

5. Prepare the old and new panel joint surfaces.

6. NOTE: On installation, a MAG run replaces two spot welds which cannot be MAG plugged due to restricted access.

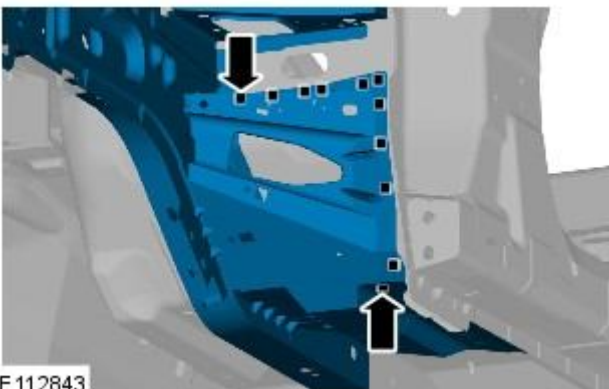
Prepare the old and new panel joint surfaces at the point indicated, where the MAG run is to be performed.



E 112856

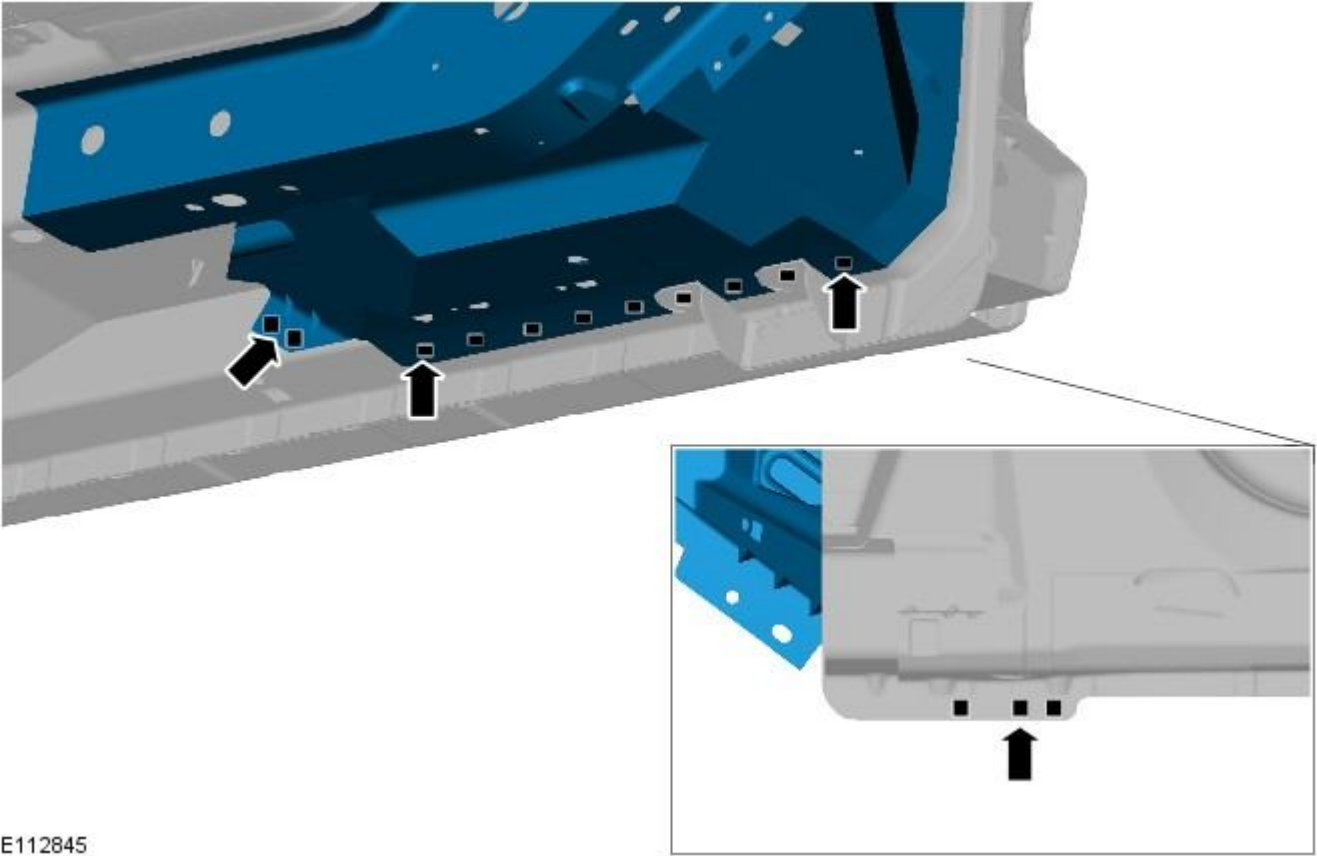
7. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

8. MAG plug weld at the points indicated.



E 112843

9. MAG plug weld at the points indicated.



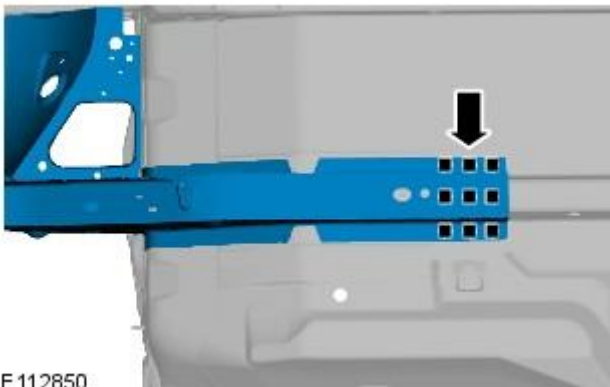
E112845

10. MAG plug weld at the points indicated.



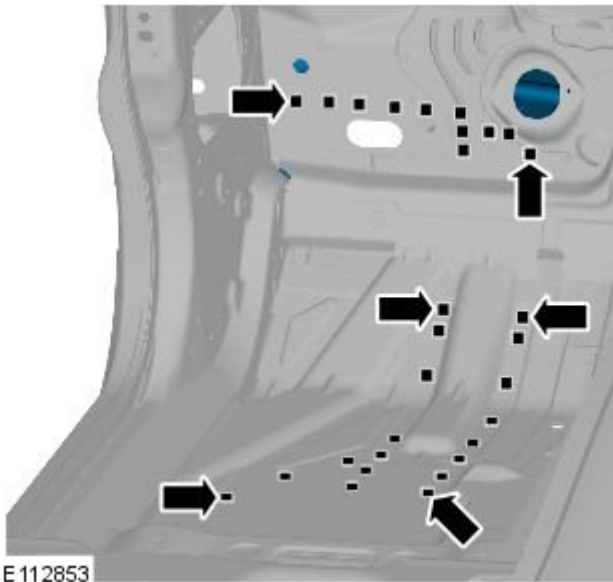
E 112848

11. MAG plug weld at the points indicated.



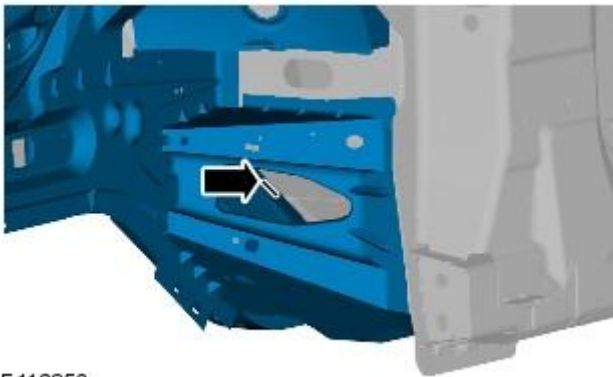
E 112850

12. MAG plug weld at the points indicated.



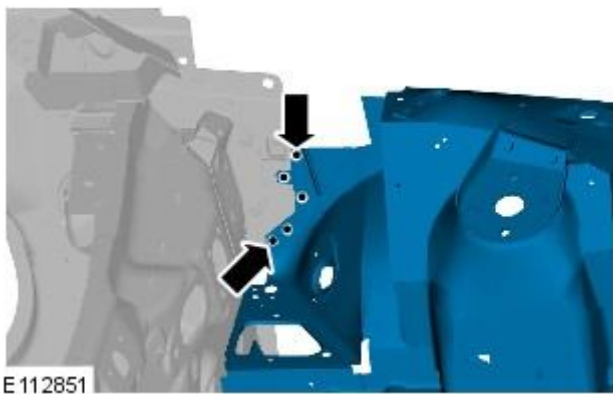
13. NOTE: A MAG weld run replaces the original two spot welds as there is no access to install spot welds or MAG plug welds in this area. The MAG weld run should be performed avoiding the area of adhesive.

Perform a MAG weld run, of approx 30mm as indicated.



14. NOTE: Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original. Where there is adhesive in the original joint, spot welds should be installed through the original.

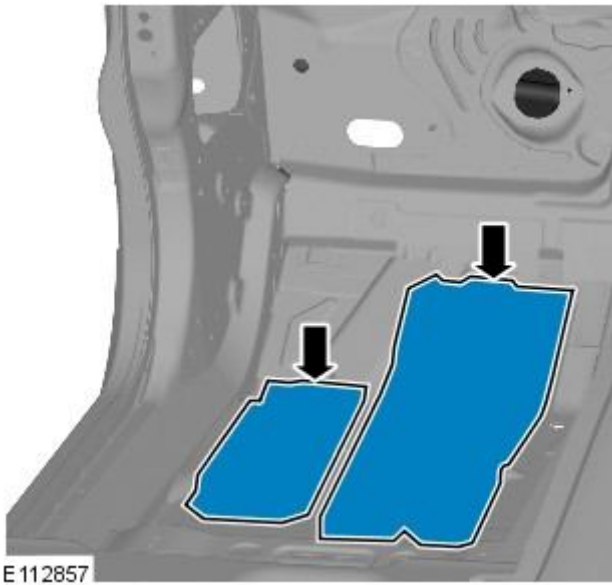
Spot weld.



15. Dress all welded joints.

16. Make sure any remaining areas of bare metal created during this procedure are treated with a zinc primer prior to the installation of outer panels.

**17.** Install the NVH sound deadening material in the areas indicated.



E 112857

**18. NOTE:** Make sure all underbody joints are fully sealed following this repair procedure.

The installation of associated panels and components is the reversal of removal procedure.

# Front End Sheet Metal Repairs - Front Side Member Closing Panel

Removal and Installation

## Removal

1. NOTE: The front side member closing panel is manufactured from High Strength Low Alloy Steel, 350MPa, (HSLA350).

The front side member closing panel is serviced as a separate weld-on panel.



E111830

2. In this procedure, to ensure the vehicle is correctly aligned, it must be placed on an approved alignment jig.
  3. The front side member closing panel is replaced in conjunction with:
    - Front bumper cover
    - Front bumper
    - Front bumper mounting
    - Hood
    - Hood latch panel
    - Front fender support bracket
    - Front fender support bracket mounting
    - Front wheelhouse section
    - Front side member
    - Engine, transmission / transaxle, front subframe and front suspension, as an assembly
  4. For additional information relating to this repair procedure please see the following:  
 For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
  5. NOTE: This procedure assumes that if the front side member closing panel is damaged, the front side member will also be damaged. Therefore, the replacement procedure for the front side member closing panel is combined within the front side member procedure.
- Remove the front side member.  
 For additional information, refer to: [Front Side Member](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).

## Installation

1. The installation of associated panels and components is the reversal of removal procedure.

# Front End Sheet Metal Repairs - Front Side Member Closing Panel Section

Removal and Installation

## Removal

1. NOTE: The front side member closing panel section is manufactured from High Strength Low Alloy Steel, 350MPa, (HSLA350).

The front side member closing panel section is cut from the front side member closing panel service panel.



E111830

2. In this procedure, to make sure that the vehicle is correctly aligned, it must be placed on an approved alignment jig.
3. The front side member closing panel section is replaced in conjunction with:
  - Front bumper cover
  - Front bumper
  - Front bumper mounting
  - Hood
  - Hood latch panel
  - Front side member section
4. For additional information relating to this repair procedure please see the following:  
 For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
5. NOTE: This procedure assumes that if the front side member closing panel section is damaged, the front side member section will also be damaged. Therefore the removal procedure for the front side member closing panel section is combined within the front side member section procedure.

Remove the front side member section.

For additional information, refer to: [Front Side Member Section](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).

## Installation

1. The installation of associated panels and components is the reversal of removal procedure.



# Front End Sheet Metal Repairs - Front Side Member Section

Removal and Installation

## Removal

1. NOTE: The front side member section is manufactured from High Strength Low Alloy Steel, 350MPa, (HSLA350).

The front side member section is cut from the front side member service panel, which includes the hood latch panel mounting bracket.



E111823

2. In this procedure, to make sure that the vehicle is correctly aligned, it must be placed on an approved alignment jig.

3. NOTE: This procedure assumes that the front side member closing panel section is damaged. Therefore, the procedure combines the repair of the front side member section and the front side member closing panel section.

The front side member section is replaced in conjunction with:

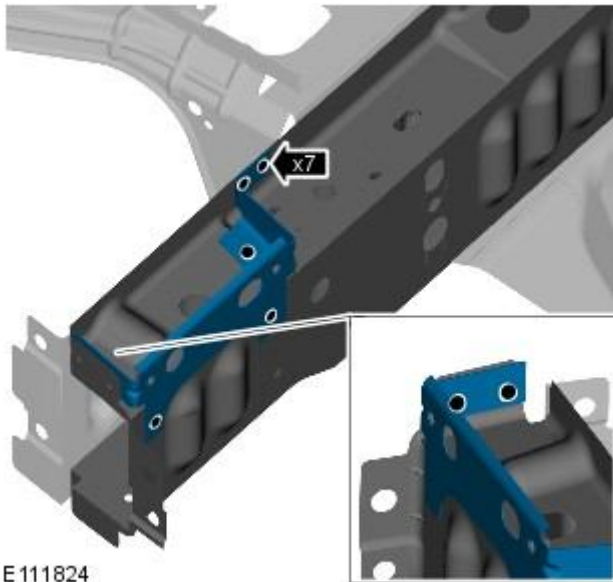
- Front bumper cover
- Front bumper
- Front bumper mounting
- Hood
- Hood latch panel
- Front side member closing panel section  
For additional information, refer to: [Front Side Member Closing Panel Section](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).

4. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

5. Remove the hood.  
For additional information, refer to: [Hood](#) (501-02, Removal and Installation).

6. Remove the front bumper mounting.  
For additional information, refer to: [Front Bumper Mounting](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).

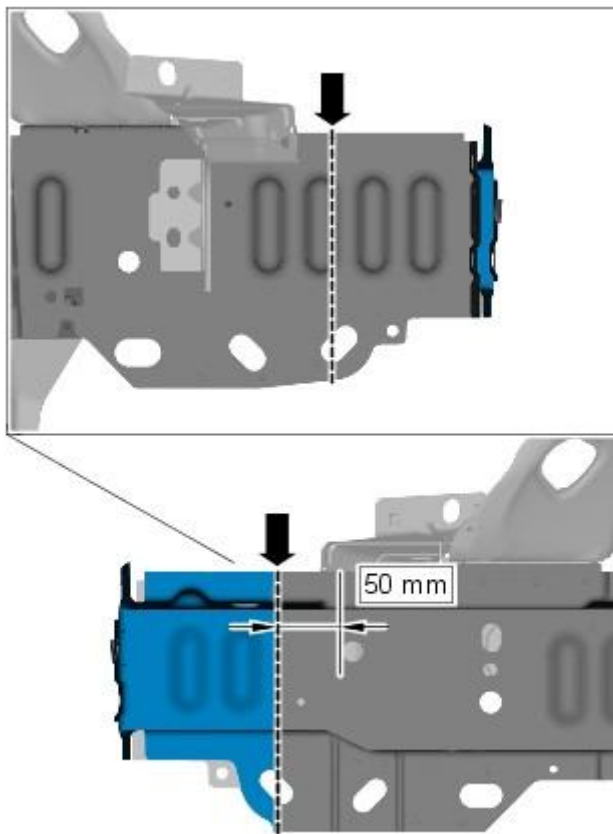
7. Disconnect the generator electrical connectors.



E111824

**8. NOTE:** Removal of the hood latch panel mounting bracket is required to enable the section cut line to be marked out and performed on the front side member.

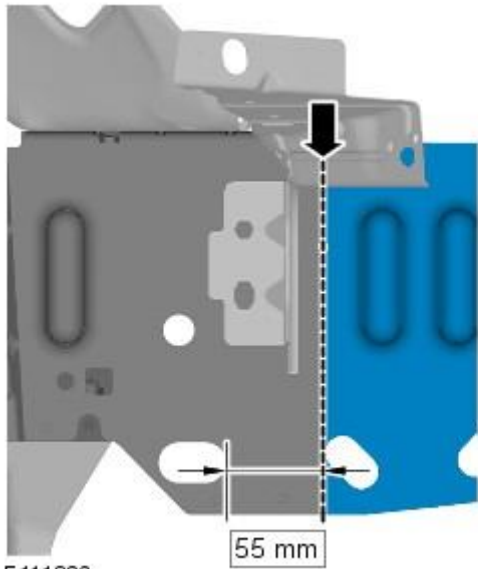
Drill out the spot welds and remove the hood latch panel mounting bracket.




E111825

**9. NOTE:** The measurements shown allow the section to be performed, avoiding the inner reinforcements and allowing for a minimum 50mm staggered joint with the front side member closing panel section.

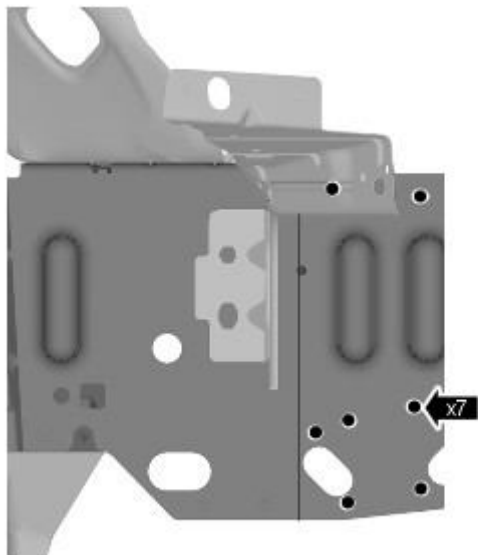
Mark out the position where the front side member section MAG butt joint is to be made. Cut through the front side member at this point, also cutting through the front side member closing panel as indicated.



E111826

10.  **CAUTION:** Care should be taken not to cut through into the front side member.

Mark out the position where the front side member closing panel section MAG butt joint is to be made. Cut through the front side member closing panel at this point as indicated.



E111827

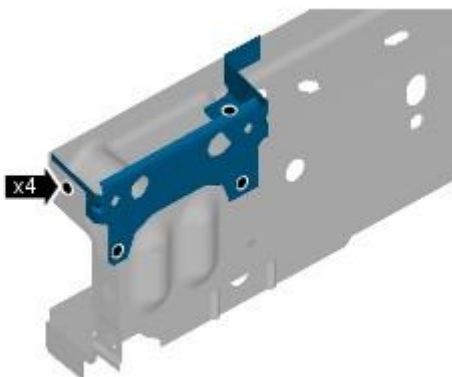
11. Drill out the spot welds from the front side member closing panel remnant.

12. Separate the joints and remove the front side member closing panel remnant.

### Installation

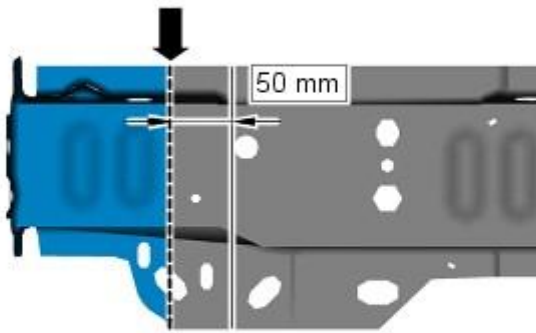
1. **NOTE:** Removal of the hood latch panel mounting bracket is required to enable the section cut line to be marked out and performed on the front side member. Retain the hood latch panel mounting bracket as it will be reused.

Drill out the spot welds and remove the hood latch panel mounting bracket from the side member service panel.



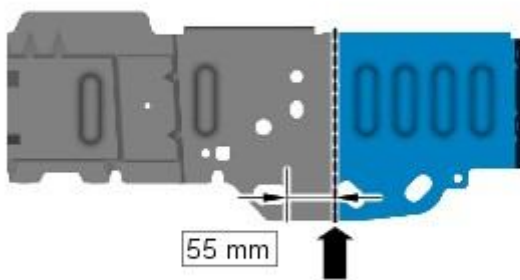
E111828

2. Mark out the position on the front side member service panel, where the section MAG butt joint is to be made and cut the panel at this point as indicated.



E 111829

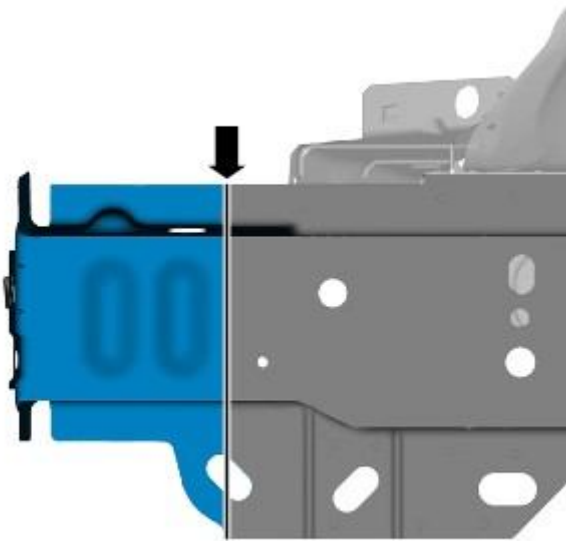
3. Mark out the position on the front side member closing panel service panel, where the section MAG butt joint is to be made and cut the panel at this point as indicated.



E 111831

4. Prepare the panel joint surfaces of the old and new front side member and front side member closing panel sections.
5. Offer up the new front side member section and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.
6. Tack MAG weld the front side member section butt joint.
7. Dress the front side member section MAG tack welds.

8. MAG weld the front side member section butt joint.



E111832

9. Dress the front side member section MAG butt joint.

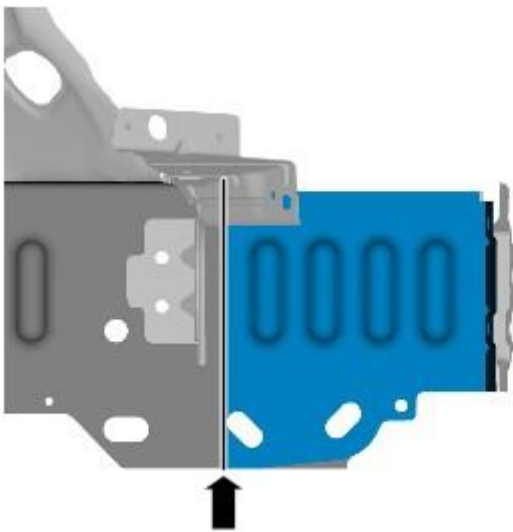
10. Apply a zinc rich primer to any bare metal surfaces at this stage.

11. Offer up the new front side member closing panel section and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

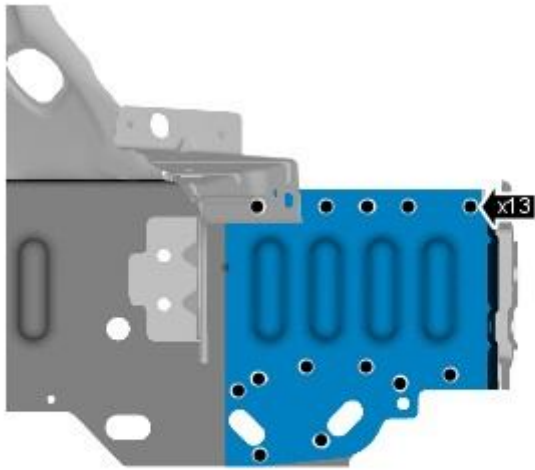
12. Tack MAG weld the front side member closing panel section butt joint.

13. Dress the front side member closing panel section MAG tack welds.

14. MAG weld the front side member closing panel section butt joint.



E111833



**15. NOTE:** Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original. Where there is adhesive in the original joint, spot welds should be installed through the original.

Spot weld the front side member closing panel section to the front side member.

E 111834

**16.** Dress the spot welds and the front side member closing panel section MAG butt joint.

**17.** Drill holes in the new hood latch panel mounting bracket ready for MAG plug welding.

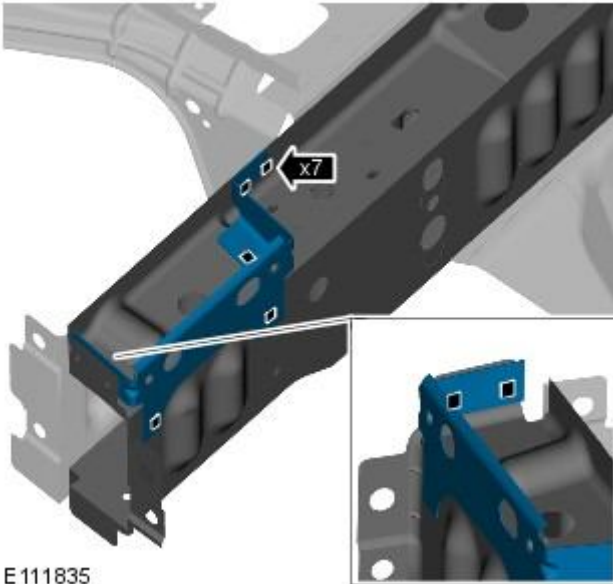


E 111906

**18.** Prepare the panel joint surfaces of the new hood latch panel mounting bracket and the corresponding joints on the front side member section.



**19.** MAG plug weld the hood latch panel mounting bracket to the front side member section.



**20.** Dress the hood latch panel mounting bracket MAG plug welds.

**21.** Make sure any remaining areas of bare metal created during this procedure are treated with a zinc primer prior to the installation of outer panels.

**22.** The installation of associated panels and components is the reversal of removal procedure.

# Front End Sheet Metal Repairs - Front Wheelhouse Section

Removal and Installation

## Removal

1. NOTE: The left hand service panel is illustrated.

• NOTE: The front wheelhouse section is manufactured from mild steel.

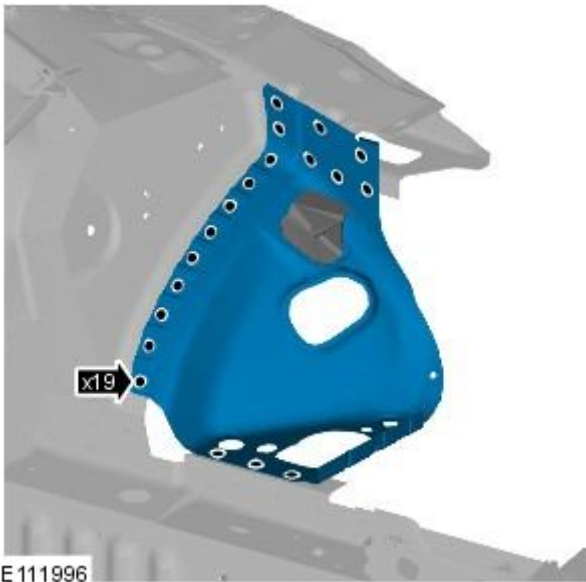
The front wheelhouse section is serviced as a separate weld-on panel, the left-hand is serviced less the weld-on air cleaner mounting bracket. It is also serviced on the front side member and suspension top mount assembly, the left-hand assembly includes the air cleaner mounting bracket.



E 111995

2. The front wheelhouse section is replaced in conjunction with:
  - Front bumper cover
  - Front fender
  - Hood latch panel
  - Front fender support bracket
3. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove the front fender support bracket.  
For additional information, refer to: [Front Fender Support Bracket](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).
5. Disconnect the generator electrical connectors.

6. Drill out the spot welds.



7. NOTE: If the left-hand front wheelhouse section is to be repaired, retain the old panel if the air cleaner mounting bracket is to be reused.

Separate the joints and remove the old panel.

8. If the left-hand front wheelhouse section is to be repaired, drill out the spot welds for the air cleaner mounting bracket from underneath so that it can be reused.



9. NOTE: If undamaged, the air cleaner mounting bracket should be retained for installation on the new panel.

Separate and remove the air cleaner mounting bracket.

## Installation

1. NOTE: If adjacent panels are being repaired and access allows, spot welds should be installed where possible.

Drill holes in the new panel ready for MAG plug welding.

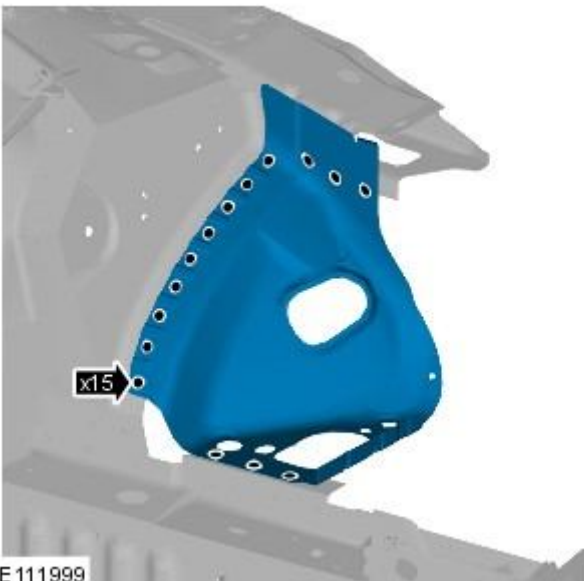


E 111998

2. Prepare the old and new panel joint surfaces.
3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

4. NOTE: Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original.

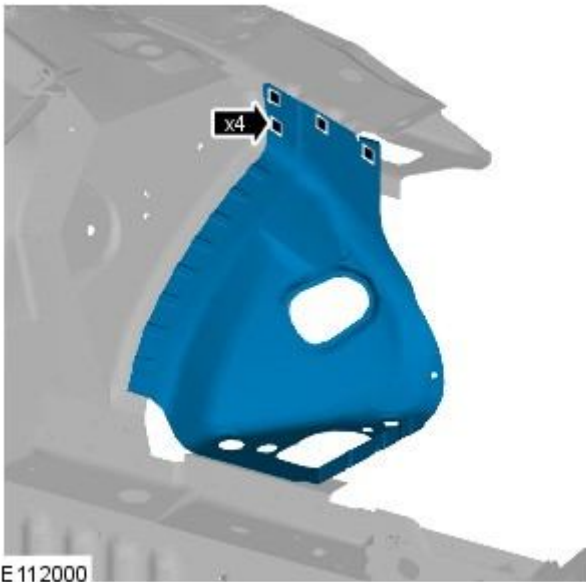
Spot weld.



E 111999

**5. NOTE:** If adjacent panels are being repaired and access allows, spot welds should be installed where possible.

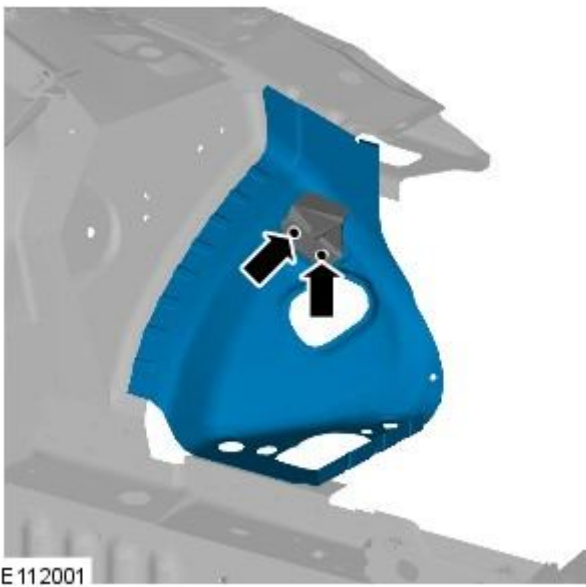
MAG plug weld.



**6.** Prepare the panel joint surfaces of the air cleaner mounting bracket.

**7.** Offer up the air cleaner mounting bracket and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

**8.** Spot weld the air cleaner mounting bracket.



**9.** Dress all welded joints.

**10.** The installation of associated panels and components is the reversal of removal procedure.

# Front End Sheet Metal Repairs - Hood Latch Panel

Removal and Installation

## Removal

1. **NOTE:** The hood latch panel is manufactured from mild steel.


The hood latch panel is serviced as a separate bolt-on panel and includes the left-hand and right-hand fender apron panel front extensions. These are removed and discarded unless damaged.



E102951

2. The hood latch panel is replaced in conjunction with:

1. Front bumper cover
2. Front bumper

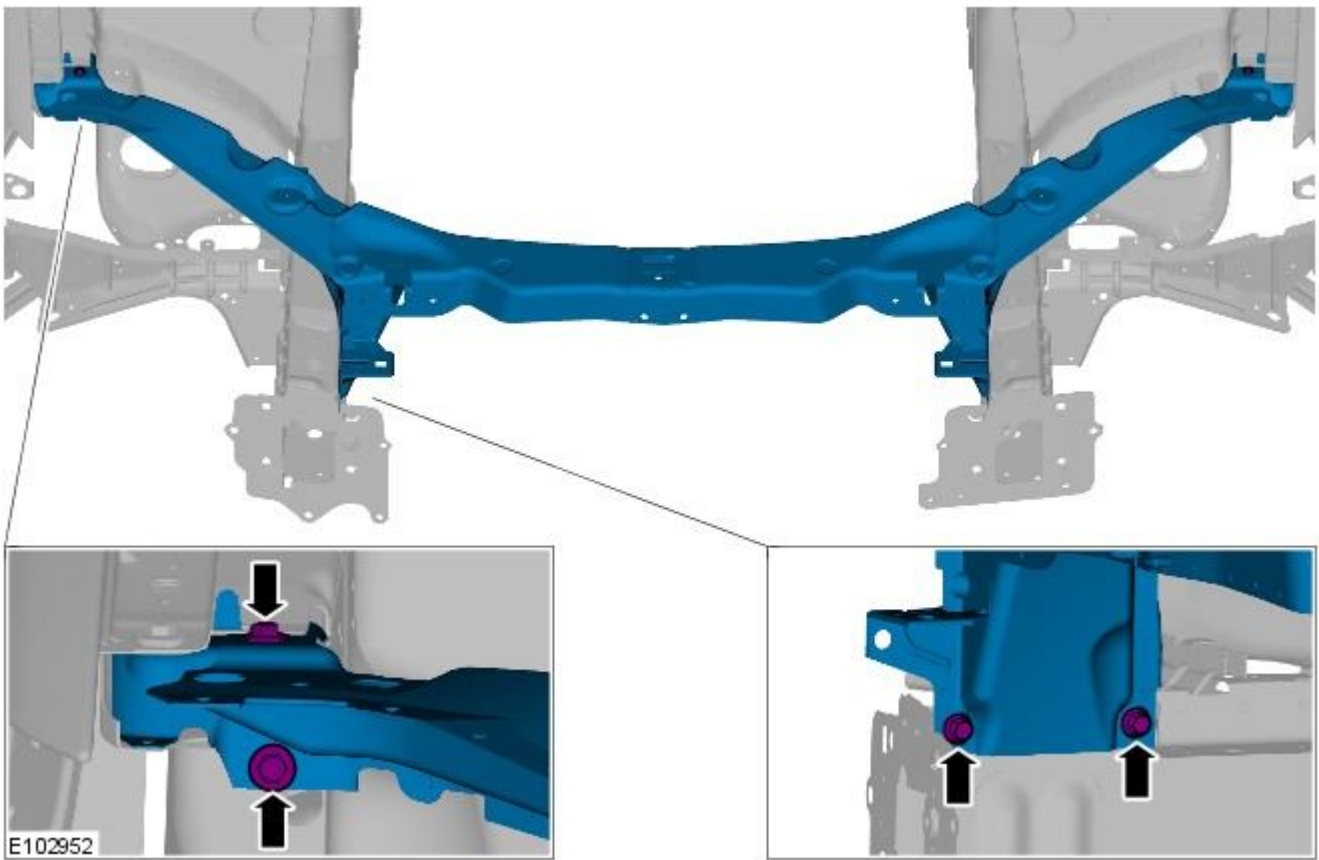
3.  **WARNING:** The hood latch panel and its associated components form part of the pedestrian protection system, it is essential that any repair or replacement operations do not affect the safe working of the system.

For additional information relating to the pedestrian safety system please see the following:  
For additional information, refer to: [Pedestrian Protection System](#) (501-20C Pedestrian Protection System, Description and Operation).

4. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
5. Remove the front bumper.  
For additional information, refer to: Front Bumper (501-19, Removal and Installation).
6. Remove both headlamp assemblies.  
For additional information, refer to: [Headlamp Assembly](#) (417-01 Exterior Lighting, Removal and Installation).
7. Remove the condenser core.  
For additional information, refer to: Condenser Core - 2.7L Diesel (412-03, Removal and Installation) / Condenser Core - 3.0L (412-03, Removal and Installation) / [Condenser Core - 4.2L NA V8 - AJV8](#) (412-03 Air Conditioning, Removal and Installation) / [Condenser Core - 4.2L SC V8 - AJV8](#) (412-03 Air Conditioning, Removal and Installation).

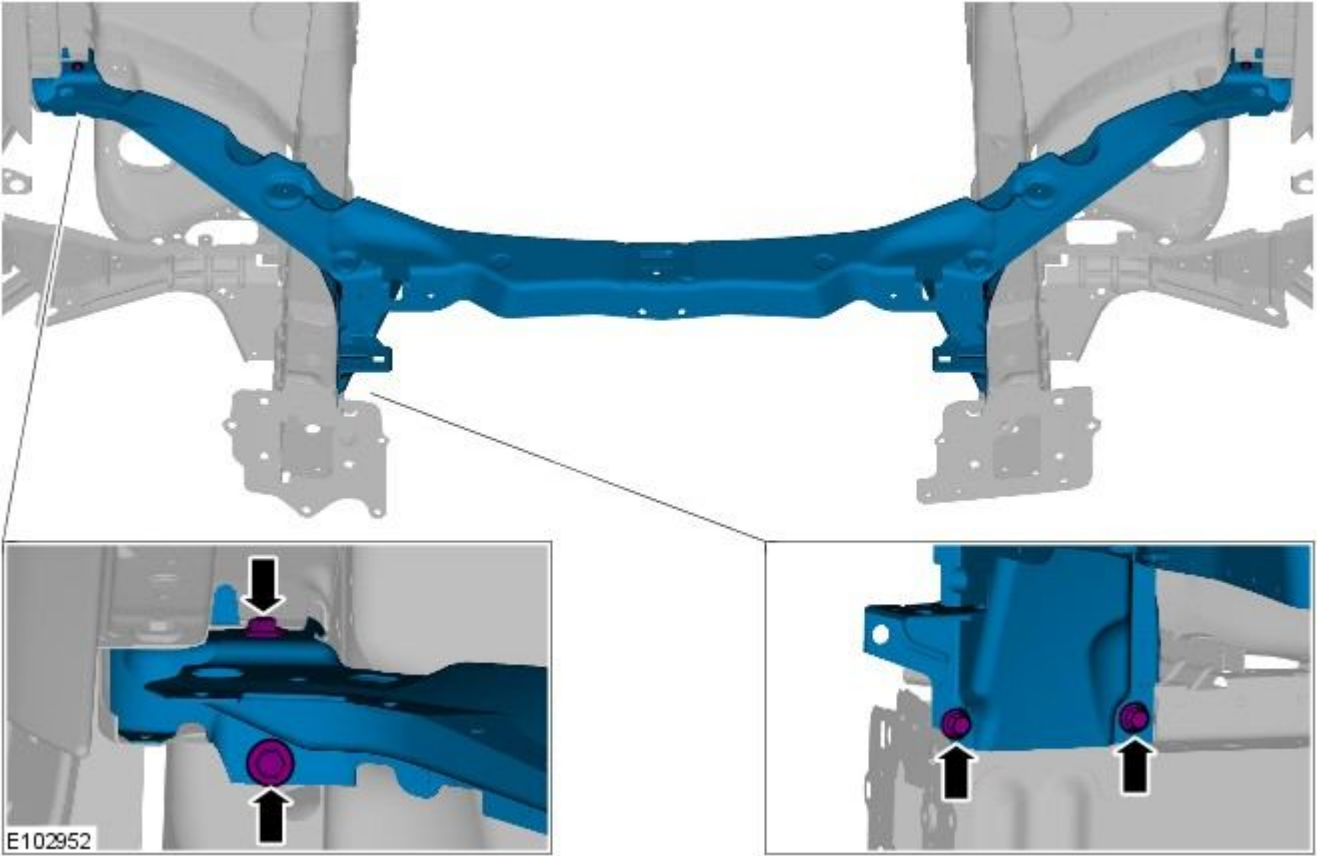


8. Remove the radiator.  
For additional information, refer to: Radiator (303-03A, Removal and Installation) / Radiator (303-03B, Removal and Installation) / [Radiator - 4.2L SC V8 - AJV8](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation) / [Radiator - 4.2L NA V8 - AJV8](#) (303-03A Engine Cooling - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
9. Remove the both hood latch panel braces.
10. Remove the cooling fan upper shroud.
11. Remove both crash sensors.  
For additional information, refer to: [Crash Sensor](#) (501-20B Supplemental Restraint System, Removal and Installation).
12. Remove the both hood latches.
13. Remove the hood safety hook guide.
14. Remove both hood latch panel buffers.
15. Release and lay aside the hood latch panel wiring harness.
16. Remove the old panel.



## Installation

1. Offer up the new panel. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.
2. Install the hood latch panel.
  - Tighten to 10 Nm.



3. The installation of associated panels and components is the reversal of removal procedure.

# Front End Sheet Metal Repairs - Hood Latch Panel Mounting Bracket

Removal and Installation

## Removal

1. NOTE: The hood latch panel mounting bracket is manufactured from mild steel.

The hood latch panel mounting bracket is serviced as a separate weld-on panel.

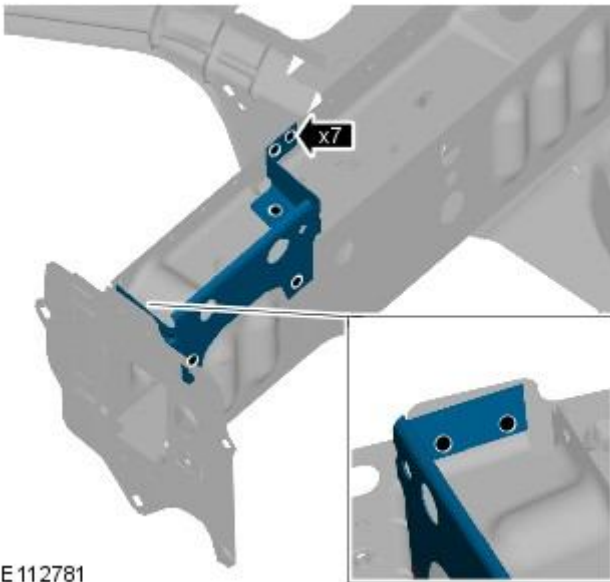


E112780

2. The hood latch panel mounting bracket is replaced in conjunction with:
  - Front bumper cover
  - Front bumper
  - Hood
  - Hood latch panel
3. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) /  
[Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) /  
[Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) /  
[Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove the hood latch panel.  
For additional information, refer to: [Hood Latch Panel](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).
5. Remove the hood.  
For additional information, refer to: [Hood](#) (501-02, Removal and Installation).

6. NOTE: Use a belt sander where there is no access to drill.

Drill out the spot welds.



E 112781

7. Separate the joints and remove the old panel.

### Installation

1. Drill holes in the new panel ready for MAG plug welding.

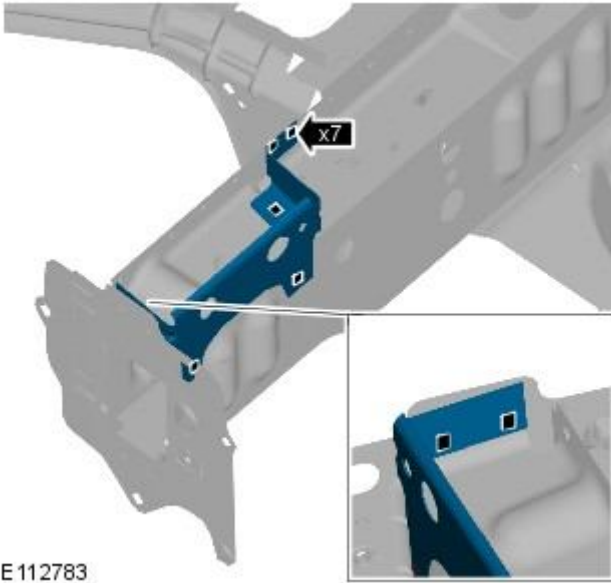


E 112782

2. Prepare the old and new panel joint surfaces.

3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

4. MAG plug weld.



E 112783

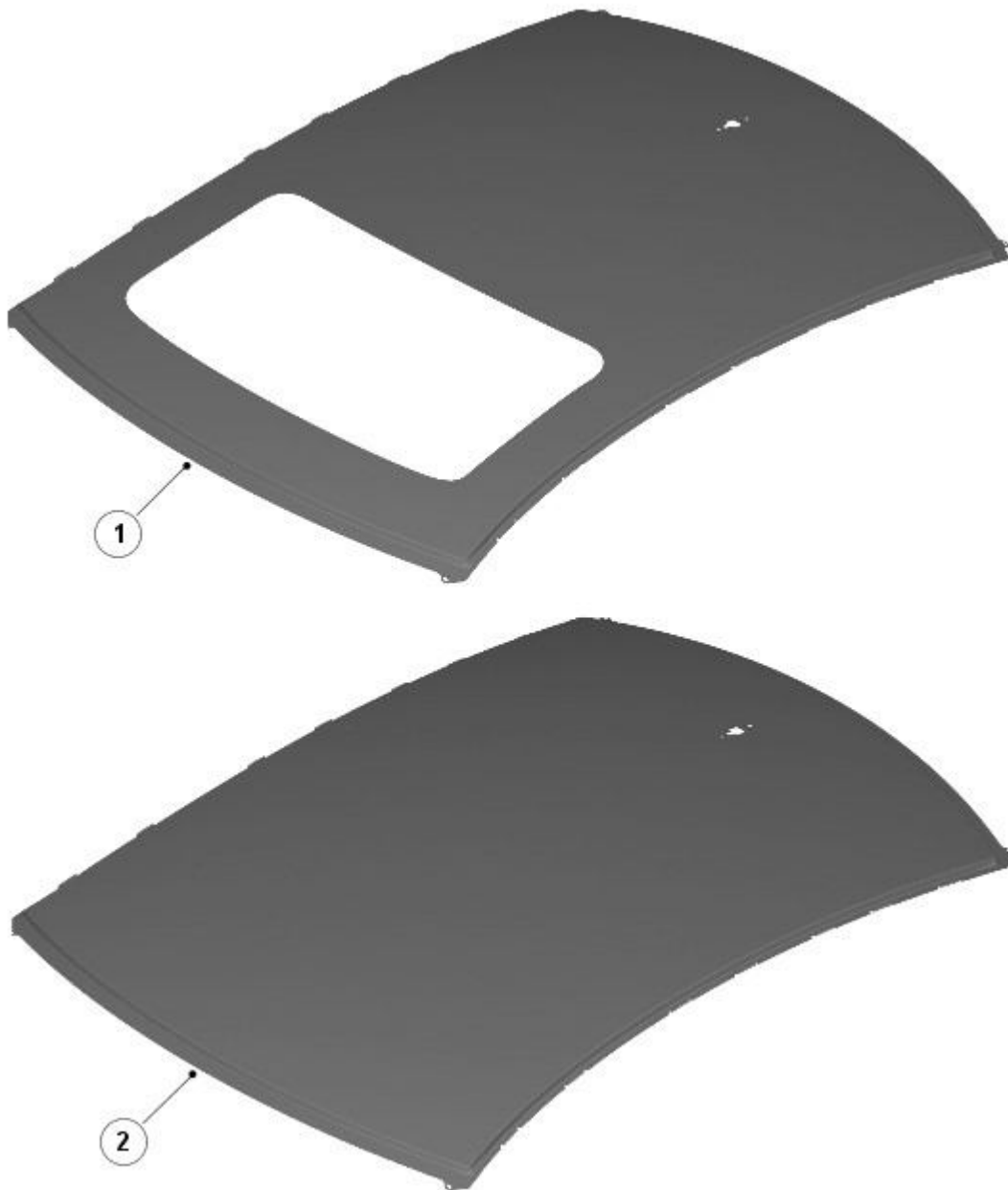
5. Dress all welded joints.

6. The installation of associated panels and components is the reversal of removal procedure.

# Roof Sheet Metal Repairs - Roof

Description and Operation

Roof service panels



E114231

Item	Description
1	Roof panel with sliding roof
2	Roof panel without sliding roof

## Time schedules, roof panels

The following information shows the total time taken to install single panels and complete assemblies. This time includes removal of Mechanical, Electrical and Trim, (MET), items, plus paint times based on Metallic Clear Over Base Paint, (blends for adjacent panels are not included).

The times shown were generated by Thatcham, (the Motor Insurance Repair Research Centre), and are to be used as a guide only.

### Single panel times

Panel Description	Hours
Roof panel without sliding roof	18.6



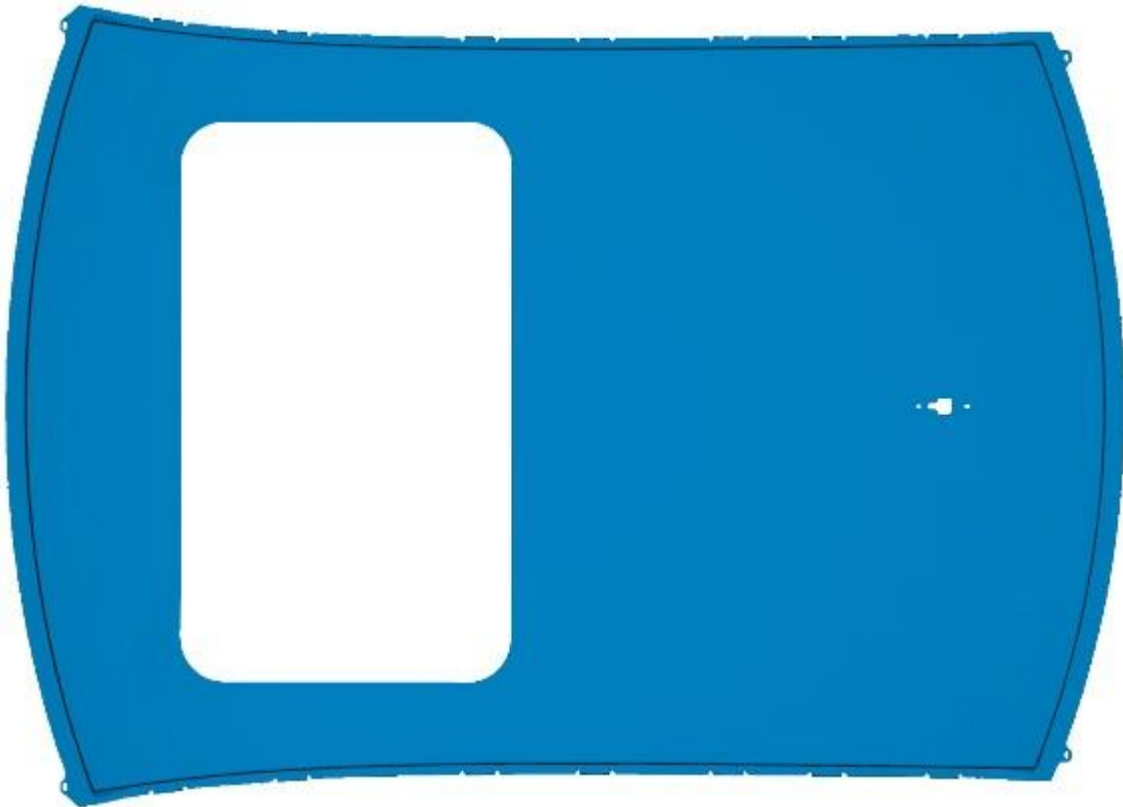
# Roof Sheet Metal Repairs - Roof Panel Vehicles With: Sliding Roof Opening Panel

Removal and Installation

## Removal

1. **NOTE:** The roof panel is manufactured from mild steel.

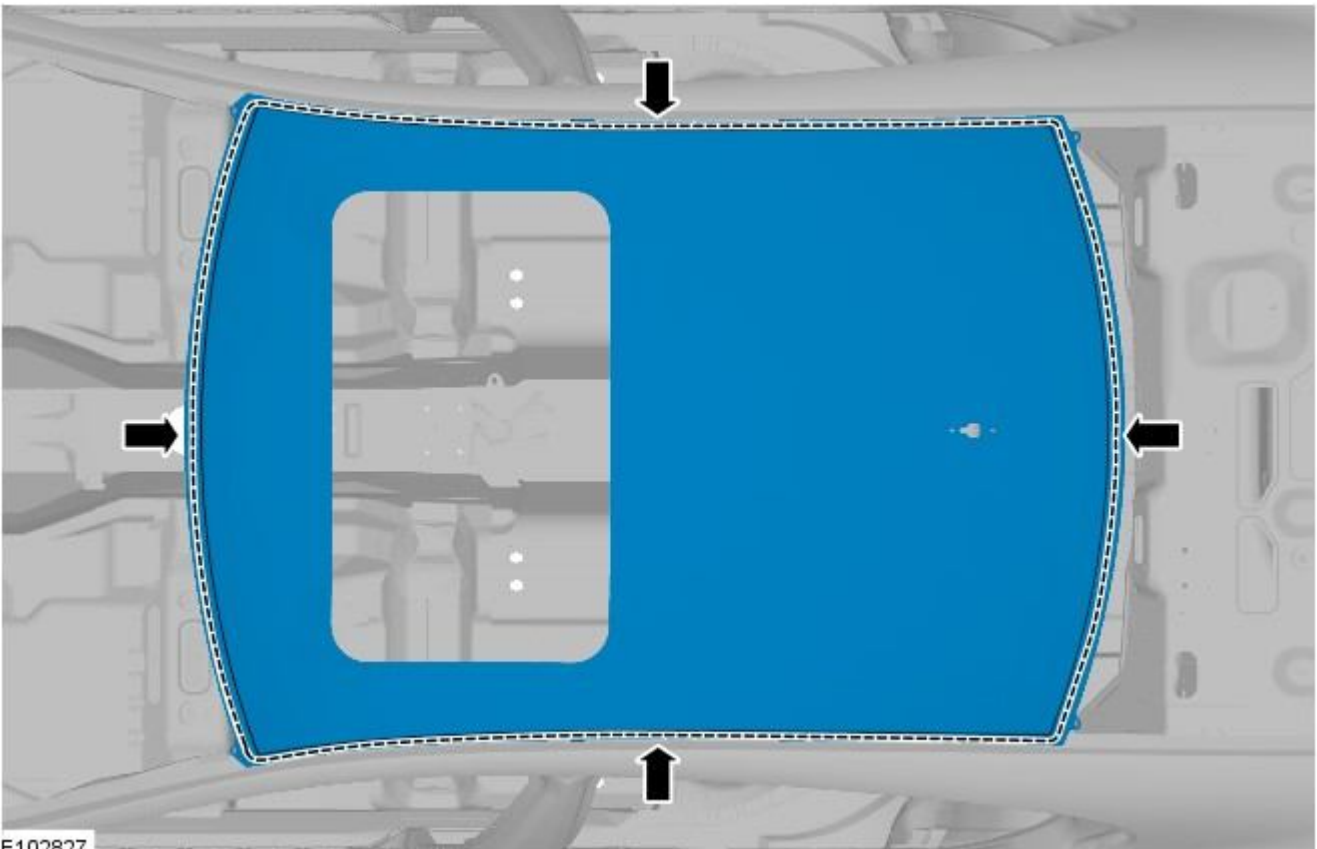
The roof panel is serviced as a separate weld-on panel.



E102825

2. The roof panel is replaced in conjunction with:
  - Headliner
  - Windshield
  - Rear window glass
3. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove both front seats.  
For additional information, refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).
5. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
6. Disconnect the generator electrical connectors.
7. Remove the windshield glass.  
For additional information, refer to: [Windshield Glass](#) (501-11 Glass, Frames and Mechanisms, Removal and Installation).
8. Remove the rear window glass.

- For additional information, refer to: [Rear Window Glass](#) (501-11 Glass, Frames and Mechanisms, Removal and Installation).
9. Remove the roof opening panel frame.  
For additional information, refer to: [Roof Opening Panel Frame](#) (501-17 Roof Opening Panel, Removal and Installation).
  10. Remove the driver and passenger side front scuff plate trim panels.  
For additional information, refer to: [Front Scuff Plate Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
  11. Remove the driver and passenger side rear scuff plate trim panels.  
For additional information, refer to: [Rear Scuff Plate Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
  12. Remove the driver and passenger side air curtain modules.  
For additional information, refer to: [Side Air Curtain Module](#) (501-20B, Removal and Installation).
  13. Remove the rear seat backrest.
  14. Remove the driver and passenger side rear safety belt retractors.  
For additional information, refer to: [Rear Safety Belt Retractor](#) (501-20A Safety Belt System, Removal and Installation).
  15. Remove the rear center safety belt retractor.  
For additional information, refer to: [Rear Center Safety Belt Retractor](#) (501-20A Safety Belt System, Removal and Installation).
  16. Remove the driver and passenger side RF filters.
  17. Remove the diversity antenna module.
  18. Remove the antenna.  
For additional information, refer to: [Navigation System Antenna](#) (419-07 Navigation System, Removal and Installation).
  19. Release and position the roof wiring harnesses to one side
  20. Position the roof opening panel front and rear drain hoses to one side.
  21. Remove the driver and passenger side roof mouldings.
  22. Drill out the spot welds.

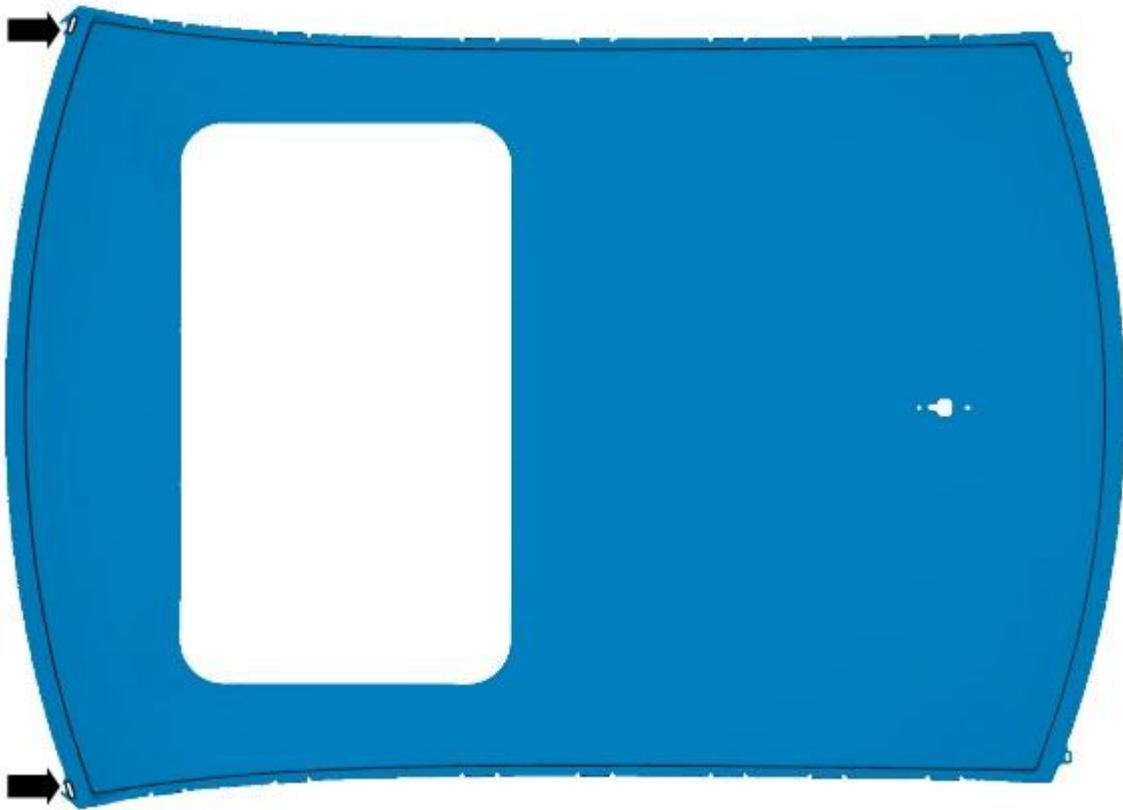
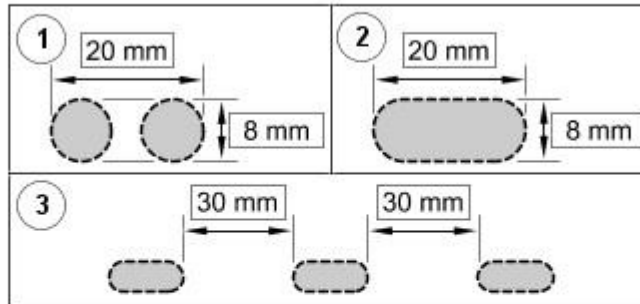


23. Separate the joints and remove the old panel.

### Installation

1. NOTE: The slots should be made so that the new roof panel can be brazed to the A-Pillar outer and inner.

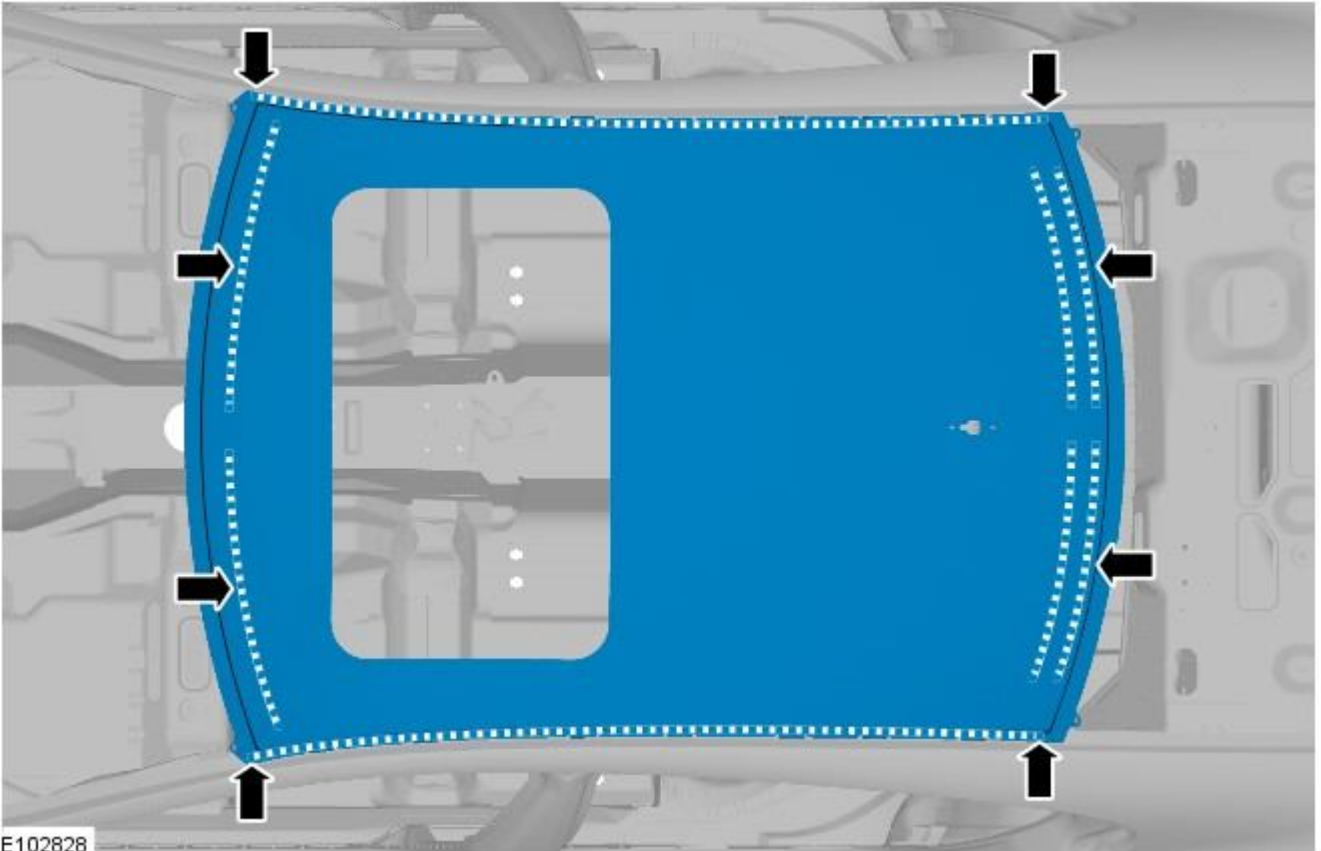
Cut 2 slots in the new roof panel.



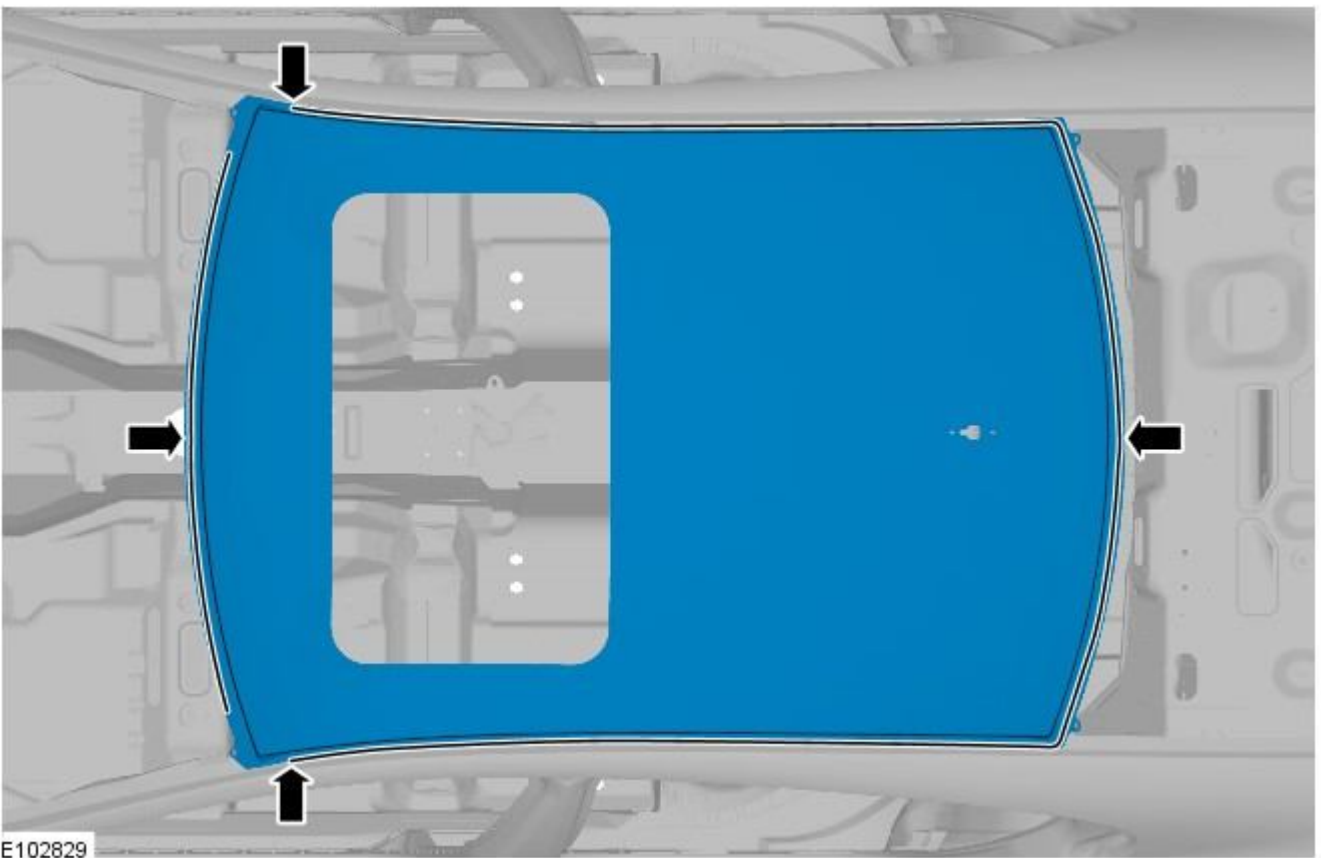
E102826

2. Prepare the old and new panel joint surfaces.
3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.
4. Remove the new panel.
5. NOTE: Make sure the adhesive is kept away from the area of MIG brazed slots.

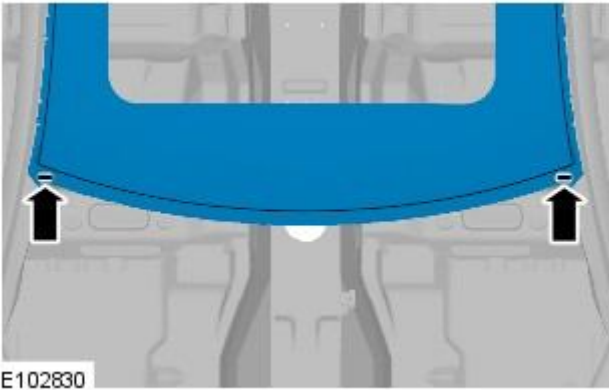
Apply adhesive to the areas indicated.



6. Offer up the new panel and clamp into position.
7. Spot weld.

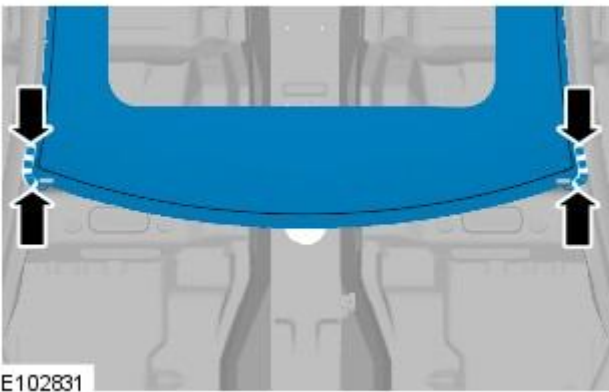


8. MIG braze the slots.

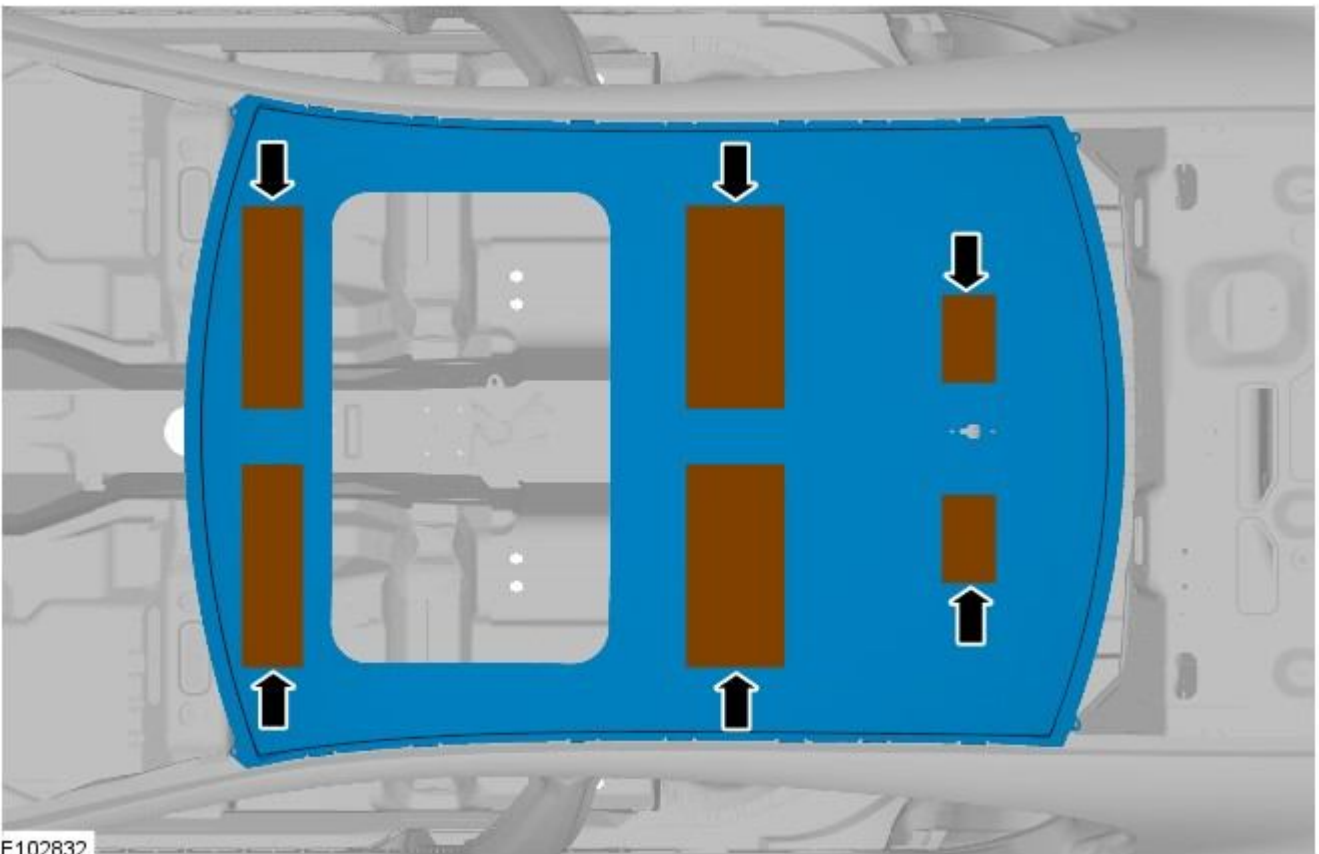


9. Remove any excess adhesive and dress all welded/brazed joints.

10. Make sure the external areas around the MIG brazed slots are sealed as part of the paint preparation process as this cannot be performed satisfactorily during panel replacement.



11. Install NVH (noise, vibration and harshness) sound deadening pads.



12. The installation of associated panels and components is the reversal of removal procedure.

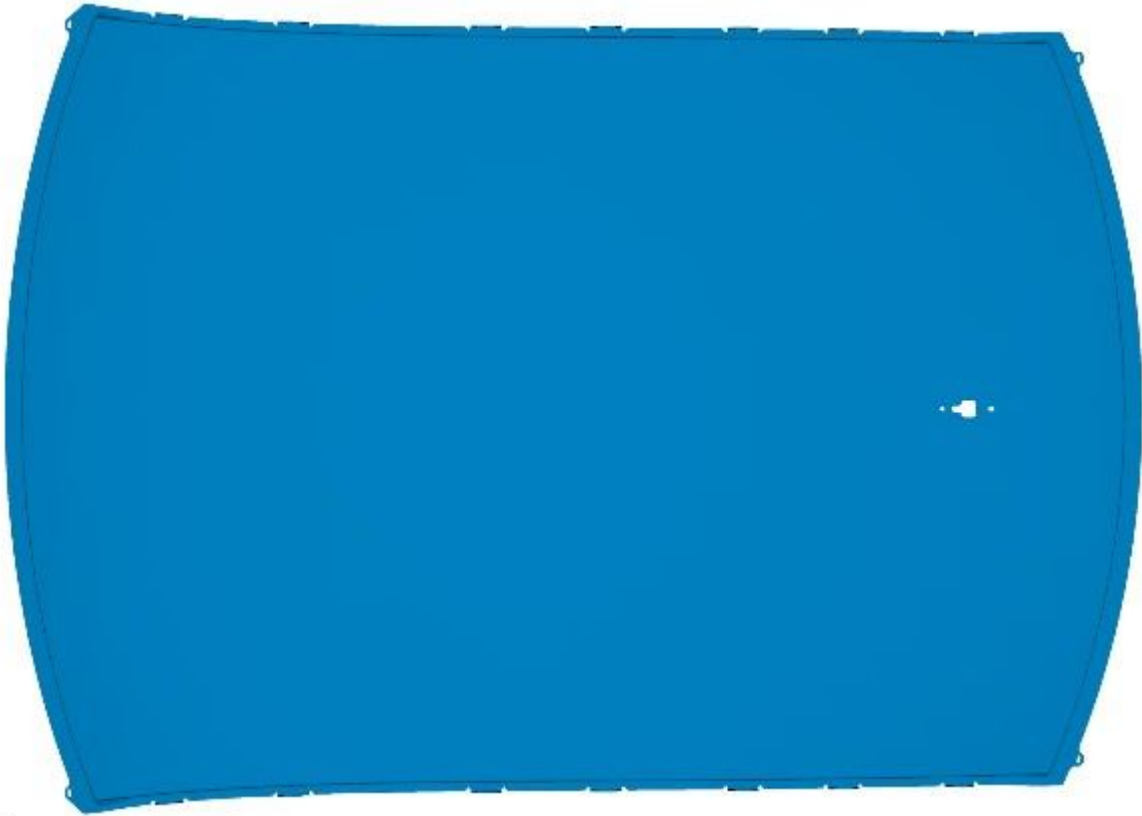
# Roof Sheet Metal Repairs - Roof Panel Vehicles Without: Sliding Roof Opening Panel

Removal and Installation

## Removal

1. **NOTE:** The roof panel is manufactured from mild steel.

The roof panel is serviced as a separate weld-on panel.

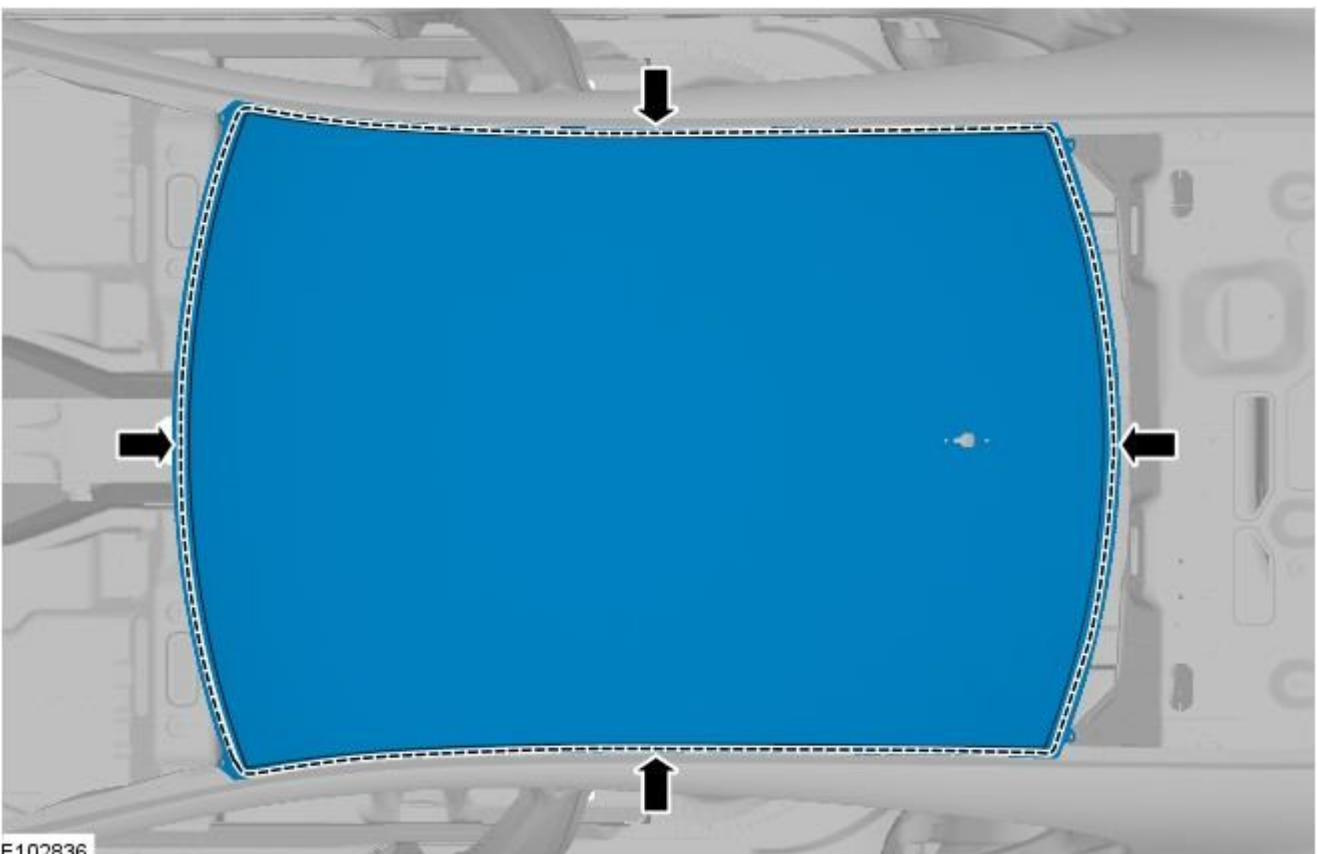


E102834

2. The roof panel is replaced in conjunction with:
  - Headliner
  - Windshield
  - Rear window glass
3. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove both front seats.  
For additional information, refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).
5. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
6. Disconnect the generator electrical connectors.
7. Remove the windshield glass.  
For additional information, refer to: [Windshield Glass](#) (501-11 Glass, Frames and Mechanisms, Removal and Installation).
8. Remove the rear window glass.



- For additional information, refer to: [Rear Window Glass](#) (501-11 Glass, Frames and Mechanisms, Removal and Installation).
9. Remove the headliner.  
For additional information, refer to: [Headliner](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
  10. Remove the driver and passenger side front scuff plate trim panels.  
For additional information, refer to: [Front Scuff Plate Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
  11. Remove the driver and passenger side rear scuff plate trim panels.  
For additional information, refer to: [Rear Scuff Plate Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
  12. Remove the driver and passenger side air curtain modules.  
For additional information, refer to: [Side Air Curtain Module](#) (501-20B, Removal and Installation).
  13. Remove the rear seat backrest.
  14. Remove the driver and passenger side rear safety belt retractors.  
For additional information, refer to: [Rear Safety Belt Retractor](#) (501-20A Safety Belt System, Removal and Installation).
  15. Remove the rear center safety belt retractor.  
For additional information, refer to: [Rear Center Safety Belt Retractor](#) (501-20A Safety Belt System, Removal and Installation).
  16. Remove the driver and passenger side RF filters.
  17. Remove the diversity antenna module.
  18. Remove the antenna.  
For additional information, refer to: [Navigation System Antenna](#) (419-07 Navigation System, Removal and Installation).
  19. Release and position the roof wiring harnesses to one side
  20. Remove the driver and passenger side roof mouldings.
  21. Drill out the spot welds.



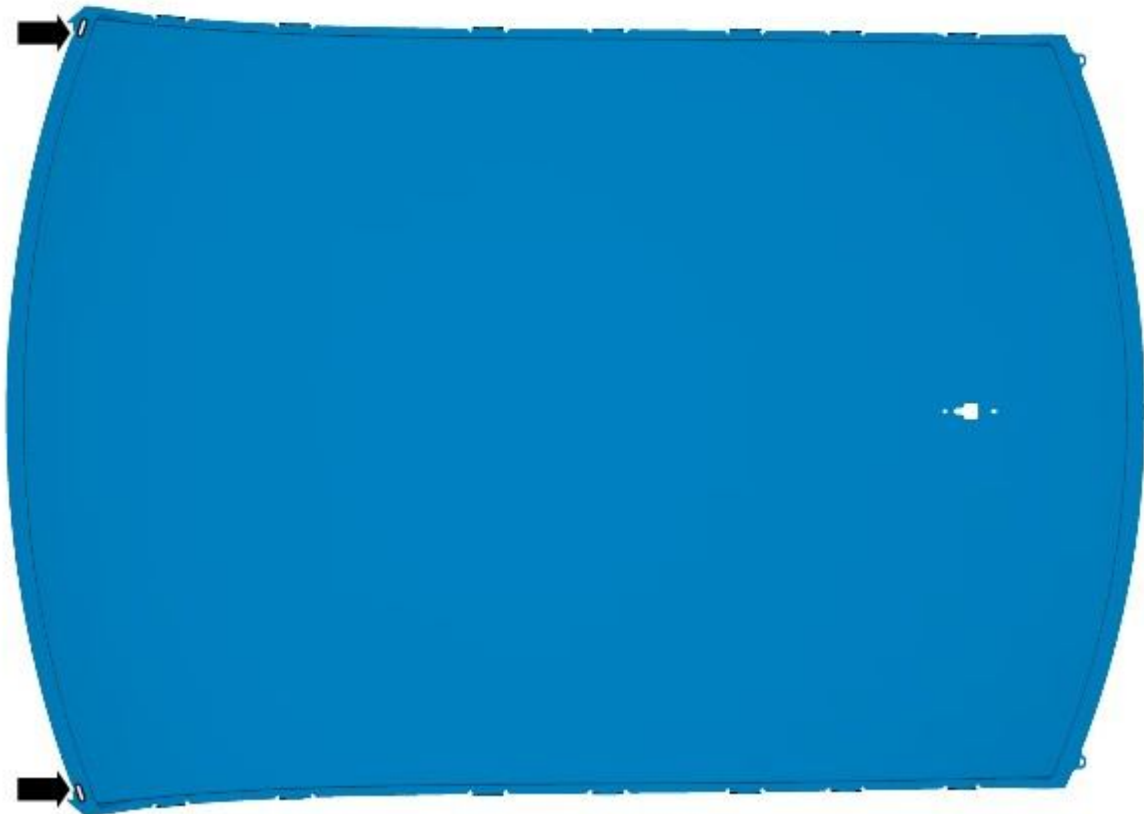
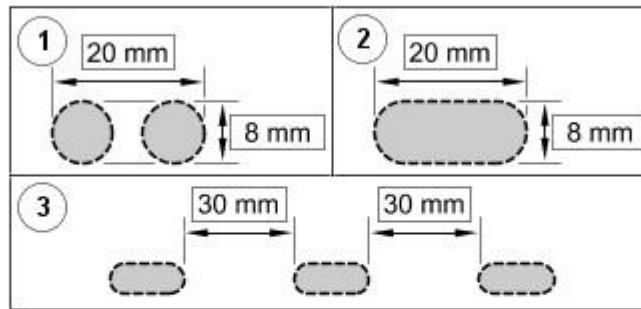
E102836

22. Separate the joints and remove the old panel.

## Installation

1. NOTE: The slots should be made so that the new roof panel can be brazed to the A-Pillar outer and inner.

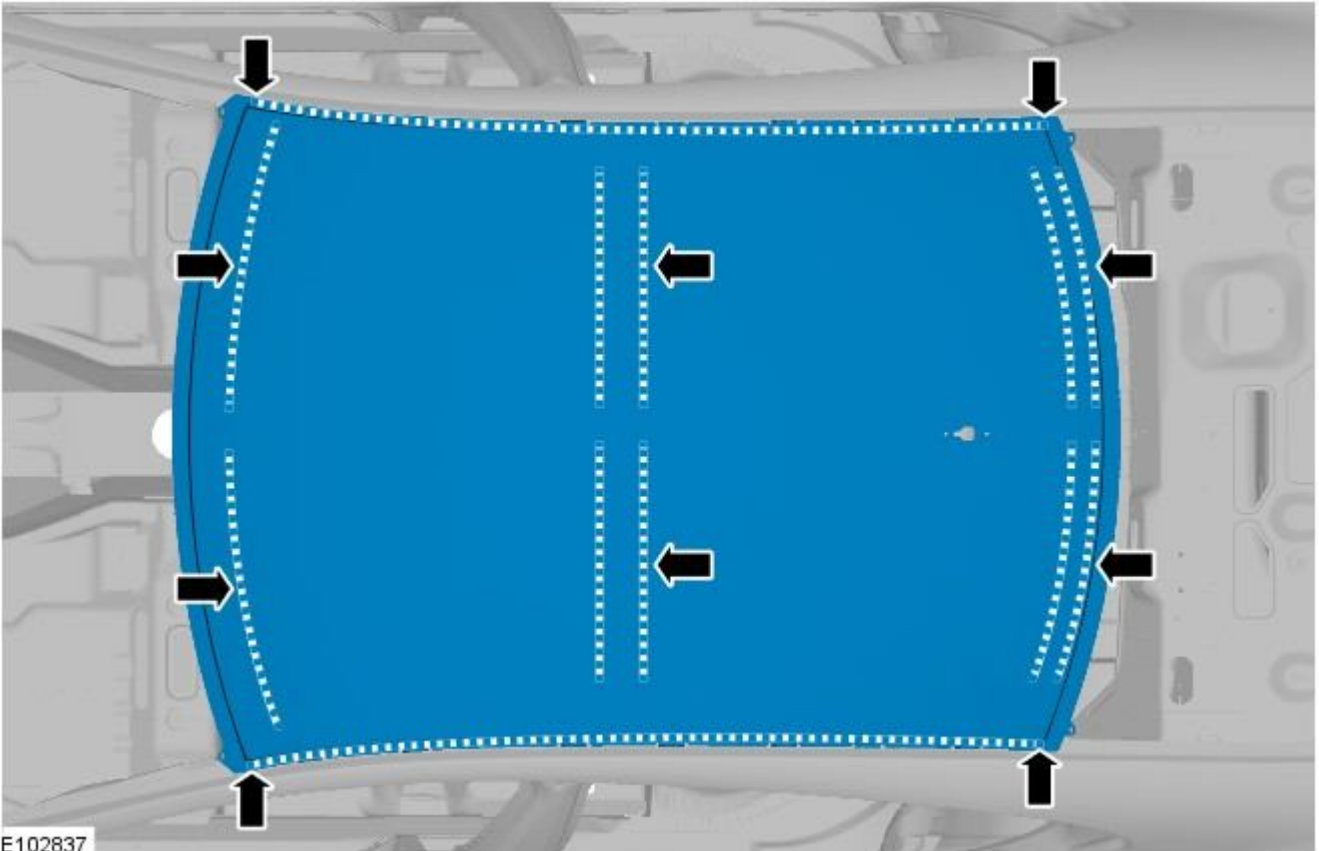
Cut 2 slots in the new roof panel.



E102835

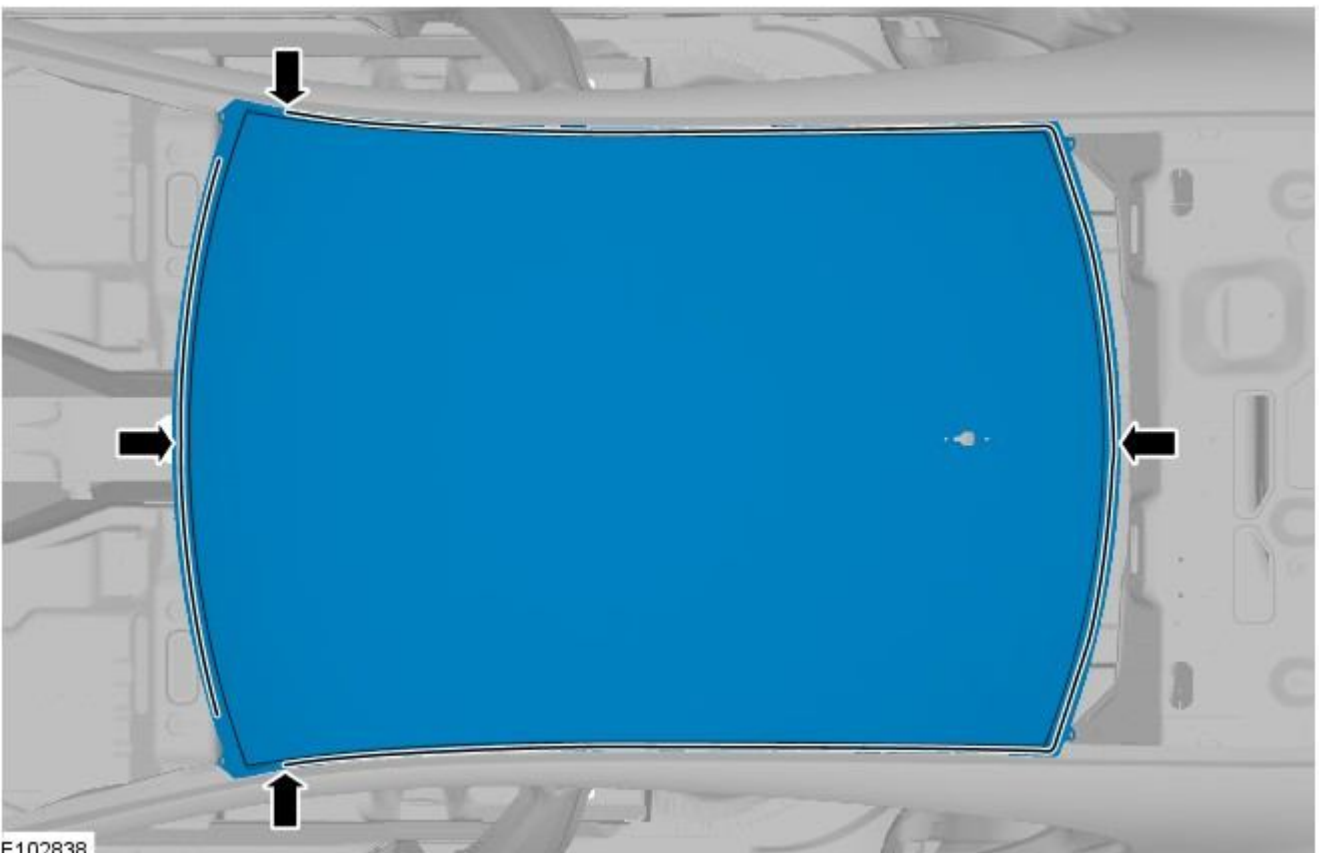
2. Prepare the old and new panel joint surfaces.
3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.
4. Remove the new panel.
5. NOTE: Make sure the adhesive is kept away from the area of MIG brazed slots.

Apply adhesive to the areas indicated.



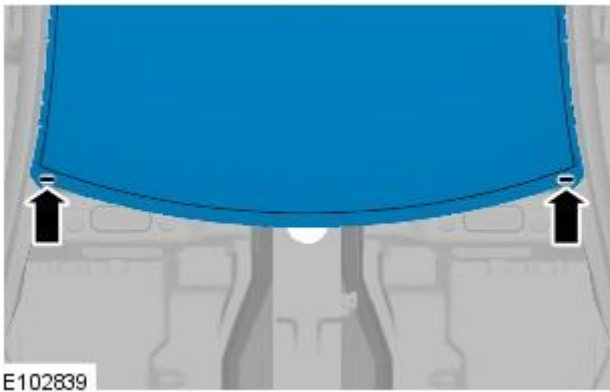
E102837

6. Offer up the new panel and clamp into position.
7. Spot weld.



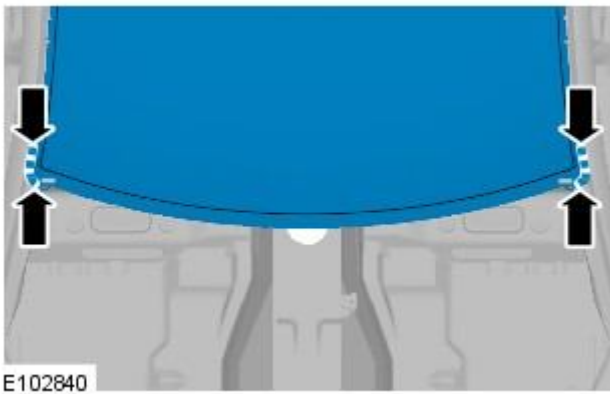
E102838

8. MIG braze the slots.

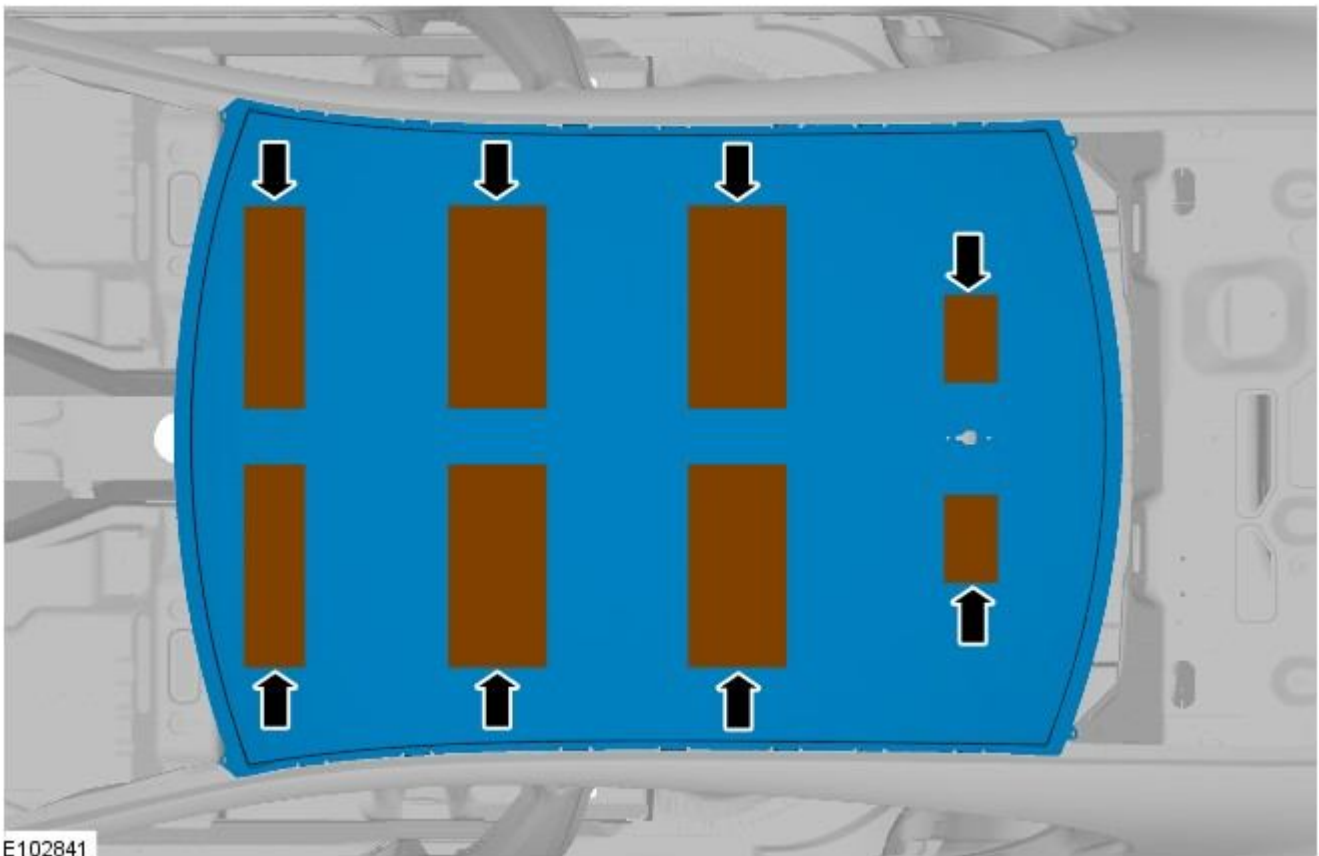


9. Remove any excess adhesive and dress all welded / brazed joints.

10. Make sure the external areas around the MIG brazed slots are sealed as part of the paint preparation process as this cannot be performed satisfactorily during panel replacement.



11. Install the NVH (noise, vibration and harshness) sound deadening pads.

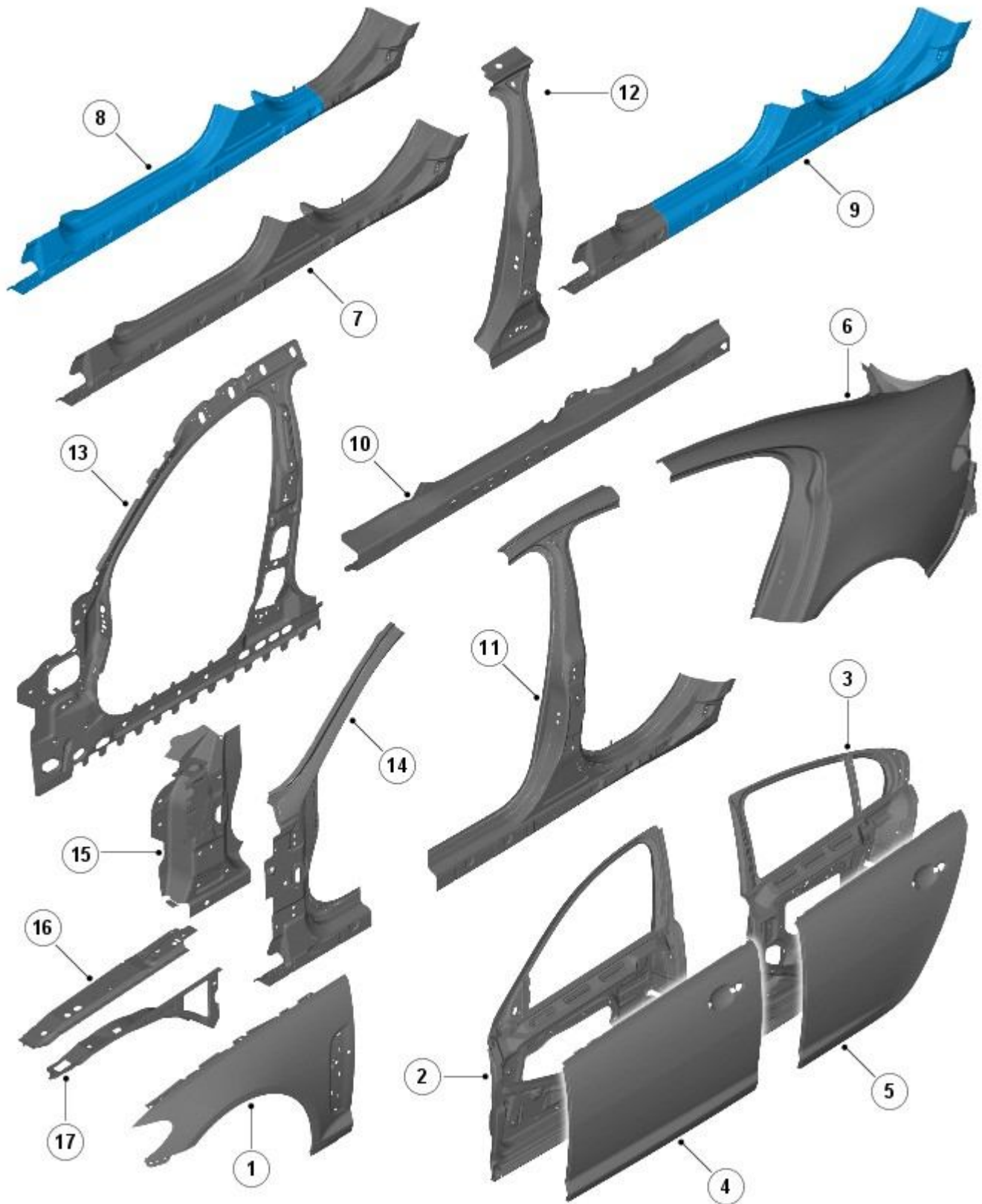


12. The installation of associated panels and components is the reversal of removal procedure.

# Side Panel Sheet Metal Repairs - Side Panel Sheet Metal

Description and Operation

Side service panels



E114230

• NOTE: The illustration may indicate either hand of the service panel, the opposite hand will be similar.

Item	Description
1	Front fender
2	Front door
3	Rear door

Item	Description
4	Front door skin panel
5	Rear door skin panel
6	Quarter panel
7	Rocker panel
8	Rocker panel front section (cut from rocker panel)
9	Rocker panel rear section (cut from rocker panel)
10	Rocker panel inner reinforcement
11	Rocker panel and b-pillar outer panel
12	B-pillar reinforcement
13	B-pillar inner panel
14	A-pillar outer panel
15	A-pillar reinforcement
16	Fender apron panel
17	Fender apron panel closing panel

### Time schedules, side panels

The following information shows the total time taken to install single panels and complete assemblies. This time includes removal of Mechanical, Electrical and Trim, (MET), items, plus paint times based on Metallic Clear Over Base Paint, (blends to adjacent panels are not included).

The times shown were generated by Thatcham, (the Motor Insurance Repair Research Centre), and are to be used as a guide only.

#### Single panel times

Panel Description	Hours
Front fender L/H	8.9
Front fender R/H	9.1
Front door	8.8
Rear door	8.7
Front door skin panel	11.1
Rear door skin panel	10.8
Quarter panel L/H	23.2
Quarter panel R/H	24.2
Rocker panel L/H	19.6
Rocker panel R/H	19.9
Rocker panel front section L/H	18.5
Rocker panel front section R/H	18.8
Rocker panel rear section L/H	16.7
Rocker panel rear section R/H	16.8
Windshield glass remove and install	2.2
Rear window glass remove and install	1.7
Headliner remove and install	3.3
Instrument panel console remove and install	5.3

#### Combination panel replacement times

The following panel combination times show the total time to remove/install body panels, MET items and paint times based on Metallic Clear Over Base Paint process, (blends to adjacent panels are not included).

#### Combination panel times

Panel Description	Hours
Front fender	
Front door	
<b>Total Time</b>	L/H 12.7 R/H 12.9

#### Combination panel times

Panel Description	Hours
Rear door	
Quarter panel	
Rear window glass remove and install	
Headliner remove and install	
<b>Total Time</b>	L/H 29.0 R/H 30.00

#### Combination panel times

Panel Description	Hours
Front door	
Rear door	
Rocker panel and b-pillar outer panel	
B-pillar reinforcement	
B-pillar inner panel	
Headliner remove and install	
<b>Total Time</b>	L/H 39.0 R/H 39.0

#### Combination panel times

Panel Description	Hours
Front fender	



<b>Panel Description</b>	<b>Hours</b>
Front door	
Rear door	
Quarter panel	
Rear window glass remove and install	
Headliner remove and install	
<b>Total Time</b>	

**Combination panel times**

<b>Panel Description</b>	<b>Hours</b>
Front fender	
Front door	
A-pillar outer panel	
A-pillar reinforcement	
Fender apron panel	
Fender apron panel closing panel	
Windshield glass remove and install	
Instrument panel console remove and install	
Headliner remove and install	
<b>Total Time</b>	

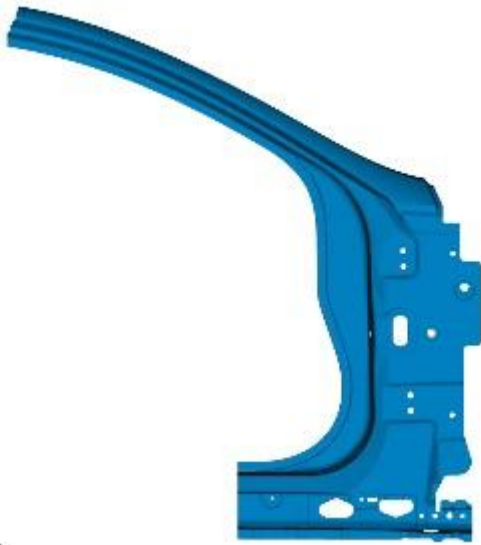
# Side Panel Sheet Metal Repairs - A-Pillar Outer Panel

Removal and Installation

## Removal

1. NOTE: The A-pillar outer panel is manufactured from mild steel.

The A-pillar outer panel is serviced as a separate weld-on panel. It is not serviced with its riv-nuts for the fender fixings or NVH (noise, vibration and harshness) components.



E 108452

2. NOTE: The A-pillar outer panel is spot welded to the A-pillar reinforcement upper, which is boron steel. In repair, spot welds are replaced with MIG braze and MIG braze slots in these areas.

In this procedure the upper butt joint is best performed as low as possible due to the work involved in the area of MIG slot braze. If damage dictates, it is permissible to make the section higher up the pillar.

3. The A-pillar outer panel is replaced in conjunction with:

1. Front bumper cover
2. Front fender
3. Hood
4. Front door
5. Headliner
6. Instrument panel console
7. Windshield glass

4. For additional information relating to this repair procedure please see the following:

For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

5. Disconnect the generator electrical connectors.

6. Remove the instrument panel console.

For additional information, refer to: [Instrument Panel Console](#) (501-12 Instrument Panel and Console, Removal and Installation).

7. Remove the headliner.

For additional information, refer to: [Headliner](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

8. Remove the windshield glass.

For additional information, refer to: [Windshield Glass](#) (501-11 Glass, Frames and Mechanisms, Removal and Installation).

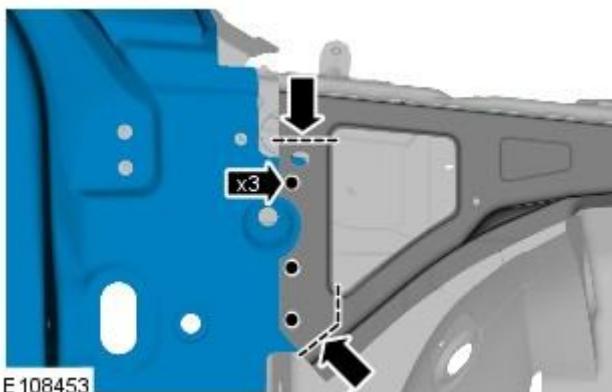
9. Remove the pedestrian protection hood actuator.

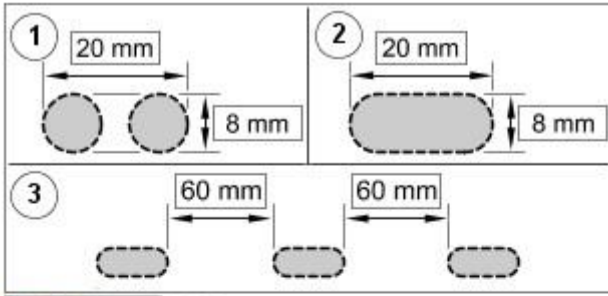
For additional information, refer to: [Pedestrian Protection Hood Actuator LH](#) (501-20C Pedestrian Protection System, Removal and Installation) / [Pedestrian Protection Hood Actuator RH](#) (501-20C Pedestrian Protection System, Removal and Installation).


10. Release and position the floor covering to one side.
11. Release and position the bulkhead insulating material to one side.
12. Release and position the inner rocker panel wiring harness to one side.
13. Remove the wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
14. Remove the underfloor splash shield.
15. If the right-hand A-pillar outer panel is to be repaired, release and position the underfloor wiring harness to one side.
16. Remove the front fender.  
For additional information, refer to: [Front Fender](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).
17. Remove the front door.  
For additional information, refer to: [Front Door](#) (501-03 Body Closures, Removal and Installation).
18. Remove the upper and lower front door hinges.
19. Remove the hood.  
For additional information, refer to: [Hood](#) (501-02, Removal and Installation).
20. Remove the hood hinge.

**21. NOTE:** If a new fender apron panel closing panel is to be fitted the section will not be required.

Drill out the spot welds and cut a section from the fender apron panel closing panel, to allow access to the A-pillar joints as indicated.



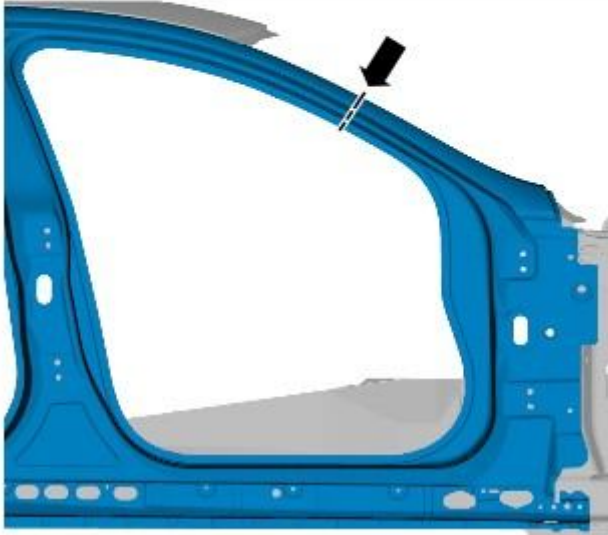


22.  CAUTION: Care should be taken not to cut through into the inner panels.

- NOTE: In this procedure the upper butt joint is best performed as low as possible due to the work involved in the area of MIG braze slots. If damage dictates, it is permissible to perform the butt joint higher up the pillar.

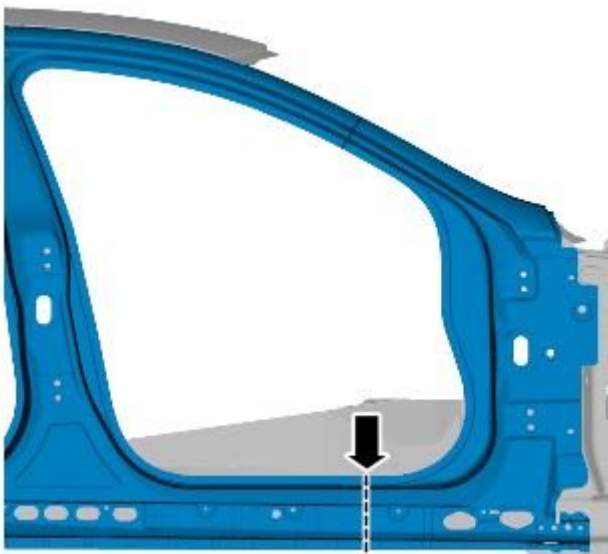
- NOTE: Observe the increased pitch required for the MIG braze slots in this area.

Using the new panel for reference and allowing for an overlap, cut the old panel at the point indicated. Make sure that the location of the upper butt joint is calculated to allow for the installation of the MIG braze slots.



E108454

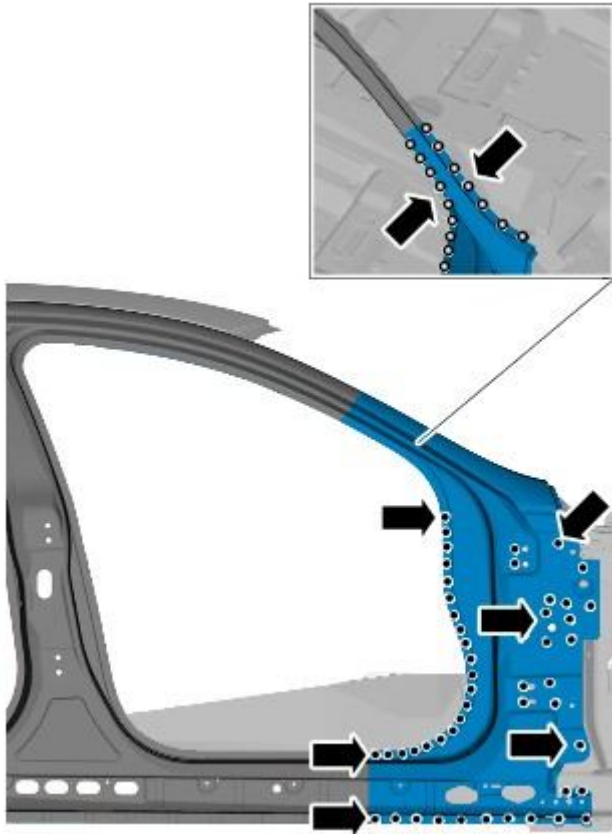
23. Using the new panel for reference and allowing for an overlap, cut the old panel at the point indicated, where the lower butt joint is to be made.



E 108455

24. NOTE: A drill bit suitable for drilling boron should be used on the upper spot welds, as indicated.

Drill out the spot welds.

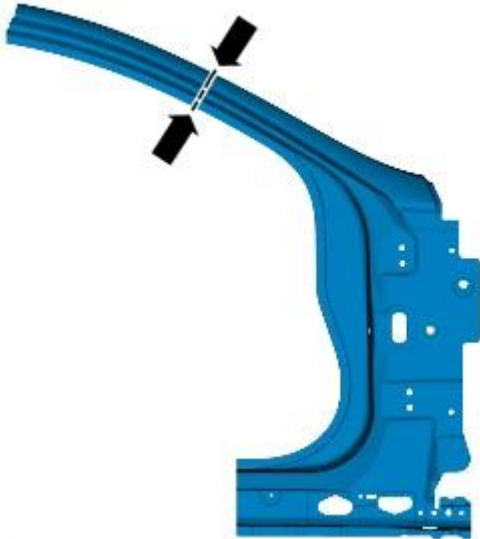


E108456

25. Separate the joints and remove the old panel, also releasing the NVH components.

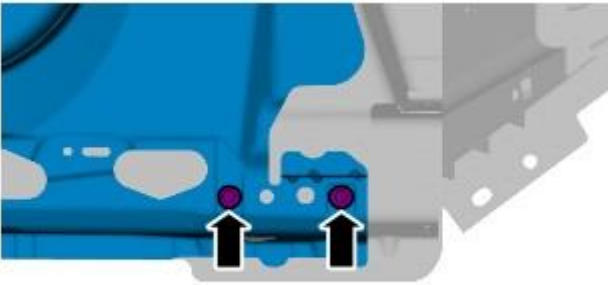
### Installation

1. Trim the excess from the upper part of the service panel.

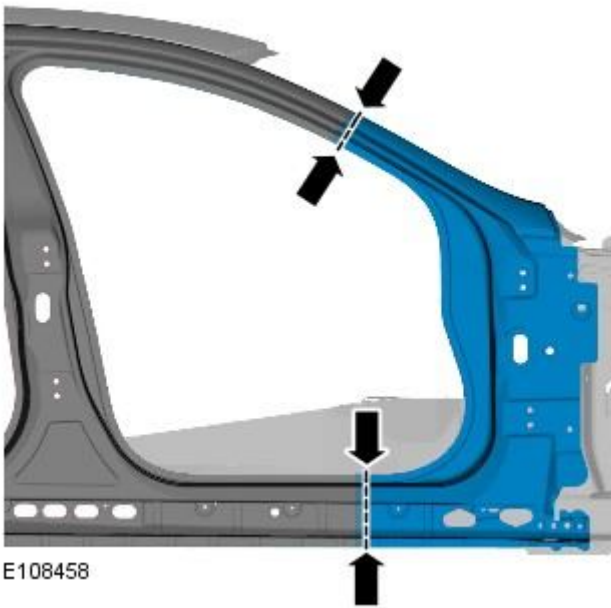


E 108457


2. Install the riv-nuts into the new rocker panel front section as indicated.



E102807



E108458

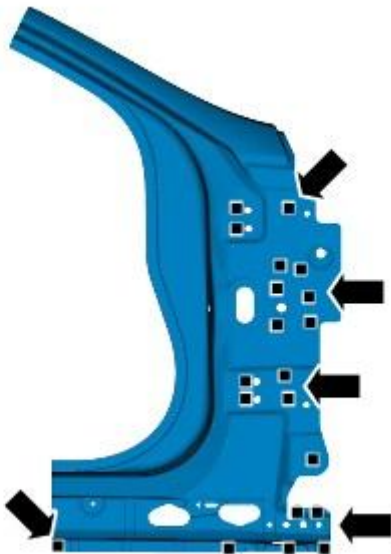
3.  CAUTION: Care should be taken not to cut through into the inner panels.

- NOTE: Temporarily install the front door and hinges to aid alignment.

Offer up, align and clamp the new panel into position, overlapping the old panel remnant. Cut through the new panel, partially cutting the old panel at the points where the butt joints are to be made.

4. Remove the front door and hinges and the new A-pillar outer panel.
5. Cut and remove the old panel remnants.
6. NOTE: Ensure the MAG plug holes are performed away from the adhesive bond path.

Drill holes in the new panel ready for MAG plug welding.

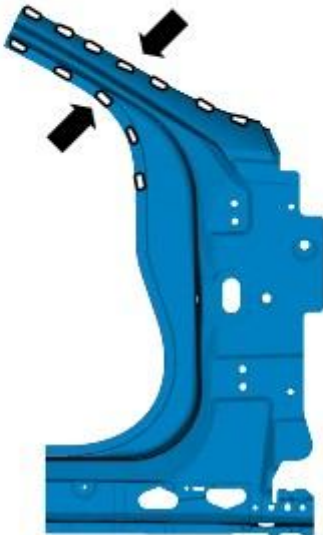
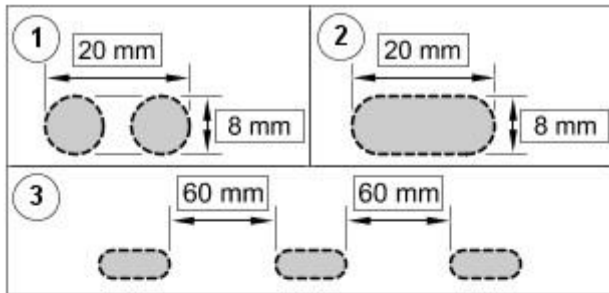


E 108459



7. NOTE: Observe the increased pitch required for the MIG braze slots in this area.

Cut slots in the new panel ready for MIG braze slots.



E108460

8. NOTE: If necessary, renew the NVH components.

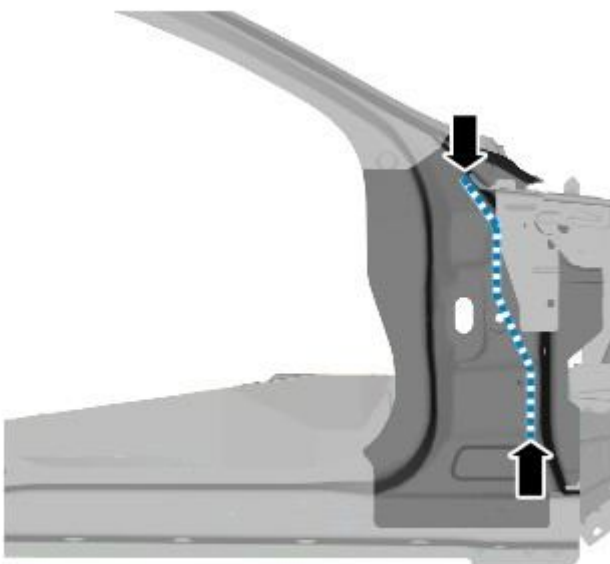
Prepare the old and new panel joint surfaces, including the NVH components.

9. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

10. Remove the new A-pillar outer panel.

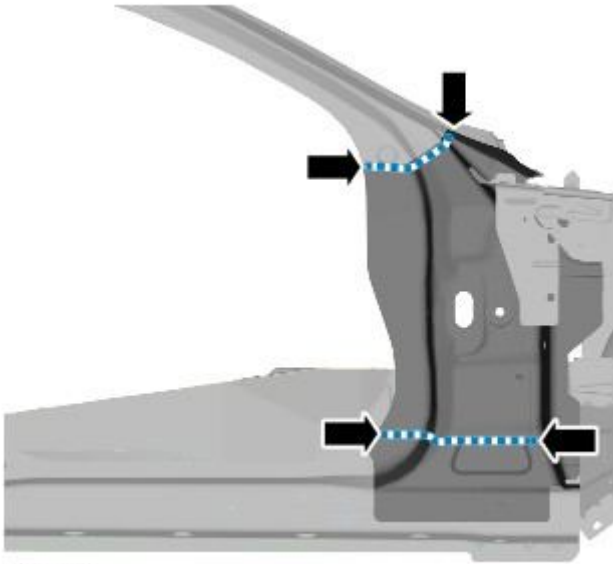
11. NOTE: Make sure the adhesive does not encroach into the area of the MAG plug welds as it will contaminate the weld (any unsealed areas must be sealed following the repair).

Apply adhesive to the area as indicated.



E 108461

12. Apply sealer adhesive to the NVH components as indicated.



E 108462

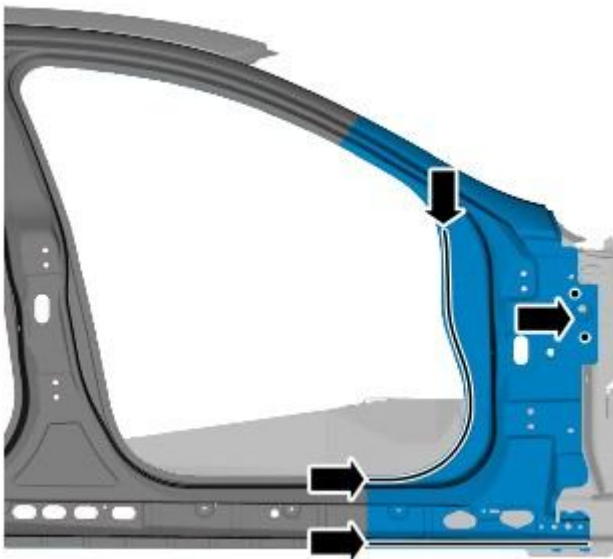
13. Offer up the new A-pillar outer panel, align and clamp into position.

14. Tack MIG braze the upper butt joint.

15. Tack MAG weld the lower butt joint.

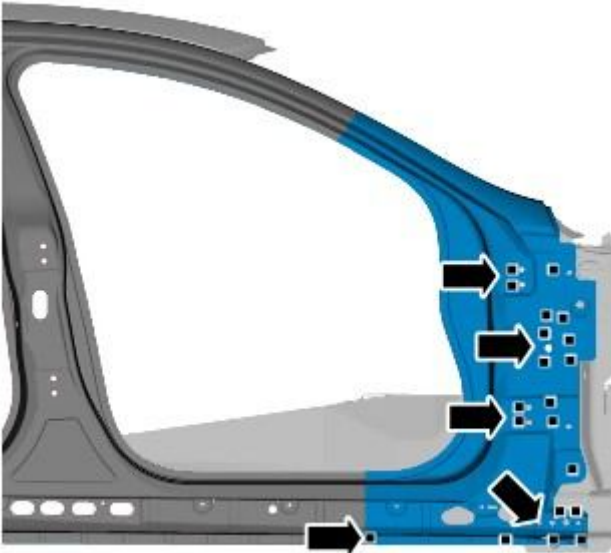
16. NOTE: Spot welds must be installed 5mm away from the originals and in the same quantities whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original. Where there is adhesive in the original joint, spot welds should be installed through the original.

Spot weld.



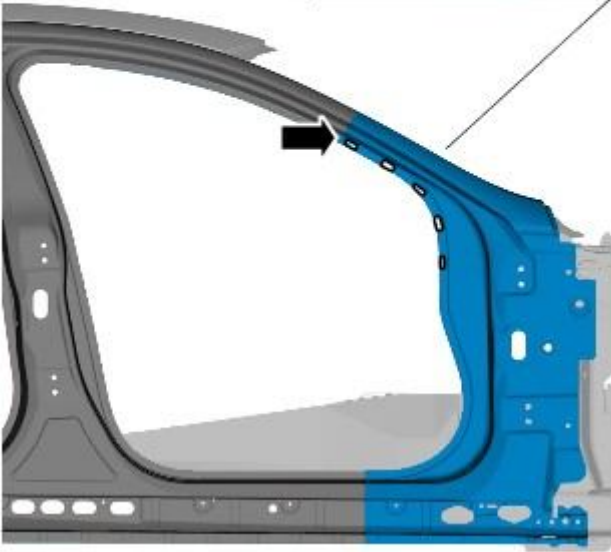
E 108463

17. MAG plug weld.



E 108464

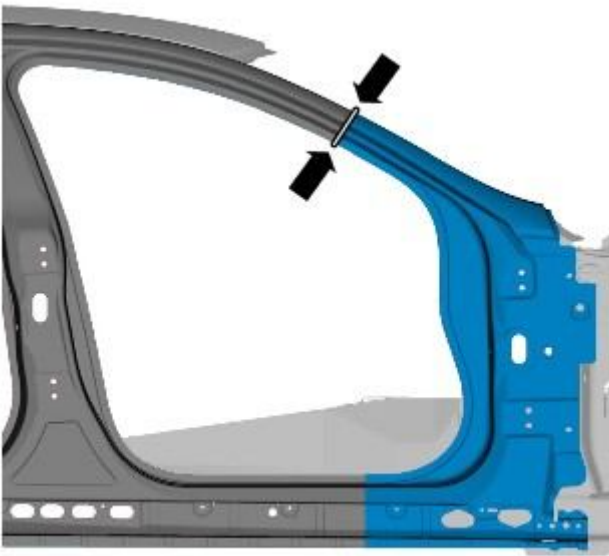
18. MIG Braze the slots.



E108465

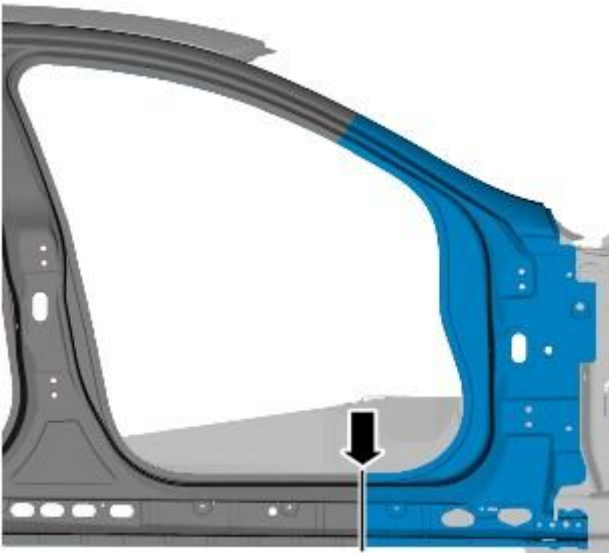
19. Dress the tack welds/braze.

20. MIG braze the upper butt joint.



E 108466

21. MAG weld the lower butt joint.



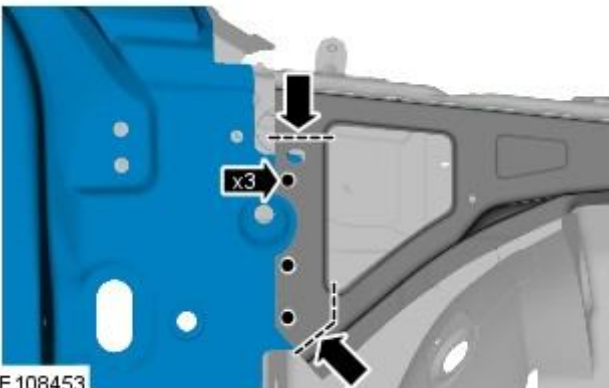
E 108467

22. Prepare the old and new panel joint surfaces of the fender apron panel closing panel section.

23. NOTE: If a new fender apron panel closing panel is to be fitted the section will not be required.

Tack MAG weld the fender apron panel closing panel section.

24. MAG plug weld and MAG weld the fender apron panel closing panel section.

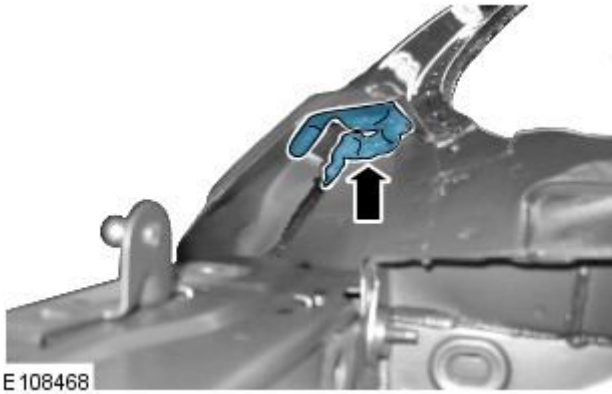


E 108453

25. Dress all welded/brazed joints.

**26. NOTE:** It may be necessary to temporarily seal the opening whilst the foam cures, to prevent it encroaching into the hood hinge area.

Apply expanding foam into the A-pillar as indicated.



**27.** Make sure that any open or exposed panel joints are suitably sealed following this procedure.

**28.** The installation of associated panels and components is the reversal of removal procedure.

- Tighten the hood hinge bolts to 17 Nm.
- Tighten the upper and lower front door hinges to 30 Nm.

# Side Panel Sheet Metal Repairs - A-Pillar Reinforcement

Removal and Installation

## Removal



E111836

1. NOTE: The A-pillar reinforcement is manufactured from Bake Hardened Steel, 300MPa, (BH300). It contains reinforcements manufactured from High Strength Low Alloy Steel, 340MPa (HSLA340).

The A-pillar reinforcement panel is serviced as a separate weld-on panel. It is not serviced with its **NVH (noise, vibration and harshness)** components.

2. NOTE: The A-pillar reinforcement is spot welded to the A-pillar reinforcement upper, which is boron steel. In repair spot welds are replaced with MIG braze slots in this area.

The A-pillar reinforcement is replaced in conjunction with:

1. Front bumper cover
2. Front fender
3. Hood
4. Hood hinge
5. Front door
6. Front door hinges
7. Fender apron panel closing panel
8. A-pillar outer panel
9. Fender apron panel
10. Headliner
11. Instrument panel console
12. Windshield glass

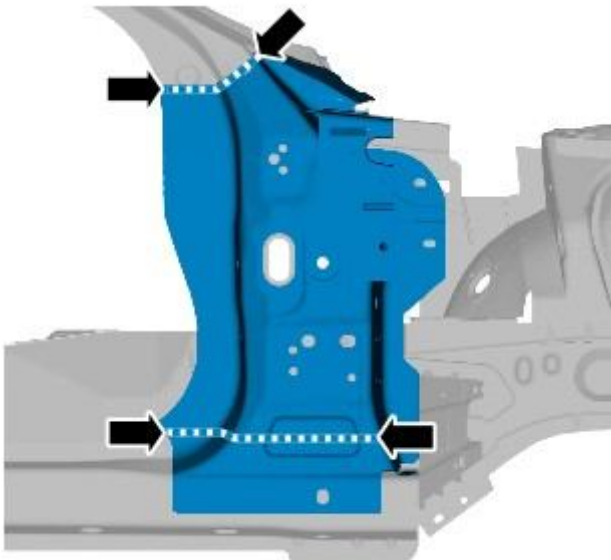
3. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Disconnect the generator electrical connectors.
5. Remove the fender apron panel.  
For additional information, refer to: [Fender Apron Panel](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).
6. Remove the A-pillar outer panel.  
For additional information, refer to: [A-Pillar Outer Panel](#) (501-29 Side Panel Sheet Metal Repairs, Removal and



Installation).

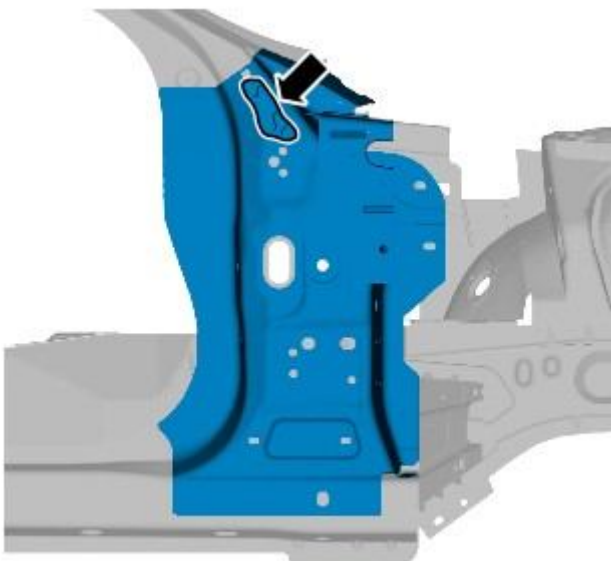
7. Remove the side air curtain module.  
For additional information, refer to: [Side Air Curtain Module \(501-20B, Removal and Installation\)](#).
8. Remove the front seat.  
For additional information, refer to: [Front Seat \(501-10 Seating, Removal and Installation\)](#).
9. Remove the floor covering.
10. If the passenger side A-pillar reinforcement is to be repaired, remove the heater core and evaporator core housing.  
For additional information, refer to: [Heater Core and Evaporator Core Housing \(412-01 Climate Control, Removal and Installation\)](#).
11. If the right-hand A-pillar reinforcement is to be repaired, remove the central junction box.  
For additional information, refer to: [Central Junction Box \(CJB\) \(418-00 Module Communications Network, Removal and Installation\)](#).
12. If the drivers side A-pillar reinforcement is to be repaired, remove the pedal box.
13. Release and lay aside the insulating material at the inner bulkhead.
14. Release and position aside the inner bulkhead and floor panel wiring harness.
15. NOTE: The NVH components may have already been removed on the outer panel.

Remove the upper and lower NVH components and if undamaged retain for reuse.



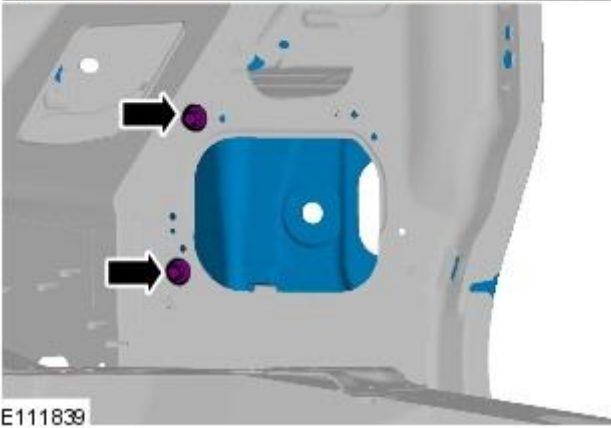
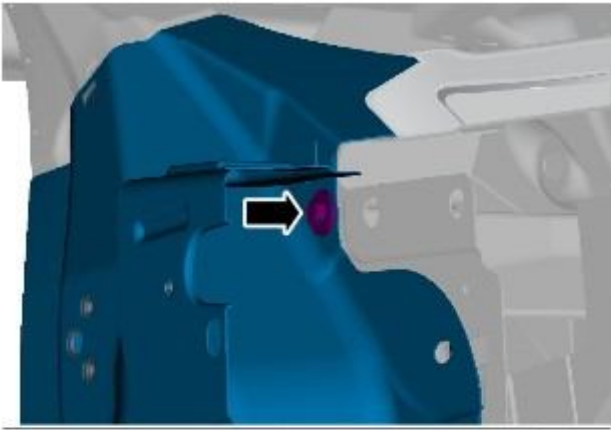
E111837

16. Remove an area of adhesive above the upper front door hinge mounting point to expose hidden spot welds.



E111838

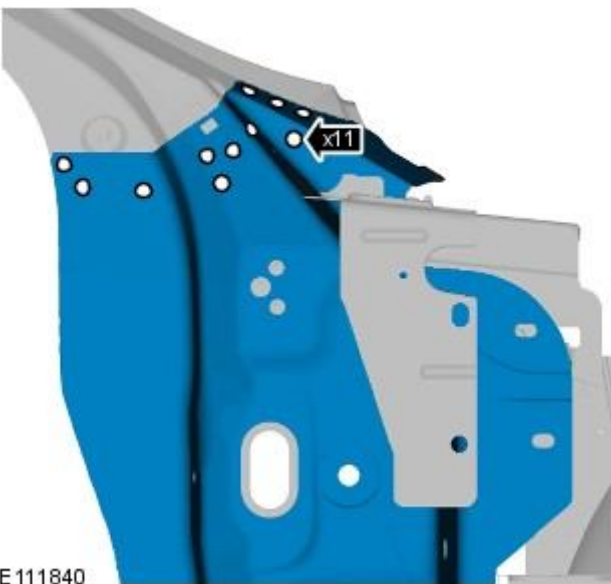
17. Remove the bolts as indicated and retain for reuse.



E111839

18. NOTE: A drill bit suitable for drilling boron should be used on the boron spot welds.

Drill out the boron spot welds as indicated.



E111840

19. NOTE: A drill bit suitable for drilling Dual Phase Steel, 600MPa, (DP600) should be used.

Drill out the spot welds as indicated.



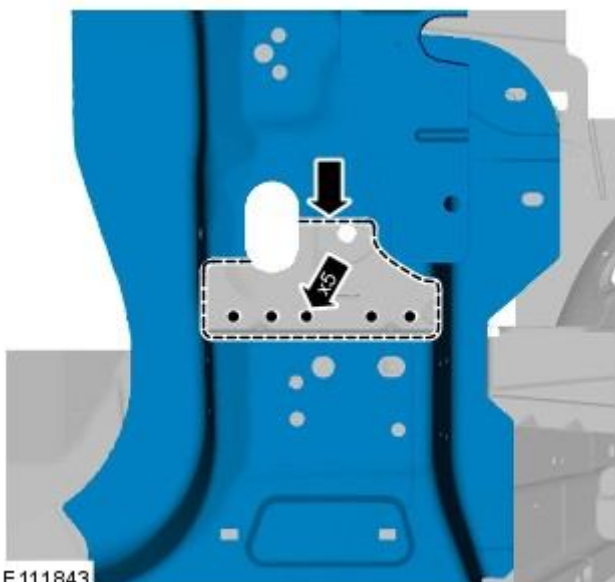
E111841

20. From inside the vehicle, drill out the spot welds as indicated.



E111842

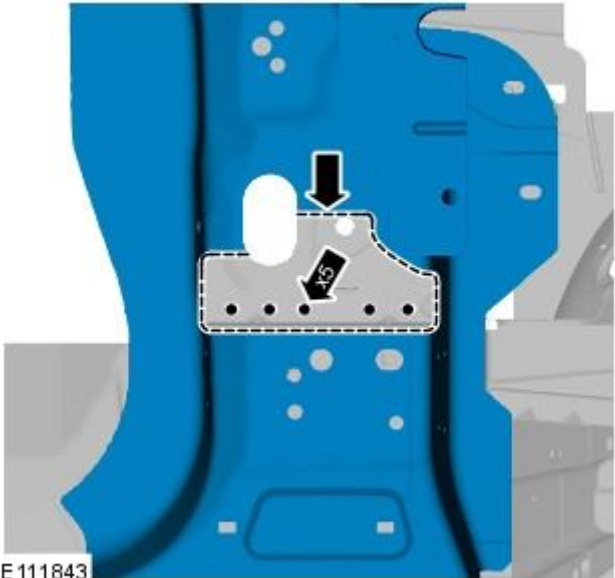
21. Cut a window in the old panel, above the front door lower hinge reinforcement, to enable access to the spot welds as indicated.



E111843

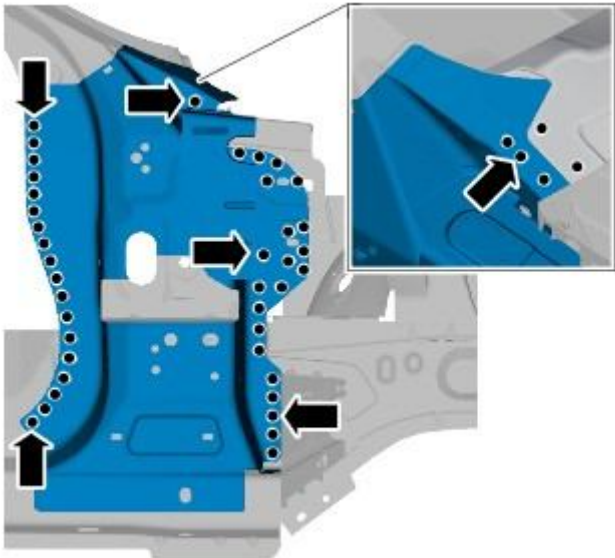
22. NOTE: The spot welds indicated should be drilled right through, to enable MAG plug welding and a MIG braze slot on installation. The MIG braze slot is required as the original panel is MIG brazed in this area.

Drill out the spot welds as indicated.



E111843

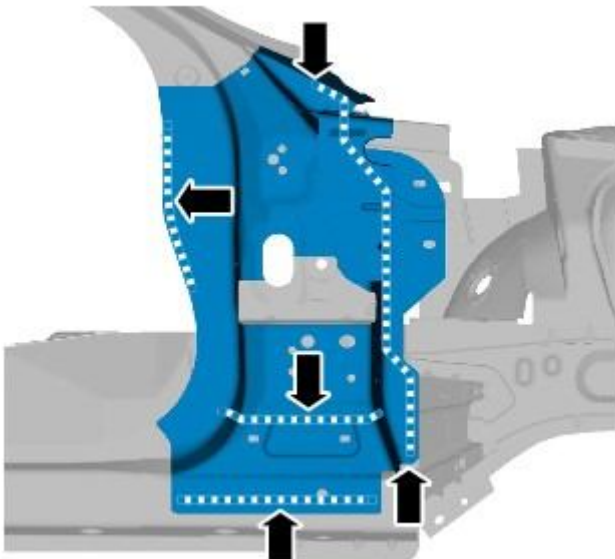
23. Drill out the spot welds as indicated.



E111844

24. NOTE: Care should be taken not to cause damage to remaining panels when separating joints containing adhesive.

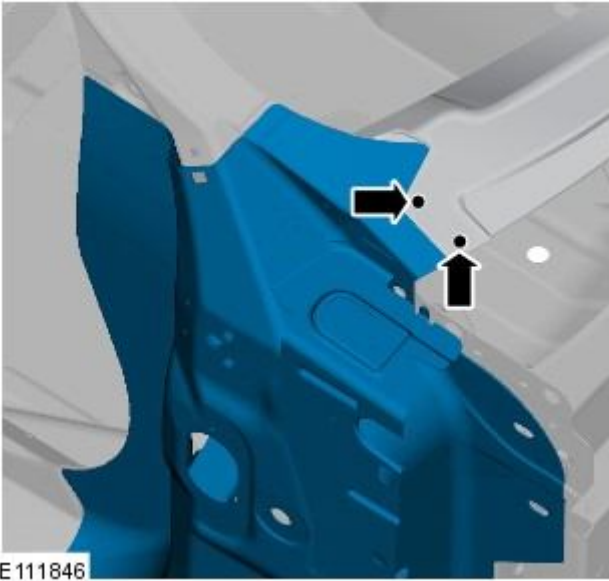
Separate the joints and remove the old panel, observing the areas of NVH component and adhesive as indicated.



E111845

## Installation

1. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.
2. With the new panel in position, mark the position of MAG plug welds as indicated.

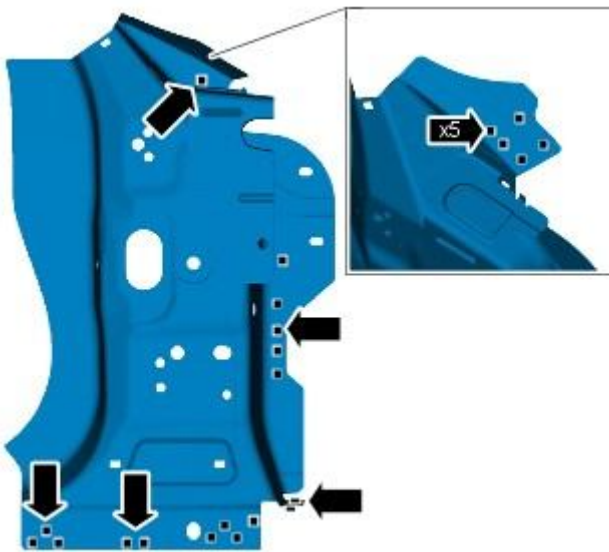


E111846

3. Remove the new panel.

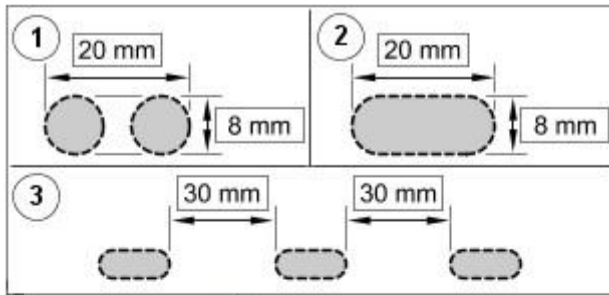
4. NOTE: In the area of the windshield wiper motor linkage mounting, there may not be access to spot weld. In this case, MAG plug welding is acceptable in this area.

Drill holes in the new panel ready for MAG plug welding.



E111847

5. Cut slots in the new panel as indicated.



E111848

6. NOTE: The MIG braze slot is required as the original panel is MIG brazed in this area.

Cut an elongated slot between the two drill outs in the A-pillar inner panel as indicated, ready for MIG brazing.



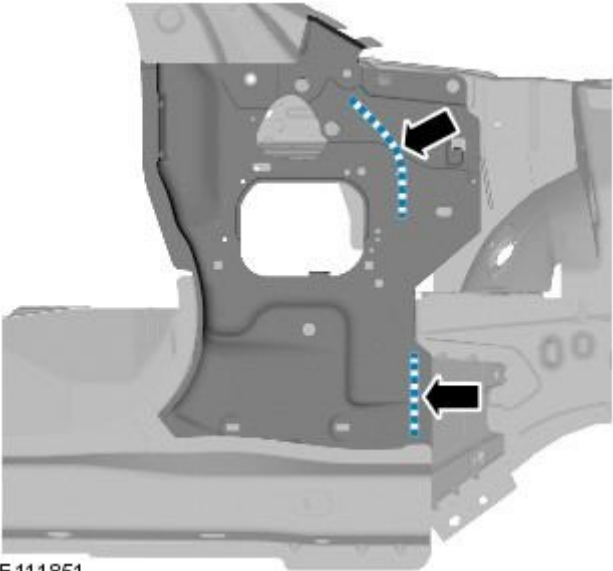
E111850

7. Prepare the old and new panel joint surfaces.
8. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.
9. Remove the new panel.



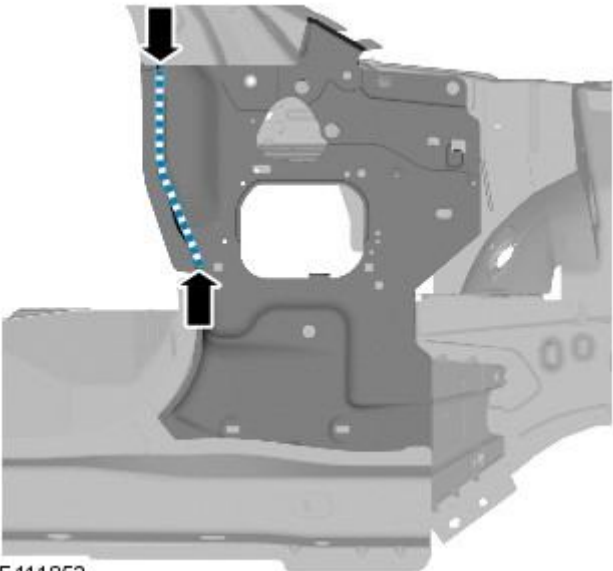
10. NOTE: Make sure the adhesive does not encroach into the areas of the MAG plug welds as it will contaminate the weld.

Apply adhesive to the area as indicated.



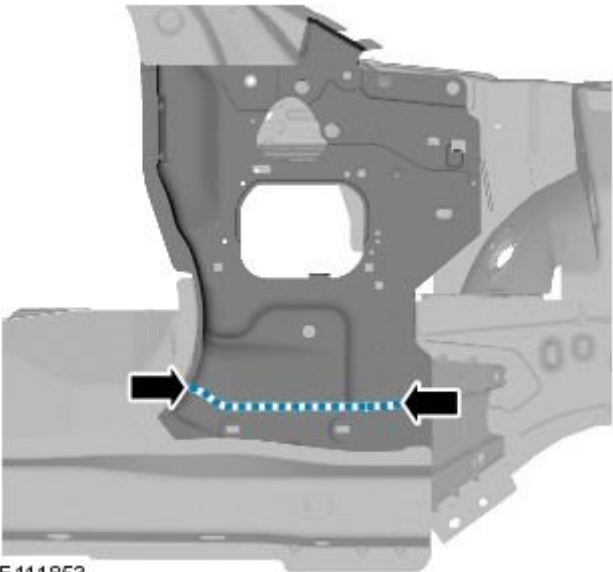
E111851

11. Apply adhesive to the area as indicated.



E111852

12. Apply sealer adhesive to the NVH components as indicated.

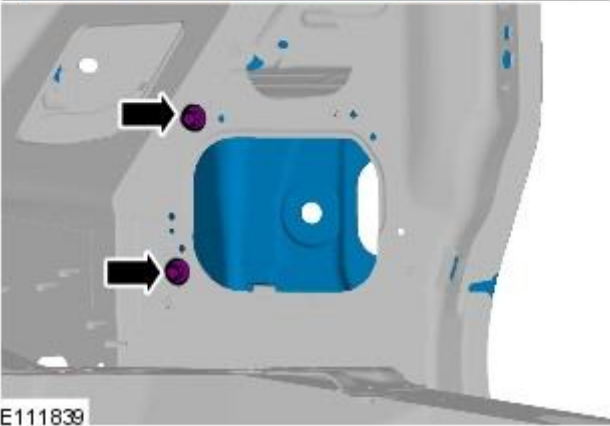
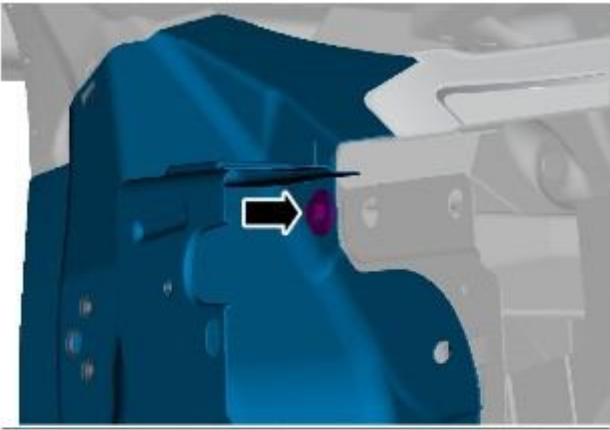


E111853

13. Offer up, align and clamp the new panel into position.

14. Install the bolts as indicated.

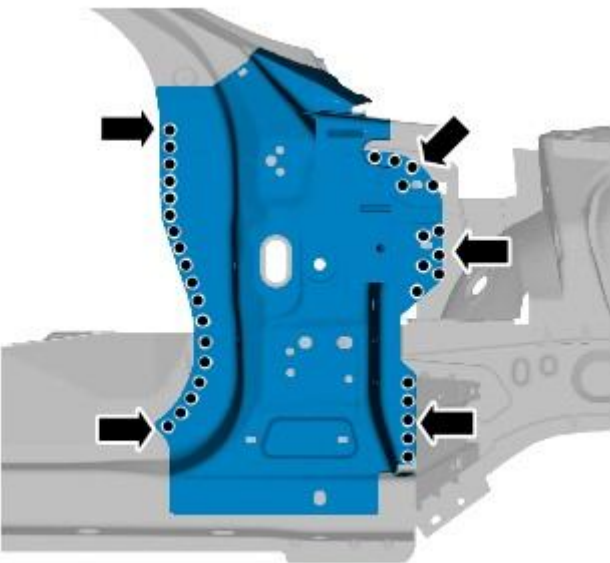
- Tighten to 25 Nm.



E111839

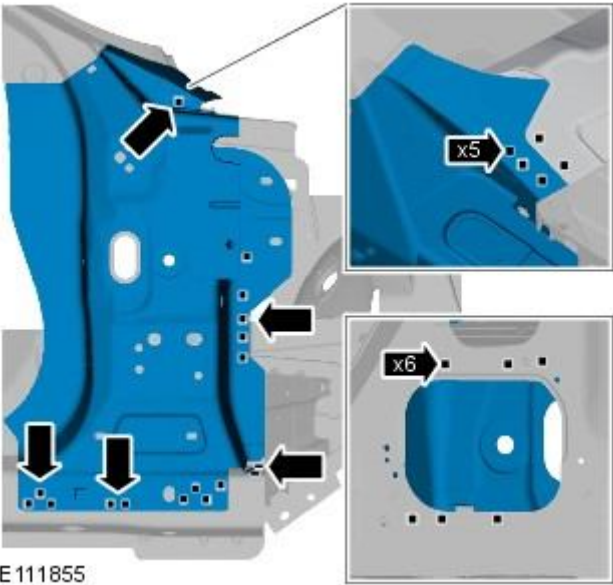
15. NOTE: Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible spot welds should be installed adjacent to the original. Where there is adhesive in the original joint, spot welds should be installed through the original.

Spot weld.



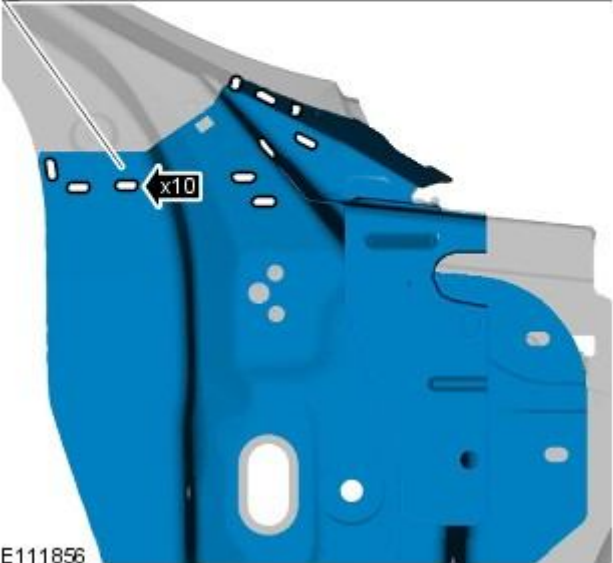
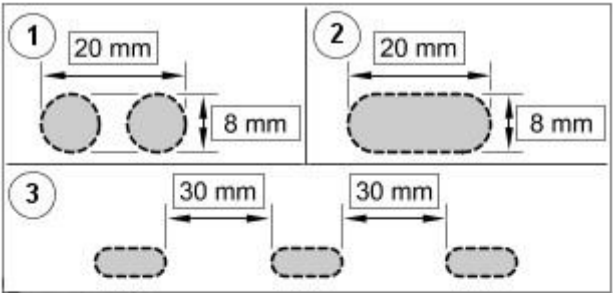
E111854

16. MAG plug weld.



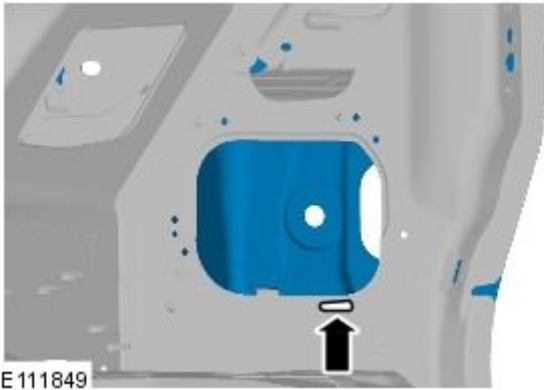
E111855

17. MIG Braze the slots.



E111856

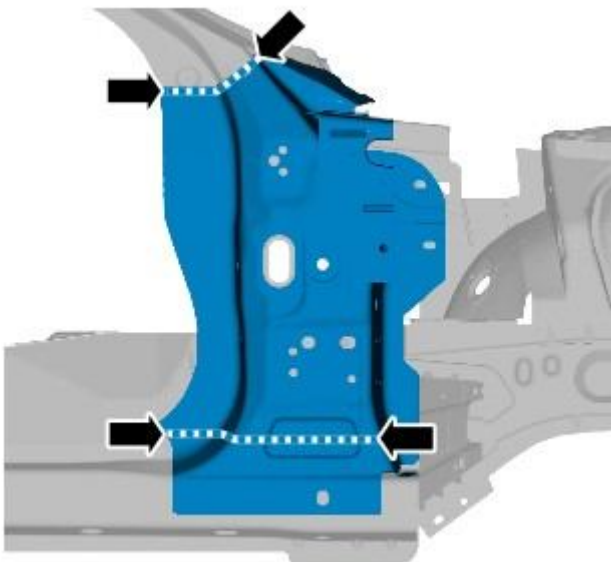
18. MIG braze the elongated slot as indicated.



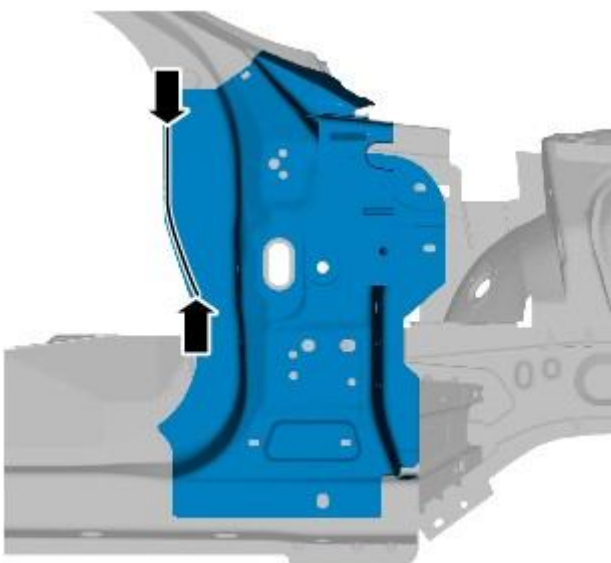
19. Dress all welded/brazed joints and remove any excess adhesive.

20. make sure any remaining areas of bare metal created during this procedure are treated with a zinc primer prior to the installation of outer panels.

21. Install the upper and lower NVH components as indicated.



22. When installing the A-pillar outer panel, the spot welded joint of the A-pillar reinforcement containing adhesive, should be spot welded in the same locations to allow a satisfactory weld.



23. The installation of associated panels and components is the reversal of removal procedure.

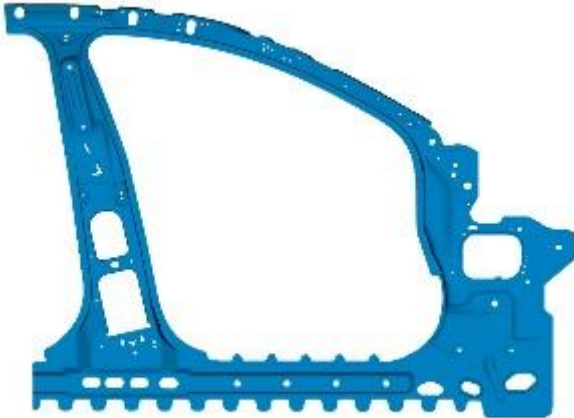
# Side Panel Sheet Metal Repairs - B-Pillar Inner Panel

Removal and Installation

## Removal

1. NOTE: The B-pillar inner panel is manufactured from mild steel.

The B-pillar inner panel is cut from the bodyside inner front section service panel.



E 112942

2. The B-pillar inner panel is replaced in conjunction with:

- Front door
- Rear door
- Rocker panel and B-pillar outer panel
- B-pillar reinforcement
- Rocker panel inner reinforcement
- Headliner

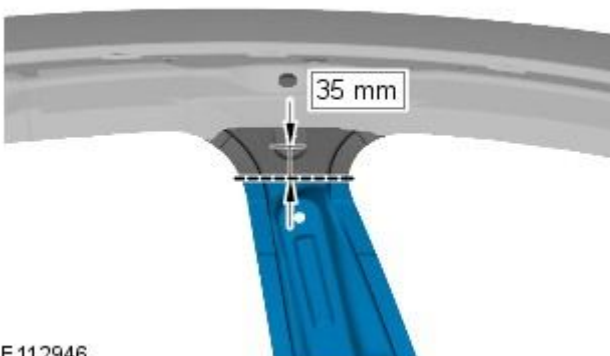
3. For additional information relating to this repair procedure please see the following:

For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

4. Remove the rocker panel inner reinforcement.

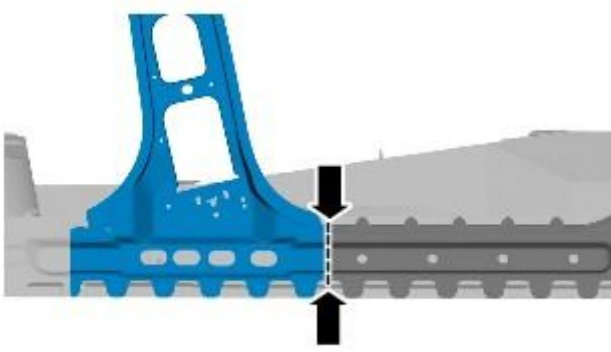
For additional information, refer to: [Rocker Panel Inner Reinforcement](#) (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).

5. Cut the old panel at the point indicated.



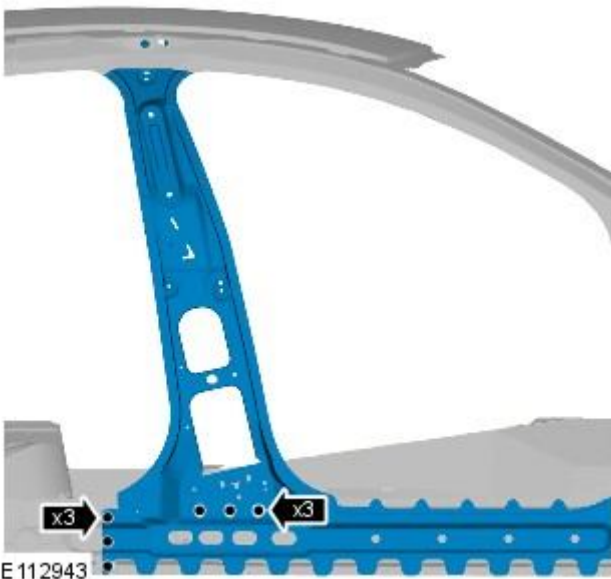
E 112946

6. Cut the old panel at the point indicated.



E 112947

7. Drill out the spot welds.



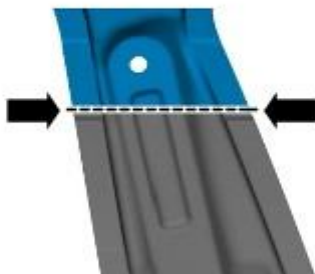
E 112943

8. NOTE: Care should be taken when separating and removing the old panel as it will be used as a template.

Carefully separate the joints and remove the old panel.

## Installation

1. Cut a template from the old panel as indicated.

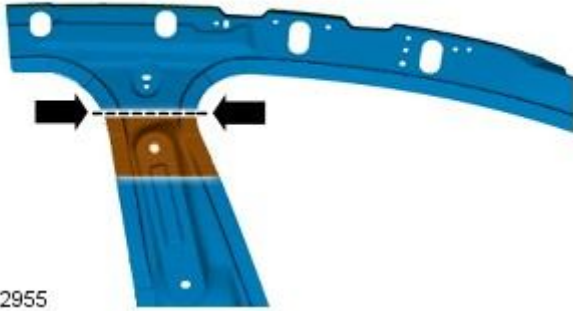


E 112954



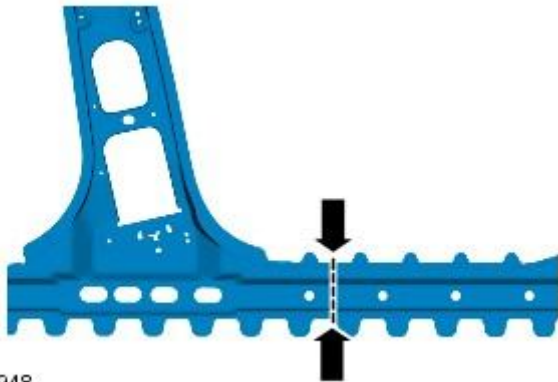
2. NOTE: Dress the panel joint surfaces of the template to ensure a good fit.

Offer up, align and clamp the template into position on the new B-pillar inner panel. Cut along the edge of the template, through the new panel, at the point indicated where the MAG butt joint is to be made.



3. Remove the template from the new panel.

4. Using the old panel for reference and allowing for an overlap, cut the new panel at the point indicated.

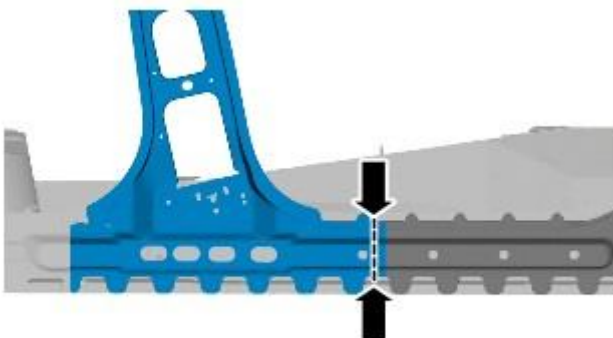


5. Drill holes in the new panel ready for MAG plug welding.



6. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

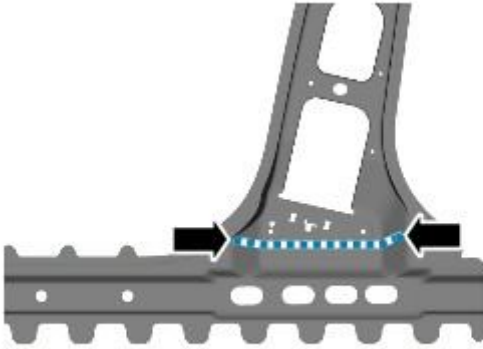
7. Cut the new and old panels at the point indicated, where the lower MAG butt joint is to be made.



8. Remove the new B-pillar inner panel.
9. Prepare the old and new panel joint surfaces.

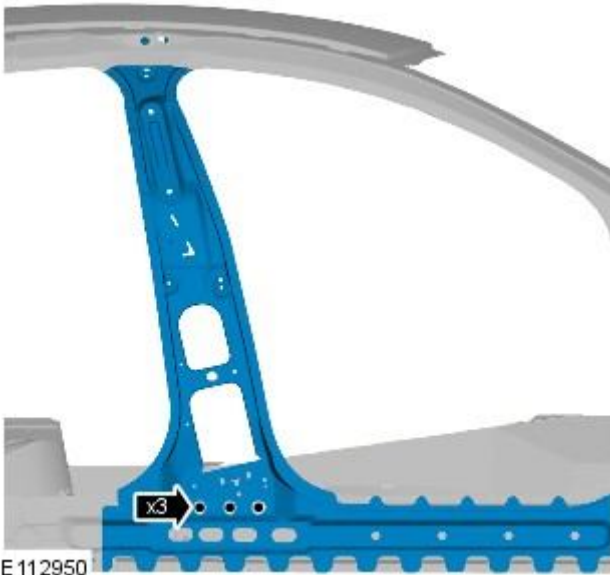
10. NOTE: Make sure the adhesive does not encroach into the area of MAG plug welds as it will contaminate the weld, (any unsealed areas must be sealed following the repair).

Apply weld through adhesive to the area as indicated.



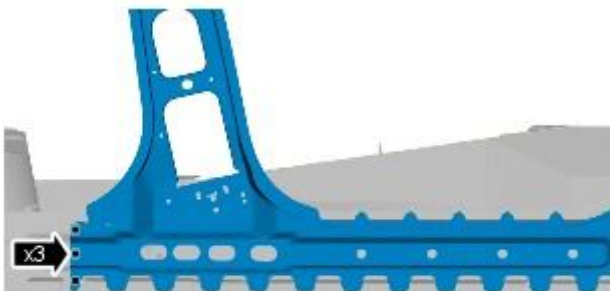
E 112945

11. Offer up the new panel and clamp into position.
12. Tack MAG weld the butt joints.
13. Spot weld.



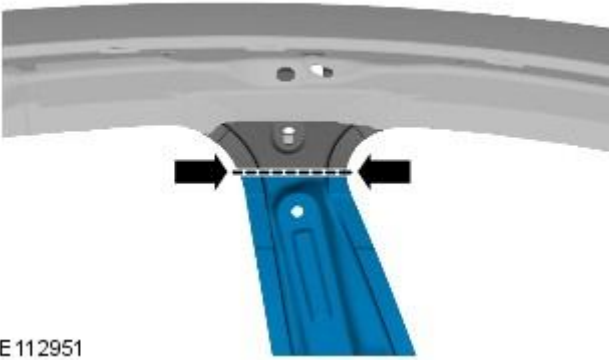
E 112950

14. Dress the tack welds.
15. MAG plug weld.



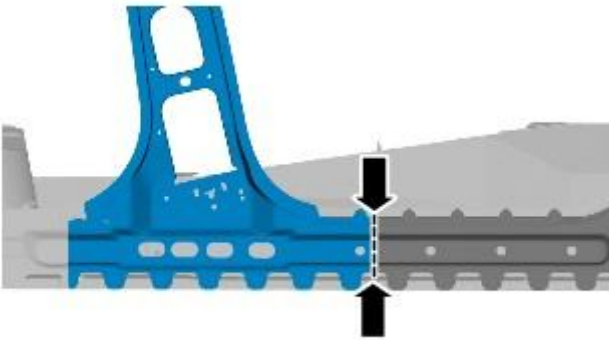
E 112949

16. MAG weld the upper butt joint.



E 112951

17. MAG weld the lower butt joint.



E 112952

18. Dress all welded joints.

19. Make sure any remaining areas of bare metal created during this procedure are treated with a zinc primer prior to the installation of other panels.
20. Make sure the joint between the B-pillar inner panel and the rocker panel inner panel is sealed following the completion of the B-pillar procedures.
21. The installation of associated panels and components is the reversal of removal procedure.

# Side Panel Sheet Metal Repairs - B-Pillar Reinforcement

Removal and Installation

## Removal

1. NOTE: The B-pillar reinforcement is manufactured from Dual Phase Steel, 450MPa, (DP450). It contains an internal boron reinforcement.

The B-pillar reinforcement panel is serviced as a separate weld-on panel. It is not serviced with its [NVH \(noise, vibration and harshness\)](#) components.



E107191

2. NOTE: The B-pillar reinforcement is spot welded to the cant rail reinforcement which is boron steel. In repair spot welds are replaced with MIG braze slots in these areas.

The b-pillar reinforcement is replaced in conjunction with:

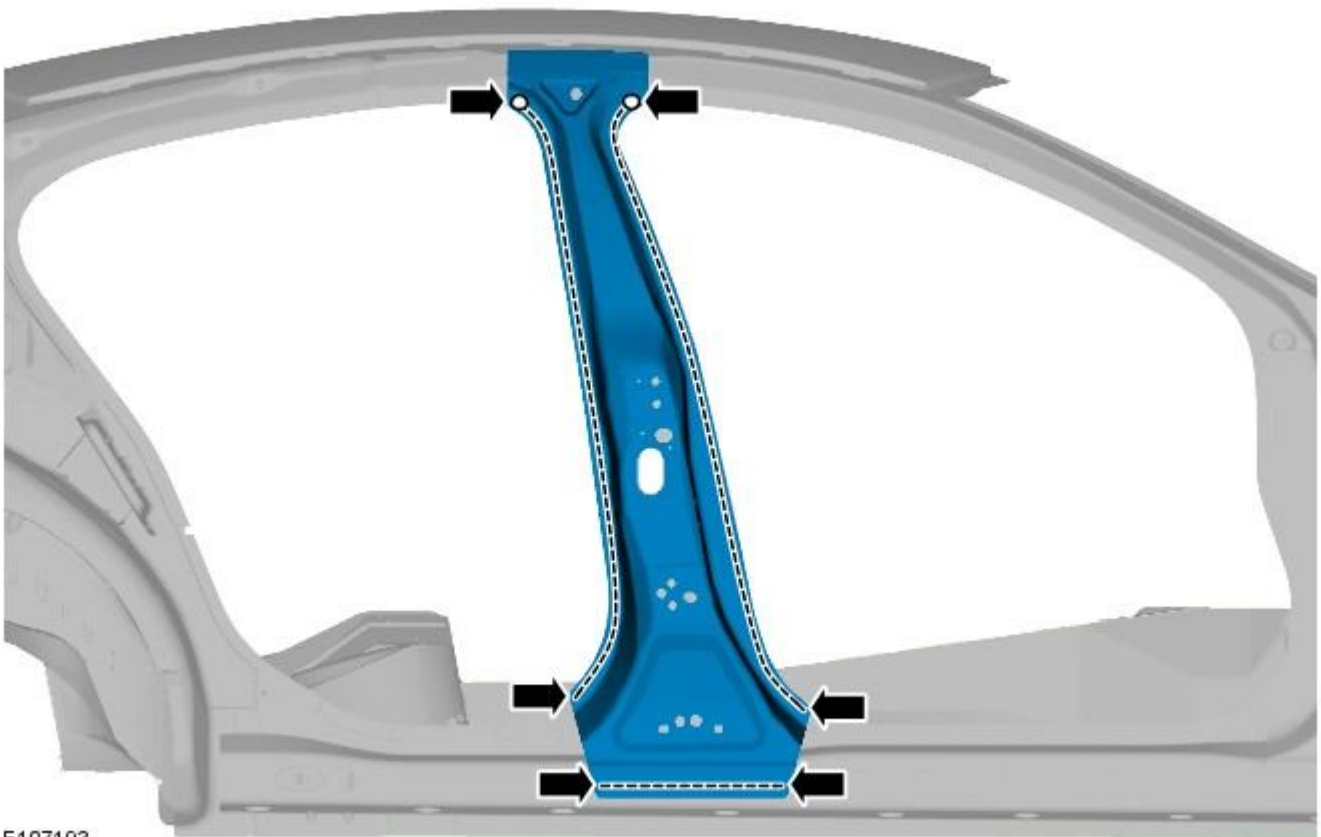
1. Front door
  2. Rear door
  3. Rocker panel and B-pillar outer panel
  4. Headliner
3. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove the rocker panel and B-pillar outer panel.  
For additional information, refer to: [Rocker Panel and B-Pillar Outer Panel](#) (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).

5. Cut the old panel at the point indicated.



6. NOTE: A drill bit suitable for drilling boron should be used on the boron spot welds.

Drill out the spot welds.

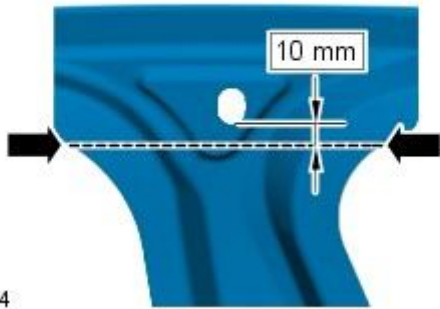


7. NOTE: Care should be taken when separating and removing the old panel as it will be used as a template. Care should also be taken in the area of the NVH components.

Carefully separate the joints and remove the old panel.

## Installation

1. Cut a template from the old panel, the cut should be made approx 10mm below the hole as indicated.



E 107194

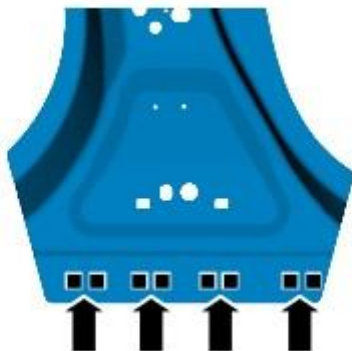
2. NOTE: Dress the panel joint surfaces of the template to ensure a good fit.

Offer up, align and clamp the template into position on the new B-pillar reinforcement panel. Cut along the edge of the template, through the new panel, at the point indicated, where the MAG butt joint is to be made.



E107195

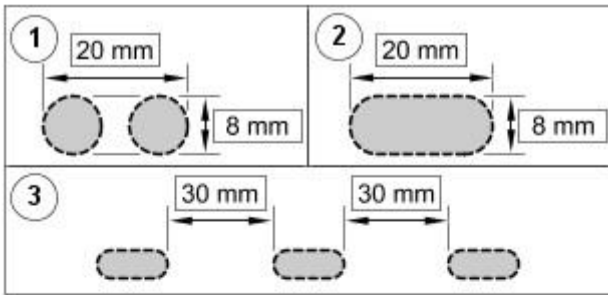
3. Remove the template from the new panel.
4. Drill holes in the new panel ready for MAG plug welding.



E 107196



5. Cut slots in the new panel ready for MIG braze slots.



E107197

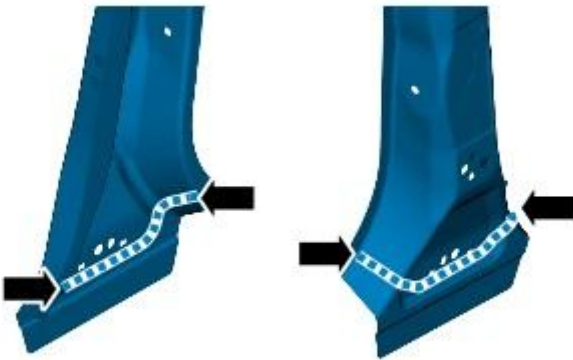
6. **NOTE:** If necessary, renew the NVH components.

Prepare the old and new panel joint surfaces, including the NVH components.

7. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

8. Remove the new B-pillar reinforcement panel.

9. Apply sealer adhesive to the NVH components, as indicated.



E107198

10. Offer up the new panel and clamp into position.

11. Tack MAG weld the upper butt joint.

12. Install a tack MAG weld between the B-pillar reinforcement and the rocker panel inner reinforcement to secure the panel in position, to enable a final alignment check prior to welding.

13. **NOTE:** Temporarily install the rocker panel and B-pillar outer panel and the front and rear doors and hinges to aid alignment.

Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

14. Remove the front and rear doors and hinges and the rocker panel and B-pillar outer panel.

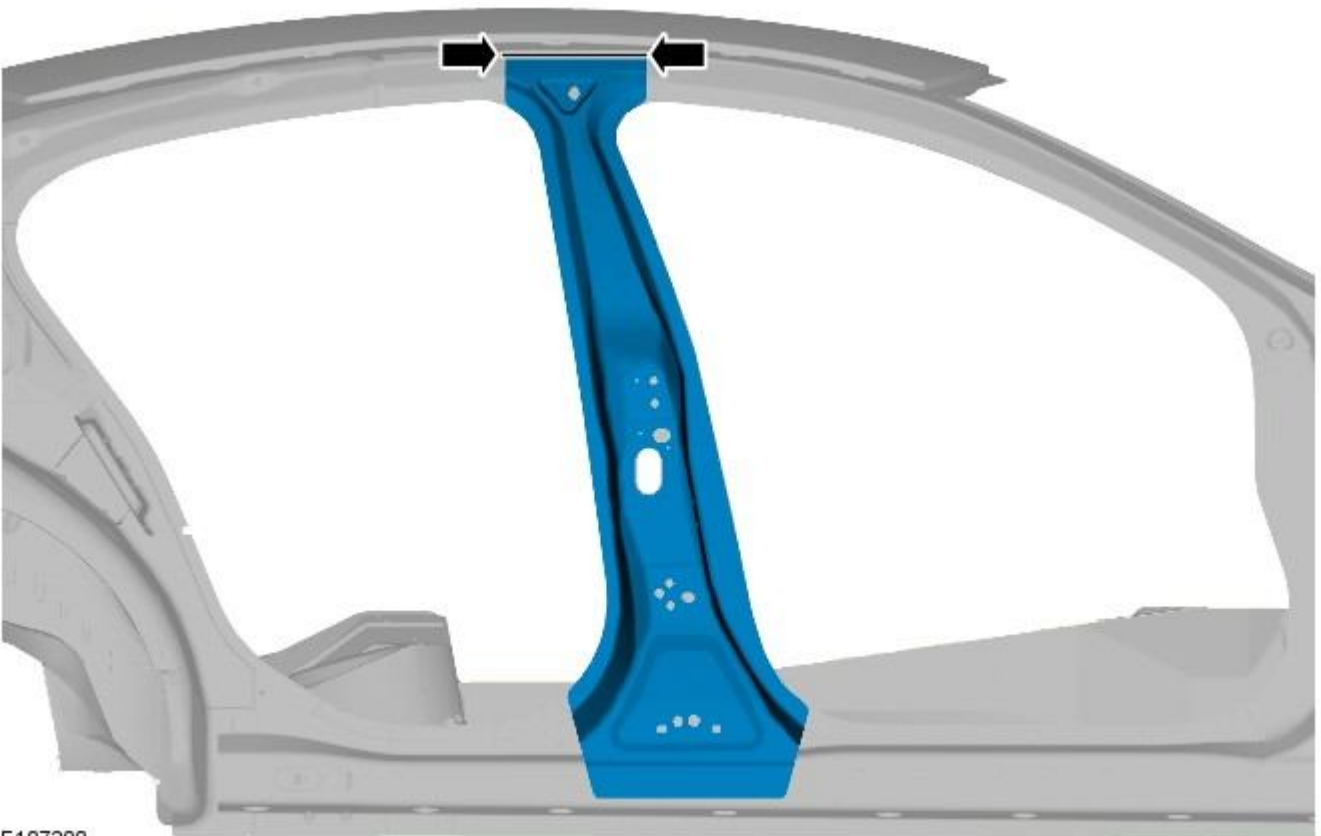
15. Dress the tack welds.

16. MAG plug weld.



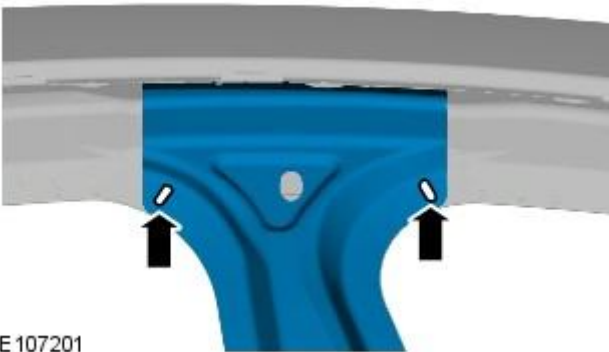
E 107199

17. MAG weld the upper butt joint.



E107200

18. MIG Braze the slots.



E 107201

19. Dress all welded/brazed joints.

20. Make sure any remaining areas of bare metal created during this procedure are treated with a zinc primer prior to the installation of outer panels.

21. The installation of associated panels and components is the reversal of removal procedure.

# Side Panel Sheet Metal Repairs - Front Door Skin Panel

Removal and Installation

## Removal

1. NOTE: The front door skin panel is manufactured from bake hardened steel, (220 MPa), plus zinc.

The front door skin panel is serviced as a separate panel.

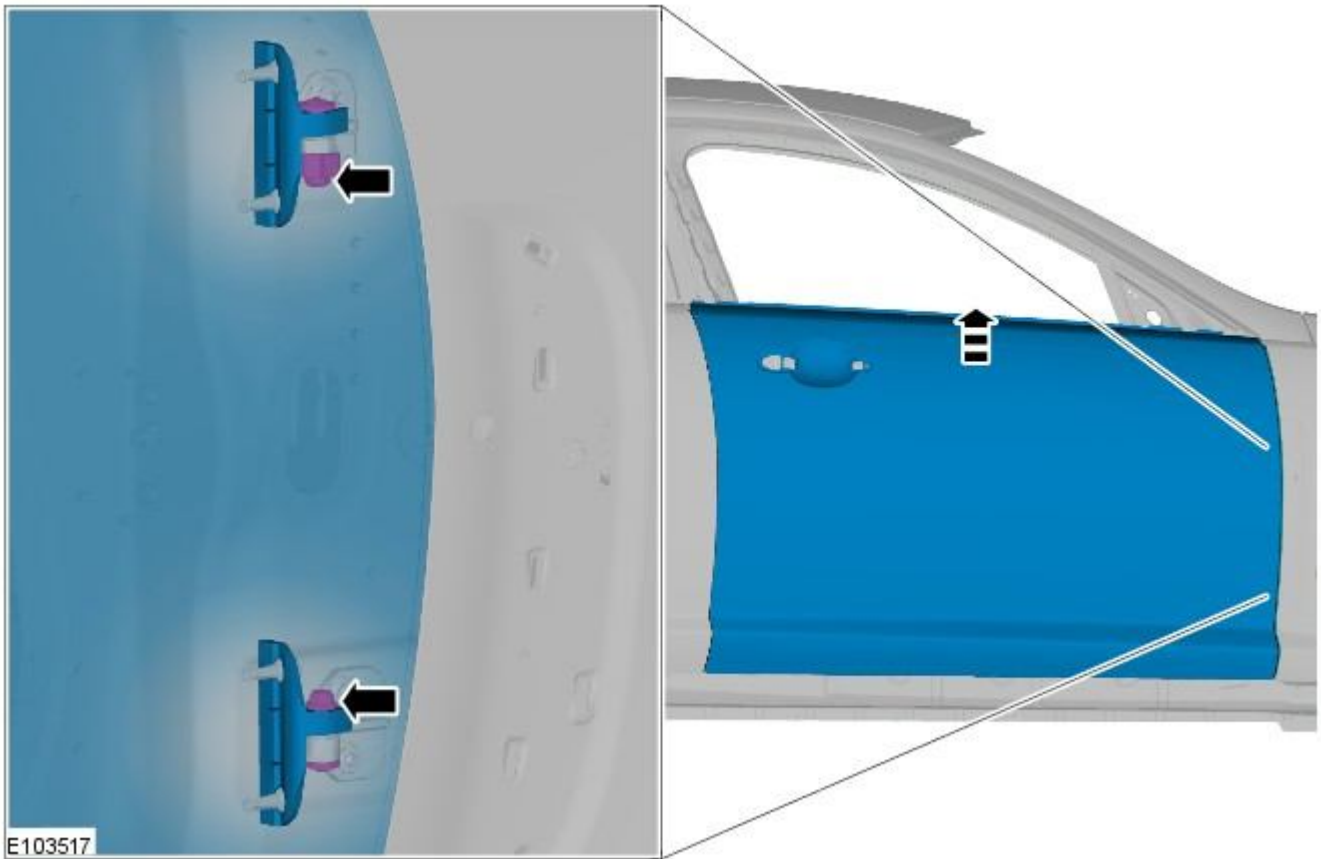


E 103510

2. The front door skin panel is replaced in conjunction with:

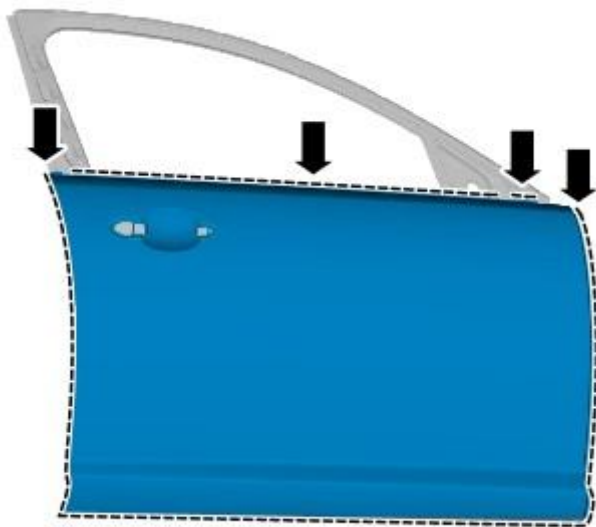
1. Front door

3. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove the front door window regulator and motor.  
For additional information, refer to: [Front Door Window Regulator and Motor](#) (501-11 Glass, Frames and Mechanisms, Removal and Installation).
5. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
6. Remove the exterior mirror.  
For additional information, refer to: [Exterior Mirror](#) (501-09 Rear View Mirrors, Removal and Installation).
7. Remove the front door latch.  
For additional information, refer to: [Front Door Latch](#) (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
8. Remove the front door outer window frame mouldings.
9. Remove the front door weatherstrips.
10. Remove the front door wiring harness.
11. Remove the front door impact absorbers.
12. Remove the front door glass run felt.
13. Disconnect the front door wiring harness, accessed behind the grommet on the A-pillar.
14. Remove the screw and release the front door check strap from the body.
15. Remove the front door.



E103517

16. Abrade the areas of folded flange on the old front door skin panel.



E 103511

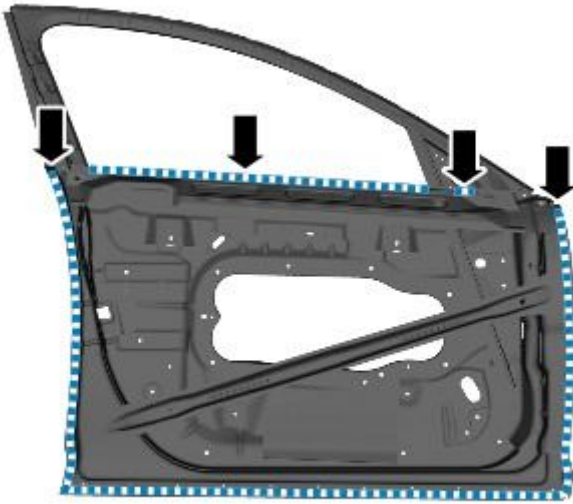
17. Separate the adhesive and remove the bulk of the old panel.

18. Separate and remove the old panel remnants from the front door frame.

### Installation

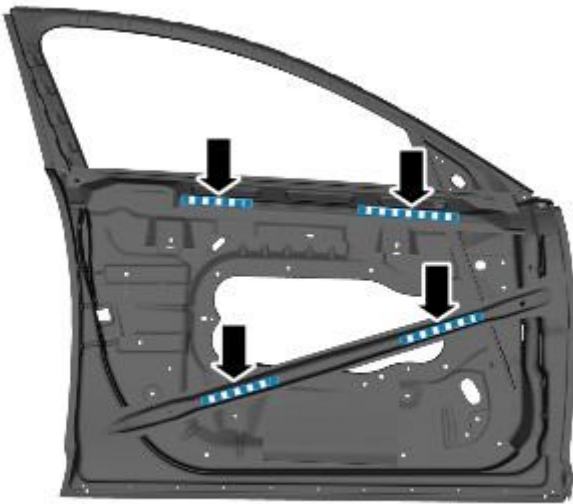
1. Prepare the old and new panel joint surfaces.
2. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.
3. Remove the new panel.

4. Apply adhesive to the areas of folded flange as indicated.



E 103512

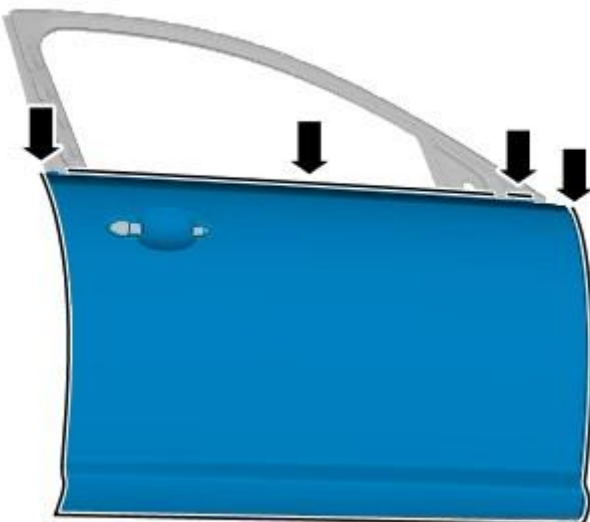
5. Apply adhesive to the impact beam/reinforcements as indicated.



E 103513

6. Offer up the new panel, align and clamp into position.

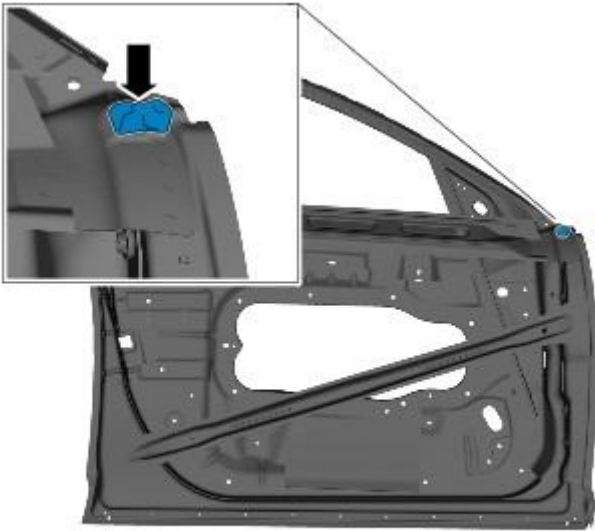
7. Fold the flange of the front door skin panel, over the front door frame as indicated.



E 103516

**8. NOTE:** There is access to apply the expanding foam sealer with the front door skin panel fitted to the front door frame.

Apply expanding foam sealer to the area indicated.



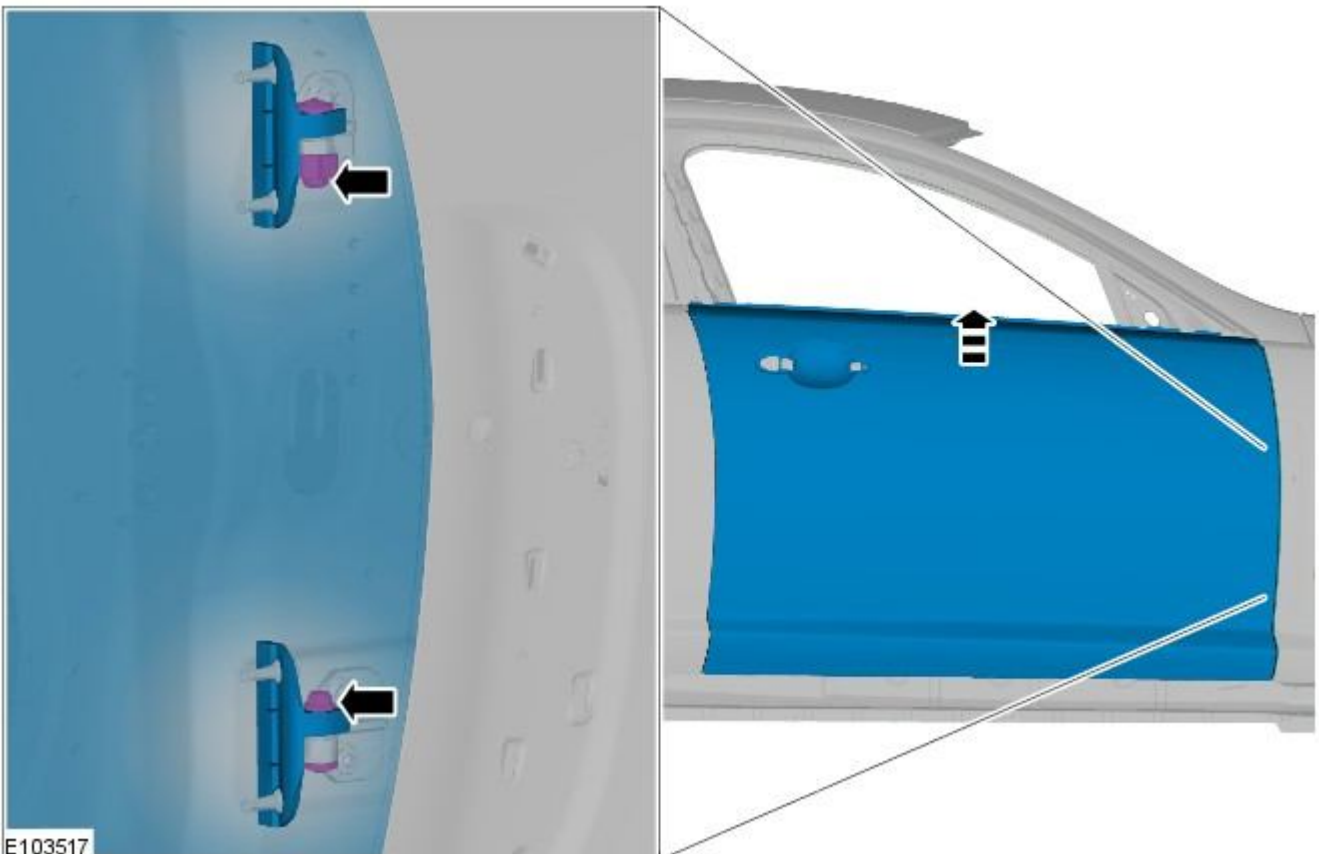
E 103514

**9.** Remove any excess adhesive or expanding foam sealer.

**10.** Dress the folded flange joints.

**11.** Install the front door.

- Tighten to 30 Nm.

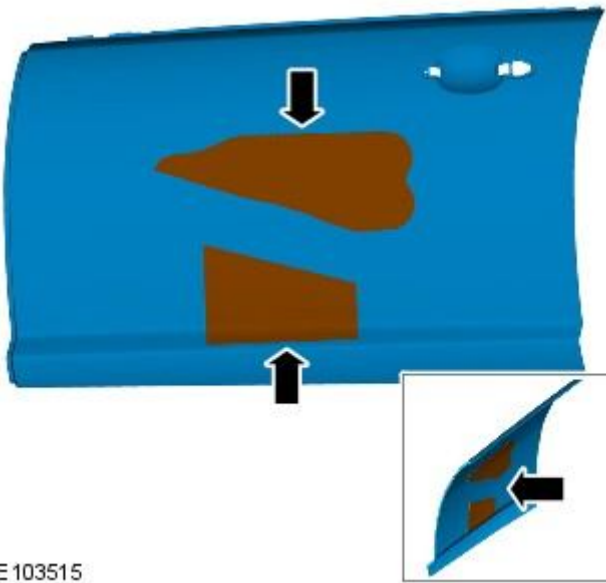


E103517

**12.** Check alignment, if correct, proceed to next step, if not rectify before proceeding.



13. Install the NVH (noise, vibration and harshness) components.



E 103515

14. NOTE: Install the front door upper frame weatherstrip prior to installing the front door.

The installation of associated panels and components is the reversal of removal procedure.

# Side Panel Sheet Metal Repairs - Rear Door Skin Panel

Removal and Installation

## Removal

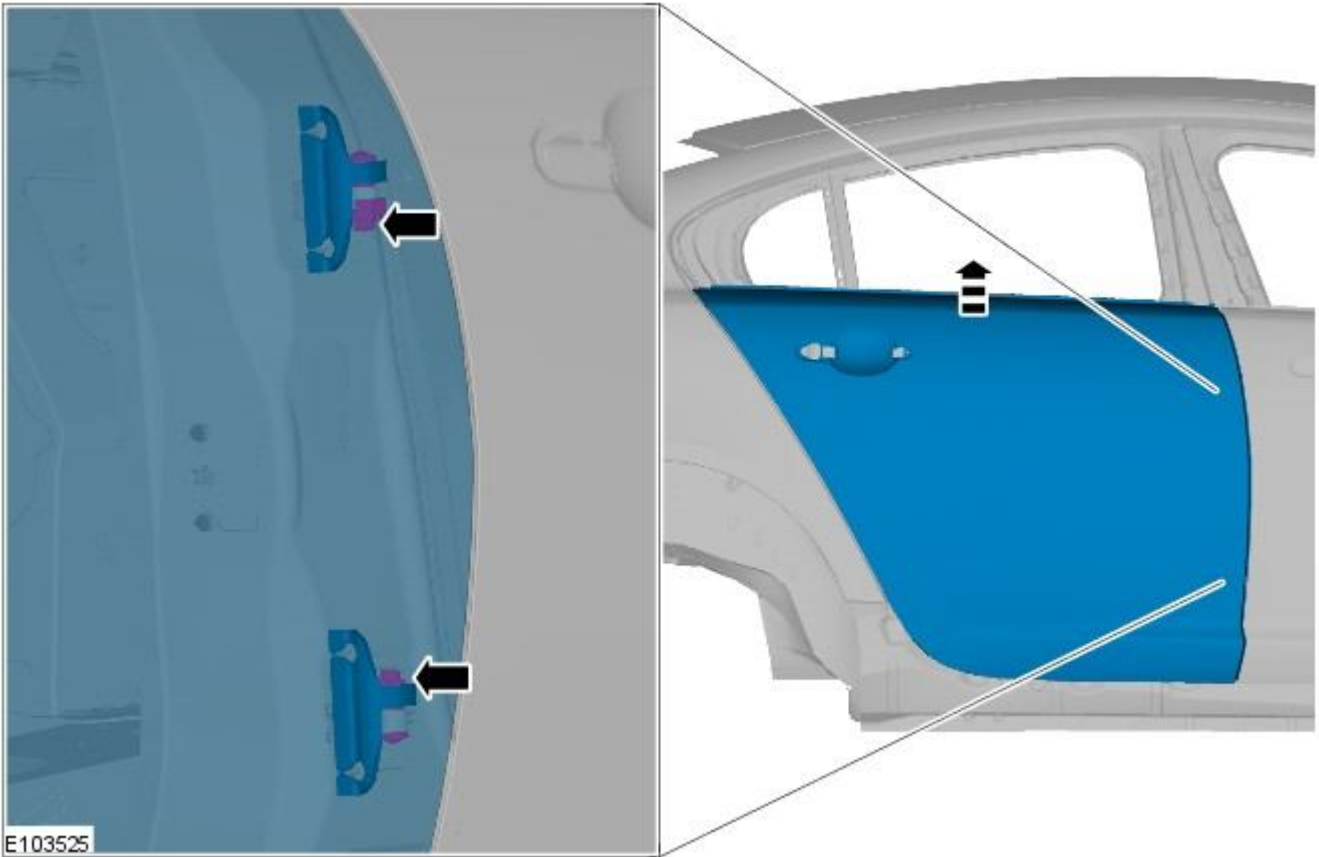
1. NOTE: The rear door skin panel is manufactured from bake hardened steel, (220 MPa), plus zinc

The rear door skin panel is serviced as a separate panel.



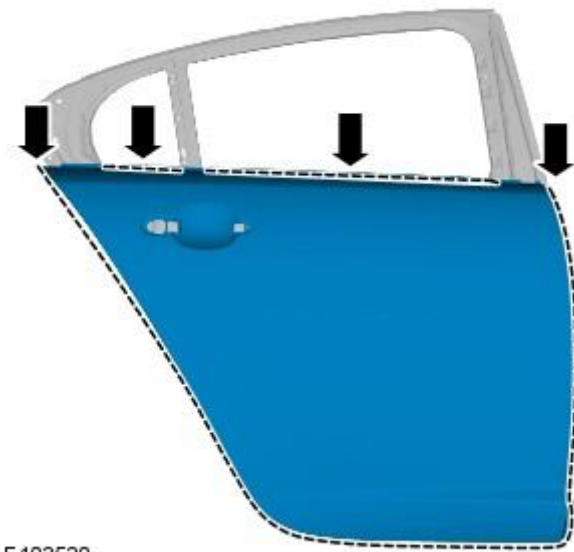
E 103519

2. The rear door skin panel is replaced in conjunction with:
  1. Rear door
3. For additional information relating to this repair procedure please see the following:  
 For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) /  
[Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) /  
[Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) /  
[Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove the rear door window regulator and motor.  
 For additional information, refer to: [Rear Door Window Regulator and Motor](#) (501-11 Glass, Frames and Mechanisms, Removal and Installation).
5. Disconnect the battery ground cable.  
 For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
6. Remove the rear door latch.  
 For additional information, refer to: [Rear Door Latch](#) (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
7. Remove the rear door outer window frame mouldings.
8. Remove the rear door weatherstrips.
9. Remove the rear door wiring harness.
10. Remove the rear door impact absorbers.
11. Remove the rear door glass run felt.
12. Disconnect the rear door wiring harness, accessed behind the grommet on the B-pillar.
13. Remove the screw and release the rear door check strap from the body.
14. Remove the rear door.



E103525

**15.** Abrade the areas of folded flange on the old rear door skin panel.



E 103520

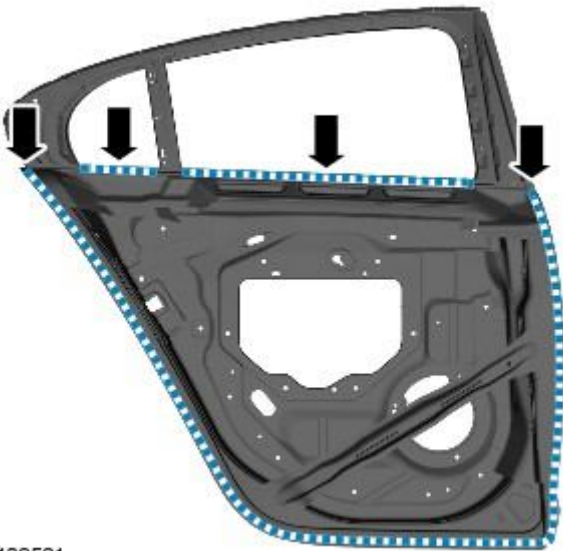
**16.** Separate the adhesive and remove the bulk of the old panel.

**17.** Separate and remove the old panel remnants from the rear door frame.

### Installation

1. Prepare the old and new panel joint surfaces.
2. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.
3. Remove the new panel.

4. Apply adhesive to the areas of folded flange as indicated.



E 103521

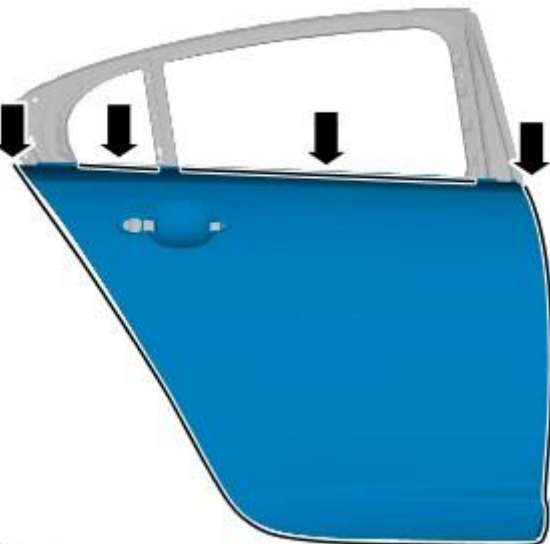
5. Apply adhesive to the impact beam/reinforcements as indicated.



E 103522

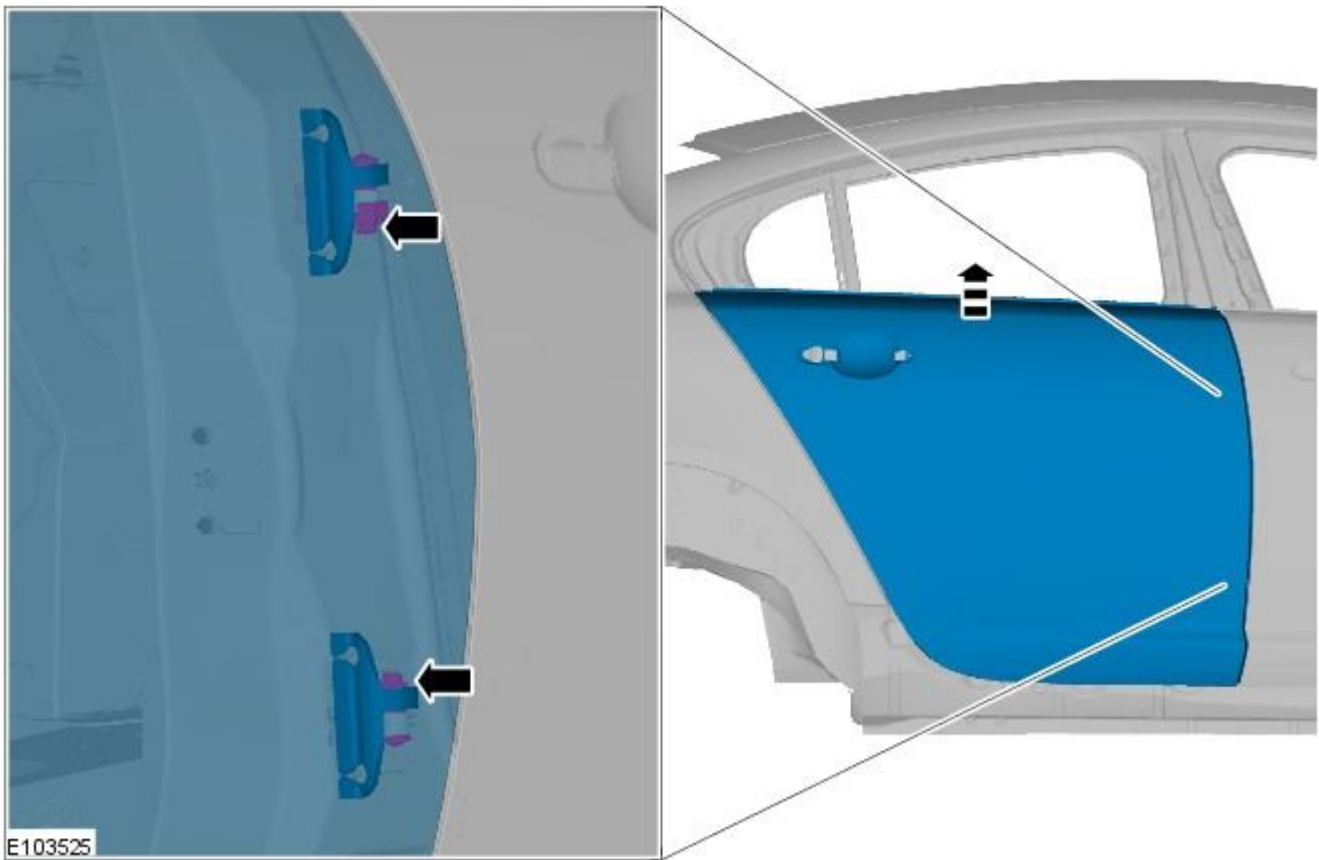
6. Offer up the new panel, align and clamp into position.

7. Fold the flange of the rear door skin panel, over the rear door frame as indicated.

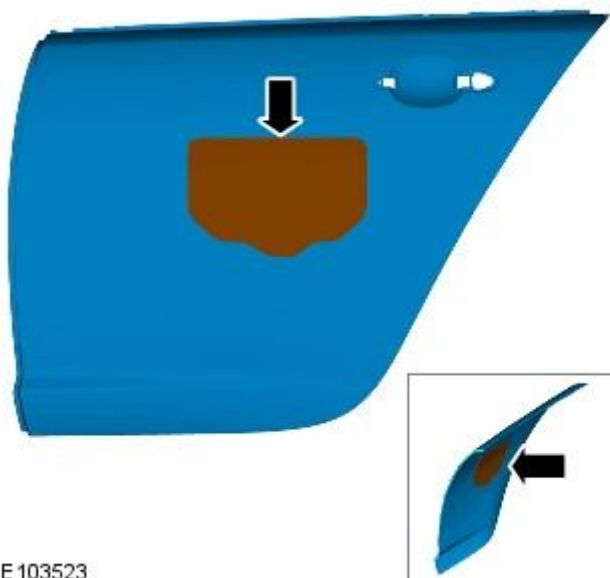


E 103524

8. Remove any excess adhesive.
9. Dress the folded flange joints.
10. Install the rear door.
  - Tighten to 30 Nm.



11. Check alignment, if correct, proceed to next step, if not rectify before proceeding.
12. Install the **NVH (noise, vibration and harshness)** components.



13. The installation of associated panels and components is the reversal of removal procedure.

# Side Panel Sheet Metal Repairs - Rocker Panel

Removal and Installation

## Removal

1. **NOTE:** The rocker panel is manufactured from mild steel.

The rocker panel is serviced as a separate weld-on panel. It is not serviced with its riv-nuts for the fender fixings, or **NVH** (noise, vibration and harshness) components.



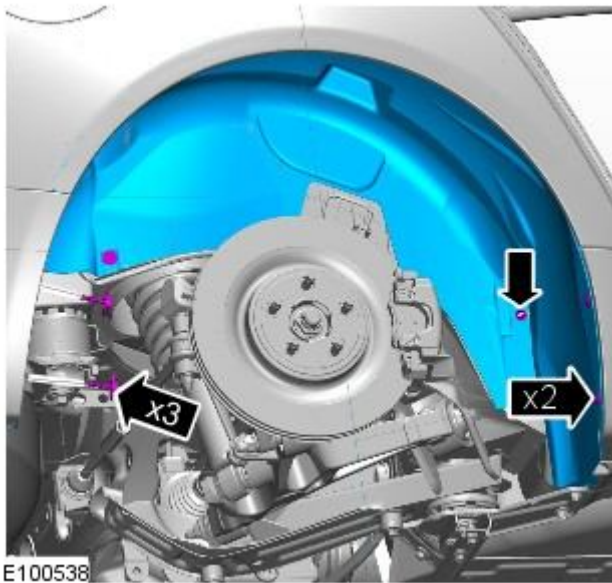
E102794


2. The rocker panel is replaced in conjunction with:
  1. Front fender
  2. Front door
  3. Rear door
3. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) /  
[Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) /  
[Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) /  
[Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove the front seat.  
For additional information, refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).
5. Disconnect the generator electrical connectors.
6. Remove the rear seat cushion.  
For additional information, refer to: [Rear Seat Cushion](#) (501-10 Seating, Removal and Installation).
7. Remove the front and rear door weatherstrips.
8. Remove the cowl side trim panel.  
For additional information, refer to: [Cowl Side Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
9. Remove the front safety belt retractor.  
For additional information, refer to: [Front Safety Belt Retractor](#) (501-20A Safety Belt System, Removal and Installation).
10. Remove the B-pillar side impact sensor.  
For additional information, refer to: [B-Pillar Side Impact Sensor](#) (501-20B Supplemental Restraint System, Removal and Installation).
11. Remove the C-pillar side impact sensor.  
For additional information, refer to: [C-Pillar Side Impact Sensor](#) (501-20B Supplemental Restraint System, Removal and



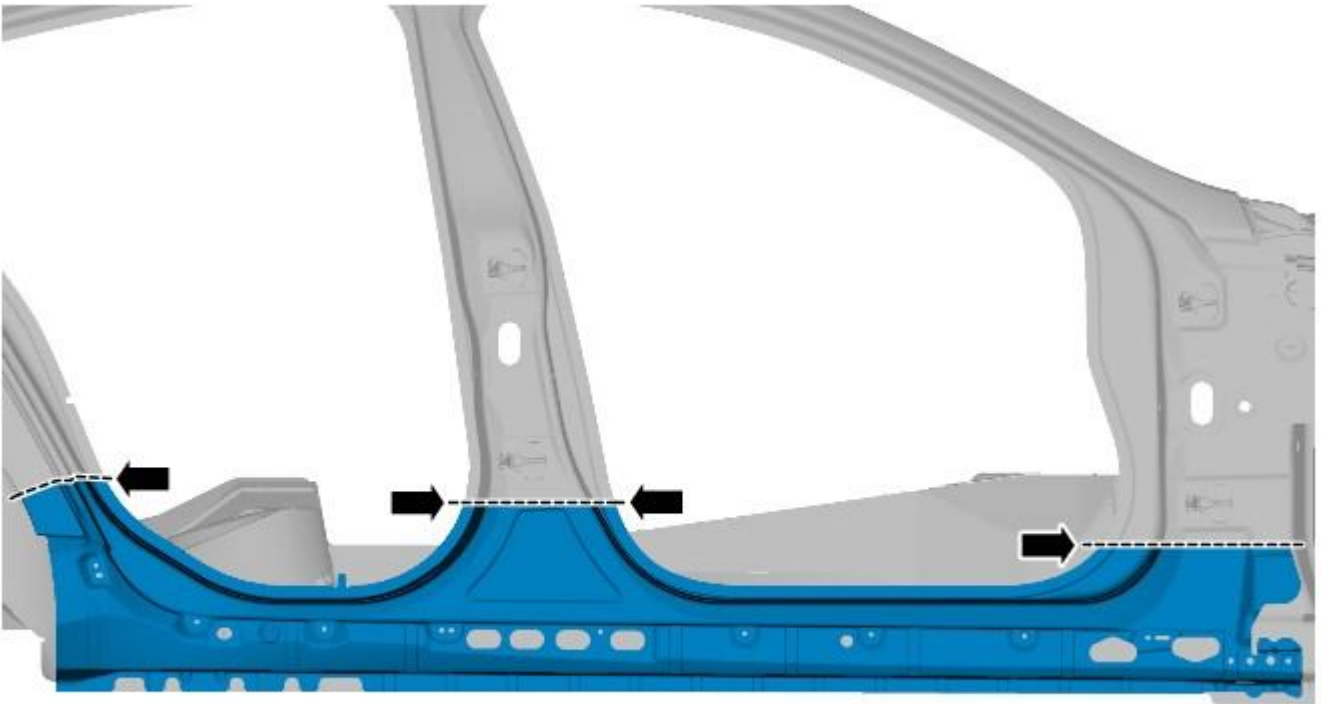
Installation).

12. Release and position the floor covering to one side.
13. Release and position the inner rocker panel wiring harness to one side.
14. Remove the rear wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
15. Remove the rear fender splash shield.



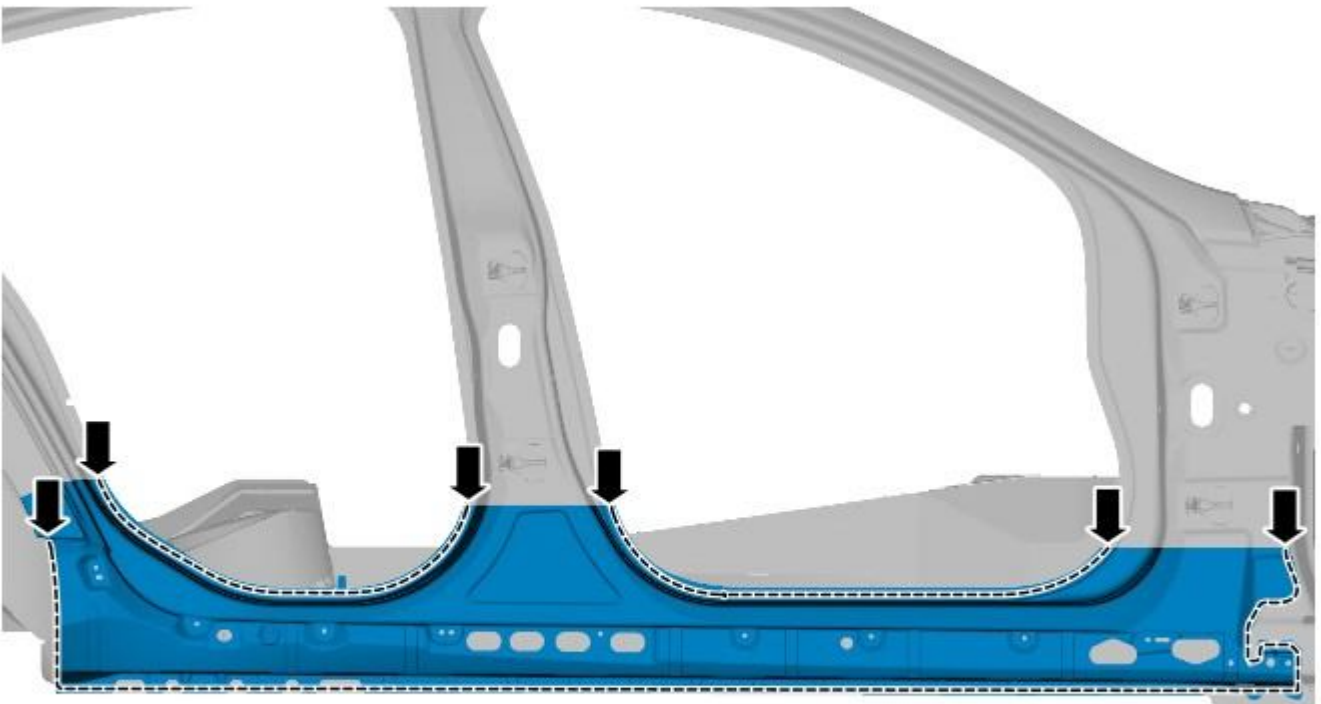
16. Remove the rocker panel outer moulding.
17. Remove the underfloor splash shield.
18. If the right-hand rocker panel is to be repaired, release and position the underfloor wiring harness to one side.
19. Remove the front fender.  
For additional information, refer to: [Front Fender](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).
20. Remove the front door.  
For additional information, refer to: [Front Door](#) (501-03 Body Closures, Removal and Installation).
21. Remove the rear door.  
For additional information, refer to: [Rear Door](#) (501-03 Body Closures, Removal and Installation).
22.  **CAUTION:** Care should be taken not to cut through into the inner panels.

Using the new panel for reference and allowing for an overlap, cut the old panel at the points indicated.



E 102795

23. Drill out the spot welds.

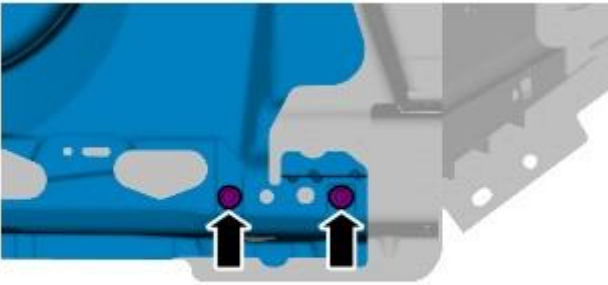


E 102796


24. Separate the joints and remove the bulk of the old panel.

## Installation

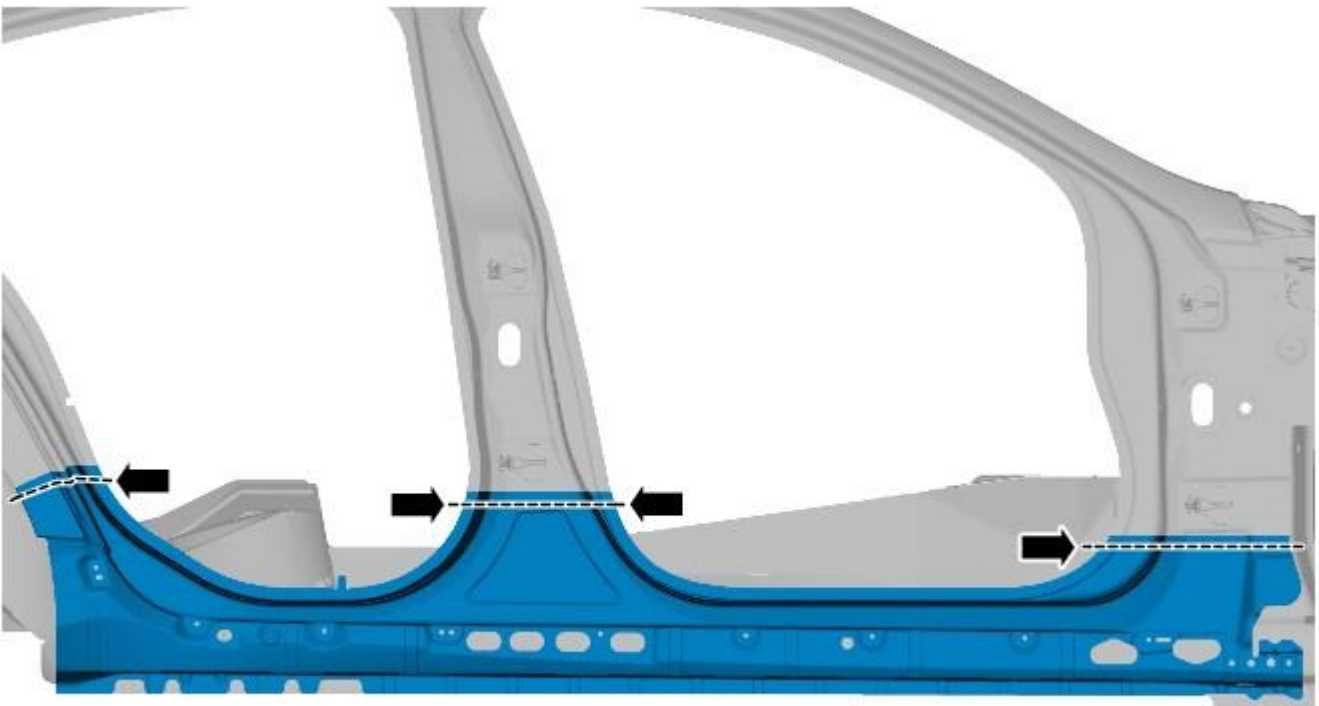
1. Install the riv-nuts into the new rocker panel as indicated.



E102797

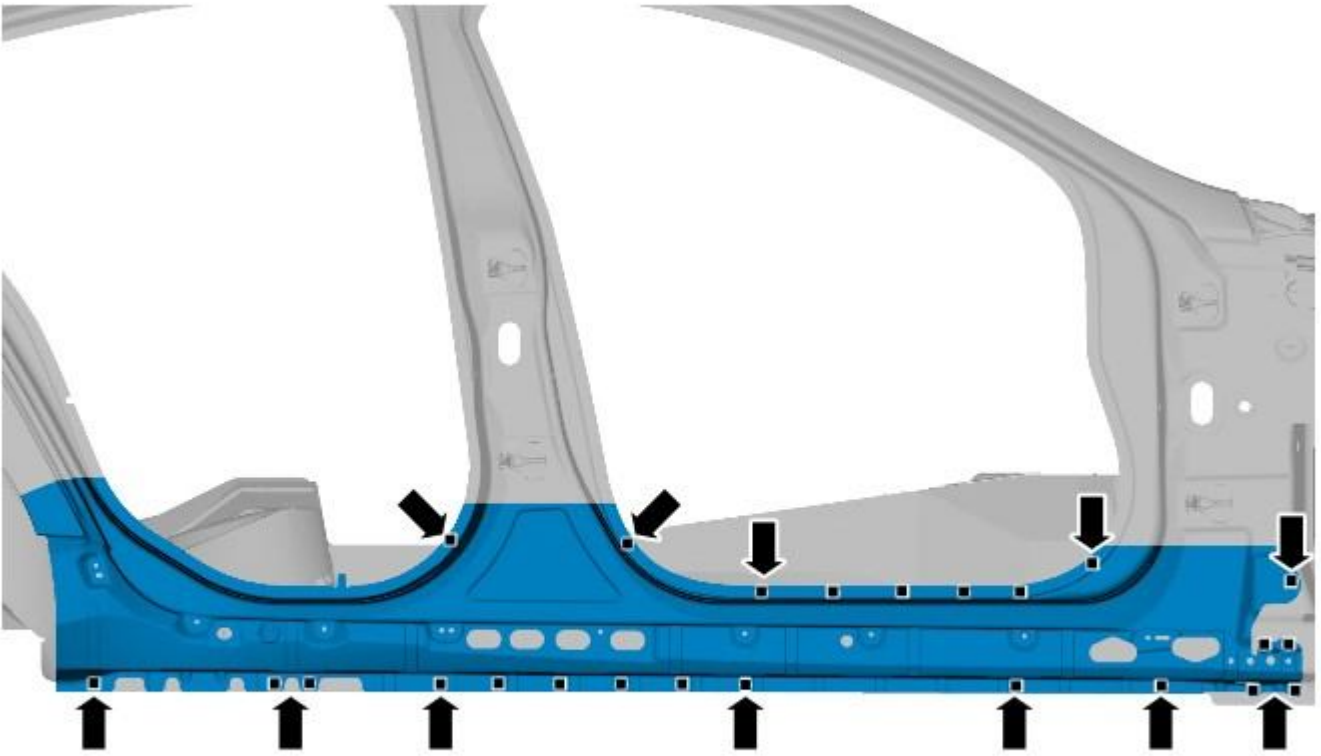
2.  CAUTION: Care should be taken not to cut through into the inner panels.

Offer up, align and clamp the new panel into position, overlapping the old panel remnant. Cut through the new panel, partially cutting the old panel at the points where the MAG butt joints are to be made.



E 102798

3. Remove the new panel.
4. Cut and remove the old panel remnants.
5. Drill holes in the new panel ready for MAG plug welding.



E 102799

**6. NOTE:** If necessary renew the NVH components.

Prepare the old and new panel joint surfaces, including the NVH components.

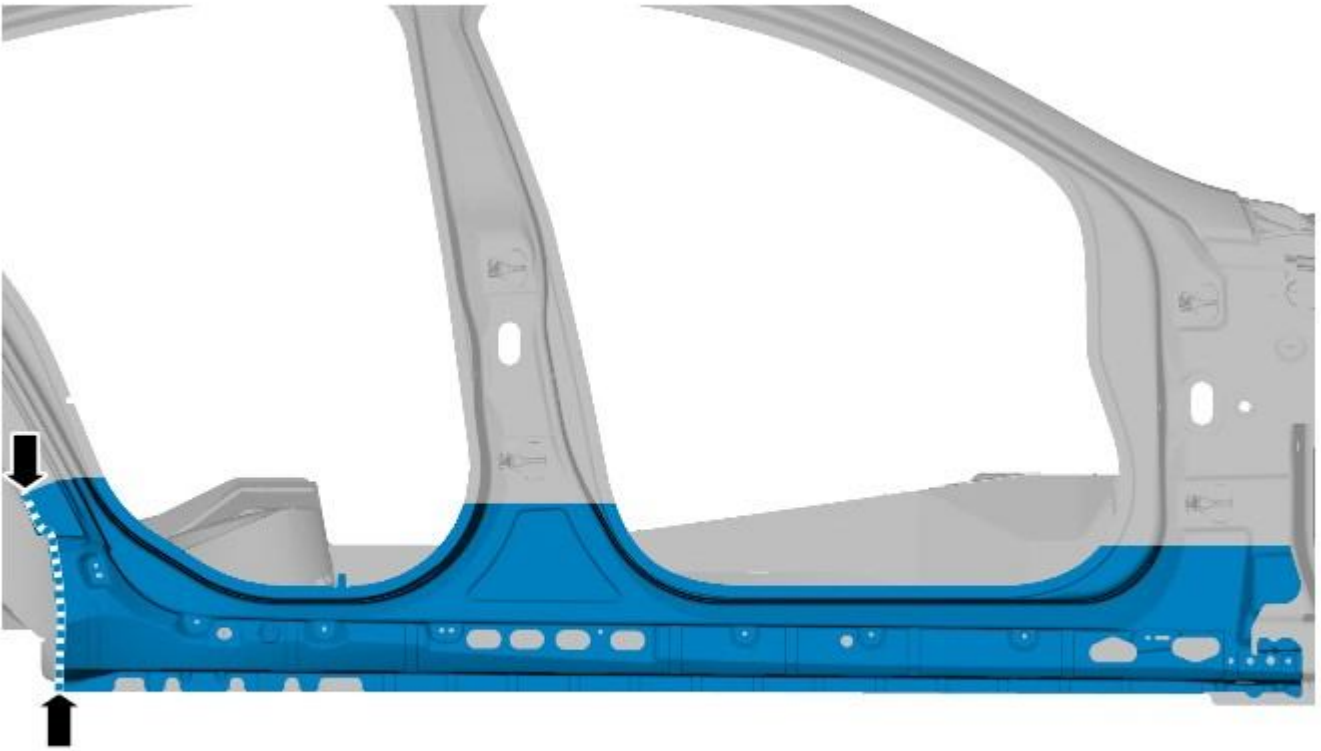
**7. NOTE:** Temporarily install the front and rear doors and front fender to aid alignment.

Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

**8.** Remove the front and rear doors, front fender and the new rocker panel.

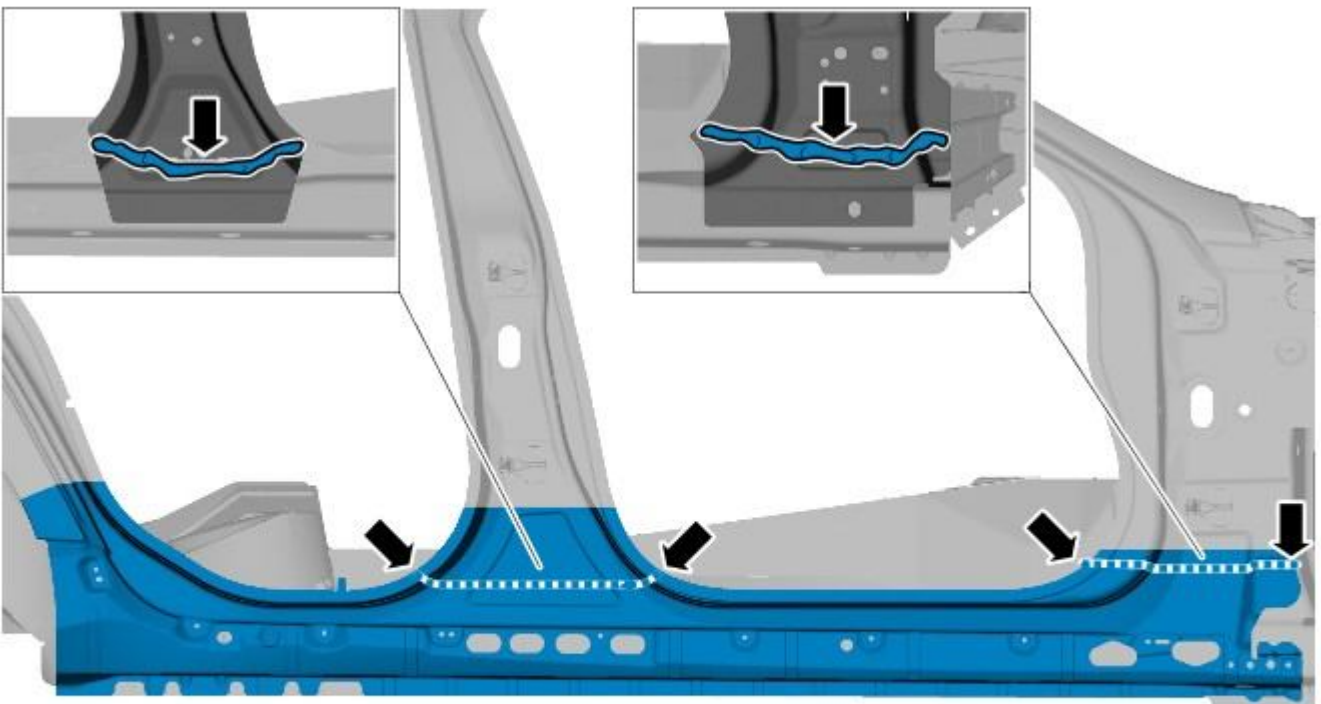
**9. NOTE:** Make sure the adhesive does not encroach into the area of the butt joint as it will contaminate the weld (any unsealed areas must be sealed following the repair).

Apply adhesive to the area as indicated.



E 102801

10. Apply sealer adhesive to the NVH components as indicated.



E 102800

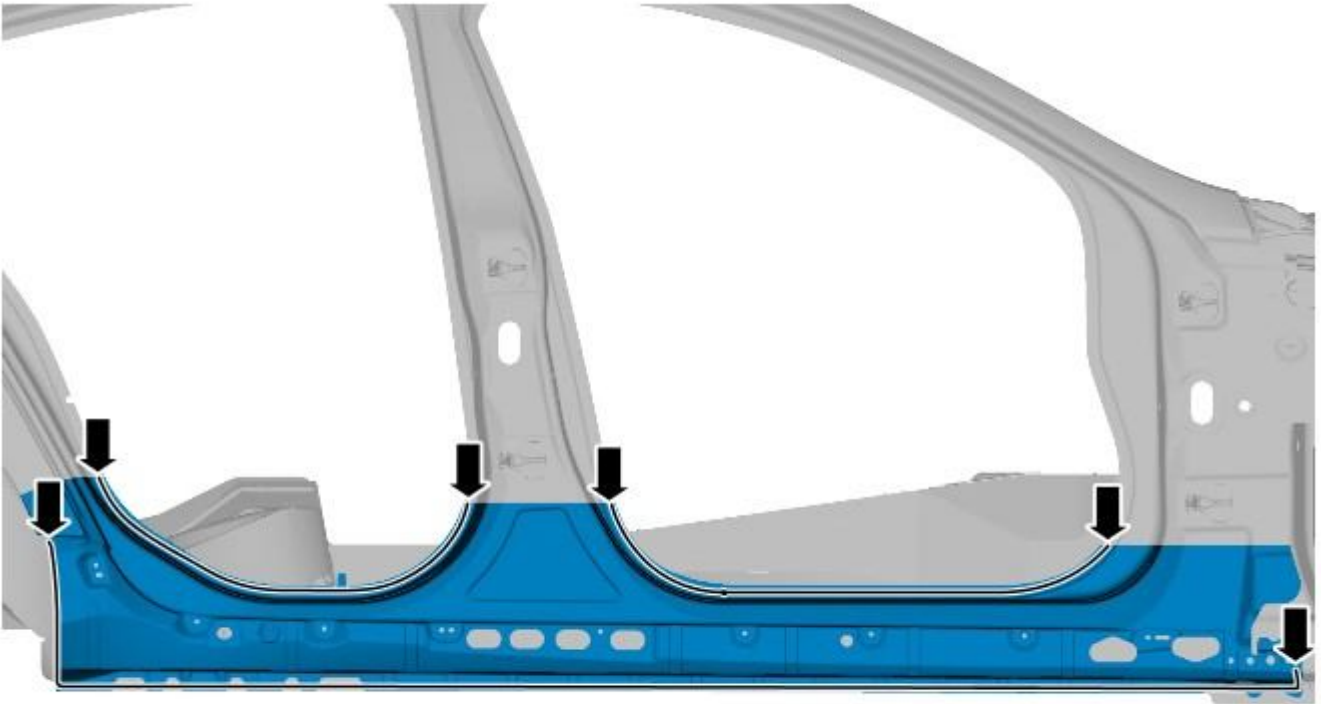
11. Offer up the new rocker panel, align and clamp into position.

12. Tack weld the butt joints.

13. NOTE: Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original. Where there is adhesive in the original

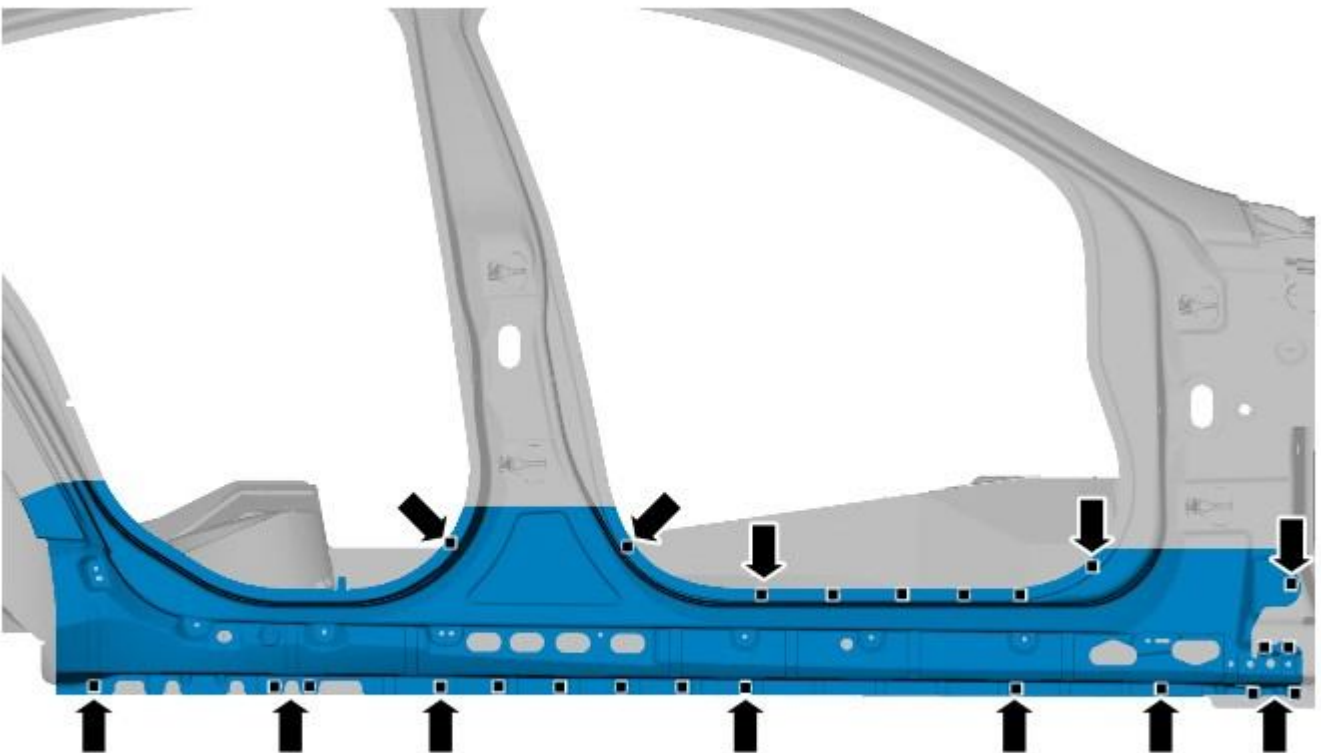
joint, spot welds should be installed through the original.

Spot weld.



E 102802

14. MAG plug weld.

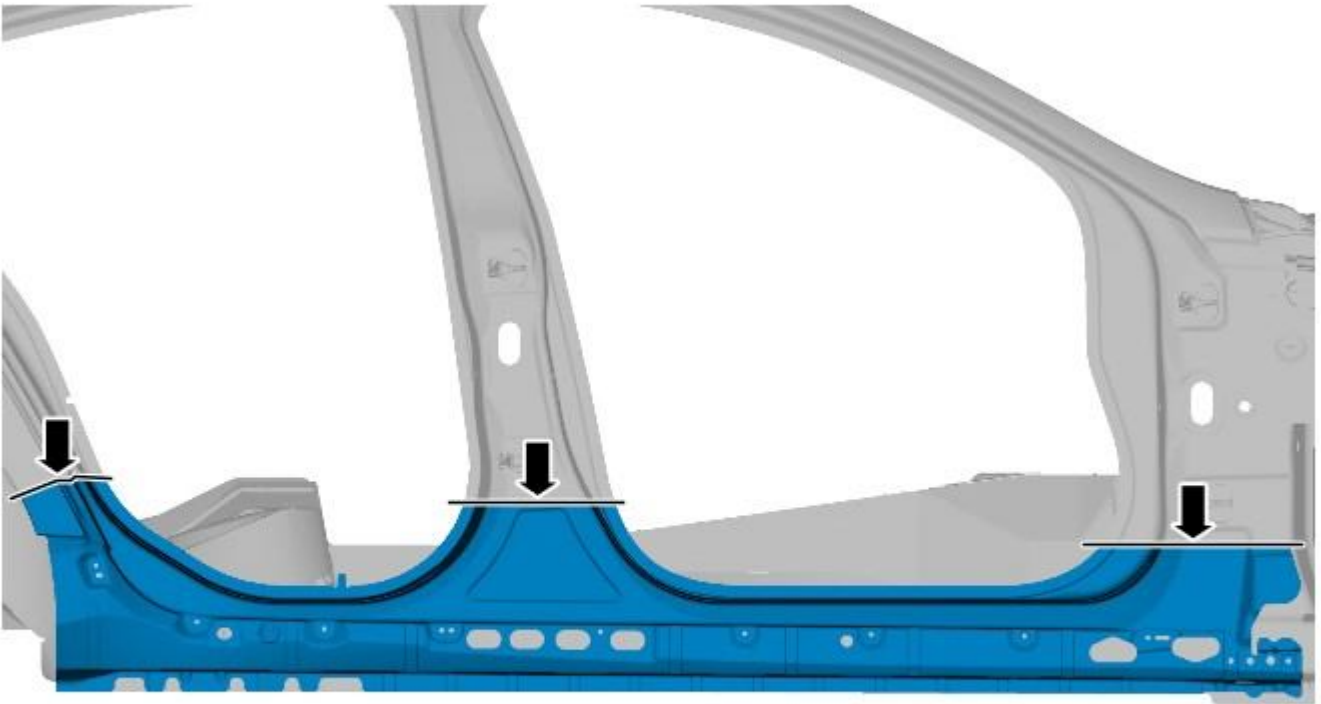


E 102799

15. Dress the tack welds.

16. MAG weld the butt joints.





E102803

**17.** Dress all welded joints.

**18.** The joint between the rocker panel and A-pillar must be sealed following the repair as indicated.



E102812

**19.** The installation of associated panels and components is the reversal of removal procedure.

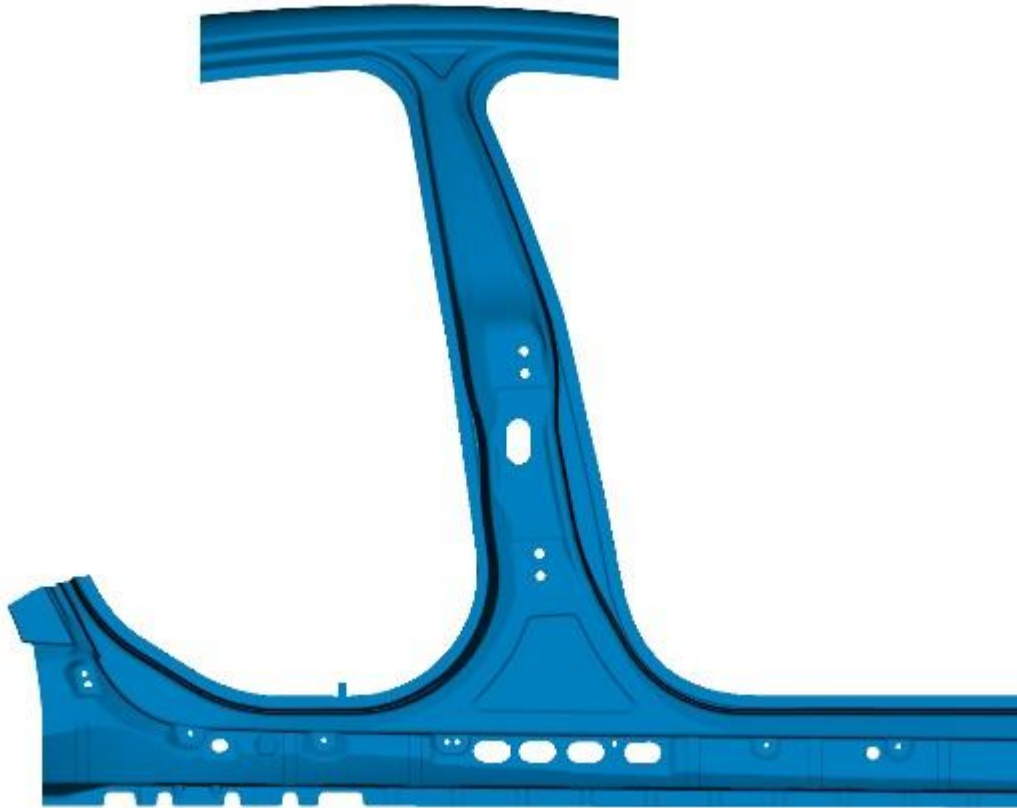
# Side Panel Sheet Metal Repairs - Rocker Panel and B-Pillar Outer Panel

Removal and Installation

## Removal

1. NOTE: The rocker panel and B-pillar outer panel is manufactured from mild steel.

The rocker panel and B-pillar outer panel is serviced as a separate weld-on panel. It is not serviced with its NVH (noise, vibration and harshness) components.



E104782

2. NOTE: The rocker panel and B-pillar outer panel is spot welded to the cant rail reinforcement which is boron steel. In repair spot welds are replaced with MIG braze and MIG braze slots in these areas.

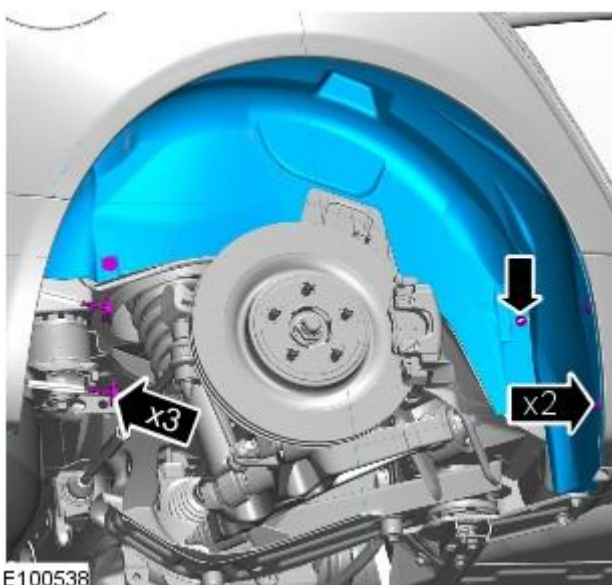
The rocker panel and B-pillar outer panel is replaced in conjunction with:

1. Front door
2. Rear door
3. B-pillar reinforcement
4. Headliner

3. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove the front seat.  
For additional information, refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).
5. Disconnect the generator electrical connectors.

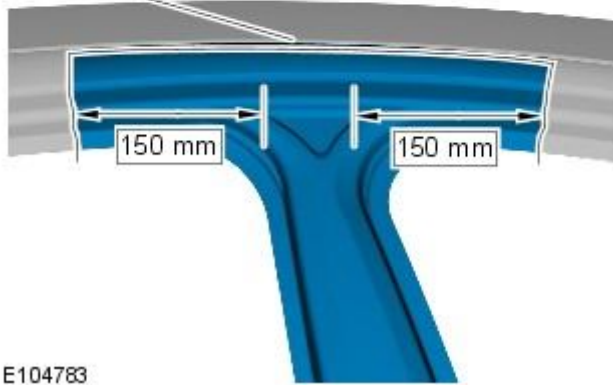
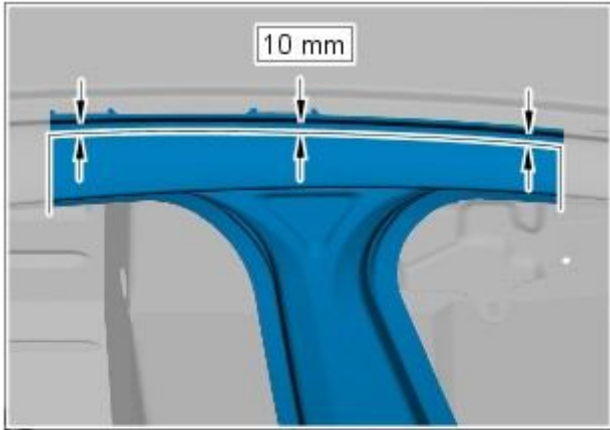
6. Remove the right-hand and left-hand front scuff plate trim panels.  
For additional information, refer to: [Front Scuff Plate Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
7. Remove the front and rear door weatherstrips.
8. Remove the right-hand and left-hand rear scuff plate trim panels.  
For additional information, refer to: [Rear Scuff Plate Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
9. Remove the headliner.  
For additional information, refer to: [Headliner](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
10. Remove the side air curtain module.  
For additional information, refer to: Side Air Curtain Module (501-20B, Removal and Installation).
11. Remove the rear seat cushion.  
For additional information, refer to: [Rear Seat Cushion](#) (501-10 Seating, Removal and Installation).
12. Remove the rear seat backrest.
13. Release and position the roof wiring harness to one side.
14. Remove the roof moulding.
15. Remove the cowl side trim panel.  
For additional information, refer to: [Cowl Side Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
16. Remove the front safety belt retractor.  
For additional information, refer to: [Front Safety Belt Retractor](#) (501-20A Safety Belt System, Removal and Installation).
17. Remove the B-pillar side impact sensor.  
For additional information, refer to: [B-Pillar Side Impact Sensor](#) (501-20B Supplemental Restraint System, Removal and Installation).
18. Remove the C-pillar side impact sensor.  
For additional information, refer to: [C-Pillar Side Impact Sensor](#) (501-20B Supplemental Restraint System, Removal and Installation).
19. Release and position the floor covering to one side.
20. Release and position the inner rocker panel wiring harness to one side.
21. Remove the rear wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
22. NOTE: Right-hand shown, left-hand similar.

Remove the rear fender splash shield.

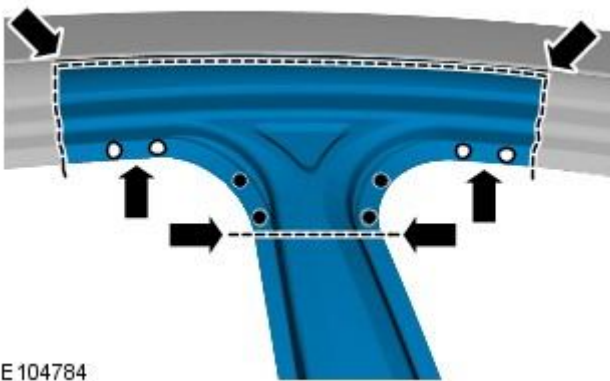


23. Remove the rocker panel outer moulding.
24. Remove the underfloor splash shield.
25. If the right-hand rocker panel is to be repaired, release and position the underfloor wiring harness to one side.


26. Remove the front door.  
For additional information, refer to: [Front Door](#) (501-03 Body Closures, Removal and Installation).
27. Remove the rear door.  
For additional information, refer to: [Rear Door](#) (501-03 Body Closures, Removal and Installation).
28. Remove the rear door upper and lower hinges from the B-pillar.
29. Measure and mark out a section on the B-pillar upper, on the vehicle as indicated.



E104783



E 104784

30.  CAUTION: Care should be taken not to cut through into the inner panels.

• NOTE: A drill bit suitable for drilling boron should be used on the 4 upper boron spot welds.

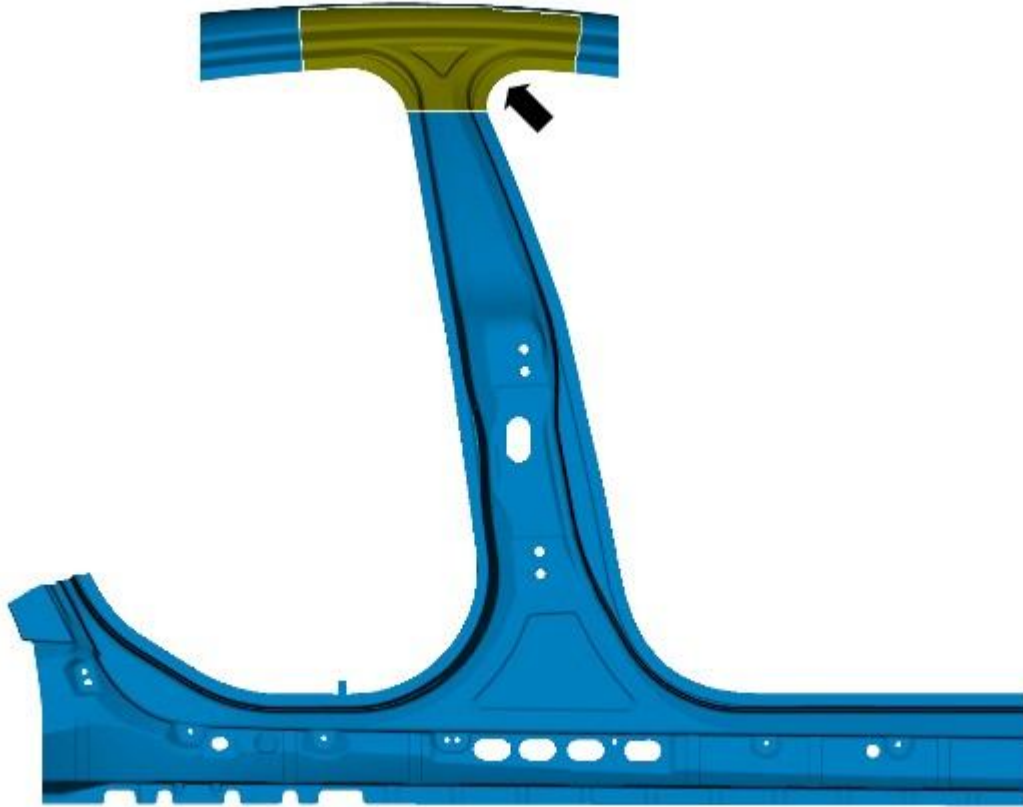
Cut the section of the B-pillar upper at the points indicated and drill out the spot welds.

31. NOTE: Care should be taken when separating and removing the section as it will be used as a template.

Carefully separate the section of the B-pillar upper and remove.

32. NOTE: Dress the panel joint surfaces of the template to make sure it is a good fit.

Offer up, align and clamp the template into position on the new rocker panel and B-pillar outer panel. Cut around the edge of the template, through the new rocker panel and B-pillar outer panel at the points indicated, where the MIG brazed butt joint is to be made.



E104788

33. Remove the template from the new panel.

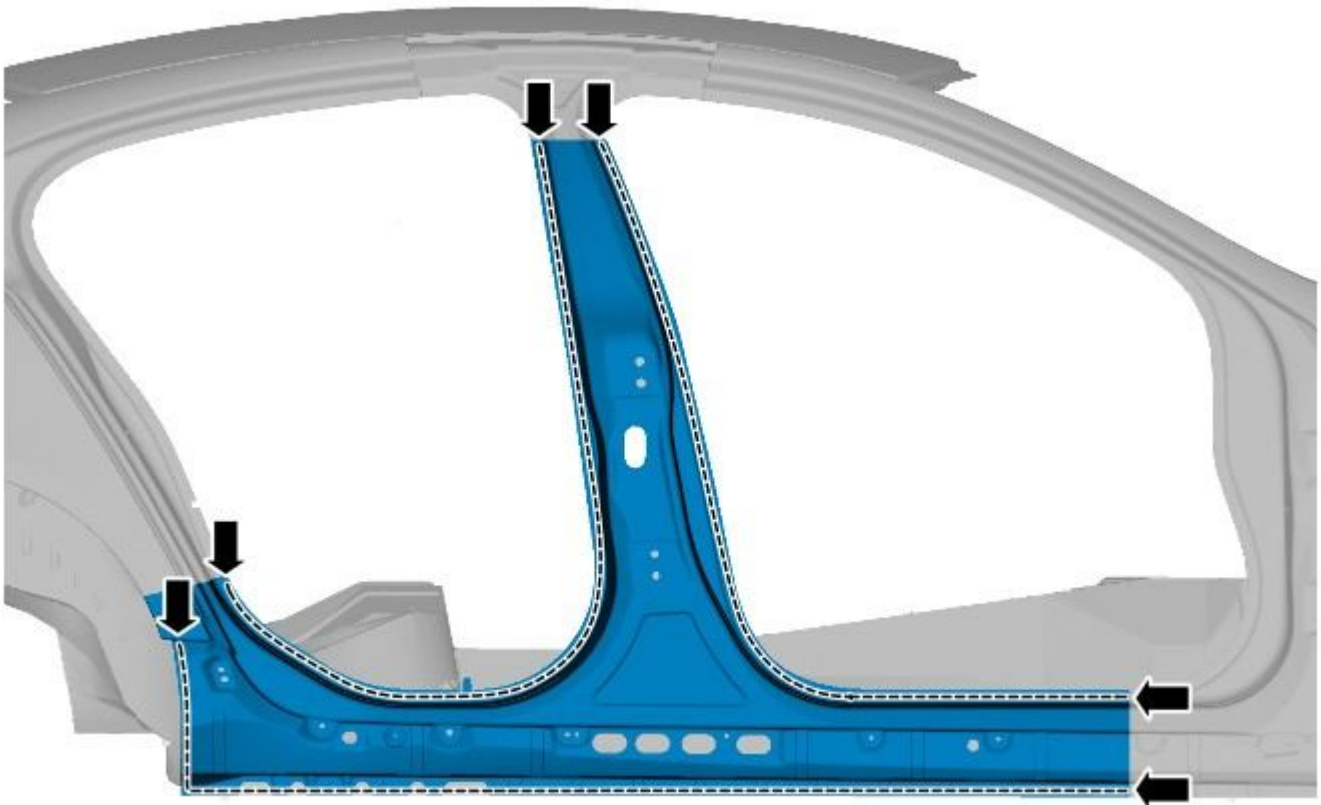
34. NOTE: This procedure shows the rocker panel part of the rocker panel and B-pillar outer panel being installed to its service condition. The rocker panel lower butt joints could be performed closer to the B-pillar, dependant on the extent of the damage.

Using the new panel for reference and allowing for an overlap, cut the old panel at the points indicated.



E104785


35. Drill out the spot welds.



E104787

36. Separate the joints and remove the bulk of the old panel.

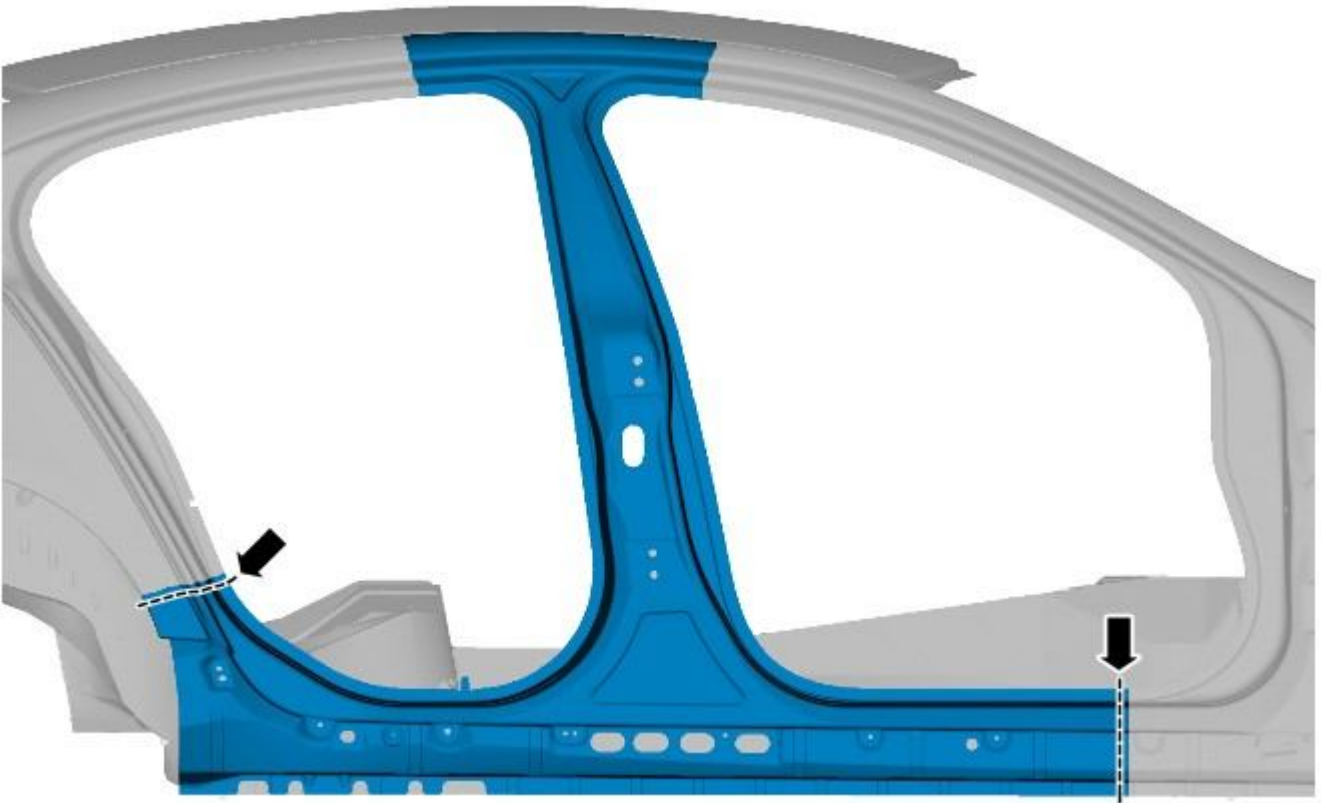
### Installation

1.  CAUTION: Care should be taken not to cut through into the inner panels.

• NOTE: Temporarily install the front door and the rear door and hinges, to aid alignment.

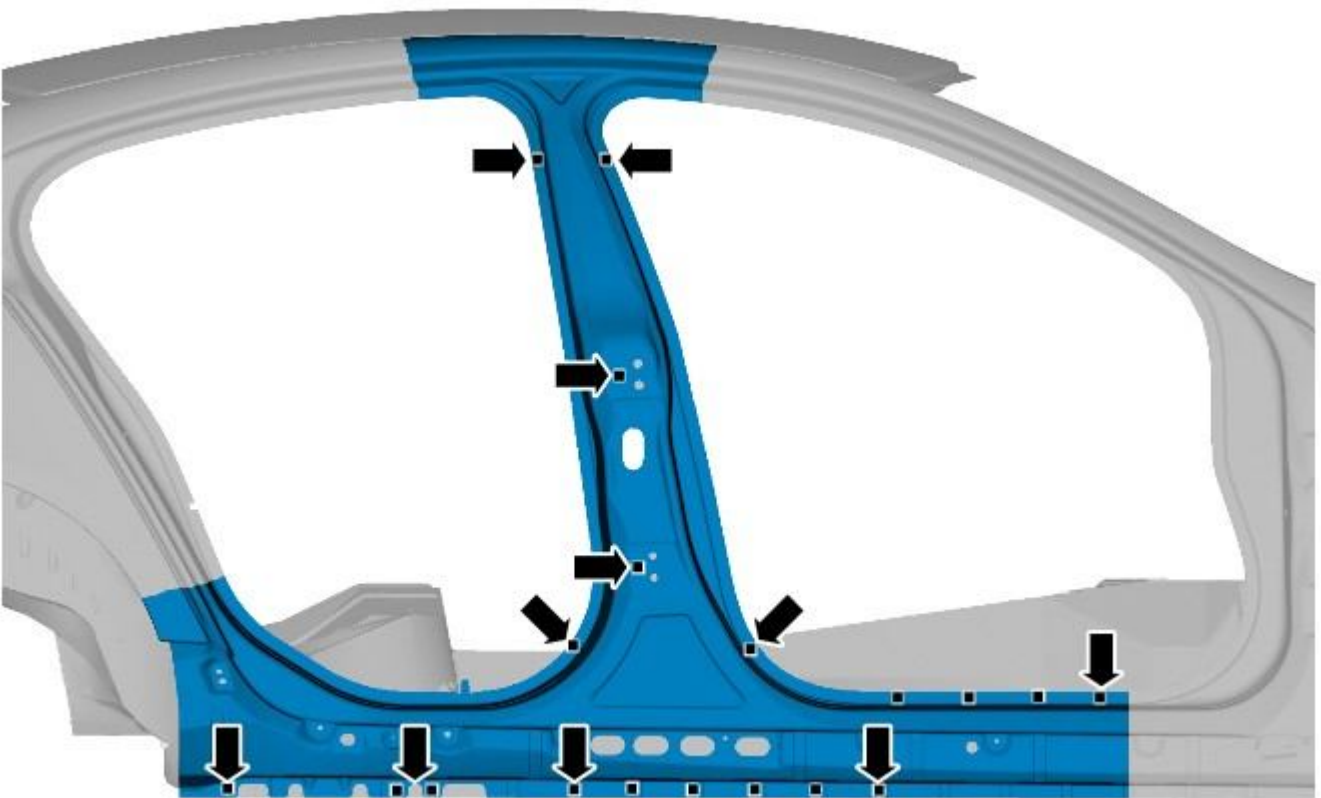
Offer up, align and clamp the new panel into position, overlapping the old panel remnant. Cut through the new panel, partially cutting the old panel at the points where the MAG butt joints are to be made.





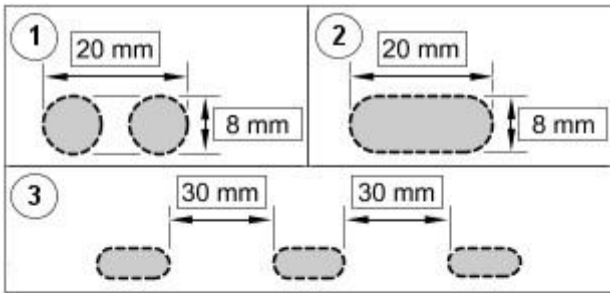
E104789

2. Remove the front door and the rear door and hinges and the new rocker panel and B-pillar outer panel.
3. Cut and remove the old panel remnants.
4. Drill holes in the new panel ready for MAG plug welding.



E104795

5. Cut slots in the new panel ready for MIG braze slots.



E104791

6. NOTE: If necessary, renew the NVH component.

Prepare the old and new panel joint surfaces, including the NVH component.

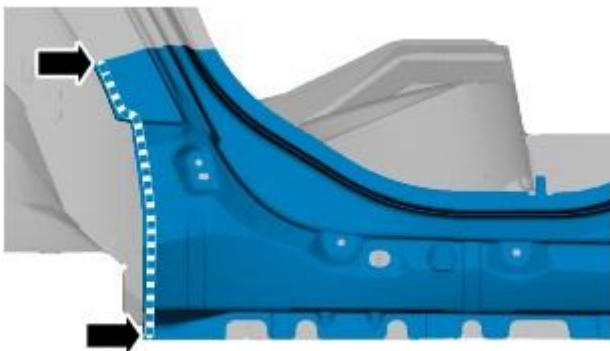
7. NOTE: Temporarily install the front door and the rear door and hinges, to aid alignment.

Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

8. Remove the front door and the rear door and hinges and the new rocker panel and B-pillar outer panel.

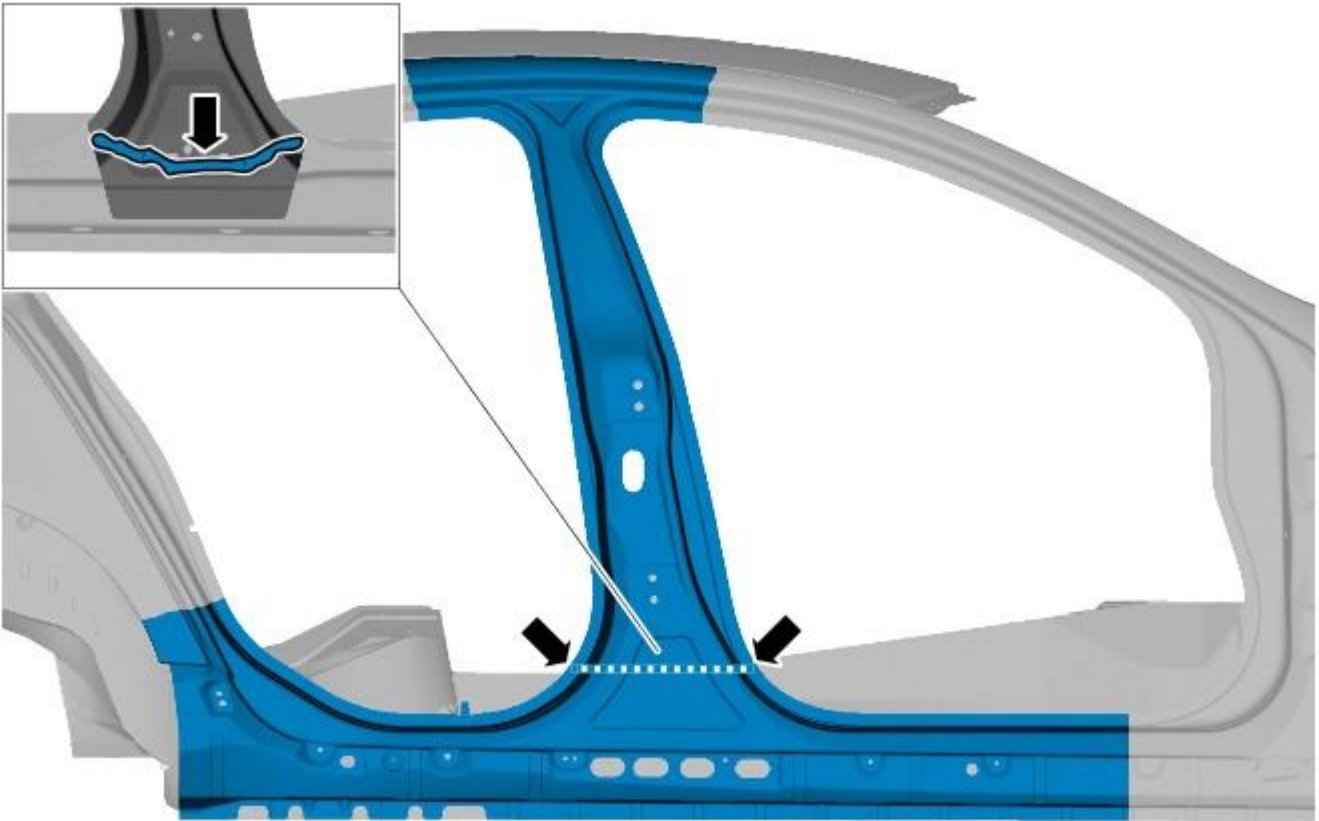
9. NOTE: Make sure the adhesive does not encroach into the area of the butt joint as it will contaminate the weld (any unsealed areas must be sealed following the repair).

Apply adhesive to the area as indicated.



E 104790

10. Apply sealer adhesive to the NVH component as indicated.



E104794

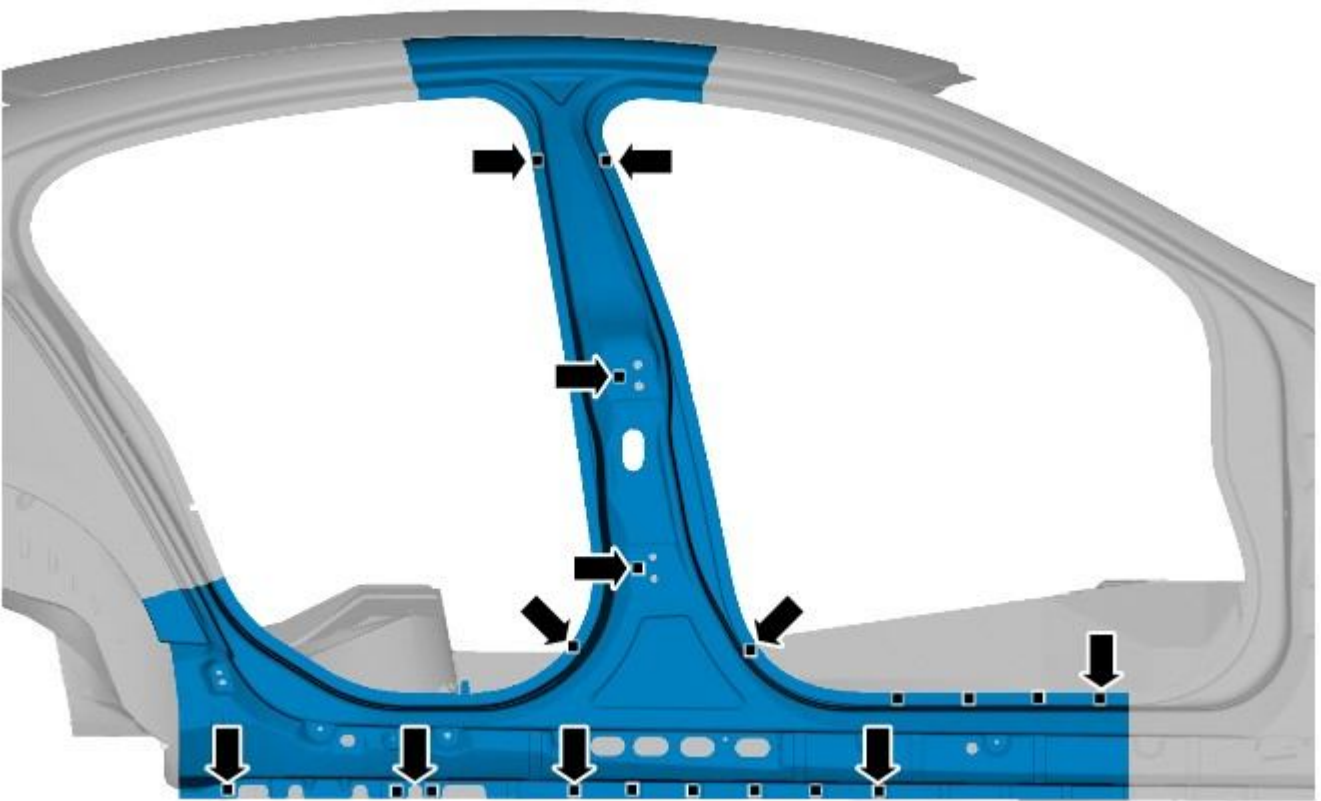
11. Offer up the new rocker panel and B-pillar outer panel, align and clamp into position.
12. Tack MIG braze the upper butt joint.
13. Tack MAG weld the lower butt joints.
14. NOTE: Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original. Where there is adhesive in the original joint, spot welds should be installed through the original.

Spot weld.



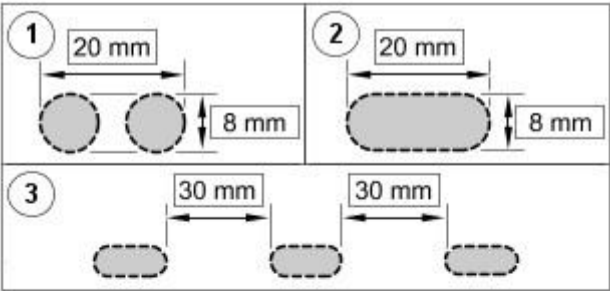
E104793

15. MAG plug weld.



E104795

16. MIG Braze the slots.



17. Dress the tack welds/braze.

18. MIG braze the upper butt joint.



19. MAG weld the lower butt joints.



E104786

**20.** Dress all welded/brazed joints.

**21.** The installation of associated panels and components is the reversal of removal procedure.



# Side Panel Sheet Metal Repairs - Rocker Panel Front Section

Removal and Installation

## Removal

1. **NOTE:** The rocker panel front section is manufactured from mild steel.

The rocker panel front section is cut from the rocker panel service panel. It is not serviced with its riv-nuts for the fender fixings, or **NVH (noise, vibration and harshness)** components.

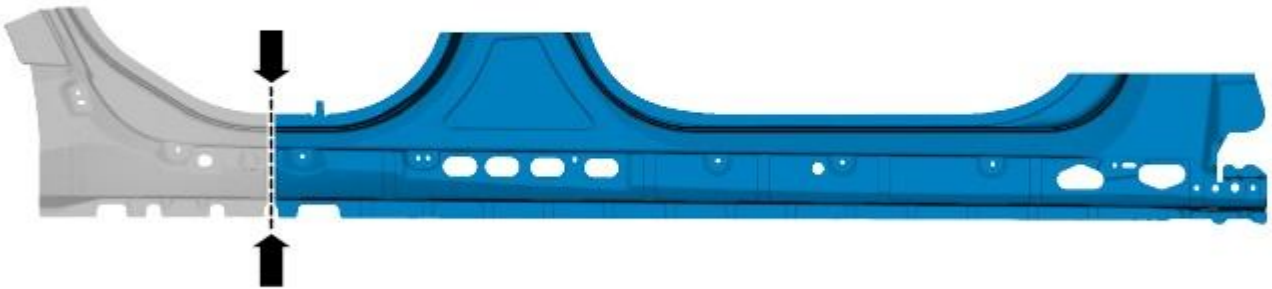


E102804


2. The rocker panel front section is replaced in conjunction with:
  1. Front fender
  2. Front door
  3. Rear door
3. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove the front seat.  
For additional information, refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).
5. Disconnect the generator electrical connectors.
6. Remove the rear seat cushion.  
For additional information, refer to: [Rear Seat Cushion](#) (501-10 Seating, Removal and Installation).
7. Remove the front and rear door weatherstrips.
8. Remove the cowl side trim panel.  
For additional information, refer to: [Cowl Side Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
9. Remove the front safety belt retractor.  
For additional information, refer to: [Front Safety Belt Retractor](#) (501-20A Safety Belt System, Removal and Installation).
10. Remove the B-pillar side impact sensor.  
For additional information, refer to: [B-Pillar Side Impact Sensor](#) (501-20B Supplemental Restraint System, Removal and Installation).
11. Remove the C-pillar side impact sensor.  
For additional information, refer to: [C-Pillar Side Impact Sensor](#)

(501-20B Supplemental Restraint System, Removal and Installation).

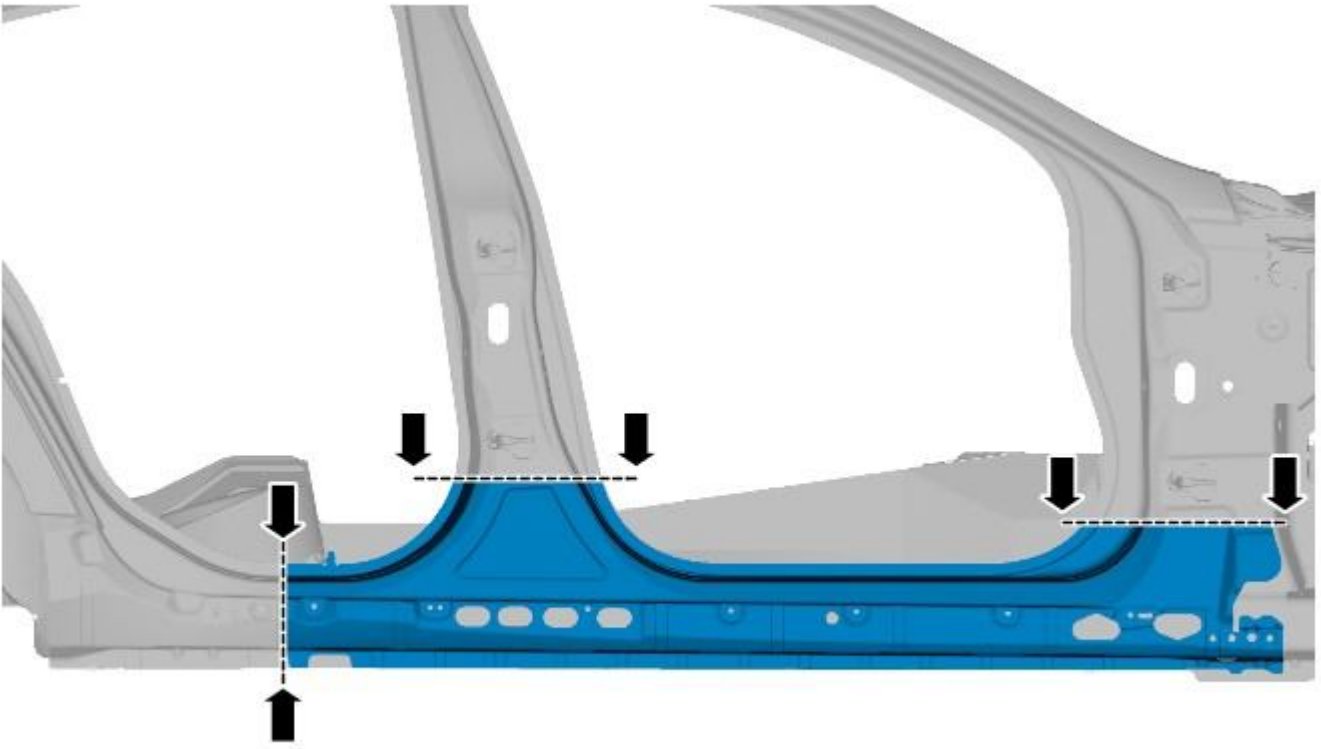
12. Release and position the floor covering to one side.
13. Release and position the inner rocker panel wiring harness to one side.
14. Remove the rocker panel outer moulding.
15. Remove the underfloor splash shield.
16. If the right-hand rocker panel front section is to be repaired, release and position the underfloor wiring harness to one side.
17. Remove the front fender.  
For additional information, refer to: [Front Fender](#) (501-27 Front End Sheet Metal Repairs, Removal and Installation).
18. Remove the front door.  
For additional information, refer to: [Front Door](#) (501-03 Body Closures, Removal and Installation).
19. Remove the rear door.  
For additional information, refer to: [Rear Door](#) (501-03 Body Closures, Removal and Installation).
20. Cut the new rocker panel front section from the new rocker panel service panel.



E102808

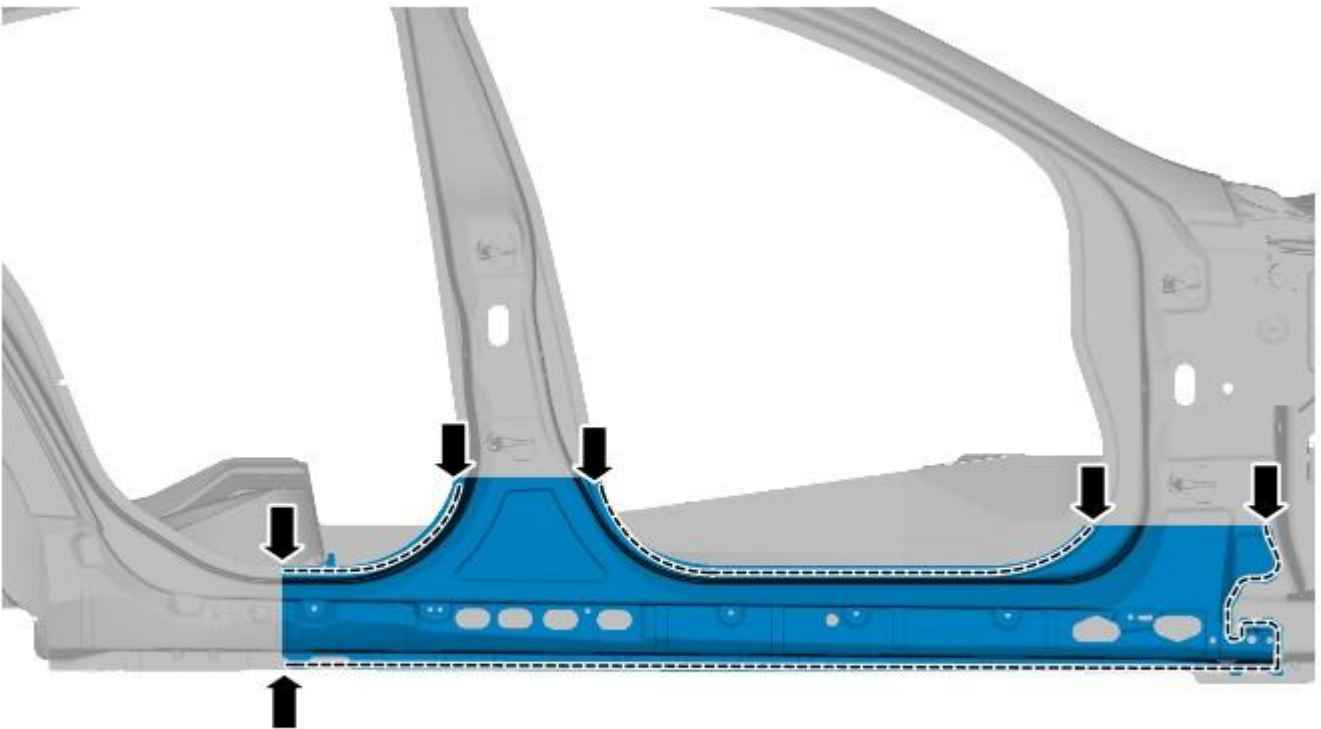
21.  **CAUTION:** Care should be taken not to cut through into the inner panels.

Using the new panel for reference and allowing for an overlap, cut the old panel at the points indicated.



E102805

22. Drill out the spot welds.

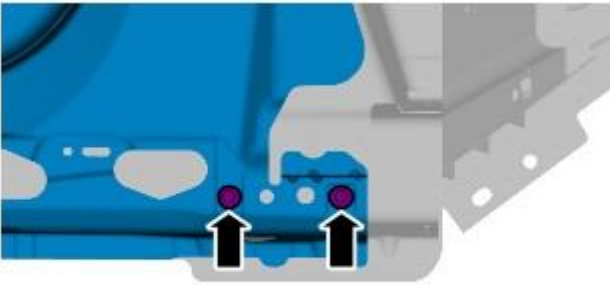


E102806


23. Separate the joints and remove the bulk of the old panel.

## Installation

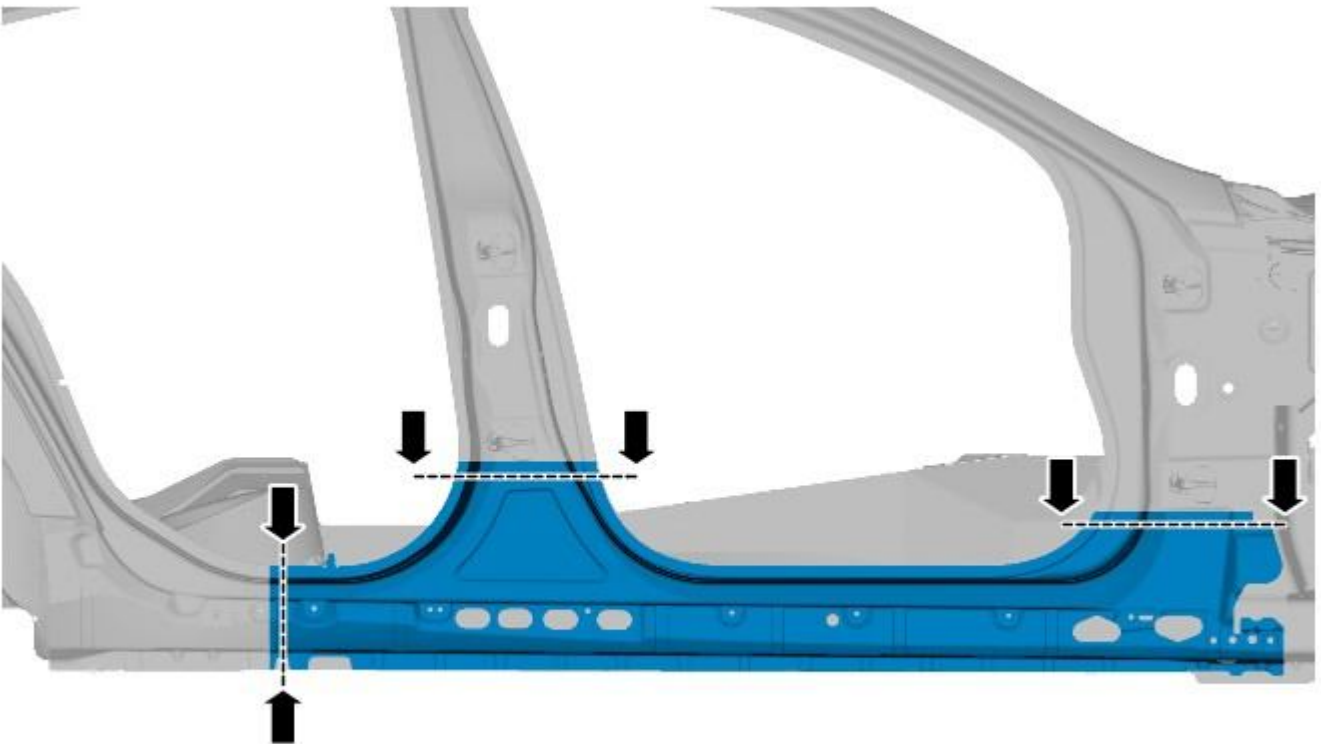
1. Install the riv-nuts into the new rocker panel front section as indicated.



E102807

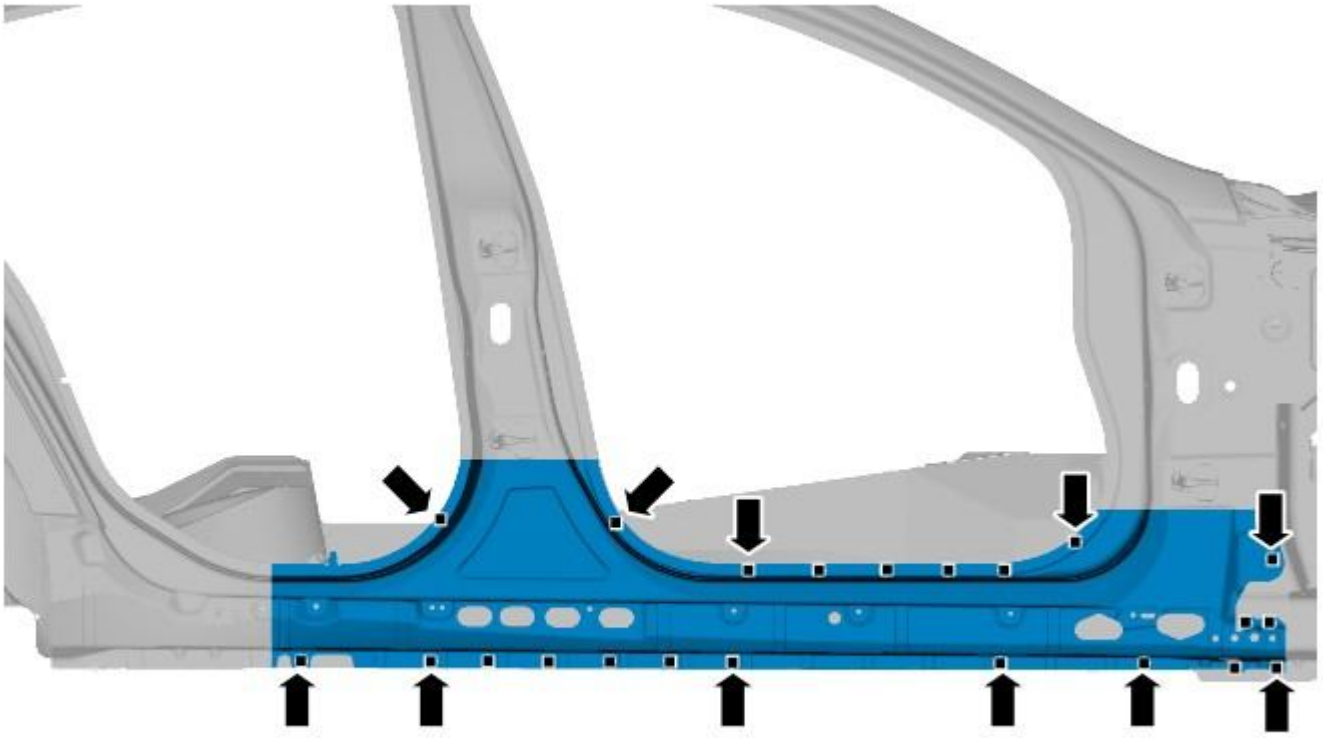
2.  CAUTION: Care should be taken not to cut through into the inner panels.

Offer up, align and clamp the new panel into position, overlapping the old panel remnant. Cut through the new panel, partially cutting the old panel, at the points where the MAG butt joints are to be made.



E102809

3. Remove the new panel.
4. Cut and remove the old panel remnants.
5. Drill holes in the new panel ready for MAG plug welding.



E102810

**6. NOTE:** If necessary renew the NVH components.

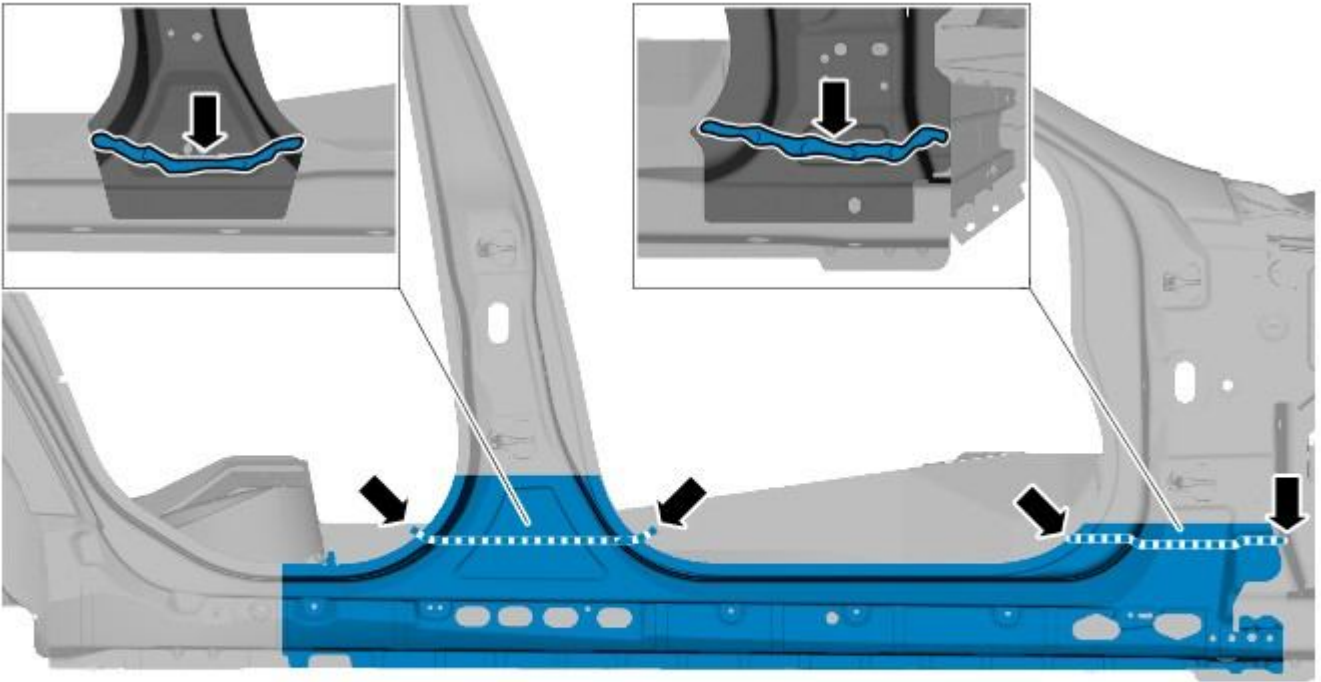
Prepare the old and new panel joint surfaces, including the NVH components.

**7. NOTE:** Temporarily install the front and rear doors and front fender to aid alignment.

Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

**8.** Remove the front and rear doors, front fender and the new rocker panel front section.

**9.** Apply sealer adhesive to the NVH components as indicated.



E102811

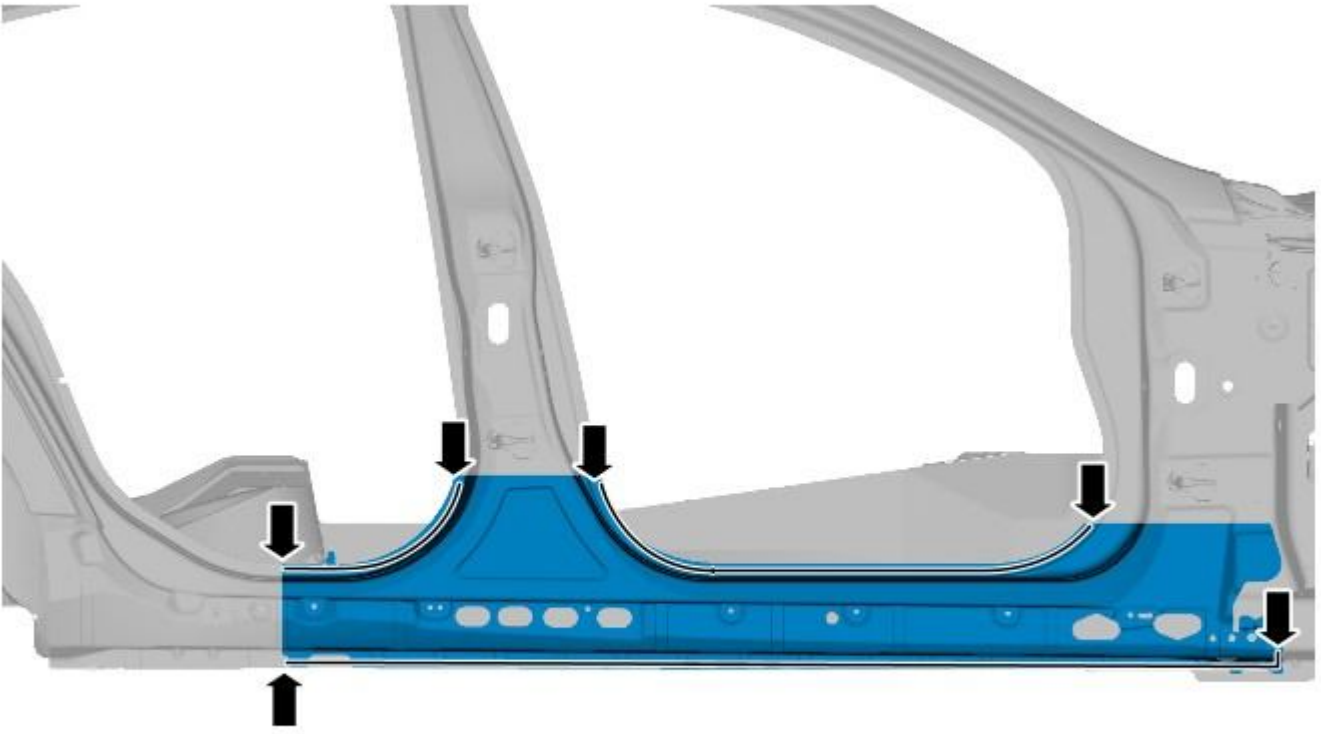
**10.** Offer up the new rocker panel front section, align and clamp into position.

**11.** Tack weld the butt joints.

**12. NOTE:** Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original. Where there is adhesive in the original joint, spot welds should be installed through the original.

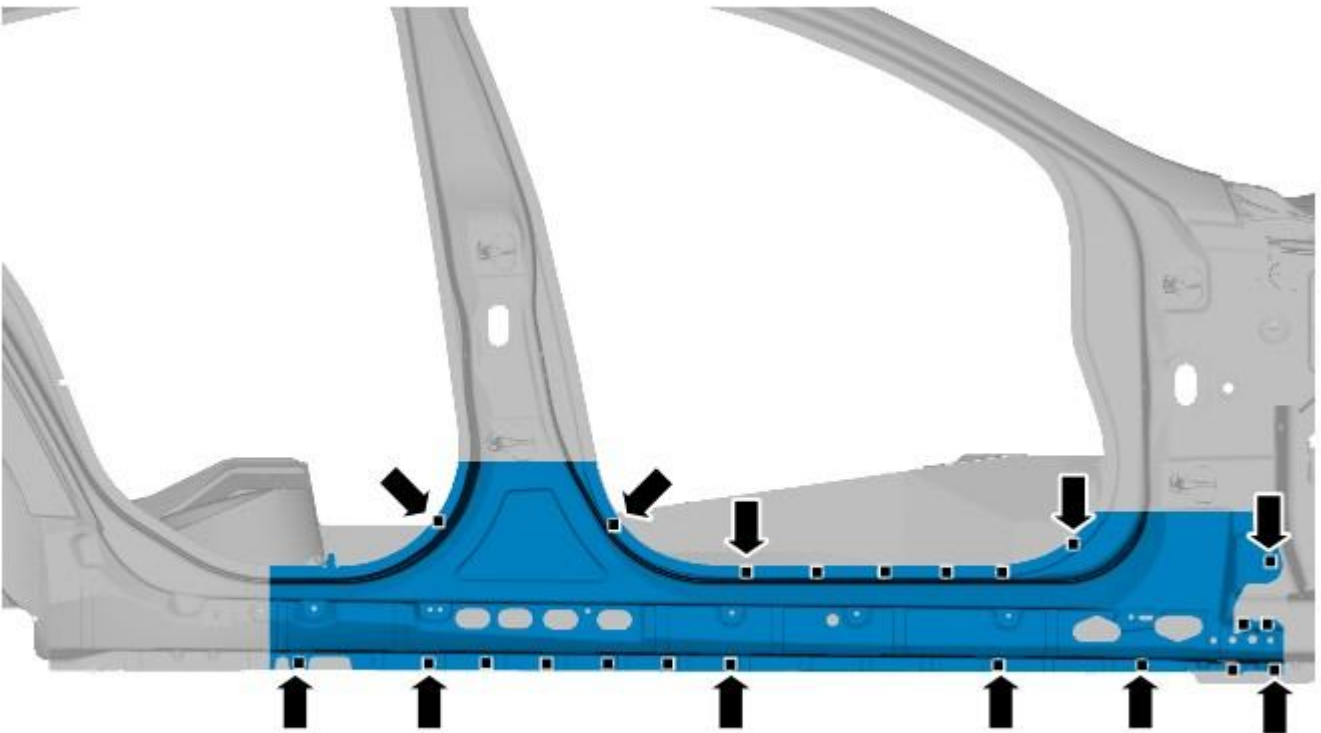
Spot weld.





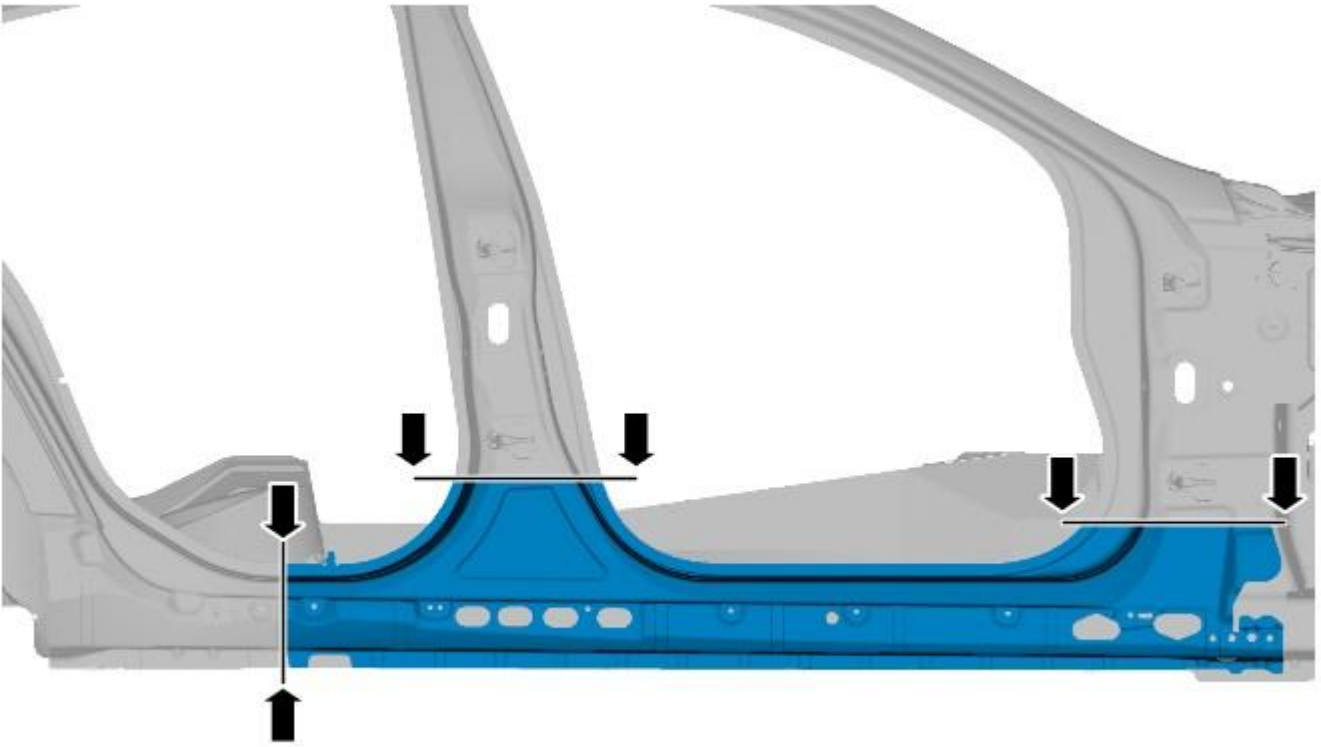
E 102813

13. MAG plug weld.



E102810

14. Dress the tack welds.  
15. MAG weld the butt joints.



E102814

**16.** Dress all welded joints.

**17.** The joint between the rocker panel and A-pillar must be sealed following the repair as indicated.



E102812

**18.** The installation of associated panels and components is the reversal of removal procedure.

# Side Panel Sheet Metal Repairs - Rocker Panel Inner Reinforcement

Removal and Installation

## Removal

**1. NOTE:** The rocker panel inner reinforcement is manufactured from Dual Phase Steel, 600MPa, (DP600).

The rocker panel inner reinforcement is serviced as a separate weld-on panel. This procedure defines the rocker panel inner reinforcement to be sectioned to enable fitment of the B-pillar inner panel.



E107660

**2.** The rocker panel inner reinforcement is replaced in conjunction with:

1. Front door
2. Rear door
3. Rocker panel and B-pillar outer panel
4. B-pillar reinforcement
5. Headliner

**3.** For additional information relating to this repair procedure please see the following:

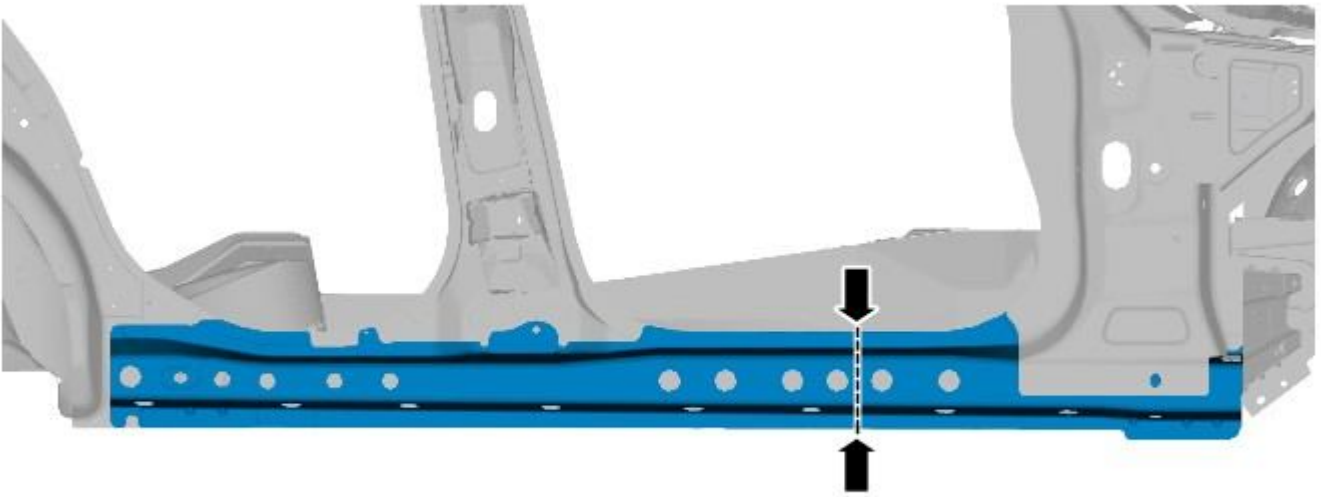
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

**4.** Remove the B-pillar reinforcement.

For additional information, refer to: [B-Pillar Reinforcement](#) (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).

**5. NOTE:** When replaced in association with other inner and outer panel sections, make sure there is always a minimum 50mm staggered joint between every section.

Cut the old panel at the point indicated.

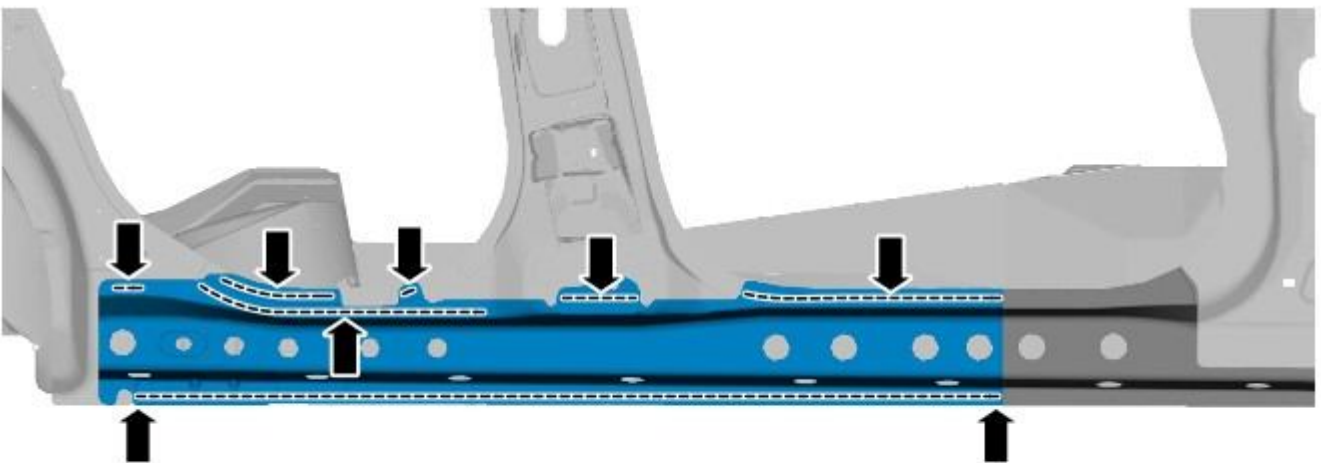


E107661

6. NOTE: A drill bit suitable for drilling DP600 should be used.

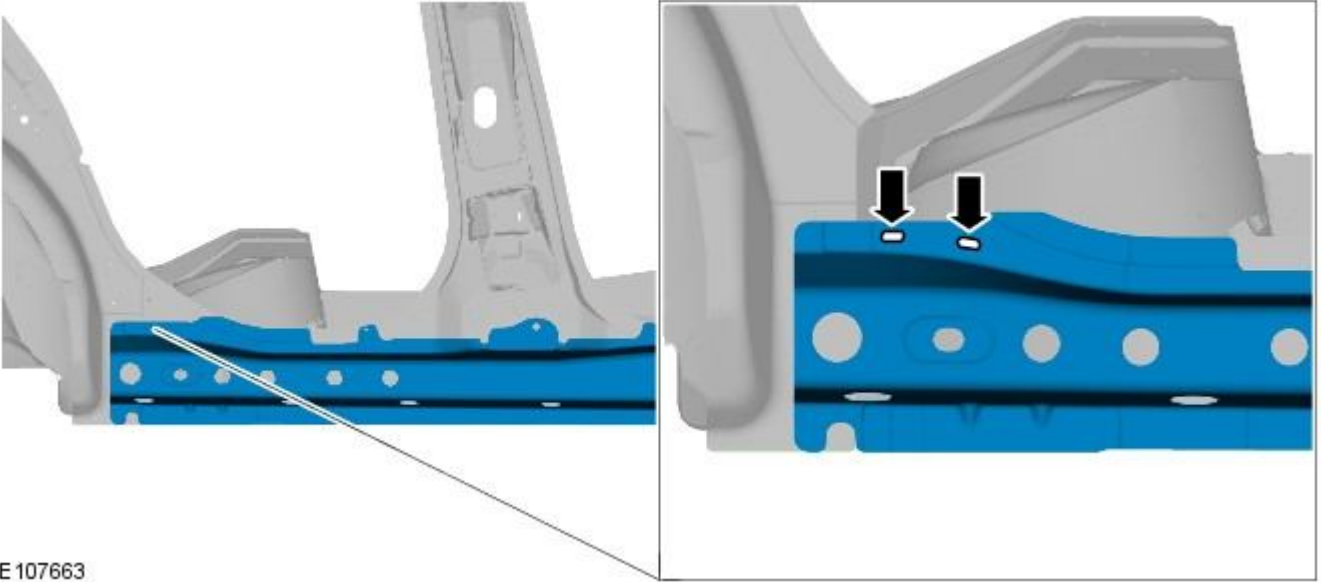
- NOTE: There are spot welds located under the adhesive residue left by the removal of the B-pillar reinforcement.

Drill out the spot welds.



E107662

7. Using a belt sander, release the rocker panel inner reinforcement from the MAG welds at the points indicated.

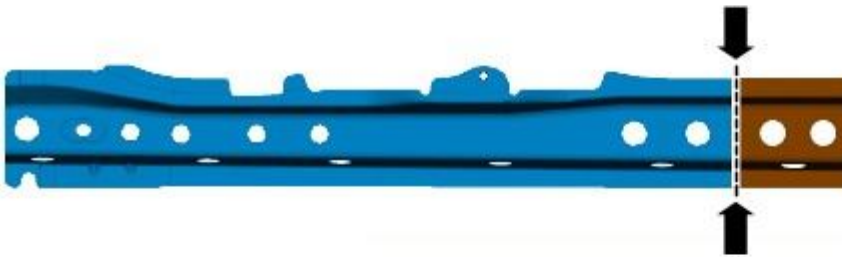


E107663

8. Separate the joints and remove the old panel.

### Installation

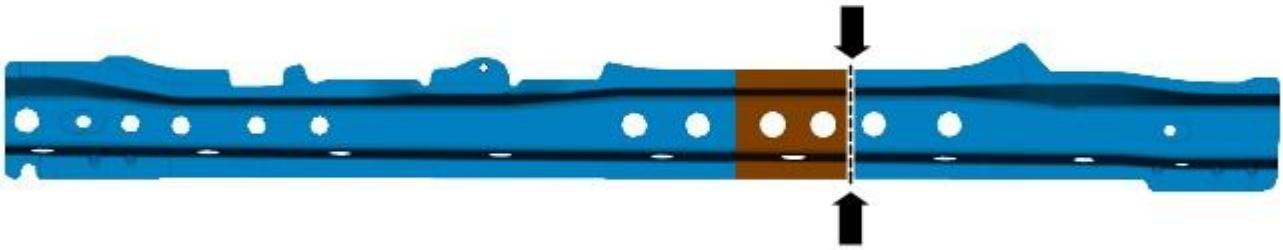
1. Cut a short section from the front end of the old panel, to be used as a template.



E107664

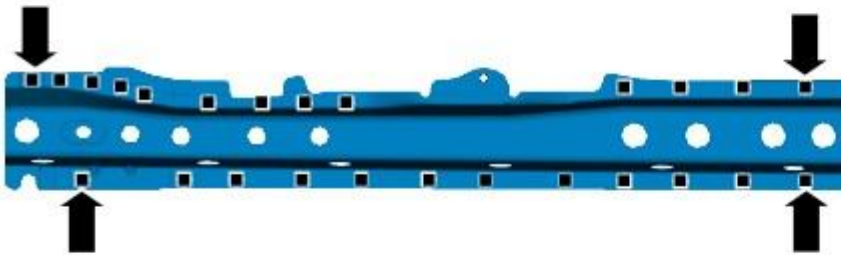
2. NOTE: Dress the panel joint surfaces of the template to ensure a good fit.

Offer up, align and clamp the template into position on the new rocker panel inner reinforcement. Cut along the edge of the template, through the new panel, at the point indicated, where the MAG butt joint is to be made.



E 107665

3. Remove the template from the new panel.
4. Drill holes in the new panel ready for MAG plug welding.

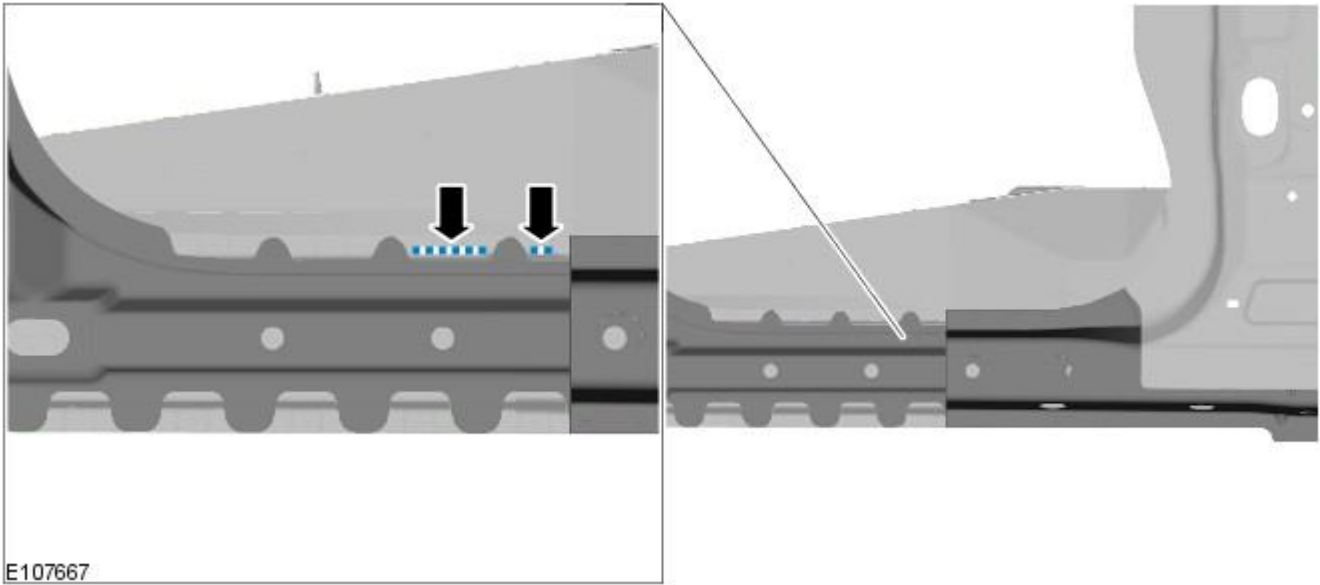


E 107666

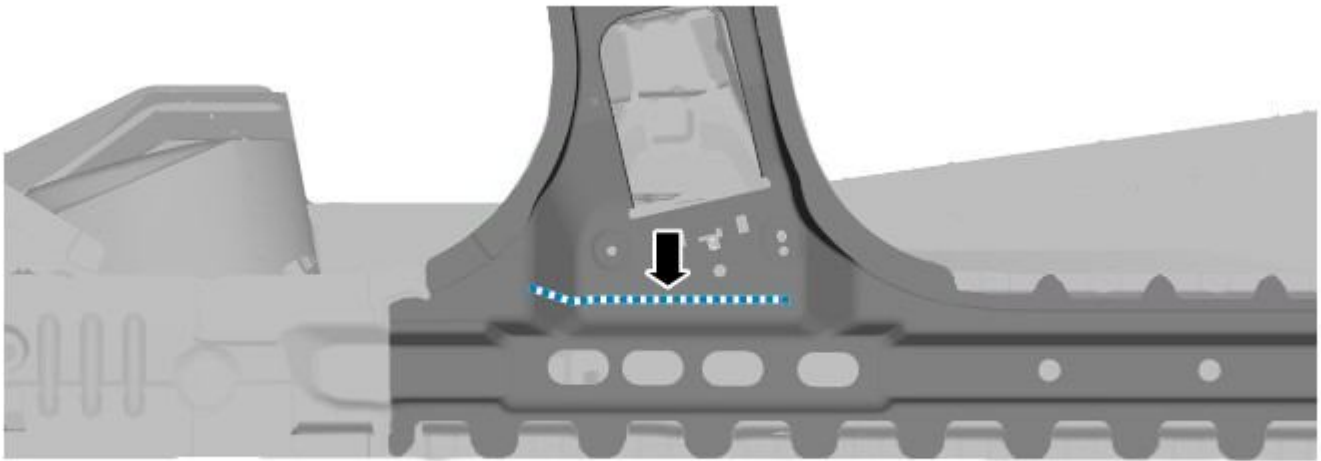
5. Prepare the old and new panel joint surfaces.
6. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.
7. Remove the new rocker panel inner reinforcement.
8. NOTE: Make sure the adhesive does not encroach into the areas of the MAG plug welds or butt joint as it will contaminate the weld.

Apply adhesive to the area, as indicated.





9. Apply adhesive to the area, as indicated.



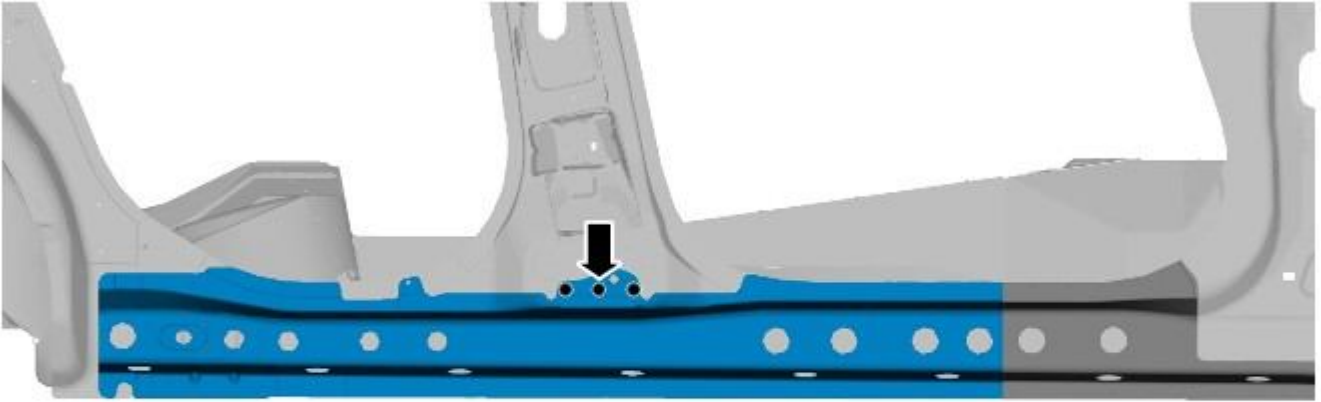
E107668

10. Offer up the new panel, align and clamp into position.

11. MAG tack weld the butt joint.

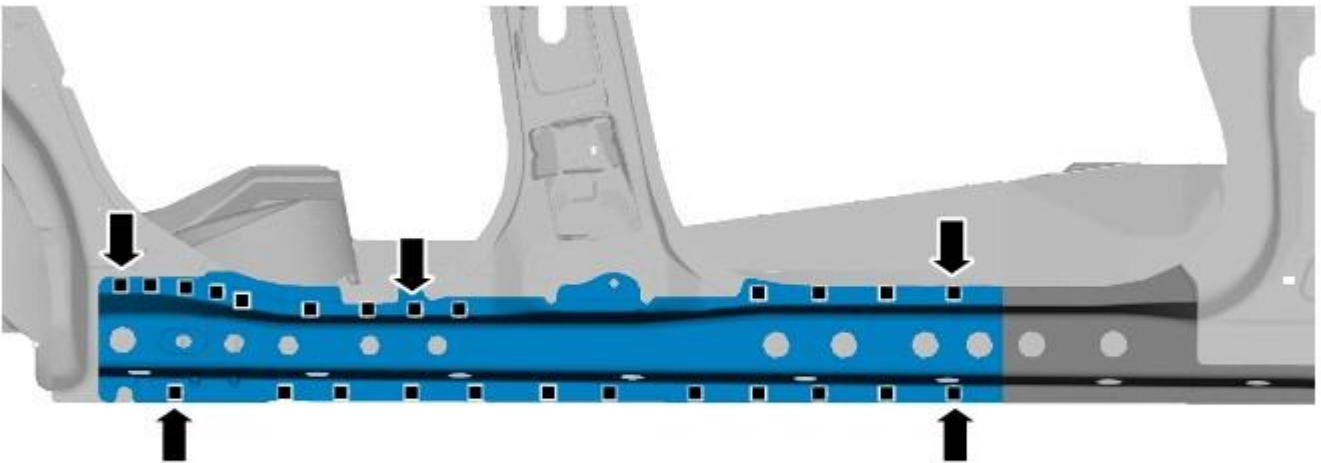
12. NOTE: Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original. Where there is adhesive in the original joint, spot welds should be installed through the original.

Spot weld.



E107669

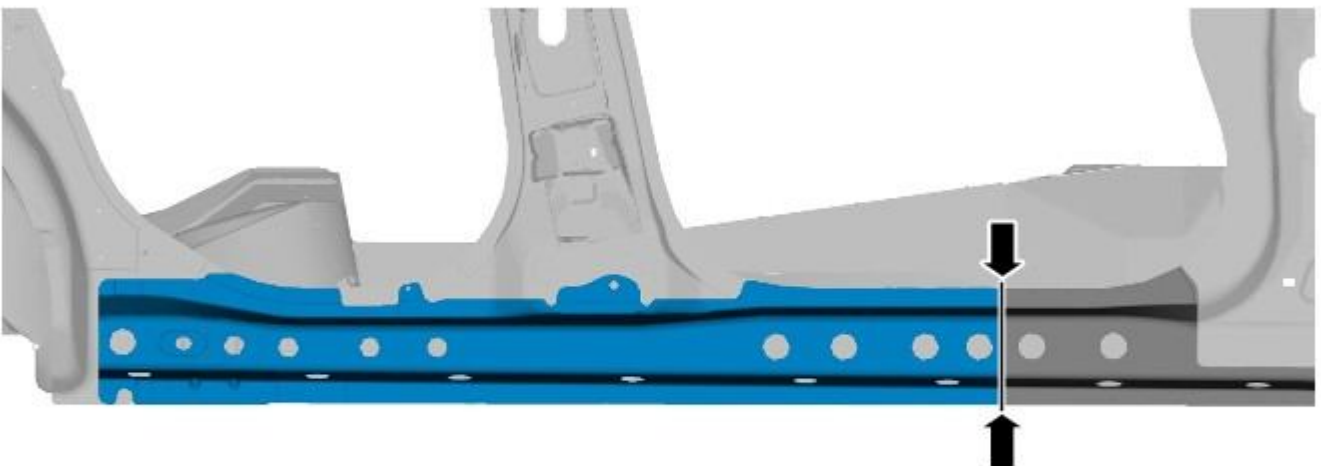
13. MAG plug weld.



E107670

14. Dress the tack welds.

15. MAG weld the butt joint.



E107671

- 16.** Dress all welded joints.
- 17.** Make sure any remaining areas of bare metal created during this procedure are treated with a zinc primer prior to the installation of outer panels.
- 18.** The installation of associated panels and components is the reversal of removal procedure.

# Side Panel Sheet Metal Repairs - Rocker Panel Rear Section

Removal and Installation

## Removal

1. **NOTE:** The rocker panel rear section is manufactured from mild steel.

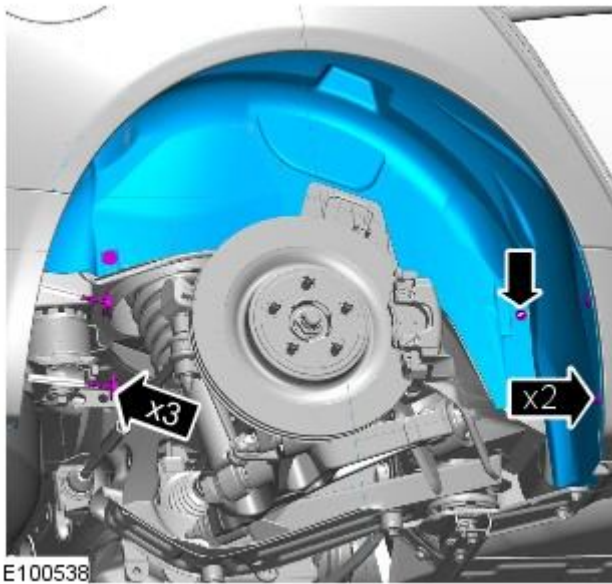
The rocker panel rear section is cut from the rocker panel service panel. It is not serviced with its **NVH (noise, vibration and harshness)** components.



E102815

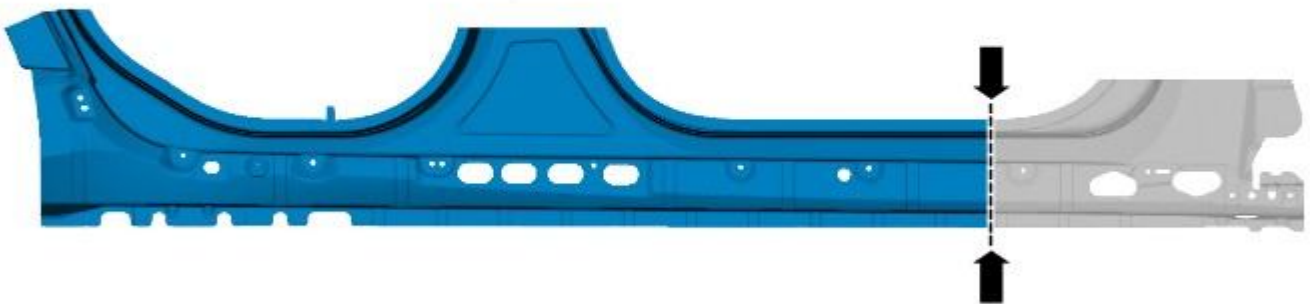
2. The rocker panel rear section is replaced in conjunction with:
  1. Front door
  2. Rear door
3. For additional information relating to this repair procedure please see the following:  
 For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) /  
[Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) /  
[Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) /  
[Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove the front seat.  
 For additional information, refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).
5. Disconnect the generator electrical connectors.
6. Remove the rear seat cushion.  
 For additional information, refer to: [Rear Seat Cushion](#) (501-10 Seating, Removal and Installation).
7. Remove the front and rear door weatherstrips.
8. Remove the cowl side trim panel.  
 For additional information, refer to: [Cowl Side Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
9. Remove the front safety belt retractor.  
 For additional information, refer to: [Front Safety Belt Retractor](#) (501-20A Safety Belt System, Removal and Installation).
10. Remove the B-pillar side impact sensor.  
 For additional information, refer to: [B-Pillar Side Impact Sensor](#) (501-20B Supplemental Restraint System, Removal and Installation).
11. Remove the C-pillar side impact sensor.  
 For additional information, refer to: [C-Pillar Side Impact Sensor](#) (501-20B Supplemental Restraint System, Removal and Installation).

12. Release and position the floor covering to one side.
13. Release and position the inner rocker panel wiring harness to one side.
14. Remove the rear wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
15. Remove the rear fender splash shield.




E100538

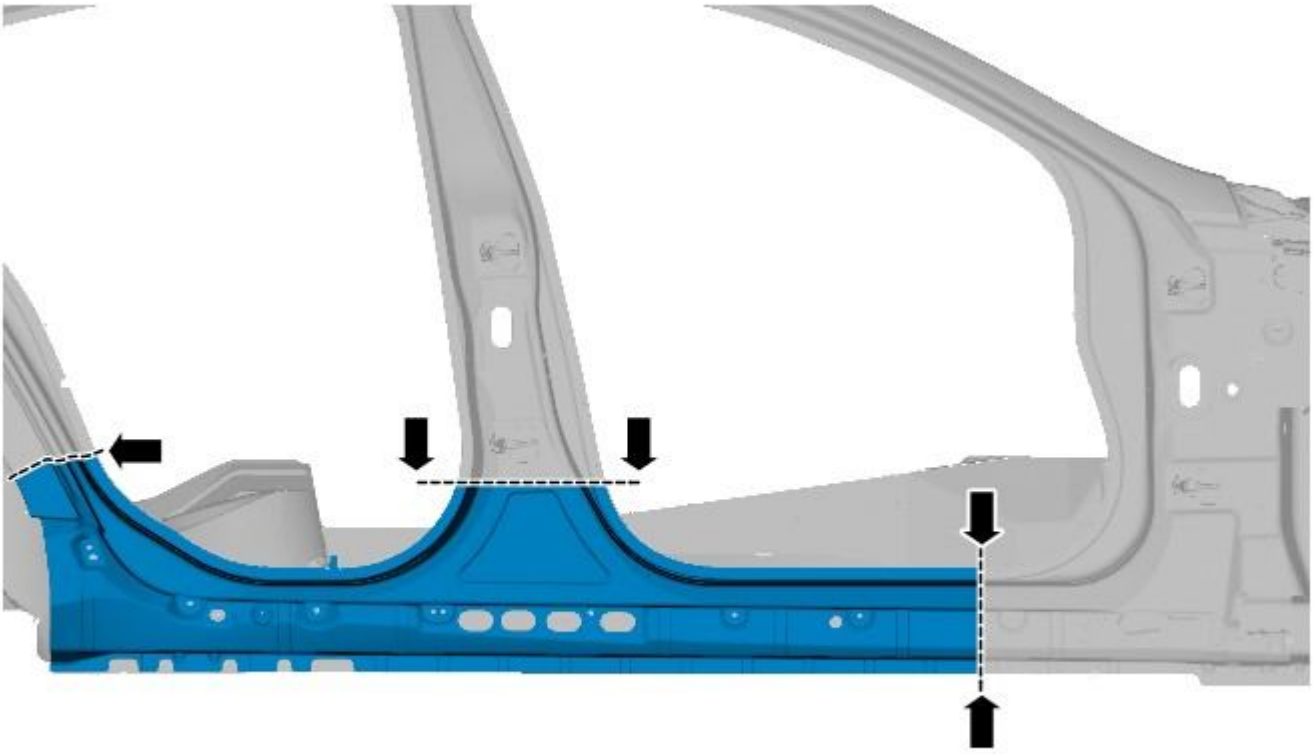
16. Remove the rocker panel outer moulding.
17. Remove the underfloor splash shield.
18. If the right-hand rocker panel rear section is to be repaired, release and position the underfloor wiring harness to one side.
19. Remove the front door.  
For additional information, refer to: [Front Door](#) (501-03 Body Closures, Removal and Installation).
20. Remove the rear door.  
For additional information, refer to: [Rear Door](#) (501-03 Body Closures, Removal and Installation).
21. Cut the new rocker panel rear section from the new rocker panel service panel.



E102818

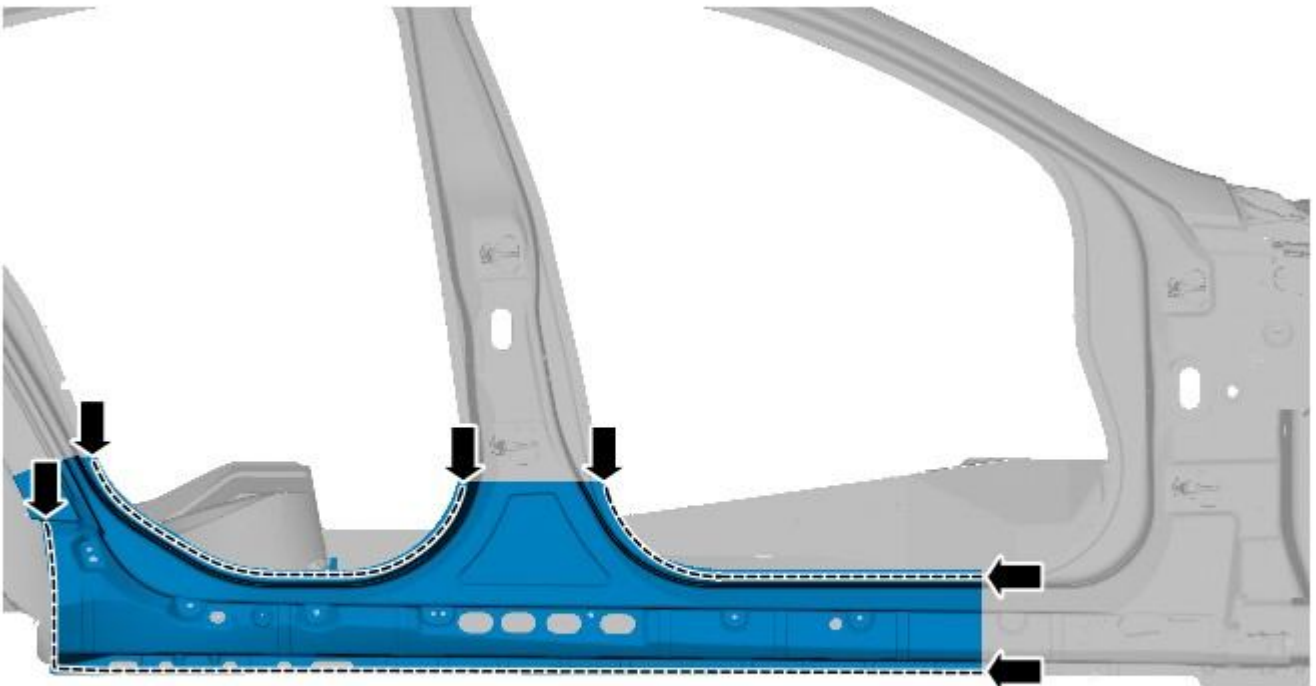
22.  **CAUTION:** Care should be taken not to cut through into the inner panels.

Using the new panel for reference and allowing for an overlap, cut the old panel at the points indicated.



E102816


23. Drill out the spot welds.



E102817

24. Separate the joints and remove the bulk of the old panel.

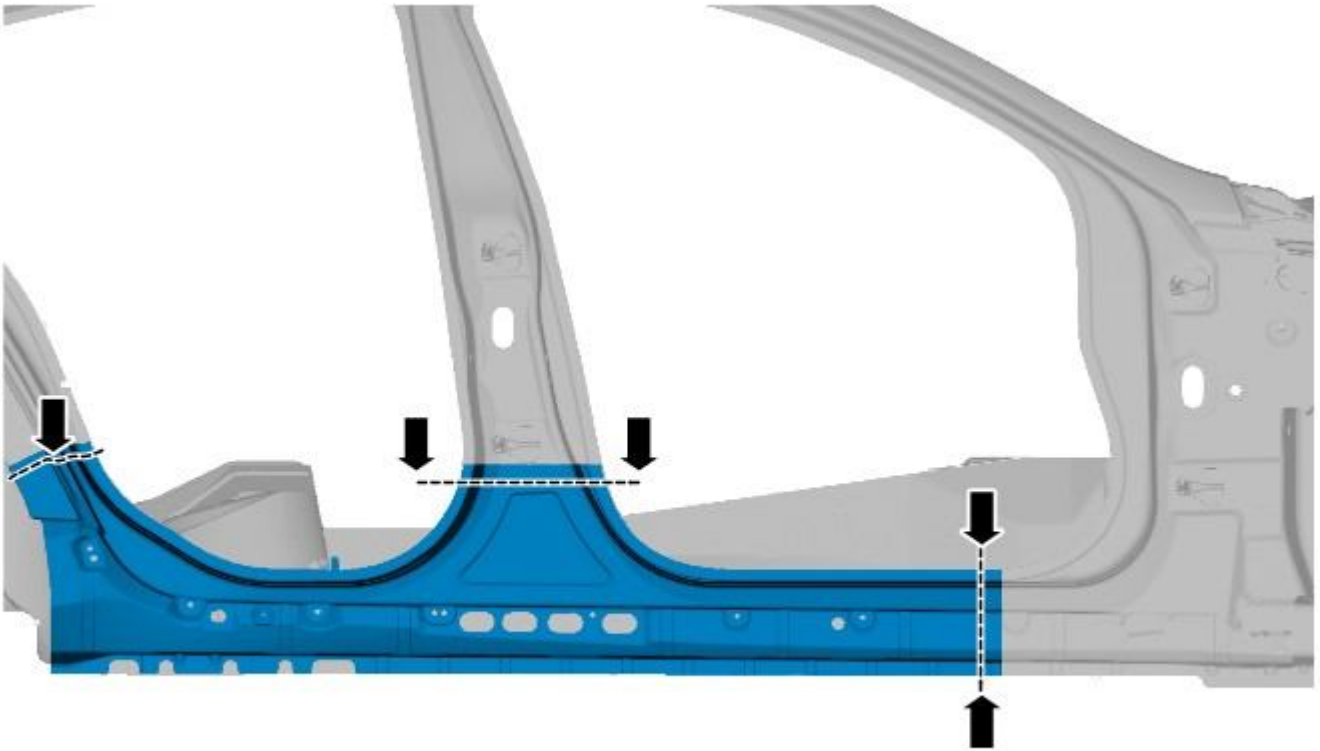
### Installation

1.  CAUTION: Care should be taken not to cut through into



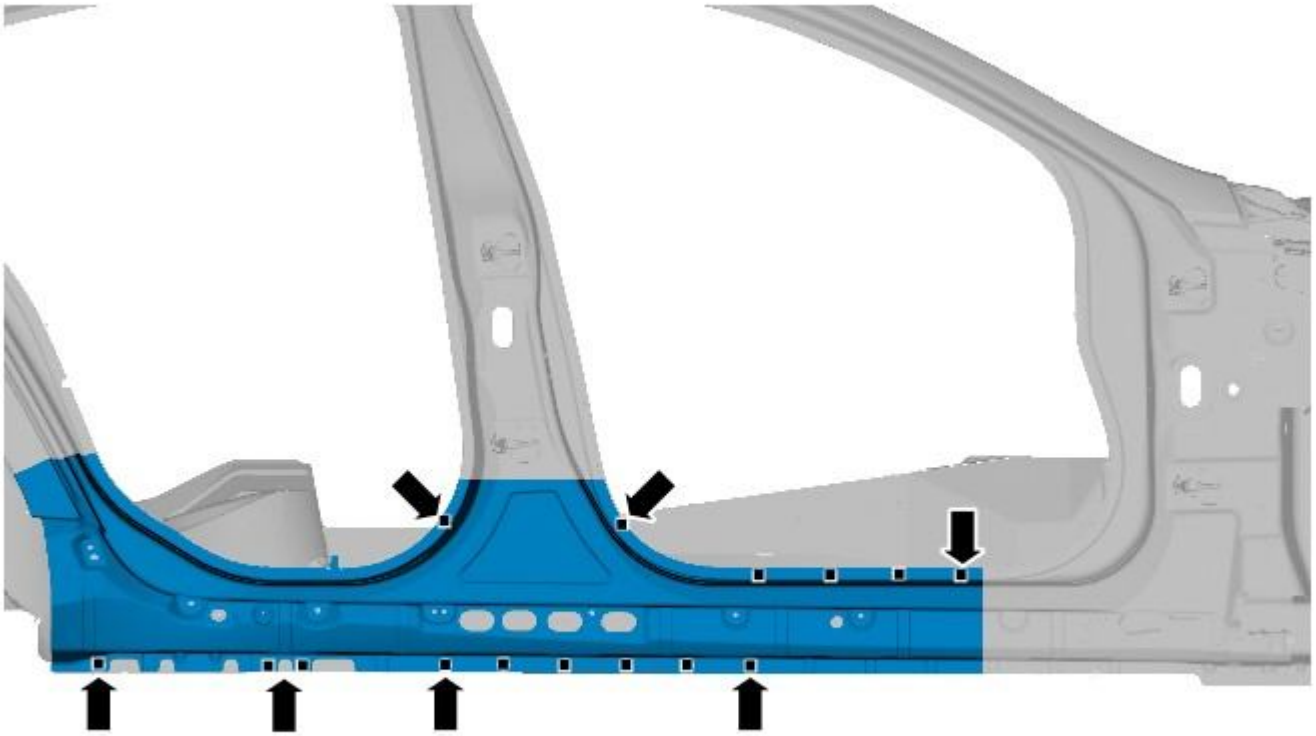
the inner panels.

Offer up, align and clamp the new panel into position, overlapping the old panel remnant. Cut through the new panel, partially cutting the old panel, at the points where the MAG butt joints are to be made.



E102819

2. Remove the new panel.
3. Cut and remove the old panel remnants.
4. Drill holes in the new panel ready for MAG plug welding.



E102820

5. NOTE: If necessary renew the NVH components.

Prepare the old and new panel joint surfaces, including the NVH components.

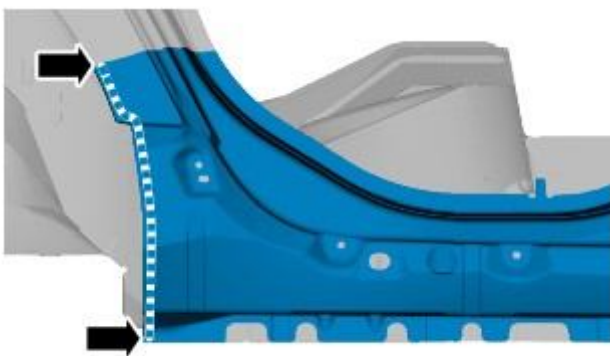
6. NOTE: Temporarily install the front and rear doors to aid alignment.

Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.

7. Remove the front and rear doors and the new rocker panel rear section.

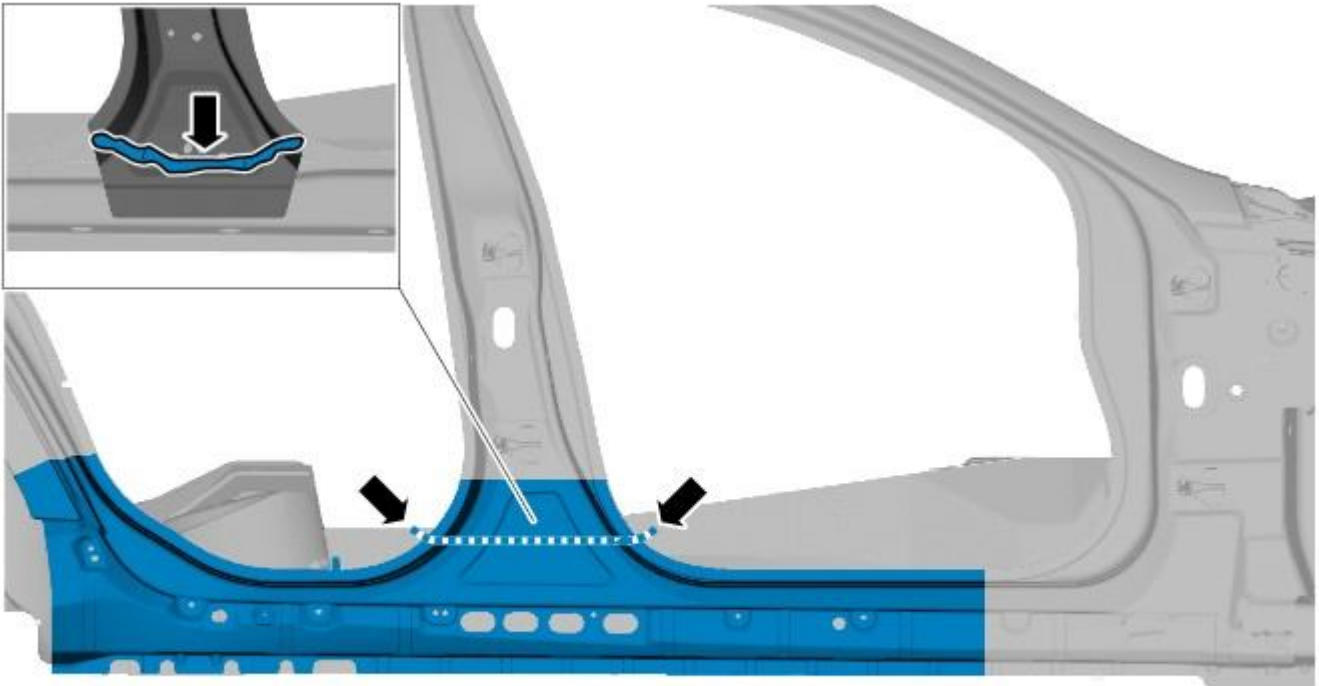
8. NOTE: Make sure the adhesive does not encroach into the area of the butt joint as it will contaminate the weld (any unsealed areas must be sealed following the repair).

Apply adhesive to the area as indicated.



E102822

9. Apply sealer adhesive to the NVH components as indicated.



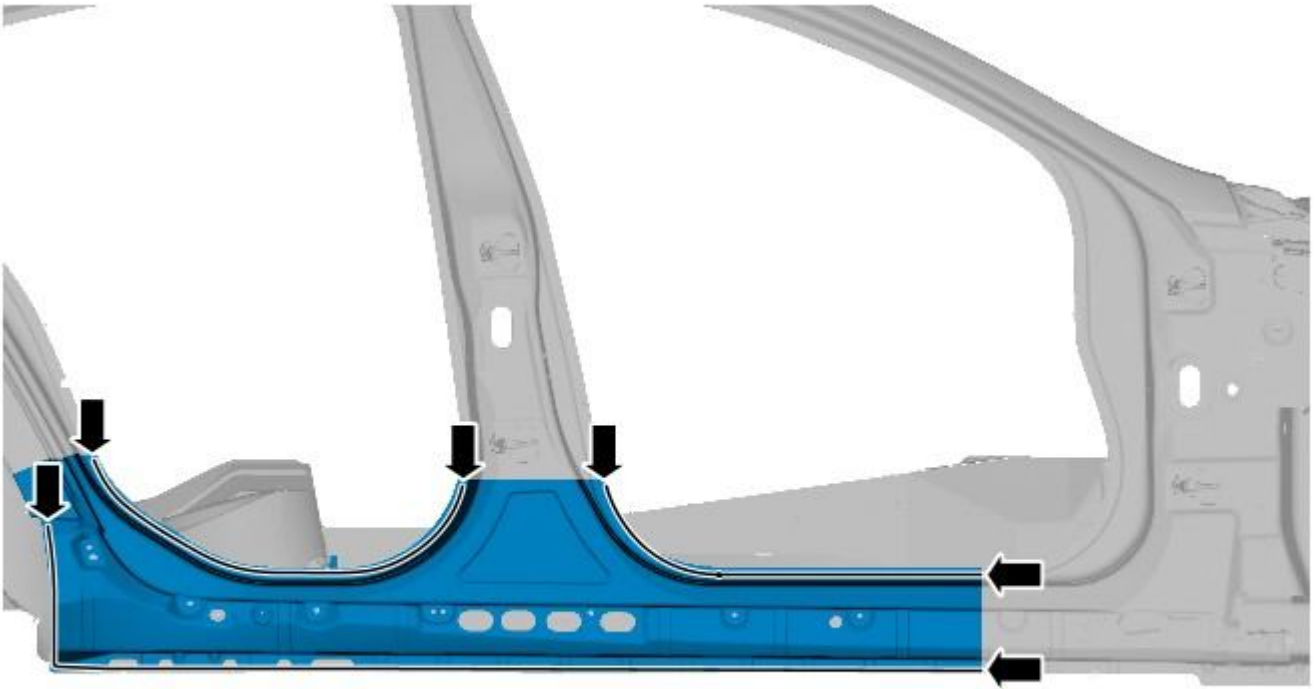
E102821

**10.** Offer up the new rocker panel rear section, align and clamp into position.

**11.** Tack weld the butt joints.

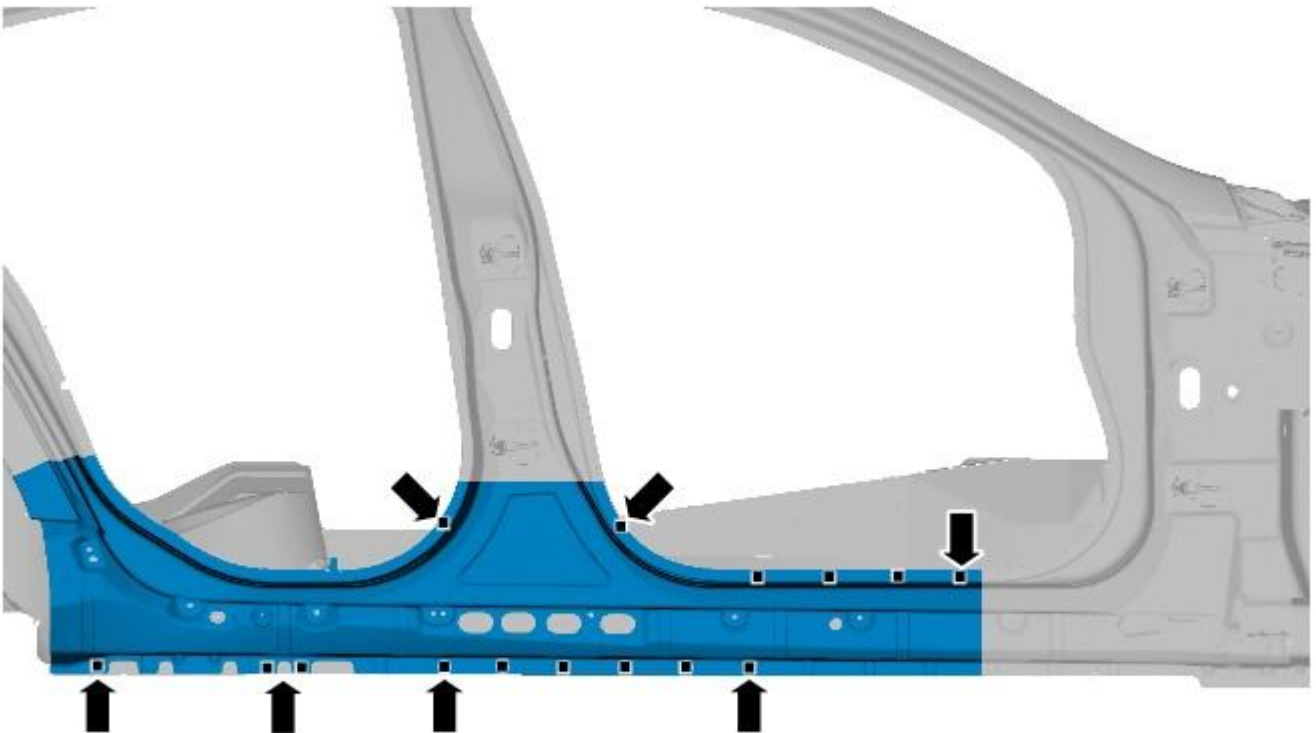
**12. NOTE:** Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original. Where there is adhesive in the original joint, spot welds should be installed through the original.

Spot weld.



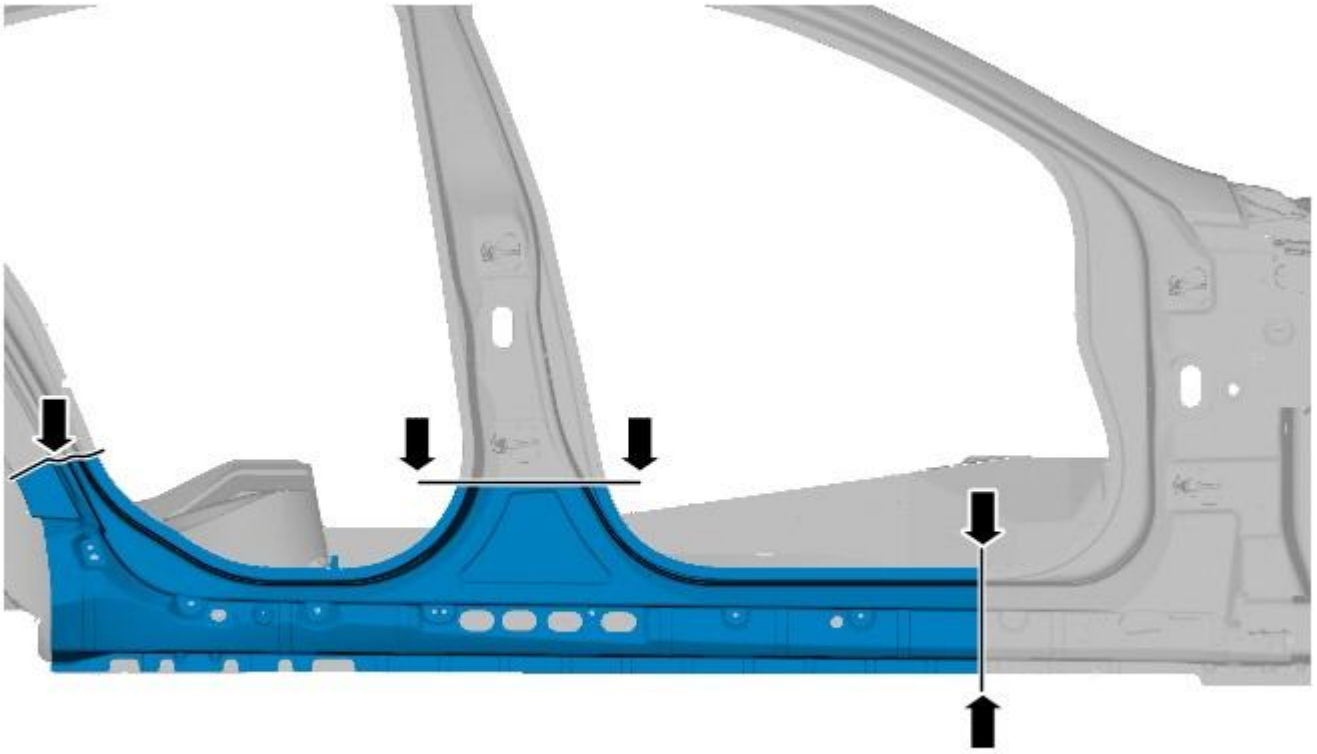
E102823

13. MAG plug weld.



E102820

14. Dress the tack welds.  
15. MAG weld the butt joints.



E 102824

**16.** Dress all welded joints.

**17.** The installation of associated panels and components is the reversal of removal procedure.

## Rear End Sheet Metal Repairs - Back Panel

Removal and Installation

### Removal

1. **NOTE:** The back panel is manufactured from mild steel.

The back panel is serviced as a separate weld-on panel, it includes the back panel inner, right-hand and left-hand rear bumper mountings, it also includes its weld studs.

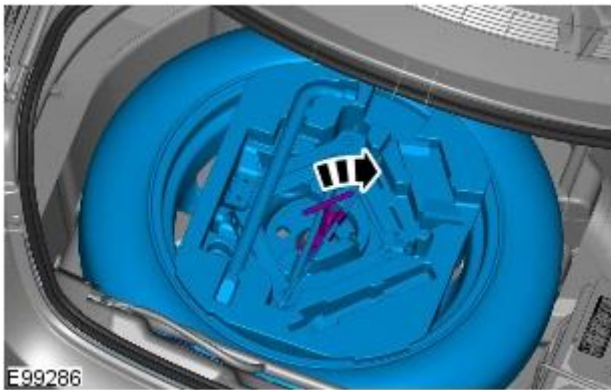


E101451

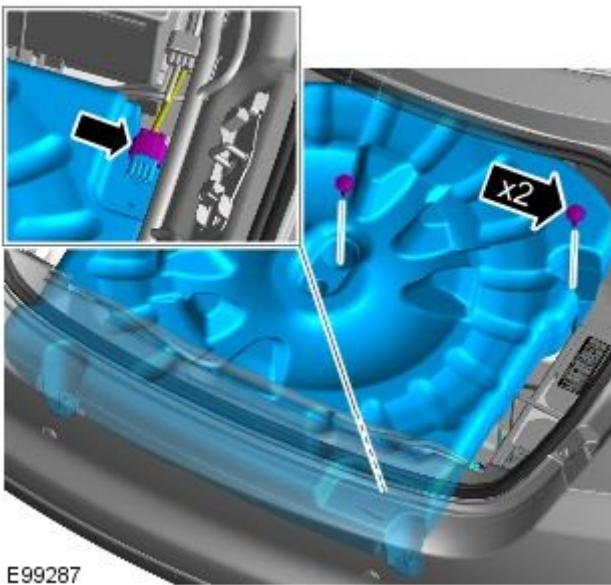
2. The back panel is replaced in conjunction with:
  - Rear bumper cover
  - Rear bumper
3. For additional information relating to this repair procedure please see the following: [Health and Safety Precautions](#) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove the rear bumper.  
For additional information, refer to: [Rear Bumper](#) (501-19 Bumpers, Removal and Installation).
5. Remove the battery.  
For additional information, refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
6. Remove the battery tray.
7. Disconnect the generator electrical connectors.
8. Remove the loadspace left-hand trim panel.  
For additional information, refer to: [Loadspace Trim Panel LH](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
9. Remove any electrical components in the local area of repair to prevent damage.
10. Remove the auxiliary junction box (AJB).  
For additional information, refer to: [Auxiliary Junction Box \(AJB\)](#) (418-00, Removal and Installation).
11. Release the external back panel wiring harness and pull through into the loadspace.
12. Remove the luggage compartment lid weatherstrip.
13. Remove the loadspace trim panel.  
For additional information, refer to: [Loadspace Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).



14. Remove the spare wheel and tire (if equipped).



15. Remove the subwoofer speaker (if equipped).



16. Release and position the back panel and loadspace wiring harness to one side.

17. Remove the luggage compartment latch striker.

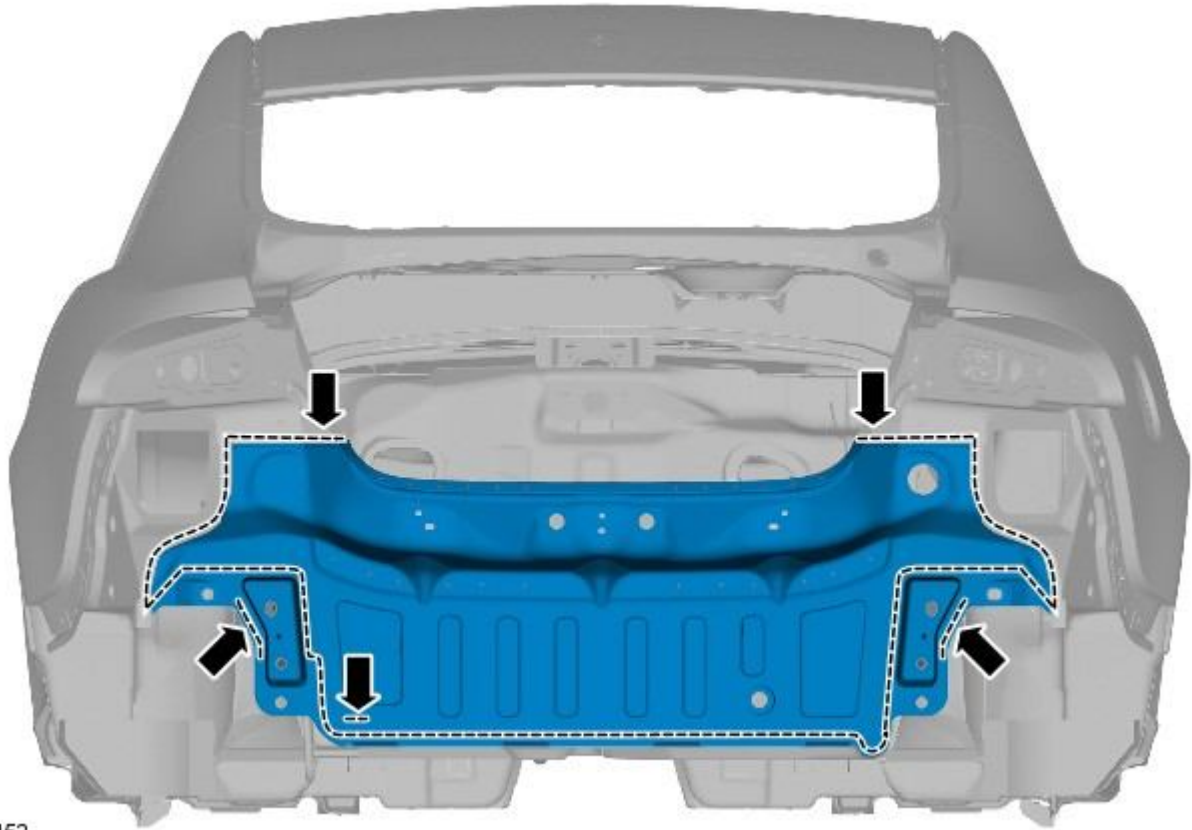
18. Remove the right-hand and left-hand forced air extraction grilles.

19. Remove the right-hand and left-hand muffler and tailpipe. For additional information, refer to: Muffler and Tailpipe (309-00A, Removal and Installation) / Muffler and Tailpipe (309-00B, Removal and Installation) / Muffler and Tailpipe (309-00C, Removal and Installation).

20. Remove the right-hand and left-hand muffler and tailpipe heatshield.

21. NOTE: Where applicable spot welds must be drilled from the inside, this will enable the new panel to be spot welded on installation. The lowest spot weld to the quarter panel lower extension has to be drilled from outside and MAG plug welded on installation.

Drill out the spot welds.



E101452

22. Separate the joints and remove the old panel.

### Installation

1. Prepare the old and new panel joint surfaces.
2. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.
3. Remove the new panel.
4. Apply adhesive to the areas indicated.



E101454

5. Offer up the new panel and clamp into position.

6. NOTE: Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original. Where there is adhesive in the original joint, spot welds should be installed through the original.

Spot weld.



E101455

7. MAG Plug weld.



E101456

8. Dress all welded joints and remove any excess adhesive.

9. The installation of associated panels and components is the reversal of removal procedure.

## Rear End Sheet Metal Repairs - Quarter Panel

Removal and Installation

### Removal

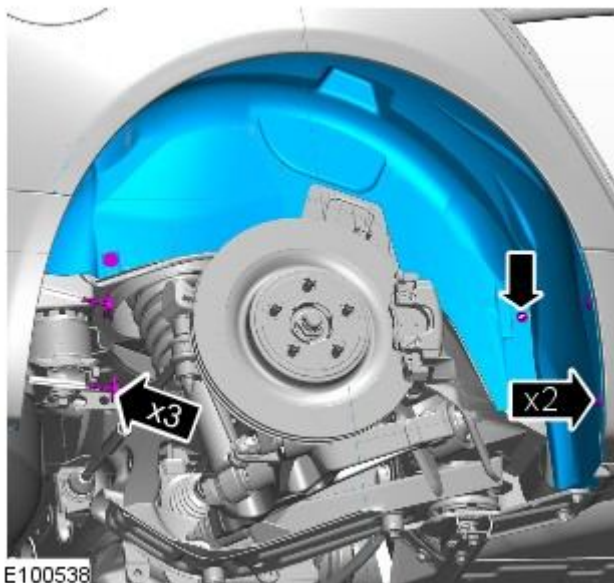
1. NOTE: The quarter panel is manufactured from mild steel.

The quarter panel is serviced as a separate weld-on panel, it includes the quarter panel lower extension, rear lamp mounting panel, rear lamp mounting panel insert, water drain panel and the door striker reinforcement. It is not serviced with its weld studs, or NVH (noise, vibration and harshness) components.



E101668

2. The quarter panel is replaced in conjunction with:
  1. Rear bumper
  2. Rear bumper cover
  3. Luggage compartment lid
  4. Rear window glass
  5. Headliner
3. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove the rear wheel and tire.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
5. Remove the rear fender splash shield.



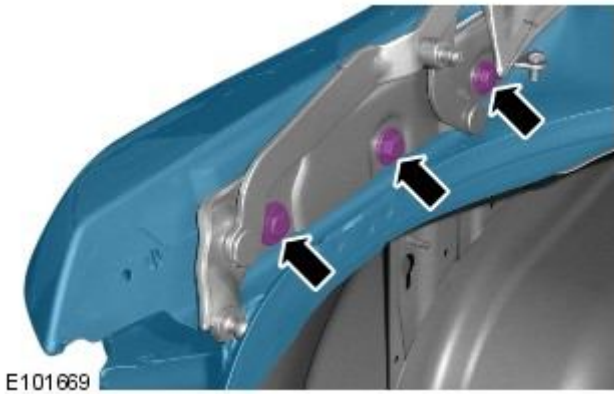
E100538

6. Remove the Rear Bumper.  
For additional information, refer to: [Rear Bumper](#) (501-19 Bumpers, Removal and Installation).

7. Remove the battery.  
For additional information, refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
8. Disconnect the generator electrical connectors.
9. If the left-hand rear quarter panel is to be repaired, remove the loadspace left-hand trim panel.  
For additional information, refer to: [Loadspace Trim Panel LH](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
10. If the right-hand rear quarter panel is to be repaired, remove the auxiliary junction box (AJB).  
For additional information, refer to: Auxiliary Junction Box (AJB) (418-00 Module Communications Network, Removal and Installation).
11. Remove any electrical components in the local area of repair to prevent damage.
12. Remove the rear muffler.  
For additional information, refer to: Rear Muffler (309-00A, Removal and Installation) / Rear Muffler (309-00C, Removal and Installation) / [Rear Muffler](#) (309-00 Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
13. Remove the exhaust muffler and tailpipe heatshield.
14. Remove the rear scuff plate trim panel.  
For additional information, refer to: [Rear Scuff Plate Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
15. Remove the loadspace trim panel.  
For additional information, refer to: [Loadspace Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
16. Remove the forced air extraction grille.
17. Release and lay aside the back panel and loadspace wiring harness.
18. Remove the luggage compartment lid weatherstrip.
19. Remove the rear bumper cover side retainer.
20. Remove the roof moulding.
21. Remove the headliner.  
For additional information, refer to: [Headliner](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
22. Remove the side air curtain module.  
For additional information, refer to: Side Air Curtain Module (501-20 Supplemental Restraint System, Removal and Installation).
23. Remove the rear window glass.
24. Remove the audio unit antenna amplifier.  
For additional information, refer to: [Audio Unit Antenna Amplifier](#) (415-01 Information and Entertainment System, Removal and Installation).
25. If the left-hand rear quarter panel is to be repaired, remove the diversity antenna module.
26. Remove the C-Pillar side impact sensor.  
For additional information, refer to: [C-Pillar Side Impact Sensor](#) (501-20B Supplemental Restraint System, Removal and Installation).
27. Remove the rear door striker.
28. Remove the luggage compartment lid.
29. If the right-hand rear quarter panel is to be repaired, drain the fuel tank.  
For additional information, refer to: [Fuel Tank Draining](#) (310-00 Fuel System - General Information, General Procedures).
30. If the right-hand rear quarter panel is to be repaired, remove the fuel filler door.
31. If the right-hand rear quarter panel is to be repaired, remove the fuel tank filler pipe.  
For additional information, refer to: Fuel Tank Filler Pipe (310-01 Fuel Tank and Lines - 3.0L, Removal and Installation) / [Fuel Tank Filler Pipe](#) (310-01 Fuel Tank and Lines - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).



32. Remove the luggage compartment lid hinge.

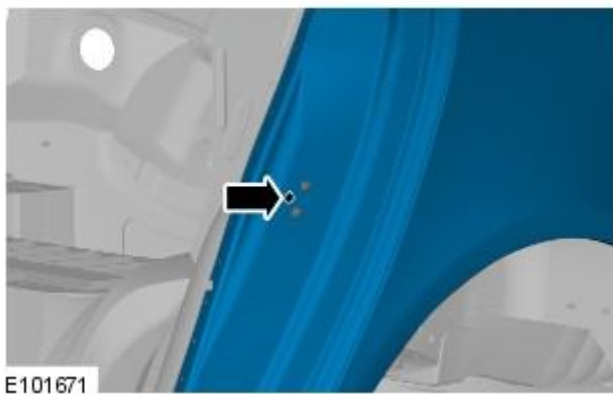


33. NOTE: The upper butt joint must be performed below the 4 metal thickness parts of the door and rear window apertures, (to enable spot welding back).



Cut the old panel at the points illustrated, allowing for overlap, ensuring the final cut is performed below the 4 metal thickness parts of the door and rear window aperture.

34. NOTE: This procedure assumes that the door striker reinforcement panel is undamaged. In this case, the original remains on the vehicle and the new door striker reinforcement panel is removed from the quarter panel service panel and discarded.

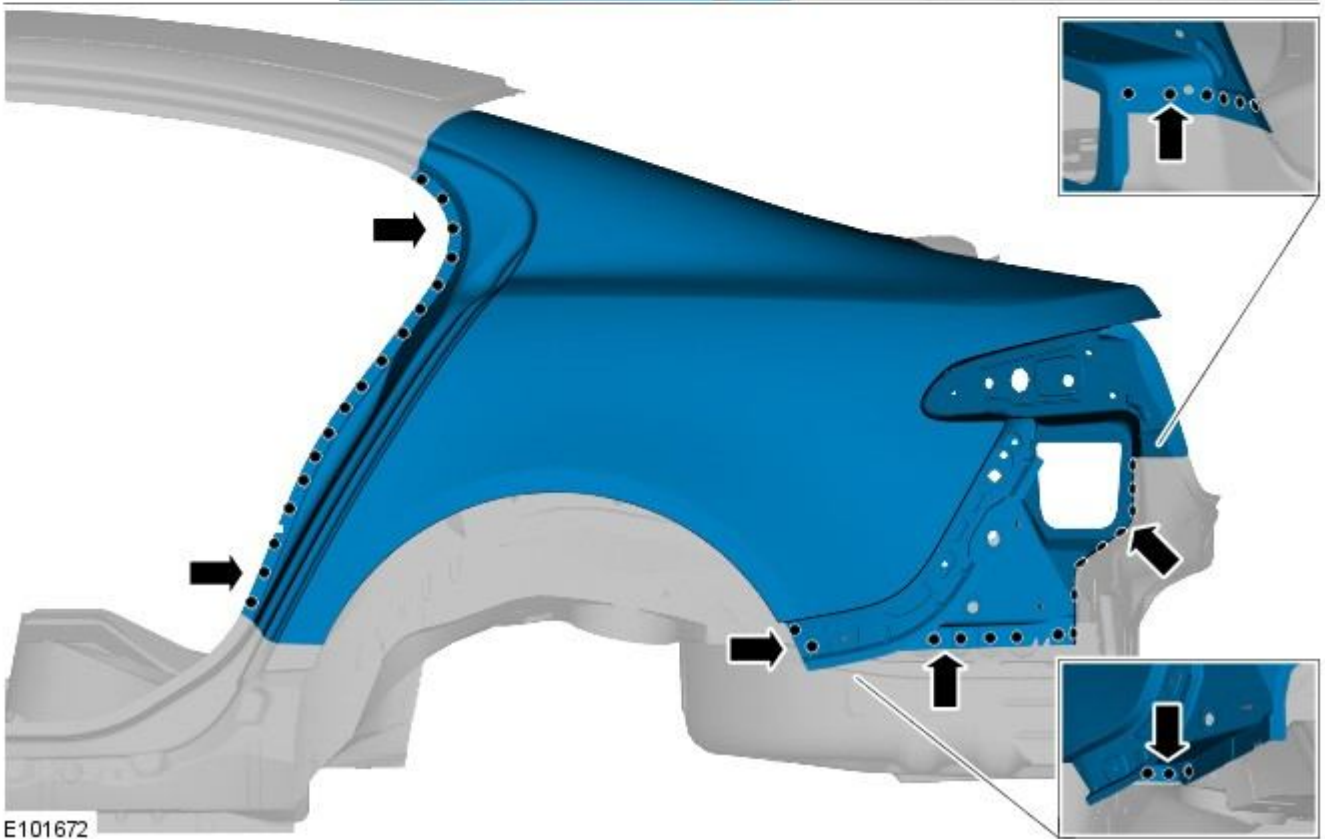
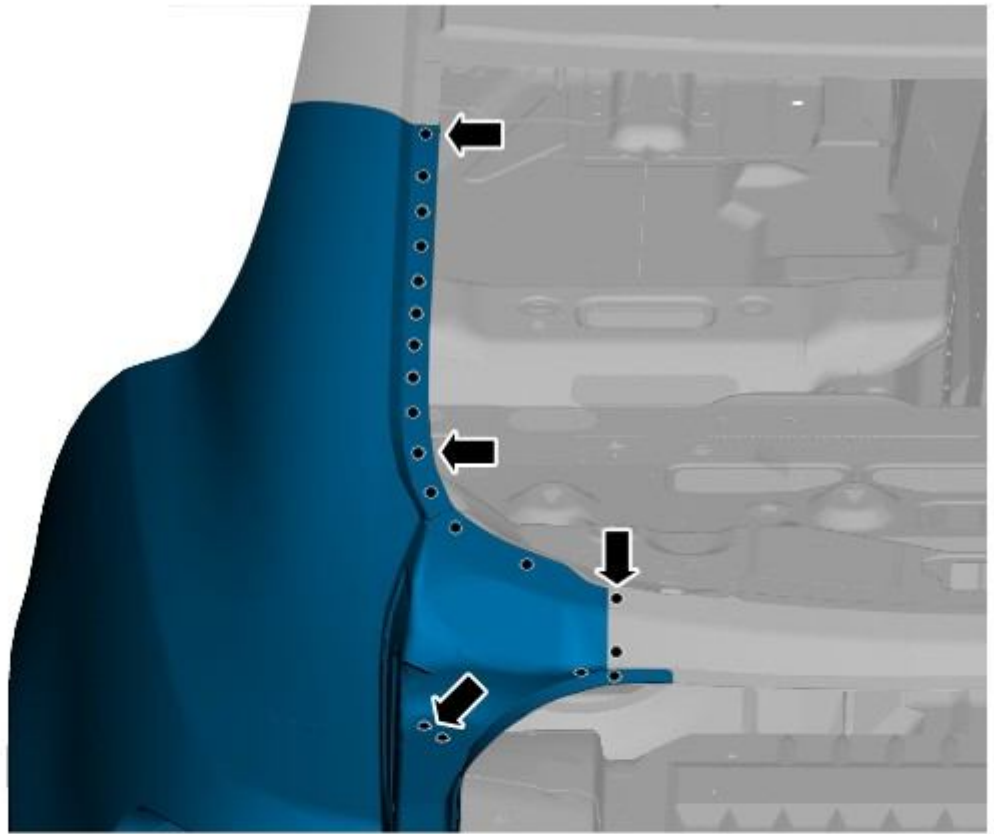


Drill out the spot weld.

35. NOTE: Use a belt sander where there is no access to drill.

Drill out the spot welds.





E101672

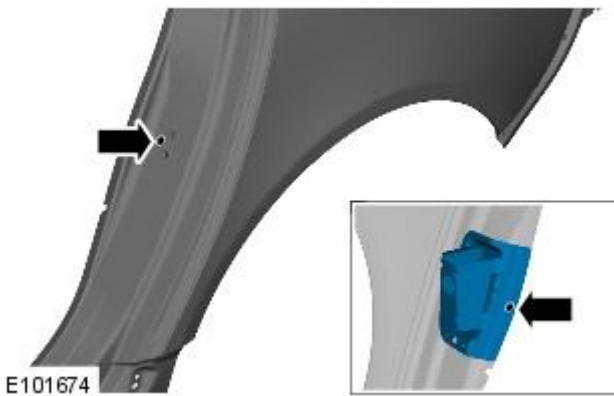
36. Separate the joints and remove the old panel, also releasing the [NVH](#) components.



### Installation

1. NOTE: This procedure assumes that the door striker reinforcement panel is undamaged. In this case, the original remains on the vehicle and the new door striker reinforcement panel is removed from the quarter panel service panel and discarded.

Remove the door striker reinforcement panel from the quarter panel service panel.



2. Trim the excess from the upper part of the service panel.



3. Prepare the old and new panel joint surfaces, including the [NVH](#) components.

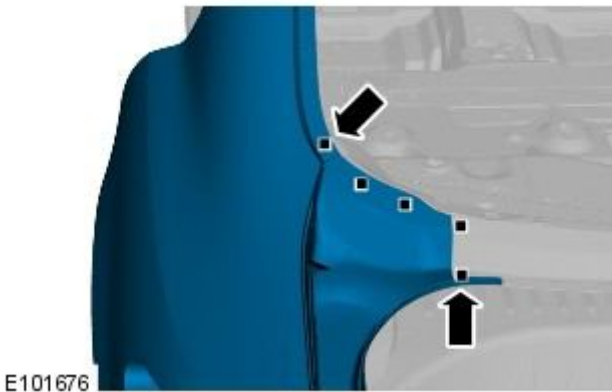
4. NOTE: Temporarily install the luggage compartment lid and hinge to aid alignment.

Offer up, align and clamp into position, overlapping the old panel. Cut the new and old panels at the points where the MAG butt joints are to be made.

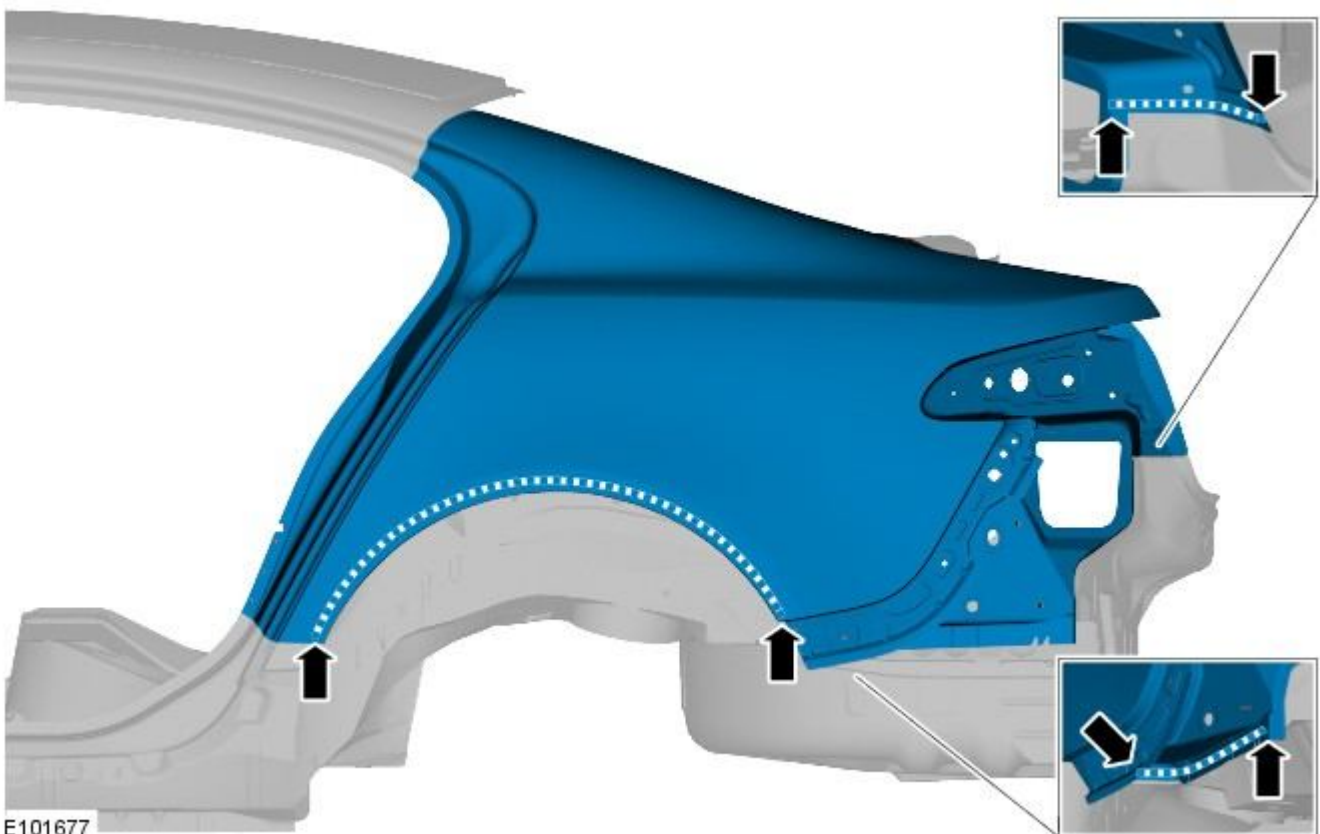


5. Remove the new panel, the luggage compartment lid and the old panel.

6. Where applicable, drill holes in the new panel ready for MAG plug welding.



7. Apply adhesive to the areas indicated.



8. If necessary, renew the NVH components.

9. Apply sealer adhesive to the NVH components.



E101678

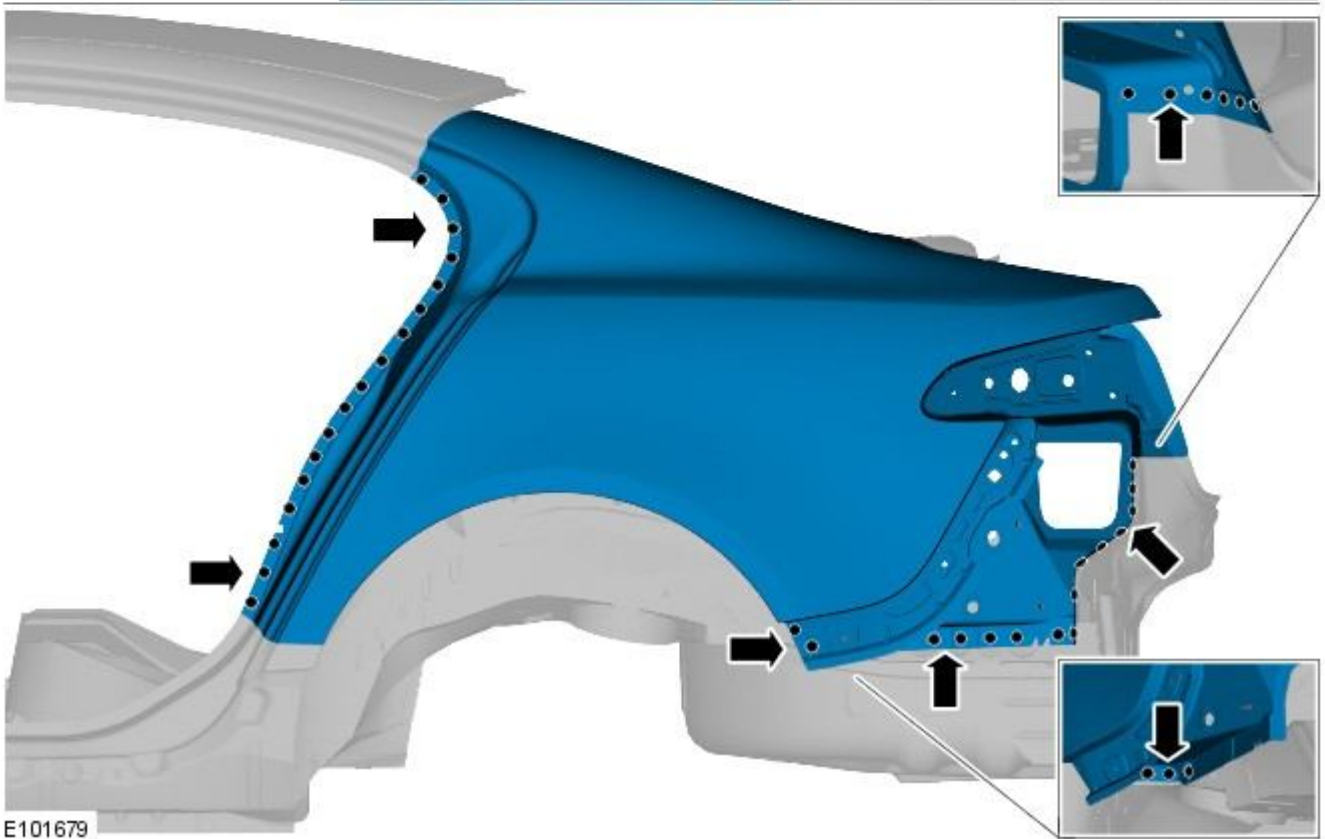
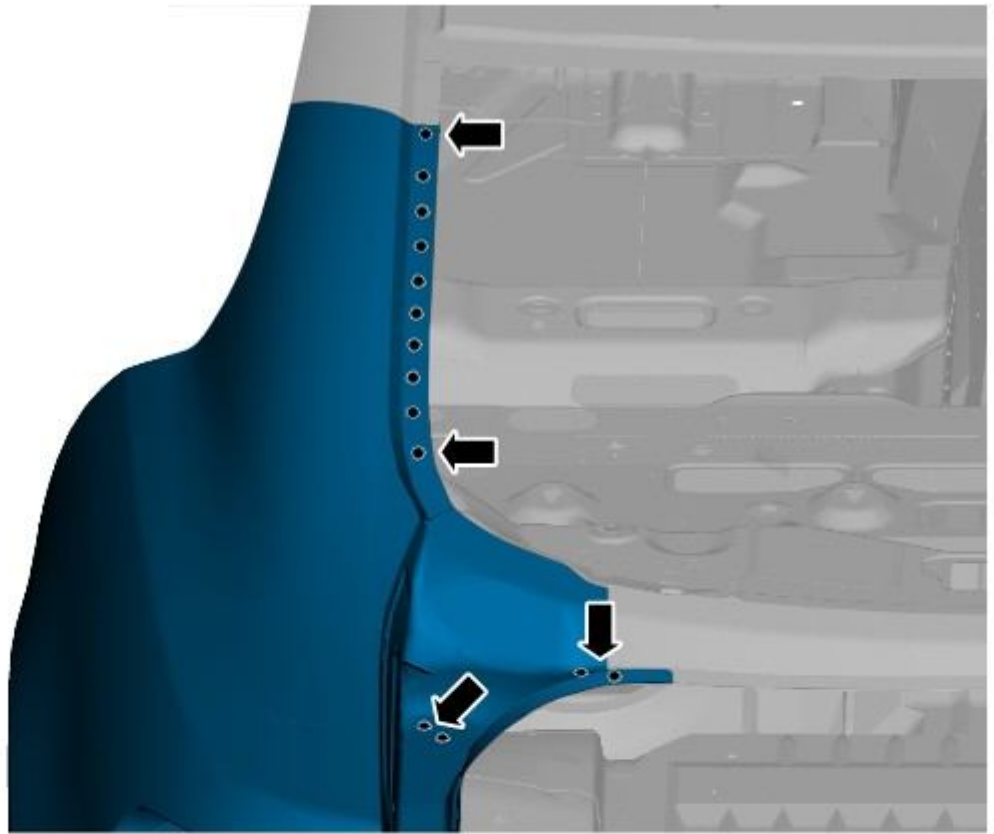
10. NOTE: Temporarily install the luggage compartment lid and hinge to aid alignment.

Offer up the new panel, align and clamp into position.

11. Tack weld the butt joints.

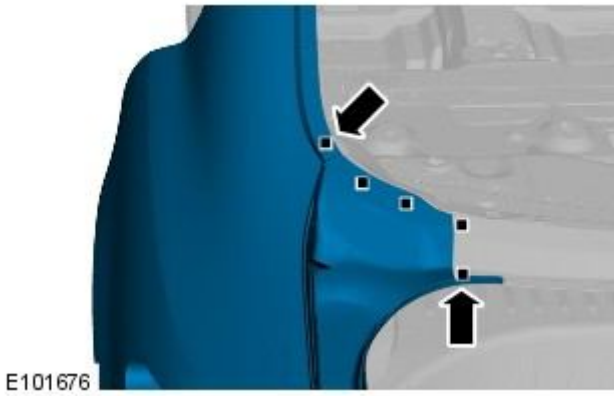
12. NOTE: Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original. Where there is adhesive in the original joint, spot welds should be installed through the original.

Spot weld.

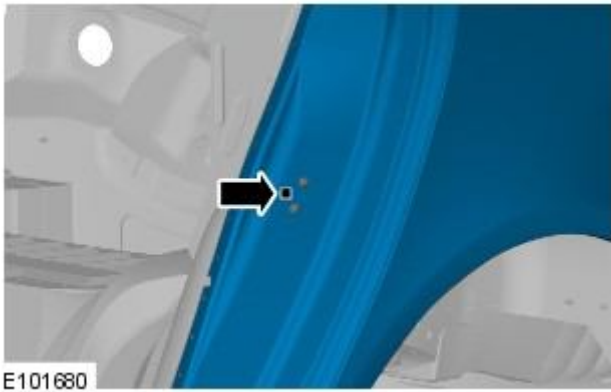


E101679

13. MAG plug weld.

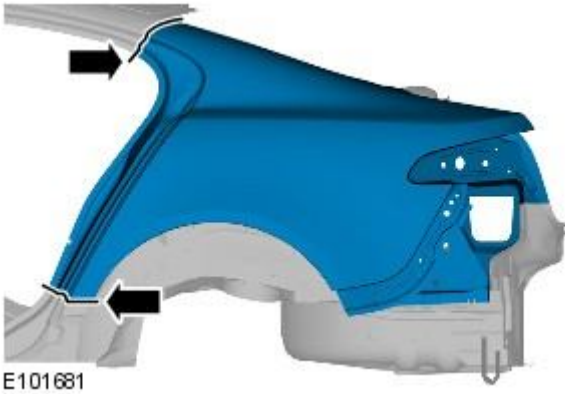


14. MAG plug weld the new panel to the door striker reinforcement panel.



15. Dress the tack welds.

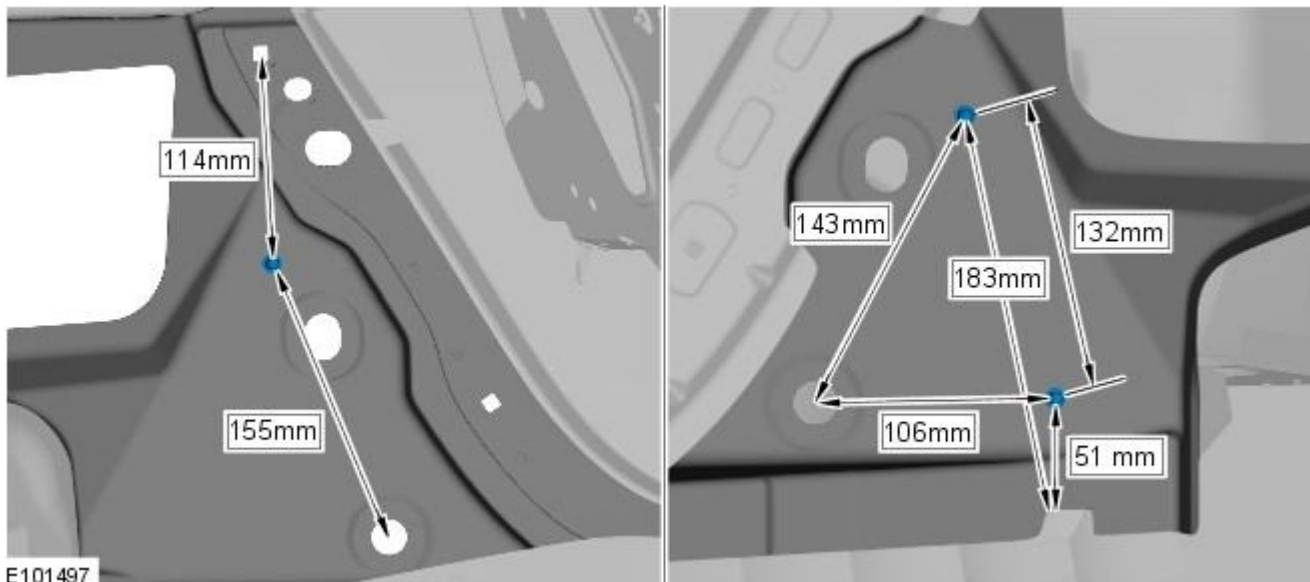
16. MAG weld the butt joints.



17. NOTE: Stud dimensions: 6mm x 1.0mm thread, 20mm length.

Prepare the new panel and install the weld studs as indicated.





E101497

18. Dress all welded joints and remove any excess adhesive.
19. The installation of associated panels and components is the reversal of removal procedure.

# Rear End Sheet Metal Repairs - Quarter Panel Lower Extension

Removal and Installation

## Removal

**1. NOTE:** The Quarter Panel Lower Extension is manufactured from mild steel.

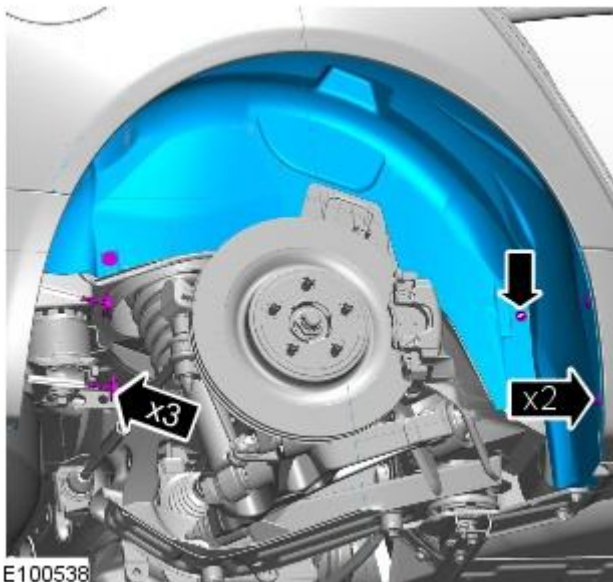
The quarter panel lower extension is serviced as a separate weld-on panel, it is also serviced on the quarter panel. It is serviced without weld studs.



E101492

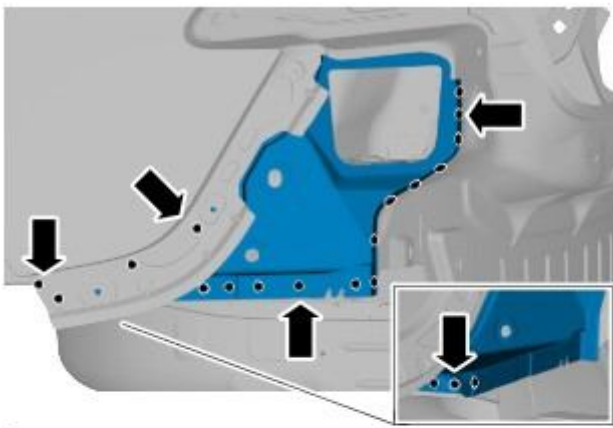
2. The quarter panel lower extension is replaced in conjunction with:
  1. Rear bumper cover
  2. Rear bumper
3. For additional information relating to this repair procedure please see the following:  
 For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Remove the battery.  
 For additional information, refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
5. Disconnect the generator electrical connectors.
6. Remove any electrical components in the local area of repair to prevent damage.
7. Remove the Rear Bumper.  
 For additional information, refer to: [Rear Bumper](#) (501-19 Bumpers, Removal and Installation).
8. Remove the rear muffler.  
 For additional information, refer to: [Rear Muffler](#) (309-00A, Removal and Installation) / [Rear Muffler](#) (309-00C, Removal and Installation) / [Rear Muffler](#) (309-00 Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
9. Remove the exhaust muffler and tailpipe heatshield.
10. Remove the forced air extraction grille.
11. Release and lay aside the back panel and loadspace wiring harness.
12. Remove the rear bumper cover side retainer.
13. Remove the rear wheel and tire.  
 For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

14. Remove the rear fender splash shield.



15. NOTE: Where applicable spot welds must be drilled from the inside, this will enable the new panel to be spot welded on installation. Use a belt sander where there is no access to drill.

Drill out the spot welds.



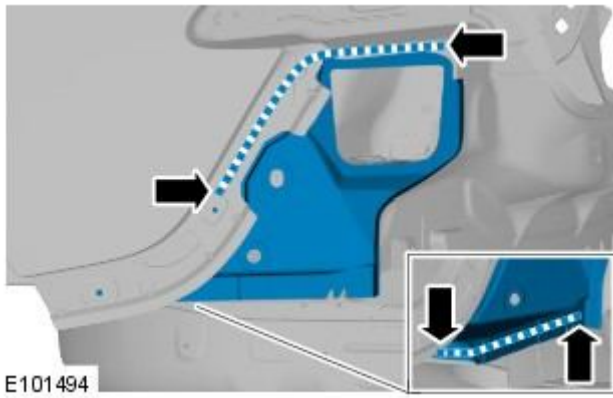
E101493

16. Separate the joints and remove the old panel.

### Installation

1. Prepare the old and new panel joint surfaces.
2. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not rectify and recheck before proceeding.
3. Remove the new panel.

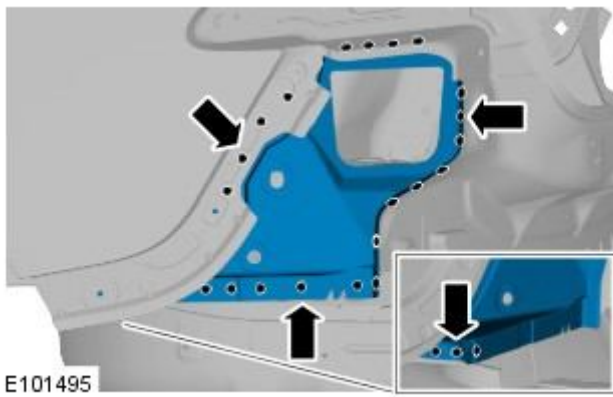
4. Apply adhesive to the areas indicated.



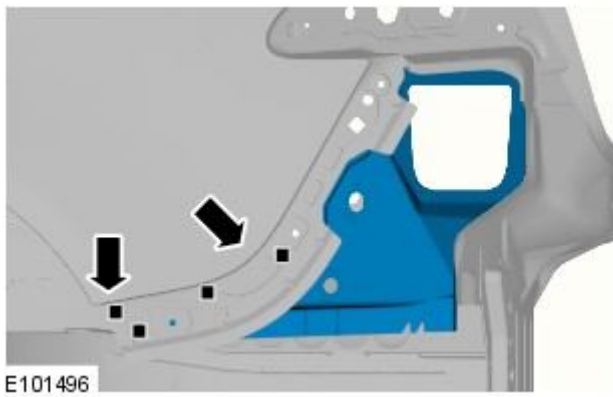
5. Offer up the new panel and clamp into position.

6. NOTE: Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original. Where there is adhesive in the original joint, spot welds should be installed through the original.

Spot weld.

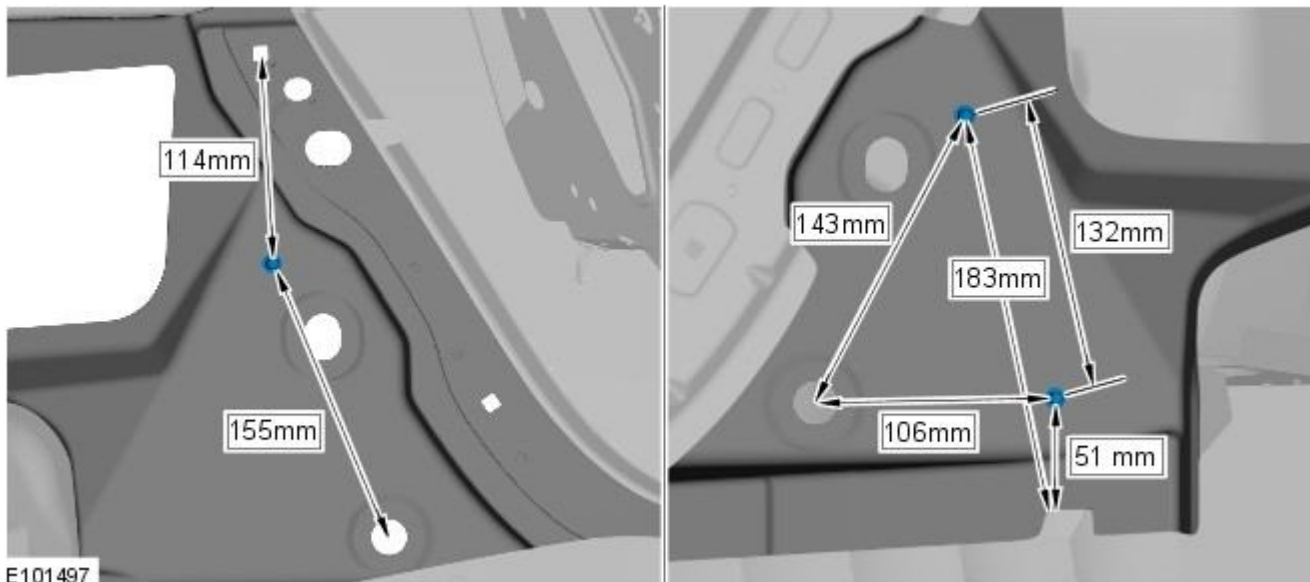


7. MAG plug weld.



8. NOTE: Stud dimensions: 6mm x 1.0mm thread, 20mm length.

Prepare the new panel and install the weld studs as indicated.



E101497

9. Dress all welded joints and remove any excess adhesive.
10. The installation of associated panels and components is the reversal of removal procedure.

# Rear End Sheet Metal Repairs - Rear Bumper Mounting

Removal and Installation

## Removal

1. NOTE: The rear bumper mounting is manufactured from mild steel.

The rear bumper mounting is serviced on the back panel and must be removed from this to carry out this procedure.

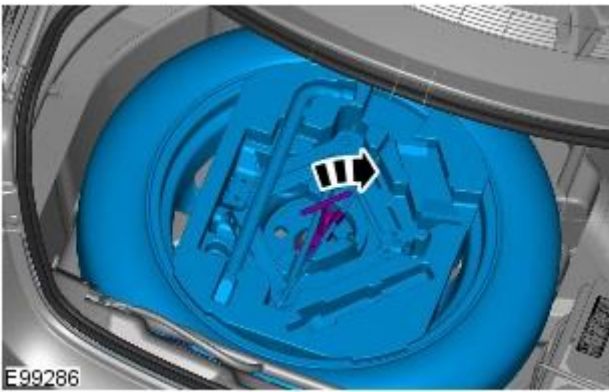


E101457

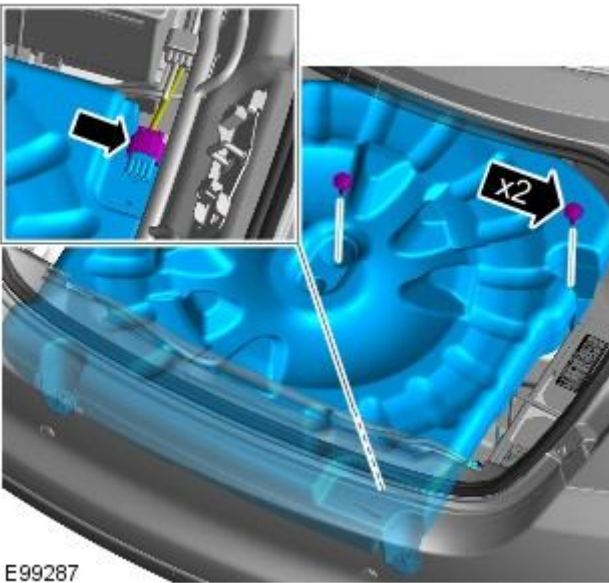
2. The rear bumper mounting is replaced in conjunction with:
  - Rear bumper cover
  - Rear bumper
3. For additional information relating to this repair procedure please see the following:  
For additional information, refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation) / [Body Repairs](#) (501-25A Body Repairs - General Information, Description and Operation) / [Corrosion Protection](#) (501-25B Body Repairs - Corrosion Protection, Description and Operation) / [Body and Frame](#) (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).
4. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
5. If the right-hand rear bumper mounting is to be repaired, remove the battery.  
For additional information, refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
6. If the right-hand rear bumper mounting is to be repaired, remove the battery tray.
7. Disconnect the generator electrical connectors.
8. Remove the rear bumper.  
For additional information, refer to: [Rear Bumper](#) (501-19 Bumpers, Removal and Installation).
9. Remove any electrical components in the local area of repair to prevent damage.
10. If the right-hand rear bumper mounting is to be repaired, remove the auxiliary junction box (AJB).  
For additional information, refer to: [Auxiliary Junction Box \(AJB\)](#) (418-00, Removal and Installation).
11. Release the external back panel wiring harness and pull through into the loadspace.
12. Remove the luggage compartment lid weatherstrip.



13. Remove the spare wheel and tire (if equipped).



14. Remove the subwoofer speaker (if equipped).



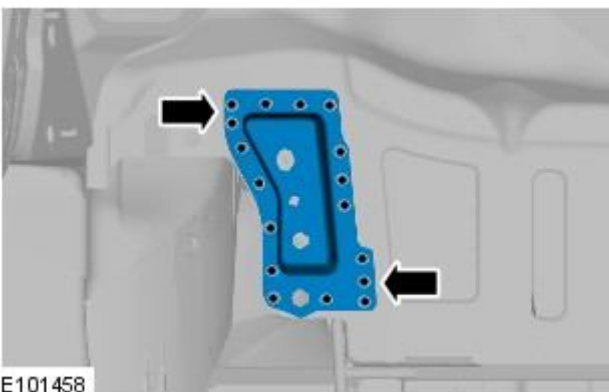
15. Release and position the back panel and loadspace wiring harness to one side.

16. Remove the right-hand or left-hand muffler and tailpipe as necessary.

For additional information, refer to: Muffler and Tailpipe (309-00A, Removal and Installation) / Muffler and Tailpipe (309-00B, Removal and Installation) / Muffler and Tailpipe (309-00C, Removal and Installation).

17. Remove the right-hand or left-hand muffler and tailpipe heatshield as necessary.

18. Drill out the spot welds.



19. Separate the joints and remove the old panel.

## Installation

1. NOTE: Spot welds must be drilled from the inside, this will enable the new panel to be spot welded on installation.

Drill the rear bumper mounting off the back panel service panel.

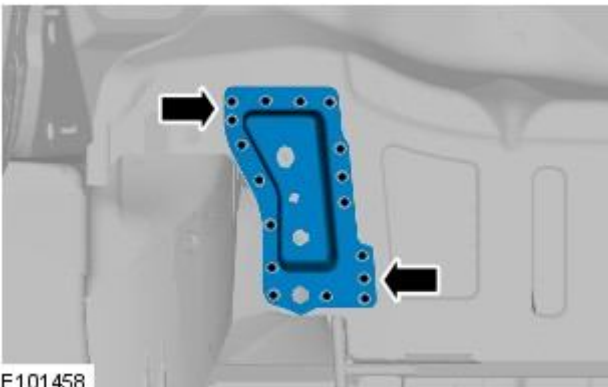


E101459

2. Prepare the old and new panel joint surfaces.
3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

4. NOTE: Spot welds must be installed 5mm away from the originals and in the same quantities, whenever this is possible. Where this is not possible, spot welds should be installed adjacent to the original. Where there is adhesive in the original joint, spot welds should be installed through the original.

Spot weld.



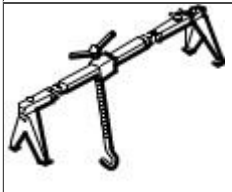
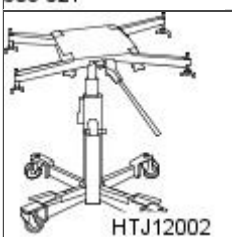


E101458

5. Dress all welded joints.
6. The installation of associated panels and components is the reversal of removal procedure.

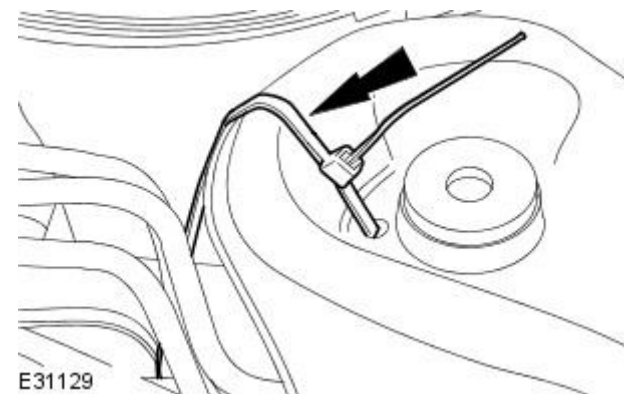
# Uni-Body, Subframe and Mounting System - Front Subframe TDV6 2.7L Diesel

Removal and Installation

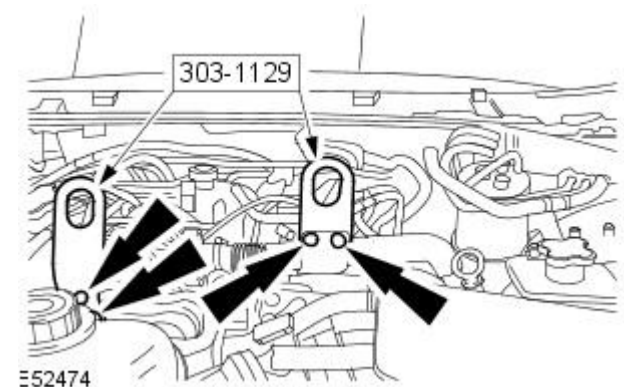
Special Tool(s)	
 <p>502-005</p>	<p>Subframe Alignment Bolt</p> <p>502-005</p>
 <p>E54554</p>	<p>Lifting Brackets - Engine</p> <p>303-1129</p>
 <p>303-021</p>	<p>Engine support bracket</p> <p>303-021</p>
 <p>HTJ12002</p>	<p>Power train assembly jack</p> <p>HTJ1200-2</p>

## Removal

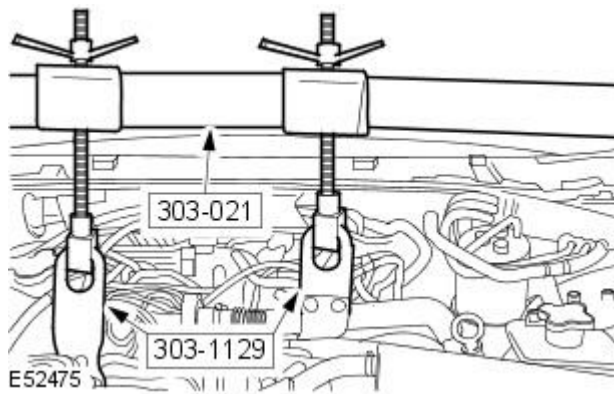
1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Using suitable tie straps, secure the radiator.



3. Remove the intake air shutoff throttle.  
For additional information, refer to: [Intake Air Shutoff Throttle](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).
4. Install the special tool.



5. Install the special tool.



6. Raise and support the vehicle.

7. Remove both the front wheels and tires.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

8. Remove the air deflector.

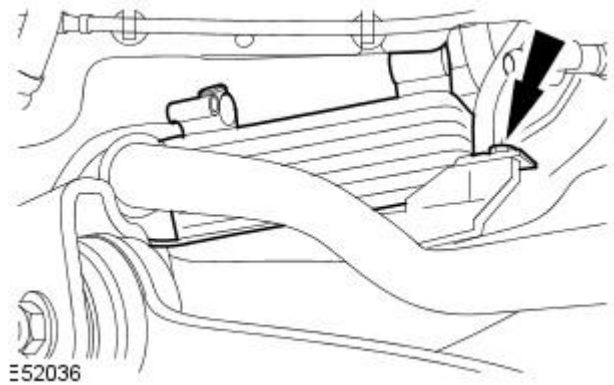
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

9. Remove the radiator splash shield.

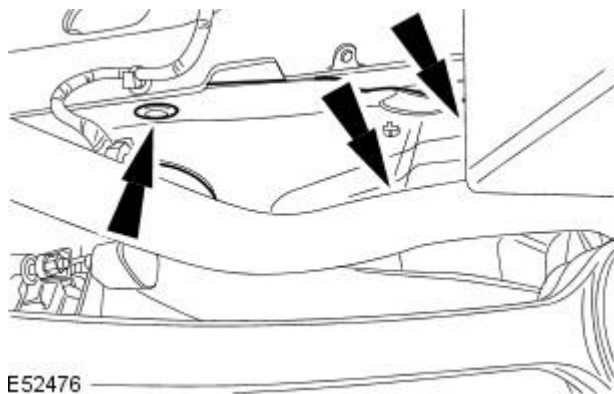
For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

10. Detach the transmission fluid cooler.

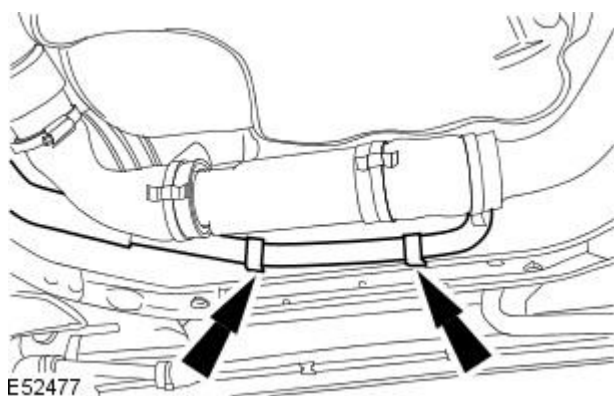
- Tie aside.



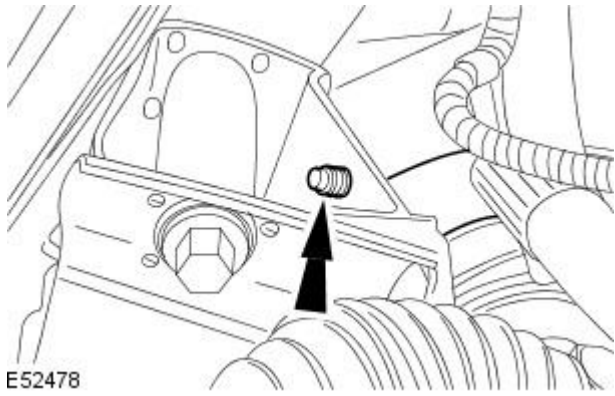
11. Remove the right-hand splash shield.



12. Detach the engine coolant inlet pipe from the front subframe.



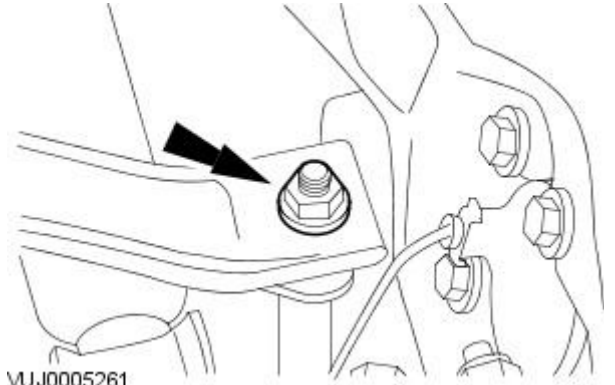
13. Detach the power steering hose retaining clip from the front subframe.



E52478

14. NOTE: Left-hand shown, right-hand similar.

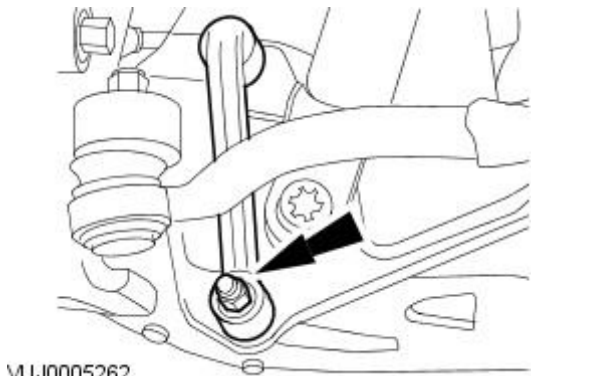
Remove the stabilizer bar link upper retaining nut.



VUJ0005261

15. NOTE: Left-hand shown, right-hand similar.

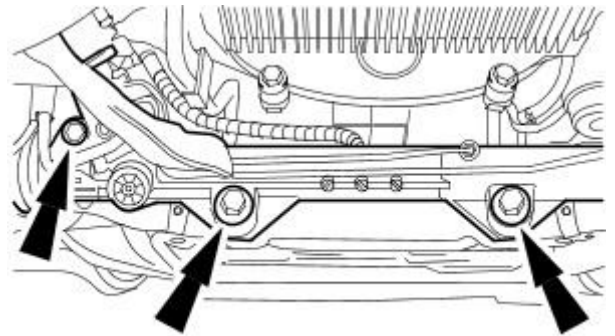
Remove the stabilizer bar link lower retaining bolt and nut and remove the stabilizer bar link.



VUJ0005262

16. Detach the steering gear.

- Secure the steering gear.

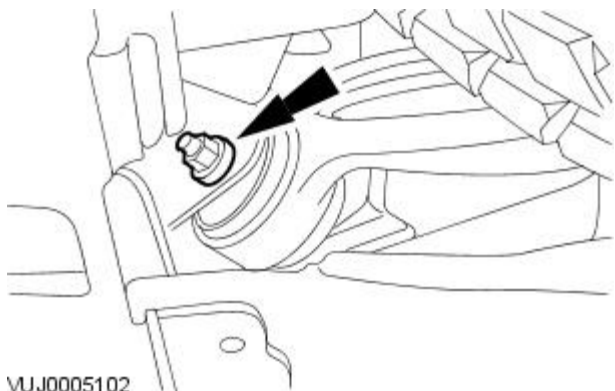


VUJ0005142

17. NOTE: Left-hand shown, right-hand similar.

Release the front lower arm and position it to one side.

- Mark the position of the bolt.

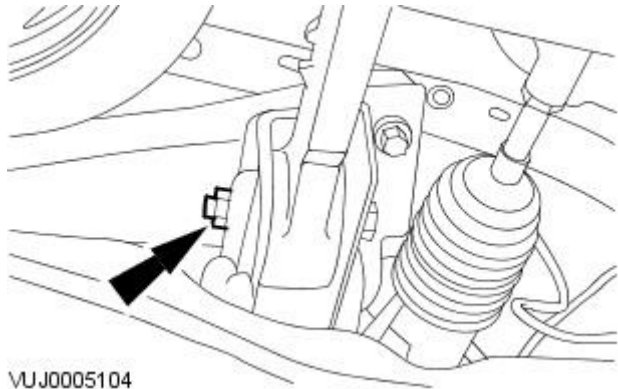


VUJ0005102



18. NOTE: Left-hand shown, right-hand similar.

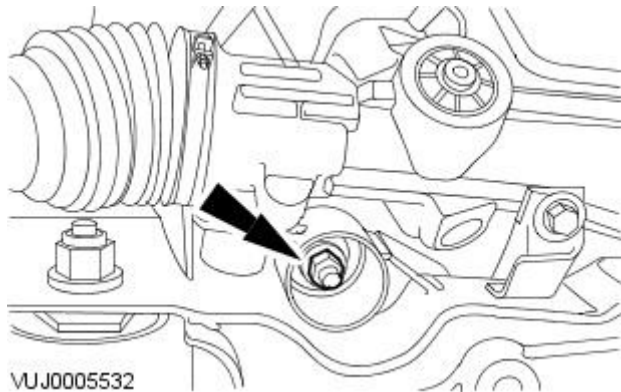
Release the rear lower arm and position it to one side.



VUJ0005104

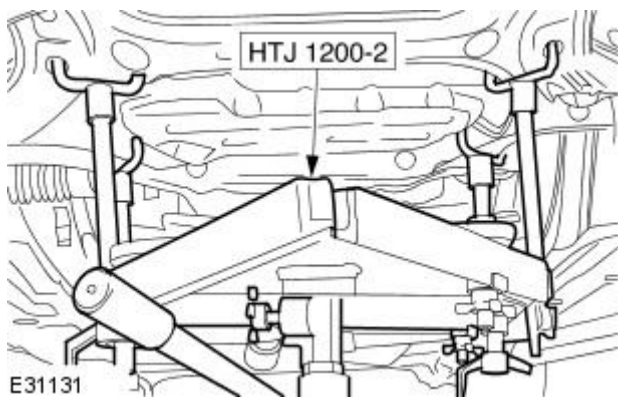
19. NOTE: Left-hand shown, right-hand similar.

Remove the engine mount retaining nut.



VUJ0005532

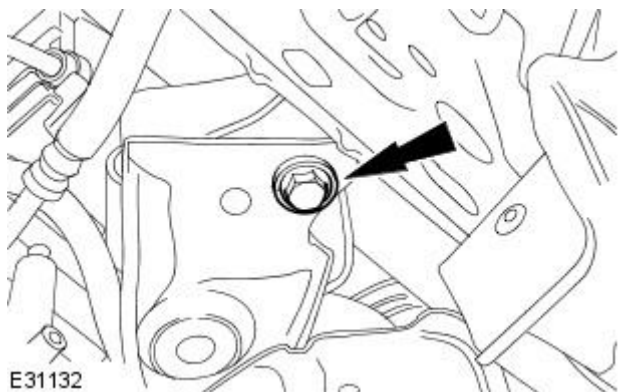
20. Install the special tool to the front subframe.



E31131

21. NOTE: Left-hand shown, right-hand similar.

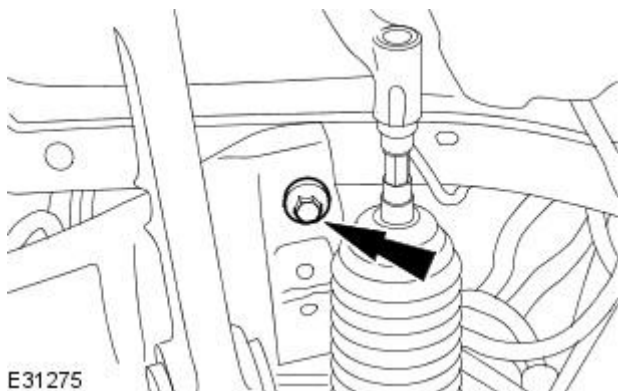
Remove the front subframe front retaining bolt.



E31132

22. NOTE: Left-hand shown, right-hand similar.

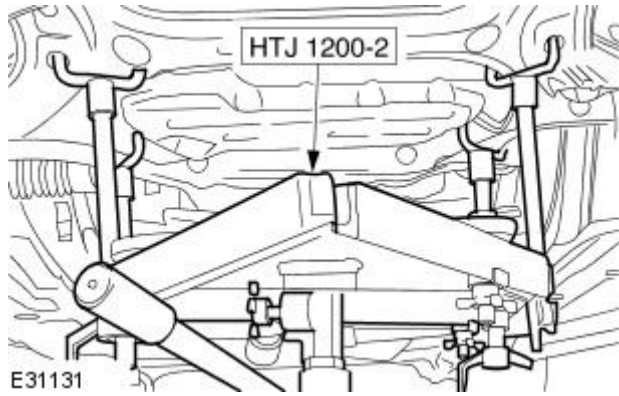
Remove the front subframe rear retaining bolt.



E31275

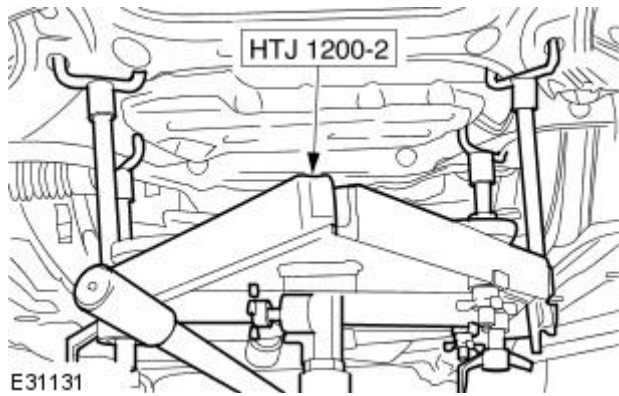


23. Remove the front subframe.



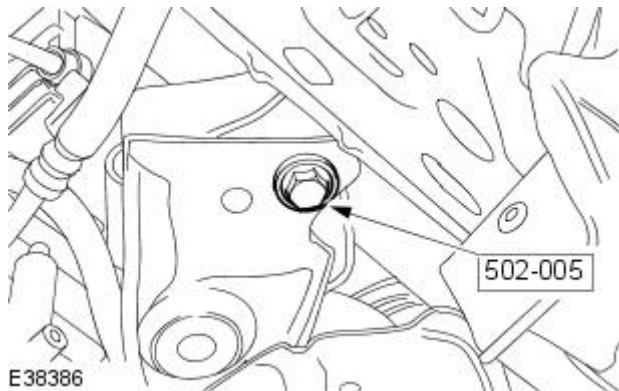
### Installation

1. Install the front subframe.



2. NOTE: Left-hand shown, right-hand similar.

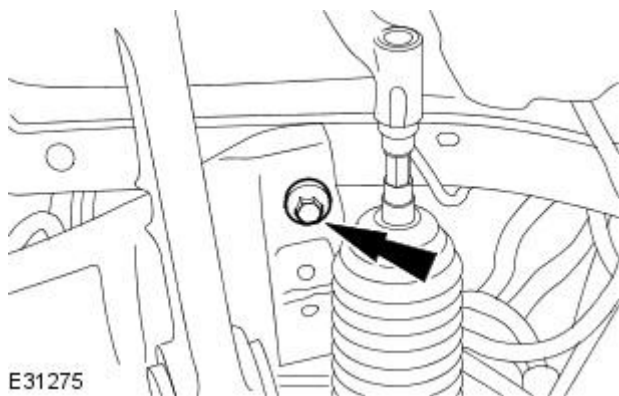
Install the special tool.



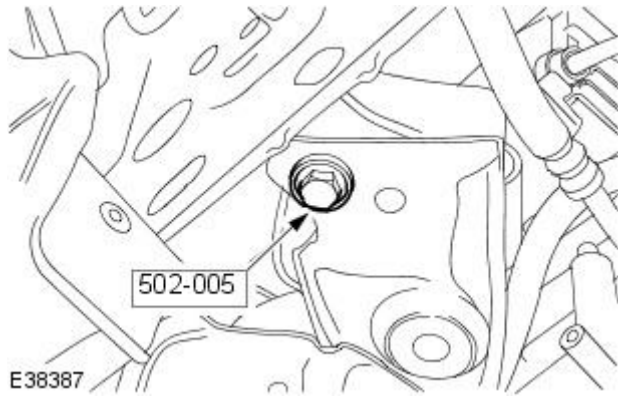
3. NOTE: Left-hand shown, right-hand similar.

Install the front subframe rear retaining bolt.

- Tighten to 80 Nm + 240°.

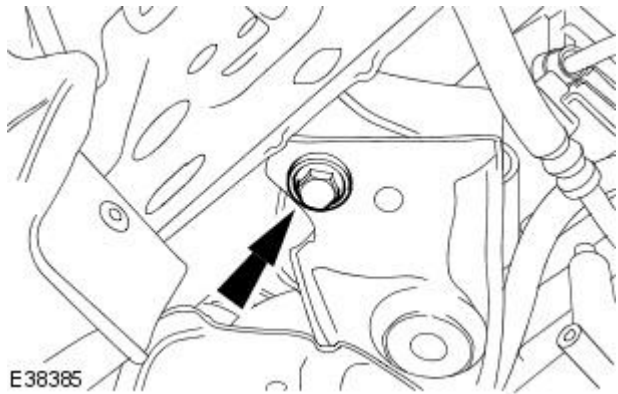


4. Remove the special tool.

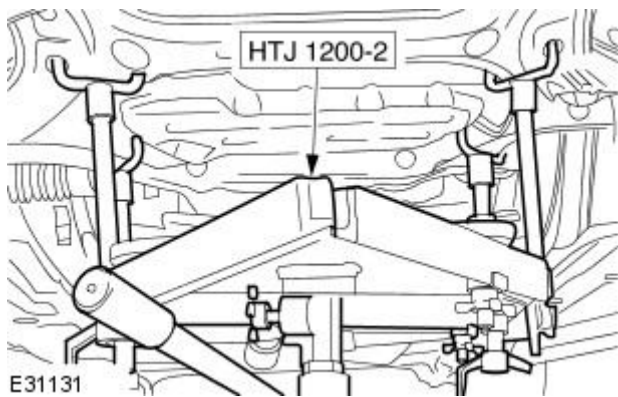


5. Install the front subframe front retaining bolt.

- Tighten to 150 Nm + 240°.



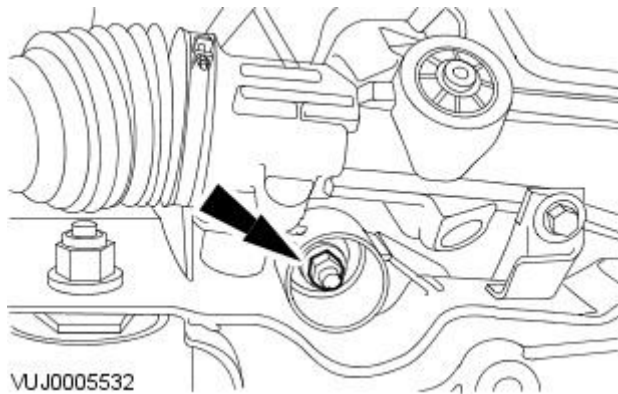
6. Remove the special tool.



7. NOTE: Left-hand shown, right-hand similar.

Install the engine mount retaining nut.

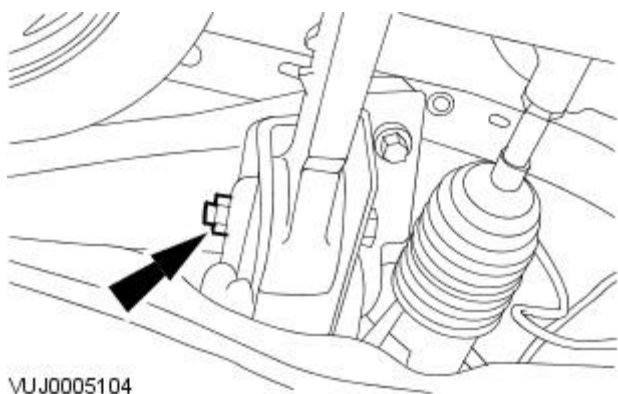
- Tighten to 63 Nm.

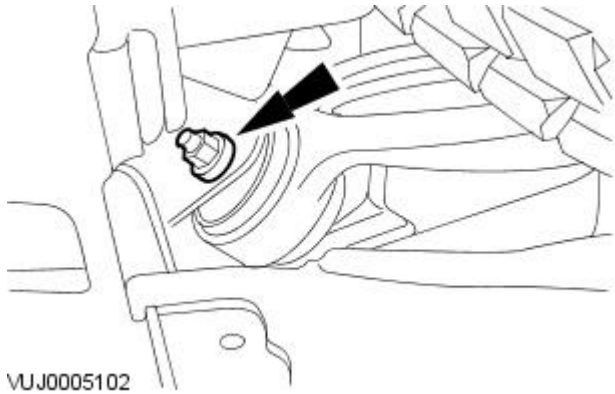


8.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.

• NOTE: Left-hand shown, right-hand similar.

Install the rear lower arm.

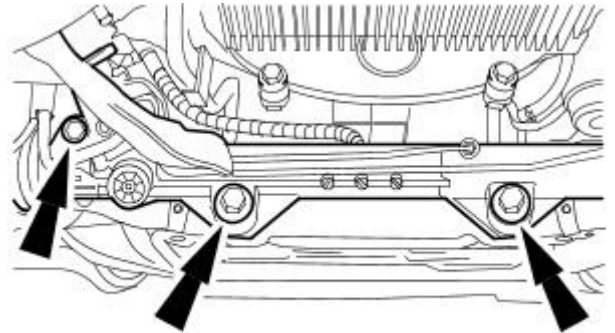




9.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.

• NOTE: Left-hand shown, right-hand similar.

Install the front lower arm.



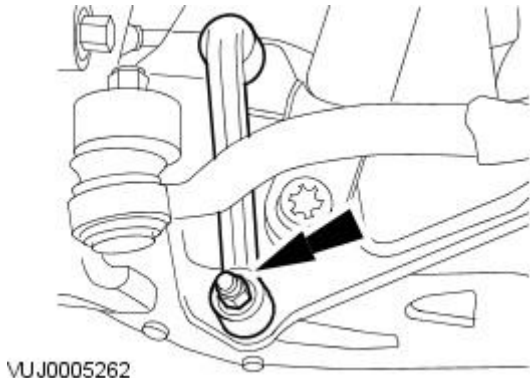
10. Install the steering gear.

- Tighten to 100 Nm.

VUJ0005142

11. NOTE: Left-hand shown, right-hand similar.

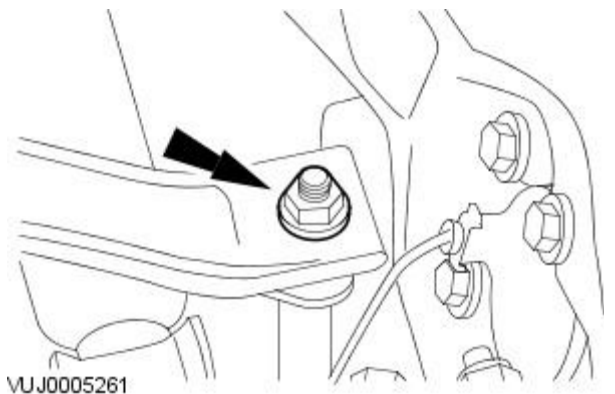
Install the stabilizer bar link.



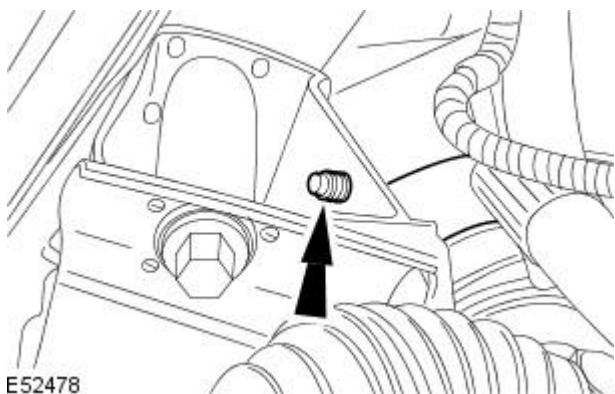
12. Attach the stabilizer bar link and install the stabilizer bar link retaining nut.

- Tighten to 43 Nm.

VUJ0005262

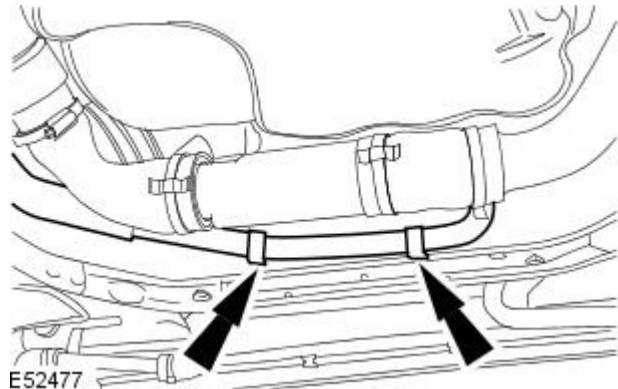


13. Attach the power steering hose retaining clip to the front subframe.

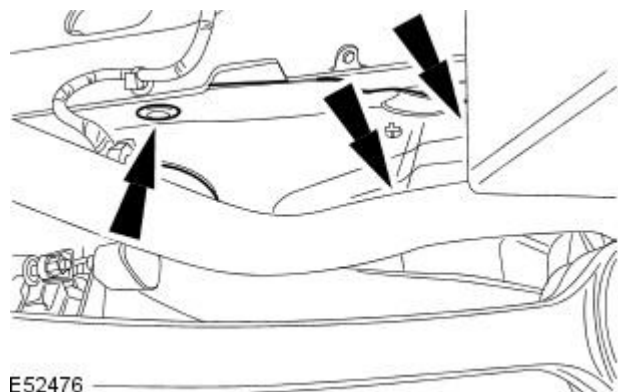


E52478

14. Attach the engine coolant inlet pipe to the front subframe.

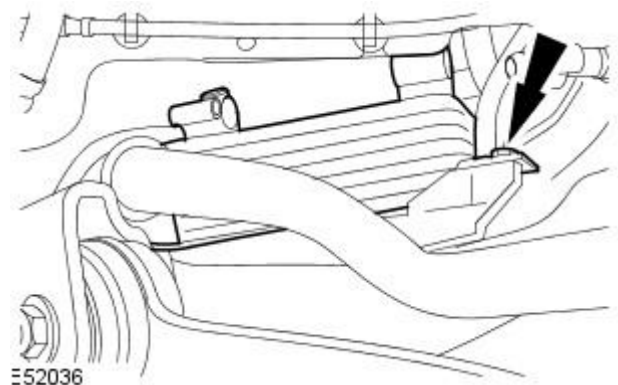


15. Install the right-hand splash shield.



16. Attach the transmission fluid cooler.

- Tighten to 10 Nm.



17. Install the radiator splash shield.

For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

18. Install the air deflector.

For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

19. Install both the front wheels and tires.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

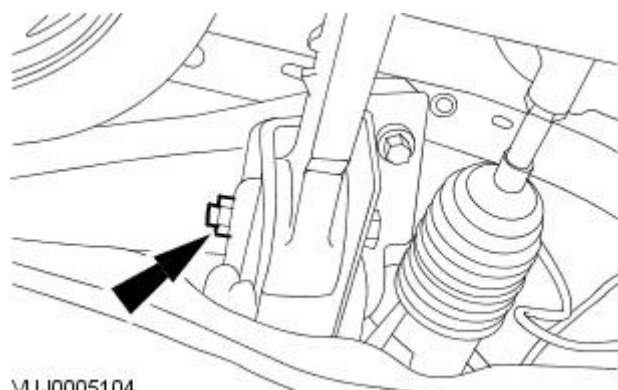
20. Lower the vehicle.

21.  **CAUTION:** The final tightening of the suspension components must be carried out with the vehicle on its wheels.

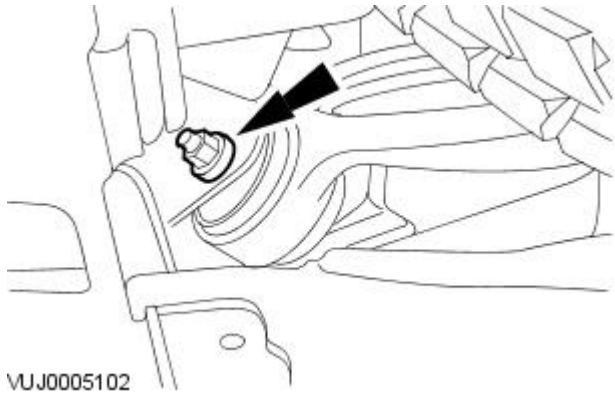
- **NOTE:** Left-hand shown, right-hand similar.

Tighten the rear lower arm retaining nut and bolt.

- Tighten to 175 Nm.





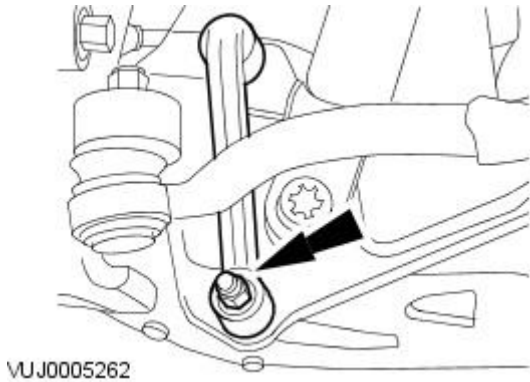


22.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.

• NOTE: Left-hand shown, right-hand similar.

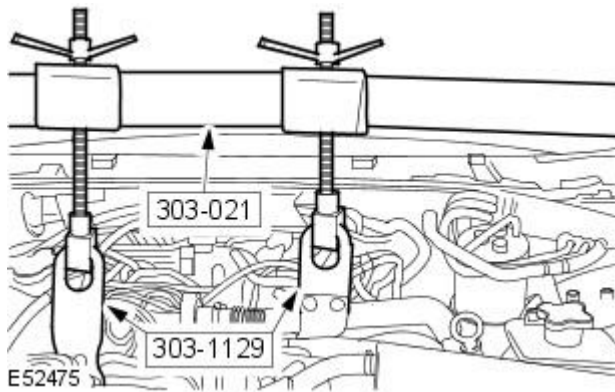
Tighten the front lower arm retaining nut and bolt.

- Tighten to 175 Nm.

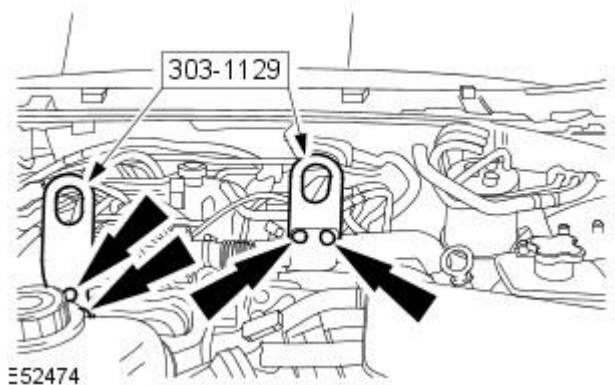


23. NOTE: Left-hand shown, right-hand similar.

Tighten to 70 Nm.



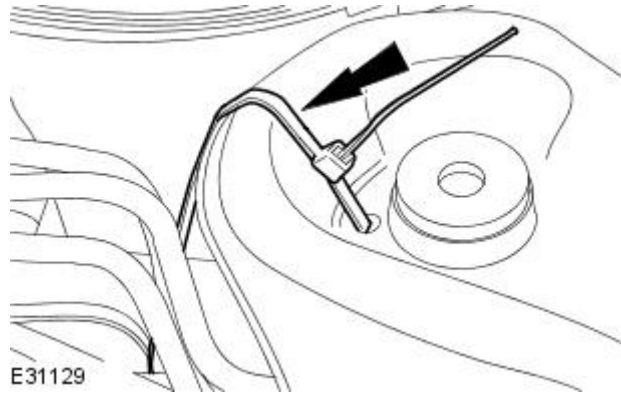
24. Remove the special tool.



25. Remove the special tool.

26. Install the intake air shutoff throttle.  
For additional information, refer to: [Intake Air Shutoff Throttle](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

27. Remove the radiator support.



28. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

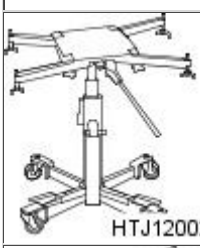
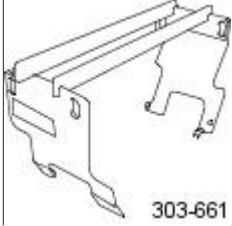


29. Using only four-wheel alignment equipment approved by Jaguar, check and adjust the wheel alignment.

For additional information, refer to: [Camber and Caster Adjustment](#) (204-00 Suspension System - General Information, General Procedures).



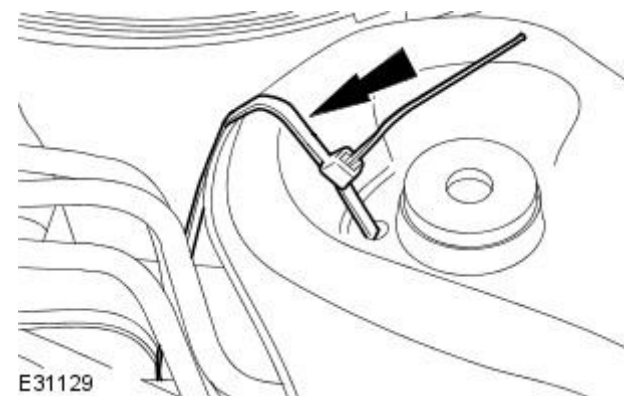
# Uni-Body, Subframe and Mounting System - Front SubframeV6 3.0L Petrol

Removal and Installation

Special Tool(s)	
 <p>HTJ1200-2</p>	Power train assembly jack HTJ1200-2
 <p>303-661</p>	Engine Lifting Bracket 303-661
 <p>303-021</p>	Engine support bracket 303-021
 <p>502-005</p>	Subframe Alignment Bolt 502-005

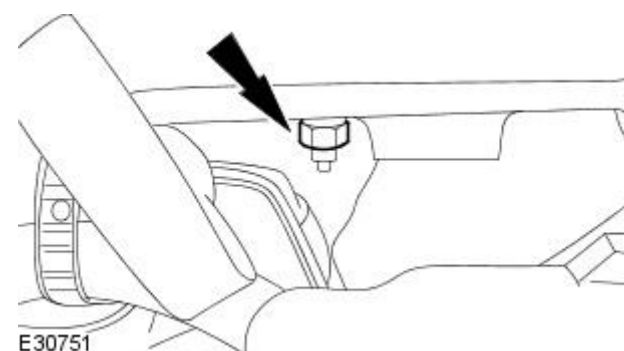
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Using suitable tie straps, secure the radiator.



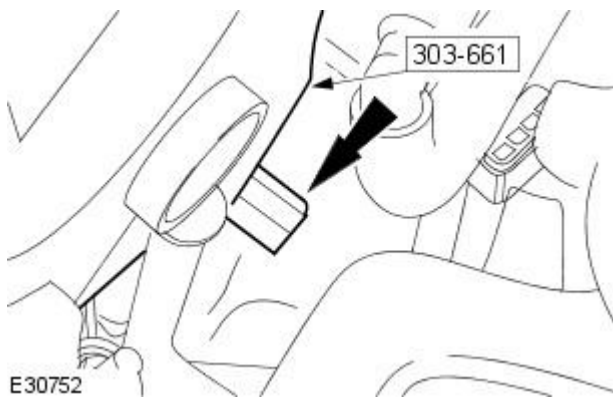
3. **NOTE:** Left-hand shown, right-hand similar.

Loosen the exhaust manifold retaining nut.



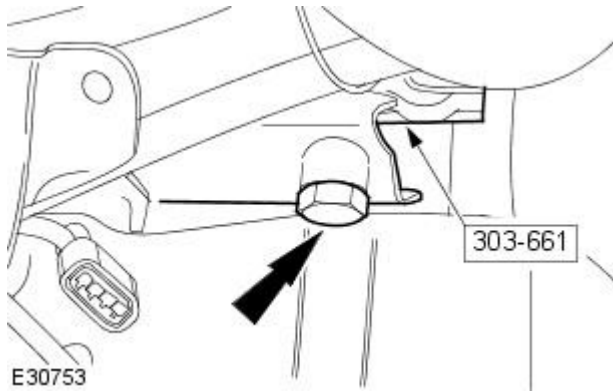
4. Install the special tool to the exhaust manifold.

- Install the retaining bolt.

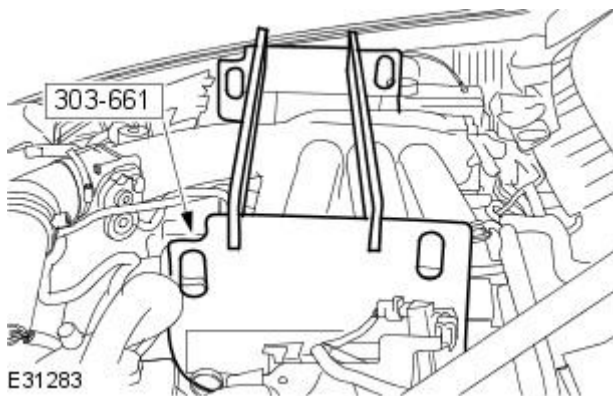


5. NOTE: Left-hand shown, right-hand similar.

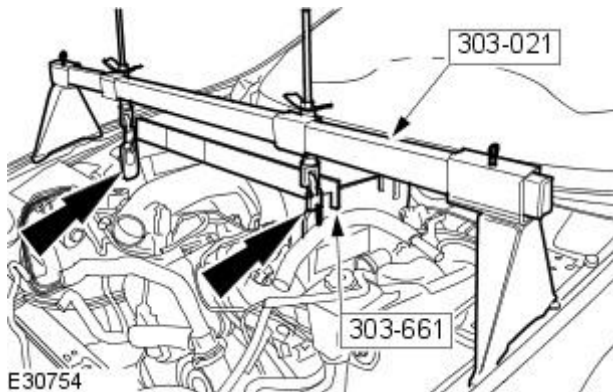
Install the retaining bolt.



6. Install the special tool support bars to the special tool.



7. Install the special tool.



8. Raise and support the vehicle.

9. Remove both the front wheels and tires.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

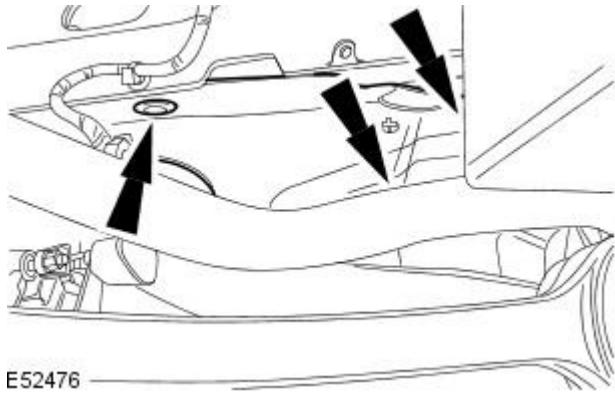
10. Remove the air deflector.

For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

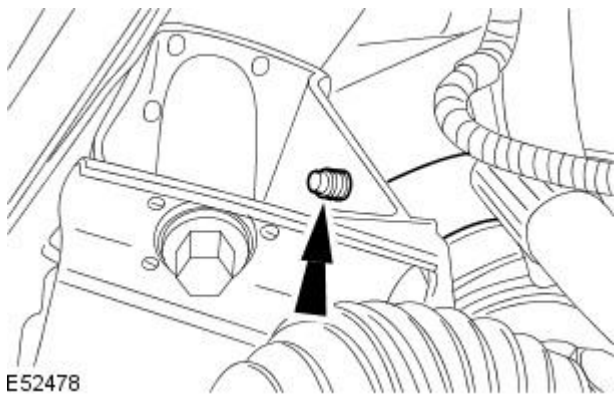
11. Remove the radiator splash shield.

For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

12. Remove the right-hand splash shield.

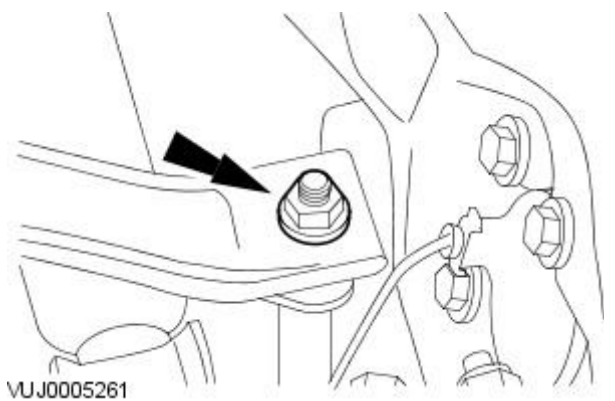


13. Detach the power steering hose retaining clip from the front subframe.



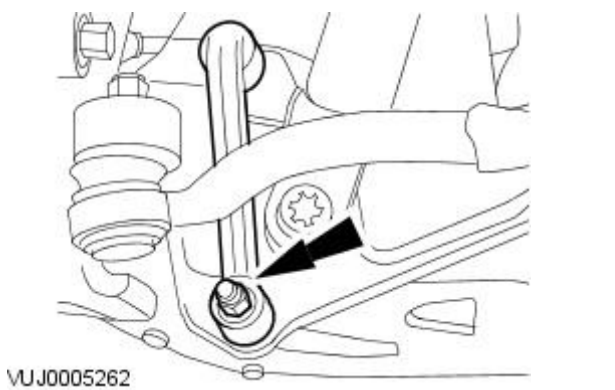
14. NOTE: Left-hand shown, right-hand similar.

Remove the stabilizer bar link upper retaining nut.



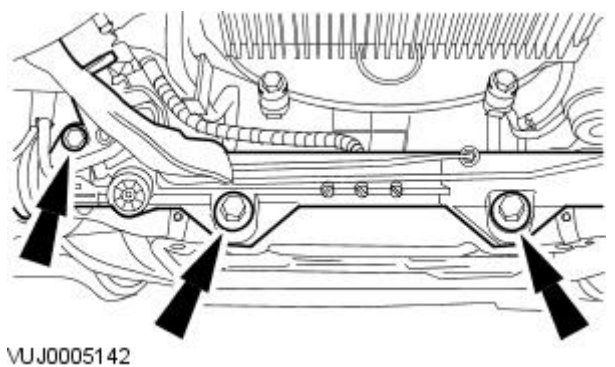
15. NOTE: Left-hand shown, right-hand similar.

Remove the stabilizer bar link lower retaining bolt and nut and remove the stabilizer bar link.



16. Detach the steering gear.

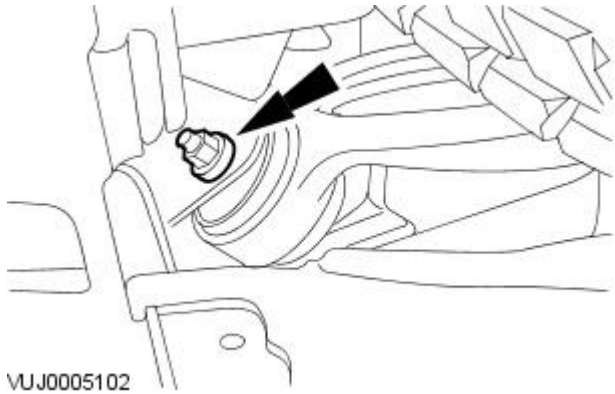
- Secure the steering gear.



**17. NOTE:** Left-hand shown, right-hand similar.

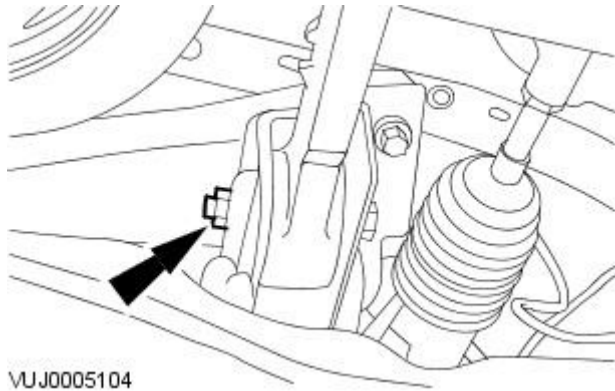
Release the front lower arm and position it to one side.

- Mark the position of the bolt.



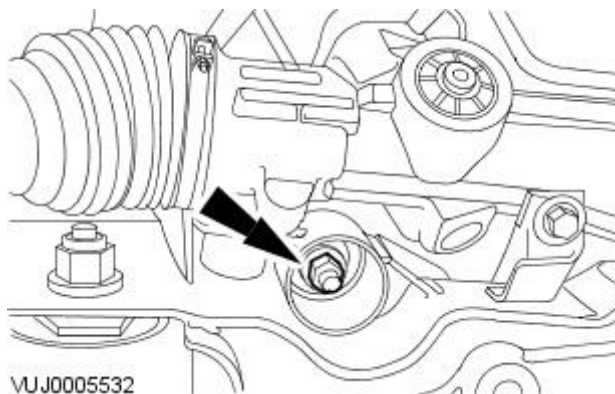
**18. NOTE:** Left-hand shown, right-hand similar.

Release the rear lower arm and position it to one side.

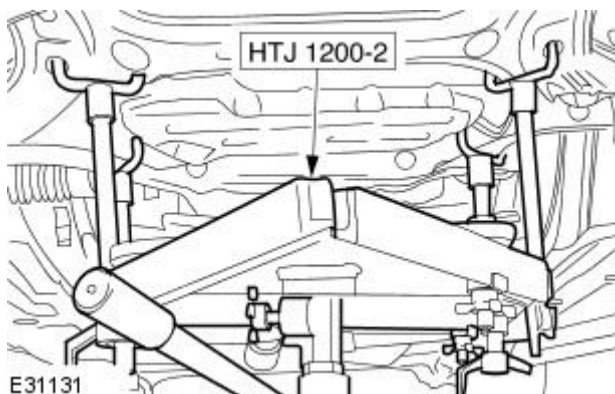


**19. NOTE:** Left-hand shown, right-hand similar.

Remove the engine mount retaining nut.

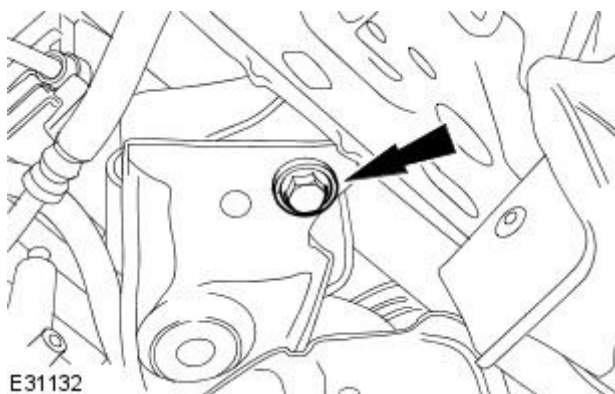


**20.** Install the special tool to the front subframe.



**21. NOTE:** Left-hand shown, right-hand similar.

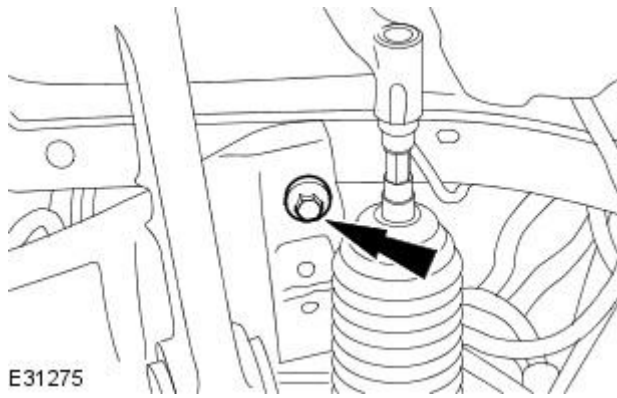
Remove the front subframe front retaining bolt.



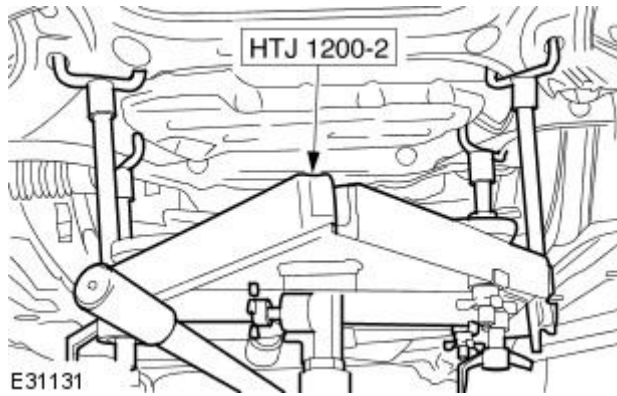


22. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe rear retaining bolt.

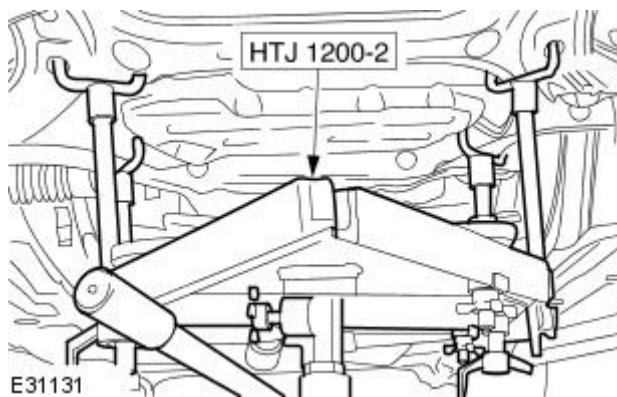


23. Remove the front subframe.



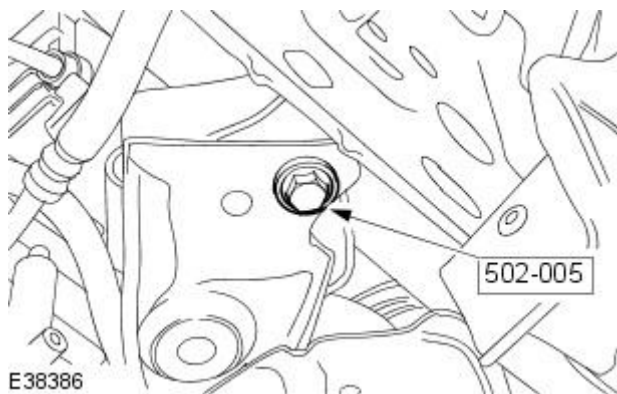
## Installation

1. Install the front subframe.



2. NOTE: Left-hand shown, right-hand similar.

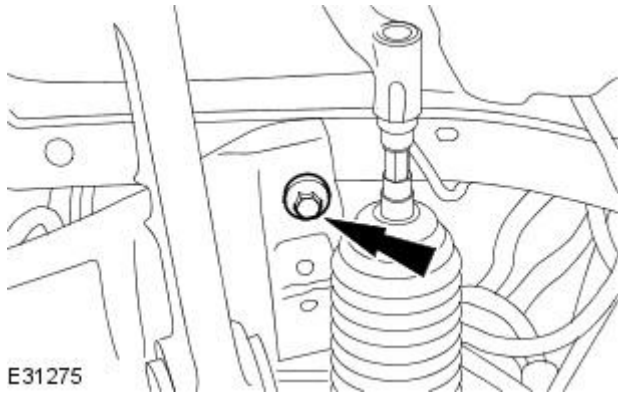
Install the special tool.



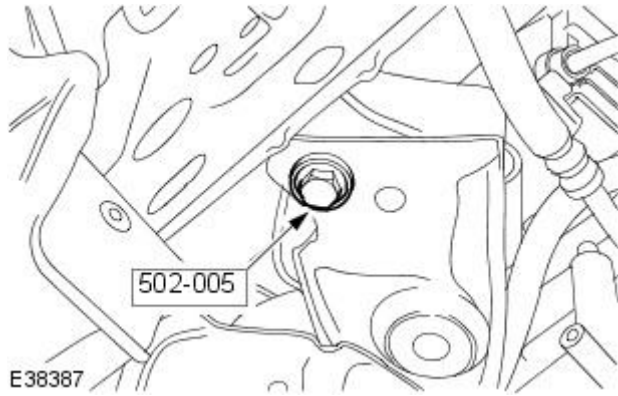
3. NOTE: Left-hand shown, right-hand similar.

Install the front subframe rear retaining bolt.

- Tighten to 80 Nm + 240°.

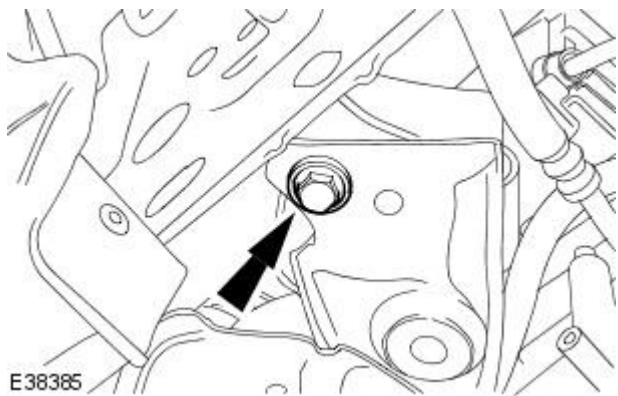


4. Remove the special tool.

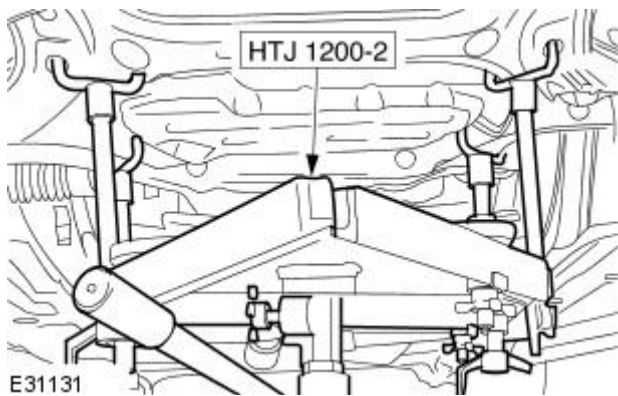


5. Install the front subframe front retaining bolt.

- Tighten to 150 Nm + 240°.



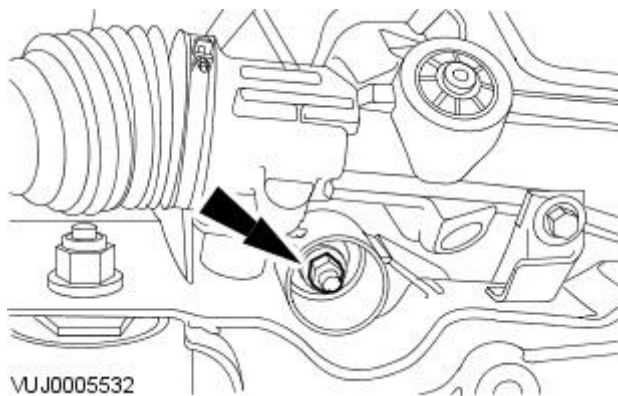
6. Remove the special tool.



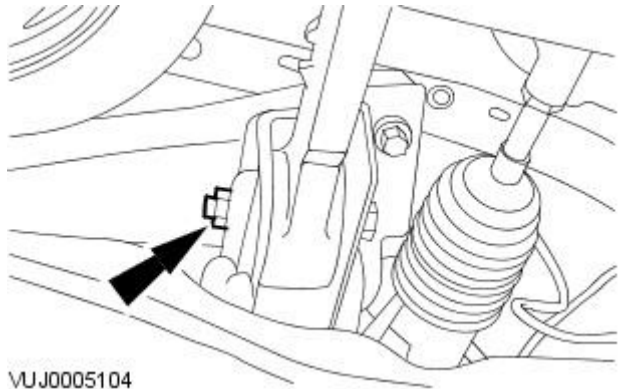
7. NOTE: Left-hand shown, right-hand similar.

Install the engine mount retaining nut.

- Tighten to 63 Nm.





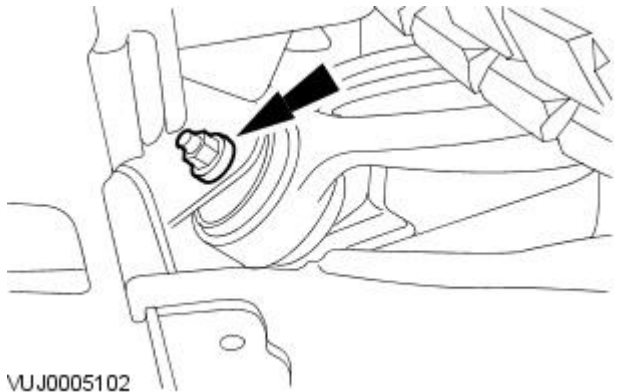


VUJ0005104

8.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.

• NOTE: Left-hand shown, right-hand similar.

Install the rear lower arm.

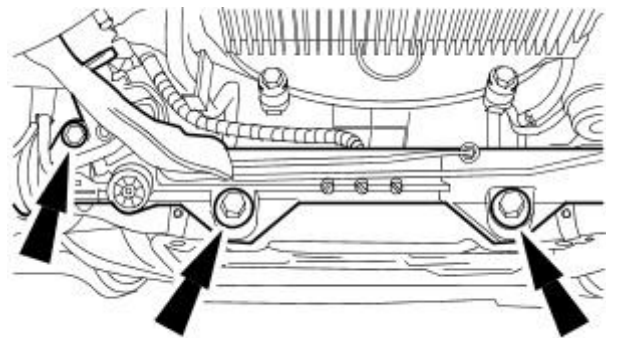


VUJ0005102

9.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.

• NOTE: Left-hand shown, right-hand similar.

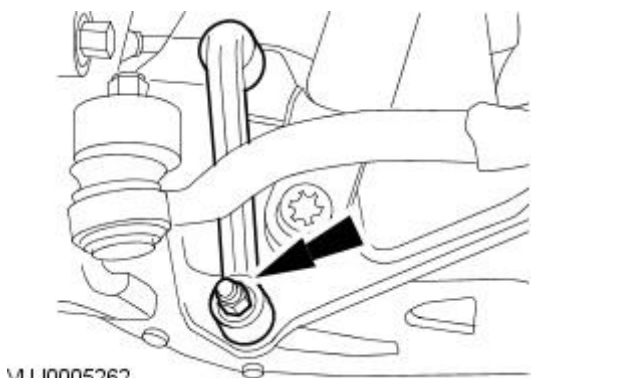
Install the front lower arm.



VUJ0005142

10. Install the steering gear.

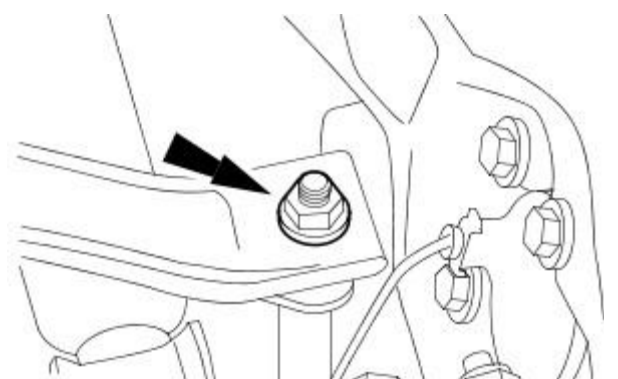
- Tighten to 100 Nm.



VUJ0005262

11. NOTE: Left-hand shown, right-hand similar.

Install the stabilizer bar link.

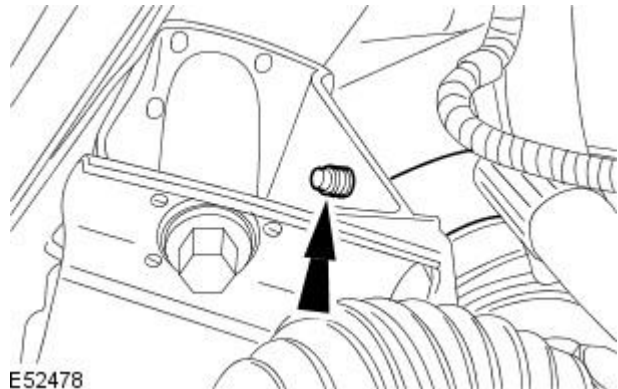


VUJ0005261

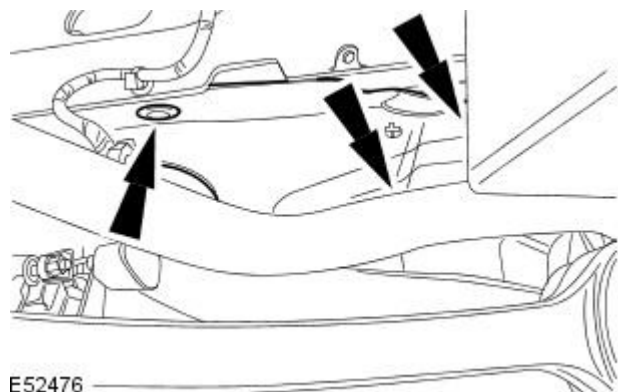
12. Attach the stabilizer bar link and install the stabilizer bar link retaining nut.

- Tighten to 43 Nm.

13. Attach the power steering hose retaining clip to the front subframe.



14. Install the right-hand splash shield.



15. Install the radiator splash shield.

For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

16. Install the air deflector.

For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

17. Install both the front wheels and tires.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

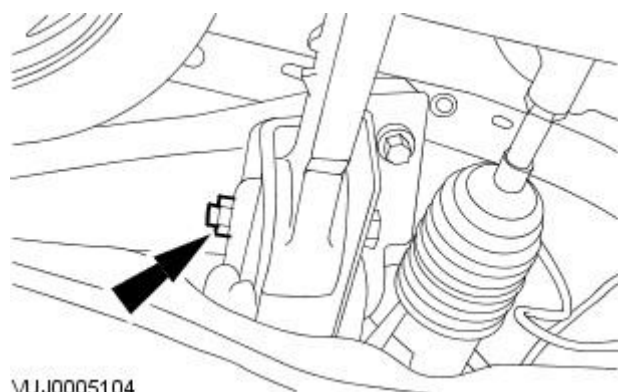
18. Lower the vehicle.

19.  **CAUTION:** The final tightening of the suspension components must be carried out with the vehicle on its wheels.

• **NOTE:** Left-hand shown, right-hand similar.

Tighten the rear lower arm retaining nut and bolt.

- Tighten to 175 Nm.

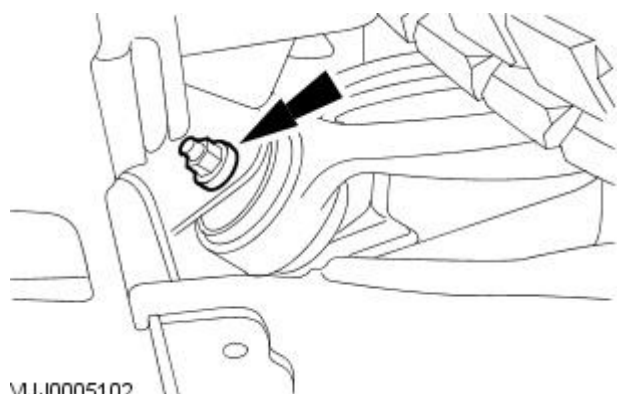


20.  **CAUTION:** The final tightening of the suspension components must be carried out with the vehicle on its wheels.

• **NOTE:** Left-hand shown, right-hand similar.

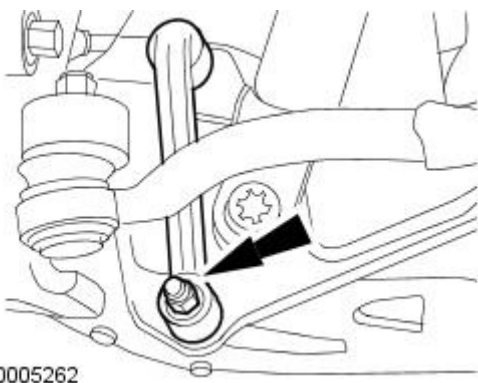
Tighten the front lower arm retaining nut and bolt.

- Tighten to 175 Nm.

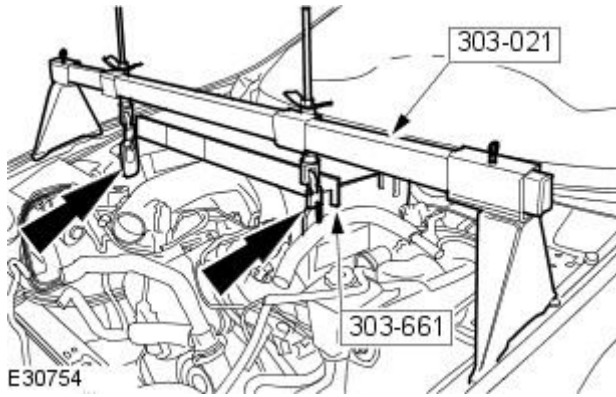


21. NOTE: Left-hand shown, right-hand similar.

Tighten to 70 Nm.



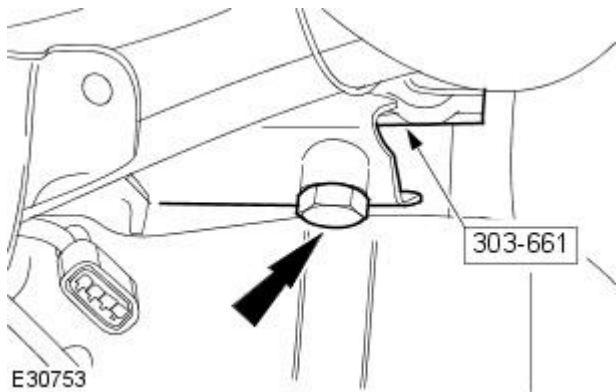
22. Remove the special tool.



23. Remove the special tool support bars from the special tool.

24. NOTE: Left-hand shown, right-hand similar.

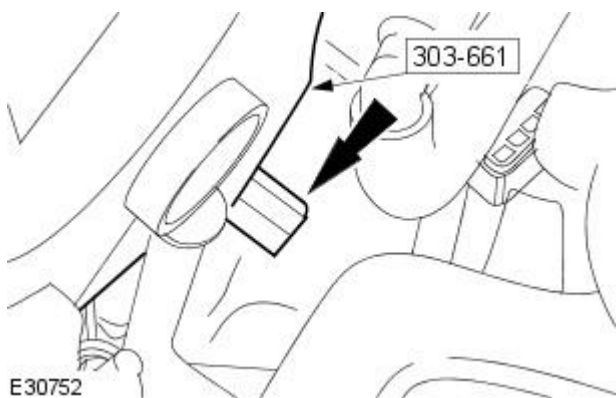
Remove the retaining bolt.



25. NOTE: Left-hand shown, right-hand similar.

Remove the special tool from the exhaust manifold.

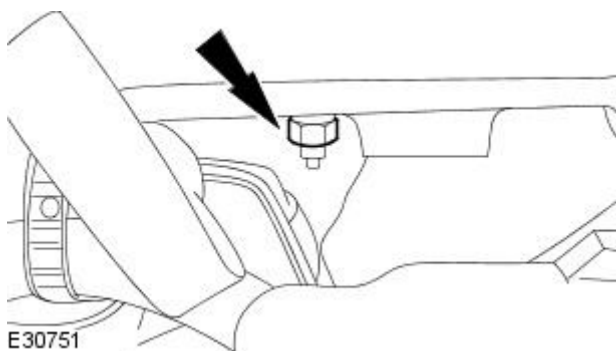
- Remove the retaining bolt.



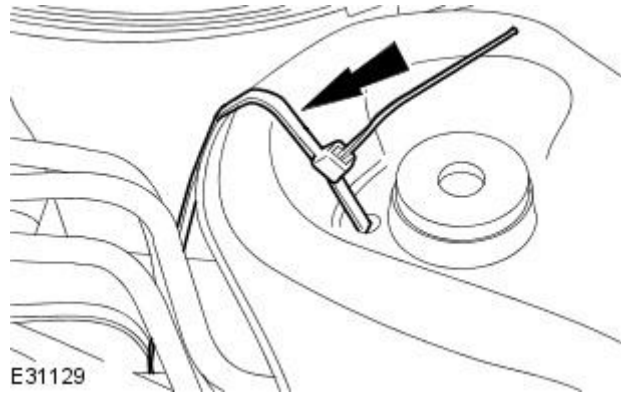
26. NOTE: Left-hand shown, right-hand similar.

Tighten the exhaust manifold retaining nut.

- Tighten to 20 Nm.



27. Remove the radiator support.



28. Connect the battery ground cable.


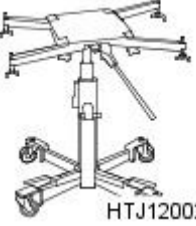

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

29. Using only four-wheel alignment equipment approved by Jaguar, check and adjust the wheel alignment.

For additional information, refer to: [Four-Wheel Alignment](#) (204-00 Suspension System - General Information, General Procedures).

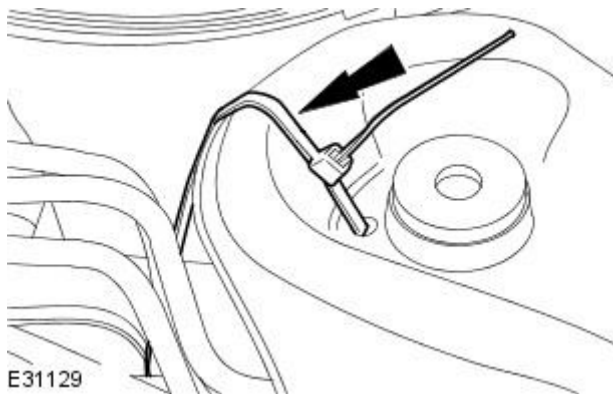
# Uni-Body, Subframe and Mounting System - Front Subframe 4.2L NA V8 - AJV8

## Removal and Installation

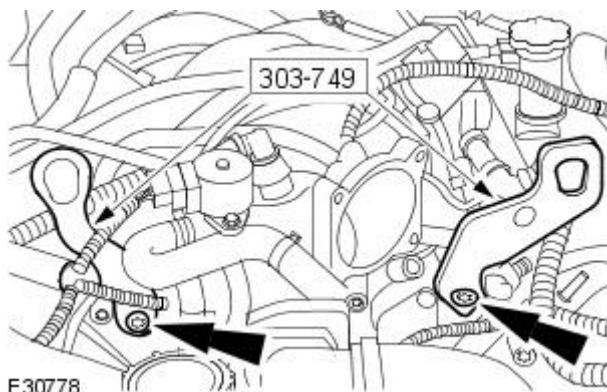
Special Tool(s)	
 303-021	Engine support bracket 303-021
 HTJ1200-2	Power train assembly jack HTJ1200-2
 502-005	Subframe Alignment Bolt 502-005

### Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Using suitable tie straps, secure the radiator.



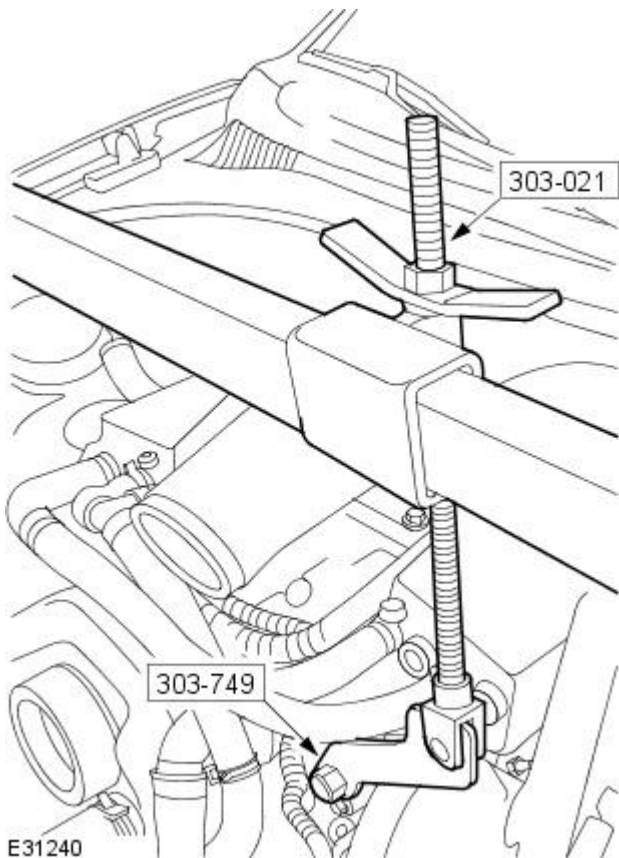
3. Remove the throttle body.  
For additional information, refer to: [Throttle Body](#) (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Removal and Installation).



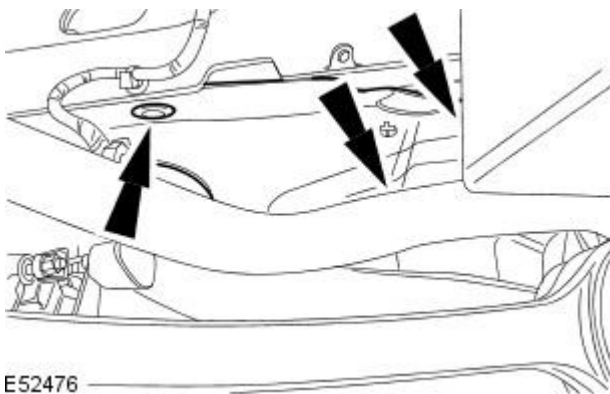
4. Install the special tools.



5. Install the special tool.

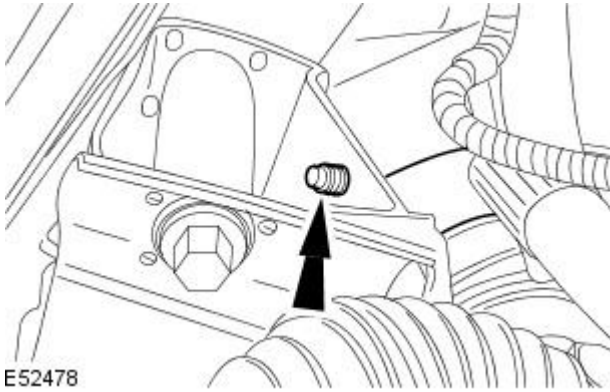


6. Raise and support the vehicle.
7. Remove both the front wheels and tires.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
8. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).
9. Remove the radiator splash shield.  
For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).
10. Remove the right-hand splash shield.



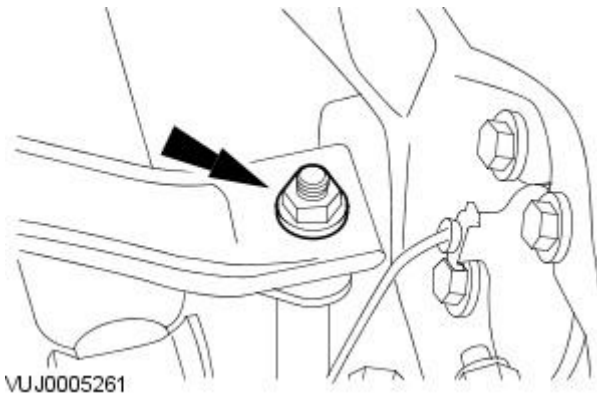


11. Detach the power steering hose retaining clip from the front subframe.



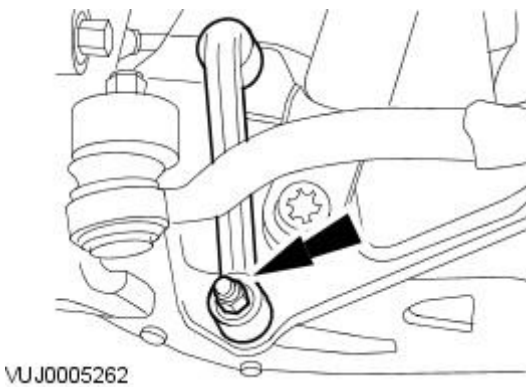
12. NOTE: Left-hand shown, right-hand similar.

Remove the stabilizer bar link upper retaining nut.



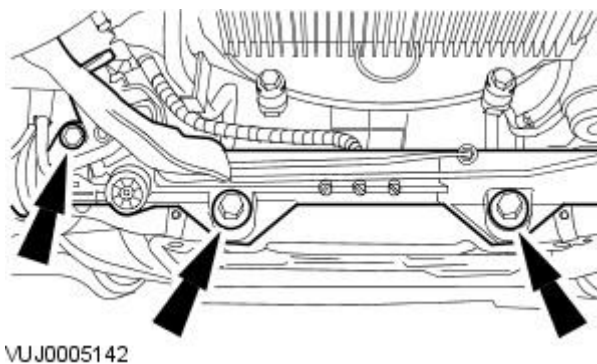
13. NOTE: Left-hand shown, right-hand similar.

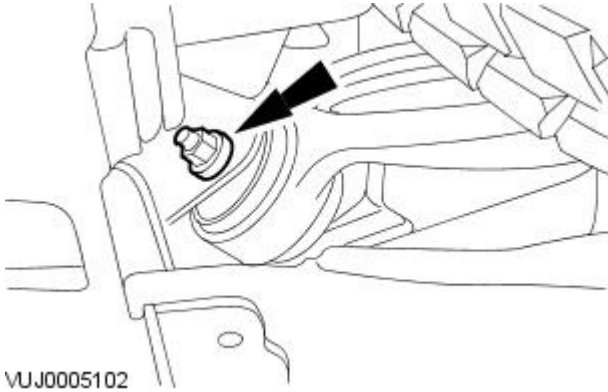
Remove the stabilizer bar link lower retaining bolt and nut and remove the stabilizer bar link.



14. Detach the steering gear.

- Secure the steering gear.

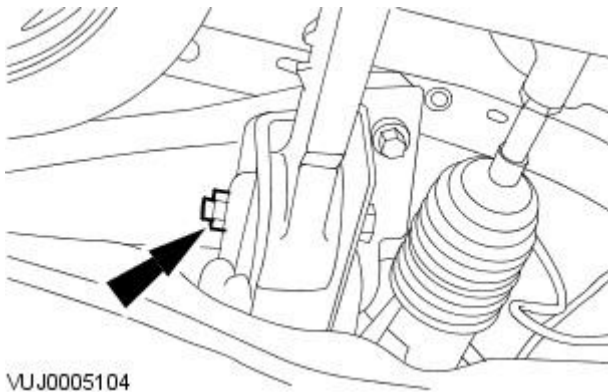




15. NOTE: Left-hand shown, right-hand similar.

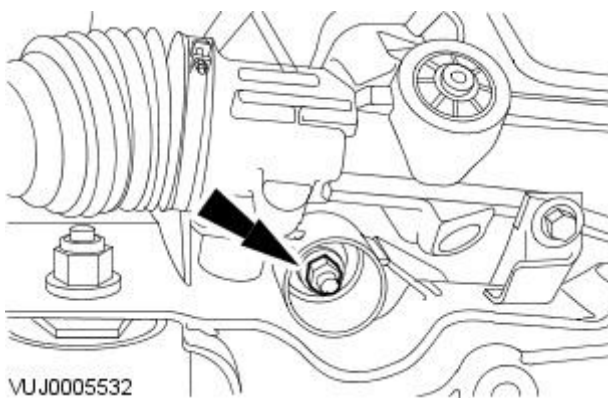
Release the front lower arm and position it to one side.

- Mark the position of the bolt.



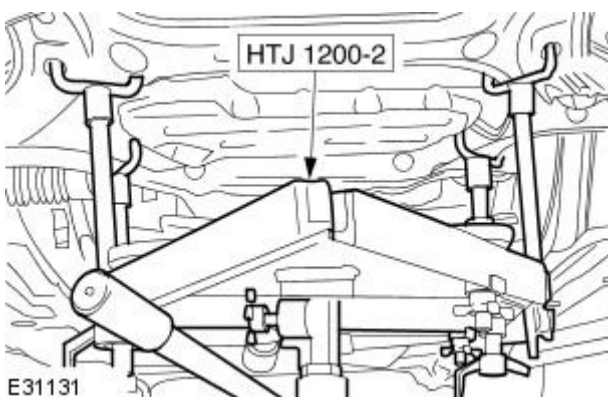
16. NOTE: Left-hand shown, right-hand similar.

Release the rear lower arm and position it to one side.



17. NOTE: Left-hand shown, right-hand similar.

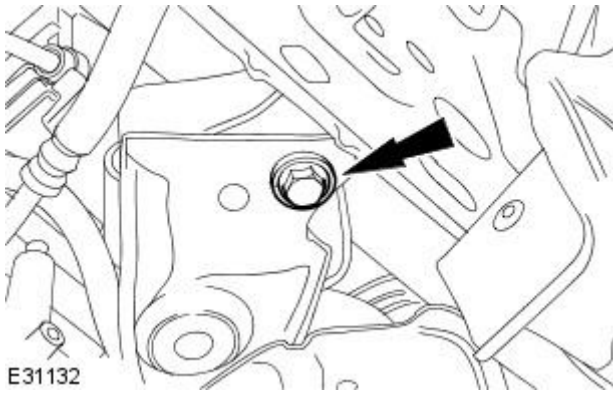
Remove the engine mount retaining nut.



18. Install the special tool to the front subframe.

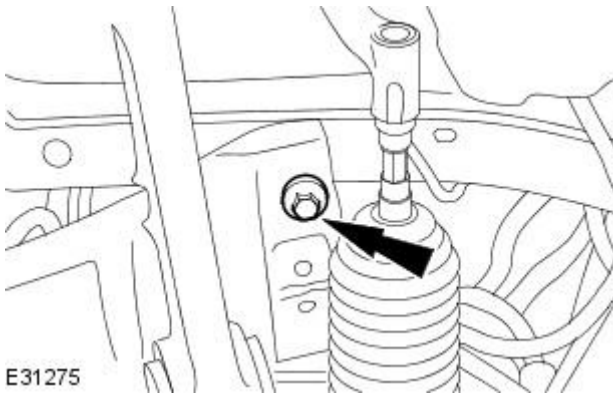
19. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe front retaining bolt.

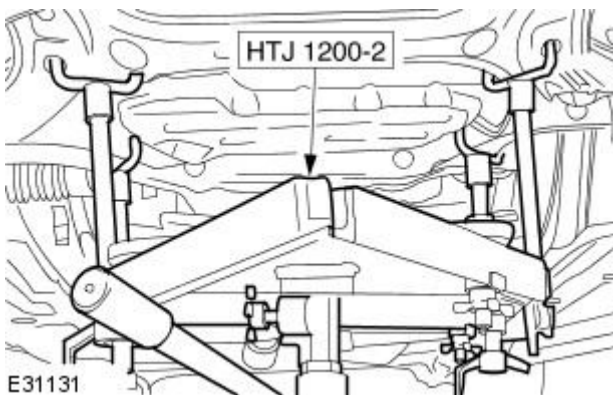


20. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe rear retaining bolt.

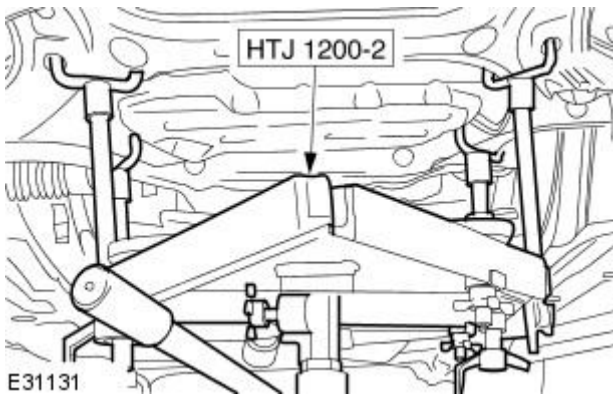


21. Remove the front subframe.



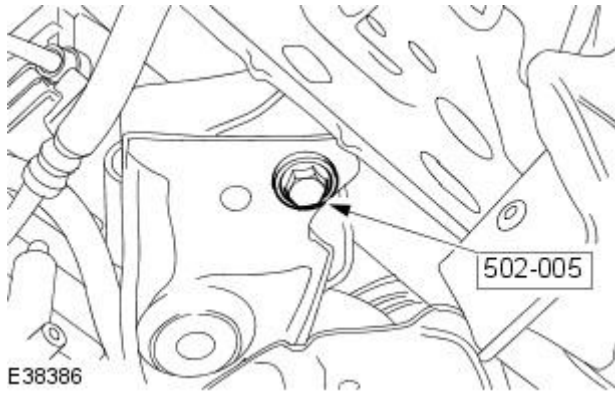
## Installation

1. Install the front subframe.



2. NOTE: Left-hand shown, right-hand similar.

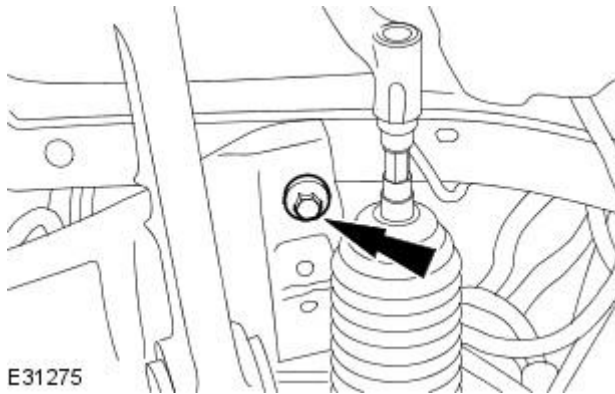
Install the special tool.



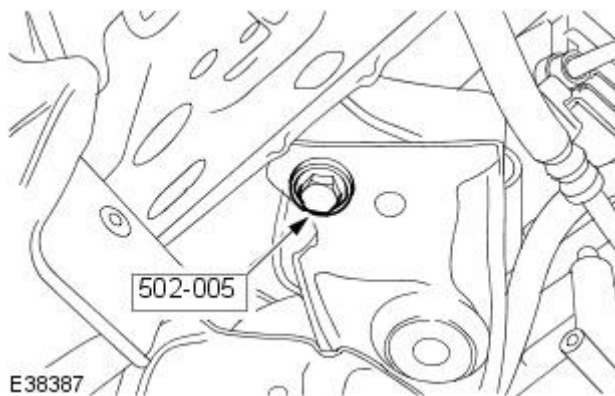
3. NOTE: Left-hand shown, right-hand similar.

Install the front subframe rear retaining bolt.

- Tighten to 80 Nm + 240°.

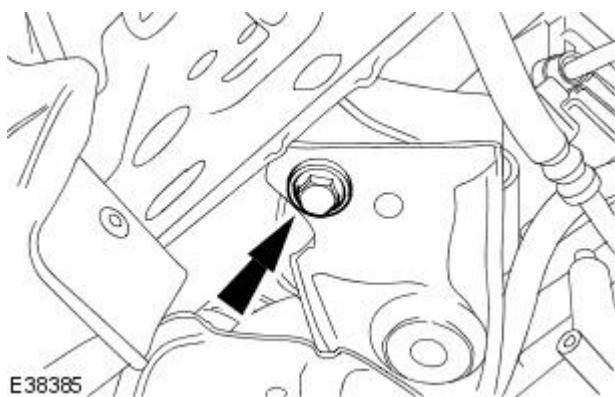


4. Remove the special tool.

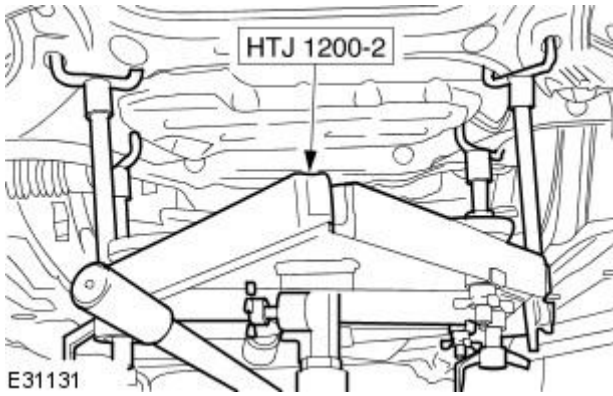


5. Install the front subframe front retaining bolt.

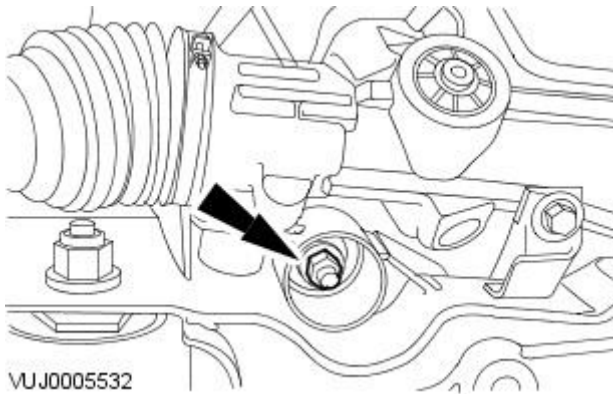
- Tighten to 150 Nm + 240°.







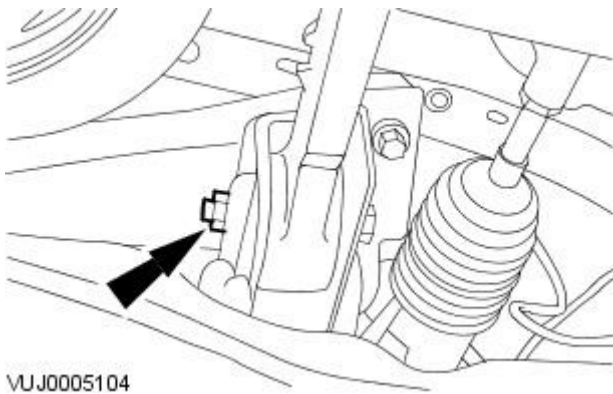
6. Remove the special tool.



7. **NOTE:** Left-hand shown, right-hand similar.

Install the engine mount retaining nut.

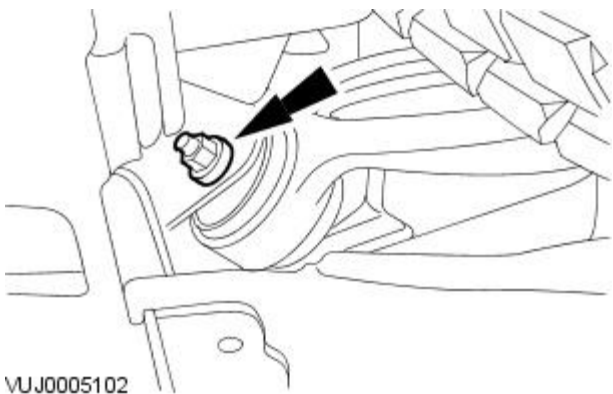
- Tighten to 63 Nm.



8. **⚠ CAUTION:** The final tightening of the suspension components must be carried out with the vehicle on its wheels.

• **NOTE:** Left-hand shown, right-hand similar.

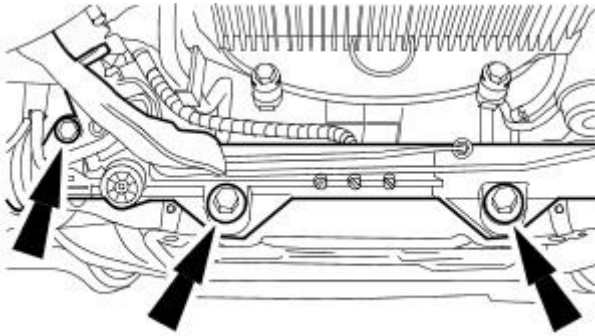
Install the rear lower arm.



9. **⚠ CAUTION:** The final tightening of the suspension components must be carried out with the vehicle on its wheels.

• **NOTE:** Left-hand shown, right-hand similar.

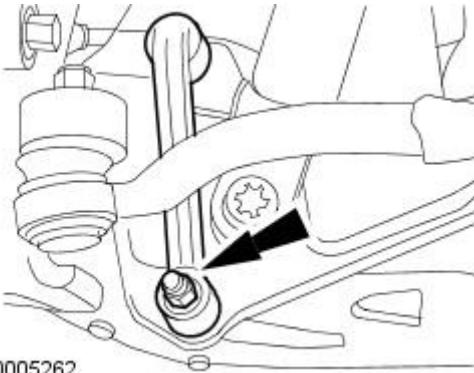
Install the front lower arm.



VUJ0005142

10. Install the steering gear.

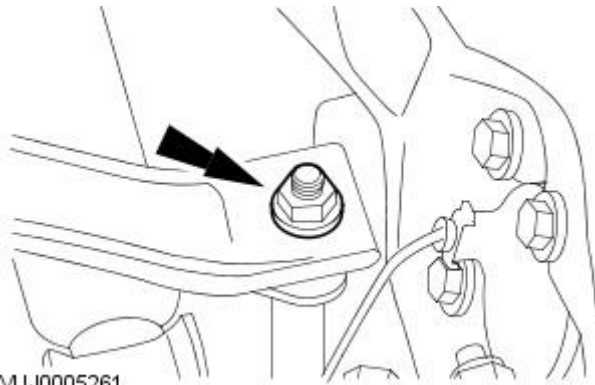
- Tighten to 100 Nm.



VUJ0005262

11. NOTE: Left-hand shown, right-hand similar.

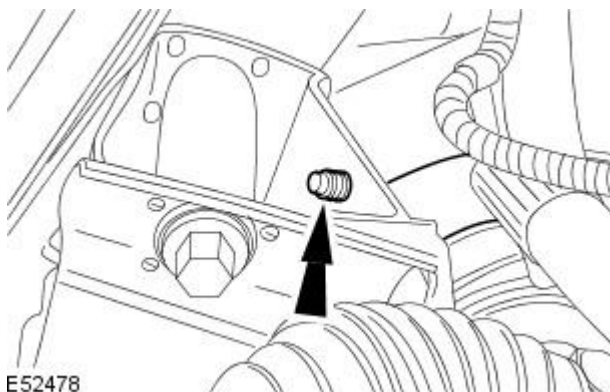
Install the stabilizer bar link.



VUJ0005261

12. Attach the stabilizer bar link and install the stabilizer bar link retaining nut.

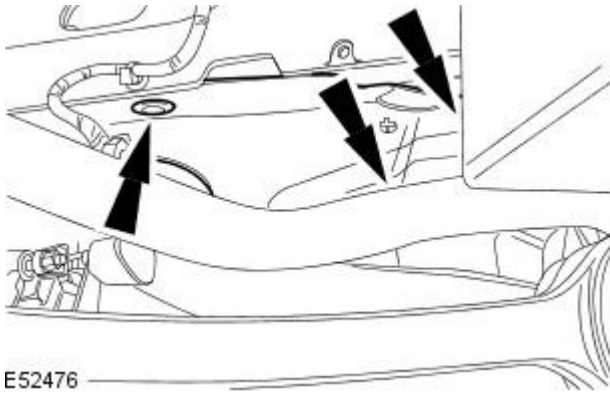
- Tighten to 43 Nm.



E52478

13. Attach the power steering hose retaining clip to the front subframe.





14. Install the right-hand splash shield.

E52476

15. Install the radiator splash shield.

For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

16. Install the air deflector.

For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).

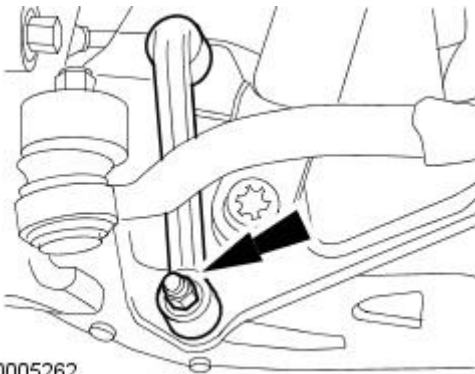
17. Install both the front wheels and tires.

For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

18. Lower the vehicle.

19. NOTE: Left-hand shown, right-hand similar.

Tighten to 70 Nm.



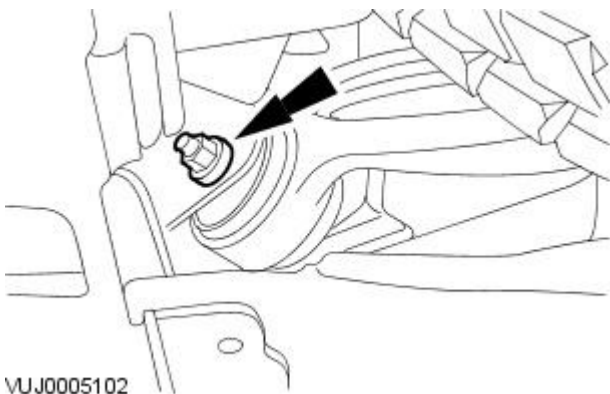
VUJ0005262

20.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.


• NOTE: Left-hand shown, right-hand similar.

Tighten the front lower arm retaining nut and bolt.

- Tighten to 175 Nm.



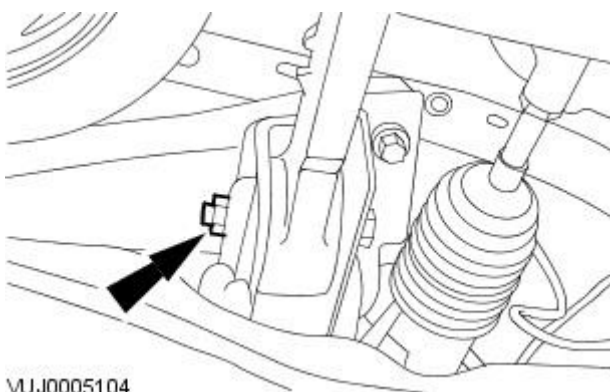
VUJ0005102

21.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.

• NOTE: Left-hand shown, right-hand similar.

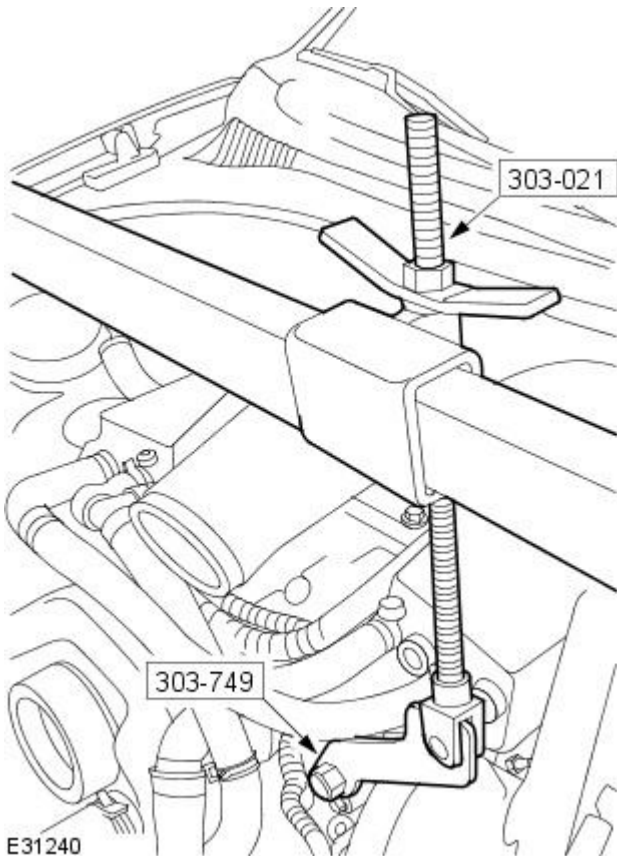
Tighten the rear lower arm retaining nut and bolt.

- Tighten to 175 Nm.



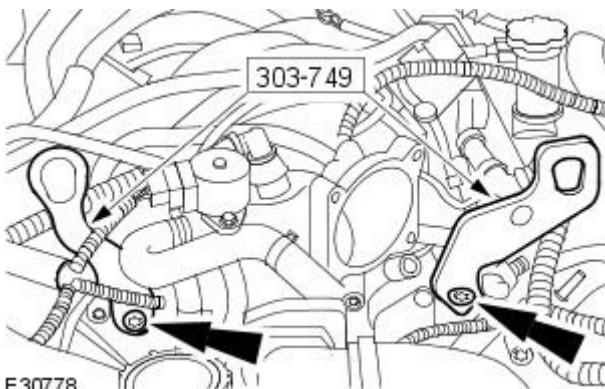
VUJ0005104

22. Remove the special tool.



E31240

23. Remove the special tool.

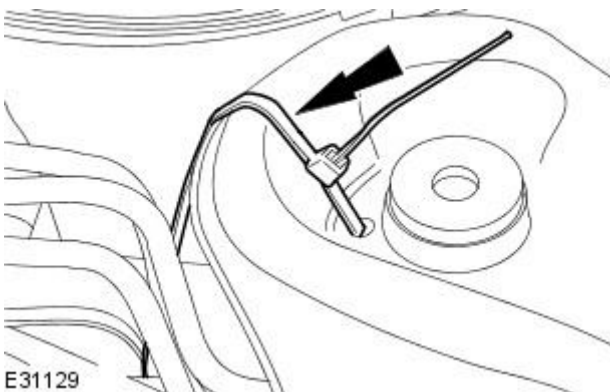


E30778

24. Install the throttle body.

For additional information, refer to: [Throttle Body](#) (303-04A Fuel Charging and Controls - 4.2L NA V8 - AJV8, Removal and Installation).

25. Remove the radiator support.



E31129

26. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).




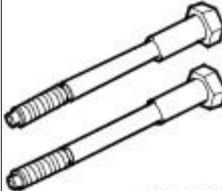
27. Using only four-wheel alignment equipment approved by

Jaguar, check and adjust the wheel alignment.  
For additional information, refer to: [Camber and Caster Adjustment](#) (204-00 Suspension System - General Information, General Procedures).

# Uni-Body, Subframe and Mounting System - Front Subframe 4.2L SC V8 -

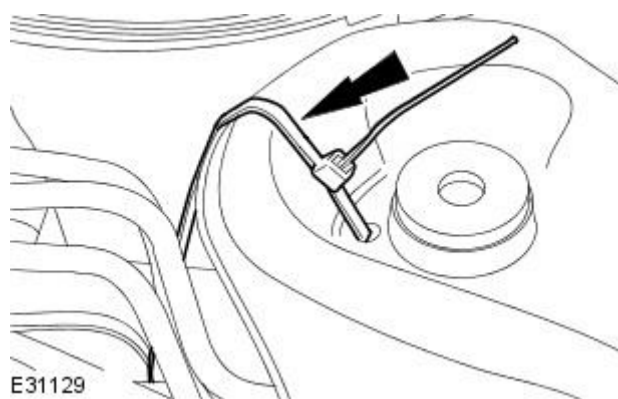
## AJV8

### Removal and Installation

Special Tool(s)	
 <p>303-749</p>	Engine lifting brackets 303-749
 <p>303-021</p>	Engine support bracket 303-021
 <p>HTJ1200-2</p>	Power train assembly jack HTJ1200-2
 <p>502-005</p>	Subframe Alignment Bolt 502-005

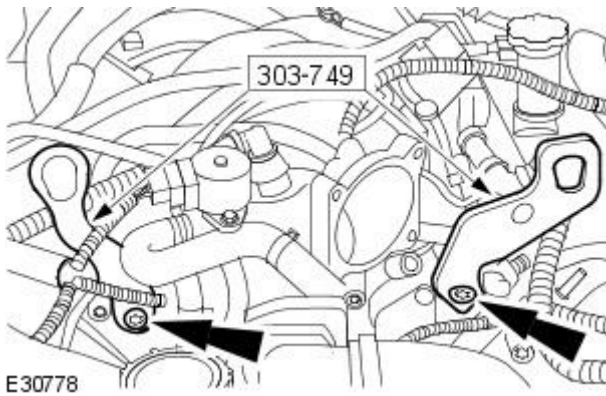
### Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Using suitable tie straps, secure the radiator.

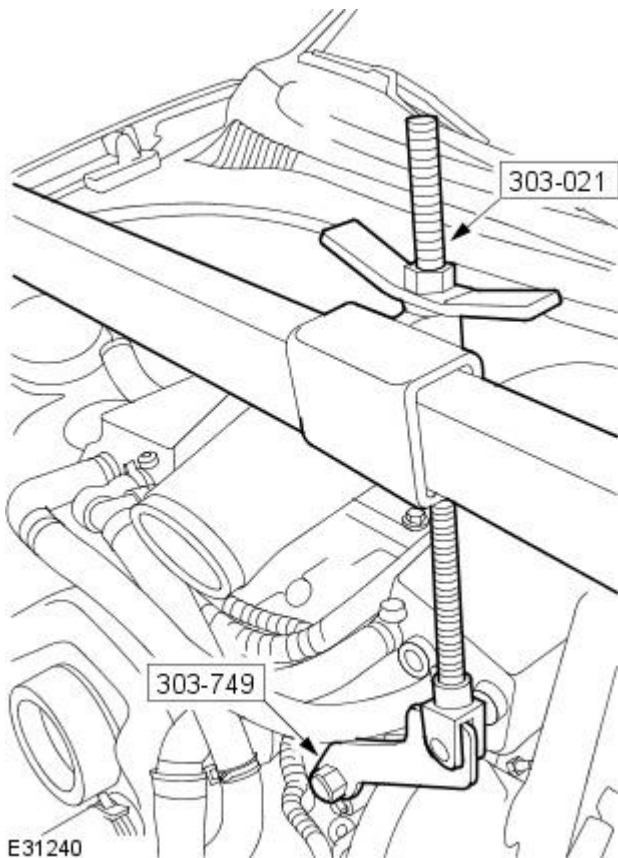


3. Remove the air filter outlet tube.  
For additional information, refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).

4. Install the special tools.

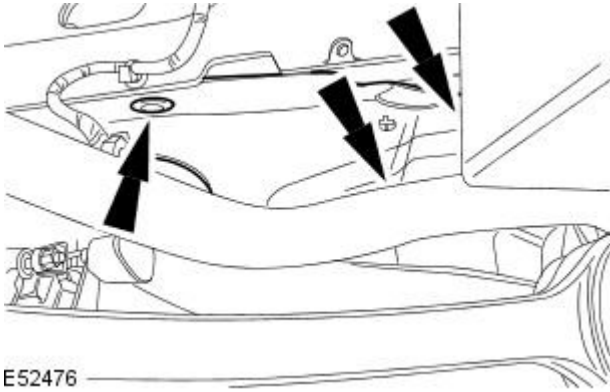


5. Install the special tool.



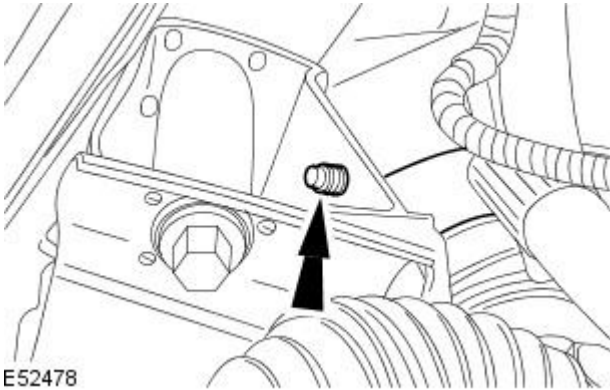
6. Raise and support the vehicle.
7. Remove both the front wheels and tires.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
8. Remove the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).
9. Remove the radiator splash shield.  
For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

10. Remove the right-hand splash shield.



E52476

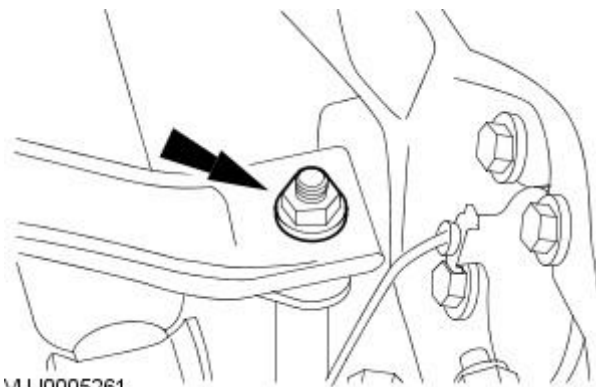
11. Detach the power steering hose retaining clip from the front subframe.



E52478

12. NOTE: Left-hand shown, right-hand similar.

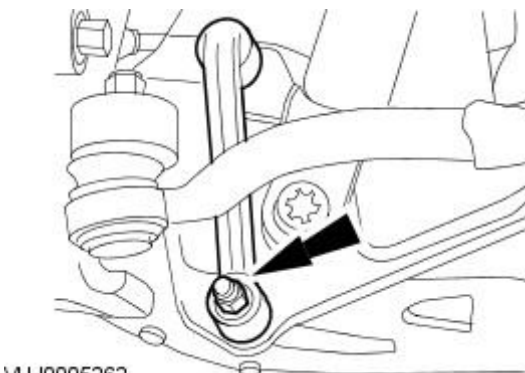
Remove the stabilizer bar link upper retaining nut.



VUJ0005261

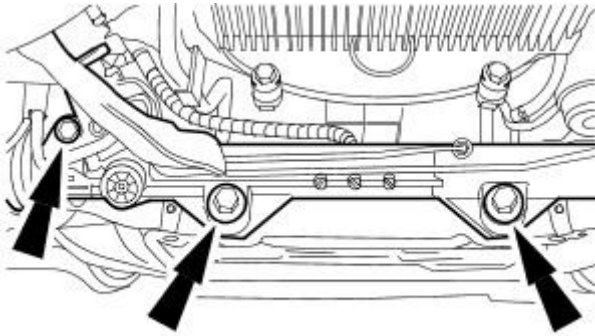
13. NOTE: Left-hand shown, right-hand similar.

Remove the stabilizer bar link lower retaining bolt and nut and remove the stabilizer bar link.



VUJ0005262

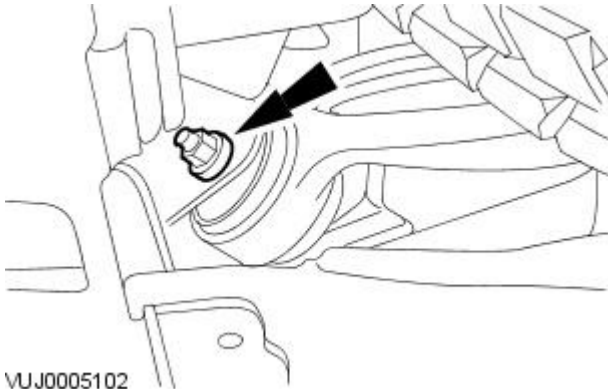




VUJ0005142

14. Detach the steering gear.

- Secure the steering gear.

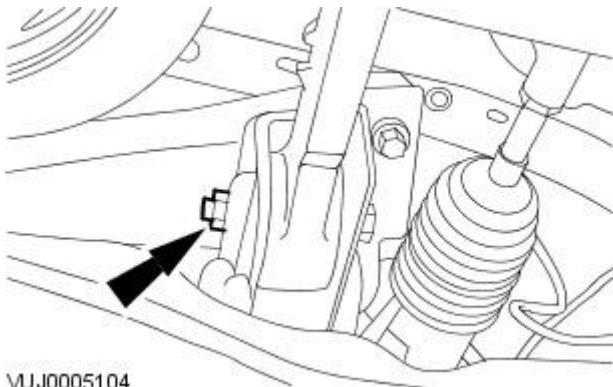


VUJ0005102

15. NOTE: Left-hand shown, right-hand similar.

Release the front lower arm and position it to one side.

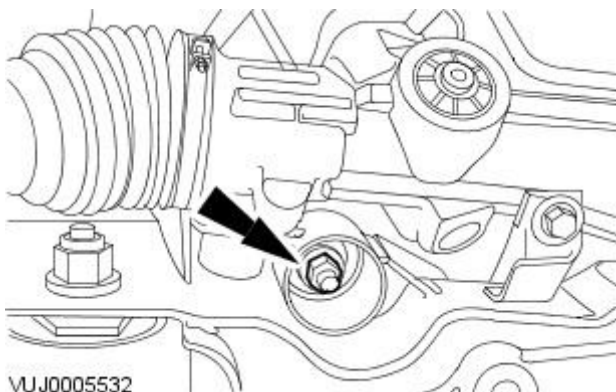
- Mark the position of the bolt.



VUJ0005104

16. NOTE: Left-hand shown, right-hand similar.

Release the rear lower arm and position it to one side.



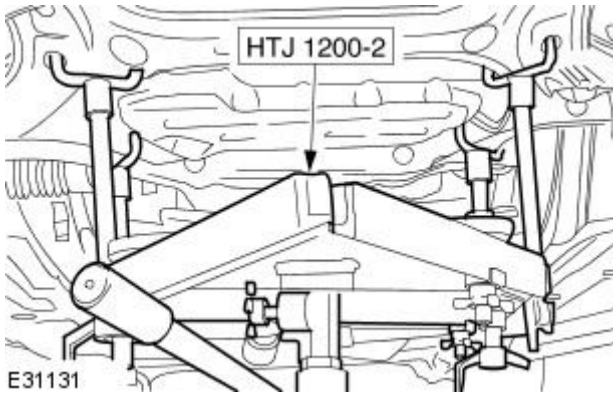
VUJ0005532

17. NOTE: Left-hand shown, right-hand similar.

Remove the engine mount retaining nut.

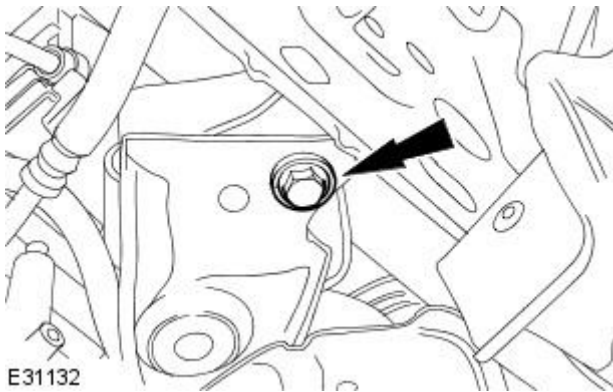


18. Install the special tool to the front subframe.



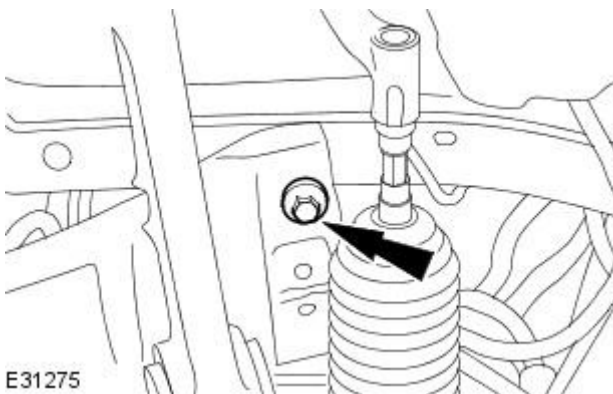
19. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe front retaining bolt.

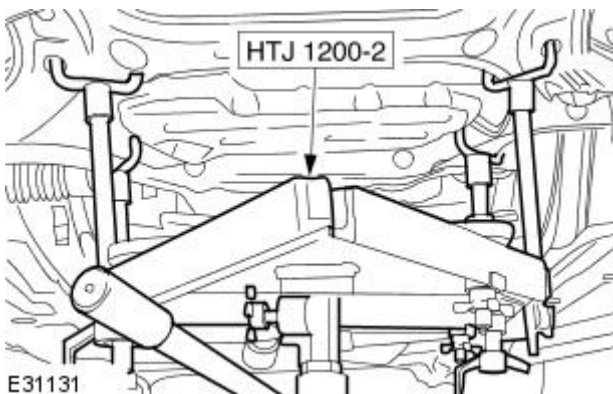


20. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe rear retaining bolt.

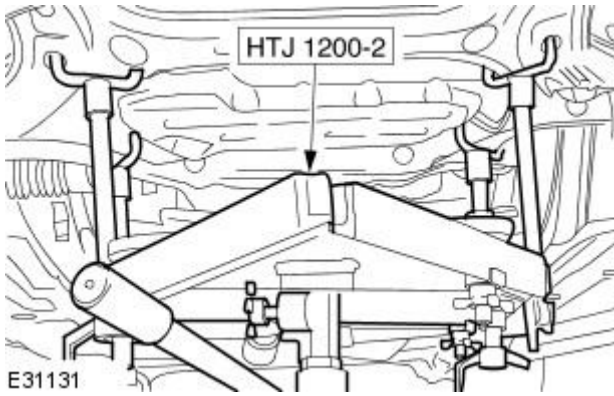


21. Remove the front subframe.



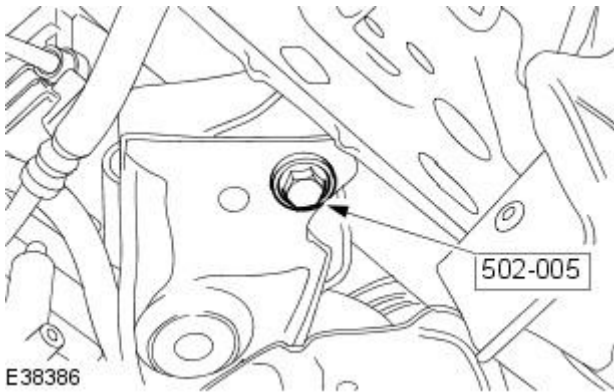
## Installation

1. Install the front subframe.



2. NOTE: Left-hand shown, right-hand similar.

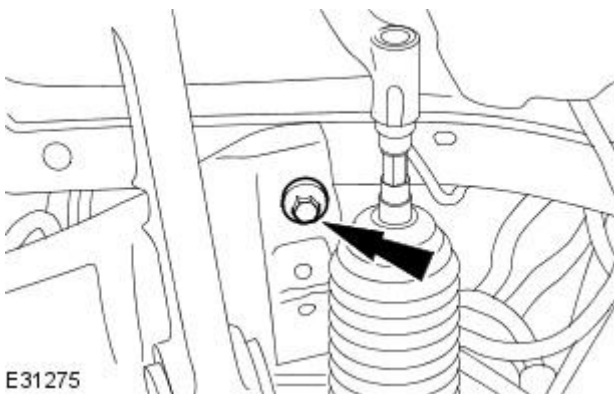
Install the special tool.



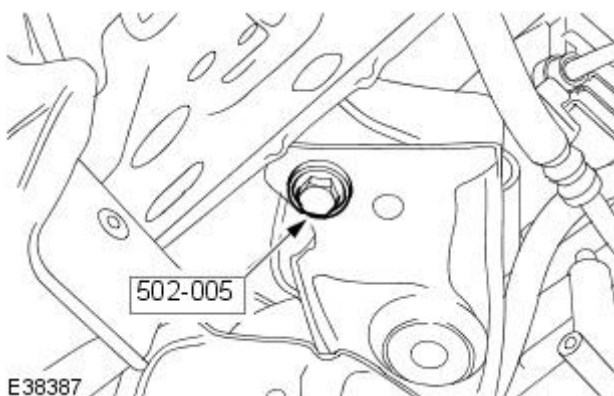
3. NOTE: Left-hand shown, right-hand similar.

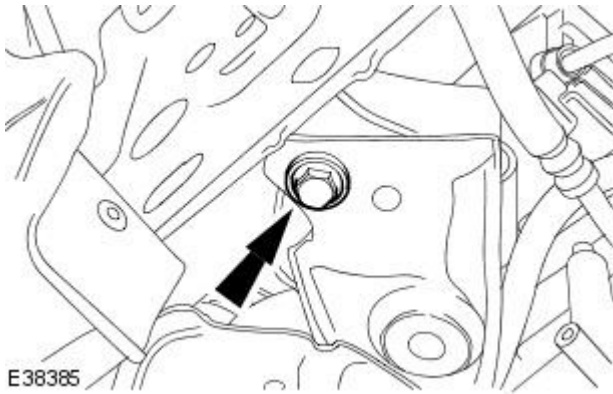
Install the front subframe rear retaining bolt.

- Tighten to 80 Nm + 240°.



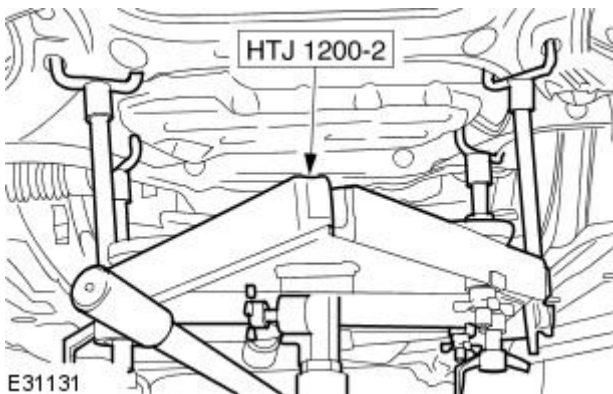
4. Remove the special tool.



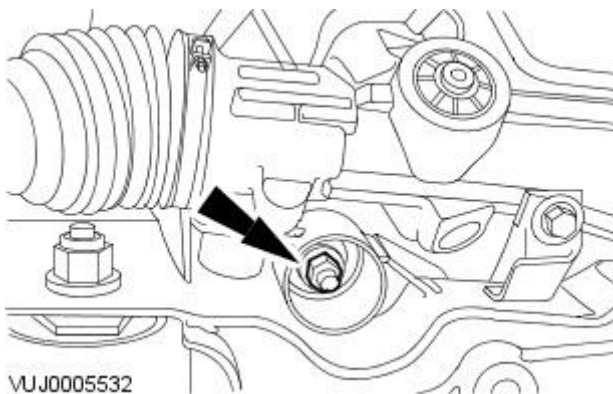


5. Install the front subframe front retaining bolt.

- Tighten to 150 Nm + 240°.



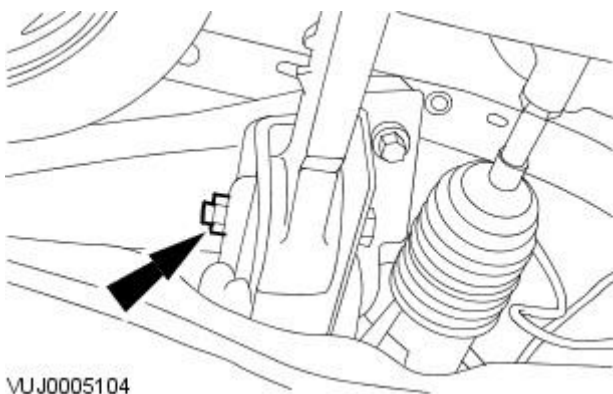
6. Remove the special tool.



7. NOTE: Left-hand shown, right-hand similar.

Install the engine mount retaining nut.

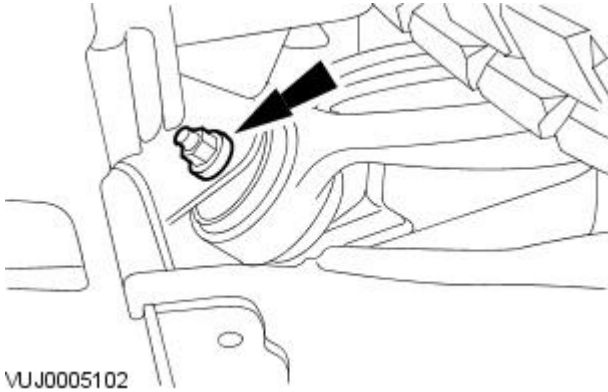
- Tighten to 63 Nm.



8.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.

• NOTE: Left-hand shown, right-hand similar.

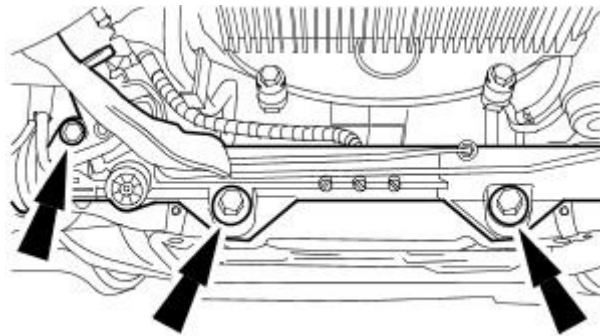
Install the rear lower arm.



9.  CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.

• NOTE: Left-hand shown, right-hand similar.

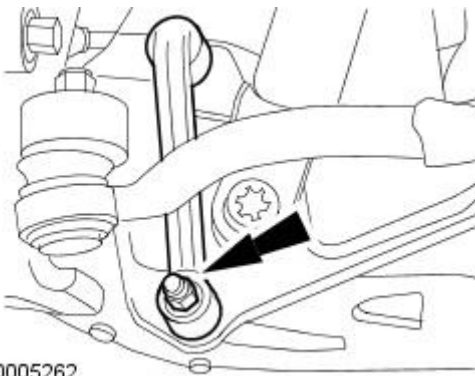
Install the front lower arm.



10. Install the steering gear.

- Tighten to 100 Nm.

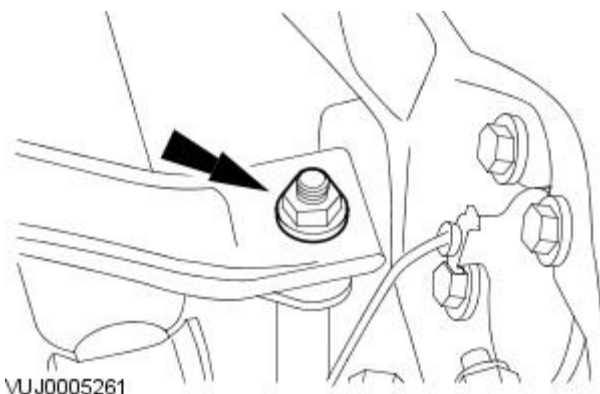
VUJ0005142



11. NOTE: Left-hand shown, right-hand similar.

Install the stabilizer bar link.

VUJ0005262



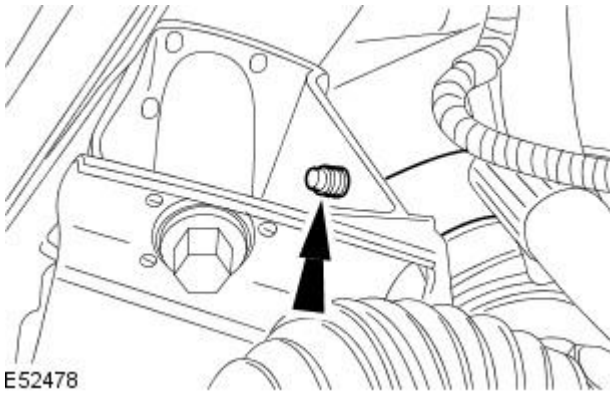
12. Attach the stabilizer bar link and install the stabilizer bar link retaining nut.

- Tighten to 43 Nm.

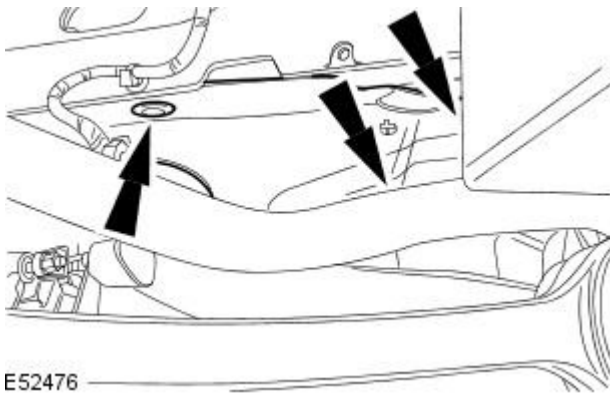
VUJ0005261



13. Attach the power steering hose retaining clip to the front subframe.



14. Install the right-hand splash shield.



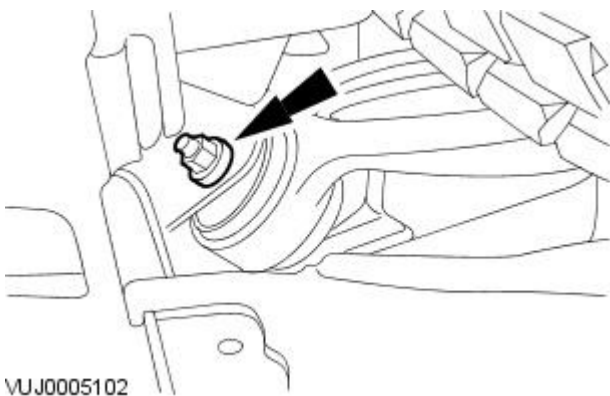
15. Install the radiator splash shield.  
For additional information, refer to: [Radiator Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).
16. Install the air deflector.  
For additional information, refer to: [Air Deflector](#) (501-02 Front End Body Panels, Removal and Installation).
17. Install both the front wheels and tires.  
For additional information, refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
18. Lower the vehicle.


19.  **CAUTION:** The final tightening of the suspension components must be carried out with the vehicle on its wheels.

- **NOTE:** Left-hand shown, right-hand similar.

Tighten the front lower arm retaining nut and bolt.

- Tighten to 175 Nm.

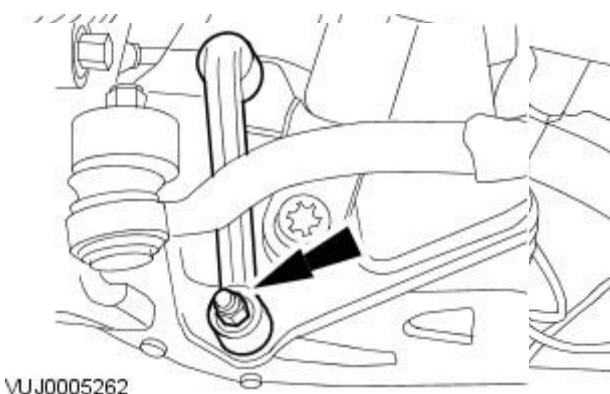


21. **NOTE:** Left-hand shown, right-hand similar.  
20.  **CAUTION:** The final tightening of the suspension components must be carried out with the vehicle on its wheels.

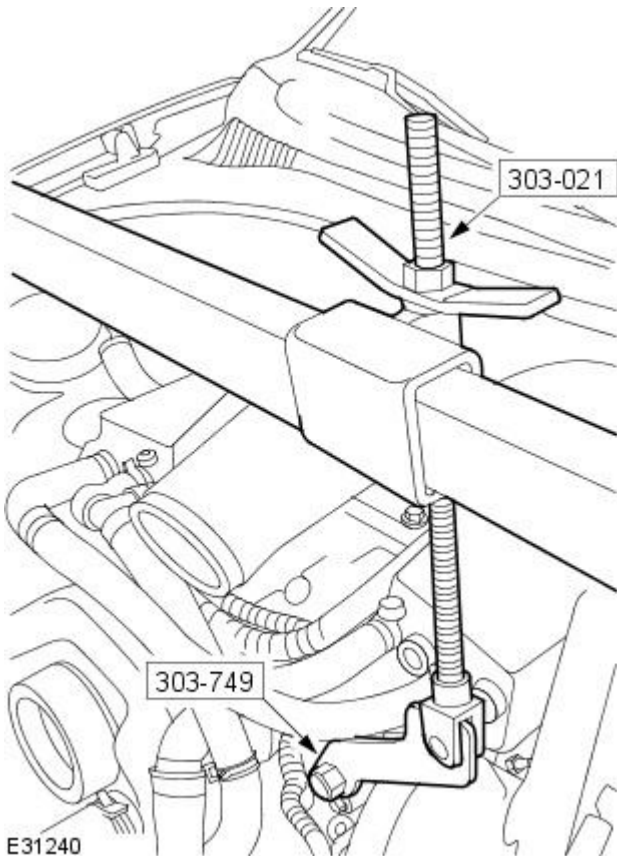
- **NOTE:** Left-hand shown, right-hand similar.

Tighten the rear lower arm retaining nut and bolt.

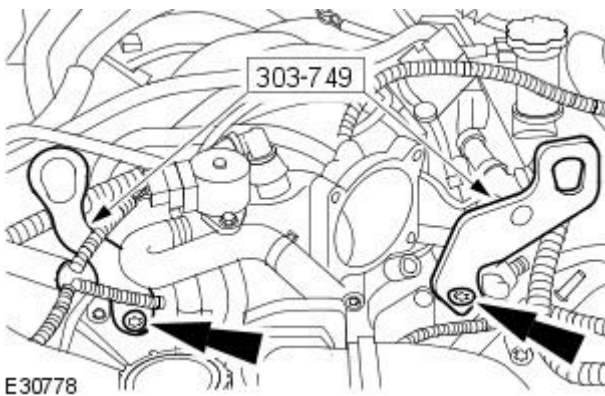
- Tighten to 175 Nm.



22. Remove the special tool.



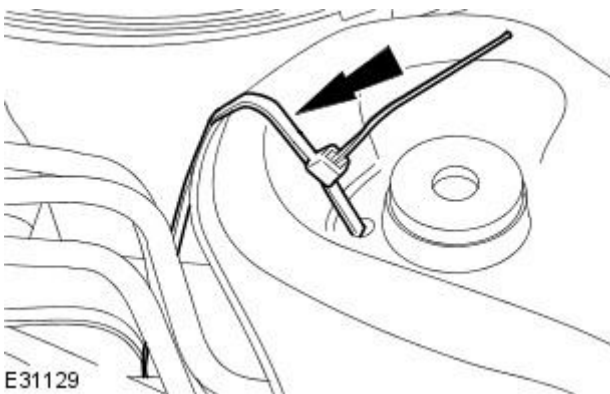
23. Remove the special tool.



24. Install the air filter outlet tube.

For additional information, refer to: [Air Cleaner Outlet Pipe](#) (303-12B Intake Air Distribution and Filtering - 4.2L SC V8 - AJV8, Removal and Installation).

25. Remove the radiator support.



26. Connect the battery ground cable.

For additional information, refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).


27. Using only four-wheel alignment equipment approved by

Jaguar, check and adjust the wheel alignment.  
For additional information, refer to: [Camber and Caster Adjustment](#) (204-00 Suspension System - General Information, General Procedures).



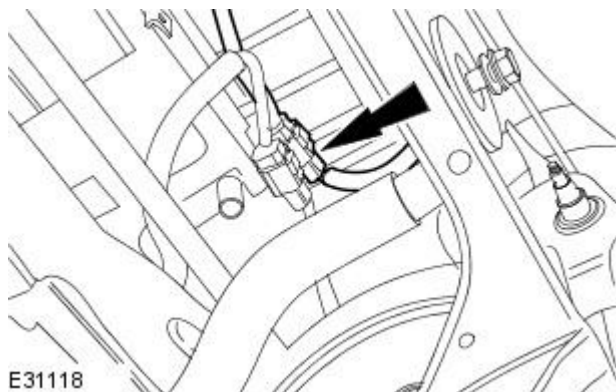
# Uni-Body, Subframe and Mounting System - Rear Subframe

Removal and Installation

Special Tool(s)	
 HTJ12002	Powertrain assembly jack
	HTJ1200-2

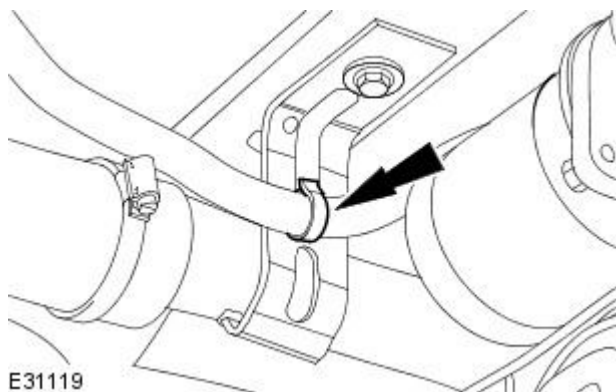
## Removal

1. Drain the fuel tank.  
For additional information, refer to: [Fuel Tank Draining](#) (310-00 Fuel System - General Information, General Procedures).
2. Remove the exhaust system.  
For additional information, refer to: Exhaust System (309-00A, Removal and Installation) / Exhaust System (309-00B, Removal and Installation) / [Exhaust System](#) (309-00 Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).
3. Remove the axle assembly.  
For additional information, refer to: [Axle Assembly - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Vehicles Without: Differential Drain Plug](#) (205-02 Rear Drive Axle/Differential, Removal and Installation).
4. Remove both the upper arms.  
For additional information, refer to: [Upper Arm](#) (204-02 Rear Suspension, Removal and Installation).
5. Disconnect the electric parking brake electrical connector.



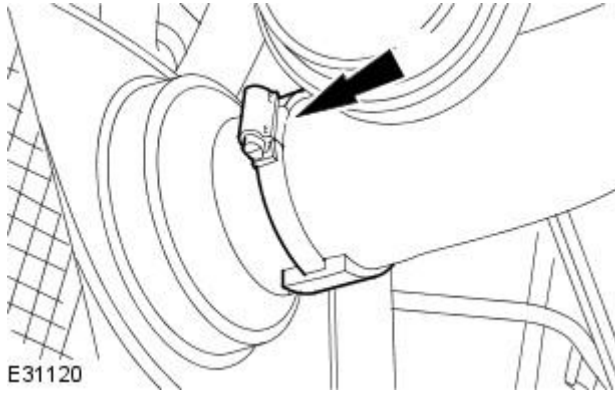
E31118

6. Detach the wiring harness.



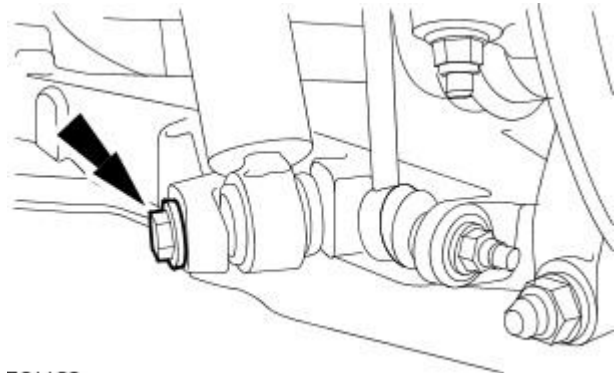
E31119

7. Detach the fuel filler hose.



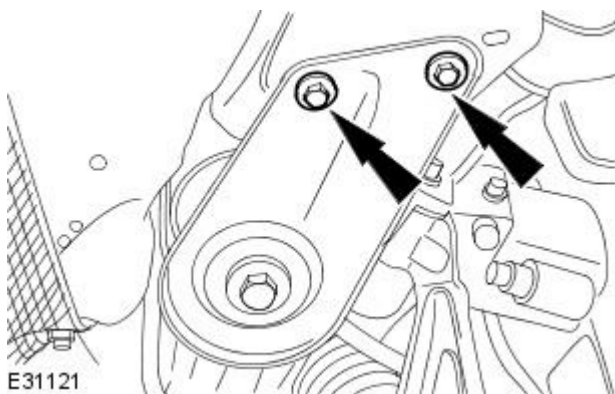
8. NOTE: Right-hand shown, left-hand similar.

Detach the shock absorber.

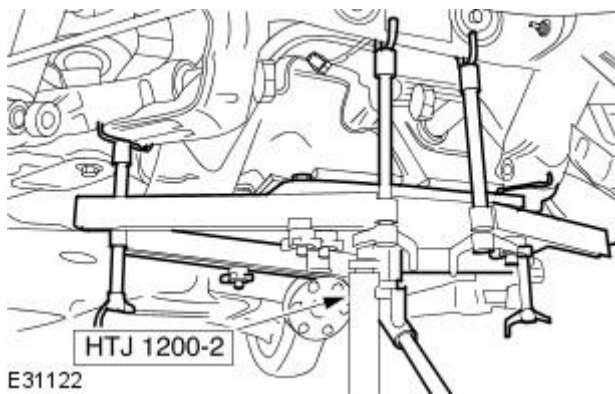


9. NOTE: Left-hand shown, right-hand similar.

Remove the rear subframe reinforcement plate retaining bolts.

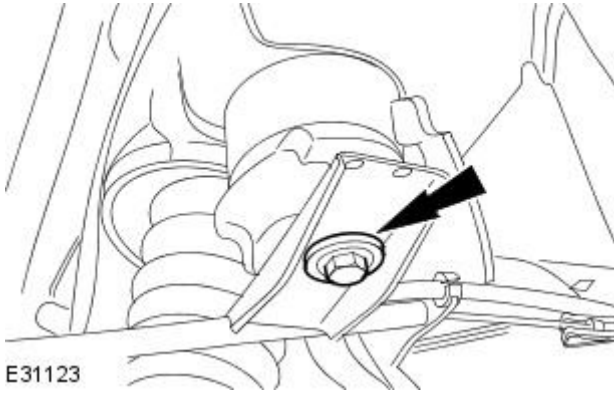


10. Install the special tool to support the rear subframe.



11. NOTE: Left-hand shown, right-hand similar.

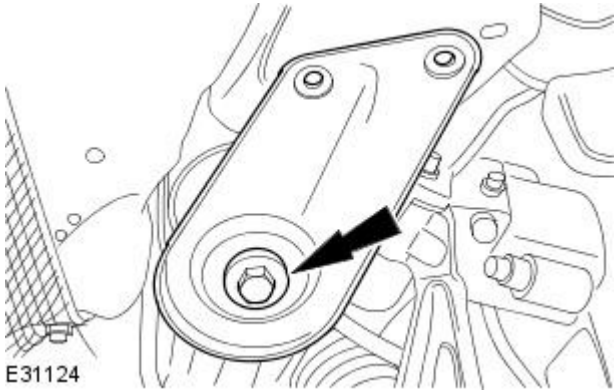
Remove the rear subframe rear retaining bolt.



E31123

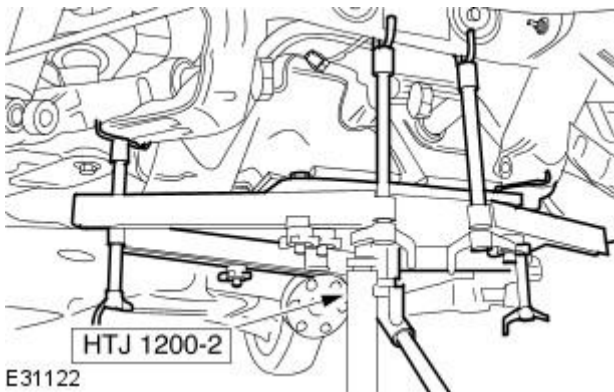
12. NOTE: Left-hand shown, right-hand similar.

Remove the rear subframe front retaining bolt.



E31124

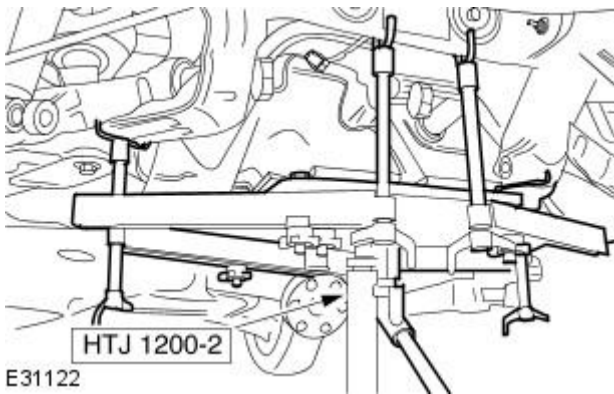
13. Remove the rear subframe.



E31122

## Installation

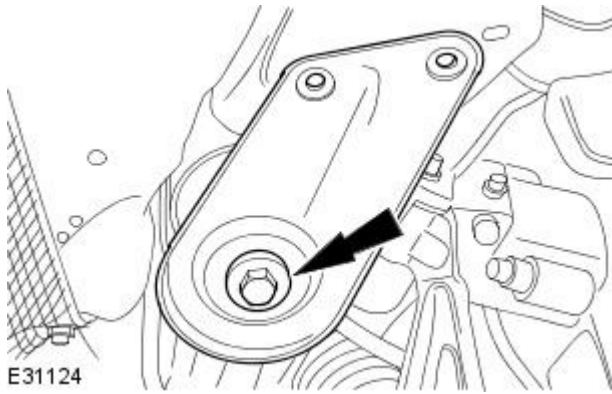
1. Install the rear subframe.



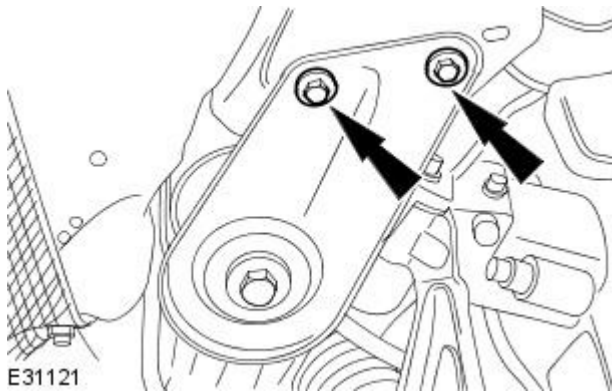
E31122

2. NOTE: Left-hand shown, right-hand similar.

Loosely install the rear subframe front bolt.

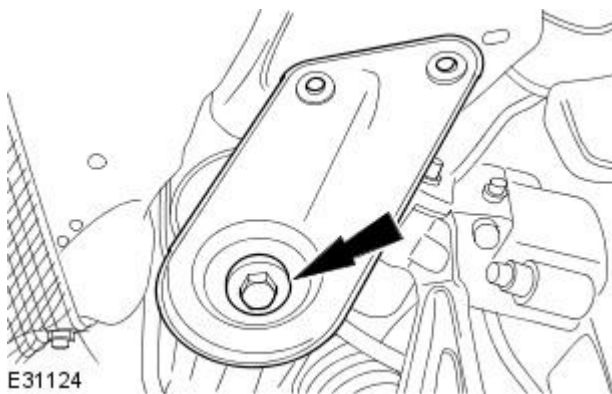


3. Loosely install the rear subframe reinforcement plate bolts.



4. Tighten to retaining bolt.

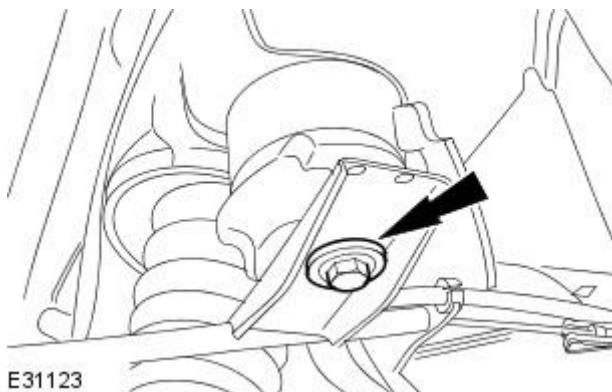
- Tighten to 80 Nm.
- Tighten a further 240 degrees.



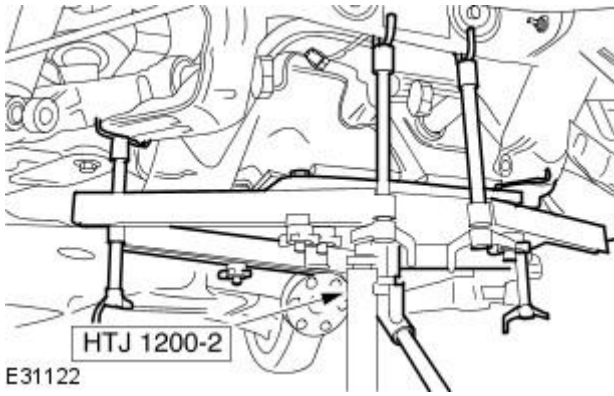
5. NOTE: Left-hand shown, right-hand similar.

Install the rear subframe rear retaining bolt.

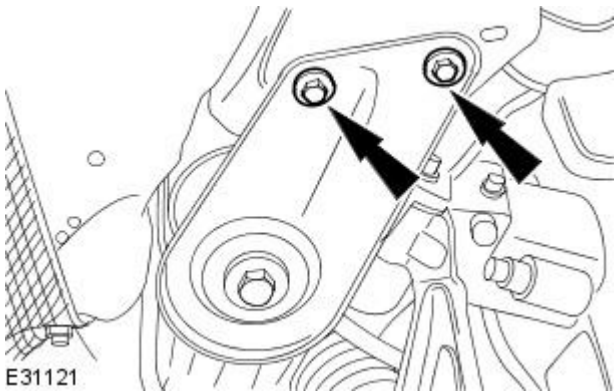
- Tighten to 125 Nm.







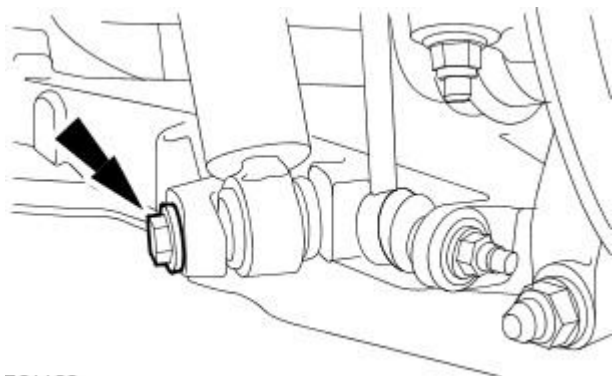
6. Remove the special tool.



7. NOTE: Left-hand shown, right-hand similar.

Install the rear subframe reinforcement plate retaining bolts.

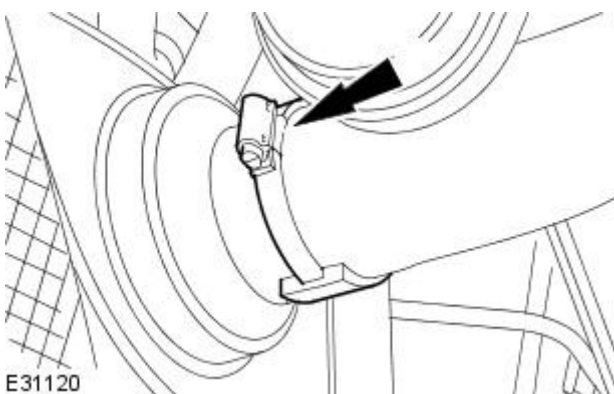
- Tighten to 47 Nm.



8. NOTE: Right-hand shown, left-hand similar.

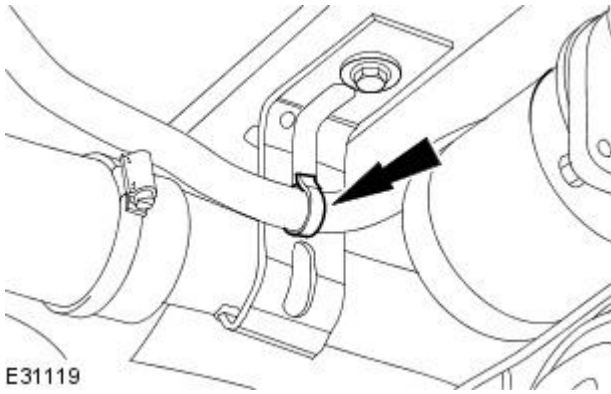
Install the shock absorber.

1. Tighten to 133 Nm.



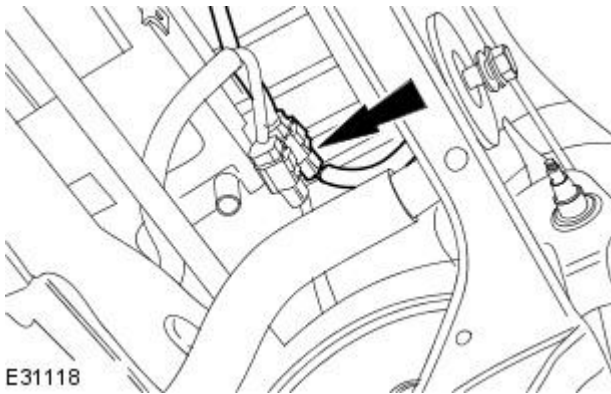
9. Connect the fuel filler hose.

10. Attach the wiring harness.



E31119

11. Connect the electric parking brake electrical connector.



E31118

12. Install both upper arms.

For additional information, refer to: [Upper Arm](#) (204-02 Rear Suspension, Removal and Installation).

13. Install the axle assembly.

For additional information, refer to: [Axle Assembly - 2.7L V6 - TdV6/3.0L NA V6 - AJ27/4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Vehicles Without Differential Drain Plug](#) (205-02 Rear Drive Axle/Differential, Removal and Installation).

14. Install the exhaust system.

For additional information, refer to: Exhaust System (309-00A, Removal and Installation) / Exhaust System (309-00B, Removal and Installation) / [Exhaust System](#) (309-00 Exhaust System - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Removal and Installation).


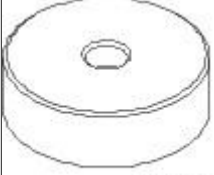
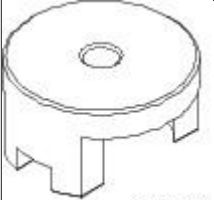
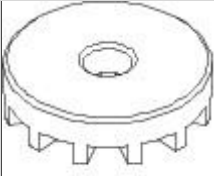
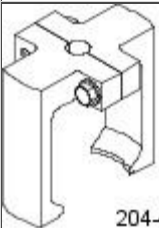
15. Refill the fuel tank.

16. Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment, and adjust if required.



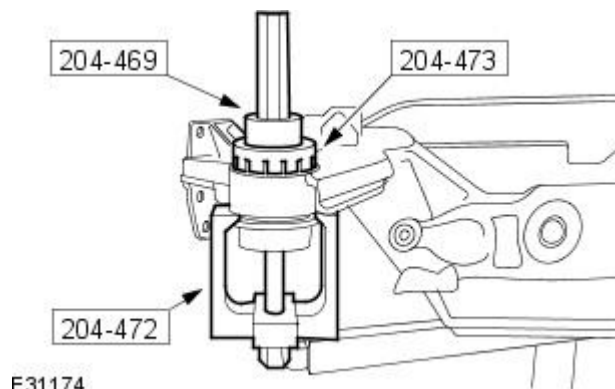
# Uni-Body, Subframe and Mounting System - Rear Subframe Rear Bushing

Removal and Installation

Special Tool(s)	
 204-469	Forcing bolt 204-469
 204-475	Receiver-bush 204-475
 204-474	Replacer-bush 204-474
 204-473	Remover bush 204-473
 204-472	Remover support-bush 204-472

## Removal

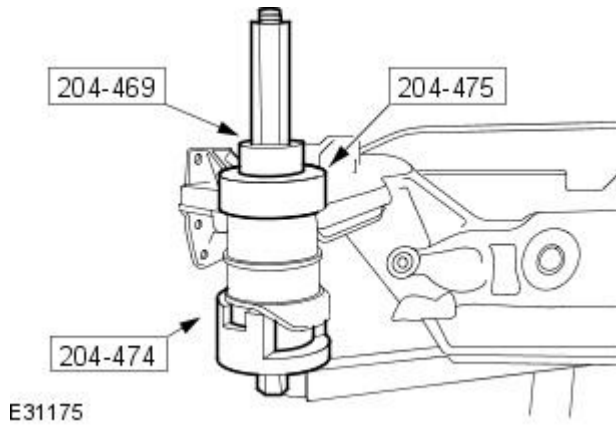
1. For additional information, refer to: [Rear Subframe](#) (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
2. **NOTE:** Note the orientation of the bushing before removal.



E31174

## Installation

1. NOTE: Make sure the bushing is correctly orientated.



2. For additional information, refer to: [Rear Subframe](#) (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).