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Engine System - General Information -

General specifications 2.0 litre diesel.

Item	Specification
Code	FMBA/FMBB
Firing order	1-3-4-2
Cylinder bore diameter	86 mm
Stroke	86 mm
Displacement	1998 cc
Compression ratio	19:1
Engine weight	195 kg (excluding front end accessory drive)
Power output at 3800 rpm	96 kW (130 PS)
Torque at 1800 rpm	325 Nm
Idle speed	900 rpm

General specifications 2.2 litre diesel.

Item	Specification
Code	QJBA
Firing order	1-3-4-2
Cylinder bore diameter	86 mm
Stroke	94.6 mm
Displacement	2198 cc
Compression ratio	19:1
Power output at 3800 rpm	114 kW (155 PS)
Torque at 1800 rpm	360 Nm
Idle speed	800 rpm

General specifications 2.0 litre.

Item	Specification
Displacement in liters	2.099
Number of cylinders	6
Bore and stroke (mm)	81.6 x 66.84
Firing order	1,4,2,5,3,6
Compression ratio	10.75:1

General specifications 2.5 litre.

Item	Specification
Displacement in liters	2.495
Number of cylinders	6
Bore and stroke (mm)	81.6 x 79.5
Firing order	1,4,2,5,3,6
Compression ratio	10.3:1

General specifications 3.0 litre.

Item	Specification
Displacement in liters	2.967
Number of cylinders	6
Bore and stroke (mm)	89.0 x 79.5
Firing order	1,4,2,5,3,6
Compression ratio	10.5:1

Cylinder Block Dimensions 2.0 litre and 2.2 litre diesel.

Description	mm
Cylinder bore diameter – Class 1	86·000 - 86·010
Cylinder bore diameter – Class 2	86·010 - 86·020
Cylinder bore diameter – Class 3	86·020 - 86·030
Main bearing shells 1 to 4 – inside diameter (bearings installed)	65·003 - 65·030
Main bearing shells 5 – inside diameter (bearings installed)	70·004 - 70·033
Main bearings 1 to 4 – radial clearance	0·033 - 0·080
Main bearing 5 – radial clearance	0·034 - 0·083
Main bearings 1 to 4 – parent bore diameter – vertical measurement	64·504 - 64·520
Main bearing 5 – parent bore diameter – vertical measurement	74·504 - 74·520
Main bearings 1 to 4 – parent bore diameter – horizontal measurement	69·502 - 69·525
Main bearing 5 – parent bore diameter – horizontal measurement	74·502 - 74·525

Piston Dimensions 2.0 litre and 2.2 litre diesel.

Description	mm
Piston cooling code	6
Piston diameter – Class A	85·94 - 85·95
Piston diameter – Class B	85·95 - 85·96
Piston diameter – Class C	85·96 - 85·97
Piston clearance in cylinder	0·05 - 0·07

Piston ring gap – piston ring installed 2.0 litre and 2.2 litre diesel.

Description	mm
Upper compression ring	0·25 - 0·50
Lower compression ring	0·50 - 0·75
Oil scraper ring	0·25 - 0·40

Piston ring gap position: Distribute the piston ring gaps evenly around the circumference of the piston. This also applies to the oil control scraper ring elements. Position the ring gaps offset at 120 degrees to one another.

Piston Pin Dimensions 2.0 litre and 2.2 litre diesel.

Description	mm
Piston pin - length	66·700
Piston pin – diameter	30·000
Piston pin - clearance in piston pin bore	0·002 - 0·012

Crankshaft Dimensions 2.0 litre and 2.2 litre diesel.

Description	mm
Main bearing journal – diameter	69·950 - 69·970
Main bearing journal – end float	0·090 - 0·305
Big-end bearing journal – diameter	52·980 - 53·000
Main bearing journals 1 to 4 – diameter	64·950 - 64·970

Connecting Rod Dimensions 2.0 litre and 2.2 litre diesel.

Description	mm
Big-end bore – diameter	55·996 - 56·016
Small-end bore – diameter	30·010 - 30·018
Bid-end bearing shell – inside diameter (bearings installed) - Vehicle with 2.0L diesel engine	56·004 - 56·032
Bid-end bearing shell – inside diameter (bearings installed) - Vehicle with 2.2L diesel engine	53·034 - 53·080
Big-end bearing – radial clearance	0·034 - 0·100
Big-end bearing – end float	0·100 - 0·320

Camshaft Dimensions 2.0 litre and 2.2 litre diesel.

Description	mm
Camshaft bearing journal – diameter	26·450
Camshaft bearing clearance – radial measurement	0·065
Camshaft – end float	0·125

Valves 2.0 litre and 2.2 litre diesel.

Description	mm
Valve stem to valve guide clearance – intake valve	0·045
Valve stem to valve guide clearance – exhaust valve	0·055

Cylinder Head 2.0 litre and 2.2 litre diesel.

Description	mm
Thickness of cylinder head gasket with piston protrusion of 0·430 - 0·520 mm	1·10 (1 hole/tooth)
Thickness of cylinder head gasket with piston protrusion of 0·521 - 0·570 mm	1·15 (2 holes/teeth)
Thickness of cylinder head gasket with piston protrusion of 0·571 - 0·620 mm	1·20 (3 holes/teeth)
Maximum longitudinal/diagonal distortion of cylinder head surface	0·100
Peak to valley height of mating surface	0·020

Cylinder Head and Valve Train 2.0 litre.

Item	Specification
Valve guide inner diameter (mm)	5.514 - 5.544
Intake valve effective length (mm)	91.13 - 90.93
Exhaust valve effective length (mm)	89.88 - 89.68
Valve stem to guide clearance intake - diameter (mm)	0.067 - 0.022
Valve stem to guide clearance exhaust - diameter (mm)	0.080 - 0.035
Valve head diameter intake (mm)	30.15 - 29.85
Valve head diameter exhaust (mm)	26.15 - 25.85
Intake valve face angle degree	45.75°
Exhaust valve face angle degree	45.25°
Valve stem diameter intake (mm)	5.492 - 5.477
Valve stem diameter exhaust (mm)	5.479 - 5.464
Valve spring free length (mm)	44.2
Valve spring installed height (mm)	33.41
Camshaft lobe lift intake (mm)	8.876
Camshaft lobe lift exhaust (mm)	8.876
Camshaft end play (mm)	0.150 - 0.070
Camshaft journal to cylinder head bearing surface clearance diameter (mm)	0.076 - 0.025
Camshaft journal diameter standard runout limit (mm)	0.040
Camshaft journal diameter standard out of round (mm)	0.013

Cylinder Head and Valve Train 2.5 litre.

Item	Specification
Valve guide inner diameter (mm)	5.514 - 5.544
Intake valve effective length (mm)	91.13 - 90.93
Exhaust valve effective length (mm)	89.88 - 89.68
Valve stem to guide clearance intake - diameter (mm)	0.067 - 0.022
Valve stem to guide clearance exhaust - diameter (mm)	0.080 - 0.035
Valve head diameter intake (mm)	30.15 - 29.85
Valve head diameter exhaust (mm)	26.15 - 25.85
Intake valve face angle degree	45.75°
Exhaust valve face angle degree	45.25°
Valve stem diameter intake (mm)	5.492 - 5.477
Valve stem diameter exhaust (mm)	5.479 - 5.464
Valve spring free length (mm)	44.2
Valve spring installed height (mm)	33.41
Camshaft lobe lift intake (mm)	9.367
Camshaft lobe lift exhaust (mm)	9.461
Camshaft end play (mm)	0.150 - 0.070
Camshaft journal to cylinder head bearing surface clearance diameter (mm)	0.076 - 0.025
Camshaft journal diameter standard runout limit (mm)	0.040
Camshaft journal diameter standard out of round (mm)	0.013

Cylinder Head and Valve Train 3.0 litre.

Item	Specification
Valve guide inner diameter (mm)	5.514 - 5.544
Intake valve effective length (mm)	91.13 - 90.93
Exhaust valve effective length (mm)	89.88 - 89.68
Valve stem to guide clearance intake - diameter (mm)	0.067 - 0.022
Valve stem to guide clearance exhaust - diameter (mm)	0.080 - 0.035
Valve head diameter intake (mm)	35.15 - 34.85

Item	Specification
Valve head diameter exhaust (mm)	30.15 - 29.85
Intake valve face angle degree	45.75°
Exhaust valve face angle degree	45.25°
Valve stem diameter intake (mm)	5.492 - 5.477
Valve stem diameter exhaust (mm)	5.479 - 5.464
Valve spring free length (mm)	44.2
Valve spring installed height (mm)	33.41
Camshaft lobe lift intake (mm)	9.367
Camshaft lobe lift exhaust (mm)	9.461
Camshaft end play (mm)	0.150 - 0.070
Camshaft journal to cylinder head bearing surface clearance diameter (mm)	0.076 - 0.025
Camshaft journal diameter standard runout limit (mm)	0.040
Camshaft journal diameter standard out of round (mm)	0.013

Lubrication system 2.0 litre and 2.2 litre diesel.

Item	Liters
Oil capacity with filter	6.7

Lubrication system 2.0, 2.5 and 3.0 litre.

Item	Liters
Oil capacity with filter	6.5

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Engine System - General Information - Engine

Description and Operation

2.0L, 2.5L and 3.0L Engines

The 2.0L, 2.5L and 3.0L engines consists of:

- A six cylinder 60 degree 'V' configuration liquid cooled aluminium cylinder block with dry cast iron liners.
- Aluminium pistons with cut-outs in the piston crown to clear the valve heads for any available combination of camshaft profile and valve phasing.
- Two aluminium cylinder heads with square squish chambers.
- Two cast iron overhead camshafts per bank.
- Four valves per cylinder.
- Mechanical tappets and top mounted steel shims.
- Continuous variable camshaft timing (VCT) of the inlet camshafts.
- Two silent timing chains with one hydraulic tensioner per chain.
- Magnesium alloy camshaft covers with rubber seals.
- A variable intake system containing two electrically controlled intake manifold tuning valves.
- Plastic lower intake manifold with integral fuel rail and injectors.
- Aluminium timing cover which accommodates the crankshaft front oil seal.
- An oil pump mounted around the crankshaft.
- An aluminium bed plate.
- An aluminium oil pan.
- A steel crankshaft (2.5L and 3.0L engines only).
- A cast iron crankshaft (2.0L engines only).
- Fracture-split connecting rods in sintered-forged steel.
- A single, six ribbed vee belt drives the front end accessories.
- A water pump belt pulley mounted directly to the exhaust camshaft of the left-hand cylinder head.
- A single, three ribbed vee belt which drives the water pump.
- A water pump mounted on the rear of the left-hand cylinder head.
- An advanced engine management system incorporating electronic throttle control.

The unit meets the requirements of the CARB OBDII USA legislation.

CAUTION: The use of supplementary oil or fuel additives is not approved unless specified by Jaguar cars in the form of a service communication or directive.

The engine code and serial number is located on the left-hand side of the bed plate near the oil cooler assembly.

2.0L and 2.2L common rail diesel engine

The 2.0L and 2.2L common rail diesel engine consists of:

- a four cylinder cast iron cylinder block
- a aluminium cylinder head
- a separate camshaft carrier
- a forged steel crankshaft with eight counterweights
- lightweight aluminium alloy pistons
- fracture split connecting rods
- a multi link drive chain which drives the camshafts and the high pressure pump
- a single link chain which drives a gear-type oil pump
- hydraulically operated timing chain tensioner
- fabricated camshafts with sintered lobes
- roller rocker valve actuation
- two exhaust valves and two inlet valves per cylinder
- a plastic composite camshaft cover
- a pressed steel timing cover which must be aligned using the special tool
- a engine oil cooler is mounted to the left hand side of the engine
- a water pump is mounted to the left hand rear of the engine and driven via the rear of the power steering pump
- a power steering pump is mounted to the left hand rear of the engine and driven by the rear of the intake camshaft via a multi-vee belt
- a variable vain turbocharger.

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Engine System - General Information - Engine

Diagnosis and Testing

Inspection and Verification

Since diagnosis and testing actually begins when repairs are taken on, the following procedure is recommended.

1. **1.** Verify the customer concern by operating the system.
2. **2.** Visually inspect for obvious signs of mechanical damage or electrical damage. If the concern cannot be reproduced, carry out a road test and/or visual check with the aid of the following table.

Visual Inspection Chart

Mechanical
○ Coolant leaks ○ Oil leaks ○ Leaks in the fuel system ○ Visibly damaged or worn parts ○ Loose or missing nuts or bolts

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

Symptom Chart

Symptom	Possible Sources	Action
Difficult to start during hot or cold start	* Piston ring(s) worn, damaged, sticking or worn piston/cylinder.	* INSTALL a new engine.
	* Head gasket damaged.	* INSPECT the head gasket.
	* Fuel system damaged or inoperative.	* For additional information, refer to Section 303-04A Fuel Charging and ControlsSection 303-04B Fuel Charging and ControlsSection 303-04C Fuel Charging and Controls - Turbocharger.
	* Ignition system inoperative.	* For additional information, refer to Section 303-04A Fuel Charging and ControlsSection 303-04B Fuel Charging and ControlsSection 303-04C Fuel Charging and Controls - Turbocharger.
Poor Idling	* Restricted exhaust system.	* INSPECT the exhaust system. For additional information, refer to Section 309-00 Exhaust System.
	* Vacuum leak.	* CARRY out the Intake Manifold Vacuum Test in this section. REPAIR and INSTALL new components as necessary.
	* Burned valve(s).	* INSPECT the valve(s).
	* Incorrect valve to valve seat contact.	* INSPECT the valve and valve seat.
	* Head gasket damaged.	* INSPECT the head gasket.
	* Fuel system damaged or inoperative.	* For additional information, refer to Section 303-04A Fuel Charging and ControlsSection 303-04B Fuel Charging and ControlsSection 303-04C Fuel Charging and Controls - Turbocharger.
Insufficient power	* Compression leakage from valve seat.	* INSPECT the valve or valve seat.
	* Valve sticking.	* INSPECT valve stem to valve guide clearance or carbon accumulation.
	* Valve spring weak or broken.	* INSPECT the valve spring.
	* Head gasket damaged.	* INSPECT the head gasket.
	* Cylinder head cracked or distorted.	* INSPECT the cylinder head.
	* Piston ring(s) worn, damaged or sticking.	* INSTALL a new engine.
	* Fuel system damaged or inoperative.	* For additional information, refer to Section 303-04A Fuel Charging and ControlsSection 303-04B Fuel Charging and ControlsSection 303-04C Fuel Charging and Controls - Turbocharger.
	* Brakes dragging.	* For additional information, refer to Section 206-00 Brake System - General Information.
	* Restricted exhaust system.	* INSPECT the exhaust system. For additional information, refer to Section 309-00 Exhaust System.
Excessive or insufficient compression.	* Valve(s) burnt or sticking.	* INSPECT the valve(s).
	* Valve spring(s) weak or broken.	* INSPECT the valve spring(s).
	* Piston ring(s) worn, damaged, sticking or worn piston/cylinder.	* INSTALL a new engine.
	* Head gasket damaged.	* INSPECT the head gasket.
	* Carbon accumulation in combustion chamber.	* ELIMINATE carbon build up.
	* Fuel system damaged or inoperative.	* For additional information, refer to Section 303-04A Fuel Charging and ControlsSection 303-04B Fuel Charging and ControlsSection 303-04C Fuel Charging and Controls - Turbocharger.
Excessive oil consumption	* Piston ring(s) worn, damaged, sticking or worn piston/cylinder.	* INSTALL a new engine.
	* Valve stem seal worn or missing.	* INSPECT the valve or valve stem seal.
	* Oil leakage.	* REPAIR oil leakage.
	* Valve stem or valve guide worn.	* INSPECT the valve stem or valve guide.
	* Incorrect oil viscosity.	* DRAIN and FILL with new oil.
	* Diluted oil.	* CHECK oil dilution. DRAIN and FILL as necessary.
	* Crankcase overfilled.	* CHECK and adjust the oil level.
	* Incorrect oil pressure.	* CHECK the oil pressure. REPAIR as necessary.
Engine noise	* Excessive crankshaft main bearing clearance.	* INSTALL a new engine.

	* Excessive crankshaft end play.	* INSTALL a new engine.
	* Excessive connecting rod bearing oil clearance.	* INSTALL a new engine.
	* Piston/cylinder worn.	* INSTALL a new engine.
	* Piston ring damaged.	* INSTALL a new engine.
	* Connecting rod bent.	* INSTALL a new engine.
	* Valve spring(s) broken.	* INSPECT the valve spring(s).
	* Excessive valve guide clearance.	* INSPECT the valve guide or valve.
	* Cooling system inoperative (water pump, vibration of radiator).	* For additional information, refer to Section 303-03A Engine CoolingSection 303-03B Engine Cooling.
	* Fuel system inoperative.	* For additional information, refer to Section 303-04A Fuel Charging and ControlsSection 303-04B Fuel Charging and ControlsSection 303-04C Fuel Charging and Controls - Turbocharger.
	* Excessive carbon buildup.	* ELIMINATE carbon buildup.
	* Exhaust gas leakage.	* REPAIR leakage. For additional information, refer to Section 309-00 Exhaust System.
	* Incorrect drive belt tension.	* INSPECT the drive belt tension. For additional information, refer to Section 303-05 Accessory Drive.
	* Generator front bearing worn.	* For additional information, refer to Section 414-02 Generator and Regulator.
Tappet noise, engine running	* Incorrect tappet clearance.	* CHECK and ADJUST the tappet clearance as necessary.

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 UV test:

Fluorescent Oil Additive Method

1. **1.** Clean the engine with a suitable cleaning fluid (brake cleaner).
2. **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. **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. **4.** As necessary, pressurize the main oil gallery system to locate leaks due to incorrectly sealed, loose or cocked plugs.
5. **5.** Repair all leaks as necessary.

Compression Test

General Remarks

• NOTE: Removing fuses and disconnecting electrical components causes the engine control module (ECM) to log an error message. After the measurements have been carried out this error message should be cleared from memory by connecting to approved Jaguar 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 operating temperature.

Check The Compression Pressure

WARNING: On manual transmissions shift the transmission into neutral. On automatic transmission vehicles, select "P". Failure to follow these instructions may result in personal injury.

1. **1.** Remove the fuel pump relay.
2. **2.** Start the engine - the engine will start, run for a few seconds then stall.
3. **3.** Remove the spark plugs.
4. **4.** Install the compression tester.
5. **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. **6.** Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.
7. **7.** Install the components in reverse order, observing the specified tightening torques.
8. **8.** Reset the ECM fault memory.

Interpretation of the Results

The indicated compression pressure are considered within specification if the lowest reading cylinder is within 75% of the highest reading.

CAUTION: If engine oil is sprayed into the combustion chamber, after carrying out the measurement run the engine at 2000 rpm for about 15 minutes, in order to burn the oil and prevent damage to the catalytic converter.

If the measurement on one or more cylinders is much lower than the specified value, spray some engine oil into the combustion chamber

and repeat the compression measurement.

If the reading greatly improves then the piston rings are damaged.

If the reading stays the same then the cause is either damaged valve seats or valve stem seals.

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.

Excessive Engine Oil Consumption

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 is a partial list of conditions that can affect oil consumption rates:

- Engine size.
- Operator driving habits.
- Ambient temperatures.
- Quality and viscosity of oil.

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) per liter oil consumption rate is about 2,400 km (1,500 miles) per liter.

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.

Oil Consumption Test

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. Vehicles in normal service should get a least 16,000 km (10,000 miles) per liter. High speed driving, towing, high ambient temperature and other factors may result in greater oil use.

1. **1.** Define excessive consumption, such as the number of miles driven per liter of oil used. Also determine customers's driving habits, such as sustained high speed operation, towing, extended idle and other considerations.

2. **2.** Verify that the engine has no external oil leaks as described under Engine Oil Leaks.

3. **3.** Verify that the engine has the correct oil level.

4. **4.** Verify that the engine is not 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. In no case should the level be above the top of the cross-hatched area and the letter "F" in FULL. If significantly overfilled, carry out step 5, sub steps 1 through 4.

5. **5.** Carry out an oil consumption test:

    1. Drain engine oil and fill with one liter less than the recommended amount.
    2. Run the engine for three minutes (10 minutes if cold), and allow oil to drain back for at least five minutes with vehicle parked on level surface.
    3. Remove the oil level indicator and wipe clean. (Do not wipe with anything contaminated with silicone compounds.) Install the oil level indicator making sure to seat the oil level indicator firmly in the oil level indicator tube. Remove the oil level indicator and draw a mark on the back (unmarked) surface at the indicated oil level. (This level should be about the same as the ADD mark on the face of the oil level indicator.)
    4. Add one liter of oil. Start the engine and allow to idle for at least two minutes. Shut off the engine and allow the engine oil to drain back for at least five minutes. Mark the oil level dipstick, using the procedure above. (This level may range from slightly below the top of the cross-hatched area to slightly below the letter "F" in FULL.
    5. Record the vehicles mileage.
    6. Instruct the customer to drive the vehicle as usual and:
        1. Check the oil level regularly at intervals of 160-240 km (100-150 miles).
        2. Return to the service point when the oil level drops below the lower (ADD) mark on the oil level indicator.
        3. Add only full liters of the same oil in an emergency. Note the mileage at which the oil is added.
    7. Check the oil level under the same conditions and at the same location as in steps 3 and 4.
        1. Measure the distance from the oil level to the UPPER mark on the oil level indicator and record.
        2. Measure the distance between the two scribe marks and record.
        3. Divide the first measurement by the second.
        4. Divide the distance driven during the oil test by the result. This quantity is the approximate oil consumption rate in kilometers per liter or in mile per quart.

5. If the oil consumption rate is unacceptable go to Step 6.

6. **6.** Check the positive crankcase ventilation (PCV) system. Make sure the system is not plugged.
7. **7.** Check for plugged oil drain-back holes in the cylinder head and cylinder block.
8. **8.** If the condition still exists after carrying out the above tests go to step 9.
9. **9.** Carry out a cylinder compression test. Refer to the procedure in this section : Compression Test. This can help determine the source of oil consumption such as valves, piston rings or other areas.
10. **10.** Check valve guides for excessive guide clearance. Install new valve stem seals after verifying valve guide clearance.
11. **11.** 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.

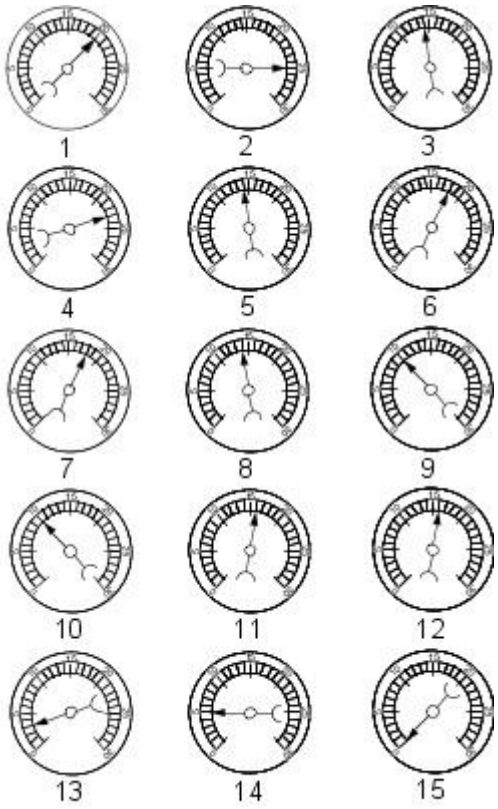
The reading should be steady. As necessary, adjust the gauge damper control (where used) if the needle is fluttering rapidly. Adjust the damper until the needle moves easily without excessive flutter.

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. **1.** NORMAL READING: Needle between 51-74 kPa (15-22 in-Hg) and holding steady.
2. **2.** NORMAL READING DURING RAPID ACCELERATION : When the engine is rapidly accelerated (dotted needle), 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. **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. **4.** WORN RINGS OR DILUTED OIL: When the engine is accelerated (dotted needle), the needle drops to 0 kPa (0 in-Hg). Upon deceleration, the needle runs slightly above 74 kPa (22 in-Hg).
5. **5.** STICKING VALVES: When the needle (dotted) 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. **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. **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.

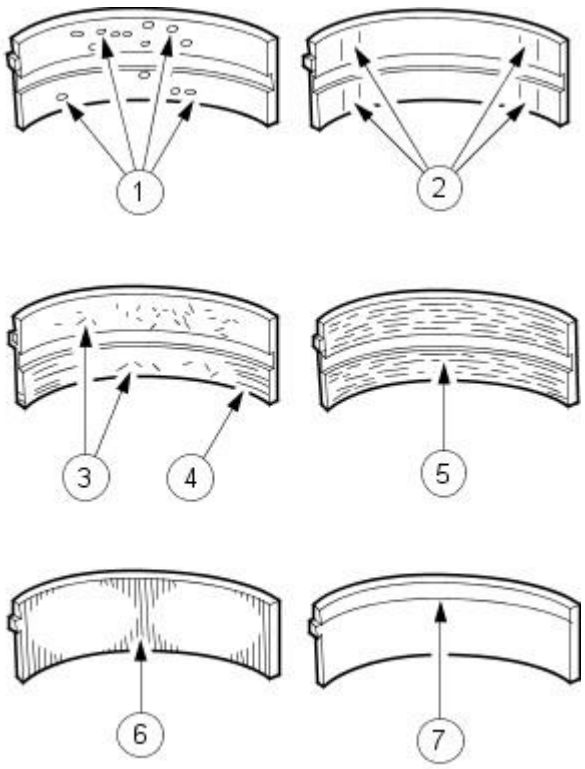
10. **10.** LATE VALVE TIMING: A steady but low reading could be caused by late valve timing.
11. **11.** IGNITION TIMING RETARDING: Retarded ignition timing will produce a steady but somewhat low reading.
12. **12.** INSUFFICIENT SPARK PLUG GAP: When spark plugs are gapped too close, a regular, small 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.

Published: 11-May-2011

Engine System - General Information - Bearing Inspection

General Procedures



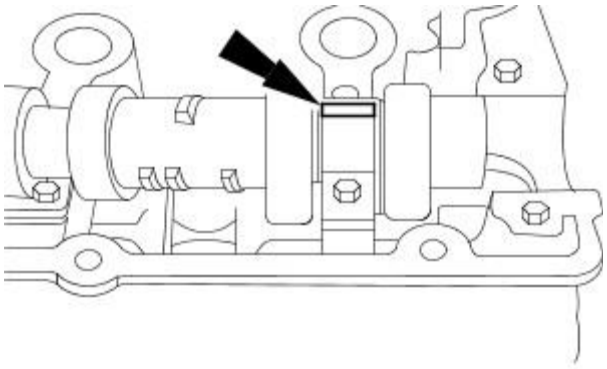
VUJ0002219

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.

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.

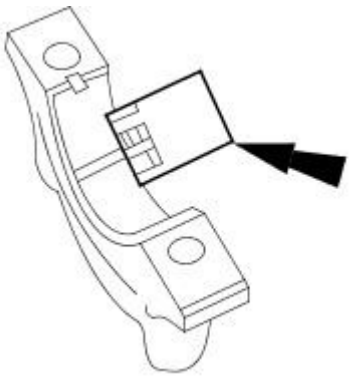
2. Install the camshaft bearing caps. For additional information, refer to Section 303-01A Engine Section 303-01B Engine.

3. NOTE: Do not strike the bearing caps.

Remove the camshaft bearing caps. For additional information, refer to Section 303-01A Engine Section 303-01B Engine.

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.

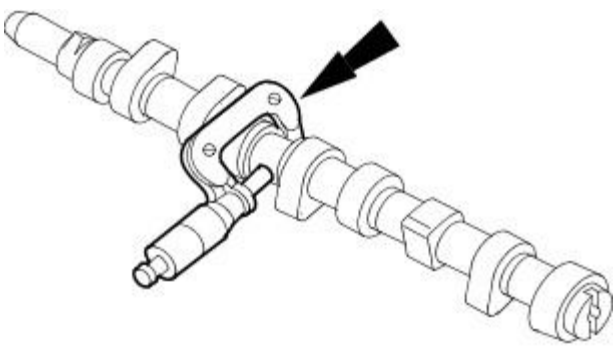


VUJ0001697

Published: 11-May-2011

Engine System - General Information - Camshaft Bearing Journal Diameter

General Procedures



VUJ0001695

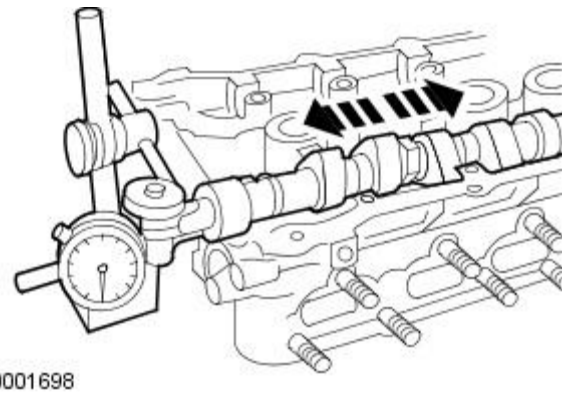
1. Determine the diameter of the camshaft journals.

- Using a micrometer measure the diameter at 90 degrees 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.

Published: 11-May-2011

Engine System - General Information - Camshaft End Play

General Procedures



VUJ0001698

1. NOTE: Make sure that the camshaft is to specification.

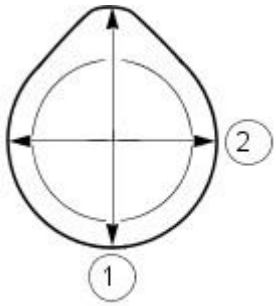
Using the special tool, measure the end play.

- 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.

Published: 11-May-2011

Engine System - General Information - Camshaft Lobe Lift

General Procedures



VUJ0001699

1. Measure the diameter (1) and diameter (2) with a vernier caliper. The difference in measurements is the lobe lift.

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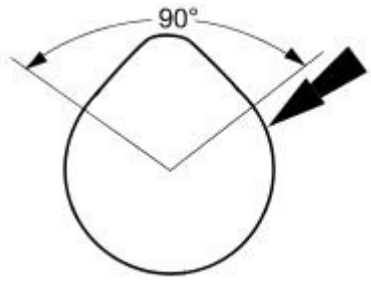
Engine System - General Information - Camshaft Surface Inspection

General Procedures



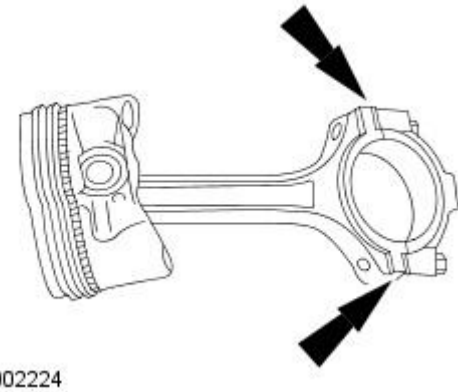
VUJ0001700

1. Inspect camshaft lobes for pitting or damage in the active area. Minor pitting is acceptable outside the active area.

Published: 11-May-2011

Engine System - General Information - Connecting Rod Cleaning

General Procedures



VUJ0002224

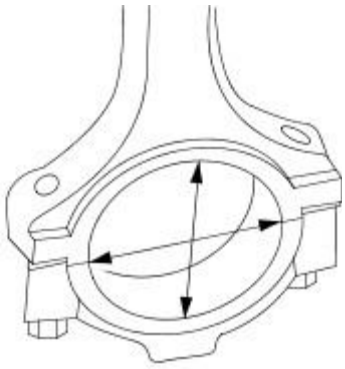
1. CAUTION: Do not use a caustic cleaning solution or damage to connecting rods may occur.

   Mark and separate the parts and clean with solvent. Clean the oil passages.

Published: 11-May-2011

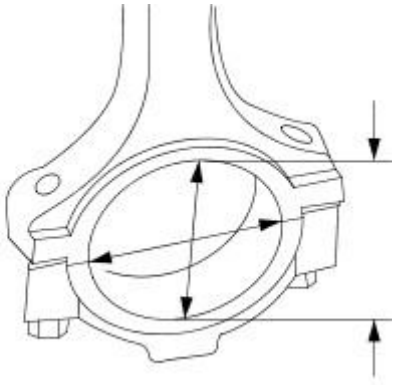
Engine System - General Information - Connecting Rod Large End Bore

General Procedures



VUJ0002223

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.



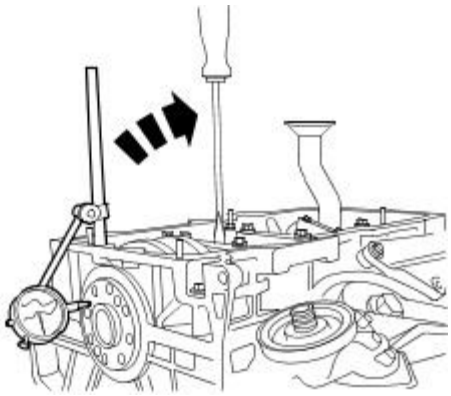
VUJ0002222

2. Measure the bearing bore diameter in two directions. Verify the bearing bore is within specification.

Published: 11-May-2011

Engine System - General Information - Crankshaft End Play

General Procedures



VUJ0002235

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.

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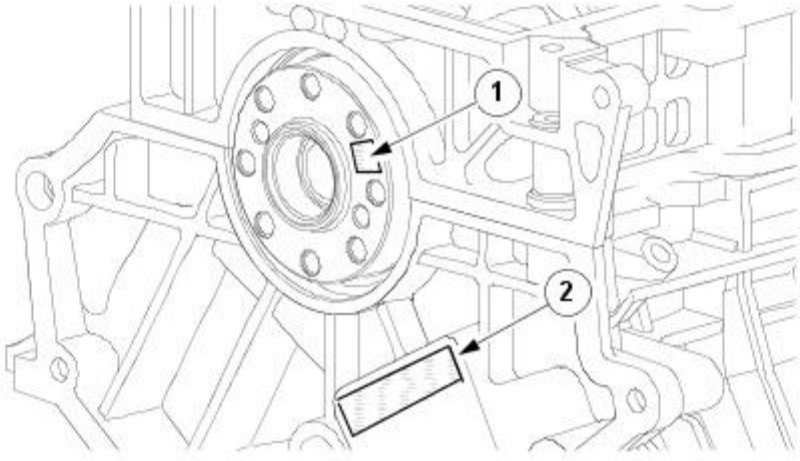
Engine System - General Information - Crankshaft Main Bearing Journal Clearance

General Procedures

1. The main bearing machine codes are displayed on the crankshaft (1) and the cylinder block (2)

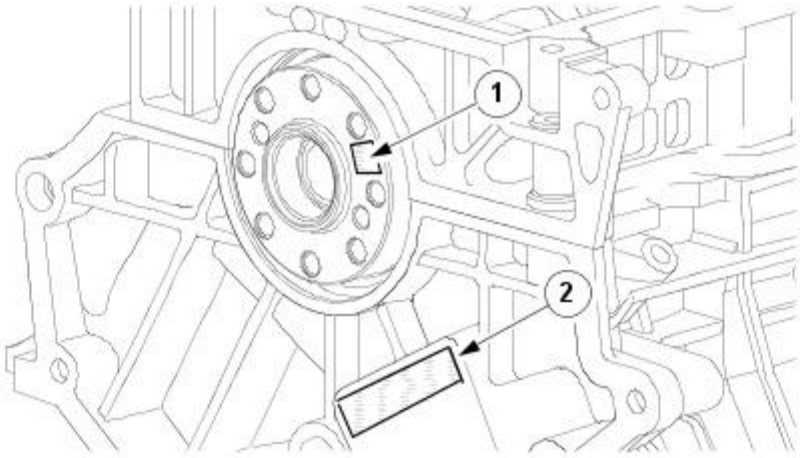


E53234

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.

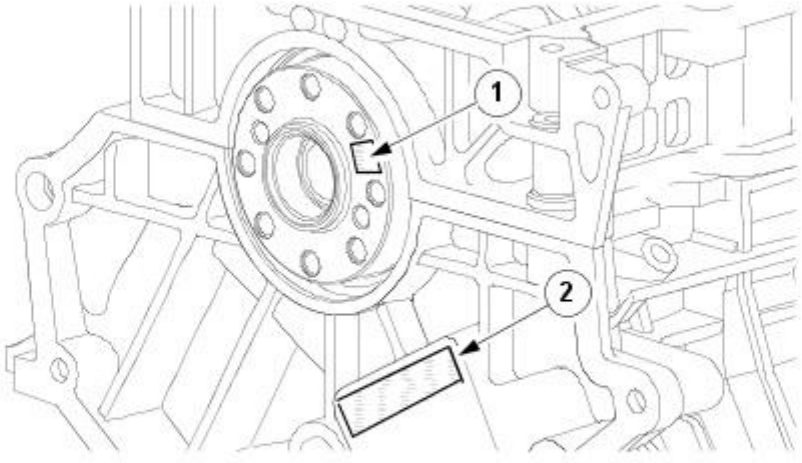


E53234

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

1	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	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3
82	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
81	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3
80	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3
79	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3
78	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3
77	1	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	2	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.

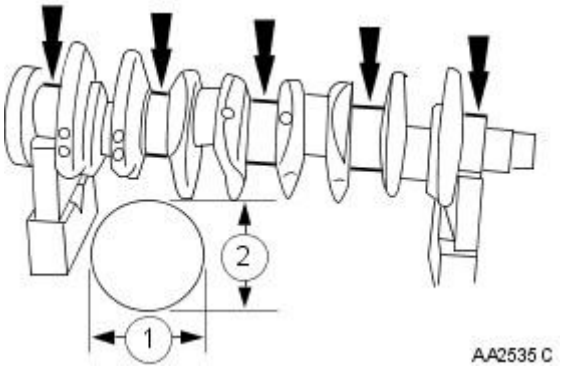
Published: 11-May-2011

Engine System - General Information - Crankshaft Main Bearing Journal Diameter

General Procedures

General Equipment

Micrometer

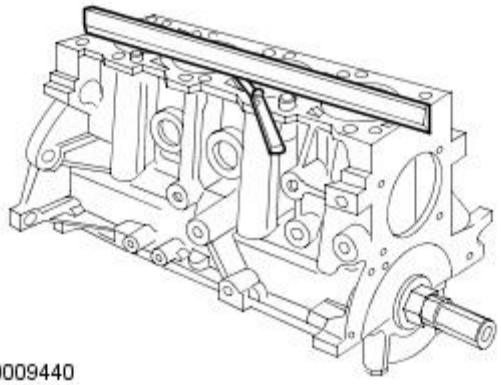


1. Measure the diameter of the main bearing journals and the big-end bearing journals.
   - Repeat the measurement with the micrometer offset by 90°, in order to determine any eccentricity which may be present.
   - Measure the journal at two different positions to determine any conicity which may be present.

Published: 11-May-2011

Engine System - General Information - Cylinder Block Distortion

General Procedures



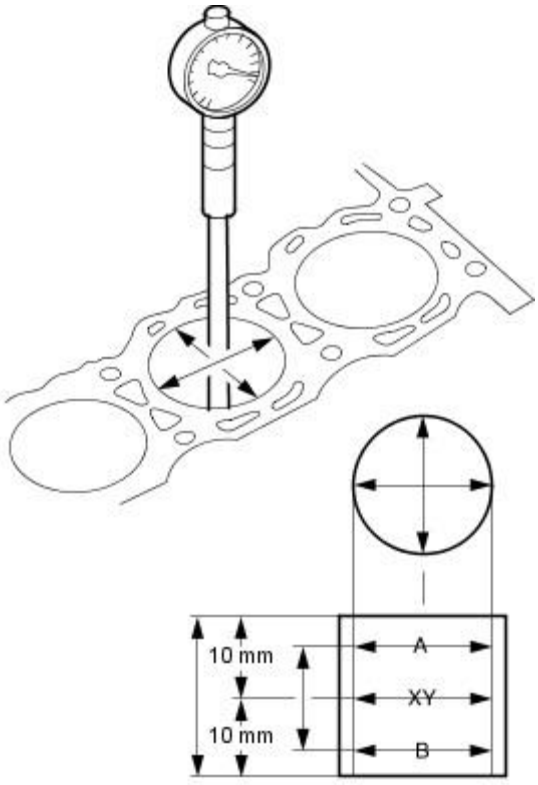
ELE0009440

1. Using a Straight Edge and a Feeler Gauge, measure the cylinder block/cylinder head distortion.
   - Measure the mating face distortion.
   - If the value is not to specification rework the mating face (if permitted).

Published: 11-May-2011

Engine System - General Information - Cylinder Bore Out-of-Round

General Procedures



VUJ0002234

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.

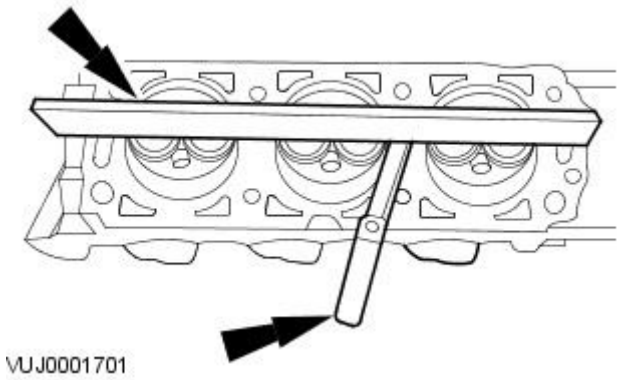
Measure the cylinder bore with an internal micrometer.

- 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.

Published: 11-May-2011

Engine System - General Information - Cylinder Head Distortion

General Procedures



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 (petrol only).

Published: 11-May-2011

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.

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Engine System - General Information - Flywheel Inspection

General Procedures

1. CAUTIONS:

Do not rework the flywheel if it is distorted.

Do not clean the dual mass flywheel with any kind of fluid. Clean the flywheel with a dry cloth only.

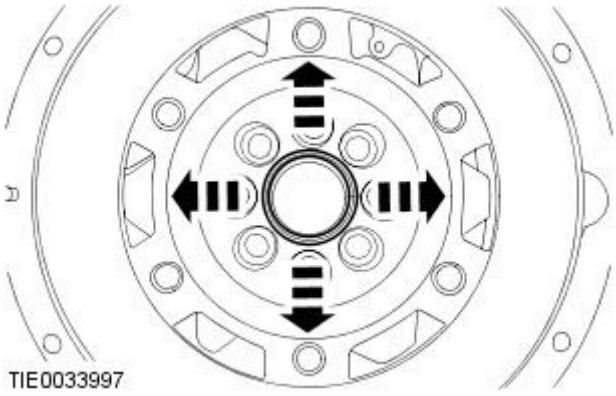
Do not clean the gap between the primary and secondary mass. Only clean the bolt connection surface and the clutch surface.

Inspect the flywheel for:

1. Any cracks.
2. Worn ring gear teeth.
3. Chipped or cracked ring gear teeth.

2. Check the flywheel for lateral movement

- Rotational movement in either one or both directions, or rock on it axis in relation to the primary mass is acceptable.
- If there is any lateral movement, install a new flywheel.

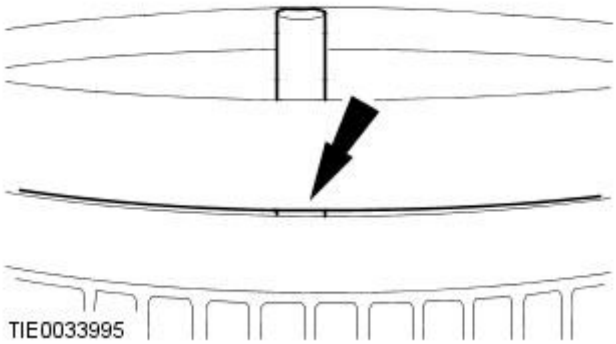


TIE0033997

3. CAUTION: Make sure that the three locating dowels are installed.

Check if the locating dowels are touching the primary mass of the flywheel.

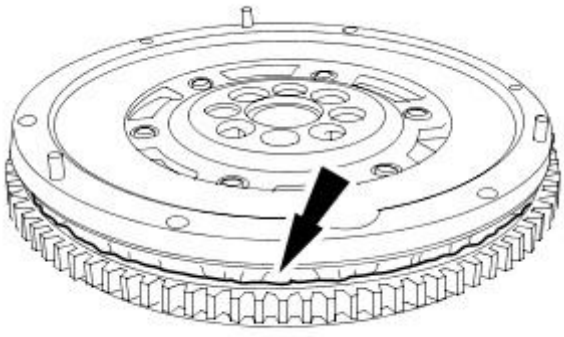
- If the locating dowels are touching the primary mass of the flywheel, install a new flywheel.



TIE0033995

4. Inspect for grease along the welding.

- If grease is evident, install a new flywheel.



TIE0033996

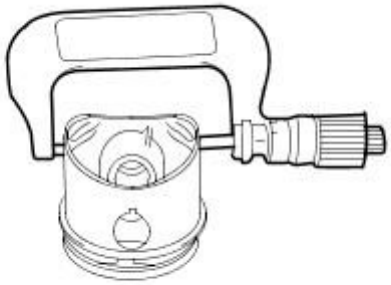
Published: 11-May-2011

Engine System - General Information - Piston Diameter

General Procedures

General Equipment

Micrometer



IAV2102103

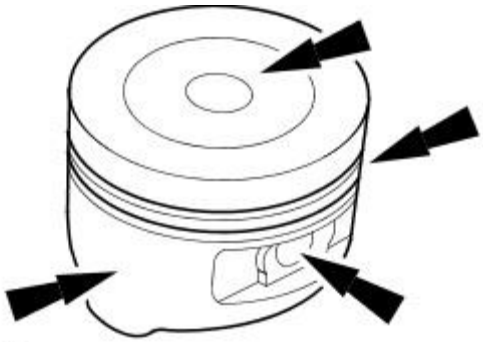
1. NOTE: Mark the piston to make sure the piston is installed correctly.

   Using a Micrometer measure the piston diameter.

Published: 11-May-2011

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.

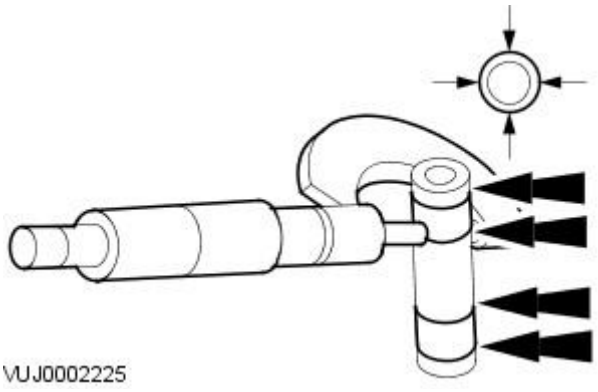
Carry out a visual inspection.

- 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.

Published: 11-May-2011

Engine System - General Information - Piston Pin Diameter

General Procedures



1. NOTE: The piston and piston pin are a matched pair. Do not mix up the components.

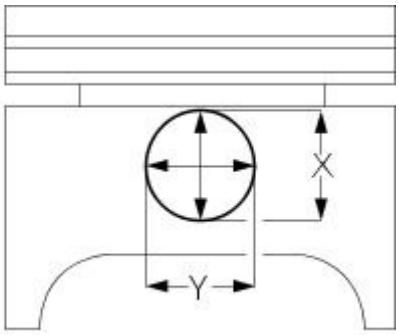
Measure the piston pin diameter.

- Measure the diameter in two directions.
- If the values are not to specification, install a new piston and a new piston pin.

Published: 11-May-2011

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.

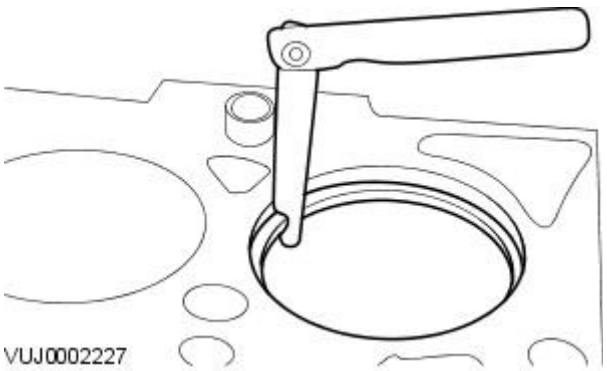
Measure the diameter of the piston pin bore.

- Measure the diameter in two directions.
- If the values are not to specification, install both a new piston and a new piston pin.

Published: 11-May-2011

Engine System - General Information - Piston Ring End Gap

General Procedures



1. CAUTION: Do not mix up the piston rings. Install the piston rings in the same position and location.

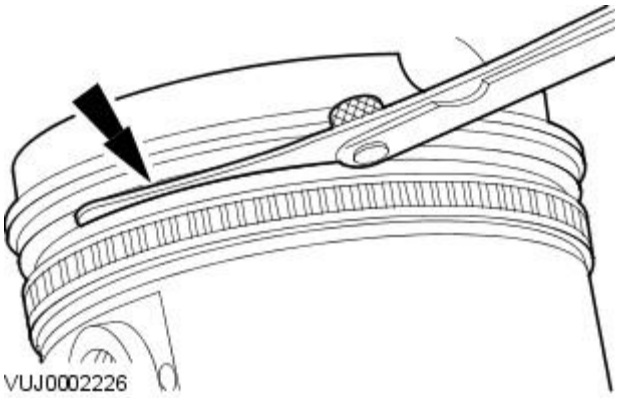
Using the Feeler Gauge, measure the piston ring gap.

- The values given in the specification refer to a gauge ring used during production.

Published: 11-May-2011

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.

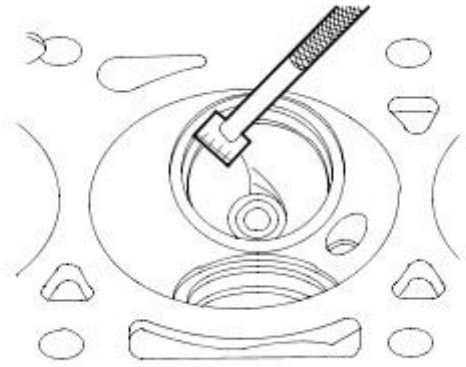
Published: 11-May-2011

Engine System - General Information - Valve Seat Inspection

General Procedures

General Equipment

Valve seat width scale



IAV2102141

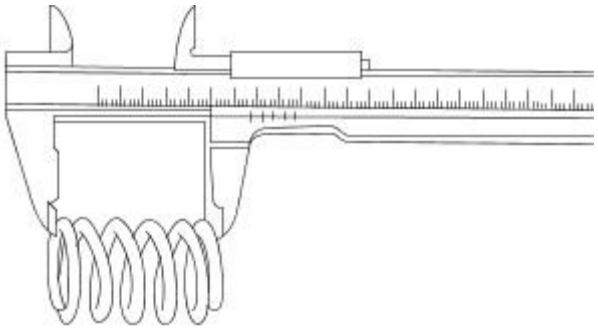
1. Measure the width of the valve seat.

- Measure the valve seat width using the Valve seat width scale.
- If the value is not to specification rework the valve seat.

Published: 11-May-2011

Engine System - General Information - Valve Spring Free Length

General Procedures



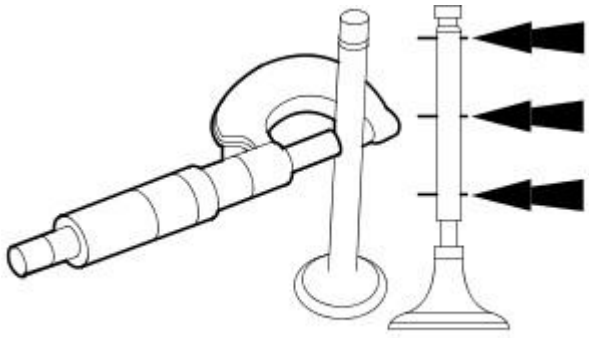
VUJ0002221

1. Using a vernier gauge, measure the free length of each valve spring. Verify the length is within specification.

Published: 11-May-2011

Engine System - General Information - Valve Stem Diameter

General Procedures



VUJ0002220

1. Using a micrometer measure the diameter of the valve stems.

- If the measurements are not to specification, install a new valve.

Published: 02-Jun-2011

Engine System - General Information - Leakage Test Using Smoke Test Equipment

General Procedures

CAUTION: The compressed air line supply pressure must be between 3.5 and 12 bar (50 and 175 psi) for the smoke test equipment to function correctly. Do not exceed this pressure. Failure to follow this instruction may result in damage to the smoke test equipment.

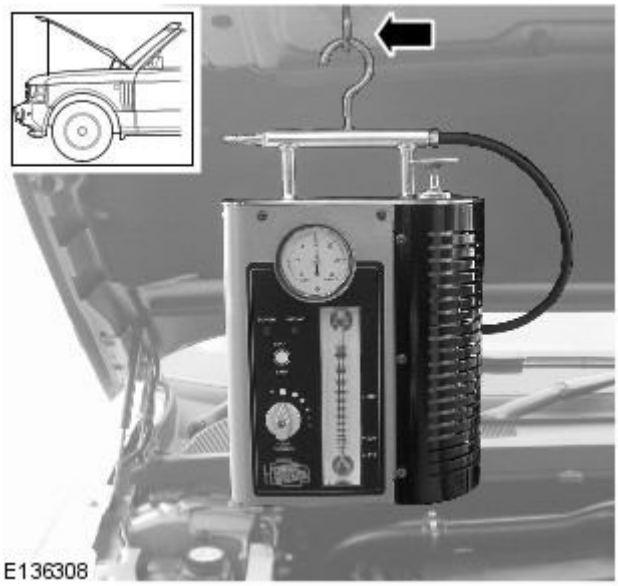
• NOTE: The vehicle battery must be in good condition and fully charged before carrying out this procedure.

• NOTE: On vehicles with 3.0L TDV6, it will be necessary to insert smoke at both air cleaner outlet pipes independently if the right hand turbocharger and associated hoses are to be tested.

• NOTE: In some cases it may be necessary to remove undertrays, trim or engine covers to obtain access to all potential leak locations.

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

• NOTE: For further information regarding operation of the test equipment refer to the manufacturers operators manual supplied with the kit.



1. WARNING: Use an additional support to prevent the hood from falling if the smoke test equipment is secured to the hood. Failure to follow this instruction may result in personal injury.

Install the smoke test equipment to a suitable location under the hood.

2. Connect a suitable compressed air line to the smoke test equipment.

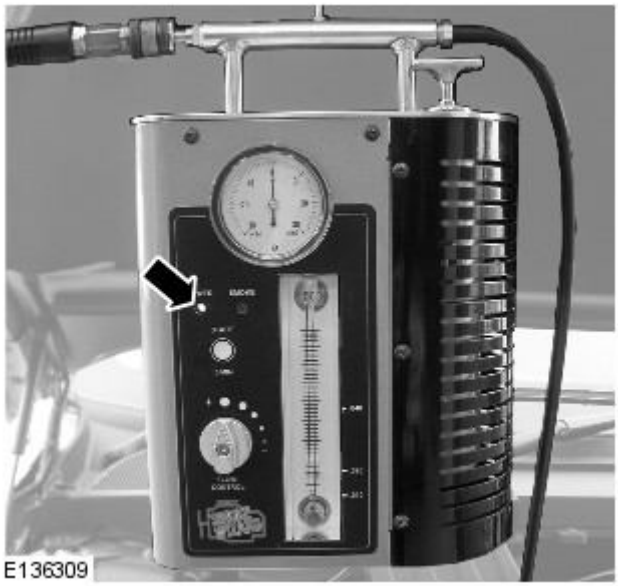
3. Connect the smoke test equipment positive power cable to the battery positive terminal.

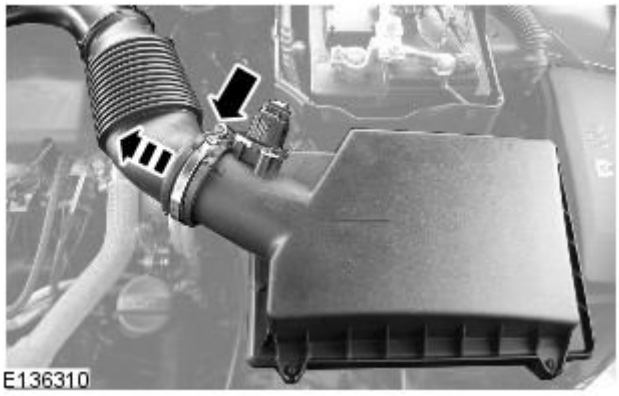
4. WARNING: Do not connect the smoke test equipment negative cable to the battery negative terminal.

Connect the smoke test equipment negative cable to a suitable body ground point.

5. NOTE: A flashing green light indicates low battery voltage. In this case, place the battery on charge and make sure that the battery is fully charged before using the smoke test equipment.

Observe the power indicator lamp on the smoke test equipment. Make sure that a continuous green light is displayed.

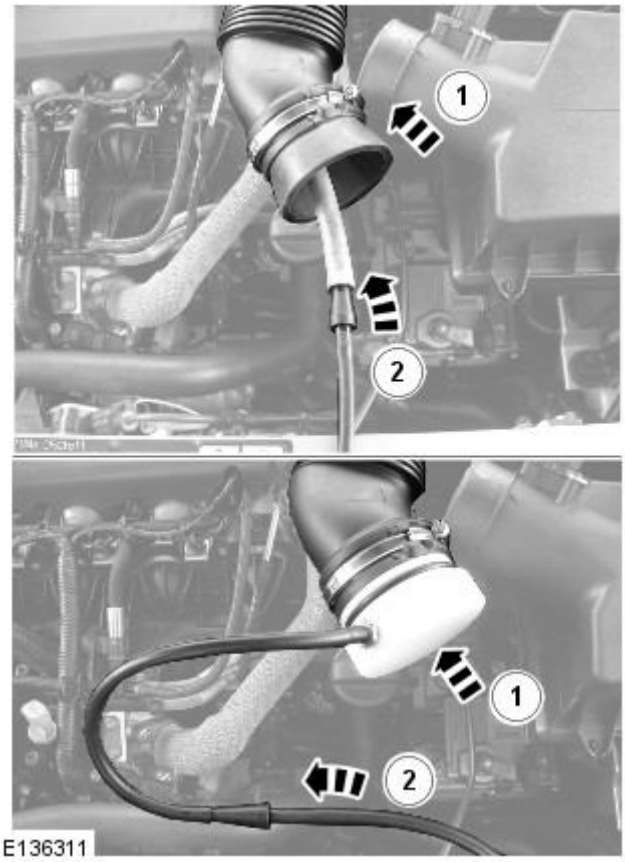




6. NOTE: In some cases it may be necessary to remove the air cleaner(s) to allow access to the air cleaner outlet pipes.

• NOTE: In some cases it will be necessary to cap one of the air cleaner outlet pipes. Use the blanking caps supplied in the kit to cap the open orifice.

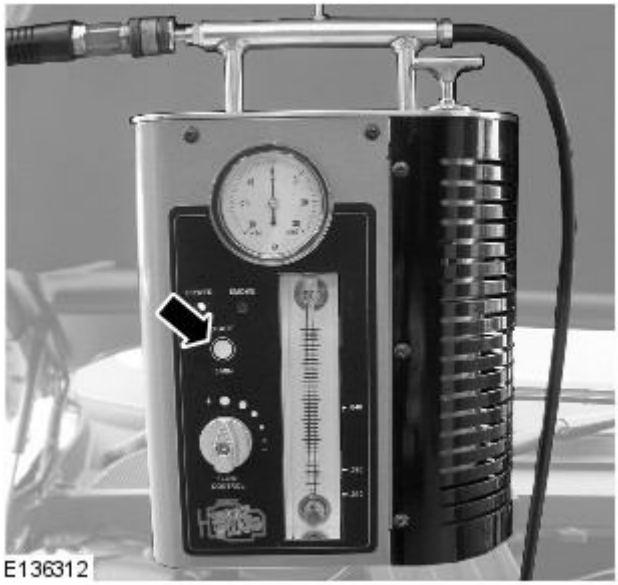
Disconnect the air cleaner outlet pipe(s).



7. NOTE: Make sure the smoke test equipment adapter is a good fit to the air cleaner outlet pipe. This must be an air tight seal.

Connect the smoke test equipment supply hose to the air cleaner outlet pipe.

1. Install the appropriate adapter to the air cleaner outlet pipe.
2. Connect the smoke test equipment supply hose to the adapter link hose.



8. NOTE: The flow control valve must be in the fully open position.

• NOTE: Smoke is produced for 5 minutes. The smoke test equipment will automatically switch off after this period of time.

Switch the smoke test equipment on.

9. Remove the oil filler cap, and observe until a constant flow of smoke is visible leaving the oil filler orifice. Install the oil filler cap.

10. NOTE: The longer smoke is allowed to exit from a leak, the more fluorescent dye will be deposited at a leak location.

Using the torch supplied in the kit set to white light, look for escaping smoke. Alternatively, use the ultraviolet light to look for fluorescent dye deposits at the source of a leak.

Published: 23-Sep-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 -

Lubricants, Fluids, Sealers and Adhesives

Description	Specification
Engine oil 2.0L gasoline, SAE 5W-30 (NAS)	API SL and ILSAC GF–3
Engine oil 2.0L gasoline, SAE 5W-30 (ROW)	API SJ / EC and ACEA A1 or A3 Jaguar WSS–M2C913–B preferred
Engine oil 2.0L Diesel (EUR)	5W–30 meeting Jaguar WSS–M2C913–B
Engine oil 2.2L Diesel (EUR)	5W–30 meeting Jaguar WSS–M2C913–B
Engine oil 2.5L Gasoline (NAS)	API SL and ILSAC GF–3
Engine oil 2.5L Gasoline (ROW)	API SJ / EC and ACEA A1 or A3 Jaguar WSS–M2C913–B preferred
Engine oil 3.0L Gasoline (NAS)	API SL and ILSAC GF–3
Engine oil 3.0L Gasoline (ROW)	API SJ / EC and ACEA A1 or A3 Jaguar WSS–M2C913–B preferred
Engine assembly lubricant	SQM-2C9003 AA EP90
Hose assembly surfactant	ESE-M99B144-B
Metal surface cleaner	WSW-M5B392-A
Sealant	WSS-M4G323-A6
Spark plug grease	'Neverseeze' ESE M12 A4A

Capacities

Description	Liters
Engine oil, initial fill	6.5
Engine oil, service fill with filter change	5.9
Coolant	8.25

Torque Specifications

Description	Nm	lb-ft	lb-in
Accessory drive idler pulley (grooved) retaining bolt	25	18	-
Accessory drive idler pulley (smooth) retaining bolt	47	35	-
Accessory drive tensioner retaining bolt	47	35	-
A/C compressor retaining bolts	25	18	-
A/C compressor mounting bracket bolts	25	18	-
A/C compressor supply and return tubes retaining bolt	25	18	-
Air filter retaining bracket retaining bolt	6	-	53
Camshaft bearing caps retaining bolts	10	7	-
Camshaft position sensor retaining bolt	6	-	53
Catalytic converter to exhaust manifold retaining nuts	A	-	-
Catalytic converter retaining studs	9	-	80
Coolant pipe retaining bracket retaining bolt	6	-	53
Coolant by-pass tube to cylinder head retaining bolts.	10	7	-
Crankshaft position sensor retaining bolt	10	7	-
Crankshaft pulley retaining bolt (stage1)	A	-	-
Cylinder head retaining bolts (stage 1)	A	-	-
Engine cover retaining bracket retaining nuts	10	7	-
Engine front cover retaining bolts	A	-	-
Engine ground strap retaining bolt	10	7	-
Engine wiring harness electrical connector retaining bolt	10	7	-
Engine wiring ground strap retaining bolt	10	7	-
Exhaust Manifold retaining nuts.	20	15	-
Exhaust manifold heat shield retaining bolts	10	7	-
Engine mount to body bracket retaining nut	83	61	-
Engine mount bracket to body retaining bolts	80	59	-
Engine support bracket to engine block retaining bolts	A	-	-
Engine support bracket to engine mount retaining bolt	80	59	-
Flexplate retaining bolts	80	59	-
Flywheel retaining bolts	80	59	-
Generator battery positive cable retaining nut	12	9	-
Generator lower retaining bolt	25	18	-
Generator upper retaining bolt	47	35	-
Ignition coil retaining bolt	6	-	53
Intake manifold wiring harness retaining bolts	10	7	-
Knock sensor retaining bolt	25	18	-
Lower intake manifold retaining bolts	A	-	-
Oil cooler retaining bolt	57	42	-
Oil level indicator tube retaining bolt with stud head	10	7	-
Oil pan retaining bolts	A	-	-
Oil pan drain plug	25	18	-
Oil pan to transmission retaining bolts	45	33	-
Oil pressure sensor	14	10	-
Oil pump retaining bolts	10	7	-
Oil pump tube retaining bolts	10	7	-
Oil pump tube retaining nut	A	-	-
Power steering pump retaining bolts	25	18	-
Engine control module (ECM) wiring harness electrical connector retaining bolt	5	-	44
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 bracket retaining bolts	10	7	-
Upper intake manifold support bracket retaining nut	6	-	53
Valve cover retaining bolts	A	-	-
Variable Valve Timing (VVT) securing bolts.	40 + 90 degrees	30 + 90 degrees	-
Water pump inlet tube retaining bolts	10	7	-
Water pump outlet tube retaining nuts	9	-	80

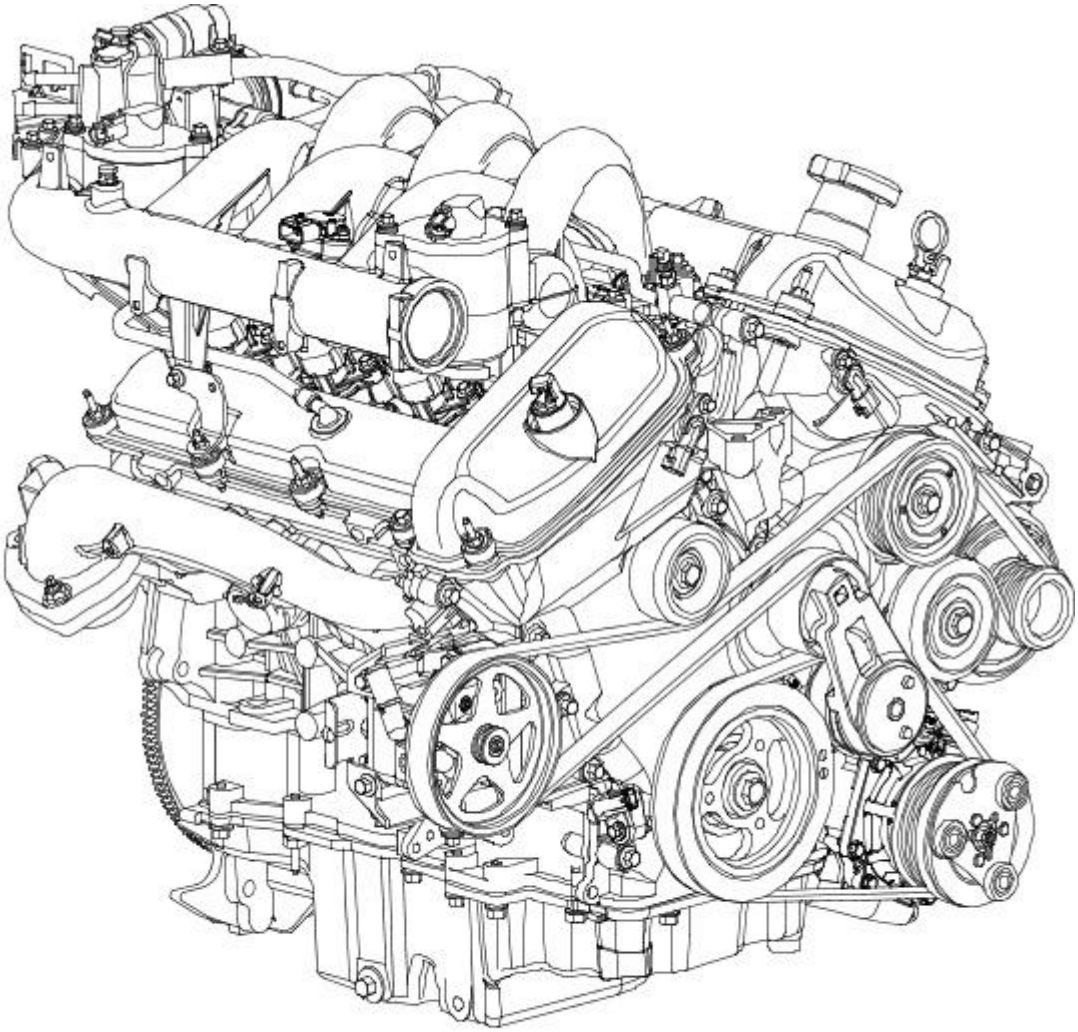
Description	Nm	lb-ft	lb-in
Wiring harness to valve cover retaining nuts	6	-	53
Throttle cable retaining bracket bolts	9	-	80
A = refer to the procedure for correct torque sequence	-	-	-

Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Engine

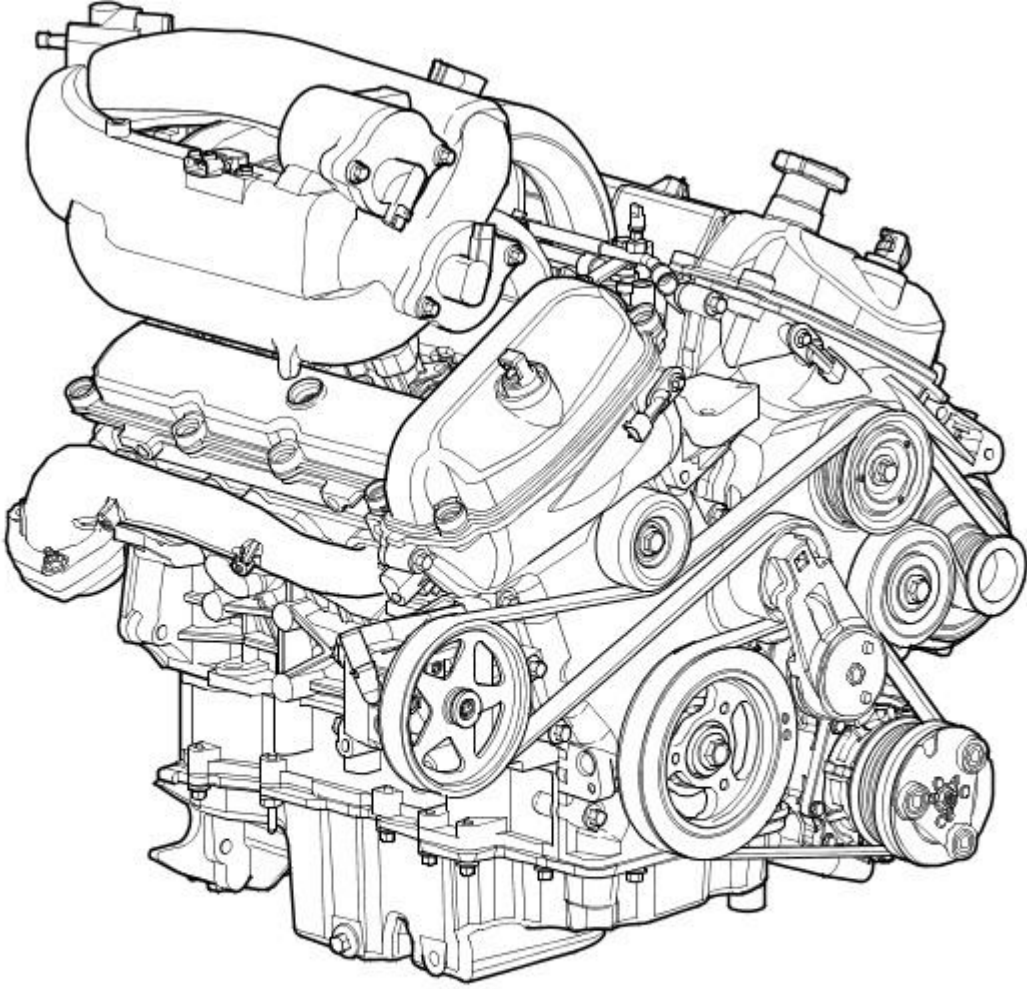
Description and Operation

2.0 Litre



E30691

2.5 and 3.0 Litre



E30815

The 2.0, 2.5 and 3.0 litre 24 valve V6 engines have four overhead camshafts and are driven by two timing chains. All three engines incorporate electronic engine management with distributorless ignition system, sequential electronic fuel injection. All three have two catalytic converters in the exhaust system which includes two oxygen sensors and two catalytic monitor sensors.

Viewed from the rear of the engine, the right-hand cylinder bank is numbered 5,3,1 and the left-hand cylinder bank is numbered 6,4,2.

The engines include the following:

- 10.75:1 compression ratio on the 2.0 litre engine.
- 10.3:1 Compression ratio on the 2.5 litre engine.
- 10.5:1 Compression ratio on the 3.0 litre engine.
- 3 Stage variable geometry intake manifold.
- Lightweight valve gear.
- Unique camshaft lift and duration.
- Single knock sensor engine management control.
- Continuous variable camshaft timing (VCT) system.
- Twin mass flywheel (manual transmission).

Variable Intake System (V.I.S).

The variable intake system consists of a three stage upper intake manifold assembly, two position electronically driven gate valves and an engine management powertrain control system.

The engine control module (ECM) switches the intake manifold tuning valves between fully open and fully closed at calibrated engine speeds.

The intake manifold efficiency is therefore increased which will also increase the engine torque and engine performance.

Engine Lubrication System

The engine lubrication system is of the force-feed type in which oil is supplied under pressure (full film) to the:

- Crankshaft main bearings.
- Crankshaft thrust main bearing.
- Connecting rod bearings.
- Valve shims.
- Camshaft bearings.
- Variable camshaft timing.

All other parts are lubricated by thin film lubrication.

Oil Pump

The rotary oil pump develops the oil pressure:

- The oil pump is located at the front of the crankshaft.
- The oil pump is 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.

Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Engine

Diagnosis and Testing

For additional information, refer toSection 303-00 Engine System - General Information.

Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Valve Clearance Adjustment

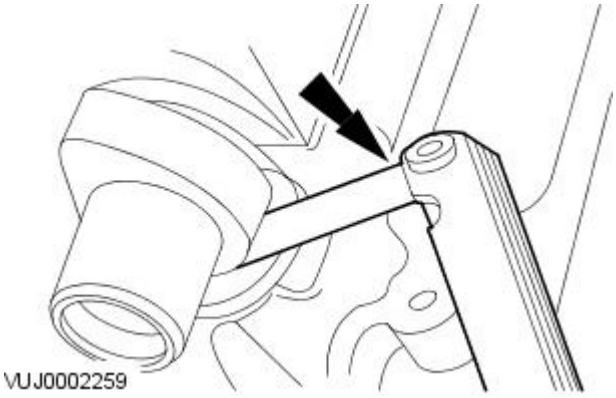
General Procedures

1. Remove the camshafts. For additional information, refer toCamshaft
2. Use compressed air to remove the shims that require replacing.
   - Blow compressed air between the shim edge and bucket to dislodge the shim.
3. Use the following formula to calculate the required shim thickness.
   - Original shim thickness + measured clearance - desired clearance = required shim thickness.
4. Apply a light coat of engine oil to the replacement shim(s) and install.
5. Install the camshafts. For additional information, refer toCamshaft

Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Valve Clearance Check

General Procedures



1. Remove the left hand valve cover. For additional information, refer to Valve Cover—LH
2. Remove the right hand valve cover. For additional information, refer to Valve Cover—RH
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 shim or valve clearance measurement will be incorrect.

   Rotate the engine clockwise to position the camshaft lobe away from the shim surface.
4. Using the feeler gauge set, measure the clearance between the camshaft and the shim surface. Record and check the readings. For additional information, refer to Section 303-00 Engine System - General Information. Adjust the clearances as necessary. For additional information, refer to Valve Clearance Adjustment

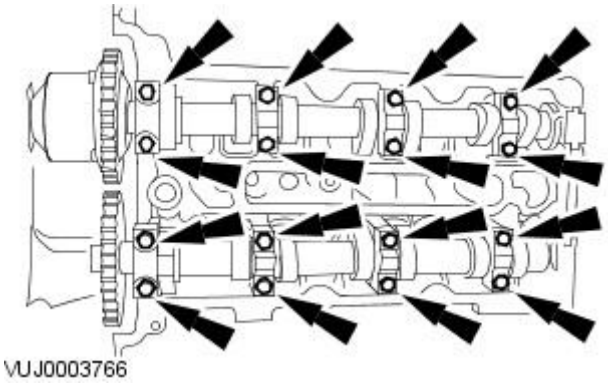
Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Camshafts LH

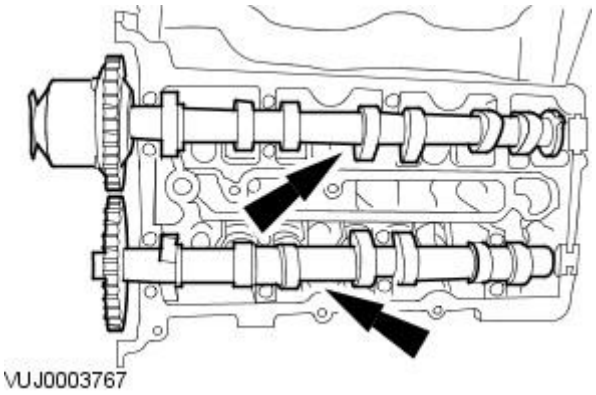
In-vehicle Repair

Removal

1. Remove the timing chains. For additional information, refer to Timing Drive Components.
2. Remove the camshaft bearing caps evenly.


VUJ0003766

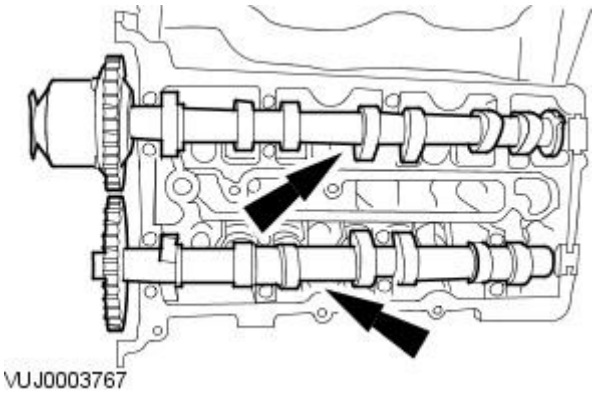
3. Remove the camshafts.


VUJ0003767

Installation

1. NOTE: Lubricate the camshafts and the camshaft bearing caps with oil WSE-M2C908-A or equivalent meeting Jaguar specification prior to installation.

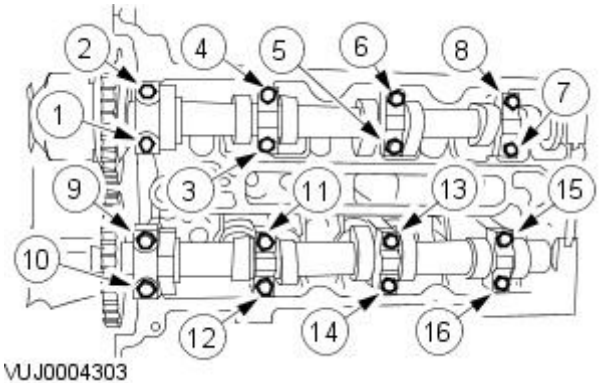
   Install the camshafts.


VUJ0003767

2. CAUTION: 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.

   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.



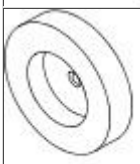
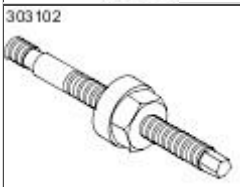
VUJ0004303

3. Carry out a valve clearance check. For additional information, refer toValve Clearance Check.
4. Install the timing chains. For additional information, refer to Timing Drive Components.

Published: 11-May-2011

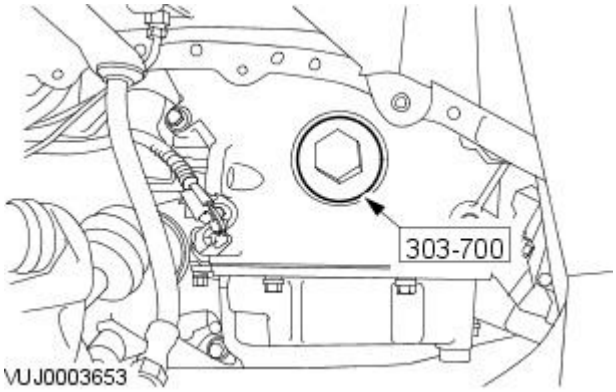
Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Crankshaft Front Seal

In-vehicle Repair

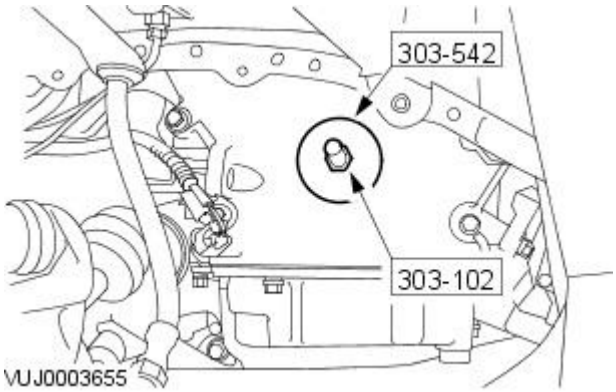
Special Tool(s)	
 303-700	Crankshaft Front Seal Remover 303-700
 303-542	Crankshaft Front Seal Installer 303-542
 303102	Crankshaft Damper Installer 303-102

Removal

1. Remove the crankshaft vibration damper. For additional information, refer to Crankshaft Pulley.
2. Using the special tool, remove the crankshaft front oil seal.



Installation



1. CAUTION: Make sure the seal and the tool are approximately parallel to the front of the engine.

• NOTE: Lubricate the seal lip with oil WSE-M2C908-A or equivalent meeting Jaguar specification.

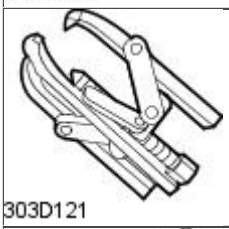
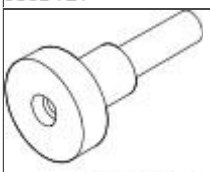
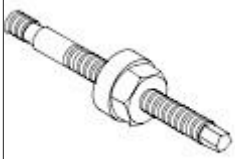
Using the special tool, install the crankshaft front oil seal.

2. Install the crankshaft vibration damper. For additional information, refer to Crankshaft Pulley.

Published: 11-May-2011

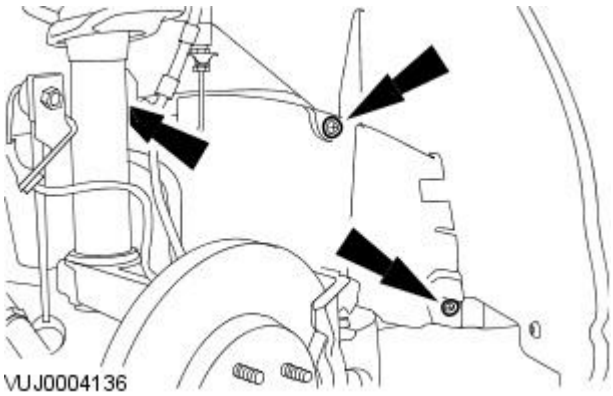
Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Crankshaft Pulley

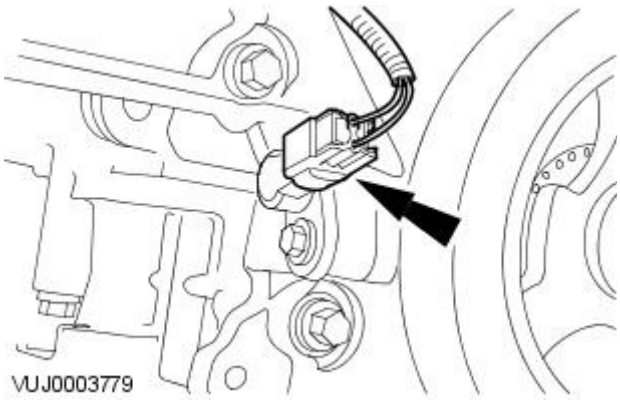
In-vehicle Repair

Special Tool(s)	
 303D055	Wrench strap-universal 303-D055
 303D121	Crankshaft Damper Remover 303-D121
 303D12101	Thrust Pad 303-D121-01
303102  303102	Crankshaft Damper Installer Draw Bolt 303-102
 303-335/2	Crankshaft Damper Installer 303-335/2
 303-703	Accessory Belt Detensioner 303-703

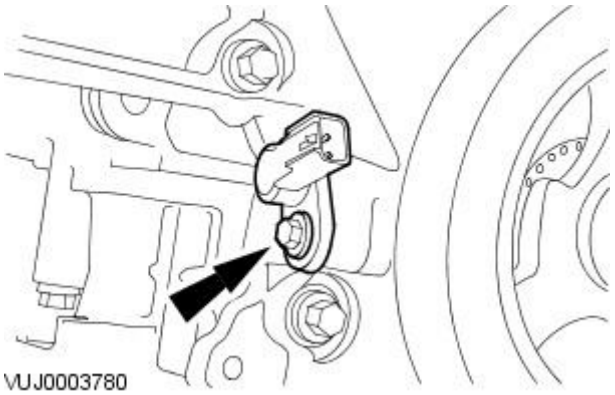
Removal

1. Remove the wheel and tire. For additional information, refer to Section 204-04 Wheels and Tires.
2. Remove the splash shield.

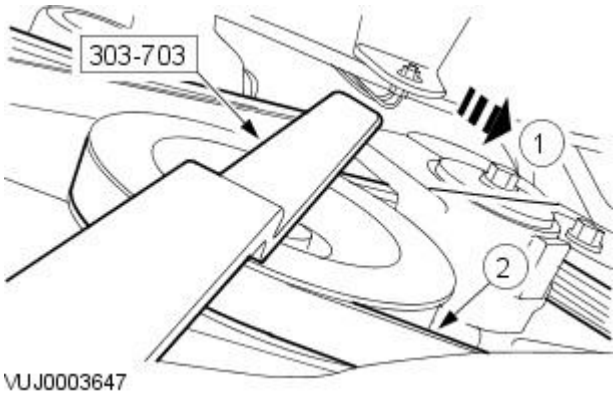




3. Disconnect the crankshaft position sensor (CKP) electrical connector.

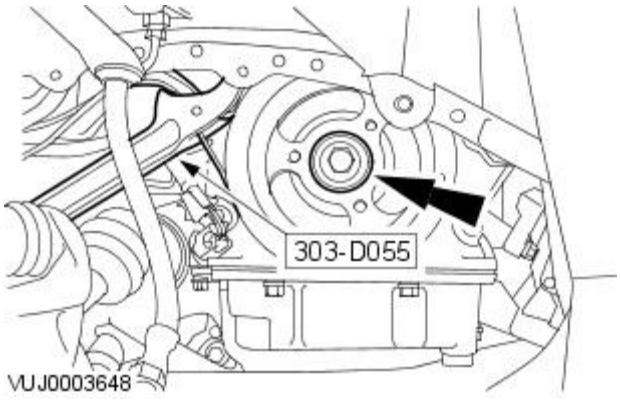


4. Remove the CKP sensor.



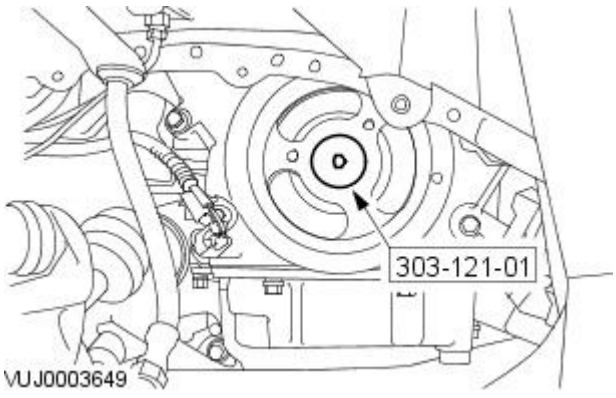
5. Detach the accessory drivebelt.

1. Using the special tool, rotate the belt tensioner counter clockwise.
2. Detach the accessory drivebelt.

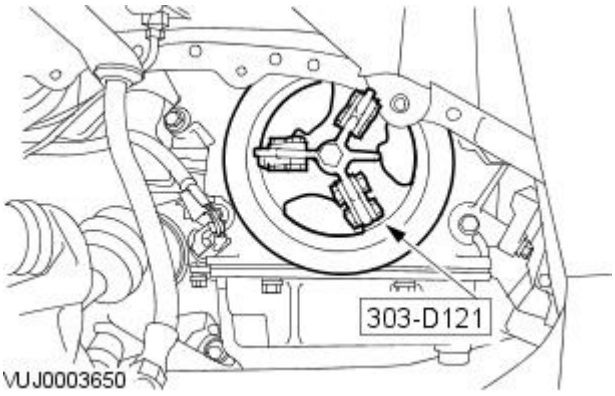


6. Using the special tool, remove the crankshaft vibration damper retaining bolt.

- Remove and discard the crankshaft vibration damper retaining bolt.

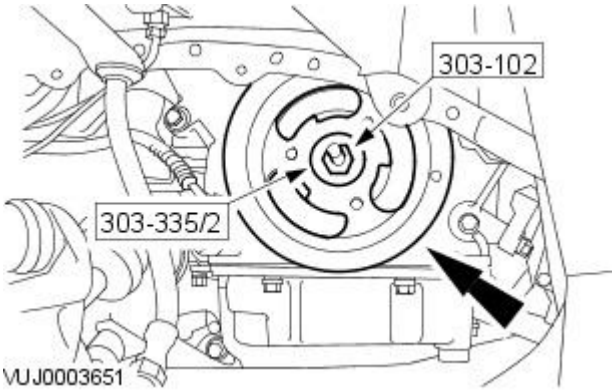


7. Install the special tool.



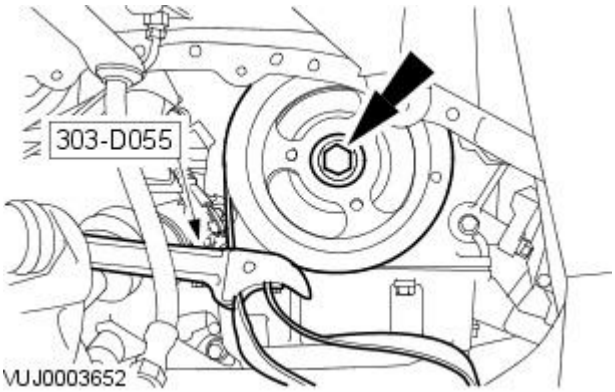
8. Using the special tools, remove the crankshaft vibration damper.

Installation



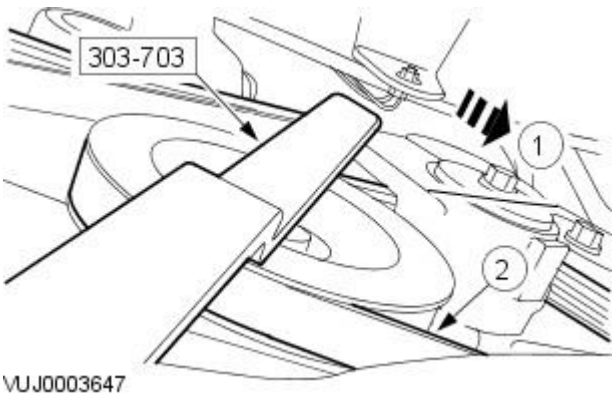
1. NOTE: Coat the crankshaft damper keyway with silicone gasket sealant WSE-M4G323-A6 or equivalent meeting Jaguar specification.

Using the special tool, install the crankshaft vibration damper.



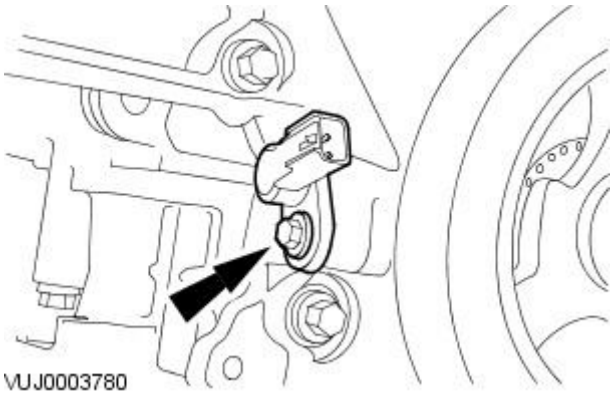
2. Using the special tool, tighten the crankshaft vibration damper retaining bolt.

- Install a new crankshaft vibration damper retaining bolt.
  1. Complete the tightening sequence.
  2. Stage 1: Torque to 120 Nm.
  3. Stage 2: Loosen the bolt (minimum 1 turn).
  4. Stage 3: Torque to 50 Nm.
  5. Stage 4: Angle Torque to 90°.



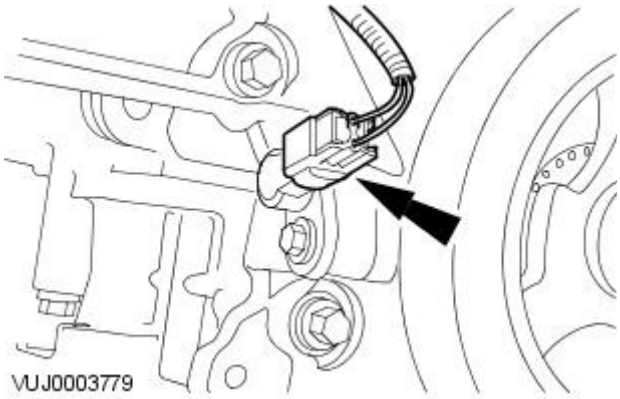
3. Attach the accessory drivebelt.

1. Using the special tool, rotate the belt tensioner counter-clockwise.
2. Attach the accessory drivebelt.

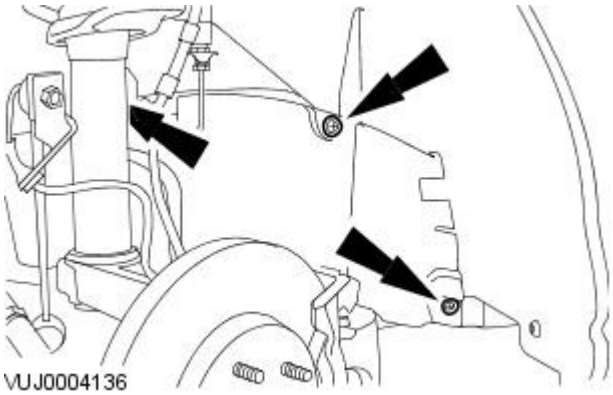


4. Install the CKP.

- Tighten to 10 Nm.



5. Connect the CKP electrical connector.



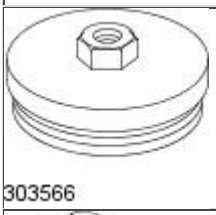
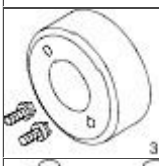
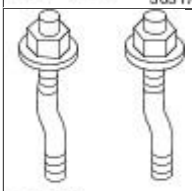
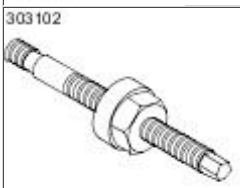
6. Install the splash shield.

7. Install the wheel and tire. For additional information, refer to Section 204-04 Wheels and Tires.

Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Crankshaft Rear Seal

In-vehicle Repair

Special Tool(s)	
 303566	Crankshaft Rear Seal Remover 303-566
 303178	Crankshaft Rear Seal Installer 303-178
 303384	Crankshaft Rear Seal Installer Adapter Bolts 303-384
303102  303102	Crankshaft Rear Seal Installer Draw Bolts 303-102

Removal

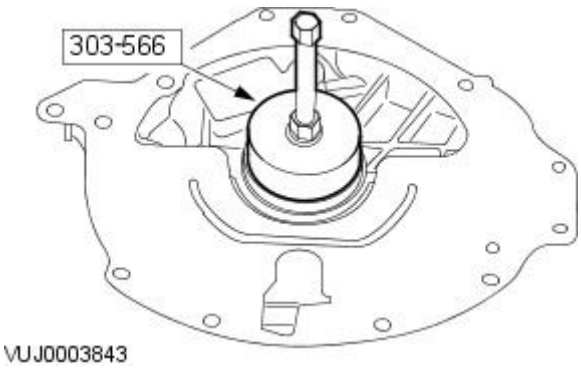
Vehicles With Manual Transmission

1. Remove the flywheel. For additional information, refer to Flywheel —Manual Transmission.

Vehicles With Automatic Transmission

2. Remove the flexplate. For additional information, refer to Flexplate —Automatic Transmission.

All Vehicles



VUJ0003843

3. CAUTION: Avoid scratching or damaging the oil seal sealing surfaces on the crankshaft and cylinder block.

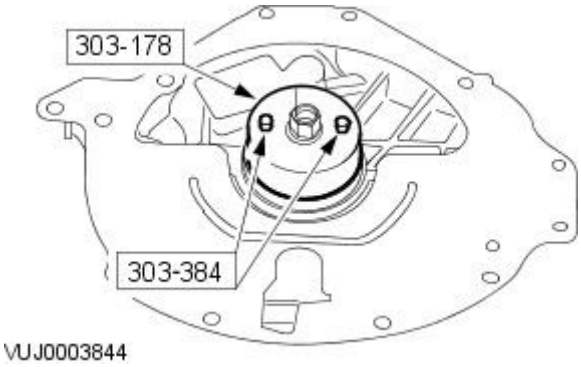
   Using the special tool, remove the crankshaft rear main oil seal.

Installation

All Vehicles

1. Clean and inspect the crankshaft rear oil seal sealing surfaces.
2. NOTE: Use oil WSE-M2C908-A or equivalent meeting Jaguar specification.

   Lubricate the seal lip with oil.



3. NOTE: Alternate bolt tightening to correctly seat the crankshaft rear oil seal until it is flush with the cylinder block.

Using the special tool, install the crankshaft rear oil seal.

Vehicles With Manual Transmission

4. Install the flywheel. For additional information, refer to Flywheel —Manual Transmission.

Vehicles With Automatic Transmission

5. Install the flexplate. For additional information, refer to Flexplate —Automatic Transmission.

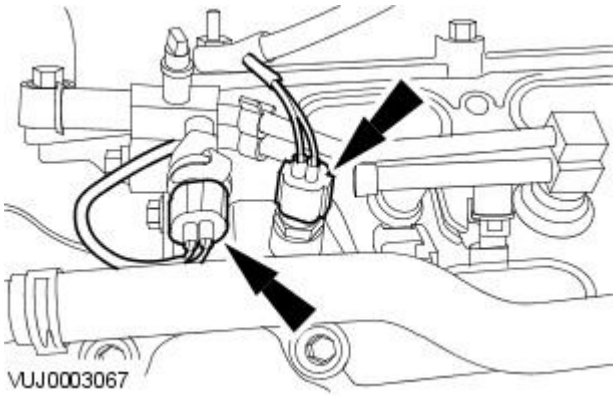
Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Cylinder Head LH

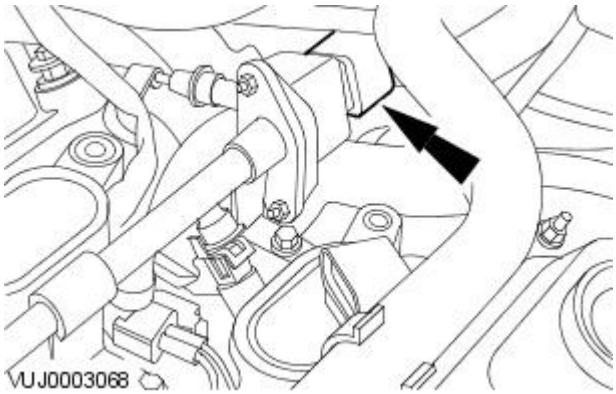
In-vehicle Repair

Removal

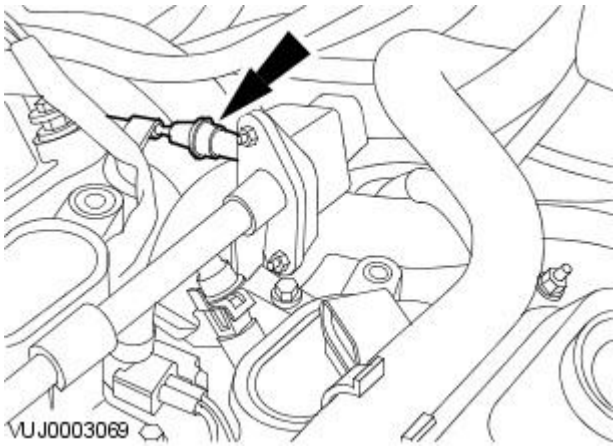
Vehicles with 2.5L or 3.0L engine



1. Disconnect the engine coolant temperature (ECT) and fuel temperature sensor (FTS) electrical connectors.

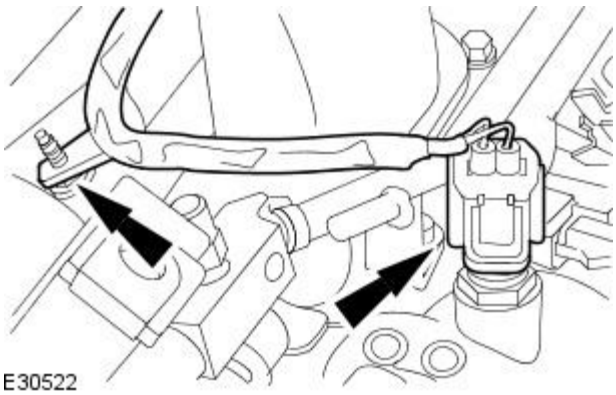


2. Disconnect the electrical connector.



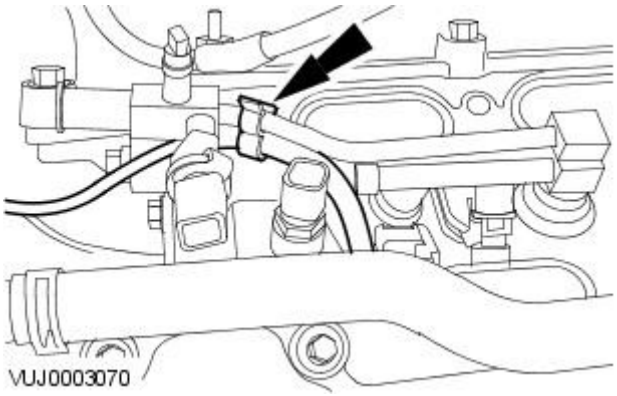
3. Detach fuel sensor vacuum line.

Vehicles with 2.0L engine



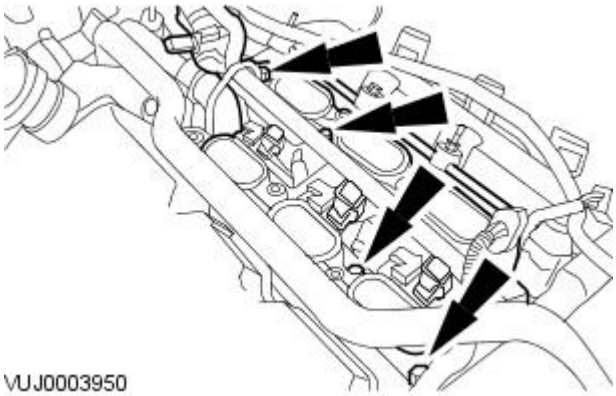
4. Disconnect the coolant temperature (ECT) electrical connector.

All vehicles


VUJ0003070

5. Detach the fuel charging wiring harness.

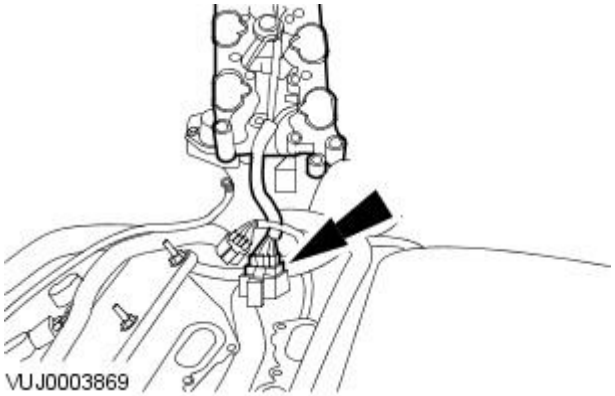
- 2.5 and 3.0L shown, 2.0L similar.


VUJ0003950

6. WARNING: Fuel may still be present in the fuel injection supply manifold, extreme care must be taken as this could cause personal injury.

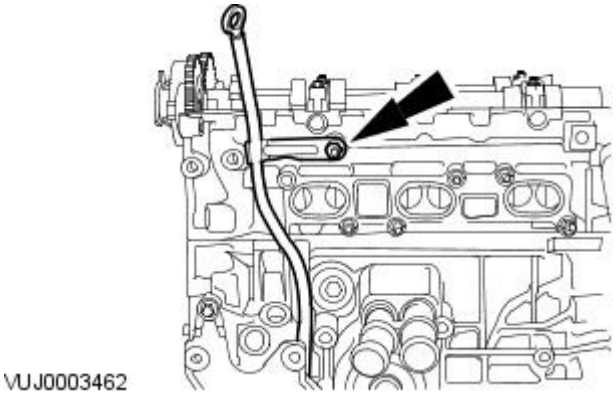
Detach the fuel injection supply manifold, lower intake manifold and place to one side.

- Remove and discard the lower intake manifold seals.
  1. 2.5 and 3.0L shown, 2.0L similar.


VUJ0003869

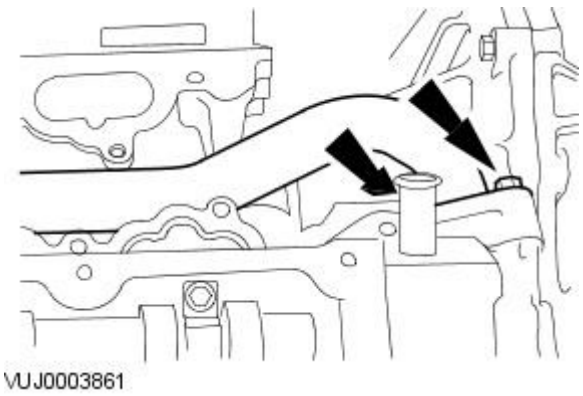
7. Remove the fuel injection supply manifold and lower intake manifold.

- Disconnect the electrical connector.


VUJ0003462

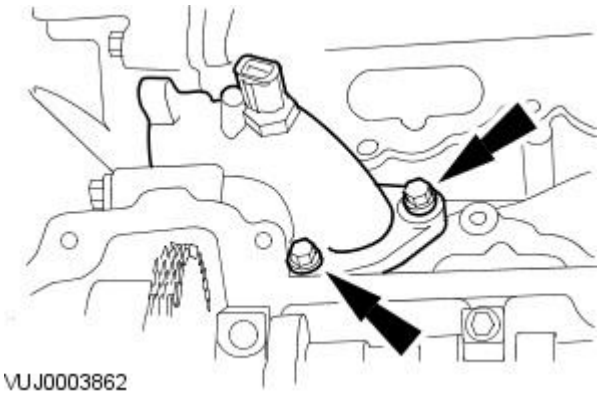
8. Remove the oil level indicator tube.

- Remove and discard the oil level indicator tube O-ring seal.


VUJ0003861

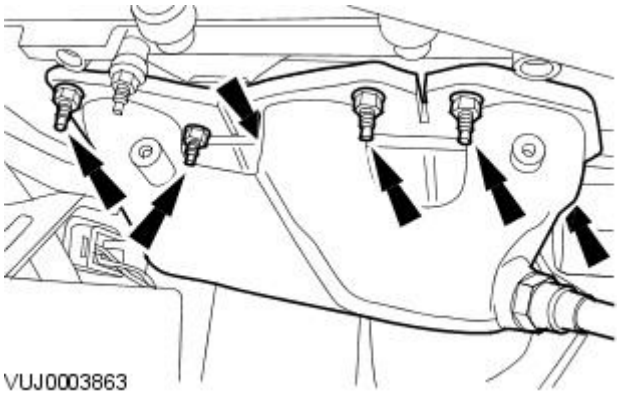
9. Remove the water pump outlet pipe.

- Remove and discard the water pump outlet pipe O-ring seals.


VUJ0003862

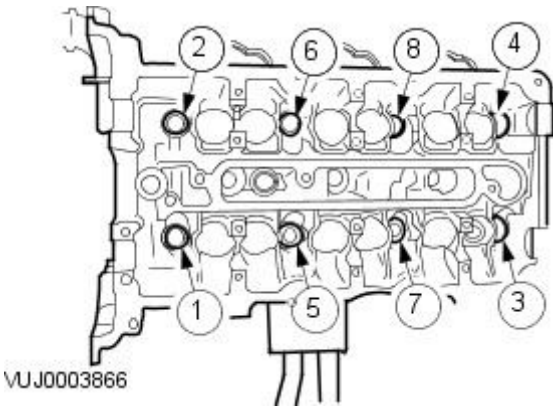
10. Remove the coolant bypass tube.

- Remove and discard the coolant bypass tube O-ring seals.


VUJ0003863

11. Remove the exhaust manifold.

- Remove and discard the exhaust manifold gasket.



VUJ0003866

12. Remove the left-hand camshafts. For additional information, refer to Camshaft.

13. NOTE: Remove the bolts in the indicated sequence.

Remove the cylinder head.

- Remove and discard the cylinder head gasket.

14. Clean and inspect the cylinder head and cylinder block. For additional information, refer to Section 303-00 Engine System - General Information.

Installation

All vehicles

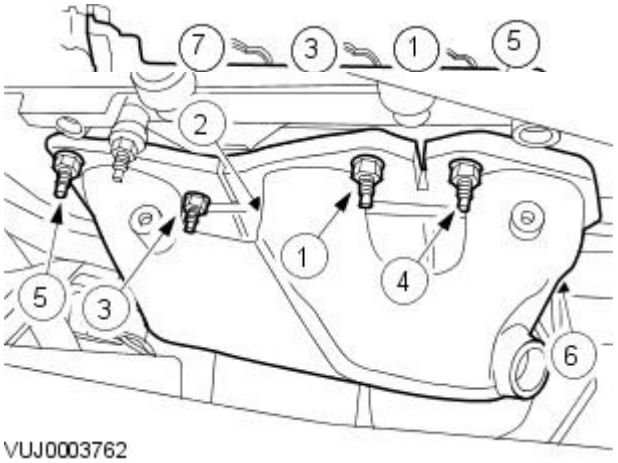
1. NOTE: The head gaskets must be installed over the cylinder block dowels.

Install a new cylinder head gasket.

2. CAUTION: Use care when installing the cylinder head. Damage to the cylinder block, cylinder head or the cylinder head gasket may result.

- NOTE: Make sure the cylinder head is installed in its original position.

Position the cylinder head and install new cylinder head bolts and washers.



VUJ0003762

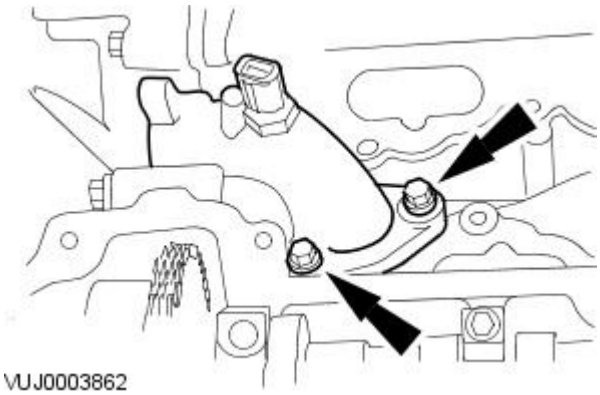
3. Install the left-hand camshafts. For additional information, refer to Camshaft.

4. Install the exhaust manifold.

- Install the new exhaust manifold gasket.

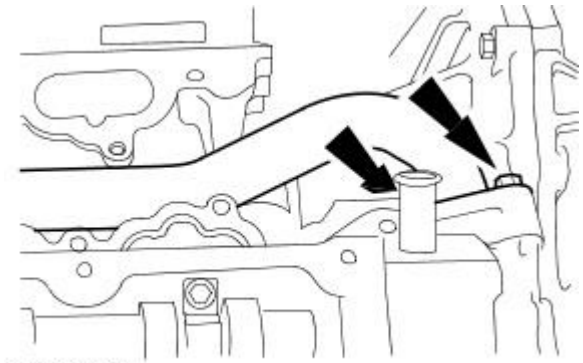
- NOTE: Tighten the bolts in the indicated sequence in six stages.

- Complete the tightening sequence.
- Tighten to 20 Nm.
- Stage 1: Tighten to 30 Nm.
- Stage 2: Tighten 90 degrees.
- Stage 3: Loosen 360 degrees (one full turn) in reverse order.
- Stage 4: Tighten to 30 Nm.
- Stage 5: Tighten 90 degrees.
- Stage 6: Tighten 90 degrees.


VUJ0003862

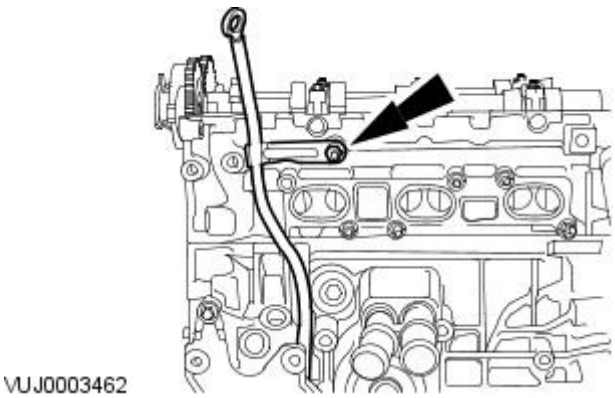
5. Install the coolant bypass tube.

- Install the new coolant bypass tube O-ring seals.
- Tighten to 10 Nm.


VUJ0003861

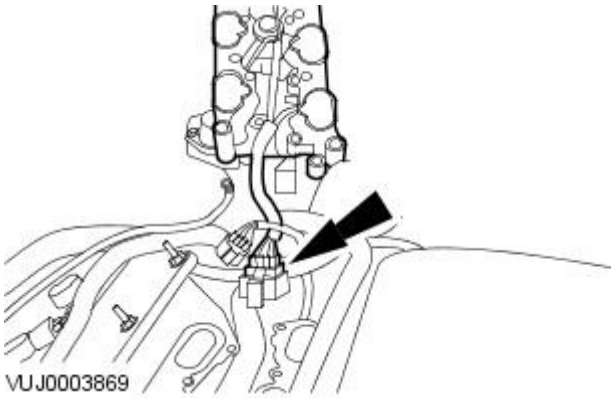
6. Install the water pump outlet pipe.

- Install the new water pump outlet pipe O-ring seals.
- Tighten to 10 Nm.


VUJ0003462

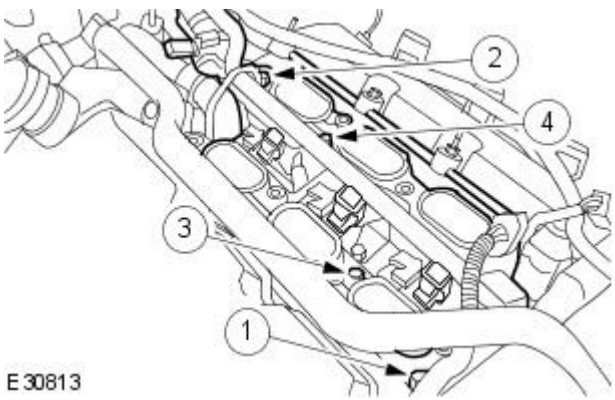
7. Install the oil level indicator tube.

- Install a new O-ring seal.
- Tighten to 10 Nm.


VUJ0003869

8. Attach the fuel injection supply manifold and lower intake manifold.

- Connect the electrical connector.



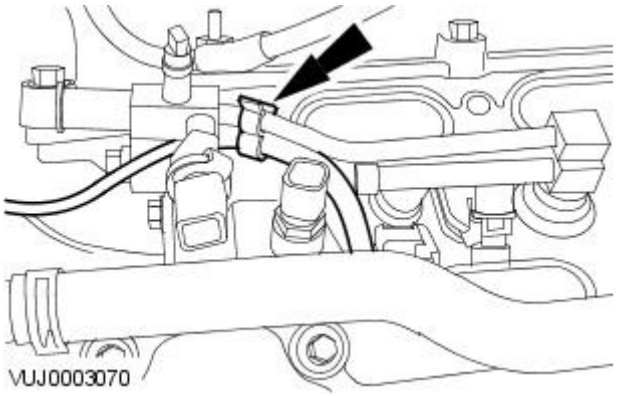
E30813

9. Install the fuel injection supply manifold, lower intake manifold.

- Install new lower intake manifold O-ring seals.
- Tighten in the sequence shown.
- Tighten to 10 Nm.

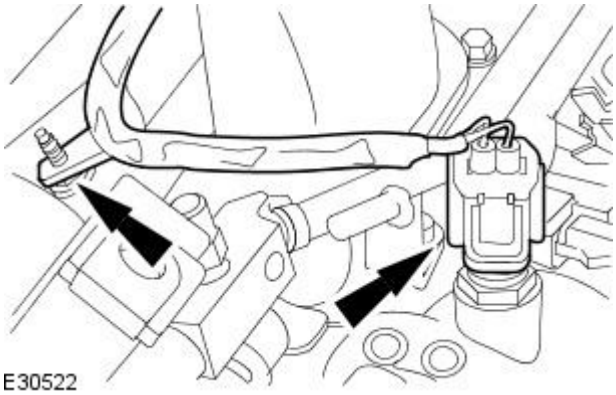
10. Attach the fuel charging wiring harness.

- 2.5 and 3.0L shown, 2.0L similar.



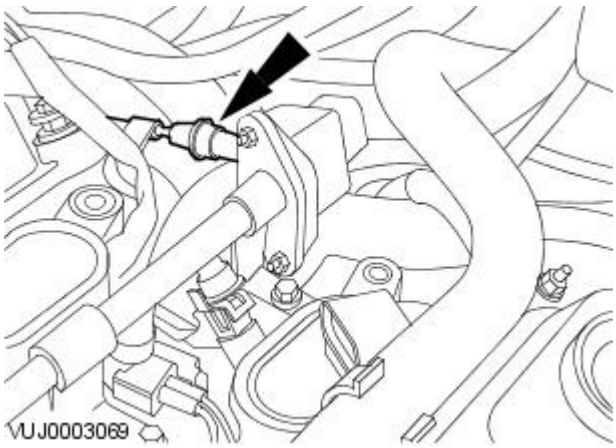
Vehicles with 2.0L engine

11. Connect the coolant temperature (ECT) electrical connector.

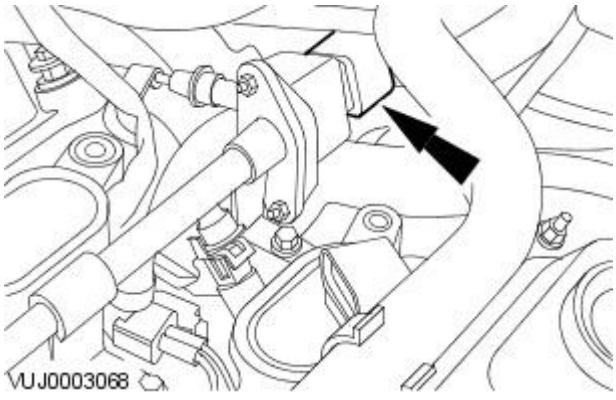


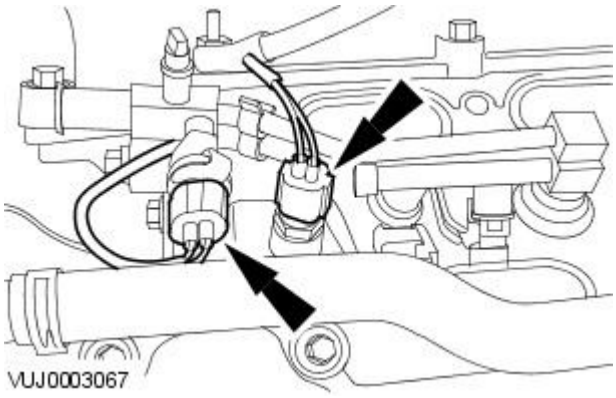
Vehicles with 2.5L or 3.0L engine

12. Attach the fuel sensor vacuum line.



13. Connect the electrical connector.





14. Connect the engine coolant temperature (ECT) and fuel temperature sensor (FTS) electrical connectors.

Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Engine Front Cover

In-vehicle Repair

Removal

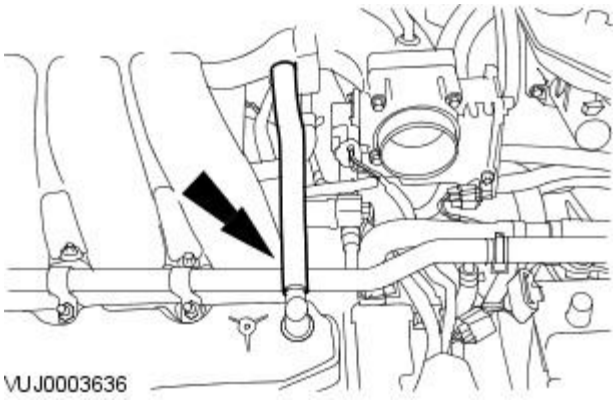
CAUTION: It is necessary to remove the engine in order to remove the engine front cover.

All vehicles

1. Using a suitable container drain the engine oil.
2. Remove the automatic or manual transmission. For additional information, refer to Section 307-01A Automatic Transmission/TransaxleSection 307-01B Automatic Transmission/Transaxle or Section 308-03 Manual Transmission/Transaxle.

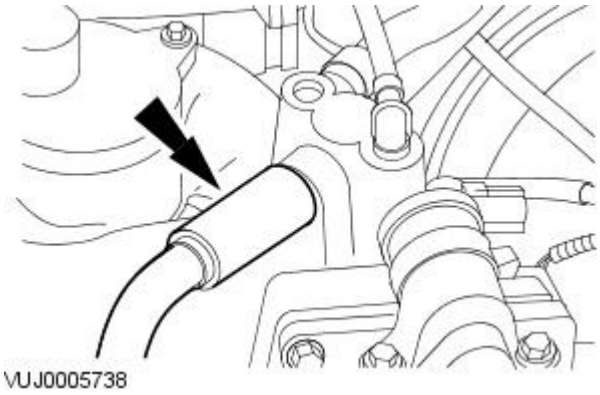
Vehicles with 2.5L or 3.0L engine

3. Detach the positive crank case ventilation hose.

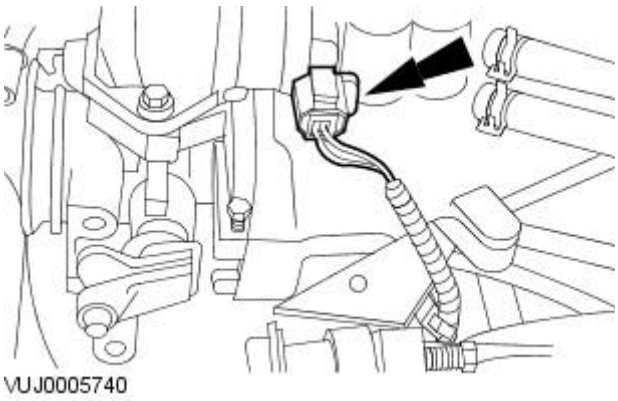


Vehicles with 2.0L engine

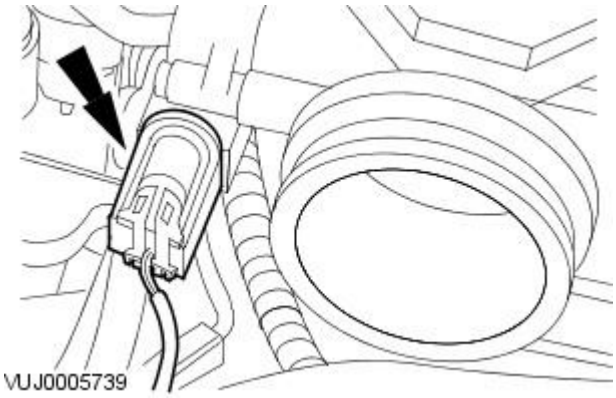
4. Detach the positive crank case ventilation hose.



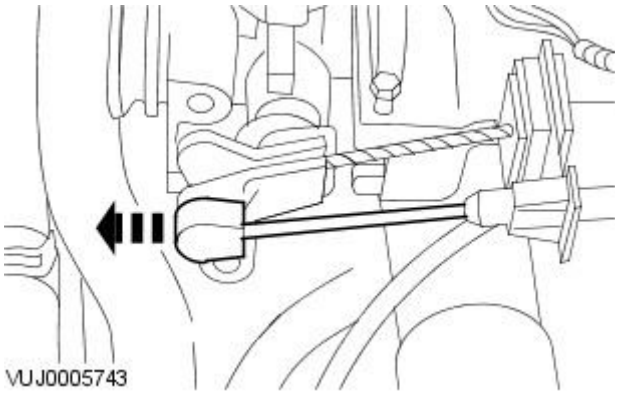
5. Disconnect the idle actuator control valve electrical connector.



6. Disconnect the throttle position sensor electrical connector.

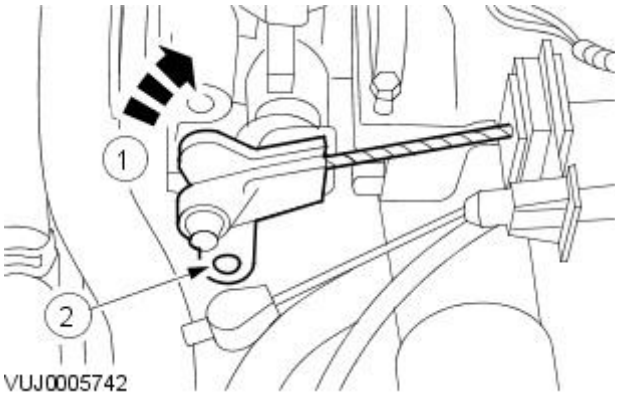


7. Detach the cruise control cable.

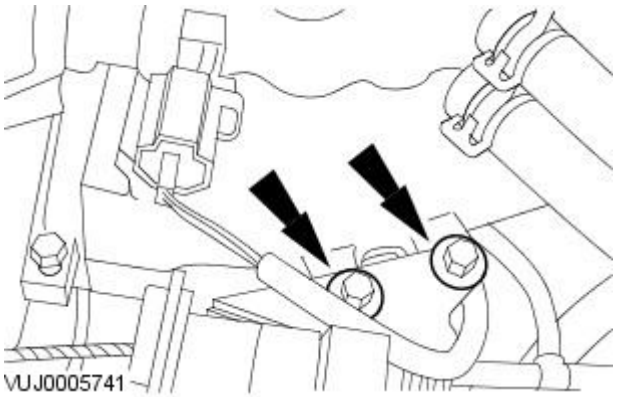


8. Detach the throttle cable.

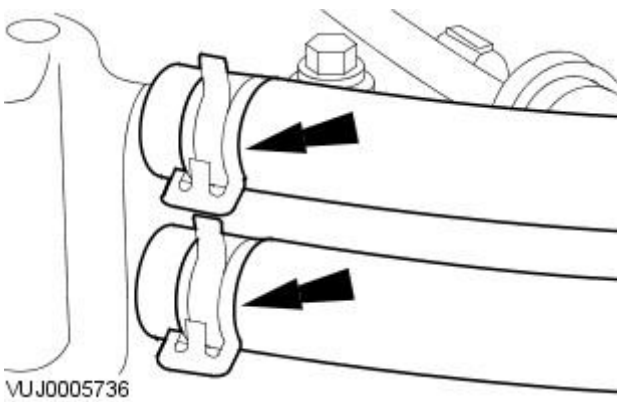
1. Reposition the throttle lever to the fully open position.
2. Detach the throttle cable.



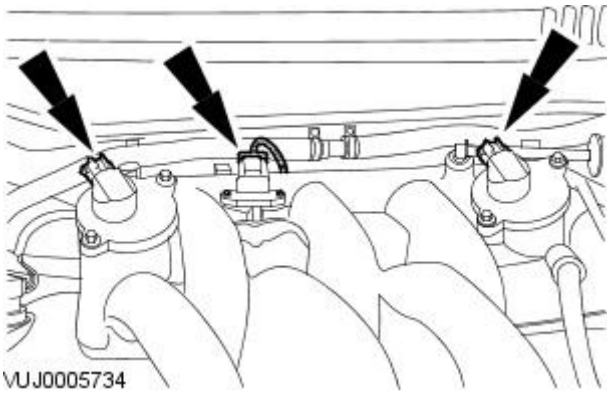
9. Detach the throttle cable retaining bracket.



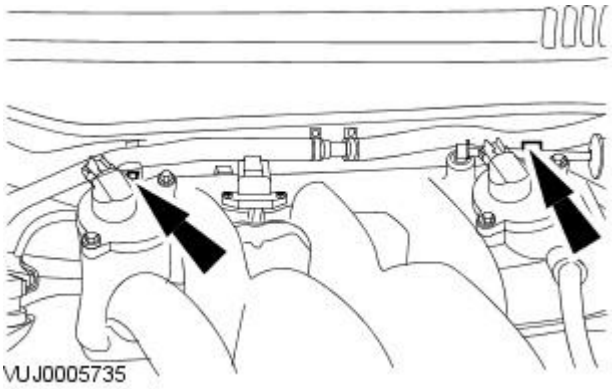
10. Detach the coolant hoses.



11. Disconnect the electrical connectors.

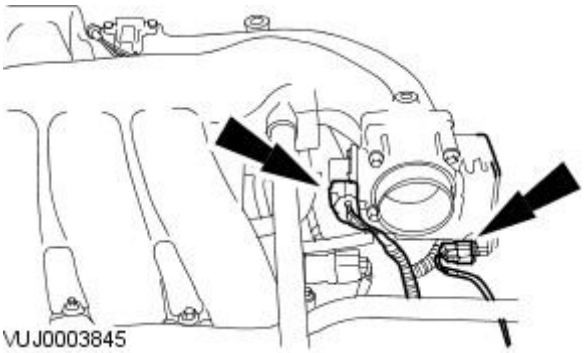


12. Detach the wiring harness.

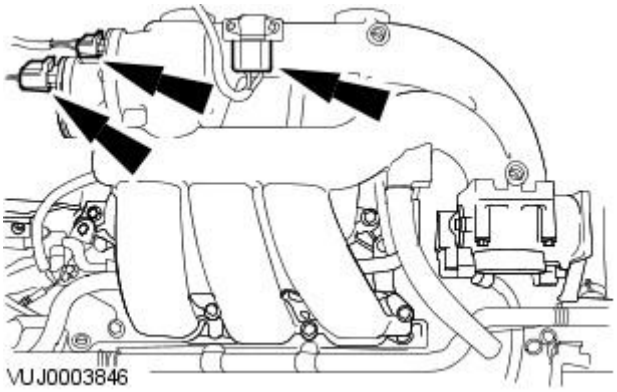


Vehicles with 2.5L or 3.0L engine

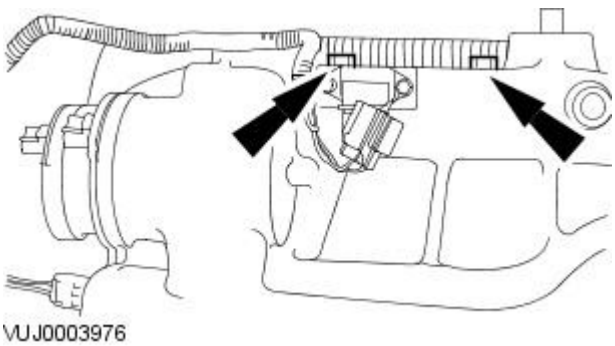
13. Disconnect the electrical connectors.



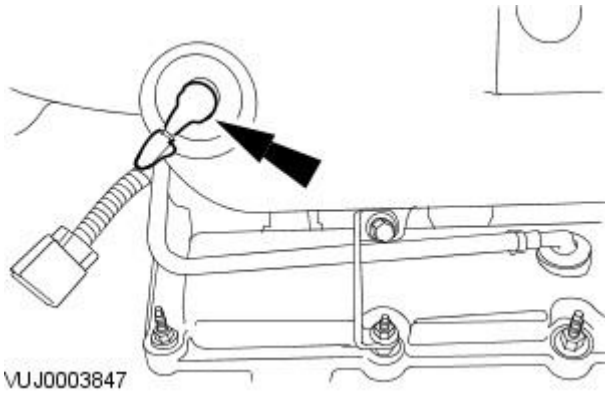
14. Disconnect the electrical connectors.



15. Detach the wiring harness.



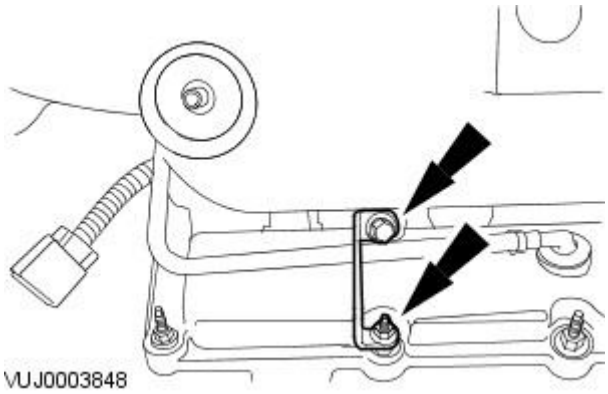
16. Detach the vacuum hose.



All vehicles

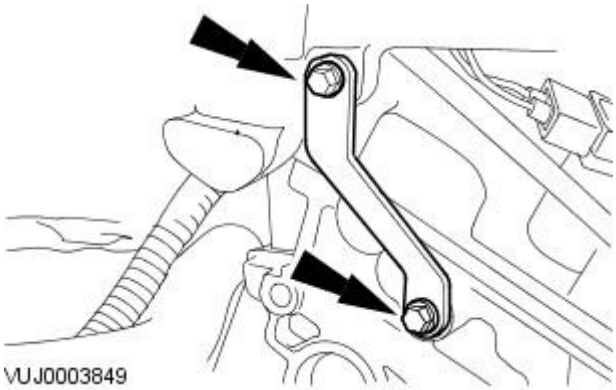
17. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Remove the intake manifold support bracket.



18. NOTE: 2.5L and 3.0L shown, 2.0L similar.

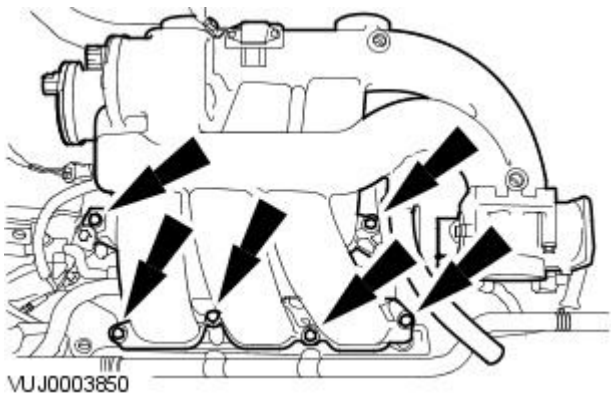
Remove the intake manifold support bracket.

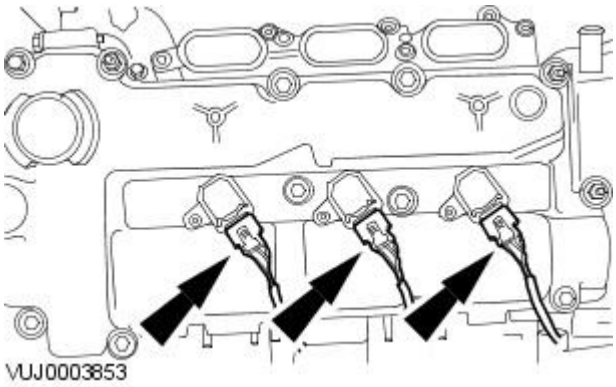


19. NOTE: 2.5L and 3.0L shown, 2.0L similar.

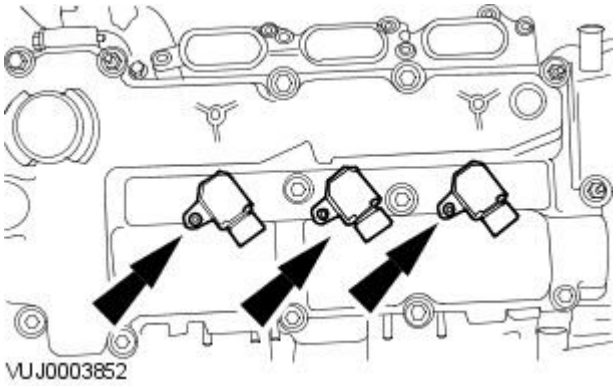
Remove the intake manifold.

- Remove and discard the intake manifold gaskets.

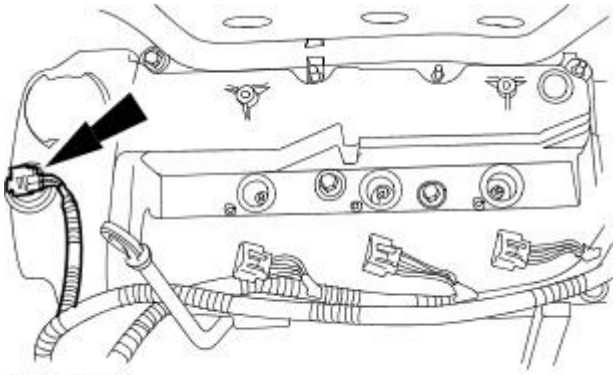



VUJ0003853

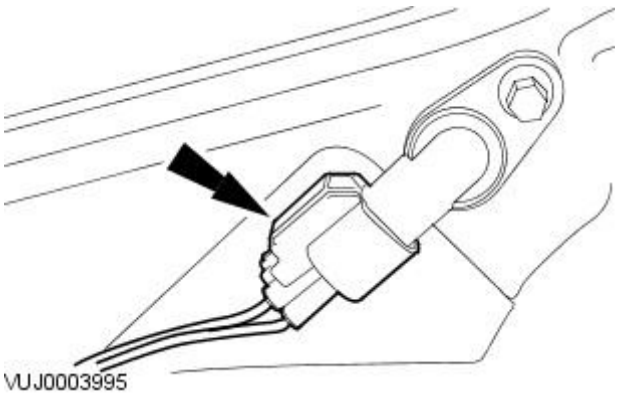
20. Disconnect the left-hand ignition coil electrical connectors.


VUJ0003852

21. Remove the left-hand ignition coils.

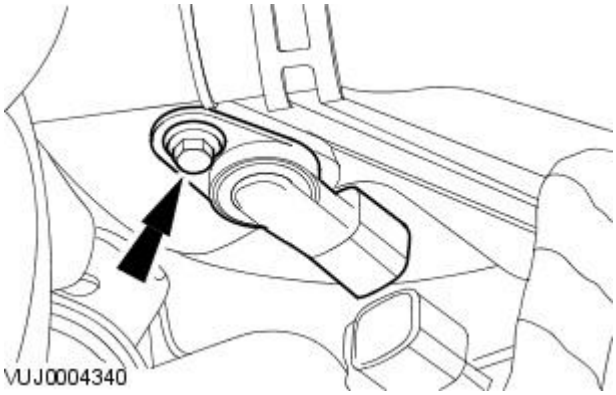

VUJ0003977

22. Disconnect the variable camshaft timing (VCT) solenoid electrical connector.


VUJ0003995

23. NOTE: Right-hand shown, left-hand similar.

Disconnect the camshaft position sensor electrical connectors.

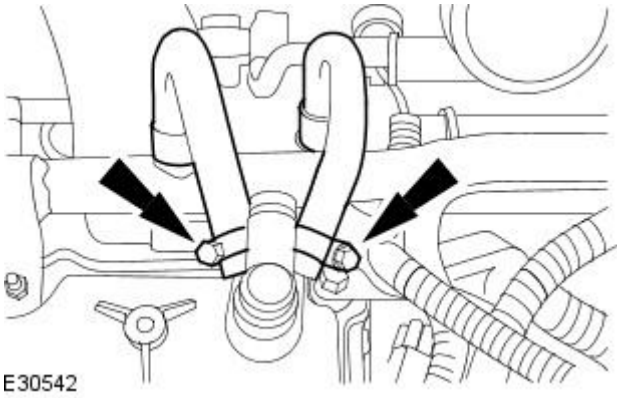

VUJ0004340

24. NOTE: Right-hand shown, left-hand similar.

Remove the (CMP) sensors.

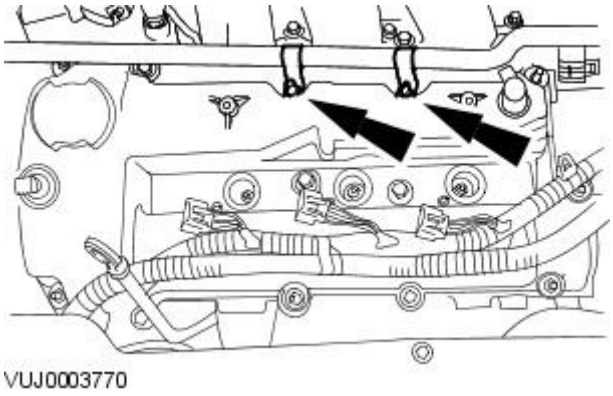
25. Reposition the left-hand wiring harness for access to the valve cover.

Vehicles with 2.0L engine


E30542

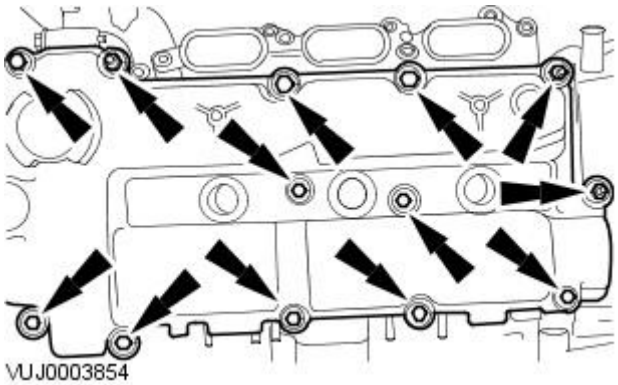
26. Detach the heated positive crankcase ventilation valve coolant hoses.

All vehicles


VUJ0003770

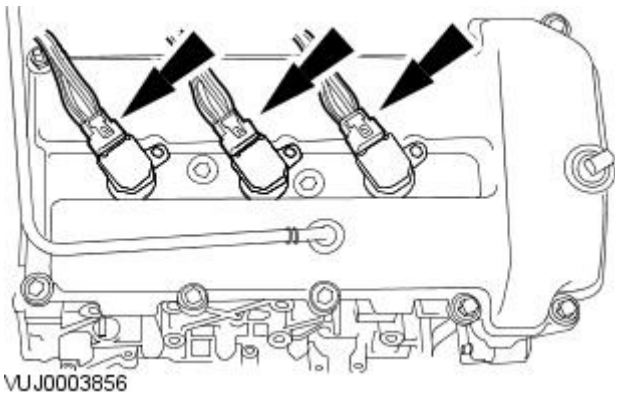
27. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Detach the coolant hose.


VUJ0003854

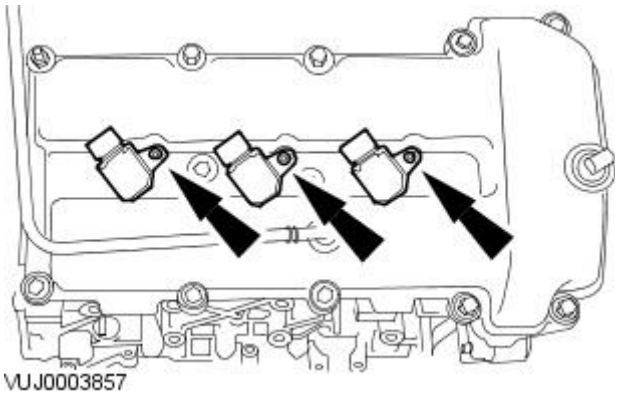
28. Remove the left-hand valve cover.

- Remove and discard the valve cover gaskets.

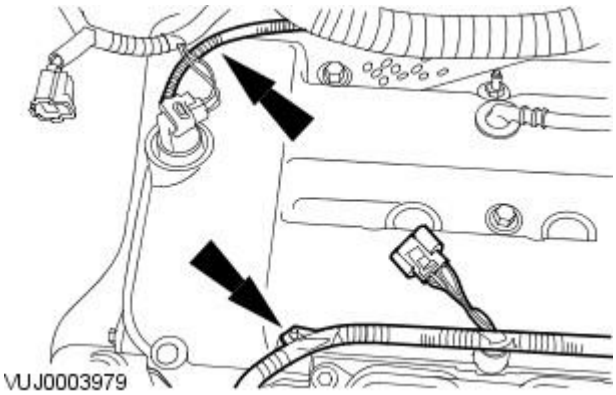

VUJ0003856

29. Disconnect the right-hand ignition coil electrical connectors.

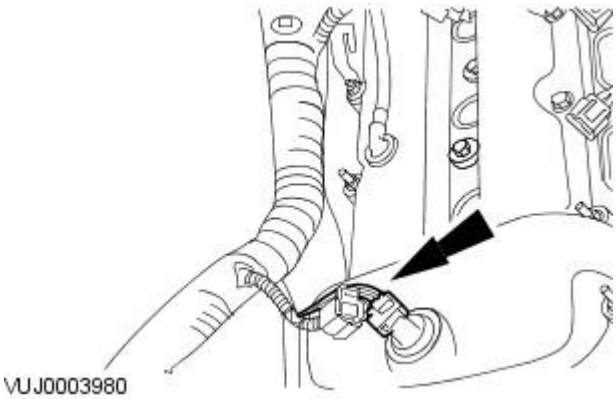
30. Remove the right-hand ignition coils.


VUJ0003857

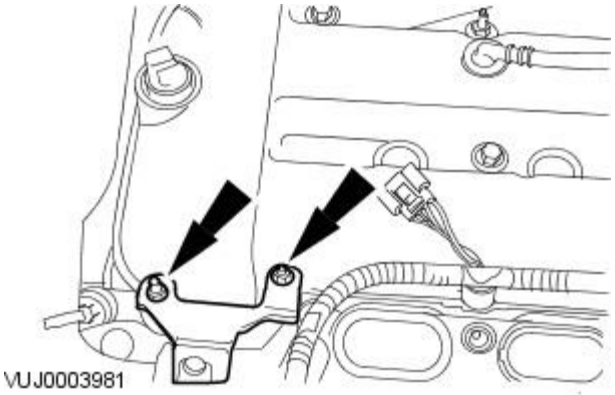
31. Detach the wiring harness.


VUJ0003979

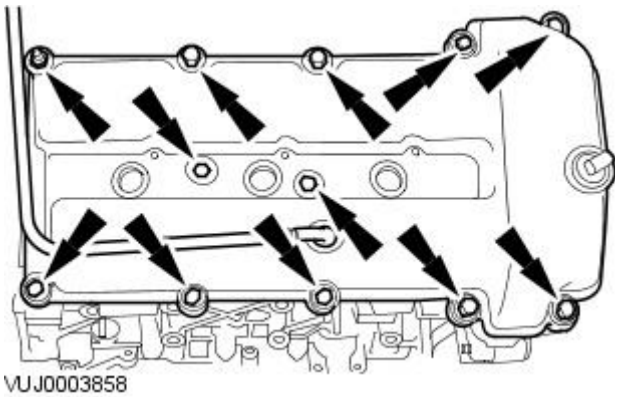
32. Disconnect and reposition the variable camshaft timing (VCT) solenoid electrical connector.


VUJ0003980

33. Remove the engine cover retaining bracket.

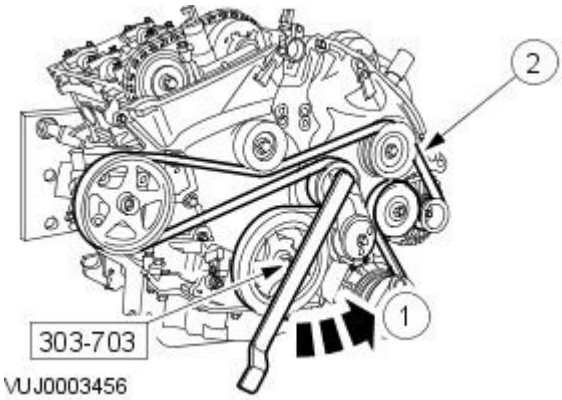

VUJ0003981

34. Reposition the right-hand wiring harness for access to the valve cover.


VUJ0003858

35. Remove the right-hand valve cover.

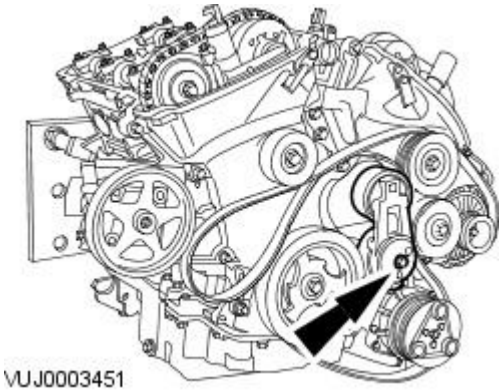
- Remove and discard the valve cover gaskets.



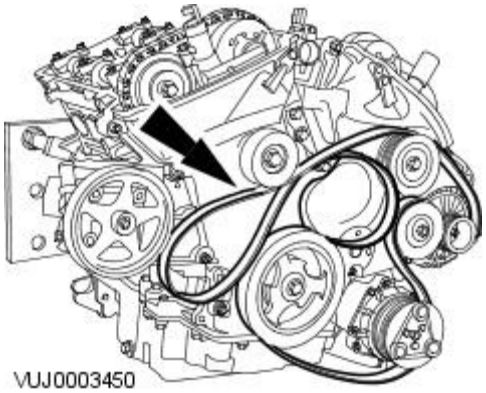
VUJ0003456

36. Detach the accessory drivebelt.

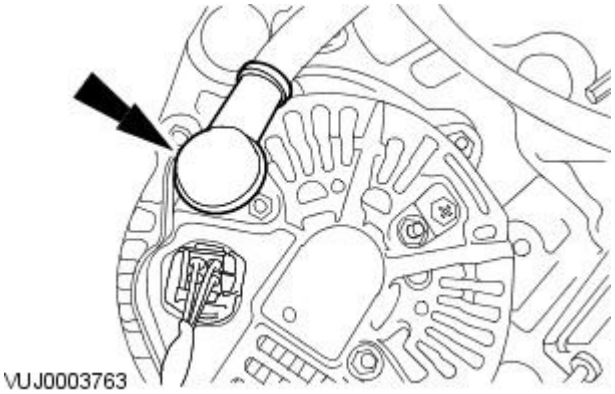
1. Using the special tool, rotate the belt tensioner counter-clockwise.
2. Detach the accessory drivebelt.


VUJ0003451

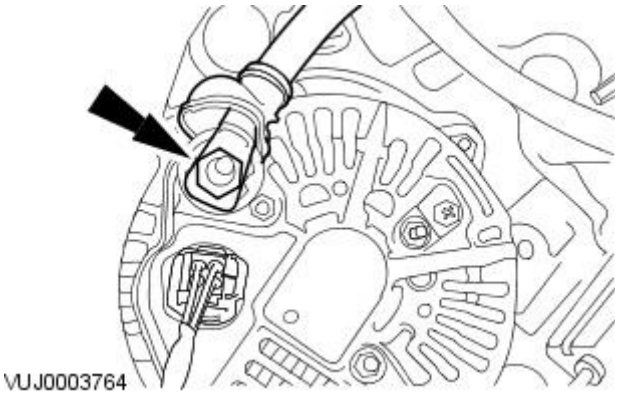
37. Remove the accessory drive belt tensioner.


VUJ0003450

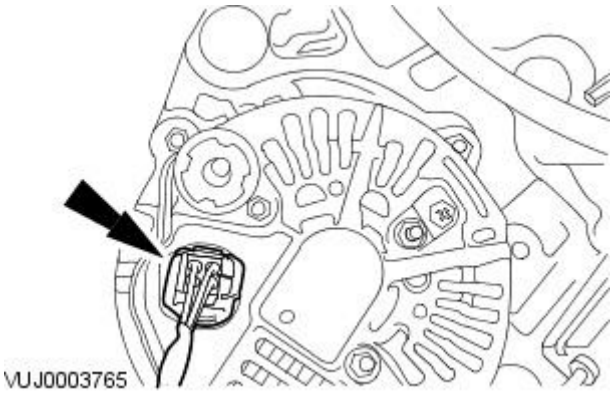
38. Remove the accessory drive belt.


VUJ0003763

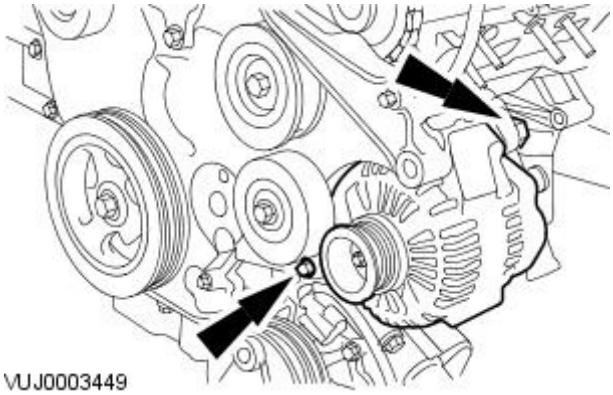
39. Detach the generator positive cable protective cover.



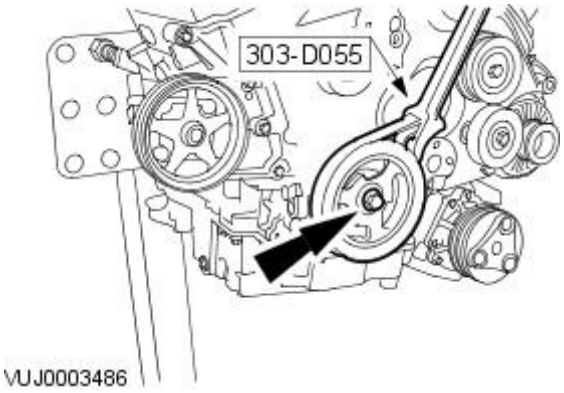
40. Disconnect the generator positive cable electrical connector.



41. Disconnect the generator electrical connector.

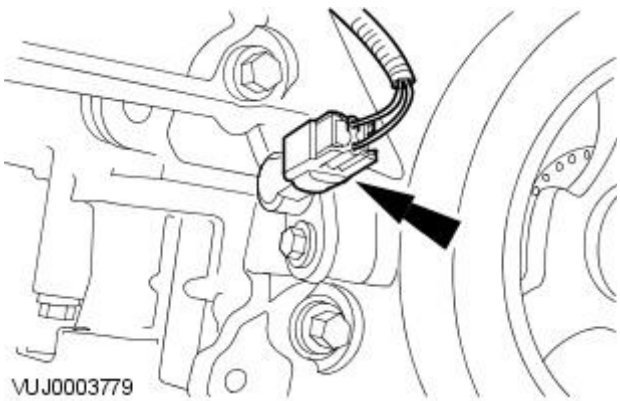


42. Remove the generator.



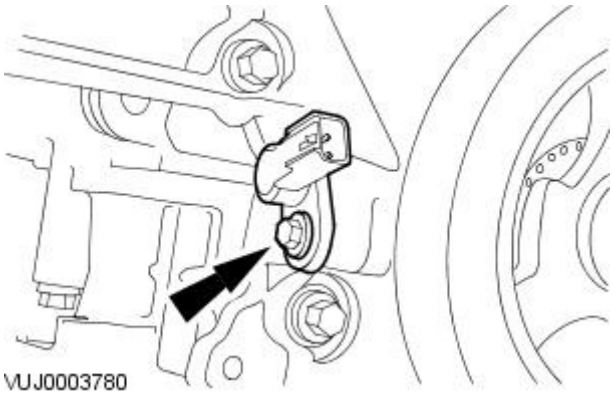
43. Using the special tool, remove the crankshaft vibration damper retaining bolt.

- Remove and discard the crankshaft vibration damper retaining bolt.

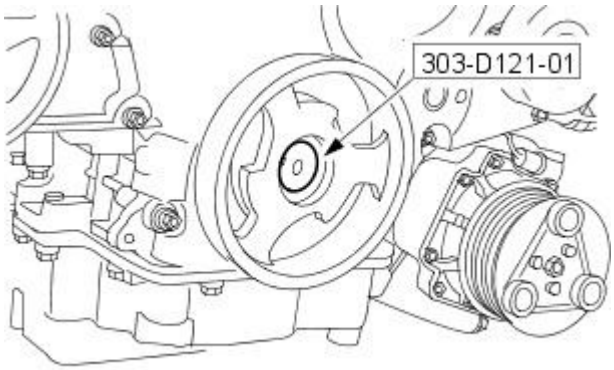


44. Disconnect the crankshaft position (CKP) sensor electrical connector.

45. Remove the CKP.

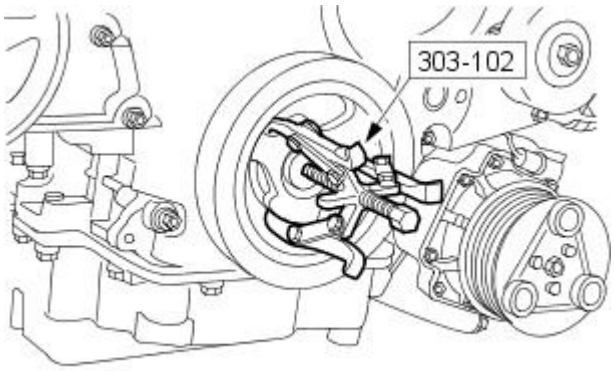

VUJ0003780

46. Install the special tool.



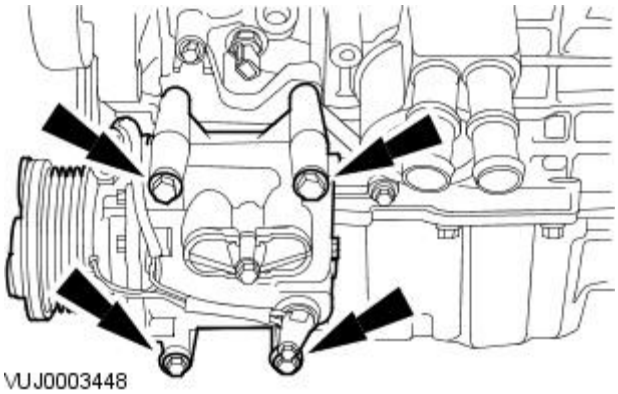
VUJ0003453

47. Using the special tools, remove the crankshaft vibration damper.

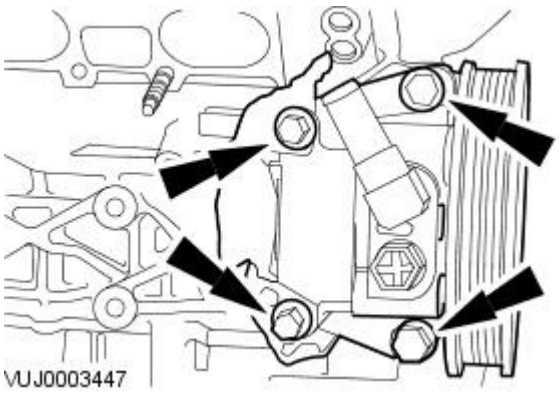


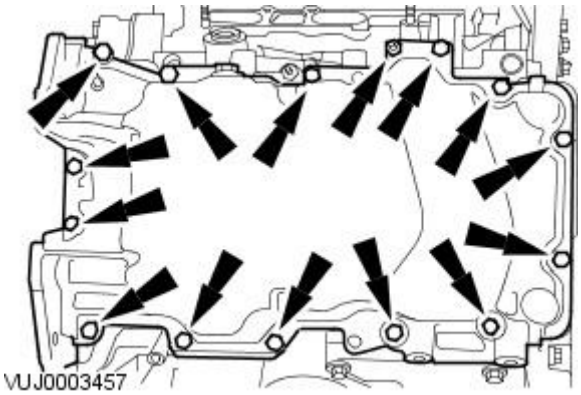
VUJ0003454

48. Remove the air conditioning compressor.


VUJ0003448

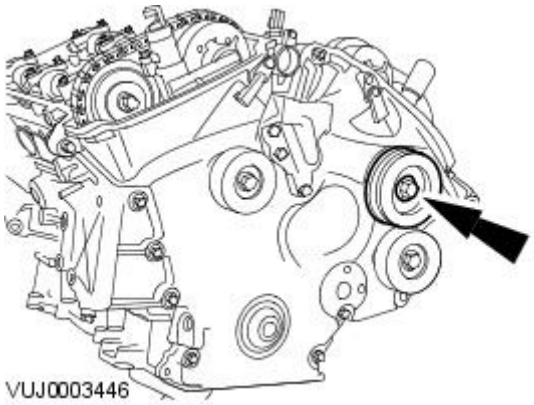
49. Remove the power steering pump.


VUJ0003447

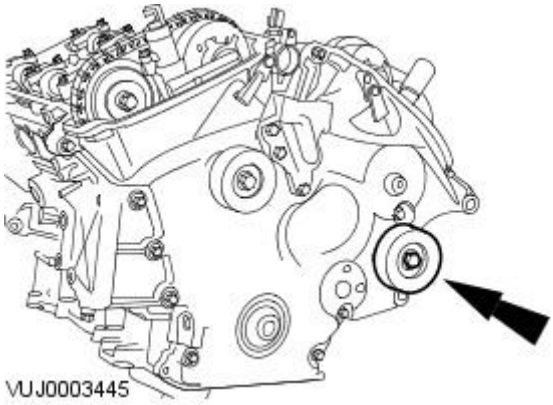


50. Remove the oil pan.

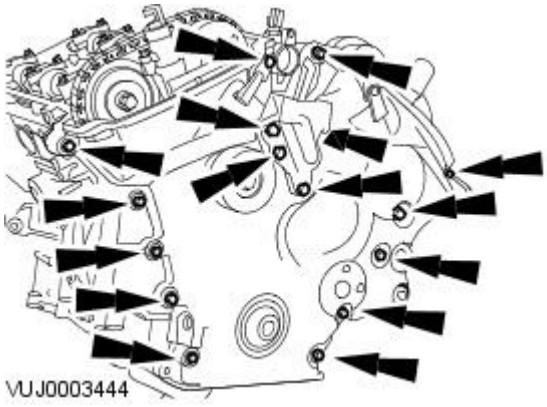
- Remove and discard the oil pan gasket.



51. Remove the idler pulley.



52. Remove the idler pulley.

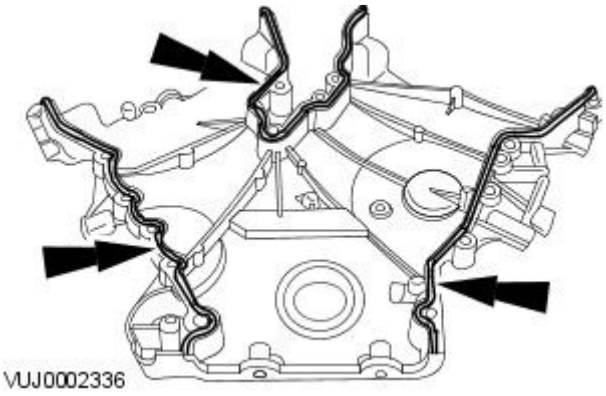


53. Remove the engine front cover.

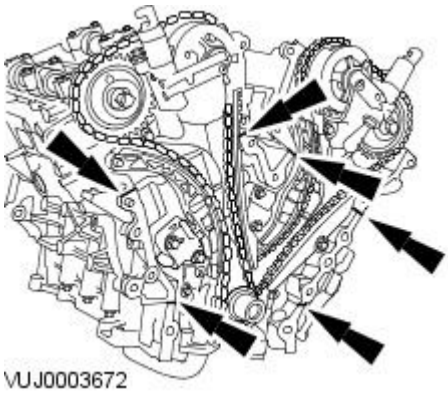
- Remove and discard the engine front cover gaskets.

Installation

All vehicles


VUJ0002336

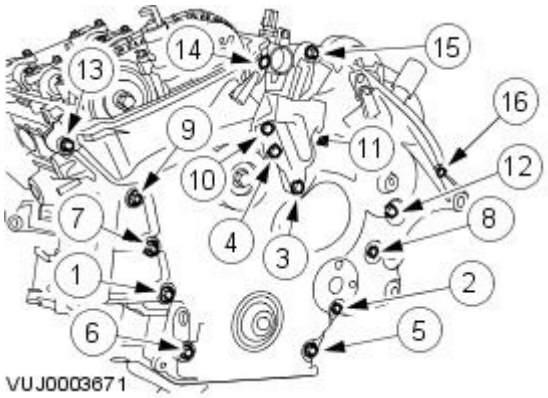
1. Install the new front timing cover gaskets.


VUJ0003672

2. NOTE: Prior to applying sealer clean the front timing cover to engine block and cylinder head sealing surfaces with metal surface cleaner.

• NOTE: Apply a 6 mm diameter dot of silicone sealant WSE-M4G323-A6 or equivalent meeting Jaguar specification to the indicated locations.

Apply silicone sealant to the indicated locations.

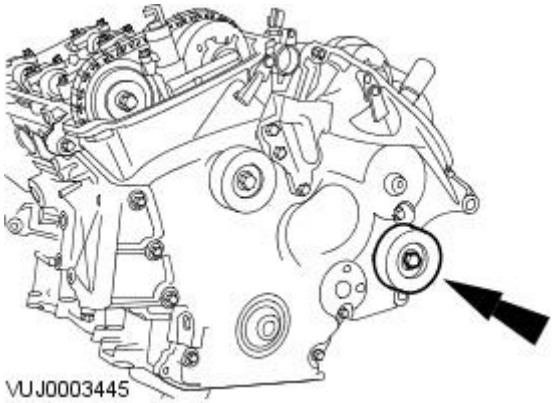


VUJ0003671

3. NOTE: The front timing 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 in number 14 is a retaining bolt with a stud head.

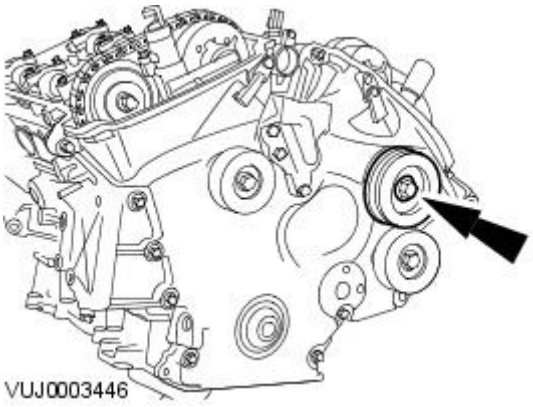
Complete the tightening sequence.

- Stage 1: Bolts 1 and 2, 25 Nm.
- Stage 2: Bolts 3 and 4, 30 Nm + 45°.
- Stage 3: Bolts 5 through 9, 25 Nm.
- Stage 4: Bolts 10 and 11, 30 Nm + 45°.
- Stage 5: Bolts 12 and 13, 25 Nm.
- Stage 6: Bolt 14, 25 Nm.
- Stage 7: Bolts 15 and 16, 25 Nm.


VUJ0003445

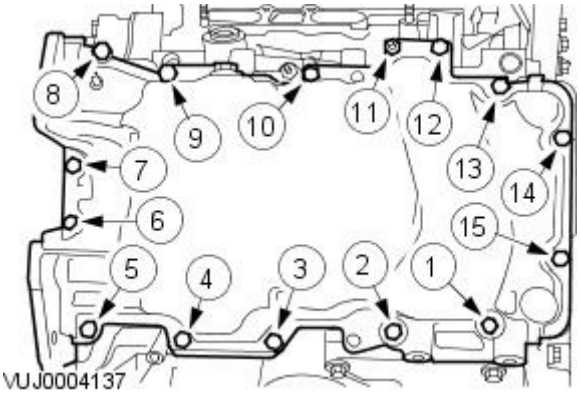
4. Install the idler pulley.

- Tighten to 47 Nm.


VUJ0003446

5. Install the idler pulley.

- Tighten to 25 Nm.



VUJ0004137

6. NOTE: Apply a 10 mm diameter dot of silicone sealant WSE-M4G323-A6 or equivalent meeting Jaguar specification to the engine front cover to the cylinder block mating joints.

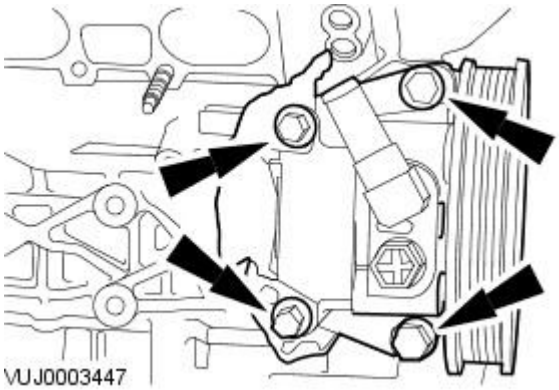
• NOTE: Loosely install the oil pan to transmission housing bolts.

• NOTE: The oil pan retaining bolts numbered 1 and 2 are longer than the retaining bolts numbered 3 through 15.

• NOTE: Tighten the oil pan bolts within six minutes of applying sealer.

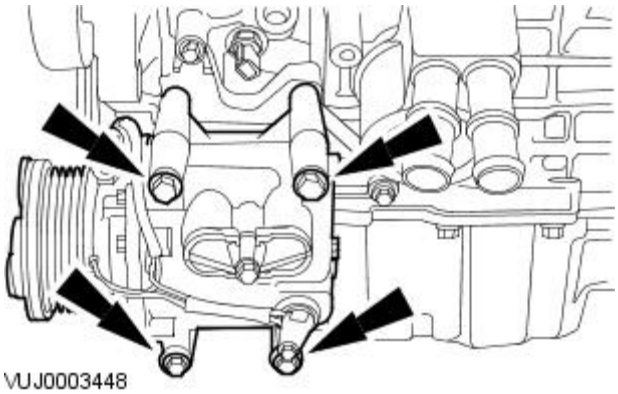
Install the oil pan.

- Install the new oil pan gasket.
- Complete the tightening sequence.
- Tighten to 25 Nm.


VUJ0003447

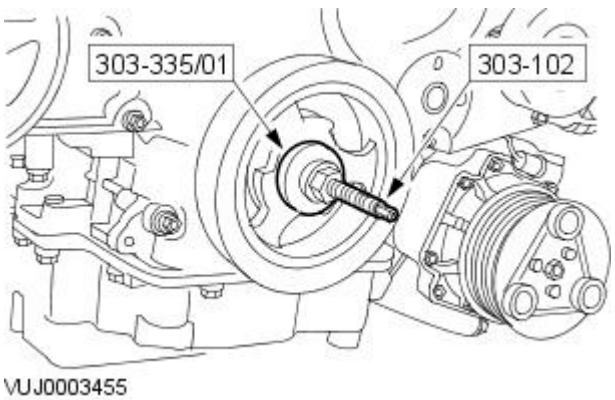
7. Install the power steering pump.

- Tighten to 25 Nm.


VUJ0003448

8. Install the air conditioning compressor.

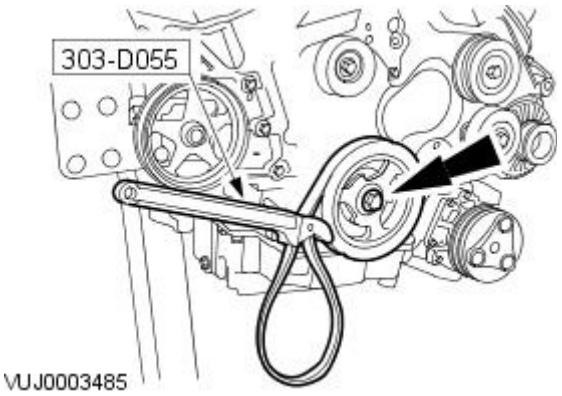
- Tighten to 25 Nm.



VUJ0003455

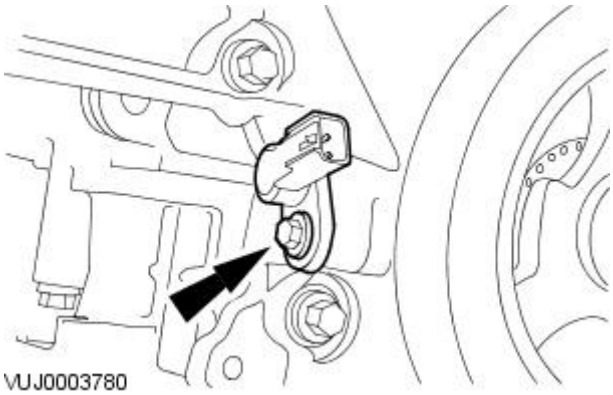
9. Using the special tool, install the crankshaft vibration damper.

- Coat the crankshaft damper keyway with silicone gasket sealant WSE-M4G323-A6 or equivalent meeting Jaguar specification.



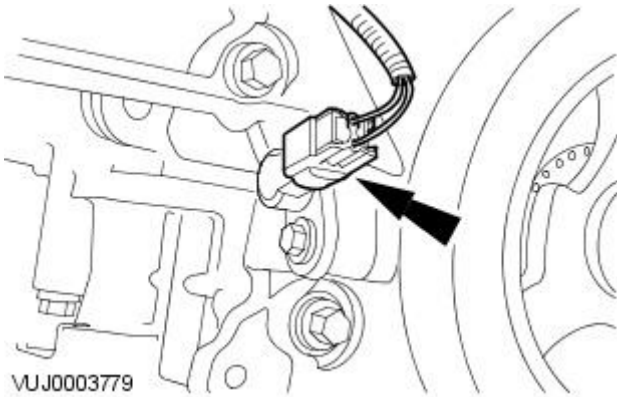
10. Using the special tool, tighten the crankshaft vibration damper retaining bolt.

- Install a new crankshaft vibration retaining bolt.
- Complete the tightening sequence.
- Stage 1: Torque to 120 Nm.
- Stage 2: Loosen the bolt (minimum 1 turn).
- Stage 3: Torque to 50 Nm.
- Stage 4: Angle Torque to 90°.

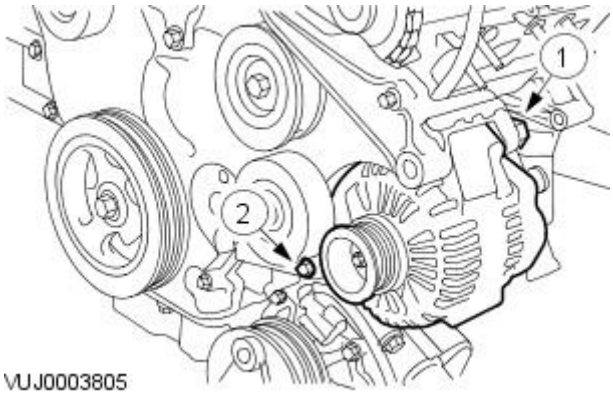


11. Install the CKP sensor.

- Tighten to 10 Nm.

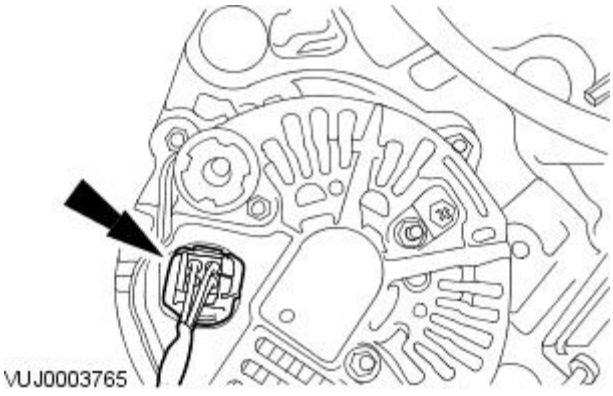


12. Connect the electrical connector.

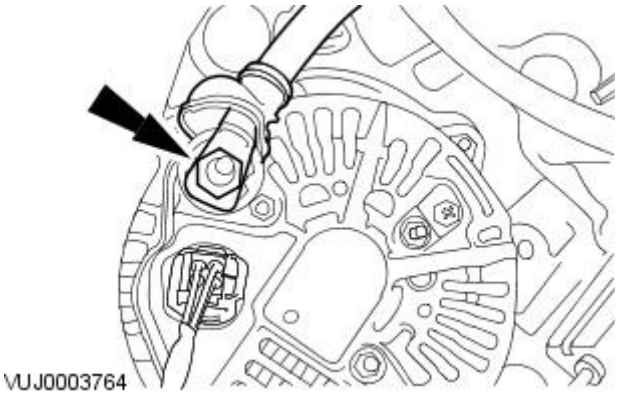


13. Install the generator retaining bolts.

- Tighten bolt 1 to 47 Nm.
- Tighten bolt 2 to 25 Nm.

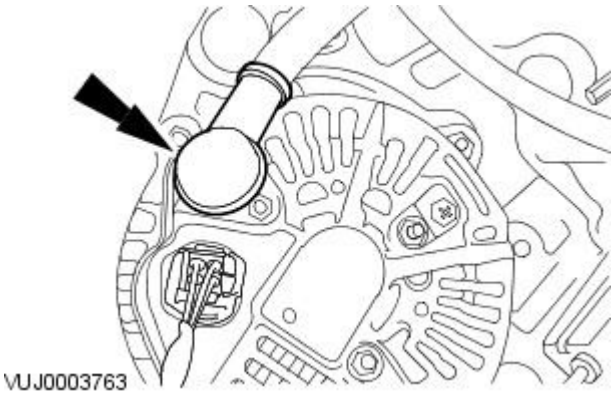


14. Connect the generator electrical connector.

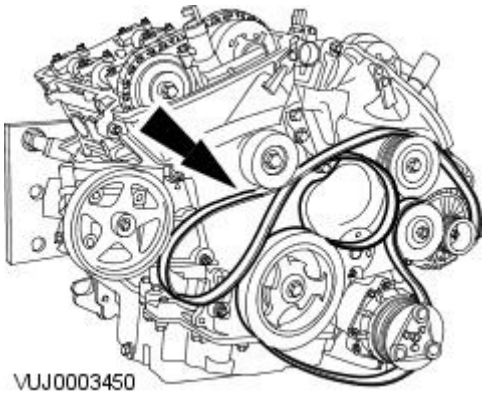

VUJ0003764

15. Connect the generator positive cable.

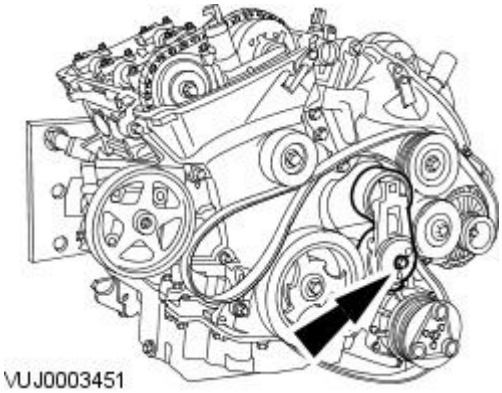
- Tighten to 12 Nm.


VUJ0003763

16. Attach the generator positive cable protective cover.

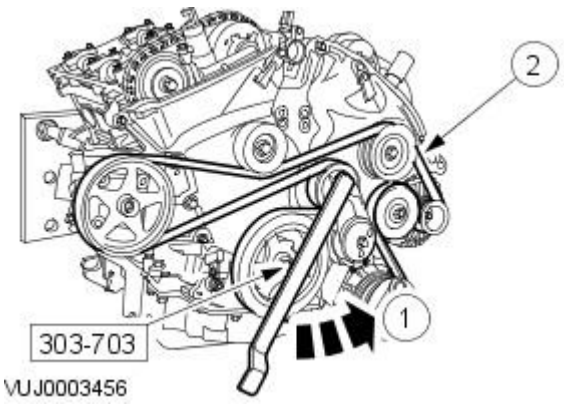

VUJ0003450

17. Attach the accessory drive belt.


VUJ0003451

18. Install the accessory drive belt tensioner.

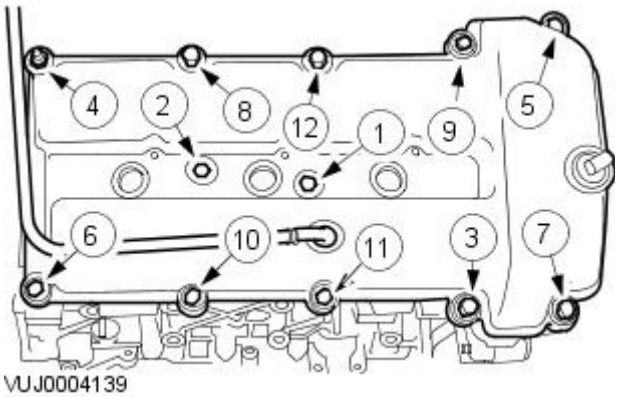
- Tighten to 47 Nm.



VUJ0003456

19. Attach the accessory drive belt.

1. Using the special tool, rotate the belt tensioner counter-clockwise.
2. Attach the accessory drivebelt.



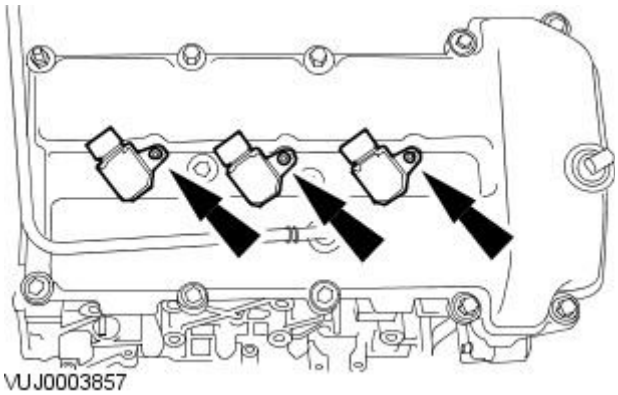
VUJ0004139

20. NOTE: Apply a 5 mm diameter bead of silicone gasket sealant WSE-M4G323-A6 or equivalent meeting Jaguar specification on the half round gaskets and apply an 8 mm diameter bead of silicone gasket sealant on the two places where the cylinder head and front timing cover join.

• NOTE: Make sure that the valve cover isolator mounts are correctly installed to the new valve cover gaskets.

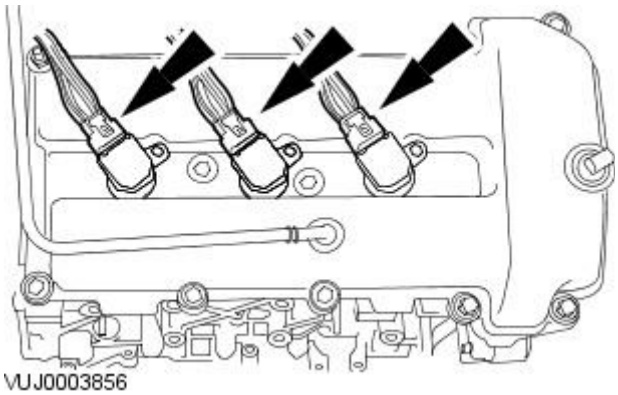
Install the new valve cover gaskets.

- Complete the tightening sequence.
- Tighten to 10 Nm.

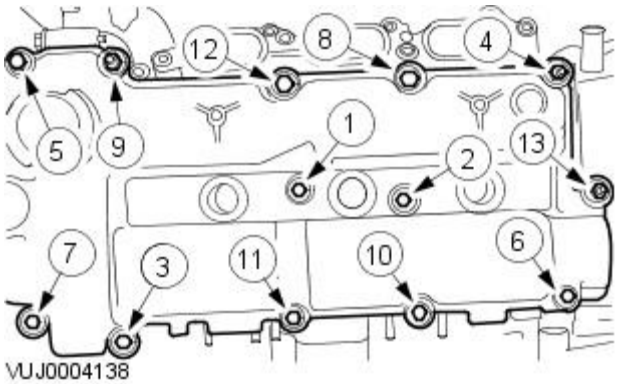

VUJ0003857

21. Install the right-hand ignition coils.

- Tighten to 6 Nm.


VUJ0003856

22. Connect the right-hand ignition coils electrical connectors.



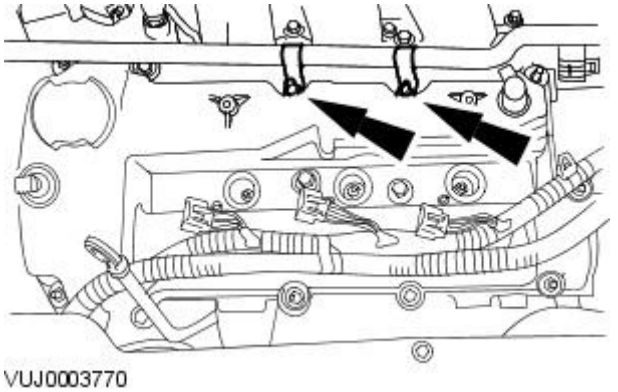
VUJ0004138

23. NOTE: Apply a 5 mm diameter bead of silicone gasket sealant WSE-M4G323-A6 or equivalent meeting Jaguar specification on the half round gaskets and apply an 8 mm diameter bead of silicone gasket sealant on the two places where the cylinder head and front timing cover join.

• NOTE: Make sure that the valve cover isolator mounts are correctly installed to the new valve cover gaskets.

Install the new valve cover gaskets.

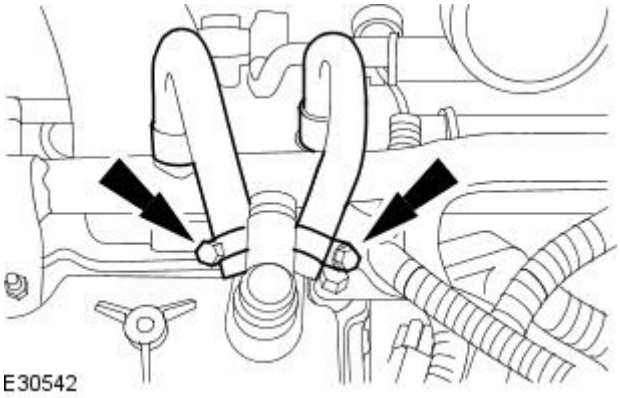
- Complete the tightening sequence.
- Tighten to 10 Nm.


VUJ0003770

24. Install the coolant hose.

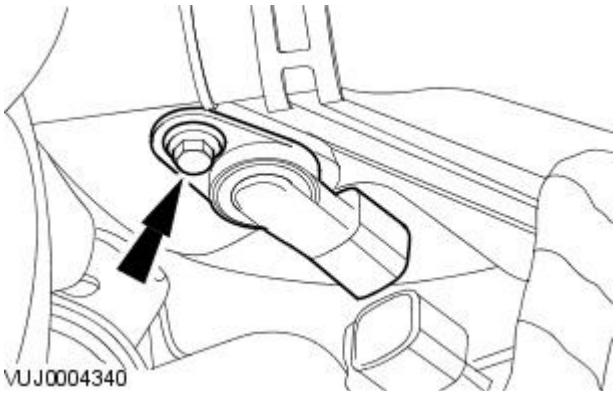
- Tighten to 6 Nm.

Vehicles with 2.0L engine



25. Install the heated positive crank case ventilation valve coolant hoses.

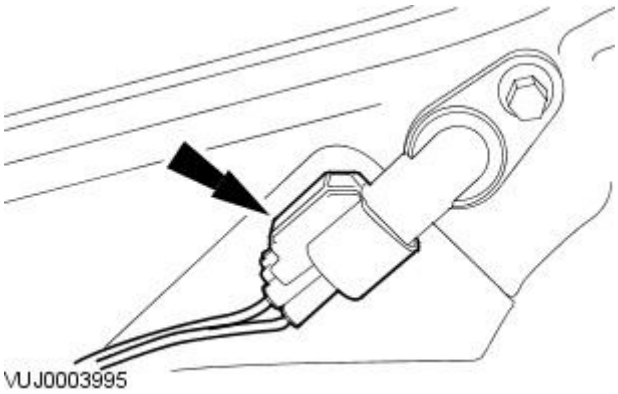
All vehicles



26. NOTE: Right-hand shown, left-hand similar.

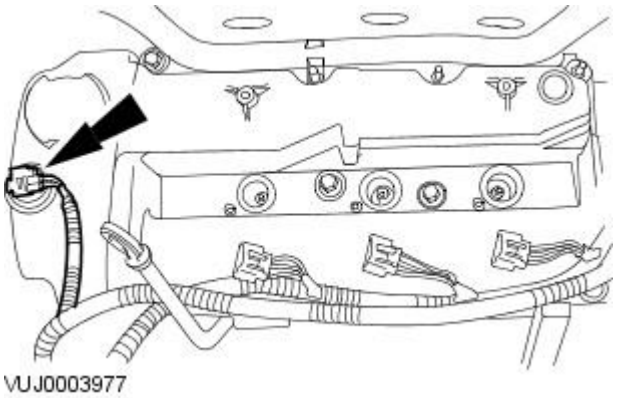
Install the (CMP) semsors.

- Tighten to 7 Nm.

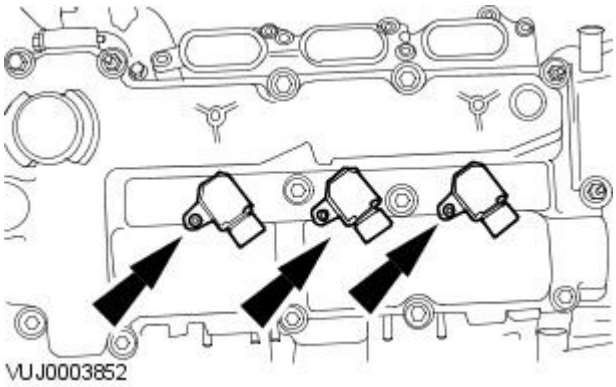


27. NOTE: Right-hand shown, left hand similar.

Connect the camshaft position sensor electrical connector.

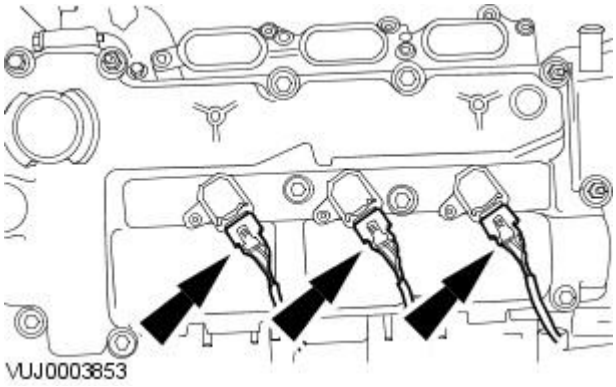


28. Connect the variable camshaft timing (VCT) solenoid electrical connector.

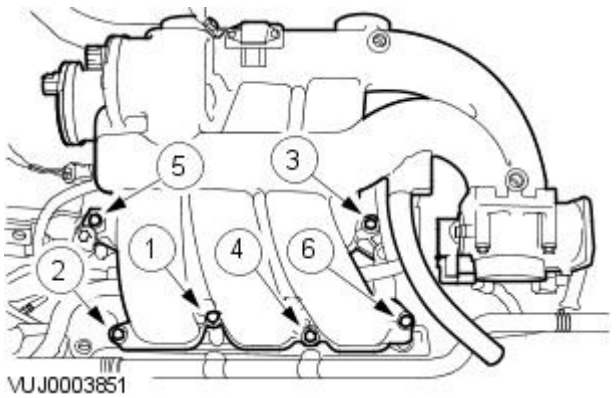

VUJ0003852

29. Install the left-hand ignition coils.

- Tighten to 6 Nm.


VUJ0003853

30. Connect the left-hand ignition coils electrical connectors.



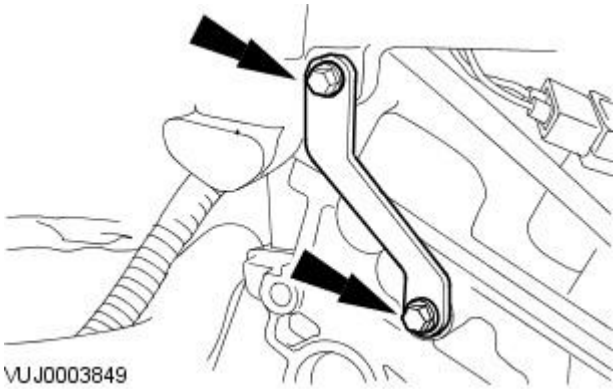
VUJ0003851

31. NOTE: 2.5L and 3.0L shown, 2.0L similar.

• NOTE: The intake manifold retaining bolts numbered 1, 2 and 3 are longer than the retaining bolts numbered 4, 5 and 6.

Install the new intake manifold gaskets.

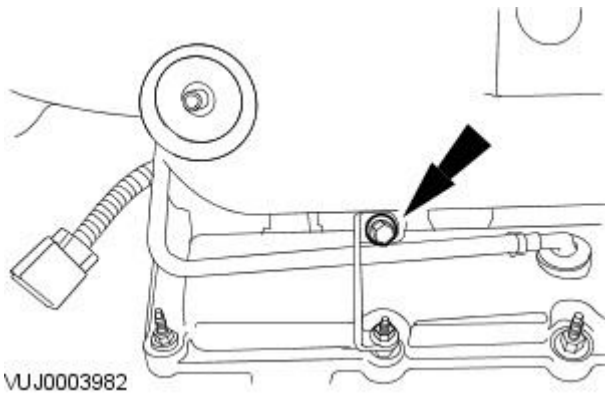
- Complete the tightening sequence.
- Tighten to 10 Nm.


VUJ0003849

32. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Install the intake manifold support bracket.

- Tighten to 10 Nm.


VUJ0003982

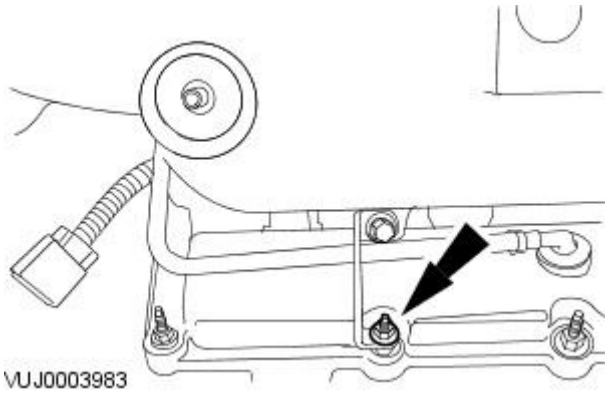
33. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Install the intake manifold support bracket.

- Tighten to 10 Nm.

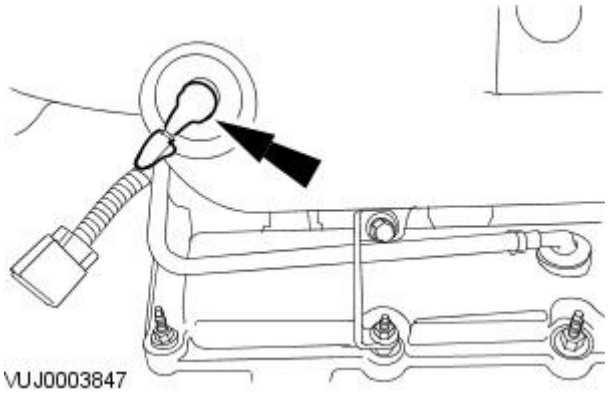
34. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Tighten to 6 Nm.



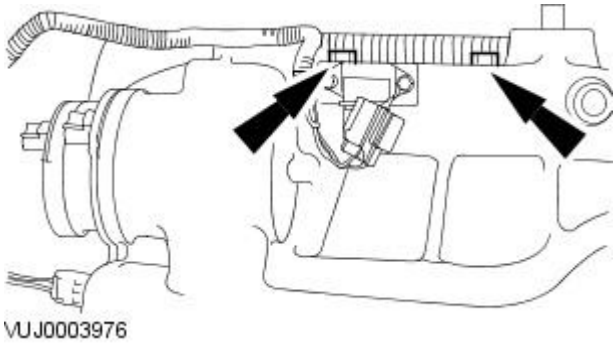
Vehicles with 2.5L or 3.0L engine

35. Connect the vacuum hose.

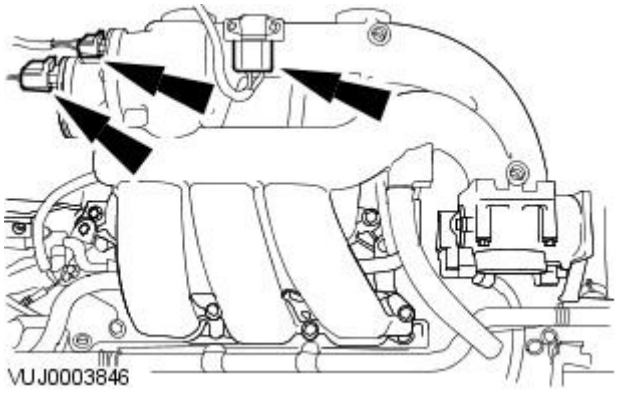


36. Attach the wiring harness.

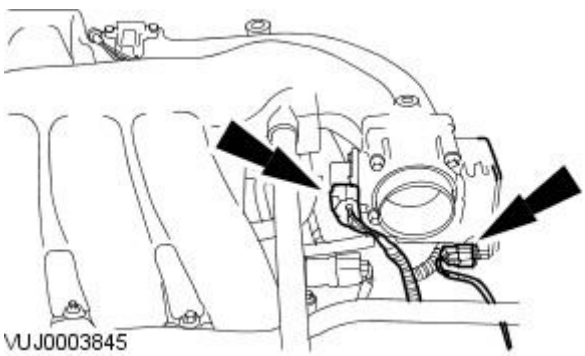
- Tighten to 10 Nm.



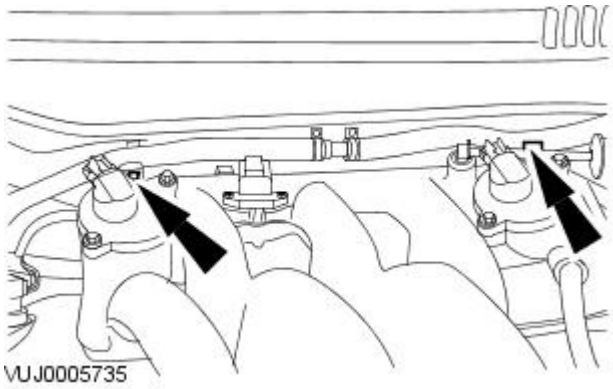
37. Connect the electrical connectors.



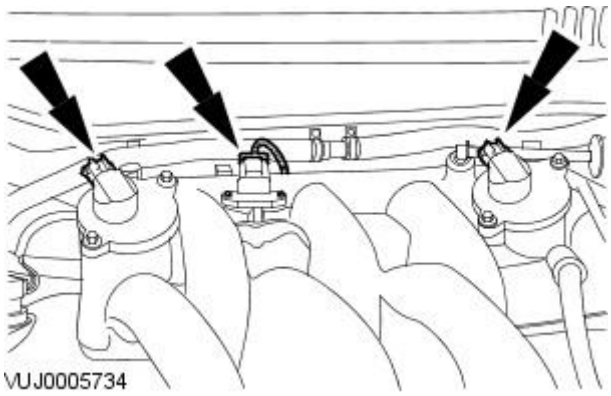
38. Connect the electrical connectors.



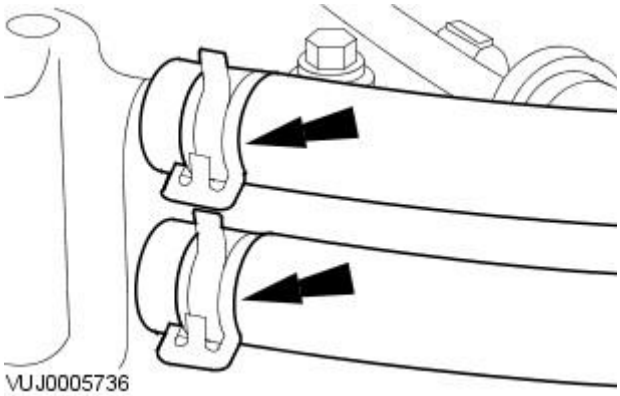
Vehicles with 2.0L engine



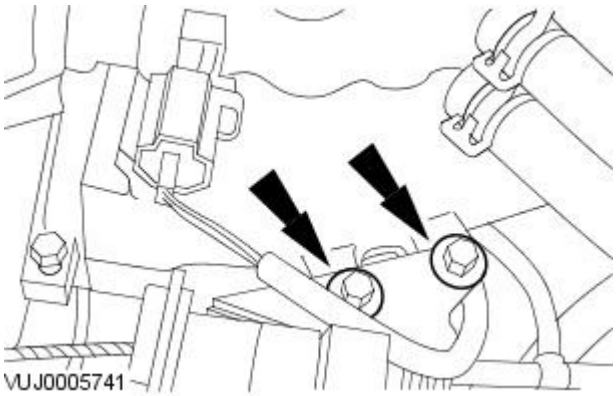
39. Attach the wiring harness.



40. Connect the electrical connectors.

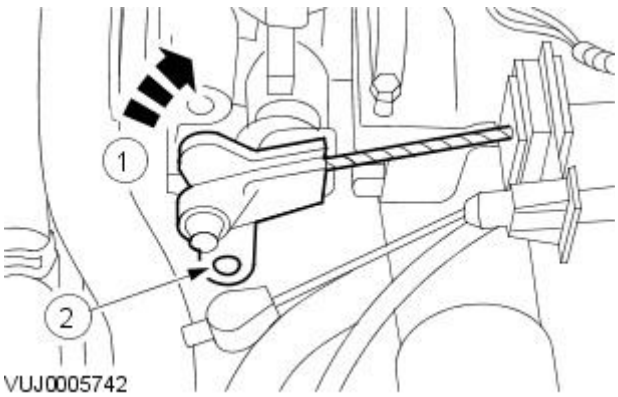


41. Install the coolant hoses.



42. Attach the throttle cable bracket.

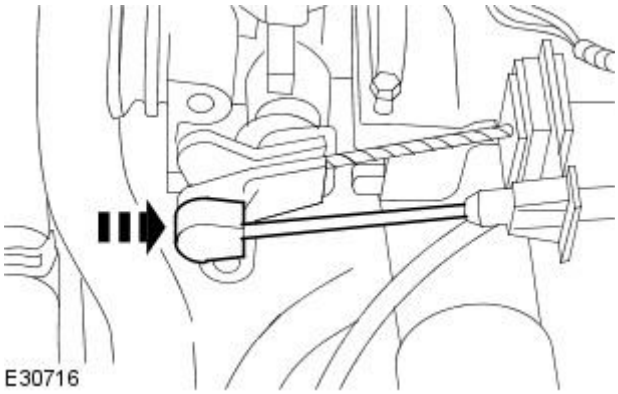
- Tighten to 9 Nm.



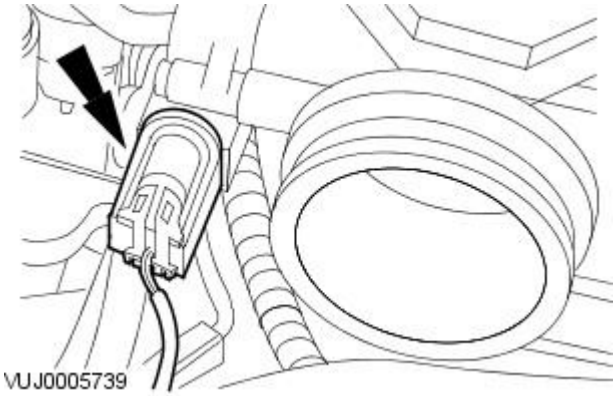
43. Attach the throttle cable.

1. Reposition the throttle lever to the fully open position.
2. Attach the throttle cable.

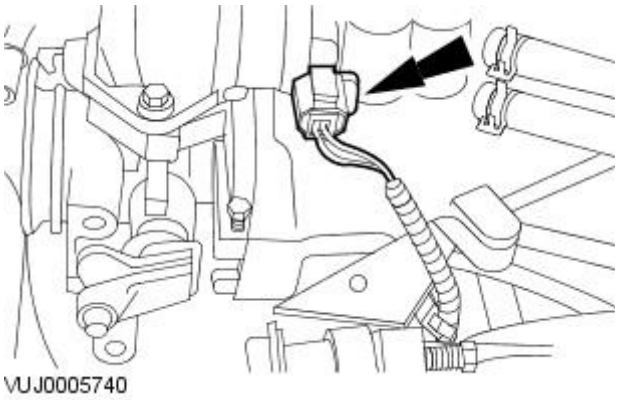
44. Attach the cruise control cable.



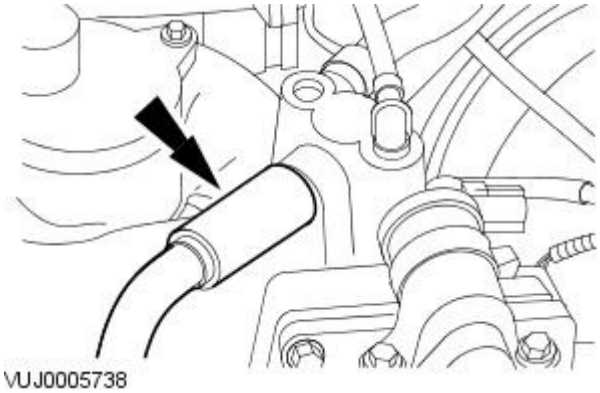
45. Connect the throttle position sensor electrical connector.



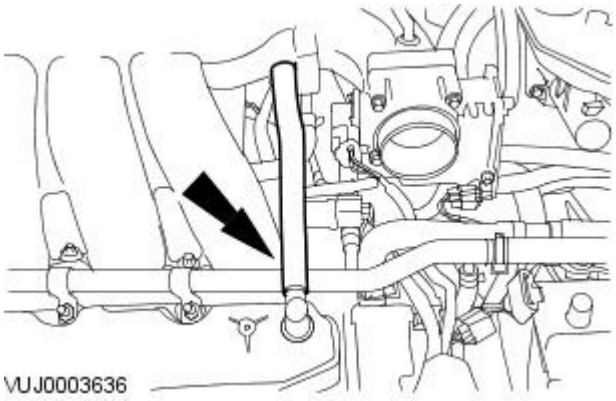
46. Connect the idle actuator control valve electrical connector.



47. Attach the positive crank case venilation hose.



Vehicles with 2.5L or 3.0L engine



48. Attach the positive crank case ventilation hose.

All vehicles

49. Install the automatic or manual transmission. For additional information, refer to Section 307-01A Automatic Transmission/TransaxleSection 307-01B Automatic Transmission/Transaxle or Section 308-03 Manual Transmission/Transaxle.

50. NOTE: Use oil WSE-M2C908-A or equivalent meeting Jaguar specification.

Refill the engine with oil.

Published: 11-May-2011

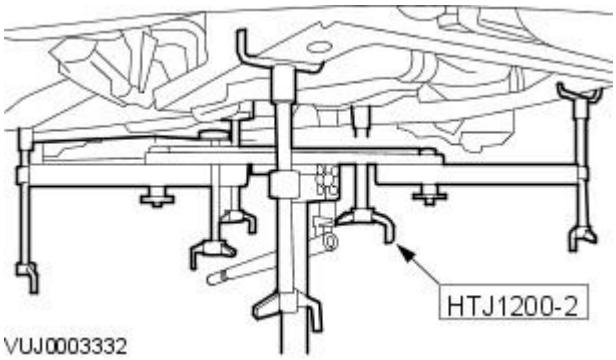
Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Engine Front Mount

In-vehicle Repair

Special Tool(s)	
	Powertrain Assembly Jack HTJ1200-02

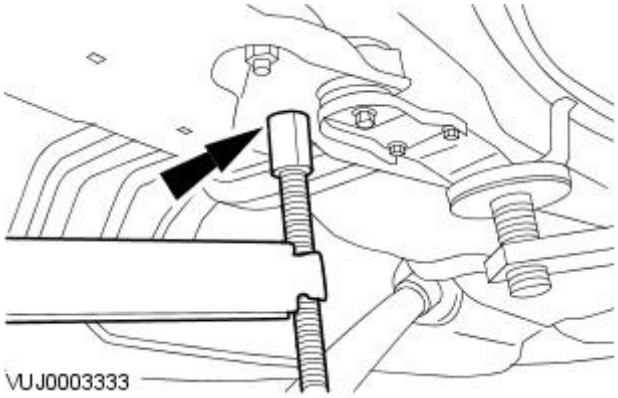
Removal

1. Drain the cooling system. For additional information, refer to . For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).
2. Install the special tool.



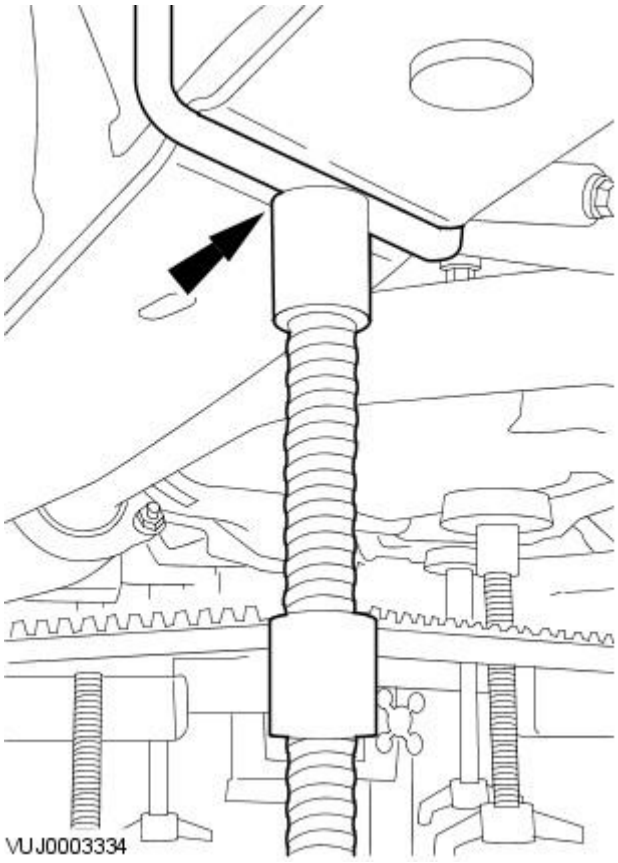
3. NOTE: Left-hand shown, right-hand similar.

   Position and adjust the special tool rear height adjuster.

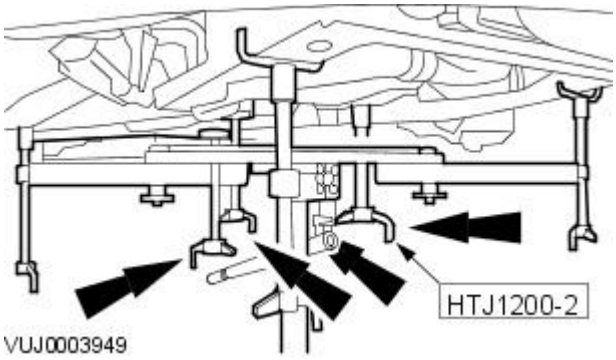


4. NOTE: Right-hand shown, left-hand similar.

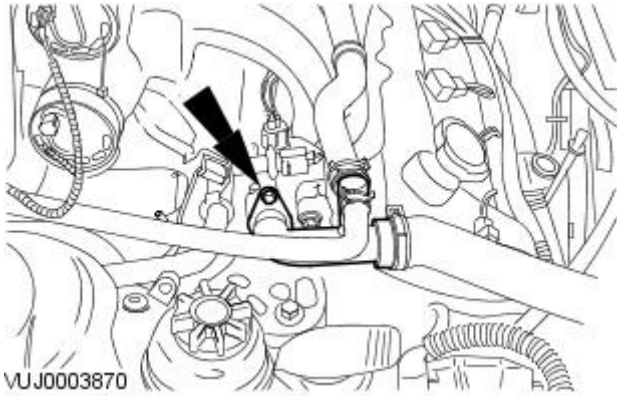
Position and adjust the special tool front height adjuster.



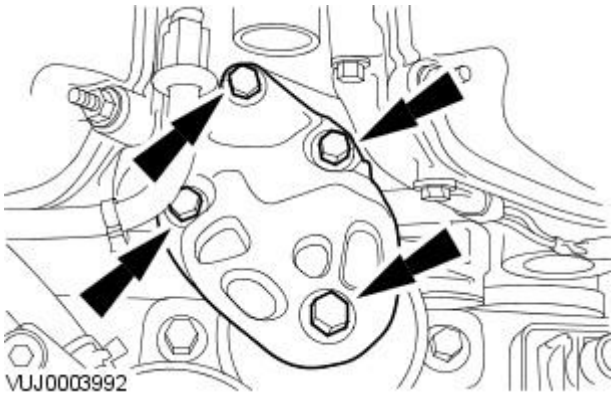
5. Position and adjust the special tool engine height adjusters.

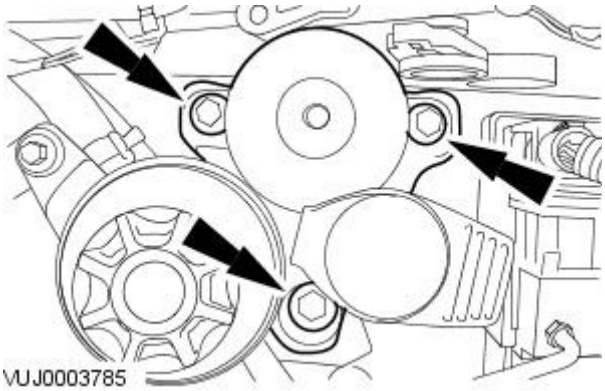


6. Detach the coolant pipe.

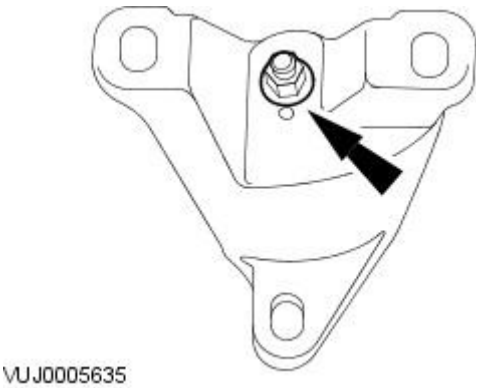


7. Remove the engine support bracket.



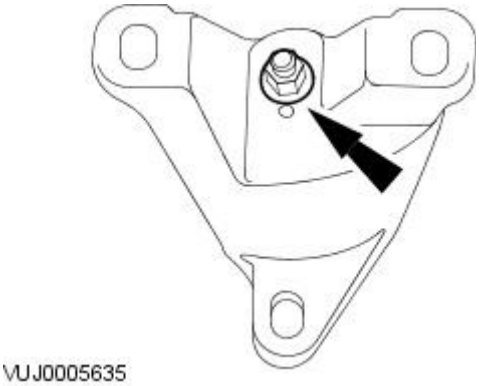

VUJ0003785

8. Remove the engine mount.


VUJ0005635

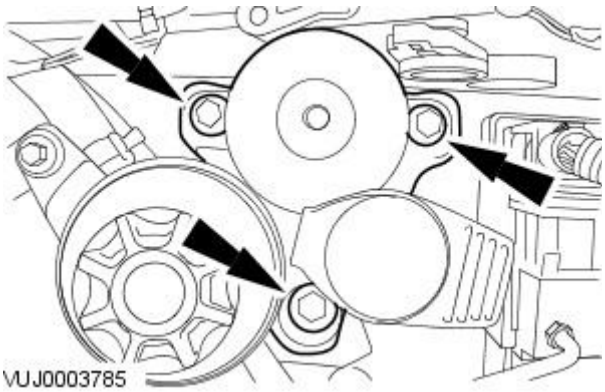
9. Remove the hydromount.

Installation

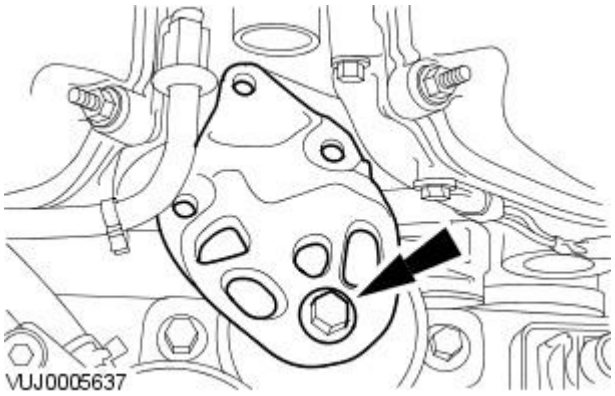

VUJ0005635

1. To install, reverse the removal procedure.

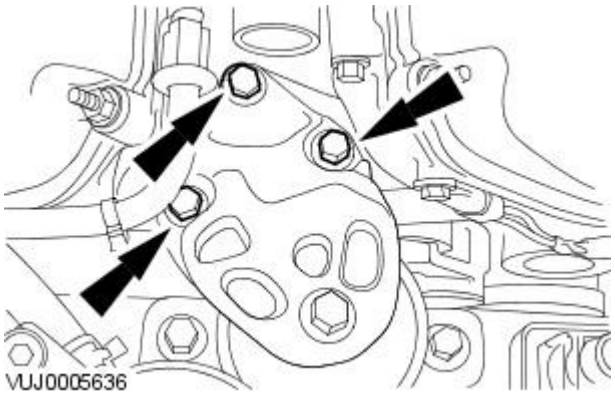
- Tighten to 83 Nm.


VUJ0003785

2. Tighten to 80 Nm.



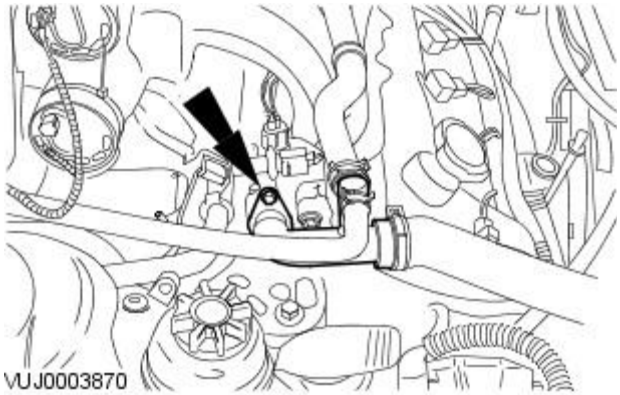
3. Tighten to 80 Nm.



4. Tighten fixings to 40 Nm or 48 Nm as outlined below.

• NOTE:

- If reusing existing fixings, on vehicles built prior to VIN J24252, tighten to 48 Nm.
- If new fixings are used on any vehicle tighten to 40 Nm.



5. Tighten to 9 Nm.

6. Fill and bleed the cooling system.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).

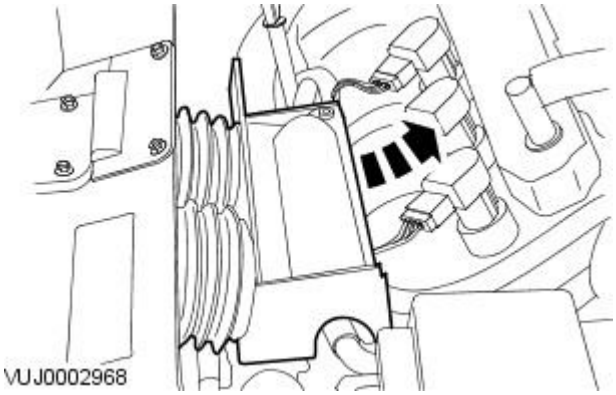
Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Exhaust Manifold LH

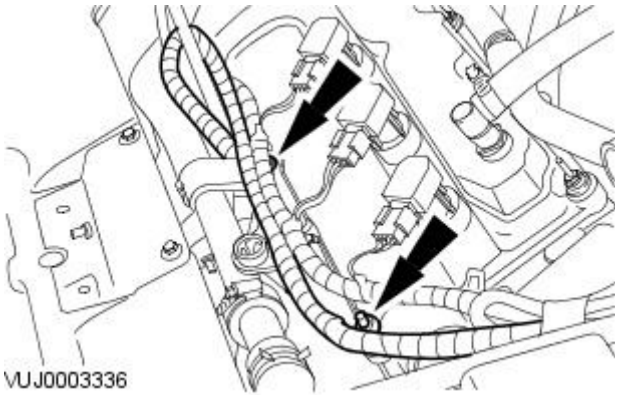
In-vehicle Repair

Removal

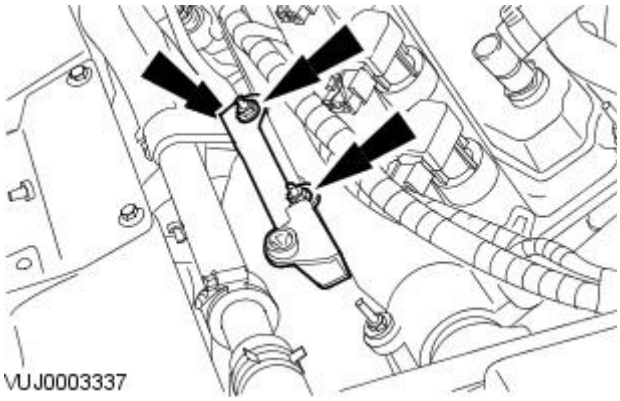
1. Drain the cooling system. For additional information, refer to Section 303-03A Engine CoolingSection 303-03B Engine Cooling.
2. Remove the cooling fan motor and shroud. For additional information, refer to Section 303-03A Engine CoolingSection 303-03B Engine Cooling.
3. Lower the vehicle.
4. Remove the air filter intake pipe.



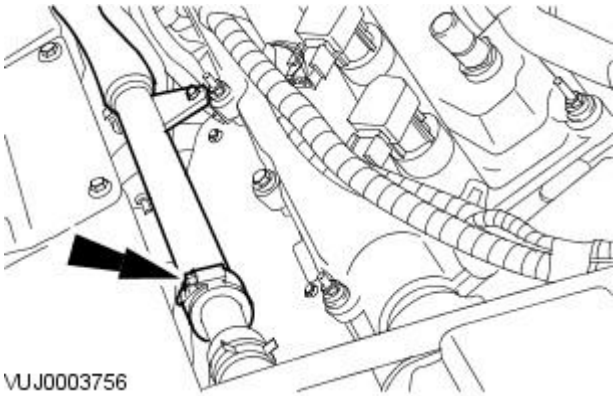
5. Detach the generator wiring harness.



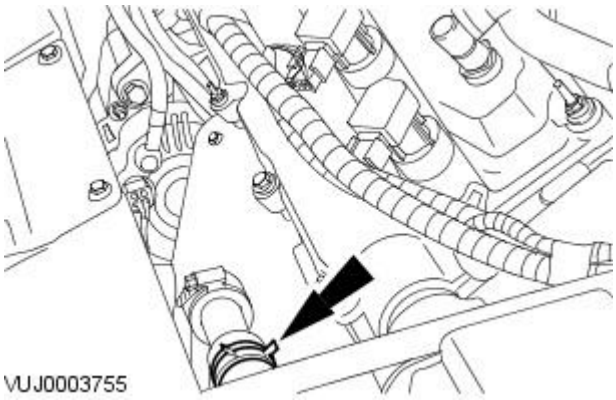
6. Remove the air filter retaining bracket.



7. Detach the coolant pipe.

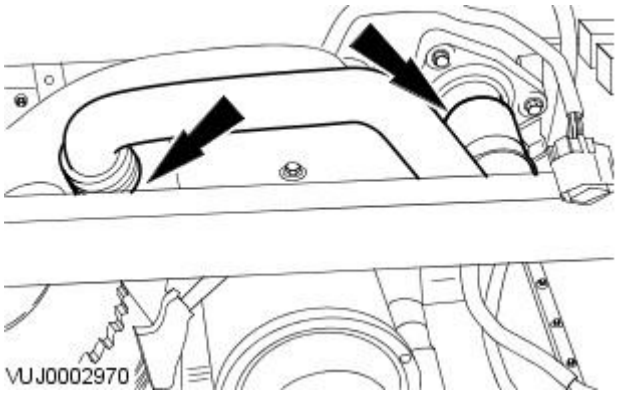


8. Detach the coolant hose.

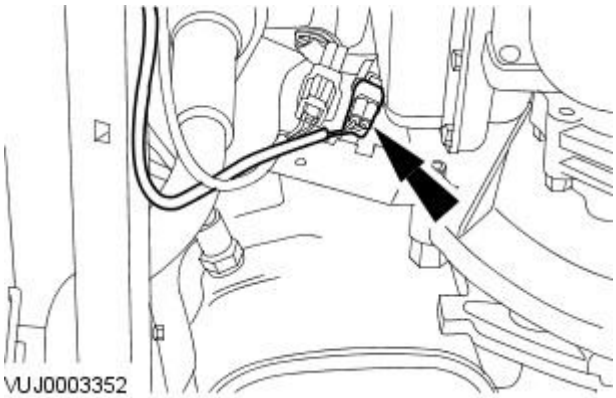


9. Raise the vehicle.

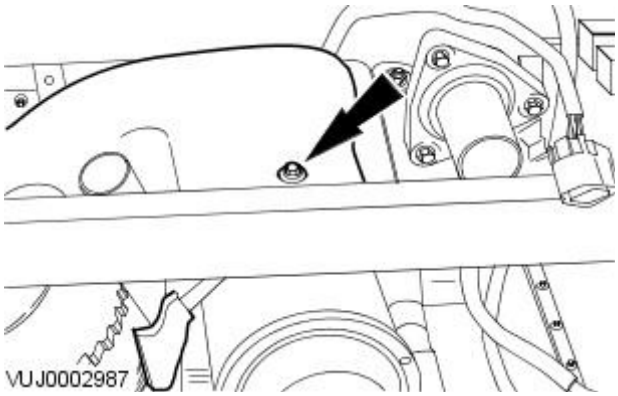
10. Remove the coolant hose.



11. Disconnect the heated oxygen sensor (HO2S) electrical connector.

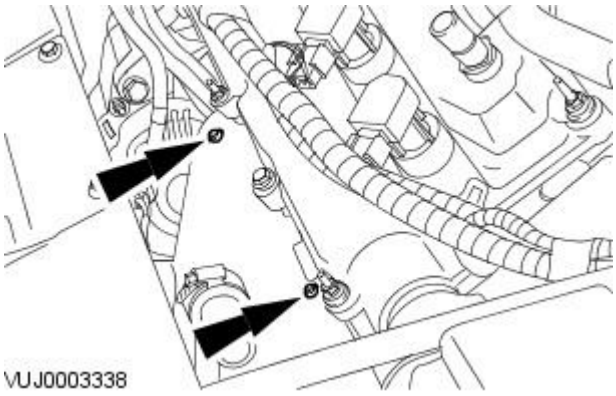


12. Remove the exhaust manifold heat shield retaining bolt.



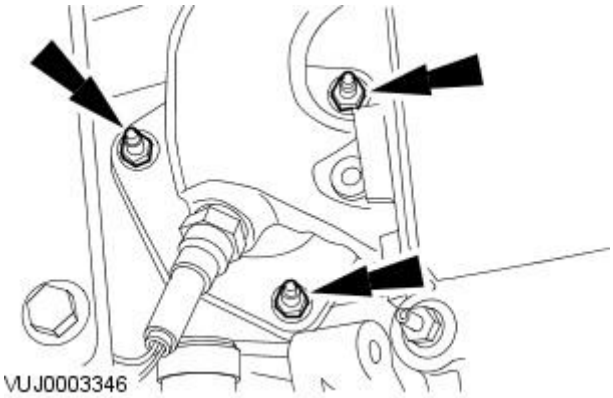
13. Lower the vehicle.

14. Remove the exhaust manifold heat shield.

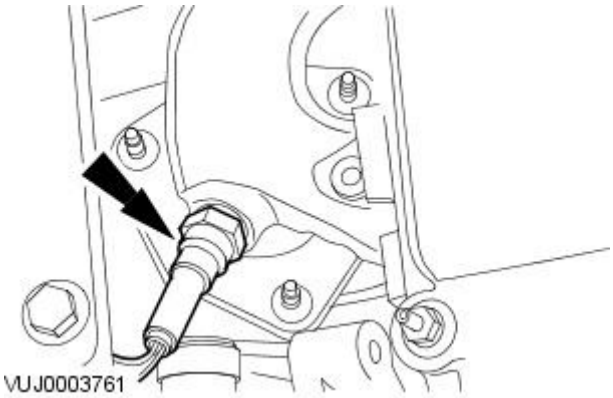


15. Detach the catalytic converter.

- Discard the retaining nuts.
- Remove and discard the retaining studs.

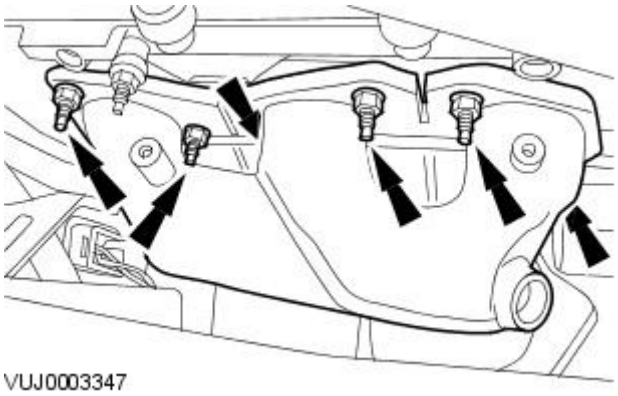


16. Using a suitable tool remove the HO2S.

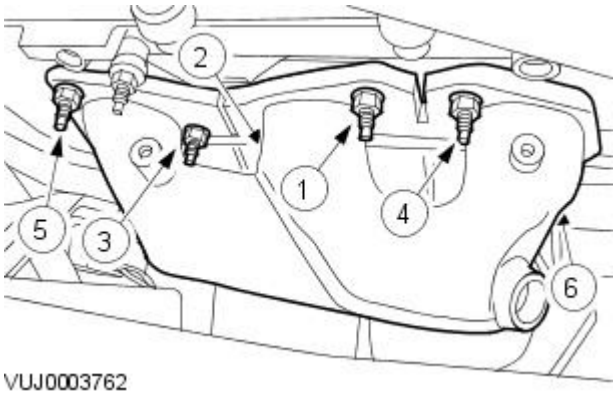


17. Remove the exhaust manifold.

- Remove and discard the exhaust manifold gasket.



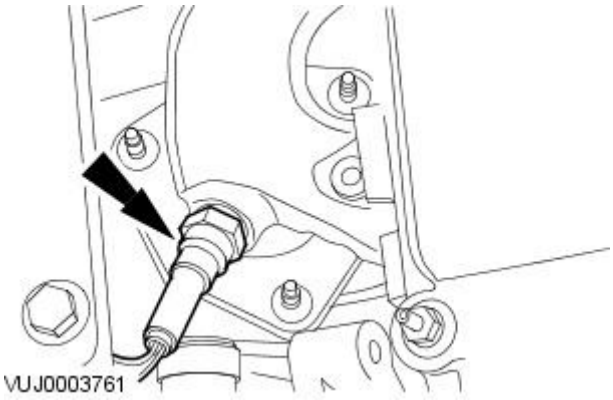
Installation



VUJ0003762

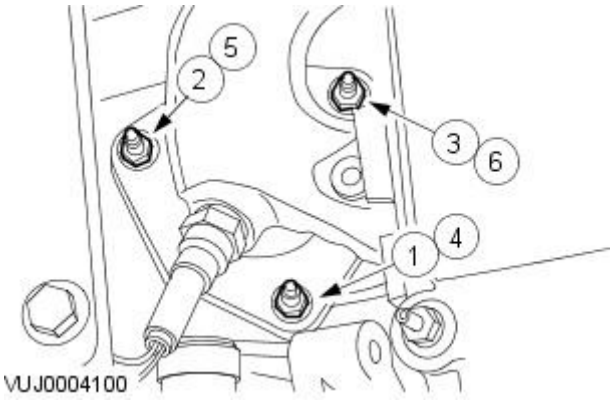
1. Install the exhaust manifold.

- Install the new exhaust manifold gasket.
- Complete the tightening sequence.
- Tighten to 20 Nm.


VUJ0003761

2. Install the H02S.

- Tighten to 40 Nm.

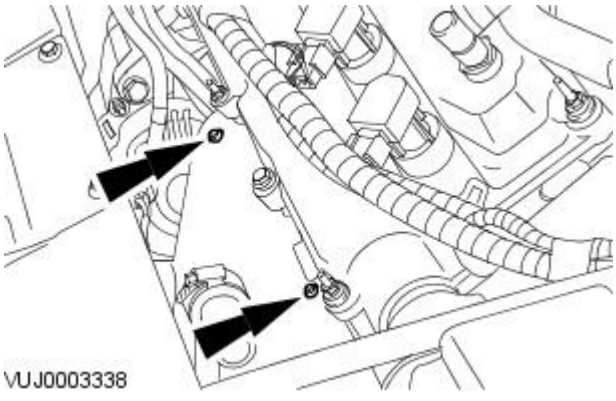


VUJ0004100

3. NOTE: Make sure that the retaining nuts are tightened twice in the sequence shown.

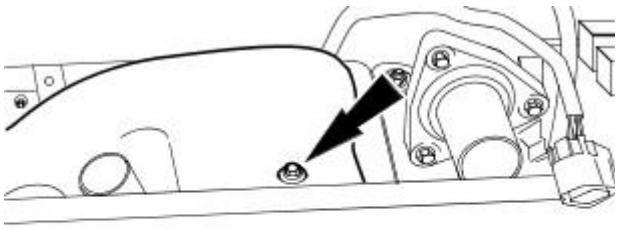
Attach the catalytic converter.

- Install new retaining nuts and studs.
- Tighten to 9 Nm.
- Tighten in the sequence shown to 25 Nm.


VUJ0003338

4. Install the exhaust manifold heat shield.

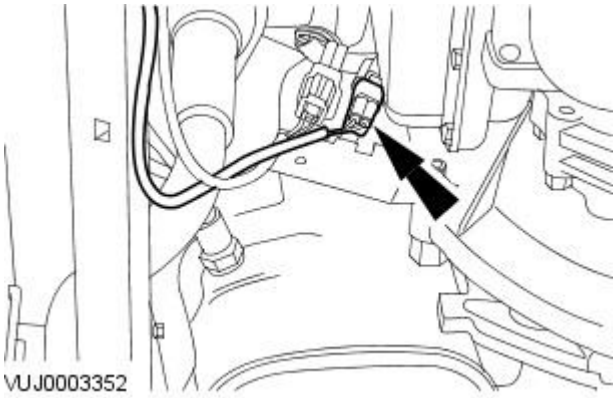
- Tighten to 11 Nm.



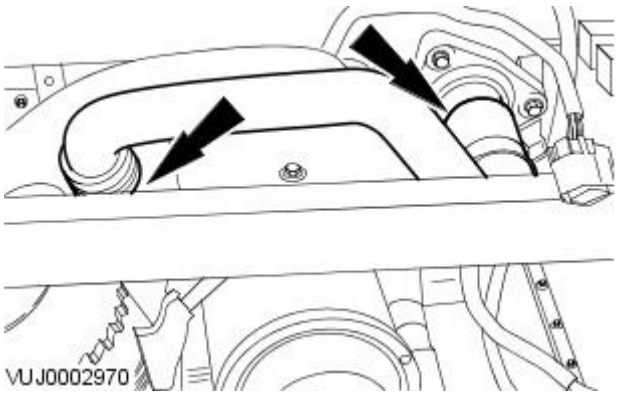

VUJ0002987

5. Raise the vehicle.

6. Tighten to 11 Nm.



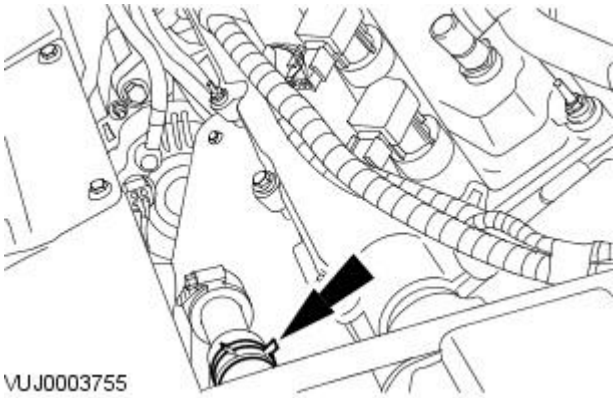
7. Connect the heated oxygen sensor (HO2S) electrical connector.

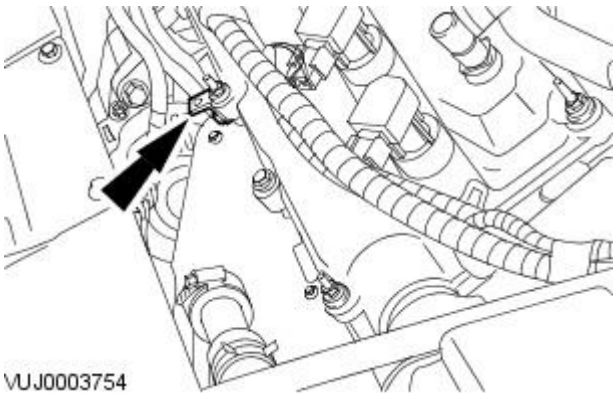


8. Install the coolant hose.

9. Lower the vehicle.

10. Attach the coolant hose.

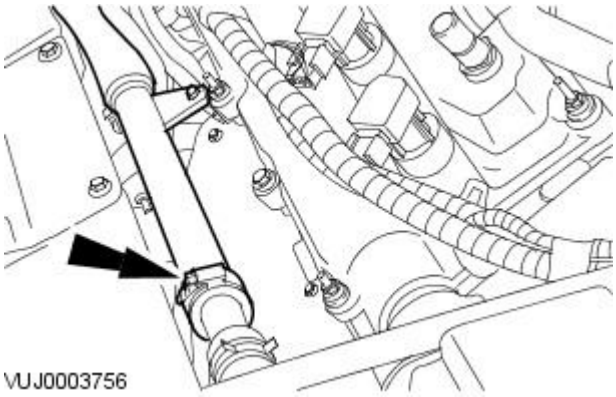




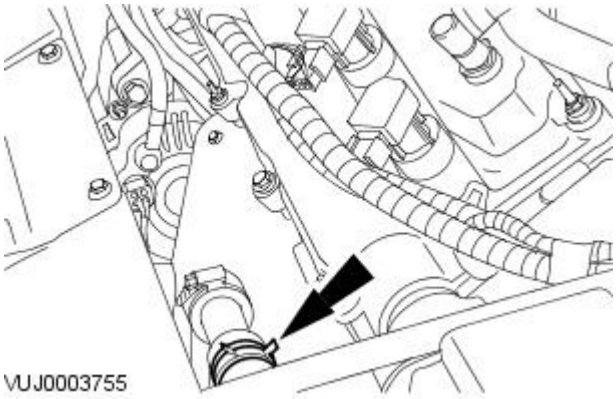
11. Install the coolant pipe retaining bracket.

- Tighten to 10 Nm.

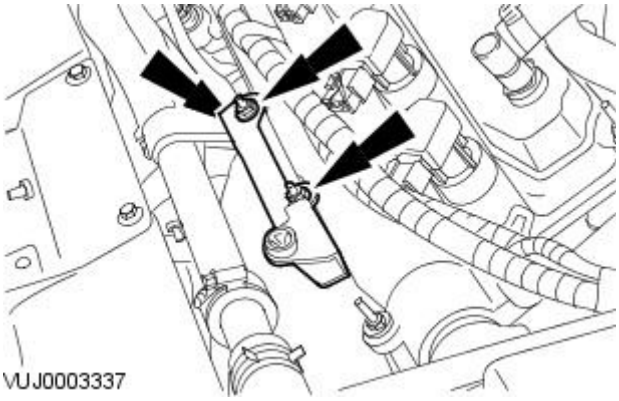
12. Attach the coolant pipe.



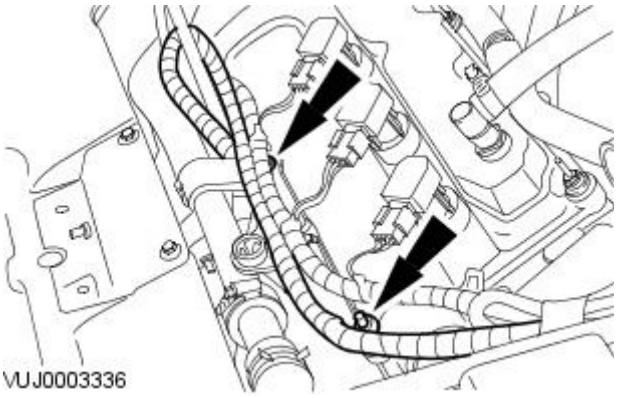
13. Attach the coolant hose.



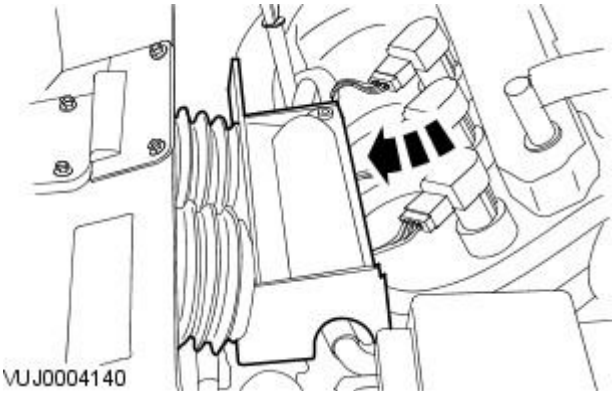
14. Install the air filter retaining bracket.



15. Attach the generator wiring harness.



16. Install the air filter intake pipe.



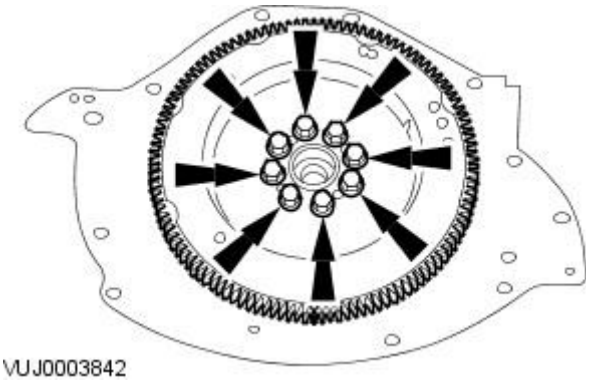
17. Install the cooling fan motor and shroud. For additional information, refer to Section 303-03A Engine CoolingSection 303-03B Engine Cooling.
18. Fill and bleed the cooling system. For additional information, refer to Section 303-03A Engine CoolingSection 303-03B Engine Cooling.

Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Flexplate

In-vehicle Repair

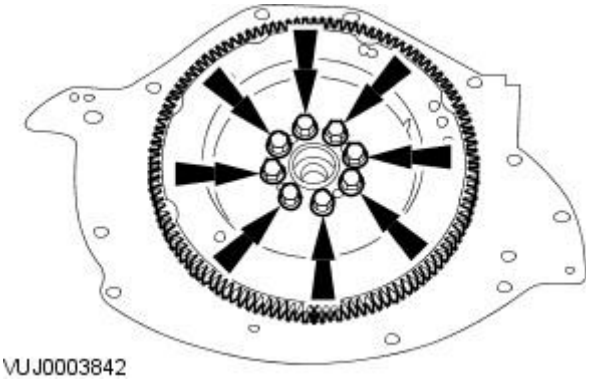
Removal


VUJ0003842

1. Remove the automatic transmission. For additional information, refer toSection 307-01A Automatic Transmission/TransaxleSection 307-01B Automatic Transmission/Transaxle.
2. NOTE: Prevent the flexplate from rotating.

   Remove the flexplate.

Installation


VUJ0003842

1. NOTE: Make sure the crankshaft and flexplate mating faces are clean before installation.

   • NOTE: The flexplate will only locate in one position.

   • NOTE: Tighten the retaining bolts working diagonally.

   Install the flexplate.

   - Prevent the flexplate from rotating.
   - Tighten to 80 Nm.

2. Install the automatic transmission. For additional information, refer toSection 307-01A Automatic Transmission/TransaxleSection 307-01B Automatic Transmission/Transaxle.

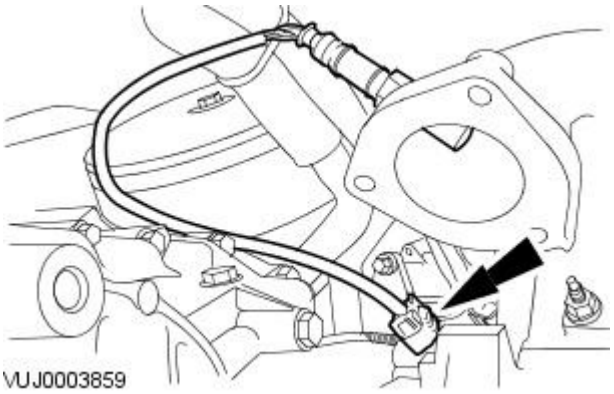
Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Exhaust Manifold RH

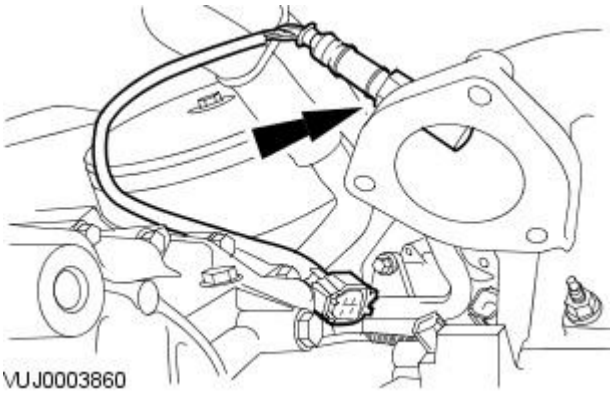
In-vehicle Repair

Removal

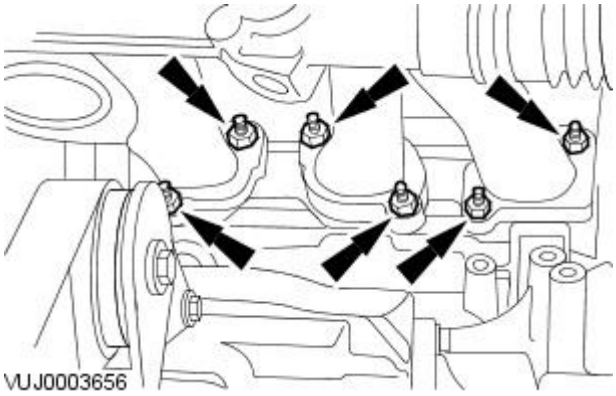
1. Remove the three way catalytic converter (TWC). For additional information, refer to Section 309-00 Exhaust System.
2. Disconnect the heated oxygen sensor (HO2S) electrical connector.



3. Using a suitable tool remove the HO2S.

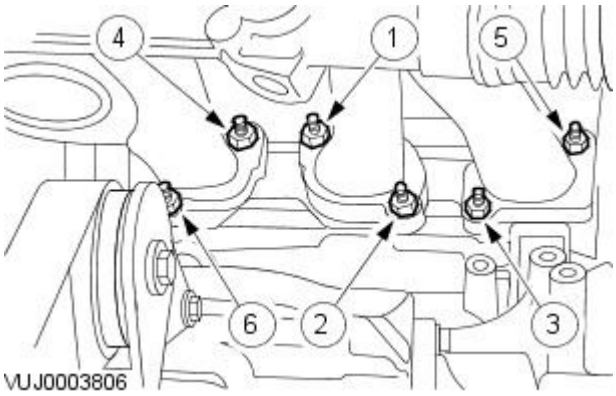


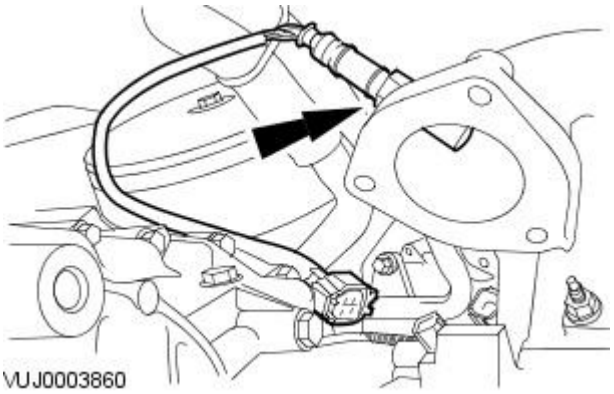
4. Remove the exhaust manifold.
   - Remove and discard the exhaust manifold gasket.



Installation

1. Install the exhaust manifold.
   - Install the new exhaust manifold gasket.
   - Complete the tightening sequence.
   - Tighten to 20 Nm.





2. Tighten to 40 Nm.

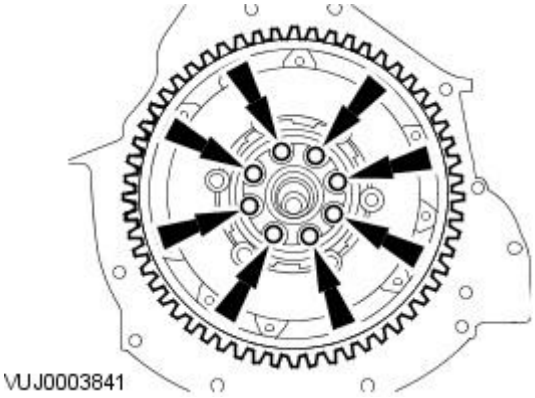
3. Install the three way catalytic converter (TWC). For additional information, refer to Section 309-00 Exhaust System.

Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Flywheel

In-vehicle Repair

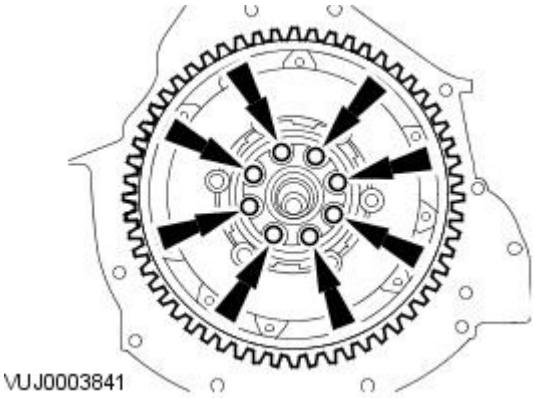
Removal



1. Remove the clutch disc and pressure plate. For additional information, refer to Section 308-01 Clutch.
2. NOTE: Prevent the flywheel from rotating.

   Remove the flywheel.

Installation



1. NOTE: Make sure the crankshaft and flywheel mating faces are clean before installation.

   • NOTE: The flywheel will only locate in one position.

   • NOTE: Tighten the retaining bolts working diagonally.

   Install the flywheel.

   - Prevent the flywheel from rotating.
   - Tighten to 80 Nm.

2. Install the clutch disc and pressure plate. For additional information, refer to Section 308-01 Clutch.

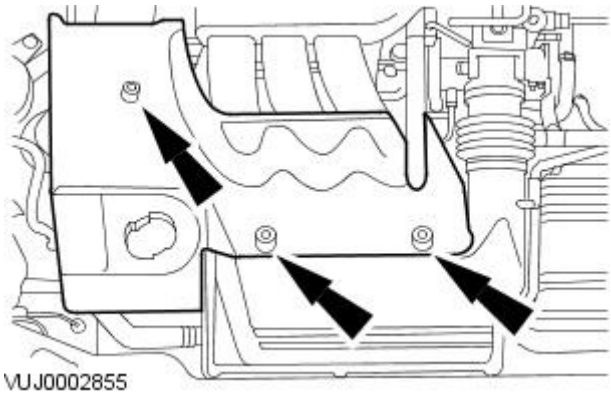
Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Intake Manifold

In-vehicle Repair

Removal

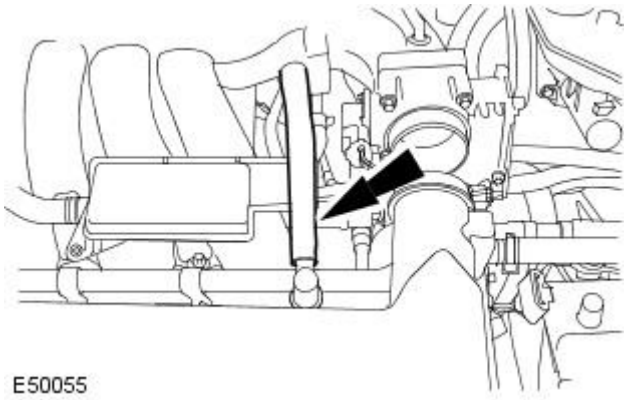
All vehicles



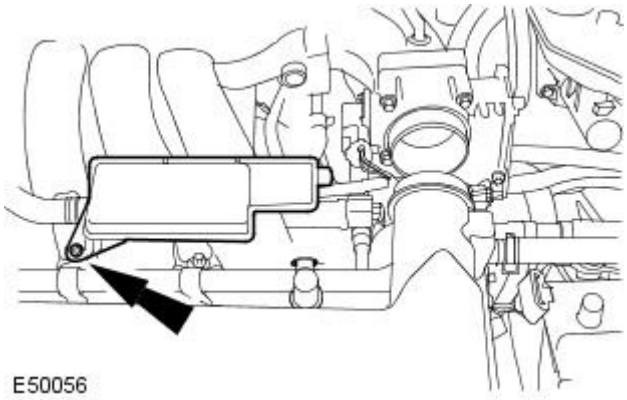
1. Remove the engine cover (if equipped).

2. Remove the air filter outlet pipe.
   For additional information, refer to: Air Cleaner Outlet Pipe (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

Vehicles with 2.5L or 3.0L engine

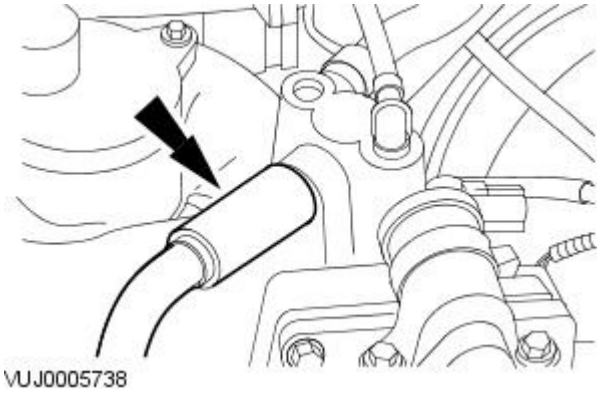


3. Remove the positive crankcase ventilation hose.

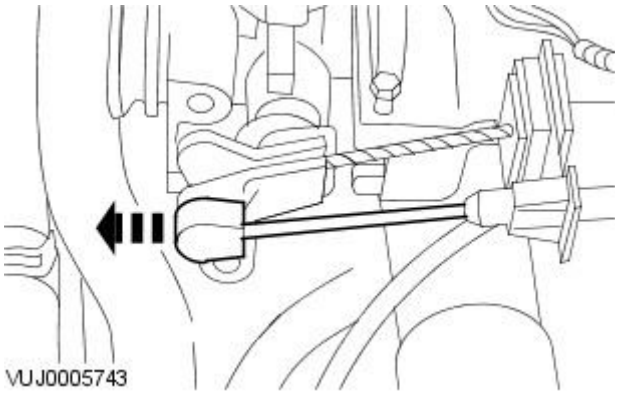


4. Remove the air cleaner resonator.

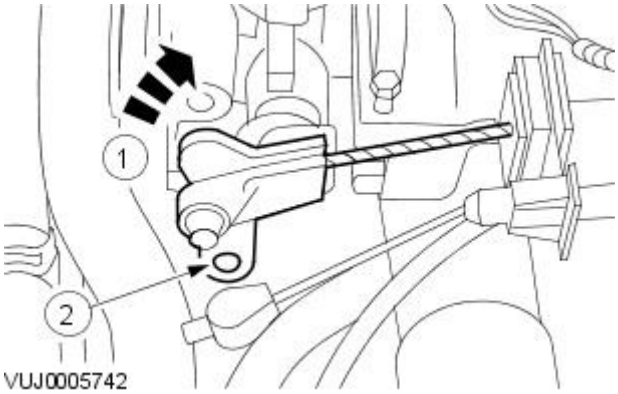
Vehicles with 2.0L engine



5. Detach the positive crank case ventilation hose.

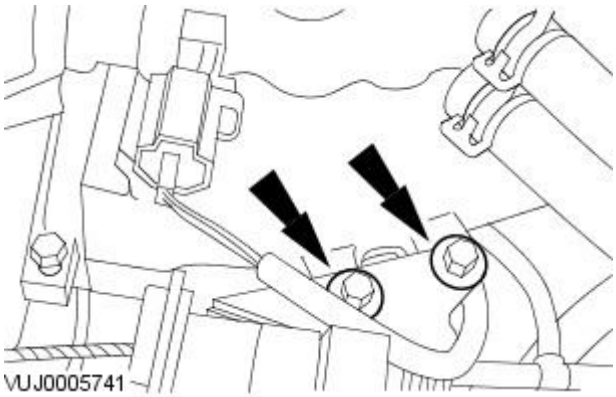


6. Detach the cruise control cable.

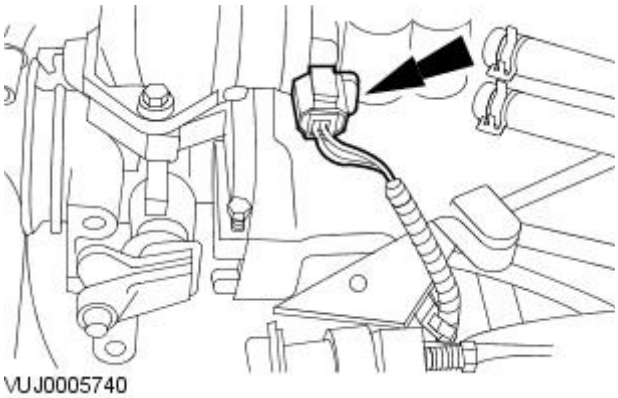


7. Detach the throttle cable.

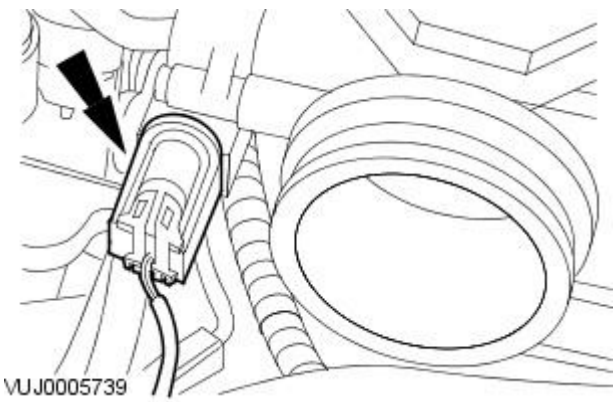
1. Reposition the throttle lever to the fully open position.
2. Detach the throttle cable.



8. Detach the throttle cable retaining bracket.

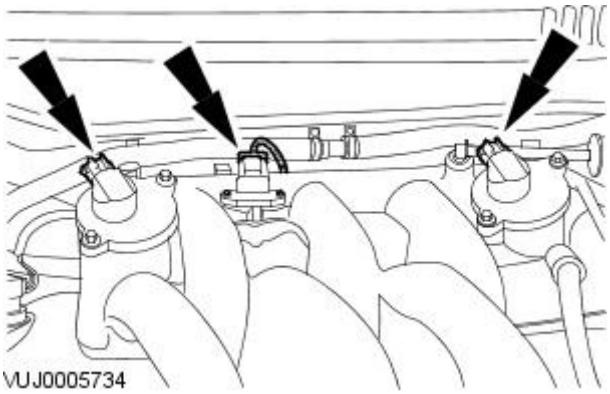


9. Disconnect the throttle body electrical connector.



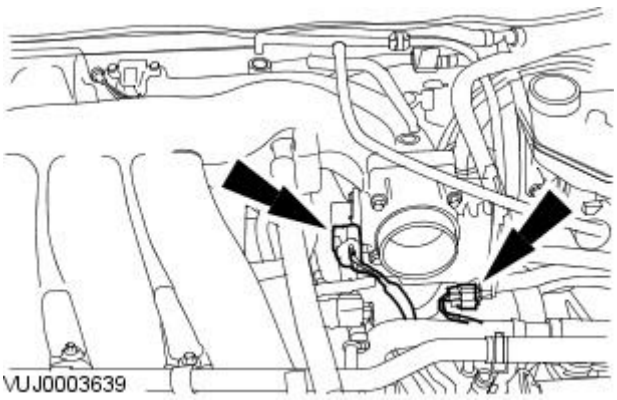
10. Disconnect the throttle body electrical connector.

11. Disconnect the electrical connectors.

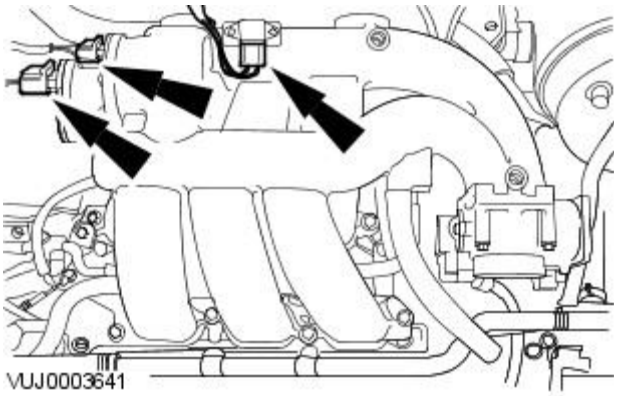


Vehicles with 2.5L or 3.0L engine

12. Disconnect the throttle body electrical connectors.



13. Disconnect the electrical connectors.

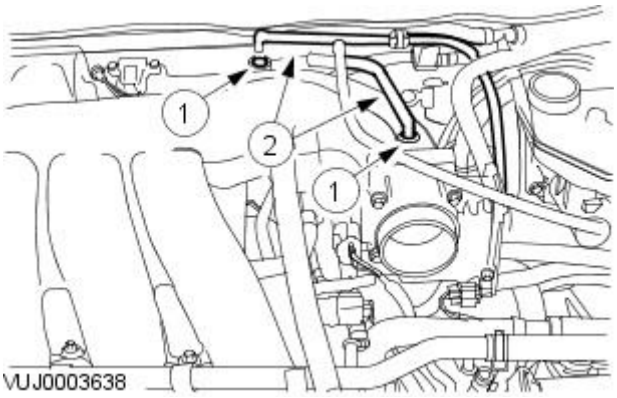


All vehicles

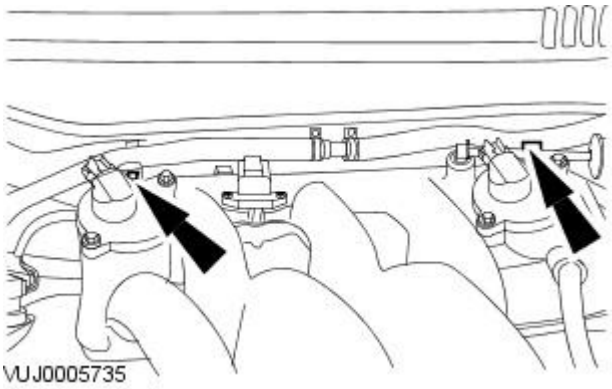
14. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Detach the vacuum hoses.

1. Press the retaining ring.
2. Detach the vacuum hose.

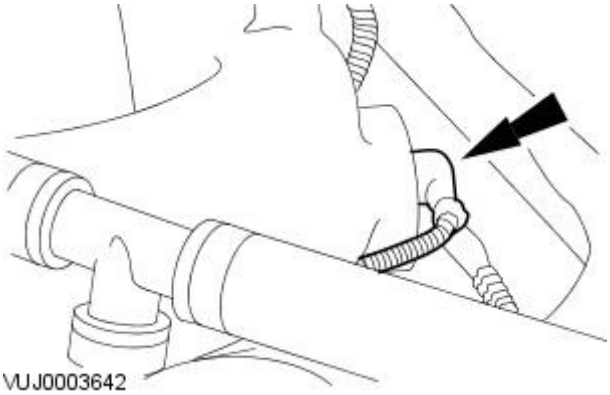


Vehicles with 2.0L engine



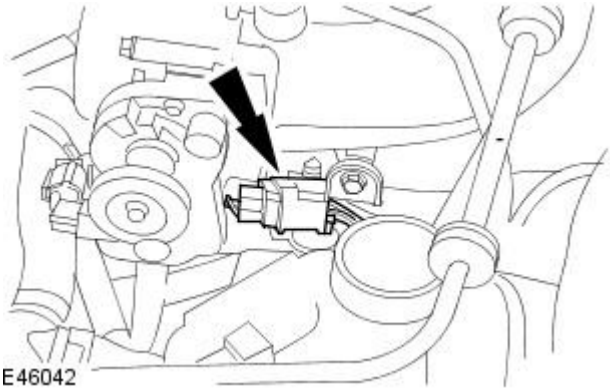
15. Detach the coolant hose from the retaining clips.

Vehicles with 2.5L or 3.0L engine

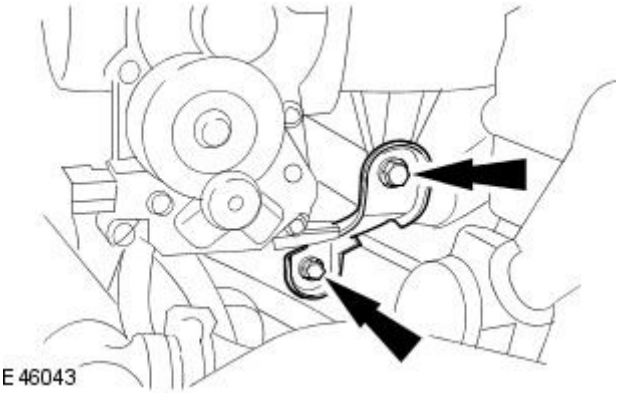


16. Disconnect the vacuum hose.

All vehicles

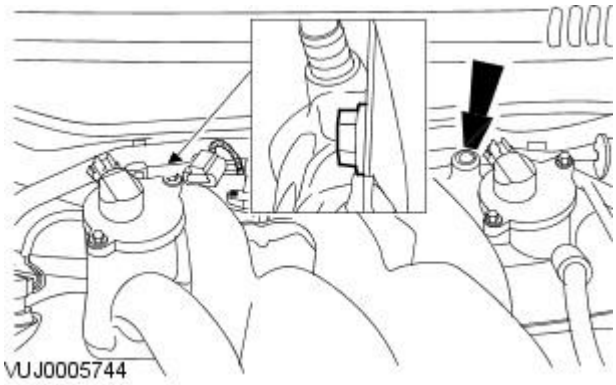


17. Detach the injector harness electrical connector from the intake manifold support bracket.



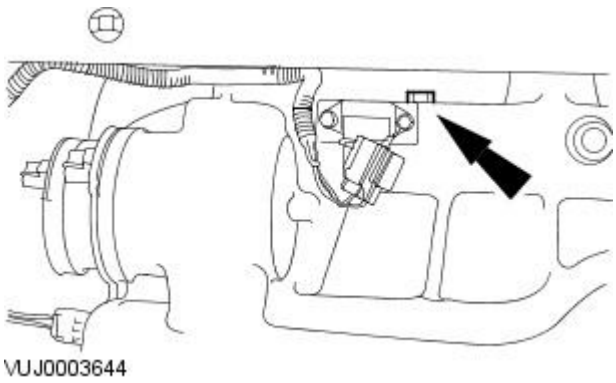
18. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Remove the intake manifold support bracket.



19. NOTE: 2.0L shown, 2.5L and 3.0L similar.

Detach the engine wiring harness bracket.



20. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Detach the intake manifold support bracket.

Vehicles with 2.0L engine

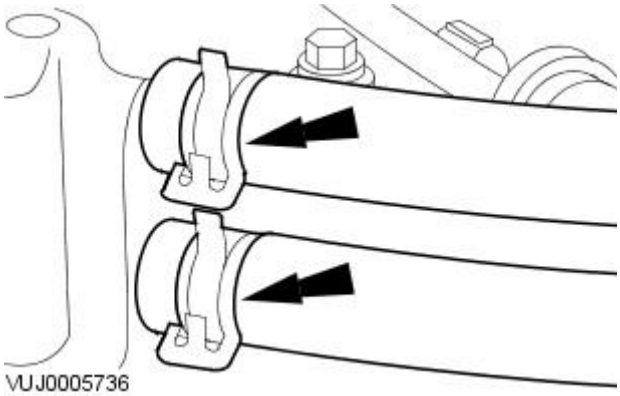
21. WARNINGS:

Never remove the coolant expansion tank pressure cap under any circumstances while the engine is operating. Failure to follow this instruction may result in personal injury.

To avoid hot coolant or steam blowing out of the cooling system, use extreme care when removing the coolant expansion tank pressure cap. Wait until the engine has cooled down, then insulate the coolant pressure cap with a suitable cloth and slowly loosen the coolant expansion tank pressure cap until the cooling system pressure is released. Do not remove the coolant expansion tank pressure cap. Step back while the pressure is released from the system. When all of the pressure has been released slowly remove the coolant expansion tank pressure cap (still with the suitable cloth in position) from the coolant expansion tank. Failure to follow this instruction may result in personal injury.

Release the cooling system pressure.

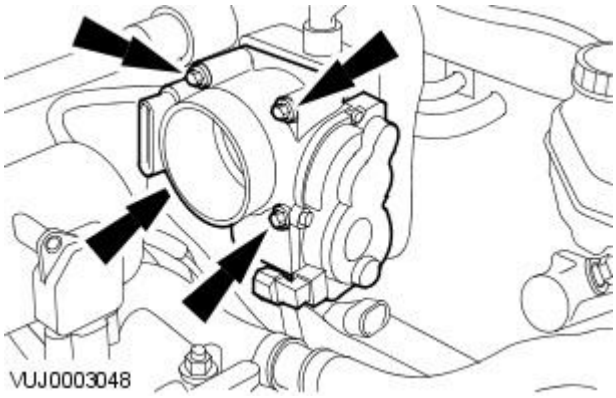
- Remove the coolant expansion tank pressure cap.



22. NOTE: Cap the coolant hoses to minimize coolant loss.

Detach the intake manifold coolant hoses.

Vehicles with 2.5L or 3.0L engine

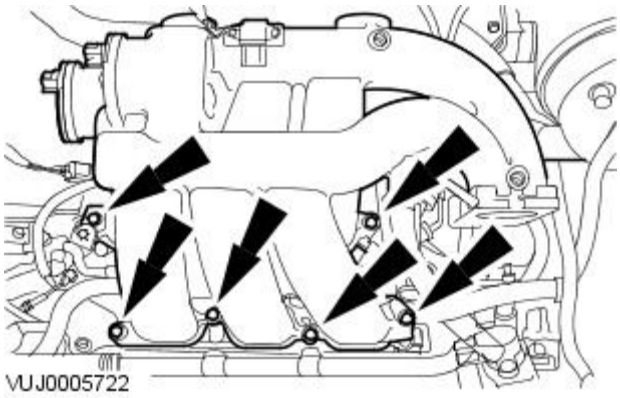

VUJ0003048

23. NOTE: Remove and discard the O-ring seal.

Detach the throttle body.

- Remove the retaining bolts.

All vehicles

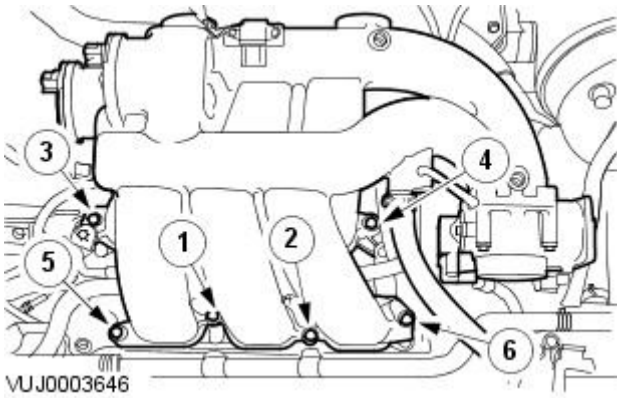

VUJ0005722

24. Remove the intake manifold.

- Remove and discard the intake manifold gaskets.

Installation

All vehicles



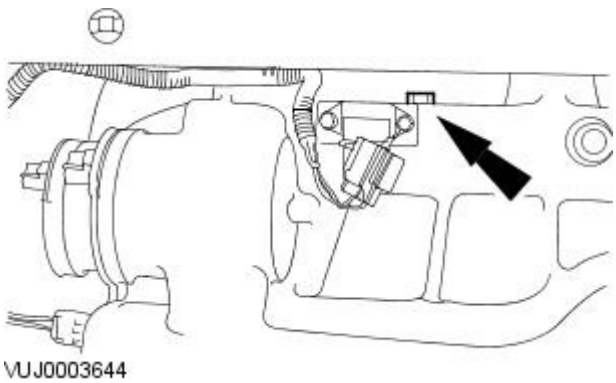
VUJ0003646

1. NOTE: Install new intake manifold gaskets.

• NOTE: The intake manifold retaining bolts in position 1, 4 and 5 are longer than the retaining bolts in position 2, 3 and 6.

• NOTE: Do not fully tighten the retaining bolts.

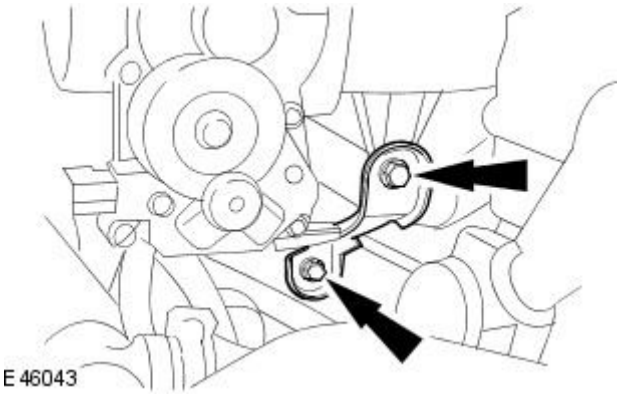
Install the intake manifold.


VUJ0003644

2. NOTE: 2.5L and 3.0L shown, 2.0L similar.

• NOTE: Do not fully tighten the retaining bolts.

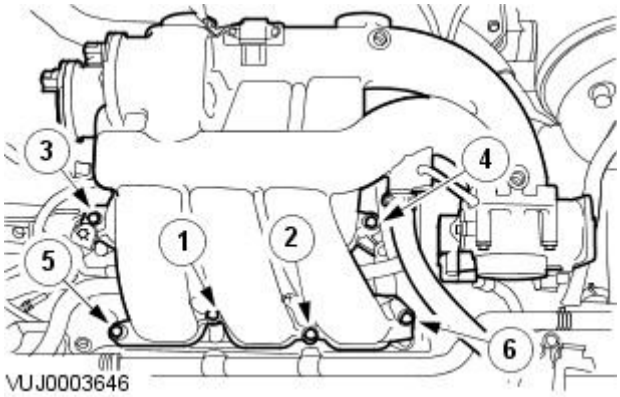
Attach the intake manifold support bracket.



3. NOTE: 2.5L and 3.0L shown, 2.0L similar.

• NOTE: Do not fully tighten the retaining bolts.

Install the intake manifold support bracket.

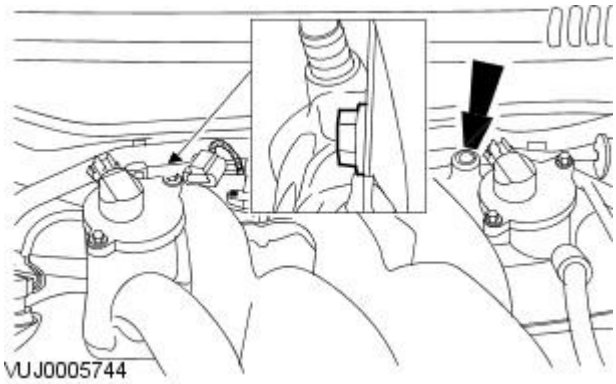


4. NOTE: The intake manifold retaining bolts in position 1, 4 and 5 are longer than the retaining bolts in position 2, 3 and 6.

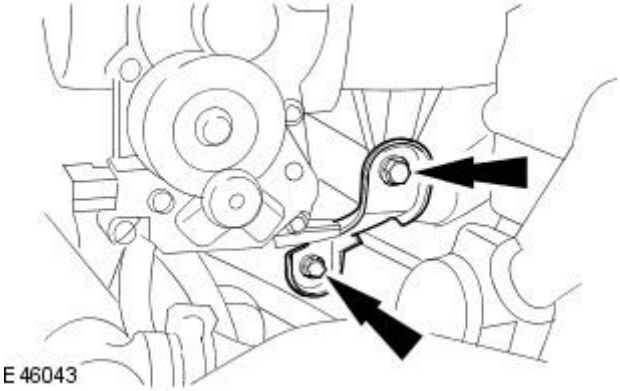
• NOTE: 2.5L and 3.0L shown, 2.0L similar.

Tighten to 10 Nm.

- Complete the tightening sequence.

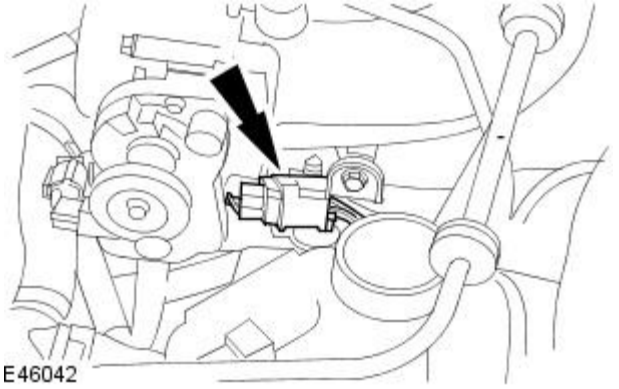


5. Tighten to 10 Nm.



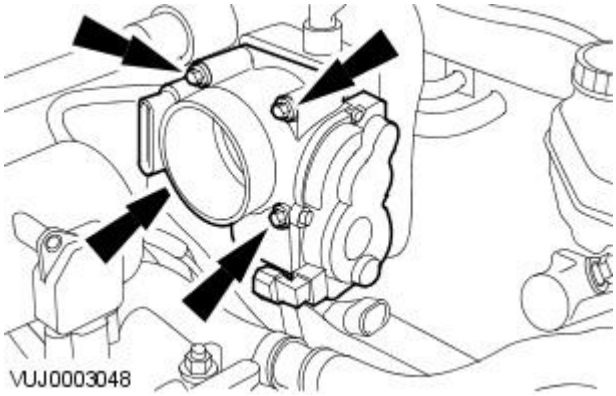
6. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Tighten to 10 Nm.



7. Attach the injector harness electrical connector to the intake manifold support bracket.

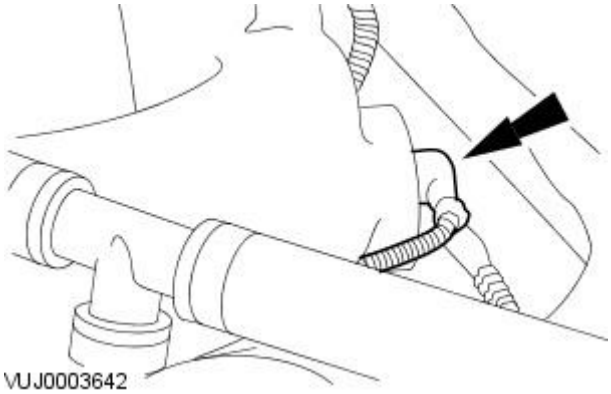
Vehicles with 2.5L or 3.0L engine


VUJ0003048

8. NOTE: Install a new O-ring seal.

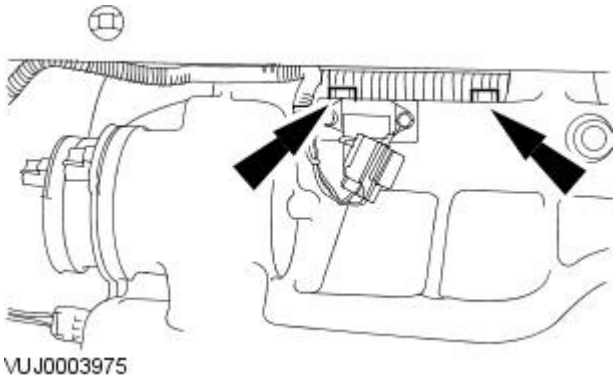
Attach the throttle body.

- Install the retaining bolts.


VUJ0003642

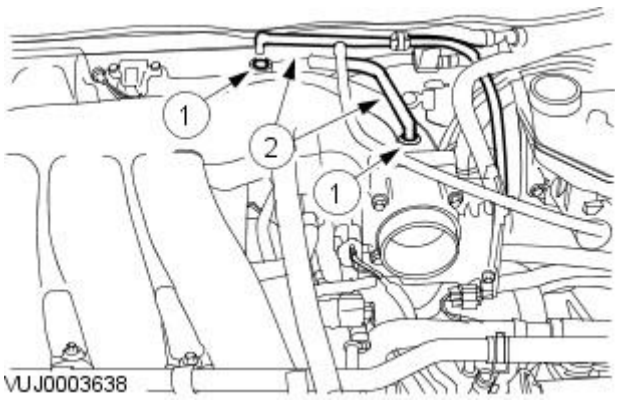
9. Connect the vacuum hose.

All vehicles


VUJ0003975

10. Attach the wiring harness.

- Tighten to 10 Nm.



VUJ0003638

11. NOTE: 2.5L and 3.0L shown, 2.0L similar.

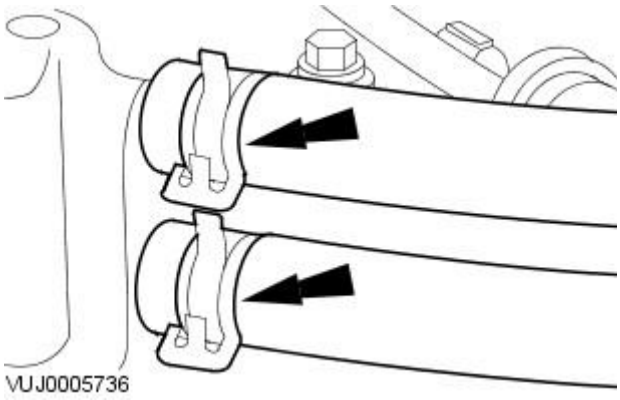
Attach the vacuum hoses.

1. Press the retaining ring.
2. Attach the vacuum hose.

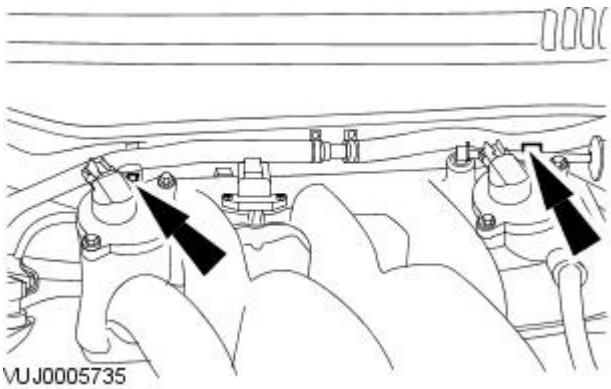
Vehicles with 2.0L engine

12. NOTE: Remove the coolant hose caps.

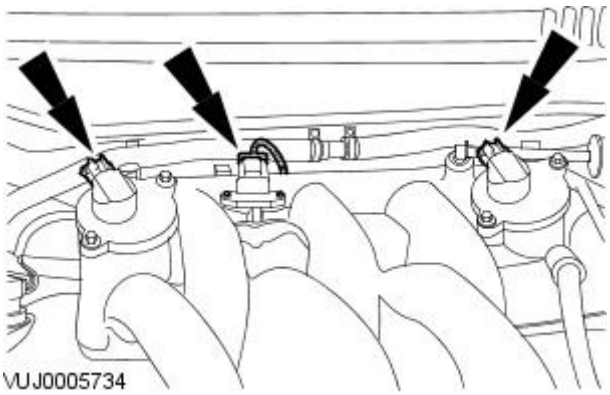
Attach the intake manifold coolant hoses.



13. Attach the coolant hose to the retaining clips.

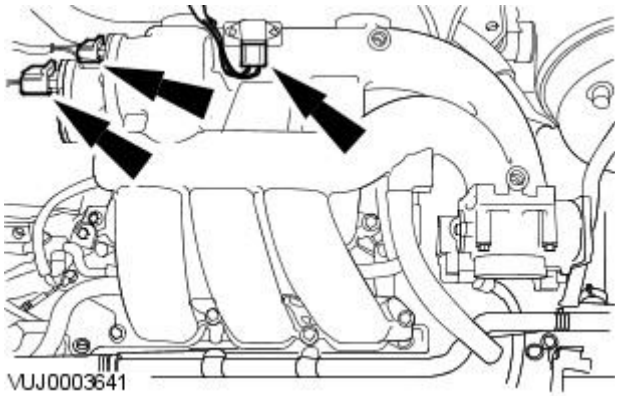


14. Connect the electrical connectors.

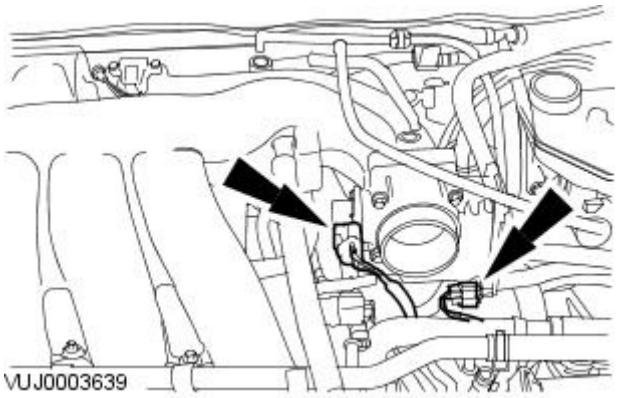


Vehicles with 2.5L or 3.0L engine

15. Connect the electrical connectors.

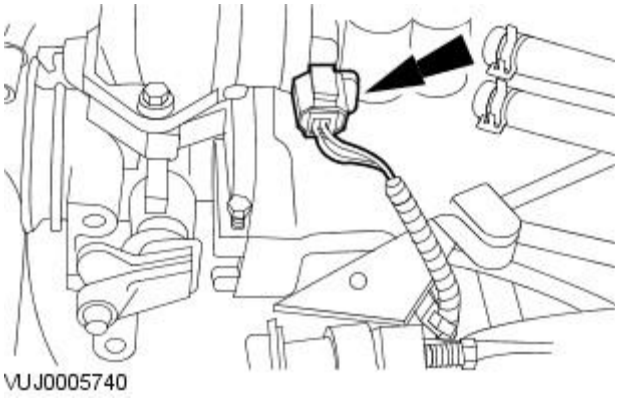


16. Connect the throttle body electrical connectors.

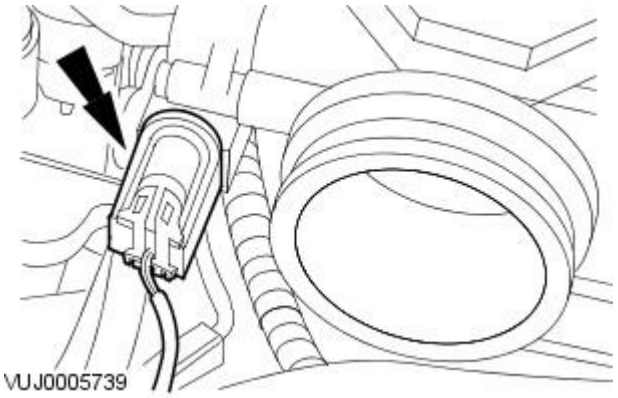


Vehicles with 2.0L engine

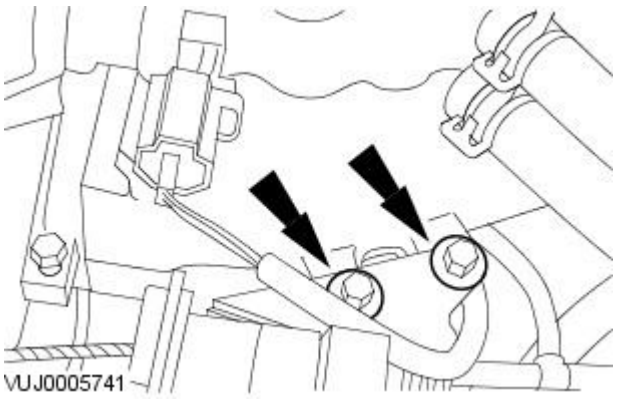
17. Connect the throttle body electrical connector.

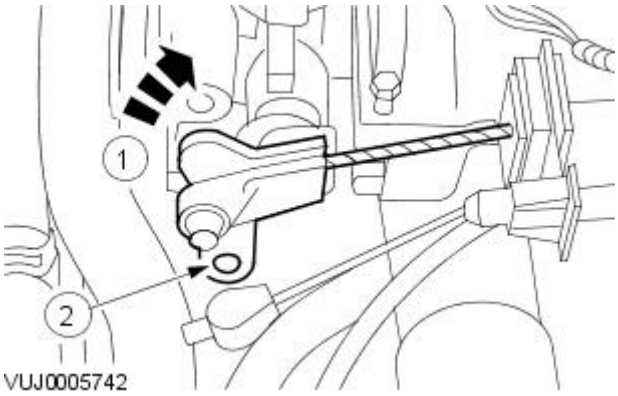


18. Connect the throttle body electrical connector.



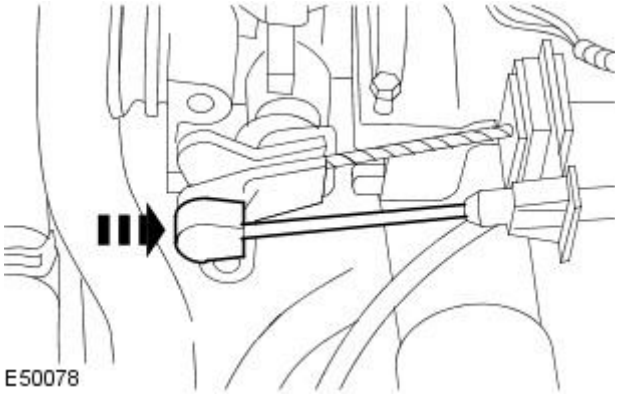
19. Attach the throttle cable retaining bracket.



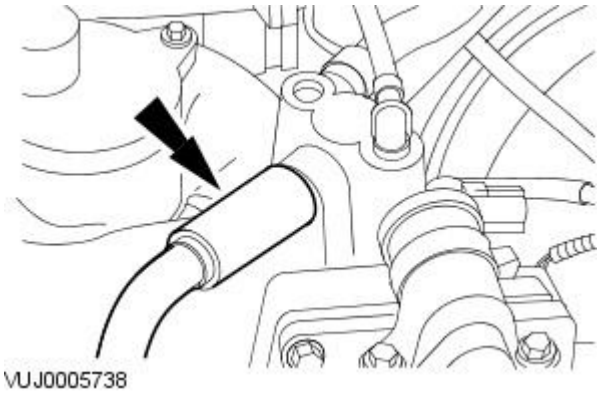


20. Attach the throttle cable.

1. Reposition the throttle lever to the fully open position.
2. Attach the throttle cable.



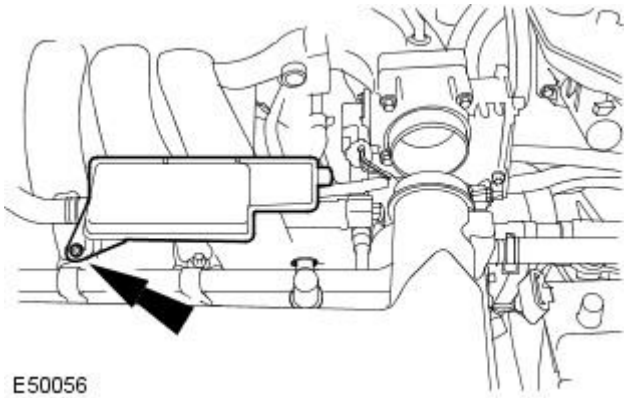
21. Attach the cruise control cable.



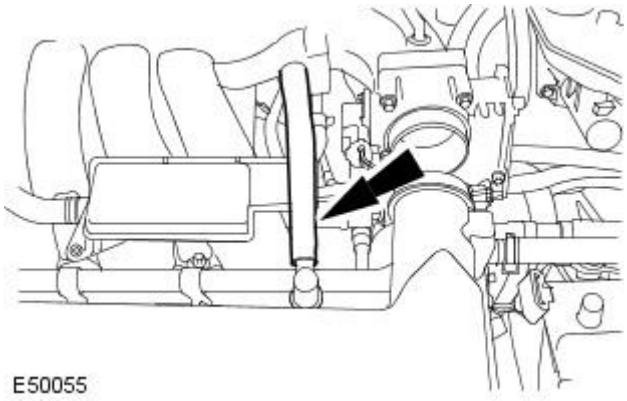
22. Attach the positive crank case ventilation hose.

23. 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.

Vehicles with 2.5L or 3.0L engine



24. Install the air cleaner resonator.

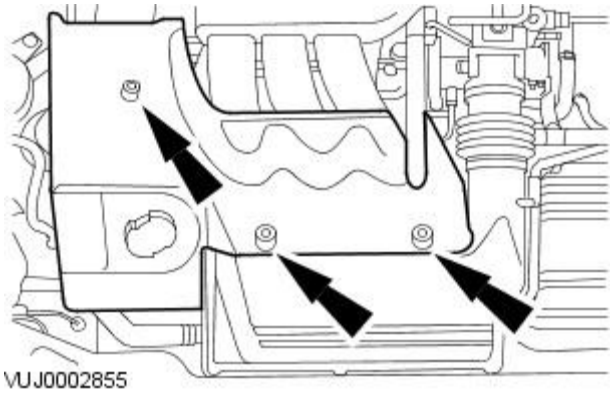


25. Install the positive crankcase ventilation hose.

All vehicles

26. Install the air filter outlet pipe.
For additional information, refer to: Air Cleaner Outlet Pipe (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

27. Install the engine cover (if equipped).



Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 - Lower Intake Manifold

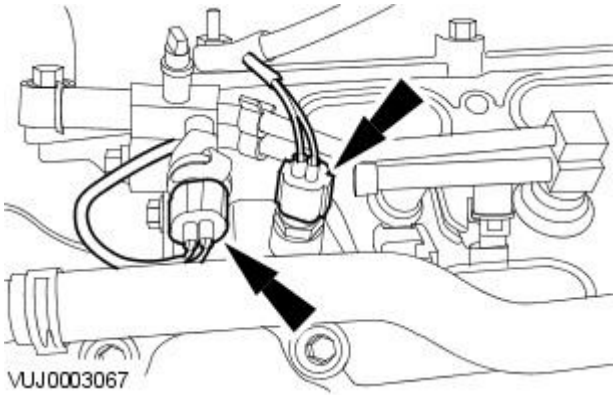
In-vehicle Repair

Removal

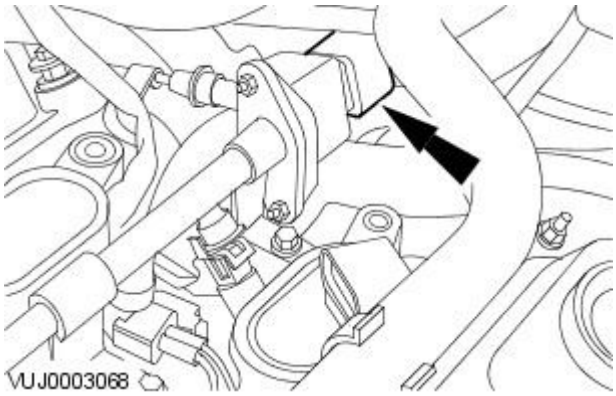
All vehicles

1. Remove the intake manifold.
   For additional information, refer to: Intake Manifold (303-01A Engine - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, In-vehicle Repair).
2. Disconnect the spring lock coupling.
   For additional information, refer to: Spring Lock Couplings (310-00 Fuel System - General Information, General Procedures).

Vehicles with 2.5L or 3.0L engine

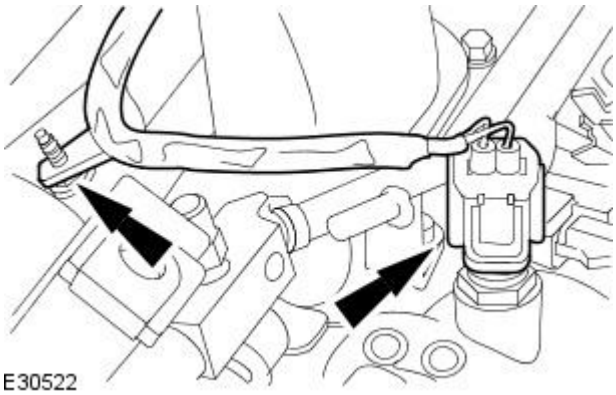


3. Disconnect the engine coolant temperature (ECT) and fuel temperature sensor electrical connectors.



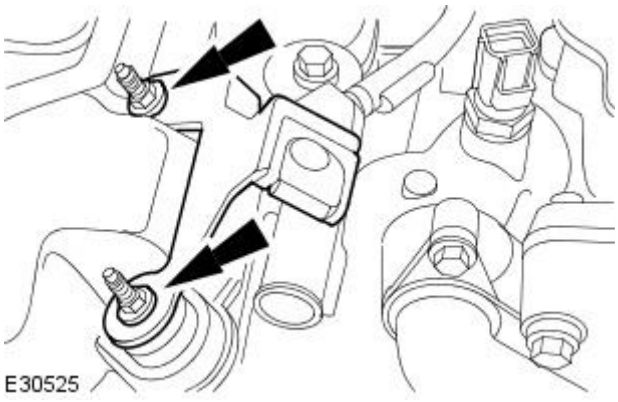
4. Disconnect the fuel pressure sensor electrical connector.

Vehicles with 2.0L engine

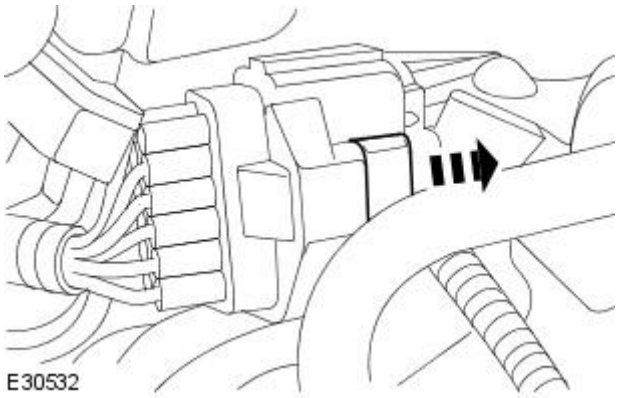


5. Disconnect the engine coolant temperature (ECT) electrical connector.
   - Detach the harness.

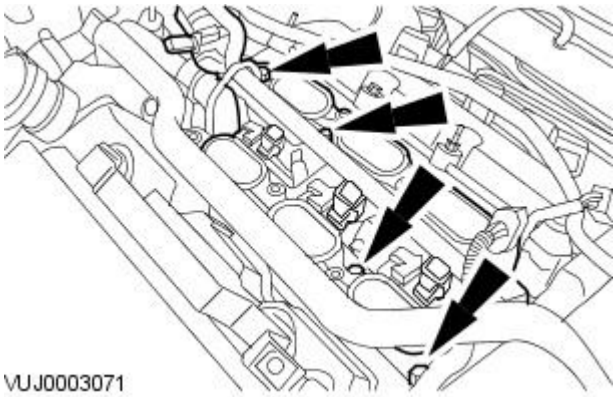
All vehicles



6. Remove the engine cover retaining bracket (if equipped).



7. Disconnect the fuel injector harness electrical connector.



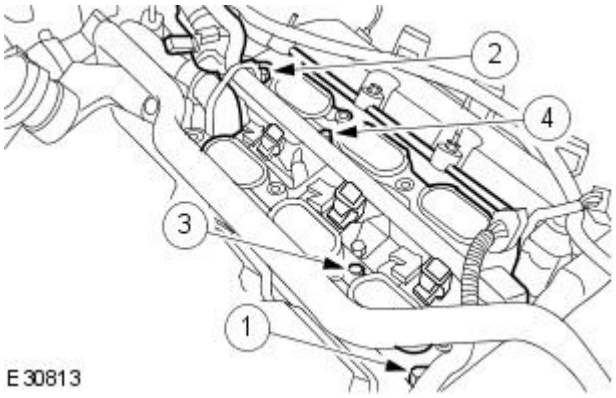
8. WARNING: Fuel may still be present in the fuel injection supply manifold.

• NOTE: Remove and discard the lower intake manifold O-ring seals.

Remove the lower intake manifold.

Installation

All vehicles

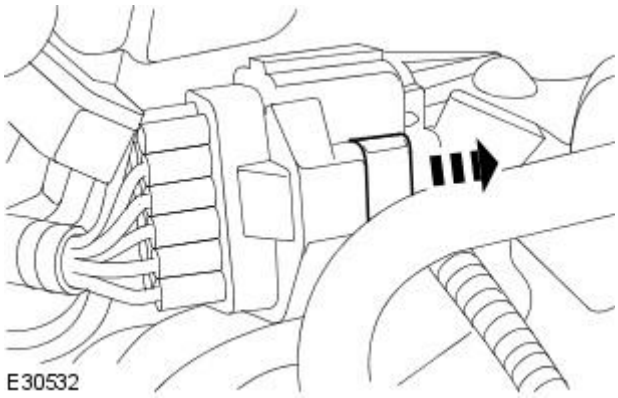


1. NOTE: Install new O-ring seals.

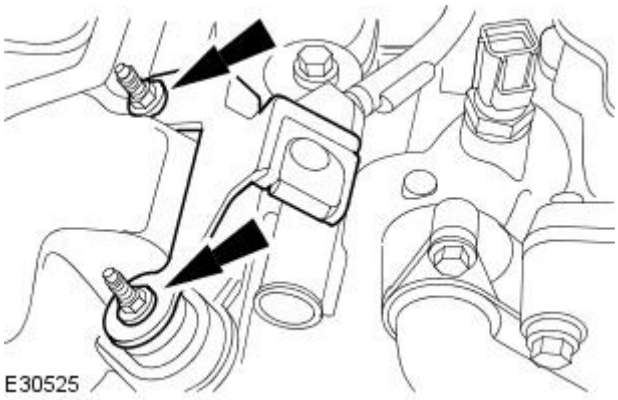
Install the lower intake manifold.

- Tighten the retaining bolts in the sequence shown.
- Tighten to 10 Nm.

2. Connect the fuel injector harness electrical connector.



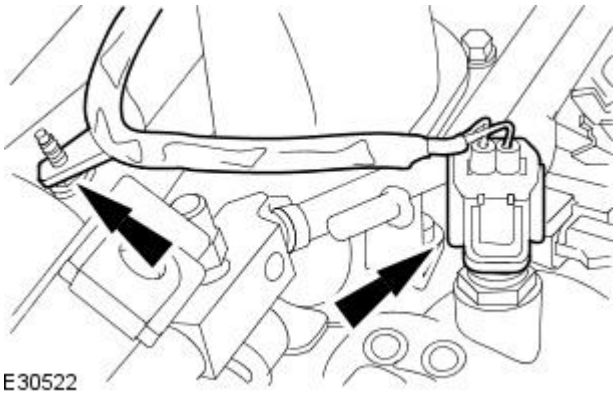
3. Install the engine cover retaining bracket (if equipped).



Vehicles with 2.0L engine

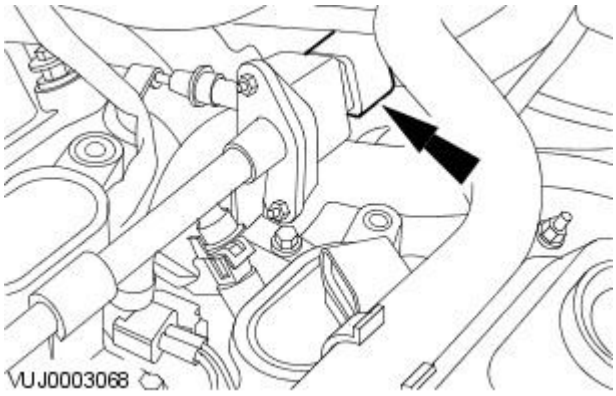
4. Connect the engine coolant temperature (ECT) electrical connector.

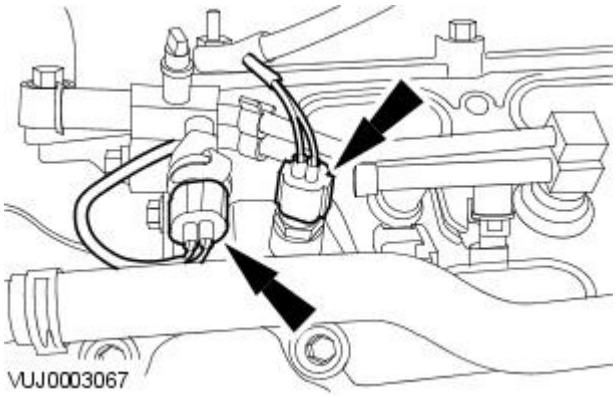
- Attach the harness.



Vehicles with 2.5L or 3.0L engine

5. Connect the fuel pressure sensor electrical connector.





6. Connect the engine coolant temperature (ECT) and fuel temperature sensor electrical connectors.

7. Connect the spring lock coupling.
   For additional information, refer to: Spring Lock Couplings (310-00 Fuel System - General Information, General Procedures).

8. Install the intake manifold.
   For additional information, refer to: Intake Manifold (303-01A Engine - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, In-vehicle Repair).

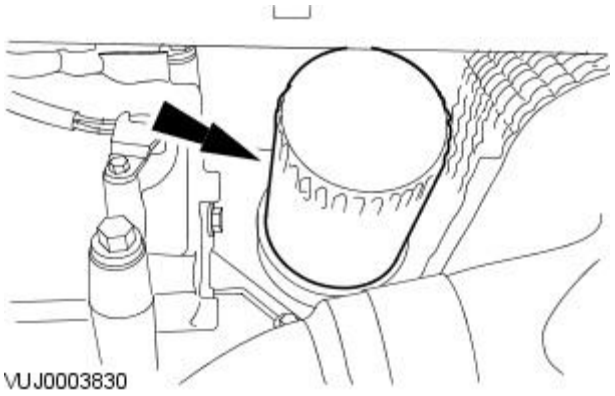
Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Oil Cooler

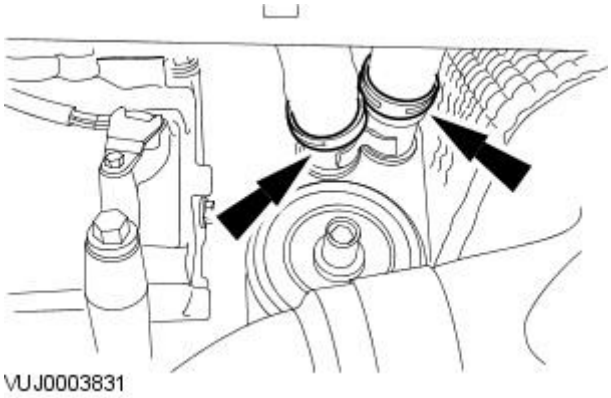
In-vehicle Repair

Removal

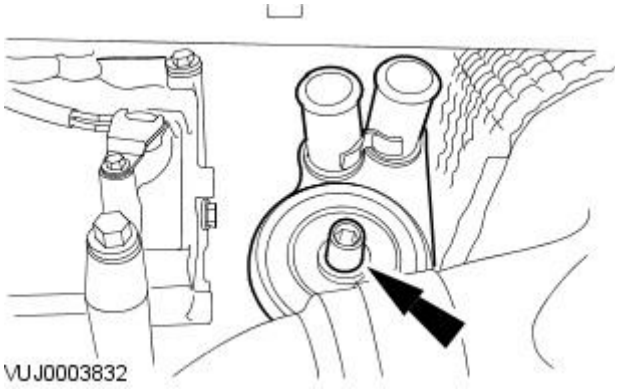
1. Drain the cooling system. For additional information, refer to Section 303-03A Engine CoolingSection 303-03B Engine Cooling.
2. Drain the engine oil.
3. Remove and discard the engine oil filter.



4. Detach the inlet and outlet coolant hoses.



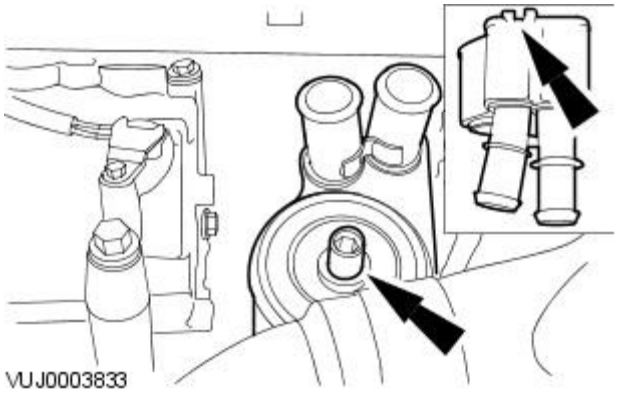
5. Remove the oil cooler.
   - Remove the oil cooler retaining bolt.
   - Remove and discard the oil cooler O-ring seal.



Installation

1. To install reverse the removal procedure.
2. NOTE: Make sure the oil cooler locating tag is correctly located.

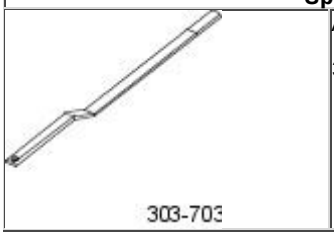
   Install the oil cooler.
   - Install a new oil cooler O-ring seal.
   - Install the oil cooler retaining bolt.
   - Tighten to 57 Nm.



Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Oil Pan

In-vehicle Repair

Special Tool(s)	
 303-703	Accessory Belt Detensioner 303-703

Removal

All vehicles

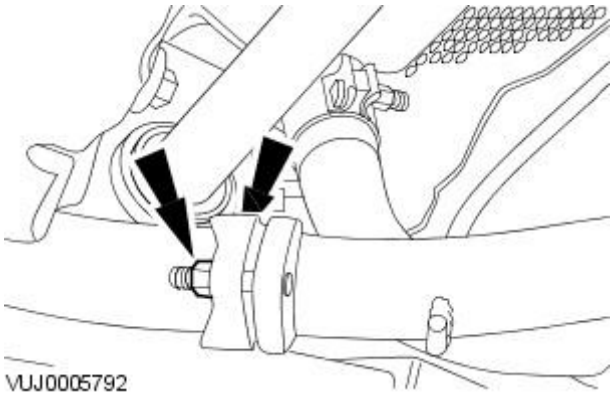
1. Drain the engine oil.

Vehicles with 2.5L or 3.0L engine

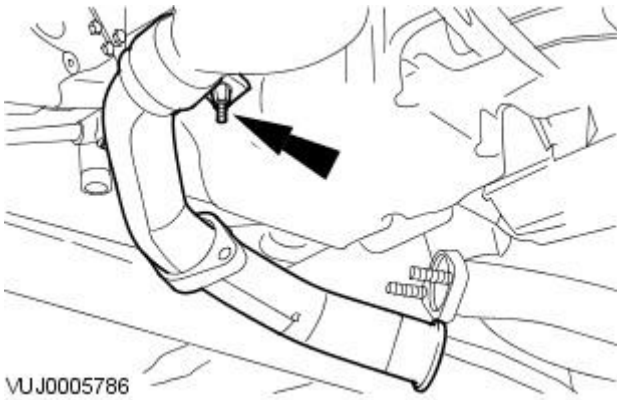
2. Remove the transfer case. For additional information, refer to Section 308-07 Transfer Case.

Vehicles with 2.0L engine

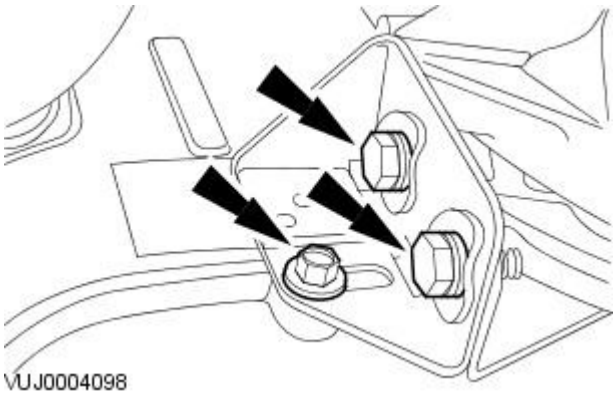
3. Detach the exhaust link pipe rear retaining clamp.


VUJ0005792

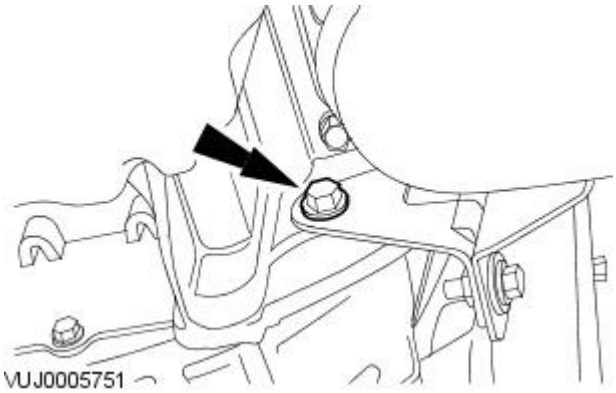
4. Remove the link pipe.


VUJ0005786

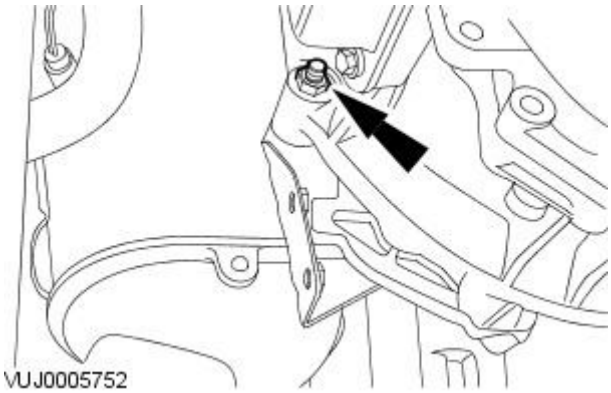
5. Remove the catalytic converter retaining bracket.


VUJ0004098

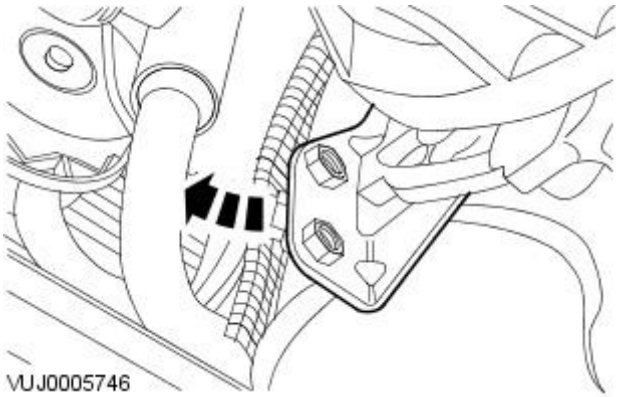
6. Remove the sump to transmission securing bolt.



7. Slacken but not remove the upper catalyst retaining bracket support securing bolt.



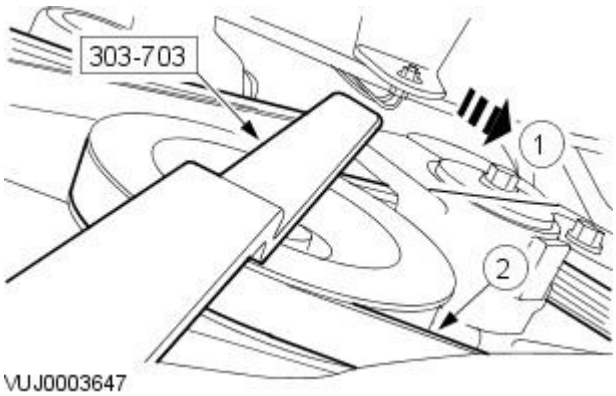
8. Reposition the catalyst retaining bracket support.



All vehicles

9. Detach the accessory drivebelt.

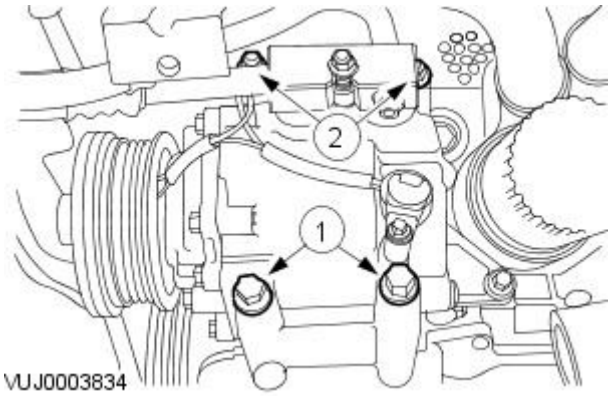
1. Using the special tool rotate the belt tensioner counter-clockwise.
2. Detach the accessory drivebelt.



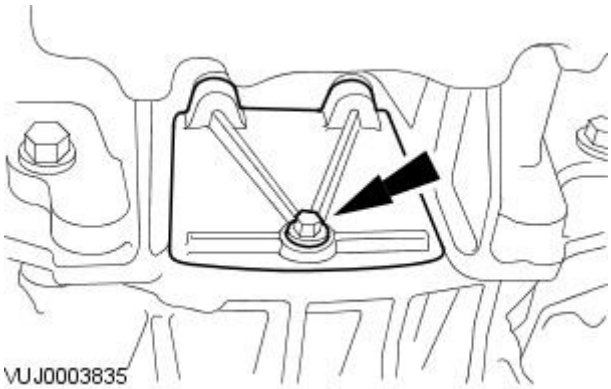
10. NOTE: Do not remove the A/C compressor upper retaining bolts.

Reposition the air conditioning (A/C) compressor.

1. Remove the A/C compressor lower retaining bolts.
2. Loosen the A/C compressor upper retaining bolts.

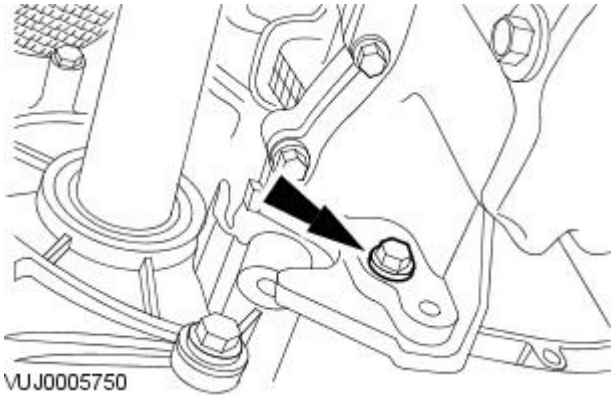


11. Remove the access cover.



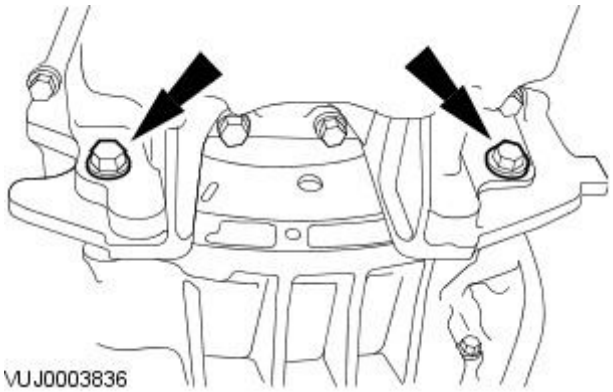
Vehicles with 2.0L engine

12. Remove the retaining bolt.

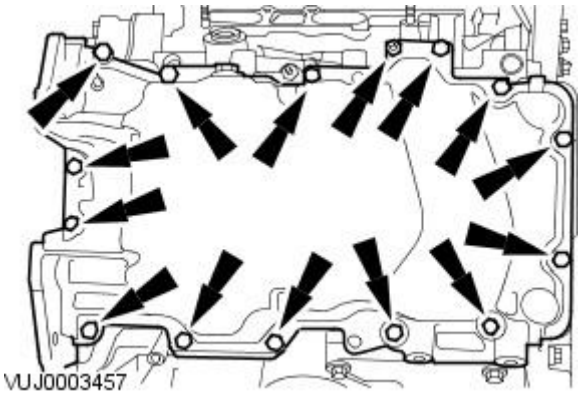


Vehicles with 2.5L or 3.0L engine

13. Remove the retaining bolts.



All vehicles

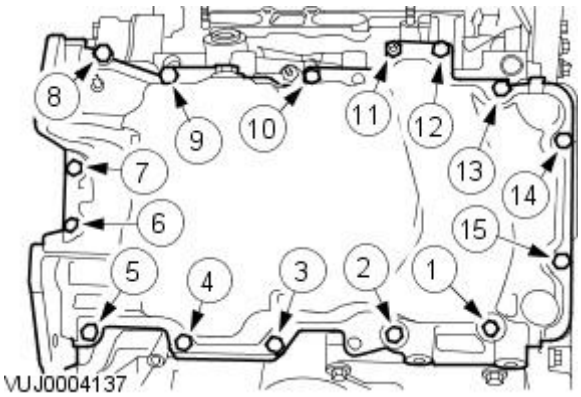


14. Remove the oil pan.

- Remove and discard the gasket.
- Clean and inspect the oil pan and the cylinder block sealing surfaces using metal surface cleaner or equivalent meeting Jaguar specification WSE-M5B392-A.

Installation

All vehicles



1. NOTE: Apply a 10 mm diameter dot of silicone sealant WSE-M4G323-A6 or equivalent meeting Jaguar specification to the engine front cover to the cylinder block mating joints.

• NOTE: Loosely install the oil pan to transmission housing bolts.

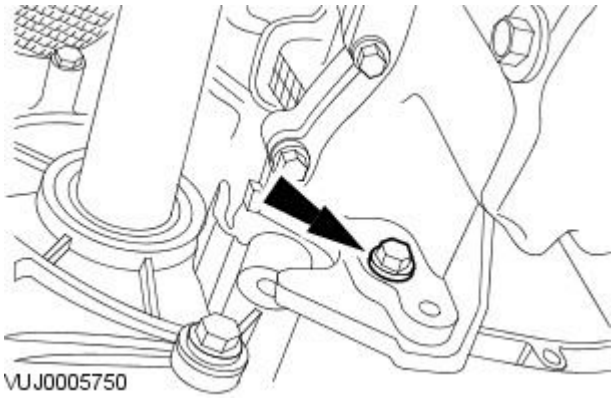
• NOTE: The oil pan retaining bolts numbered 1 and 2 are longer than the retaining bolts numbered 3 through 15.

• NOTE: Tighten the oil pan bolts within six minutes of applying sealer.

To install, reverse the removal procedure.

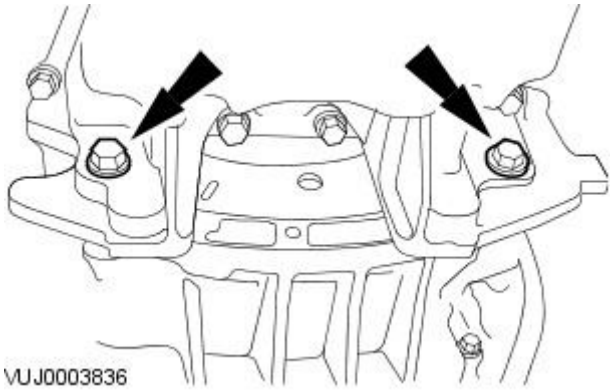
- Install the new oil pan gasket.
- Complete the tightening sequence.
- Tighten to 25 Nm.

Vehicles with 2.0L engine



2. Tighten to 45 Nm.

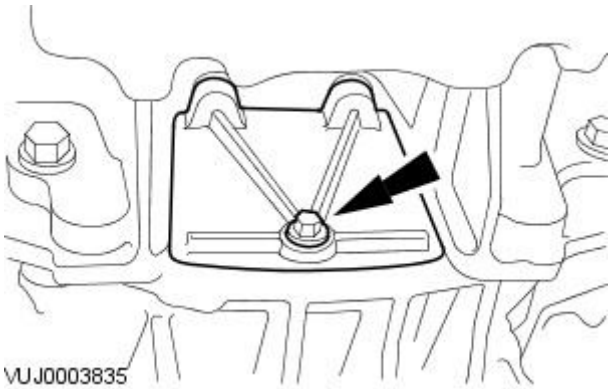
Vehicles with 2.5L or 3.0L engine



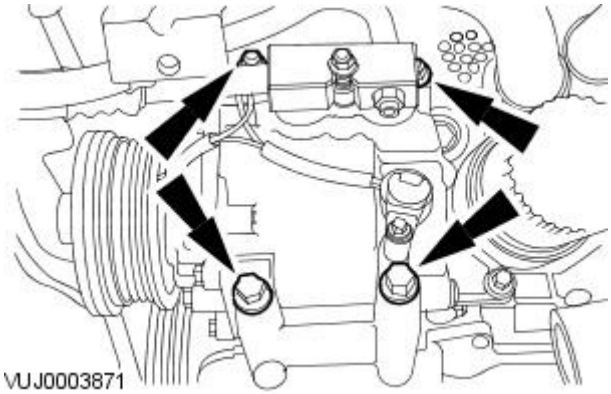
3. Tighten to 45 Nm.

All vehicles

4. Tighten to 10 Nm.

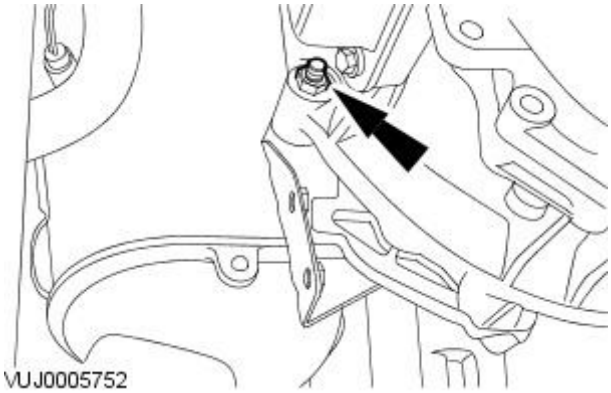


5. Tighten to 25 Nm.

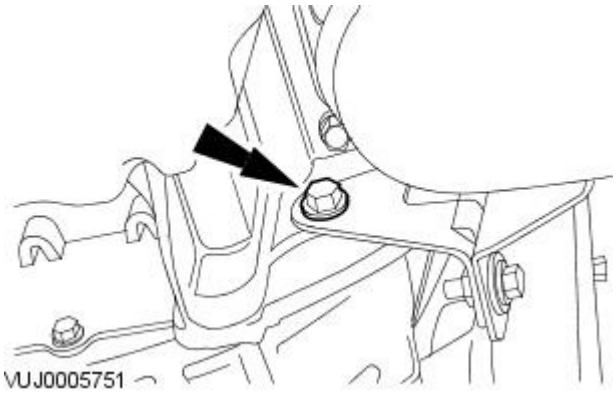


Vehicles with 2.0L engine

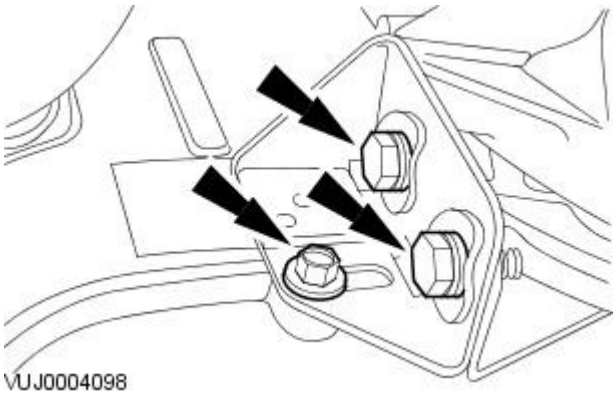
6. Tighten to 25 Nm.



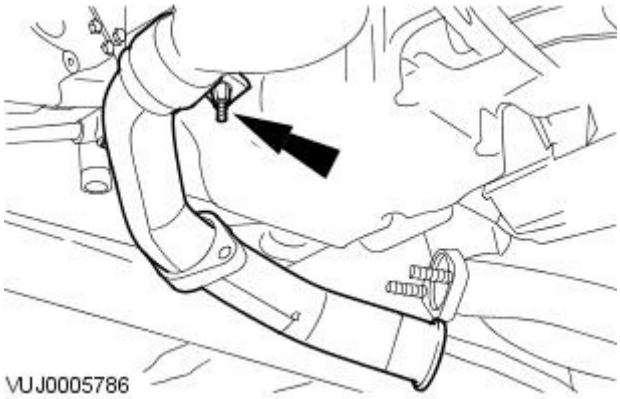
7. Tighten to 45 Nm.



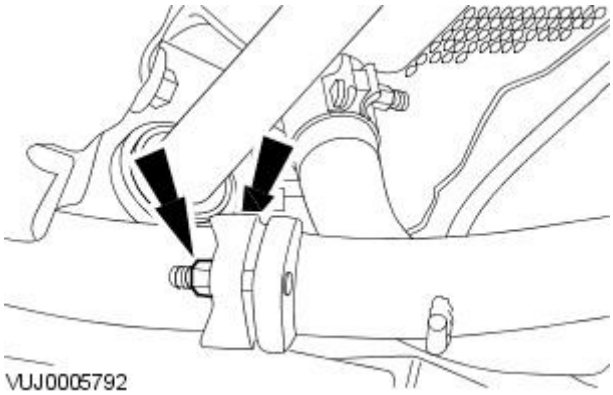
8. Tighten to 25 Nm,



9. Tighten to 55 Nm.



10. Tighten to 55 Nm.



Vehicles with 2.5L or 3.0L engine

11. Install the transfer case. For additional information, refer to Section 308-07 Transfer Case.

All vehicles

12. NOTE: Use oil WSE-M2C908-A or equivalent meeting Jaguar specification.

Refill the engine with oil.

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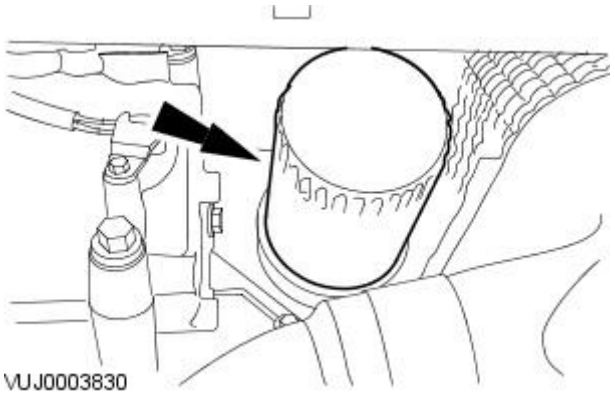
Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Oil Pressure Sender

In-vehicle Repair

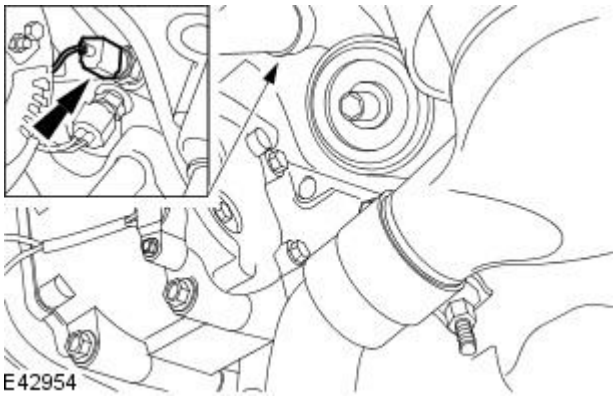
Removal

1. Raise and support the vehicle.
For additional information, refer to Section 100-02 Jacking and Lifting.

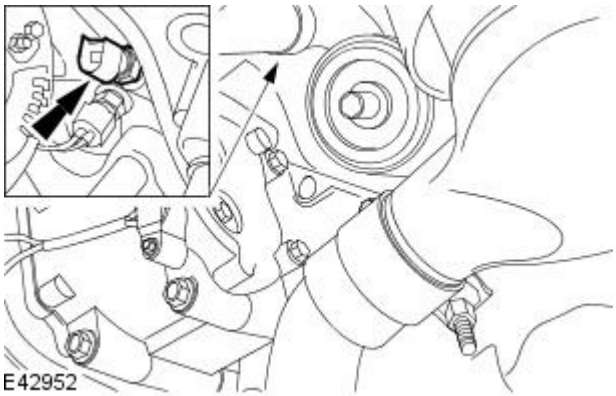
2. Remove and discard the oil filter.



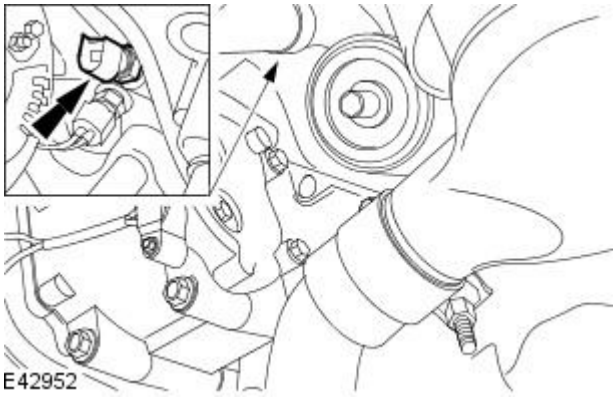
3. Disconnect the oil pressure sender electrical connector.



4. Remove the oil pressure sender.



Installation



1. NOTE: Apply a small bead of sealant WSK-M4G328-A3 or equivalent sealant meeting Jaguar specification on the first three threads of the oil pressure sender.

To install, reverse the removal procedure.

- Tighten to 15 Nm.

2. Install a new oil filter.

3. NOTE: Use oil WSE-M2C908-A or equivalent meeting Jaguar specification.

Check and top up the engine with oil.

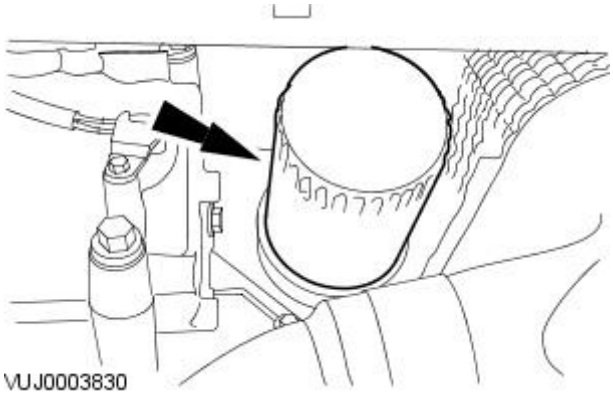
Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Oil Pump

In-vehicle Repair

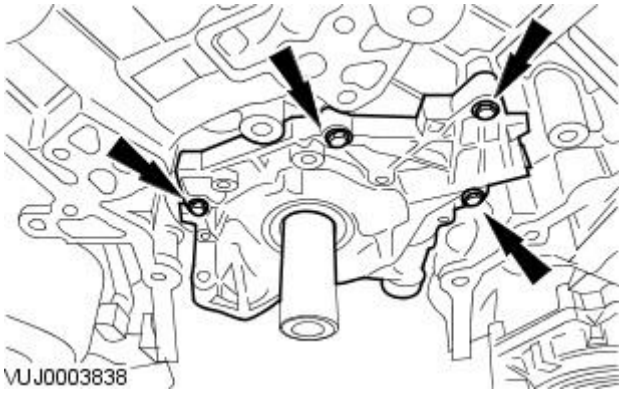
Removal

1. Remove the timing chains. For additional information, refer to Timing Drive Components.
2. Remove and discard the engine oil filter.

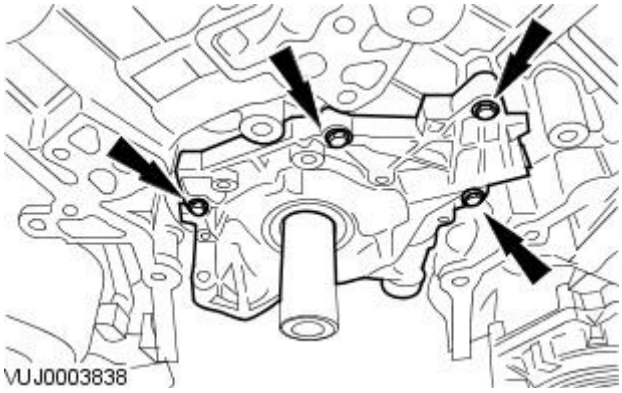


3. Remove the oil pump tube.

4. Remove the oil pump.
   - Remove and discard the O-ring seal.
   - Inspect the oil pump for damage and wear.



Installation



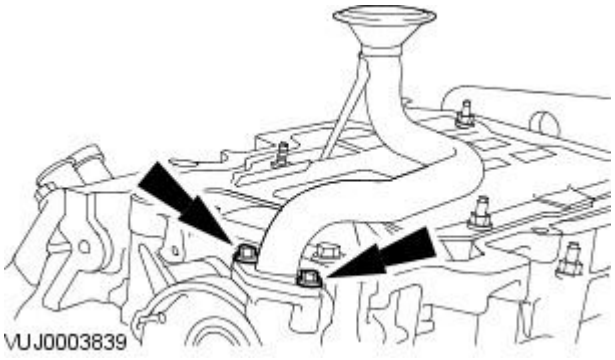
1. CAUTIONS:

⚠ 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.

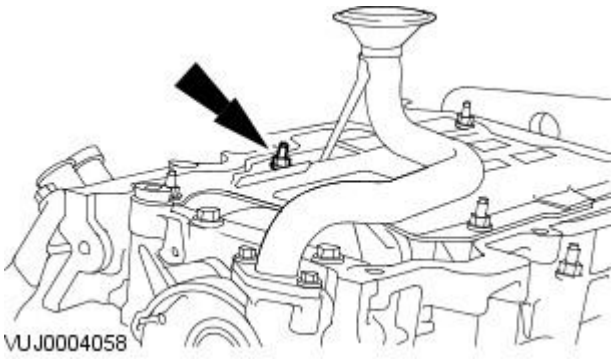
Install the oil pump.

- Tighten to 10 Nm.

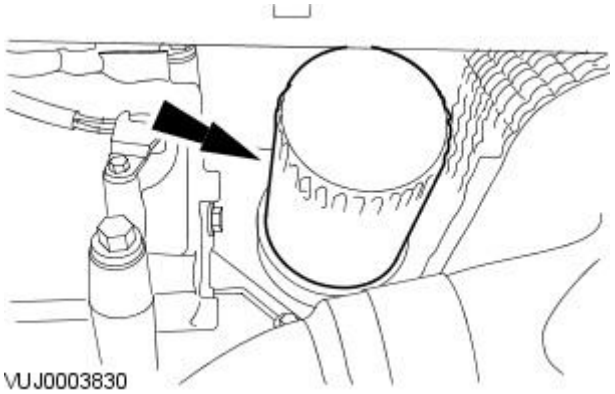


2. Install the oil pump tube.

- Install a new O-ring seal.
- Tighten to 10 Nm.



3. Tighten to 5 Nm + 45°.



4. Install a new engine oil filter.

5. Install the timing chains. For additional information, refer to Timing Drive Components.

Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Timing Drive Components

In-vehicle Repair

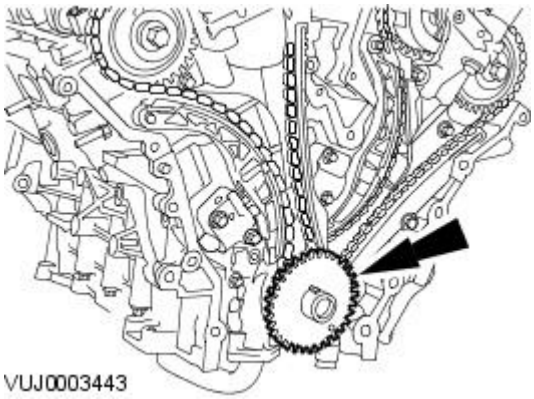
Removal

1. Remove the engine front cover.
For additional information, refer to: Engine Front Cover (303-01A Engine - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, In-vehicle Repair).

2. Remove the spark plugs.

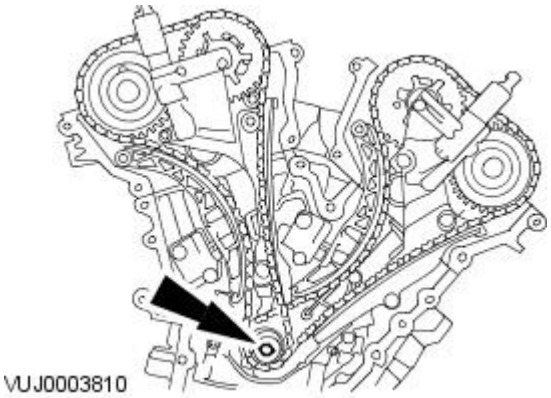
3. NOTE: Note the position of the crankshaft position (CKP) sensor pulse wheel during removal. It must be returned to its original position during installation.

Remove the crankshaft position (CKP) sensor pulse wheel.


VUJ0003443

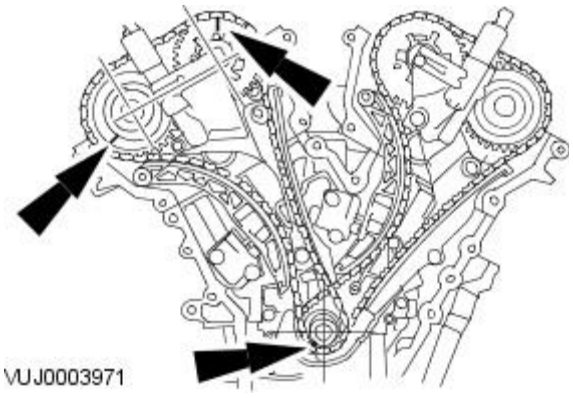
4. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Install the crankshaft pulley retaining bolt and washer.

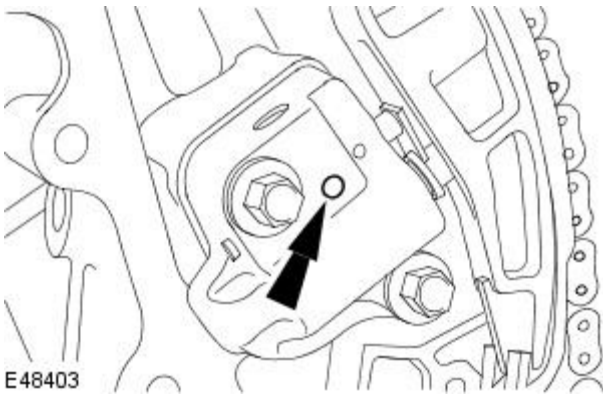

VUJ0003810

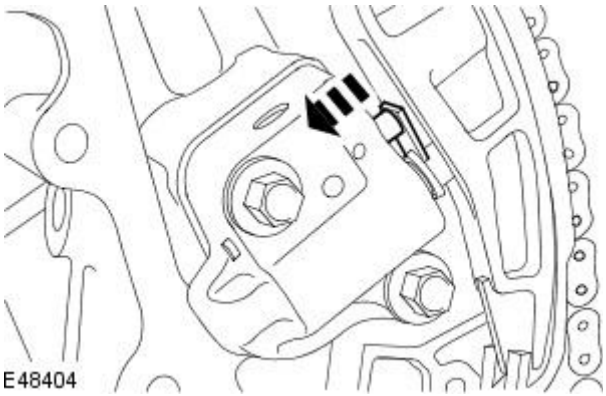
5. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

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.


VUJ0003971

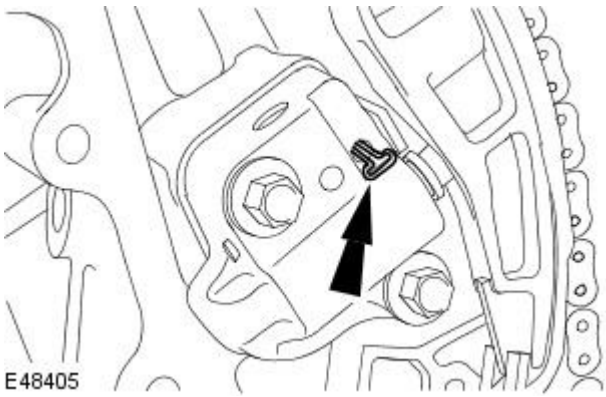
6. Release the timing chain tensioner ratchet.


E48403

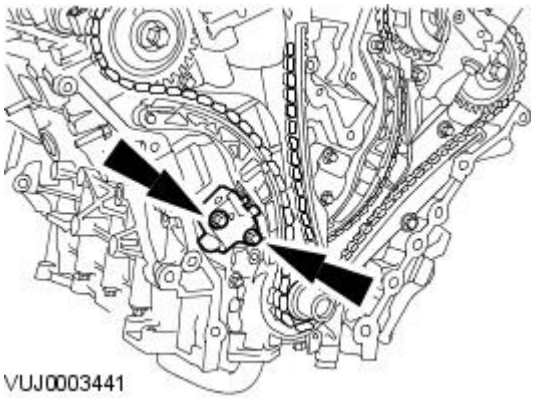


7. NOTE: Keep the timing chain tensioner ratchet released.

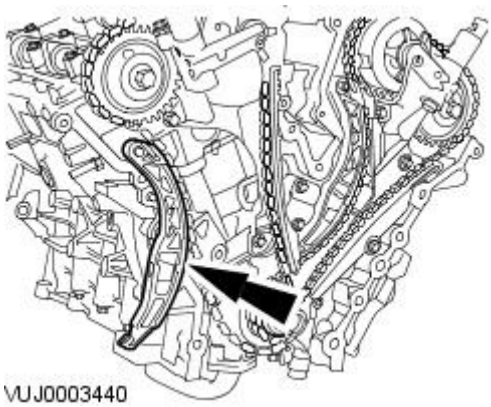
Reposition the timing chain tensioner plunger.



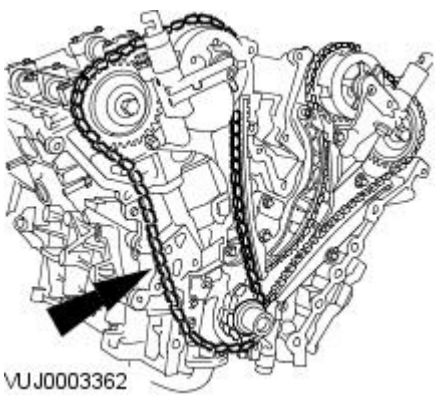
8. Retain the timing chain tensioner plunger.



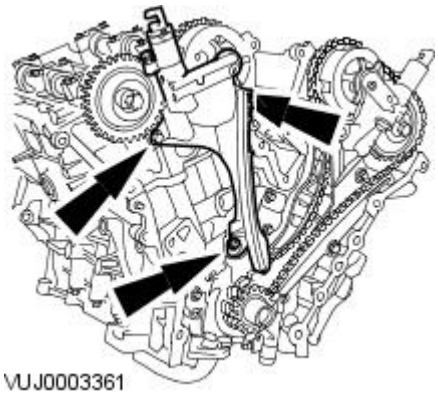
9. Remove the right-hand timing chain tensioner.



10. Remove the right-hand timing chain outer guide.

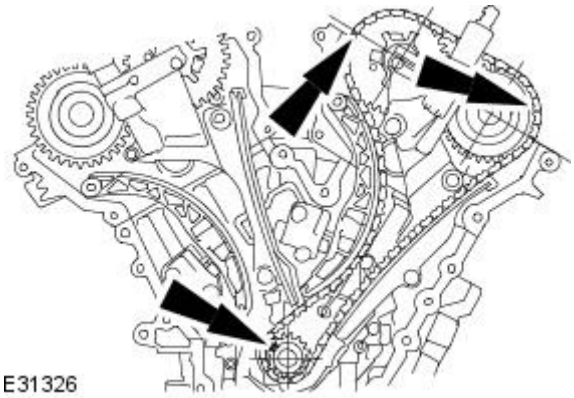


11. Remove the right-hand timing chain.


VUJ0003361

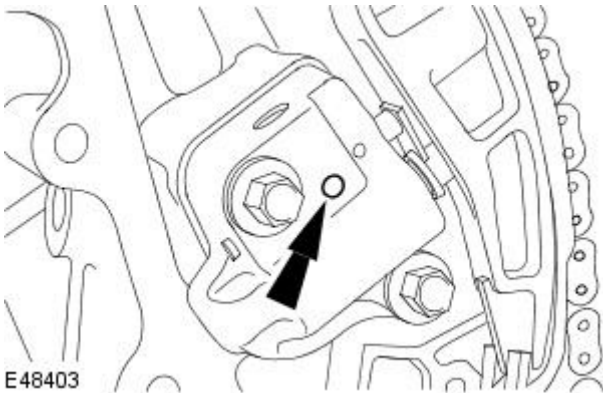
12. CAUTION: Inspect and replace the O-ring seal if necessary.

Remove the right-hand timing chain inner guide.


E31326

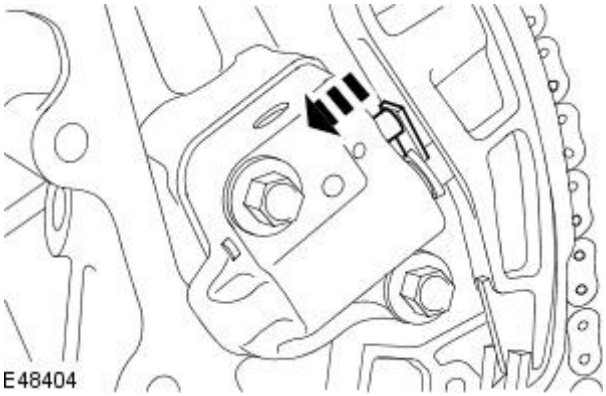
13. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

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.


E48403

14. NOTE: Right-hand bank shown, left-hand bank similar.

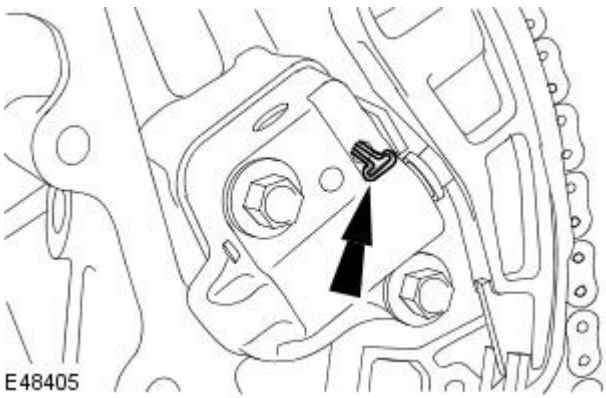
Release the timing chain tensioner ratchet.


E48404

15. NOTE: Right-hand bank shown, left-hand bank similar.

- NOTE: Keep the timing chain tensioner ratchet released.

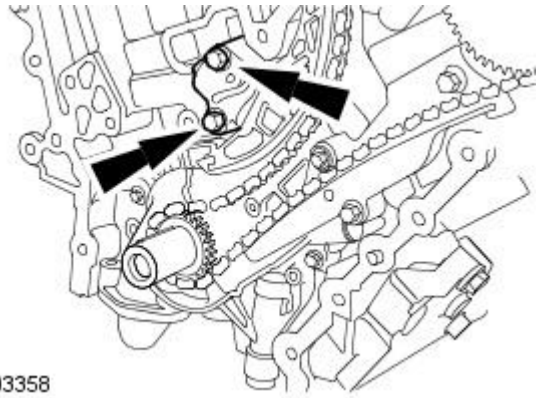
Reposition the timing chain tensioner plunger.


E48405

16. NOTE: Right-hand bank shown, left-hand bank similar.

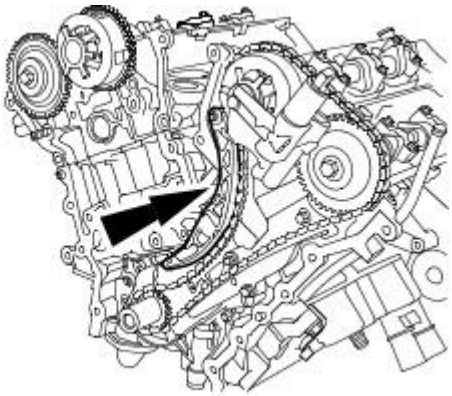
Retain the timing chain tensioner plunger.

17. Remove the left-hand timing chain tensioner.



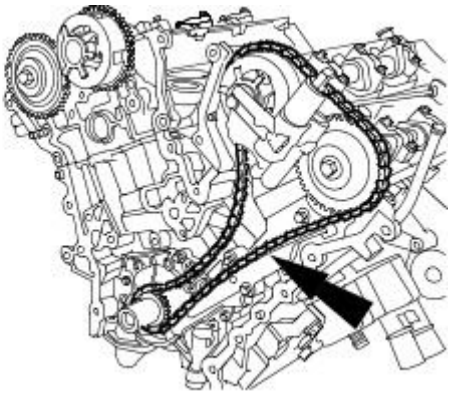
VUJ0003358

18. Remove the left-hand timing chain inner guide.



VUJ0003357

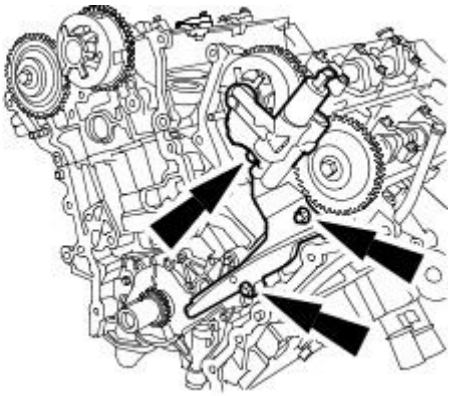
19. Remove the left-hand timing chain.



VUJ0003356

20. CAUTION: Inspect and replace the O-ring seal if necessary.

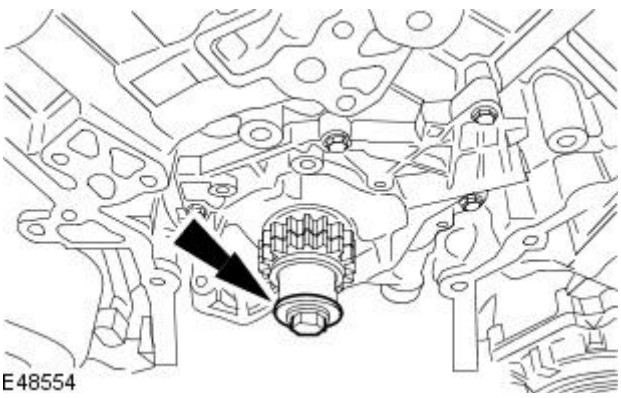
Remove the left-hand timing chain outer guide.



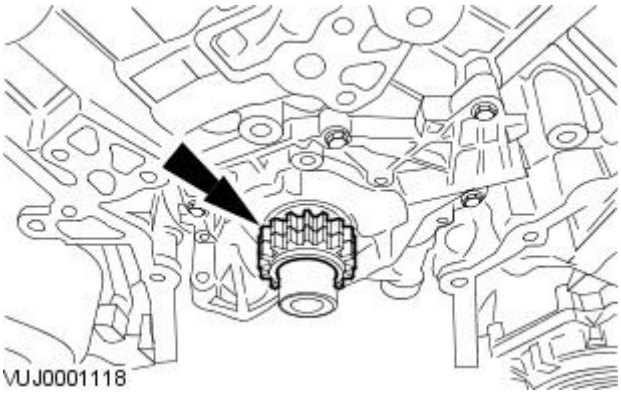
VUJ0003355

21. 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.

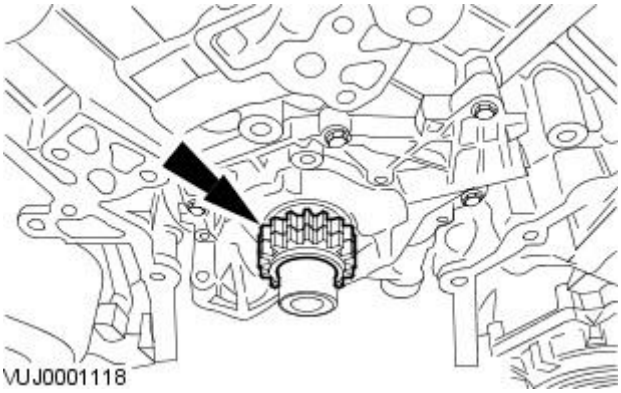


E48554



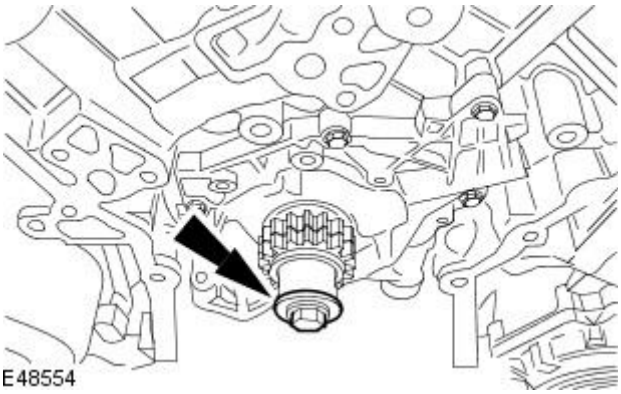
22. Remove the crankshaft sprocket.

Installation



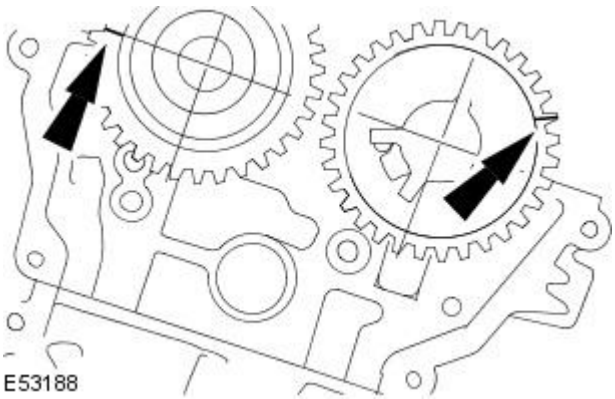
1. NOTE: Make sure the crankshaft sprocket timing marks are facing outwards.

Install the crankshaft sprocket.

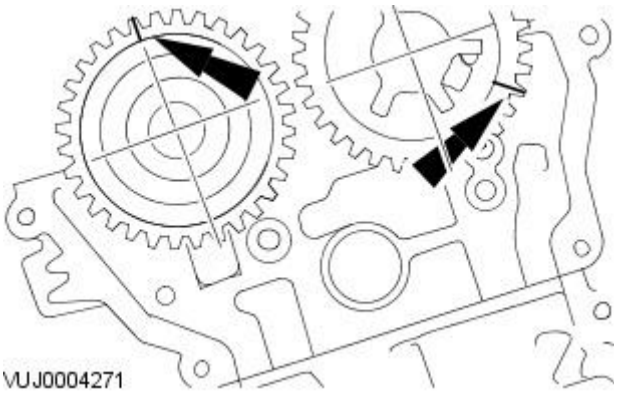


2. CAUTION: Make sure the crankshaft keyway is at the 9 O'clock position before the camshaft positions are aligned.

Install the crankshaft pulley retaining bolt and washer.



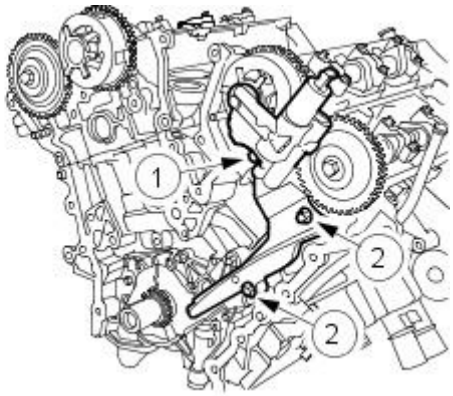
3. Rotate the left-hand intake camshaft clockwise until the camshaft sprocket alignment mark is at the 9 O'clock position and rotate the left-hand exhaust camshaft sprocket clockwise until the camshaft sprocket alignment mark is at the 2 O'clock position.


VUJ0004271

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 sprocket clockwise until the camshaft sprocket alignment mark is at the 12 O'clock position.

5. Rotate the crankshaft clockwise until the keyway is at the 11 O'clock position.

6. CAUTIONS:



VUJ0003807

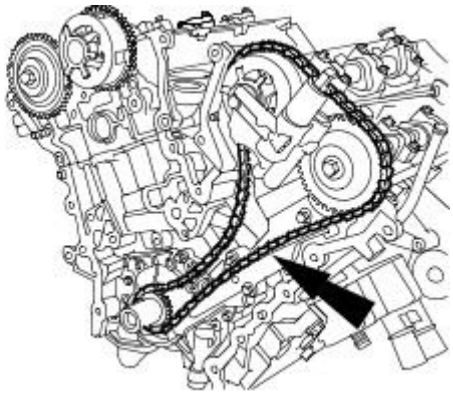
Inspect and replace the O-ring seal if necessary.

Make sure the O-ring seal is correctly installed.

Install the left-hand timing chain outer guide.

- Tighten the retaining bolts in the sequence shown in two stages.
- Stage 1: Tighten bolt 1 to 25 Nm.
- Stage 2: Tighten bolts 2 to 25 Nm.

7. CAUTIONS:


VUJ0003356

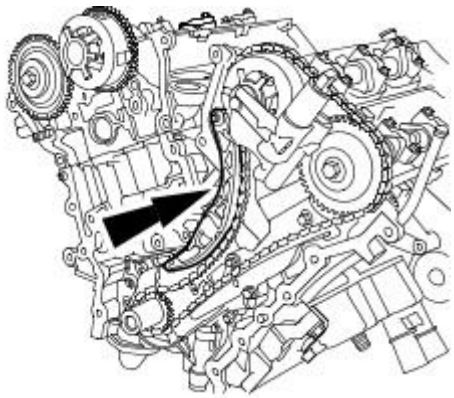
Make sure the crankshaft keyway is at the 11 O'clock position, the alignment mark on the left-hand intake camshaft sprocket is at the 9 O'clock position and the alignment mark on the left-hand exhaust camshaft sprocket is at the 2 O'clock position.

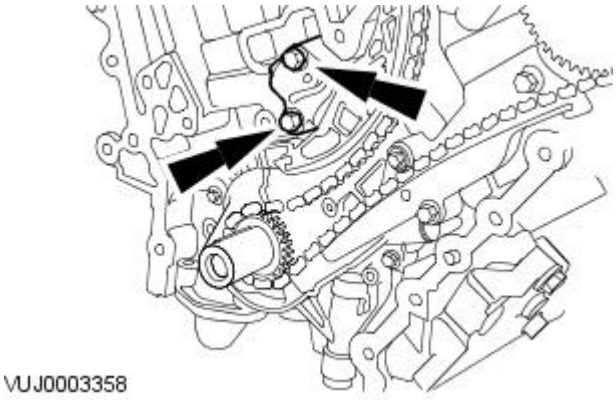
Make sure the timing chain alignment marks are correctly positioned to the crankshaft sprocket and camshaft sprocket alignment marks.

Make sure the timing chain slack is on the tensioned side of the timing chain.

Install the left-hand timing chain.

8. Install the left-hand timing chain inner guide.

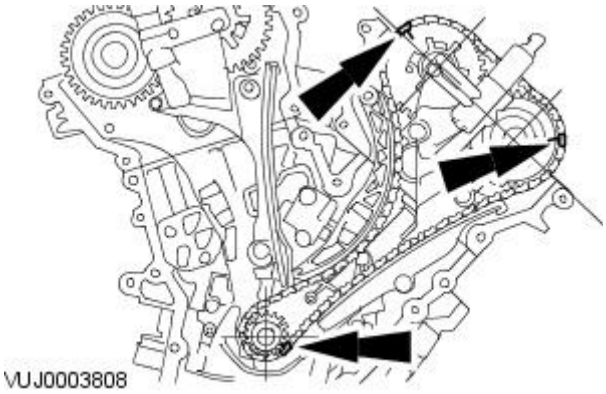

VUJ0003357


VUJ0003358

9. CAUTION: Do not manually adjust the timing chain tensioner.

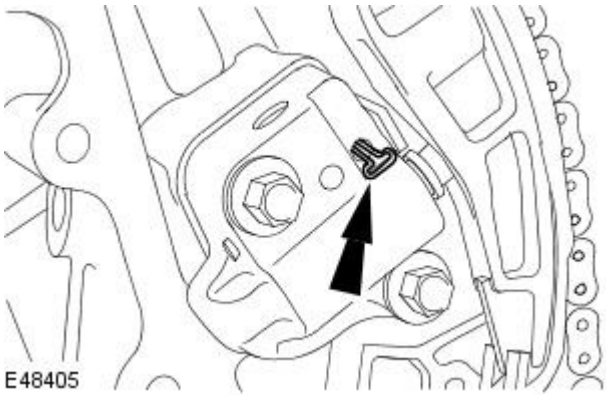
Install the left-hand timing chain tensioner.

- Tighten to 25 Nm.


VUJ0003808

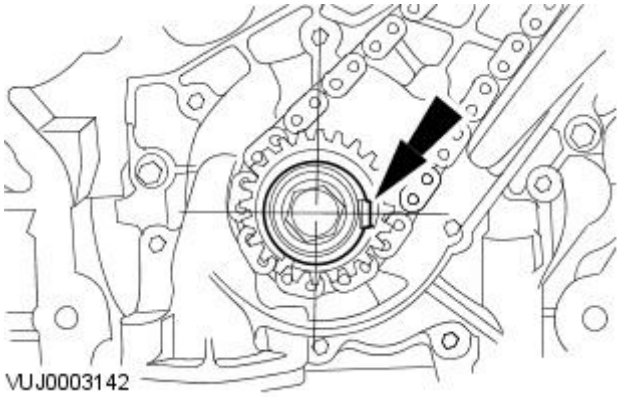
10. CAUTION: Do not manually adjust the timing chain tensioner.

Make sure the left-hand timing chain alignment marks have remained correctly positioned to the camshaft sprocket and crankshaft sprocket alignment marks.


E48405

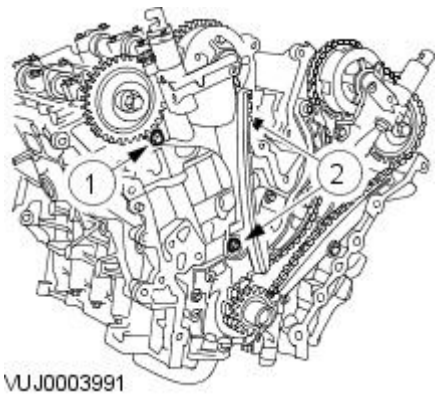
11. CAUTION: Do not manually adjust the timing chain tensioner.

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

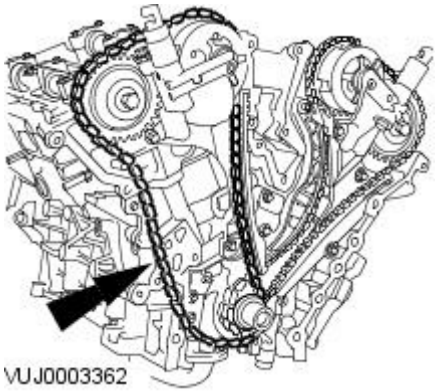
13. CAUTIONS:

Inspect and replace the O-ring seal if necessary.

Make sure the O-ring seal is correctly installed.

Install the right-hand timing chain inner guide.

- Tighten the retaining bolts in the sequence shown in two stages.
- Stage 1: Tighten bolt 1 to 25 Nm.
- Stage 2: Tighten bolts 2 to 25 Nm.


VUJ0003362

14. CAUTIONS:

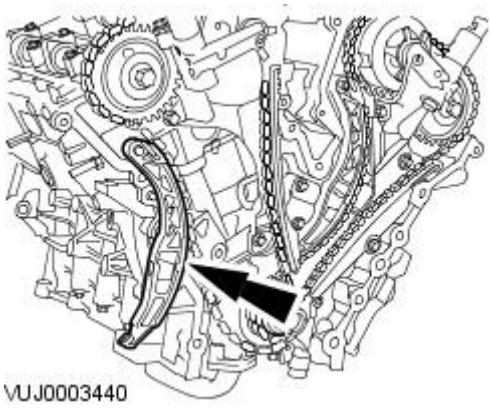
Make sure the crankshaft keyway is at the 3 O'clock position, the alignment mark on the right-hand intake camshaft sprocket is at the 5 O'clock position and the alignment mark on the right-hand exhaust camshaft sprocket is at the 12 O'clock position.

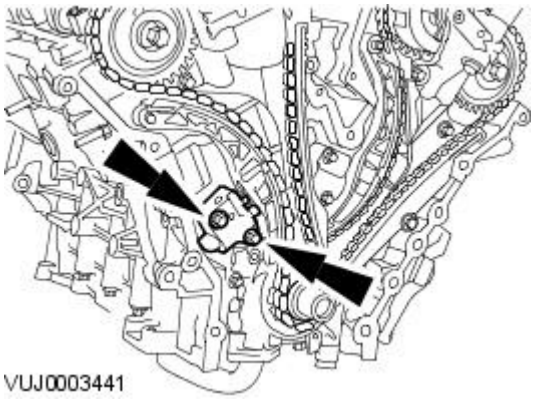
Make sure the timing chain alignment marks are correctly positioned to the crankshaft sprocket and camshaft sprocket alignment marks.

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.

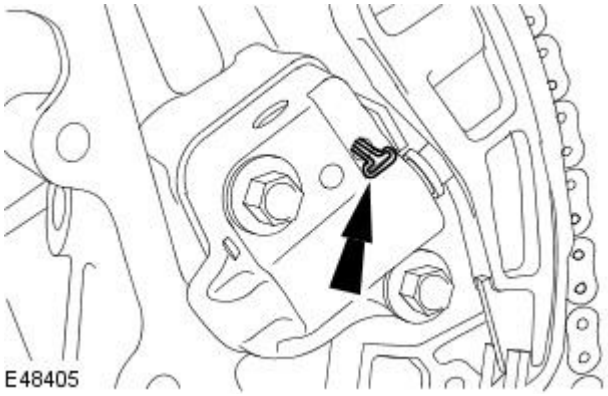

VUJ0003440


VUJ0003441

16. CAUTION: Do not manually adjust the timing chain tensioner.

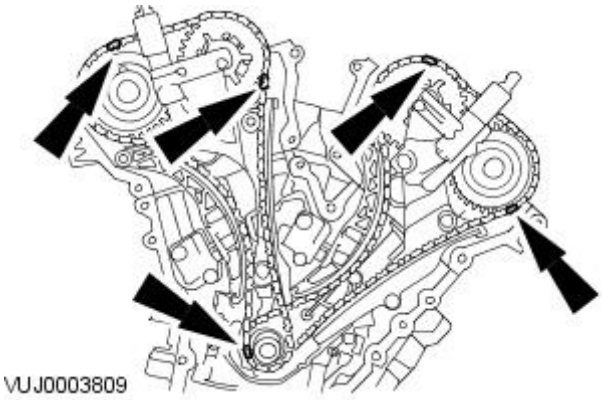
Install the right-hand timing chain tensioner.

- Tighten to 25 Nm.


E48405

17. CAUTION: Do not manually adjust the timing chain tensioner.

Remove the timing chain tensioner retaining pin.


VUJ0003809

18. CAUTIONS:

Make sure the right-hand timing chain alignment marks have remained correctly positioned to the camshaft sprocket and crankshaft sprocket alignment marks.

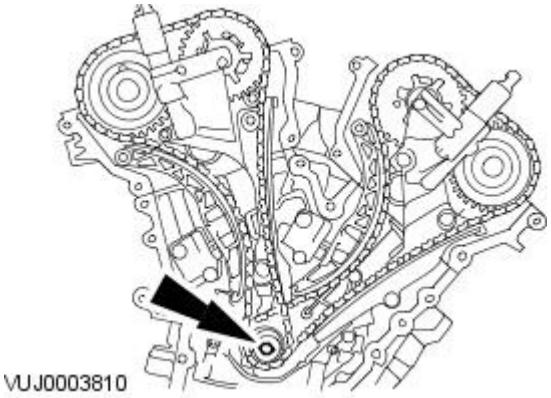
Do not manually adjust the timing chain tensioner.

Make sure all the timing chain alignment marks are in the positions shown.

19. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

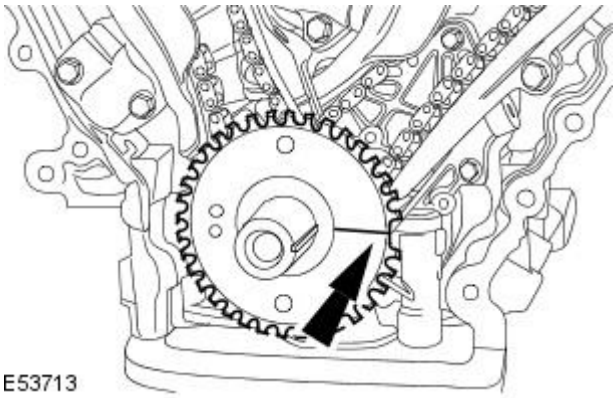
• NOTE: Rotate the crankshaft using hand tools only

Rotate the crankshaft two complete turns clockwise to make sure the valves and pistons do not clash.


VUJ0003810

20. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Remove the crankshaft pulley retaining bolt and washer.


E53713

21. CAUTIONS:

Make sure the CKP sensor pulse wheel is correctly installed with the missing tooth aligned to the crankshaft keyway.

Make sure the CKP sensor pulse wheel is correctly installed with the teeth pointing outwards.

Install the 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 (303-01A Engine - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, In-vehicle Repair).

Published: 11-May-2011

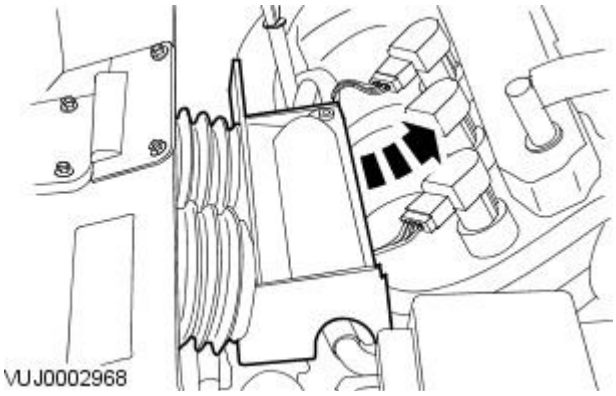
Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Valve Cover LH

In-vehicle Repair

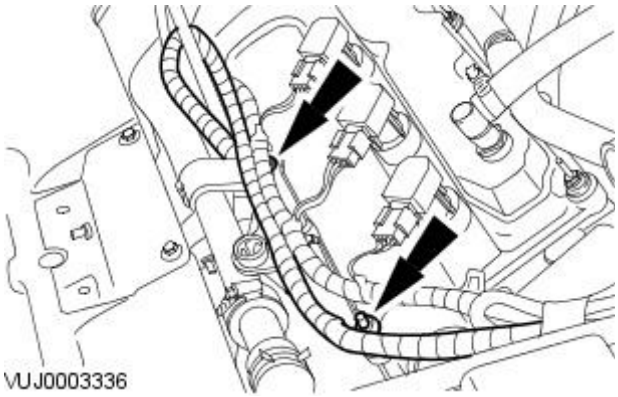
Removal

All vehicles

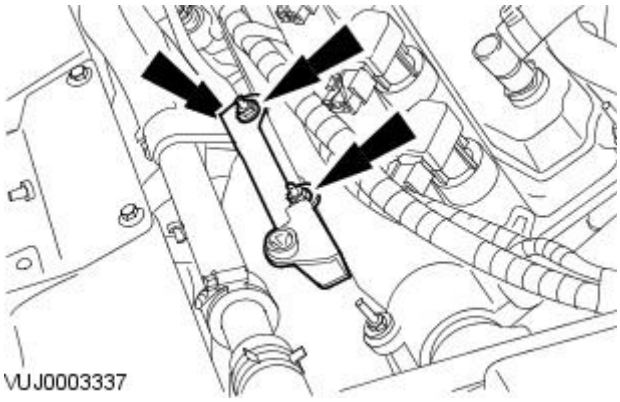
1. Remove the ignition coils. For additional information, refer to Section 303-07A Engine IgnitionSection 303-07B Glow Plug System.
2. Remove the air filter intake pipe.
   - 2.5 and 3.0L shown, 2.0L similar.



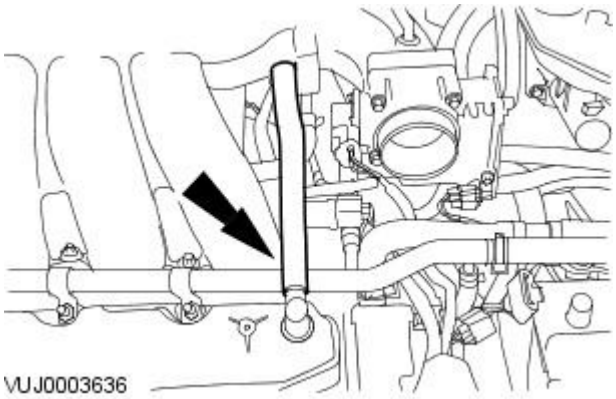
3. Detach the wiring harness.
   - 2.5 and 3.0L shown, 2.0L similar.



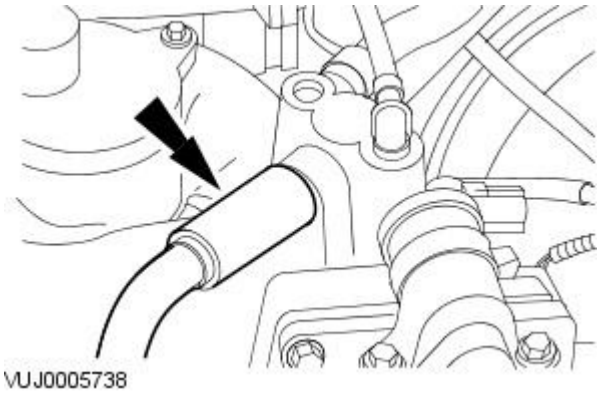
4. Remove the air filter retaining bracket.
   - 2.5 and 3.0L shown, 2.0L similar.



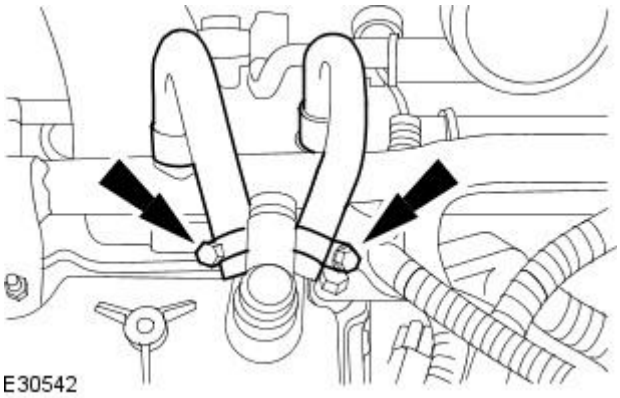
5. Detach the positive crank case ventilation hose.
   - 2.5 and 3.0L shown, 2.0L similar.



Vehicles with 2.0L engine

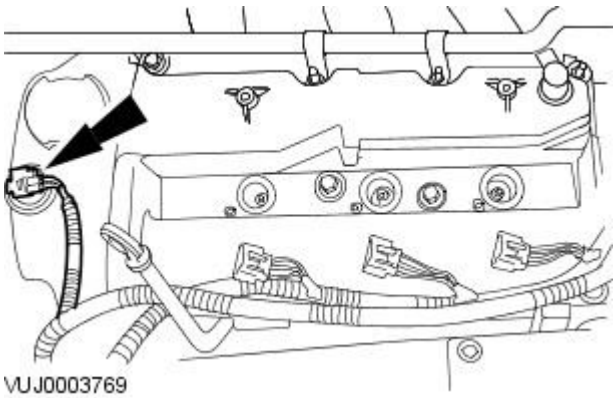

VUJ0005738

6. Detach the positive crank case ventilation hose.


E30542

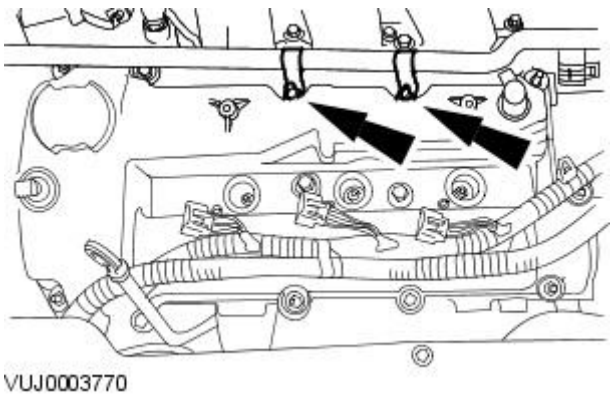
7. Detach the heated positive crankcase ventilation valve coolant pipes.

All vehicles


VUJ0003769

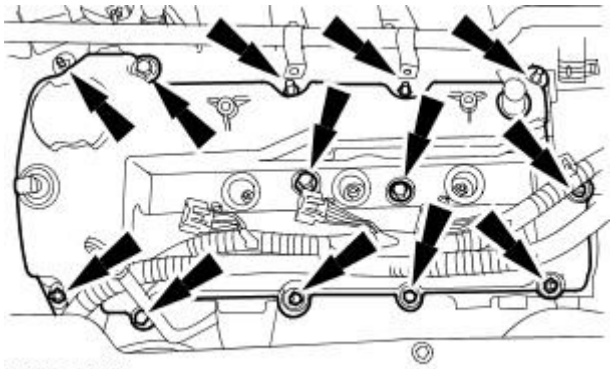
8. Disconnect the variable camshaft timing (VCT) solenoid electrical connector.

- 2.5 and 3.0L shown, 2.0L similar.


VUJ0003770

9. Detach the coolant hose.

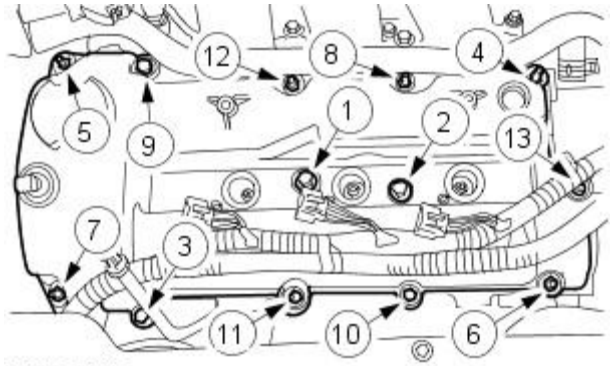
- 2.5 and 3.0L shown, 2.0L similar.


VUJ0003771

10. Remove the valve cover.

- Remove and discard the valve cover gaskets.
  1. 2.5 and 3.0L shown, 2.0L similar.

Installation



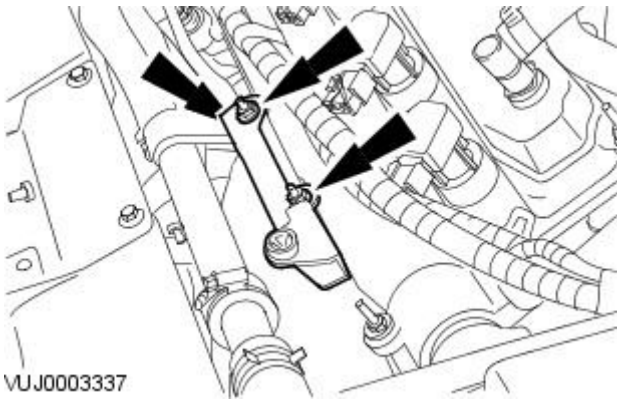
VUJ0003772

1. NOTE: Apply a 5 mm diameter bead of silicone gasket sealant WSE-M4G323-A6 or equivalent meeting Jaguar specification on the half round gaskets, apply an 8 mm diameter bead of silicone gasket sealant on the two places where the cylinder head and front timing cover join and the twe places wherethe cylindar head and the water pump join.

• NOTE: Make sure that the valve cover isolator mounts are correctly installed to the new valve cover gaskets.

To install, reverse the removal procedure.

- Install the new valve cover gaskets.
- Complete the tightening sequence.
- Tighten to 10 Nm.
  1. 2.5 and 3.0L shown, 2.0L similar.


VUJ0003337

2. Tighten to 6 Nm.

- 2.5 and 3.0L shown, 2.0L similar.

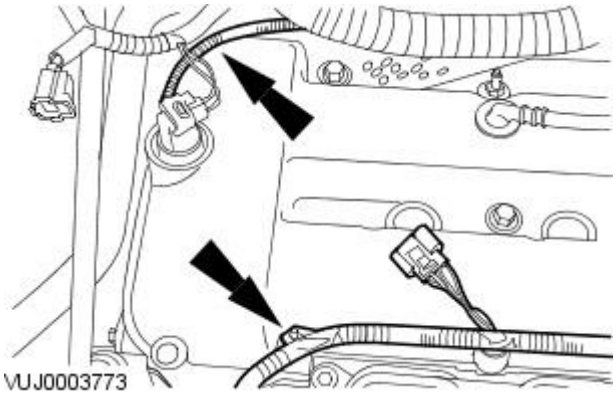
Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Valve Cover RH

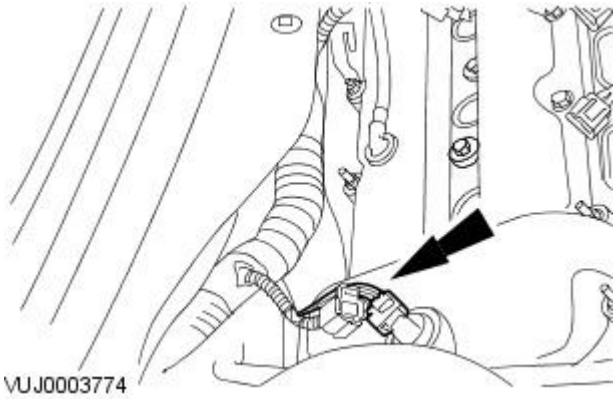
In-vehicle Repair

Removal

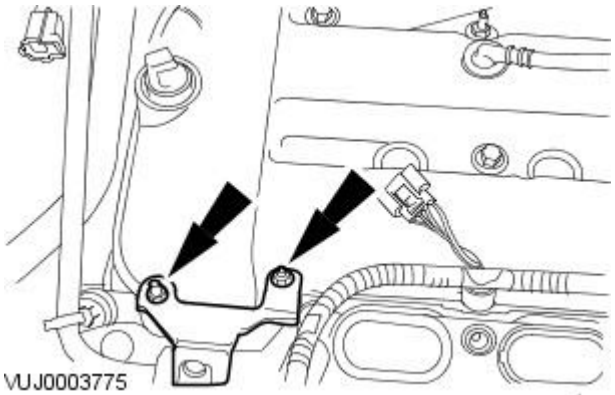
1. Remove the ignition coils. For additional information, refer toSection 303-07A Engine IgnitionSection 303-07B Glow Plug System.
2. Detach the wiring harness.



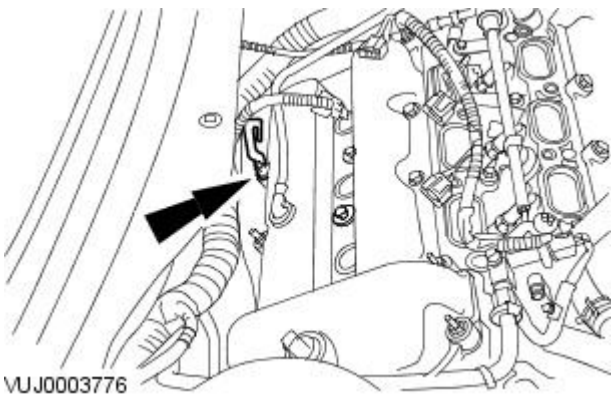
3. Disconnect the variable camshaft timing (VCT) solenoid electrical connector.

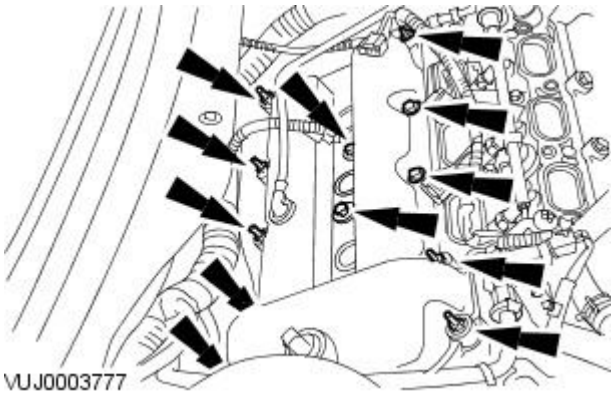


4. Remove the engine cover retaining bracket.



5. Remove the intake manifold support bracket.

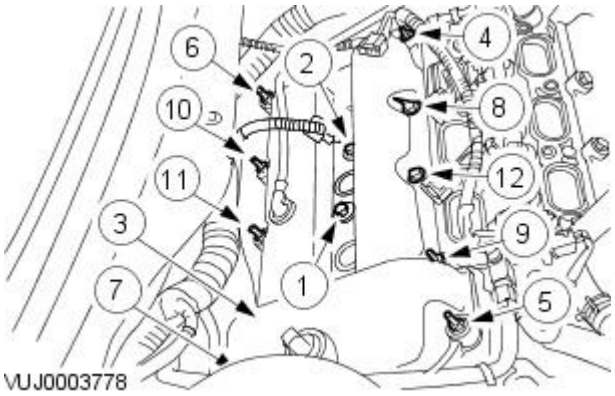




6. Remove the valve cover.

- Remove and discard the valve cover gaskets.

Installation

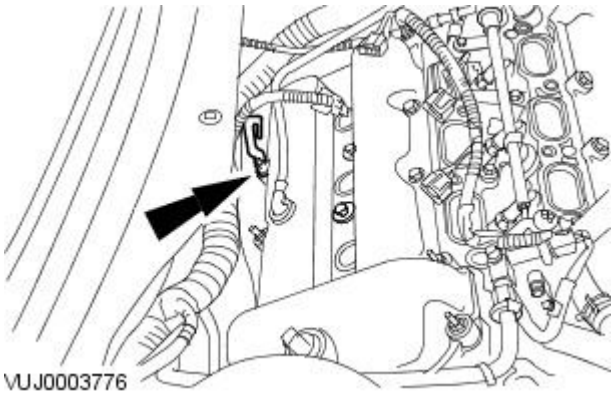


1. NOTE: Apply a 5 mm diameter bead of silicone gasket sealant WSE-M4G323-A6 or equivalent meeting Jaguar specification on the half round gaskets and apply an 8 mm diameter bead of silicone gasket sealant on the two places where the cylinder head and front timing cover join.

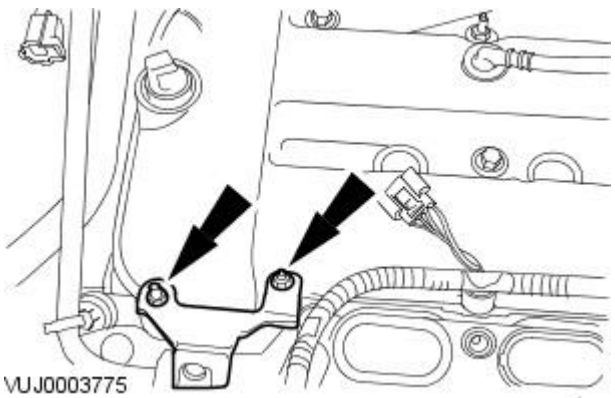
• NOTE: Make sure that the valve cover isolator mounts are correctly installed to the new valve cover gaskets.

To install, reverse the removal procedure.

- Install the new valve cover gaskets.
- Complete the tightening sequence.
- Tighten to 10 Nm.



2. Tighten to 6 Nm.

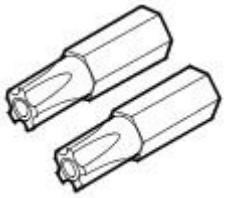
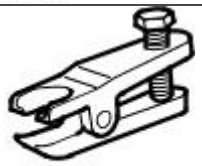
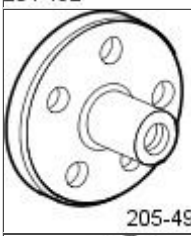
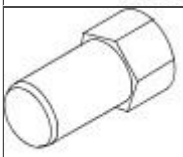
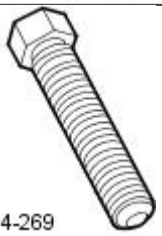
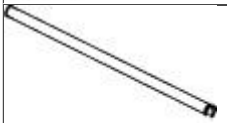


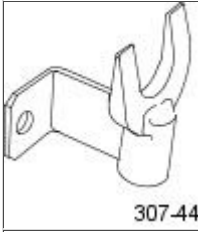
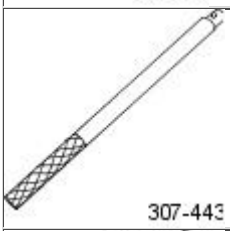
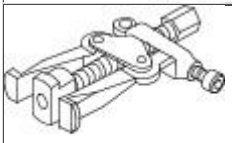
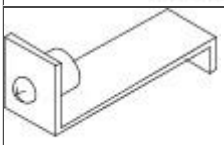
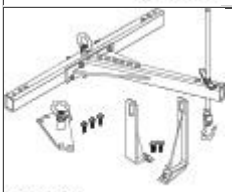
3. Tighten to 6 Nm.

Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - EngineVehicles With: 5-Speed Manual Transmission - MT75 / 6-Speed Manual Transaxle - MMT6

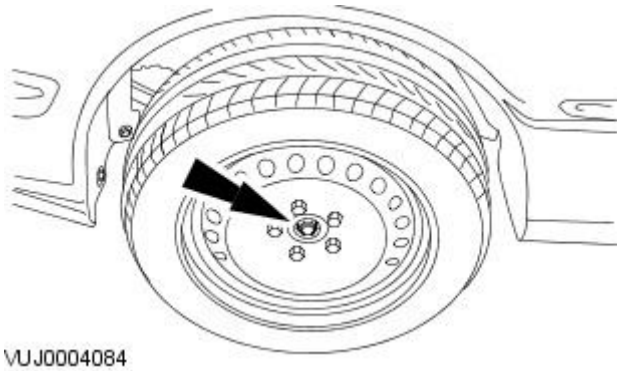
Removal

Special Tool(s)	
 HTJ12002	Powertrain Assembly Jack HTJ1200-2
 418-535	5 Point Security Torx Bit 418-535
 204-192	Ball joint splitter 204-192
 205-491	Wheel hub puller 205-491
 20549101	Adaptor nuts 205-491-01
 204-269	Forcing screw 204-269
 100012	Slide hammer 100-012
 100-012-02	Slide hammer shaft 100-012-02
 204-226	Halfshaft remover fork 204-226

 307-442	Right-hand halfshaft splitter 307-442
 307-443	Right-hand halfshaft splitter handle 307-443
 308-208	Pinion oil seal remover 308-208
 307-446	Link shaft limiting tool 307-446
 303707	Engine lifting kit 303-707

Removal

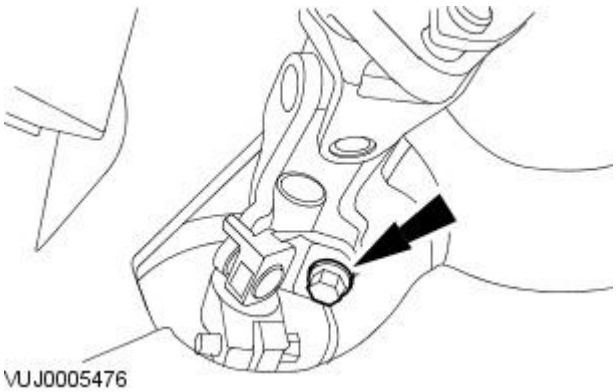
All vehicles


VUJ0004084

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

   Loosen the front hub retaining nuts.

2. Drain the transaxle.
   For additional information, refer to: Transaxle Draining and Filling - Vehicles With: 6-Speed Manual Transaxle - MMT6 (308-03 Manual Transmission/Transaxle, General Procedures).
3. Remove the steering column lower retaining bolt.

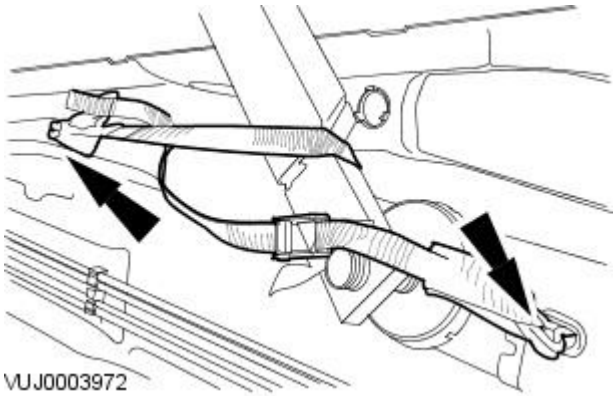

VUJ0005476

4. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
5. Recover the air conditioning (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).

6. Remove the front wheels and tires.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

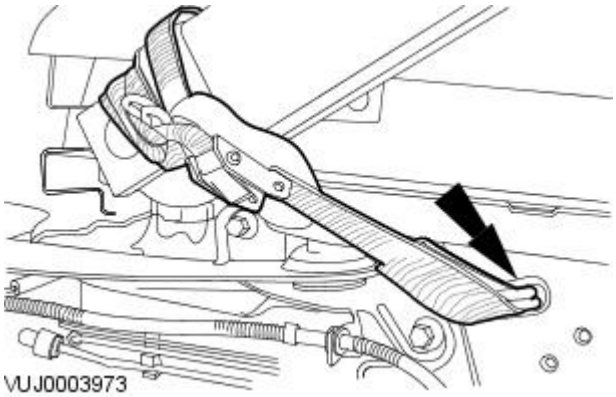
7. Drain the cooling system.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).


VUJ0003972

8. CAUTION: To prevent the vehicle becoming unstable when the engine and transmission assembly are removed, install the vehicle tie down straps.

• NOTE: Right-hand shown, left-hand similar.

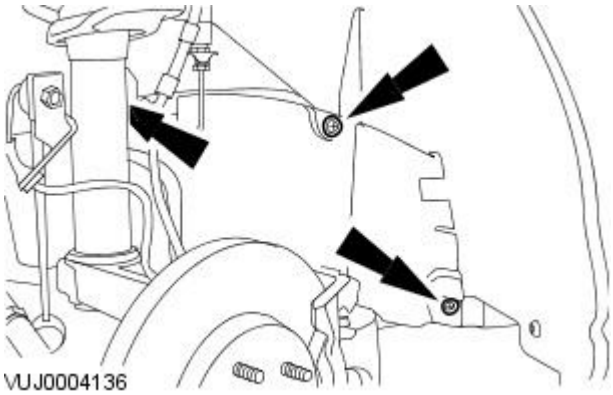
Install the front vehicle tie down strap.


VUJ0003973

9. CAUTION: To prevent the vehicle becoming unstable when the engine and transmission assembly are removed, install the vehicle tie down straps.

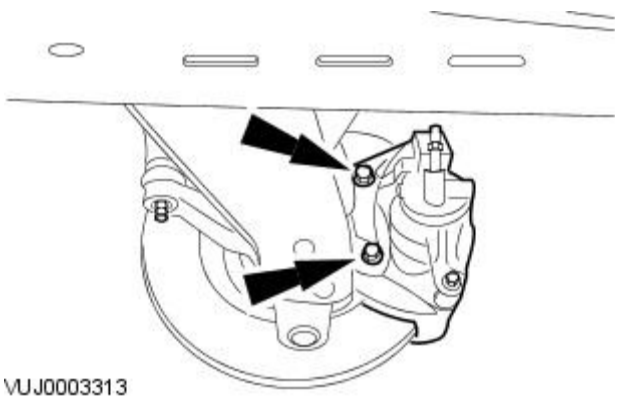
• NOTE: Right-hand shown, left-hand similar.

Install the rear vehicle tie down strap.


VUJ0004136

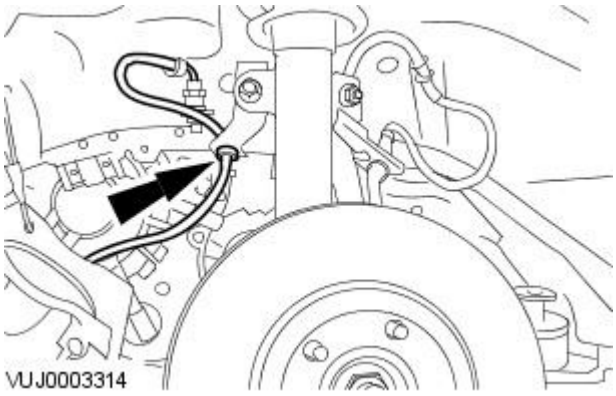
10. NOTE: Right-hand shown, left-hand similar.

Remove the splash shield.


VUJ0003313

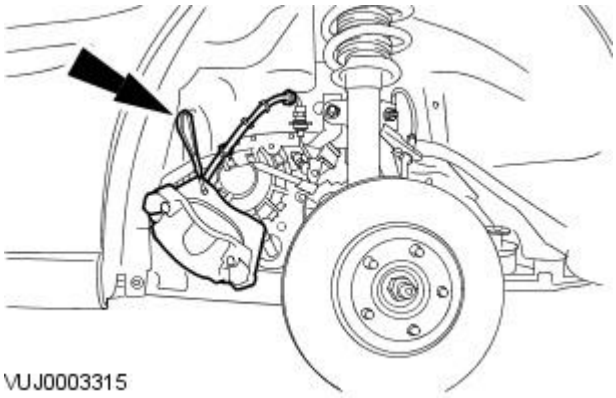
11. NOTE: Left-hand shown, right-hand similar.

Detach the brake caliper assembly.



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

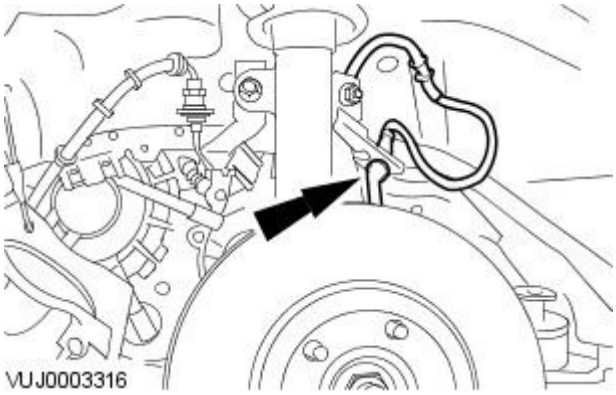
Detach the brake pipe.



13. NOTE: Support the brake caliper assembly using tie straps.

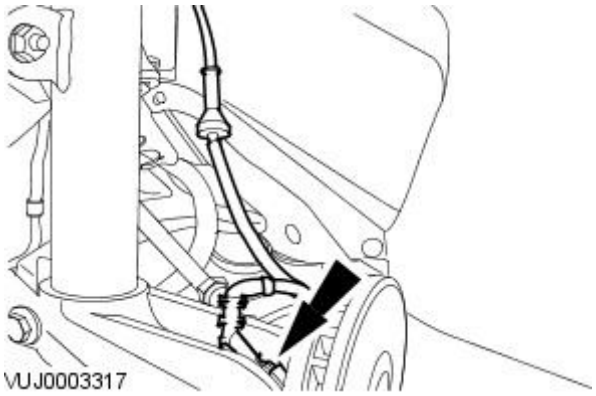
- NOTE: Left-hand shown, right-hand similar.

Reposition and secure the brake caliper assembly.



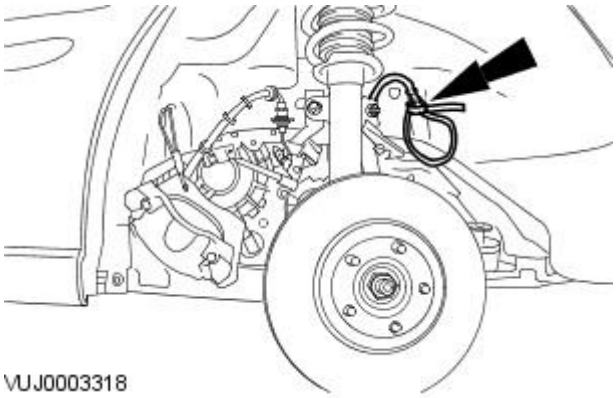
14. NOTE: Left-hand shown, right-hand similar.

Detach the anti-lock braking system (ABS) wheel speed sensor.



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

Disconnect the ABS wheel speed sensor.



16. NOTE: Secure the ABS wheel speed sensor using tie straps.

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

Reposition and secure the ABS wheel speed sensor.

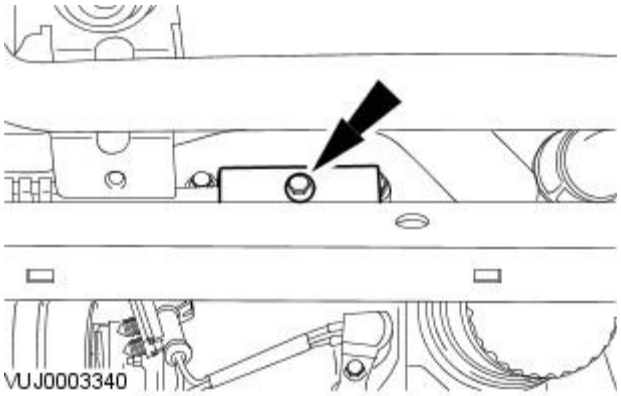
17. Remove the cooling fan motor and shroud.
For additional information, refer to: Cooling Fan Motor and Shroud (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

Vehicles with 2.5L or 3.0L engine

18. Remove the driveshaft.
For additional information, refer to: Driveshaft (205-01 Driveshaft, Removal and Installation).

All vehicles

19. Remove the front muffler.
For additional information, refer to: Front Muffler - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (309-00 Exhaust System, Removal and Installation).



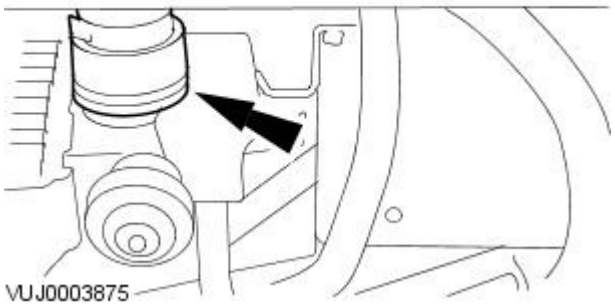
20. NOTE: Using a suitable blanking plug, seal the tube and the A/C compressor.

• NOTE: Secure the A/C compressor supply and return tubes using tie straps.

Detach the A/C compressor supply and return tubes.

- Remove and discard the O-ring seals.

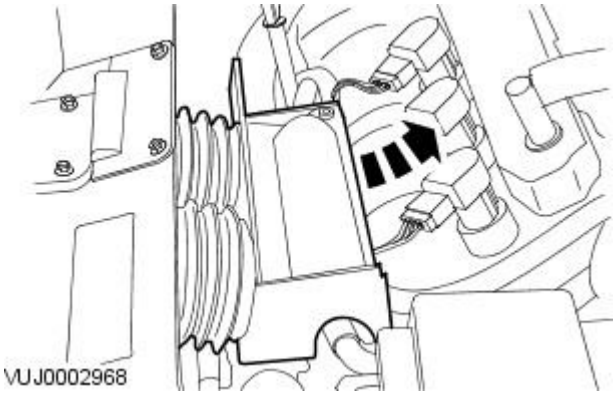
21. Detach the coolant hose.



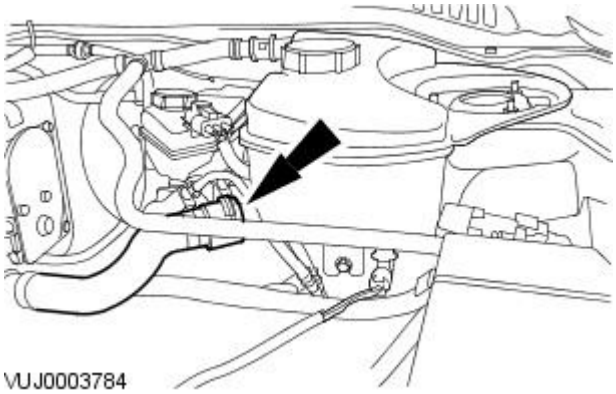
22. Lower the vehicle.

23. Remove the air cleaner.
For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

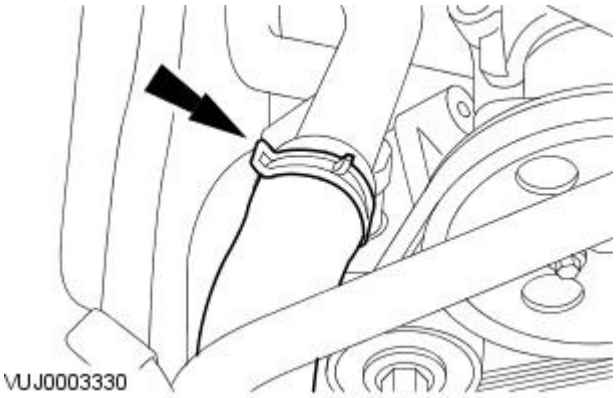
24. Remove the air filter intake pipe.



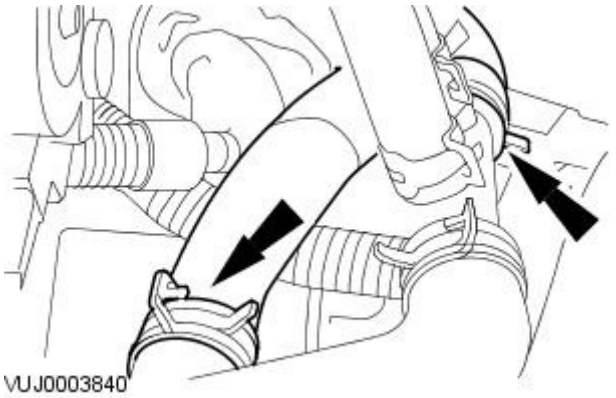
25. Detach the coolant hose.



26. Detach the coolant hose.

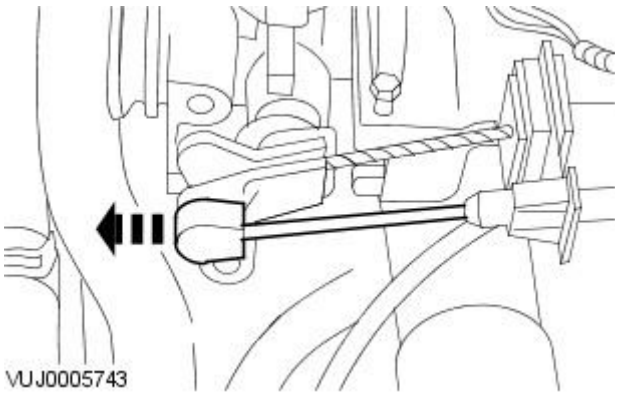


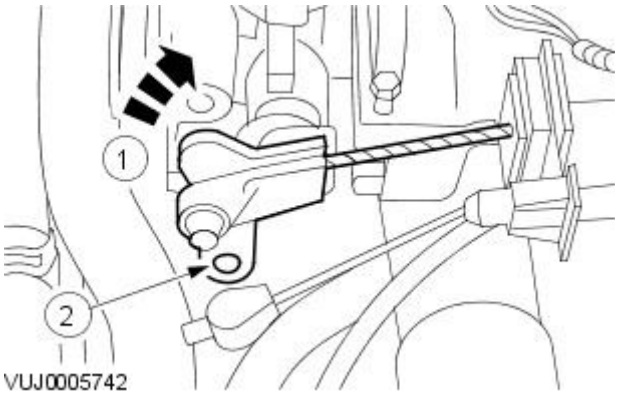
27. Detach the coolant hoses.



Vehicles with 2.0L engine

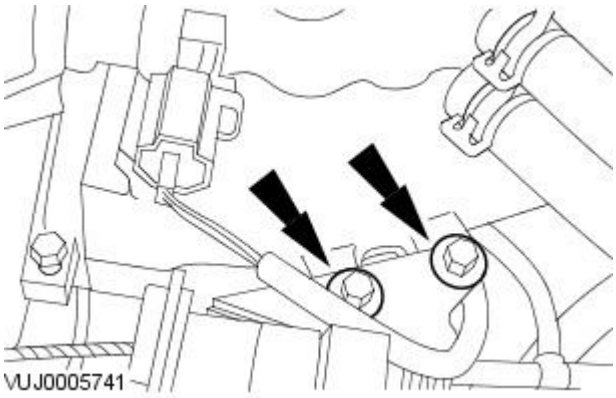
28. Detach the cruise control cable.



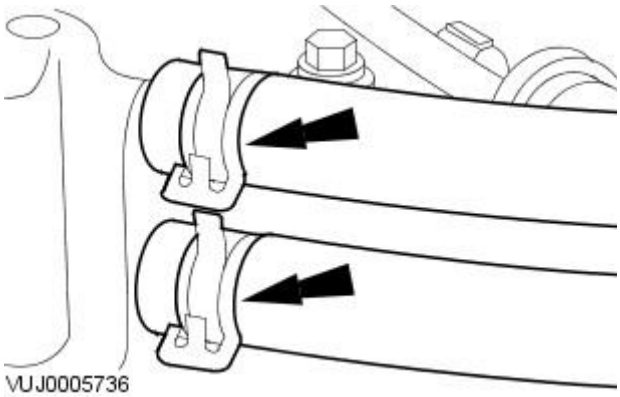


29. Detach the accelerator cable.

1. Reposition the accelerator lever to the fully open position.
2. Detach the accelerator cable.

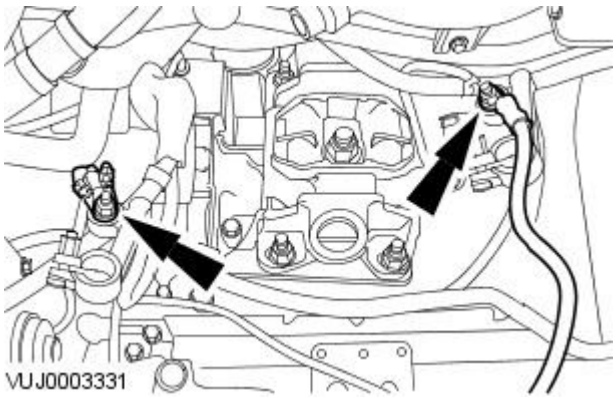


30. Detach the accelerator cable retaining bracket.

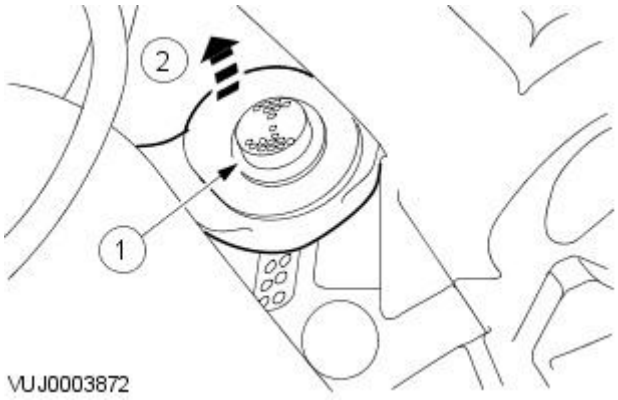


31. Detach the coolant hoses.

All vehicles



32. Detach the battery cables.

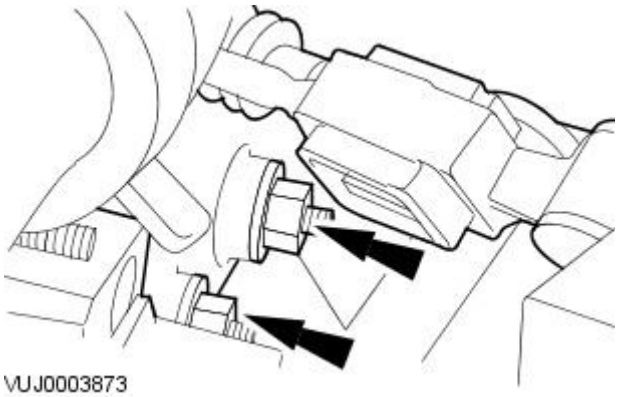


VUJ0003872

33. NOTE: Upper selector cable shown, lower selector cable similar.

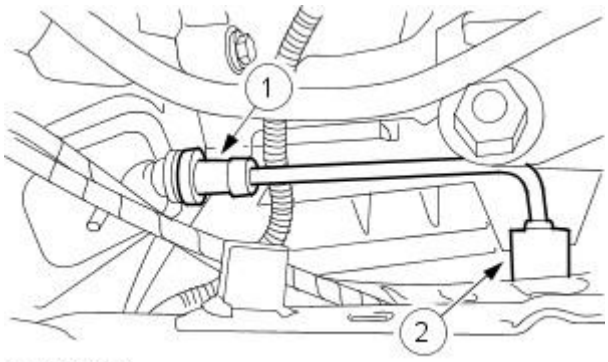
Detach the selector cables.

1. Press the button.
2. Detach the selector cables.


VUJ0003873

34. NOTE: Secure the selector cables using tie straps.

Detach the selector cables.



VUJ0003874

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

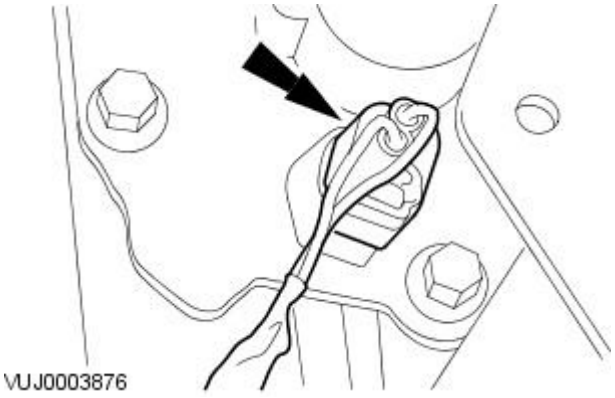
• NOTE: Drain the fluid into a suitable container.

• NOTE: Using a suitable blanking plug, seal the pipe and the slave cylinder.

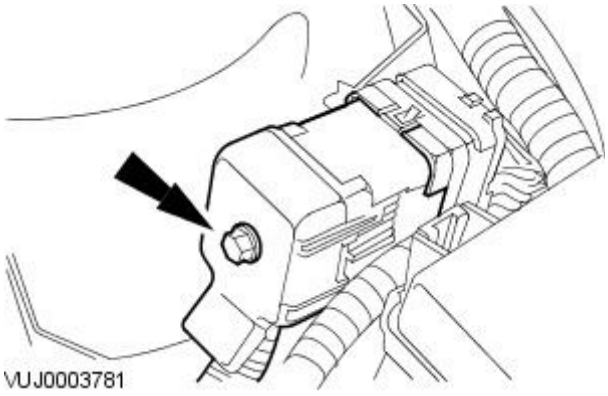
• NOTE: Secure the clutch slave cylinder pipe using tie straps.

Disconnect the clutch slave cylinder pipe and secure to one side.

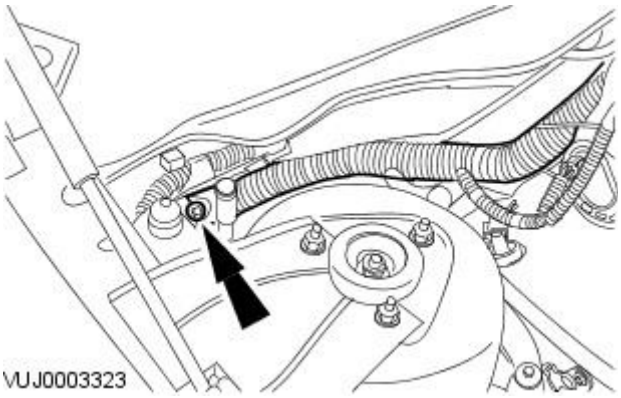
1. Detach the clutch slave cylinder pipe from the slave cylinder.
2. Detach the clutch cylinder from the retaining bracket.


VUJ0003876

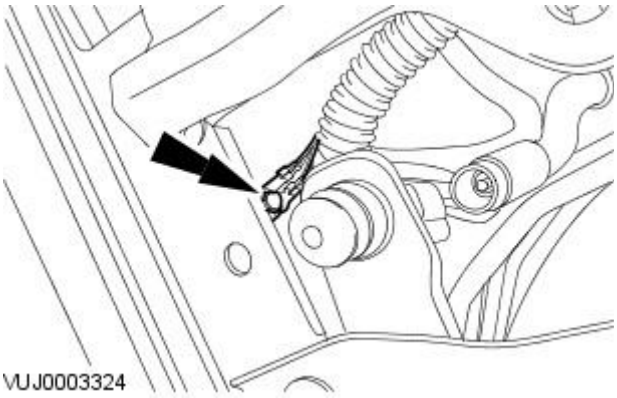
36. Disconnect the reverse light switch electrical connector.


VUJ0003781

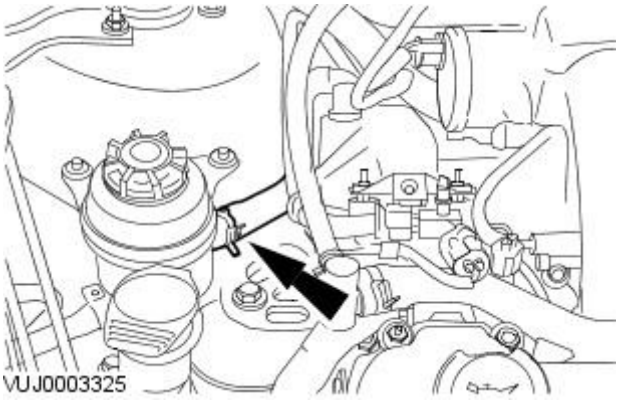
37. Disconnect the engine harness electrical connector.



38. Using special tool 418-535, disconnect the engine control module (ECM) electrical connector.



39. Disconnect the ground cable.

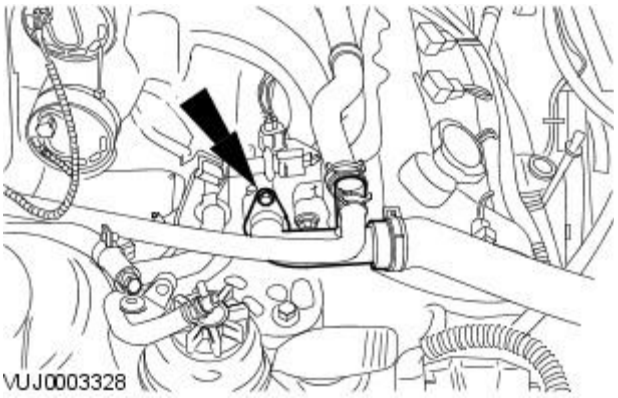


40. NOTE: Drain the fluid into a suitable container.

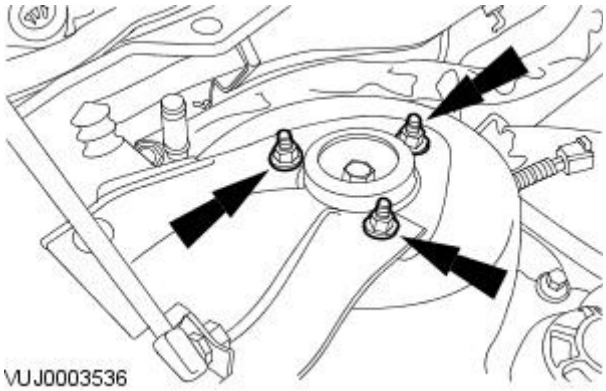
- NOTE: Use a suitable blanking plug to seal the hose.

Detach the power steering hose.

41. Disconnect the spring lock coupling.
For additional information, refer to: Spring Lock Couplings (310-00 Fuel System - General Information, General Procedures).



42. Detach the coolant pipe.

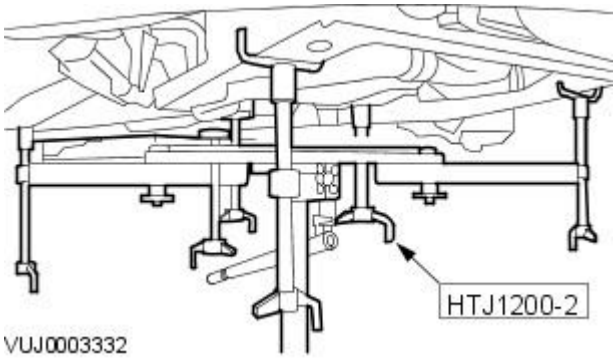


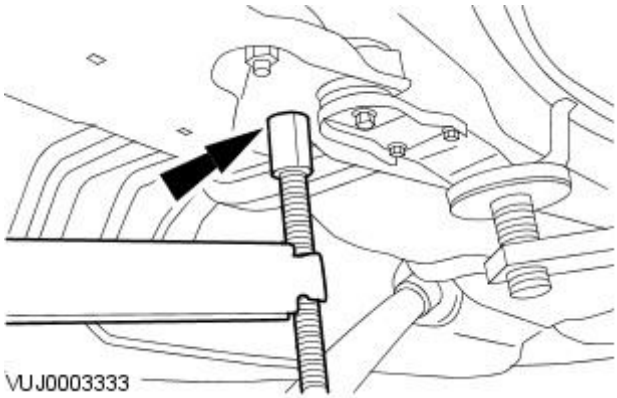
43. NOTE: Right-hand shown, left-hand similar.

Detach the strut and spring assembly.

44. Raise the vehicle.

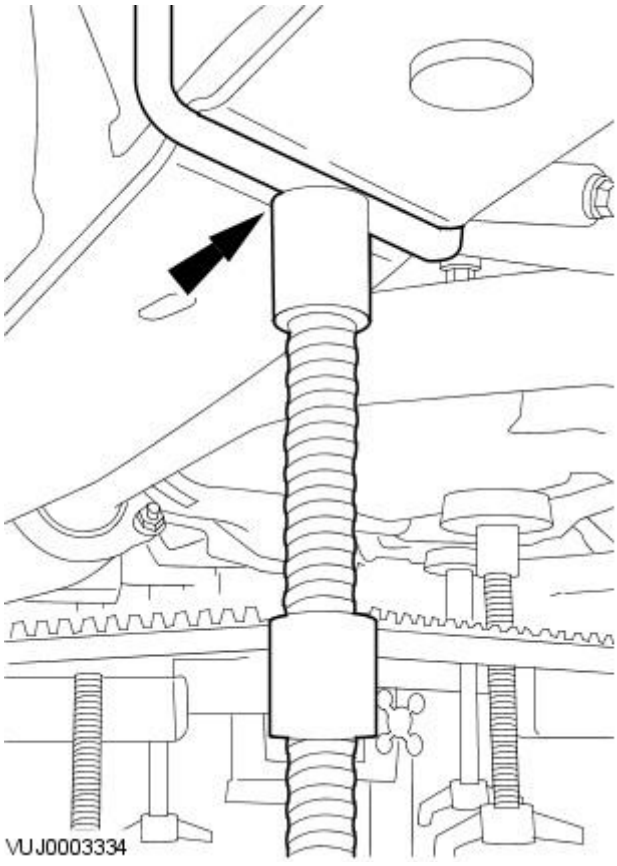
45. Install the special tool.





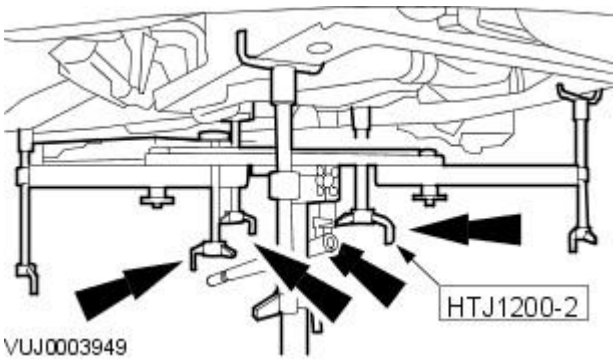
46. NOTE: Left-hand shown, right-hand similar.

Position and adjust the special tool rear height adjuster.

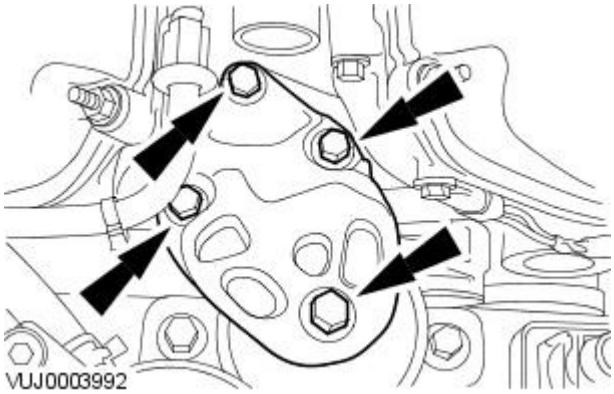


47. NOTE: Right-hand shown, left-hand similar.

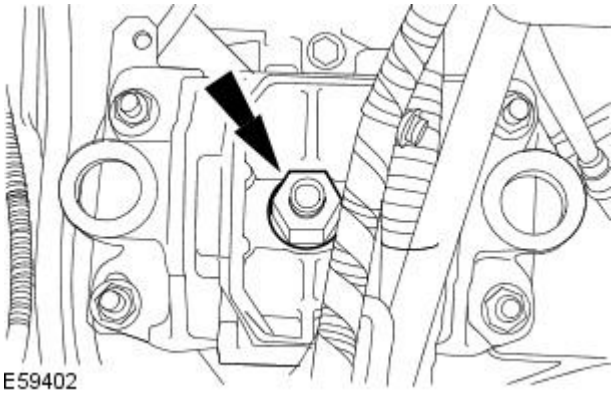
Position and adjust the special tool front height adjuster.



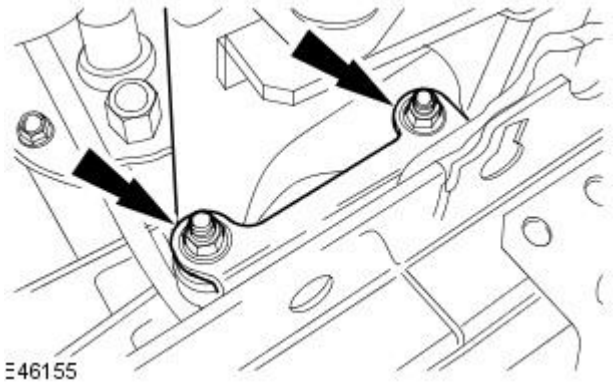
48. Position and adjust the special tool engine height adjusters.



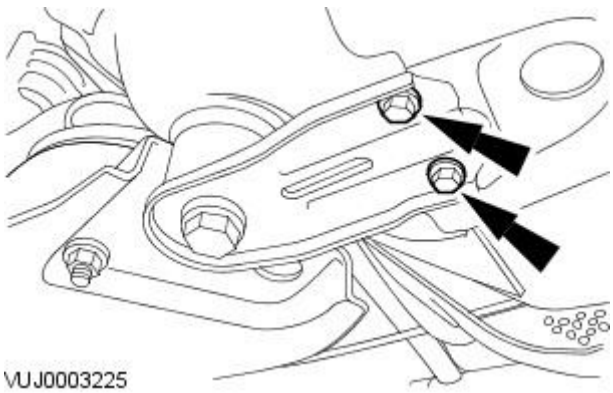
49. Remove the engine support bracket.



50. Remove the transaxle mount bracket securing nut.

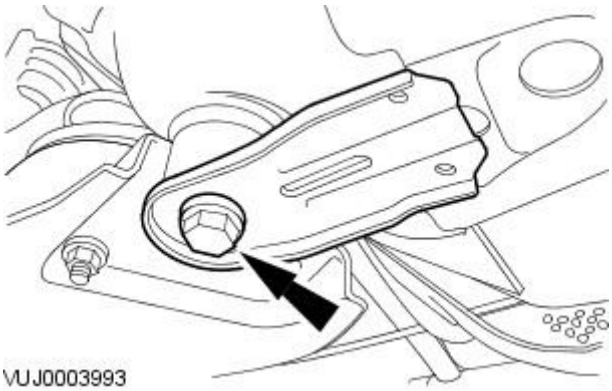


51. Remove the clutch master cylinder to clutch slave cylinder high-pressure pipe support bracket.



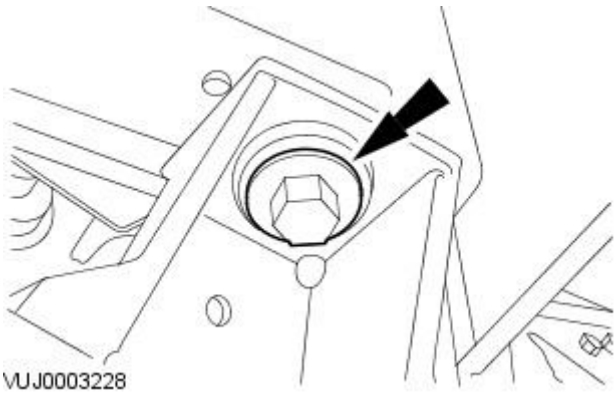
52. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe reinforcement plate retaining bolts.



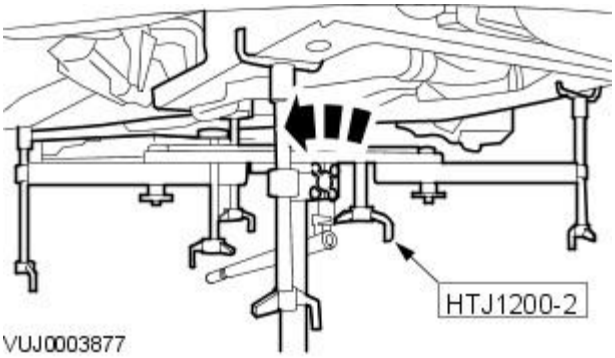
53. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe reinforcement plate.



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

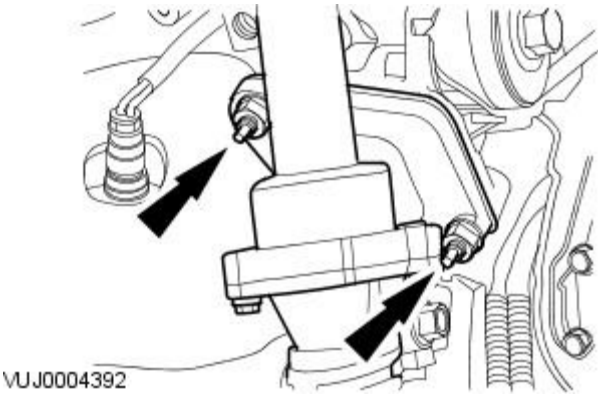
Detach the front subframe.



55. WARNING: Rotate the special tool height adjustment valve slowly. Failure to follow this instruction may result in personal injury.

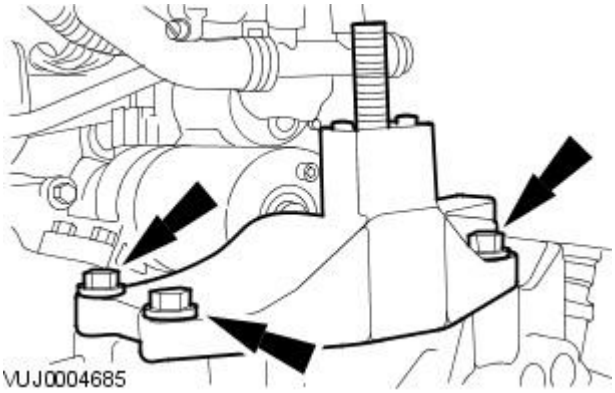
Remove the engine and transaxle assembly.

- Rotate the special tool height adjustment valve counter clockwise.



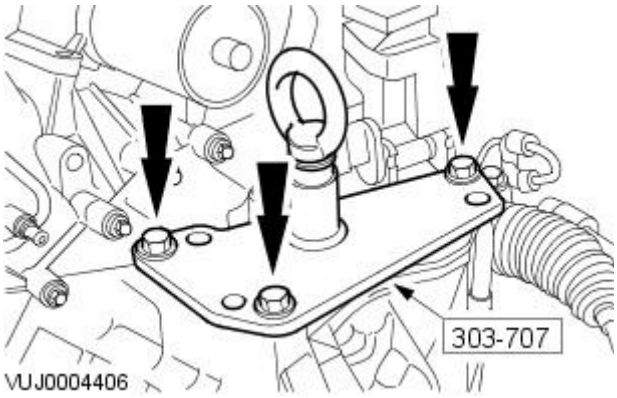
56. Remove the coolant system top hose.

- Remove and discard the gasket.

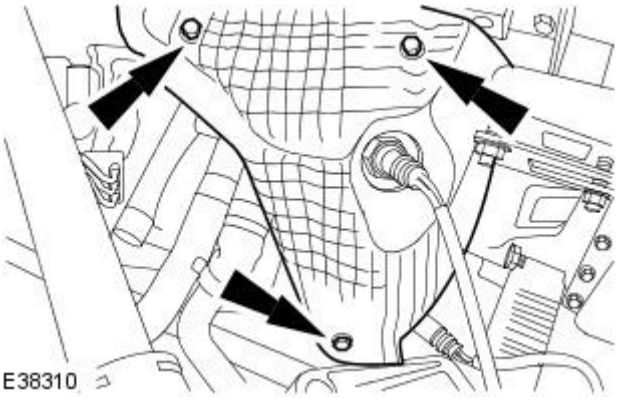


57. Remove the transaxle mount.

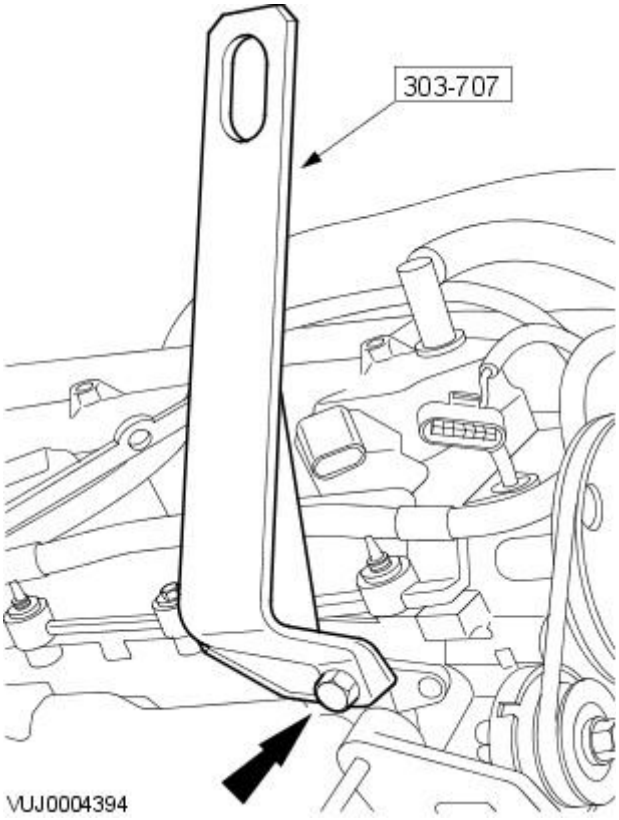
58. Install the special tool.



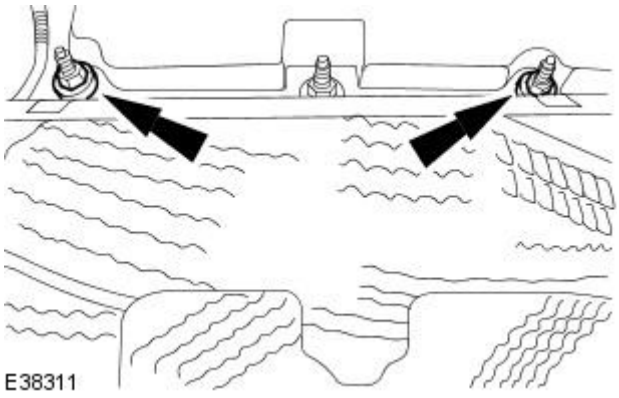
59. Remove the left-hand exhaust manifold heat shield.



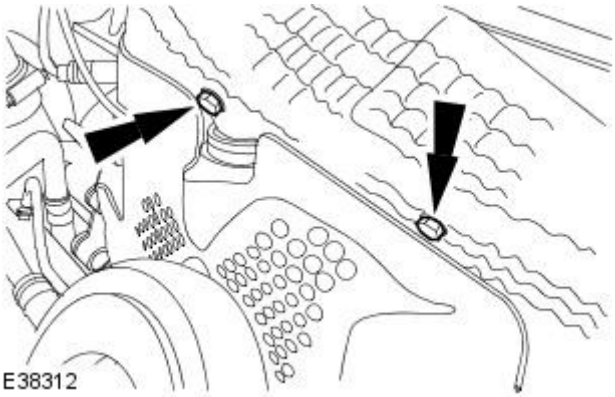
60. Install the special tool.



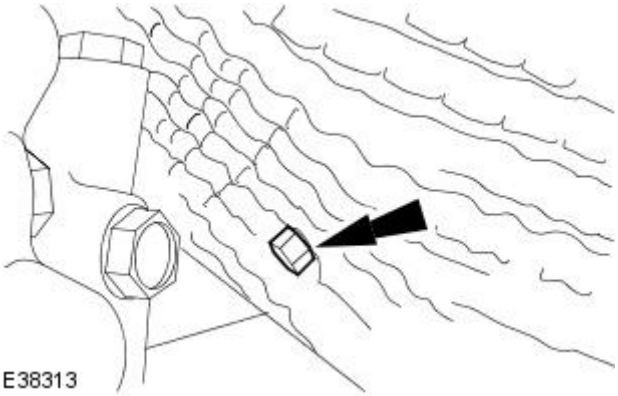
61. Remove the upper exhaust heat shield.



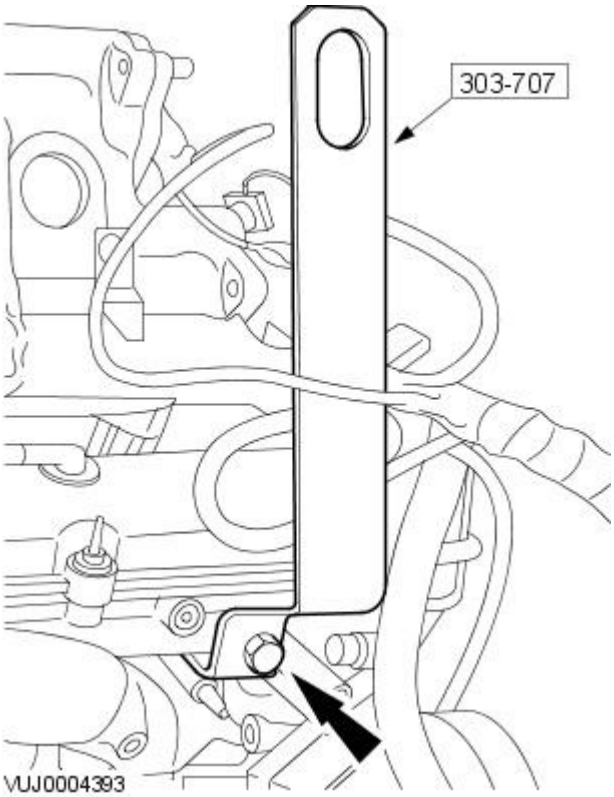
62. Remove the center exhaust heat shield retaining bolts.



63. Remove the center exhaust heat shield.

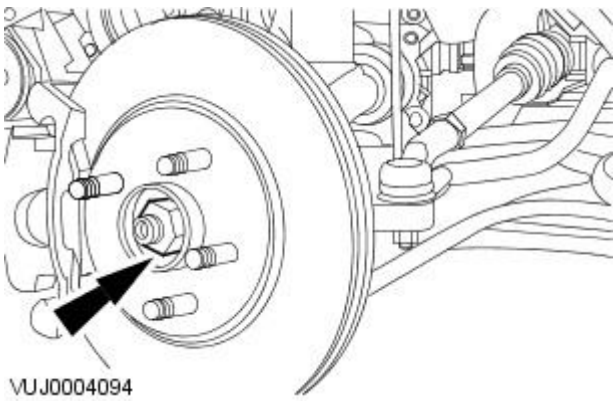


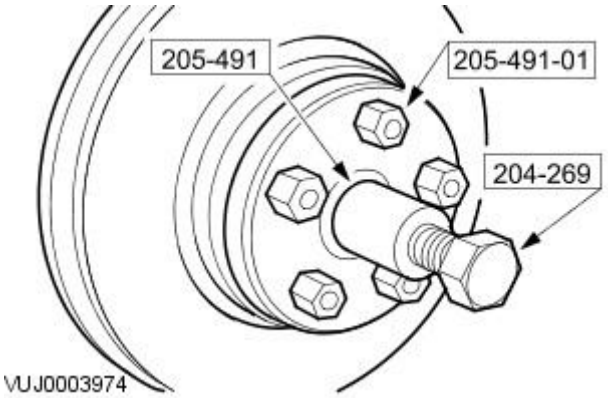
64. Install the special tool.



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

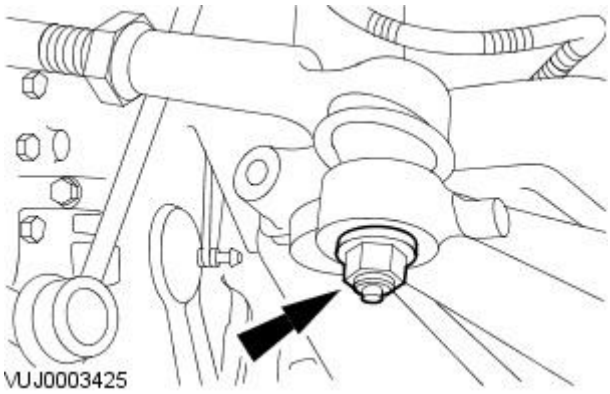
Remove the front wheel hub retaining nuts.





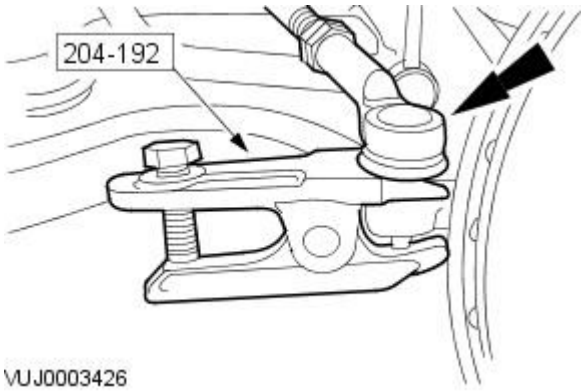
66. NOTE: Left-hand shown, right-hand similar.

Using the special tools, detach the halfshafts.



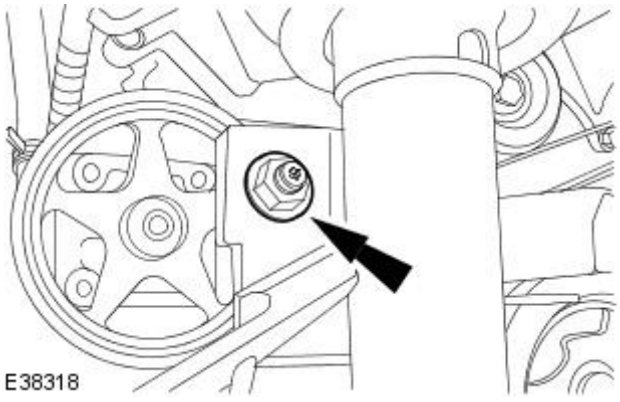
67. NOTE: Left-hand shown, right-hand similar.

Remove the tie rod end retaining nuts.



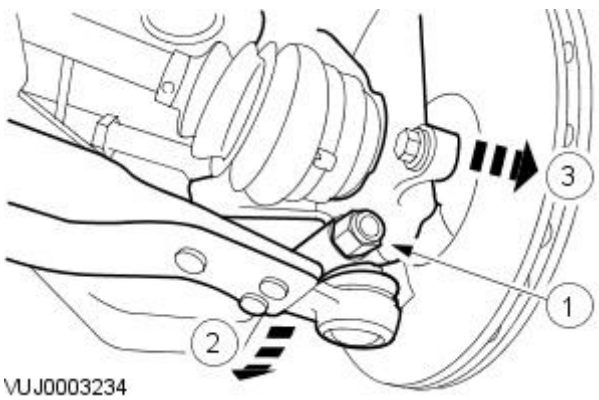
68. NOTE: Right-hand shown, left-hand similar.

Using the special tool, detach the tie rod ends.



69. NOTE: Right-hand shown, left-hand similar.

Detach the stabilizer bar link arms.

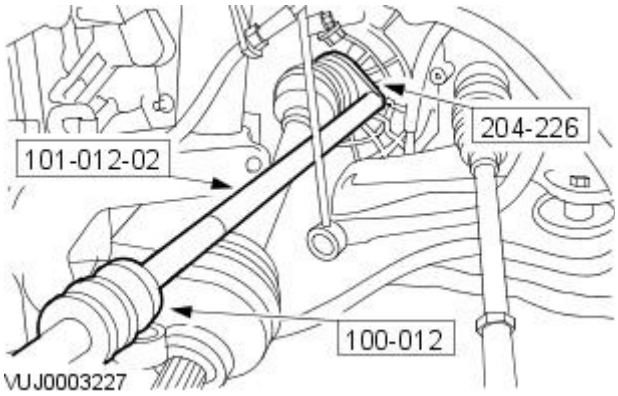


70. NOTE: Left-hand shown, right-hand similar.

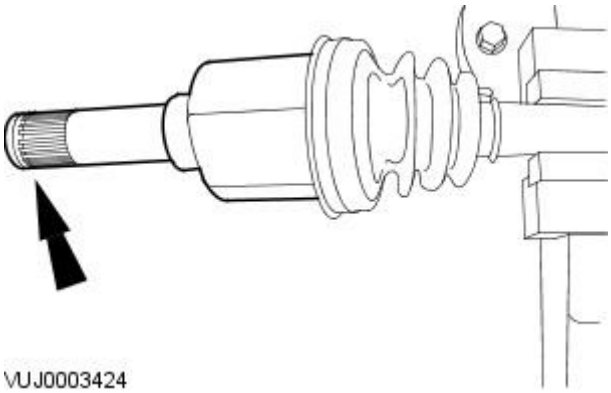
Detach the wheel knuckles.

1. Remove the lower arm ball joint retaining bolt.
2. Reposition the lower arm.
3. Detach the wheel knuckles.

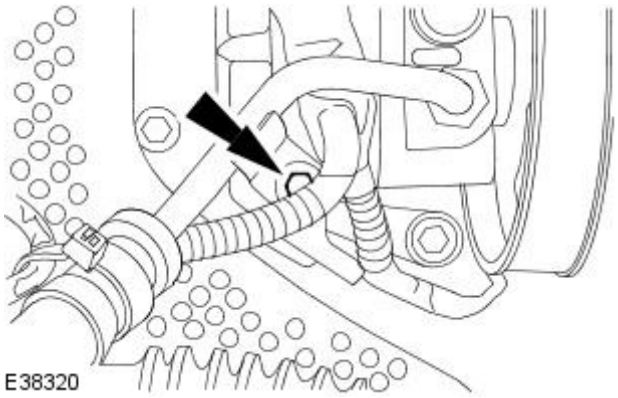
71. Using the special tools, remove the left-hand halfshaft.



72. Remove and discard the halfshaft snap ring.

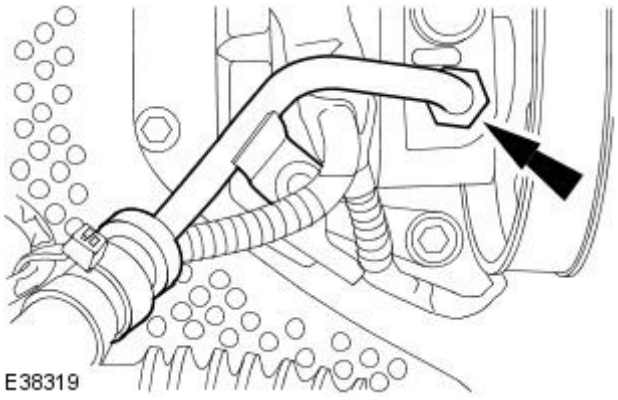


73. Remove the power steering high-pressure pipe retaining bolt.

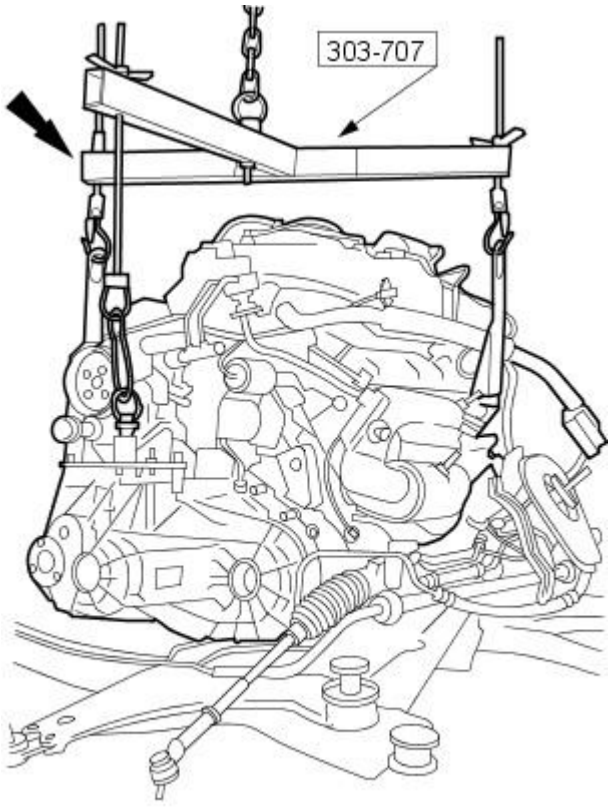


74. Disconnect the power steering high-pressure pipe.

- Remove and discard the O-ring seal.

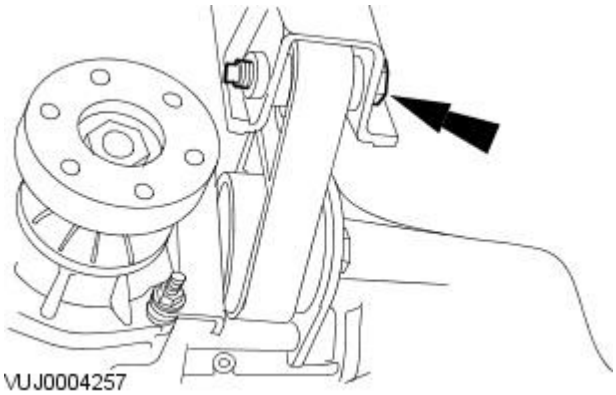


75. Install the special tool.



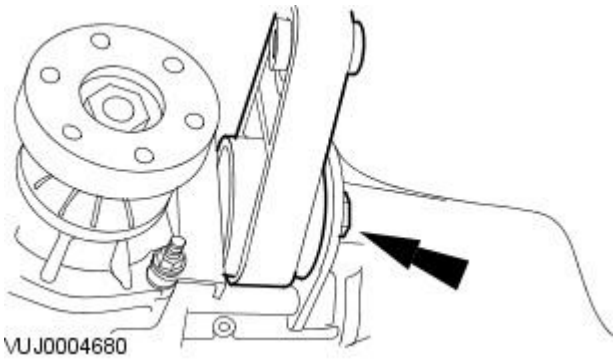
VUJ0004404

76. Remove the engine roll restrictor retaining bolt.

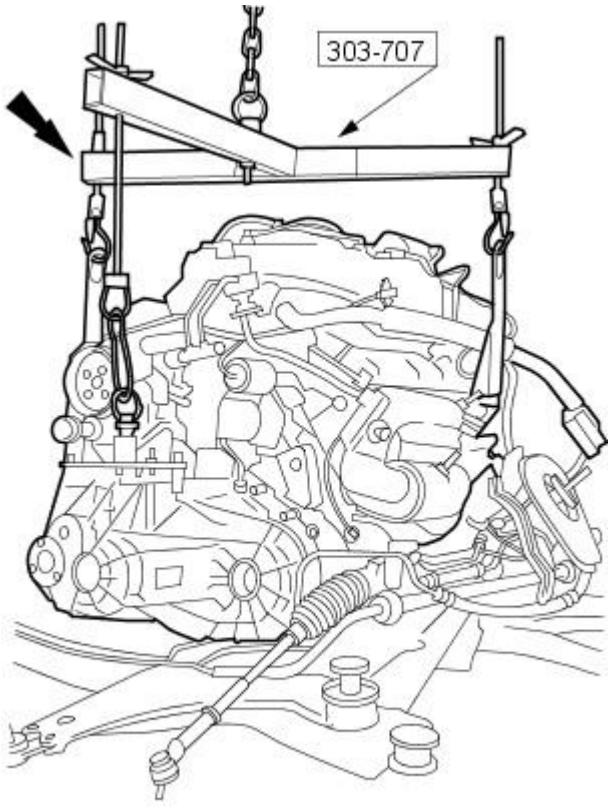


VUJ0004257

77. Remove the engine roll restrictor.



VUJ0004680

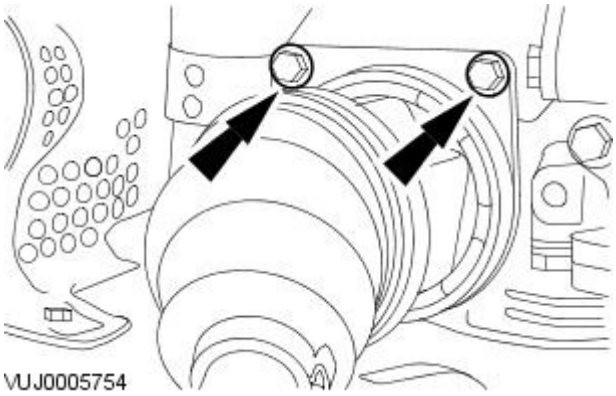


VUJ0004404

78. CAUTION: Make sure the right-hand drive halfshaft is supported, failure to follow this instruction may result in damage to the component.

Using the special tool, remove the engine and transaxle from the subframe.

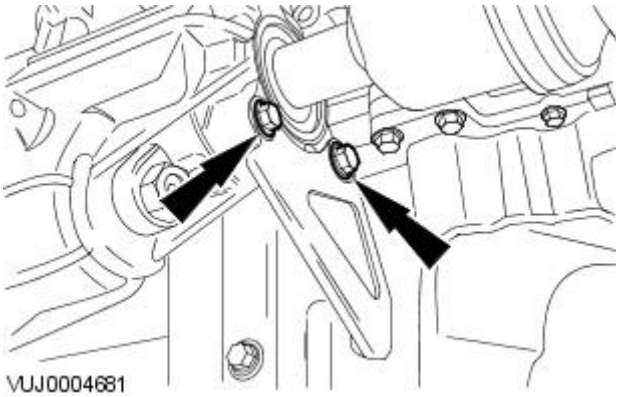
Vehicles with 2.0L engine


VUJ0005754

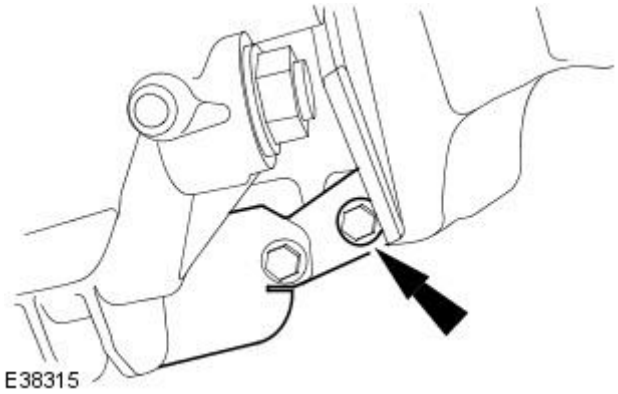
79. Remove the halfshaft and intermediate shaft assembly.

- Remove the intermediate shaft bearing carrier retaining bolts.

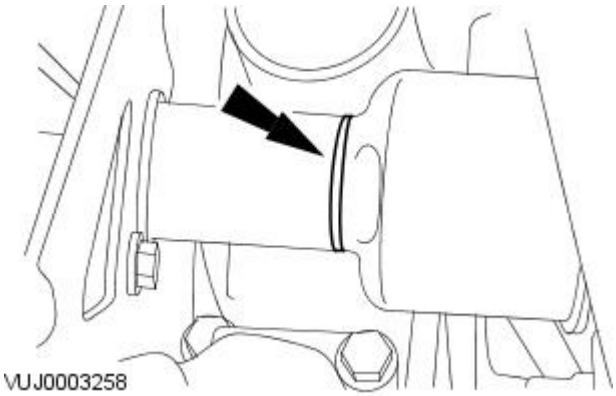
Vehicles with 2.5L or 3.0L engine


VUJ0004681

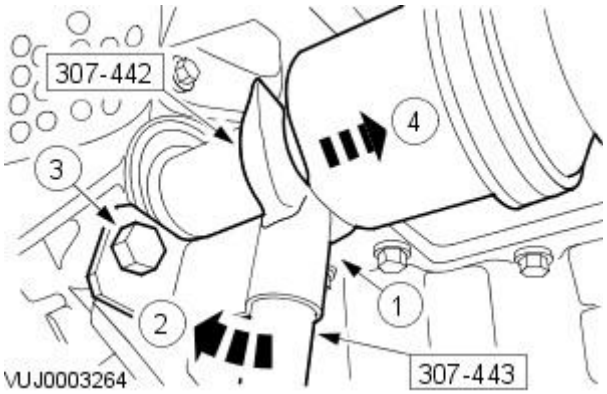
80. Remove the transfer case Y bracket retaining bolts.



81. Remove the transfer case Y bracket.



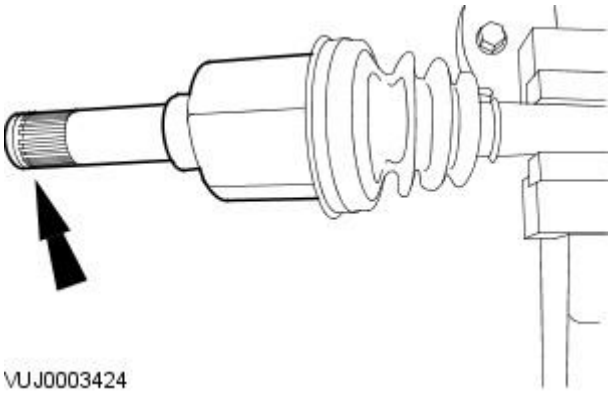
82. Remove the halfshaft seal.



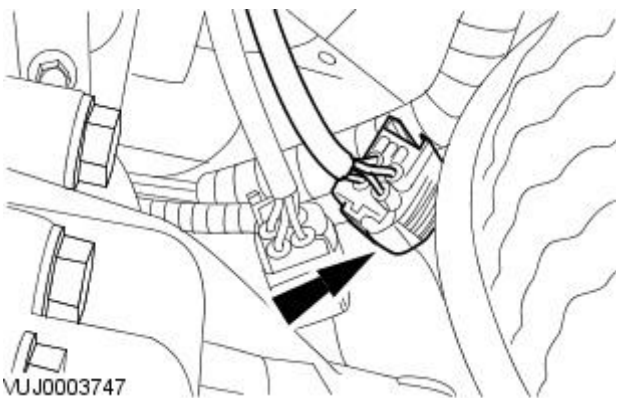
83. CAUTION: To prevent damage to the transfer case internal seal, make sure the link shaft is not retracted further that 200 mm (7.87 inches) from the transfer case.

Using the special tools, remove the halfshaft.

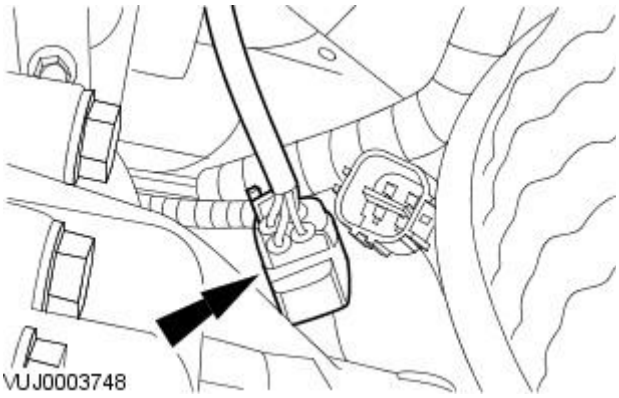
1. Attach the special tools to the halfshaft.
2. Lever the special tools, to detach the halfshaft.
3. Install the transfer case Y bracket retaining bolt.
4. Remove the halfshaft.



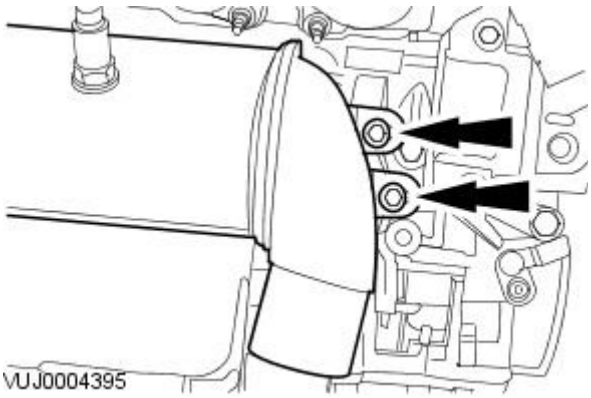
84. Remove and discard the halfshaft snap ring.



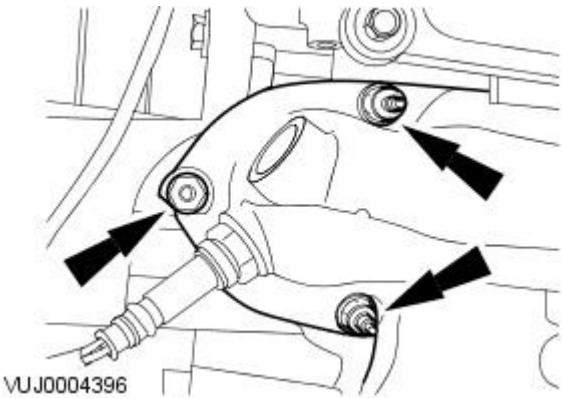
85. Disconnect the right-hand catalyst monitor sensor electrical connector.


VUJ0003748

86. Disconnect the right-hand heated oxygen sensor (HO2S) electrical connector.

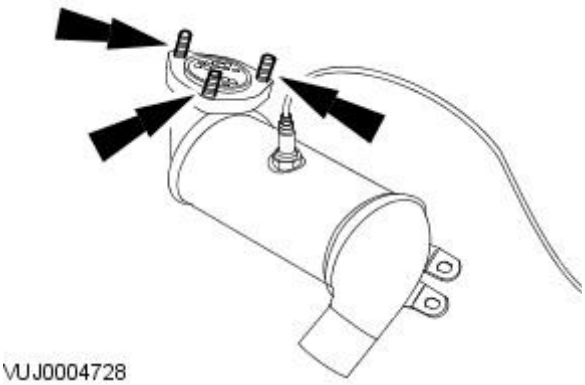

VUJ0004395

87. Remove the right-hand catalytic converter retaining bolts.

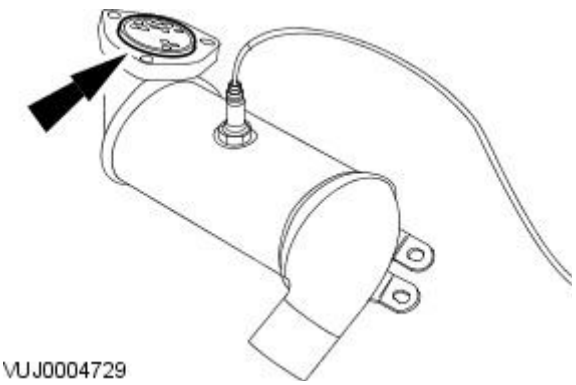

VUJ0004396

88. Remove the right-hand catalytic converter.

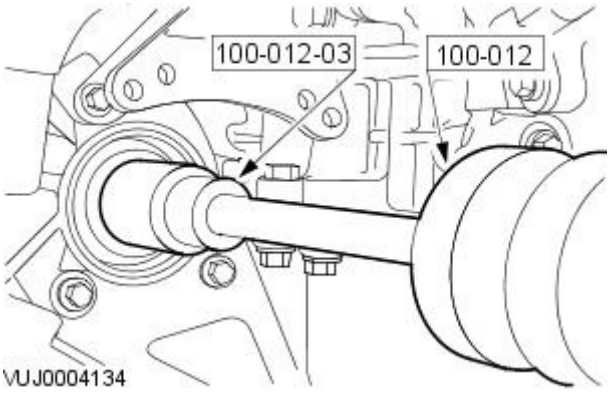
- Remove and discard the retaining nuts.


VUJ0004728

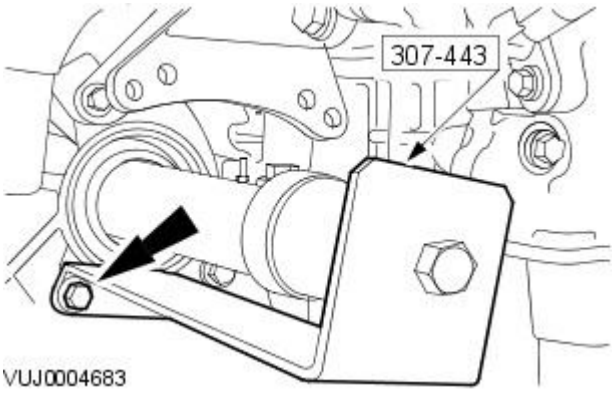
89. Remove and discard the catalytic converter retaining studs.


VUJ0004729

90. Remove and discard the catalytic converter sealing ring.

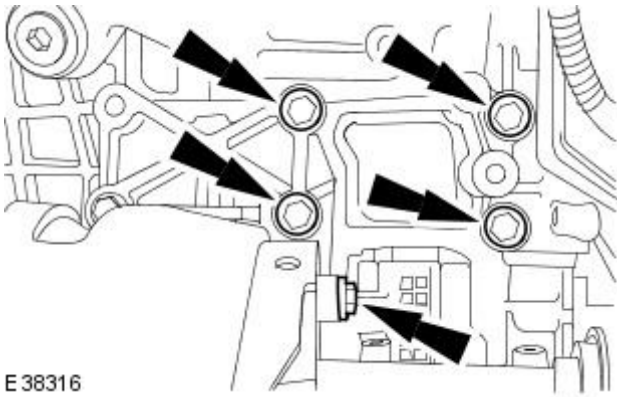


91. Using the special tool, detach the transfer case link shaft.

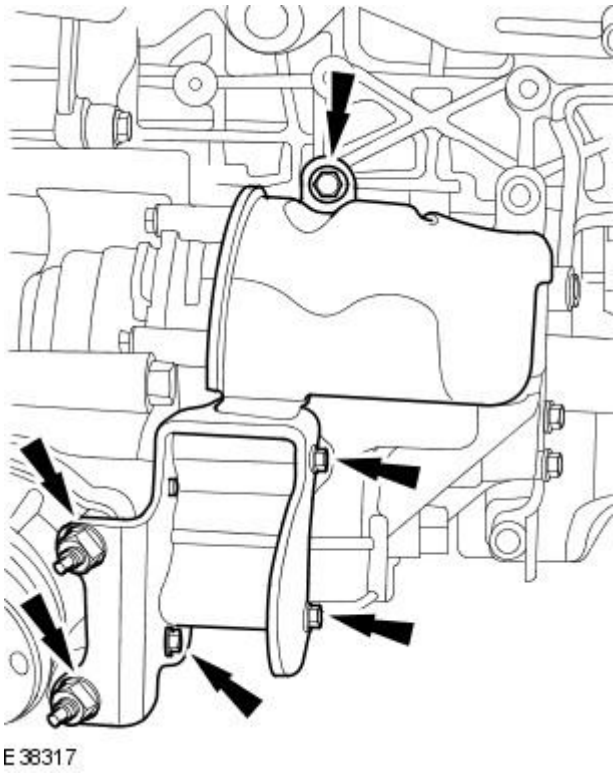


92. CAUTION: To prevent damage to the transfer case internal seal, make sure the link shaft is not retracted further that 200 mm (7.87 inches) from the transfer case.

Using the special tool, partially remove transfer case link shaft.

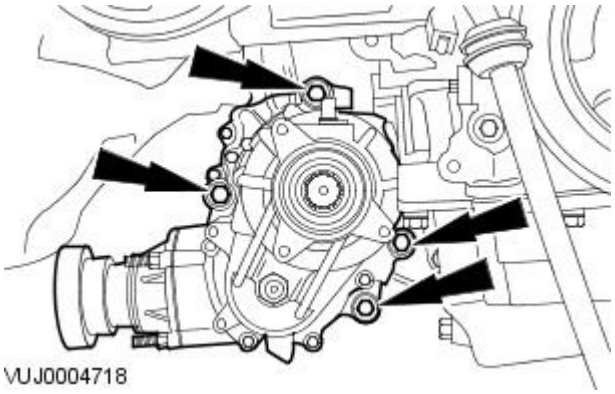


93. Remove the catalytic converter mounting bracket.

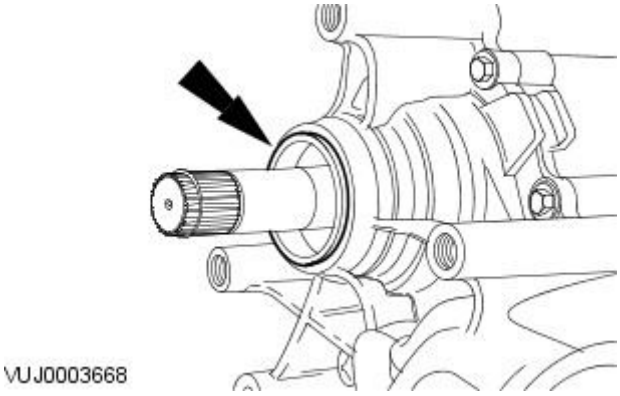


94. Remove the transfer case mounting bracket.

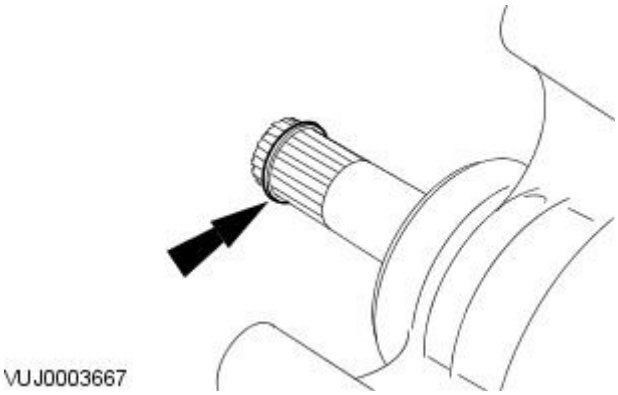
95. Remove the transfer case.


VUJ0004718

96. Remove and discard the transfer case O-ring seal.

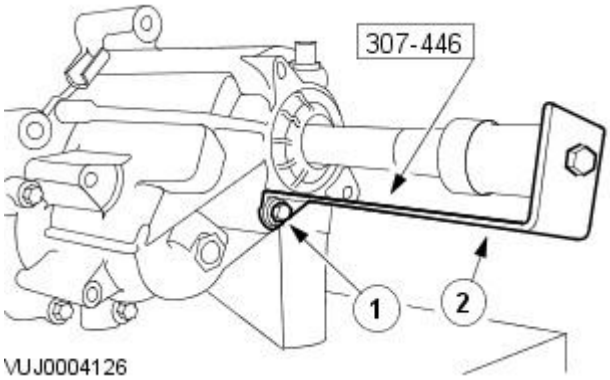

VUJ0003668

97. Remove and discard the link shaft snap ring.


VUJ0003667

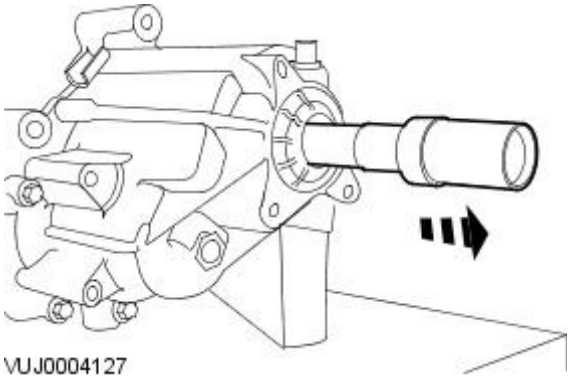
98. Remove the link shaft limiting tool.

1. Remove the retaining bolt.
2. Remove the link shaft limiting tool.

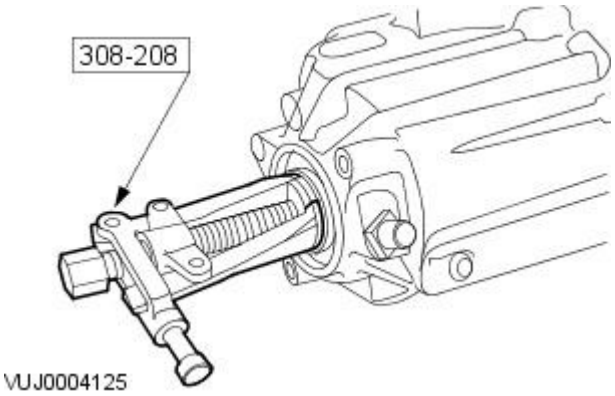


VUJ0004126

99. Remove the link shaft.

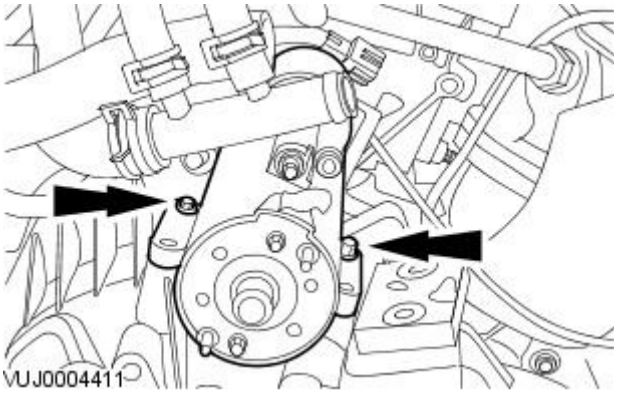

VUJ0004127

100. Using the special tool, remove and discard the link shaft oil seal.

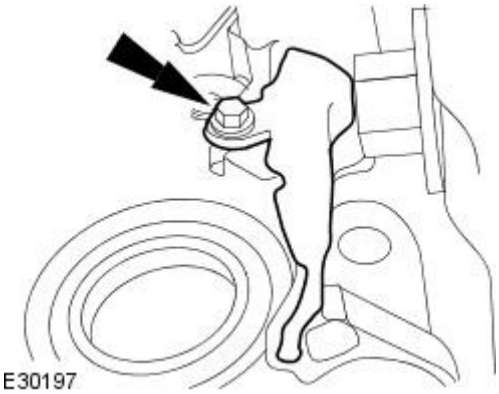


All vehicles

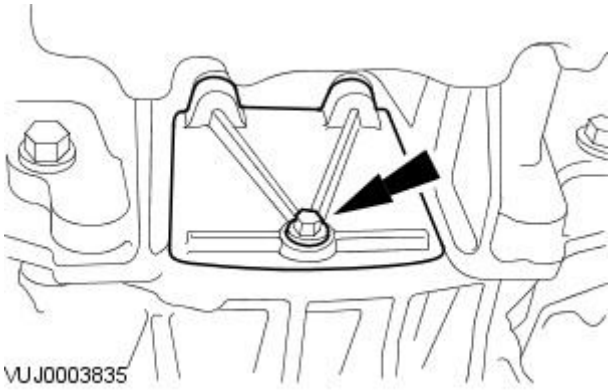
101. Remove the starter motor.



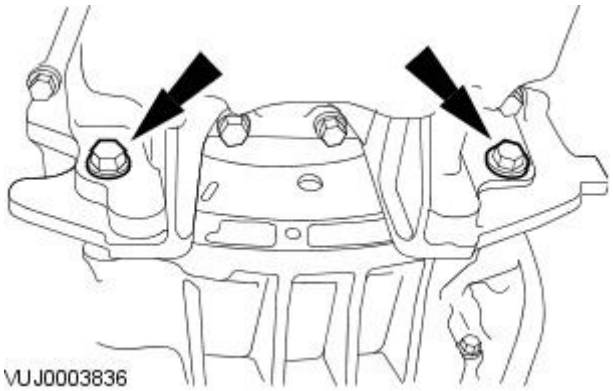
102. Remove the dust cover.



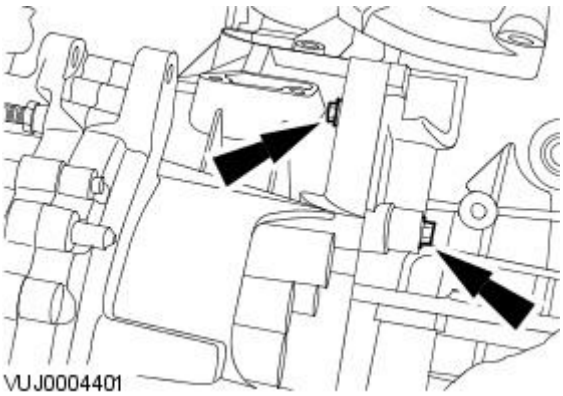
103. Remove the access cover.



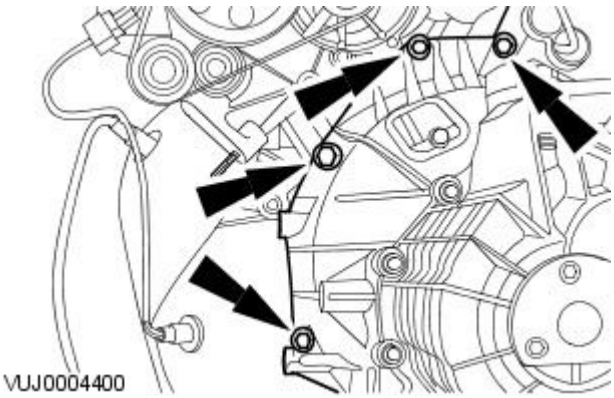
104. Remove the transaxle retaining bolts.



105. Remove the transaxle retaining bolts.

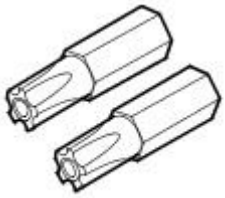
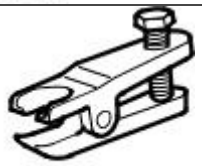
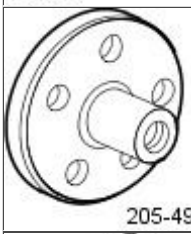
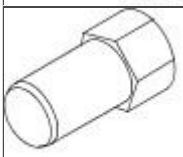
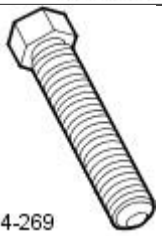
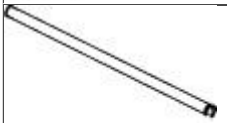


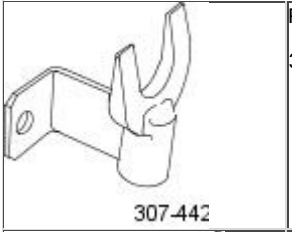
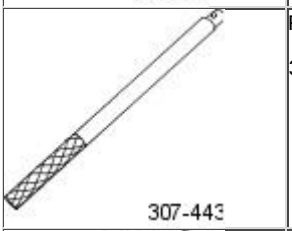
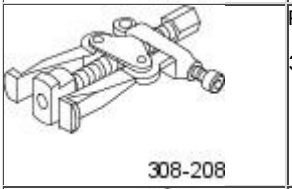
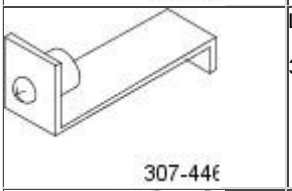
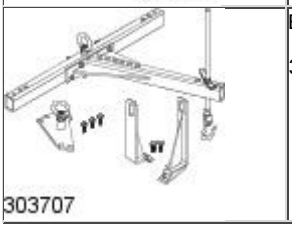
106. Remove the transaxle.



Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - EngineVehicles With: 5-Speed Automatic Transaxle - JATCO / 6-Speed Automatic Transaxle - AWF21

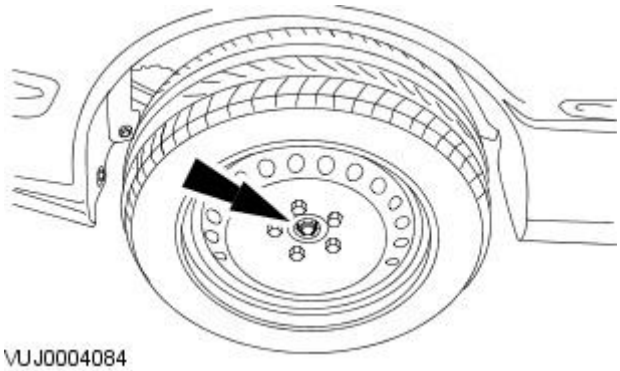
Removal

Special Tool(s)	
 HTJ12002	Powertrain Assembly Jack HTJ1200-2
 418-535	5 Point Security Torx Bit 418-535
 204-192	Ball joint splitter 204-192
 205-491	Wheel hub puller 205-491
 20549101	Adaptor nuts 205-491-01
 204-269	Forcing screw 204-269
 100012	Slide hammer 100-012
 100-012-02	Slide hammer shaft 100-012-02
 204-226	Halfshaft remover fork 204-226

	Right-hand halfshaft splitter 307-442
	Right-hand halfshaft splitter handle 307-443
	Pinion oil seal remover 308-208
	Link shaft limiting tool 307-446
	Engine lifting kit 303-707

Removal

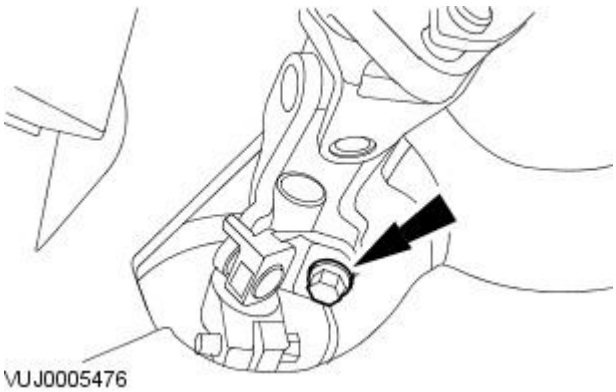
All vehicles



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

   Loosen the front hub retaining nuts.

2. Drain the transaxle.
   For additional information, refer to: Transmission Fluid Drain and Refill (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).
3. Remove the steering column lower retaining bolt.

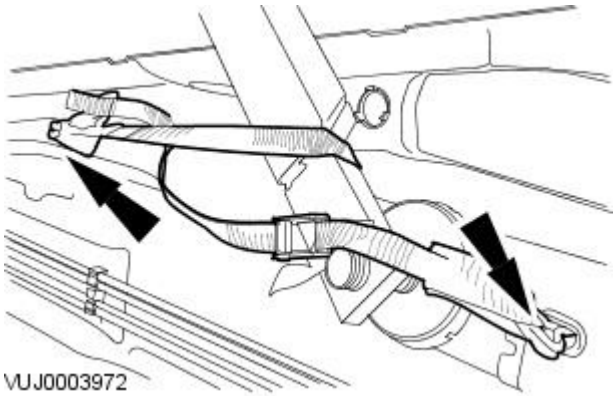


4. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
5. Recover the air conditioning (A/C) refrigerant.

For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

6. Remove the front wheels and tires.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

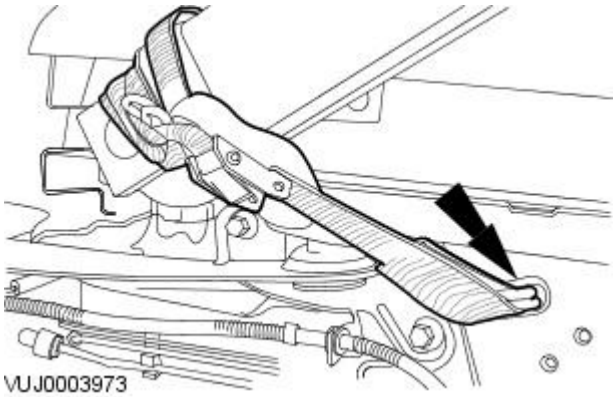
7. Drain the cooling system.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).


VUJ0003972

8. CAUTION: To prevent the vehicle becoming unstable when the engine and transmission assembly are removed, install the vehicle tie down straps.

• NOTE: Right-hand shown, left-hand similar.

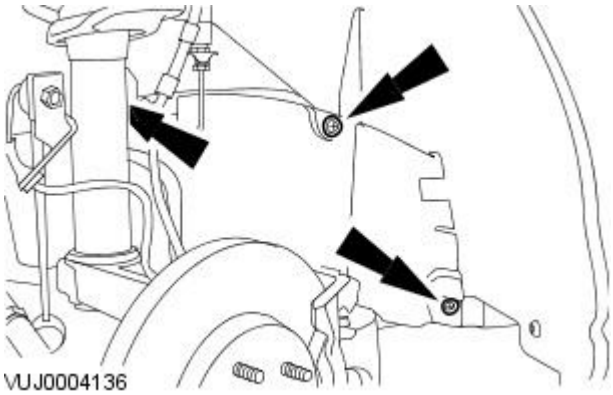
Install the front vehicle tie down strap.


VUJ0003973

9. CAUTION: To prevent the vehicle becoming unstable when the engine and transmission assembly are removed, install the vehicle tie down straps.

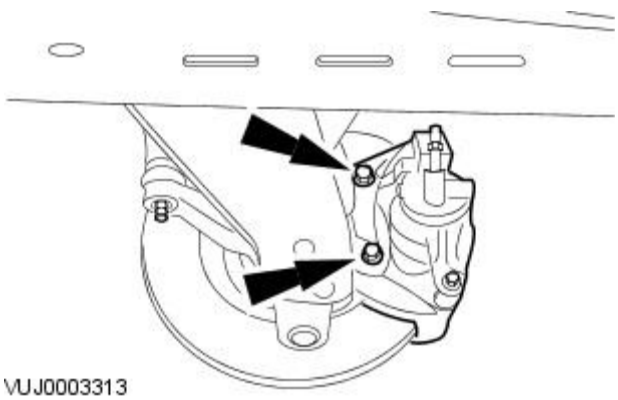
• NOTE: Right-hand shown, left-hand similar.

Install the rear vehicle tie down strap.


VUJ0004136

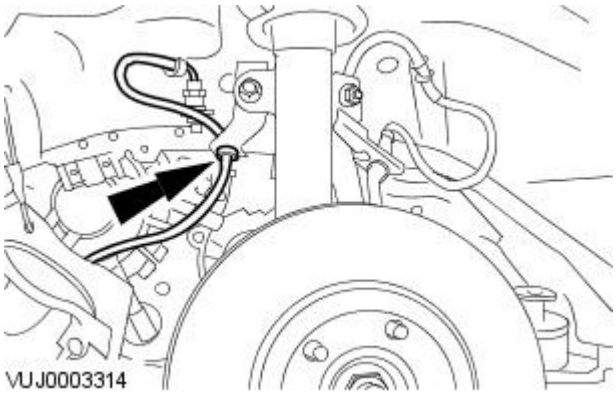
10. NOTE: Right-hand shown, left-hand similar.

Remove the splash shield.


VUJ0003313

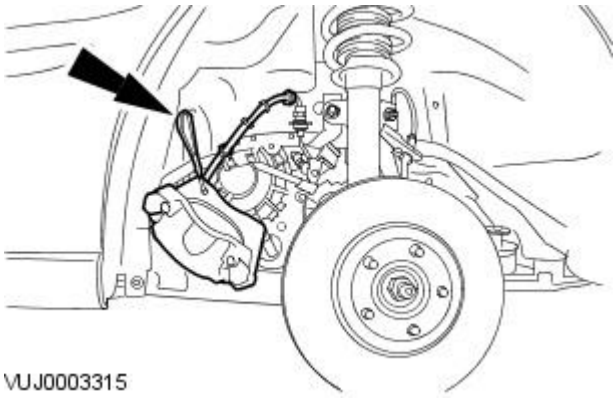
11. NOTE: Left-hand shown, right-hand similar.

Detach the brake caliper assembly.



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

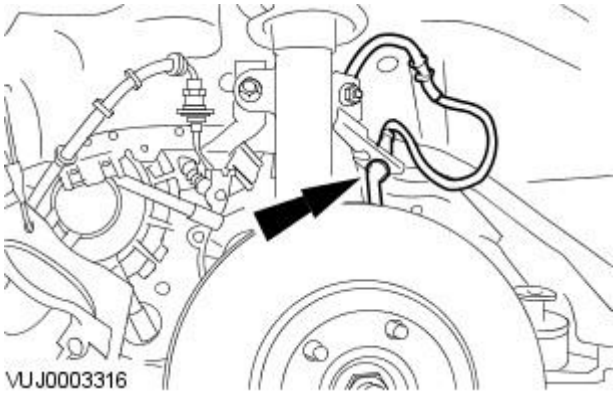
Detach the brake pipe.



13. NOTE: Support the brake caliper assembly using tie straps.

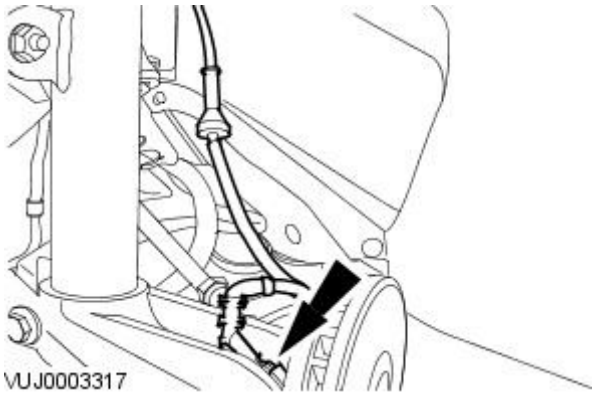
- NOTE: Left-hand shown, right-hand similar.

Reposition and secure the brake caliper assembly.



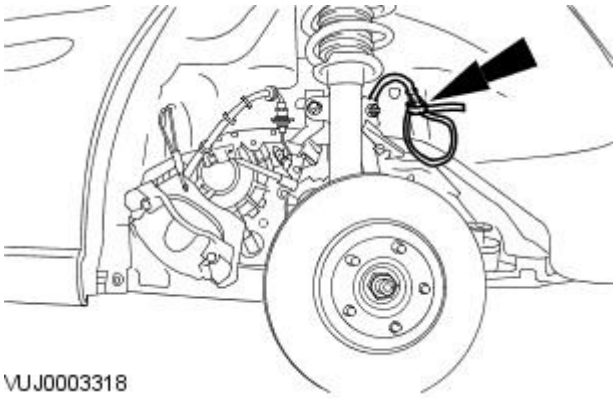
14. NOTE: Left-hand shown, right-hand similar.

Detach the anti-lock braking system (ABS) wheel speed sensor.



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

Disconnect the ABS wheel speed sensor.



16. NOTE: Secure the ABS wheel speed sensor using tie straps.

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

Reposition and secure the ABS wheel speed sensor.

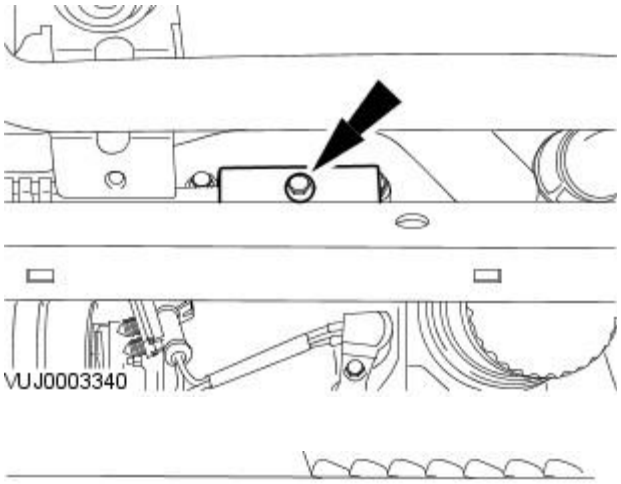
17. Remove the cooling fan motor and shroud.
For additional information, refer to: Cooling Fan Motor and Shroud (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

Vehicles with 2.5L or 3.0L engine

18. Remove the driveshaft.
For additional information, refer to: Driveshaft (205-01 Driveshaft, Removal and Installation).

All vehicles

19. Remove the front muffler.
For additional information, refer to: Front Muffler - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (309-00 Exhaust System, Removal and Installation).


VUJ0003340

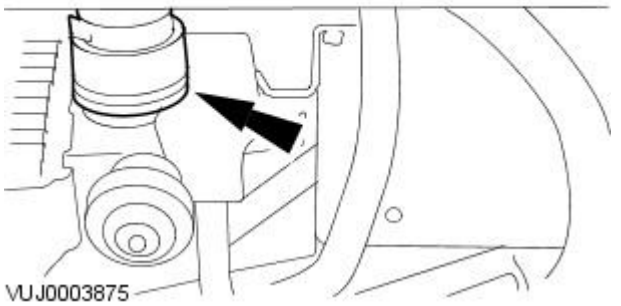
20. NOTE: Using a suitable blanking plug, seal the tube and the A/C compressor.

• NOTE: Secure the A/C compressor supply and return tubes using tie straps.

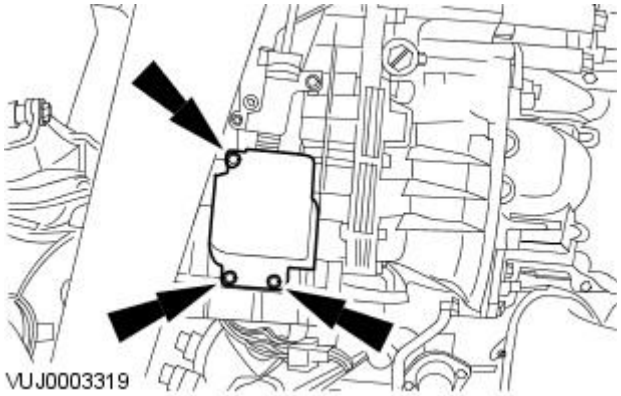
Detach the A/C compressor supply and return tubes.

- Remove and discard the O-ring seals.

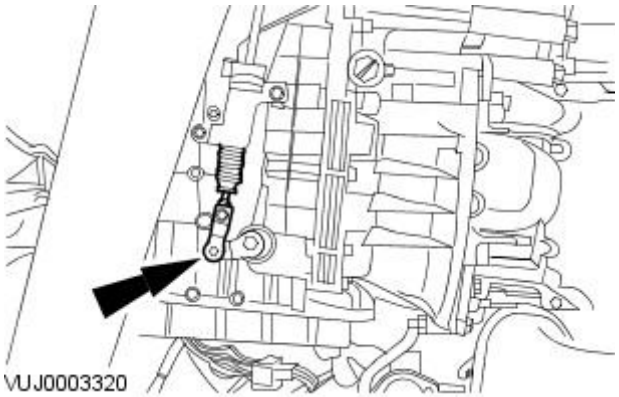
21. Detach the coolant hose.


VUJ0003875

22. Remove the selector cable shield.

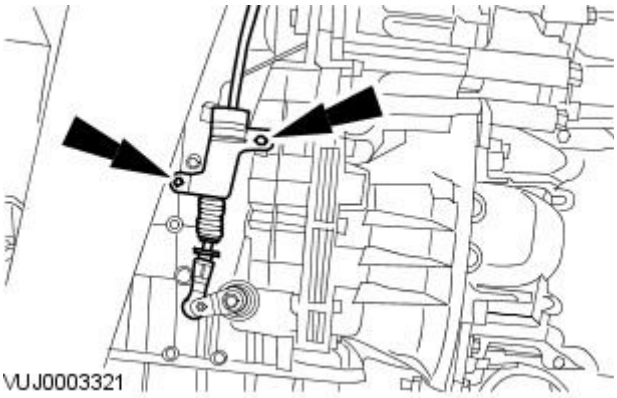

VUJ0003319

23. Detach the selector cable.

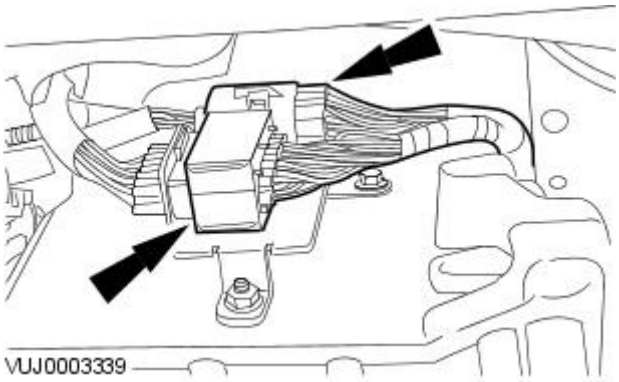

VUJ0003320

24. NOTE: Secure the selector cable using tie straps

Disconnect the selector cable.



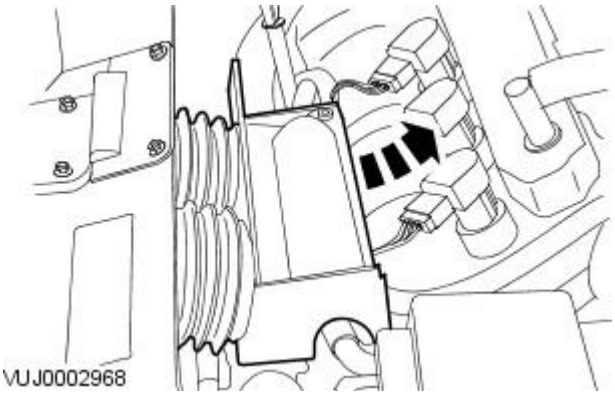
25. Disconnect the automatic transaxle electrical connectors.



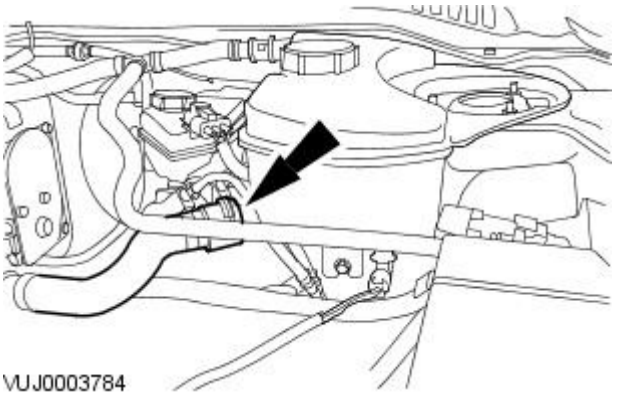
26. Lower the vehicle.

27. Remove the air cleaner.
For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

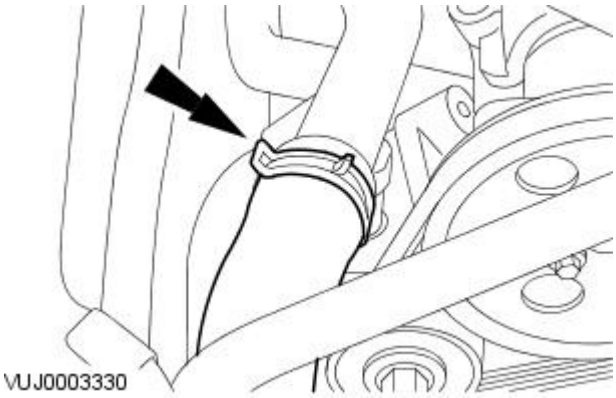
28. Remove the air filter intake pipe.



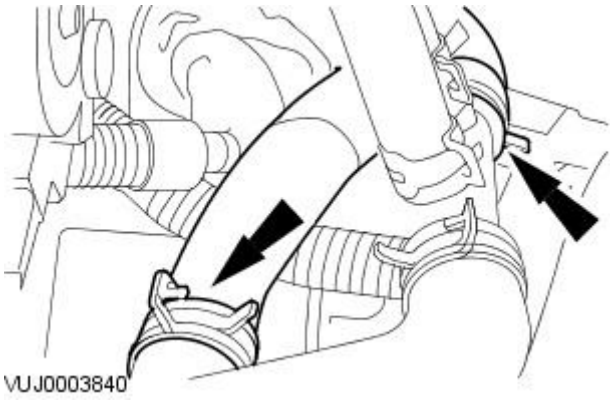
29. Detach the coolant hose.



30. Detach the coolant hose.

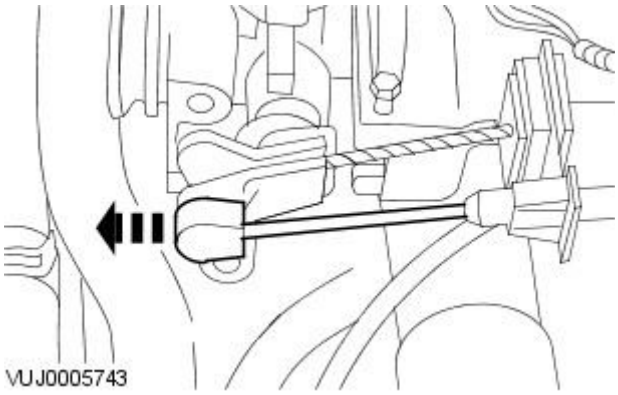


31. Detach the coolant hoses.



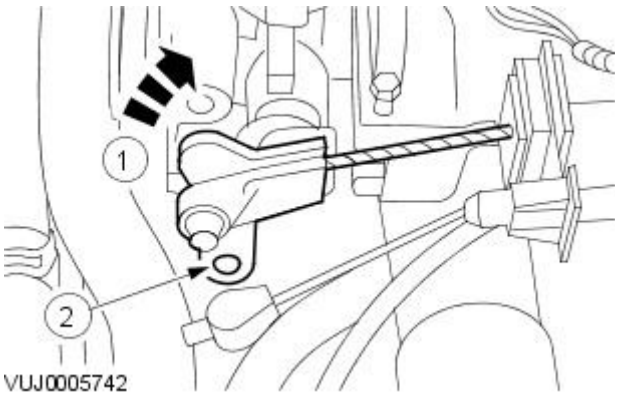
Vehicles with 2.0L engine

32. Detach the cruise control cable.

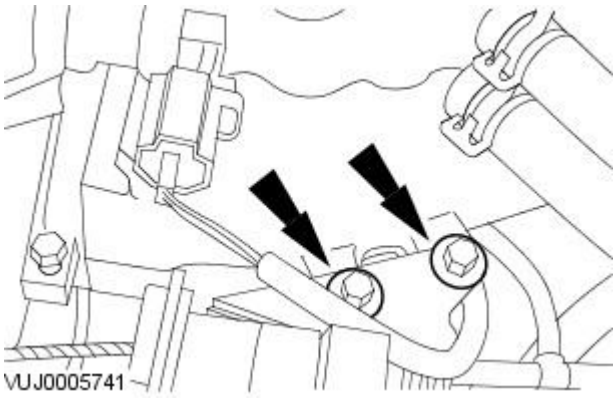


33. Detach the accelerator cable.

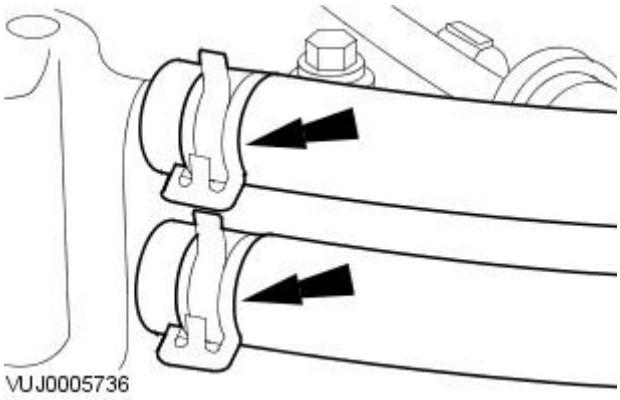
1. Reposition the accelerator lever to the fully open position.
2. Detach the accelerator cable.



34. Detach the accelerator cable retaining bracket.

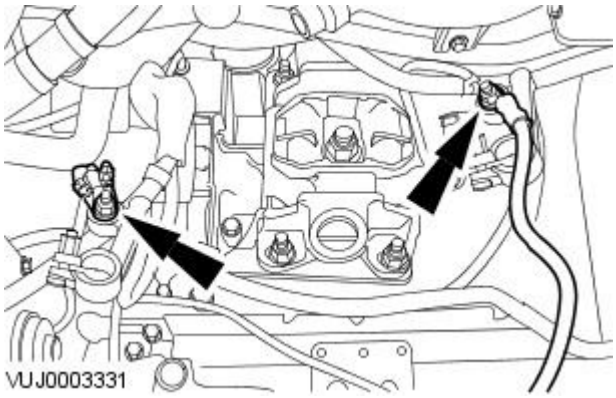


35. Detach the coolant hoses.

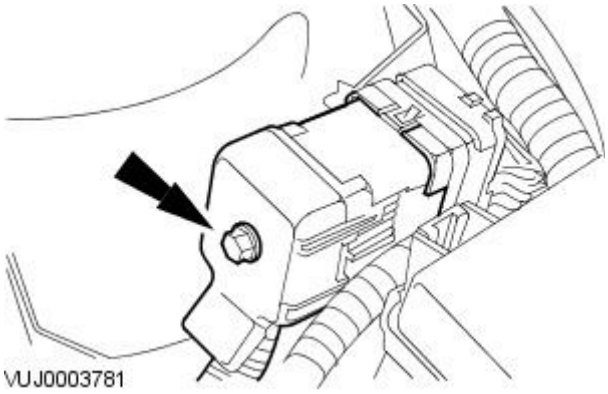


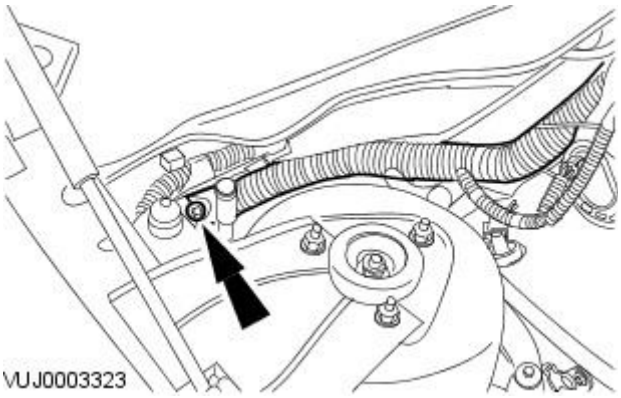
All vehicles

36. Detach the battery cables.

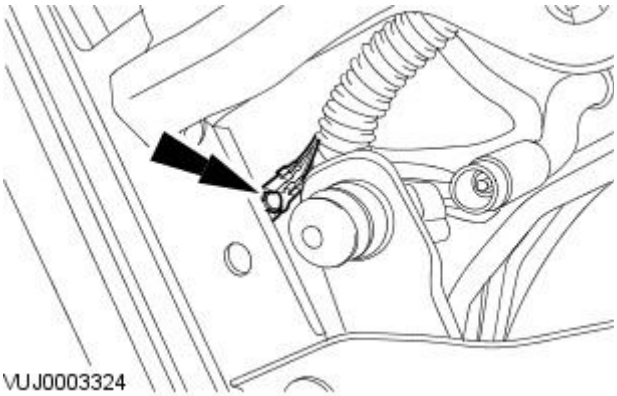


37. Disconnect the engine harness electrical connector.

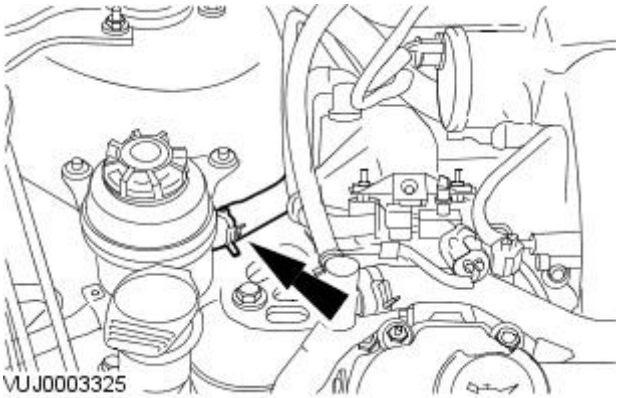




38. Using special tool 418-535 disconnect the engine control module (ECM) electrical connector.



39. Disconnect the ground cable.

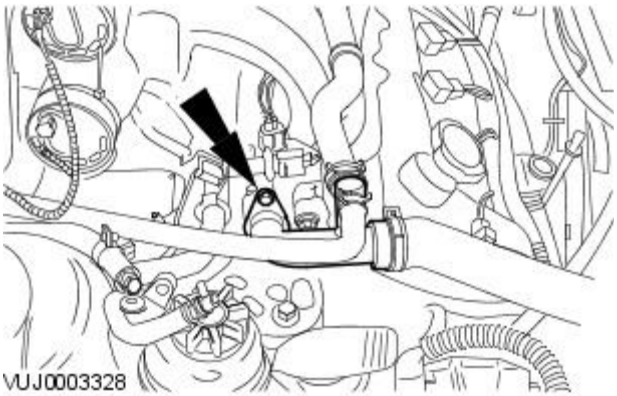


40. NOTE: Drain the fluid into a suitable container.

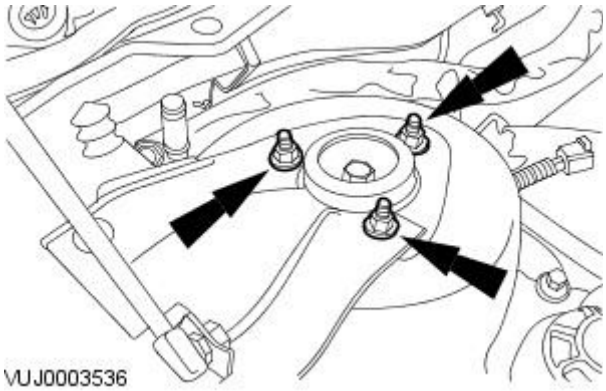
- NOTE: Use a suitable blanking plug to seal the hose.

Detach the power steering hose.

41. Disconnect the spring lock coupling.
For additional information, refer to: Spring Lock Couplings (310-00 Fuel System - General Information, General Procedures).



42. Detach the coolant pipe.

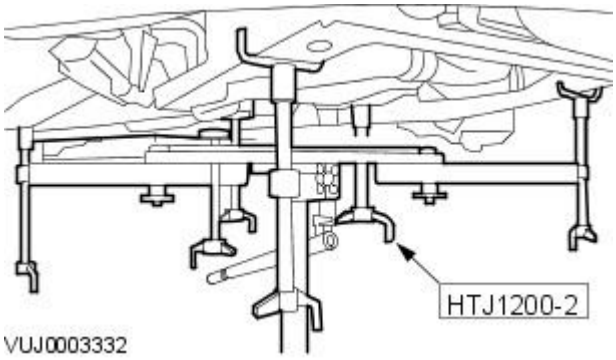


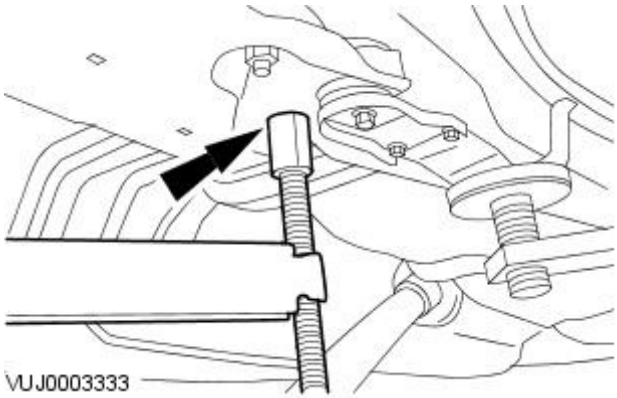
43. NOTE: Right-hand shown, left-hand similar.

Detach the strut and spring assembly.

44. Raise the vehicle.

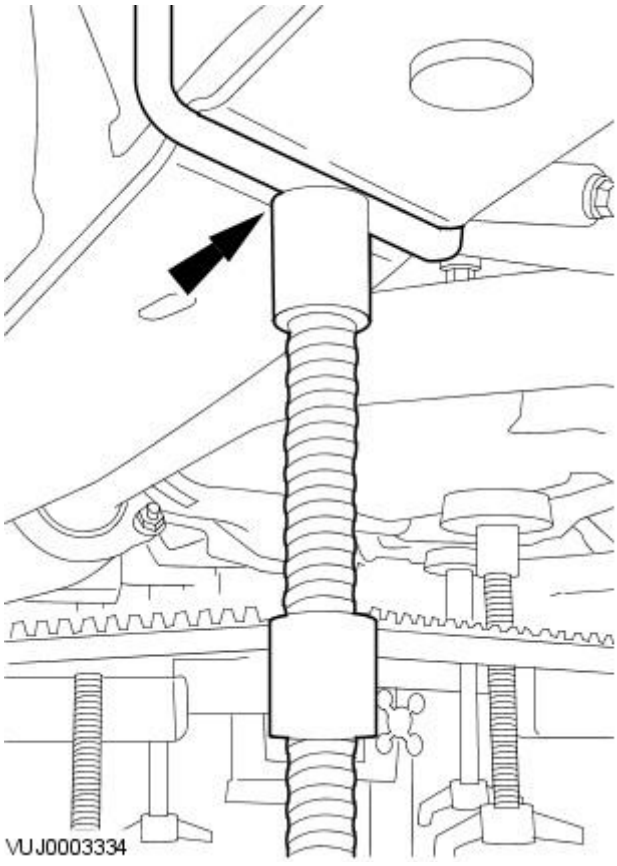
45. Install the special tool.





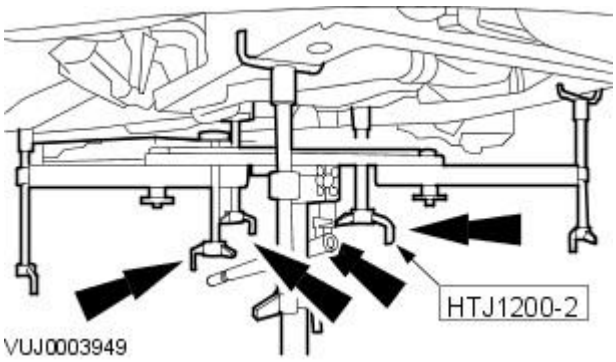
46. NOTE: Left-hand shown, right-hand similar.

Position and adjust the special tool rear height adjuster.

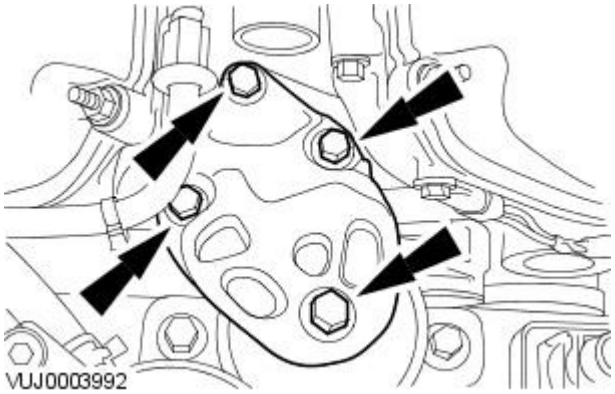


47. NOTE: Right-hand shown, left-hand similar.

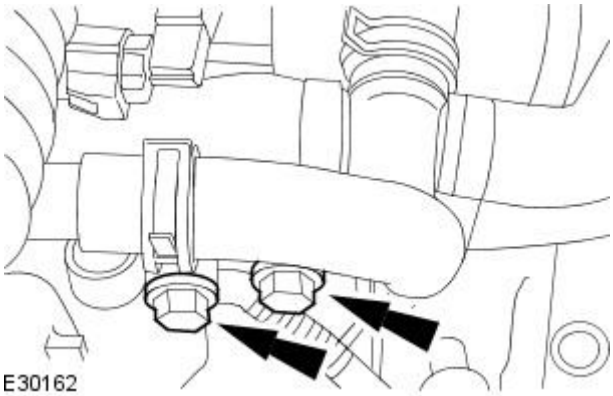
Position and adjust the special tool front height adjuster.



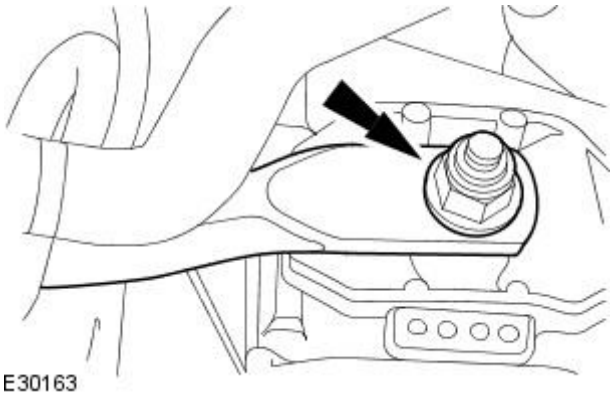
48. Position and adjust the special tool engine height adjusters.



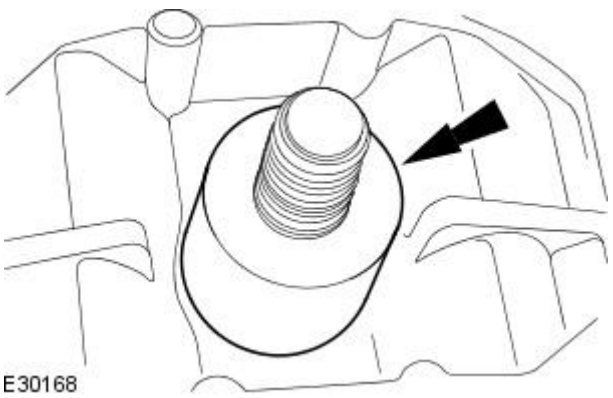
49. Remove the engine support bracket.



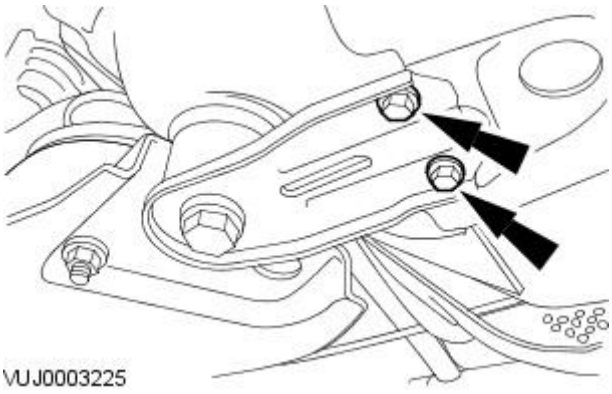
50. Detach the support bar.



51. Remove the support bar.

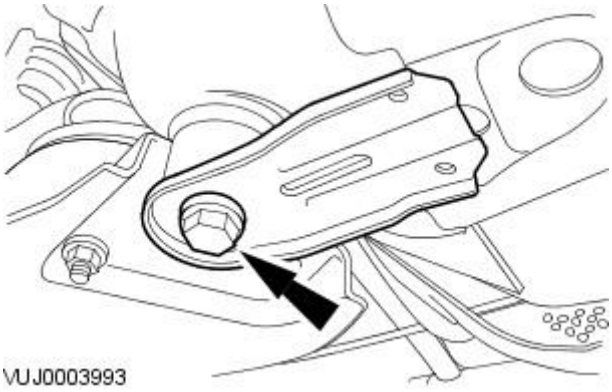


52. Remove the spacer.



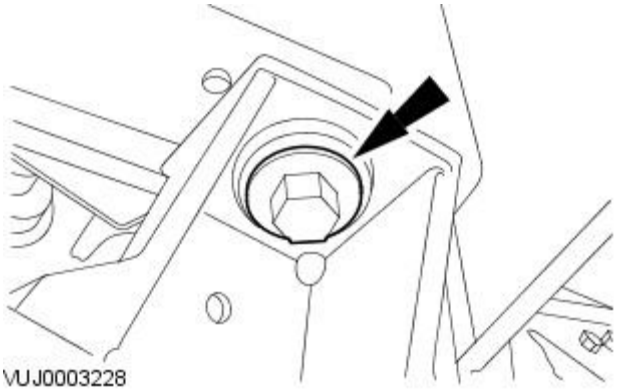
53. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe reinforcement plate retaining bolts.



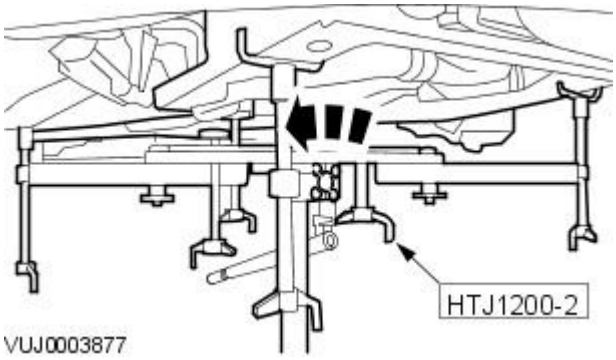
54. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe reinforcement plate.



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

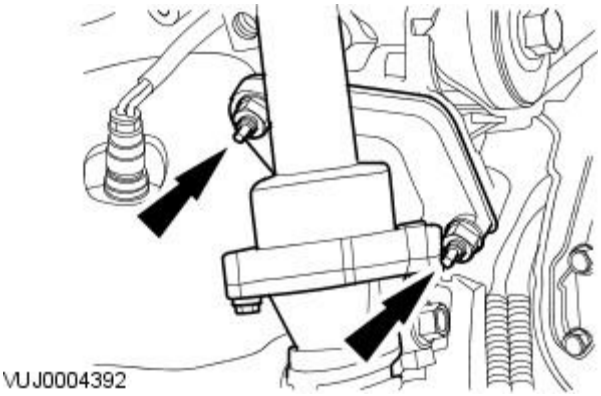
Detach the front subframe.



56. WARNING: Rotate the special tool height adjustment valve slowly. Failure to follow this instruction may result in personal injury.

Remove the engine and transaxle assembly.

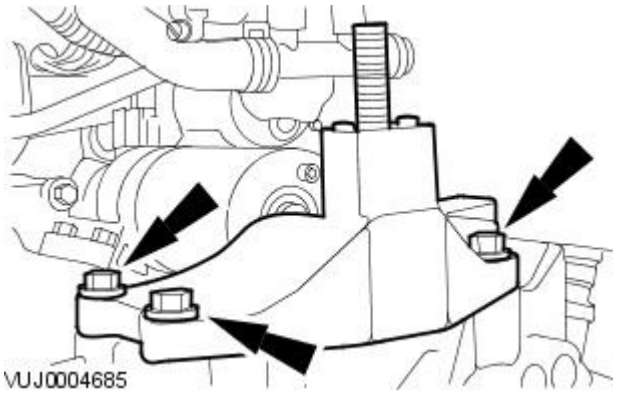
- Rotate the special tool height adjustment valve counter clockwise.



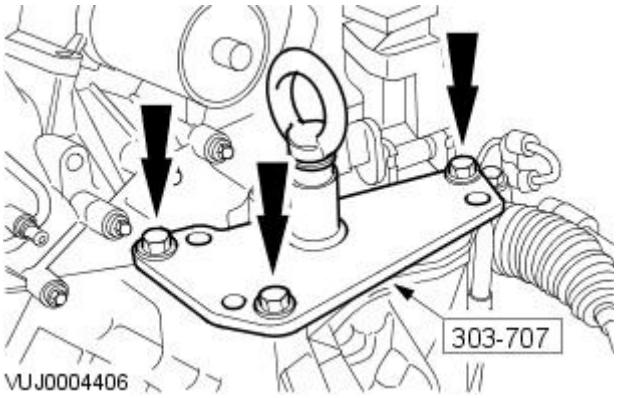
57. Remove the coolant system top hose.

- Remove and discard the gasket.

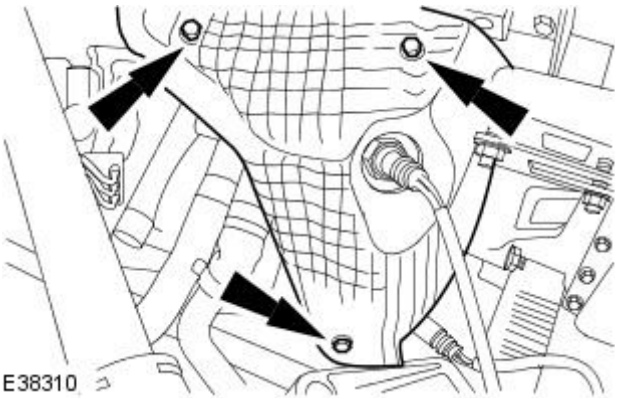
58. Remove the transaxle mount.



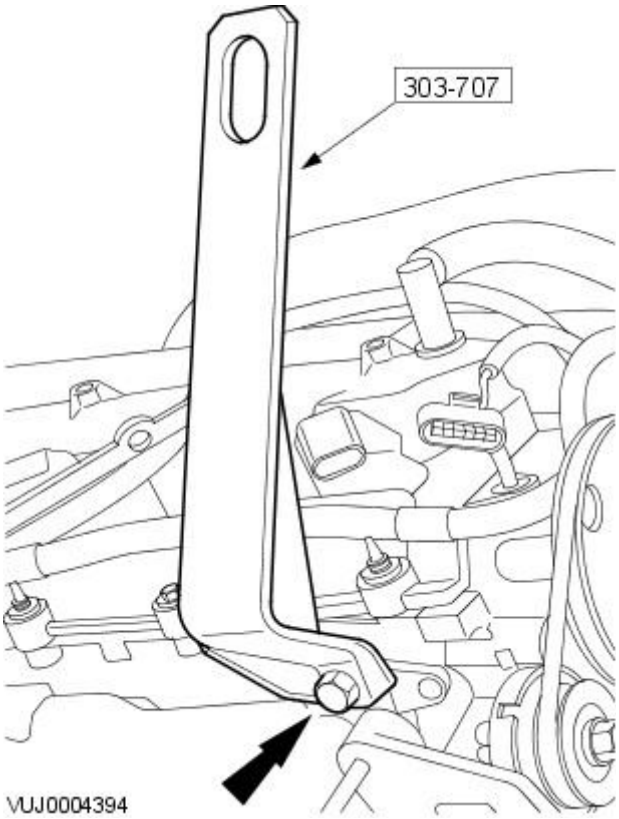
59. Install the special tool.



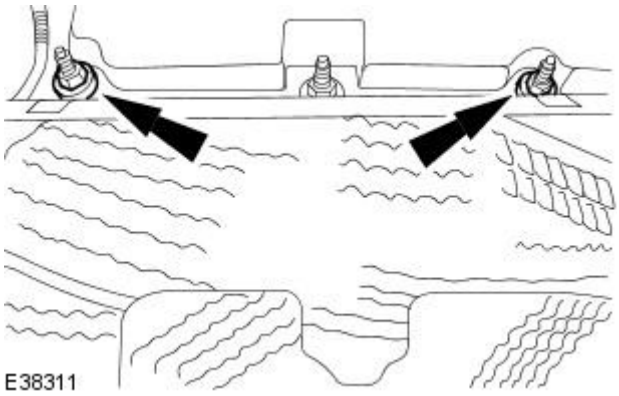
60. Remove the left-hand exhaust manifold heat shield.



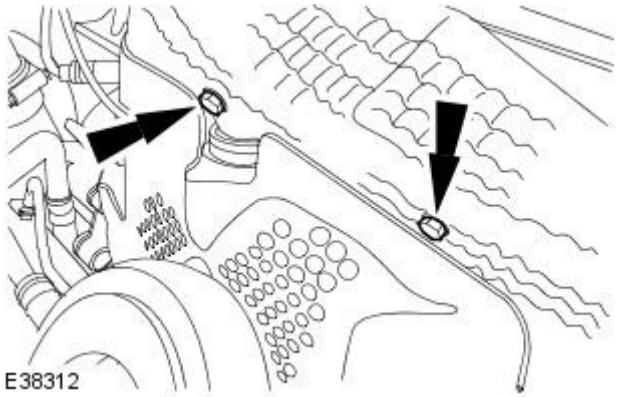
61. Install the special tool.



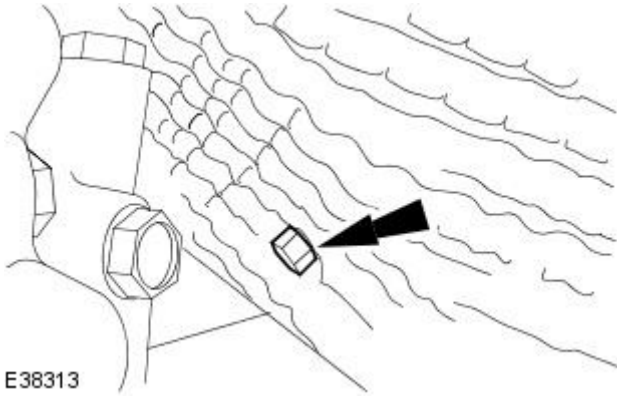
62. Remove the upper exhaust heat shield.



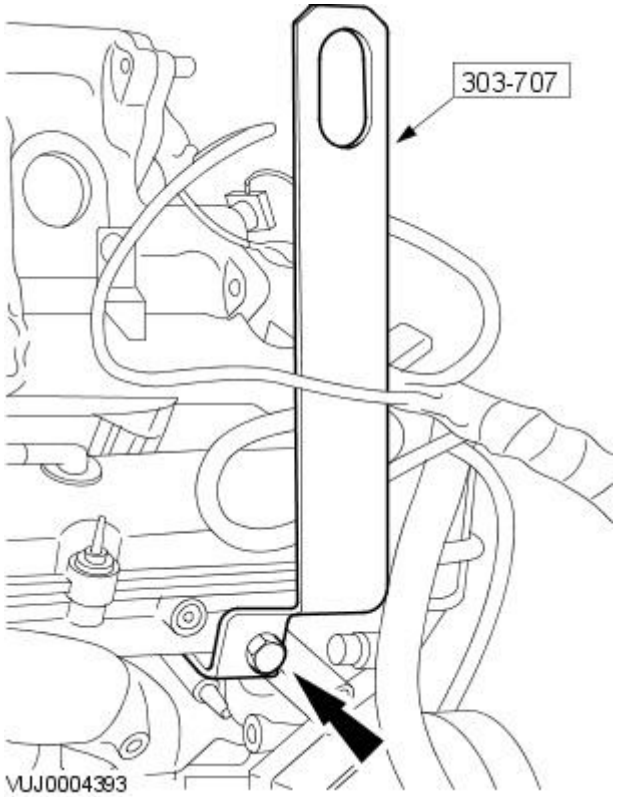
63. Remove the center exhaust heat shield retaining bolts.

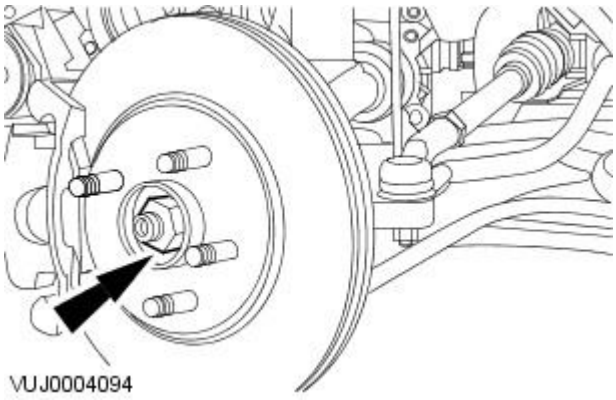


64. Remove the center exhaust heat shield.



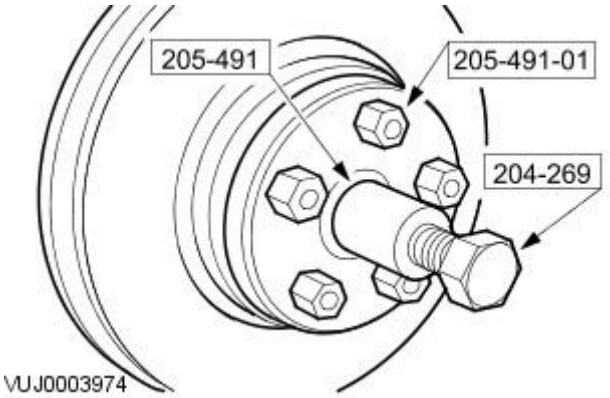
65. Install the special tool.





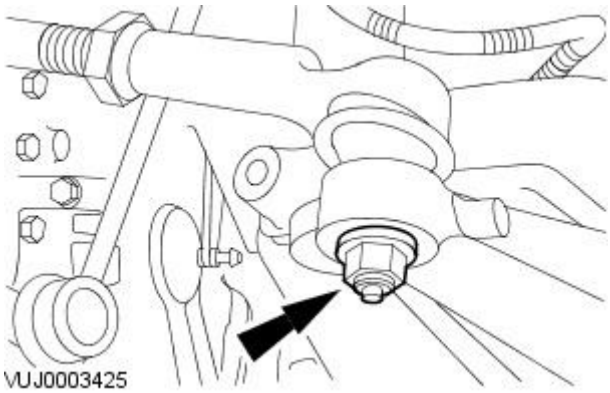
66. NOTE: Left-hand shown, right-hand similar.

Remove the front wheel hub retaining nuts.



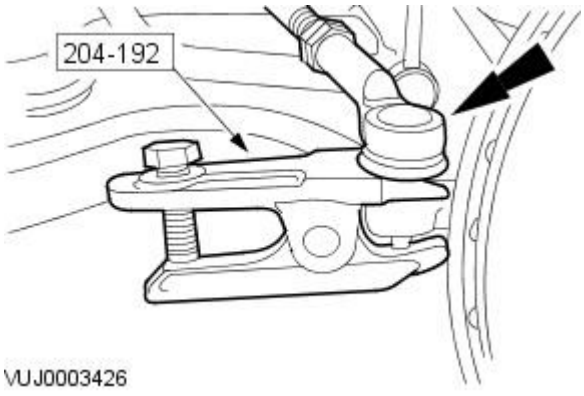
67. NOTE: Left-hand shown, right-hand similar.

Using the special tools, detach the halfshafts.



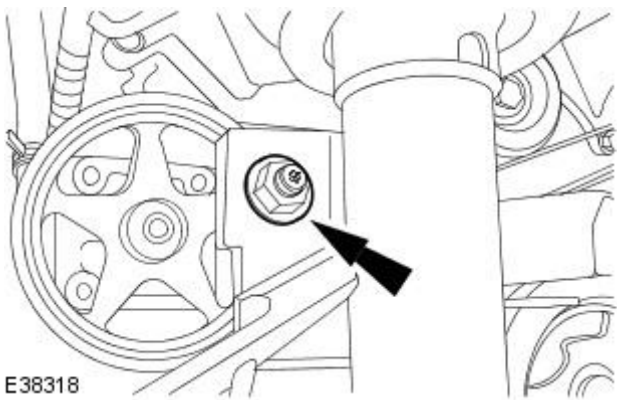
68. NOTE: Left-hand shown, right-hand similar.

Remove the tie rod end retaining nuts.



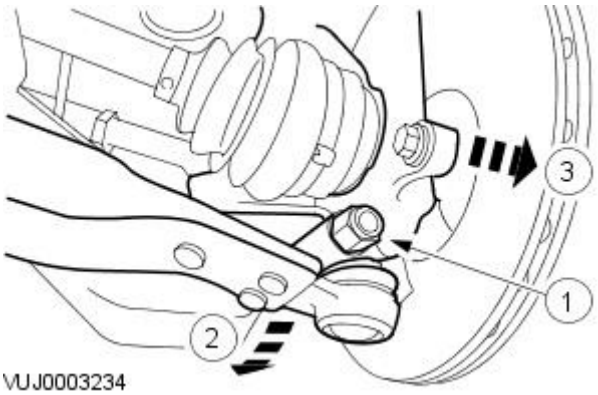
69. NOTE: Right-hand shown, left-hand similar.

Using the special tool, detach the tie rod ends.



70. NOTE: Right-hand shown, left-hand similar.

Detach the stabilizer bar link arms.

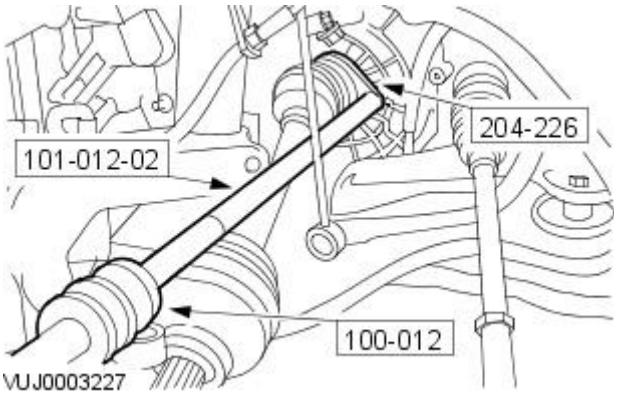


VUJ0003234

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

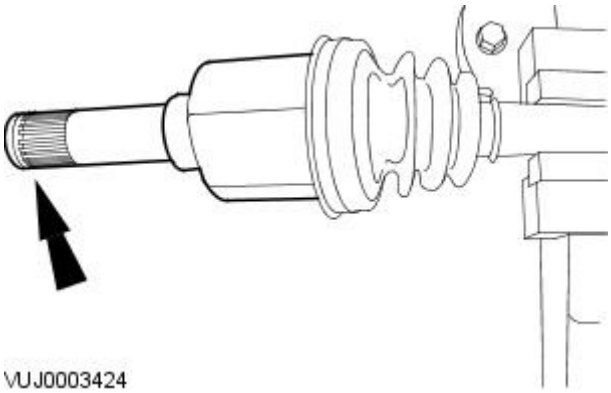
Detach the wheel knuckles.

1. Remove the lower arm ball joint retaining bolt.
2. Reposition the lower arm.
3. Detach the wheel knuckles.

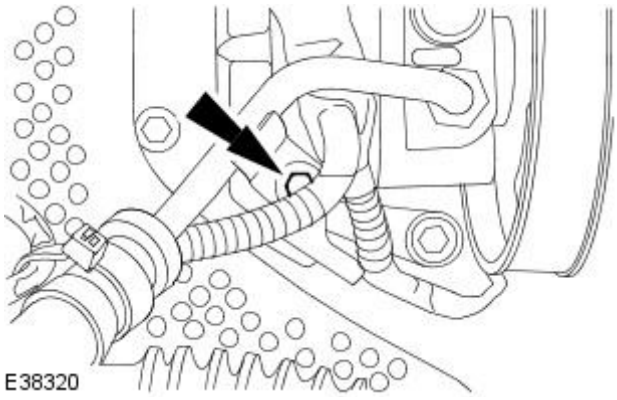


VUJ0003227

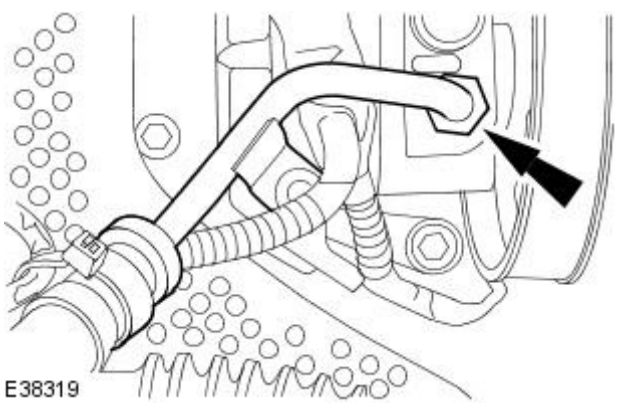
72. Using the special tools, remove the left-hand halfshaft.


VUJ0003424

73. Remove and discard the halfshaft snap ring.


E38320

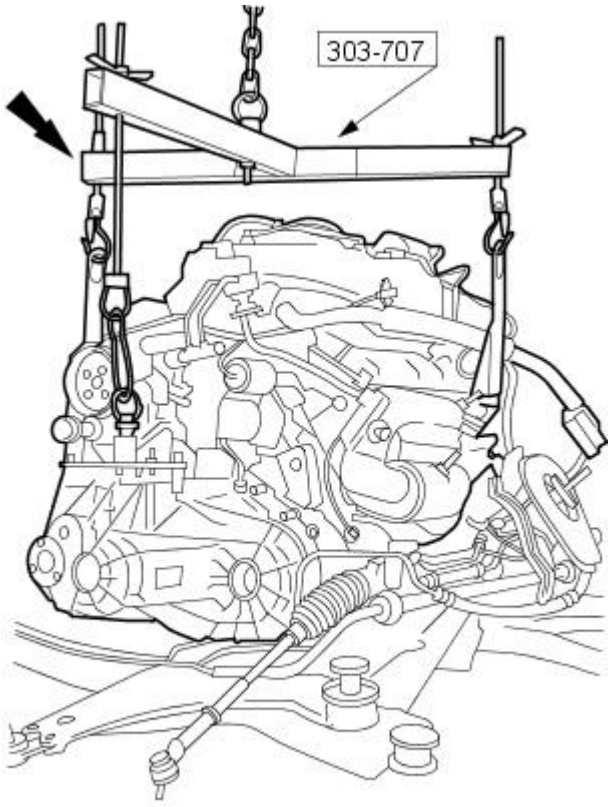
74. Remove the power steering high-pressure pipe retaining bolt.


E38319

75. Disconnect the power steering high-pressure pipe.

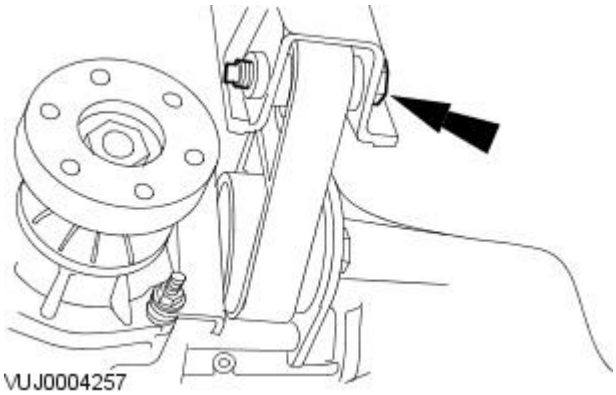
- Remove and discard the O-ring seal.

76. Install the special tool.



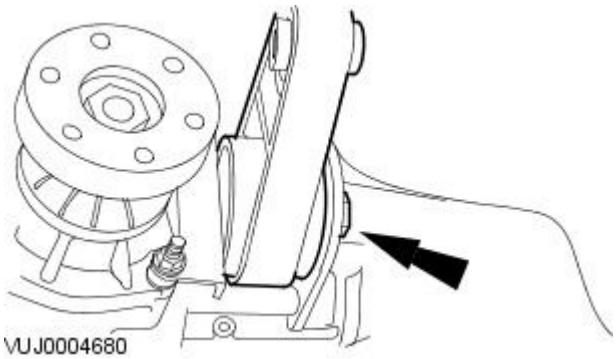
VUJ0004404

77. Remove the engine roll restrictor retaining bolt.

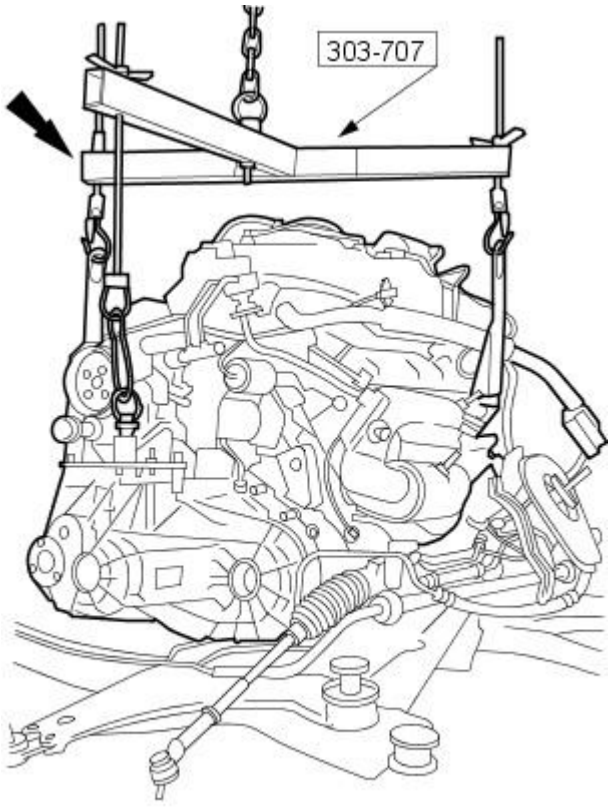


VUJ0004257

78. Remove the engine roll restrictor.



VUJ0004680

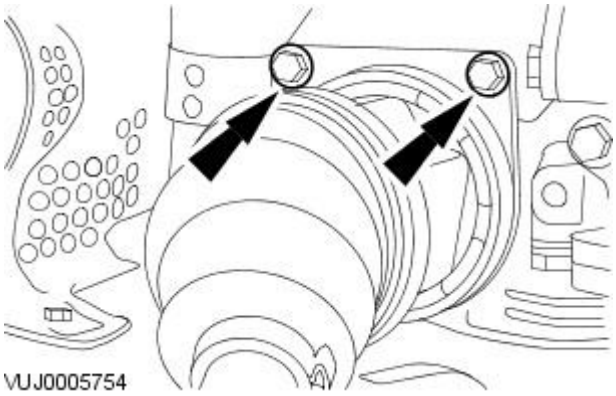


VUJ0004404

79. CAUTION: Make sure the right-hand drive halfshaft is supported, failure to follow this instruction may result in damage to the component.

Using the special tool, remove the engine and transaxle from the subframe.

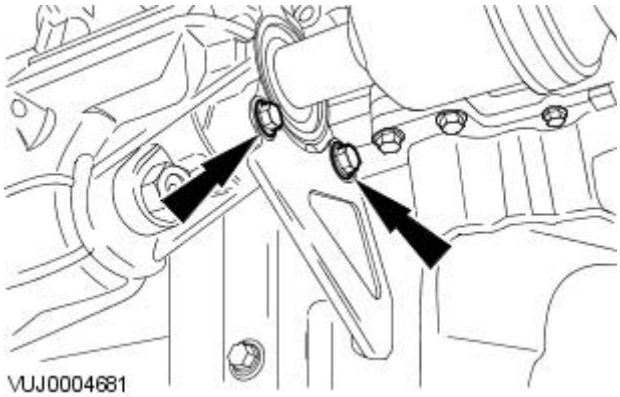
Vehicles with 2.0L engine


VUJ0005754

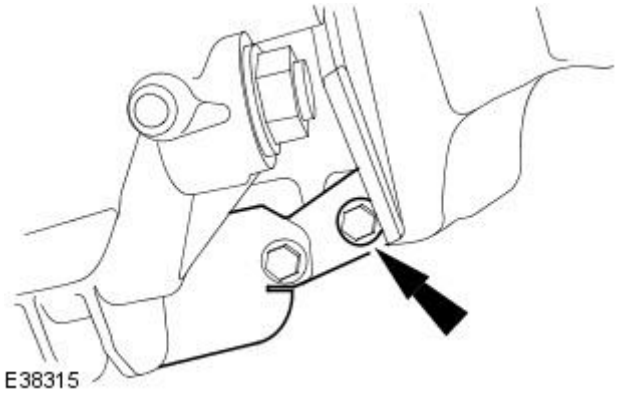
80. Remove the halfshaft and intermediate shaft assembly.

- Remove the intermediate shaft bearing carrier retaining bolts.

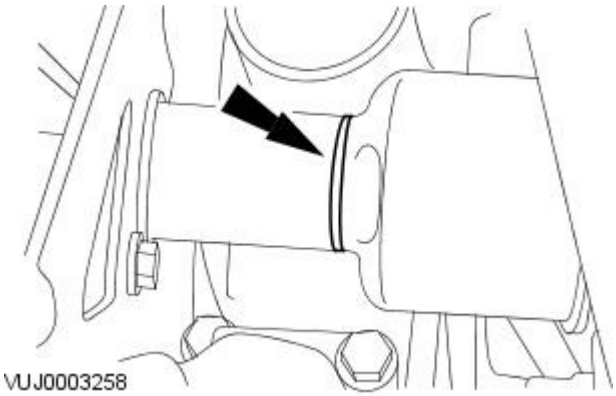
Vehicles with 2.5L or 3.0L engine


VUJ0004681

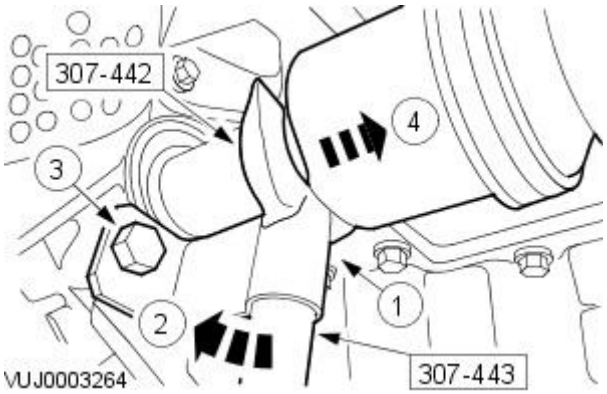
81. Remove the transfer case Y bracket retaining bolts.



82. Remove the transfer case Y bracket.



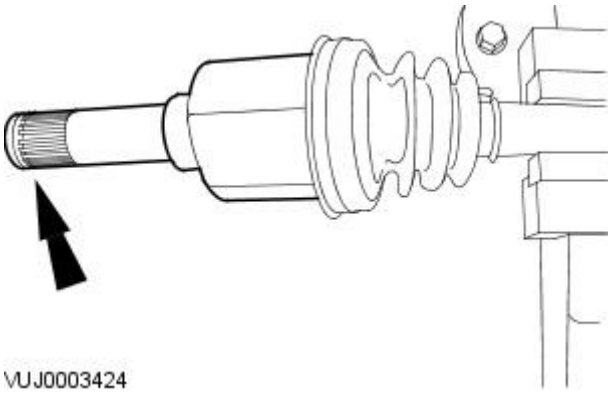
83. Remove the halfshaft seal.



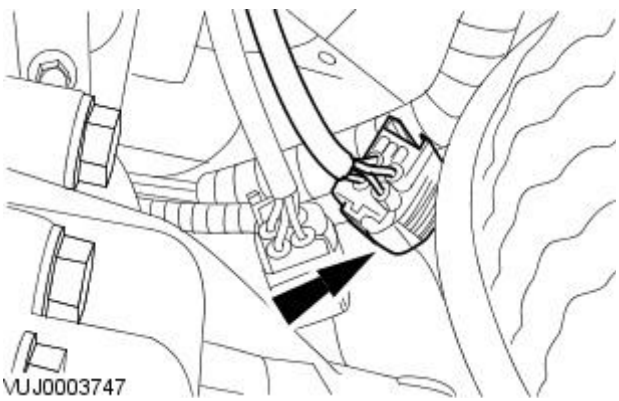
84. CAUTION: To prevent damage to the transfer case internal seal, make sure the link shaft is not retracted further that 200 mm (7.87 inches) from the transfer case.

Using the special tools, remove the halfshaft.

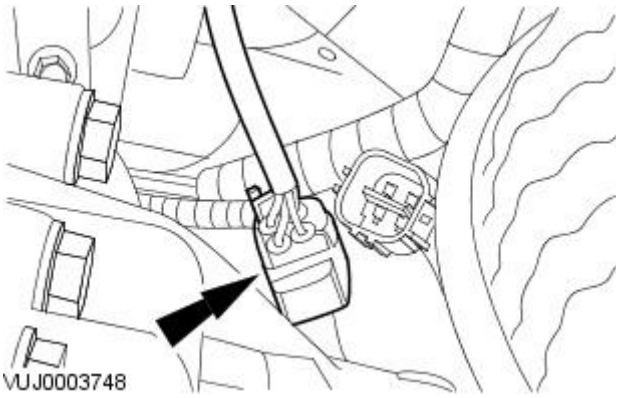
1. Attach the special tools to the halfshaft.
2. Lever the special tools, to detach the halfshaft.
3. Install the transfer case Y bracket retaining bolt.
4. Remove the halfshaft.



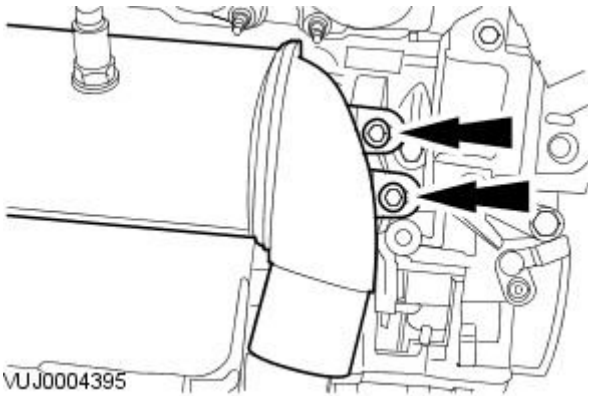
85. Remove and discard the halfshaft snap ring.



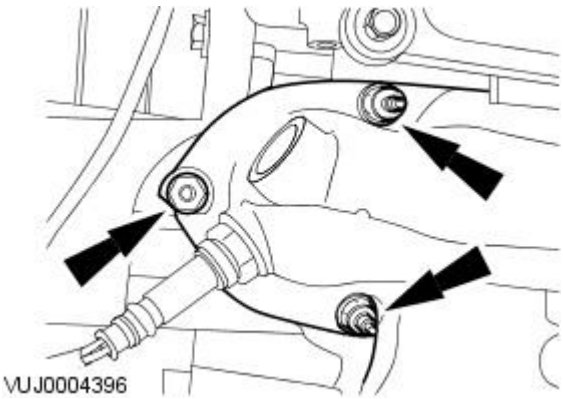
86. Disconnect the right-hand catalyst monitor sensor electrical connector.


VUJ0003748

87. Disconnect the right-hand heated oxygen sensor (HO2S) electrical connector.

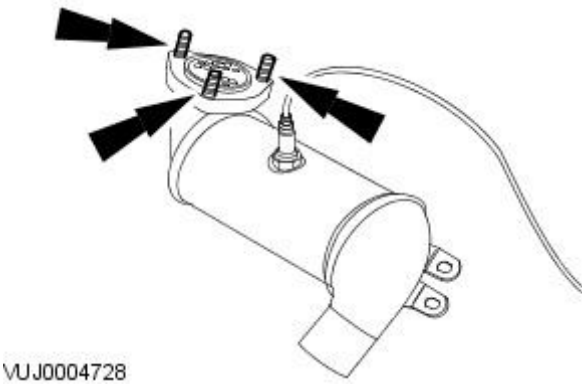

VUJ0004395

88. Remove the right-hand catalytic converter retaining bolts.

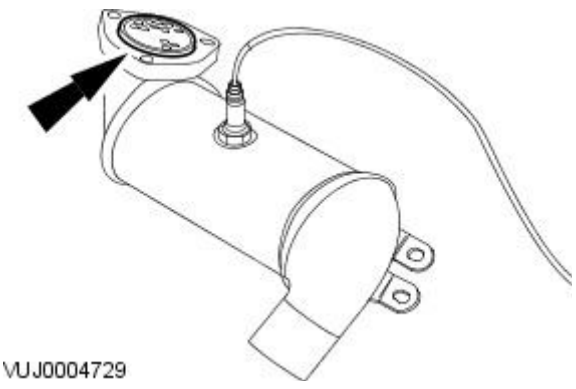

VUJ0004396

89. Remove the right-hand catalytic converter.

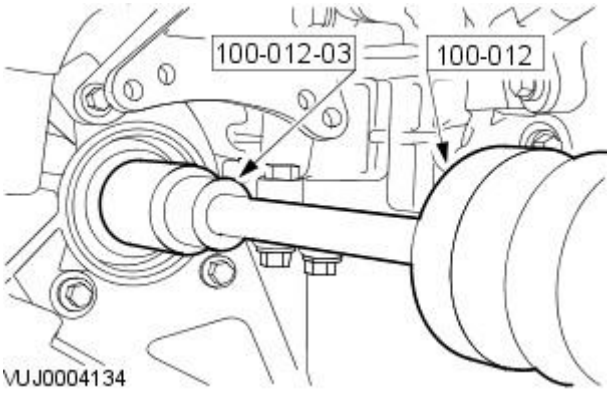
- Remove and discard the retaining nuts.


VUJ0004728

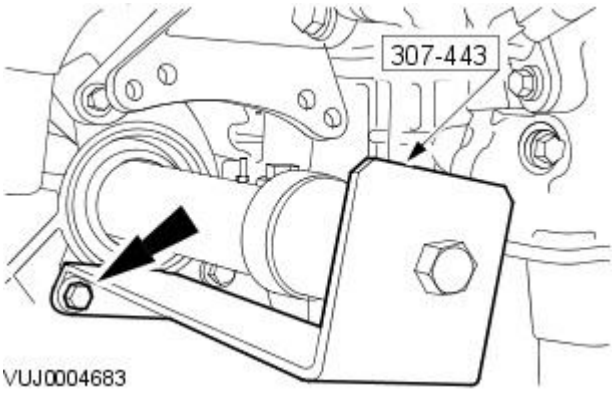
90. Remove and discard the catalytic converter retaining studs.


VUJ0004729

91. Remove and discard the catalytic converter sealing ring.

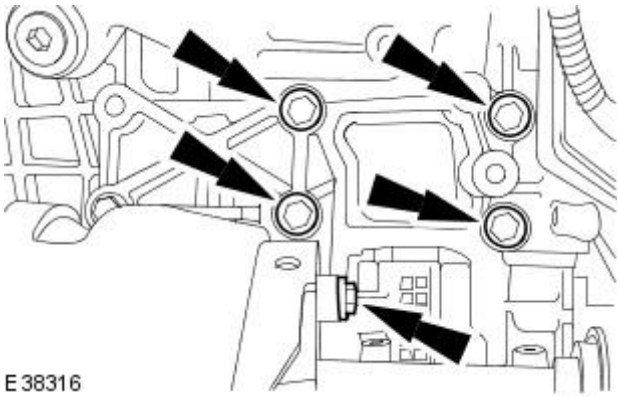


92. Using the special tool, detach the transfer case link shaft.

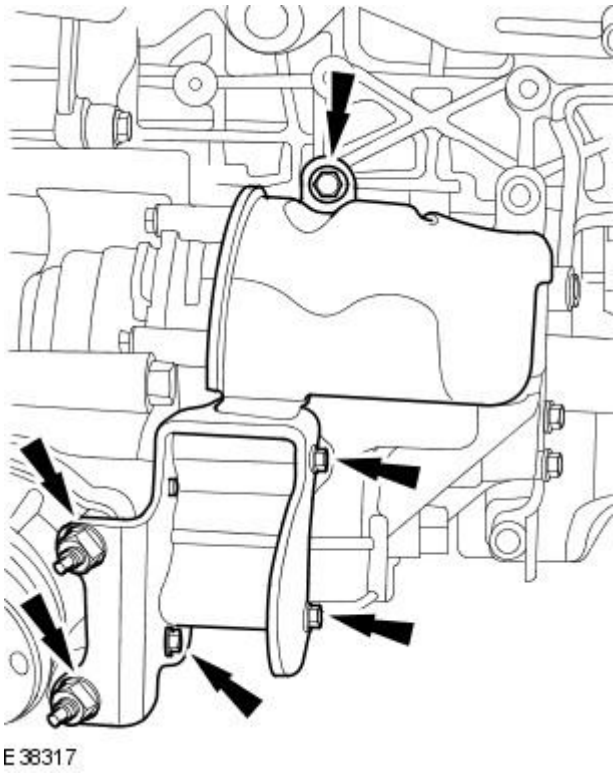


93. CAUTION: To prevent damage to the transfer case internal seal, make sure the link shaft is not retracted further that 200 mm (7.87 inches) from the transfer case.

Using the special tool, partially remove transfer case link shaft.

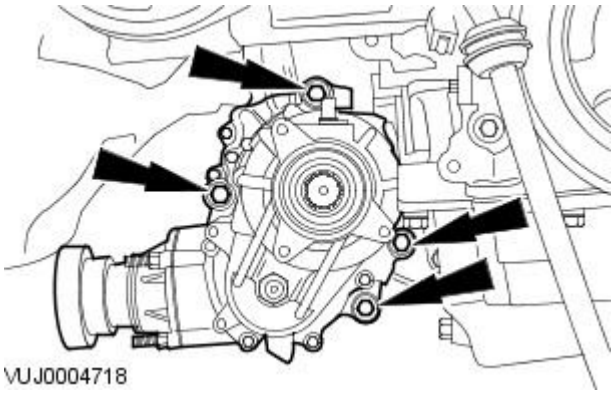


94. Remove the catalytic converter mounting bracket.

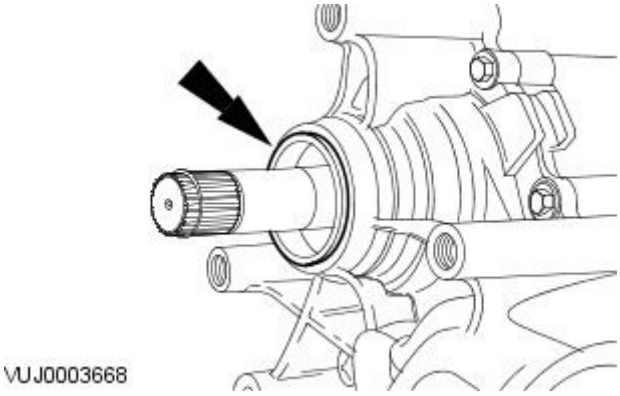


95. Remove the transfer case mounting bracket.

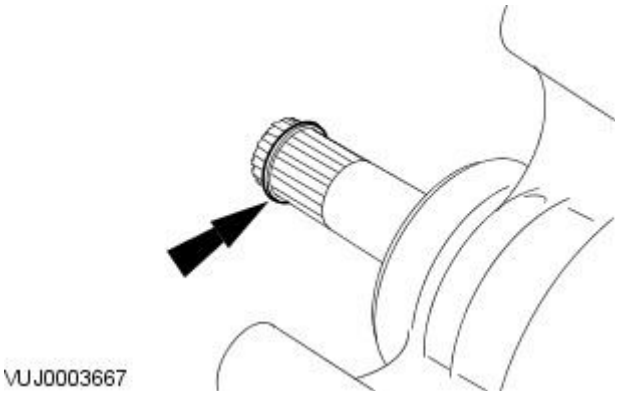
96. Remove the transfer case.


VUJ0004718

97. Remove and discard the transfer case O-ring seal.

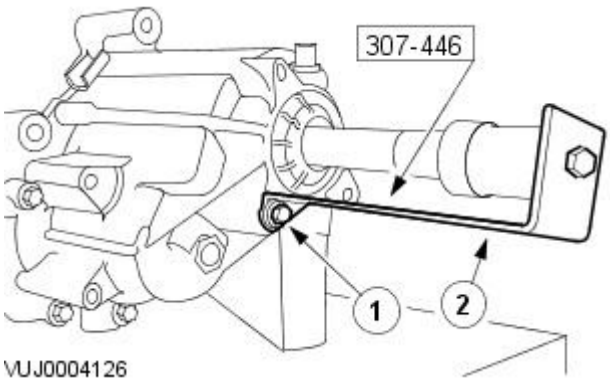

VUJ0003668

98. Remove and discard the link shaft snap ring.


VUJ0003667

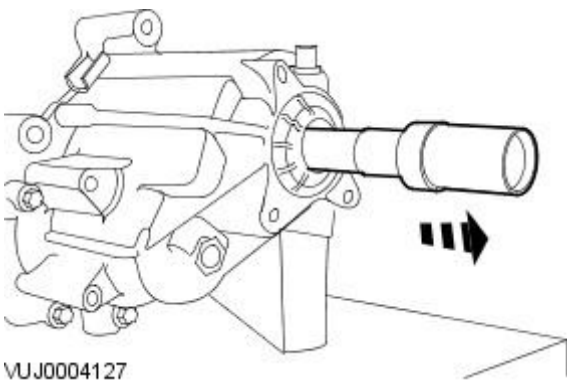
99. Remove the link shaft limiting tool.

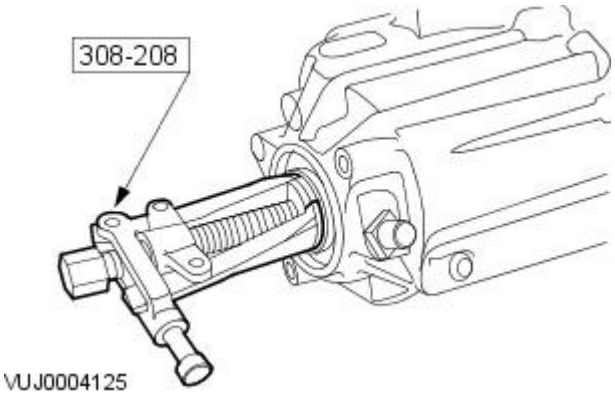
1. Remove the retaining bolt.
2. Remove the link shaft limiting tool.



VUJ0004126

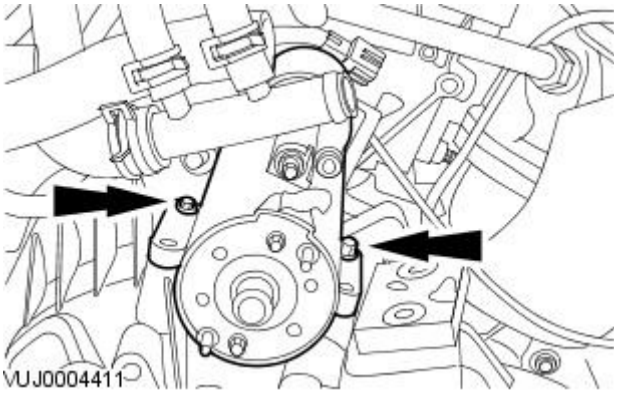
100. Remove the link shaft.


VUJ0004127

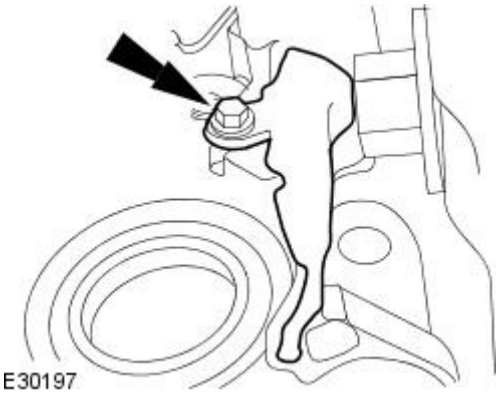


101. Using the special tool, remove and discard the link shaft oil seal.

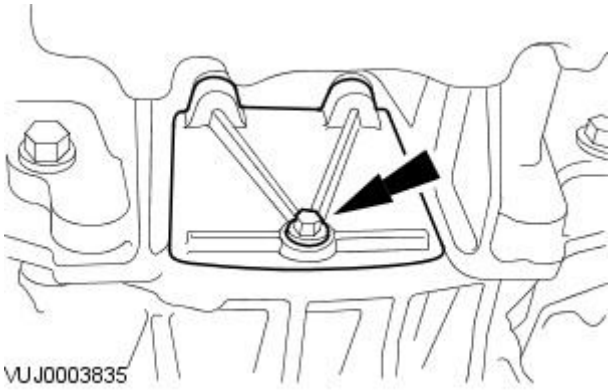
All vehicles



102. Remove the starter motor.



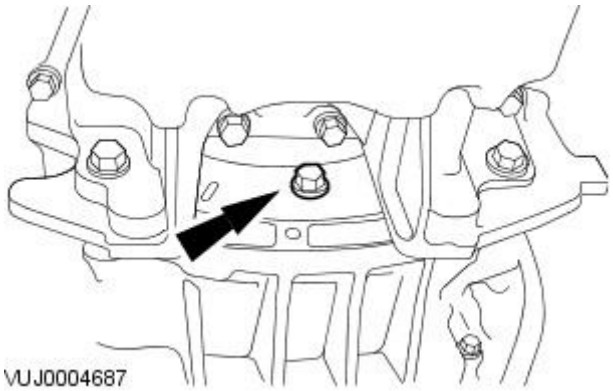
103. Remove the dust cover.



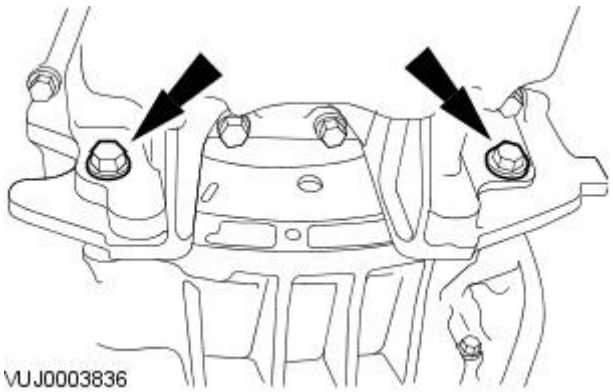
104. Remove the access cover.

105. NOTE: Rotate the torque converter to gain access to the remaining retaining bolts.

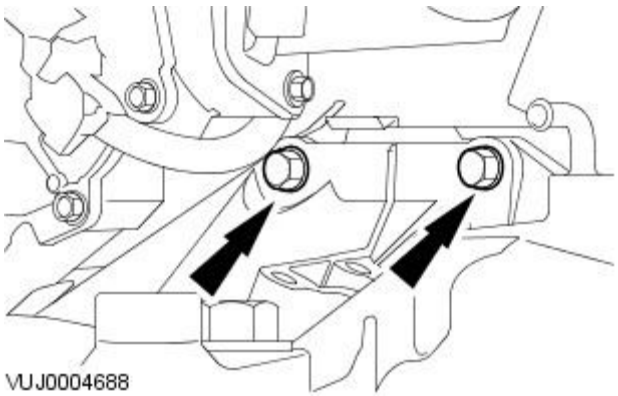
Remove the torque converter retaining bolts.



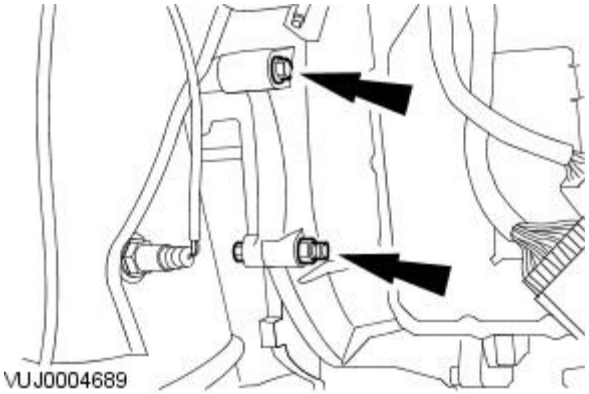
106. Remove the transaxle retaining bolts.



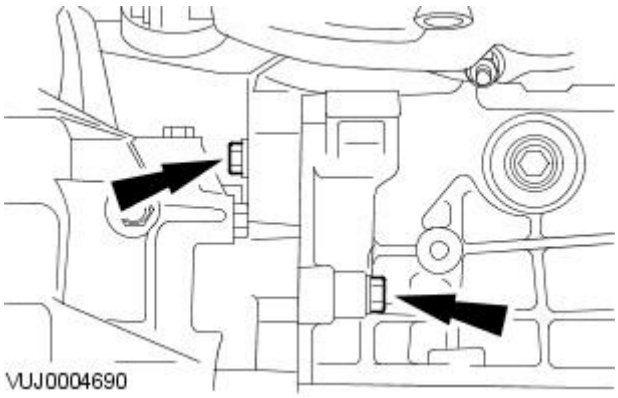
107. Remove the transaxle retaining bolts.

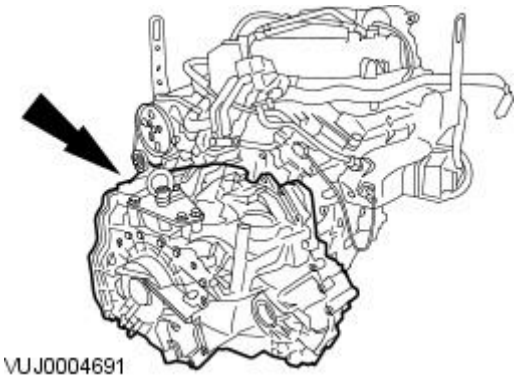


108. Remove the transaxle retaining bolts.



109. Remove the transaxle retaining bolts.



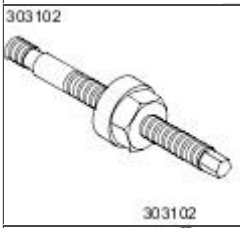

VUJ0004691

110. WARNING: Do not let the torque converter drop out of the transaxle. Failure to follow this instruction may result in personal injury.

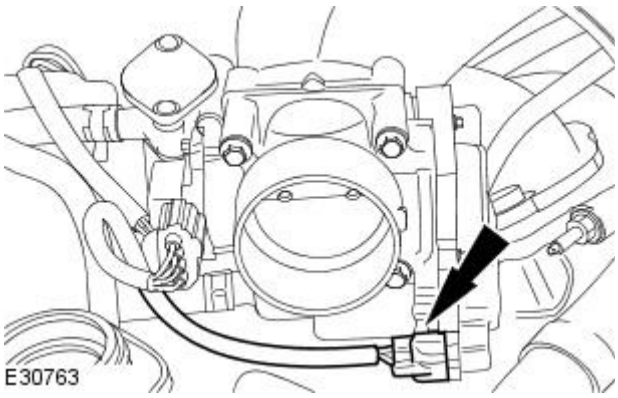
Remove the transaxle.

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Engine

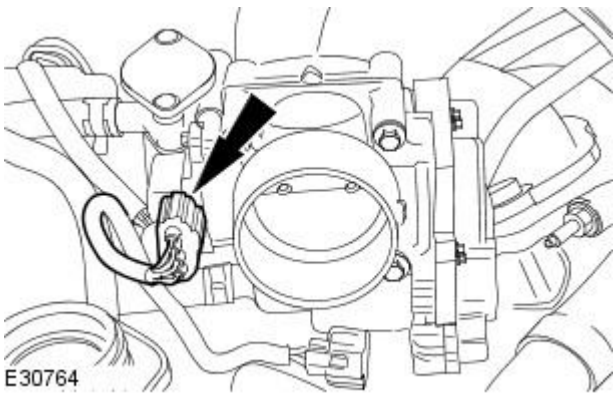
Disassembly

Special Tool(s)	
	Wrench strap-universal 303-D055
	Crankshaft Pulley Remover 303-D121
	Crankshaft Pulley Installer 303-102
	Trust Pad 303-D121-01
	Crankshaft pulley installer 303-335/2

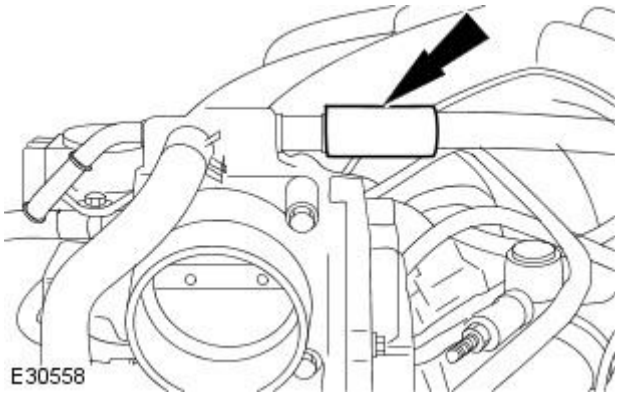
Disassembly



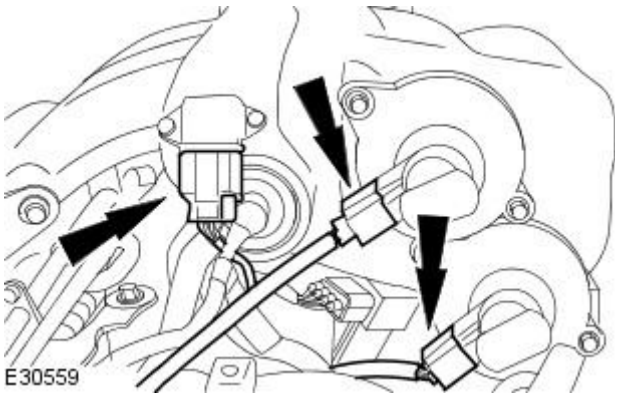
1. Disconnect the throttle motor electrical connector.



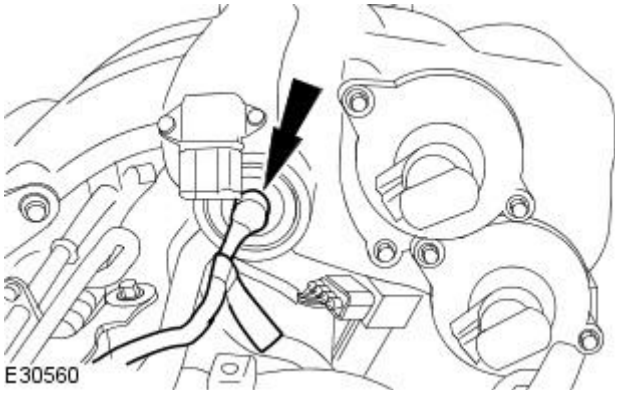
2. Disconnect the throttle position sensor.



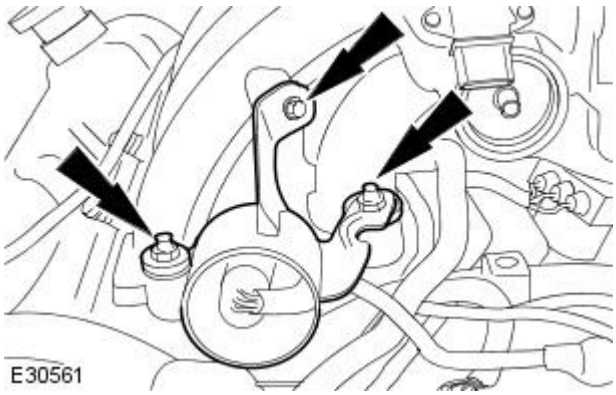
3. Disconnect the positive crankcase ventilation (PCV) hose.



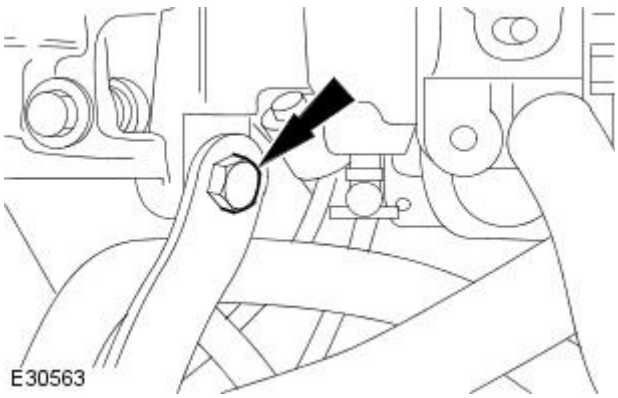
4. Disconnect the electrical connectors.



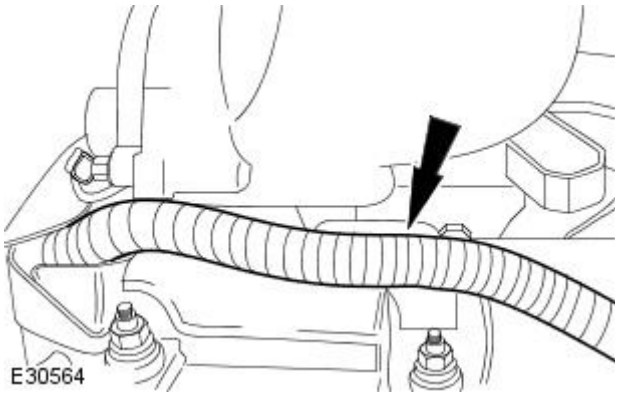
5. Disconnect the fuel pressure regulator vacuum hose.



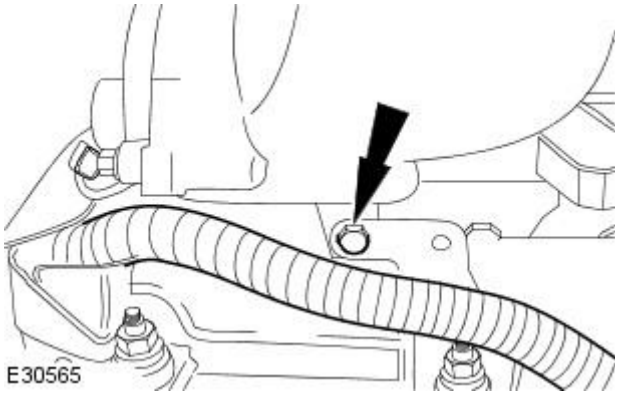
6. Remove the fuel pressure regulator bracket.



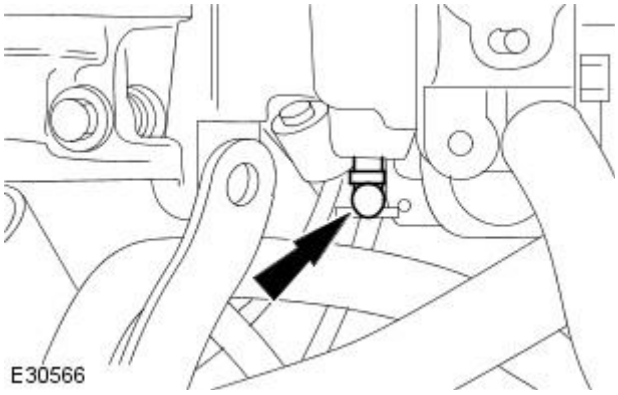
7. Detach the intake manifold front retaining bracket.



8. Detach the engine wiring harness from the intake manifold rear retaining bracket.

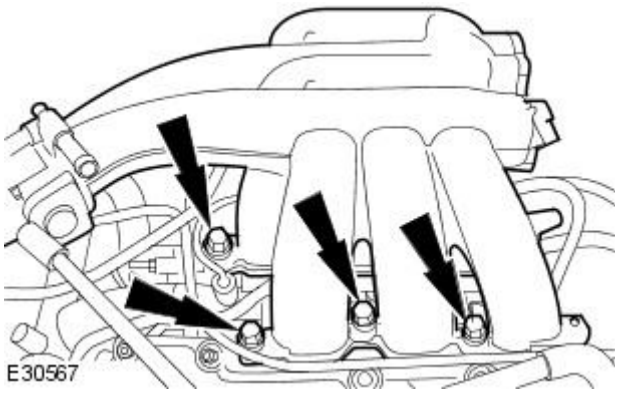


9. Detach the intake manifold rear retaining bracket.

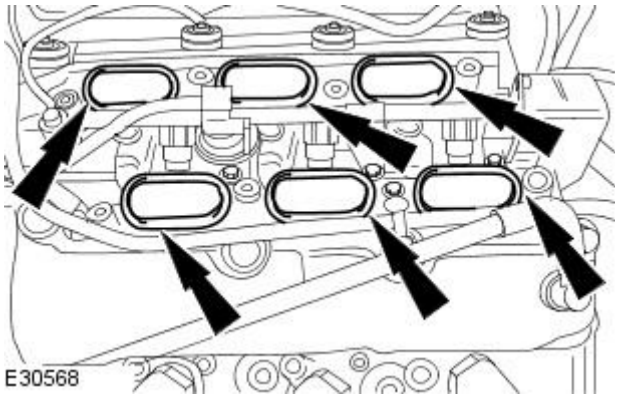


10. NOTE: The evaporative emission canister purge valve transfer pipe is attached to the induction manifold by a quick release coupling.

Disconnect the evaporative emission canister purge valve transfer pipe.

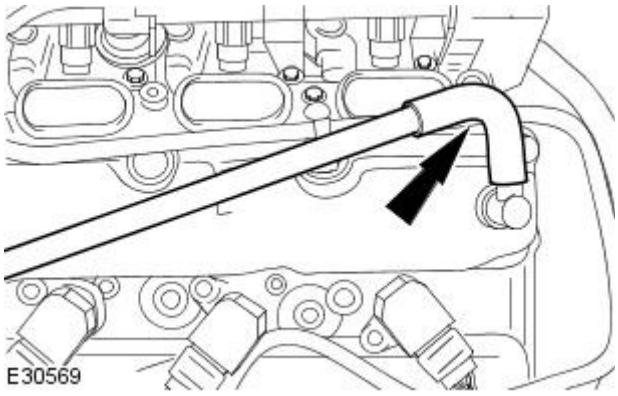


11. Remove the intake manifold.

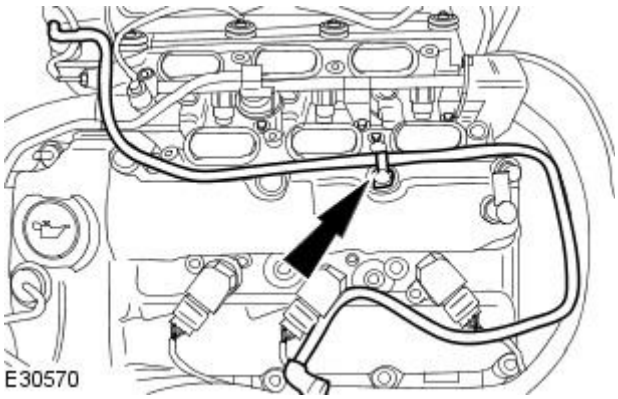


12. Remove and discard the intake manifold gaskets.

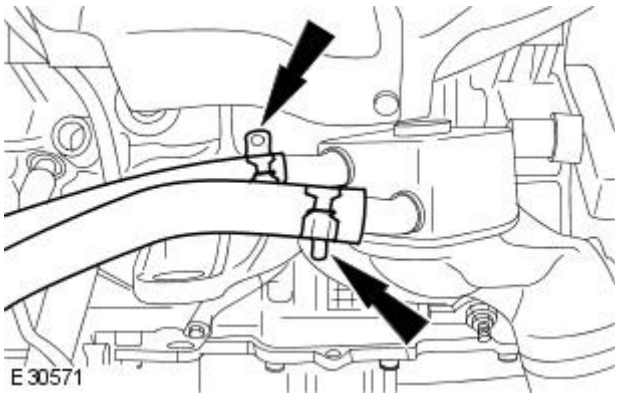
13. Remove the engine breather hose.



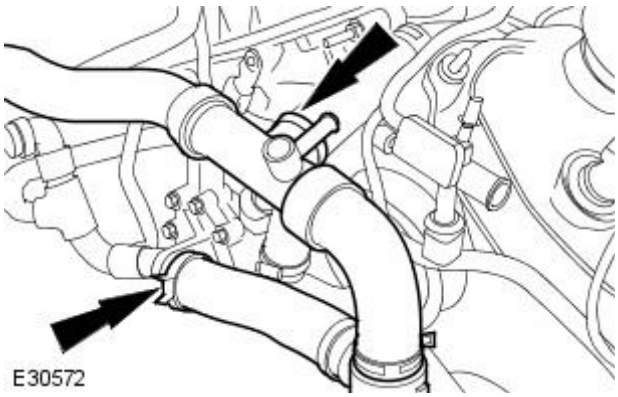
14. Remove the evaporative emission purge valve hose.



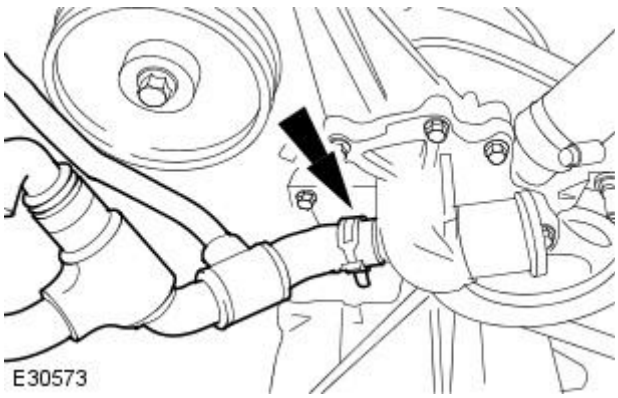
15. Disconnect the oil cooler coolant hoses.



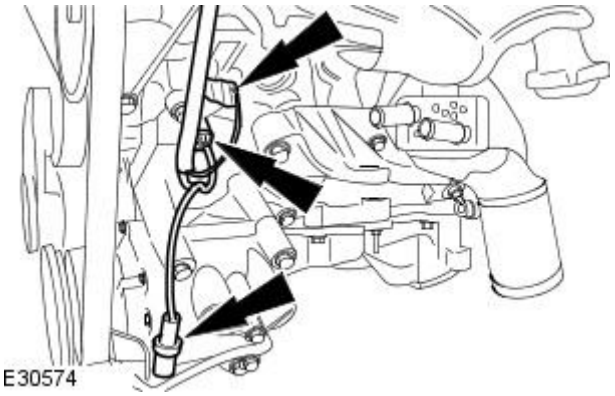
16. Remove the coolant hose.



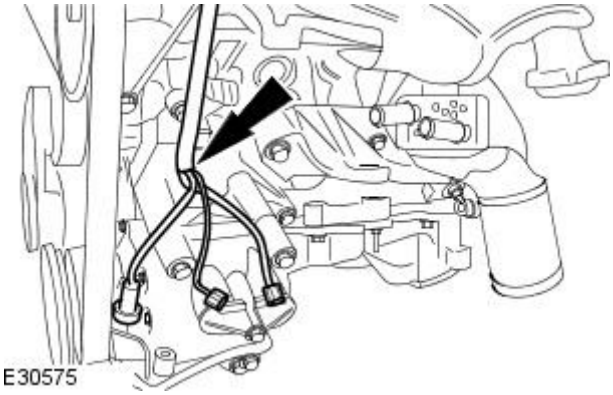
17. Remove the coolant hose.



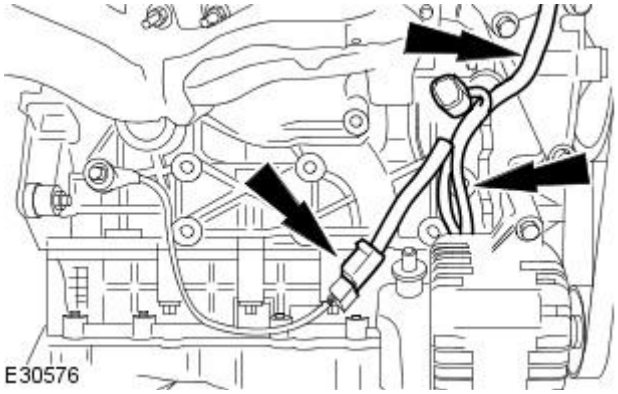
18. Disconnect the electrical connectors.



19. Detach the engine harness.

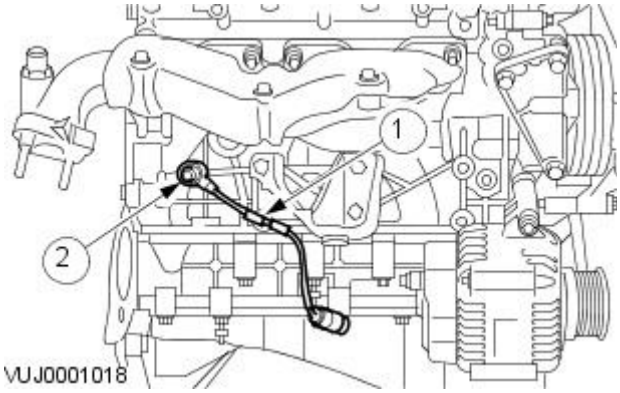


20. Detach engine harness.

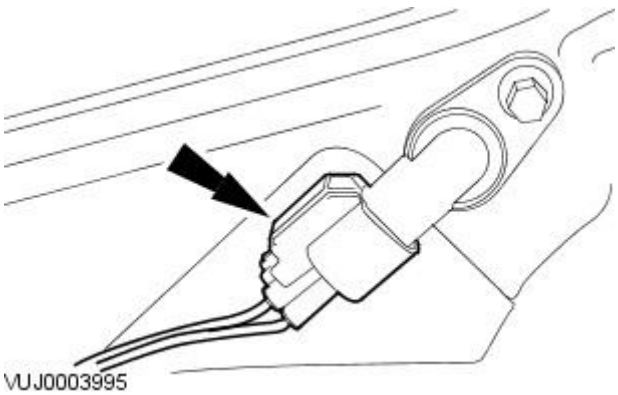


21. Remove the rear knock sensor.

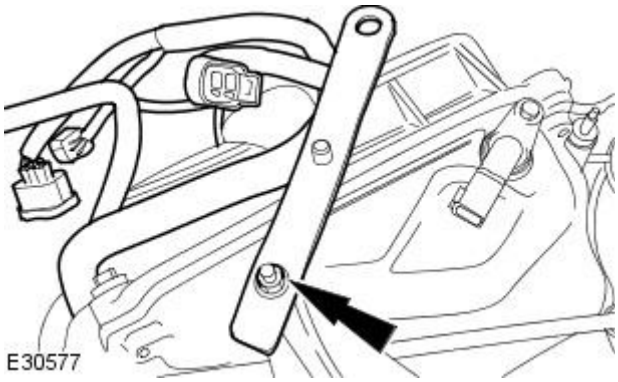
1. Detach the knock sensor wiring harness.
2. Remove the rear knock sensor.



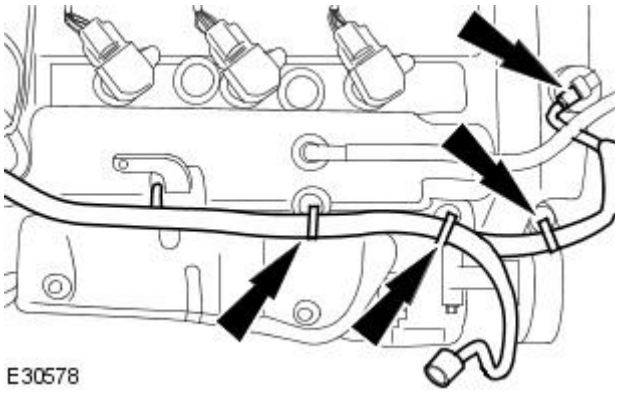
22. Disconnect the right-hand camshaft position sensor.



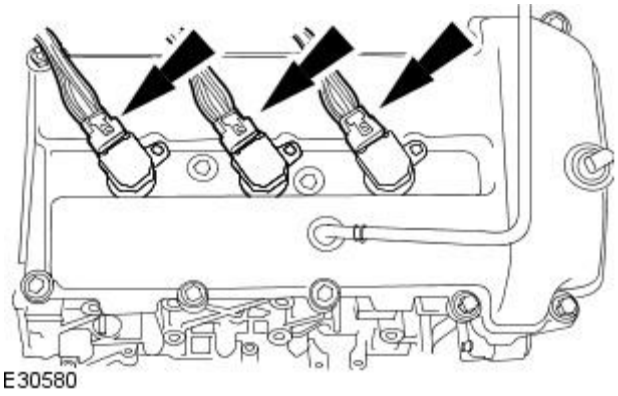
23. Detach the engine harness retaining bracket.



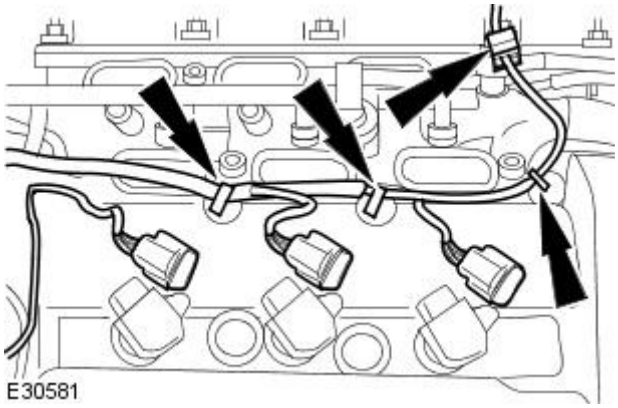
24. Detach the engine harness.



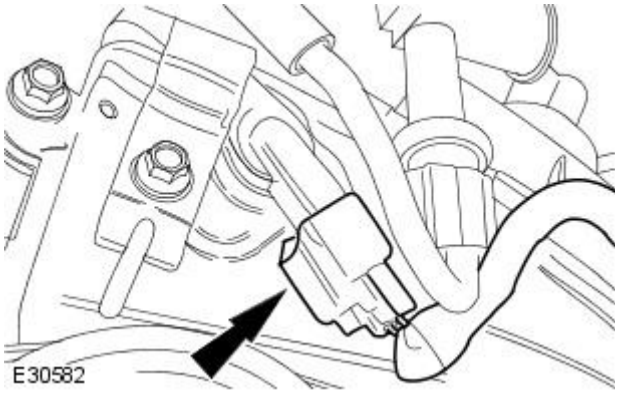
25. Disconnect the right-hand ignition coils.

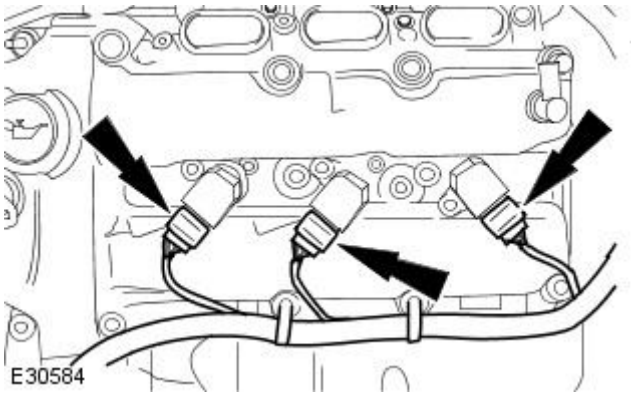


26. Detach the engine harness.

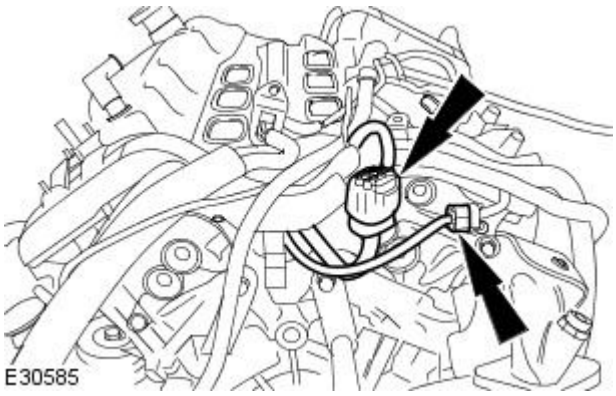


27. Disconnect the left-hand camshaft position sensor.

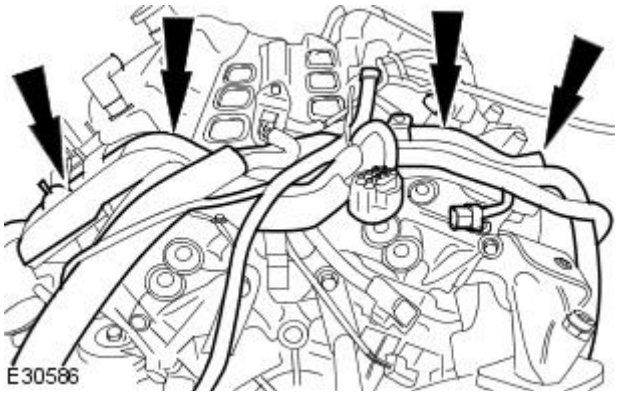




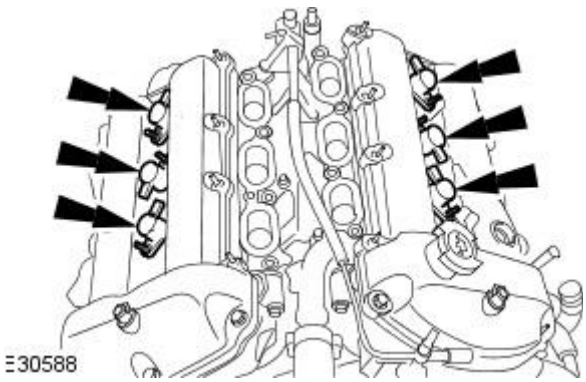
28. Disconnect the left-hand ignition coils.



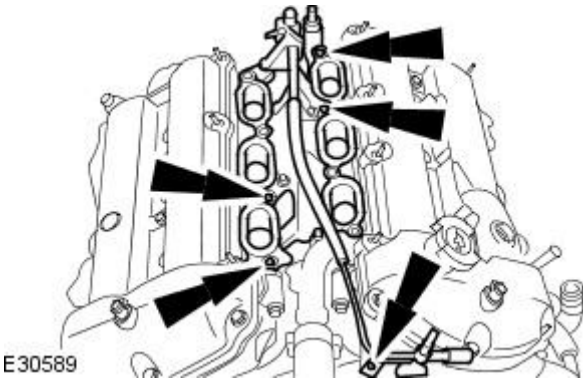
29. Disconnect the engine wiring harness electrical connectors.



30. Remove the engine wiring harness.

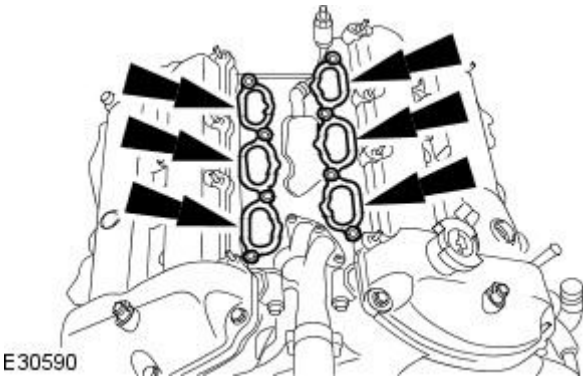


31. Remove the ignition coils.

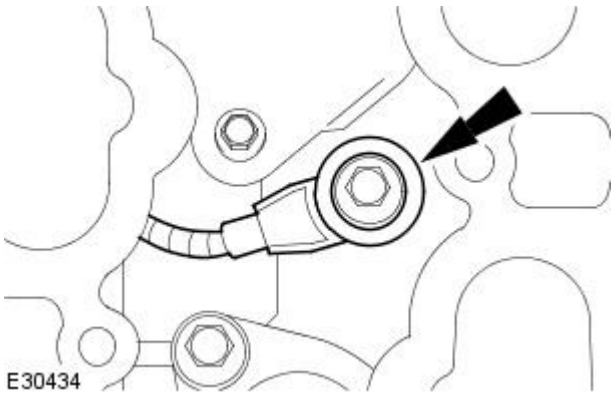


32. Remove the lower intake manifold and injector supply manifold.

33. Remove and discard the lower intake manifold gaskets.

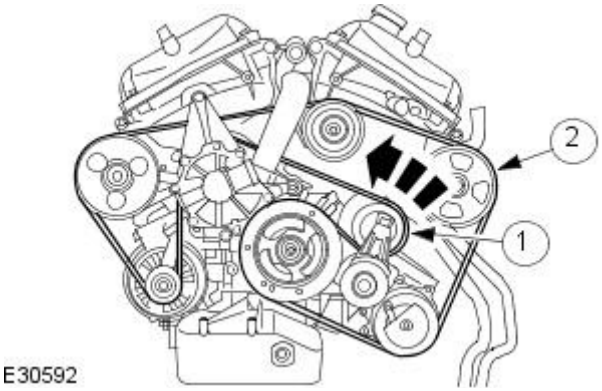


34. Remove the left-hand knock sensor.

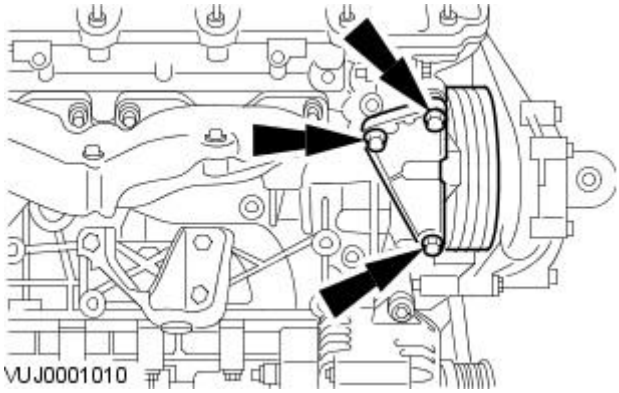


35. Remove the accessory drive belt.

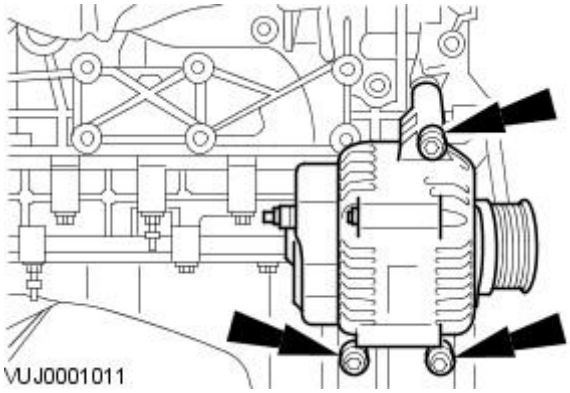
1. Use a 3/8 inch drive bar to release the accessory drive belt tensioner.
2. Remove the accessory drive belt.



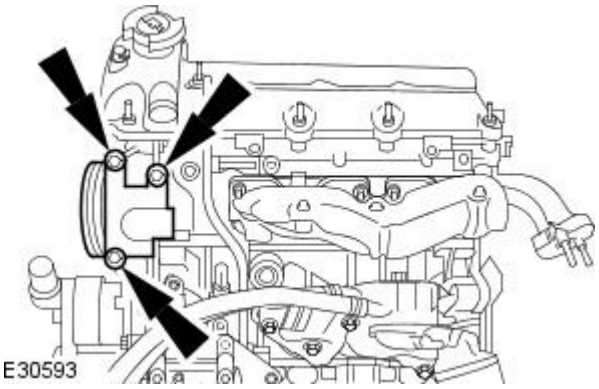
36. Remove the right-hand idler pulley.



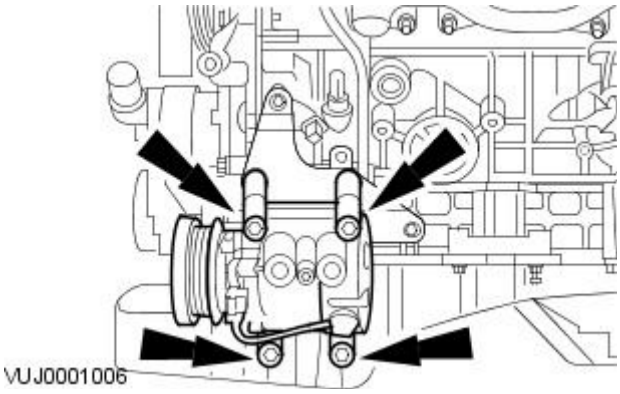
37. Remove the generator.



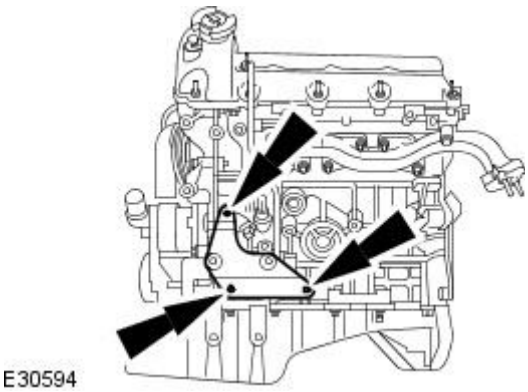
38. Remove the power steering pump.



39. Remove the air conditioning (A/C) compressor.

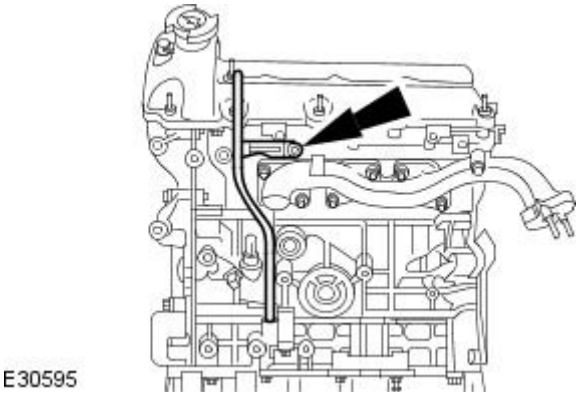


40. Remove the A/C compressor mounting bracket.



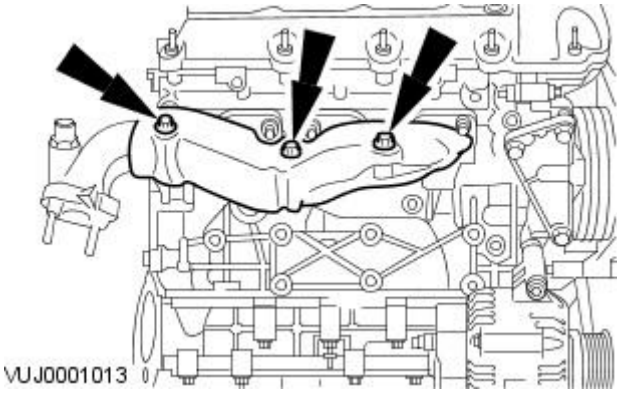
41. Remove the oil level indicator tube.

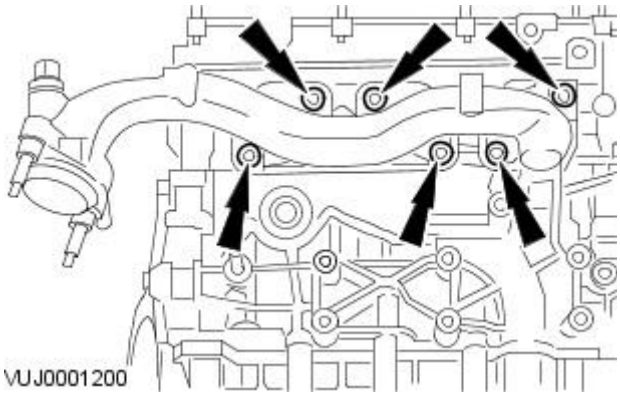
1. Remove and discard the O-ring seal.



42. NOTE: Right-hand shown, Left-hand similar.

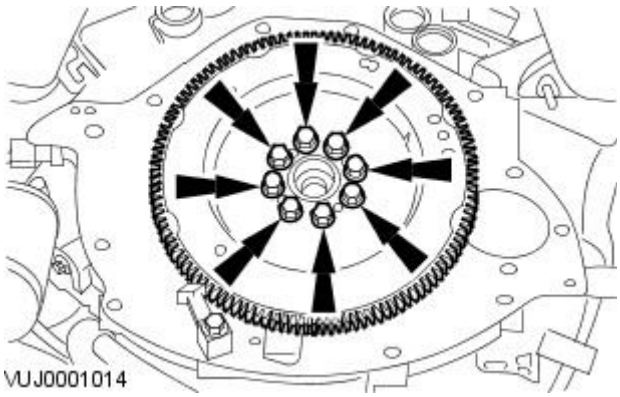
Remove the exhaust manifold heat shields.





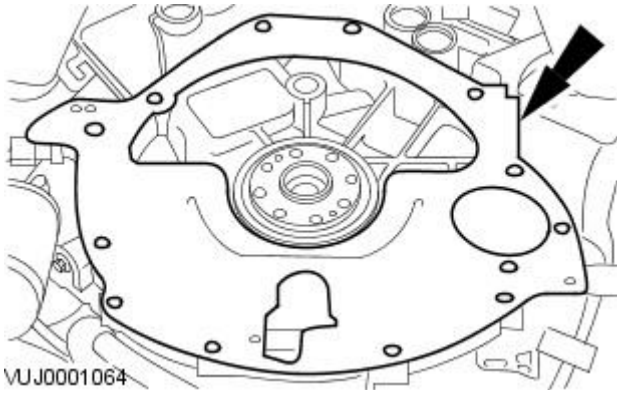
43. NOTE: Right-hand shown, Left-hand similar.

Remove the exhaust manifolds.

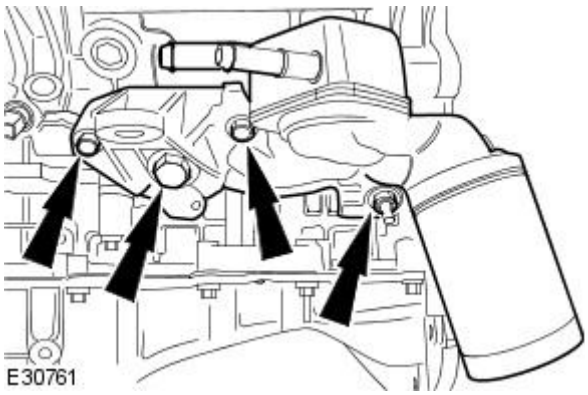


44. Remove the flywheel.

- Prevent the engine from rotating.

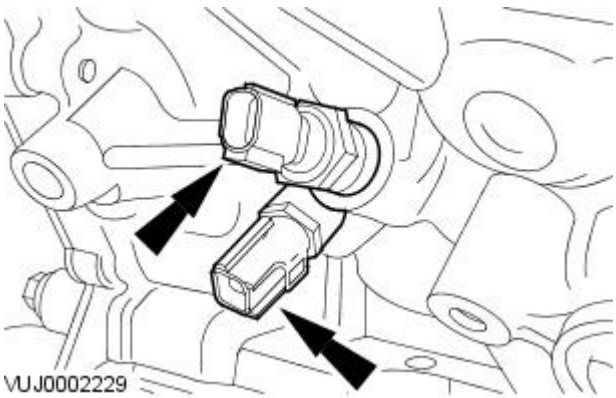


45. Remove the engine rear backing plate.

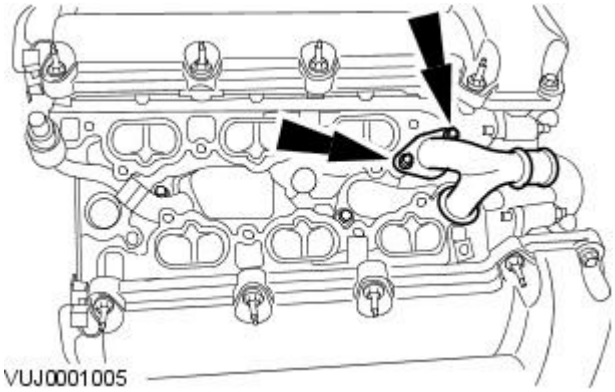


46. Remove the oil filter housing assembly.

- Remove and discard the O-ring seal.

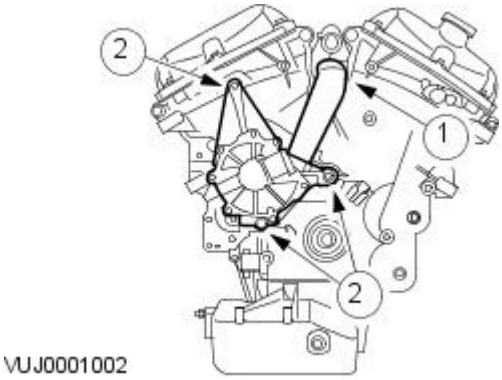


47. Remove the engine oil pressure and oil temperature sensors.


VUJ0001005

48. Remove the coolant crossover tube.

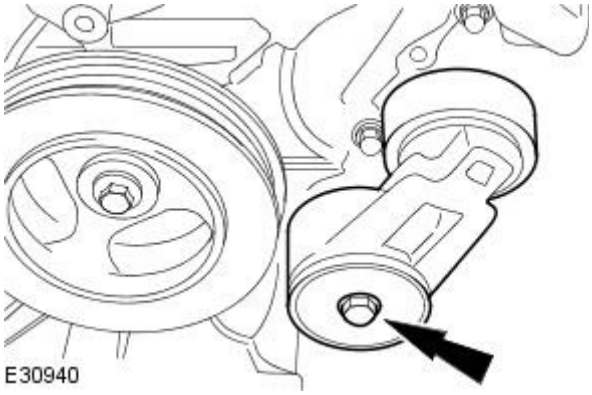
- Remove and discard the O-ring seals.



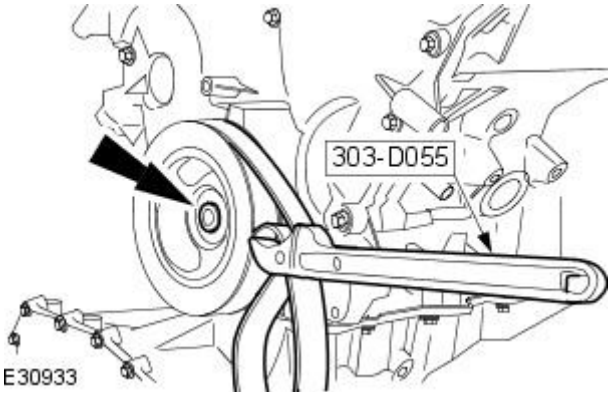
VUJ0001002

49. Remove the water pump and coolant hose assembly.

1. Detach the hose.
2. Remove the water pump and coolant hose assembly.

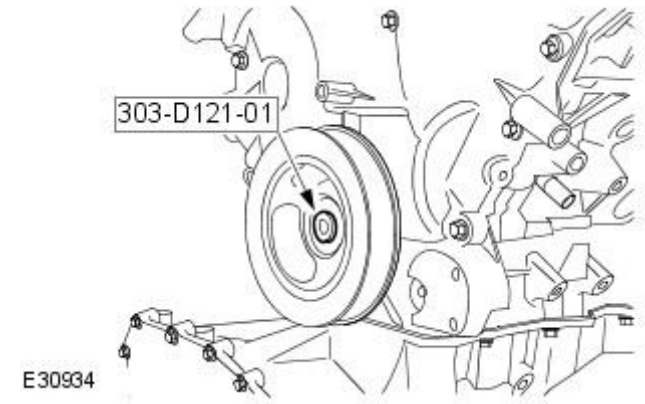

E30940

50. Remove the accessory drive belt tensioner.



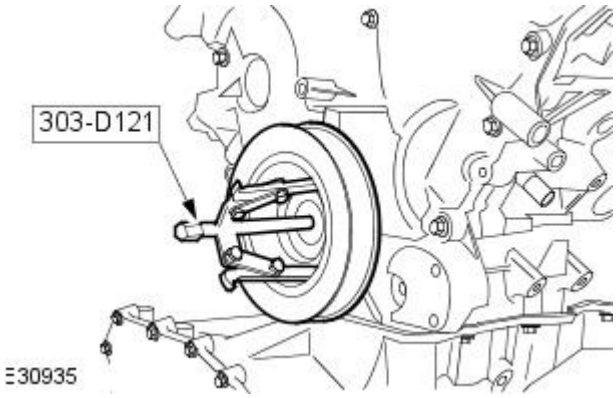
E30933

51. Install the special tool, loosen the crankshaft pulley retaining bolt.

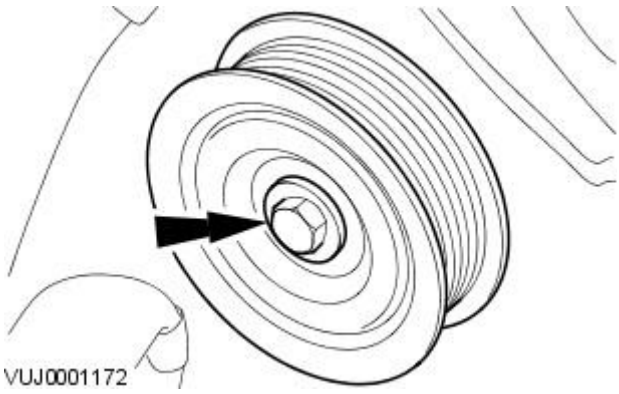


E30934

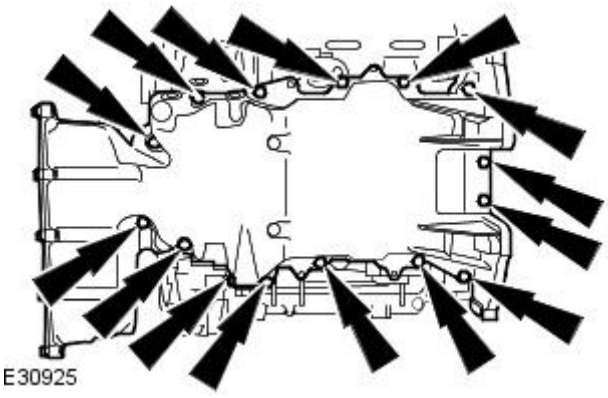
52. Install the special tool.



53. Using the special tool, remove the crankshaft vibration damper.

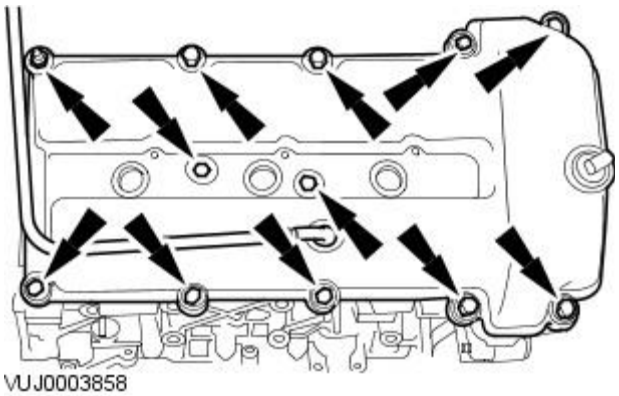


54. Remove the left-hand idler pulley.



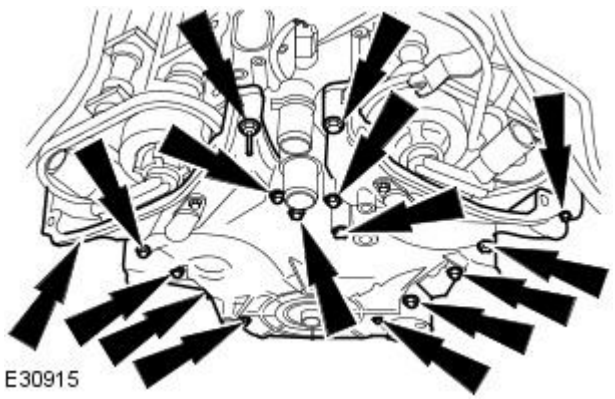
55. Remove the oil pan.

- 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.



56. NOTE: Right-hand shown, left-hand similar.

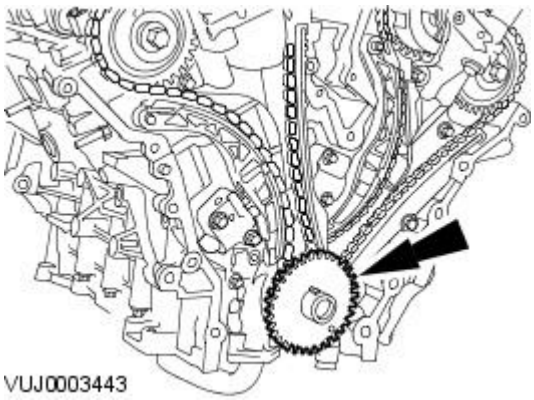
Remove the valve covers.



57. Remove the engine front cover

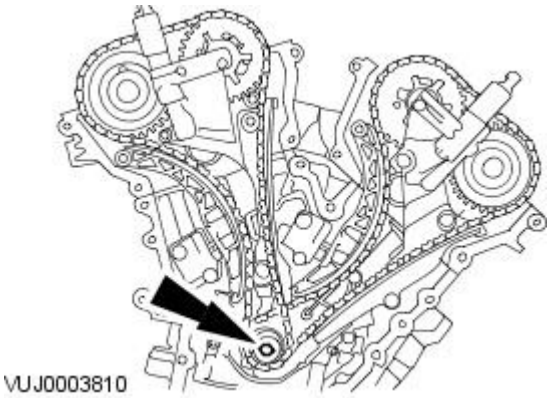
- Remove and discard the engine front cover gaskets.

58. Remove the crankshaft position (CKP) sensor pulse wheel.


VUJ0003443

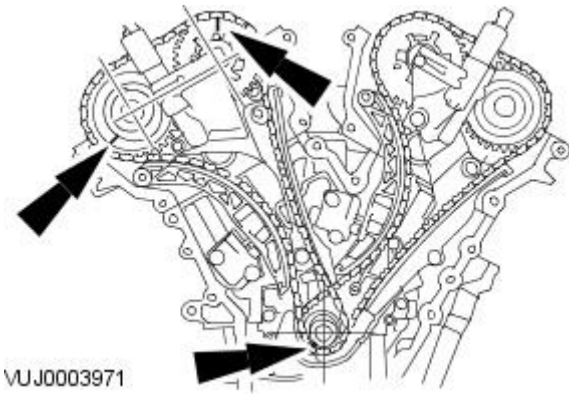
59. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Install the crankshaft pulley retaining bolt and washer.


VUJ0003810

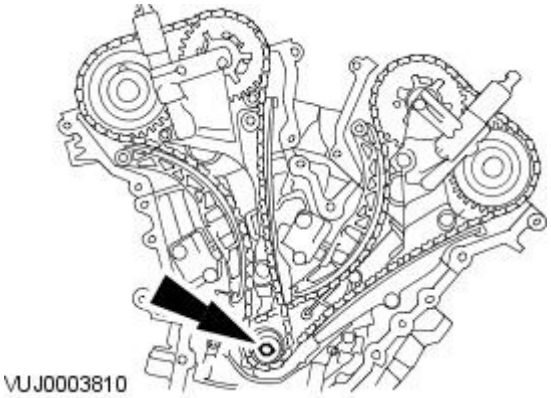
60. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

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.

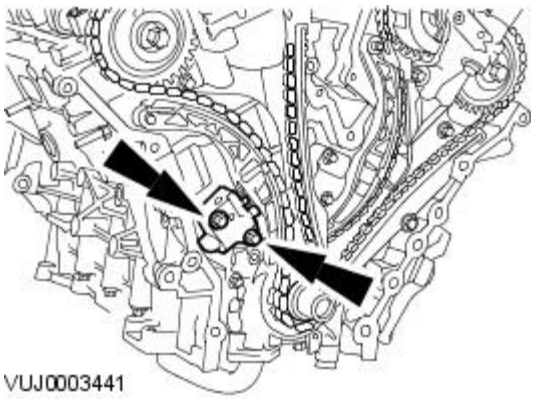

VUJ0003971

61. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

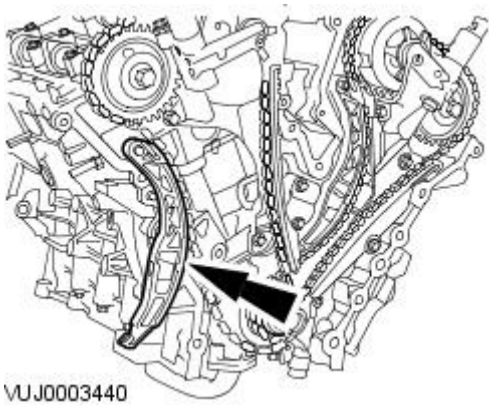
Remove the crankshaft pulley retaining bolt and washer.


VUJ0003810

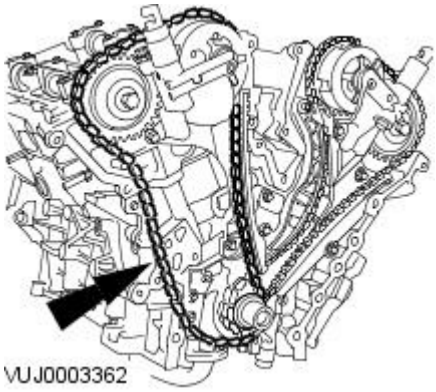
62. Remove the right-hand timing chain tensioner.


VUJ0003441

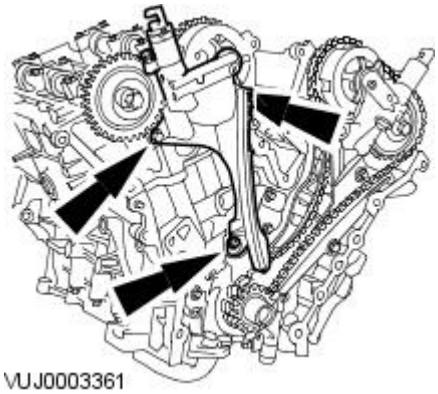
63. Remove the right-hand timing chain outer guide.


VUJ0003440

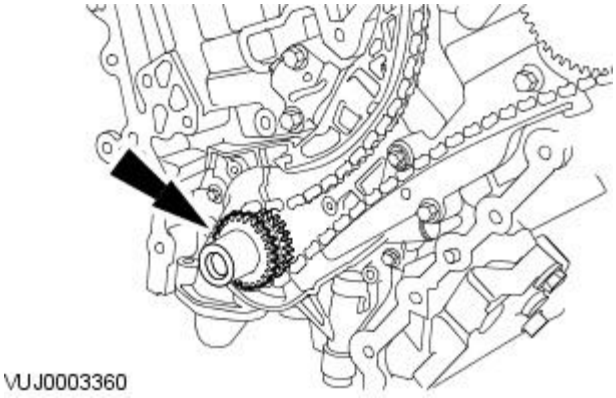
64. Remove the right-hand timing chain.


VUJ0003362

65. Remove the right-hand timing chain inner guide.

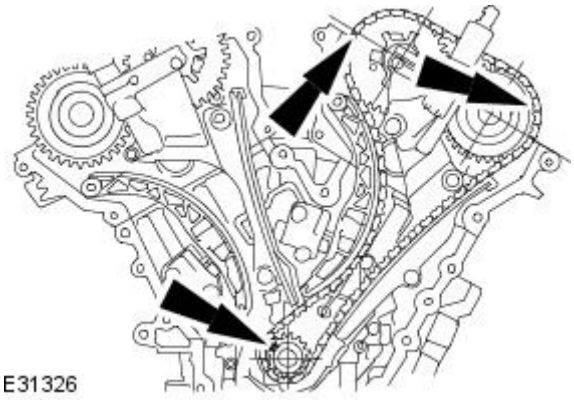

VUJ0003361

66. Remove the crankshaft outer sprocket.


VUJ0003360

67. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Install the crankshaft pulley retaining bolt and washer.


E31326

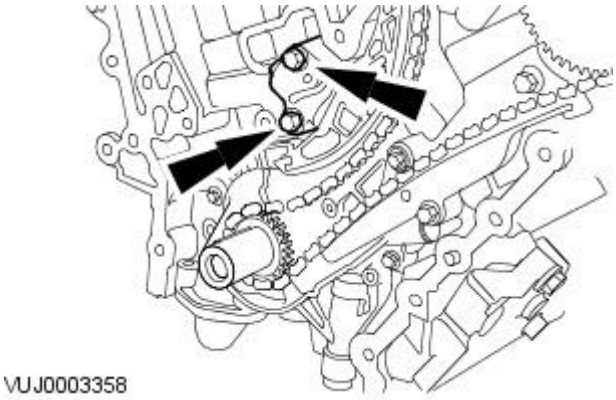
68. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

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.

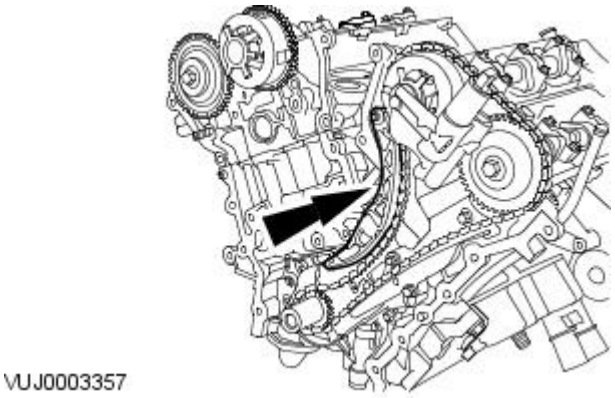
69. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Remove the crankshaft pulley retaining bolt and washer.

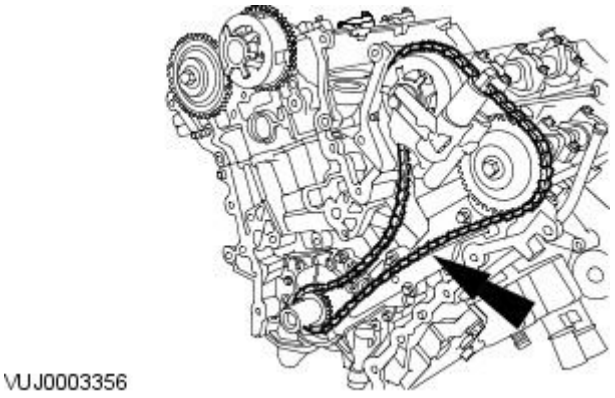
70. Remove the left-hand timing chain tensioner.

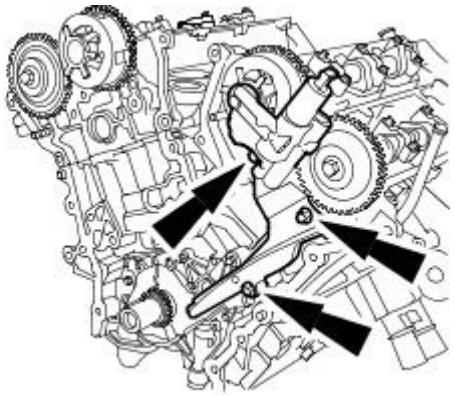

VUJ0003358

71. Remove the left-hand timing chain inner guide.


VUJ0003357

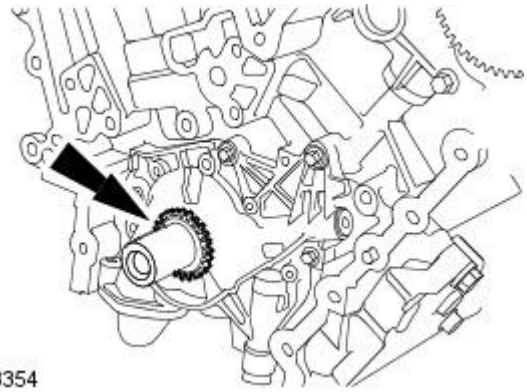
72. Remove the left-hand timing chain.


VUJ0003356



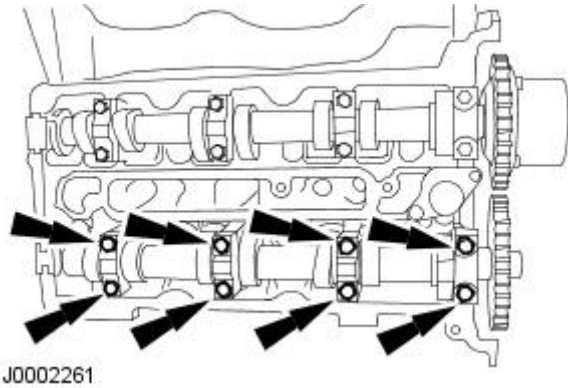
VUJ0003355

73. Remove the left-hand timing chain outer guide.



VUJ0003354

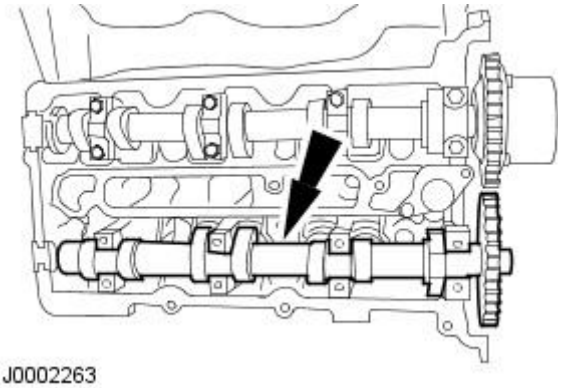
74. Remove the crankshaft inner sprocket.



VUJ0002261

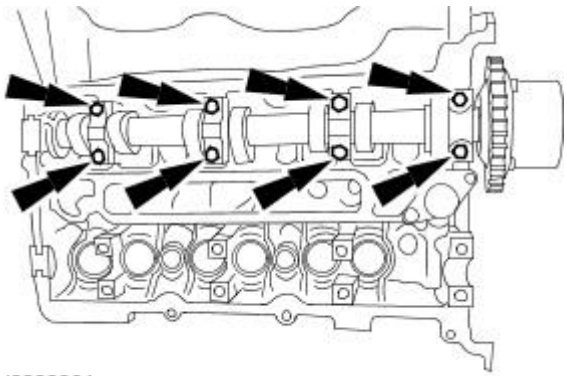
75. Remove the RH exhaust camshaft bearing cap bolts evenly.

- Remove the exhaust camshaft bearing caps.



VUJ0002263

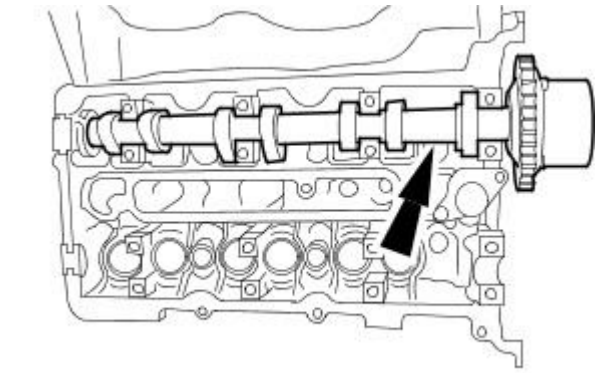
76. Remove the RH exhaust camshaft.



VUJ0002264

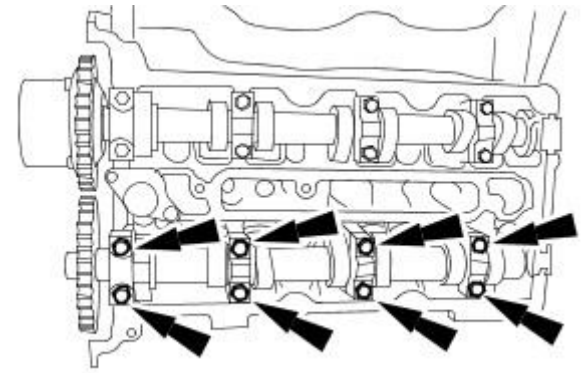
77. Remove the RH inlet camshaft bearing cap bolts evenly.

- Remove the inlet camshaft bearing caps.



VUJ0002266

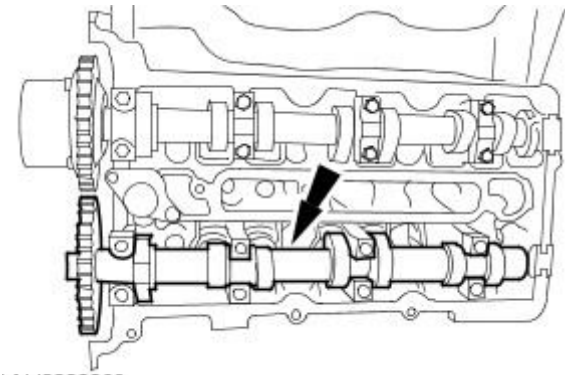
78. Remove the RH inlet camshaft.



VUJ0002267

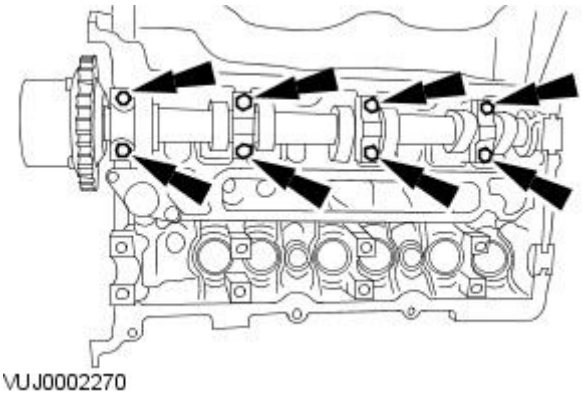
79. Remove the LH exhaust camshaft bearing cap bolts evenly.

- Remove the exhaust camshaft bearing caps.



VUJ0002269

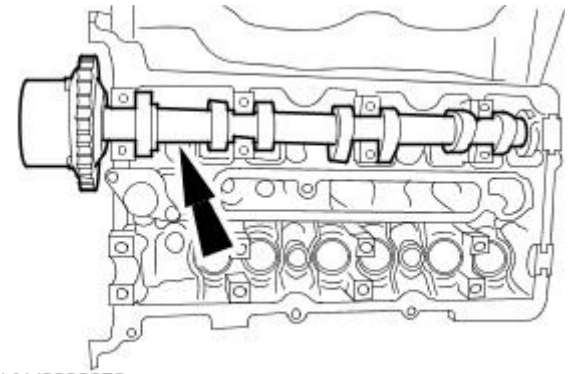
80. Remove the LH exhaust camshaft.



VUJ0002270

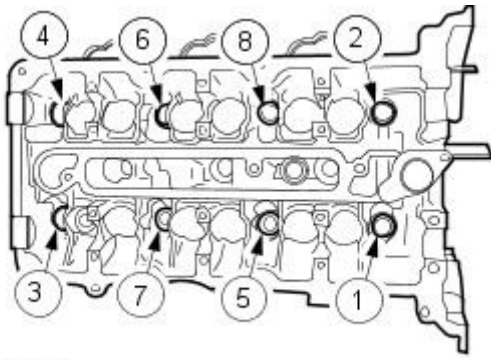
81. Remove the LH inlet camshaft bearing cap bolts evenly.

- Remove the inlet camshaft bearing caps.



VUJ0002272

82. Remove the LH inlet camshaft.

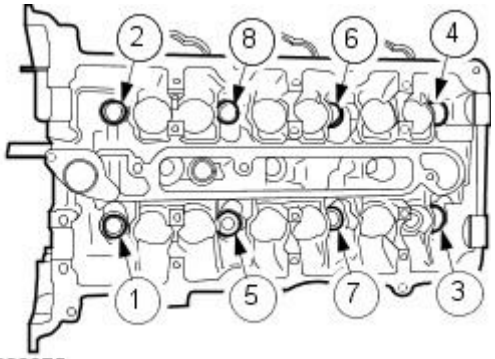


VUJ0002273

83. NOTE: Remove the bolts in the indicated sequence.

Remove the RH cylinder head.

- Discard the gasket.

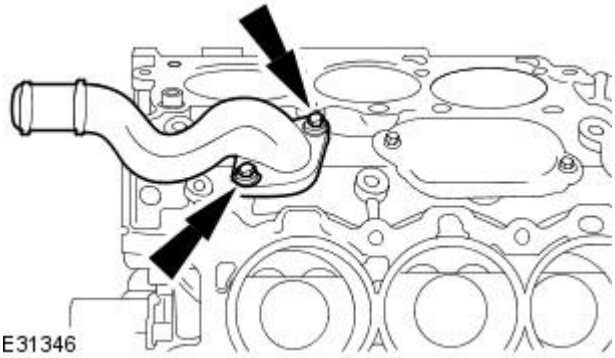


VUJ0002275

84. NOTE: Remove the bolts in the indicated sequence.

Remove the LH cylinder head.

- Discard the gasket.


E31346

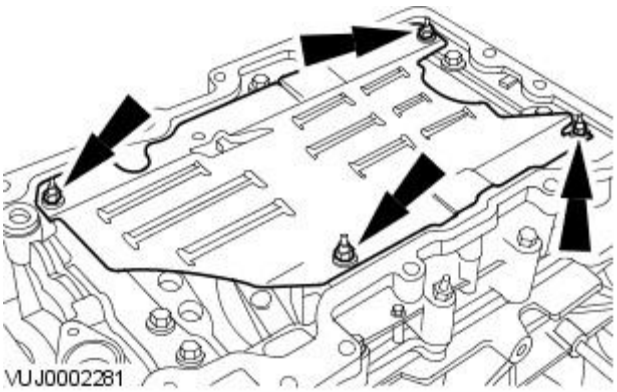
85. Remove the engine coolant housing.

- Discard the 'O' ring seals.

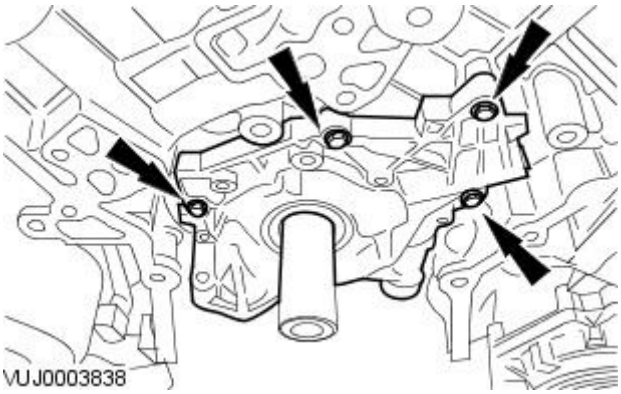

VUJ0003458

86. NOTE: Engine inverted for clarity.

Remove the oil pump tube.

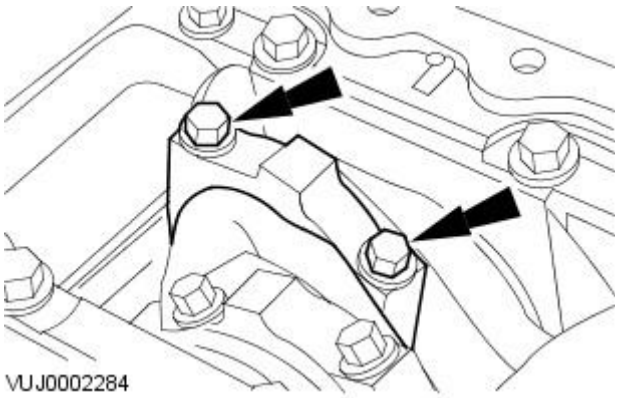

VUJ0002281

87. Remove the oil pan baffle.



88. Remove the oil pump.

- Remove and discard the O-ring seal.
- Inspect the oil pump for damage and wear.



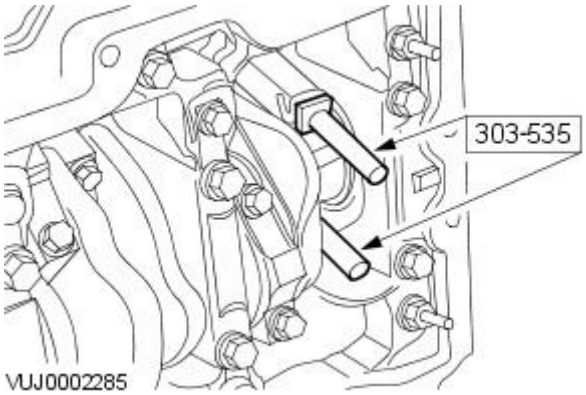
89. CAUTION: Pistons, connecting rods and connecting rod bearings should be numbered to make sure they are reassembled in the same position.

• NOTE: Mark the position of the connecting rod caps to the connecting rods to make sure correct insulation.

• NOTE: Discard the connecting rod bolts after removal.

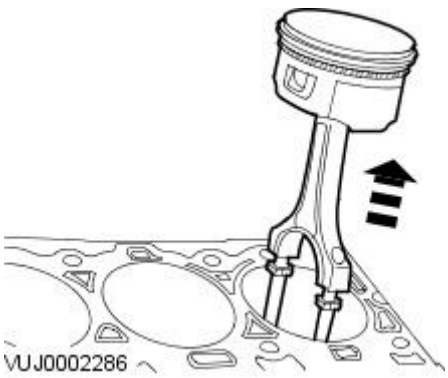
Remove the connecting rod bolts, the connecting rod caps and the lower connecting rod bearings.

90. Inspect the tops of the cylinder bores. As necessary remove ridge and carbon build up from each cylinder.



91. CAUTION: Use appropriate protection to prevent damage to the crankshaft bearing journals and cylinder bore surfaces.

Install special tools to the connecting rods.



92. CAUTION: Care should be taken not to damage the connecting rod and cap joint face surfaces or possible engine damage may occur. Avoid contaminating the fracture joint surfaces with dirt or grease.

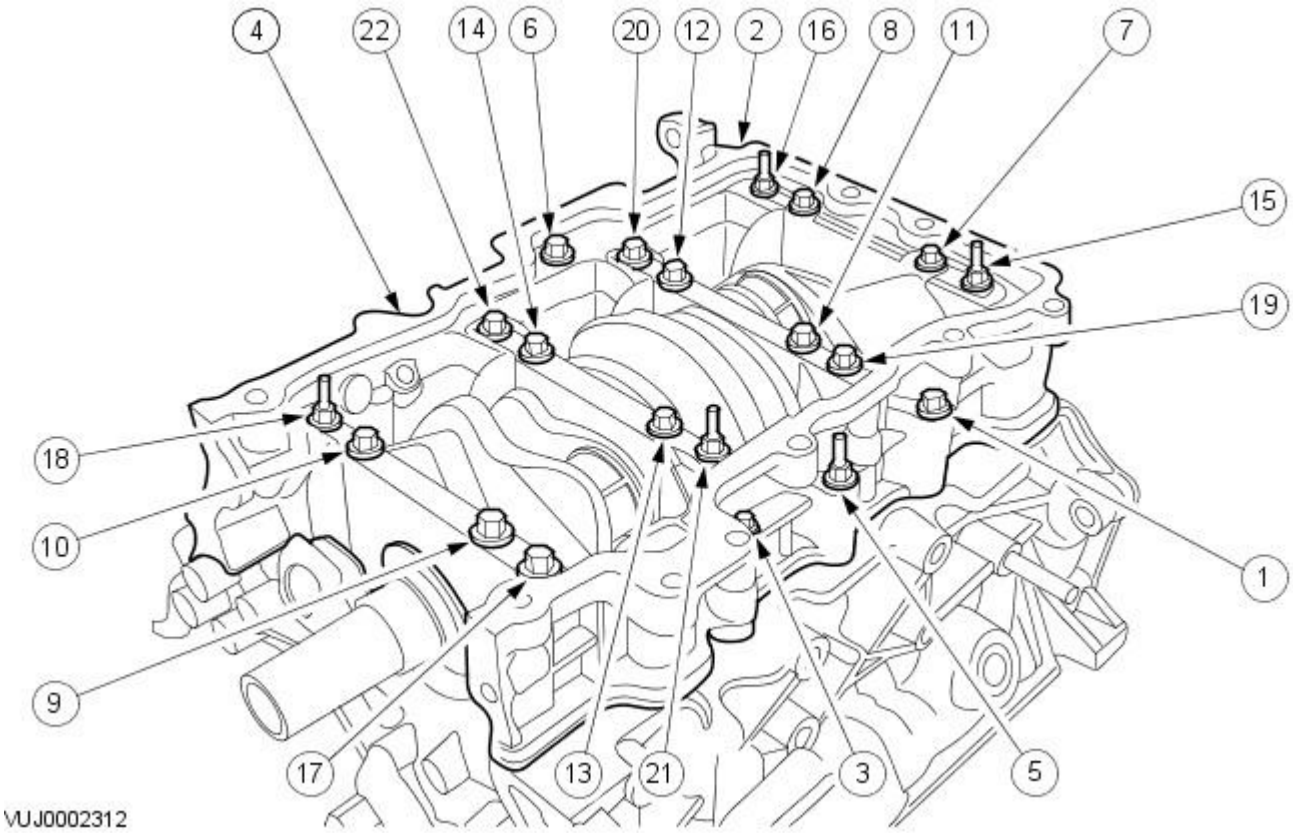
• NOTE: Reattach the connecting rods and caps after removal to avoid mismatch.

Remove the pistons.

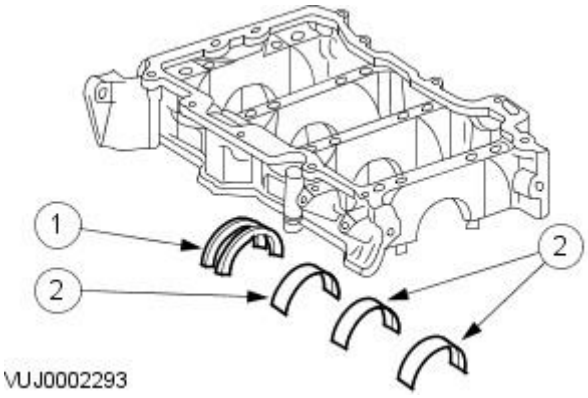
- Rotate the crankshaft to locate pistons at the bottom of travel.
- Push the piston, connecting rod and upper bearing through the top of the cylinder.

93. NOTE: Remove the lower cylinder block bolts in the indicated sequence.

Remove the lower cylinder block.



VUJ0002312

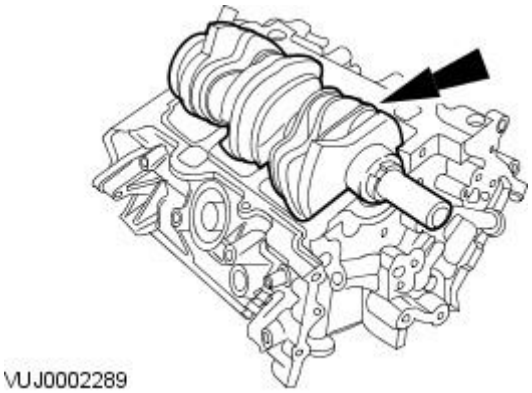


VUJ0002293

94. NOTE: Mark the position of the upper and lower crankshaft main bearing and the crankshaft thrust bearing for reassembly.

Remove the lower crankshaft bearings.

1. Remove the lower crankshaft thrust main bearing.
2. Remove the lower crankshaft main bearings.

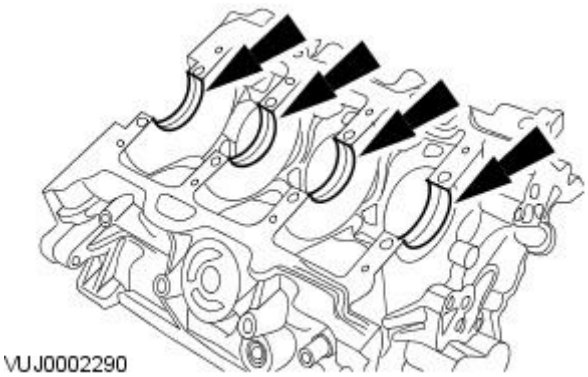

VUJ0002289

95. CAUTION: Avoid damage to any crankshaft bearing surfaces.

• NOTE: Never remove any pipe plugs or dowels unless they are to be newly installed or the cylinder block is to be washed.

Remove the crankshaft.

- Discard the crankshaft rear main oil seal.

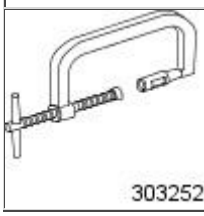

VUJ0002290

96. Remove the upper crankshaft main bearings.

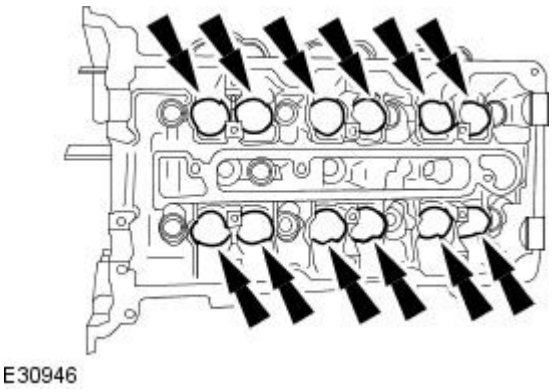
97. Clean the cylinder block with a soap and water solution. Dry the cylinder block completely with compressed air.

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Cylinder Head

Disassembly and Assembly of Subassemblies

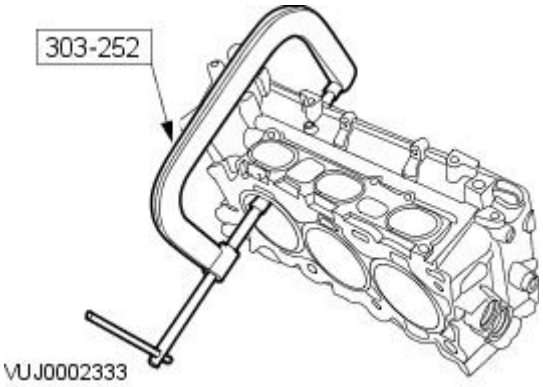
Special Tool(s)	
 303252	Valve Spring Compressor 303-252

Disassembly


E30946

1. CAUTION: If the cylinder head valve components are to be reused, mark position of the valve components to make sure they are reassembled in the same position.

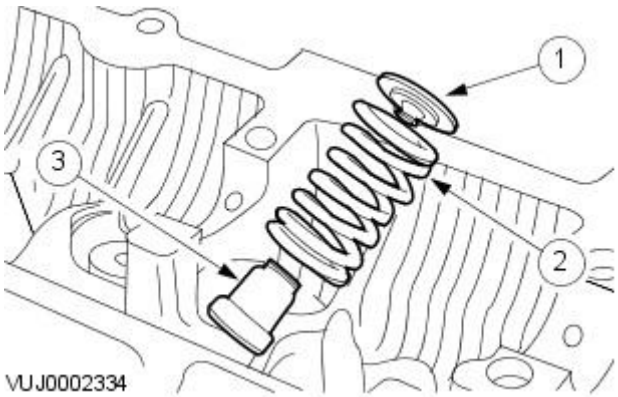
Remove the bucket tappet and shim assemblies.



VUJ0002333

2. Using the special tool, compress the valve springs.

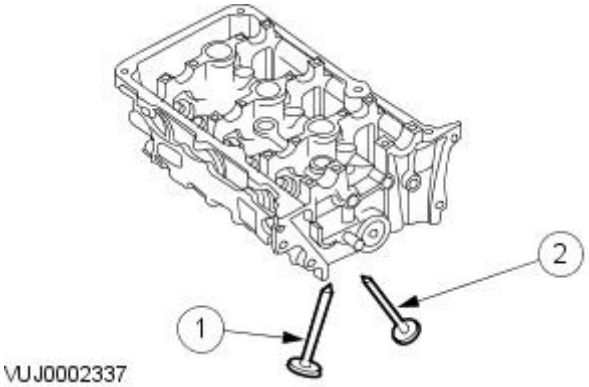
- Remove the valve collets.



VUJ0002334

3. Remove the valve spring retainers and valve springs.

1. Remove the valve spring retainers.
2. Remove the valve springs.
3. Remove the valve stem oil seals.



VUJ0002337

4. Remove the valves from the cylinder heads.

1. Remove the intake valves.
2. Remove the exhaust valves.

5. Inspect the cylinder heads and the related components.
For additional information, refer to Section 303-00 Engine System -

General Information.

6. Remove the pipe plugs and alignment dowels as necessary to clean the cylinder heads.

Assembly

1. WARNING: Eye protection is required during use of compressed air. Failure to follow these instructions may result in personal injury.

CAUTION: The cylinder head surface finish is measured in microns. For correct head gasket sealing, avoid any contact of finish with metallic objects.

Clean gasket material, dirt and foreign material from cylinder heads. Wash with a suitable soap and water solution and dry completely using compressed air if pipe plugs have been removed.

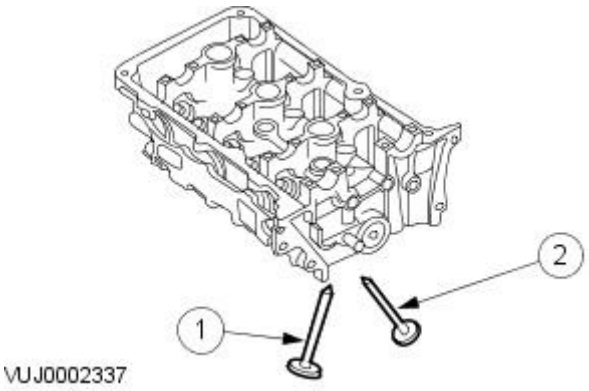
2. Install the pipe plugs and alignment dowels to cylinder heads.

- Apply pipe sealant to plugs prior to installation.

3. NOTE: Lubricate the valve stems before assembly.

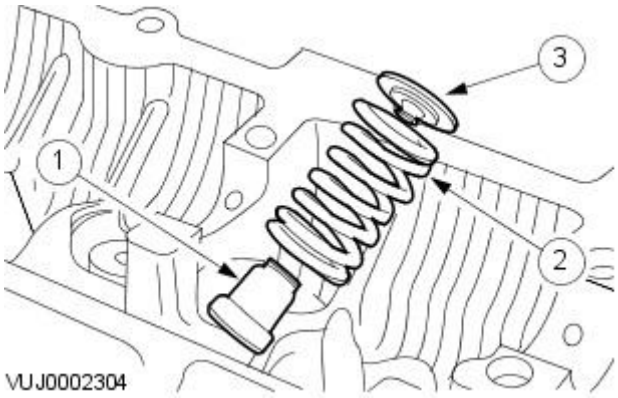
Install the valves into the cylinder heads.

1. Install the intake valves.
2. Install the exhaust valves.



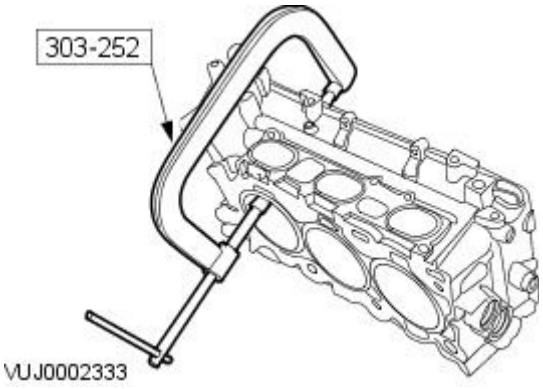
4. Install the valve spring retainers and valve springs.

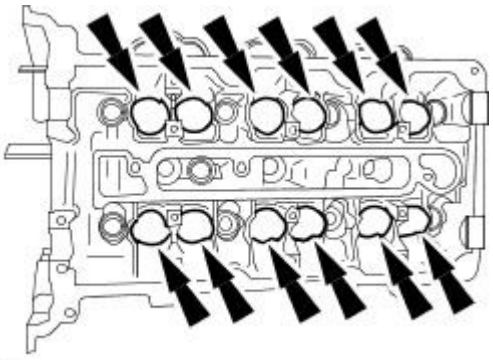
1. Install the valve stem oil seals.
2. Install the valve springs.
3. Install the valve spring retainers.



5. Using the special tool, compress the valve springs.

- Install the valve collets.





E30946

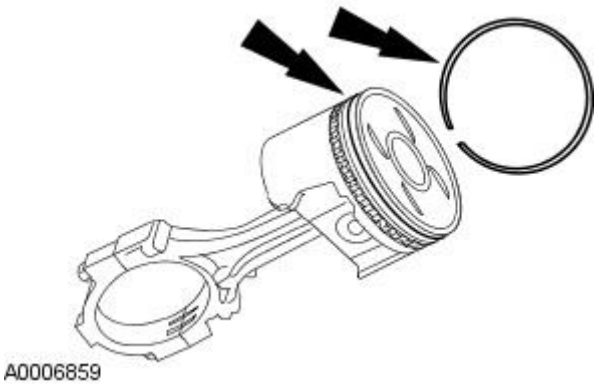
6. Install the bucket tappet and shim assemblies.

Published: 11-May-2011

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Piston

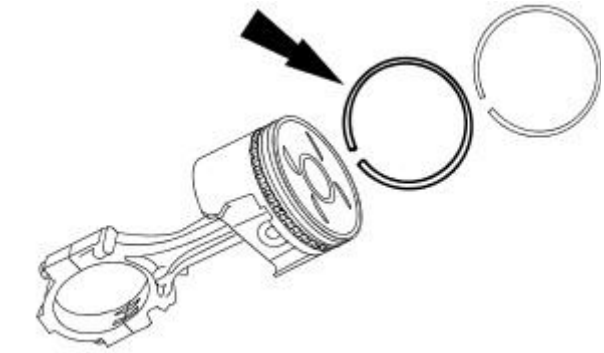
Disassembly and Assembly of Subassemblies

Disassembly

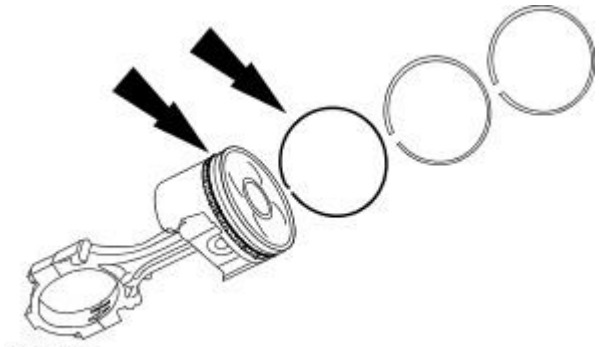

A0006859

1. NOTE: Mark the pistons to the original connecting rods to make sure correct installation in the same cylinders from which they were removed.

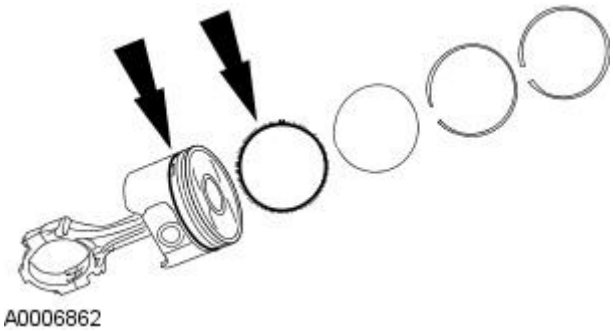
Remove the top compression ring.


A0006860

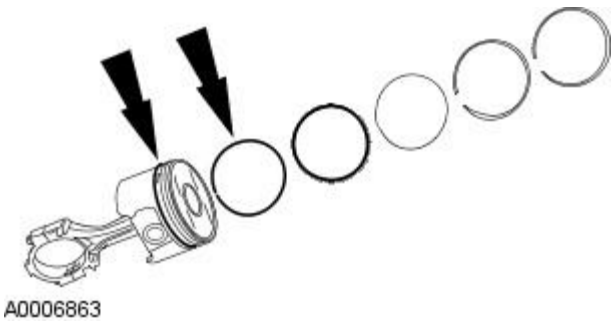
2. Remove the second compression ring.


A0006861

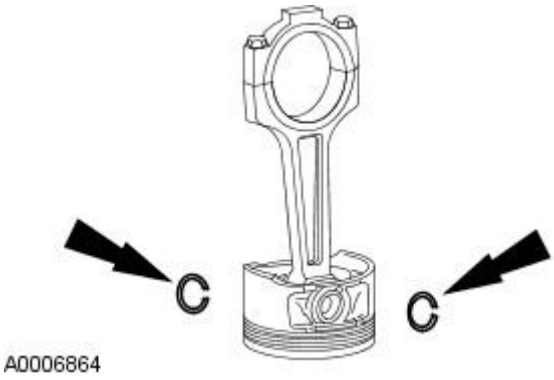
3. Remove the first oil control ring.


A0006862

4. Remove the oil control spacer ring.


A0006863

5. Remove the second oil control ring.



A0006864

6. WARNING: The retaining rings have a tendency to spring out during removal. Cover the end of the pin bore with a hand or a rag when removing the retaining ring. Eye protection should be worn. Failure to follow these instructions may result in personal injury.

Remove the retaining clips.


A0006865

7. Remove the piston pin and the connecting rod from the piston.

8. Clean and inspect the connecting rod and the piston. For additional information, refer to Section 303-00 Engine System - General Information.

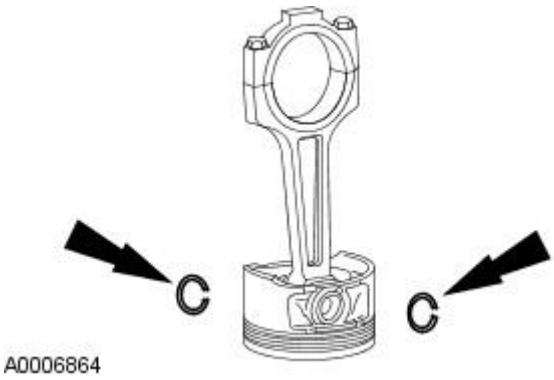
Assembly

1. Install the piston pin.

- Lubricate the piston pin and piston bore.


A0006866

2. Install the retaining clips.

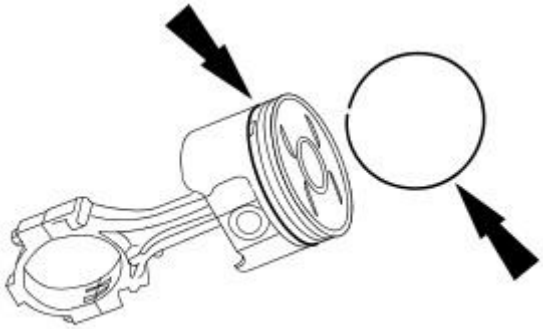


A0006864

3. Check the piston ring end gap. For additional information, refer to Section 303-00 Engine System - General Information.

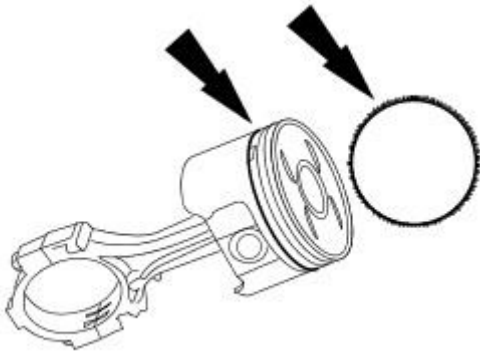
4. Lubricate the piston and piston rings.

5. Install the second oil control ring.



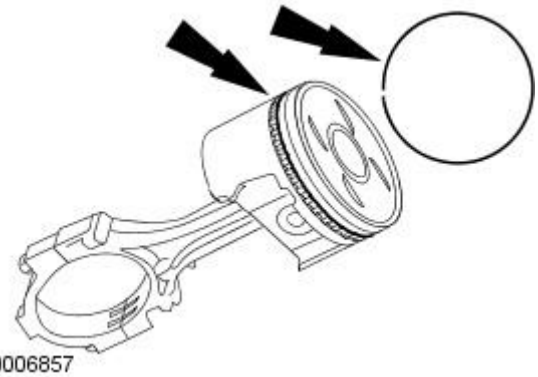
A0006867

6. Install the oil control spacer ring.



A0006856

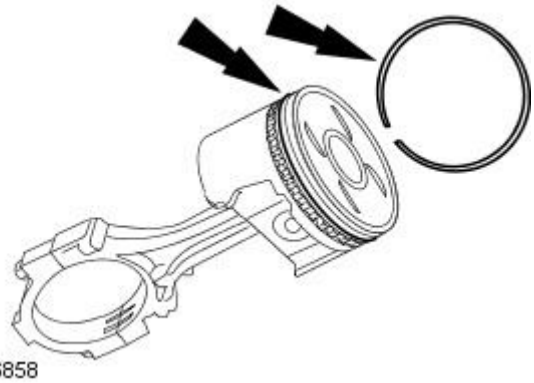
7. Install the first oil control ring.



A0006857

8. Install the second compression ring.

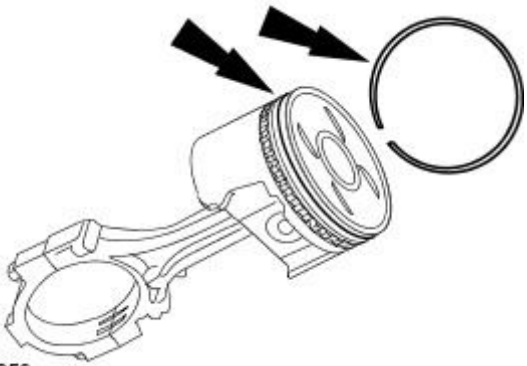
- The top of the second compression ring has a "0" marked on it. Position this side of the ring towards the top of the piston.



A0006858

9. Install the top compression ring.

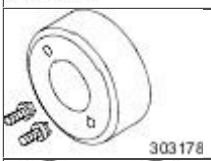
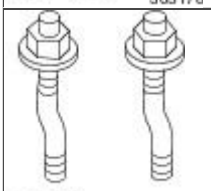
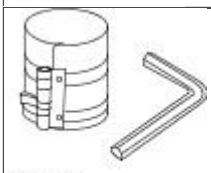
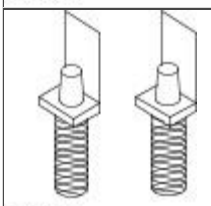
- The top compression ring can be installed with either side up.



A0006859

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Engine

Assembly

Special Tool(s)	
 303D055	Wrench Strap-Universal 303-D055
 303178	Crankshaft Rear Seal Installer 303-178
 303384	Crankshaft Rear Seal Installer Adapter Bolts 303-384
 303372	Piston Ring Compressor 303-372
 303535	Cylinder Bore Protector 303-535

Assembly

1. CAUTION: Use only plastic scraper when removing old gasket material.

Clean all the mating faces and reusable parts thoroughly and check for damage.

- If gasket material remains on the cylinder head after cleaning, use a plastic tipped scraper to remove remaining material.

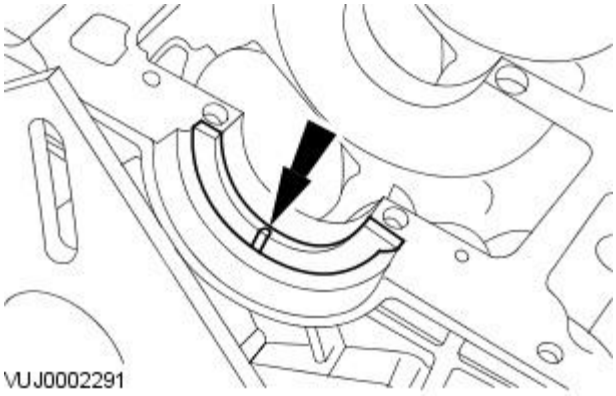
2. NOTE: Never remove pipe plugs or alignment dowels unless they are to be serviced.

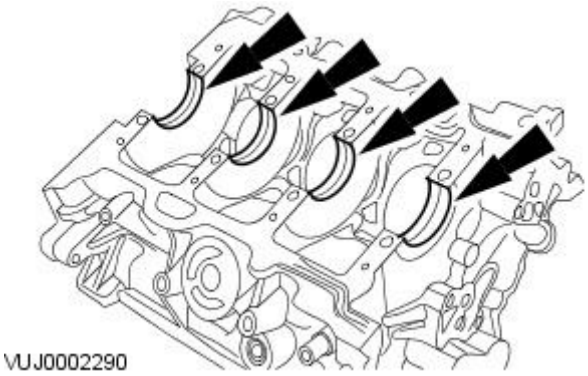
Reseal oil passage blanking plugs, as necessary.

3. NOTE: The main bearings are precision selective fit. For additional information, refer to Section 303-00 Engine System - General Information.

Install the upper crankshaft thrust washer.

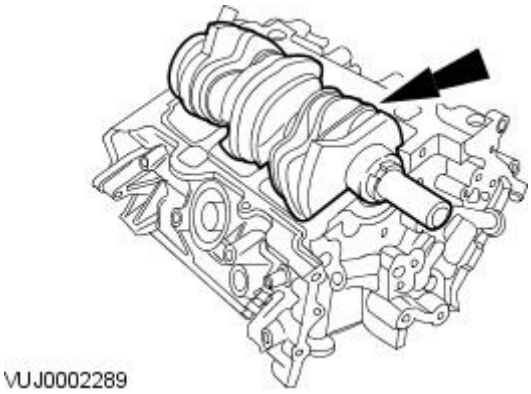
- Align assembly tab on thrust bearing to machining spot face on cylinder block.




VUJ0002290

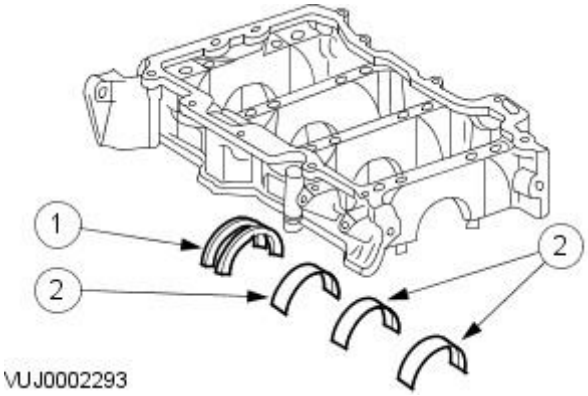
4. Install the upper crankshaft main bearings.

- Lubricate the bearings and thrust washer.


VUJ0002289

5. CAUTION: Avoid damage to any crankshaft journal bearing surfaces.

Install the crankshaft.



VUJ0002293

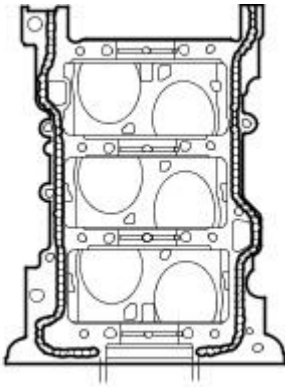
6. NOTE: Push the crankshaft rearward prior to installation of upper thrust bearings.

• NOTE: Visually inspect the bearings to verify that the bearing oiling holes align with cylinder block oil feed holes.

Install the lower crankshaft bearings into the cylinder block.

1. Install the lower crankshaft thrust main bearing into lower cylinder block.
2. Install the lower crankshaft main bearings into lower cylinder block.

- Lubricate the bearings and thrust washer.


VUJ0002294

7. NOTE: Sealant application must stop 6 mm from the rear crankshaft bore on each side.

• NOTE: Install lower cylinder block and tighten all bolts to specification within four minutes of applying sealer.

Apply a bead of sealant to the cylinder block housing.

- Use Silicone gasket and sealant.

8. CAUTION: Make sure all dowels are fully seated into lower cylinder block prior to tightening the bolts.

• NOTE: Before installing the bolts lightly seat the crankshaft forward.

• NOTE: Do not lubricate the lower cylinder block bolts.

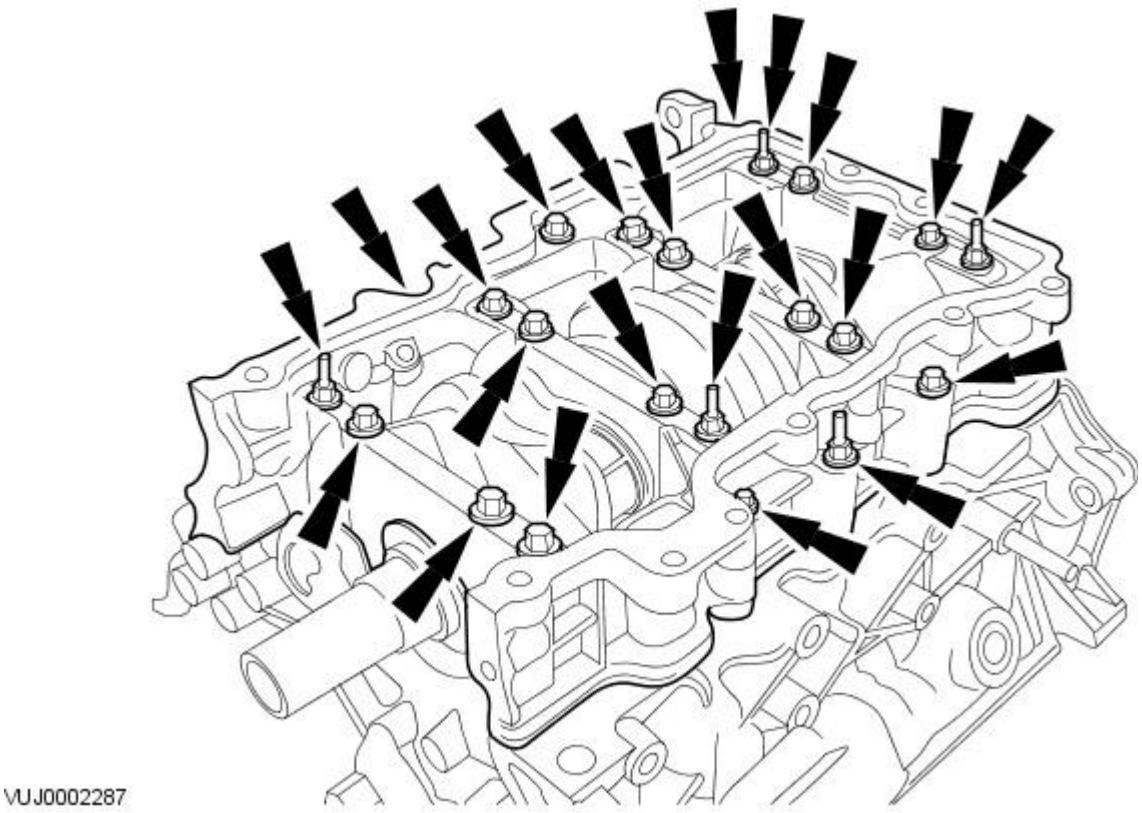
• NOTE: Loosely install the lower cylinder block bolts.

• NOTE: Do not rotate crankshaft until all bolts are tightened to specification.

• NOTE: Bolts must be tightened within 4 minutes of applying sealant.

Install the lower cylinder block on the cylinder block.

- Push crankshaft rearward to seat the crankshaft thrust washer.



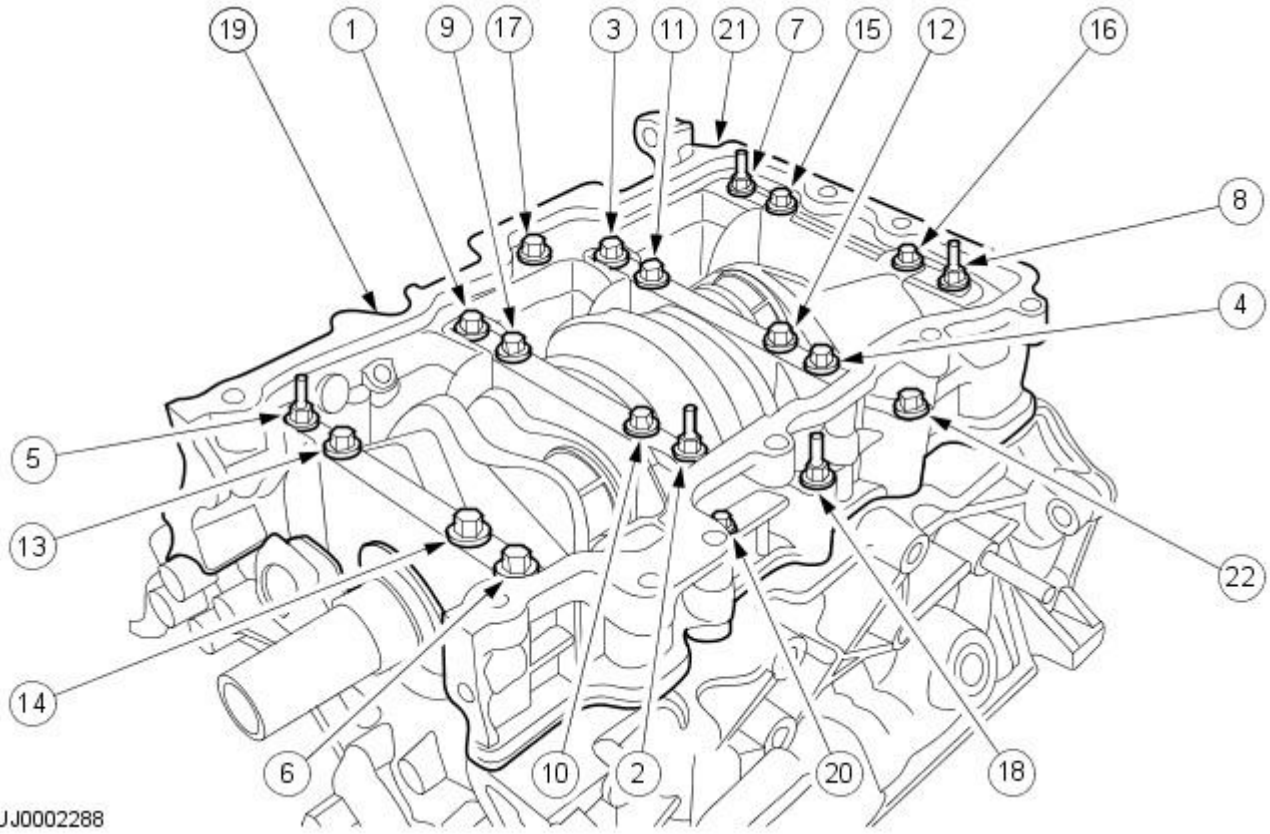
VUJ0002287

9. CAUTION: Bolts 1 through 16 are tighten-to-yield and must be replaced.

• NOTE: Tighten the bolts in the indicated sequence in four stages.

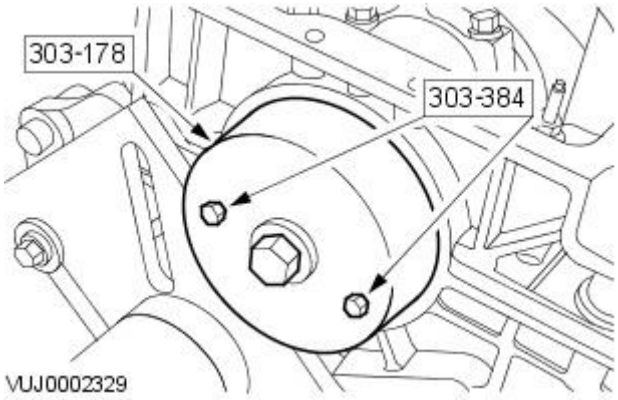
Complete the tightening sequence.

- Stage 1: Bolts 1-8, 25 Nm
- Stage 2: Bolts 9-16, 40 Nm
- Stage 3: Bolts 1-16, 90°
- Stage 4: Bolts 17-22, 25 Nm
- Verify the crankshaft rotates freely.



VUJ0002288

10. Remove excess sealant which may squeeze out at the front cover sealing surface.



11. 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 oil seal.

12. CAUTION: Use appropriate protection to prevent damage to the crankshaft bearing journals and cylinder bore surfaces.

Install special tools to the connecting rods.

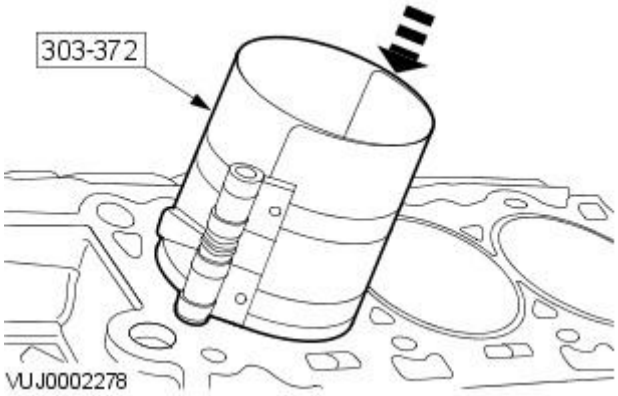
- Position the crankshaft journal at the bottom of the stroke.

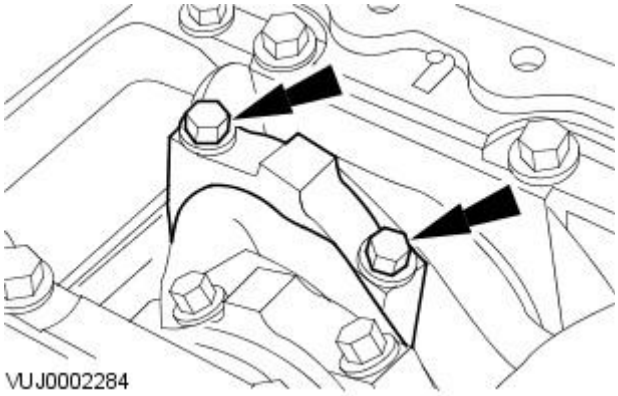
13. NOTE: Make sure the piston ring gaps are positioned at different locations opposite the thrust side of the piston before installation.

• NOTE: Install pistons with arrow to front of engine.

Using the special tool compress the rings and install the piston and connecting rod.

- Lubricate all piston components.





14. CAUTIONS:

When assembling the connecting rods and connecting rod caps, it is imperative that bearing slots and tangs be located on the same side of the connecting rods.

Connecting rod bolts are torqued to yield and must be replaced.

• NOTE: Remove the special tools from the connecting rods.

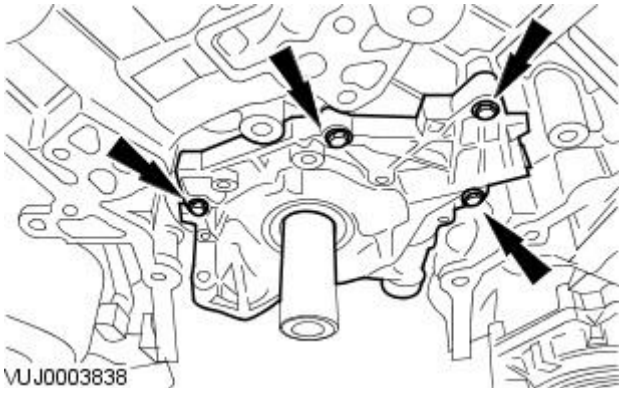
• NOTE: Tighten the bolts in the indicated sequence in three stages.

Position the connecting rod cap on the appropriate connecting rod.

- Stage 1: 23 Nm
- Stage 2: 43 Nm
- Stage 3: 105°

15. Rotate the crankshaft to check correct operation.

16. CAUTIONS:

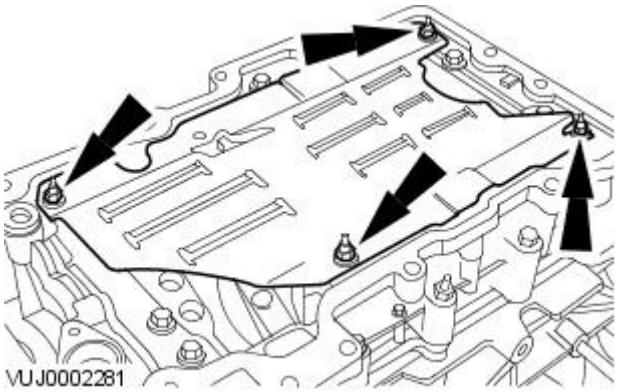


Install the oil pump flush to the cylinder block for correct sealing.

Rotate the inner rotor of the oil pump to align with the flats on the crankshaft before installation.

Install the oil pump.

- Tighten to 10 Nm.

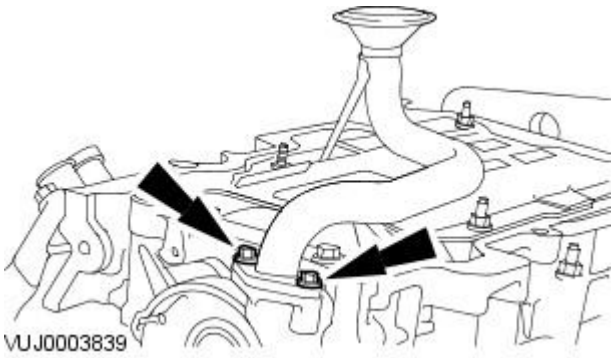


17. CAUTION: Oil pan baffle nuts are tightened to yield and must not be reused.

• NOTE: Tighten the bolts in the indicated sequence in two stages.

Install the oil pan baffle.

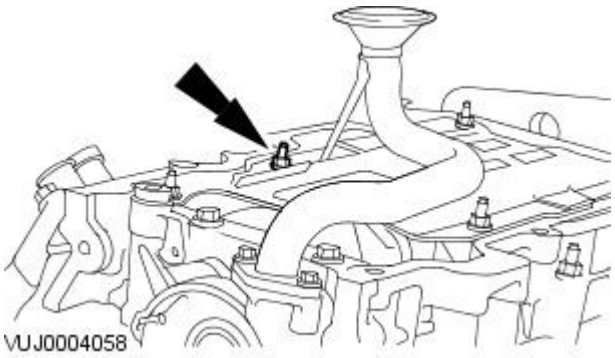
- Stage 1: 5 Nm
- Stage 2: 45°



18. NOTE: Engine inverted for clarity.

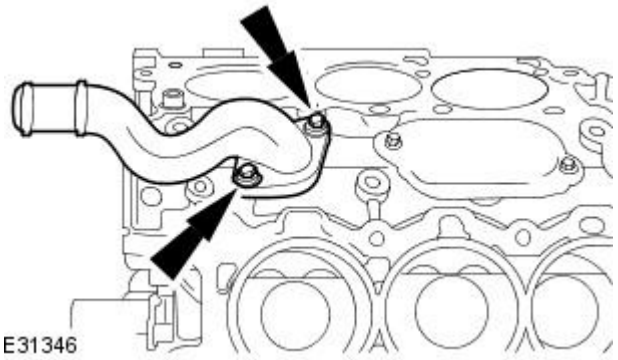
Install the oil pump tube.

- Install a new O-ring seal.
- Tighten to 10 Nm.



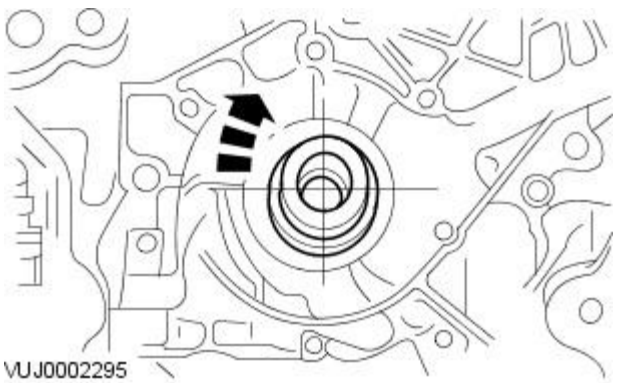
19. NOTE: Engine inverted for clarity.

Tighten to 5 Nm + 45°.



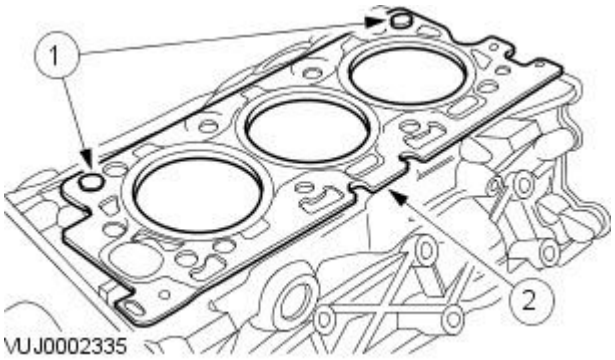
20. Install the engine coolant housing.

- Install new 'O' ring seals.
- Tighten to 25 Nm.



21. Position the crankshaft.

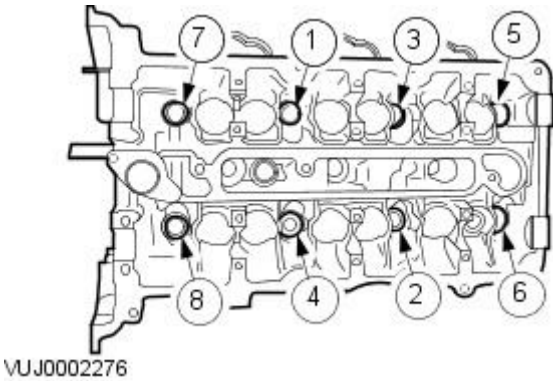
- Turn the crankshaft until the key is in the 11 o'clock position.
- Remove the crankshaft pulley bolt and washer.



VUJ0002335

22. Install a new cylinder head gasket (LH shown - RH similar).

1. Make sure the cylinder head dowels are correctly located.
2. Install a new cylinder head gasket.

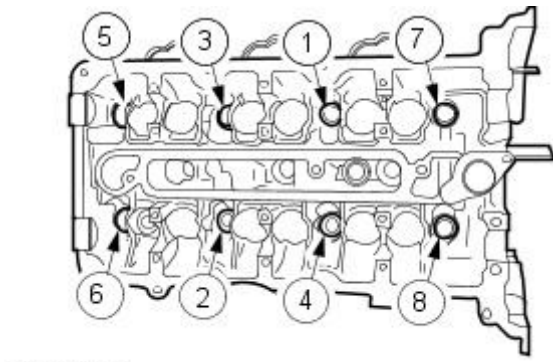


VUJ0002276

23. NOTE: Install the bolts in the indicated sequence.

Install the LH cylinder head.

- Tighten to 30 Nm.
- Tighten 90°.
- Loosen 360°.
- Tighten to 30 Nm.
- Tighten 90°.
- Tighten 90°.

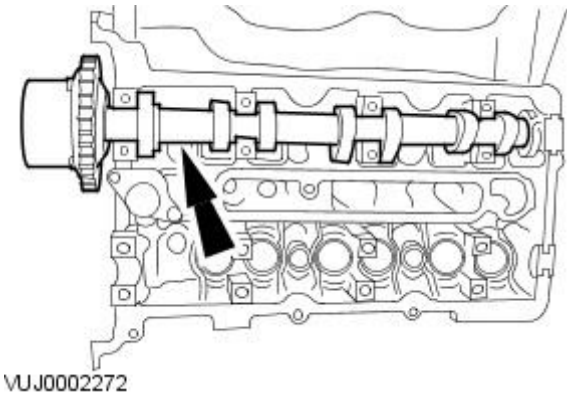


VUJ0002274

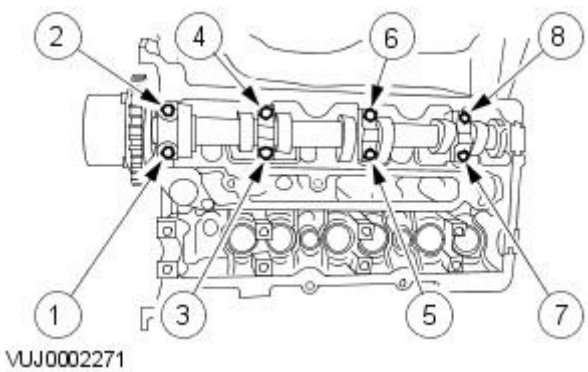
24. NOTE: Install the bolts in the indicated sequence.

Install the RH cylinder head.

- Tighten to 30 Nm.
- Tighten 90°.
- Loosen 360°.
- Tighten to 30 Nm.
- Tighten 90°.
- Tighten 90°.


VUJ0002272

25. Install the LH inlet camshaft.



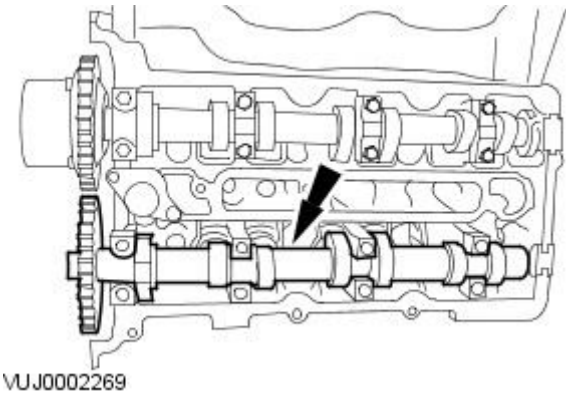
VUJ0002271

26. CAUTION: 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.

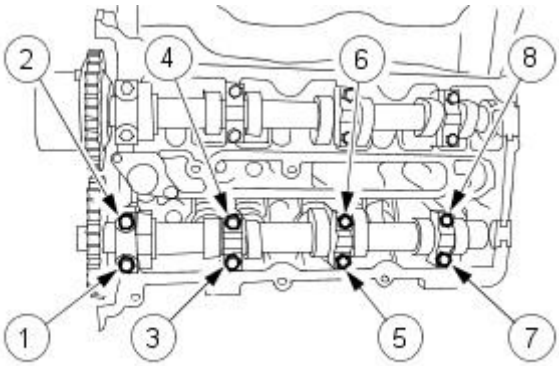
• NOTE: Lubricate the camshafts and the camshaft bearing caps with oil WSE-M2C908-A or equivalent meeting Jaguar specification prior to installation.

Install the LH inlet camshaft bearing cap bolts evenly.

- Install the inlet camshaft bearing caps.
- Tighten to 10 Nm.


VUJ0002269

27. Install the LH exhaust camshaft.



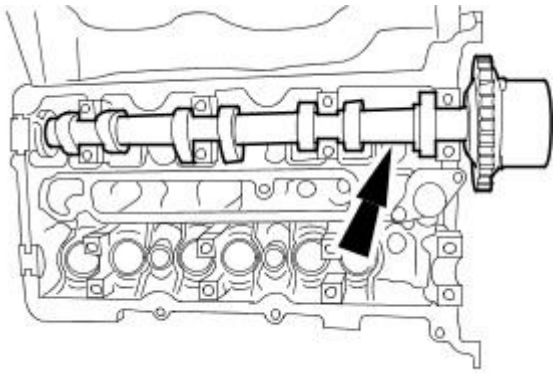
VUJ0002268

28. CAUTION: 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.

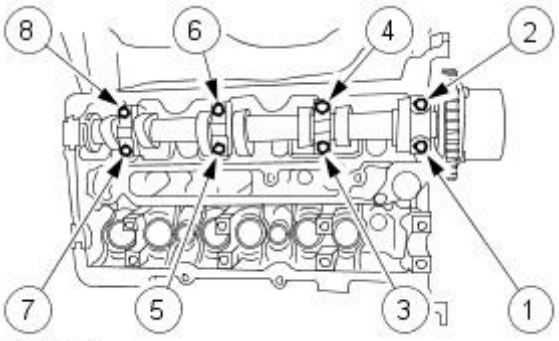
• NOTE: Lubricate the camshafts and the camshaft bearing caps with oil WSE-M2C908-A or equivalent meeting Jaguar specification prior to installation.

Install the LH exhaust camshaft bearing cap bolts evenly.

- Install the exhaust camshaft bearing caps.


VUJ0002266

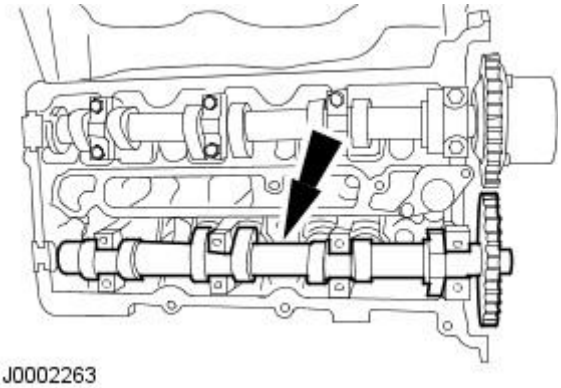
29. Install the RH inlet camshaft.



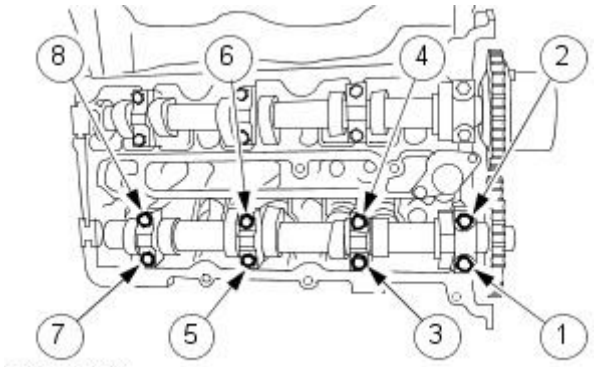
VUJ0002265

30. Install the RH inlet camshaft bearing cap bolts evenly.

- Install the inlet camshaft bearing caps.


VUJ0002263

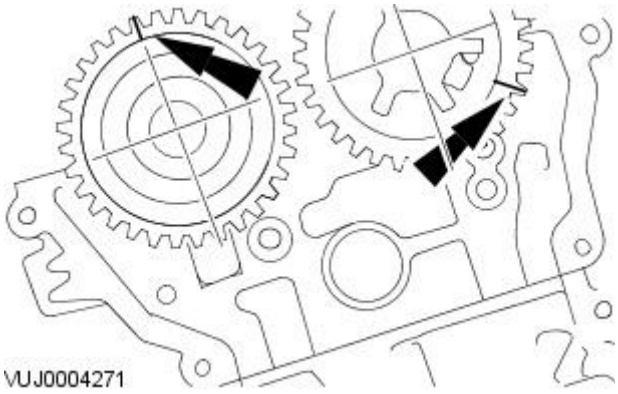
31. Install the RH exhaust camshaft.



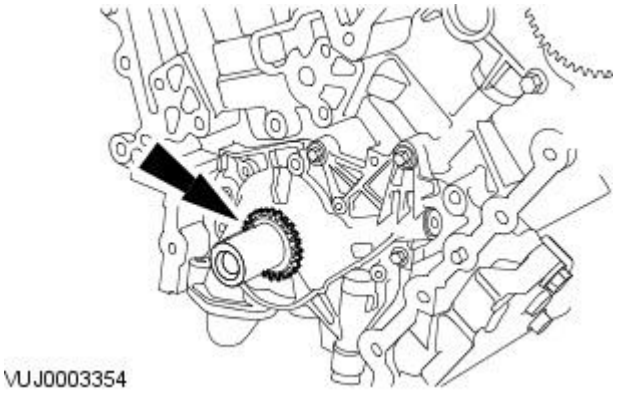
VUJ0002262

32. Install the RH exhaust camshaft bearing cap bolts evenly.

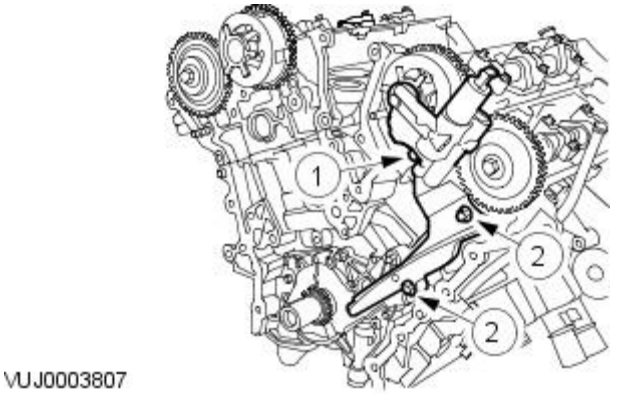
- Install the exhaust camshaft bearing caps.


VUJ0004271

33. 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 sprocket clockwise until the camshaft sprocket alignment mark is at the 12 O'clock position.


VUJ0003354

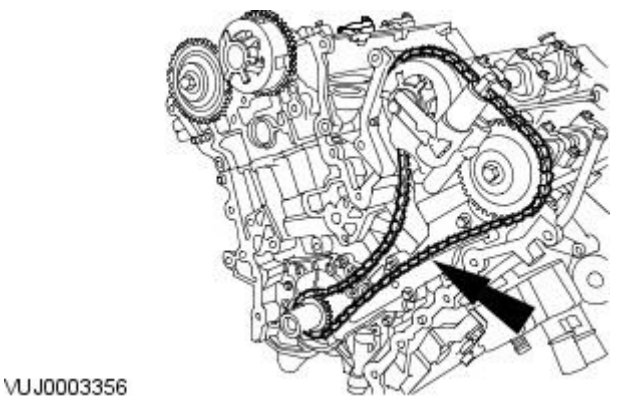
34. Install the crankshaft inner sprocket.



VUJ0003807

35. Install the left-hand timing chain outer guide.

- Tighten the retaining bolts in the sequence shown in two stages.
- Stage 1: Tighten bolt 1 to 25 Nm.
- Stage 2: Tighten bolts 2 to 25 Nm.


VUJ0003356

36. CAUTIONS:

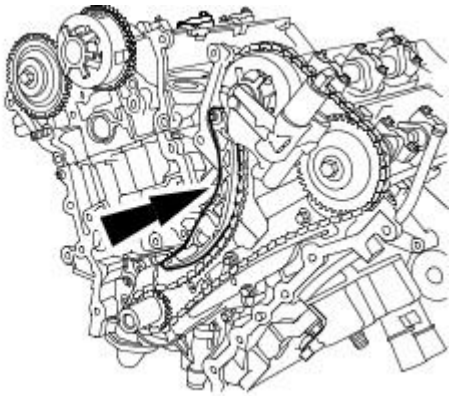
Make sure the crankshaft keyway is at the 11 O'clock position, the alignment mark on the left-hand intake camshaft sprocket is at the 9 O'clock position and the alignment mark on the left-hand exhaust camshaft sprocket is at the 2 O'clock position.

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.

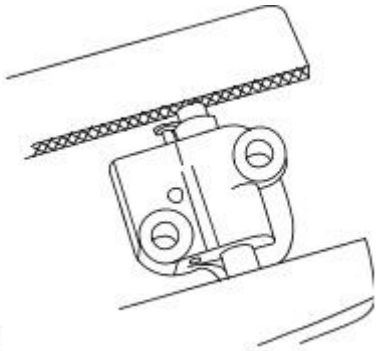
37. Install the left-hand timing chain inner guide.



VUJ0003357

38. CAUTION: Use suitable protective covers on the vice jaws to protect the timing chain tensioner.

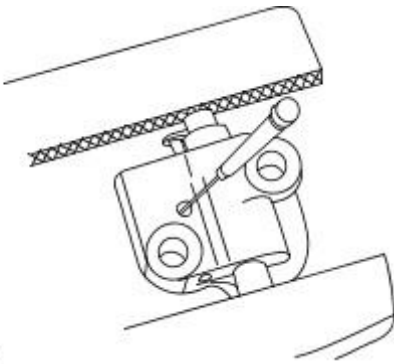
Secure the left-hand timing chain tensioner in the vice jaws.



GA3138-B

39. 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.

Using a suitable tool, hold the left-hand timing chain tensioner ratchet lock mechanism away from the ratchet stem.



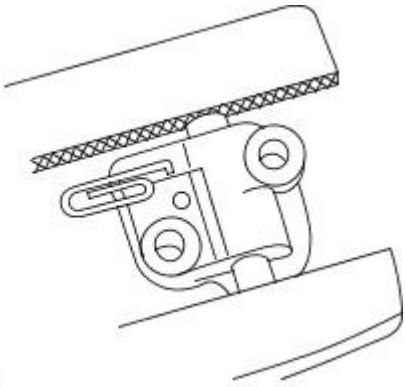
GA3139-B

40. NOTE: The timing chain tensioner piston should retract with minimal force. If binding occurs, reposition the timing chain tensioner to eliminate side loading.

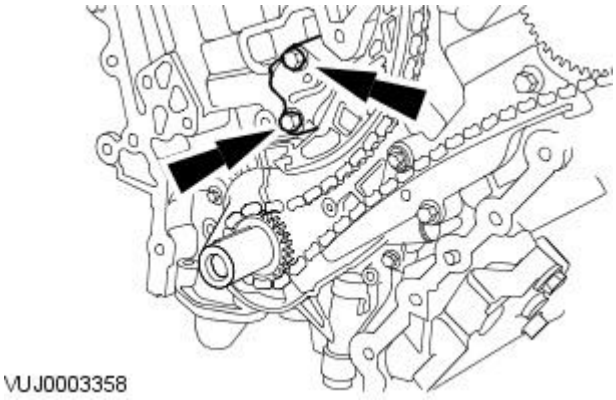
Slowly compress the left-hand timing chain tensioner.

41. NOTE: The retaining tool must remain in the timing chain tensioner until the timing chain tensioner is installed to the engine with the piston bottomed in the bore.

Using a suitable tool, retain the left-hand timing chain tensioner piston.

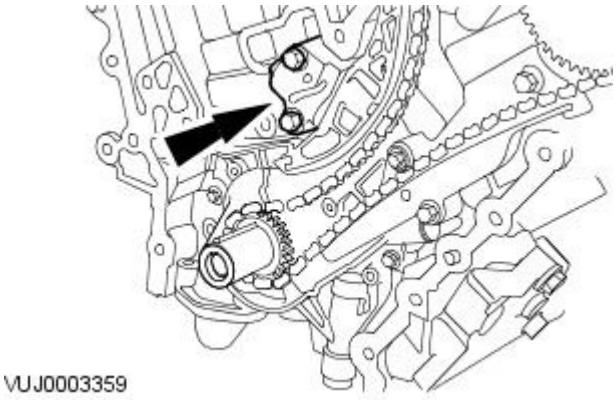


GA3140-A


VUJ0003358

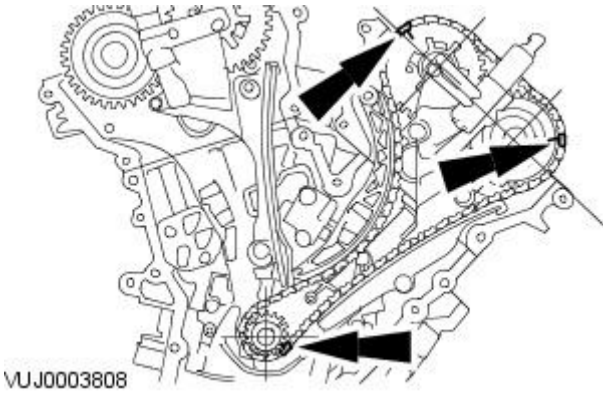
42. Install the left-hand timing chain tensioner.

- Tighten to 25 Nm.


VUJ0003359

43. Release the tension in the left-hand timing chain tensioner.

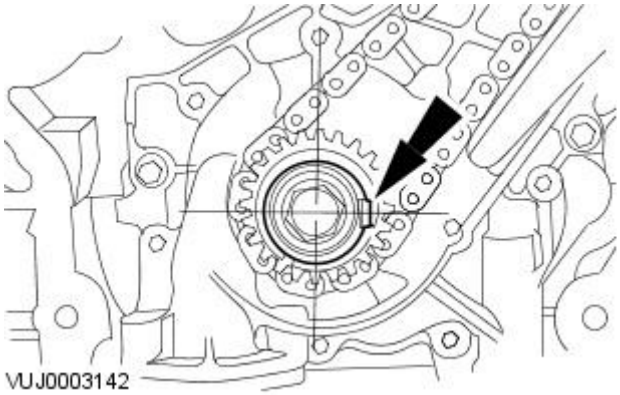
- Remove the retaining tool.


VUJ0003808

44. Make sure the left-hand timing chain alignment marks have remained correctly positioned to the camshaft sprocket and crankshaft sprocket alignment marks.

45. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Install the crankshaft pulley retaining bolt and washer.

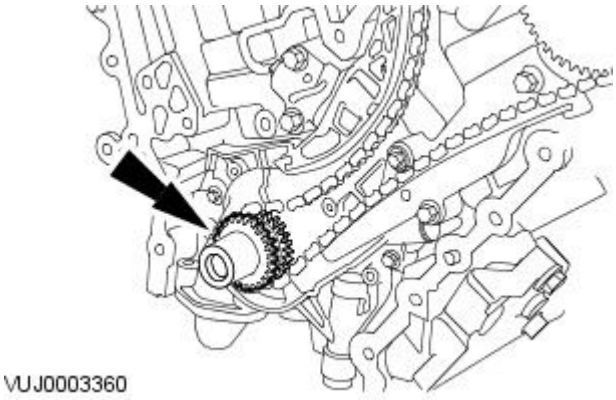

VUJ0003142

46. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

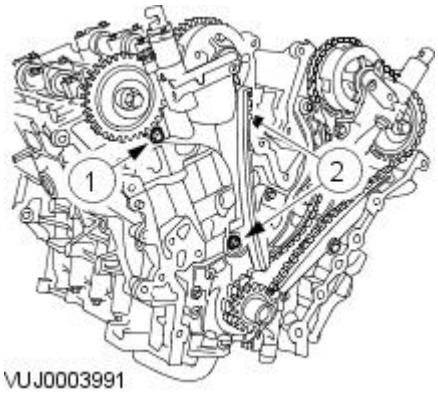
Rotate the crankshaft clockwise until the crankshaft keyway is at the 3 O'clock position.

47. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Remove the crankshaft pulley retaining bolt and washer.


VUJ0003360

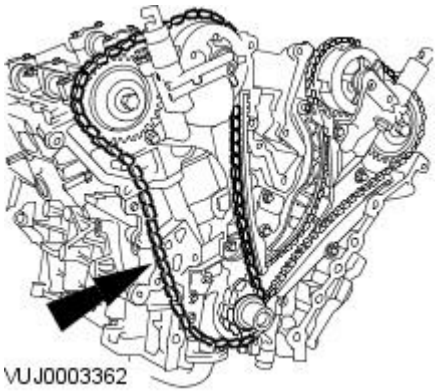
48. Install the crankshaft outer sprocket.



VUJ0003991

49. Install the right-hand timing chain inner guide.

- Tighten the retaining bolts in the sequence shown in two stages.
- Stage 1: Tighten bolt 1 to 25 Nm.
- Stage 2: Tighten bolts 2 to 25 Nm.


VUJ0003362

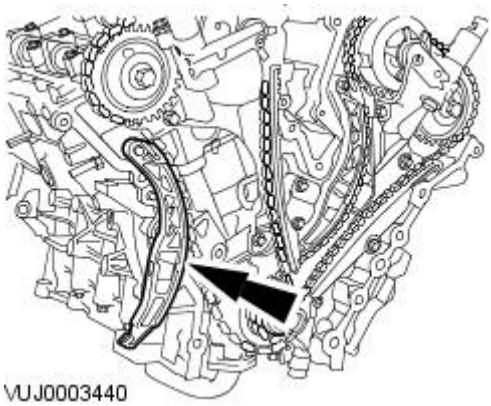
50. CAUTIONS:

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.

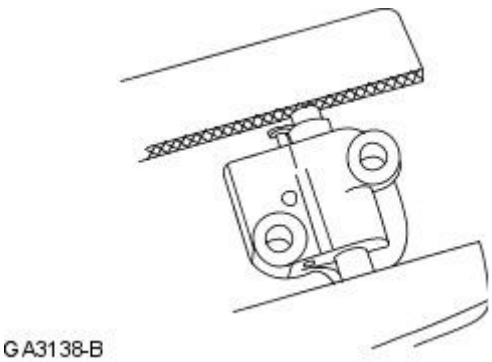
Make sure the timing chain alignment marks are correctly positioned to the crankshaft sprocket and camshaft sprocket alignment marks.

Make sure the timing chain slack is on the tensioned side of the timing chain.

Install the right-hand timing chain.

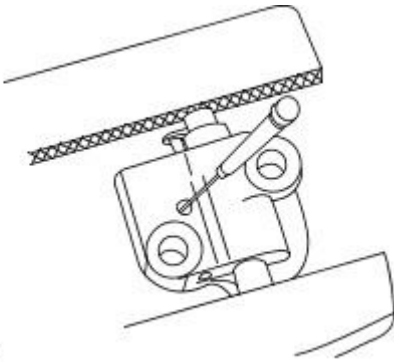

VUJ0003440

51. Install the right-hand timing chain outer guide.


GA3138-B

52. CAUTION: Use suitable protective covers on the vice jaws to protect the timing chain tensioner.

Secure the right-hand timing chain tensioner in the vice jaws.



GA3139-B

53. 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.

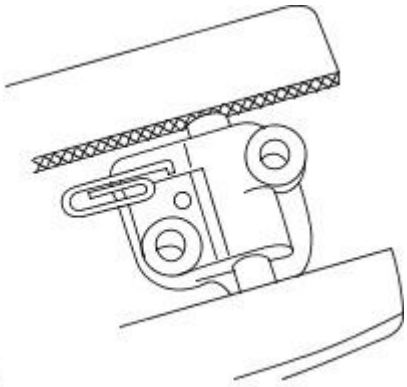
Using a suitable tool, hold the right-hand timing chain tensioner ratchet lock mechanism away from the ratchet stem.

54. NOTE: The timing chain tensioner piston should retract with minimal force. If binding occurs, reposition the timing chain tensioner to eliminate side loading.

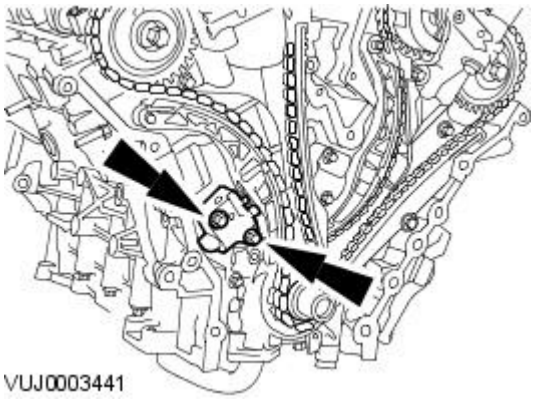
Slowly compress the right-hand timing chain tensioner.

55. NOTE: The retaining tool must remain in the timing chain tensioner until the timing chain tensioner is installed to the engine with the piston bottomed in the bore.

Using a suitable tool, retain the right-hand timing chain tensioner piston.



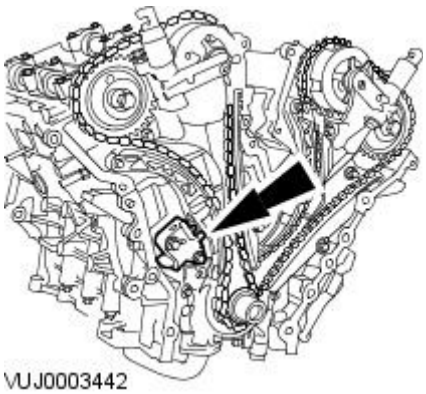
GA3140-A



VUJ0003441

56. Install the right-hand timing chain tensioner.

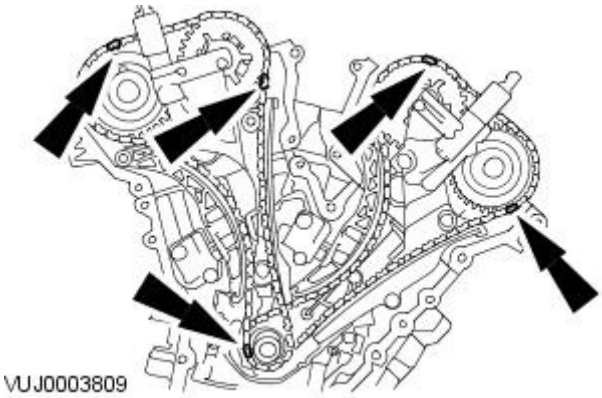
- Tighten to 25 Nm.



VUJ0003442

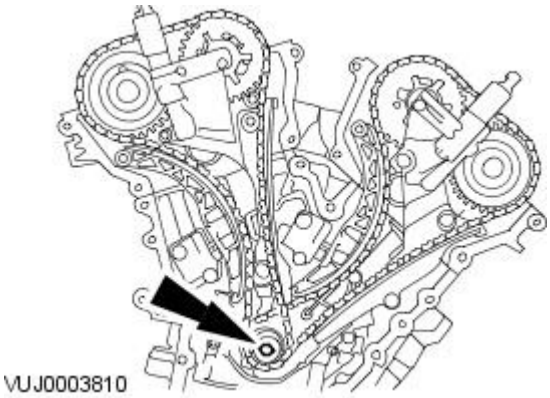
57. Release the tension in the right-hand timing chain tensioner.

- Remove the retaining tool.


VUJ0003809

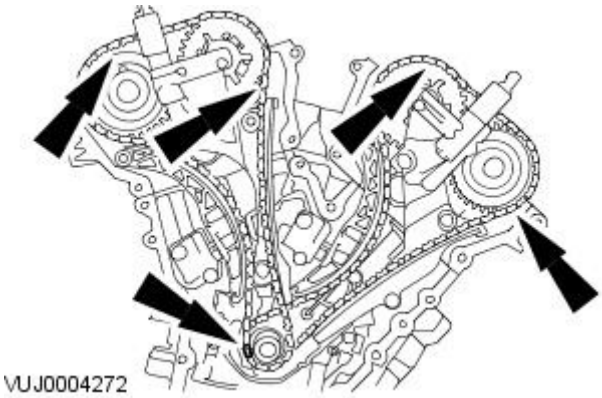
58. CAUTION: Make sure the right-hand timing chain alignment marks have remained correctly positioned to the camshaft sprocket and crankshaft sprocket alignment marks.

Make sure all the timing chain alignment marks are in the positions shown.


VUJ0003810

59. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

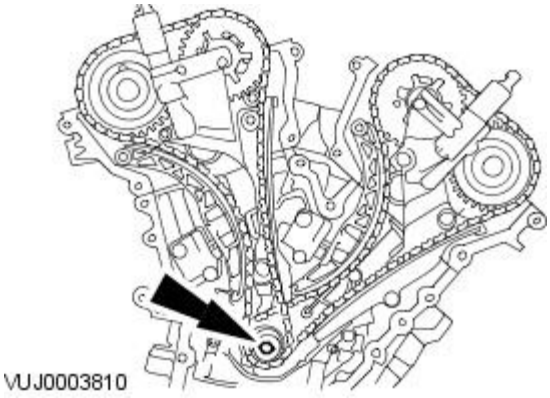
Install the crankshaft pulley retaining bolt and washer.


VUJ0004272

60. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

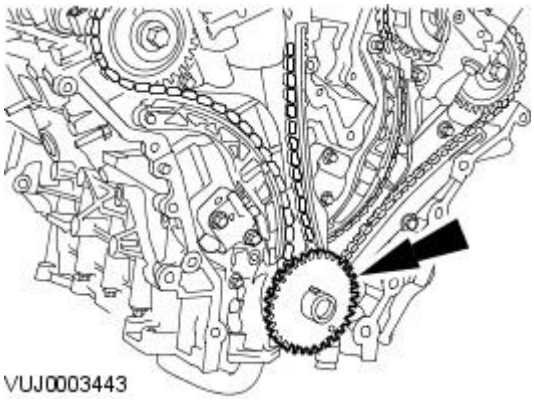
Check the engine valve timing is correctly set.

- Rotate the crankshaft two complete turns clockwise. Make sure the alignment marks on the camshaft sprockets are in the positions shown when the crankshaft keyway is at the 11 O'clock position.


VUJ0003810

61. CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Remove the crankshaft pulley retaining bolt and washer.

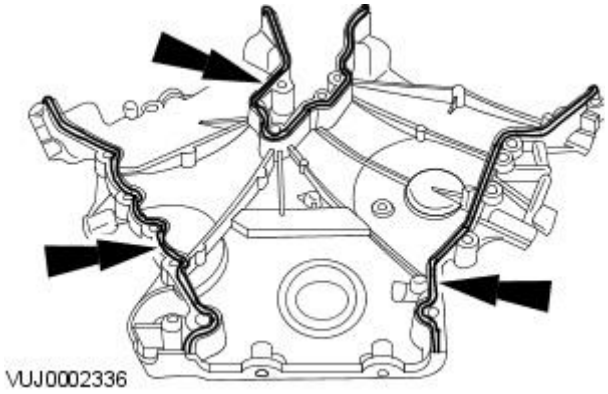

VUJ0003443

62. NOTE: Make sure the CKP sensor pulse wheel is correctly installed with the teeth pointing outwards.

Install the CKP sensor pulse wheel.

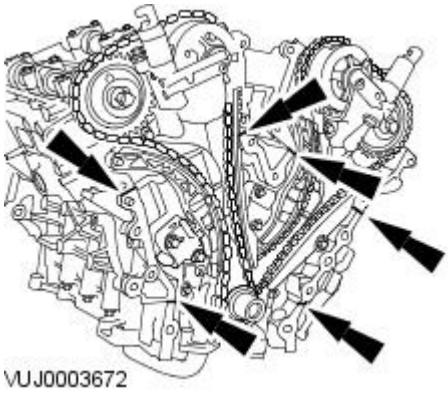
63. Carry out a valve clearance check.
For additional information, refer to Valve Clearance Check in this section.

64. Install new front timing cover gaskets.


VUJ0002336

65. NOTE: Prior to applying sealer clean the front cover to engine block and cylinder head sealing surfaces with metal surface cleaner.

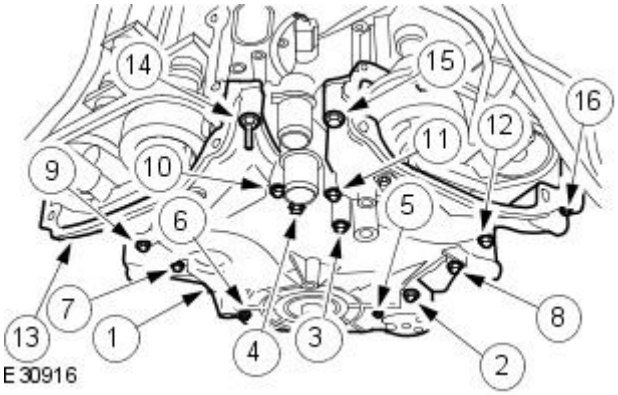
Apply a 6 mm diameter dot of silicone sealant meeting Jaguar specification to the indicated locations.


VUJ0003672

66. 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, completing the tightening sequence .

- Tighten to 25 Nm.



E30916

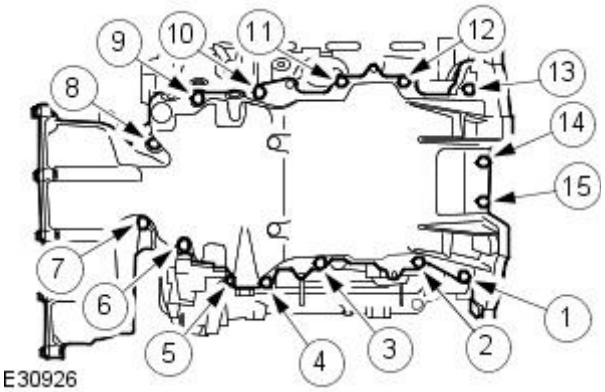
67. NOTE: Apply an 10 mm dot of silicone gasket and sealant meeting Jaguar specification to the engine block and front cover mating surface.

• NOTE: Loosely install the oil pan to transmission housing bolts.

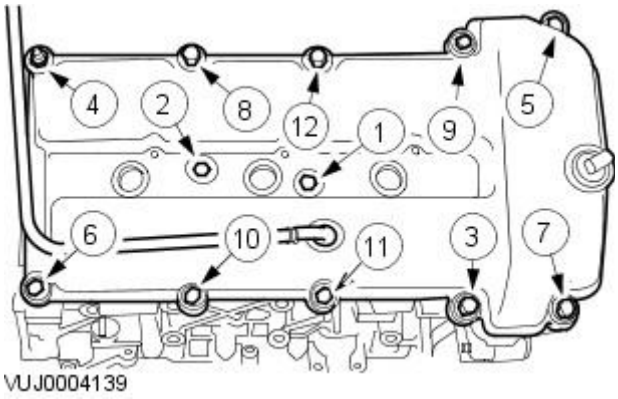
• NOTE: Tighten all oil pan retaining bolts with in six minutes of applying the sealer.

Install the oil pan rear retaining bolts.

- Complete the tightening sequence.
- Tighten to 25 Nm.



E30926

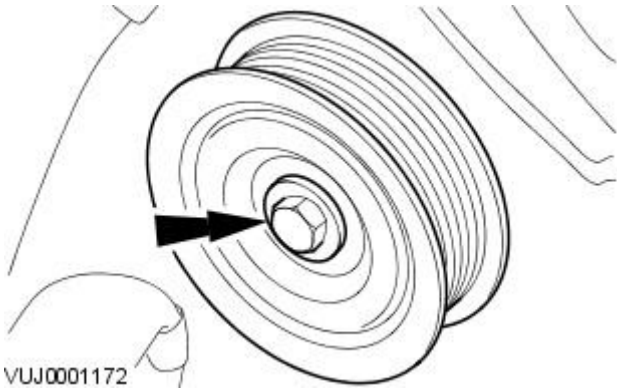


VUJ0004139

68. NOTE: Right-hand shown, left-hand similar.

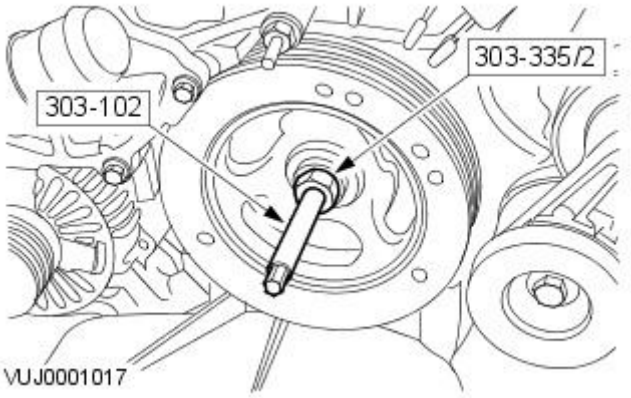
Install the valve covers.

- Complete the tightening sequence.
- Tighten to 10 Nm.


VUJ0001172

69. Install the left-hand idler pulley.

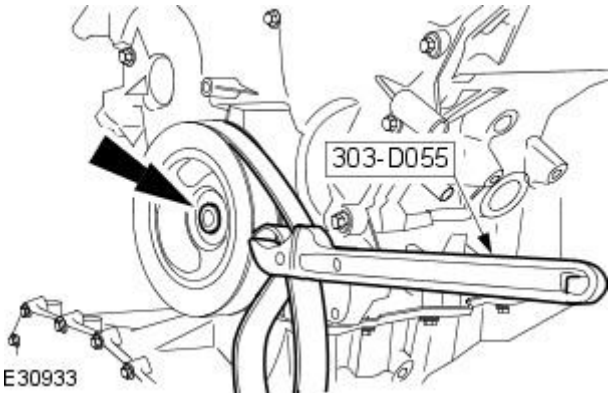
- Tighten to 25 Nm.



VUJ0001017

70. Using the special tools, install the crankshaft pulley.

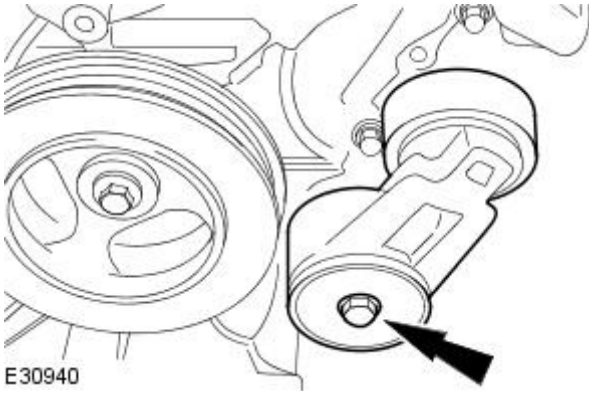
- Coat the crankshaft pulley keyway with silicone gasket sealant meeting Jaguar specification.
- Coat the sealing surfaces of the crankshaft pulley with silicone gasket sealant meeting Jaguar specification.



E30933

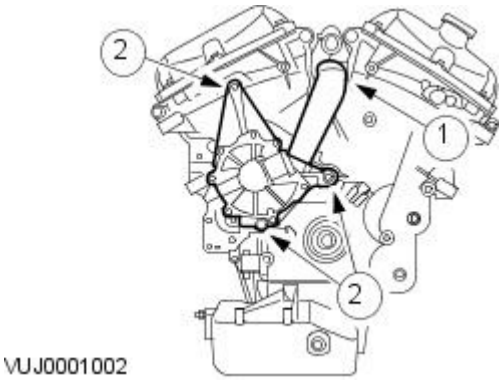
71. Install the crankshaft pulley retaining bolt.

- Torque to 120 Nm.
- Loosen the bolt (minimum 1 turn).
- Torque to 50 Nm.
- Angle Torque to 90°.


E30940

72. Install the accessory drive belt tensioner.

- Tighten 45 Nm.

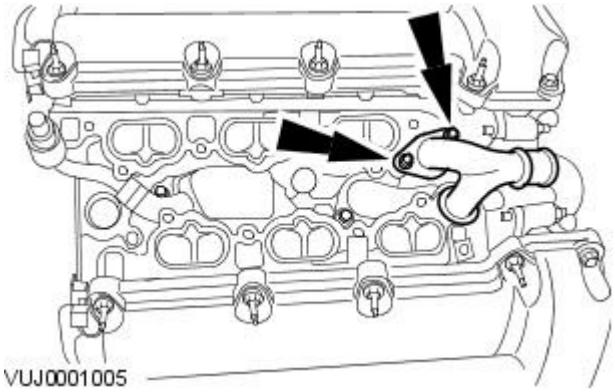


VUJ0001002

73. Install the water pump and coolant hose assembly.

1. Attach the hose.
2. Install the water pump and coolant hose assembly.

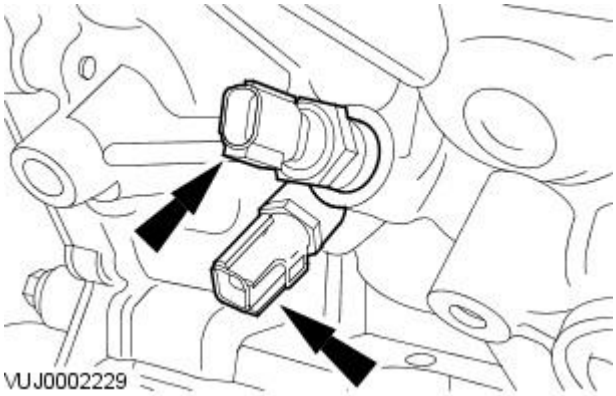
- Tighten to 25 Nm.


VUJ0001005

74. NOTE: Install new coolant crossover O-ring seals.

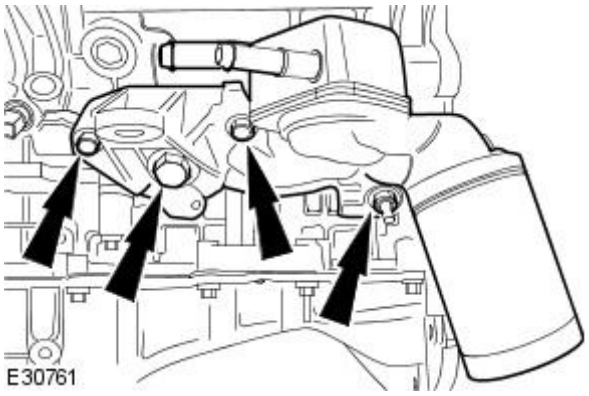
Install the coolant crossover tube.

- Tighten to 10 Nm,


VUJ0002229

75. Install the engine oil pressure and oil temperature sensors.

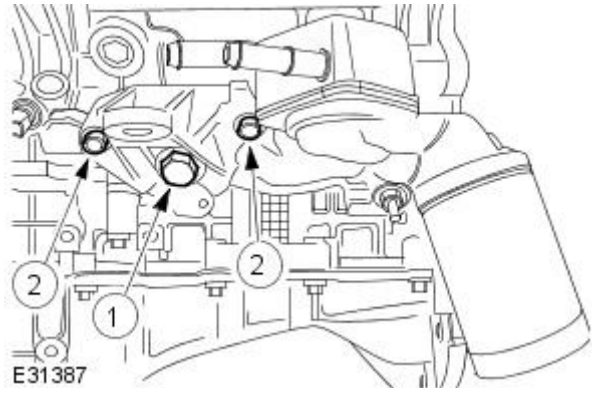
- Tighten to 14Nm.


E30761

76. NOTE: Install new O-ring seals.

Install the oil filter housing assembly.

- Tighten all oil filter housing retaining bolts to 25 Nm.

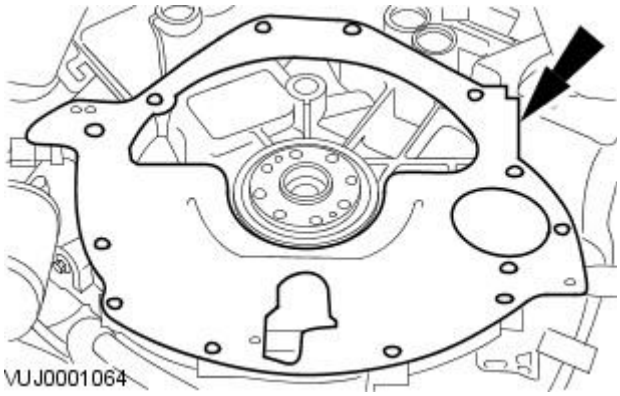


E31387

77. Tighten the oil filter housing assembly retaining bolts in sequence.

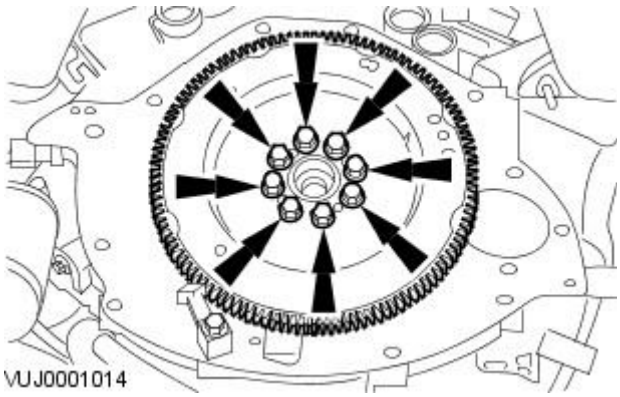
1. Tighten to 150 Nm.
2. Tighten to 40 Nm + 90 degrees.

78. Install the engine rear backing plate.



79. Install the flywheel.

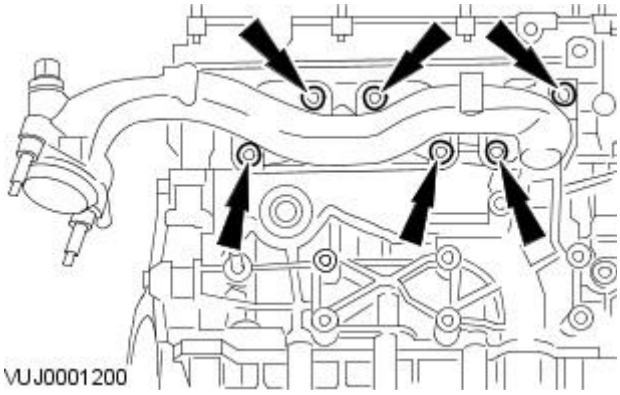
- Prevent the engine from rotating.
- Tighten to 80 Nm.



80. NOTE: Right-hand shown, Left-hand similar.

Install the exhaust manifolds.

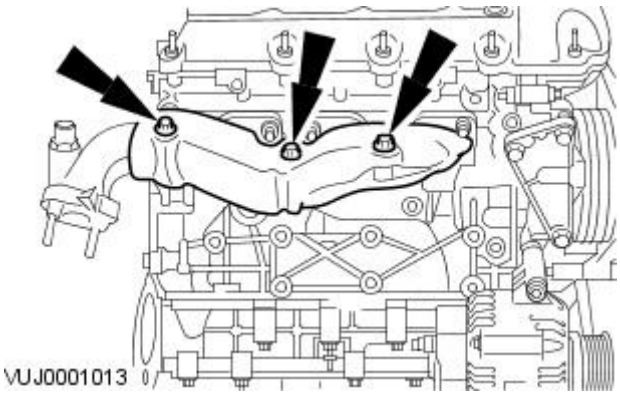
- Tighten to 25 Nm.



81. NOTE: Right-hand shown, Left-hand similar.

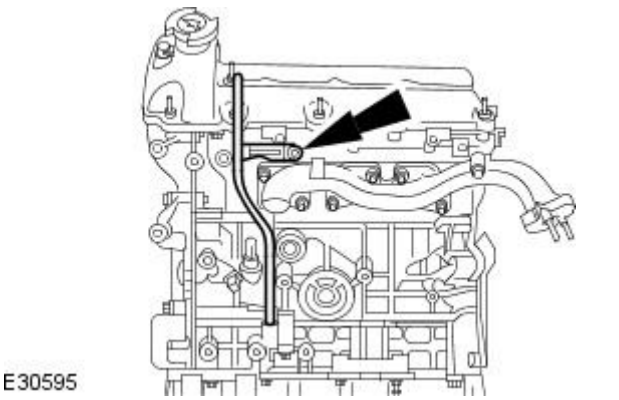
Install the exhaust manifold heat shields.

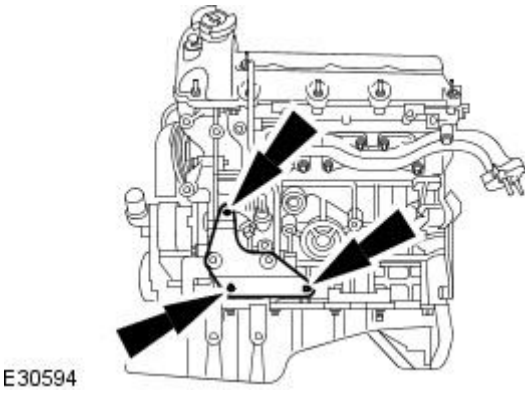
- Tighten to 10 Nm.



82. NOTE: Install a new O-ring seal.

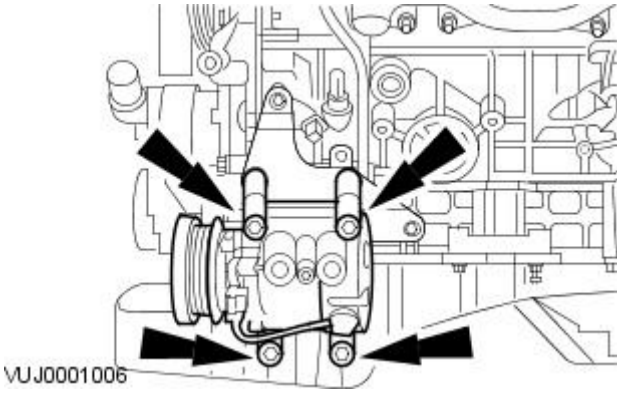
Install the oil level indicator tube.




E30594

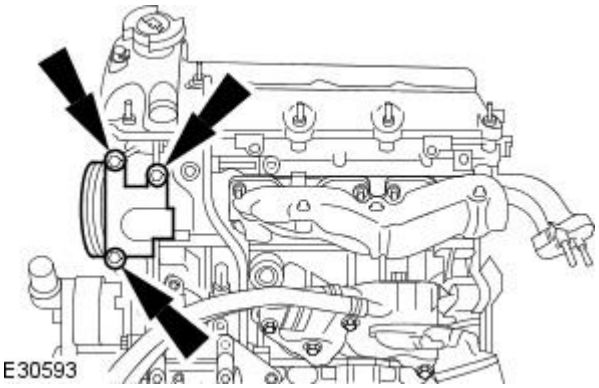
83. Install the A/C compressor mounting bracket.

- Tighten to 25 Nm.


VUJ0001006

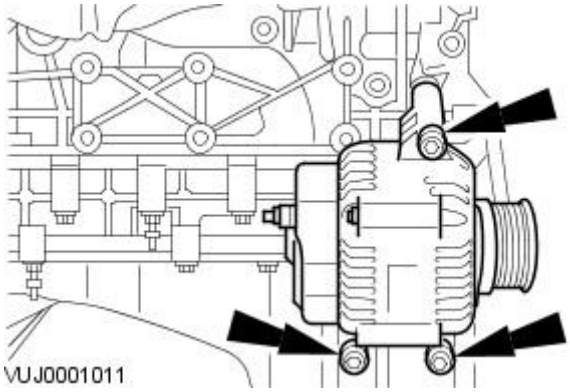
84. Install the air conditioning (A/C) compressor.

- Tighten to 25 Nm.


E30593

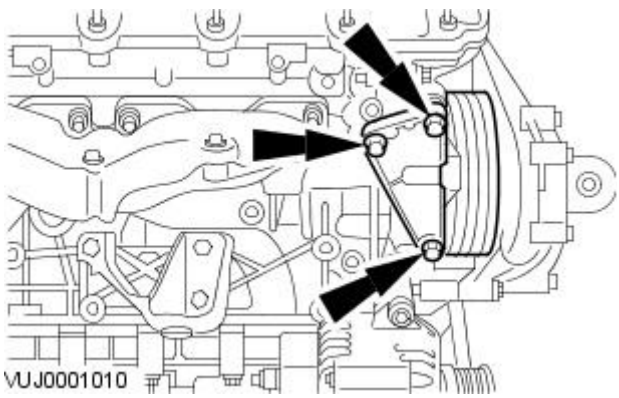
85. Install the power steering pump.

- Tighten to 25 Nm.


VUJ0001011

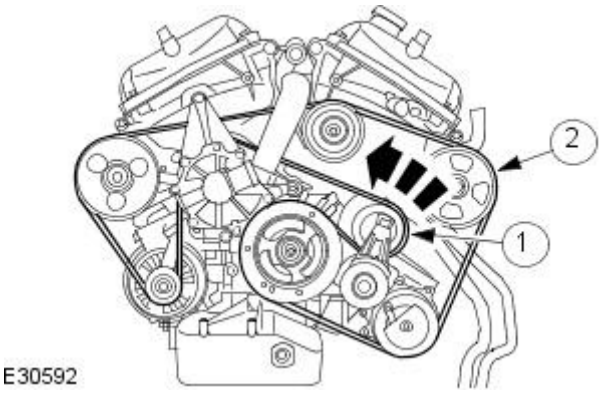
86. Install the generator.

- Tighten to 48 Nm.


VUJ0001010

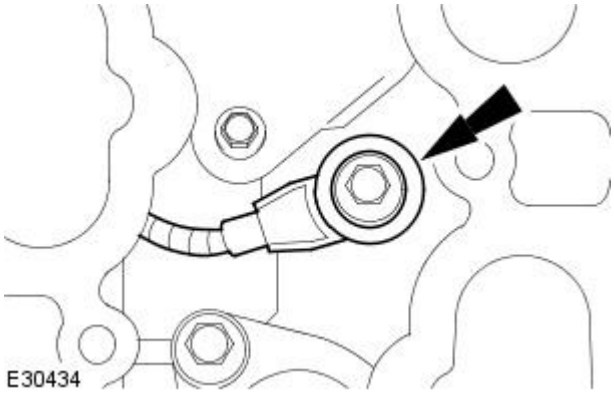
87. Install the right-hand idler pulley.

- Tighten to 25 Nm.



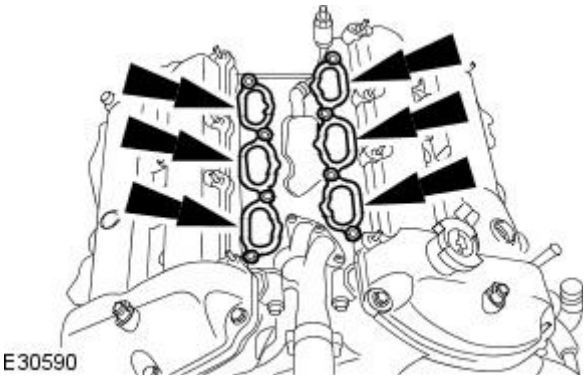
88. Install the accessory drive belt.

1. Use a 3/8 inch drive bar to release the accessory drive belt tensioner.
2. Install the accessory drive belt.

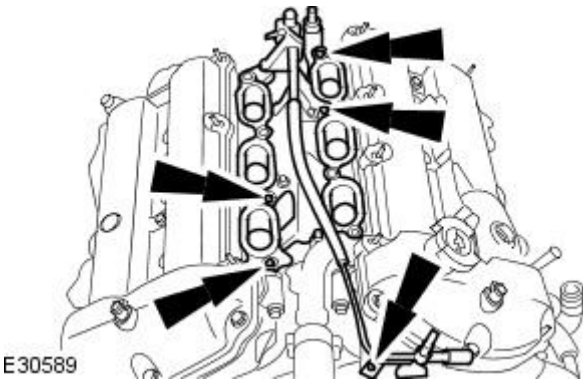


89. Install the left-hand knock sensor.

- Tighten to 25 Nm.

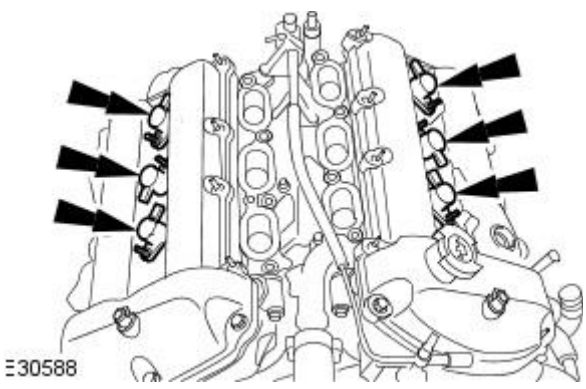


90. Install new lower intake manifold gaskets.



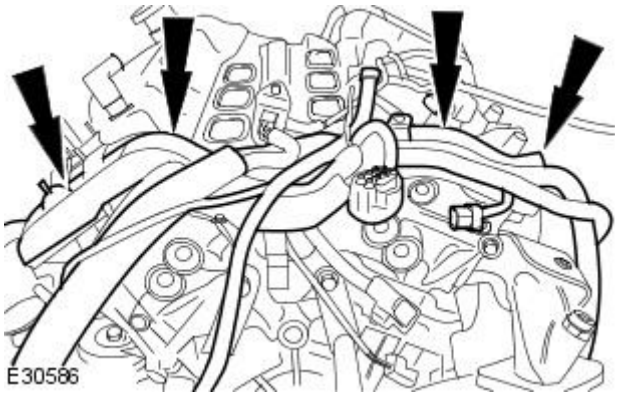
91. Install the lower intake manifold and injector supply manifold.

- Tighten to 10 Nm.



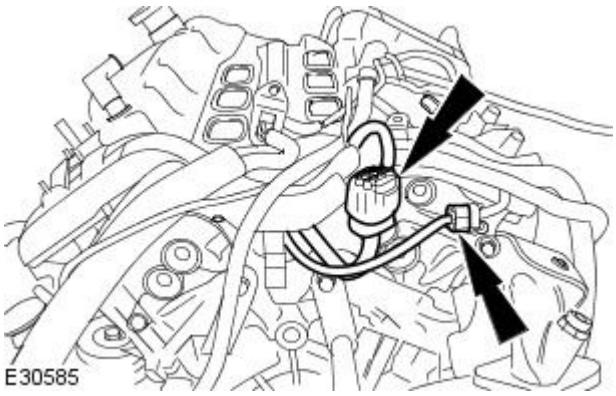
92. Install the ignition coils.

- Tighten to 10 Nm.

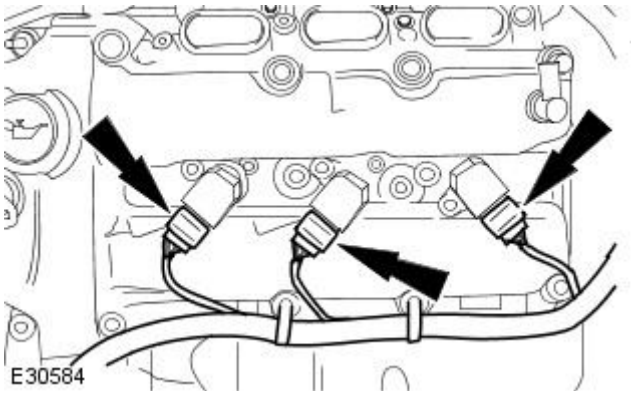


93. Install the engine wiring harness.

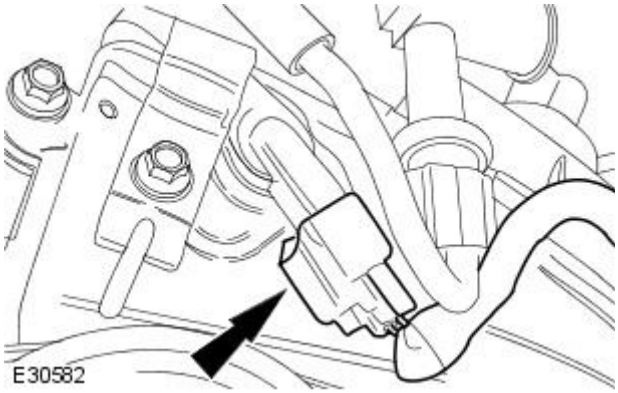
- Tighten to 10 Nm.



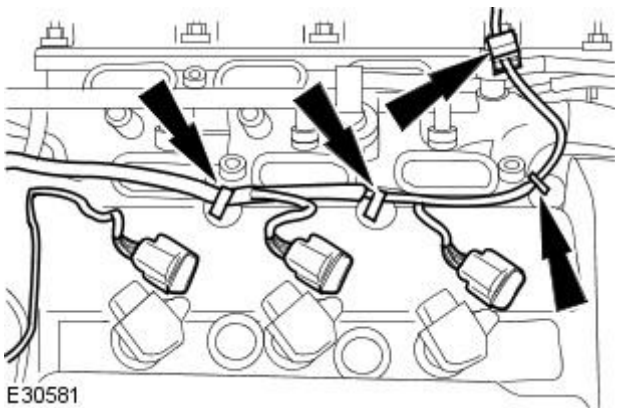
94. Connect the engine wiring harness electrical connectors.



95. Connect the left-hand ignition coils.

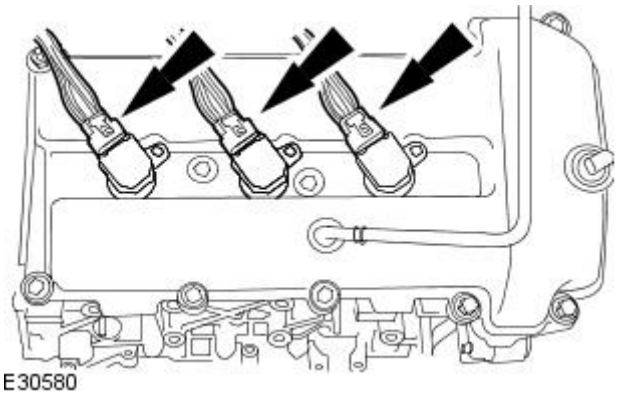


96. Connect the left-hand camshaft position sensor.

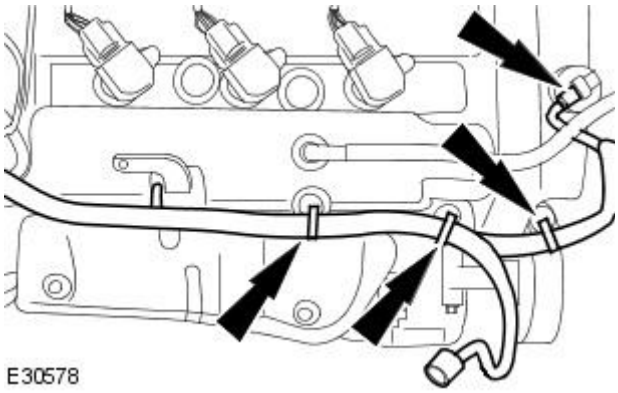


97. Attach the engine harness.

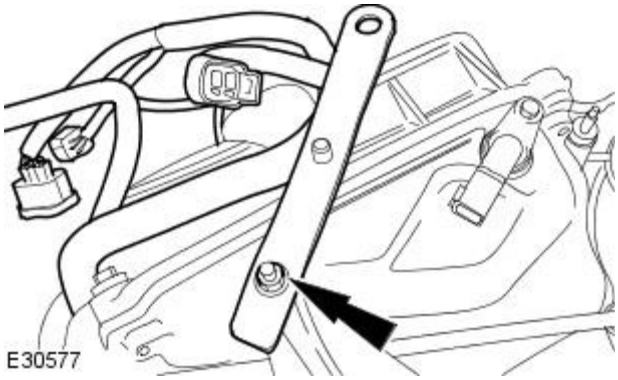
98. Connect the right-hand ignition coils.


E30580

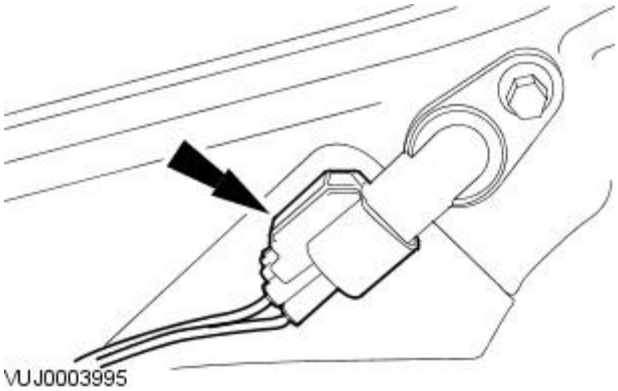
99. Attach the engine harness.


E30578

100. Attach the engine harness retaining bracket.


E30577

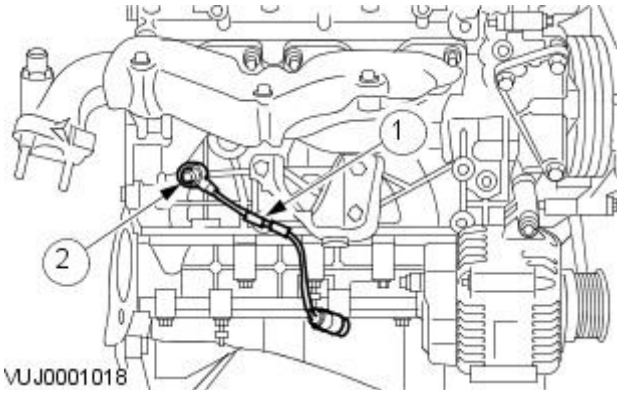
101. Disconnect the right-hand camshaft position sensor.


VUJ0003995

102. Install the rear knock sensor.

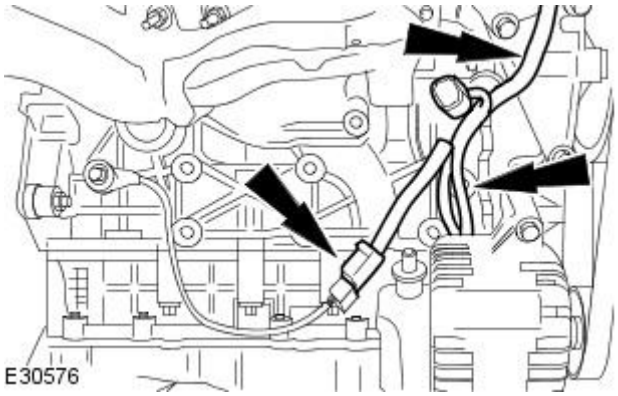
1. Attach the knock sensor wiring harness.
2. Install the rear knock sensor.

- Tighten to 25 Nm.

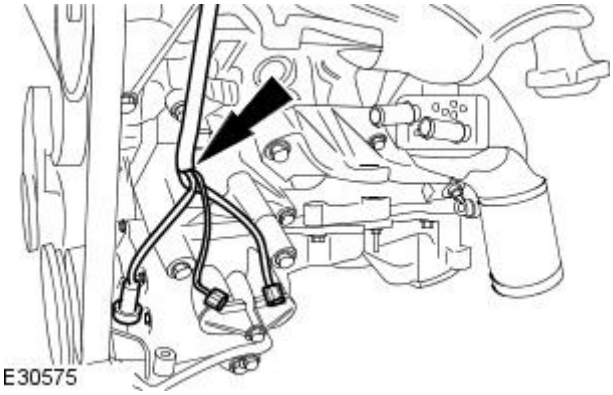


VUJ0001018

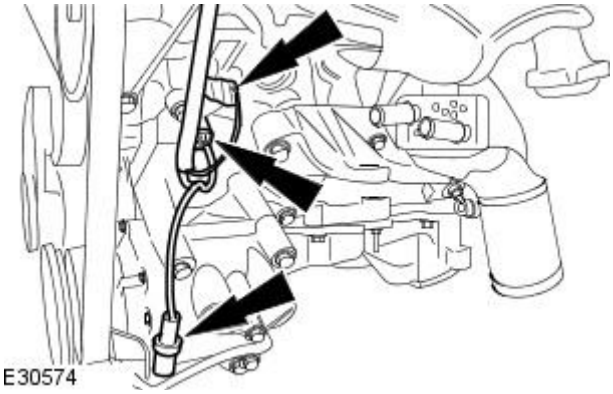
103. Attach engine harness.



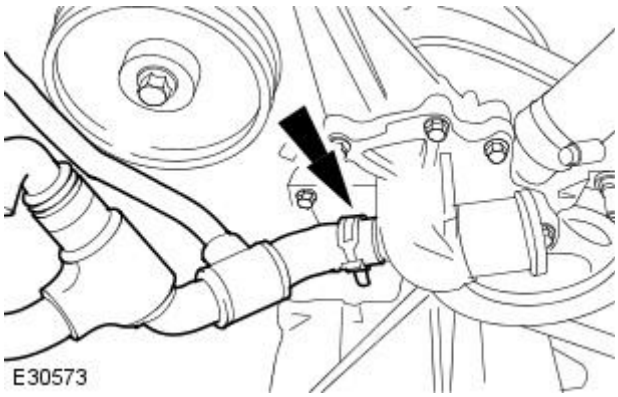
104. Attach the engine harness.



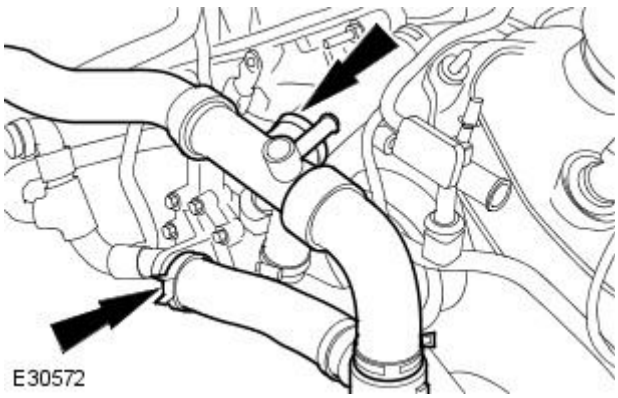
105. Connect the electrical connectors.

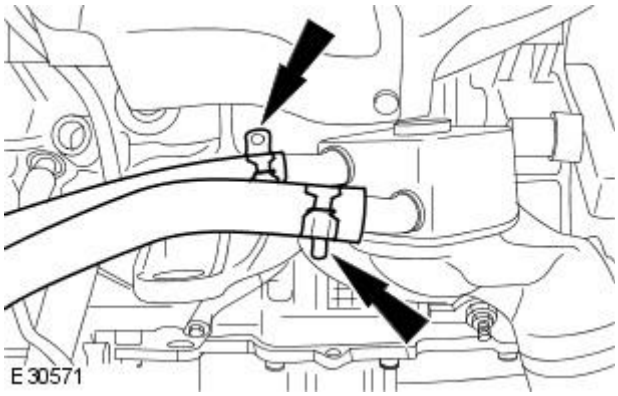


106. Install the coolant hose.

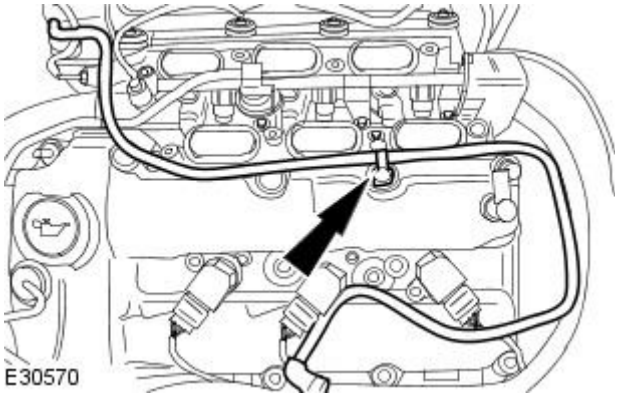


107. Install the coolant hose.

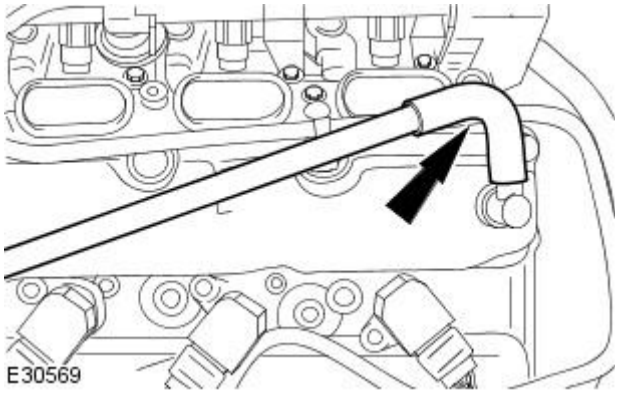




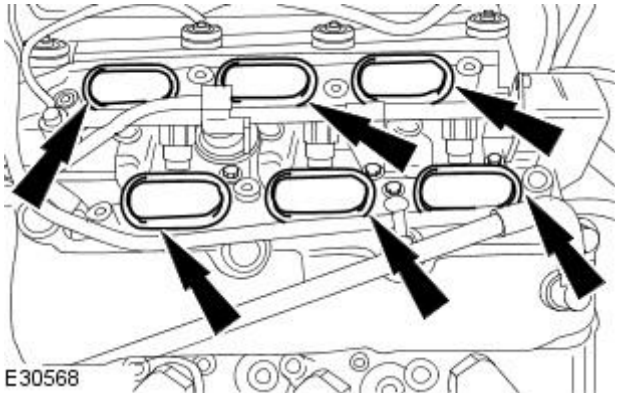
108. Connect the oil cooler coolant hoses.



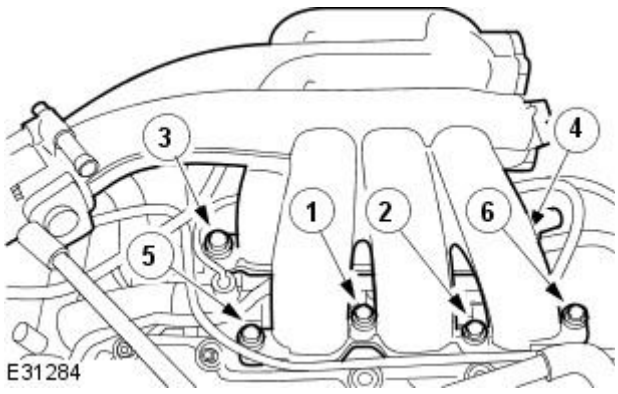
109. Install the evaporative emission purge valve hose.



110. Install the engine breather hose.



111. Install new intake manifold gaskets.

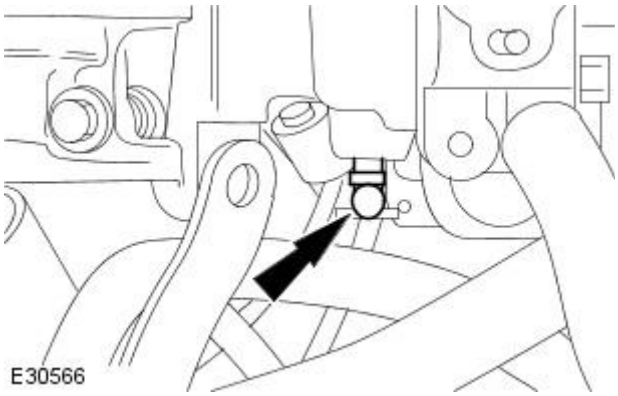


112. NOTE: The intake manifold retaining bolts in position 1,2,3 and are longer than the retaining bolts in position 4,5 and 6.

To install, reverse the removal procedure.

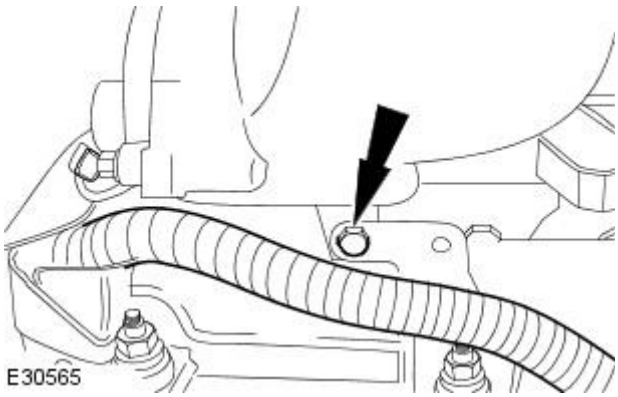
- Install new intake manifold gaskets.
- Tighten to 10 Nm.

113. Connect the evaporative emission canister purge valve transfer pipe.

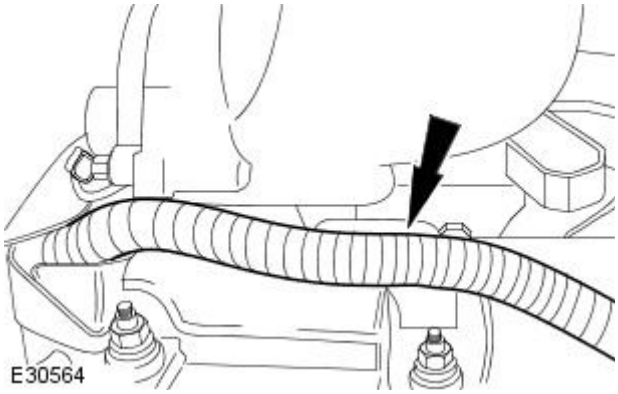


114. Attach the intake manifold rear retaining bracket.

- Tighten to 10 Nm.

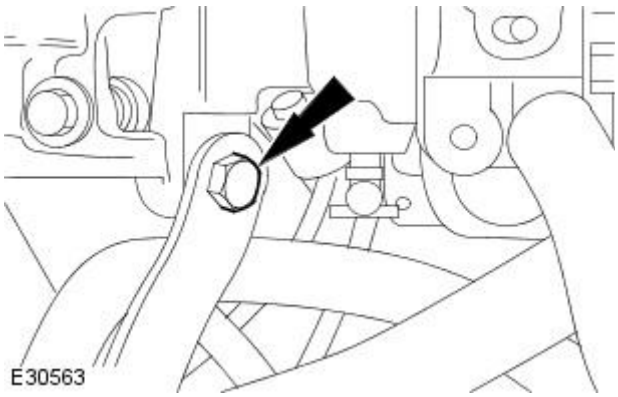


115. Attach the engine wiring harness from the intake manifold rear retaining bracket.



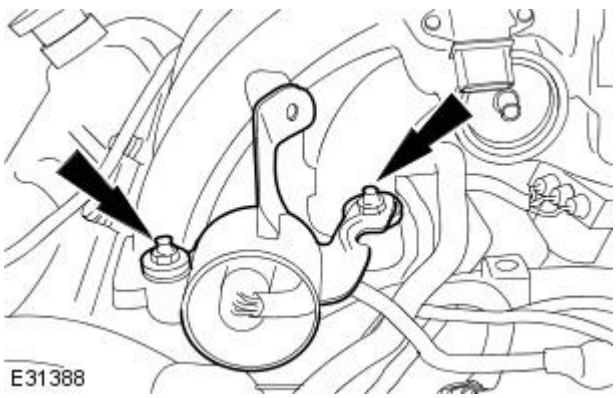
116. Attach the intake manifold front retaining bracket.

- Tighten to 10 Nm.

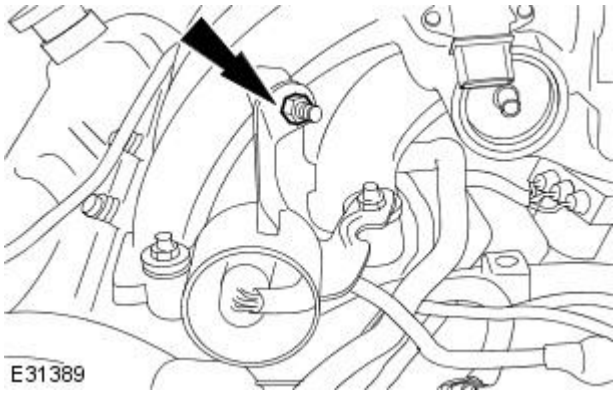


117. Install the fuel pressure regulator bracket.

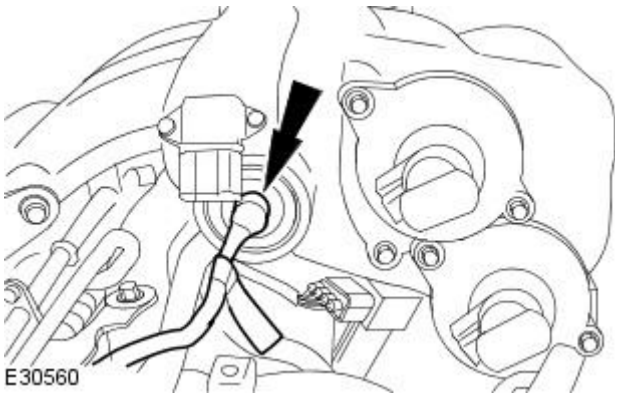
- Tighten to 10 Nm.



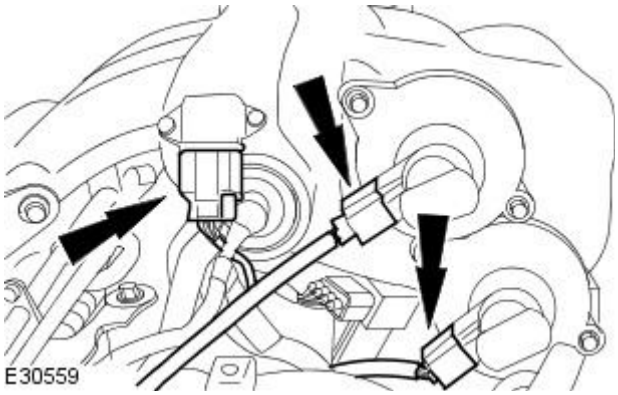
118. Tighten to 7 Nm.



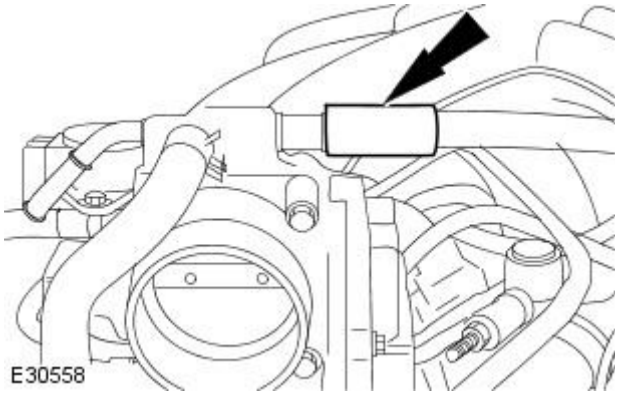
119. Connect the fuel pressure regulator vacuum hose.



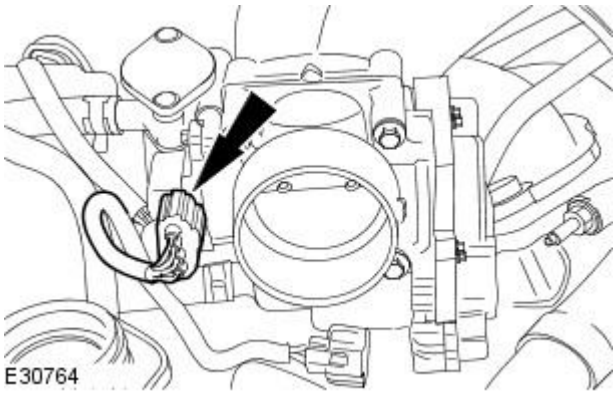
120. Connect the electrical connectors.

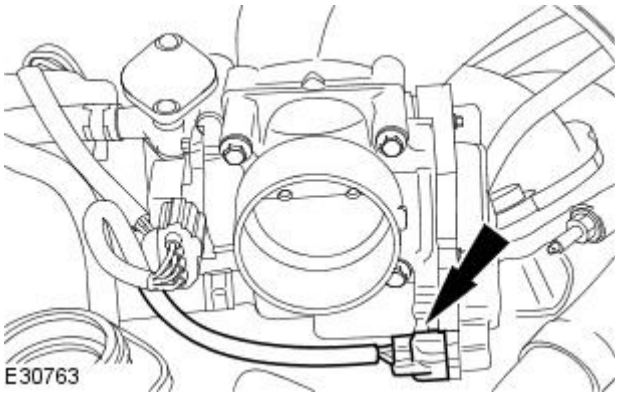


121. Connect the positive crankcase ventilation (PCV) hose.



122. Connect the throttle position sensor.

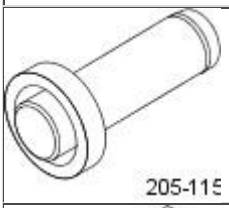
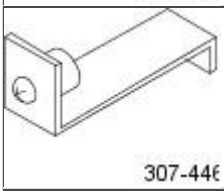
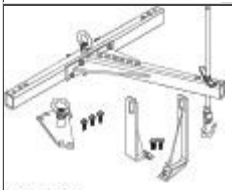
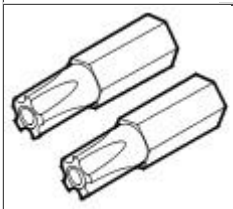




123. Connect the throttle motor electrical connector.

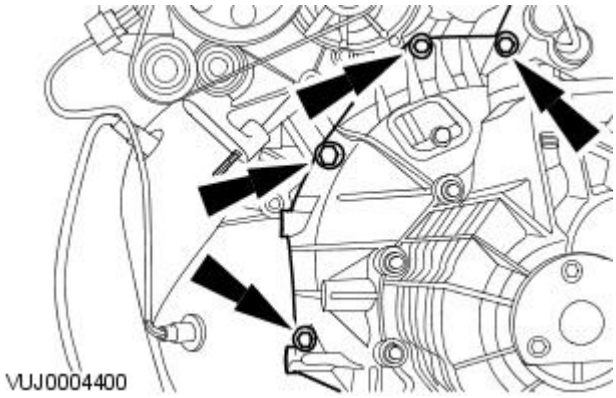
Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - EngineVehicles With: 5-Speed Manual Transmission - MT75 / 6-Speed Manual Transaxle - MMT6

Installation

Special Tool(s)	
 205-115	Halfshaft oil seal installer 205-115
 307-446	Link shaft limiting tool 307-446
 303707	Engine lifting kit 303-707
 HTJ12002	Powertrain Assembly Jack HTJ12000-2
 418-535	5 Point Security Torx Bit 418-535

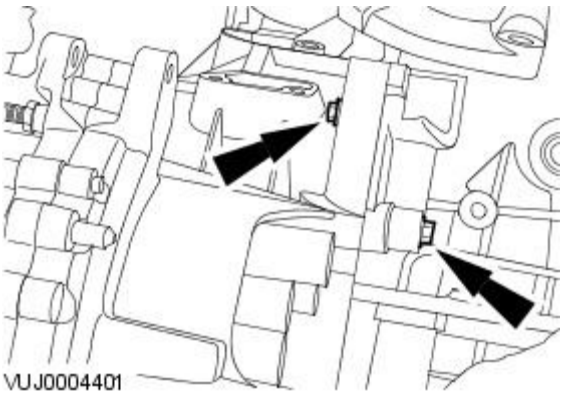
Installation

All vehicles


VUJ0004400

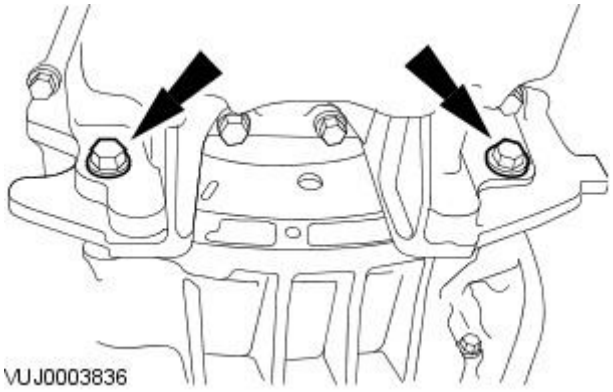
1. Install the transaxle.

- Tighten to 47 Nm.


VUJ0004401

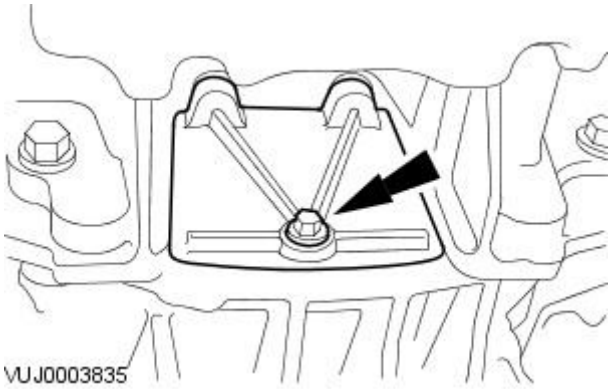
2. Install the transaxle retaining bolts.

- Tighten to 47 Nm.



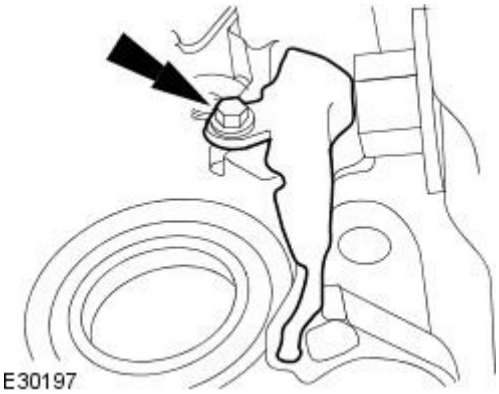
3. Install the transaxle retaining bolts.

- Tighten to 47 Nm.



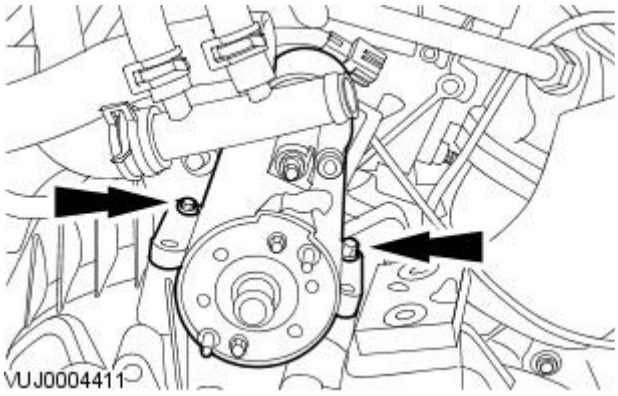
4. Install the access cover.

- Tighten to 10 Nm.



5. Install the dust cover.

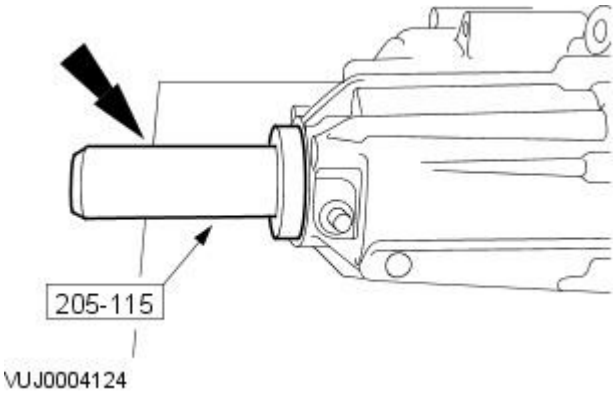
- Tighten to 10 Nm.



6. Install the starter motor.

- Tighten to 35 Nm.

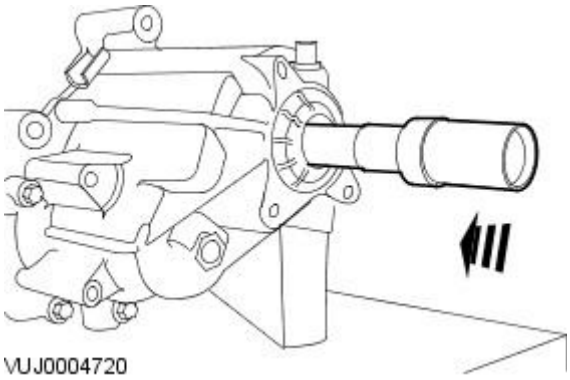
Vehicles with 2.5L or 3.0L engine



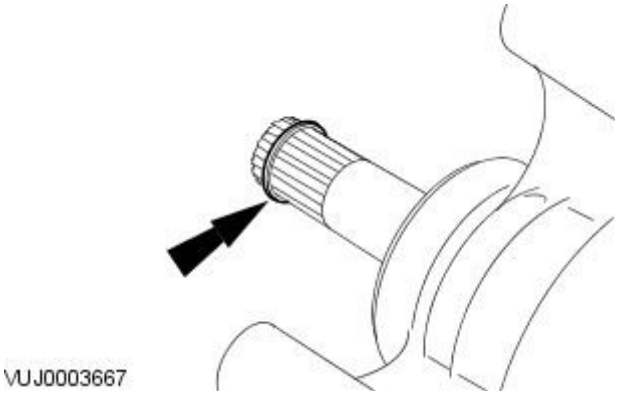
VUJ0004124

7. NOTE: Using a suitable surface cleaner, WSE-M5B392-A or equivalent, meeting the Jaguar specification. Clean the seal face on the transfer case before installing the new link shaft oil seal.

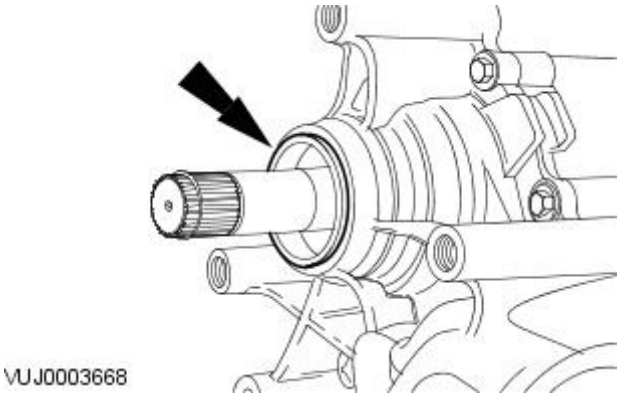
Using the special tool, install a new link shaft oil seal.


VUJ0004720

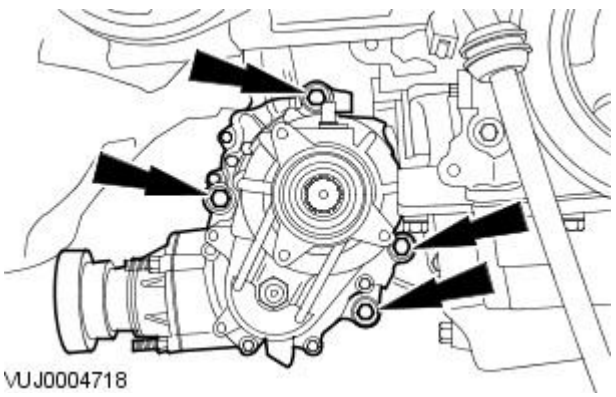
8. Install the link shaft.


VUJ0003667

9. Install a new link shaft snap ring.


VUJ0003668

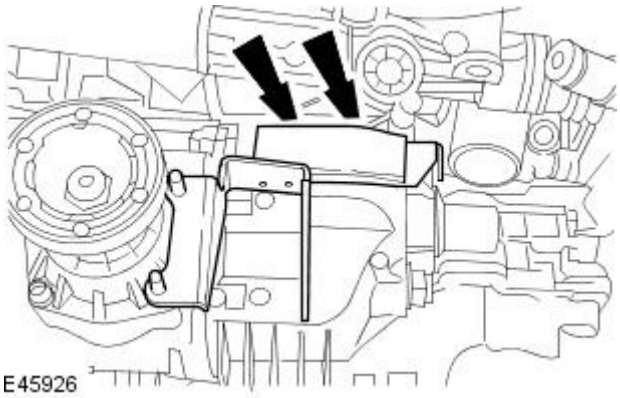
10. Install a new transfer case O-ring seal.


VUJ0004718

11. NOTE: Engage the link shaft into the transaxle.

Install the transfer case.

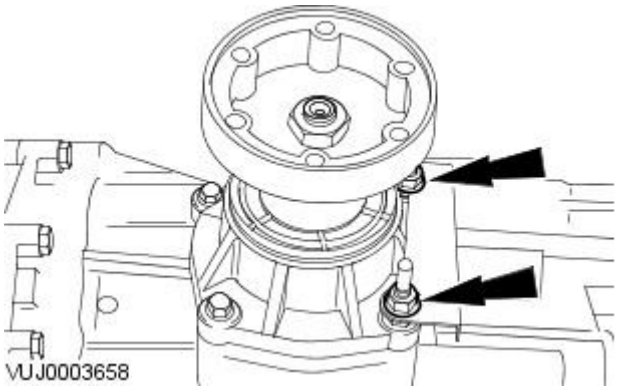
- Tighten to 90 Nm.



12. NOTE: Do not tighten the engine roll restrictor bracket top retaining bolts at this stage at this stage.

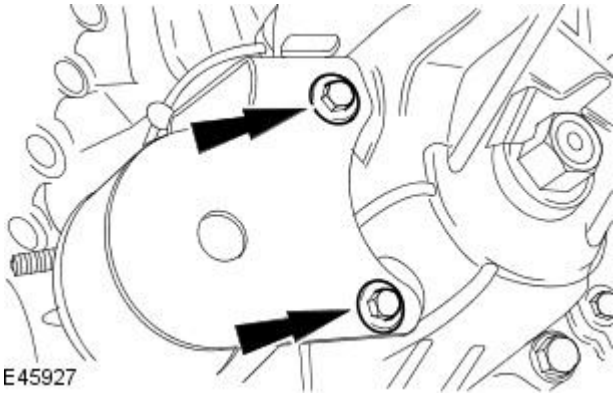
Install the engine roll restrictor bracket.

- Install the engine roll restrictor bracket top retaining bolts.



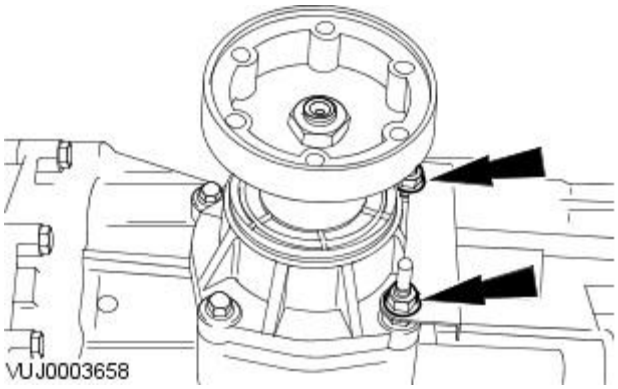
13. NOTE: Do not tighten the engine roll restrictor bracket retaining nuts at this stage.

Install the engine roll restrictor bracket.



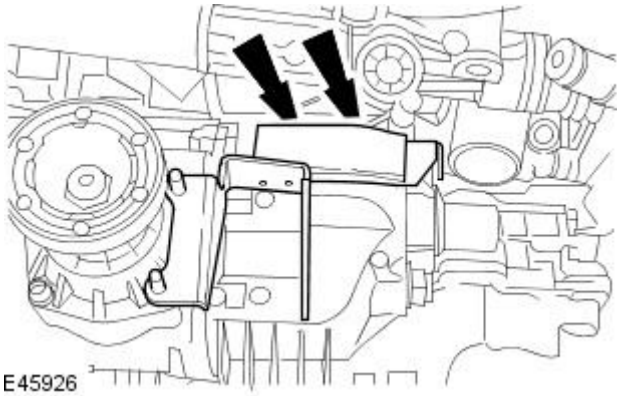
14. Install the engine roll restrictor bracket side retaining bolts.

- Tighten to 35 Nm.



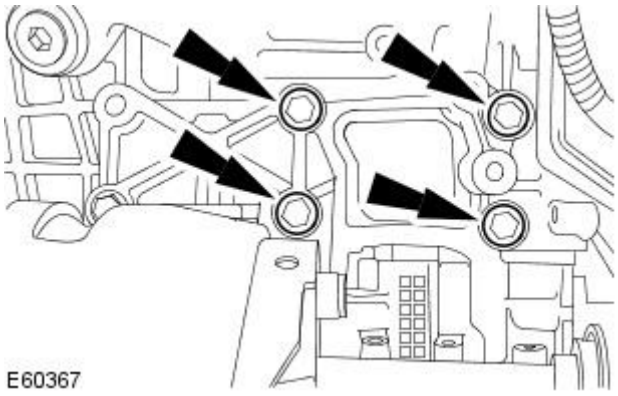
15. Tighten the engine roll restrictor bracket retaining nuts.

- Tighten to 35 Nm.



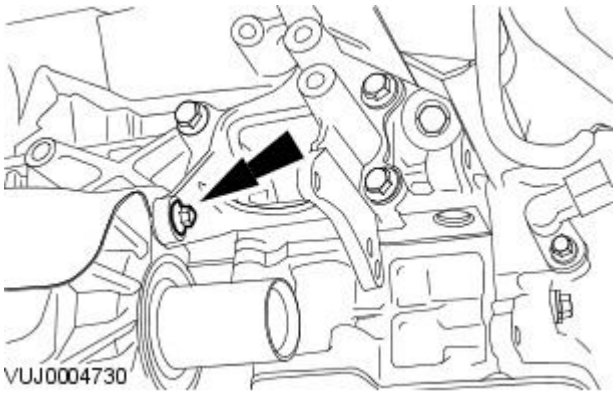
16. Tighten the engine roll restrictor bracket top retaining bolts.

- Tighten to 55 Nm.



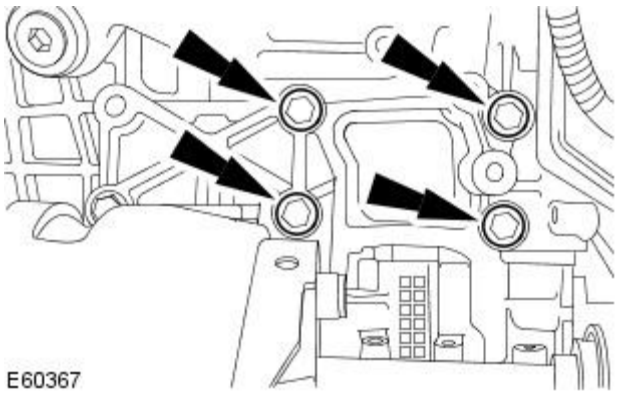
17. NOTE: Do not tighten the catalytic converter retaining bolts at this stage.

Install the catalytic converter mount bracket.



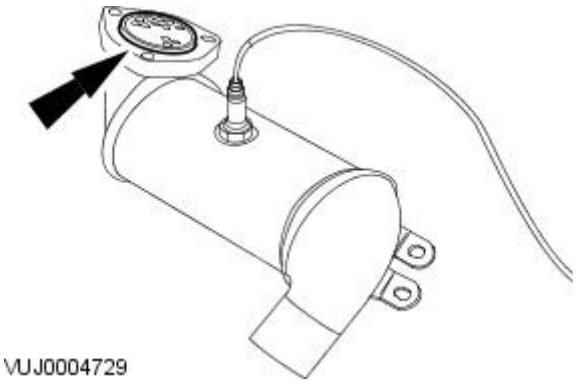
18. Install the catalytic converter mount bracket retaining bolt.

- Tighten to 25 Nm.

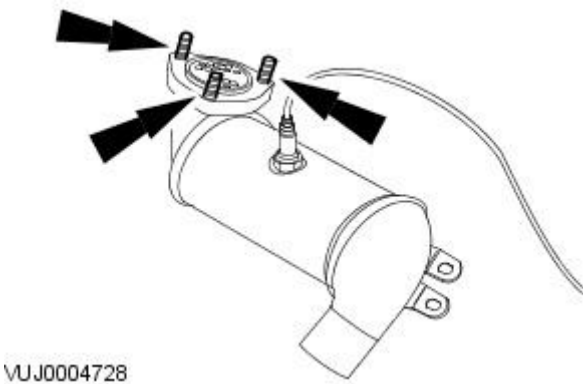


19. Tighten the catalytic converter mount bracket retaining bolts.

- Tighten to 55 Nm.

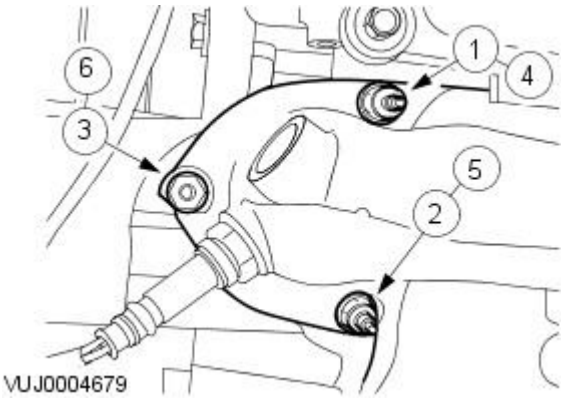


20. Install a new catalytic converter sealing ring.



21. Install new catalytic converter retaining studs.

- Tighten to 9 Nm.

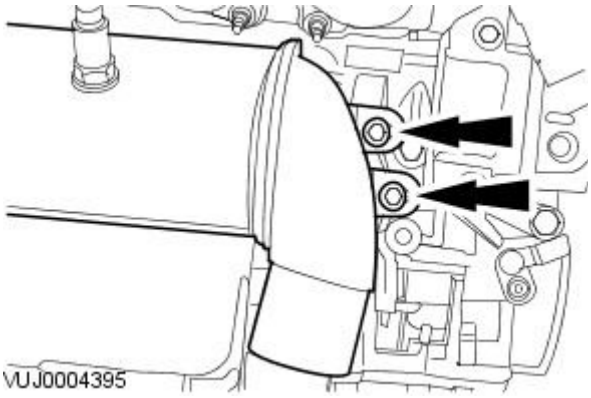


22. CAUTION: Never use jointing compound forward of the catalytic converter. Failure to follow this instruction may result in damage to the component.

• NOTE: Make sure the retaining nuts are tightened twice in the sequence shown.

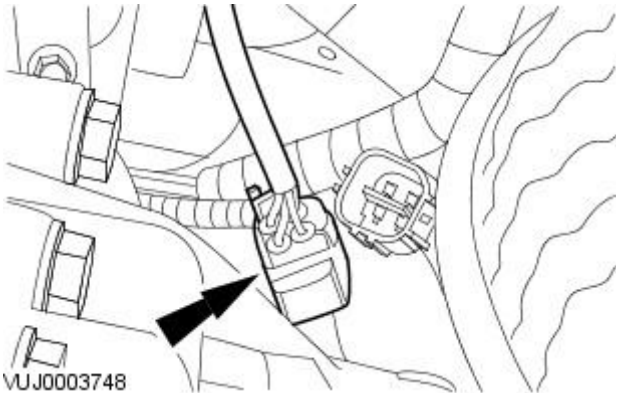
Install the right-hand catalytic converter.

- Install new retaining nuts.
- Tighten in the sequence shown to 25 Nm.

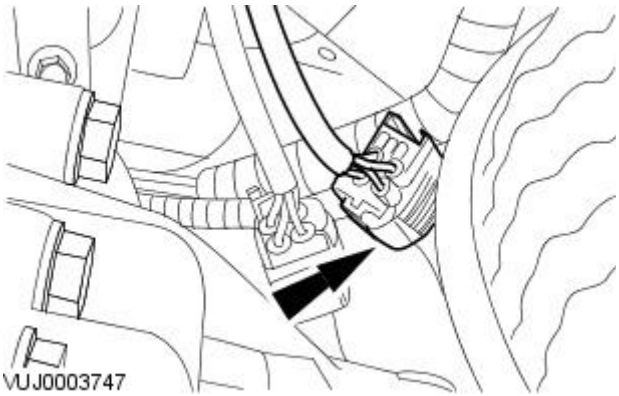


23. Install the right-hand catalytic converter retaining bolts.

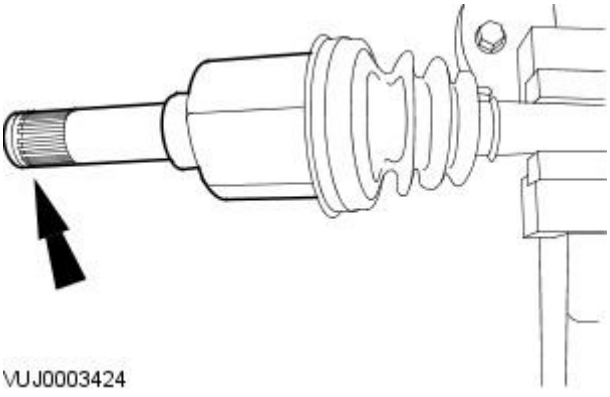
- Tighten to 25 Nm.



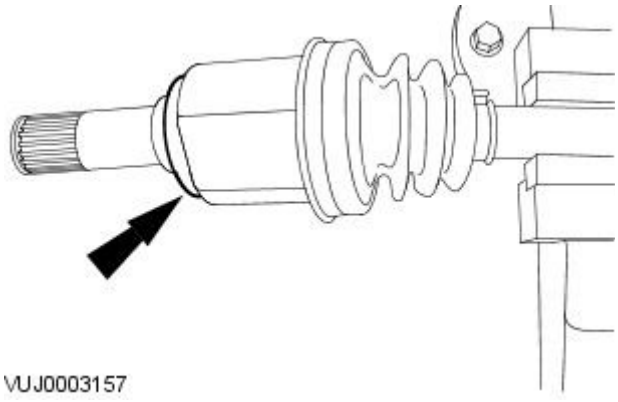
24. Connect the right-hand heated oxygen sensor (HO2S) electrical connector.



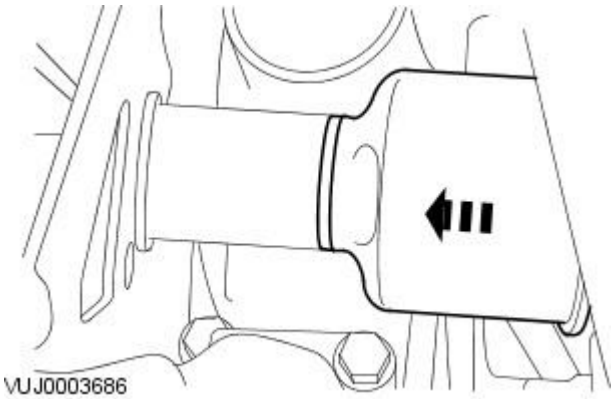
25. Connect the right-hand heated catalyst monitor sensor electrical connector.



26. Install a new halfshaft snap ring.


VUJ0003157

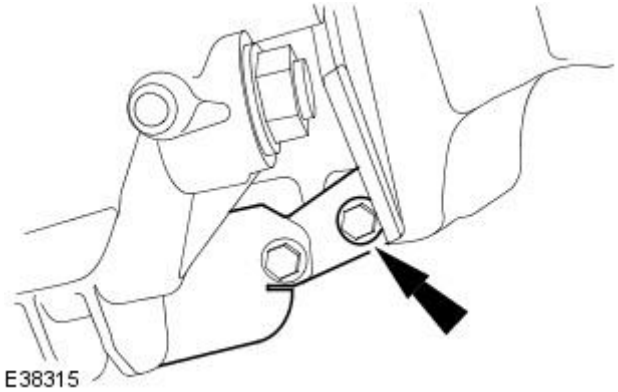
27. Install a new halfshaft seal.


VUJ0003686

28. CAUTION: Do not use excessive force when engaging the halfshaft to the link shaft. Failure to follow this instruction may result in damage to the component.

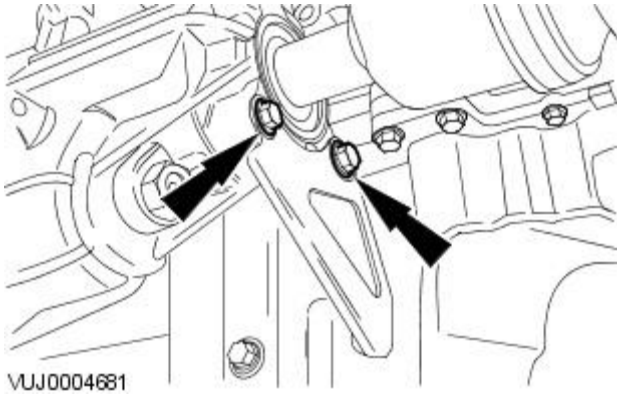
• NOTE: Make sure the halfshaft is fully located to the link shaft.

Install the halfshaft.


E38315

29. Install the transfer case Y bracket.

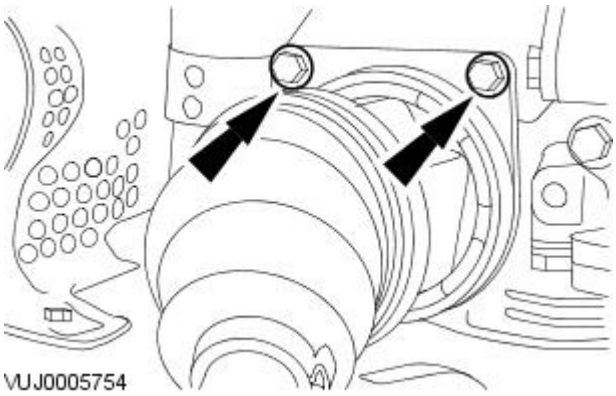
- Tighten to 55 Nm.


VUJ0004681

30. Install the transfer case Y bracket retaining bolts.

- Tighten to 25 Nm.

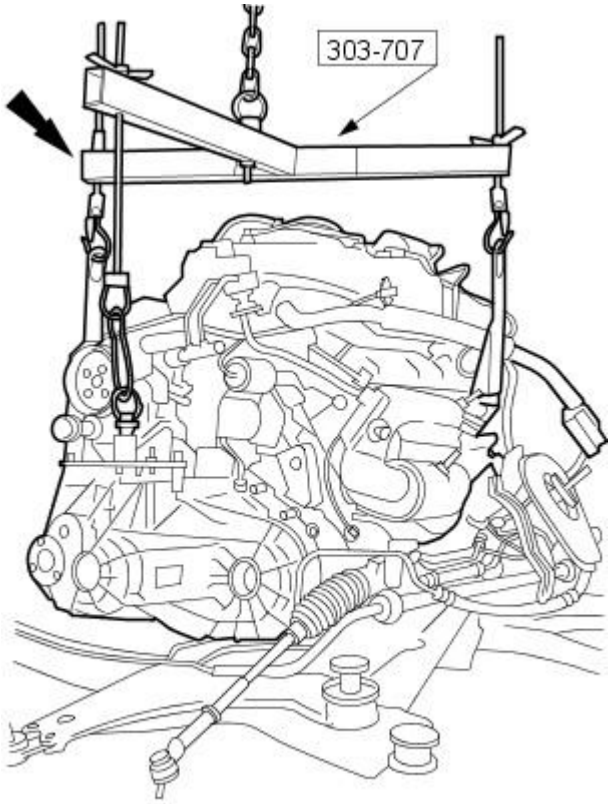
Vehicles with 2.0L engine


VUJ0005754

31. Install the halfshaft and intermediate shaft assembly.

- Tighten to 20 Nm.

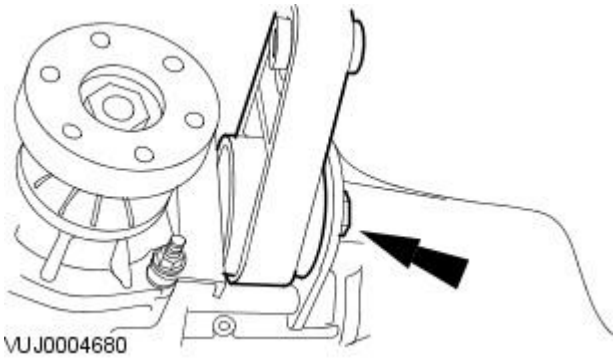
All vehicles



VUJ0004404

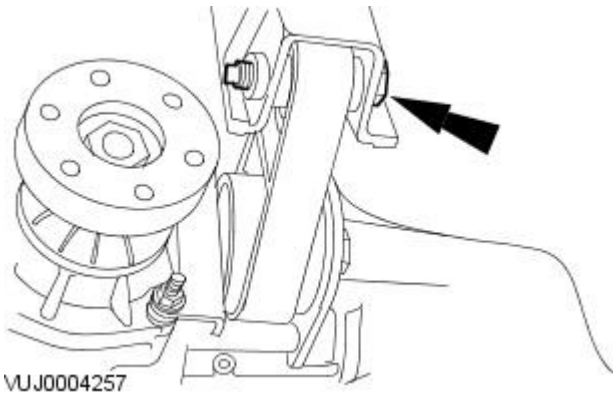
32. CAUTION: Make sure the right-hand drive halfshaft is supported, failure to follow this instruction may result in damage to the component.

Using the special tool, install the engine and transaxle to the subframe.


VUJ0004680

33. Install the engine roll restrictor.

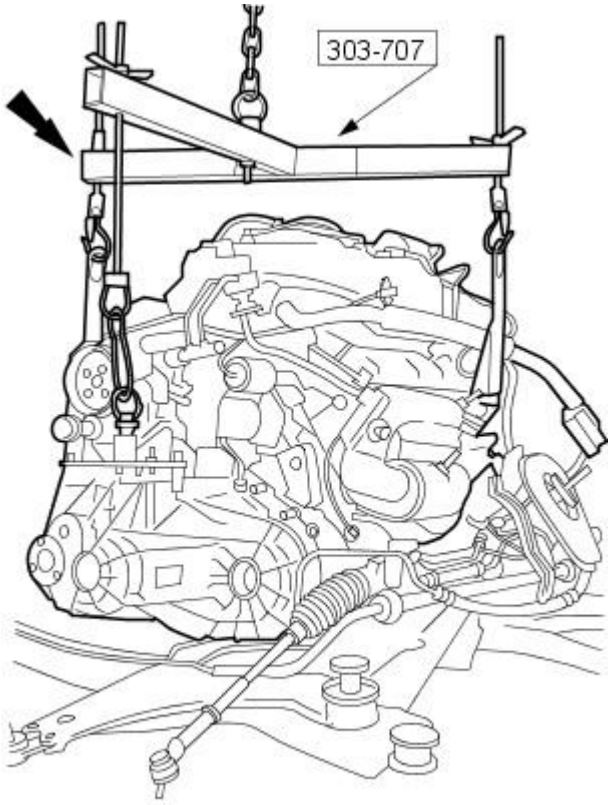
- Tighten to 80 Nm.


VUJ0004257

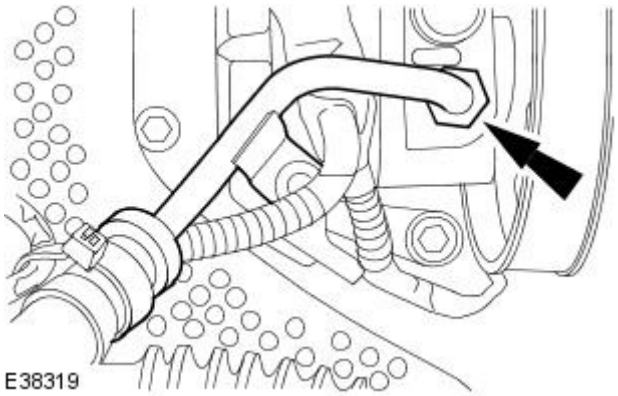
34. Install the engine roll restrictor retaining bolt.

- Tighten to 80 Nm.

35. Remove the special tool.



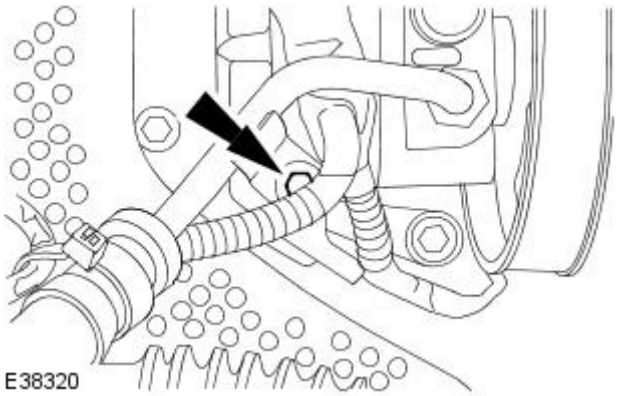
VUJ0004404



E38319

36. Connect the power steering high-pressure pipe.

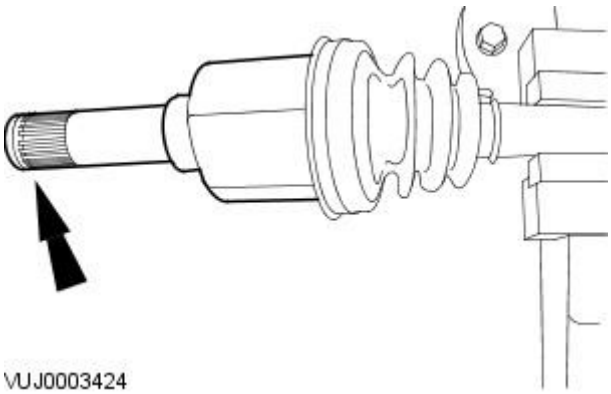
- Install a new O-ring seal.
- Tighten to 30 Nm.



E38320

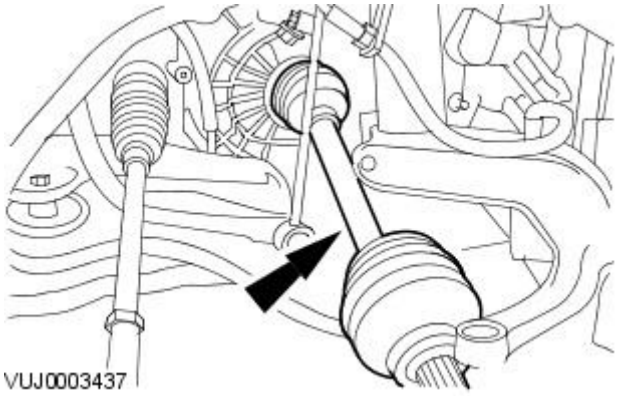
37. Install the power steering high-pressure pipe retaining bolt.

- Tighten to 25 Nm.

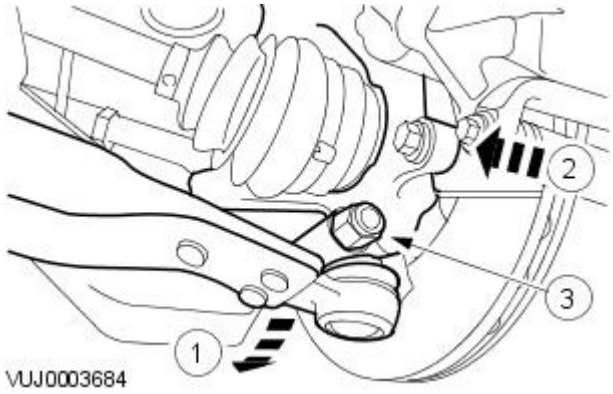


VUJ0003424

38. Install a new halfshaft snap ring.



39. Install the left-hand halfshaft.

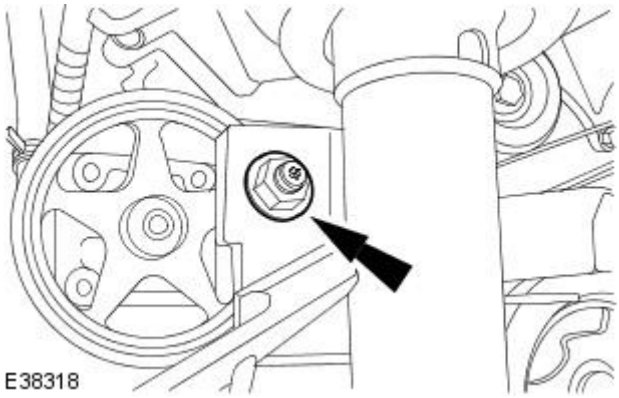


40. NOTE: Left-hand shown, right-hand similar.

• NOTE: Make sure the halfshaft is aligned to the front wheel hub.

Attach the wheel knuckles.

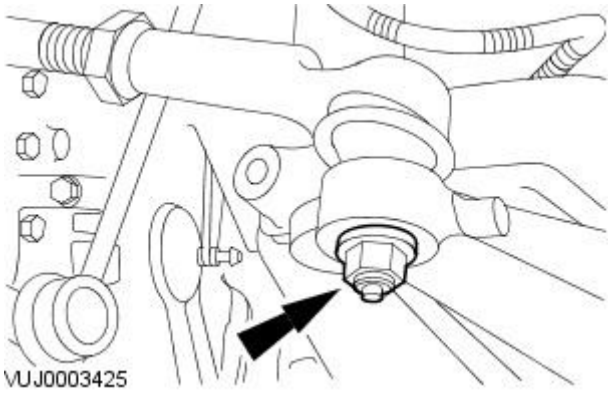
1. Reposition the lower arm.
2. Attach the wheel knuckles.
3. Install the lower arm ball joint retaining bolt.
    1. Tighten to 83 Nm.



41. NOTE: Right-hand shown, left-hand similar.

Attach the stabilizer bar link arms.

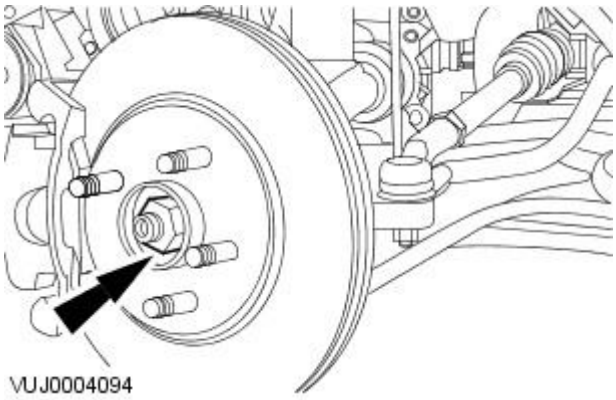
- Tighten to 48 Nm.



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

Attach the tie rod ends.

- Tighten to 35 Nm.

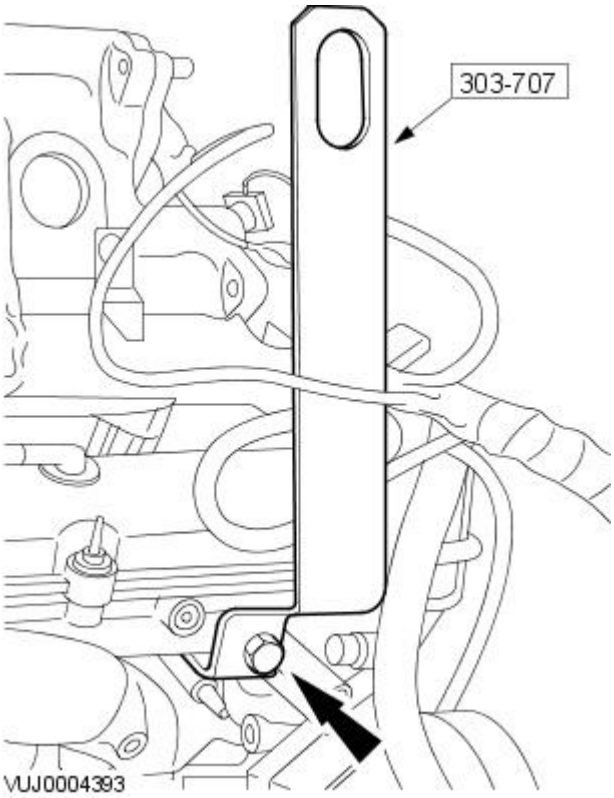


43. NOTE: Left-hand shown, right-hand similar.

• NOTE: Do not tighten the front wheel hub retaining nuts at this stage.

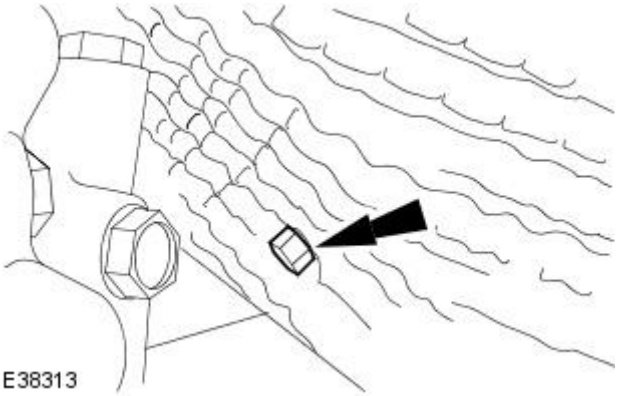
Install the front wheel hub retaining nuts.

44. Remove the special tool.



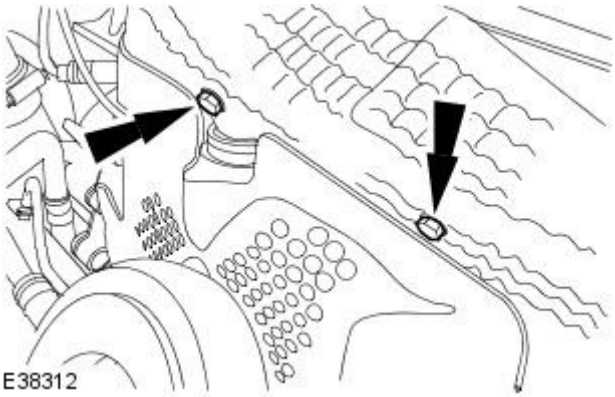
45. Install the center exhaust heat shield.

- Tighten to 10 Nm.



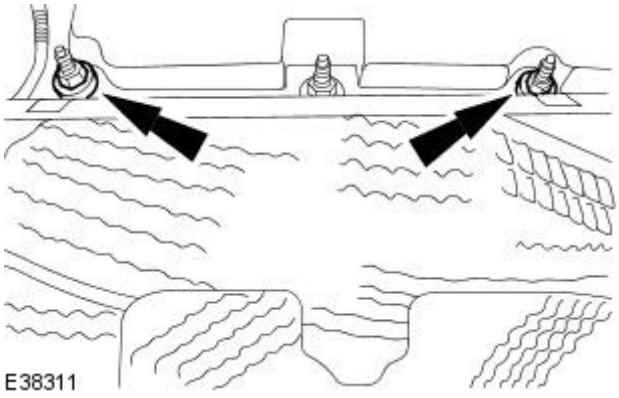
46. Install the center exhaust heat shield retaining bolts.

- Tighten to 10 Nm.

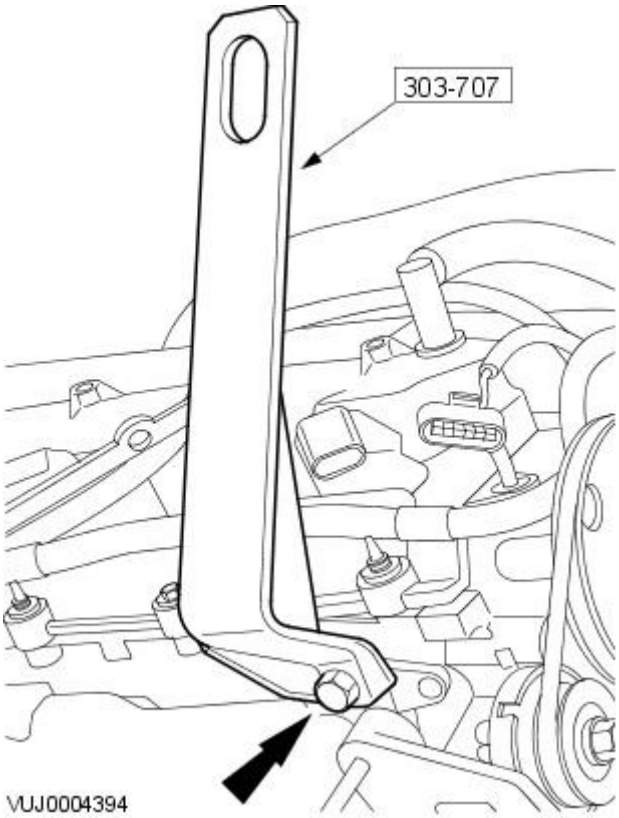


47. Install the upper exhaust heat shield.

- Tighten to 6 Nm.

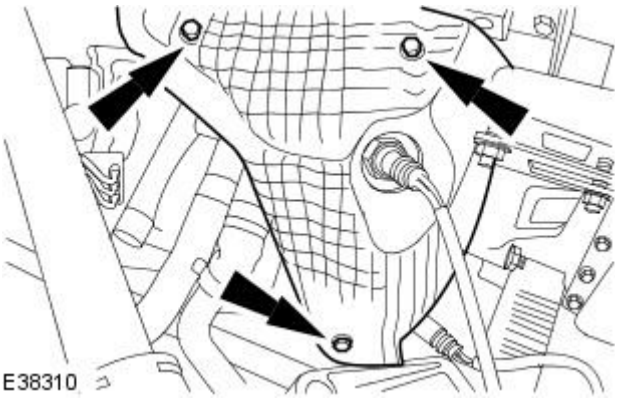


48. Remove the special tool.

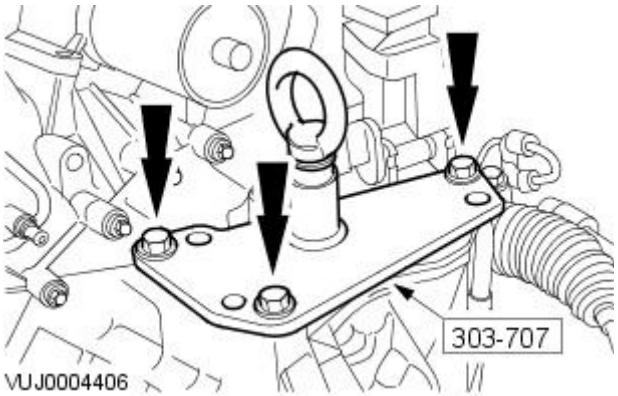


49. Install the left-hand exhaust manifold heat shield.

- Tighten to 10 Nm.

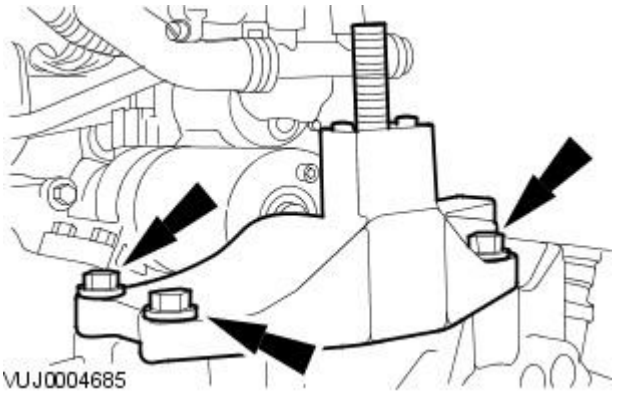


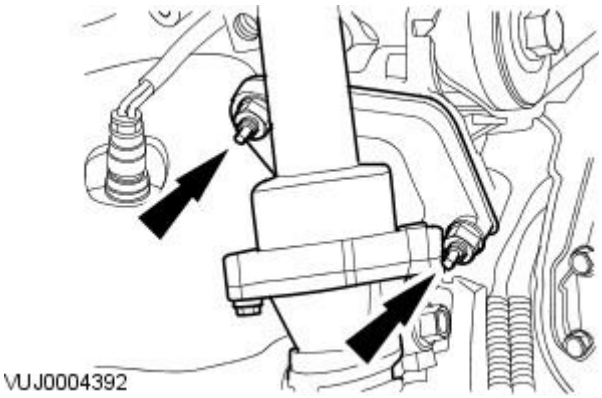
50. Remove the special tool.



51. Install the transaxle mount.

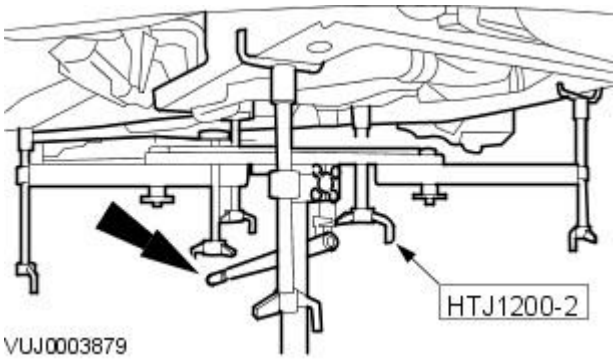
- Tighten to 80 Nm.





52. Install the coolant system top hose.

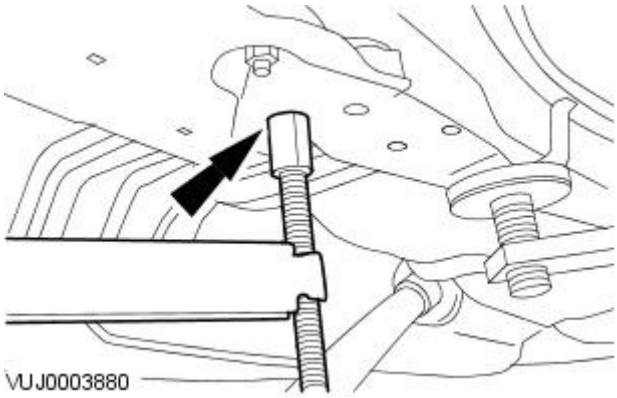
- Install a new gasket.
- Tighten to 9 Nm.



53. WARNING: Raise the special tool platform slowly. Failure to follow this instruction can result in personal injury.

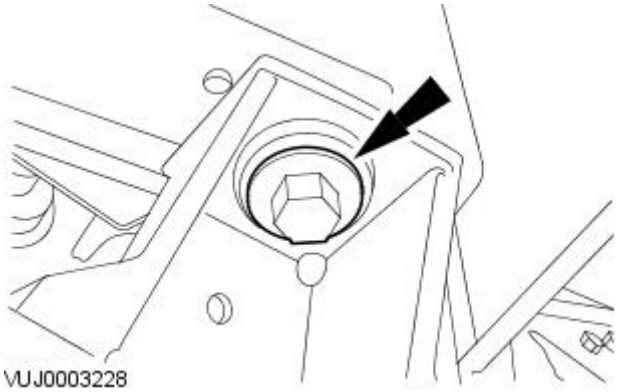
Install the engine and transaxle assembly.

- Raise the special tool platform.



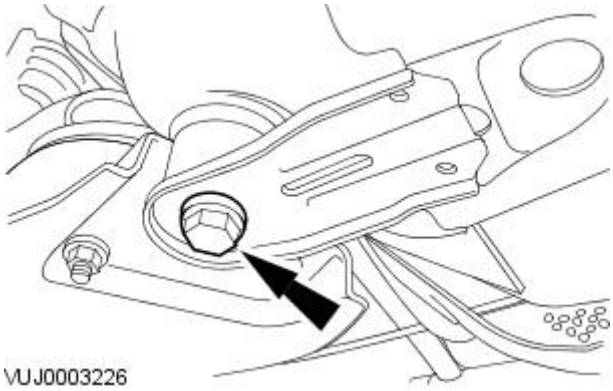
54. NOTE: Left-hand shown, right-hand similar.

Make sure the special tool rear height adjuster aligns into the locating hole in the vehicle floor pan.



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

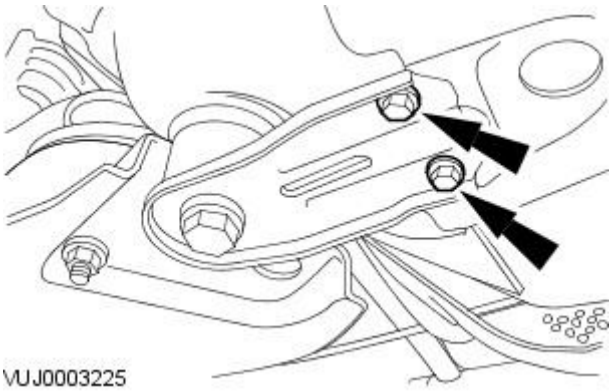
Loosely install the front subframe retaining bolt.



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

Install the front subframe reinforcement plate.

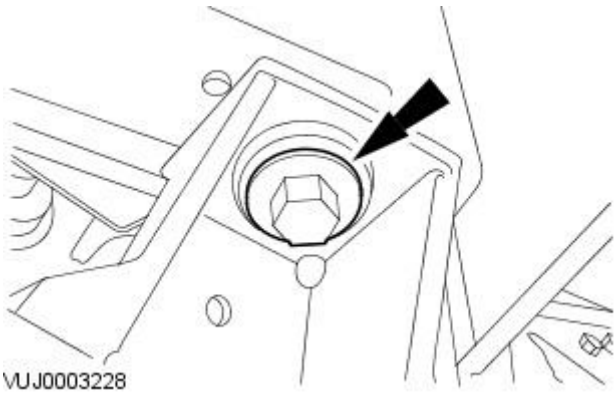
- Loosely install the front subframe rear retaining bolt.



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

Tighten the front subframe reinforcement bolts.

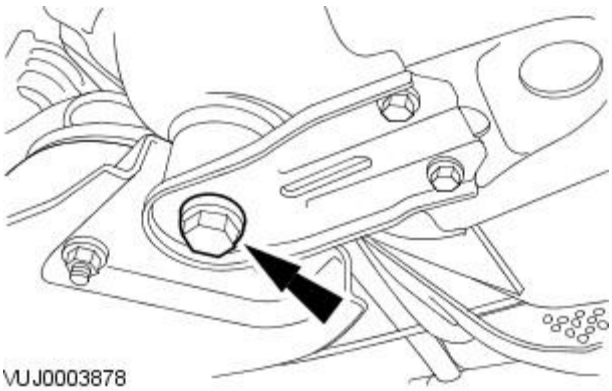
- M8 to 35 Nm.
- M10 to 70 Nm.



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

Tighten the front subframe retaining bolt.

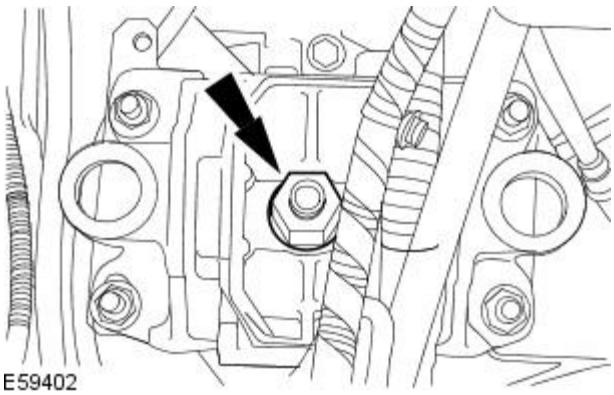
- Tighten to 142 Nm.



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

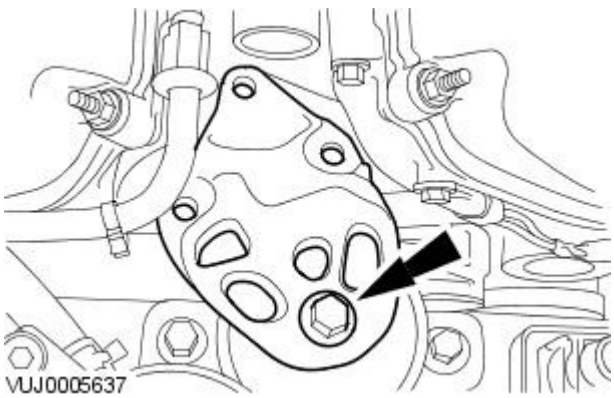
Tighten the front subframe rear retaining bolt.

- Tighten to 142 Nm.



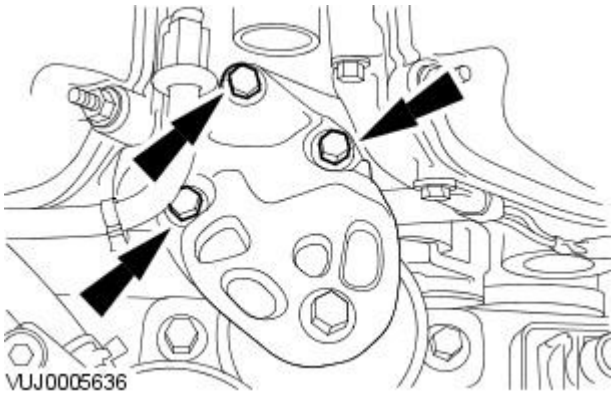
60. Install the transaxle mount bracket securing nut.

- Tighten to 133 Nm.



61. Install the engine support bracket.

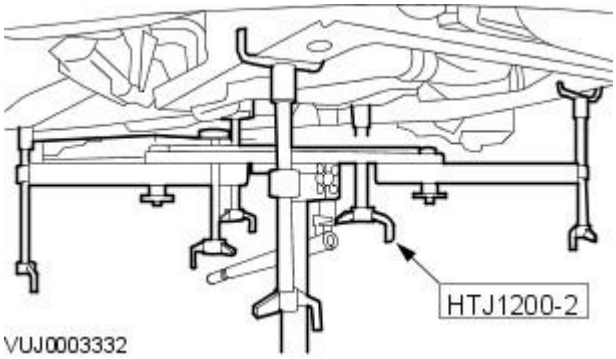
- Tighten to 80 Nm.



62. Tighten the engine support bracket retaining bolts.

- Tighten to 40 Nm.

• NOTE: If fixings can be re-used on vehicles built prior to VIN J24254, then the old torque must be used (48 Nm). If new fixings are used on any vehicle use the new torque.



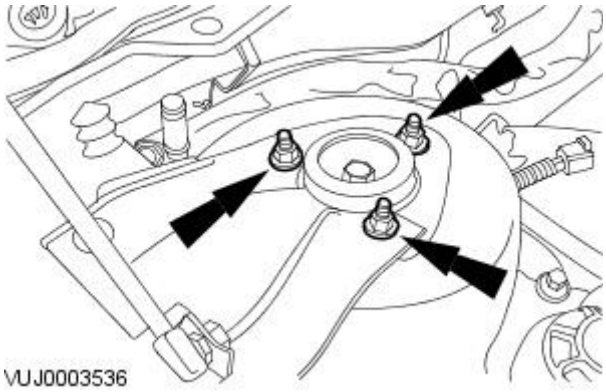
63. Remove the special tool.

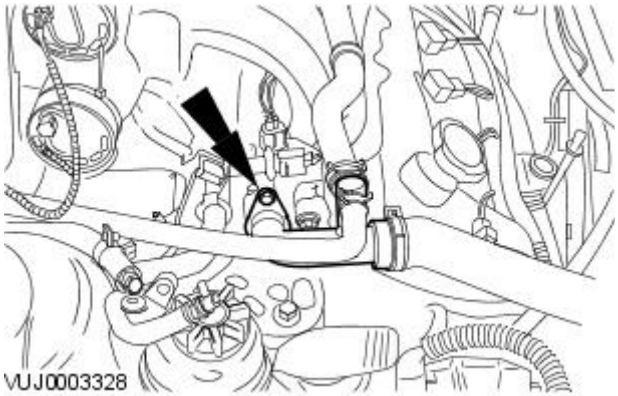
64. Lower the vehicle.

65. NOTE: Right-hand shown, left-hand similar.

Attach the strut and spring assembly.

- Tighten to 30 Nm.

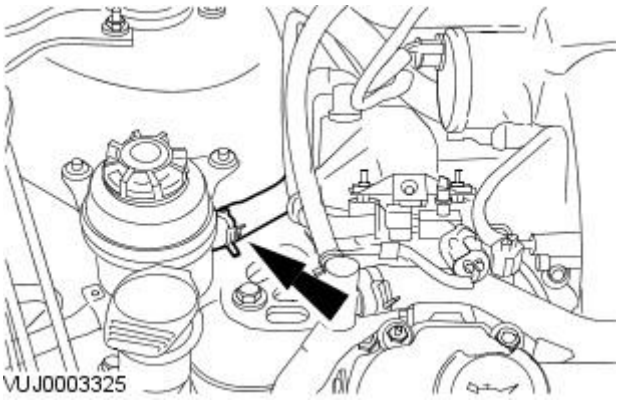




66. Attach the coolant pipe.

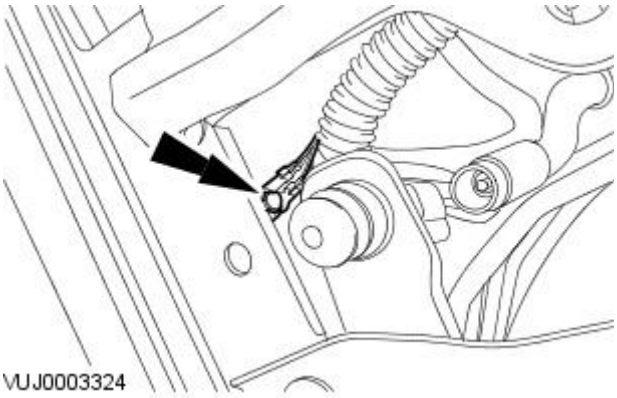
- Tighten to 9 Nm.

67. Connect the spring lock coupling.
For additional information, refer to: Spring Lock Couplings (310-00 Fuel System - General Information, General Procedures).



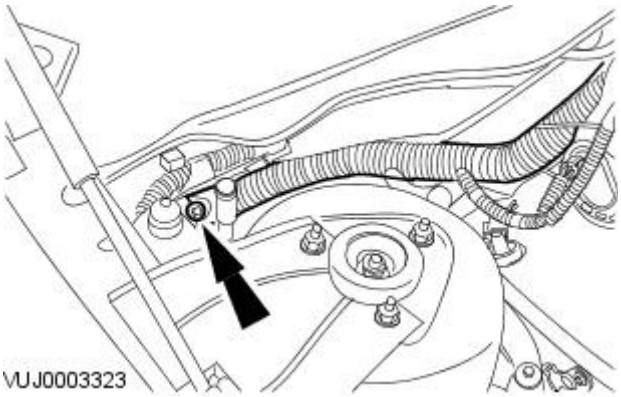
68. NOTE: Remove the blanking plug from the hose.

Attach the power steering hose.



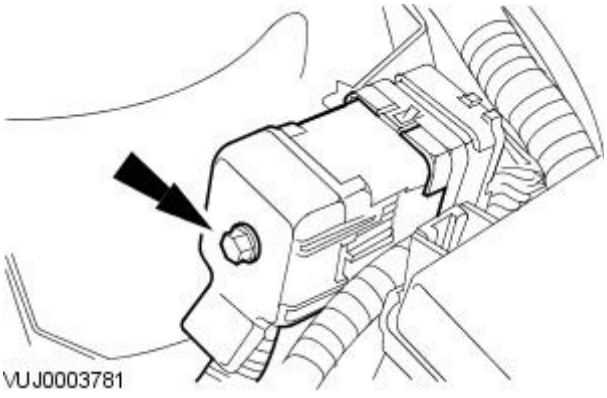
69. Connect the ground cable.

- Tighten to 10 Nm.



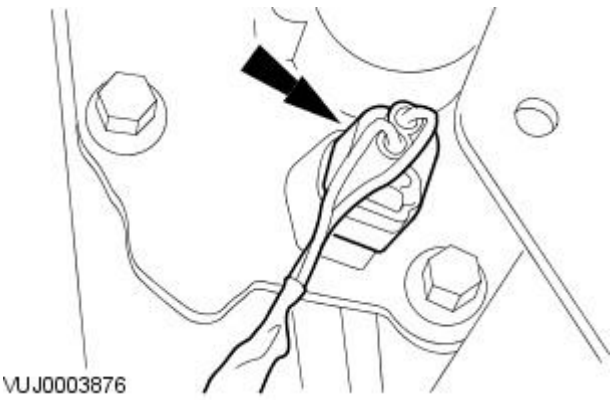
70. Connect the engine control module (ECM) electrical connector.

- Using special tool 418-535, tighten to 5 Nm.

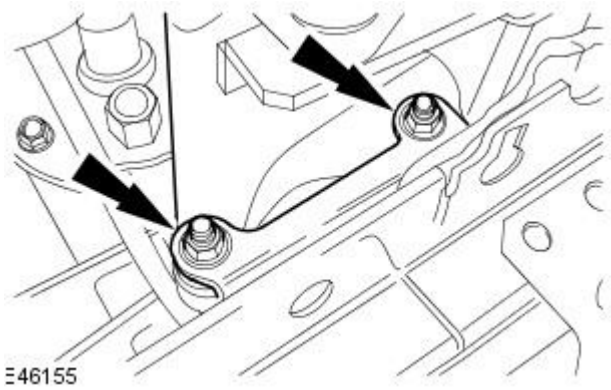


71. Connect the electrical connector.

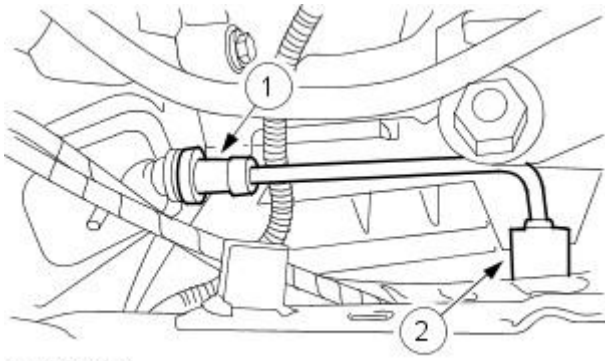
- Tighten to 10 Nm.



72. Connect the reverse light switch electrical connector.



73. Install the clutch master cylinder to clutch slave cylinder high pressure pipe support bracket.



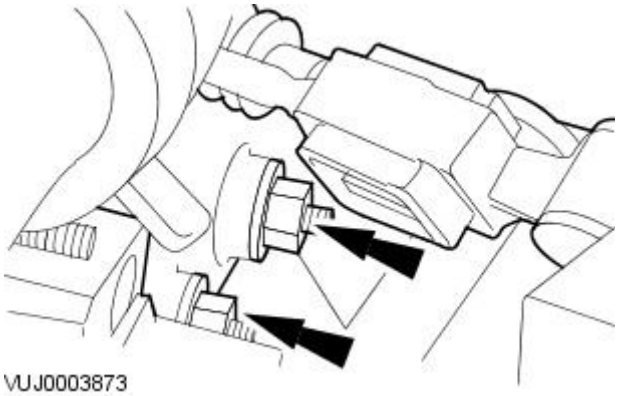
74. CAUTION: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

• NOTE: Remove the tie straps.

• NOTE: Remove the blanking plugs from the pipe and slave cylinder.

Connect the clutch slave cylinder pipe.

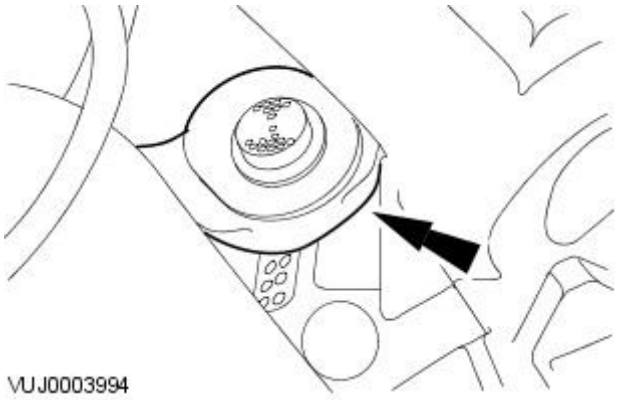
1. Attach the clutch slave cylinder pipe to the slave cylinder.
2. Attach the clutch cylinder to the retaining bracket.



75. NOTE: Remove the tie straps.

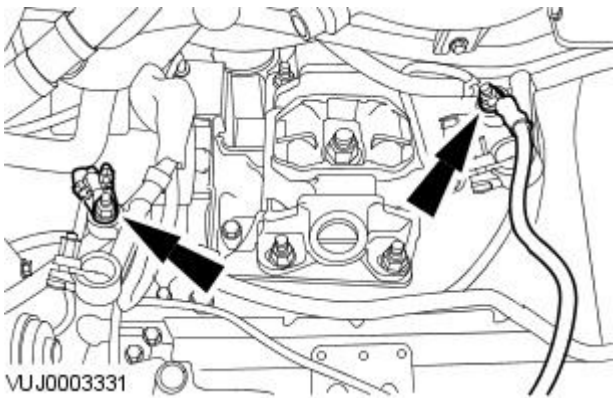
Attach the selector cables.

- Tighten to 25 Nm.



76. NOTE: Upper selector cable shown, lower selector cable similar.

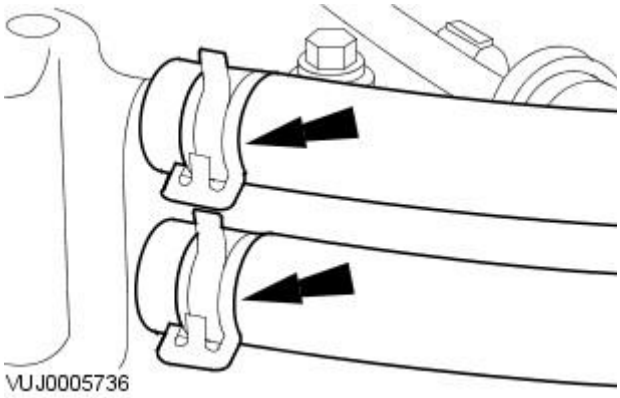
Attach the selector cables.



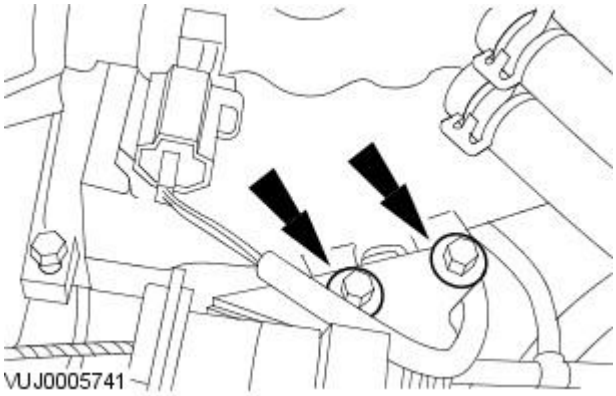
77. Attach the battery cables.

- Tighten to 10 Nm.

Vehicles with 2.0L engine

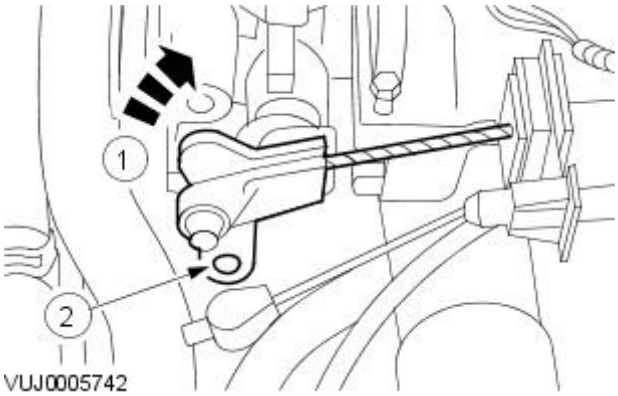


78. Attach the coolant hoses.



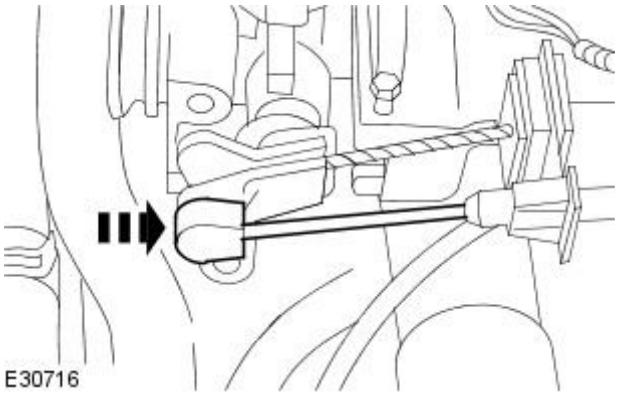
79. Attach the accelerator cable retaining bracket.

- Tighten to 9 Nm.



80. Attach the accelerator cable.

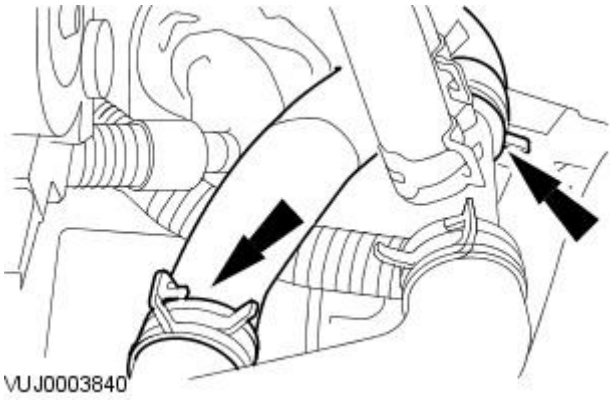
1. Reposition the accelerator lever to the fully open position.
2. Attach the accelerator cable.



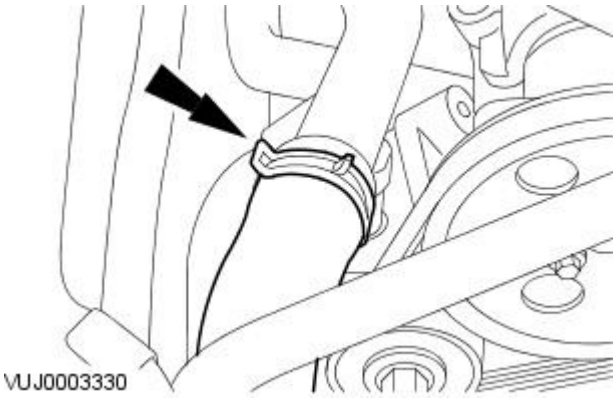
81. Attach the cruise control cable.

All vehicles

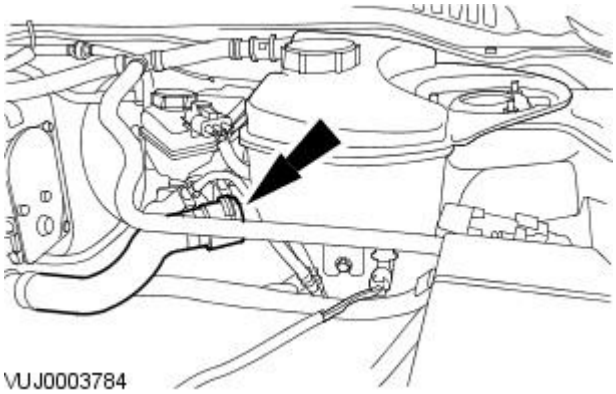
82. Attach the coolant hoses.



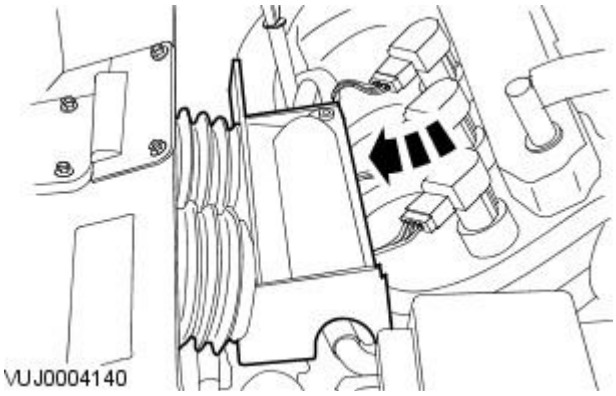
83. Attach the coolant hose.



84. Attach the coolant hose.



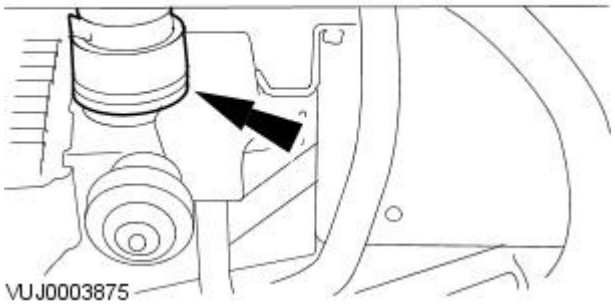
85. Install the air filter intake pipe.



86. Install the air cleaner.
For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

87. Raise the vehicle.

88. Attach the coolant hose.

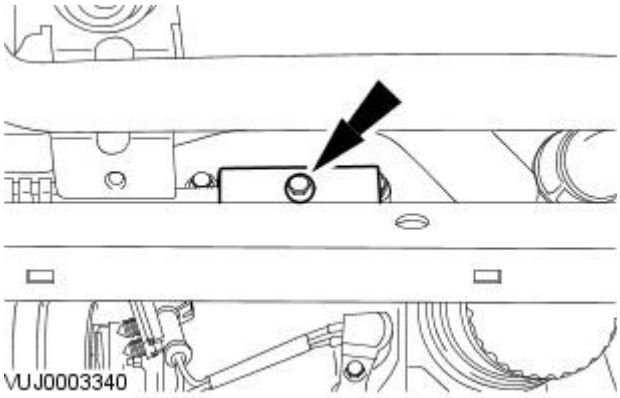


89. NOTE: Remove the tie straps.

• NOTE: Remove the blanking plugs from the tube and the A/C compressor.

Attach the A/C compressor supply and return tubes.

- Install new O-ring seals.
- Tighten to 25 Nm.



90. Install the front muffler.
For additional information, refer to: Front Muffler - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (309-00 Exhaust System, Removal and Installation).

Vehicles with 2.5L or 3.0L engine

91. Install the driveshaft.
For additional information, refer to: Driveshaft (205-01 Driveshaft, Removal and Installation).

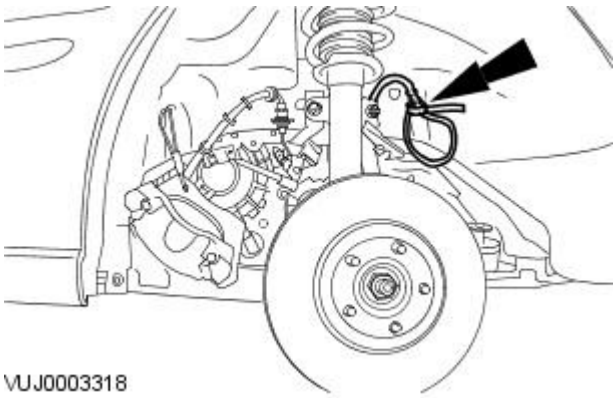
All vehicles

92. Install the cooling fan motor and shroud.
For additional information, refer to: Cooling Fan Motor and Shroud (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

93. NOTE: Remove the tie straps.

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

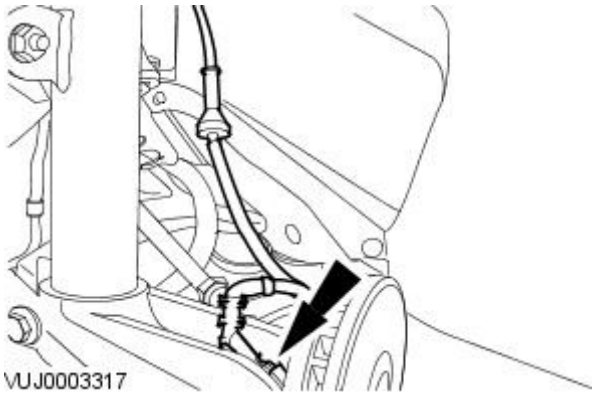
Detach and reposition the anti-lock brake system (ABS) wheel speed sensor.

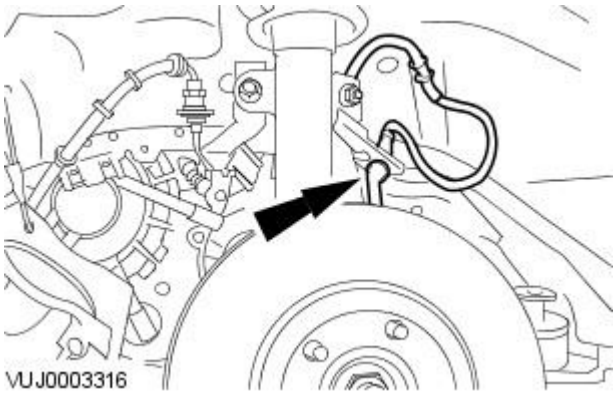


94. NOTE: Left-hand shown, right-hand similar.

Connect the ABS wheel speed sensor.

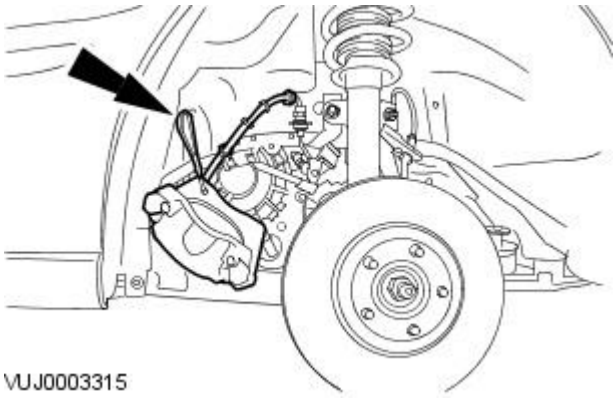
- Tighten to 5 Nm.




VUJ0003316

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

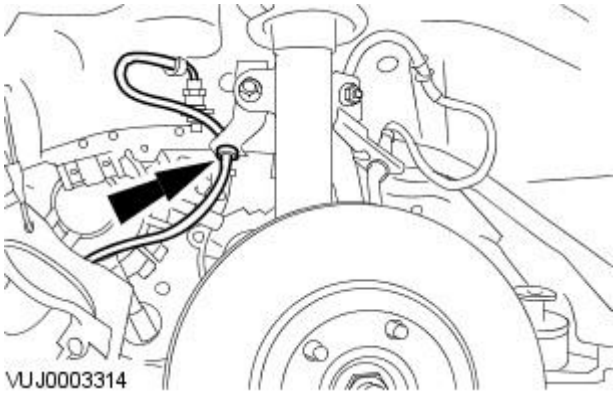
Attach the ABS wheel speed sensor.


VUJ0003315

96. NOTE: Remove the tie straps.

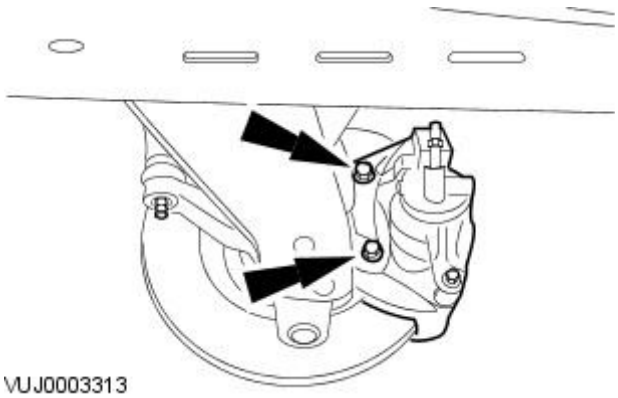
• NOTE: Left-hand shown, right-hand similar.

Detach and reposition the brake caliper assembly.


VUJ0003314

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

Attach the brake pipe.

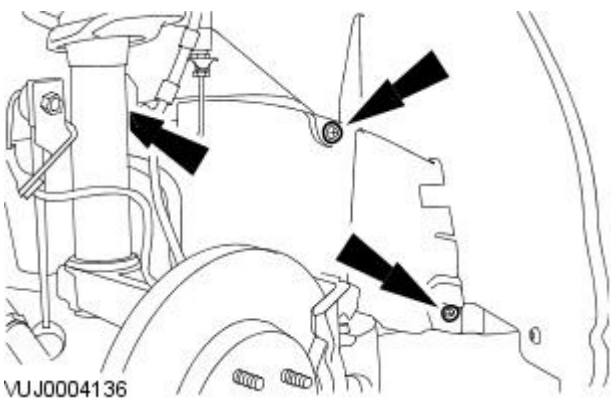

VUJ0003313

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

• NOTE: Install new brake caliper anchor plate retaining bolts.

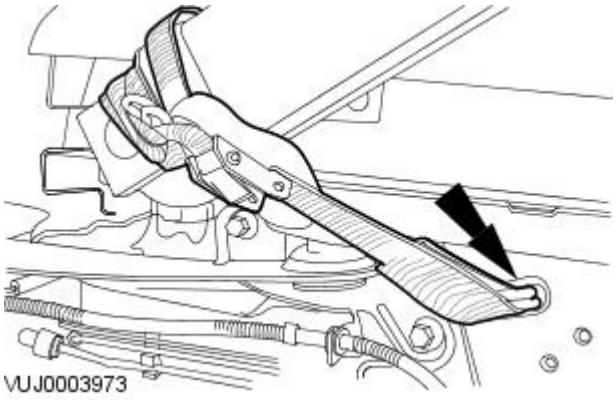
Attach the brake caliper assembly.

- Tighten to 133 Nm.


VUJ0004136

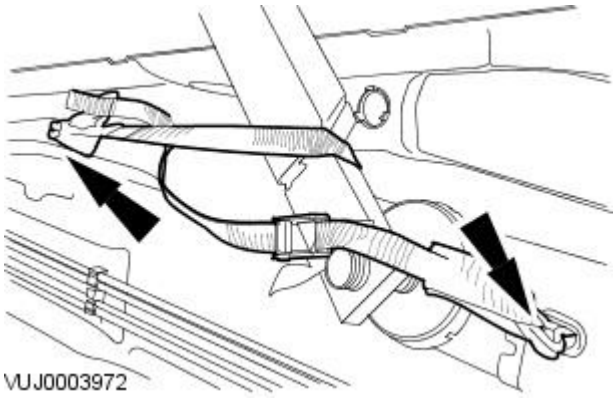
99. NOTE: Right-hand shown, left-hand similar.

Install the splash shield.


VUJ0003973

100. NOTE: Right-hand shown, left-hand similar.

Remove the rear vehicle tie down strap.


VUJ0003972

101. NOTE: Right-hand shown, left-hand similar.

Remove the front vehicle tie down strap.

102. Install the front wheels and tires.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

103. Install the battery tray.
For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

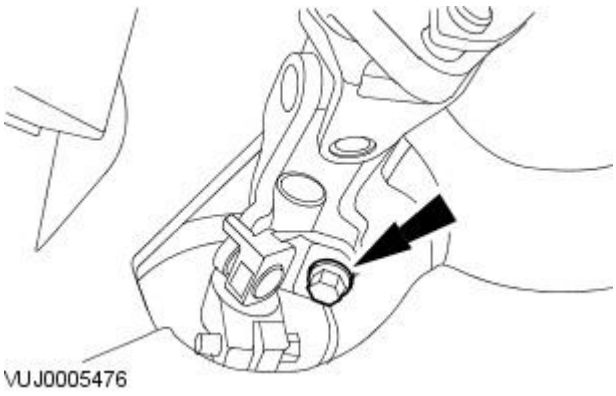
104. Fill and bleed the cooling system.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).

105. Bleed the power steering system.
For additional information, refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).

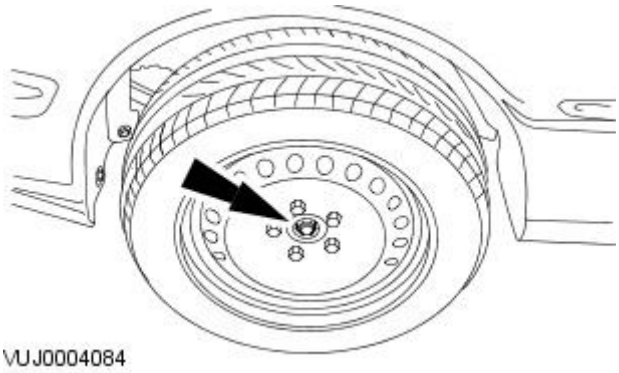
106. Recharge the A/C refrigerant.
For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

107. Install the steering column lower retaining bolt.

- Tighten to 25 Nm.


VUJ0005476

108. Fill the transaxle.
For additional information, refer to: Transaxle Draining and Filling - Vehicles With: 6-Speed Manual Transaxle - MMT6 (308-03 Manual Transmission/Transaxle, General Procedures).



VUJ0004084

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

Tighten the front hub retaining nuts.

- Tighten to 290 Nm.

110. Carry out the underbody misalignment check.
For additional information, refer to: Underbody Misalignment Check (502-00 Uni-Body, Subframe and Mounting System, General Procedures).

111. Check the engine oil level and correct as necessary.

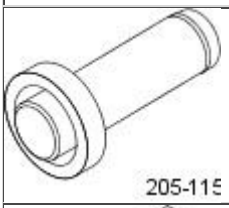
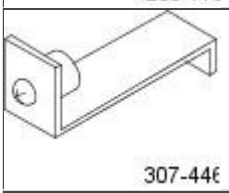
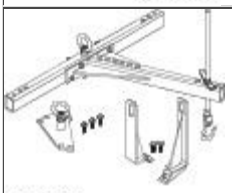
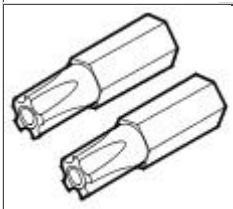
112. NOTE: When the battery has been disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy.

Finishing operations.

- Check the routing of the vacuum hoses and wiring and secure them with cable ties.
- Check the fluid levels after the road test and correct as necessary.
- Check the engine and cooling system for leaks (visual inspection).

Engine - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - EngineVehicles With: 5-Speed Automatic Transaxle - JATCO / 6-Speed Automatic Transaxle - AWF21

Installation

Special Tool(s)	
 205-115	Halfshaft oil seal installer 205-115
 307-446	Link shaft limiting tool 307-446
 303707	Engine lifting kit 303-707
 HTJ12002	Powertrain Assembly Jack HTJ12000-2
 418-535	5 Point Security Torx Bit 418-535

Installation

All vehicles

1. NOTE: Use high temperature grease ESD-M1C220-A or equivalent meeting the Jaguar specification.

Apply a thin layer of grease to the centering spigot bore on the torque converter.

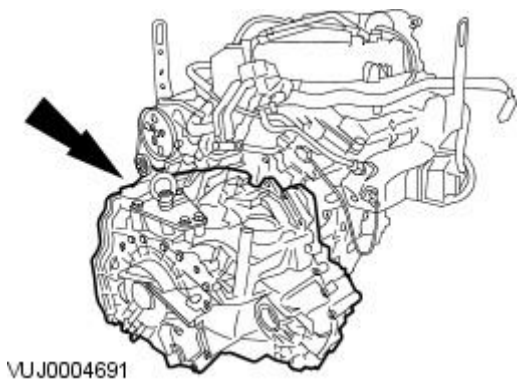
2. CAUTION: The torque converter must remain at the correct installation depth throughout the whole installation procedure.

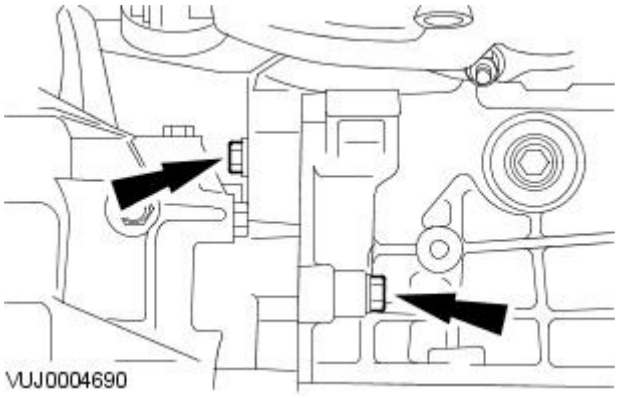
• NOTE: The torque converter must engage fully in the oil pump drive gear.

Check the installation depth between the transmission flange and the torque converter is at least 0.04 mm (0.015 in).

3. WARNING: Do not let the torque converter drop out of the transaxle. Failure to follow this instruction may result in personal injury.

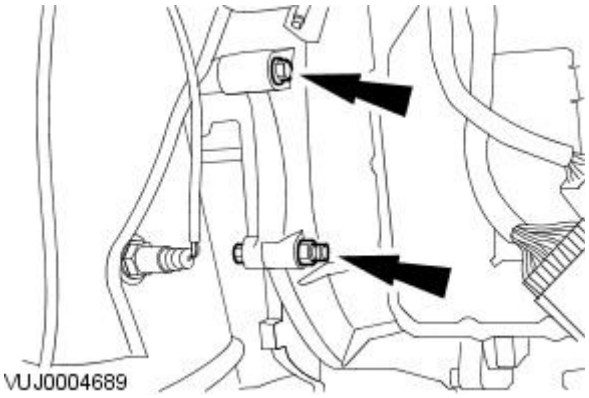
Install the transaxle.


VUJ0004691


VUJ0004690

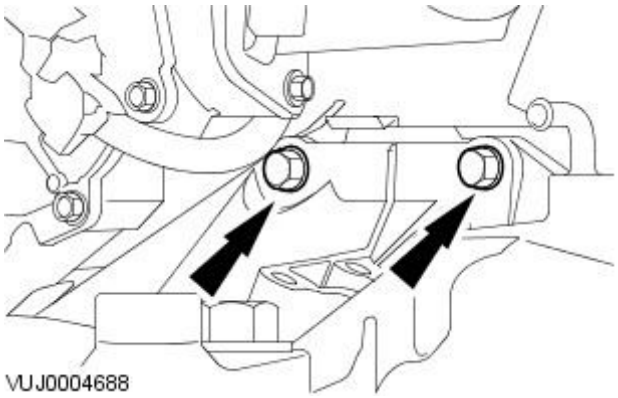
4. Install the transaxle retaining bolts.

- Tighten to 48 Nm.


VUJ0004689

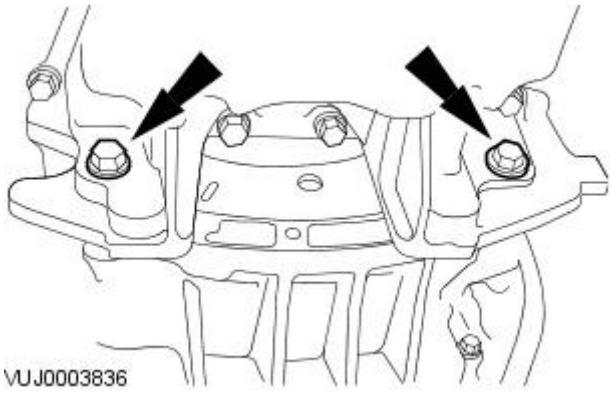
5. Install the transaxle retaining bolts.

- Tighten to 48 Nm.


VUJ0004688

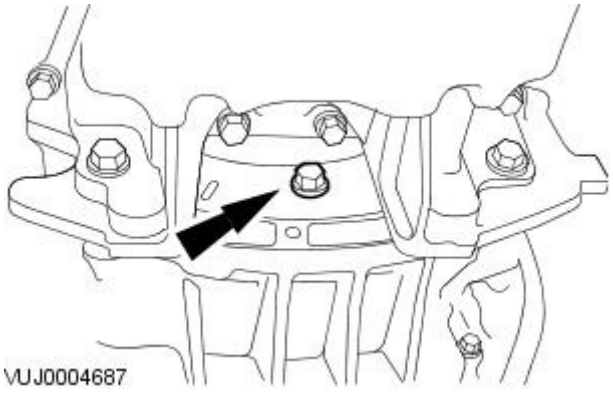
6. Install the transaxle retaining bolts.

- Tighten to 48 Nm.


VUJ0003836

7. Install the transaxle retaining bolts.

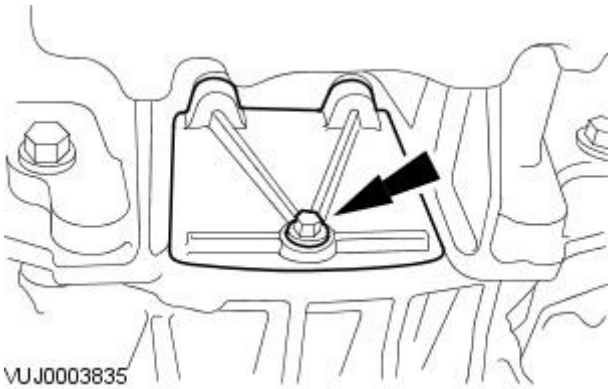
- Tighten to 48 Nm.


VUJ0004687

8. NOTE: Rotate the torque converter to gain access to the remaining retaining bolts.

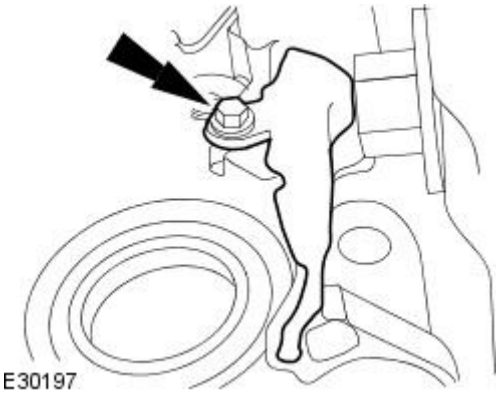
Install the torque converter retaining bolts.

- Tighten to 55 Nm.



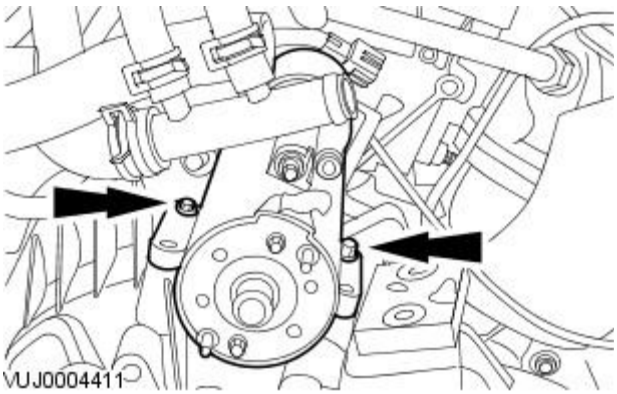
9. Install the access cover.

- Tighten to 10 Nm.



10. Install the dust cover.

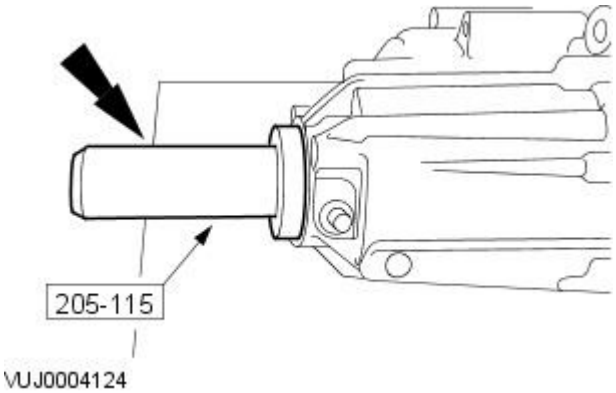
- Tighten to 10 Nm.



11. Install the starter motor.

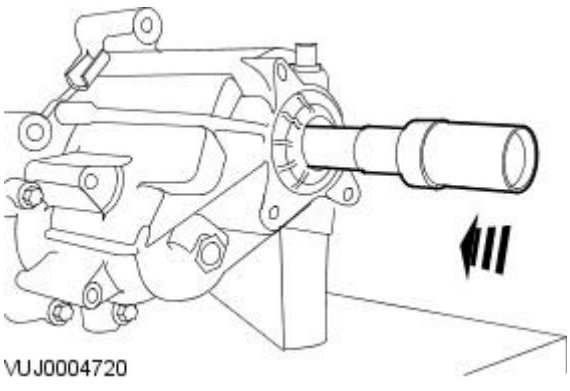
- Tighten to 35 Nm.

Vehicles with 2.5L or 3.0L engine



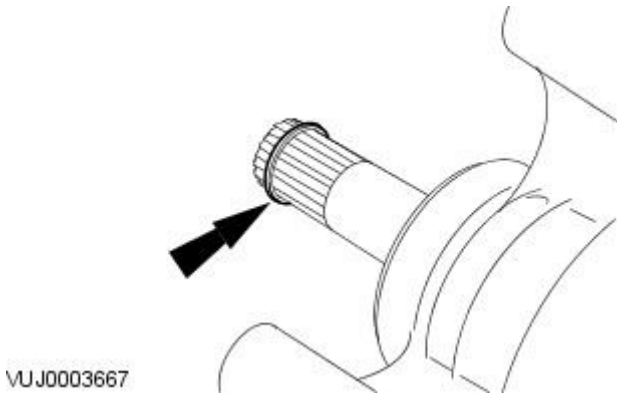
12. NOTE: Using a suitable surface cleaner, WSE-M5B392-A or equivalent, meeting the Jaguar specification. Clean the seal face on the transfer case before installing the new link shaft oil seal.

Using the special tool, install a new link shaft oil seal.

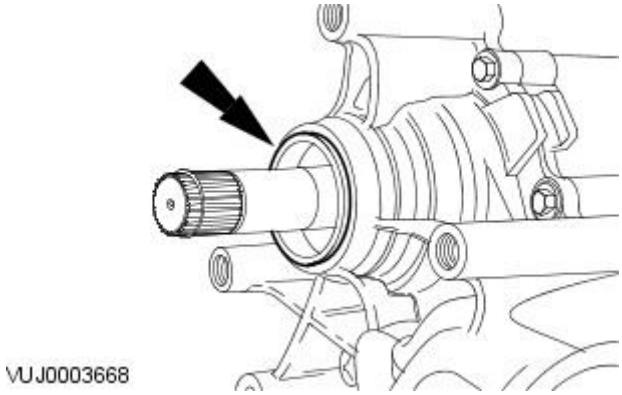


13. Install the link shaft.

14. Install a new link shaft snap ring.



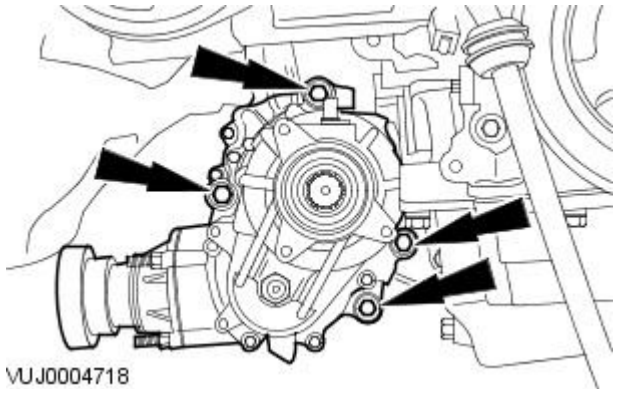
15. Install a new transfer case O-ring seal.



16. NOTE: Engage the link shaft into the transaxle.

Install the transfer case.

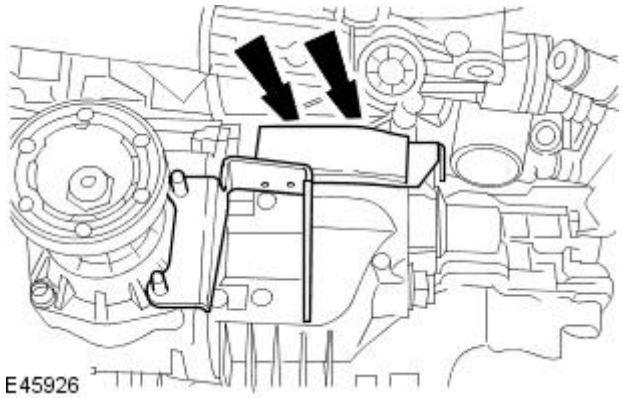
- Tighten to 90 Nm.



17. NOTE: Do not tighten the engine roll restrictor bracket top retaining bolts at this stage at this stage.

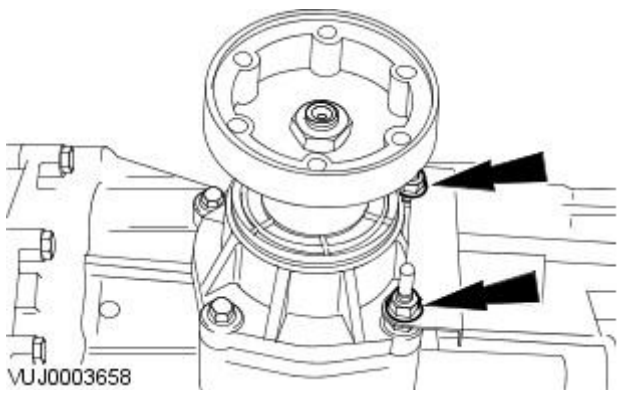
Install the engine roll restrictor bracket.

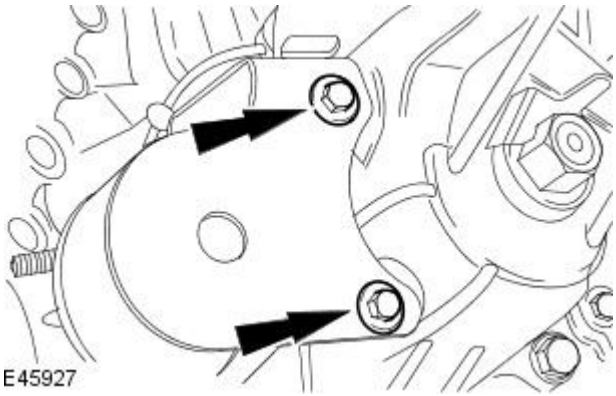
- Install the engine roll restrictor bracket top retaining bolts.



18. NOTE: Do not tighten the engine roll restrictor bracket retaining nuts at this stage.

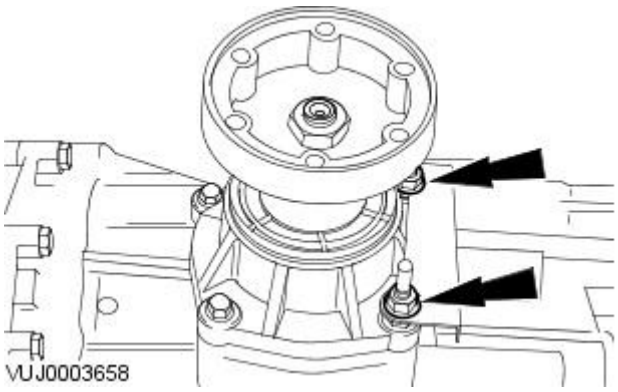
Install the engine roll restrictor bracket.





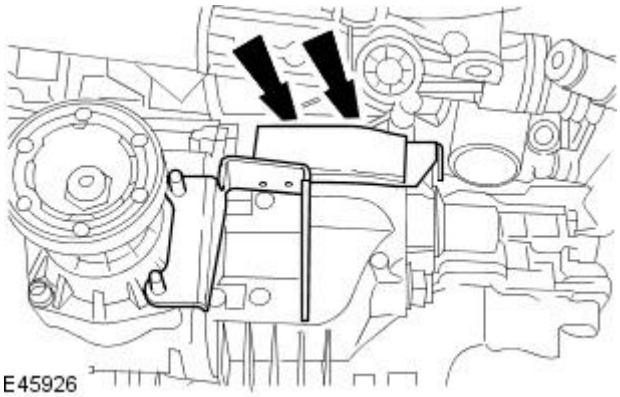
19. Install the engine roll restrictor bracket side retaining bolts.

- Tighten to 35 Nm.



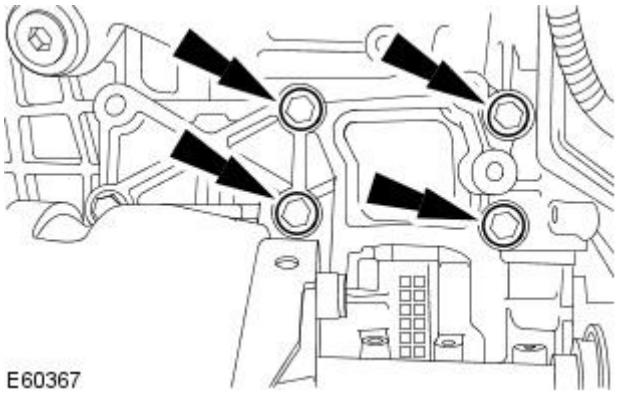
20. Tighten the engine roll restrictor bracket retaining nuts.

- Tighten to 35 Nm.



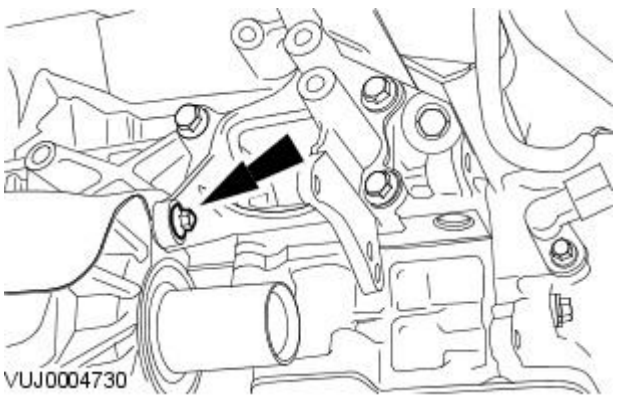
21. Tighten the engine roll restrictor bracket top retaining bolts.

- Tighten to 55 Nm.



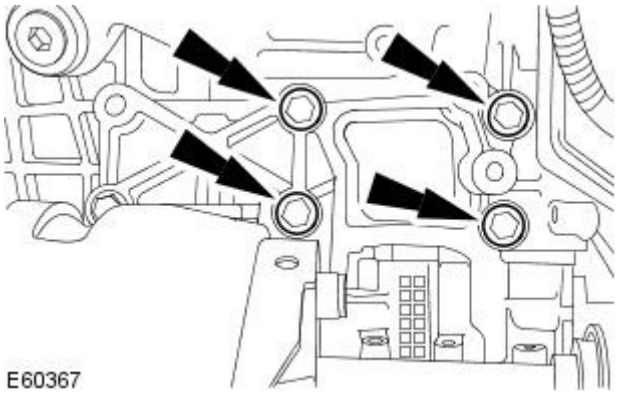
22. NOTE: Do not tighten the catalytic converter retaining bolts at this stage.

Install the catalytic converter mount bracket.



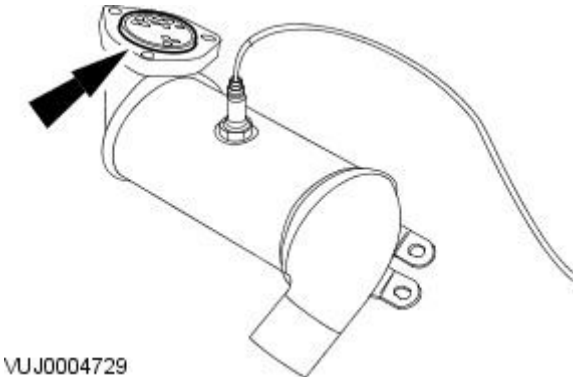
23. Install the catalytic converter mount bracket retaining bolt.

- Tighten to 25 Nm.

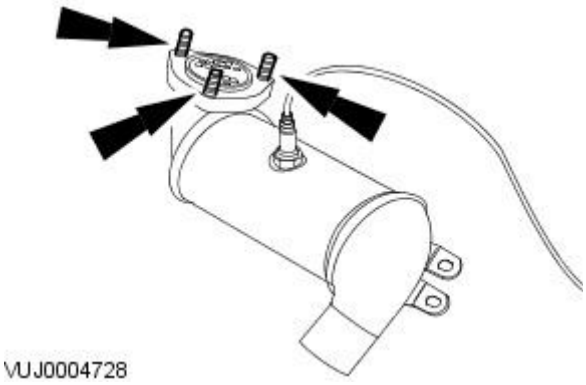


24. Tighten the catalytic converter mount bracket retaining bolts.

- Tighten to 55 Nm.

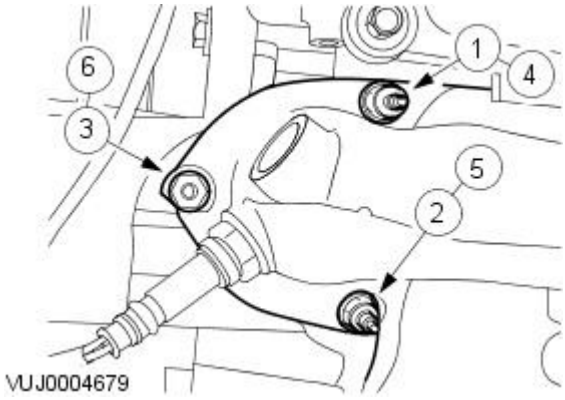


25. Install a new catalytic converter sealing ring.



26. Install new catalytic converter retaining studs.

- Tighten to 9 Nm.

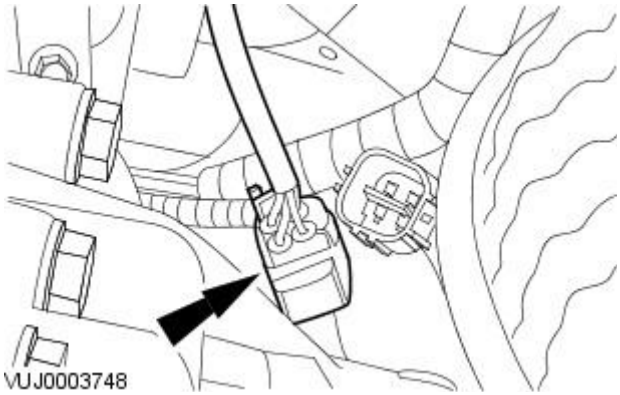


27. CAUTION: Never use jointing compound forward of the catalytic converter. Failure to follow this instruction may result in damage to the component.

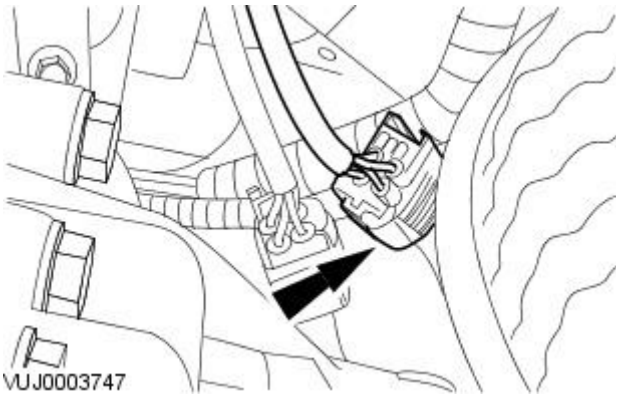
• NOTE: Make sure the retaining nuts are tightened twice in the sequence shown.

Install the right-hand catalytic converter.

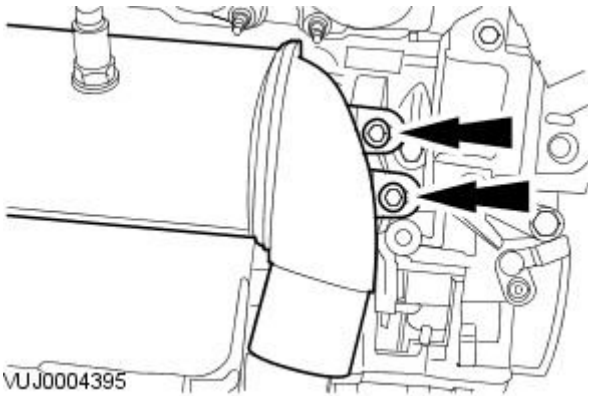
- Install new retaining nuts.
- Tighten in the sequence shown to 25 Nm.



28. Connect the right-hand heated oxygen sensor (HO2S) electrical connector.

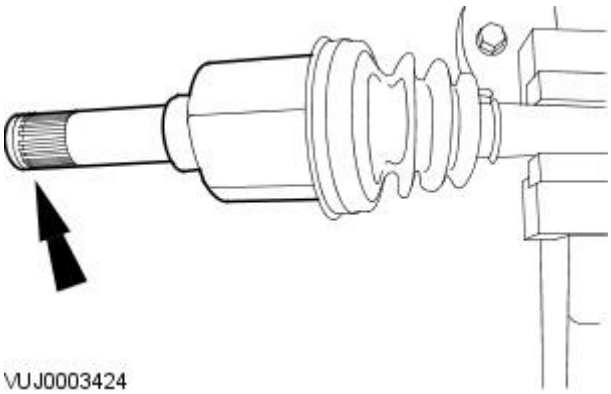

VUJ0003747

29. Connect the right-hand catalyst monitor sensor electrical connector.

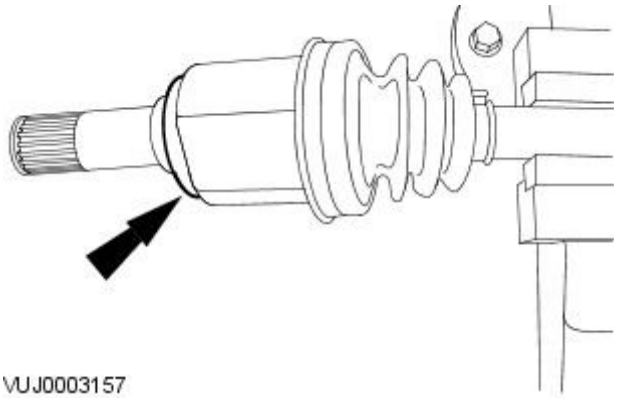

VUJ0004395

30. Install the right-hand catalytic converter retaining bolts.

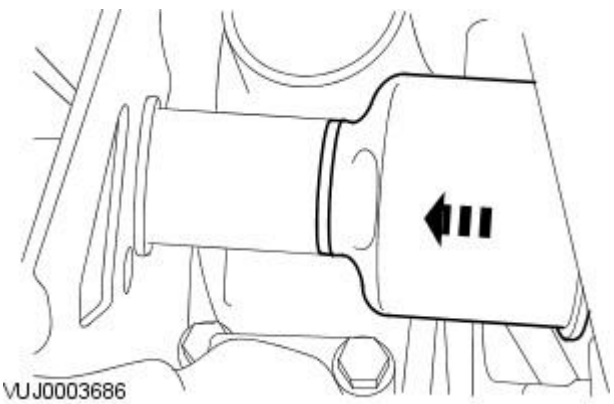
- Tighten to 25 Nm.


VUJ0003424

31. Install a new halfshaft snap ring.


VUJ0003157

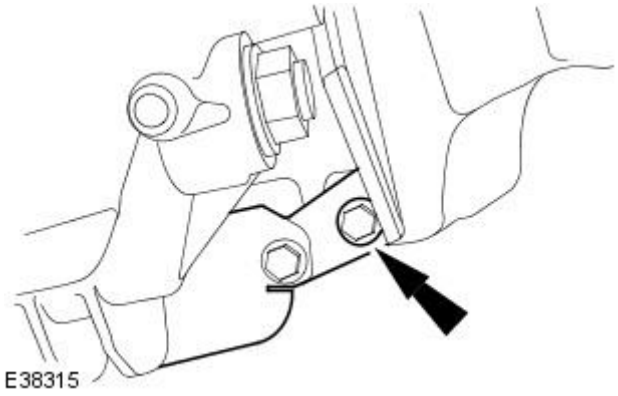
32. Install a new halfshaft seal.


VUJ0003686

33. CAUTION: Do not use excessive force when engaging the halfshaft to the link shaft. Failure to follow this instruction may result in damage to the component.

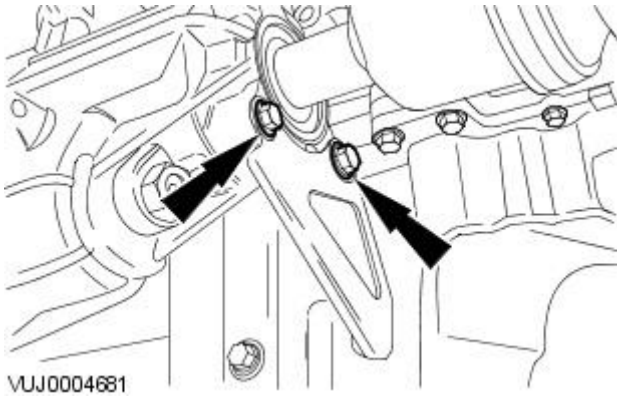
• NOTE: Make sure the halfshaft is fully located to the link shaft.

Install the halfshaft.



34. Install the transfer case Y bracket.

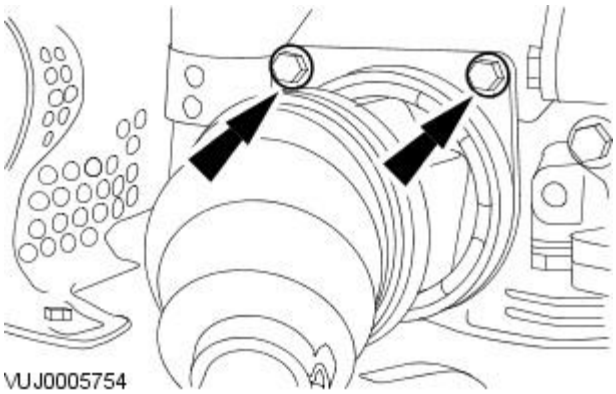
- Tighten to 55 Nm.



35. Install the transfer case Y bracket retaining bolts.

- Tighten to 25 Nm.

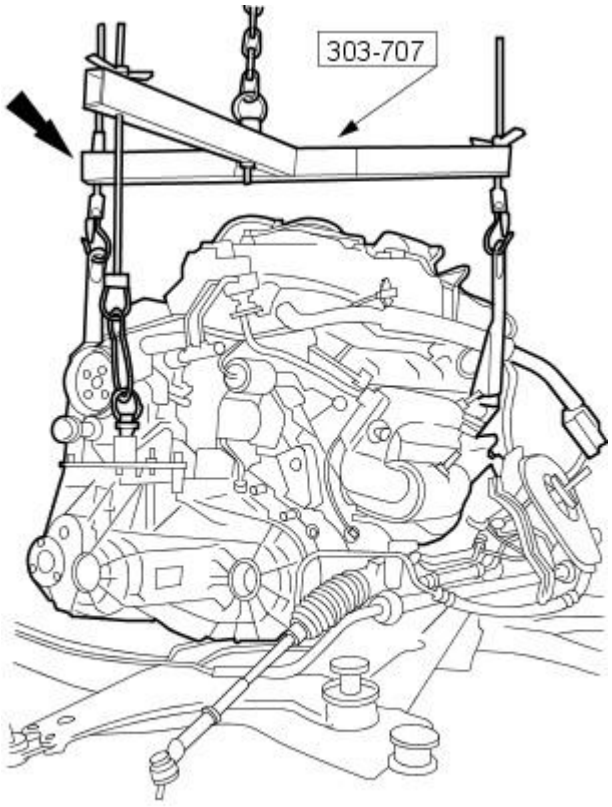
Vehicles with 2.0L engine



36. Install the halfshaft and intermediate shaft assembly.

- Tighten to 20 Nm.

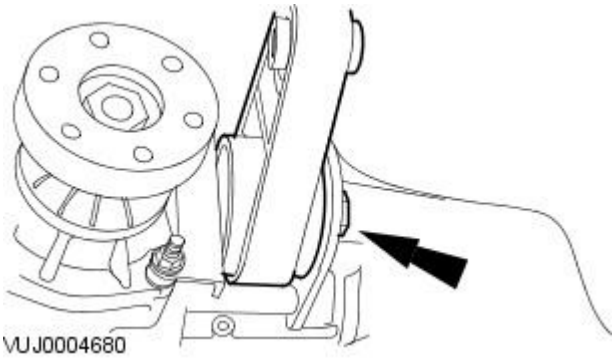
All vehicles



VUJ0004404

37. CAUTION: Make sure the right-hand drive halfshaft is supported, failure to follow this instruction may result in damage to the component.

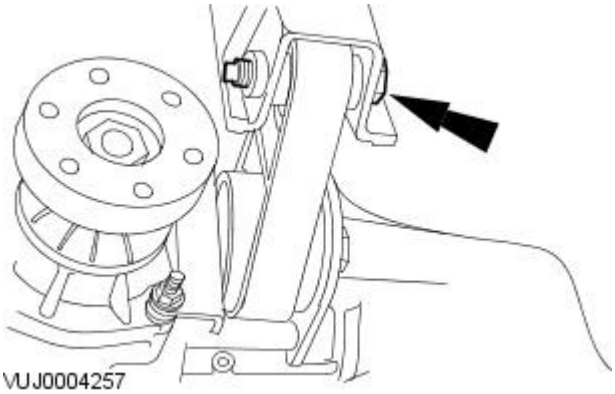
Using the special tool, install the engine and transaxle to the subframe.



VUJ0004680

38. Install the engine roll restrictor.

- Tighten to 80 Nm.

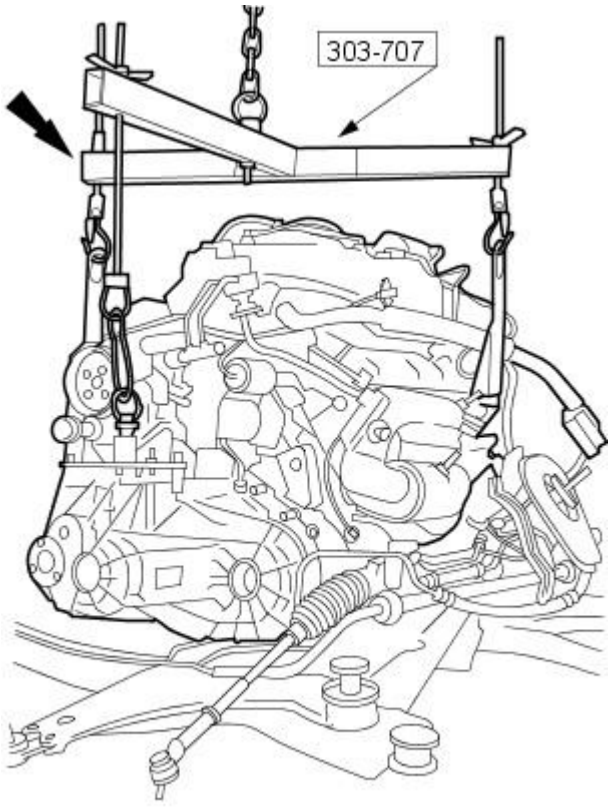


VUJ0004257

39. Install the engine roll restrictor retaining bolt.

- Tighten to 80 Nm.

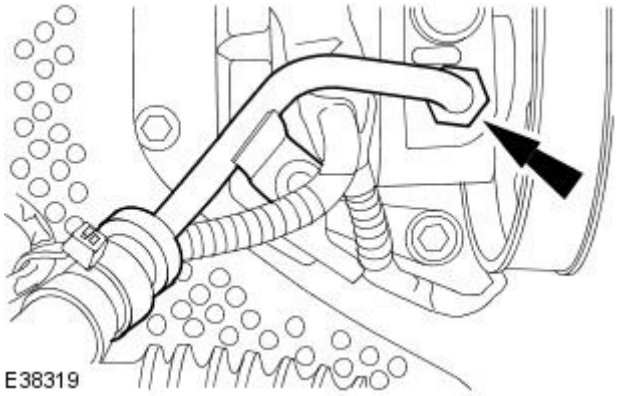
40. Remove the special tool.



VUJ0004404

41. Connect the power steering high-pressure pipe.

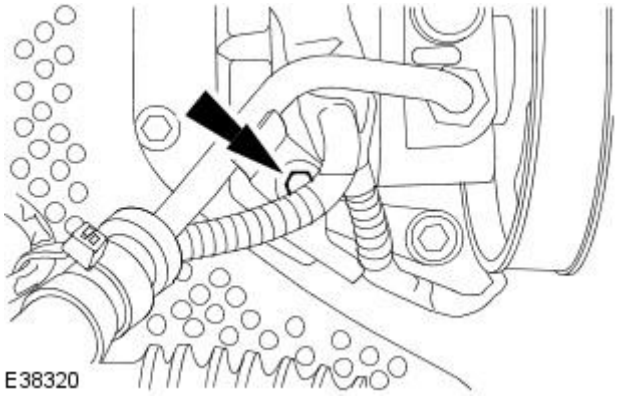
- Install a new O-ring seal.
- Tighten to 30 Nm.



E38319

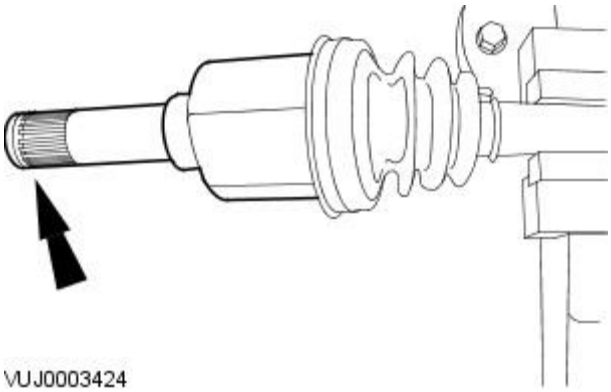
42. Install the power steering high-pressure pipe retaining bolt.

- Tighten to 25 Nm.

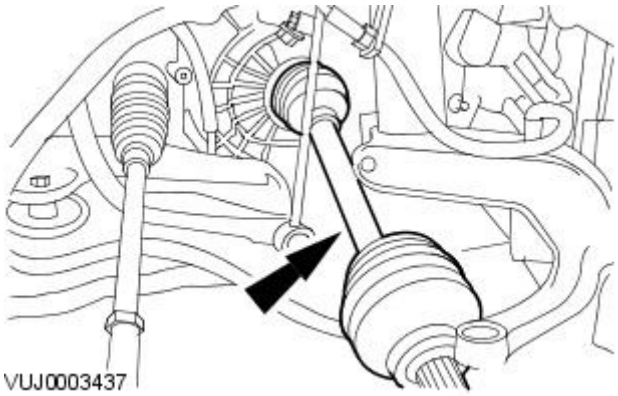


E38320

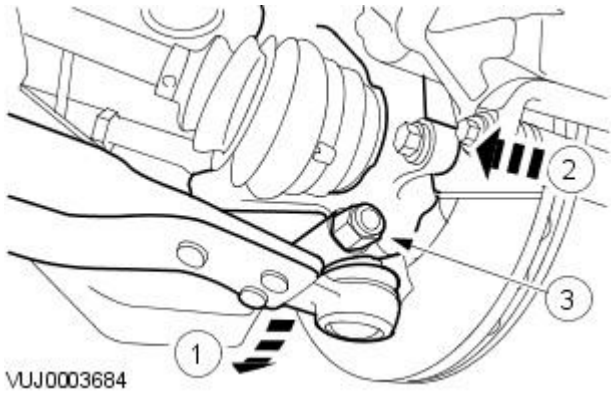
43. Install a new halfshaft snap ring.



VUJ0003424



44. Install the left-hand halfshaft.

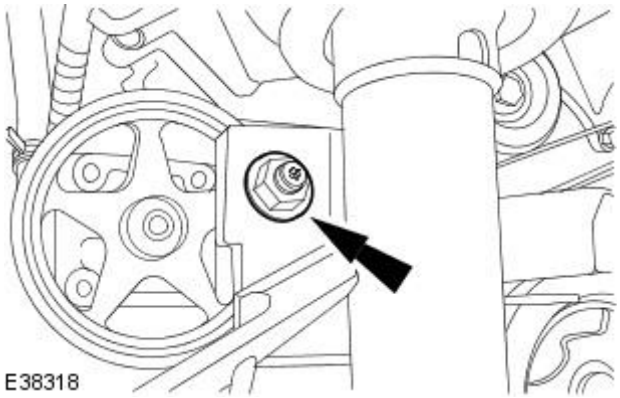


45. NOTE: Left-hand shown, right-hand similar.

• NOTE: Make sure the halfshaft is aligned to the front wheel hub.

Attach the wheel knuckles.

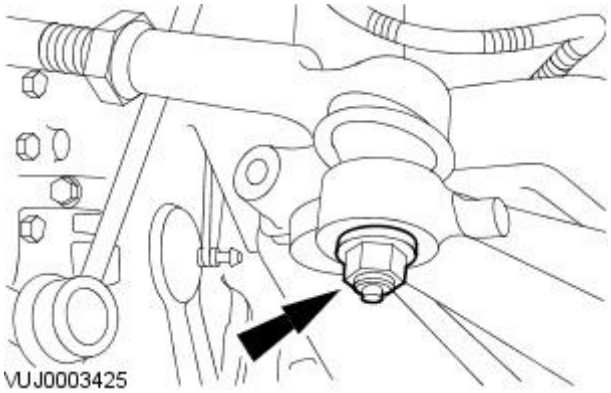
1. Reposition the lower arm.
2. Attach the wheel knuckles.
3. Install the lower arm ball joint retaining bolt.
    1. Tighten to 83 Nm.



46. NOTE: Right-hand shown, left-hand similar.

Attach the stabilizer bar link arms.

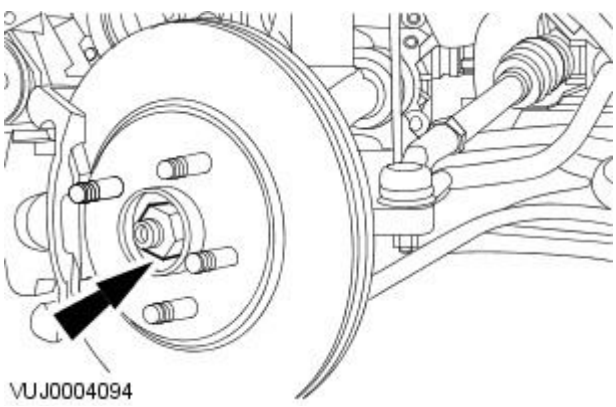
- Tighten to 48 Nm.



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

Attach the tie rod ends.

- Tighten to 35 Nm.

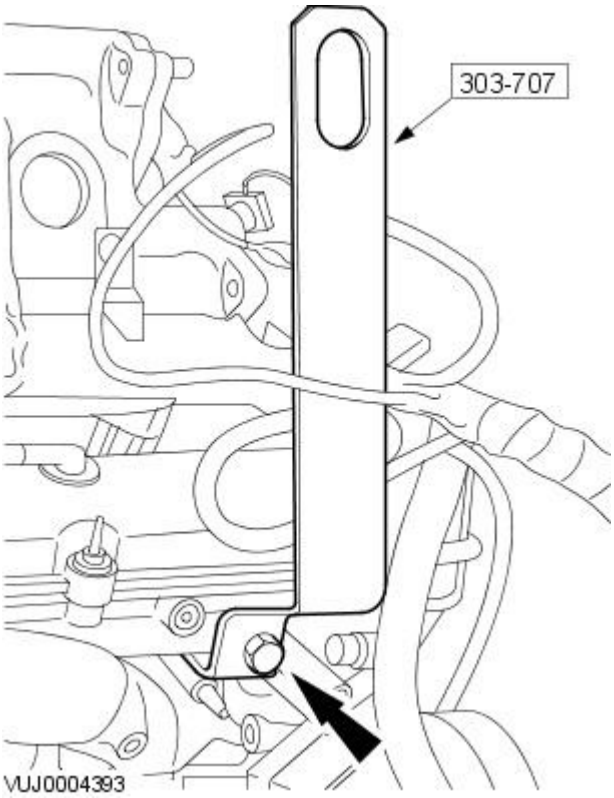


48. NOTE: Left-hand shown, right-hand similar.

• NOTE: Do not tighten the front wheel hub retaining nuts at this stage.

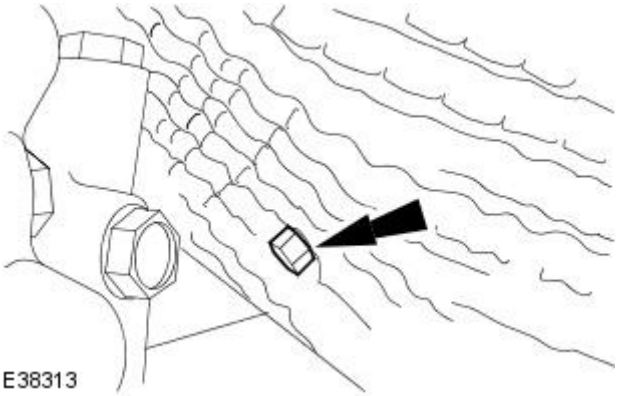
Install the front wheel hub retaining nuts.

49. Remove the special tool.



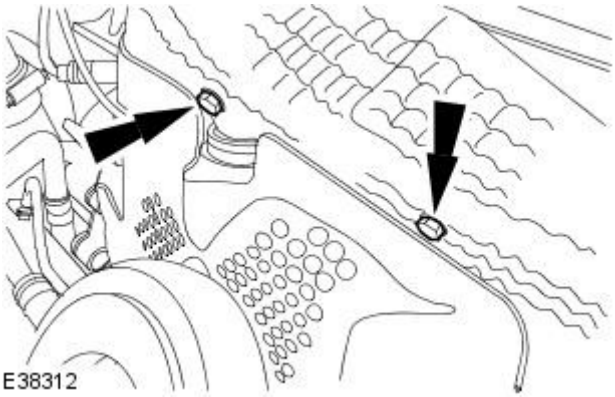
50. Install the center exhaust heat shield.

- Tighten to 10 Nm.



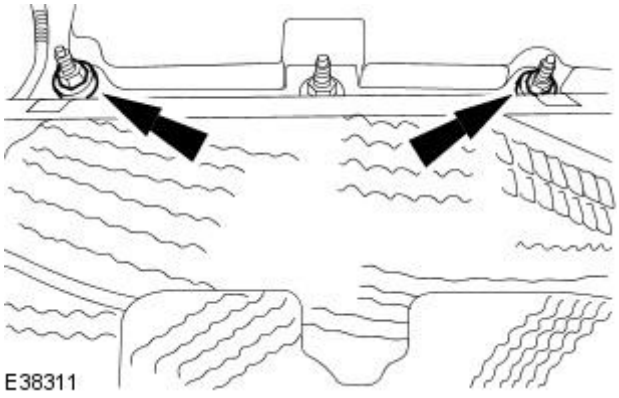
51. Install the center exhaust heat shield retaining bolts.

- Tighten to 10 Nm.

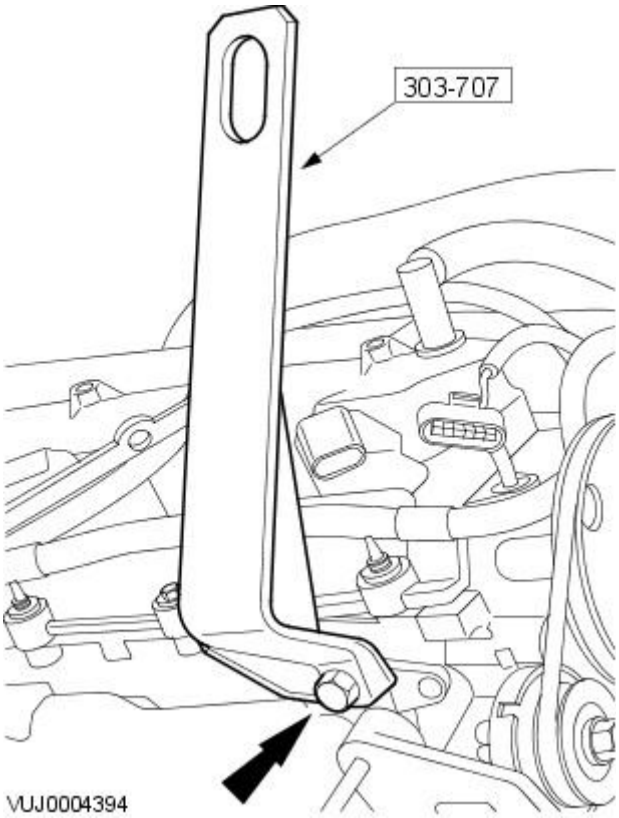


52. Install the upper exhaust heat shield.

- Tighten to 6 Nm.

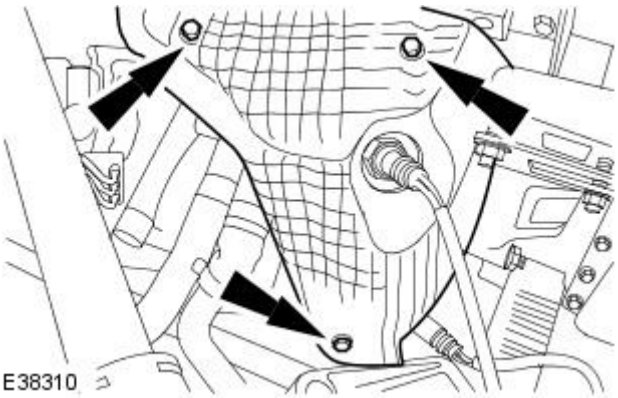


53. Remove the special tool.

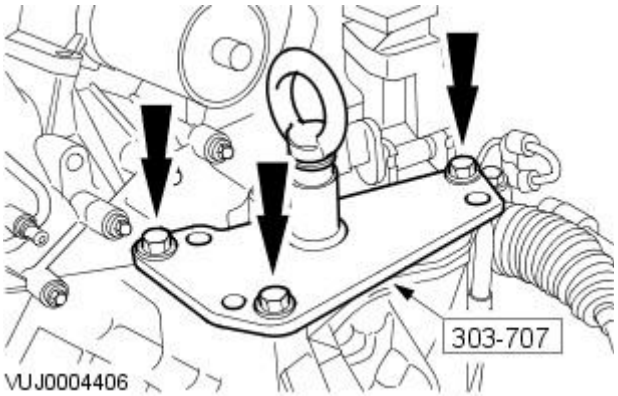


54. Install the left-hand exhaust manifold heat shield.

- Tighten to 10 Nm.

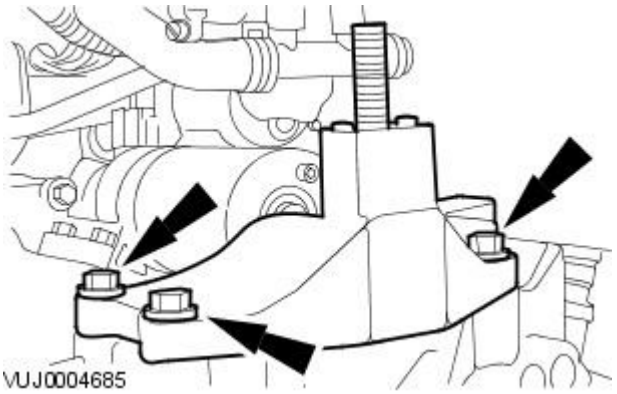


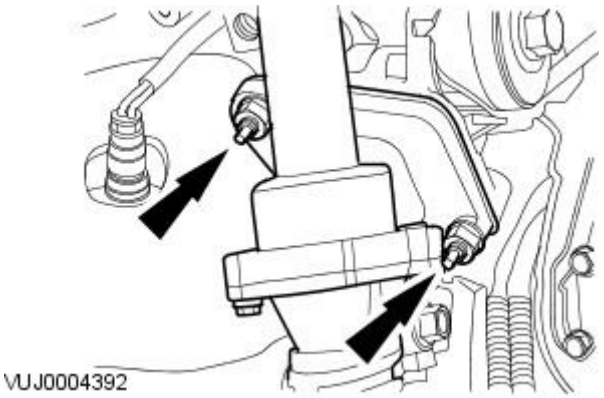
55. Remove the special tool.



56. Install the transaxle mount.

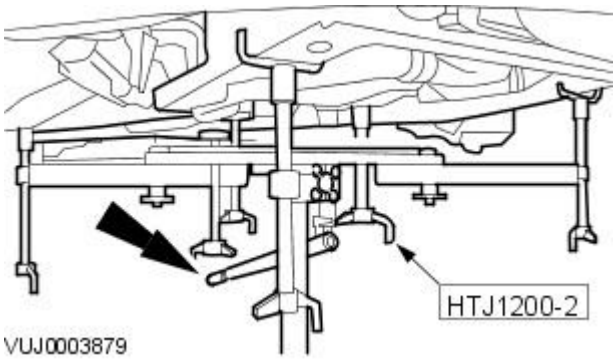
- Tighten to 80 Nm.





57. Install the coolant system top hose.

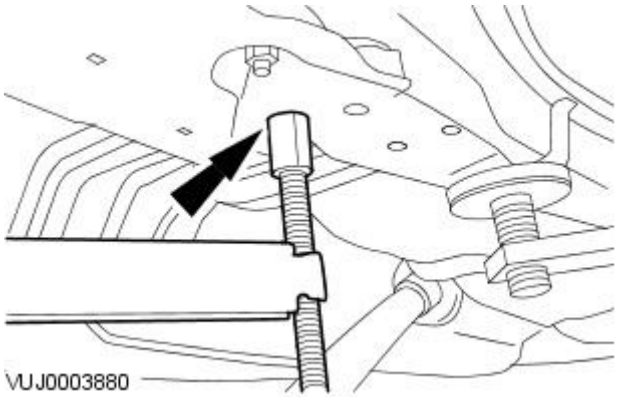
- Install a new gasket.
- Tighten to 9 Nm.



58. WARNING: Raise the special tool platform slowly. Failure to follow this instruction can result in personal injury.

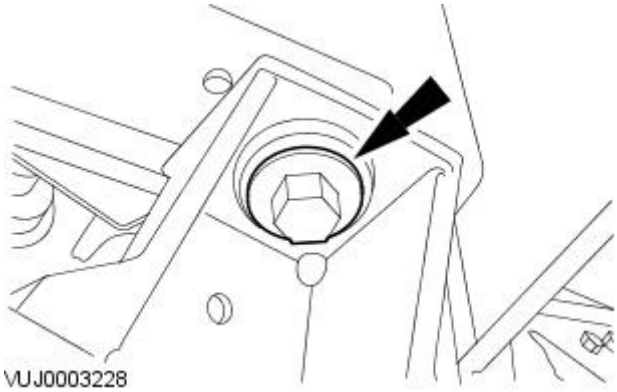
Install the engine and transaxle assembly.

- Raise the special tool platform.



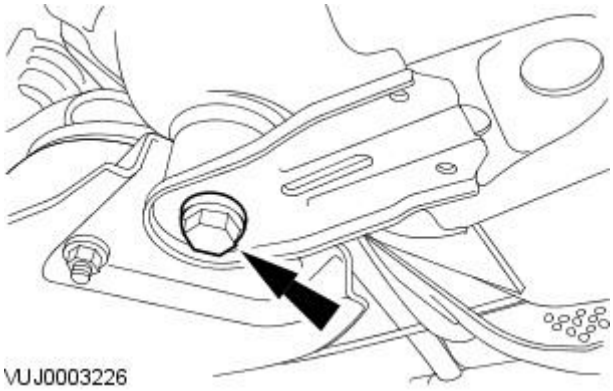
59. NOTE: Left-hand shown, right-hand similar.

Make sure the special tool rear height adjuster aligns into the locating hole in the vehicle floor pan.



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

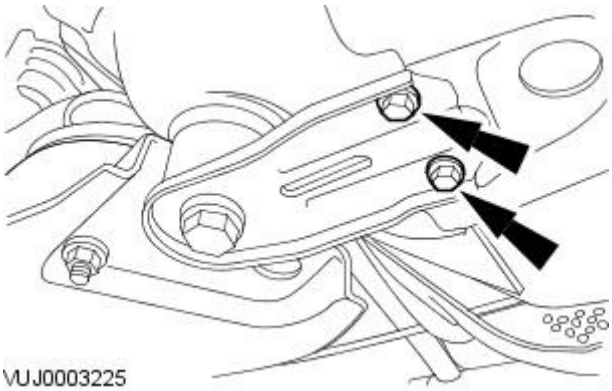
Loosely install the front subframe retaining bolt.



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

Install the front subframe reinforcement plate.

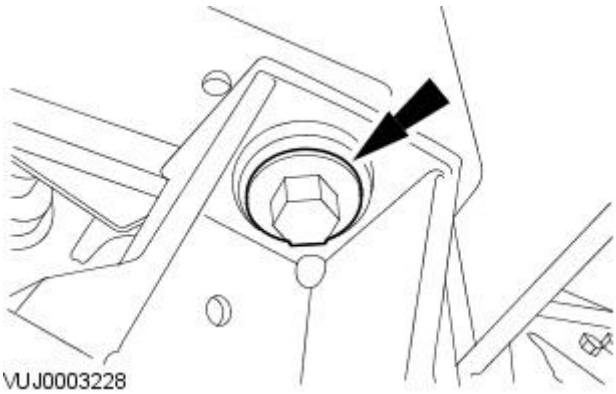
- Loosely install the front subframe rear retaining bolt.



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

Tighten the front subframe reinforcement bolts.

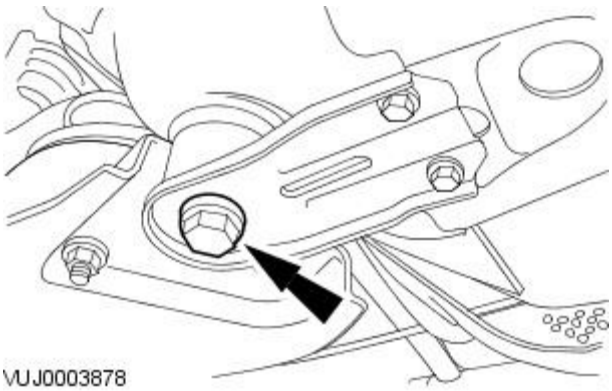
- M8 to 35 Nm.
- M10 to 70 Nm.



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

Tighten the front subframe retaining bolt.

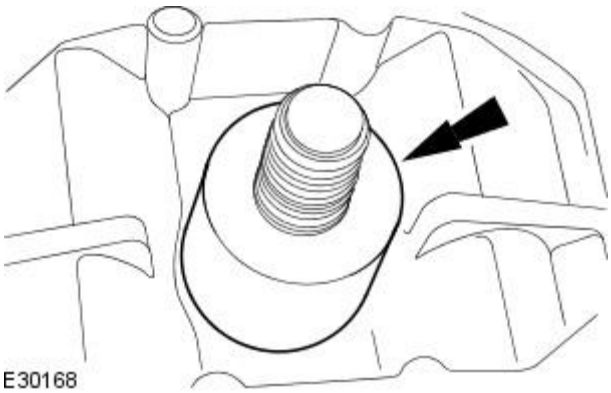
- Tighten to 142 Nm.



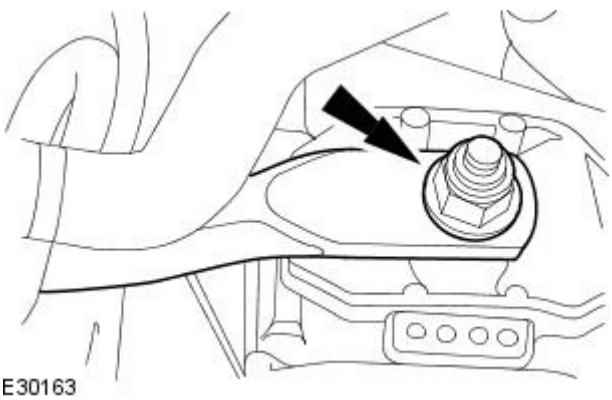
64. NOTE: Left-hand shown, right-hand similar.

Tighten the front subframe rear retaining bolt.

- Tighten to 142 Nm.

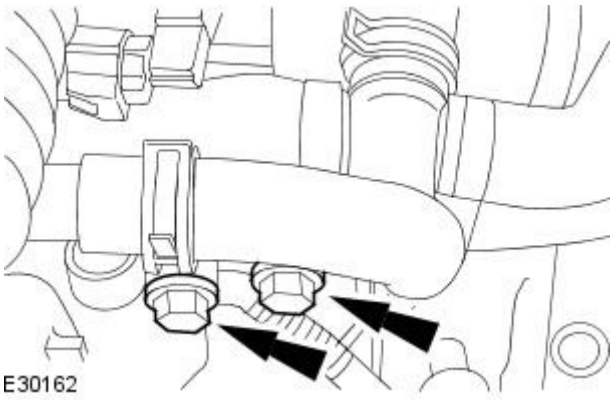


65. Install the spacer.



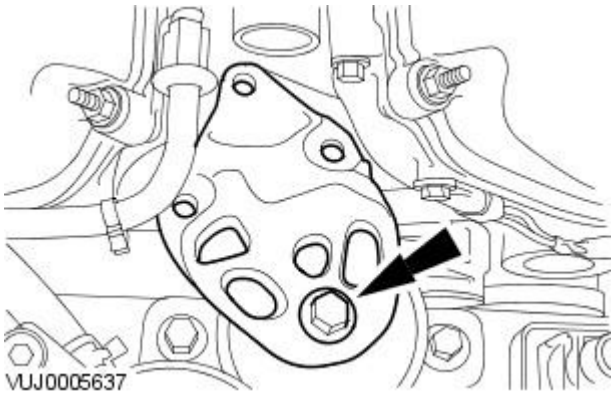
66. Install the support bar.

- Tighten to 133 Nm.



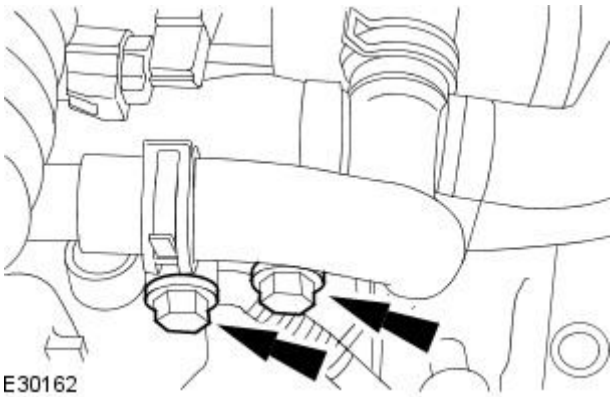
67. Tighten to the support bar retaining bolts.

- Tighten to 25 Nm.



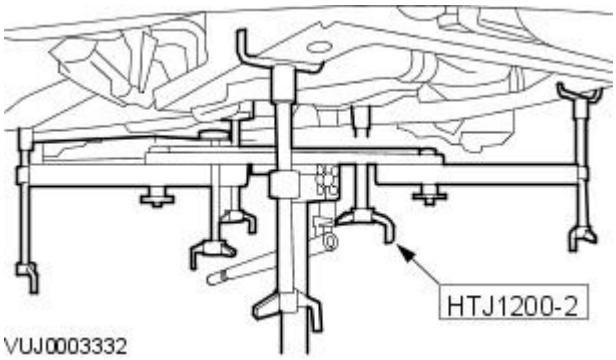
68. Install the engine support bracket.

- Tighten to 80 Nm.



69. Tighten the support bar retaining bolts.

- Tighten to 25 Nm.



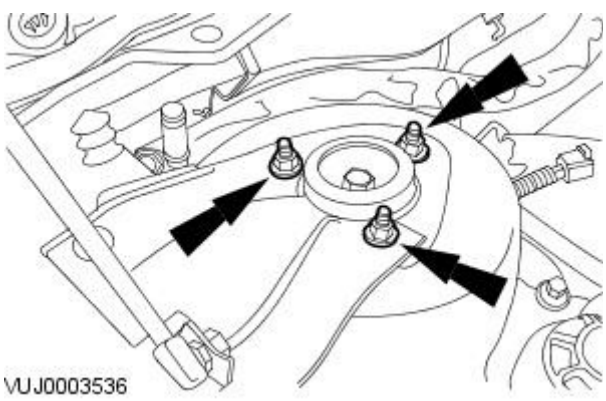
70. Remove the special tool.

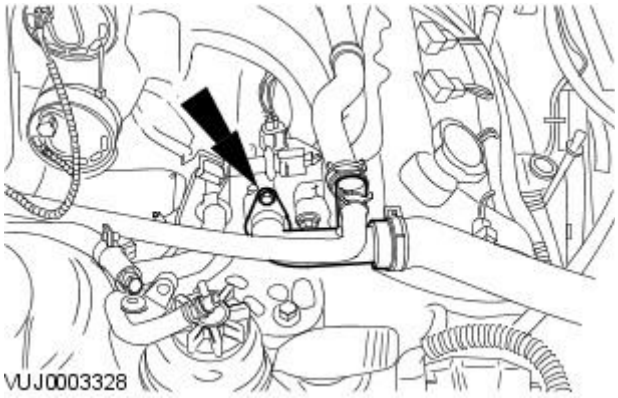
71. Lower the vehicle.

72. NOTE: Right-hand shown, left-hand similar.

Attach the strut and spring assembly.

- Tighten to 30 Nm.

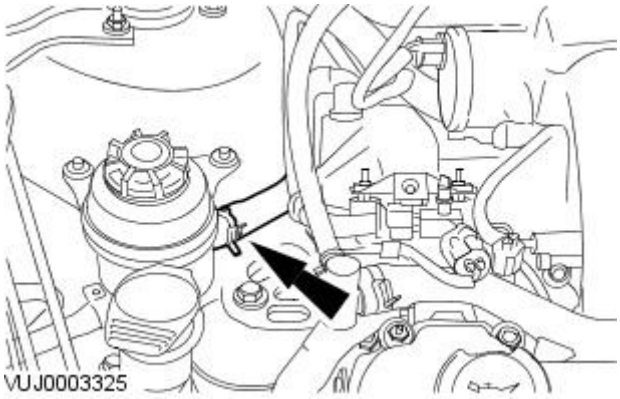




73. Attach the coolant pipe.

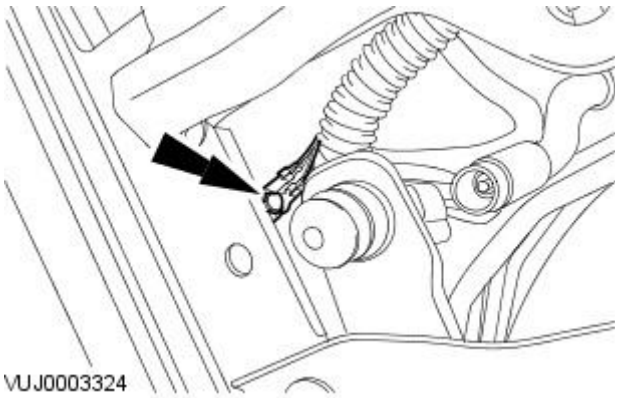
- Tighten to 9 Nm.

74. Connect the spring lock coupling.
For additional information, refer to: Spring Lock Couplings (310-00 Fuel System - General Information, General Procedures).



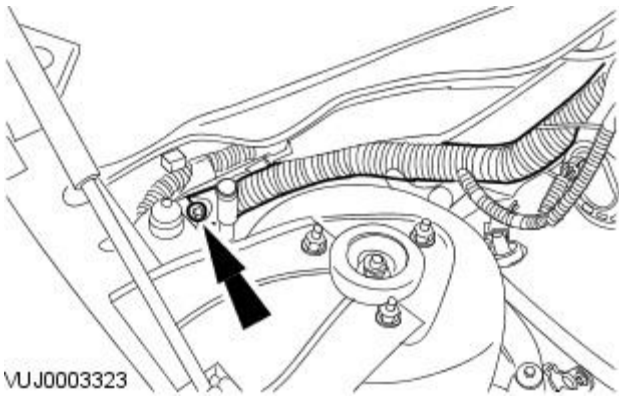
75. NOTE: Remove the blanking plug from the hose.

Attach the power steering hose.



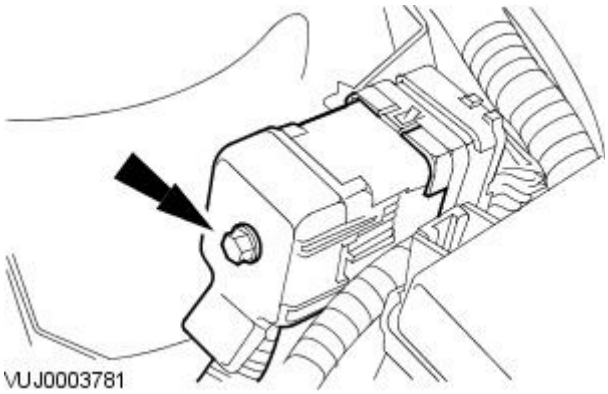
76. Connect the ground cable.

- Tighten to 10 Nm.



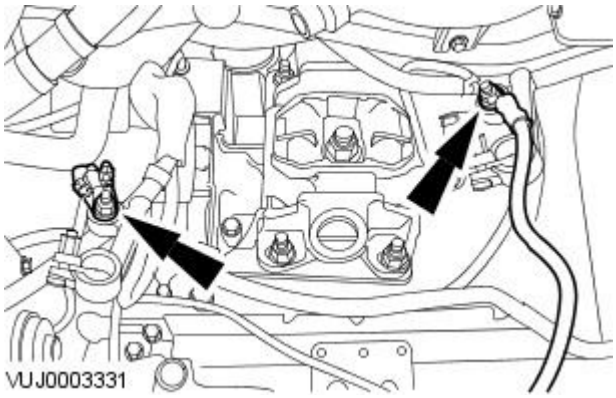
77. Connect the engine control module (ECM) electrical connector.

- Using special tool 418-535, tighten to 5 Nm.



78. Connect the engine harness electrical connector.

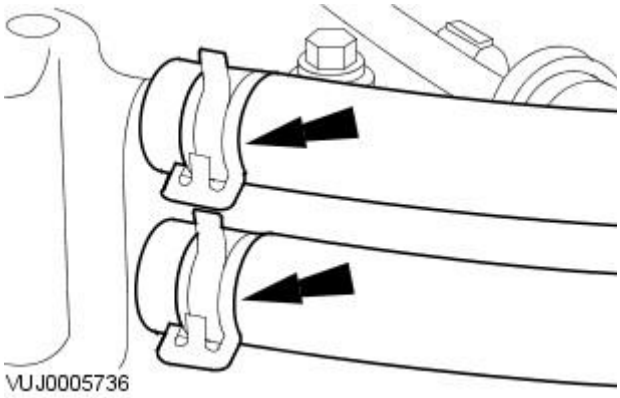
- Tighten to 10 Nm.



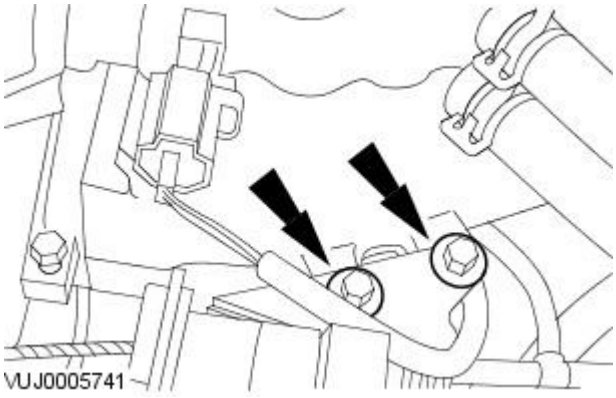
79. Attach the battery cables.

- Tighten to 10 Nm.

Vehicles with 2.0L engine

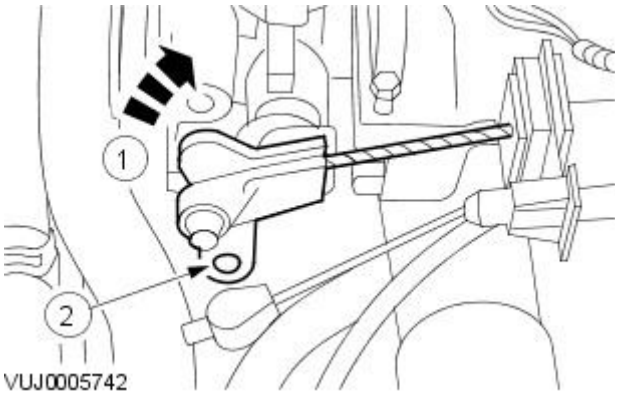


80. Attach the coolant hoses.



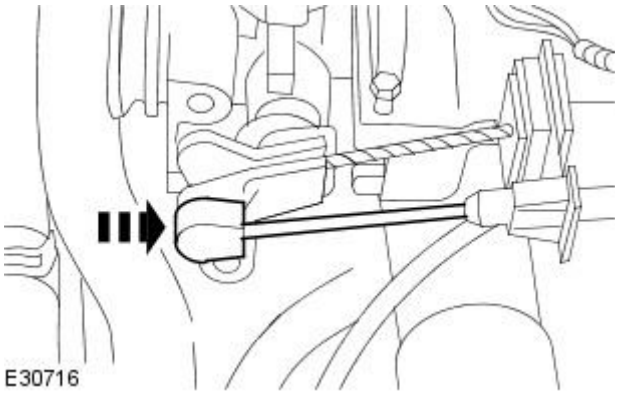
81. Attach the accelerator cable retaining bracket.

- Tighten to 9 Nm.



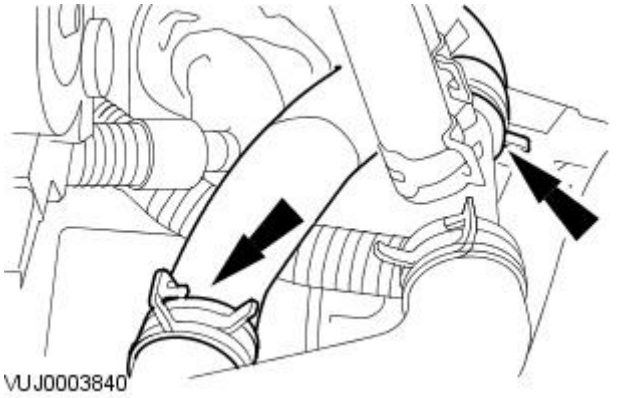
82. Attach the accelerator cable.

1. Reposition the accelerator lever to the fully open position.
2. Attach the accelerator cable.

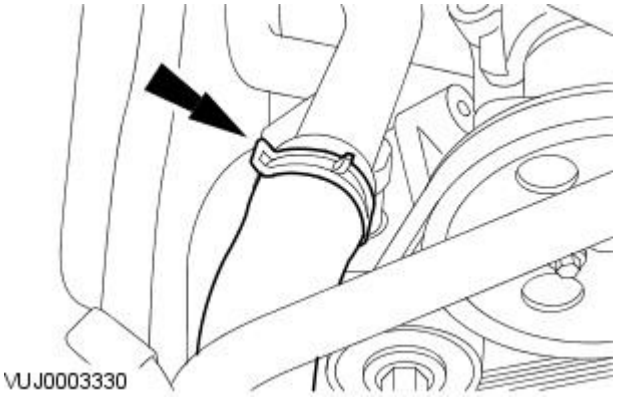


83. Attach the cruise control cable.

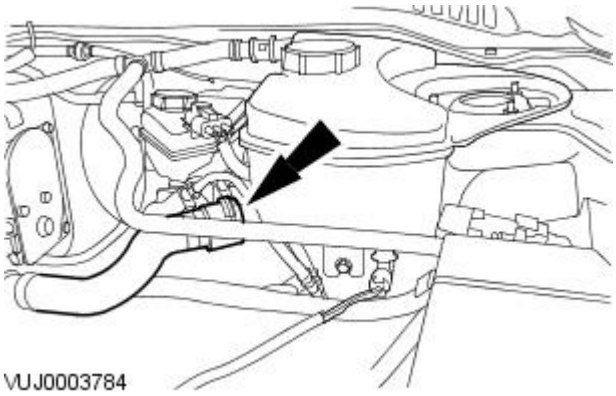
All vehicles



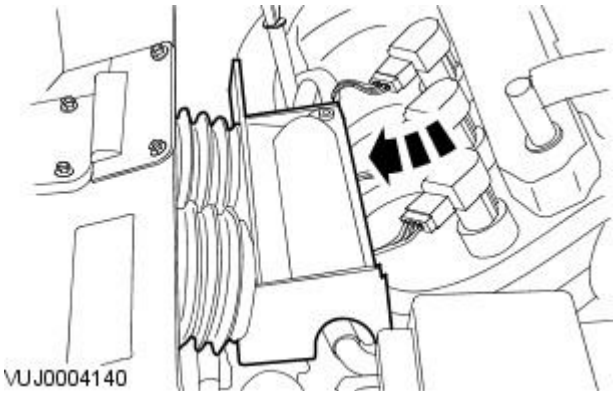
84. Attach the coolant hoses.



85. Attach the coolant hose.


VUJ0003784

86. Attach the coolant hose.

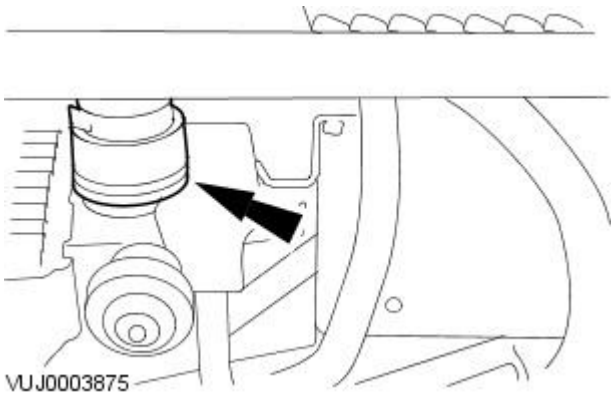

VUJ0004140

87. Install the air filter intake pipe.

88. Install the air cleaner.
For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

89. Raise the vehicle.

90. Attach the coolant hose.

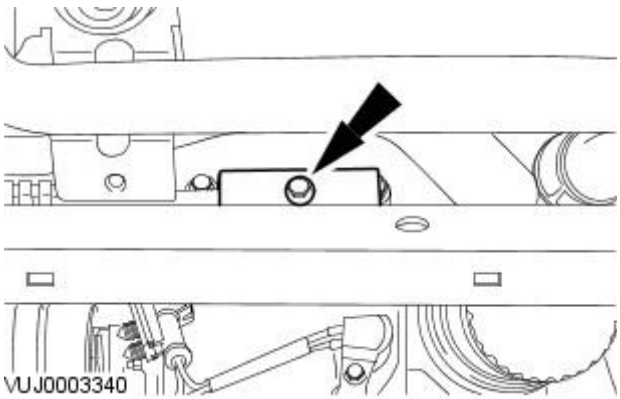

VUJ0003875

91. NOTE: Remove the tie straps.

• NOTE: Remove the blanking plugs from the tube and the air conditioning (A/C) compressor.

Attach the air conditioning (A/C) compressor supply and return tubes.

- Install new O-ring seals.
- Tighten to 25 Nm.


VUJ0003340

92. Install the front muffler.
For additional information, refer to: Front Muffler - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (309-00 Exhaust System, Removal and Installation).

Vehicles with 2.5L or 3.0L engine

93. Install the driveshaft.
For additional information, refer to: Driveshaft (205-01 Driveshaft, Removal and Installation).

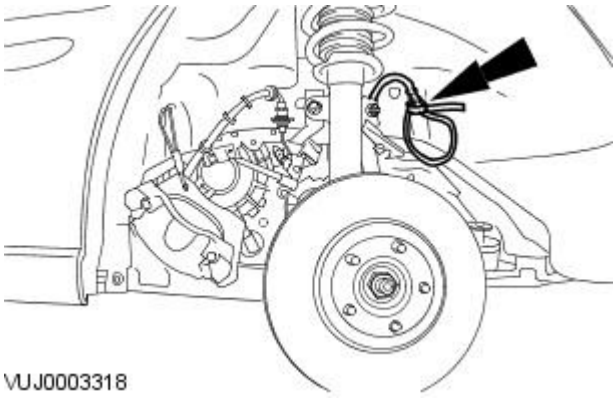
All vehicles

94. Install the cooling fan motor and shroud.
For additional information, refer to: Cooling Fan Motor and Shroud (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

95. NOTE: Remove the tie straps.

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

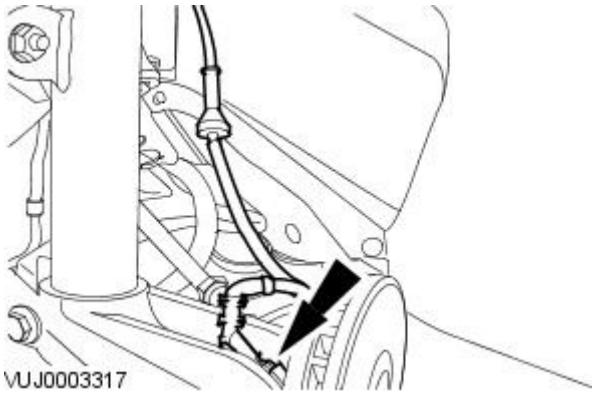
Detach and reposition the anti-lock brake system (ABS) wheel speed sensor.


VUJ0003318

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

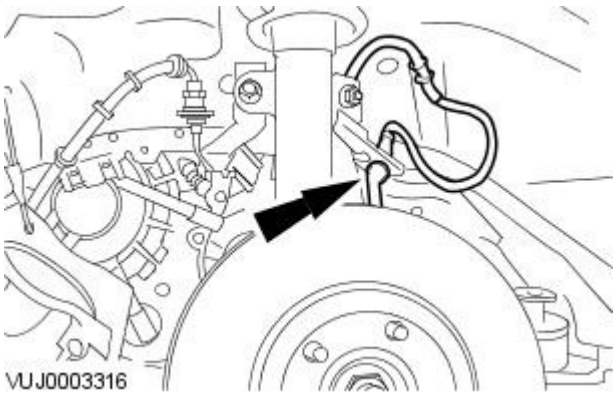
Connect the ABS wheel speed sensor.

- Tighten to 5 Nm.


VUJ0003317

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

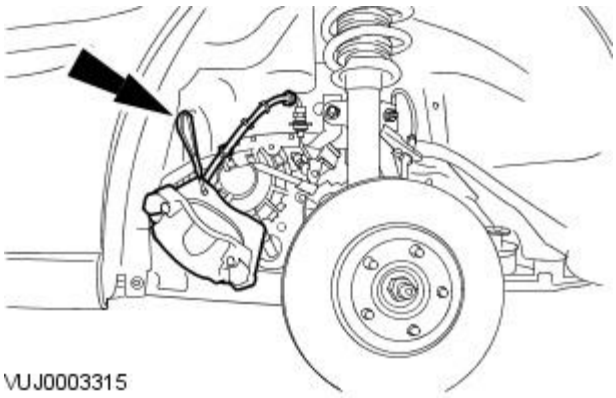
Attach the ABS wheel speed sensor.


VUJ0003316

98. NOTE: Remove the tie straps.

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

Detach and reposition the brake caliper assembly.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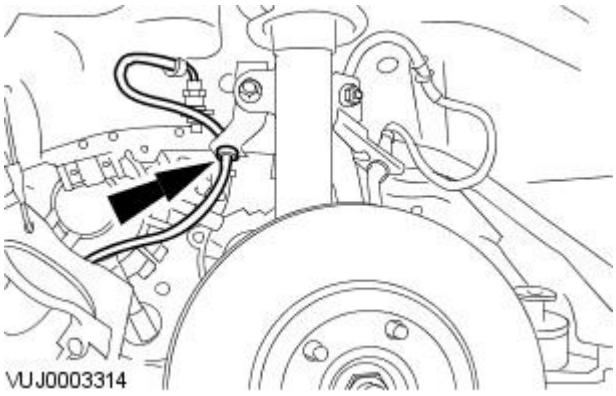
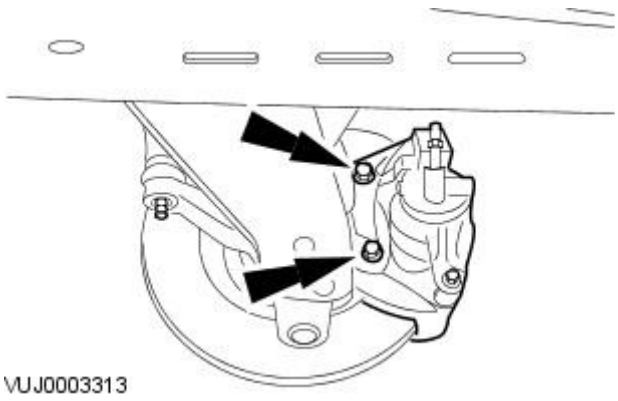

VUJ0003314

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

Attach the brake pipe.

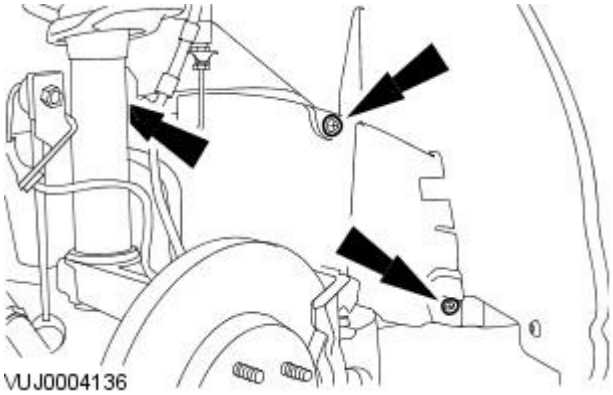

VUJ0003313

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

• NOTE: Install new brake caliper anchor plate retaining bolts.

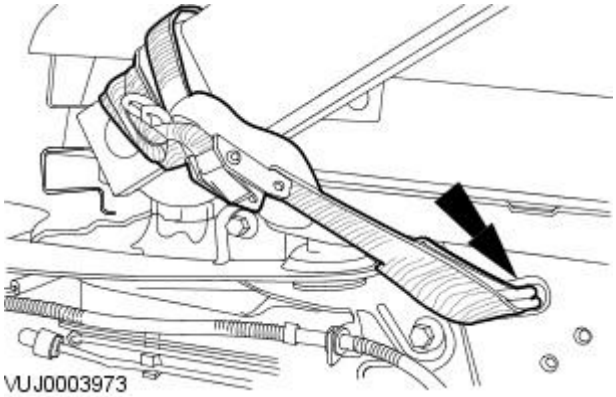
Attach the brake caliper assembly.

- Tighten to 133 Nm.


VUJ0004136

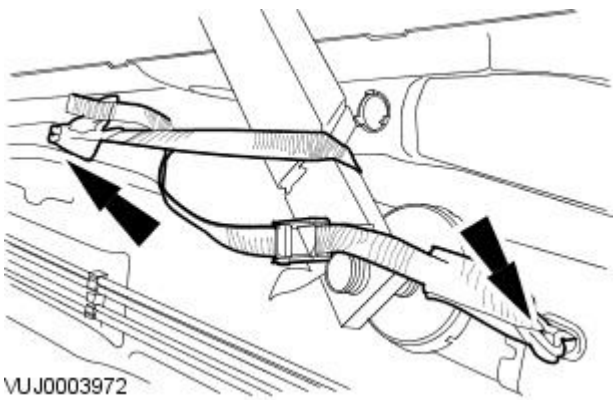
101. NOTE: Right-hand shown, left-hand similar.

Install the splash shield.


VUJ0003973

102. NOTE: Right-hand shown, left-hand similar.

Remove the rear vehicle tie down strap.


VUJ0003972

103. NOTE: Right-hand shown, left-hand similar.

Remove the front vehicle tie down strap.

104. Install the front wheels and tires.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

105. Install the battery tray.
For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

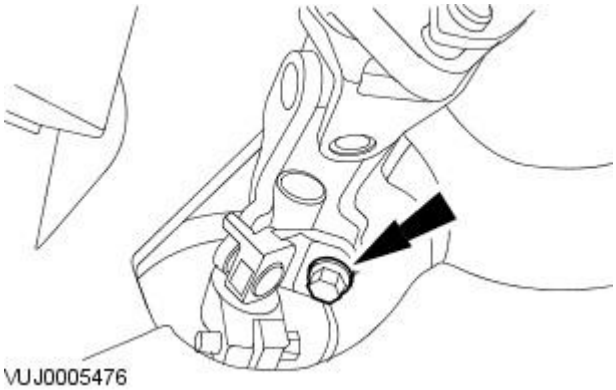
106. Fill and bleed the cooling system.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).

107. Bleed the power steering system.
For additional information, refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).

108. Recharge 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).

109. Install the steering column lower retaining bolt.

- Tighten to 25 Nm.

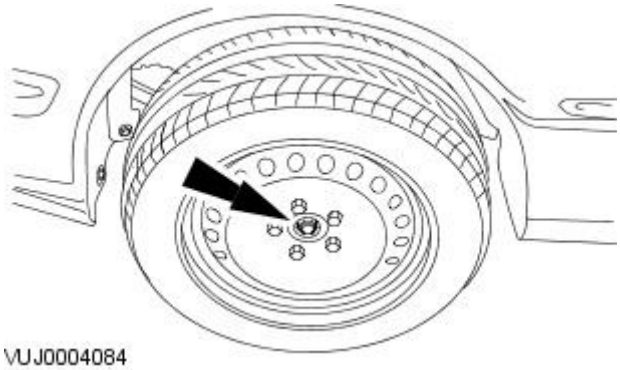

VUJ0005476

110. Fill the transaxle.
For additional information, refer to: Transmission Fluid Drain and Refill (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

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

Tighten the front hub retaining nuts.

- Tighten to 290 Nm.


VUJ0004084

112. Carry out the underbody misalignment check.
For additional information, refer to: Underbody Misalignment Check (502-00 Uni-Body, Subframe and Mounting System, General Procedures).

113. Check the engine oil level and correct as necessary.

114. NOTE: When the battery has been disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy.

Finishing operations.

- Check the routing of the vacuum hoses and wiring and secure them with cable ties.
- Check the fluid levels after the road test and correct as necessary.
- Check the engine and cooling system for leaks (visual inspection).

Published: 11-May-2011

Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma -

Engine Oil Capacity

Description	Liters
Initial fill including oil filter	6·7
Service fill including oil filter	6·0
Service fill without oil filter	5·8

Lubricants, Sealers and Adhesives

Item	Specification
SAE 5W-30 engine oil	WSS-M2C913-B
Sealant – Loctite 5910	WSE-M4G323-A4

Oil Pressure – Specifications

Description	Bar
Maximum oil pressure at idle speed	1·2
Maximum oil pressure at 2000 rpm	2·0

Tightening Torques

Description	Nm	lb-ft	lb-in
Engine to transmission retaining bolts	40	30	-
Rear engine mount retaining stud	133	98	-
Front engine mounting	80	59	-
Engine roll restrictor to transmission	80	59	-
Front subframe rear bolts	142	105	-
Front subframe rear bracket bolts	70	52	-
Steering gear to subframe	133	98	-
Engine roll restrictor to subframe	80	59	-
Lower suspension arm ball joint	83	61	-
Axle driveshaft center bearing	25	18	-
Engine ground cable	13	10	-
Thermostat housing	23	17	-
Thermostat cover	10	-	89
Crankshaft pulley	a	-	-
Crankshaft rear oil seal carrier	10	-	89
Flywheel	a	-	-
Crankshaft bearing caps	a	-	-
Big-end bearing caps	a	-	-
Fuel injectors	47	35	-
Injection pump sprocket	33	24	-
Injector tubes	38	28	-
Lower crankcase	a	-	-
Camshaft carrier (M8)	a	-	-
Camshaft carrier (M6)	a	-	-
Rocker shafts	a	-	-
Timing chain guides	15	11	-
Timing chain tensioner	15	11	-
Oil pump chain tensioner	16	12	-
Camshaft sprocket	33	24	-
Auxiliary unit drive belt tensioner	23	17	-
Exhaust gas recirculation valve (EGR valve)	10	-	89
Line for EGR valve	23	17	-
Coolant pump	25	18	-
Dip stick tube (M8 x 14)	23	17	-
Oil intake pipe.	10	-	89
Oil filter cooler	23	17	-
Oil pump	10	-	89
Oil pan drain plug	23	17	-
Oil pan	a	-	-
Cylinder head bolts (M10 x 160)	a	-	-
Cylinder head bolts (M8 x 120)	a	-	-
Engine front cover	a	-	-
Glow plugs	13	10	-
Glow plug wires (M4 x 14)	3	-	27
Power steering pump	18	13	-
Power steering pump bracket	23	17	-
Intake manifold	16	12	-
Exhaust manifold and turbocharger	40	30	-
Turbocharger oil return line	10	-	89
Turbocharger oil feed line	14	10	-
Front engine lifting eye (M8 x 20)	23	17	-
Common rail studs	23	17	-
Knock sensor (KS)	20	15	-
Crankshaft position sensor (CKP sensor) (M6 x 16)	7	-	62
Camshaft position sensor (CMP sensor)	10	-	89
Cylinder head temperature sensor (CHT sensor)	11	8	-

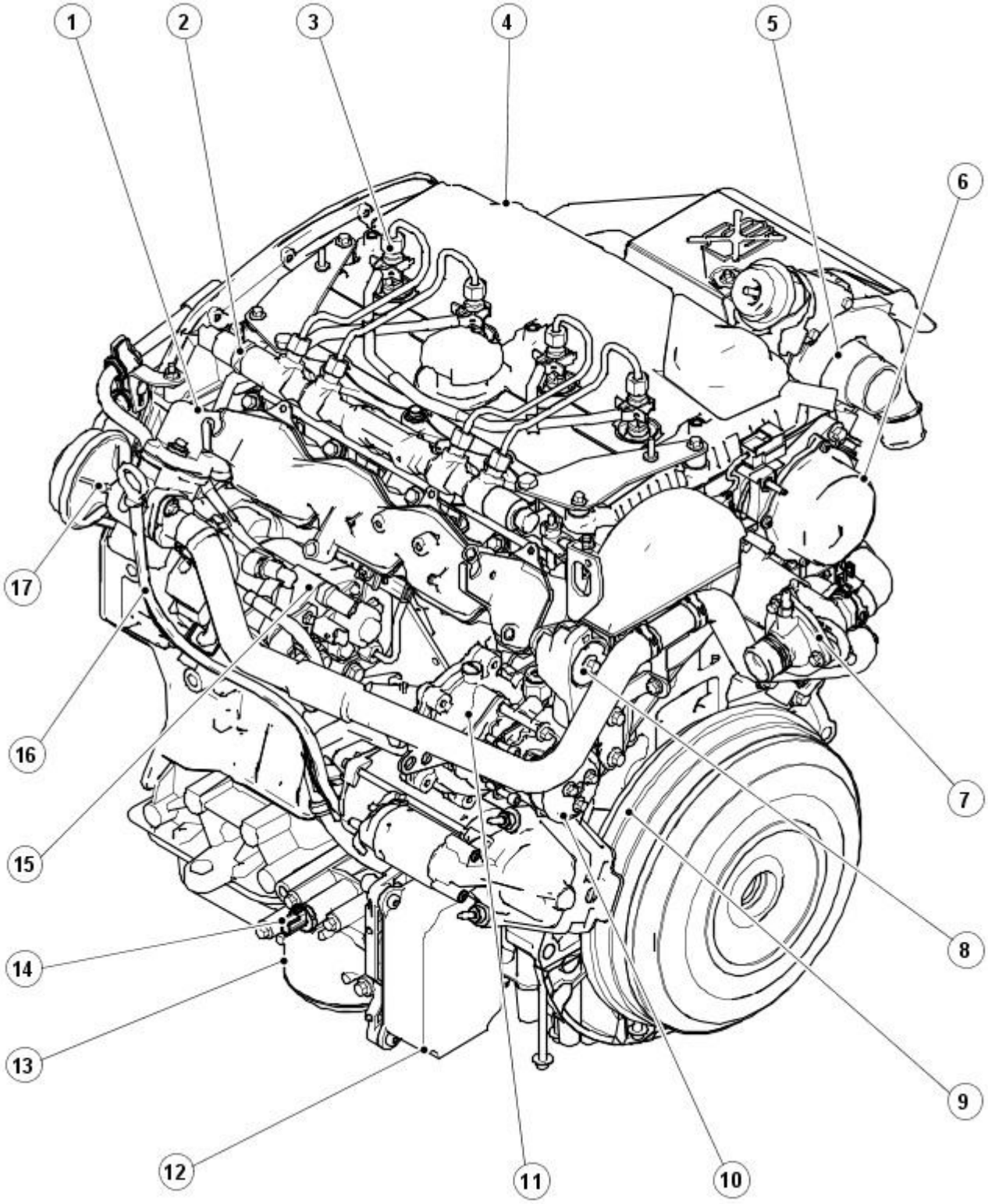
a = Refer to the procedure in this section.

Published: 11-May-2011

Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Engine

Description and Operation

General View



E44113

Item	Part Number	Description
1	-	Intake manifold
2	-	Fuel injection supply manifold
3	-	Fuel injector
4	-	Valve cover
5	-	Turbocharger
6	-	Brake vacuum pump
7	-	Thermostat housing
8	-	Rear accessory drive belt tensioner
9	-	Flywheel
10	-	Power steering pump
11	-	Waterpump
12	-	Oil cooler
13	-	Oil filter housing

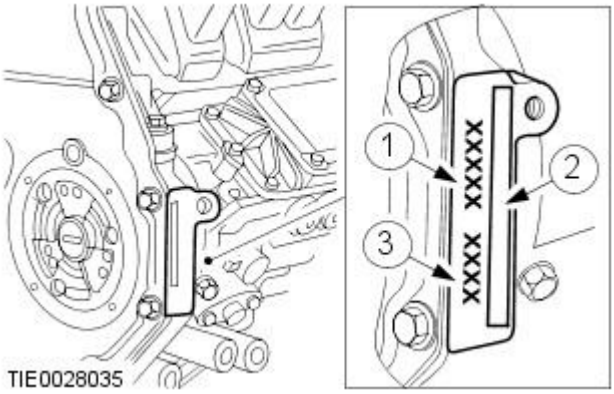
14	-	Oil pressure switch
15	-	Fuel injection pump
16	-	Oil level indicator and tube
17	-	Exhaust gas recirculation (EGR) valve

Engine Identification Code

Engine code and engine serial number

The engine code (4-digit) and the engine serial number (consisting of two letters for the year and month and five numbers, which constitute the serial number) are located on the cylinder block, adjacent to the injection pump.

When replacing the engine or the cylinder block, the vehicle identification number must be stamped at the location indicated.



Item	Part Number	Description
1	-	Engine serial number
2	-	Vehicle identification number
3	-	Engine code

General

The 2.0L and 2.2L diesel engines are both 4-cylinder, 16-valve, common rail direct injection turbo charged diesel engines.

This diesel engine design incorporates twin rocker shafts with 16 valves operated by hydraulically adjusted rocker arm. The intake ports are designed to ensure optimum charging and swirl of the mixture charge of air and fuel at all engine speeds.

The two overhead camshafts and the fuel injection pump are driven by means of multilink chain with automatic hydraulic adjustment.

The new design of cylinder head and high fuel pressures produces an optimum torque curve. Continuous torque is maintained even at low engine speed.

The engine features smooth running characteristics, achieved through the use of a modern engine management system and an advanced fuel injection system.

Low fuel consumption of the engine is the result of efficient combustion and high injection pressures which has also led to reduced emissions of carbon dioxide CO_2.

Fuel metering is controlled electronically by a mapped engine management system (EMS) with driver input with fly by wire accelerator. These characteristics, including electronically controlled EGR system coupled with an oxidation catalyst, meet current exhaust emission standards. In addition, the engine has the potential to meet future exhaust emission limits.

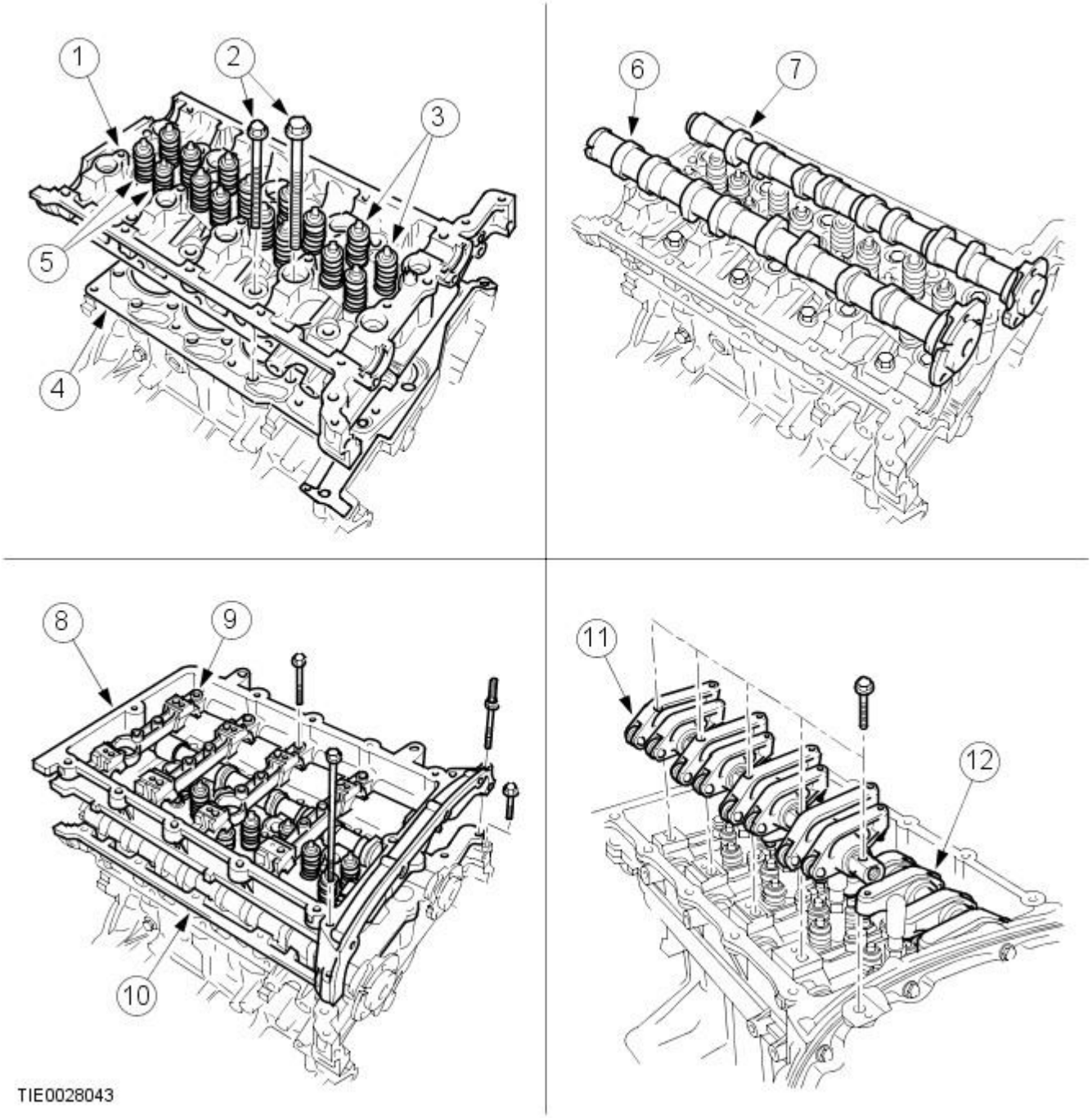
European Stage 4 Diesel Emissions - Vehicles built from VIN:E25782

In order to meet European stage 4 diesel emission legislation, the 2.0L diesel engine has the following changes:-

- A revised piston crown design to improve combustion swirl.
- An electronically controlled turbocharger.
  For additional information, refer to: Turbocharger (303-04C Fuel Charging and Controls - Turbocharger, Description and Operation).
- An electronically controlled EGR system.

These changes have therefore been utilized on the 2.2L diesel engine.

Cylinder Head

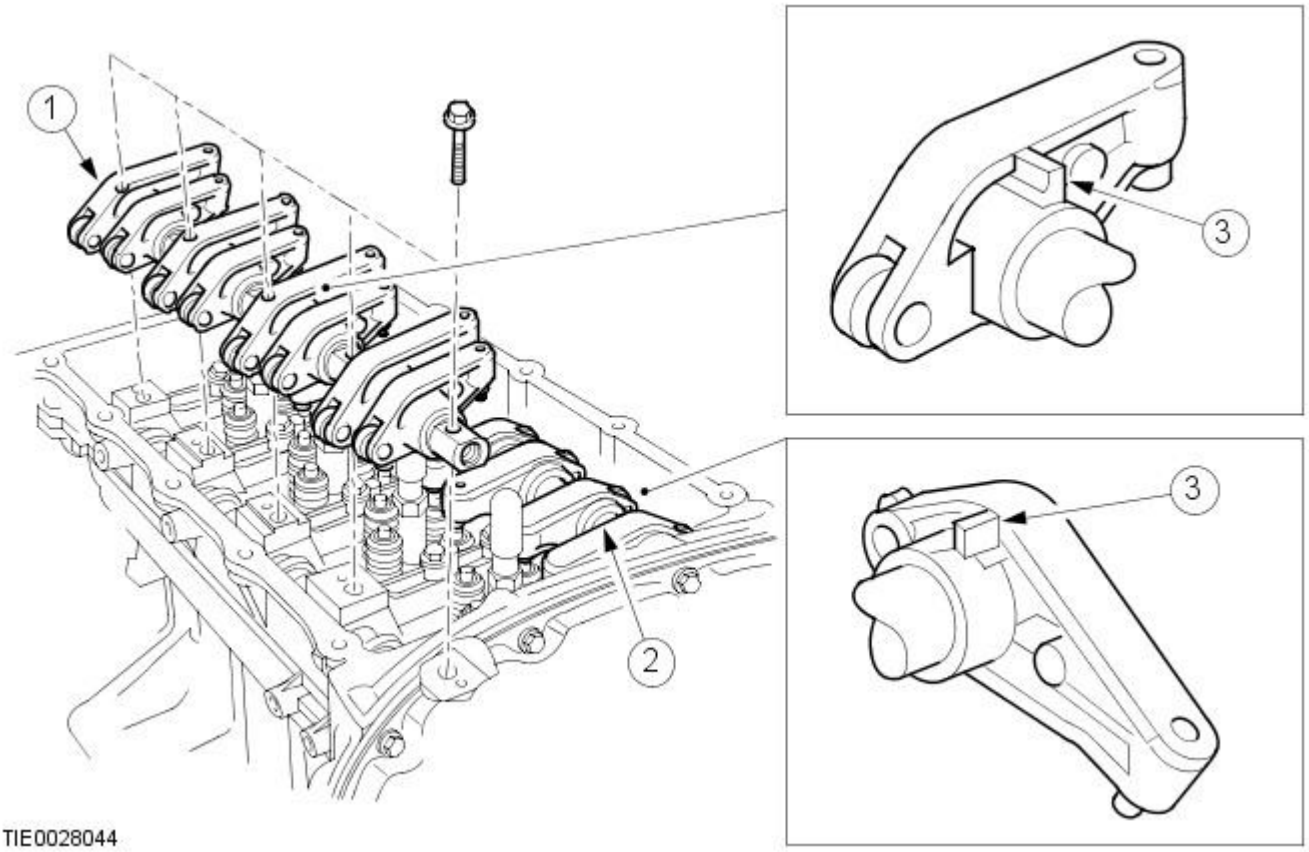


Item	Part Number	Description
1	-	Cylinder head
2	-	Cylinder head bolts
3	-	Intake valves
4	-	Cylinder head gasket
5	-	Exhaust valves
6	-	Exhaust camshaft
7	-	Intake camshaft
8	-	Camshaft carrier
9	-	Camshaft carrier bearing brackets (5 off)
10	-	Sealing surface
11	-	Rocker shaft with rocker arms (exhaust)
12	-	Rocker shaft with rocker arms (intake)

Cylinders head

The cylinder head is of aluminium construction and **CANNOT** be reworked. The cylinder head is secured to the engine block by two sizes of bolts the inner bolts being the larger. **THE CYLINDER HEAD BOLTS BOLTS MUST ALWAYS BE RENEWED**.

Rocker Arms

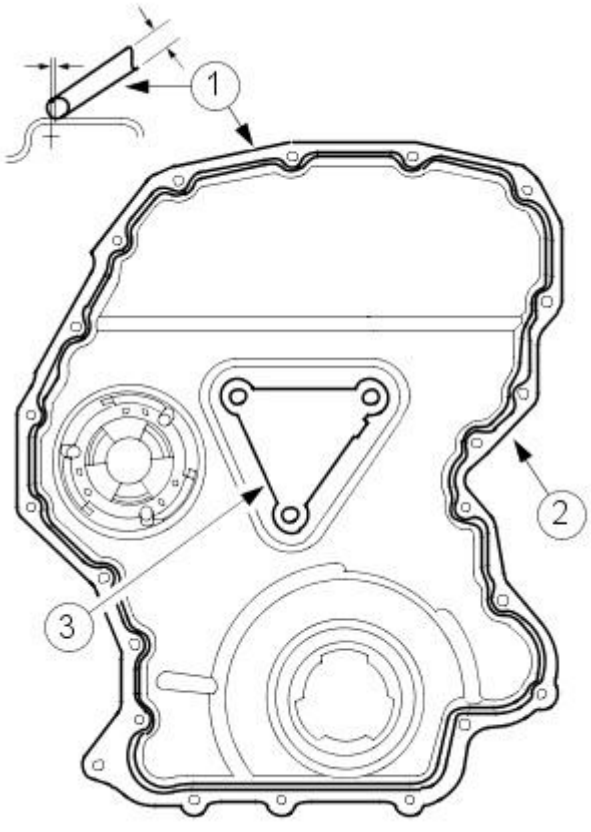


Item	Part Number	Description
1	-	Rocker shaft, exhaust rocker arm
2	-	Rocker shaft, intake rocker arm
3	-	Stud on rocker arm

The valves are operated by lightweight aluminium rocker arms, which are mounted on two rocker shafts. The rocker arms are of different lengths to match the offset valve configuration. Therefore, the distances between the inlet valves and exhaust valves differ. It will be noted that the inlet rocker shaft has helical springs fitted between the rocker arms; this is to keep the arms equally spaced. The rocker shafts are marked for assembly purpose and care must be taken to follow correct installation.

The rocker shafts are supplied with engine oil through oil bores. When installing the rocker shafts make sure that the oil bores face downwards. The rocker shafts are marked for assembly purpose and care must be taken to follow correct installation.

Front Cover



Item	Part Number	Description
1	-	Sealing bead
2	-	Engine front cover

3	-	Engine front cover gasket

Front Cover

The timing cover is of steel construction and is fitted using sealing compound. Prior to fitting, the mating faces on the timing case and cover must be cleaned thoroughly. A special tool is used to align the cover to the engine in relation to the crankshaft.

Camshaft cover

The camshaft cover is made from plastic composite material and is secured to the camshaft carrier. It also incorporates the crankcase ventilation and location for the fuel injector seals. The cover is sealed to the carrier by means of rubber gasket. The head incorporates four valves per cylinder to ensure improved cylinder charging. A vertical centrally placed fuel injector guarantees maximum distribution of fuel into the combustion chamber. The valve stem oil seals also form the lower guide for the valve spring.

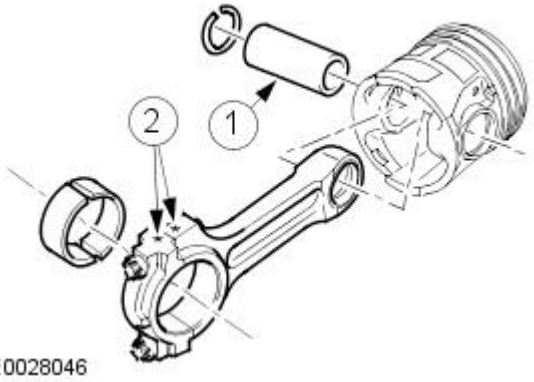
Pistons and connecting rods

Connecting rod dimensions

The connecting rods of the diesel engine are divided into the following length categories:

- K
- L
- M

• NOTE: For tolerances refer to the specifications table.



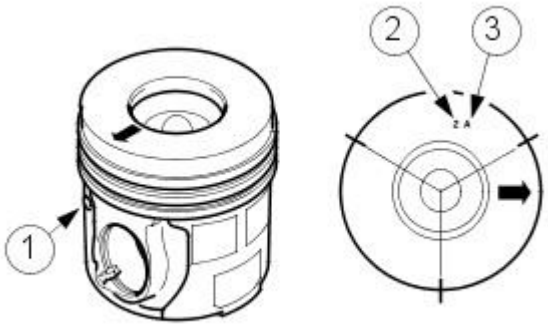
TIE0028046

Item	Part Number	Description
1	-	Piston pin
2	-	Length category

Piston

The piston crown incorporates a pronounced bowl that forms the combustion chamber. This promotes swirl and turbulence which is necessary for good combustion and improved emission. In addition, the piston skirt, which comes into contact with the cylinder bore, has molybdenum-coated surfaces. These counteract scoring of the cylinder and piston therefore helping to increase engine life.

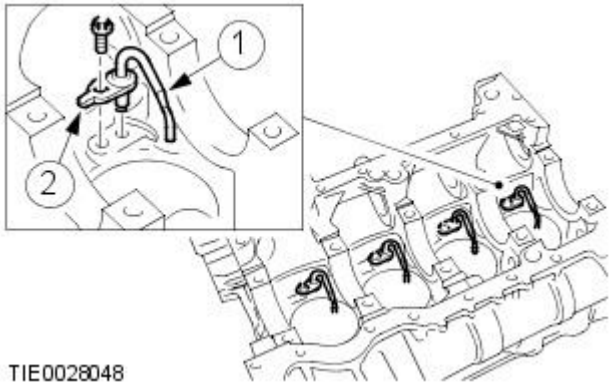
When installing the pistons, it must be ensured that the arrow on the piston points to the timing chain side.



TIE0028047

Item	Part Number	Description
1	-	Mark on piston skirt
2	-	Engine cooling code
3	-	Piston skirt diameter code

Oil Spray Nozzles



Item	Part Number	Description
1	-	Oil spray nozzle
2	-	Tab

The piston also incorporates an oil gallery for cooling purposes. This is supplied by oil spray nozzles which are located in engine block oil gallery. Optimum piston cooling is ensured, which is necessary due to high power output and high combustion temperatures.

Oil pump

The oil pump is a gear-type pump and is bolted to the underside of the bedplate. It is driven from the crankshaft by means of a chain, and is fitted with its own hydraulic tensioner. Care must be taken when the oil pump is installed. The sprocket on the oil pump must be aligned precisely with the sprocket on the crankshaft, to prevent noise and premature chain failure.

Oil cooler and filter

The oil cooler forms a unit with the oil filter and is mounted on the side of the cylinder block. The oil is cooled using the engine cooling system. This eliminates an additional oil cooler remotely mounted. The engine is lubricated by a forced-feed oil circulation system with full flow oil filter. The oil filter and cooler is designed to incorporate the oil filter.

Crankshaft

The crankshaft has induction-hardened journals which run in five bearings with clamped two-layer bearing shells. The bearing shells are made of steel and roll-bounded aluminium-tin alloy. The upper shell of main bearing No 3 is flanged which limits the end float of the crankshaft. All main bearing caps are numbered and are marked with an arrow which must point towards the timing chain.

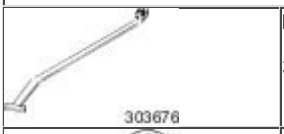
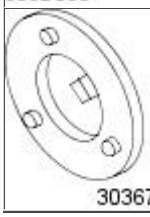
Cylinder Block

The cylinder block is made of grey cast iron with the cylinder bores machined directly into the block. Three different bore diameters are in production to ensure precise clearance between pistons and cylinders. Once the bore diameter has been established the optimum piston is fitted.

Published: 11-May-2011

Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Crankshaft Front Seal

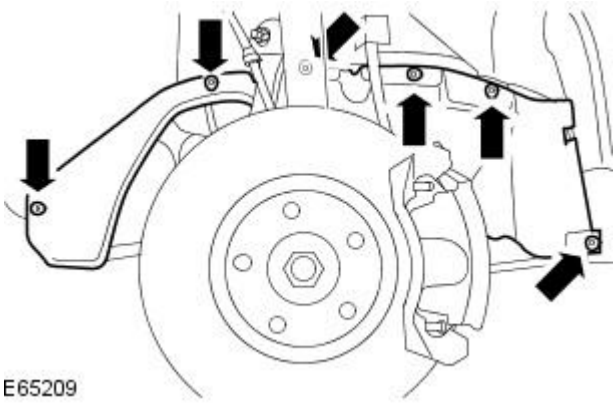
In-vehicle Repair

Special Tool(s)	
 303676	Release tool, belt tensioner 303-676
 303D055	Wrench strap-universal 303-D055
 303679	Remover/Installer, Front Oil Seal 303-679 (21-238)

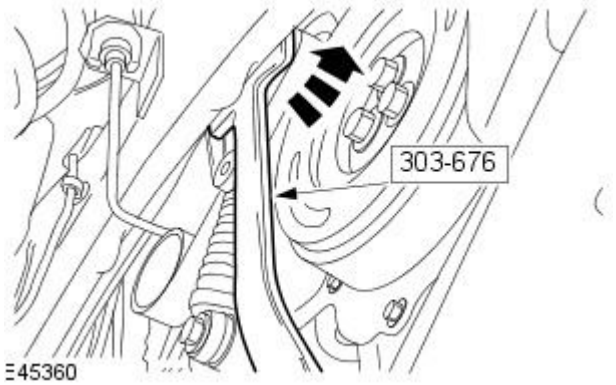
Removal

1. Remove the front road wheel and tire.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

2. Remove the right-hand wheel arch liner access panel.

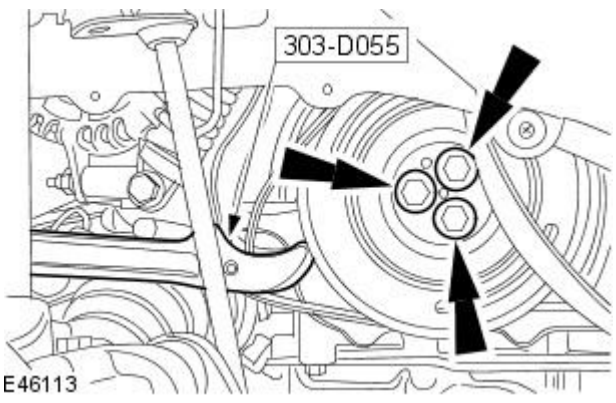


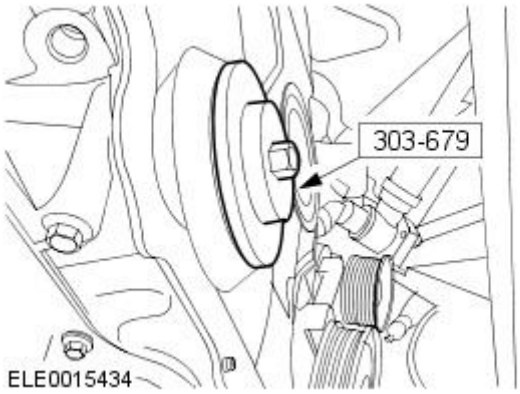
3. Using the special tool, detach the accessory drive belt.



4. Using the special tool, remove the crankshaft pulley.

- Remove and discard the crankshaft pulley bolts.

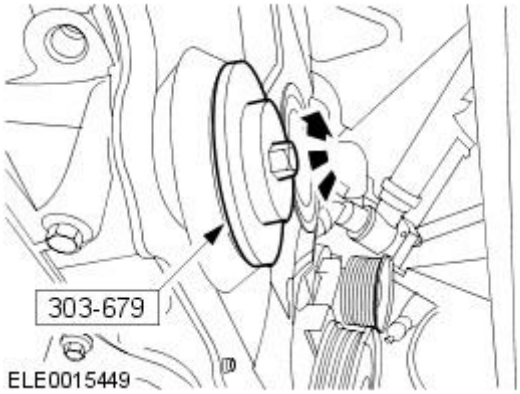




5. Using the special tool, remove the crankshaft front oil seal.

- Discard the oil seal.

Installation

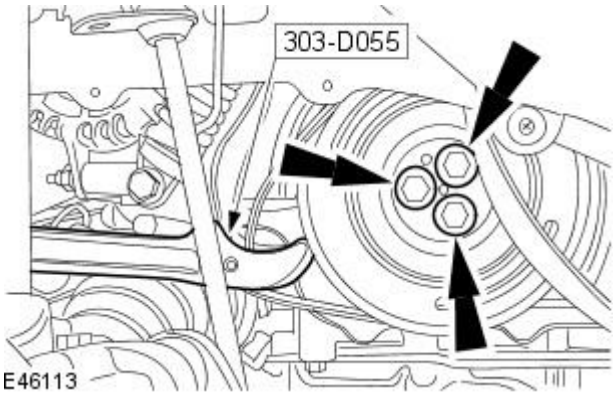


1. NOTE: Install a new crankshaft front oil seal.

• NOTE: A new crankshaft front oil seal is supplied with an alignment sleeve that will be pushed out during installation.

Using the special tool, install the crankshaft front oil seal.

- Tighten to 19 Nm.



2. CAUTIONS:

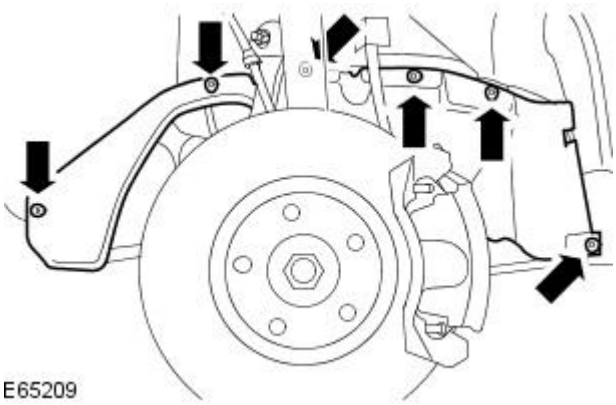
Install new crankshaft pulley retaining bolts. Failure to follow this instruction many result in damage to the vehicle.

Tighten the new crankshaft pulley bolts in 2 stages. Failure to follow this instruction many result in damage to the vehicle.

Install the crankshaft pulley.

- Using the special tool, retain the crankshaft pulley.
- Stage 1: 45 Nm.
- Stage 2: 120 degrees.

3. Using the special tool, install the accessory drive belt.



4. Install the right-hand wheel arch liner access panel.

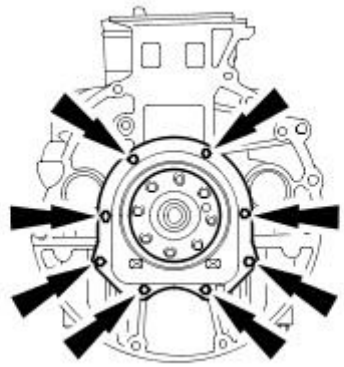
5. Install the front road wheel and tire.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Published: 11-May-2011

Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Crankshaft Rear Seal

In-vehicle Repair

Removal

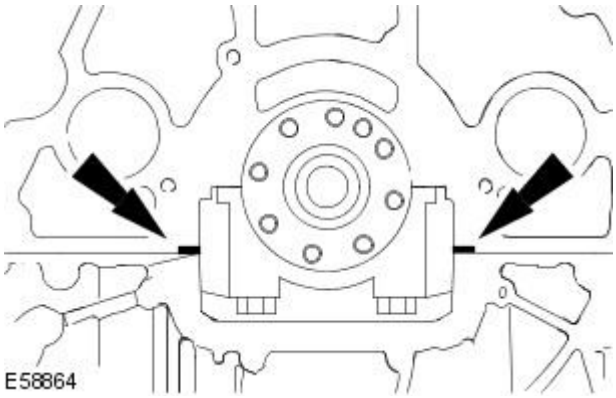

TIE0012994

1. Remove the flywheel.
   For additional information, refer to: Flywheel (303-01B Engine - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, In-vehicle Repair).
2. Remove the crankshaft rear seal.
   - Discard the crankshaft rear seal and the bolts.

Installation

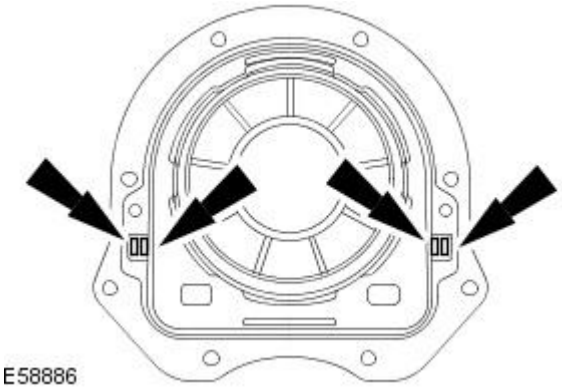
CAUTION: A new crankshaft rear seal is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Clean area on engine before installing a new crankshaft rear seal carrier.


E58864

1. Check the two foam pads are located as shown on the ladder frame gasket.
   - If the ladder frame gasket tabs are present, trim using a suitable tool flush to the engine block and ladder frame.

     • NOTE: Make sure the sealant sits between the joints between the engine block and the ladder frame.
   - Apply a thin layer of sealant to the areas shown.


E58886

2. CAUTIONS:

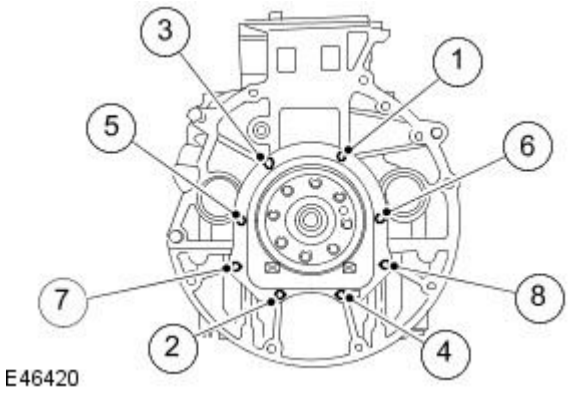
   Install the new crankshaft rear seal within five minutes of applying the recommended sealant. Failure to follow this instruction may result in damage to the vehicle.

   Do not add any more than the specified quantity of sealant or add the sealant anywhere other than the area shown.

   Using the recommended sealant completely fill the square areas shown. For additional information, refer to: Specifications (303-01B Engine - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Specifications).

3. NOTE: Do not fully tighten the crankshaft rear oil seal retaining bolts at this stage.

   Install the crankshaft rear oil seal.
   - Install the new retaining bolts.



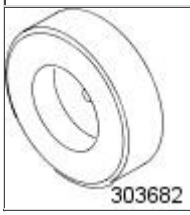
4. Tighten the crankshaft rear oil seal carrier retaining bolts.
   - Tighten the bolts in the sequence shown.
   - Tighten to 10 Nm.

5. Remove the crankshaft rear oil seal alignment sleeve.
6. Install the flywheel.
   For additional information, refer to: Flywheel (303-01B Engine - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, In-vehicle Repair).

Published: 11-May-2011

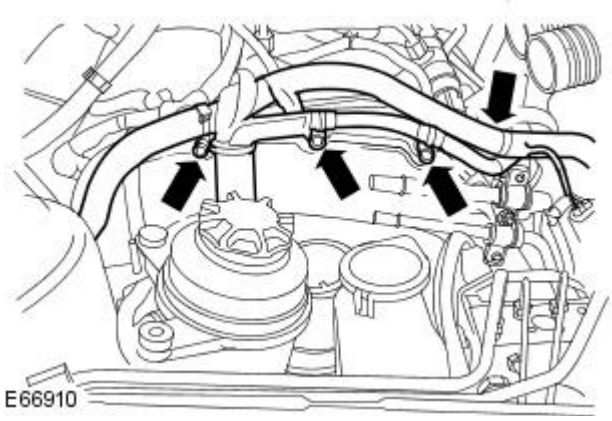
Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Engine Front Cover

In-vehicle Repair

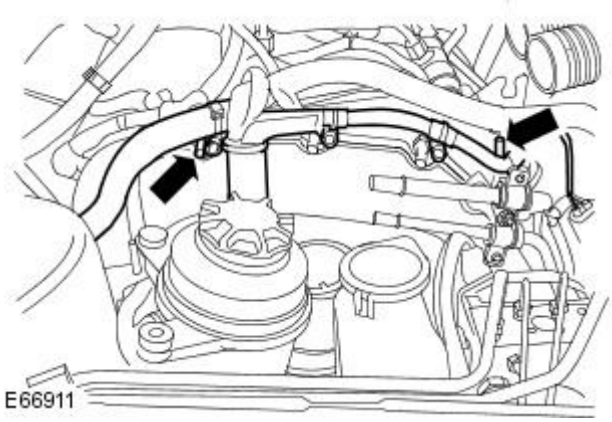
Special Tool(s)	
 303682	Aligner, Front Cover 303-682 (21-241)

Removal

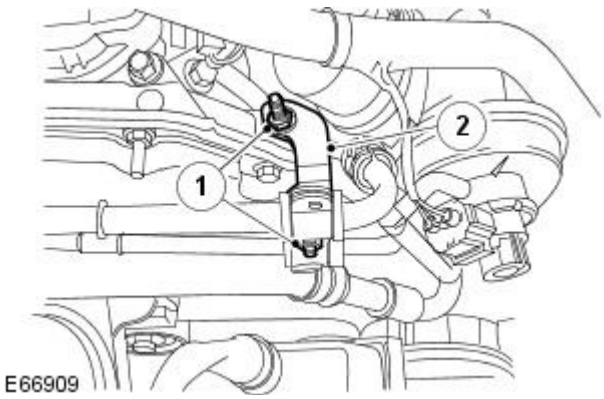
1. Remove the engine front mount.
   For additional information, refer to: Engine Front Mount (303-01B Engine - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, In-vehicle Repair).
2. Detach the engine wiring harness.



3. Detach the engine wiring harness.

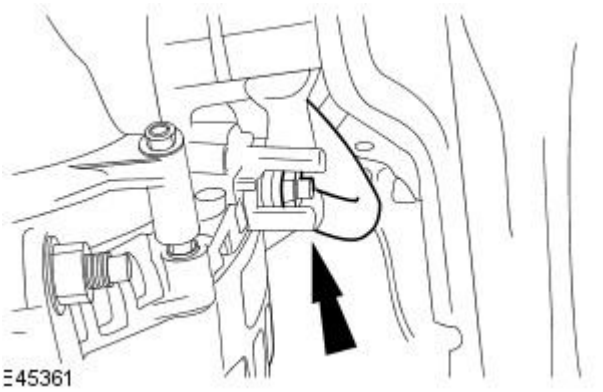


4. Remove the retaining bracket.
   1. Remove the retaining nuts.
   2. Remove the retaining bracket.



5. Remove the crankshaft front seal.
   For additional information, refer to: Crankshaft Front Seal (303-01B Engine - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, In-vehicle Repair).

6. Detach the generator positive cable.

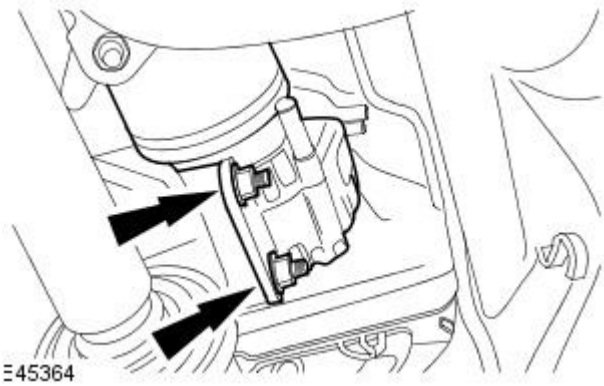


7. Disconnect the generator electrical connector.

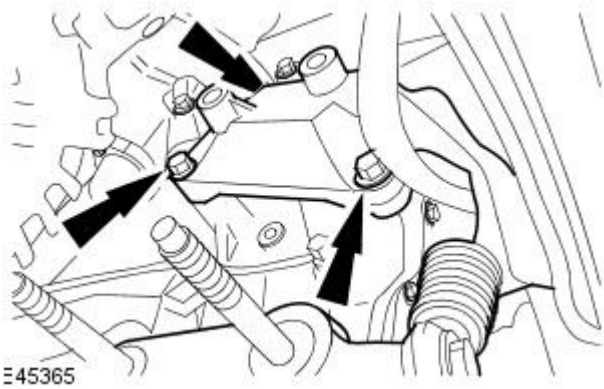
8. Remove the generator upper retaining bolt.

9. Detach the generator.

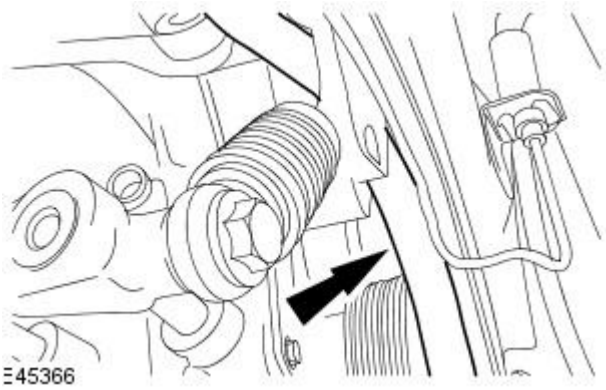
- Slide the generator rearwards as far away from the accessory drive belt tensioner assembly as possible.



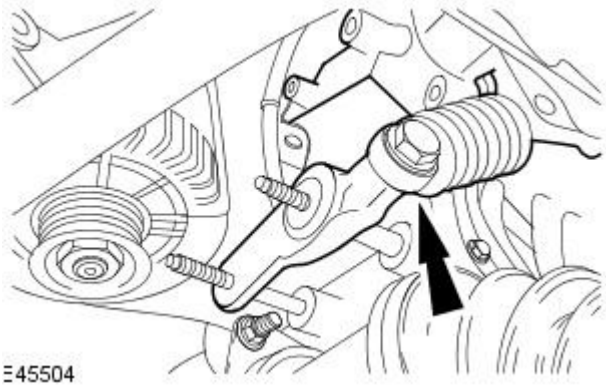
10. Detach the accessory drive belt tensioner assembly.



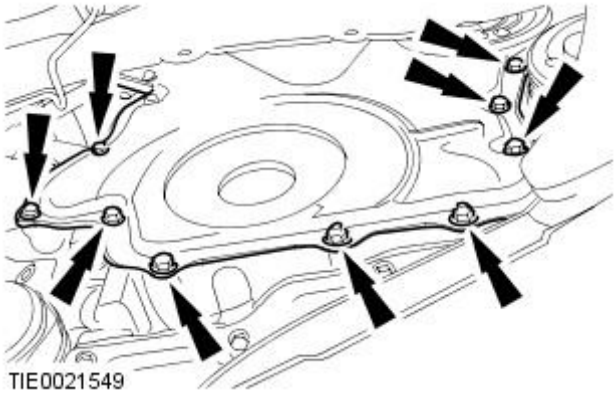
11. Detach the accessory drive belt.



12. Remove the accessory drive belt tensioner.



13. Remove the engine front cover lower retaining nuts and bolts.

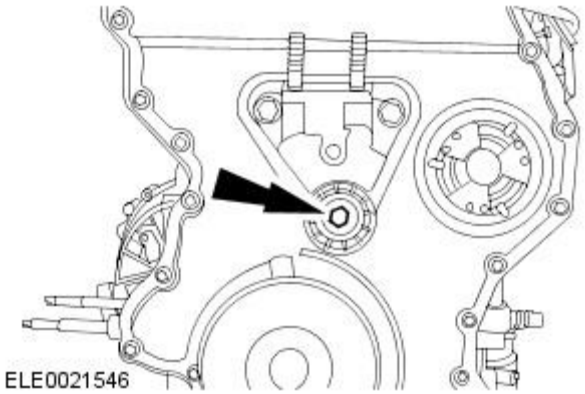


14. Lower the vehicle.

15. NOTE: Engine shown removed for clarity.

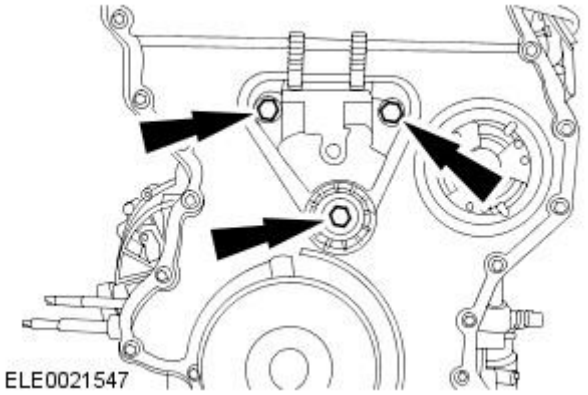
• NOTE: The idler pulley can not be removed until the engine mount bracket is removed.

Remove the idler pulley retaining nut.



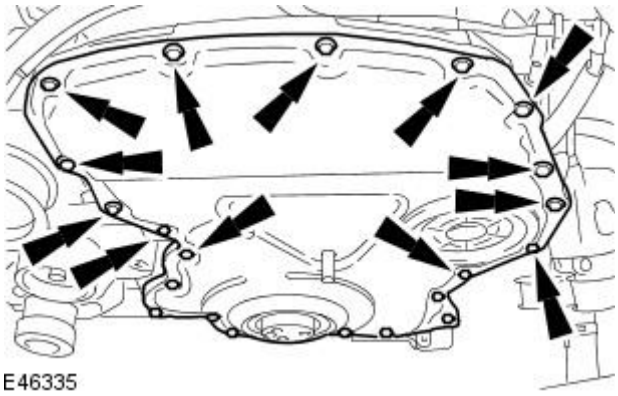
16. NOTE: Engine shown removed for clarity.

Remove the front engine mount bracket and idler pulley.



17. NOTE: Engine shown removed for clarity.

Remove the engine front cover upper retaining bolts.

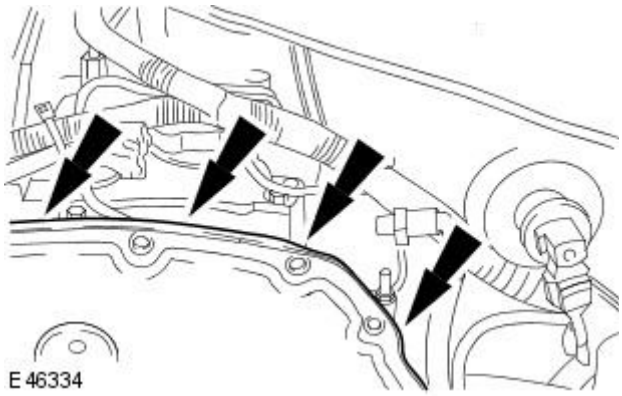


18. CAUTION: Avoid damage to the engine front cover mating face on the engine. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Lubricate the suitable tool with clean engine oil.

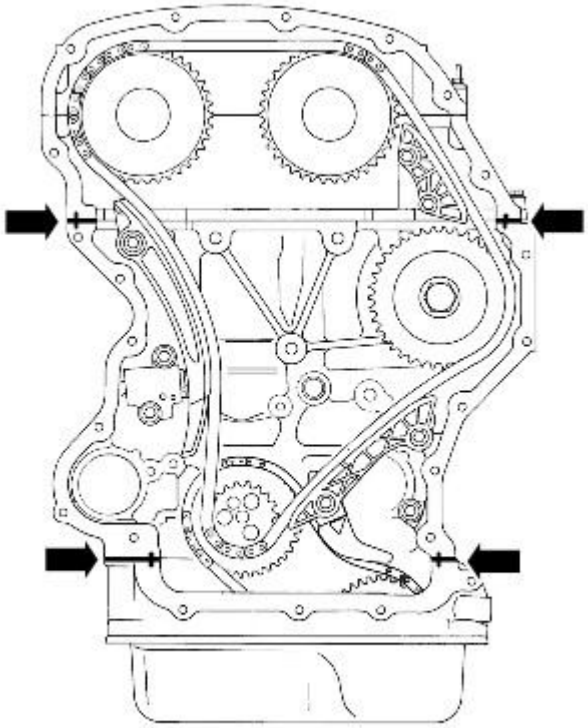
Using a suitable tool, remove and discard the engine front cover.

- Insert the suitable tool between the front cover and the engine, slide the suitable tool in between the engine and engine front cover.



Installation

1. Clean the engine front cover mating faces.



E100334

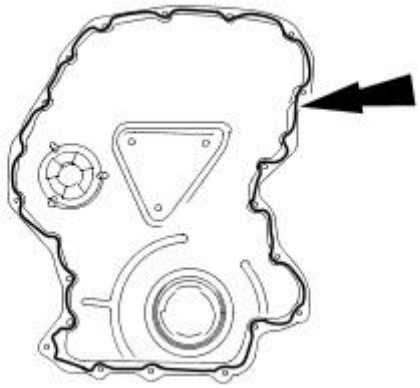
2. CAUTIONS:

A new engine front cover must be installed. Failure to follow this instruction may result in damage to the vehicle.

Install the engine front cover within five minutes of applying the sealer. Failure to follow this instruction may result in damage to the vehicle.

Apply a 3 mm (0.118 inch) bead of sealer to the four T-joints.

3. Apply a 3 mm (0.118 inch) bead of selaer to the engine front cover.



TIE0020780

4. WARNING: Make sure that the engine front cover does not come into contact with the engine until correct position is obtained.

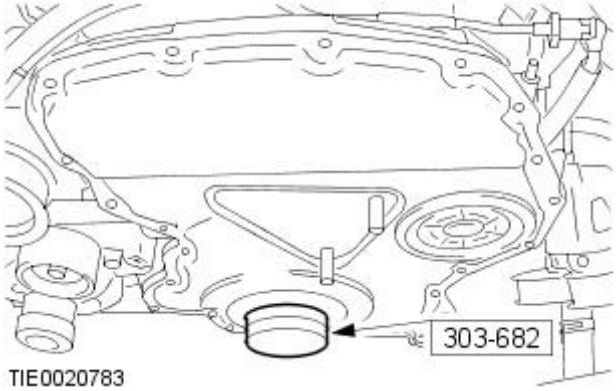
With the aid of a second technician, position the engine front cover.

5. Raise the vehicle.

6. NOTE: Engine shown removed for clarity.

Using the special tool, align the engine front cover.

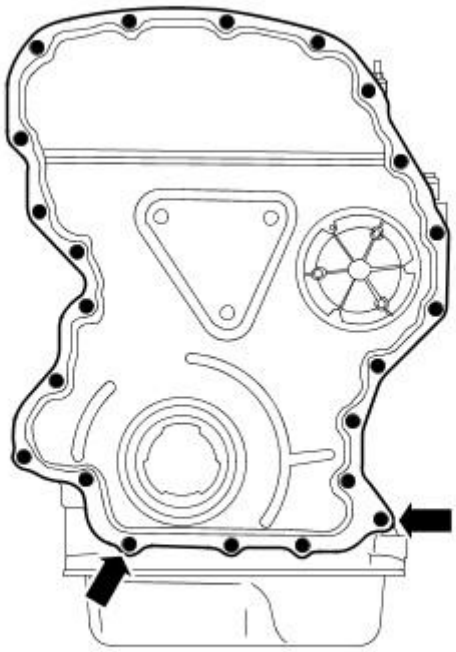
- Intall and tighten 2 engine front cover bolts to 6 Nm.
- Install and tighten the remaining 16 engine front cover bolts and 2 nuts to 6 Nm.
- Slacken the engine front cover bolts and nuts 360 degrees.
- Install the special tool.



TIE0020783

7. Tighten the engine front cover lower retaining nuts and bolts.

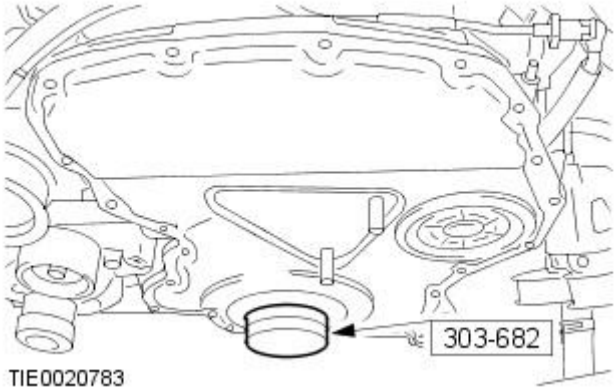
- Tighten the engine front cover nuts and bolts to 3 Nm.
- Tighten the engine front cover nuts and bolts in the following sequence:
- Tighten the 2 bolts indicated to 11 Nm.
- Tighten the remaining nuts and bolts to 10 Nm.



E100335

8. NOTE: Engine shown removed for clarity.

Remove the special tool.



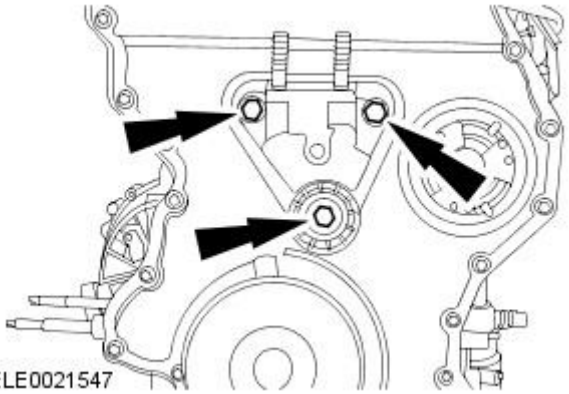
TIE0020783

9. NOTE: Engine shown removed for clarity.

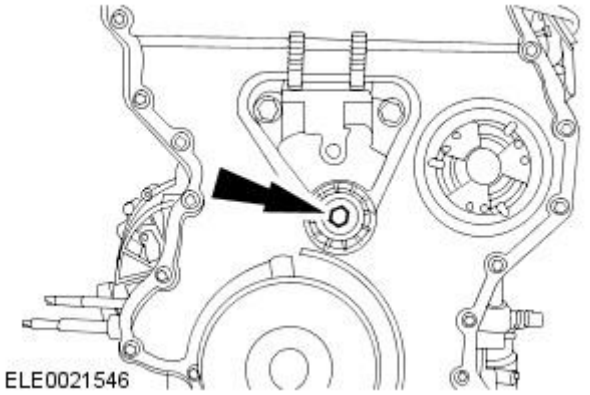
• NOTE: Install the engine front mount bracket, the idler pulley and bolts as one item.

Install the front engine mount bracket and idler pulley.

- Tighten to 80 Nm.



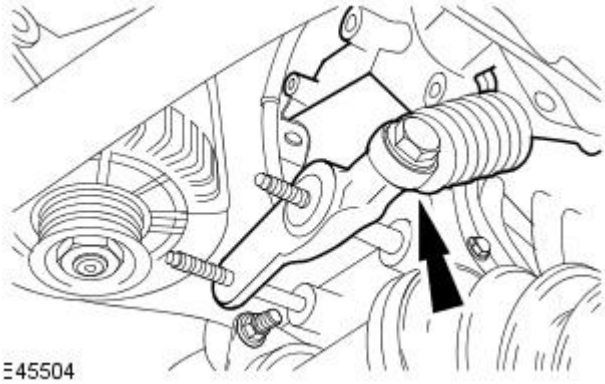
ELE0021547



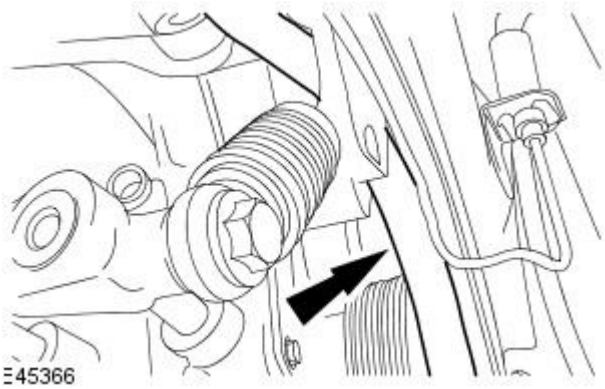
10. NOTE: Engine shown removed for clarity.

Install the idler pulley retaining nut.

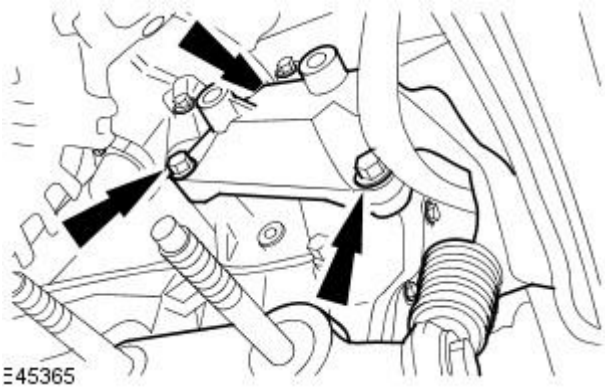
- Tighten to 43 Nm.



11. Install the accessory drive belt tensioner.

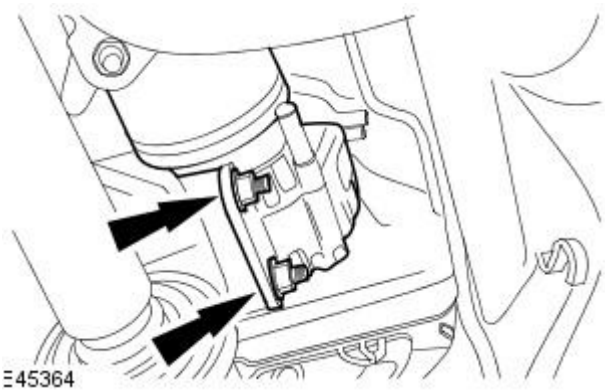


12. Attach the accessory drive belt.



13. Attach the accessory drive belt tensioner assembly.

- Tighten to 47 Nm.

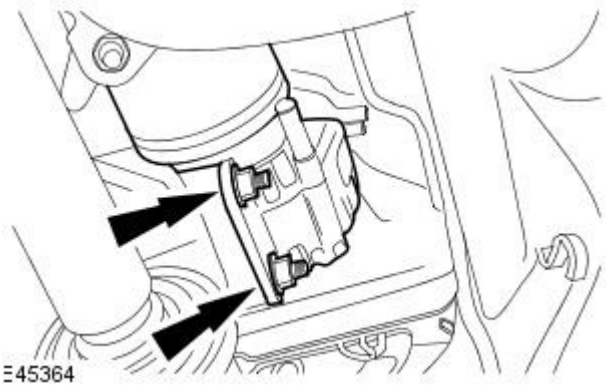


14. NOTE: Do not tighten the generator retaining nuts at this stage.

Attach the generator.

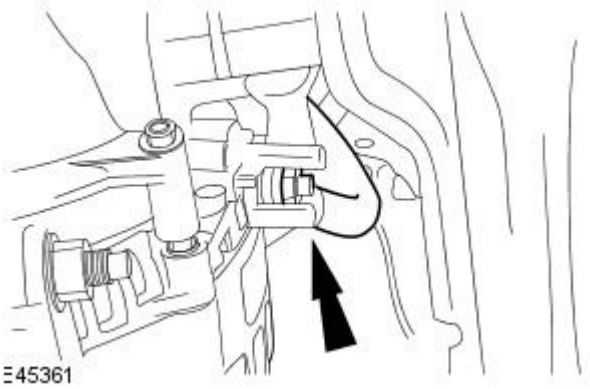
15. Install the generator upper retaining bolt.

- Tighten to 47 Nm.



16. Tighten to 47 Nm.

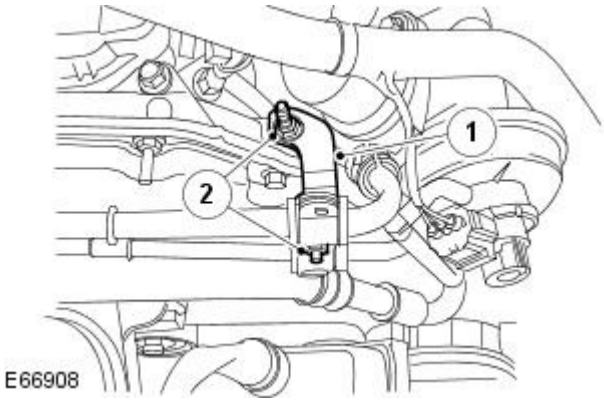
17. Connect the generator electrical connector.



18. Attach the generator positive cable.

- Tighten to 8 Nm.

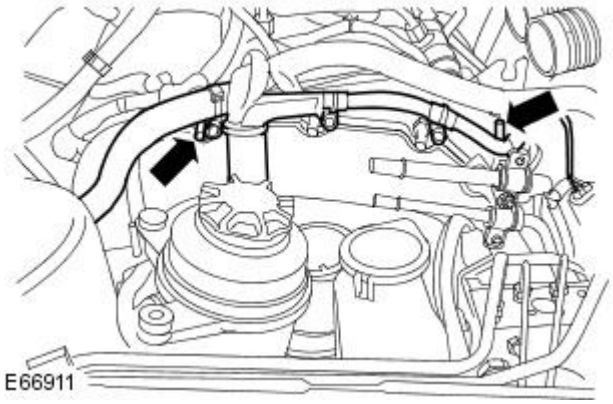
19. Install the crankshaft front seal.
For additional information, refer to: Crankshaft Front Seal (303-01B Engine - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, In-vehicle Repair).



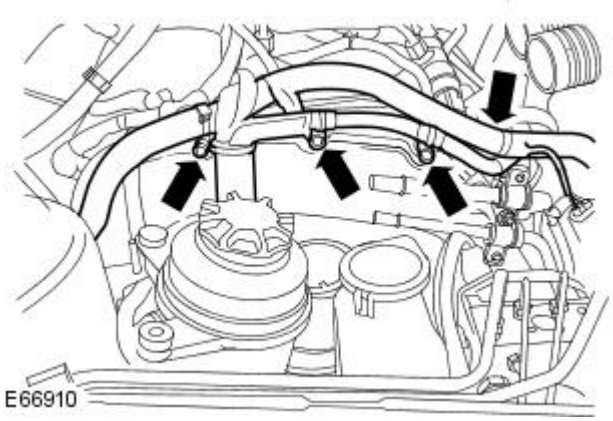
20. Install the retaining nuts.

1. Install the retaining bracket.
2. Install the retaining nuts.

21. Attach the engine wiring harness.



22. Attach the engine wiring harness.



23. Install the engine front mount.
For additional information, refer to: Engine Front Mount (303-01B Engine - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, In-vehicle Repair).

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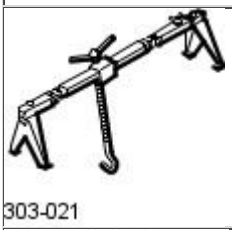
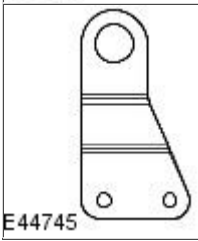
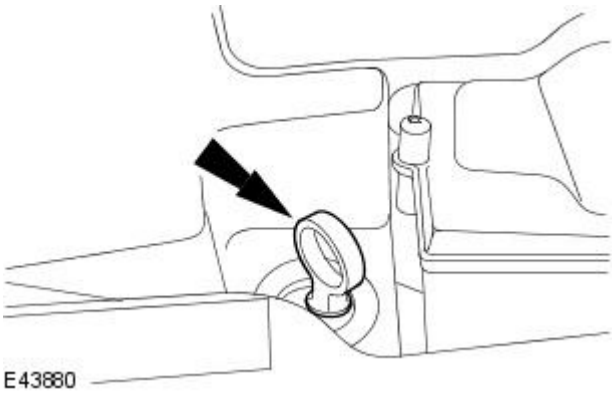
Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Engine Front Mount

In-vehicle Repair

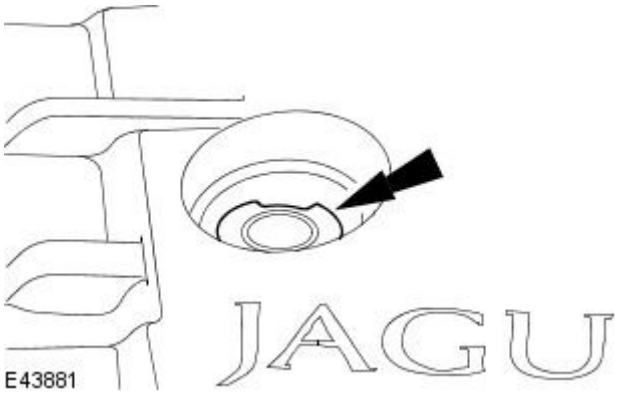
Special Tool(s)	
 303-021	Engine support bracket 303-021
 E44745	Engine lifting eye 303-1067

Removal

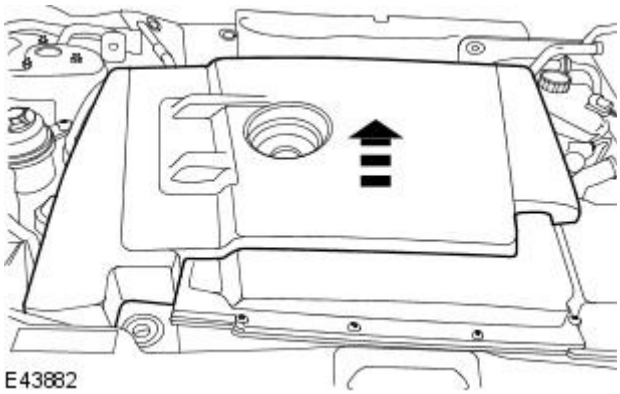
All vehicles


E43880

1. Remove the oil level indicator.

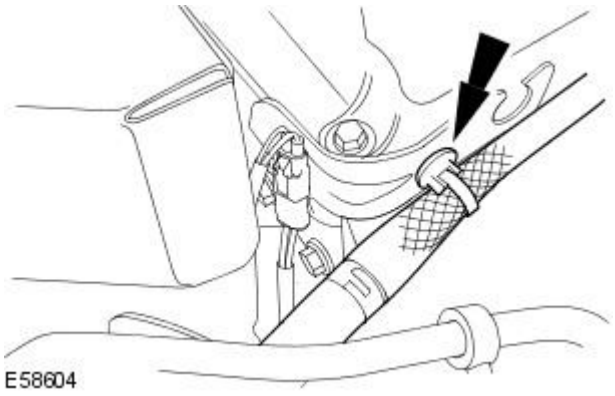

E43881

2. Remove the oil filler cap.

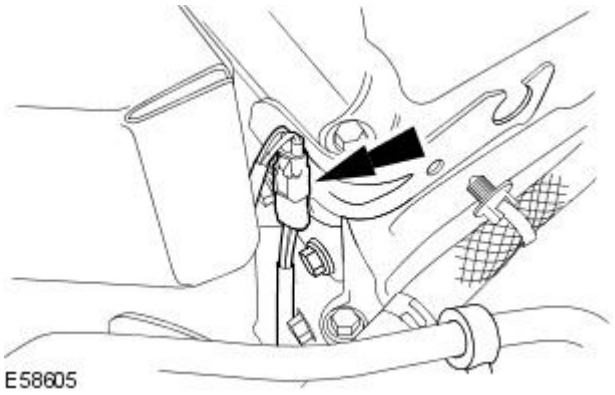

E43882

3. NOTE: Install the oil filler cap and oil level indicator to prevent foreign material entering the valve cover.

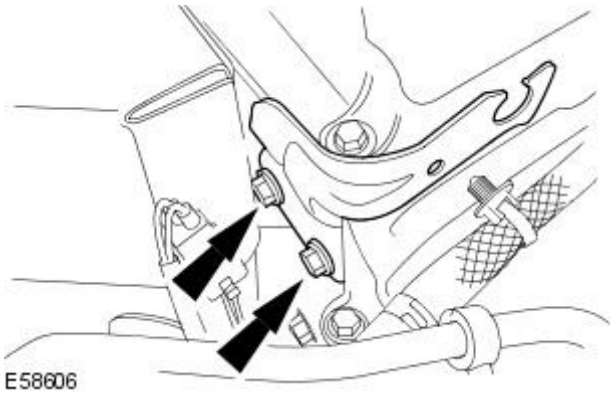
Remove the engine cover.



4. Detach the wiring harness from the engine cover mounting bracket.



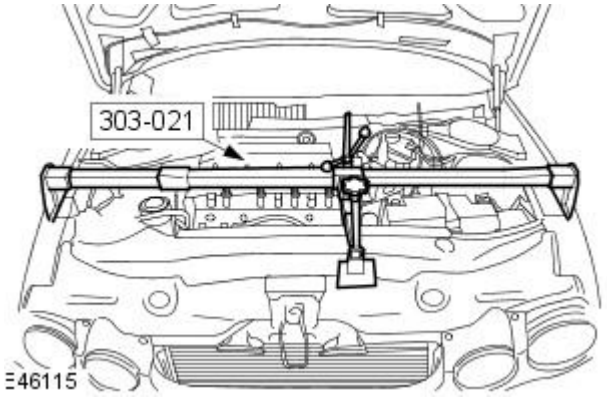
5. Detach the electrical connector from the engine cover mounting bracket.



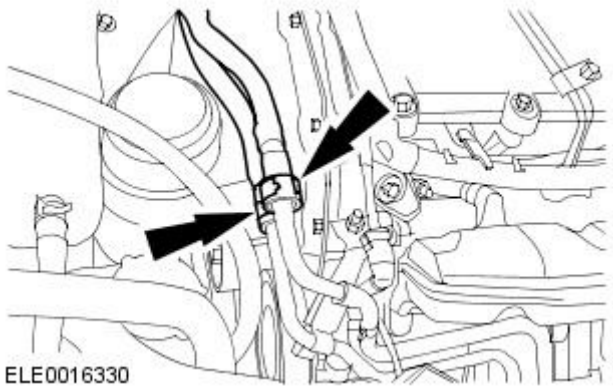
6. Remove the engine cover mounting bracket.

7. Install the special tool.

- Tighten to 23 Nm.

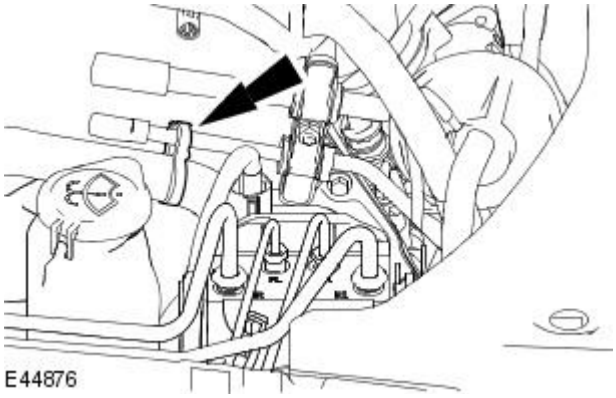


8. Using the special tool, support the engine and transmission assembly.

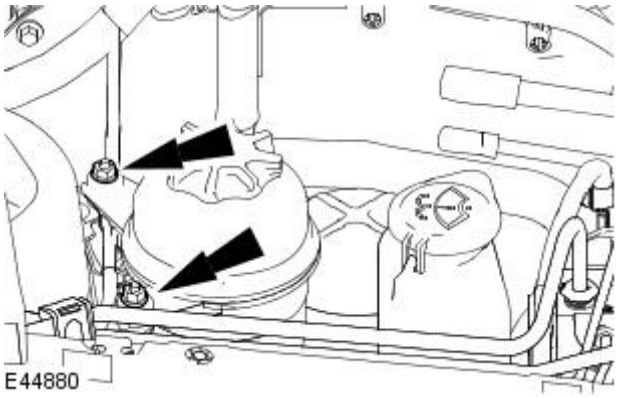


9. Disconnect the fuel pump fuel supply and return lines.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

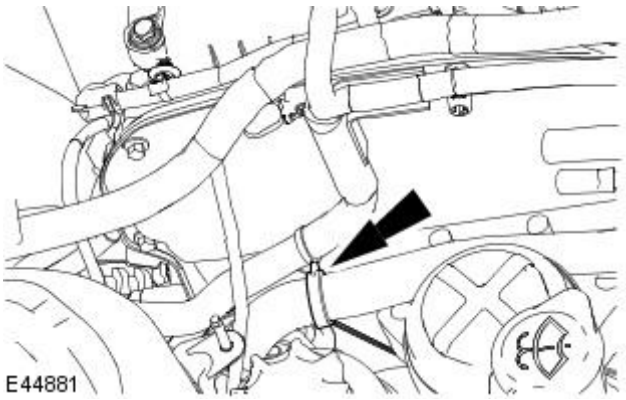
- Install blanking plugs to the fuel pump fuel supply and return line male and female connectors.



10. Detach the power steering fluid hose from the fuel return line.

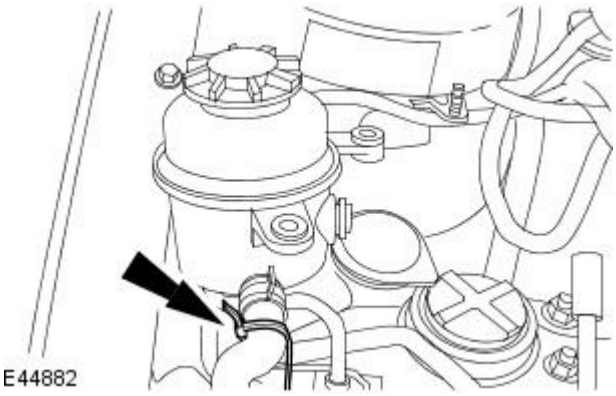


11. Remove the power steering fluid reservoir retaining nuts.

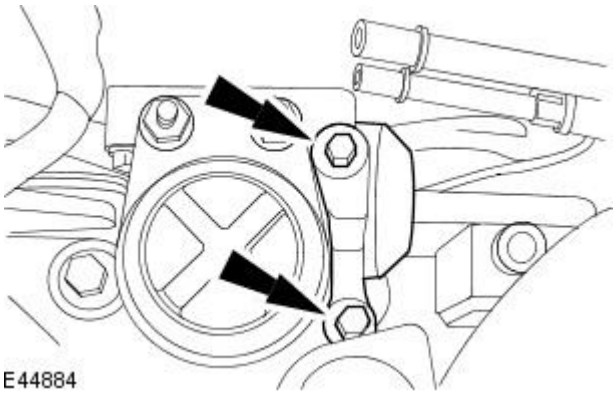


12. Detach the power steering fluid reservoir.

13. Secure the power steering fluid reservoir to one side.

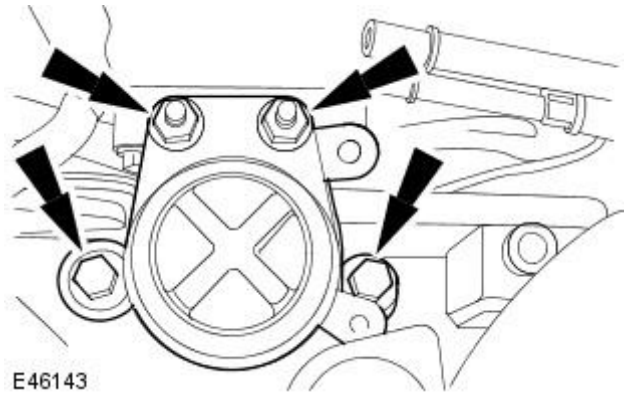


14. Remove the engine mount damper.

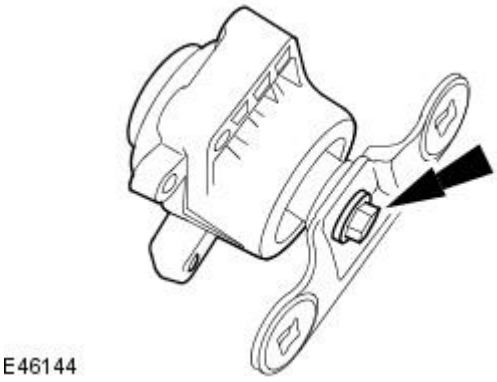


15. NOTE: Mark the position of the engine mount before removal.

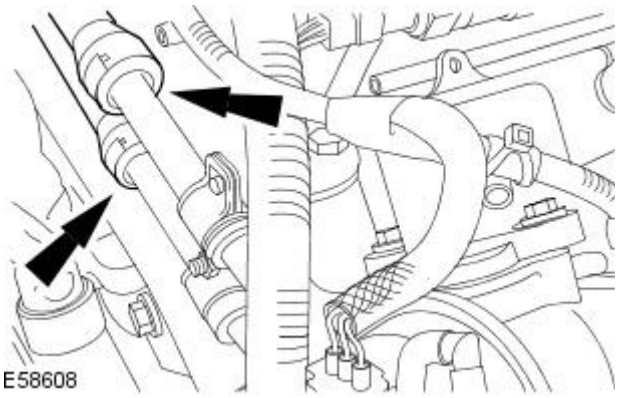
Remove the engine mount and bracket assembly.



16. Remove the engine mount.

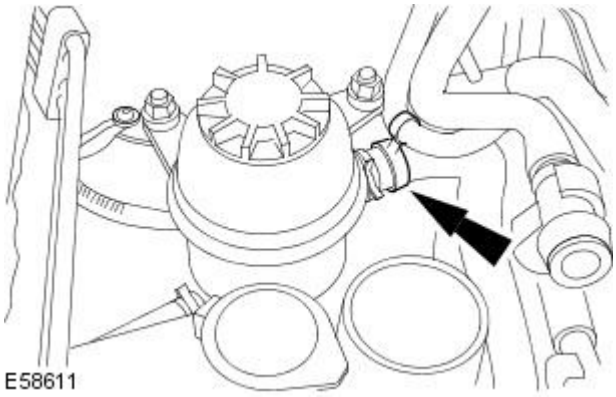


Vehicles built from VIN:E43869

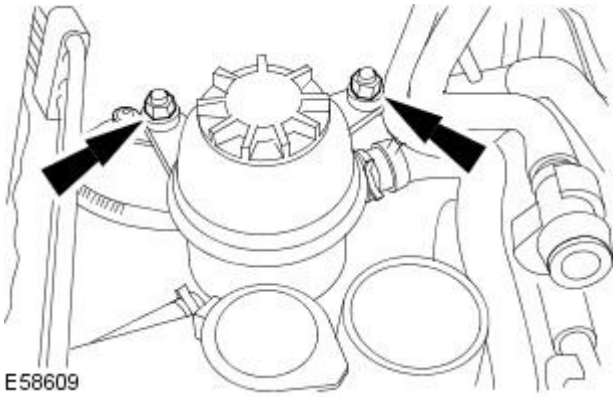


17. Disconnect the fuel pump fuel supply and return lines.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

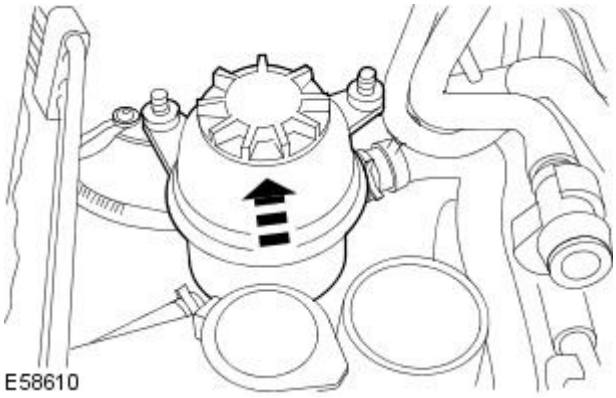
- Install blanking plugs to the fuel pump fuel supply and return line male and female connectors.



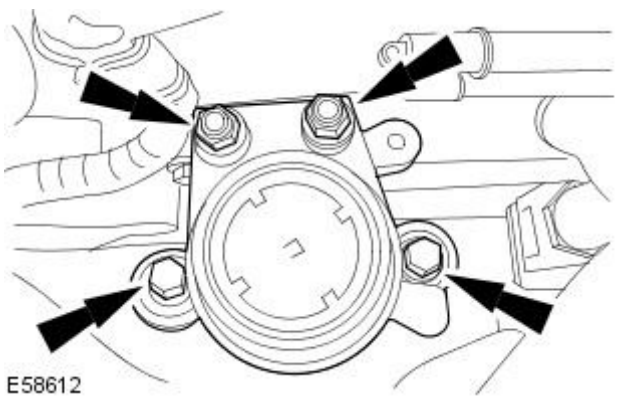
18. Detach the power steering fluid hose from the fuel return line.



19. Remove the power steering fluid reservoir retaining nuts.



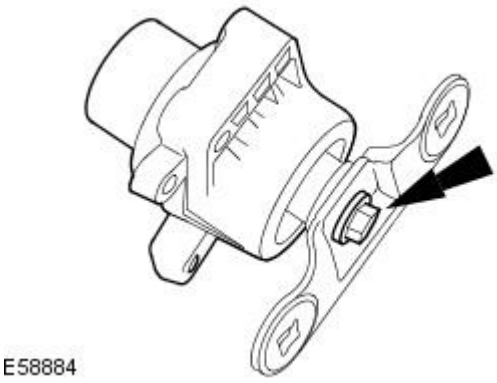
20. Detach the power steering reservoir away from the power steering reservoir retaining bracket.



21. NOTE: Mark the position of the engine mount before removal.

Remove the engine mount and bracket assembly.

22. Remove the engine mount.


E58884

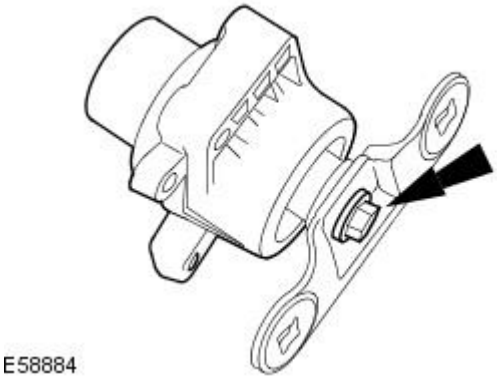
Installation

Vehicles built from VIN:E43869

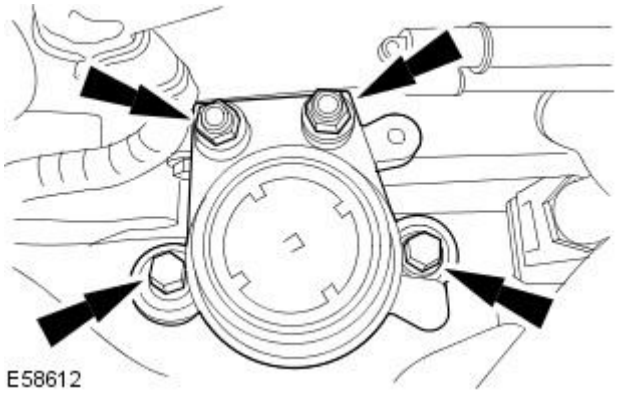
1. NOTE: Clean the front engine mount mating faces.

To install, reverse the removal procedure.

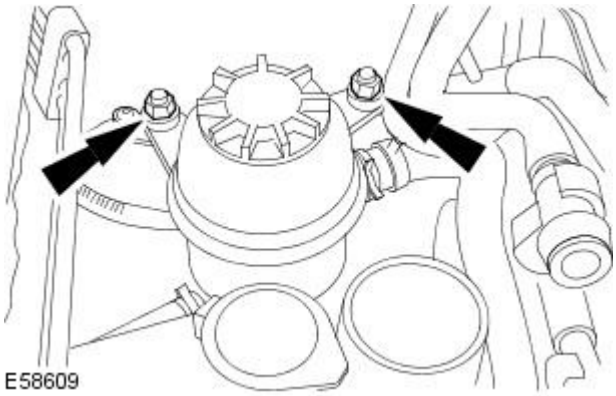
- Tighten to 80 Nm.


E58884

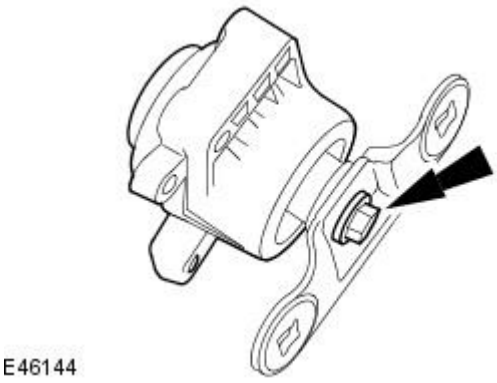
2. Tighten to 80 Nm.


E58612

3. Tighten to 10 Nm.


E58609

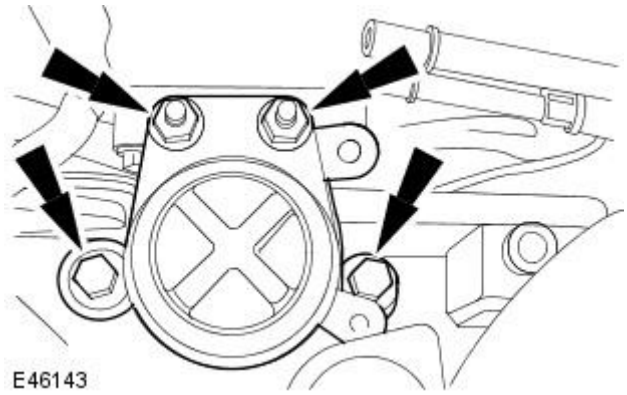
Vehicles built up to VIN:E43868


E46144

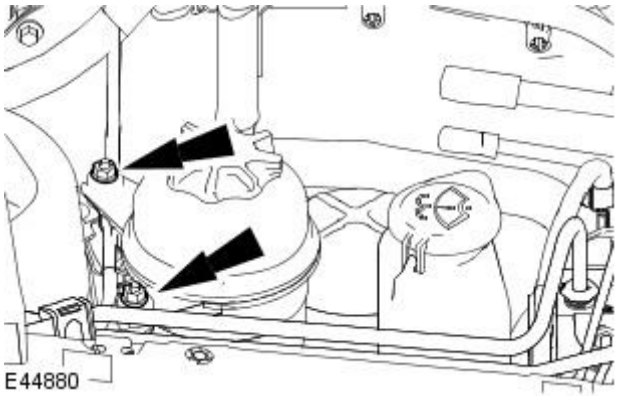
4. NOTE: Clean the front engine mount mating faces.

To install, reverse the removal procedure.

- Tighten to 80 Nm.

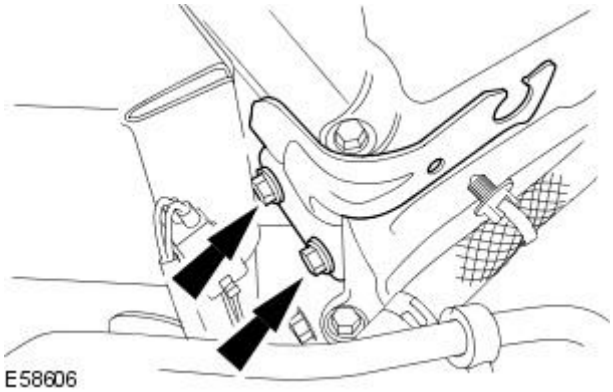

E46143

5. Tighten to 80 Nm.


E44880

6. Tighten to 10 Nm.

All vehicles


E58606

7. Tighten to 23 Nm.

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Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Flexplate

In-vehicle Repair

Removal

E100904

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 transmission.
   For additional information, refer to: Transmission (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Removal).
4. CAUTION: Discard the bolts.

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

Remove the flexplate.

- Remove the 8 bolts.

Installation

E100905

1. CAUTION: Make sure that new bolts are installed.

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

Install the flexplate.

- Stage 1: Tighten bolts in the sequence shown to 25 Nm.
- Stage 2: Tighten bolts in the sequence shown to 40 Nm.
- Stage 3: Tighten bolts in the sequence shown a further 48 degrees.

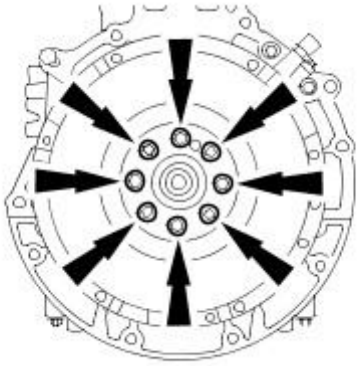
2. Install the transmission.
   For additional information, refer to: Transmission (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Removal).
3. Connect the battery ground cable.
   For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Published: 11-May-2011

Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Flywheel

In-vehicle Repair

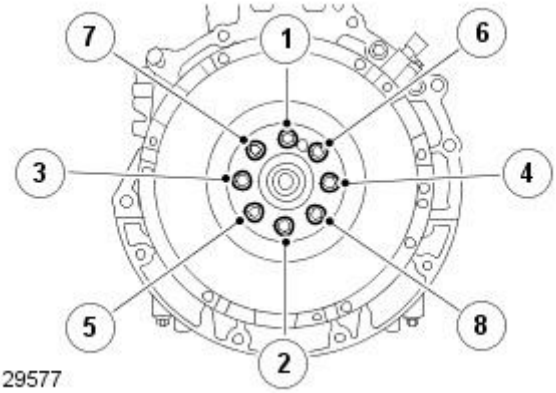
Removal



TIE0012992

1. Remove the clutch disc and pressure plate. For additional information, refer to: Clutch Disc and Pressure Plate (308-01 Clutch, Removal and Installation).
2. Remove the flywheel.
   - Discard the bolts.

Installation



E129577

1. NOTE: Install new flywheel bolts.

   Install the flywheel.
   - Tighten the bolts in the sequence shown in three stages.
   - Stage 1: Tighten bolts 1 through 8 to 15 Nm.
   - Stage 2: Tighten bolts 1 through 8 to 30 Nm.
   - Stage 3: Tighten bolts 1 through 8 to 75 Nm.
   - Stage 4: Tighten bolts 1 through 8 to 45 degrees.
2. Install the clutch disc and pressure plate. For additional information, refer to: Clutch Disc and Pressure Plate (308-01 Clutch, Removal and Installation).

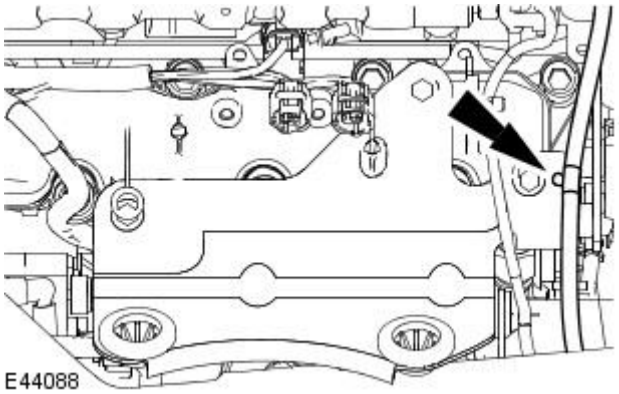
Published: 11-May-2011

Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Intake Manifold

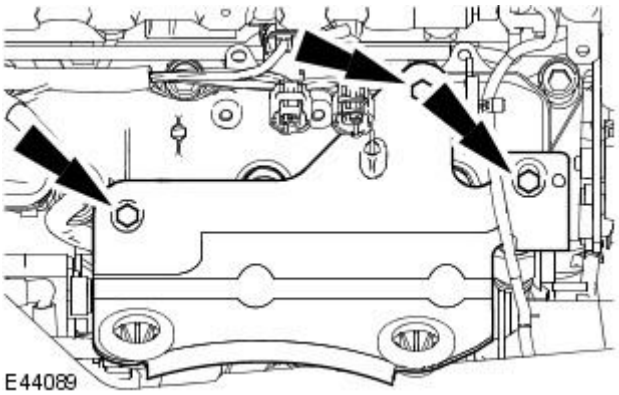
In-vehicle Repair

Removal

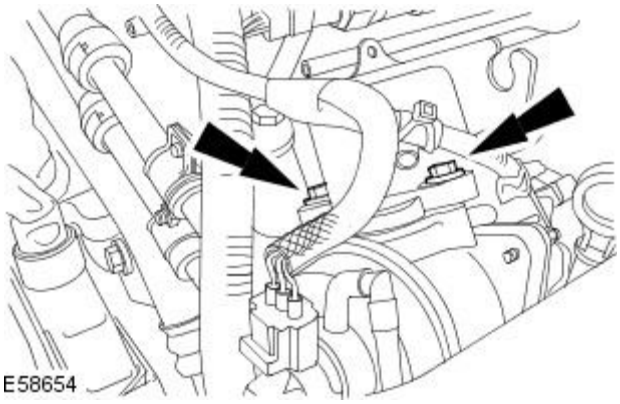
1. Remove the air cleaner assembly.
   For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
2. Detach the engine wiring harness.



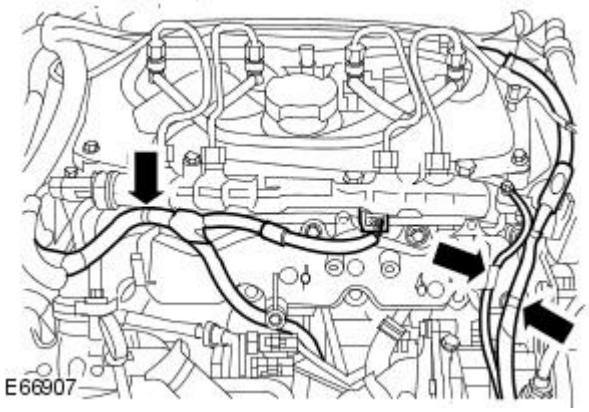
3. Remove the air cleaner mount bracket.

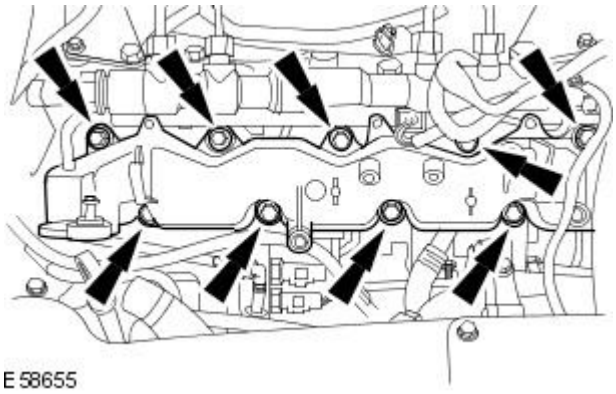


4. Detach the exhaust gas recirculation (EGR) valve from the intake manifold.
   - Remove and discard the EGR valve gasket.



5. Detach the engine wiring harness from the intake manifold.

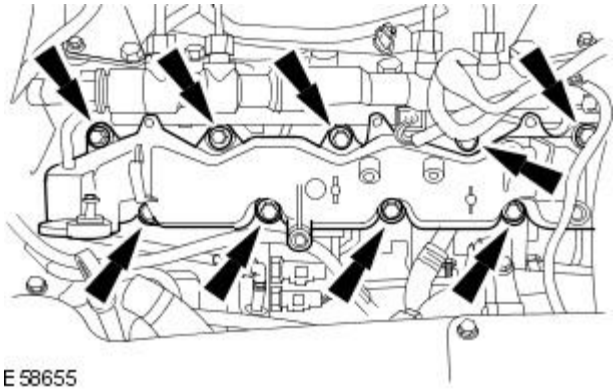




6. Remove the intake manifold.

- Remove and discard the intake manifold gaskets.

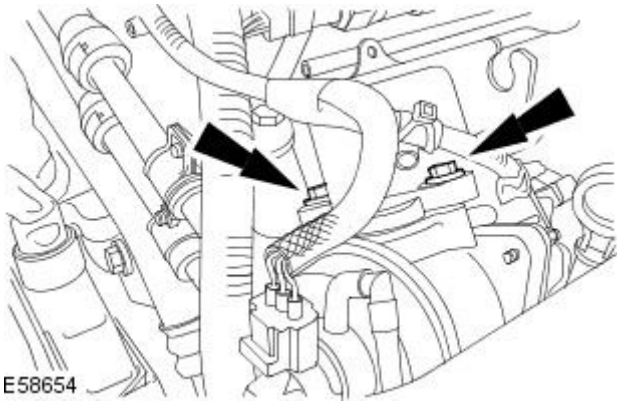
Installation



1. NOTE: Install new intake manifold gaskets.

To install, reverse the removal procedure.

- Tighten to 15 Nm.



2. NOTE: Install a new EGR valve gasket.

Tighten to 10 Nm.

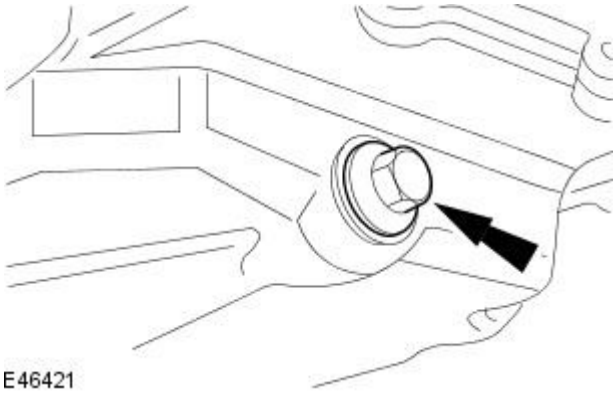
Published: 11-May-2011

Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Oil Pan

In-vehicle Repair

Removal

All vehicles

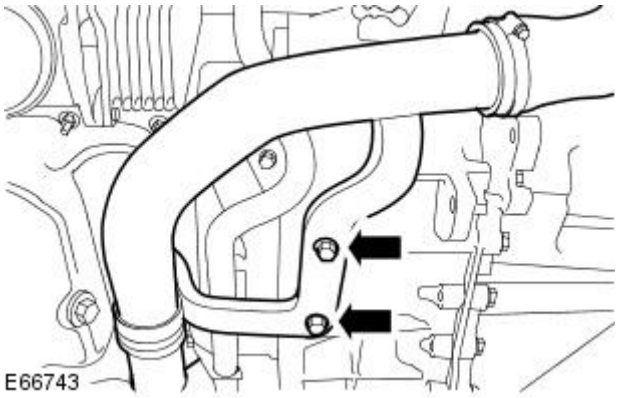


1. Remove the air deflector.
   For additional information, refer to: Air Deflector - 2.2L Diesel/2.0L Diesel (501-02 Front End Body Panels, Removal and Installation).
2. Drain the engine oil.
3. NOTE: Install a new drain plug seal.

   Install the drain plug.

   - Tighten to 23 Nm.

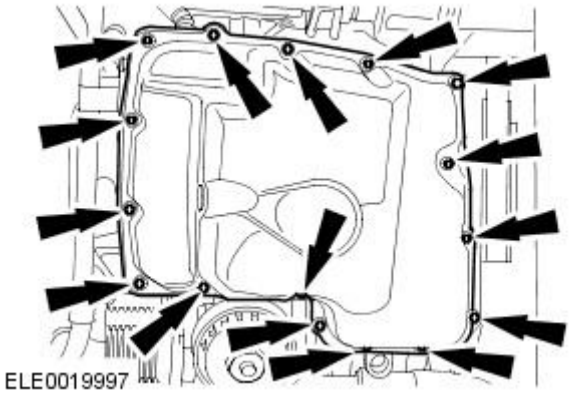
Vehicles with 2.2L diesel engine

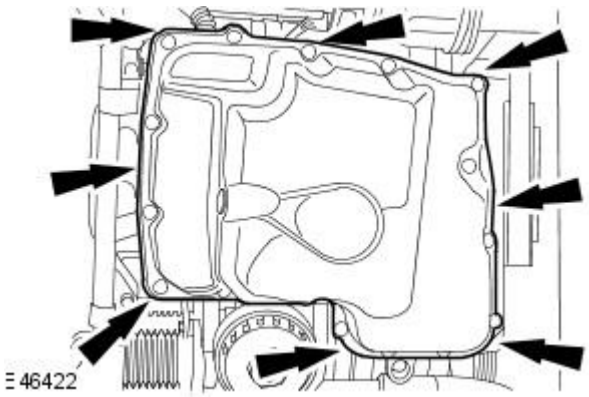


4. Remove the charge air cooler intake pipe retaining bolts.
   - Reposition the charge air cooler intake pipe for access.

All vehicles

5. Remove the oil pan retaining bolts.





6. CAUTIONS:

   A new oil pan must be installed. Failure to follow this instruction may cause damage to the vehicle.

   Avoid damage to the oil pan mating face of the engine. Failure to follow this instruction may cause damage to the vehicle.

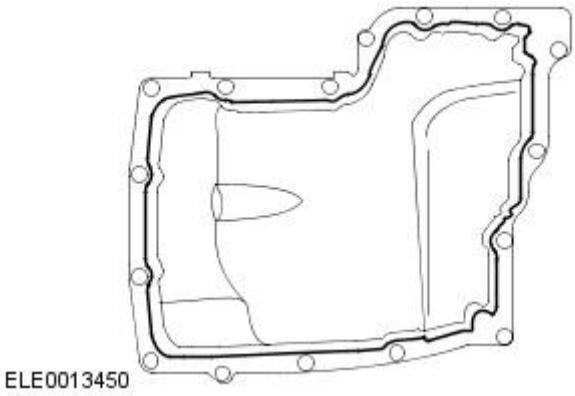
   • NOTE: Lubricate the suitable tool with clean engine oil.

   Using a suitable tool remove and discard the oil pan.

   - Insert the suitable tool between the oil pan and the engine, slide the suitable tool in between the engine and oil pan.

Installation

All vehicles


ELE0013450

1. CAUTION: Avoid damage to the oil pan mating face of the cylinder block. Failure to follow this instruction may cause damage to the vehicle.

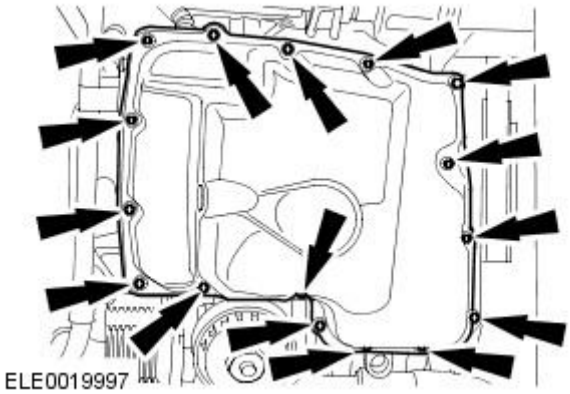
Clean the cylinder block mating faces.

2. CAUTIONS:

A new oil pan must be installed. Failure to follow this instruction may cause damage to the vehicle.

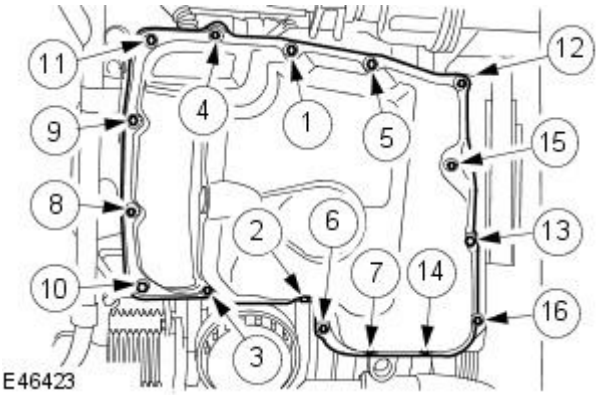
Install the oil pan within five minutes of applying the sealer. Failure to follow this instruction may cause damage to the vehicle.

Apply a 3 mm bead of sealer WSE-M4G323-A4 to the oil pan.


ELE0019997

3. NOTE: Do not fully tighten the oil pan retaining bolts at this stage.

Install the oil pan.

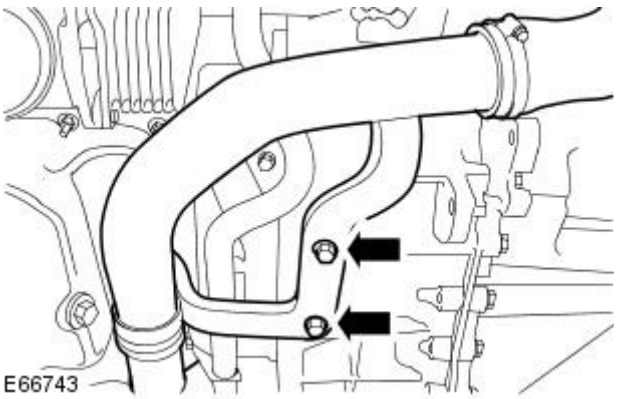


E46423

4. Tighten the oil pan retaining bolts.

- Tighten the bolts in the sequence shown in two stages.
- Stage 1: Tighten bolts 1 through 16 to 7 Nm.
- Stage 2: Tighten bolts 1 through 16 to 14 Nm.

Vehicles with 2.2L diesel engine


E66743

5. Reposition the charge air cooler pipe.

- Install the charge air cooler pipe retaining bolts.
- Tighten to 35 Nm.

All vehicles

6. Install the air deflector.

For additional information, refer to: Air Deflector - 2.2L Diesel/2.0L Diesel (501-02 Front End Body Panels, Removal and Installation).

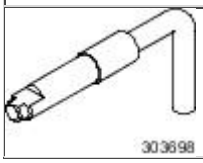
7. Lower the vehicle.

8. Fill the engine with engine oil.

Published: 11-May-2011

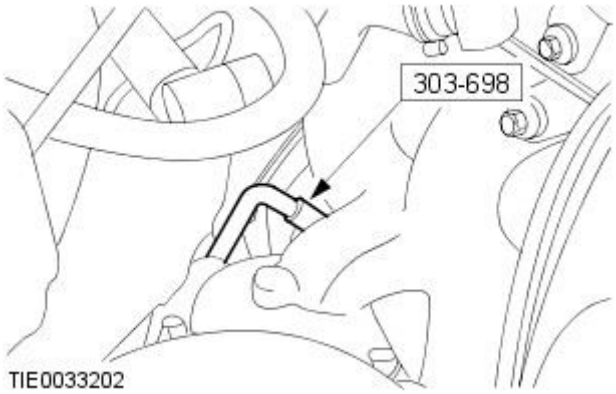
Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Timing Chain

In-vehicle Repair

Special Tool(s)	
 303698	Timing Tool, Crankshaft 303-698 (21-251)

Removal

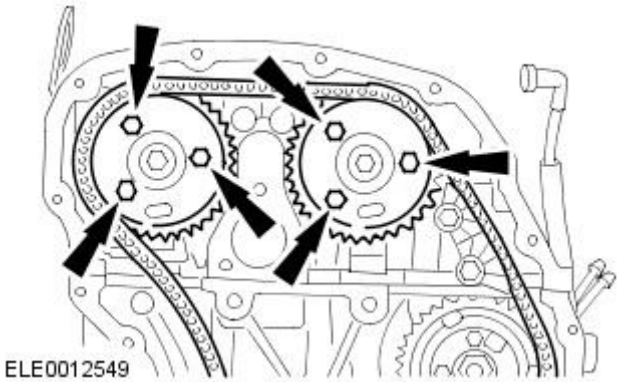
1. Remove the engine front cover.
   For additional information, refer to: Engine Front Cover (303-01B Engine - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, In-vehicle Repair).
2. Remove the air cleaner outlet pipe.
   For additional information, refer to: Air Cleaner Outlet Pipe (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
3. Remove the crankshaft position (CKP) sensor.
   For additional information, refer to: Crankshaft Position (CKP) Sensor (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).



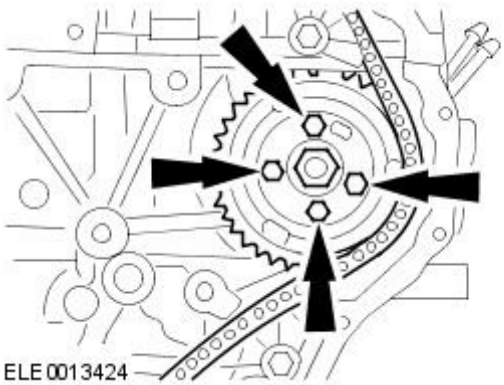
4. CAUTION: Do not turn the crankshaft when the special tool is fully located into the flywheel. Failure to follow this instruction will cause damage to the CKP sensor hole.

• NOTE: Make sure the crankshaft is only rotated in the normal direction of rotation.

Turn the crankshaft to 50 degrees before top dead center (BTDC) and insert the special tool through the CKP sensor hole.

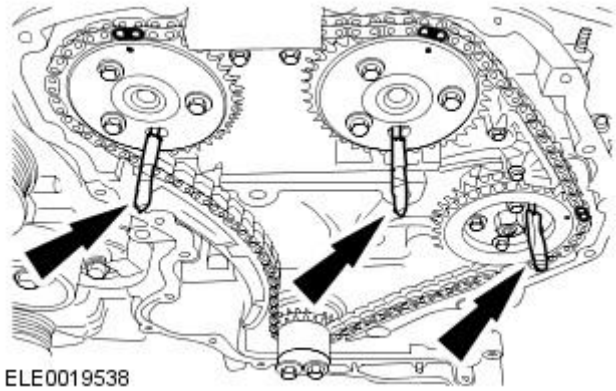


5. Loosen the camshaft sprocket retaining bolts.



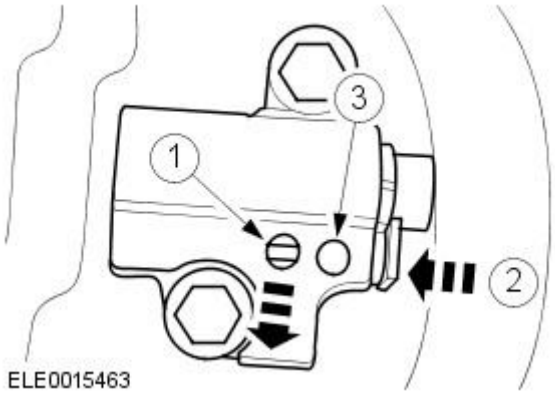
6. Loosen the fuel injection pump sprocket retaining bolts.

7. Using suitable 6 mm bar, lock the timing drive sprockets.


ELE0019538

8. Detension and lock the timing chain tensioner.

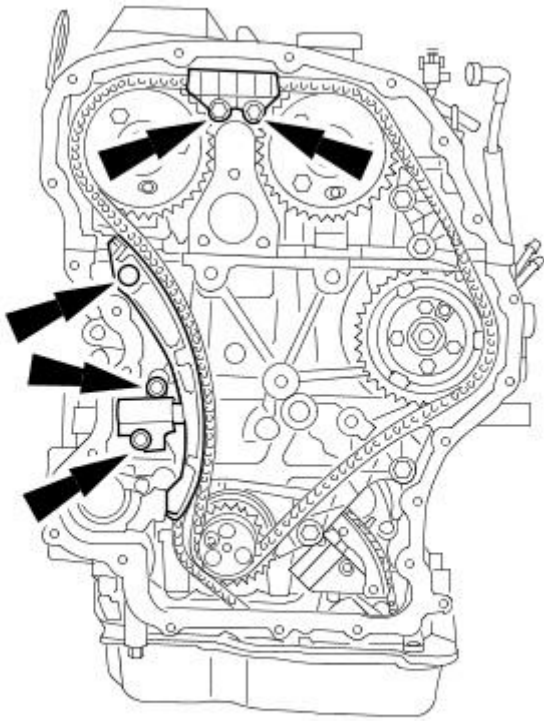
1. Retract the pawl.
2. Push the lock in.
3. Insert a pin.



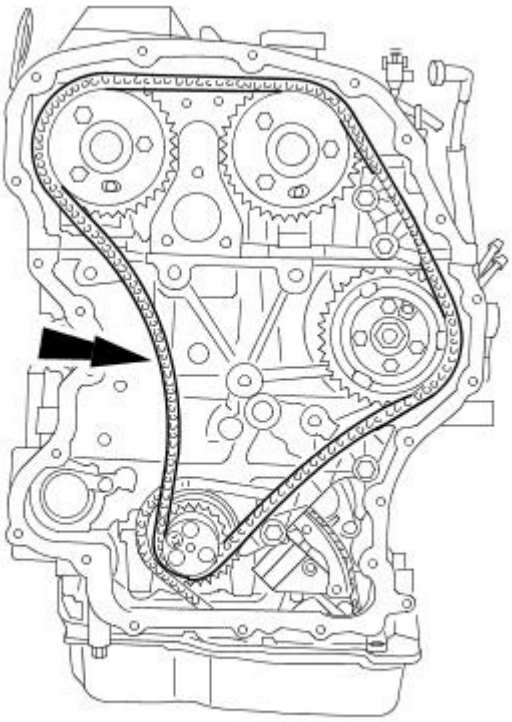
ELE0015463

9. NOTE: Engine removed for clarity.

Remove the timing chain tensioner and guides.

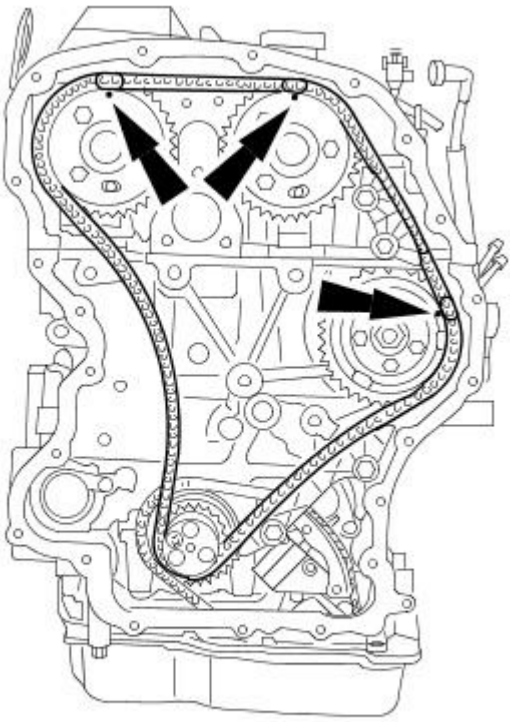


10. Remove the timing chain.



E46626

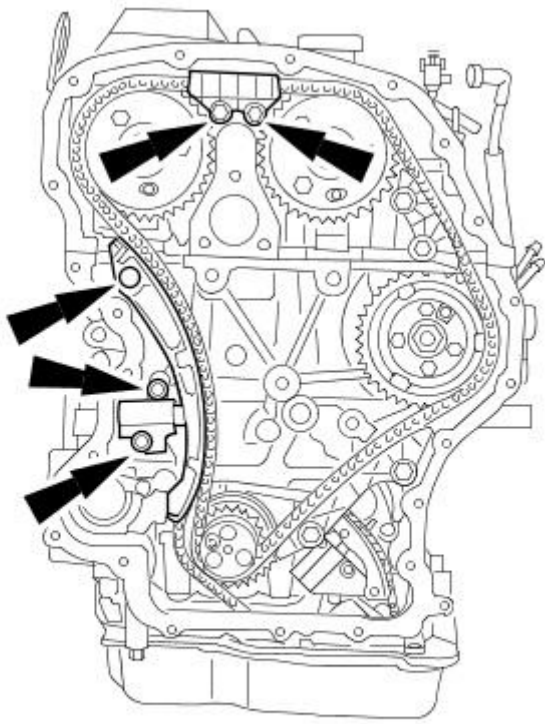
Installation



E46627

1. CAUTION: Make sure the colored links align to the timing marks. Failure to follow this instruction may result in damage to the vehicle.

Install the timing chain.

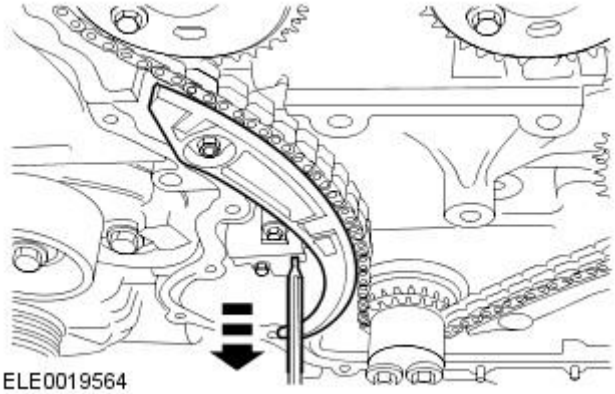


2. CAUTION: Make sure the timing chain tensioner is fully retracted before installation. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Engine removed for clarity.

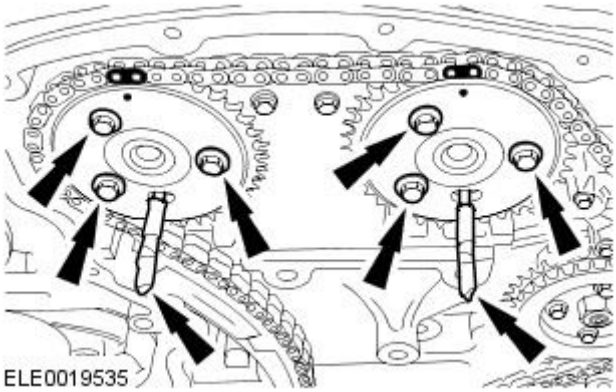
Install the timing chain tensioner and guides.

- Tighten to 15 Nm.



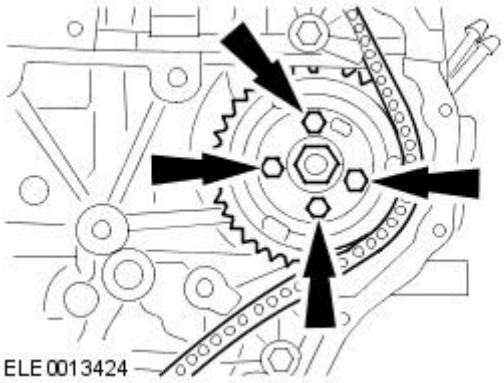
3. NOTE: Make sure the timing chain tensioner is completely released.

Unlock the timing chain tensioner.

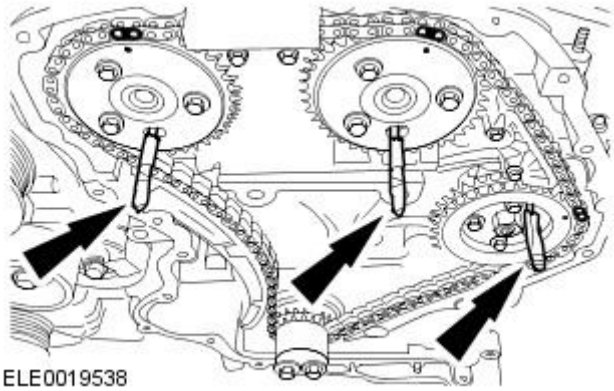


4. Tighten to 35 Nm.

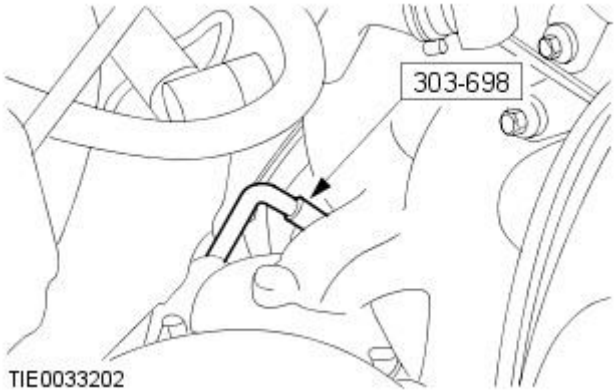
5. Tighten to 33 Nm.



6. Remove the suitable 6 mm bar.

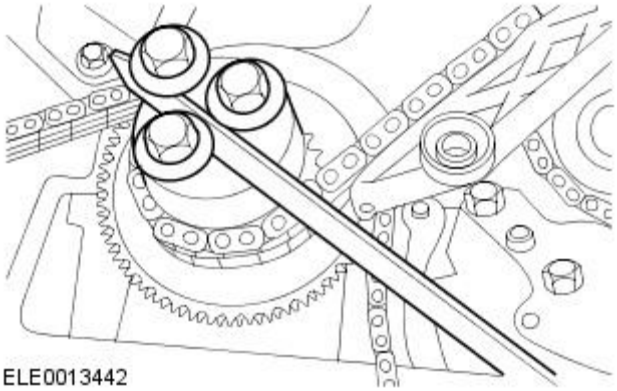


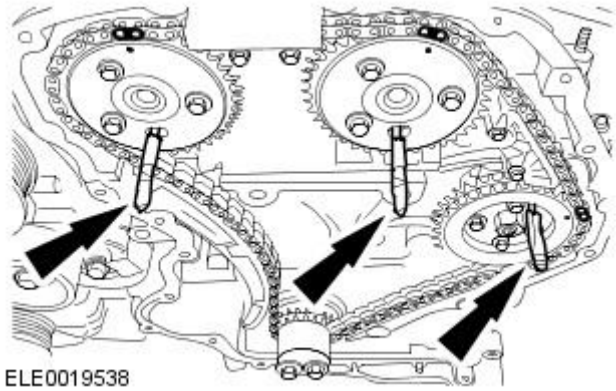
7. Remove the special tool from the crankshaft position (CKP) sensor hole.



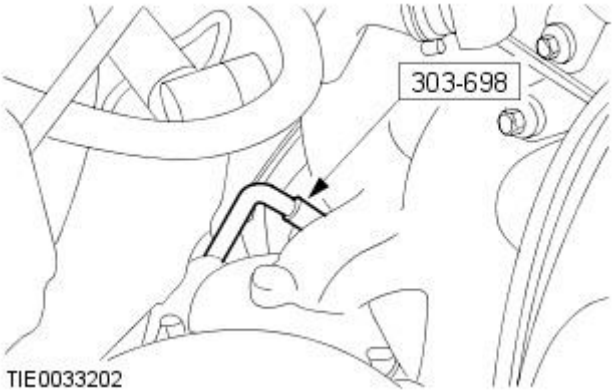
8. NOTE: Only turn the engine in the normal direction of rotation.

Using a suitable screwdriver, turn the engine clockwise two revolutions.




ELE0019538

9. Check the camshaft timing by inserting a suitable 6 mm bar through the holes in the camshaft and fuel injection pump sprockets.



TIE0033202

10. Check the timing by inserting the special tool in the CKP sensor hole.

11. Remove the special tool and the suitable 6 mm bar.

12. Install the CKP sensor.
For additional information, refer to: Crankshaft Position (CKP) Sensor (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

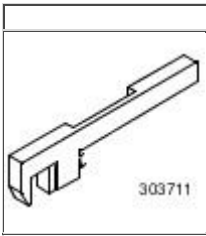
13. Install the air intake pipe.
For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

14. Install the engine front cover.
For additional information, refer to: Engine Front Cover (303-01B Engine - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, In-vehicle Repair).

Published: 11-May-2011

Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Valve Cover

In-vehicle Repair

Special Tool(s)	
	Aligner, Fuel Injector 303-711 (21-258)

General Equipment

Pneumatic vacuum gun

Materials

Name	Specification
High pressure fuel supply line union	TBD
lubricant TBD	

Removal

• WARNINGS:

Wait at least 15 minutes 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 mixtures 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 injection system with the engine running. The fuel pressure within the system can be as high as 1600 bar. Failure to follow this instruction may result in personal injury.

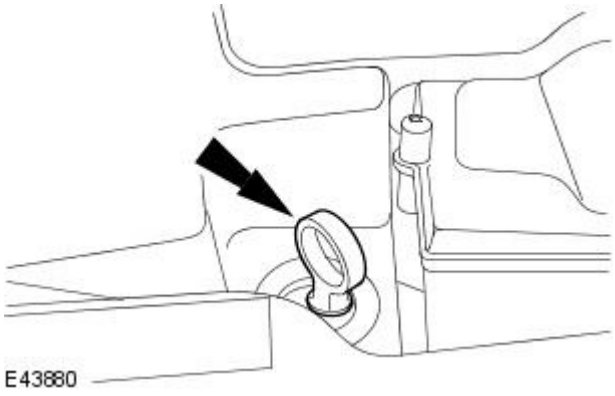
• CAUTIONS:

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.

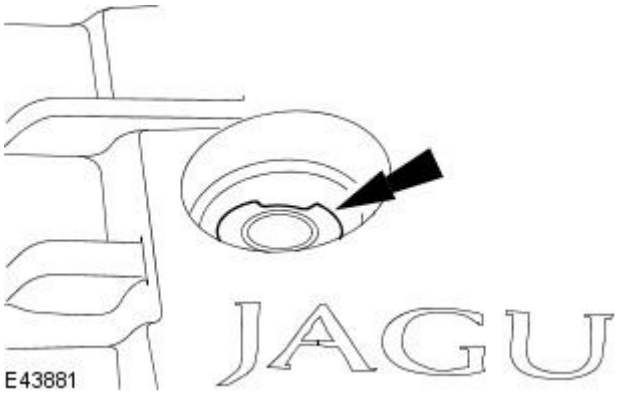
Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

Do not disassemble the fuel injectors or clean the nozzles, even with an ultrasonic cleaner. Always install new fuel injectors when required.



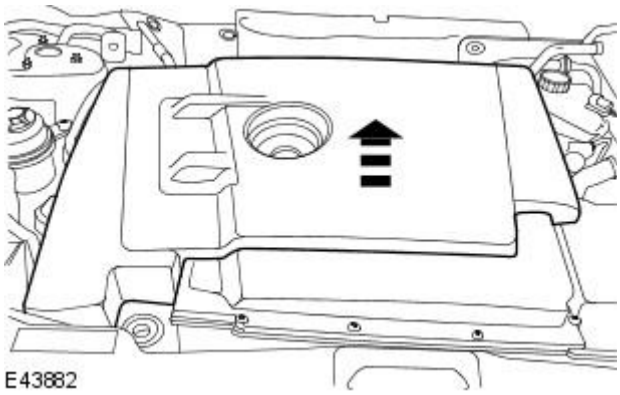
1. Remove the oil level indicator.

2. Remove the oil filler cap.



3. NOTE: Install the engine oil filler cap to prevent foreign material entering the valve cover.

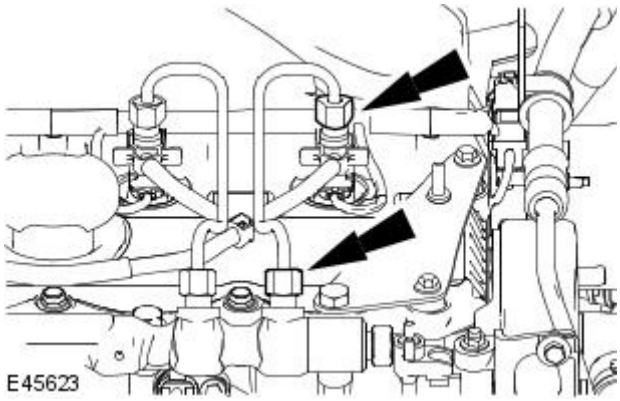
Remove the engine cover.



4. CAUTION: Protect the fuel injector electrical connectors with lint-free material to prevent contamination from the cleaning fluid.

Clean the fuel injector, high-pressure fuel supply line and surrounding areas.
For additional information, refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

5. CAUTIONS:



Make sure that 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 the tool used to loosen the high-pressure fuel supply line unions is used at the top of the unions as this is where there is most material. Failure to follow this instruction may result in damage to the unions.

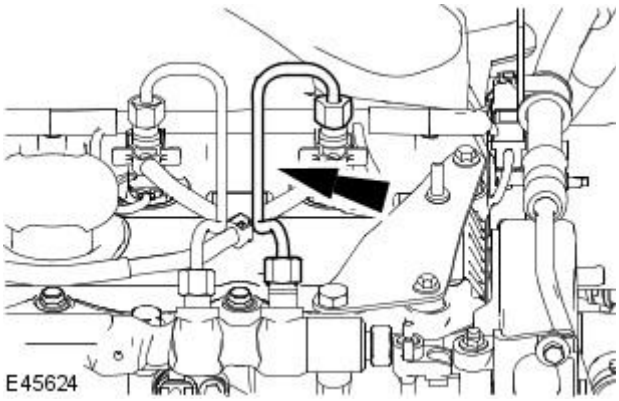
Make sure that the fuel injector does not move when loosening the high-pressure fuel supply lines. Failure to follow this instruction will result in damage to the fuel injector and the fuel injector sealing washer.

• NOTE: One pipe shown other pipes are similar.

Loosen the high-pressure fuel supply line from the fuel injector and fuel injection supply manifold.

6. CAUTION: Make sure that 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.

Using the pneumatic vacuum gun, vacuum foreign material from the high-pressure fuel supply line, the fuel injector and the fuel injection supply manifold.

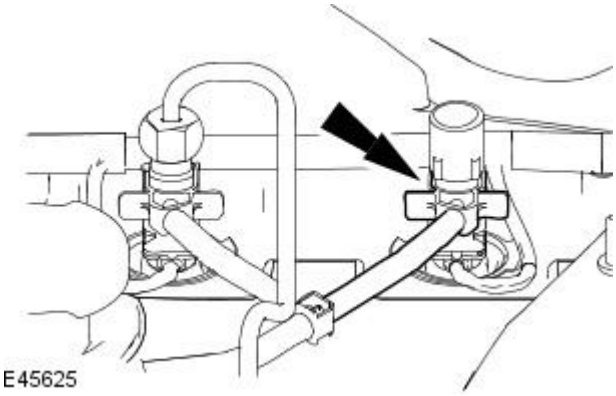


7. NOTE: One pipe shown other pipes are similar.

Remove and discard the high-pressure fuel supply line.

8. Using the pneumatic vacuum gun, vacuum foreign material from the fuel injector and the fuel injection supply manifold.

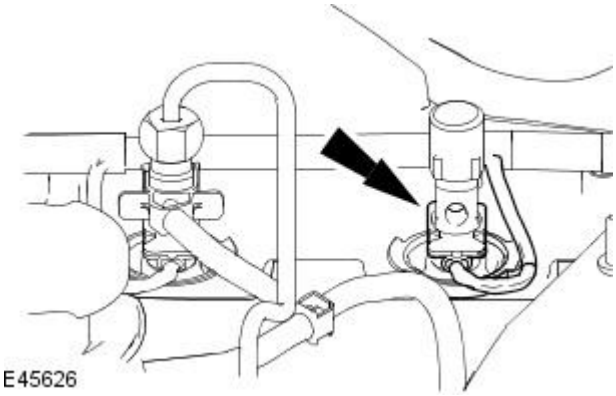
9. Install blanking caps to the open threaded ports on the fuel injector and the fuel injection supply manifold.



10. NOTE: One fuel return line shown other fuel return lines are similar.

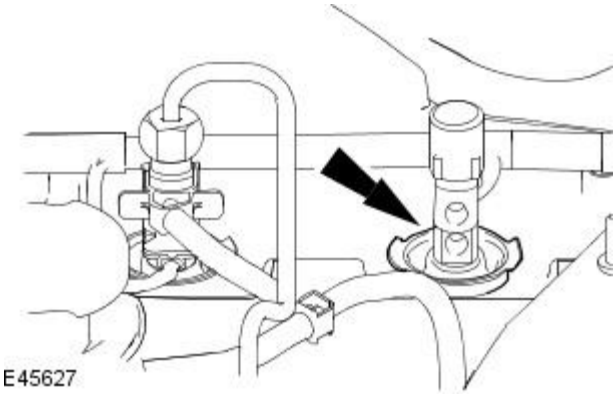
Disconnect the fuel return line from the fuel injector.

- Discard the fuel return line O-ring seal.



11. NOTE: One fuel injector electrical connector shown other fuel injector electrical connectors are similar.

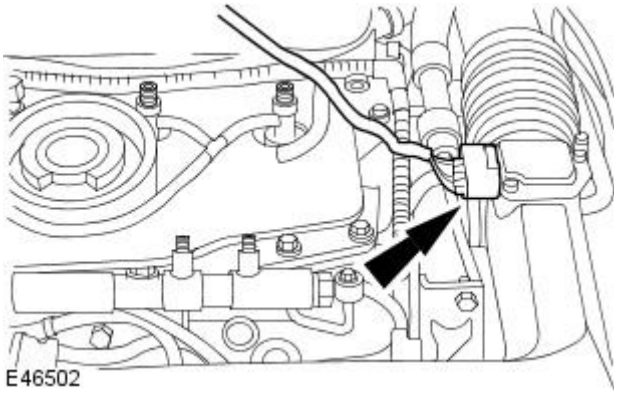
Disconnect the fuel injector electrical connector.



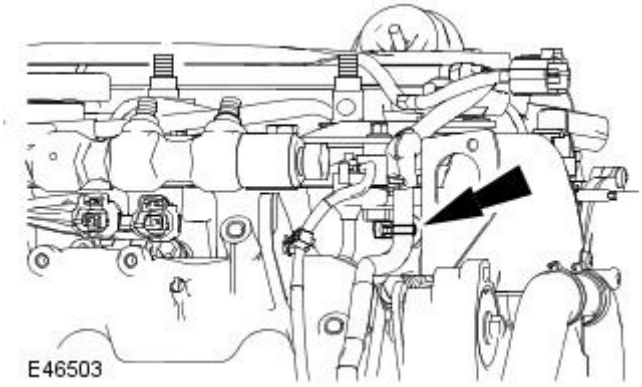
12. NOTE: One fuel injector shown other fuel injectors are similar.

Remove the valve cover fuel injector seal.

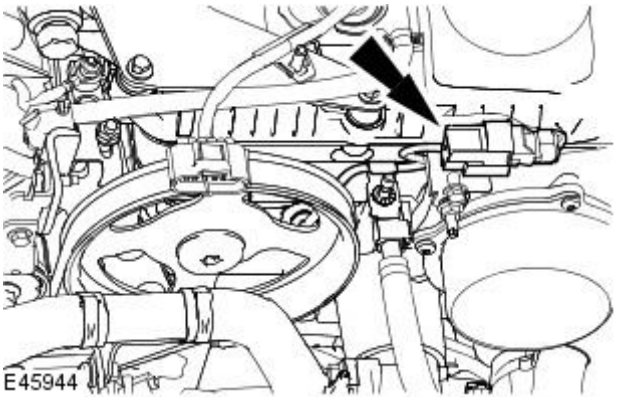
- Discard the valve cover fuel injector seal.



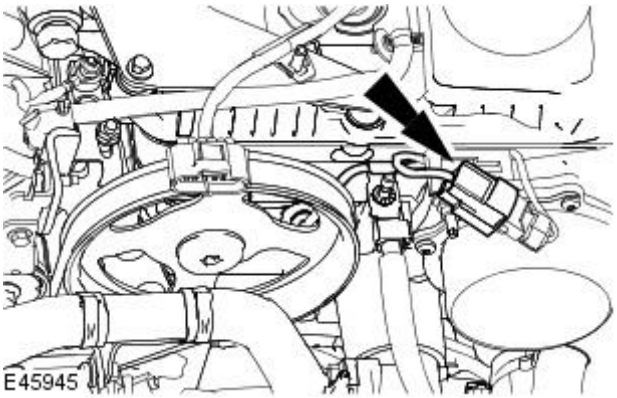
13. Disconnect the mass air flow (MAF) sensor electrical connector.



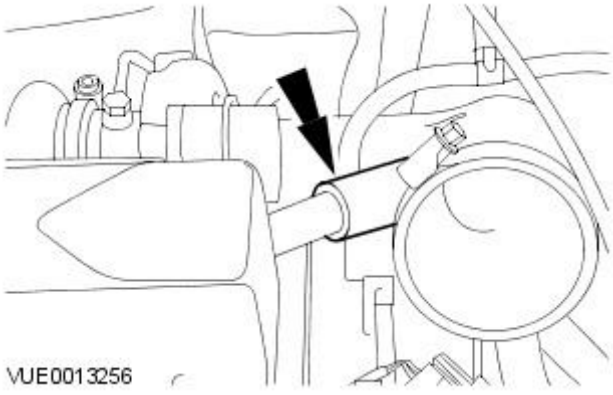
14. Detach the starter motor wiring harness.



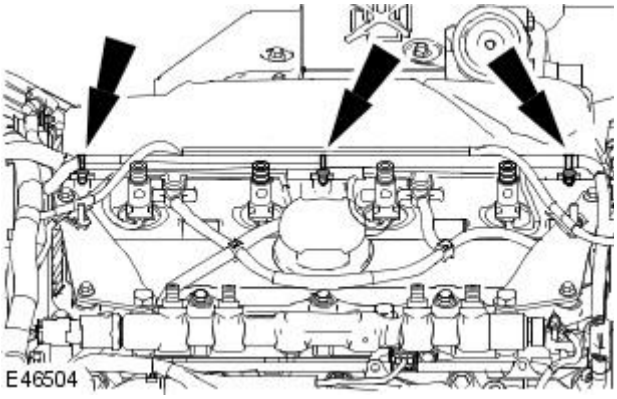
15. Detach the cylinder head temperature (CHT) sensor electrical connector.



16. Disconnect the CHT sensor electrical connector.

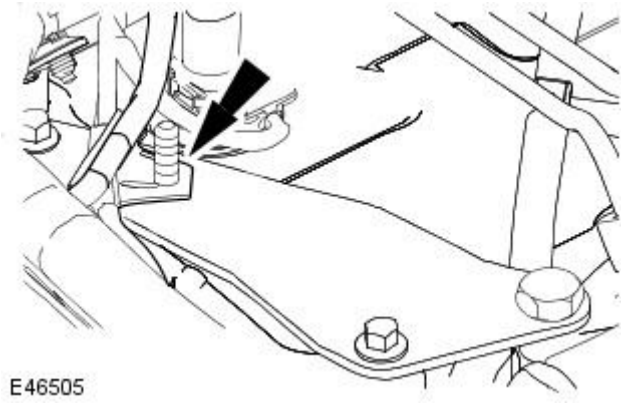


17. Disconnect the positive crankcase ventilation (PCV) hose from the valve cover.



18. Detach the starter motor and injector wiring harness.

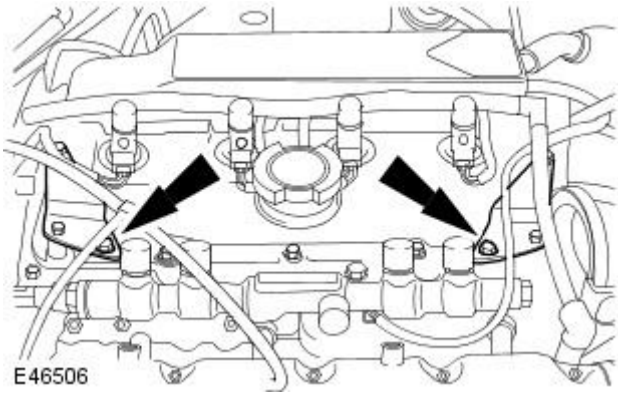
- Reposition and tie the wiring harness aside.



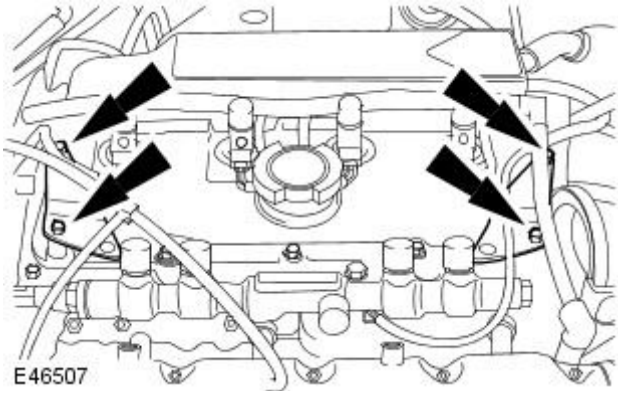
19. NOTE: Right-hand shown left-hand similar.

Detach the mass air flow (MAF) sensor wiring harness.

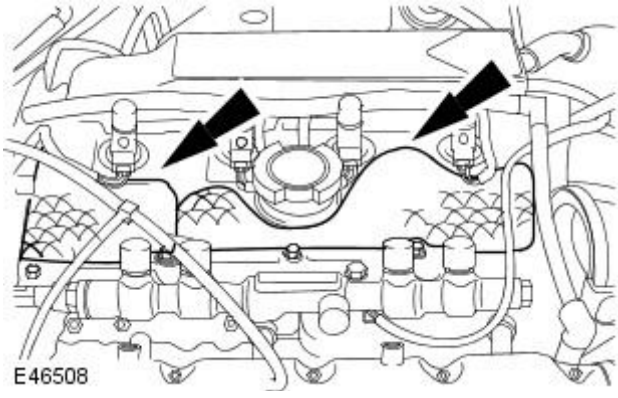
- Reposition and tie the wiring harness aside.



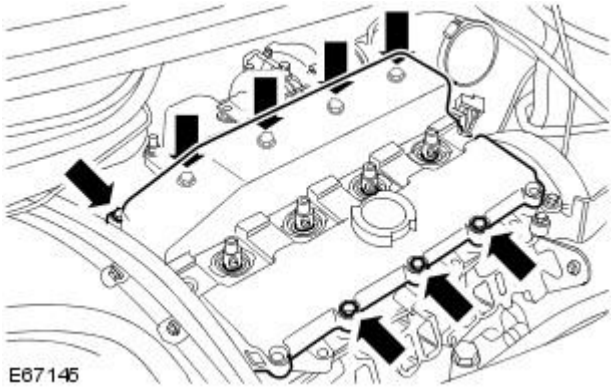
20. Remove the fuel injection supply manifold retaining bolts.



21. Remove the fuel injection supply manifold support brackets.



22. Remove the sound proof padding.



23. Remove the valve cover.

- Remove and discard the valve cover gasket.

Installation

• 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.

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.

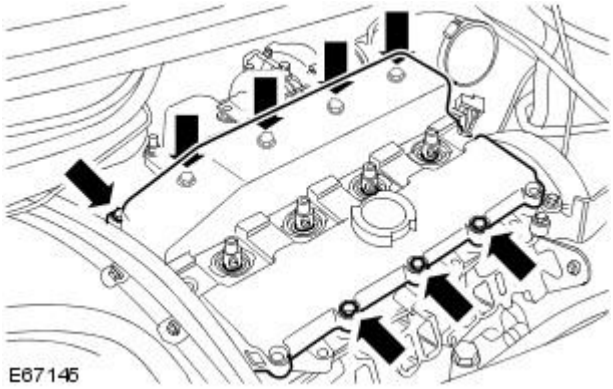
Do not disassemble the fuel injectors or clean the nozzles, even with an ultrasonic cleaner. Always install new fuel injectors when required.

• NOTE: Install new high-pressure fuel supply lines.

• NOTE: Install a new valve cover fuel injector seal.

• NOTE: Install a new injector nut O-ring seal (if equipped).

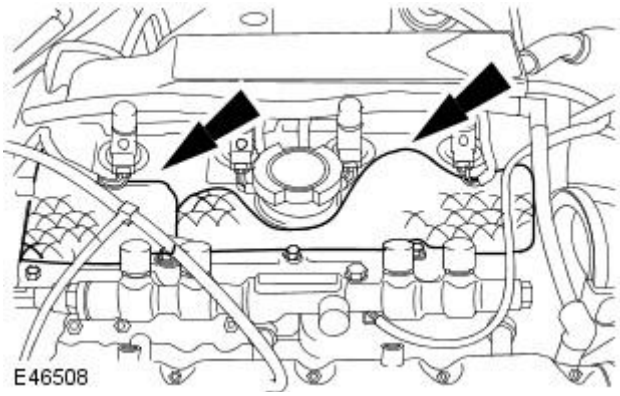
• NOTE: Install new fuel return line O-ring seals.



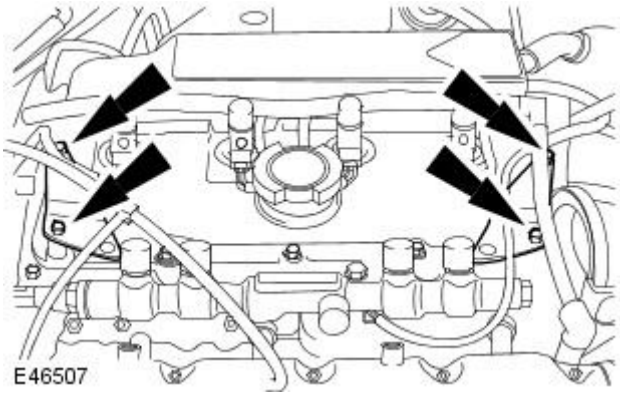
1. NOTE: Install a new valve cover gasket.

Install the valve cover.

- Tighten to 10 Nm.

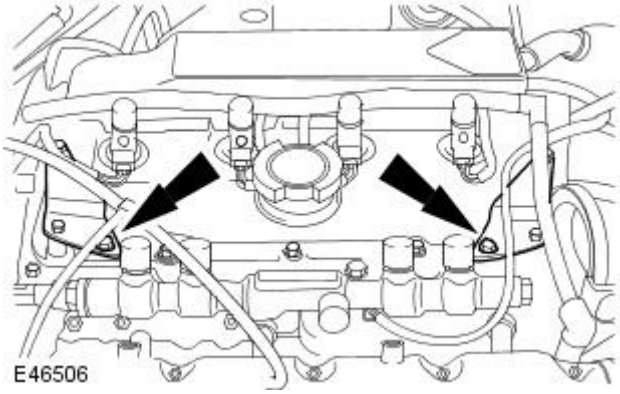


2. Install the sound proof padding.



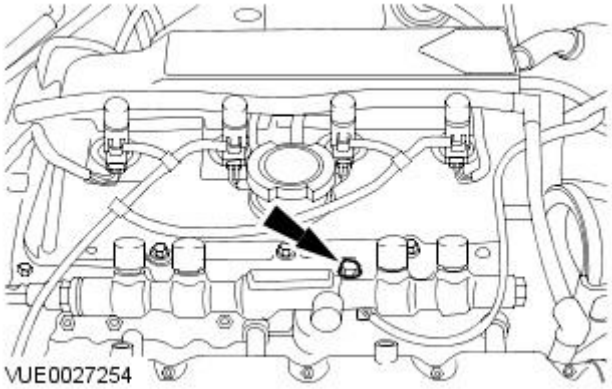
3. NOTE: Do not tighten the retaining bolts at this stage.

Install the fuel rail brackets.

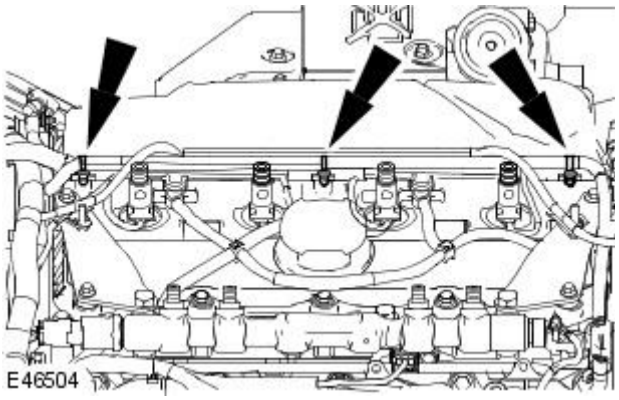


4. NOTE: Do not tighten the retaining bolts at this stage.

Install the fuel injection supply manifold retaining bolts.

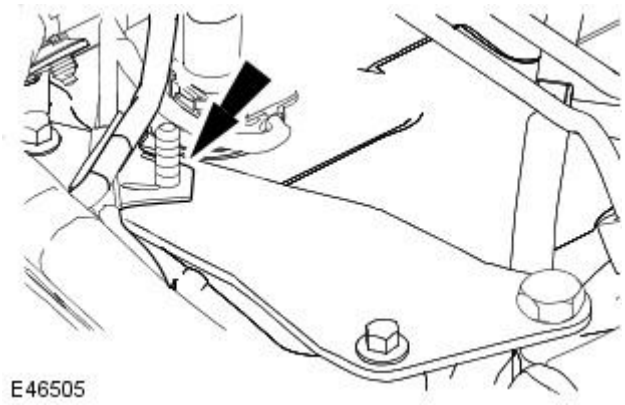


5. Loosen the fuel injection supply manifold retaining bolt.



6. NOTE: Remove the tie strap.

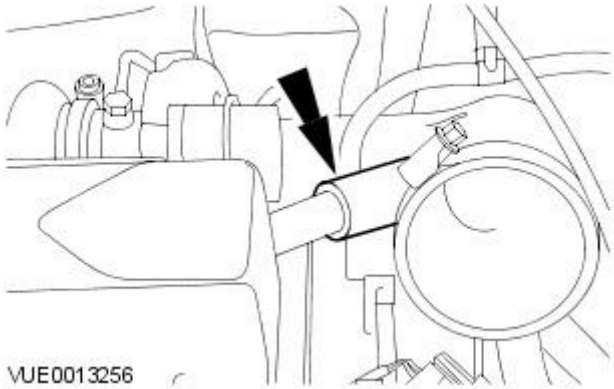
Attach the starter motor and injector wiring harness.



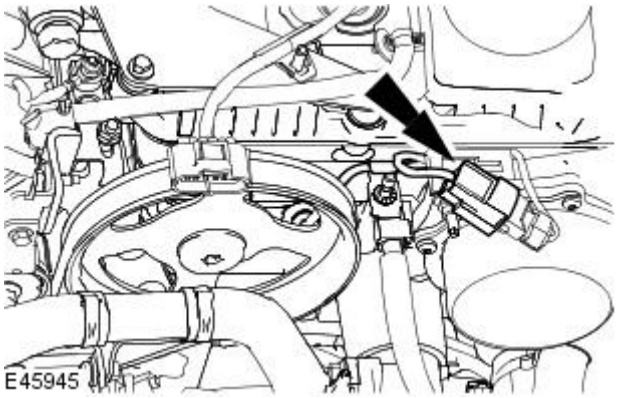
7. NOTE: Right-hand shown left-hand similar.

Attach the MAF sensor wiring harness.

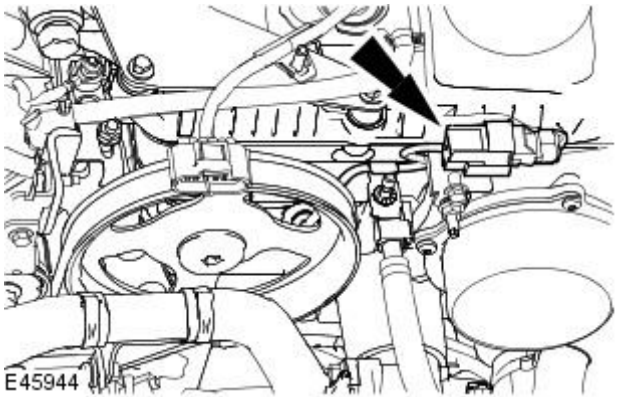
8. Connect the positive crankcase ventilation (PCV) hose to the valve cover.



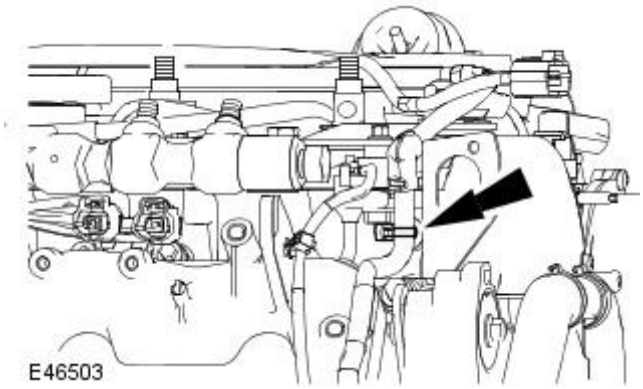
9. Connect the CHT sensor electrical connector.



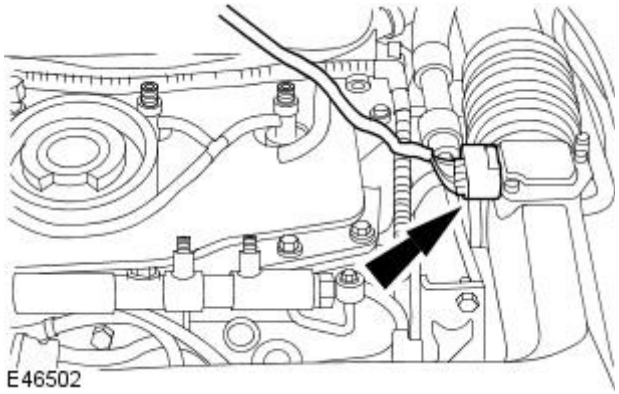
10. Attach the (CHT) sensor electrical connector.

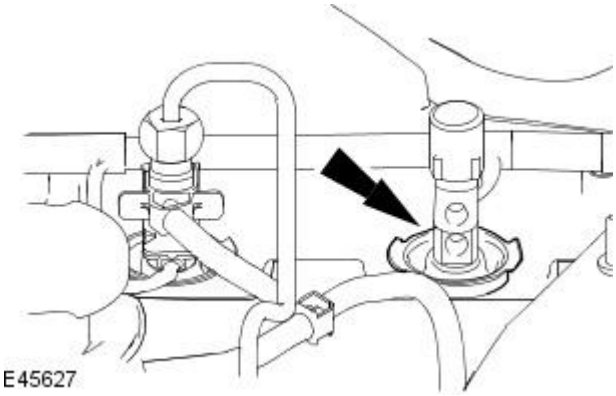


11. Attach the starter motor wiring harness.



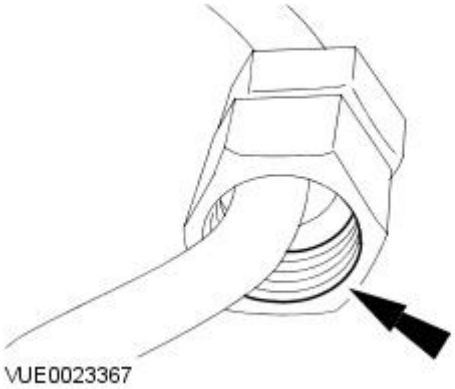
12. Connect the MAF sensor electrical connector.





13. NOTE: One fuel injector shown other fuel injectors are similar.

Install a new valve cover fuel injector seal.



14. Lubricate the high-pressure fuel supply line union threads with clean lubricant.

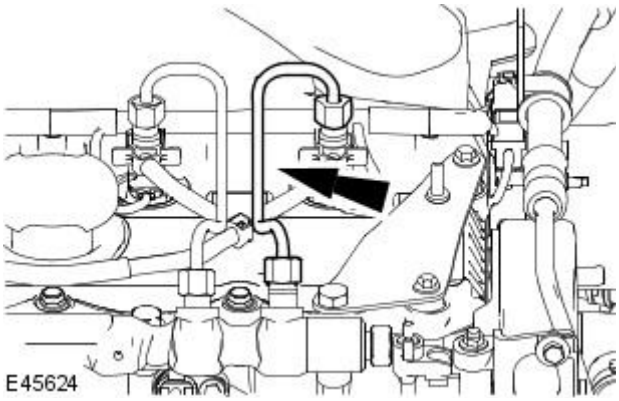
15. CAUTION: Do not allow the unions to hit the olive ends of the high-pressure fuel supply line as this may damage the ends of the line and allow foreign matter to enter the fuel injection system.

• NOTE: The yellow colored collar is fitted at the fuel injector end and the blue colored collar is fitted at the fuel supply manifold end of the high-pressure fuel supply line.

• NOTE: To aid identification of the high-pressure fuel supply line, the union at the fuel injector end is etched with the cylinder number.

Position the high-pressure fuel supply line as near to the final installation position as possible and then remove and discard the blanking plugs from the high-pressure fuel supply line.

16. Remove the blanking plug from the fuel injector and the fuel injection supply manifold threaded port.

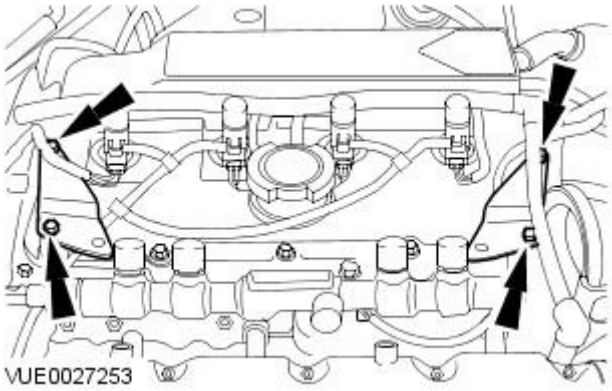


17. CAUTION: Maintain pressure on the high-pressure fuel supply line to keep the olives in contact with the fuel injectors and the fuel injection supply manifold cones while installing the unions.

• NOTE: Install the high-pressure fuel supply lines to the fuel injection supply manifold end first followed by the fuel injector end.

• NOTE: Do not tighten the high-pressure fuel supply line unions at this stage.

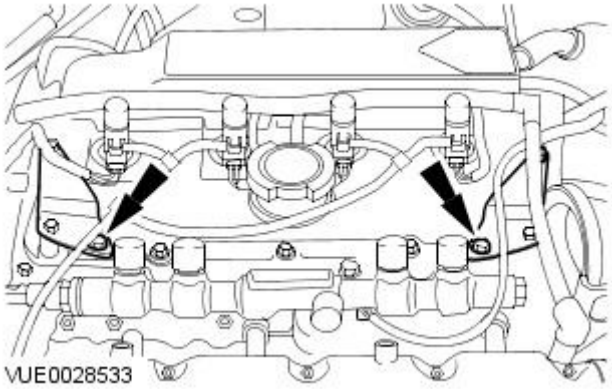
Install new high-pressure fuel supply lines.



18. NOTE: High pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold support brackets retaining bolts.

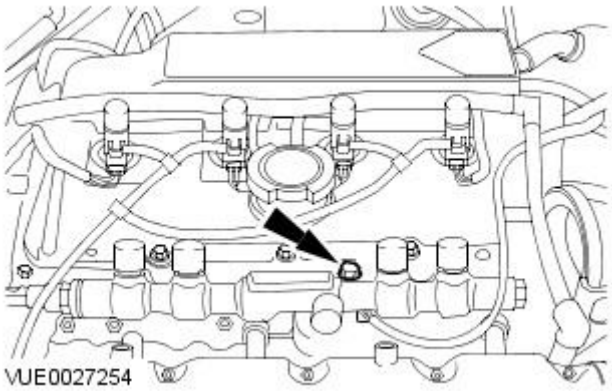
- Tighten to 14 Nm.



19. NOTE: High pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold retaining bolts.

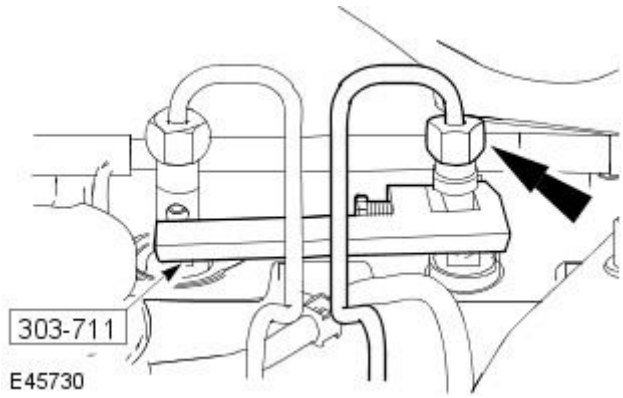
- Tighten to 23 Nm.



20. NOTE: High pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold retaining bolt.

- Tighten to 23 Nm.



21. CAUTIONS:

Make sure the special tool is clamped around the fuel injector which is being tightened and is resting up against the adjacent fuel injector.

Make sure the tool used to tighten the high-pressure fuel supply line unions is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

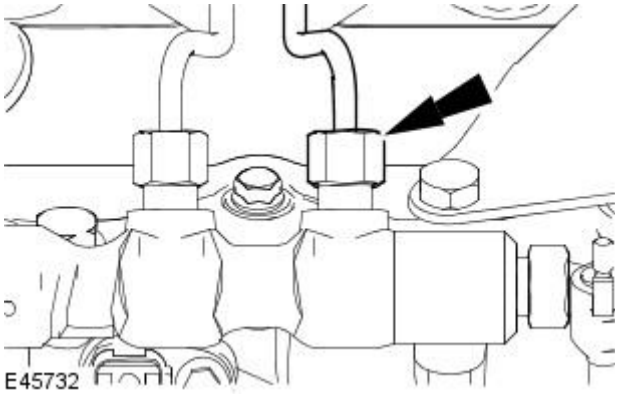
Make sure that the fuel injector does not move when tightening the high-pressure fuel supply lines. Failure to follow this instruction will result in damage to the fuel injector and the fuel injector sealing washer.

• NOTE: One fuel injector shown other fuel injectors are similar.

Install the special tool and tighten the high-pressure fuel supply line union at the fuel injector.

- Tighten to 40 Nm.

22. Remove the special tool.

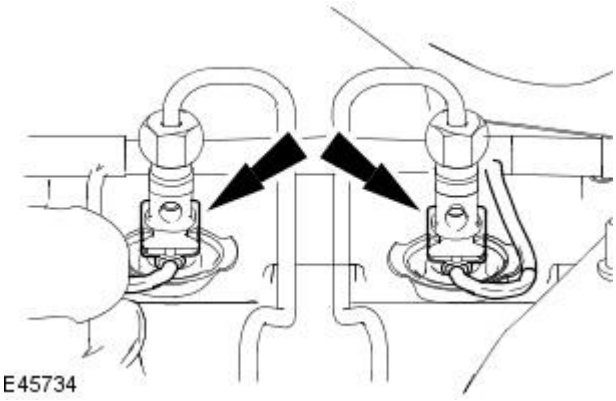


23. CAUTION: Make sure the tool used to tighten the high-pressure fuel supply line unions is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

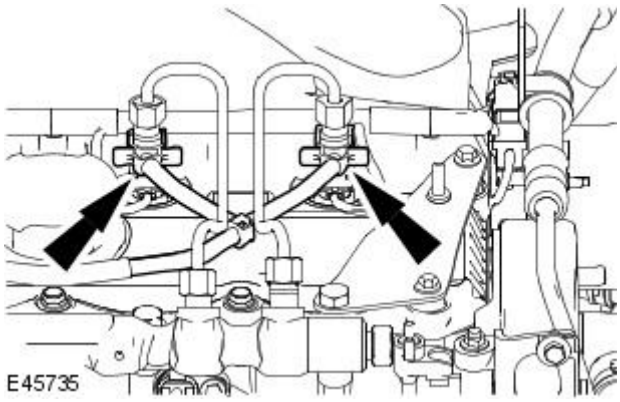
Tighten the high-pressure fuel supply line union at the fuel injection supply manifold.

- Tighten to 40 Nm.

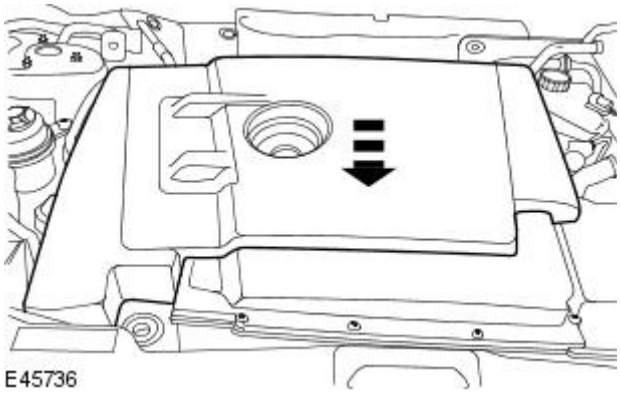
24. Connect the fuel injector electrical connectors.



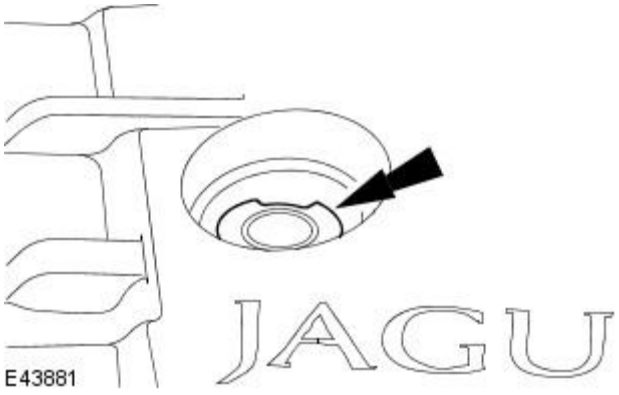
25. Connect the fuel return lines to the fuel injectors.



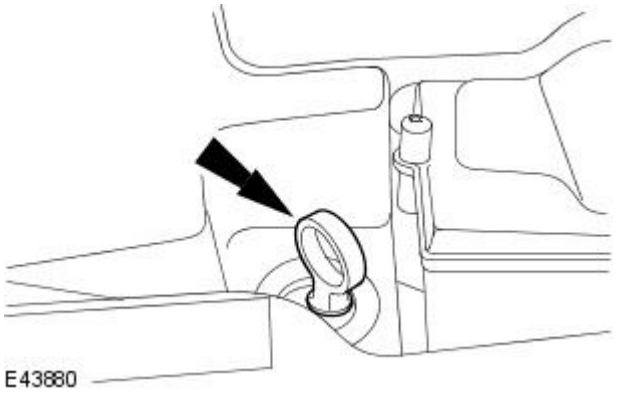
26. Install the engine cover.



27. Install the oil filler cap.

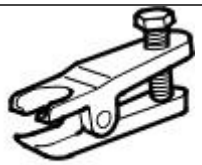
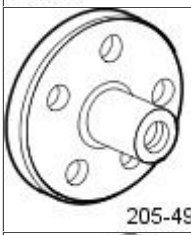
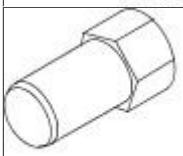
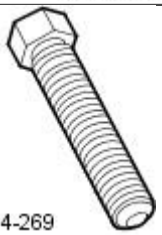
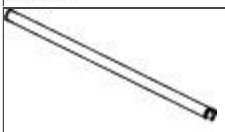
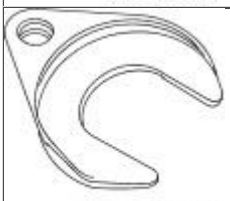


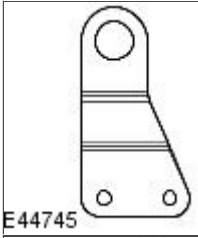
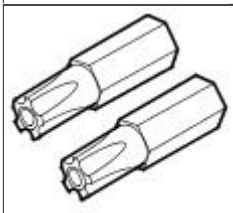
28. Install the oil level indicator.



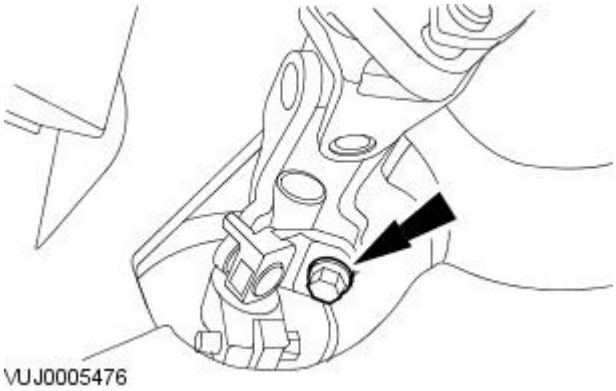
Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Engine2.0L Duratorq-TDCi

Removal

Special Tool(s)	
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)
 204-192	Ball joint splitter 204-192
 205-491	Wheel hub puller 205-491
 20549101	Adaptor nuts 205-491-01
 204-269	Forcing screw 204-269
 100012	Slide hammer 100-012
 100-012-02	Slide hammer shaft 100-012-02
 204-226	Halfshaft remover fork 204-226
 HTJ12002	Powertrain assembly jack HTJ1200-02

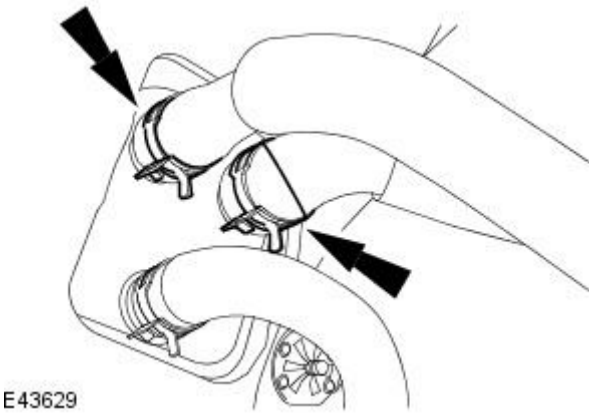
 E44745	Engine lifting eye 303-1067
 418-535	5 Point Security Torx Bit 418-535

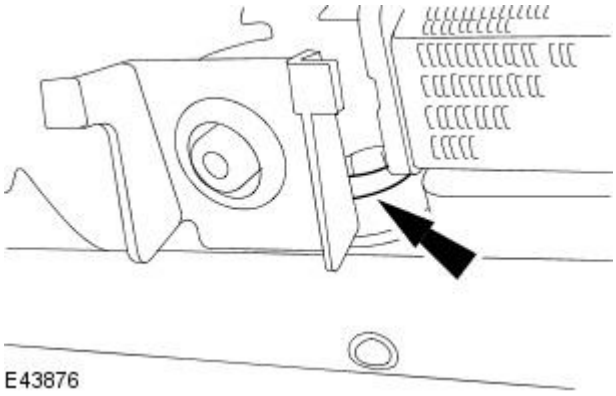
Removal


VUJ0005476

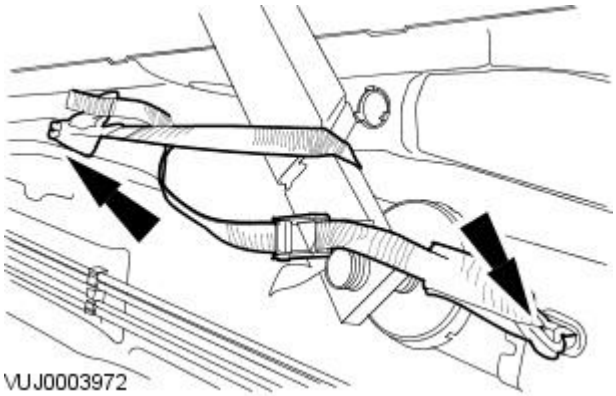
1. Detach the lower steering column shaft.

2. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
3. Recover the air conditioning refrigerant.
   For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
4. Drain the cooling system.
   For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
5. Remove the exhaust flexible pipe.
   For additional information, refer to: Exhaust Flexible Pipe - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (309-00 Exhaust System, Removal and Installation).
6. Disconnect the heater hoses from the heater core.


E43629



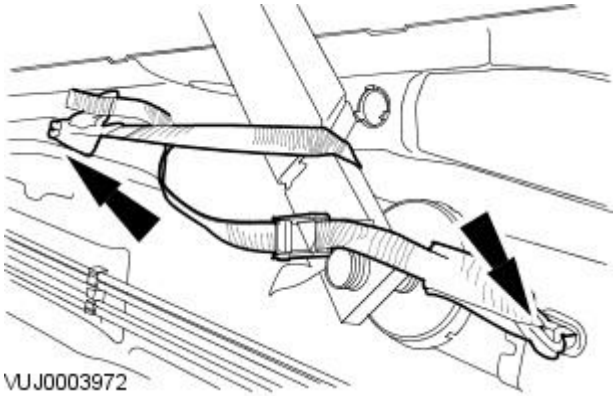
7. Disconnect the radiator lower coolant hose.



8. CAUTION: To prevent the vehicle becoming unstable when the engine and transmission assembly are removed, install the vehicle tie-down straps. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Right-hand shown, left-hand similar.

Install the front vehicle tie down straps.



9. CAUTION: To prevent the vehicle becoming unstable when the engine and transmission assembly are removed, install the vehicle tie-down straps. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Right-hand shown, left-hand similar.

Install the rear vehicle tie down straps.

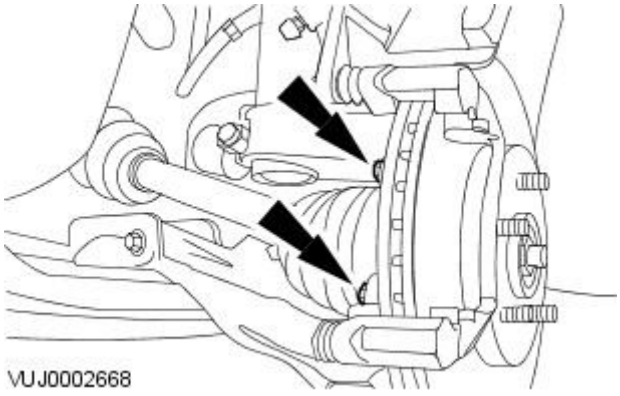
10. Lower the vehicle to a suitable working height.

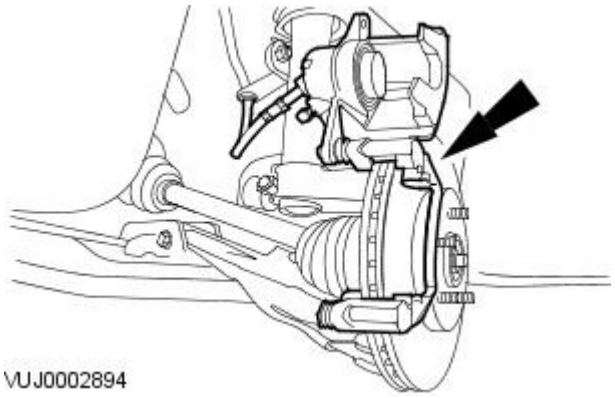
11. Remove the front wheels and tires.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

12. Remove the front brake pads.
For additional information, refer to: Brake Pads (206-03 Front Disc Brake, Removal and Installation).

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

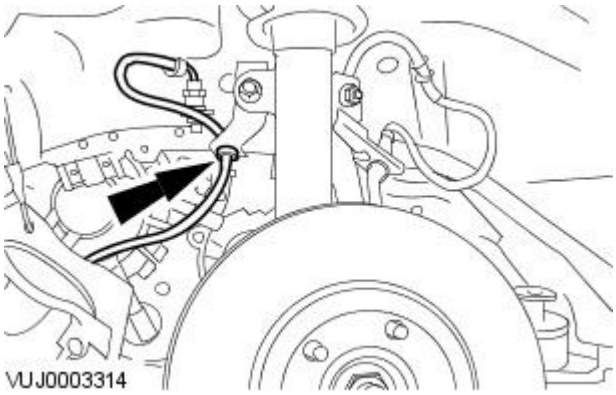
Remove and discard the brake caliper anchor plate retaining bolts.




VUJ0002894

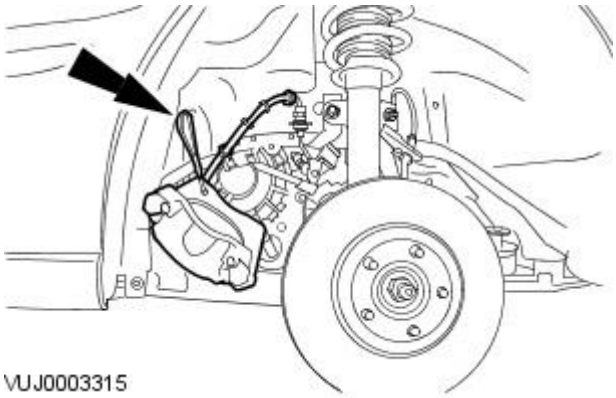
14. NOTE: Left-hand shown, right-hand similar.

Detach the brake caliper and brake caliper anchor plate assembly.


VUJ0003314

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

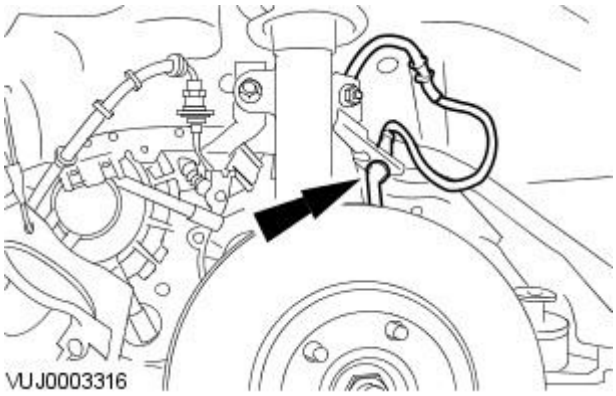
Detach the brake pipe.


VUJ0003315

16. CAUTION: Support the brake caliper assembly using tie straps. Failure to follow this instruction may result in damage to the vehicle.

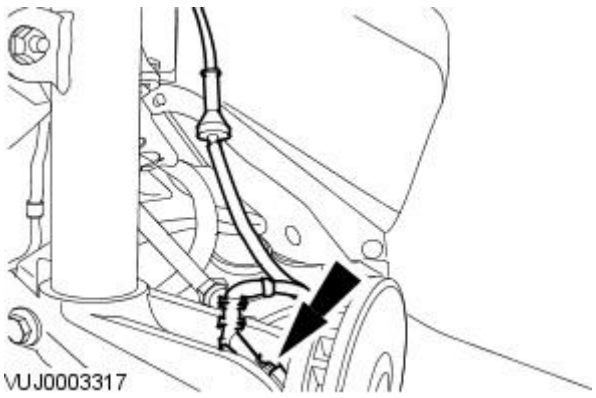
• NOTE: Left-hand shown, right-hand similar.

Reposition and attach the brake caliper assembly.


VUJ0003316

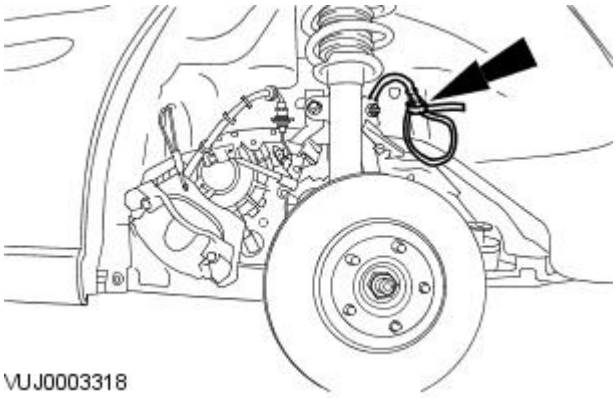
17. NOTE: Left-hand shown, right-hand similar.

Detach the anti-lock braking system (ABS) wheel speed sensor.


VUJ0003317

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

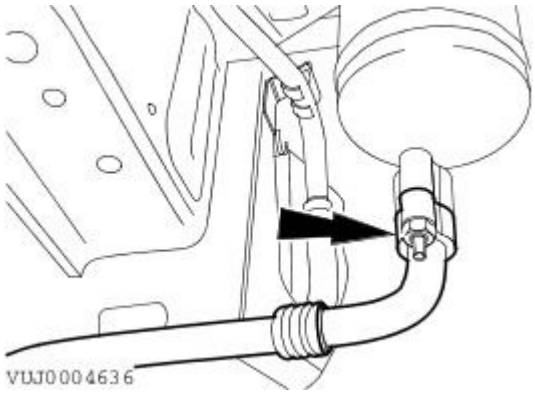
Disconnect the ABS wheel speed sensor.



19. CAUTION: Secure the ABS wheel speed sensor using tie straps. Failure to follow this instruction may result in damage to the vehicle.

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

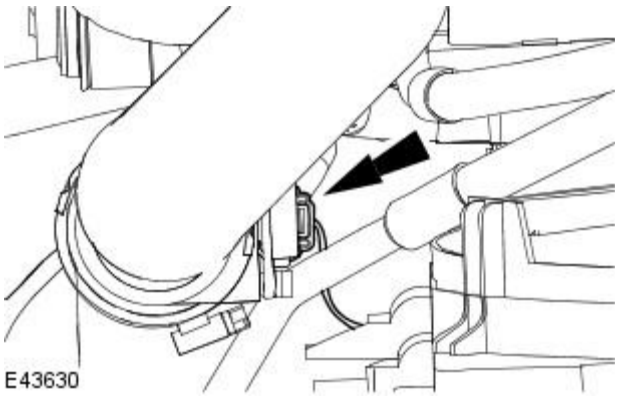
Reposition and attach the ABS wheel speed sensor.



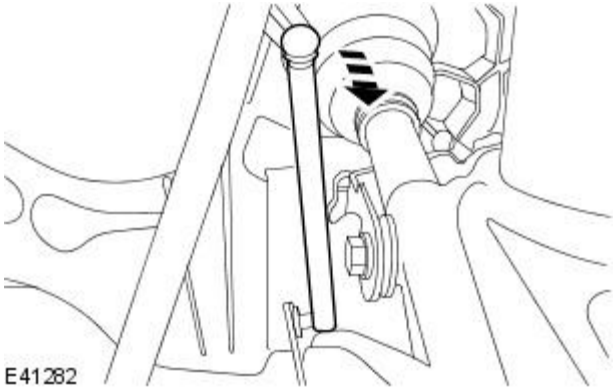
20. NOTE: Remove and discard the O-ring seal.

• NOTE: Cap the exposed ports.

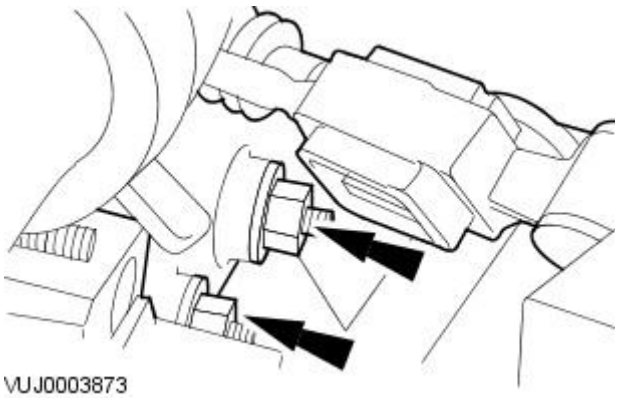
Disconnect the suction accumulator pipe.



21. Disconnect the air temperature sensor electrical connector.



22. Disconnect the high intensity discharge (H.I.D) sensor drop arm.

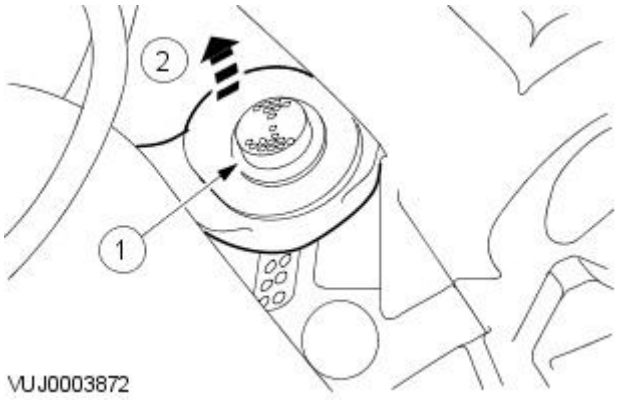


23. Detach the selector cables.

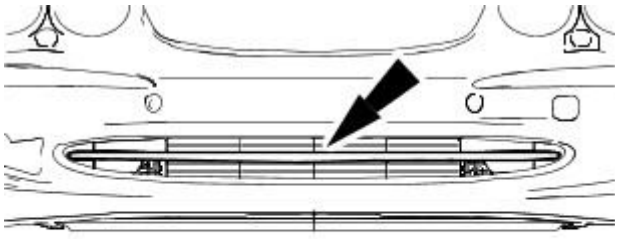
24. NOTE: Secure the selector cables using tie straps.

Detach the selector cables.

1. Press the retaining clip.
2. Detach the selector cables.

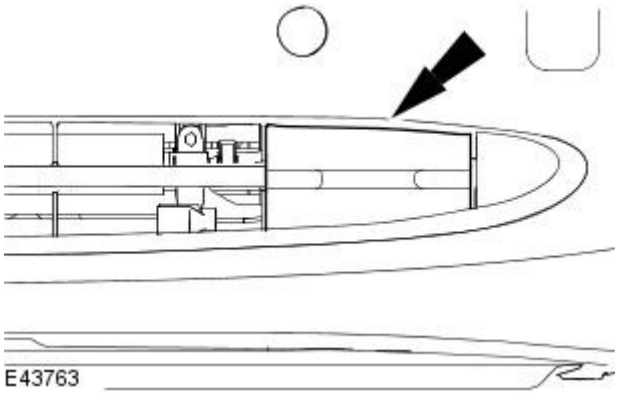


25. Remove the front bumper splitter vain.



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

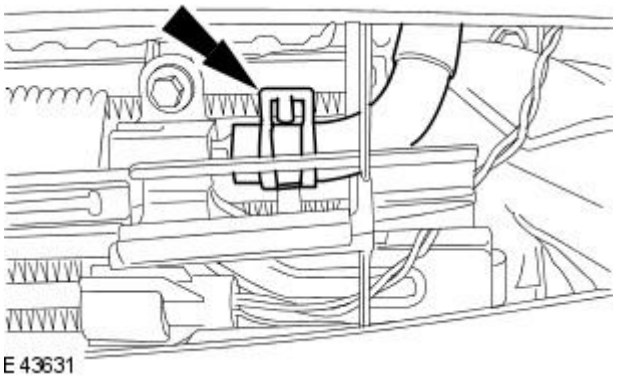
Remove the front bumper splitter vain finisher trims.



27. NOTE: Drain the fluid into a suitable container.

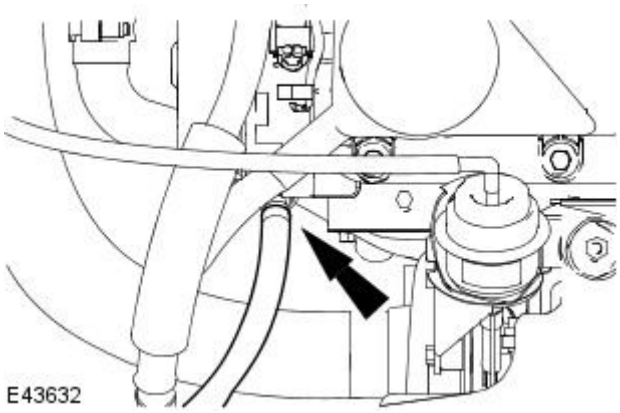
• NOTE: Cap the exposed ports.

Disconnect the power assisted steering hose.

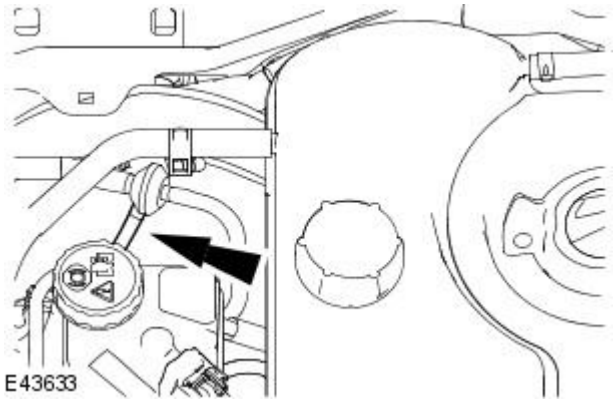


28. Lower the vehicle to a suitable working height.

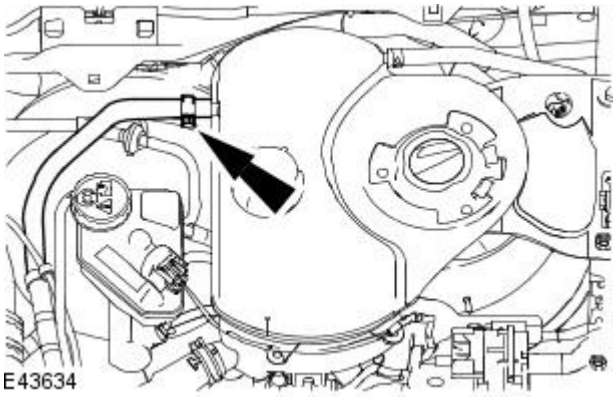
29. Disconnect the brake vacuum pump vacuum hose.



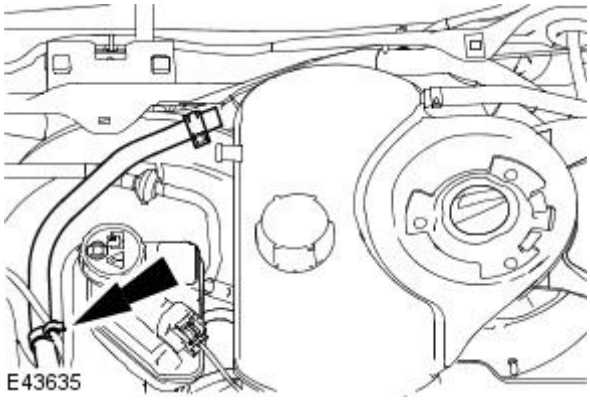
30. Disconnect the exhaust gas recirculation (E.G.R) valve module vacuum hose.



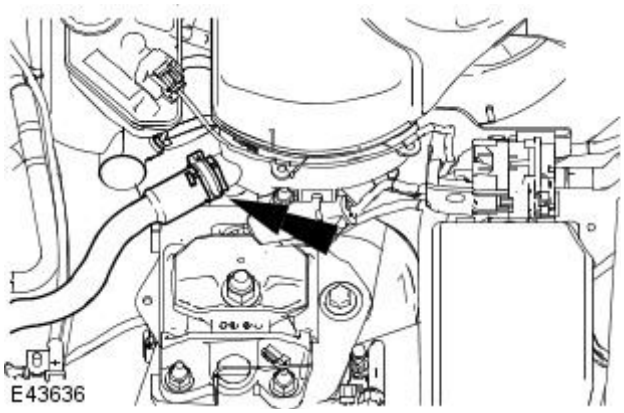
31. Disconnect the expansion tank vent hose.

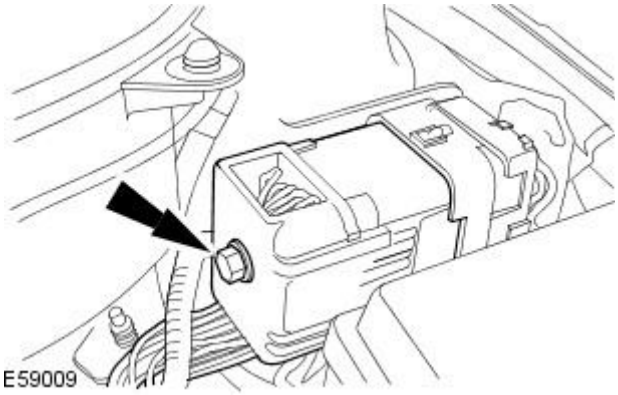


32. Detach the cooling system hose.



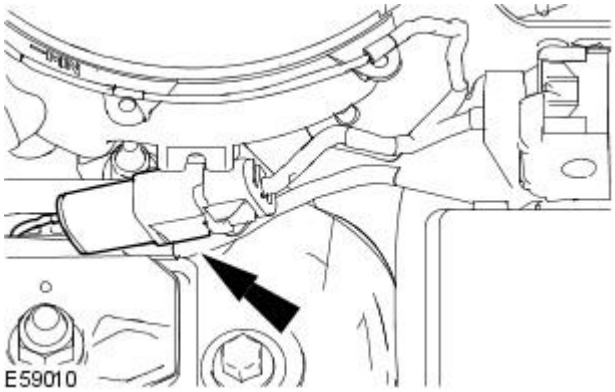
33. Disconnect the expansion tank outlet hose.



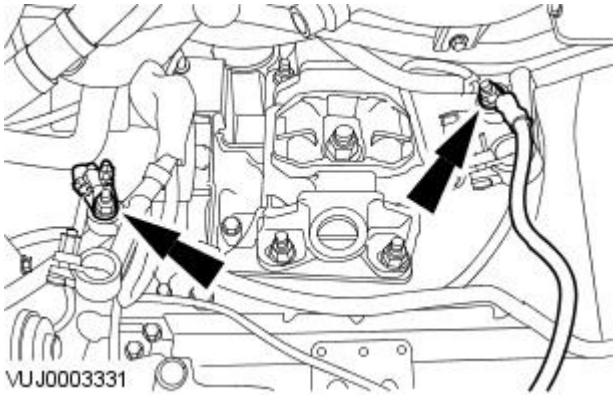


34. NOTE: The retaining bolt remains captive in the electrical connector.

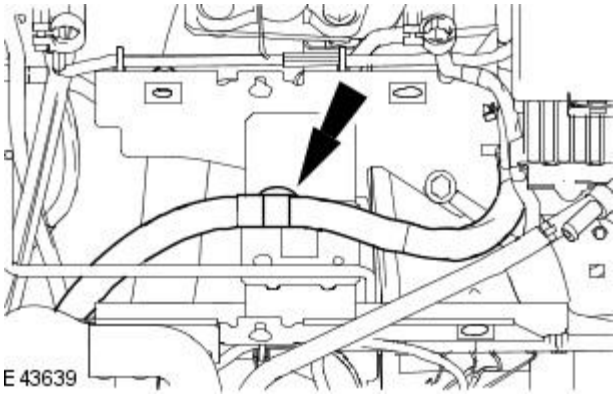
Disconnect the engine harness electrical connector.



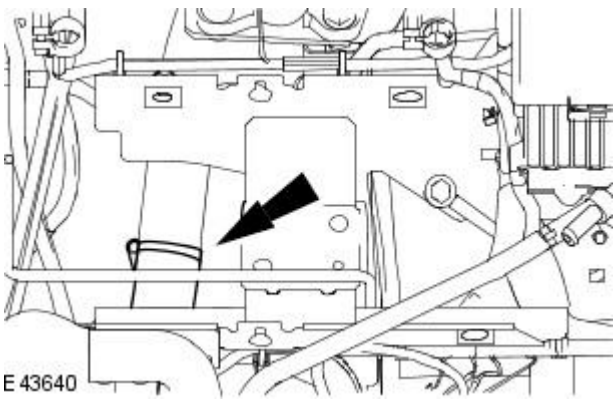
35. Disconnect the glow plug harness electrical connector.



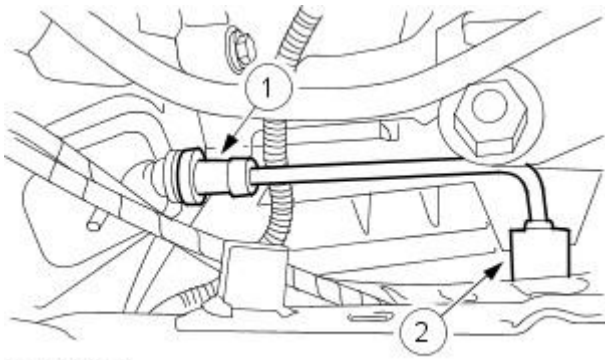
36. Disconnect the battery cables.



37. Detach the wiring harness from the battery tray mount.



38. Disconnect the charge air cooler hose.



VUJ0003874

39. CAUTION: If fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water. Failure to follow this instruction may result in damage to the vehicle.

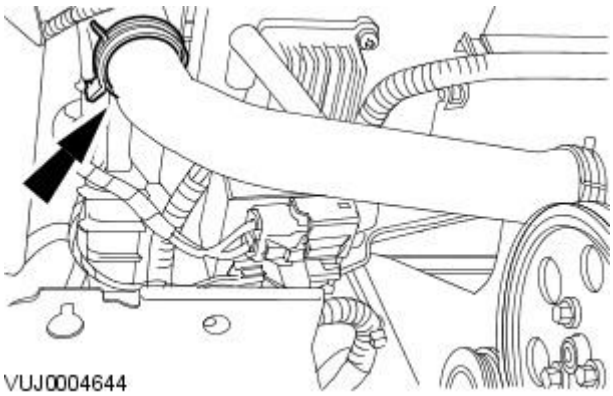
• NOTE: Drain the fluid into a suitable container.

• NOTE: Cap the exposed ports.

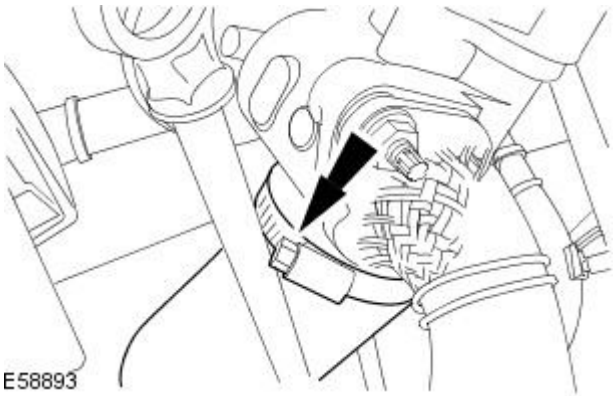
• NOTE: Secure the clutch slave cylinder pipe using tie strap.

Disconnect the clutch slave cylinder pipe and secure to one side.

1. Detach the clutch slave cylinder pipe from the slave cylinder.
2. Disconnect the clutch slave cylinder pipe and secure to one side.

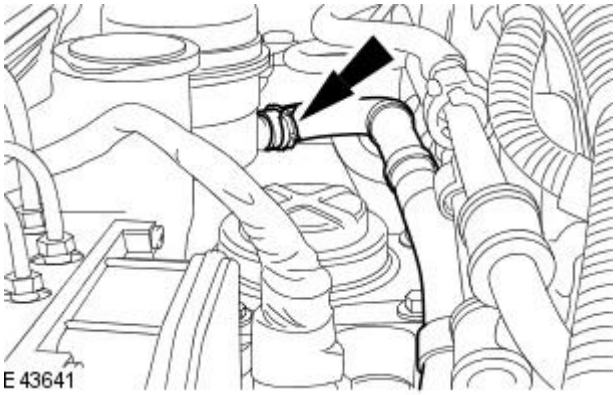

VUJ0004644

40. Disconnect the radiator upper coolant hose.


E58893

41. Disconnect the charge air cooler hose.

42. Remove the exhaust manifold to E.G.R valve tube.
For additional information, refer to: Exhaust Gas Recirculation (EGR) Cooler to EGR Valve Tube (303-08 Engine Emission Control - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

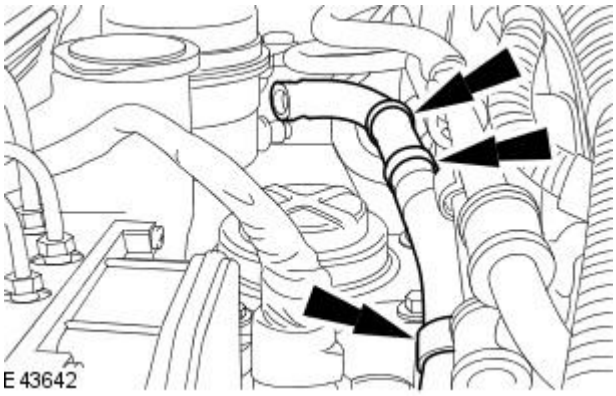

E43641

43. NOTE: Place suitable absorbent material below the fluid reservoir to absorb fluid spillage.

• NOTE: Cap the exposed ports.

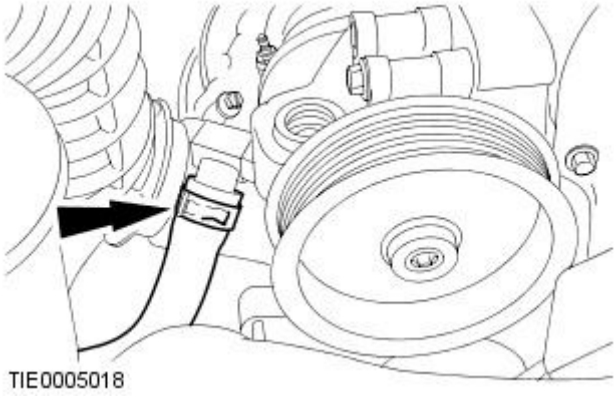
Disconnect the power assisted steering hose.

44. Detach the power assisted steering hose.



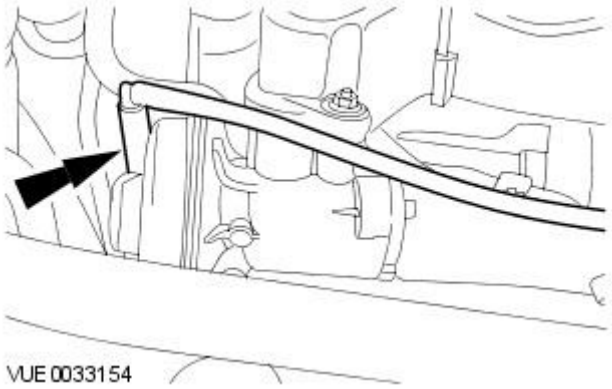
45. NOTE: Cap the exposed ports.

Disconnect the power assisted steering hose.

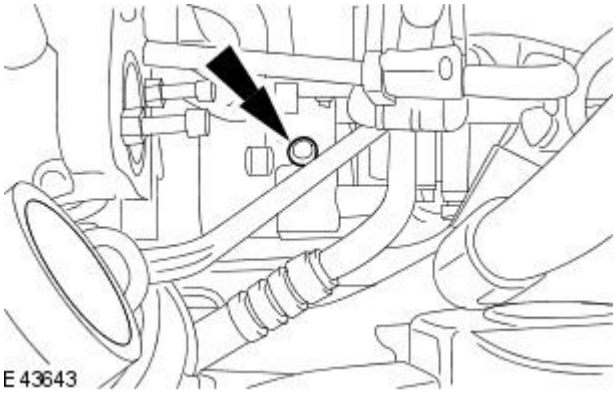


46. NOTE: Cap the exposed ports.

Disconnect the E.G.R valve vacuum pipe.



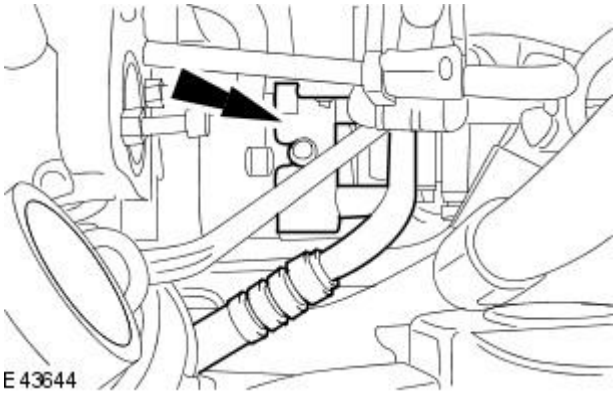
47. Loosen the air conditioning compressor line retaining bolt.

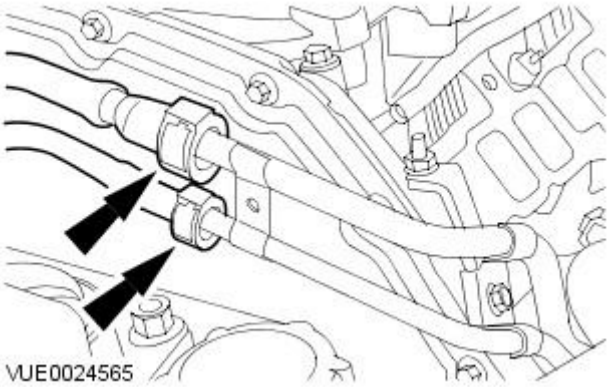


48. NOTE: Remove and discard the O-ring seals.

- NOTE: Cap the exposed ports.

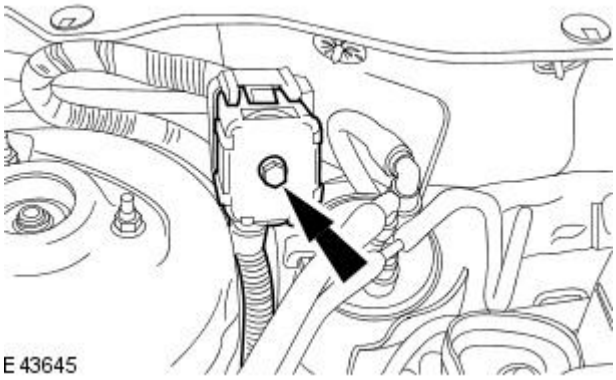
Disconnect the air conditioning compressor lines.



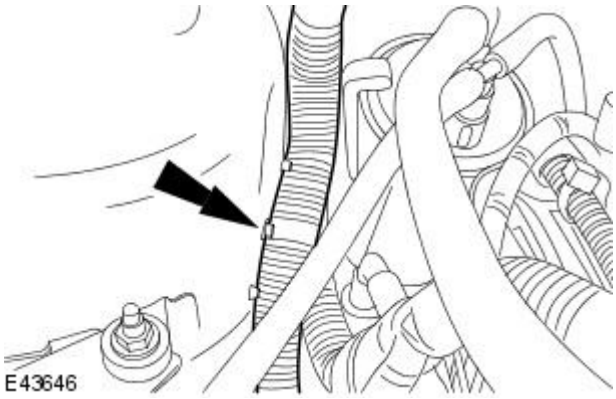


49. Disconnect the fuel lines.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

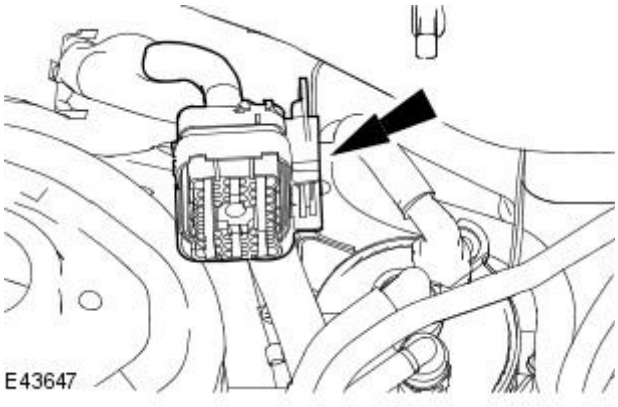
- Install blanking plugs to the fuel pump fuel supply and fuel return line male and female connectors.



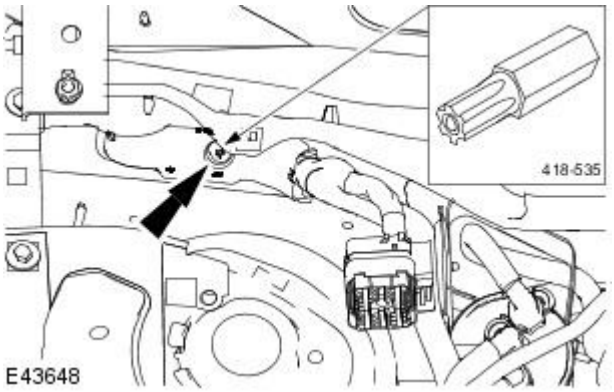
50. Disconnect the engine wiring harness electrical connector.



51. Detach the engine wiring harness retaining clip.

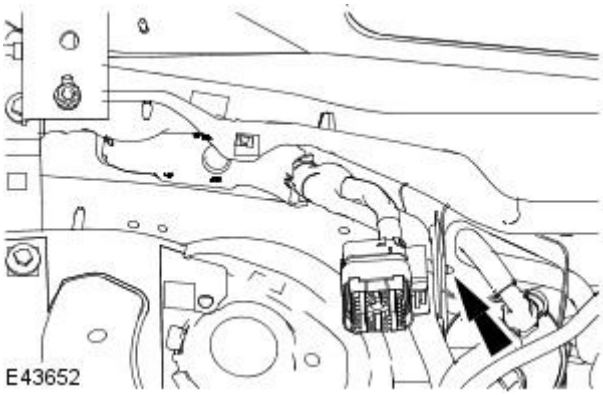


52. Detach the engine wiring harness electrical connector.

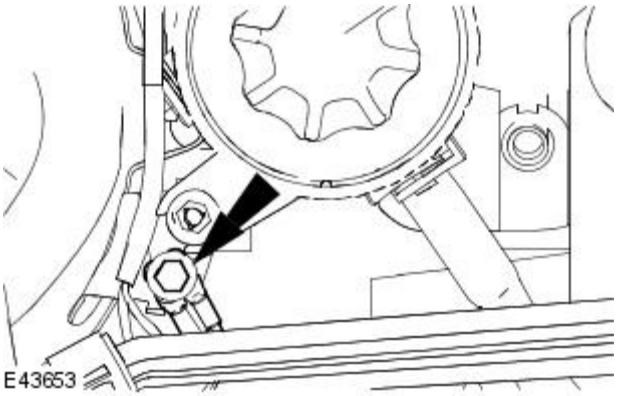


53. NOTE: Bolt remains captive in the engine control module (ECM) electrical connector.

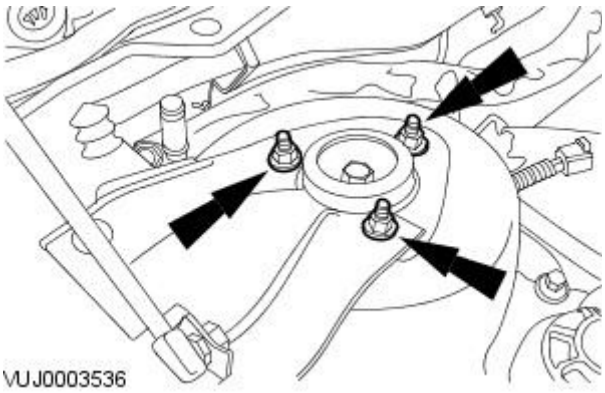
Using the special tool, disconnect the ECM harness electrical connector.



54. Detach the engine wiring harness retaining clip.



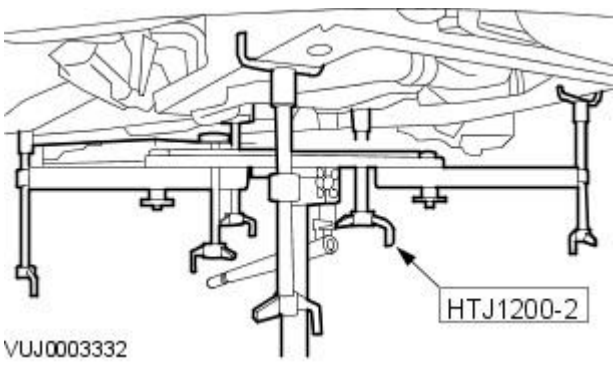
55. Detach the engine wiring harness earth lead.



56. NOTE: Right-hand shown, left-hand similar.

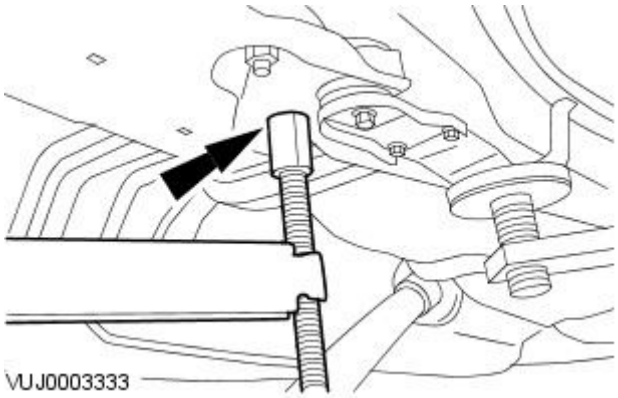
Detach the strut and spring assembly.

57. Raise the vehicle.



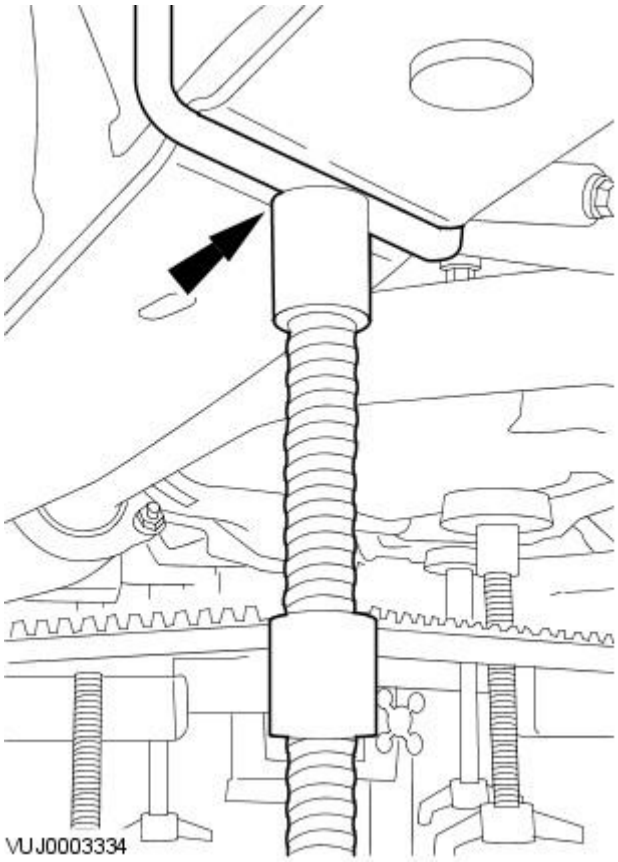
58. CAUTION: Do not support the engine and transaxle assembly directly on the oil pan.

Install the special tool.



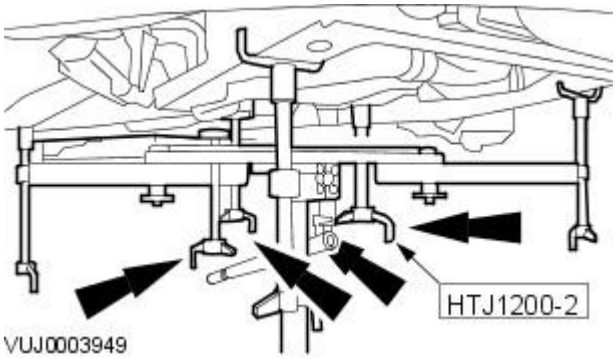
59. NOTE: Left-hand shown, right-hand similar.

Position and adjust the special tool rear height adjuster.

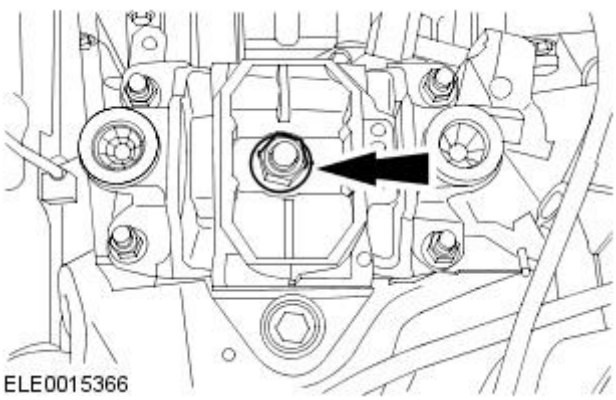


60. NOTE: Right-hand shown, left-hand similar.

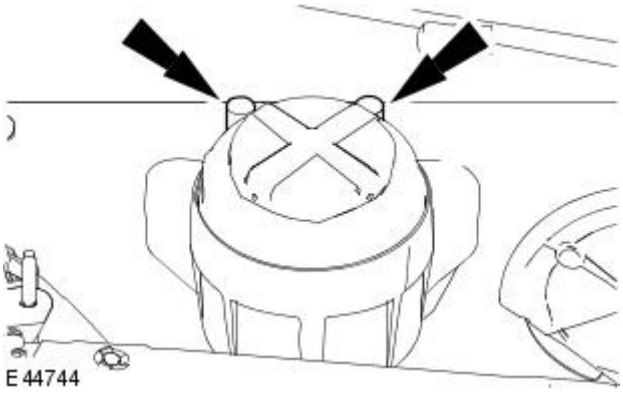
Position and adjust the special tool front height adjuster.



61. Position and adjust the special tool engine height adjusters.

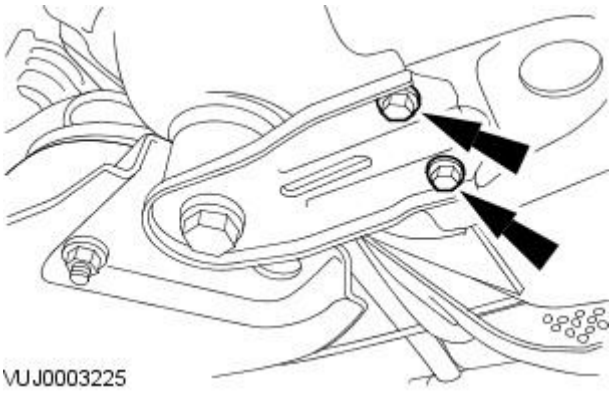


62. Remove the engine rear mount retaining nut.



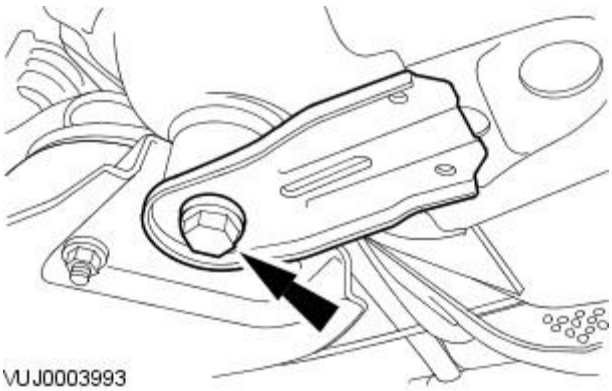
63. NOTE: Discard the retaining nuts.

Remove the engine front mount retaining nuts.



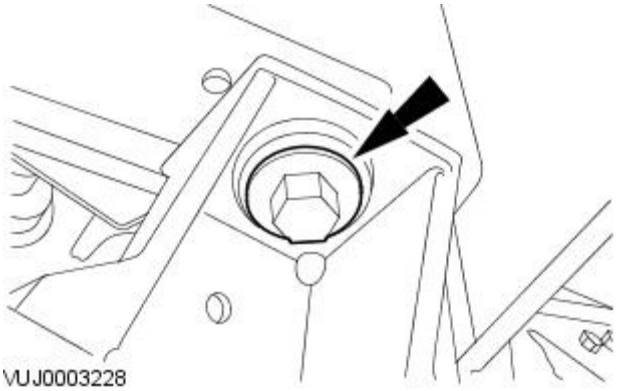
64. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe reinforcement plate retaining bolts.



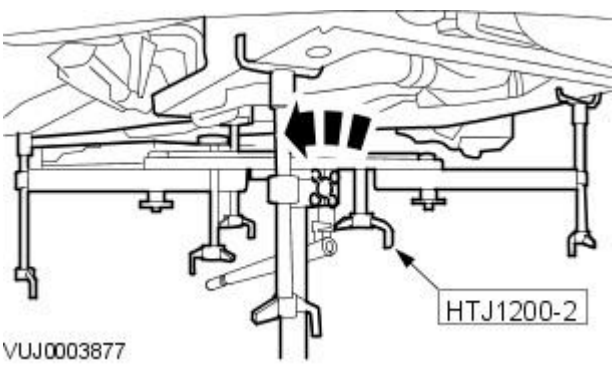
65. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe reinforcement plate.



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

Detach the front subframe.



67. WARNING: Rotate the special tool height adjustment valve slowly. Failure to follow this instruction may result in personal injury.

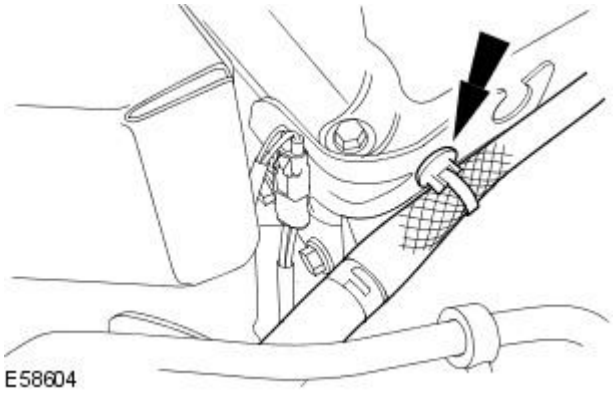
Remove the engine, suspension and transmission assembly.

- Rotate the special tool height adjustment valve counter clockwise.

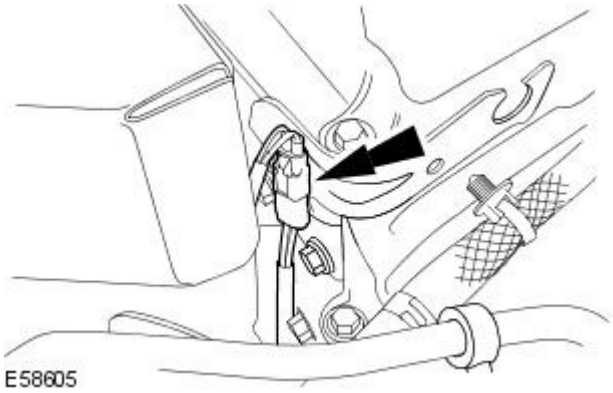
68. CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

Place the engine, suspension and transmission assembly to a suitable working area.

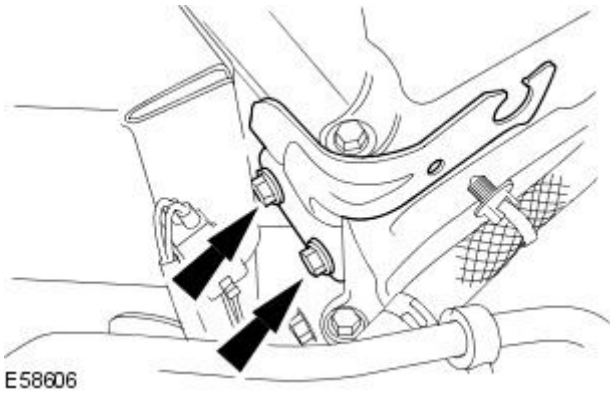
69. Detach the engine harness.



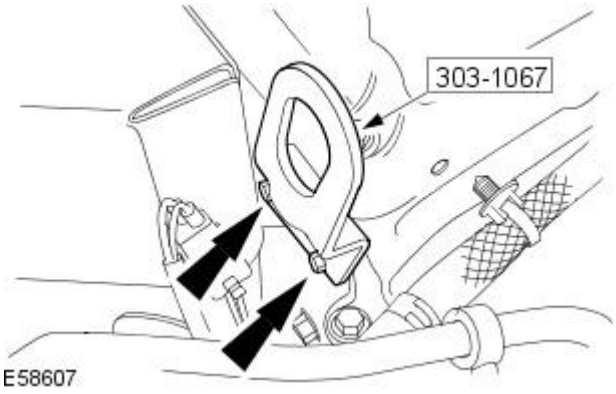
70. Detach the electrical connector.

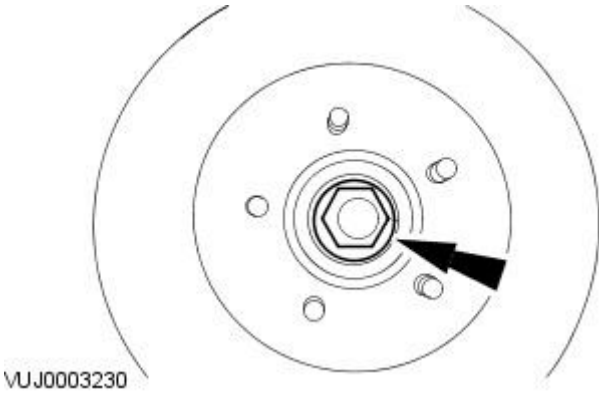


71. Remove the engine cover rear mount bracket.



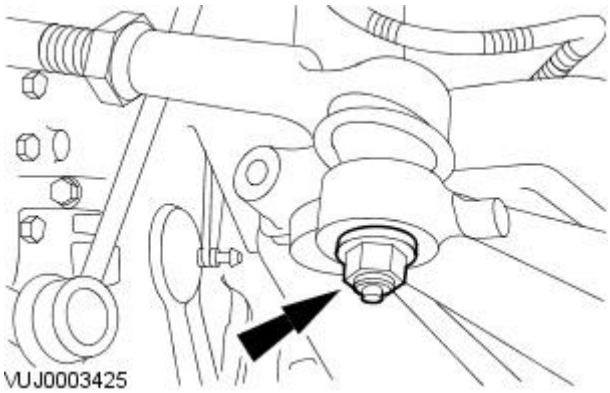
72. Install the engine rear lifting eye.





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

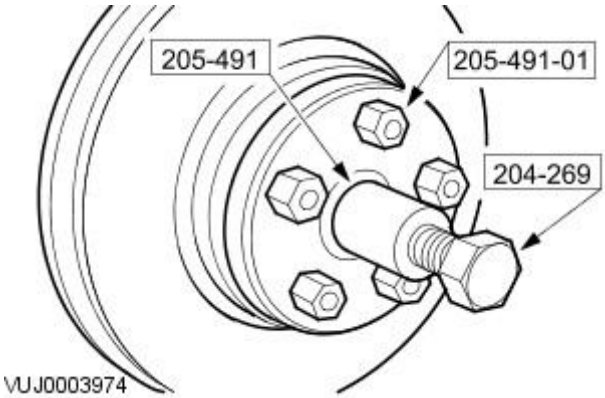
Remove and discard the wheel hub nuts.



74. CAUTION: When the tie-rod end is separated from the wheel hub assembly, the ball joint seal should be protected to prevent damage.

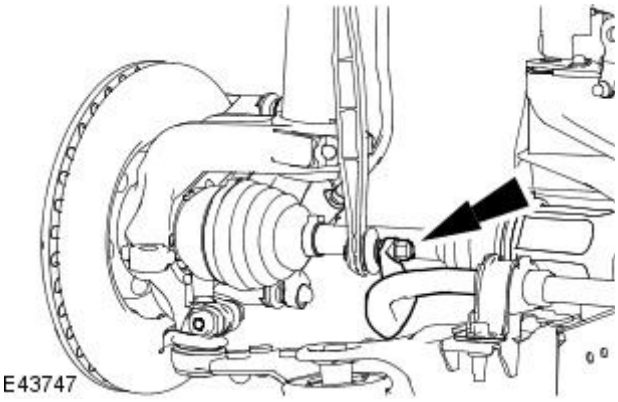
• NOTE: Left-hand shown, right-hand similar.

Remove and discard the tie rod-end retaining nuts.



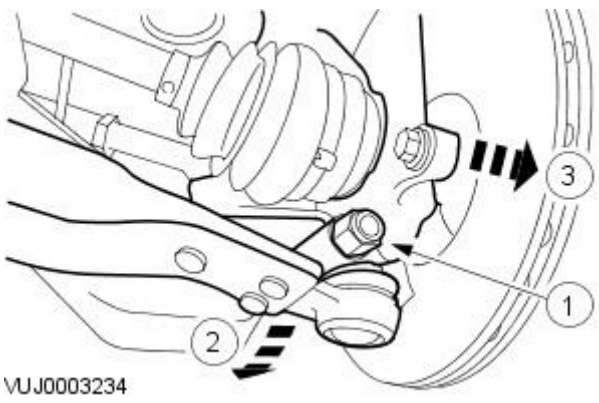
75. NOTE: Left-hand shown, right-hand similar.

Using the special tools, detach the drive halfshaft.



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

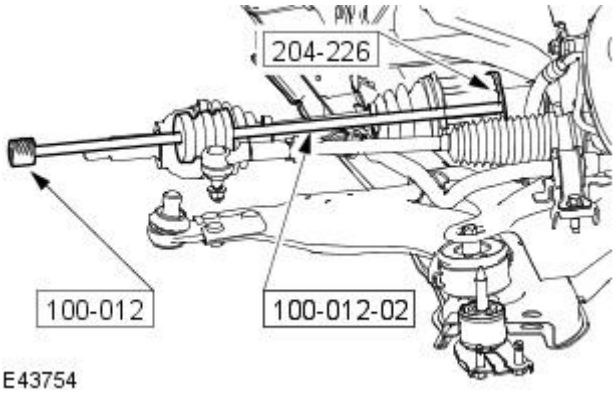
Remove the anti-roll bar link retaining nut.



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

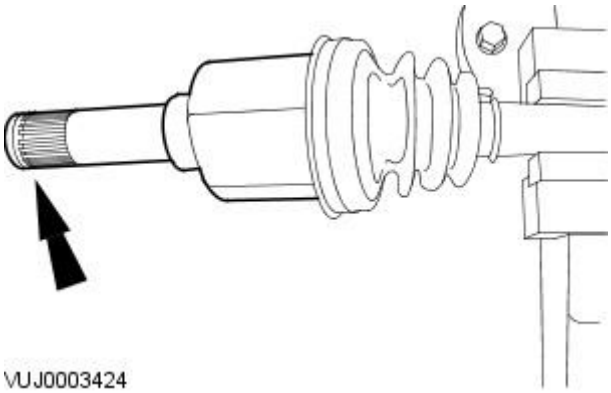
Remove the wheel knuckle and strut.

1. Remove and discard the lower arm ball joint retaining nut and bolt.
2. Reposition the lower arms.
3. Remove the wheel knuckle and strut.

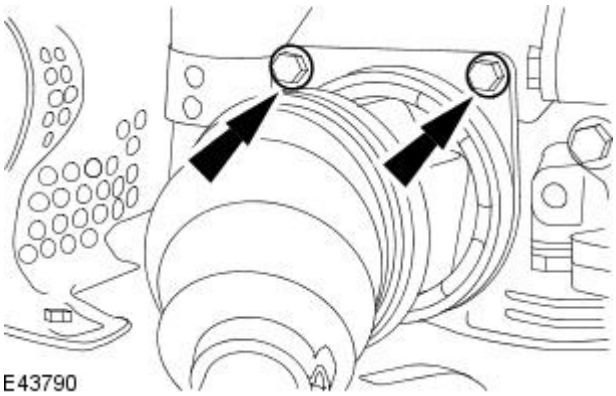


E43754

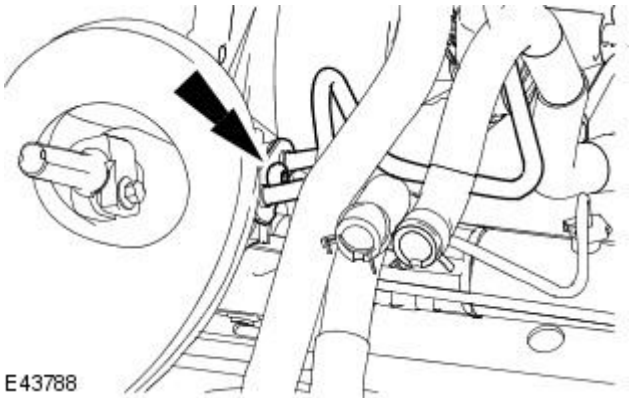
78. Using the special tools, remove the drive halfshaft.


VUJ0003424

79. Remove and discard the drive halfshaft snap ring.


E43790

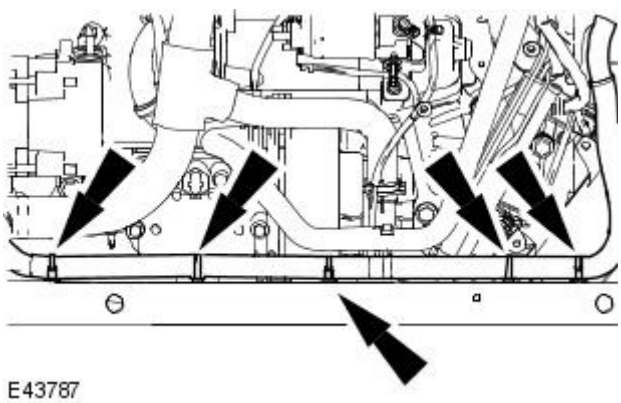
80. Remove the drive halfshaft.


E43788

81. NOTE: Discard the O-ring seals.

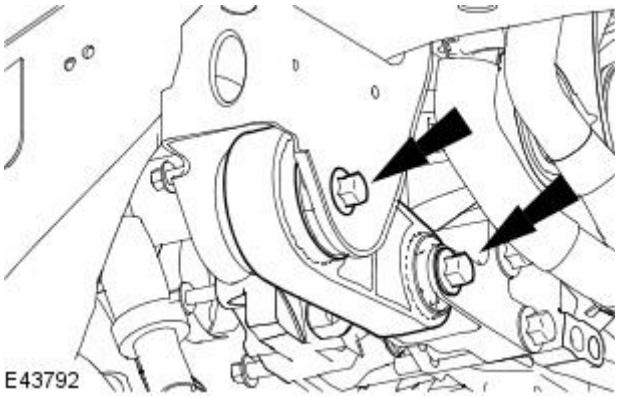
- NOTE: Cap the exposed ports.

Disconnect the power steering lines.


E43787

82. Detach the wiring harness.

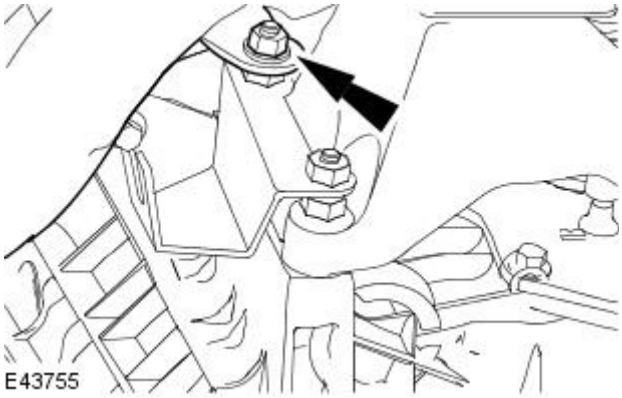
83. Remove the engine roll restrictor.



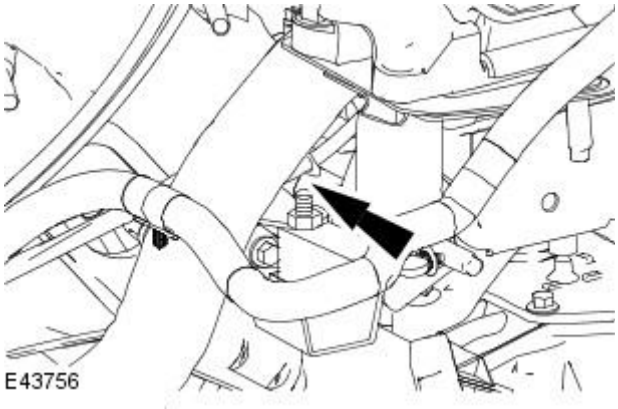
84. CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

Using a suitable hydraulic lift, remove the engine and transmission from the subframe and place to a suitable working area.

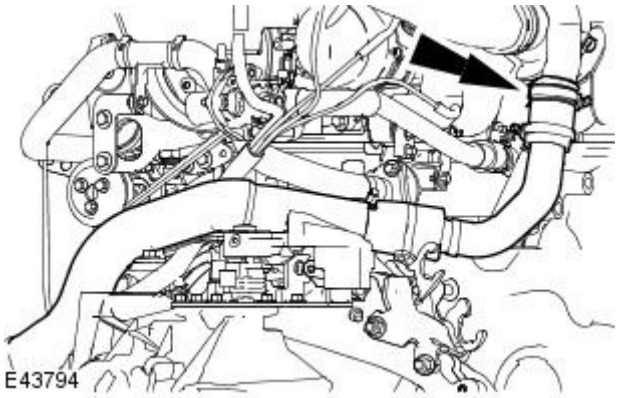
85. Remove the charge air cooler pipe retaining nut.



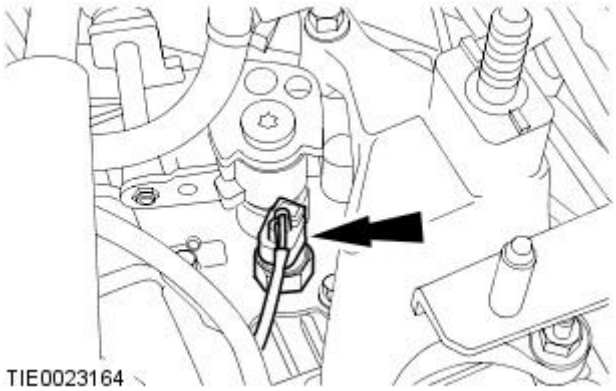
86. Detach the reverse lamp switch wiring harness retaining clip.



87. Remove the charge air cooler pipe.

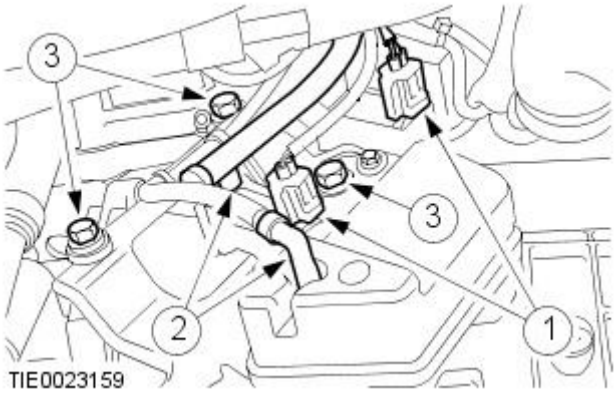


88. Disconnect the reverse lamp switch electrical connector.

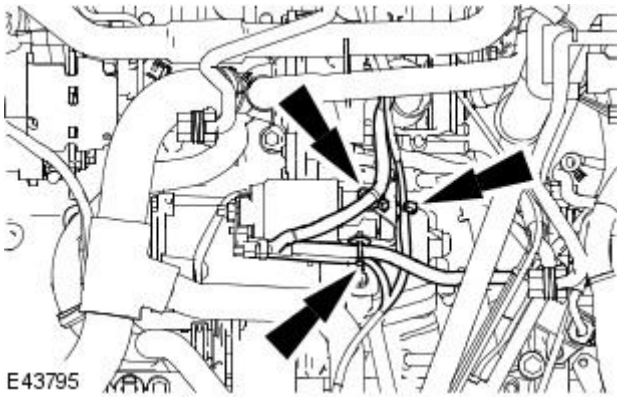


89. Remove the vacuum regulator solenoid valve.

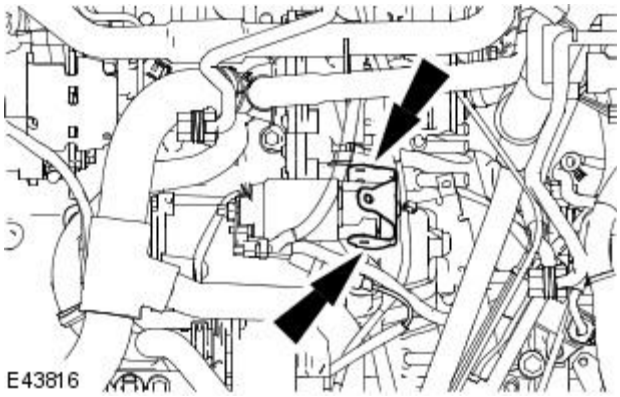
1. Disconnect the electrical connectors.
2. Detach the vacuum hoses.
3. Remove the vacuum regulator solenoid valve.

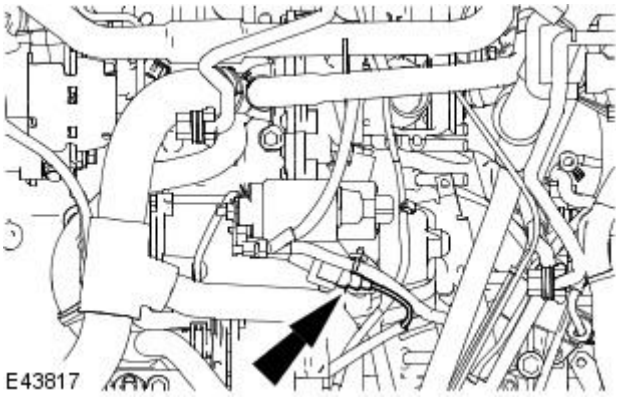


90. Detach the starter motor wiring harness.

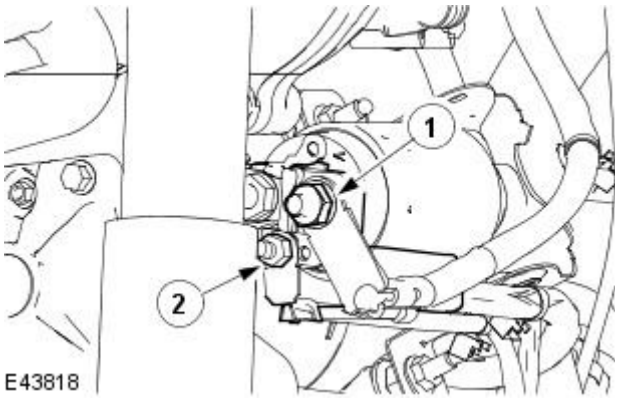


91. Remove the starter motor wiring harness retaining bracket.



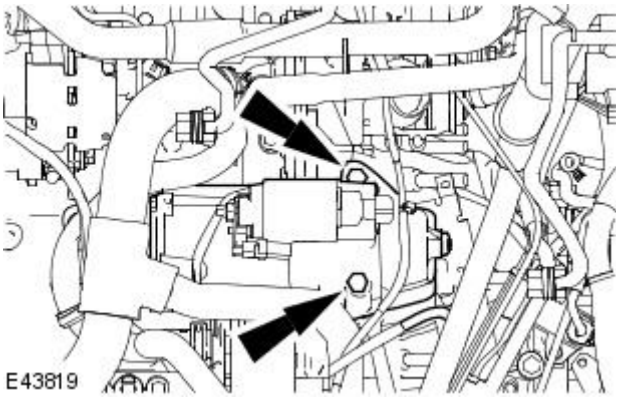


92. Disconnect the starter motor wiring harness electrical connector.

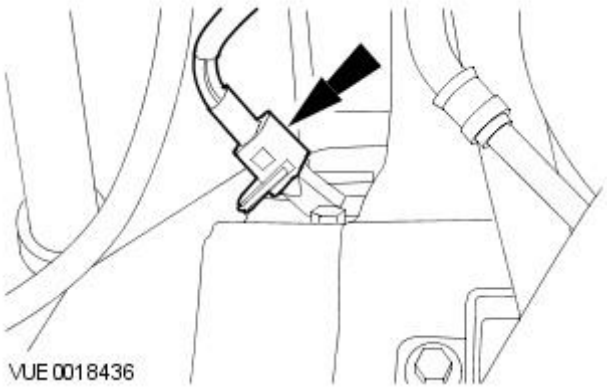


93. Detach the starter motor wiring harness.

1. Disconnect the starter motor electrical connector.
2. Disconnect the starter motor solenoid electrical connector.

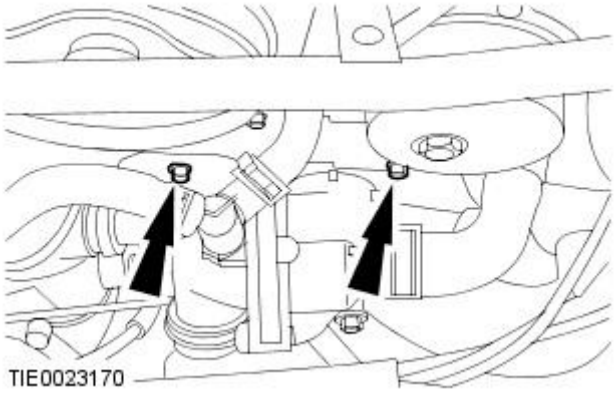


94. Remove the starter motor.

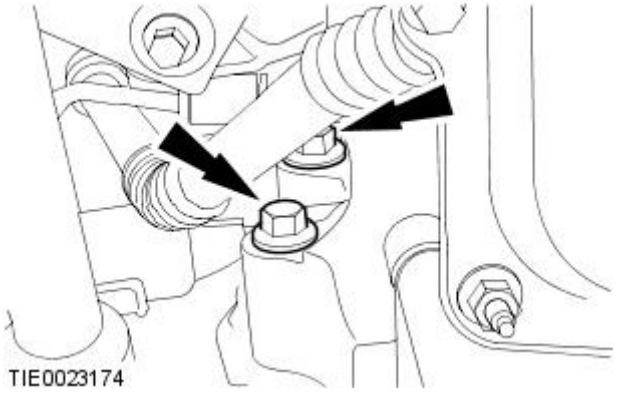


95. Disconnect the crankshaft sensor electrical connector.

96. Remove the transmission upper retaining bolts.

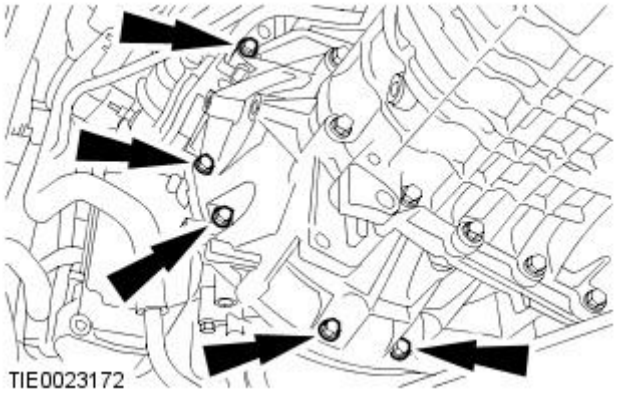

TIE0023170

97. Remove the transmission right-hand retaining bolts.


TIE0023174

98. CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

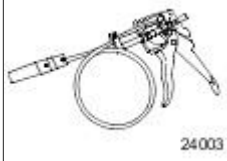
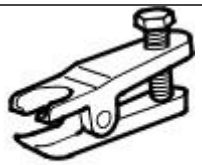
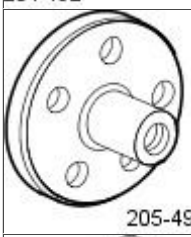
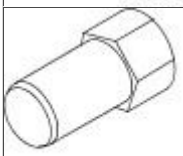
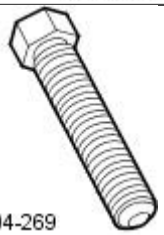
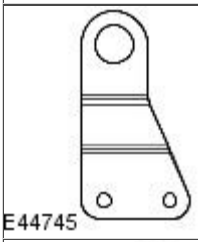
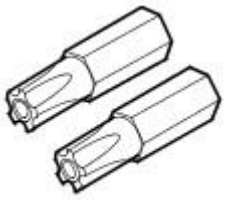
Remove the engine assembly from the transmission assembly.


TIE0023172

Published: 11-May-2011

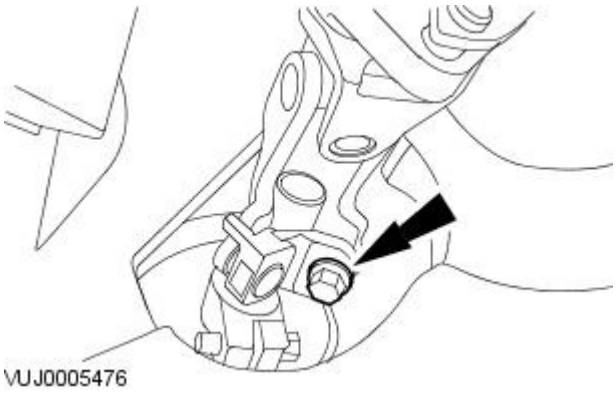
Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Engine2.2L Duratorq-TDCi (110kW / 150PS) - Puma

Removal

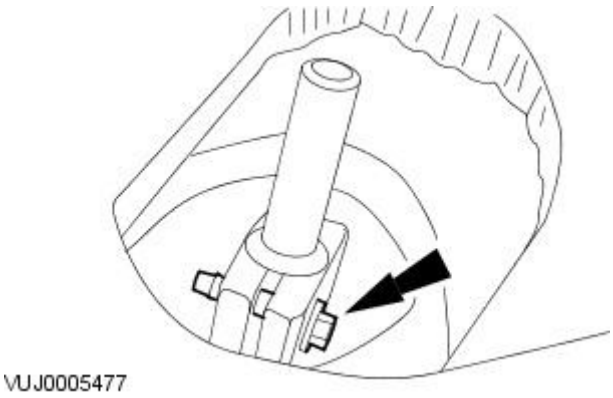
Special Tool(s)	
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)
 204-192	Ball joint splitter 204-192
 205-491	Wheel hub puller 205-491
 20549101	Adaptor nuts 205-491-01
 204-269	Forcing screw 204-269
 HTJ12002	Powertrain assembly jack HTJ1200-02
 E44745	Engine lifting eye 303-1067
 418-535	5 Point Security Torx Bit 418-535

Removal

All vehicles


VUJ0005476

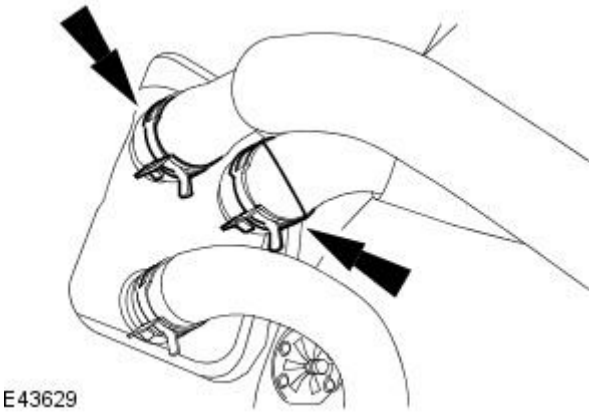
1. Remove and discard the steering column lower retaining bolt.


VUJ0005477

2. Remove the steering column coupling.

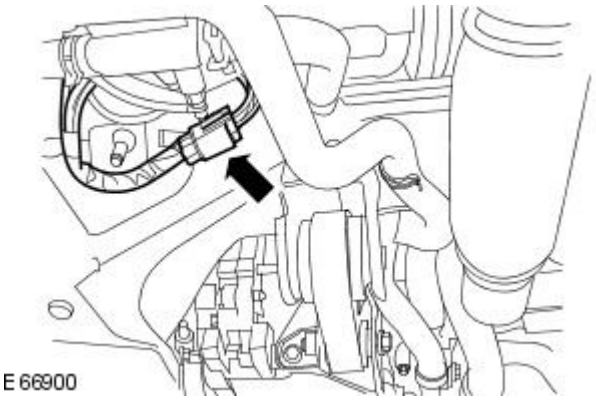
3. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
4. Recover the air conditioning refrigerant.
   For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
5. Drain the cooling system.
   For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
6. Remove the exhaust flexible pipe.
   For additional information, refer to: Exhaust Flexible Pipe - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (309-00 Exhaust System, Removal and Installation).

Vehicles without auxiliary heating

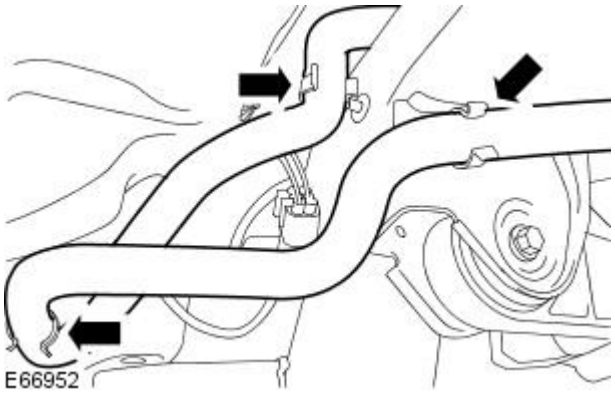

E43629

7. Disconnect the heater hoses from the heater core.

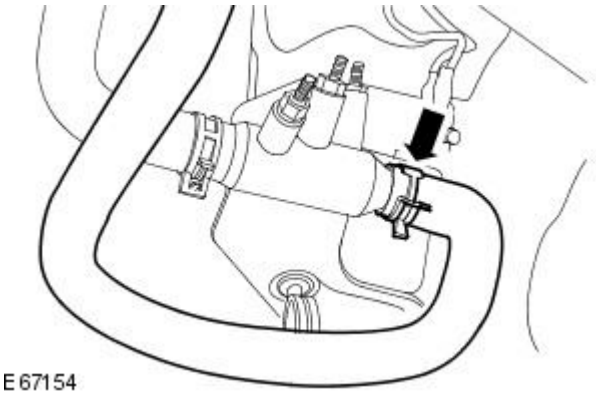
Vehicles with electric booster heater



8. Detach the electric booster heater electrical connector from the subframe retaining tang.



9. Detach the coolant hoses from the retaining clips.

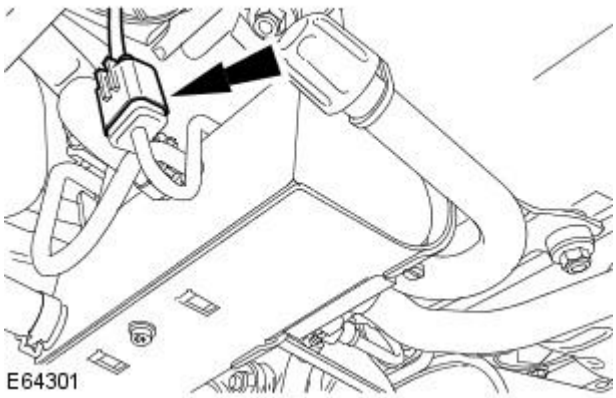


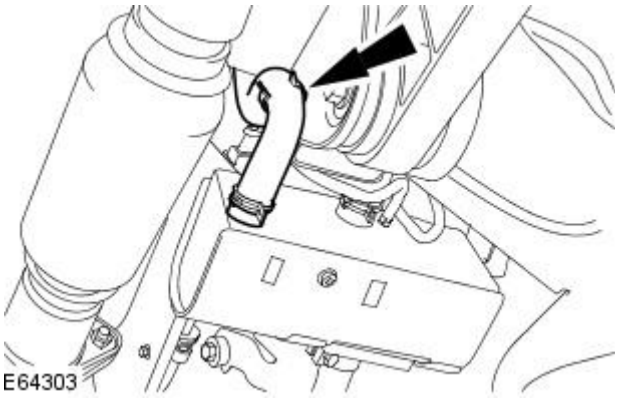
10. Detach the coolant hose.

- Disconnect the coolant hose.

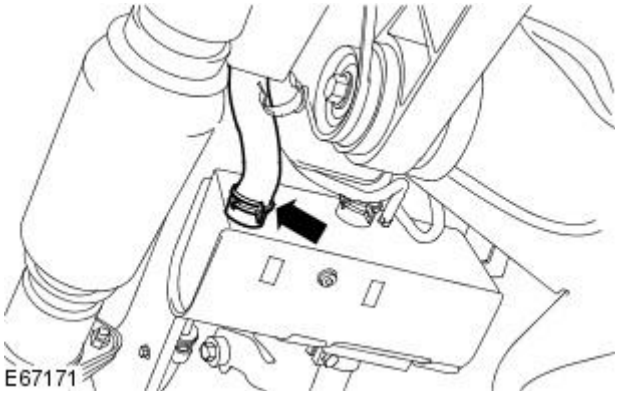
Vehicles with fuel fired booster heater

11. Disconnect the fuel fired booster heater electrical connector from the subframe retaining tang.



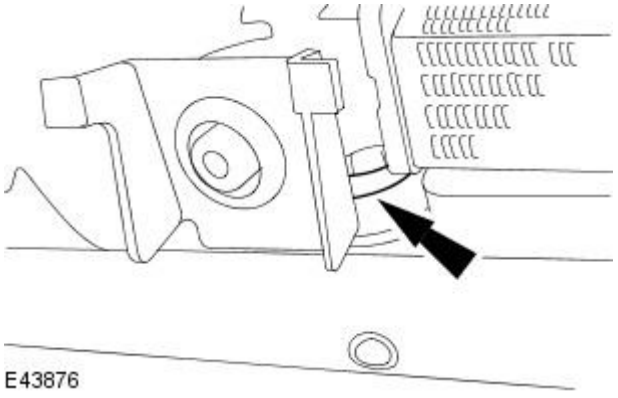


12. Detach the coolant hose.

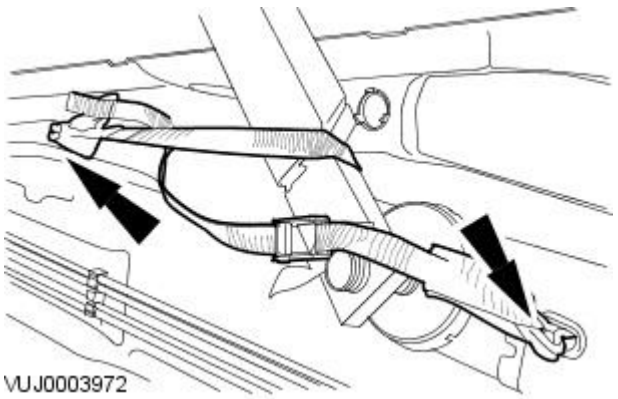


13. Disconnect the coolant hose.

All vehicles



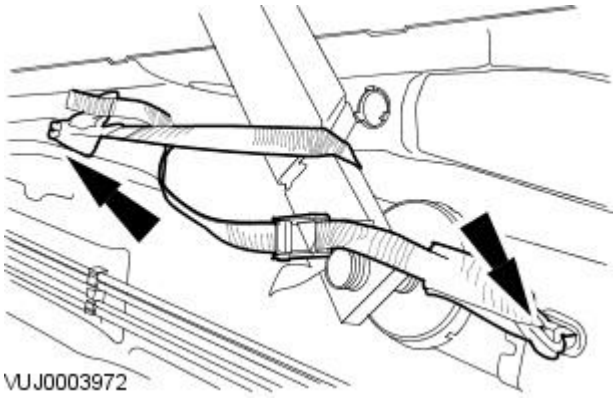
14. Disconnect the radiator lower coolant hose.



15. CAUTION: To prevent the vehicle becoming unstable when the engine and transmission assembly are removed, install the vehicle tie-down straps. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Right-hand shown, left-hand similar.

Install the front vehicle tie down straps.



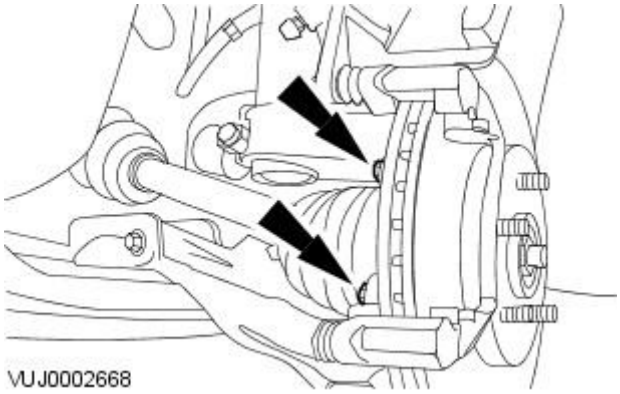
16. CAUTION: To prevent the vehicle becoming unstable when the engine and transmission assembly are removed, install the vehicle tie-down straps. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Right-hand shown, left-hand similar.

Install the rear vehicle tie down straps.

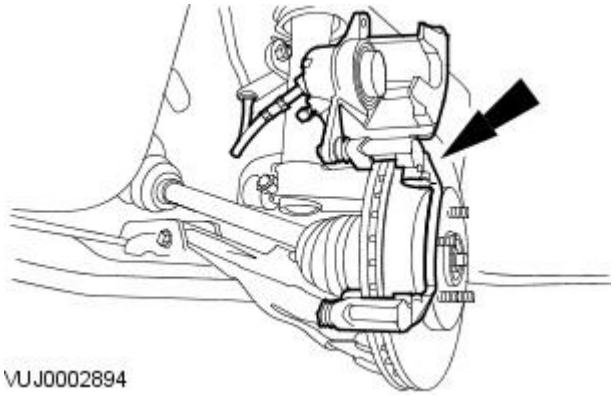
17. Lower the vehicle to a suitable working height.

18. Remove the front brake pads.
For additional information, refer to: Brake Pads (206-03 Front Disc Brake, Removal and Installation).



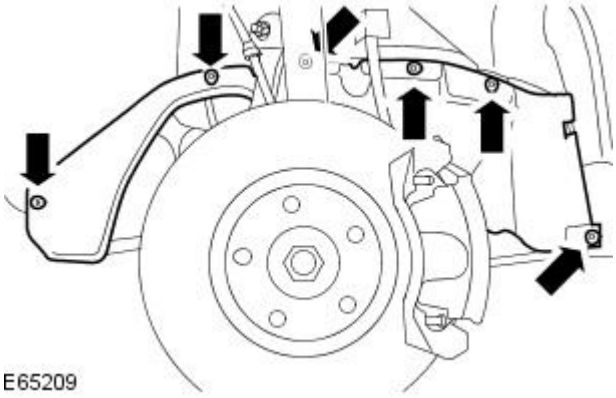
19. NOTE: Left-hand shown, right-hand similar.

Remove and discard the brake caliper anchor plate retaining bolts.



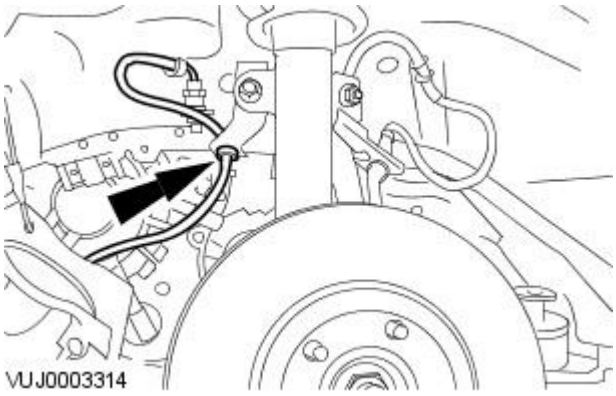
20. NOTE: Left-hand shown, right-hand similar.

Detach the brake caliper and brake caliper anchor plate assembly.



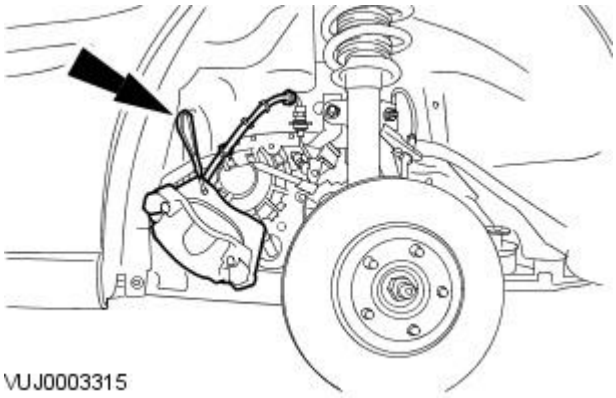
21. NOTE: Right-hand shown, left-hand similar.

Remove the wheel arch liner access cover.


VUJ0003314

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

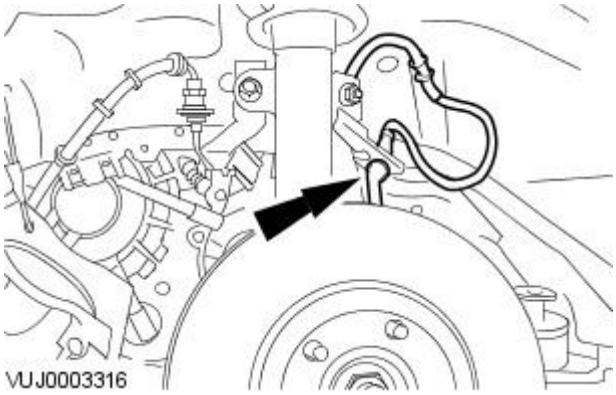
Detach the brake pipe.


VUJ0003315

23. CAUTION: Support the brake caliper assembly using tie straps. Failure to follow this instruction may result in damage to the vehicle.

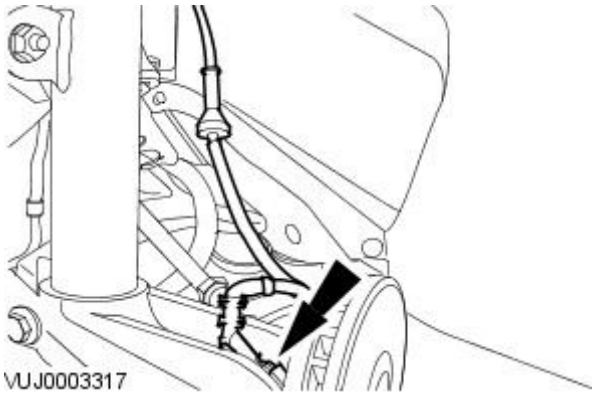
- NOTE: Left-hand shown, right-hand similar.

Reposition and attach the brake caliper assembly.


VUJ0003316

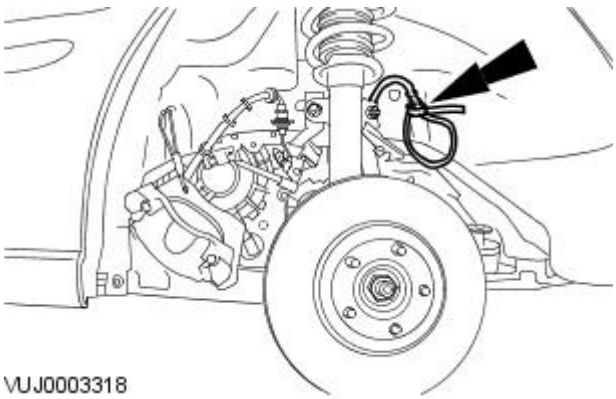
24. NOTE: Left-hand shown, right-hand similar.

Detach the anti-lock braking system (ABS) wheel speed sensor.


VUJ0003317

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

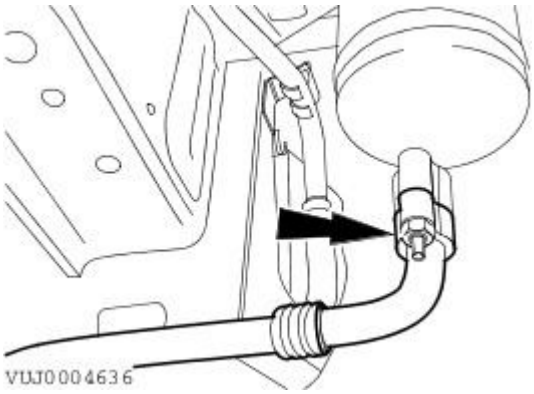
Disconnect the ABS wheel speed sensor.


VUJ0003318

26. CAUTION: Secure the ABS wheel speed sensor using tie straps. Failure to follow this instruction may result in damage to the vehicle.

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

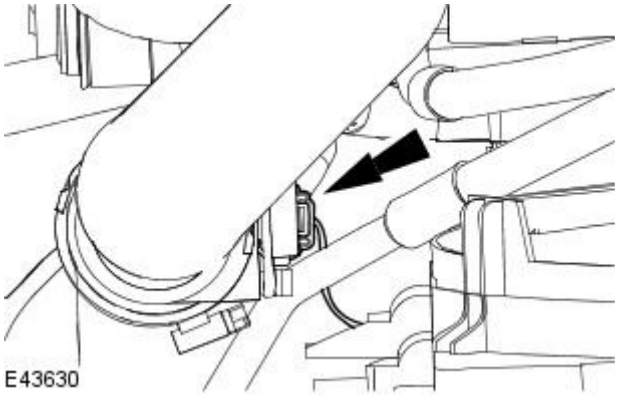
Reposition and attach the ABS wheel speed sensor.



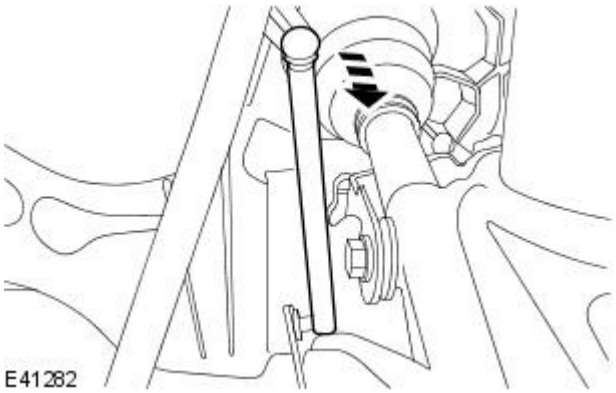
27. NOTE: Remove and discard the O-ring seal.

• NOTE: Cap the exposed ports.

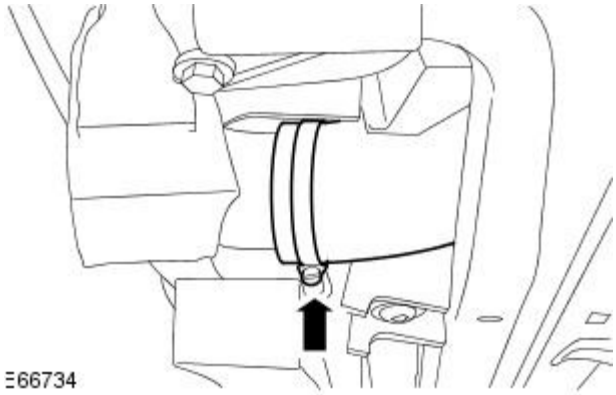
Disconnect the suction accumulator pipe.



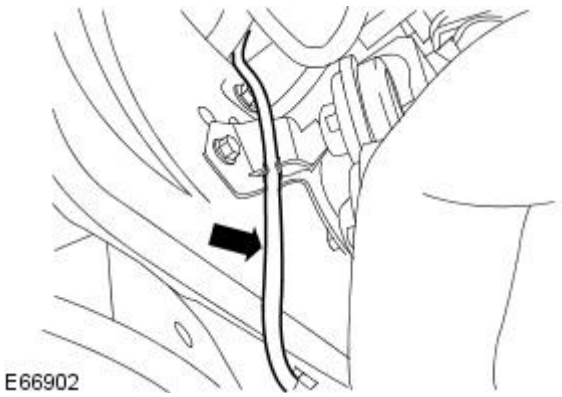
28. Disconnect the air temperature sensor electrical connector.



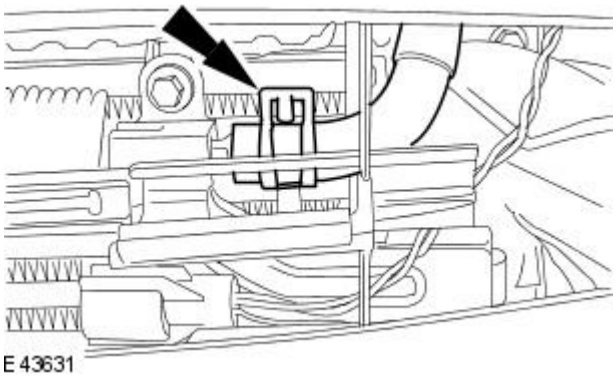
29. Disconnect the high intensity discharge (H.I.D) sensor drop arm.



30. Detach the charge air cooler outlet hose from the charge air cooler.



31. Detach the battery breather hose.



32. NOTE: Drain the fluid into a suitable container.

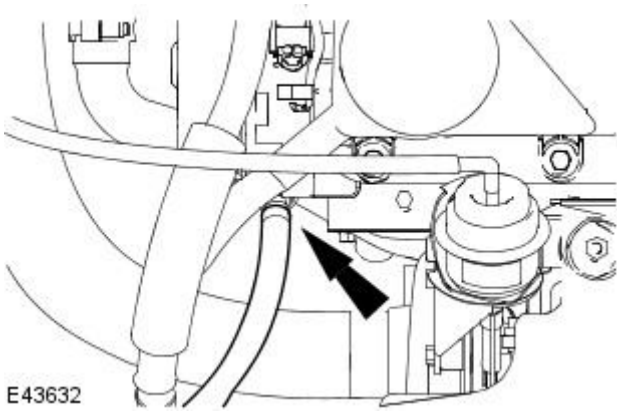
- NOTE: Cap the exposed ports.
- NOTE: Use care when repositioning power assisted steering hose.

Disconnect the power assisted steering hose.

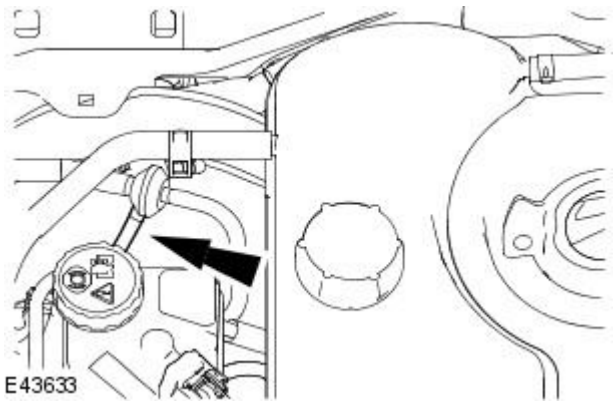
- Remove the power assisted steering hose retaining clip.
- Reposition the power assisted hose through the radiator side seal.

33. Lower the vehicle to a suitable working height.

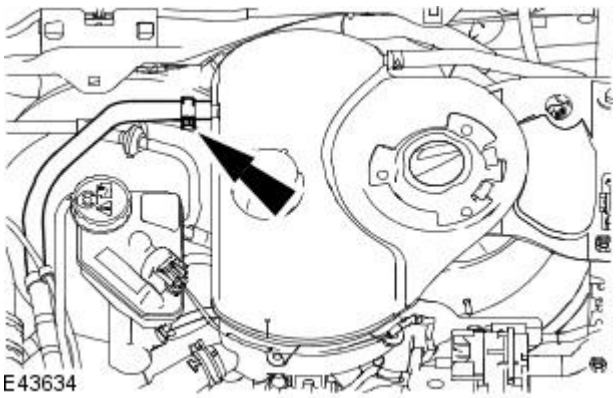
34. Disconnect the brake vacuum pump vacuum hose.



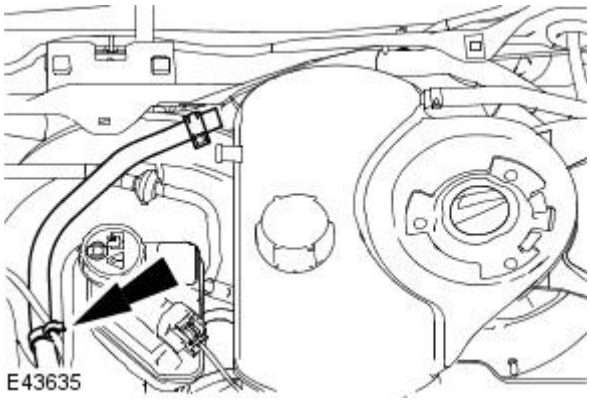
35. Disconnect the exhaust gas recirculation (EGR) valve module vacuum hose.



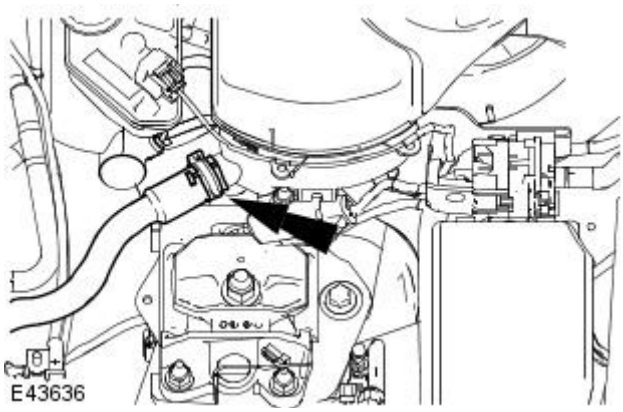
36. Disconnect the expansion tank vent hose.



37. Detach the cooling system hose.

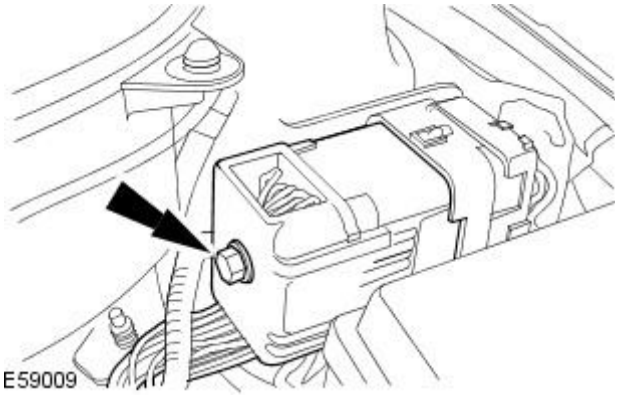


38. Disconnect the expansion tank outlet hose.

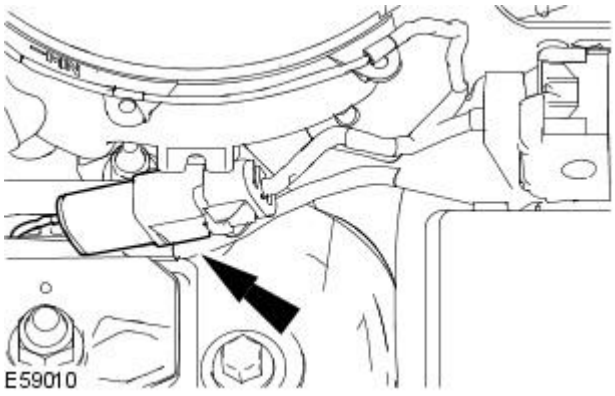


39. NOTE: The retaining bolt remains captive in the electrical connector.

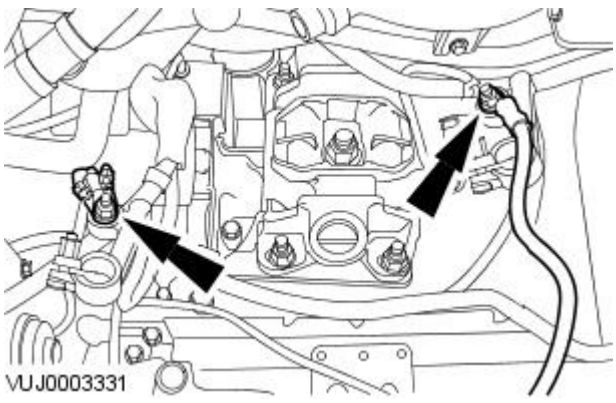
Disconnect the engine harness electrical connector.

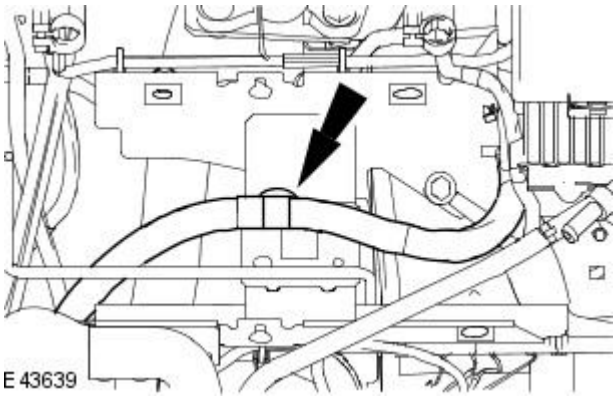


40. Disconnect the glow plug harness electrical connector.

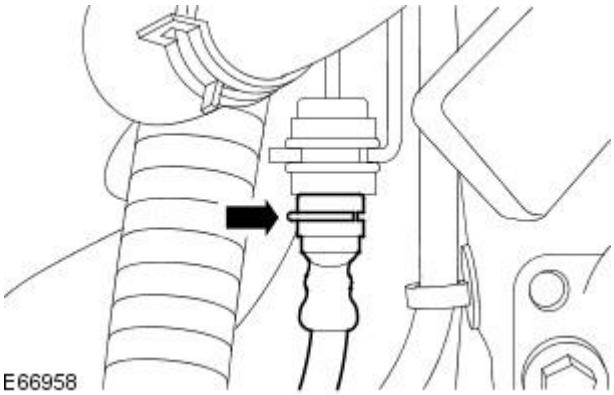


41. Disconnect the battery cables.





42. Detach the wiring harness from the battery tray mount.

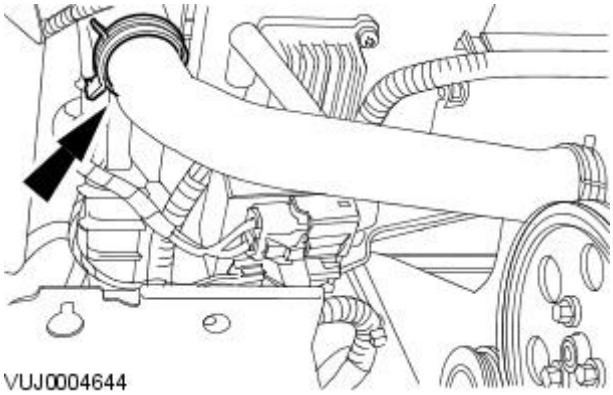


43. CAUTION: If fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water. Failure to follow this instruction may result in damage to the vehicle.

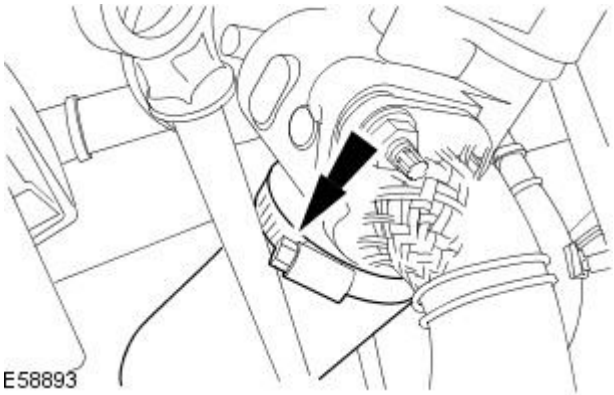
- NOTE: Drain the fluid into a suitable container.
- NOTE: Cap the exposed ports.
- NOTE: Secure the clutch slave cylinder hose using a tie strap.

Detach the clutch slave cylinder hose from the clutch slave cylinder pipe.

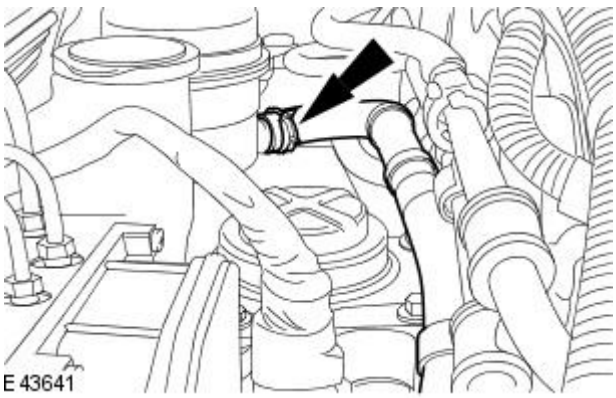
- Release the clutch slave cylinder hose retaining clip.
- Disconnect the clutch slave cylinder hose and secure to one side.



44. Disconnect the radiator upper coolant hose.



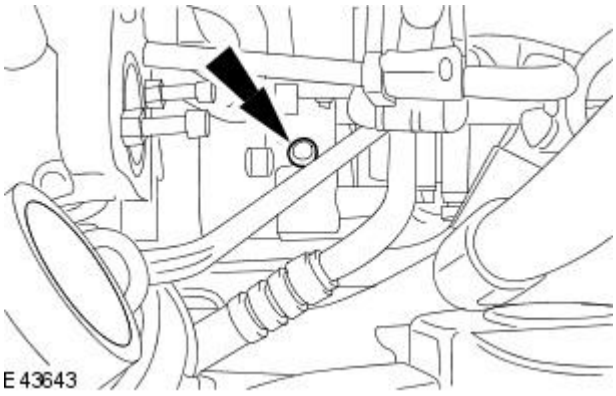
45. Disconnect the charge air cooler hose.



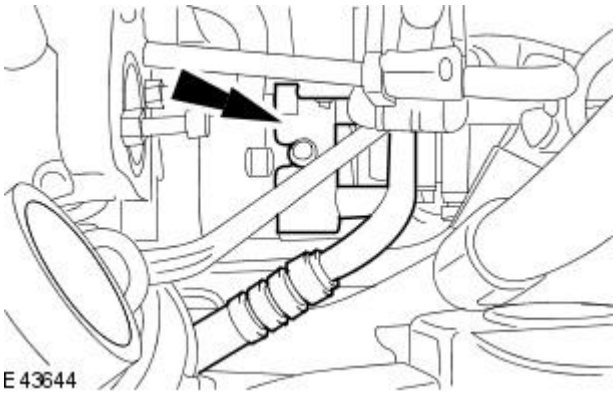
46. NOTE: Place suitable absorbent material below the fluid reservoir to absorb fluid spillage.

- NOTE: Cap the exposed ports.

Disconnect the power assisted steering hose.



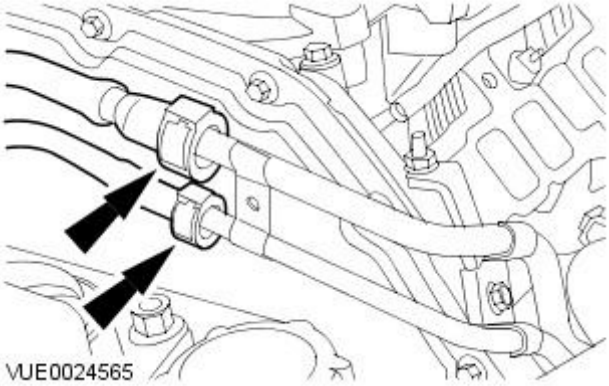
47. Loosen the air conditioning (A/C) compressor line retaining bolt.



48. NOTE: Remove and discard the O-ring seals.

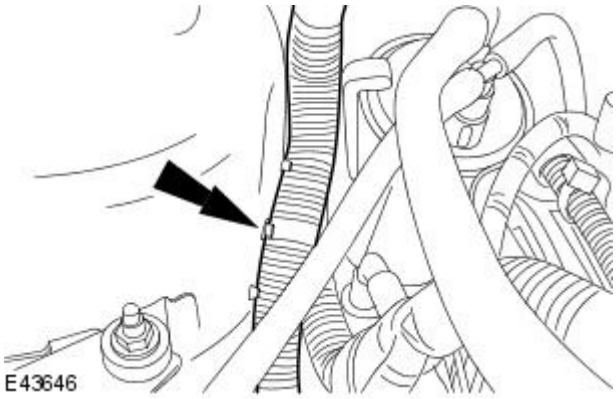
• NOTE: Cap the exposed ports.

Disconnect the A/C compressor lines.

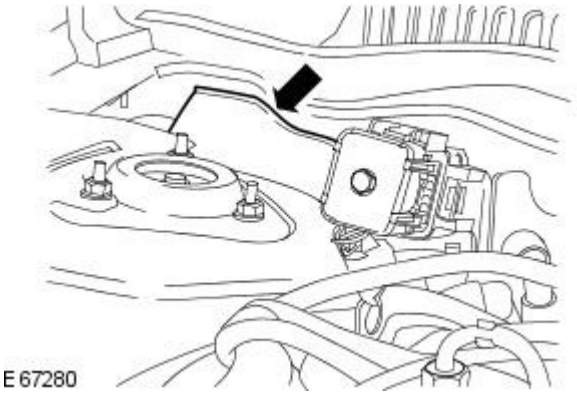


49. Disconnect the fuel lines.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

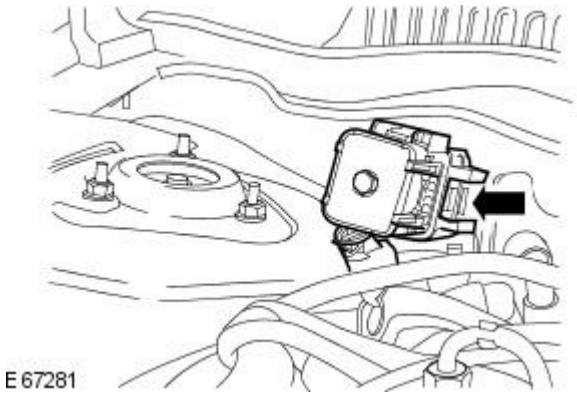
- Install blanking plugs to the fuel pump fuel supply and fuel return line male and female connectors.



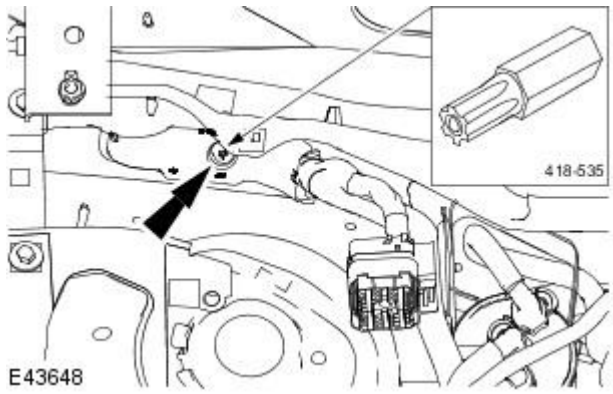
50. Detach the engine wiring harness retaining clip.



51. Remove the engine wiring harness trim panel.

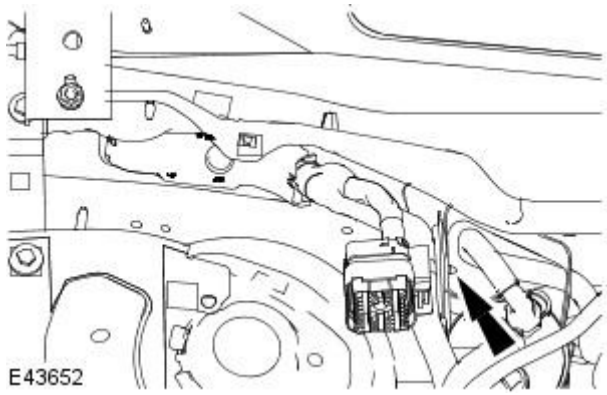


52. Detach the engine wiring harness electrical connector.

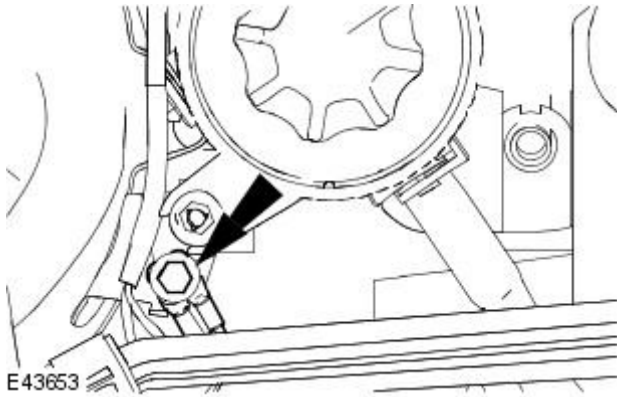


53. NOTE: Bolt remains captive in the engine control module (ECM) electrical connector.

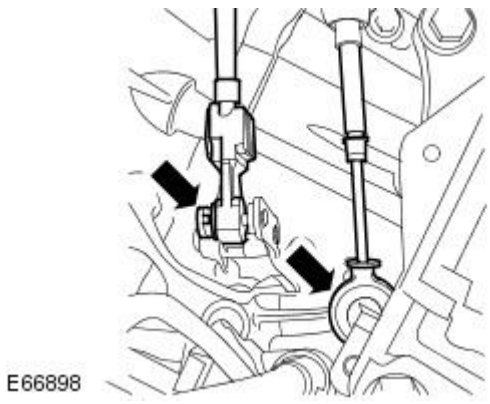
Using the special tool, disconnect the ECM harness electrical connector.



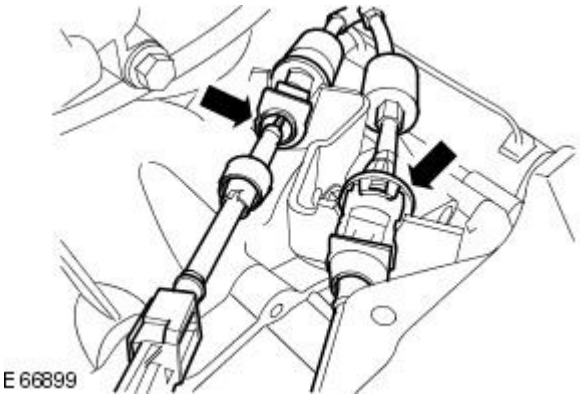
54. Detach the engine wiring harness retaining clip.



55. Detach the engine wiring harness earth lead.

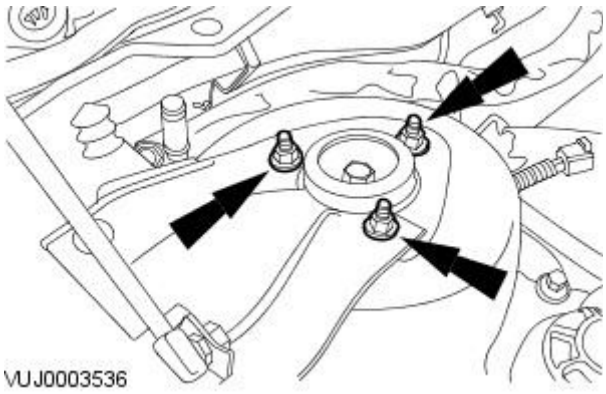


56. Detach the selector cables.



57. NOTE: Secure the selector cables using tie straps.

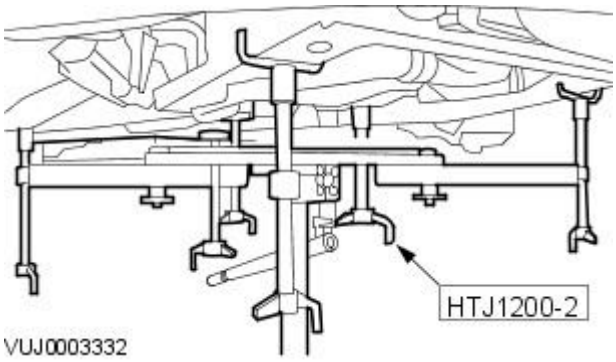
Detach the selector cables.



58. NOTE: Right-hand shown, left-hand similar.

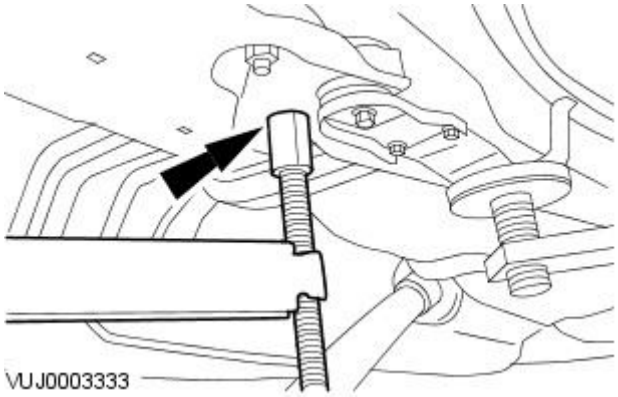
Detach the strut and spring assembly.

59. Raise the vehicle.



60. CAUTION: Do not support the engine and transaxle assembly directly on the oil pan.

Install the special tool.

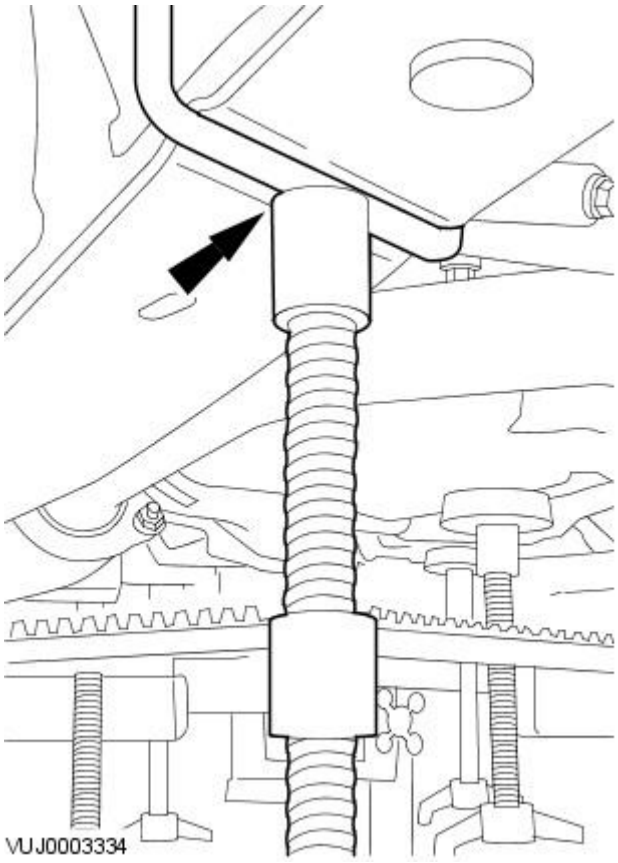


61. NOTE: Left-hand shown, right-hand similar.

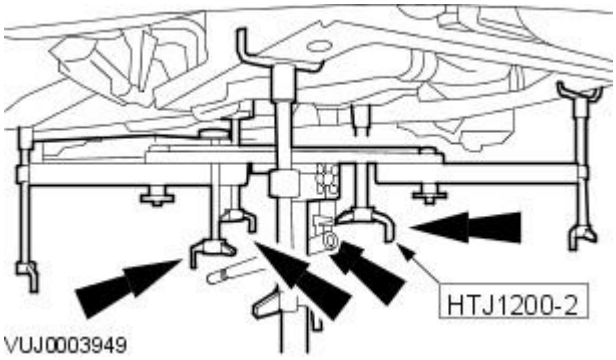
Position and adjust the special tool rear height adjuster.

62. NOTE: Right-hand shown, left-hand similar.

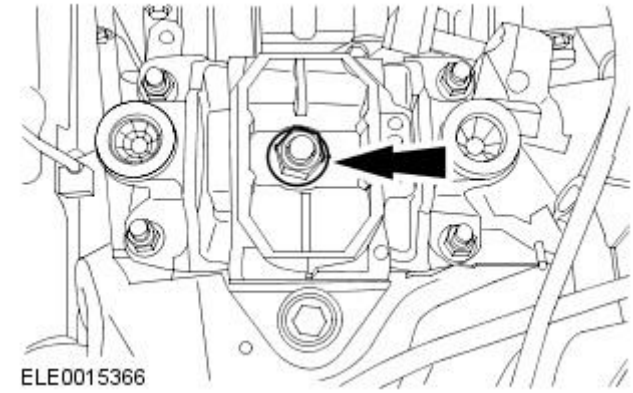
Position and adjust the special tool front height adjuster.



63. Position and adjust the special tool engine height adjusters.

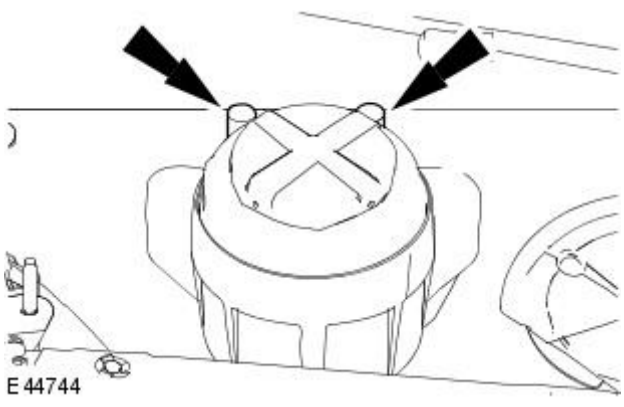


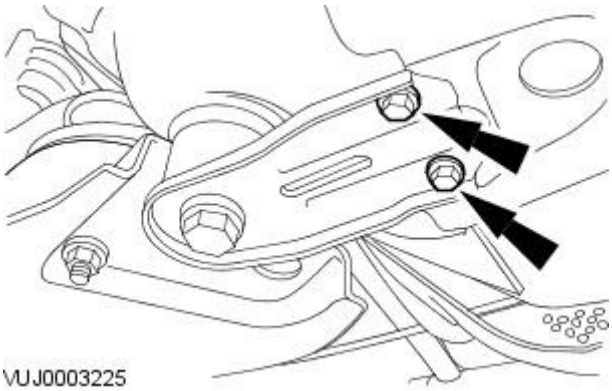
64. Remove the engine rear mount retaining nut.



65. NOTE: Discard the retaining nuts.

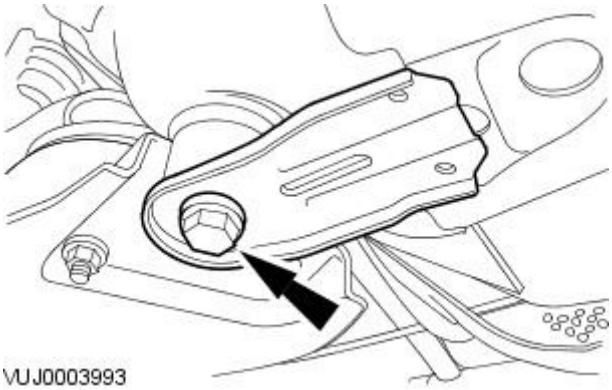
Remove the engine front mount retaining nuts.





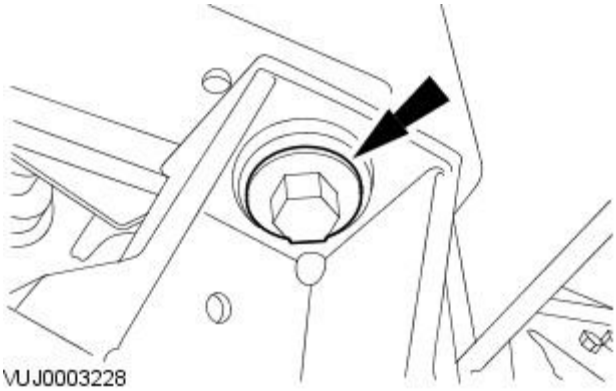
66. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe reinforcement plate retaining bolts.



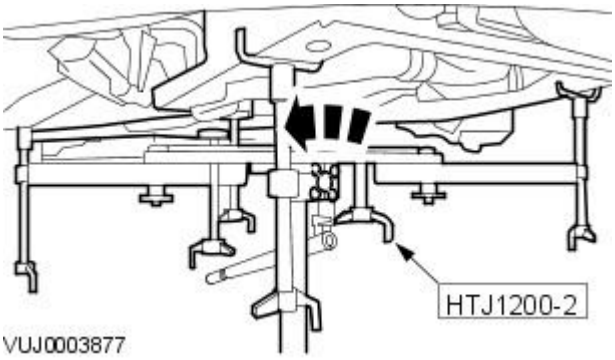
67. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe reinforcement plate.



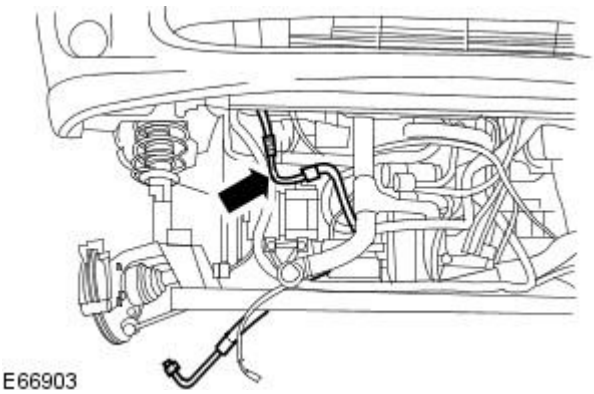
68. NOTE: Left-hand shown, right-hand similar.

Detach the front subframe.



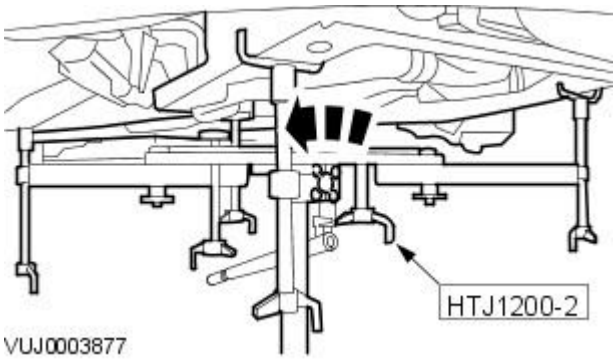
69. Lower the engine, suspension and transmission assembly to gain access to the A/C pipe.

- Rotate the special tool height adjustment valve counter clockwise.



70. NOTE: Secure the A/C pipe using tie straps.

Reposition the AC pipe clear of the engine, suspension and transmission assembly.



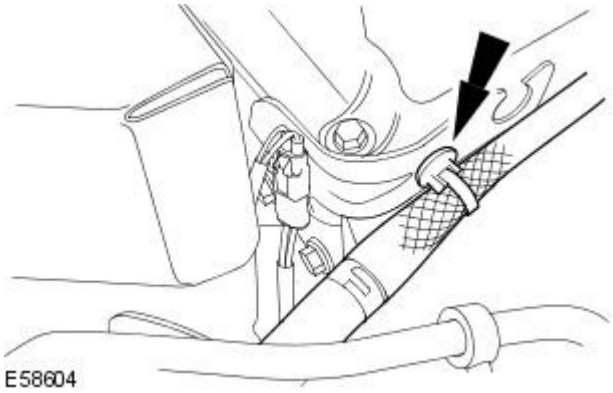
71. Remove the engine, suspension and transmission assembly.

- Rotate the special tool height adjustment valve counter clockwise.

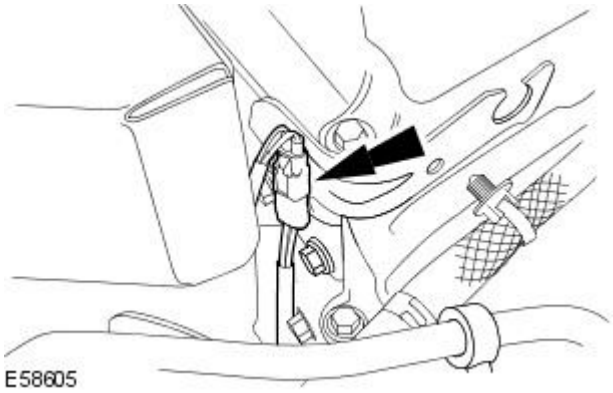
72. CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

Place the engine, suspension and transmission assembly to a suitable working area.

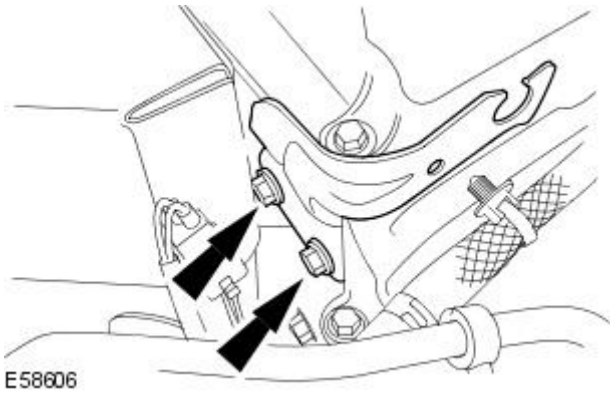
73. Detach the engine harness.



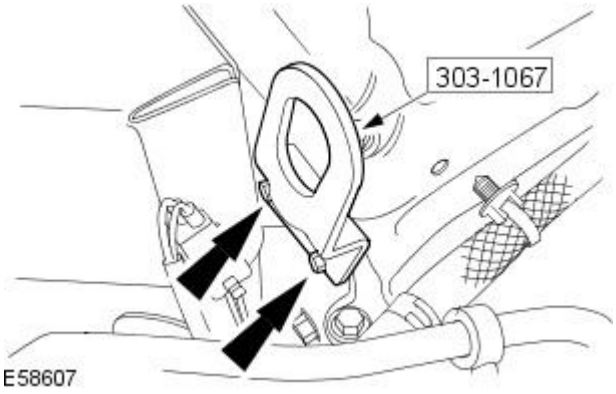
74. Detach the electrical connector.



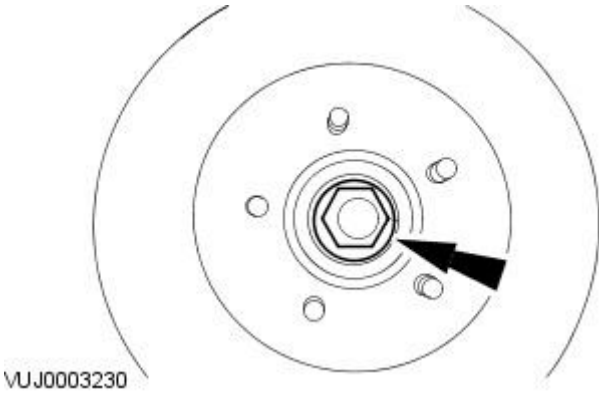
75. Remove the engine cover rear mount bracket.



76. Install the engine rear lifting eye.

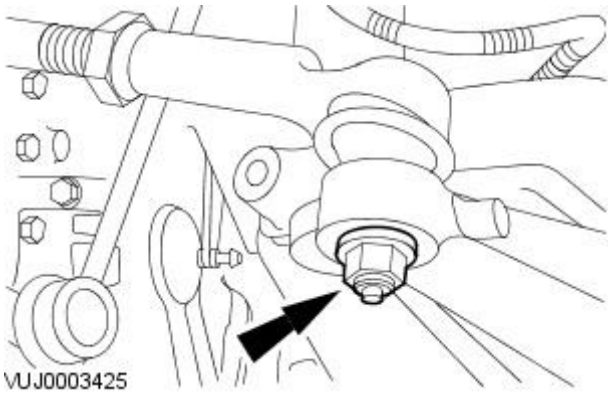


77. Remove and discard the right-hand wheel hub nut.

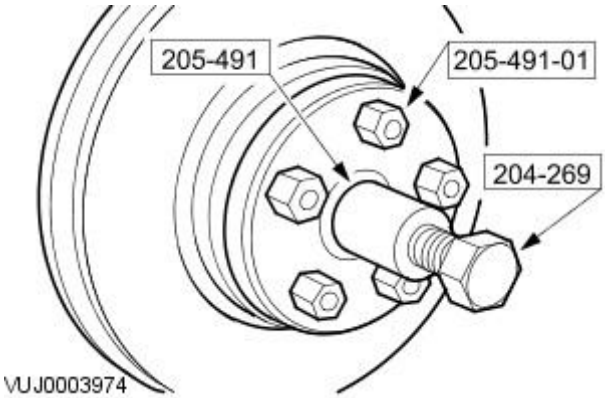


78. CAUTION: When the tie-rod end is separated from the wheel hub assembly, the ball joint seal should be protected to prevent damage.

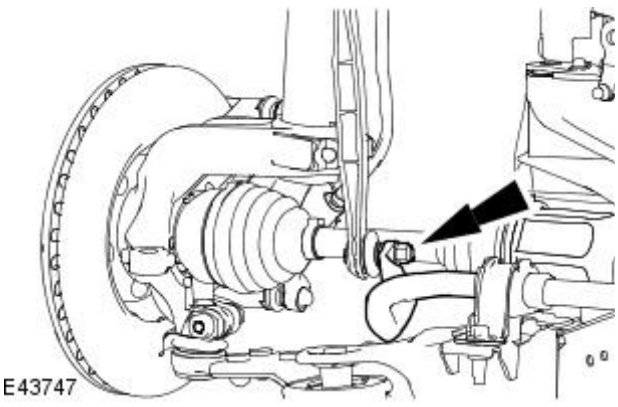
Remove and discard the right-hand tie rod-end retaining nut.

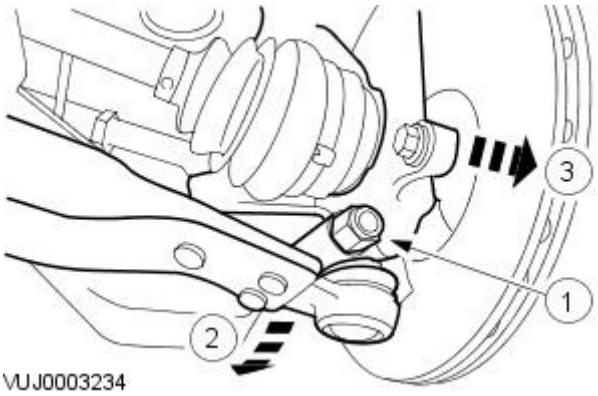


79. Using the special tools, detach the right-hand drive halfshaft.



80. Remove the right-hand anti-roll bar link retaining nut.

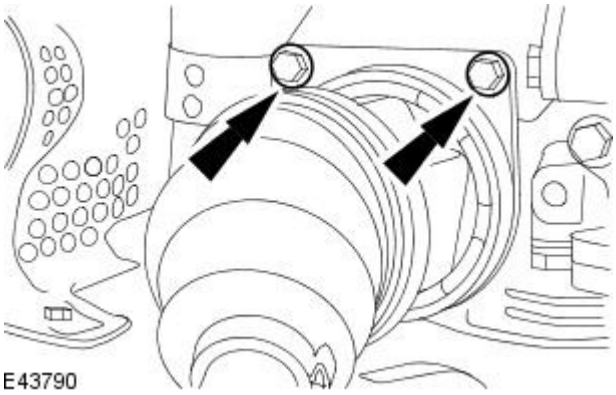




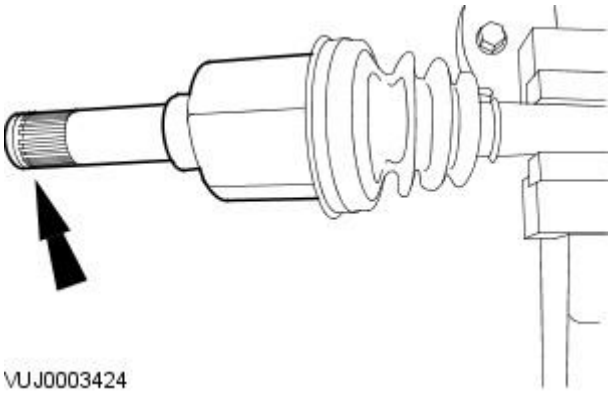
VUJ0003234

81. Remove the right-hand wheel knuckle and strut.

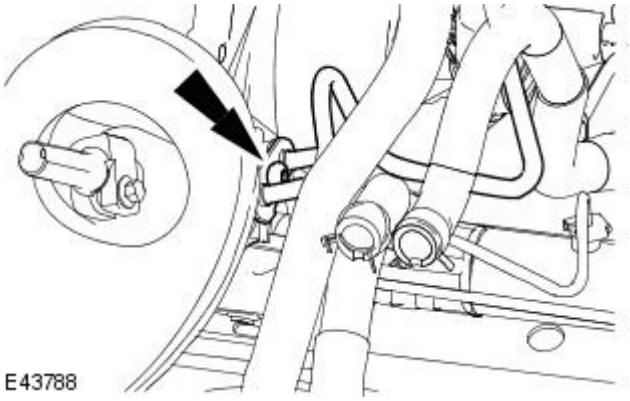
1. Remove and discard the lower arm ball joint retaining nut and bolt.
2. Reposition the lower arms.
3. Remove the wheel knuckle and strut.


E43790

82. Remove the right-hand drive halfshaft.


VUJ0003424

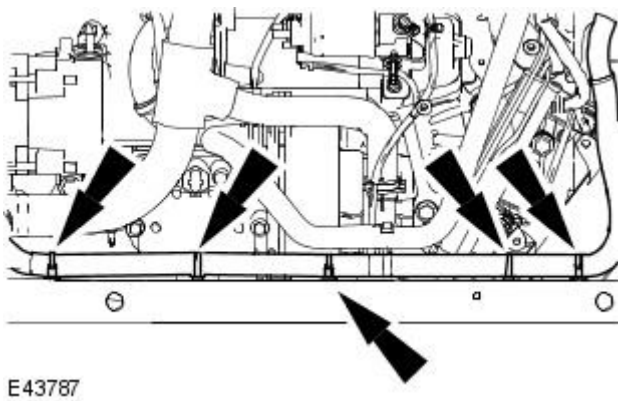
83. Remove and discard the drive halfshaft snap ring.


E43788

84. NOTE: Discard the O-ring seals.

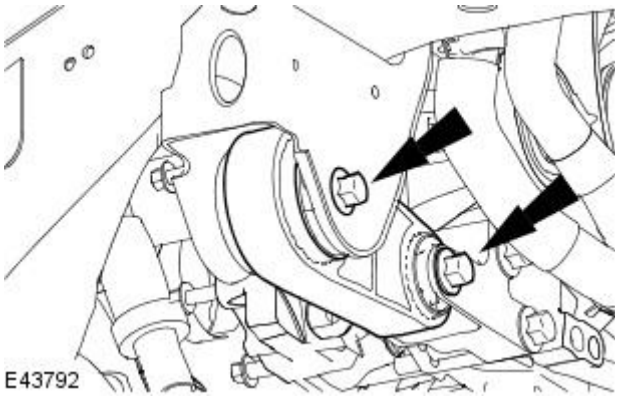
• NOTE: Cap the exposed ports.

Disconnect the power steering lines.


E43787

85. Detach the wiring harness.

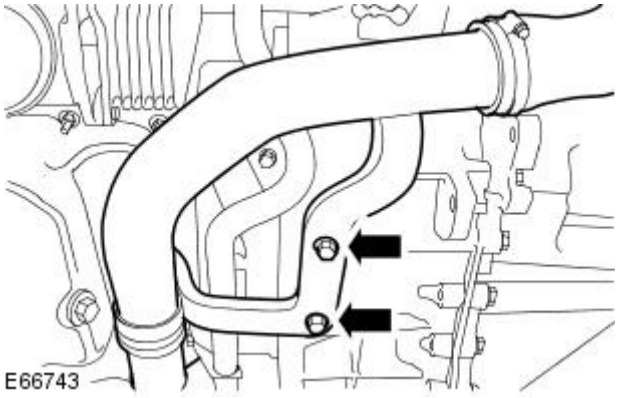
86. Remove the engine roll restrictor.



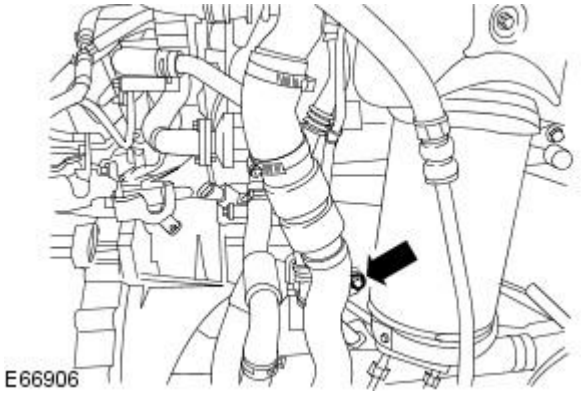
87. CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

Using a suitable hydraulic lift, raise the engine and transmission from the subframe.

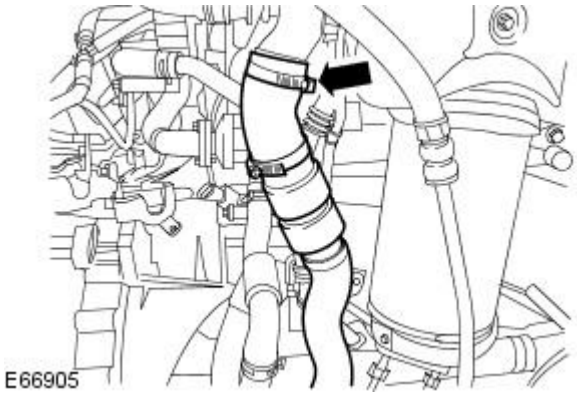
88. Remove the charge air cooler intake pipe retaining bolts.

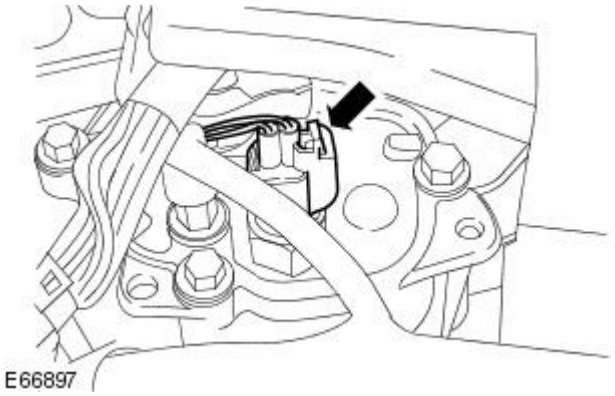


89. Remove the charge air cooler pipe retaining bolt.

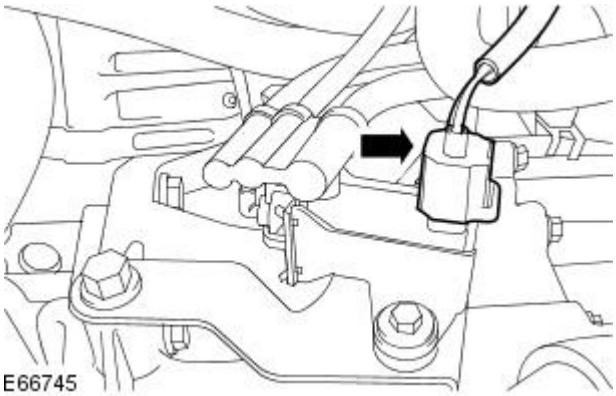


90. Remove the charge air cooler pipe.

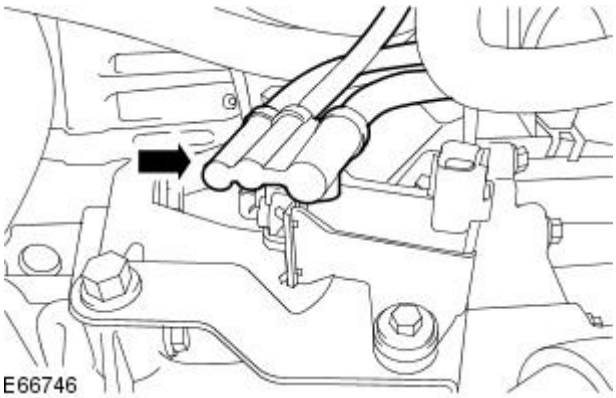



E66897

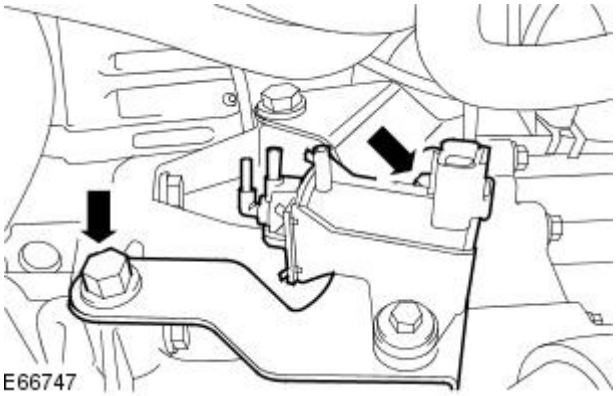
91. Disconnect the reverse lamp switch electrical connector.


E66745

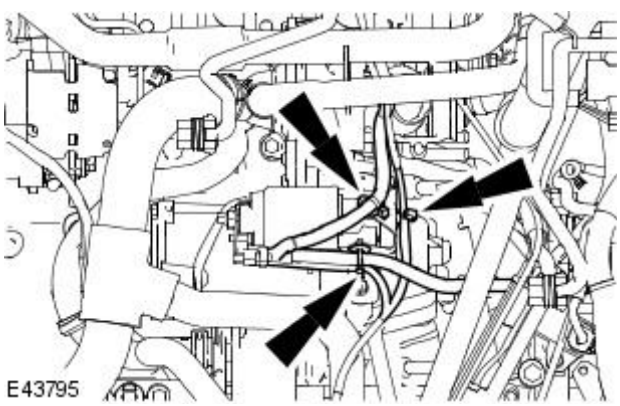
92. Disconnect the emission control solenoid electrical connector.


E66746

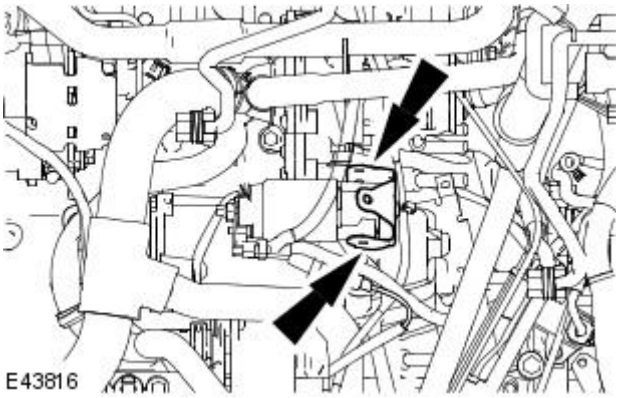
93. Disconnect the emission control solenoid hose.


E66747

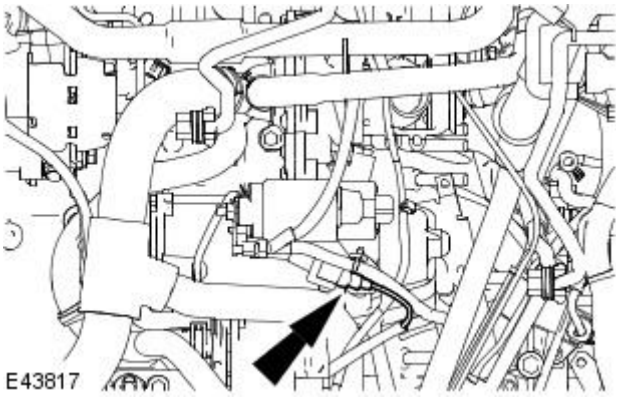
94. Remove the emission control solenoid assembly.


E43795

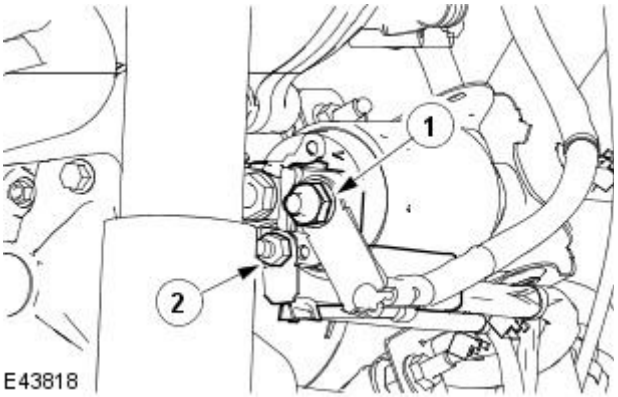
95. Detach the starter motor wiring harness.



96. Remove the starter motor wiring harness retaining bracket.

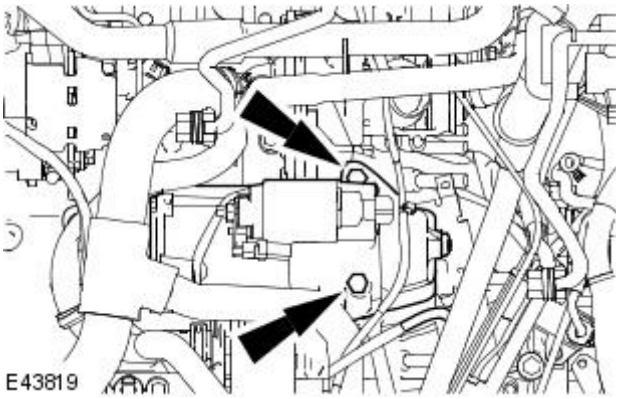


97. Disconnect the starter motor wiring harness electrical connector.

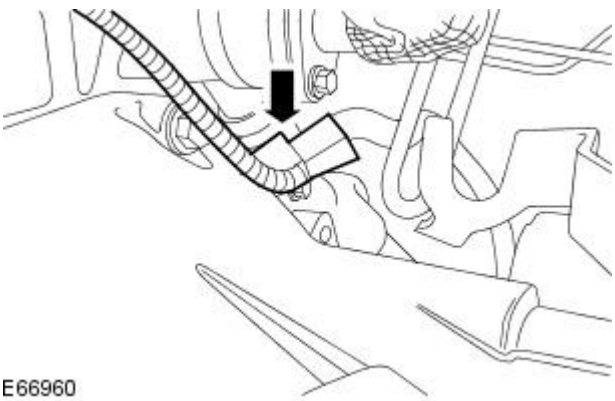


98. Detach the starter motor wiring harness.

1. Disconnect the starter motor electrical connector.
2. Disconnect the starter motor solenoid electrical connector.

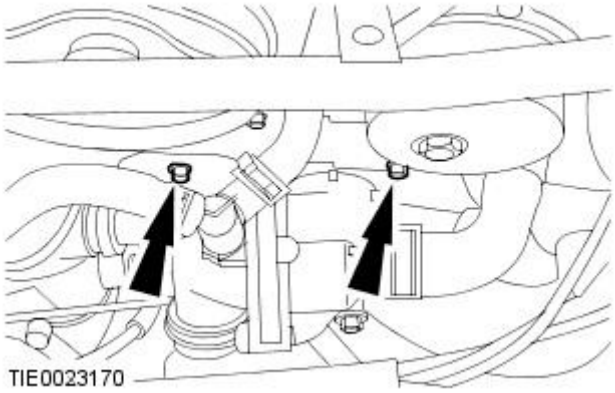


99. Remove the starter motor.

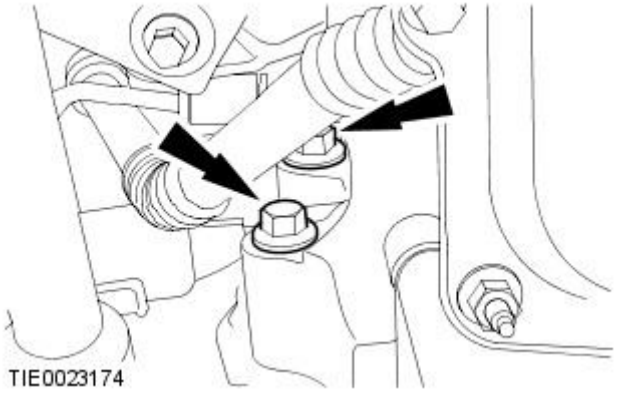


100. Disconnect the crankshaft position (CKP) sensor electrical connector.

101. Remove the transmission upper retaining bolts.

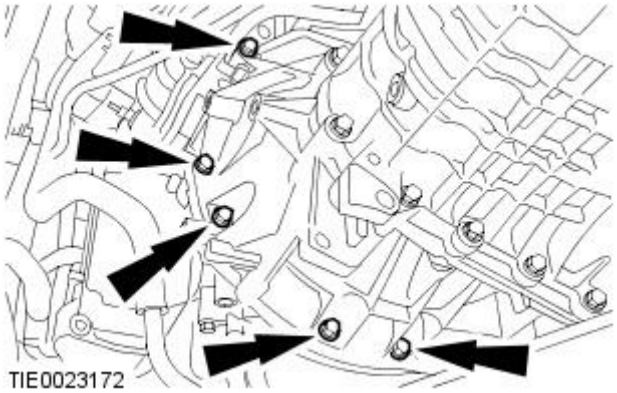

TIE0023170

102. Remove the transmission right-hand retaining bolts.


TIE0023174

103. CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

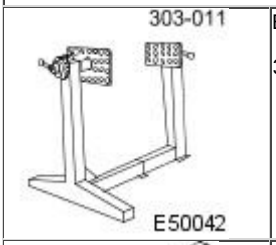
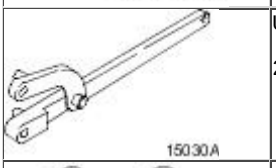
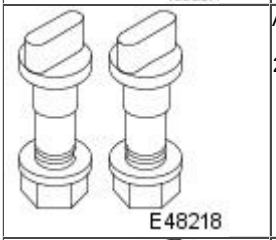
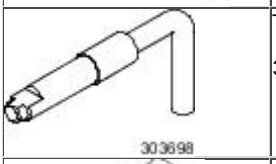
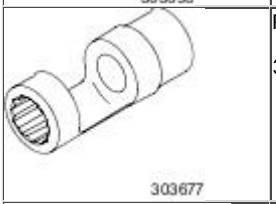
Remove the engine assembly from the transmission assembly.


TIE0023172

Published: 11-May-2011

Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Engine

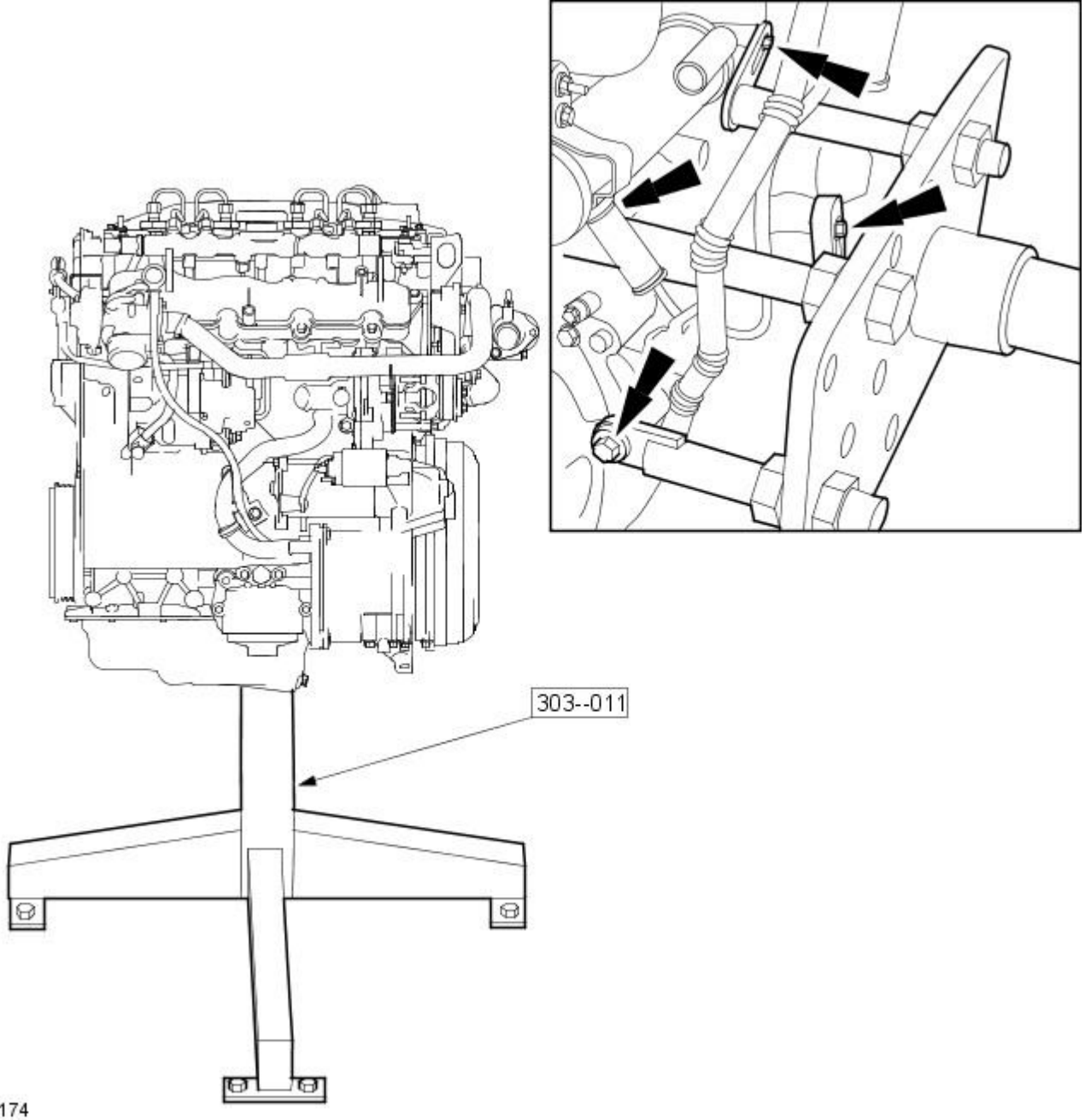
Disassembly

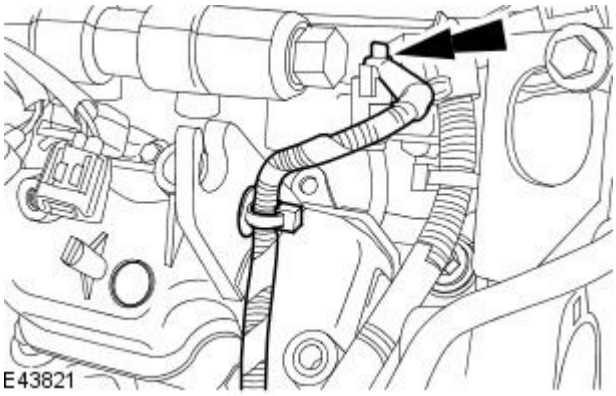
Special Tool(s)	
	Engine stand 303-011
	Universal Flange Holding Wrench 205-053
	Adapter for 205-053-02 205-053-02
	Timing Tool, Crankshaft 303-698
	Remover, Fuel Injector 303-711
	Remover/Installer, Cooling Hose Clamp 303-397

Disassembly

All vehicles

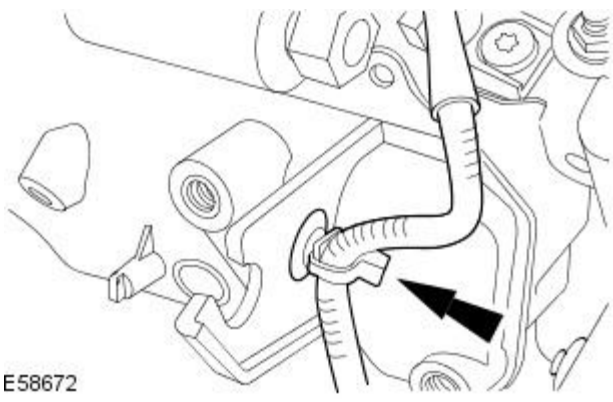
1. Using the special tool, mount the engine to the engine stand.



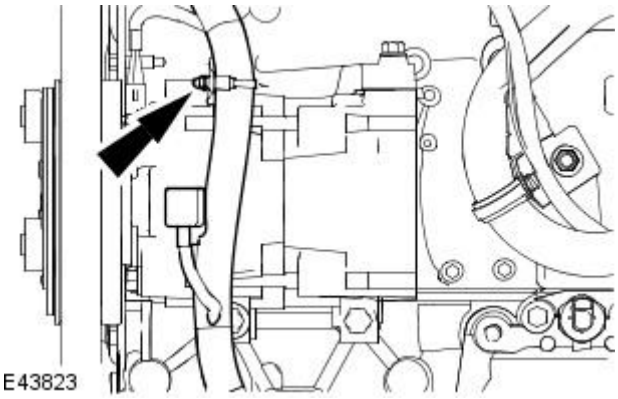


2. Detach the glow plug wiring harness.

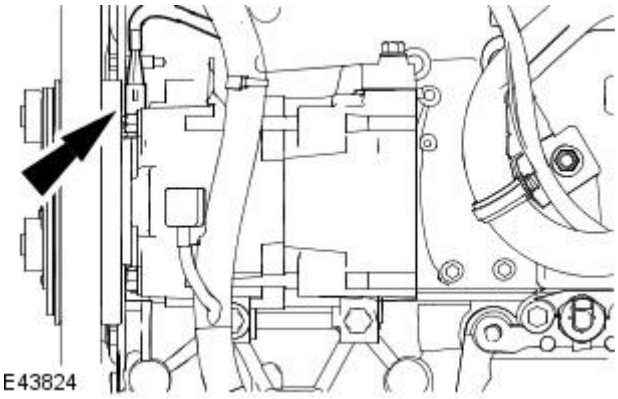
- Remove the glow plug wiring harness securing nut.



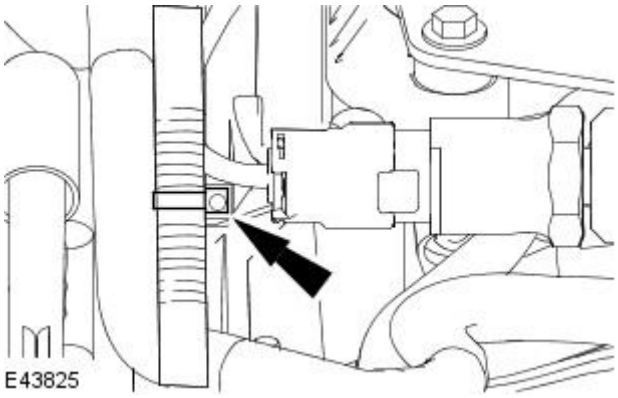
3. Detach the wiring harness from the intake manifold.



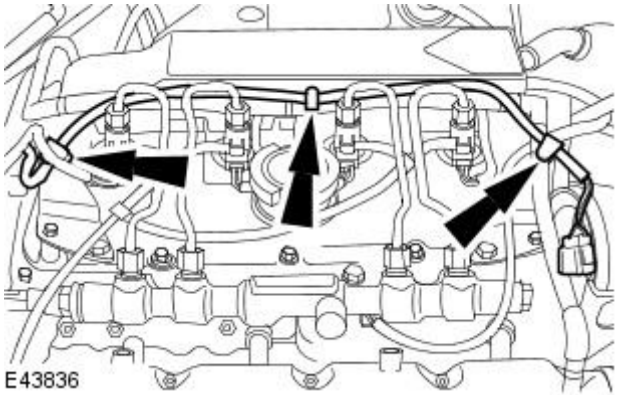
4. Detach the wiring harness from the air conditioning (AC) compressor.



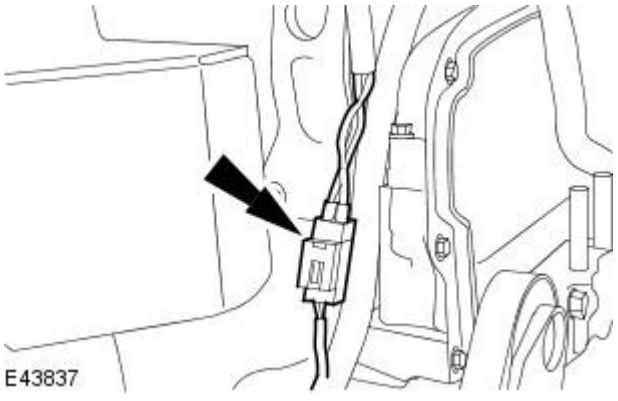
5. Disconnect the AC compressor electrical connector.



6. Detach the wiring harness from the retaining stud.

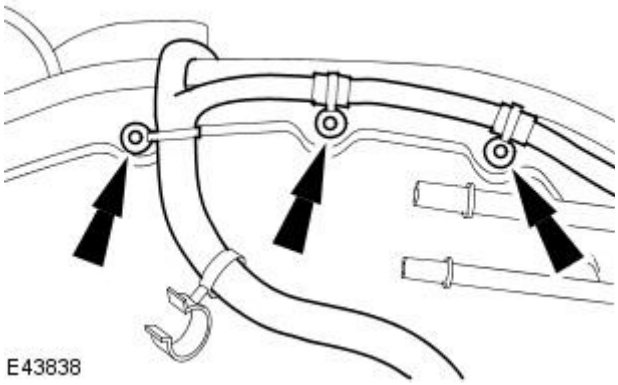


7. Detach the mass air flow (MAF) sensor wiring harness.



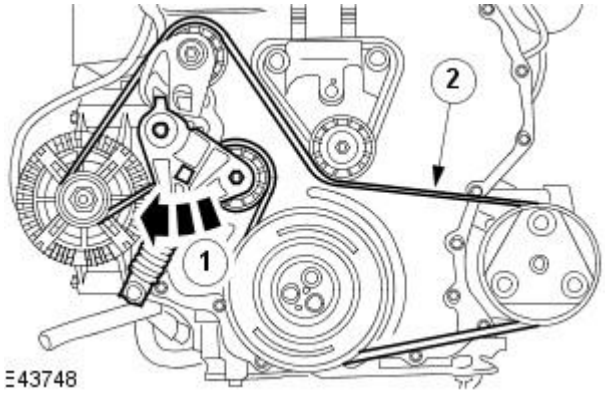
8. Detach the generator wiring harness electrical connector.

9. Remove the wiring harness.



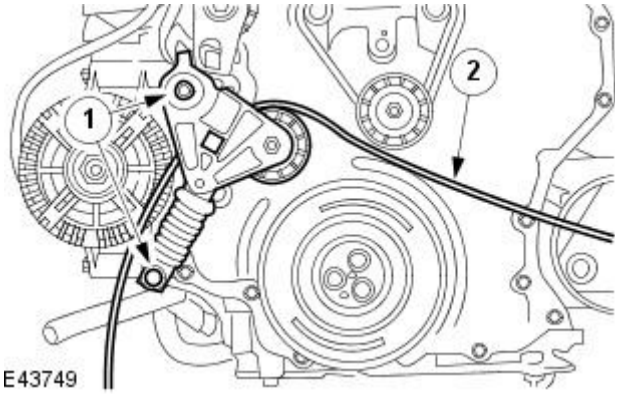
10. Detach the accessory drive belt.

1. Reposition the accessory drive belt tensioner.
2. Detach the accessory drive belt.

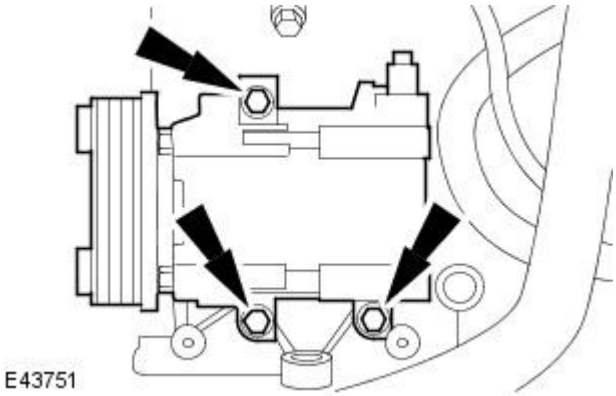


11. Remove the accessory drive belt.

1. Remove the accessory drive belt tensioner.
2. Remove the accessory drive belt.

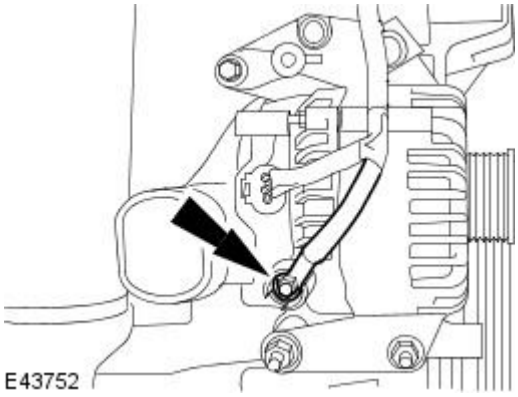


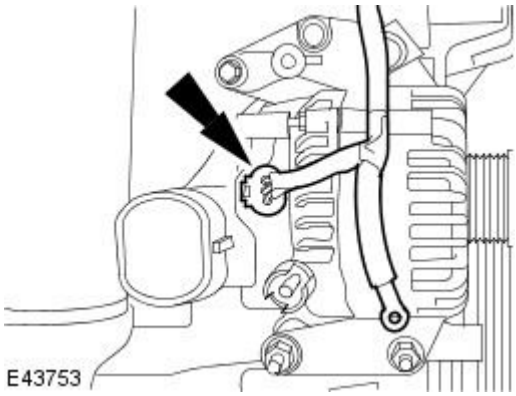
12. Remove the AC compressor.



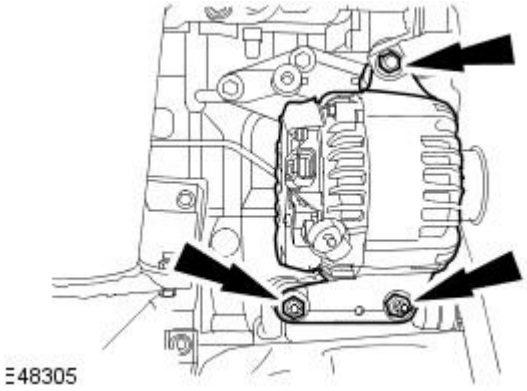
13. Detach the generator electrical connector.

- Remove the generator electrical connector securing nut.



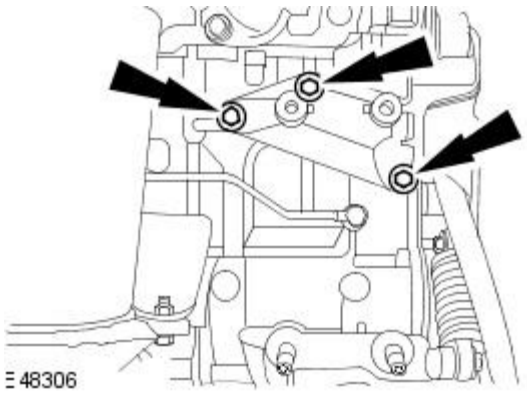


14. Disconnect the generator electrical connector.



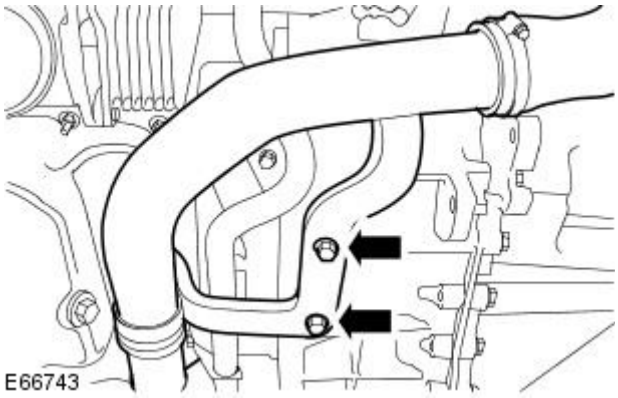
15. Remove the generator.

- Remove the wiring harness support bracket from the generator upper retaining bolt.

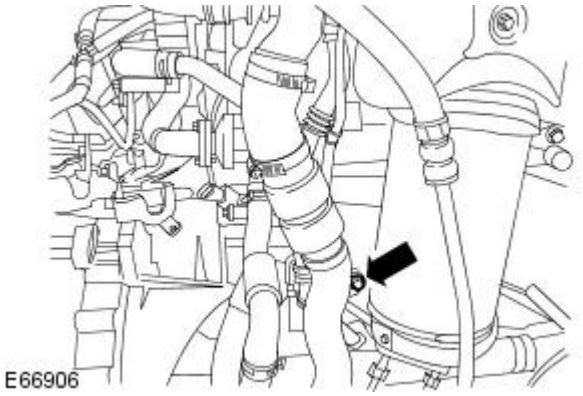


16. Remove the accessory drive belt tensioner bracket.

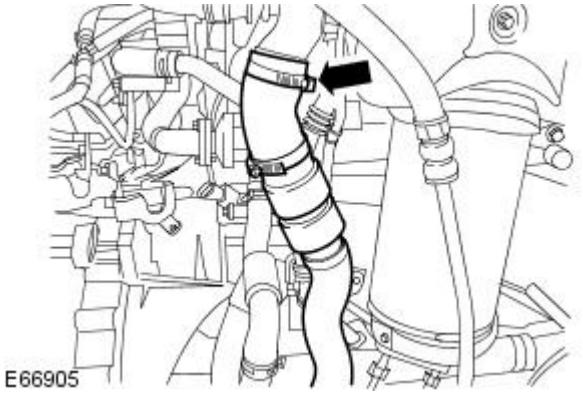
Vehicles with 2.2L diesel engine



17. Remove the charge air cooler intake pipe retaining bolts.

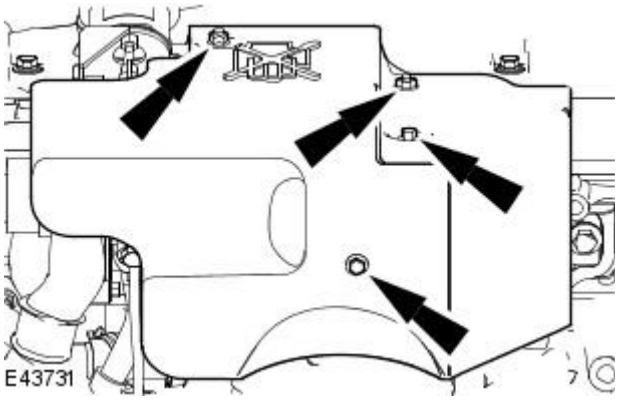


18. Remove the turbo outlet pipe retaining bolt.

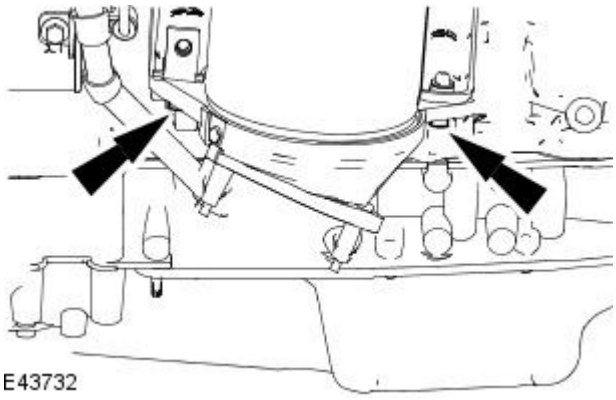


19. Remove the turbo outlet pipe and charge air cooler intake pipe assembly.

All vehicles

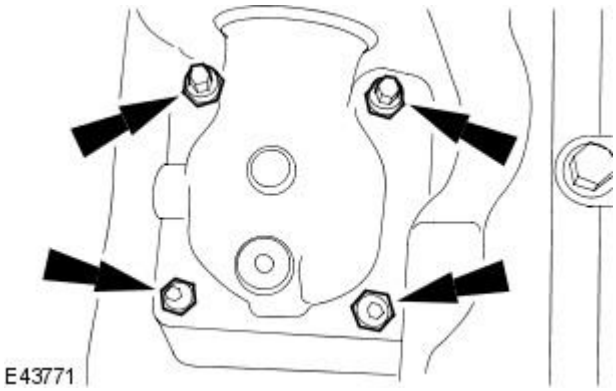


20. Remove the turbocharger heat shield.



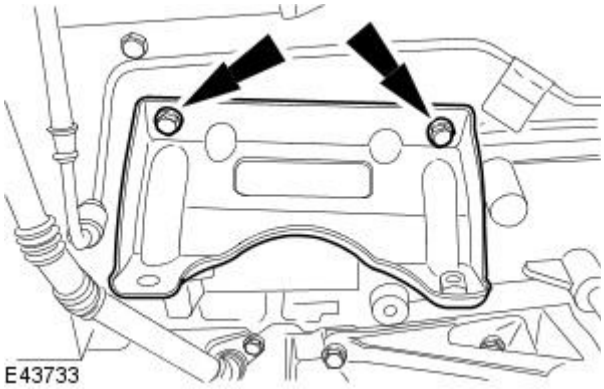
21. Remove the catalytic converter retaining bolts.

- Remove the catalytic converter securing bracket.

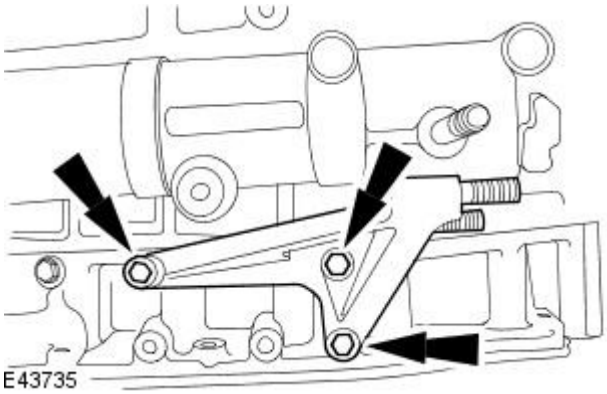


22. Remove the catalytic converter.

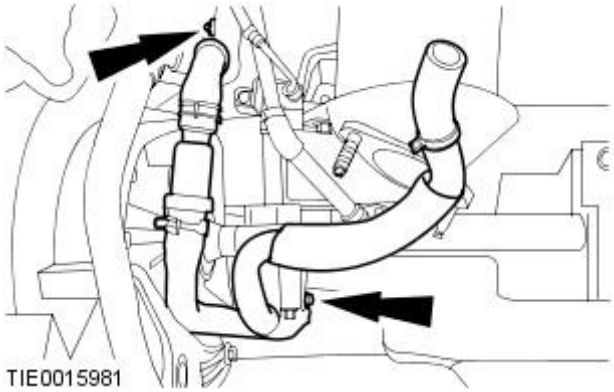
- Remove and discard the retaining nuts.



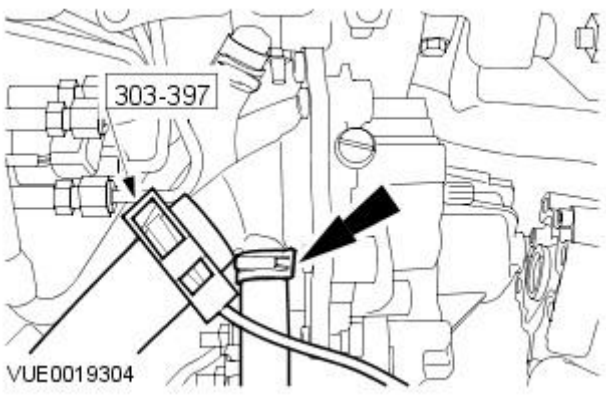
23. Remove the catalytic converter retaining bracket.



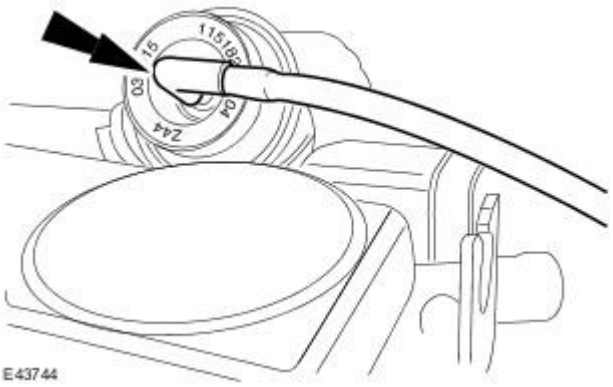
24. Remove the halfshaft retaining bracket.



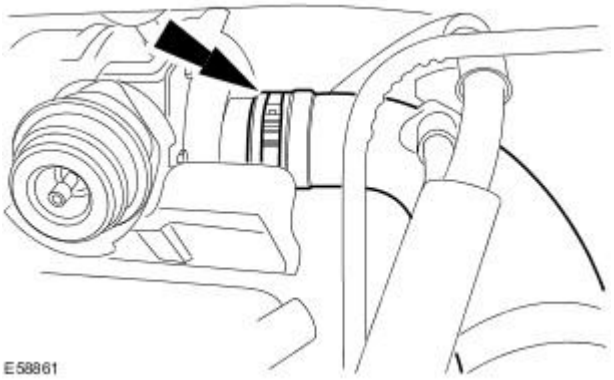
25. Remove the exhaust gas recirculation (EGR) cooler coolant hose.



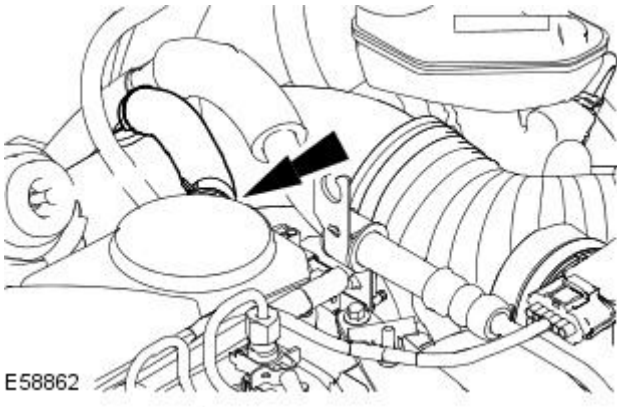
26. Using the special tool, remove the water pump hoses.



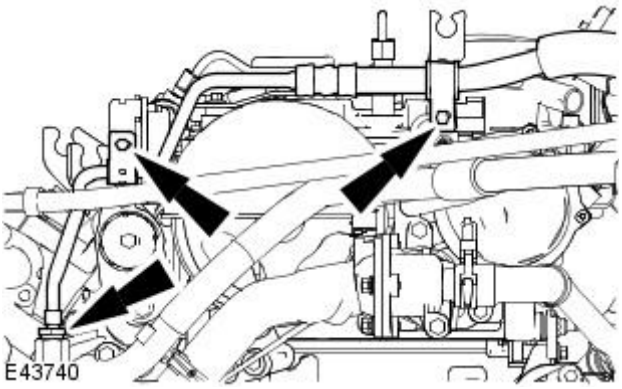
27. Disconnect the turbocharger vacuum hose.



28. Remove the air filter outlet tube retaining clip.

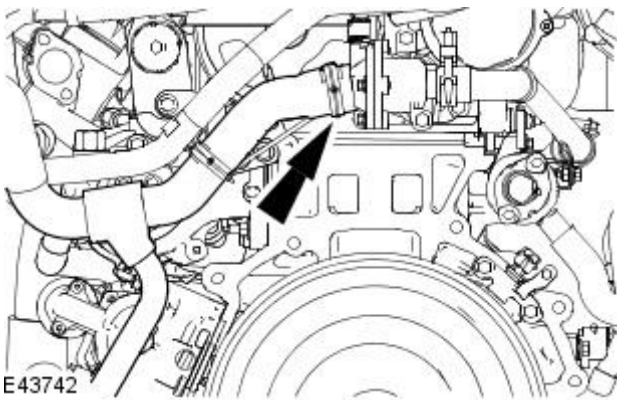


29. Remove the air filter outlet tube.



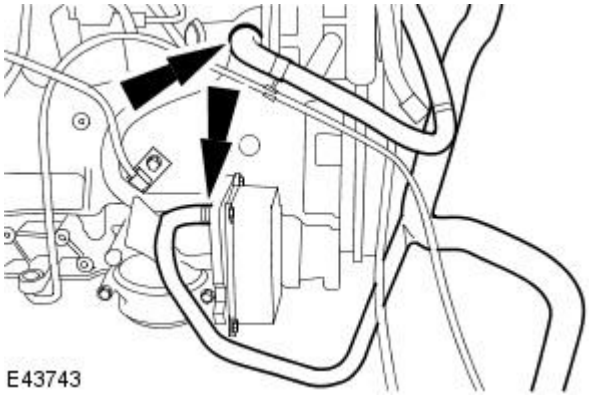
30. Remove the power assisted steering high-pressure pipe.

- Discard the O-ring seal.

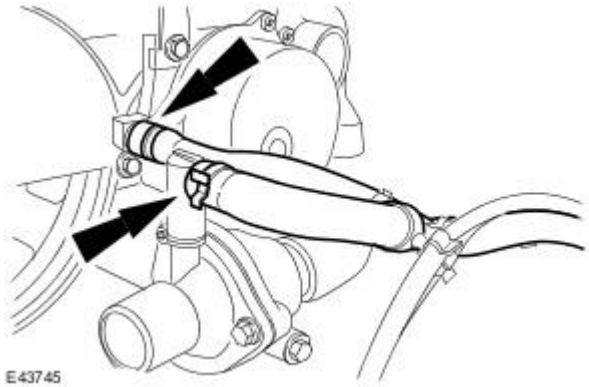


31. Disconnect the coolant hose.

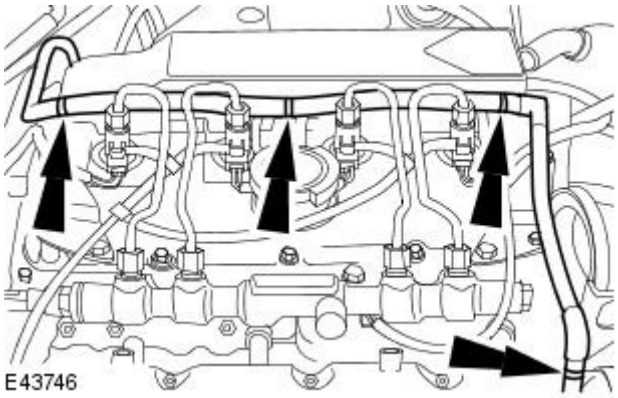
32. Remove the coolant hose.



33. Remove the coolant hose.

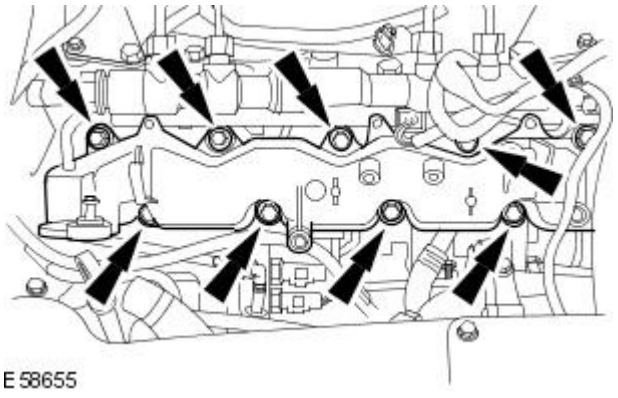


34. Remove the starter motor to generator wiring harness.

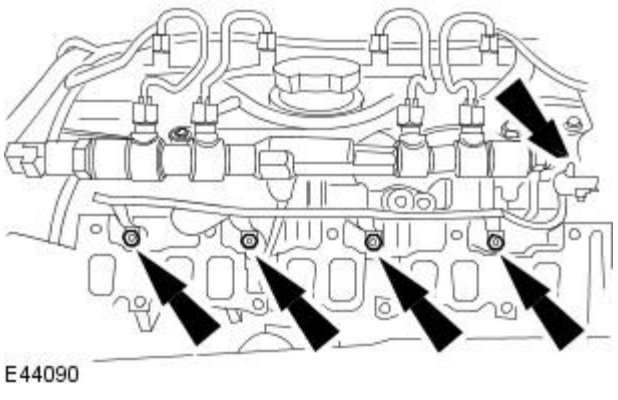


35. Remove the intake manifold.

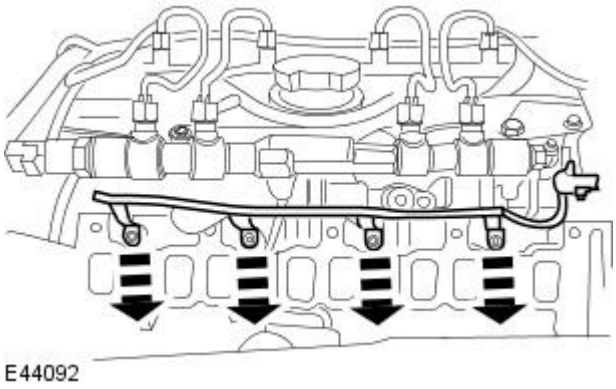
- Remove and discard the intake manifold gaskets.



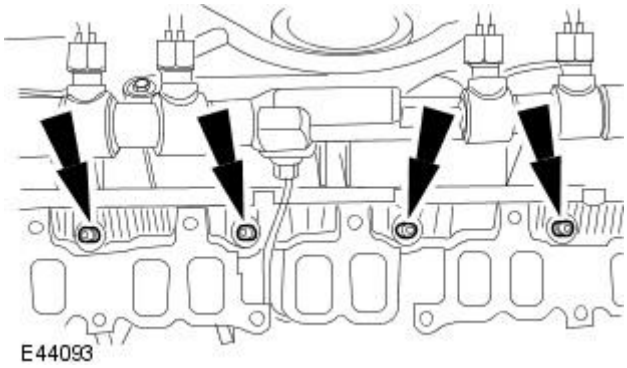
36. Remove the glow plug wire retaining nuts.



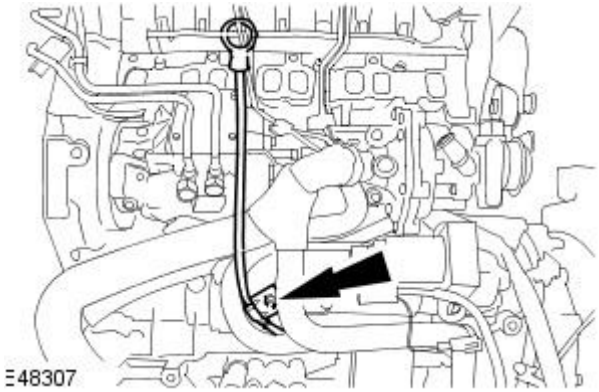
37. Remove the glow plug wiring harness.



38. Remove the glow plugs.

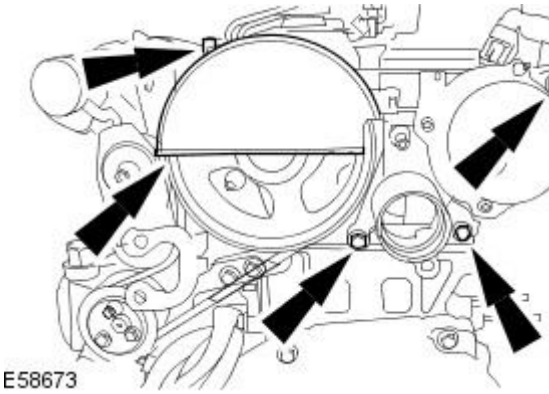


39. Remove the oil level indicator and tube.



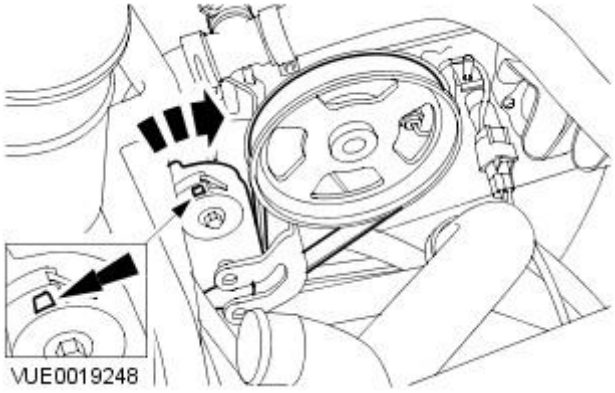
40. Remove the brake vacuum pump retaining bolts.

- Remove the power steering pump belt cover.

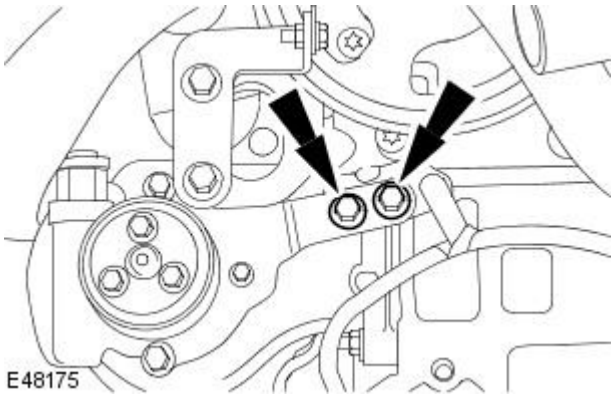


41. Remove the power steering pump belt.

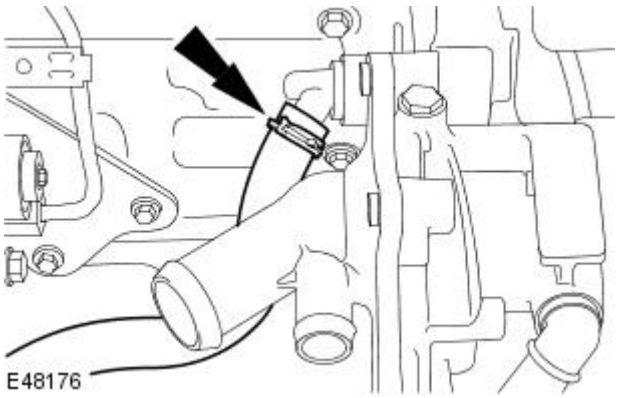
- Rotate the power steering pump belt tensioner clockwise.



42. Remove the power assisted steering pump bracket retaining bolts.

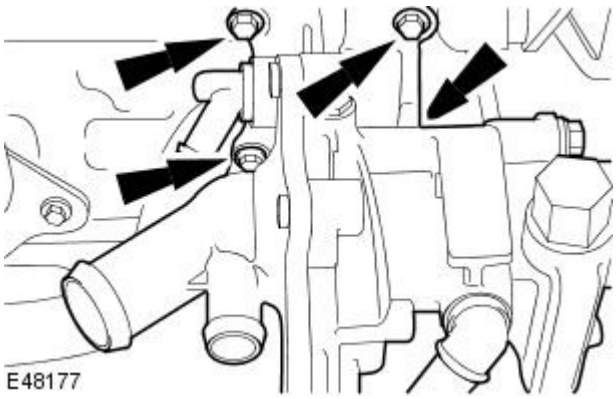


43. Disconnect the coolant hose from the water pump.

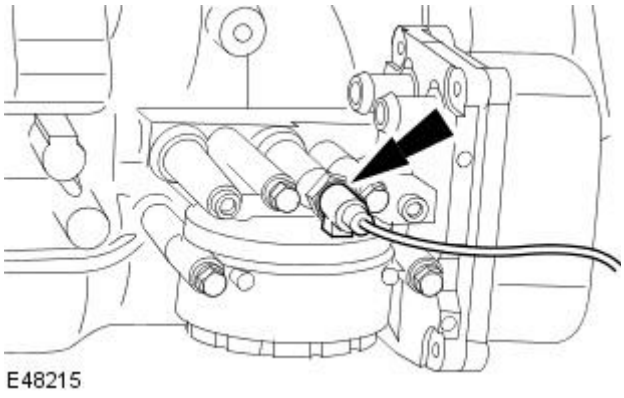


44. Remove the water pump and power assisted steering pump assembly.

- Remove and discard the gasket.

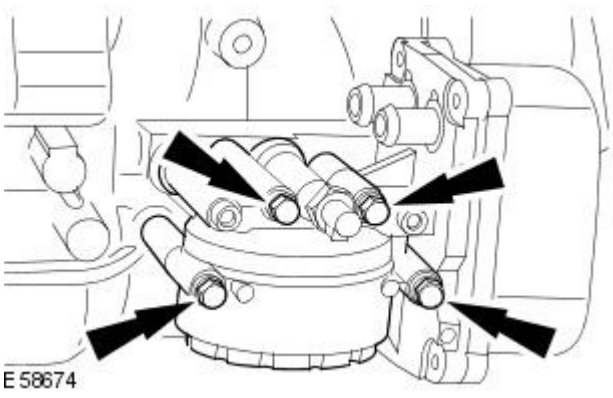


45. Disconnect the oil pressure switch electrical connector.

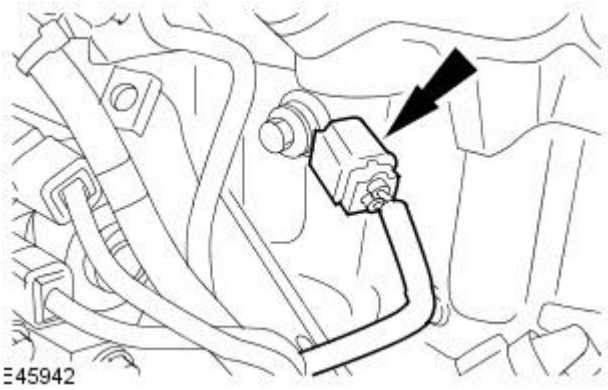


46. Remove the oil filter housing.

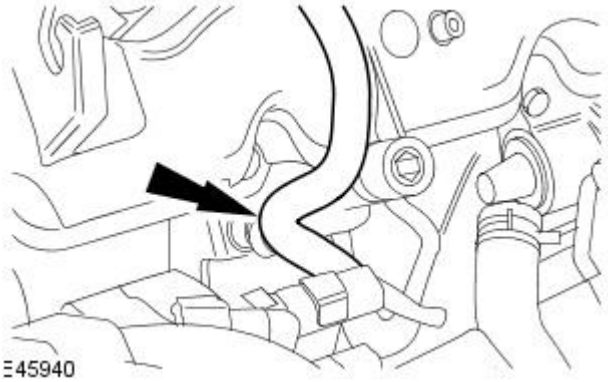
- Remove and discard the oil filter.
- Remove and discard the O-ring seals.



47. Disconnect the knock sensor (KS) electrical connector.

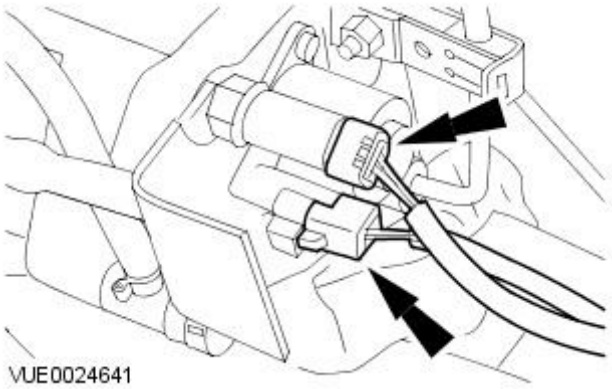


48. Detach the wiring harness.



49. NOTE: Protect the fuel metering valve and fuel temperature sensor electrical connectors with lint free cloth to prevent contamination from the cleaning fluid.

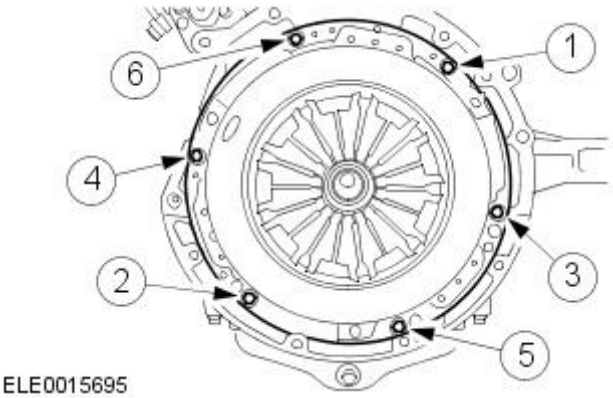
Disconnect the fuel metering valve and fuel temperature sensor electrical connectors.



50. CAUTION: Loosen the clutch pressure plate retaining bolts by two turns at a time in the sequence shown.

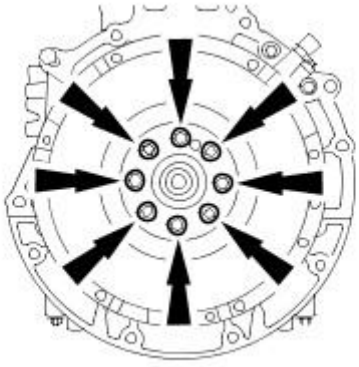
Remove the clutch disc and pressure plate.

- Remove and discard the retaining bolts.



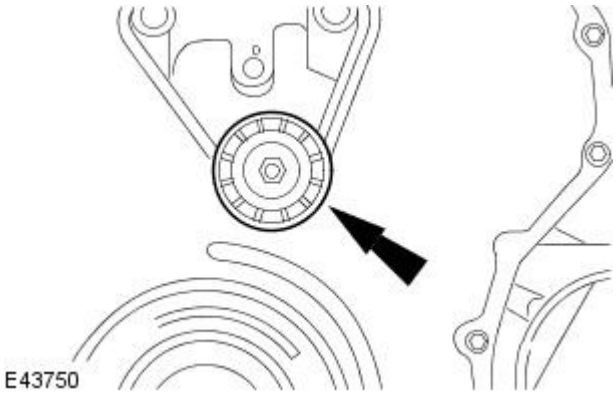
51. Remove the flywheel.

- Remove and discard the retaining bolts.



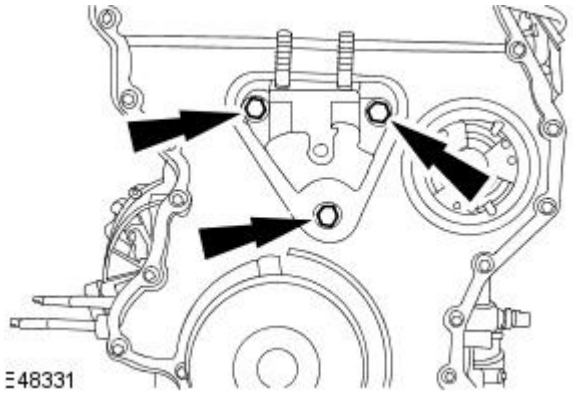
TIE0012992

52. Remove the idler pulley.



E43750

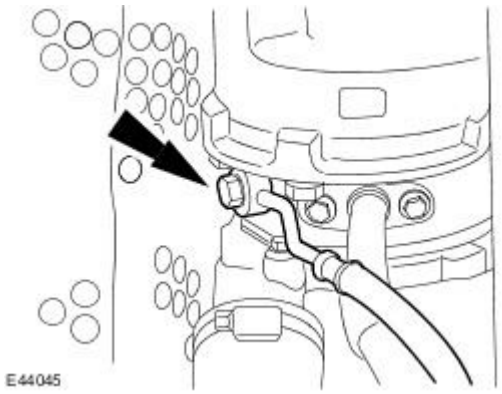
53. Remove the engine front mount bracket.



E48331

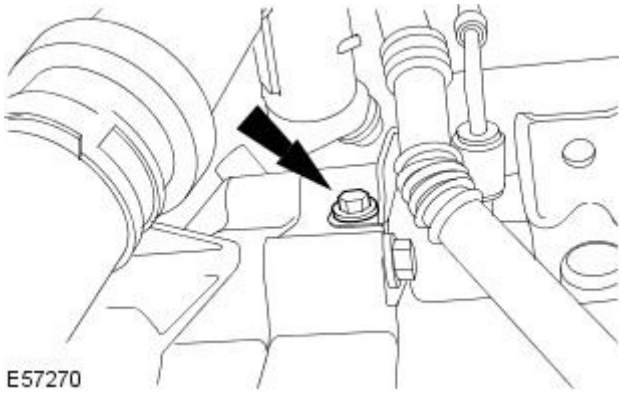
54. Disconnect the oil supply tube from the turbocharger.

- Remove and discard the sealing washers.



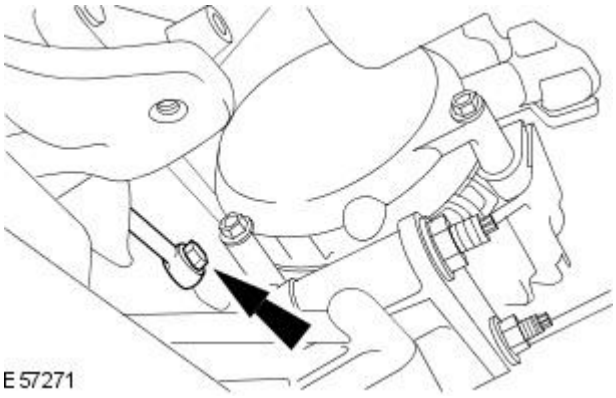
E44045

55. Detach the oil supply tube.



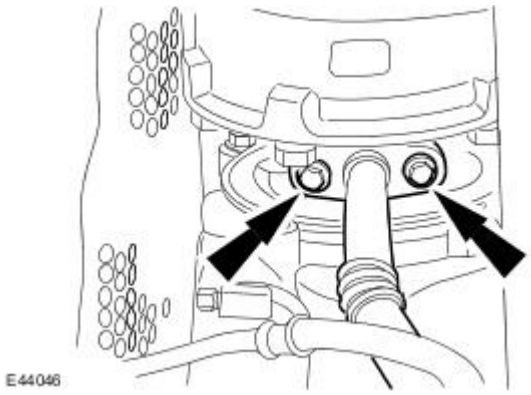
E57270

56. Remove the oil supply tube.



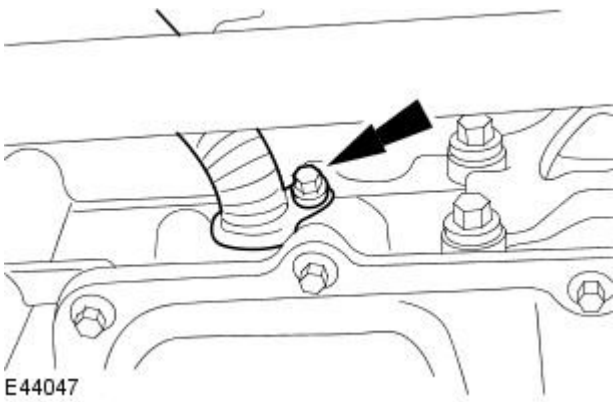
57. Disconnect the oil return tube from the turbocharger.

- Remove and discard the gasket.

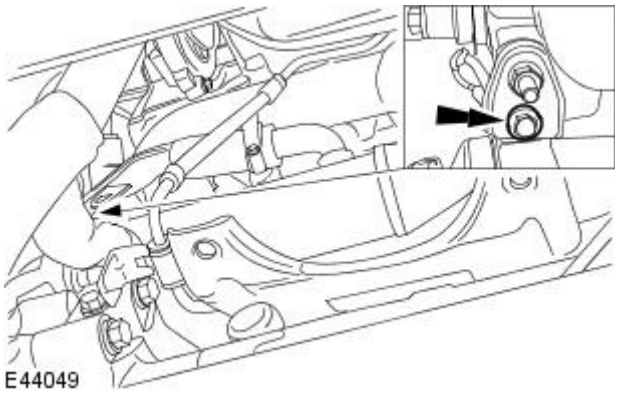


58. Remove the oil return tube.

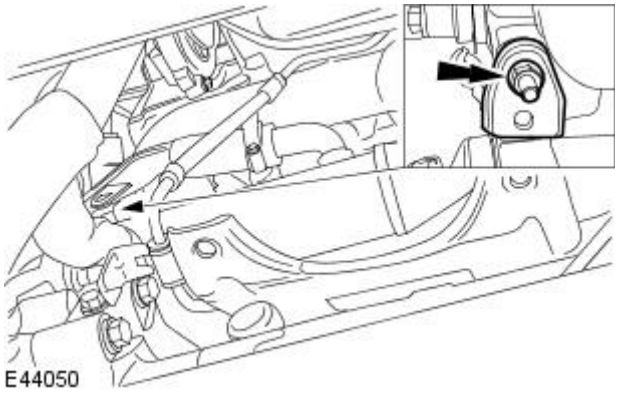
- Remove and discard the O-ring seal.

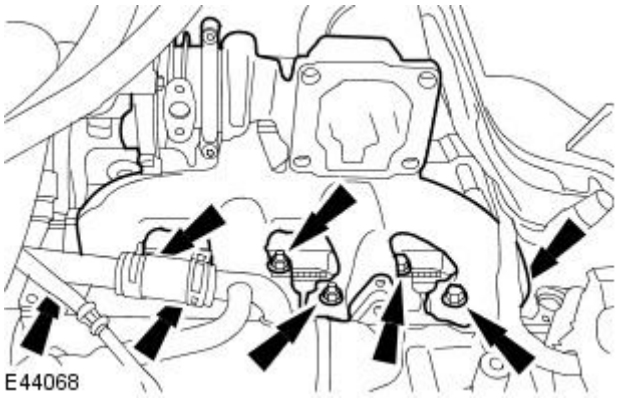


59. Remove the EGR cooler mount bracket retaining bolt.



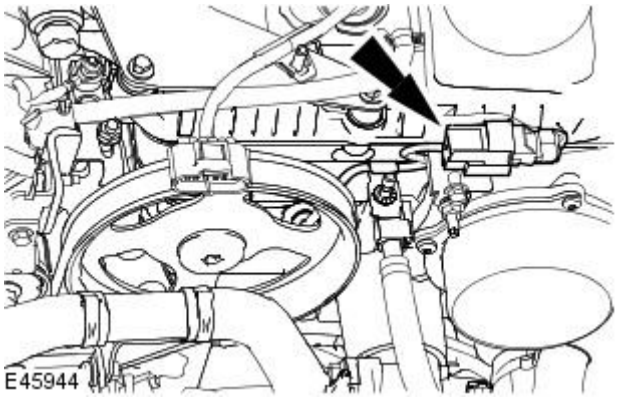
60. Remove the EGR cooler mount bracket.



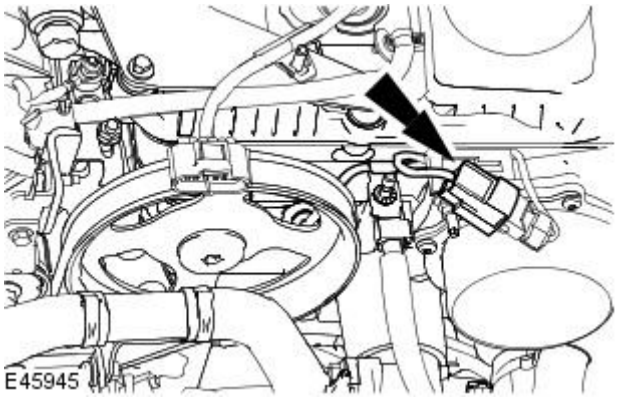


61. Remove the exhaust manifold.

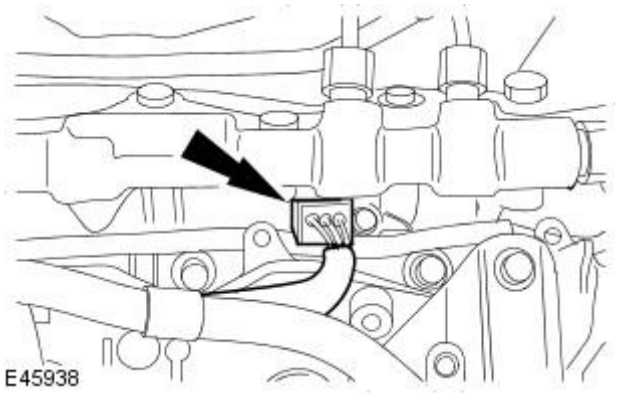
- Remove and discard the retaining bolts and nuts.



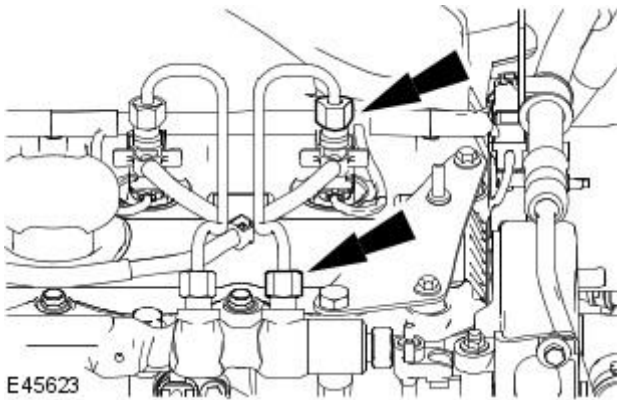
62. Detach the cylinder head temperature (CHT) sensor electrical connector.



63. Disconnect the CHT sensor electrical connector.



64. Disconnect the camshaft position (CMP) sensor electrical connector.



65. CAUTIONS:

Make sure that 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 the tool used to loosen the high-pressure fuel supply line unions is used at the top of the unions as this is where there is most material. Failure to follow this instruction may result in damage to the unions.

Make sure that the fuel injector does not move when loosening the high-pressure fuel supply lines. Failure to follow this instruction will result in damage to the fuel injector and the fuel injector sealing washer.

• NOTE: Injector number 4 shown, injector numbers 1, 2 and 3 similar.

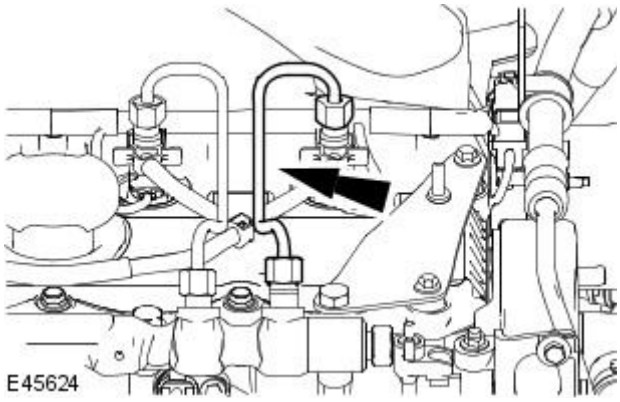
Loosen the high-pressure fuel supply line from the fuel injector and fuel injection supply manifold.

66. CAUTION: Make sure that 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.

Using the pneumatic vacuum gun, vacuum foreign material from the high-pressure fuel supply line, the fuel injector and the fuel injection supply manifold.

67. NOTE: Injector number 4 shown, injector numbers 1, 2 and 3 similar.

Remove and discard the high-pressure fuel supply line.



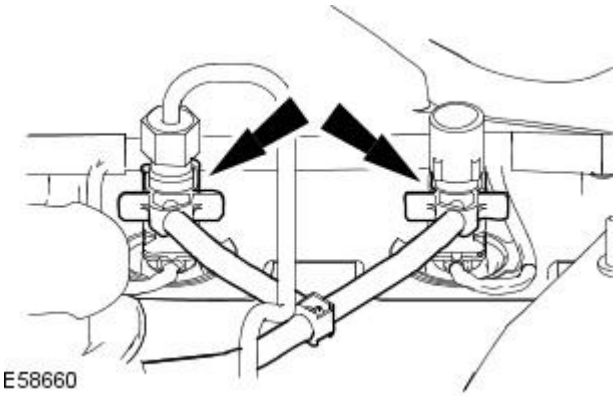
68. Using the pneumatic vacuum gun, vacuum foreign material from the fuel injector and the fuel injection supply manifold.

69. Install blanking caps to the open threaded ports on the fuel injector and the fuel injection supply manifold.

70. NOTE: Injector number 4 shown, injector numbers 1, 2 and 3 similar.

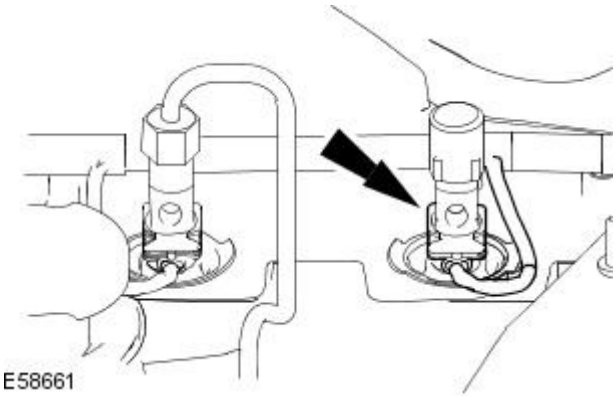
Disconnect the fuel return lines from the fuel injectors.

- Discard the fuel return line O-ring seals.



71. NOTE: Injector number 4 shown, injector numbers 1, 2 and 3 similar.

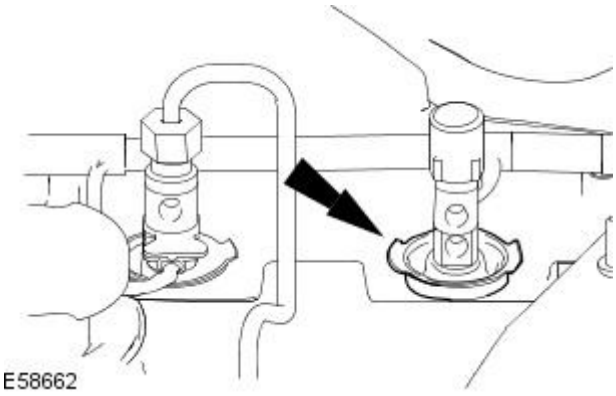
Disconnect the fuel injector electrical connector.

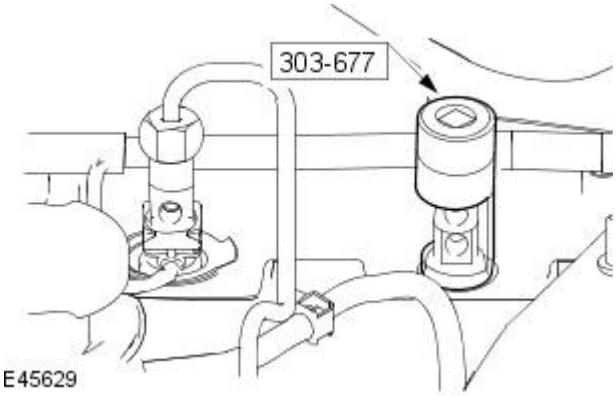


72. NOTE: Injector number 4 shown, injector numbers 1, 2 and 3 similar.

Remove the valve cover fuel injector seal.

- Discard the valve cover fuel injector seal.

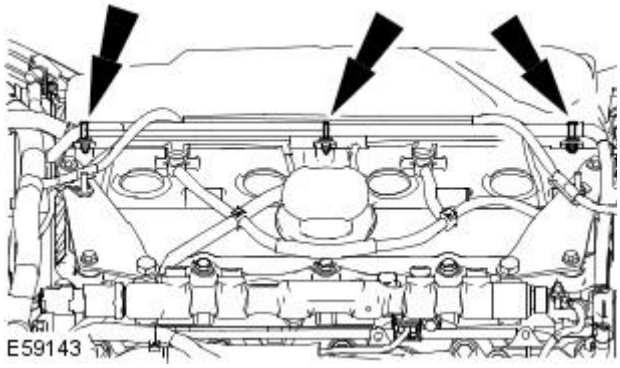




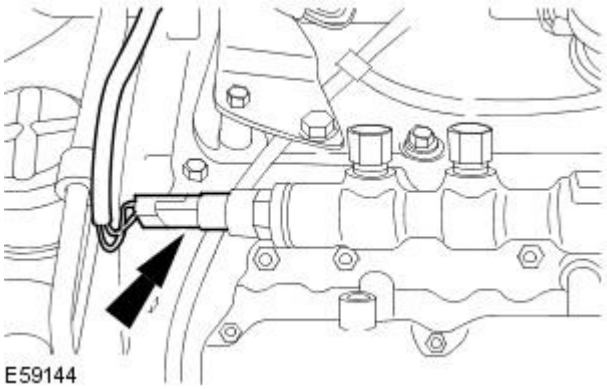
73. CAUTION: Make sure that the fuel injector does not move when loosening the fuel injector locking collar. Failure to follow this instruction will result in damage to the fuel injector and the fuel injector sealing washer.

• NOTE: Injector number 4 shown, injector numbers 1, 2 and 3 similar.

Using the special tool, remove the fuel injector.



74. Detach the starter motor and injector wiring harness.



75. Remove the wiring harness.

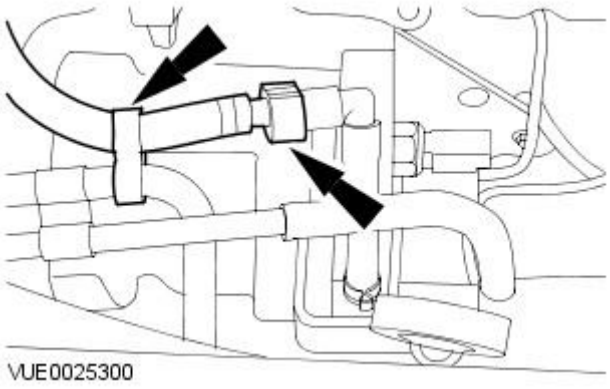
- Disconnect the fuel pressure sensor electrical connector.

76. CAUTION: Make sure that the high pressure fuel supply line remains in contact with both the fuel pump 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.

Using the pneumatic vacuum gun, vacuum foreign material from the high pressure fuel supply line and the fuel pump.

77. Disconnect the fuel injector to fuel pump fuel return line and detach the line from the retaining clip.

- Install blanking plugs to the fuel injector to fuel pump fuel return line male and female connectors.

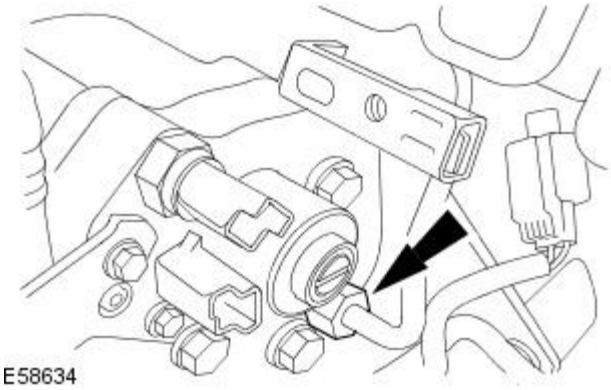


78. Clean the fuel injectors and high pressure fuel supply lines and surrounding areas.
For additional information, refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

79. CAUTION: Make sure that 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.

Using the pneumatic vacuum gun, vacuum foreign material from the high-pressure fuel supply line, the fuel injector and the fuel injection supply manifold.

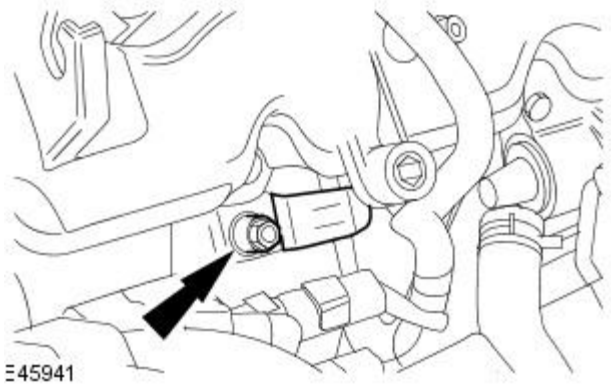


80. CAUTIONS:

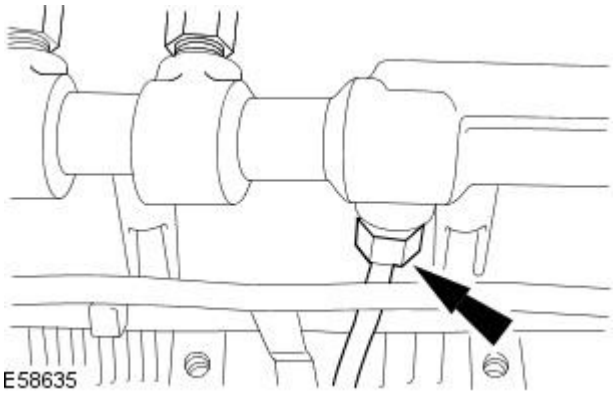
Make sure the tool used to loosen the high-pressure fuel supply line union is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Maintain pressure on the high-pressure fuel supply line to keep the olive in contact with the fuel pump cone while unscrewing the union. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Loosen the high-pressure fuel supply line at the fuel pump.



81. Remove the fuel pump to fuel injection supply manifold high pressure pipe retaining bracket.



82. CAUTIONS:

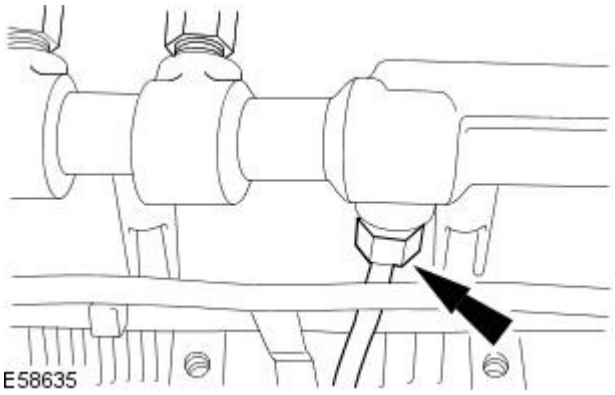
Make sure the tool used to loosen the high-pressure fuel supply line union is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Maintain pressure on the high-pressure fuel supply line to keep the olive in contact with the fuel injection supply manifold cone while unscrewing the union. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

While maintaining the pressure on the high-pressure fuel supply line, clean and vacuum foreign material from the line and union.

Loosen the high-pressure fuel supply line at the fuel injection supply manifold.

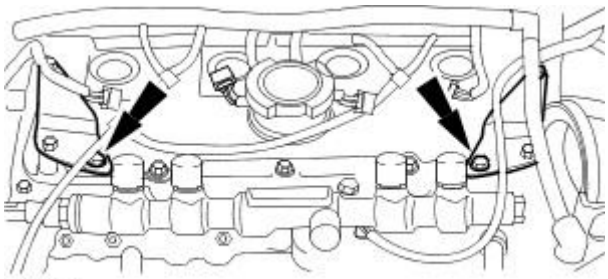
83. Remove and discard the high pressure fuel supply line.



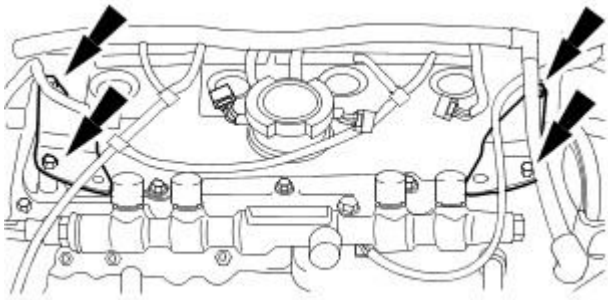
84. Install blanking caps to the open threaded ports on the fuel pump and the fuel injection supply manifold.

85. Clean the fuel injection supply manifold and surrounding areas.
For additional information, refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

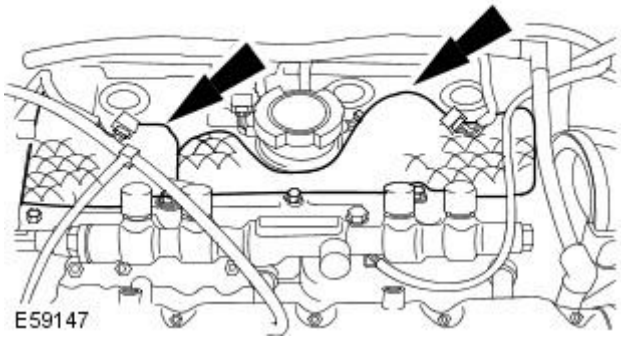
86. Remove the fuel injection supply manifold retaining bolts.


E59145

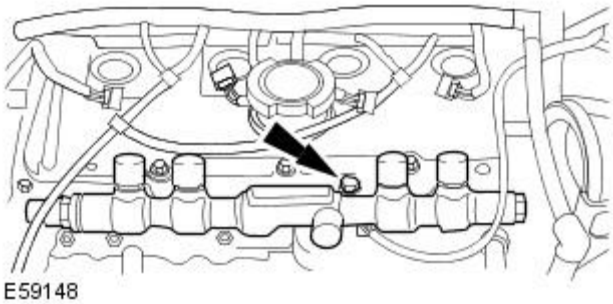
87. Loosen the fuel injection supply manifold support brackets.


E59146

88. Remove the sound proof padding.

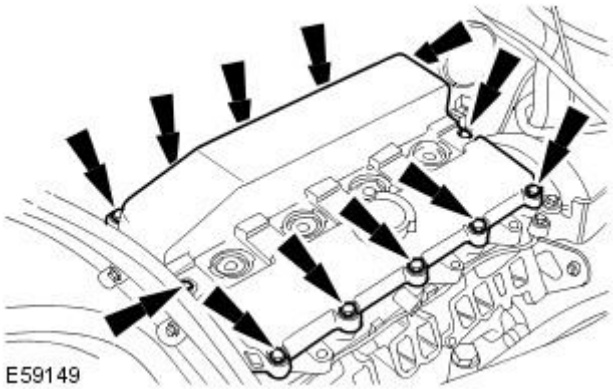

E59147

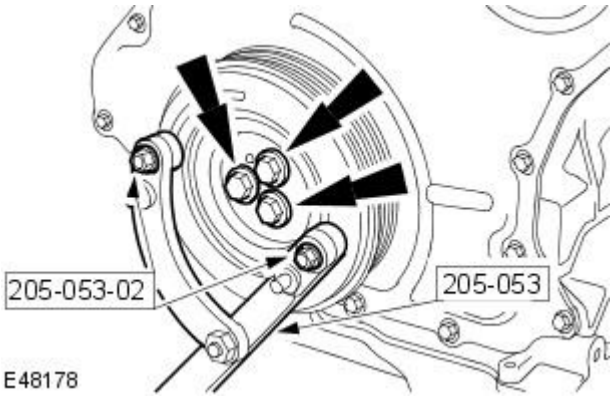
89. Remove the fuel injection supply manifold.


E59148

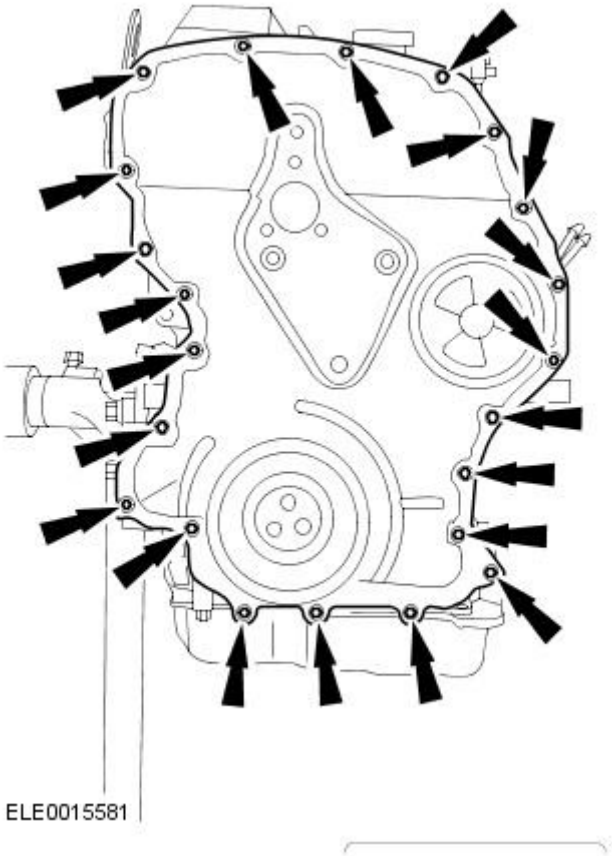
90. Remove the valve cover.

- Remove and discard the valve cover gasket.


E59149

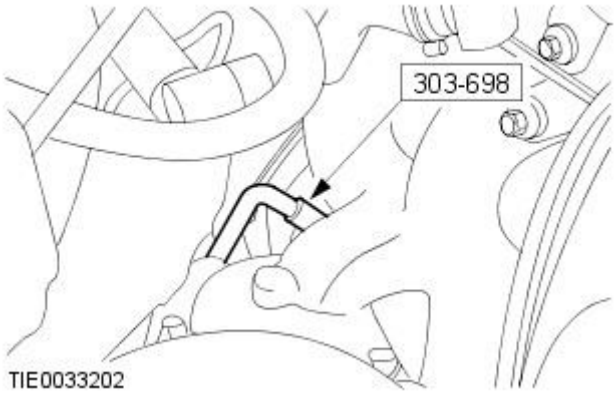


91. Using the special tools, remove the crankshaft damper.



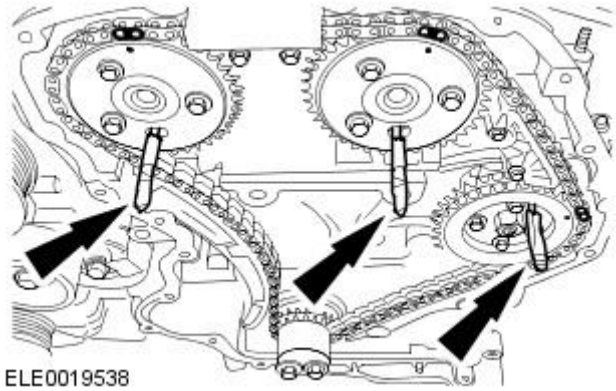
92. Remove and discard the engine front cover.

- Remove the engine front cover retaining nuts and bolts.

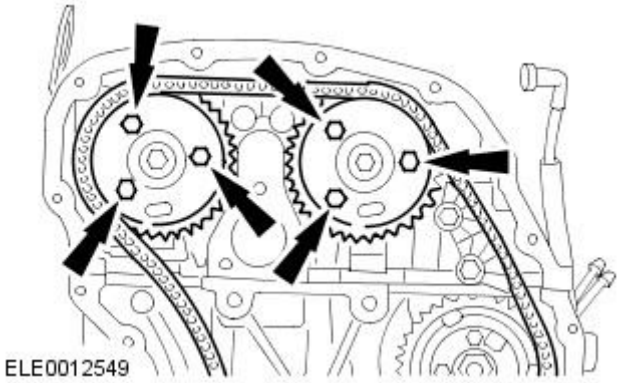


93. Turn the crankshaft to 50 degrees before top dead center (BTDC) and insert the special tool 303-698, through the crankshaft position (CKP) sensor hole.

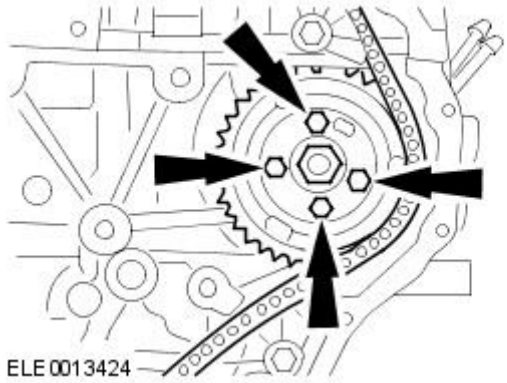
94. Using suitable 6 mm bar, lock the timing drive sprockets.


ELE0019538

95. Loosen the camshaft sprocket retaining bolts.

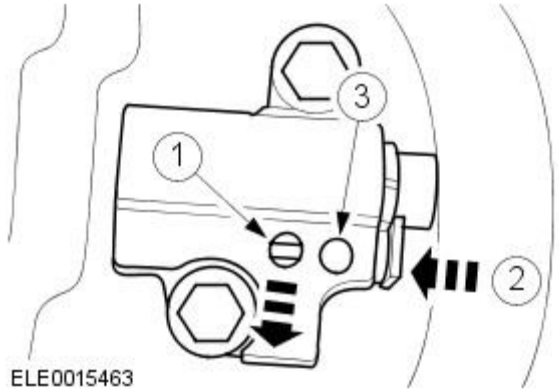

ELE0012549

96. Loosen the fuel injection pump sprocket retaining bolts.


ELE0013424

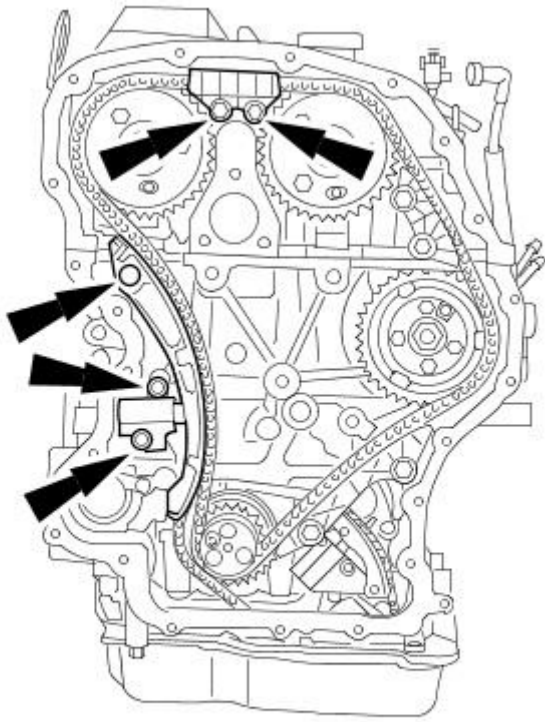
97. Using a suitable tool, retain the timing chain tensioner piston.

1. Retract the pawl.
2. Push the lock in.
3. Insert a pin.

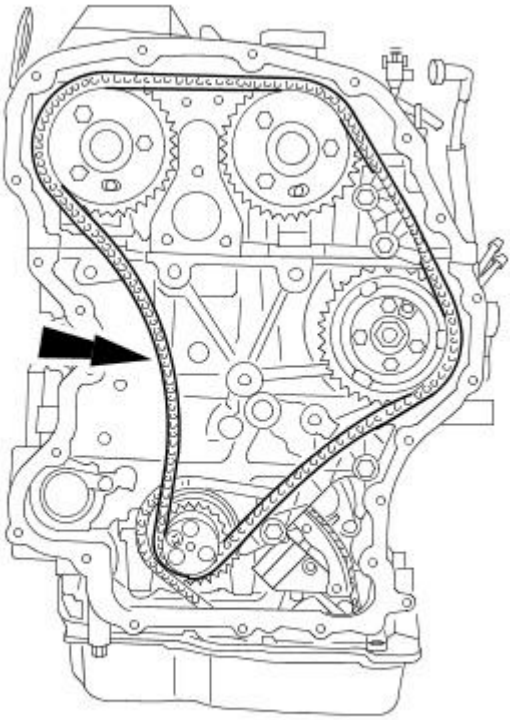


ELE0015463

98. Remove the timing chain tensioner and guides.

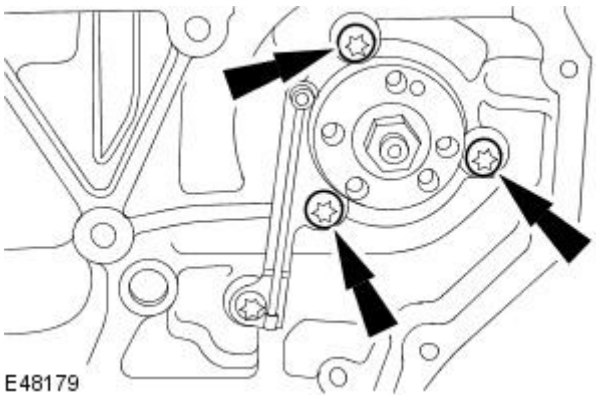


99. Remove the timing chain.



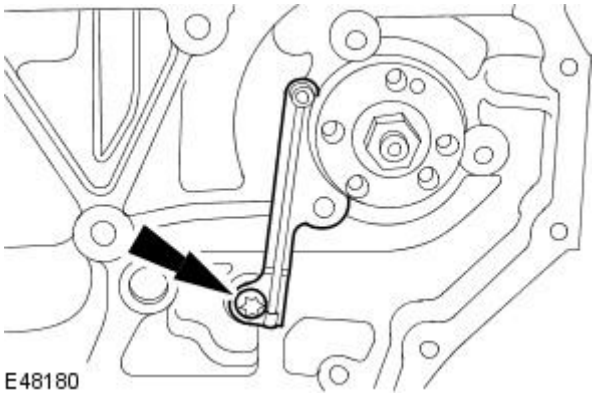
E46626

100. Remove the high-pressure fuel pump retaining bolts.



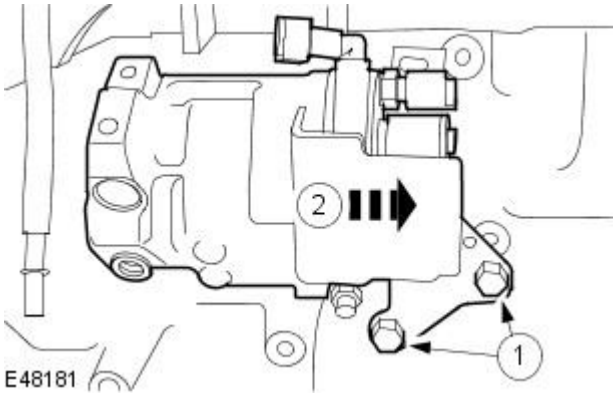
E48179

101. Remove the timing chain oil feed pipe.

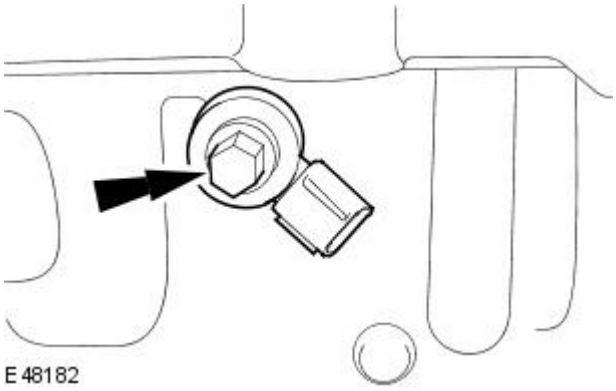


102. Remove the high-pressure fuel pump.

1. Remove the retaining bolts.
2. Remove the high-pressure fuel pump.

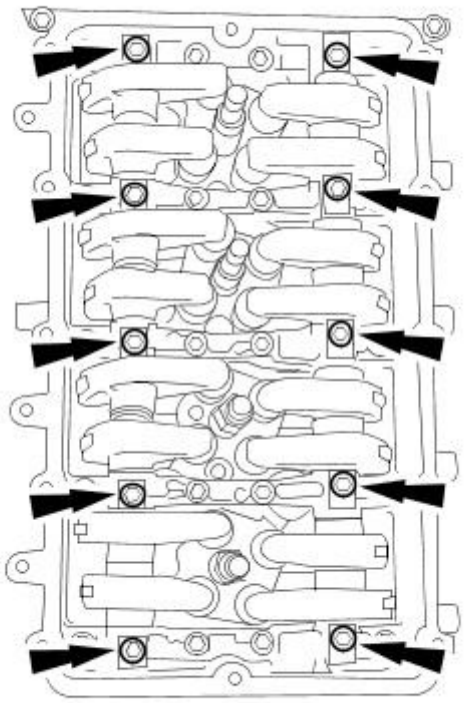


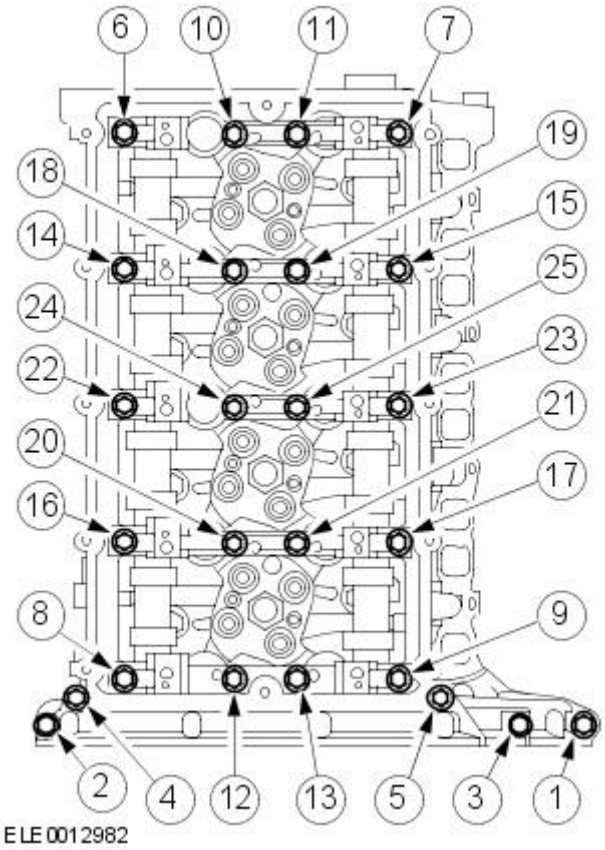
103. Remove the KS.



104. Remove the rocker shafts.

- Remove and discard the retaining bolts.





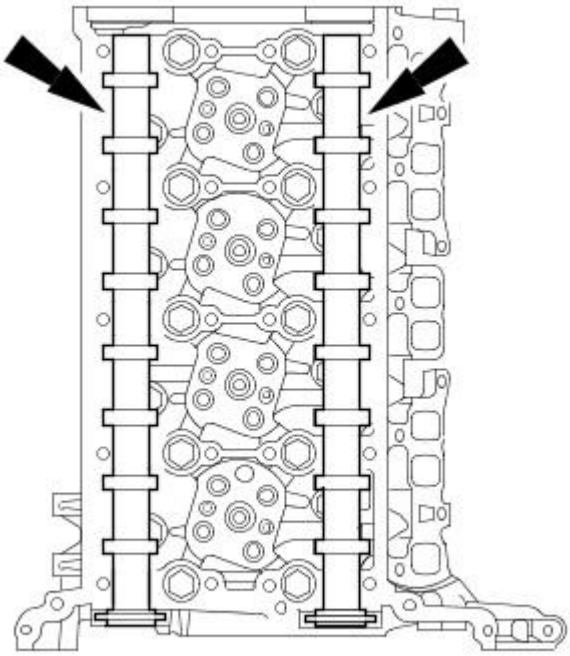
ELE0012982

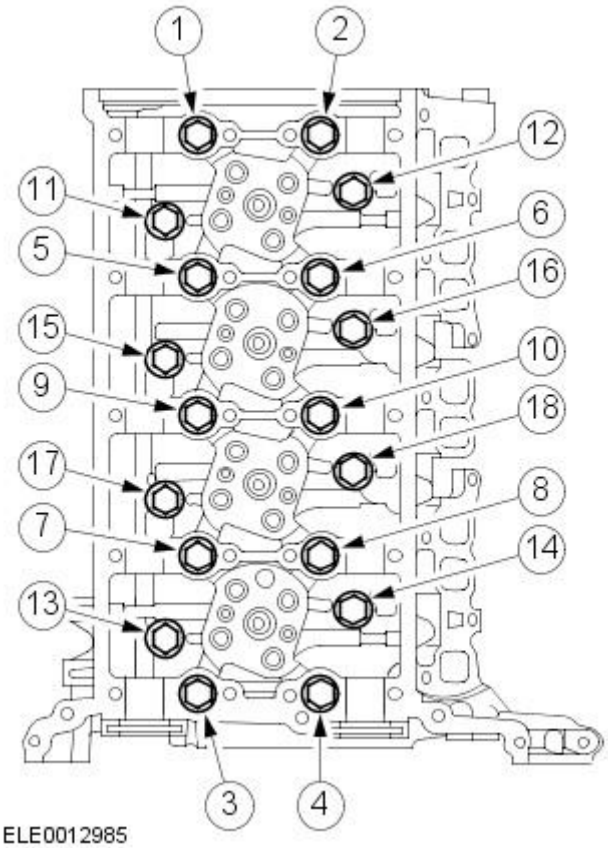
105. CAUTION: Remove the camshaft carrier bolts in the sequence shown.

Remove the camshaft carrier.

106. Remove the camshafts.

- Remove and discard the intake camshaft rear oil seal.


E48216

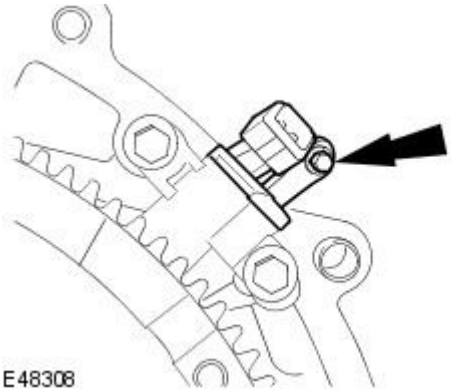


ELE0012985

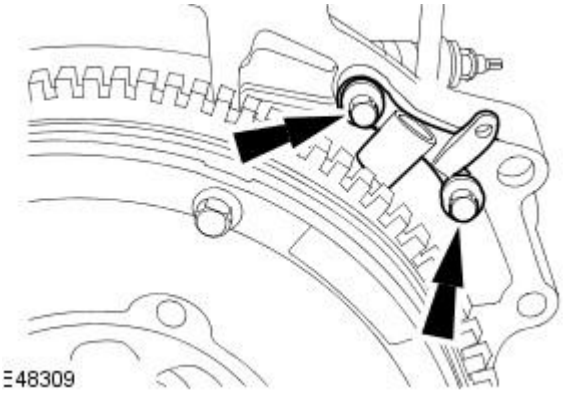
107. CAUTION: Remove the cylinder head bolts in the sequence shown.

Remove the cylinder head.

- Remove and discard the cylinder head gasket and the bolts.


E48308

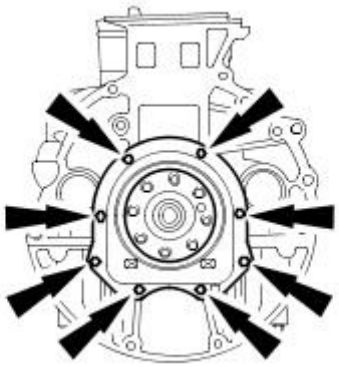
108. Remove the CKP sensor.


E48309

109. Remove the CKP sensor bracket.

110. NOTE: Do not discard the crankshaft rear oil seal carrier.

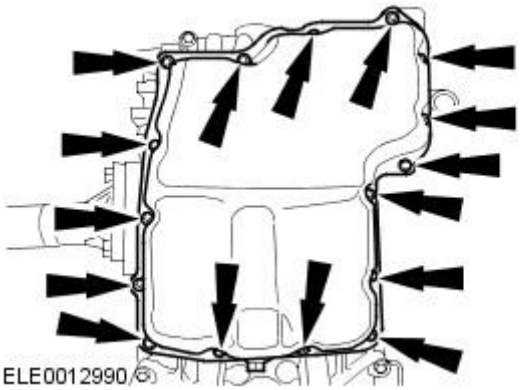
Remove the crankshaft rear oil seal carrier.



TIE0012994

111. Remove and discard the oil pan.

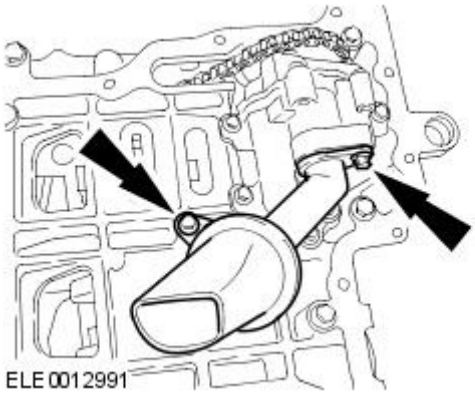
- Remove the oil pan retaining nuts and bolts.



ELE0012990

112. Remove the oil pump pickup tube.

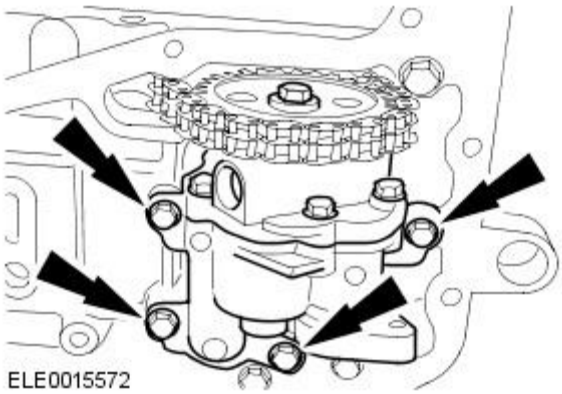
- Remove and discard the O-ring seal.



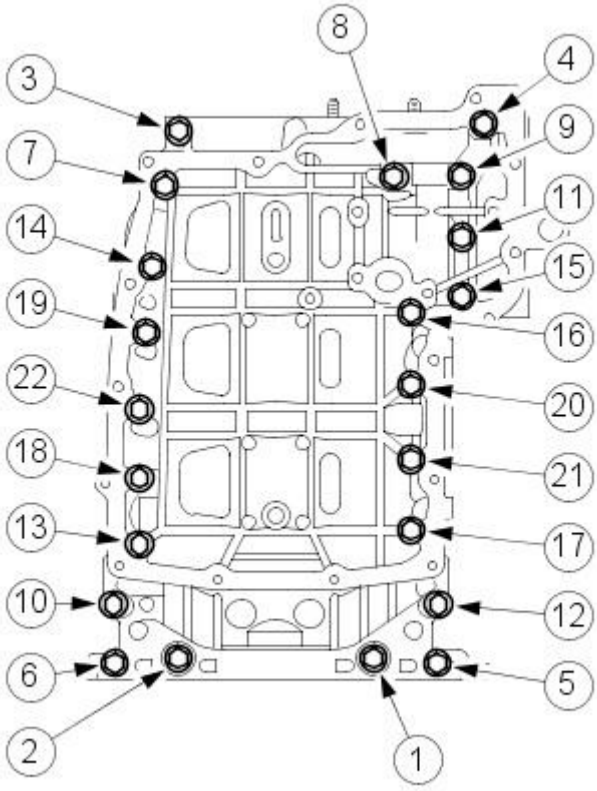
ELE0012991

113. Remove the oil pump.

- Remove the chain from the crankshaft sprocket.



ELE0015572

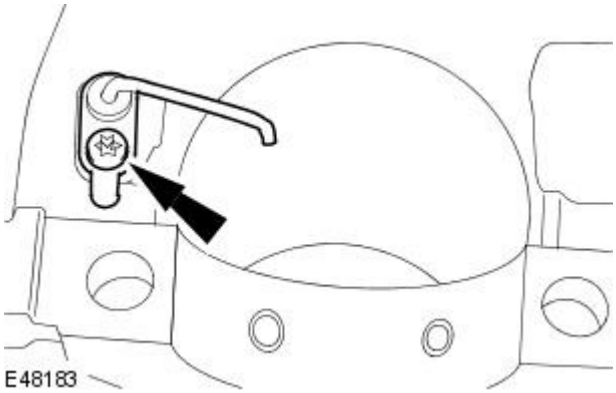


ELE0015834

114. CAUTION: Remove the ladder frame bolts in the sequence shown.

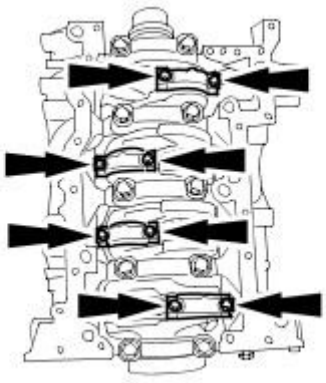
Remove the ladder frame.

- Remove and discard the ladder frame gasket.


E48183

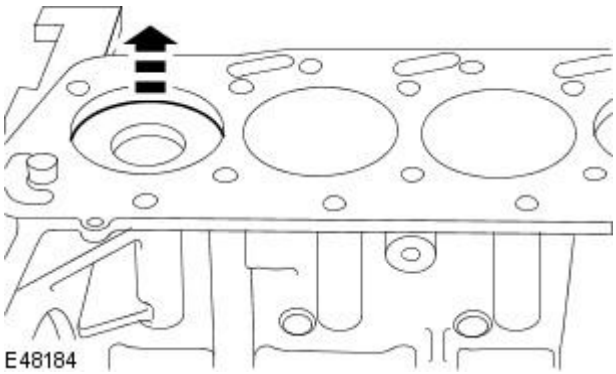
115. NOTE: One piston oil cooler jet shown, other piston oil cooler jets similar.

Remove the piston oil cooler jets.


ELE0012996

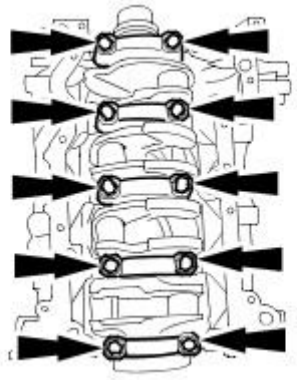
116. CAUTION: Keep the connecting rod bearing caps in order for installation.

Remove the connecting rod bearing caps.


E48184

117. CAUTION: Match the piston and connecting rods to the connecting rod caps.

Remove the pistons.

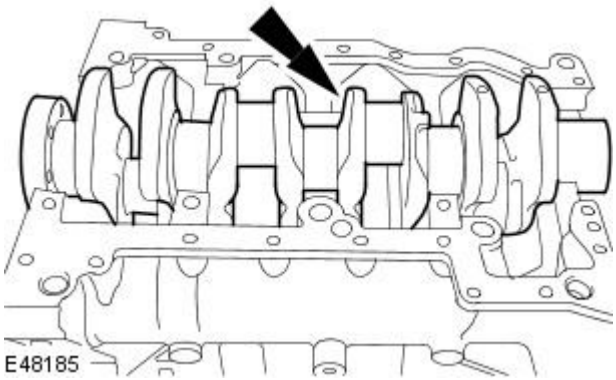


ELE0013006

118. CAUTION: Keep the crankshaft main bearing caps in order for installation.

Remove the crankshaft main bearing caps.

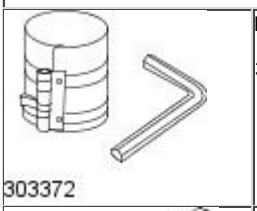
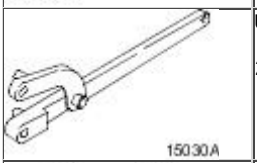
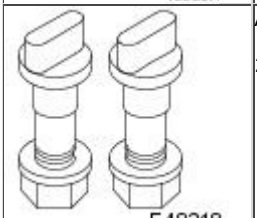
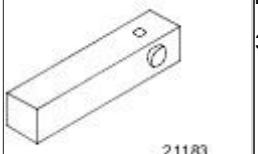
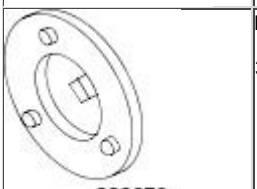
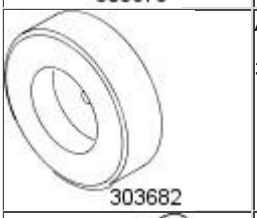
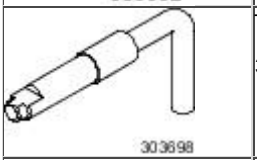
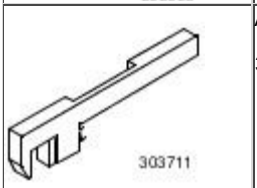
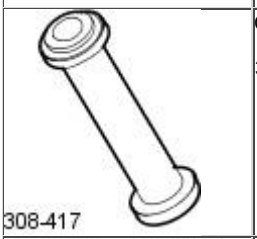
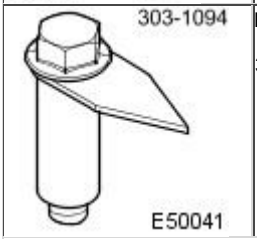
119. Remove the crankshaft.

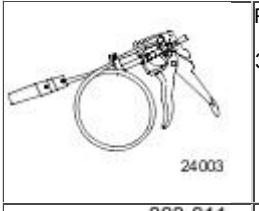
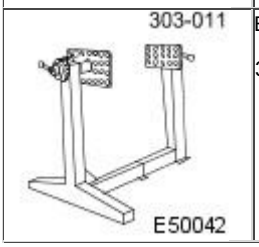


E48185

Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Engine

Assembly

Special Tool(s)	
 303372	Piston ring compressor 303-372
 15030A	Universal Flange Holding Wrench 205-053
 E48218	Adapter for 205-053 205-053-02
 21183	Bedplate alignment plate 303-1095
 303679	Remover/Installer Crankshaft Front Oil Seal 303-679
 303682	Aligner, Engine Front Cover 303-682
 303698	Timing Tool, Crankshaft 303-698
 303711	Aligner, Fuel Injector 303-711
 308-417	Oil seal installer 308-417
303-1094  E50041	Pointer, top dead center (TDC) 303-1094

	Remover/Installer, Cooling Hose Clamp 303-397
	Engine stand 303-011

Assembly

All vehicles

• 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.

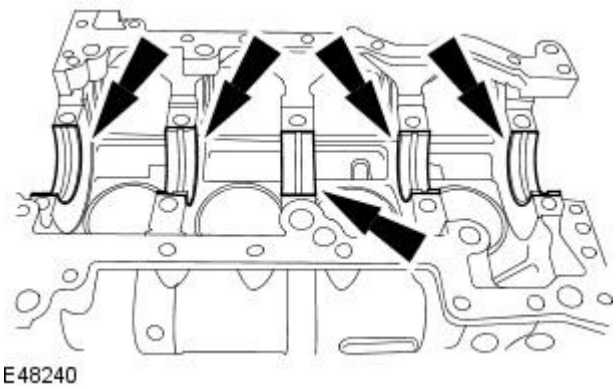
This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

• 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.

Do not disassemble or clean inside the fuel injection supply manifold, even with an ultrasonic cleaner. Always install a new fuel injection supply manifold and fuel lines when required.

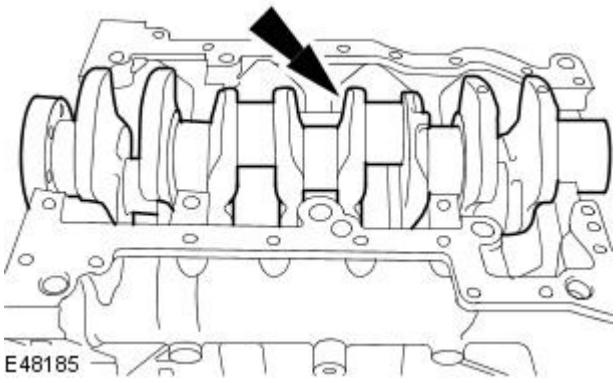
Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.



1. Clean the mating faces of the cylinder head and cylinder block with suitable metal surface cleaner.

2. NOTE: Lubricate the crankshaft main bearing shells with clean engine oil.

Install the crankshaft main bearing shells.



3. NOTE: Lubricate the crankshaft and the crankshaft main bearing shells with clean engine oil.

Install the crankshaft.

4. CAUTIONS:

Assemble caps with arrows pointing forward. Caps are identified from front to rear, F, 2, 3, 4, R.

Crankshaft main bearing cap bolts must only be used four times.

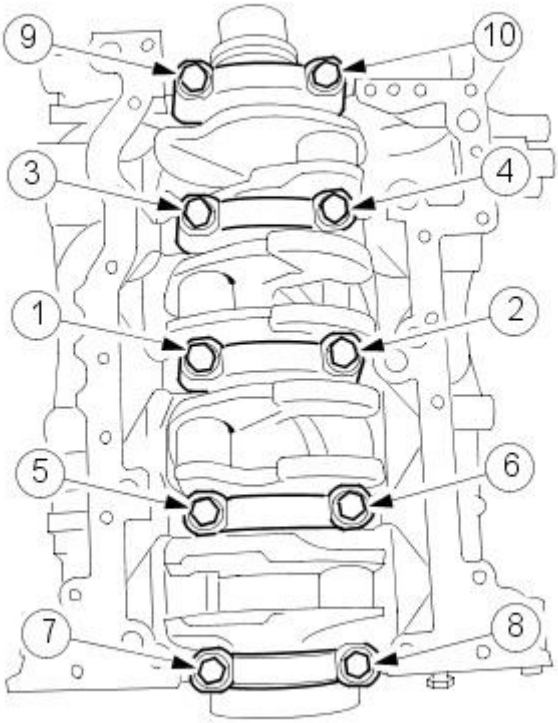
Tighten the bolts in three stages in the sequence shown.

• NOTE: Lubricate the crankshaft and the crankshaft main bearing shells with clean engine oil.

• NOTE: Stamp the bolt heads with a center punch to indicate usage.

Install the crankshaft main bearing caps.

- Stage 1: 45 Nm.
- Stage 2: 80 Nm.
- Stage 3: 80 degrees.



TIE0018206

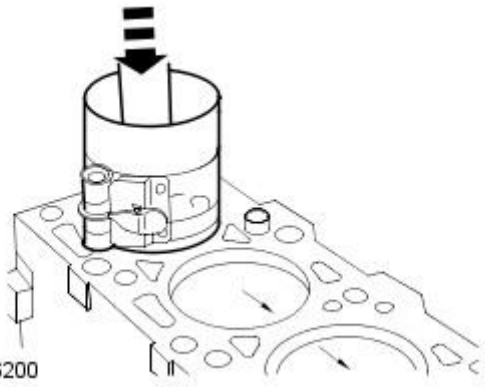
5. Lubricate the cylinder bores and pistons with clean engine oil.

6. CAUTION: Make sure the connecting rod does not damage the crankshaft big end bearing surface.

• NOTE: The piston ring gaps must be distributed evenly around the circumference of the piston. This also applies to the oil control ring elements. Align the piston ring gaps at 120 degrees to each other.

• NOTE: The arrow on the piston must point to the front to the engine.

Using the special tool 303-372, install the pistons.



ELE0016200

7. Lubricate the connecting rod bearing shells with clean engine oil.

8. CAUTIONS:

Connecting rod bearing cap bolts must only be used four times.

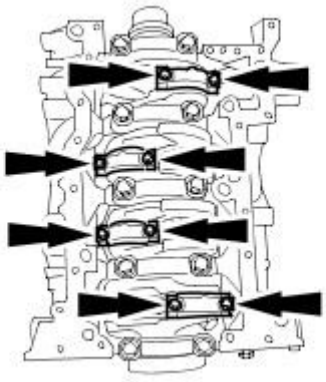
Make sure that the fracture split connecting rod bearing cap is installed correctly.

• NOTE: Stamp the bolt heads with a center punch to indicate usage.

• NOTE: The identification marks on the big-end bearing caps must point to the front of the engine.

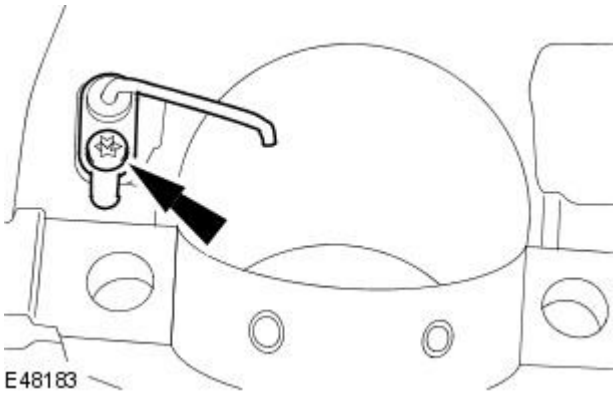
Install the connecting rod bearing caps.

- Tighten the bolts in two stages.
- Stage 1: 30 Nm.
- Stage 2: 80 degrees.



ELE0012996

9. Install the piston oil cooler jets.

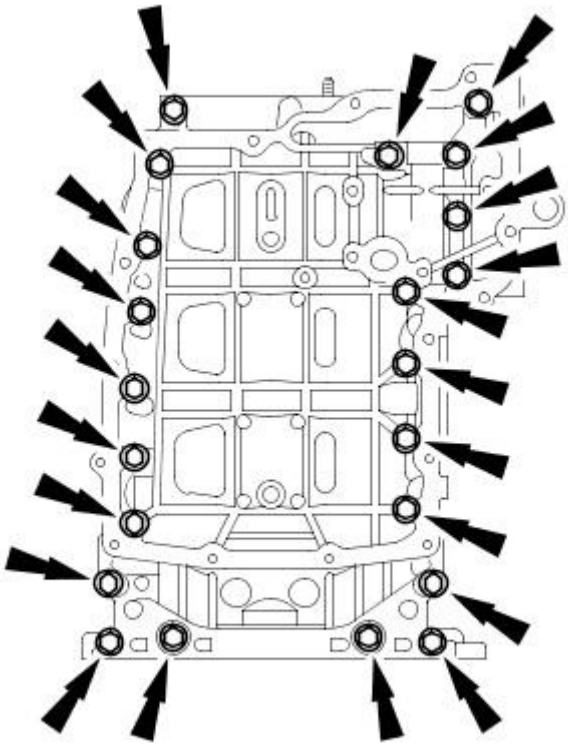


10. CAUTION: Do not trim or damage protruding foam pads.

• NOTE: Install new ladder frame gaskets.

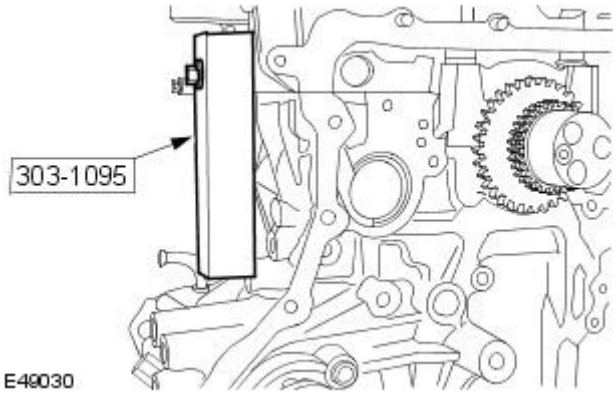
• NOTE: Do not fully tighten the ladder frame retaining nuts and bolts at this stage.

Install the ladder frame.

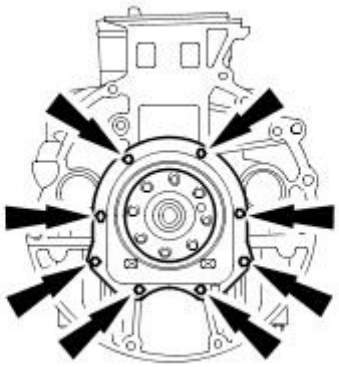


11. CAUTION: The ladder frame and the cylinder block must be aligned so that the side clearance does not exceed 0.05 mm overlap to 0.05 mm gap.

Using the special tool 303-1095 align the ladder frame to the cylinder block.



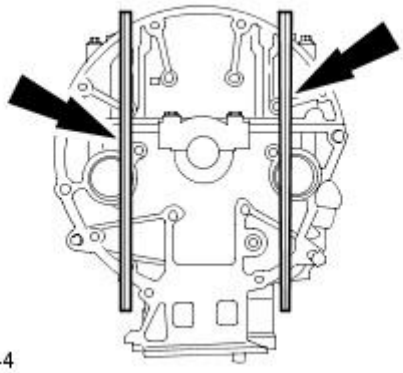
12. Install the old crankshaft rear seal and carrier.



TIE0012994

13. CAUTION: The ladder frame and the cylinder block must be aligned so that the rear clearance does not exceed 0.01 mm overlap to 0.2 mm gap.

Using a suitable straight edge, align the ladder frame to the cylinder block.

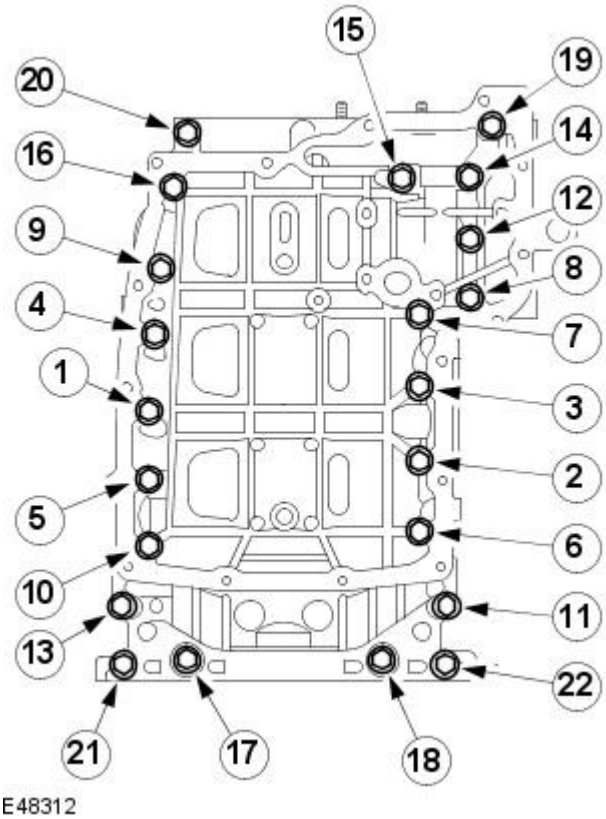


ELE0013444

14. NOTE: Tighten the nuts and bolts in the sequence shown.

Tighten the ladder frame nuts and bolts.

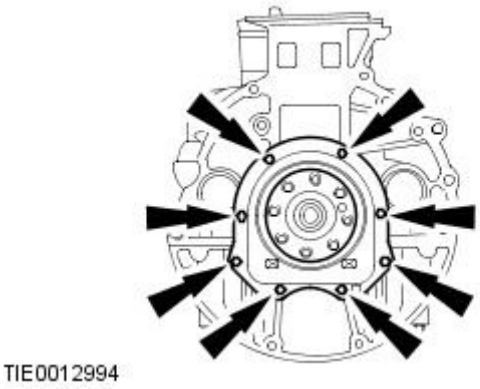
- Tighten to 23 Nm.



E48312

15. Remove the old crankshaft rear seal and carrier.

- Remove and discard the crankshaft rear oil seal.



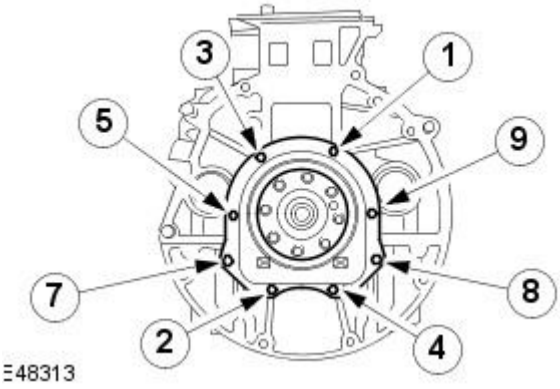
16. NOTE: Install a new crankshaft rear oil seal carrier and crankshaft rear oil seal carrier retaining bolts.

• NOTE: A new crankshaft rear oil seal carrier is supplied with an alignment sleeve that must be removed following installation.

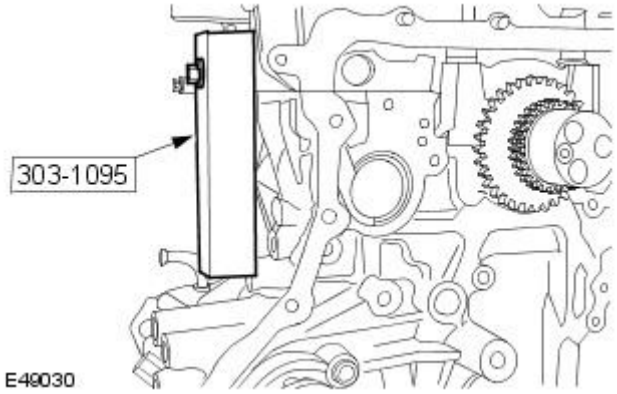
• NOTE: Tighten the nuts and bolts in the sequence shown.

Install the crankshaft rear oil seal carrier.

- Tighten to 10 Nm.

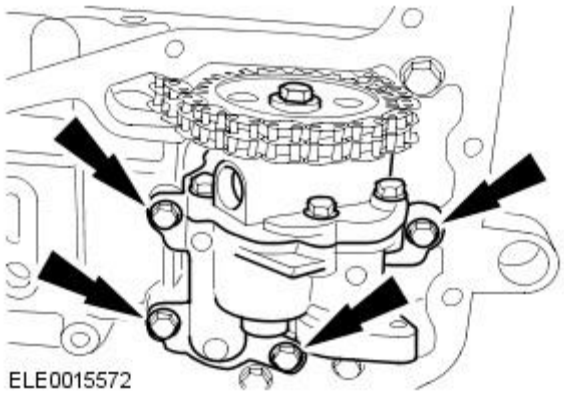


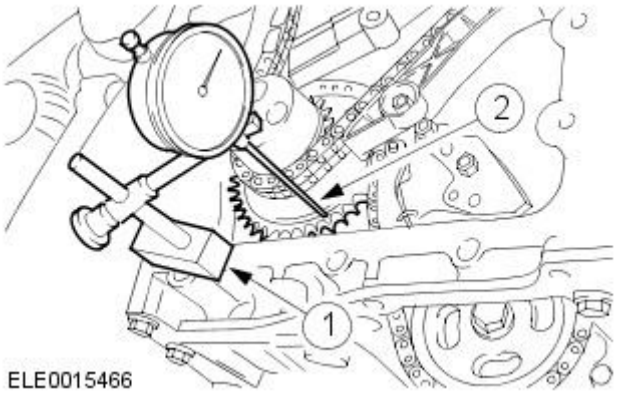
17. Remove the special tool.



18. NOTE: Do not fully tighten the oil pump retaining bolts at this stage.

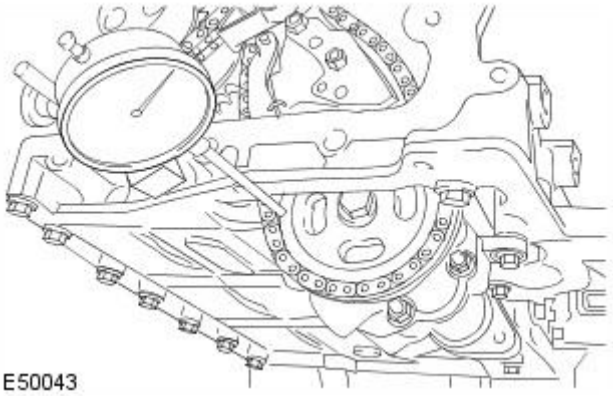
Install the oil pump and oil pump chain.





19. Using a suitable dial indicator gauge take a reference measurement from the front face of the crankshaft sprocket.

1. Position the dial gauge holding fixture on the cylinder block.
2. Position the dial indicator gauge plunger on the crankshaft sprocket and set the dial to zero.

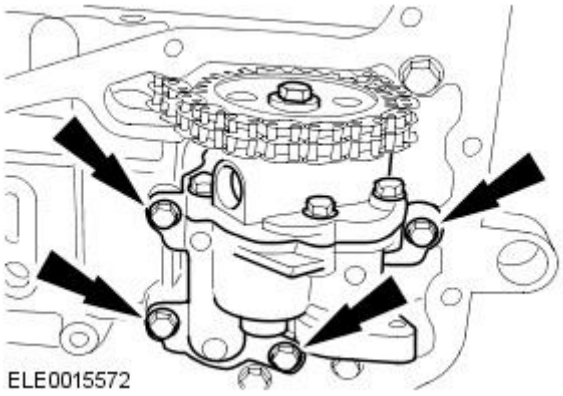


20. NOTE: Take measurements at two different points on the oil pump sprocket.

Using the dial indicator gauge align the oil pump sprocket and tighten the oil pump retaining bolts.

21. Check the alignment of the oil pump sprocket with the crankshaft sprocket. Repeat the alignment procedure if necessary.

22. Tighten to 10 Nm.



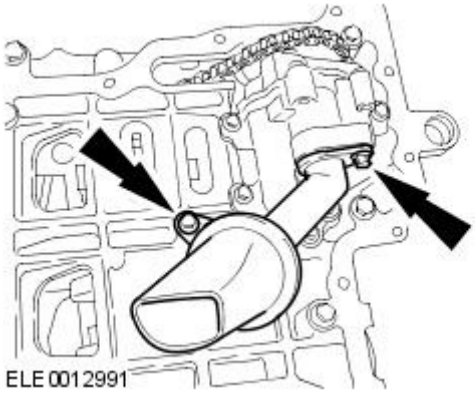
23. Check the alignment of the oil pump sprocket with the crankshaft sprocket. Repeat the alignment procedure if necessary.

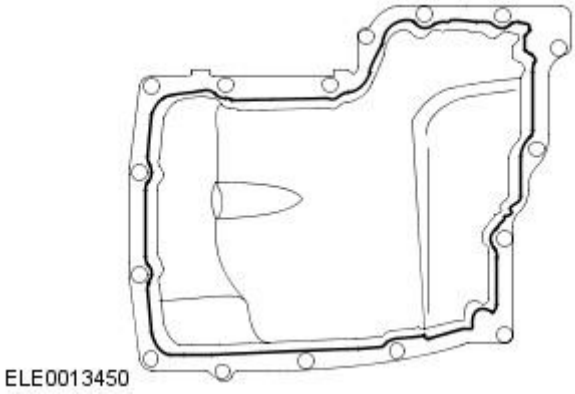
24. Install the oil pump tensioner.

25. NOTE: Install a new O-ring seal.

Install the oil pump pickup tube.

- Tighten to 10 Nm.



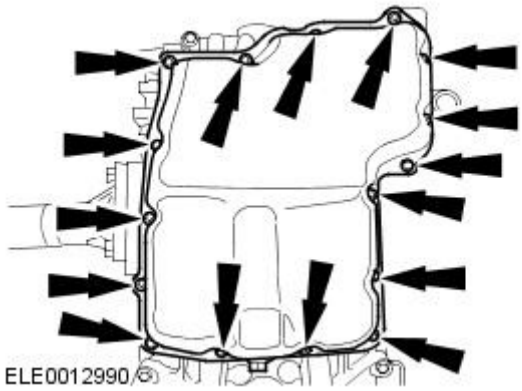


26. CAUTIONS:

⚠ A new oil pan must be installed

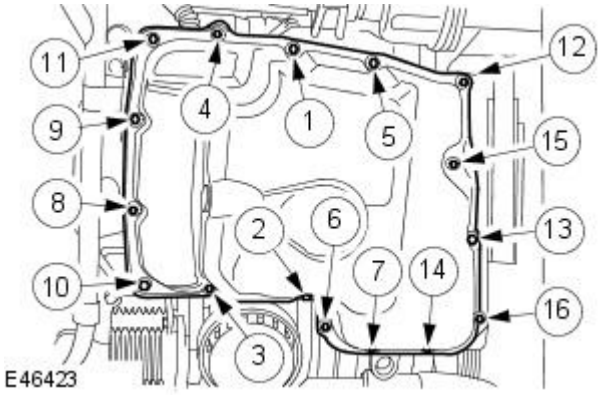
⚠ Install the oil pan within five minutes of applying the sealer.

Apply a 3 mm bead of sealer WSE-M4G323-A4 to the oil pan.



27. NOTE: Do not fully tighten the oil pan retaining bolts at this stage.

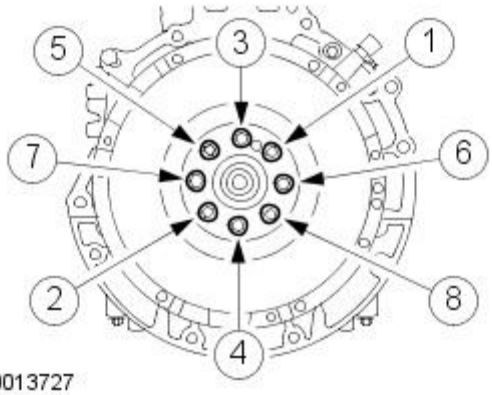
Install the oil pan.



28. NOTE: Tighten the bolts in the sequence shown in two stages.

Tighten the oil pan retaining bolts in the sequence shown.

- Stage 1: Tighten bolts 1 through 16 to 7 Nm.
- Stage 2: Tighten bolts 1 through 16 to 14 Nm.



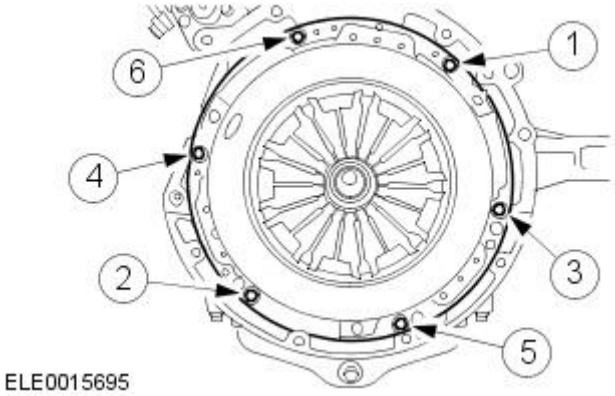
29. NOTE: Install new flywheel retaining bolts.

• NOTE: Tighten the retaining bolts in the sequence shown in three stages.

Install the flywheel.

- Stage 1: 25 Nm.
- Stage 2: 40 Nm.
- Stage 3: 48 degrees.

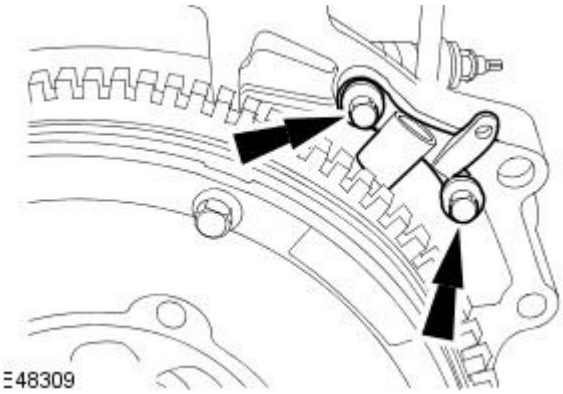
30. NOTE: Tighten the retaining bolts in the sequence shown.



Install the clutch disc and pressure plate.

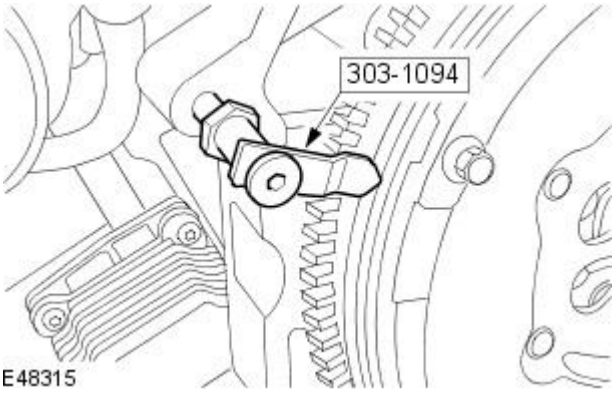
- Tighten to 29 Nm.

31. NOTE: Do not fully tighten the crankshaft position sensor bracket retaining bolts at this stage.



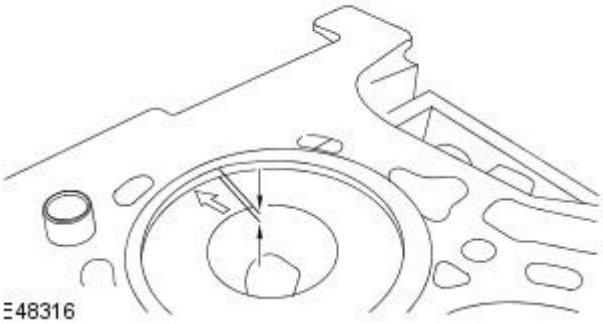
Install the crankshaft position (CKP) sensor bracket.

32. NOTE: After installation do not move the special tool.

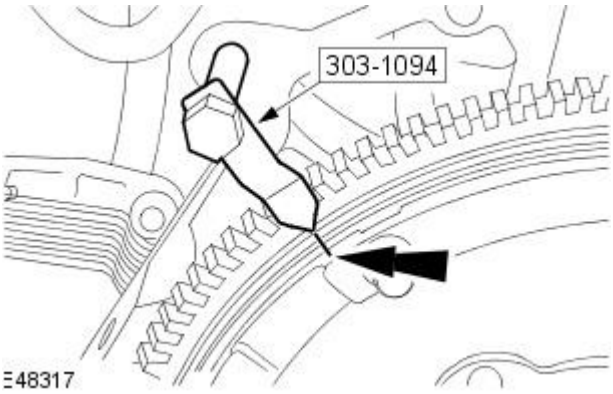


Install the special tool.

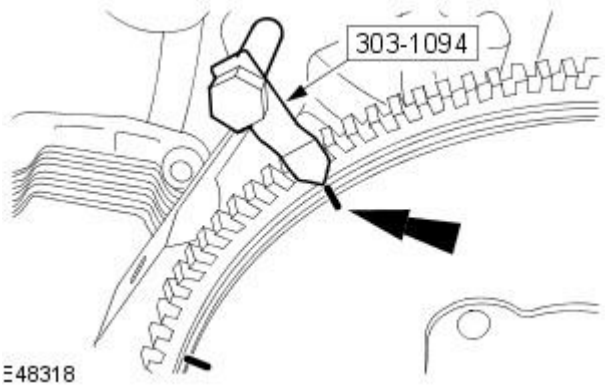
33. Rotate the crankshaft until piston number one is approximately 10 mm before top dead center (TDC).



34. Zero the dial indicator gauge.



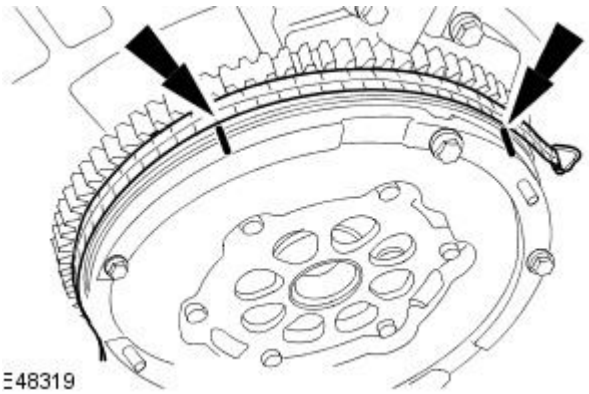
35. Mark the position on the flywheel primary mass.



36. NOTE: Rotate the crankshaft counterclockwise.

Rotate the crankshaft until the piston number one achieves zero on the dial indicator gauge.

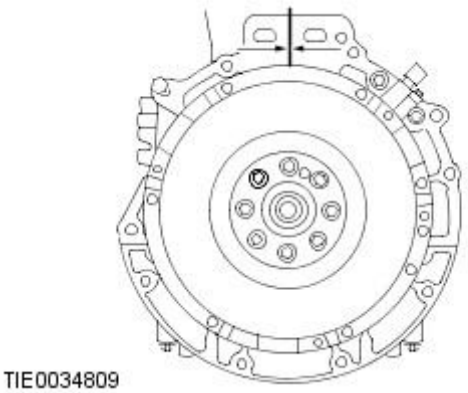
- Mark the position on the flywheel primary mass.



37. Repeat the previous steps to make sure that the marking is correct.

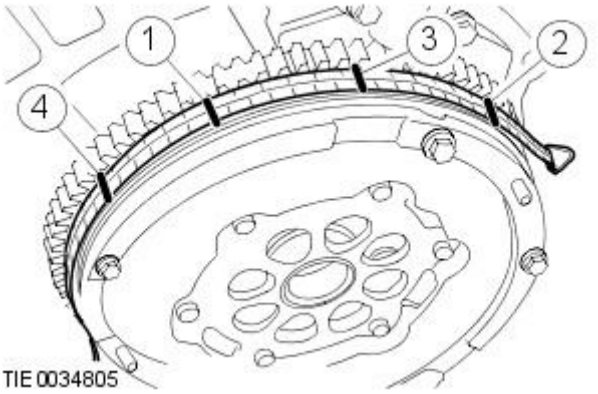
38. NOTE: The middle of the markings is TDC.

Measure the distance between the two marks.



39. Divide the amount by two and mark the TDC position on the flywheel primary mass.

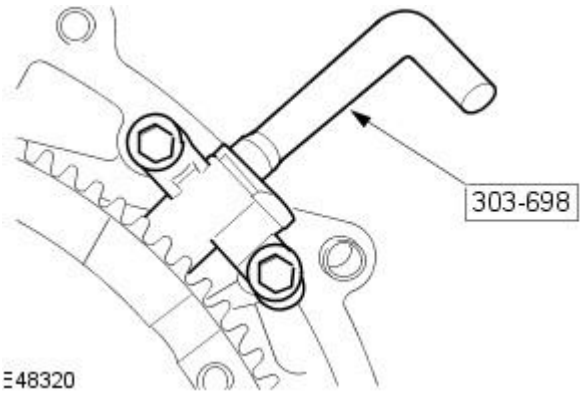
40. Measure the circumference of the flywheel primary mass.



41. NOTE: Mark the calculated amount on the flywheel primary mass by measuring from TDC counterclockwise.

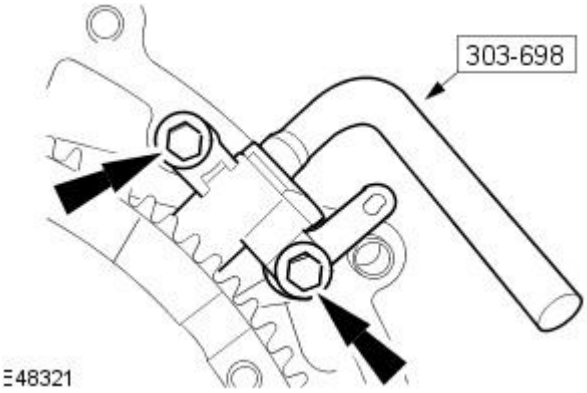
Multiply the circumference by 0.1388.

1. First mark.
2. Second mark.
3. Determined TDC.
4. Determined 50 degrees before top dead center (BTDC).



42. NOTE: Rotate the crankshaft in the normal direction of rotation to the mark of the calculated 50 degrees BTDC.

Install the special tool 303-698.



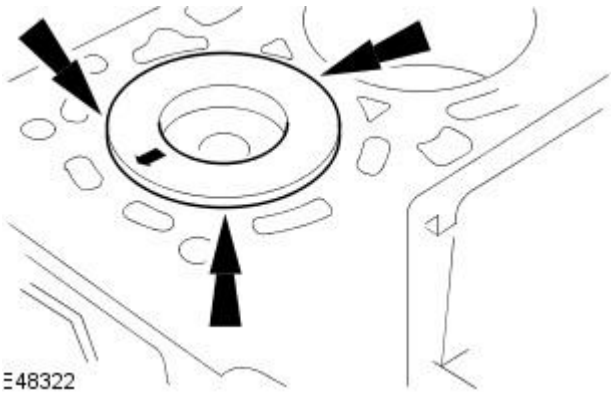
43. Tighten the CKP sensor bracket retaining bolts.

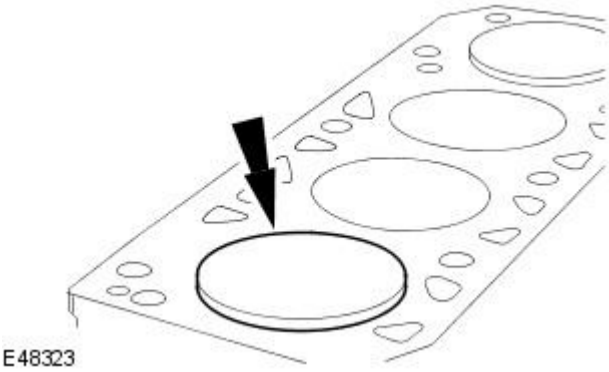
- Tighten to 23 Nm.

44. Clean the cylinder block mating face and the piston.

45. NOTE: Measure the piston protrusion of each cylinder at top dead center (TDC).

Measure the distance between the piston crown and the cylinder block at the points indicated.

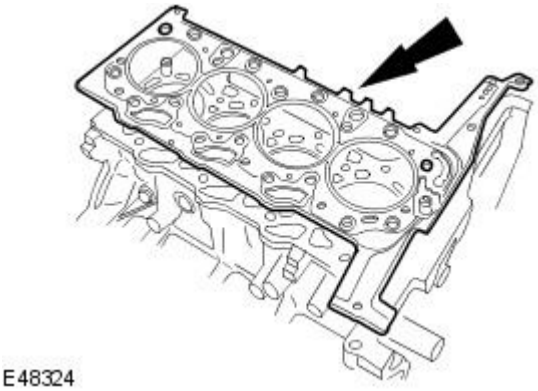



E48323

46. NOTE: The largest measurement determines the choice of the cylinder head gasket.

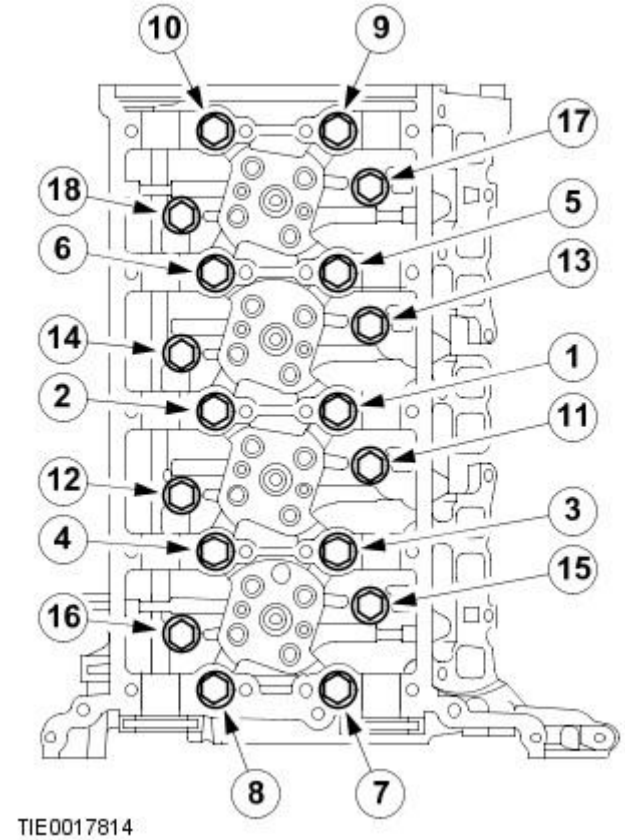
Using a suitable tool, measure the piston protrusion.

47. Determine the cylinder head gasket thickness.
For additional information, refer to: Specifications (303-01B Engine - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Specifications).


E48324

48. CAUTION: The thickness of the new cylinder head gasket depends on the piston protrusion (hole/tooth marked).

Install a new cylinder head gasket.



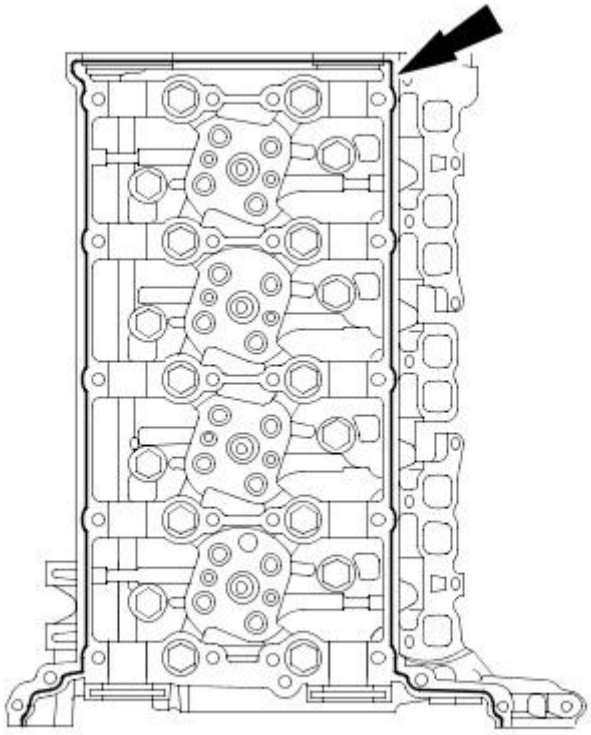
TIE0017814

49. CAUTION: Install new cylinder head bolts.

Install the cylinder head.

- Tighten the bolts in the sequence shown in six stages.
- Stage 1: Tighten bolts 1 through 10 to 20 Nm.
- Stage 2: Tighten bolts 11 through 18 to 10 Nm.
- Stage 3: Tighten bolts 1 through 10 to 40 Nm.
- Stage 4: Tighten bolts 11 through 18 to 20 Nm.
- Stage 5: Tighten bolts 1 through 10 to 180 degrees.
- Stage 6: Tighten bolts 11 through 18 to 180 degrees.

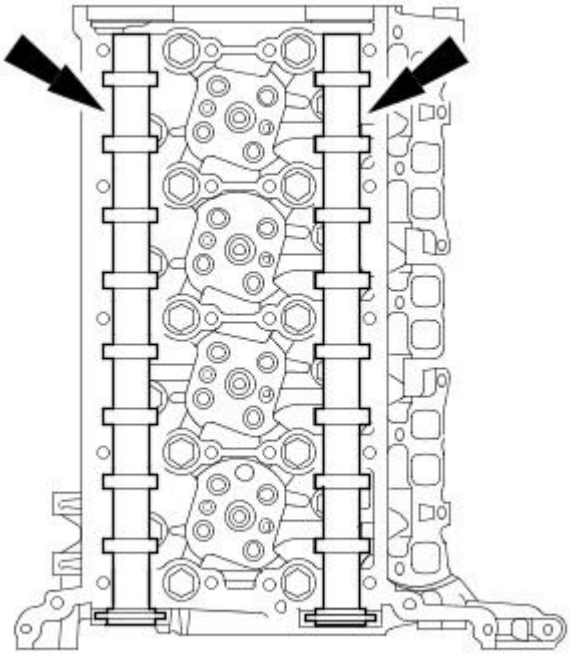
50. Apply a 2.5 mm diameter bead of sealer WSE-M4G323-A4 to the mating face of the cylinder head.



ELE0013422

51. Remove the camshafts.

- Remove and discard the intake camshaft rear oil seal.

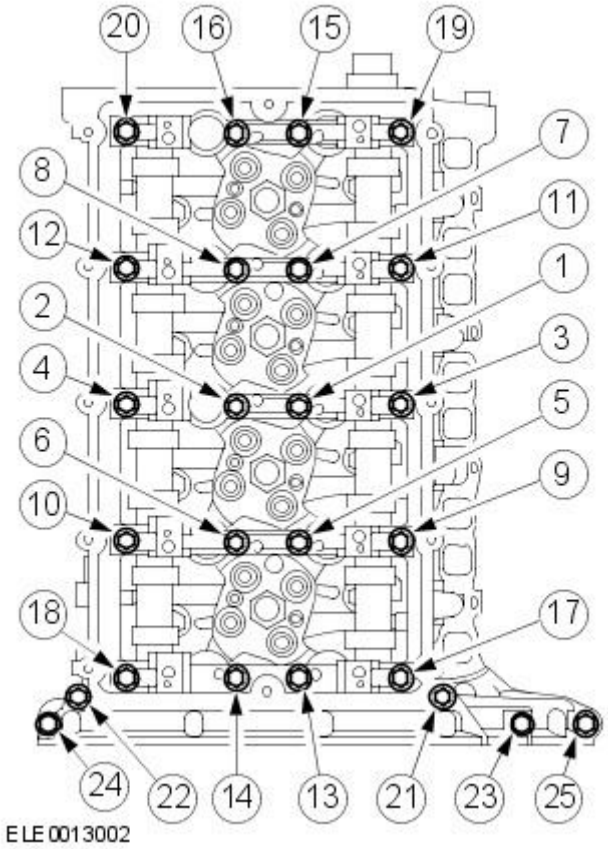


E48216

52. NOTE: Tighten the bolts in the sequence shown in two stages.

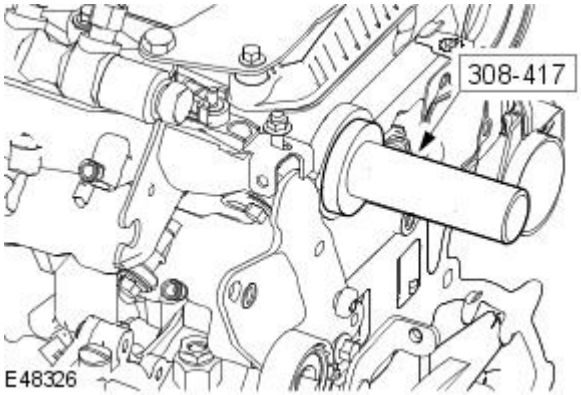
Install the camshaft carrier.

- Stage 1: Tighten bolts 1 through 22 to 23 Nm.
- Stage 2: Tighten bolts 23 through 25 to 10 Nm.



ELE0013002

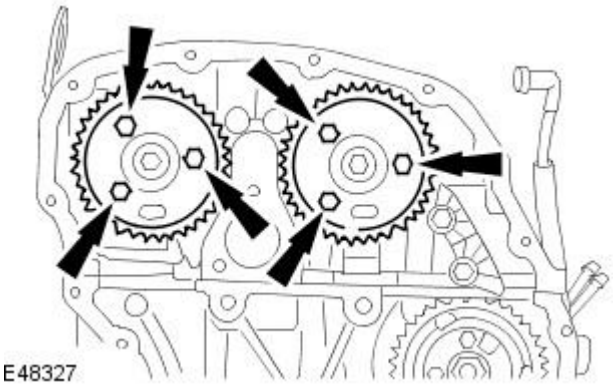
53. Using special tool 308-417, install a new camshaft rear seal.



E48326

54. NOTE: Do not fully tighten at this stage.

Install the camshaft sprocket retaining bolts.


E48327

55. NOTE: Install new rocker shaft retaining bolts.

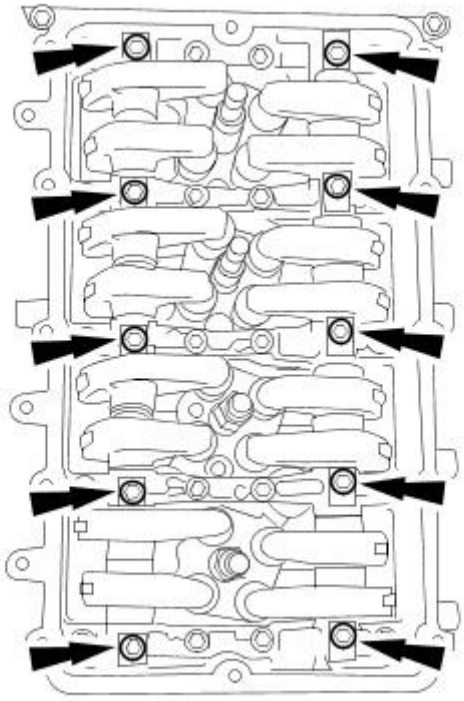
• NOTE: Lubricate the rocker shafts with clean engine oil.

• NOTE: The oil supply holes in the rocker shafts must point down.

• NOTE: Tighten the bolts in two stages.

Install the rocker shafts.

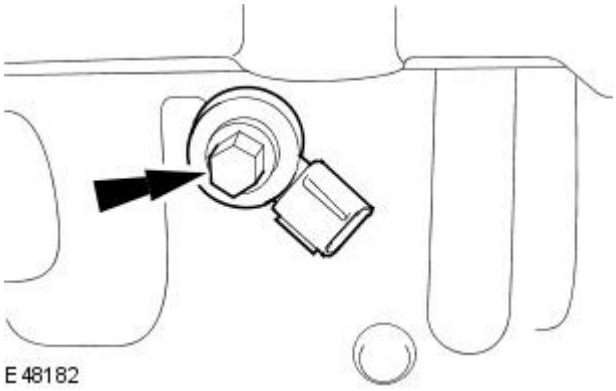
- Stage 1: 13 Nm.
- Stage 2: 45 degrees.



ELE0015429

56. Install the knock sensor (KS).

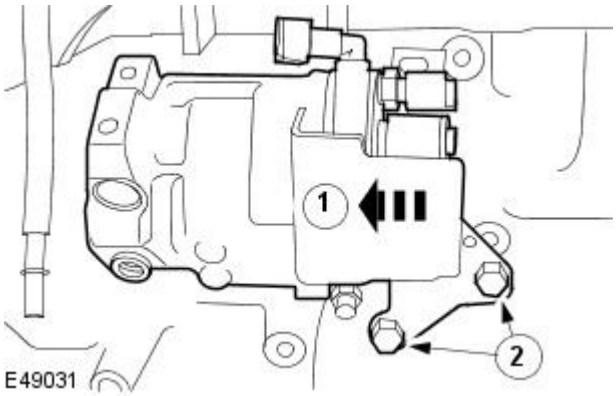
- Tighten to 20 Nm.



E48182

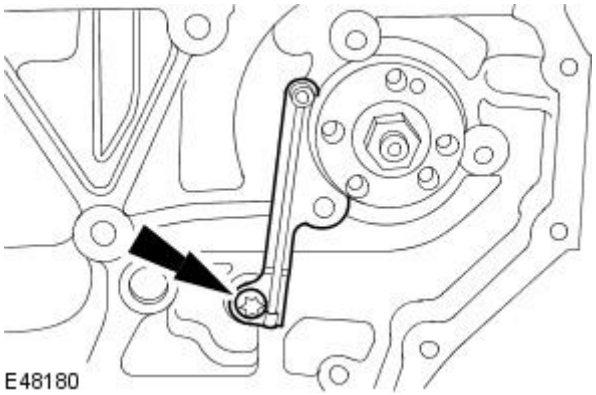
57. Install the high-pressure fuel pump.

1. Install the high-pressure fuel pump.
2. Tighten to 33 Nm..

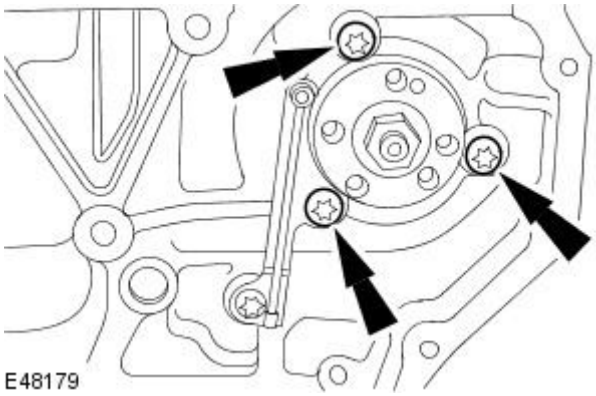


E49031

58. Install the timing chain oil feed pipe.

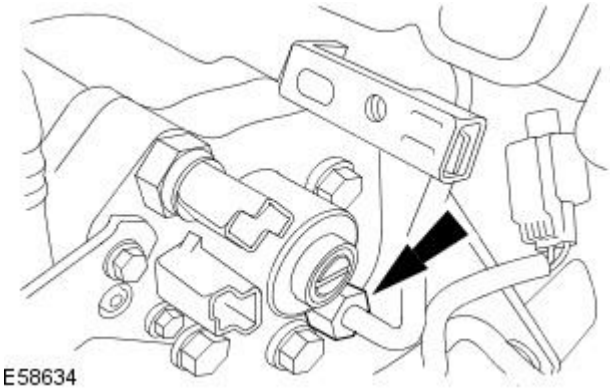


E48180



59. Install the high-pressure fuel pump retaining bolts.

- Tighten to 22 Nm.

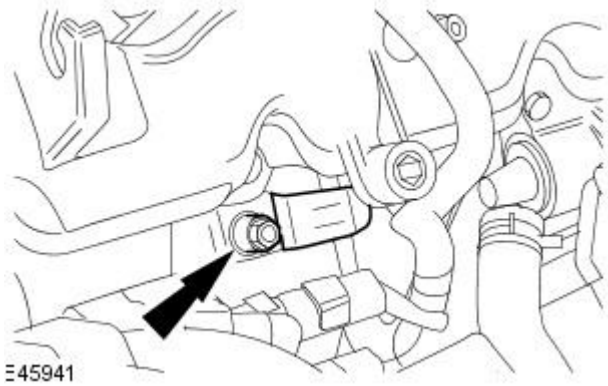


60. CAUTIONS:

Do not tighten the high-pressure fuel supply line union at this stage.

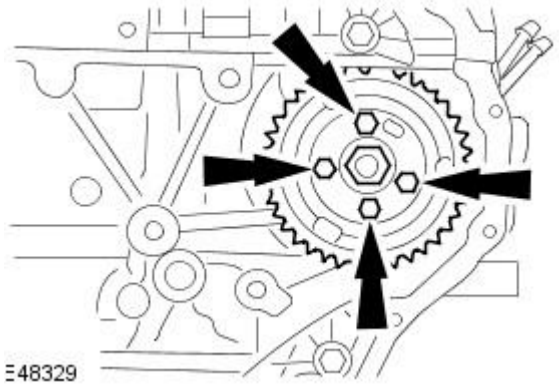
Maintain pressure on the high-pressure fuel supply line to keep the olive in contact with the fuel pump cone while hand installing the union. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Install a new high-pressure fuel supply line to the fuel pump.



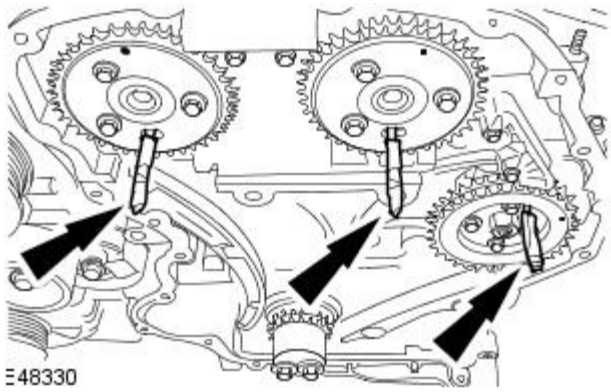
61. NOTE: Do not tighten the retaining nut at this stage.

Install the high-pressure fuel pump pipe retaining bracket.

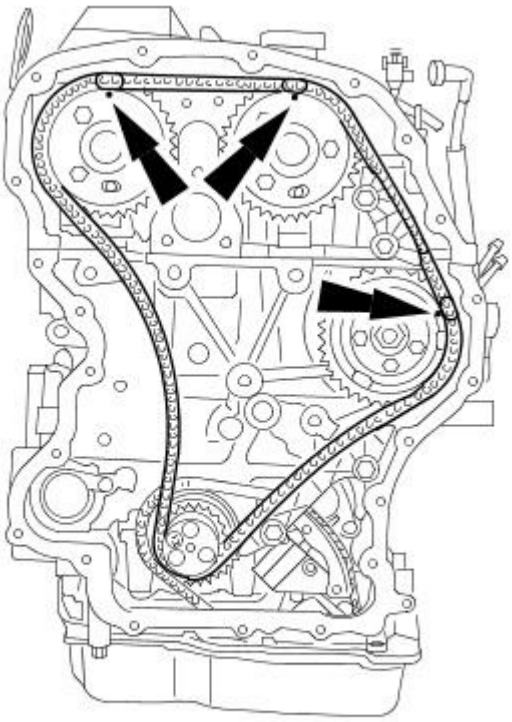


62. NOTE: Do not tighten the retaining bolts at this stage.

Install the fuel injection pump sprocket.



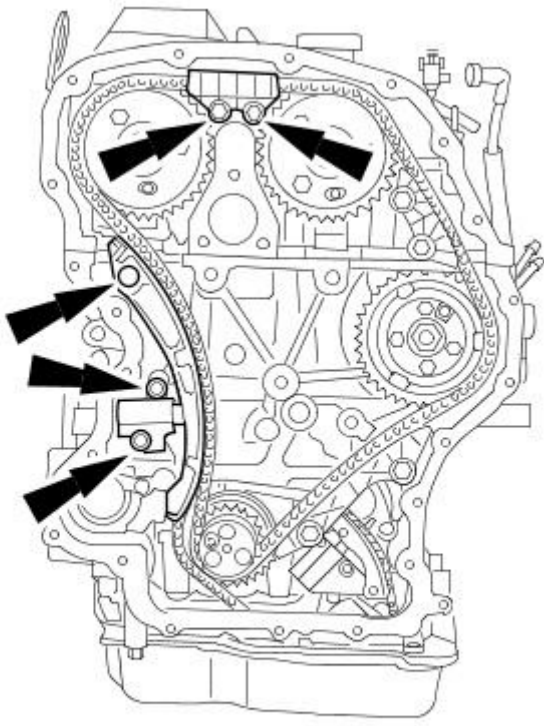
63. Using suitable 6 mm bar, lock the timing drive sprockets.



E46627

64. CAUTION: Make sure the colored links align to the timing marks. Failure to follow this instruction may result in damage to the vehicle.

Install the timing chain.

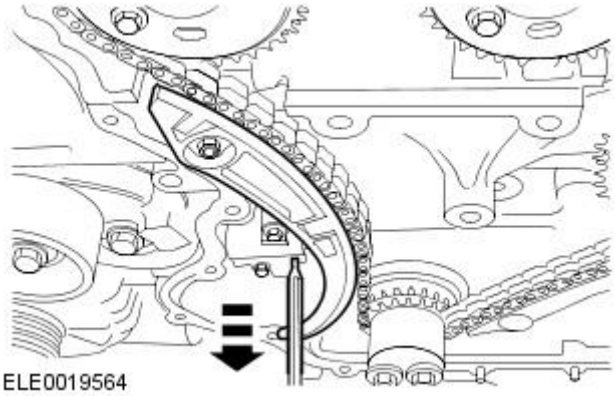


65. CAUTION: Make sure the timing chain tensioner is fully retracted before installation. Failure to follow this instruction may result in damage to the vehicle.

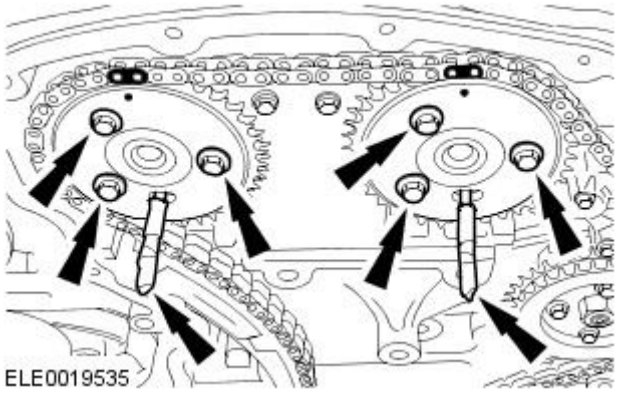
Install the timing chain tensioner and guides.

- Tighten to 14 Nm.

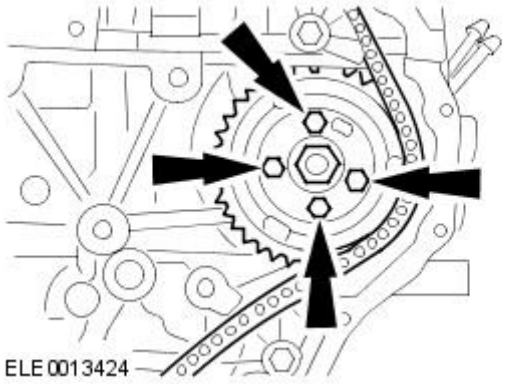
66. Unlock the timing chain tensioner.


ELE0019564

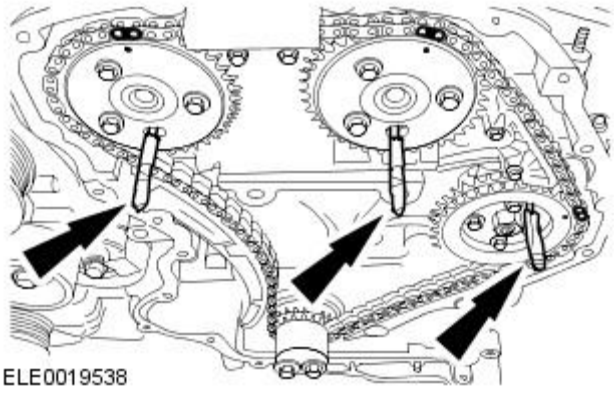
67. Tighten to 33 Nm.

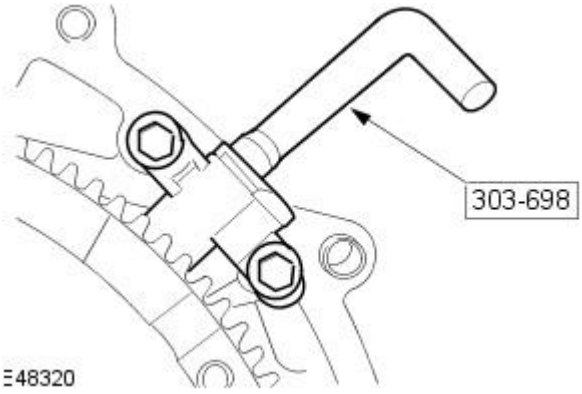

ELE0019535

68. Tighten to 33 Nm.

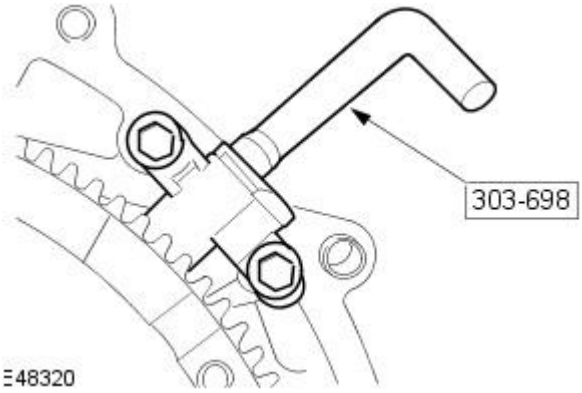

ELE0013424

69. Remove the locking pins from the timing drive sprockets.


ELE0019538

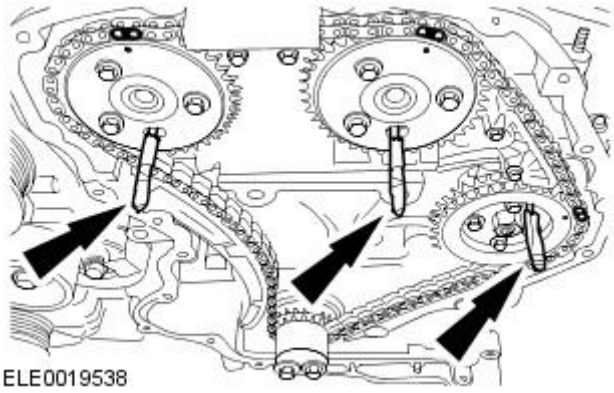


70. Remove the special tool 303-698.

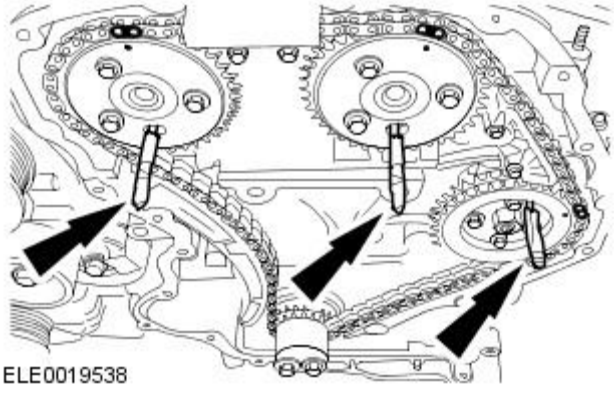


71. Rotate the crankshaft two revolutions.

72. Using special tool 303-698, check the timing by inserting the special tool in the CKP sensor hole.

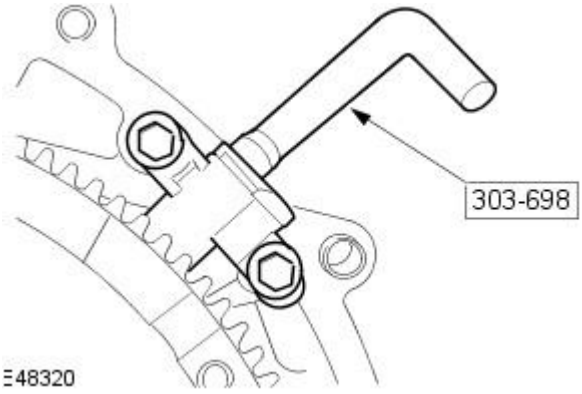


73. Check the camshaft timing by inserting a suitable 6 mm bar through the holes in the camshaft and fuel injection pump sprockets.

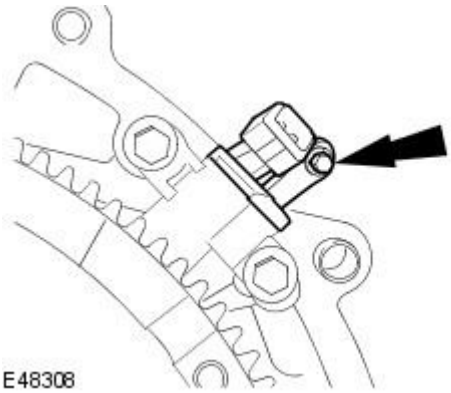


74. Remove the locking pins from the timing drive sprockets.

75. Remove the special tool.



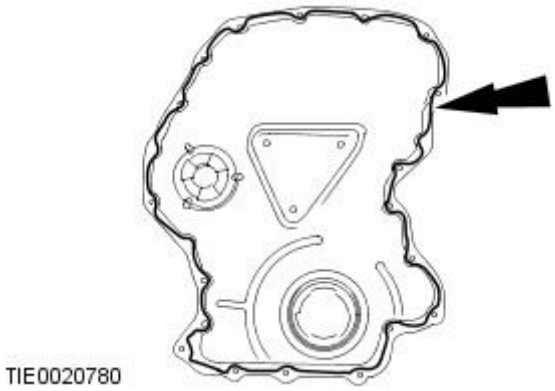
76. Install the CKP sensor.



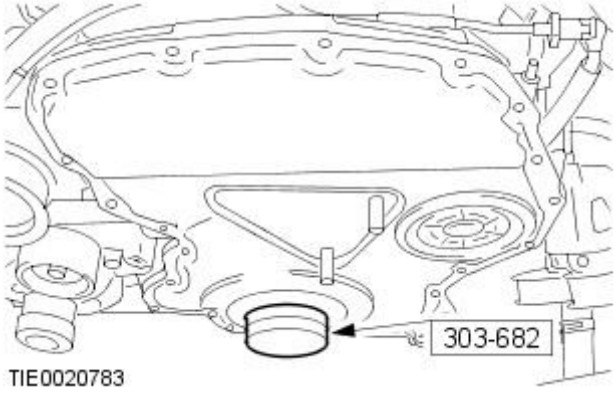
77. CAUTION: Install the engine front cover within five minutes of applying the sealer.

- NOTE: Install a new engine front cover.

Apply a 3 mm diameter bead of sealer WSE-M4G323-A4 to the engine front cover.

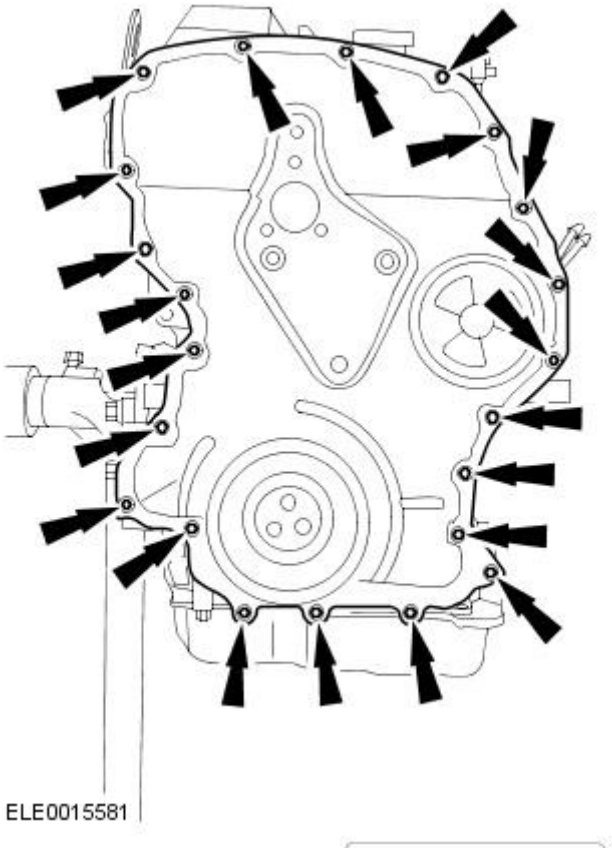


78. Using the special tool 303-682, install the engine front cover.

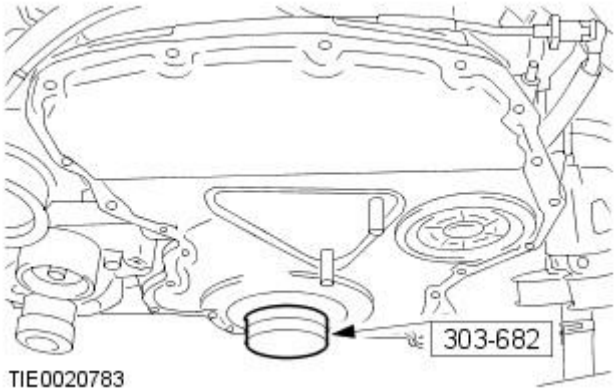


79. Install the front cover retaining nuts and bolts.

- Tighten the bolts to 14 Nm.
- Tighten the nuts to 10 Nm.



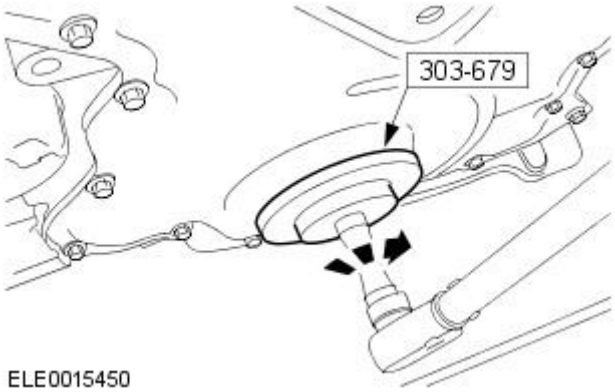
80. Remove special tool.

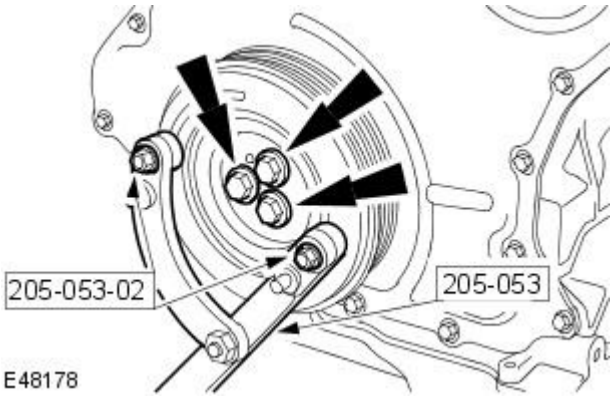


81. NOTE: Install a new crankshaft front oil seal.

• NOTE: A new crankshaft front oil seal is supplied with an alignment sleeve that will be pushed out during installation.

Using the special tool 303-679, install the crankshaft front seal.

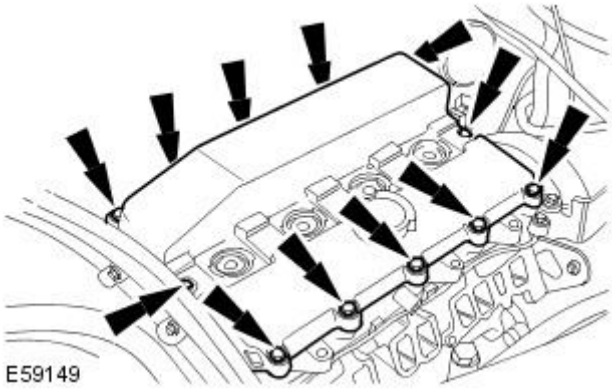




82. NOTE: New crankshaft pulley bolts must be installed.

Using the special tools 205-053 and 205-053-02, install the crankshaft damper.

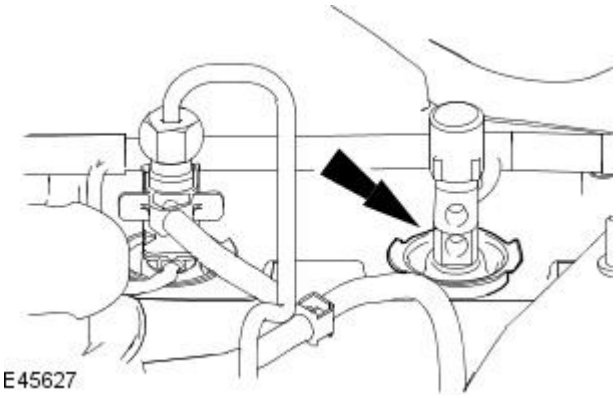
- Stage 1: 45 Nm.
- Stage 2: 120 degrees.



83. NOTE: Install a new valve cover gasket.

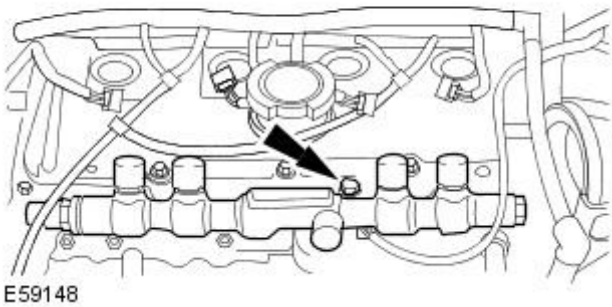
Install the valve cover.

- Tighten to 10 Nm.



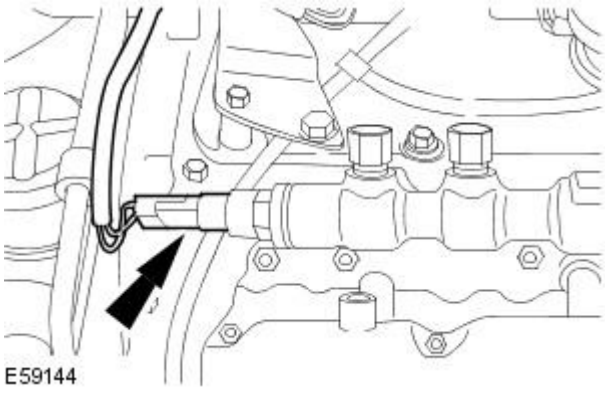
84. NOTE: One valve cover fuel injector seal shown, other valve cover fuel injector seals similar.

Install new valve cover fuel injector seals.



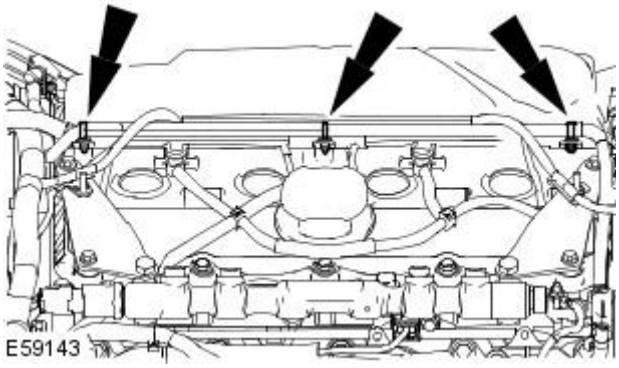
85. NOTE: Do not fully tighten the fuel injection supply manifold retaining bolt at this stage.

Install the fuel injection supply manifold.

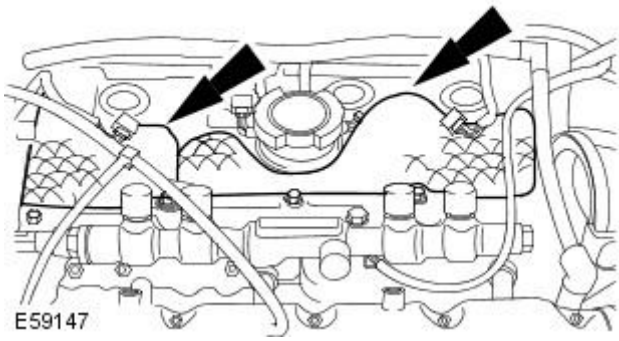


86. Connector the fuel pressure sensor electrical connector.

87. Attach the starter motor and injector wiring harness.

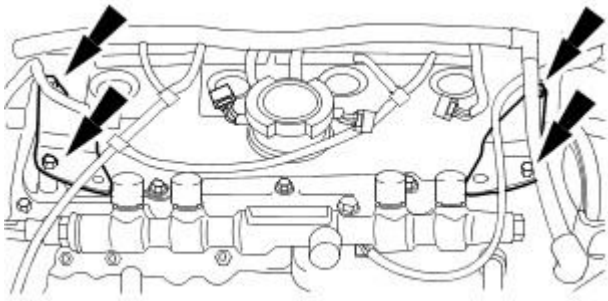

E59143

88. Install the sound proof padding.


E59147

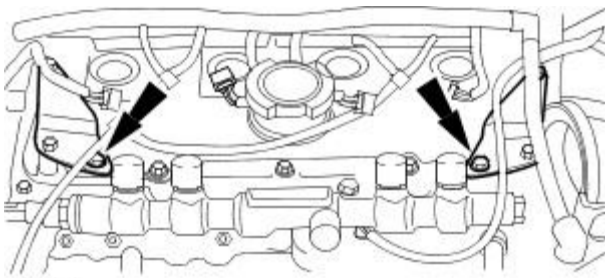
89. NOTE: Do not fully tighten the fuel injection supply manifold support bracket bolts at this stage.

Install the fuel injection supply manifold support brackets.

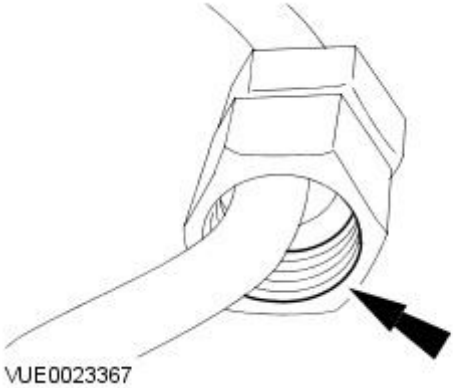

E59146

90. NOTE: Do not fully tighten the fuel injection supply manifold retaining bolts at this stage.

Install the fuel injection supply manifold retaining bolts.


E59145

91. Using a suitable multipurpose lubricant spray, lubricate the new high-pressure fuel supply line union threads.


VUE0023367

92. CAUTION: 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 line and allow foreign matter to enter the fuel injection system.

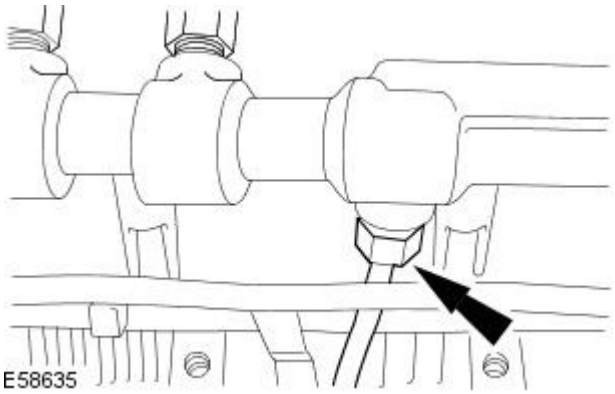
• NOTE: The yellow colored collar is fitted at the fuel pump end and the

blue colored collar is fitted at the fuel injection supply manifold end of the high pressure fuel supply line.

• NOTE: To aid identification of the high pressure fuel supply lines, the union at the fuel pump end is etched with the word Pump.

Position the high-pressure fuel supply line as near to the final installation position as possible and then remove and discard the blanking plugs from the high-pressure fuel supply line.

93. Remove the blanking plugs from the fuel injection supply manifold threaded ports.



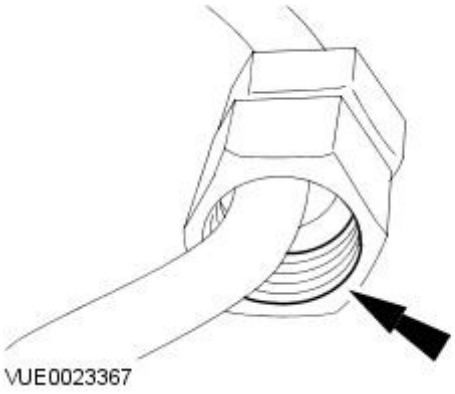
94. CAUTIONS:

⚠ Do not tighten the high-pressure fuel supply line union at this stage.

⚠ Maintain pressure on the high-pressure fuel supply line to keep the olive in contact with the fuel injection supply manifold cone while hand installing the union. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Attach the high-pressure fuel supply line to the fuel injection supply manifold.

95. Using a suitable multipurpose lubricant spray, lubricate the new high-pressure fuel supply line union threads.



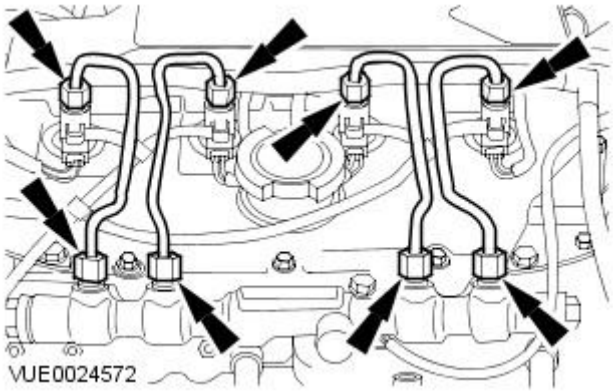
96. ⚠ CAUTION: Do not allow the unions to hit the olive ends of the high-pressure fuel supply line as this may damage the ends of the line and allow foreign matter to enter the fuel injection system.

• NOTE: The yellow colored collar is fitted at the fuel injector end and the blue colored collar is fitted at the fuel supply manifold end of the high-pressure fuel supply line.

• NOTE: To aid identification of the high-pressure fuel supply line, the union at the fuel injector end is etched with the cylinder number.

Position the high-pressure fuel supply line as near to the final installation position as possible and then remove and discard the blanking plugs from the high-pressure fuel supply line.

97. Remove the blanking plugs from the fuel injector and the fuel injection supply manifold threaded ports.

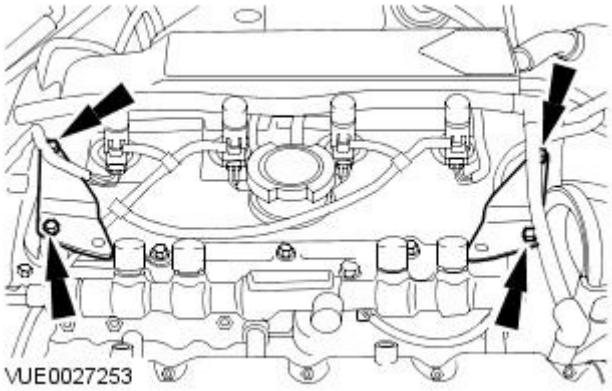


98. ⚠ CAUTION: Maintain pressure on the high-pressure fuel supply line to keep the olives in contact with the fuel injectors and the fuel injection supply manifold cones while hand installing the unions.

• NOTE: Install the high-pressure fuel supply lines to the fuel injection supply manifold end first followed by the fuel injector end.

• NOTE: Do not tighten the high-pressure fuel supply line unions at this stage.

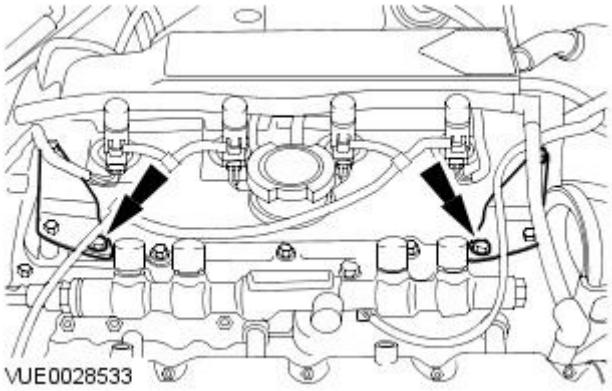
Install new high-pressure fuel supply lines.



99. NOTE: High-pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold support brackets.

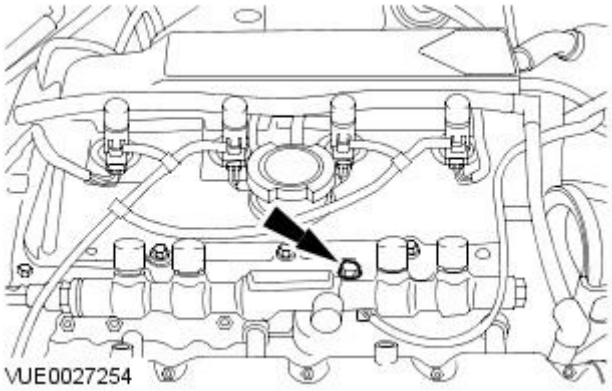
- Tighten to 14 Nm.



100. NOTE: High-pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold retaining bolts.

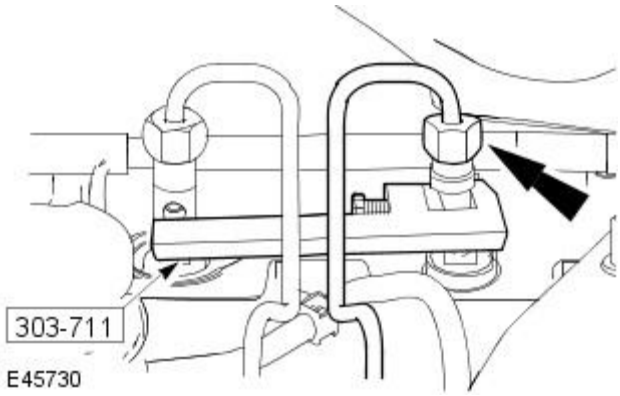
- Tighten to 23 Nm.



101. NOTE: High-pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold retaining bolt.

- Tighten to 23 Nm.



102. CAUTIONS:

Make sure the special tool is clamped around the fuel injector which is being tightened and is resting up against the adjacent fuel injector.

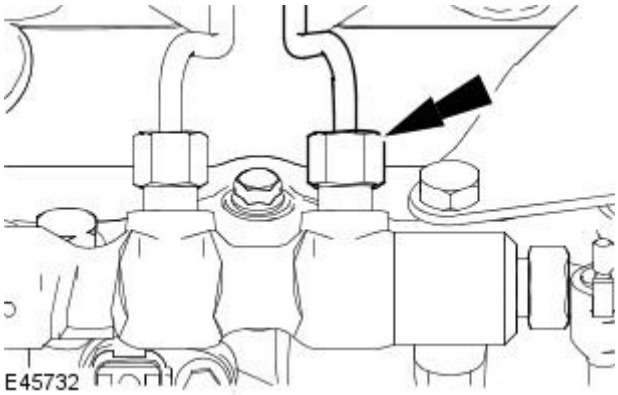
Make sure the tool used to tighten the high-pressure fuel supply line unions is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Make sure that the fuel injector does not move when tightening the high-pressure fuel supply lines. Failure to follow this instruction will result in damage to the fuel injector and the fuel injector sealing washer.

Install the special tool and tighten the high pressure fuel supply line union at the fuel injector.

- Tighten to 40 Nm.

103. Remove the special tool.



104. CAUTION: Make sure the tool used to tighten the high-pressure fuel supply line unions is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Tighten the high-pressure fuel supply line union at the fuel injection supply manifold.

- Tighten to 40 Nm.

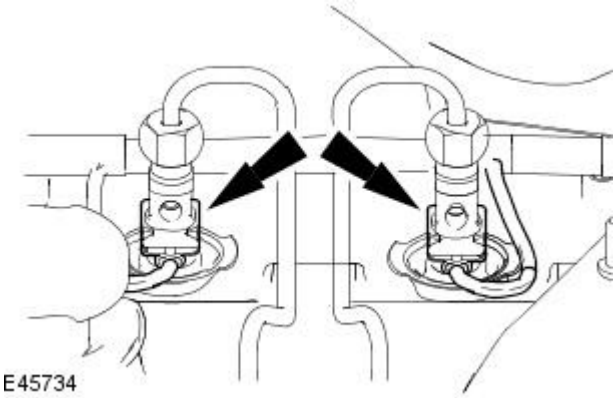
105. Repeat steps 97, 98 and 99 for tightening the three remaining high-pressure fuel supply line unions.

106. NOTE: Cylinders three and four fuel injectors shown, cylinders one and two fuel injectors similar.

• NOTE: Install new O-ring seals.

Install the wiring harness.

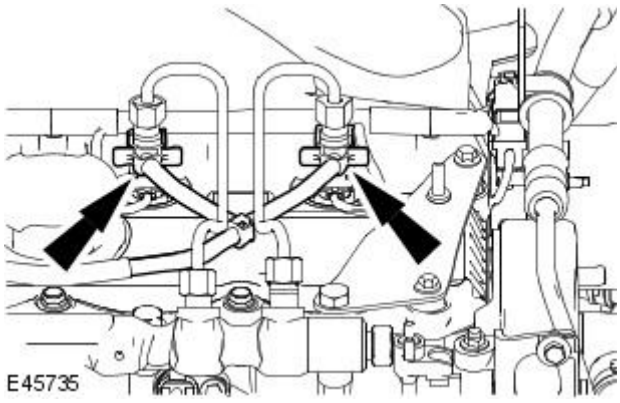
- Connect the fuel injector electrical connectors.



107. NOTE: Cylinders three and four fuel injectors shown, cylinders one and two fuel injectors similar.

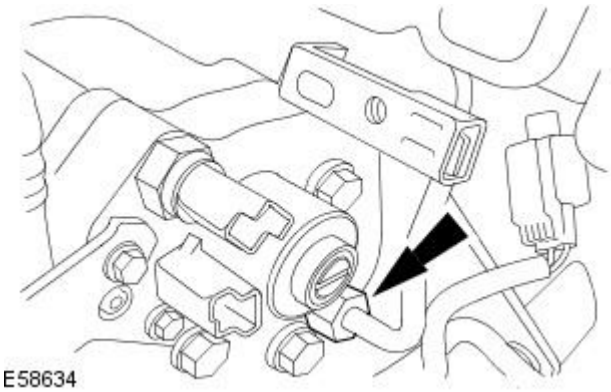
• NOTE: Install new O-ring seals.

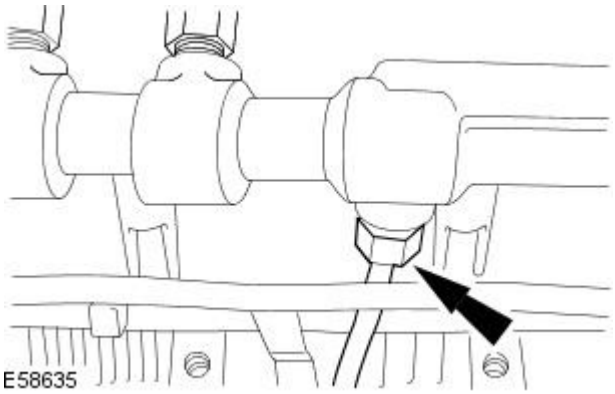
Connect the fuel return lines to the fuel injectors.



108. Tighten the high pressure fuel supply line union at the fuel injection supply manifold.

- Tighten to 40 Nm.

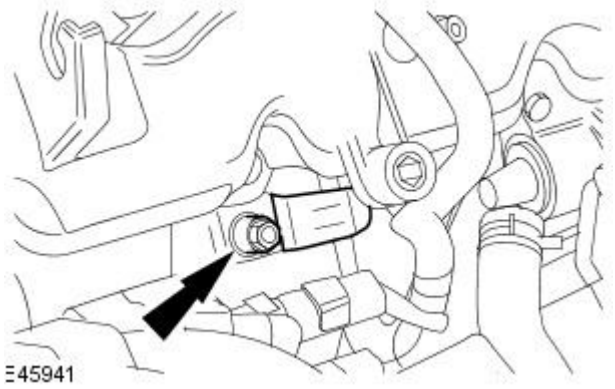




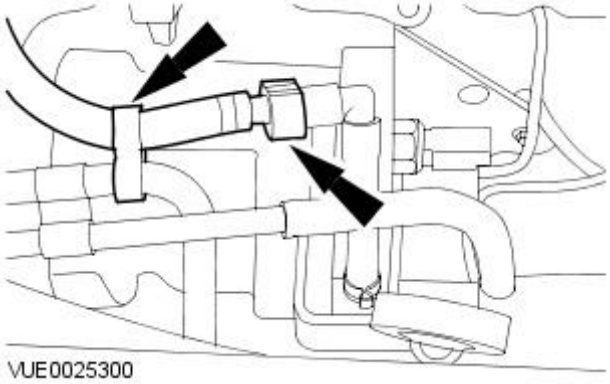
109. CAUTION: Make sure the tool used to tighten the high pressure fuel supply line union is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Tighten the high pressure fuel supply line union at the fuel injection supply manifold.

- Tighten to 40 Nm.

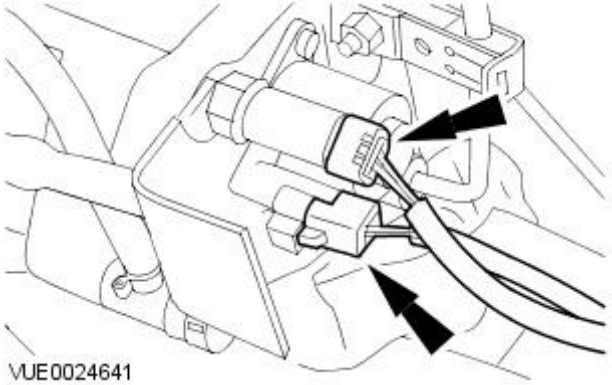


110. Tighten to 8 Nm.

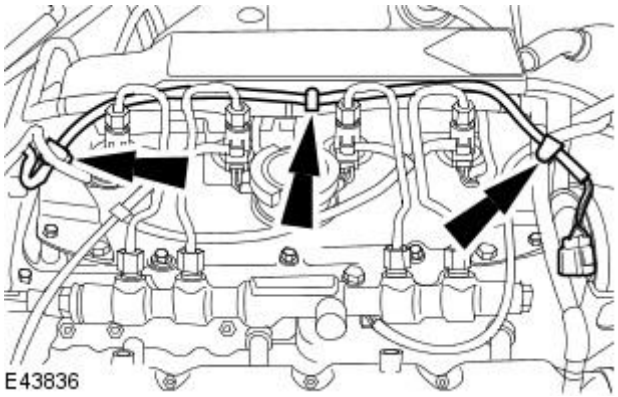


111. NOTE: Remove the blanking plugs from the fuel injector to fuel pump fuel return line male and female connectors.

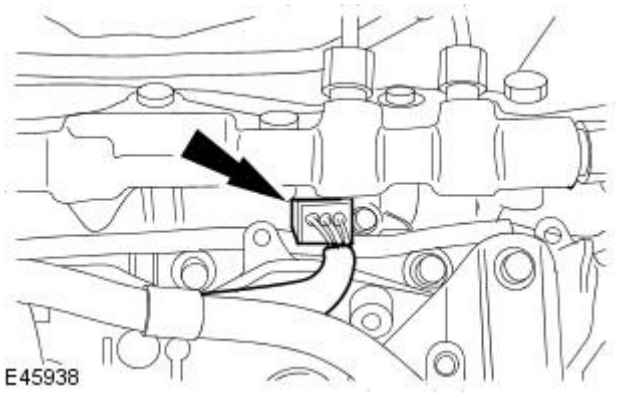
Connect the fuel injector to fuel pump fuel return line and attach the line to the retaining clip.



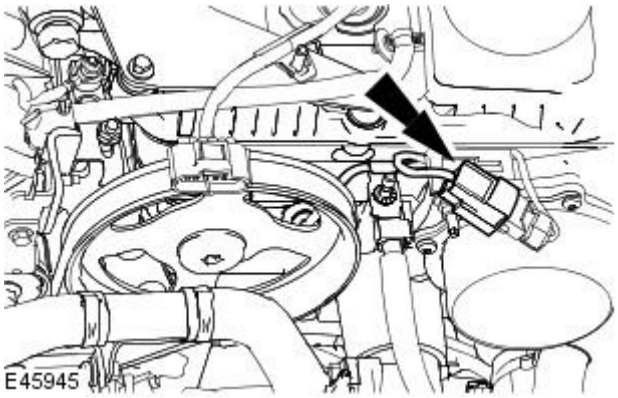
112. Connect the fuel metering valve and fuel temperature sensor electrical connectors.



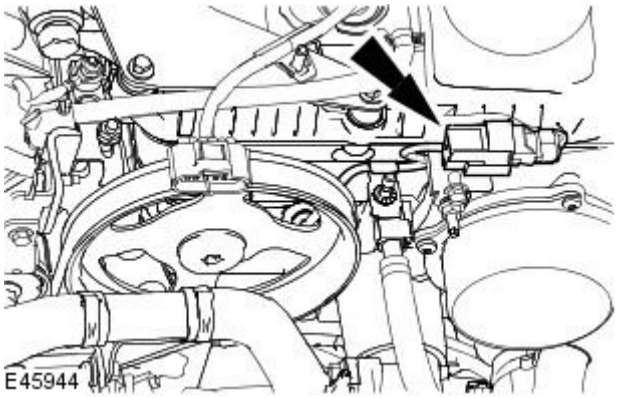
113. Attach the mass air flow (MAF) sensor wiring harness.



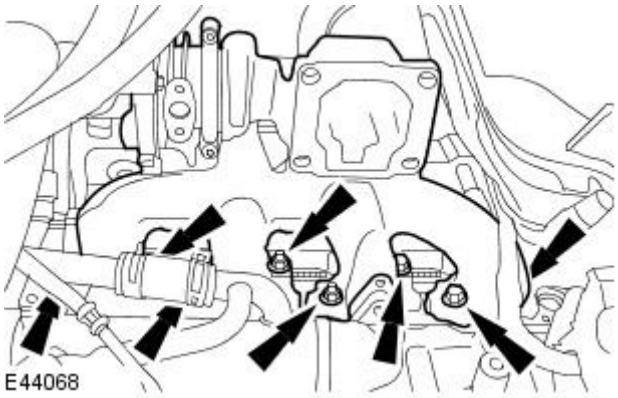
114. Connect the camshaft position (CMP) sensor electrical connector.



115. Connect the cylinder head temperature (CHT) sensor electrical connector.

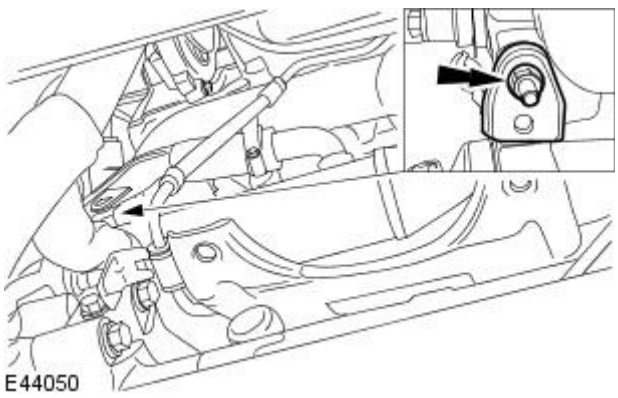


116. Attach the CHT sensor electrical connector.



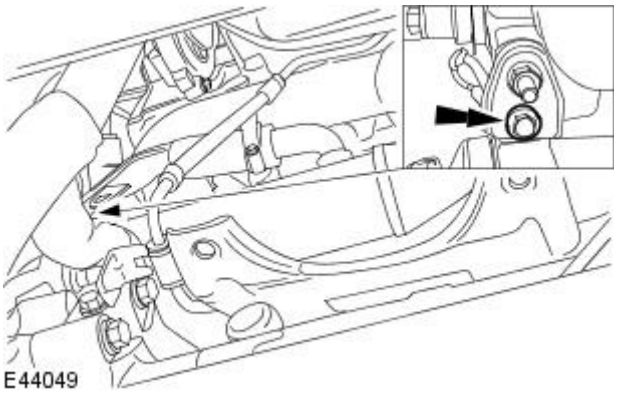
117. Install the exhaust manifold.

- Tighten to 40 Nm.



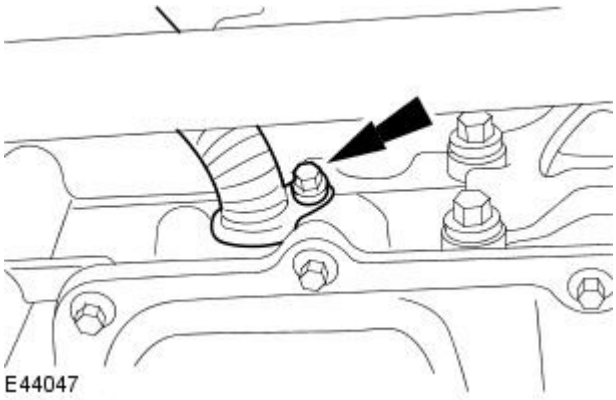
118. Install the exhaust gas recirculation (EGR) cooler mount bracket.

- Tighten to 10 Nm.



119. Install the EGR cooler mount bracket retaining bolt.

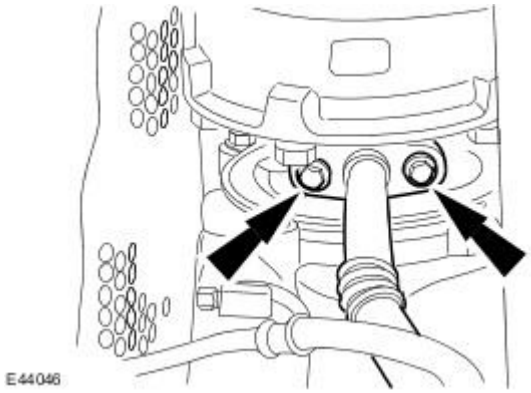
- Tighten to 10 Nm.



120. NOTE: Install a new O-ring seal.

Install the oil return tube.

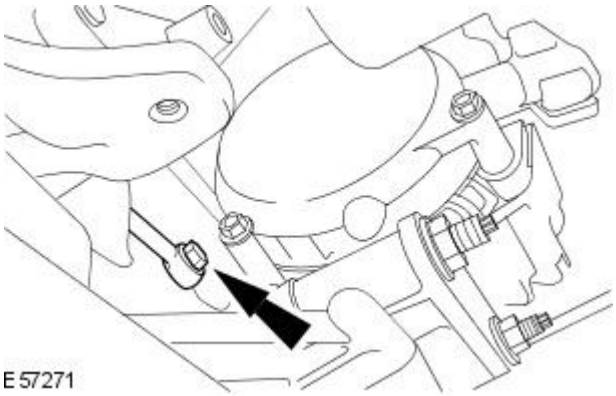
- Tighten to 10 Nm.



121. NOTE: Install a new gasket.

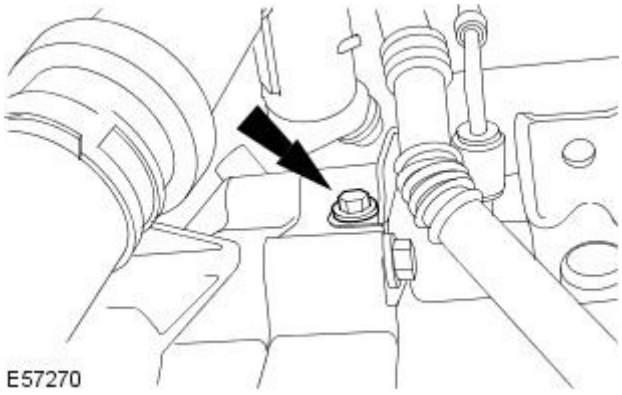
Connect the oil return tube to the turbocharger.

- Tighten to 10 Nm.



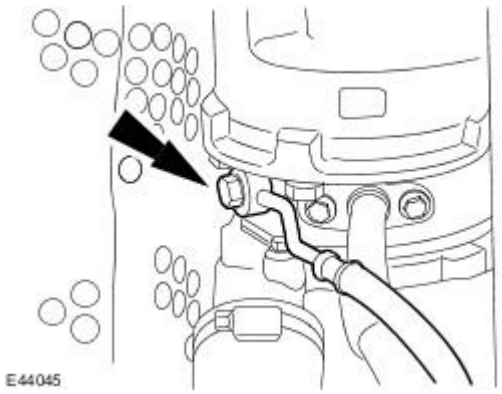
122. Install the oil supply tube.

- Tighten to 14 Nm.



123. Attach the oil supply tube.

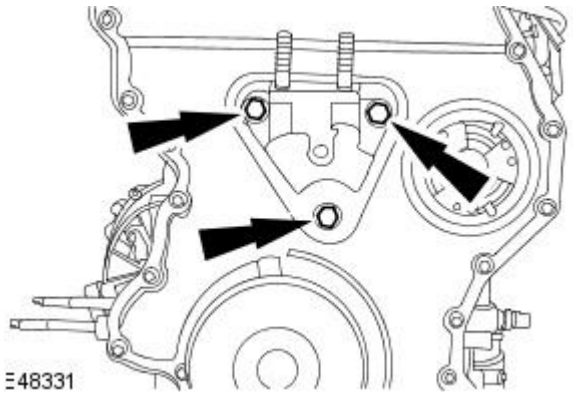
- Tighten to 23 Nm.



124. NOTE: Install new sealing washers.

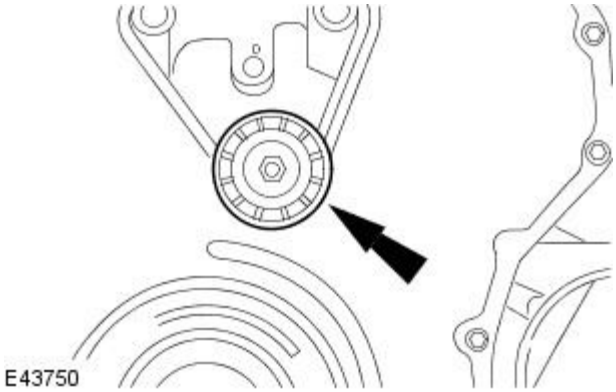
Connect the oil supply tube to the turbocharger.

- Tighten to 14 Nm.



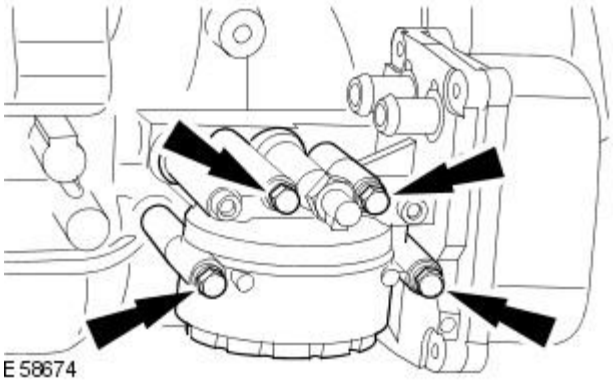
125. Install the engine front mount bracket.

- Tighten to 80 Nm.



126. Install the idler pulley.

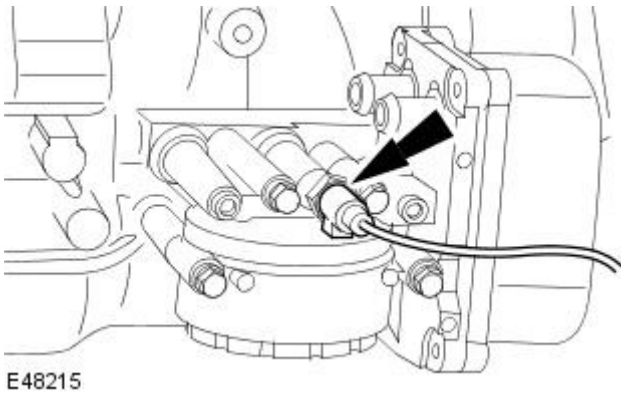
- Tighten to 43 Nm.



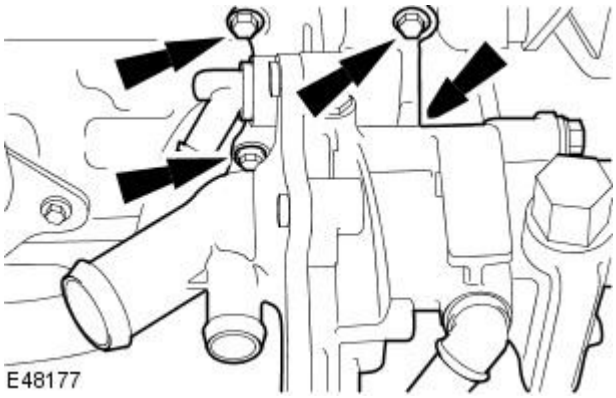
127. NOTE: Install new O-ring seals.

Install the oil filter housing.

- Tighten to 22 Nm.



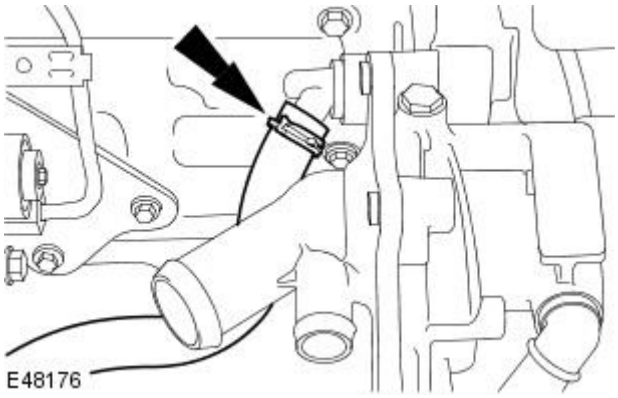
128. Connect the oil pressure switch electrical connector.



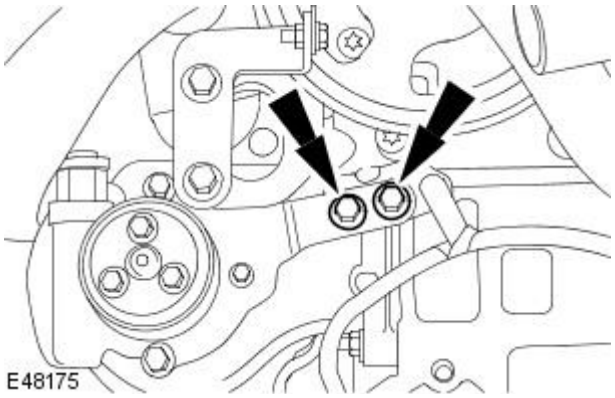
129. NOTE: Install a new water pump gasket.

Install the water pump and power assisted steering pump assembly.

- Tighten to 22 Nm.

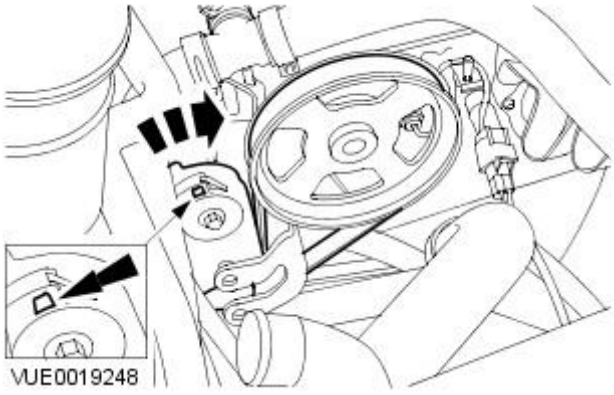


130. Connect the coolant hose to the water pump.



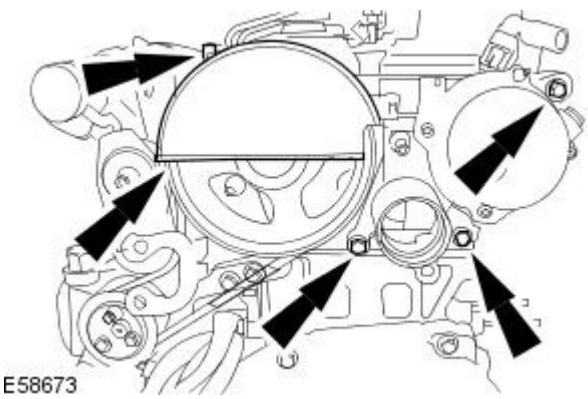
131. Install the power assisted steering pump bracket retaining bolts.

- Tighten to 22 Nm.



132. Install the power assisted steering pump belt.

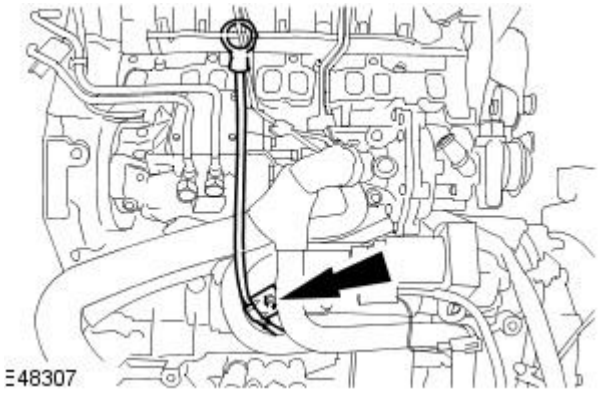
- Rotate the tensioner clockwise.



133. Install the brake vacuum pump retaining bolts.

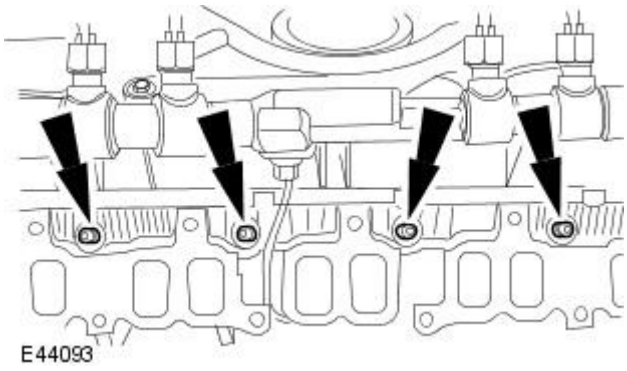
- Tighten to 10 Nm.

134. Install the oil level indicator and tube.



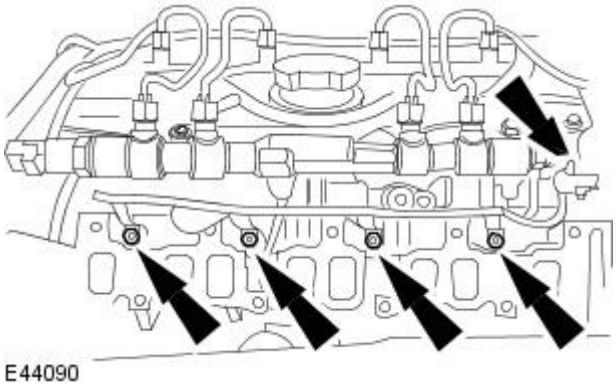
135. Install the glow plugs.

- Tighten to 13 Nm.



136. Install the glow plug wire.

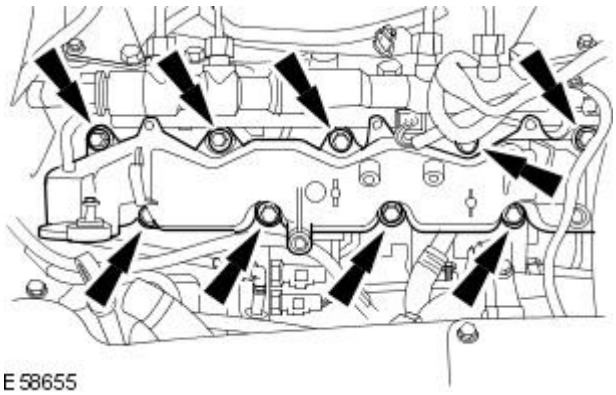
- Tighten to 2 Nm.



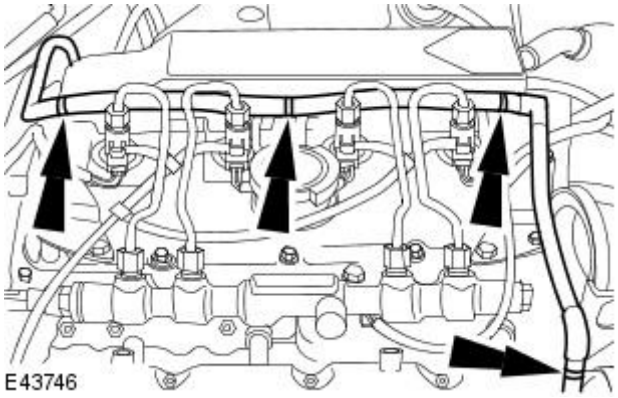
137. NOTE: Install new manifold gaskets.

Install the intake manifold.

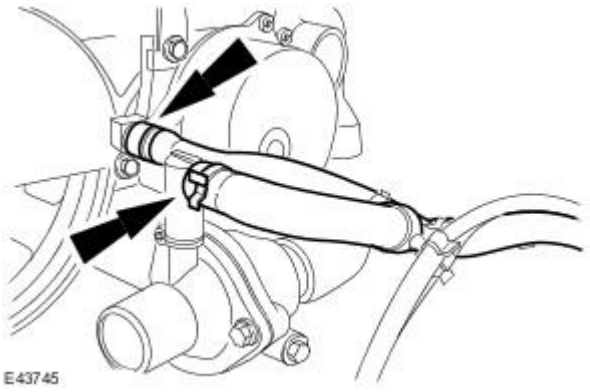
- Tighten to 15 Nm.



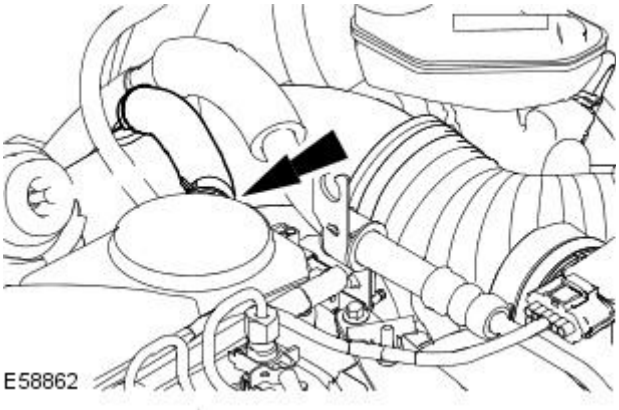
138. Install the starter motor to generator wiring harness.



139. Install the coolant hoses.

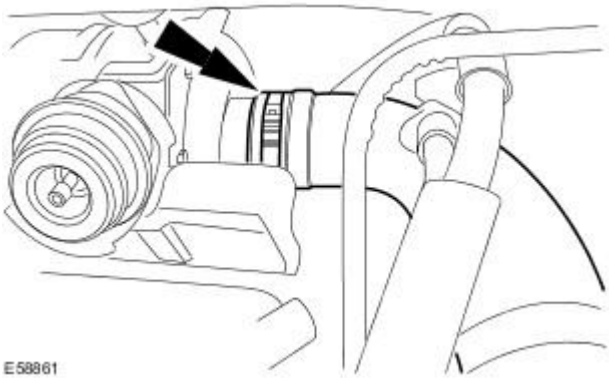


140. Install the air filter outlet tube.

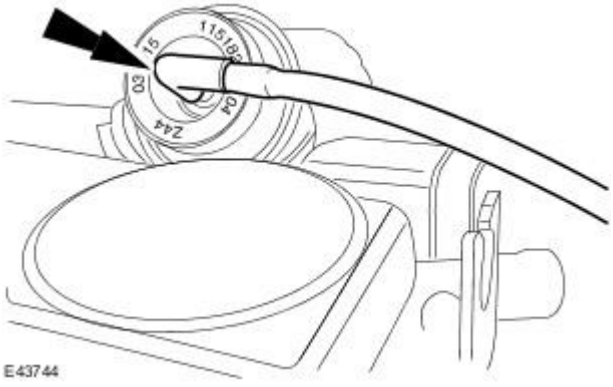


141. NOTE: Install a new air filter outlet tube retaining clip.

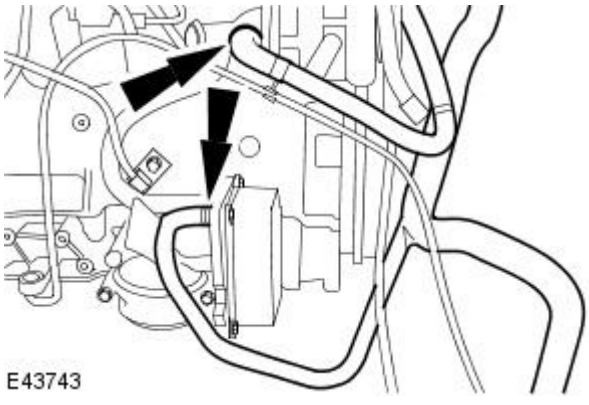
Install the air filter outlet tube.



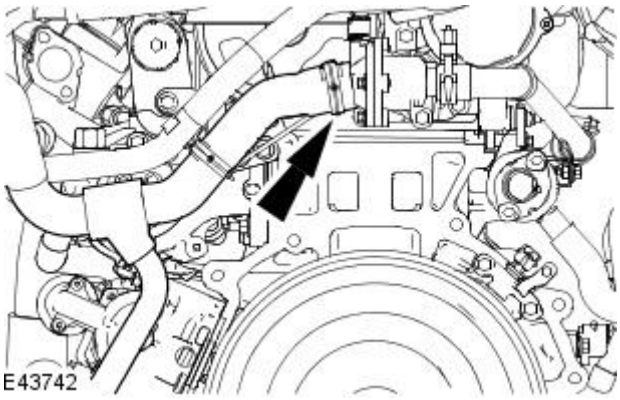
142. Connect the turbocharger vacuum hose.



143. Connect the coolant hoses.

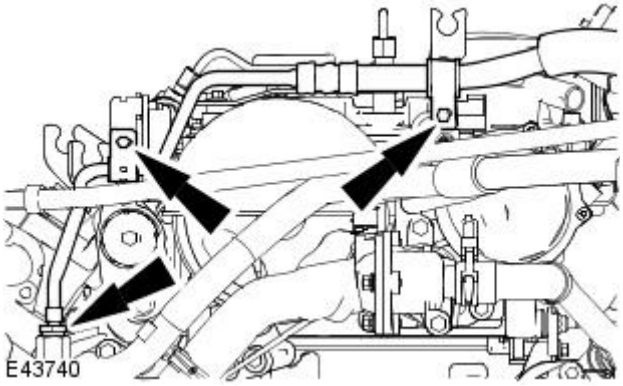


144. Connect the coolant hose.

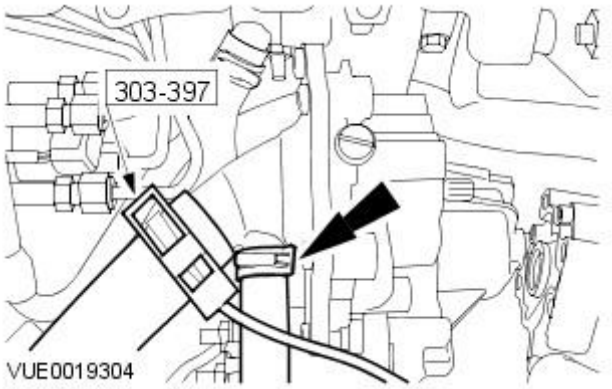


145. NOTE: Install a new power assisted steering high-pressure O-ring seal.

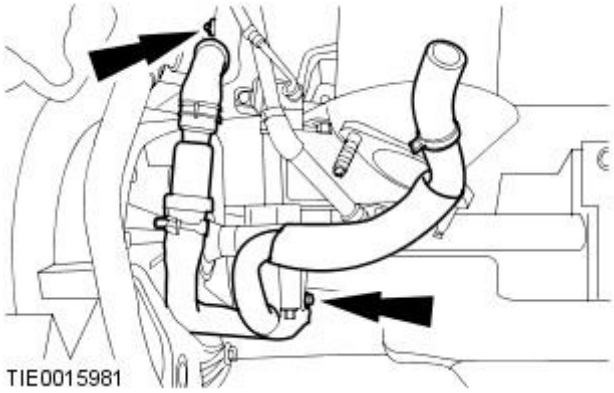
Install the power assisted steering high pressure pipe.



146. Using the special tool, install the water pump hoses.

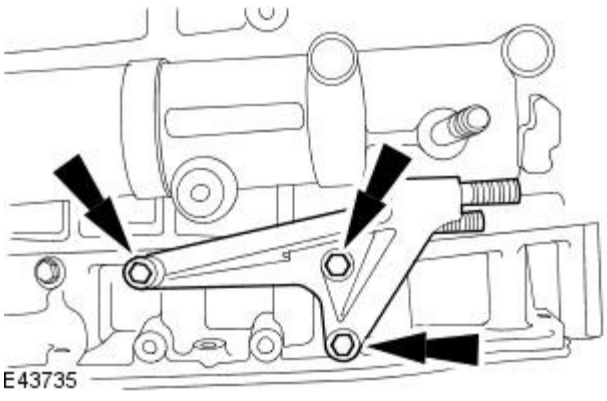


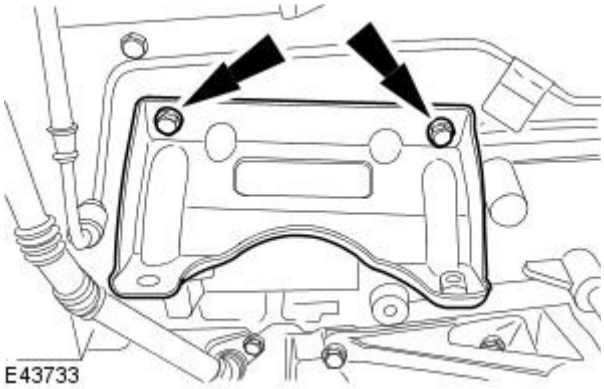
147. Install the EGR cooler coolant hose.



148. Install the halfshaft bracket.

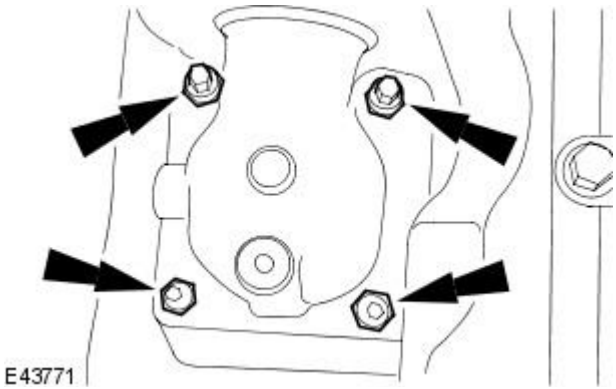
- Tighten to 25 Nm.





149. Install the catalytic converter bracket.

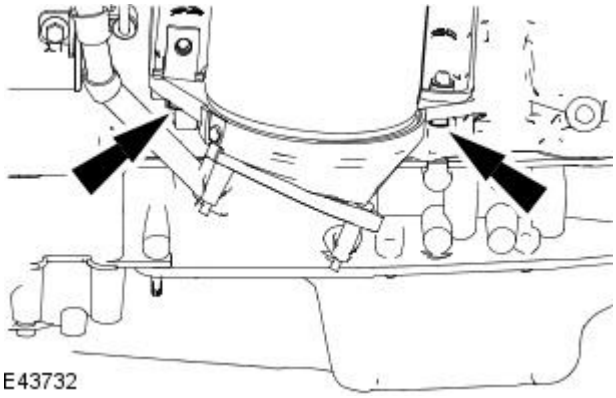
- Tighten to 46 Nm.



150. NOTE: Install new retaining nuts.

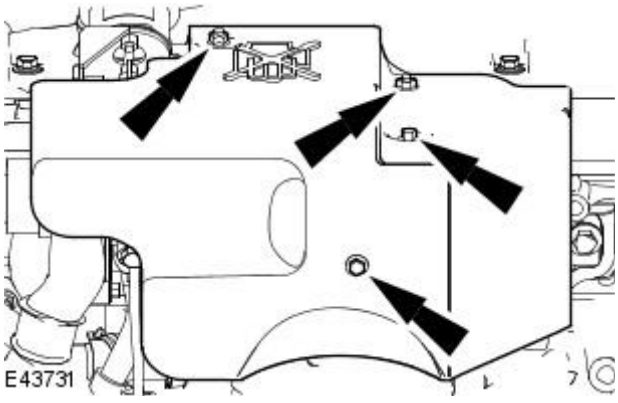
Install the catalytic converter.

- Tighten to 46 Nm.



151. Install the catalytic converter retaining bolts.

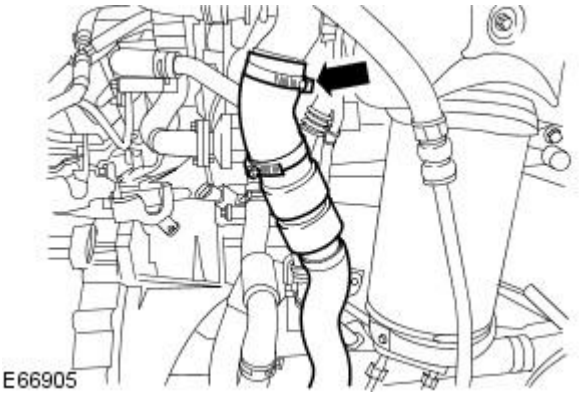
- Install the catalytic converter securing bracket.
- Tighten to 46 Nm.



152. Install the turbocharger heat shield.

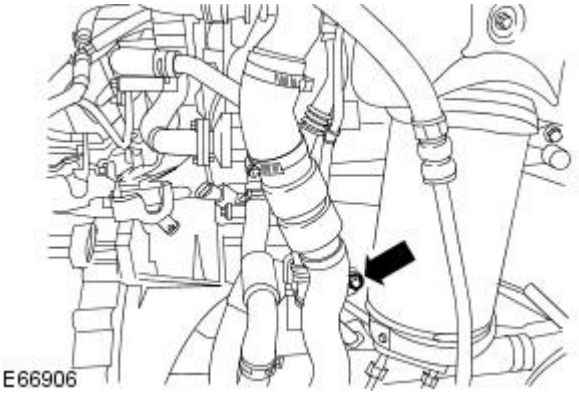
- Tighten to 8 Nm.

Vehicles with 2.2L diesel engine

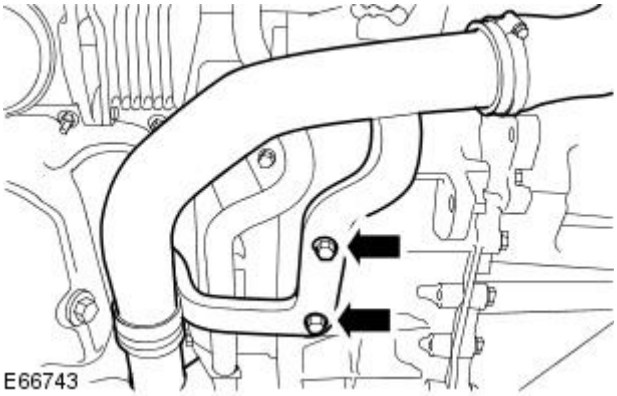


153. NOTE: Do not tighten the retaining clip.

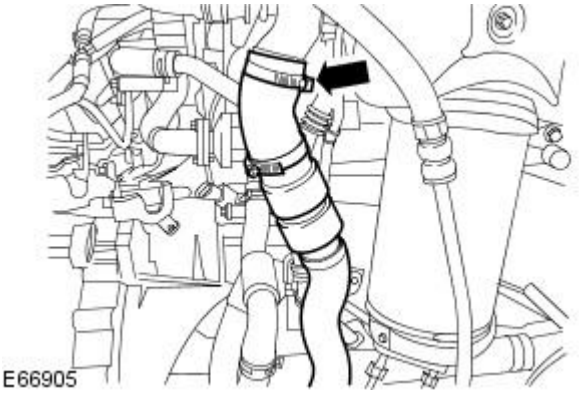
Align the turbo outlet pipe and charge air cooler intake pipe assembly.



154. Install the turbo outlet pipe retaining bolt.



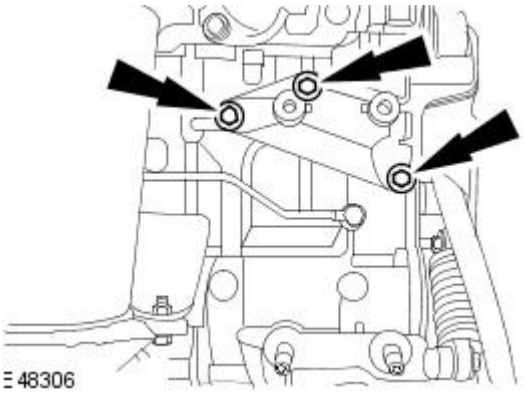
155. Install the charge air cooler intake pipe retaining bolts.



156. Tighten the retaining clip.

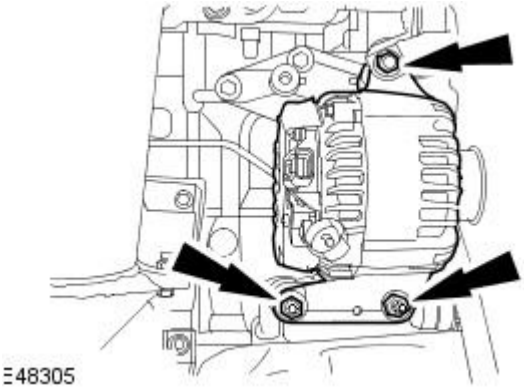
- Tighten to 4 Nm.

All vehicles



157. Install the accessory drive belt tensioner bracket.

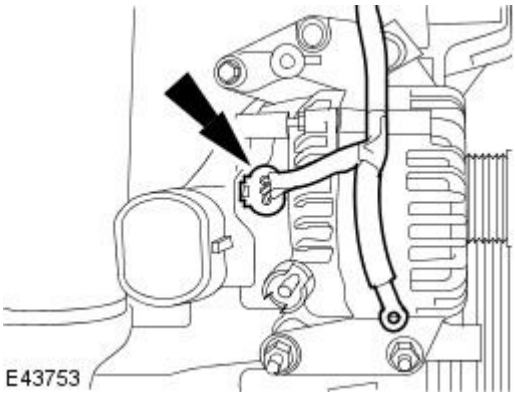
- Tighten to 25 Nm.



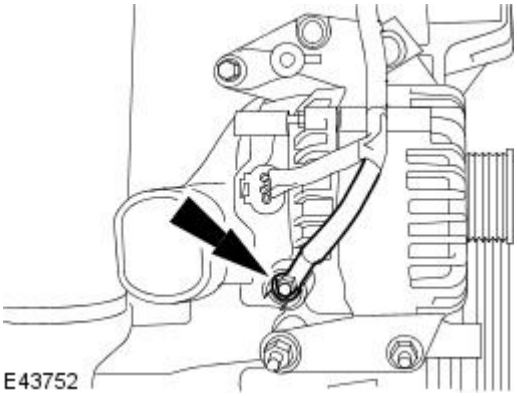
158. NOTE: Install the wiring harness support bracket to the generator upper retaining bolt.

Install the generator.

- Tighten to 47 Nm.

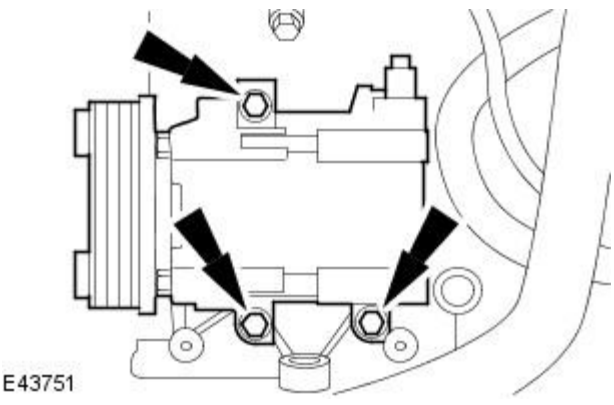


159. Connect the generator electrical connector.



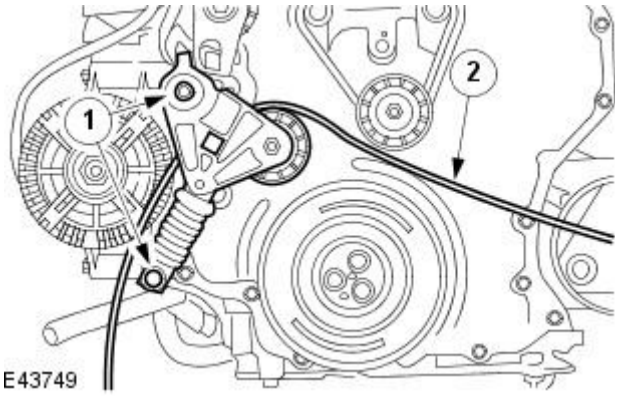
160. Attach the generator electrical connector.

- Tighten to 8 Nm.



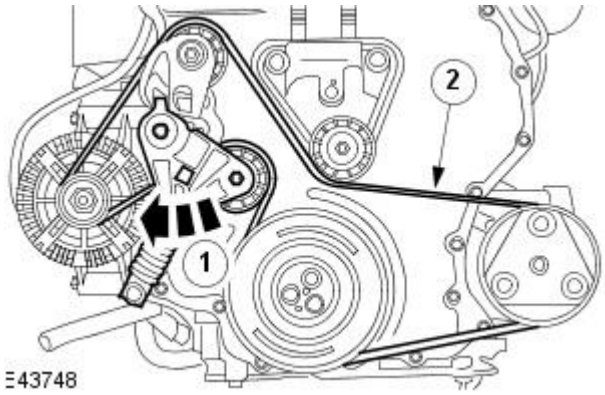
161. Install the air conditioning (AC) compressor.

- Tighten to 25 Nm.



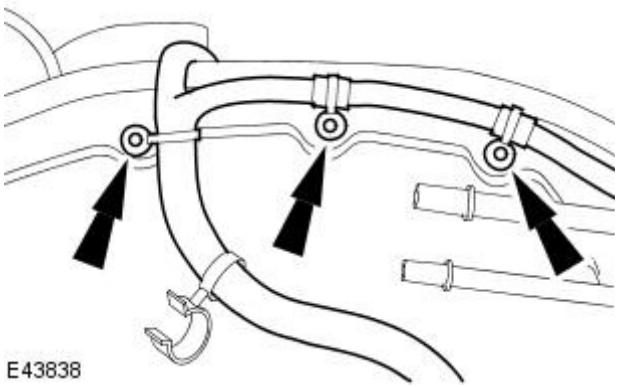
162. Install the accessory drive belt tensioner.

1. Install the accessory drive belt.
2. Install the accessory drive belt tensioner.

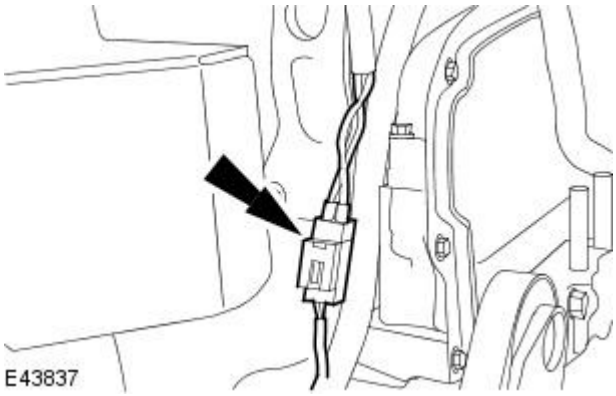


163. Attach the accessory drive belt.

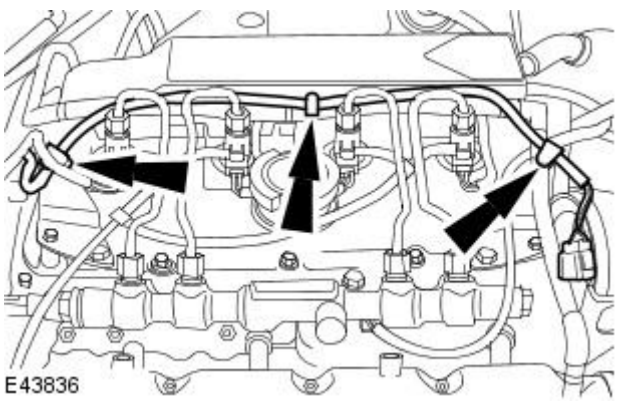
1. Reposition the accessory drive belt tensioner.
2. Attach the accessory drive belt.



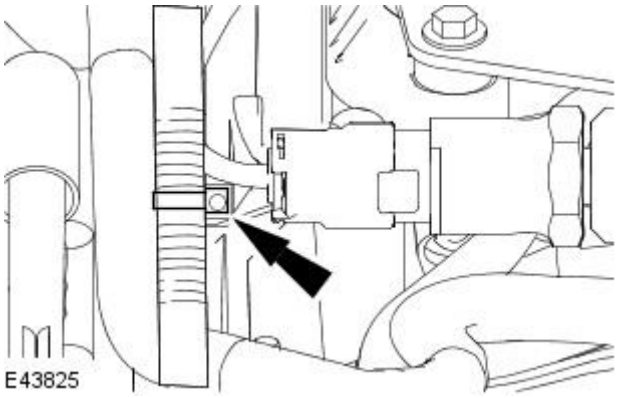
164. Install the wiring harness.



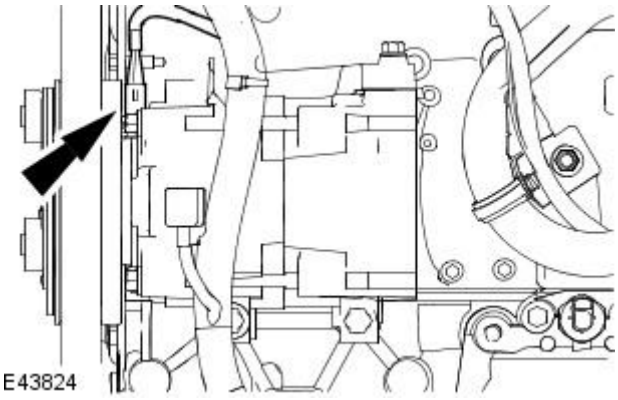
165. Connect the generator wiring harness electrical connector.



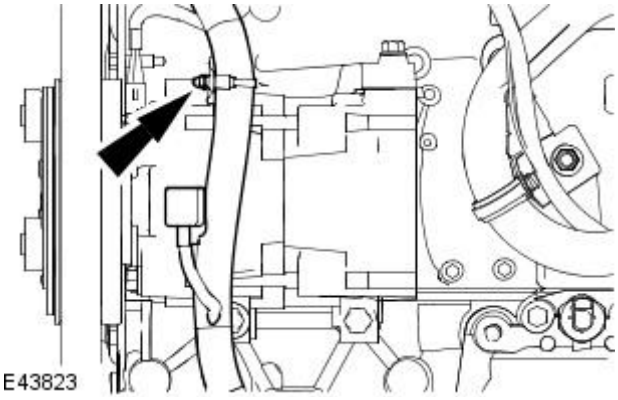
166. Attach the mass air flow (MAF) sensor wiring harness.



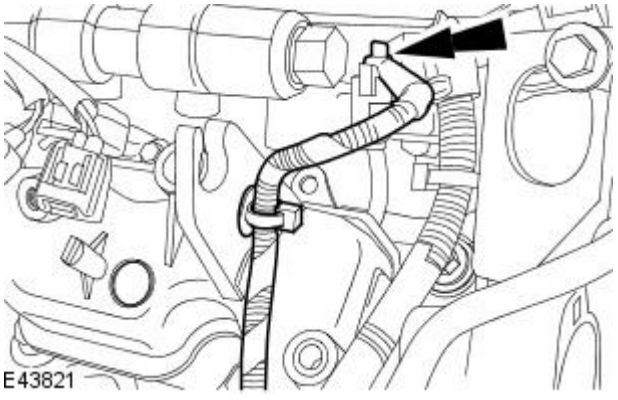
167. Attach the wiring harness to the retaining stud.



168. Connect the AC compressor electrical connector.

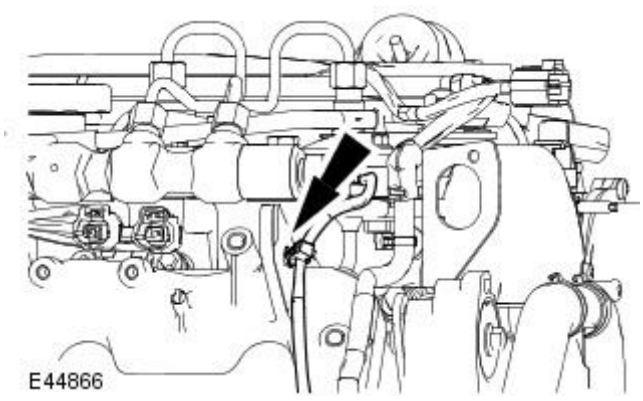


169. Attach the wiring harness to the AC compressor.



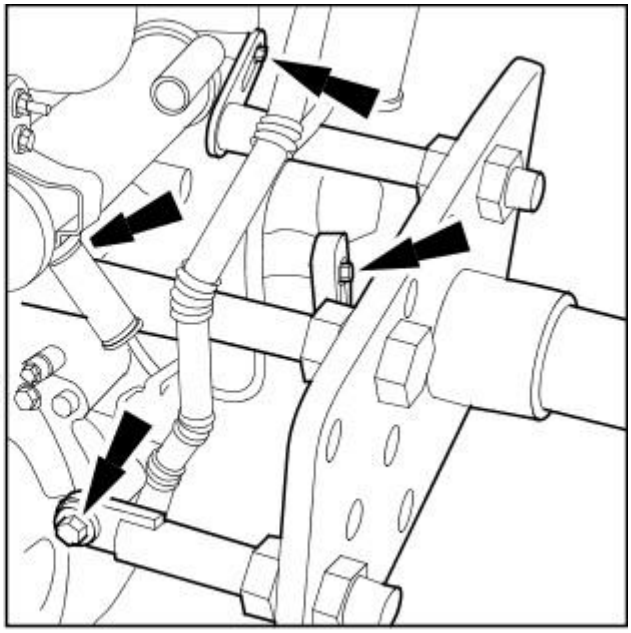
170. Attach the glow plug wiring harness.

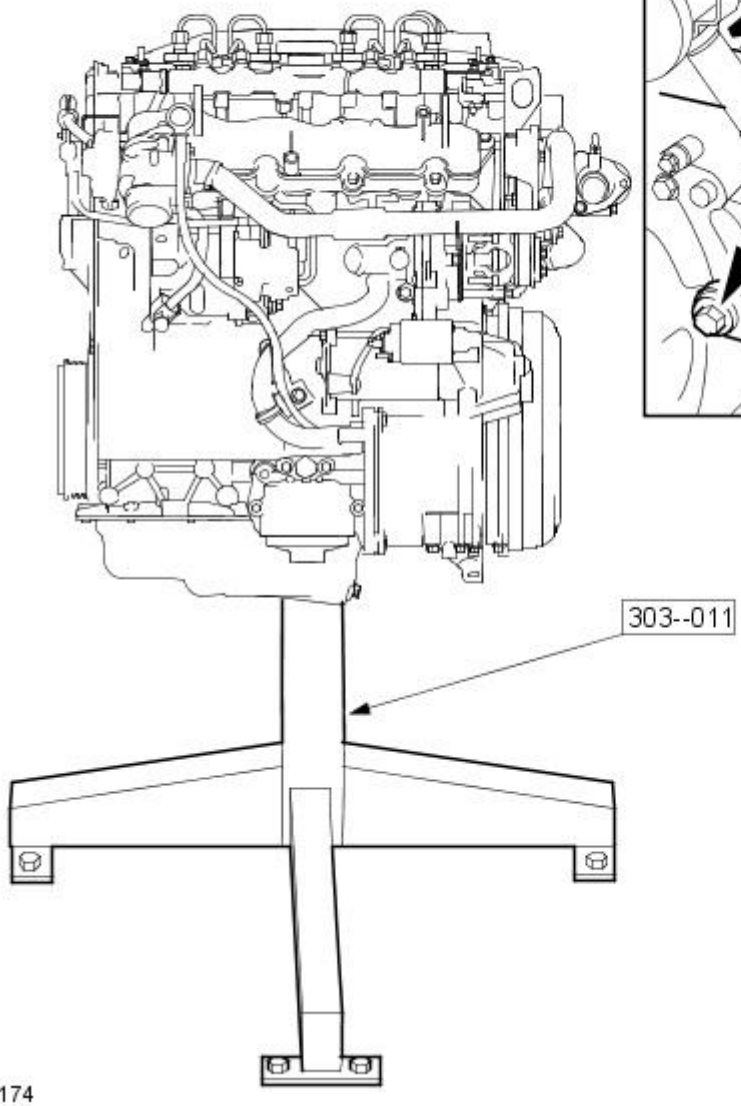
- Tighten to 5 Nm.



171. Attach the wiring harness to the intake manifold.

172. Remove the engine from the engine stand.

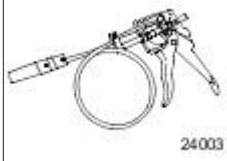
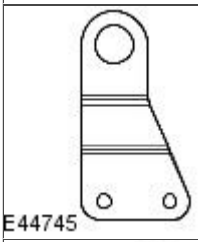
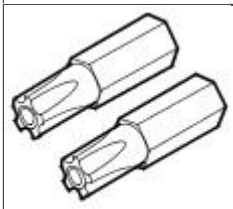




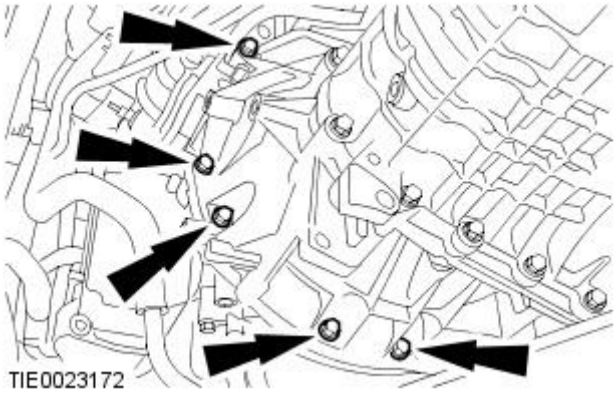
E48174

Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Engine2.0L Duratorq-TDCi

Installation

Special Tool(s)	
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)
 HTJ12002	Powertrain assembly jack HTJ1200-02
 E44745	Engine lifting eye 303-1067
 418-535	5 Point Security Torx Bit 418-535

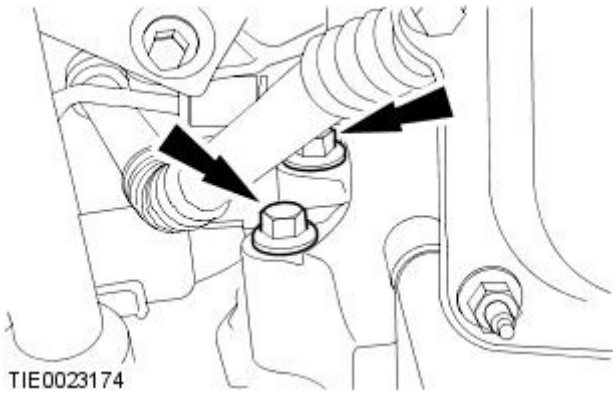
Installation


TIE0023172

1. CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

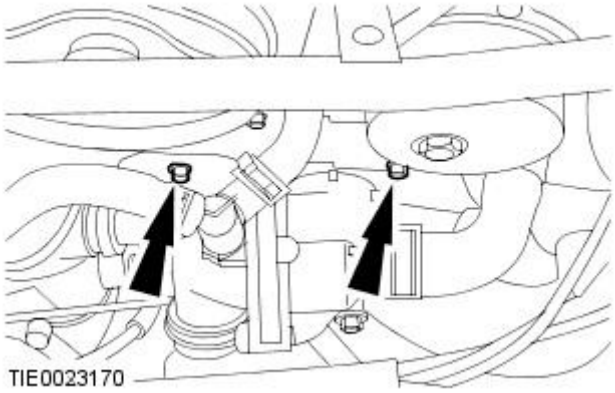
Install the engine assembly to the transmission assembly.

- Tighten to 40 Nm.


TIE0023174

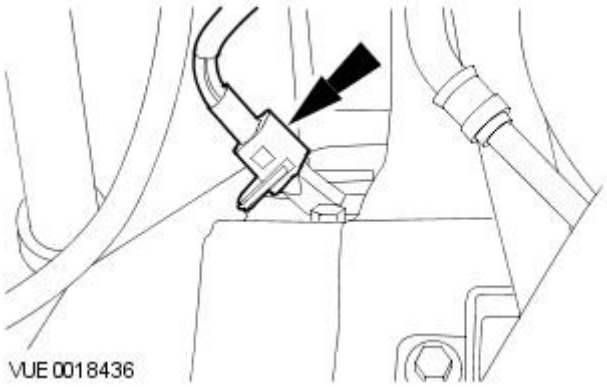
2. Install the transmission right-hand retaining bolts.

- Tighten to 40 Nm.

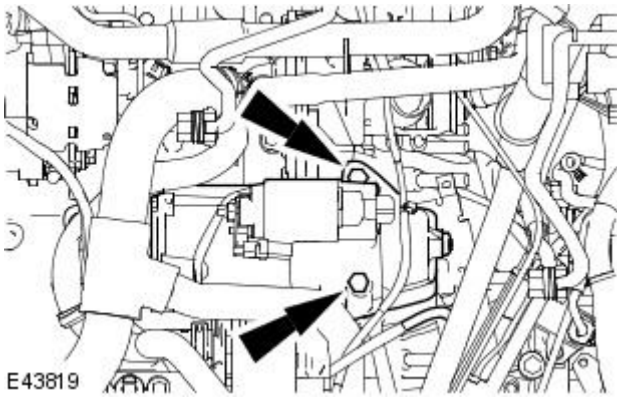


3. Install the transmission upper retaining bolts.

- Tighten to 40 Nm.

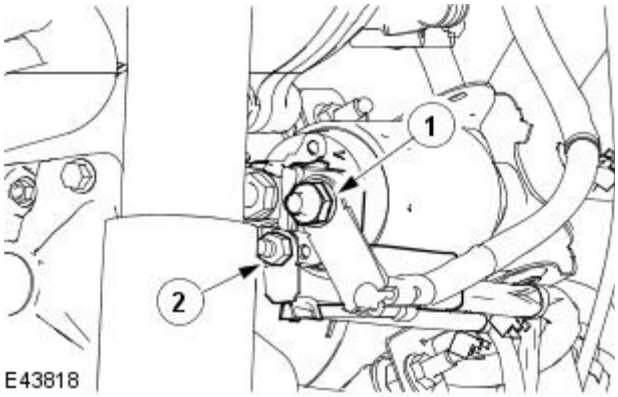


4. Connect the crankshaft sensor electrical connector.



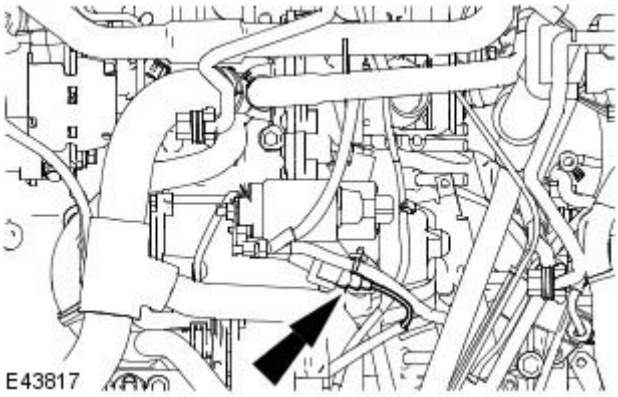
5. Install the starter motor.

- Tighten to 25 Nm.

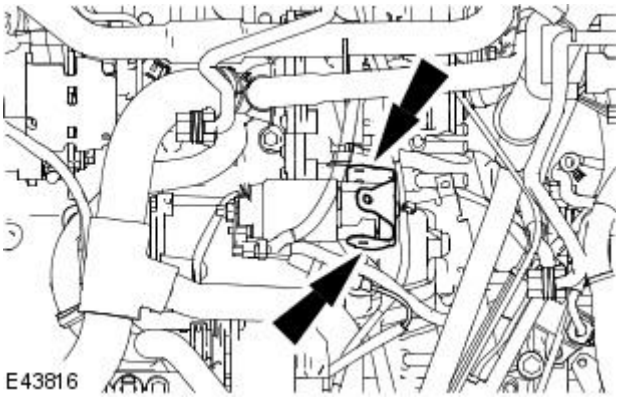


6. Attach the starter motor wiring harness.

1. Tighten to 12 Nm.
2. Tighten to 6 Nm.

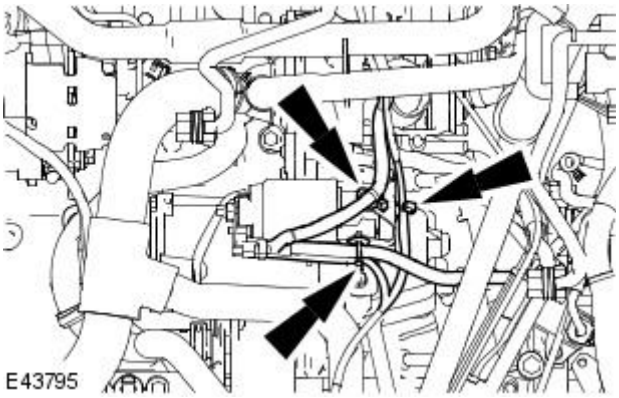


7. Connect the starter motor wiring harness electrical connector.

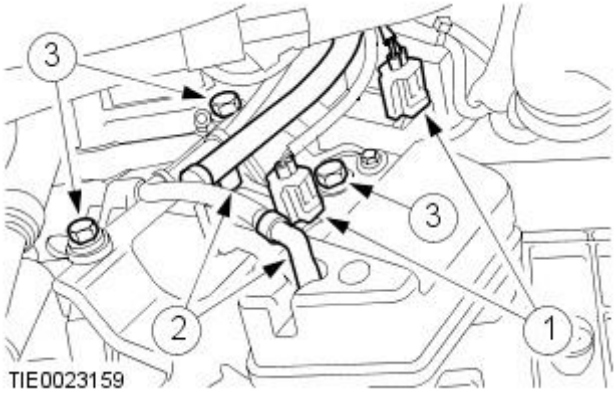


8. Install the starter motor wiring harness retaining bracket.

- Tighten to 20 Nm.



9. Attach the starter motor wiring harness.

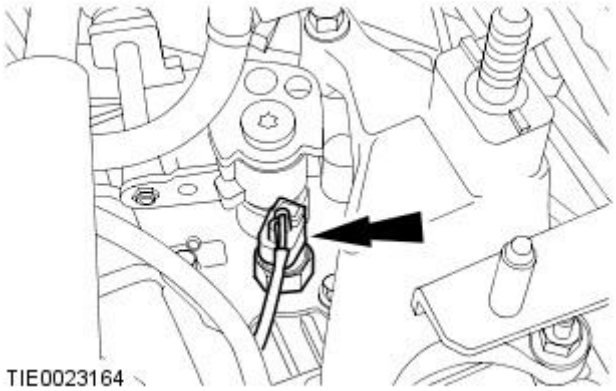


10. Install the vacuum regulator solenoid valve.

1. Connect the electrical connectors.
2. Attach the vacuum hoses.
3. Install the vacuum regulator solenoid valve.

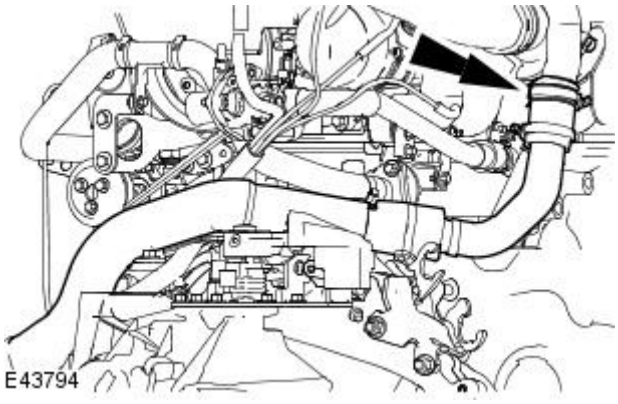
- Tighten to 23 Nm.

11. Connect the reverse lamp switch electrical connector.

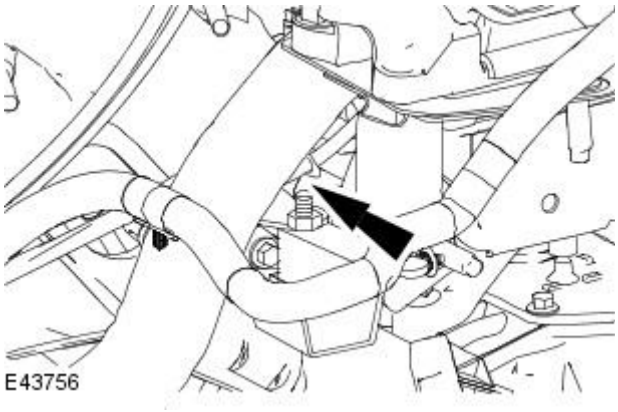


12. Install the charge air cooler pipe.

- Tighten to 4 Nm.

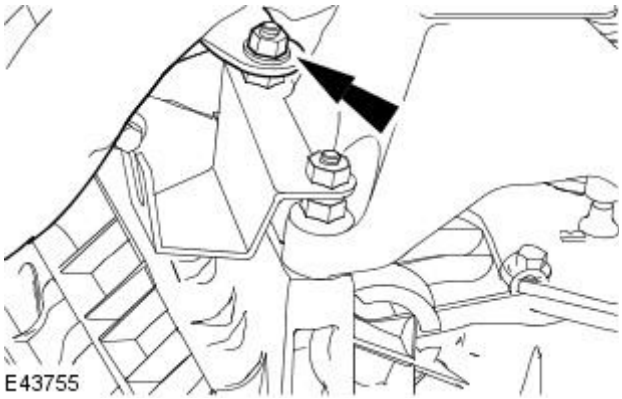


13. Attach the reverse lamp switch wiring harness retaining clip.



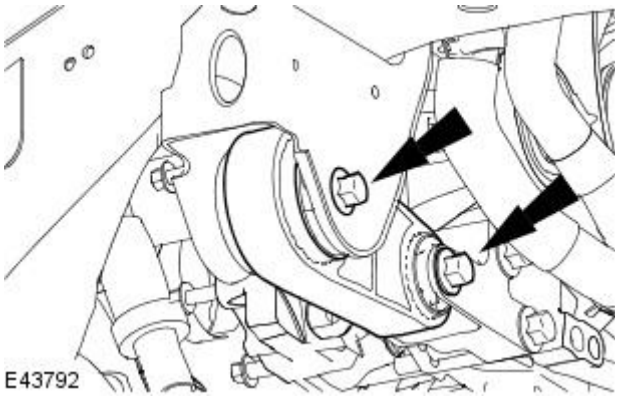
14. Install the charge air cooler pipe retaining nut.

- Tighten to 23 Nm.



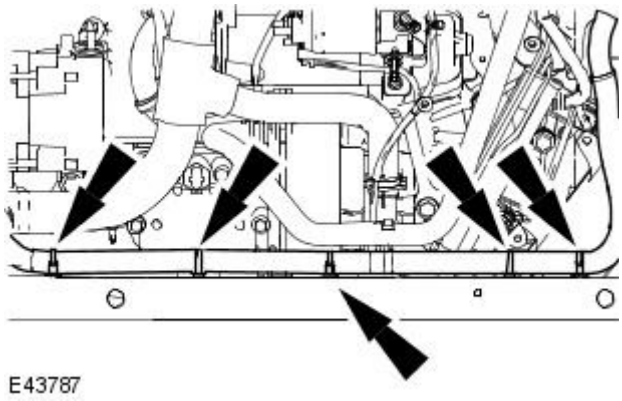
15. CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

Using a suitable hydraulic lift install the engine and transmission to the subframe.

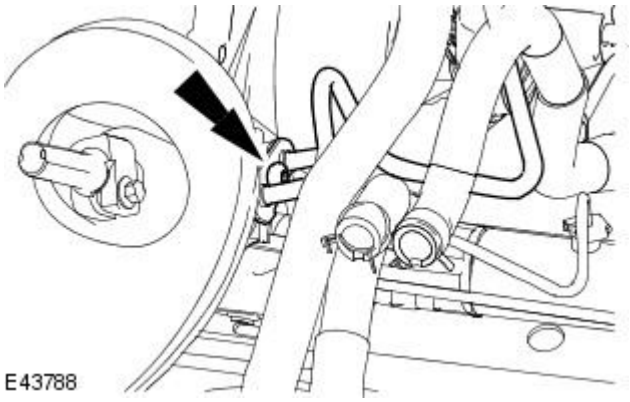


16. Install the engine roll restrictor.

- Tighten to 80 Nm.



17. Attach the wiring harness.

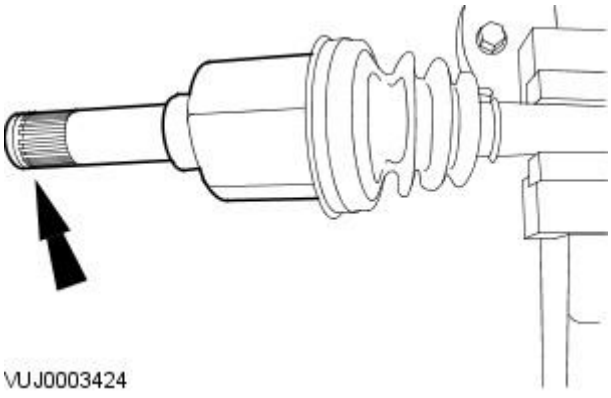


18. NOTE: Un-Cap the exposed ports.

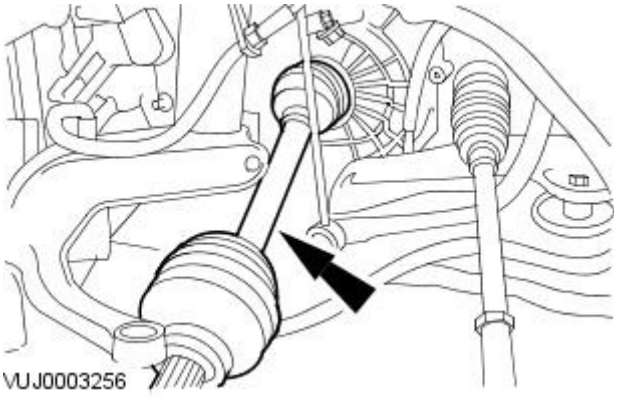
• NOTE: Install new O-ring seals.

Connect the the power steering lines.

- Tighten to 10 Nm.



19. Install a new drive halfshaft snap ring.

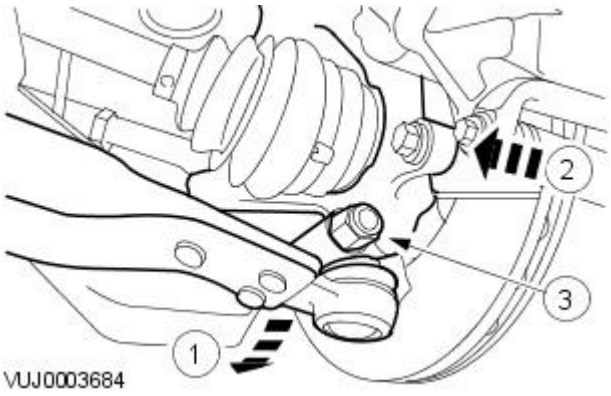


20. CAUTIONS:

Make sure the CV joint splines are located fully. Do not use excessive force when engaging the CV joint into the transmission.

Do not damage the oil seal.

Install the drive halfshaft.

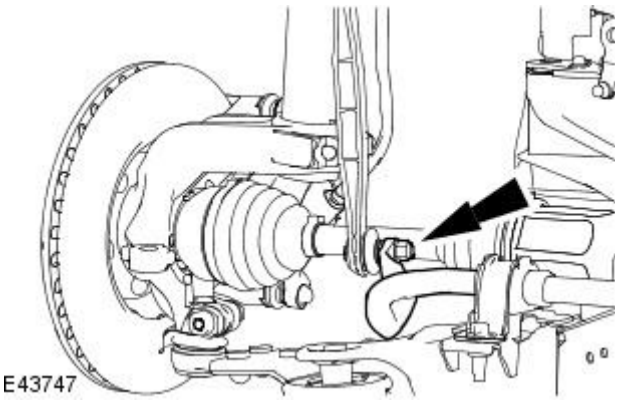


21. NOTE: Left-hand shown, right-hand similar.

Attach the wheel knuckle.

1. Reposition the lower arm.
2. Attach the wheel knuckle.
3. Install a new lower arm ball joint retaining nut and bolt.

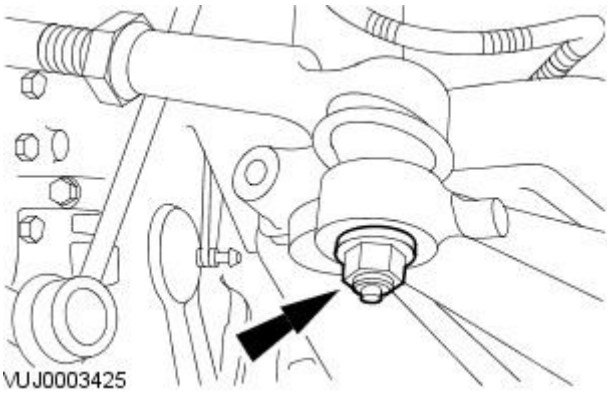
- Tighten to 83 Nm.



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

Install a new anti-roll bar link retaining nut.

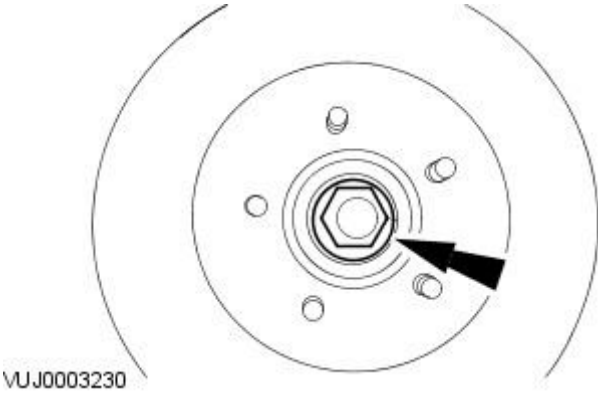
- Tighten to 48 Nm.



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

Install a new tie rod-end retaining nut.

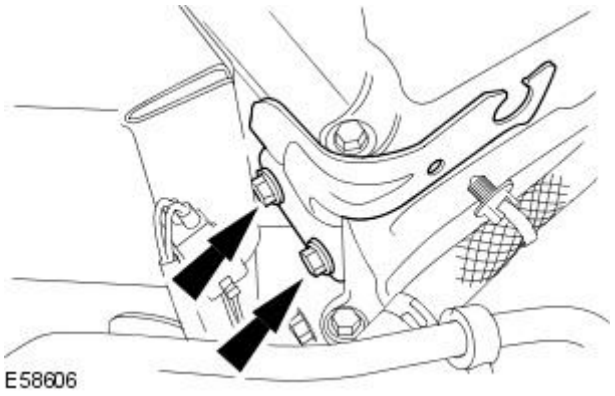
- Tighten to 35 Nm.



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

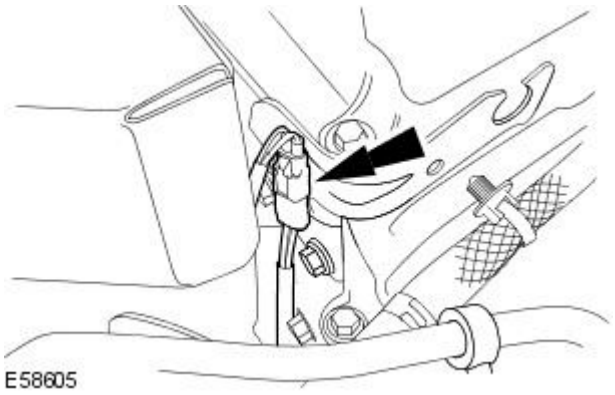
Loosely install a new wheel hub nut.

25. Remove the engine rear lifting eye.

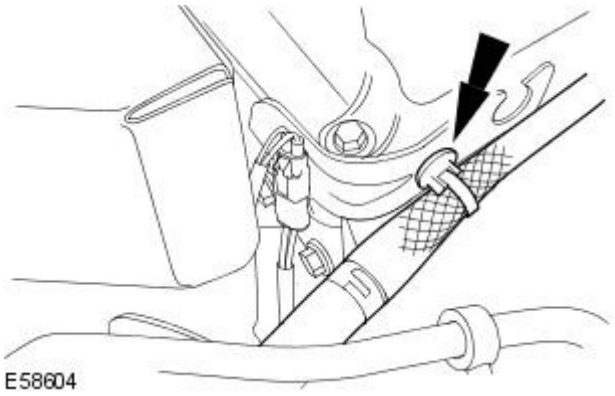


26. Install the engine cover rear mount bracket.

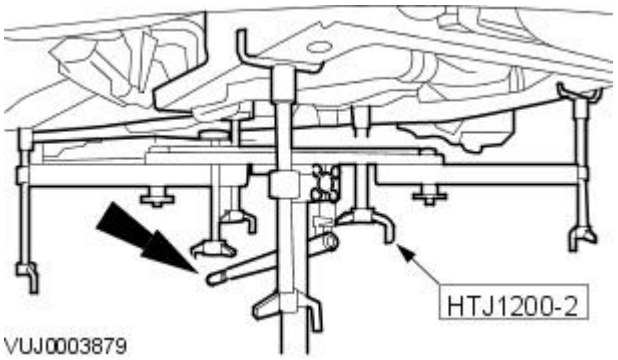
- Tighten to 23 Nm.



27. Attach the electrical connector.



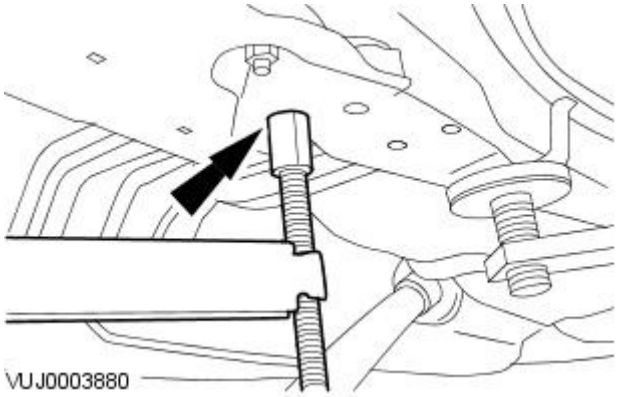
28. Attach the engine harness.



29. WARNING: Raise the special tool platform slowly. Failure to follow this instruction can result in personal injury.

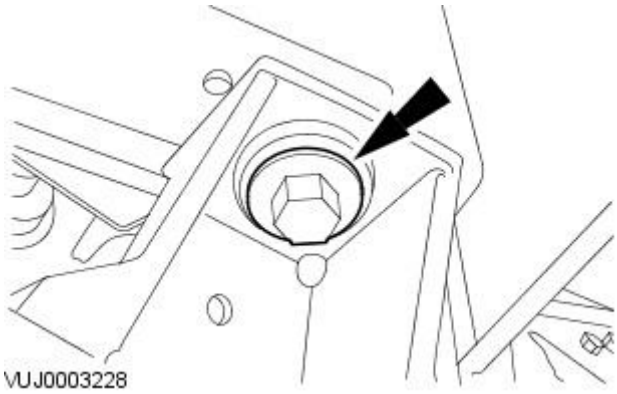
Install the engine.

- Raise the special tool.



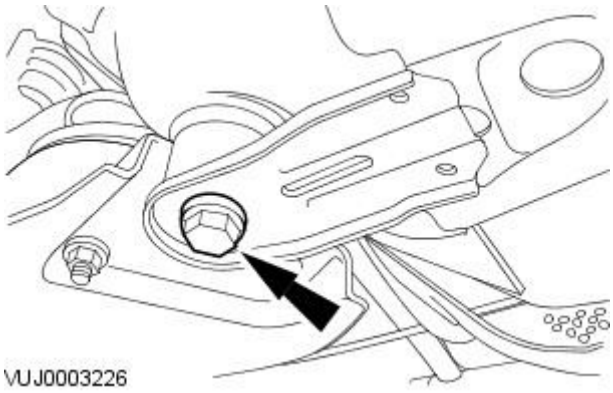
30. NOTE: Left-hand shown, right-hand similar.

Make sure the special tool rear height adjuster aligns into the locating hole in the vehicle floor pan.



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

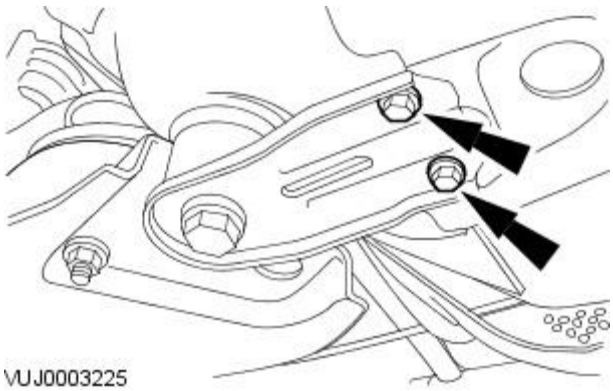
Loosely install the front subframe retaining bolts.



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

Install the front subframe reinforcement plate.

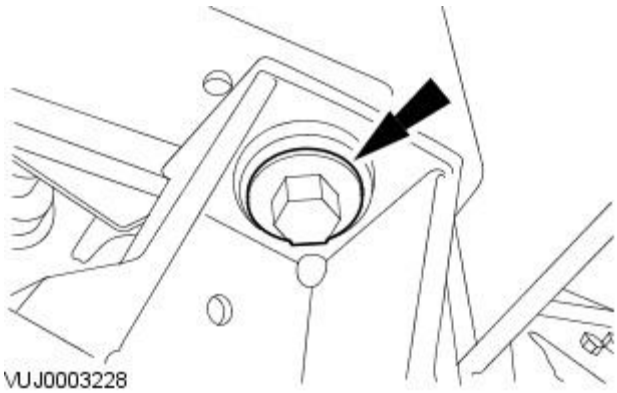
- Loosely install the front subframe rear retaining bolts.



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

Install the front subframe reinforcement plate retaining bolts.

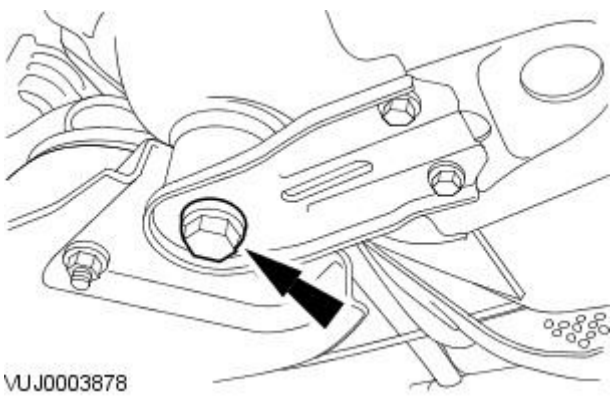
- Tighten to 70 Nm.



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

Fully tighten the front subframe retaining bolts.

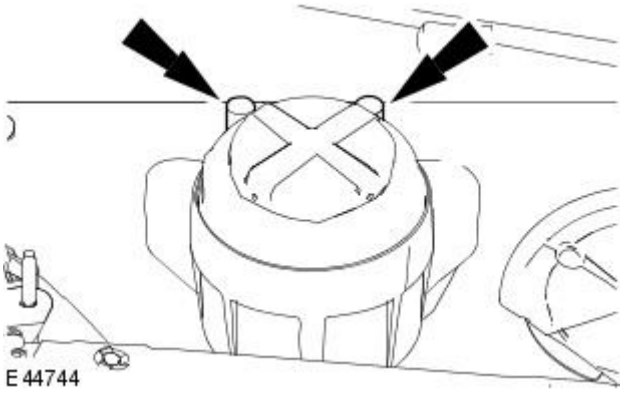
- Tighten to 142 Nm.



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

Fully tighten the front subframe retaining bolts.

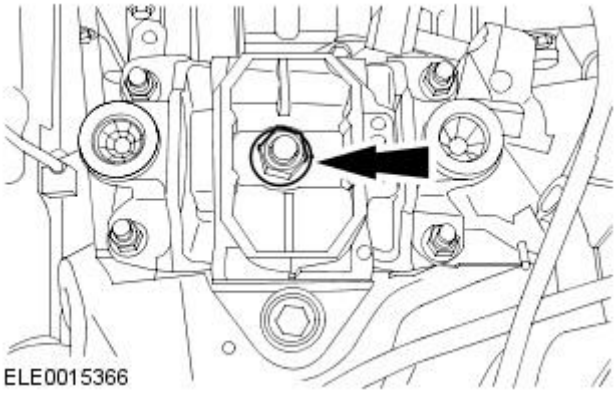
- Tighten to 142 Nm.



36. NOTE: Install new retaining nuts.

Install the engine front mount retaining nuts.

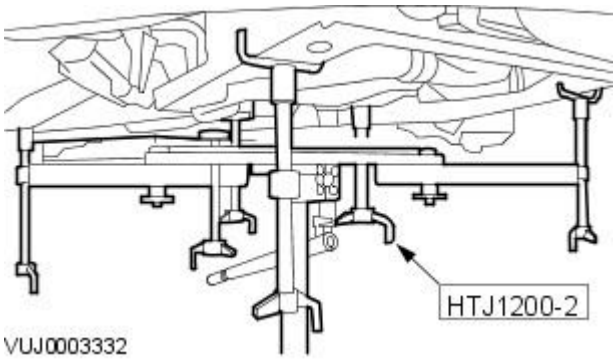
- Tighten to 80 Nm.



37. NOTE: Install a new retaining nut.

Install the engine rear mount retaining nut.

- Tighten to 133 Nm.

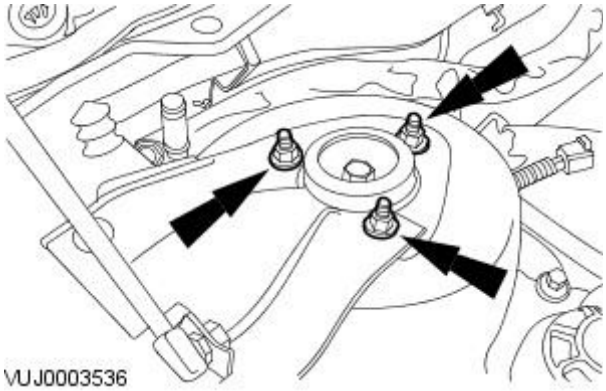


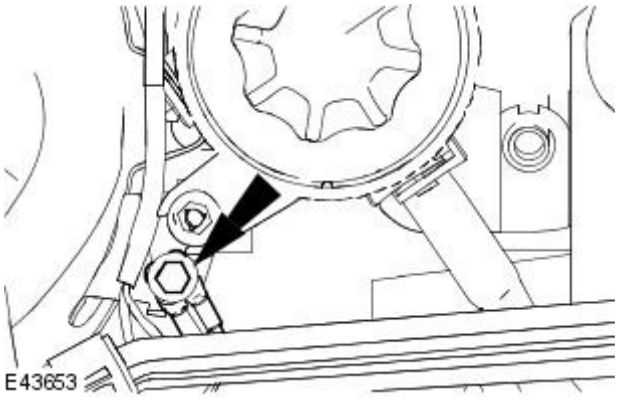
38. Remove the special tool.

39. Lower the vehicle.

40. Attach the strut and spring assembly.

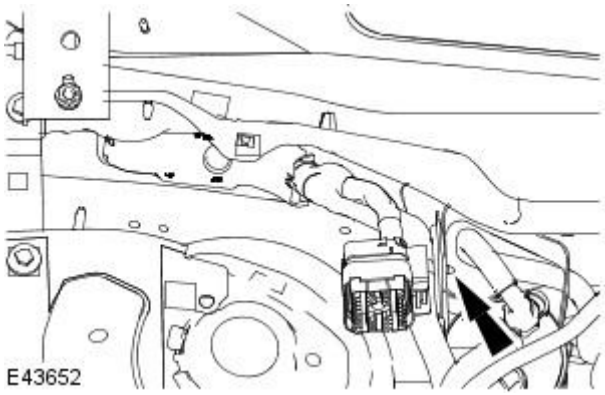
- Tighten to 30 Nm.



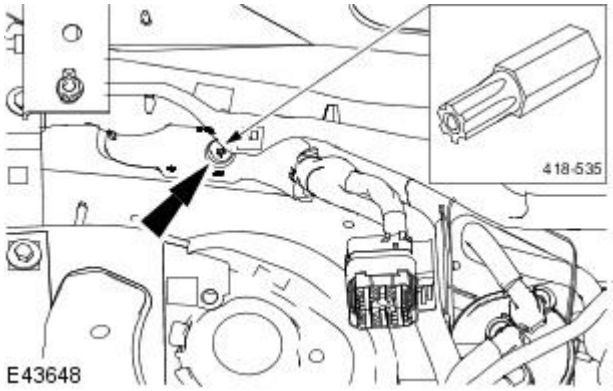


41. Attach the engine wiring harness earth lead.

- Tighten to 10 Nm.



42. Attach the engine wiring harness retaining clip.

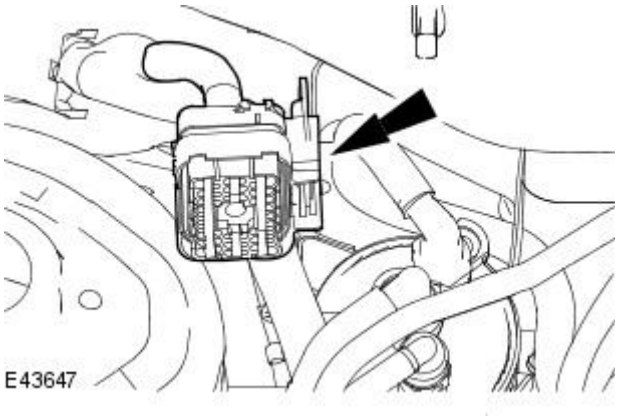


43. CAUTION: Make sure that the electrical connector locates correctly in the ECM. Do not force or overtighten the electrical connector. Failure to follow this instruction may result in damage to the components.

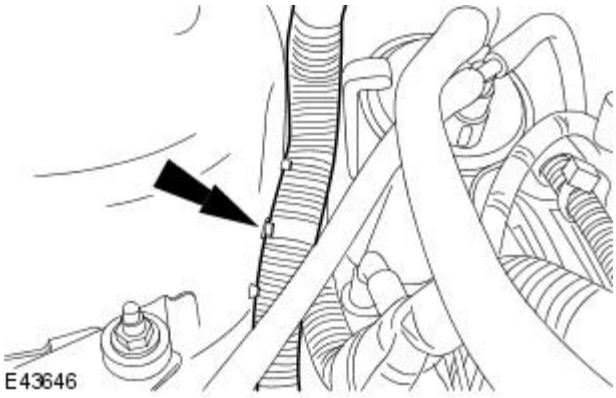
• NOTE: Bolt remains captive in the ECM electrical connector.

Using the special tool, connect the ECM harness electrical connector.

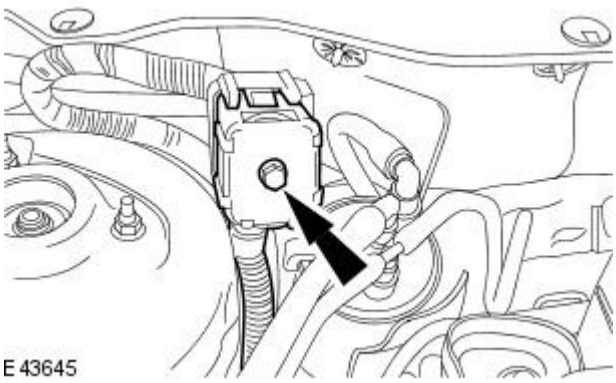
- Tighten to 10 Nm.



44. Attach the engine wiring harness electrical connector.

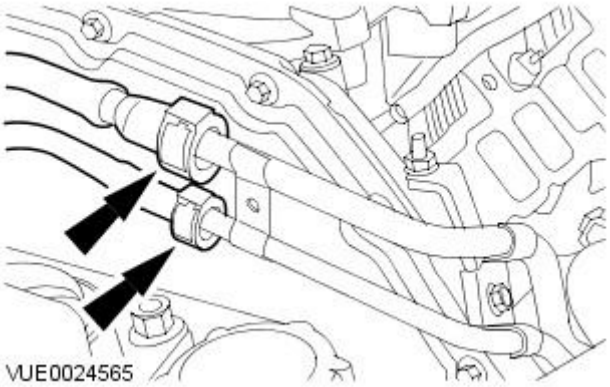


45. Attach the engine wiring harness retaining clip.



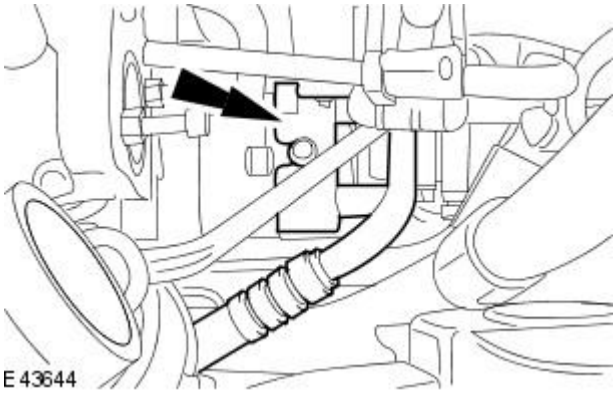
46. Connect the engine wiring harness electrical connector.

- Tighten to 10 Nm.



47. Connect the fuel lines.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

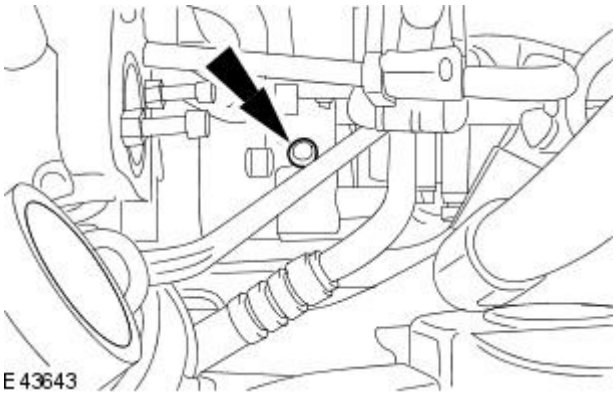
- Remove the blanking plugs.



48. NOTE: Install new O-ring seals.

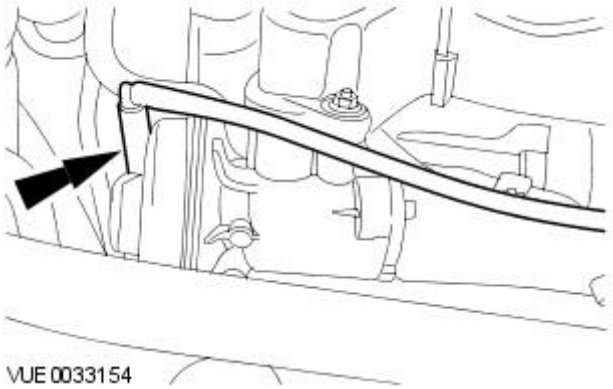
• NOTE: Un-cap the exposed ports.

Connect the air conditioning compressor lines.



49. Fully tighten the air conditioning compressor line retaining bolt.

- Tighten to 20 Nm.

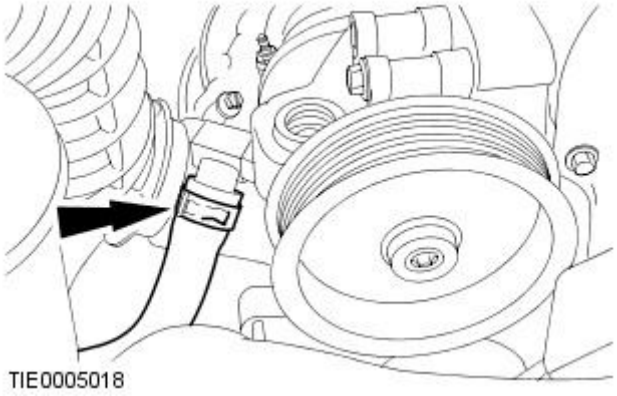


50. NOTE: Un-cap the exposed ports.

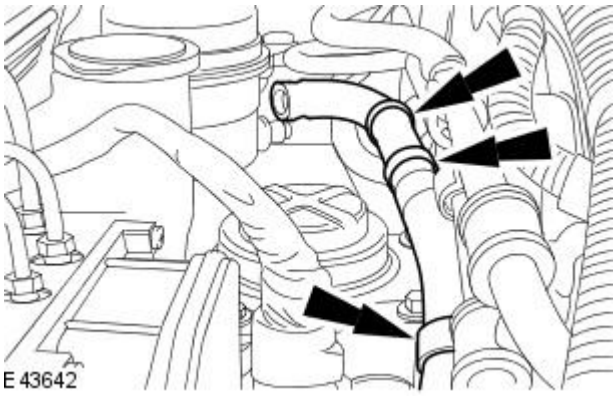
Connect the exhaust gas recirculation (EGR) valve vacuum pipe.

51. NOTE: Un-cap the exposed ports.

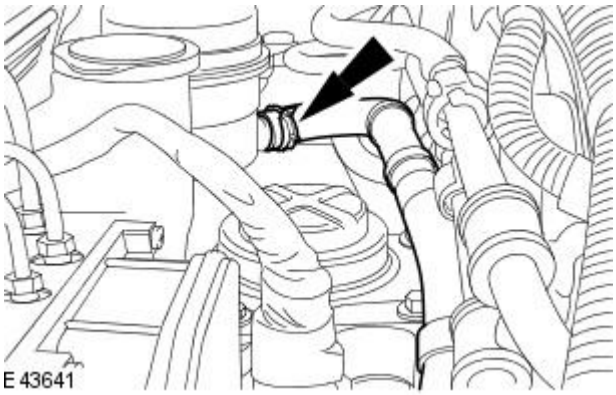
Install the power assisted steering hose.



52. Attach the power assisted steering hose.



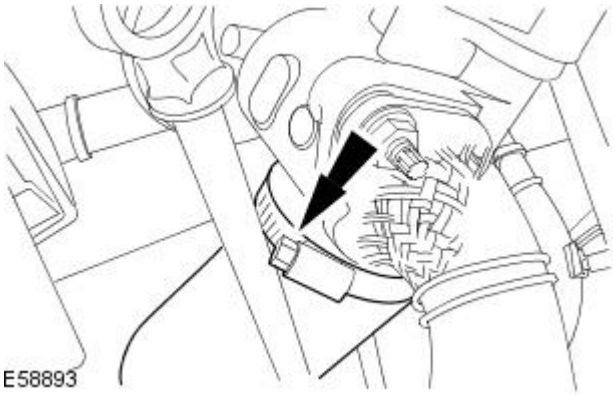
53. Connect the power assisted steering hose.

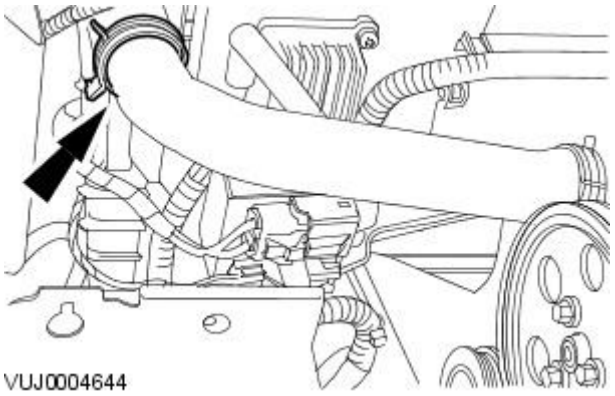


54. Install the exhaust manifold to EGR valve tube.
For additional information, refer to: Exhaust Gas Recirculation (EGR) Cooler to EGR Valve Tube (303-08 Engine Emission Control - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

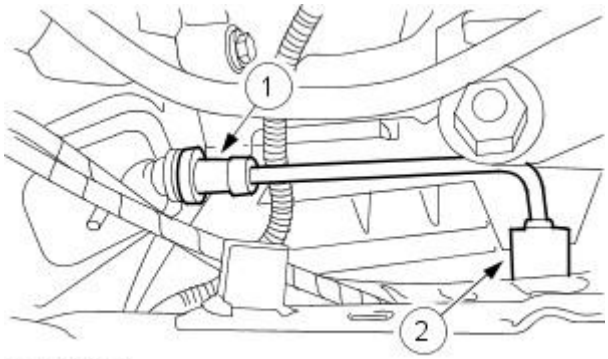
55. Connect the charge air cooler hose.

- Tighten to 4 Nm.




VUJ0004644

56. Connect the radiator upper coolant hose.



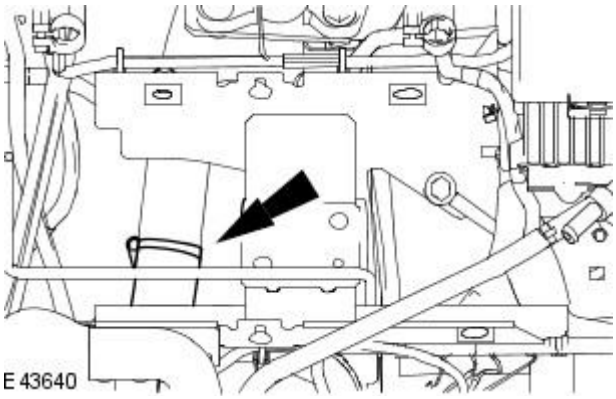
VUJ0003874

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

- NOTE: Un-cap the exposed ports.
- NOTE: Remove the tie strap.

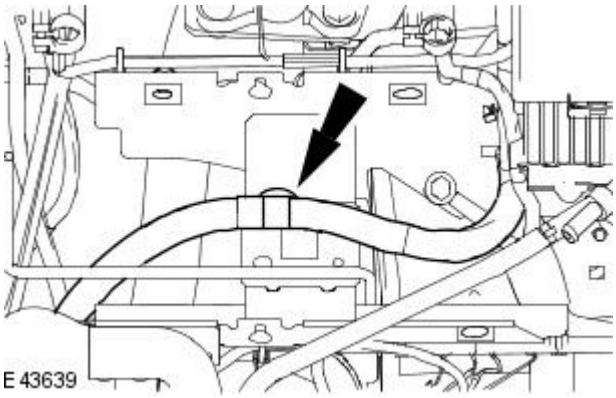
Attach the clutch slave cylinder pipe.

1. Connect and fully seat the clutch slave cylinder pipe and retaining clip.
2. Attach the clutch slave cylinder pipe.

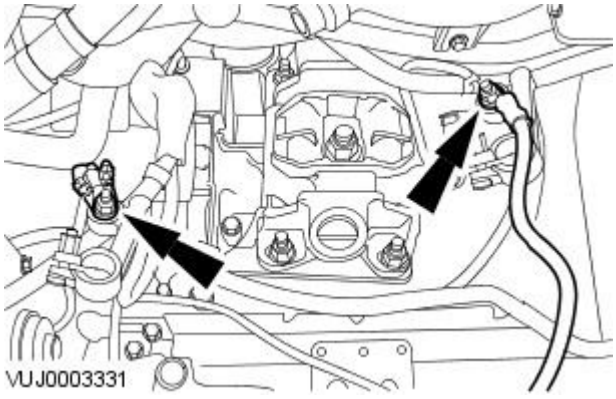

E 43640

58. Connect the charge air cooler hose.

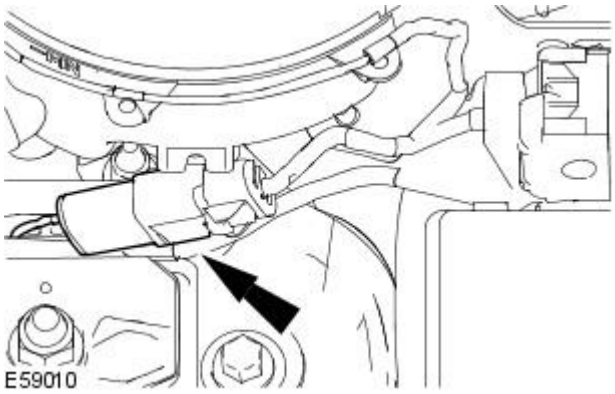
- Tighten to 4 Nm.


E 43639

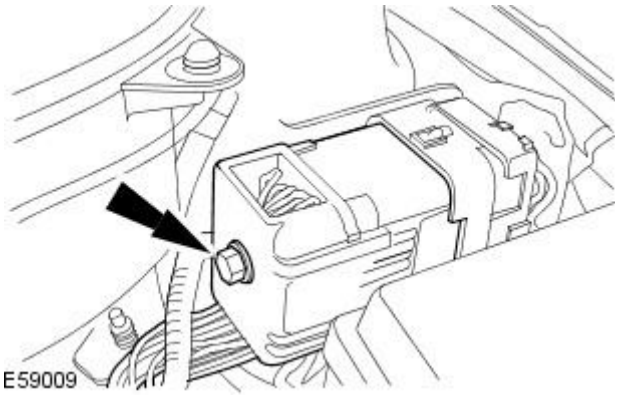
59. Attach the wiring harness to the battery tray mount.


VUJ0003331

60. Connect the battery cables.

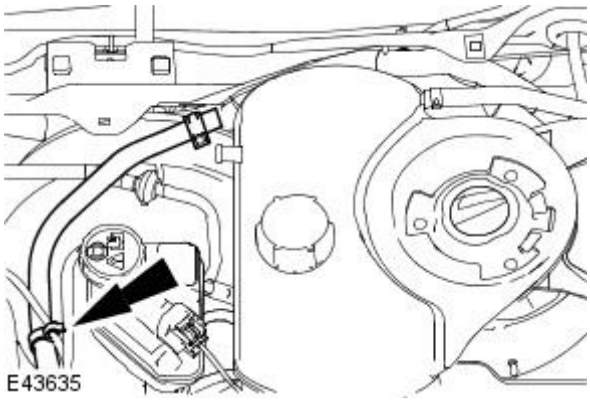


61. Connect the glow plug harness electrical connector.

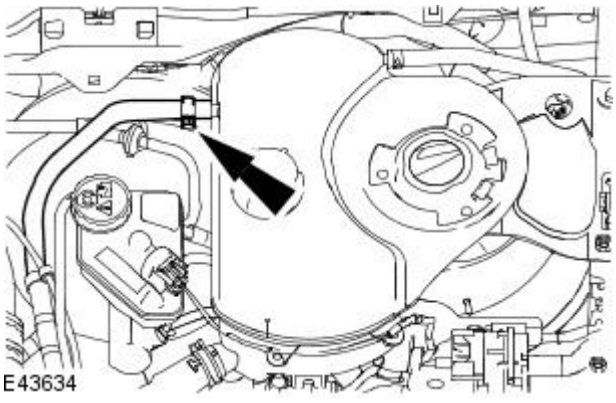


62. Connect the engine harness electrical connector.

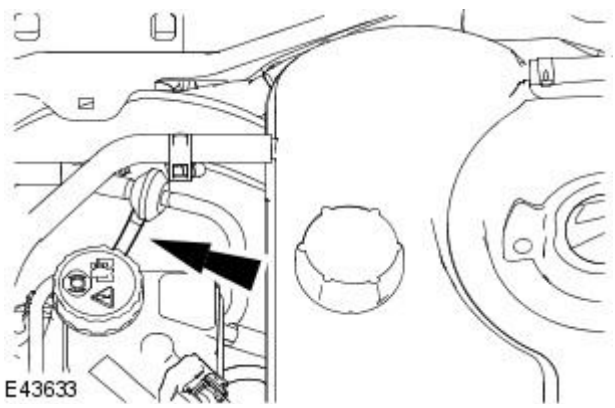
- Tighten to 10 Nm.



63. Attach the the expansion tank outlet hose.

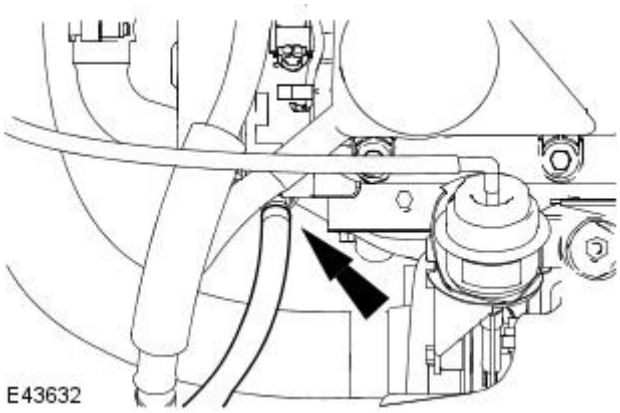


64. Connect the expansion tank outlet hose.



65. Connect the exhaust gas recirculation (EGR) valve module vacuum hose.

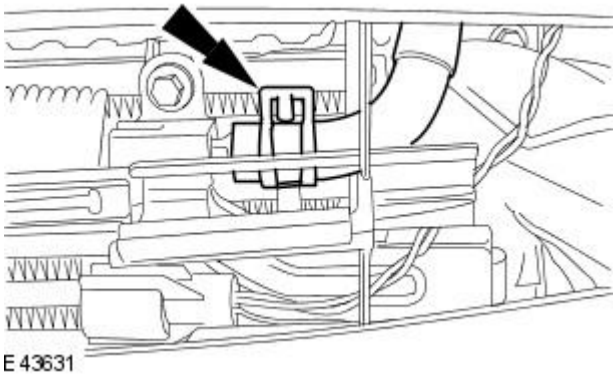
66. Connect the brake vacuum pump vacuum hose.



67. Raise the vehicle.

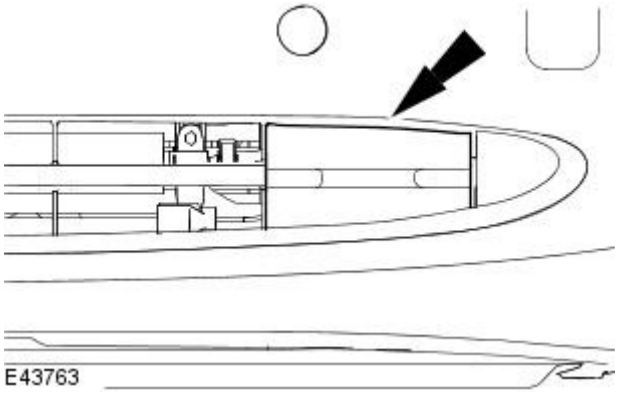
68. NOTE: Un-cap the exposed ports.

Connect the power assisted steering hose.

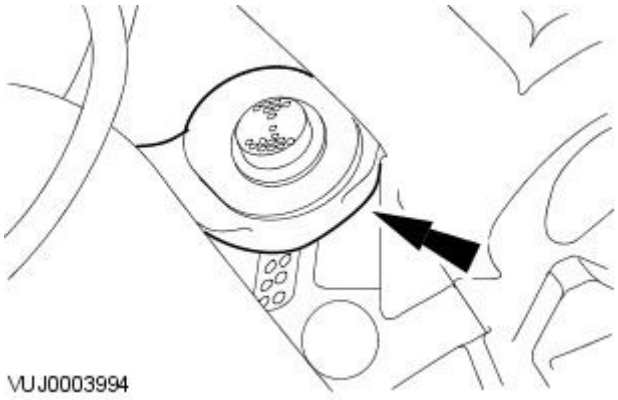


69. NOTE: Left-hand shown, right-hand similar.

Install the front bumper splitter vain finisher trims.

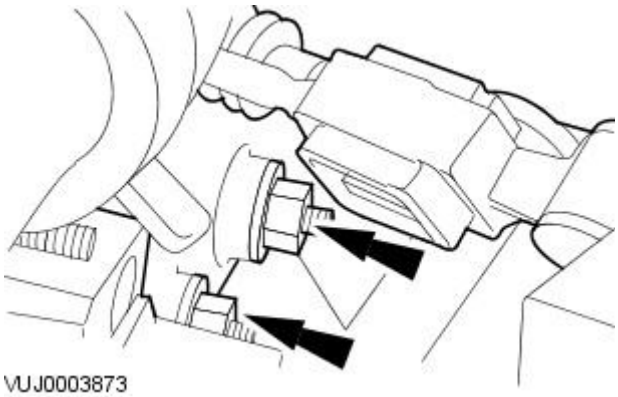


70. Install the front bumper splitter vain.

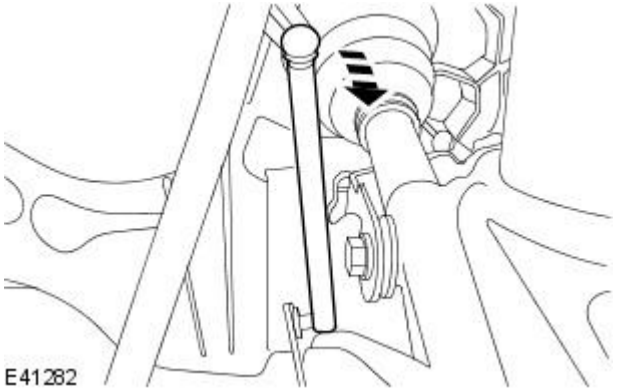


71. NOTE: Remove the selector cables tie straps.

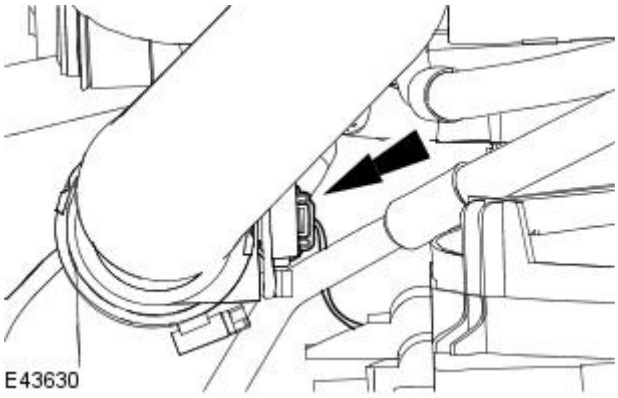
Attach the selector cables.



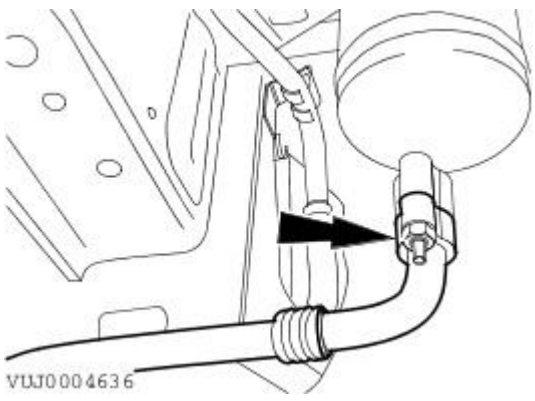
72. Attach the selector cables.



73. Connect the high intensity discharge (HID) sensor drop arm.



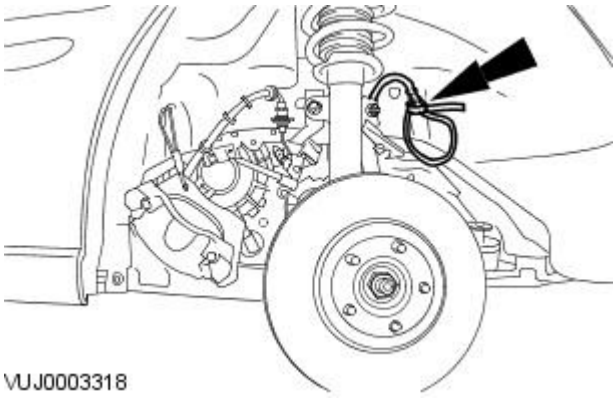
74. Connect the air temperature sensor electrical connector.



75. NOTE: Install a new O-ring seal.

- NOTE: Un-cap the exposed ports.

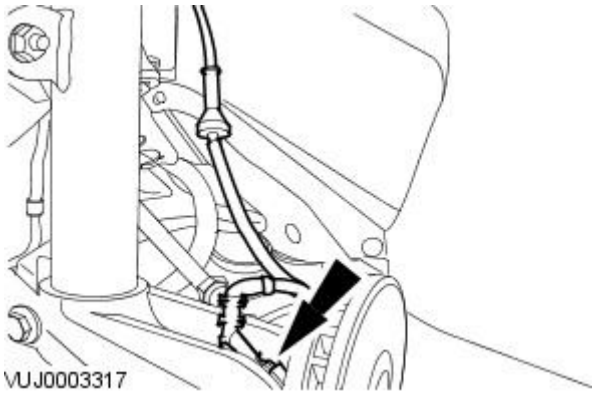
Connect the suction accumulator pipe.


VUJ0003318

76. NOTE: Remove the anti-lock braking system (ABS) wheel speed sensor tie straps.

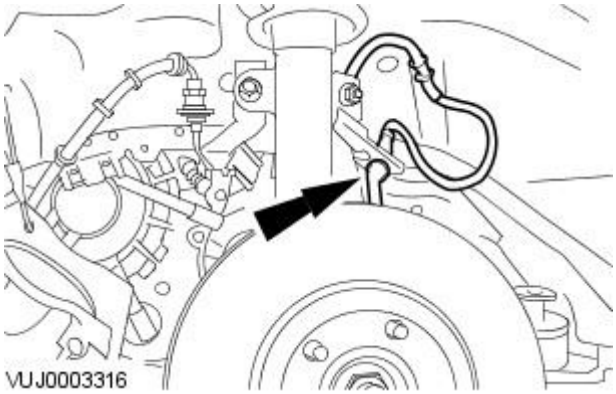
- NOTE: Left-hand shown, right-hand similar.
- NOTE: Remove the tie strap.

Detach and reposition the ABS wheel speed sensor.


VUJ0003317

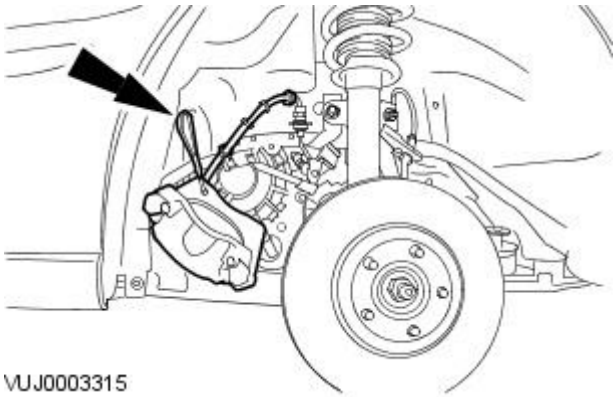
77. NOTE: Left-hand shown, right-hand similar.

Connect the ABS wheel speed sensor.


VUJ0003316

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

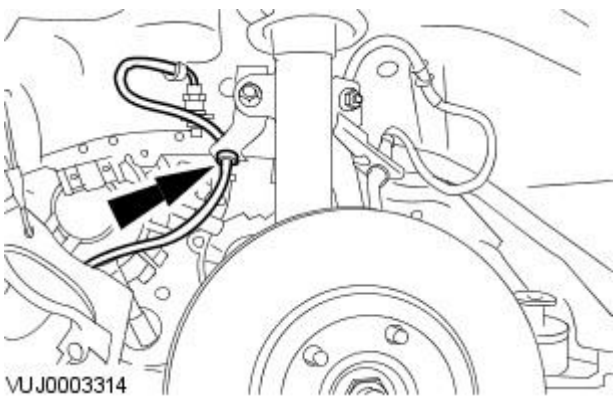
Attach the ABS wheel speed sensor.


VUJ0003315

79. NOTE: Remove the brake caliper assembly tie straps.

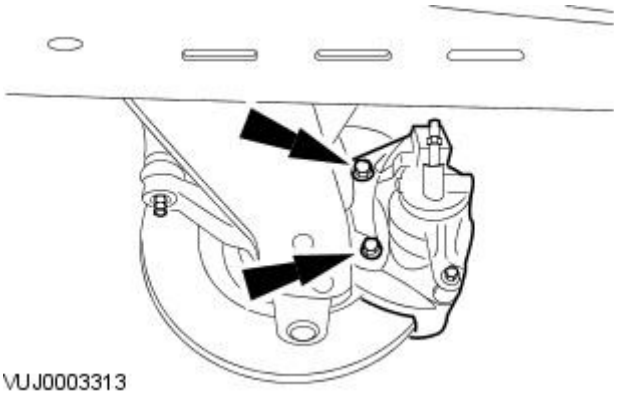
- NOTE: Left-hand shown, right-hand similar.

Detach and reposition the brake caliper assembly.


VUJ0003314

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

Attach the brake pipe.


VUJ0003313

81. NOTE: Install new brake caliper anchor plate retaining bolts.

Attach the brake caliper and brake caliper anchor plate assembly.

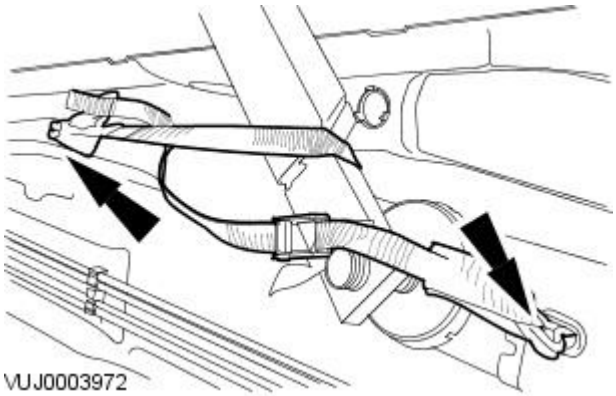
- Tighten to 133 Nm.

82. Install the front brake pads.
For additional information, refer to: Brake Pads (206-03 Front Disc Brake, Removal and Installation).

83. Install the front wheels and tires.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

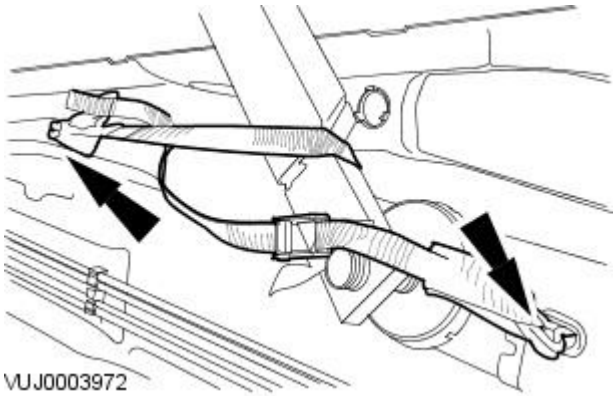
84. NOTE: Right-hand shown, left-hand similar.

Remove the rear vehicle tie down strap.

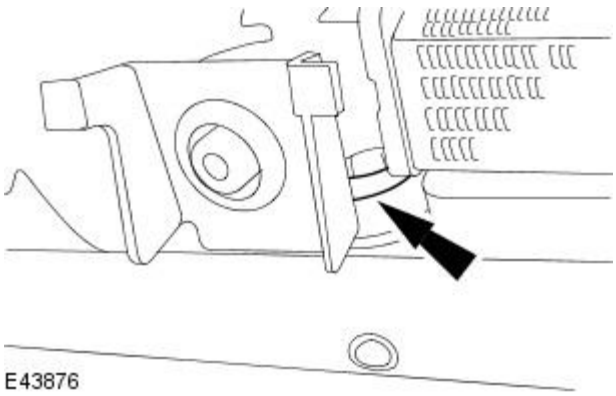

VUJ0003972

85. NOTE: Right-hand shown, left-hand similar.

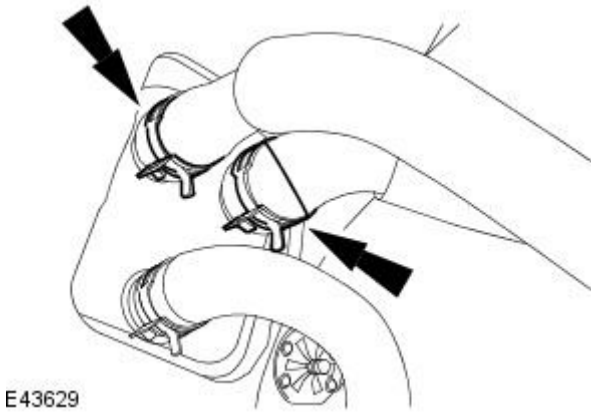
Remove the front vehicle tie down strap.


VUJ0003972

86. Connect the radiator lower coolant hose.


E43876

87. Connect the heater hoses to the heater core.



88. Install the exhaust flexible pipe.
For additional information, refer to: Exhaust Flexible Pipe - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (309-00 Exhaust System, Removal and Installation).

89. Install the battery tray.
For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

90. Check and top up the transmission fluid level.
For additional information, refer to: Transaxle Draining and Filling - Vehicles With: 6-Speed Manual Transaxle - MMT6 (308-03 Manual Transmission/Transaxle, General Procedures).

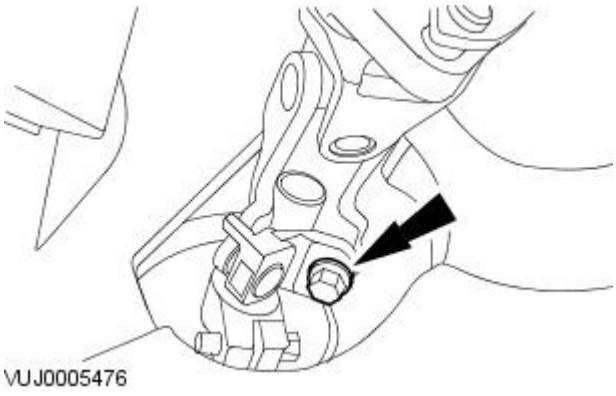
91. Carry out the clutch bleeding system procedure.
For additional information, refer to: Clutch System Bleeding - Vehicles With: 6-Speed Manual Transaxle - MMT6 (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

92. Fill and bleed the cooling system.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

93. Recharge the air conditioning refrigerant.
For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

94. Attach the lower steering column shaft.

- Tighten to 25 Nm.



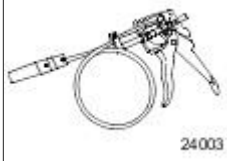
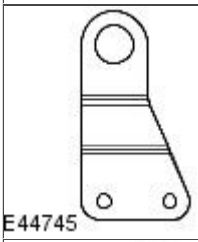
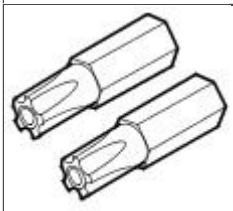
95. Bleed the power steering system.
For additional information, refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).

96. Carry out the gear shift cable adjustment procedure.
For additional information, refer to: Gearshift Cable Adjustment (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

97. Carry out the underbody misalignment check.
For additional information, refer to: Underbody Misalignment Check (502-00 Uni-Body, Subframe and Mounting System, General Procedures).

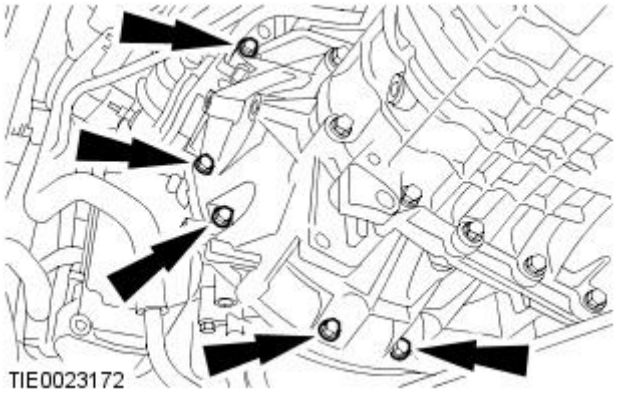
Engine - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Engine2.2L Duratorq-TDCi (110kW / 150PS) - Puma

Installation

Special Tool(s)	
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)
 HTJ12002	Powertrain assembly jack HTJ1200-02
 E44745	Engine lifting eye 303-1067
 418-535	5 Point Security Torx Bit 418-535

Installation

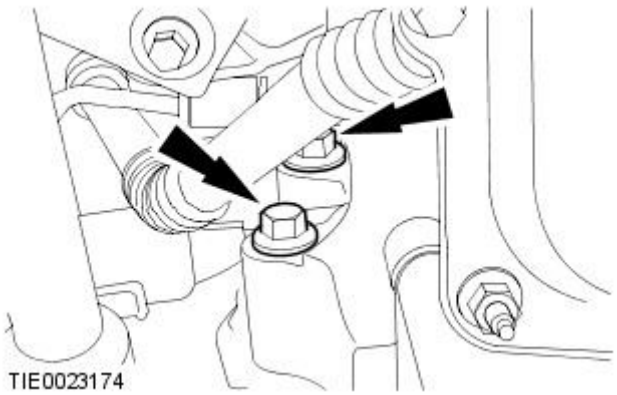
All vehicles


TIE0023172

1. CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

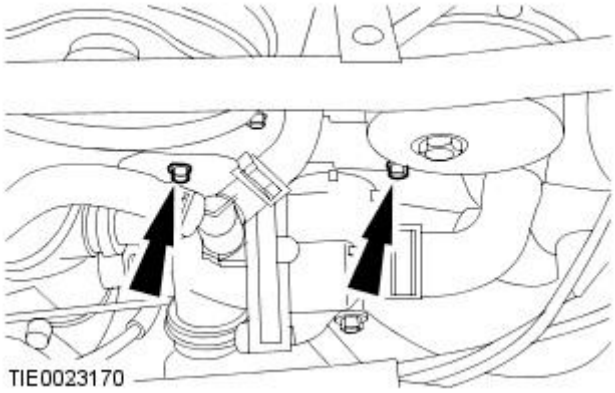
Using a suitable hydraulic lift, install the engine assembly to the transmission assembly.

- Tighten to 40 Nm.


TIE0023174

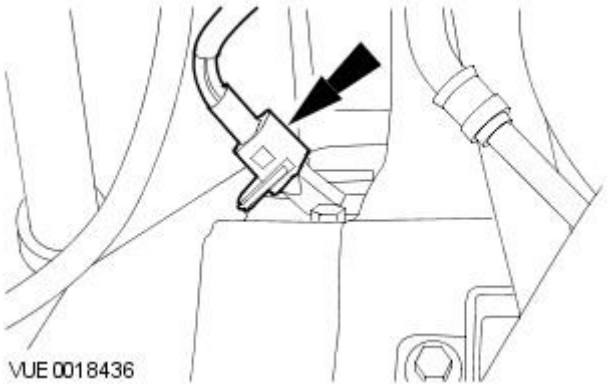
2. Install the transmission right-hand retaining bolts.

- Tighten to 40 Nm.

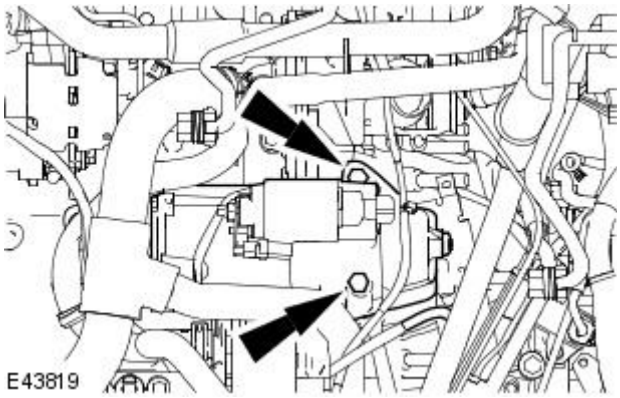


3. Install the transmission upper retaining bolts.

- Tighten to 40 Nm.

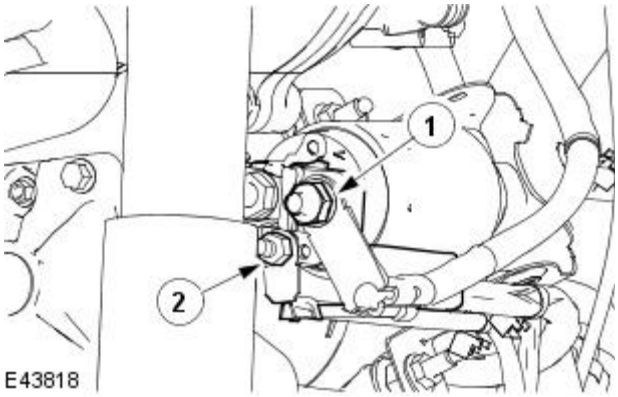


4. Connect the crankshaft position (CKP) sensor electrical connector.



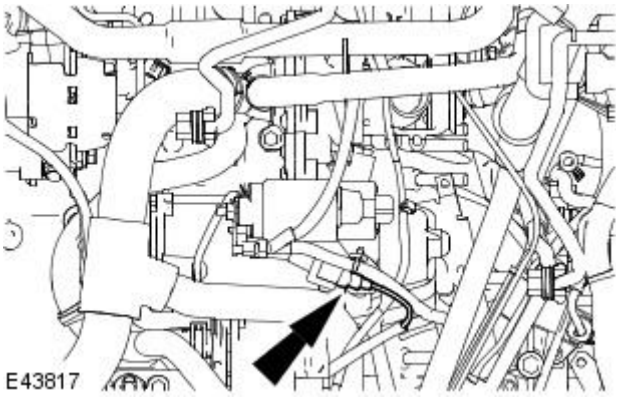
5. Install the starter motor.

- Tighten to 25 Nm.

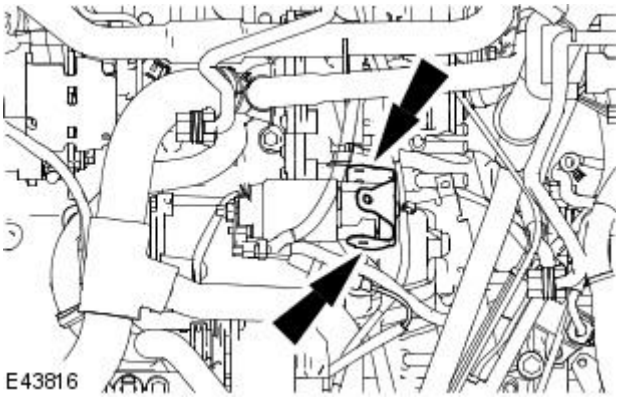


6. Attach the starter motor wiring harness.

1. Tighten to 12 Nm.
2. Tighten to 6 Nm.

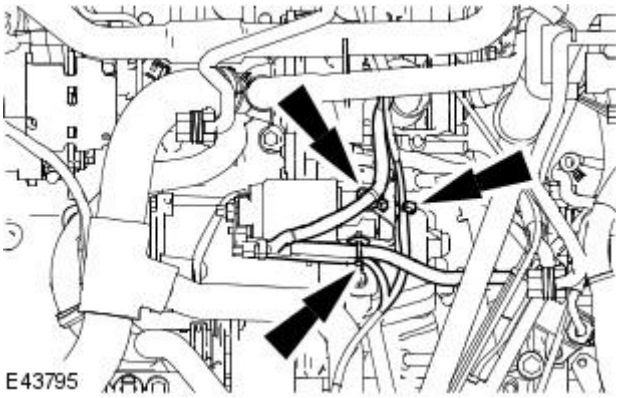


7. Connect the starter motor wiring harness electrical connector.

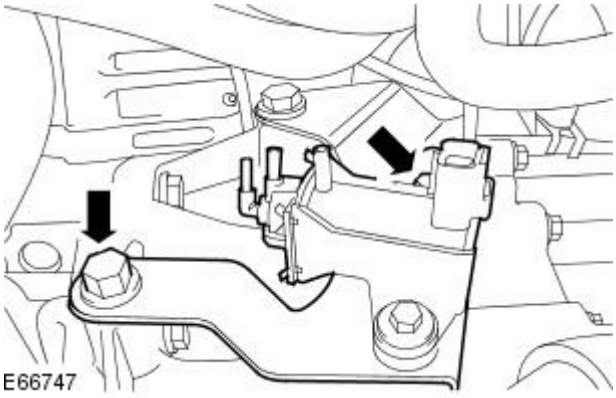


8. Install the starter motor wiring harness retaining bracket.

- Tighten to 20 Nm.

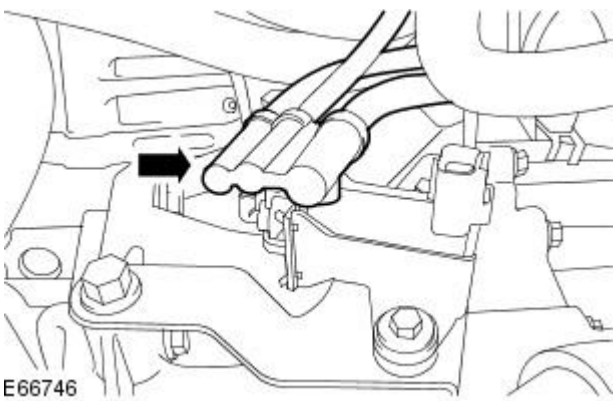


9. Attach the starter motor wiring harness.

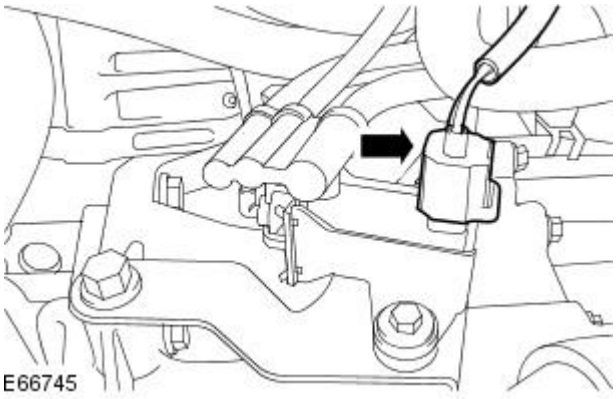


10. Install the emission control solenoid assembly.

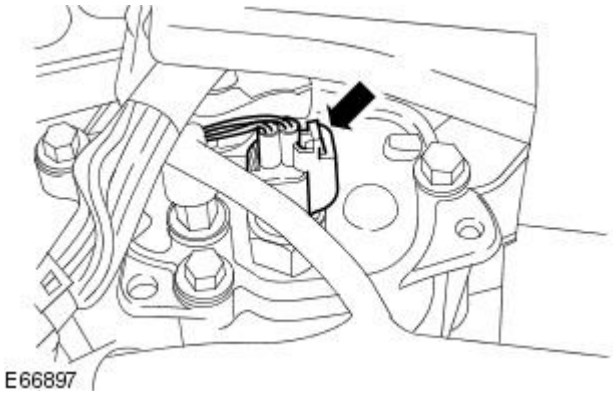
- Tighten to 23 Nm.



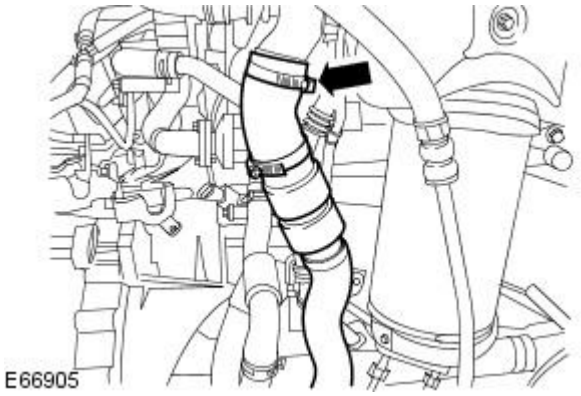
11. Connect the emission control solenoid hose.


E66745

12. Connect the emission control solenoid electrical connector.

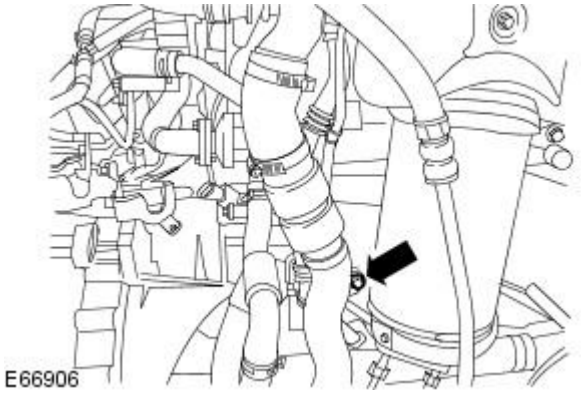

E66897

13. Connect the reverse lamp switch electrical connector.


E66905

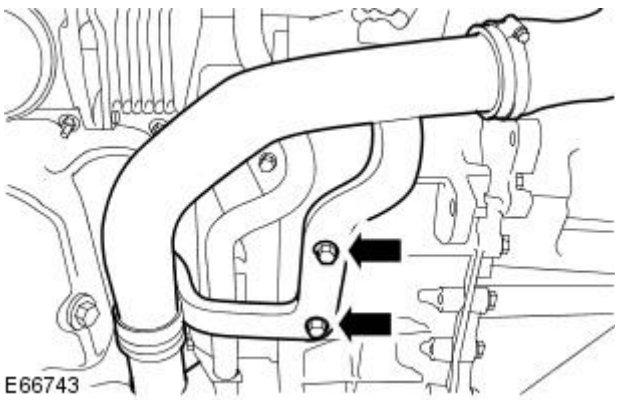
14. Install the charge air cooler pipe.

- Tighten to 4 Nm.


E66906

15. Install the charge air cooler pipe retaining bolt.

- Tighten to 10 Nm.


E66743

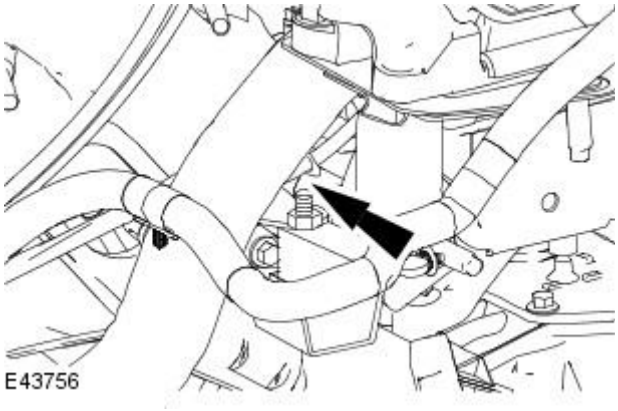
16. Install the charge air cooler intake pipe retaining bolts.

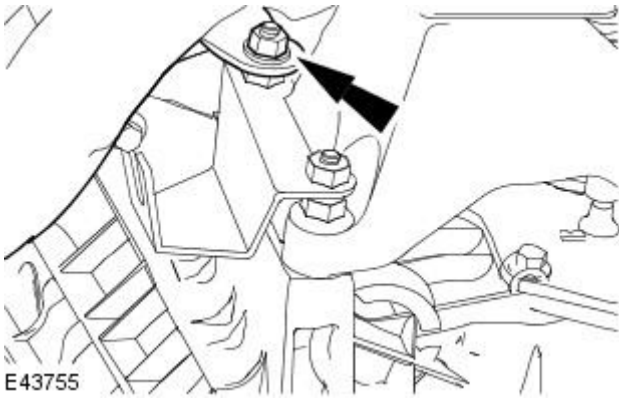
- Tighten to 35 Nm.

17. CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

Using a suitable hydraulic lift, lower the engine and transmission from the subframe.

18. Attach the reverse lamp switch wiring harness retaining clip.





19. Install the charge air cooler pipe retaining nut.

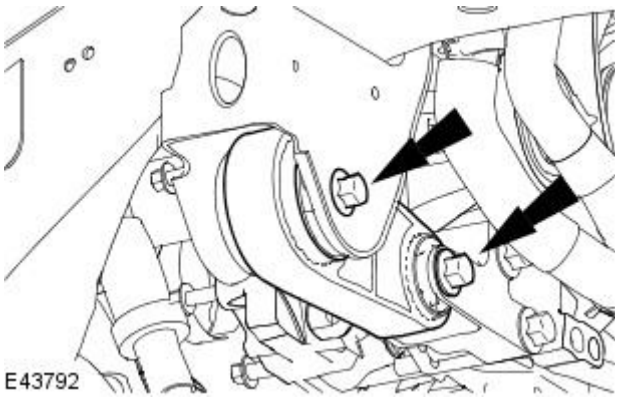
- Tighten to 23 Nm.

20. CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

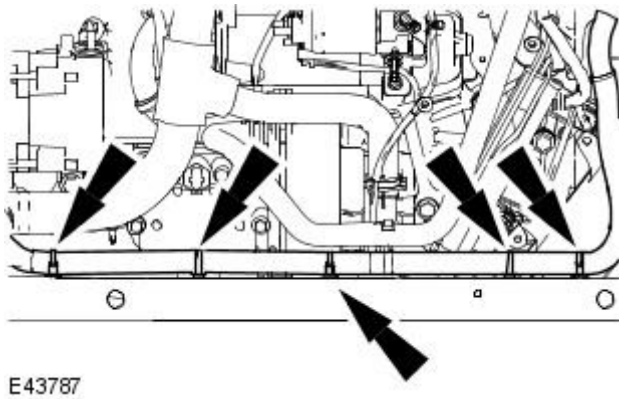
Using a suitable hydraulic lift install the engine and transmission to the subframe.

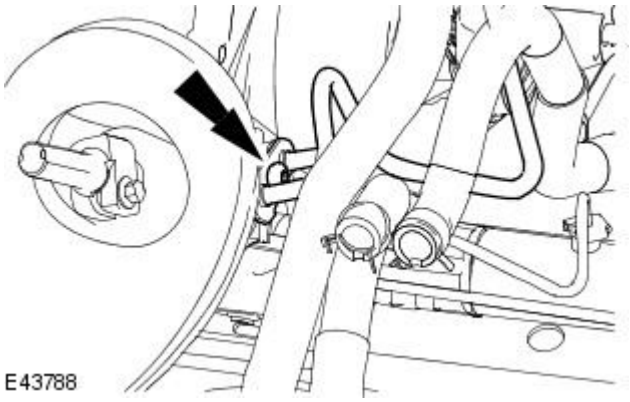
21. Install the engine roll restrictor.

- Tighten to 80 Nm.



22. Attach the wiring harness.



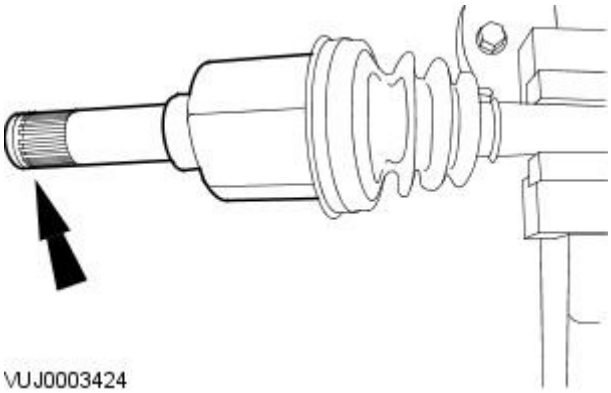


23. NOTE: Un-Cap the exposed ports.

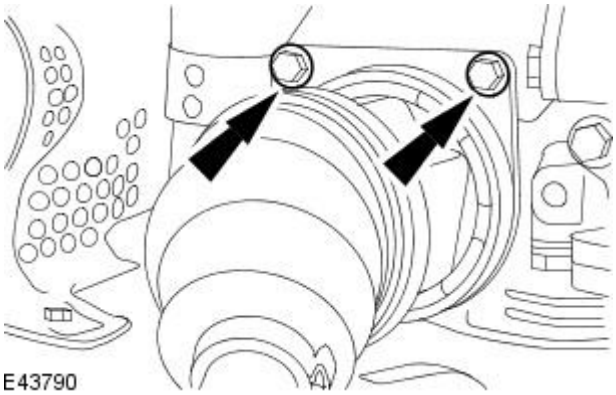
• NOTE: Install new O-ring seals.

Connect the the power steering lines.

- Tighten to 10 Nm.



24. Install a new drive halfshaft snap ring.



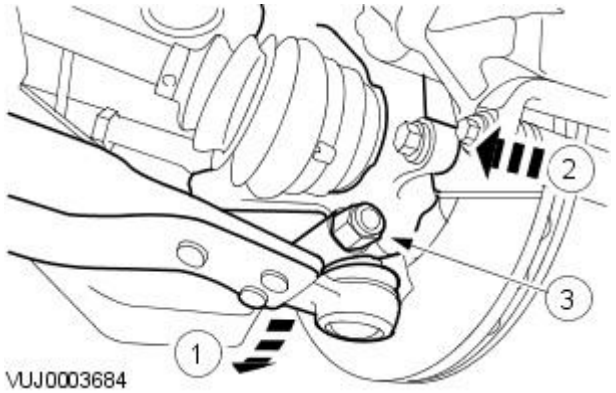
25. CAUTIONS:

⚠ Make sure the CV joint splines are located fully. Do not use excessive force when engaging the CV joint into the transmission.

⚠ Do not damage the oil seal.

Install the right-hand drive halfshaft.

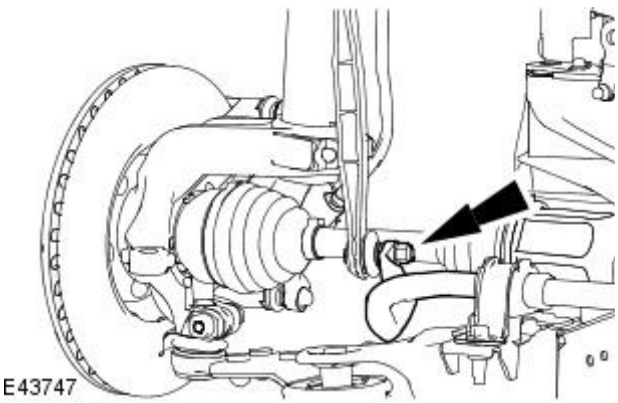
- Tighten to 25 Nm.



26. Attach the right-hand wheel knuckle.

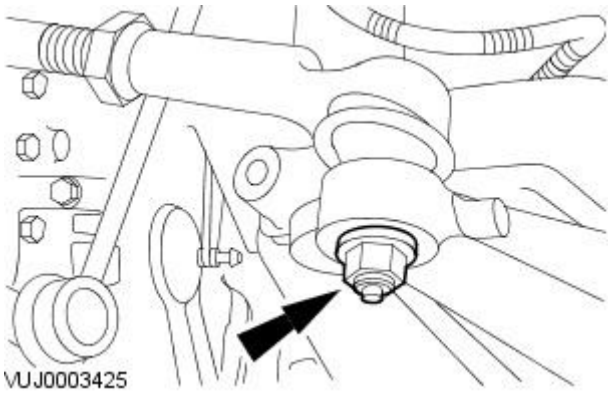
1. Reposition the lower arm.
2. Attach the wheel knuckle.
3. Install a new lower arm ball joint retaining nut and bolt.

- Tighten to 83 Nm.



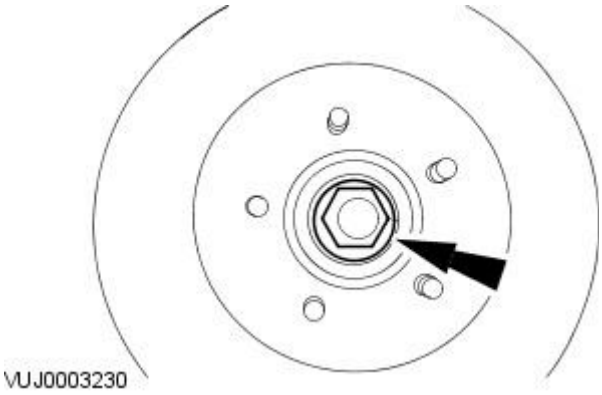
27. Install a new right-hand anti-roll bar link retaining nut.

- Tighten to 48 Nm.

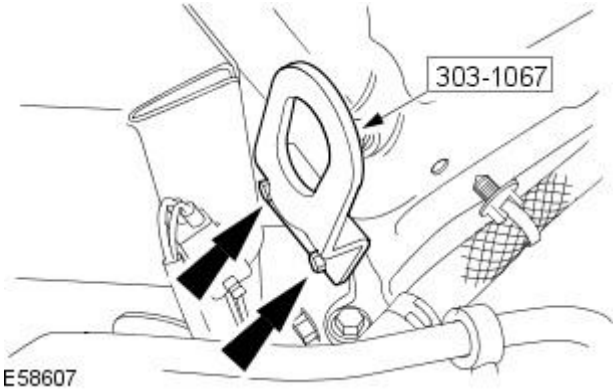

VUJ0003425

28. Install a new right-hand tie rod-end retaining nut.

- Tighten to 35 Nm.

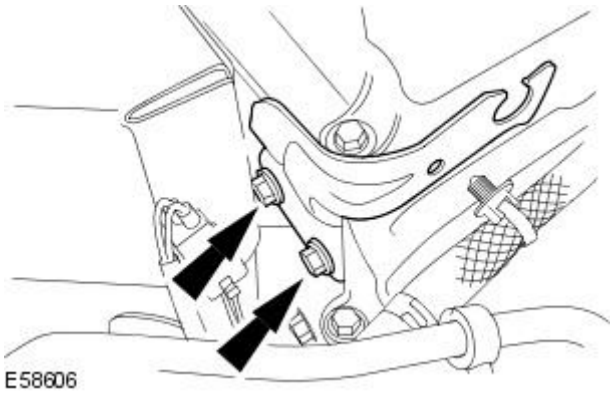

VUJ0003230

29. Loosely install a new wheel right-hand hub nut.



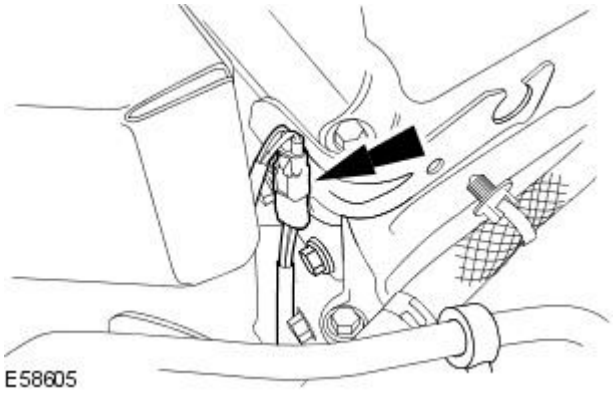
E58607

30. Remove the engine rear lifting eye.

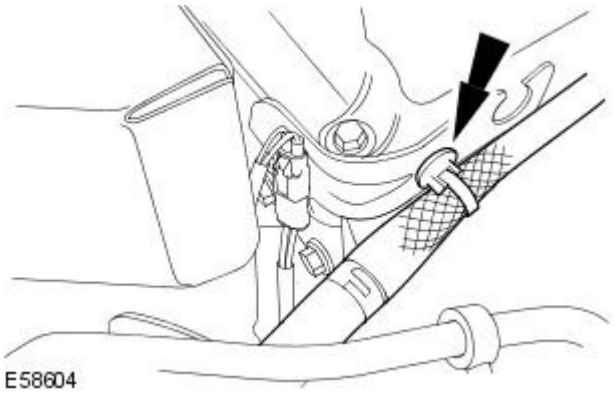

E58606

31. Install the engine cover rear mount bracket.

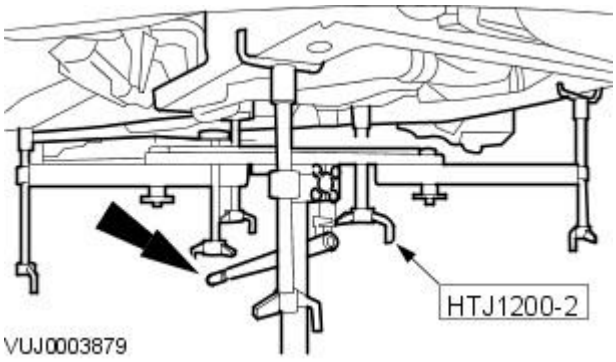
- Tighten to 23 Nm.


E58605

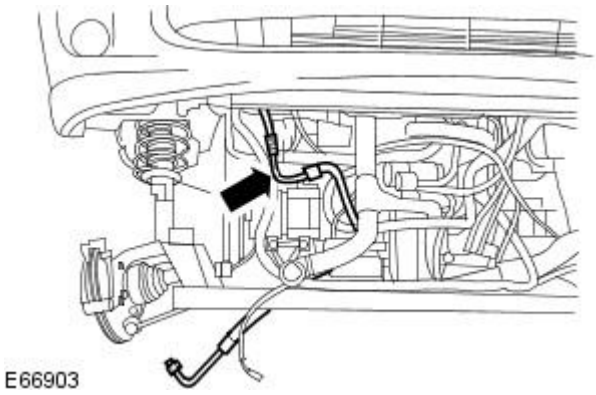
32. Attach the electrical connector.



33. Attach the engine harness.

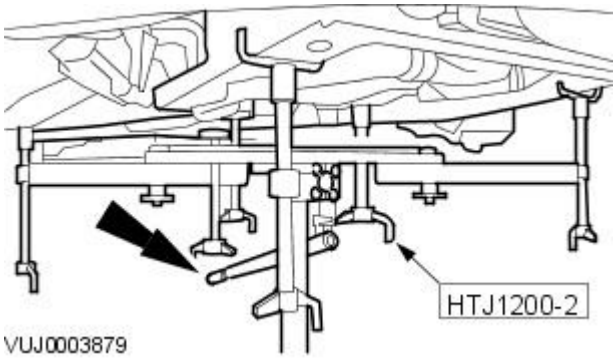


34. Raise the engine, suspension and transmission assembly to a suitable height.



35. NOTE: Remove the tie straps.

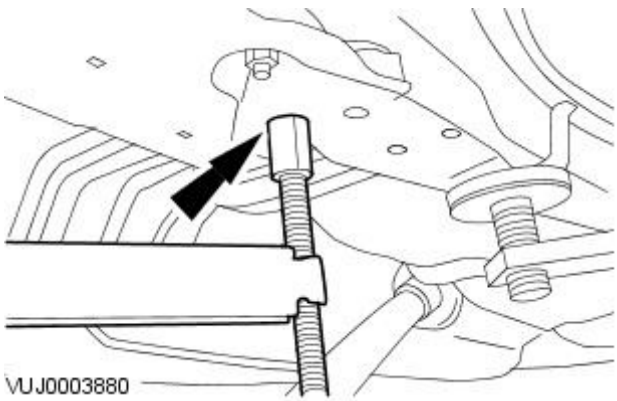
Reposition the air conditioning (A/C) pipe to the engine, suspension and transmission assembly.



36. WARNING: Raise the special tool platform slowly. Failure to follow this instruction can result in personal injury.

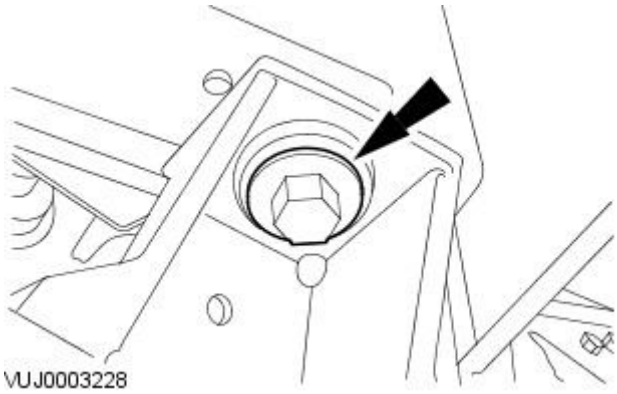
Install the engine.

- Raise the special tool.



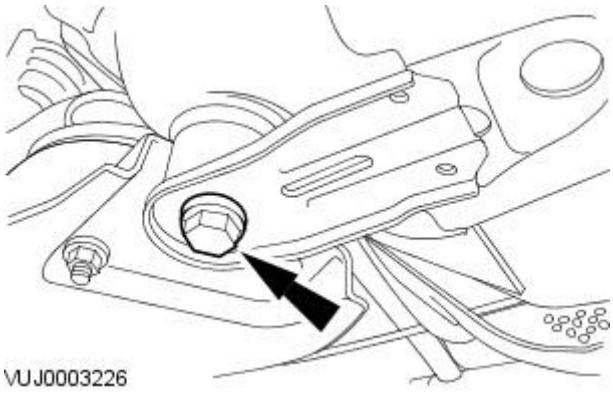
37. NOTE: Left-hand shown, right-hand similar.

Make sure the special tool rear height adjuster aligns into the locating hole in the vehicle floor pan.



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

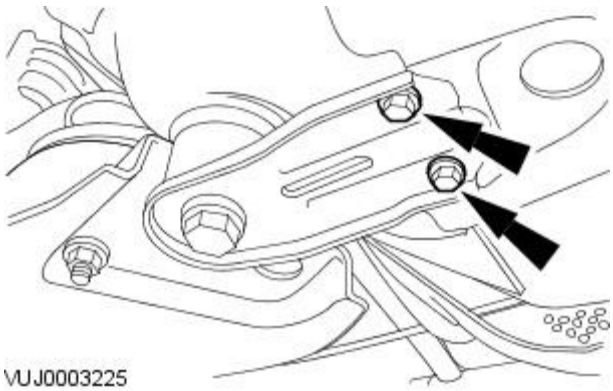
Loosely install the front subframe retaining bolts.



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

Install the front subframe reinforcement plate.

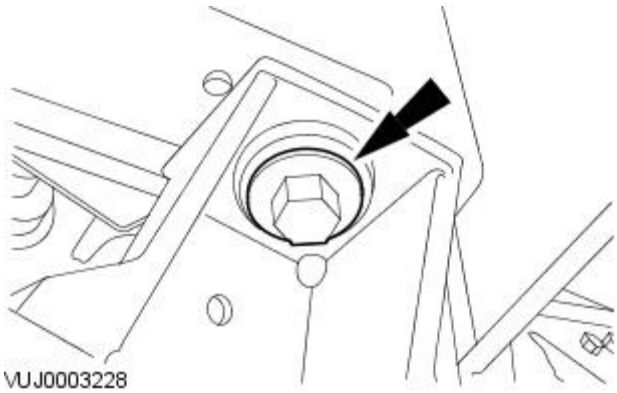
- Loosely install the front subframe rear retaining bolts.



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

Install the front subframe reinforcement plate retaining bolts.

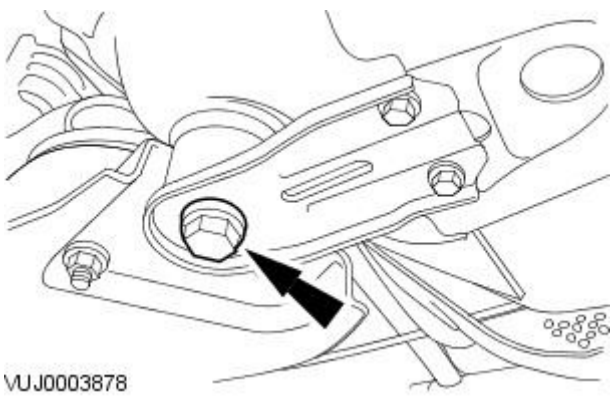
- Tighten to 70 Nm.



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

Fully tighten the front subframe retaining bolts.

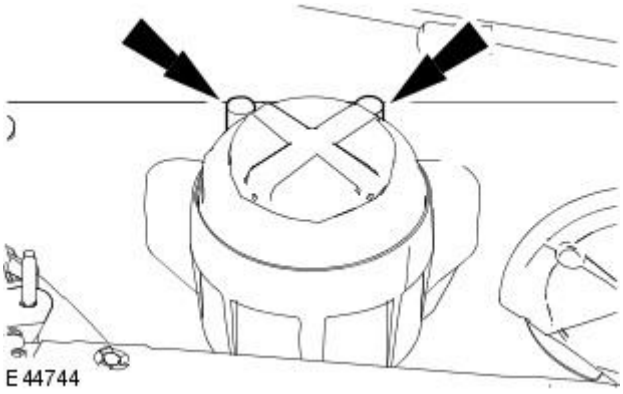
- Tighten to 142 Nm.



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

Fully tighten the front subframe retaining bolts.

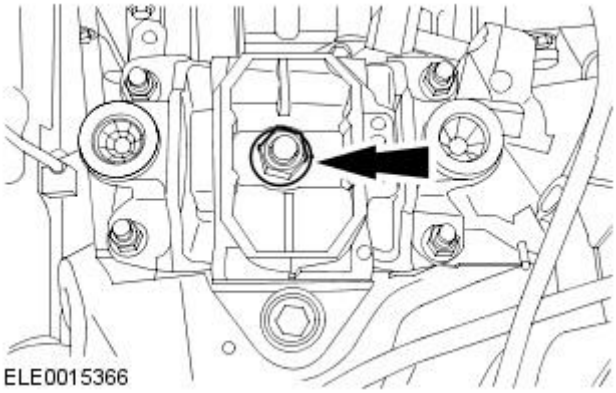
- Tighten to 142 Nm.



43. NOTE: Install new retaining nuts.

Install the engine front mount retaining nuts.

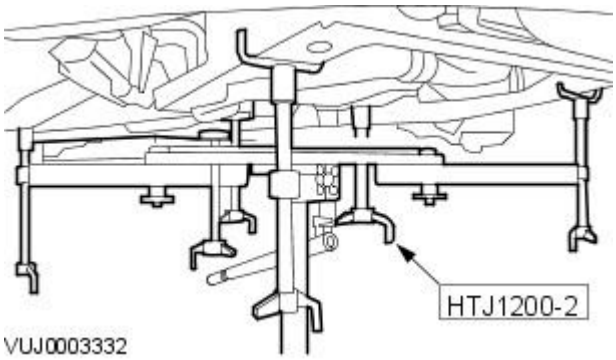
- Tighten to 80 Nm.



44. NOTE: Install a new retaining nut.

Install the engine rear mount retaining nut.

- Tighten to 133 Nm.

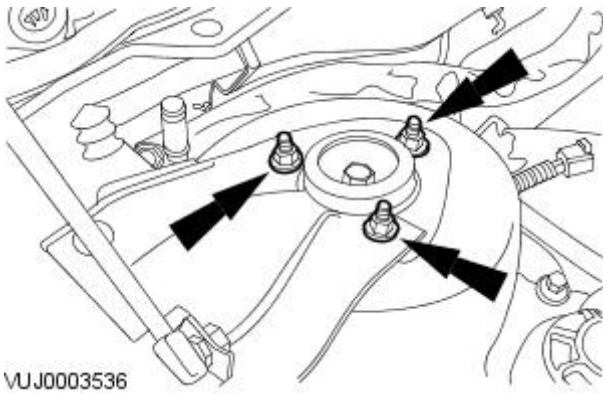


45. Remove the special tool.

46. Lower the vehicle.

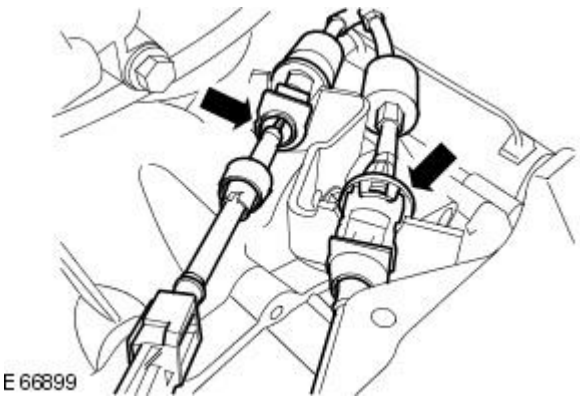
47. Attach the strut and spring assembly.

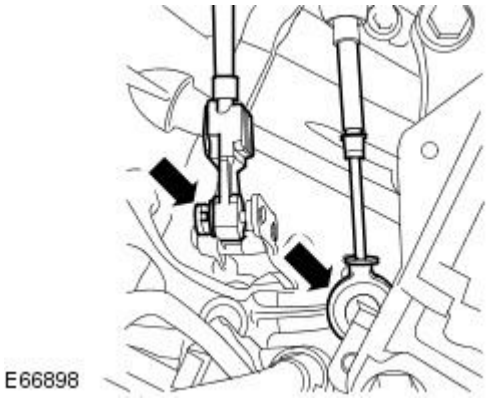
- Tighten to 30 Nm.



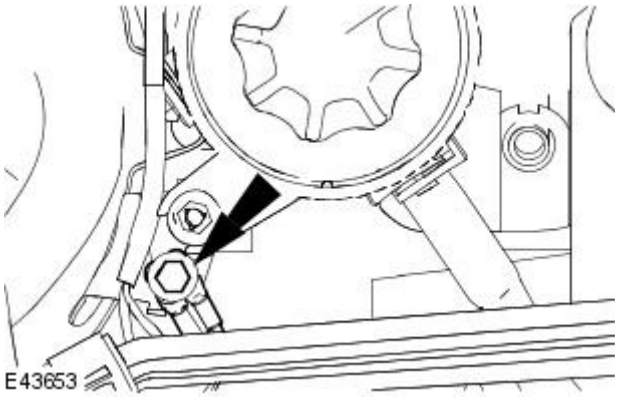
48. NOTE: Remove the tie straps.

Attach the selector cables.



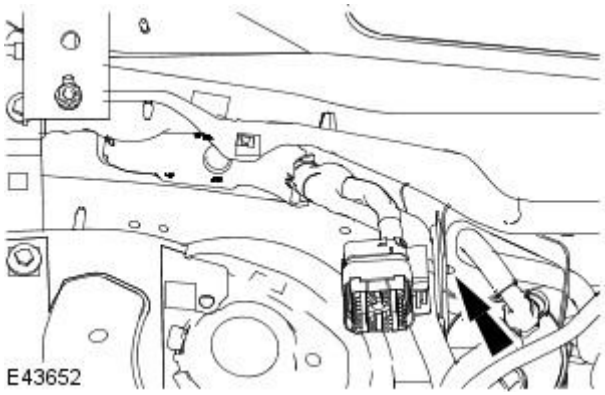


49. Attach the selector cables.

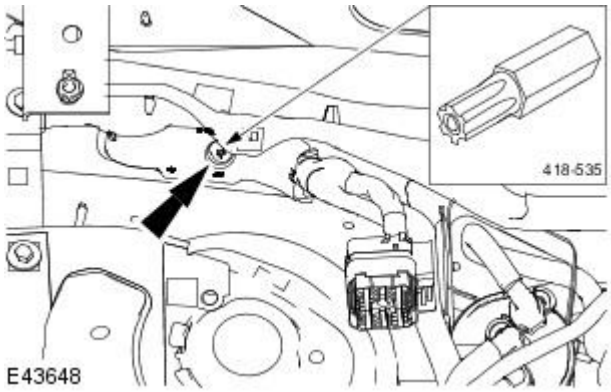


50. Attach the engine wiring harness earth lead.

- Tighten to 10 Nm.



51. Attach the engine wiring harness retaining clip.

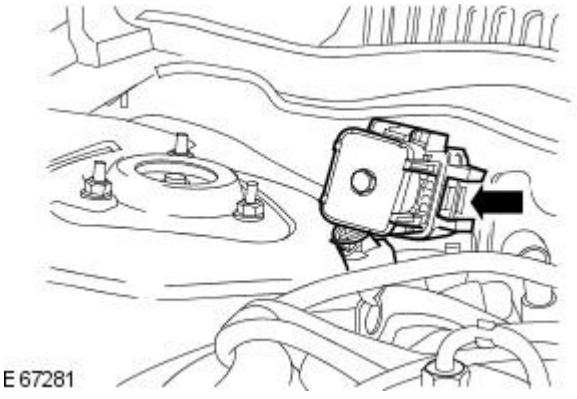


52. CAUTION: Make sure that the electrical connector locates correctly in the ECM. Do not force or overtighten the electrical connector. Failure to follow this instruction may result in damage to the components.

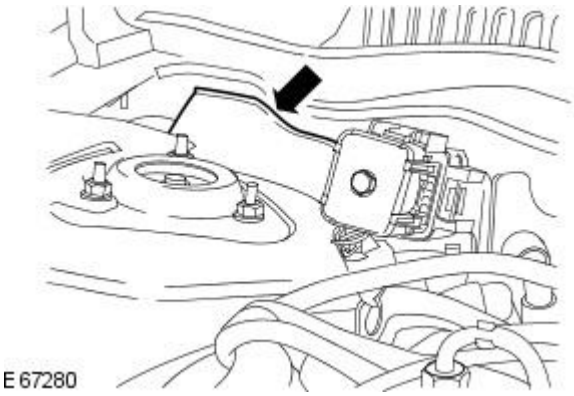
• NOTE: Bolt remains captive in the ECM electrical connector.

Using the special tool, connect the ECM harness electrical connector.

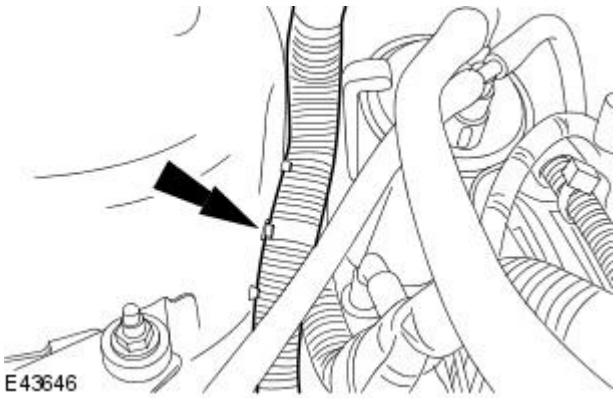
- Tighten to 10 Nm.



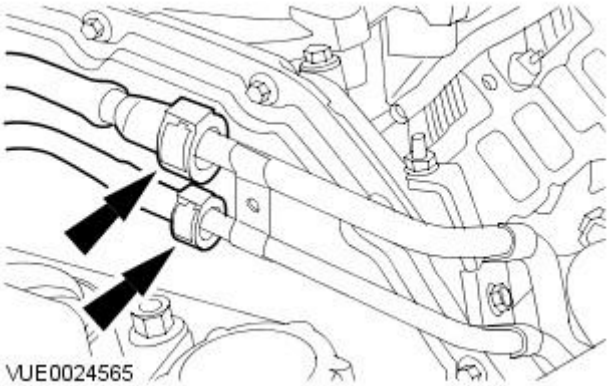
53. Attach the engine wiring harness electrical connector.



54. Install the engine wiring harness trim panel.

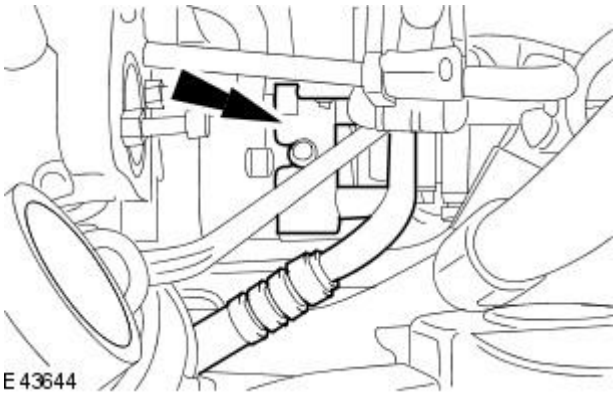


55. Attach the engine wiring harness retaining clip.



56. Connect the fuel lines.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

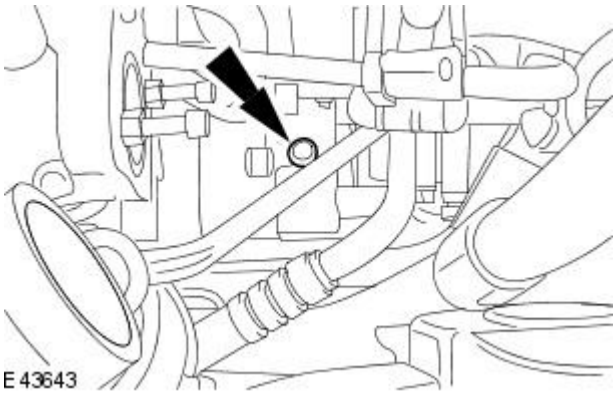
- Remove the blanking plugs.



57. NOTE: Install new O-ring seals.

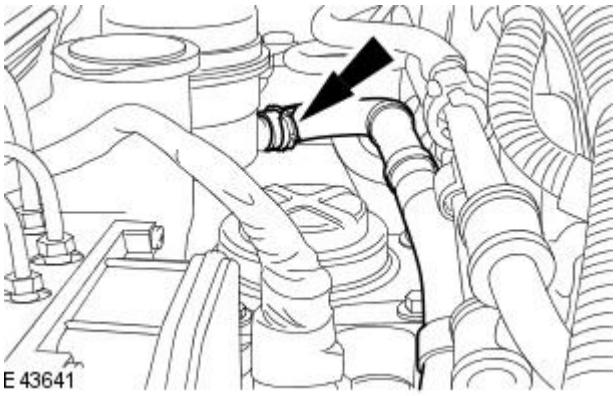
• NOTE: Un-cap the exposed ports.

Connect the air conditioning (A/C) compressor lines.

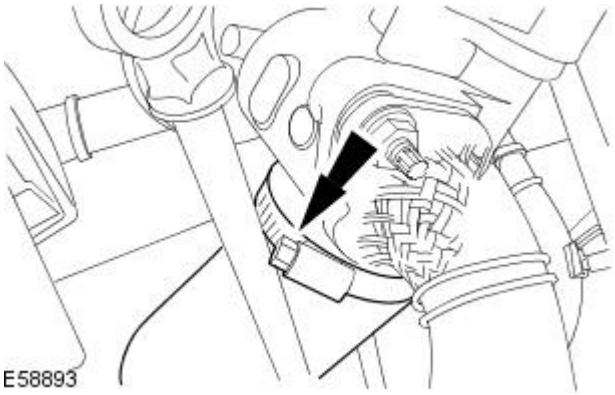


58. Fully tighten the A/C compressor line retaining bolt.

- Tighten to 20 Nm.

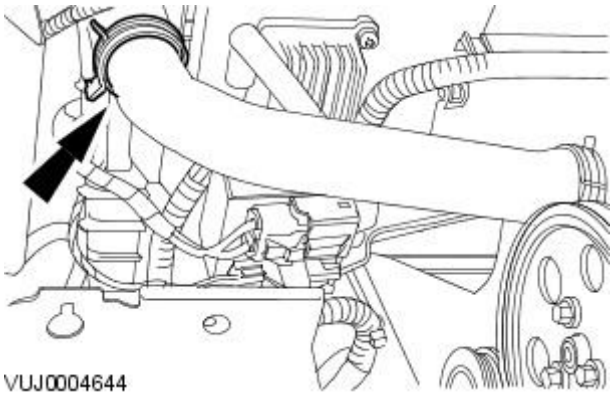


59. Connect the power assisted steering hose.

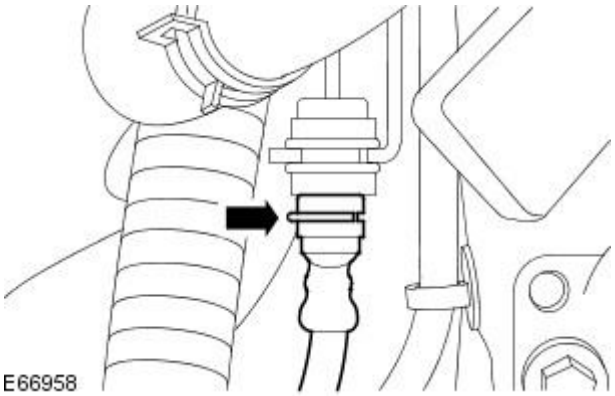


60. Connect the charge air cooler hose.

- Tighten to 4 Nm.



61. Connect the radiator upper coolant hose.



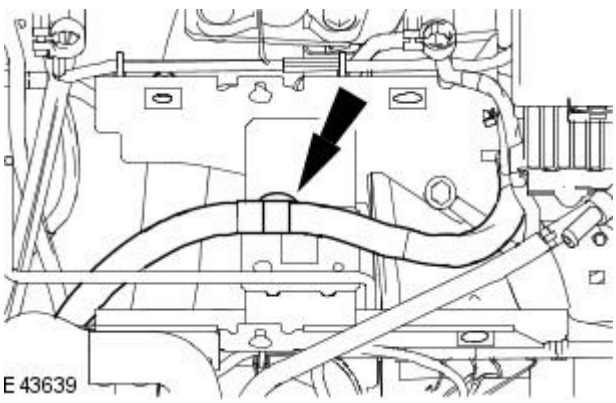
62. CAUTION: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

• NOTE: Un-cap the exposed ports.

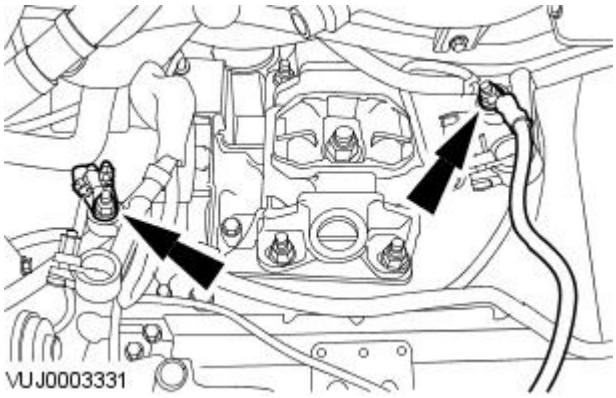
• NOTE: Remove the tie strap.

Attach the clutch slave cylinder pipe.

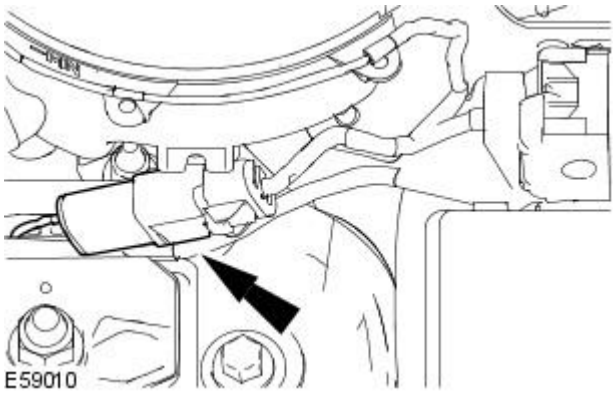
- Connect and fully seat the clutch slave cylinder pipe and retaining clip.



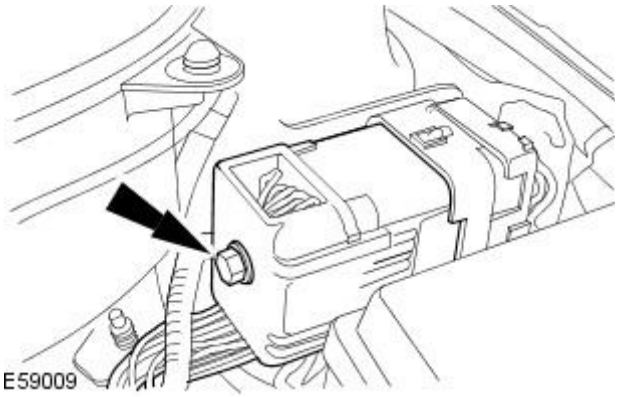
63. Attach the wiring harness to the battery tray mount.



64. Connect the battery cables.

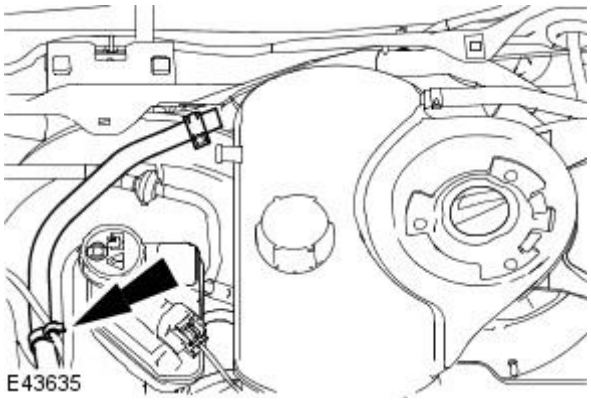


65. Connect the glow plug harness electrical connector.

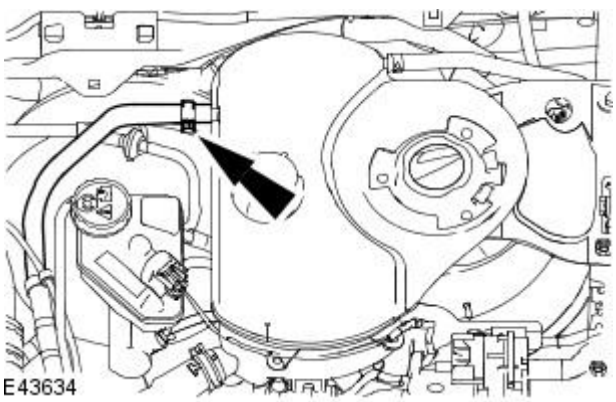


66. Connect the engine harness electrical connector.

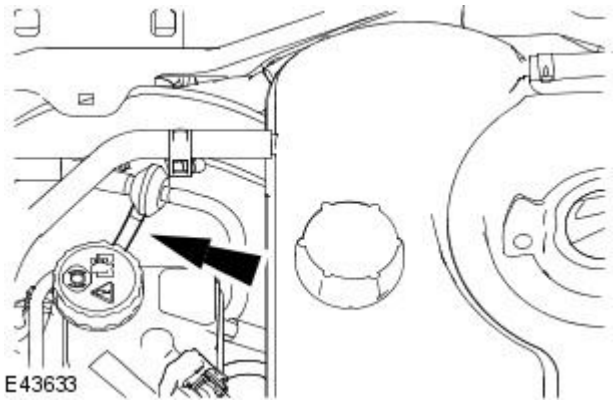
- Tighten to 10 Nm.



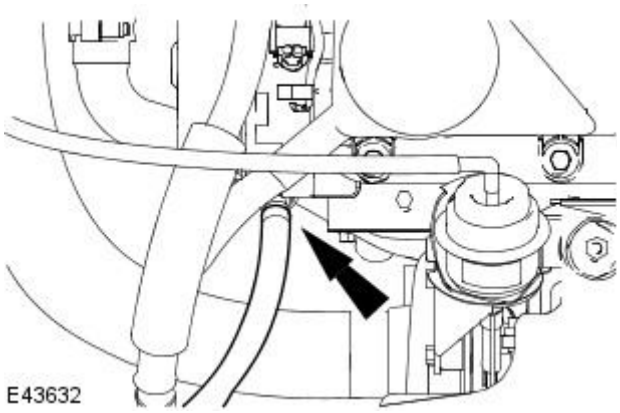
67. Attach the the expansion tank outlet hose.



68. Connect the expansion tank outlet hose.



69. Connect the exhaust gas recirculation (EGR) valve module vacuum hose.



70. Connect the brake vacuum pump vacuum hose.

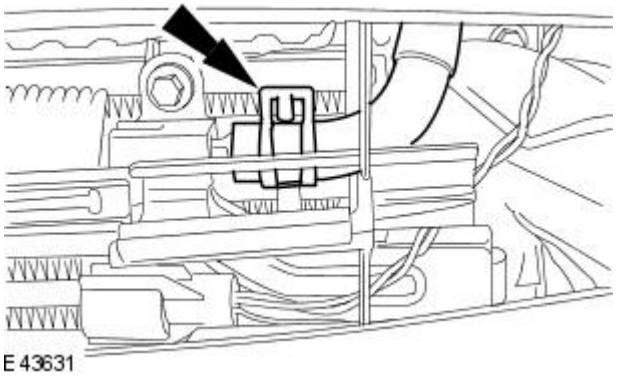
71. Raise the vehicle.

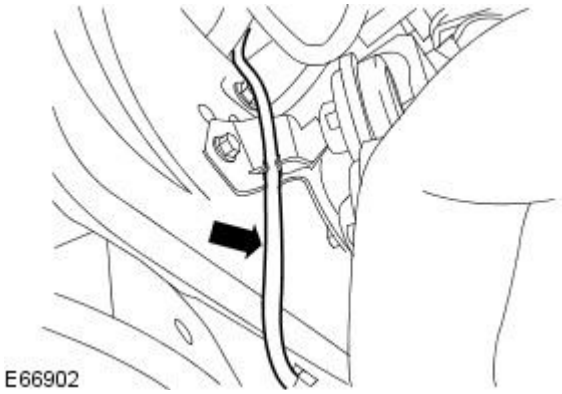
72. NOTE: Un-cap the exposed ports.

• NOTE: Use care when repositioning power assisted steering hose.

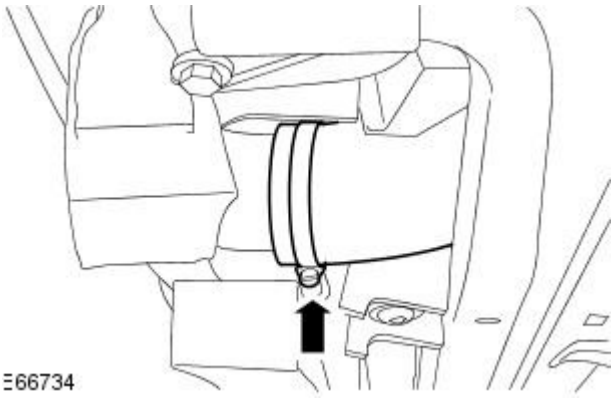
Connect the power assisted steering hose.

- Reposition the power assisted hose through the radiator side seal.
- Install the power assisted steering hose retaining clip.

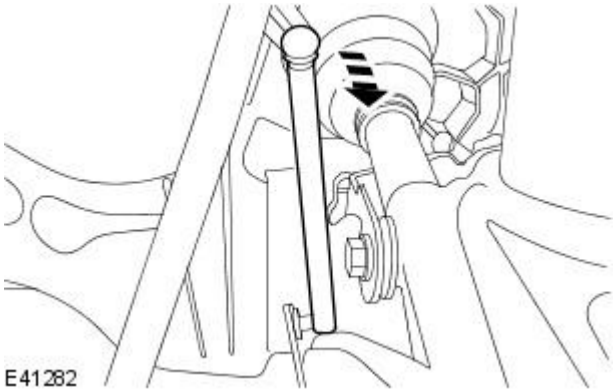




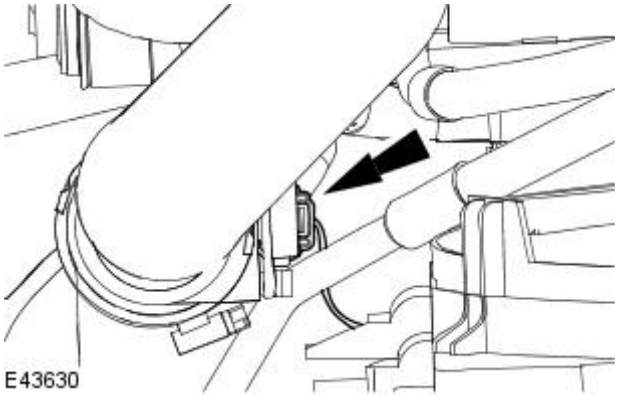
73. Attach the battery breather hose.



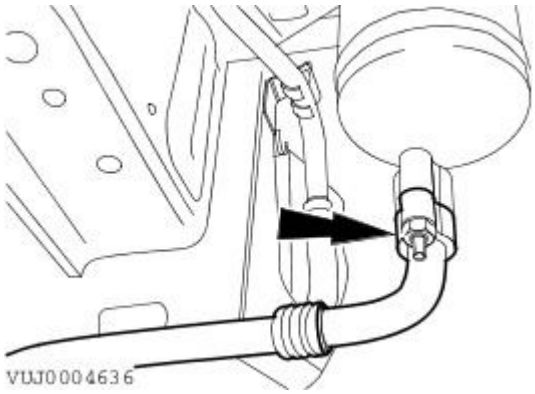
74. Attach the charge air cooler outlet hose to the charge air cooler.



75. Connect the high intensity discharge (HID) sensor drop arm.



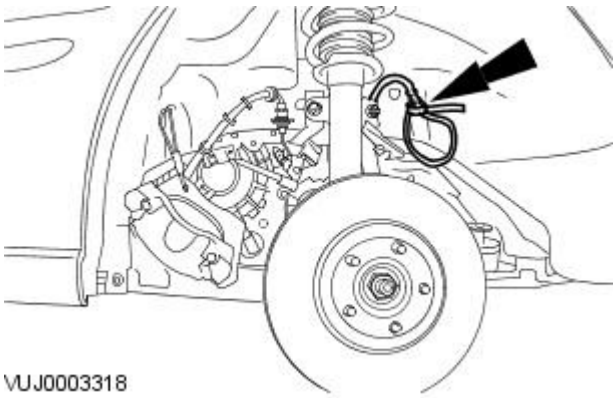
76. Connect the air temperature sensor electrical connector.



77. NOTE: Install a new O-ring seal.

- NOTE: Un-cap the exposed ports.

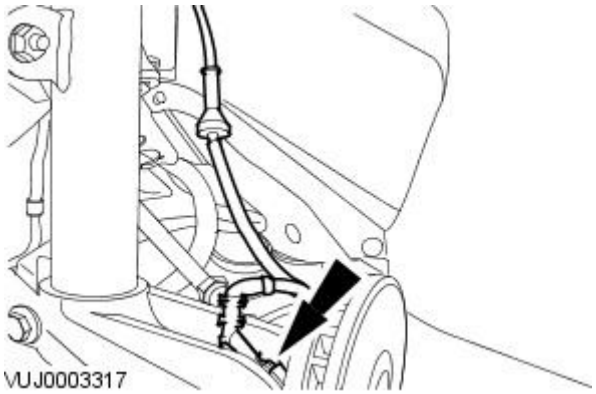
Connect the suction accumulator pipe.



78. NOTE: Remove the anti-lock braking system (ABS) wheel speed sensor tie straps.

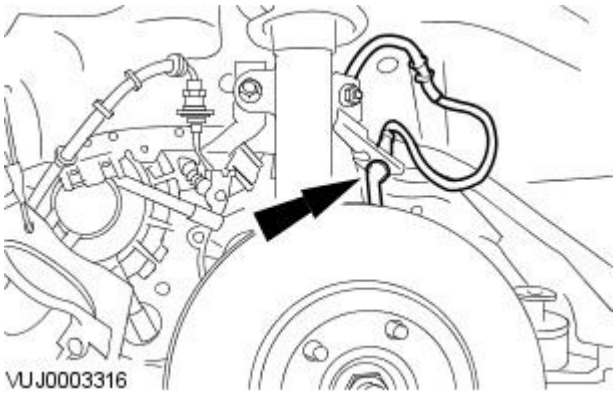
- NOTE: Left-hand shown, right-hand similar.
- NOTE: Remove the tie strap.

Detach and reposition the ABS wheel speed sensor.



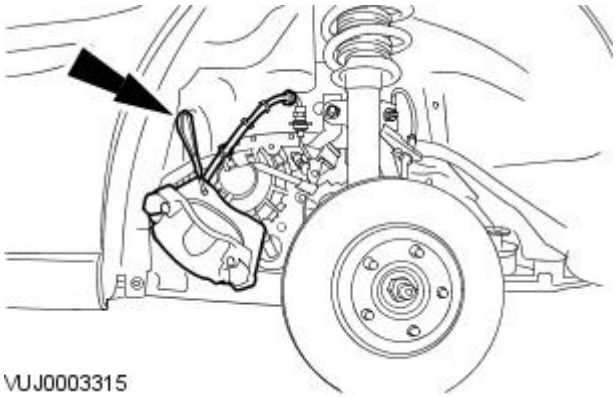
79. NOTE: Left-hand shown, right-hand similar.

Connect the ABS wheel speed sensor.



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

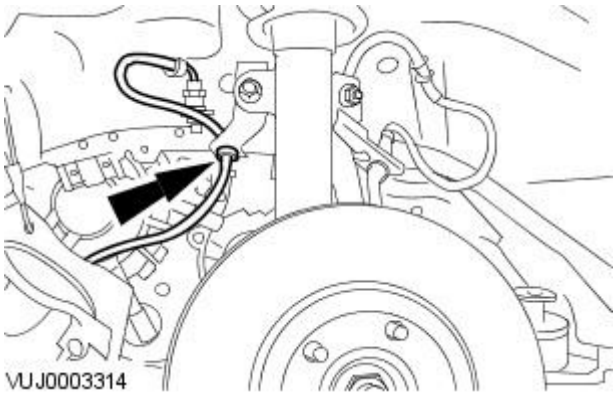
Attach the ABS wheel speed sensor.



81. NOTE: Remove the brake caliper assembly tie straps.

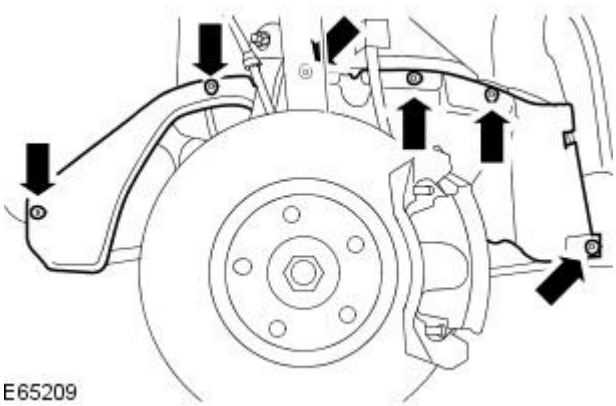
• NOTE: Left-hand shown, right-hand similar.

Detach and reposition the brake caliper assembly.



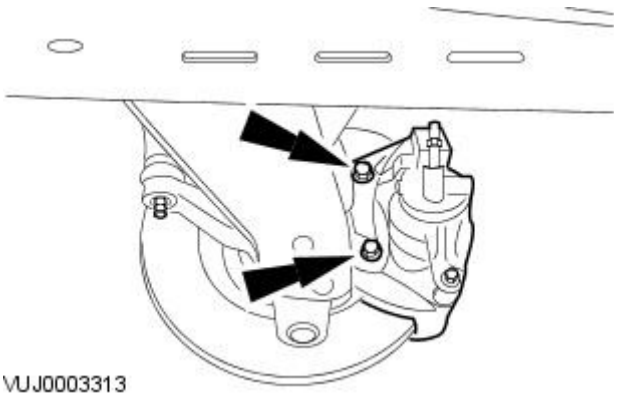
82. NOTE: Left-hand shown, right-hand similar.

Attach the brake pipe.



83. NOTE: Right-hand shown, left-hand similar.

Install the wheel arch liner access cover.


VUJ0003313

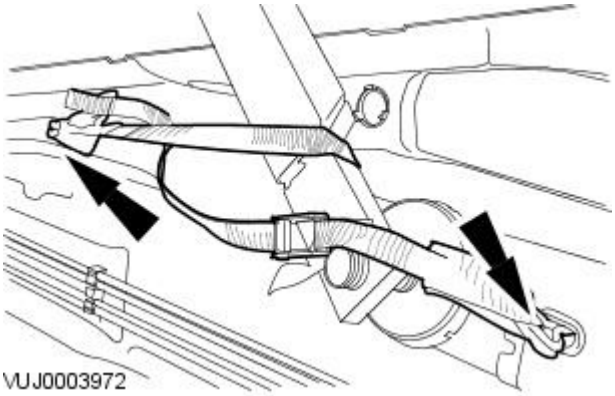
84. NOTE: Left-hand shown, right-hand similar.

• NOTE: Install new brake caliper anchor plate retaining bolts.

Attach the brake caliper and brake caliper anchor plate assembly.

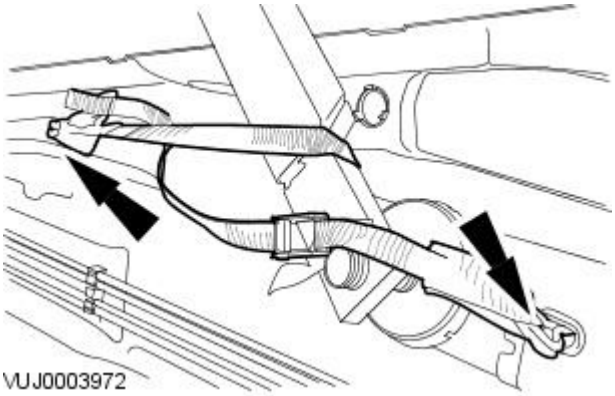
- Tighten to 133 Nm.

85. Install the front brake pads.
For additional information, refer to: Brake Pads (206-03 Front Disc Brake, Removal and Installation).


VUJ0003972

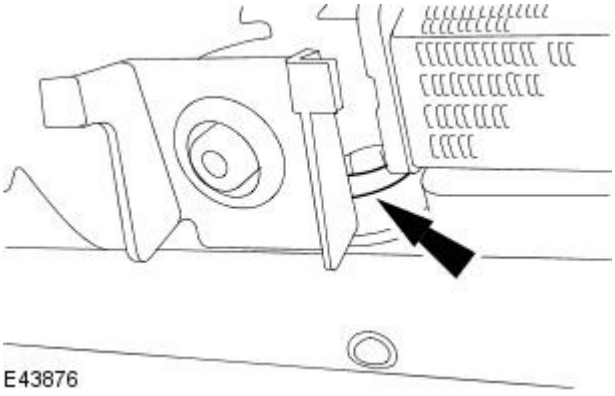
86. NOTE: Right-hand shown, left-hand similar.

Remove the rear vehicle tie down strap.


VUJ0003972

87. NOTE: Right-hand shown, left-hand similar.

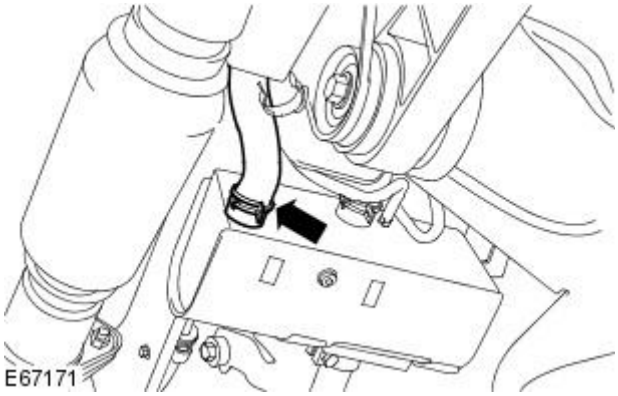
Remove the front vehicle tie down strap.


E43876

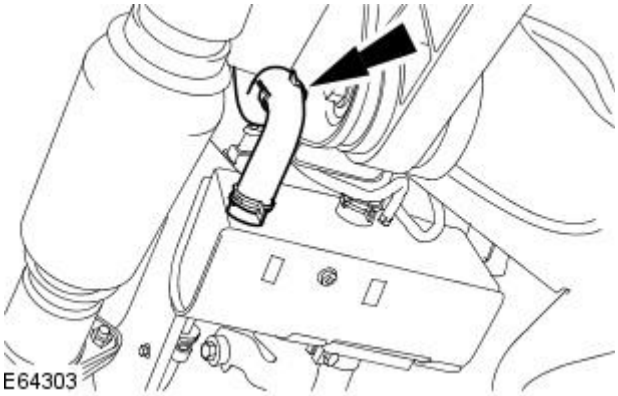
88. Connect the radiator lower coolant hose.

Vehicles with fuel fired booster heater

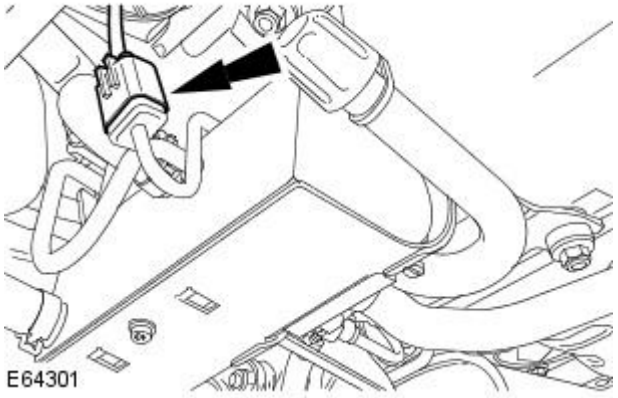
89. Connect the coolant hose.



90. Attach the coolant hose.



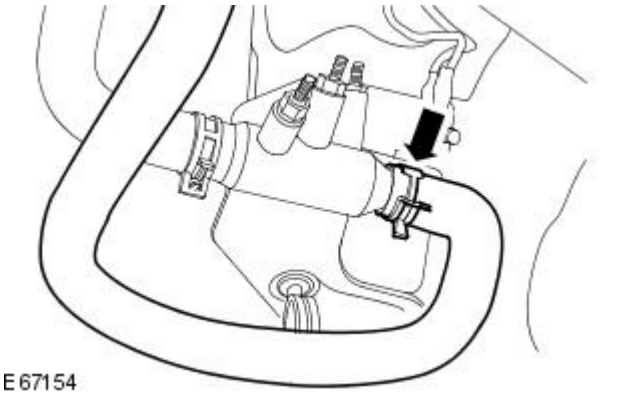
91. Connect the fuel fired booster heater electrical connector to the subframe retaining tang.

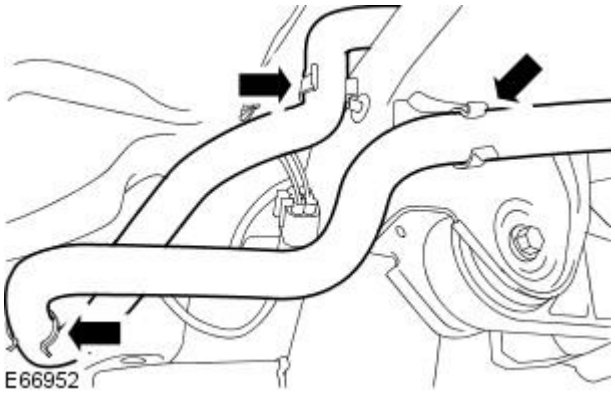


Vehicles without electric booster heater

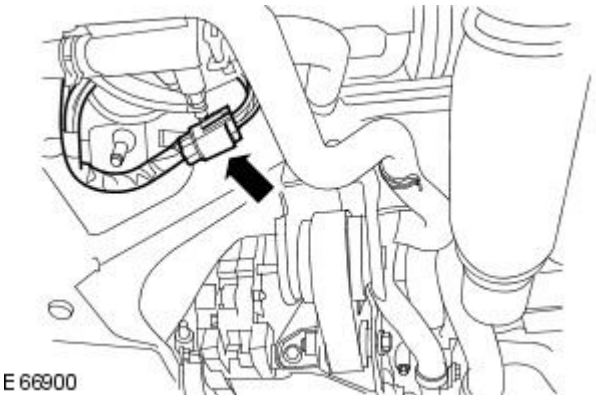
92. Attach the coolant hose.

- Connect the coolant hose.



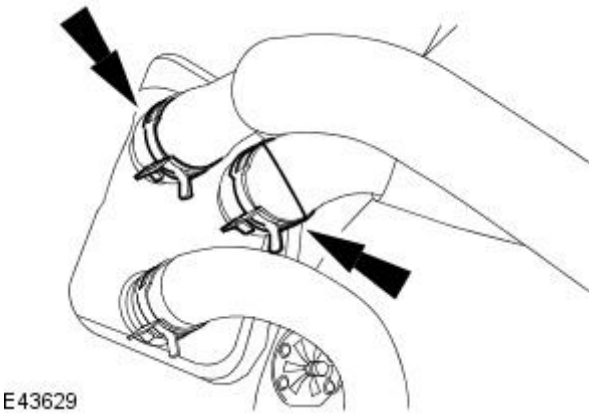


93. Attach the coolant hoses to the retaining clips.



94. Attach the electric booster heater electrical connector to the subframe retaining tang.

Vehicles without auxiliary heating



95. Connect the heater hoses to the heater core.

All vehicles

96. Install the exhaust flexible pipe.
For additional information, refer to: Exhaust Flexible Pipe - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (309-00 Exhaust System, Removal and Installation).

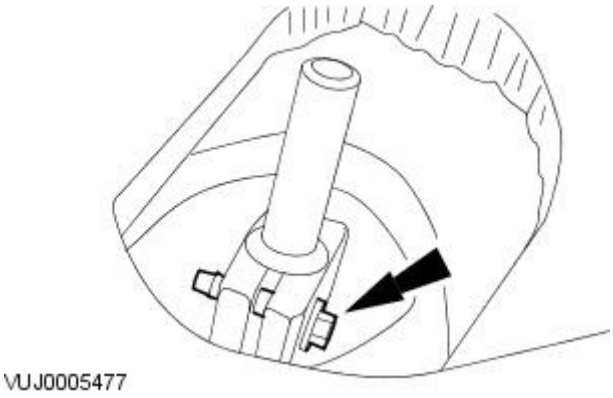
97. Install the battery tray.
For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

98. Check and top up the transmission fluid level.
For additional information, refer to: Transaxle Draining and Filling - Vehicles With: 5-Speed Manual Transmission - MT75 (308-03 Manual Transmission/Transaxle, General Procedures).

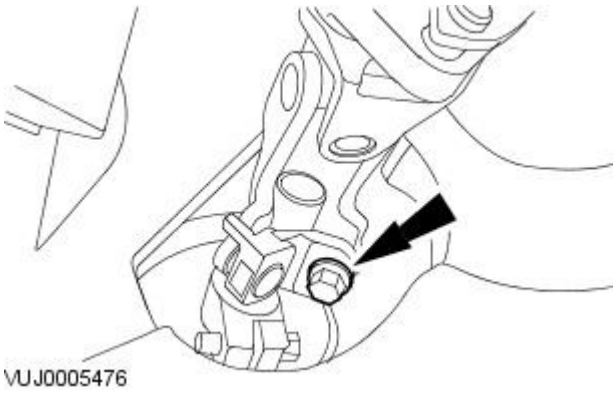
99. Carry out the clutch bleeding system procedure.
For additional information, refer to: Clutch System Bleeding - Vehicles With: 5-Speed Manual Transmission - MT75 (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

100. Fill and bleed the cooling system.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

101. Recharge the air conditioning refrigerant.
For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).


VUJ0005477

102. Install the steering column coupling.


VUJ0005476

103. Attach the lower steering column shaft.

- Install a new retaining bolt.
- Tighten to 25 Nm.

104. Bleed the power steering system.
For additional information, refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).

105. Carry out the gear shift cable adjustment procedure.
For additional information, refer to: Gearshift Cable Adjustment (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

106. Carry out the underbody misalignment check.
For additional information, refer to: Underbody Misalignment Check (502-00 Uni-Body, Subframe and Mounting System, General Procedures).

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Engine Cooling - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 -

Fluids and Lubricants

Description	Specification
Jaguar Premium Cooling System Fluid	ESE-M97B44-A
Premium Cooling System Flush	EGR-M14P7-A
O-Ring Lubricant	ESE-M99B176-A

Cooling System Refill Capacities

Engine	Capacity
2.5/3.0L	8.25L

Torque Specifications

Description	Nm	lb-ft	lb-in
Air conditioning condenser retaining bolts	7	-	62
Block heater	40	30	-
Coolant expansion tank retaining bolt	3	-	27
Cooling fan motor control module retaining screws	2	-	18
Cooling fan motor retaining nuts	6	-	53
Engine block drain plug	40	30	-
Radiator drain plug	1	-	9
Radiator support beam retaining bolts	25	18	-
Thermostat housing retaining bolts	10	-	89
Water pump housing retaining bolts	10	-	89
Water pump to water pump housing retaining bolts	10	-	89
Water pump drive pulley retaining bolts	11	8	-
Water pump housing inlet pipe retaining nuts	9	-	80
Water pump housing inlet pipe retaining studs	12	9	-
Water pump housing outlet pipe retaining bolts	10	-	89

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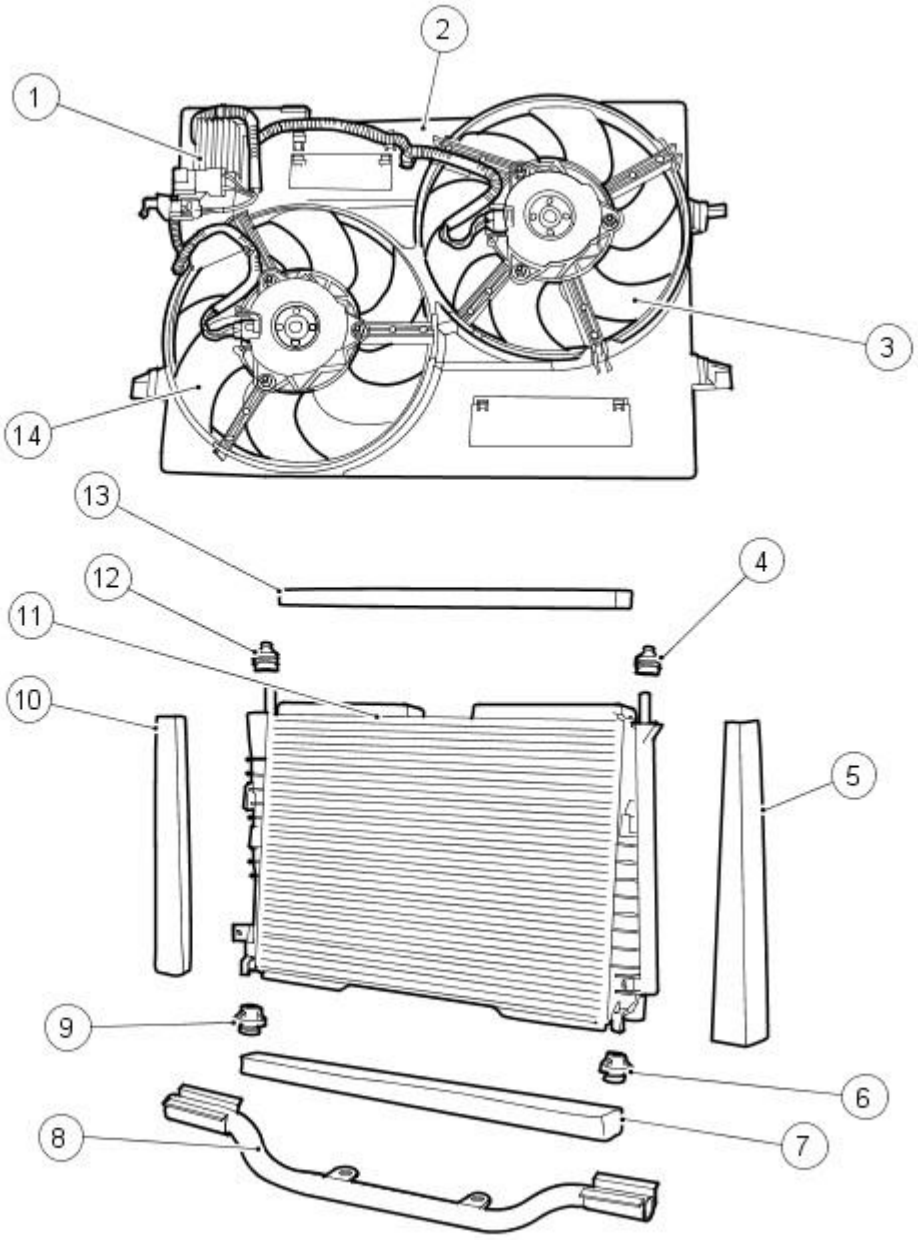
Engine Cooling - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Engine Cooling

Description and Operation

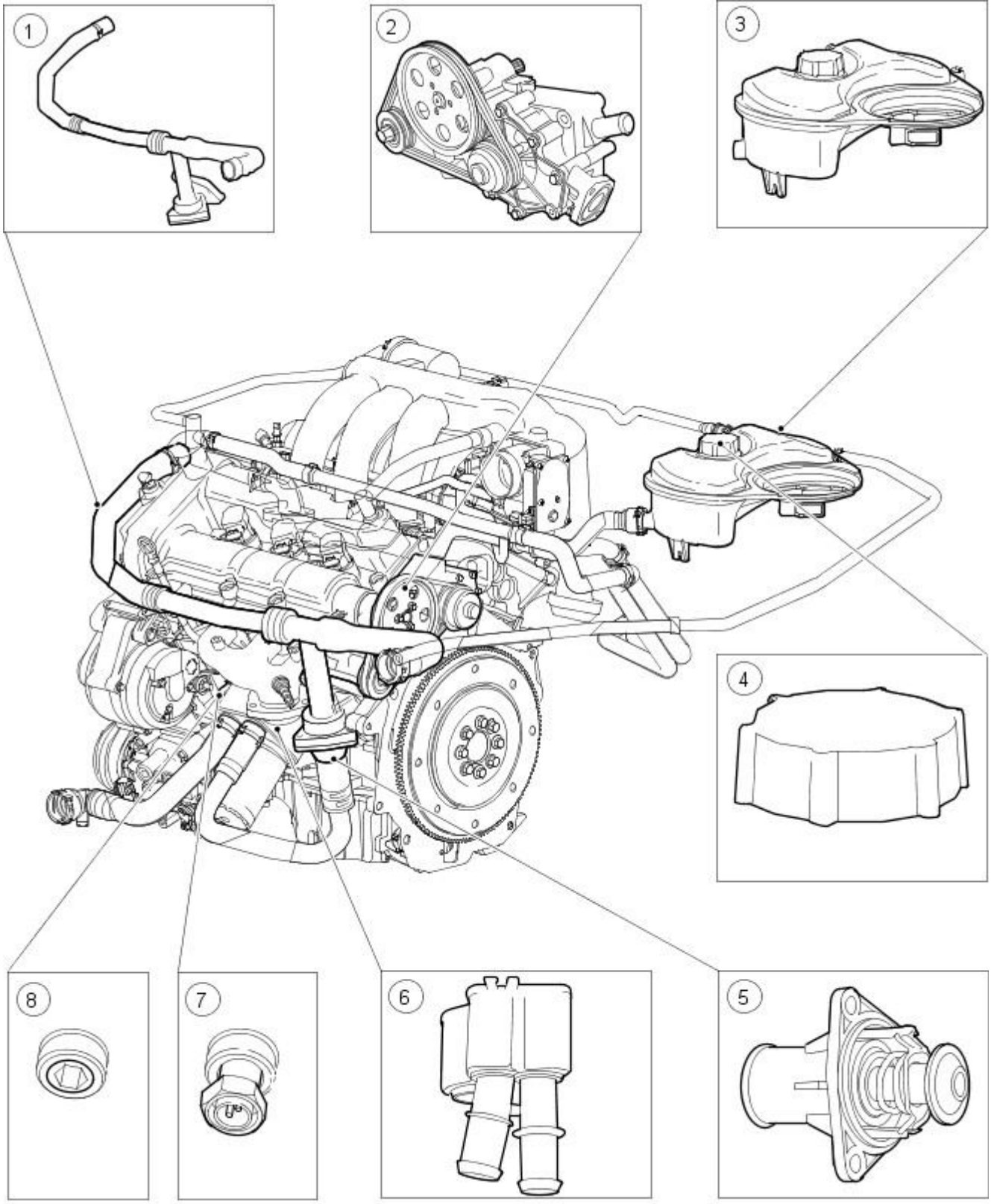
Cooling Module Components



VUJ0004066

Item	Part Number	Description
1	—	Cooling fan motor control module
2	—	Cooling fan shroud
3	—	Cooling fan, R/H
4	—	Radiator upper isolator mounting
5	—	Radiator side seal
6	—	Radiator lower isolator mounting
7	—	Radiator lower seal
8	—	Radiator support beam
9	—	Radiator lower isolator mounting
10	—	Radiator side seal
11	—	Radiator
12	—	Radiator upper isolator mounting
13	—	Radiator upper seal
14	—	Cooling fan, L/H

Engine Cooling System Components



VUJ0004061

Item	Part Number	Description
1	—	Upper coolant hose
2	—	Water pump
3	—	Coolant expansion tank
4	—	Coolant pressure cap
5	—	Thermostat
6	—	Engine oil cooler
7	—	Engine block heater (cold climate market vehicles only)
8	—	Engine block drain plug

• 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 blow 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.

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.

Remove fuse 37 from the engine compartment fuse box prior to performing any under hood service in the area of the cooling fans when the engine is hot, since the cooling fan motors could operate if the engine has been switched OFF. 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.

Never remove the coolant pressure cap under any circumstances while the engine is operating. Failure to follow this instruction may result in damage to the engine.

The cooling system consists of the following:

- Water pump.
- Thermostat.
- Radiator.
- Coolant expansion tank.
- Coolant pressure cap.
- Two electric cooling fans.
- Cooling fan motor control module.
- Engine oil cooler.

Water Pump

The water pump is of a conventional design and is located at the rear of the engine. It is driven by the L/H exhaust camshaft through the water pump drive pulley and belt. The water pump belt tension is maintained by an automatic drive belt tensioner. For additional information, refer to Section 303-05 Accessory Drive.

Thermostat

The thermostat is located in a housing in the upper coolant hose and allows rapid engine warm-up by restricting coolant flow through the radiator below 82°C (180°F). The thermostat also assists in keeping the engine operating temperature within predetermined limits. The thermostat begins to open at 82°C (180°F) and is fully open at 93°C (199°F).

When the engine is cold and the thermostat is closed, coolant flows from the water pump through the engine. It then returns to the water pump through the upper coolant hose.

When the engine is warm and the thermostat is open, coolant flows into the radiator through the upper coolant hose. It then returns to the water pump from the radiator through the lower coolant hose and engine oil cooler.

The heater core is on a parallel circuit and is unaffected by the position of the thermostat.

Radiator

The radiator is of aluminium construction with plastic end tanks. Foam seals are fitted to the radiator to prevent the cooling air from by passing the radiator core. The radiator is located by four isolator mountings and supported by the radiator support beam. A coolant drain plug is provided in the lower coolant hose for the draining of the coolant. The Cooling fan shroud is attached to the radiator.

Cooling Fans

Two variable speed electric cooling fans are housed in the cooling fan shroud for the cooling of the radiator. The speed of the electric cooling fans are adjusted by the cooling fan motor control module, which is controlled by the engine control module (ECM).

The ECM determines the cooling fan speed by receiving inputs from the engine coolant temperature (ECT) sensor and the dual automatic temperature control module (DATC). The ECM sends a variable pulse width modulated (PWM) signal to the fan motor control module to operate the cooling fans at the required speed. The cooling fans are operated at slow speed when the engine coolant temperature is at 95°C (203°F) and are operated at full speed when the engine coolant temperature is at 105°C (221°F). A coolant temperature between these temperatures will cause the cooling fans to be operated at a speed which is proportional to the engine coolant temperature.

When the engine is running with the ECT above 100°C (212°F), if the ignition switch is turned to the OFF position the cooling fans will continue to operate for a time which is determined by the ECM.

If the PWM signal from the ECM to the cooling fan control module is between 7% and 95% the cooling fan control module will operate the cooling fans at the required speed. If the PWM signal from the ECM to the cooling fan control module is below 3% and above 95% the cooling fan control module will operate the cooling fans at maximum speed. If the PWM signal from the ECM to the cooling fan control module is between 3% and 7% the cooling fans will not be operated.

Engine Block Heater

For vehicle markets subject to very cold climate conditions, an engine block heater for connection to an external mains power supply, is fitted in place of the engine block drain plug.

Coolant Recovery System

A pressurized coolant expansion tank system is used which continuously separates the air from the cooling system and replenishes the system through the coolant expansion tank outlet hose, attached to the heater return hose.

A continuous vent from the engine and radiator to the coolant expansion tank prevents air locks from forming in the cooling system.

No manual bleed points are provided on the system.

The coolant expansion tank serves as the location for:

- Service fill.

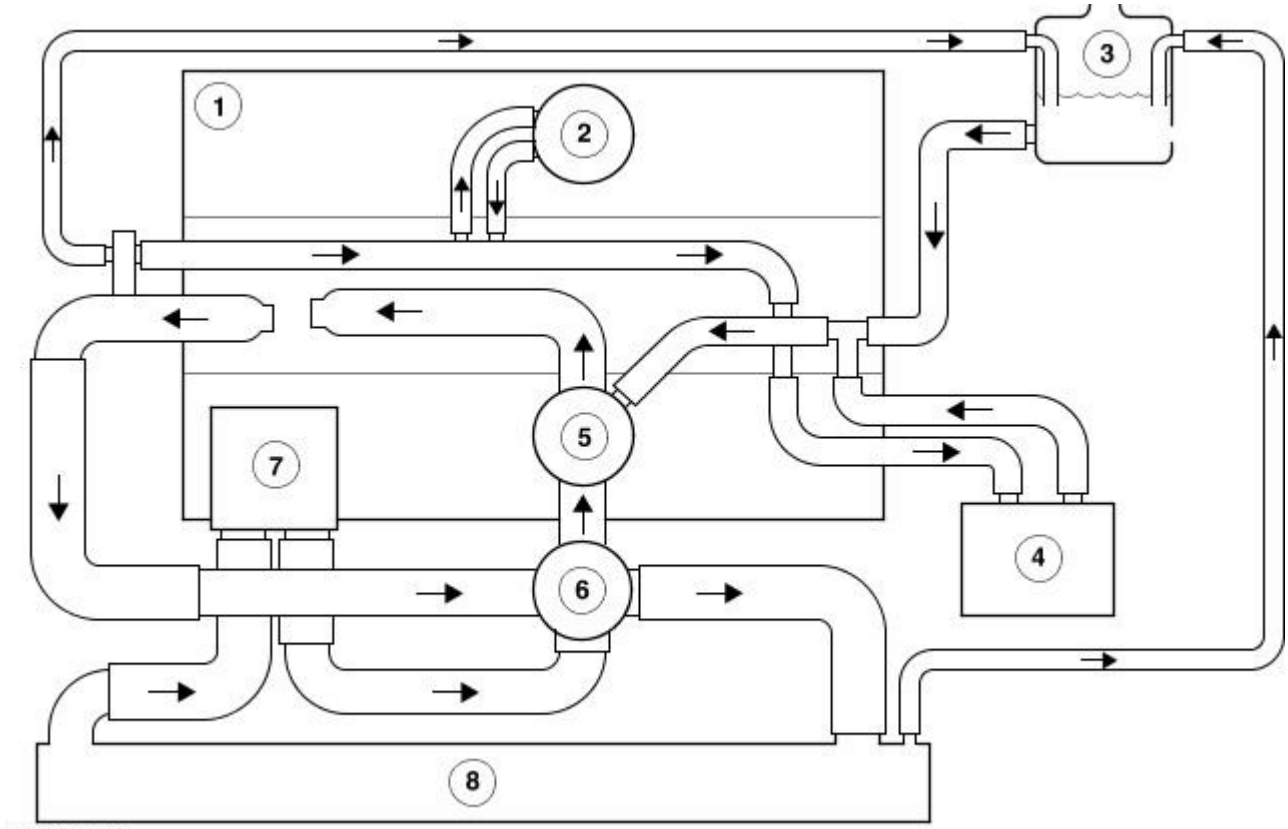
- Coolant expansion during warm-up.
- Air separation during operation.
- System pressurization by the coolant pressure cap.
- The coolant expansion tank is designed to have approximately 0.5 to 1 liter of air when cold to allow for coolant expansion.

Engine Oil Cooler

The engine oil cooler is a Modine oil to water type. The oil cooler is fitted between the oil filter housing and the oil filter and is a full flow system.

The coolant supply for the engine oil cooler is through the radiator bottom hose.

Coolant Flow Diagram (Thermostat open)



VUJ0004060

Item	Part Number	Description
1	—	Engine
2	—	Throttle body
3	—	Expansion tank
4	—	Heater core
5	—	Water pump
6	—	Thermostat
7	—	Engine oil cooler
8	—	Radiator

Engine Coolant

The long life engine coolant is formulated to last for five years or 240,000 km (150,000 miles). The coolant is silicate free and orange in color. The long life engine coolant must not be mixed with conventional engine coolant.

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Engine Cooling - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Engine Cooling

Diagnosis and Testing

1. **1.** Verify the customer concern.
2. **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. **3.** Visually inspect for obvious signs of mechanical or electrical damage.
4. **4.** If the concern is not an electrical fault and is not visually evident, verify the concern and refer to the symptom chart.
5. **5.** If the concern is an electrical fault and is not visually evident, use a fault code reader to retrieve the fault codes before proceeding to the symptom chart.

Visual Inspection Chart

Mechanical	Electrical
Leaks	Fuse
Coolant expansion tank	Wiring harness
Coolant pressure cap	Loose or corroded connector(s)
Cooling fan motor(s)	Cooling fan motor(s)
Radiator	Engine coolant temperature (ECT) sensor
Water pump	Cooling fan motor control module
-	Block heater

Symptom chart

Symptom	Possible Sources	Action
DTC P0480; High/low signal from the cooling fan motor control module to the engine control module (ECM)	* Fuse F40 (80A), power distribution fuse box. * Circuit. * Cooling fan motor. * Cooling fan motor control module. * ECM.	* GO to Pinpoint Test A.
Loss of coolant	* Hoses. * Hose connections. * Radiator. * Water pump. * Heater core. * Gaskets. * Coolant expansion tank. * Coolant pressure cap. * Engine casting cracks. * Engine core plugs.	* Go to Pinpoint Test B.
Engine overheats	* Engine coolant. * Thermostat. * Fuse F40 (80A), power distribution fuse box. * Circuit. * Cooling fan motor(s). * Radiator. * Water pump. * Water pump drive belt. * Engine coolant temperature (ECT) sensor. * ECM. * Cooling fan motor control module.	* Go to Pinpoint Test C.
Engine block heater does not operate properly	* Block heater power cable. * Block heater.	* Go to Pinpoint Test D.
The engine does not reach normal operating temperature	* Thermostat.	* INSTALL a new thermostat.

PINPOINT TEST A : DTC P0480; HIGH/LOW SIGNAL FROM THE COOLING FAN MOTOR CONTROL MODULE TO THE ECM

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE OPERATION OF THE COOLING FANS	
	1 Disconnect the engine coolant temperature sensor electrical connector.
	2 Connect a 100 ohm resistor to the engine coolant temperature sensor electrical connector.
	3 START and RUN the engine.
	Are the cooling fans operating? **Yes** GO to A2. . **No** GO to A7. .
A2: CHECK THE OPERATION OF THE TWO COOLING FANS	
	1 Inspect the operation of the two cooling fans.
	Are both the cooling fans operating? **Yes** Connect the engine coolant temperature sensor electrical connector.GO to A4. . **No** GO to A3. .
A3: RUN THE TWO COOLING FANS AT MAXIMUM SPEED.	
	1 Turn the ignition switch to the OFF position and disconnect the cooling fan control module electrical connector JB187 (to VIN E71957) and connector JB190 (from VIN 71958).
	2 Remove the PWM signal wire from the cooling fan control module electrical connector JB187-1 (WU) (to VIN E71957) and connector JB190-4 (WU) (from VIN 71958).

	3 Connect the cooling fan control module electrical connector JB187 (to VIN E71957) and connector JB190 (from VIN 71958) and turn the ignition switch to the RUN position. The cooling fans will run at maximum speed.
	4 Allow the cooling fans to run for 5 minutes. Turn the ignition switch to the OFF position and disconnect the cooling fan control module electrical connector JB187 (to VIN E71957) and connector JB190 (from VIN 71958).
	5 Install the PWM signal wire to the cooling fan control module electrical connector JB187-1 (WU) (to VIN E71957) and connector JB190-4 (WU) (from VIN 71958).
	6 Connect the cooling fan control module electrical connector JB187 (to VIN E71957) and connector JB190 (from VIN 71958) to the cooling fan control module.
	7 Turn the ignition switch to the RUN position.
	Are both the cooling fans operating? **Yes** Connect the engine coolant temperature sensor electrical connector.GO to A4. . **No** INSTALL a new cooling fan motor as necessary. For additional information, refer to REFER to: Cooling Fan Motor (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). . CLEAR the DTC. TEST the system for normal operation.
A4: CHECK CONTINUITY OF THE COOLING FAN MOTOR CONTROL MODULE SIGNAL WIRE FROM THE ECM	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16 and the cooling fan motor control module electrical connector JB187 (to VIN E71957) and connector JB190 (from VIN 71958).
	3 Measure the resistance between electrical **connector (JB187-1 to VIN E71957) or connector (JB190-4 from VIN 71958)** and EN16-51.
	Is the resistance less than 5 ohms? **Yes** GO to A5. . **No** REPAIR the circuit from the ECM to the cooling fan motor control module. CLEAR the DTC. TEST the system for normal operation.
A5: CHECK THE COOLING FAN MOTOR CONTROL MODULE SIGNAL WIRE FROM THE ECM FOR A SHORT TO GROUND	
	1 Measure the resistance between **connector (JB187-1 to VIN E71957) or connector (JB190-4 from VIN 71958)** and ground.
	Is the resistance less than 10,000 ohms? **Yes** GO to A6. . **No** REPAIR the circuit from the ECM to the cooling fan motor control module. CLEAR the DTC. TEST the system for normal operation.
A6: CHECK THE COOLING FAN MOTOR CONTROL MODULE SIGNAL WIRE FROM THE ECM FOR A SHORT TO BATTERY POSITIVE	
	1 Measure the resistance between JB187-1 and JB187-2 (to VIN E71957) or JB190-4 and JB190-3 (from VIN 71958).
	Is the resistance less than 10,000 ohms? **Yes** INSTALL a new cooling fan motor control module. For additional information, refer to REFER to: Cooling Fan Module (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). . CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, refer to REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Description and Operation). . **No** REPAIR the circuit from the ECM to the cooling fan motor control module. CLEAR the DTC. TEST the system for normal operation.
A7: CHECK FUSE F40 IN THE POWER DISTRIBUTION FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to A9. . **No** GO to A8. .
A8: CHECK FUSE F40 OF THE POWER DISTRIBUTION FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB212-1 of the power distribution fuse box and ground.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the engine compartment fuse box and the cooling fan motor control module. INSTALL a new fuse. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. CLEAR the DTC. TEST the system for normal operation.
A9: CHECK THE POWER SUPPLY TO THE COOLING FAN MOTOR CONTROL MODULE	
	1 Measure the voltage between the cooling fan motor control module electrical connector JB212-1 and ground.
	Is the voltage less than 10 volts? **Yes** GO to A10. . **No** GO to A11. .
A10: CHECK FOR BATTERY VOLTAGE AT FUSE F40 OF THE ENGINE COMPARTMENT FUSE BOX	
	1 Measure the voltage between the engine compartment fuse box electrical connector JB212-1 and ground
	Is the voltage less than 10 volts? **Yes** Repair the circuit between engine compartment fuse box and the battery. CLEAR the DTC. TEST the system for normal operation. **No** REPAIR the circuit between the engine compartment fuse box and the cooling fan motor control module. CLEAR the DTC. TEST the system for normal operation.
A11: CHECK THE IGNITION SUPPLY TO THE COOLING FAN MOTOR CONTROL MODULE	
	1 Turn the ignition switch to the RUN position.
	2 Measure the voltage between the cooling fan motor control module electrical connector (JB187-2 to VIN E71957) or connector (JB190-3 from VIN 71958) and ground.

	Is the voltage less than 10 volts? **Yes** REPAIR the circuit between the engine compartment fuse box and the cooling fan motor control module. CLEAR the DTC. TEST the system for normal operation. **No** GO to A12. .
A12: CHECK THE COOLING FAN MOTOR CONTROL MODULE GROUND CIRCUIT	
	1 Measure the resistance between the cooling fan motor control module electrical connector (JB188-2 to VIN E71957) or connector (JB190-2 from VIN 71958) and ground.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new cooling fan motor control module. For additional information, refer to REFER to: Cooling Fan Module (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). . CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, refer to REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Description and Operation). . **No** REPAIR the ground circuit to the cooling fan motor control module. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST B : LOSS OF COOLANT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: VISUAL INSPECTION	
	1 Visually inspect for loss of coolant.
	Is the engine cooling system leaking? **Yes** INSTALL a new component as required. For additional information, refer to the appropriate section. TEST the cooling system for normal operation. **No** Carry out the Cooling System Pressure TEST. For additional information, refer to the component test in this section.

PINPOINT TEST C : THE ENGINE OVERHEATS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK COOLANT	
WARNING: 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 blow 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.	
CAUTION: Never remove the coolant pressure cap under any circumstances while the engine is operating. Failure to follow this instruction may result in personal damage to the engine.	
	1 Inspect the coolant level.
	Is the coolant level OK? **Yes** GO to C2. . **No** DIAGNOSE and REPAIR the coolant leaks. REFILL the cooling system. For additional information, refer to REFER to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures). . TEST the cooling system for normal operation.
C2: CHECK THE CONDITION OF THE WATER PUMP DRIVE BELT	
	1 Inspect the water pump drive belt. For additional information, refer to REFER to: Water Pump Belt - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-05 Accessory Drive, Removal and Installation). .
	Is the water pump drive belt OK? **Yes** GO to C3. . **No** INSTALL a new water pump drive belt. For additional information, refer to REFER to: Water Pump Belt - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-05 Accessory Drive, Removal and Installation). . TEST the cooling system for normal operation.
C3: CHECK THE WATER PUMP DRIVE	
	1 Remove the water pump drive belt. For additional information, refer to REFER to: Water Pump Belt - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-05 Accessory Drive, Removal and Installation). .
	2 Attempt to turn the water pump drive pulley by hand.
	Does the water pump drive pulley turn? **Yes** GO to C4. . **No** GO to C5. .
C4: CHECK THE LEFT HAND EXHAUST CAMSHAFT	
	1 Remove the water pump. For additional information, refer to REFER to: Water Pump (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). .
	2 Inspect the water pump drive shaft splines of the exhaust camshaft.

	Are the drive splines OK? **Yes** Install a new water pump. For additional information, refer to REFER to: Water Pump (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). . TEST the system for normal operation. **No** INSTALL a new camshaft. For additional information, refer to REFER to: Camshafts LH (303-01A Engine - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, In-vehicle Repair). . Install a new water pump. For additional information, refer to REFER to: Water Pump (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). . TEST the system for normal operation.
C5: CHECK THE OPERATION OF THE COOLING FANS	
	1 Disconnect the engine coolant temperature (ECT) sensor electrical connector.
	2 Connect a 100 ohm resistor to the engine coolant temperature sensor electrical connector.
	3 Turn the ignition switch to the RUN position.
	Are the cooling fans operating? **Yes** Turn the ignition switch to the OFF position. Connect the ECT sensor. GO to C7. . **No** Turn the ignition switch to the OFF position. Connect the ECT sensor. GO to A1. .
C6: CHECK THE AIR CONDITIONING CONDENSER AND RADIATOR CORE FOR OBSTRUCTION.	
	1 INSPECT the air conditioning condenser and radiator core for obstruction.
	Is the air conditioning condenser or radiator core obstructed? **Yes** Remove the obstruction and clean the air conditioning condenser and radiator core. TEST the system for normal operation. **No** GO to C8. .
C7: CHECK THE OPERATION OF THE COOLING FANS WITH THE ENGINE RUNNING AT NORMAL OPERATING TEMPERATURE	
	1 START and RUN the engine until the ECT is between 95°C (203°F) and 105°C (221°F).
	Are the cooling fans operating? **Yes** Turn the ignition switch to the OFF position. GO to C8. . **No** DIAGNOSE the electronic engine controls. For additional information, refer to REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). .
C8: CHECK THE TEMPERATURE OF THE RADIATOR	
	1 Check the radiator core temperature.
	Is the radiator core hot? **Yes** GO to C9. . **No** GO to C10. .
C9: CHECK THE RADIATOR CORE FOR COLD SPOTS	
	1 Check the radiator core for cold spots.
	Does the radiator core have any cold spots? **Yes** Backflush the radiator. For additional information, refer to REFER to: Cooling System Backflushing (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures). . TEST the system for normal operation. If the fault is still present, INSTALL a new radiator. For additional information, refer to REFER to: Radiator (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). . **No** GO to C10. .
C10: CHECK THE THERMOSTAT	
	1 TEST the thermostat. For additional information, refer to the component TEST in this section.
	Is the thermostat OK? **Yes** GO to C11. . **No** INSTALL a new thermostat. For additional information, refer to REFER to: Thermostat (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). . TEST the system for normal operation.
C11: CHECK THE ENGINE OIL COOLER FOR A BLOCKAGE	
	1 Remove the engine oil cooler. For additional information, refer to REFER to: Oil Cooler (303-01A Engine - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, In-vehicle Repair). .
	2 Check the engine oil cooler for a coolant blockage.
	Is the engine oil cooler blocked? **Yes** Install a new engine oil cooler. For additional information, refer to REFER to: Oil Cooler (303-01A Engine - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, In-vehicle Repair). . TEST the system for normal operation. **No** INSTALL a new water pump. For additional information, refer to REFER to: Water Pump (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

	. TEST the system for normal operation.

PINPOINT TEST D : THE ENGINE BLOCK HEATER DOES NOT OPERATE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK CONTINUITY OF THE BLOCK HEATER POWER SUPPLY CABLE AND THE BLOCK HEATER	
	1 Measure the resistance between the live supply terminal and the negative terminal of the block heater power supply connector.
	Is the resistance less than 20 ohms? **Yes** Repair the mains power supply to the vehicle block heater cable. TEST the system for normal operation. **No** GO to D2. .
D2: CHECK THE CONTINUITY OF THE BLOCK HEATER	
	1 Disconnect the block heater electrical connector from the block heater.
	2 Measure the resistance between the live supply terminal and the negative terminal of the block heater.
	Is the resistance less than 20 ohms? **Yes** GO to D3. . **No** INSTALL a new block heater. For additional information, refer to REFER to: Block Heater (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). . TEST the system for normal operation.
D3: CHECK THE BLOCK HEATER FOR A SHORT TO GROUND	
	1 Measure the resistance between the live supply terminal and the earth terminal of the block heater.
	Is the resistance less than 10,000 ohms? **Yes** Install a new block heater. For additional information, refer to REFER to: Block Heater (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). . TEST the system for normal operation. **No** GO to D4. .
D4: CHECK THE CONTINUITY OF THE BLOCK HEATER POWER SUPPLY CABLE	
	1 Measure the resistance of the live supply wire of the block heater cable.
	2 Measure the resistance of the neutral supply wire of the block heater cable.
	3 Measure the resistance of the ground supply wire of the block heater cable.
	Is the resistance less than 5 ohms? **Yes** GO to D5. . **No** Install a new block heater power supply cable. TEST the system for normal operation.
D5: CHECK THE BLOCK HEATER POWER SUPPLY CABLE FOR A SHORT CIRCUIT	
	1 Measure the resistance between the live supply wire and the neutral supply wire of the block heater cable.
	2 Measure the resistance between the live supply wire and the ground wire of the block heater cable.
	Is the resistance less than 10,000 ohms? **Yes** Install a new block heater power supply cable. TEST the system for normal operation. **No** Repair the mains power supply to the vehicle block heater cable. TEST the system for normal operation.

Component Tests

Pressure Test

WARNING: 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 blow 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. **1.** Switch the engine OFF.
2. **2.** Open the hood and install protective fender covers.
3. **3.** Carefully remove the coolant pressure cap from the coolant expansion tank to relieve pressure from the cooling system. Add coolant to the coolant expansion tank as necessary.
4. **4.** Install the cooling system Pressure Tester adaptor tightly to the coolant expansion tank.
5. **5.** Attach the pressure pump and gauge to the adapter fitting and pressurize the cooling system to 100 kPa (14.5 psi).
6. **6.** Observe the gauge reading for approximately two minutes. The pressure should not drop during this time.
   - If system holds pressure, proceed to step 8.
   - If the pressure drops check for leaks in the cooling system. Correct any leaks found and recheck the system.
7. **7.** Release the system pressure by slowly loosening the cooling system Pressure Tester adaptor. Check the coolant level and replenish as necessary with the correct coolant solution.
8. **8.** Conduct the pressure cap Pressure Test in this section.

Coolant Expansion Tank Pressure Cap Pressure Test

WARNING: Never remove the coolant expansion tank cap under any circumstances while the engine is operating. Failure to follow these instructions may result in damage to the cooling system or engine and/or personal injury. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the coolant expansion tank cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant expansion tank cap and turn it slowly until the pressure begins to release, step back while the pressure is released from the system. When certain that all pressure has been released, (still with a cloth) turn and remove the coolant expansion tank cap. Failure to follow these instructions may result in personal injury.

1. **1.** Remove the coolant pressure cap from the coolant expansion tank.
2. **2.** Install the coolant pressure cap to the coolant system Pressure Tester.
3. **3.** Operate the cooling system pressure tester. Pressurize the coolant pressure cap until the pressure relief valve in the coolant pressure cap opens and observe the gauge reading.

   • NOTE: If the plunger of the pump is operated too quickly, an erroneous pressure reading will result.

   3. Compare the gauge reading with the maximum opening pressure of the coolant pressure cap: 100 KPa (14.5 psi).
4. **4.** Release the pressure. Repeat Step 3 at least twice to make sure that the pressure test reading is repeatable and within acceptable gauge reading limits of the expansion tank cap.
5. **5.** If the pressure test gauge readings are not within acceptable gauge reading limits, install a new coolant pressure cap.
6. **6.** Pressurize the coolant pressure cap until the pressure is just below the opening pressure of the coolant pressure cap.
7. **7.** Observe the reading of the pressure gauge for one minute. The pressure should not fall within this time.
8. **8.** If the pressure falls below 10 KPa (1.5 psi) of the recorded pressure, install a new coolant pressure cap.

Thermostat Test, Mechanical

• NOTE: Fully open means the thermostat valve lifts a distance of 9.0 mm (0.35 inch) or more off the valve seat.

1. **1.** Remove the thermostat. For additional information, refer to
   REFER to: Thermostat (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).
   .
2. **2.** Immerse the thermostat in water.
3. **3.** Increase the temperature of the water.
4. **4.** Observe the state of the thermostat and the temperature of the water.
5. **5.** The thermostat should begin to open at 82°C (179°F) and is fully open at 93°C (199°F).
6. **6.** If the thermostat fails to open within acceptable limits, install a new thermostat.

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 aluminum.

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.

A separate clean test tank is recommended for aluminium radiators. If a separate tank is not available for aluminium radiator testing, rinse the test tank each time before testing an aluminium radiator.

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Engine Cooling - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Cooling System Backflushing

General Procedures

• CAUTIONS:

The heater core must be backflushed separately from the engine cooling system to prevent the engine cooling system particles from clogging the heater core tubes and reducing (or eliminating) coolant flow through the heater core.

All engine cooling system flushing and backflushing procedures must include a separate backflushing of the heater core after the flushing or backflushing of the engine cooling system.

Heater core internal pressure must not exceed 100 kPa (14.5 psi). Failure to follow this instruction may cause damage to the heater core.

• NOTE: Cooling system backflushing should be carried out before the cooling system components are installed after the cooling system flushing procedure.

1. Disconnect the heater outlet coolant hose from the engine and connect the heater hose to a suitable hose pipe.
2. Disconnect the heater inlet coolant hose from the engine and allow the coolant to drain into a suitable container.
3. Turn the water supply valve to the hose ON and allow water pressure to flow through the heater core.
4. Allow water pressure to flow through the heater core for approximately five minutes.
5. Turn the water supply valve to the hose OFF and disconnect the hose pipe from the heater hose.
6. Connect the heater inlet coolant hose to the engine.
7. Connect the heater outlet coolant hose to the engine.
8. Fill the cooling system as described using a 50% mixture of Jaguar Premium Cooling System Fluid, or equivalent meeting Jaguar specification ESE-M97B44-A and 50% distilled water.
9. Test the system for correct heater performance with the specified engine cooling system conditions.

Radiator Backflushing

1. Remove the radiator. For additional information, refer to Radiator.
2. Invert the radiator.
3. Connect a suitable hose pipe to the lower coolant hose connection of the radiator.
4. Turn the water supply valve to the hose ON and allow water pressure to flow through the radiator.
5. Allow water pressure to flow through the radiator for approximately five minutes.
6. Turn the water supply valve to the hose OFF and disconnect the hose pipe from the radiator.
7. Allow the coolant to drain from the radiator.
8. Install the radiator. For additional information, refer to Radiator.

Engine Backflushing

• NOTE: Make sure that the thermostat is removed before backflushing the engine.

1. Position the high-pressure water hose into the engine through the engine return and backflush the engine.
2. Connect a suitable hose pipe to the upper coolant hose connection of the engine.
3. Turn the water supply valve to the hose ON and allow water pressure to flow through the engine.
4. Allow water pressure to flow through the engine for approximately five minutes.
5. Turn the water supply valve to the hose OFF and disconnect the hose pipe from the upper coolant hose connection of the engine.
6. Connect the upper coolant hose to the engine.
7. Fill the cooling system as described using a 50% mixture of Jaguar Premium Cooling System Fluid or equivalent, meeting Jaguar specification ESE-M97B44-A and 50% distilled water.

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Engine Cooling - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Cooling System Draining, Filling and Bleeding

General Procedures

• 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 blow 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.

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.

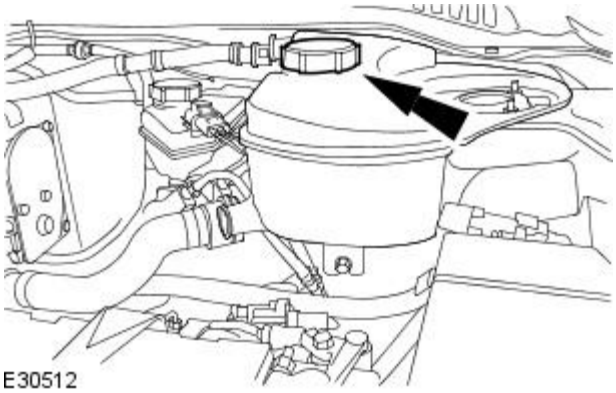
• CAUTIONS:

Do not run the engine without first making sure the engine cooling fans operate. Start the engine, set air conditioning (A/C) to maximum cold, set the blower motor to maximum and observe that the engine cooling fan operates. Failure to follow this instruction may cause damage to the engine.

The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage.

Do not RUN the engine with the coolant pressure cap removed. Failure to follow this instruction may cause damage to the engine.

Do not RUN the engine without the correct level of coolant. Failure to follow this instruction may cause damage to the engine.



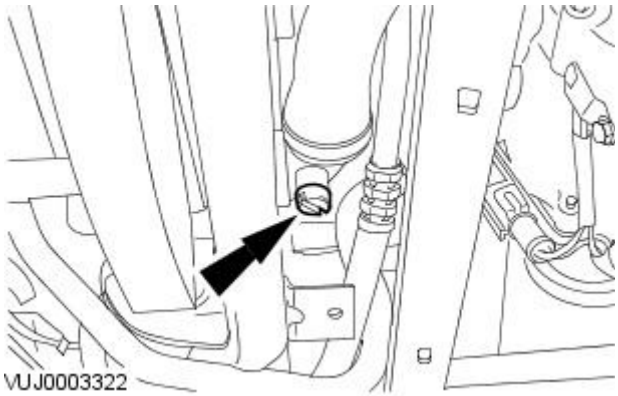
1. WARNING: Relieve the cooling system pressure by unscrewing the coolant pressure cap.

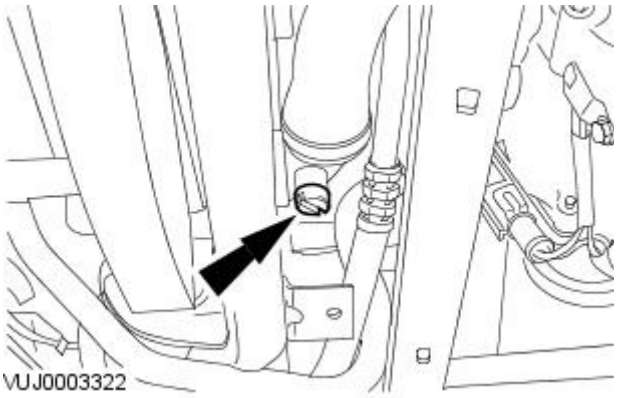
Remove the coolant expansion tank pressure cap.

2. Remove the undertray. For additional information, refer to Section 501-02 Front End Body Panels.

3. Remove the coolant drain plug.

- Drain the coolant into a suitable container.

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4. CAUTION: Do not over tighten the drain plug. Failure to follow this instruction may cause damage to the vehicle.

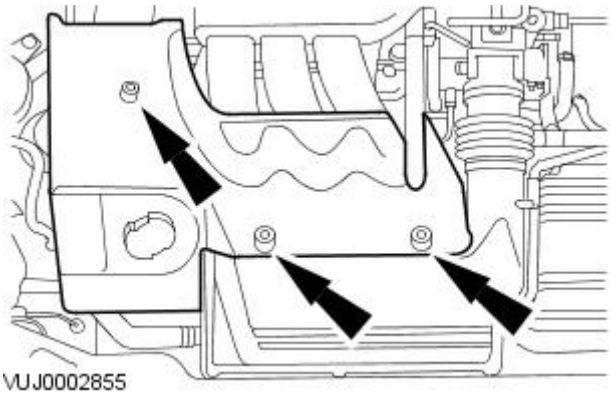
Install the drain plug when all coolant has drained.

- Tighten to 1 Nm.
- Remove the drain tray.

5. Install the undertray. For additional information, refer to Section 501-02 Front End Body Panels.

6. Lower the vehicle.

7. Remove the engine cover.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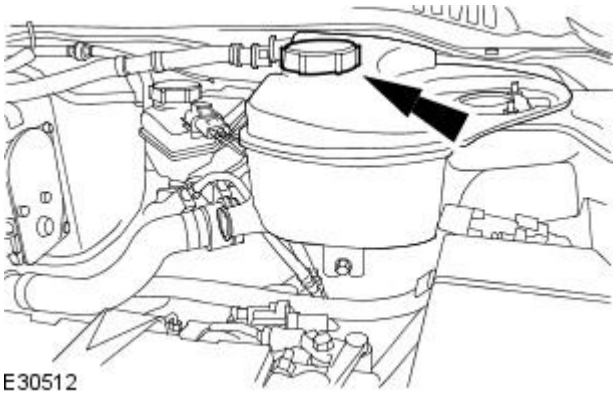
8. Fill the cooling system up to the MAX mark on the coolant expansion tank using a 50% mixture of Jaguar Premium Cooling System Fluid or equivalent, meeting Jaguar specification ESE-M97B44-A and 50% distilled water.

9. Install the coolant expansion tank pressure cap.

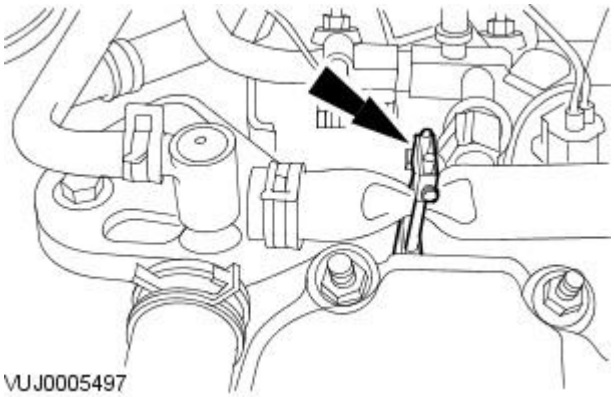

E30512

10. NOTE: During this procedure the thermostat should open.

START and RUN the engine at 2000 rpm until the cooling fan operates.

11. Stop the engine and allow to cool for two minutes.

12. Loosely install a pipe clamp to the heater inlet hose.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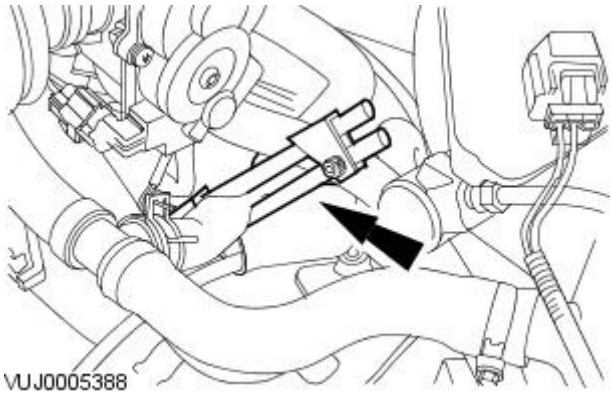
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13. Loosely install a pipe clamp to the heater return hose.

14. START and RUN the engine at 2000 rpm.

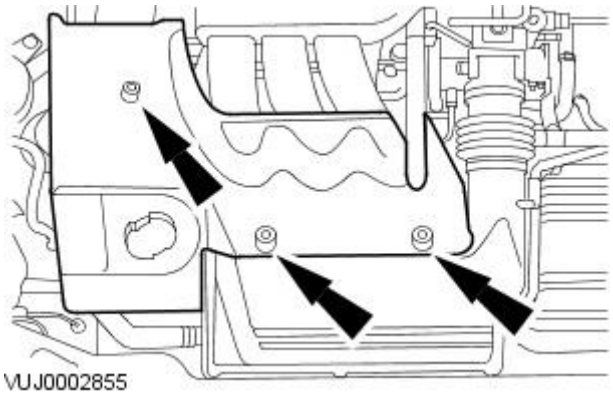
15. With the engine at 2000 rpm, fully clamp the heater outlet hose and then fully clamp the heater inlet hose.

16. Continue to run the engine for a further two minutes.

17. Switch the engine off.

18. Remove the heater hose clamps.

19. Fit the engine cover.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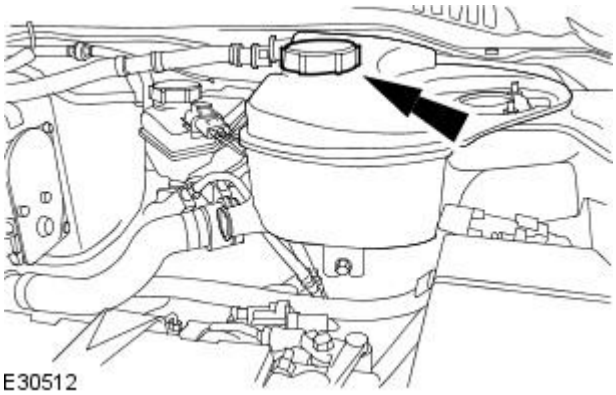
20. Allow the vehicle to cool to room temperature.

21. Remove the coolant expansion tank pressure cap, top up the coolant level to the MAX mark on the coolant expansion tank.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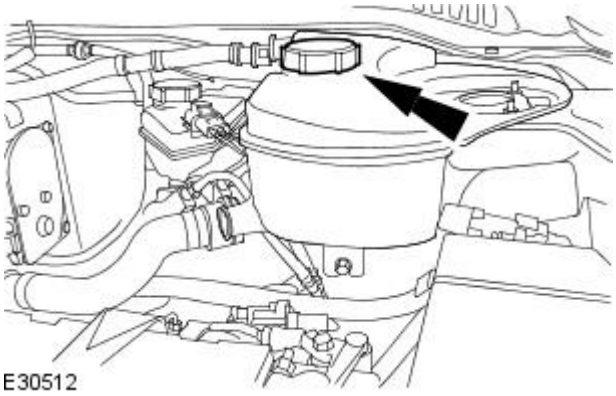
22. Install the coolant expansion tank pressure cap.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Engine Cooling - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Cooling System Flushing

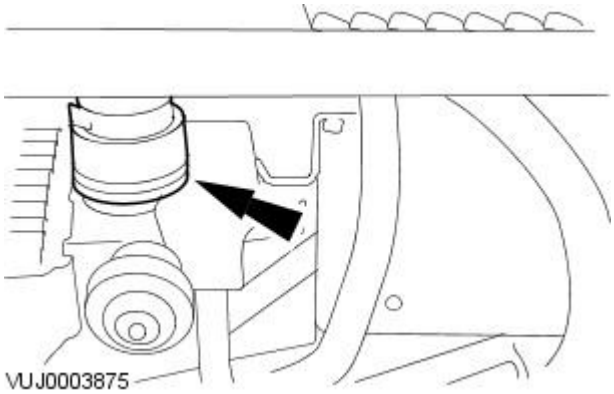
General Procedures

• NOTE: To remove rust, sludge and other foreign material from the cooling system, use Premium Cooling System flush, meeting Jaguar specification EGR-M14P7-A, which is safe for use with aluminium cooling systems. This cleaning restores cooling system efficiency and helps prevent overheating.

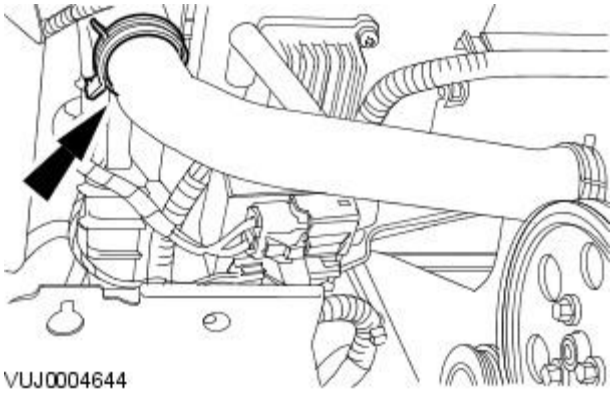
• NOTE: In severe cases where cleaning solvents will not properly clean the cooling system, it will be necessary to use the pressure flushing method using Cooling System Flusher, 164-R3670 to restore efficient operation.

• NOTE: A pulsating or reversed direction of flushing water will loosen sediment more quickly than a steady flow in the normal coolant flow direction.

• NOTE: Dispose of old coolant and flushing water contaminated with coolant and cleaning chemicals in accordance with local, state and federal laws.



1. Remove the air cleaner. For additional information, refer to Section 303-12A Intake Air Distribution and FilteringSection 303-12B Intake Air Distribution and Filtering.
2. Remove the thermostat. For additional information, refer to Thermostat.
3. Detach the lower coolant hose from the radiator and position to one side.



4. Lower the vehicle.
5. Detach the upper coolant hose from the radiator.
6. Connect a hose pipe to the radiator upper coolant hose connection using a suitable connector.
7. CAUTION: Radiator internal pressure must not exceed 100 kPa (14.5 psi). Failure to follow this instruction may cause damage to the radiator.

   Flush the radiator using the hose pipe until the coolant flowing from the radiator lower coolant hose connection is clear.
8. Remove the hose pipe from the radiator upper coolant hose connection.
9. Connect a hose pipe to the upper coolant hose using a suitable connector.
10. Flush the engine using the hose pipe until the coolant flowing from the radiator lower coolant hose is clear.
11. Remove the hose pipe from the upper coolant hose connection.
12. Connect the upper coolant hose to the radiator.
13. Install the thermostat. For additional information, refer to Thermostat.
14. Fill the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding.
15. Install the undertray. For additional information, refer to Section 501-02 Front End Body Panels.
16. Install the air cleaner. For additional information, refer to Section 303-12A Intake Air Distribution and FilteringSection 303-12B Intake Air Distribution and Filtering.

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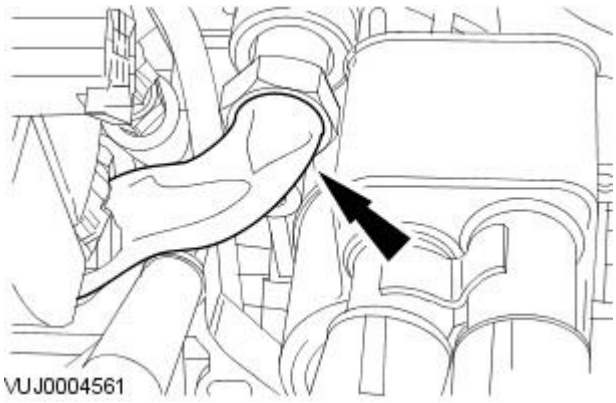
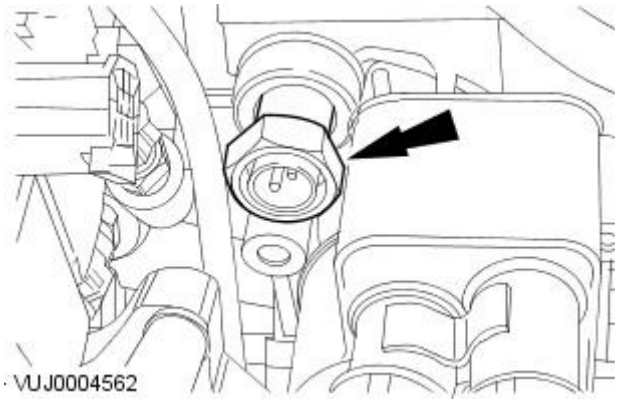
Engine Cooling - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Block Heater

Removal and Installation

Removal

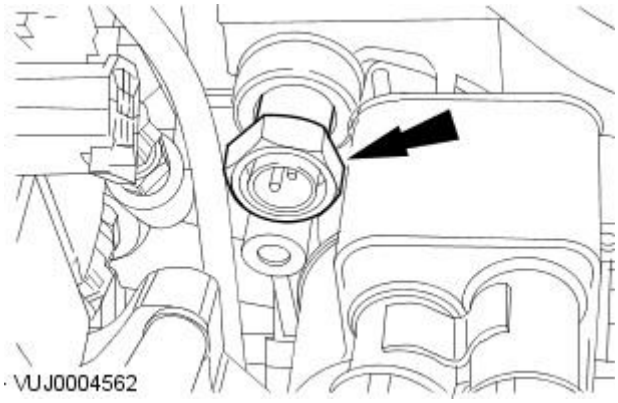


1. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding.
2. Disconnect the block heater electrical connector.



3. Remove the block heater.

Installation



1. To install, reverse the removal procedure.
   - Tighten to 40 Nm.
2. Fill the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding.

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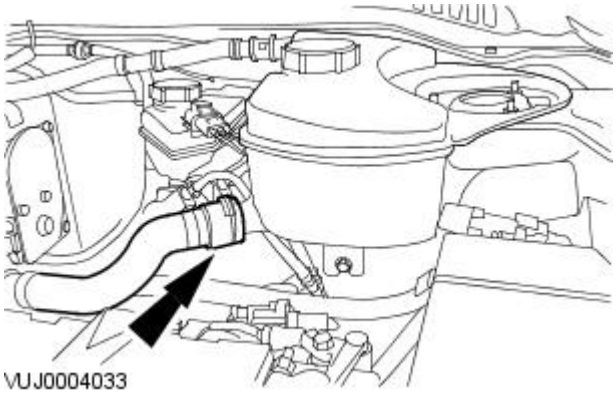
Engine Cooling - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Coolant Expansion Tank

Removal and Installation

Removal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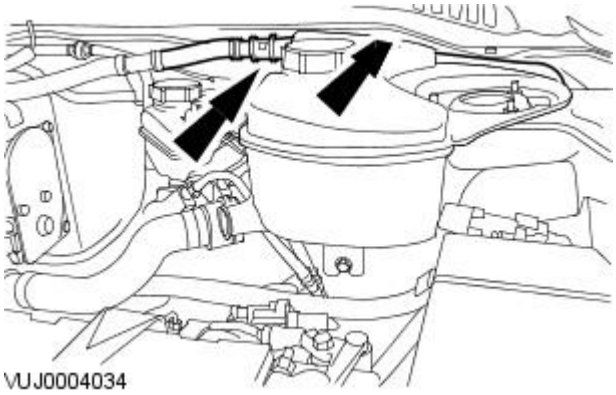
1. NOTE: Clamp the hose to minimize coolant loss.

Detach the coolant expansion tank outlet hose from the coolant expansion tank.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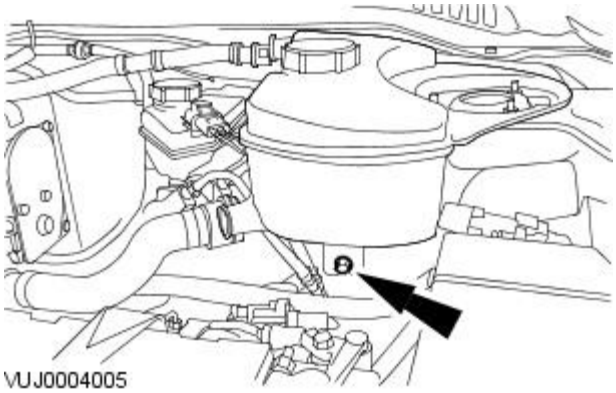
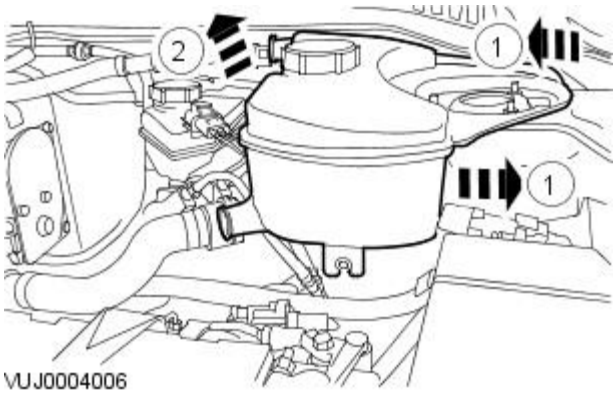
2. NOTE: Clamp the hoses to minimize coolant loss.

Detach the cooling system vent hoses from the coolant expansion tank.


VUJ0004005

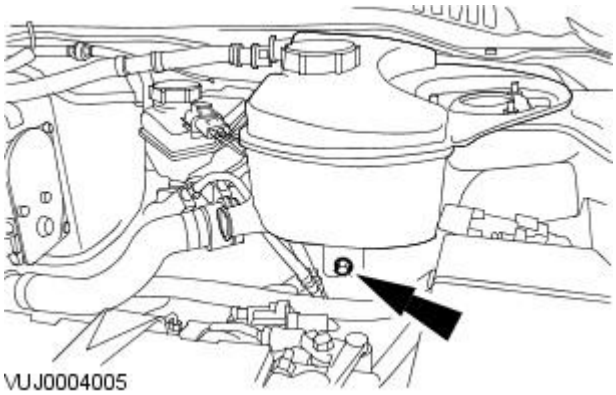
3. Remove the coolant expansion tank retaining bolt.



VUJ0004006

4. Remove the coolant expansion tank.

Installation



1. To install, reverse the removal procedure.

- Tighten to 3 Nm.

2. Check and top up the cooling system.

Published: 11-May-2011

Engine Cooling - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Cooling Fan Module

Removal and Installation

Removal

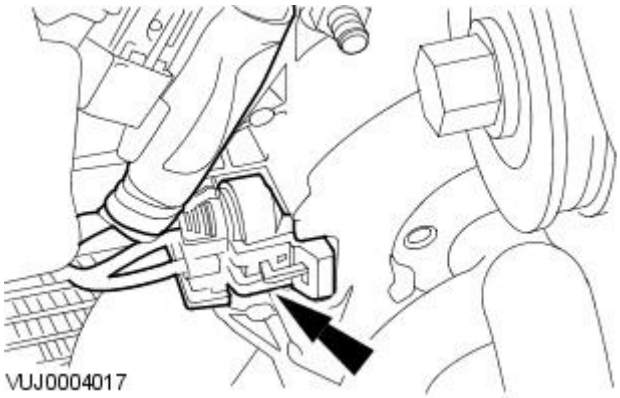
1. Remove the air cleaner. For additional information, refer to:

Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation),
Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

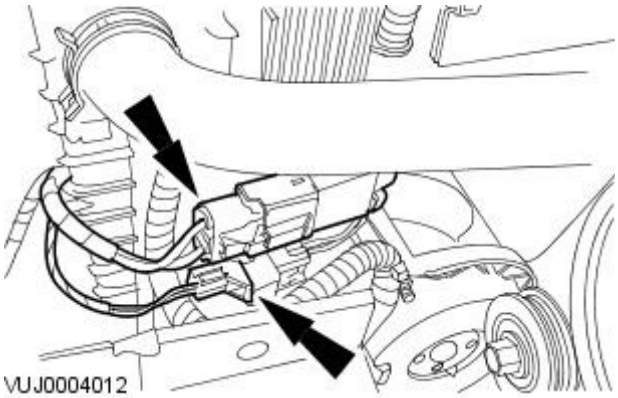
2. Remove the battery tray.
For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

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

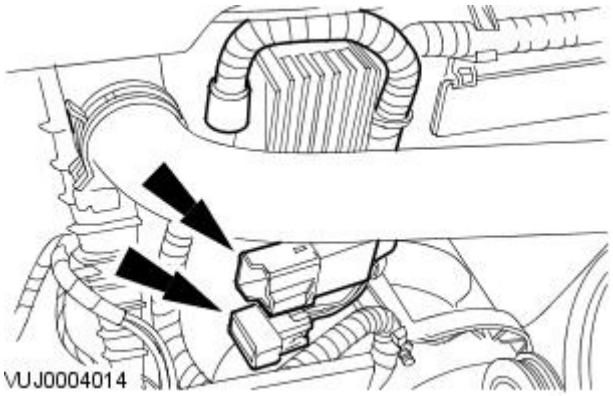
Disconnect the cooling fan motor electrical connectors.

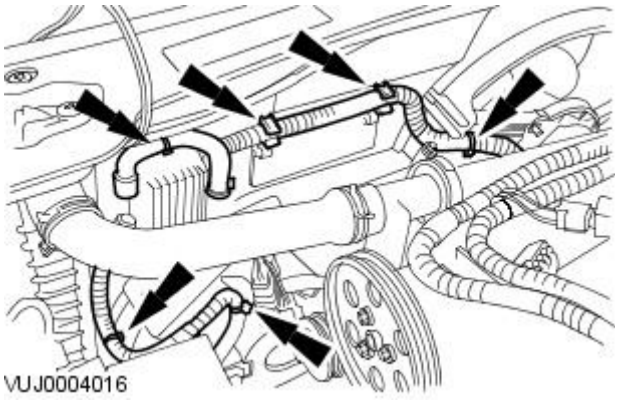


4. Disconnect the cooling fan module electrical connectors.

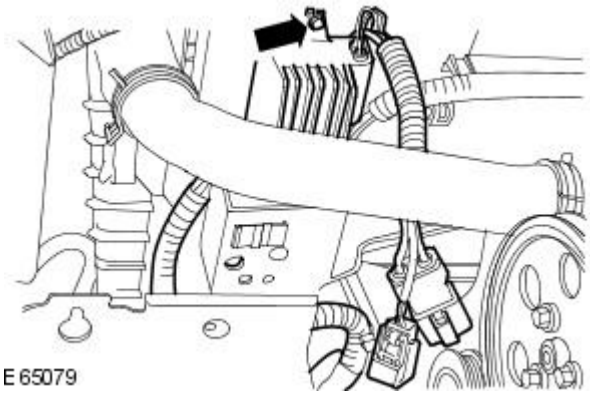


5. Detach the cooling fan module electrical connectors from the cooling fan shroud.



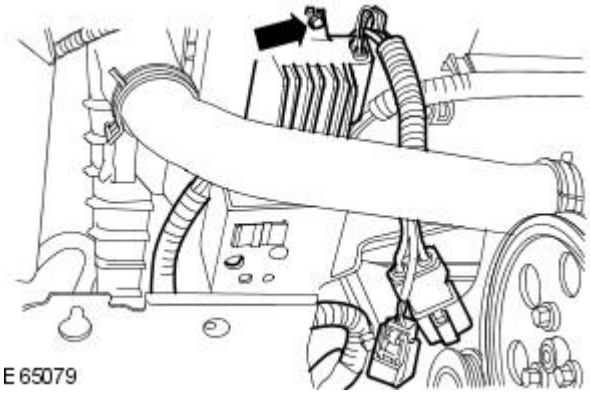


6. Detach the cooling fan module wiring harness from the cooling fan shroud.



7. Remove the cooling fan module.

Installation



1. To install reverse the removal procedure.

- Tighten to 3 Nm.

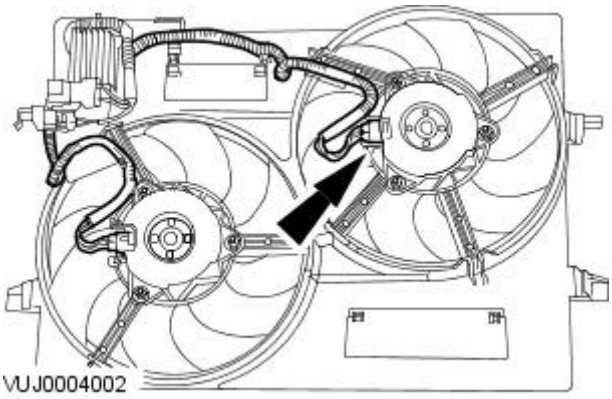
Published: 11-May-2011

Engine Cooling - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Cooling Fan Motor

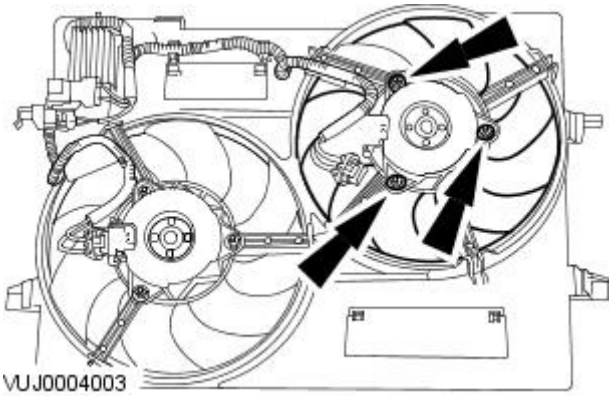
Removal and Installation

Removal

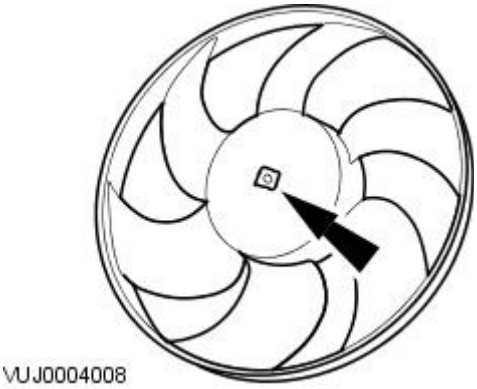
1. Remove the cooling fan motor and shroud. For additional information, refer to Cooling Fan Motor and Shroud.
2. Disconnect the cooling fan motor electrical connector.



3. Remove the cooling fan motor assembly.

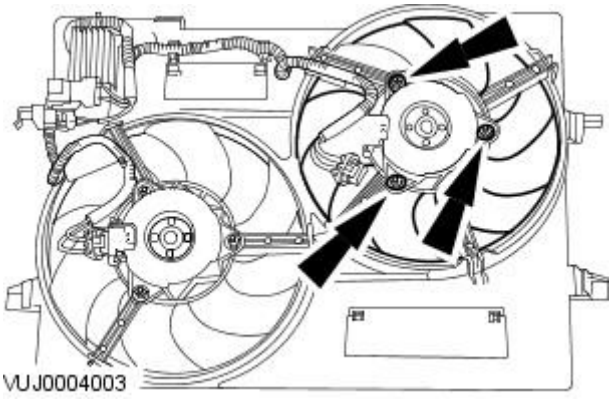


4. Remove the cooling fan from the cooling fan motor.



Installation

1. To install, reverse the removal procedure.
   - Tighten to 6 Nm.



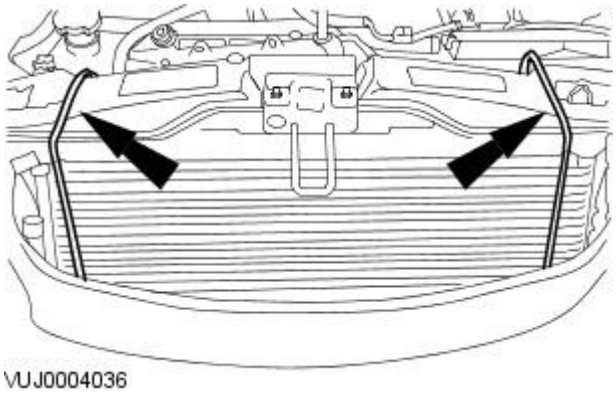
Published: 11-May-2011

Engine Cooling - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Cooling Fan Motor and Shroud

Removal and Installation

Removal

All vehicles


VUJ0004036

1. Remove the air cleaner.
For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

2. CAUTION: Make sure that the air conditioning (A/C) condenser is not damaged when installing the retaining straps. Failure to follow this instruction may result in damage to the vehicle.

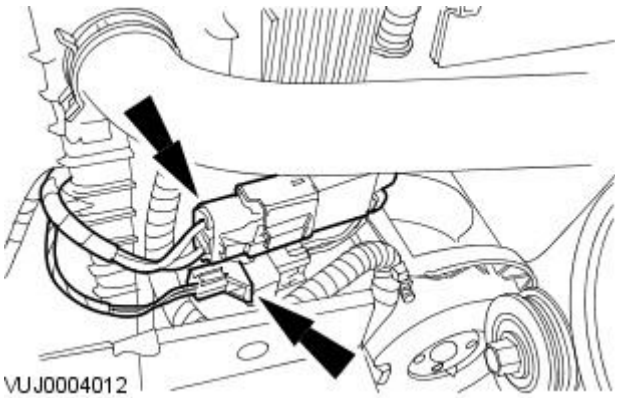
• NOTE: To allow the cooling module to be partially lowered and supported when the radiator support beam is removed, suitable retaining straps must be installed to the radiator.

Loosely attach suitable retaining straps to the radiator.

3. Drain the cooling system.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).

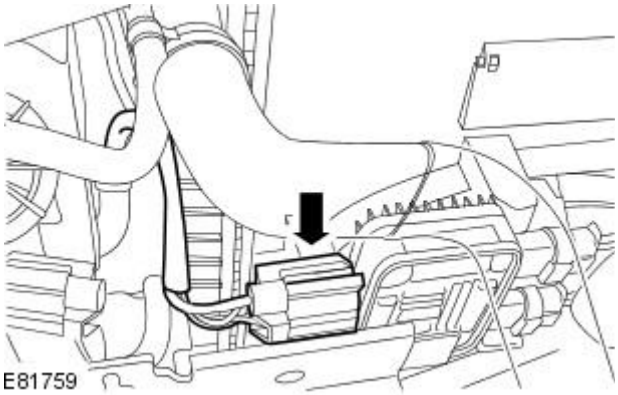
4. Lower the vehicle.

Vehicles built up to VIN:E71956


VUJ0004012

5. Disconnect the cooling fan motor control module electrical connectors.

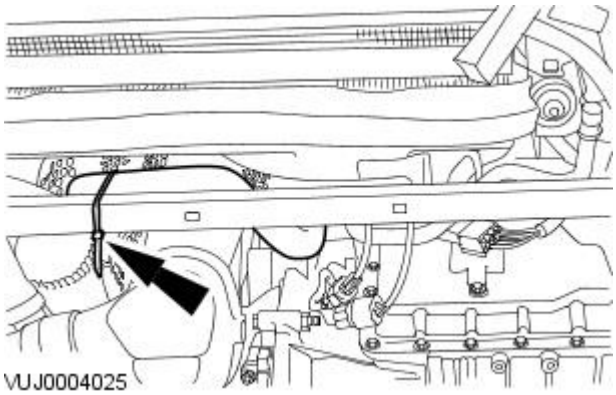
Vehicles built from VIN:E71957


E81759

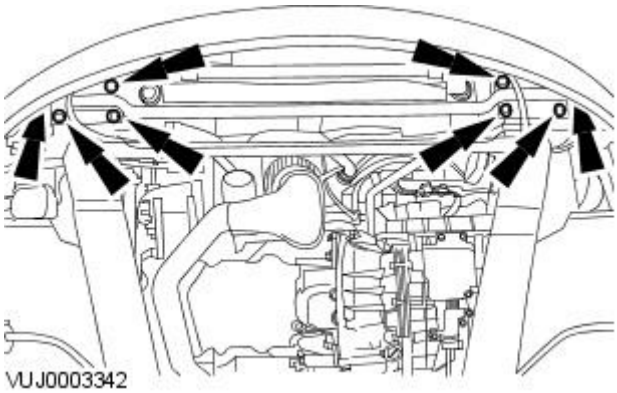
6. Disconnect the cooling fan motor control module electrical connector.

All vehicles

7. Raise the vehicle.

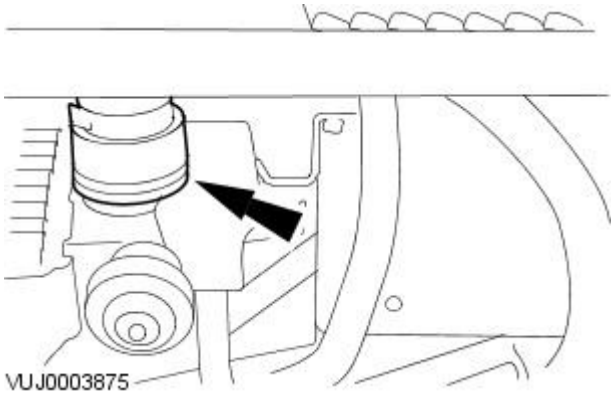

VUJ0004025

8. Reposition the coolant hose from the engine oil cooler to the thermostat housing and secure it to the front cross member using a suitable retaining strap.

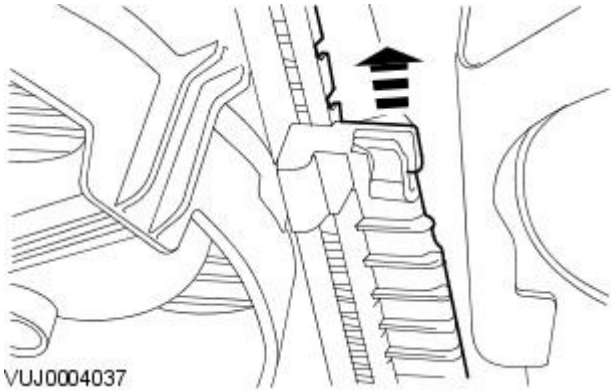

VUJ0003342

9. Remove the radiator support beam.

- Allow the cooling module to be partially lowered and supported by the retaining straps.


VUJ0003875

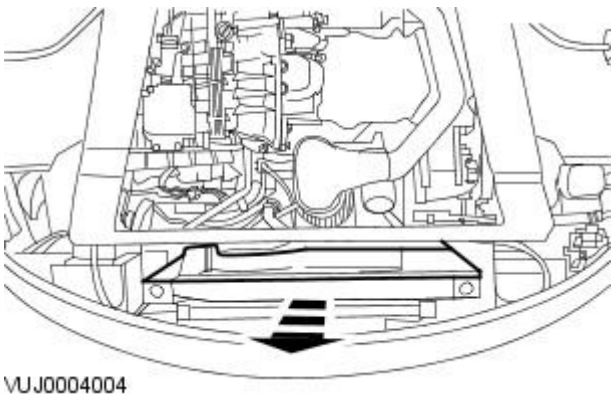
10. Detach the lower coolant hose from the radiator and position to one side.


VUJ0004037

11. CAUTION: Make sure that the retaining lugs of the radiator are not damaged when displacing the cooling fan motor and shroud. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Right-hand shown, left-hand similar.

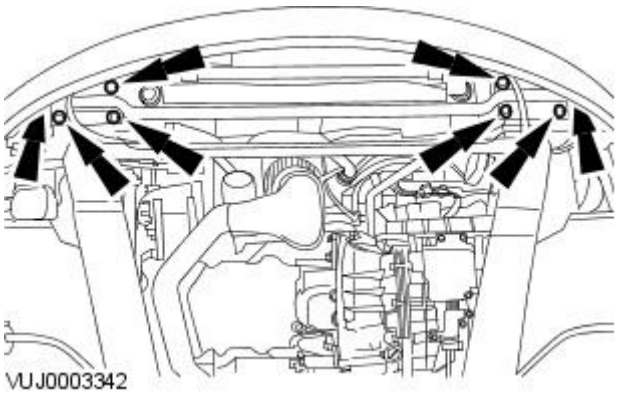
Displace the cooling fan motor and shroud from the retaining lugs of the radiator.


VUJ0004004

12. CAUTION: Make sure that the radiator is not damaged when removing the cooling fan motor and shroud. Failure to follow this instruction may result in damage to the vehicle.

Remove the cooling fan motor and shroud.

Installation



1. CAUTIONS:

Make sure that the radiator is not damaged when installing the cooling fan motor and shroud. Failure to follow this instruction may result in damage to the vehicle.

Make sure that the retaining lugs of the radiator are not damaged when installing the cooling fan motor and shroud. Failure to follow this instruction may result in damage to the vehicle.

To install, reverse the removal procedure.

- Tighten to 25 Nm.

2. Fill the cooling system.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).

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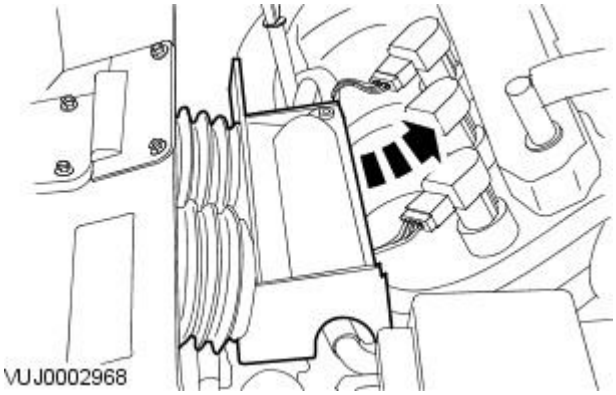
Engine Cooling - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Cooling Module

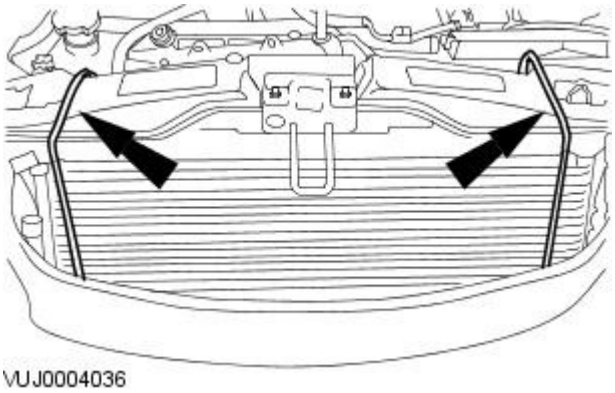
Removal and Installation

Removal

All Vehicles


VUJ0002968

1. Remove the air cleaner.
   For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).
2. Remove the air cleaner intake duct.

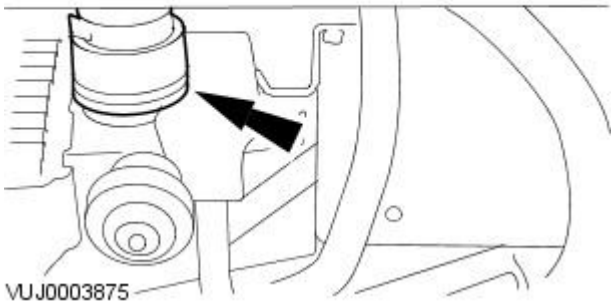

VUJ0004036

3. CAUTION: Make sure that the air conditioning (A/C) condenser is not damaged when installing the retaining straps. Failure to follow this instruction may result in damage to the vehicle.

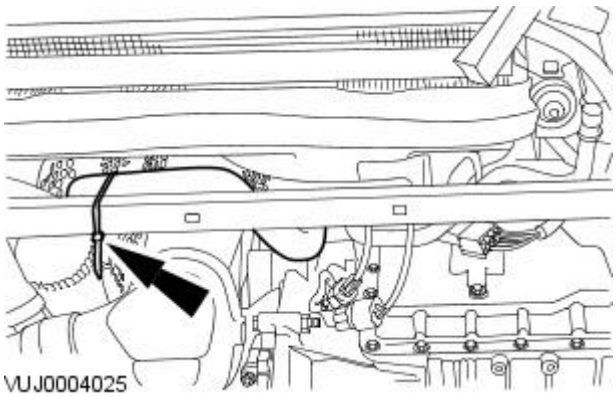
   • NOTE: To allow the cooling module to be partially lowered and supported when the radiator support beam is removed, suitable retaining straps must be installed to the A/C condenser.

   Loosely attach suitable retaining straps to the A/C condenser.

4. Drain the cooling system.
   For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).
5. Detach the lower coolant hose from the radiator and position to one side.


VUJ0003875

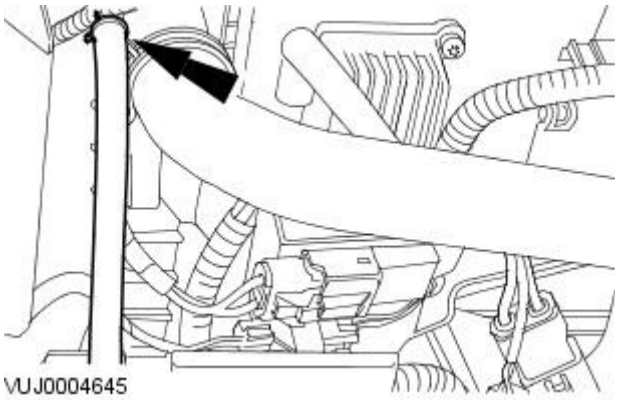
6. Reposition the coolant hose from the engine oil cooler to the thermostat housing and secure it to the front cross member using a suitable retaining strap.


VUJ0004025

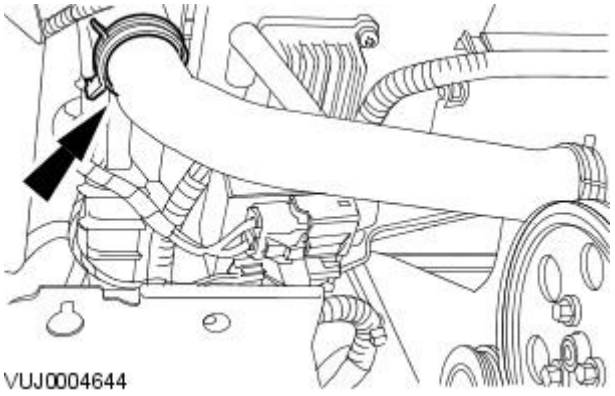
7. Lower the vehicle.

Vehicles built up to VIN:E71956

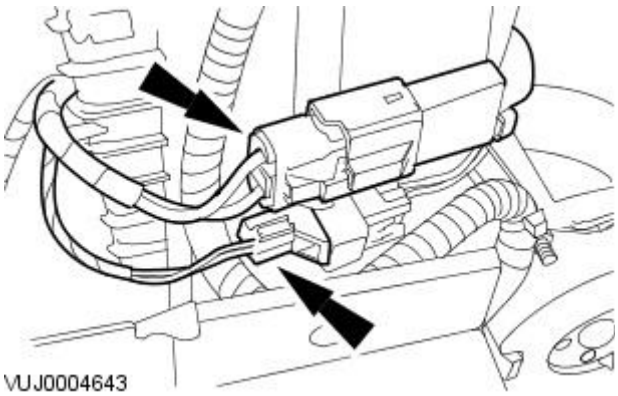
8. Detach the radiator vent hose from the radiator.



9. Detach the upper coolant hose from the radiator.

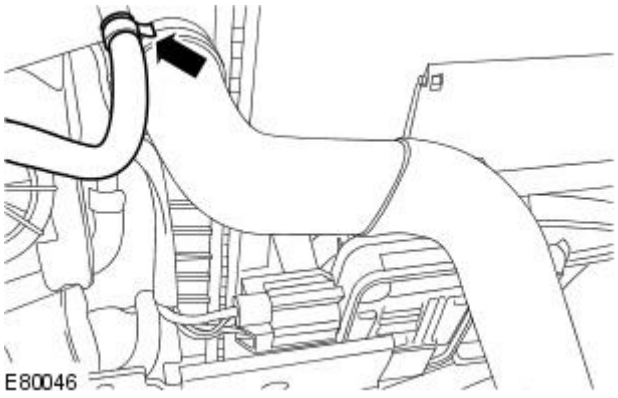


10. Disconnect the cooling fan motor control module electrical connectors.

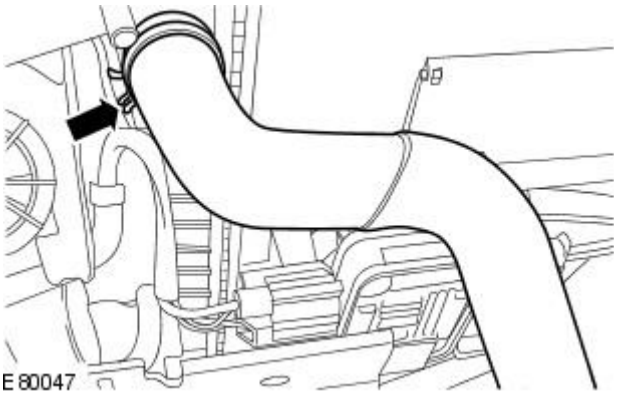


Vehicles built from VIN:E71957

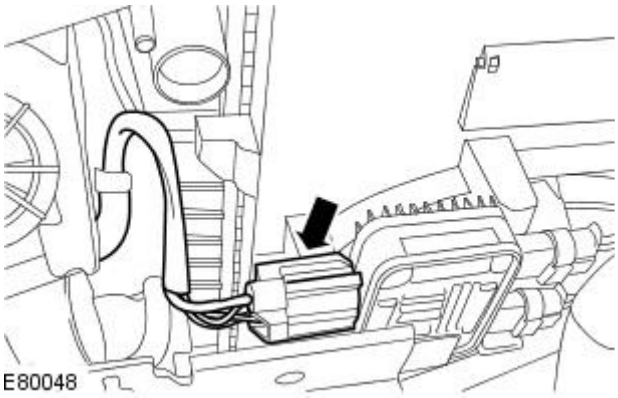
11. Detach the radiator vent hose from the radiator.



12. Detach the upper coolant hose from the radiator.



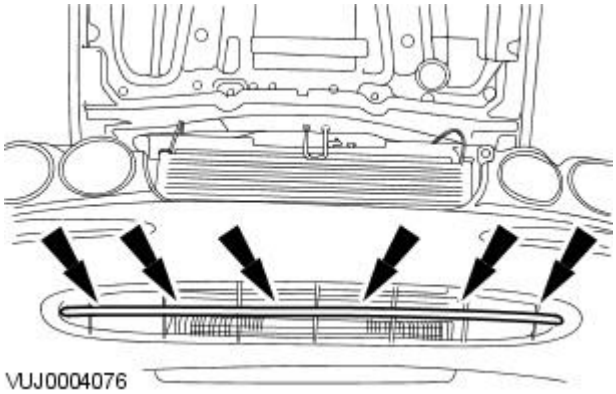
13. Disconnect the cooling fan motor control module electrical connector.



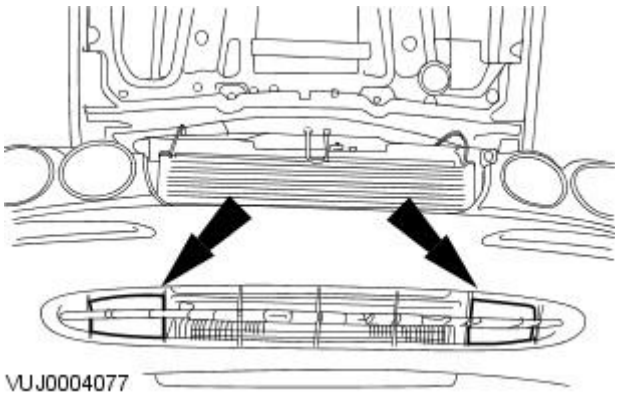
All vehicles

14. Raise the vehicle.

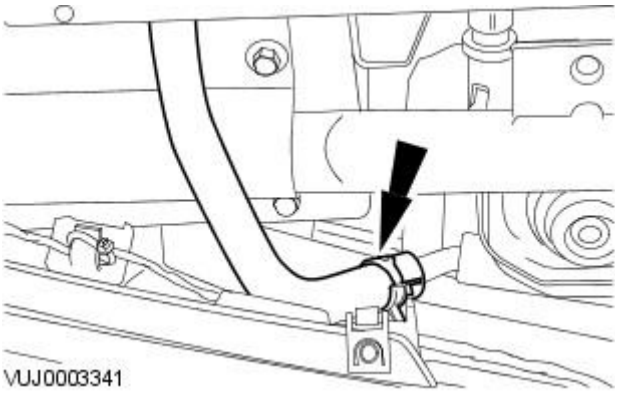
15. Remove the air splitter grille.



16. Remove the front towing eye trims.



Vehicles With Automatic Transmission

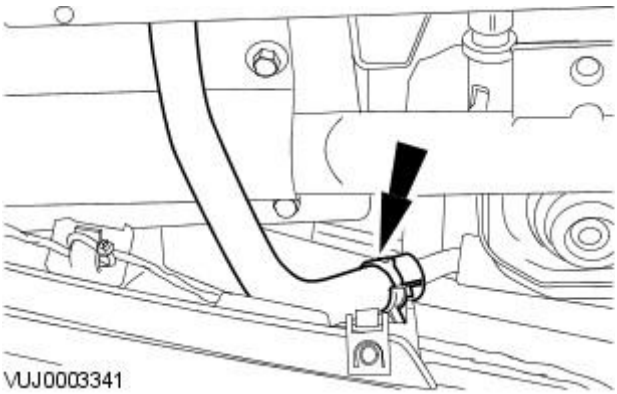


17. NOTE: Left-hand side shown, right-hand side similar.

Detach the power assisted steering oil cooler inlet and return pipes.

- Allow the power assisted steering fluid to drain into a suitable container.
- Using suitable blanking plugs, blank the exposed ports.

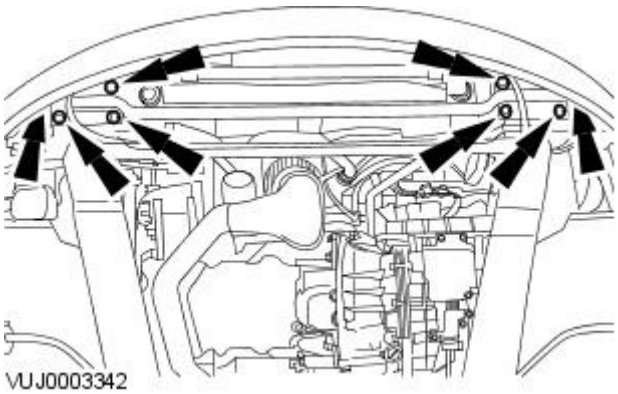
Vehicles With Manual Transmission



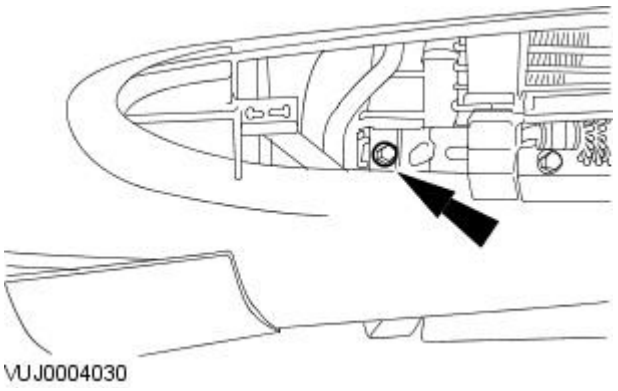
18. Detach the power assisted steering oil cooler inlet pipe.

- Allow the power assisted steering fluid to drain into a suitable container.
- Using suitable blanking plugs, blank the exposed ports.

All Vehicles

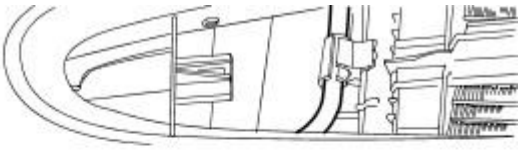


19. Remove the radiator support beam.

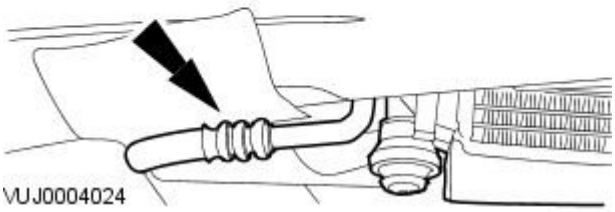


20. CAUTION: Apply suitable tape to the right-hand side lower section of the front bumper to prevent damage to the paintwork from the A/C pipe when the cooling module is lowered. Failure to follow this procedure may cause damage to the vehicle.

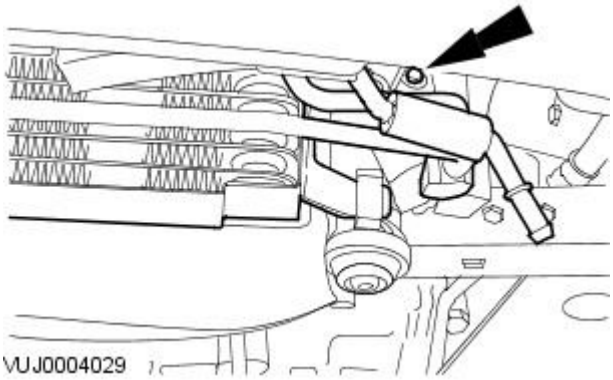
Remove the right-hand side A/C condenser retaining bolt from the radiator.



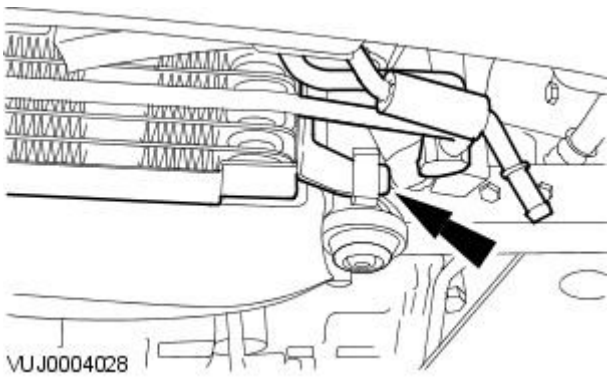
21. Lower the cooling module and the A/C condenser to a position where the air conditioning pipe is forward of the front bumper.



22. Remove the left-hand side A/C condenser retaining bolt from the radiator.



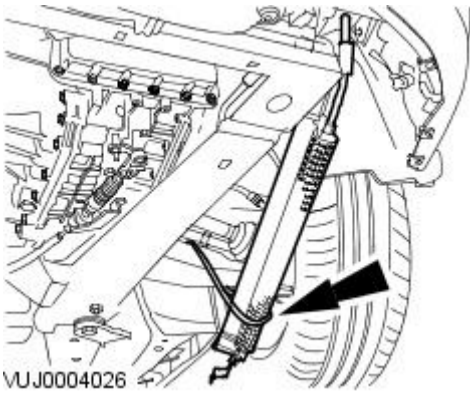
Vehicles With Automatic Transmission



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

• NOTE: The power assisted steering oil cooler remains captive to the automatic transmission oil cooler.

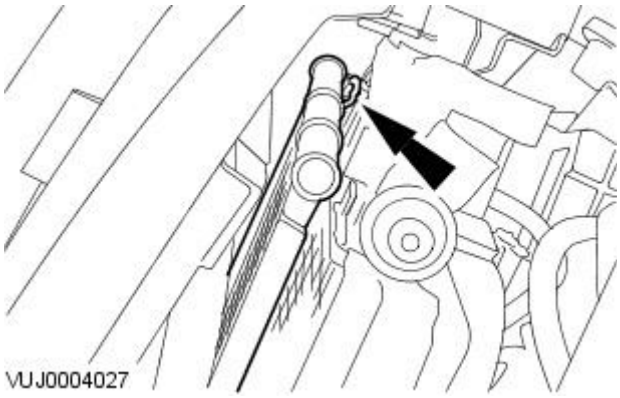
Detach the automatic transmission oil cooler from the radiator.



24. CAUTION: Do not allow the power assisted steering oil cooler and automatic transmission oil cooler to hang on the automatic transmission oil cooler pipes. Failure to follow this instruction may cause damage to the vehicle.

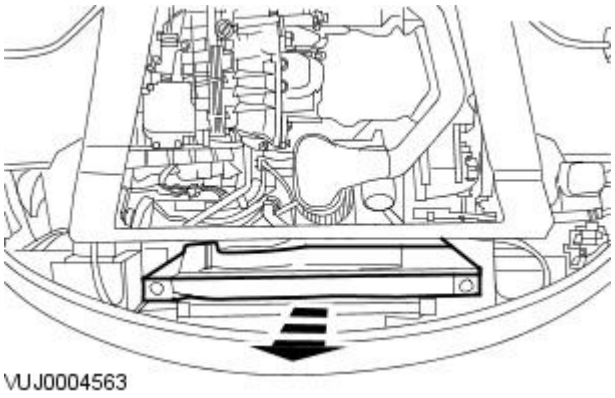
Position the power assisted steering oil cooler and the automatic transmission oil cooler to one side and secure with suitable retaining straps.

All vehicles



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

Detach the cooling module from the A/C condenser.

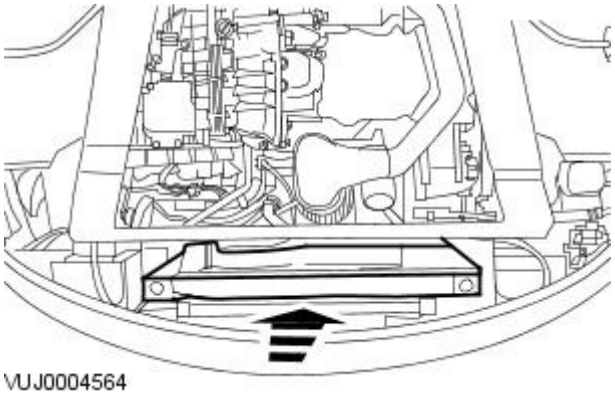


26. CAUTION: Make sure that the radiator and the A/C condenser are not damaged during the removal of the cooling module. Failure to follow this instruction may cause damage to the vehicle.

Remove the cooling module.

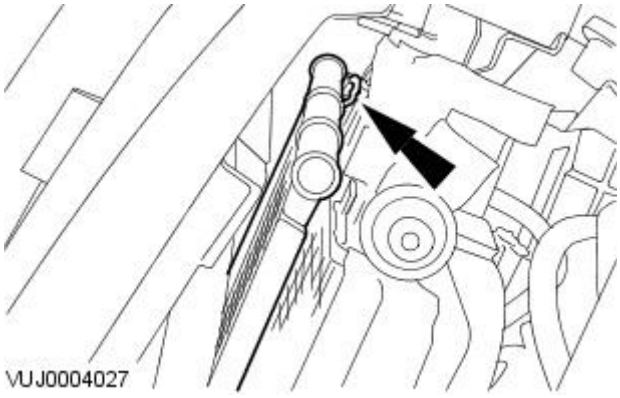
Installation

All vehicles



1. CAUTION: Make sure that the radiator and the A/C condenser are not damaged whilst installing the cooling module. Failure to follow this instruction may cause damage to the vehicle.

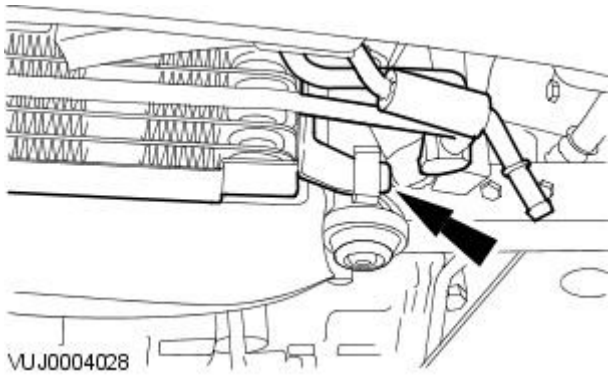
Install the cooling module.



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

Attach the cooling module to the A/C condenser.

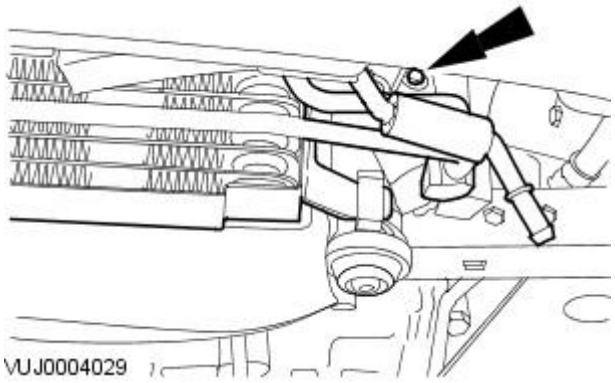
Vehicles With Automatic Transmission



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

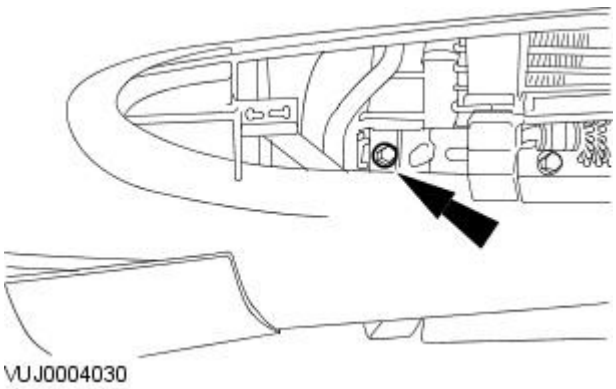
Install the automatic transmission oil cooler to the radiator.

All Vehicles



4. Install the left-hand side A/C condenser retaining bolt.

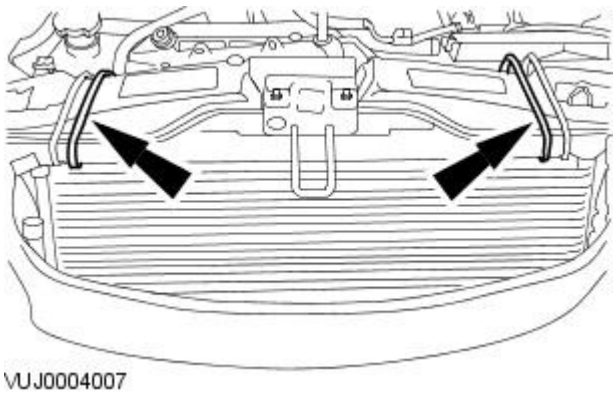
- Tighten to 7 Nm.



5. Install the right-hand side A/C condenser retaining bolt.

- Tighten to 7 Nm.

6. Lower the vehicle.



7. CAUTION: Do not over tighten the retaining straps. Failure to follow this instruction may cause damage to the vehicle.

• NOTE: To allow installation of the radiator support beam, install retaining straps to the radiator to hold the cooling module in position.

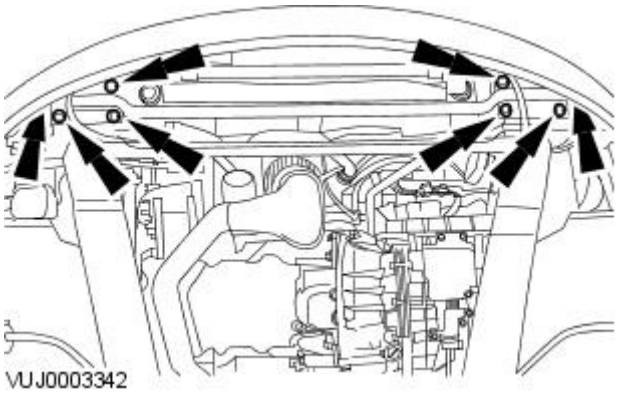
Install suitable retaining straps to the radiator. Align the cooling module to the upper isolator mounting points.

- Carefully tension the retaining straps to hold the cooling module in position.

8. Raise the vehicle.

9. Install the radiator support beam.

- Tighten to 25 Nm.

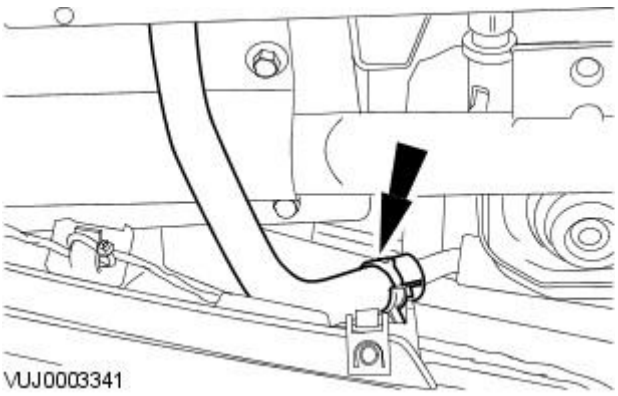


Vehicles With Automatic Transmission

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

Connect the power assisted steering oil cooler inlet and return pipes.

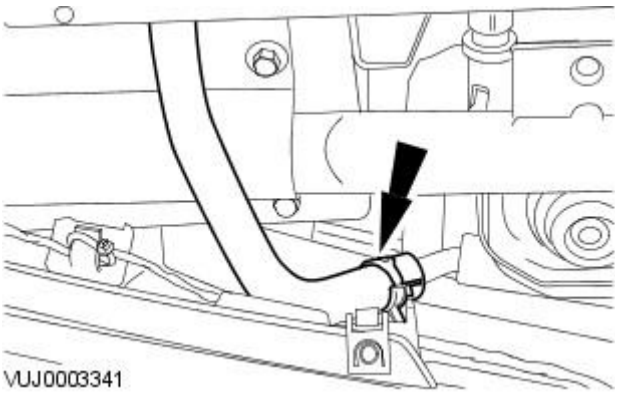
- Remove the blanking plugs.



Vehicles With Manual Transmission

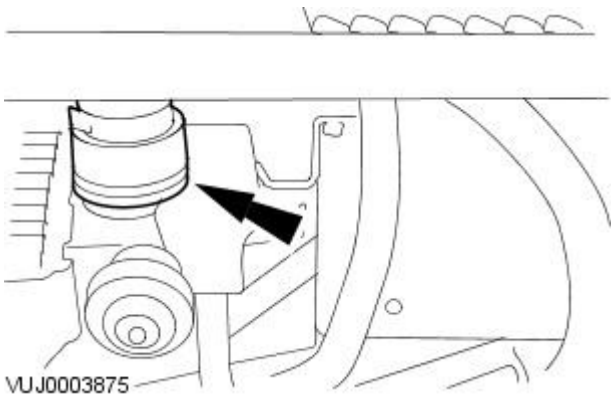
11. Connect the power assisted steering oil cooler inlet pipe.

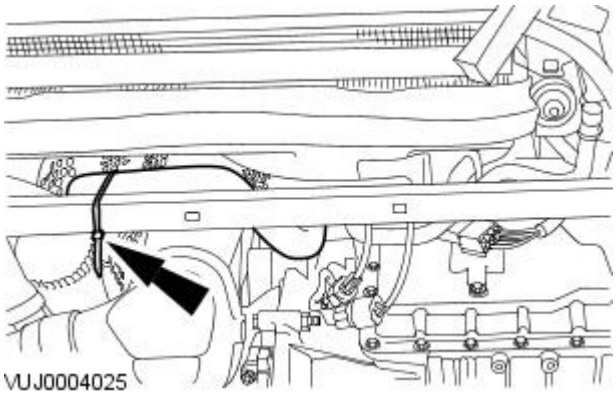
- Remove the blanking plugs.



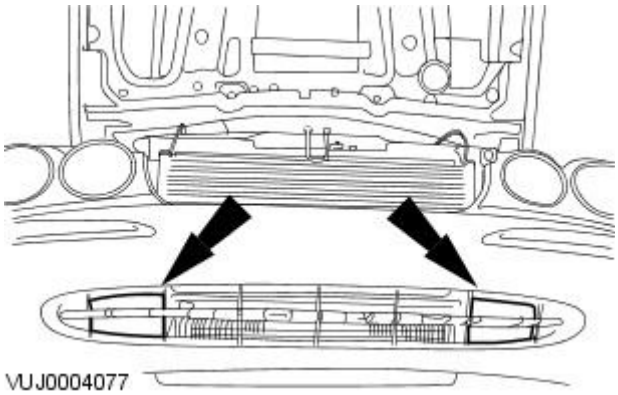
All Vehicles

12. Connect the lower coolant hose to the radiator.

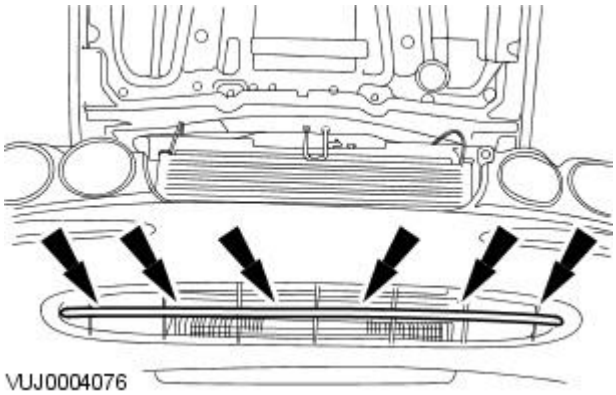



VUJ0004025

13. Remove the retaining strap from the engine oil cooler coolant hose.


VUJ0004077

14. Install the front towing eye trims.

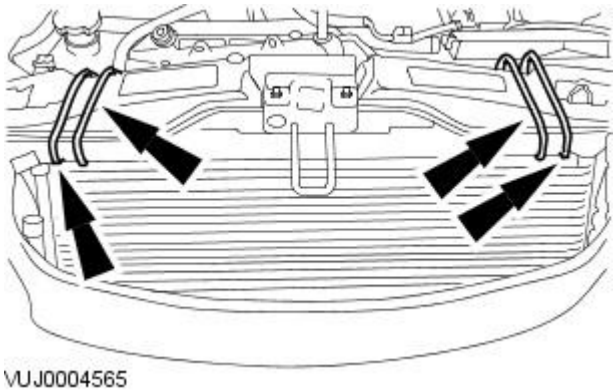

VUJ0004076

15. Install the air splitter grille.

- Remove the protective tape from the front bumper.

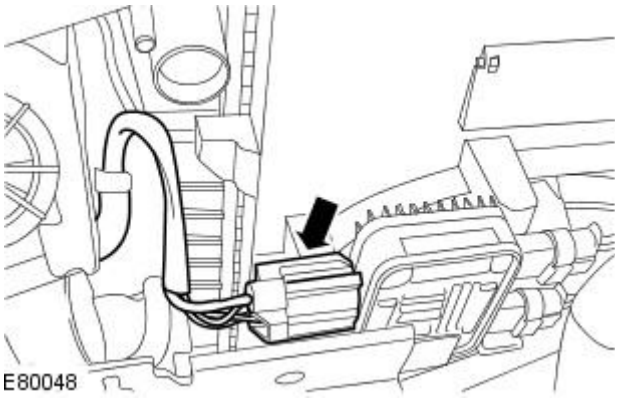
16. Lower the vehicle.

17. Remove the retaining straps from the A/C condenser and radiator.

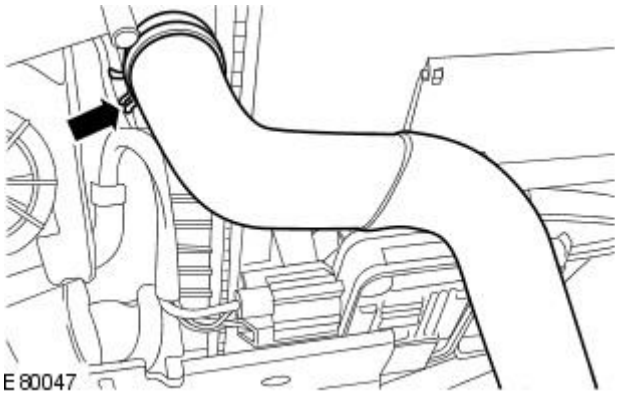

VUJ0004565

Vehicles built from VIN:E71957

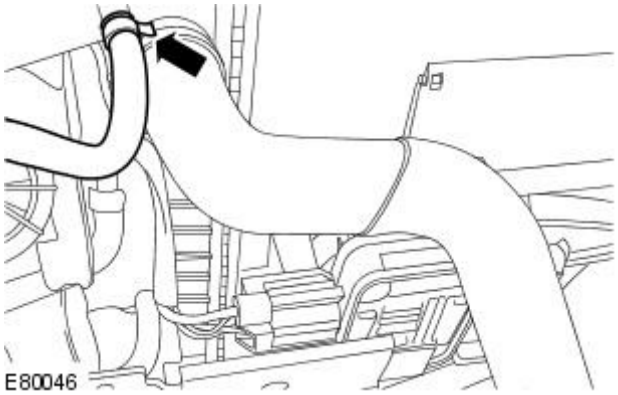
18. Connect the cooling fan motor control module electrical connector.



19. Connect the upper coolant hose onto the radiator.

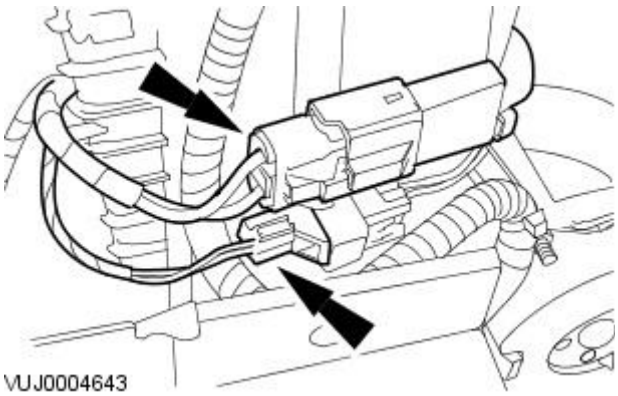


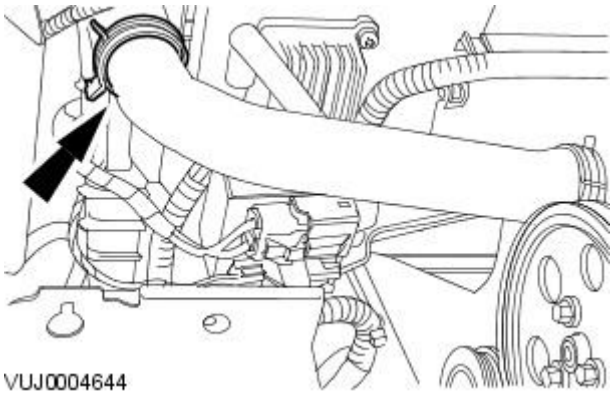
20. Connect the radiator vent hose onto the radiator.



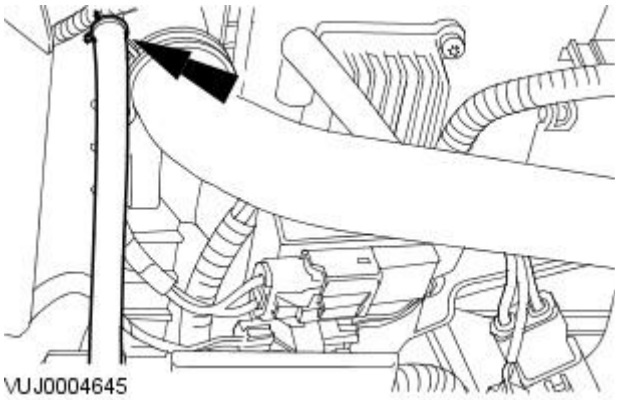
Vehicles built up to VIN:E71956

21. Connect the cooling fan motor control module electrical connectors.



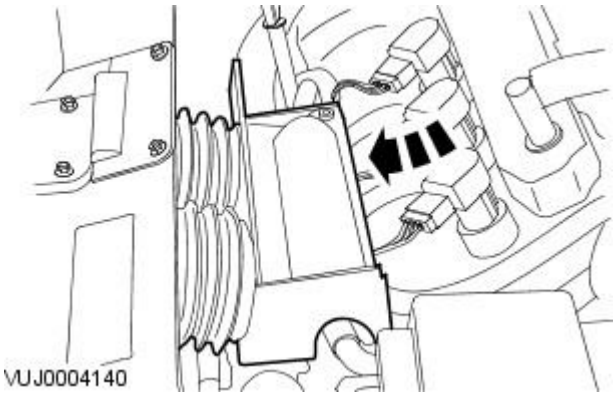


22. Connect the upper coolant hose onto the radiator.



23. Connect the radiator vent hose onto the radiator.

All vehicles



24. Install the air cleaner intake duct.

25. Install the air cleaner.
For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

26. Fill the cooling system.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).

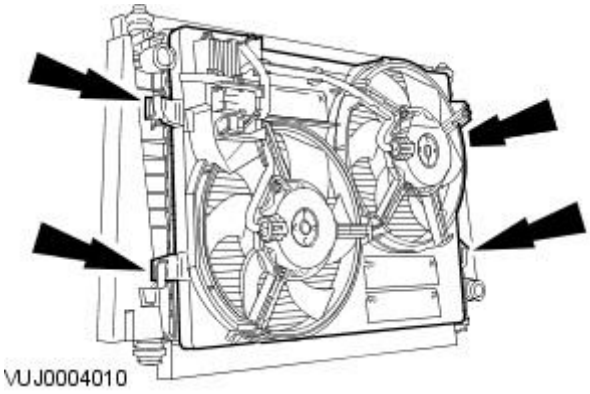
27. Check and adjust the power assisted steering fluid level.

Published: 11-May-2011

Engine Cooling - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Radiator

Removal and Installation

Removal

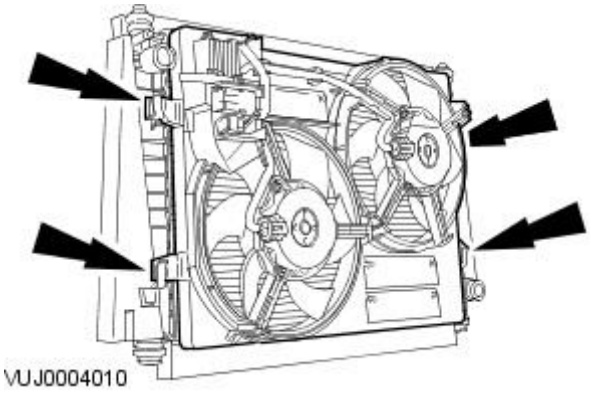


1. Remove the cooling module. For additional information, refer to Cooling Module.

2. CAUTION: Make sure that the retaining lugs of the radiator are not damaged when removing the cooling fan motor and shroud from the radiator.

Remove the cooling fan motor and shroud.

Installation



1. CAUTIONS:

Make sure that the retaining lugs of the radiator are not damaged when installing the cooling fan motor and shroud to the radiator.

The radiator isolator mountings are constructed from a special material. Use only the correct specification radiator isolator mountings.

Inspect the radiator isolator mountings for damage and fatigue. Install new radiator isolator mountings if required.

Inspect the radiator seals for damage and security. Install new radiator seals if required.

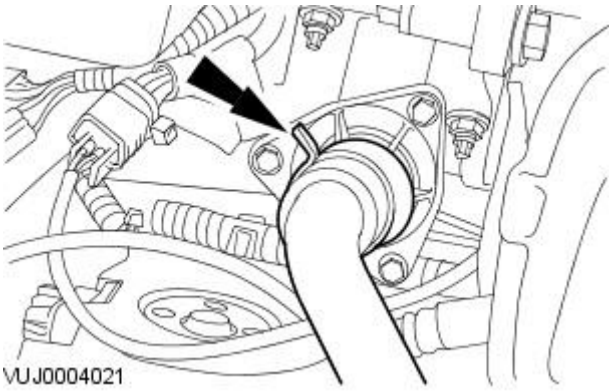
To install, reverse the removal procedure.

Published: 11-May-2011

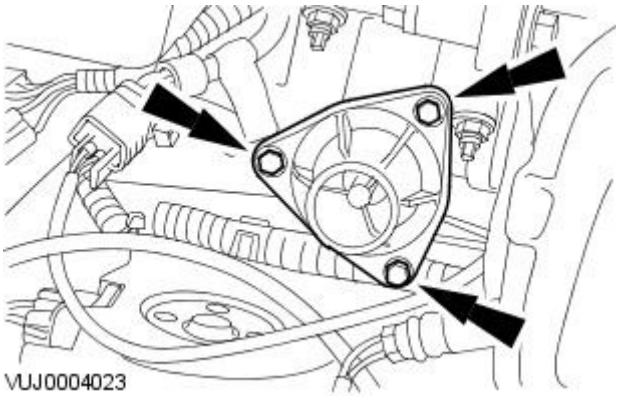
Engine Cooling - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Thermostat

Removal and Installation

Removal


VUJ0004021

1. Drain the cooling system. For additional information, refer to For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).
.
2. Detach the oil cooler coolant hose from the thermostat housing and position to one side.

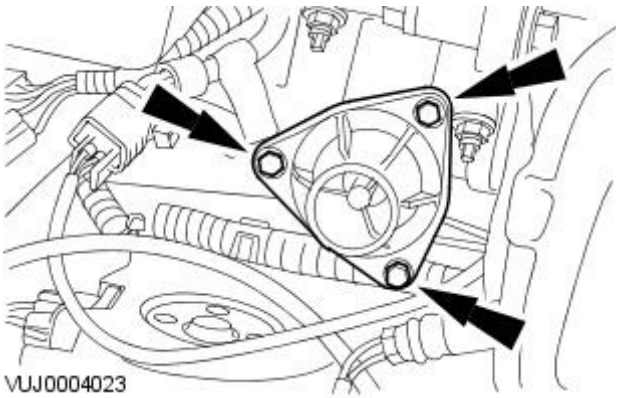

VUJ0004023

3. NOTE: The thermostat remains captive in the thermostat housing.

   Remove the thermostat.

   - Remove and discard the gasket.

Installation


VUJ0004023

1. NOTE: Install a new gasket.

   To install, reverse the removal procedure.

   1. Tighten to 10 Nm.

2. Fill the cooling system. For additional information, refer to For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).
.
3. 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 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).

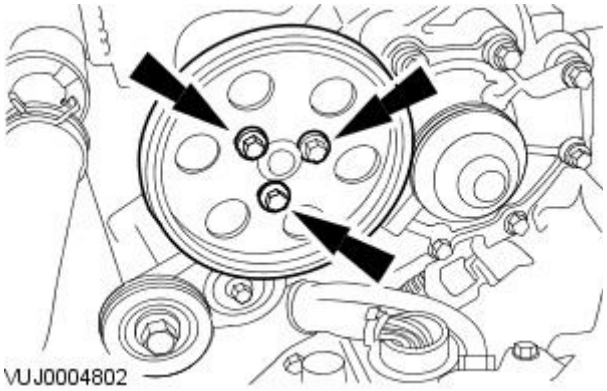
Published: 11-May-2011

Engine Cooling - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Water Pump

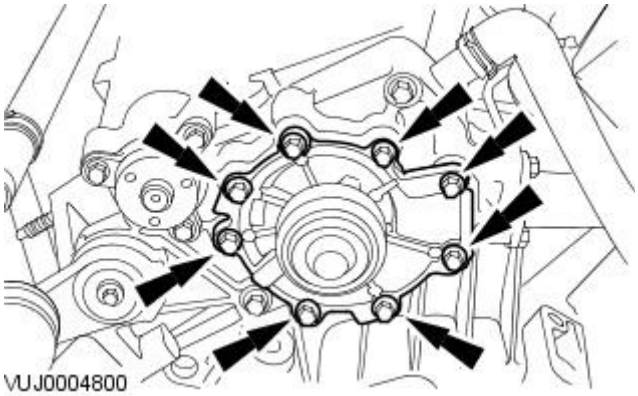
Removal and Installation

Removal

1. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding.
2. Lower the vehicle.
3. Remove the water pump belt. For additional information, refer to Section 303-05 Accessory Drive.
4. Remove the water pump drive pulley.



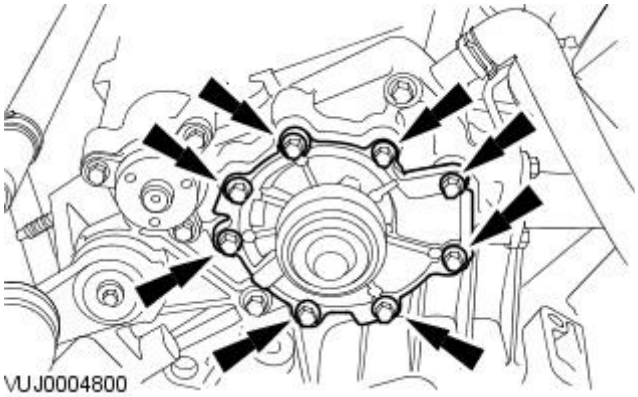
5. Remove the water pump.
   - Remove and discard the gasket.



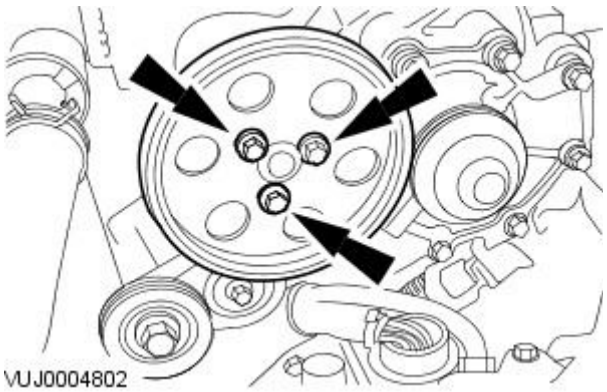
Installation

1. NOTE: Install a new gasket.

   To install, reverse the removal procedure.
   - Tighten to 10 Nm.



2. Tighten to 11 Nm.



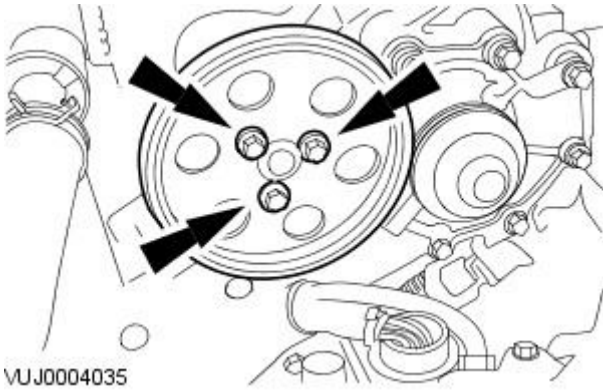
Published: 11-May-2011

Engine Cooling - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Water Pump Housing

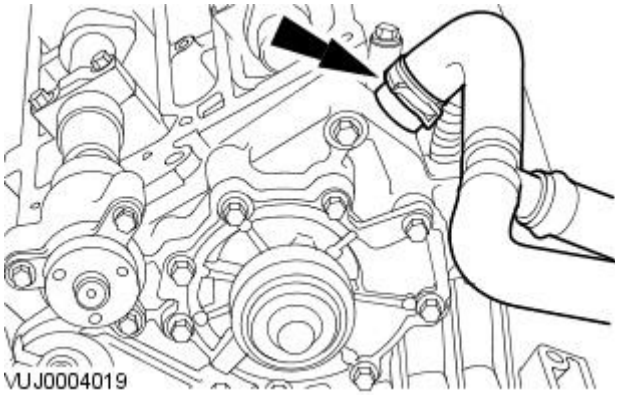
Removal and Installation

Removal

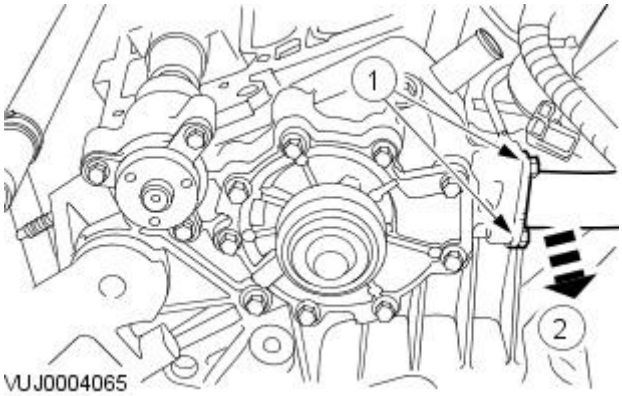
1. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding.
2. Lower the vehicle.
3. Remove the water pump belt tensioner. For additional information, refer to Section 303-05 Accessory Drive.
4. Remove the left-hand valve cover. For additional information, refer to Section 303-01A EngineSection 303-01B Engine.
5. Remove the water pump drive pulley.



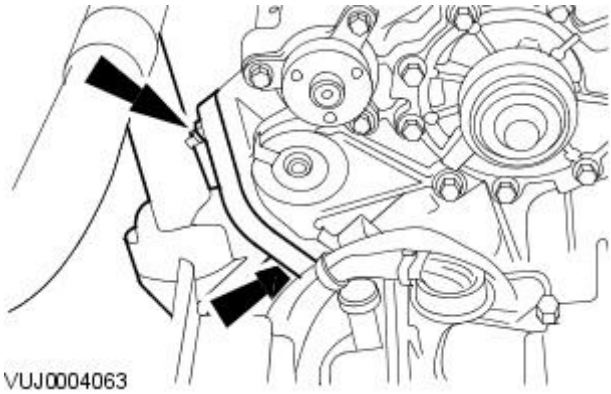
6. Detach the coolant expansion tank outlet hose from the water pump housing.

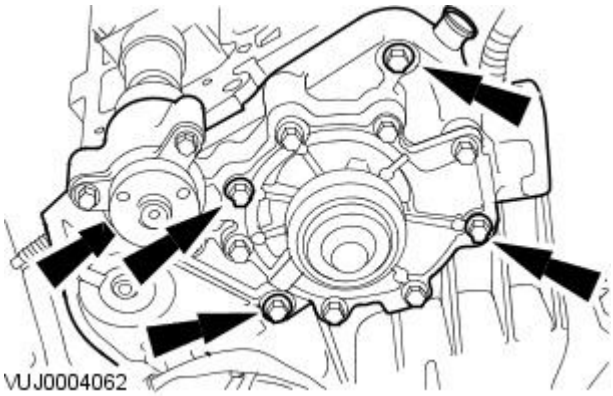


7. Remove the water pump coolant outlet pipe.
   - Remove and discard the seals.



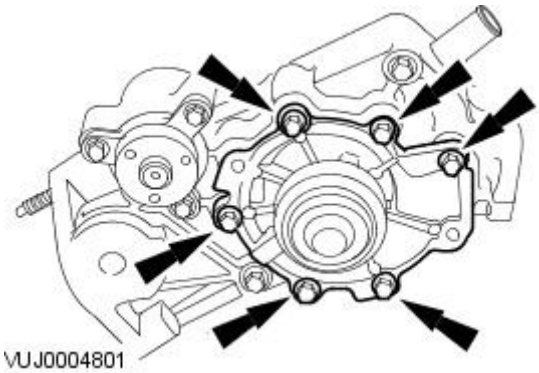
8. Detach the coolant inlet pipe from the water pump housing.
   - Remove and discard the gasket.





9. Remove the water pump housing.

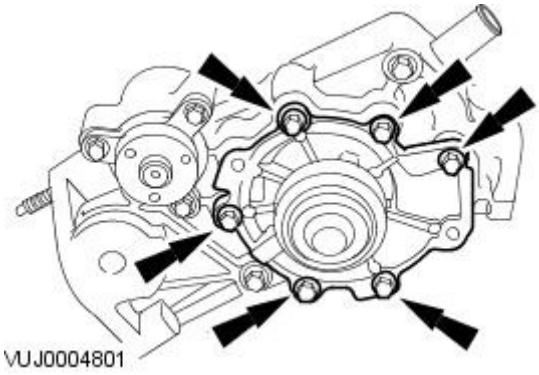
- Remove and discard the gasket.



10. Remove the water pump from the water pump housing.

- Remove and discard the gasket from the water pump.

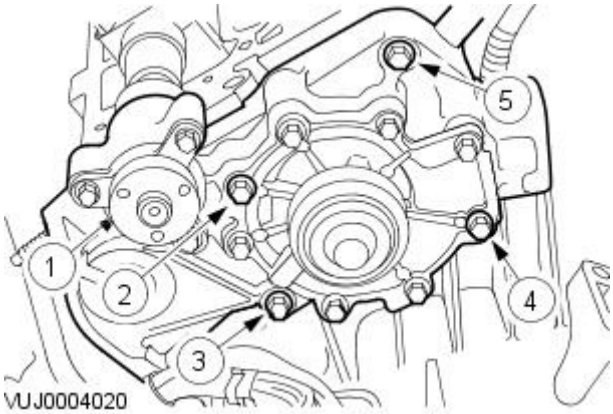
Installation



1. NOTE: Install a new gasket.

To install, reverse the removal procedure.

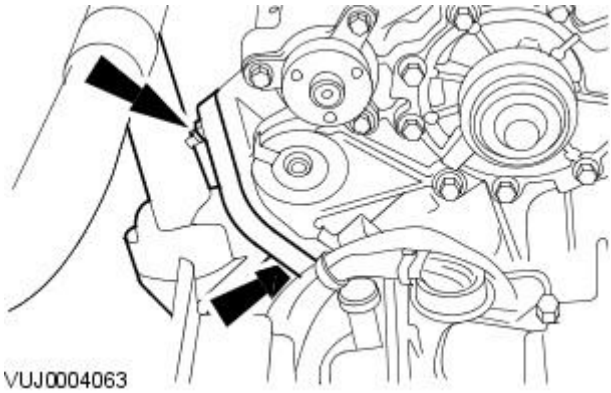
- Tighten to 10 Nm.



2. CAUTION: Make sure that the water pump housing is tightened in the sequence shown. Failure to follow this instruction may result in damage to the water pump drive pulley bearings.

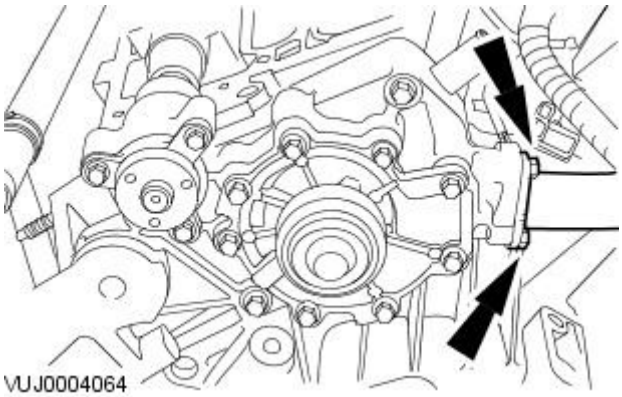
• NOTE: Install a new gasket.

Tighten in the sequence shown to 10 Nm.



3. NOTE: Install a new gasket.

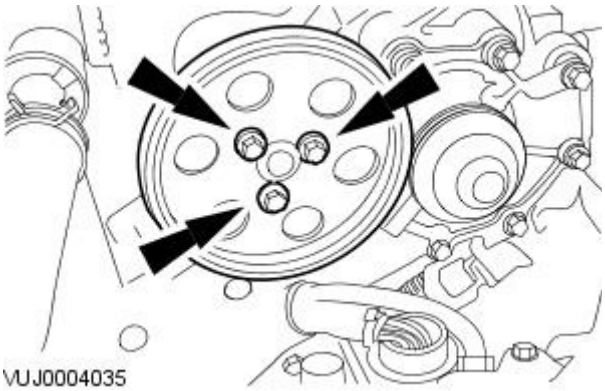
Tighten to 9 Nm.



4. NOTE: Install new O-ring seals to the water pump coolant outlet pipe.

• NOTE: Prior to installation of the water pump outlet pipe, lubricate the O-ring seal of the water pump outlet pipe at the joint with the engine coolant inlet tube with lubricant ESE-M99B176-A.

Tighten to 12 Nm.



5. Tighten to 11 Nm.

6. Fill the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding.

Published: 11-May-2011

Engine Cooling - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma -

Fluids and Lubricants

Description	Specification
Jaguar Premium Cooling System Fluid	ESE-M97B44-A
Premium Cooling System Flush	EGR-M14P7-A
O-Ring Lubricant	ESE-M99B176-A

Cooling System Capacities

Engine	Capacity
2.0L & 2.2 Diesel	10.0L (initial fill)

Antifreeze

Specific Gravity (providing no other additive is in coolant)	Approximate percentage of Anti-Freeze (by volume)	Remains Fluid to	Solidifies at
1.061 at +15°C	50%	–25°C (–13°F)	–30°C (–22°F)

Cooling System Pressure Specification

Description	Pressure kpa (psi)
Radiator pressure test	138 kpa (20 PSI)
Coolant expansion tank cap release pressure	130 to 150kpa (18 to 21)

Torque Specifications

Description	Nm	lb-ft	lb-in
Radiator support bracket retaining bolts	25	18	
Thermostat housing retaining bolt x 1	23	17	-
Thermostat housing retaining bolts x 3	10	-	89
Water pump retaining bolts	23	17	-
Water pump cover	10	-	89
Water pump bleed screw	10	-	89
Engine oil temperature control thermostat retaining bolt	10	-	89

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Engine Cooling - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Engine Cooling

Description and Operation

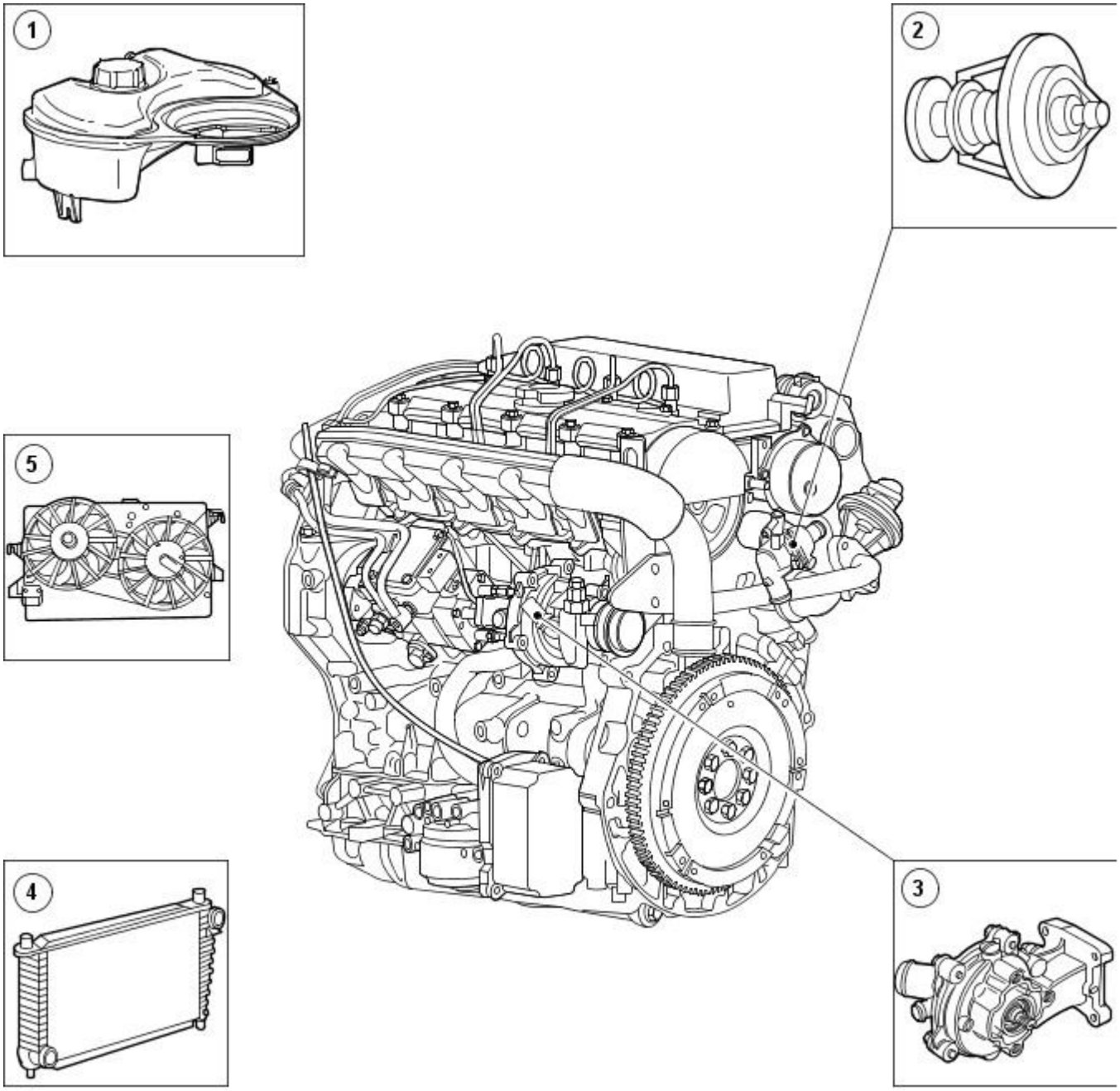
• WARNINGS:

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 blow 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.

Remove fuses 40 and 16 from the engine compartment fuse box prior to performing any under hood service in the area of the cooling fans when the engine is hot, since the cooling fan motors could operate if the engine has been switched off. Failure to follow this instruction may result in personal injury.

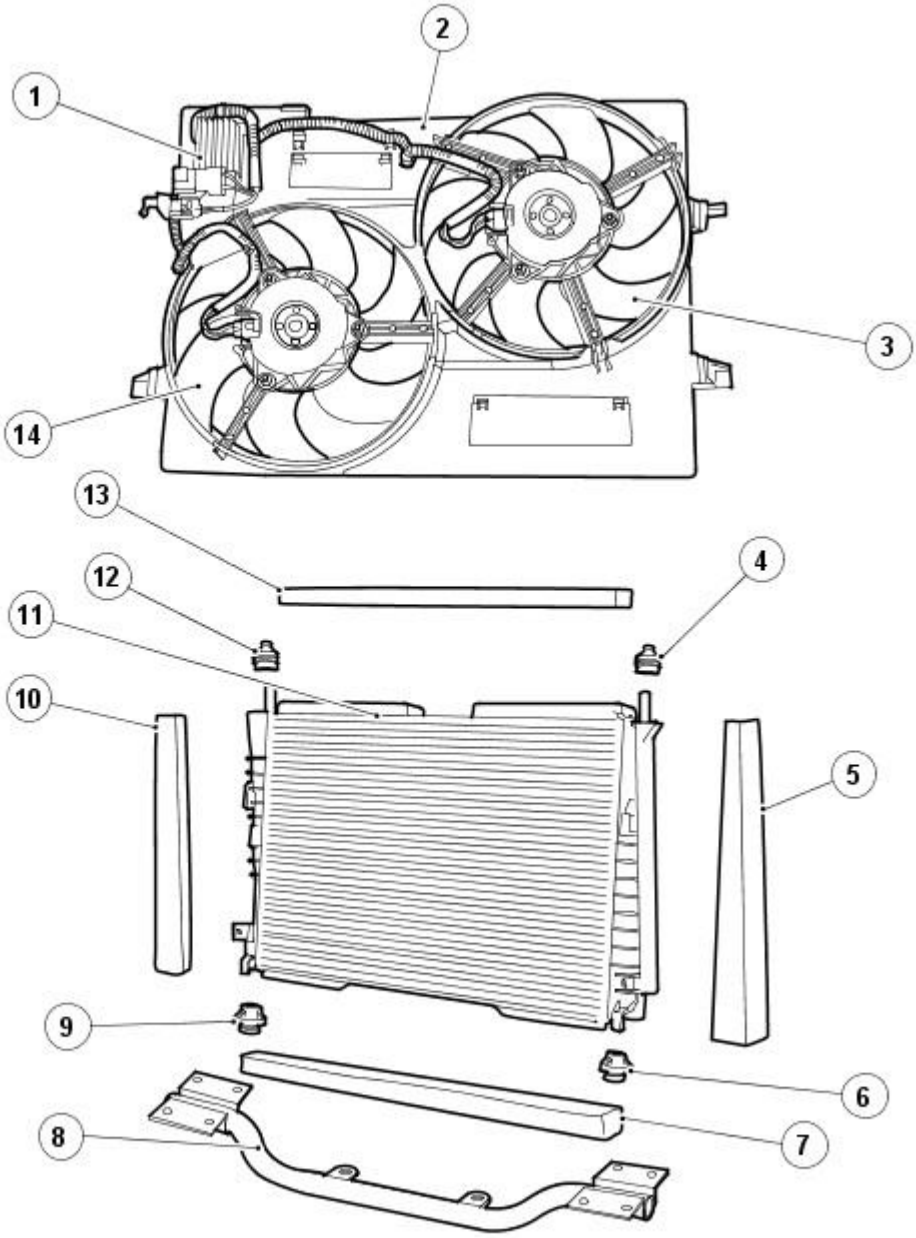
CAUTION: The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage. Failure to follow this instruction may result in damage to the engine.

Vehicles with diesel engine



E45775

Item	Part Number	Description
1	-	Coolant expansion tank
2	-	Thermostat
3	-	Water pump
4	-	Radiator
5	-	Cooling fan motor and shroud



E45776

Item	Part Number	Description
1	-	Cooling module
2	-	Cooling fan motor and shroud
3	-	Cooling fan
4	-	Radiator upper isolator mounting
5	-	Radiator side seal
6	-	Radiator lower isolator mounting
7	-	Radiator lower seal
8	-	Radiator support beam
9	-	Radiator lower isolator mounting
10	-	Radiator side seal
11	-	Radiator
12	-	Radiator upper isolator mounting
13	-	Radiator upper seal
14	-	Cooling fan

The cooling system consists of a:

- water pump.
- thermostat.
- radiator.
- coolant expansion tank.
- coolant pressure cap.
- two electric cooling fans.
- cooling module.
- engine oil cooler.
- engine oil temperature control thermostat.

Water Pump

The water pump is mounted directly to the cylinder block at the transmission-end of the engine. The water pump is directly driven by the power steering pump.

Thermostat

The thermostat is located in the thermostat housing which is bolted to the cylinder head and allows rapid engine warm-up by restricting coolant flow through the radiator below 88°C (190°F). The thermostat also assists in keeping the engine operating temperature within predetermined limits. The thermostat begins to open at 88°C (190°F) and is fully open at 102°C (216°F).

When the engine is cold and the thermostat is closed, coolant flows from the water pump through the engine. It then returns to the water pump through the upper coolant hose.

When the engine is warm and the thermostat is open, coolant flows into the radiator through the upper coolant hose. It then returns to the water pump from the radiator through the lower coolant hose and engine oil cooler.

The heater core is on a parallel circuit and is unaffected by the position of the thermostat.

Radiator

The radiator is of aluminium construction with plastic end tanks. Foam seals are fitted to the radiator to prevent the cooling air from by passing the radiator core. The radiator is located by four isolator mountings and supported by the radiator support beam. A coolant drain plug is provided in the lower coolant hose for the draining of the cooling system. The cooling fan motor and shroud is attached to the radiator via retaining clips.

Electric Cooling Fans

Two variable speed electric cooling fans are housed in the cooling fan shroud for the cooling of the radiator. The speed of the electric cooling fans is adjusted by the cooling fan control module, which is controlled by the engine control module (ECM).

The ECM determines the cooling fan speed by receiving inputs from the cylinder head temperature (CHT) sensor. The ECM sends a variable pulse width modulated (PWM) signal to the cooling fan control module to operate the cooling fans at the required speed. The cooling fans are operated at slow speed when the engine coolant temperature is at 95°C (203°F) and are operated at full speed when the engine coolant temperature is at 105°C (221°F). A coolant temperature between these temperatures will cause the cooling fans to be operated at a speed which is proportional to the engine coolant temperature.

When the engine is running with the CHT above 100°C (212°F), if the ignition switch is turned to the **OFF** position the cooling fans will continue to operate for a time which is determined by the ECM.

If the PWM signal from the ECM to the cooling fan control module is between 7% and 95% the cooling fan control module will operate the cooling fans at the required speed. If the PWM signal from the ECM to the cooling fan control module is below 3% and above 95% the cooling fan control module will operate the cooling fans at maximum speed. If the PWM signal from the ECM to the cooling fan control module is between 3% and 7% the cooling fans will not operate.

Coolant Recovery System

A pressurized coolant expansion tank system is used which continuously separates the air from the cooling system and replenishes the system through the coolant expansion tank outlet hose, attached to the heater return hose.

A continuous vent from the engine and radiator to the coolant expansion tank prevents air locks from forming in the cooling system.

The coolant expansion tank serves as the location for:

- service filling.
- coolant expansion during warm-up.
- air separation during operation.
- system pressurization by the coolant pressure cap.

Engine Oil Cooler

The engine oil cooler is a oil to water type. The oil cooler is mounted to the oil filler housing an sealed with two O-ring seals.

The coolant supply for the engine oil cooler is through the radiator bottom hose.

Engine oil cooler thermostat

The engine oil cooler thermostat is located in the water pump housing and helps to reduce the warm-up time by limiting the coolant flow through the lubrication system until the engine reaches it's optimum operating temperature. The engine oil cooler thermostat starts to open at 75°C (167°F) and is fully open at 89°C (192°F).

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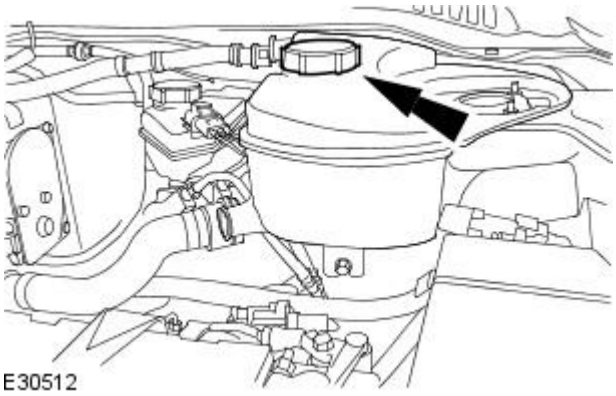
Engine Cooling - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Cooling System Draining, Filling and Bleeding

General Procedures



1. WARNING: When releasing the cooling system pressure, 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.

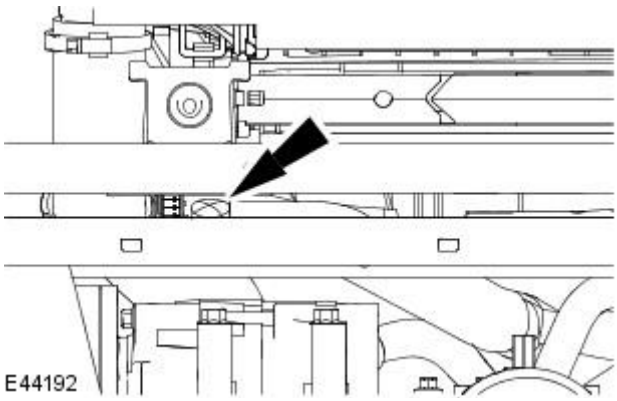
• NOTE: Release the cooling system pressure by slowly turning the coolant expansion tank cap a quarter of a turn.

Remove the coolant expansion tank cap.

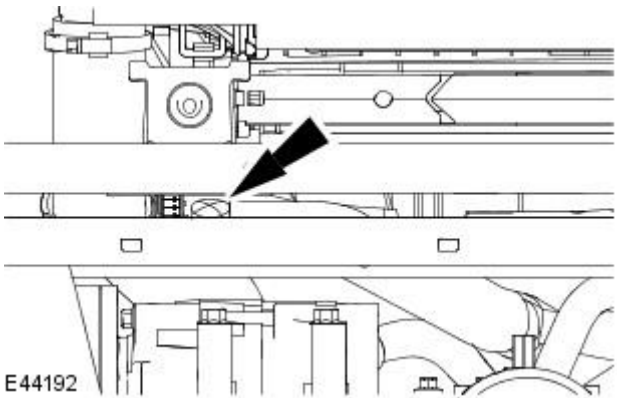
2. Remove the radiator splash shield.
For additional information, refer to: Radiator Splash Shield (501-02 Front End Body Panels, Removal and Installation).

3. Drain the cooling system.

- Allow the coolant to drain into a suitable container.



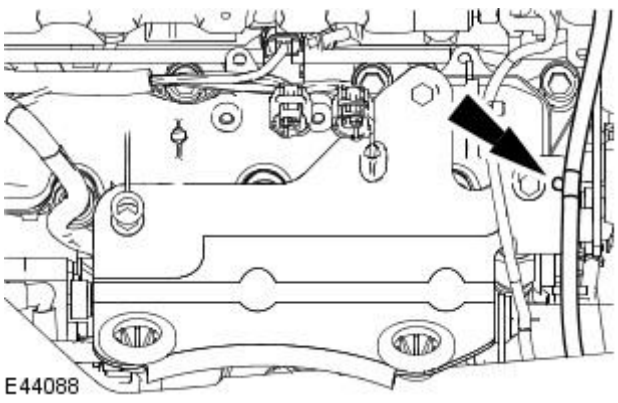
4. Install the radiator drain plug.

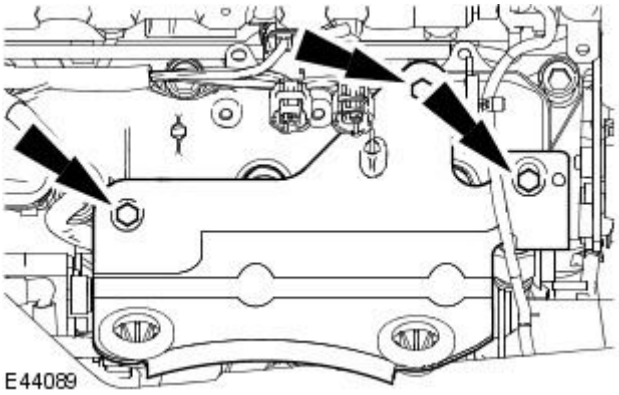


5. Install the radiator splash shield.
For additional information, refer to: Radiator Splash Shield (501-02 Front End Body Panels, Removal and Installation).

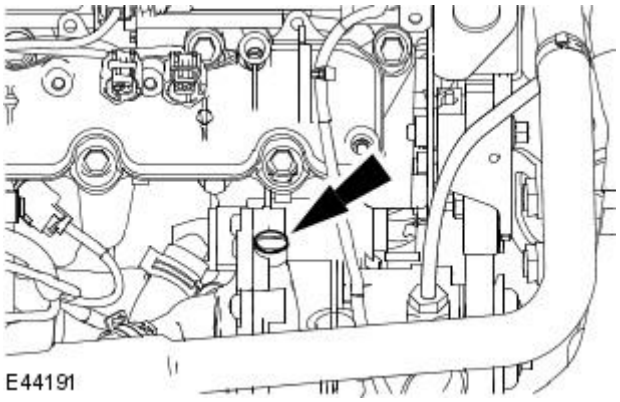
6. Remove the air cleaner assembly.
For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

7. Detach the wiring harness.





8. Remove the air cleaner mount bracket.

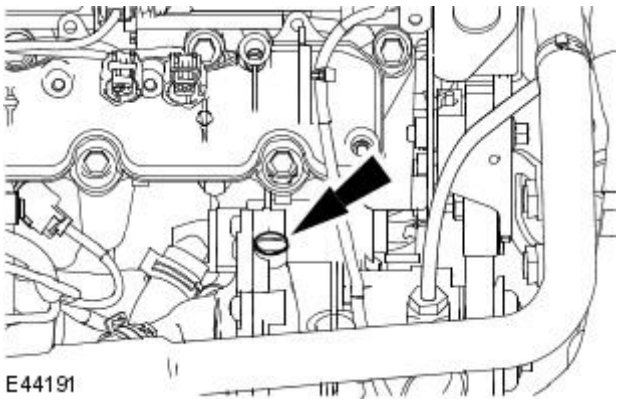


9. Loosen the cooling system air bleed screw.

10. Fill the coolant expansion tank until coolant emerges from the cooling system air bleed screw.

11. Tighten the cooling system air bleed screw.

- Tighten to 10 Nm.

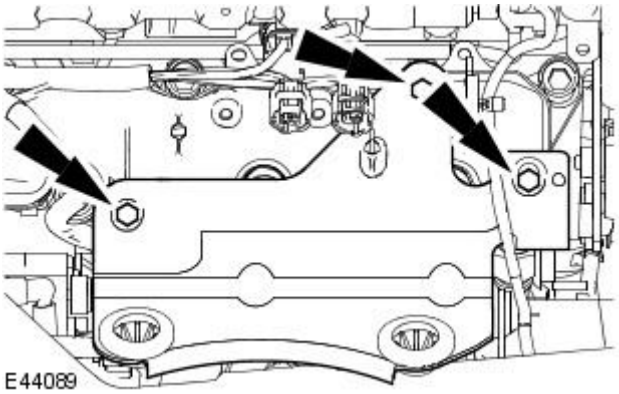


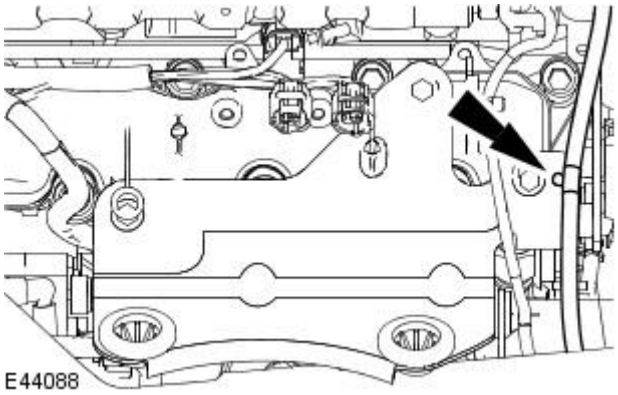
12. CAUTION: The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage.

Fill the coolant expansion tank to the **Max** mark.

13. Install the air cleaner mount bracket.

- Tighten the retaining bolts.





14. Attach the wiring harness.

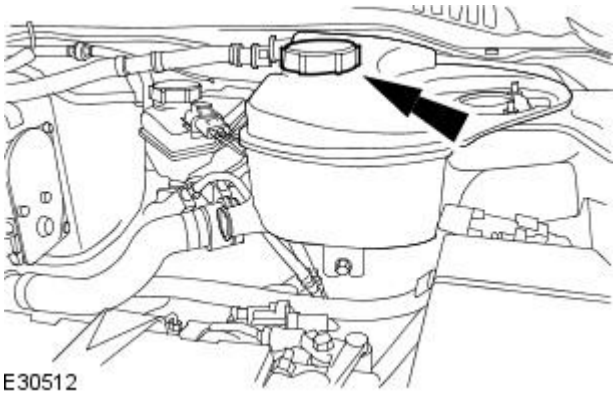
15. Install the air cleaner assembly.
For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

16. Start the engine and maintain an engine speed of 1500 revolutions per minute (RPM) for 20 seconds.

17. Switch the engine off.

18. Fill the coolant expansion tank to 15mm above the **MAX** mark.

19. Install the coolant expansion tank cap.



20. Start the engine, allow the engine to idle for a two minutes.

21. CAUTION: Observe the engine temperature gauge. If the engine starts to over-heat switch off immediately and allow to cool. Failure to follow this instruction may cause damage to the vehicle.

Raise the engine speed to 3000 RPM and maintain at 3000 RPM until the engine cooling fan operates, while observing the engine temperature gauge.

22. CAUTION: Observe the engine temperature gauge. If the engine starts to over-heat switch off immediately and allow to cool. Failure to follow this instruction may cause damage to the vehicle.

Allow the engine to idle for a further five minutes.

23. Switch off the engine.

24. Allow the engine to cool.

25. Remove the coolant expansion tank cap.

26. CAUTION: The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage.

Fill the coolant expansion tank to the **Max** mark.

27. Install the coolant expansion tank cap.

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Engine Cooling - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Cooling System Draining and Vacuum Filling

General Procedures

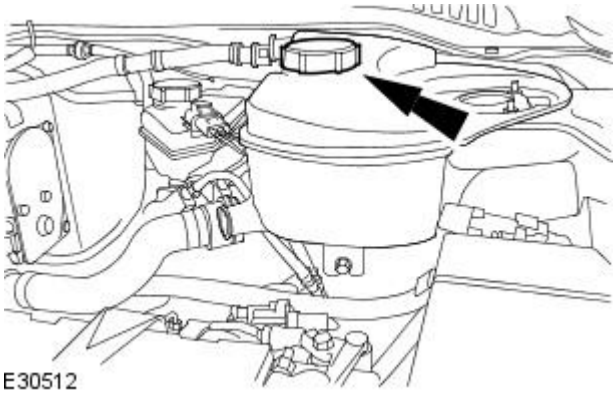
WARNING: To avoid having scalding hot coolant or steam blowing out of the cooling system, use extreme care when removing the coolant pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant pressure cap and turn it slowly until the pressure 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.

• 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 vehicle.

Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.

Do not run the engine without first making sure the engine cooling fans operate. Start the engine, set air conditioning (A/C) to maximum cold, set the blower motor to maximum and observe that the engine cooling fan operates. Failure to follow this instruction may cause damage to the engine.

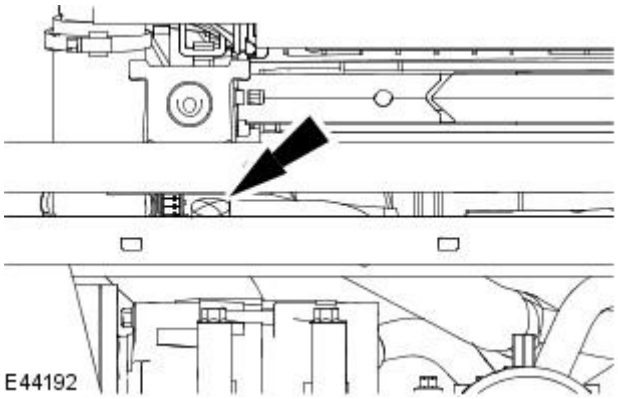


1. Set the heater controls to maximum HOT.

2. WARNING: Relieve the cooling system pressure by unscrewing the coolant pressure cap. Failure to follow this instruction may result in personal injury.

CAUTION: Do not RUN the engine with the coolant pressure cap removed. Failure to follow this instruction may cause damage to the engine.

Remove the coolant expansion tank pressure cap.

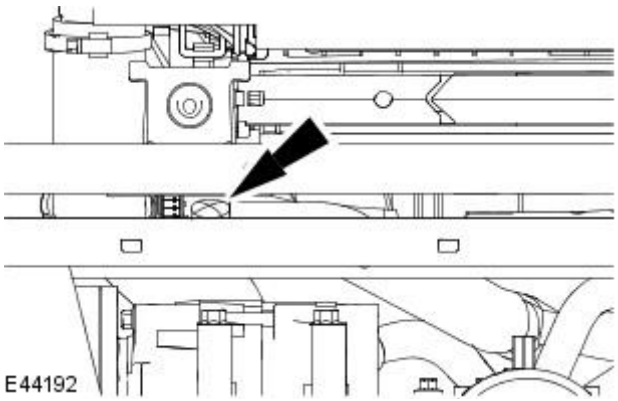


3. Remove the radiator splash shield.
For additional information, refer to: Radiator Splash Shield (501-02 Front End Body Panels, Removal and Installation).

4. NOTE: Remove and discard the radiator drain plug O-ring seal.

Remove the coolant drain plug.

- Drain the coolant into a suitable container.



5. CAUTION: Do not over tighten the drain plug. Failure to follow this instruction may result in damage to the vehicle.

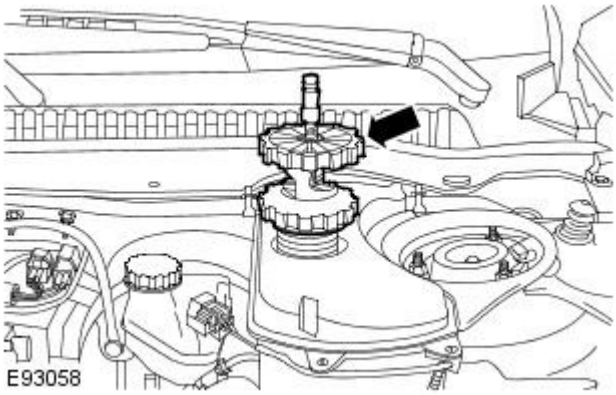
• NOTE: Install a new O-ring seal.

Install the coolant drain plug.

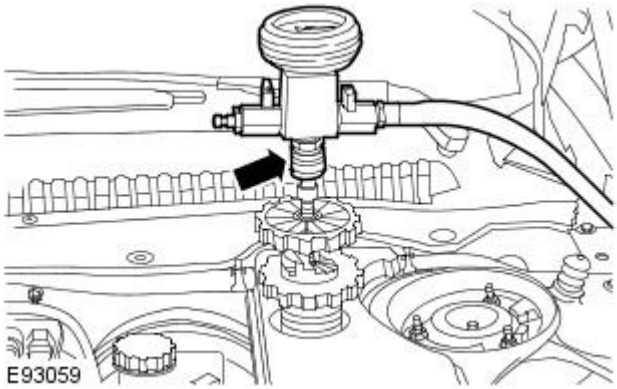
- Tighten to 1 Nm.
- Remove the drain tray.

6. Lower the vehicle.

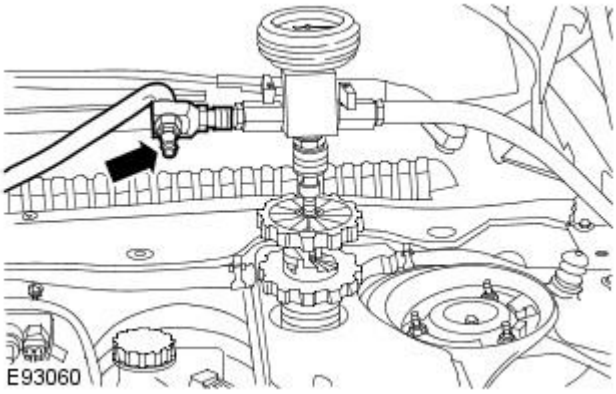
7. Install the cooling system vacuum refill adaptor to the expansion tank.



8. Install the vacuum filler gauge to the cooling system vacuum refill adaptor.



9. Install the venturi tube assembly to the vacuum filler gauge.

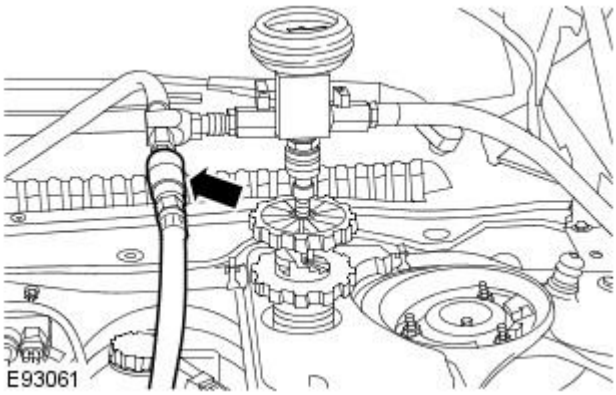


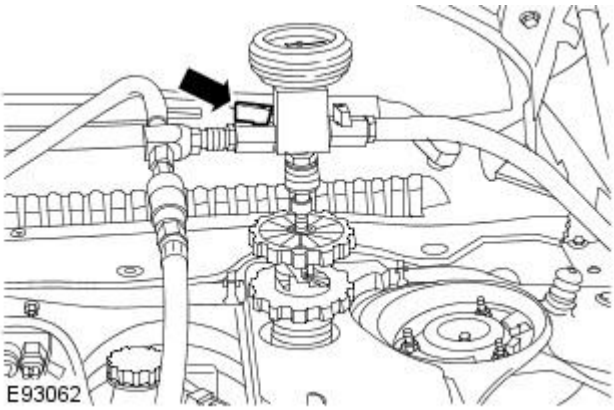
10. NOTE: Make sure that both valves are in the closed position on the vacuum filler gauge assembly.

• NOTE: The coolant vacuum fill tool needs an air pressure of 6 to 8 bar (87 to 116 psi) to operate correctly.

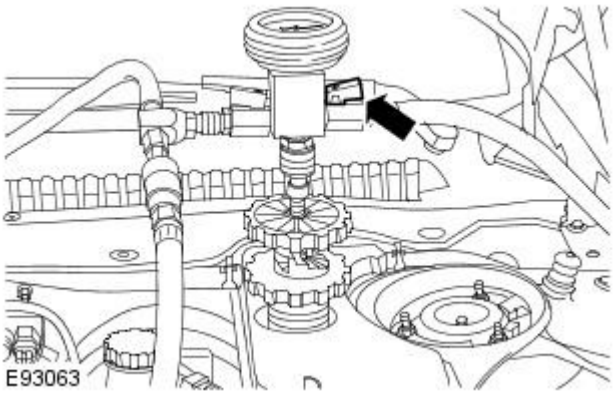
• NOTE: Small diameter or long airlines may restrict airflow to the coolant vacuum fill tool.

Connect a regulated compressed air supply to the venturi tube assembly.



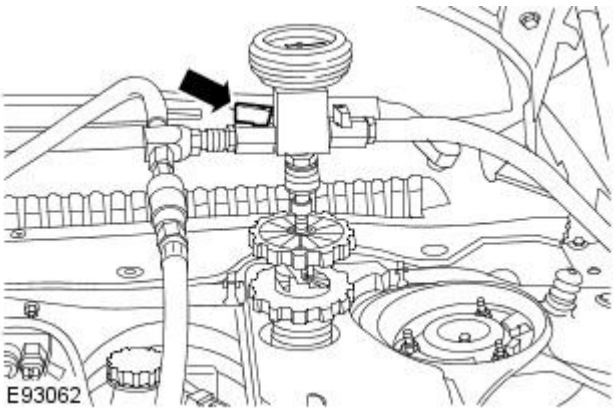


11. Open the air supply valve.

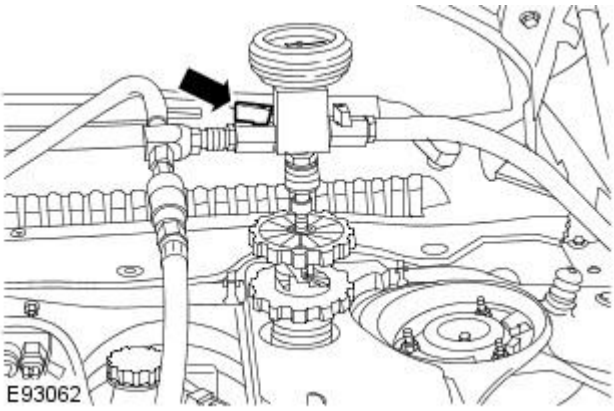


12. NOTE: Make sure the coolant supply hose is positioned into a container of fifty percent mixture of Jaguar Premium Cooling System Fluid or equivalent, meeting Jaguar specification WSS M97B44-D and fifty percent water. Make sure no air can enter the coolant supply hose.

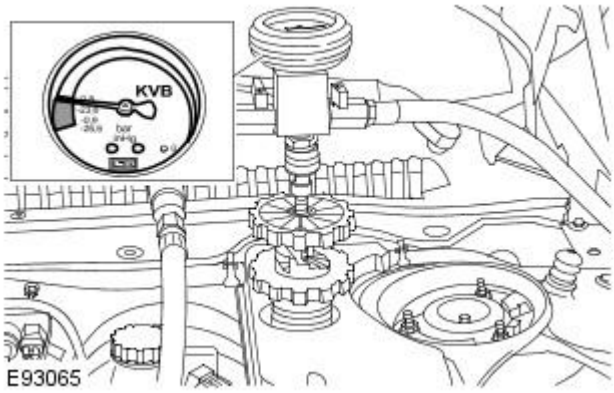
Open the coolant supply valve for 2 seconds to prime the coolant supply hose.



13. Apply air pressure progressively until the arrow on the vacuum filler gauge reaches the green segment.

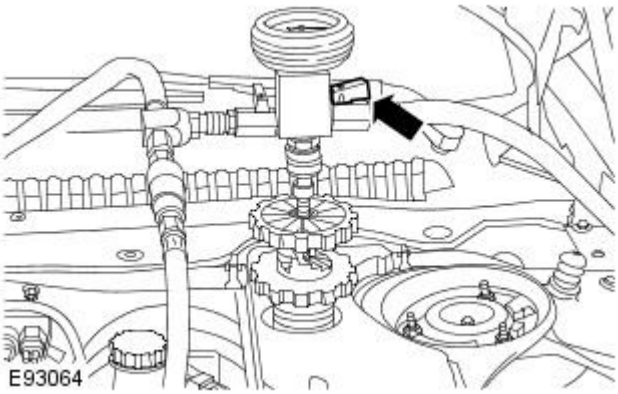


14. Close the air supply valve.



15. Allow one minute to check the vacuum is held.

- Disconnect the air supply.

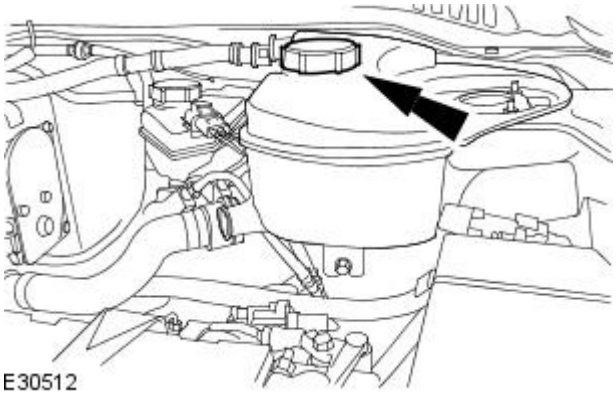


16. NOTE: Close the coolant supply valve when the coolant expansion tank MAX mark is reached or coolant movement has ceased.

Open the coolant supply valve and allow the coolant to be drawn into the system.

17. Remove the vacuum filler gauge and cooling system vacuum refill adaptor assembly.

18. Install the coolant expansion tank pressure cap.



19. Set the heating system to the COLD position.

20. Start the engine, allow the engine to idle for a two minutes.

21. NOTE: During this procedure the thermostat should open.

Raise the engine speed to 3000 RPM and maintain until the engine cooling fan operates.

22. Allow the engine to idle for a further five minutes.

23. Switch the engine OFF and allow to cool.

24. WARNING: To avoid having scalding hot coolant or steam blow 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.

After two minutes, release the cooling system pressure.

- Remove the coolant expansion tank pressure cap.

25. Check and top-up the coolant if required.

26. Raise the vehicle.

27. Check for coolant leaks.

28. Install the radiator splash shield.
For additional information, refer to: Radiator Splash Shield (501-02 Front End Body Panels, Removal and Installation).

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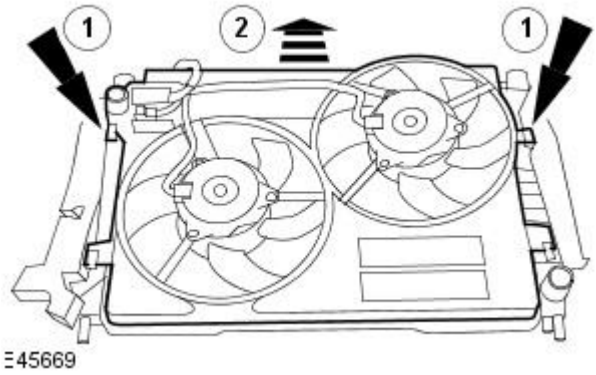
Engine Cooling - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Cooling Fan Motor and Shroud

Removal and Installation

Removal



1. Remove the cooling module.
   For additional information, refer to: Cooling Module (303-03B Engine Cooling - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
2. Remove the cooling fan motor and shroud assembly.
   1. Release the retaining tangs.
   2. Remove the cooling fan motor and shroud assembly.

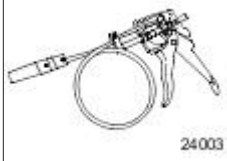
Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

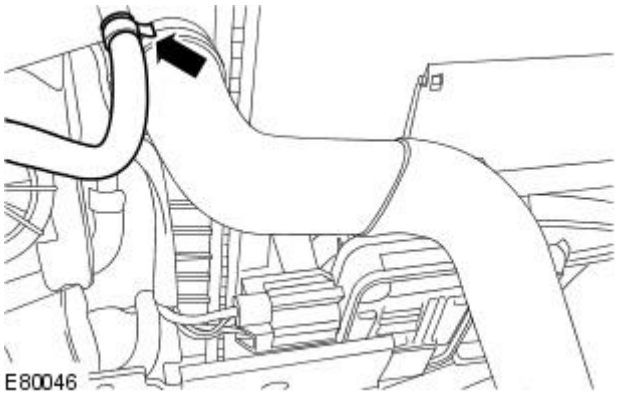
Engine Cooling - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma - Cooling Module

Removal and Installation

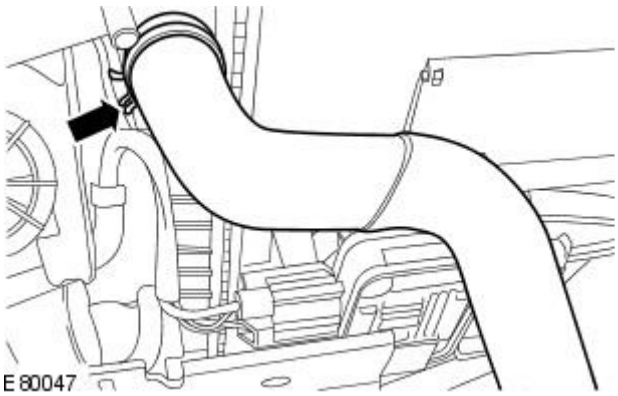
Special Tool(s)	
 24003	Remover/installer, cooling hose clamp. 303-397

Removal

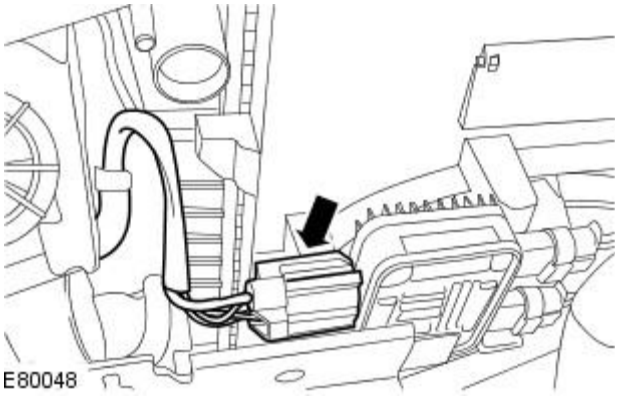
1. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
2. Carry out the air conditioning (A/C) system recovery procedure.
   For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
3. Carry out the cooling system drain procedure.
   For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
4. Lower the vehicle.
5. Detach the radiator vent hose.


E80046

6. Detach the radiator upper coolant hose.


E80047

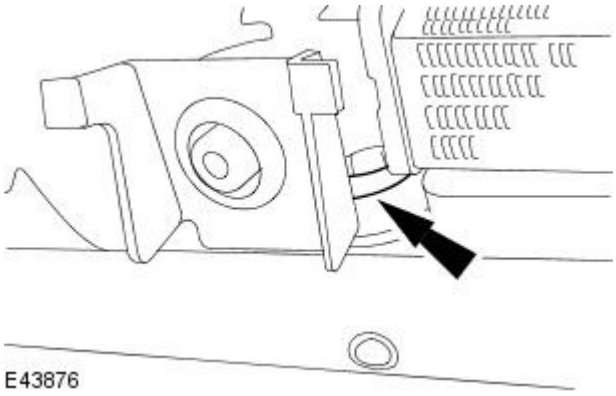
7. Disconnect the electrical connector.


E80048

8. Remove the charge air cooler.
   For additional information, refer to: Charge Air Cooler - 2.0L Duratorq-TDCi (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and

Installation) /
Charge Air Cooler - 2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

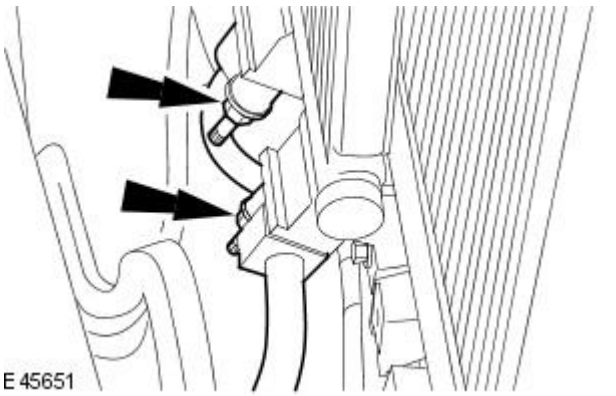
9. Disconnect the radiator lower coolant hose.



10. NOTE: Install blanking plugs to the exposed ports.

Disconnect the A/C lines.

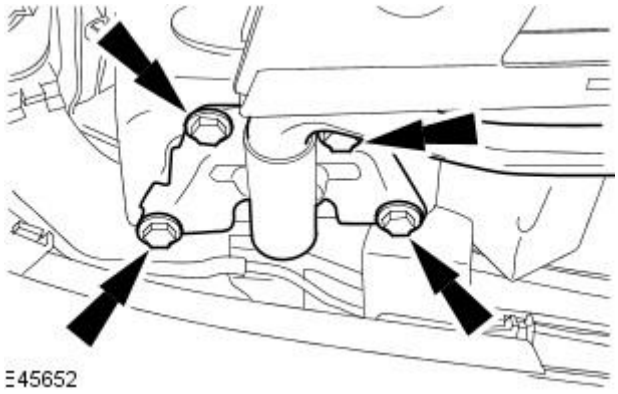
- Remove and discard the O-ring seals.



11. WARNING: Using an assistant support the cooling module. Failure to follow this instruction may result in personal injury.

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

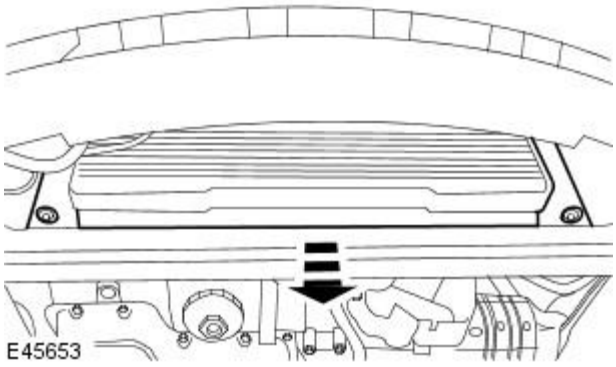
Using an assistant, remove the radiator support beam.



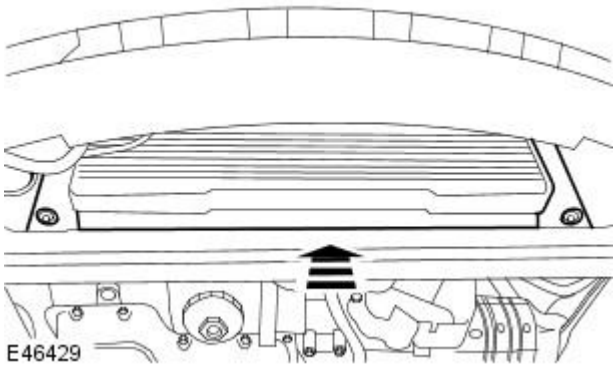
12. WARNING: Using an assistant, remove the cooling module. Failure to follow this instruction may result in personal injury.

CAUTION: Make sure that the radiator and the air conditioning condenser are not damaged during the removal of the cooling module. Failure to follow this instruction may result in damage to the vehicle.

Using an assistant, remove the cooling module.



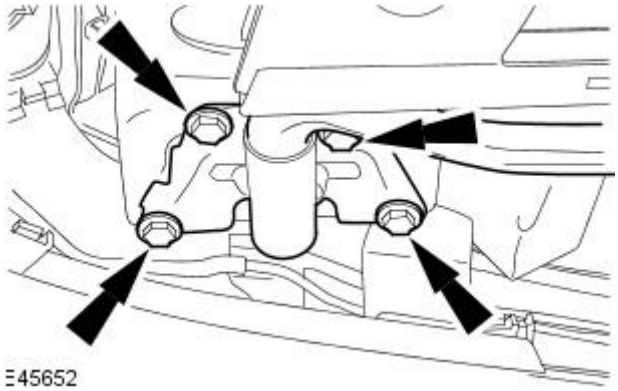
Installation



1. WARNING: Using an assistant, install the cooling module. Failure to follow this instruction may result in personal injury.

CAUTION: Make sure that the radiator and the air conditioning condenser are not damaged during the installation of the cooling module.

Using an assistant, install the cooling module.

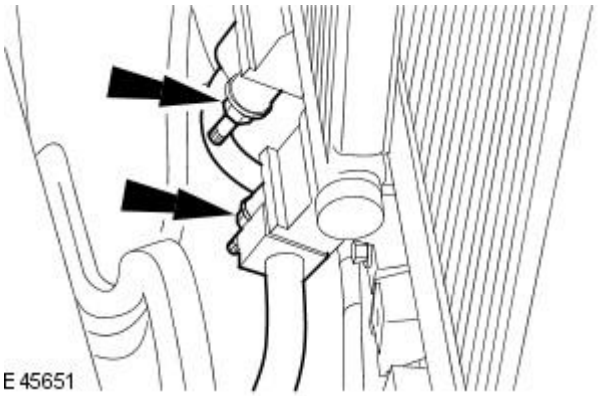


2. WARNING: Using an assistant support the cooling module. Failure to follow this instruction may result in personal injury.

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

Using an assistant, install the radiator support beam.

- Tighten to 25 Nm.

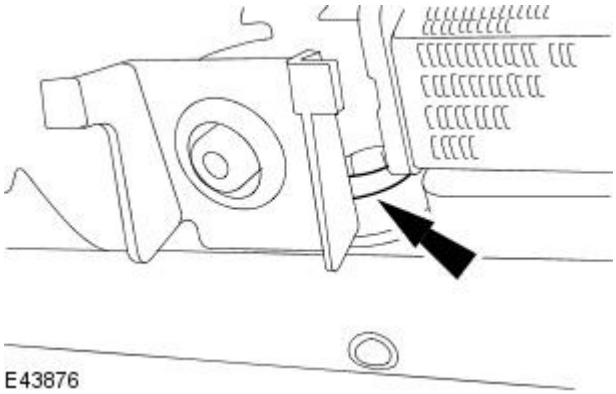


3. NOTE:

• NOTE: Remove the blanking plugs.

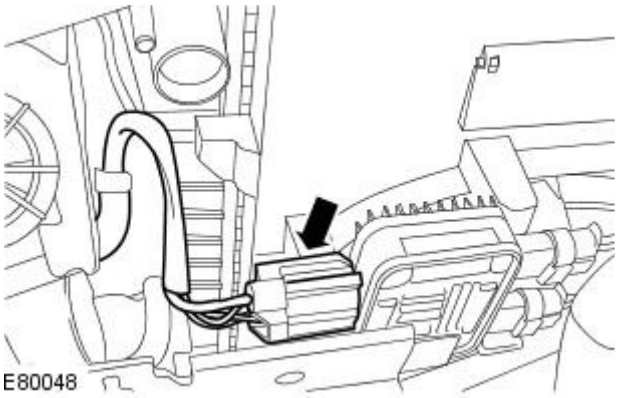
Connect the A/C lines.

- Install new O-ring seals.
- Tighten to 25 Nm.

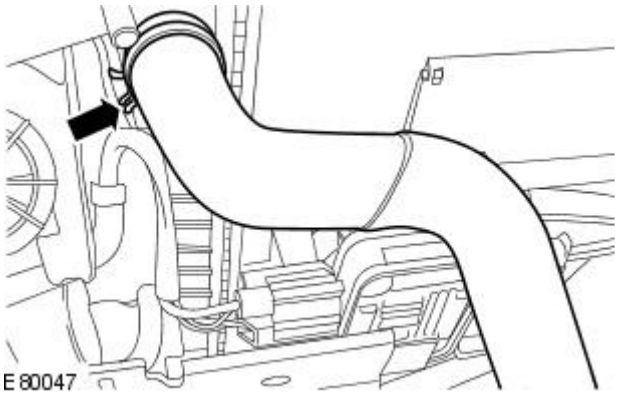


4. Connect the radiator lower coolant hose.

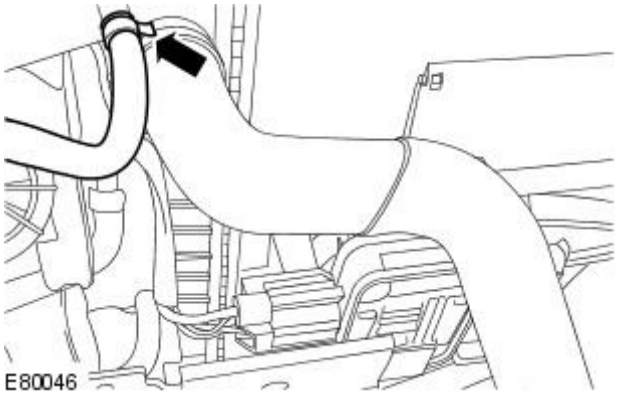
5. Install the charge air cooler.
For additional information, refer to: Charge Air Cooler - 2.0L Duratorq-TDCi (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation) /
Charge Air Cooler - 2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).



6. Connect the electrical connector.



7. Connect the radiator upper coolant hose.



8. Connect the radiator vent hose.

9. Install the battery tray.
For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

10. Carry out the cooling system filling and bleeding procedure.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

11. Carry out the A/C system evacuation and charging procedure.
For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

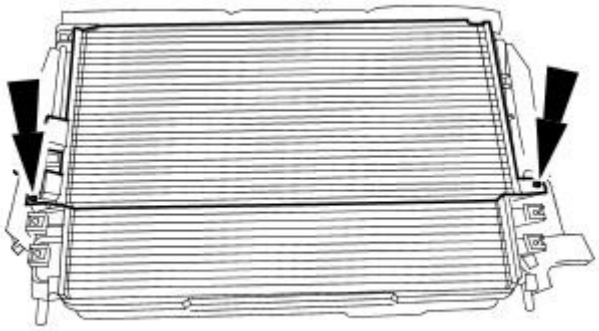
Published: 11-May-2011

Engine Cooling - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Radiator

Removal and Installation

Removal

1. Remove the cooling fan motor and shroud.
   For additional information, refer to: Cooling Fan Motor and Shroud (303-03B Engine Cooling - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
2. Remove the radiator.



E45681

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Engine Cooling - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Water Pump

Removal and Installation

Special Tool(s)	
	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)

Materials

Name	Specification
Grease	WSS-M12A4-A2

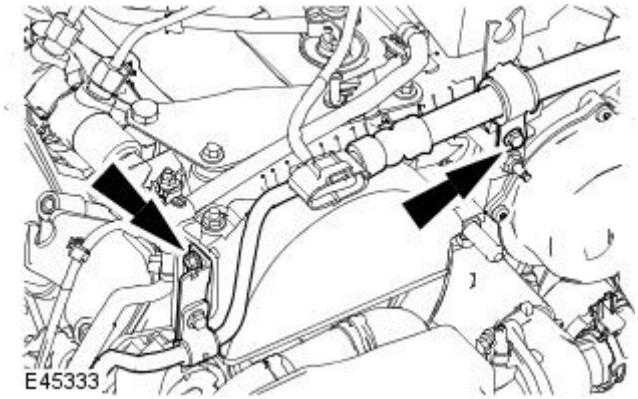
Removal

Vehicles with 2.2L diesel engine

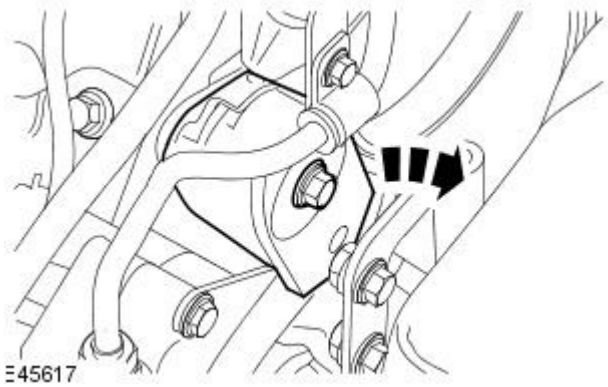
1. Remove the exhaust gas recirculation (EGR) tube.
   For additional information, refer to: Exhaust Gas Recirculation (EGR) Cooler to EGR Valve Tube (303-08 Engine Emission Control - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

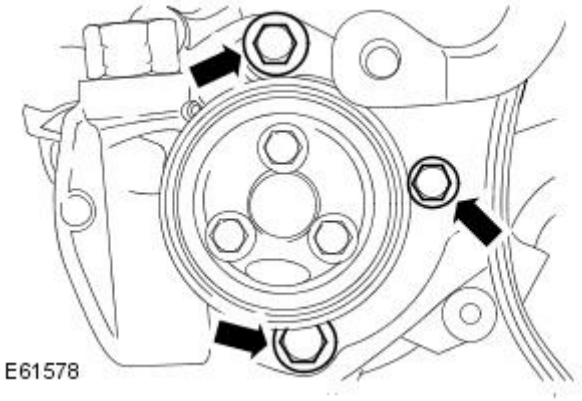
All vehicles

2. Drain the cooling system.
   For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
3. Detach the power steering fluid pipe.



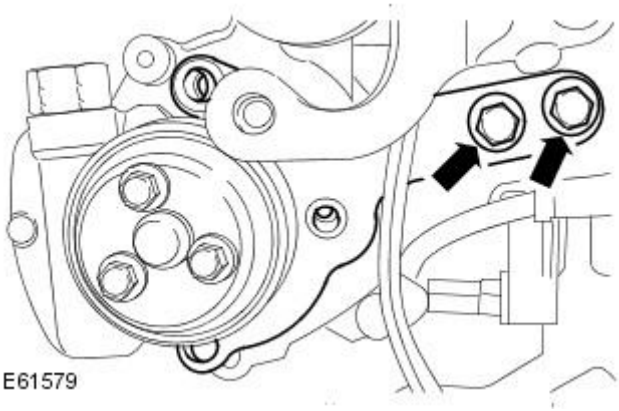
4. Detach the power steering pump belt.
   - Rotate the power steering pump belt tensioner clockwise.




E61578

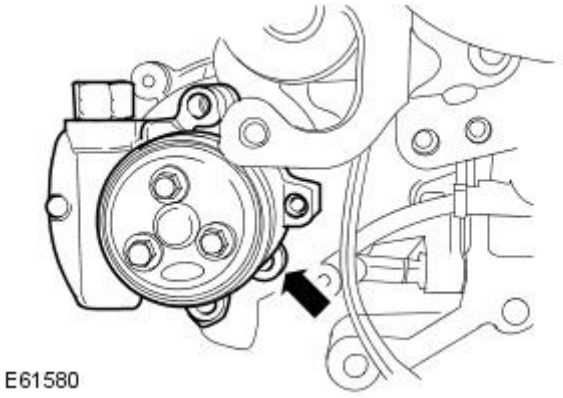
5. NOTE: Shown with the exhaust gas recirculation (EGR) cooler to EGR valve tube removed for clarity.

Remove the power steering pump retaining bolts.


E61579

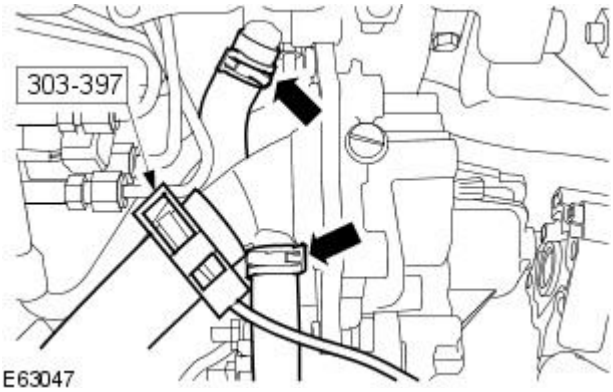
6. NOTE: Shown with the EGR cooler to EGR valve tube removed for clarity.

Remove the power steering pump securing bracket.


E61580

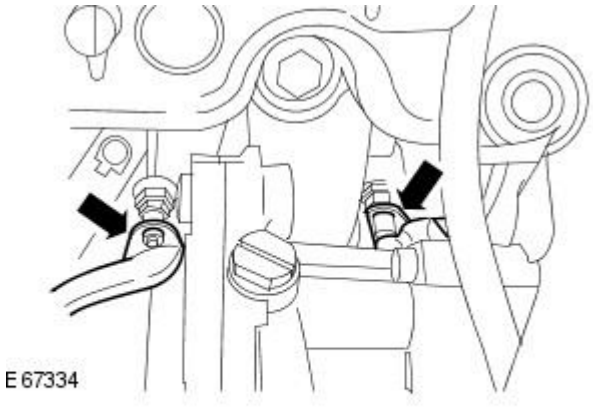
7. NOTE: Shown with the EGR cooler to EGR valve tube removed for clarity.

Detach the power steering pump from the water pump.



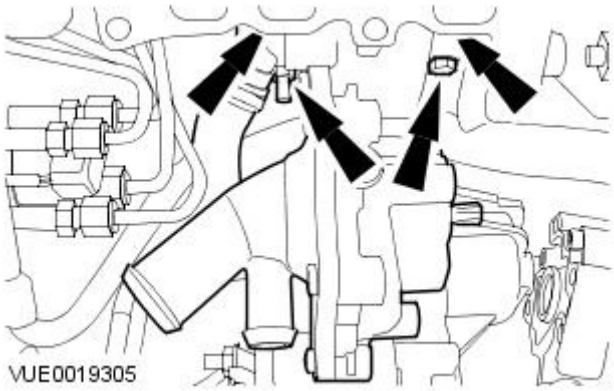
E63047

8. Using the special tool, disconnect the coolant hoses from the water pump.



9. NOTE: Shown with the EGR cooler to EGR valve tube removed for clarity.

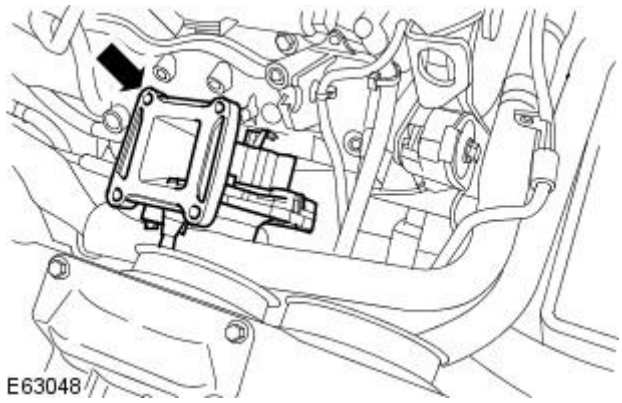
Detach the wiring harness.



10. NOTE: Shown with the EGR cooler to EGR valve tube removed for clarity.

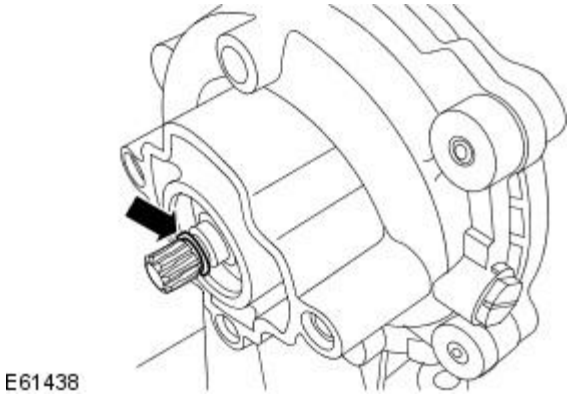
Detach the water pump.

- Detach the wiring harness from the water pump lower retaining bolts.



11. Remove the water pump.

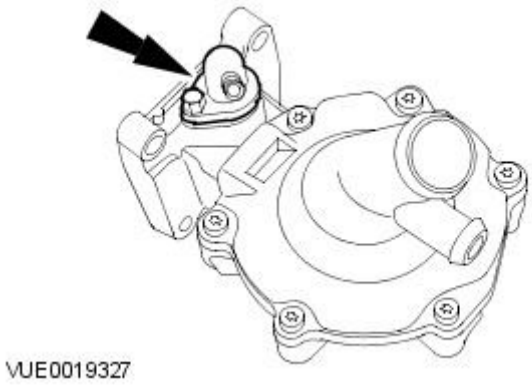
- Remove and discard the gasket.



12. Remove and discard the water pump O-ring seal.

13. Remove the engine oil temperature control thermostat.

- Remove and discard the O-ring seal.

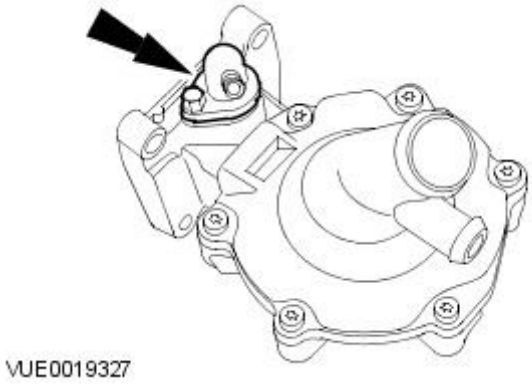

VUE0019327

Installation

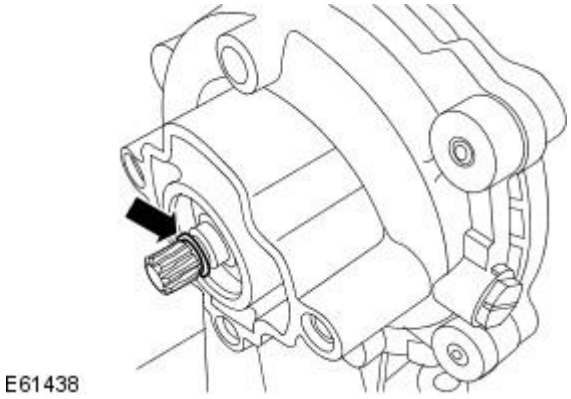
All vehicles

1. NOTE: Install a new engine oil temperature control thermostat O-ring seal.

Install the engine oil temperature control thermostat.

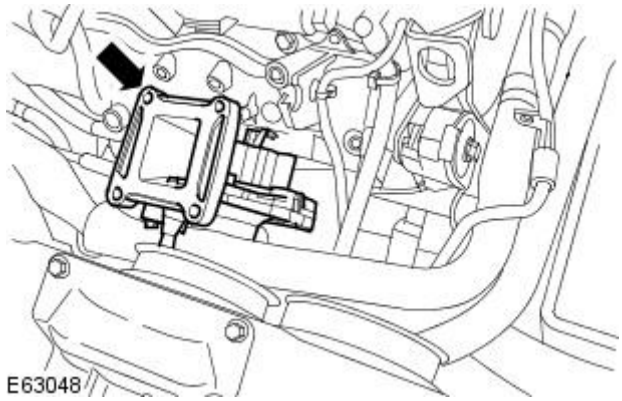

VUE0019327

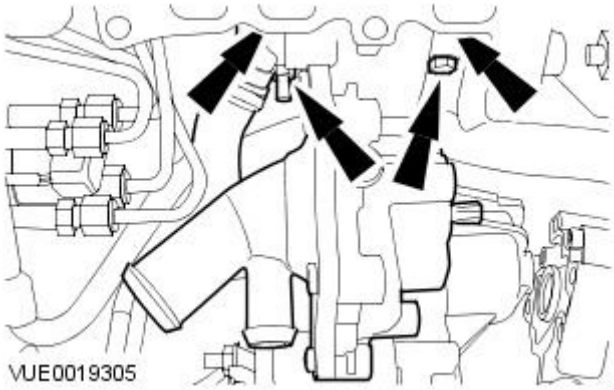
2. Install a new water pump O-ring seal.


E61438

3. NOTE: Install a new water pump gasket.

Install the water pump.

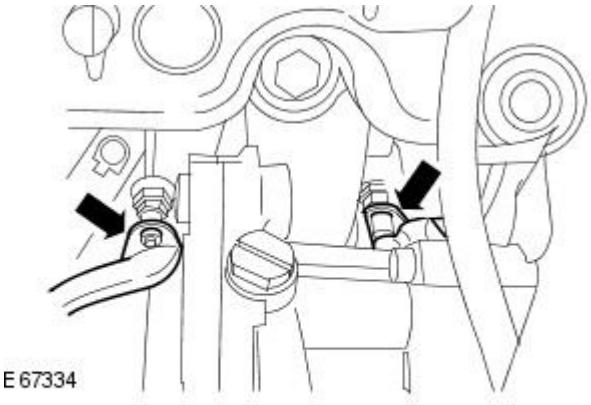

E63048



4. NOTE: Shown with the EGR cooler to EGR valve tube removed for clarity.

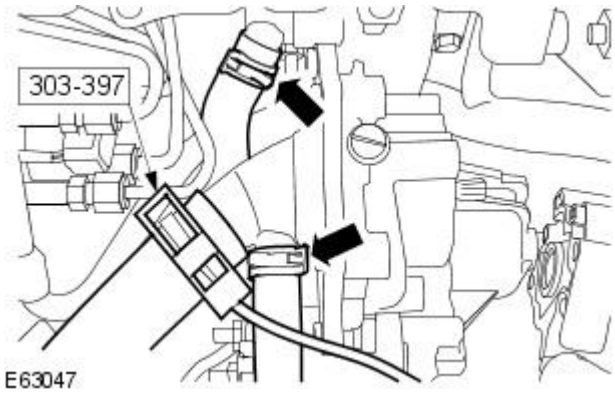
Attach the water pump.

- Tighten the water pump retaining bolts to 24 Nm.
- Attach the wiring harness to the water pump lower retaining bolts.

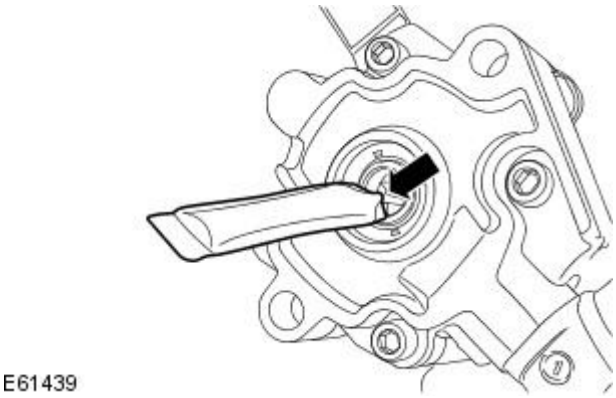


5. NOTE: Shown with the EGR cooler to EGR valve tube removed for clarity.

Attach the wiring harness.



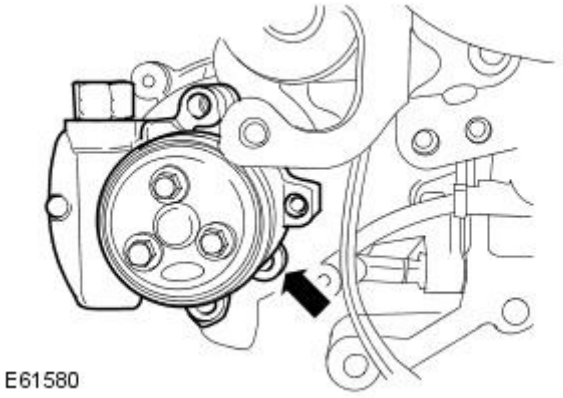
6. Using the special tool, connect the coolant hoses to the water pump.



7. Coat the power steering pump drive shaft splines with grease.

8. NOTE: Shown with the EGR cooler to EGR valve tube removed for clarity.

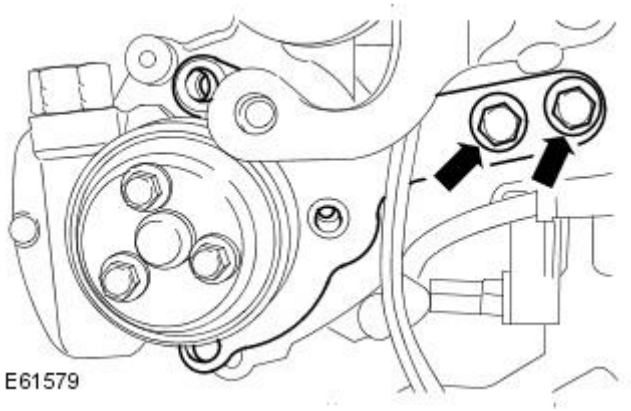
Attach the power steering pump to the water pump.


E61580

9. NOTE: Shown with the EGR cooler to EGR valve tube removed for clarity.

Install the power steering pump securing bracket.

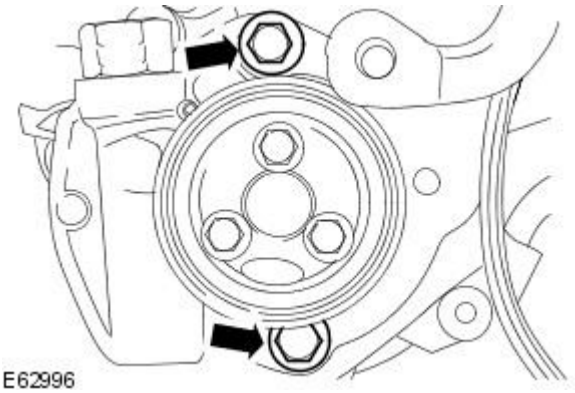
- Tighten to 25 Nm.


E61579

10. NOTE: Shown with the EGR cooler to EGR valve tube removed for clarity.

Install the power steering pump retaining bolts.

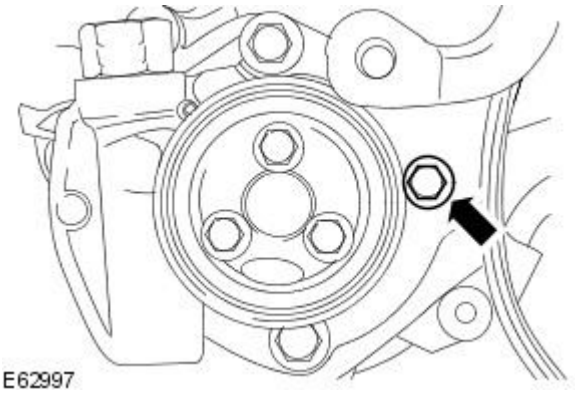
- Tighten to 25 Nm.

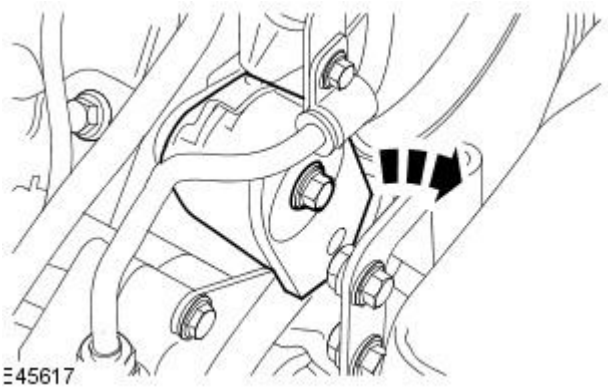

E62996

11. NOTE: Shown with the EGR cooler to EGR valve tube removed for clarity.

Install the power steering pump retaining bolts.

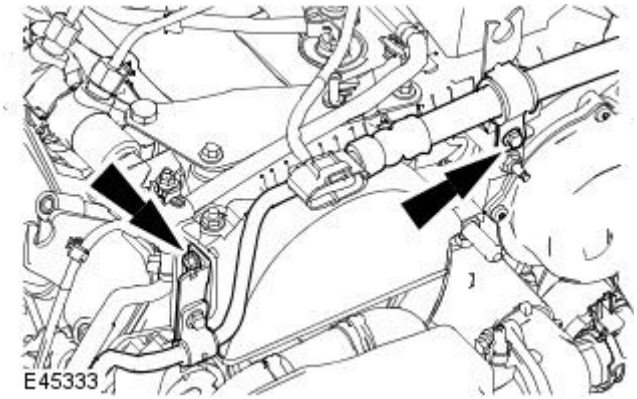
- Tighten to 10 Nm.


E62997



12. Attach the power steering pump belt.

- Rotate the power steering pump belt tensioner clockwise.



13. Attach the power steering fluid pipe.

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 - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

Vehicles with 2.2L diesel engine

15. Install the exhaust gas recirculation (EGR) tube.
For additional information, refer to: Exhaust Gas Recirculation (EGR) Cooler to EGR Valve Tube (303-08 Engine Emission Control - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

Published: 11-May-2011

Fuel Charging and Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 -

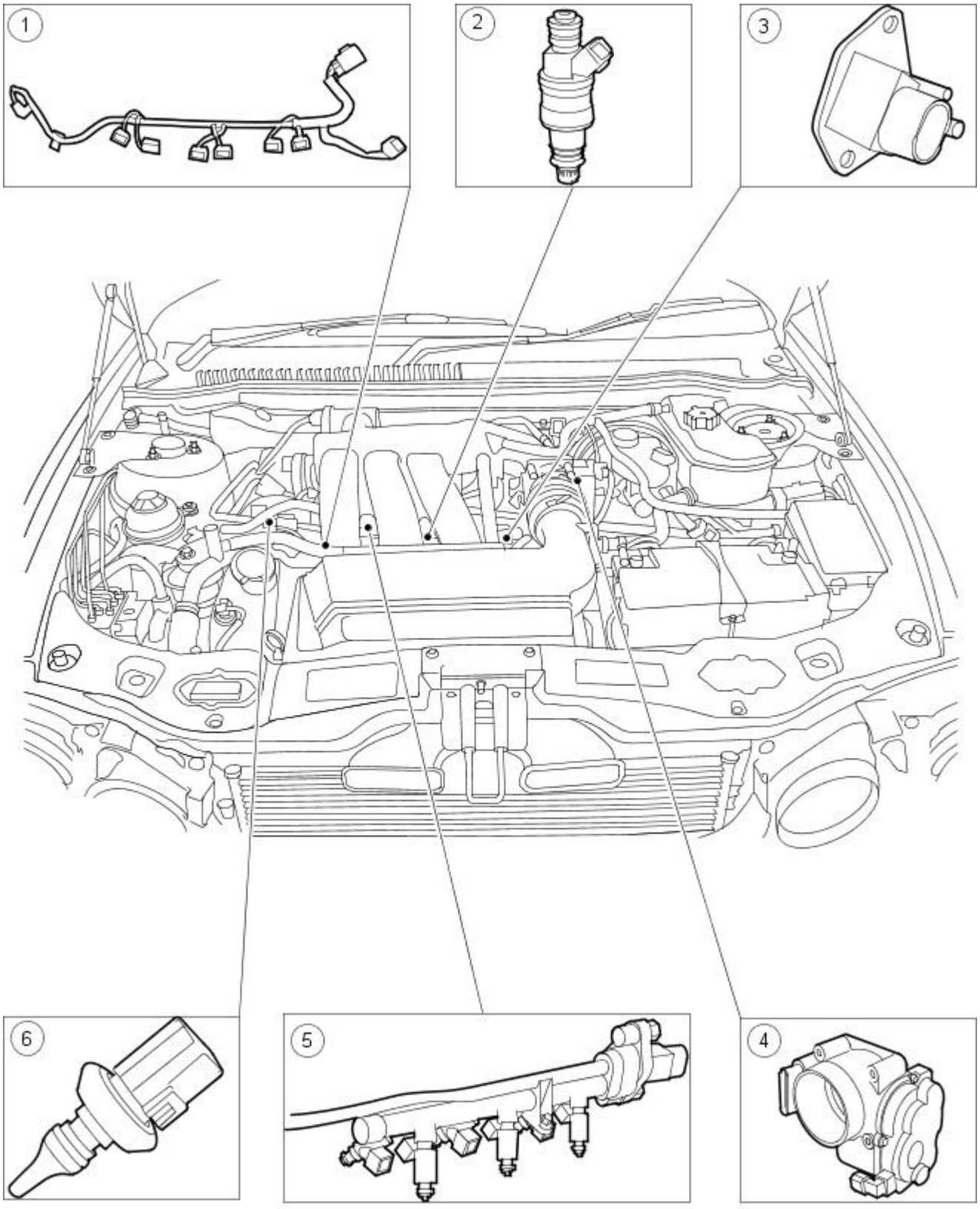
Torque Specifications

Description	Nm	lb-ft	lb-in
Lower intake manifold retaining bolts	10	-	89
Fuel injection supply manifold retaining bolts	10	-	89
Fuel pressure sensor retaining bolts	10	-	89
Throttle body retaining bolts	10	-	89

Published: 11-May-2011

Fuel Charging and Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Fuel Charging and Controls

Description and Operation



VUJ0003183

Item	Part Number	Description
1	—	Fuel charging wiring harness
2	—	Fuel injector
3	—	Fuel pressure sensor
4	—	Throttle body
5	—	Fuel injection supply manifold
6	-	Fuel temperature sensor

The electronic returnless fuel system utilized has the advantages of reduced fuel tank vapor, requires less electrical power and does not require a fuel return line.

Fuel is supplied at high pressure to the injectors via a fuel rail which incorporates six fuel injectors, a fuel pressure regulator and a fuel temperature sensor. The engine control module (ECM) maintains 380 kPa across the injectors, by increasing the pulse width modulation signal to the fuel pump controller. This in turn controls the voltage output to the fuel pump.

CAUTION: The use of supplementary oil or fuel additives is not approved unless specified by Jaguar Cars in the form of a service communication or directive.

A fuel pressure relief valve is fitted to the fuel rail at the front of the camshaft cover. This valve allows the fuel system to be depressurized during servicing and troubleshooting.

Published: 11-May-2011

Fuel Charging and Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Fuel Charging and Controls2.0L NA V6 - AJV6

Diagnosis and Testing

1. **1.** Verify the customer concern by operating the system.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.
3. **3.** Make sure there is sufficient fuel in the vehicle.
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.** The DTC summaries are generated to support the Jaguar approved diagnostic system, but also provide the basis for diagnosis of OBD related concerns using a suitable generic scan tool, in conjunction with the electrical guides. Until the DTC summaries and electrical guides are available, the fuel charging and controls system can only be diagnosed using the Jaguar approved diagnostic system. For additional information, refer to Dealer technical support.

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Fuel Charging and Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Fuel Charging and Controls2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27, VIN Range: E96603->J28492

Diagnosis and Testing

1. **1.** Verify the customer concern by operating the system.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.
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, use a fault code reader to retrieve fault codes before proceeding to the Symptom Chart.

Symptom Chart

DTC	Condition	Possible Causes	Action
P0171	Right-Hand bank combustion too lean	• Engine misfire • Air intake leak between MAF sensor and throttle • Fuel injector restriction • Fuel filter/system restriction • Fuel pressure sensor failure (low fuel pressure) • Low fuel pump output • HO2S (1/1; 1/2) harness wiring condition fault • Exhaust leak (before catalyst) • engine control module (ECM) receiving incorrect signal from one or more of the following components; ECT sensor, MAF sensor, IAT sensor, IP sensor, EFT sensor, TP sensor	REFER to: Engine Ignition - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing) / Engine (303-01A Engine - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing) / Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing) / Fuel Injectors (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation) / Exhaust System (309-00 Exhaust System, Diagnosis and Testing) / Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0172	Right-hand bank combustion too rich	• Restricted air filter • Leaking fuel injector(s) • Fuel pressure sensor failure (high fuel pressure) • ECM receiving incorrect signal from one or more of the following components; ECT sensor, MAF sensor, IAT sensor, IP sensor, EFT sensor, TP sensor	REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing) / Fuel Injectors (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation) / Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0174	Left-hand bank combustion too lean	• Engine misfire • Air intake leak between MAF sensor and throttle • Fuel injector restriction • Fuel filter/system restriction • Fuel pressure sensor failure (low fuel pressure) • Low fuel pump output • HO2S (2/1; 2/2) harness wiring condition fault • Exhaust leak (before catalyst) • ECM receiving incorrect signal from one or more of the following components; ECT sensor, MAF sensor, IAT sensor, IP sensor, EFT sensor, TP sensor	REFER to: Engine Ignition - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing) / Engine (303-01A Engine - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing) / Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing) / Fuel Injectors (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation) / Exhaust System (309-00 Exhaust System, Diagnosis and Testing) / Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0175	Left-hand bank combustion too rich	• Restricted air filter • Leaking fuel injector(s) • Fuel pressure sensor failure (high fuel pressure) • ECM receiving incorrect signal from one or more of the following components; ECT sensor, MAF sensor, IAT sensor, IP sensor, EFT sensor, TP sensor	REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing) / Fuel Injectors (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation) / Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P1251, P1631, P1657, P1658	Concern with throttle motor relay	• Throttle motor relay • Throttle motor relay circuit	REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).

DTC	Condition	Possible Causes	Action
P0112, P0113	Concern with IAT sensor	• Engine faulty leading to overheating • Intake air temperature (IAT) sensor fault • Harness fault • ECM failure	REFER to: Acceleration Control (310-02 Acceleration Control, Diagnosis and Testing) / Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0121, P0122, P0123, P0222, P0223	Concern with throttle position (TP) sensor	• TP sensor fault • Harness fault • ECM failure	REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0116, P0117, P0118, P0125	Concern with engine coolant temperature	• Engine coolant temperature sensor • Harness fault • ECM failure	REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0201, P0202, P0203, P0204, P0205, P0206	Concern with fuel injectors	• Faulty injector(s) • Harness fault • ECM failure	REFER to: Fuel Injectors (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation) / Fuel Charging Wiring Harness (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation) / Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0191	Concern with injection pressure (IP) sensor	• Fuel rail pressure sensor • Harness fault • Fuel filter/system restriction • Fuel system leak • Incorrect fuel pump output • IP sensor to ECM sensing circuit; high resistance, open circuit, short circuit to high voltage • IP sensor to splice in sensor supply circuit; high resistance, open circuit • IP sensor to splice in sensor ground circuit; high resistance, open circuit • IP sensor to splice in sensor ground circuit; high resistance, open circuit, short circuit to ground, short circuit to high voltage • IP sensor failure	GO to Pinpoint Test B.
P0192	Concern with injection pressure (IP) sensor (low voltage/low pressure)	• IP sensor disconnected • IP sensor to ECM sensing circuit; open circuit or short circuit to ground • IP sensor to splice in sensor supply circuit; high resistance, open circuit • IP sensor failure	GO to Pinpoint Test B.
P0193	Concern with injection pressure (IP) sensor (high voltage/high pressure)	• IP sensor to ECM wiring (supply/sense) short circuit to each other • IP sensor to ECM sense circuit; short circuit to high voltage • IP sensor to splice in sensor ground circuit; open circuit • IP sensor failure	GO to Pinpoint Test B.
P0460	Concern with fuel level sensors	• Fuel level sensor to instrument cluster circuit(s); intermittent short circuit, open circuit, high resistance • Fuel level sensor failure • Instrument cluster fault	GO to Pinpoint Test C.
P1234, P1236	Concern with fuel pump commands (no commands received by ECM)	• ECM to fuel pump control module control and/or feedback circuits; open circuit, short circuit, high resistance • Fuel pump control module failure	GO to Pinpoint Test D.

DTC	Condition	Possible Causes	Action
P1338	Concern with fuel pump commands (fuel pump not activated when requested by ECM)	• ECM to fuel pump control module control and/or feedback circuits; open circuit, short circuit, high resistance • Fuel pump control module failure	GO to Pinpoint Test E.
P1229	Concern with throttle motor control circuit	• Throttle motor disconnected • Throttle motor to ECM drive circuits; short circuit or open circuit • Throttle motor failure	GO to Pinpoint Test F.
P1224	Concern with throttle control position	• Throttle adaptions not performed after battery disconnect • TP sensor disconnected • TP sensor to ECM sense circuits; open circuit, high resistance • Throttle motor relay failure • Throttle motor relay to ECM circuit fault • Throttle motor relay power supply open circuit • ECM ground circuit fault (relay coil drive) • Throttle motor to ECM drive circuits; open circuit, short circuit, high resistance • Throttle motor failure • Throttle body failure	GO to Pinpoint Test F. REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). Individual Pinpoint tests for components and circuits listed
P1250, P1254	Concern with throttle valve return spring and "limp-home" spring	Throttle body	These DTCs can only be accurately diagnosed using the Jaguar approved diagnostic system. If this is not available, INSTALL a new throttle body. REFER to: Throttle Body (303-04, Removal and Installation). CLEAR the DTC, TEST the system for normal operation.
P1656	Concern with TP sensor amplifier circuit	ECM	REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).

PINPOINT TEST A : FUEL INJECTORS, P0201, P0202, P0203, P0204, P0205, P0206.

• NOTE: The DTC set will indicate which cylinder injector or circuit is faulty. Only in the event of multiple cylinder misfires will it be necessary to check more than one injector or circuit, in which case, multiple DTCs will be set.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE INJECTOR COIL RESISTANCE	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the relevant injector electrical connector (IJ1 to 6).
	3 Measure the resistance between the injector pins.
	Is the resistance between 12 and 16 ohms? **Yes** GO to A2. **No** INSTALL a new injector. REFER to: Fuel Injectors (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.
A2: CHECK THE INJECTOR COIL INSULATION	
	1 Measure the resistance between the injector pin 1 and the injector body.
	2 Measure the resistance between the injector pin 2 and the injector body.
	Are both resistances greater than 10 Mohms? **Yes** GO to A3. **No** INSTALL a new injector. REFER to: Fuel Injectors (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.
A3: CHECK THE INJECTOR SUPPLY VOLTAGE	
	1 Turn the ignition switch to the ON position.
	2 Disconnect the relevant injector harness electrical connector (IJ1 to 6).
	3 Measure the voltage between the relevant injector harness electrical connector (IJ1 to 6) pin 2 and GROUND.
	Is the voltage greater than 12 Volts? **Yes** GO to A4. **No** REPAIR the circuit between the relevant injector harness electrical connector, (IJ1 to 6) pin 2 and battery. This circuit includes the power distribution fuse box, fuse 41, and the EMS control relay. For additional information, refer to wiring diagrams. CLEAR DTC. TEST the system for normal operation.
A4: CHECK THE INJECTOR GROUND CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.

	3 Measure the resistance between the relevant injector harness electrical connector (IJ1 to 6) pin 1 and EN16 pins as follows - • Injector 1 pin 1 (NW) and ECM pin 115. • Injector Cyl 3 pin 1 (N) and ECM pin 114. • Injector Cyl 5 pin 1 (NR) and ECM pin 113. • Injector Cyl 2 pin 1 (NU) and ECM pin 120. • Injector Cyl 4 pin 1 (NG) and ECM pin 119. • Injector Cyl 6 pin 1 (NY) and ECM pin 118.
	Is the resistance less than 5 ohms? **Yes** GO to A5. **No** REPAIR the circuit between the relevant injector harness electrical connector pin 1 and the ECM electrical connector. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
A5: CHECK THE INJECTOR GROUND CIRCUIT FOR SHORT CIRCUIT TO BATTERY	
	1 Measure the voltage between the relevant injector harness electrical connector (IJ1 to 6) pin 1 and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to A6.
A6: CHECK THE INJECTOR GROUND CIRCUIT FOR SHORT CIRCUIT TO GROUND	
	1 Measure the resistance between the relevant injector harness electrical connector (IJ1 to 6) pin 1 and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new ECM. REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). Before replacing a ECM, contact Dealer technical support.

PINPOINT TEST B : FUEL RAIL PRESSURE SENSOR. P0190, P0192, P0193	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE FUEL RAIL PRESSURE SENSOR SUPPLY VOLTAGE	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the fuel rail pressure sensor electrical connector IJ007.
	3 Turn the ignition switch to the ON position.
	4 Measure the supply voltage to the fuel rail pressure sensor electrical connector IJ007 pin 1 (YG) and GROUND.
	Is the supply voltage between 4.5 and 5.5 volts? **Yes** GO to B2. **No** REPAIR the circuit between IJ007 pin 1, (YG) and ENS07. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). Before replacing a ECM, contact Dealer technical support. (The fault could be in any of the components or sensors in the 5 volt supply circuit, or the ECM)
B2: CHECK THE FUEL RAIL PRESSURE SENSOR GROUND CIRCUIT FOR OPEN CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Measure the resistance between the fuel rail pressure sensor electrical connector IJ007 pin 2, (WG) and GROUND.
	Is the resistance greater than 10,000 ohms? **Yes** REPAIR the circuit between IJ007 pin 2 (WG) and ground at IJS02. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to B3.
B3: CHECK THE FUEL RAIL PRESSURE SENSOR SIGNAL CIRCUIT FOR OPEN CIRCUIT	
	1 Disconnect the ECM electrical connector EN16.
	2 Measure the resistance between the fuel rail pressure sensor electrical connector IJ007 pin 3 (WG) and EN16 pin 73.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the circuit between IJ007 pin 3 (WG) and EN016 pin 73 (WG). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to B4.
B4: CHECK THE FUEL RAIL PRESSURE SENSOR SIGNAL CIRCUIT FOR SHORT TO GROUND	
	1 Measure the resistance between the fuel rail pressure sensor electrical connector IJ007 pin 3 (WG) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the circuit between IJ007 pin 3 (WG) and EN016 pin 73 (WG). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to B5.
B5: CHECK THE FUEL RAIL PRESSURE SENSOR CIRCUIT RESISTANCE	
	1 Disconnect the fuel rail pressure sensor electrical connector IJ007.
	2 Measure the resistance between the fuel rail pressure sensor pins 1 and 2.
	Is the resistance between 10,000 and 12,000 ohms? **Yes** GO to B6. **No** Install a new fuel rail pressure sensor.

	REFER to: Fuel Pulse Damper - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.
B6: CHECK THE FUEL RAIL PRESSURE SENSOR CIRCUIT RESISTANCE	
	1 Measure the resistance between the fuel rail pressure sensor pins 2 and 3.
	Is the resistance between 22,000 and 33,000 ohms? **Yes** GO to B7. **No** Install a new fuel rail pressure sensor. REFER to: Fuel Pulse Damper - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.
B7: CHECK THE FUEL RAIL PRESSURE SENSOR CIRCUIT RESISTANCE	
	1 Measure the resistance between the fuel rail pressure sensor pins 1 and 3.
	Is the resistance between 22,000 and 33,000 ohms? **Yes** Install a new ECM. REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). Before replacing a ECM, contact Dealer technical support. **No** Install a new fuel rail pressure sensor. REFER to: Fuel Pulse Damper - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST C : FUEL LEVEL SENSORS. P0460	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE FUEL LEVEL SENSOR (1) GROUND CIRCUIT	
	1 Disconnect the fuel level sensor electrical connector FT2.
	2 Turn the ignition switch to the ON position.
	3 Measure the resistance between electrical connector FT2 pin 3 (B) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to C2. **No** REPAIR the circuit between electrical connector FT2 pin 3 (B) and GROUND. For additional information, refer to wiring diagrams.CLEAR the DTC. TEST the system for normal operation.
C2: CHECK THE FUEL LEVEL SENSOR (1) SIGNAL CIRCUIT	
	1 Disconnect the Instrument cluster electrical connector IP10.
	2 Measure the resistance between electrical connector FT2 pin 1 (WU) and electrical connector IP10 pin 7 (WU)
	Is the resistance less than 5 ohms? **Yes** GO to C3. **No** REPAIR the circuit between FT2 pin 1 (WU) and IP10 pin 7 (WU). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
C3: CHECK THE FUEL LEVEL SENSOR (1) RHEOSTAT (EMPTY)	
	1 Empty the fuel tank.
	2 Measure the resistance between pins 1 and 3 of the fuel level sensor.
	Is the resistance 20 ohms? **Yes** GO to C4. **No** INSTALL a new fuel level sensor. REFER to: Fuel Tank and Lines (310-01 Fuel Tank and Lines, Diagnosis and Testing). CLEAR the DTC. TEST the system for normal operation.
C4: CHECK THE FUEL LEVEL SENSOR (1) RHEOSTAT (FULL)	
	1 Fill the fuel tank.
	2 Measure the resistance between pins 1 and 3 of the fuel level sensor.
	Is the resistance 160 ohms? **Yes** INSTALL a new instrument cluster. REFER to: Instrument Cluster (413-01 Instrument Cluster, Diagnosis and Testing). CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuel level sensor. REFER to: Fuel Tank and Lines (310-01 Fuel Tank and Lines, Diagnosis and Testing). CLEAR the DTC. TEST the system for normal operation.
C5: CHECK THE FUEL LEVEL SENSOR (2) GROUND CIRCUIT	
	1 Disconnect the fuel level sensor electrical connector, FT3.
	2 Turn the ignition switch to the ON position.
	3 Measure the resistance between electrical connector FT3, pin 3 (B) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to C6. **No** REPAIR the circuit between FT3 pin 3 (B) and ground. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
C6: CHECK THE FUEL LEVEL SENSOR (2) SIGNAL CIRCUIT	
	1 Disconnect the instrument cluster electrical connector IP10.
	2 Measure the resistance between electrical connector FT3 pin 1 (WB) and electrical connector IP10 pin 8(WB)

	Is the resistance less than 5 ohms? **Yes** GO to C7. **No** REPAIR the circuit between FT3 pin 1 (WB) and IP10 pin 8 (WB). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
C7: CHECK THE FUEL LEVEL SENSOR (2) RHEOSTAT (EMPTY)	
	1 Empty the fuel tank.
	2 Measure the resistance between pins 1 and 3 of the fuel level sensor.
	Is the resistance 20 ohms? **Yes** GO to C8. **No** INSTALL a new fuel level sensor. REFER to: Fuel Tank and Lines (310-01 Fuel Tank and Lines, Diagnosis and Testing). CLEAR the DTC. TEST the system for normal operation.
C8: CHECK THE FUEL LEVEL SENSOR (2) RHEOSTAT (FULL)	
	1 Fill the fuel tank.
	2 Measure the resistance between pins 1 and 3 of the fuel level sensor.
	Is the resistance 160 ohms? **Yes** INSTALL a new instrument cluster. REFER to: Instrument Cluster (413-01 Instrument Cluster, Diagnosis and Testing). CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuel level sensor. REFER to: Fuel Tank and Lines (310-01 Fuel Tank and Lines, Diagnosis and Testing). CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST D : FUEL PUMP CONTROL MODULE. P1234, P1236	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE POWER SUPPLY TO THE FUEL PUMP MODULE	
	1 Disconnect the fuel pump module electrical connector CA105.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage at CA105 pin 9 (NG)
	Is the voltage greater than 10 volts? **Yes** GO to D2. **No** REPAIR the circuit between electrical connector CA105 pin 9 (NG) and the ignition switch. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the central junction fuse box, ignition relay, and the inertia switch. For additional information, refer to wiring diagrams)
D2: CHECK THE GROUND CIRCUIT TO THE FUEL PUMP MODULE	
	1 Measure the resistance between CA105 pin 2 (B) and ground.
	Is the resistance less than 5 ohms? **Yes** GO to D3. **No** REPAIR the circuit between electrical connector CA105 pin 2 (B) and GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
D3: CHECK THE SIGNAL GROUND CIRCUIT TO THE FUEL PUMP MODULE	
• NOTE: This test would be necessary if there were an EMC (Electro Magnetic Compatibility) issue with the vehicle.	
	1 Turn the ignition switch to the CRANK position.
	2 Measure the resistance between electrical connector CA105 pin 4 (BG) and ground.
	Is the resistance less than 5 ohms? **Yes** GO to D4. **No** REPAIR the circuit between electrical connector CA105 pin 4 (BG) and GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM)
D4: CHECK THE POWER SUPPLY CIRCUIT TO THE FUEL PUMP	
	1 Reconnect the fuel pump module electrical connector CA105.
	2 Disconnect the fuel pump electrical connector FT2.
	3 Turn the ignition switch to the ON position.
	4 Measure the voltage between electrical connector FT2 pin 2 (R) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to D5. **No** INSTALL a new fuel pump module. REFER to: Fuel Tank and Lines (310-01 Fuel Tank and Lines, Diagnosis and Testing). CLEAR the DTC. TEST the system for normal operation.
D5: CHECK THE SIGNAL GROUND CIRCUIT FOR CONTINUITY	
	1 Disconnect the fuel pump module electrical connector CA105.
	2 Measure the resistance between electrical connector CA105 pin 3 (Y) and electrical connector FT2 pin 4 (Y)
	Is the resistance less than 5 ohms? **Yes** INSTALL a new fuel pump module. REFER to: Fuel Tank and Lines (310-01 Fuel Tank and Lines, Diagnosis and Testing). If the DTC is repeated, INSTALL a new fuel pump. REFER to: Fuel Tank and Lines (310-01 Fuel Tank and Lines, Diagnosis and Testing). CLEAR the DTC. TEST the system for normal operation. **No** REPAIR the circuit between electrical connector CA105 pin 3 (Y) and electrical connector FT2 pin 4 (Y). For additional

	information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST E : FUEL PUMP FEEDBACK CIRCUITS. P1338	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK SIGNAL POWER CIRCUIT TO FUEL PUMP MODULE	
	1 Disconnect fuel pump module electrical connector CA105.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between electrical connector CA105 pin 9 (NG) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to E2. **No** GO to E4.
E2: CHECK FEEDBACK CIRCUIT TO FUEL PUMP MODULE	
	1 Reconnect fuel pump module electrical connector CA105.
	2 Turn the ignition switch to the CRANK position.
	3 Measure the voltage between ECM electrical connector EN16 pin 25 (W) and GROUND.
	Is the voltage greater than 4 volts? **Yes** No electrical fault in circuit. Recheck DTCs. **No** GO to E3.
E3: CHECK FEEDBACK CIRCUIT FOR CONTINUITY	
	1 Disconnect fuel pump module electrical connector CA105.
	2 Disconnect ECM electrical connector EN16.
	3 Measure the resistance between electrical connector CA105 pin 7 (W) and electrical connector EN16 pin 25 (W).
	Is the resistance less than 5 ohms? **Yes** GO to E4. **No** REPAIR the circuit between electrical connector CA105 pin 7 (W) and electrical connector EN16 pin 25 (W). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
E4: CHECK CONTROL CIRCUIT FOR CONTINUITY	
	1 Measure the resistance between electrical connector CA105 pin 1 (N) and electrical connector EN16 pin 27 (N).
	Is the resistance less than 5 ohms? **Yes** INSTALL a new fuel pump module. REFER to: Fuel Tank and Lines (310-01 Fuel Tank and Lines, Diagnosis and Testing). CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). Before replacing a ECM, contact Dealer technical support. **No** REPAIR the circuit between electrical connector CA105 pin 1 (N) and electrical connector EN16 pin 27 (N). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST F : THROTTLE CONTROL POSITION ERROR. P1224, P1229	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK THROTTLE CONTROL CIRCUIT FOR CONTINUITY	
	1 Disconnect throttle motor electrical connector EN10.
	2 Disconnect ECM electrical connector EN16.
	3 Measure the resistance between ECM electrical connector EN16 pin 80 (G) and throttle motor electrical connector EN10 pin 2 (G).
	Is the resistance less than 5 ohms? **Yes** GO to F2. **No** REPAIR the circuit between ECM electrical connector EN16 pin 80 (G) and throttle motor electrical connector EN10 pin 2 (G). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
F2: CHECK THROTTLE CONTROL CIRCUIT FOR CONTINUITY	
	1 Measure the resistance between ECM electrical connector EN16 pin 106 (R) and throttle motor electrical connector EN10 pin 1 (R).
	Is the resistance less than 5 ohms? **Yes** INSTALL a new ECM. REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). CLEAR the DTC. TEST the system for normal operation. **No** REPAIR the circuit between ECM electrical connector EN16 pin 106 (R) and throttle motor electrical connector EN10 pin 1 (R). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

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Fuel Charging and Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Fuel Charging and Controls2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27, VIN Range: J28493->V99999

Diagnosis and Testing

1. **1.** Verify the customer concern by operating the system.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.
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, use a fault code reader to retrieve fault codes before proceeding to the Symptom Chart.

Symptom Chart

DTC	Condition	Possible Causes	Action
P0171	Right-hand bank combustion too lean	• Engine misfire • Air intake leak between MAF sensor and throttle • Fuel injector restriction • Fuel filter/system restriction • fuel pulse damper failure (low fuel pressure) • Low fuel pump output • HO2S (1/1; ½) harness wiring condition fault • Exhaust leak (before catalyst) • engine control module (ECM) receiving incorrect signal from one or more of the following components; ECT sensor, MAF sensor, IAT sensor, IP sensor, EFT sensor, TP sensor	REFER to: Engine Ignition - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing), Engine (303-01A Engine - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing), Exhaust System (309-00 Exhaust System, Diagnosis and Testing), Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: J28493->V99999 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0172	Right-hand bank combustion too rich	• Restricted air filter • Leaking fuel injector(s) • fuel pulse damper failure (high fuel pressure) • ECM receiving incorrect signal from one or more of the following components; ECT sensor, MAF sensor, IAT sensor, IP sensor, EFT sensor, TP sensor	REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing), Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: J28493->V99999 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0174	Left-hand bank combustion too lean	• Engine misfire • Air intake leak between MAF sensor and throttle • Fuel injector restriction • Fuel filter/system restriction • fuel pulse damper failure (low fuel pressure) • Low fuel pump output • HO2S (2/1; 2/2) harness wiring condition fault • Exhaust leak (before catalyst) • ECM receiving incorrect signal from one or more of the following components; ECT sensor, MAF sensor, IAT sensor, IP sensor, EFT sensor, TP sensor	REFER to: Engine Ignition - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing), Engine (303-01A Engine - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing), Exhaust System (309-00 Exhaust System, Diagnosis and Testing), Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: J28493->V99999 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0175	Left-hand bank combustion too rich	• Restricted air filter • Leaking fuel injector(s) • fuel pulse damper failure (high fuel pressure) • ECM receiving incorrect signal from one or more of the following components; ECT sensor, MAF sensor, IAT sensor, IP sensor, EFT sensor, TP sensor	REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing), Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: J28493->V99999 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P1251, P1631, P1657, P1658	Concern with throttle motor relay	• Throttle motor relay • Throttle motor relay circuit	REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: J28493->V99999 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0112, P0113	Concern with IAT sensor	• Engine faulty leading to overheating • Intake air temperature (IAT) sensor fault • Harness fault • ECM failure	REFER to: Acceleration Control (310-02 Acceleration Control, Diagnosis and Testing), Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: J28493->V99999 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0121, P0122, P0123, P0222, P0223	Concern with throttle position (TP) sensor	• TP sensor fault • Harness fault • ECM failure	REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: J28493->V99999 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).

DTC	Condition	Possible Causes	Action
P0116, P0117, P0118, P0125	Concern with engine coolant temperature	• Engine coolant temperature sensor • Harness fault • ECM failure	REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: J28493->V99999 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0201, P0202, P0203, P0204, P0205, P0206	Concern with fuel injectors	• Faulty injector(s) • Harness fault • ECM failure	REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: J28493->V99999 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0191	Concern with injection pressure (IP) sensor	• fuel pulse damper sensor • Harness fault • Fuel filter/system restriction • Fuel system leak • Incorrect fuel pump output • IP sensor to ECM sensing circuit; high resistance, open circuit, short circuit to high voltage • IP sensor to splice in sensor supply circuit; high resistance, open circuit • IP sensor to splice in sensor ground circuit; high resistance, open circuit • IP sensor to splice in sensor ground circuit; high resistance, open circuit, short circuit to ground, short circuit to high voltage • IP sensor failure	GO to Pinpoint Test B.
P0192	Concern with injection pressure (IP) sensor (low voltage/low pressure)	• IP sensor disconnected • IP sensor to ECM sensing circuit; open circuit or short circuit to ground • IP sensor to splice in sensor supply circuit; high resistance, open circuit • IP sensor failure	GO to Pinpoint Test B.
P0193	Concern with injection pressure (IP) sensor (high voltage/high pressure)	• IP sensor to ECM wiring (supply/sense) short circuit to each other • IP sensor to ECM sense circuit; short circuit to high voltage • IP sensor to splice in sensor ground circuit; open circuit • IP sensor failure	GO to Pinpoint Test B.
P0460	Concern with fuel level sensors	• Fuel level sensor to instrument cluster circuit(s); intermittent short circuit, open circuit, high resistance • Fuel level sensor failure • Instrument cluster fault	GO to Pinpoint Test C.
P0627, P0628, P0629	Concern with fuel pump commands	• ECM to fuel pump control module control and/or feedback circuits; open circuit, short circuit, high resistance • Fuel pump control module failure	GO to Pinpoint Test D.
P2635	Concern with fuel pump operation	• ECM to fuel pump control module control and/or feedback circuits; open circuit, short circuit, high resistance • Fuel pump control module failure	GO to Pinpoint Test E.
P1250, P1254	Concern with throttle valve return spring and "limp-home" spring	Throttle body	These DTCs can only be accurately diagnosed using the Jaguar approved diagnostic system. If this is not available, INSTALL a new throttle body. REFER to: Throttle Body (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC, TEST the system for normal operation.
P2107	Concern with throttle "watchdog circuit" circuit	ECM	REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: J28493->V99999 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P2118	Concern with throttle motor control circuit	• Throttle motor disconnected • Throttle motor to ECM drive circuits; short circuit or open circuit • Throttle motor failure	GO to Pinpoint Test F.
P2119	Concern with throttle control position	• Throttle adaptions not performed after battery disconnect • TP sensor disconnected • TP sensor to ECM sense circuits; open circuit, high resistance • Throttle motor relay failure • Throttle motor relay to ECM circuit fault • Throttle motor relay power supply open circuit • ECM ground circuit fault (relay coil drive) • Throttle motor to ECM drive circuits;	REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: J28493->V99999 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). Individual Pinpoint tests for components and circuits listed

DTC	Condition	Possible Causes	Action
		open circuit, short circuit, high resistance • Throttle motor failure • Throttle body failure	
P1656	Concern with TP sensor amplifier circuit	ECM	REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: J28493->V99999 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).

PINPOINT TEST A : FUEL INJECTORS, P0201, P0202, P0203, P0204, P0205, P0206.

• NOTE: The DTC set will indicate which cylinder injector or circuit is faulty. Only in the event of multiple cylinder misfires will it be necessary to check more than one injector or circuit, in which case, multiple DTCs will be set.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE INJECTOR COIL RESISTANCE	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the relevant injector electrical connector (IL1 to 6).
	3 Measure the resistance between the injector pins.
	Is the resistance between 12 and 16 ohms? **Yes** GO to A2. **No** INSTALL a new injector. REFER to: Fuel Injectors (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.
A2: CHECK THE INJECTOR COIL INSULATION	
	1 Measure the resistance between the injector pin 1 and the injector body.
	2 Measure the resistance between the injector pin 2 and the injector body.
	Are both resistances greater than 10 OHMS? **Yes** GO to A3. **No** INSTALL a new injector. REFER to: Fuel Injectors (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.
A3: CHECK THE INJECTOR SUPPLY VOLTAGE	
	1 Turn the ignition switch to the ON position.
	2 Disconnect the relevant injector harness electrical connector (IL1 to 6).
	3 Measure the voltage between the relevant injector harness electrical connector (IL1 to 6) pin 2 and GROUND.
	Is the voltage greater than 12 Volts? **Yes** GO to A4. **No** REPAIR the circuit between the relevant injector harness electrical connector, (IL1 to 6) pin 2 and battery. This circuit includes the power distribution fuse box, fuse 41, and the EMS control relay. For additional information, refer to wiring diagrams. CLEAR DTC. TEST the system for normal operation.
A4: CHECK THE INJECTOR GROUND CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between the relevant injector harness electrical connector (IL1 to 6) pin 1 and EN16 pins as follows - • Injector 1 pin 1 (NW) and ECM pin 115. • Injector Cyl 3 pin 1 (N) and ECM pin 114. • Injector Cyl 5 pin 1 (NR) and ECM pin 113. • Injector Cyl 2 pin 1 (NU) and ECM pin 120. • Injector Cyl 4 pin 1 (NG) and ECM pin 119. • Injector Cyl 6 pin 1 (NY) and ECM pin 118.
	Is the resistance less than 5 ohms? **Yes** GO to A5. **No** REPAIR the circuit between the relevant injector harness electrical connector pin 1 and the ECM electrical connector. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
A5: CHECK THE INJECTOR GROUND CIRCUIT FOR SHORT CIRCUIT TO BATTERY	
	1 Measure the voltage between the relevant injector harness electrical connector (IL1 to 6) pin 1 and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to A6.
A6: CHECK THE INJECTOR GROUND CIRCUIT FOR SHORT CIRCUIT TO GROUND	
	1 Measure the resistance between the relevant injector harness electrical connector (IL1 to 6) pin 1 and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

	Before replacing a ECM, contact Dealer technical support.

PINPOINT TEST B : FUEL PULSE DAMPER SENSOR. P0190, P0192, P0193	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE FUEL PULSE DAMPER SENSOR SUPPLY VOLTAGE	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the fuel pulse damper sensor electrical connector IL007.
	3 Turn the ignition switch to the ON position.
	4 Measure the supply voltage to the fuel pulse damper sensor electrical connector IL007 pin 1 (YG) and GROUND.
	Is the supply voltage between 4.5 and 5.5 volts? **Yes** GO to B2. **No** REPAIR the circuit between IL007 pin 1, (YG) and ENS07. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing a ECM, contact Dealer technical support. (The fault could be in any of the components or sensors in the 5 volt supply circuit, or the ECM)
B2: CHECK THE FUEL PULSE DAMPER SENSOR GROUND CIRCUIT FOR OPEN CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Measure the resistance between the fuel pulse damper sensor electrical connector IL007 pin 2, (WG) and GROUND.
	Is the resistance greater than 10,000 ohms? **Yes** REPAIR the circuit between IL007 pin 2 (WG) and ground at ILS02. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to B3.
B3: CHECK THE FUEL PULSE DAMPER SENSOR SIGNAL CIRCUIT FOR OPEN CIRCUIT	
	1 Disconnect the ECM electrical connector EN16.
	2 Measure the resistance between the fuel pulse damper sensor electrical connector IL007 pin 3 (WG) and EN16 pin 73.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the circuit between IL007 pin 3 (WG) and EN016 pin 73 (WG). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to B4.
B4: CHECK THE FUEL PULSE DAMPER SENSOR SIGNAL CIRCUIT FOR SHORT TO GROUND	
	1 Measure the resistance between the fuel pulse damper sensor electrical connector IL007 pin 3 (WG) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the circuit between IL007 pin 3 (WG) and EN016 pin 73 (WG). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to B5.
B5: CHECK THE FUEL PULSE DAMPER SENSOR CIRCUIT RESISTANCE	
	1 Disconnect the fuel pulse damper sensor electrical connector IL007.
	2 Measure the resistance between the fuel pulse damper sensor pins 1 and 2.
	Is the resistance between 10,000 and 12,000 ohms? **Yes** GO to B6. **No** Install a new fuel pulse damper sensor. REFER to: Fuel Pulse Damper - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.
B6: CHECK THE FUEL PULSE DAMPER SENSOR CIRCUIT RESISTANCE	
	1 Measure the resistance between the fuel pulse damper sensor pins 2 and 3.
	Is the resistance between 22,000 and 33,000 ohms? **Yes** GO to B7. **No** Install a new fuel pulse damper sensor. REFER to: Fuel Pulse Damper - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.
B7: CHECK THE FUEL PULSE DAMPER SENSOR CIRCUIT RESISTANCE	
	1 Measure the resistance between the fuel pulse damper sensor pins 1 and 3.
	Is the resistance between 22,000 and 33,000 ohms? **Yes** Install a new ECM. REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: J28493->V99999 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). Before replacing a ECM, contact Dealer technical support. **No** Install a new fuel pulse damper sensor. REFER to: Fuel Pulse Damper - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST C : FUEL LEVEL SENSORS. P0460	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE FUEL LEVEL SENSOR (1) GROUND CIRCUIT	
	1 Disconnect the fuel level sensor electrical connector FT2.

	2 Turn the ignition switch to the ON position.
	3 Measure the resistance between electrical connector FT2 pin 3 (B) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to C2. **No** REPAIR the circuit between electrical connector FT2 pin 3 (B) and GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
C2: CHECK THE FUEL LEVEL SENSOR (1) SIGNAL CIRCUIT	
	1 Disconnect the Instrument cluster electrical connector IP10.
	2 Measure the resistance between electrical connector FT2 pin 1 (WU) and electrical connector IP10 pin 7 (WU).
	Is the resistance less than 5 ohms? **Yes** GO to C3. **No** REPAIR the circuit between FT2 pin 1 (WU) and IP10 pin 7 (WU). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
C3: CHECK THE FUEL LEVEL SENSOR (1) RHEOSTAT (EMPTY)	
	1 Empty the fuel tank.
	2 Measure the resistance between pins 1 and 3 of the fuel level sensor.
	Is the resistance 20 ohms? **Yes** GO to C4. **No** INSTALL a new fuel level sensor. REFER to: (310-01 Fuel Tank and Lines) Fuel Level Sender LH - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (Removal and Installation), Fuel Level Sender RH - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (Removal and Installation). CLEAR the DTC. TEST the system for normal operation.
C4: CHECK THE FUEL LEVEL SENSOR (1) RHEOSTAT (FULL)	
	1 Fill the fuel tank.
	2 Measure the resistance between pins 1 and 3 of the fuel level sensor.
	Is the resistance 160 ohms? **Yes** INSTALL a new instrument cluster. REFER to: Instrument Cluster (413-01 Instrument Cluster, Removal and Installation). CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuel level sensor. REFER to: Fuel Level Sender LH - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation) / Fuel Level Sender RH - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.
C5: CHECK THE FUEL LEVEL SENSOR (2) GROUND CIRCUIT	
	1 Disconnect the fuel level sensor electrical connector, FT3.
	2 Turn the ignition switch to the ON position.
	3 Measure the resistance between electrical connector FT3, pin 3 (B) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to C6. **No** REPAIR the circuit between FT3 pin 3 (B) and ground. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
C6: CHECK THE FUEL LEVEL SENSOR (2) SIGNAL CIRCUIT	
	1 Disconnect the instrument cluster electrical connector IP10.
	2 Measure the resistance between electrical connector FT3 pin 1 (WB) and electrical connector IP10 pin 8 (WB).
	Is the resistance less than 5 ohms? **Yes** GO to C7. **No** REPAIR the circuit between FT3 pin 1 (WB) and IP10 pin 8 (WB). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
C7: CHECK THE FUEL LEVEL SENSOR (2) RHEOSTAT (EMPTY)	
	1 Empty the fuel tank.
	2 Measure the resistance between pins 1 and 3 of the fuel level sensor.
	Is the resistance 20 ohms? **Yes** GO to C8. **No** INSTALL a new fuel level sensor. REFER to: Fuel Level Sender LH - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation) / Fuel Level Sender RH - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.
C8: CHECK THE FUEL LEVEL SENSOR (2) RHEOSTAT (FULL)	
	1 Fill the fuel tank.
	2 Measure the resistance between pins 1 and 3 of the fuel level sensor.
	Is the resistance 160 ohms? **Yes** INSTALL a new instrument cluster. REFER to: Instrument Cluster (413-01 Instrument Cluster, Removal and Installation). CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuel level sensor. REFER to: Fuel Level Sender LH - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation) / Fuel Level Sender RH - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST D : FUEL PUMP CONTROL MODULE. P0627, P0628, P0629	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK SIGNAL POWER CIRCUIT TO FUEL PUMP MODULE	
	1 Disconnect fuel pump module electrical connector CA105.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between electrical connector CA105 pin 9 (NG) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to D2. **No** GO to D4.
D2: CHECK FEEDBACK CIRCUIT TO FUEL PUMP MODULE	
	1 Reconnect fuel pump module electrical connector CA105.
	2 Turn the ignition switch to the CRANK position.
	3 Measure the voltage between ECM electrical connector EN16 pin 25 (W) and GROUND.
	Is the voltage greater than 4 volts? **Yes** No electrical fault in circuit. Recheck DTCs. **No** GO to D3.
D3: CHECK FEEDBACK CIRCUIT FOR CONTINUITY	
	1 Disconnect fuel pump module electrical connector CA105.
	2 Disconnect ECM electrical connector EN16.
	3 Measure the resistance between electrical connector CA105 pin 7 (W) and electrical connector EN16 pin 25 (W).
	Is the resistance less than 5 ohms? **Yes** GO to D4. **No** REPAIR the circuit between electrical connector CA105 pin 7 (W) and electrical connector EN16 pin 25 (W). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
D4: CHECK CONTROL CIRCUIT FOR CONTINUITY	
	1 Measure the resistance between electrical connector CA105 pin 1 (N) and electrical connector EN16 pin 27 (N).
	Is the resistance less than 5 ohms? **Yes** INSTALL a new fuel pump module. REFER to: Fuel Pump Module - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation). CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing a ECM, contact Dealer technical support. **No** REPAIR the circuit between electrical connector CA105 pin 1 (N) and electrical connector EN16 pin 27 (N). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST E : FUEL PUMP CONTROL MODULE. P2635	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK THE POWER SUPPLY TO THE FUEL PUMP MODULE	
	1 Disconnect the fuel pump module electrical connector CA105.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage at CA105 pin 9 (NG)
	Is the voltage greater than 10 volts? **Yes** GO to E2. **No** REPAIR the circuit between electrical connector CA105 pin 9 (NG) and the ignition switch. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the central junction fuse box, ignition relay, and the inertia switch. For additional information, refer to wiring diagrams)
E2: CHECK THE GROUND CIRCUIT TO THE FUEL PUMP MODULE	
	1 Measure the resistance between CA105 pin 2 (B) and ground.
	Is the resistance less than 5 ohms? **Yes** GO to E3. **No** REPAIR the circuit between electrical connector CA105 pin 2 (B) and GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
E3: CHECK THE SIGNAL GROUND CIRCUIT TO THE FUEL PUMP MODULE	
• NOTE: This test would be necessary if there were an EMC (Electro Magnetic Compatibility) issue with the vehicle.	
	1 Turn the ignition switch to the CRANK position.
	2 Measure the resistance between electrical connector CA105 pin 4 (BG) and ground.
	Is the resistance less than 5 ohms? **Yes** GO to E4. **No** REPAIR the circuit between electrical connector CA105 pin 4 (BG) and GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM)
E4: CHECK THE POWER SUPPLY CIRCUIT TO THE FUEL PUMP	
	1 Reconnect the fuel pump module electrical connector CA105.
	2 Disconnect the fuel pump electrical connector FT2.
	3 Turn the ignition switch to the ON position.
	4 Measure the voltage between electrical connector FT2 pin 2 (R) and GROUND.

	Is the voltage greater than 10 volts? **Yes** GO to E5. **No** INSTALL a new fuel pump module. REFER to: Fuel Pump Module - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.
E5: CHECK THE SIGNAL GROUND CIRCUIT FOR CONTINUITY	
	1 Disconnect the fuel pump module electrical connector CA105.
	2 Measure the resistance between electrical connector CA105 pin 3 (Y) and electrical connector FT2 pin 4 (Y)
	Is the resistance less than 5 ohms? **Yes** INSTALL a new fuel pump module. REFER to: Fuel Pump Module - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation). If the DTC is repeated, INSTALL a new fuel level sender. REFER to: Fuel Level Sender LH - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation) / Fuel Level Sender RH - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation). CLEAR the DTC. TEST the system for normal operation. **No** REPAIR the circuit between electrical connector CA105 pin 3 (Y) and electrical connector FT2 pin 4 (Y). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST F : THROTTLE CONTROL CIRCUIT P2118.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK THROTTLE CONTROL CIRCUIT FOR CONTINUITY	
	1 Disconnect throttle motor electrical connector EN10.
	2 Disconnect ECM electrical connector EN16.
	3 Measure the resistance between ECM electrical connector EN16 pin 80 (G) and throttle motor electrical connector EN95 pin 2 (G).
	Is the resistance less than 5 ohms? **Yes** GO to F2. **No** REPAIR the circuit between ECM electrical connector EN16 pin 80 (G) and throttle motor electrical connector EN95 pin 2 (G). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
F2: CHECK THROTTLE CONTROL CIRCUIT FOR CONTINUITY	
	1 Measure the resistance between ECM electrical connector EN16 pin 106 (R) and throttle motor electrical connector EN95 pin 1 (R).
	Is the resistance less than 5 ohms? **Yes** INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation. **No** REPAIR the circuit between ECM electrical connector EN16 pin 106 (R) and throttle motor electrical connector EN95 pin 1 (R). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

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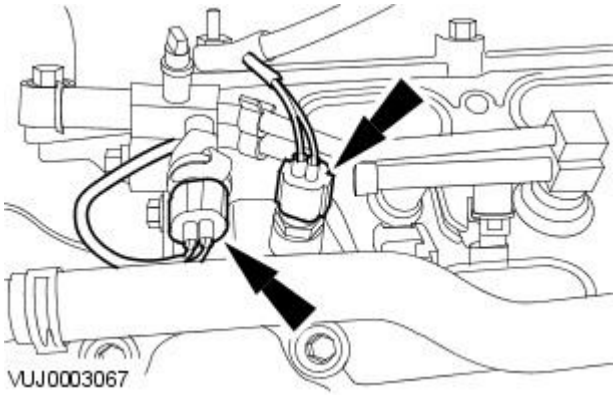
Fuel Charging and Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Fuel Charging Wiring Harness

Removal and Installation

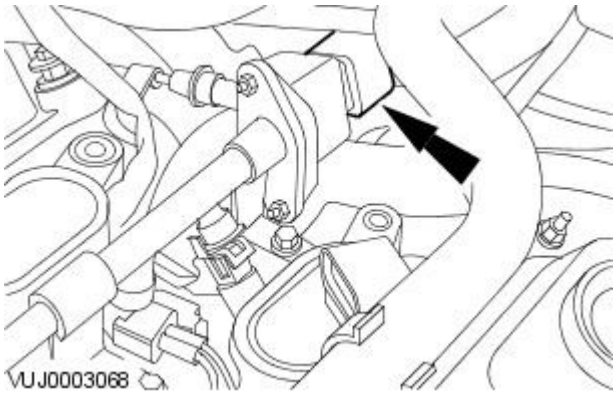
Removal

Vehicles with 2.5L or 3.0L engine

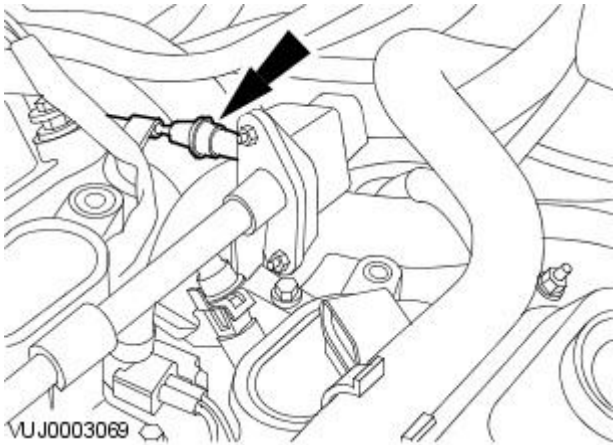
1. Remove the intake manifold. For additional information, refer to Section 303-01A Engine Section 303-01B Engine.
2. Disconnect the spring lock coupling. For additional information, refer to Section 310-00 Fuel System - General Information.
3. Disconnect the engine coolant temperature (ECT) and fuel temperature sensor electrical connectors.



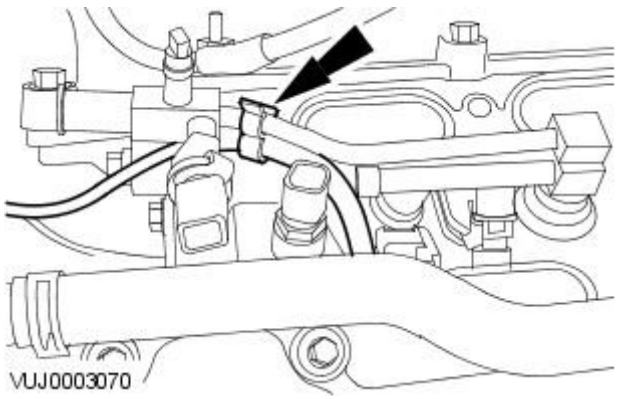
4. Disconnect the electrical connector.

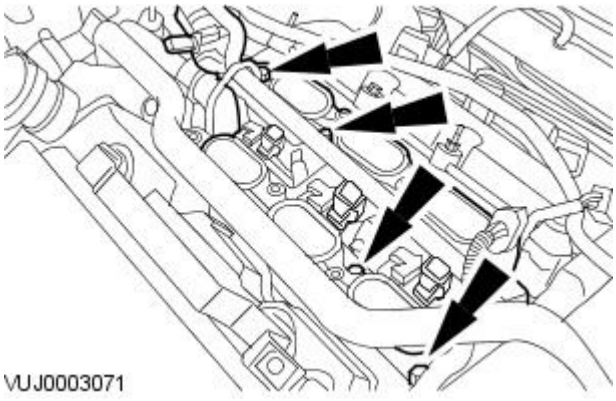


5. Detach the fuel pressure sensor vacuum line.



6. Detach the fuel charging wiring harness.

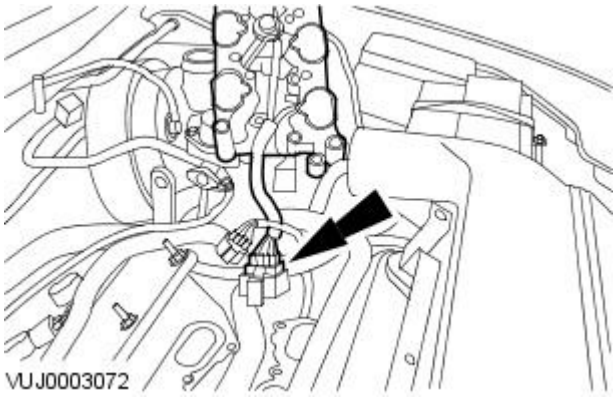



VUJ0003071

7. NOTE: Fuel may still be present in the fuel injection supply manifold.

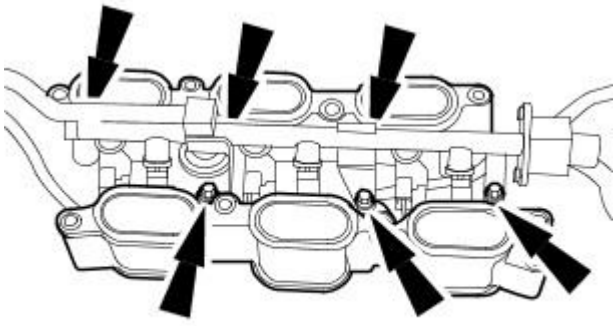
Detach the fuel injection supply manifold and lower intake manifold and place to one side.

- Remove and discard the lower intake manifold O-ring seals.


VUJ0003072

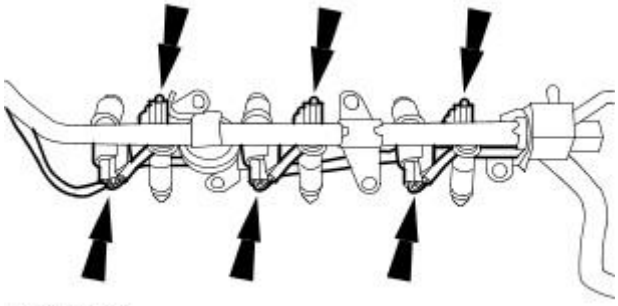
8. Remove the fuel injection supply manifold and lower intake manifold.

- Disconnect the electrical connector.


VUJ0003074

9. Remove the lower intake manifolds.

- Remove and discard the fuel injector O-ring seals.


VUJ0003075

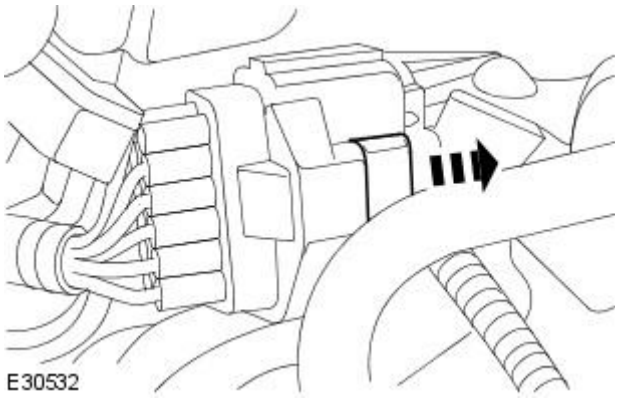
10. Remove the fuel charging wiring harness.

- Disconnect the electrical connectors.

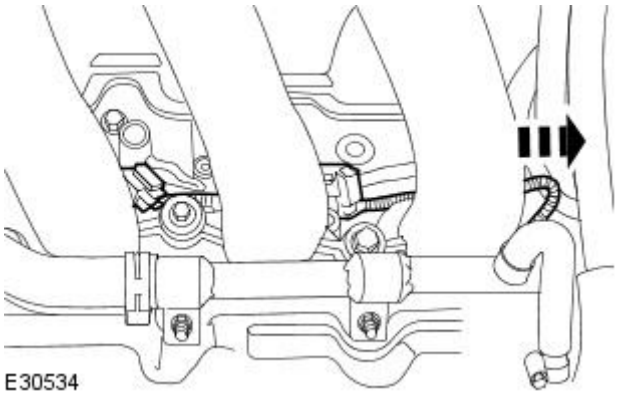
Vehicles with 2.0L engine

11. Remove the fuel rail.
For additional information, refer to Fuel Injection Supply Manifold in this section.

12. Disconnect the electrical connector.


E30532

13. Remove the fuel charging wiring harness.


E30534

Installation

Vehicles with 2.0L engine

1. To install, reverse the removal procedure.

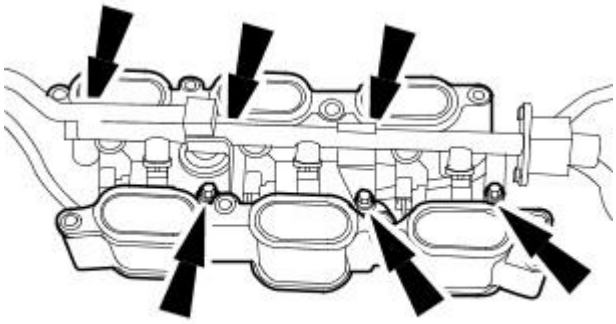
Vehicles with 2.5L or 3.0L engine

2. NOTE: Install new fuel injector O-ring seals.

• NOTE: Install new lower intake manifold O-ring seals.

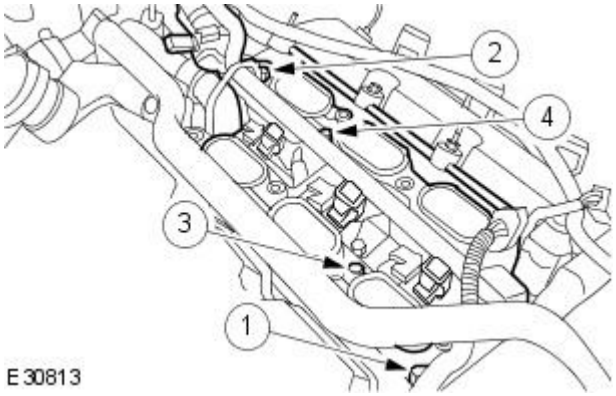
To install, reverse the removal procedure.

- Tighten to 10 Nm.


VUJ0003074

3. Tighten in the sequence shown.

- Tighten to 10 Nm.



E30813

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Fuel Charging and Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Fuel Injection Supply Manifold

Removal and Installation

Removal

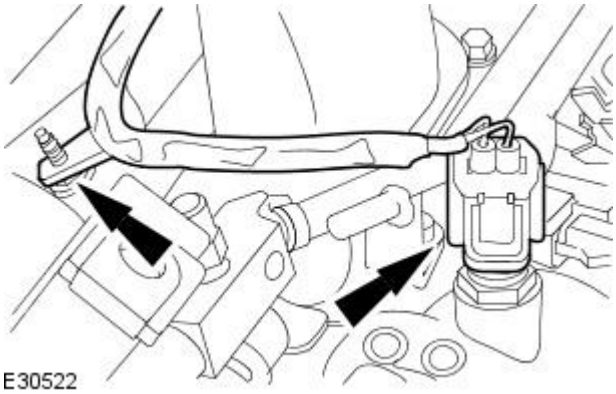
All vehicles

1. Disconnect the battery ground cable.
   For additional information, refer to Section 414-01 Battery, Mounting and Cables.
2. Disconnect the spring lock coupling.
   For additional information, refer to Section 310-00 Fuel System - General Information.

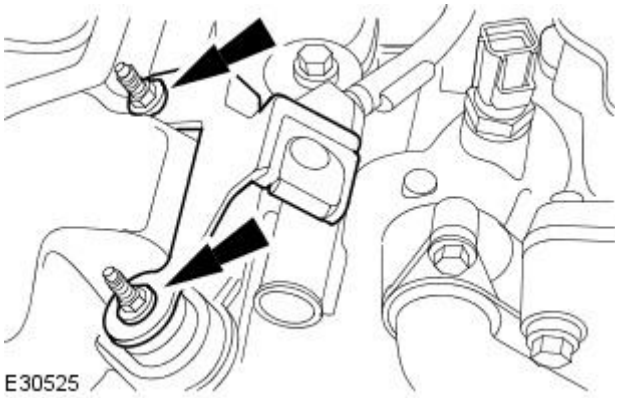
Vehicles with 2.5L or 3.0L engine

3. Remove the fuel injectors. For additional information, refer to Fuel Injectors.

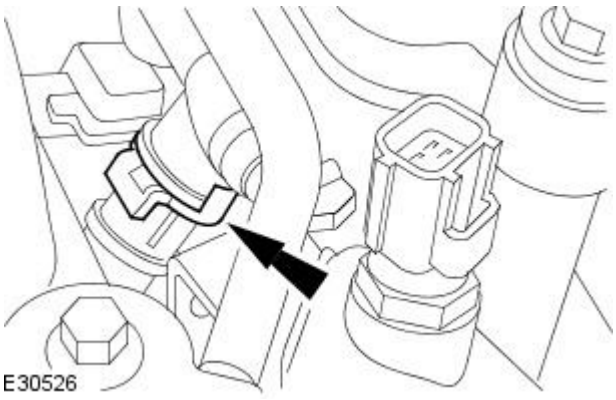
Vehicles with 2.0L engine



4. Disconnect the electrical connector.
   - Detach the harness.

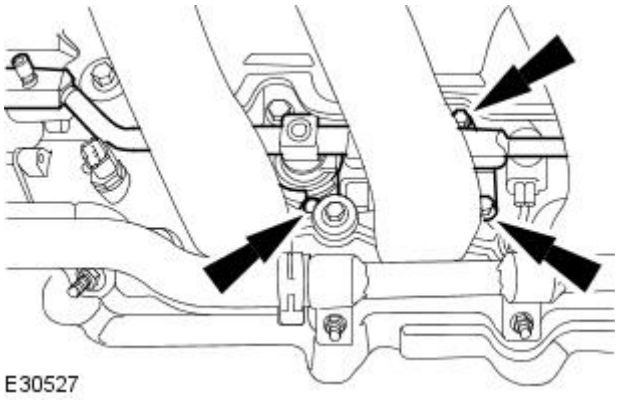


5. Remove the engine trim retaining bracket.

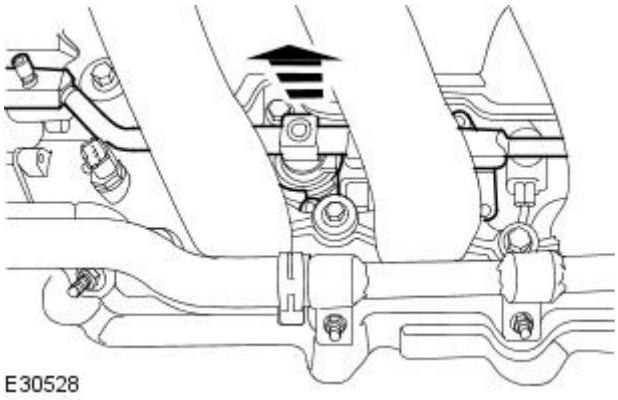


6. Remove the injector retaining clip.

7. Remove the fuel rail retaining bolts.

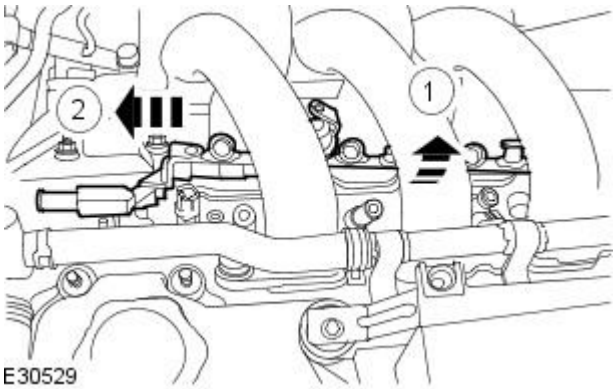


8. Disconnect the fuel rail from the injectors.



9. Remove the fuel injection rail.

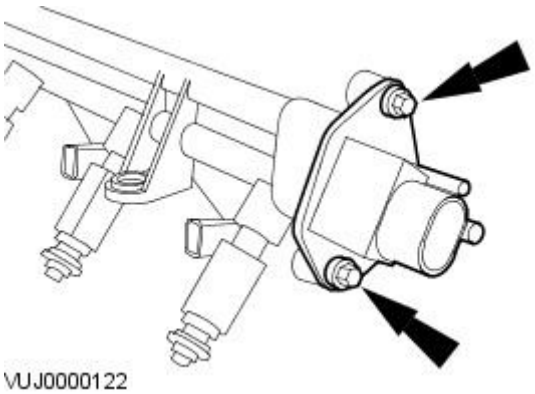
1. Rotate the fuel injection rail through 180°.
2. Remove the fuel injection rail.



Vehicles with 2.5L or 3.0L engine

10. Remove the fuel pressure sensor.

- Remove and discard the gasket.



Installation

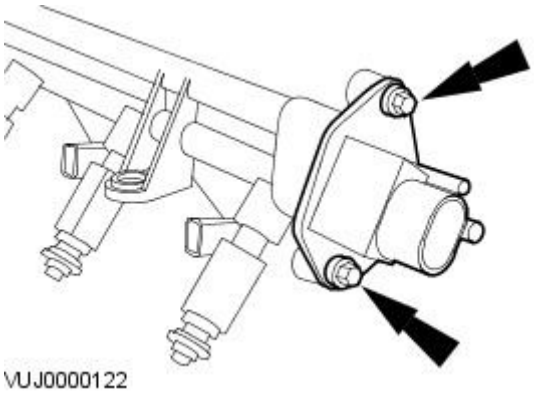
All vehicles

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.

Vehicles with 2.5L or 3.0L engine

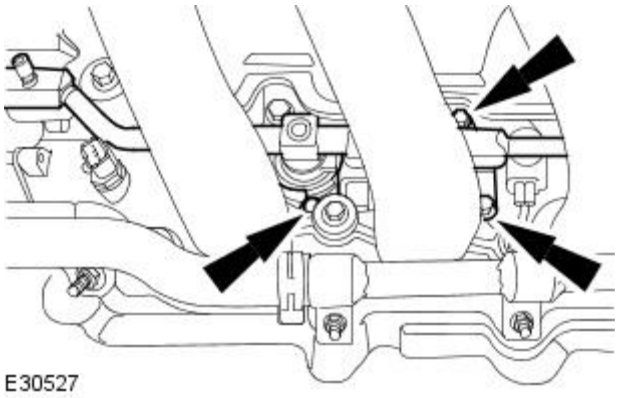

VUJ0000122

2. NOTE: Install a new gasket.

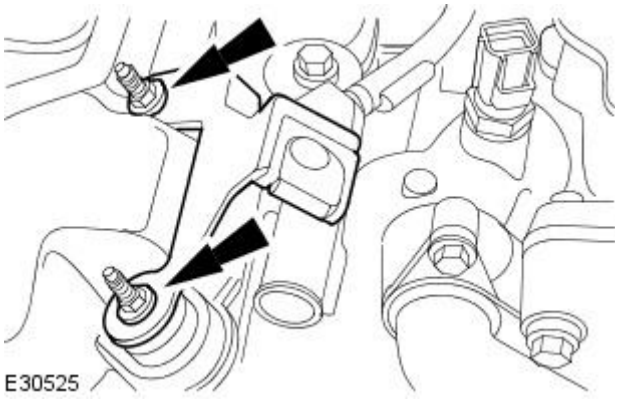
Tighten to 10 Nm.

Vehicles with 2.0L engine

3. Tighten to 10 Nm.


E30527

4. Tighten to 6 Nm.


E30525

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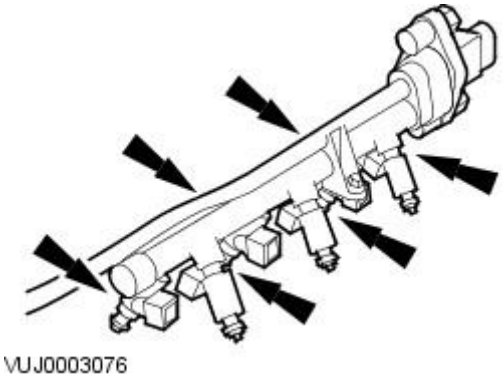
Fuel Charging and Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Fuel Injectors

Removal and Installation

Removal

Vehicles with 2.5L or 3.0L engine

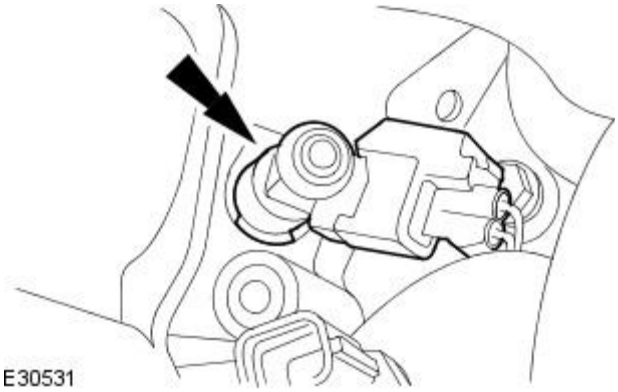
1. Remove the fuel charging wiring harness.
   For additional information, refer to Fuel Charging Wiring Harness in this section.
2. Remove the fuel injectors.
   - Remove the fuel injector retaining clips.



VUJ0003076

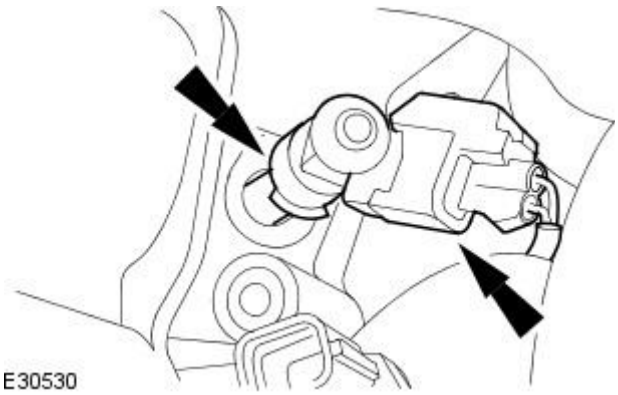
Vehicles with 2.0L engine

3. Remove the fuel injection supply manifold.
   For additional information, refer to Fuel Injection Supply Manifold in this section.
4. Detach the injectors from the lower intake manifold.



E30531

5. Remove the injectors.
   - Disconnect the electrical connectors.



E30530

All vehicles

6. Remove and discard the O-ring seals.

VUJ0000564

7.

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.

VUJ0000564

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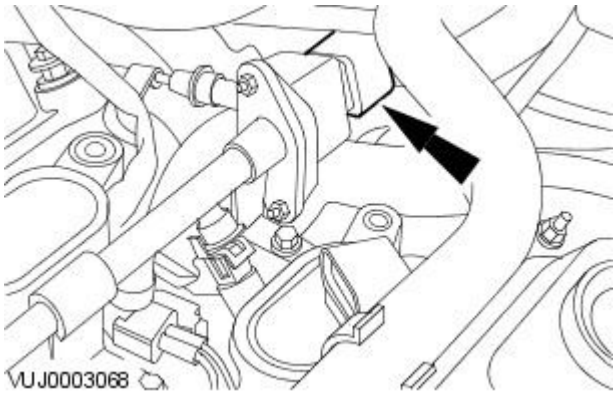
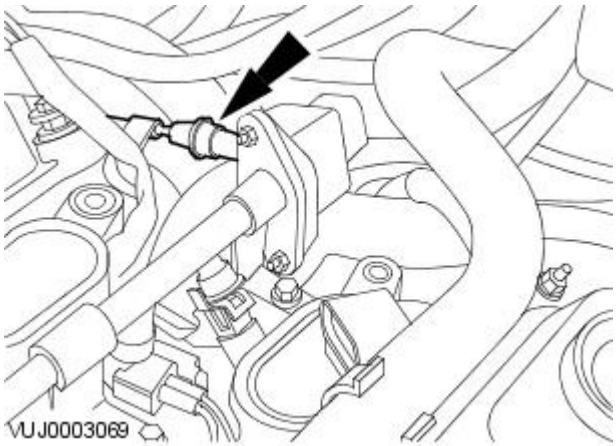
Fuel Charging and Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Fuel Pulse Damper2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Removal and Installation

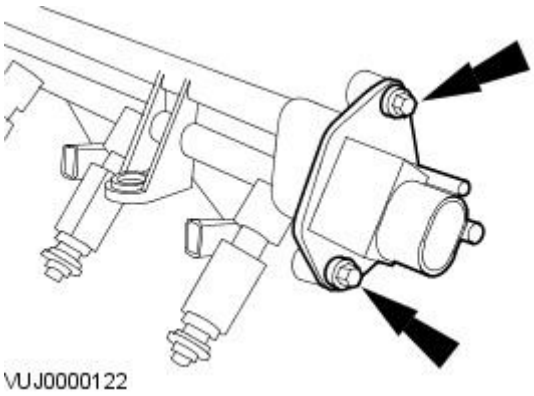
Removal



1. Remove the throttle body. For additional information, refer to Throttle Body.
2. Disconnect the electrical connector.

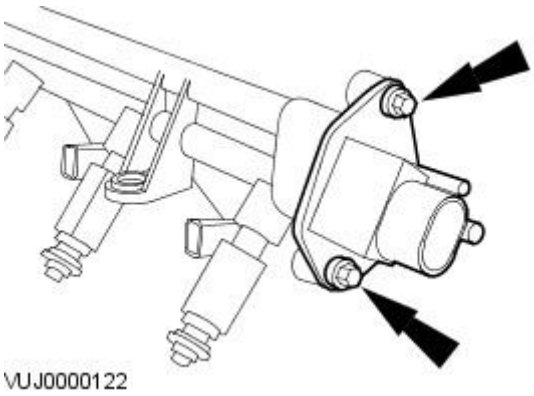


3. Detach the fuel pressure sensor vacuum line.



4. Remove the fuel pressure sensor.
   - Remove and discard the gasket.

Installation



1. NOTE: Install a new gasket.

   To install, reverse the removal procedure.
   - Tighten to 10 Nm.

Published: 11-May-2011

Fuel Charging and Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Throttle Body

Removal and Installation

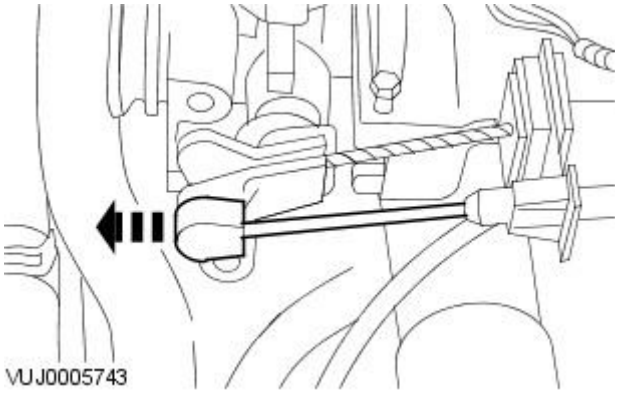
Removal

All vehicles

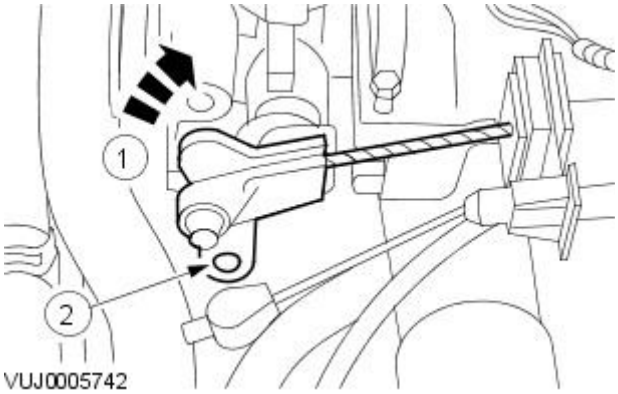
CAUTION: Do not attempt to clean the throttle body. The bore and the throttle plate has a special coating applied during manufacture which should not be removed.

1. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12A Intake Air Distribution and FilteringSection 303-12B Intake Air Distribution and Filtering.

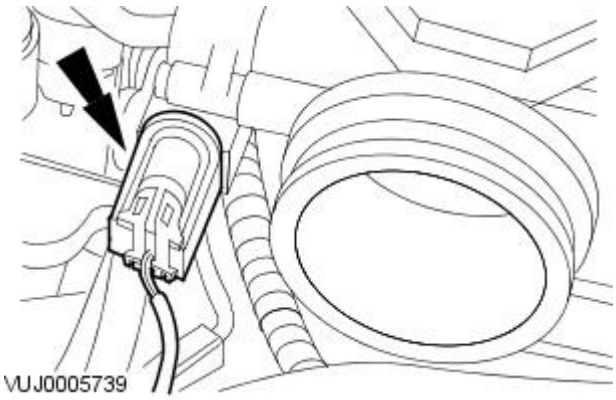
Vehicles with 2.0L engine



2. Disconnect the cruise control cable.

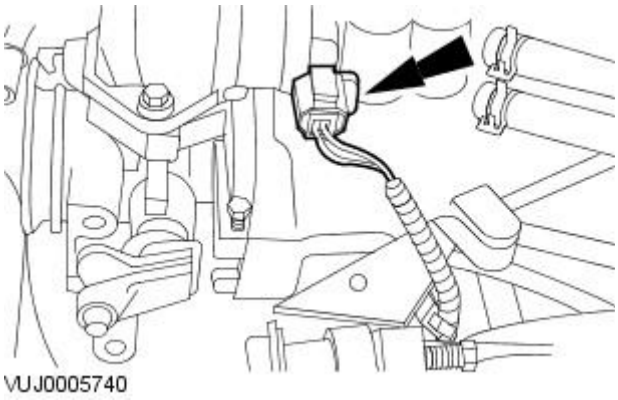


3. Disconnect the accelerator cable.
    1. Position the accelerator actuator to the open position.
    2. Disconnect the accelerator cable.



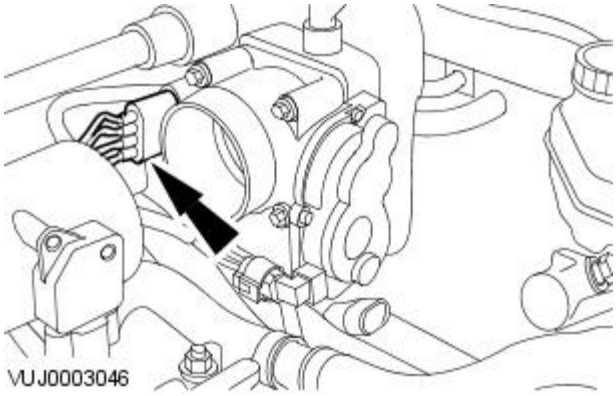
4. Disconnect the electrical connector.

5. Disconnect the electrical connector.

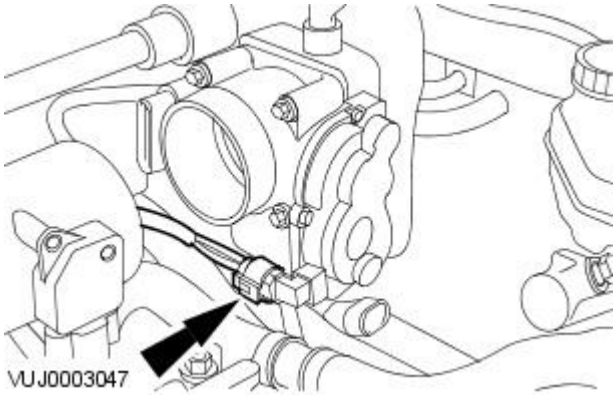


Vehicles with 2.5L or 3.0L engine

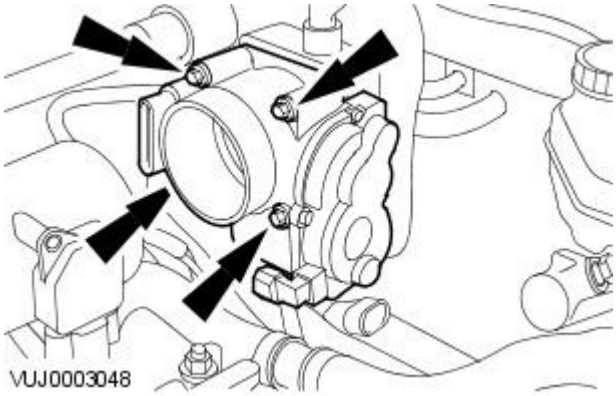
6. Disconnect the electrical connector.



7. Disconnect the electrical connector.

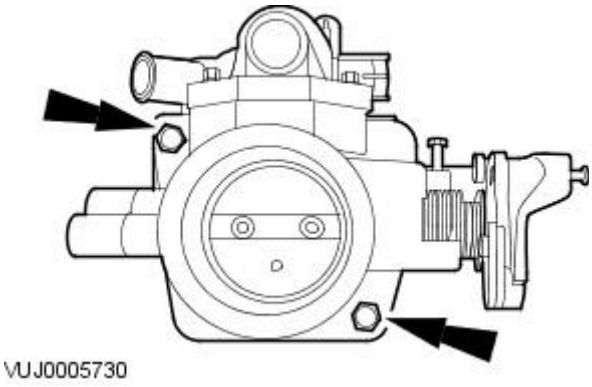


8. Remove the throttle body.



Vehicles with 2.0L engine

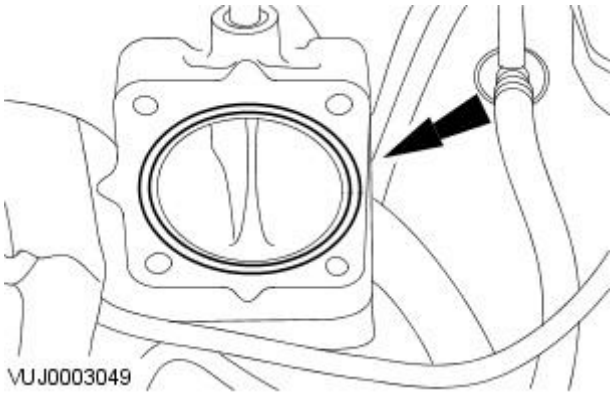
9. Remove the throttle body.



All vehicles

10. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Remove and discard the O-ring seal.



Installation

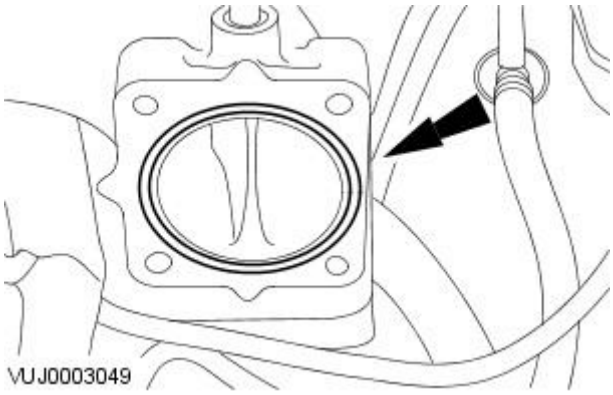
All vehicles

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.

1. NOTE: 2.5L and 3.0L shown, 2.0L similar.

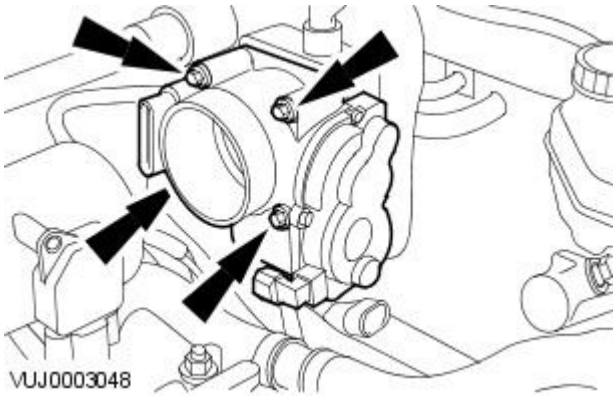
To install, reverse the removal procedure.

- Install a new O-ring seal.



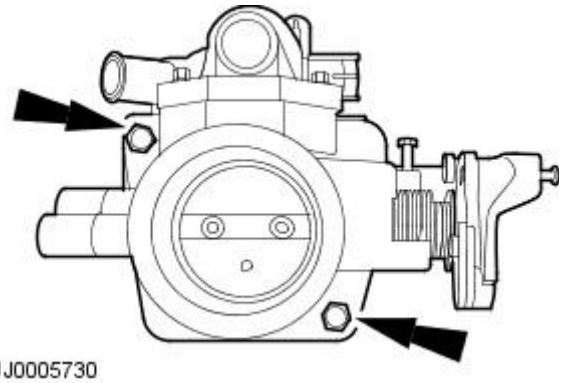
Vehicles with 2.5L or 3.0L engine

2. Tighten to 10 Nm.



Vehicles with 2.0L engine

3. Tighten to 10 Nm.



VUJ0005730

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Fuel Charging and Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma -

Torque Specifications

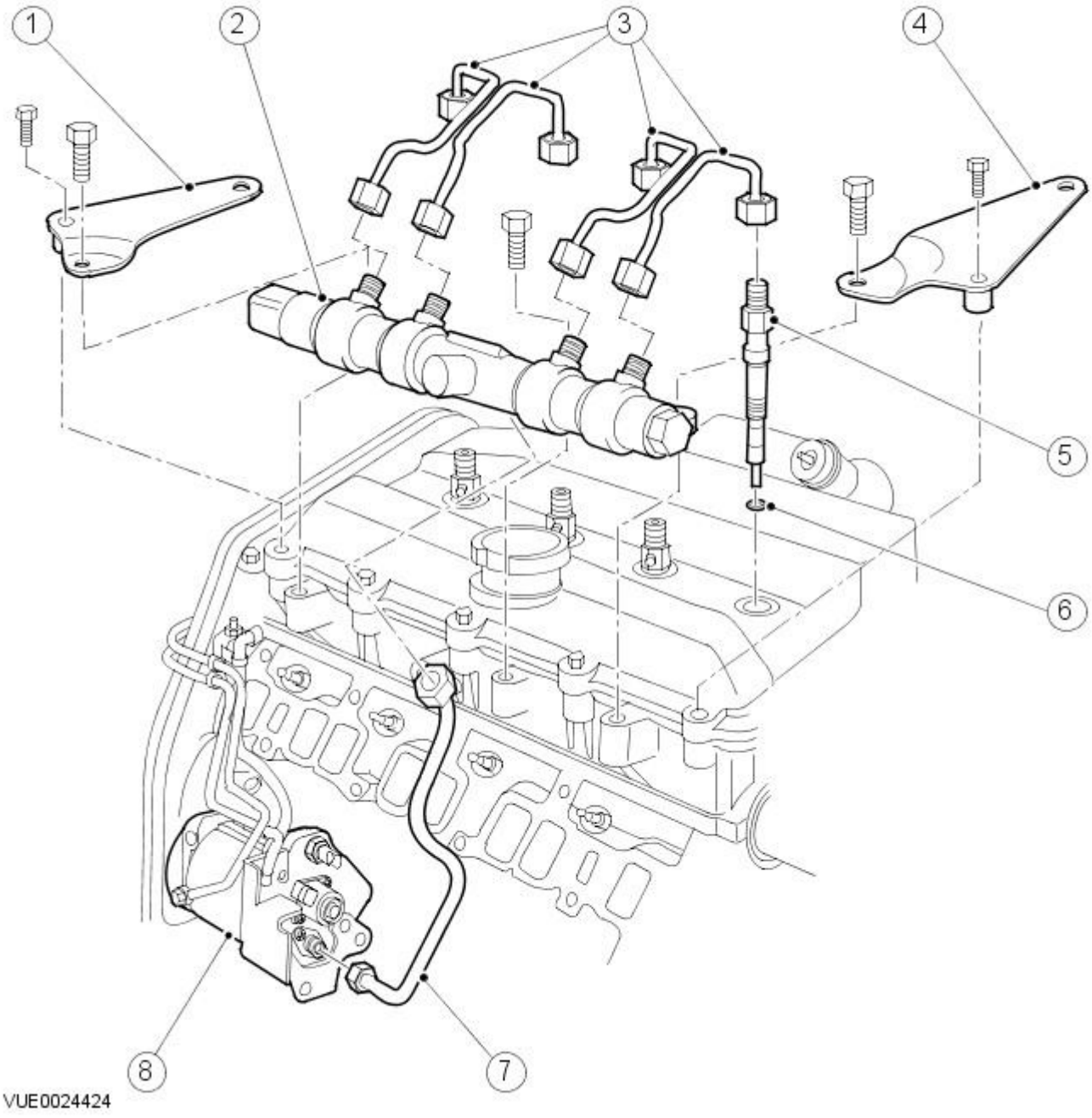
Description	Nm	lb-ft	lb-in
High-pressure fuel supply lines	40	30	-
High-pressure fuel supply line support bracket retaining nut	8	-	71
Fuel injectors	47	35	-
Fuel injection supply manifold retaining bolts	23	17	-
Fuel injection supply manifold support bracket retaining bolts	14	10	-
Fuel pump shield lower retaining bolt	33	24	-
Fuel pump shield upper retaining bolts	8	-	71
Fuel pump support bracket to fuel pump retaining bolts	33	24	-
Fuel pump support bracket to cylinder block retaining bolts	23	17	-
Fuel pump retaining bolts	22	16	-
Fuel pump sprocket retaining bolts	32	24	-
Fuel supply line to fuel pump union retaining nut	20	15	-
Exhaust gas recirculation (EGR) valve retaining bolts	10	-	89
Intake manifold retaining bolts	15	11	-
Fuel return line venturi retaining bolt	6	-	53

Published: 11-May-2011

Fuel Charging and Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Fuel Charging and Controls

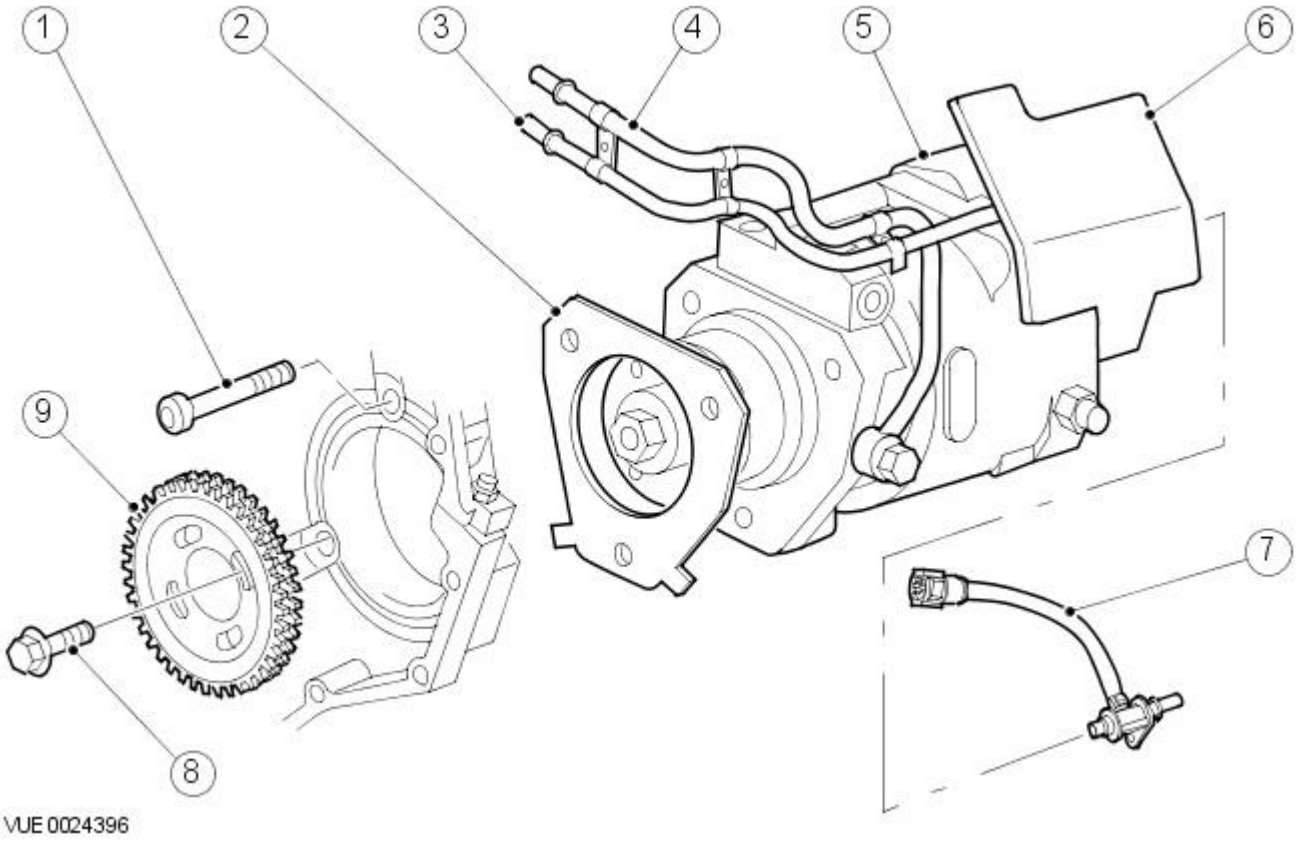
Description and Operation

High Pressure Fuel Injection Components



Item	Part Number	Description
1	-	Fuel injection supply manifold support bracket
2	-	Fuel injection supply manifold
3	-	High-pressure fuel supply lines (fuel injection supply manifold to fuel injectors)
4	-	Fuel injection supply manifold support bracket
5	-	Fuel injector
6	-	Fuel injector sealing washer
7	-	High-pressure fuel supply line (fuel pump to fuel injection supply manifold)
8	-	Fuel pump

Fuel Pump



Item	Part Number	Description
1	-	Fuel pump retaining bolt
2	-	Fuel pump gasket
3	-	Fuel pump fuel return line
4	-	Fuel pump fuel supply line
5	-	Fuel pump
6	-	Fuel pump shield
7	-	Fuel return line venturi
8	-	Fuel pump sprocket retaining bolt
9	-	Fuel pump sprocket

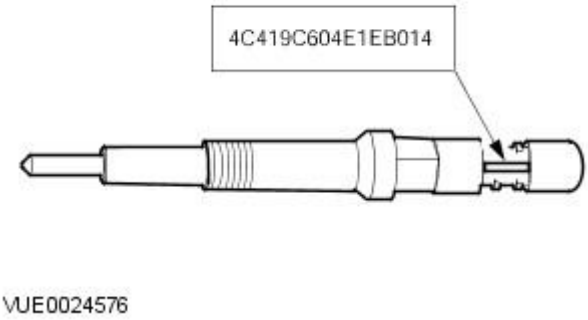
Fuel Injectors

The fuel injectors are operated electrically by the engine control module (ECM) and inject a precise amount of fuel into the combustion chamber at the required time.

The injectors have been designed to:

- allow pilot and main injections with short intervals between each injection.
- be fully electrically controlled.

Each injector is calibrated and given its own unique identification number at manufacture. The identification number is a set of letters and numbers located near to the top of the injector.



CAUTION: If any of the high pressure fuel pipe retaining nuts are loosened, the high pressure fuel pipe it is installed to must be renewed. Failure to follow this instruction may allow metal fragments to enter the fuel system and result in damage to the fuel system components.

When the injectors are fitted to an engine, the injector identification number and the cylinder number to which it is installed must be programmed into the ECM. This gives the ECM a base calibration for each cylinder of the engine, as the vehicle is run the ECM will adapt from this calibration. If any of the injectors are replaced the ECM will have to be reprogrammed with all of the injector identification numbers and cylinder number to which each is fitted.

Fuel Injection Supply Manifold

The fuel injection supply manifold is a reservoir for the pressurized fuel that is produced by the fuel pump. It also incorporates a pressure sensor so that the ECM can monitor/adjust the pressure of the fuel to be injected into the cylinder. The fuel injection supply manifold and the pressure sensor are serviced as an assembly and must not under any circumstance be disassembled.

Fuel Pump

The fuel pump is located under the intake manifold and is driven by the timing chain at the front of the engine. The fuel pump includes a transfer pump and a high pressure pump which are serviced as one unit.

The transfer pump draws the fuel from the fuel tank and through the fuel filter, it then pumps the fuel to the high pressure pump. The transfer pump maintains a constant pressure of 6 bar (87.02 lb/in²) via a regulating valve within the fuel pump, this is known as transfer pressure.

The high pressure pump receives fuel at transfer pressure from the transfer pump and increases the fuel pressure to between 200 and 1600 bar. The high pressure fuel is then transferred from the high pressure pump to the fuel injection supply manifold.

Fuel Return Line Venturi

The fuel return system incorporates a fuel return line venturi, installed to the back of the fuel pump. The fuel return line venturi is a partial restriction in the fuel return line, which creates a negative pressure in the fuel return system prior to its position in the system. The negative pressure created by the fuel return line venturi helps in the removal and the return to the fuel tank of the fuel leaked off by the fuel injectors.

Fuel Filter

The fuel filter is located at the top of the bulkhead on the right-hand side of the vehicle. The fuel filter incorporates a fuel pre heat function, which utilizes a ball valve operated by a bimetallic strip. When the temperature is less than 15° C (59° F), the ball valve allows the warm fuel in the fuel return system to pass back through the fuel filter to the fuel pump to improve cold running. Once the temperature exceeds 31° C (88° F) a bimetallic strip closes the ball valve in the fuel filter and all of the fuel in the fuel return system is directed back to the fuel tank.

Published: 12-Jul-2011

Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma - Fuel Charging and Controls

Diagnosis and Testing

Principle of operation

This section covers the fuel system from the fuel filter to the fuel injectors, and includes the fuel rail and pump.

For additional information on the description and operation of the system:
REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Description and Operation).

Inspection and verification

WARNING: Make sure that all suitable safety precautions are observed when carrying out any work on the fuel system. failure to observe this warning may result in personal injury:

REFER to: Important Safety Instructions (100-00 General Information, Description and Operation).

CAUTION: Make sure 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 damage to the vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious mechanical or electrical faults.

Mechanical	Electrical
• Fuel level (minimum of four liters for run out of fuel strategy) • Contaminated fuel • Fuel leak(s) • Fuel filter • Air cleaner element • Vacuum line(s)/vacuum connections • Hose(s)/hose connections • Tube(s)/tube connections • Fuel supply line(s) • Fuel return line(s) • High-pressure fuel supply line(s) • Fuel injection supply manifold • Fuel injectors • Fuel pump - Investigate other fuel system components before condemning a pump	• Glow plug indicator • Sensor(s) • Engine control module (ECM) • Fuel metering valve • Fuel temperature sensor • Inertia fuel shutoff (IFS) switch • Fuel injectors • Injector programming • Fuel rail pressure (FRP) sensor • Crankshaft position (CKP) sensor • Camshaft position (CMP) sensor

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.** Use the approved diagnostic system or a scan tool to retrieve any diagnostic trouble codes (DTCs) before moving onto the symptom chart or DTC index.
    - Make sure that all DTCs are cleared following rectification.

Symptom Chart

Symptom (general)	Symptom (specific)	Possible source	Action
Non-Start	Engine does not crank	• Security system /Immobilizer engaged • Battery condition/charge • Starter relay fault • Starting system fault • Engine control module (ECM) relay fault • **Park/Neutral** switch fault • Engine siezed	Make sure that the immobilizer system is disarmed. Check the battery condition and state of charge. Check that the engine turns by hand. Check the starting system and circuits. Refer to the electrical guides. Check for DTCs indicating an ECM relay or park/neutral switch fault. Rectify as necessary.
	Engine cranks, but does not start	• Security system /Immobilizer engaged • Low/Contaminated fuel • Air ingress • Blocked air cleaner • Blocked fuel filter • Low-pressure circuit fault • Fuel metering valve blocked/contaminated • Injector(s) fault/programming • Intake air temperature (IAT) sensor fault • Glow plug(s)/circuit fault • Fuel pressure sensor fault • Camshaft position (CMP) sensor fault	Make sure that the immobilizer system is disarmed. 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 low-pressure fuel system for leaks/damage, check for air ingress. Check the air cleaner element. Check that fuel flows through the fuel filter. Check for DTCs indicating a fuel metering valve or injector fault. Check for DTCs indicating an engine management sensor fault. Check the valve train, check the compressions, REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing). Check the catalytic converter condition, etc. Check for diesel particulate filter DTCs. Refer to the warranty policy and procedures manual if an ECM is suspect.

Symptom (general)	Symptom (specific)	Possible source	Action
		• Crankshaft position (CKP) sensor fault • Cylinder head temperature (CHT) sensor fault • Fuel pump fault • Low compression • Valve train fault • Blocked catalyst • Engine control module (ECM) fault	
Difficult to start	Difficult to start cold	• Glow plug(s)/circuit fault • Contaminated fuel • Air ingress • Blocked air cleaner • Blocked fuel filter • Low-pressure circuit fault • Fuel metering valve blocked/contaminated • Fuel pressure sensor fault • Intake air temperature (IAT) sensor fault • Cylinder head temperature (CHT) sensor fault • Camshaft position (CMP) sensor fault • Crankshaft position (CKP) sensor fault • Injector(s) fault/programming • Pump fault • Blocked catalyst • Valve train fault • Low compression	Check the glow plugs and circuits. Refer to the electrical guides. 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 low-pressure fuel system for leaks/damage, check for air ingress. Check the air cleaner element. Check that fuel flows through the fuel filter. Check for DTCs indicating a fuel metering valve or injector fault. Check for DTCs indicating an engine management sensor fault. Check the valve train, check the compressions, REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing). Check the catalytic converter condition, etc. Check for diesel particulate filter DTCs.
	Difficult to start hot	• Contaminated fuel • Air ingress • Blocked air cleaner • Blocked fuel filter • Low-pressure circuit fault • Fuel metering valve blocked/contaminated • Exhaust gas recirculation (EGR) valve fault • Fuel pressure sensor fault • Intake air temperature (IAT) sensor fault • Camshaft position (CMP) sensor fault • Crankshaft position (CKP) sensor fault • Injector(s) fault/programming • Pump fault • Blocked catalyst • Valve train fault • Low compression	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 low-pressure fuel system for leaks/damage, check for air ingress. Check the air cleaner element. Check that fuel flows through the fuel filter. Check for DTCs indicating a fuel metering valve or injector fault. Check for DTCs indicating an engine management sensor fault. Check the valve train, check the compressions, REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing). Check the catalytic converter condition, etc. Check for diesel particulate filter DTCs.
	Engine cranks too fast/slow	• Battery condition/charge • Starting system fault • Low compression	Check the battery condition and state of charge. Check the starting system circuits. Refer to the electrical guides. Rectify as necessary. Check the compressions, REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).
Driveability	Rough idle	• Low/Contaminated fuel • Air ingress • Injector(s) fault/programming • Fuel metering valve blocked/contaminated • Exhaust gas recirculation (EGR) valve fault • Blocked air cleaner • Blocked fuel filter • Pump fault • Crankshaft position (CKP) sensor fault • Intake air temperature (IAT) sensor fault • Manifold absolute pressure (MAP) sensor fault • Knock sensor (KS) fault	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 low-pressure fuel system for leaks/damage, check for air ingress. Check for DTCs indicating an injector programming or EGR fault. Check the air cleaner element. Check that fuel flows through the fuel filter. Check for DTCs indicating a fuel metering valve fault. Check for DTCs indicating an engine management sensor fault. Check the dual-mass flywheel.

Symptom (general)	Symptom (specific)	Possible source	Action
		• Dual-mass flywheel fault	
	Idle speed high or low	• Accelerator pedal position (APP) sensor fault • Intake air temperature (IAT) sensor fault	Check for DTCs indicating an APP or IAT sensor fault. Rectify as necessary.
	Engine speed out of control	• Engine oil level too high • Excessive blow-by • Accelerator pedal position (APP) sensor fault • Turbocharger bearing/seal failure	Check/correct the engine oil level. Check the engine condition. Check for DTCs indicating an APP sensor fault. Rectify as necessary. Check the turbocharger bearing/seal condition by assessing the movement in the turbocharger shaft and the amount of oil in the turbocharger body. Note that a small amount of oil is normal.
	Lack of power when accelerating	• Contaminated fuel • Air intake circuit fault • Low fuel pressure • Exhaust gas recirculation (EGR) valve fault • Fuel filter blocked • Fuel lines kinked/restricted • Pump fault • Injector(s) fault/programming • Vehicle speed sensor fault • Cylinder head temperature (CHT) sensor fault • Intake air temperature (IAT) sensor fault • Manifold absolute pressure (MAP) sensor fault • Accelerator pedal position (APP) sensor fault • Fuel rail temperature (FRT) sensor fault • Fuel rail pressure (FRP) sensor fault • Fuel metering valve fault • Turbocharger fault • Catalyst blocked • Valve timing fault • Low compression	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 air intake system and low-pressure fuel circuit. Rectify as necessary. Check for DTCs indicating an EGR fault. Check for DTCs indicating an engine management sensor or injector programming fault. Check the turbocharger condition and operation. Check the catalytic converter condition. Rectify as necessary. For valve timing and compression information, REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).
	Engine stops/stalls	• Low/Contaminated fuel • Air cleaner element blocked • Fuel metering valve blocked/contaminated • Pump fault • High-pressure leak • Low-pressure circuit fault (air ingress) • Relay fault • Crankshaft position (CKP) sensor fault • Camshaft position (CMP) sensor fault • Cylinder head temperature (CHT) sensor fault • Fuel rail pressure (FRP) sensor fault • Dual-mass flywheel fault • Engine control module (ECM) fault	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 air intake system and low-pressure fuel circuit. Rectify as necessary. Check for DTCs indicating a relay, engine management sensor or ECM fault. Check the dual-mass flywheel. Refer to the warranty policy and procedures manual if an ECM is suspect.
	Engine judders	• Low/Contaminated fuel • Fuel metering valve blocked/contaminated • High-pressure leak • Air intake circuit fault • Low-pressure circuit fault (air ingress) • Pump fault • Exhaust gas recirculation (EGR) valve fault • Accelerator pedal position (APP) sensor fault	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 air intake system and low-pressure fuel circuit. Rectify as necessary. Check for DTCs indicating an engine management sensor or injector programming fault. Check the catalytic converter and turbocharger condition. Rectify as necessary. Check the dual-mass flywheel. For cylinder head, compression and camshaft information, REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).

Symptom (general)	Symptom (specific)	Possible source	Action
		• Cylinder head temperature (CHT) sensor fault • Camshaft position (CMP) sensor fault • Crankshaft position (CKP) sensor fault • Intake air temperature (IAT) sensor fault • Manifold absolute pressure (MAP) sensor fault • Knock sensor (KS) fault • Fuel rail pressure (FRP) sensor fault • Injector(s) fault/programming • Catalyst blocked • Turbocharger fault • Dual-mass flywheel fault • Cylinder head gasket fault • Camshafts/Valve clearances • Low compression	
	Engine will not stop	• Engine oil level too high • Turbocharger fault • Engine control module (ECM) fault	Check/correct the engine oil level. Check the turbocharger condition and operation. Check for DTCs indicating an ECM fault. Refer to the warranty policy and procedures manual if an ECM is suspect.
General	Excessive fuel consumption	• Incorrect engine oil • Air intake circuit fault • Low-pressure circuit fault (air ingress/leaks) • Fuel metering valve/circuit • High-pressure leak • Exhaust gas recirculation (EGR) valve fault • Injector(s) fault/programming • Cylinder head temperature (CHT) sensor fault • Intake air temperature (IAT) sensor fault • Manifold absolute pressure (MAP) sensor fault • Turbocharger fault • Dual-mass flywheel fault • Valve timing fault • Low compression	Make sure that the correct grade of oil is used in the engine. Check the air intake and low-pressure circuits. Check for DTCs indicating an EGR, injector programming or engine management sensor fault. Check the turbocharger condition and operation. Check the dual-mass flywheel. For valve timing and compression information, REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).
	Excessive black smoke	• Air intake circuit fault • Exhaust gas recirculation (EGR) valve fault • Injector(s) fault/programming • Accelerator pedal position (APP) sensor fault • Crankshaft position (CKP) sensor fault • Knock sensor (KS) fault • Fuel rail pressure (FRP) sensor fault • Turbocharger bearings/seals fault • Valve timing fault	Check the air intake circuit. Check for DTCs indicating an EGR, injector programming or engine management sensor fault. Check the turbocharger bearing/seal condition by assessing the movement in the turbocharger shaft and the amount of oil in the turbocharger body. Note that a small amount of oil is normal. For valve timing information, REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).

For a complete list of all diagnostic trouble codes that could be logged on this vehicle.
REFER to: Electronic Engine Controls (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).

Published: 11-May-2011

Fuel Charging and Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - 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 injection system with the engine running. The fuel pressure within the system can be as high as 1600 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.

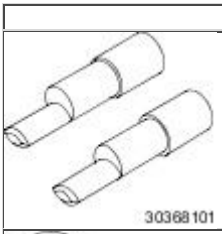
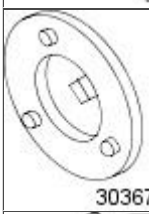
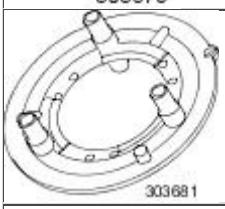
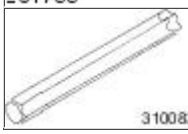
 Before using the cleaning fluid, protect all electrical components and connectors with lint-free non-flocking material.

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.

Published: 11-May-2011

Fuel Charging and Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Fuel Injection Pump

Removal and Installation

Special Tool(s)	
 303681 01	Adapter for 303-681-01 303-681-01
 303679	Remover/Installer, Crankshaft Oil Seal 303-679
 303681	Locking Tool, Fuel Injection Pump Sprocket 303-681
 E61755	Locking Tool, Fuel Injection Pump Sprocket 303-1151
 310083	Socket, Fuel Injection Pump 303-083A (23-057)

Removal

• NOTE: **If the fuel injection pump is being renewed in conjunction with the fuel injectors and high-pressure fuel lines, SRO 195010 must be claimed.**

All vehicles

• WARNINGS:

Wait at least 15 minutes 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 mixtures 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 injection system with the engine running. The fuel pressure within the system can be as high as 1600 bar (23,206 lb/in²). 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.

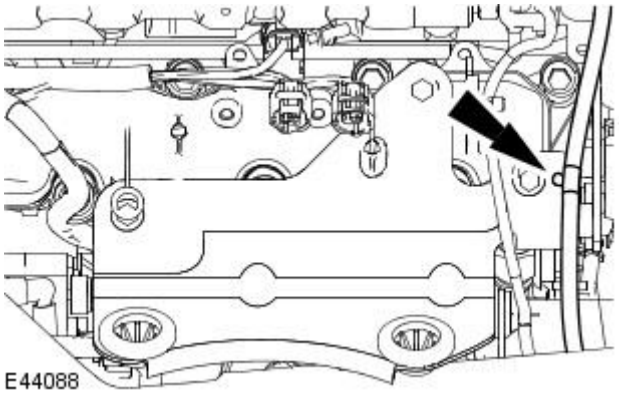
Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

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.

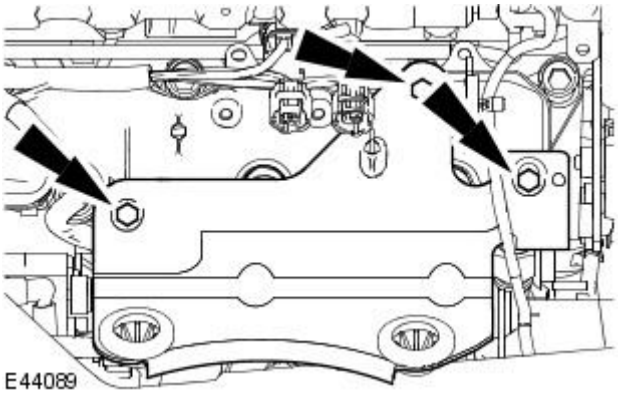
Do not disassemble or clean inside the fuel injection pump, even with an ultrasonic cleaner. Always install a new fuel injection pump when required.

• NOTE: If the fuel injection pump has suffered a major mechanical failure, new fuel injectors should also be installed.

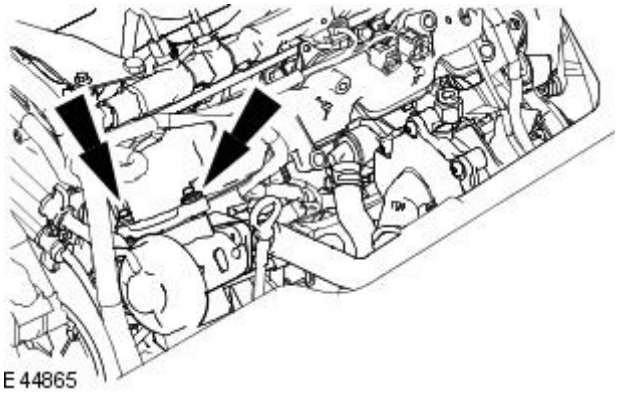
1. Remove the exhaust gas recirculation (EGR) cooler to EGR valve tube. For additional information, refer to: Exhaust Gas Recirculation (EGR) Cooler to EGR Valve Tube (303-08 Engine Emission Control - 2.0L Diesel/2.2L Diesel, Removal and Installation).
2. Detach the wiring harness.


E44088

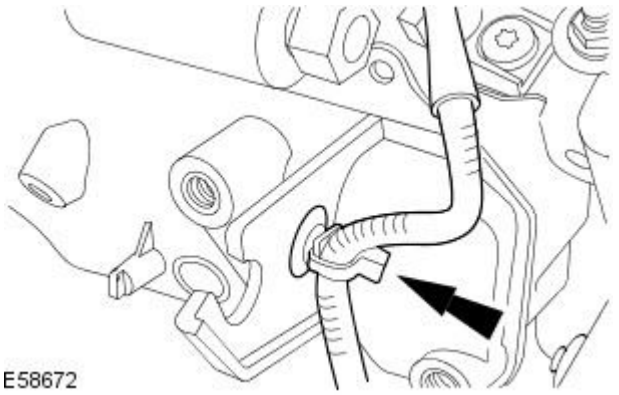
3. Remove the air cleaner mount bracket.

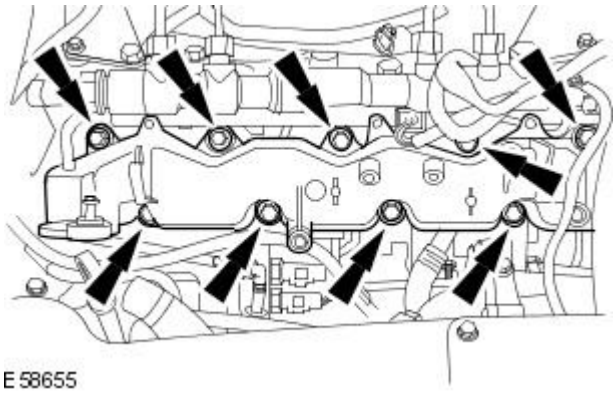

E44089

4. Detach the EGR valve from the intake manifold.
   - Discard the EGR valve gasket.


E44865

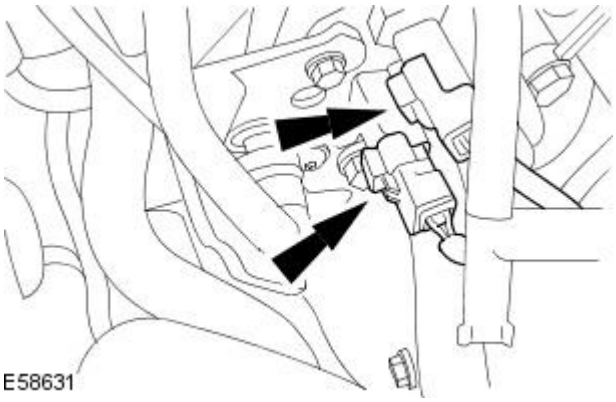
5. Detach the wiring harness from the intake manifold.


E58672

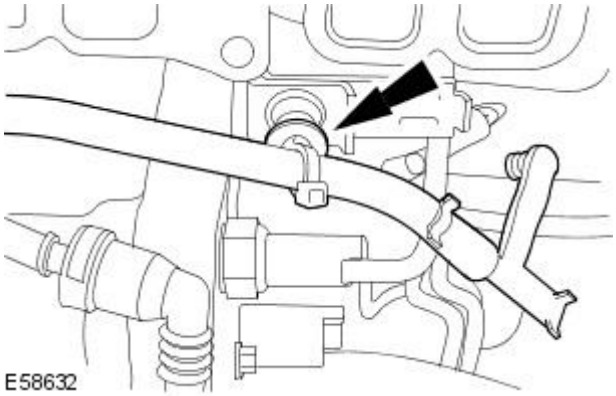


6. Remove the intake manifold.

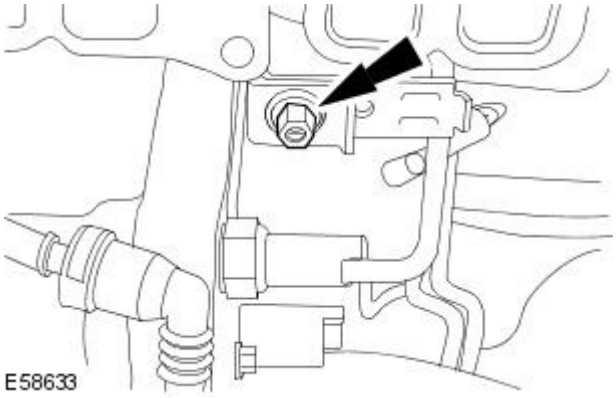
- Discard the intake manifold gaskets.



7. Disconnect the fuel metering valve and fuel temperature sensor electrical connectors.

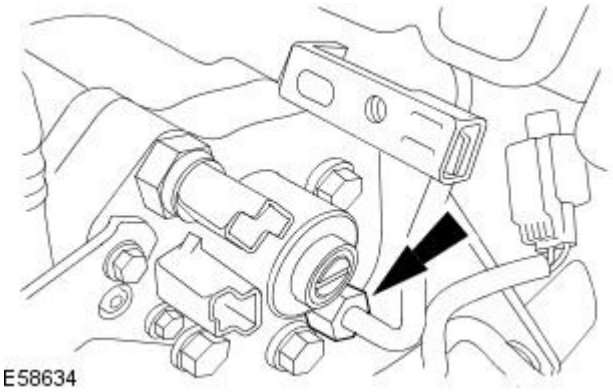


8. Detach the wiring harness.



9. Detach the high-pressure fuel supply line support bracket.

10. Clean the fuel injection pump, high-pressure fuel supply line and surrounding areas.
For additional information, refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).


E58634

11. CAUTIONS:

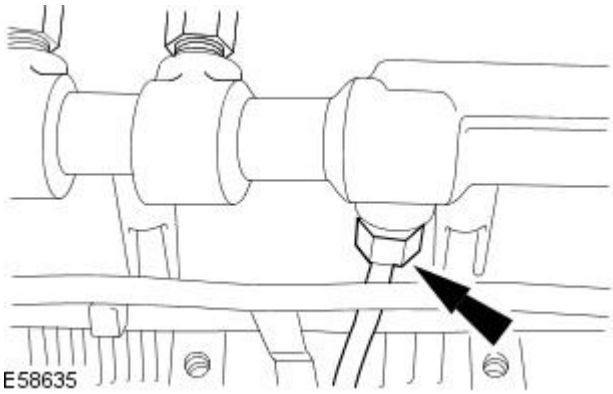
Make sure the tool used to loosen the high pressure fuel supply line union is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Maintain pressure on the high pressure fuel supply line to keep the olive in contact with the fuel injection pump cone while unscrewing the union. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Loosen the high-pressure fuel supply line at the fuel injection pump.

12. CAUTION: Make sure that the high pressure fuel supply line remains in contact with both the fuel injection pump 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.

Using the pneumatic vacuum gun, vacuum foreign material from the high-pressure fuel supply line and the fuel injection pump.


E58635

13. CAUTIONS:

Make sure the tool used to loosen the high pressure fuel supply line union is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Maintain pressure on the high pressure fuel supply line to keep the olive in contact with the fuel injection supply manifold cone while unscrewing the union. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

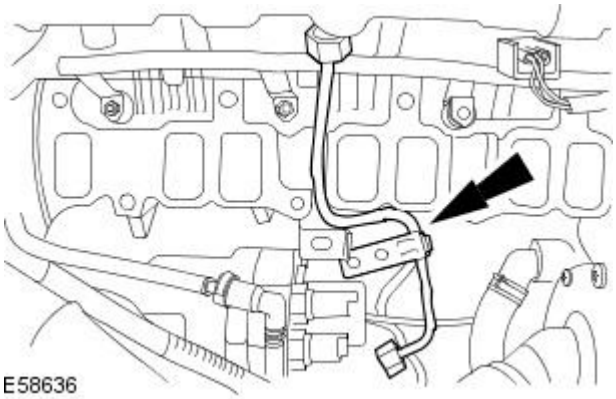
While maintaining the pressure on the high pressure fuel supply line, clean and vacuum foreign material from the line and union.

Loosen the high-pressure fuel supply line at the fuel injection supply manifold.

14. CAUTION: Make sure that the high pressure fuel supply line remains in contact with both the fuel injection pump 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.

Using the pneumatic vacuum gun, vacuum foreign material from the high pressure fuel supply line and the fuel injection supply manifold.

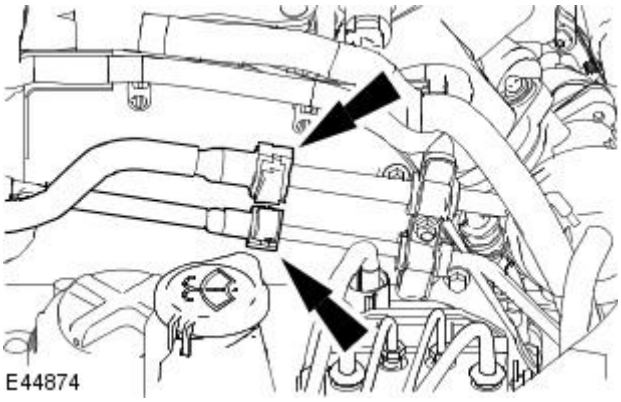
15. Remove and discard the high-pressure fuel supply line.


E58636

16. Using the pneumatic vacuum gun, vacuum foreign material from the fuel injection pump and the fuel injection supply manifold.

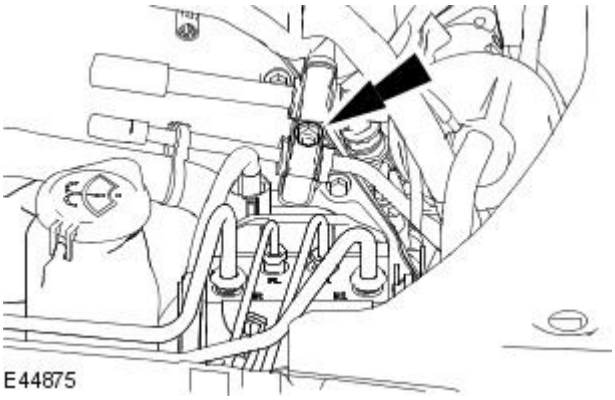
17. Install blanking caps to the open threaded ports on the fuel injection pump and the fuel injection supply manifold.

Vehicles built up to VIN:E43868

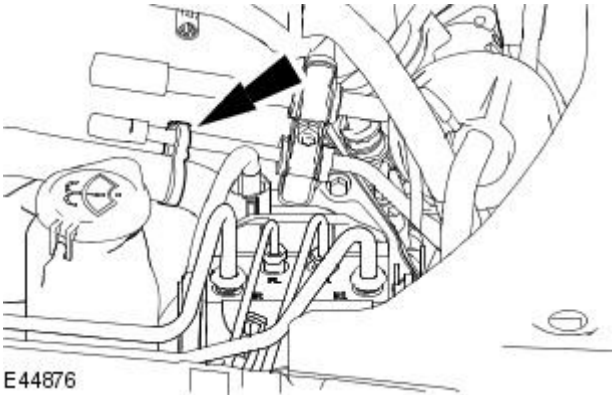


18. Disconnect the fuel injection pump fuel supply and return lines. For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

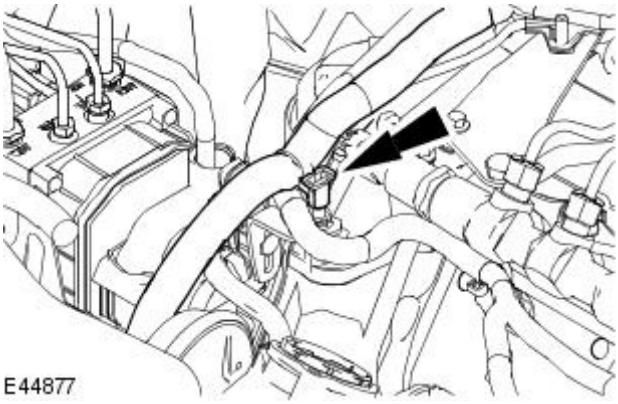
- Install blanking plugs to the fuel injection pump fuel supply and return line male and female connectors.



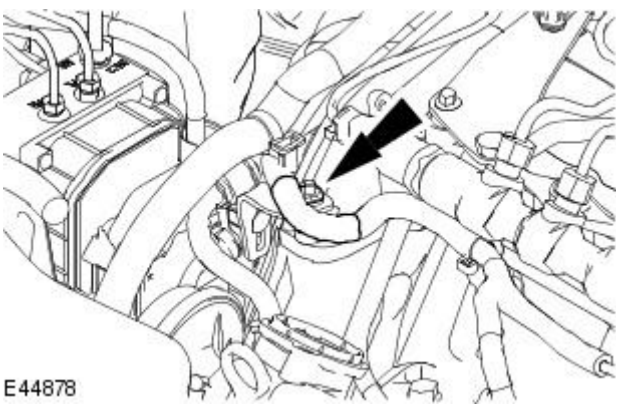
19. Loosen the fuel supply and return line support bracket retaining nut.



20. Detach the power steering fluid hose from the fuel return line.

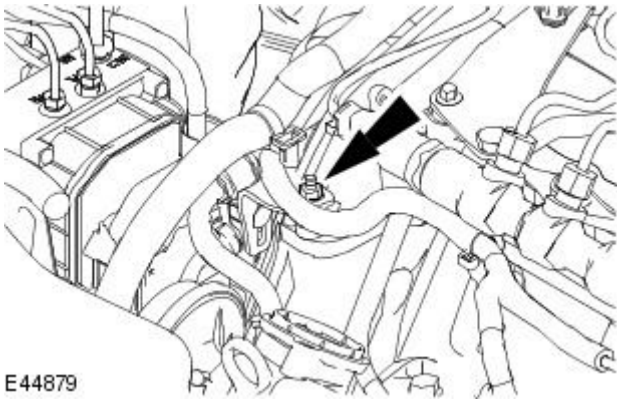


21. Detach the wiring harness retaining clip.

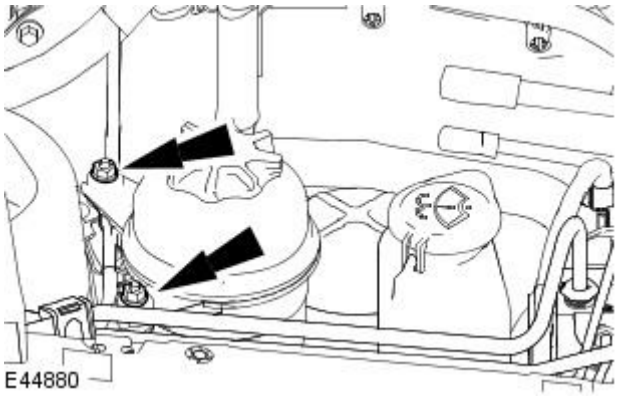


22. Detach the wiring harness retaining clip.

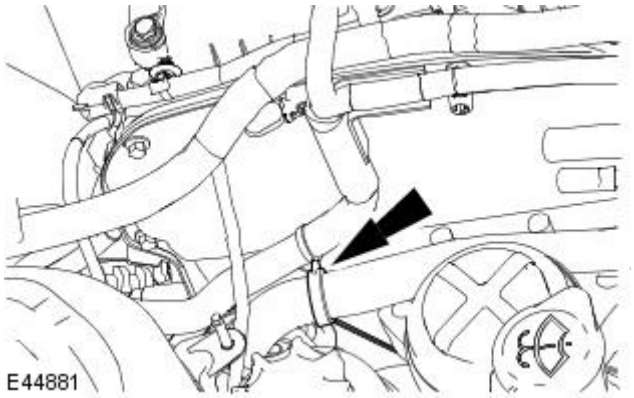
23. Detach the fuel supply and fuel return line support bracket.



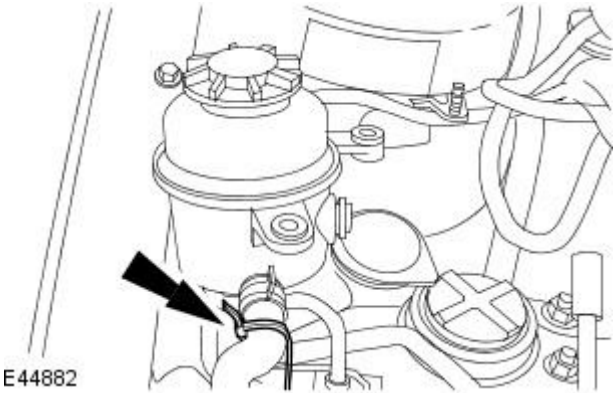
24. Remove the power steering fluid reservoir retaining nuts.



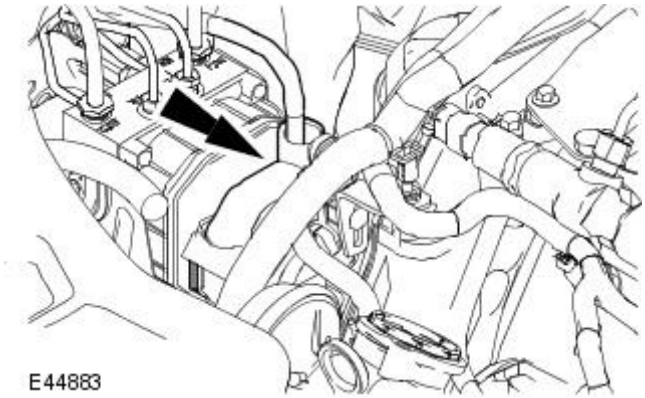
25. Detach the power steering fluid reservoir.

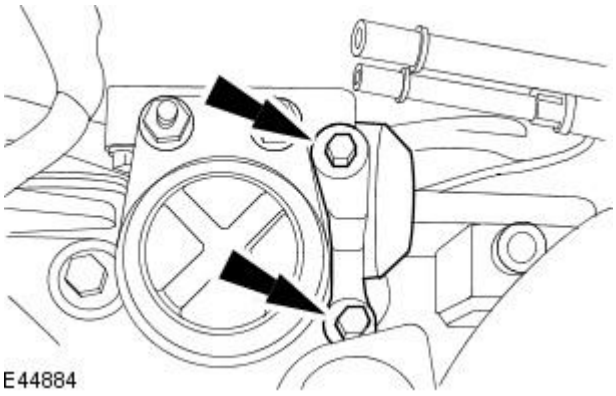


26. Secure the power steering fluid reservoir to one side.



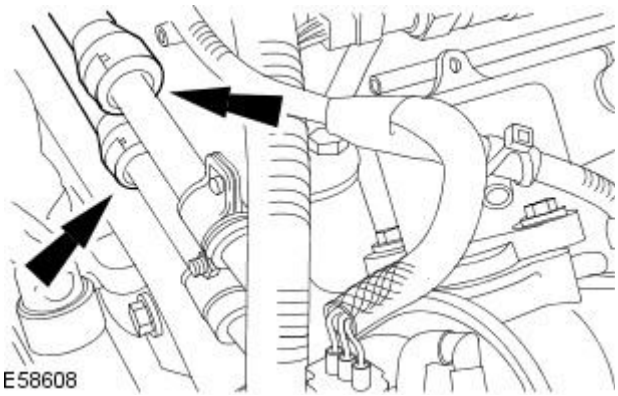
27. Disconnect the hydraulic control unit electrical (HCU) connector.





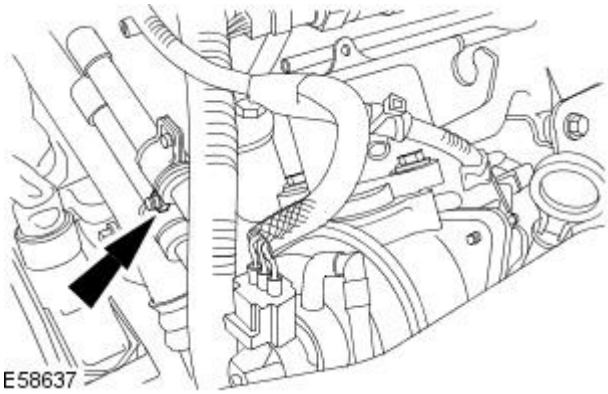
28. Remove the engine mount damper.

Vehicles built from VIN:E43869

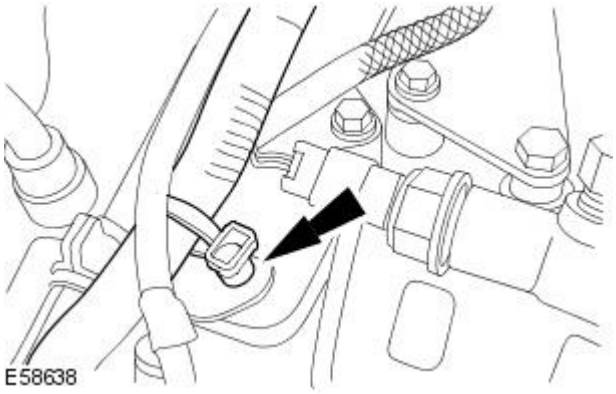


29. Disconnect the fuel injection pump fuel supply and return lines. For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

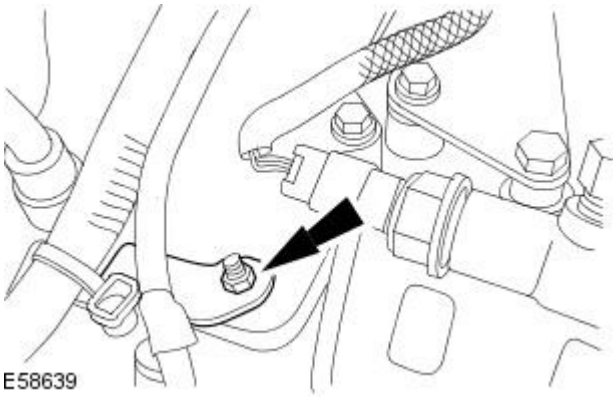
- Install blanking plugs to the fuel injection pump fuel supply and return line male and female connectors.



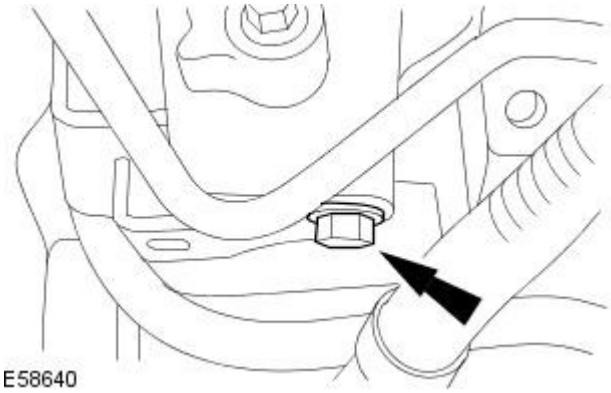
30. Remove the fuel supply and return line support bracket retaining nut.



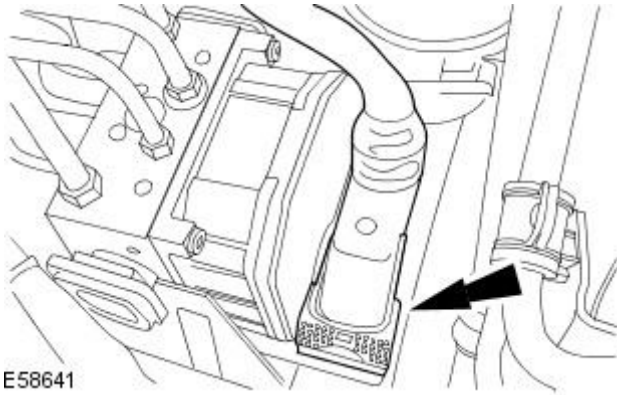
31. Detach the wiring harness retaining clip.


E58639

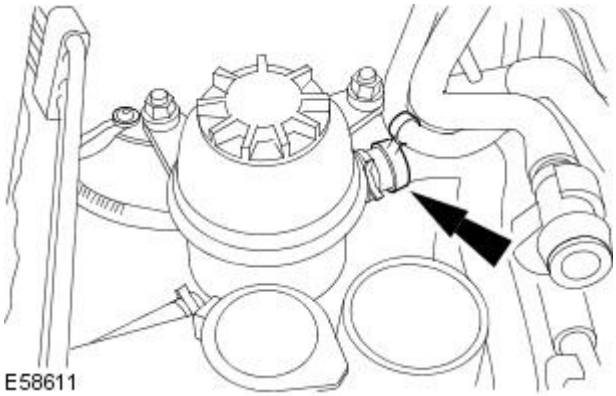
32. Remove the fuel supply and return line support bracket retaining nut.


E58640

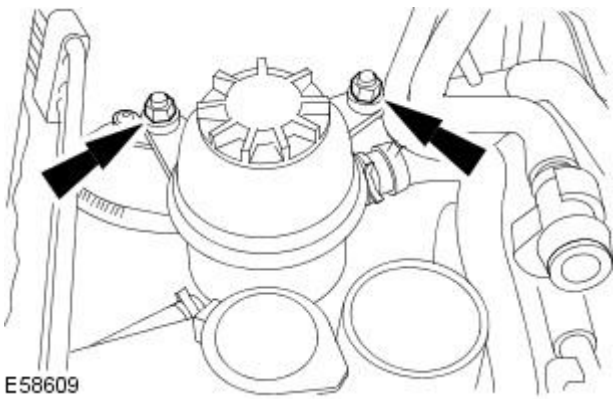
33. Detach the fuel supply and return lines.


E58641

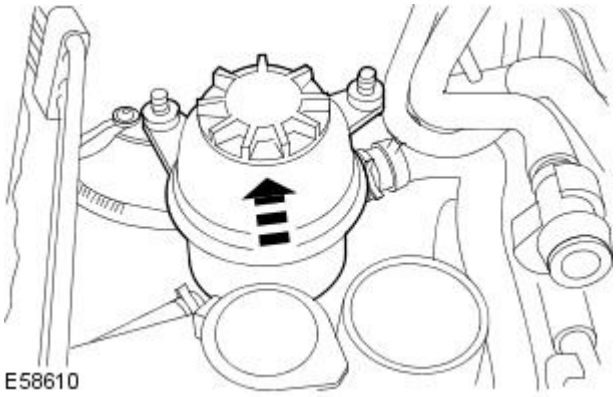
34. Disconnect the HCU electrical connector.


E58611

35. Detach the power steering pipe to engine wiring harness retaining clip.

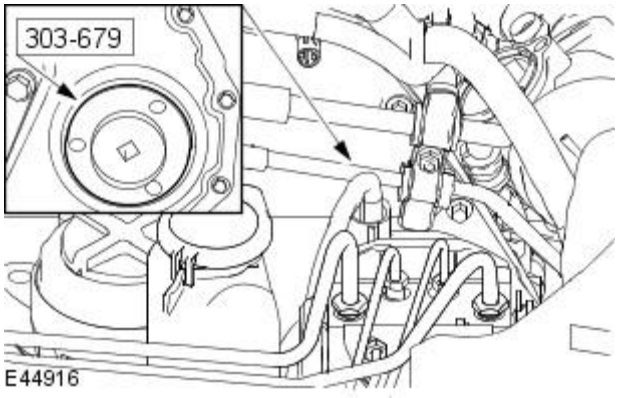

E58609

36. Remove the power steering fluid reservoir retaining nuts.

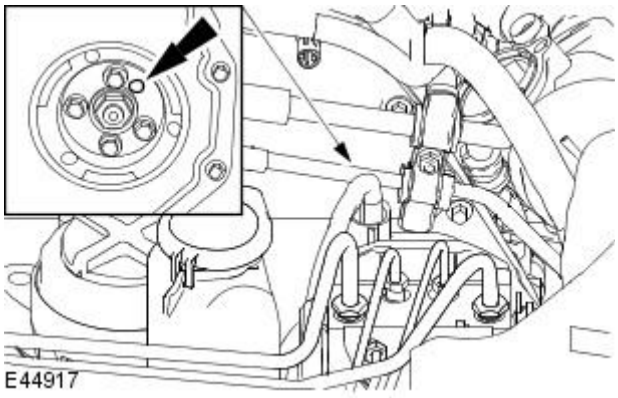


37. Detach the power steering fluid reservoir.

All vehicles

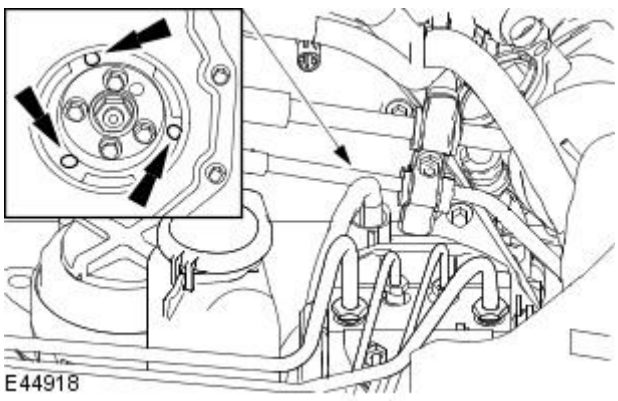


38. Using the special tool, remove the fuel injection pump sprocket access cover.



39. NOTE: Turn the engine in the normal direction of rotation only.

Turn the engine until the fuel injection pump sprocket timing hole is at the 1 o'clock position.



40. NOTE: The fuel injection pump retaining bolts remain captive behind the fuel injection pump sprocket after removal.

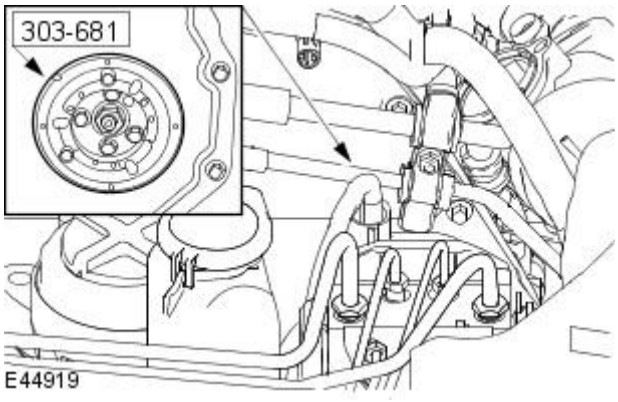
• NOTE: Use a torx 45 drive socket with a minimum shaft length of 43 mm (1.69 in).

Remove the fuel injection pump retaining bolts.

- If available use special tool 303-083A.

41. From 2006 MY special tool numbers 303-681 and 303-681-01 have now been superseded by special tool numbers 303-1151 and 303-083A.

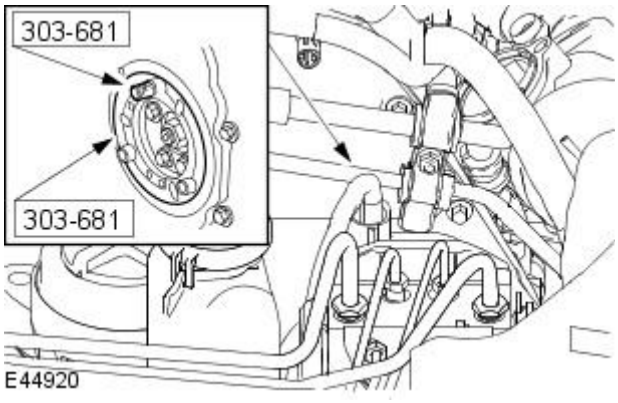
- To carry out the procedure using special tool numbers 303-681 and 303-681-01 see steps 43 - 46.
- To carry out the procedure using special tool numbers 303-1151 and 303-083A see steps 47 - 49.



42. NOTE: For additional information, see step 41.

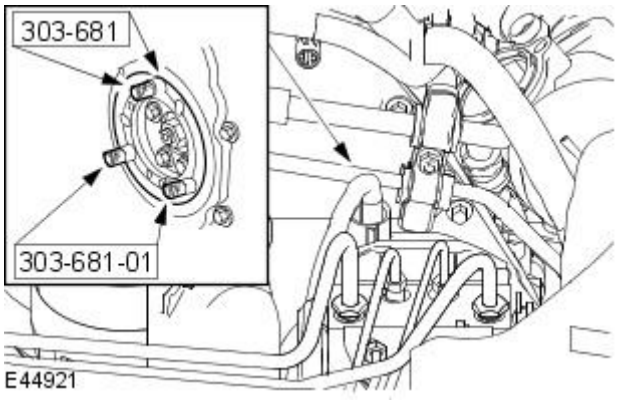
• NOTE: The special tool locking pin holes are offset. During installation of the special tool, check that the offset pin hole is located at the top.

Install the special tool.



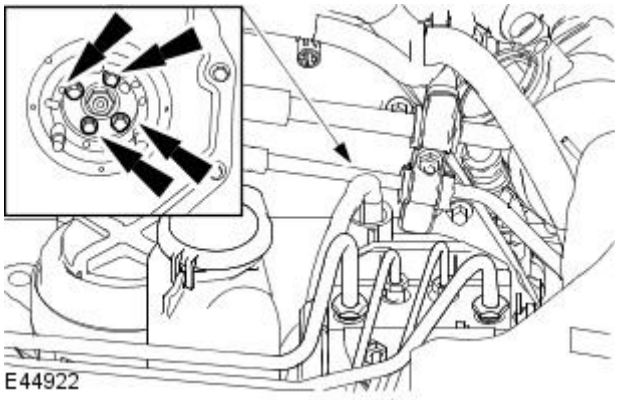
43. NOTE: For additional information, see step 41.

Using the special tools, lock the fuel injection pump sprocket.



44. NOTE: For additional information, see step 41.

Install the special tools.



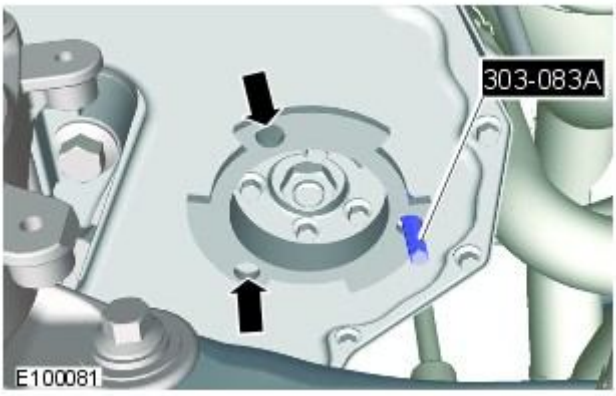
45. NOTE: For additional information, see step 41.

Remove the fuel injection pump sprocket retaining bolts.

46. NOTE: For additional information, see step 41.

• NOTE:

Using the special tool, support the fuel injection pump sprocket.

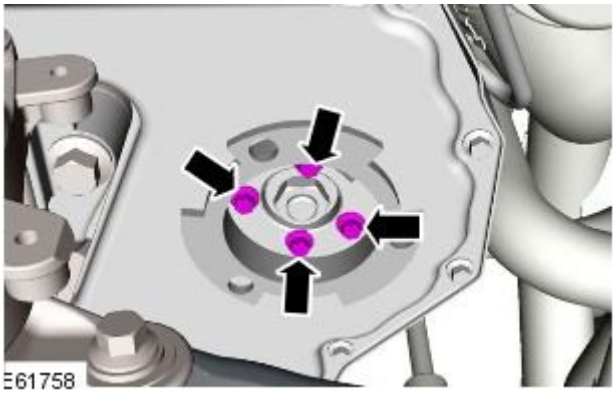


47. NOTE: For additional information, see step 41.

• NOTE: Access the fuel injection pump retaining bolts through the holes provided in the special tool (Tool no. 303-1151 and tool no. 303-083A) and the fuel injection pump sprocket. The fuel injection pump retaining bolts cannot be completely removed.

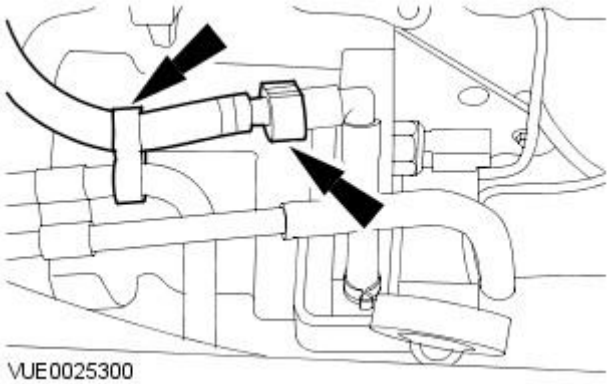
Using the special tool, remove the fuel injection pump retaining bolts.

- If available use special tool 303-083A.



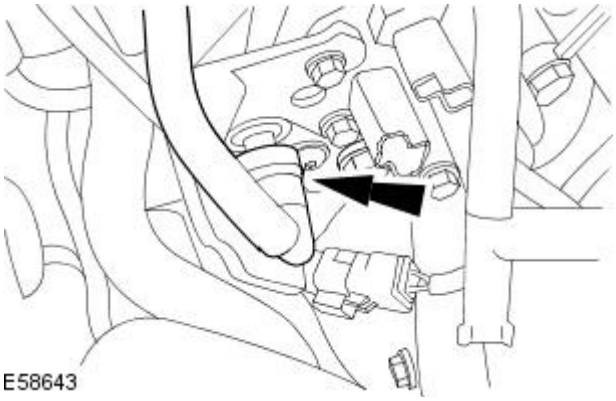
48. NOTE: For additional information, see step 41.

Remove the fuel injection pump sprocket retaining bolts.

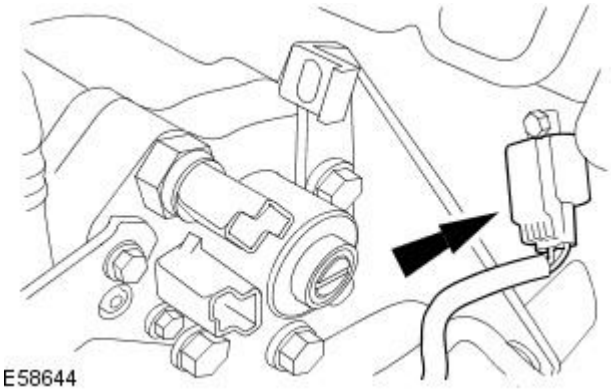


49. Disconnect the fuel injector to fuel injection pump fuel return line.

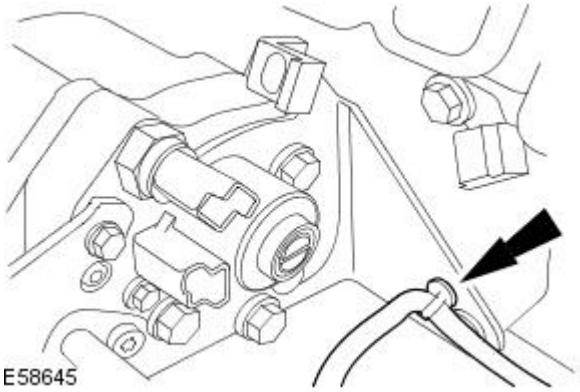
- Detach the fuel injector to fuel injection pump return line retaining clip (if equipped).
- Install blanking plugs to the fuel injector to fuel injection pump fuel return line male and female connectors.



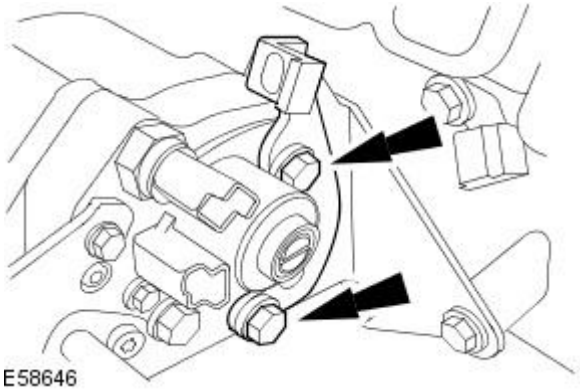
50. Disconnect the fuel pipe.



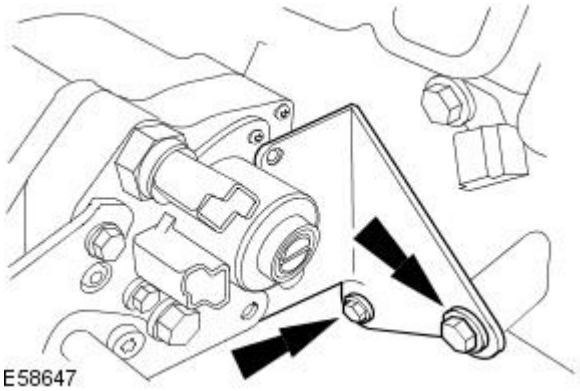
51. Disconnect the knock sensor (KS) electrical connector.



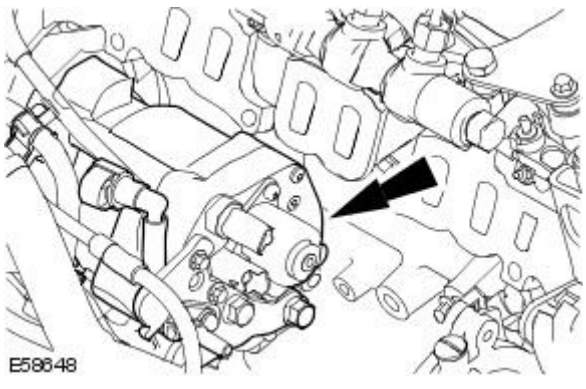
52. Detach the engine wiring harness.



53. Remove the fuel injection pump support bracket.



54. Remove the fuel injection pump support bracket to engine cylinder block retaining bolts.

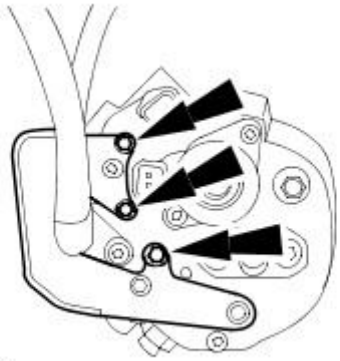


55. NOTE: When removing the fuel injection pump the special tool locking pins must not be removed. Failure to follow this instruction will require the engine front cover to be removed to retrieve the fuel injection pump sprocket and the valve timing to be reset.

Remove the fuel injection pump.

- Discard the fuel injection pump gasket.

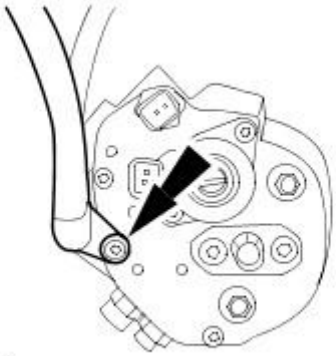
56. Remove the fuel injection pump shield from the fuel injection pump.



VUE0025306

57. Detach the fuel return line venturi from the fuel injection pump.

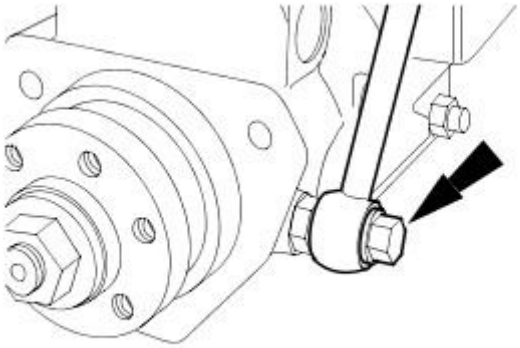
- Discard the fuel return line venturi O-ring seal.



VUE0025302

58. Remove the fuel injection pump fuel supply line and fuel return line assembly from the fuel injection pump.

- Discard the fuel supply line O-ring seals.



VUE 0025303

Installation

All vehicles

• 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.

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:

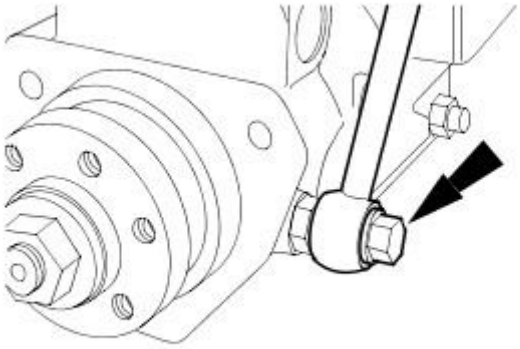
Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

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.

Do not disassemble or clean inside the fuel injection pump, even with an ultrasonic cleaner. Always install a new fuel injection pump when required.

Install a new high-pressure fuel supply line. Failure to follow this instruction may result in damage to the vehicle.

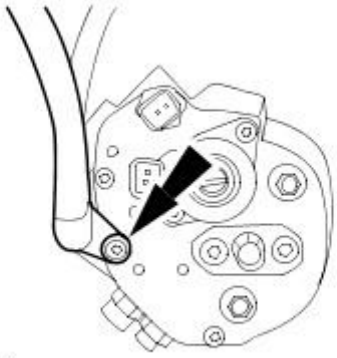


VUE 0025303

1. NOTE: Install new fuel injection pump supply line O-ring seals.

Install the fuel injection pump fuel supply line and fuel return line assembly to the fuel injection pump.

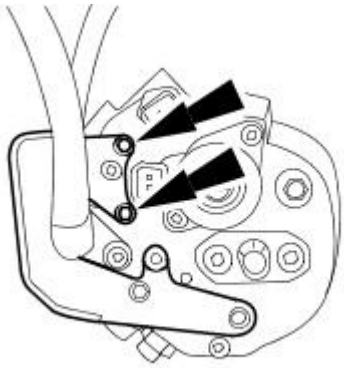
- Tighten 20 Nm.



VUE0025302

2. NOTE: Install a new O-ring seal to the fuel return line venturi.

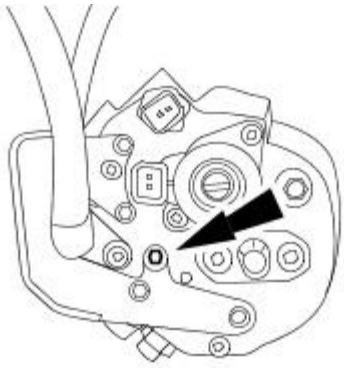
Attach the fuel return line venturi to the fuel injection pump.



E45130

3. Install the fuel injection pump shield to the fuel injection pump.

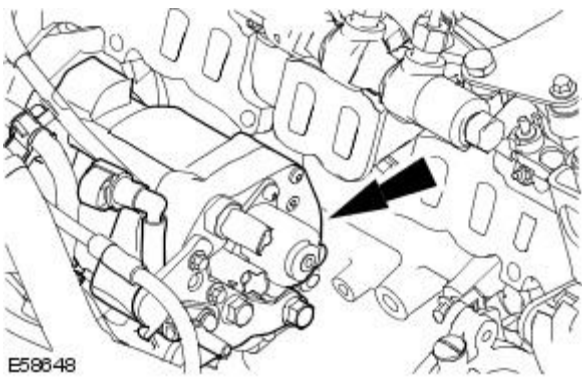
- Tighten to 8 Nm.



E45131

4. Install the fuel injection pump shield retaining bolt.

- Tighten to 33 Nm.

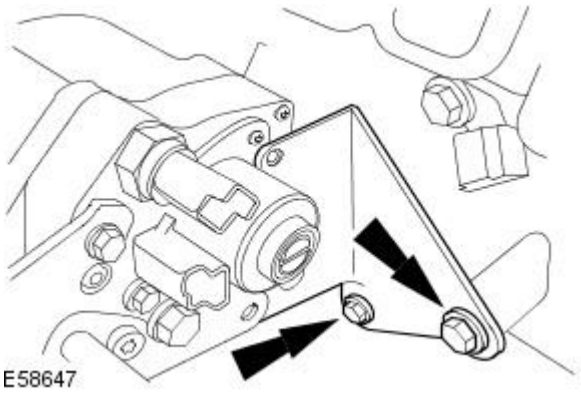


E58648

5. NOTE: Install a new fuel injection pump gasket.

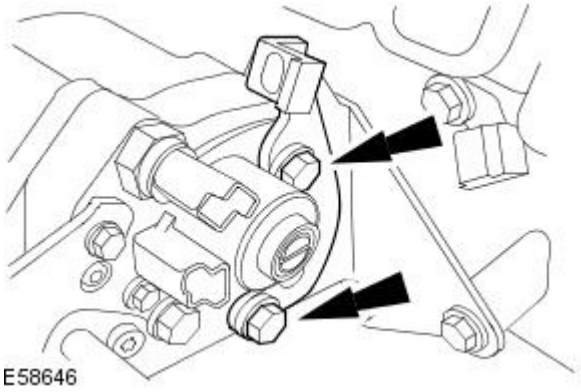
• NOTE: Apply a small bead of loctite 572 on the fuel injection pump retaining bolts.

Install the fuel injection pump.



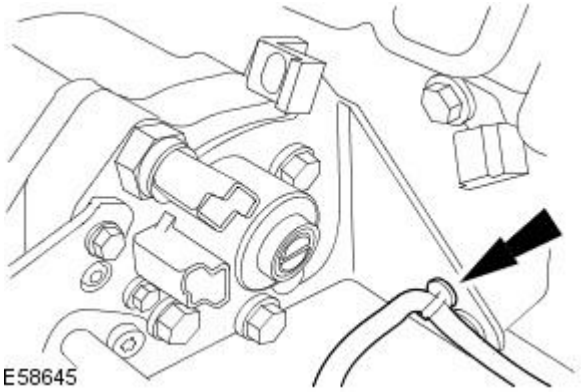
6. NOTE: Install the fuel injection pump retaining bolts evenly in order to pull the fuel injection pump squarely into position.

Loosely install the fuel injection pump support bracket to engine cylinder block retaining bolts.

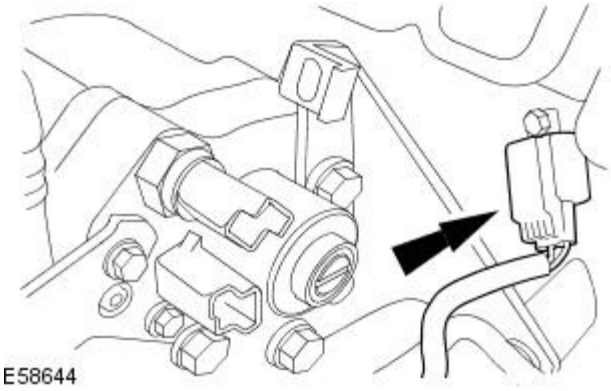


7. NOTE: Do not fully tighten the fuel injection pump support bracket bolts at this stage.

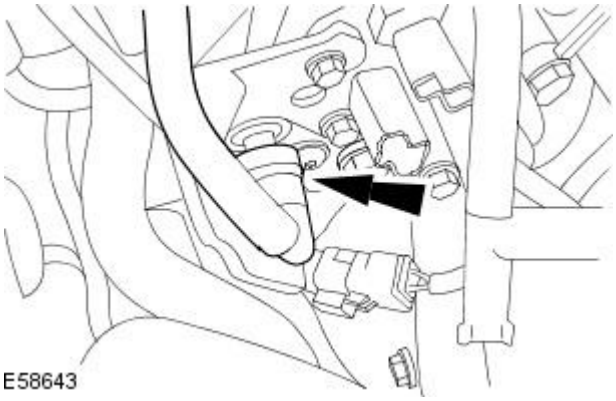
Install the fuel injection pump support bracket to the fuel injection pump.



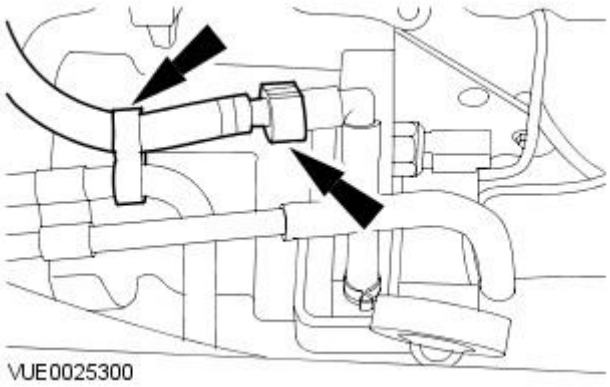
8. Attach the engine wiring harness.



9. Connect the KS electrical connector.



10. Connect the fuel pipe.

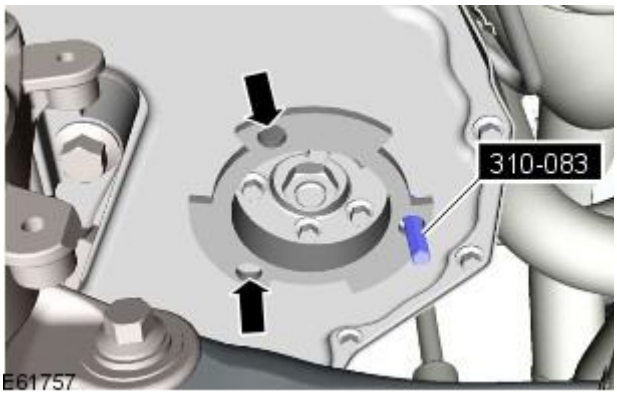


11. Connect the fuel injector to fuel injection pump fuel return line.

- Attach the fuel injector to fuel injection pump return line retaining clip (if equipped).
- Remove the blanking plugs from the fuel injector to fuel injection pump fuel return line male and female connectors.

12. From 2006 MY special tool numbers 303-681 and 303-681-01 have now been superseded by special tool numbers 303-1151 and 303-083A.

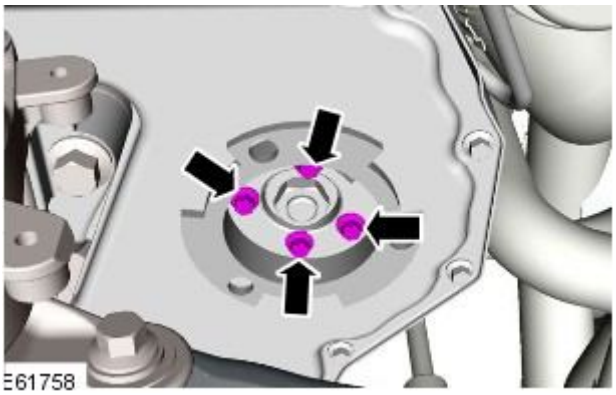
- To carry out the procedure using special tool numbers 303-1151 and 303-083A see steps 13 - 15.
- To carry out the procedure using special tool numbers 303-681 and 303-681-01 see steps 16 - 18.



13. NOTE: For additional information, see step 12.

Using the special tool tighten the fuel injection pump retaining bolts.

- Tighten to 22 Nm.
- If available use special tool 303-083A.



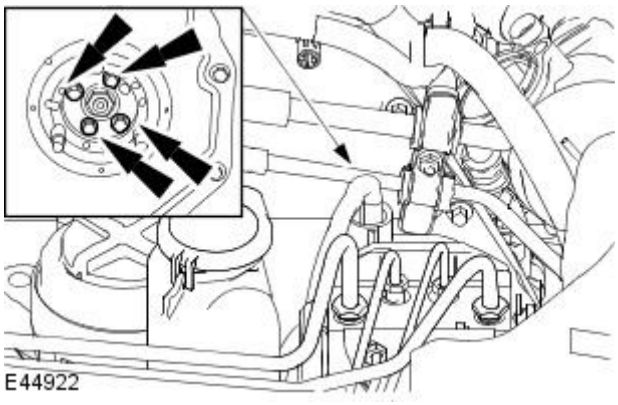
14. NOTE: For additional information, see step 12.

Install the fuel injection pump sprocket retaining bolts.

- Tighten to 32 Nm.

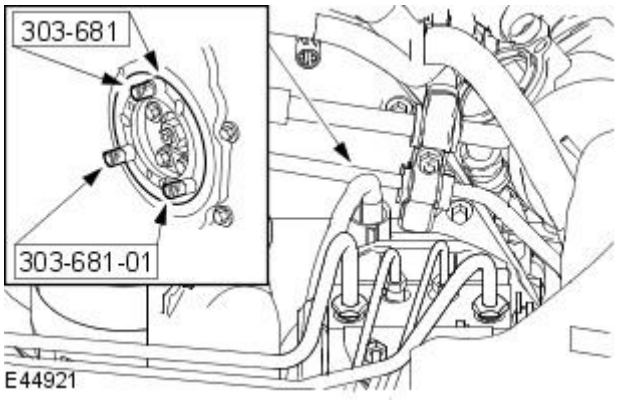
15. NOTE: For additional information, see step 12.

Remove the special tools.

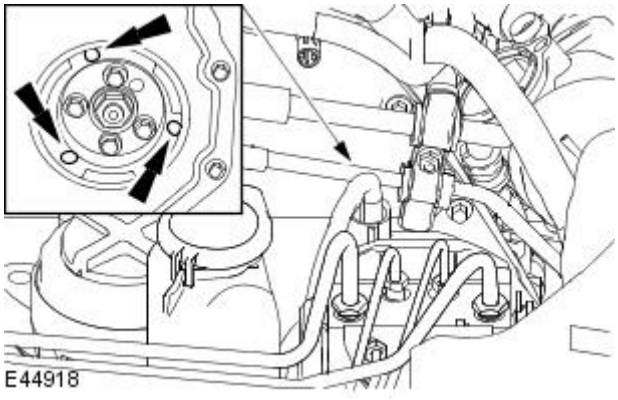


16. Install the fuel injection pump sprocket retaining bolts.

- Tighten to 32 Nm.



17. Remove the special tools.

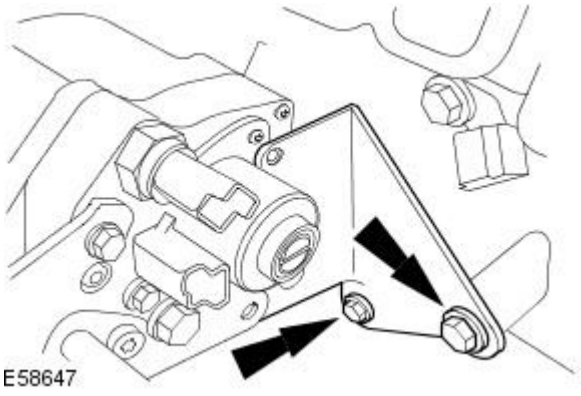


18. NOTE: Install the fuel injection pump retaining bolts evenly in order to pull the fuel injection pump squarely into position.

• NOTE: Use a torx 45 drive socket with a minimum shaft length of 43 mm (1.69 in).

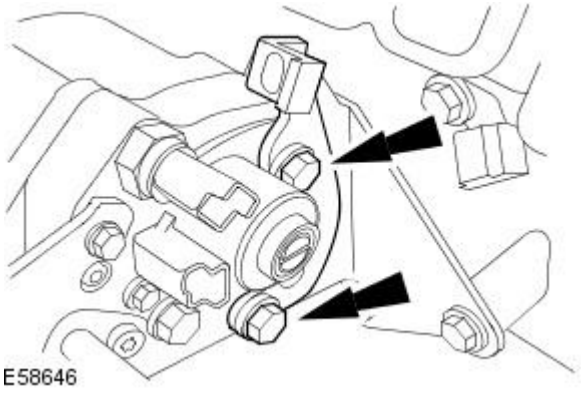
Tighten the fuel injection pump retaining bolts.

- Tighten to 22 Nm.
- If available use special tool 303-083A.



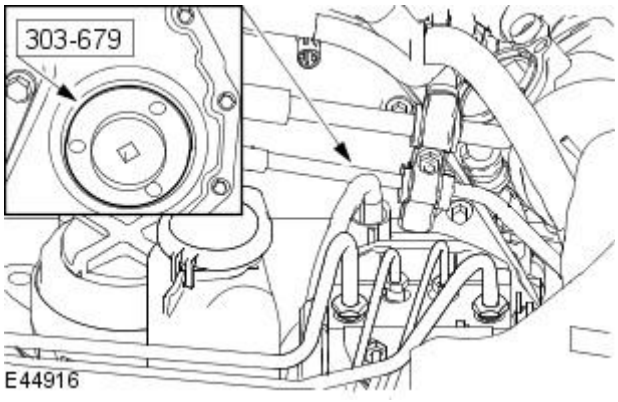
19. Tighten the fuel injection pump support bracket to cylinder block retaining bolts.

- Tighten to 23 Nm.



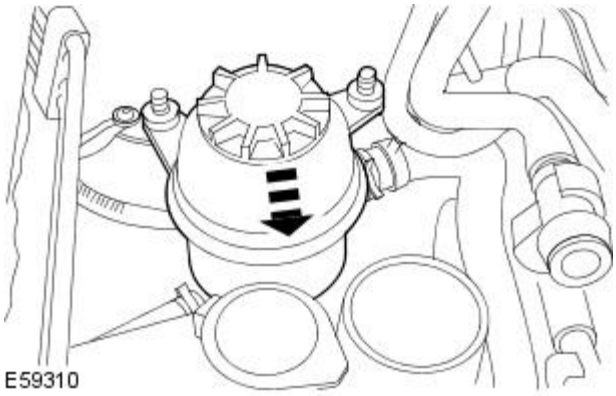
20. Tighten the fuel injection pump support bracket retaining bolts.

- Tighten to 33 Nm.

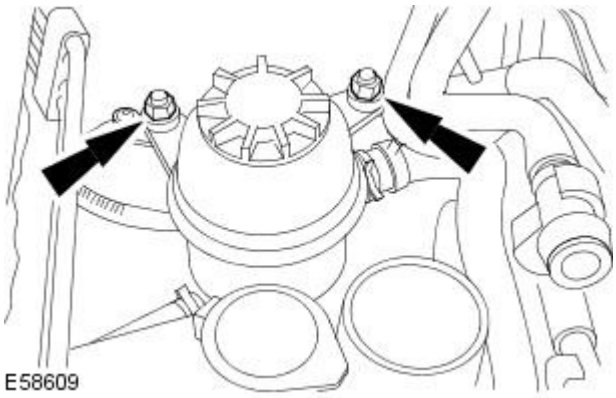


21. Using the special tool, install the fuel injection pump sprocket access cover.

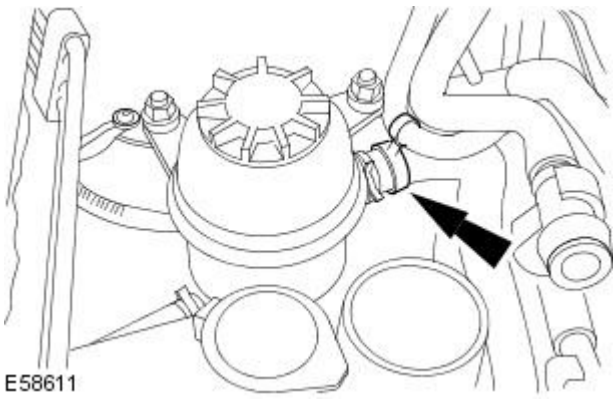
Vehicles built from VIN:E43869



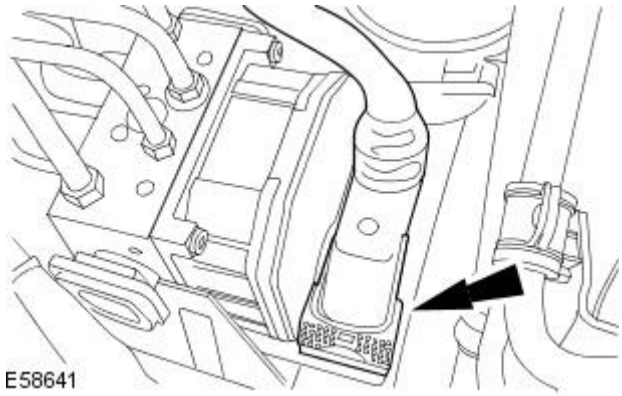
22. Attach the power steering fluid reservoir.



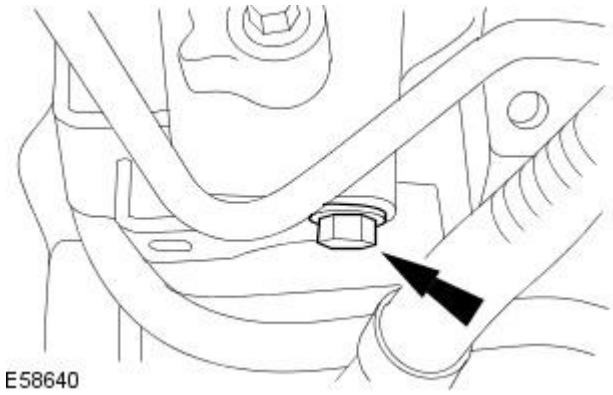
23. Install the power steering fluid reservoir retaining nuts.



24. Attach the power steering pipe to the engine wiring harness securing clip.

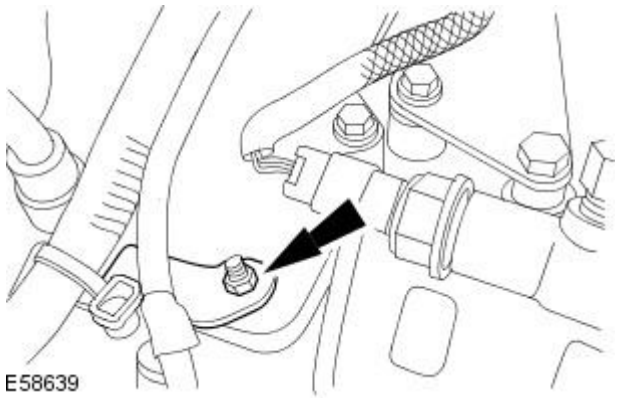

E58641

25. Connect the HCU electrical connector.


E58640

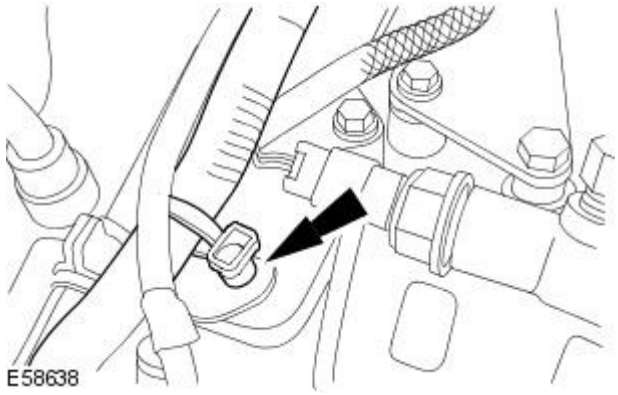
26. Attach the fuel supply and return lines.

- Tighten to 23 Nm.

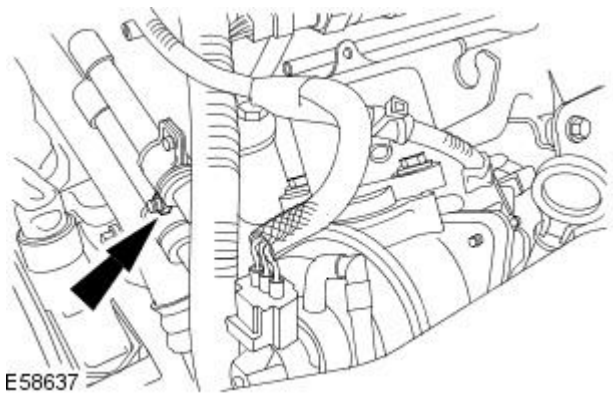

E58639

27. Install the fuel supply and return lines support bracket retaining nut.

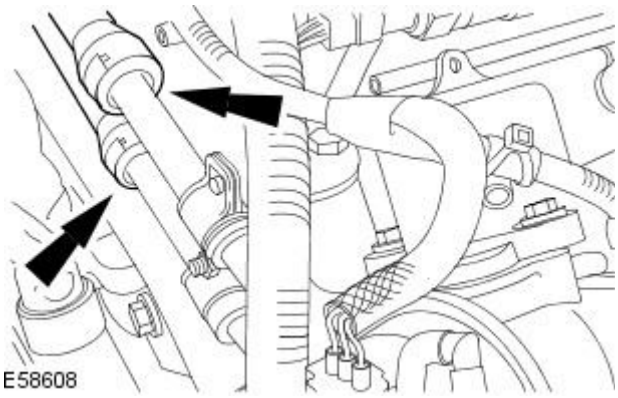
- Tighten to 8 Nm.


E58638

28. Attach the wiring harness retaining clip.

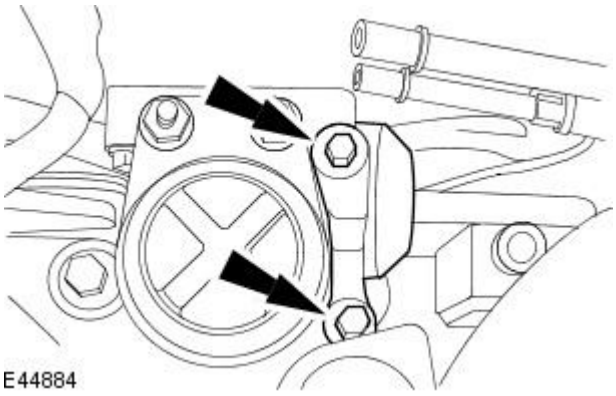

E58637

29. Install the fuel supply and return lines support bracket retaining nut.

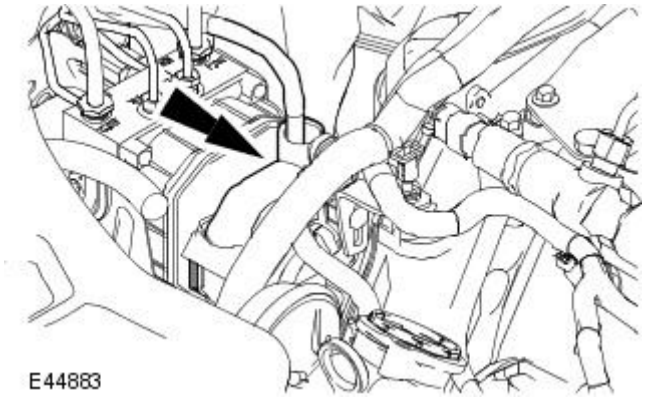


30. Connect the fuel injection pump fuel supply and return lines. For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

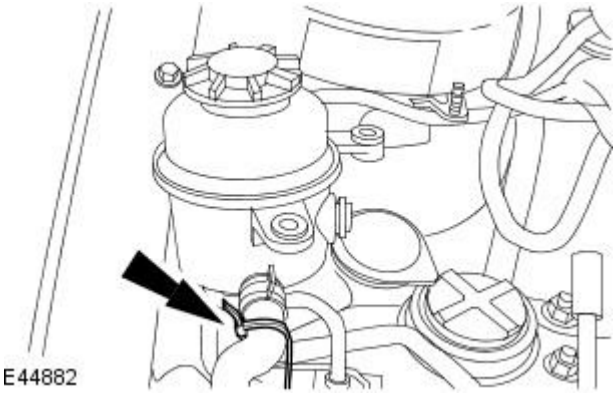
Vehicles built up to VIN:E43868



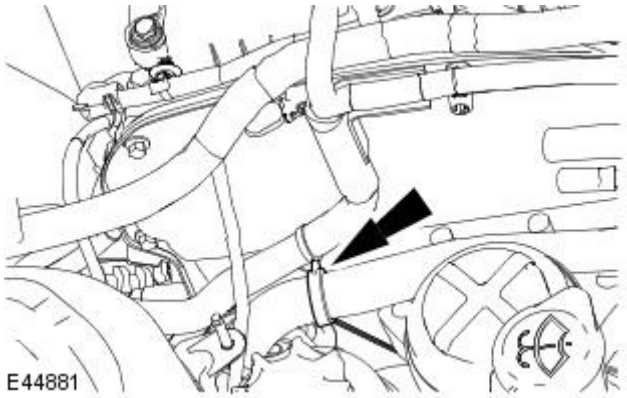
31. Install the engine mount damper.



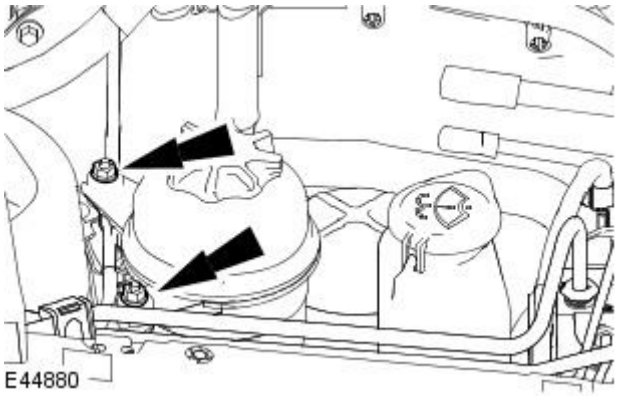
32. Connect the HCU electrical connector.



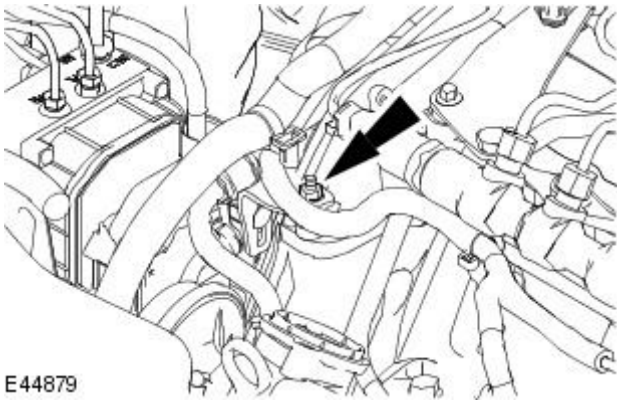
33. Detach the power steering fluid reservoir.



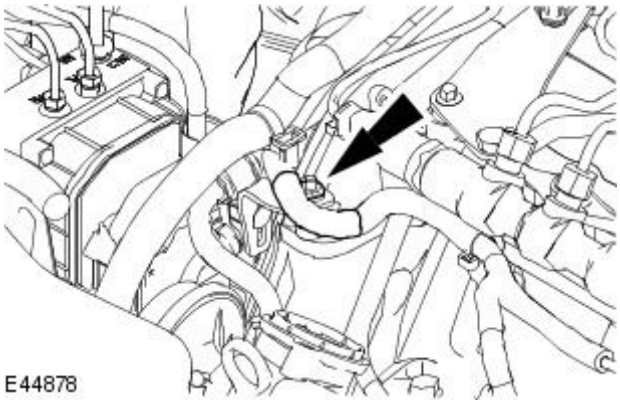
34. Attach the power steering fluid reservoir.



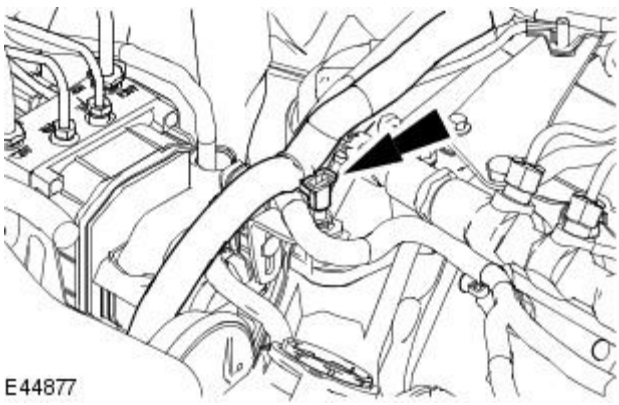
35. Install the power steering fluid reservoir retaining nuts.



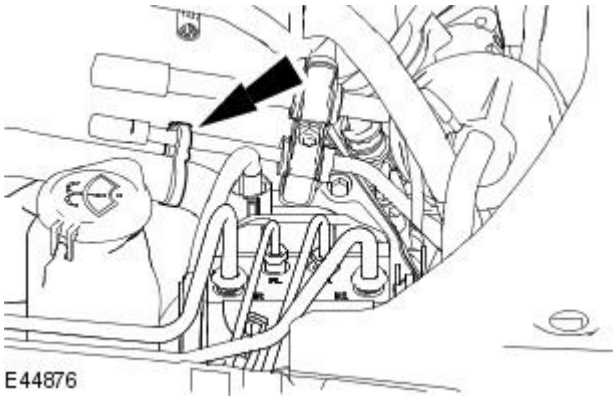
36. Attach the fuel supply and fuel return line support bracket.



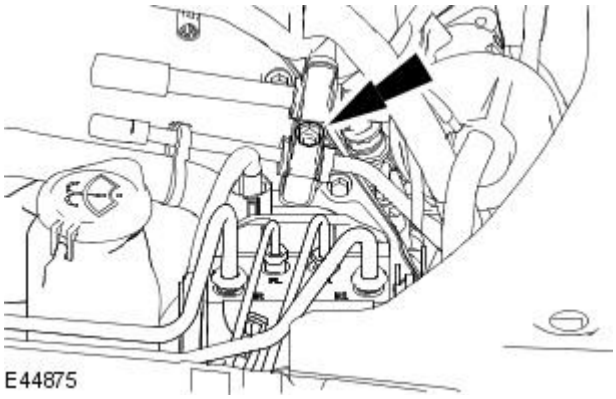
37. Attach the wiring harness retaining clip.



38. Attach the wiring harness retaining clip.

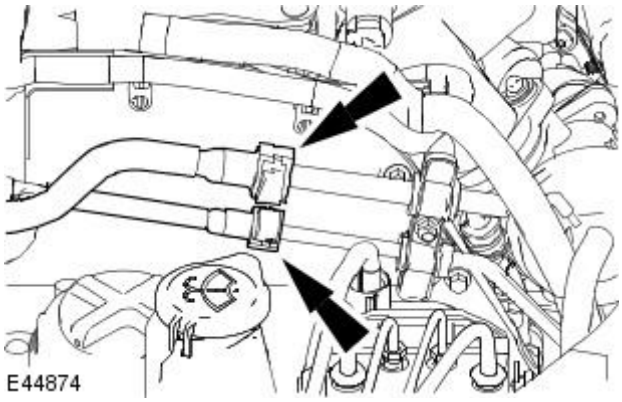


39. Attach the power steering fluid hose to the fuel return line.



40. Tighten the fuel supply and return lines support bracket retaining nut.

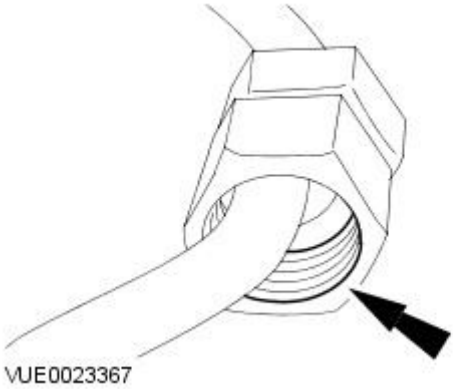
- Tighten to 8 Nm.



41. Connect the fuel injection pump fuel supply and return lines. For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

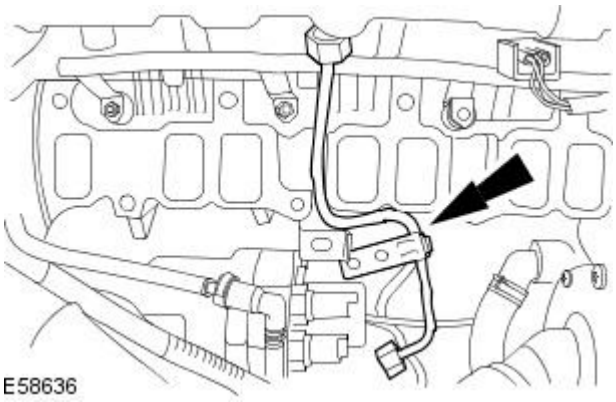
- Remove the blanking plugs from the fuel injection pump fuel supply and return line male and female connectors.

All vehicles



42. Using a suitable multipurpose lubricant spray, lubricate the high-pressure fuel supply line union threads.

43. Remove the blanking plugs from the fuel injection pump and fuel injection supply manifold threaded ports.



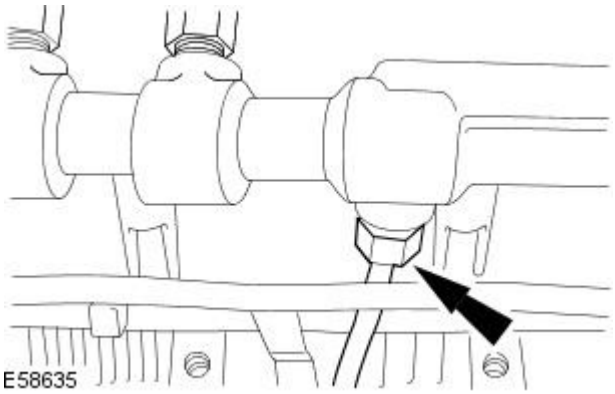
44. CAUTION: Do not allow the unions to hit the olive ends of the high-pressure fuel supply line as this may damage the ends of the line and allow foreign matter to enter the fuel injection system.

• NOTE: Position the high pressure fuel supply line as near to the final installation position as possible and then remove the blanking plugs from the high-pressure fuel supply line.

• NOTE: The yellow colored collar is fitted at the fuel injection pump end and the blue colored collar is fitted at the fuel injection supply manifold end of the high-pressure fuel supply line.

• NOTE: To aid identification of the high pressure fuel supply line, the union at the fuel injection pump end is etched with the word, Pump.

Install the high-pressure fuel supply line.

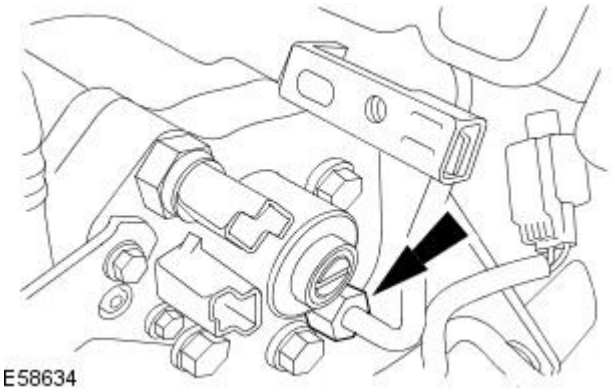


45. CAUTIONS:

Do not tighten the high-pressure fuel supply line union at this stage.

Maintain pressure on the high-pressure fuel supply line to keep the olive in contact with the fuel injection supply manifold cone while installing the union. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Loosely install the high-pressure fuel supply line to the fuel injection supply manifold.

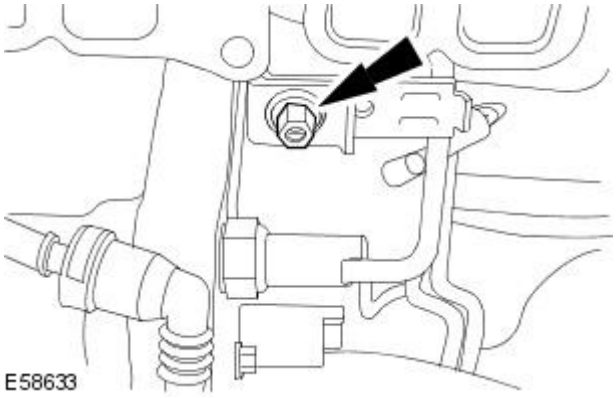


46. CAUTIONS:

Do not tighten the high-pressure fuel supply line union at this stage.

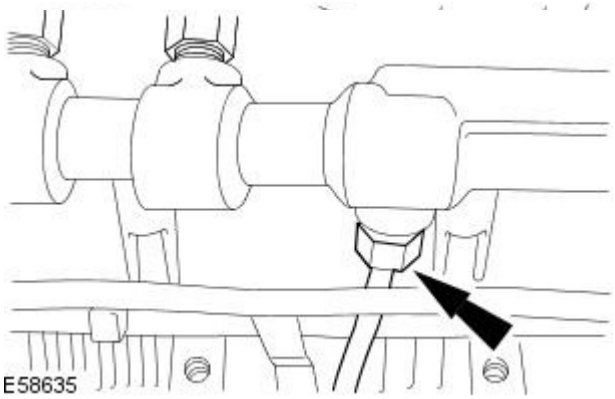
Maintain pressure on the high-pressure fuel supply line to keep the olive in contact with the fuel injection pump cone while installing the union. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Loosely install the high-pressure fuel supply line to the fuel injection pump.



47. Attach the high-pressure fuel supply line support bracket.

- Tighten to 8 Nm.



48. IONS:

49. CAUTION: Make sure the tool used to tighten the high-pressure fuel supply line union is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

CAUTION: Make sure the tool used to tighten the high-pressure fuel supply line union is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Tighten the high-pressure fuel supply line union at the fuel injection supply manifold.

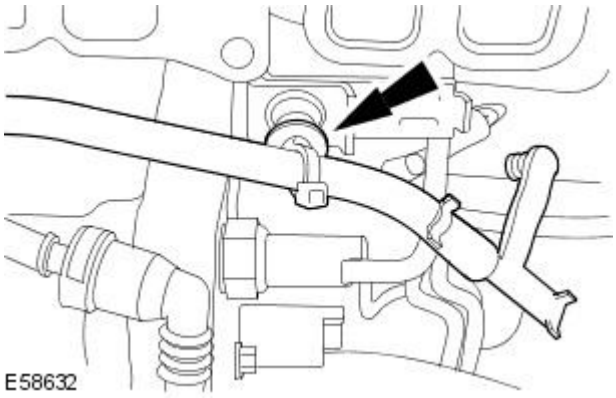
- Tighten to 40 Nm.

Make sure the tool used to tighten the high-pressure fuel supply line union does not come into contact with the inlet metering valve while tightening the high-pressure fuel supply line union. Failure to follow this instruction may result in fuel leaking from the union.

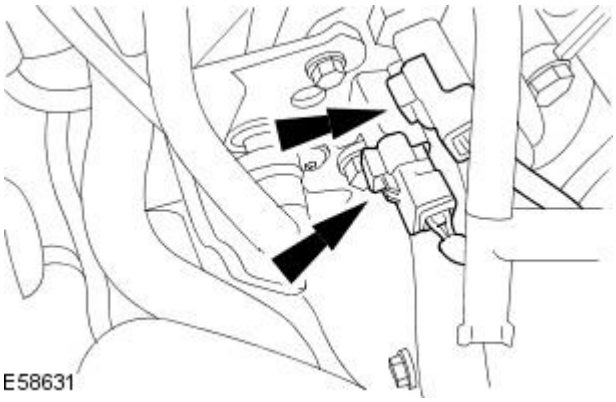
Tighten the high-pressure fuel supply line union at the fuel injection pump.

- Tighten to 40 Nm.

50. Attach the wiring harness.



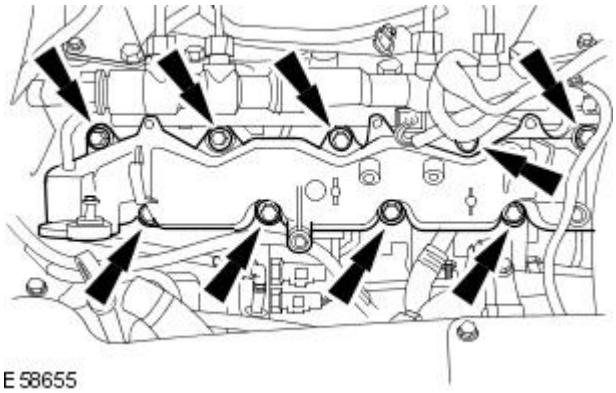
51. Connect the fuel metering valve and fuel temperature sensor electrical connectors.



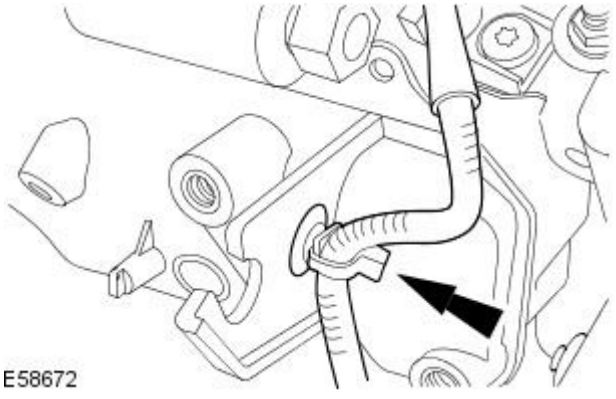
52. NOTE: Install new intake manifold gaskets.

Install the intake manifold.

- Tighten to 15 Nm.



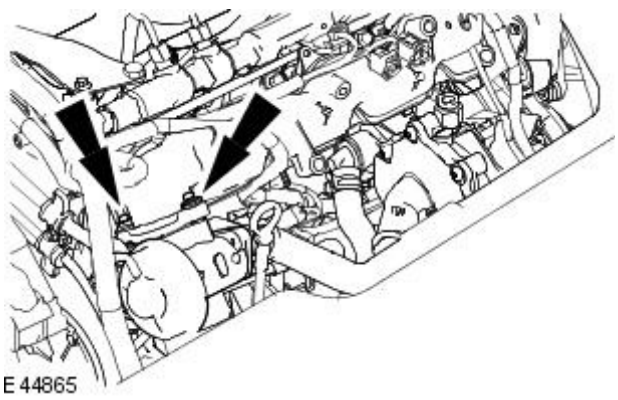
53. Attach the wiring harness onto the intake manifold.

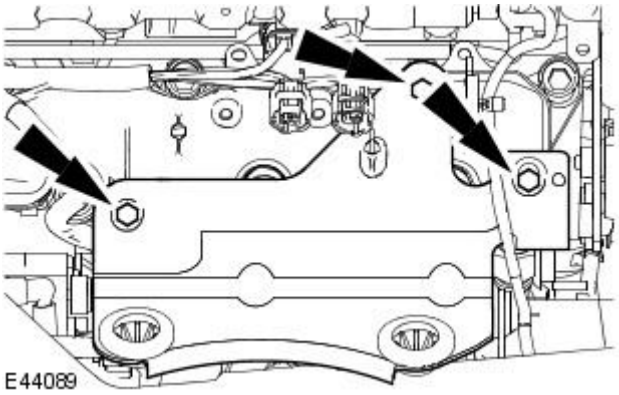


54. NOTE: Install a new EGR valve gasket.

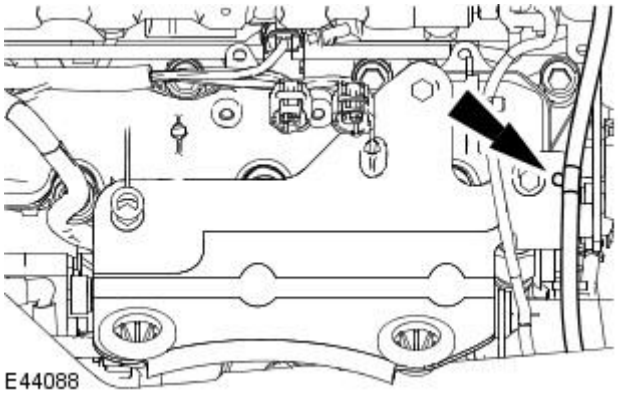
Attach the EGR valve to the intake manifold.

- Tighten to 10 Nm.





55. Install the air cleaner mount bracket.



56. Attach the wiring harness.

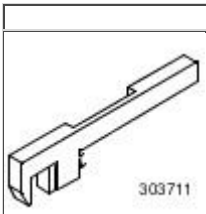
57. Install the EGR cooler to EGR valve tube.
For additional information, refer to: Exhaust Gas Recirculation (EGR) Cooler to EGR Valve Tube (303-08 Engine Emission Control - 2.0L Diesel/2.2L Diesel, Removal and Installation).

58. Install a new fuel filter.
For additional information, refer to: Fuel Filter - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (310-01 Fuel Tank and Lines, Removal and Installation).

Published: 11-May-2011

Fuel Charging and Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Fuel Injection Supply Manifold

Removal and Installation

Special Tool(s)	
	Aligner, Fuel Injector 303-711 (21-258)

General Equipment

Pneumatic vacuum gun

Materials

Name	Specification
High pressure fuel supply line union	TBD
lubricant TBD	

Removal

• WARNINGS:

Wait at least 15 minutes 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 mixtures 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 injection system with the engine running. The fuel pressure within the system can be as high as 1600 bar. Failure to follow this instruction may result in personal injury.

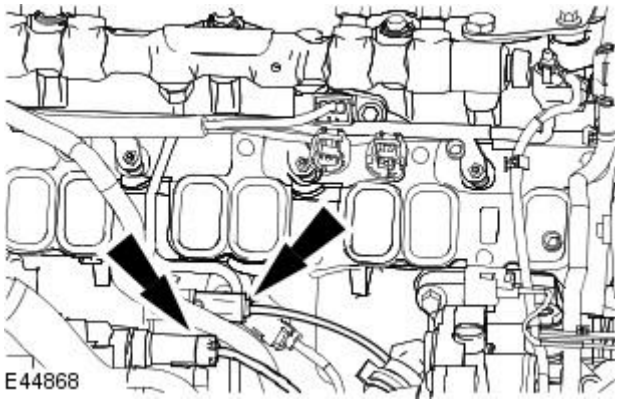
• CAUTIONS:

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.

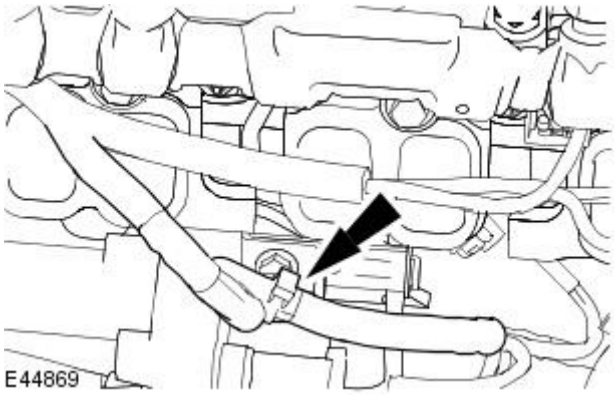
Do not disassemble or clean inside the fuel injection supply manifold, even with an ultrasonic cleaner. Always install a new fuel injection supply manifold when required.



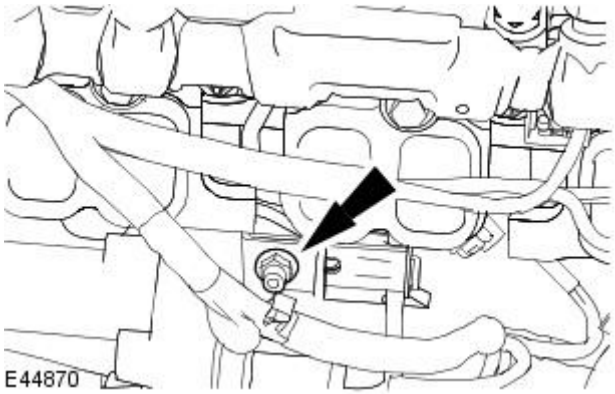
1. Remove the intake manifold.
For additional information, refer to: Intake Manifold (303-01B Engine - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, In-vehicle Repair).

2. NOTE: Protect the electrical connectors with lint-free material to prevent contamination from the cleaning fluid.

Disconnect the fuel metering valve and fuel temperature sensor electrical connectors.

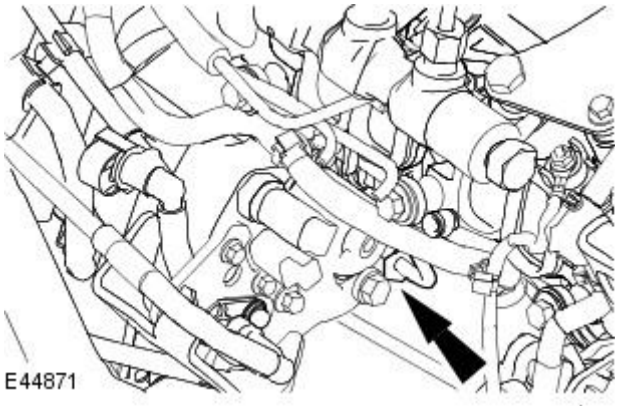


3. Detach the wiring harness.



4. Detach the high pressure fuel supply line support bracket.

5. Clean the fuel pump, high pressure fuel supply line and surrounding areas.
For additional information, refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).



6. CAUTIONS:

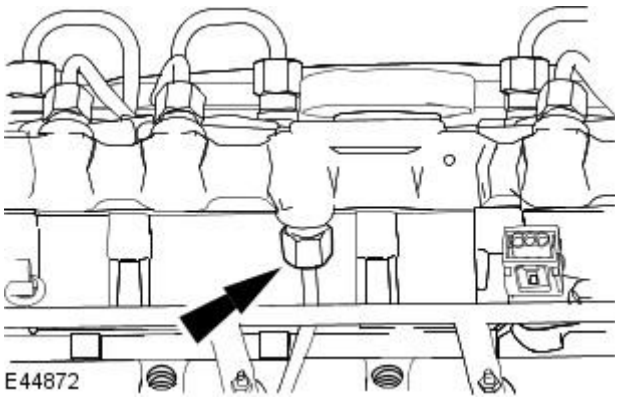
Make sure the tool used to loosen the high pressure fuel supply line union is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Maintain pressure on the high pressure fuel supply line to keep the olive in contact with the fuel pump cone while unscrewing the union. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Loosen the high pressure fuel supply line at the fuel pump.

7. CAUTION: Make sure that the high pressure fuel supply line remains in contact with both the fuel pump 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.

Using the pneumatic vacuum gun, vacuum foreign material from the high pressure fuel supply line and the fuel pump.



8. CAUTIONS:

Make sure the tool used to loosen the high pressure fuel supply line union is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Maintain pressure on the high pressure fuel supply line to keep the olive in contact with the fuel injection supply manifold cone while unscrewing the union. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

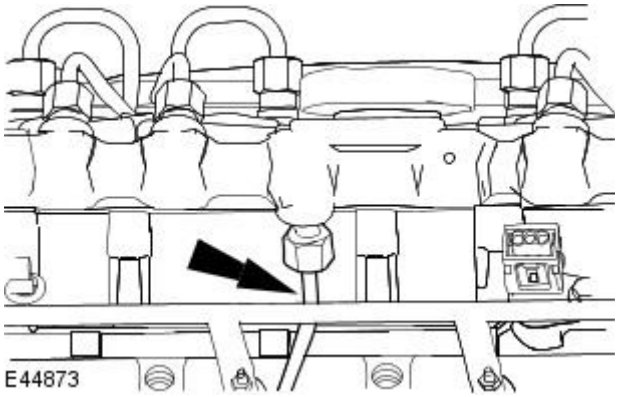
While maintaining the pressure on the high pressure fuel supply line, clean and vacuum foreign material from the line and union.

Loosen the high pressure fuel supply line at the fuel injection supply manifold.

9. CAUTION: Make sure that the high pressure fuel supply line remains in contact with both the fuel pump 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.

Using the pneumatic vacuum gun, vacuum foreign material from the high pressure fuel supply line and the fuel injection supply manifold.

10. Remove and discard the high pressure fuel supply line.

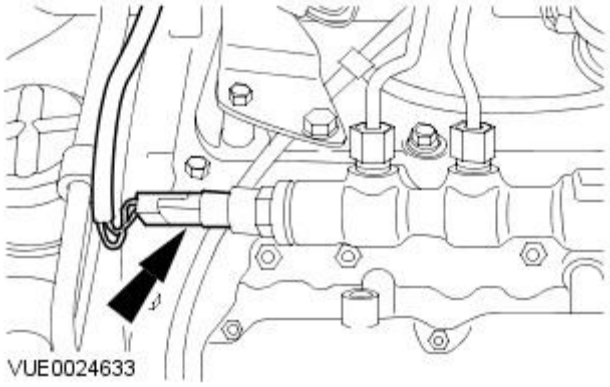


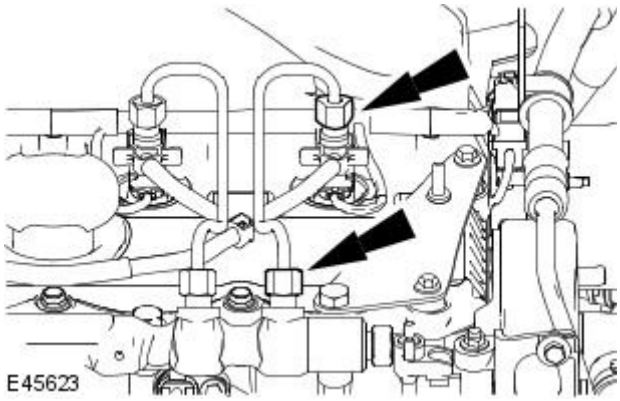
11. Using the pneumatic vacuum gun, vacuum foreign material from the fuel pump and the fuel injection supply manifold.

12. Install blanking caps to the open threaded ports on the fuel pump and the fuel injection supply manifold.

13. Clean the fuel injectors, fuel injection supply manifold, high pressure fuel supply lines and surrounding areas.
For additional information, refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

14. Disconnect the fuel pressure sensor electrical connector.





15. CAUTIONS:

Make sure that 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.

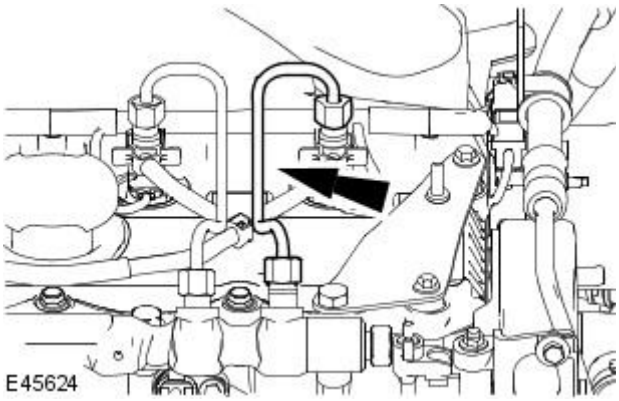
Make sure the tool used to loosen the high pressure fuel supply line unions is used at the top of the unions as this is where there is most material. Failure to follow this instruction may result in damage to the unions.

Make sure that the fuel injector does not move when loosening the high pressure fuel supply lines. Failure to follow this instruction will result in damage to the fuel injector and the fuel injector sealing washer.

Loosen the high pressure fuel supply line from the fuel injector and the fuel injection supply manifold.

16. CAUTION: Make sure that 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.

Using the pneumatic vacuum gun, vacuum foreign material from the fuel injector and the fuel injection supply manifold.



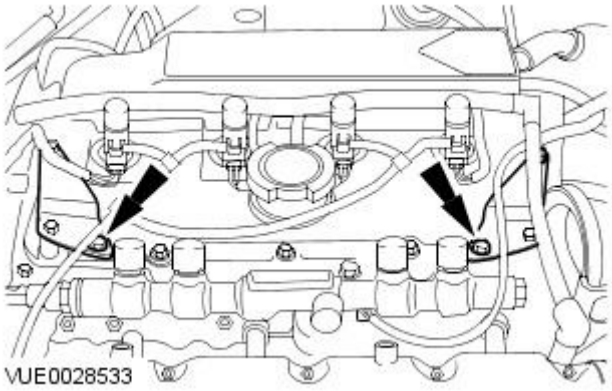
17. Remove and discard the high pressure fuel supply line.

18. Repeat steps 14 and ,15 to remove the 3 remaining high pressure fuel supply lines.

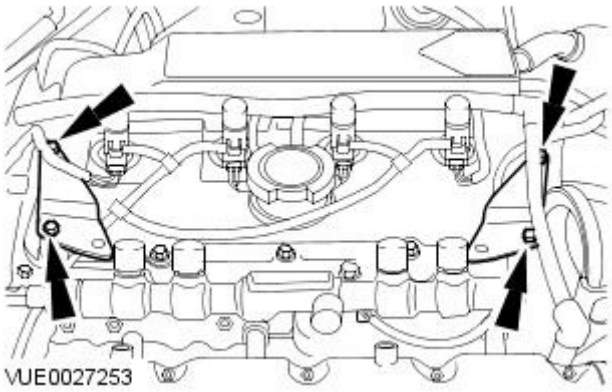
19. Using the pneumatic vacuum gun, vacuum foreign material from the fuel injector and the fuel injection supply manifold.

20. Install blanking caps to the open threaded ports on the fuel injectors and the fuel injection supply manifold.

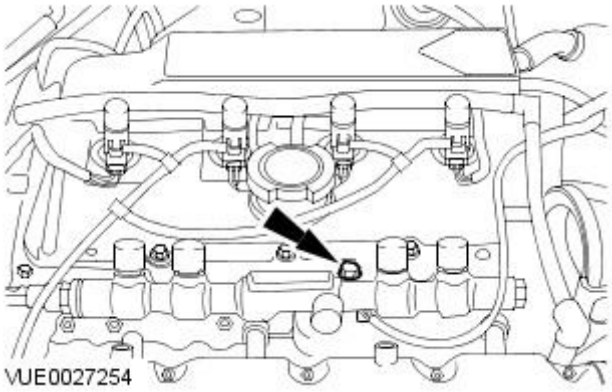
21. Remove the fuel injection supply manifold retaining bolts.



22. Loosen the fuel injection supply manifold support brackets.



23. Remove the fuel injection supply manifold.



Installation

• 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.

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:

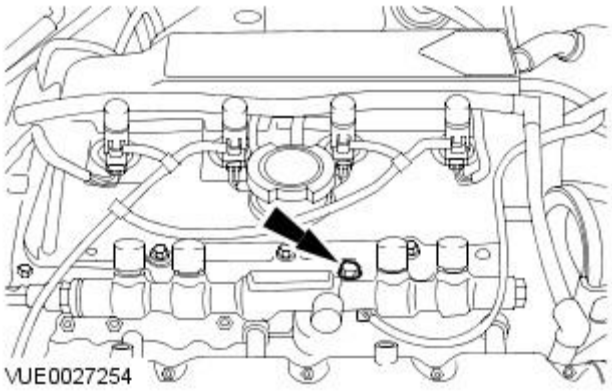
Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

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.

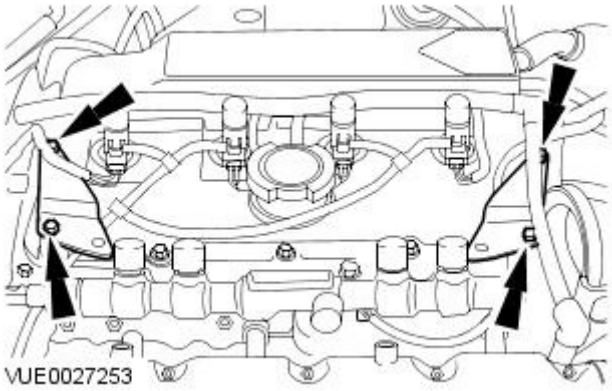
Do not disassemble or clean inside the fuel injection supply manifold, even with an ultrasonic cleaner. Always install a new fuel injection supply manifold when required.

• NOTE: Install new high pressure fuel supply lines.



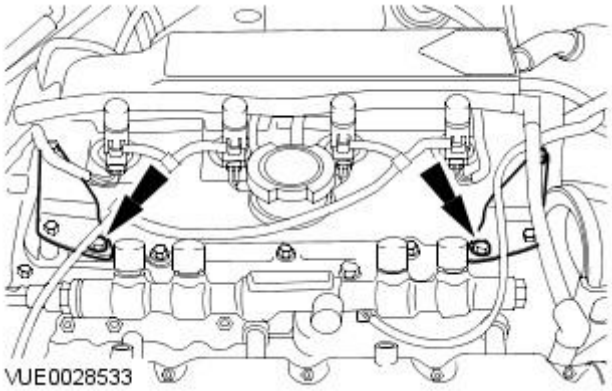
1. NOTE: Do not tighten the fuel injection supply manifold retaining bolt at this stage.

Install the fuel injection supply manifold.



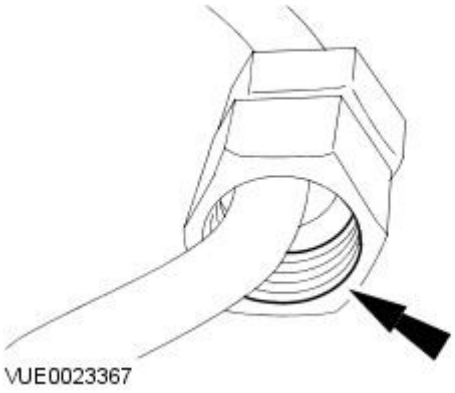
2. NOTE: Do not tighten the fuel injection supply manifold support bracket bolts at this stage.

Install the fuel injection supply manifold support brackets.



3. NOTE: Do not tighten the fuel injection supply manifold retaining bolts at this stage.

Install the fuel injection supply manifold retaining bolts.



4. Lubricate the new high pressure fuel supply line union threads with clean lubricant.

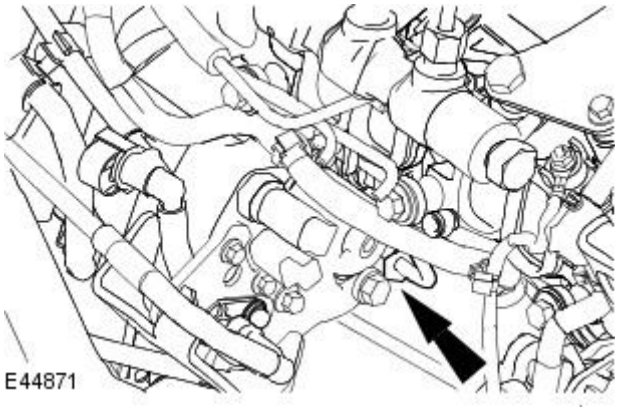
5. CAUTION: Do not allow the unions to hit the olive ends of the high pressure fuel supply line as this may damage the ends of the line and allow foreign matter to enter the fuel injection system.

• NOTE: The yellow colored collar is fitted at the fuel pump end and the blue colored collar is fitted at the fuel injection supply manifold end of the high pressure fuel supply line.

• NOTE: To aid identification of the high pressure fuel supply lines, the union at the fuel pump end is etched with the word Pump.

Position the high pressure fuel supply line as near to the final installation position as possible and then remove and discard the blanking plugs from the high pressure fuel supply line.

6. Remove the blanking plugs from the fuel pump and the fuel injection supply manifold threaded ports.

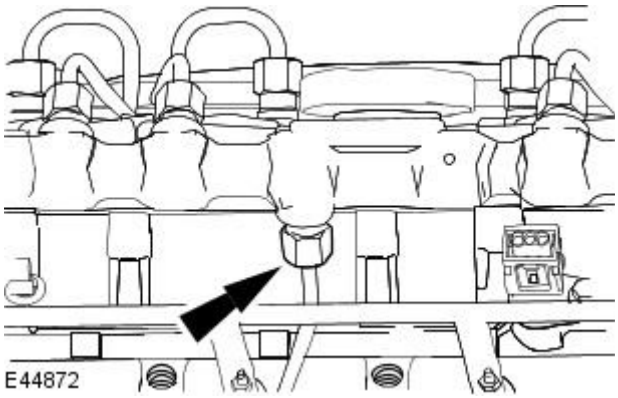


7. CAUTIONS:

Do not tighten the high pressure fuel supply line union at this stage.

Maintain pressure on the high pressure fuel supply line to keep the olive in contact with the fuel pump cone while hand installing the union. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Install the high pressure fuel supply line to the fuel pump.

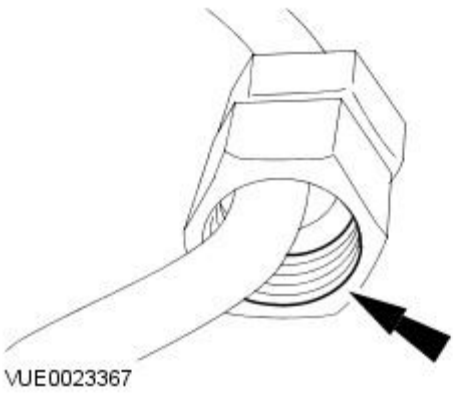


8. CAUTIONS:

Do not tighten the high pressure fuel supply line union at this stage.

Maintain pressure on the high pressure fuel supply line to keep the olive in contact with the fuel injection supply manifold cone while hand installing the union. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Install the high pressure fuel supply line to the fuel injection supply manifold.



9. Lubricate the new high pressure fuel supply line union threads with clean lubricant.

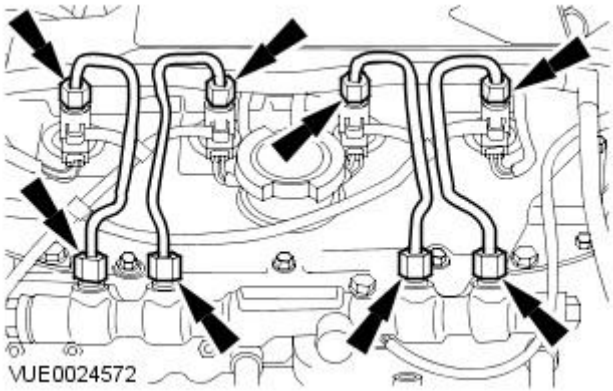
10. CAUTION: Do not allow the unions to hit the olive ends of the high pressure fuel supply line as this may damage the ends of the line and allow foreign matter to enter the fuel injection system.

• NOTE: The yellow colored collar is fitted at the fuel injector end and the blue colored collar is fitted at the fuel supply manifold end of the high pressure fuel supply line.

• NOTE: To aid identification of the high pressure fuel supply line, the union at the fuel injector end is etched with the cylinder number.

Position the high pressure fuel supply line as near to the final installation position as possible and then remove and discard the blanking plugs from the high pressure fuel supply line.

11. Remove the blanking plugs from the fuel injector and the fuel injection supply manifold threaded ports.



12. CAUTION: Maintain pressure on the high pressure fuel supply line to keep the olives in contact with the fuel injectors and the fuel injection supply manifold cones while hand installing the unions.

• NOTE: Install the high pressure fuel supply lines to the fuel injection supply manifold end first followed by the fuel injector end.

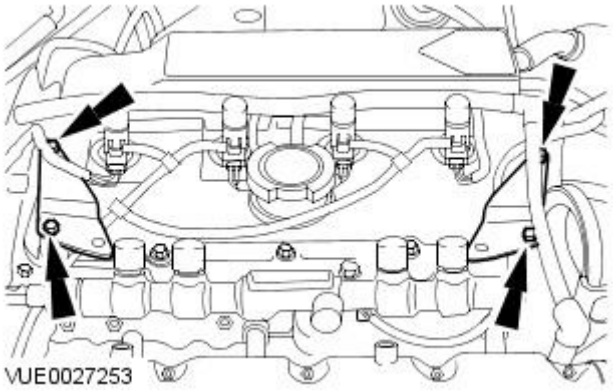
• NOTE: Do not tighten the high pressure fuel supply line unions at this stage.

Install new high pressure fuel supply lines.

13. NOTE: High pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold support brackets.

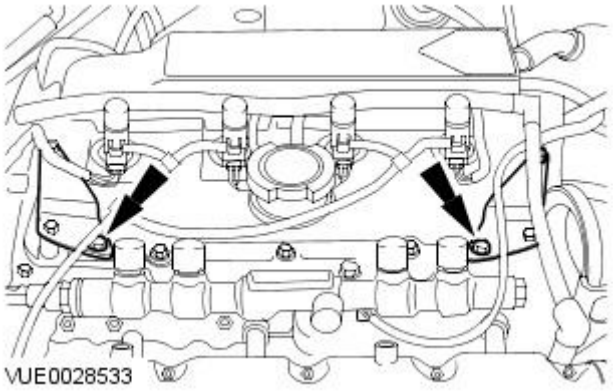
- Tighten to 14 Nm.

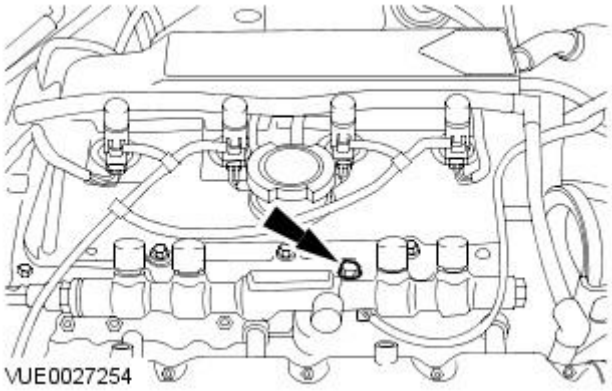


14. NOTE: High pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold retaining bolts.

- Tighten to 23 Nm.

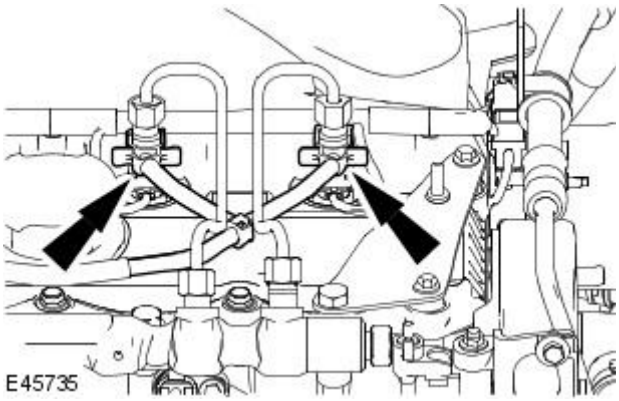




15. NOTE: High pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold retaining bolt.

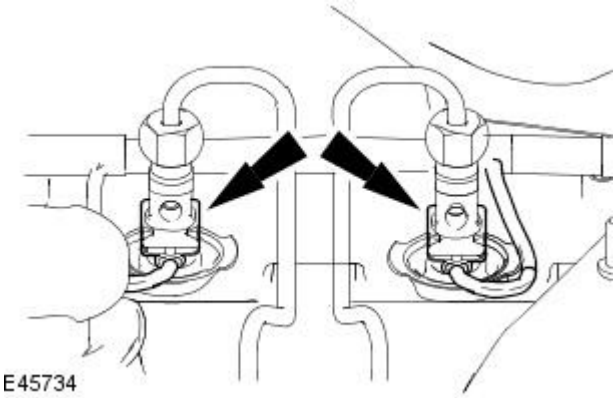
- Tighten to 23 Nm.



16. NOTE: Two fuel injector shown, other fuel injectors similar.

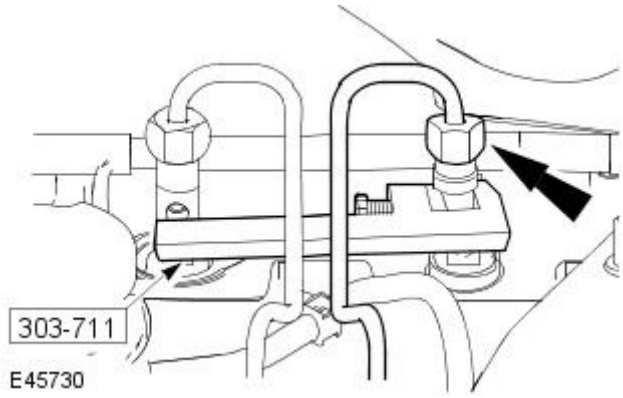
Disconnect the fuel return lines from the fuel injectors.

- Discard the fuel return line O-ring seal.



17. NOTE: Two fuel injector shown, other fuel injectors similar.

Disconnect the fuel injector electrical connectors.



18. CAUTIONS:

Make sure the special tool is clamped around the fuel injector which is being tightened and is resting up against the adjacent fuel injector.

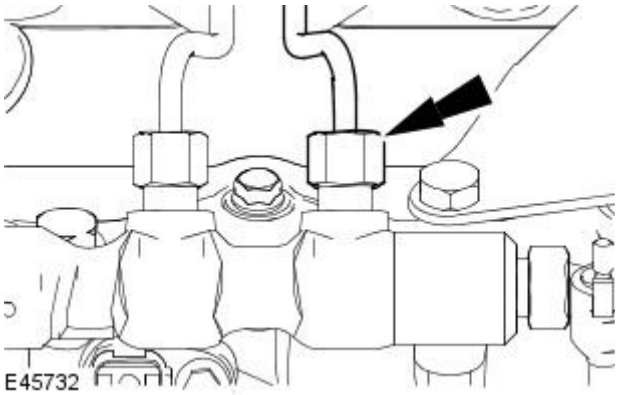
Make sure the tool used to tighten the high pressure fuel supply line unions is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Make sure that the fuel injector does not move when tightening the high pressure fuel supply lines. Failure to follow this instruction will result in damage to the fuel injector and the fuel injector sealing washer.

Install the special tool and tighten the high pressure fuel supply line union at the fuel injector.

- Tighten to 40 Nm.

19. Remove the special tool.

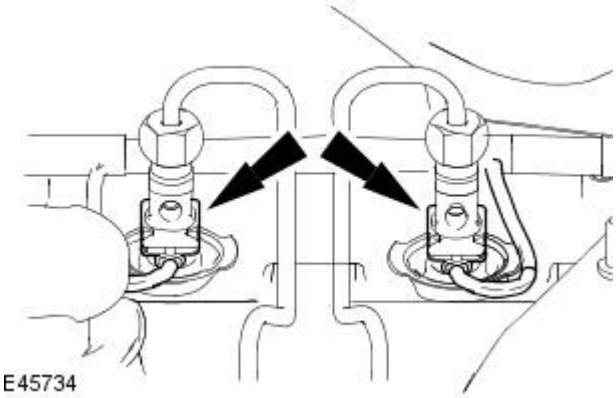


20. CAUTION: Make sure the tool used to tighten the high pressure fuel supply line unions is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Tighten the high pressure fuel supply line union at the fuel injection supply manifold.

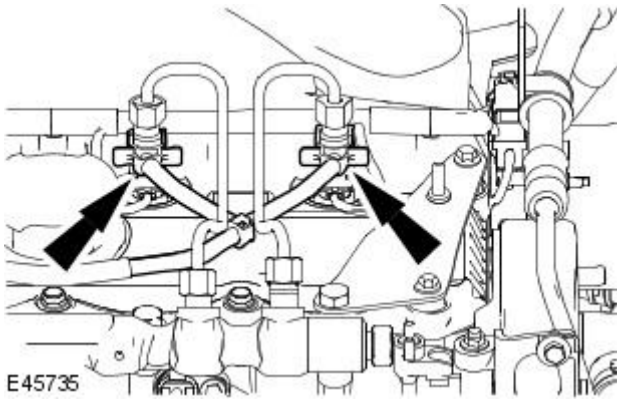
- Tighten to 40 Nm.

21. Repeat steps 16, 17 and 18 for tightening the 3 remaining high pressure fuel supply line unions.



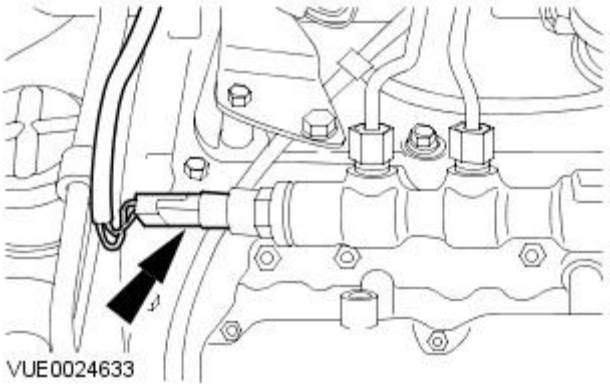
22. NOTE: Cylinders three and four fuel injectors shown, cylinders one and two fuel injectors similar.

Connect the fuel injector electrical connectors.

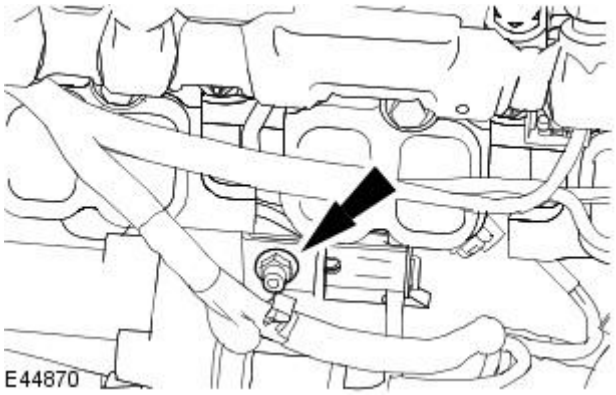


23. NOTE: Cylinders three and four fuel injectors shown, cylinders one and two fuel injectors similar.

Connect the fuel return lines to the fuel injectors.

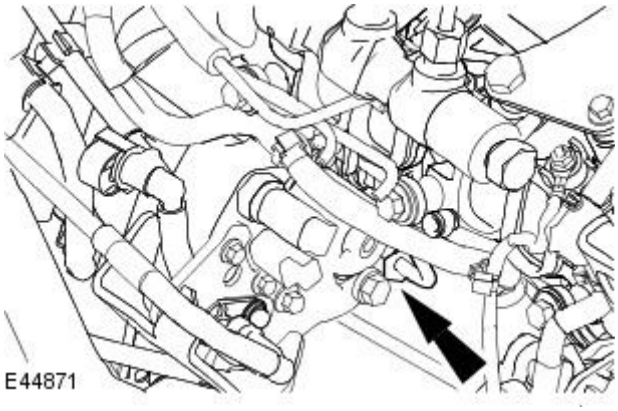


24. Connect the fuel pressure sensor electrical connector.



25. Attach the high pressure fuel supply line support bracket.

- Tighten to 8 Nm.



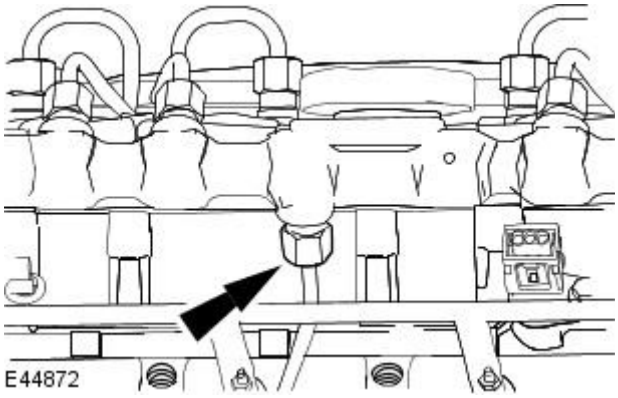
26. CAUTIONS:

Make sure the tool used to tighten the high pressure fuel supply line union is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Make sure the tool used to tighten the high pressure fuel supply line union does not come into contact with the inlet metering valve while tightening the high pressure fuel supply line union. Failure to follow this instruction may result in fuel leaking from the union.

Tighten the high pressure fuel supply line union at the fuel pump.

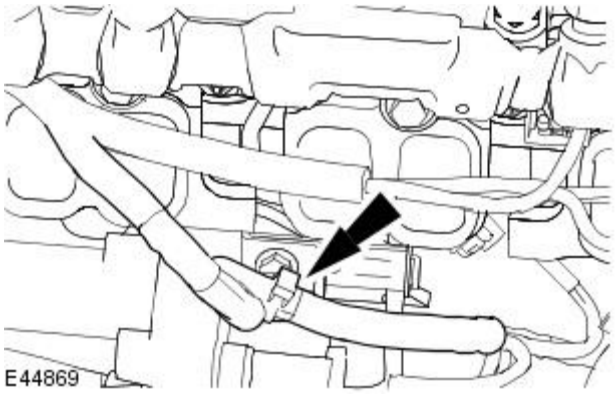
- Tighten to 40 Nm.



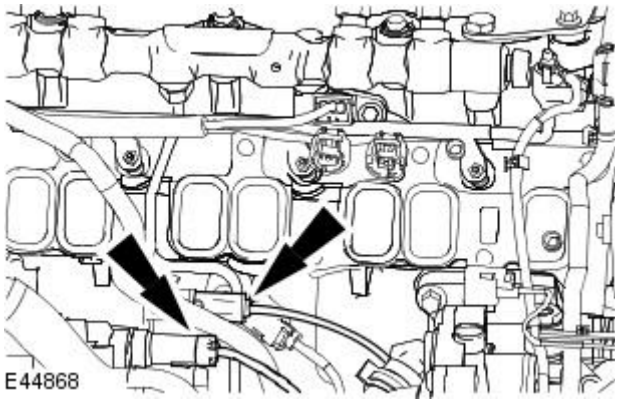
27. CAUTION: Make sure the tool used to tighten the high pressure fuel supply line union is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Tighten the high pressure fuel supply line union at the fuel injection supply manifold.

- Tighten to 40 Nm.



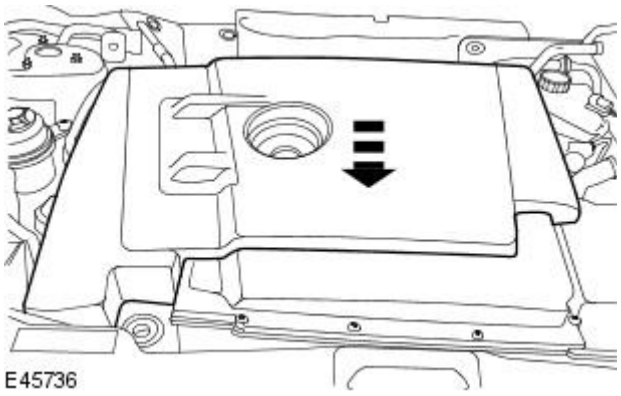
28. Attach the wiring harness.



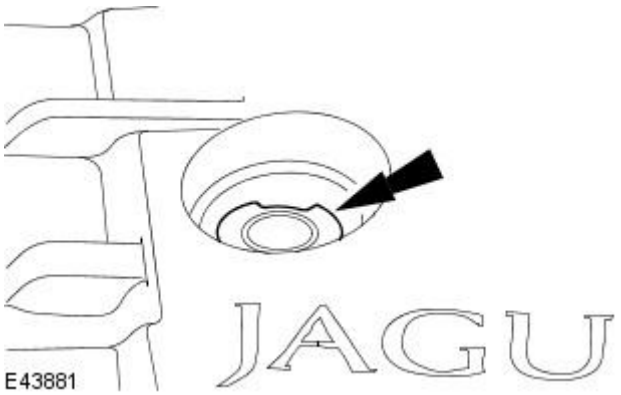
29. Connect the fuel metering valve and fuel temperature sensor electrical connectors.

30. Install the intake manifold.
For additional information, refer to: Intake Manifold (303-01B Engine - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, In-vehicle Repair).

31. Install the engine cover.

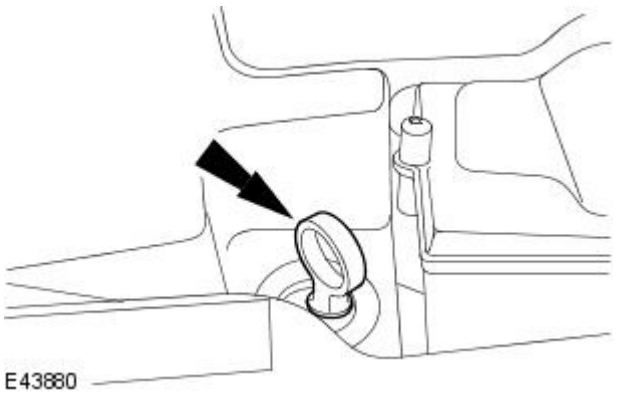

E45736

32. Install the oil filler cap.



E43881

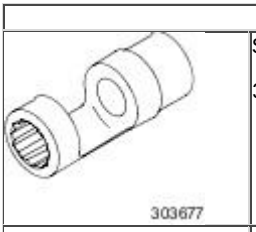
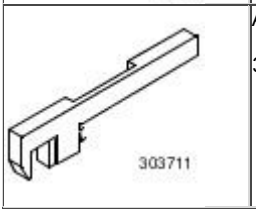
33. Install the oil level indicator.


E43880

Published: 11-May-2011

Fuel Charging and Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Fuel Injector

Removal and Installation

Special Tool(s)	
	Socket, Fuel Injector Remover/Installer 303-677
	Aligner, Fuel Injector 303-711

General Equipment

Pneumatic vacuum gun

Removal

• WARNINGS:

Wait at least 15 minutes 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 mixtures 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 injection system with the engine running. The fuel pressure within the system can be as high as 1600 bar (23,206 lb/in²). 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.

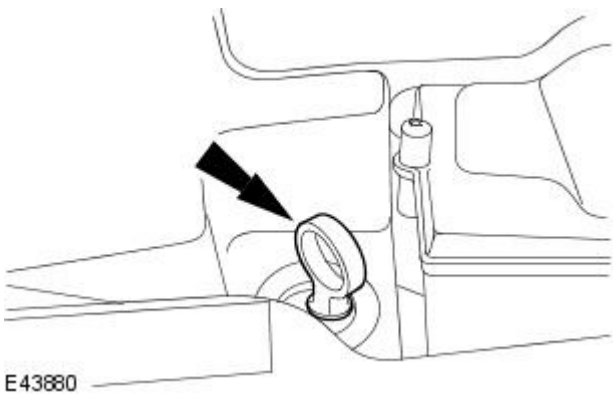
Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

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.

Do not disassemble the fuel injectors or clean the nozzles, even with an ultrasonic cleaner. Always install new fuel injectors when required.

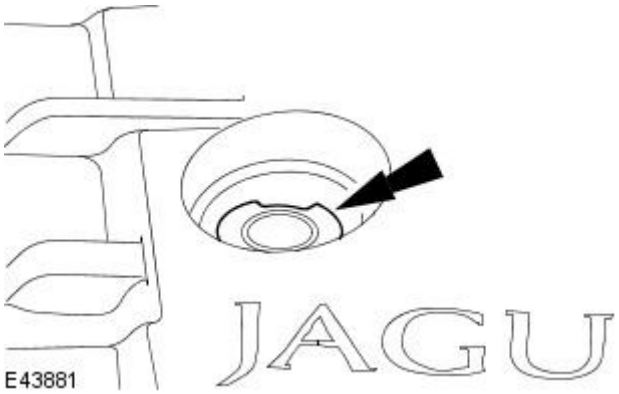
• NOTE: If the fuel injection pump has suffered a major mechanical failure, new fuel injectors should also be installed.

• NOTE: **If the fuel injectors are being renewed in conjunction with the fuel injection pump and high-pressure fuel lines, SRO 195010 must be claimed.**



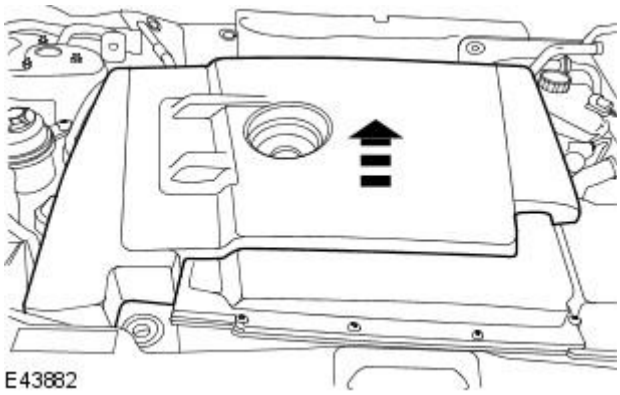
1. Remove the oil level indicator.

2. Remove the oil filler cap.



3. NOTE: Install the oil filler cap and oil level indicator to prevent foreign material entering the valve cover.

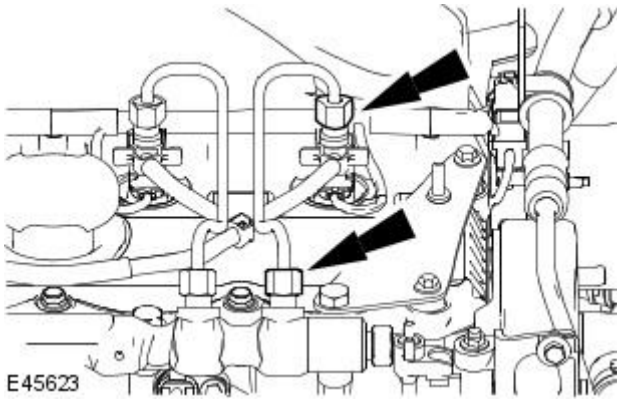
Remove the engine cover.



4. CAUTION: Protect the fuel injector electrical connectors with lint-free material to prevent contamination from the cleaning fluid.

Clean the fuel injector, high-pressure fuel supply line and surrounding areas.
For additional information, refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

5. CAUTIONS:



Make sure that 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.

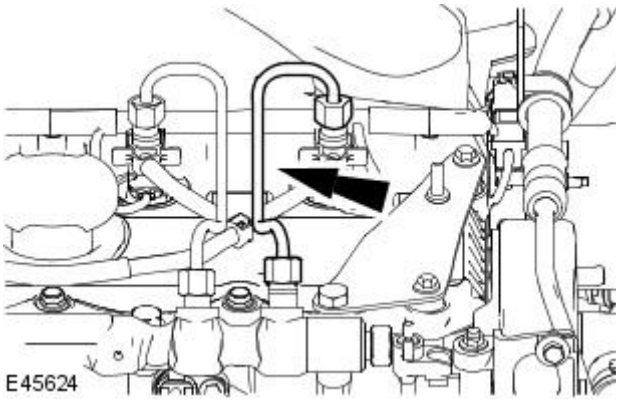
Make sure the tool used to loosen the high-pressure fuel supply line unions is used at the top of the unions as this is where there is most material. Failure to follow this instruction may result in damage to the unions.

Make sure that the fuel injector does not move when loosening the high-pressure fuel supply lines. Failure to follow this instruction will result in damage to the fuel injector and the fuel injector sealing washer.

Loosen the high-pressure fuel supply line from the fuel injector and fuel injection supply manifold.

6. CAUTION: Make sure that 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.

Using the pneumatic vacuum gun, vacuum foreign material from the high-pressure fuel supply line, the fuel injector and the fuel injection supply manifold.



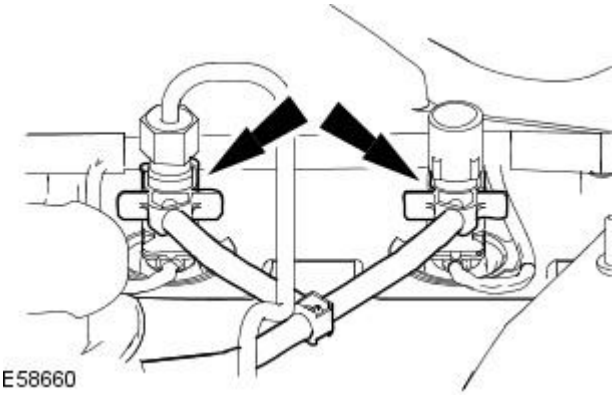
7. Remove and discard the high-pressure fuel supply line.

8. Using the pneumatic vacuum gun, vacuum foreign material from the fuel injector and the fuel injection supply manifold.

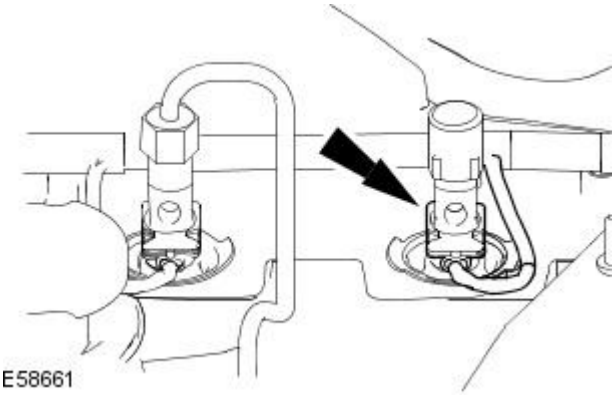
9. Install blanking caps to the open threaded ports on the fuel injector and the fuel injection supply manifold.

10. Disconnect the fuel return lines from the fuel injectors.

- Discard the fuel return line O-ring seals.

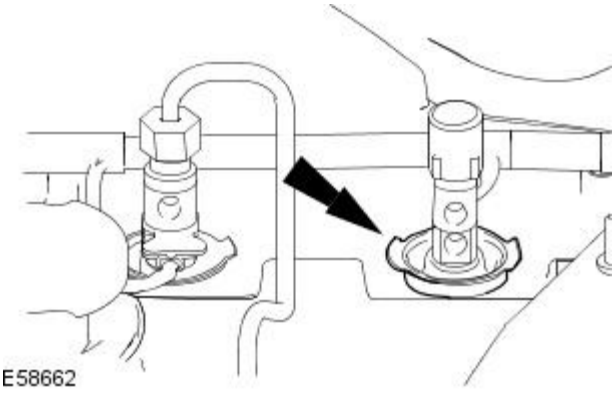


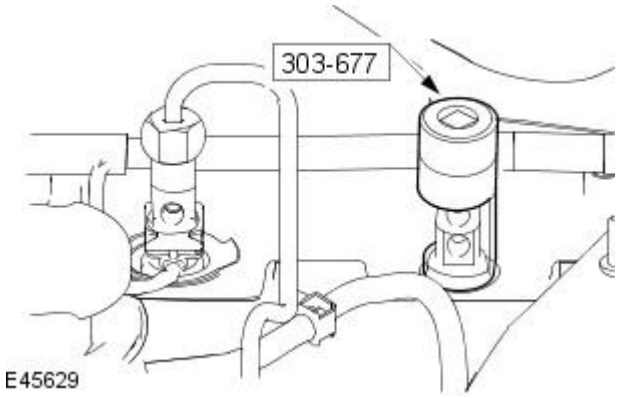
11. Disconnect the fuel injector electrical connector.



12. Remove the valve cover fuel injector seal.

- Discard the valve cover fuel injector seal.





13. CAUTION: Make sure that the fuel injector does not move when loosening the fuel injector locking collar. Failure to follow this instruction will result in damage to the fuel injector and the fuel injector sealing washer.

Using the special tool, remove the fuel injector.

Installation

• 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.

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.

Do not disassemble the fuel injectors or clean the nozzles, even with an ultrasonic cleaner. Always install new fuel injectors when required.

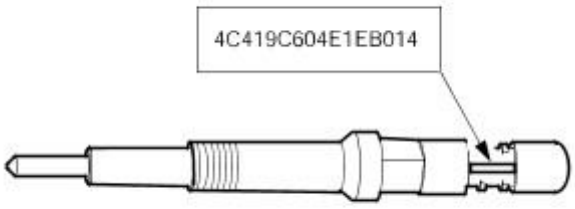
• NOTE: Install new high-pressure fuel supply lines.

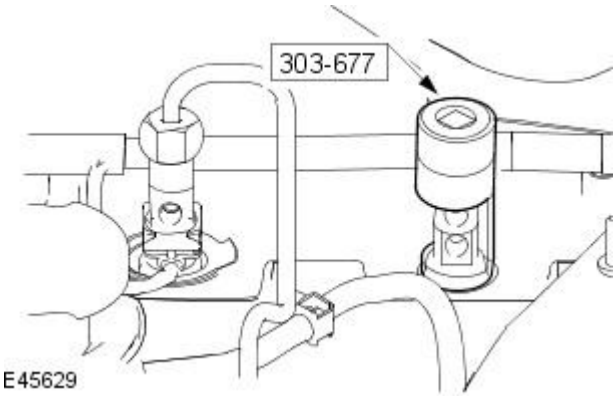
• NOTE: Install a new valve cover fuel injector seal.

• NOTE: Install a new injector nut O-ring seal (if equipped).

• NOTE: Install new fuel return line O-ring seals.

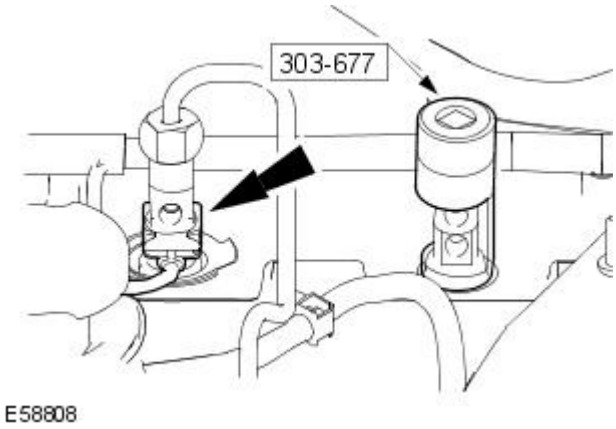
1. Record the identification code from the new fuel injector to upload into the Jaguar approved diagnostic system during configuration (graphic shows an example of the identification code only).



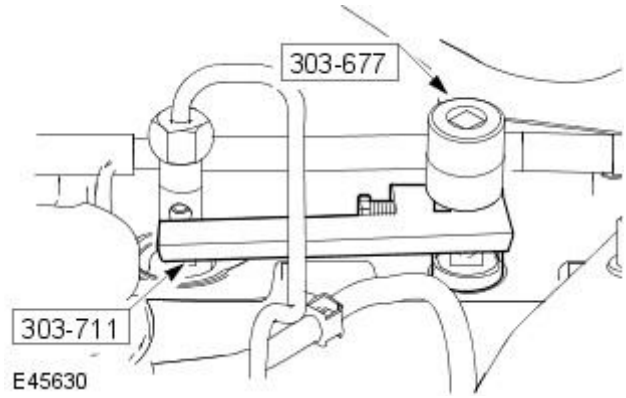


2. NOTE: Do not tighten the fuel injector locking collar at this stage.

Using the special tool, install the fuel injector.

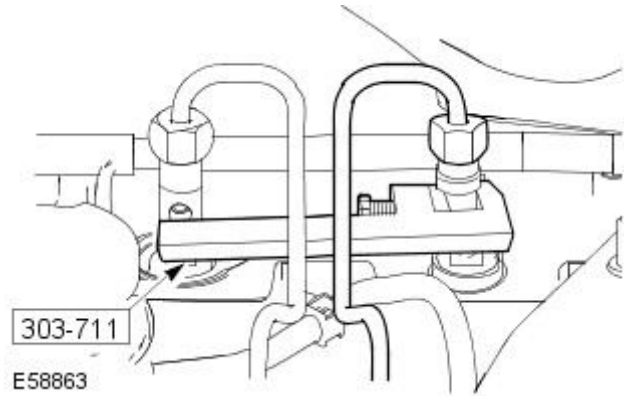


3. Disconnect the fuel injector electrical connector.

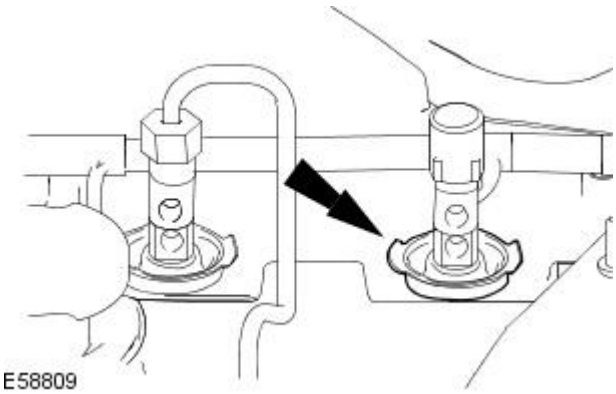


4. Using the special tools, tighten the fuel injector locking collar.

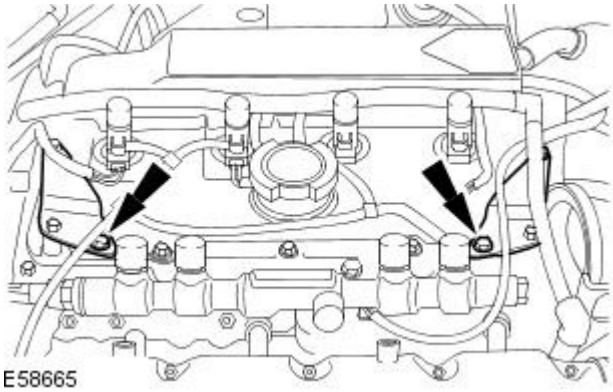
- Tighten to 47 Nm.



5. Remove the special tool.

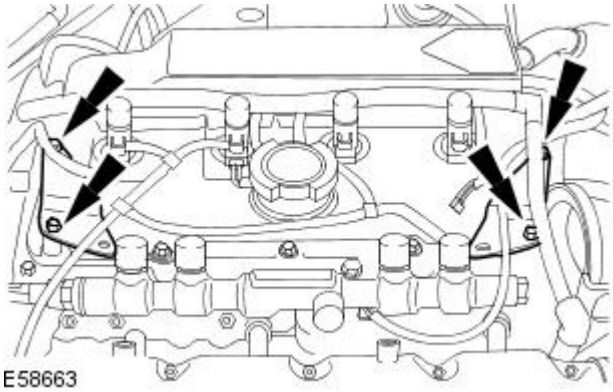


6. Install the valve cover fuel injector seal.


E58665

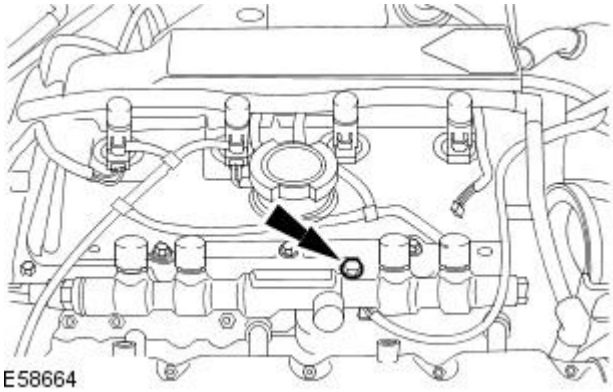
7. NOTE: High-pressure fuel supply lines shown removed for clarity.

Loosen the fuel injection supply manifold retaining bolts.


E58663

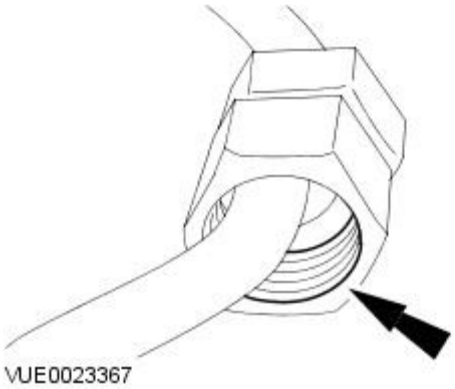
8. NOTE: High-pressure fuel supply lines shown removed for clarity.

Loosen the fuel injection supply manifold support brackets.


E58664

9. NOTE: High-pressure fuel supply lines shown removed for clarity.

Loosen the fuel injection supply manifold retaining bolt.


VUE0023367

10. Using a suitable multipurpose lubricant spray, lubricate the high-pressure fuel supply line union threads.

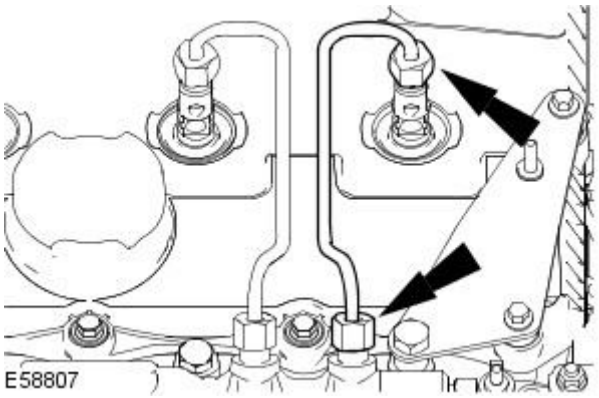
11. CAUTION: Do not allow the unions to hit the olive ends of the high-pressure fuel supply line as this may damage the ends of the line and allow foreign matter to enter the fuel injection system.

• NOTE: The yellow colored collar is fitted at the fuel injector end and the blue colored collar is fitted at the fuel supply manifold end of the high-pressure fuel supply line.

• NOTE: To aid identification of the high-pressure fuel supply line, the union at the fuel injector end is etched with the cylinder number.

Position the high-pressure fuel supply line as near to the final installation position as possible and then remove and discard the blanking plugs from the high-pressure fuel supply line.

12. Remove the blanking plug from the fuel injector and the fuel injection supply manifold threaded port.

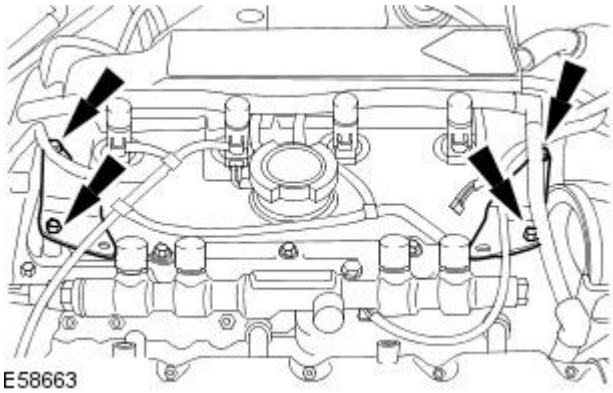


13. CAUTION: Maintain pressure on the high-pressure fuel supply line to keep the olives in contact with the fuel injectors and the fuel injection supply manifold cones while installing the unions.

• NOTE: Install the high-pressure fuel supply lines to the fuel injection supply manifold end first followed by the fuel injector end.

• NOTE: Do not tighten the high-pressure fuel supply line unions at this stage.

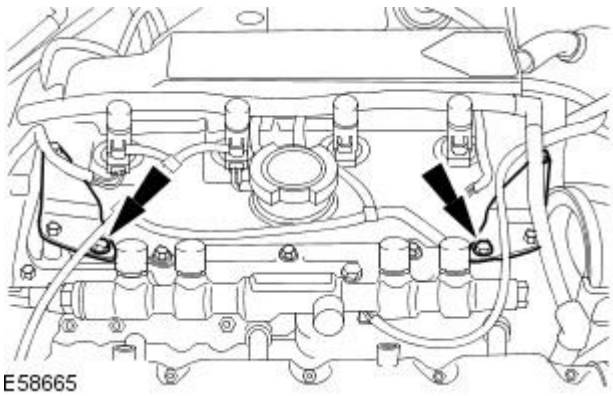
Install new high-pressure fuel supply line.



14. NOTE: High-pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold support brackets retaining bolts.

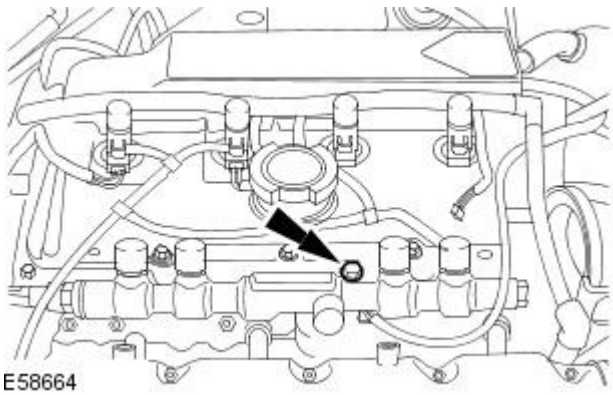
- Tighten to 14 Nm.



15. NOTE: High-pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold retaining bolts.

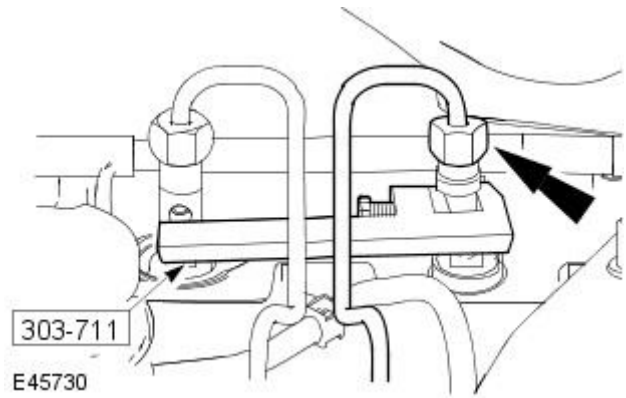
- Tighten to 23 Nm.



16. NOTE: High-pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold retaining bolt.

- Tighten to 23 Nm.



17. CAUTIONS:

Make sure the special tool is clamped around the fuel injector which is being tightened and is resting up against the adjacent fuel injector.

Make sure the tool used to tighten the high-pressure fuel supply line unions is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

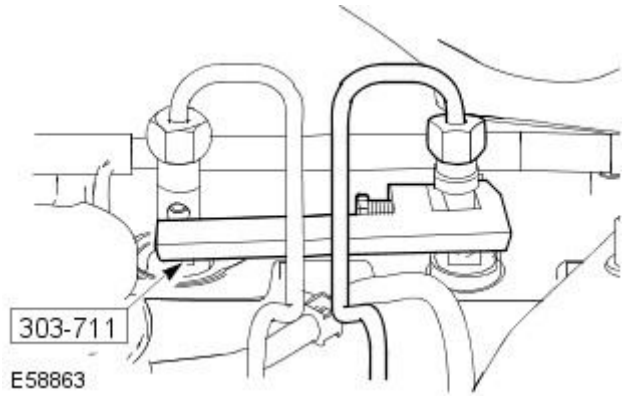
Make sure that the fuel injector does not move when tightening the high-pressure fuel supply lines. Failure to follow this instruction will result in damage to the fuel injector and the fuel injector sealing washer.

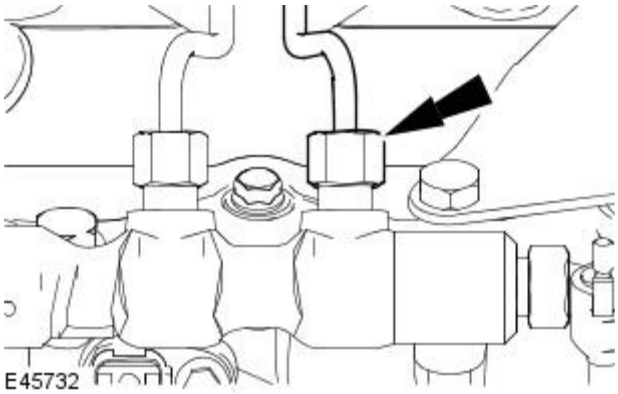
Install the special tool and tighten the high-pressure fuel supply line

union at the fuel injector.

- Tighten to 40 Nm.

18. Remove the special tool.



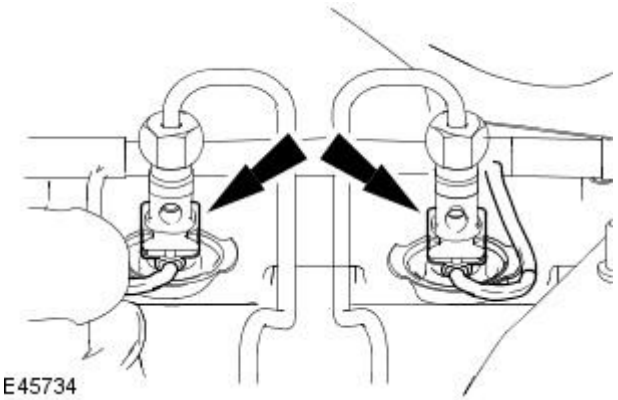


19. CAUTION: Make sure the tool used to tighten the high-pressure fuel supply line unions is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

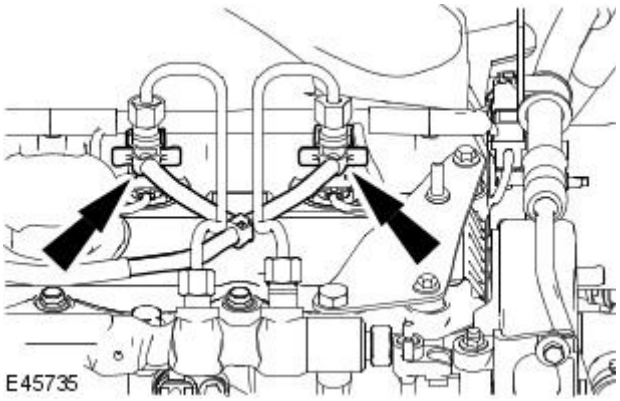
Tighten the high-pressure fuel supply line union at the fuel injection supply manifold.

- Tighten to 40 Nm.

20. Connect the fuel injector electrical connectors.

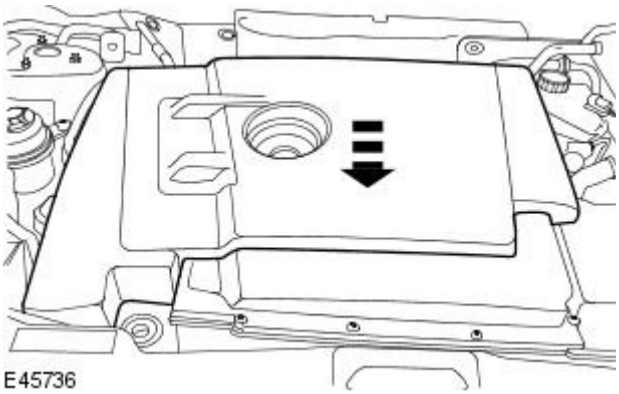


21. Connect the fuel return lines to the fuel injectors.

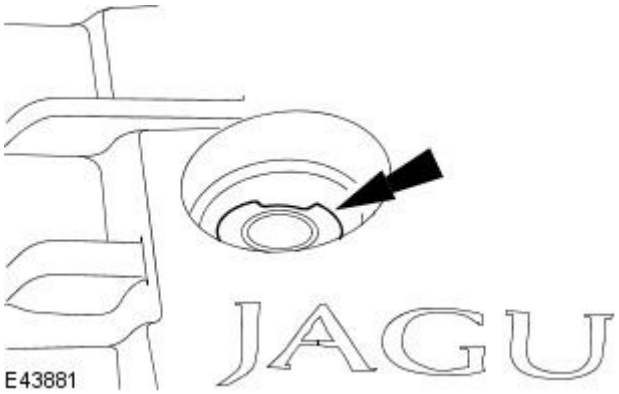


22. NOTE: Remove the oil filler cap and oil level indicator.

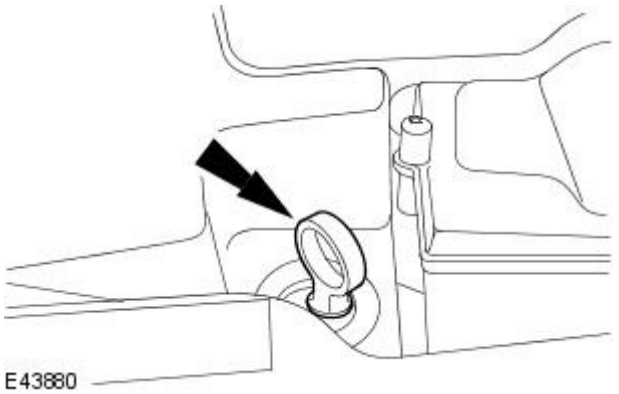
Install the engine cover.



23. Install the oil filler cap.



24. Install the oil level indicator.



25. Using the Jaguar approved diagnostic system, configure the new fuel injector to the engine control module (ECM).

Published: 11-May-2011

Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma - Fuel Metering Valve

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 mixtures 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.

The fuel system remains pressurized after the ignition is switched off. If communications with a suitable tester (able to read fuel rail pressure and temperature) can be established, wait until the tester indicates pressure of less than 20 bar (290 lb/in²), and temperature of less than 35 degrees C (95 degrees F) before working on the system. If communications with a suitable tester cannot be established, the fuel system must NOT be worked on for a period of fifteen minutes following the ignition being switched off. Failure to follow this instruction may result in personal injury.

If taken internally, **DO NOT** induce vomiting. Seek medical attention. Failure to follow this instruction may result in personal injury.

If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek medical attention. Failure to follow this instruction may result in personal injury.

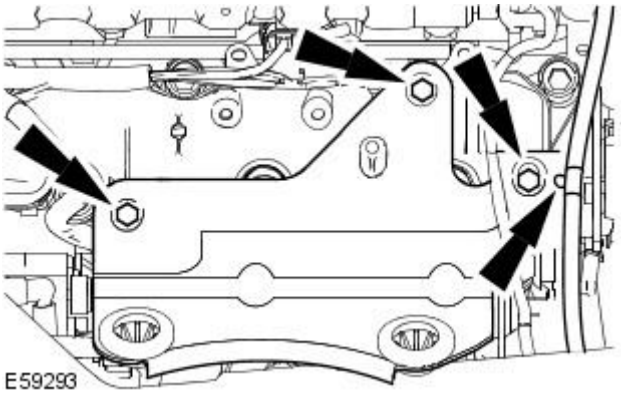
Wash hands thoroughly afer handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention. Failure to follow this instruction may result in personal injury.

• 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.

Before disconnecting any part of the system, it is imperative that all dust, dirt and debris is removed from around components to prevent ingress of foreign matter in to the fuel system. Failure to follow this instruction may result in damage to the vehicle.

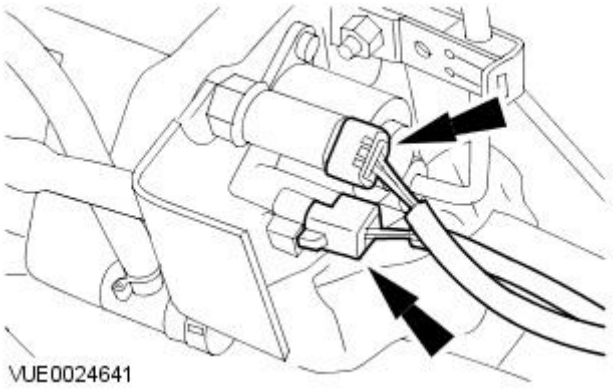
Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.



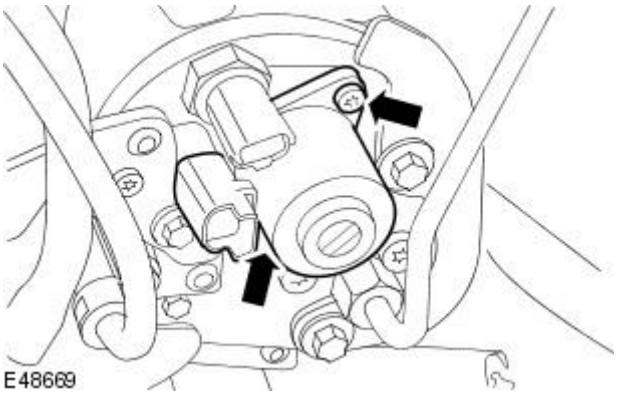
1. Remove the air cleaner assembly.
   For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
2. Remove the air cleaner mount bracket.
   - Detach the wiring harness.
   - Remove the air cleaner bracket retaining bolts.

3. CAUTION: Protect the fuel metering valve and fuel temperature sensor electrical connectors to prevent contamination with the cleaning fluid.

   Clean the fuel pump and surrounding areas.
   For additional information, refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).



4. Disconnect the fuel metering valve and fuel temperature sensor electrical connectors.



5. CAUTION: 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.

Remove the fuel metering valve.

- Install a new blanking plug to the open port of the fuel pump.

Installation

• 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.

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.

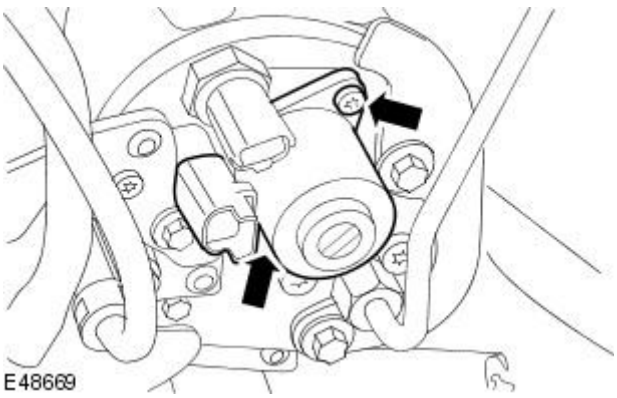
Make sure the workshop area in which the vehicle is being worked on is as clean and dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

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.

• NOTE: Install a new fuel metering valve and O-ring seal.

1. Remove and discard the blanking plug from the fuel pump.
2. Using a suitable multipurpose lubricant spray, lubricate the O-ring seal.
3. CAUTIONS:

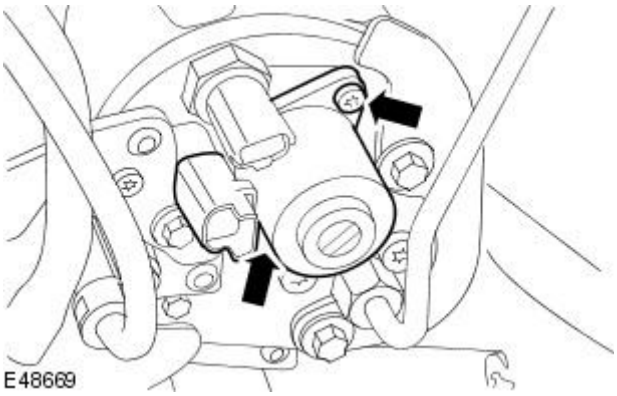


The fuel metering valve must be installed correctly into the fuel pump so that the mating faces are in contact with each other. Failure to follow this instruction may result in damage to the fuel metering valve.

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.

Install the fuel metering valve and O-ring seal.

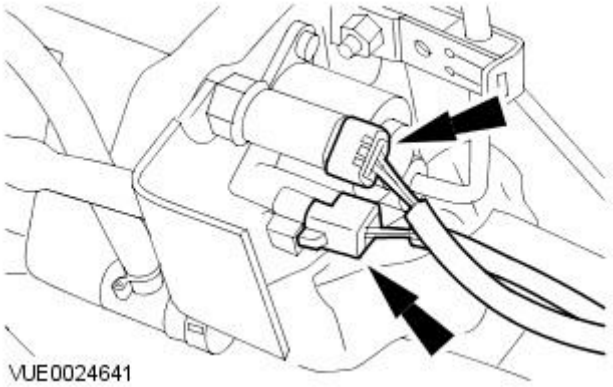
- Install the fuel metering valve retaining bolts finger tight.



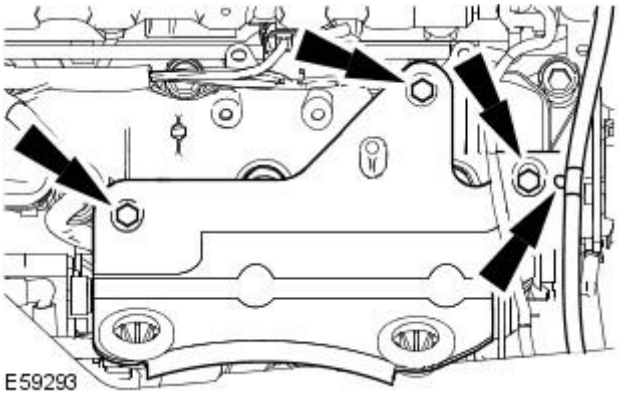
4. CAUTION: The fuel metering valve retaining bolts must be tightened in the following stages. Failure to follow this instruction may result in damage to the fuel metering valve.

Tighten the fuel metering valve retaining bolts in two stages.

- Stage 1: 2.5 Nm
- Stage 2: 5.5 Nm



5. Connect the fuel metering valve and fuel temperature sensor electrical connectors.



6. Install the air cleaner mount bracket.

- Tighten the retaining bolts.
- Attach the wiring harness.

7. Install the air cleaner.
For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

Published: 11-May-2011

Fuel Charging and Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Fuel Return Line Venturi

Removal and Installation

General Equipment

Pneumatic vacuum gun

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 mixtures 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.

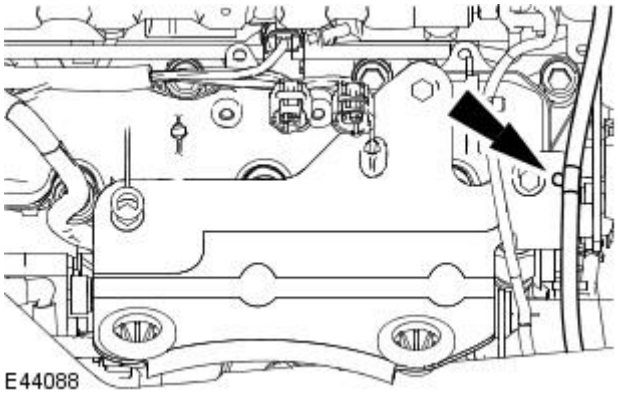
• CAUTIONS:

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.

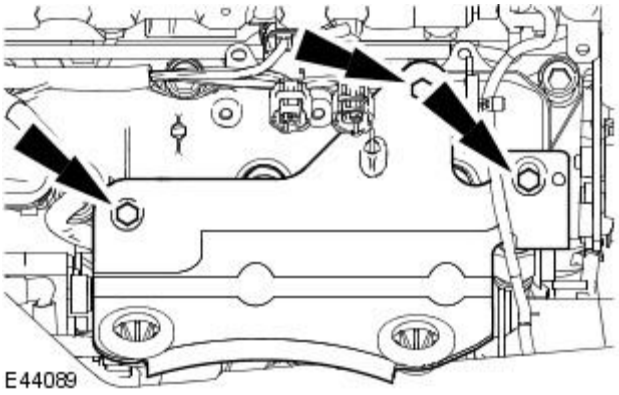
Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

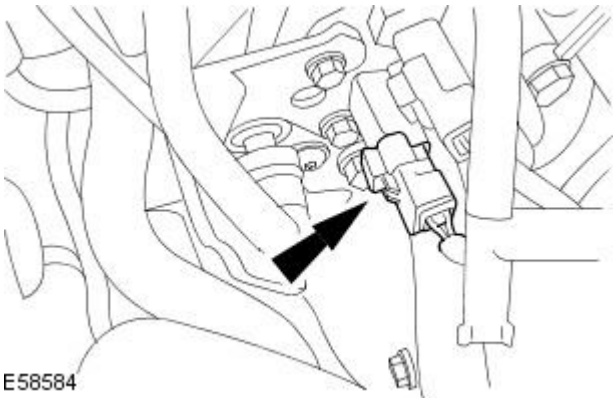
Remove the air cleaner.
For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

2. Detach the engine wiring harness.



3. Remove the air cleaner mount bracket.

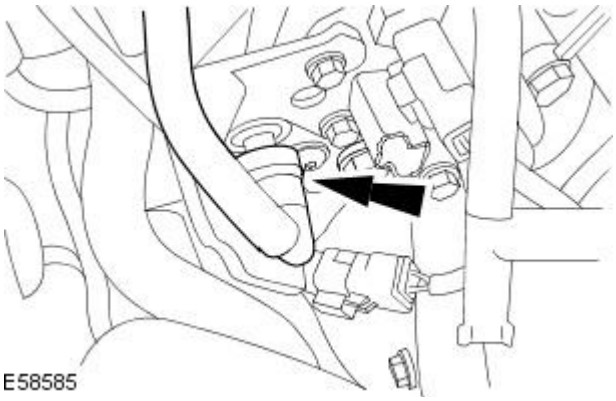




4. NOTE: Protect the fuel metering valve electrical connector with lint-free material to prevent contamination from the cleaning fluid.

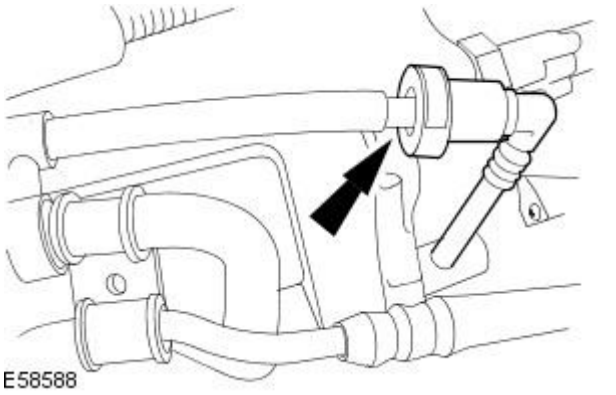
Disconnect the fuel metering valve electrical connector.

5. Clean the fuel pump, fuel return lines and surrounding area.
For additional information, refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).



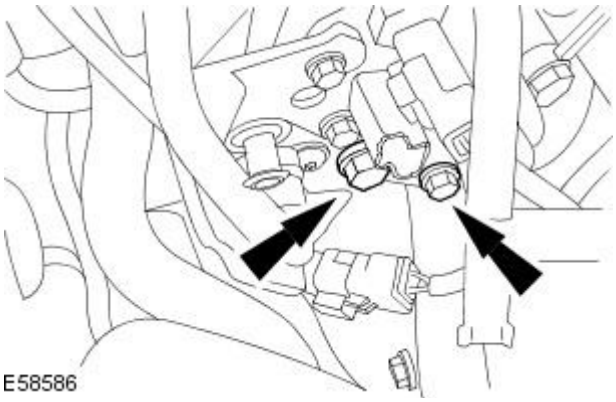
6. Disconnect the fuel filter return line from the fuel pump.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

- Install blanking plugs to the open orifices.

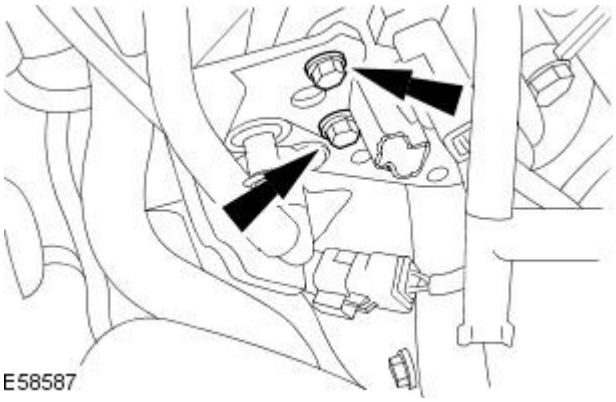


7. Disconnect the fuel injector to fuel pump return line.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

- Install blanking plugs to the open orifices.



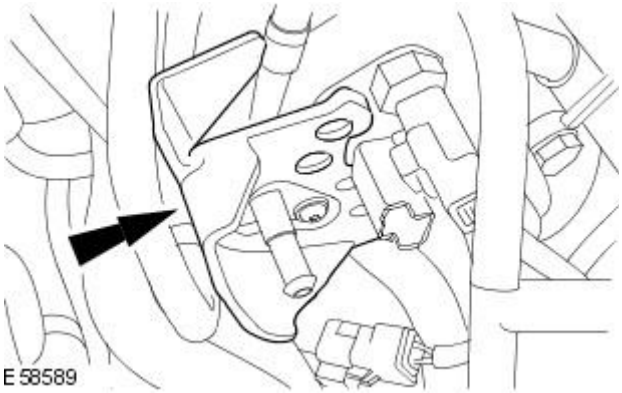
8. Remove the fuel pump shield lower retaining bolts.



9. Remove the fuel pump shield upper retaining bolts.

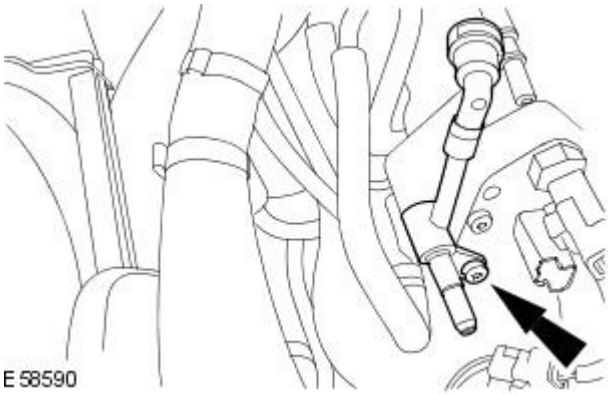
10. Using the pneumatic vacuum gun, vacuum foreign material from the fuel pump, fuel return line venturi and the fuel pump fuel return lines.

11. Remove the fuel pump shield.

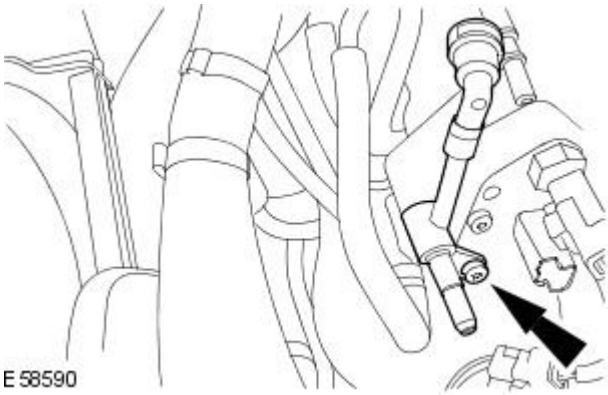


12. Remove the fuel return line venturi.

- Install a blanking plug to the open port on the fuel pump.



Installation



1. WARNINGS:

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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.

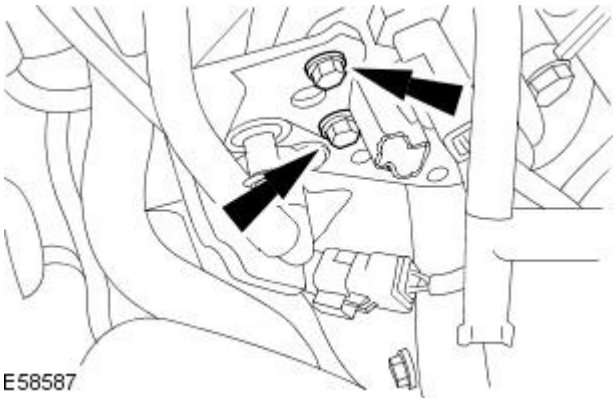
• CAUTIONS:

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.

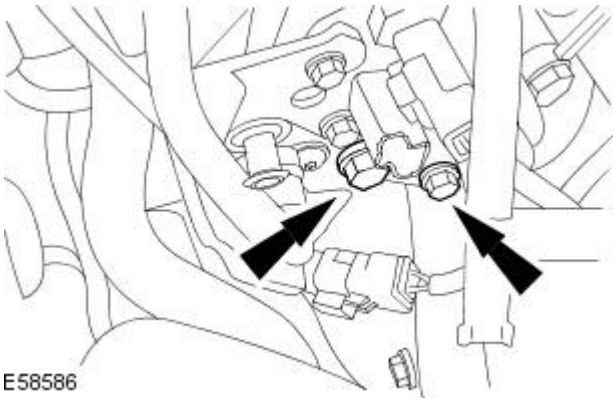
Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

To install, reverse the removal procedure.

- Tighten to 6 Nm.



2. Tighten to 8 Nm.



3. Tighten to 33 Nm.

Published: 11-May-2011

Fuel Charging and Controls - Turbocharger -

Torque Specifications

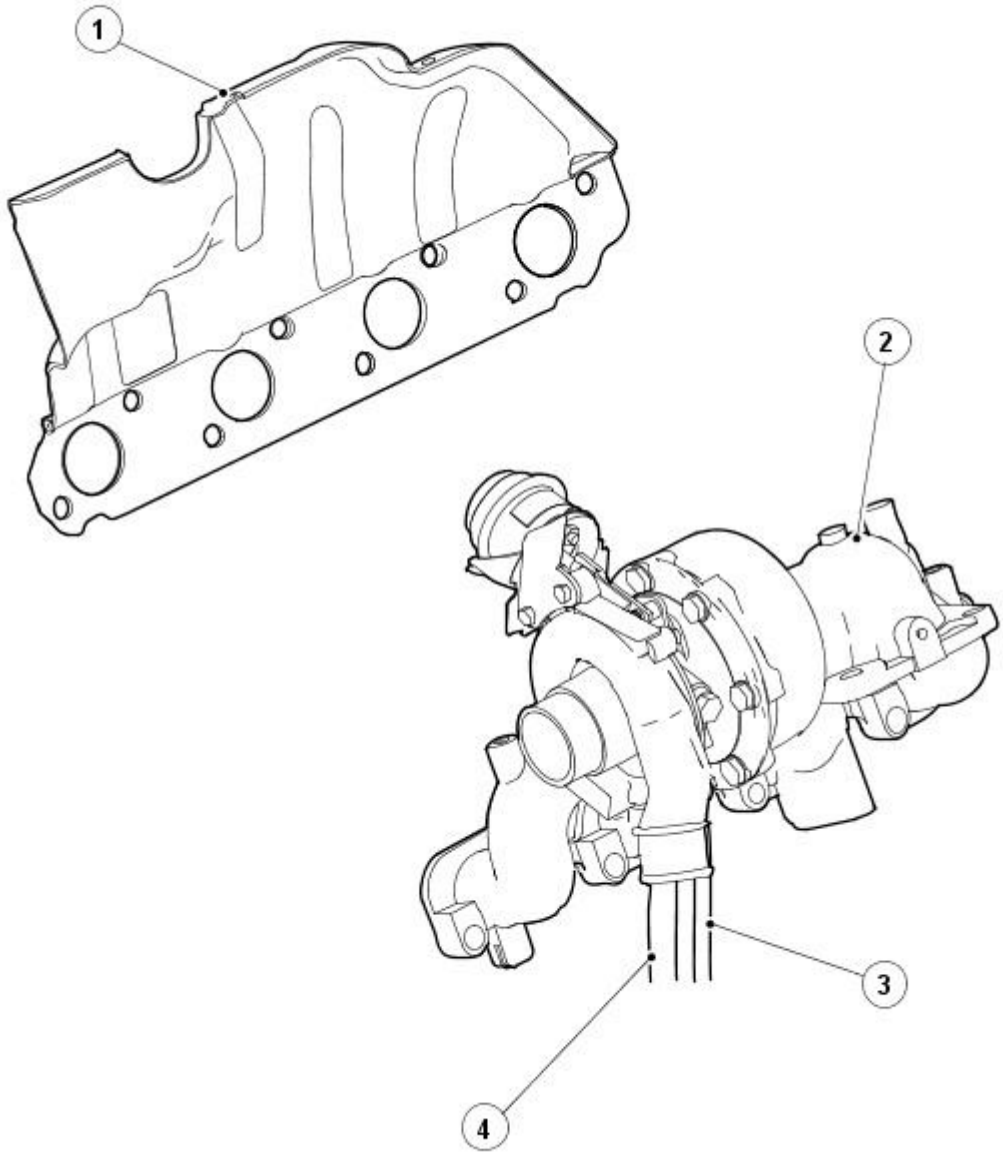
Description	Nm	lb-ft	lb-in
Oil supply tube union retaining bolt	14	10	-
Oil return tube to turbocharger retaining bolts	10	-	89
Oil return tube to cylinder block retaining bolt	10	-	89
Exhaust gas recirculation (EGR) cooler to exhaust manifold retaining bolt	37	27	-
EGR cooler mount bracket retaining nut	10	-	89
EGR cooler mount bracket retaining bolt	10	-	89
Exhaust manifold retaining nuts and bolts	40	30	-
Exhaust manifold gasket retaining bolts	10	-	89

Published: 11-May-2011

Fuel Charging and Controls - Turbocharger - Turbocharger

Description and Operation

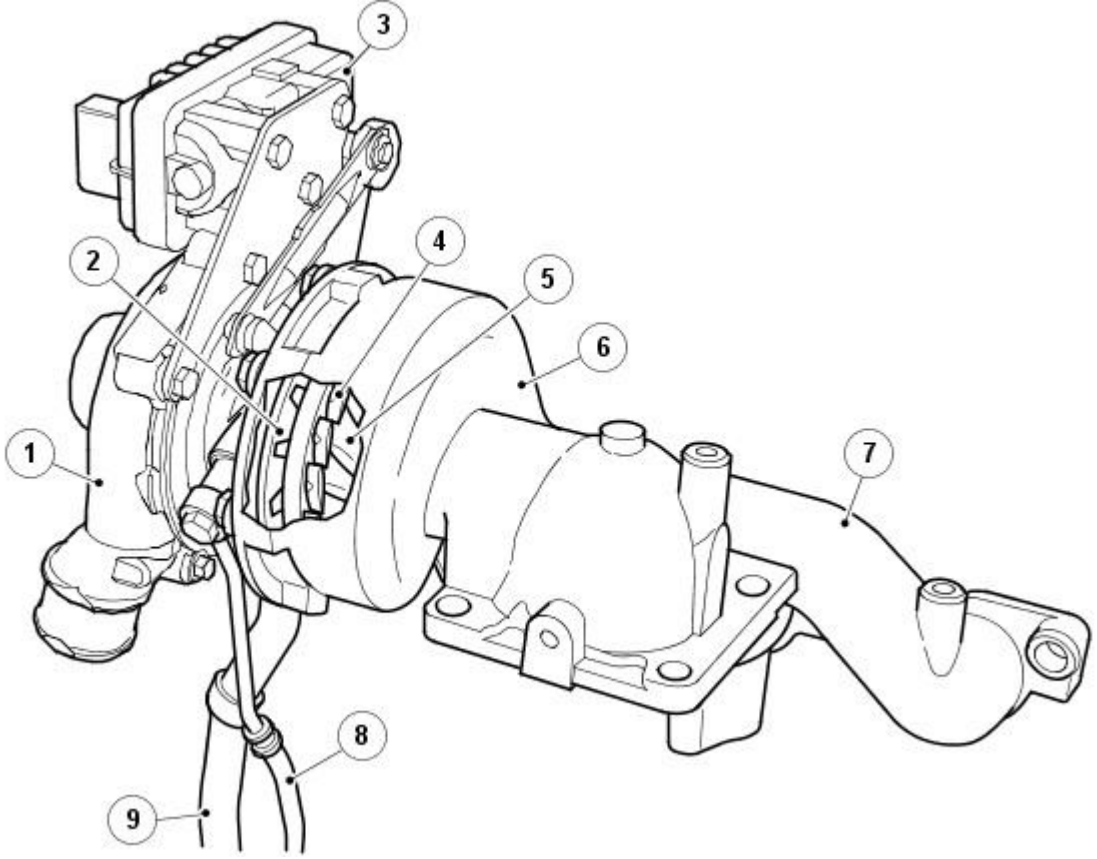
Variable vane turbocharger - Vehicles built up to VIN:E25781



E44406

Item	Part Number	Description
1	-	Exhaust manifold gasket/heat shield
2	-	Turbocharger/exhaust manifold
3	-	Oil supply tube
4	-	Oil return tube

Variable vane turbocharger - Vehicles built from VIN:E25782



E67499

Item	Part Number	Description
1	-	Compressor casing
2	-	Variable vane adjustment ring
3	-	Rotary electronic actuator
4	-	Variable vane
5	-	Exhaust turbine
6	-	Turbine casing
7	-	Exhaust manifold
8	-	Oil supply line
9	-	Oil drain line

The turbocharger and exhaust manifold are a combined assembly and although it is possible to separate them, they are not supplied separately and should therefore not be disassembled.

The turbocharger consists of two elements, a turbine and a compressor both installed on a single shaft.

The turbocharger bearings are supplied with oil from the engine.

The turbine uses the flow of the exhaust gas to drive the compressor. The compressor draws air through the air cleaner and forces it into the intake manifold.

Principles of Operation - Variable vane turbocharger

The turbocharger is designed to improve engine induction and engine performance. The list below details the concerns relating to turbocharger performance.

- High engine speed produces excessive turbine speed and therefore creates excessive turbocharger boost pressure.
- Low engine speed does not produce sufficient turbine speed and therefore not enough turbocharger boost pressure is achieved.

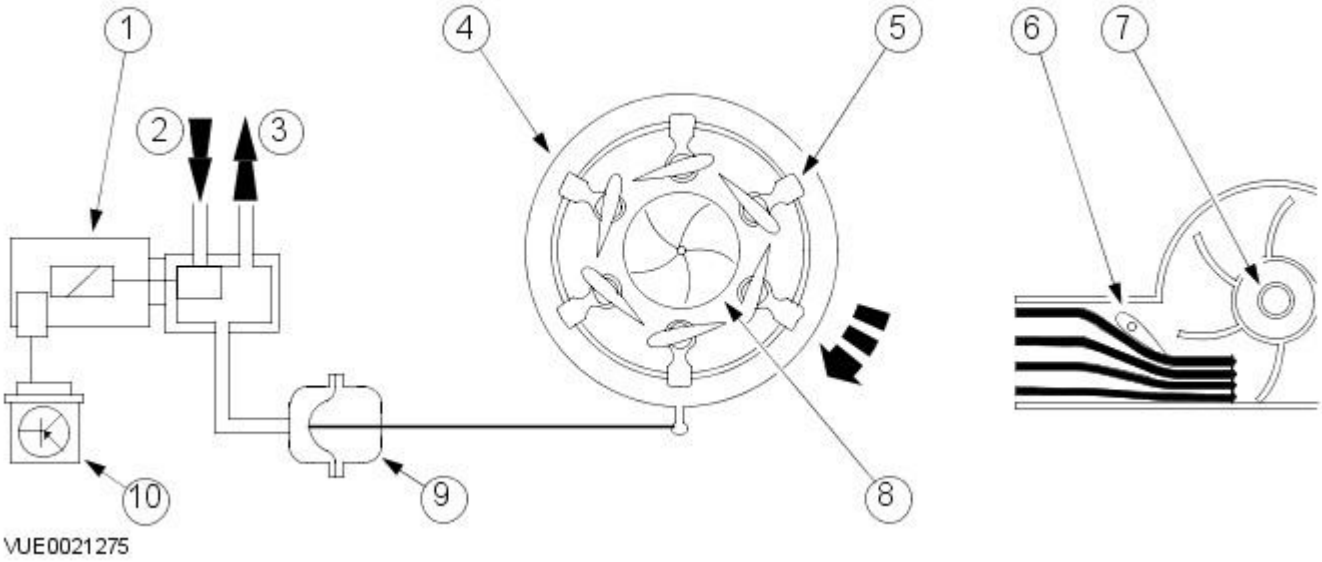
The turbocharger does not have a wastegate control valve. Instead, it has variable turbocharger vanes which are located in the turbocharger turbine housing and directs the air flow into the turbocharger turbine. The turbocharger vanes act as the control for the turbocharger boost pressure.

The turbocharger produces its full turbocharger boost pressure over the entire engine speed range, not just at high engine speed. This is achieved through the adjustment of the vanes and the resulting change in the flow of the exhaust gas.

The speed of the exhaust gas flow within the turbocharger is increased independent of engine speed by varying the intake cross section in front of the turbocharger turbine. This is achieved by adjusting the angle of the vanes controlling the air flow into the turbocharger turbine and drives the turbocharger turbine faster. The higher turbocharger speed produces a high turbocharger boost pressure at all engine speeds.

The engine control module (ECM) controls the turbocharger vanes.

Regulation at Low Engine Speed

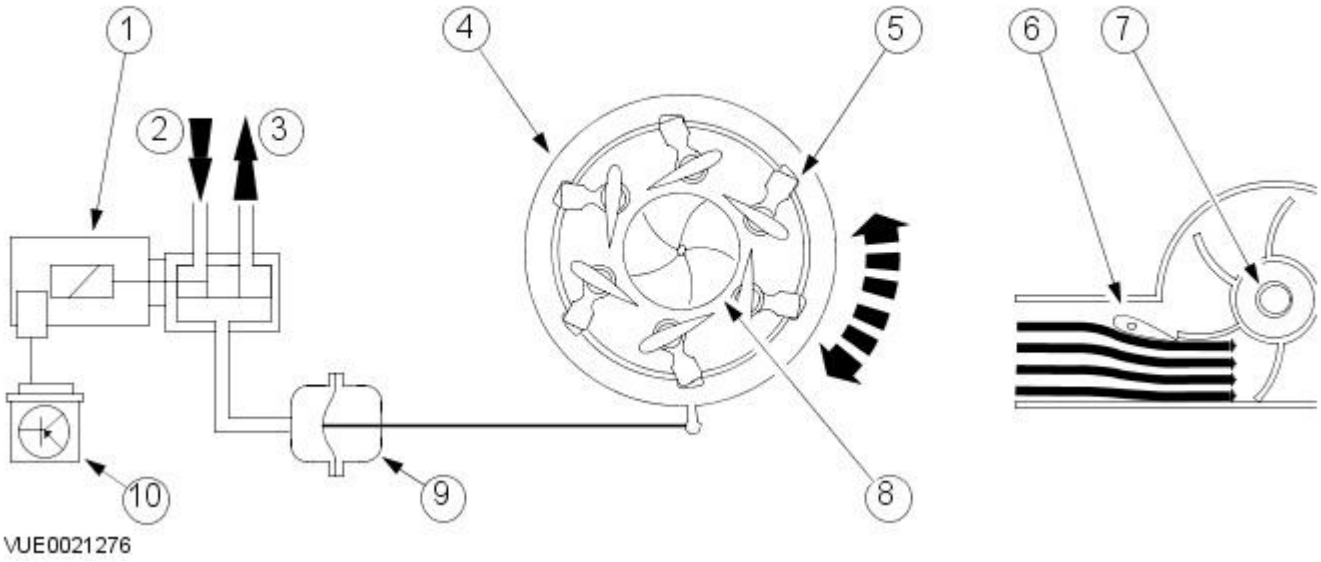


VUE0021275

Item	Part Number	Description
1	-	Vane adjustment solenoid valve
2	-	Atmospheric pressure
3	-	Vacuum
4	-	Adjusting ring
5	-	Vanes
6	-	Vanes
7	-	Turbine
8	-	Turbine
9	-	Vacuum diaphragm unit
10	-	ECM

At low engine speeds the ECM actuates the vane adjustment solenoid valve to enable a vacuum to be applied. The vacuum diaphragm unit moves the adjusting ring so that the vanes are set at a shallow angle. The shallow intake cross section this creates for the stream of exhaust gas allows the turbocharger boost pressure to build up rapidly and easily at low engine speeds.

Regulation at Moderate Engine Speed

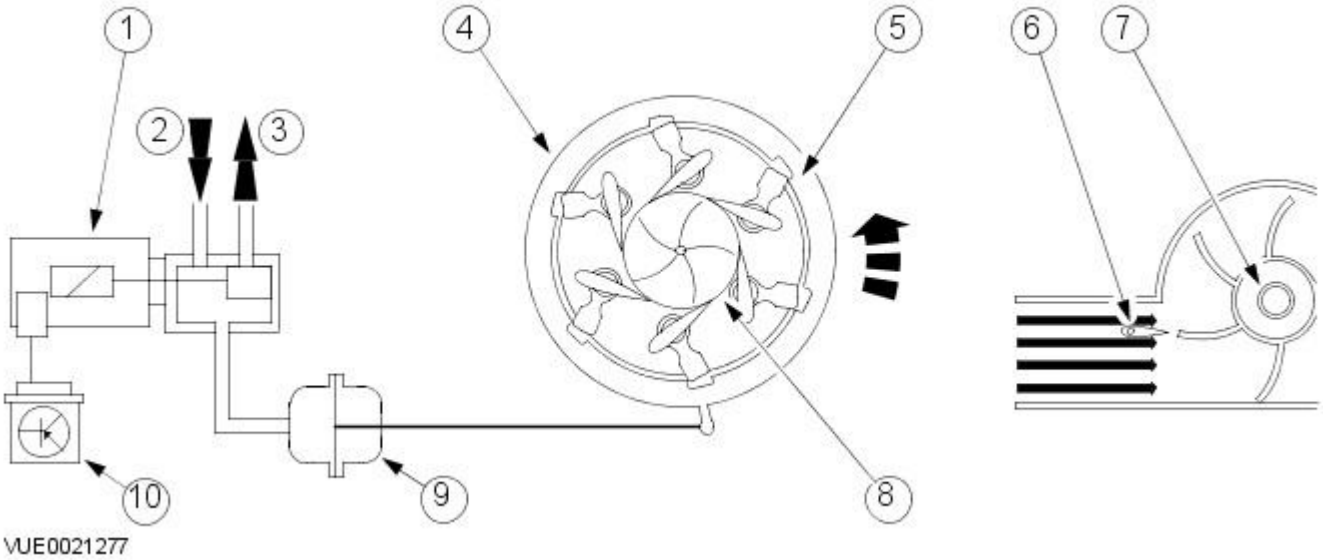


VUE0021276

Item	Part Number	Description
1	-	Vane adjustment solenoid valve
2	-	Atmospheric pressure
3	-	Vacuum
4	-	Adjusting ring
5	-	Vanes
6	-	Vanes
7	-	Turbine
8	-	Turbine
9	-	Vacuum diaphragm unit
10	-	ECM

As the engine speed increases and the quantity of exhaust gas increases as a result, the vane adjustment solenoid valve adjusts the vacuum level within the vacuum diaphragm unit. The vacuum diaphragm unit moves the adjusting ring so that the vanes are set at a steeper angle. The steeper angle opens the intake cross section effectively reducing the gas flow and turbine speed while maintaining constant turbocharger boost pressure.

Regulation at Maximum Engine Speed



Item	Part Number	Description
1	-	Vane adjustment solenoid valve
2	-	Atmospheric pressure
3	-	Vacuum
4	-	Adjusting ring
5	-	Vanes
6	-	Vanes
7	-	Turbine
8	-	Turbine
9	-	Vacuum diaphragm unit
10	-	ECM

As the engine speed increases the intake cross section in front of the turbocharger turbine is continuously enlarged. The turbine speed and hence the quantity of the air supplied to the engine, is adjusted to suit the engine speed. This means that the turbocharger boost pressure remains optimized over all engine speeds.

The maximum position of the turbocharger vanes (maximum opening cross section) is also an emergency position, in the event of an electrical concern or leak in the vacuum system. This lowers the chance of engine damage due to excessive boost in the event of a turbocharger control concern.

Published: 26-Jul-2011

Fuel Charging and Controls - Turbocharger - Turbocharger

Diagnosis and Testing

Overview

For information on the operation of the turbocharger:
REFER to: Turbocharger (303-04C Fuel Charging and Controls - Turbocharger, Description and Operation).

Inspection and Verification

• WARNINGS:

The following tests may involve working in close proximity to hot components. Make sure adequate protection is used. Failure to follow this instruction may result in personal injury.

The turbocharger can continue to rotate after the engine has stopped. Do not attempt to check the turbocharger until one minute has elapsed since the engine was switched off. Failure to follow this instruction may result in personal injury.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious mechanical or electrical faults.

Visual inspection chart

Mechanical	Electrical
• Intake air system • Hose(s)/hose connections • Turbocharger • General engine condition.	• Circuit(s) • Electrical connections and harnesses • Manifold absolute pressure and temperature (MAPT) sensor • Turbocharger actuator • Engine control module (ECM)

Symptom chart

Symptom	Possible source	Action
Poor performance (off-boost)	• Low/Contaminated fuel • Restricted intake air system • General engine condition • Engine control module (ECM) failure	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. if there are indications of a mechanical fault. Check for DTCs indicating a module fault. Refer to the warranty policy and procedures manual if a module is suspect.
No boost	• Electrical connections and harnesses • Restricted intake air system • Charge air cooler restricted/leaking • Turbocharger actuator failure • Turbocharger failure • Engine control module (ECM) failure	Check the electrical connections and harnesses. Check the intake air system for restriction/leakage. Check the turbocharger actuator and circuit. Refer to the electrical guides. Check the turbocharger for wear. Disconnect the turbocharger intake and outlet pipework and turn the turbocharger by hand. Any roughness indicates a fault. Check any up and down movement in the turbocharger shaft. Excessive movement indicates a fault. If in doubt, compare the suspect unit with a new turbocharger. Check for DTCs indicating an actuator or module fault. Refer to the warranty policy and procedures manual if a module is suspect.
No boost/excessive noise	• Turbocharger failure	Disconnect the turbocharger intake and outlet pipework and turn the turbocharger by hand. Any roughness indicates a fault. Check any up and down movement in the turbocharger shaft. Excessive movement indicates a fault. If in doubt, compare the suspect unit with a new turbocharger.

For a complete list of all diagnostic trouble codes that could be logged on this vehicle. REFER to: Electronic Engine Controls (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).

Diagnostic Trouble Codes (DTC) Relating to Turbocharger Issues

DTC	Description
P2263	Turbocharger/Supercharger Boost System Performance
.	This vehicle may not feature all of the components listed.
.	This DTC may be caused by:
.	Damaged or disconnected vacuum hose. Check for air leaks at turbocharger. Vanes on the turbocharger sticking closed. Turbocharger defective.
.	Or
.	Fault reported by the rotary electronic actuator.
.	This DTC may be caused by:
.	CAN communication BUS fault. Rotary electric actuator. Low battery voltage. Turbocharger defective.
P132A	Turbocharger/Supercharger Boost Control A Electrical
.	Fault reported by the rotary electronic actuator.
.	This DTC may be caused by:
.	Rotary electric actuator. Renew the variable geometry turbocharger.
P132B	Turbocharger/Supercharger Boost Control A Performance
.	Fault reported by the rotary electronic actuator.
.	This DTC may be caused by:
.	Faulty turbocharger, mechanism may be sticking.
.	Rotary electric actuator. Renew the variable geometry turbocharger.
P132C	Turbocharger/Supercharger Boost Control A Voltage
.	Fault reported by the rotary electronic actuator.

DTC	Description
.	This DTC may be caused by:
.	Low battery voltage. Check the condition of the battery. Check the wiring and the appropriate fuse. High battery voltage. Check the battery charging system.
P138D	Turbocharger/Supercharger Boost Control A Temperature Too High
.	Fault reported by the rotary electronic actuator.
.	This DTC may be caused by:
.	Leaking exhaust system. Engine overheat condition.
.	Rotary electric actuator. Renew the variable geometry turbocharger.
P179A	CAN Engine Control Module (ECM)/Turbocharger Boost Control A Actuator Circuit Malfunction
.	Fault reported by the rotary electronic actuator or powertrain control module (PCM).
.	This DTC may be caused by:
.	Controller area network (CAN) communication BUS fault. Check CAN wiring/CAN Network is functioning. If CAN wiring/CAN Network is functioning but the vehicle has loss of power, then renew the variable geometry turbocharger.

Diagnostic Procedure

Log any concerns raised by the customer regarding the fault with the vehicle – Discuss with workshop supervisor/receptionist

Check logged DTC - Rectify concern

Check the vehicle Integrated Diagnostic System (IDS) DVD patch file calibration – Update to the latest level

Quick Check List
Listen for unusual mechanical noise and watch for vibration
Listen for a high pitched noise (it can indicate air or gas leaks)
Listen for noise level cycling. It can indicate a restriction in the air cleaner or ducting
Inspect for missing or loose nuts, bolts, clamps and washers
Inspect for loose or damaged intake and exhaust manifolds and their ducting and clamps
Inspect for damaged or restricted oil supply and drain lines
Inspect for cracked or deteriorating turbocharger housings
Inspect for external oil leakage; external deposits (indicates air, oil, exhaust or coolant leakage)
Inspect for a restricted air filter
Check the turbocharger variable vane actuator arm for normal operation, free movement and damage

Point Health Check:

- 1. **Turbocharger Data Plate:**
  - 1. Check the turbocharger data stamped on the compressor housing. Record assembly number, serial number and turbocharger type
  - 2. Ensure turbocharger type and assembly number are correct for the engine application

- 2. **Compressor / Turbine Wheel (Turbocharger System Trouble Shooting):**
  -

   WARNING: Ensure wheels have stopped rotating before handling

   CAUTION: Never attempt to straighten blades. If any bent blades are detected replace the turbocharger

  • NOTE: Root cause of failure should be identified to eliminate repeat failure. Please make reference to section 'Turbocharger Trouble Shooting'

  1. Check for cracked/bent or damaged compressor (impeller) blades - Replace turbocharger if damaged
  - 2. Check for cracked/bent or damaged turbine blades - Replace turbocharger if damaged

- 3. **Compressor / Turbine Housing:**
  -
  • NOTE: Removal of the compressor or turbine housings will invalidate the Warranty

  1. Check for foreign objects, damage, or for excessive oil at the compressor housing air inlet and outlet
  - 2. Check for foreign objects, damage, or for excessive oil at the turbine housing exhaust inlet and outlet

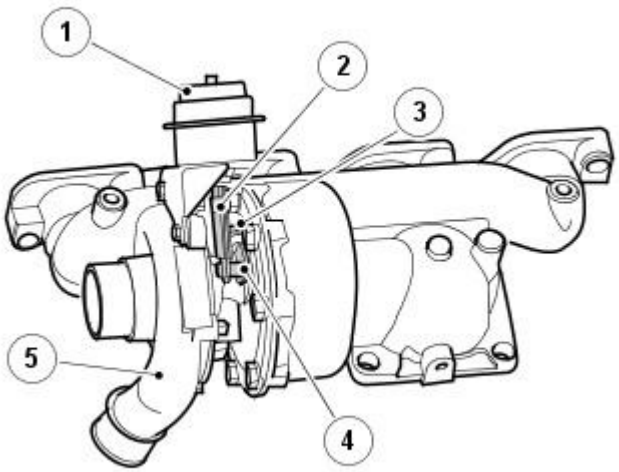
- 4. **Turbocharger Bearing Clearances:**
  -
  • NOTE: If there is contact between compressor/turbine wheel and housing - Replace the turbocharger

  1. Gently rotate the compressor wheel and check for smooth operation
  - 2. Gently hold to one side and rotate the compressor wheel and check for smooth operation

- 5. **Bearing Housing:**
  -
  • NOTE: Removal of the compressor or turbine housings will invalidate the Warranty

  1. Check oil feed and drain port for loose fasteners, adapters or damage to flanges, housing faces or threads which may cause leakage
  - 2. Check for loose or broken turbine and compressor housing fasteners. If mounting flanges are damaged, replace or tighten (torque to manufacturer's specification)

Point Health Check:

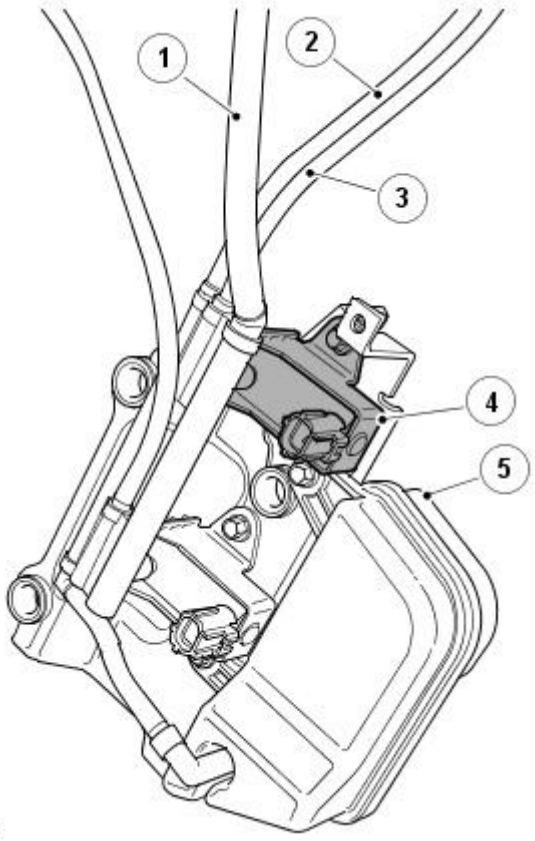


E88405

- 6. **Check for loose or broken turbine and compressor housing fasteners. If mounting flanges are damaged, replace or tighten (torque to manufacturer's specification):**
- **Legend**
  - 1. Boost pressure actuator
  - 2. Actuator arm
  - 3. Low flow adjusting screw
  - 4. Actuator heel
  - 5. Compressor casing

- 7. **Stage 3: Vacuum Actuation:**
  - 1. Check for correct installation of boost pressure actuator and check for loose bolts etc. If unsure, check and compare with another vehicle
  - 2. Check for DTCs and rectify fault before moving to next step
  -
  • NOTE: If the actuator arm is stuck in the open vane position, check solenoid for correct operation

  3. Check/observe actuator arm movement during key ON/OFF calibration
  - 3. Start Engine and allow to idle: Actuator (2) will retract under smooth operation and rest on the low flow adjuster screw at idle (3) – Turbocharger vanes closed
  - 4. Key off: Actuator will retract to the fully open position – Turbocharger vanes fully open
  - 5. If the above is not observed, check vacuum supply to boost pressure actuator (1)
  - **Check system: Utilizing Vacuum Gauge**
  - 6. Remove hose from actuator and apply a clean regulated vacuum of 47cmHg to the actuator (using a suitable hand-held vacuum pump) - check for smooth actuator movement, and that the actuator heel rests on the low-flow adjusting screw
  - 7. The boost pressure actuator (1) should hold a vacuum of 47cmHg for 20 seconds; if not, replace the turbocharger
  - 8. Release the vacuum from regulator, and the actuator should snap open under the boost pressure actuator spring force (default fully opens the vanes). If not, replace turbocharger



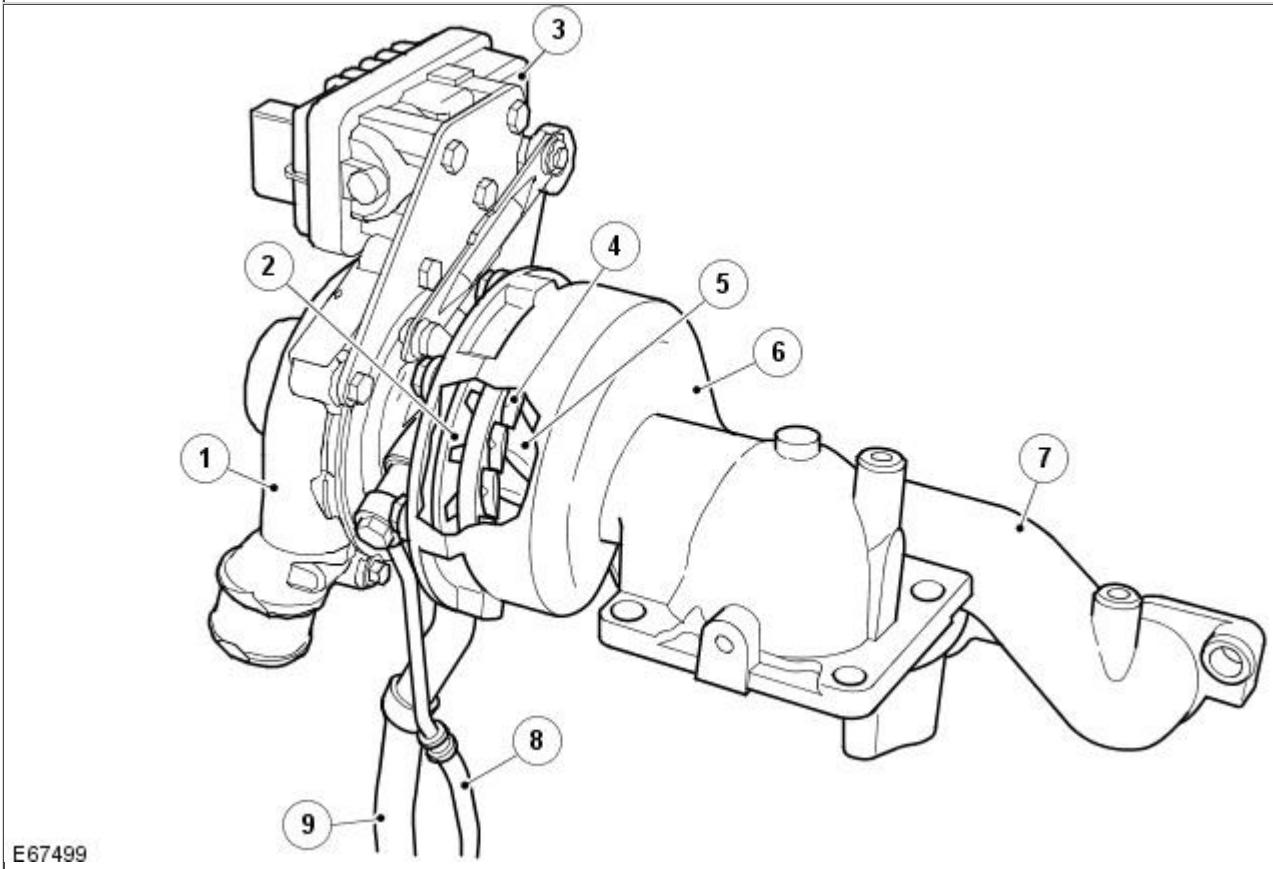
E88404

Point Health Check:

- 8. **Check Vacuum supply system:**
- **Legend**
  - 1. Atmospheric pipe from air cleaner
  - 2. Vacuum from brake booster
  - 3. Vacuum to VGT actuator
  - 4. Turbo charger solenoid valve
  - 5. Vacuum reservoir

- WARNING: Keep hands away from rod and mechanism. Finger injury may result from sudden movement of the assembly when the air pressure is applied

9. **Connect a vacuum gauge to the pipe from the vacuum reservoir / solenoid valve:**
   - 1. Start engine and allow to idle; the vacuum should read 47 cmHg. If not, check vacuum system for leaks, faulty solenoid and check wiring integrity from the ECM to the solenoid (solenoid located on the side of the transmission)



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- 10. **Components:**
- **Legend**
  - 1. Compressor casing
  - 2. Variable vane adjustment ring
  - 3. Rotary electronic actuator
  - 4. Variable vane
  - 5. Exhaust turbine
  - 6. Turbine casing
  - 7. Exhaust manifold
  - 8. Oil supply line
  - 9. Oil drain line

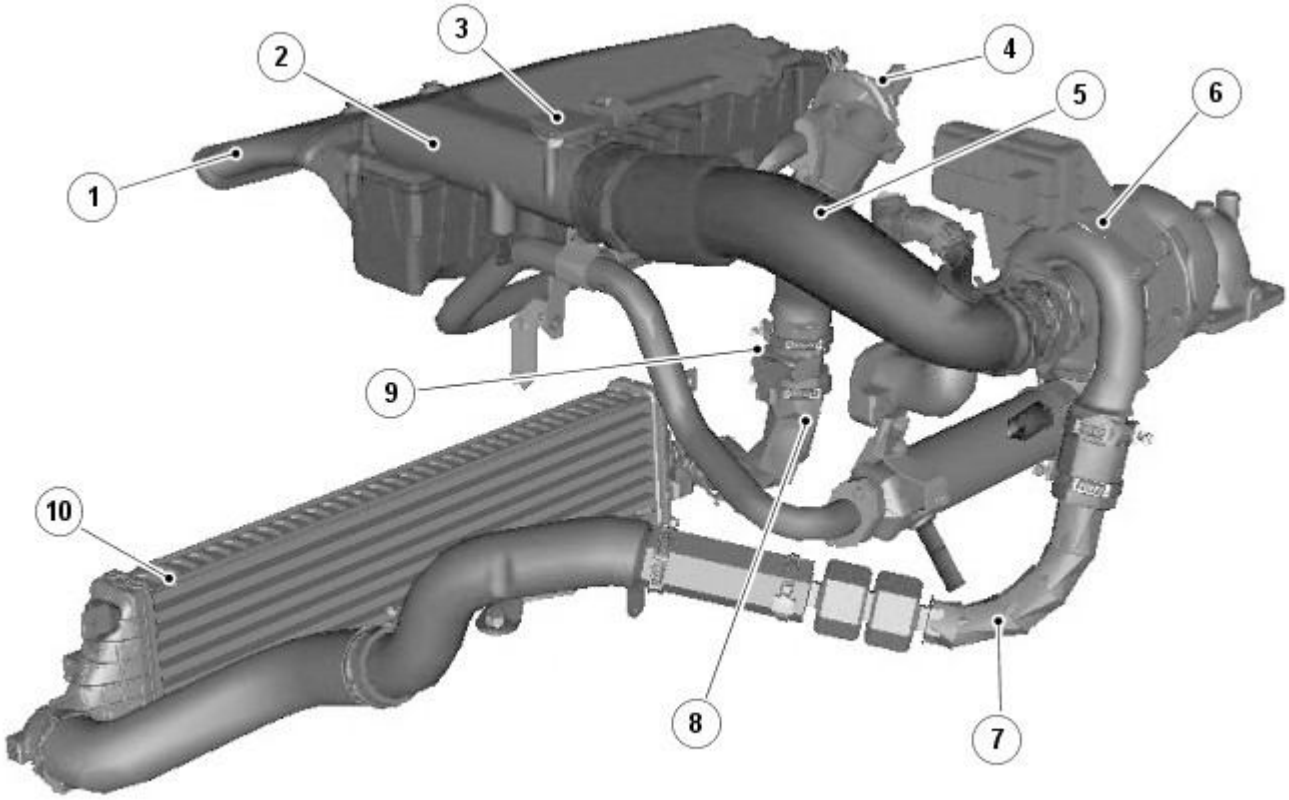
- 11. **Stage 4 (2L): Rotary Electronic Actuator**
  - 1. Check for correct installation of the rotary electronic actuator, and check for loose bolts etc
  - 2. Check for DTCs and rectify fault before moving to next step
  - 3. Check for DTCs pertaining to a turbocharger fault
  -
  • NOTE: If actuator sticks when extending during start up and idle – Check REA Wiring integrity, Recheck DTCs if all OK replace Turbocharger. If actuator sticks when retracting during key OFF– Check REA wiring integrity, recheck DTCs if all OK replace Turbocharger

  4. Check actuator arm movement during key ON/OFF calibration. The actuator should extend during start up and idle, and retract when the engine is switched OFF - There should be a DTC logged to cover this situation - Check wiring integrity, if OK, replace Turbocharger

Turbocharger Troubleshooting Guide

- Frequently, fully serviceable turbo chargers are replaced due to mis-diagnosis of a problem
- Before replacing a turbocharger it is important to identify the cause of the problem
- The following troubleshooting guide will determine turbocharger condition and prevent the unnecessary removal, mis-diagnosis and repeat failures of the turbocharger unit
- Familiarize yourself with the intake air system and the turbocharger boost circuit

Turbocharger Troubleshooting Guide



E87138

- 1. **Legend**
  - 1. Dirty air duct
  - 2. Air Cleaner
  - 3. MAF sensor
  - 4. EGR valve
  - 5. Turbocharger compressor intake air pipe
  - 6. Turbocharger
  - 7. Post charge air cooler pipe
  - 8. Pre charge air cooler pipe
  - 9. MAP sensor
  - 10. Charge air cooler

• NOTE: Discuss concern with customer before carrying out any investigation, record all symptoms and conditions i.e temperatures, drive conditions including drive patterns etc. Record all customer information with respect to concern on job card. The information will be useful for future reference. If you are unsure of any operation or component fitment, please compare with another vehicle. If in doubt contact DTS

- 2. **Common Symptoms of failed Turbocharger boost system component**
  - 1. Poor performance/hesitation
  - 2. Smoky exhaust – black smoke
  - 3. Smoky exhaust – blue smoke
  - 4. Oil consumption
  - 5. Noisy operation

- **Air Intake System - Check for:**
- 3. **Dirty Air Duct:**
  - 1. Check for restricted air flow
  - 2. Blockage from dirt
  - 3. Blockage from foreign object (including snow)
  - 4. Pipe connection to air cleaner
  - 5. Misaligned connection
  - 6. **Corrective action: Clear restriction, establish pipe connection or replace if damaged**

- 4. **Air Cleaner:**
  - 1. Restricted air filter
  - 2. Blockage from dirt
  - 3. Blockage from foreign object (including snow)
  - 4. Restriction due to water saturation
  - 5. Check air cleaner housing for damage and air path restrictions
  - 6. **Corrective action: Replace sensor as new ONLY if the substitute sensor rectifies fault. Corrective action: Replace air filter housing if damaged. Replace filter only if clearly blocked or damaged**

- 5. **Turbocharger compressor intake air pipe:**
  - 1. Air leaks – air cleaner connection
  - 2. Air leaks – turbocharger compressor connection
  - 3. Air leaks – breather pipe connection
  - 4. Badly located clamps
  - 5. Check pipe for damage
  - 6. Check for collapsing of hose – breather pipe end
  - 7. **Corrective action: Ensure clamps / pipe are correctly located – change pipe if found to be damaged. Replace sensor as new, ONLY if the substitute sensor rectifies fault**

Turbocharger Troubleshooting Guide

- **Turbocharger Boost Circuit – Check for:**
- 6. **Pre Charge Air Cooler Pipes:**
  - 1. Split hose
  - 2. Badly located hose
  - 3. Badly located clamp
  - 4. Incorrect clamp torque
  - 5. Oil saturation of hose
  - 6. Check for blockage – Remove pipes to check
  - 7. Check MAP sensor installation and wiring integrity
  - 8. **Correction action: Realign any badly located pipes or replace any damaged or split pipes**

- 7. **Post Charge Air Cooler leaks:**
  - 1. Split hose
  - 2. Badly located hose
  - 3. Badly located clamp
  - 4. Check charge air cooler for damage
  - 5. Check charge air cooler for oil contamination
  -

  CAUTION: Engine oil should always be removed from charge air cooler and intake manifold once a concern has been identified

  6. **Corrective action: Ensure correct fitment of hose pipes, replace damaged charge air cooler. Ensure oil is removed from charge air cooler and intake manifold**

- 8. **Check Charge Air Cooler for Leaks:**
  - 1. Badly located hose
  - 2. Badly located clamp
  - 3. Incorrect clamp torque
  - 4. Oil saturation of hose
  - 5. Check for blockage – Remove pipes to check
  - 6. Check MAP sensor installation and connections
  -

  CAUTION: Make sure the clips that have been re-used are secure and do not over-tighten - may cause damage to the clip

  • NOTE: Take care when replacing pipes: Do not introduce additional faults

  7. **Corrective action: Realign any badly located pipes or replace any damaged or split pipes**

- **Exhaust System - Check for:**
- 9. **Exhaust system for gas leaks:**
  - 1. Distorted manifold flange
  - 2. Missing or misaligned gasket
  - 3. Check exhaust system for blockages
  - 4. Check catalytic converter for blockage – Remove and inspect
  - 5. Check exhaust manifolds for leaks and loose bolts/incorrect torque

- **Turbocharger:**
- 10. Remove compressor intake pipe and heat shield

- 11. **Visual and Mechanical Inspection:**
  -

  • NOTE: Tools to aid with inspection; inspection lamp and vacuum pump/gauge

  1. Check turbocharger exterior for correct installation
  - 2. Check turbocharger for oil leaks
  - 3. Check for excessive sooting under heat shield. A small amount of sooting is acceptable

- 12. **Turbine wheel:**
  - 1. **Corrective action: Difficult to inspect due to design - Remove exhaust system**

- 13. **Compressor wheel:**
  - 1. Inspect for foreign body
  - 2. Inspect for oil residue – Do not change turbocharger due to oil deposits. This may be the effect, not the cause
  - 3. Inspect blades for damage – If damaged, check for foreign object in the intake system
  - 4. Check compressor wheel/housing for evidence of rubbing, bending or seizure
  -

  • NOTE: A small amount of lateral movement of the compressor wheel is normal due to the bearing clearance. Do not force the compressor wheel to touch the housing

  5. Check compressor wheel (gently rotate the compressor wheel and check for smooth operation) – Check for burrs on the compressor wheel or rub marks on the housing, that indicate the compressor wheel was rubbing. If possible, compare with a known good turbocharger

- **Turbocharger Replacement:**
- 14. **Turbocharger:**
  -

  CAUTION: The following must be carried out after turbocharger replacement and before running the engine to avoid engine damage

  1. When replacing turbocharger units where excessive oil is evident in the compressor housing, charge air cooler and associated pipework, if excessive blue smoke was exhibited from the exhaust, the following should be carried out:
  - 2. Remove and clean charge air cooler and associating pipework
  - 3. Remove and clean the intake manifold
  - 4. The vehicle should be then run for approximately 30miles (48 kilometre) to remove the residual oil from the exhaust system – Motorway road test is recommended

Published: 11-May-2011

Fuel Charging and Controls - Turbocharger - Turbocharger

Removal and Installation

Removal

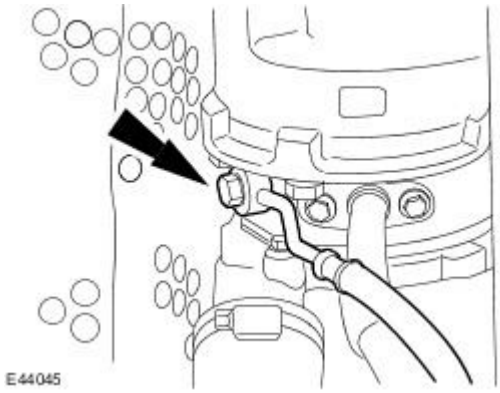
All vehicles

1. Remove the catalytic converter.
   For additional information, refer to: Catalytic Converter - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (309-00 Exhaust System, Removal and Installation).

Vehicles with 2.2L diesel engine

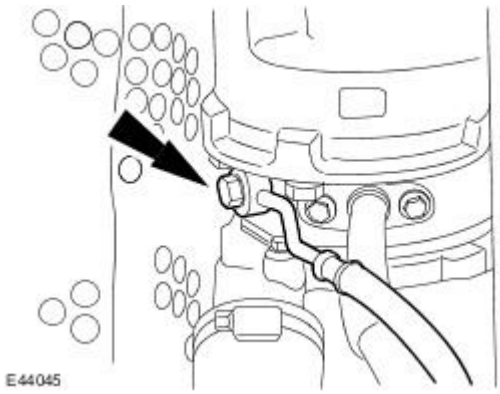
2. Remove the right-hand halfshaft.
   For additional information, refer to: Front Halfshaft RH - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (205-04 Front Drive Halfshafts, Removal and Installation).

Vehicles built up to VIN:E25781

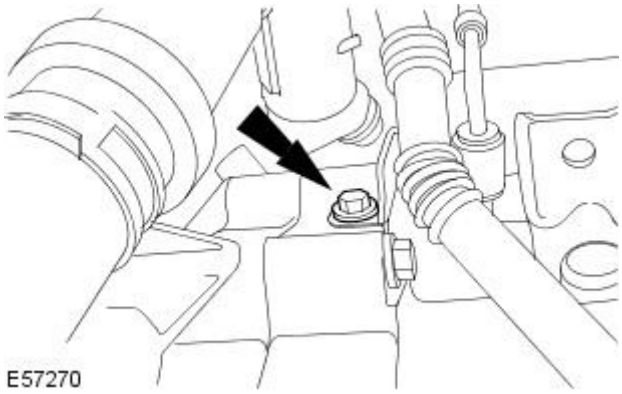


3. Detach the oil supply tube from the turbocharger.
   - Discard the sealing washers.

Vehicles built from VIN:E25782

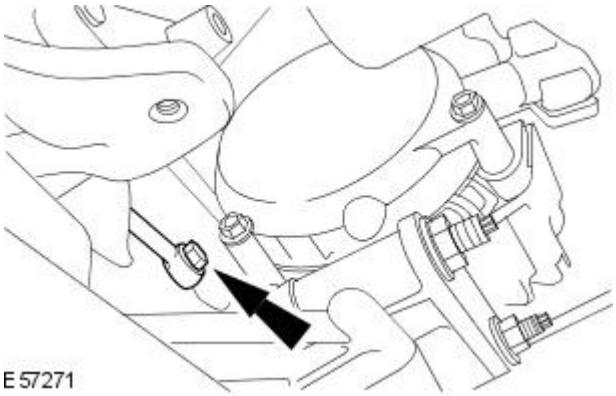


4. Detach the oil supply tube from the turbocharger.



5. Detach the oil supply tube.

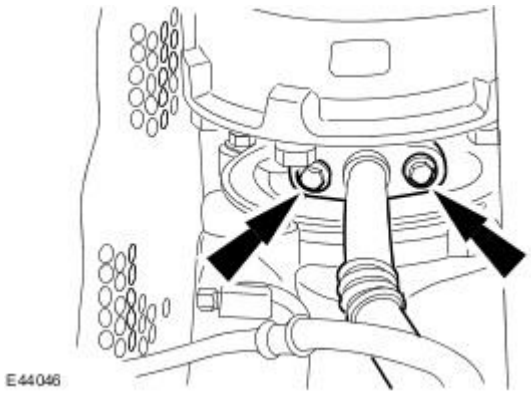
6. Remove the oil supply tube.


E57271

All vehicles

7. Detach the oil return tube from the turbocharger.

- Discard the gasket.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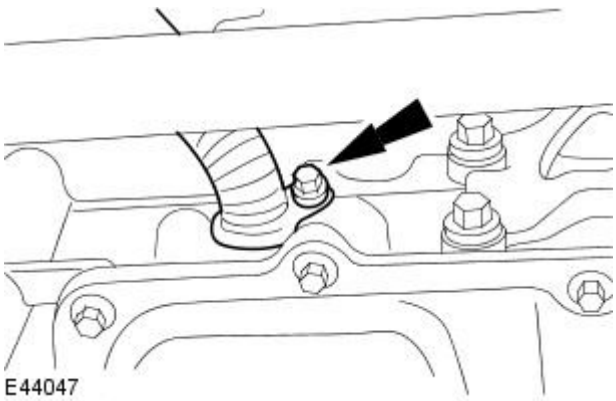
8. Remove the oil return tube.

- Discard the O-ring seal.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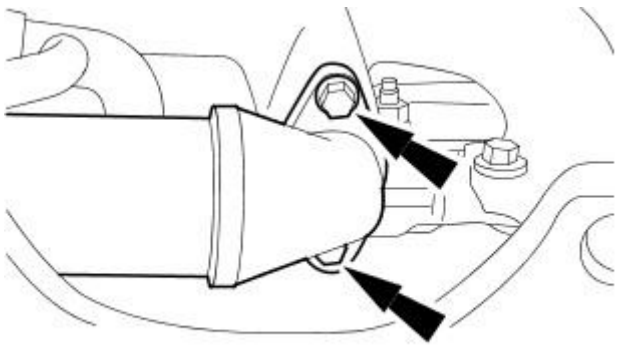
9. Detach the exhaust gas recirculation (EGR) cooler from the exhaust manifold.

- Discard the gasket.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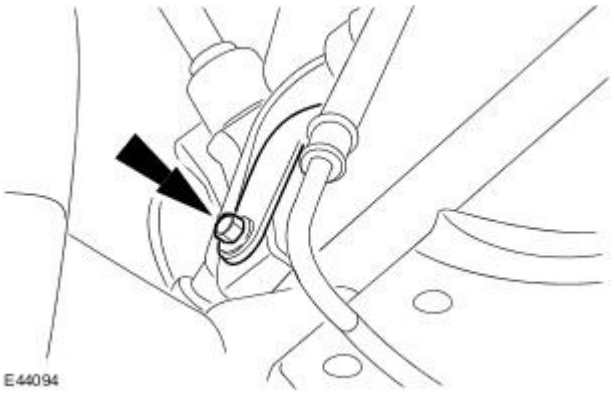
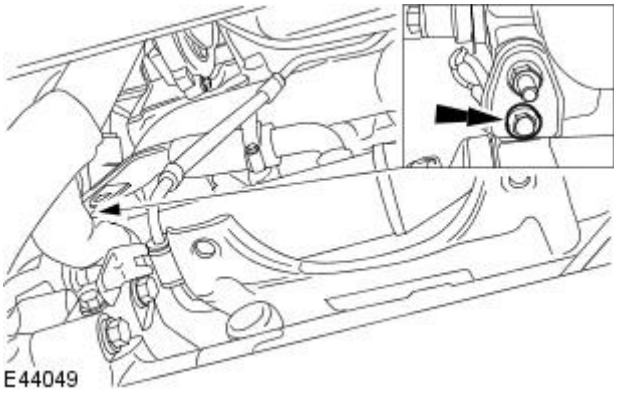
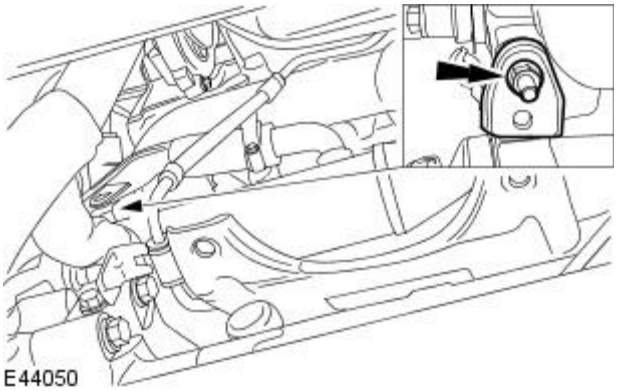


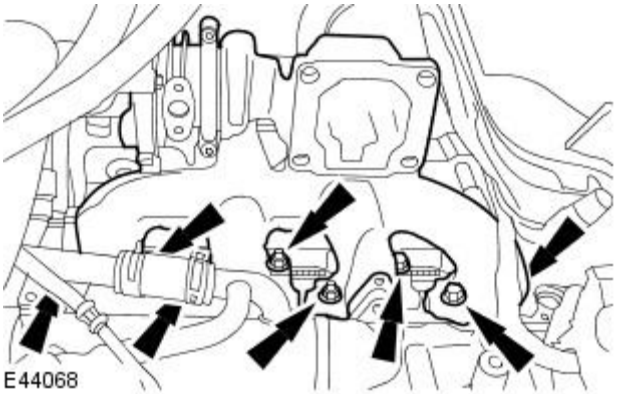
10. Detach the coolant pipe from the EGR cooler.



11. Remove the EGR cooler mount bracket retaining bolt.



12. Remove the EGR cooler mount bracket.



13. Remove the exhaust manifold retaining bolts and nuts.

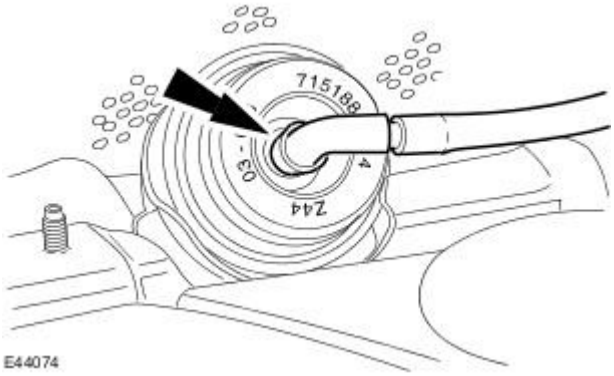
- Discard the bolts and nuts.

14. Lower the vehicle.

15. Remove the cowl vent screen.
For additional information, refer to: Cowl Vent Screen (501-02 Front End Body Panels, Removal and Installation).

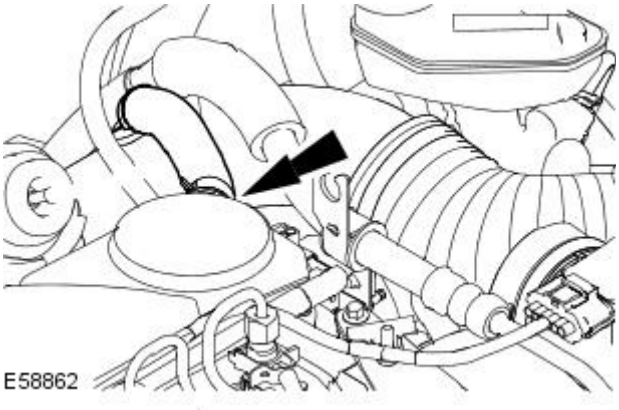
Vehicles built up to VIN:E43868

16. Disconnect the vacuum hose.



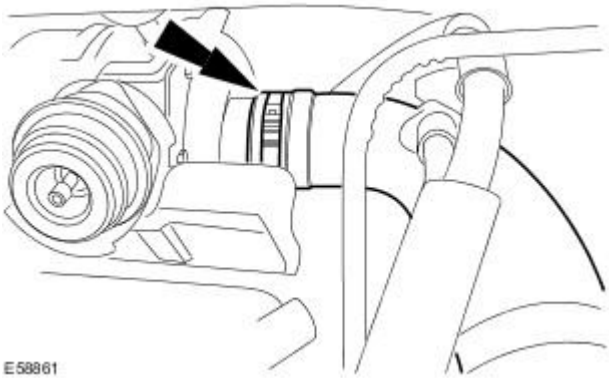
17. Detach the positive crankcase ventilation hose from the valve cover.

- Discard the positive crankcase ventilation hose retaining clip.



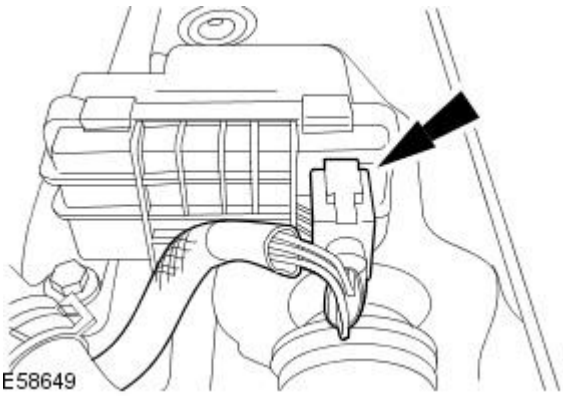
18. Detach the air cleaner outlet pipe from the turbocharger.

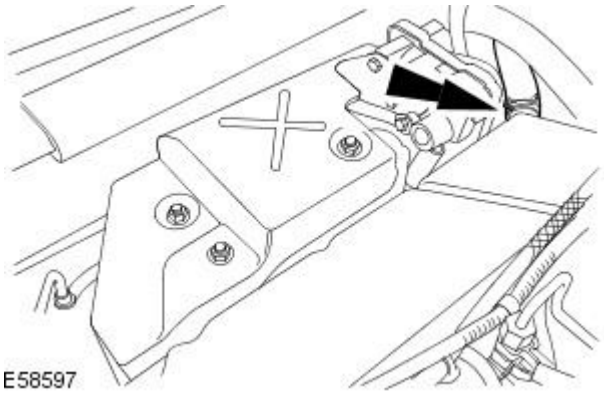
- Discard the air cleaner outlet pipe retaining clip.



Vehicles built from VIN:E43869

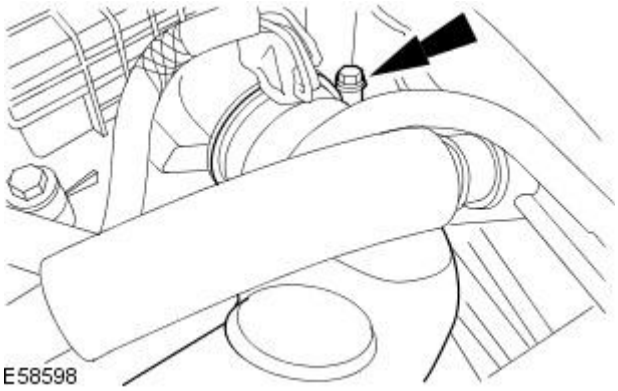
19. Disconnect the electrical connector.





20. Detach the positive crankcase ventilation hose from the valve cover.

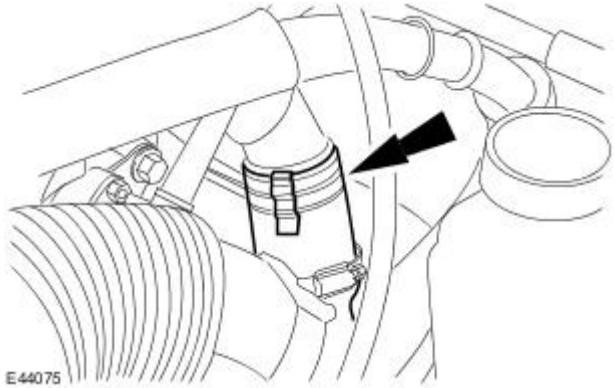
- Discard the positive crankcase ventilation hose retaining clip.



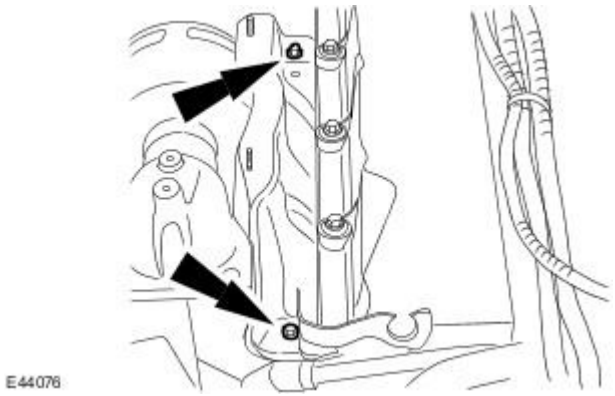
21. Detach the air cleaner outlet pipe from the turbocharger.

- Discard the air cleaner outlet pipe retaining clip.

All vehicles



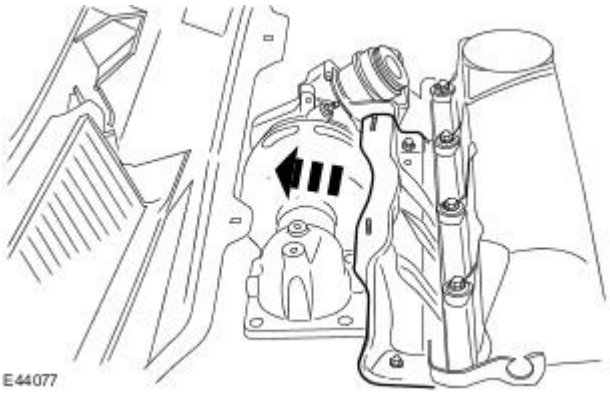
22. Detach the charge air cooler intake pipe from the turbocharger .



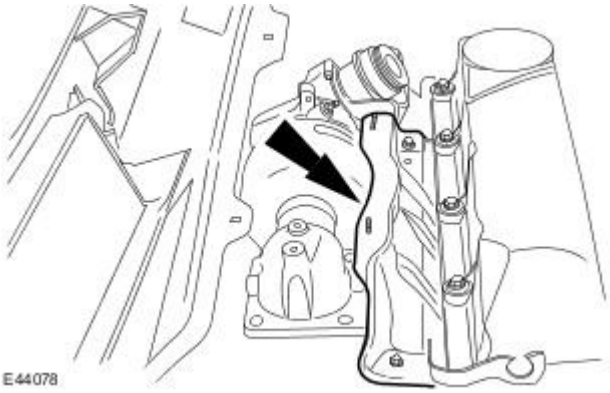
23. Remove the exhaust manifold gasket retaining bolts.

Vehicles built up to VIN:E43868

24. Detach the turbocharger from the cylinder head.

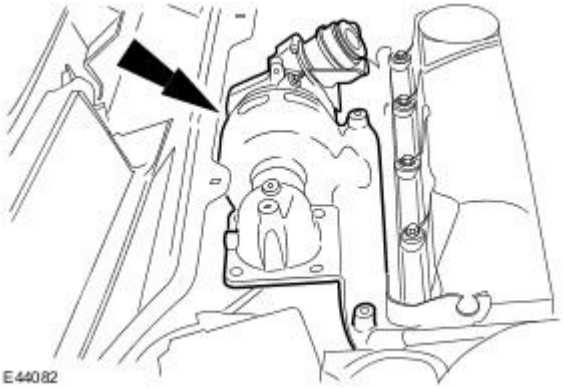


25. Remove and discard the exhaust manifold gasket.



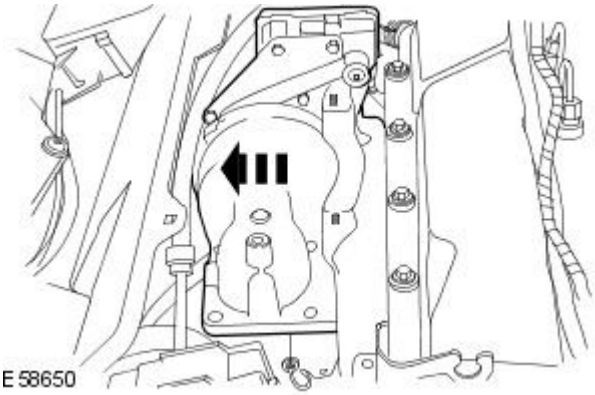
26. Remove the turbocharger.

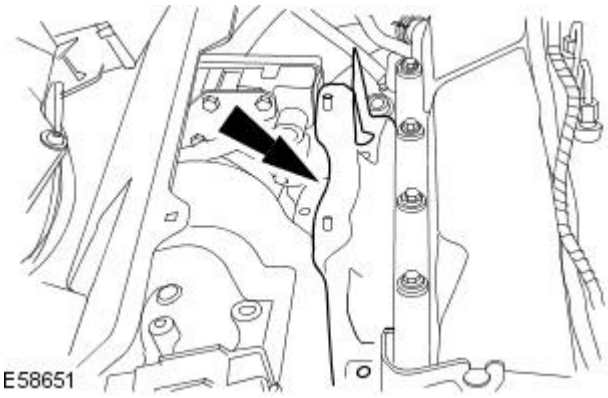
- Remove and discard the turbocharger retaining studs.



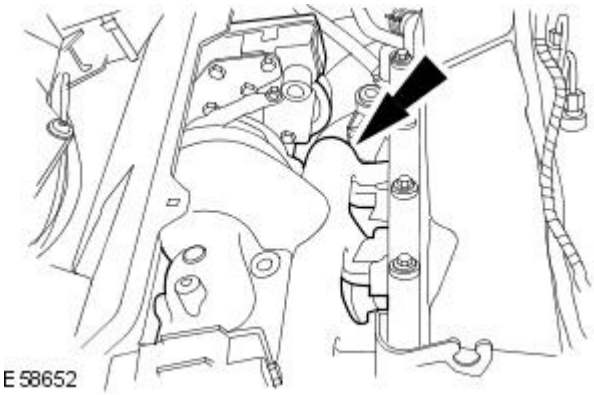
Vehicles built from VIN:E43869

27. Detach the turbocharger from the cylinder head.





28. Remove and discard the exhaust manifold gasket.

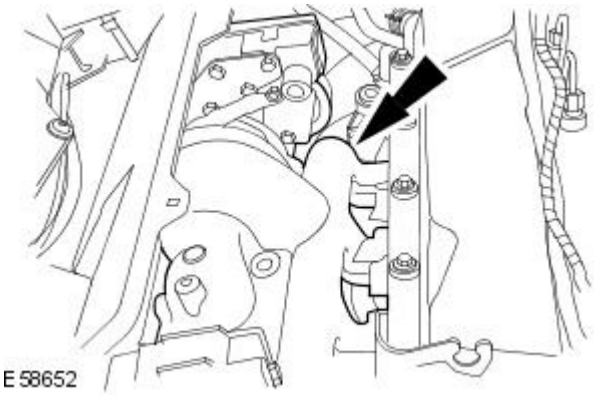


29. Remove the turbocharger.

- Remove and discard the turbocharger retaining studs.

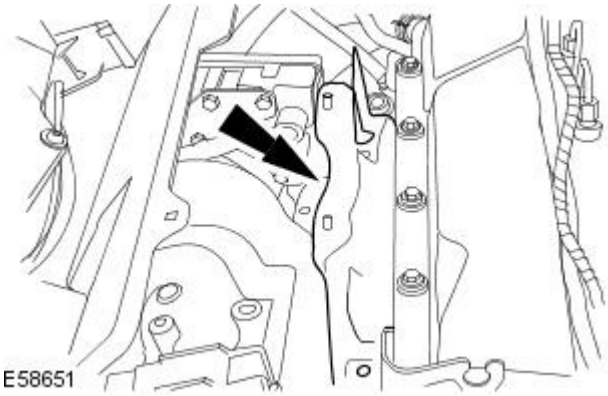
Installation

Vehicles built from VIN:E43869



1. NOTE: Install new turbocharger retaining studs.

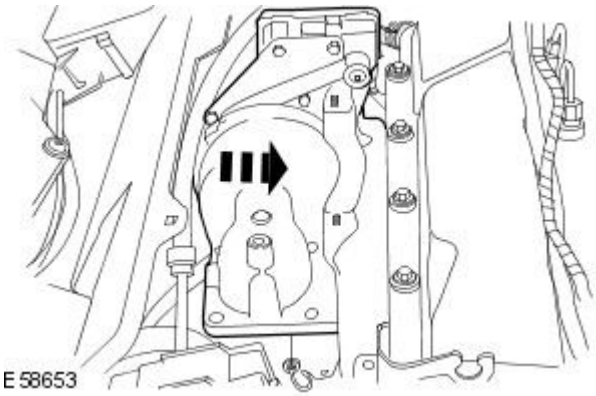
Install the turbocharger.



2. NOTE: Install a new gasket.

Install the exhaust manifold gasket.

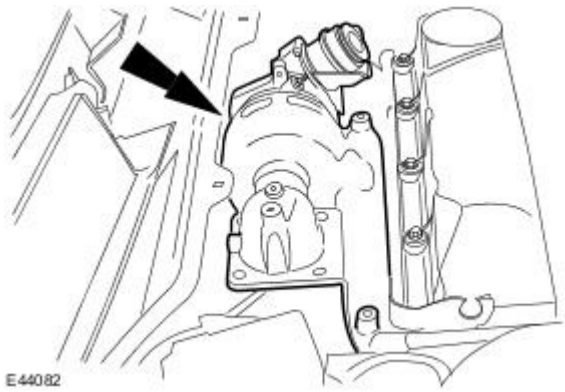
3. Attach the turbocharger to the cylinder head.



Vehicles built up to VIN:E43868

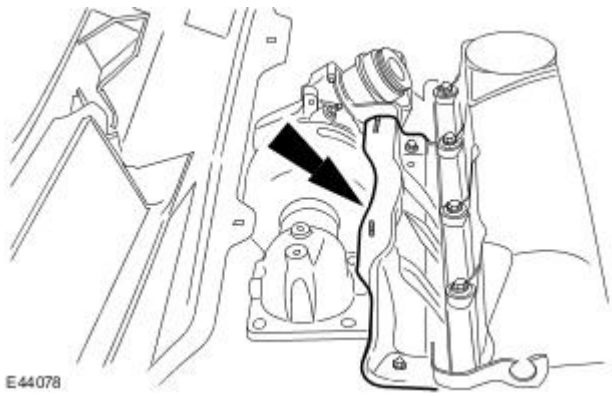
4. NOTE: Install new turbocharger retaining studs.

Install the turbocharger.

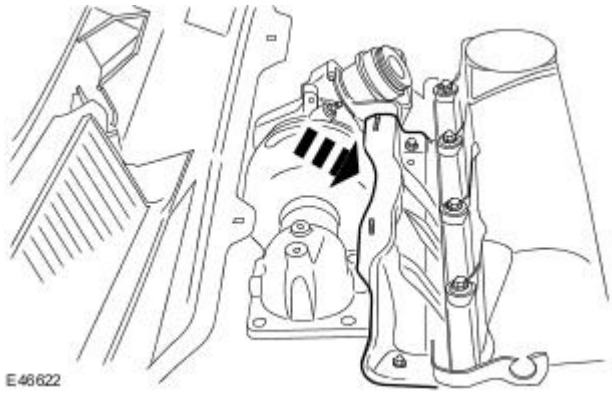


5. NOTE: Install a new gasket.

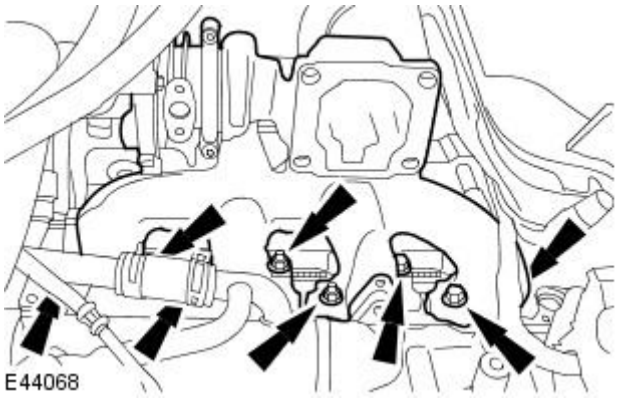
Install the exhaust manifold gasket.



6. Attach the turbocharger to the cylinder head.



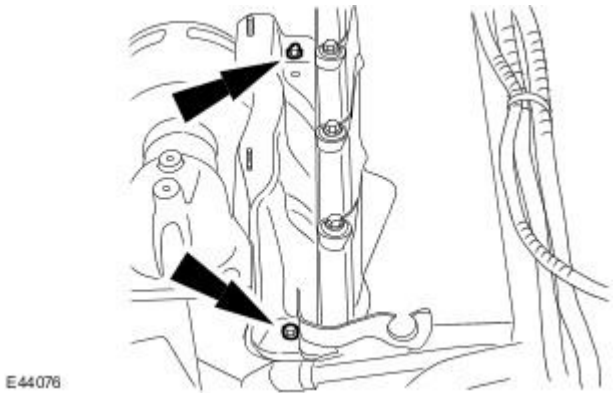
All vehicles



7. NOTE: Install new exhaust manifold retaining nuts and bolts

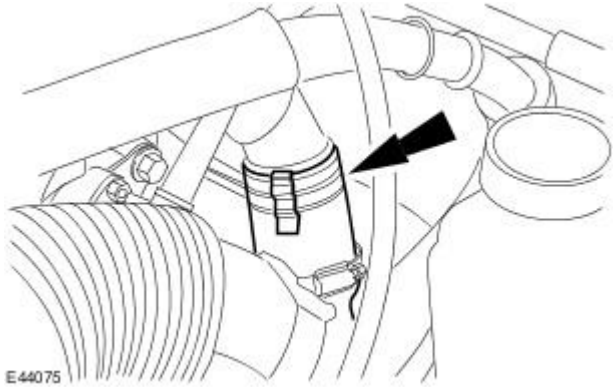
• NOTE: Vehicle shown raised for clarity.

Loosely install the exhaust manifold retaining nuts and bolts.



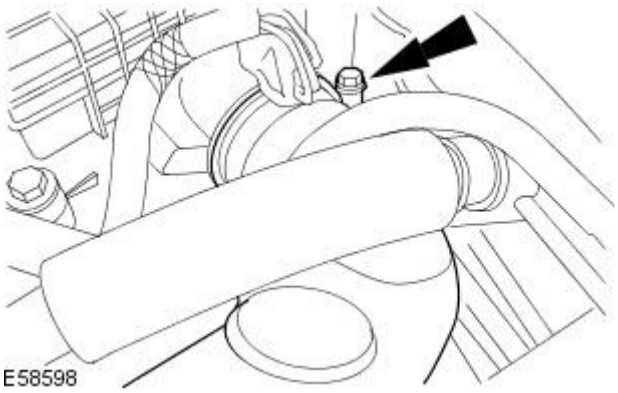
8. Install the exhaust manifold gasket retaining studs.

- Tighten to 10 Nm.



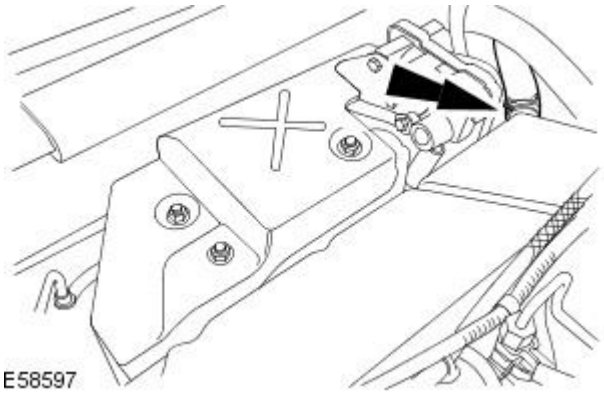
9. Attach the charge air cooler intake pipe to the turbocharger.

Vehicles built from VIN:E43869



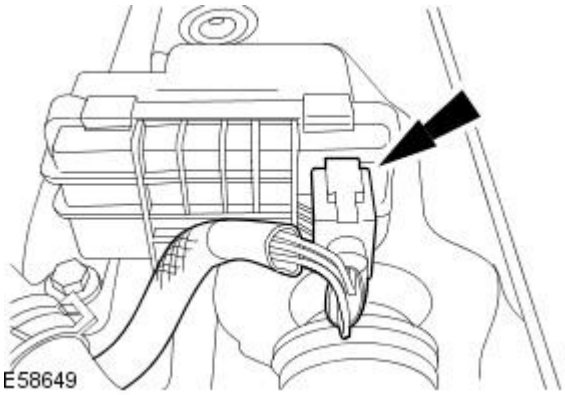
10. NOTE: Install a new air cleaner outlet pipe retaining clip.

Attach the air cleaner outlet pipe to the turbocharger.



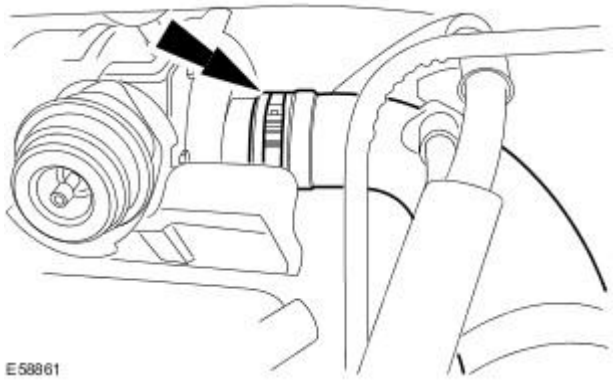
11. NOTE: Install a new positive crankcase ventilation hose retaining clip.

Attach the positive crankcase ventilation hose to the valve cover.



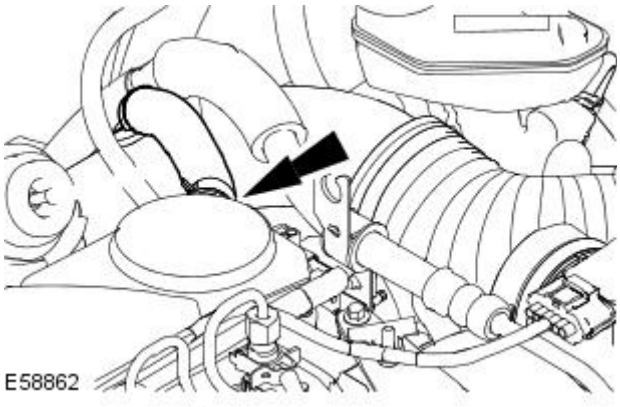
12. Connect the electrical connector.

Vehicles built up to VIN:E43868



13. NOTE: Install a new air cleaner outlet pipe retaining clip.

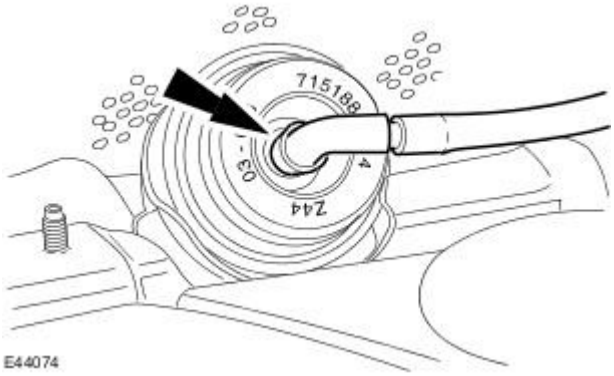
Attach the air cleaner outlet pipe to the turbocharger.



14. NOTE: Install a new positive crankcase ventilation hose retaining clip.

Attach the positive crankcase ventilation hose to the valve cover.

15. Connect the vacuum hose.



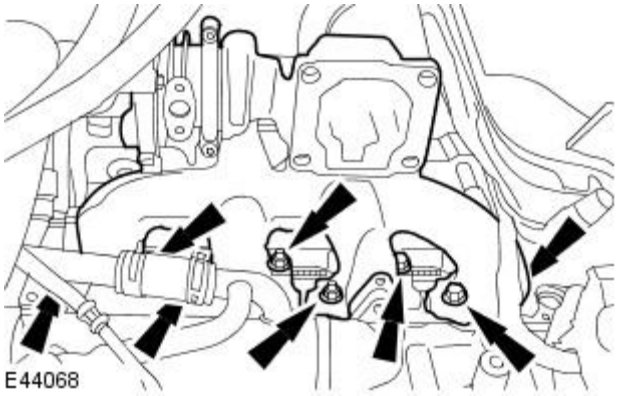
All vehicles

16. Install the cowl vent screen.
For additional information, refer to: Cowl Vent Screen (501-02 Front End Body Panels, Removal and Installation).

17. Raise the vehicle.

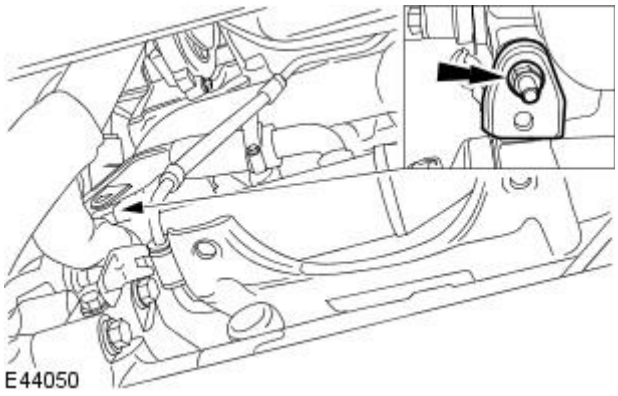
18. Tighten the exhaust manifold retaining nuts and bolts.

- Tighten to 40 Nm.



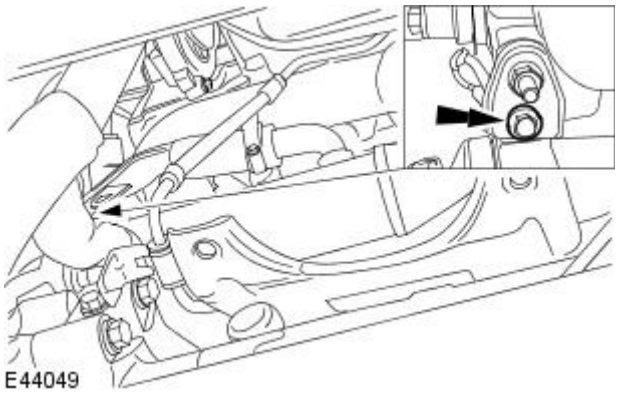
19. Install the EGR cooler mount bracket.

- Tighten to 10 Nm.

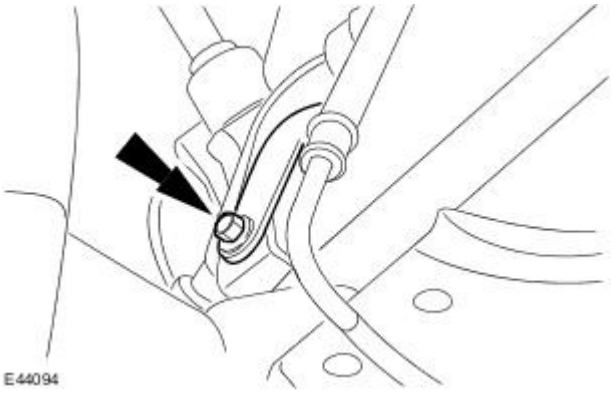


20. Install the EGR cooler mount bracket retaining bolt.

- Tighten to 10 Nm.



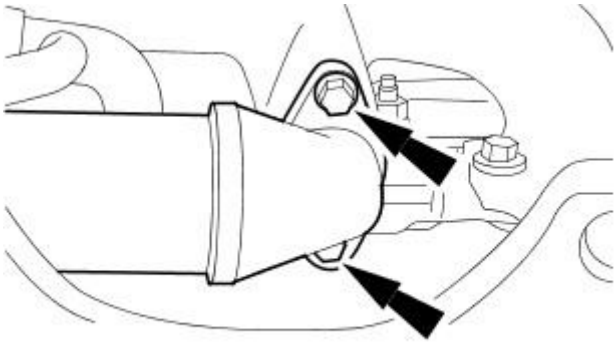
21. Attach the coolant pipe to the EGR cooler.


E44094

22. NOTE: Install a new gasket.

Attach the EGR cooler to the exhaust manifold.

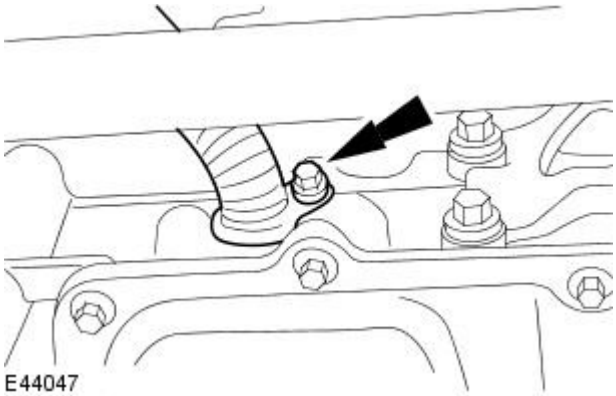
- Tighten to 37 Nm.


E44048

23. NOTE: Install a new O-ring seal.

Install the oil return tube.

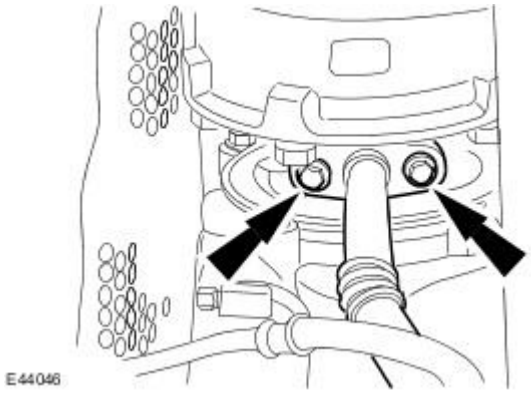
- Tighten to 10 Nm.


E44047

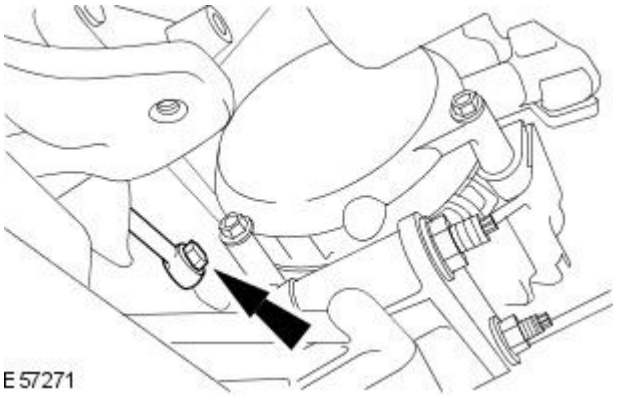
24. NOTE: Install a new gasket.

Attach the oil return tube to the turbocharger.

- Tighten to 10 Nm.


E44046

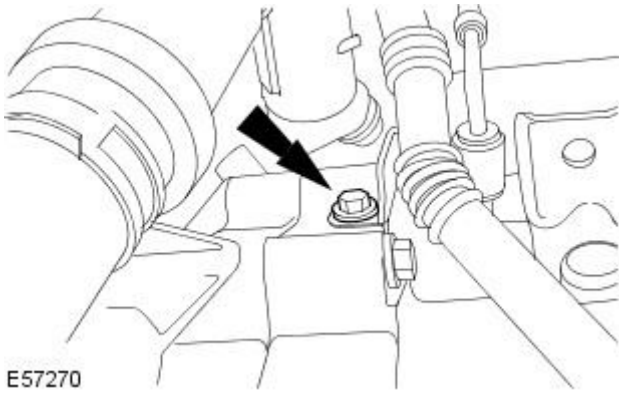
Vehicles built from VIN:E25782



25. CAUTION: If a new oil supply tube is to be installed, ensure that the blanking caps have been removed prior to installation. Failure to follow this instruction may result in damage to the turbocharger.

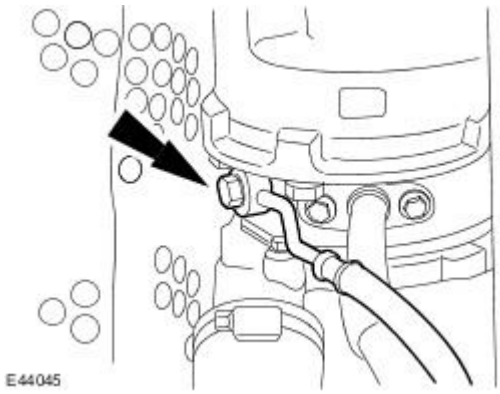
Install the oil supply tube.

- Tighten to 14 Nm.



26. Attach the oil supply tube.

- Tighten to 23 Nm.

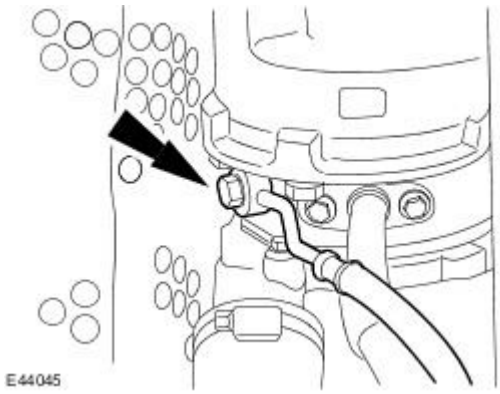


27. CAUTION: When installing the oil supply tube union to the turbocharger, check the routing of the oil supply tube and make sure that it is not touching the turbocharger.

Attach the oil supply tube to the turbocharger.

- Tighten to 14 Nm.

Vehicles built up to VIN:E25781



28. CAUTION: When installing the oil supply tube union to the turbocharger, check the routing of the oil supply tube and make sure it is not touching the turbocharger.

• NOTE: Install new sealing washers.

Attach the oil supply tube to the turbocharger.

- Tighten to 14 Nm.

Vehicles with 2.2L diesel engine

29. Install the right-hand halfshaft.
For additional information, refer to: Front Halfshaft RH - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (205-04 Front Drive Halfshafts, Removal and Installation).

All vehicles

30. Install the catalytic converter.
For additional information, refer to: Catalytic Converter - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (309-00 Exhaust System, Removal and Installation).

31. NOTE: Use oil WSS-M2C913-B or equivalent meeting Jaguar specification.

Check and top up the engine with oil if necessary.

Published: 11-May-2011

Accessory Drive -

Torque Specifications

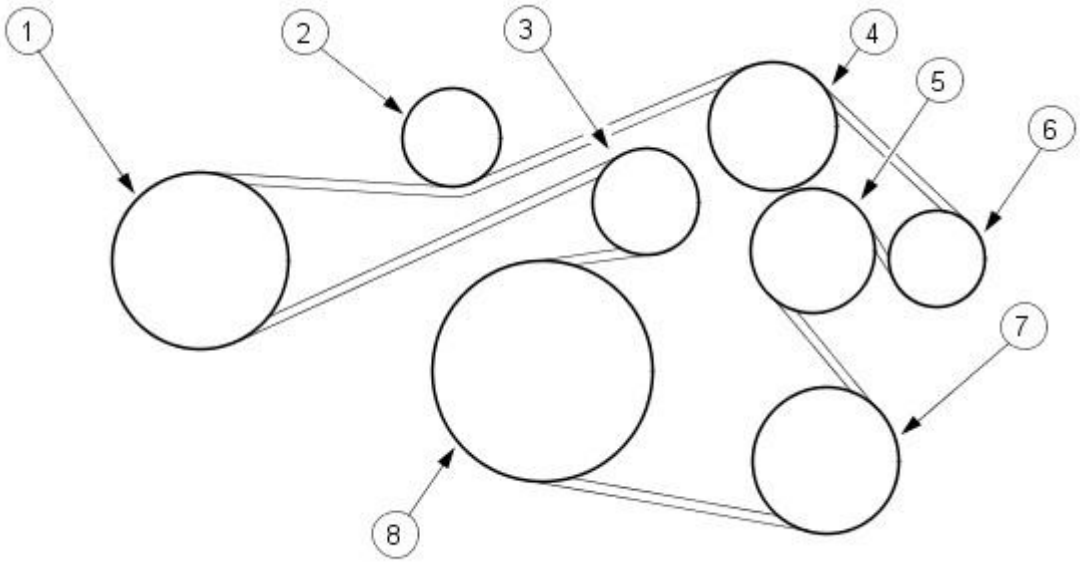
Description	Nm	lb-ft	lb-in
Accessory drive belt tensioner retaining bolt - vehicles with 2.0L, 2.5L or 3.0L engine	47	35	-
Belt idler pulley retaining bolt - A bank pulley - vehicles with 2.0L, 2.5L or 3.0L engine	25	18	-
Belt idler pulley retaining bolt - B bank upper pulley - vehicles with 2.0L, 2.5L or 3.0L engine	25	18	-
Belt idler pulley retaining bolt - B bank lower pulley - vehicles with 2.0L, 2.5L or 3.0L engine	25	18	-
Water pump drive belt tensioner retaining bolt - vehicles with 2.0L, 2.5L or 3.0L engine	10	-	89
Accessory drive belt tensioner assembly retaining bolts - vehicles with 2.0L or 2.2L diesel engine	47	35	-
Generator retaining bolt - vehicles with 2.0L or 2.2L diesel engine	47	35	-
Generator retaining nuts - vehicles with 2.0L or 2.2L diesel engine	47	35	-
Generator positive cable retaining nut - vehicles with 2.0L or 2.2L diesel engine	8	-	71
Exhaust gas recirculation (EGR) cooler to EGR valve tube support bracket upper retaining bolt - vehicles with 2.0L or 2.2L diesel engine	10	-	89
EGR cooler to EGR valve tube support bracket lower retaining bolts - vehicles with 2.0L or 2.2L diesel engine	23	17	-
Power steering pump belt cover retaining nut	10	-	89
Power steering pump belt tensioner retaining bolt - vehicles with 2.0L or 2.2L diesel engine	23	17	-

Published: 11-May-2011

Accessory Drive - Accessory Drive

Description and Operation

2.0L, 2.5L and 3.0L engine



VUJ0003794

Item	Part Number	Description
1	—	Power steering pump pulley
2	—	Accessory drive belt idler pulley
3	—	Accessory drive belt tensioner
4	—	Accessory drive belt idler pulley
5	—	Accessory drive belt idler pulley
6	—	Generator pulley
7	—	Air conditioning pump pulley
8	—	Crankshaft pulley

Crankshaft Pulley

The combined crankshaft pulley and torsional vibration damper drives a single, six ribbed vee belt. The belt drives the following engine-mounted accessories; the generator, power assisted steering pump, and the air-conditioning compressor. The coolant water pump is driven by a separate drive on the rear of the engine.

Air Conditioning Compressor Drive

This is positioned at the lowest point of the front-end accessory-drive on the lower left accessory mounting.

Power Assisted Steering Pump Drive

The power assisted steering pump pulley is located on the right of the engine, above the steering gear.

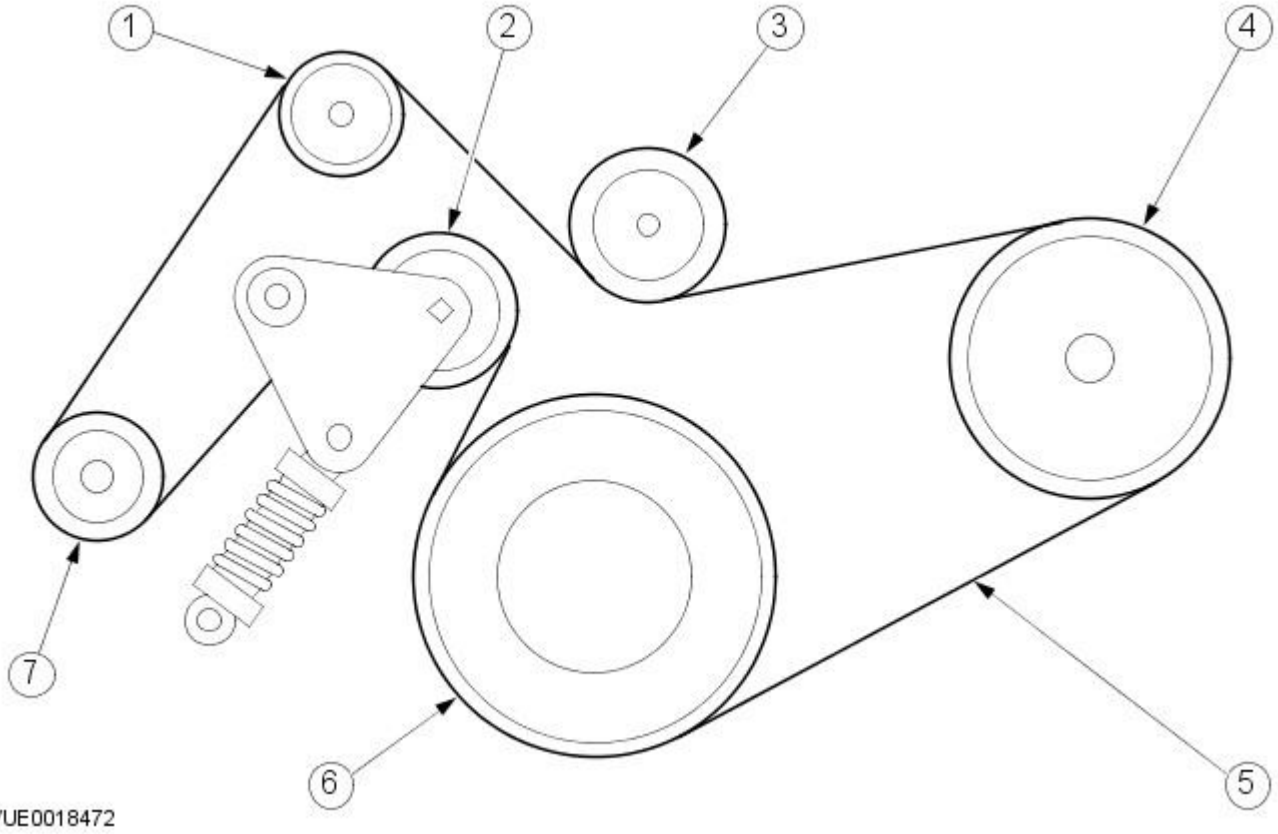
Generator Drive

The generator is fitted on the upper left accessory mounting.

Belt Tensioner

Automatic tensioners are calibrated to provide the correct amount of tension to the belt for a given accessory 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.

2.0L and 2.2L diesel engine



Item	Part Number	Description
1	—	Accessory drive belt idler pulley
2	—	Accessory drive belt tensioner
3	—	Accessory drive belt idler pulley
4	—	Air conditioning pump pulley
5	—	Accessory drive belt
6	—	Crankshaft pulley
7	—	Generator pulley

Crankshaft Pulley

The crankshaft pulley drives a single, six ribbed vee belt. The belt drives the generator and the air-conditioning compressor. The power assisted steering pump is driven by a separate drive belt on the rear of the engine. The coolant water pump is driven by the power assisted steering pump.

Air Conditioning Compressor Drive

This is positioned on the upper left accessory mounting.

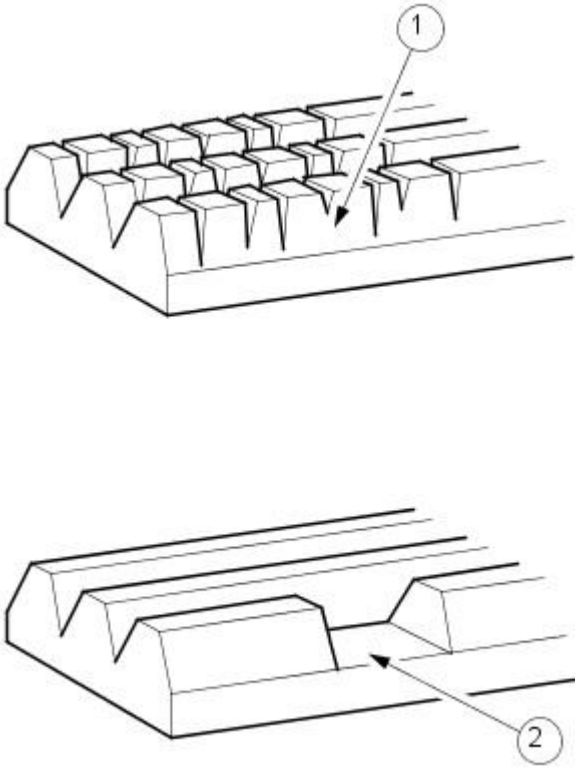
Generator Drive

The generator is fitted on the lower right accessory mounting.

Belt Tensioner

Automatic tensioners are calibrated to provide the correct amount of tension to the belt for a given accessory 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.

Drive Belt



VUJ0000908

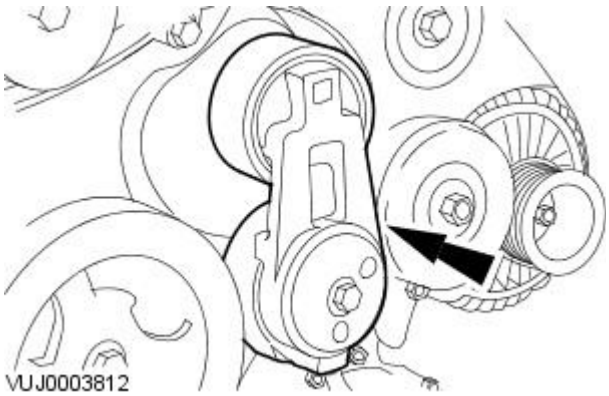
Item	Description
1	Acceptable Drive Belt Cracking
2	Unacceptable Drive Belt Damage

The drive belt should be inspected at every routine service for excessive wear and damage. A drive belt which displays symptoms of cracking may be perfectly fit for further service.

Should cracking be detected, serviceability may be assessed using the following guidelines:

- Fifteen cracks per rib over a 100 mm length of drive belt is acceptable.
- Section(s) of belt missing from any rib is not acceptable and the drive belt must be renewed.

Automatic Belt Tensioner



• NOTE: Petrol engine belt tensioner shown, diesel engine belt tensioner similar in operation.

The automatic belt tensioners consist of an idler pulley which is free to rotate on a bearing, located at the end of a spring-loaded pivot arm.

The pivot arm can be partially rotated to slacken the belt and allow belt removal and installation.

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Accessory Drive - Accessory Drive

Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
Damaged or contaminated belt
Belt tension
Belt tensioner
Pulleys
Loose hardware

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

Symptom Chart

Symptom	Possible Sources	Action
Belt noise or squeal	* Pulley(s) * Lubricant or other contamination * Belt	* DETERMINE where the noise is coming from. CHECK pulley alignment, freedom of rotation or damage. REPAIR or INSTALL new parts as necessary. * CHECK belt for contamination. REMOVE belt and wash with detergent and water. If belt cannot be cleaned or is damaged, INSTALL a new belt. For additional information refer to Accessory Drive Belt - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 or REFER to: Accessory Drive Belt - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-05 Accessory Drive, Removal and Installation). * CHECK belt for correct application.
Belt does not hold tension	* Belt cracking or damaged * Tensioner worn or damaged	* INSPECT belt for cracking or damage. INSTALL a new belt if required. For additional information refer to Accessory Drive Belt - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 or REFER to: Accessory Drive Belt - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-05 Accessory Drive, Removal and Installation). * CHECK belt tensioner for damage and correct operation. INSTALL a new belt tensioner if required. For additional information refer to Accessory Drive Belt Tensioner - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 or REFER to: Accessory Drive Belt Tensioner - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-05 Accessory Drive, Removal and Installation).

Component Tests

Belt Tensioner-Mechanical

The only mechanical check that needs to be made is a check for tensioner "stick, grab or bind".

1. **1.** Remove the 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 test the tensioner dynamically. If the tensioner does not meet the above criteria install a new tensioner. For additional information, refer to Accessory Drive Belt Tensioner - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma or REFER to: Accessory Drive Belt Tensioner - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-05 Accessory Drive, Removal and Installation).

Belt Tensioner-Dynamic

The automatic belt tensioner can be checked dynamically as follows:

1. **1.** With the engine running, observe belt tensioner movement. The tensioner should move (respond) when the air conditioning clutch cycles, or when the engine is accelerated rapidly. If the tensioner movement is not constant without the air conditioning clutch cycling or engine acceleration, a pulley or shaft is probably bent, or a pulley is out of round. Excessive belt rideout (uneven depth of grooves in the belt) can cause excessive tensioner movement. Check condition by installing a new belt.
2. **2.** With the engine off, check routing of the belt. For additional information, refer to the illustrations under Description and Operation.
3. **3.** Rotate the belt tensioner and check for a binding or seized condition. Install a new belt if necessary. For additional information refer to Accessory Drive Belt - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 or REFER to: Accessory Drive Belt - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-05 Accessory Drive, Removal and Installation).

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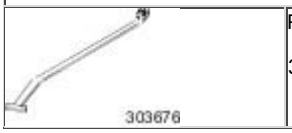
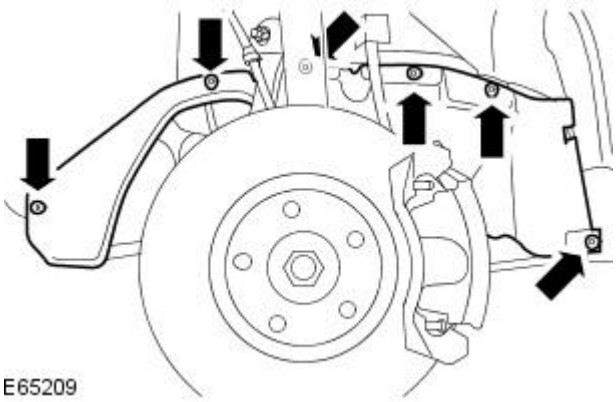
Accessory Drive - Accessory Drive Belt2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma

Removal and Installation

Special Tool(s)	
 303676	Release tool, belt tensioner 303-676

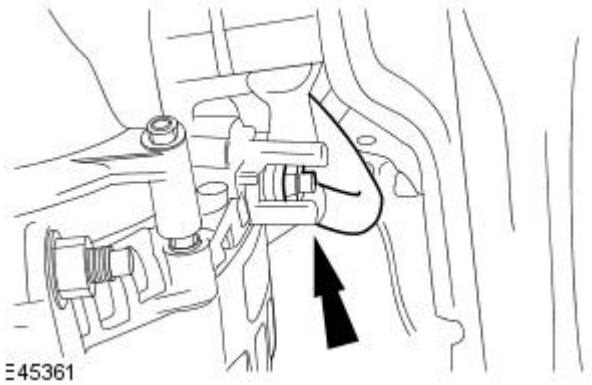
Removal

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 - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (501-02 Front End Body Panels, Removal and Installation).
3. Remove the right-hand road wheel.
   For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
4. Remove the right-hand wheel arch liner access panel.



5. Using the special tool, detach the accessory drive belt.

6. Detach the generator positive cable.

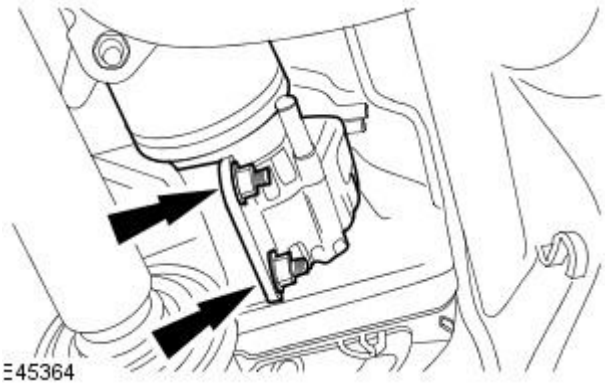



E45362

7. Disconnect the generator electrical connector.

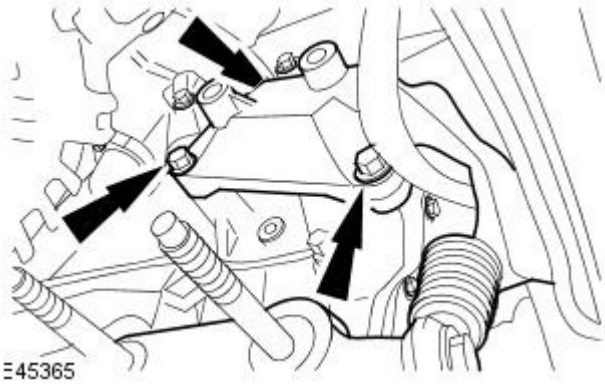

E45363

8. Remove the generator upper retaining bolt.

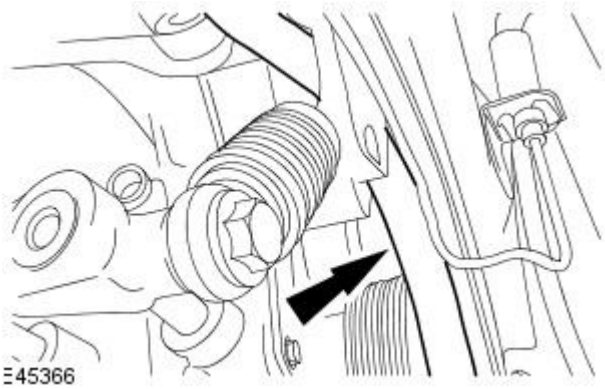

E45364

9. Detach the generator.

- Slide the generator rearwards as far away from the accessory drive belt tensioner assembly as possible.

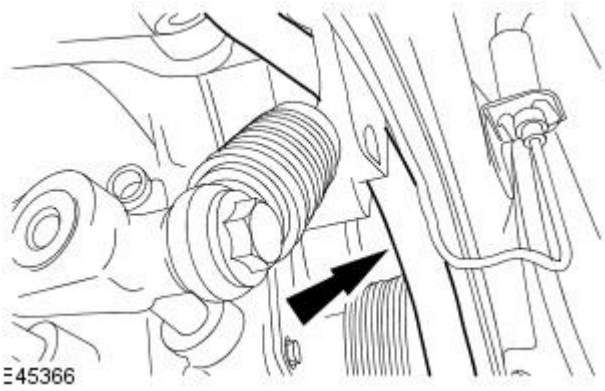

E45365

10. Detach the accessory drive belt tensioner assembly.

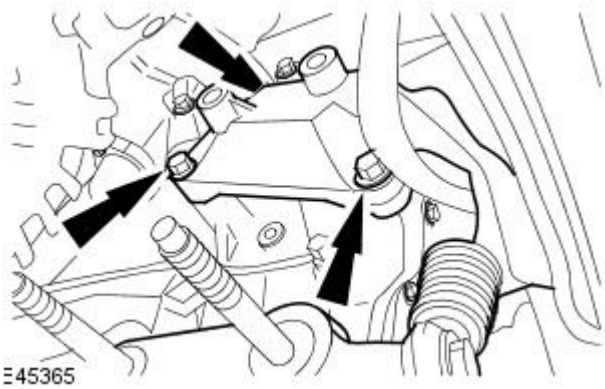

E45366

11. Remove the accessory drive belt.

Installation

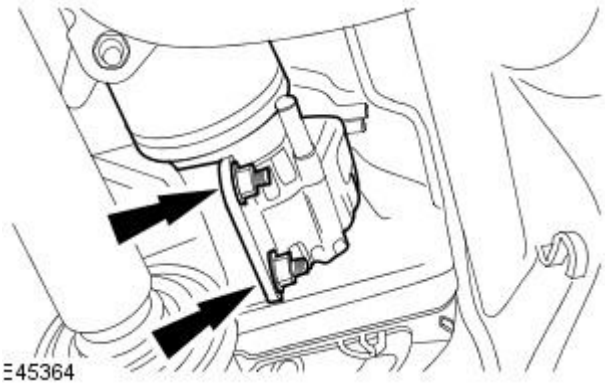


1. Install the accessory drive belt.



2. Attach the accessory drive belt tensioner assembly.

- Tighten to 47 Nm.

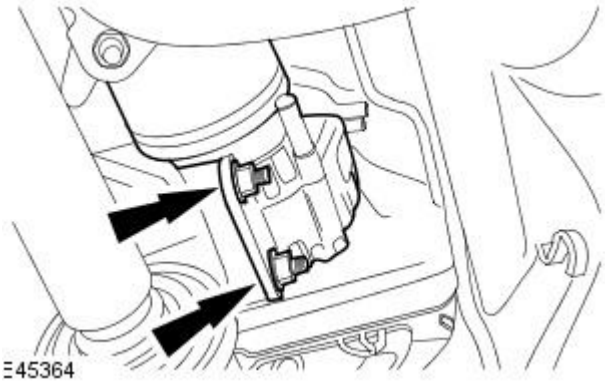


3. NOTE: Loosely install the generator retaining nuts.

Attach the generator.

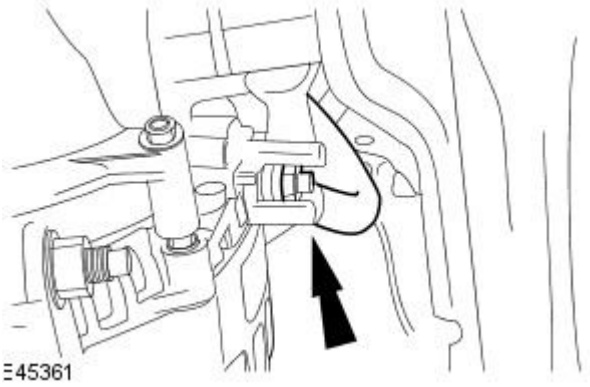
4. Install the generator retaining bolt.

- Tighten to 47 Nm.



5. Tighten to 47 Nm.

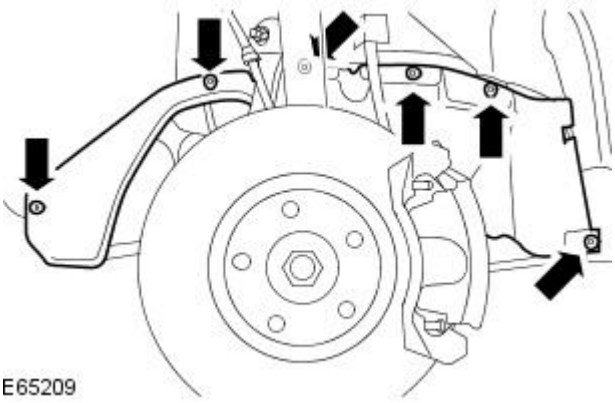
6. Connect the generator electrical connector.



7. Attach the generator positive cable.

- Tighten to 8 Nm.

8. Using the special tool, install the accessory drive belt.



9. Install the right-hand wheel arch liner access panel.

10. Install the right-hand road wheel.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

11. Install the air deflector.
For additional information, refer to: Air Deflector - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (501-02 Front End Body Panels, Removal and Installation).

12. Connect the battery ground cable.
For additional information, refer to: Battery Connect (414-01 Battery, Mounting and Cables, General Procedures).

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Accessory Drive - Accessory Drive Belt2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

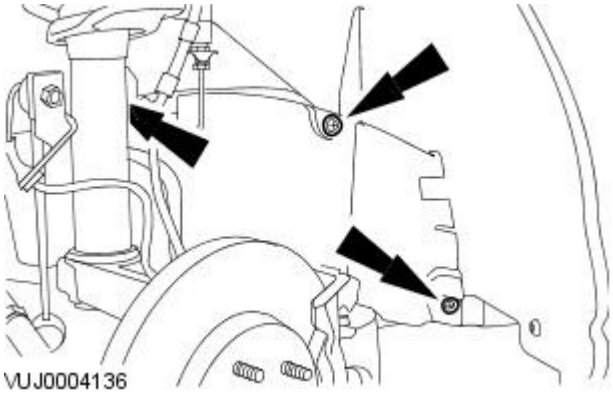
Removal and Installation

Special Tool(s)	
 303-703	Accessory Belt De-tensioner 303-703

Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 Battery, Mounting and Cables.

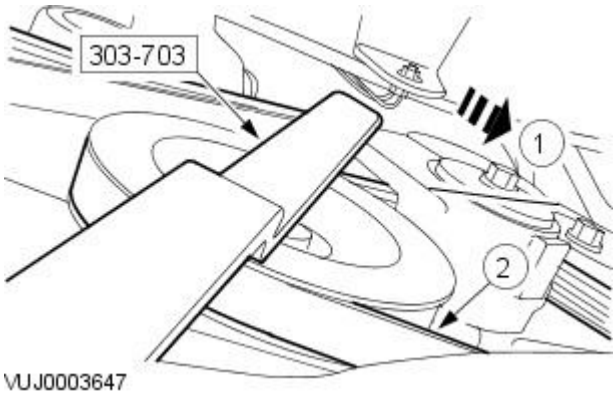
2. Remove the splash shield.


VUJ0004136

3. Remove the wheel and tire assembly. For additional information, refer to Section 204-04 Wheels and Tires.

4. Detach the accessory drive belt.

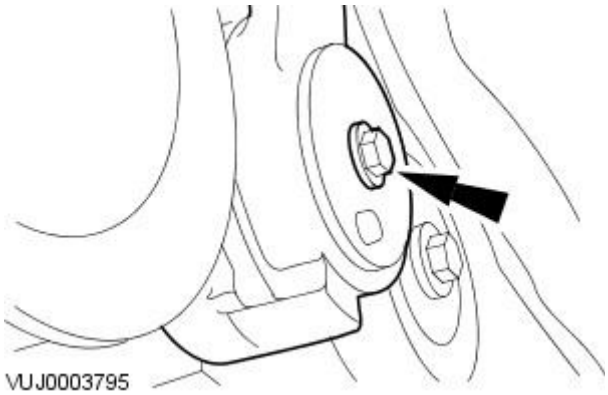
1. Using the special tool, de-tension the accessory drive belt.
2. Detach the accessory drive belt.



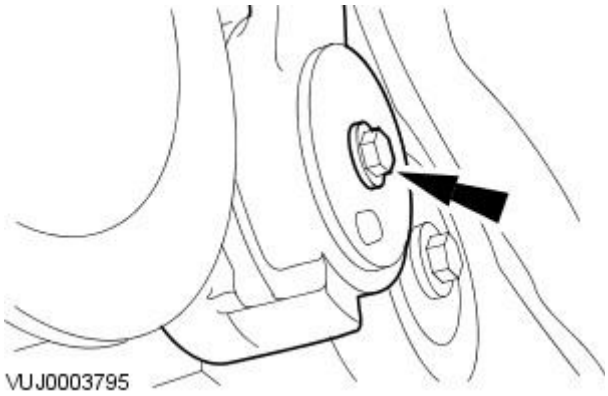
VUJ0003647

5. Remove the accessory drive belt.

1. Slacken the tensioner.
2. Remove the accessory drive belt.


VUJ0003795

Installation



1. To install, reverse the removal procedure.

- Tighten to 47 Nm.

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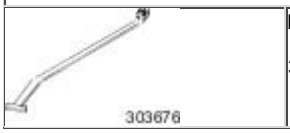
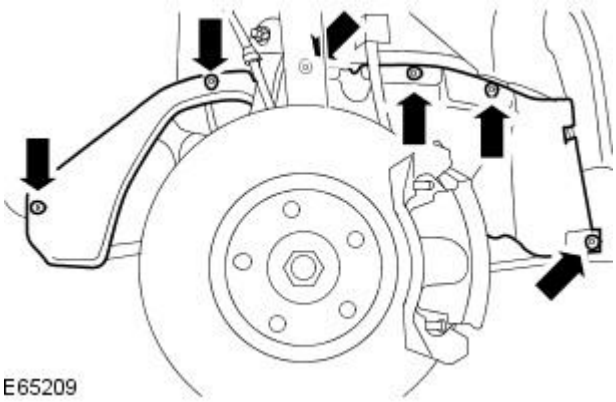
Accessory Drive - Accessory Drive Belt Tensioner2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma

Removal and Installation

Special Tool(s)	
 303676	Release tool, belt tensioner 303-676

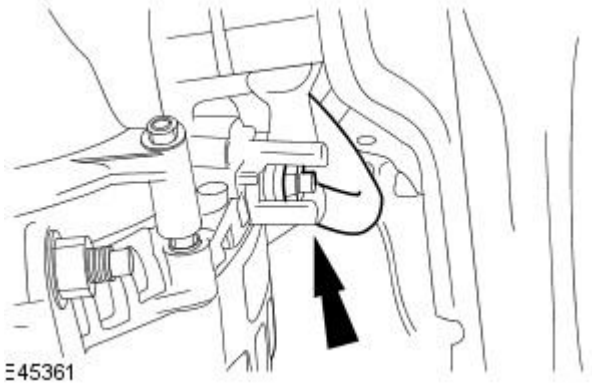
Removal

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 - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (501-02 Front End Body Panels, Removal and Installation).
3. Remove the right-hand road wheel.
   For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
4. Remove the right-hand wheel arch liner access panel.



5. Using the special tool, detach the accessory drive belt.

6. Detach the generator positive cable.

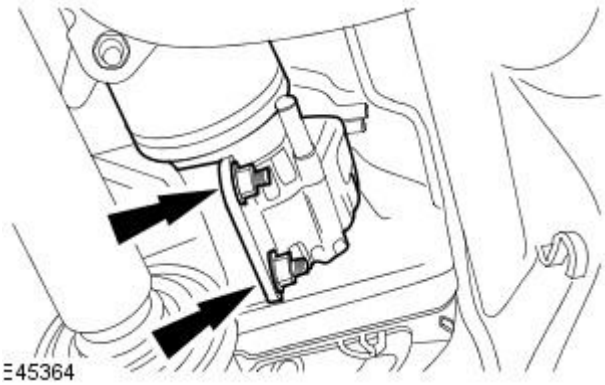



E45362

7. Disconnect the generator electrical connector.

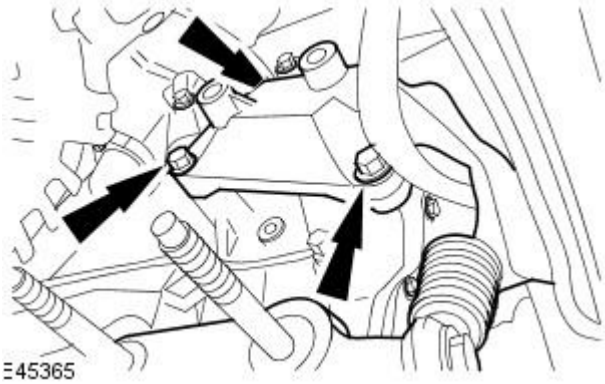

E45363

8. Remove the generator upper retaining bolt.

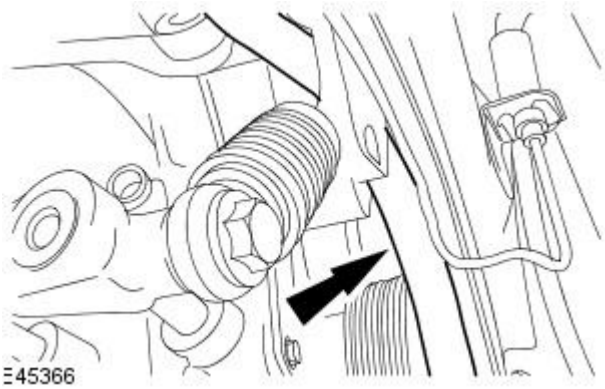

E45364

9. Detach the generator.

- Slide the generator rearwards as far away from the accessory drive belt tensioner assembly as possible.

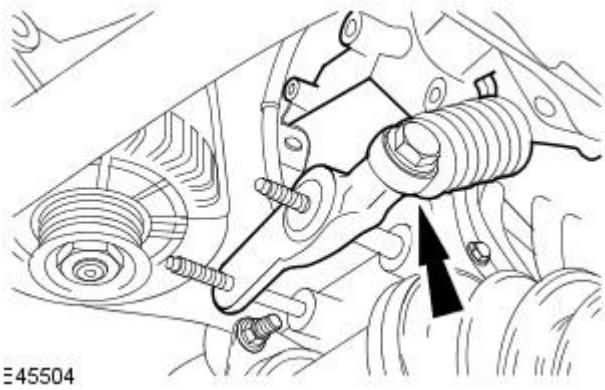

E45365

10. Detach the accessory drive belt tensioner assembly.


E45366

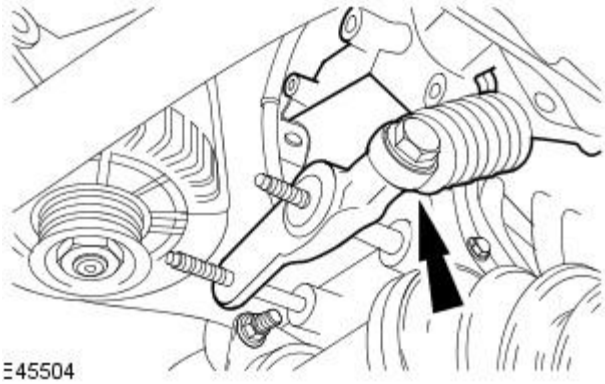
11. Detach the accessory drive belt.

12. Remove the accessory drive belt tensioner.

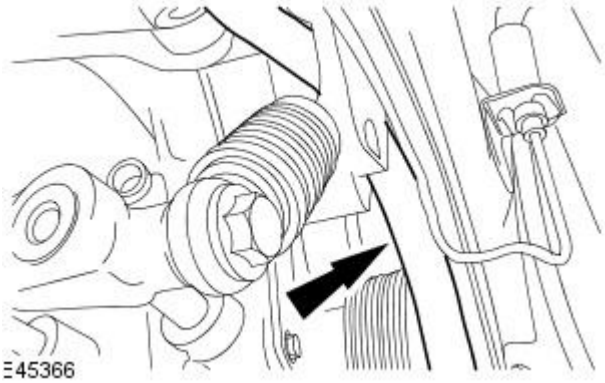


Installation

1. Install the accessory drive belt tensioner.

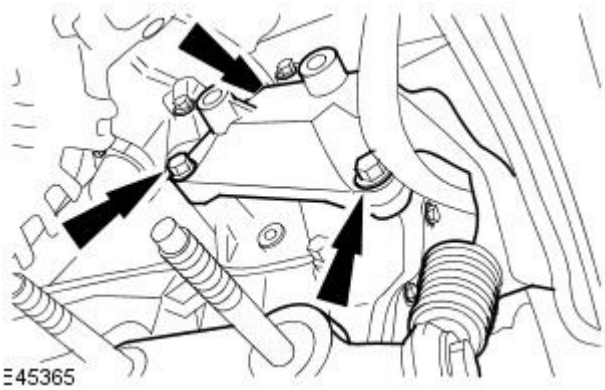


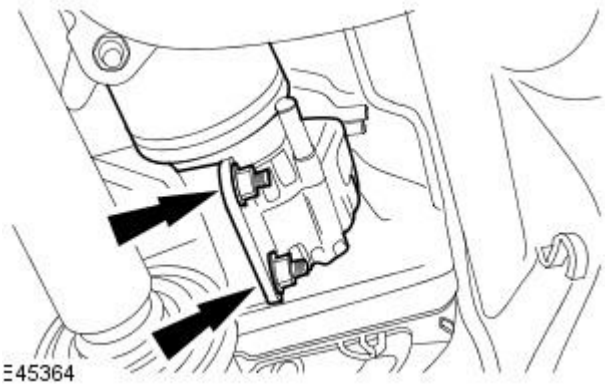
2. Attach the accessory drive belt.



3. Attach the accessory drive belt tensioner assembly.

- Tighten to 47 Nm.



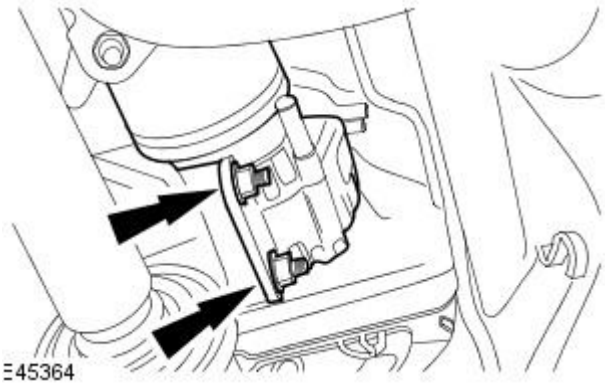


4. NOTE: Loosely install the generator retaining nuts.

Attach the generator.

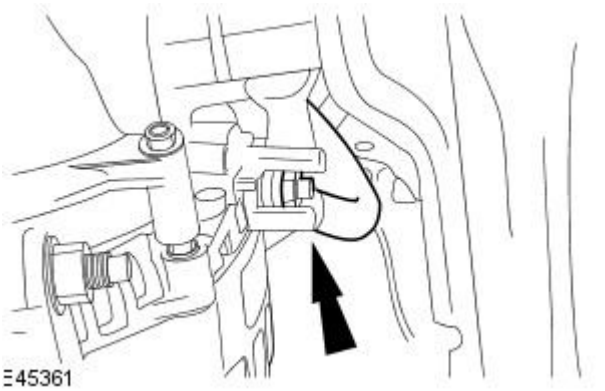
5. Install the generator retaining bolt.

- Tighten to 47 Nm.



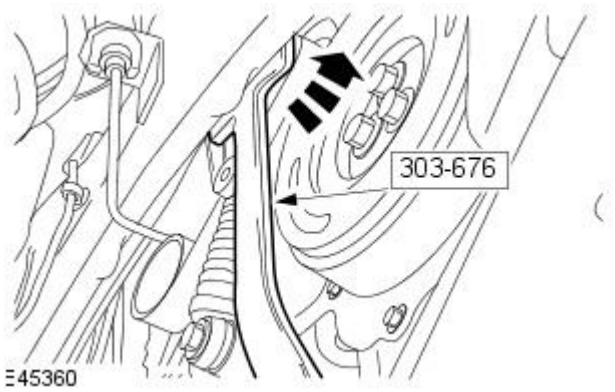
6. Tighten to 47 Nm.

7. Connect the generator electrical connector.

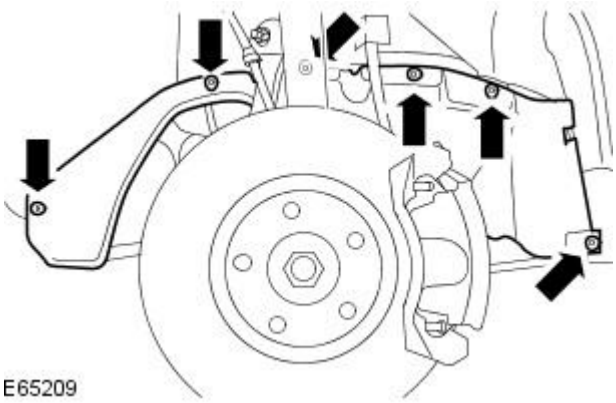


8. Attach the generator positive cable.

- Tighten to 8 Nm.



9. Using the special tool, install the accessory drive belt.



10. Install the right-hand wheel arch liner access panel.

11. Install the right-hand road wheel.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

12. Install the air deflector.
For additional information, refer to: Air Deflector - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (501-02 Front End Body Panels, Removal and Installation).

13. Connect the battery ground cable.
For additional information, refer to: Battery Connect (414-01 Battery, Mounting and Cables, General Procedures).

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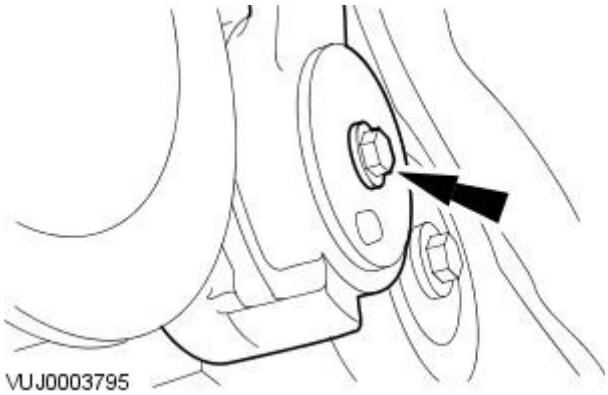
Accessory Drive - Accessory Drive Belt Tensioner2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

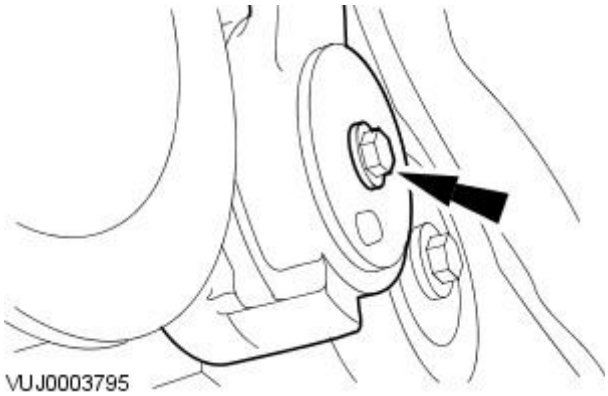
Removal and Installation

Removal



1. Remove the accessory drive belt. For additional information, refer to the Accessory Drive Belt.
2. Remove the accessory drive belt tensioner.

Installation



1. To install, reverse the removal procedure.
   - Tighten to 47 Nm.

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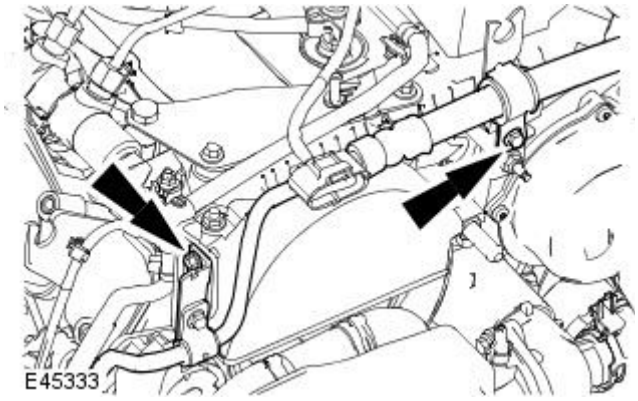
Accessory Drive - Power Steering Pump Belt2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma

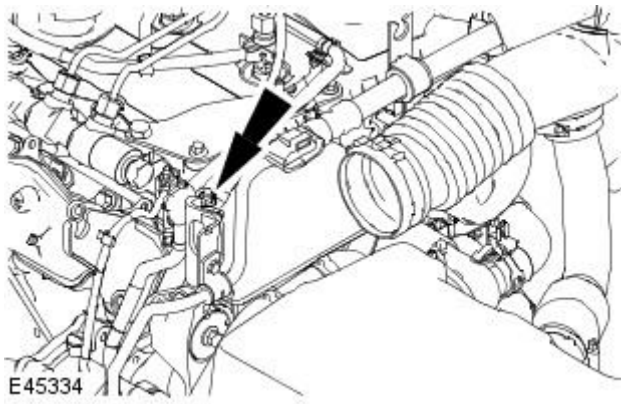
Removal and Installation

Removal

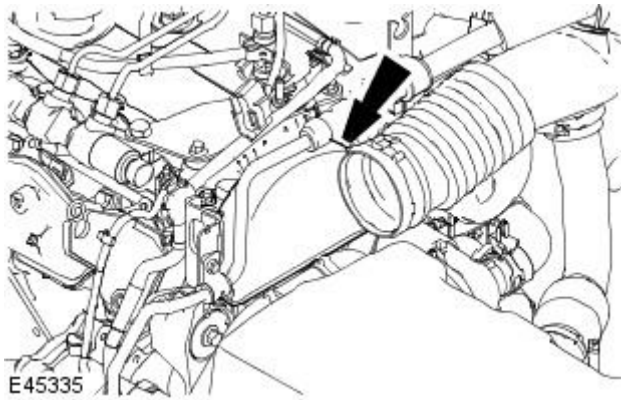
1. Remove the air cleaner assembly.
   For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
2. Detach the power steering fluid pipe.



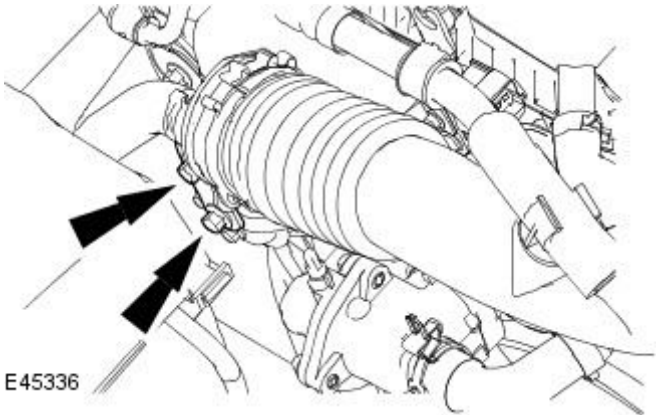
3. Remove the power steering pump belt cover retaining nut.

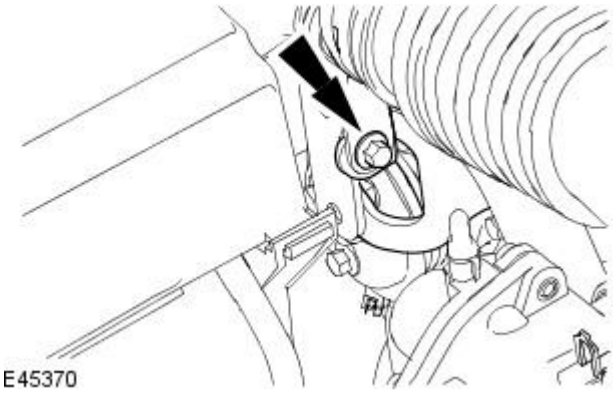


4. Remove the power steering pump belt cover.

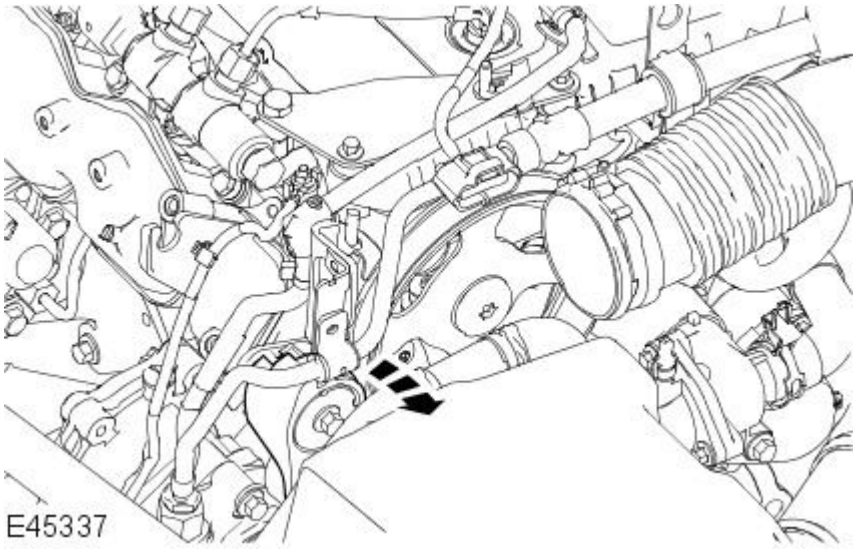


5. Remove the exhaust gas recirculation (EGR) cooler to EGR valve tube support bracket lower retaining bolts.





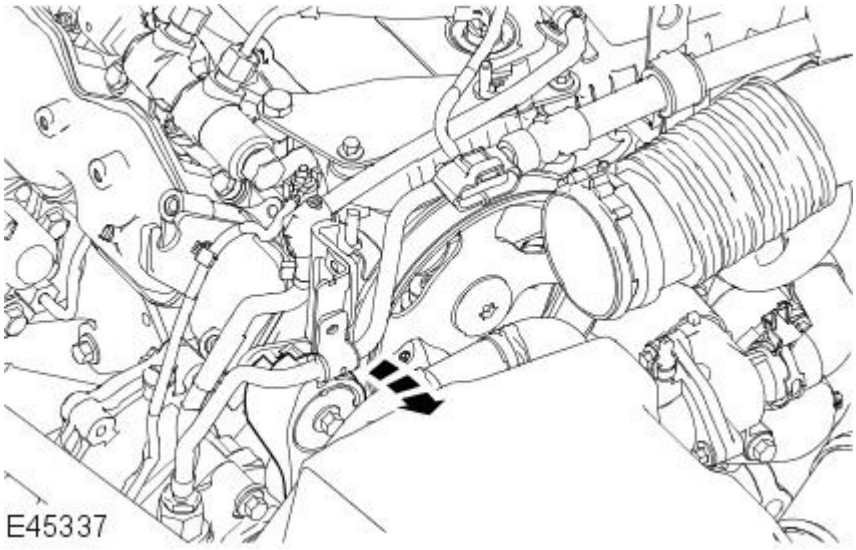
6. Remove the EGR cooler to EGR valve tube support bracket.



7. Remove the power steering pump belt.

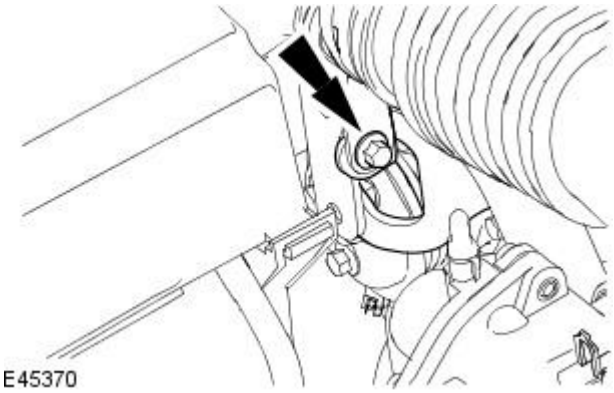
- Rotate the tensioner clockwise.

Installation



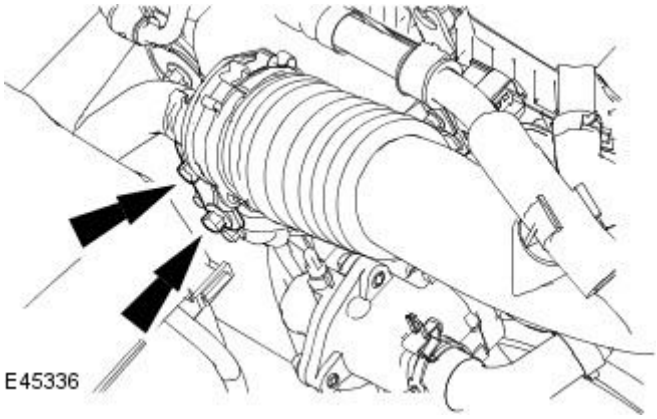
1. Install the power steering pump belt.

- Rotate the tensioner clockwise.



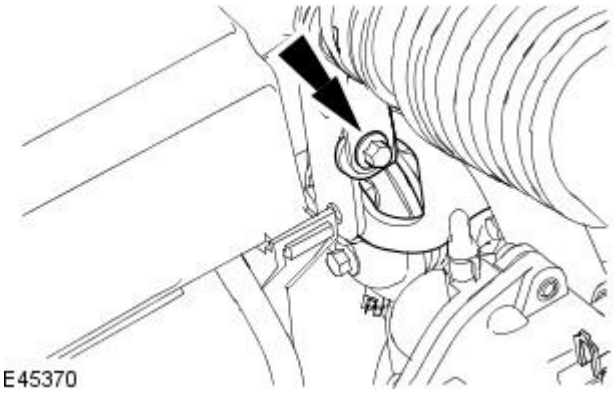
2. NOTE: Do not tighten the EGR cooler to EGR valve tube support bracket upper retaining bolt at this stage.

Install the EGR cooler to EGR valve tube support bracket.

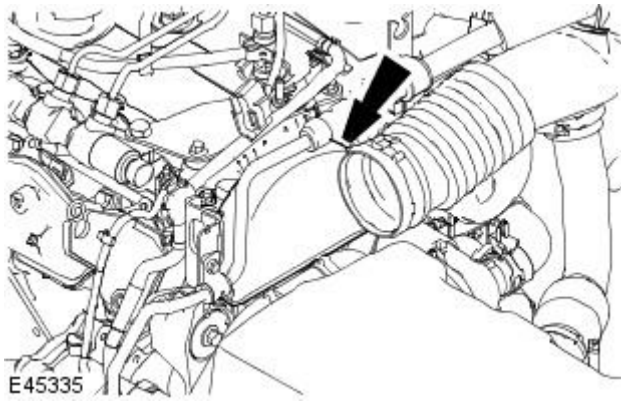


3. Install the EGR cooler to EGR valve tube support bracket lower retaining bolts.

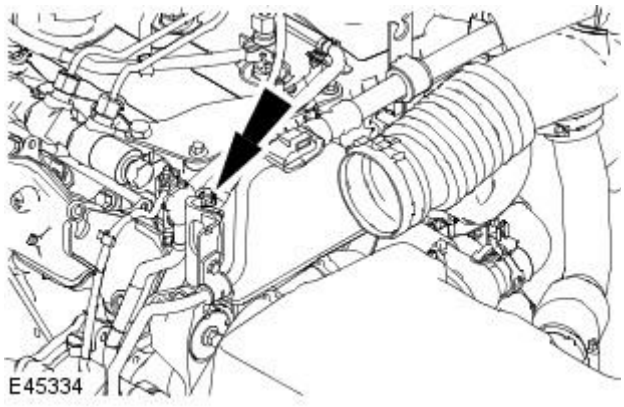
- Tighten to 23 Nm.



4. Tighten to 10 Nm.

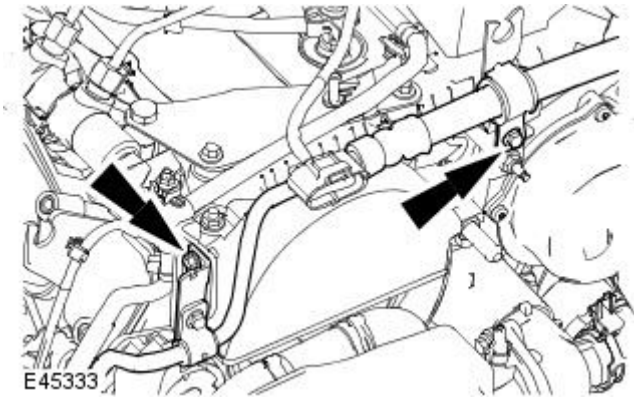


5. Install the power steering pump belt cover.



6. Install the power steering pump belt cover retaining nut.

- Tighten to 10 Nm.



7. Attach the power steering fluid pipe.

8. Install the air cleaner assembly.
For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

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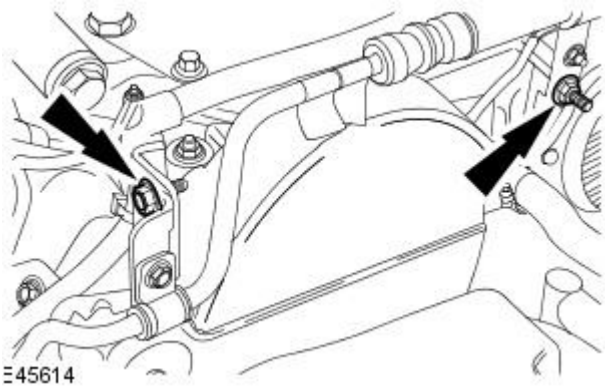
Accessory Drive - Power Steering Pump Belt Tensioner2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma

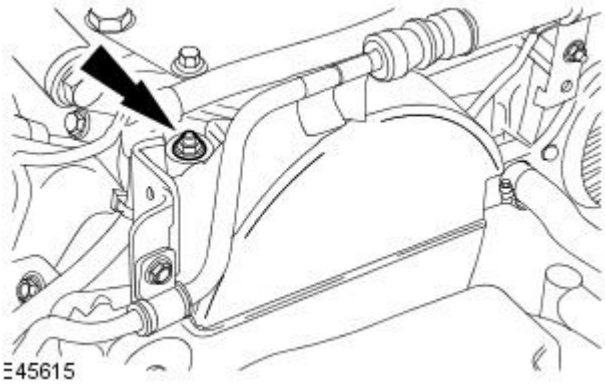
Removal and Installation

Removal

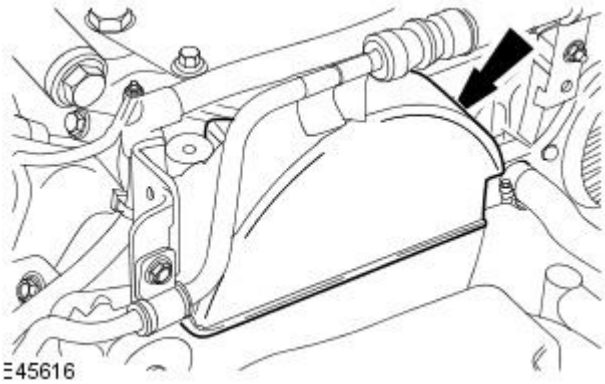
1. Remove the exhaust gas recirculation (EGR) cooler to EGR valve tube. For additional information, refer to: Exhaust Gas Recirculation (EGR) Cooler to EGR Valve Tube (303-08 Engine Emission Control - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
2. Detach the power steering fluid pipe.



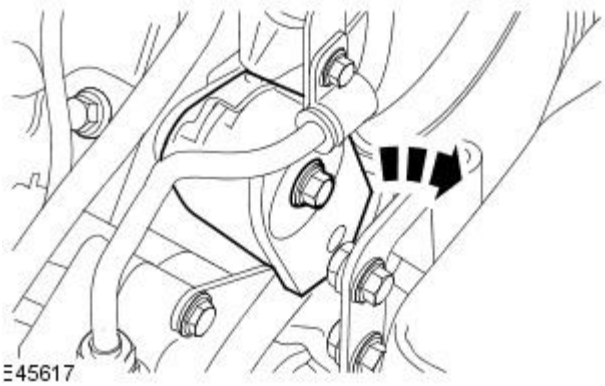
3. Remove the power steering pump belt cover retaining nut.

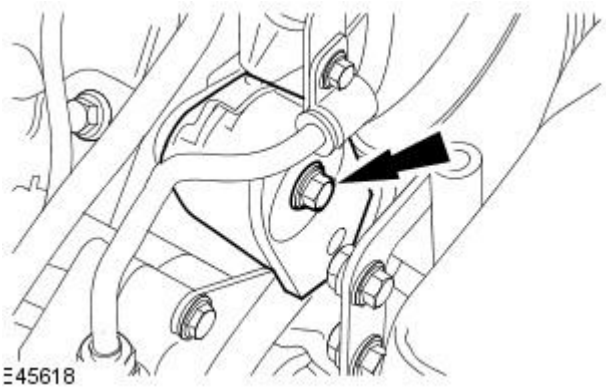


4. Remove the power steering pump belt cover.



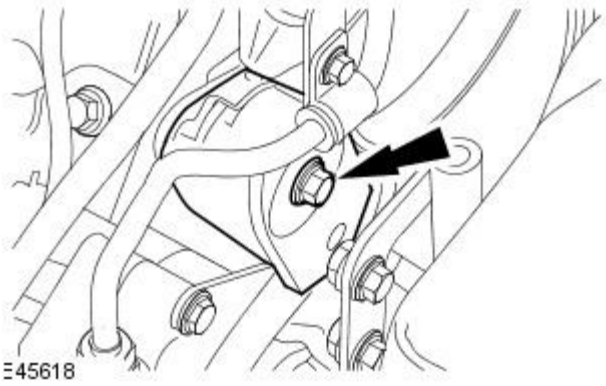
5. Detach the power steering pump belt.
   - Rotate the tensioner clockwise.





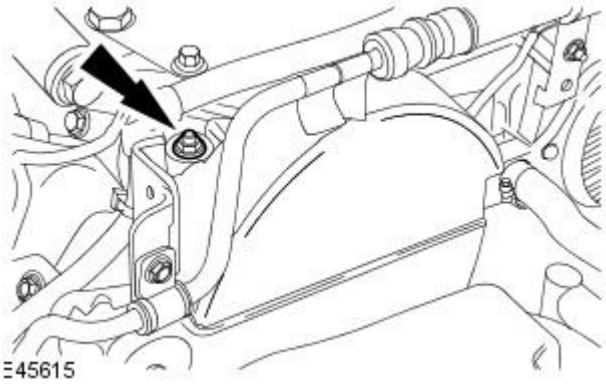
6. Remove the power steering pump belt tensioner.

Installation



1. To install, reverse the removal procedure.

- Tighten to 23 Nm.



2. Tighten to 10 Nm.

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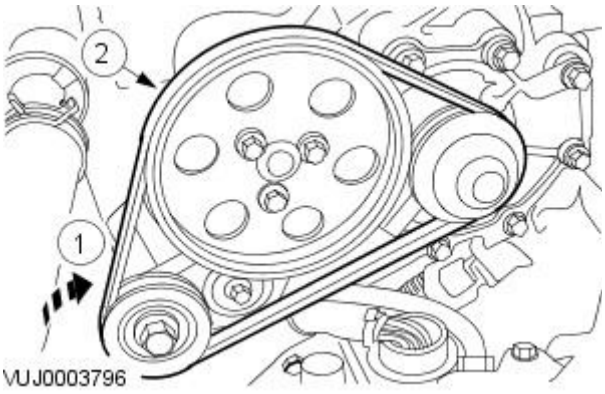
Accessory Drive - Water Pump Belt2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Removal and Installation

Removal



1. Remove the battery tray. For additional information, refer to Section 414-01 Battery, Mounting and Cables.
2. Remove the water pump belt.
    1. De-tension the water pump belt.
    2. Remove the water pump belt.

Installation

1. To install, reverse the removal procedure.

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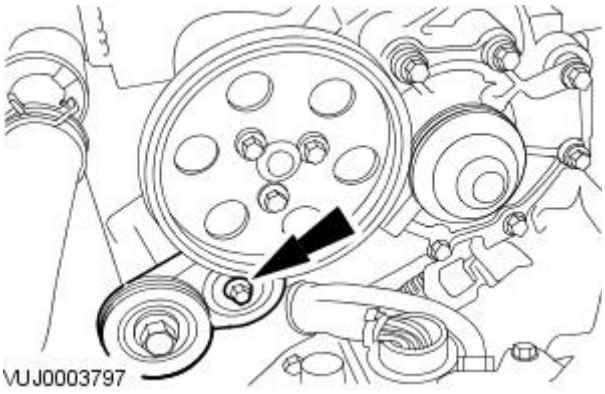
Accessory Drive - Water Pump Belt Tensioner2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

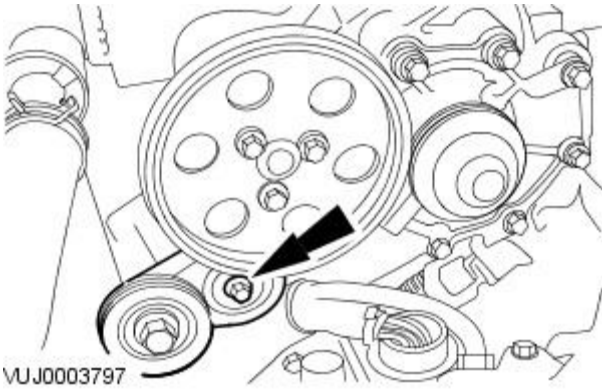
Removal and Installation

Removal



1. Remove the water pump belt. For additional information, refer to the Water Pump Belt.
2. Remove the water pump belt tensioner.

Installation



1. To install, reverse the removal procedure.
   - Tighten to 10 Nm.

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Starting System -

Torque Specifications

Description	Nm	lb-ft	lb-in
Starter motor retaining bolts - vehicles with 2.0L, 2.5L or 3.0L engines	35	26	-
Starter motor cable retaining nut - vehicles with 2.0L, 2.5L or 3.0L engines	12	9	-
Solenoid cable retaining nut - vehicles with 2.0L, 2.5L or 3.0L engines	6	-	53
Starter motor retaining bolts - vehicles with 2.0L and 2.2L diesel engine	25	18	-
Starter motor electrical connector retaining nut - vehicles with 2.0L and 2.2L diesel engine	12	9	-
Starter motor solenoid electrical connector retaining nut - vehicles with 2.0L and 2.2L diesel engine	6	-	53
Vacuum solenoid valves and vacuum reservoir mount bracket securing bolts - vehicles with 2.0L and 2.2L diesel engine	23	17	-

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Starting System - Starting System

Description and Operation

The function of the starting system is to crank the engine fast enough to allow the engine to start. Heavy cables, connectors and switches are used in the system because of the large currents required.

The starting system consists of a pre-engaged type starter motor, battery, remote control switch (ignition switch) and relay. The operation of the starter relay is controlled by the engine control module (ECM).

To protect the starter motor from damage, the ECM prevents the starter from being engaged when the engine is running. This is done by the ECM inhibiting the starter relay operation.

Vehicles equipped with automatic transmission have a transmission range sensor attached to the circuit which prevents operation of the starter motor unless NEUTRAL or PARK are selected.

USA market vehicles equipped with manual transmission have a clutch pedal start inhibit switch which prevents operation of the starter motor unless the clutch pedal is operated.

The ECM will only operate the starter relay providing the following conditions are met:

- The ignition switch has been in the start position for a predetermined time
- The security response between the ECM and the instrument cluster (IC) has passed
- The engine is not running
- The transmission range switch is in the NEUTRAL or PARK position (vehicles fitted with automatic transmission)
- The clutch pedal is operated (USA vehicles fitted with manual transmission)

The starter relay remains energized until one of the following occur:

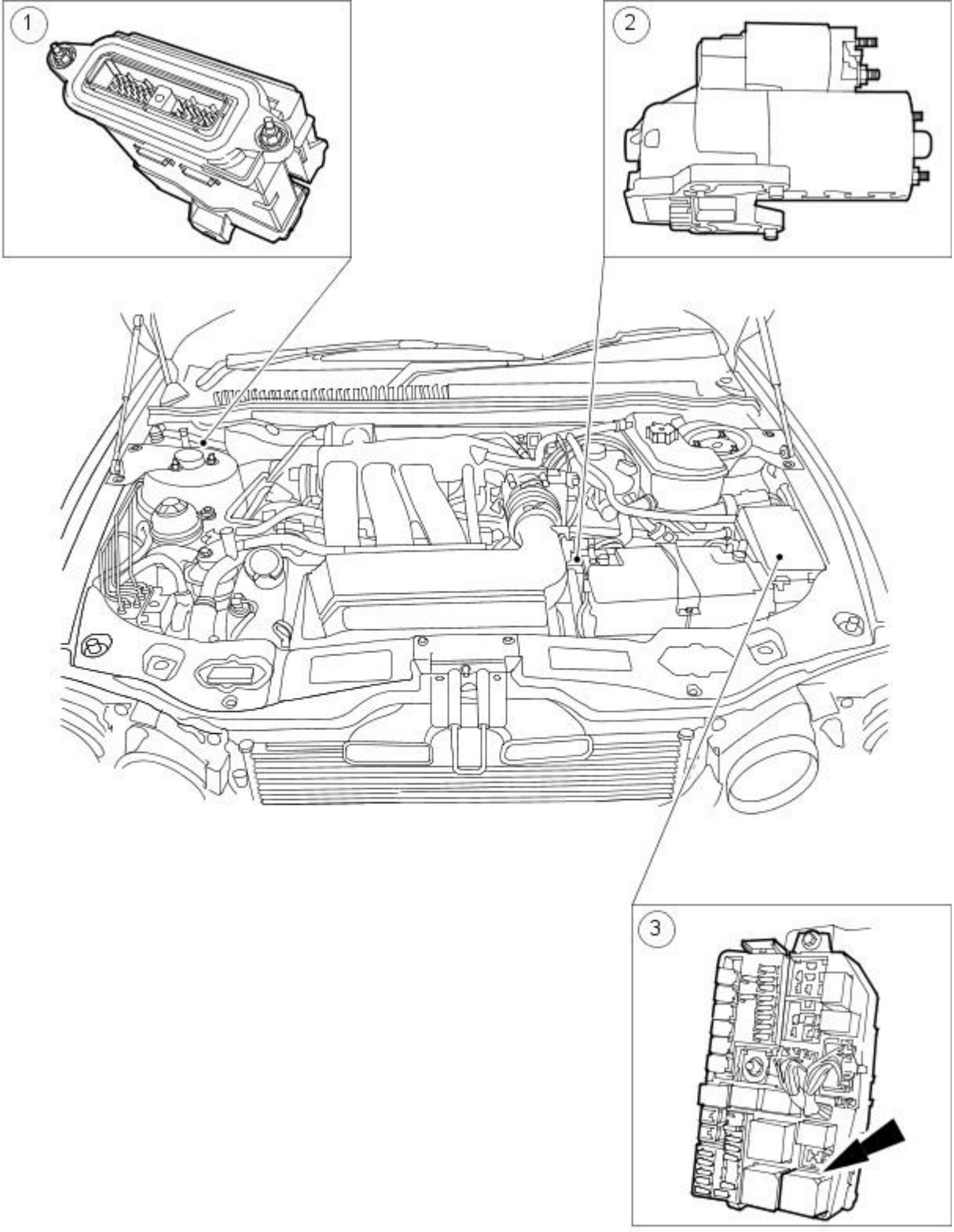
- The maximum cranking time is exceeded
- The ECM detects an engine running signal
- The ignition switch is no longer in the start position
- The transmission range switch is no longer in the NEUTRAL or PARK position (vehicles fitted with automatic transmission)
- The clutch pedal is released (USA vehicles fitted with manual transmission)
- The set engine speed is reached (vehicles with 2.0L engine)
- The vehicle is cranked for 30 seconds and the engine has failed to start

With the ignition switch in the start position, providing the ECM start conditions are met, the starter relay is energized and the engagement lever moves the pinion into mesh with the engine ring gear teeth. The electrical contacts within the solenoid complete the high power circuit and the starter motor operates to turn the engine.

The sequence of operation is as follows:

- Ignition switch in the start position
- Starter relay activated by the ECM
- Voltage provided to the starter motor solenoid
- Starter solenoid engages the drive pinion to the ring gear
- Starter solenoid switches the battery current to the starter motor
- The starter remains engaged until the ECM start conditions are no longer met

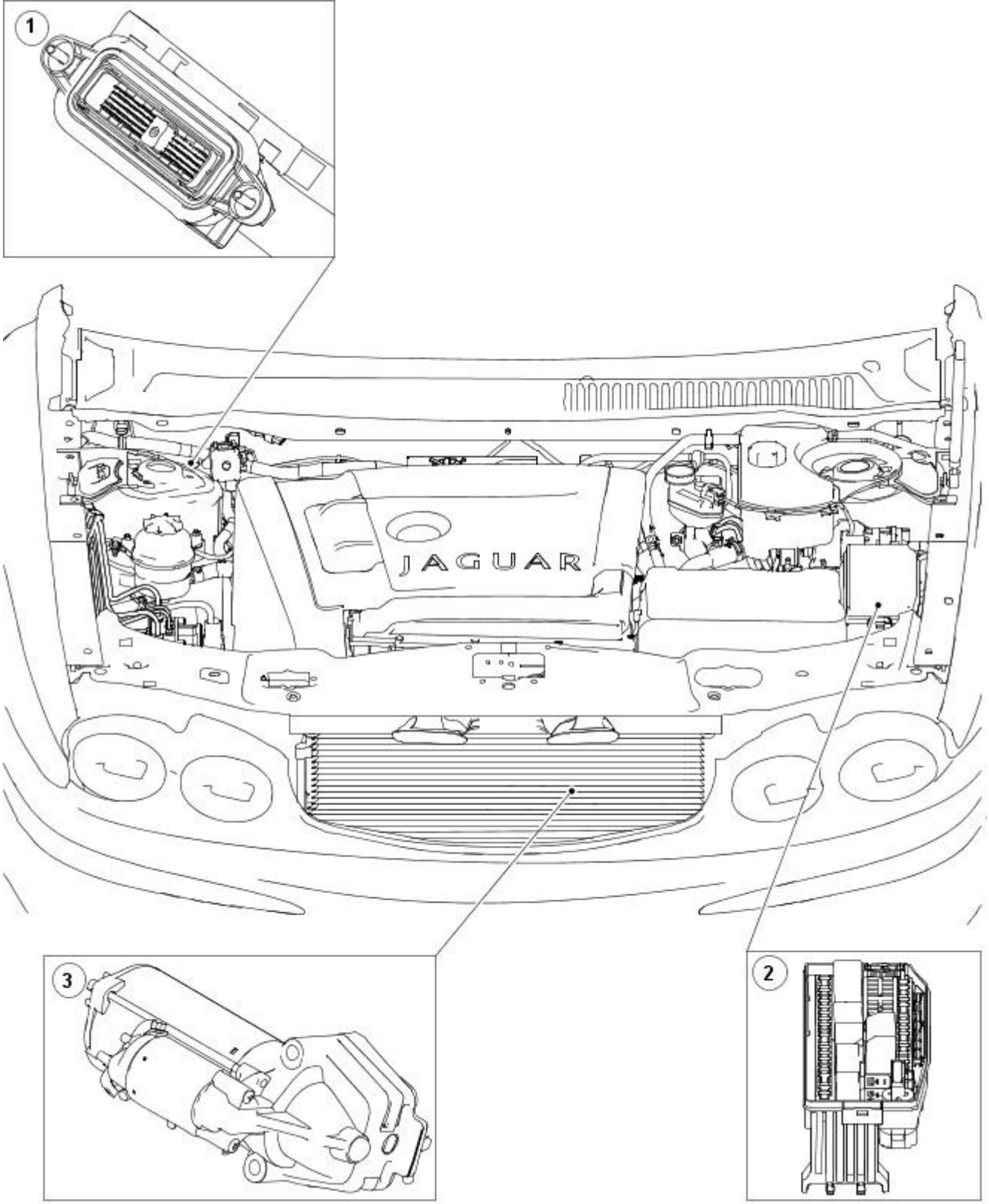
Vehicles with 2.0L, 2.5L or 3.0L engines



VUJ0003535

Item	Part Number	Description
1	—	Engine control module (ECM)
2	—	Starter motor
3	—	Starter motor relay

Vehicles with 2.0L and 2.2L diesel engines



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Item	Part Number	Description
1	—	Engine control module (ECM)
2	—	Starter motor relay
3	—	Starter motor

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Starting System - Starting System2.0L NA V6 - AJV6

Diagnosis and Testing

 WARNING: Beware of rotating parts. Failure to follow these instructions may result in personal injury.

1. **1.** Visually inspect for obvious signs of mechanical and electrical damage.
2. **2.** Verify the customer concern by operating the system.
3. **3.** Make sure the vehicle is in NEUTRAL or PARK for automatic vehicles, NEUTRAL for manual vehicles.

Mechanical	Electrical
• Starter Motor • Flywheel Ring Gear • Engine Seized	• Starter Motor • Battery • Fuse 28 (30A) • Fuse 29 (30A) • Fuse 92 (10A) • Starter relay • Transmission range switch • Wiring harness(es) • Damaged, loose or corroded connectors • Engine control module (ECM)

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.** The DTC summaries are generated to support the Jaguar approved diagnostic system, but also provide the basis for diagnosis of OBD related concerns using a suitable generic scan tool, in conjunction with the electrical guides. Until the DTC summaries and electrical guides are available, the starting system can only be diagnosed using the Jaguar approved diagnostic system, other than basic electrical faults. For additional information, refer to Dealer technical support.

Starting System - Starting System2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Diagnosis and Testing

1. **1.** Verify the customer concern by operating the system.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.
3. **3.** Make sure the vehicle is in NEUTRAL or PARK for automatic vehicles, NEUTRAL for manual vehicles.
4. **4.** Make sure the clutch pedal is fully depressed for Federal manual vehicles.

Visual Inspection Chart

Mechanical	Electrical
• Starter Motor • Flywheel Ring Gear • Engine Seized	• Starter Motor • Battery • Fuse 28 (15A) • Fuse 29 (30A) • Fuse 92 (10A) • Starter relay • Transmission range switch • Clutch switch; manual transmission (USA only) • Wiring harness(es) • Damaged, loose or corroded connectors • Engine control module (ECM)

5. **5.** If an obvious cause for an observed or reported concern is found, correct the cause, (if possible) before proceeding to the next step.
6. **6.** If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

DTC	Condition	Possible Sources	Action
P0616, P0617	The engine does not crank.	• Battery. • Circuit. • Starter motor. • Relay. • Inertia switch. • Ignition switch. • Transmission range switch (automatic transmission). • Clutch switch; manual transmission (USA only).	GO to Pinpoint Test A.
None.	The engine cranks slowly.	• Battery. • Circuit. • Starter motor.	GO to Pinpoint Test B.
None.	Unusual starter motor noise.	• Starter motor. • Flywheel ring gear.	INSPECT flywheel ring gear. For additional information, REFER to Section 303-00 Engine System - General Information. INSPECT starter motor for alignment, cracked case. Make sure the mounting bolts are tightened. If necessary, INSTALL a new starter motor.
None.	The starter spins, but the engine does not crank.	• Starter motor. • Flywheel ring gear.	INSPECT the flywheel ring gear for missing teeth. REFER to Section 303-00 Engine System - General Information. INSPECT starter motor pinion gear for missing teeth. CHECK starter motor for correct mounting. If concern persists, INSTALL a new starter motor.

PINPOINT TEST A : P0616, P0617. THE ENGINE DOES NOT CRANK

WARNING: Beware of rotating parts. Failure to follow these instructions may result in personal injury.

• NOTE: Make sure the vehicle is in NEUTRAL or PARK for automatic vehicles, NEUTRAL for manual vehicles. Make sure the clutch pedal is fully depressed for Federal manual vehicles.

• NOTE: Check that the inertia switch has not tripped.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE BATTERY	
	1 Check the battery. For additional information. REFER to Section 414-00 Battery and Charging System - General Information.
	Is the battery OK? **Yes** GO to A2. **No** INSTALL a new battery. REFER to Section 414-01 Battery, Mounting and Cables. CLEAR the DTC. TEST the system for normal operation.
A2: CHECK THE STARTER RELAY	
	1 Turn the ignition switch to the CRANK position.
	Does the starter relay make an audible click? **Yes** GO to A16. **No** GO to A3.
A3: CHECK FOR CRANK SUPPLY VOLTAGE TO STARTER RELAY	
	1 Remove the starter relay.
	2 Turn the ignition switch to the CRANK position, and hold.
	3 Measure the voltage between terminal 1 of the relay base and GROUND.

	Is the voltage greater than 10 volts? **Yes** GO to A20. **No** GO to A4.
A4: CHECK FOR CRANK SUPPLY VOLTAGE TO ECM	
	1 Disconnect the ECM electrical connector EN16.
	2 Turn the ignition switch to the CRANK position, and hold.
	3 Measure the voltage between EN16 pin 6 (Y) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to A6. **No** GO to A5.
A5: CHECK FUSE 28 IN THE ENGINE COMPARTMENT FUSE BOX.	
	1 Check the fuse.
	Is the fuse OK? **Yes** CHECK and repair the circuit including the power distribution fuse box, the starter relay base pin 1 and EN16 pin 6. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ignition switch) **No** INSTALL a new fuse. TEST the circuit for cause of fuse failure.GO to A6.
A6: CHECK ECM GROUND SIGNAL TO STARTER RELAY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the CRANK position.
	3 Measure the resistance between terminal 2 of the relay base and GROUND.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new starter relay. For additional information, refer to the Electrical guide. CLEAR the DTC. TEST the system for normal operation. **No** GO to A7.
A7: CHECK ECM GROUND SIGNAL CIRCUIT FOR CONTINUITY	
	1 Disconnect the ECM electrical connector EN16.
	2 Measure the resistance between terminal 2 of the starter relay base and EN16 pin 41 (GO).
	Is the resistance less than 5 ohms? **Yes** Automatic transmission vehicles.GO to A8. Manual transmission vehicles.GO to A12. Federal spec. manual transmission vehicles.GO to A13. **No** REPAIR the circuit between the starter relay and the ECM. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
A8: CHECK FOR IGNITION VOLTAGE TO TRANSMISSION RANGE SENSOR	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between JB156 pin 10 and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to A11. **No** GO to A9.
A9: CHECK FUSE 92 IN THE CENTRAL JUNCTION FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** Repair the circuit between the power distribution fuse box and the transmission range switch. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the central junction fuse box, inertia switch, ignition switch, ignition relay, and power distribution fuse box (Fuse 28, See test A5)) **No** INSTALL a new fuse. TEST the circuit for cause of fuse failure. CLEAR the DTC. TEST the system for normal operation.
A10: CHECK THE CIRCUIT BETWEEN TRANSMISSION RANGE SENSOR AND ECM FOR CONTINUITY	
	1 Measure the resistance between EN16 pin 31 (B) and JB156 pin 6 (B).
	Is the resistance less than 5 ohms? **Yes** GO to A11. **No** REPAIR the circuit between EN16 pin 31 (B) and JB156 pin 6 (B). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
A11: CHECK THE TRANSMISSION RANGE SENSOR	
	1 Disconnect the transmission range sensor electrical connector JB156.
	2 Select PARK or NEUTRAL.
	3 Measure the resistance between pins 6 and 10 of the TR sensor.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new ECM. REFER to Section 303-14A Electronic Engine Controls / 303-14B Electronic Engine Controls. Before replacing a ECM, contact Dealer technical support. **No** INSTALL a new transmission range sensor. REFER to Section 307-01A Automatic Transmission/Transaxle / 307-01B Automatic Transmission/Transaxle. CLEAR the DTC. TEST the system for normal operation.
A12: CHECK FOR IGNITION VOLTAGE TO ECM	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between EN16 pin 31 (B) and GROUND.

	Is the voltage greater than 10 volts? **Yes** INSTALL a new ECM. REFER to Section 303-14A Electronic Engine Controls / 303-14B Electronic Engine Controls. Before replacing a ECM, contact Dealer technical support. **No** REPAIR the circuit between the ECM and the power distribution fuse box. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the central junction fuse box, inertia switch, ignition switch, ignition relay, and power distribution fuse box (Fuse 28, See test A5))
A13: CHECK FOR IGNITION VOLTAGE TO CLUTCH SWITCH; MANUAL TRANSMISSION (USA ONLY)	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the clutch switch electrical connector PA5 pin 1 (B) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to A15. **No** Repair the circuit between the power distribution fuse box and the clutch switch. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the central junction fuse box, inertia switch, ignition switch, and power distribution fuse box (Fuse 28, See test A5))
A14: CHECK THE CLUTCH SWITCH CIRCUIT FOR CONTINUITY; MANUAL TRANSMISSION (USA ONLY).	
	1 Disconnect the clutch switch electrical connector PA5.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between PA5 pin 2 (W) and EN16 pin 31 (B).
	Is the resistance less than 5 ohms? **Yes** GO to A15. **No** REPAIR the circuit between PA5 pin 2 (W) and EN16 pin 31 (B). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
A15: CHECK THE CLUTCH SWITCH; MANUAL TRANSMISSION (USA ONLY).	
	1 Measure the resistance between PA5 pins 1 and 2.
	2 Operate the clutch pedal while observing the ohmmeter reading.
	Does the resistance switch between 0 ohms and 10,000 ohms as the pedal is operated? **Yes** INSTALL a new ECM. REFER to Section 303-14A Electronic Engine Controls / 303-14B Electronic Engine Controls. Before replacing a ECM, contact Dealer technical support. **No** INSTALL a new clutch switch. CLEAR the DTC. TEST the system for normal operation.
A16: CHECK THE STARTER SOLENOID INPUT	
• NOTE: The starter motor will disengage once a start is detected by the ECM.	
	1 Turn the ignition switch to the CRANK position.
	2 Measure the voltage between starter motor connector ST3 and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to A20. **No** GO to A17.
A17: CHECK THE STARTER SOLENOID INPUT CIRCUIT FOR CONTINUITY	
	1 REMOVE the starter relay.
	2 Disconnect starter motor connector ST3
	3 Measure the resistance between ST3 and pin 5 of the starter relay base.
	Is the resistance less than 5 ohms? **Yes** GO to A18. **No** REPAIR the circuit between ST3 and pin 5 of the starter relay base. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
A18: CHECK THE STARTER RELAY BASE PIN 3 FOR PERMANENT SUPPLY	
	1 Measure the voltage between the starter relay base pin 3 and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to A20. **No** GO to A19.
A19: CHECK FUSE 29 OF THE POWER DISTRIBUTION FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** REPAIR the circuit between the starter relay base pin 3 and the battery. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. Check the circuit for cause of fuse failure. CLEAR the DTC. TEST the system for normal operation.
A20: CHECK THE STARTER FOR BATTERY VOLTAGE	
	1 Measure the voltage between the starter connector ST2 and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to A21. **No** REPAIR the starter motor permanent live supply circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
A21: CHECK THE STARTER GROUND	
	1 Measure the resistance between starter outer casing and GROUND.
	Is the resistance less than 2 Ohms? **Yes** INSTALL a new starter motor. REFER to Section 303-06 Starting System. CLEAR the DTC. TEST the system for normal operation.

	No REPAIR starter GROUND strap or connections. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST B : THE ENGINE CRANKS SLOWLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK FOR VOLTAGE DROP	
	 WARNING: Beware of rotating parts. Failure to follow these instructions may result in personal injury.
• NOTE: The starter motor will disengage once a start is detected by the ECM.	
• NOTE: Check battery condition before commencing this test.GO to Pinpoint Test A.	
	1 Turn the ignition switch to the CRANK position, and hold.
	2 Measure the voltage between the starter motor permanent voltage supply terminal and the positive battery terminal while cranking.
	Is the voltage less than 0.5 volts? **Yes** Turn the ignition switch to the OFF position. GO to B2. **No** CLEAN and TIGHTEN all positive battery cable connections. TEST the system for normal operation. If the concern persists, INSTALL a new positive battery cable. REFER to Section 414-01 Battery, Mounting and Cables.
B2: CHECK FOR GROUND CONNECTION VOLTAGE DROP	
	1 Turn the ignition switch to the CRANK position, and hold.
	2 Measure the voltage between the starter motor case and the battery negative terminal.
	Is the voltage less than 0.5 volts? **Yes** INSTALL a new starter motor. REFER to Section 303-06 Starting System. TEST the system for normal operation. **No** CLEAN and TIGHTEN all negative battery cable connections, starter motor mounting and starter motor GROUND cable. TEST the system for normal operation. If the concern persists, INSTALL a new negative battery cable. REFER to Section 414-01 Battery, Mounting and Cables.

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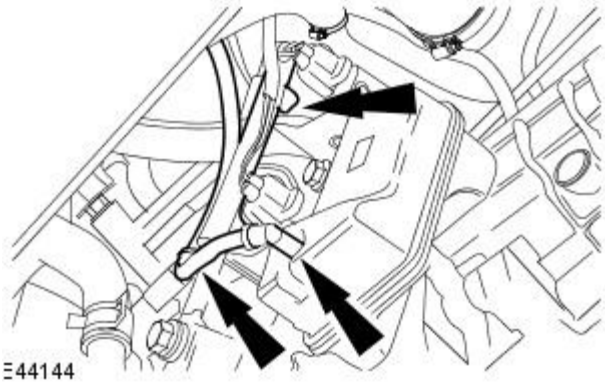
Starting System - Starter Motor2.0L Duratorq-TDCi

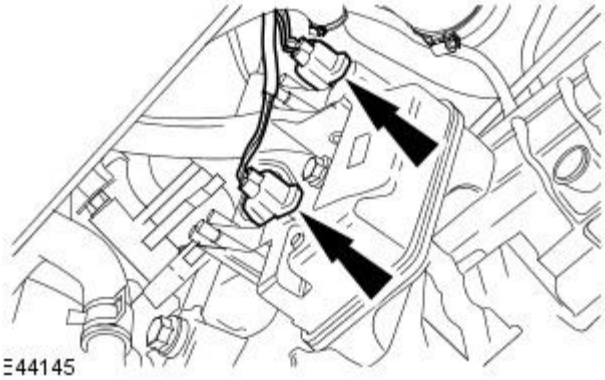
Removal and Installation

Removal

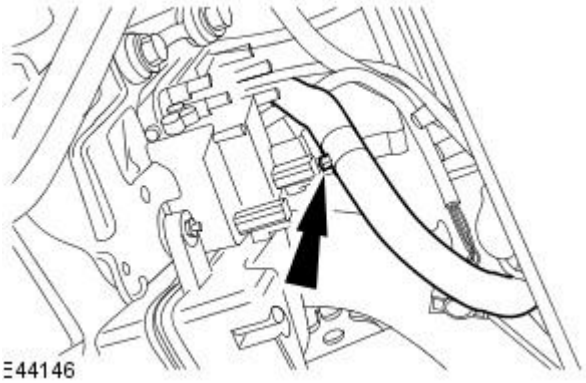
1. Disconnect the battery.
   For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the air deflector.
   For additional information, refer to: Air Deflector - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (501-02 Front End Body Panels, Removal and Installation).
3. Disconnect the vacuum pipes from the vacuum solenoid valves and the vacuum reservoir.



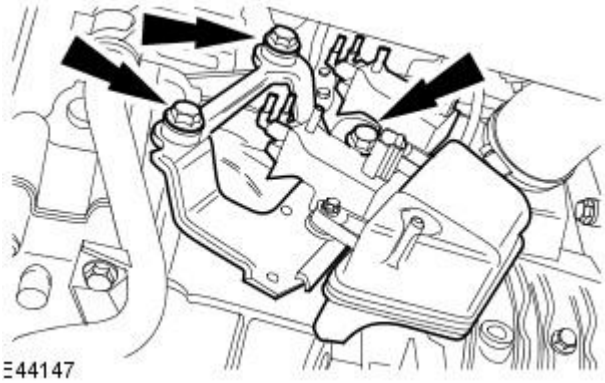
4. Disconnect the vacuum solenoid valves electrical connectors.

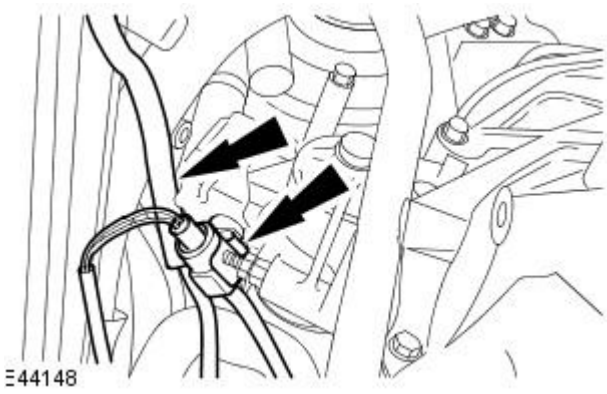


5. Detach the wiring harness from the vacuum solenoids and vacuum reservoir mount bracket.

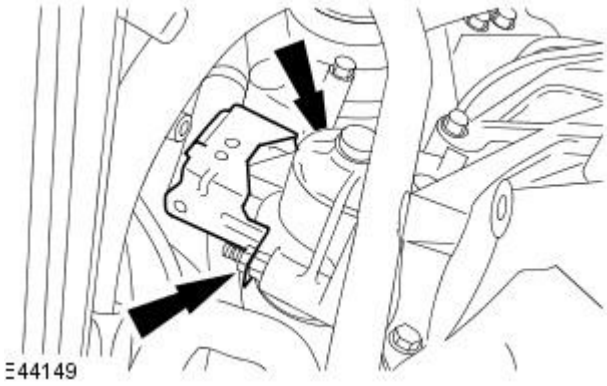


6. Remove the vacuum solenoids and vacuum reservoir mount bracket assembly.

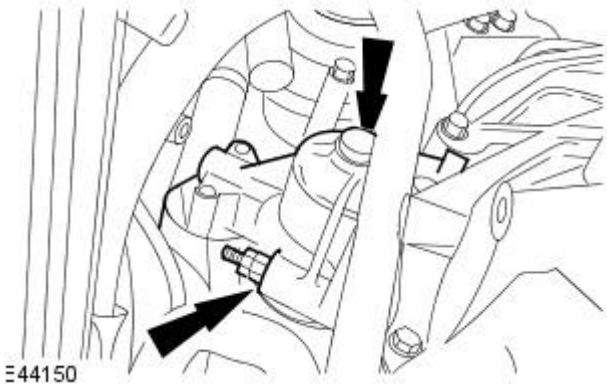




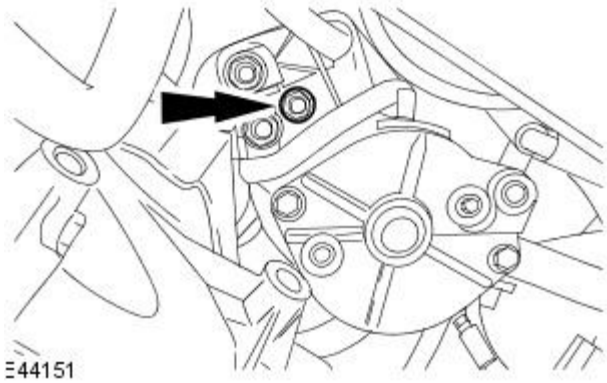
7. Detach the wiring harness retaining clips from the wiring harness support bracket.



8. Remove the wiring harness support bracket.



9. Detach the starter motor.

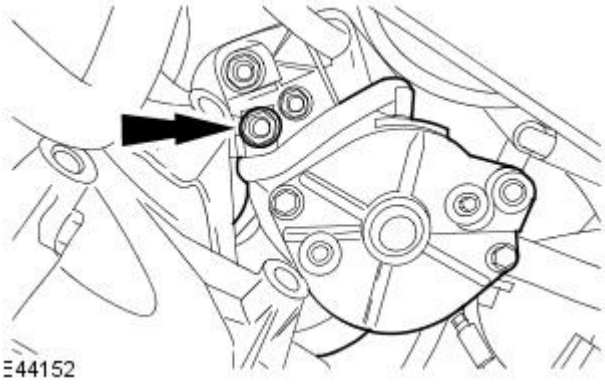


10. Position the starter motor to provide access to the starter motor cables.

11. Remove the starter motor solenoid cover and electrical connector retaining nut.

12. Remove the starter motor.

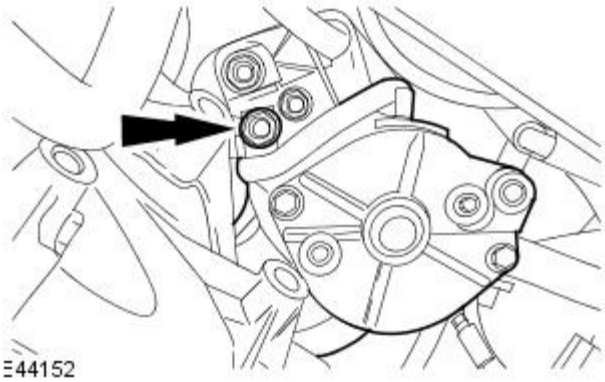
- Remove the starter motor electrical connector retaining nut.



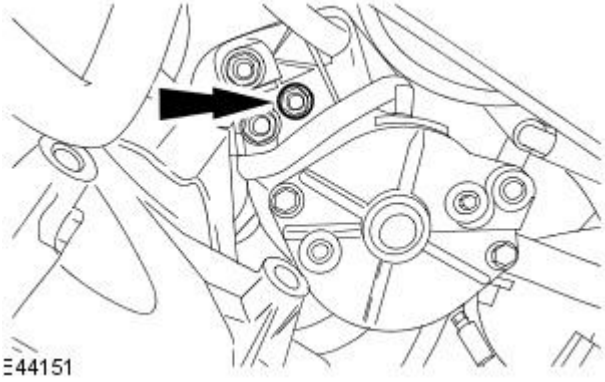
Installation

1. To install, reverse the removal procedure.

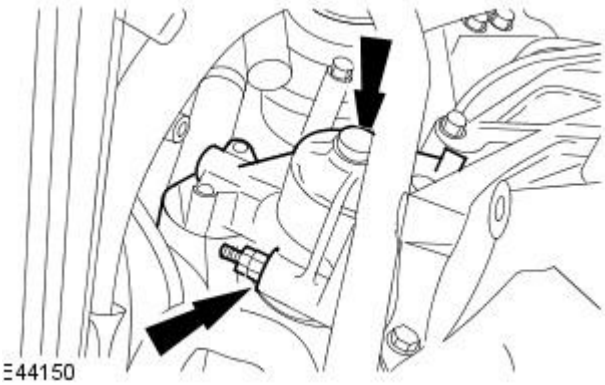
- Tighten to 12 Nm.

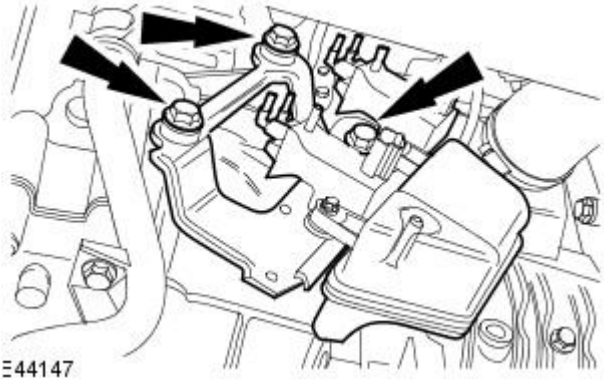


2. Tighten to 6 Nm.



3. Tighten to 25 Nm.





4. Tighten to 23 Nm.

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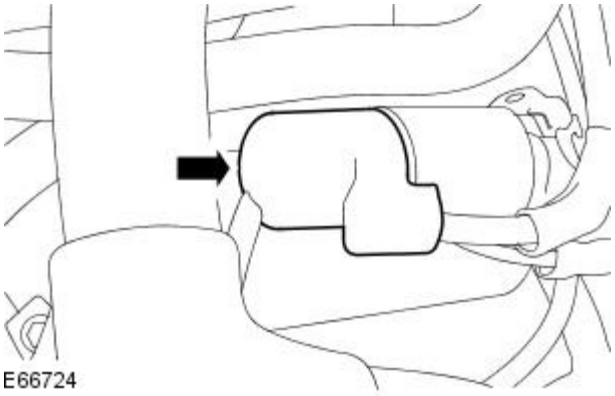
Starting System - Starter Motor2.2L Duratorq-TDCi (110kW/150PS) - Puma

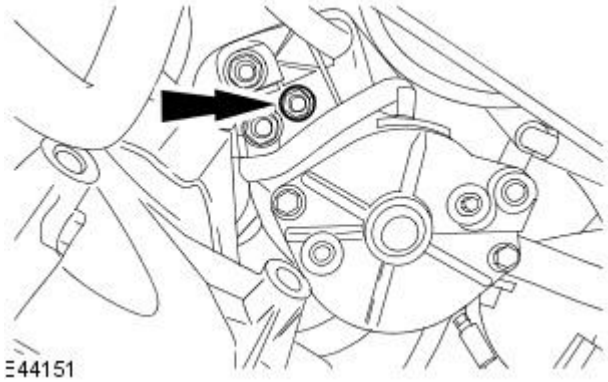
Removal and Installation

Removal

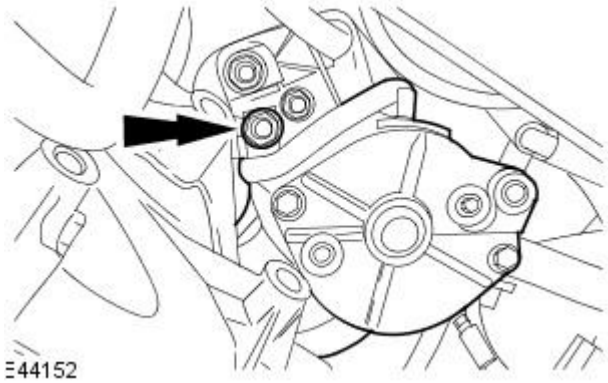
1. Disconnect the battery.
   For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the air deflector.
   For additional information, refer to: Air Deflector - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (501-02 Front End Body Panels, Removal and Installation).
3. Reposition the starter motor solenoid cover.



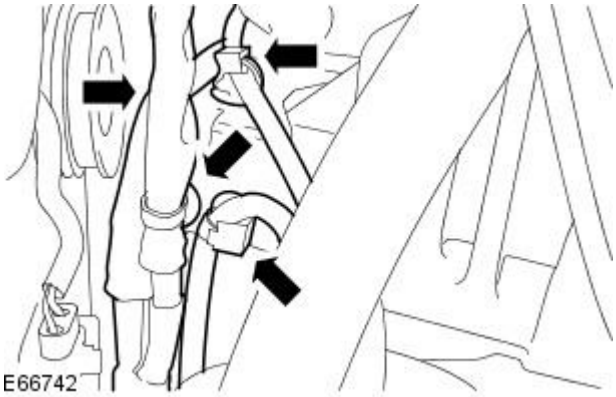
4. Remove the starter motor electrical connector retaining nut.
   - Disconnect the electrical connector.

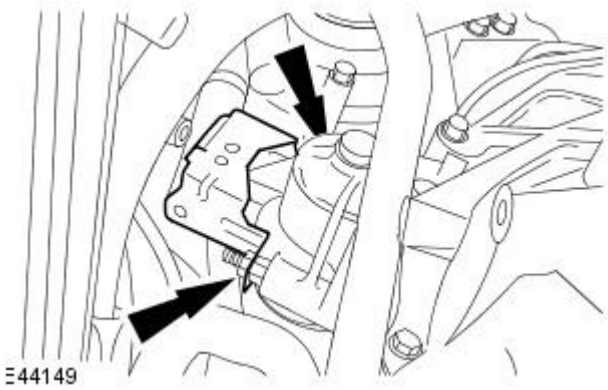


5. Remove the starter motor electrical connector retaining nut.
   - Disconnect the electrical connector.

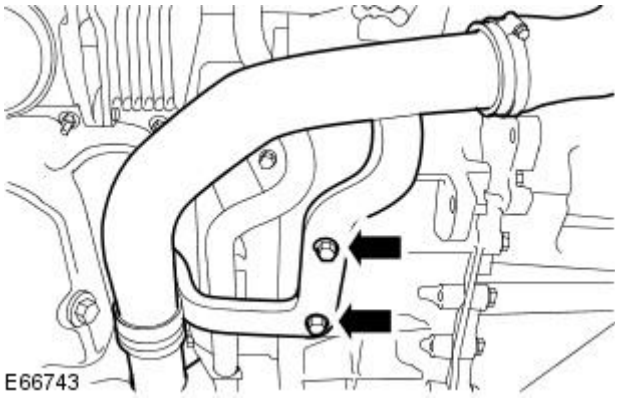


6. Detach the wiring harness retaining clips from the wiring harness support bracket.



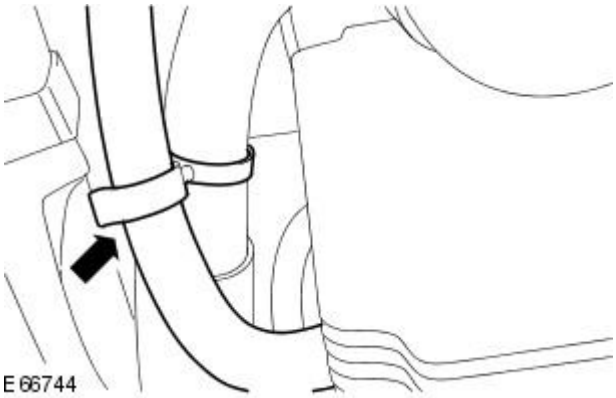


7. Remove the wiring harness support bracket.

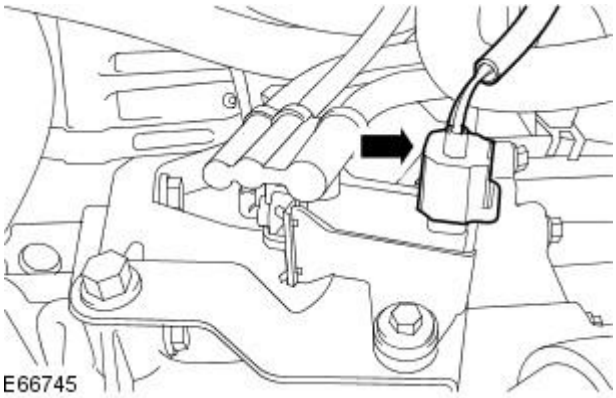


8. Remove the charge air cooler intake pipe retaining bolts.

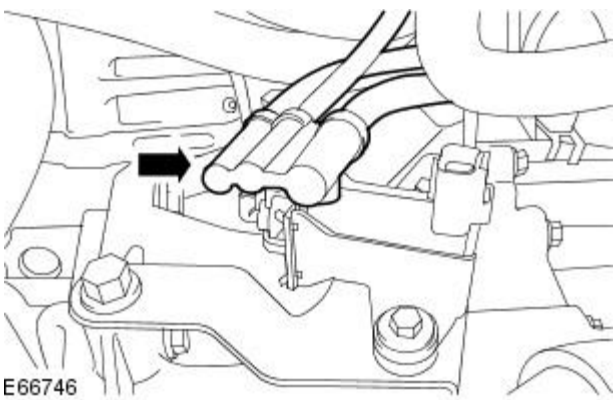
- Reposition the charge air cooler intake pipe for access.



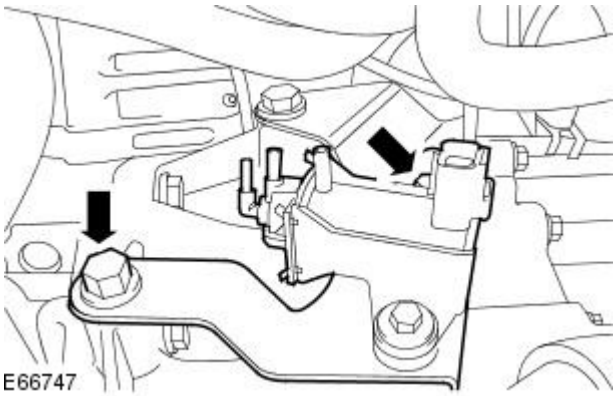
9. Detach the coolant hose.



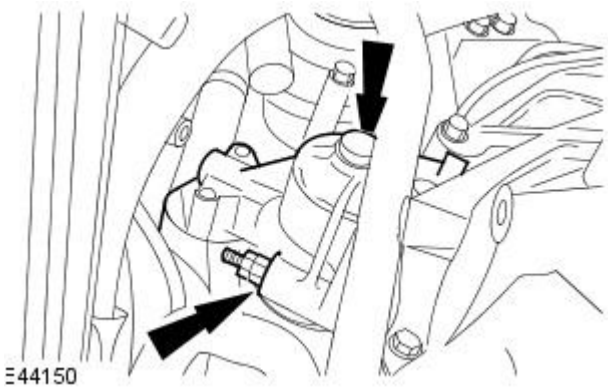
10. Disconnect the vacuum solenoid valve electrical connector.



11. Disconnect the vacuum pipes from the vacuum solenoid valve.

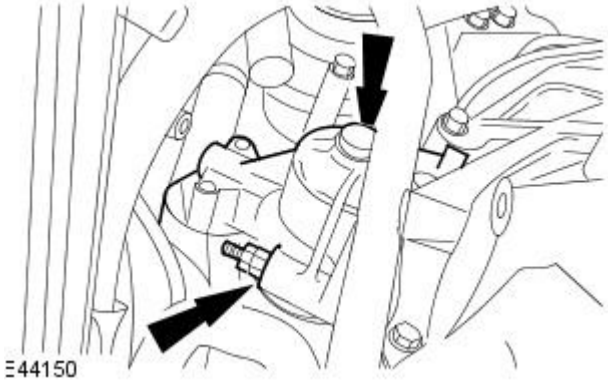


12. Remove the vacuum solenoid mount bracket assembly.



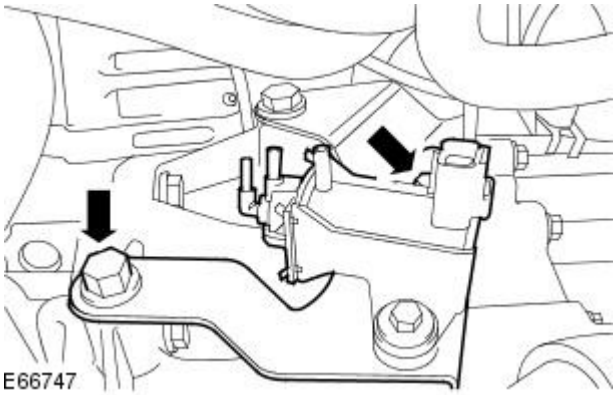
13. Remove the starter motor.

Installation



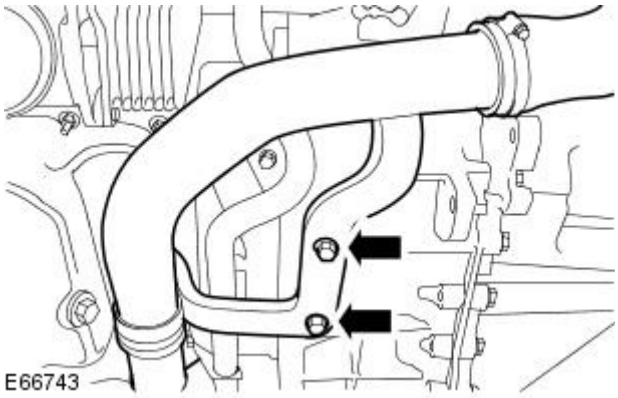
1. To install reverse the removal procedure.

- Tighten to 25 Nm.

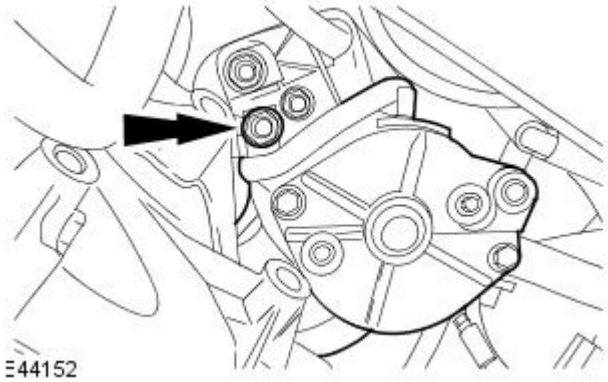


2. Tighten to 30 Nm.

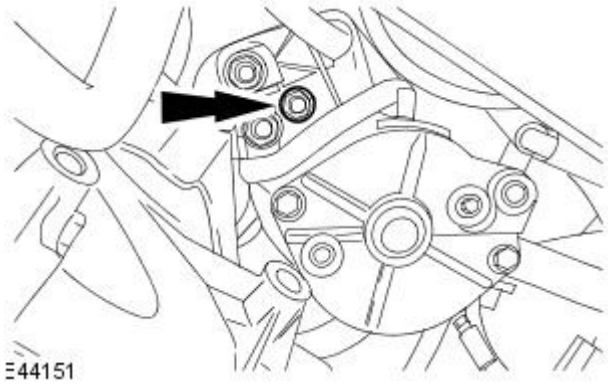
3. Tighten to 35 Nm.



4. Tighten to 12 Nm.



5. Tighten to 6 Nm.



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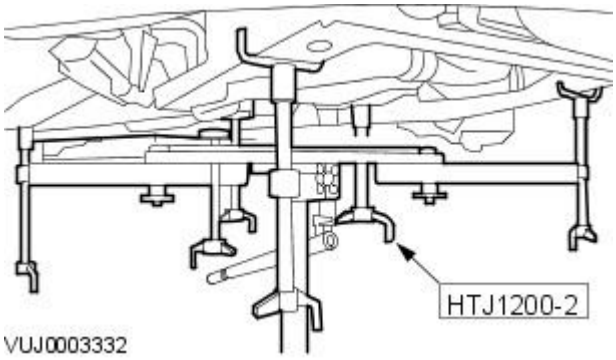
Starting System - Starter Motor2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Removal and Installation

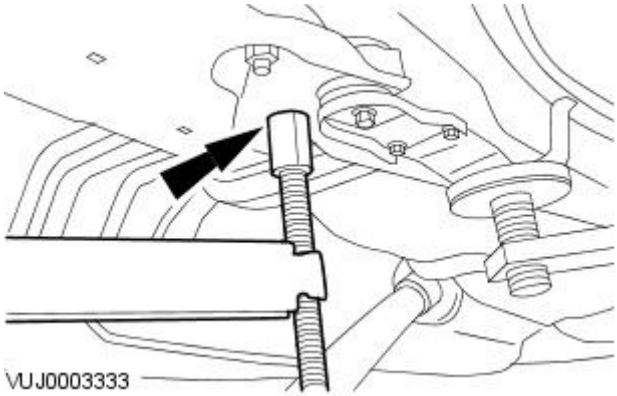
Special Tool(s)	
 HTJ12002	Powertrain assembly jack HTJ1200-2

Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 Battery, Mounting and Cables.
2. Raise and support the vehicle.
   For additional information, refer to Section 100-02 Jacking and Lifting.
3. Install the special tool.

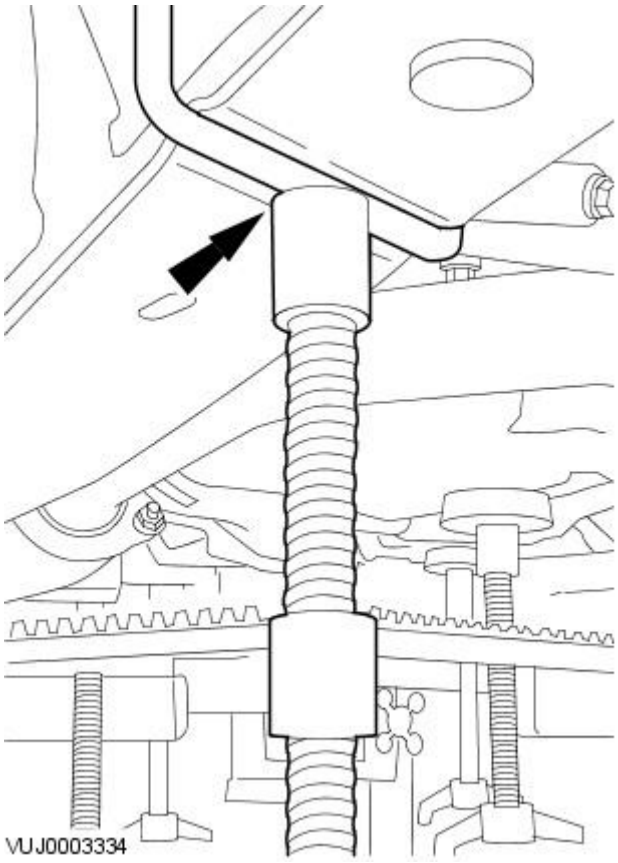


4. Position and adjust the special tool rear height adjuster.
   - Left-hand shown, right-hand similar.

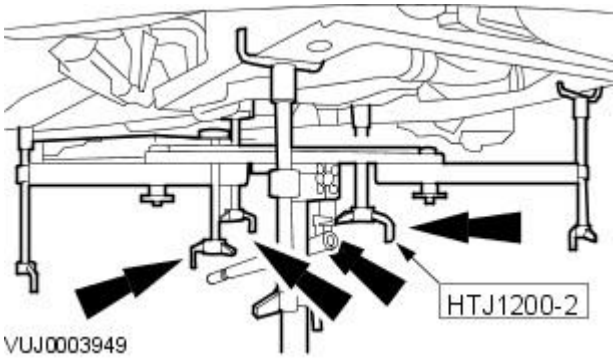


5. Position and adjust the special tool front height adjuster.

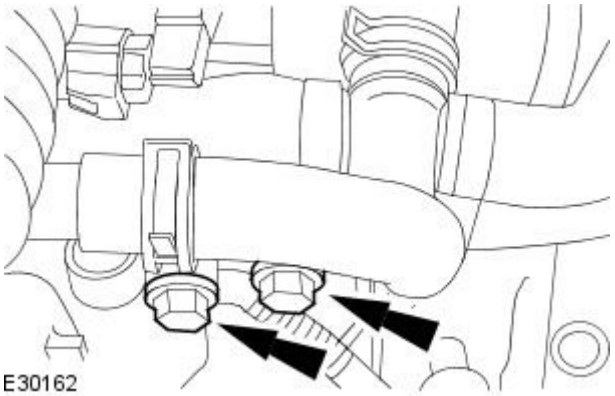
- Right-hand shown, left-hand similar.



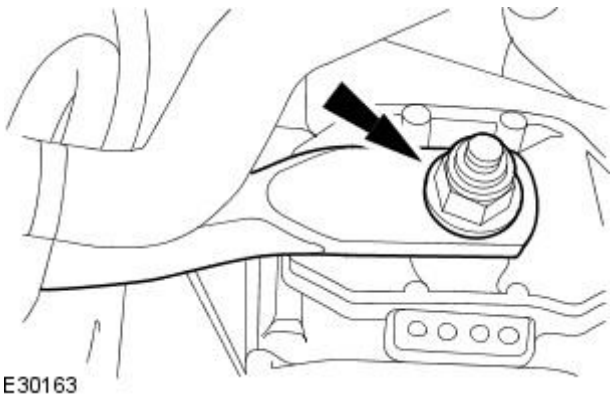
6. Position and adjust the special tool engine height adjusters.



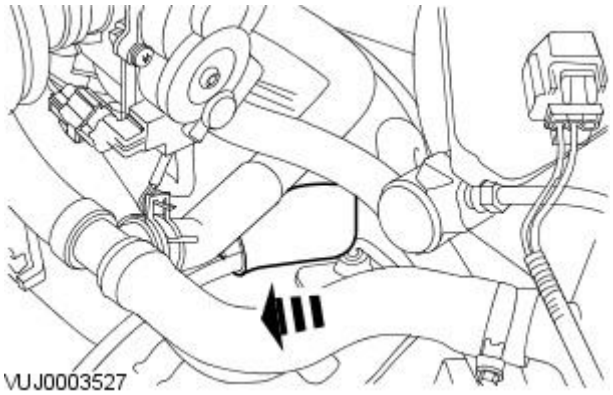
7. Detach the support bar.



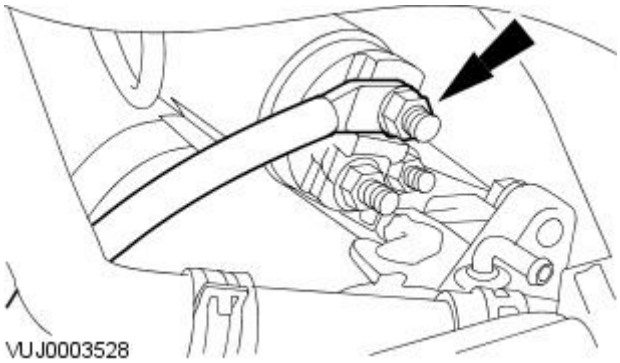
8. Remove the support bar.



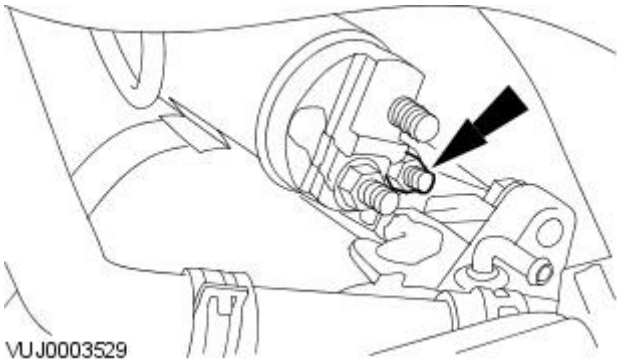
9. Detach the starter motor solenoid cover.



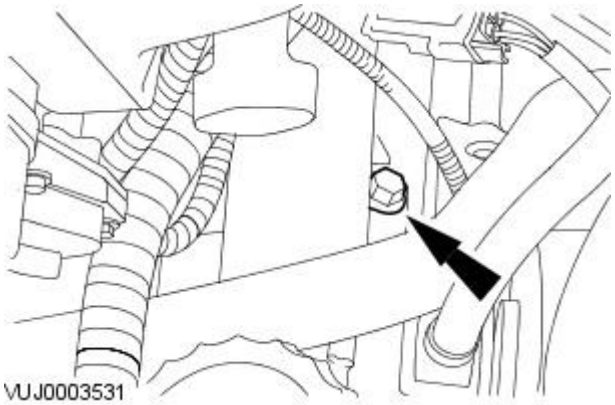
10. Disconnect the starter motor electrical connector.



11. Disconnect the starter motor solenoid electrical connector.

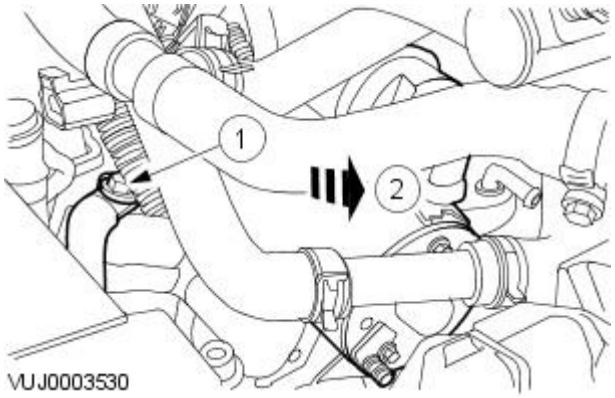


12. Remove the starter motor rear retaining bolt.

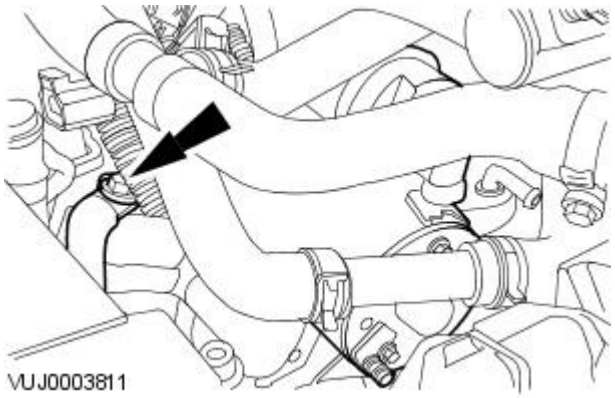


13. Remove the starter motor.

1. Remove the starter motor front retaining bolt.
2. Remove the starter motor.

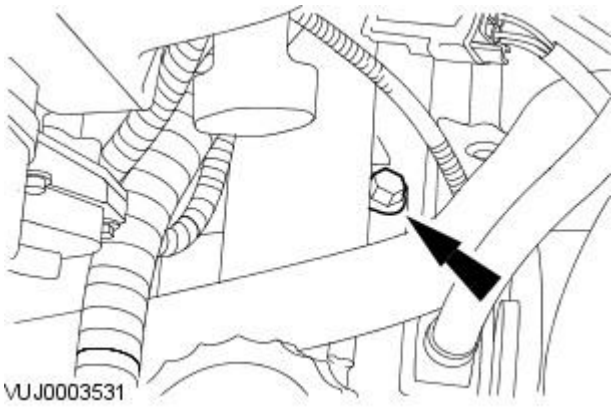


Installation

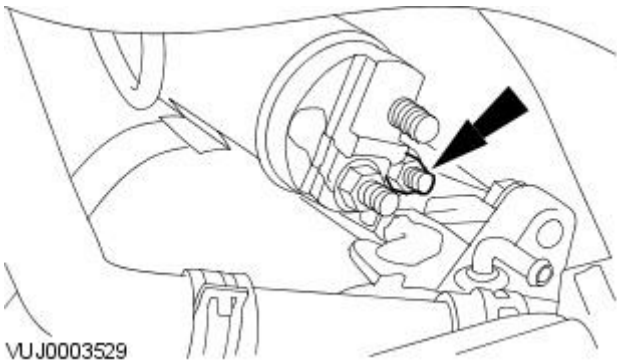


1. To install, reverse the removal procedure.

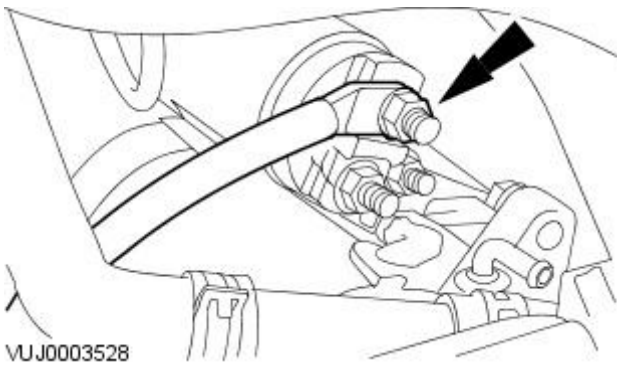
- Tighten to 35 Nm.



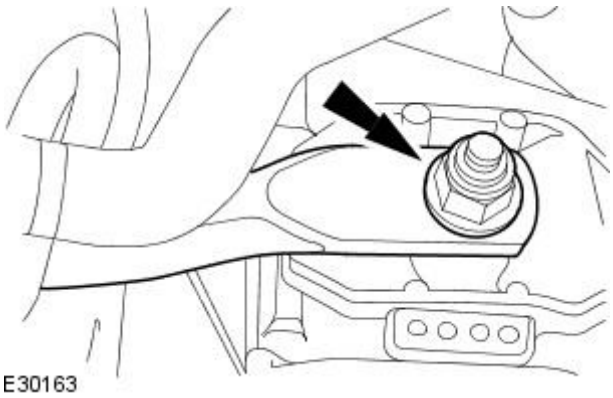
2. Tighten to 35 Nm.



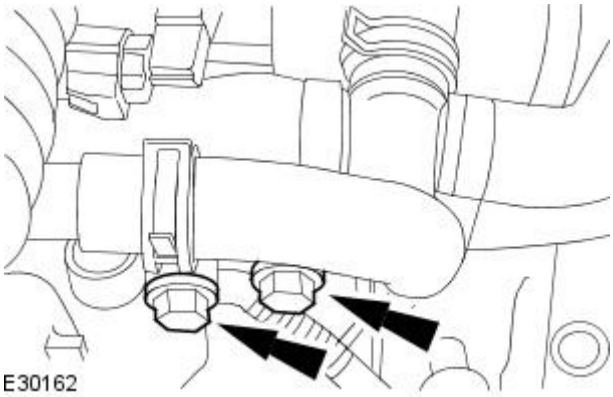
3. Tighten to 6 Nm.



4. Tighten to 12 Nm.



5. Tighten to 133 Nm.



6. Tighten to 25 Nm.

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Engine Ignition - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 -

General Specifications

Item	Specification
Firing Order	1,4,2,5,3,6
Spark Plug Gap mm (in)	1.3-1.45 (0.051-0.057)
Spark Plug Type	XW4E-12405
Silicone Dielectric Compound D7AZ-19A331-A (Spark Plug Connector)	ESE-M1C171-A
High Temperature Nickel Anti-Seize Lubricant F6AZ-9L494-AA (Spark Plug Thread)	ESE-M12A4-A

Torque Specifications

Description	Nm	lb-ft
Spark plugs	15	11
Ignition coil retaining bolts	6	4

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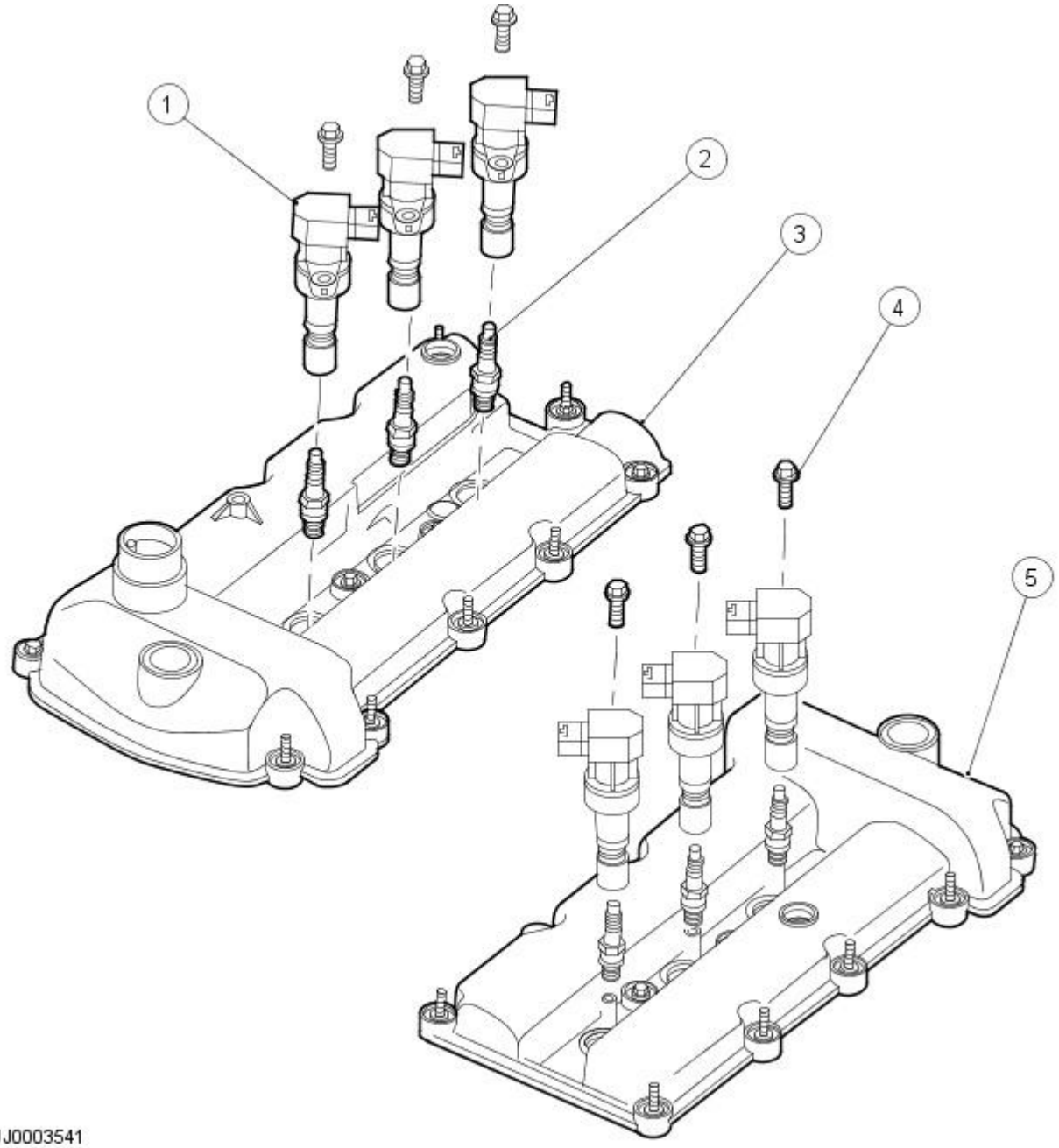
Engine Ignition - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Engine Ignition

Description and Operation

Component Locations



VUJ0003541

Item	Part Number	Description
1	-	Ignition Coil
2	-	Spark Plug
3	-	RH Bank
4	-	Ignition Coil Retaining Bolt
5	-	LH Bank

In order for the correct firing order to be observed it should be noted that the correct cylinder numbering is, when viewed from the rear of the engine, the right-hand cylinder bank is numbered 5,3,1 and the left-hand cylinder bank is numbered 6,4,2.

The ignition system consists of an ignition coil for each individual cylinder located on each individual spark plug. This allows the ignition timing to be adjusted more rapidly and independently.

The crankshaft position (CKP) sensor signal is the basis for ignition timing calculations. The alternating voltage signal from the CKP sensor is converted by the engine control module (ECM). This digital signal is then used to position the closing time of the primary circuit of the ignition coil. The effective range for ignition timing control is increased by the fact that there are no rotating parts.

On the basis of engine speed and load inputs, the ECM determines the ignition timing. This function also takes other inputs into consideration such as engine temperature, throttle position, knock control and electronic transmission control inputs.

This ignition system allows the customer to drive the vehicle home if an ignition coil or ignition coil wiring harness failure occurs. In the event of a wiring harness failure between the ECM and the ignition coil, the ignition coil will fail instead of its fuse. This will allow the remaining ignition coils to continue to function.

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Engine Ignition - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Engine Ignition2.0L NA V6 - AJV6

Diagnosis and Testing

1. **1.** Verify the customer concern by operating the system.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.
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.** The DTC summaries are generated to support the Jaguar approved diagnostic system, but also provide the basis for diagnosis of OBD related concerns using a suitable generic scan tool, in conjunction with the electrical guides. Until the DTC summaries and electrical guides are available, the engine ignition system can only be accurately diagnosed using the Jaguar approved diagnostic system. For additional information, refer to Dealer technical support.

Published: 11-May-2011

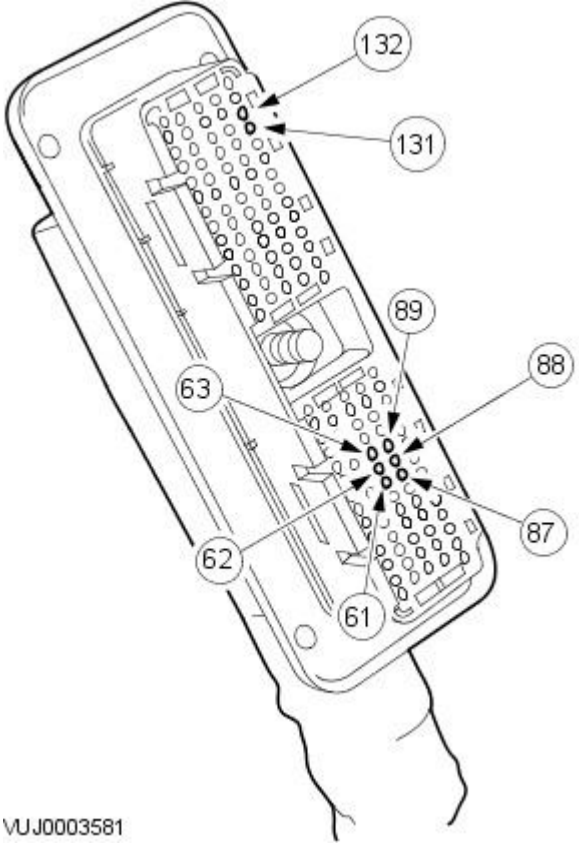
Engine Ignition - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Engine Ignition2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Diagnosis and Testing

1. **1.** Verify the customer concern by operating the system.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.
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, refer to the Symptom Chart.

Symptom Chart

DTC	Condition	Possible Source	Action
• P0300 • P0301 • P0302 • P0303 • P0304 • P0305 • P0306	Random misfire detected. Misfire at cylinders 1 to 6	• Poor cylinder compression. • Damaged or worn piston rings. • Inlet/exhaust valve stuck open/closed. • Worn camshaft. • Damaged cylinder head gasket. • Spark plug fouled/damaged, incorrect gap.	REFER to Section 303-01A Engine / 303-01B Engine.
		• Fuel delivery pressure high/low. • Faulty injector inoperative/leaking. • Fuel injector continuously open. • Fuel contamination. • Fuel injector circuit fault.	REFER to Section 303-04A Fuel Charging and Controls / 303-04B Fuel Charging and Controls / 303-04C Fuel Charging and Controls - Turbocharger.
		• Damaged ignition coil. • Damaged electrical harness/connection. • Damaged spark plug.	GO to Pinpoint Test A.
• P0351 • P0353 • P0355	Ignition coils 1A, 2A or 3A primary circuit malfunctions.	• Ignition coil open/short circuit. • Ignition coil insulation breakdown. • Damaged harness. • Connector pins bent or corroded. • Ignition circuit ground fault. • Damaged engine control module (ECM).	GO to Pinpoint Test A.
• P0352 • P0354 • P0356	Ignition coils 1B, 2B or 3B primary circuit malfunctions.	• Ignition coil open/short circuit. • Ignition coil insulation breakdown. • Damaged harness. • Connector pins bent or corroded. • Ignition circuit ground fault. • Damaged ECM.	GO to Pinpoint Test A.
P1367	Ignition amplifier group 1 fault. (Cylinders 1, 3, and 5).	• Ignition coil open/short circuit. • Ignition coil insulation breakdown. • Damaged harness. • Connector pins bent or corroded. • Ignition circuit ground fault. • Damaged ECM.	GO to Pinpoint Test A.
P1368	Ignition amplifier group 2 fault. (Cylinders 2, 4, and 6).	• Ignition coil open/short circuit. • Ignition coil insulation breakdown. • Damaged harness. • Connector pins bent or corroded. • Ignition circuit ground fault. • Damaged ECM.	GO to Pinpoint Test A.



VUJ0003581

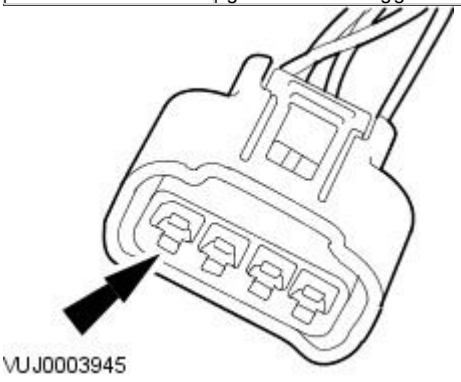
Engine Control Module (ECM) Harness Connector

Pin Number	Circuit Function	Circuit Color
61	1B ignition coil trigger	Green/Blue
62	2B ignition coil trigger	Green/white
63	3B ignition coil trigger	Green/red
87	1A ignition coil trigger	Green/Blue
88	2A ignition coil trigger	Green/white
89	3A ignition coil trigger	Green/red


VUJ0003945

1A, 2A, 3A Ignition Coil Harness Connectors

Pin Number	Circuit Function	Circuit Color
1	Ignition coil voltage supply	Red/white
2	Ignition coil diagnostic signal	Yellow/green
3	Ignition coil ground supply	Black
4	Ignition coil trigger	1A - Green/blue, 2A - Green/white, 3A - Green/red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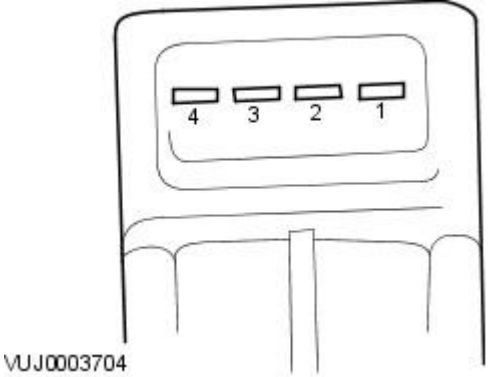
1B, 2B, 3B Ignition Coil Harness Connectors

Pin Number	Circuit Function	Circuit Color
1	Ignition coil voltage supply	Red/white
2	Ignition coil diagnostic signal	Yellow/green
3	Ignition coil ground supply	Black
4	Ignition coil trigger	1B - Green/blue, 2B - Green/white, 3B - Green/red



1A, 2A, 3A, 1B, 2B, 3B Ignition Coils

Pin Number	Circuit Function
1	Ignition coil voltage supply
2	Ignition coil diagnostic signal
3	Ignition coil ground supply
4	Ignition coil trigger

PINPOINT TEST A : IGNITION COILS — P0351, P0352, P0353, P0354, P0355, P0356, P1367, P1368	
• NOTE: Unless multiple cylinder misfires are apparent, only one circuit will normally need to be tested. The DTC set will indicate which cylinder is misfiring.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK COIL FUNCTION BY SUBSTITUTION	
	1 Swap suspect coil for known good unit.
	2 CLEAR the DTC. TEST the system for normal operation.
	Does the same DTC reoccur? The DTC will indicate if the same cylinder is misfiring. **Yes** GO to A2. **No** CLEAR the DTC. TEST the system for normal operation.
A2: CHECK THE IGNITION COIL SUPPLY VOLTAGE CIRCUIT	
	1 Disconnect the relevant A bank ignition coil electrical connector(s).
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between: • Cyl A1. EN051 pin 1, (RW) and GROUND. • Cyl A2. EN052 pin 1, (RW) and GROUND. • Cyl A3. EN053 pin 1, (RW) and GROUND.
	4 Disconnect the relevant B bank ignition coil electrical connector(s).
	5 Measure the voltage between: • Cyl B1. EN054 pin 1, (RW) and GROUND. • Cyl B2. EN055 pin 1, (RW) and GROUND. • Cyl B3. EN056 pin 1, (RW) and GROUND.
	Is the voltage greater than 10.5 Volts? **Yes** GO to A3. **No** REPAIR the relevant ignition coil supply voltage circuit. For additional information, refer to wiring digrams. CLEAR the DTCs. TEST the system for normal operation.
A3: CHECK THE IGNITION COIL GROUND CIRCUIT	
	1 Switch the ignition to the OFF position.
	2 Disconnect the relevant A bank ignition coil electrical connector(s).
	3 Measure the resistance between: • Cyl A1. EN051 pin 3, (B) and GROUND. • Cyl A2. EN052 pin 3, (B) and GROUND. • Cyl A3. EN053 pin 3, (B) and GROUND.
	4 Disconnect the relevant B bank ignition coil electrical connector(s).
	5 Measure the resistance between: • Cyl B1. EN054 pin 3, (B) and GROUND. • Cyl B2. EN055 pin 3, (B) and GROUND. • Cyl B3. EN056 pin 3, (B) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to A4. **No** REPAIR the relevant ignition coil ground circuit. For additional information, refer to wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
A4: CHECK THE CONTINUITY OF THE IGNITION COIL TRIGGER SUPPLY CIRCUIT	
	1 Disconnect the ECM electrical connector EN016.
	2 Check the continuity of the ignition coil trigger supply circuit between the relevant ignition coil electrical connector(s) and the ECM electrical connector: • Cyl A1. EN051 pin 4, (GU) and EN016 pin 87, (GU) • Cyl A2. EN052 pin 4, (GW) and EN016 pin 88, (GW) • Cyl A3. EN053 pin 4, (GR) and EN016 pin 89, (GR) • Cyl B1. EN054 pin 4, (GU) and EN016 pin 61, (GU)

	• Cyl B2. EN055 pin 4, (GW) and EN016 pin 62, (GW) • Cyl B3. EN056 pin 4, (GR) and EN016 pin 63, (GR)
	Is the resistance less than 5 ohms? **Yes** GO to A5. **No** REPAIR the ignition coil trigger supply circuit between the relevant ignition coil electrical connector(s) and the ECM electrical connector. CLEAR the DTCs. TEST the system for normal operation.
A5: CHECK THE CONTINUITY BETWEEN THE IGNITION COIL AND THE ECM	
	1 Check the continuity of the ignition coil diagnostic signal circuit, between the ignition coil electrical connector(s) and the ECM electrical connector: • Cyl A1. EN051 pin 2, (YG) and EN016 pin 131, (YG) • Cyl A2. EN052 pin 2, (YG) and EN016 pin 131, (YG) • Cyl A3. EN053 pin 2, (YG) and EN016 pin 131, (YG) • Cyl B1. EN054 pin 2, (YG) and EN016 pin 132, (YG) • Cyl B2. EN055 pin 2, (YG) and EN016 pin 132, (YG) • Cyl B3. EN056 pin 2, (YG) and EN016 pin 132, (YG)
	Is the resistance less than 5 Ohms? **Yes** INSTALL a new ECM. For additional information refer to Section 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls Before replacing a ECM, contact Dealer technical support. CLEAR the DTCs. TEST the system for normal operation. **No** REPAIR the circuit between the ignition coil electrical connector(s) and the ECM electrical connector. CLEAR the DTCs. TEST the system for normal operation.

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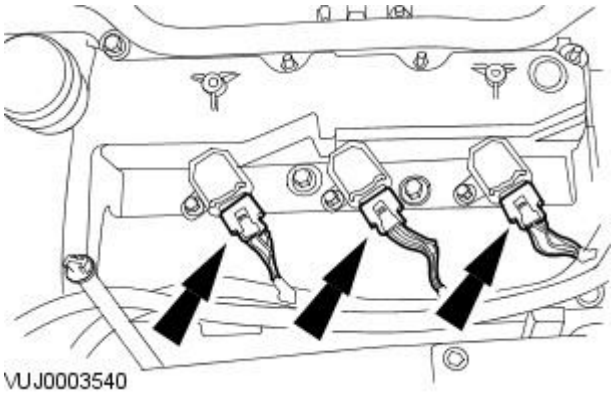
Engine Ignition - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Ignition Coil-On-Plug LH

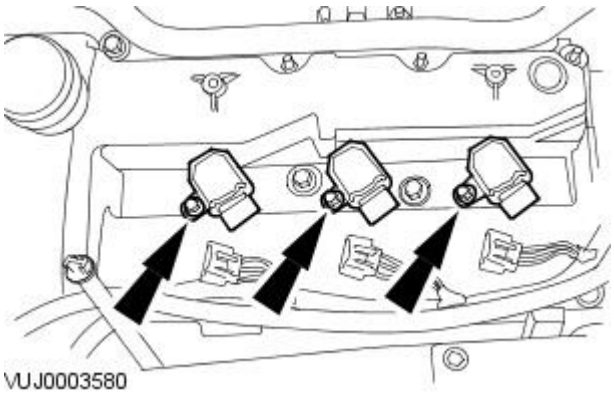
Removal and Installation

Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 Battery, Mounting and Cables.
2. Remove the air cleaner. For additional information, refer to Section 303-12A Intake Air Distribution and FilteringSection 303-12B Intake Air Distribution and Filtering.
3. Disconnect the electrical connectors.

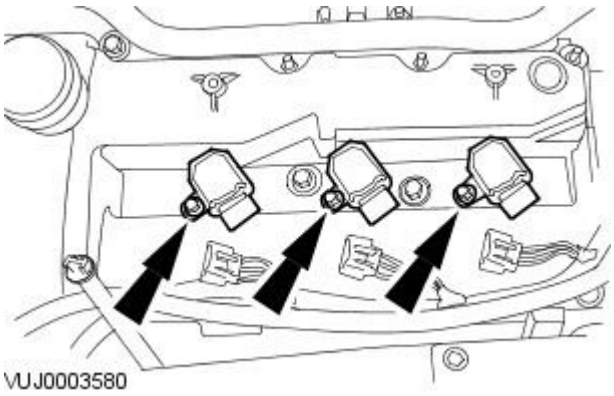


4. Remove the ignition coils.



Installation

1. To install, reverse the removal procedure.
   - Tighten to 6 Nm.



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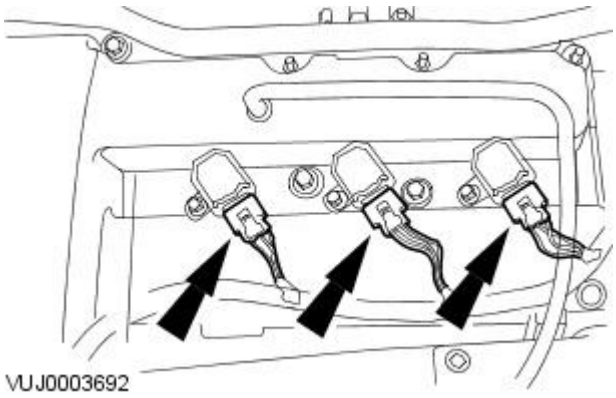
Engine Ignition - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Ignition Coil-On-Plug RH

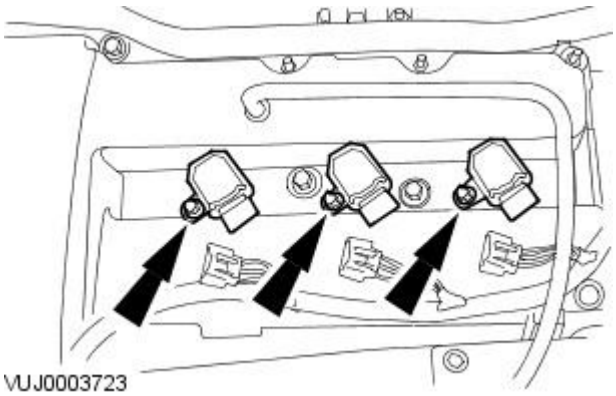
Removal and Installation

Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 Battery, Mounting and Cables.
2. Remove the intake manifold. For additional information, refer to Section 303-01A EngineSection 303-01B Engine.
3. Disconnect the electrical connectors.

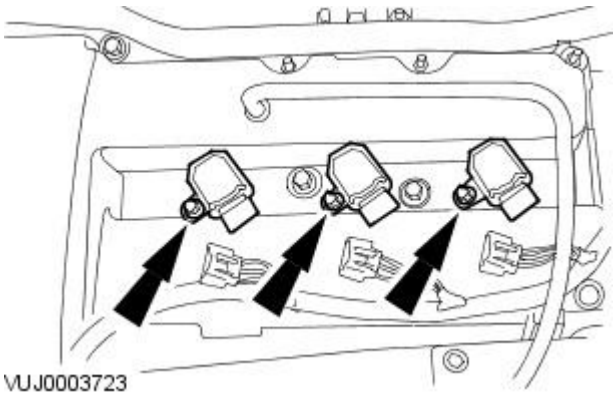


4. Remove the ignition coils.



Installation

1. To install, reverse the removal procedure.
   - Tighten to 6 Nm.



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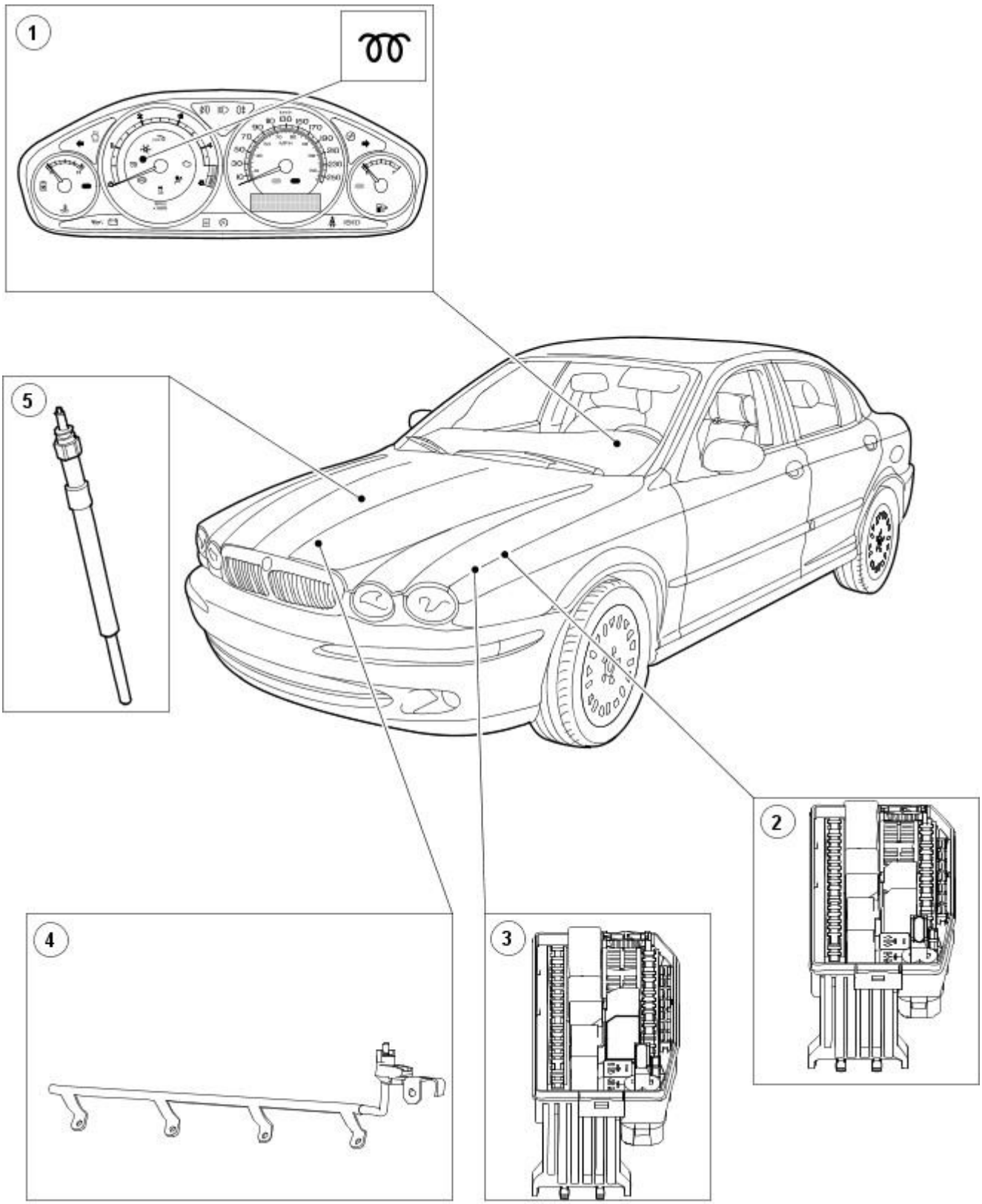
Glow Plug System -

Torque Specifications

Description	Nm	lb-ft	lb-in
Glow plug	13	10	-
Glow plug electrical connector retaining nut	2	-	18
Main wiring harness to glow plug wiring harness nut	4	-	35
Glow plug terminal block retaining screw	5	-	44

Glow Plug System - Glow Plug System

Description and Operation



E44084

Item	Part Number	Description
1	-	Glow plug indicator lamp
2	-	Glow plug fuse
3	-	Glow plug relay
4	-	Glow plug wire
5	-	Glow plug

The glow plugs are located in the side of the cylinder head and aid engine starting and efficiency. The glow plugs and the glow plug indicator lamp are controlled by the engine control module (ECM).

The glow plugs preheat the combustion chambers, which aids cold starting. During the preheat stage, the ECM receives an engine temperature signal from the cylinder head temperature (CHT) sensor and this determines the preheat time. The lower the temperature, the longer the preheat time. There is a maximum preheat time of 8 seconds at -20° C (-4° F)or lower. At temperatures above 80° C (176° F) there is no preheat phase.

Once the engine has started, the glow plugs enter an after-glow phase. The after-glow phase helps to improve idling and reduce hydrocarbon emissions through more efficient combustion just after starting. The after-glow phase only operates at engine speeds below 2500 RPM, above that, the after-glow phase is interrupted to increase the durability of the glow plugs. There is a maximum after-glow time

of 30 seconds at -20° C (-4° F) or lower. At temperatures above 50°C (122° F) there is no after-glow phase.

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Glow Plug System - Glow Plug System

Diagnosis and Testing

Principle of operation

As common rail diesel engines have better cold-starting characteristics than traditional diesel engines, the glow plugs have two functions on this engine:

Pre-heat stage

In this stage, the glow plugs function as normal, preheating the combustion chambers to aid cold starting.

After-glow stage

At engine speeds below 2,500 rpm, and at temperatures below 50 degrees C (122 degrees F), the glow plugs continue to heat the cylinders to improve idling and reduce emissions.

Warning light

The glow plug warning light on this vehicle not only informs the driver that the glow plugs are operating, but also as a malfunction indicator lamp (MIL) for the engine management system. For additional information,
REFER to: Glow Plug System (303-07B Glow Plug System, Description and Operation).

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of electrical damage.

Electrical
• Fuse 22, front power distribution box (60 Amp) • Fuse 18, front power distribution box (10 Amp) • Glow plug relay (R10, front power distribution box) • Engine management control relay (R7, front power distribution box) • Wiring harness • Electrical connector(s) • Glow plug(s) • Engine control module (ECM)

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: This section contains references to Parameter Identifiers (PIDs). Where the Jaguar approved diagnostic system is not available, a scan tool may be used to access these PIDs, all of which give information, and some of which can be used to both read information and to activate components. The format of the information may vary, depending on the tool used.

• NOTE: As well as carrying out its normal function the glow plug indicator also acts as an engine check lamp which will flash continuously when a hard diagnostic trouble code (DTC) is detected by the ECM. Soft DTCs are also stored by the ECM but will only be identified if the system is checked for DTCs using the Jaguar approved diagnostic system or a scan tool.

• NOTE: If a DTC is detected, all DTCs must be cleared after the concern is repaired. Failure to clear all DTCs may cause driveability concerns.

• 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 the symptom is not present when performing the pinpoint tests, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

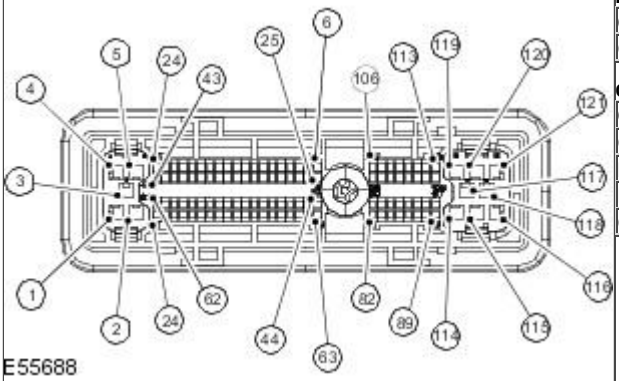
3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

Diagnostic trouble code (DTC) index

DTC	Condition	Possible source	Action
P0380	Glow plug heater circuit	• Glow plug heater circuit: relay driver open circuit, short circuit	For glow plug circuit tests, GO to Pinpoint Test A.

Pinpoint Tests

PINPOINT TEST A : GLOW PLUG CIRCUIT TESTS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE GLOW PLUG CIRCUIT(S) FOR SHORT CIRCUIT TO POWER	



Engine control module (ECM) connector

Circuit	Pin
Glow plug - control	20

Glow plug relay connector

Circuit	Pin
Glow plug relay - control	02
Permanent 12 volt supply	03
ECM relay controlled 12 volt supply	01
Glow plug relay - output	05

1. Key off.
2. Glow plug fuse connector disconnected.
3. Key on, engine off.
4. Measure the resistance between:

Glow plug relay connector	Vehicle battery
Glow plug - control - Pin 02	Positive post

Is the resistance greater than 10 ohms?

Yes

GO to A3.

No

GO to A2.

A2: CHECK WHETHER THE SHORT CIRCUIT TO POWER IS IN THE HARNESS OR THE GLOW PLUGS

1. Glow plug assembly connector disconnected.
2. Measure the resistance between:

Glow plug relay connector	Vehicle battery
Glow plug - control - Pin 02	Positive post

Is the resistance greater than 10 ohms?

Yes

Harness is OK.Suspect :- Glow plug assembly.
REFER to: Glow Plugs (303-07B Glow Plug System, Removal and Installation).

No

REPAIR the short circuit. For additional information, refer to the wiring diagrams.

A3: CHECK THE GLOW PLUG CIRCUIT CONTINUITY

1. Measure the resistance between:

Glow plug relay connector	Vehicle battery
Glow plug - control - Pin 02	Negative post

Is the resistance between 0.5 ohm - 10 ohms?

Yes

GO to A6.

No

GO to A4.

A4: CHECK THE GLOW PLUG CIRCUIT FOR SHORT CIRCUIT TO GROUND

1. Glow plug assembly connector disconnected.
2. Measure the resistance between:

Glow plug relay connector	Vehicle battery
Glow plug - control - Pin 02	Negative post

Is the resistance greater than 10 ohms?

Yes

GO to A5.

No

REPAIR the short circuit. For additional information, refer to the wiring diagrams.

A5: CHECK THE GLOW PLUG CIRCUIT(S) FOR OPEN CIRCUIT IN THE HARNESS

1. Measure the resistance between:

Glow plug relay connector	Glow plug relay connector
Glow plug - control - 15S-RD15 - Pin 01	Glow plug - control - Pin 02

Is the resistance less than 10 ohms?

Yes

Suspect:- Glow plug assembly
REFER to: Glow Plugs (303-07B Glow Plug System, Removal and Installation).
- Glow plug assembly GROUND

No

REPAIR the open circuit. For additional information, refer to the wiring diagrams.

A6: CHECK THE GLOW PLUG CONTROL LINE 'ON' STATE

1. Scan tool connected.
2. Access and control the PID.
3. Activate the glow plugs.
4. Measure the voltage between:

Glow plug relay connector	Vehicle battery
Glow plug relay - output - Pin 01	Negative post

Is the voltage between 9 volts - 15 volts?

Yes

GO to A12.

No

GO to A7.

A7: CHECK THE GLOW PLUG CONTROL LINE FOR SHORT CIRCUIT TO GROUND

1 Key off.
2 Glow plug relay connector disconnected.
3 Key on, engine off.
4 Measure the resistance between:

Glow plug relay connector	Vehicle battery
Glow plug relay - output - Pin 01	Negative post

Is the resistance greater than 10 ohms?
Yes
GO to A8.
No
INSTALL a new front power distribution box assembly.

A8: CHECK THE GLOW PLUG CONTROL LINE FOR CONTINUITY

1 Measure the resistance between:

Glow plug relay connector	Glow plug relay connector
Glow plug relay - output - Pin 01	Glow plug relay - output - Pin 05

Is the resistance less than 10 ohms?
Yes
GO to A9.
No
REPAIR the open circuit. For additional information, refer to the wiring diagrams.

A9: CHECK SUPPLIES TO THE GLOW PLUG RELAY

1 Measure the voltage between:

Glow plug relay connector	Vehicle battery
ECM relay controlled 12 volt supply - Pin 01	Negative post
Permanent 12 volt supply - Pin 03	Negative post

Are the voltages between 9 volts - 15 volts?
Yes
GO to A10.
No
No supply to the glow plug relay circuit. Check and repair the circuit as necessary.

A10: CHECK THE ECM CONTROL LINE 'ON' STATE

1 Scan tool connected.
2 Access and control the glow plug control PID.
3 Activate the glow plugs.
4 Measure the resistance between:

Glow plug relay connector	Vehicle battery
Glow plug relay - control - Pin 02	Negative post

Is the resistance less than 10 ohms?
Yes
Suspect:**-** Glow plug relay connector**-** Glow plug relay fault
No
GO to A11.

A11: CHECK THE ECM CONTROL LINE FOR SHORT CIRCUIT TO POWER

1 Measure the resistance between:

Glow plug relay connector	Vehicle battery
Glow plug relay - control - Pin 02	Positive post

Is the resistance greater than 10 ohms?
Yes
GO to A17.
No
GO to A16.

A12: CHECK THE GLOW PLUG CONTROL LINE 'OFF' STATE

1 Scan tool connected.
2 Access and control the glow plug control PID.
3 De-activate the glow plugs.
4 Measure the resistance between:

Glow plug relay connector	Vehicle battery
Glow plug relay - output - Pin 01	Positive post

Is the resistance greater than 10 ohms?
Yes
An intermittent fault may be present in the wiring harness. Visually check for chaffed wires or other physical damage to the harness. If no fault is found in the circuit, suspect the following component(s):**-** Glow plug fuse connector**-** Glow plug fuse fault
No
GO to A13.

A13: CHECK THE GLOW PLUG CIRCUIT FOR SHORT CIRCUIT TO POWER IN THE HARNESS

1 Key off.
2 Glow plug relay connector disconnected.
3 Key on, engine off.
4 Measure the resistance between:

Glow plug relay connector	Vehicle battery
Glow plug relay - output - Pin 01	Positive post

Is the resistance greater than 10 ohms?
Yes
GO to A14.
No
INSTALL a new front power distribution box assembly.

A14: CHECK THE ECM CONTROL LINE FOR A SHORT CIRCUIT TO GROUND

1 Measure the resistance between:

Glow plug relay connector	Vehicle battery
Glow plug relay - control - Pin 02	Negative post

Is the resistance greater than 10 ohms?
Yes
Suspect :- Glow plug relay fault
No
GO to A15.

A15: CHECK WHETHER THE SHORT CIRCUIT TO GROUND IS IN THE ECM HARNESS OR ECU

1 Key off.
2 ECM connector disconnected.
3 Key on, engine off.
4 Measure the resistance between:

Glow plug relay connector	Vehicle battery
Glow plug relay - control - Pin 02	Negative post

Is the resistance greater than 10 ohms?
Yes
Harness is OK.Suspect :- ECM fault
No
REPAIR the short circuit. For additional information, refer to the wiring diagrams.

A16: CHECK WHETHER THE SHORT CIRCUIT TO POWER IS IN THE ECM HARNESS OR ECU

1 Key off.
2 ECM connector disconnected.
3 Key on, engine off.
4 Measure the resistance between:

Glow plug relay connector	Vehicle battery
Glow plug relay - control - Pin 02	Positive post

Is the resistance greater than 10 ohms?
Yes
Harness is OK.Suspect :- ECM fault
No
REPAIR the short circuit. For additional information, refer to the wiring diagrams.

A17: CHECK THE ECM CONTROL LINE FOR CONTINUITY

1 Key off.
2 ECM connector disconnected.
3 Measure the resistance between:

Glow plug relay connector	Vehicle battery
Glow plug relay - control - Pin 02	Glow plug - control - Pin 20

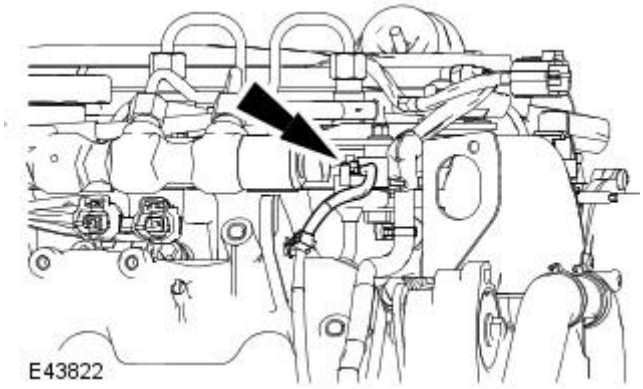
Is the resistance less than 10 ohms?
Yes
Suspect :- ECM connector fault-ECM fault
No
REPAIR the open circuit. For additional information, refer to the wiring diagrams.

Published: 11-May-2011

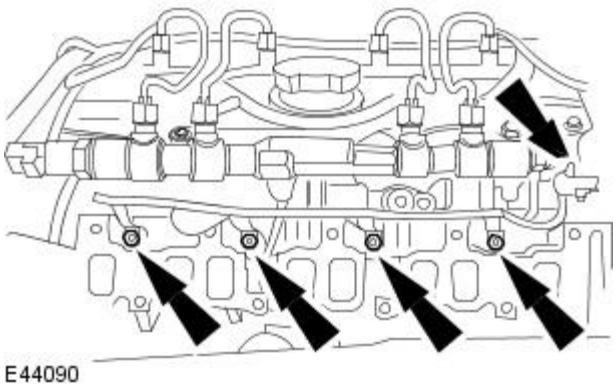
Glow Plug System - Glow Plugs

Removal and Installation

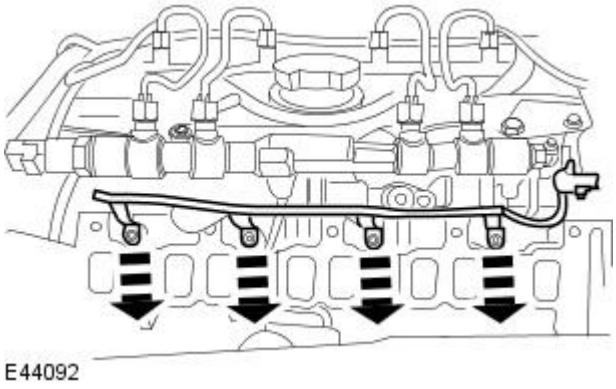
Removal



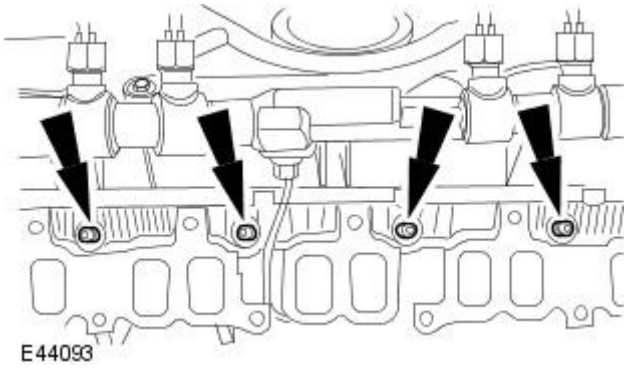
1. Disconnect the battery ground cable.
   For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Detach the glow plug wire electrical connector.



3. Remove the intake manifold.
   For additional information, refer to: Intake Manifold (303-01B Engine - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, In-vehicle Repair).
4. Remove the glow plug wire retaining nuts.

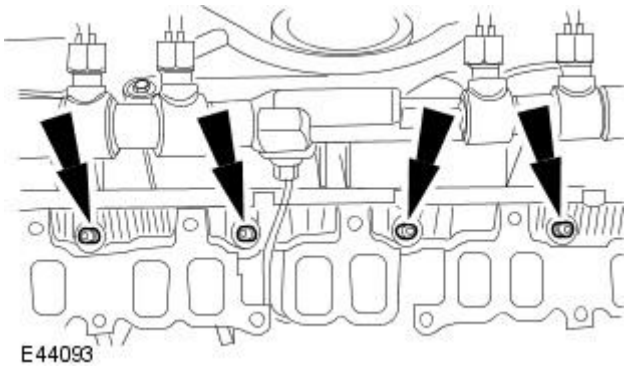


5. Remove the glow plug wire.



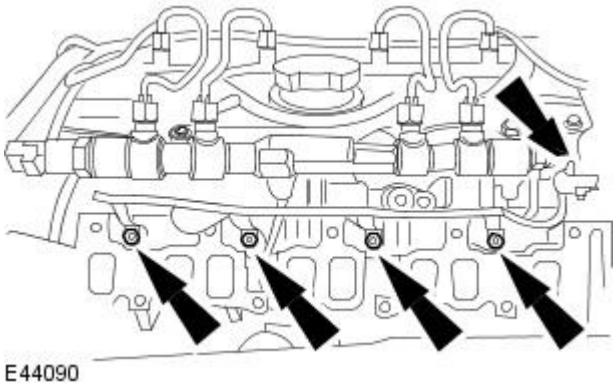
6. Remove the glow plugs.

Installation

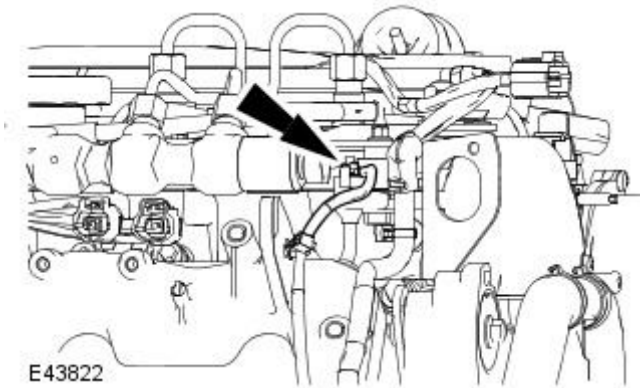


1. To install, reverse the removal procedure.

- Tighten to 13 Nm.



2. Tighten to 2 Nm.



3. Tighten to 5 Nm.

4. Connect the battery ground cable.
For additional information, refer to: Battery Connect (414-01 Battery, Mounting and Cables, General Procedures).

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Engine Emission Control - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma -

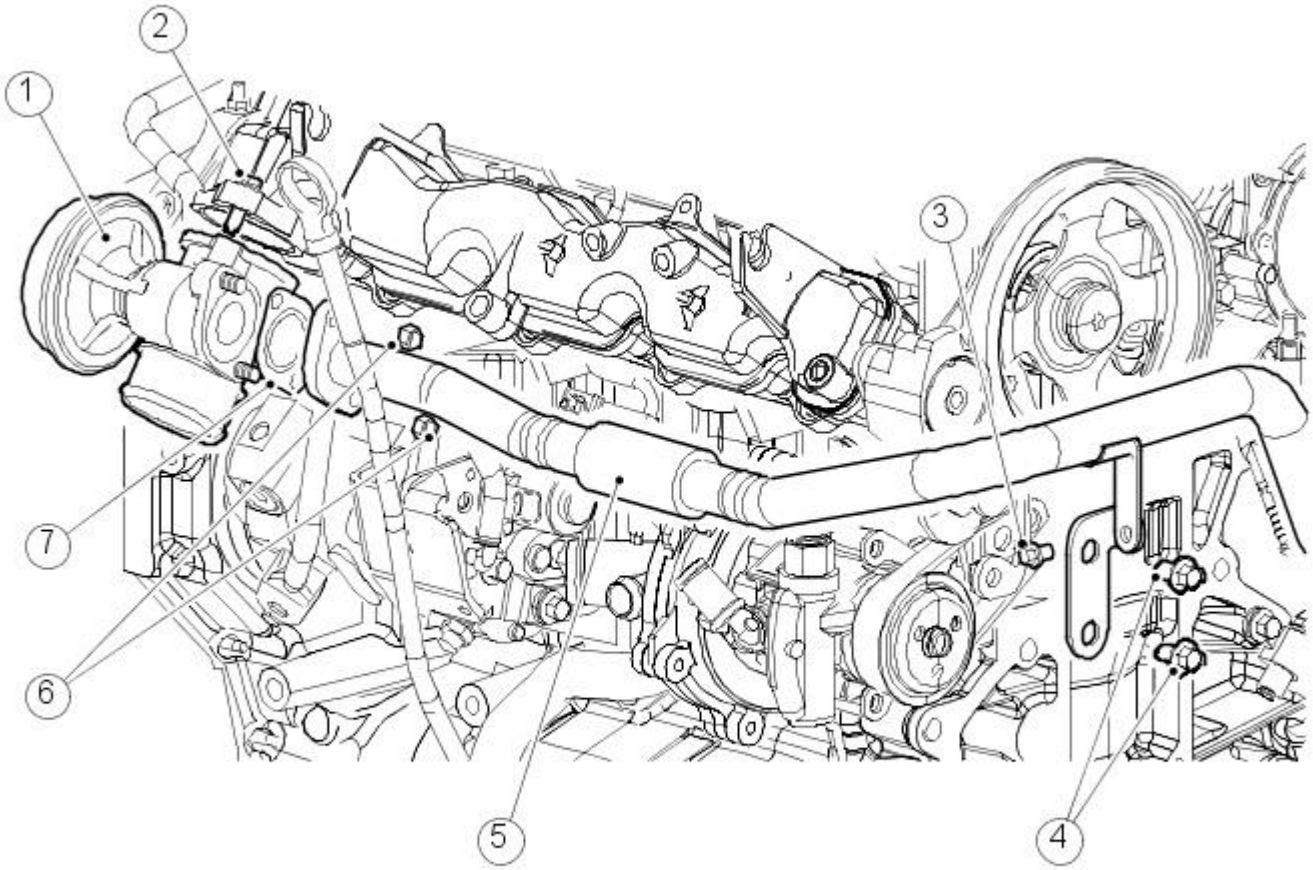
Torque Specifications

Description	Nm	lb-ft	lb-in
Exhaust gas recirculation (EGR) valve to intake manifold retaining bolts	10	-	89
EGR valve tube to EGR valve retaining nuts	10	-	89
EGR valve tube to EGR valve retaining studs	11	8	-
EGR cooler to EGR valve tube mounting bracket retaining bolts	10	-	89
EGR cooler to EGR valve tube retaining bolts	10	-	89
Manifold absolute pressure (MAP) sensor retaining bolt	4	-	35

Published: 11-May-2011

Engine Emission Control - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Engine Emission Control

Description and Operation



VUE0032383

Item	Part Number	Description
1	-	EGR valve
2	-	EGR valve to intake manifold retaining bolt
3	-	EGR cooler to EGR valve tube mounting bracket upper retaining bolt
4	-	EGR cooler to EGR valve tube mounting bracket lower retaining bolts
5	-	EGR cooler to EGR valve tube
6	-	EGR cooler to EGR valve tube to EGR valve retaining nuts
7	-	EGR cooler to EGR valve tube to EGR valve gasket

Published: 12-Jul-2011

Engine Emission Control - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Engine Emission Control

Diagnosis and Testing

Overview

For information on the description and operation of the emission control system:
REFER to: Engine Emission Control (303-08 Engine Emission Control - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Description and Operation).

Inspection and verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious mechanical or electrical faults.

Visual Inspection

Mechanical	Electrical
● Engine breather hoses ● Exhaust gas recirculation (EGR) pipes (check for cracks) ● EGR valve ● EGR cooler	● Fuse(s) ● Wiring harness ● Loose or corroded electrical connector(s) ● EGR valve ● Engine control module (ECM)

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.** Use the approved diagnostic system or a scan tool to retrieve any diagnostic trouble codes (DTCs) before moving onto the symptom chart or DTC index.
    - ○ Make sure that all DTCs are cleared following rectification.

Symptom chart

Symptom (specific)	Possible cause	Action
Difficult to start Poor/Erratic idle Lack of power when accelerating	● Exhaust gas recirculation (EGR) valve(s) stuck open	Check the EGR valve and circuits. Refer to the electrical guides. Check the mechanical condition of the EGR valves. Rectify as necessary.
Engine stops/stalls	● Exhaust gas recirculation (EGR) valve(s) stuck open ● Breather system disconnected/restricted/blocked	Check the EGR valve and circuits. Refer to the electrical guides. Check the mechanical condition of the EGR valves. Check the engine breather system. Check for DTCs indicating an EGR valve, throttle or sensor fault. Rectify as necessary.
Excessive fuel consumption Excessive black smoke Excessive emissions	● Exhaust gas recirculation (EGR) valve(s) stuck open ● EGR not operating ● Breather system restricted/blocked	
Excessive blow-by	● Breather system restricted/blocked	Check the engine breather system. Rectify as necessary.
Engine oil leaks	● Breather system restricted/blocked	Check the engine breather system. Rectify as necessary.

For a complete list of all diagnostic trouble codes that could be logged on this vehicle. REFER to: Electronic Engine Controls (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).

Published: 11-May-2011

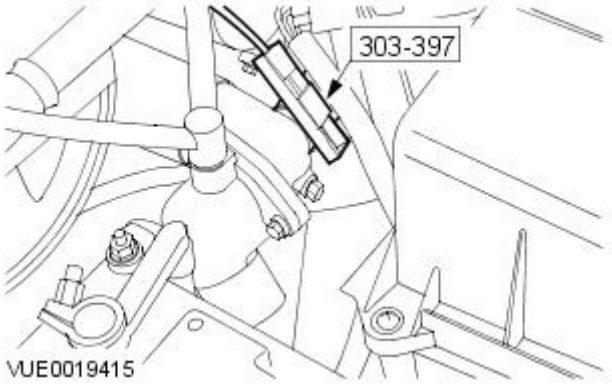
Engine Emission Control - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Exhaust Gas Recirculation (EGR) Cooler

Removal and Installation

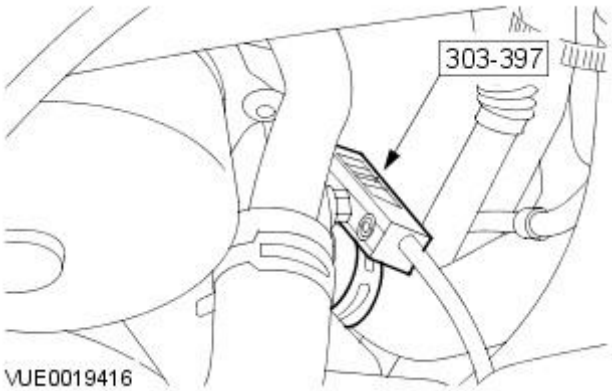
Special Tool(s)	
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)

Removal

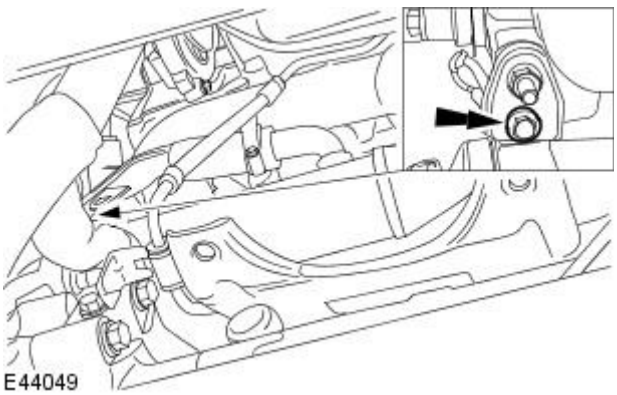
1. Drain the cooling system.
   For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
2. Remove the catalytic converter.
   For additional information, refer to: Catalytic Converter - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (309-00 Exhaust System, 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 - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
4. Using the special tool, disconnect the EGR cooler coolant hose from the thermostat housing.



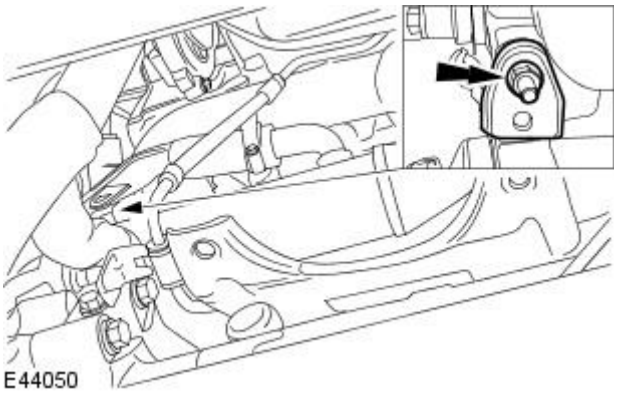
5. Using the special tool, disconnect the coolant hose from the EGR cooler.



6. Raise the vehicle.
7. Remove the EGR cooler mount bracket retaining bolt.



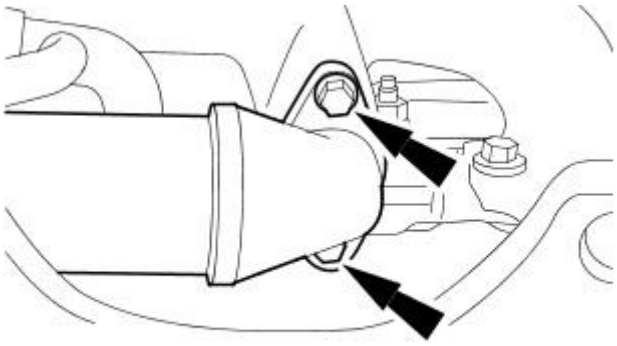
8. Remove the EGR cooler mount bracket.



E44050

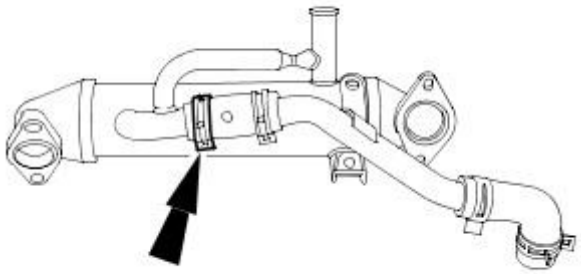
9. Remove the EGR cooler.

- Discard the gasket.



E44048

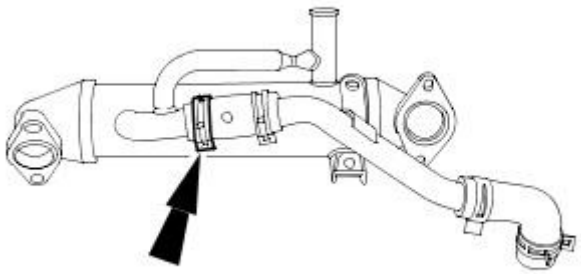
10. Remove the coolant hose from the EGR cooler.



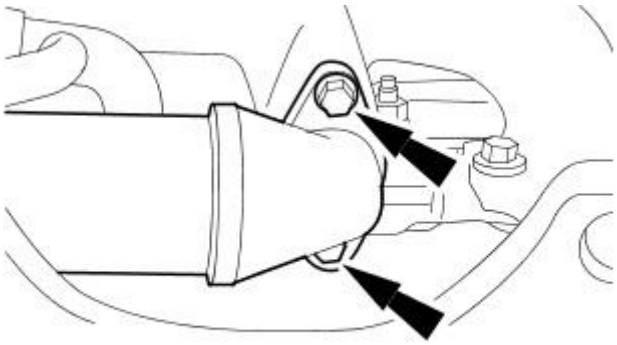
VUE 0026748

Installation

1. Install the coolant hose to the EGR cooler.



VUE 0026748

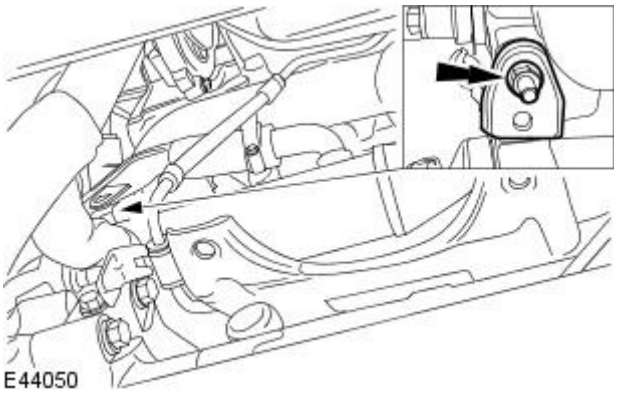


E44048

2. NOTE: Install a new EGR cooler gasket.

Install the EGR cooler.

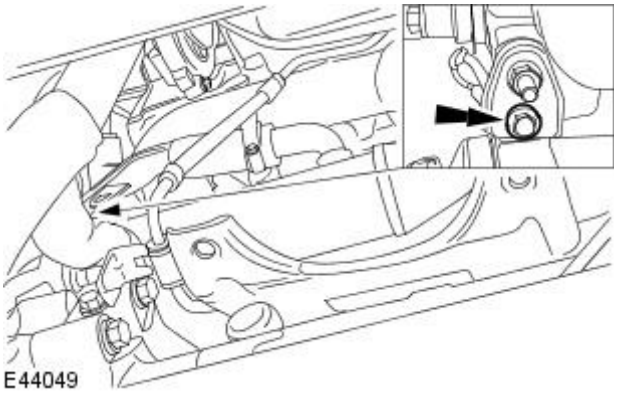
- Tighten to 37 Nm.



E44050

3. Install the EGR cooler mount bracket.

- Tighten to 10 Nm.



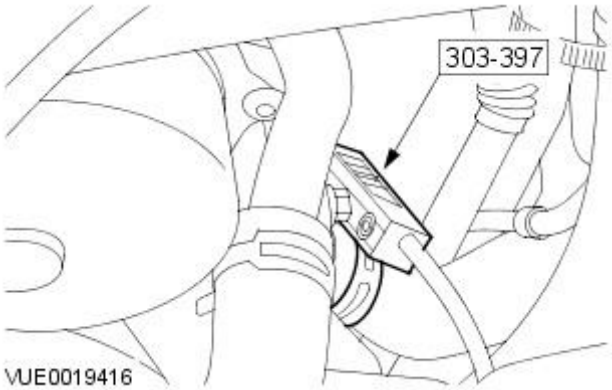
E44049

4. Install the EGR cooler mount bracket retaining bolt.

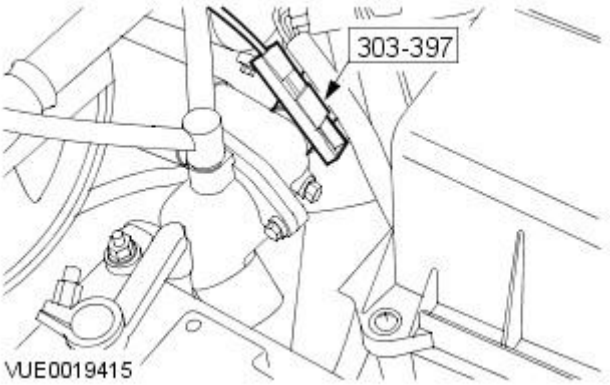
- Tighten to 10 Nm.

5. Lower the vehicle.

6. Using the special tool, connect the coolant hose to the EGR cooler.



VUE0019416



7. Using the special tool, connect the EGR cooler coolant hose to the thermostat housing.

8. Install the air cleaner outlet pipe.
   For additional information, refer to: Air Cleaner Outlet Pipe (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

9. Install the catalytic converter.
   For additional information, refer to: Catalytic Converter - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (309-00 Exhaust System, Removal and Installation).

10. Carry out the cooling system filling and bleeding procedure.
    For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

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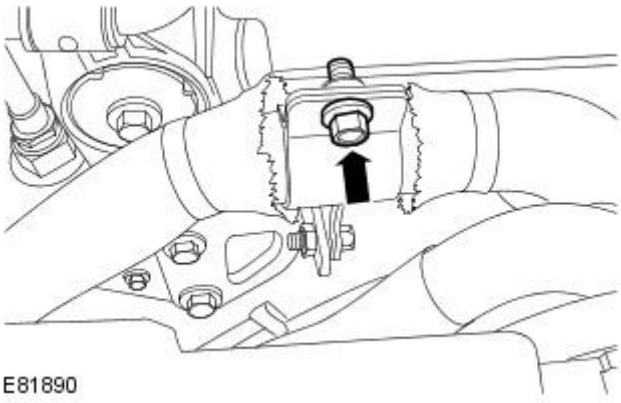
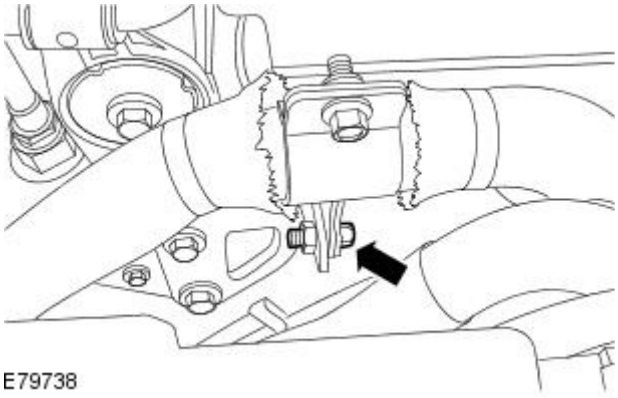
Engine Emission Control - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Exhaust Gas Recirculation (EGR) Cooler to EGR Valve Tube

Removal and Installation

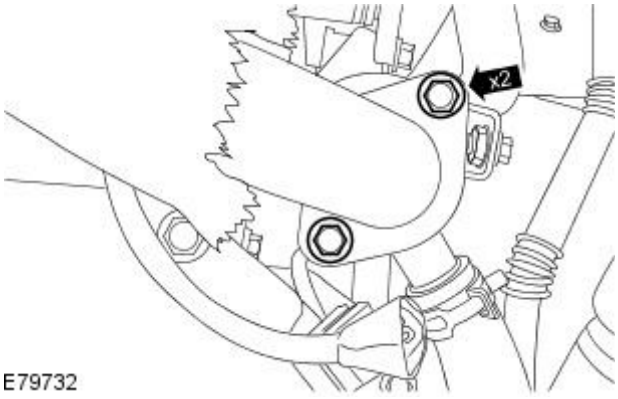
Removal



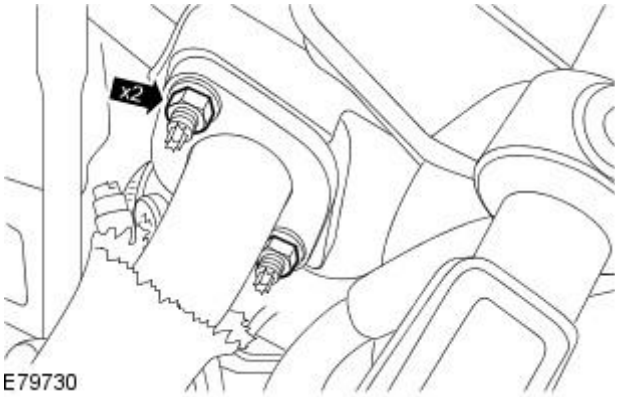
1. Remove the air cleaner.
   For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
2. Loosen the exhaust gas recirculation (EGR) cooler to EGR valve tube mounting bracket upper retaining bolt.



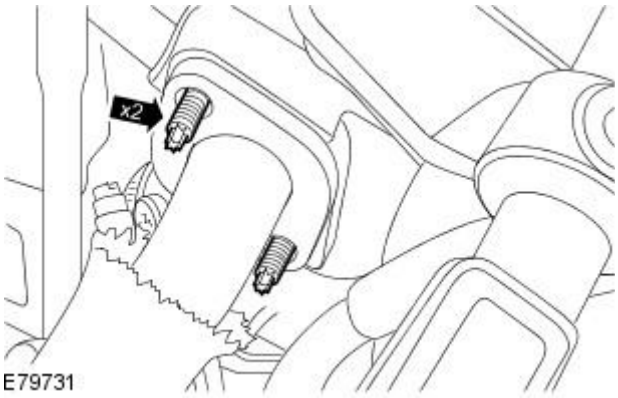
3. Remove the EGR cooler to EGR valve tube mounting bracket lower retaining bolt.



4. Remove the EGR valve tube to EGR cooler retaining bolts.
   - Remove and discard the gasket.

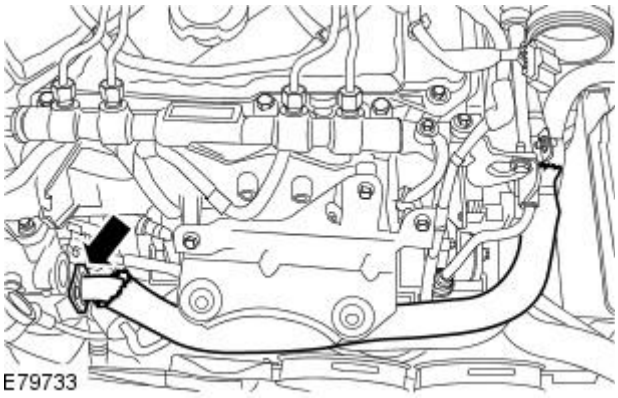


5. Remove the EGR valve tube to EGR valve retaining nuts.



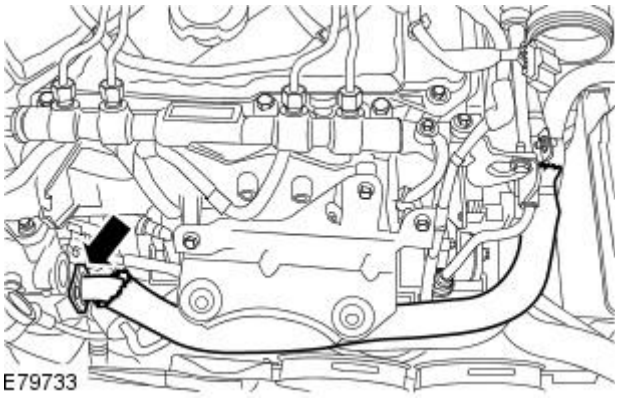
6. Remove the EGR valve tube to EGR valve retaining studs.

- Remove and discard the gasket.



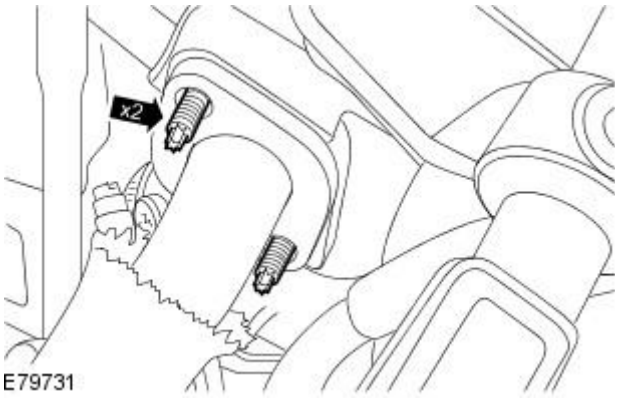
7. Remove the EGR cooler to EGR valve tube.

Installation



1. CAUTION: The tightening sequence of the EGR cooler to EGR valve tube retaining nuts and bolts is critical. Follow the exact order of tightening shown in the installation procedure. Failure to follow this instruction may result in damage to the vehicle.

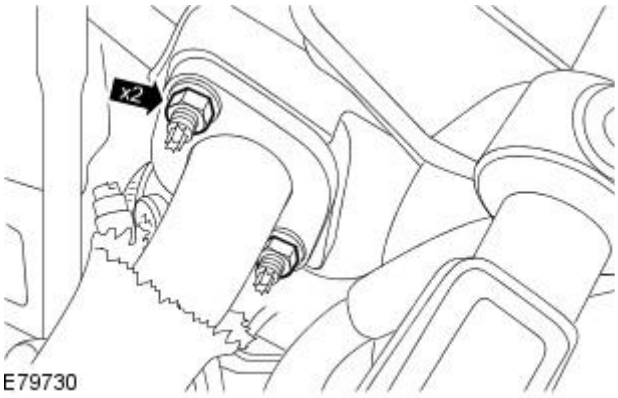
Install the EGR cooler to EGR valve tube.



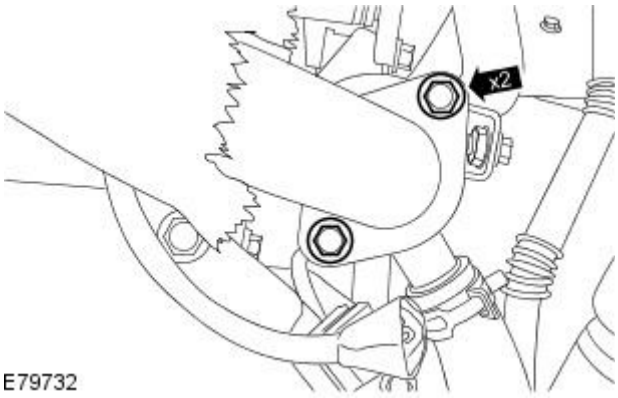
2. NOTE: Install a new EGR valve tube to EGR valve gasket.

Install the EGR valve tube to EGR valve retaining studs.

- Tighten to 11 Nm.

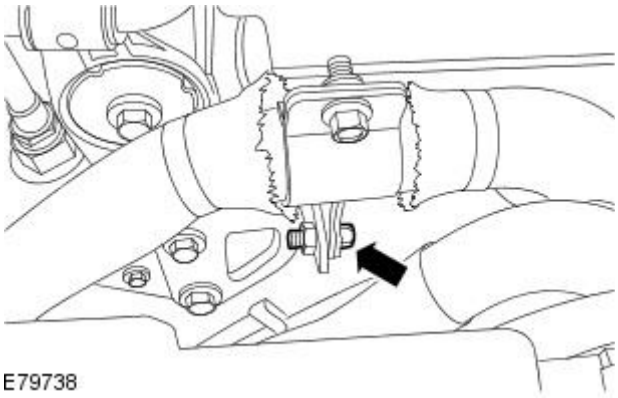


3. Loosely install the EGR valve tube to EGR valve retaining nuts.

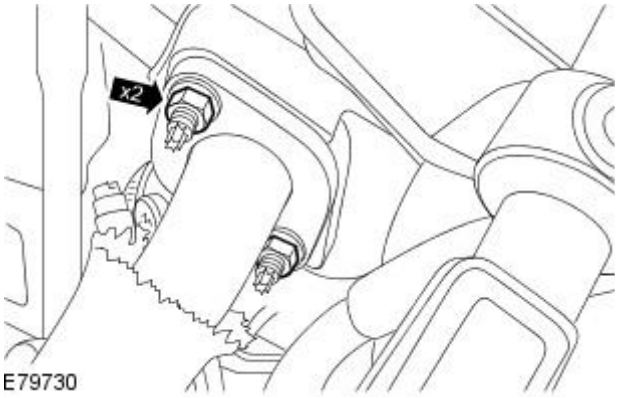


4. NOTE: Install a new EGR valve tube to EGR cooler gasket.

Loosely install the EGR valve tube to EGR cooler retaining bolts.

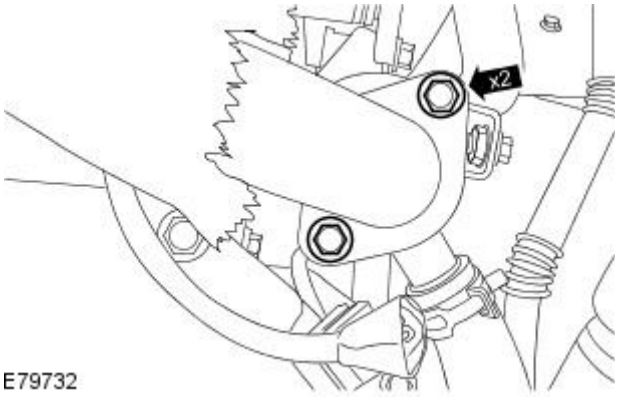


5. Loosely install the EGR cooler to EGR valve tube mounting bracket lower retaining bolt.



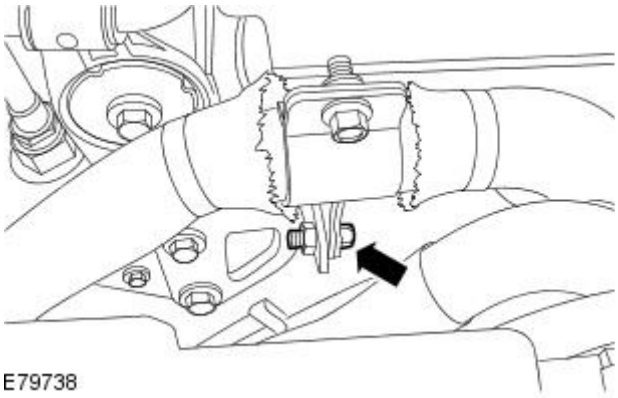
6. Tighten the EGR valve tube to EGR valve retaining nuts.

- Tighten to 10 Nm.



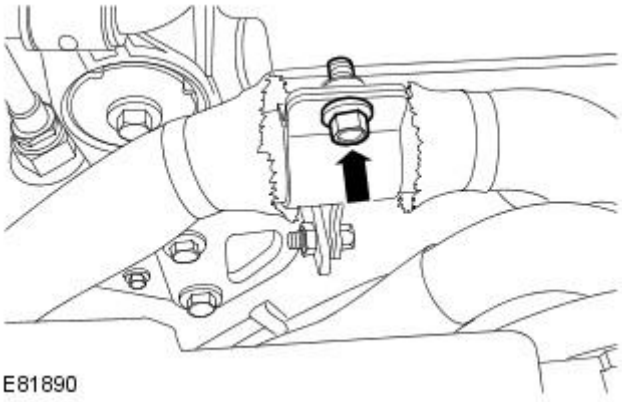
7. Tighten the EGR valve tube to EGR cooler retaining bolts.

- Tighten to 10 Nm.


E79738

8. Tighten the EGR cooler to EGR valve tube mounting bracket lower retaining bolt.

- Tighten to 10 Nm.


E81890

9. Tighten the EGR cooler to EGR valve tube mounting bracket upper retaining bolt.

- Tighten to 10 Nm.

10. Install the air cleaner.
For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

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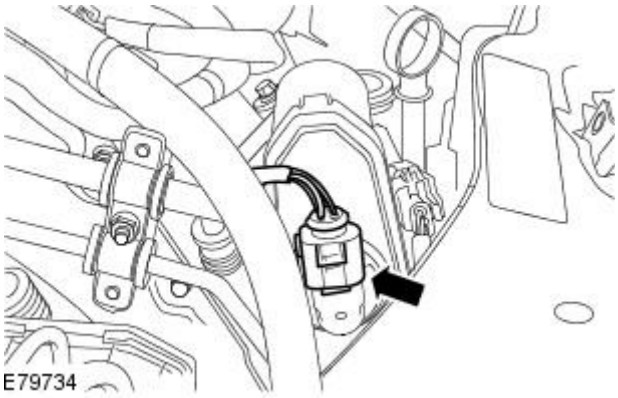
Engine Emission Control - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Exhaust Gas Recirculation (EGR) Valve

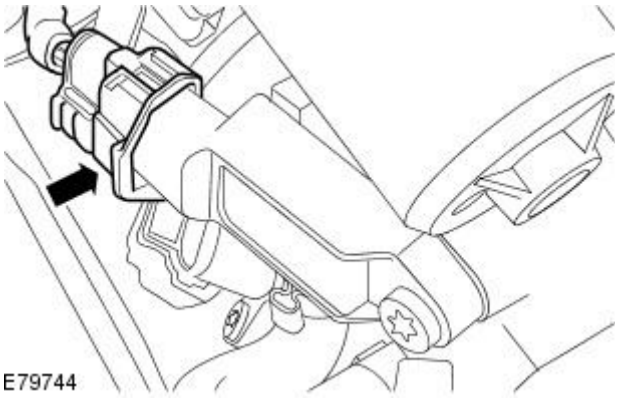
Removal and Installation

Removal

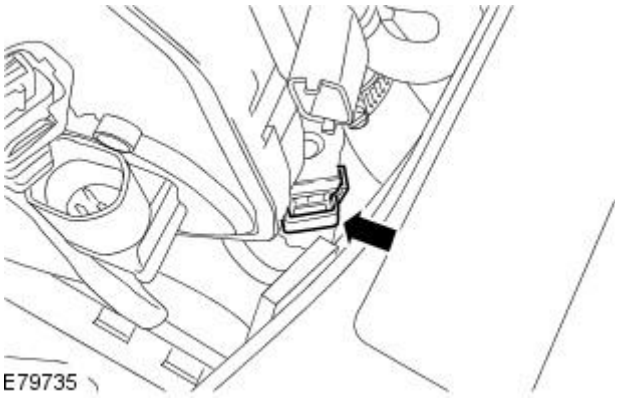
1. Remove the air cleaner.
   For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
2. Disconnect the Exhaust Gas Recirculation (EGR) valve electrical connector.



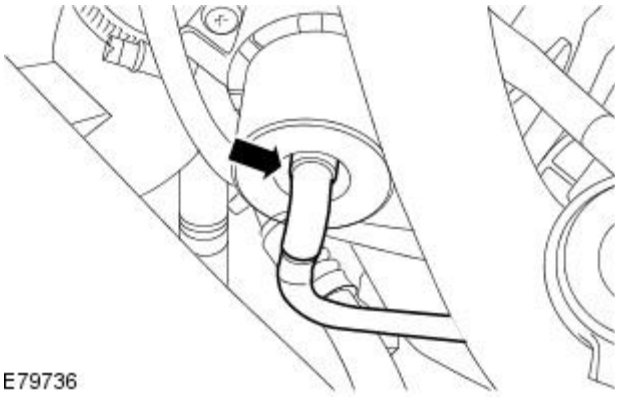
3. Disconnect the Manifold Absolute Pressure (MAP) sensor electrical connector.

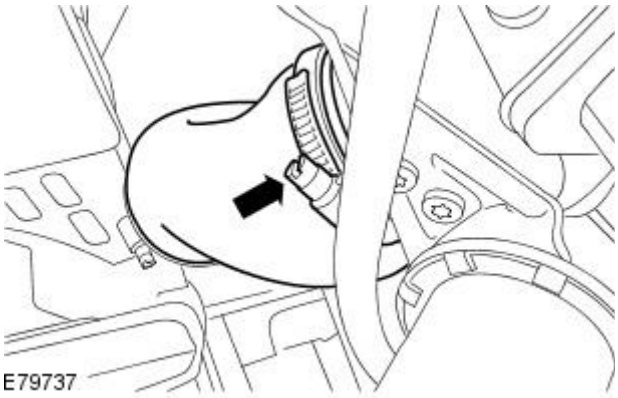


4. Disconnect the throttle plate position sensor electrical connector.

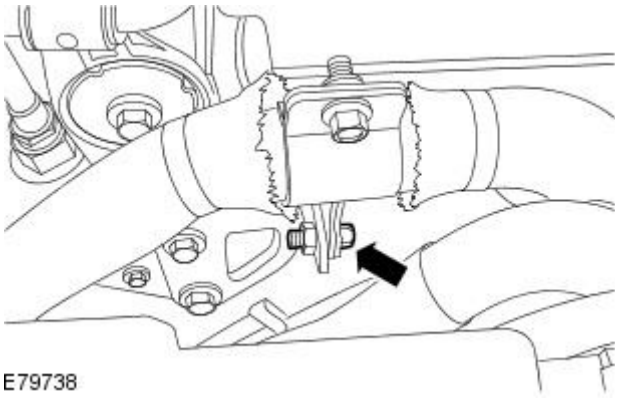


5. Disconnect the vacuum hose.

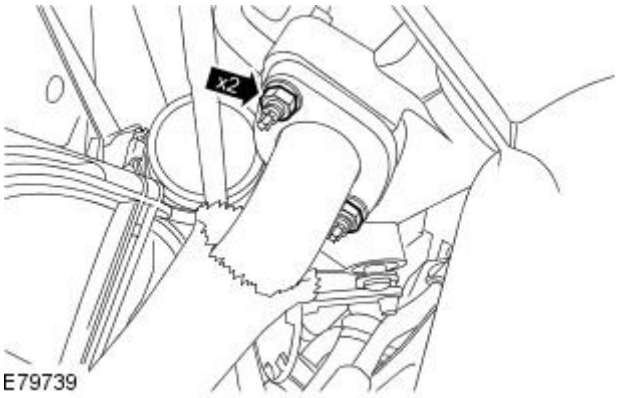




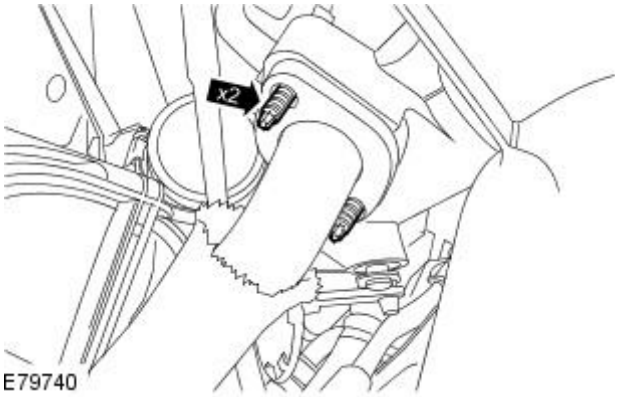
6. Detach the charge air cooler hose.



7. Loosen the EGR cooler to EGR valve tube mounting bracket lower retaining bolt.

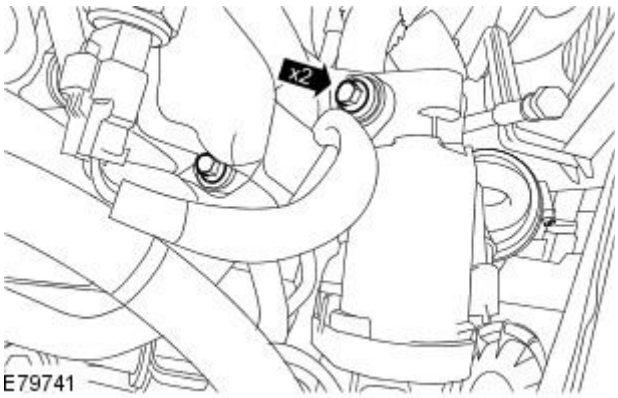


8. Remove the EGR valve tube to EGR valve retaining nuts.



9. Remove the EGR valve tube to EGR valve retaining studs.

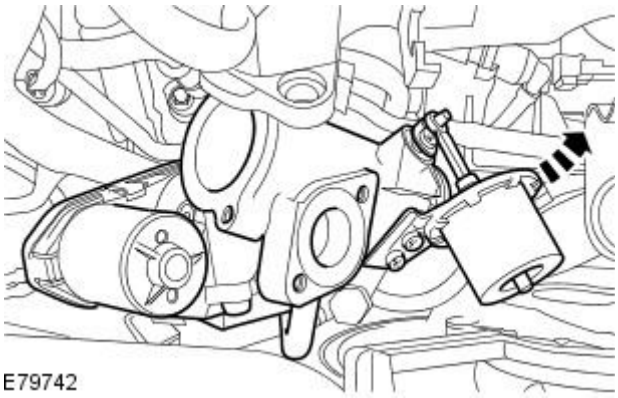
- Remove and discard the gasket.



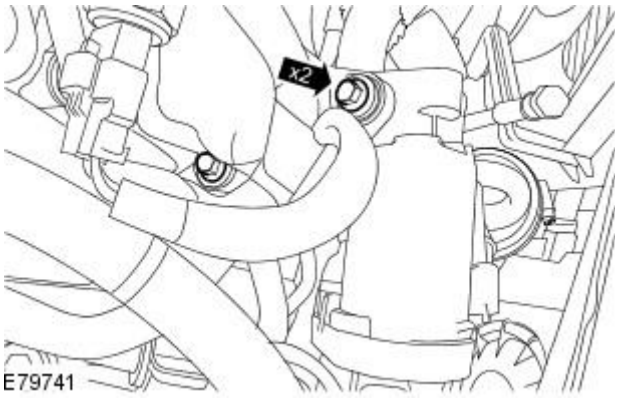
10. Remove the EGR valve to inlet manifold retaining bolts.

- Remove and discard the O-ring seal.

11. Remove the EGR valve.



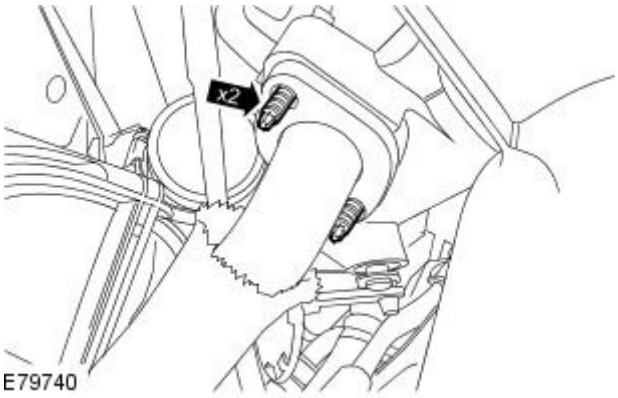
Installation



1. NOTE: Install a new EGR valve O-ring seal.

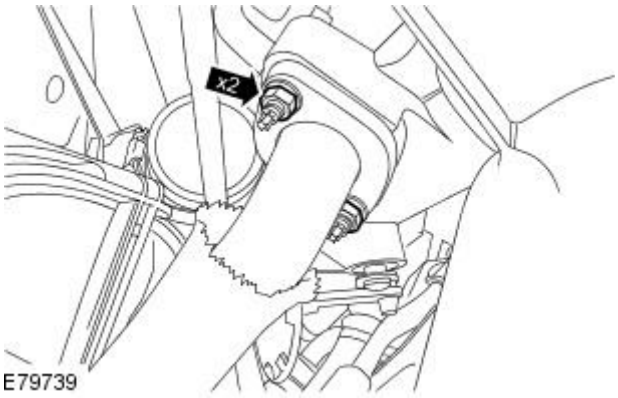
To install, reverse the removal procedure.

- Tighten to 10 Nm.

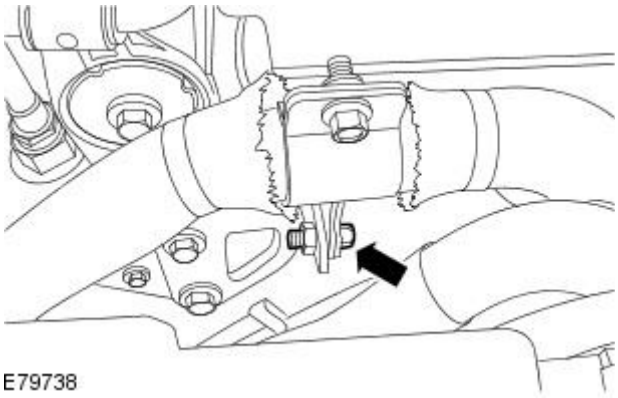


2. NOTE: Install a new EGR valve gasket.

Tighten to 11 Nm.



3. Tighten to 10 Nm.



E79738

4. Tighten to 10 Nm.

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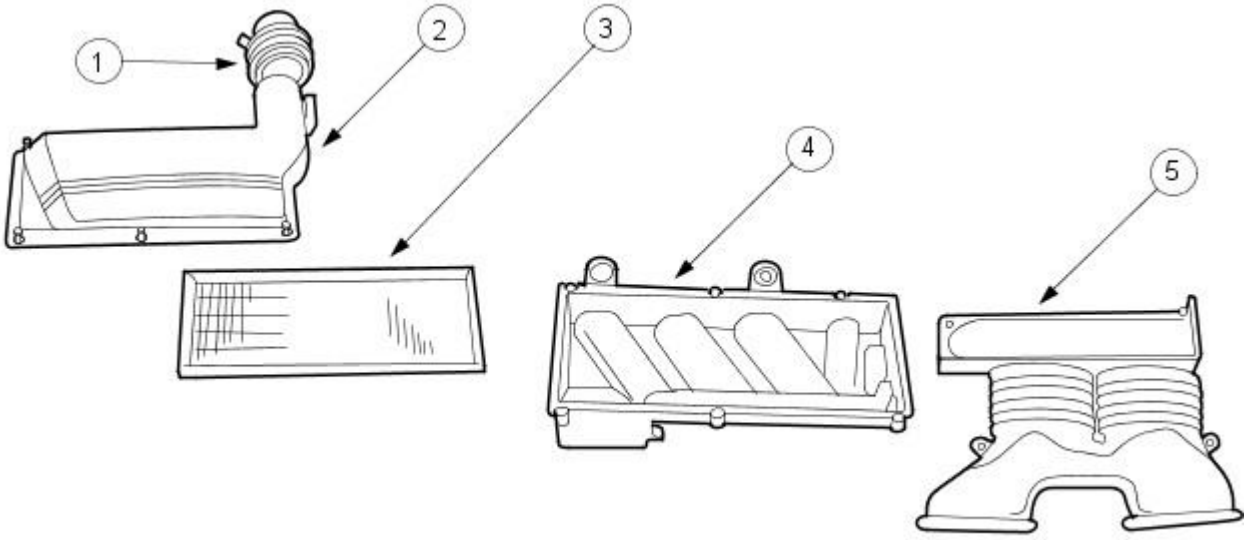
Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Intake Air Distribution and Filtering

Description and Operation



VUJ0002799

Item	Part Number	Description
1	—	Air cleaner outlet pipe
2	—	Air cleaner cover
3	—	Air cleaner element
4	—	Air cleaner
5	—	Air cleaner intake pipe

Published: 11-May-2011

Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Intake Air Distribution and Filtering

Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
• Air cleaner intake pipe • Air cleaner outlet pipe • Air cleaner element

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 Jaguar Approved Diagnostic System.

Published: 11-May-2011

Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Air Cleaner

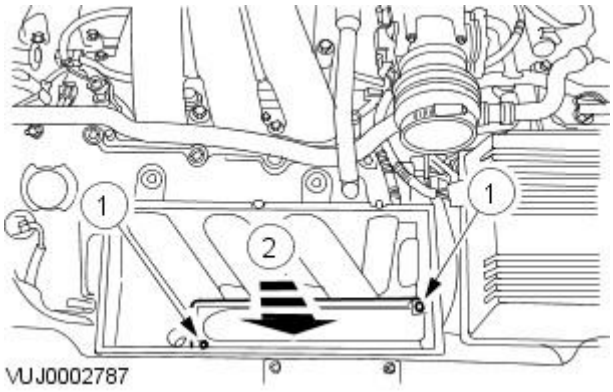
Removal and Installation

Removal

1. Remove the air cleaner element. For additional information, refer to the procedure in this section: Air Cleaner Element

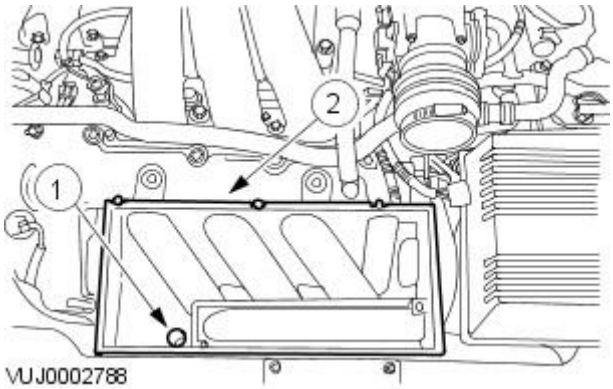
2. Detach the air cleaner intake pipe.

1. Remove the air cleaner intake pipe retaining screws.
2. Detach the air cleaner intake pipe.



3. Remove the air cleaner.

1. Detach the air cleaner from the retaining grommet.
2. Remove the air cleaner.



Installation

1. NOTE: When installing the air cleaner, make sure that the locating peg is installed correctly into the retaining bracket grommet.

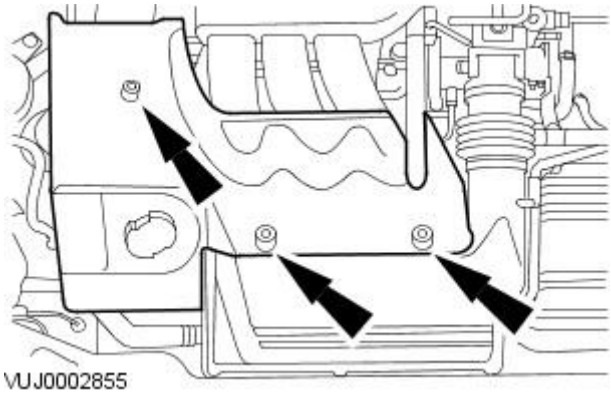
To install, reverse the removal procedure.

Published: 11-May-2011

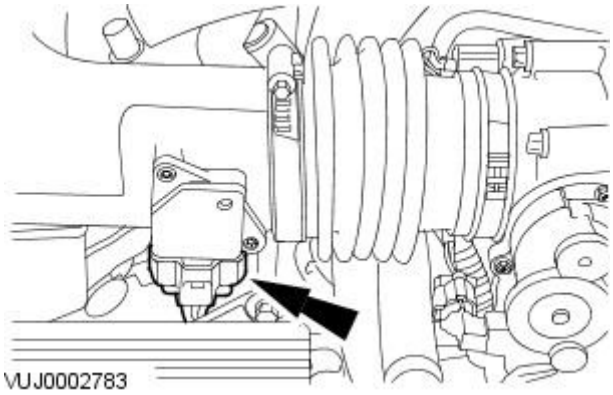
Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Air Cleaner Element

Removal and Installation

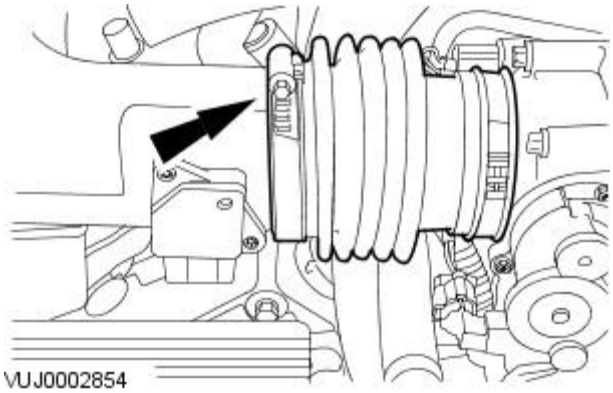
Removal


VUJ0002855

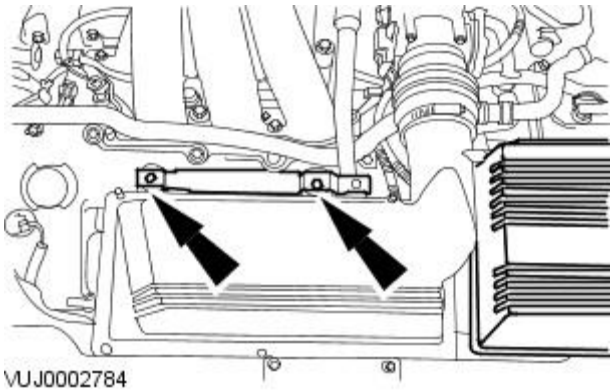
1. Remove the engine cover.


VUJ0002783

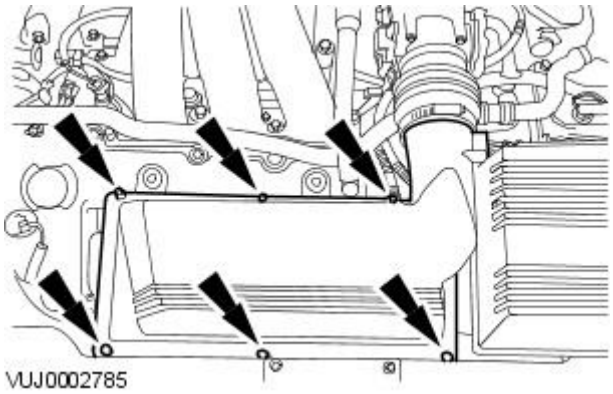
2. Disconnect the mass airflow sensor electrical connector.


VUJ0002854

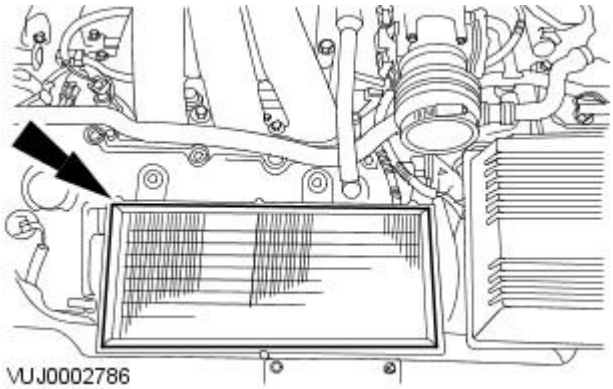
3. Disconnect the air cleaner outlet pipe.


VUJ0002784

4. Remove the engine cover mounting plate.


VUJ0002785

5. Remove the air cleaner cover.


VUJ0002786

6. Remove the air cleaner element.

Installation

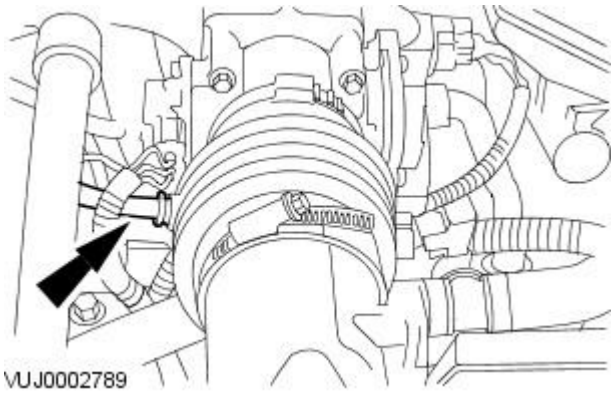
1. To install, reverse the removal procedure.

Published: 11-May-2011

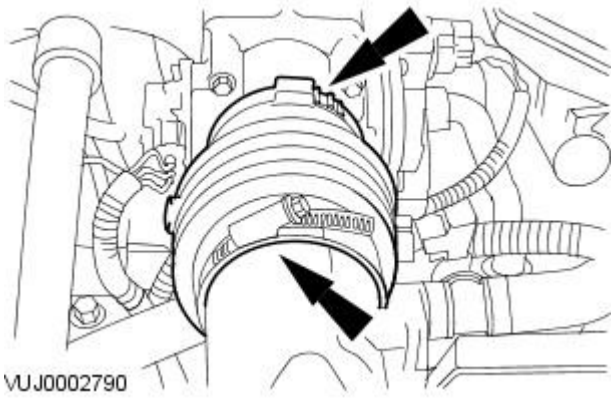
Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Air Cleaner Outlet Pipe

Removal and Installation

Removal



1. Disconnect the positive crankcase ventilation hose.



2. Remove the air cleaner outlet pipe.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma -

Torque Specifications

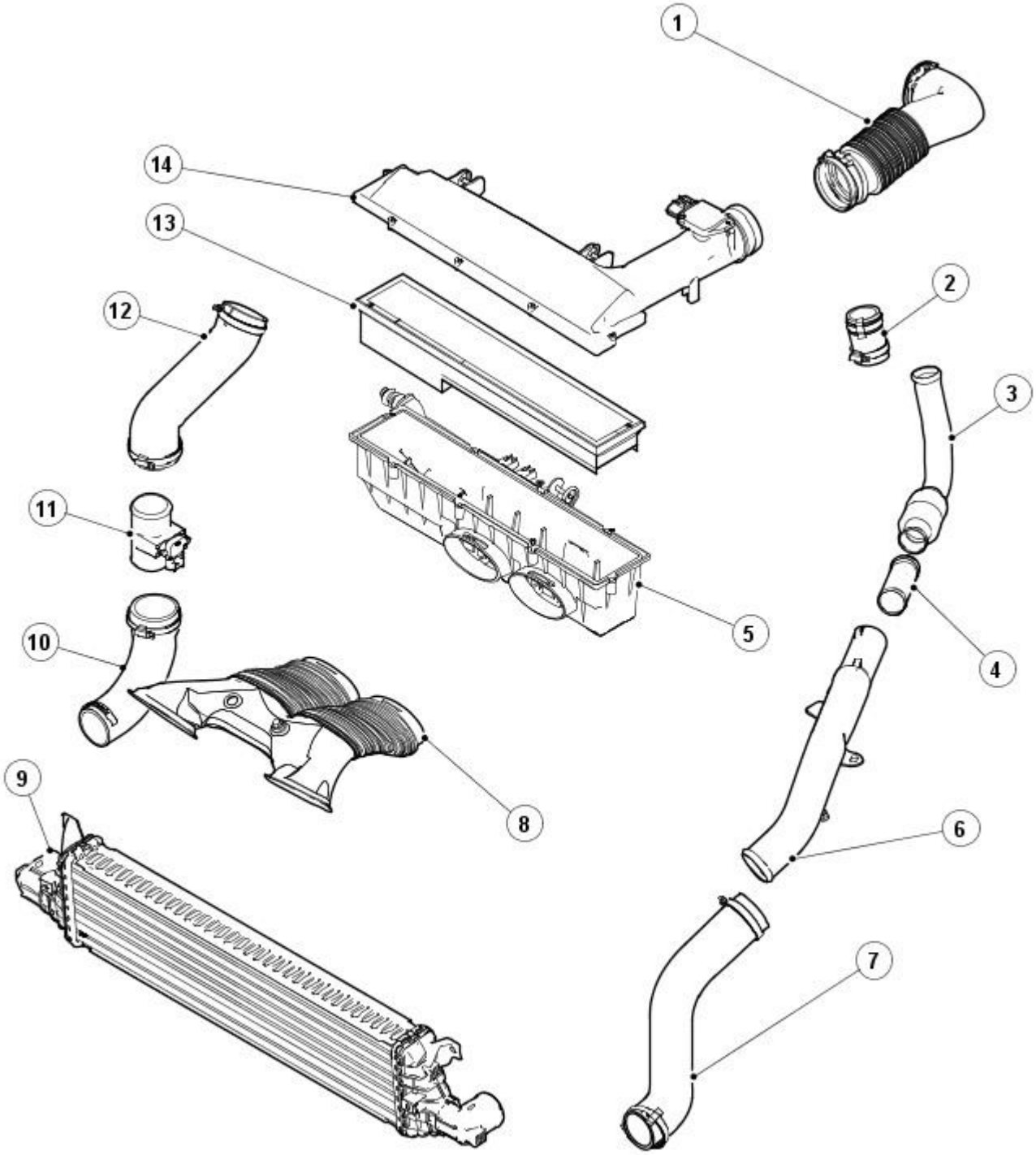
Description	Nm	lb-ft	lb-in
Charge air cooler retaining bolts	7	–	62
Charge air cooler outlet hose	4	–	35
Charge air cooler intake hose	4	–	35
Power steering fluid cooler retaining bolts	7	–	62

Published: 11-May-2011

Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Intake Air Distribution and Filtering

Description and Operation

Vehicles with 2.0L diesel engine

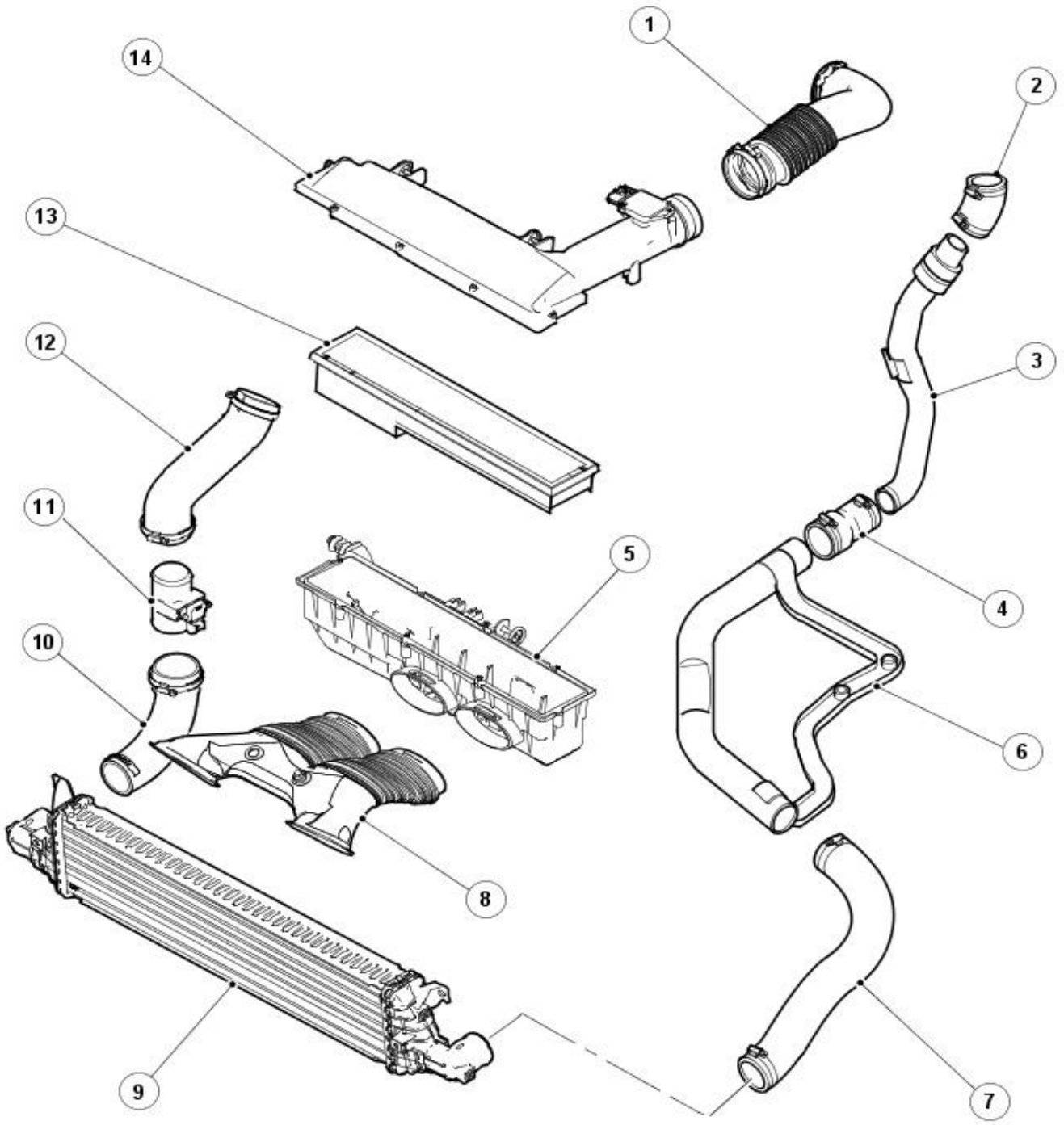


E44052

Item	Part Number	Description
1	-	Air cleaner outlet pipe
2	-	Turbo to turbo outlet pipe connecting hose
3	-	Turbo outlet pipe
4	-	Turbo outlet pipe to charge air cooler intake pipe connecting hose
5	-	Air cleaner
6	-	Charge air cooler intake pipe
7	-	Charge air cooler intake hose
8	-	Air cleaner intake pipe
9	-	Charge air cooler
10	-	Charge air cooler outlet hose
11	-	Thermal manifold absolute pressure (TMAP) sensor

12	-	Intake manifold inlet hose
13	-	Air cleaner element
14	-	Air cleaner cover

Vehicles with 2.2L diesel engine



E67313

Item	Part Number	Description
1	-	Air cleaner outlet pipe
2	-	Turbo to turbo outlet pipe connecting hose
3	-	Turbo outlet pipe
4	-	Turbo outlet pipe to charge air cooler intake pipe connecting hose
5	-	Air cleaner
6	-	Charge air cooler intake pipe
7	-	Charge air cooler intake hose
8	-	Air cleaner intake pipe
9	-	Charge air cooler
10	-	Charge air cooler outlet hose
11	-	Thermal manifold absolute pressure (TMAP) sensor
12	-	Intake manifold inlet hose
13	-	Air cleaner element
14	-	Air cleaner cover

Published: 11-May-2011

Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Intake Air Distribution and Filtering

Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
• Check the air cleaner housing for restriction/blockage • Check the air cleaner element for restriction/blockage • Check the charge air cooler for damage

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.

Pinpoint tests

WARNING: The following tests may involve working in close proximity to hot components. Make sure adequate protection is used. Failure to follow this instruction may result in personal injury.

PINPOINT TEST A : CHECK FOR RESTRICTION IN AIR INTAKE	
TEST CONDITIONS	**DETAILS / RESULTS / ACTIONS**
A1: CHECK FOR AIR FLOW THROUGH INTAKE SYSTEM	
	1 Inspect the air intake pipes between the air cleaner intake and the charge air cooler inlet (pay particular attention to the joints between the metal and rubber pipes).
	2 Disconnect the air intake pipe at the charge air cooler inlet and the turbocharger outlet.
	3 Using a suitable length of hose blow gently through the pipe.
	Is there an unrestricted flow of air through the hose? **Yes** GO to A2. **No** Remove the pipe and remove the cause of the restriction/blockage. Reassemble the removed parts and test the vehicle for normal operation.
A2: CHECK FOR AIR FLOW TO THE TURBOCHARGER	
	1 Disconnect the air intake pipe between the air cleaner and the turbocharger inlet.
	2 Check the pipe for restriction/blockage (this is a large-bore pipe, and can be checked visually).
	Is there an unrestricted flow of air through the hose? **Yes** GO to A3. **No** Clear the restriction/blockage. Reassemble the removed parts and test the vehicle for normal operation.
A3: CHECK FOR AIR FLOW TO THE CHARGE AIR COOLER	
	1 Remove the radiator splash shield.
	2 Disconnect the intake pipe from between the charge air cooler and the intake manifold.
	3 Using a suitable length of hose, blow gently through the pipe.
	Is there an unrestricted flow of air through the pipe? **Yes** GO to A4. **No** Clear the restriction/blockage. Reassemble the removed parts and test the vehicle for normal operation.
A4: CHECK FOR AIR FLOW THROUGH THE CHARGE AIR COOLER	
	1 Using a suitable length of hose, blow through the charge air cooler and monitor the flow.
	Is there an unrestricted flow of air through the charge air cooler? **Yes** GO to A5. **No** INSTALL a new charge air cooler. REFER to: Charge Air Cooler - 2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
A5: CHECK FOR AIR FLOW THROUGH THE TURBOCHARGER	
	1 Using a suitable length of hose, blow through the turbocharger and monitor the flow.
	Is there an unrestricted flow of air through the turbocharger? **Yes** No restriction found in the air intake. Check for other possible causes for the customer concern. **No** Remove and inspect the turbocharger. REFER to Section 303-04A Fuel Charging and Controls / 303-04B Fuel Charging and Controls / 303-04C Fuel Charging and Controls - Turbocharger.

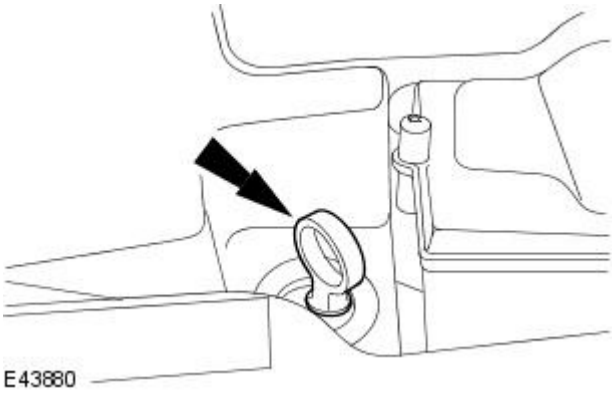
Published: 11-May-2011

Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Air Cleaner

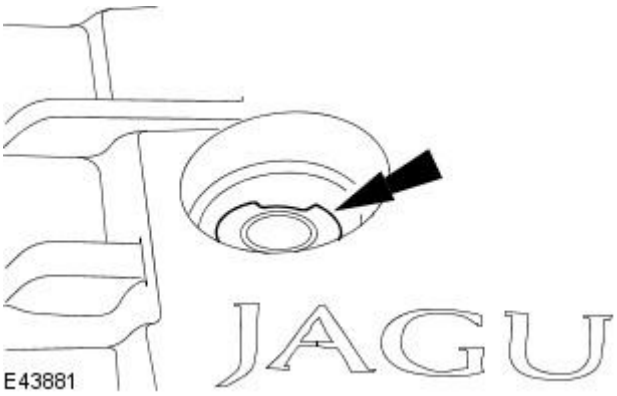
Removal and Installation

Removal

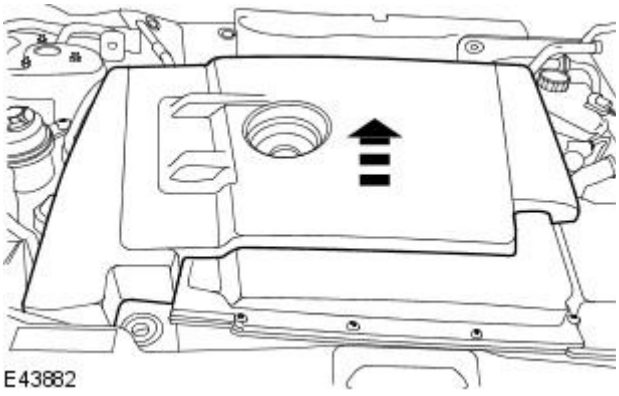
All vehicles



1. Remove the oil level indicator.

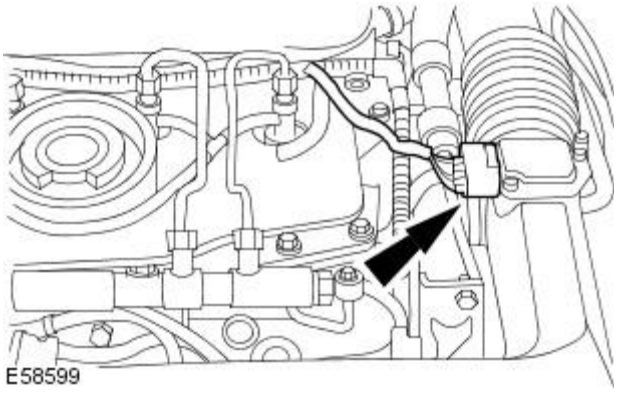


2. Remove the oil filler cap.



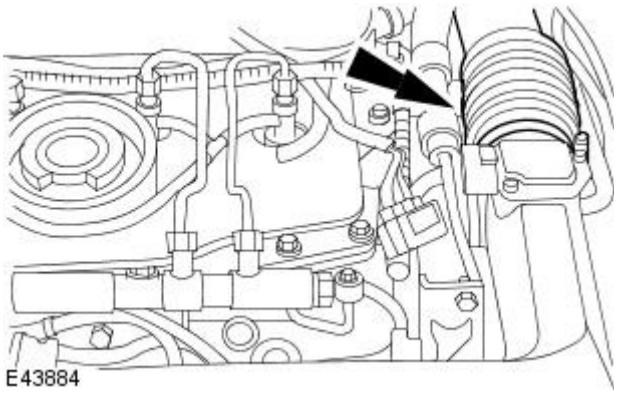
3. NOTE: Install the oil filler cap and oil level indicator to prevent foreign material entering the valve cover.

Remove the engine cover.



4. Disconnect the mass air flow (MAF) sensor electrical connector.

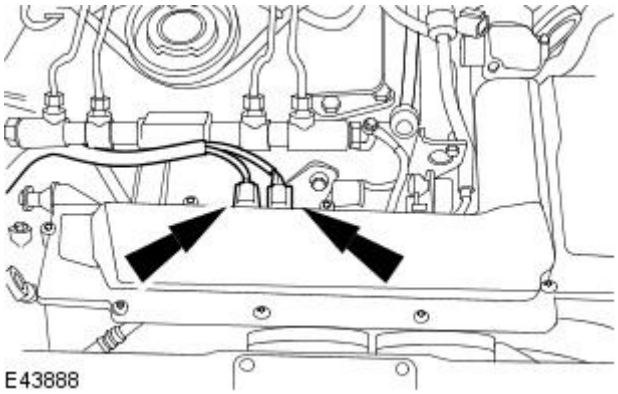
5. Detach the air cleaner outlet pipe.



E43884

Vehicles built up to VIN:E43868

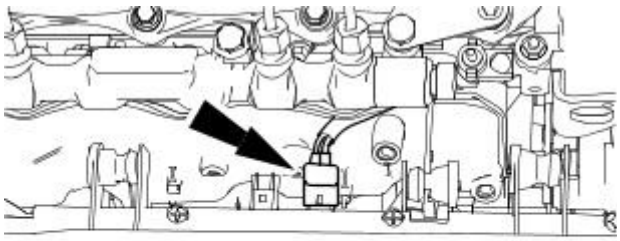
6. Disconnect the electrical connectors.



E43888

Vehicles built from VIN:E43869

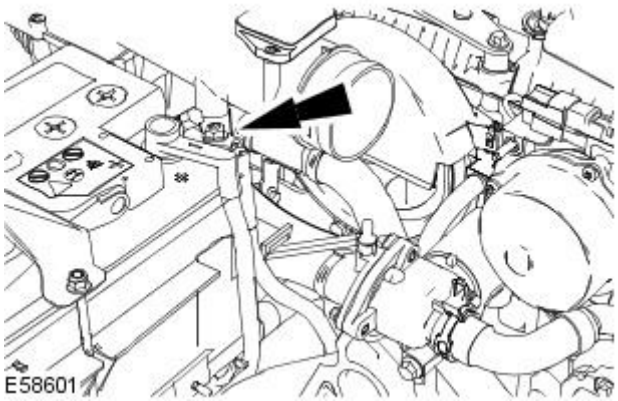
7. Disconnect the electrical connector.



E58600

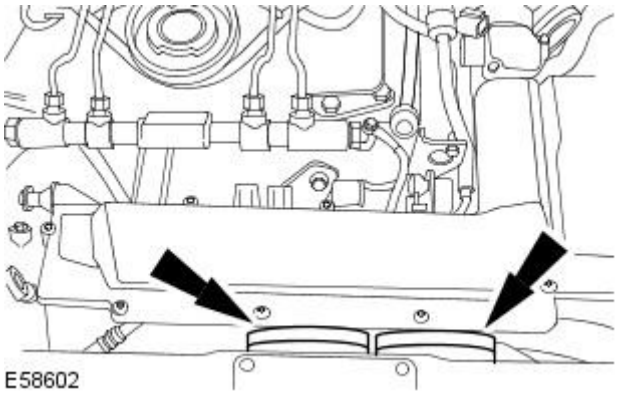
All vehicles

8. Detach the vacuum pipe from the air cleaner.

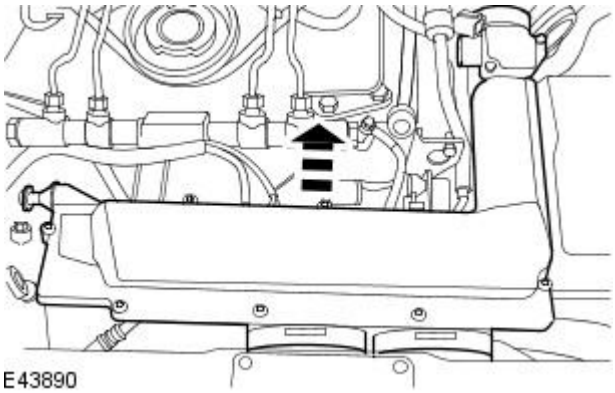


E58601

9. Detach the air cleaner intake pipe.



10. Remove the air cleaner.



Installation

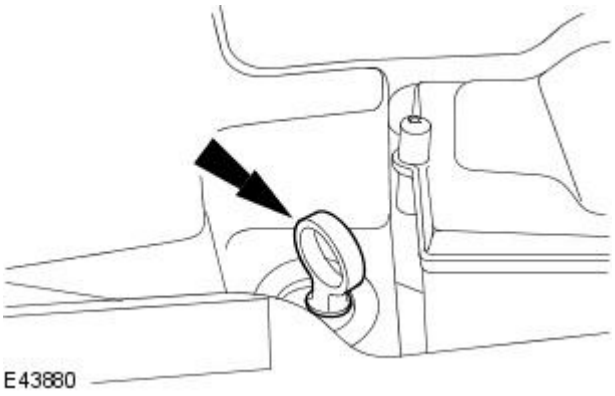
1. To install, reverse the removal procedure.

Published: 11-May-2011

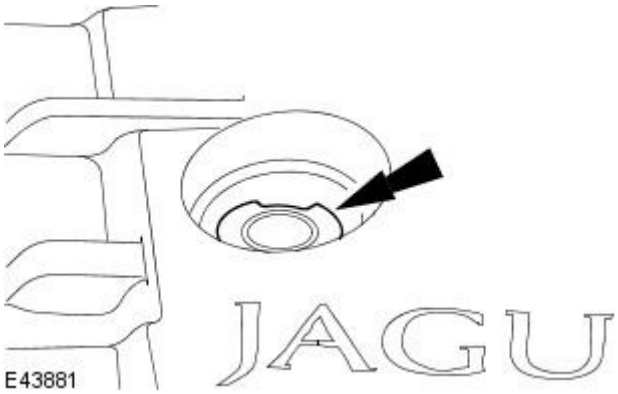
Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Air Cleaner Element

Removal and Installation

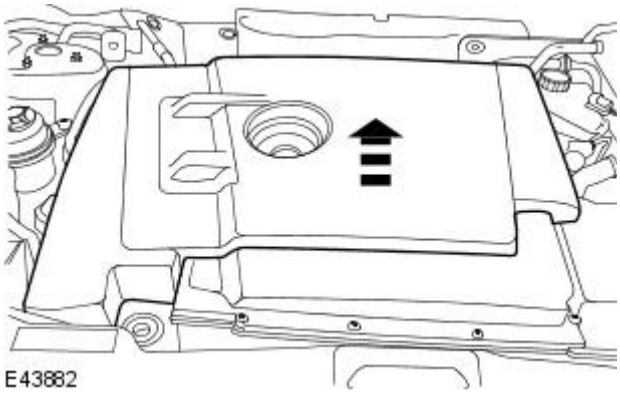
Removal



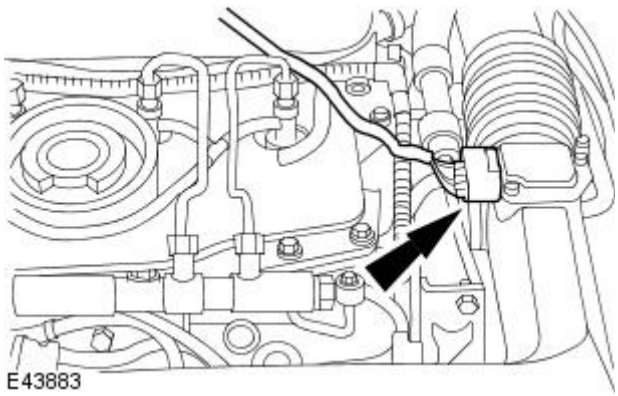
1. Remove the oil level indicator.



2. Remove the oil filler cap.

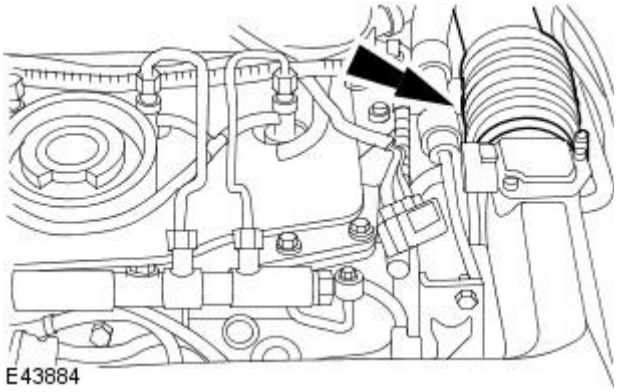


3. Remove the engine cover.

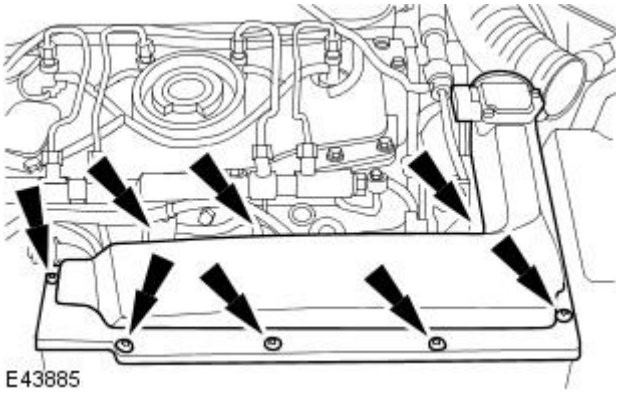


4. Disconnect the mass air flow (MAF) sensor electrical connector.

5. Detach the air cleaner outlet pipe.

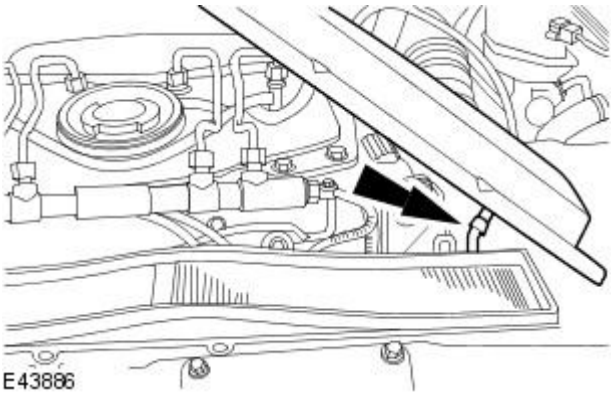


6. Detach the air cleaner cover.

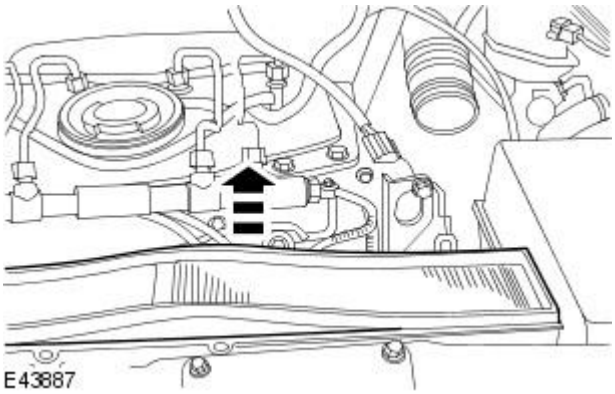


7. Remove the air cleaner cover.

- Disconnect the breather pipe.



8. Remove the air cleaner element.



Installation

1. To install, reverse the removal procedure.

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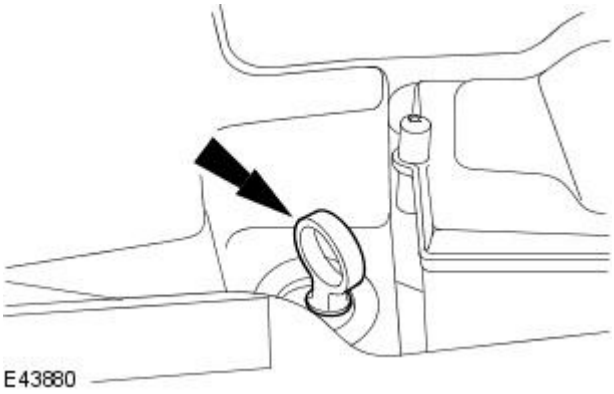
Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Air Cleaner Outlet Pipe

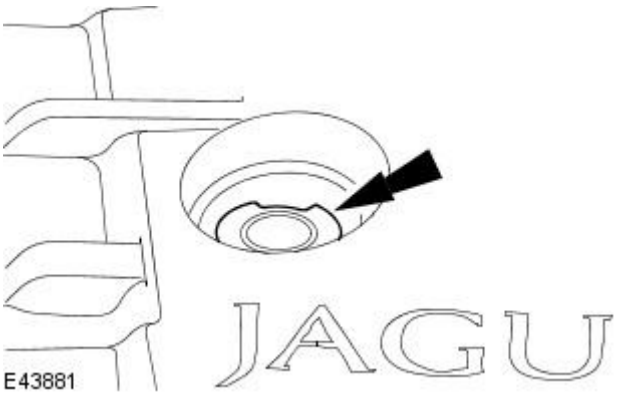
Removal and Installation

Removal

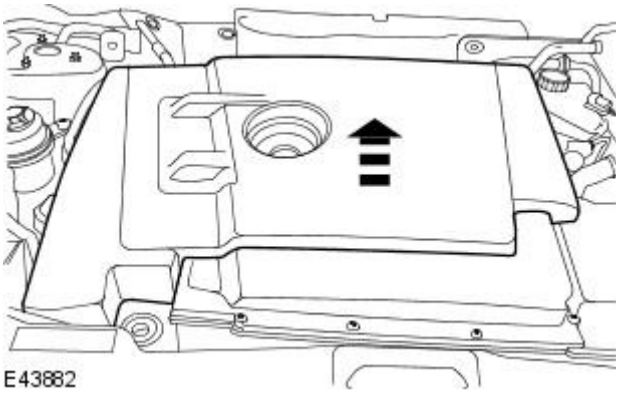
All vehicles



1. Remove the oil level indicator.



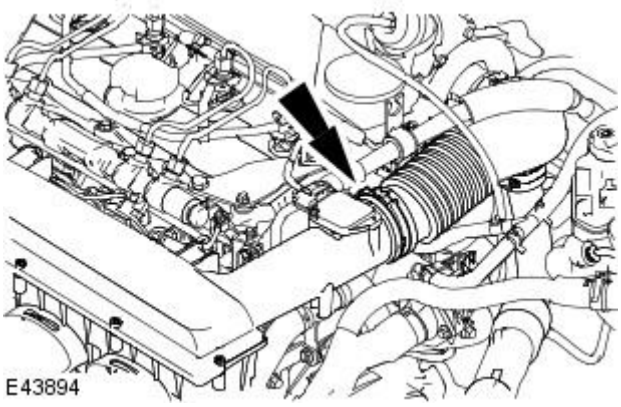
2. Remove the oil filler cap.



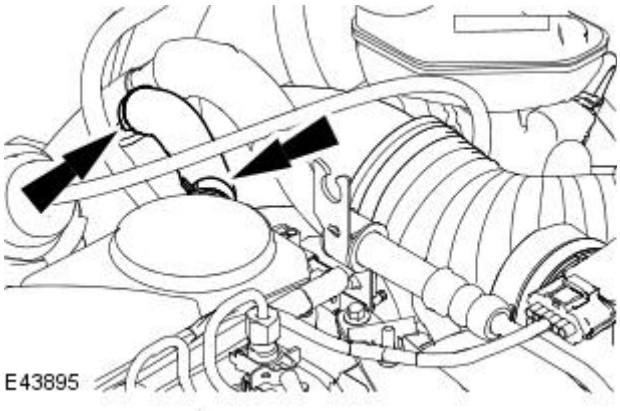
3. NOTE: Install the oil filler cap and oil level indicator to prevent foreign material entering the valve cover.

Remove the engine cover.

Vehicles built up to VIN:E43868

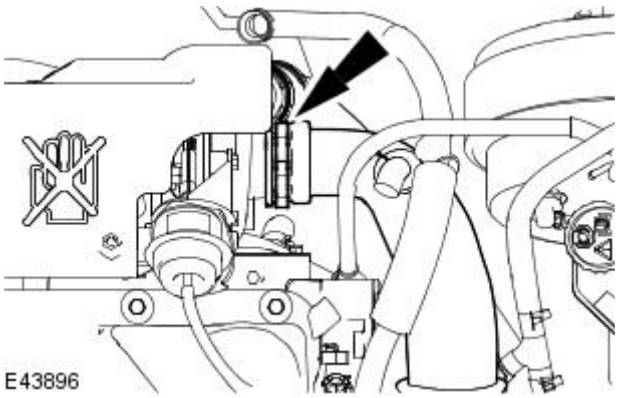


4. Detach the air cleaner outlet pipe.



5. Remove the positive crankcase ventilation hose.

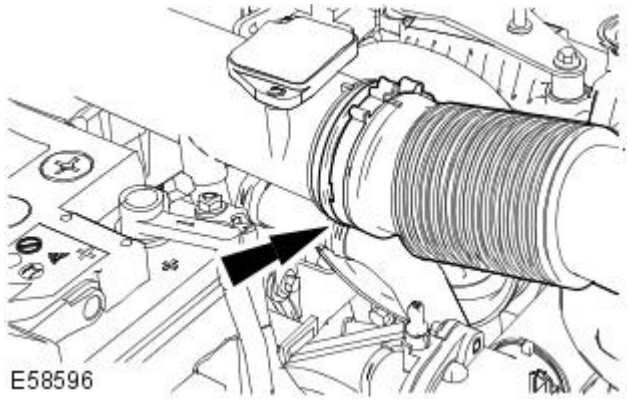
- Remove and discard the positive crankcase ventilation hose retaining clips.



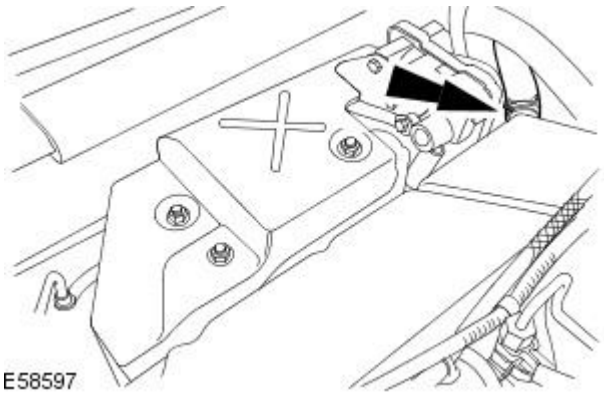
6. Remove the air cleaner outlet pipe.

- Remove and discard the air cleaner outlet pipe retaining clip.

Vehicles built from VIN:E43869

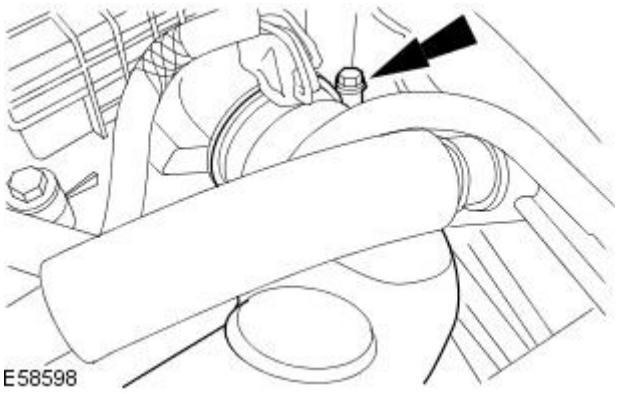


7. Detach the air cleaner outlet pipe.



8. Remove the positive crankcase ventilation hose.

- Remove and discard the positive crankcase ventilation hose retaining clips.



9. Remove the air cleaner outlet pipe.

- Remove and discard the air cleaner outlet pipe retaining clip.

Installation

1. NOTE: Install new positive crankcase ventilation hose retaining clips.

• NOTE: Install a new air cleaner outlet pipe retaining clip.

To install, reverse the removal procedure.

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Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Charge Air Cooler2.0L Duratorq-TDCi

Removal and Installation

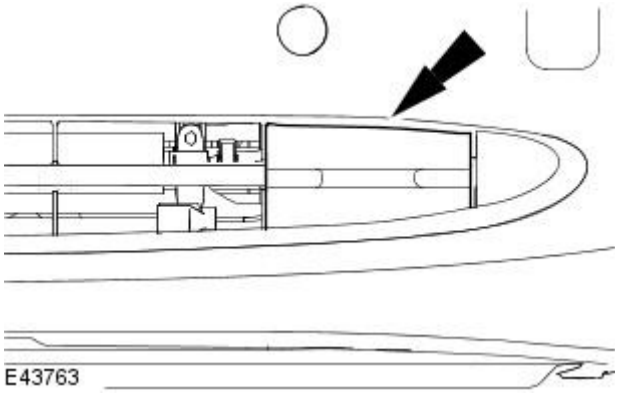
Removal

1. Remove the radiator splash shield.
   For additional information, refer to: Radiator Splash Shield (501-02 Front End Body Panels, Removal and Installation).
2. Remove the air splitter grille.

E43762

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

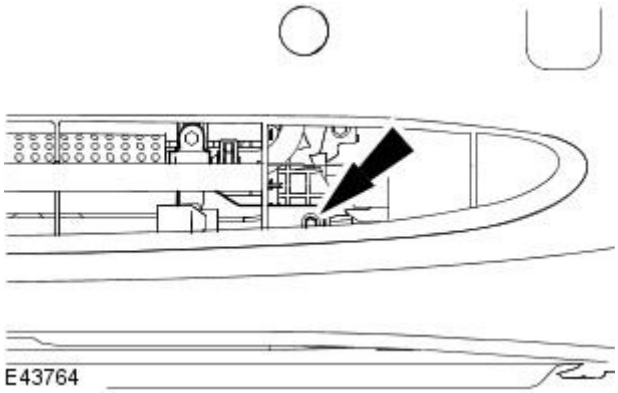
   Remove the air splitter grille finish panel.



E43763

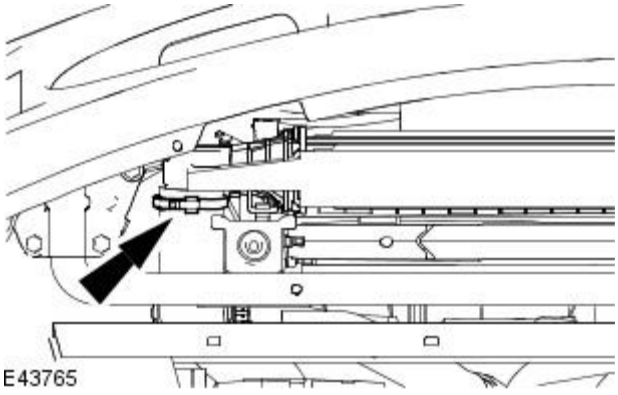
4. NOTE: Left-hand shown, right-hand similar.

   Detach the power steering fluid cooler.



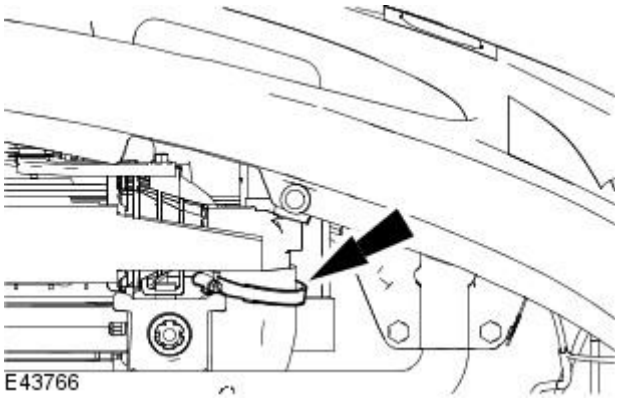
E43764

5. Detach the charge air cooler outlet hose from the charge air cooler.



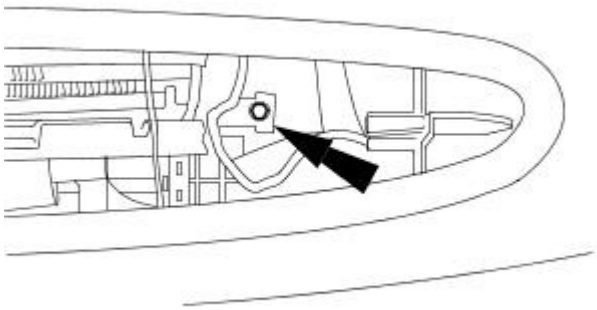
E43765

6. Detach the charge air cooler intake hose from the charge air cooler.

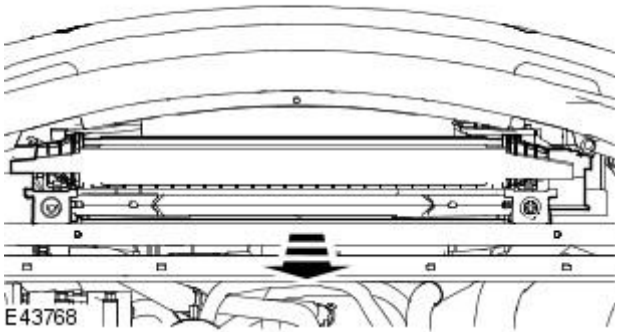

E43766

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

Remove the charge air cooler retaining bolt.


E43767

8. Remove the charge air cooler.


E43768

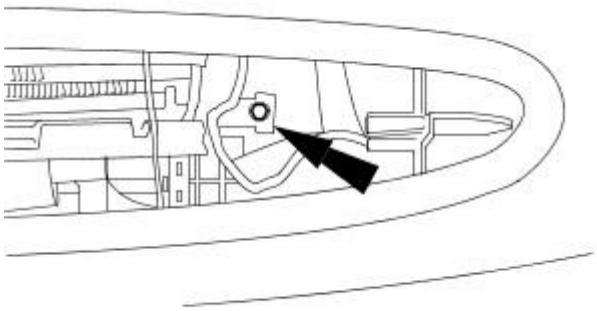
Installation

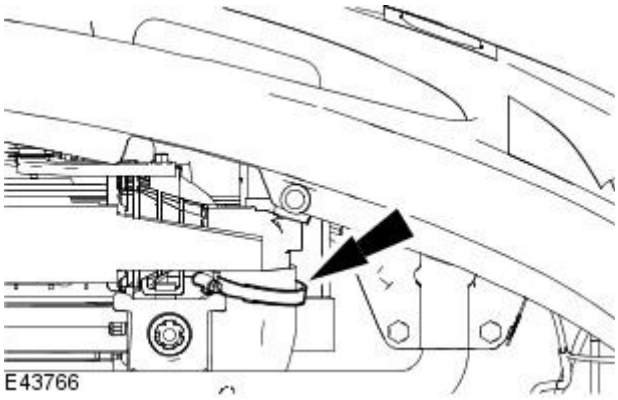
1. NOTE: Make sure the charge air cooler hoses are not split or cracked and are free of grease and contaminants.

To install, reverse the removal procedure.

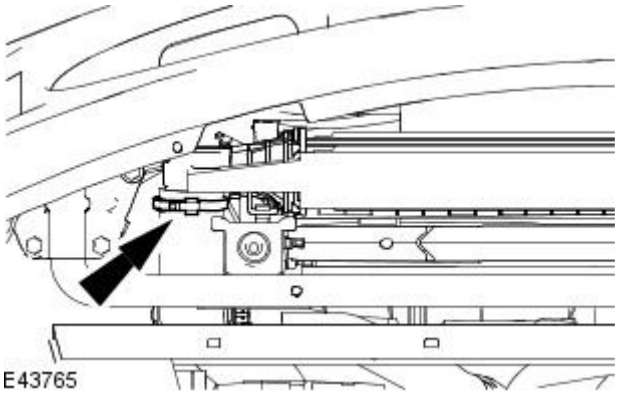
2. NOTE: Left-hand shown, right-hand similar.

Tighten to 7 Nm.

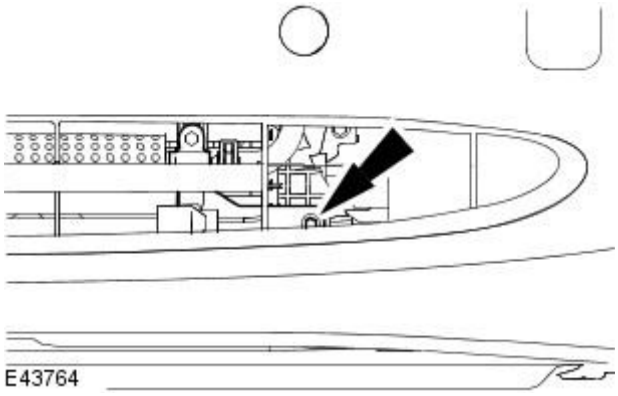

E43767



3. Tighten to 4 Nm.



4. Tighten to 4 Nm.



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

Tighten to 7 Nm.

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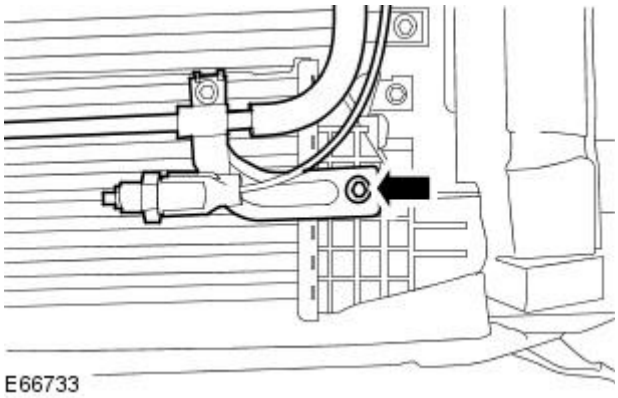
Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Charge Air Cooler2.2L Duratorq-TDCi (110kW / 150PS) - Puma

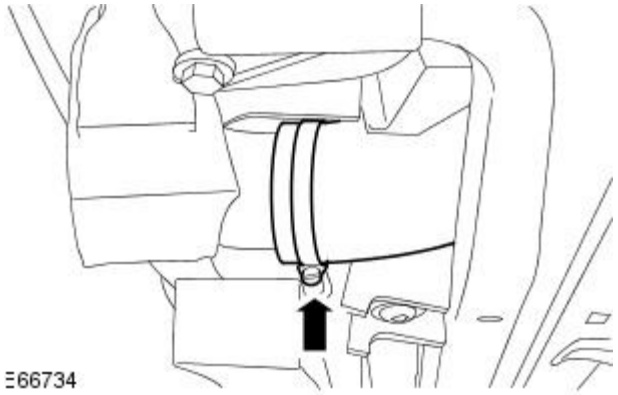
Removal and Installation

Removal

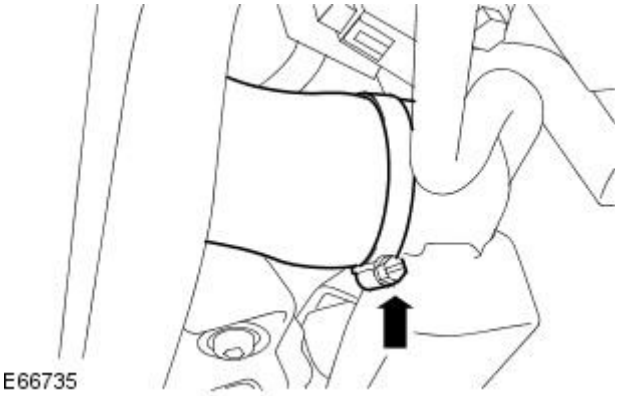


1. Remove the front bumper cover.
   For additional information, refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).
2. NOTE: Left-hand shown, right-hand similar.

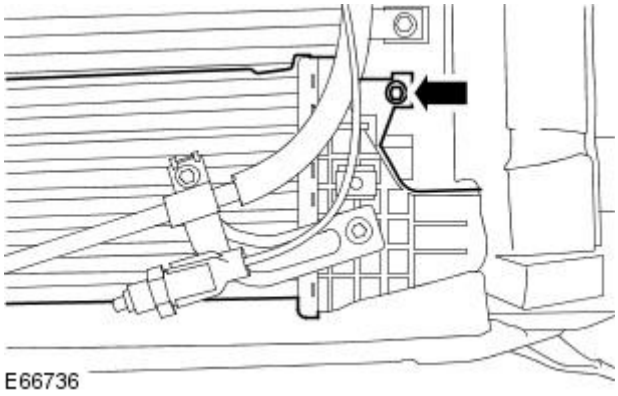
   Detach the power steering fluid cooler.



3. Detach the charge air cooler outlet hose from the charge air cooler.



4. Detach the charge air cooler intake hose from the charge air cooler.



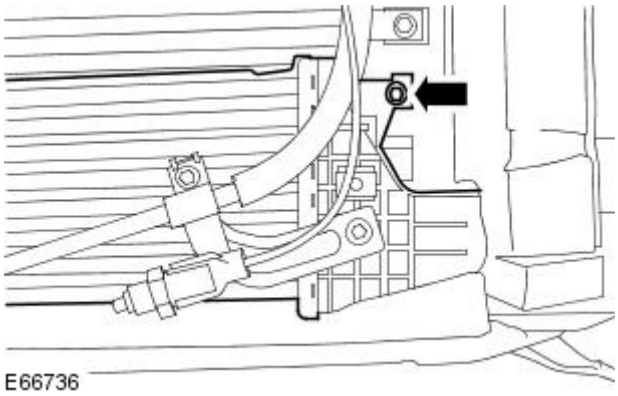
5. NOTE: Left-hand shown, right-hand similar.

   Remove the charge air cooler.

Installation

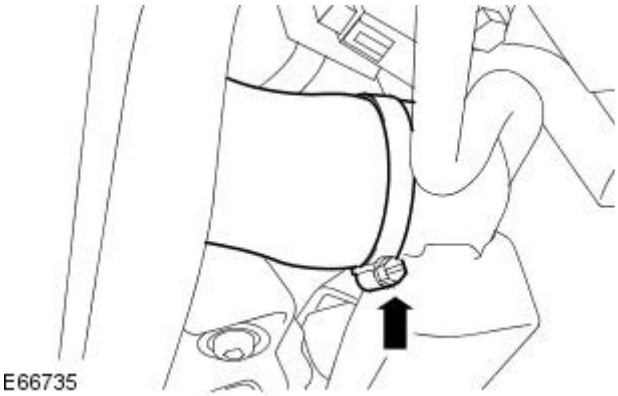
1. NOTE: Make sure the charge air cooler hoses are not split or cracked and are free of grease and contaminants.

To install, reverse the removal procedure.

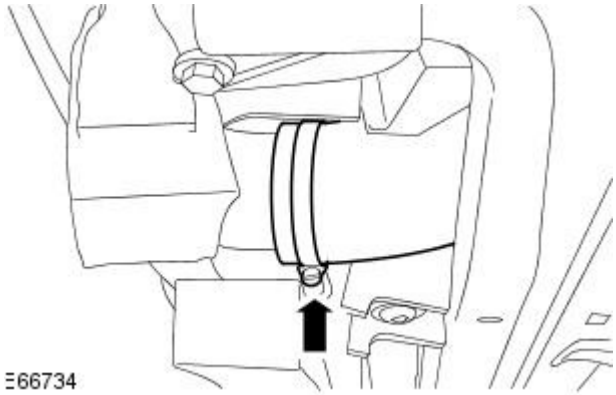


2. NOTE: Left-hand shown, right-hand similar.

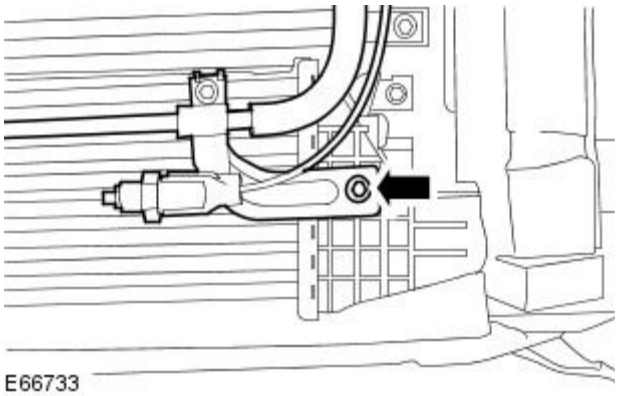
Tighten to 7 Nm.



3. Tighten to 4 Nm.



4. Tighten to 4 Nm.



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

Tighten to 7 Nm.

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Evaporative Emissions -

Torque Specifications

Description	Nm	lb-ft	lb-in
Evaporative emission canister retaining nuts and bolts	5	-	44
Accelerator cable retaining bracket retaining bolts - vehicles with 2.0L engine	9	-	80
Fuel tank support strap retaining bolts	25	18	-
Fuel tank filler pipe to fuel tank hose retaining clip	3	-	27

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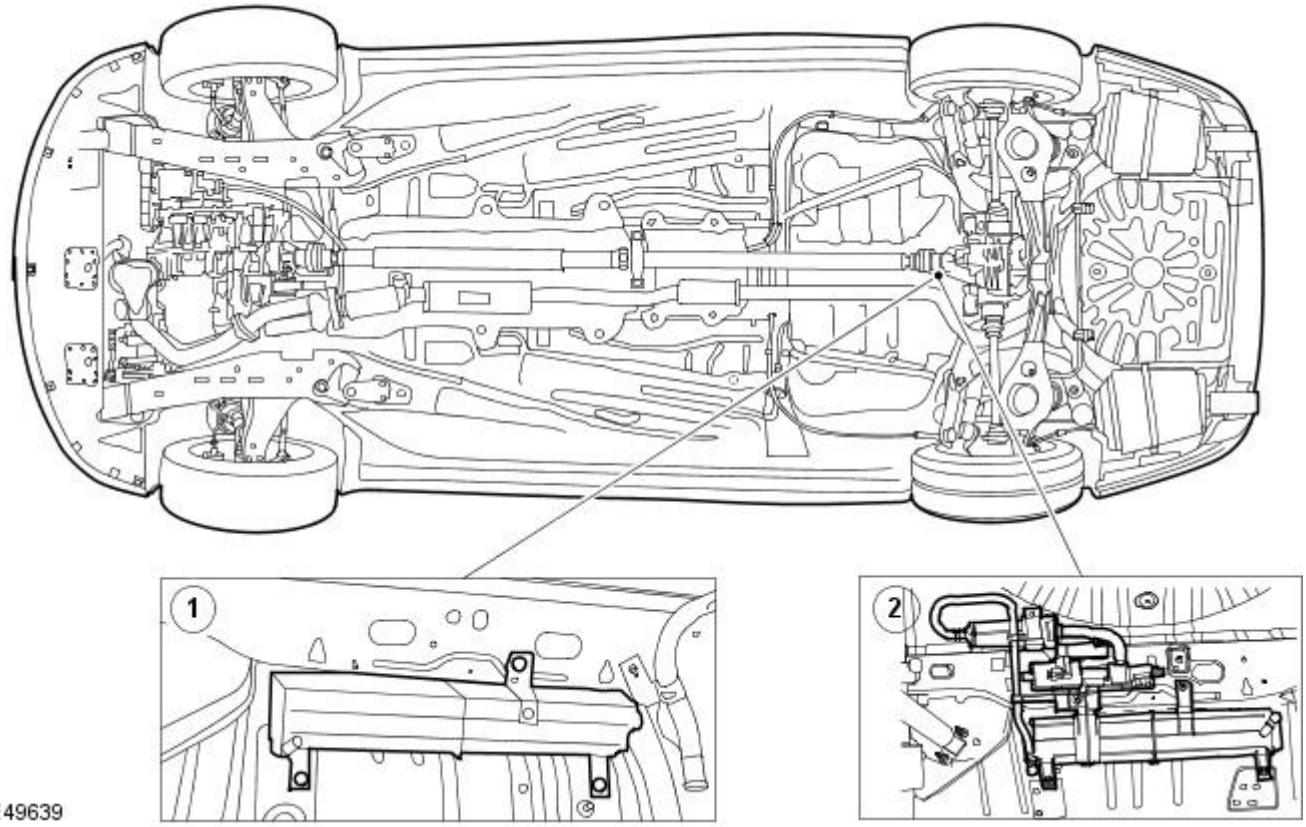
Evaporative Emissions - Evaporative Emissions

Description and Operation



Item	Part Number	Description
1	—	Evaporative emission canister - non federal market vehicles
2	—	Evaporative emission canister - federal market vehicles

• NOTE: 2.5L and 3.0L shown, 2.0L similar.

The evaporative emission fuel vapor management system consists of an evaporative emission canister and a canister purge valve. A combination of rigid and flexible low permeation hoses connect the fuel tank to the evaporative emission canister and canister purge valve intake manifold.

To satisfy LEV2 emission requirements, the fuel vapor management system uses a solenoid controlled canister close valve and a fuel tank pressure sensor which are used during the engine management system on-board diagnostic routines.

When the canister purge valve is closed, the fuel tank vapor is vented into the canister through the fuel tank roll-over valves. The canister absorbs the fuel vapor and prevents the release of hydrocarbons into the atmosphere. When the vapor management valve is cycled, the canister is exposed to the intake manifold vacuum and the fuel vapor deposits are drawn into the manifold where they mix with the incoming air/fuel charge. This air/fuel mixture ratio is controlled by the engine management system.

The evaporative emission fuel vapor management system is controlled by the engine control module (ECM) according to calibrated data tables.

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Evaporative Emissions - Evaporative Emissions2.0L NA V6 - AJV6

Diagnosis and Testing

1. **1.** Visually inspect for obvious signs of mechanical or electrical damage, blown fuses, etc.
2. **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. **3.** If the concern is not visually evident, verify the symptom and proceed with diagnosis, using the Jaguar approved diagnostic system, where available.
4. **4.** The DTC summaries are generated to support the Jaguar approved diagnostic system, but also provide the basis for diagnosis of OBD related concerns using a suitable generic scan tool, in conjunction with the electrical guides. Until the DTC summaries and electrical guides are available, the evaporative emissions system can only be accurately diagnosed using the Jaguar approved diagnostic system. For additional information, refer to Dealer technical support.

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Evaporative Emissions - Evaporative Emissions2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Diagnosis and Testing

Preliminary Inspection

1. **1.** Visually inspect for obvious signs of mechanical or electrical damage, blown fuses, etc.
2. **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. **3.** If the concern is not visually evident, verify the symptom and proceed with diagnosis, using the Jaguar approved diagnostic system, where available.
4. **4.** Where K-Line equipment is available, it should be used as an aid to diagnosis.

Diagnostic Drive Cycles

Following the setting of a DTC, the appropriate repairs must be carried out, and the normal operation of the system checked. This will be done by performing a series of drive cycles which will enable the vehicle to operate the Evaporative Emissions system as a function check. The following drive cycles cover the use of the Jaguar approved diagnostic system, GDS510 instrument, and a test with no additional equipment, where possible.

Flow check monitor drive cycle conditions (non-Federal)

• NOTE: These conditions must be satisfied before the test is commenced.

This drive cycle should be performed following rectification work on the system.

- Make sure the fuel tank is between one quarter and three quarters full. (Adding fuel will increase vapor generation; the diagnostic will not run if the vapor concentration is too great).
- Make sure the ambient air temperature is above -5°C (23°F).

Flow check monitor drive cycle (non-Federal)

- Drive the vehicle for a minimum of 15 minutes, avoiding severe or excessive fuel movement.
- Avoiding excessive fuel movement, gently bring the vehicle to rest. (Coast to a stop).
- Allow the vehicle to idle for two minutes.

Full Evaporative system monitor drive cycle conditions

• NOTE: These conditions must be satisfied before the test is commenced.

- Make sure the fuel filler cap is correctly fitted. (Minimum three clicks).
- Clear the DTCs. (Perform a code clear, even if no codes are present. This will reset TIDs).
- Make sure the fuel tank is between one quarter and three quarters full. (Adding fuel will increase vapor generation; the diagnostic will not run if the vapor concentration is too great).
- Drive the vehicle for a minimum of two minutes, and until fully warm. (Temperature gauge just below mid-point).
- Make sure that the purge valve is operating, either by touch, sound, or using datalogger. (Purge vapor management valve-duty cycle).
  - If the purge is not active, perform the "Drive cycle for green engine control module (ECM)" in this section.

Full Evaporative system monitor drive cycle

- Drive the vehicle to a suitable road where the test can be carried out, switch off the ignition.
- Leave the ignition switched off for 30 seconds.
- Restart the engine, accelerate briskly to 80 Kilometres per hour (50 miles per hour), making sure that the engine speed reaches at least 3500 RPM for a minimum of five seconds.

40 thou test, using the Jaguar approved diagnostic system

- Avoiding high engine loads, drive the vehicle steadily between 64 and 97 Kilometres per hour. (40 and 60 miles per hour). Using the Jaguar approved diagnostic system, monitor the Evaporative valve duty cycle (Purge vapor management valve-duty cycle), CCV status (Canister close valve-vapor recovery system), and the FTPS (Fuel tank pressure-vapor recovery system). The Jaguar approved diagnostic system will give an indication when the test is active. Dependant on the level of vapor concentration, it may take up to 30 minutes for the test to initialise. (Vapor concentration cannot be measured using the Jaguar approved diagnostic equipment). When the test has initialised (CCV closed), it will take up to 90 seconds to complete. Avoid excessive fuel movement while the test is active.

20 thou test, using the Jaguar approved diagnostic system

- Continue driving the vehicle steadily between 64 and 97 Kilometres per hour. (40 and 60 miles per hour). avoiding high engine loads for a further 10 minutes.
- Avoiding excessive fuel movement, gently bring the vehicle to rest. (Coast to a stop).
- Allow the vehicle to idle for 2 minutes.
- Use the Jaguar approved diagnostic system to monitor the Evaporative valve duty cycle (Purge vapor management valve-duty cycle), CCV status (Canister close valve-vapor recovery system), and the FTPS (Fuel tank pressure-vapor recovery system). The Jaguar approved diagnostic system will give an indication when the test is active. When the test has initialised (CCV closed), it will take up to 90 seconds to complete.

If the 20 thou test has not run, it is likely that the vapor concentration in the purge system is too great. In this case, carry out the following -

- Drive the vehicle steadily for a further 30 minutes, avoiding excessive fuel movement.
- Avoiding excessive fuel movement, gently bring the vehicle to rest. (Coast to a stop).
- Allow the vehicle to idle for 2 minutes.
- Use the Jaguar approved diagnostic system to monitor the Evaporative valve duty cycle (Purge vapor management valve-duty cycle), CCV status (Canister close valve-vapor recovery system), and the FTPS (Fuel tank pressure-vapor recovery system). The Jaguar approved diagnostic system will give an indication when the test is active. When the test has initialised (CCV closed), it will take up to 90 seconds to complete.

If the 20 thou test fails to run a second time, repeat the entire test.

- Check for DTCs. Rectify as indicated.

40 thou test, using GDS510

- Avoiding high engine loads, drive the vehicle steadily between 64 and 97 Kilometres per hour. (40 and 60 miles per hour)
- When the test has initialised, using the GDS510, monitor the Evaporative valve duty cycle, CCV status, and the FTPS. (The GDS510 will give an indication when the test is active).
- When the test has initialised (CCV closed), it will take up to 90 seconds to complete.
- To make sure that the test has completed, TID 08 in mode 6 must be checked. (If the test has not completed, this TID will display 0. Any other value indicates test completion).
- If the test did not complete, repeat the test.

20 thou test, using GDS510

- Continue driving the vehicle steadily between 64 and 97 Kilometres per hour. (40 and 60 miles per hour) avoiding high engine loads for a further 10 minutes.
- Avoiding excessive fuel movement, gently bring the vehicle to rest. (Coast to a stop).
- Allow the vehicle to idle for 2 minutes.
- When the test has initialised, using the GDS510, monitor the Evaporative valve duty cycle, CCV status, and the FTPS. (The GDS510 will give an indication when the test is active).
- When the test has initialised (CCV closed), it will take up to 90 seconds to complete.
- To make sure that the test has completed, TID 06 in mode 6 must be checked. (If the test has not completed, this TID will display 0. Any other value indicates test completion).
- If the test did not complete, repeat the test.
- If the 20 thou test has not run, it is likely that the vapor concentration in the purge system is too great. In this case, drive the vehicle steadily for a further 30 minutes, avoiding excessive fuel movement, then repeat the test.
- Check for DTCs. Rectify as indicated.

40 thou and 20 thou tests using no additional equipment

The test procedure and conditions are as for the Jaguar approved diagnostic system or GDS510, but no confirmation of the test having run is possible without the use of one of these instruments. The DTC will be set if the fault still exists, but the possibility exists that the conditions for the test to run may not have been met, in which case, the DTC may not be set until the owner reproduces the conditions in which the fault originally occurred.

Drive cycle for "green" ECM

- To enable the ECM to re-learn fuelling adaptions.

• NOTE: This procedure should be performed whenever the vehicle battery has been disconnected.

Due to component tolerance and wear during the normal running of a vehicle, fuelling and air requirements for an engine will vary over time. The ECM has the ability to adjust for this variation by "learning" the level of compensation that is required. (These compensation values are referred to as adaptions)

If the vehicle battery is disconnected, all adaptions held within the ECM will be lost (ie, set to Zero) The ECM is then referred to as "green". To enable the vehicle to function correctly, the ECM must "relearn" these adaptions.

There are four areas or sites that need to be relearnt.

- Allow the vehicle to idle until fully warm. (Temperature gauge just below mid-point).
- Allow to idle for a further three minutes, minimum.
- Drive the vehicle with the air conditioning OFF on a level road using a constant throttle, or speed control if fitted, for at least one minute in the following gears, at the stated engine speeds for each of the sites below.

The vehicle speed is for guidance only. DO NOT use the vehicle speed as the target to set adaptions.

"Green" ECM drive cycle chart. Site 1

Engine / transmission software level	3.0L Man Z65 on	3.0L Auto Z65 on	2.5L Man Z65 on	2.5L Auto Z65 on
GEAR	N	P/N	N	P/N
ENGINE SPEED	Idle	Idle	Idle	Idle
VEHICLE SPEED (GUIDE ONLY)	0MPH	0MPH	0MPH	0MPH

"Green" ECM drive cycle chart. Site 2

Engine / transmission software level	3.0L Man Z65 on	3.0L Auto Z65 on	2.5L Man Z65 on	2.5L Auto Z65 on
GEAR	3rd	3rd	3rd	3rd
ENGINE SPEED	2000RPM	1750RPM	2000RPM	1750RPM
VEHICLE SPEED (GUIDE ONLY)	45KPH (28MPH)	39KPH (24MPH)	47KPH (29MPH)	37KPH (23MPH)

"Green" ECM drive cycle chart. Site 3

Engine / transmission software level	3.0L Man Z65 on	3.0L Auto Z65 on	2.5L Man Z65 on	2.5L Auto Z65 on
GEAR	4th	4th	4th	4th
ENGINE SPEED	2250RPM	2000RPM	2250RPM	2250RPM
VEHICLE SPEED (GUIDE ONLY)	68KPH (42MPH)	64KPH (40MPH)	72KPH (45MPH)	69KPH (43MPH)

"Green" ECM drive cycle chart. Site 4

Engine / transmission software level	3.0L Man Z65 on	3.0L Auto Z65 on	2.5L Man Z65 on	2.5L Auto Z65 on
GEAR	4th	4th	4th	4th
ENGINE SPEED	2750RPM	2500RPM	2750RPM	2750RPM
VEHICLE SPEED (GUIDE ONLY)	84KPH (52MPH)	80KPH (50MPH)	87KPH (54MPH)	87KPH (54MPH)

Bring the vehicle to rest, allow to idle for one minute.

 WARNING: The following tests may involve parts which are hot.

If sufficient adaptions have occurred, the Evaporative valve should now be operating. This can be verified manually by either touching or listening to the valve. By touching the Evaporative valve, it should be possible to feel the valve switching. Listening to the Evaporative valve is best done using a workshop stethoscope, through which it should be possible to hear the valve operating.

Diagnostic Trouble Code Charts

Diagnostic Trouble Code Chart

Diagnostic Trouble Code	Description	Possible Source	Action
P0441	Evaporative purge valve flow check.	• Evaporative purge valve. • Hose and connections.	GO to Pinpoint Test A.
P0442	Leak detected. 40 thou.	• Hoses and connections. • Fuel tank filler cap. • Carbon canister. • Canister close valve.	GO to Pinpoint Test B.
P0443	Evaporative purge valve leaking.	Evaporative purge valve.	GO to Pinpoint Test C.
P0444	Evaporative purge valve circuit open.	Evaporative purge valve or circuit.	GO to Pinpoint Test D.
P0445	Evaporative purge valve circuit shorted.	Evaporative purge valve or circuit.	GO to Pinpoint Test E.
P0446	Canister close valve stuck closed.	• Filter box. • Hoses and connections. • CCV. • Fuel tank vapor port. • Carbon canister.	GO to Pinpoint Test F.
P0447	Canister close valve circuit open circuit.	CCV or circuit.	GO to Pinpoint Test G.
P0448	Canister close valve circuit shorted.	CCV or circuit.	GO to Pinpoint Test H.
P0450	Fuel tank Pressure Sensor malfunction	FTPS.	GO to Pinpoint Test I.
P0452	FTPS low input.	FTPS or circuit.	GO to Pinpoint Test J.
P0453	FTPS high input.	FTPS or circuit.	GO to Pinpoint Test J.
P0455	Gross leak.	• Fuel tank and lines. • Fuel filler cap. • Carbon Canister. • Evaporative purge valve stuck closed. • CCV. • Blockage in vapor lines from engine to fuel tank.	GO to Pinpoint Test K.
P0456	Leak detected. 20 thou.	• Fuel tank and lines. • Fuel filler cap. • Carbon Canister. • CCV.	GO to Pinpoint Test L.

Pinpoint Tests

PINPOINT TEST A : P0441. EVAPORATIVE PURGE VALVE FLOW CHECK. VALVE STUCK CLOSED	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK EVAPORATIVE PURGE VALVE IS OPERATING	
	1 Disconnect the Vapor pipe from the inlet port of the Evaporative purge valve (ie, from fuel tank).
	2 RUN the engine for 2 minutes, making sure that the engine reaches normal operating temperature.
	3 CHECK that the Evaporative purge valve is operating, by touch or by sound. (Using a stethoscope, it will be possible to hear the valve operating).
	Is the valve operating? **Yes** GO to A2. **No** CHECK for DTC P0444, P0445. Conduct "green" ECM drive cycle. For additional information, see "diagnostic drive cycles" above.
A2: CHECK FOR VACUUM AT EVAPORATIVE PURGE VALVE	
	1 CHECK for vacuum at the valve.
	Is a vacuum present? **Yes** Possible intermittent fault. CLEAR the DTC. Carry out a flow check monitor drive cycle. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above. **No** GO to A3.
A3: CHECK FOR BLOCKAGES IN THE SYSTEM	
	1 CHECK for blockages in the intake manifold drilling, and the pipe from the intake manifold to the Evaporative purge valve.
	Was a blockage found? **Yes** Rectify the blockage. CLEAR the DTC. Carry out a flow check monitor drive cycle. For additional information, see "diagnostic drive cycles" above. **No** INSTALL a new Evaporative purge valve. REFER to Evaporative Emission Canister Purge Valve in this section. CLEAR the DTC. Carry out a flow check monitor drive cycle. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above.

PINPOINT TEST B : P0442. LEAK DETECTED. 40 THOU	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK FUEL FILLER CAP FITMENT AND CONDITION OF PIPES AND CONNECTORS	
	1 Make sure that the fuel filler cap is correctly installed and tightened. (Minimum 3 clicks).
	2 Check the condition of all accessible pipes and connectors in the vapor line.
	Are all pipes and connectors in good condition? **Yes** Suspect concern with fuel tank assembly or carbon canister assembly. **No** REPAIR as necessary. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above.

PINPOINT TEST C : P0443. EVAPORATIVE PURGE VALVE LEAKING	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK EVAPORATIVE PURGE VALVE INTEGRITY	
	1 Disconnect the outlet pipe from the Evaporative purge valve. (From valve to manifold).
	2 Apply a vacuum to the valve outlet pipe.
	Does the valve hold vacuum? **Yes** Possible intermittent fault. CLEAR the DTC. Carry out a full Evap system monitor drive cycle. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above. **No** INSTALL a new Evaporative purge valve. REFER to Evaporative Emission Canister Purge Valve in this section. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above.

PINPOINT TEST D : P0444. EVAPORATIVE PURGE VALVE CIRCUIT OPEN CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK SUPPLY VOLTAGE TO EVAPORATIVE PURGE VALVE	
	1 Disconnect Evaporative purge valve electrical connector, JB170.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage at JB170, pin 1 (GU).
	Is the voltage greater than 10 volts? **Yes** GO to D2. **No** REPAIR the circuit between Evaporative purge valve electrical connector, JB170, pin 1 (GU) and the EMS control relay. For additional information, refer to wiring diagrams. CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above.
D2: CHECK THE EVAPORATIVE PURGE VALVE SIGNAL WIRE FOR CONTINUITY	
	1 Disconnect the ECM electrical connector, EN16.
	2 Measure the resistance between EN16, pin 66 (UY) and JB170, pin 2 (UY).
	Is the resistance less than 5 ohms? **Yes** GO to D3. **No** REPAIR the circuit between EN16, pin 66 (UY) and JB170, pin 2 (UY). CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above.
D3: CHECK THE EVAPORATIVE PURGE VALVE SIGNAL WIRE FOR SHORT TO GROUND	
	1 Measure the resistance between JB170, pin 2 (UY) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to ground. For additional information, refer to wiring diagrams. CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above. **No** GO to D4.
D4: CHECK THE EVAPORATIVE PURGE VALVE SIGNAL WIRE FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector, EN16.
	2 Turn the ignition switch to the ON position.
	3 CHECK for a voltage at JB170, pin 2 (UY).
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to wiring diagrams. CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above. **No** GO to D5.
D5: CHECK THE EVAPORATIVE PURGE VALVE RESISTANCE	
	1 CHECK the resistance between pins 1 and 2 of the Evaporative purge valve.
	Is the resistance 30 to 34 ohms at 20°C (68°F)? **Yes** INSTALL a new ECM. REFER to Section 303-14A Electronic Engine Controls / 303-14B Electronic Engine Controls. Before replacing a ECM, contact Dealer technical support. **No** INSTALL a new Evaporative purge valve. REFER to Evaporative Emission Canister Purge Valve in this section. CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above.

PINPOINT TEST E : P0445. EVAPORATIVE PURGE VALVE CIRCUIT SHORTED

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: CHECK EVAPORATIVE PURGE VALVE SIGNAL WIRE FOR SHORT TO GROUND	
	1 Disconnect Evaporative purge valve electrical connector JB170.
	2 Disconnect ECM electrical connector, EN16.
	3 Measure the resistance between JB170, pin 2 (UY) and ground.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to ground. For additional information, refer to wiring diagrams. CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above. **No** NO short found. A short in the Evaporative purge valve supply circuit may result in a blown fuse 36, PDFB. See initial checks. CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above.

PINPOINT TEST F : P0446. CANISTER CLOSE VALVE STUCK CLOSED	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: CHECK FOR FLOW THROUGH SYSTEM	
• NOTE: Depending on the severity of the blockage, it is possible that some difficulty has been experienced during refuelling.	
	1 Disconnect the vapor line from Evaporative purge valve inlet port and apply low pressure.
	2 CHECK for free flow of air through the following, paying attention to kinked or flattened pipes. ● Filter. ● Interconnecting pipe. (Filter to CCV). ● CCV. ● Interconnecting pipe. (CCV to carbon canister). ● Carbon canister. ● Interconnecting pipe. (Carbon canister to fuel tank). ● Fuel tank vapor port.
	Is there a restriction? **Yes** RECTIFY as necessary. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle, RECHECK DTCs. For additional information, see "diagnostic drive cycles" above. **No** CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle, RECHECK DTCs. For additional information, see "diagnostic drive cycles" above.

PINPOINT TEST G : P0447. CANISTER CLOSE VALVE CIRCUIT OPEN CIRCUIT	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
G1: CHECK SUPPLY VOLTAGE TO CCV	
	1 Disconnect canister close valve electrical connector, FT5.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage at FT5, pin 1 (GU).
	Is the voltage greater than 10 volts? **Yes** GO to G2. **No** REPAIR the circuit between FT5, pin 1 (GU) and the EMS control relay. For additional information, refer to wiring diagrams. CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above.
G2: CHECK THE CCV SIGNAL WIRE FOR CONTINUITY.	
	1 Disconnect the ECM electrical connector, EN16.
	2 Measure the resistance between EN16, pin 67 (O) and FT5, pin 2 (O).
	Is the resistance less than 5 ohms? **Yes** GO to G4. **No** REPAIR the circuit between EN16, pin 67 (O) and FT5, pin 2 (O). For additional information, refer to wiring diagrams. CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above.
G3: CHECK THE CCV SIGNAL WIRE FOR SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position.
	2 CHECK for a voltage at FT5, pin 2 (O).
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to wiring diagrams. CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above. **No** GO to G4.
G4: CHECK THE CCV RESISTANCE	
	1 CHECK the resistance between pins 1 and 2 of the CCV.
	Is the resistance 25 to 30 Ohms at 20°C (68°F)? **Yes** INSTALL a new ECM. REFER to Section 303-14A Electronic Engine Controls / 303-14B Electronic Engine Controls. Before replacing a ECM, contact Dealer technical support. **No** INSTALL a new CCV. CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above.

PINPOINT TEST H : P0448. CCV CIRCUIT SHORTED.	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

H1: CHECK CCV SIGNAL WIRE FOR SHORT TO GROUND.	
	1 Disconnect CCV electrical connector, FT5.
	2 Disconnect ECM electrical connector, EN16.
	3 Measure the resistance between FT5, pin 2 (O) and ground.
	Is the resistance less than 10,000 Ohms? **Yes** REPAIR the short to ground. For additional information, refer to wiring diagrams. CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above. **No** NO short found. A short in the CCV supply circuit may result in a blown fuse 36, PDFB. See initial checks.

PINPOINT TEST I : P0450. FUEL TANK PRESSURE SENSOR MALFUNCTION.	
• NOTE: Prior to commencing this test, REFER to Section 303-14A Electronic Engine Controls / 303-14B Electronic Engine Controls. Electronic Engine Controls, Diagnosis and Testing, sensor supply and ground circuits.	
• NOTE: Access to the FTP sensor involves the removal of the fuel tank. To reduce the amount of work necessary, a slave harness and sensor could be used. This can be connected at the access port beneath the rear seat. Tests can then be carried out via the slave harness and sensor. If system operation is normal with the slave harness and sensor, the fault lies in the vehicle's harness or sensor.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: CHECK EVAPORATIVE PURGE VALVE IS OPERATING.	
	1 Disconnect electrical connector CA005. (Beneath rear seat).
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between pins 4 and 6 of CA005.
	Is the voltage 2.9 - 3.7 volts? **Yes** GO to I2. Reconnect CA005. **No** INSTALL a new FTPS. REFER to Section 310-01 Fuel Tank and Lines. Reconnect CA005. CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above.
I2: CHECK SIGNAL VOLTAGE AT FTPS.	
	1 Run the engine for two minutes, and until fully warm.
	2 Make sure Evaporative purge valve is operating.
	3 Steadily increase engine speed to 3000 RPM.
	4 Measure the voltage between pins 4 and 6 of CA005.
	Does the voltage reduce? **Yes** Possible intermittent fault. RECHECK DTCs, For additional information, see "diagnostic drive cycles" above. Contact Dealer technical support. **No** INSTALL a new FTPS. REFER to Section 310-01 Fuel Tank and Lines. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above.

PINPOINT TEST J : P0452, O0453. FUEL TANK PRESSURE SENSOR LOW/HIGH INPUT.	
• NOTE: Prior to commencing this test, REFER to Section 303-14A Electronic Engine Controls / 303-14B Electronic Engine Controls. Electronic Engine Controls, Diagnosis and Testing, sensor supply and ground circuits.	
• NOTE: Access to the FTP sensor involves the removal of the fuel tank. To reduce the amount of work necessary, a slave harness and sensor could be used. This could be connected at the access port beneath the rear seat. Tests can then be carried out via the slave harness and sensor. If system operation is normal with the slave harness and sensor, the fault lies in the vehicle's harness or sensor.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
J1: CHECK FTPS SIGNAL WIRE FOR CONTINUITY UP TO CONNECTOR CA5.	
	1 Disconnect ECM electrical connector, EN16.
	2 Disconnect FTPS electrical connector, CA5.
	3 Check for continuity between EN16, pin 104 (RG) and CA5, pin 4 (RG). • This test will not check the continuity of the harness from CA5 to FT1. If the circuit is continuous to CA5, the fuel tank must be removed and the harness and sensor continuity checked.
	Is the circuit continuous? **Yes** INSTALL a new FTPS, (and/or harness, CA5 to FT1). CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above. If the DTC is repeated, INSTALL a new ECM. REFER to Section 303-14A Electronic Engine Controls / 303-14B Electronic Engine Controls. Before replacing a ECM, contact Dealer technical support. **No** REPAIR the circuit between EN16, pin 104 (RG) and CA5, pin 4 (RG). CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. For additional information, see "diagnostic drive cycles" above. RECHECK DTCs.
J2: CHECK FTPS SUPPLY WIRE FOR SHORT TO GROUND UP TO CONNECTOR CA5	
	1 Measure the resistance between CA5, pin 5 (OY) and GROUND. • This test will not check the integrity of the harness from CA5 to FT1. If the circuit is sound to CA5, the fuel tank must be removed and the harness and sensor continuity checked.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above. **No** GO to J3.
J3: CHECK FTPS SIGNAL WIRE FOR SHORT TO GROUND, UP TO CONNECTOR CA5.	
	1 Connect ECM electrical connector, EN16.

	2 Measure the resistance between CA5, pin 4 (RG) and GROUND. • This test will not check the integrity of the harness from CA5 to FT1. If the circuit is sound to CA5, the fuel tank must be removed and the harness and sensor continuity checked.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above. **No** GO to J4.
J4: CHECK FTPS SIGNAL WIRE FOR SHORT TO BATTERY, UP TO CONNECTOR CA5	
	1 Turn the ignition switch to the ON position.
	2 Check for a voltage at CA5, pin 4 (RG). • This test will not check the integrity of the harness from CA5 to FT1. If the circuit is sound to CA5, the fuel tank must be removed and the harness and sensor continuity checked.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to wiring diagrams. CLEAR the DTC. Turn the ignition switch to the ON position. Leave switched on for minimum 30 seconds. RECHECK DTCs. For additional information, see "diagnostic drive cycles" above. **No** GO to J5.
J5: CHECK FTPS GROUND WIRE FOR SHORT TO BATTERY, UP TO CONNECTOR CA5	
	1 Turn the ignition switch to the ON position.
	2 Check for a voltage at CA5, pin 6 (BG).
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to wiring diagrams. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle, RECHECK DTCs. For additional information, see "diagnostic drive cycles" above. **No** GO to J2.
J6: CHECK FTPS SUPPLY WIRE FOR SHORT TO BATTERY UP TO CONNECTOR CA5	
	1 Connect ECM electrical connector, EN16.
	2 Turn the ignition switch to the ON position.
	3 Check for a voltage at CA5, pin 5 (OY). • This test will not check the integrity of the harness from CA5 to FT1. If the circuit is sound to CA5, the fuel tank must be removed and the harness and sensor continuity checked.
	Is the voltage greater than 5 volts? **Yes** REPAIR the short to battery. For additional information, refer to wiring diagrams. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle, RECHECK DTCs. For additional information, see "diagnostic drive cycles" above. **No** INSTALL a new FTPS, (and/or harness, CA5 to FT1). REFER to Section 310-01 Fuel Tank and Lines. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle, RECHECK DTCs. For additional information, see "diagnostic drive cycles" above. If the DTC is repeated, INSTALL a new ECM. REFER to Section 303-14A Electronic Engine Controls / 303-14B Electronic Engine Controls. Before replacing a ECM, contact Dealer technical support.

PINPOINT TEST K : P0455. GROSS LEAK DETECTED.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
K1: CHECK FUEL FILLER CAP FITMENT AND CONDITION OF PIPES AND CONNECTORS.	
	1 Make sure that the fuel filler cap is correctly installed and tightened. (Minimum 3 clicks).
	2 Check the condition of all accessible pipes and connectors in the vapor line.
	Are all pipes and connectors in good condition? **Yes** Suspect concern with - 1. Blockage in vapor line. (Engine to fuel tank).2. Evaporative purge valve stuck closed.3. Fuel tank assembly.4. Carbon canister assembly. **No** REPAIR as necessary. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle, RECHECK DTCs. For additional information, see "diagnostic drive cycles" above.

PINPOINT TEST L : P0456. LEAK DETECTED. 20 THOU.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
L1: CHECK FUEL FILLER CAP FITMENT AND CONDITION OF PIPES AND CONNECTORS.	
	1 Make sure that the fuel filler cap is correctly installed and tightened. (Minimum 3 clicks).
	2 Check the condition of all accessible pipes and connectors in the vapor line.
	Are all pipes and connectors in good condition? **Yes** Suspect concern with fuel tank assembly or carbon canister assembly. **No** REPAIR as necessary. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle, RECHECK DTCs. For additional information, see "diagnostic drive cycles" above.

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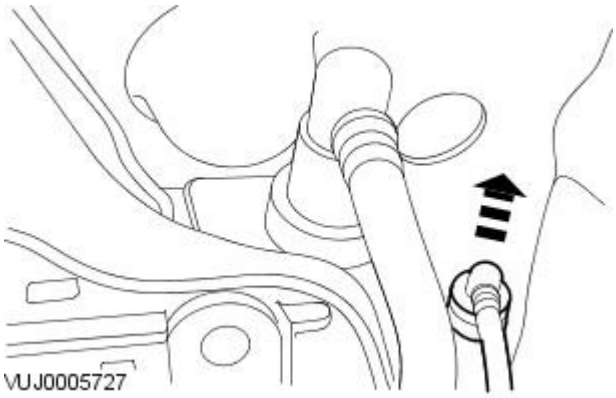
Evaporative Emissions - Evaporative Emission Canister2.0L NA V6 - AJV6

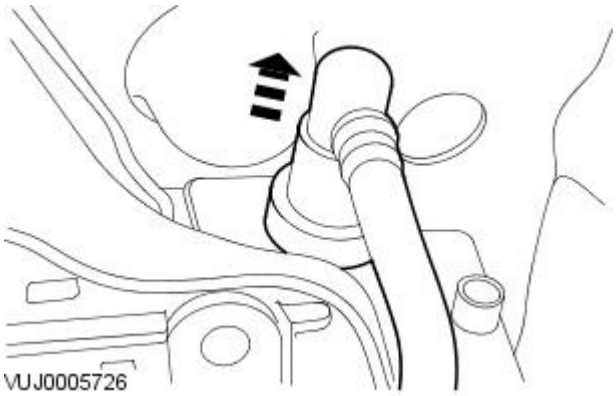
Removal and Installation

Removal

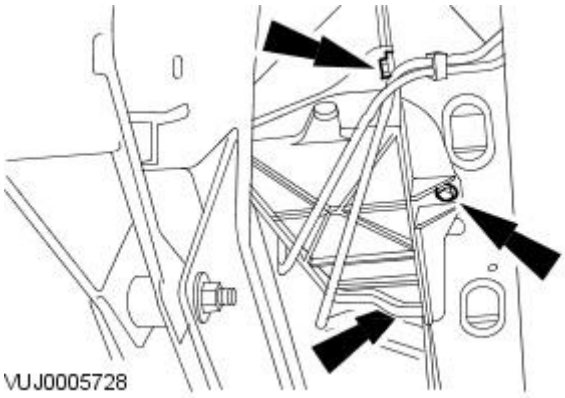
1. Raise and support the vehicle.
   For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. Disconnect the evaporative emission canister pipe.



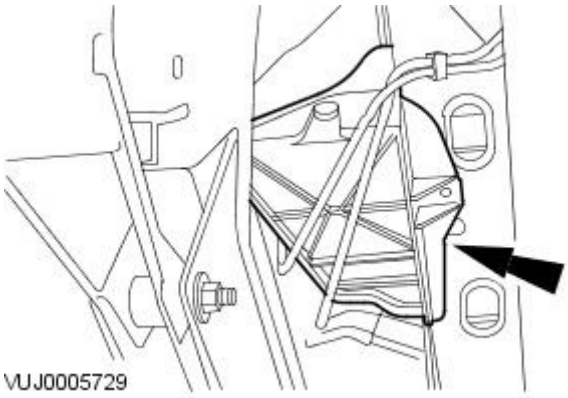
3. Disconnect the evaporative emission canister pipe.



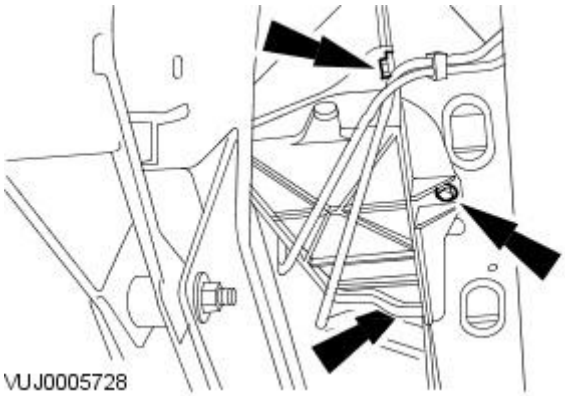
4. Remove the evaporative emission canister retaining bolts.



5. Remove the evaporative emission canister.



Installation



1. To install, reverse the removal procedure.

- Tighten to 5 Nm.

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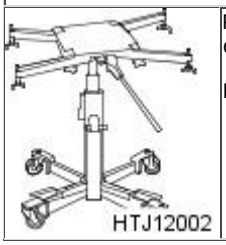
Evaporative Emissions - Evaporative Emission Canister2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Removal and Installation

Special Tool(s)	
 HTJ12002	Powertrain Assembly Jack (federal market vehicles only) HTJ1200-2

Removal

• WARNINGS:

Do not smoke or carry lighted tobacco or an 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.

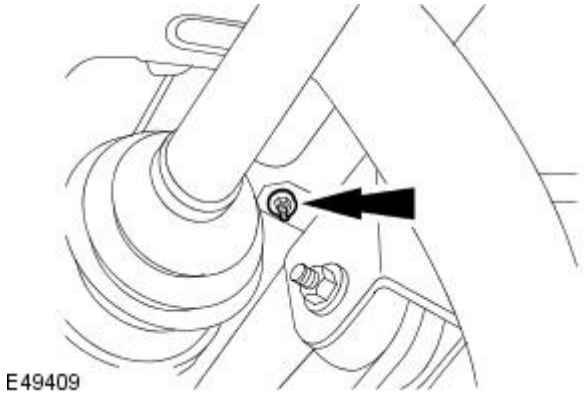
Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

Due to the heavy weight, make sure that the fuel tank is securely attached to the powertrain assembly jack when installing.

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.

• NOTE: Non federal market vehicles, refer to steps 1 to 3.

• NOTE: Federal market vehicles, refer to steps 4 to 22.

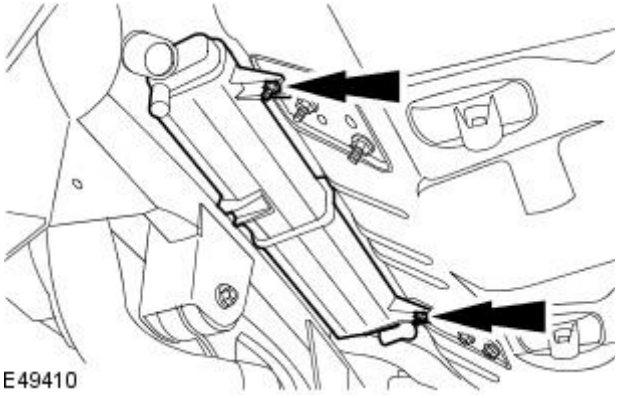

E49409

1. NOTE: Non federal market vehicles only.

Remove the fuel tank.
For additional information, refer to: Fuel Tank - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation).

2. NOTE: Non federal market vehicles only.

Remove the evaporative emission canister rear retaining nut.


E49410

3. NOTE: Non federal market vehicles only.

Remove the evaporative emission canister.

4. NOTE: Federal market vehicles only.

Disconnect the battery ground cable.
For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

5. NOTE: Federal market vehicles only.

Remove the fuel filler cap.

6. NOTE: Federal market vehicles only.

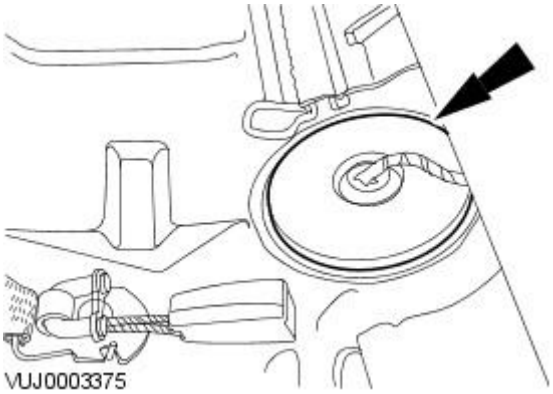
De-pressurize the fuel system.
For additional information, refer to: Fuel System Pressure Release (310-00 Fuel System - General Information, General Procedures).

7. NOTE: Federal market vehicles only.

Remove the rear seat cushion.
For additional information, refer to: Rear Seat Cushion (501-10 Seating, Removal and Installation).

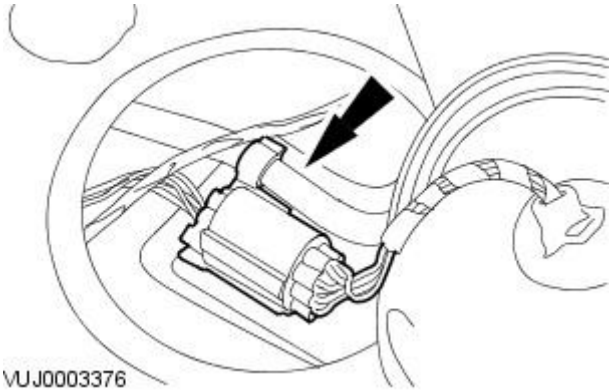
8. NOTE: Federal market vehicles only.

Detach the wiring harness grommet.


VUJ0003375

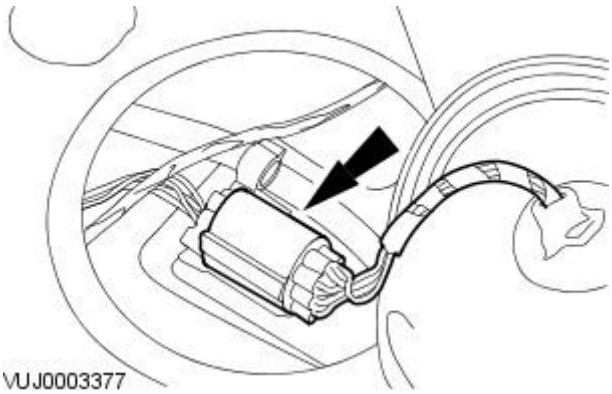
9. NOTE: Federal market vehicles only.

Detach the electrical connector.


VUJ0003376

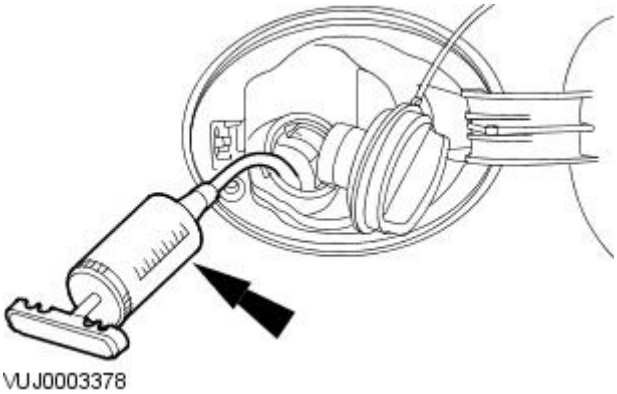
10. NOTE: Federal market vehicles only.

Disconnect the electrical connector.


VUJ0003377

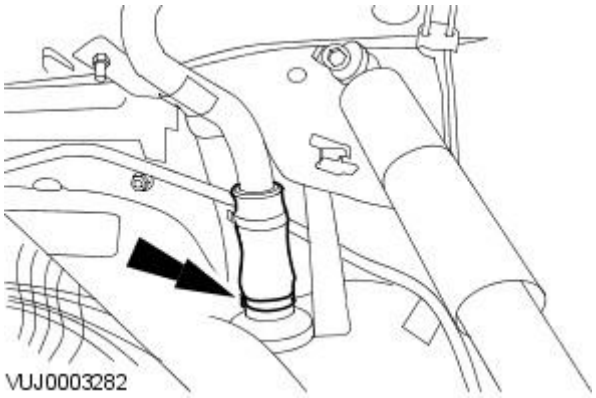
11. NOTE: Federal market vehicles only.

Using a suitable suction device drain the fuel tank filler pipe.


VUJ0003378

12. NOTE: Federal market vehicles only.

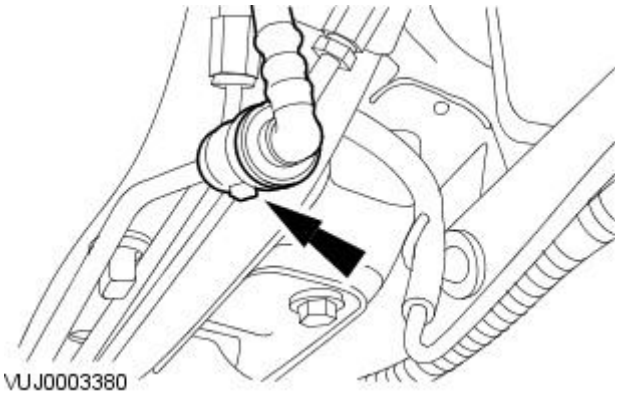
Remove the rear subframe.
For additional information, refer to: Rear Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



13. NOTE: Federal market vehicles only.

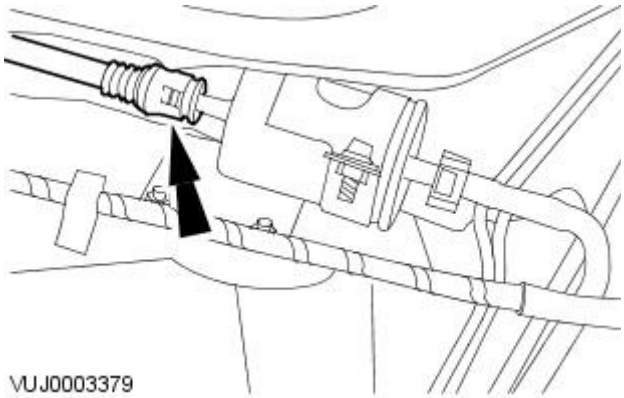
• NOTE: Note the orientation of the fuel tank filler pipe to fuel tank hose retaining clip before loosening.

Detach the fuel tank filler pipe hose from the fuel tank.



14. NOTE: Federal market vehicles only.

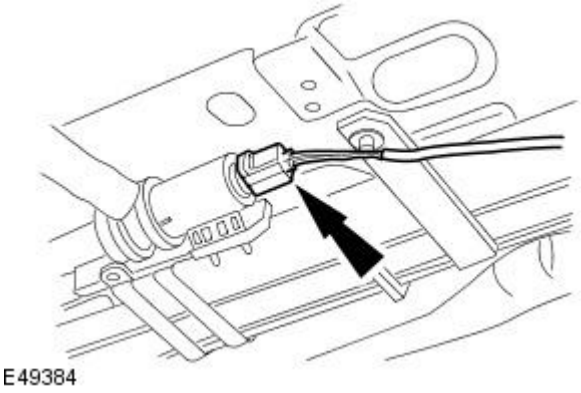
Disconnect the evaporative emission canister purge hose quick release coupling.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).



15. NOTE: Federal market vehicles only.

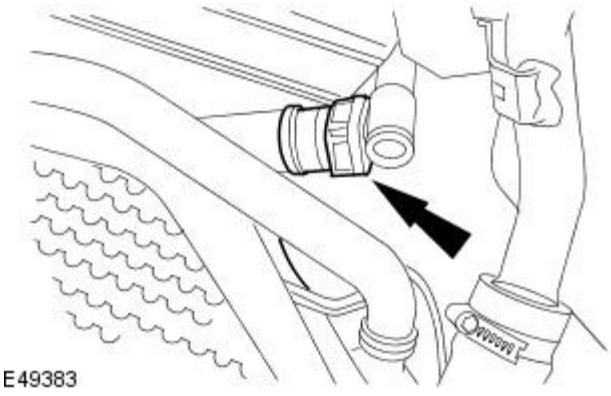
Disconnect the fuel filter line quick release coupling.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

- Install blanking plugs to the male and female connectors.



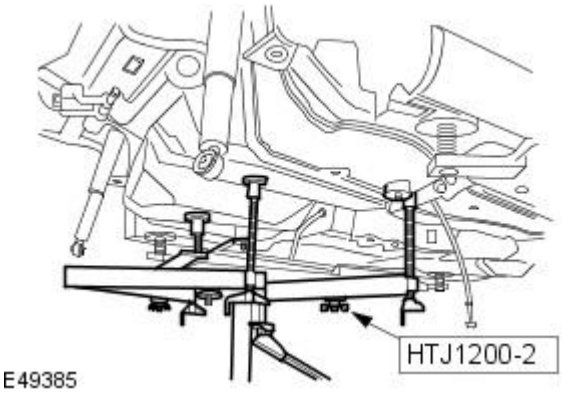
16. NOTE: Federal market vehicles only.

Disconnect the evaporative emission canister close valve electrical connector.



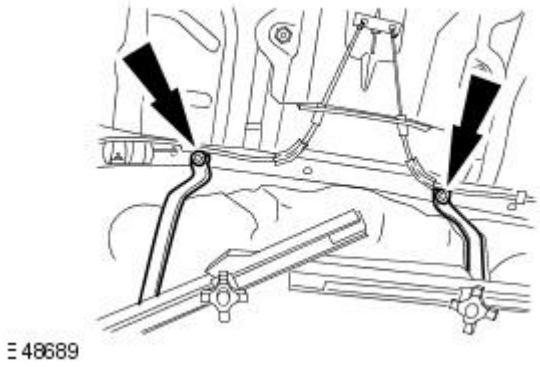
17. NOTE: Federal market vehicles only.

Disconnect the evaporative emission canister hose from the evaporative emission canister.



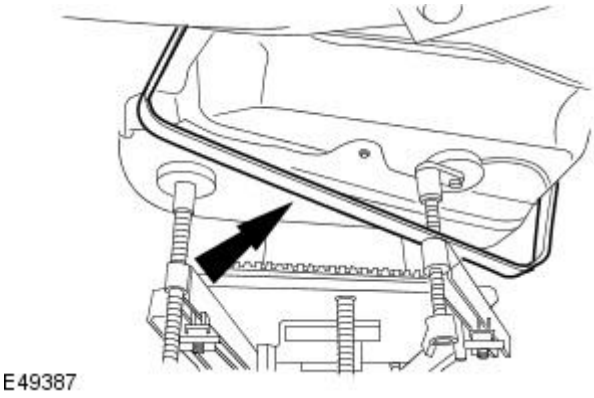
18. NOTE: Federal market vehicles only.

Using the special tool, support the fuel tank.



19. NOTE: Federal market vehicles only.

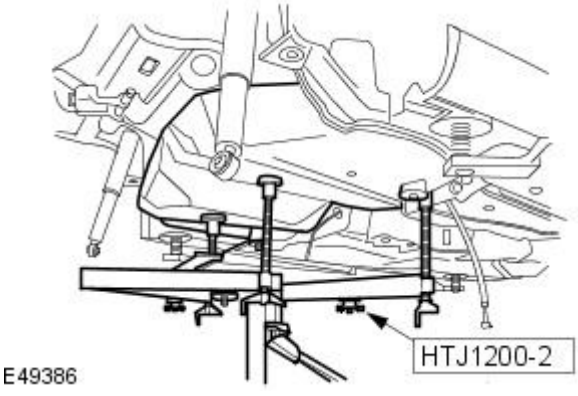
Remove the fuel tank support straps retaining bolts.



20. NOTE: Federal market vehicles only.

• NOTE: Right-hand shown, left-hand similar.

Remove the fuel tank support straps.

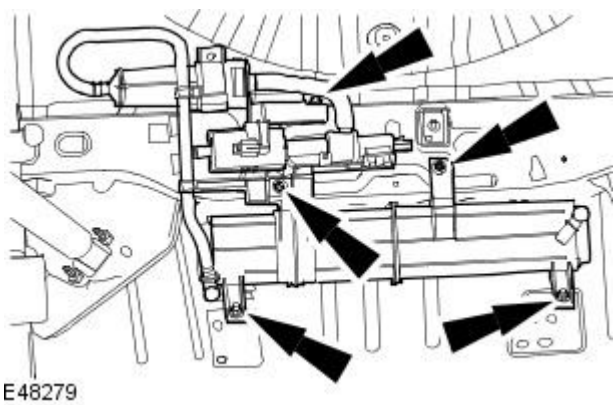


21. WARNING: The fuel tank cannot be drained in vehicle. Due to the heavy weight, make sure that the fuel tank is securely attached to the powertrain assembly jack when removing. Failure to follow this instruction may result in personal injury.

• NOTE: Federal market vehicles only.

Using the special tool, remove the fuel tank.

- Detach the fuel filler pipe hose from the fuel tank.
- Install blanking plugs to the fuel tank and fuel filler pipe hose.



22. NOTE: Federal market vehicles only.

Remove the evaporative emission canister.

Installation

• WARNINGS:

Do not smoke or carry lighted tobacco or an 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.

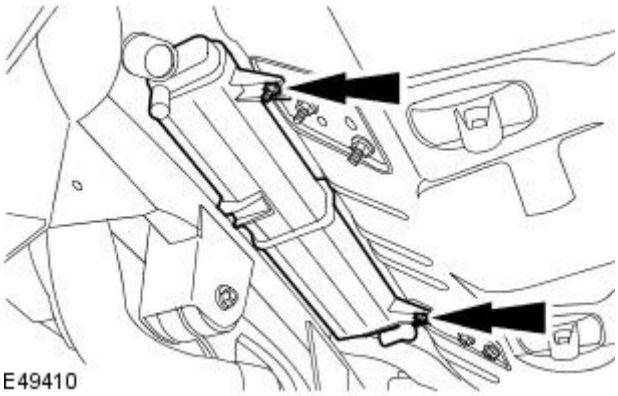
Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

Due to the heavy weight, make sure that the fuel tank is securely attached to the powertrain assembly jack when installing.

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.

• NOTE: Non federal vehicles, refer to steps 1 to 3.

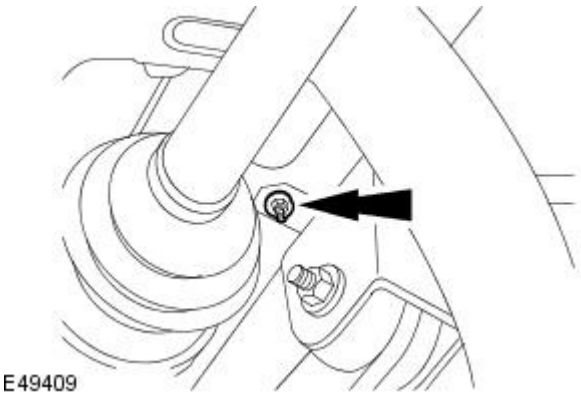
• NOTE: Federal vehicles, refer to steps 1 to 21.


E49410

1. NOTE: Non federal market vehicles only.

Install the evaporative emission canister.

- Tighten to 5 Nm.


E49409

2. NOTE: Non federal market vehicles only.

Install the evaporative emission canister rear retaining nut.

- Tighten to 5 Nm.

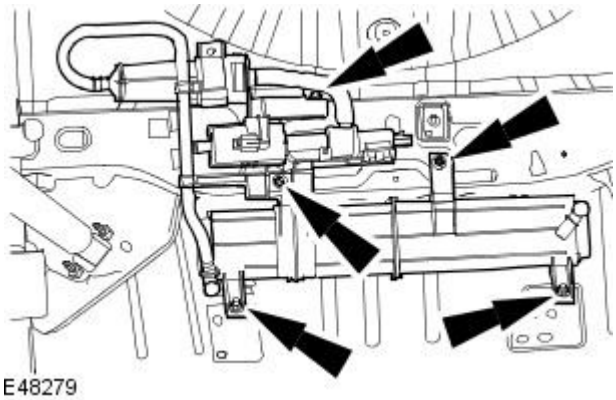
3. NOTE: Non federal market vehicles only.

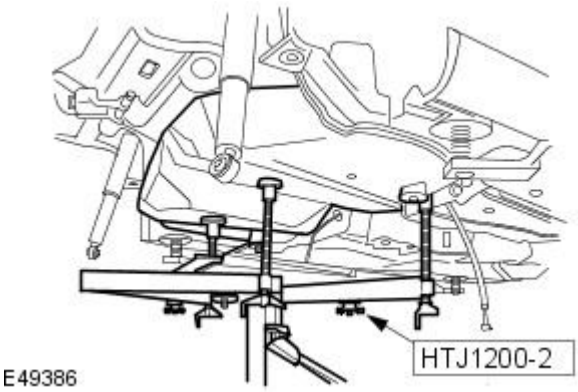
Install the fuel tank.
For additional information, refer to: Fuel Tank - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation).

4. NOTE: Federal market vehicles only.

Install the evaporative emission canister.

- Tighten to 5 Nm.


E48279



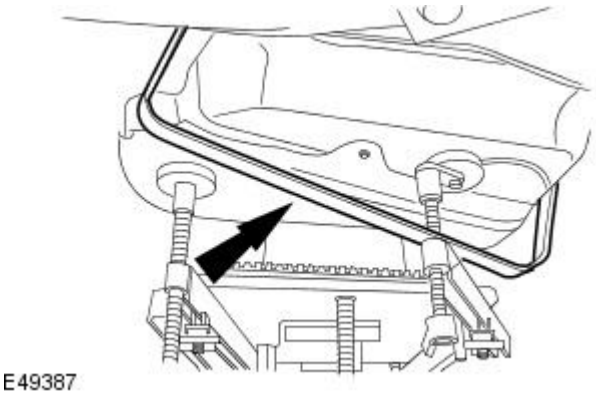
5. WARNING: The fuel tank cannot be drained in vehicle. Due to the heavy weight, make sure that the fuel tank is securely attached to the powertrain assembly jack when removing. Failure to follow this instruction may result in personal injury.

• NOTE: Federal market vehicles only.

• NOTE: Remove the blanking plugs from the fuel tank and fuel filler pipe hose.

Using the special tool, install the fuel tank.

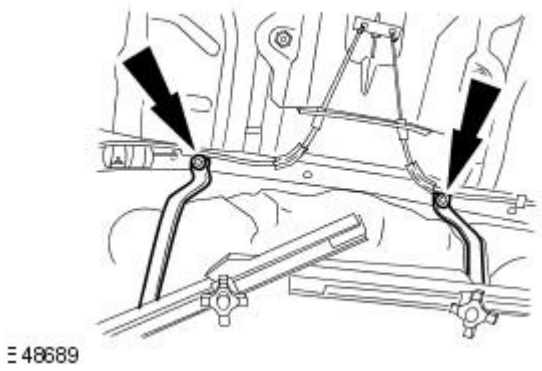
- Attach the fuel filler pipe hose to the fuel tank.



6. NOTE: Federal market vehicles only.

• NOTE: Right-hand shown, left-hand similar.

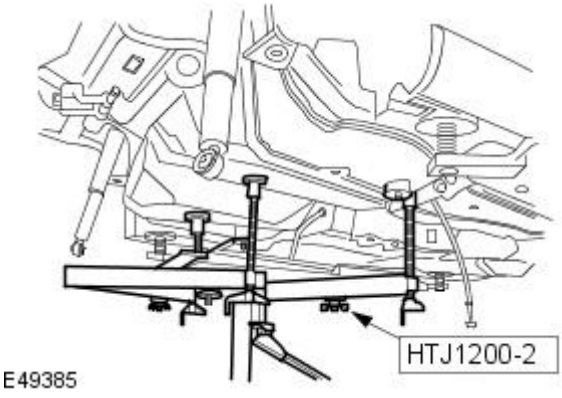
Install the fuel tank support straps.



7. NOTE: Federal market vehicles only.

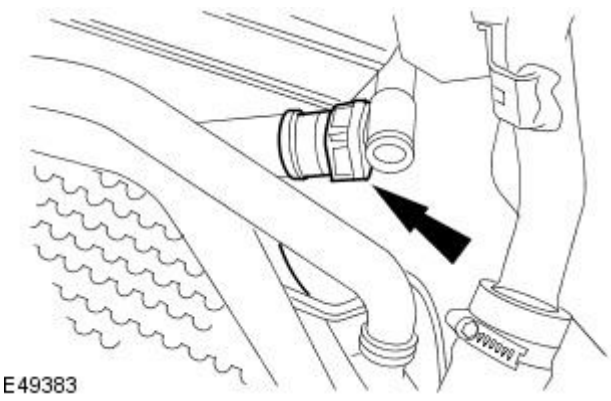
Install the fuel tank support straps retaining bolts.

- Tighten to 25 Nm.



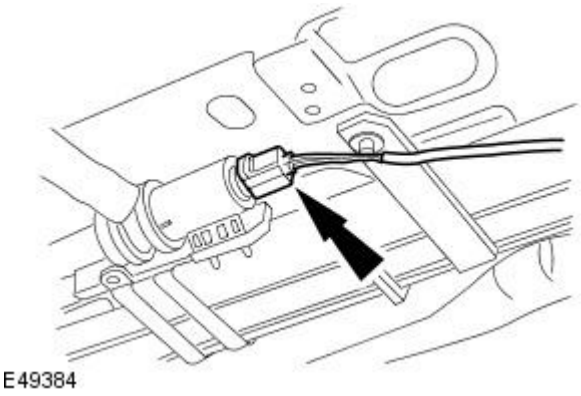
8. NOTE: Federal market vehicles only.

Remove the special tool.



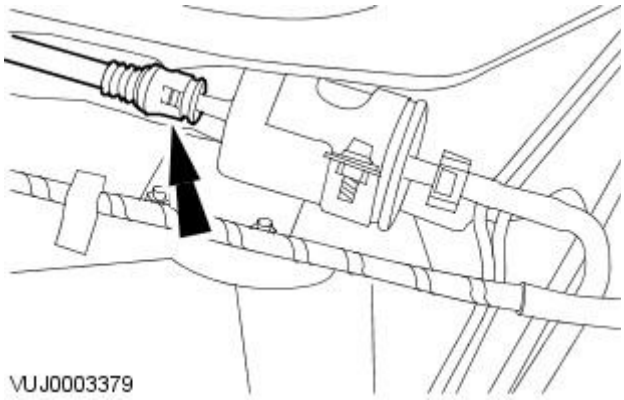
9. NOTE: Federal market vehicles only.

Connect the evaporative emission canister hose to the evaporative emission canister.


E49384

10. NOTE: Federal market vehicles only.

Connect the evaporative emission canister close valve electrical connector.

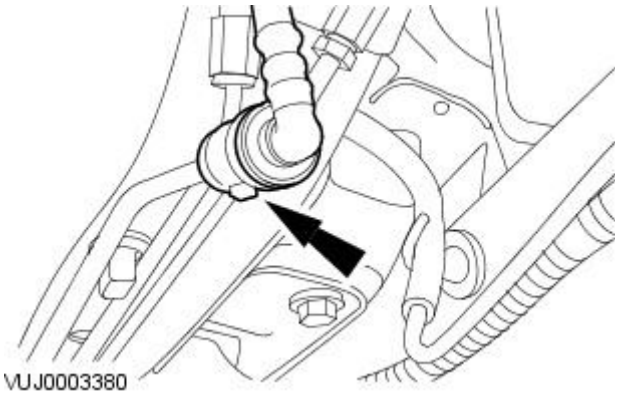

VUJ0003379

11. NOTE: Federal market vehicles only.

• NOTE: Remove the blanking plugs.

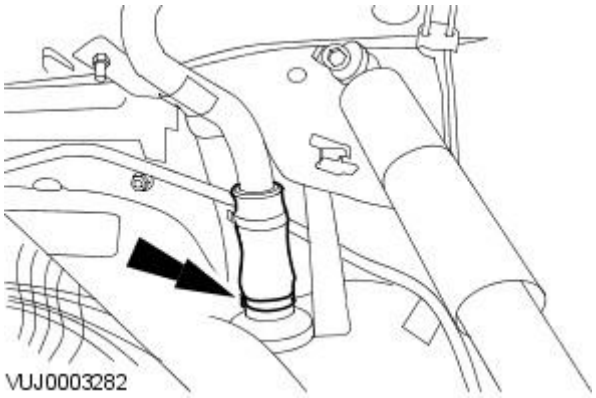
Connect the fuel filter line quick release coupling.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

- Install blanking plugs to the male and female connectors.


VUJ0003380

12. NOTE: Federal market vehicles only.

Connect the evaporative emission canister purge hose quick release coupling.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).


VUJ0003282

13. NOTE: Federal market vehicles only.

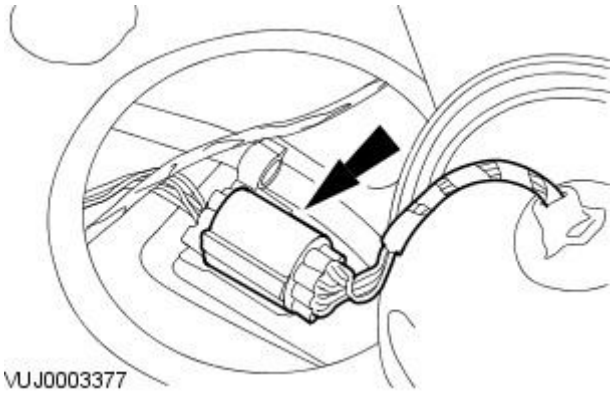
• NOTE: Make sure the fuel tank filler pipe to fuel tank hose retaining clip is correctly orientated.

Tighten the fuel tank filler pipe to fuel tank hose retaining clip.

- Tighten to 3 Nm.

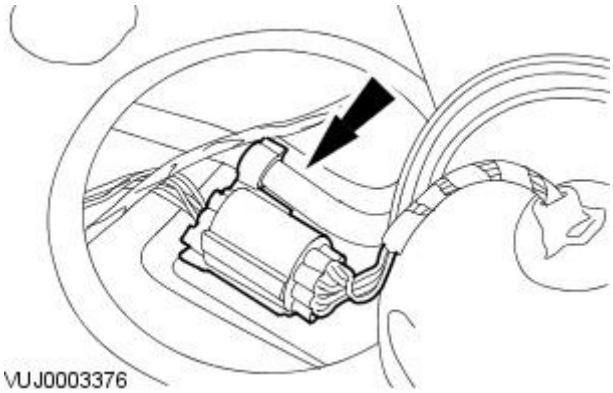
14. NOTE: Federal market vehicles only.

Install the rear subframe.
For additional information, refer to: Rear Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



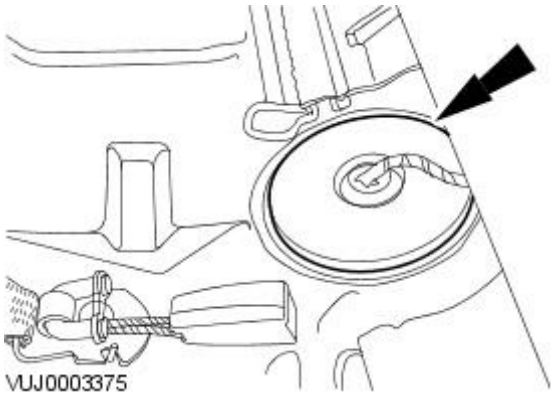
15. NOTE: Federal market vehicles only.

Connect the electrical connector.



16. NOTE: Federal market vehicles only.

Attach the electrical connector.



17. NOTE: Federal market vehicles only.

Attach the wiring harness grommet.

18. NOTE: Federal market vehicles only.

Install the rear seat cushion.
For additional information, refer to: Rear Seat Cushion (501-10 Seating, Removal and Installation).

19. NOTE: Federal market vehicles only.

Fill the fuel tank with the fuel drained from the fuel filler pipe.

20. NOTE: Federal market vehicles only.

Install the fuel filler cap.

21. NOTE: Federal market vehicles only.

Connect the battery ground cable.
For additional information, refer to: Battery Connect (414-01 Battery, Mounting and Cables, General Procedures).

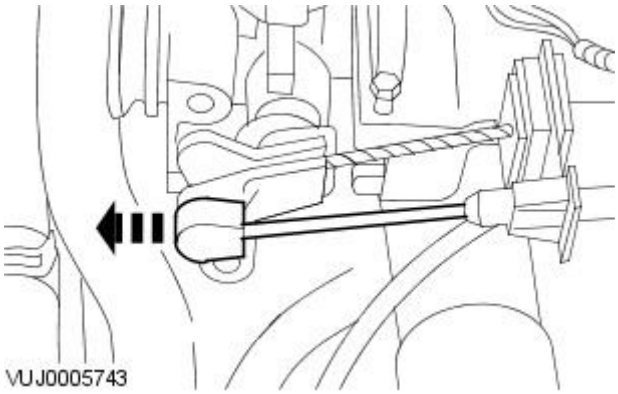
Published: 11-May-2011

Evaporative Emissions - Evaporative Emission Canister Purge Valve

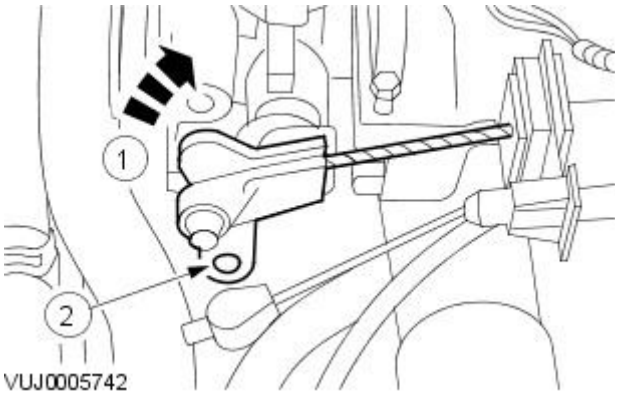
Removal and Installation

Removal

Vehicles with 2.0L engine

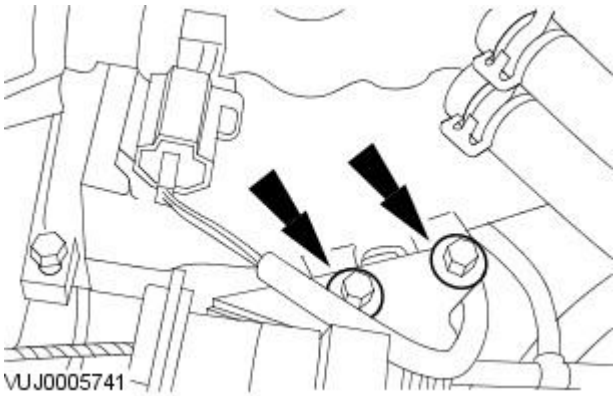


1. Detach the speed control cable.



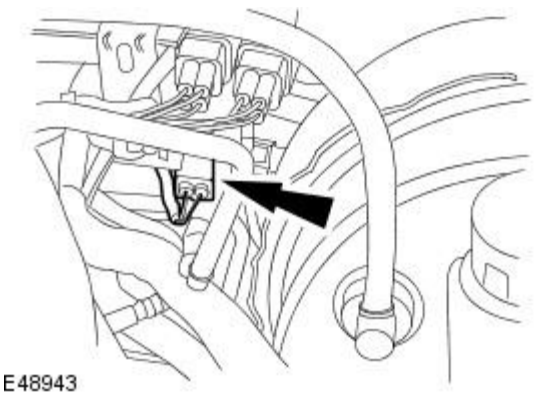
2. Detach the accelerator cable.

1. Reposition the accelerator lever to the fully open position.
2. Detach the accelerator cable.

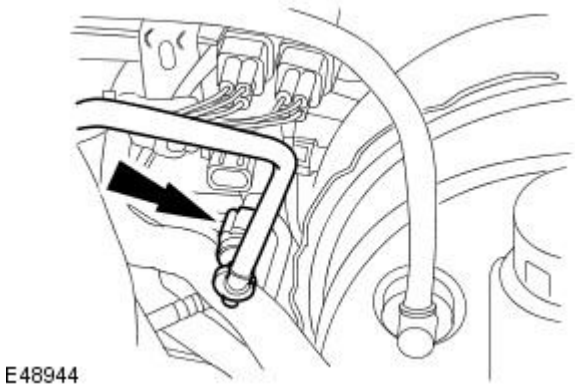


3. Detach the accelerator cable retaining bracket.

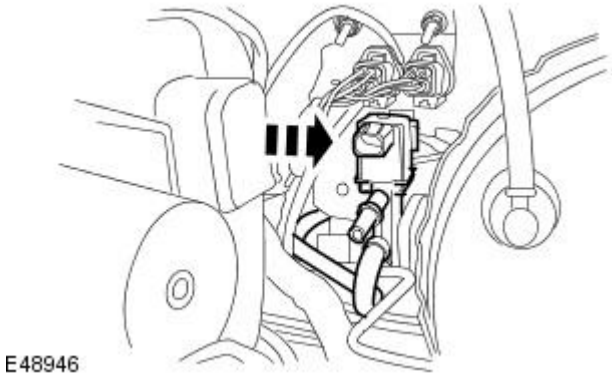
All vehicles



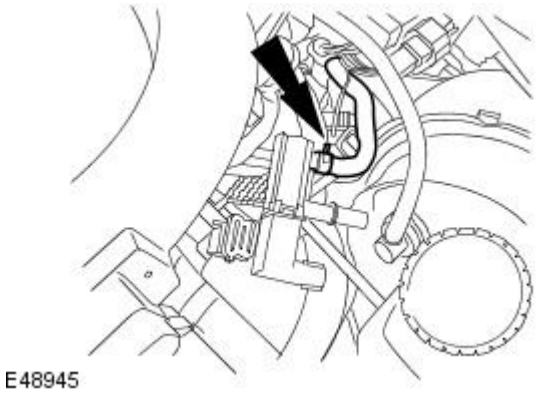
4. Disconnect the evaporative emission canister purge valve electrical connector.


E48944

5. Disconnect the upper fuel vapour hose from the evaporative emission canister purge valve.


E48946

6. Detach the evaporative emission canister purge valve from the retaining bracket.


E48945

7. Remove the evaporative emission canister purge valve.

- Disconnect the lower fuel vapour hose from the evaporative emission canister purge valve.

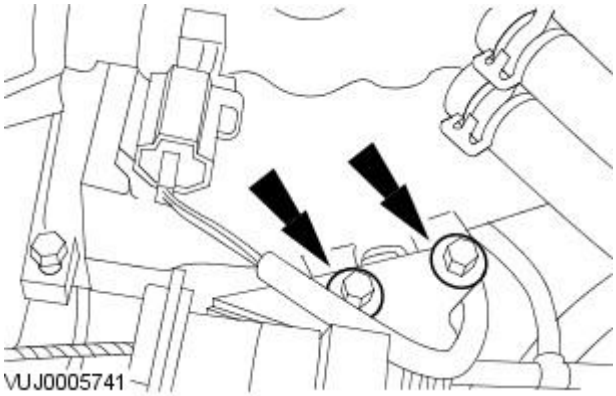
Installation

All vehicles

1. To install, reverse the removal procedure.

Vehicles with 2.0L engine

2. Tighten to 9 Nm.


VUJ0005741

Published: 11-May-2011

Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 -

Torque Specifications

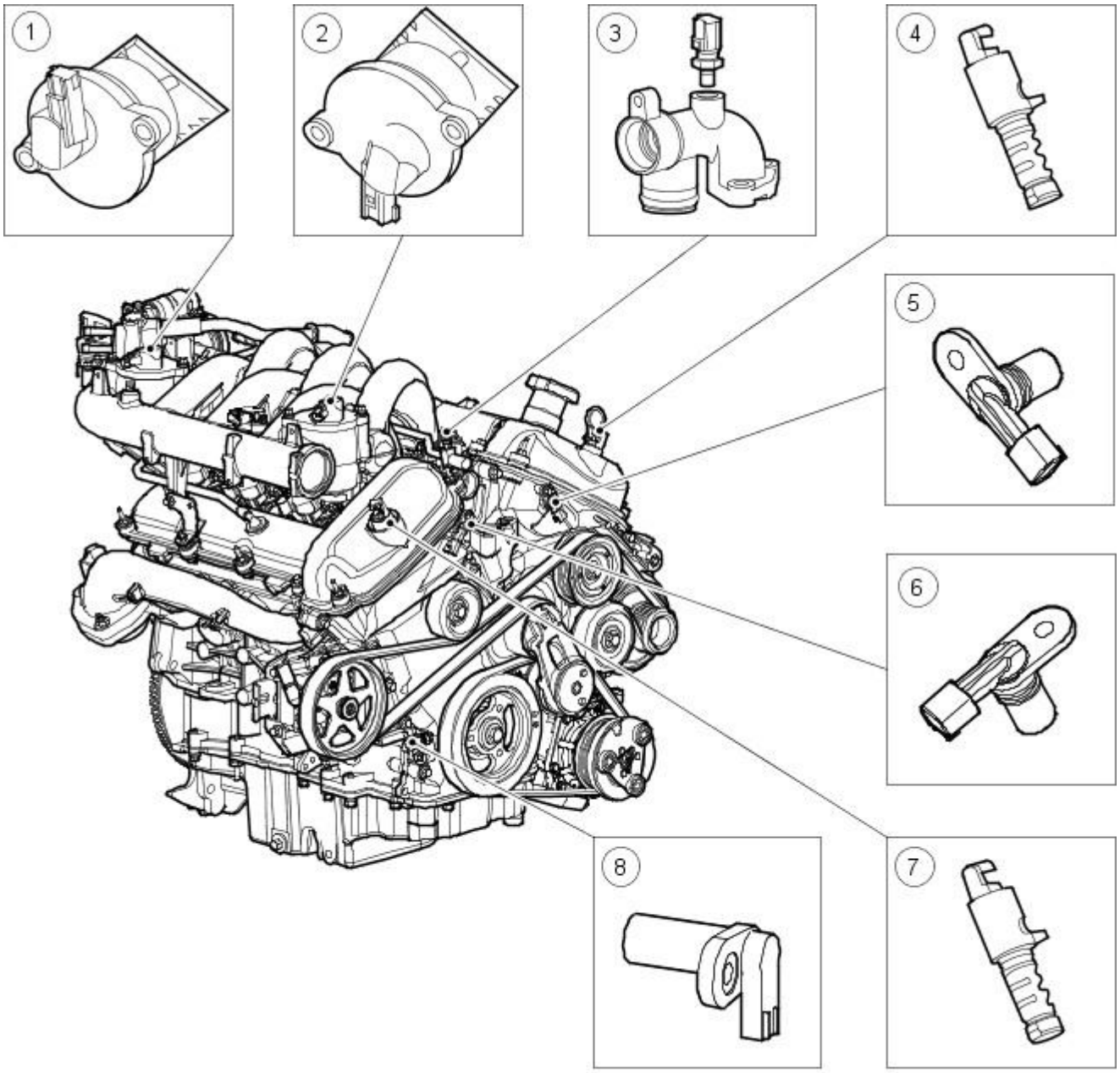
Description	Nm	lb-ft	lb-in
Camshaft position sensor retaining bolt	7	-	62
Heated oxygen sensor	40	30	-
Catalyst monitor sensor	40	30	-
Crankshaft position sensor retaining bolt	10	7	-
Knock sensor retaining bolt	25	18	-
Variable camshaft timing oil control solenoid retaining bolt	10	7	-
Oil temperature sensor	15	11	-
Engine control module (ECM) retaining nut	10	7	-
ECM electrical connector retaining bolt	10	7	-
Engine block coolant inlet pipe retaining bolts	25	18	-
Water pump coolant outlet pipe retaining bolts	10	7	-
Throttle position sensor retaining screws	7	-	62

Published: 11-May-2011

Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Electronic Engine Controls

Description and Operation

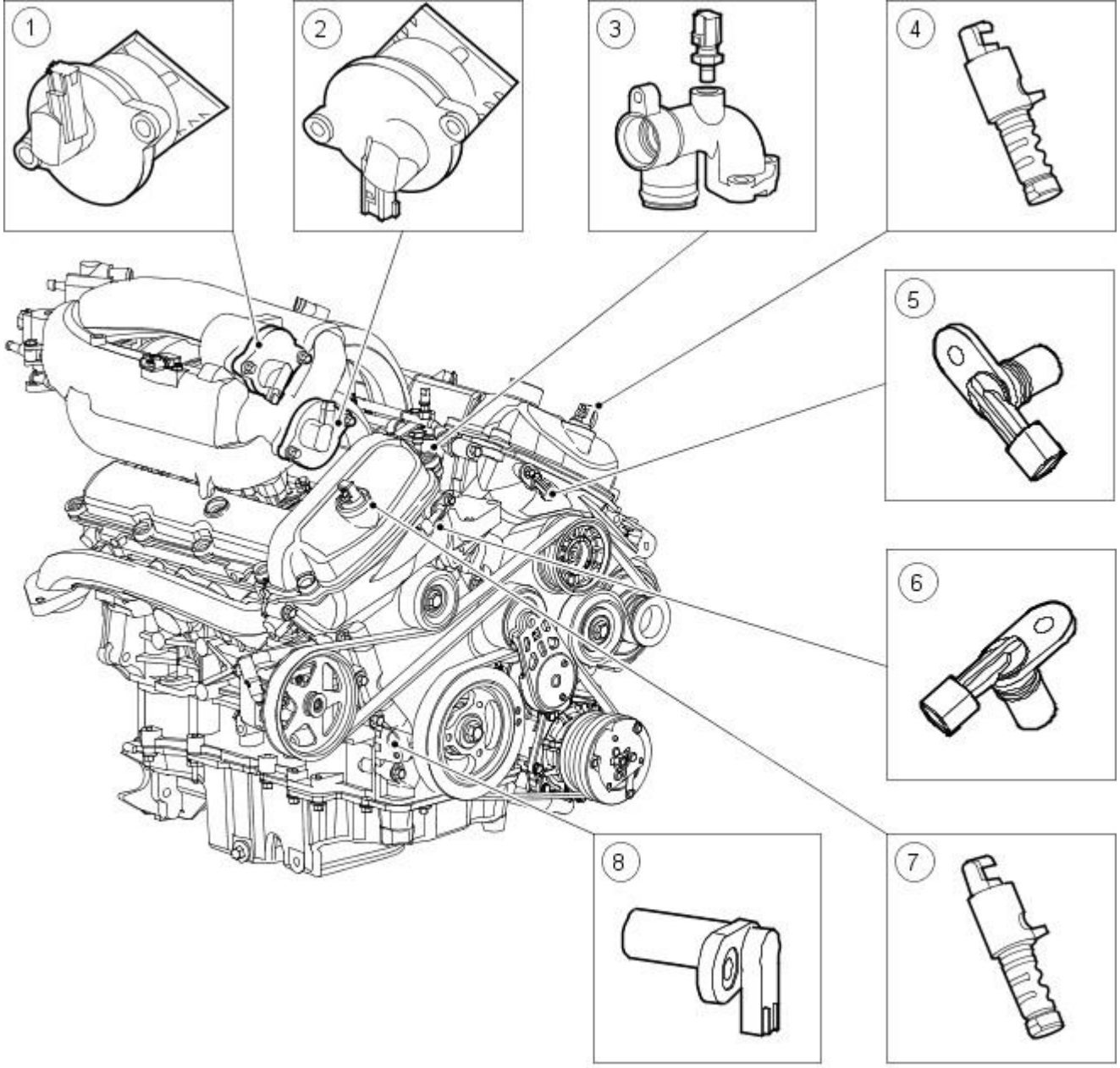
2.0L Engine



E30812

Item	Part Number	Description
1	—	Intake Manifold Tuning (IMT) Valve - upper
2	—	Intake Manifold Tuning (IMT) Valve - lower
3	—	Engine Coolant Temperature (ECT) Sensor
4	—	Variable Camshaft Timing Oil Control Solenoid LH
5	—	Camshaft Position (CMP) Sensor LH
6	—	Camshaft Position (CMP) Sensor RH
7	—	Variable Camshaft Timing Oil Control Solenoid RH
8	—	Crankshaft Position (CKP) Sensor

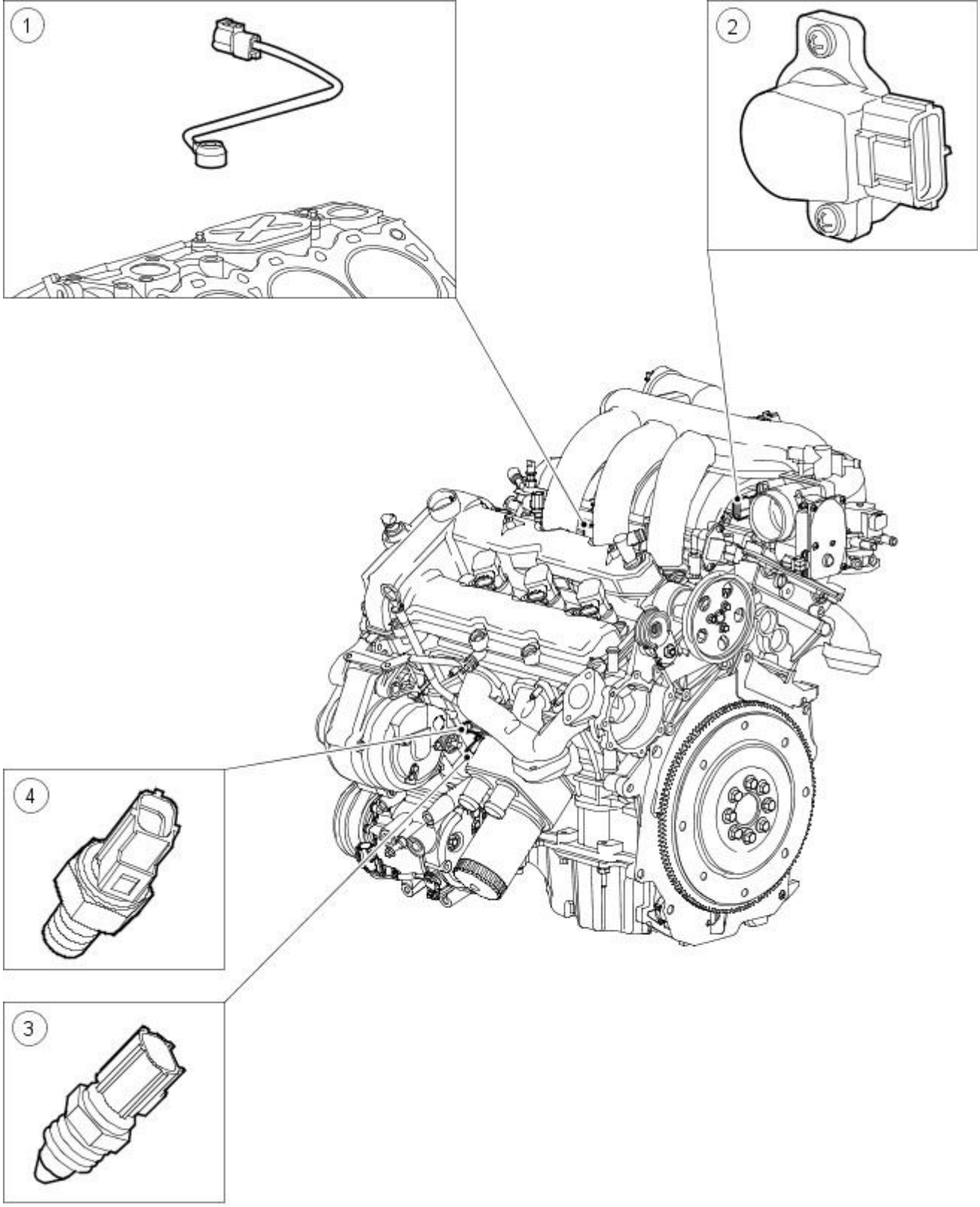
2.5L and 3.0L Engine



VUJ0004252

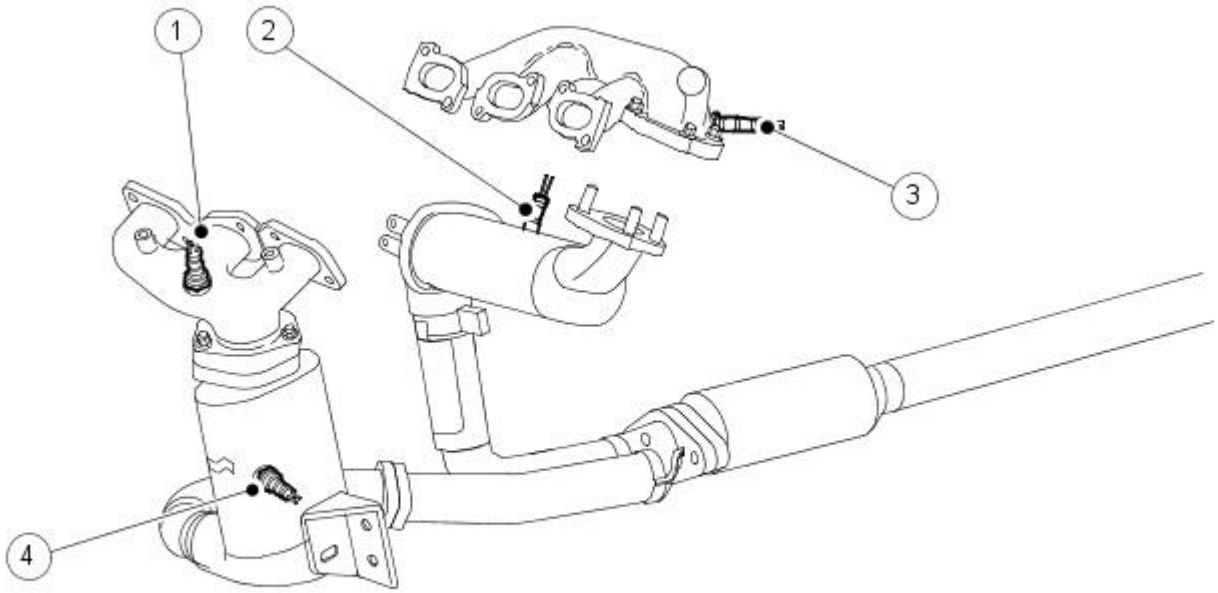
Item	Part Number	Description
1	—	Intake Manifold Tuning (IMT) Valve - upper
2	—	Intake Manifold Tuning (IMT) Valve - lower
3	—	Engine Coolant Temperature (ECT) Sensor
4	—	Variable Camshaft Timing Oil Control Solenoid LH
5	—	Camshaft Position (CMP) Sensor LH
6	—	Camshaft Position (CMP) Sensor RH
7	—	Variable Camshaft Timing Oil Control Solenoid RH
8	—	Crankshaft Position (CKP) Sensor

2.0L, 2.5L and 3.0L Engine



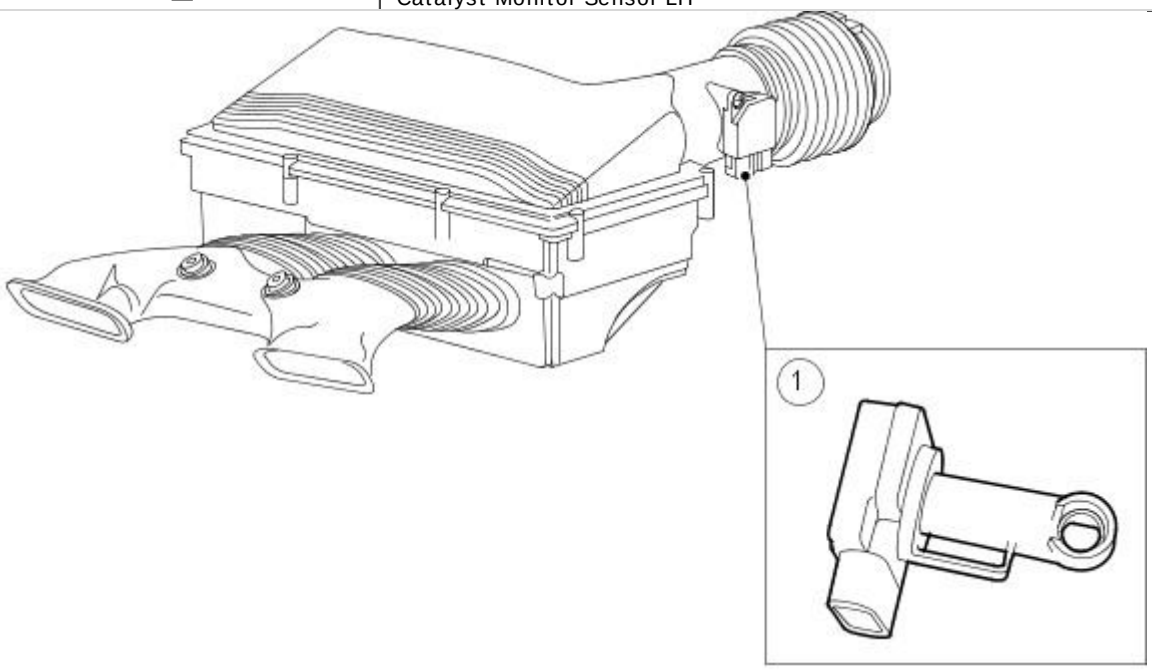
VUJ0004253

Item	Part Number	Description
1	—	Knock Sensor (KS)
2	—	Throttle Position (TP) Sensor
3	—	Oil Temperature Sensor
4	—	Oil Pressure Switch



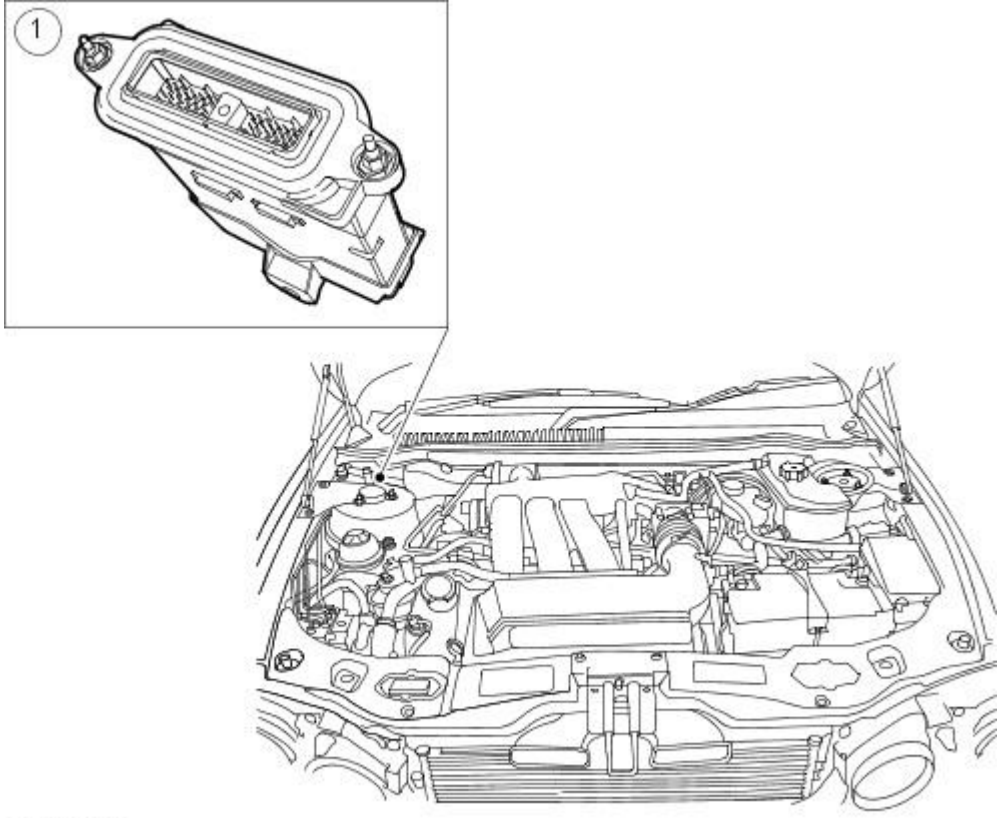
VUJ0004254

Item	Part Number	Description
1	—	Heated Oxygen Sensor (HO2S) LH
2	—	Catalyst Monitor Sensor RH
3	—	Heated Oxygen Sensor (HO2S) RH
4	—	Catalyst Monitor Sensor LH



VUJ0004255

Item	Part Number	Description
1	—	Mass Air flow (MAF) Sensor



VUJ0004256

Item	Part Number	Description
1	—	Engine Control Module (ECM)

Engine Control Module (ECM)

The electronic engine control system consists of a engine control module (ECM) and a number of sensing and actuating devices. The sensors supply the ECM with input signals which relate to the engine operating conditions and driver requirements. The sensor information is evaluated by the ECM using the results to activate the appropriate response from the actuating devices. The system provides the necessary engine control accuracy and adaptability to:

- Minimize exhaust emissions and fuel consumption.
- Provide optimum driver control under all conditions.
- Minimize evaporative emissions.
- Provide system diagnostics.

In addition to these functions the ECM also interfaces with other vehicle systems through the controller area network (CAN).

Camshaft Position (CMP) Sensor

The camshaft position (CMP) sensors monitor the position of both camshafts to allow the ECM to control the phase of the inlet camshafts relative to the position of the crankshaft.

Variable Camshaft Timing Oil Control Solenoid

The variable camshaft timing oil control solenoid is a hydraulic actuator, which advances and retards the inlet camshaft timing, thereby altering the camshaft to crankshaft phasing for optimum engine performance.

Intake Manifold Tuning (IMT) Valve

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 to optimize torque across the engine's speed and load range. The IMT valves work in conjunction with the throttle body. The upper IMT valve opens between 3,000 and 6,000 rpm while the lower IMT valve opens between 5,000 and 6,000 rpm.

Knock Sensor (KS)

The knock sensor (KS) detects combustion knock within the engine cylinders and sends a signal to the ECM. The ECM uses this information to gradually adjust the ignition timing until the combustion knock is eliminated.

Mass Air flow (MAF) Sensor

The mass air flow (MAF) sensor informs the ECM of the rate of air flow entering the engine by producing a voltage which is proportional to the rate of air flow into the engine. The voltage produced by the MAF sensor increases as the rate of air flow increases. The MAF sensor also takes into account the density of the air entering the air intake system so that it is possible to maintain the required air to fuel ratio, and to compensate for variations in atmospheric pressure.

Integral to the MAF sensor is the intake air temperature sensor (IAT) which measures the temperature of the air entering the air intake system. The ECM uses this information to compensate for higher than normal air intake temperatures.

Throttle Position (TP) Sensor

The ECM monitors the angle of the throttle plate within the throttle housing through the throttle position (TP) sensor. The TP sends a voltage to the ECM which is proportional to the angle of the throttle plate. The voltage from the TP increases with the angle of the throttle plate. There are two sensor tracks within the TP sensor.

Crankshaft Position (CKP) Sensor

The crankshaft position (CKP) sensor is an inductive pulse generator, which scans protrusions on a pulse ring fitted to the front of the crankshaft to inform the ECM of the crankshaft's position and speed. The CKP sensor produces an alternating voltage which is increases with

engine speed.

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor is a thermistor type sensor that provides an input signal to the ECM which is proportional to the engine coolant temperature. The ECT sensor is a negative temperature coefficient (NTC) sensor and its resistance decreases with a proportional increase in engine coolant temperature.

Oil Temperature Sensor

The oil temperature sensor is a thermistor type sensor that provides an input signal to the ECM which is proportional to the engine oil temperature.

Oil Pressure Switch

The oil pressure switch is connected to the instrument cluster and is not directly part of the electronic engine control system.

Heated Oxygen Sensor (HO2S)

The heated oxygen sensor (HO2S) is a linear characteristic type sensor, fitted forward of the exhaust system's catalytic converter. The ECM uses this as it's primary sensor to measure the oxygen content of the exhaust gasses within the exhaust system to provide closed-loop fuelling control.

Catalyst Monitor Sensor

The catalyst monitor sensor is a non-linear characteristic type sensor fitted to the exhaust system's catalytic converter. The ECM uses this as it's secondary sensor to measure the oxygen content of the exhaust gasses within the exhaust after they have passed through the catalytic converter. As well as providing additional closed-loop fuelling control the ECM uses this information to determine the efficiency of the catalytic converter.

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Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Electronic Engine Controls2.0L NA V6 - AJV6

Diagnosis and Testing

Principle of Operation

For a detailed description of the engine control system, refer to the relevant Description and Operation sections in the workshop manual. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Description and Operation).

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Engine oil level • Cooling system • Fuel charging system • Fuel contamination • Throttle body • Air intake system • Exhaust system	• Vehicle battery (fully charged and correctly connected) • Fuses. (9, 31, 32, 37) • Wiring harness • Electrical connector(s) • Sensor(s) • Engine control module (ECM)

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 program is in operation, prior to the installation of a new module/component.

• 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: 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
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	• bank 1 upstream HO2 sensor (heater) failure • bank 1 downstream HO2 sensor (heater) failure • bank 1 upstream HO2 sensor (sensing) failure • bank 1 downstream HO2 sensor (sensing) failure • upstream sensor to ECM wiring fault • downstream sensor to ECM wiring fault • Exhaust system fault • Catalyst conversion failure	Refer to pinpoint tests for components listed. Visually inspect catalytic converters.
P0430	Catalyst System Efficiency Below Threshold (Bank 2)	• bank 2 upstream HO2 sensor (heater) failure • bank 2 downstream HO2 sensor (heater) failure • bank 2 downstream HO2 sensor (sensing) failure • upstream sensor to ECM wiring fault • downstream sensor to ECM wiring fault • Exhaust system fault	Refer to pinpoint tests for components listed. Visually inspect catalytic converters.

DTC	Description	Possible Cause	Action
		• Catalyst conversion failure	
P0300	Random Misfire Detected	• Ignition system components • Ignition system wiring harness	Check all ignition coils for secure fixing and check wiring harness connector for damage and correct engagement. Visually confirm condition and grade of all sparking plugs. Check the crank position sensor is correctly mounted and secure. Refer to the appropriate circuit diagram, check the crank position sensor cable screening is intact between the sensor and the engine control module and connected to ground. Check the security and connection of the ignition relay located in the front power distribution box. Check ignition relay ground line for intermittent open circuits between front power distribution box and its ground point. Check the wiring harness between the ignition relay to the harness splice where the feeds separate to each ignition module for shorts to ground or intermittent open circuits. Refer to the appropriate wiring diagram. Inspect ignition system capacitor for damage or short circuits. Check capacitor wiring back to harness splice for open circuits or short to power.
P0301	Cylinder 1 Misfire Detected	• Ignition system cylinder 1 • Ignition system wiring harness	Check cylinder 1 ignition coil for secure fixing and check wiring harness connector for damage and correct engagement. Visually confirm condition and grade of spark plug. Install a new sparkplug of the correct grade if required. Refer to appropriate wiring diagram: check power supply line for open circuits or shorts to ground, check line to ignition coil from ignition relay in front power distribution box. Check ground connection between ignition coil and ground point for open circuits. Check ignition line from engine control module to ignition coil for open circuits, short to power, short to ground. Check feedback line from ignition coil to engine control module for open circuits or short to ground/power. Minimum supply voltage at coil is 10.5 volts. maximum resistance in signal lines is 5 ohms. Repair wiring using appropriate repair kit as required. Minimum supply voltage at coil is 10.5 volts. maximum resistance in signal lines is 5 ohms. Repair wiring using appropriate repair kit as required. If there are no wiring faults, swap suspect ignition coil to a different cylinder, clear DTCs. retest vehicle. If the misfire changes cylinder replace the ignition coil.
P0303	Cylinder 3 Misfire Detected	• Ignition system cylinder 3 • Ignition system wiring harness	Check cylinder 3 ignition coil for secure fixing and check wiring harness connector for damage and correct engagement. Visually confirm condition and grade of spark plug. Install a new sparkplug of the correct grade if required. Refer to appropriate wiring diagram: check power supply line for open circuits or shorts to ground, check line to ignition coil from ignition relay in front power distribution box. Check ground connection between ignition coil and ground point for open circuits. Check ignition line from engine control module to ignition coil for open circuits, short to power, short to ground. Check feedback line from ignition coil to engine control module for open circuits or short to ground/power. Minimum supply voltage at coil is 10.5 volts. maximum resistance in signal lines is 5 ohms. Repair wiring using appropriate repair kit as required. If there are no wiring faults, swap suspect ignition coil to a different cylinder, clear DTCs. retest vehicle. If the misfire changes cylinder replace the ignition coil.
P0305	Cylinder 5 Misfire Detected	• Ignition system cylinder 5 • Ignition system wiring harness	Check cylinder 5 ignition coil for secure fixing and check wiring harness connector for damage and correct engagement. Visually confirm condition and grade of spark plug. Install a new sparkplug of the correct grade if required. Refer to appropriate wiring diagram: check power supply line for open circuits or shorts to ground, check line to ignition coil from ignition relay in front power distribution box. Check ground connection between ignition coil and ground point for open circuits. Check ignition line from engine control module to ignition coil for open circuits, short to power, short to ground. Check feedback line from ignition coil to engine control module for open circuits or short to ground/power. Minimum supply voltage at coil is 10.5 volts. maximum resistance in signal lines is 5 ohms. Repair wiring using appropriate repair kit as required. If there are no wiring faults, swap suspect ignition coil to a different cylinder, clear DTCs. retest vehicle. If the misfire changes cylinder replace the ignition coil.
P0302	Cylinder 2 Misfire Detected	• Ignition system cylinder 2 • Ignition system wiring harness	Check cylinder 2 ignition coil for secure fixing and check wiring harness connector for damage and correct engagement. Visually confirm condition and grade of spark plug. Install a new sparkplug of the correct grade if required. Refer to appropriate wiring diagram: check power supply line for open circuits or shorts to ground, check line to ignition coil from ignition relay in front power distribution box. Check ground connection between ignition coil and ground point for open circuits. Check ignition line from engine control module to ignition coil for open circuits, short to power, short to ground. Check feedback line from ignition coil to engine control module for open circuits or short to ground/power. Minimum supply voltage at coil is 10.5 volts. maximum resistance in signal lines is 5 ohms. Repair wiring using appropriate repair kit as required. If there are no wiring faults, swap suspect ignition coil to a different cylinder, clear DTCs. retest vehicle. If the misfire changes cylinder replace the ignition coil.
P0304	Cylinder 4 Misfire Detected	• Ignition system cylinder 4 • Ignition system wiring harness	Check cylinder 4 ignition coil for secure fixing and check wiring harness connector for damage and correct engagement. Visually confirm condition and grade of spark plug. Install a new sparkplug of the correct grade if required. Refer to appropriate wiring diagram: check power supply line for open circuits or shorts to ground, check line to ignition coil from ignition relay in front power distribution box. Check ground connection between ignition coil and ground point for open circuits. Check ignition line from engine control module to ignition coil for open circuits, short to power, short to ground. Check feedback line from ignition coil to engine control module for open circuits or short to ground/power. Minimum supply voltage at coil is 10.5 volts. maximum resistance in signal lines is 5 ohms. Repair wiring using appropriate repair kit as required. If there are no wiring faults, swap suspect ignition coil to a different cylinder, clear DTCs. retest vehicle. If the misfire changes cylinder replace the ignition coil.
P0306	Cylinder 6 Misfire Detected	• Ignition system cylinder 6 • Ignition system wiring harness	Check cylinder 6 ignition coil for secure fixing and check wiring harness connector for damage and correct engagement. Visually confirm condition and grade of spark plug. Install a new sparkplug of the correct grade if required. Refer to appropriate wiring diagram: check power supply line for open circuits or shorts to ground, check line to ignition coil from ignition relay in front power distribution box. Check ground connection between ignition coil and ground point for open circuits. Check ignition line from engine control module to ignition coil for open circuits, short to power, short to ground. Check feedback line from ignition coil to

DTC	Description	Possible Cause	Action
			engine control module for open circuits or short to ground/power. Minimum supply voltage at coil is 10.5 volts. maximum resistance in signal lines is 5 ohms. Repair wiring using appropriate repair kit as required. If there are no wiring faults, swap suspect ignition coil to a different cylinder, clear DTCs. retest vehicle. If the misfire changes cylinder replace the ignition coil.
P1313	Misfire Rate Catalyst Damage Fault - Bank 1	• Concern with ignition system and wiring harness on bank 1	Refer to the appropriate wiring diagram. Check ignition circuits on bank one for damage to insulation. Check ignition coil power supply, ground and signal circuits for open circuits, shorts to ground or power, high resistance. Repair any wiring defects using appropriate methods and materials. Clear DTC and retest the system to check for normal operation.
P1314	Misfire Rate Catalyst Damage Fault - Bank 2	• Concern with ignition system and wiring harness on bank 2	Refer to the appropriate wiring diagram. Check ignition circuits on bank two for damage to insulation. Check ignition coil power supply, ground and signal circuits for open circuits, shorts to ground or power, high resistance. Repair any wiring defects using appropriate methods and materials. Clear DTC and retest the system to check for normal operation.
P1316	Injector Driver Module Codes Detected	• Ignition system • Ignition system harness	Refer to repair manual, check ignition system components. Inspect ignition system harness for evidence of damage. Check power supply to ignition coils, check EMS control lines. Repair wiring faults using appropriate materials and methods. Clear DTC and retest system to confirm correct operation.
P0131	O2 Circuit Low Voltage (Bank 1, Sensor 1)	• Concern with upstream O2 sensor • Wiring between upstream O2 sensor and ECM	Refer to the appropriate wiring diagram: check the wiring harness connections between the engine control module and upstream oxygen sensor. Check sensor signal circuits for short to ground or high resistance.
P0132	O2 Circuit High Voltage (Bank 1, Sensor 1)	• Concern with upstream O2 sensor • Wiring between upstream O2 sensor and ECM	Refer to the appropriate wiring diagram: check the wiring harness connections between the engine control module and upstream oxygen sensor.
P0133	O2 Circuit Slow Response (Bank 1, Sensor 1)	• Exhaust leak/damage • Concern with upstream O2 sensor • Upstream O2 sensor not achieving normal operating temperature • Wiring between upstream O2 sensor and ECM • Fuel injector flow partially blocked • Catalyst efficiency decrease	Inspect exhaust system for damage and evidence of leakage. replace any defective components. Clear the DTCs and retest the system. Check fuse for power supply to O2 sensor heater. Install a replacement fuse and inspect wiring for short circuits if defective. Clear the DTCs and retest the system. Check power supply line from front power distribution box to O2 sensor heater for open circuits and high resistance. Repair defects using appropriate harness repair kit. Clear the DTCs and retest the system. Check ground circuit from O2 sensor heater to engine control module connector for open circuits. Repair defects using appropriate wiring repair kit. Clear the DTCs and retest the system. Disconnect oxygen sensor connector and measure the continuity though the heating circuit of the sensor. If there is no continuity, replace the sensor. Clear the DTCs and retest the system
P0031	HO2S Heater Control Circuit Low (Bank 1, Sensor 1)	• Concern with upstream O2 sensor heater • Wiring fault between upstream O2 sensor and ECM • Wiring fault between Upstream O2 sensor and Front Power Distribution Box	Inspect wiring harness from O2 sensor for damage. Replace or repair any damaged components. clear DTCs and retest vehicle. Check voltage supply from front power distribution box to O2 sensor heater circuit. If less than 10.5 volts check and repair
P0032	HO2S Heater Control Circuit High (Bank 1, Sensor 1)	• Concern with upstream O2 sensor heater • Wiring fault between upstream O2 sensor and ECM • Wiring fault between Upstream O2 sensor and Front Power Distribution Box	Check wiring between oxygen sensor and engine control module for obvious defects. Refer to the appropriate circuit diagram and check the ground connection from the heater circuit for open circuits or high resistance. Repair circuits, clear DTC, retest systems.
P0152	O2 Circuit High Voltage (Bank 2, Sensor 1)	• Concern with upstream O2 sensor heater • Wiring fault between upstream O2 sensor and ECM • Wiring fault between Upstream O2 sensor and Front Power Distribution Box	Check wiring between oxygen sensor and engine control module for obvious defects. Refer to the appropriate circuit diagram and check the signal lines for short to power. Repair circuits, clear DTC, retest systems.
P0153	O2 Circuit Slow Response (Bank 2, Sensor 1)	• Exhaust leak/damage • Concern with upstream O2 sensor • Upstream O2 sensor not achieving normal operating temperature	Check exhaust system is free from defects and is not leaking. Repair as required, clear DTCs and retest. Check oxygen sensor heater power supply and ground lines for open circuits and shorts. Repair defective wiring as required. Refer to circuit diagrams, check oxygen sensor signal lines to engine control module for open circuits, short circuits and high resistance. Repair circuits as required, clear DTC and retest system. Clean fuel injectors using approved equipment. clear DTCs, retest system. Check fuel for evidence of contamination which may have damaged oxygen sensors or catalysts.

DTC	Description	Possible Cause	Action
		• Wiring between upstream O2 sensor and ECM • Fuel injector flow partially blocked • Catalyst efficiency decrease	
P0051	HO2S Heater Control Circuit Low (Bank 2, Sensor 1)	• Concern with upstream O2 sensor heater • Wiring fault between upstream O2 sensor and ECM • Wiring fault between Upstream O2 sensor and Front Power Distribution Box	Check power supply to HO2S heater element connector pin with the ignition on. If the voltage is less than 10.5 volts check the front power distribution box fuses. Check the wiring circuit from the front power distribution box to the HO2S sensor connector for open circuits or shorts to ground. Repair any wiring faults using approved methods and materials, replace any blown fuses and clear the DTC. retest the system for correct operation. Check wiring circuit between the HO2S sensor connector and the engine control module.
P0052	HO2S Heater Control Circuit High (Bank 2, Sensor 1)	• Concern with upstream O2 sensor heater • Wiring fault between upstream O2 sensor and ECM	Check power supply to HO2S heater element connector pin with the ignition on. If the voltage is less than 10.5 volts check the front power distribution box fuses. Check the wiring circuit from the front power distribution box to the HO2S sensor connector for open circuits or shorts to ground. Repair any wiring faults using approved methods and materials, replace any blown fuses and clear the DTC. retest the system for correct operation.
P0137	O2 Circuit Low Voltage (Bank 1, Sensor 2)	• Concern with downstream O2 sensor • Wiring between downstream O2 sensor and ECM	Check oxygen sensor wiring harness for signs of damage to the insulation. Check the signal and screen circuits for open circuits, and shorts to ground. Check heater circuit power circuit is supplied with power and the control line is not open circuit. Check sensor for evidence of fouling
P0138	O2 Circuit High Voltage (Bank 1, Sensor 2)	• Concern with downstream O2 sensor heater • Wiring fault between downstream O2 sensor and ECM • Wiring fault between downstream O2 sensor and Front Power Distribution Box	Check oxygen sensor wiring harness for signs of damage to the insulation. Check the signal and screen circuits for shorts to power.
P0140	O2 Circuit No Activity Detected (Bank 1, Sensor 2)	• Power supply to oxygen sensor heater not present • Wiring harness fault • Oxygen sensor faulty	Check power distribution box fuses to ensure the heater element of the oxygen sensor is powered. Check oxygen sensor heating element control line is not open circuit or has a high resistance. Check sensor signal lines for open circuits and shorts to ground. Repair wiring fault using approved methods and materials. Check oxygen sensor for contamination or masked sensing tip. Replace the sensor if suspect. Clear DTC, retest the system to confirm correct operation.
P0037	HO2S Heater Control Circuit Low (Bank 1, Sensor 2)	• Concern with downstream O2 sensor heater • Wiring fault between downstream O2 sensor and ECM • Wiring fault between downstream O2 sensor and Front Power Distribution Box	Check power supply to HO2S heater element connector pin with the ignition on. If the voltage is less than 10.5 volts check the front power distribution box fuses. Check the wiring circuit from the front power distribution box to the HO2S sensor connector for open circuits or shorts to ground. Repair any wiring faults using approved methods and materials, replace any blown fuses and clear the DTC. retest the system for correct operation.
P0038	HO2S Heater Control Circuit High (Bank 1, Sensor 2)	• Concern with downstream O2 sensor heater • Wiring fault between downstream O2 sensor and ECM	Check engine wiring harness for signs of damage. Check HO2S heater control circuit for short to power. Check HO2S for internal short circuit. Repair wiring using appropriate methods and materials, clear DTC and retest system for correct operation. Replace HO2S if suspect. Clear DTC and retest systems to confirm correct operation.
P0157	O2 Circuit Low Voltage (Bank 2, Sensor 2)	• Concern with downstream O2 sensor • Wiring fault between downstream O2 sensor and ECM	Check oxygen sensor wiring harness for signs of damage to the insulation. Check the signal and screen circuits for open circuits, and shorts to ground. Check heater circuit power circuit is supplied with power and the control line is not open circuit. Check sensor for evidence of fouling
P0158	O2 Circuit High Voltage (Bank 2, Sensor 2)	• Concern with downstream O2 sensor • Wiring fault between downstream O2 sensor and ECM	Check oxygen sensor wiring harness for signs of damage to the insulation. Check the signal and screen circuits for shorts to power.

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Diagnosis and Testing

1. **1.** Verify the customer concern by operating the system.
2. **2.** Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Engine oil level • Cooling system coolant level • Fuel Contamination • Throttle body	• Fuses (9, 31, 32, 37) • Wiring harness • Electrical connector(s) • Sensor(s) • Engine control module (ECM)

3. **3.** Verify the following systems are working correctly:

- Air intake system
- Cooling system
- Charging system
- Fuel charging system

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 concern is not visually evident and the Jaguar Approved Diagnostic System is not available, use a fault code reader to retrieve the fault codes before proceeding to the Diagnostic Trouble Code (DTCs) Index Chart.
6. **6.** Make sure that a power supply is present to the ECM from fuse 32 of the engine compartment fuse box before carrying out diagnostic work on the electronic engine control system.

Diagnostic Trouble Code (DTC) Index

DTC	Description	Possible Source	Action
P0116, P0117, P0118, P0125	Concern with engine coolant temperature (ECT) sensor.	• ECT sensor. • ECT sensor circuit(s). • Low/contaminated coolant. • Thermostat failure. • Overheating.	GO to Pinpoint Test A.
P0128	Concern with engine temperature, set by ECT sensor inputs.	• Thermostat. • ECT sensor. • ECT sensor circuit(s).	Mechanical check of thermostat.GO to Pinpoint Test A.
P0335, P0336	Concern with crankshaft position (CKP) sensor.	• CKP sensor. • CKP sensor circuit(s). • CKP sensor air gap. • CKP sensor debris.	GO to Pinpoint Test B.
P0340, P0341	Concern with right-hand bank camshaft position (CMP) sensor.	• CMP sensor. • CMP sensor circuit(s). • CMP sensor air gap. • CMP sensor debris.	GO to Pinpoint Test C.
P1340, P1341	Concern with left-hand bank camshaft position (CMP) sensor.	• CMP sensor. • CMP sensor circuit(s). • CMP sensor air gap. • CMP sensor debris.	GO to Pinpoint Test D.
P0031, P0032	Concern with right-hand bank heated oxygen sensor (HO2S 1/1) heater.	• H02S 1/1 failure. • H02S 1/1 circuit(s). • Fuse 38.	GO to Pinpoint Test E.
P0181, P0182, P0183	Concern with fuel temperature sensor.	• Fuel temperature sensor. • Fuel temperature sensor circuit(s).	GO to Pinpoint Test F.
P0327, P0328, P0332, P0333, P1648	Concern with knock sensor (KS).	• KS. • KS circuit(s). • Poor contact with cylinder block. • ECM failure.	GO to Pinpoint Test G.
P0197, P0198, P0196	Concern with oil temperature sensor.	• Oil temperature sensor. • Oil temperature sensor circuit(s).	GO to Pinpoint Test H.
P0131, P0132	Concern with right-hand bank heated oxygen sensor (HO2S 1/1).	• HO2S 1/1. • HO2S 1/1 circuit(s).	GO to Pinpoint Test I.
P0133	Concern with right-hand bank heated oxygen sensor (HO2S 1/1). Slow response	• Engine misfire. • H02S 1/1 disconnected. • H02S 1/1 mechanical damage. • H02S 1/1 to ECM wiring fault.	GO to Pinpoint Test I. Refer to pinpoint tests for components listed, REFER to: Exhaust System (309-00 Exhaust System, Diagnosis and Testing) / Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging

DTC	Description	Possible Source	Action
		• H02S 1/1 short circuit to ground. • H02S 1/1 wiring shield open circuit. • H02S 1/1 heater circuit fault. • Exhaust leak. • Low exhaust temperature. • Injector flow partially blocked. • Catalyst efficiency decrease. • H02S 1/1 failure.	and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P1646	Concern with right-hand bank heated oxygen sensor (HO2S 1/1).	• H02S 1/1 heater failure. • H02S 1/1 sensing circuit, short circuit to ground. • H02S 1/1 sensing circuit, short circuit to high voltage. • H02S 1/1 sensing circuit, open circuit. • ECM failure.	GO to Pinpoint Test I. Refer to pinpoint tests for components listed.
P0037, P0038, P0137, P0138	Concern with right-hand bank catalyst monitor sensor (H02S 1/2).	• H02S 1/2. • H02S 1/2 circuit(s). • Fuse 38.	GO to Pinpoint Test J.
P0140	Concern with right-hand bank catalyst monitor sensor (H02S 1/2).	• Exhaust leak. • Low exhaust temperature.	Inspect exhaust system, REFER to: Exhaust System (309-00 Exhaust System, Diagnosis and Testing).
P0151, P0152	Concern with left-hand bank heated oxygen sensor (HO2S 2/1).	• HO2S 2/1. • HO2S 2/1 circuit(s).	GO to Pinpoint Test K.
P0153	Concern with left-hand bank heated oxygen sensor (HO2S 2/1). Slow response	• Engine misfire. • H02S 2/1 disconnected. • H02S 2/1 mechanical damage. • H02S 2/1 to ECM wiring fault. • H02S 2/1 short circuit to ground. • H02S 2/1 wiring shield open circuit. • H02S 2/1 heater circuit fault. • Exhaust leak. • Low exhaust temperature. • Injector flow partially blocked. • Catalyst efficiency decrease. • H02S 2/1 failure.	GO to Pinpoint Test K. Refer to pinpoint tests for components listed, REFER to: Exhaust System (309-00 Exhaust System, Diagnosis and Testing) / Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P1647	Concern with left-hand bank heated oxygen sensor (HO2S 2/1).	• H02S 2/1 heater failure. • H02S 2/1 sensing circuit, short circuit to ground. • H02S 2/1 sensing circuit, short circuit to high voltage. • H02S 2/1 sensing circuit, open circuit. • ECM failure.	GO to Pinpoint Test K. Refer to pinpoint tests for components listed.
P0057, P0058, P0157, P0158	Concern with left-hand bank catalyst monitor sensor (HO2S 2/2).	• HO2S 2/2. • HO2S 2/2 sensor circuit(s). • Fuse 42.	GO to Pinpoint Test L.
P0160	Concern with left-hand bank catalyst monitor sensor (HO2S 2/2).	• Exhaust leak. • Low exhaust temperature.	Inspect exhaust system, REFER to: Exhaust System (309-00 Exhaust System, Diagnosis and Testing).
P0420	Concern with right-hand bank catalytic converter system. (Efficiency below threshold)	• HO2 sensor disconnected. • HO2 sensor to ECM wiring fault. • HO2 sensor heater to ECM wiring fault. • HO2 sensor heater failure. • Upstream HO2 sensor failure. • Downstream HO2 sensor failure. • HO2 sensor failed. • Catalytic converter	Refer to pinpoint tests for components listed. Visually inspect catalytic converters.

DTC	Description	Possible Source	Action
		failure.	
P0430	Concern with left-hand bank catalytic converter system (Efficiency below threshold).	• HO2 sensor disconnected. • HO2 sensor to ECM wiring fault. • HO2 sensor heater to ECM wiring fault. • HO2 sensor heater failure. • Upstream HO2 sensor failure. • Downstream HO2 sensor failure. • HO2 sensor failed. • Catalytic converter failure.	Refer to pinpoint tests for components listed. Visually inspect catalytic converters, REFER to: Exhaust System (309-00 Exhaust System, Diagnosis and Testing).
P0101, P0102	Concern with mass air flow (MAF) sensor.	• MAF sensor. • MAF sensor circuit(s). • Blocked air filter. • Air intake leak. • Engine breather leak. • Throttle control malfunction.	GO to Pinpoint Test M. Visually inspect components listed, REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing) / Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0103, P1104	Concern with mass air flow (MAF) sensor.	• MAF sensor. • MAF sensor circuit(s).	GO to Pinpoint Test M.
P0111	Concern with the intake air temperature (IAT) sensor.	• MAF sensor. • MAF sensor circuit(s). • Blocked air filter. • Air intake leak. • Engine breather leak.	GO to Pinpoint Test N. Visually inspect components listed. REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0112, P0113	Concern with the intake air temperature (IAT) sensor.	• Intake air temperature (IAT) sensor. • Intake air temperature (IAT)sensor circuit.	GO to Pinpoint Test N.
P0051, P0052	Concern with the left-hand bank heated oxygen sensor (HO2S 2/1) heater.	• HO2S 2/1. • HO2S 2/1 circuit. • Fuse 42.	GO to Pinpoint Test O.
P1606	Concern with ECM relay.	• ECM. • ECM relay. • ECM relay circuit(s). • Fuse 31.	GO to Pinpoint Test P.
P0105, P1107, P1108	Concern with MAP sensor.	• MAP sensor. • MAP sensor circuits.	GO to Pinpoint Test Q.
P0106, P0107, P0108	Concern with barometric (HAC) sensor.	Barometric sensor within the ECM.	GO to Pinpoint Test Q. INSTALL a new ECM, for additional information, refer to dealer technical support.
P0010, P1384	Concern with VVT circuit, right-hand bank.	• VVT solenoid and circuit. • Oil flow. • Camshaft failure.	GO to Pinpoint Test R. REFER to: Variable Camshaft Timing (VCT) Oil Control Solenoid (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).
P0020, P1396	Concern with VVT circuit, left-hand bank.	• VVT solenoid and circuit. • Oil flow. • Camshaft failure.	GO to Pinpoint Test S. REFER to: Variable Camshaft Timing (VCT) Oil Control Solenoid (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).
P1251, P1631, P1657, P1658	Concern with throttle motor relay.	• Throttle motor relay. • Throttle motor relay circuit.	GO to Pinpoint Test T. Check Fuse 18.
P1549	Concern with IMT Valve 1 circuit.	• IMT valve. • IMT valve circuit.	GO to Pinpoint Test U.
P1532	Concern with IMT Valve 2 circuit.	• IMT valve. • IMT valve circuit.	GO to Pinpoint Test V.
P1582	"Flight Recorder" data stored.	This code does not indicate a failure of a component or system.	GO to Pinpoint Test W.
P1240, P1241, P1242	Concern with sensor power supply.	• ECM. • Power supply circuits. • Sensors within the circuit.	GO to Pinpoint Test X.
P1243	Concern with sensor ground circuit.	• ECM. • Sensor ground circuits. • Sensors within the circuit.	GO to Pinpoint Test Y.
P1122, P1123, P1344	Concern with accelerator pedal position sensor; Track 1.	• APP sensor. • APP sensor circuits.	GO to Pinpoint Test Z.

DTC	Description	Possible Source	Action
P1215, P1216, P1344	Concern with accelerator pedal position sensor; Track 3.	• APP sensor. • APP sensor circuits.	GO to Pinpoint Test AA.
P0480	Concern with radiator cooling fan module drive.	• Cooling fan module. • Cooling fan module circuits.	GO to Pinpoint Test AB.
P0646, P0647	Concern with air conditioning clutch relay drive.	• Air conditioning clutch relay. • Air conditioning clutch relay circuits.	GO to Pinpoint Test AC.
P1516, P1517	Concern with P/N switch starting/driving malfunctions.	• CJFB. • Ignition relay. • TR sensor. • Inertia switch and circuits.	GO to Pinpoint Test AD.
P1245, P1246	Concern with engine crank signal, high/low voltage.	• Starter relay. • ECM. • Ignition switch. • Associated circuits.	GO to Pinpoint Test AE.
P1260	Security input malfunction.	• GEM. • Ignition key. • PATS circuits. • CAN network.	Reprogramme key, check CAN network, REFER to: Communications Network - VIN Range: E96603->J28492 (418-00 Module Communications Network, Diagnosis and Testing).
P0506	Idle RPM lower than expected.	• Air intake restriction. • Accessory drive overload. (defective/seized component). • Throttle valve stuck closed. • Throttle body failure.	REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing) / Accessory Drive (303-05 Accessory Drive, Diagnosis and Testing) / Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0507	Idle RPM higher than expected.	• Speed control switches internal steering wheel circuit; Short circuit to ground. • Steering wheel cassette reel; Short circuit to ground. • Cassette reel to ECM circuit; Short circuit to ground. • RESUME switch failure (stuck ON).	REFER to: Speed Control - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-03 Speed Control, Diagnosis and Testing).
P0603, P1611, P1633, P1634, P1656	Concern with powertrain control module (ECM).	ECM.	INSTALL a new ECM. For additional information, refer to dealer technical support.
P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206	Concern with fuel system too lean/rich.	• Fuel injector(s). • Fuel delivery fault.	REFER to: Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0300, P0301, P0302, P0303, P0304, P0305, P0306, P1313, P1314, P1316	Concern with ignition system/misfire monitoring.	• Ignition system. • Ignition system wiring harness.	REFER to: Engine Ignition - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0351, P0352, P0353, P0354, P0355, P0356	Concern with ignition primary circuits.	• Ignition modules. • Ignition module circuits.	REFER to: Engine Ignition - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0441, P0442, P0443, P0444, P0445, P0446, P0447, P0448, P0450, P0452, P0453, P0455, P0456	Concern with evaporative emissions system.	• Evaporative/purge valve and circuits. • Fuel tank and lines. • Filler cap. • Carbon canister. • Canister close valve and circuits. • Fuel tank pressure sensor. • Fuel tank vapor port. • Vapor lines.	REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0460	Concern with fuel level sensors.	• Fuel level sensors. • Fuel level sensor circuits. • Instrument cluster.	REFER to: Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0560	ECM battery power supply voltage malfunction. (This DTC could be set due to a fuel injection pressure sensor fault. If P0193 is also set, rectify P0193 first).	ECM battery power supply circuit open circuit or high resistance.	Repair the circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

DTC	Description	Possible Source	Action
P0565, P0566, P0567, P0568, P0569, P0570, P0831, P0832, P0834, P0835, P1571	Concern with vehicle speed control.	• Switchpack. • Switchpack circuits. • Clutch cancel switch. • Clutch safety switch. • Brake on/off switch.	REFER to: Speed Control - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-03 Speed Control, Diagnosis and Testing).
P0616, P0617	Concern with the starter relay circuit.	• Starter relay. • Starter relay drive circuit.	REFER to: Starting System - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-06 Starting System, Diagnosis and Testing).
P1224, P1229, P1250, P1254	Concern with throttle body.	• Throttle motor. • Throttle motor relay. • Throttle motor relay circuits. • Throttle body. • Throttle position sensor. • Throttle position sensor circuits. • Throttle return spring. • Limp-home spring.	REFER to: Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P1234, P1236, P1338	Concern with fuel pump commands.	• Fuel pump control module. • Fuel pump control module circuits. • ECM.	REFER to: Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P1244, P1629, P1632, P1146	Concern with charging system.	• Charging system. • Charging system wiring harness.	REFER to: Charging System - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (414-00 Battery and Charging System - General Information, Diagnosis and Testing).
P0191, P0192, P0193	Concern with fuel pressure sensor.	• Fuel pressure sensor circuit(s). • Fuel pressure sensor. • Fuel system leak/blockage.	REFER to: Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0121, P0122, P0123, P0222, P0223	Concern with throttle position (TP) sensor.	• TP sensor. • TP sensor circuit(s).	REFER to: Throttle Position (TP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).
P1000	System check not complete since last memory clear.	OBD errors not cleared by diagnosis.	Carry out comprehensive component monitor drive cycle. Refer to the DTC section of JTIS, accessed by the icon on the opening page.
P1111	System check complete since last memory clear.	This code does not indicate a failure of a component or system.	No action necessary.
P1367	Concern with right-hand bank ignition amplifier.	• Ignition module. • Ignition module circuits.	REFER to: Engine Ignition - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P1368	Concern with left-hand bank ignition amplifier.	• Ignition module. • Ignition module circuits.	REFER to: Engine Ignition - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P1656	Concern with TP sensor amplifier circuit.	ECM.	INSTALL a new ECM. For additional information, refer to, dealer technical support.
P1609	CPU to CPU communications.	ECM.	INSTALL a new ECM. For additional information, refer to, dealer technical support.
P1637, P1638. P1642, P1643, P1699	Concern with CAN network.	CAN network modules and circuits.	REFER to: Communications Network - VIN Range: E96603->J28492 (418-00 Module Communications Network, Diagnosis and Testing).

PINPOINT TEST A : DTC P0116, P0117, P0118, P0125. ECT SENSOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE ENGINE COOLANT TEMPERATURE (ECT) SENSOR SIGNAL WIRE FOR OPEN CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECT sensor electrical connector EN18.
	3 Disconnect the ECM electrical connector, EN16.
	4 Measure the resistance between the ECT sensor electrical connector EN18, pin 2 (UY) and the ECM electrical connector EN16, pin 70 (UY).
	Is the resistance less than 5 ohms? **Yes** GO to A2. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
A2: CHECK THE ECT SENSOR SIGNAL WIRE FOR A SHORT TO GROUND	
	1 Measure the resistance between the ECT sensor electrical connector EN18, pin 2 (UY) and EN16, pin 19.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to A3.
A3: CHECK THE ECT SENSOR GROUND CIRCUIT	
	1 Measure the resistance between the ECT sensor electrical connector EN18, pin 1 (BG) and EN16, pin 19.

	Is the resistance less than 5 ohms? **Yes** GO to A4. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
A4: CHECK THE ECT SENSOR GROUND CIRCUIT FOR A SHORT TO BATTERY POSITIVE	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the ECT electrical connector EN18, pin 1 (BG) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to A5.
A5: CHECK THE ECT SENSOR CIRCUIT FOR A SHORT TO BATTERY POSITIVE	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between the ECT sensor electrical connector EN18, pin 2 (UY) and GROUND.
	Is the voltage greater than 5 volts? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new ECT sensor. CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST B : DTC P0335, P0336, P1245, P1246. CRANKSHAFT POSITION (CKP) SENSOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE CKP SENSOR FOR CORRECT INSTALLATION	
	1 Turn the ignition switch to the OFF position.
	2 Check the CKP sensor for correct installation.
	Is the CKP sensor correctly installed? **Yes** GO to B2. **No** INSTALL the CKP sensor correctly. REFER to: Crankshaft Position (CKP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Reconnect the sensor. CLEAR the DTCs. TEST the system for normal operation.
B2: CHECK THE CKP SENSOR FOR DEBRIS	
	1 Remove the CKP sensor and inspect for debris.
	Is the CKP sensor free of debris? **Yes** GO to B3. **No** CLEAN the sensor and wheel. INSTALL the sensor. REFER to: Crankshaft Position (CKP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Reconnect the sensor. CLEAR the DTCs. TEST the system for normal operation.
B3: CHECK THE CKP SENSOR GROUND WIRE FOR OPEN CIRCUIT	
	1 Disconnect the ECM electrical connector EN16.
	2 Disconnect the CKP sensor electrical connector EN12.
	3 Measure the resistance between the CKP sensor electrical connector EN12, pin 1 (Y) and the ECM electrical connector EN16, pin 37 (Y).
	Is the resistance less than 5 ohms? **Yes** GO to B4. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. Reconnect all connectors. CLEAR the DTCs. TEST the system for normal operation.
B4: CHECK THE CKP SENSOR SIGNAL WIRE FOR OPEN CIRCUIT	
	1 Measure the resistance between the CKP sensor electrical connector EN12, pin 2 (P) and the ECM electrical connector EN16, pin 36 (P).
	Is the resistance less than 5 ohms? **Yes** GO to B5. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. Reconnect all connectors. CLEAR the DTCs. TEST the system for normal operation.
B5: CHECK THE CKP SENSOR GROUND WIRE FOR A SHORT TO GROUND	
	1 Measure the resistance between the CKP sensor electrical connector EN12 pin 1 (Y) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. Reconnect all connectors. CLEAR the DTCs. TEST the system for normal operation. **No** GO to B6.
B6: CHECK THE CKP SENSOR SIGNAL WIRE FOR A SHORT TO GROUND	
	1 Measure the resistance between the CKP sensor electrical connector EN12 pin 2 (P) and GROUND.

	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. Reconnect all connectors. CLEAR the DTCs. TEST the system for normal operation. **No** GO to B7.
B7: CHECK THE CKP SENSOR GROUND WIRE FOR A SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the CKP sensor electrical connector EN12 pin 1 (Y) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. Reconnect all connectors. CLEAR the DTCs. TEST the system for normal operation. **No** GO to B8.
B8: CHECK THE CKP SENSOR SIGNAL WIRE FOR A SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the CKP sensor electrical connector EN12 pin 2 (P) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. Reconnect all connectors. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new CKP sensor. REFER to: Crankshaft Position (CKP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Reconnect all connectors. CLEAR the DTCs. TEST the system for normal operation. If the concern persists INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST C : DTC P0340, P0341: RIGHT-HAND BANK CAMSHAFT POSITION (CMP) SENSOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE RIGHT-HAND BANK CMP SENSOR FOR CORRECT INSTALLATION	
	1 Turn the ignition switch to the OFF position.
	2 Check the CMP sensor for correct installation.
	Is the CMP sensor correctly installed? **Yes** GO to C2. **No** INSTALL the CMP sensor correctly. REFER to: Camshaft Position (CMP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation.
C2: CHECK THE RIGHT-HAND BANK CMP SENSOR FOR FOREIGN DEBRIS	
	1 Remove the CMP sensor and inspect for foreign debris.
	Is the CMP sensor free of foreign debris? **Yes** GO to C3. **No** CLEAN the sensor and wheel. INSTALL the sensor. REFER to: Camshaft Position (CMP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation.
C3: CHECK THE RIGHT-HAND BANK CMP SENSOR SIGNAL WIRE FOR OPEN CIRCUIT	
	1 Disconnect the ECM electrical connector EN16.
	2 Disconnect the CMP sensor electrical connector EN43.
	3 Measure the resistance between the CMP sensor electrical connector EN43, pin 1 (O) and the ECM electrical connector EN16, pin 94 (O).
	Is the resistance less than 5 ohms? **Yes** GO to C4. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
C4: CHECK THE RIGHT-HAND BANK CMP GROUND WIRE FOR OPEN CIRCUIT	
	1 Measure the resistance between the CMP sensor electrical connector EN43, pin 2 (B) and the ECM electrical connector EN16, pin 95 (B).
	Is the resistance less than 5 ohms? **Yes** GO to C5. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
C5: CHECK THE RIGHT-HAND BANK CMP SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND	
	1 Measure the resistance between the CMP sensor electrical connector EN43, pin 1 (O) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to C6.
C6: CHECK THE RIGHT-HAND BANK CMP SENSOR GROUND CIRCUIT FOR A SHORT TO GROUND	
	1 Measure the resistance between the CMP sensor electrical connector EN43, pin 2 (B) and GROUND.

	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to C7.
C7: CHECK THE RIGHT-HAND BANK CMP SENSOR SIGNAL CIRCUIT FOR A SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the CMP sensor electrical connector EN43, pin 1 (O) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to C8.
C8: CHECK THE RIGHT-HAND BANK CMP SENSOR GROUND CIRCUIT FOR A SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the CMP sensor electrical connector EN43, pin 2 (B) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new CMP sensor. REFER to: Camshaft Position (CMP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST D : DTC P1340, P1341: LEFT-HAND BANK CAMSHAFT POSITION (CMP) SENSOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE LEFT-HAND BANK CMP SENSOR FOR CORRECT INSTALLATION	
	1 Turn the ignition switch to the OFF position.
	2 Check the CMP sensor for correct installation.
	Is the CMP sensor correctly installed? **Yes** GO to D2. **No** INSTALL the CMP sensor correctly. REFER to: Camshaft Position (CMP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation.
D2: CHECK THE LEFT-HAND BANK CMP SENSOR FOR FOREIGN DEBRIS	
	1 Remove the CMP sensor and inspect for foreign debris.
	Is the CMP sensor free of foreign debris? **Yes** GO to D3. **No** CLEAN the sensor and wheel. INSTALL the sensor. REFER to: Camshaft Position (CMP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation.
D3: CHECK THE LEFT-HAND BANK CMP SENSOR SIGNAL WIRE FOR OPEN CIRCUIT	
	1 Disconnect the ECM electrical connector EN16.
	2 Disconnect the CMP sensor electrical connector EN33.
	3 Measure the resistance between the CMP sensor electrical connector EN33, pin 1 (G) and the ECM electrical connector EN16, pin 68 (G).
	Is the resistance less than 5 ohms? **Yes** GO to D4. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
D4: CHECK THE LEFT-HAND BANK CMP GROUND WIRE FOR OPEN CIRCUIT	
	1 Measure the resistance between the CMP sensor electrical connector EN33, pin 2 (N) and the ECM electrical connector EN16, pin 69 (N).
	Is the resistance less than 5 ohms? **Yes** GO to D5. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
D5: CHECK THE LEFT-HAND BANK CMP SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND	
	1 Measure the resistance between the CMP sensor electrical connector EN33, pin 1 (G) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to D6.
D6: CHECK THE LEFT-HAND BANK CMP SENSOR GROUND CIRCUIT FOR A SHORT TO GROUND	
	1 Disconnect the ECM electrical connector, EN16.
	2 Measure the resistance between the CMP sensor electrical connector EN33, pin 2 (N) and GROUND.

	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to D7.
D7: CHECK THE LEFT-HAND BANK CMP SENSOR SIGNAL CIRCUIT FOR A SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the CMP sensor electrical connector EN33, pin 1 (G) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to D8.
D8: CHECK THE LEFT-HAND BANK CMP SENSOR GROUND CIRCUIT FOR A SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the CMP sensor electrical connector EN33, pin 2 (N) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new CMP sensor. REFER to: Camshaft Position (CMP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST E : DTC P0031, P0032. RIGHT-HAND BANK HO2S HEATER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK THE POWER SUPPLY CIRCUIT TO THE RIGHT-HAND BANK HO2S HEATER	
	1 Disconnect HO2S sensor electrical connector, EN37.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between the HO2S electrical connector EN37, pin 2 (WG) and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to E5. **No** GO to E2.
E2: CHECK THE GROUND CIRCUIT TO THE RIGHT-HAND BANK HO2S HEATER FOR OPEN CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between the HO2S electrical connector EN37, pin 1 (RU) and the ECM electrical connector EN16, pin 1 and pin 2 (RU).
	Is the resistance of each wire less than 5 ohms? **Yes** GO to E3. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
E3: CHECK THE RIGHT-HAND BANK HO2S GROUND CIRCUIT FOR SHORT TO GROUND	
	1 Measure the resistance between the bank 1 HO2S electrical connector EN37, pin 1 (RU) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to E4.
E4: CHECK THE RIGHT-HAND BANK HO2S GROUND CIRCUIT FOR SHORT TO BATTERY	
	1 Check for a voltage between the HO2S electrical connector EN37, pin 1 (RU) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new HO2S. REFER to: Heated Oxygen Sensor (HO2S) RH (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.
E5: CHECK FUSE 38 OF THE ENGINE COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to E7. **No** GO to E6.
E6: CHECK FUSE 38 OF THE ENGINE COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB34 pin 97 of the engine compartment fuse box and GROUND.

	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the engine compartment fuse box and the right-hand bank HO2S. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. CLEAR the DTC. TEST the system for normal operation.
E7: CHECK THE POWER SUPPLY TO FUSE 38 IN THE ENGINE COMPARTMENT FUSE BOX	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between electrical connector JB34 pin 131 and GROUND.
	Is the voltage less than 10 volts? **Yes** Repair the circuit between the battery and the EMS relay. Test the relay, renew as necessary. CLEAR the DTC. TEST the system for normal operation. **No** Repair the circuit from the ECM control relay to the engine compartment fuse box. For additional information, refer to the wiring diagrams.GO to P1. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST F : DTC P0181, P0182, P0183. FUEL TEMPERATURE SENSOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK CONTINUITY OF THE FUEL TEMPERATURE SENSOR POWER SUPPLY CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the fuel temperature sensor electrical connector IJ8.
	3 Disconnect the ECM electrical connector EN16.
	4 Measure the resistance between the fuel temperature sensor electrical connector IJ8, pin 2 (WU) and the ECM electrical connector EN16, pin 50 (WU).
	Is the resistance less than 5 ohms? **Yes** GO to F2. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
F2: CHECK THE FUEL TEMPERATURE SENSOR GROUND CIRCUIT	
	1 Measure the resistance between the fuel temperature sensor electrical connector IJ8 pin 1 (NU) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to F3. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
F3: CHECK THE FUEL TEMPERATURE SENSOR CIRCUIT FOR A SHORT TO GROUND	
	1 Measure the resistance between the fuel temperature sensor electrical connector IJ8 pin 2 (WU) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to F4.
F4: CHECK THE FUEL TEMPERATURE SENSOR GROUND CIRCUIT FOR A SHORT TO BATTERY	
	1 Disconnect the FTP sensor electrical connector, FT1.
	2 Turn the ignition switch to the ON position.
	3 Check for a voltage between FT1, pin 3 (BG) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to F5.
F5: CHECK THE FUEL TEMPERATURE SENSOR CIRCUIT FOR A SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between the fuel temperature sensor electrical connector IJ8, pin 2 (WU) and GROUND.
	Is the voltage greater than 10 volts? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new fuel temperature sensor. REFER to: Fuel Temperature Sensor - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST G : DTC P0327, P0328, P0332, P0333, P1648. KNOCK SENSOR (KS)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: CHECK THE KS SIGNAL WIRE FOR OPEN CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the KS sensor electrical connector EN23.
	3 Disconnect the ECM electrical connector EN16.
	4 Measure the resistance between EN23, pin 1 (N) and EN16, pin 98 (N).

	Is the resistance less than 5 ohms? **Yes** GO to G2. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
G2: CHECK THE KS SIGNAL WIRE FOR SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position.
	2 Check for a voltage between EN23, pin 1 (N) and GROUND.
	Is a voltage present? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to G3.
G3: CHECK THE KS SIGNAL WIRE FOR A SHORT TO GROUND	
	1 Measure the resistance between the KS sensor electrical connector EN23, pin 1 (N) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new KS. REFER to: Knock Sensor (KS) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). CLEAR DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.
G4: CHECK THE KS GROUND CIRCUIT FOR OPEN CIRCUIT	
	1 Measure the resistance between the KS electrical connector EN23 pin 2 (W) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the circuit between EN23, pin 2 (W) and GROUND. CLEAR the DTCs. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams) **No** GO to G5.
G5: CHECK THE KS GROUND LEAD FOR OPEN CIRCUIT	
	1 Disconnect the KS electrical connector, EN23.
	2 Disconnect the ECM electrical connector, EN16.
	3 Measure the resistance between EN23, pin2 (W) and EN16, pin 100 (BG).
	Is the resistance less than 5 ohms? **Yes** GO to G6. **No** REPAIR the circuit between EN23, pin2 (W) and EN16, pin 100 (BG). For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
G6: CHECK THE KS GROUND LEAD FOR SHORT TO BATTERY	
	1 Connect the KS sensor electrical connector EN23.
	2 Connect the ECM electrical connector EN16.
	3 Turn the ignition switch to the ON position.
	4 Check for a voltage between EN23, pin 2 (W) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new KS. REFER to: Knock Sensor (KS) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST H : DTC P0196, P0197, P0198. OIL TEMPERATURE SENSOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: CHECK THE OIL TEMPERATURE SENSOR SIGNAL WIRE FOR OPEN CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the oil temperature sensor electrical connector EN25.
	3 Disconnect the ECM electrical connector EN16.
	4 Measure the resistance between the oil temperature sensor electrical connector EN25, pin 1 (Y) and the ECM electrical connector EN16, pin 78 (Y).
	Is the resistance less than 5 ohms? **Yes** GO to H2. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
H2: CHECK THE OIL TEMPERATURE SENSOR GROUND CIRCUIT FOR OPEN CIRCUIT	
	1 Measure the resistance between the oil temperature sensor electrical connector EN25, pin 2 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to H3. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for

	normal operation.
H3: CHECK THE OIL TEMPERATURE SENSOR GROUND CIRCUIT FOR SHORT TO BATTERY	
	1 Connect ECM electrical connector, EN16.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between the oil temperature sensor electrical connector EN25, pin 2 (BG) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to H4.
H4: CHECK THE OIL TEMPERATURE SENSOR CIRCUIT FOR A SHORT TO GROUND	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect ECM electrical connector, EN16.
	3 Measure the resistance between the oil temperature sensor electrical connector EN25, pin 1 (Y) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to H5.
H5: CHECK THE OIL TEMPERATURE SENSOR CIRCUIT FOR A SHORT TO BATTERY	
	1 Connect ECM electrical connector, EN16.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between the oil temperature sensor electrical connector EN25, pin 1 (Y) and GROUND.
	Is the voltage greater than 10 volts? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new oil temperature sensor. REFER to: Oil Temperature Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST I : DTC P0131, P0132, P0133, P1646. RIGHT-HAND BANK HO2S	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: CHECK THE CONSTANT CIRCUIT OF THE RIGHT-HAND BANK HO2S FOR OPEN CIRCUIT	
	1 Disconnect the HO2S electrical connector EN37.
	2 Disconnect the ECM electrical connector, EN16.
	3 Measure the resistance between EN16, pin 84 (P) and EN37, pin 4 (P).
	Is the resistance less than 5 ohms? **Yes** GO to I2. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
I2: CHECK THE CONSTANT CIRCUIT OF THE RIGHT-HAND BANK HO2S FOR SHORT TO GROUND	
	1 Measure the resistance between EN16, pin 84 (P) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to I3.
I3: CHECK THE CONSTANT CIRCUIT OF THE RIGHT-HAND BANK HO2S FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between EN37, pin 4 (P) and GROUND.
	Is the voltage greater than 5 volts? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to I4.
I4: CHECK THE VARIABLE CIRCUIT OF THE RIGHT-HAND BANK HO2S FOR OPEN CIRCUIT	
	1 Disconnect the ECM electrical connector, EN16.
	2 Measure the resistance between EN16, pin 83 (Y) and EN37, pin 3 (Y).
	Is the resistance less than 5 ohms? **Yes** GO to I5. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
I5: CHECK THE VARIABLE CIRCUIT OF THE RIGHT-HAND BANK HO2S FOR SHORT TO GROUND	
	1 Measure the resistance between EN16, pin 83 (Y) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to I6.

I6: CHECK THE VARIABLE CIRCUIT OF THE RIGHT-HAND BANK HO2S FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between EN37, pin 3 (Y) and GROUND.
	Is the voltage greater than 5 volts? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new HO2S. REFER to: Heated Oxygen Sensor (HO2S) RH (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST J : DTC P0037, P0038, P0137, P0138, P0140. RIGHT-HAND BANK CATALYST MONITOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
J1: CHECK THE POWER SUPPLY CIRCUIT TO THE RIGHT-HAND BANK CATALYST MONITOR HEATER	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the catalyst monitor sensor electrical connector EN14.
	3 Turn the ignition switch to the ON position.
	4 Measure the voltage between the catalyst monitor sensor electrical connector EN14, pin 2 (WG) and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to J6. **No** GO to J2.
J2: CHECK CONTINUITY OF THE RIGHT-HAND BANK CATALYST MONITOR SENSOR GROUND CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between the catalyst monitor sensor electrical connector EN14, pin 3 (W) and the ECM electrical connector EN16, pin 130.
	Is the resistance less than 5 ohms? **Yes** GO to J3. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
J3: CHECK CONTINUITY OF THE POWER SUPPLY WIRE TO THE RIGHT-HAND BANK CATALYST MONITOR SENSOR	
	1 Measure the resistance between the RH bank catalyst monitor sensor electrical connector EN14, pin 4 (N) and the ECM electrical connector EN16, pin 128 (N).
	Is the resistance less than 5 ohms? **Yes** GO to J4. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
J4: CHECK THE RIGHT-HAND BANK CATALYST MONITOR SENSOR POWER SUPPLY WIRE FOR A SHORT TO GROUND	
	1 Measure the resistance between the catalyst monitor sensor electrical connector EN14, pin 4 (N) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to ground. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to J5.
J5: CHECK THE RIGHT-HAND BANK CATALYST MONITOR SENSOR POWER SUPPLY WIRE FOR A SHORT TO BATTERY	
	1 Measure the voltage between the catalyst monitor sensor electrical connector EN14, pin 4 (N) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new RH bank catalyst monitor sensor. For additional information, REFER to: Catalyst Monitor Sensor RH (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.
J6: CHECK THE RIGHT-HAND BANK CATALYST MONITOR SENSOR POWER SUPPLY CIRCUIT	
	1 Measure the voltage between the catalyst monitor sensor electrical connector EN14 pin 2 (WG) and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to J8. **No** GO to J7.
J7: CHECK CONTINUITY OF THE RIGHT-HAND BANK CATALYST MONITOR SENSOR HEATER GROUND CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between the catalyst monitor sensor electrical connector EN14, pin 1 (U) and the ECM electrical connector EN16, pin 92 (U).

	Is the resistance less than 5 ohms? **Yes** INSTALL a new ECM. For additional information, REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing a ECM, contact Dealer technical support. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
J8: CHECK FUSE 38 OF THE ENGINE COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to J10. **No** GO to J9.
J9: CHECK FUSE 38 OF THE ENGINE COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB34, pin 97 of the engine compartment fuse box and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the engine compartment fuse box and the right-hand bank HO2S. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. Check the circuit for cause of fuse failure. CLEAR the DTC. TEST the system for normal operation.
J10: CHECK THE POWER SUPPLY TO FUSE 38 IN THE ENGINE COMPARTMENT FUSE BOX	
	1 Measure the voltage between fuse 38 electrical connector JB34 pin 97 and GROUND.
	Is the voltage less than 10 volts? **Yes** Repair the circuit from the ECM control relay to the engine compartment fuse box. CLEAR the DTC. TEST the system for normal operation. **No** Repair the circuit between the engine compartment fuse box and the HO2S. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST K : P0151, P0152, P0153, P1647. LEFT-HAND BANK HO2S	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
K1: CHECK THE CONSTANT CIRCUIT OF THE LEFT-HAND BANK HO2S FOR OPEN CIRCUIT	
	1 Disconnect the HO2S electrical connector EN32.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between EN16, pin 108 (P) and EN32, pin 4 (P)
	Is the resistance less than 5 ohms? **Yes** GO to K2. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
K2: CHECK THE CONSTANT CIRCUIT OF THE LEFT-HAND BANK HO2S FOR SHORT TO GROUND	
	1 Measure the resistance between EN16, pin 108 (P) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to K3.
K3: CHECK THE CONSTANT CIRCUIT OF THE LEFT-HAND BANK HO2S FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between EN32, pin 4 (P) and GROUND.
	Is the voltage greater than 5 volts? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to K4.
K4: CHECK THE VARIABLE CIRCUIT OF THE LEFT-HAND BANK HO2S FOR OPEN CIRCUIT	
	1 Disconnect the HO2S electrical connector EN32.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between EN16, pin 107 (Y) and EN32, pin 3 (Y)
	Is the resistance less than 5 ohms? **Yes** GO to K5. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
K5: CHECK THE VARIABLE CIRCUIT OF THE LEFT-HAND BANK HO2S FOR SHORT TO GROUND	
	1 Measure the resistance between EN16, pin 107 (Y) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to K6.
K6: CHECK THE VARIABLE CIRCUIT OF THE LEFT-HAND BANK HO2S FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.

	3 Measure the voltage between EN32 pin 3 (Y) and GROUND.
	Is the voltage greater than 5 volts? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new left-hand HO2S. REFER to: Heated Oxygen Sensor (HO2S) LH (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST L : DTC P0057, P0058, P0157, P0158, P0160. LEFT-HAND BANK CATALYST MONITOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
L1: CHECK THE POWER SUPPLY CIRCUIT TO THE LEFT-HAND BANK CATALYST MONITOR HEATER	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the catalyst monitor sensor electrical connector EN9.
	3 Turn the ignition switch to the ON position.
	4 Measure the voltage between the catalyst monitor sensor electrical connector EN9 pin 2 (WR) and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to L6. **No** GO to L2.
L2: CHECK CONTINUITY OF THE LEFT-HAND BANK CATALYST MONITOR SENSOR GROUND CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between the catalyst monitor sensor electrical connector EN9 pin 3 (W) and EN16, pin 130.
	Is the resistance less than 5 ohms? **Yes** GO to L3. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
L3: CHECK CONTINUITY OF THE POWER SUPPLY WIRE TO THE LEFT-HAND BANK CATALYST MONITOR SENSOR	
	1 Measure the resistance between the catalyst monitor sensor electrical connector EN9 pin 4 (N) and the ECM electrical connector EN16 pin 129 (N).
	Is the resistance less than 5 ohms? **Yes** GO to L4. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
L4: CHECK THE LEFT-HAND BANK CATALYST MONITOR SENSOR POWER SUPPLY WIRE FOR A SHORT TO GROUND	
	1 Measure the resistance between the catalyst monitor sensor electrical connector EN9 pin 4 (N) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to ground. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to L5.
L5: CHECK THE LEFT-HAND BANK CATALYST MONITOR SENSOR POWER SUPPLY WIRE FOR A SHORT TO BATTERY	
	1 Measure the voltage between the catalyst monitor sensor electrical connector EN9 pin 4 (N) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new left-hand bank catalyst monitor sensor. For additional information, REFER to: Catalyst Monitor Sensor LH (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.
L6: CHECK THE LEFT-HAND BANK CATALYST MONITOR SENSOR POWER SUPPLY CIRCUIT	
	1 Measure the voltage between the catalyst monitor sensor electrical connector EN9 pin 2 (WR) and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to L8. **No** GO to L7.
L7: CHECK CONTINUITY OF THE LEFT-HAND BANK CATALYST MONITOR SENSOR HEATER GROUND CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between the catalyst monitor sensor electrical connector EN9 pin 1 (UY) and the ECM electrical connector EN16 pin 93 (UY).
	Is the resistance less than 5 ohms? **Yes** INSTALL a new ECM. For additional information, REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support. **No**

	REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
L8: CHECK FUSE 42 OF THE ENGINE COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to L10. **No** GO to L9.
L9: CHECK FUSE 42 OF THE ENGINE COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB34 pin 105 of the engine compartment fuse box and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the engine compartment fuse box and the left-hand bank HO2S. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. Check the circuit for cause of fuse failure. CLEAR the DTC. TEST the system for normal operation.
L10: CHECK THE POWER SUPPLY TO FUSE 42 IN THE ENGINE COMPARTMENT FUSE BOX	
	1 Measure the voltage between Fuse 42 electrical connector JB34 pin 105 and GROUND.
	Is the voltage less than 10 volts? **Yes** Repair the circuit from the ECM control relay to the engine compartment fuse box. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Repair the circuit between the engine compartment fuse box and the HO2S. For additional information, refer to wiring diagrams.

PINPOINT TEST M : DTC P0101, P0102, P0103, P1104. MASS AIR FLOW SENSOR (MAF)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
M1: CHECK THE MAF SENSOR POWER SUPPLY	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the MAF sensor electrical connector EN6.
	3 Turn the ignition switch to the ON position.
	4 Measure the voltage between the MAF sensor electrical connector EN6 pin 1 (GU) and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to M5. **No** GO to M2.
M2: CHECK CONTINUITY OF THE MAF SENSOR GROUND CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between the MAF sensor electrical connector EN6 pin 3 (GW) and the ECM electrical connector EN16 pin 44 (GW).
	Is the resistance less than 5 ohms? **Yes** GO to M3. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
M3: CHECK CONTINUITY OF THE MAF SENSOR GROUND CIRCUIT	
	1 Measure the resistance between the MAF sensor electrical connector EN6 pin 2 (BW) and the ECM electrical connector EN16 pin 45 and pin 46 (BW).
	Is the resistance less than 5 ohms? **Yes** GO to M4. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
M4: CHECK THE MAF SENSOR CIRCUIT FOR SHORT TO GROUND	
	1 Measure the resistance between the MAF sensor electrical connector EN6 pin 3 (GW) and GROUND.
	Is the resistance greater than 10,000 ohms? **Yes** INSTALL a new MAF sensor. For additional information, REFER to: Mass Air Flow (MAF) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support. **No** REPAIR the short to ground. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
M5: CHECK FUSE 36 OF THE ENGINE COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to M7. **No** GO to M6.
M6: CHECK FUSE 36 OF THE ENGINE COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB34 pin 93 of the engine compartment fuse box and GROUND.

	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the engine compartment fuse box and the MAF sensor. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. Check the circuit for cause of fuse failure. CLEAR the DTC. TEST the system for normal operation.
M7: CHECK THE POWER SUPPLY FROM FUSE 36 IN THE ENGINE COMPARTMENT FUSE BOX TO THE MAF SENSOR	
	1 Measure the voltage between the engine compartment fuse box electrical connector JB34 pin 93 and GROUND.
	Is the voltage less than 10 volts? **Yes** Repair the circuit from the engine compartment fuse box to the MAF sensor. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Recheck DTCs.

PINPOINT TEST N : P0111, P0112, P0113. IAT SENSOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
N1: CHECK CONTINUITY OF THE INTAKE AIR TEMPERATURE (IAT) SENSOR POWER SUPPLY CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the MAF sensor electrical connector EN6.
	3 Disconnect the ECM electrical connector EN16.
	4 Measure the resistance between the MAF sensor electrical connector EN6 pin 4 (O) and the ECM electrical connector EN16, pin 71 (O).
	Is the resistance less than 5 ohms? **Yes** GO to N2. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
N2: CHECK CONTINUITY OF THE IAT SENSOR CIRCUIT	
	1 Measure the resistance between the MAF sensor electrical connector EN6 pin 5 (BG) and the ECM electrical connector EN16, pin 19 (BG).
	Is the resistance less than 5 ohms? **Yes** GO to N4. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
N3: CHECK THE IAT SENSOR CIRCUIT FOR SHORT TO BATTERY	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the MAF sensor electrical connector EN6.
	3 Check for a voltage between EN6 pin 5 (BG) and GROUND.
	Is the voltage greater than 1 volt? **Yes** GO to N1. **No** INSTALL a new MAF sensor. REFER to: Mass Air Flow (MAF) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.
N4: CHECK THE IAT SENSOR POWER SUPPLY CIRCUIT FOR SHORT TO GROUND	
	1 Measure the resistance between the MAF sensor electrical connector EN6 pin 4 (O) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to N5.
N5: CHECK THE IAT SENSOR GROUND CIRCUIT FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector, EN16.
	2 Turn the ignition switch to the ON position.
	3 Check for voltage at EN6 pin 5 (BG)
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new MAF sensor. REFER to: Mass Air Flow (MAF) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST O : DTC P0051, P0052. LEFT-HAND BANK H02S HEATER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
O1: CHECK THE POWER SUPPLY CIRCUIT TO THE LEFT-HAND BANK HO2S HEATER	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the HO2S electrical connector EN32 pin 2 (WR) and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to O4. **No**

	GO to O2.
O2: CHECK THE GROUND CIRCUIT TO THE LEFT-HAND BANK HO2S HEATER	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between the HO2S electrical connector EN32 pin 1 (GO) and the ECM electrical connector EN16 pins 55 and 56 (GO).
	Is the resistance of each wire less than 5 ohms? **Yes** GO to O3. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
O3: CHECK THE LEFT-HAND BANK HO2S CIRCUIT FOR SHORT TO GROUND	
	1 Measure the resistance between the HO2S electrical connector EN32 pin 1 (GO) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to ground. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new left-hand bank HO2S. For additional information, REFER to: Heated Oxygen Sensor (HO2S) LH (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.
O4: CHECK FUSE 42 OF THE ENGINE COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to O6. **No** GO to O5.
O5: CHECK FUSE 42 OF THE ENGINE COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB34 pin 105 of the engine compartment fuse box and GROUND
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the engine compartment fuse box and the left-hand bank HO2S. For additional information, refer to wiring digrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. Check the circuit for cause of fuse failure. CLEAR the DTC. TEST the system for normal operation.
O6: CHECK THE POWER SUPPLY TO FUSE 42 IN THE ENGINE COMPARTMENT FUSE BOX	
	1 Measure the voltage between fuse 42, electrical connector JB34 pin 105 and GROUND.
	Is the voltage less than 10 volts? **Yes** Repair the circuit from the ECM control relay to the engine compartment fuse box. For additional information, refer to wiring digrams. CLEAR the DTC. TEST the system for normal operation. **No** Repair the circuit between the engine compartment fuse box and the HO2S. For additional information, refer to wiring digrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST P : DTC P1606. ECM RELAY.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
P1: CHECK THE ECM CONTROL RELAY	
	1 Turn the ignition switch to the ON position.
	Does the ECM relay make an audible click? **Yes** GO to P2. **No** GO to P6.
P2: CHECK FOR POWER SUPPLY FROM THE ECM CONTROL RELAY	
	1 Measure the voltage between the ECM control relay JB34 pin 131 and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to P3. **No** REPAIR the circuit from the ECM control relay to the ECM. For additional information, refer to wiring digrams. CLEAR the DTC. TEST the system for normal operation.
P3: CHECK FUSE 9 IN THE ENGINE COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to P4. **No** INSTALL a new fuse. Check the circuit for cause of fuse failure. CLEAR the DTC. TEST the system for normal operation.
P4: CHECK THE POWER SUPPLY TO FUSE 9 IN THE ENGINE COMPARTMENT FUSE BOX	
	1 Measure the voltage between Fuse 9 electrical connector JB34 pin 75 and GROUND.
	Is the voltage less than 10 volts? **Yes** Repair the circuit from the battery positive to the engine compartment fuse box. CLEAR the DTC. TEST the system for normal operation. **No** GO to P5.
P5: CHECK THE POWER SUPPLY FROM FUSE 9 IN THE ENGINE COMPARTMENT FUSE BOX TO THE ECM CONTROL RELAY	

	1 Measure the voltage between the ECM control relay electrical connector JB34 pin 132 and GROUND.
	Is the voltage less than 10 volts? **Yes** Repair the circuit from the engine compartment fuse box to the ECM control relay. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new ECM control relay. For additional information, refer to the electrical guide. CLEAR the DTC. TEST the system for normal operation.
P6: CHECK FUSE 31 OF THE ENGINE COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to P7. **No** GO to P10.
P7: CHECK POWER SUPPLY TO THE ECM CONTROL RELAY FROM FUSE 31 OF THE ENGINE COMPARTMENT FUSE BOX	
	1 Measure the voltage between ECM relay electrical connector JB34 pin 133 and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to P8. **No** GO to P12.
P8: CHECK CONTINUITY OF THE ECM CONTROL RELAY GROUND CIRCUIT	
	1 Disconnect the ECM electrical connector EN16.
	2 Remove the ECM control relay from the engine compartment fuse box.
	3 Measure the resistance between the ECM electrical connector EN16 pin 40 and JB34 pin 134 of the engine compartment fuse box.
	Is the resistance less than 5 ohms? **Yes** GO to P9. **No** REPAIR the circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the power distribution fuse box and the EMS relay and diode)
P9: CHECK CONTINUITY OF THE ECM CONTROL RELAY WINDING	
	1 Measure the resistance of the ECM control relay winding between pins 1 and 2 of the ECM control relay.
	Is the resistance less than 60 ohms? **Yes** INSTALL a new ECM control relay. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support. CLEAR the DTC. TEST the system for normal operation.
P10: CHECK FUSE 31 OF THE ENGINE COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB34 pin 83 of the engine compartment fuse box and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to GROUND between the engine compartment fuse box and the ECM control relay. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. CLEAR the DTC. TEST the system for normal operation.
P11: CHECK FUSE 9 OF THE ENGINE COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB34 pin 132 of the engine compartment fuse box and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the engine compartment fuse box and the ECM control relay. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. CLEAR the DTC. TEST the system for normal operation.
P12: CHECK THE ECM CONTROL RELAY DIODE	
	1 Remove the ECM control relay diode from the engine compartment fuse box.
	2 Measure the continuity of ECM control relay diode.
	Is the resistance less than 5 ohms? **Yes** Possible intermittent fault. Recheck DTCs. **No** INSTALL a new ECM control relay diode. Make sure that the ECM control relay diode is installed correctly. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST Q : P0105, P0106, P0107, P0108, P1107, P1108. MAP SENSOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Q1: CHECK THE GROUND CIRCUIT TO THE MAP SENSOR	
	1 Disconnect the MAP sensor electrical conector EN8.
	2 Measure the resistance between the MAP sensor electrical conector EN8 pin 4 (BG) and GROUND. • Reconnect electrical connectors following test.
	Is the resistance less than 5 ohms? **Yes** GO to Q2. **No** REPAIR the circuit between the MAP sensor and GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
Q2: CHECK THE POWER SUPPLY CIRCUIT TO THE MAP SENSOR FOR SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position.

	2 Measure the voltage between the MAP sensor electrical connector EN8 pin 2 (OY) and GROUND.
	Is the voltage greater than 6 volts? **Yes** REPAIR the short to battery. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to Q3.
Q3: CHECK THE POWER SUPPLY CIRCUIT TO THE MAP SENSOR FOR SHORT TO GROUND	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the MAP sensor electrical connector EN8 pin 2 (OY) and GROUND.
	Is the voltage less than 4 volts? **Yes** REPAIR the short to GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to Q4.
Q4: CHECK CONTINUITY OF THE MAP SENSOR SIGNAL WIRE	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the MAP sensor electrical connector EN8.
	3 Disconnect the ECM electrical connector EN16.
	4 Measure the resistance of the circuit between MAP sensor electrical connector EN8 pin 1 (BW) and ECM electrical connector EN16 pin 127 (BW).
	Is the resistance less than 5 ohms? **Yes** GO to Q5. **No** REPAIR the circuit between the MAP sensor electrical connector EN8 pin 1 (BW) and ECM electrical connector EN16 pin 127 (BW). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
Q5: CHECK THE MAP SENSOR SIGNAL WIRE FOR SHORT TO GROUND	
	1 Disconnect the ECM electrical connector EN16.
	2 Disconnect the MAP sensor electrical connector EN8.
	3 Measure the resistance between EN8 pin 1 (BW) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (The fault could be in any of the components or sensors in the 5 volt supply circuit, or the ECM) **No** GO to Q6.
Q6: CHECK THE MAP SENSOR SIGNAL WIRE FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Check for a voltage at EN8 pin 1 (BW)
	Is the voltage greater than 10 volts? **Yes** Repair the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (The fault could be in any of the components or sensors in the 5 volt supply circuit, or the ECM) **No** INSTALL a new MAP sensor. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST R : P0010, P1384. VVT RIGHT-HAND BANK	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
R1: CHECK THE GROUND CIRCUIT TO THE RIGHT-HAND BANK VVT SOLENOID	
	1 Disconnect the VVT solenoid electrical connector EN61.
	2 Measure the resistance between the VVT solenoid electrical connector EN61 pin 2 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to R2. **No** REPAIR the circuit between VVT solenoid electrical connector EN61 pin 2 (BG) and GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
R2: CHECK CONTINUITY OF THE RIGHT-HAND BANK VVT SOLENOID SIGNAL WIRE	
	1 Measure the resistance between VVT solenoid electrical connector EN61 pin 1 (RW) and ECM electrical connector EN16 pin 109 (RW).
	Is the resistance less than 5 ohms? **Yes** GO to R3. **No** REPAIR the circuit between VVT solenoid electrical connector EN61 pin 1 (RW) and ECM electrical connector EN16 pin 109 (RW). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
R3: CHECK FOR SHORT TO GROUND AT THE RIGHT-HAND BANK VVT SOLENOID SIGNAL WIRE	
	1 Disconnect the ECM electrical connector EN16.
	2 Measure the resistance between EN61 pin 1 (RW) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to R4.
R4: CHECK FOR SHORT TO BATTERY AT THE RIGHT-HAND BANK VVT SOLENOID SIGNAL WIRE	
	1 TURN the ignition switch to the ON position.
	2 Check for a voltage at EN61 pin 1 (RW).

	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new right-hand bank VVT solenoid. REFER to: Variable Camshaft Timing (VCT) Oil Control Solenoid (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST S : P0020, P1396. VVT LEFT-HAND BANK	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
S1: CHECK GROUND CIRCUIT TO THE LEFT-HAND BANK VVT SOLENOID	
	1 Disconnect the VVT solenoid electrical connector, EN42.
	2 Measure the resistance between the VVT solenoid electrical connector EN42 pin 2 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to S2. **No** REPAIR the circuit between VVT solenoid electrical connector EN42 pin 2 (BG) and GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
S2: CHECK CONTINUITY OF THE LEFT-HAND BANK VVT SOLENOID SIGNAL WIRE.	
	1 Measure the resistance between VVT solenoid electrical connector EN42 pin 1 (G) and ECM electrical connector EN16 pin 110 (G).
	Is the resistance less than 5 ohms? **Yes** GO to S3. **No** REPAIR the circuit between VVT solenoid electrical connector EN42 pin 1 (G) and ECM electrical connector EN16 pin 110 (G). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
S3: CHECK FOR SHORT TO GROUND AT THE LEFT-HAND BANK VVT SOLENOID SIGNAL WIRE	
	1 Disconnect the ECM electrical connector EN16.
	2 Measure the resistance between EN61 pin 1 (RW) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to S4.
S4: CHECK FOR SHORT TO BATTERY AT THE LEFT-HAND BANK VVT SOLENOID SIGNAL WIRE	
	1 TURN the ignition switch to the ON position.
	2 Check for a voltage at EN61 pin 1 (RW).
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new left-hand bank VVT solenoid. REFER to: Variable Camshaft Timing (VCT) Oil Control Solenoid (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST T : P1251, P1631, P1657, P1658. THROTTLE MOTOR RELAY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
T1: CHECK THE POWER SUPPLY CIRCUIT TO THE THROTTLE MOTOR RELAY	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between pin 1 of the throttle motor relay base and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to T2. **No** REPAIR the circuit between pin 1 of the throttle motor relay base and the EMS control relay. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
T2: CHECK CONTINUITY OF THE THROTTLE MOTOR RELAY SIGNAL WIRE	
	1 Turn the ignition switch to the OFF position.
	2 Measure the resistance between the throttle motor relay base, pin 2 and the ECM electrical connector EN16 pin 52 (GR).
	Is the resistance less than 5 ohms? **Yes** GO to T3. **No** REPAIR the circuit between the throttle motor relay base pin 2 and the ECM electrical connector EN16 pin 52 (GR). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
T3: CHECK THE THROTTLE MOTOR RELAY SIGNAL WIRE FOR SHORT TO BATTERY	
	1 Turn the ignition switch to the OFF position.
	2 Remove the throttle motor relay.
	3 Disconnect the ECM electrical connector EN16.
	4 Check for a voltage between the throttle motor relay base pin 2 and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to wiring digrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to T4.

T4: CHECK THE THROTTLE MOTOR RELAY SIGNAL WIRE FOR SHORT TO GROUND	
	1 Measure the resistance between the throttle motor relay base pin 2 and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to wiring digrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to T5.
T5: CHECK CONTINUITY OF THE THROTTLE MOTOR RELAY OUTPUT WIRE	
	1 Test for continuity between throttle motor relay base pin 5 and ECM electrical connector EN16 pin 134 (RW).
	Is the circuit continuous? **Yes** INSTALL a new throttle motor relay. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing a ECM, contact Dealer technical support **No** REPAIR the circuit between throttle motor relay base pin 2 and ECM electrical connector EN16 pin 134 (RW). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
T6: CHECK THE THROTTLE MOTOR RELAY OUTPUT WIRE FOR SHORT TO BATTERY	
	1 Check for a voltage between the throttle motor relay base pin 5 and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to wiring digrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to T7.
T7: CHECK THE THROTTLE MOTOR RELAY OUTPUT WIRE FOR SHORT TO GROUND	
	1 Measure the resistance between the throttle motor relay base pin 5 and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to wiring digrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new throttle motor relay. For additional information, refer to the electrical guide. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST U : P1549. IMT VALVE 1	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
U1: CHECK THE POWER SUPPLY CIRCUIT TO THE IMT VALVE 1	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between IMT valve 1 electrical connector EN999 pin 1 (NG) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to U2. **No** REPAIR the circuit between the IMT valve 1 electrical connector EN999 pin 1 (NG) and the Battery power bus 2. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the power distribution fuse box and the EMS control relay. For additional information, refer to wiring diagrams)
U2: CHECK CONTINUITY OF THE IMT VALVE 1 SIGNAL WIRE.	
	1 Disconnect the ECM electrical connector EN16.
	2 Measure the resistance between the IMT valve 1 electrical connector EN999 pin 2 (OY) and the ECM electrical connector EN16 pin 38 (OY).
	Is the resistance less than 5 ohms? **Yes** GO to U3. **No** REPAIR the circuit between the IMT valve 1 electrical connector EN999 pin 2 (OY) and the ECM electrical connector EN16 pin 38 (OY). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
U3: CHECK IMT VALVE SIGNAL WIRE FOR SHORT TO GROUND	
	1 Measure the resistance between EN999 pin 2 (OY) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to wiring digrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to U4.
U4: CHECK IMT VALVE SIGNAL WIRE FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Check for a voltage at EN999 pin 2 (OY).
	Is the voltage greater than 10 volts? **Yes** REPAIR the short to battery. For additional information, refer to wiring digrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new IMT valve. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST V : P1532. IMT VALVE 2

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
V1: CHECK THE POWER SUPPLY CIRCUIT TO THE IMT VALVE 2	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between IMT valve 2 electrical connector EN998 pin 1 (NG) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to V2. **No** REPAIR the circuit between the IMT valve 2 electrical connector EN998 pin 1 (NG) and the Battery power bus 2. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the power distribution fuse box and the EMS control relay. For additional information, refer to wiring diagrams)
V2: CHECK CONTINUITY OF THE IMT VALVE 2 SIGNAL WIRE	
	1 Disconnect the ECM electrical connector EN16.
	2 Measure the resistance between the IMT valve 2 electrical connector EN998 pin 2 (OY) and the ECM electrical connector EN16 pin 39 (OY).
	Is the resistance less than 5 ohms? **Yes** GO to V3. **No** REPAIR the circuit between the IMT valve 2 electrical connector EN998 pin 2 (OY)and the ECM electrical connector EN16 pin 39 (OY). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
V3: CHECK IMT VALVE SIGNAL WIRE FOR SHORT TO GROUND	
	1 Measure the resistance between EN998 pin 2 (OY) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to wiring digrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to V4.
V4: CHECK IMT VALVE SIGNAL WIRE FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Check for a voltage at EN998 pin 2 (OY).
	Is the voltage greater than 10 volts? **Yes** REPAIR the short to battery. For additional information, refer to wiring digrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new IMT valve. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support

PINPOINT TEST W : P1582. FLIGHT RECORDER DATA STORED

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
W1: EXTRACT THE FLIGHT RECORDER DATA	
	• NOTE: Flight recorder data can only be extracted using the Jaguar approved diagnostic system, where available. 1 Connect the Jaguar approved diagnostic system, or code reader.
	Is DTC P1582 stored? **Yes** Refer to dealer technical support for information on extracting data. **No** Test not applicable.

PINPOINT TEST X : P1240, P1241, P1242. SENSOR POWER SUPPLY

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
X1: CHECK THE POWER SUPPLY CIRCUIT TO THE IP SENSOR	
	1 Disconnect the IP sensor electrical connector, IJ7.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between IP sensor electrical connector IJ7 pin 1 (YG) and GROUND.
	Is the voltage greater than 4 volts? **Yes** GO to X2. **No** REPAIR the circuit between the IP sensor electrical connector IJ7 pin 1 (YG) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The fault could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams)
X2: CHECK THE POWER SUPPLY CIRCUIT TO THE IP SENSOR FOR SHORT TO BATTERY	
	1 Measure the voltage between IP sensor electrical connector IJ7 pin 1 (YG) and GROUND.
	Is the voltage greater than 6 volts? **Yes** REPAIR the circuit between the IP sensor electrical connector IJ7 pin 1 (YG) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The short could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams) **No** GO to X3.
X3: CHECK THE POWER SUPPLY CIRCUIT TO THE MAP SENSOR	
	1 Disconnect the MAP sensor electrical connector EN8.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between MAP sensor electrical connector EN8 pin 2 (OY) and GROUND.

	Is the voltage greater than 4 volts? **Yes** GO to X4. **No** REPAIR the circuit between the MAP sensor electrical connector EN8 pin 2 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The fault could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams)
X4: CHECK THE POWER SUPPLY CIRCUIT TO THE MAP SENSOR FOR SHORT TO BATTERY	
	1 Measure the voltage between MAP sensor electrical connector EN8 pin 2 (OY) and GROUND.
	Is the voltage greater than 6 volts? **Yes** REPAIR the circuit between the MAP sensor electrical connector EN8 pin 2 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The short could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams) **No** GO to X5.
X5: CHECK THE POWER SUPPLY CIRCUIT TO THE FTP SENSOR	
• NOTE: Access to the FTP sensor involves the removal of the fuel tank. To reduce the amount of work necessary, a slave harness could be used. This can be connected at the access port beneath the rear seat. Tests can then be carried out via the slave harness and sensor. If system operation is normal with the slave harness and sensor, the fault lies in the vehicle's harness or sensor.	
	1 Disconnect the FTP sensor electrical connector FT1. (See note above). 2 Turn the ignition switch to the ON position. 3 Measure the voltage between FTP sensor electrical connector FT1 pin 1 (OY) and GROUND.
	Is the voltage greater than 4 volts? **Yes** GO to X6. **No** REPAIR the circuit between the FTP sensor electrical connector FT1 pin 1 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The fault could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams)
X6: CHECK THE POWER SUPPLY CIRCUIT TO THE FTP SENSOR FOR SHORT TO BATTERY	
	1 Measure the voltage between FTP sensor electrical connector FT1 pin 1 (OY) and GROUND.
	Is the voltage greater than 6 volts? **Yes** REPAIR the circuit between the FTP sensor electrical connector FT1 pin 1 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The short could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams) **No** GO to X7.
X7: CHECK THE POWER SUPPLY CIRCUIT TO THE APP SENSOR	
	1 Disconnect the APP sensor electrical connector. 2 Turn the ignition switch to the ON position. 3 Measure the voltage between APP sensor electrical connector PA1 pin 5 (OY) and GROUND.
	Is the voltage greater than 4 volts? **Yes** GO to X8. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 5 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The fault could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams)
X8: CHECK THE POWER SUPPLY CIRCUIT TO THE APP SENSOR FOR SHORT TO BATTERY	
	1 Measure the voltage between APP sensor electrical connector PA1 pin 5 (OY) and GROUND.
	Is the voltage greater than 6 volts? **Yes** REPAIR the circuit between the APP sensor electrical connector PA1 pin 5 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The short could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams) **No** GO to X9.
X9: CHECK THE POWER SUPPLY CIRCUIT TO THE TP SENSOR	
	1 Turn the ignition switch to the ON position. 2 Measure the voltage between TP sensor electrical connector EN13 pin 2 (OY) and GROUND.
	Is the voltage greater than 4 volts? **Yes** GO to X10. **No** REPAIR the circuit between the TP sensor electrical connector EN13 pin 2 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The fault could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams)
X10: CHECK THE POWER SUPPLY CIRCUIT TO THE TP SENSOR FOR SHORT TO BATTERY	
	1 Measure the voltage between TP sensor electrical connector EN13 pin 2 (OY) and GROUND.
	Is the voltage greater than 6 volts? **Yes** REPAIR the circuit between the TP sensor electrical connector EN13 pin 2 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The short could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams) **No** GO to X11.
X11: CHECK THE POWER SUPPLY CIRCUIT TO THE AIR CONDITIONING PRESSURE (ACP) SENSOR	
	1 Turn the ignition switch to the ON position. 2 Measure the voltage between ACP sensor electrical connector JB106 pin 2 (OY) and GROUND.

	Is the voltage greater than 4 volts? **Yes** GO to X12. **No** REPAIR the circuit between the ACP sensor electrical connector JB106 pin 2 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The fault could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams)
X12: CHECK THE POWER SUPPLY CIRCUIT TO THE AIR CONDITIONING PRESSURE SENSOR FOR SHORT TO BATTERY	
	1 Measure the voltage between ACP sensor electrical connector JB106 pin 2 (OY) and GROUND.
	Is the voltage greater than 6 volts? **Yes** REPAIR the circuit between the ACP sensor electrical connector JB106 pin 2 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The short could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams.) **No** No electrical fault in power supply circuit. Recheck DTCs using the Jaguar approved diagnostic system, or code reader. (This fault could also be a PSV failure within the ECM.)

PINPOINT TEST Y : P1243. SENSOR GROUND CIRCUITS.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Y1: CHECK THE GROUND CIRCUIT TO THE ECT SENSOR	
	1 Measure the resistance between ECT sensor electrical connector EN18 pin 1 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to Y2. **No** REPAIR the circuit between the ECT sensor electrical connector EN18 pin 1 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams)
Y2: CHECK THE GROUND CIRCUIT TO THE EOT SENSOR	
	1 Measure the resistance between EOT sensor electrical connector EN25 pin 2 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to Y3. **No** REPAIR the circuit between the EOT sensor electrical connector EN25 pin 2 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams)
Y3: CHECK THE GROUND CIRCUIT TO THE IP SENSOR	
	1 Measure the resistance between IP sensor electrical connector IJ7 pin 2 (WG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to Y4. **No** REPAIR the circuit between the IP sensor electrical connector IJ7 pin 2 (WG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams)
Y4: CHECK THE GROUND CIRCUIT TO THE EFT SENSOR	
	1 Measure the resistance between EFT sensor electrical connector IJ8 pin 1 (NU) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to Y5. **No** REPAIR the circuit between the EFT sensor electrical connector IJ8 pin 1 (NU) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams)
Y5: CHECK THE GROUND CIRCUIT TO THE MAP SENSOR	
	1 Measure the resistance between MAP sensor electrical connector EN8 pin 4 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to Y6. **No** REPAIR the circuit between the MAP sensor electrical connector EN8 pin 4 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams)
Y6: CHECK THE GROUND CIRCUIT TO THE FTP SENSOR	
• NOTE: Access to the FTP sensor involves the removal of the fuel tank. To reduce the amount of work necessary, a slave harness could be used. This can be connected at the access port beneath the rear seat. Tests can then be carried out via the slave harness and sensor. If system operation is normal with the slave harness and sensor, the fault lies in the vehicle's harness or sensor.	
	1 Measure the resistance between FTP sensor electrical connector FT1 pin 3 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to Y7. **No** REPAIR the circuit between the FTP Sensor electrical connector FT1 pin 3 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams)
Y7: CHECK THE GROUND CIRCUIT TO THE APP SENSOR (TRACK 1)	
	1 Measure the resistance between APP sensor electrical connector PA1 pin 3 (BG) and GROUND.

	Is the resistance less than 5 ohms? **Yes** GO to Y8. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 3 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams)
Y8: CHECK THE GROUND CIRCUIT TO THE TP SENSOR	
	1 Measure the resistance between TP sensor electrical connector EN13 pin 1 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to Y9. **No** REPAIR the circuit between the TP sensor electrical connector EN13 pin 1 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams)
Y9: CHECK THE GROUND CIRCUIT TO THE APP SENSOR (TRACK 3)	
	1 Measure the resistance between APP sensor electrical connector PA1 pin 6 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to Y10. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 6 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams)
Y10: CHECK THE GROUND CIRCUIT TO THE AIR CONDITIONING PRESSURE SENSOR	
	1 Measure the resistance between ACP sensor electrical connector JB106 pin 1 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** No electrical fault in ground circuit. Recheck DTCs. **No** REPAIR the circuit between the ACP sensor electrical connector JB106 pin 1 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams)

PINPOINT TEST Z : P1122, P1123, P1344. APP SENSOR (TRACK 1)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Z1: CHECK THE POWER SUPPLY CIRCUIT TO THE APP SENSOR. TRACK 1	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between APP sensor electrical connector PA1 pin 2 (Y) and GROUND.
	Is the voltage greater than 4volts? **Yes** GO to Z2. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 2 (Y) and the sensor 5 volt supply 2. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM, EMS control relay, and power distribution fuse box. For additional information, refer to wiring diagrams)
Z2: CHECK THE GROUND CIRCUIT TO THE APP SENSOR	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect APP Sensor electrical connector PA1.
	3 Measure the resistance between APP sensor electrical connector PA1 pin 6 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to Z5. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 6 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams)
Z3: CHECK THE GROUND CIRCUIT TO THE APP SENSOR. FOR CONTINUITY	
	1 Disconnect the ECM electrical connector EN16.
	2 Disconnect the APP sensor electrical connector PA1.
	3 Measure the resistance between EN16 pin 20 (BG) and PA1 pin 6 (BG).
	Is the resistance less than 5 ohms? **Yes** GO to Z4. **No** REPAIR the circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
Z4: CHECK THE GROUND CIRCUIT TO THE APP SENSOR. FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Check for a voltage at PA1 pin 6 (BG).
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to Z5.
Z5: CHECK CONTINUITY OF THE APP SENSOR SIGNAL WIRE	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the APP sensor electrical connector PA1.
	3 Measure the resistance between APP sensor electrical connector PA1 pin 4 (R) and the ECM electrical connector EN16 pin 102 (R).

	Is the resistance less than 5 ohms? **Yes** GO to Z6. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 4 (R) and the ECM electrical connector EN16 pin 102 (R). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
Z6: CHECK CONTINUITY OF THE APP SENSOR POTENTIOMETER	
	1 Measure the resistance between APP sensor electrical connector PA1 pins 4 and 6.
	2 Operate the accelerator pedal through it's full range while observing the resistance reading.
	Does the resistance vary as the pedal is operated? **Yes** INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support. **No** INSTALL a new accelerator pedal position sensor, REFER to: Accelerator Pedal (310-02 Acceleration Control, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST AA : P1215, P1216, P1344. APP SENSOR (TRACK 3)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AA1: CHECK THE POWER SUPPLY CIRCUIT TO THE APP SENSOR. TRACK 3	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between APP sensor electrical connector PA1 pin 1(Y) and GROUND.
	Is the voltage greater than 4 volts? **Yes** GO to AA2. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 1 (Y) and the sensor 5 volt supply. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM, EMS control relay, and power distribution fuse box. For additional information, refer to wiring diagrams. This supply is also linked to other sensors. The fault could be in any of these or their wiring.)
AA2: CHECK THE GROUND CIRCUIT TO THE APP SENSOR	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the APP sensor electrical connector PA1.
	3 Measure the resistance between APP sensor electrical connector PA1 pin 3 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to AA5. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 3 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams.)
AA3: CHECK THE GROUND CIRCUIT TO THE APP SENSOR FOR CONTINUITY	
	1 Disconnect the ECM electrical connector EN16.
	2 Disconnect the APP sensor electrical connector PA1.
	3 Measure the resistance between EN16 pin 19 (BG) and PA1 pin 3 (BG).
	Is the resistance less than 5 ohms? **Yes** GO to AA4. **No** REPAIR the circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
AA4: CHECK THE GROUND CIRCUIT TO THE APP SENSOR FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Check for a voltage at PA1 pin 3 (BG).
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AA5.
AA5: CHECK CONTINUITY OF THE APP SENSOR SIGNAL WIRE	
	1 Measure the resistance between APP sensor electrical connector PA1 pin 1 (Y) and the ECM electrical connector EN16 pin 103 (Y).
	Is the resistance less than 5 ohms? **Yes** GO to AA6. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 1 (Y) and the ECM electrical connector EN16 pin 103 (Y). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
AA6: CHECK CONTINUITY OF THE APP SENSOR POTENTIOMETER	
	1 Measure the resistance between APP sensor electrical connector PA1 pins 1and 3.
	2 Operate the accelerator pedal through it's full range while observing the resistance reading.
	Does the resistance vary as the pedal is operated? **Yes** INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing a ECM, contact Dealer technical support. **No** INSTALL a new accelerator pedal position sensor,

	REFER to: Accelerator Pedal (310-02 Acceleration Control, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST AB : P0480. RADIATOR COOLING FAN MODULE DRIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AB1: CHECK THE PULSE WIDTH MODULATED SIGNAL TO THE COOLING FAN MODULE	
	1 Disconnect the radiator cooling fan module electrical connector PWM1.
	2 RUN the engine to a temperature at which the cooling fans would operate.
	3 Using a suitable meter, test for a pulse width modulated signal at PWM1 pin 3 (WU).
	Is a PWM signal present? **Yes** INSTALL a new cooling fan module. CLEAR the DTC. TEST the system for normal operation. **No** GO to AB2.
AB2: CHECK CONTINUITY OF THE RADIATOR COOLING FAN MODULE SIGNAL WIRE	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between the radiator cooling fan module electrical connector PWM1 pin 3 (WU) and the ECM electrical connector EN16 pin 51 (WU).
	Is the resistance less than 5 ohms? **Yes** INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support. **No** REPAIR the circuit between the radiator cooling fan module electrical connector PWM1 pin 3 (WU) and the ECM electrical connector EN16 pin 51 (WU). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST AC : P0646, P0647. AIR CONDITIONING CLUTCH RELAY DRIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AC1: CHECK THE GROUND SUPPLY TO THE AIR CONDITIONING CLUTCH	
	WARNING: This test involves working in proximity to rotating parts. Make sure due care is exercised.
	1 Turn the ignition switch to the ON position.
	2 Disconnect the ECM electrical connector EN16.
	3 Disconnect the air conditioning clutch electrical connector EN30.
	4 Measure the resistance between EN30 pin 2 (B) and GROUND.
	Is the resistance less than 5 ohms? **Yes** REPAIR the circuit between EN30 pin 2 (B) and GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AC2.
AC2: CHECK THE CIRCUIT INTEGRITY BETWEEN THE ECM AND THE AIR CONDITIONING CLUTCH	
	1 Apply a GROUND to the disconnected ECM electrical connector EN16 pin 34 (BG).
	2 Measure the voltage at air conditioning clutch electrical connector EN30 pin 1 (RG).
	Is the voltage greater than 10 volts? **Yes** GO to AC3. **No** GO to AC4.
AC3: CHECK THE AIR CONDITIONING CLUTCH RELAY TO ECM CIRCUIT FOR SHORT TO GROUND	
	1 Measure the resistance between EN16 pin 34 (BG) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** GO to AC4. **No** INSTALL a new air conditioning compressor clutch relay. For additional information, refer to the electrical guide. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.
AC4: CHECK THE CIRCUIT BETWEEN THE AIR CONDITIONING COMPRESSOR CLUTCH AND THE RELAY FOR SHORT TO BATTERY	
	1 Measure the voltage between EN30 pin 1 (RG) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AC5.
AC5: CHECK THE CIRCUIT BETWEEN THE AIR CONDITIONING COMPRESSOR CLUTCH AND THE ACCC RELAY FOR SHORT TO GROUND	
	1 Measure the resistance between EN30 pin 1 (RG) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AC6.
AC6: CHECK THE CIRCUIT BETWEEN FUSE 23 OF THE POWER DISTRIBUTION FUSE BOX AND THE ACCC RELAY FOR SHORT TO GROUND	
	1 Remove Fuse 23.

	2 Measure the resistance between fuse box electrical connector JB34 pin 79 and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AC7.
AC7: CHECK THE ACCC RELAY BASE FOR BATTERY VOLTAGE AT PIN 3	
	1 Refit Fuse 23.
	2 Measure the voltage between the ACCC relay base pin 3 and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to AC8. **No** Check/replace fuses. REPAIR the circuit between the relay base and the battery power bus 1. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
AC8: CHECK THE CIRCUIT BETWEEN PIN 1 OF THE ACCC RELAY BASE AND THE POWER DISTRIBUTION FUSE BOX FOR SHORT TO GROUND	
	1 Remove Fuse 36.
	2 Measure the resistance between the ACCC relay base pin 1 and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AC9.
AC9: CHECK THE ACCC RELAY BASE FOR BATTERY VOLTAGE AT PIN 1	
	1 Refit Fuse 36.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between ACCC relay base pin 1 and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to AC10. **No** Check/replace fuses. REPAIR the circuit between the relay base and the battery power bus 2. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the EMS relay, and Fuses 9 and 31)
AC10: CHECK THE CIRCUIT BETWEEN THE ECM AND THE ACCC RELAY BASE FOR CONTINUITY	
	1 Remove the ACCC relay.
	2 Measure the resistance between the ECM electrical connector EN16 pin 34 (BG) and ACCC relay base pin 2.
	Is the resistance less than 5 ohms? **Yes** GO to AC11. **No** REPAIR the circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
AC11: CHECK THE CIRCUIT BETWEEN THE ECM AND THE ACCC RELAY BASE FOR SHORT TO BATTERY	
	1 Check for a voltage between the ECM electrical connector EN16 pin 34 (BG) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AC12.
AC12: CHECK THE CIRCUIT BETWEEN THE ECM AND THE ACCC RELAY BASE FOR SHORT TO GROUND	
	1 Measure the resistance between the ECM electrical connector EN16 pin 34 (BG) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new ACCC relay. For additional information, refer to the electrical guide. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST AD : P1516, P1517. P/N SWITCH STARTING/DRIVING MALFUNCTIONS.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AD1: CHECK THE P/N INPUT TO THE ECM.	
	1 Select PARK.
	2 Set the ignition switch to the ON position.
	3 Measure the voltage at the ECM electrical connector EN16 pin 31 (B).
	Is the voltage greater than 10 volts? **Yes** INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing a ECM, contact Dealer technical support. **No** REPAIR the circuit between the ECM electrical connector EN16 pin 31 (B) and the ignition switch. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (On automatic transmission vehicles, this circuit includes the TR sensor, central junction fuse box, ignition relay, and inertia switch. On NAS manual transmission vehicles, this circuit also includes the clutch safety switch.)

PINPOINT TEST AE : P1245; P1246. IGNITION SWITCH CRANK SIGNAL

WARNING: Make sure the starter motor does not engage in the course of these tests. Failure to follow these instructions may result in personal injury.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AE1: CHECK THE START INPUT TO THE ECM	
	1 Move the gear selector to the N position.
	2 Disconnect the ECM electrical connector EN16.
	3 Remove the starter relay from the power distribution fuse box.
	4 Turn the ignition switch to the CRANK position.
	5 Measure the voltage between EN16 pin 6 (Y) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to AE2. **No** REPAIR the circuit between the ECM and the battery. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ignition switch and the power distribution fuse box. [Fuse 28].)
AE2: CHECK THE START INPUT TO THE STARTER RELAY	
	1 Turn the ignition switch to the START position and hold.
	2 Measure the voltage between the starter relay base (R10) pin 1 and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to AE3. **No** REPAIR the circuit between the starter relay base and the battery. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ignition switch and the power distribution fuse box)
AE3: CHECK THE START INPUT WIRE FOR SHORT TO BATTERY AT ECM	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between EN16 pin 6 (Y) and GROUND.
	Is the voltage greater than 10 volts? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AE4.
AE4: CHECK THE START INPUT WIRE FOR SHORT TO BATTERY AT RELAY	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the starter relay base pin 1 and GROUND.
	Is the voltage greater than 10 volts? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AE5.
AE5: CHECK THE STARTER RELAY INPUT FROM THE ECM FOR CONTINUITY	
	1 Measure the resistance between EN16 pin 41 (GO) and relay base pin 2.
	Is the resistance less than 5 ohms? **Yes** GO to AE6. **No** REPAIR the open circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
AE6: CHECK THE STARTER RELAY INPUT FROM THE ECM FOR SHORT TO GROUND	
	1 Disconnect ignition switch electrical connector IP18.
	2 Measure the resistance between EN16 pin 41 (GO) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AE7.
AE7: CHECK THE STARTER RELAY INPUT FROM THE ECM FOR SHORT TO BATTERY	
	1 Measure the voltage between the starter relay base pin 2 and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new starter relay. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.

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Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Electronic Engine Controls2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27, VIN Range: J28493->V99999

Diagnosis and Testing

1. **1.** Verify the customer concern by operating the system.
2. **2.** Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Engine oil level • Cooling system coolant level • Fuel Contamination • Throttle body	• Fuses (9, 31, 32, 37) • Wiring harness • Electrical connector(s) • Sensor(s) • Engine control module (ECM)

3. **3.** Verify the following systems are working correctly:

- Air intake system
- Cooling system
- Charging system
- Fuel charging system

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 concern is not visually evident and the Jaguar Approved Diagnostic System is not available, use a fault code reader to retrieve the fault codes before proceeding to the Diagnostic Trouble Code (DTCs) Index Chart.
6. **6.** Make sure that a power supply is present to the ECM from fuse 32 of the engine compartment fuse box before carrying out diagnostic work on the electronic engine control system.

Diagnostic Trouble Code (DTC) Index

DTC	Description	Possible Source	Action
P0116, P0117, P0118, P0125	Concern with engine coolant temperature (ECT) sensor.	• ECT sensor. • ECT sensor circuit(s). • Low/contaminated coolant. • Thermostat failure. • Overheating.	GO to Pinpoint Test A. .
P0128	Concern with engine temperature, set by ECT sensor inputs.	• Thermostat. • ECT sensor. • ECT sensor circuit(s).	Mechanical check of thermostat.GO to Pinpoint Test A. .
P0335, P0336	Concern with crankshaft position (CKP) sensor.	• CKP sensor. • CKP sensor circuit(s). • CKP sensor air gap. • CKP sensor debris.	GO to Pinpoint Test B. .
P0011, P0012, P0340, P0341	Concern with right-hand bank camshaft position (CMP) sensor. Right-hand camshaft position timing over-advanced/over-retarded.	• CMP sensor. • CMP sensor circuit(s). • CMP sensor air gap. • CMP sensor debris.	GO to Pinpoint Test C. .
P0021, P0022, P1340, P1341	Concern with left-hand bank camshaft position (CMP) sensor. Left-hand camshaft position timing over-advanced/over-retarded.	• CMP sensor. • CMP sensor circuit(s). • CMP sensor air gap. • CMP sensor debris.	GO to Pinpoint Test D. .
P0031, P0032	Concern with right-hand bank heated oxygen sensor (HO2S 1/1) heater.	• H02S 1/1 failure. • H02S 1/1 circuit(s). • Fuse 38.	GO to Pinpoint Test E. .
P0181, P0182, P0183	Concern with fuel temperature sensor.	• Fuel temperature sensor. • Fuel temperature sensor circuit(s).	GO to Pinpoint Test F. ..
P0324, P0327, P0328, P0332, P0333	Concern with knock sensor (KS).	• KS. • KS circuit(s). • Poor contact with cylinder block. • ECM failure.	GO to Pinpoint Test G. .
P0197, P0198, P0196	Concern with oil temperature sensor.	• Oil temperature sensor. • Oil temperature sensor circuit(s).	GO to Pinpoint Test H. .
P0131, P0132	Concern with right-hand bank heated oxygen sensor (HO2S 1/1).	• HO2S 1/1. • HO2S 1/1 circuit(s).	GO to Pinpoint Test I. .
P0133	Concern with right-hand bank heated oxygen sensor (HO2S 1/1). Slow response.	• Engine misfire. • H02S 1/1 disconnected. • H02S 1/1 mechanical damage. • H02S 1/1 to ECM wiring fault. • H02S 1/1 short circuit to	GO to Pinpoint Test I. Refer to pinpoint tests for components listed, REFER to: Exhaust System (309-00 Exhaust System, Diagnosis and Testing) / Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 -

DTC	Description	Possible Source	Action
		ground. • H02S 1/1 wiring shield open circuit. • H02S 1/1 heater circuit fault. • Exhaust leak. • Low exhaust temperature. • Injector flow partially blocked. • Catalyst efficiency decrease. • H02S 1/1 failure.	AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P1646	Concern with right-hand bank heated oxygen sensor (HO2S 1/1).	• H02S 1/1 heater failure. • H02S 1/1 sensing circuit, short circuit to ground. • H02S 1/1 sensing circuit, short circuit to high voltage. • H02S 1/1 sensing circuit, open circuit. • ECM failure.	GO to Pinpoint Test I. Refer to pinpoint tests for components listed.
P0037, P0038, P0137, P0138	Concern with right-hand bank catalyst monitor sensor (H02S ½).	• H02S ½. • H02S ½ circuit(s). • Fuse 38.	GO to Pinpoint Test J. .
P0139, P0140	Concern with right-hand bank catalyst monitor sensor (H02S ½).	• H02S ½. • H02S ½ circuit(s). • Exhaust leak. • Low exhaust temperature. • Injector flow partially blocked.	GO to Pinpoint Test J. Inspect exhaust system, REFER to: Exhaust System (309-00 Exhaust System, Diagnosis and Testing). Inspect fuel system, REFER to: Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0151, P0152	Concern with left-hand bank heated oxygen sensor (HO2S 2/1).	• HO2S 2/1. • HO2S 2/1 circuit(s).	GO to Pinpoint Test K. .
P0153	Concern with left-hand bank heated oxygen sensor (HO2S 2/1). Slow response.	• Engine misfire. • H02S 2/1 disconnected. • H02S 2/1 mechanical damage. • H02S 2/1 to ECM wiring fault. • H02S 2/1 short circuit to ground. • H02S 2/1 wiring shield open circuit. • H02S 2/1 heater circuit fault. • Exhaust leak. • Low exhaust temperature. • Injector flow partially blocked. • Catalyst efficiency decrease. • H02S 2/1 failure.	GO to Pinpoint Test K. Refer to pinpoint tests for components listed, REFER to: Exhaust System (309-00 Exhaust System, Diagnosis and Testing) / Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P1647	Concern with left-hand bank heated oxygen sensor (HO2S 2/1).	• H02S 2/1 heater failure. • H02S 2/1 sensing circuit, short circuit to ground. • H02S 2/1 sensing circuit, short circuit to high voltage. • H02S 2/1 sensing circuit, open circuit. • ECM failure.	GO to Pinpoint Test K. Refer to pinpoint tests for components listed.
P0057, P0058, P0157, P0158	Concern with left-hand bank catalyst monitor sensor (HO2S 2/2).	• HO2S 2/2. • HO2S 2/2 sensor circuit(s). • Fuse 42.	GO to Pinpoint Test L. .
P0159, P0160	Concern with left-hand bank catalyst monitor sensor (HO2S 2/2).	• H02S 2/2. • H02S 2/2 circuit(s). • Exhaust leak. • Low exhaust temperature. • Injector flow partially blocked.	GO to Pinpoint Test L. Inspect exhaust system, REFER to: Exhaust System (309-00 Exhaust System, Diagnosis and Testing). Inspect fuel system, REFER to: Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). .
P0420	Concern with right-hand bank catalytic converter system. (Efficiency below threshold).	• HO2 sensor disconnected. • HO2 sensor to ECM wiring fault. • HO2 sensor heater to ECM wiring fault. • HO2 sensor heater failure.	Refer to pinpoint tests for components listed. Visually inspect catalytic converters. REFER to: Exhaust System (309-00 Exhaust System, Diagnosis and Testing).

DTC	Description	Possible Source	Action
		• Upstream HO2 sensor failure. • Downstream HO2 sensor failure. • HO2 sensor failed. • Catalytic converter failure.	
P0430	Concern with left-hand bank catalytic converter system. (Efficiency below threshold).	• HO2 sensor disconnected. • HO2 sensor to ECM wiring fault. • HO2 sensor heater to ECM wiring fault. • HO2 sensor heater failure. • Upstream HO2 sensor failure. • Downstream HO2 sensor failure. • HO2 sensor failed. • Catalytic converter failure.	Refer to pinpoint tests for components listed. Visually inspect catalytic converters, REFER to: Exhaust System (309-00 Exhaust System, Diagnosis and Testing).
P0101, P0102	Concern with mass air flow (MAF) sensor.	• MAF sensor. • MAF sensor circuit(s). • Blocked air filter. • Air intake leak. • Engine breather leak. • Throttle control malfunction.	GO to Pinpoint Test M. Visually inspect components listed, REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing) / Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0103, P1104	Concern with mass air flow (MAF) sensor.	• MAF sensor. • MAF sensor circuit(s).	GO to Pinpoint Test M. .
P0111	Concern with the intake air temperature (IAT) sensor.	• MAF sensor. • MAF sensor circuit(s). • Blocked air filter. • Air intake leak. • Engine breather leak.	GO to Pinpoint Test N. Visually inspect components listed. REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0112, P0113	Concern with the intake air temperature (IAT) sensor.	• Intake air temperature (IAT) sensor. • Intake air temperature (IAT)sensor circuit.	GO to Pinpoint Test N. .
P0051, P0052	Concern with the left-hand bank heated oxygen sensor (HO2S 2/1) heater.	• HO2S 2/1. • HO2S 2/1 circuit. • Fuse 42.	GO to Pinpoint Test O. .
P1606	Concern with ECM relay.	• ECM. • ECM relay. • ECM relay circuit(s). • Fuse 31.	GO to Pinpoint Test P. .
P0106, P0107, P0108	Concern with MAP sensor.	• MAP sensor. • MAP sensor circuits.	GO to Pinpoint Test Q. .
P0069, P2228, P2229	Concern with barometric pressure (HAC) sensor.	Barometric pressure sensor within the ECM.	INSTALL a new ECM. For additional information, refer to, dealer technical support.
P0010, P1384	Concern with VVT circuit, right-hand bank.	• VVT solenoid and circuit. • Oil flow. • Camshaft failure.	GO to Pinpoint Test R. REFER to: Variable Camshaft Timing (VCT) Oil Control Solenoid (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).
P0020, P1396	Concern with VVT circuit, left-hand bank.	• VVT solenoid and circuit. • Oil flow. • Camshaft failure.	GO to Pinpoint Test S. REFER to: Variable Camshaft Timing (VCT) Oil Control Solenoid (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).
P1251, P1631, P1657, P1658	Concern with throttle motor relay.	• Throttle motor relay. • Throttle motor relay circuit.	GO to Pinpoint Test T. Check Fuse 18.
P1549	Concern with IMT Valve 1 circuit.	• IMT valve. • IMT valve circuit.	GO to Pinpoint Test U.
P1532	Concern with IMT Valve 2 circuit.	• IMT valve. • IMT valve circuit.	GO to Pinpoint Test V. .
P1582	"Flight Recorder" data stored.	This code does not indicate a failure of a component or system.	GO to Pinpoint Test W. .
P0561, P0562, P0563	Concern with sensor power circuit.	• ECM. • Power supply circuits. • Sensors within the circuit.	GO to Pinpoint Test AC. .
P1243	Concern with sensor ground circuit.	• ECM. • Sensor ground circuits. • Sensors within the circuit.	GO to Pinpoint Test X. .

DTC	Description	Possible Source	Action
P0226, P00227, P0228	Concern with accelerator pedal position sensor; Track 1.	• APP sensor. • APP sensor circuits.	GO to Pinpoint Test Z. .
P2122, P2123	Concern with accelerator pedal position sensor; Track 3.	• APP sensor. • APP sensor circuits.	GO to Pinpoint Test AA. .
P0480	Concern with radiator cooling fan module drive.	• Cooling fan module. • Cooling fan module circuits.	GO to Pinpoint Test Y. .
P0646, P0647	Concern with air conditioning clutch relay drive.	• Air conditioning clutch relay. • Air conditioning clutch relay circuits.	GO to Pinpoint Test AE. .
P0851, P0852	Concern with P/N switch starting/driving malfunctions.	• CJFB. • Ignition relay. • TR sensor. • Inertia switch and circuits.	GO to Pinpoint Test AD. .
P0512, P1245	Concern with engine crank signal, high/low voltage.	• Starter relay. • ECM. • Ignition switch. • Associated circuits.	GO to Pinpoint Test AB. .
P1260	Security input malfunction.	• GEM. • Ignition key. • PATS circuits. • CAN network.	Reprogram key, check CAN network, REFER to: Communications Network - VIN Range: E96603->J28492 (418-00 Module Communications Network, Diagnosis and Testing).
P0506	Cold start monitor engine speed low.	• Air intake restriction. • Accessory drive overload. (defective/seized component). • Throttle valve stuck closed. • Throttle body failure.	REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing) / Accessory Drive (303-05 Accessory Drive, Diagnosis and Testing) / Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0507	Cold start monitor engine speed high.	• Intake air leak between MAF sensor and throttle. • Intake air leak between throttle and engine. • Engine crankcase breather leak.	REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P050A	Cold start monitor airflow low/high.	• Air intake restriction. • Accessory drive overload. (defective/seized component). • Throttle valve stuck closed. • Throttle body failure. • Intake air leak between MAF sensor and throttle. • Intake air leak between throttle and engine. • Engine crankcase breather leak.	REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing) / Accessory Drive (303-05 Accessory Drive, Diagnosis and Testing) / Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P050B	Cold start ignition timing performance.	• Blocked intake system. • Sticking/slow throttle. • Poor engine condition.	Check the intake air system, including the air cleaner element. Carry out a complete vehicle read for related DTCs. Rectify as necessary.
P0603, P0607, P1633, P1656	Concern with powertrain control module (ECM).	ECM.	INSTALL a new ECM. For additional information, refer to dealer technical support.
P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206	Concern with fuel system too lean/rich.	• Fuel injector(s). • Fuel delivery fault.	REFER to: Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0300, P0301, P0302, P0303, P0304, P0305, P0306, P1313, P1314, P1316	Concern with ignition system/misfire monitoring.	• Ignition system. • Ignition system wiring harness.	REFER to: Engine Ignition - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0351, P0352, P0353, P0354, P0355, P0356	Concern with ignition primary circuits.	• Ignition modules. • Ignition module circuits.	REFER to: Engine Ignition - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0442, P0443, P0444, P0445, P0446, P0447, P0448, P0450, P0452, P0453, P0455, P0456, P0457	Concern with evaporative emissions system.	• Evaporative/purge valve and circuits. • Fuel tank and lines. • Filler cap. • Carbon canister. • Canister close valve and circuits. • Fuel tank pressure sensor. • Fuel tank vapor port.	REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).

DTC	Description	Possible Source	Action
		• Vapor lines.	
P0460	Concern with fuel level sensors.	• Fuel level sensors. • Fuel level sensor circuits. • Instrument cluster.	REFER to: Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0560	ECM battery power supply voltage malfunction. (This DTC could be set due to a fuel injection pressure sensor fault. If P0193 is also set, rectify P0193 first).	ECM battery power supply circuit open circuit or high resistance.	Repair the circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
P0565, P0566, P0567, P0568, P0569, P0570, P0831, P0832, P0834, P0835, P1571	Concern with vehicle speed control.	• Switchpack. • Switchpack circuits. • Clutch cancel switch. • Clutch safety switch. • Brake on/off switch.	REFER to: Speed Control - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-03 Speed Control, Diagnosis and Testing).
P0616, P0617	Concern with the starter relay circuit.	• Starter relay. • Starter relay drive circuit.	REFER to: Starting System - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-06 Starting System, Diagnosis and Testing).
P1250, P1254,	Concern with throttle body.	• Throttle motor. • Throttle motor relay. • Throttle motor relay circuits. • Throttle body. • Throttle return spring. • Limp-home spring.	REFER to: Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P2107	Concern with throttle body control.	ECM	REFER to: Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P2118, P2119	Concern with throttle body.	• Throttle actuator control motor circuit: short circuit to power. • Throttle actuator control motor circuit: short circuit to ground. • Throttle actuator control motor circuit: short circuit to power. • Throttle actuator control motor fault. • Throttle body contaminated/sticking.	REFER to: Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0627, P0628, P0629, P2635	Concern with fuel pump commands.	• Fuel pump control module. • Fuel pump control module circuits. • ECM.	REFER to: Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P1244, P1629, P1632, P1146, P2503, P2504	Concern with charging system.	• Charging system. • Charging system wiring harness.	REFER to: Charging System - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (414-00 Battery and Charging System - General Information, Diagnosis and Testing).
P0191, P0192, P0193	Concern with fuel pulse damper.	• fuel pulse damper circuit(s). • fuel pulse damper. • Fuel system leak/blockage.	REFER to: Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P0122, P0123, P0222, P0223, P2135	Concern with throttle position (TP) sensor.	• TP sensor. • TP sensor circuit(s).	REFER to: Throttle Position (TP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).
P1000	System check not complete since last memory clear.	OBD errors not cleared by diagnosis.	Carry out comprehensive component monitor drive cycle. Refer to the DTC section of GTR, accessed by the icon on the opening page.
P1111	System check complete since last memory clear.	This code does not indicate a failure of a component or system.	No action necessary.
P1367	Concern with right-hand bank ignition amplifier.	• Ignition module. • Ignition module circuits.	REFER to: Engine Ignition - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P1368	Concern with left-hand bank ignition amplifier.	• Ignition module. • Ignition module circuits.	REFER to: Engine Ignition - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
P1656	Concern with TP sensor amplifier circuit.	ECM.	INSTALL a new ECM. For additional information, refer to, dealer technical support.
P1609	CPU to CPU communications.	ECM.	INSTALL a new ECM. For additional information, refer to, dealer technical support.
P2610	ECM/PCM internal engine off timer performance.	ECM.	INSTALL a new ECM. For additional information, refer to, dealer technical support.

DTC	Description	Possible Source	Action
P0860, P1637, P1638. P1642, P1643, P1699	Concern with CAN network.	CAN network modules and circuits.	REFER to: Communications Network - VIN Range: E96603->J28492 (418-00 Module Communications Network, Diagnosis and Testing).

PINPOINT TEST A : DTC P0116, P0117, P0118, P0125. ECT SENSOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE ENGINE COOLANT TEMPERATURE (ECT) SENSOR SIGNAL WIRE FOR OPEN CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECT sensor electrical connector EN18.
	3 Disconnect the ECM electrical connector, EN16.
	4 Measure the resistance between the ECT sensor electrical connector EN18, pin 2 (UY) and the ECM electrical connector EN16, pin 70 (UY).
	Is the resistance less than 5 ohms? **Yes** GO to A2. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
A2: CHECK THE ECT SENSOR SIGNAL WIRE FOR A SHORT TO GROUND	
	1 Measure the resistance between the ECT sensor electrical connector EN18, pin 2 (UY) and EN16, pin 19.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to A3.
A3: CHECK THE ECT SENSOR GROUND CIRCUIT	
	1 Measure the resistance between the ECT sensor electrical connector EN18, pin 1 (BG) and EN16, pin 19.
	Is the resistance less than 5 ohms? **Yes** GO to A4. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
A4: CHECK THE ECT SENSOR GROUND CIRCUIT FOR A SHORT TO BATTERY POSITIVE	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the ECT electrical connector EN18, pin 1 (BG) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to A5.
A5: CHECK THE ECT SENSOR CIRCUIT FOR A SHORT TO BATTERY POSITIVE	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between the ECT sensor electrical connector EN18, pin 2 (UY) and GROUND.
	Is the voltage greater than 5 volts? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new ECT sensor. CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST B : DTC P0335, P0336. CRANKSHAFT POSITION (CKP) SENSOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE CKP SENSOR FOR CORRECT INSTALLATION	
	1 Turn the ignition switch to the OFF position.
	2 Check the CKP sensor for correct installation.
	Is the CKP sensor correctly installed? **Yes** GO to B2. **No** INSTALL the CKP sensor correctly. REFER to: Crankshaft Position (CKP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Reconnect the sensor. CLEAR the DTCs. TEST the system for normal operation.
B2: CHECK THE CKP SENSOR FOR DEBRIS	
	1 Remove the CKP sensor and inspect for debris.
	Is the CKP sensor free of debris? **Yes** GO to B3. **No** CLEAN the sensor and wheel. INSTALL the sensor. REFER to: Crankshaft Position (CKP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Reconnect the sensor. CLEAR the DTCs. TEST the system for normal operation.
B3: CHECK THE CKP SENSOR GROUND WIRE FOR OPEN CIRCUIT	
	1 Disconnect the ECM electrical connector EN16.
	2 Disconnect the CKP sensor electrical connector EN12.

	3 Measure the resistance between the CKP sensor electrical connector EN12, pin 1 (Y) and the ECM electrical connector EN16, pin 37 (Y).
	Is the resistance less than 5 ohms? **Yes** GO to B4. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. Reconnect all connectors. CLEAR the DTCs. TEST the system for normal operation.
B4: CHECK THE CKP SENSOR SIGNAL WIRE FOR OPEN CIRCUIT	
	1 Measure the resistance between the CKP sensor electrical connector EN12, pin 2 (P) and the ECM electrical connector EN16, pin 36 (P).
	Is the resistance less than 5 ohms? **Yes** GO to B5. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. Reconnect all connectors. CLEAR the DTCs. TEST the system for normal operation.
B5: CHECK THE CKP SENSOR GROUND WIRE FOR A SHORT TO GROUND	
	1 Measure the resistance between the CKP sensor electrical connector EN12 pin 1 (Y) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. Reconnect all connectors. CLEAR the DTCs. TEST the system for normal operation. **No** GO to B6.
B6: CHECK THE CKP SENSOR SIGNAL WIRE FOR A SHORT TO GROUND	
	1 Measure the resistance between the CKP sensor electrical connector EN12 pin 2 (P) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. Reconnect all connectors. CLEAR the DTCs. TEST the system for normal operation. **No** GO to B7.
B7: CHECK THE CKP SENSOR GROUND WIRE FOR A SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the CKP sensor electrical connector EN12 pin 1 (Y) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. Reconnect all connectors. CLEAR the DTCs. TEST the system for normal operation. **No** GO to B8.
B8: CHECK THE CKP SENSOR SIGNAL WIRE FOR A SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the CKP sensor electrical connector EN12 pin 2 (P) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. Reconnect all connectors. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new CKP sensor. REFER to: Crankshaft Position (CKP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Reconnect all connectors. CLEAR the DTCs. TEST the system for normal operation. If the concern persists INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST C : DTC P0011, P0012, P0340, P0341: RIGHT-HAND BANK CAMSHAFT POSITION (CMP) SENSOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE RIGHT-HAND BANK CMP SENSOR FOR CORRECT INSTALLATION	
	1 Turn the ignition switch to the OFF position.
	2 Check the CMP sensor for correct installation.
	Is the CMP sensor correctly installed? **Yes** GO to C2. **No** INSTALL the CMP sensor correctly. REFER to: Camshaft Position (CMP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation.
C2: CHECK THE RIGHT-HAND BANK CMP SENSOR FOR FOREIGN DEBRIS	
	1 Remove the CMP sensor and inspect for foreign debris.
	Is the CMP sensor free of foreign debris? **Yes** GO to C3. **No** CLEAN the sensor and wheel. INSTALL the sensor. REFER to: Camshaft Position (CMP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation.
C3: CHECK THE RIGHT-HAND BANK CMP SENSOR SIGNAL WIRE FOR OPEN CIRCUIT	
	1 Disconnect the ECM electrical connector EN16.
	2 Disconnect the CMP sensor electrical connector EN43.
	3 Measure the resistance between the CMP sensor electrical connector EN43, pin 1 (O) and the ECM electrical connector EN16, pin 94 (O).

	Is the resistance less than 5 ohms? **Yes** GO to C4. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
C4: CHECK THE RIGHT-HAND BANK CMP GROUND WIRE FOR OPEN CIRCUIT	
	1 Measure the resistance between the CMP sensor electrical connector EN43, pin 2 (B) and the ECM electrical connector EN16, pin 95 (B).
	Is the resistance less than 5 ohms? **Yes** GO to C5. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
C5: CHECK THE RIGHT-HAND BANK CMP SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND	
	1 Measure the resistance between the CMP sensor electrical connector EN43, pin 1 (O) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to C6.
C6: CHECK THE RIGHT-HAND BANK CMP SENSOR GROUND CIRCUIT FOR A SHORT TO GROUND	
	1 Measure the resistance between the CMP sensor electrical connector EN43, pin 2 (B) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to C7.
C7: CHECK THE RIGHT-HAND BANK CMP SENSOR SIGNAL CIRCUIT FOR A SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the CMP sensor electrical connector EN43, pin 1 (O) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to C8.
C8: CHECK THE RIGHT-HAND BANK CMP SENSOR GROUND CIRCUIT FOR A SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the CMP sensor electrical connector EN43, pin 2 (B) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new CMP sensor. REFER to: Camshaft Position (CMP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST D : DTC P0021, P0022, P1340, P1341: LEFT-HAND BANK CAMSHAFT POSITION (CMP) SENSOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE LEFT-HAND BANK CMP SENSOR FOR CORRECT INSTALLATION	
	1 Turn the ignition switch to the OFF position.
	2 Check the CMP sensor for correct installation.
	Is the CMP sensor correctly installed? **Yes** GO to D2. **No** INSTALL the CMP sensor correctly. REFER to: Camshaft Position (CMP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation.
D2: CHECK THE LEFT-HAND BANK CMP SENSOR FOR FOREIGN DEBRIS	
	1 Remove the CMP sensor and inspect for foreign debris.
	Is the CMP sensor free of foreign debris? **Yes** GO to D3. **No** CLEAN the sensor and wheel. INSTALL the sensor. REFER to: Camshaft Position (CMP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation.
D3: CHECK THE LEFT-HAND BANK CMP SENSOR SIGNAL WIRE FOR OPEN CIRCUIT	
	1 Disconnect the ECM electrical connector EN16.
	2 Disconnect the CMP sensor electrical connector EN33.
	3 Measure the resistance between the CMP sensor electrical connector EN33, pin 1 (G) and the ECM electrical connector EN16, pin 68 (G).

	Is the resistance less than 5 ohms? **Yes** GO to D4. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
D4: CHECK THE LEFT-HAND BANK CMP GROUND WIRE FOR OPEN CIRCUIT	
	1 Measure the resistance between the CMP sensor electrical connector EN33, pin 2 (N) and the ECM electrical connector EN16, pin 69 (N).
	Is the resistance less than 5 ohms? **Yes** GO to D5. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
D5: CHECK THE LEFT-HAND BANK CMP SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND	
	1 Measure the resistance between the CMP sensor electrical connector EN33, pin 1 (G) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to D6.
D6: CHECK THE LEFT-HAND BANK CMP SENSOR GROUND CIRCUIT FOR A SHORT TO GROUND	
	1 Disconnect the ECM electrical connector, EN16. 2 Measure the resistance between the CMP sensor electrical connector EN33, pin 2 (N) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to D7.
D7: CHECK THE LEFT-HAND BANK CMP SENSOR SIGNAL CIRCUIT FOR A SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position. 2 Measure the voltage between the CMP sensor electrical connector EN33, pin 1 (G) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to D8.
D8: CHECK THE LEFT-HAND BANK CMP SENSOR GROUND CIRCUIT FOR A SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position. 2 Measure the voltage between the CMP sensor electrical connector EN33, pin 2 (N) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new CMP sensor. REFER to: Camshaft Position (CMP) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST E : DTC P0031, P0032. RIGHT-HAND BANK HO2S HEATER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK THE POWER SUPPLY CIRCUIT TO THE RIGHT-HAND BANK HO2S HEATER	
	1 Disconnect HO2S sensor electrical connector, EN37. 2 Turn the ignition switch to the ON position. 3 Measure the voltage between the HO2S electrical connector EN37, pin 2 (WG) and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to E5. **No** GO to E2.
E2: CHECK THE GROUND CIRCUIT TO THE RIGHT-HAND BANK HO2S HEATER FOR OPEN CIRCUIT	
	1 Turn the ignition switch to the OFF position. 2 Disconnect the ECM electrical connector EN16. 3 Measure the resistance between the HO2S electrical connector EN37, pin 1 (RU) and the ECM electrical connector EN16, pin 1 and pin 2 (RU).
	Is the resistance of each wire less than 5 ohms? **Yes** GO to E3. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
E3: CHECK THE RIGHT-HAND BANK HO2S GROUND CIRCUIT FOR SHORT TO GROUND	
	1 Measure the resistance between the bank 1 HO2S electrical connector EN37, pin 1 (RU) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No**

	GO to E4.
E4: CHECK THE RIGHT-HAND BANK HO2S GROUND CIRCUIT FOR SHORT TO BATTERY	
	1 Check for a voltage between the HO2S electrical connector EN37, pin 1 (RU) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new HO2S. REFER to: Heated Oxygen Sensor (HO2S) RH (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support.
E5: CHECK FUSE 38 OF THE ENGINE COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to E7. **No** GO to E6.
E6: CHECK FUSE 38 OF THE ENGINE COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB34 pin 97 of the engine compartment fuse box and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the engine compartment fuse box and the right-hand bank HO2S. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. CLEAR the DTC. TEST the system for normal operation.
E7: CHECK THE POWER SUPPLY TO FUSE 38 IN THE ENGINE COMPARTMENT FUSE BOX	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between electrical connector JB34 pin 131 and GROUND.
	Is the voltage less than 10 volts? **Yes** Repair the circuit between the battery and the EMS relay. Test the relay, renew as necessary. CLEAR the DTC. TEST the system for normal operation. **No** Repair the circuit from the ECM control relay to the engine compartment fuse box. For additional information, refer to the wiring diagrams. GO to P1. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST F : DTC P0181, P0182, P0183. FUEL TEMPERATURE SENSOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK CONTINUITY OF THE FUEL TEMPERATURE SENSOR POWER SUPPLY CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the fuel temperature sensor electrical connector IJ8.
	3 Disconnect the ECM electrical connector EN16.
	4 Measure the resistance between the fuel temperature sensor electrical connector IJ8, pin 2 (WU) and the ECM electrical connector EN16, pin 50 (WU).
	Is the resistance less than 5 ohms? **Yes** GO to F2. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
F2: CHECK THE FUEL TEMPERATURE SENSOR GROUND CIRCUIT	
	1 Measure the resistance between the fuel temperature sensor electrical connector IJ8 pin 1 (NU) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to F3. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
F3: CHECK THE FUEL TEMPERATURE SENSOR CIRCUIT FOR A SHORT TO GROUND	
	1 Measure the resistance between the fuel temperature sensor electrical connector IJ8 pin 2 (WU) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to F4.
F4: CHECK THE FUEL TEMPERATURE SENSOR GROUND CIRCUIT FOR A SHORT TO BATTERY	
	1 Disconnect the FTP sensor electrical connector, FT1.
	2 Turn the ignition switch to the ON position.
	3 Check for a voltage between FT1, pin 3 (BG) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to F5.
F5: CHECK THE FUEL TEMPERATURE SENSOR CIRCUIT FOR A SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between the fuel temperature sensor electrical connector IJ8, pin 2 (WU) and GROUND.

	Is the voltage greater than 10 volts? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new fuel temperature sensor. REFER to: Fuel Temperature Sensor - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST G : DTC P0324, P0327, P0328, P0332, P0333. KNOCK SENSOR (KS)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: CHECK THE KS SIGNAL WIRE FOR OPEN CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the KS sensor electrical connector EN23.
	3 Disconnect the ECM electrical connector EN16.
	4 Measure the resistance between EN23, pin 1 (N) and EN16, pin 98 (N).
	Is the resistance less than 5 ohms? **Yes** GO to G2. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
G2: CHECK THE KS SIGNAL WIRE FOR SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position.
	2 Check for a voltage between EN23, pin 1 (N) and GROUND.
	Is a voltage present? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to G3.
G3: CHECK THE KS SIGNAL WIRE FOR A SHORT TO GROUND	
	1 Measure the resistance between the KS sensor electrical connector EN23, pin 1 (N) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new KS. REFER to: Knock Sensor (KS) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation) / Knock Sensor (KS) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). CLEAR DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support.
G4: CHECK THE KS GROUND CIRCUIT FOR OPEN CIRCUIT	
	1 Measure the resistance between the KS electrical connector EN23 pin 2 (W) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the circuit between EN23, pin 2 (W) and GROUND. CLEAR the DTCs. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams.) **No** GO to G5.
G5: CHECK THE KS GROUND LEAD FOR OPEN CIRCUIT	
	1 Disconnect the KS electrical connector, EN23.
	2 Disconnect the ECM electrical connector, EN16.
	3 Measure the resistance between EN23, pin2 (W) and EN16, pin 100 (BG).
	Is the resistance less than 5 ohms? **Yes** GO to G6. **No** REPAIR the circuit between EN23, pin2 (W) and EN16, pin 100 (BG). For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
G6: CHECK THE KS GROUND LEAD FOR SHORT TO BATTERY	
	1 Connect the KS sensor electrical connector EN23.
	2 Connect the ECM electrical connector EN16.
	3 Turn the ignition switch to the ON position.
	4 Check for a voltage between EN23, pin 2 (W) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new KS. REFER to: Knock Sensor (KS) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST H : DTC P0196, P0197, P0198. OIL TEMPERATURE SENSOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: CHECK THE OIL TEMPERATURE SENSOR SIGNAL WIRE FOR OPEN CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the oil temperature sensor electrical connector EN25.
	3 Disconnect the ECM electrical connector EN16.
	4 Measure the resistance between the oil temperature sensor electrical connector EN25, pin 1 (Y) and the ECM electrical connector EN16, pin 78 (Y).
	Is the resistance less than 5 ohms? **Yes** GO to H2. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
H2: CHECK THE OIL TEMPERATURE SENSOR GROUND CIRCUIT FOR OPEN CIRCUIT	
	1 Measure the resistance between the oil temperature sensor electrical connector EN25, pin 2 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to H3. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
H3: CHECK THE OIL TEMPERATURE SENSOR GROUND CIRCUIT FOR SHORT TO BATTERY	
	1 Connect ECM electrical connector, EN16.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between the oil temperature sensor electrical connector EN25, pin 2 (BG) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to H4.
H4: CHECK THE OIL TEMPERATURE SENSOR CIRCUIT FOR A SHORT TO GROUND	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect ECM electrical connector, EN16.
	3 Measure the resistance between the oil temperature sensor electrical connector EN25, pin 1 (Y) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to H5.
H5: CHECK THE OIL TEMPERATURE SENSOR CIRCUIT FOR A SHORT TO BATTERY	
	1 Connect ECM electrical connector, EN16.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between the oil temperature sensor electrical connector EN25, pin 1 (Y) and GROUND.
	Is the voltage greater than 10 volts? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new oil temperature sensor. REFER to: Oil Temperature Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST I : DTC P0131, P0132, P0133, P1646. RIGHT-HAND BANK HO2S	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: CHECK THE CONSTANT CIRCUIT OF THE RIGHT-HAND BANK HO2S FOR OPEN CIRCUIT	
	1 Disconnect the HO2S electrical connector EN37.
	2 Disconnect the ECM electrical connector, EN16.
	3 Measure the resistance between EN16, pin 84 (P) and EN37, pin 4 (P).
	Is the resistance less than 5 ohms? **Yes** GO to I2. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
I2: CHECK THE CONSTANT CIRCUIT OF THE RIGHT-HAND BANK HO2S FOR SHORT TO GROUND	
	1 Measure the resistance between EN16, pin 84 (P) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to I3.
I3: CHECK THE CONSTANT CIRCUIT OF THE RIGHT-HAND BANK HO2S FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between EN37, pin 4 (P) and GROUND.

	Is the voltage greater than 5 volts? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to I4.
I4: CHECK THE VARIABLE CIRCUIT OF THE RIGHT-HAND BANK HO2S FOR OPEN CIRCUIT	
	1 Disconnect the ECM electrical connector, EN16.
	2 Measure the resistance between EN16, pin 83 (Y) and EN37, pin 3 (Y).
	Is the resistance less than 5 ohms? **Yes** GO to I5. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
I5: CHECK THE VARIABLE CIRCUIT OF THE RIGHT-HAND BANK HO2S FOR SHORT TO GROUND	
	1 Measure the resistance between EN16, pin 83 (Y) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to I6.
I6: CHECK THE VARIABLE CIRCUIT OF THE RIGHT-HAND BANK HO2S FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between EN37, pin 3 (Y) and GROUND.
	Is the voltage greater than 5 volts? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new HO2S. REFER to: Heated Oxygen Sensor (HO2S) RH (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST J : DTC P0037, P0038, P0137, P0138, P0139, P0140. RIGHT-HAND BANK CATALYST MONITOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
J1: CHECK THE POWER SUPPLY CIRCUIT TO THE RIGHT-HAND BANK CATALYST MONITOR HEATER	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the catalyst monitor sensor electrical connector EN14.
	3 Turn the ignition switch to the ON position.
	4 Measure the voltage between the catalyst monitor sensor electrical connector EN14, pin 2 (WG) and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to J6. **No** GO to J2.
J2: CHECK CONTINUITY OF THE RIGHT-HAND BANK CATALYST MONITOR SENSOR GROUND CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between the catalyst monitor sensor electrical connector EN14, pin 3 (W) and the ECM electrical connector EN16, pin 130.
	Is the resistance less than 5 ohms? **Yes** GO to J3. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
J3: CHECK CONTINUITY OF THE POWER SUPPLY WIRE TO THE RIGHT-HAND BANK CATALYST MONITOR SENSOR	
	1 Measure the resistance between the RH bank catalyst monitor sensor electrical connector EN14, pin 4 (N) and the ECM electrical connector EN16, pin 128 (N).
	Is the resistance less than 5 ohms? **Yes** GO to J4. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
J4: CHECK THE RIGHT-HAND BANK CATALYST MONITOR SENSOR POWER SUPPLY WIRE FOR A SHORT TO GROUND	
	1 Measure the resistance between the catalyst monitor sensor electrical connector EN14, pin 4 (N) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to ground. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to J5.
J5: CHECK THE RIGHT-HAND BANK CATALYST MONITOR SENSOR POWER SUPPLY WIRE FOR A SHORT TO BATTERY	
	1 Measure the voltage between the catalyst monitor sensor electrical connector EN14, pin 4 (N) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.

	No INSTALL a new RH bank catalyst monitor sensor. For additional information, REFER to: Catalyst Monitor Sensor RH (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support.
J6: CHECK THE RIGHT-HAND BANK CATALYST MONITOR SENSOR POWER SUPPLY CIRCUIT	
	1 Measure the voltage between the catalyst monitor sensor electrical connector EN14 pin 2 (WG) and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to J8. **No** GO to J7.
J7: CHECK CONTINUITY OF THE RIGHT-HAND BANK CATALYST MONITOR SENSOR HEATER GROUND CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between the catalyst monitor sensor electrical connector EN14, pin 1 (U) and the ECM electrical connector EN16, pin 92 (U).
	Is the resistance less than 5 ohms? **Yes** INSTALL a new ECM. For additional information, REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing a ECM, contact Dealer technical support. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
J8: CHECK FUSE 38 OF THE ENGINE COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to J10. **No** GO to J9.
J9: CHECK FUSE 38 OF THE ENGINE COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB34, pin 97 of the engine compartment fuse box and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the engine compartment fuse box and the right-hand bank HO2S. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. Check the circuit for cause of fuse failure. CLEAR the DTC. TEST the system for normal operation.
J10: CHECK THE POWER SUPPLY TO FUSE 38 IN THE ENGINE COMPARTMENT FUSE BOX	
	1 Measure the voltage between fuse 38 electrical connector JB34 pin 97 and GROUND.
	Is the voltage less than 10 volts? **Yes** Repair the circuit from the ECM control relay to the engine compartment fuse box. CLEAR the DTC. TEST the system for normal operation. **No** Repair the circuit between the engine compartment fuse box and the HO2S. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST K : P0151, P0152, P0153, P1647. LEFT-HAND BANK HO2S	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
K1: CHECK THE CONSTANT CIRCUIT OF THE LEFT-HAND BANK HO2S FOR OPEN CIRCUIT	
	1 Disconnect the HO2S electrical connector EN32.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between EN16, pin 108 (P) and EN32, pin 4 (P).
	Is the resistance less than 5 ohms? **Yes** GO to K2. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
K2: CHECK THE CONSTANT CIRCUIT OF THE LEFT-HAND BANK HO2S FOR SHORT TO GROUND	
	1 Measure the resistance between EN16, pin 108 (P) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to K3.
K3: CHECK THE CONSTANT CIRCUIT OF THE LEFT-HAND BANK HO2S FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between EN32, pin 4 (P) and GROUND.
	Is the voltage greater than 5 volts? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to K4.

K4: CHECK THE VARIABLE CIRCUIT OF THE LEFT-HAND BANK HO2S FOR OPEN CIRCUIT	
	1 Disconnect the HO2S electrical connector EN32.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between EN16, pin 107 (Y) and EN32, pin 3 (Y)
	Is the resistance less than 5 ohms? **Yes** GO to K5. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
K5: CHECK THE VARIABLE CIRCUIT OF THE LEFT-HAND BANK HO2S FOR SHORT TO GROUND	
	1 Measure the resistance between EN16, pin 107 (Y) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to K6.
K6: CHECK THE VARIABLE CIRCUIT OF THE LEFT-HAND BANK HO2S FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between EN32 pin 3 (Y) and GROUND.
	Is the voltage greater than 5 volts? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new left-hand HO2S. REFER to: Heated Oxygen Sensor (HO2S) LH (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST L : DTC P0057, P0058, P0157, P0158, P0159, P0160. LEFT-HAND BANK CATALYST MONITOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
L1: CHECK THE POWER SUPPLY CIRCUIT TO THE LEFT-HAND BANK CATALYST MONITOR HEATER	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the catalyst monitor sensor electrical connector EN9.
	3 Turn the ignition switch to the ON position.
	4 Measure the voltage between the catalyst monitor sensor electrical connector EN9 pin 2 (WR) and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to L6. **No** GO to L2.
L2: CHECK CONTINUITY OF THE LEFT-HAND BANK CATALYST MONITOR SENSOR GROUND CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between the catalyst monitor sensor electrical connector EN9 pin 3 (W) and EN16, pin 130.
	Is the resistance less than 5 ohms? **Yes** GO to L3. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
L3: CHECK CONTINUITY OF THE POWER SUPPLY WIRE TO THE LEFT-HAND BANK CATALYST MONITOR SENSOR	
	1 Measure the resistance between the catalyst monitor sensor electrical connector EN9 pin 4 (N) and the ECM electrical connector EN16 pin 129 (N).
	Is the resistance less than 5 ohms? **Yes** GO to L4. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
L4: CHECK THE LEFT-HAND BANK CATALYST MONITOR SENSOR POWER SUPPLY WIRE FOR A SHORT TO GROUND	
	1 Measure the resistance between the catalyst monitor sensor electrical connector EN9 pin 4 (N) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to ground. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to L5.
L5: CHECK THE LEFT-HAND BANK CATALYST MONITOR SENSOR POWER SUPPLY WIRE FOR A SHORT TO BATTERY	
	1 Measure the voltage between the catalyst monitor sensor electrical connector EN9 pin 4 (N) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new left-hand bank catalyst monitor sensor. For additional information, REFER to: Catalyst Monitor Sensor LH (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information,

	REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support.
L6: CHECK THE LEFT-HAND BANK CATALYST MONITOR SENSOR POWER SUPPLY CIRCUIT	
	1 Measure the voltage between the catalyst monitor sensor electrical connector EN9 pin 2 (WR) and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to L8. **No** GO to L7.
L7: CHECK CONTINUITY OF THE LEFT-HAND BANK CATALYST MONITOR SENSOR HEATER GROUND CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between the catalyst monitor sensor electrical connector EN9 pin 1 (UY) and the ECM electrical connector EN16 pin 93 (UY).
	Is the resistance less than 5 ohms? **Yes** INSTALL a new ECM. For additional information, REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
L8: CHECK FUSE 42 OF THE ENGINE COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to L10. **No** GO to L9.
L9: CHECK FUSE 42 OF THE ENGINE COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB34 pin 105 of the engine compartment fuse box and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the engine compartment fuse box and the left-hand bank HO2S. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. Check the circuit for cause of fuse failure. CLEAR the DTC. TEST the system for normal operation.
L10: CHECK THE POWER SUPPLY TO FUSE 42 IN THE ENGINE COMPARTMENT FUSE BOX	
	1 Measure the voltage between Fuse 42 electrical connector JB34 pin 105 and GROUND.
	Is the voltage less than 10 volts? **Yes** Repair the circuit from the ECM control relay to the engine compartment fuse box. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Repair the circuit between the engine compartment fuse box and the HO2S. For additional information, refer to wiring diagrams.

PINPOINT TEST M : DTC P0101, P0102, P0103, P1104. MASS AIR FLOW SENSOR (MAF)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
M1: CHECK THE MAF SENSOR POWER SUPPLY	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the MAF sensor electrical connector EN6.
	3 Turn the ignition switch to the ON position.
	4 Measure the voltage between the MAF sensor electrical connector EN6 pin 1 (GU) and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to M5. **No** GO to M2.
M2: CHECK CONTINUITY OF THE MAF SENSOR GROUND CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between the MAF sensor electrical connector EN6 pin 3 (GW) and the ECM electrical connector EN16 pin 44 (GW).
	Is the resistance less than 5 ohms? **Yes** GO to M3. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
M3: CHECK CONTINUITY OF THE MAF SENSOR GROUND CIRCUIT	
	1 Measure the resistance between the MAF sensor electrical connector EN6 pin 2 (BW) and the ECM electrical connector EN16 pin 45 and pin 46 (BW).
	Is the resistance less than 5 ohms? **Yes** GO to M4. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
M4: CHECK THE MAF SENSOR CIRCUIT FOR SHORT TO GROUND	
	1 Measure the resistance between the MAF sensor electrical connector EN6 pin 3 (GW) and GROUND.

	Is the resistance greater than 10,000 ohms? **Yes** INSTALL a new MAF sensor. For additional information, REFER to: Mass Air Flow (MAF) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support. **No** REPAIR the short to ground. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
M5: CHECK FUSE 36 OF THE ENGINE COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to M7. **No** GO to M6.
M6: CHECK FUSE 36 OF THE ENGINE COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB34 pin 93 of the engine compartment fuse box and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the engine compartment fuse box and the MAF sensor. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. Check the circuit for cause of fuse failure. CLEAR the DTC. TEST the system for normal operation.
M7: CHECK THE POWER SUPPLY FROM FUSE 36 IN THE ENGINE COMPARTMENT FUSE BOX TO THE MAF SENSOR	
	1 Measure the voltage between the engine compartment fuse box electrical connector JB34 pin 93 and GROUND.
	Is the voltage less than 10 volts? **Yes** Repair the circuit from the engine compartment fuse box to the MAF sensor. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Recheck DTCs.

PINPOINT TEST N : P0111, P0112, P0113. IAT SENSOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
N1: CHECK CONTINUITY OF THE INTAKE AIR TEMPERATURE (IAT) SENSOR POWER SUPPLY CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the MAF sensor electrical connector EN6.
	3 Disconnect the ECM electrical connector EN16.
	4 Measure the resistance between the MAF sensor electrical connector EN6 pin 4 (O) and the ECM electrical connector EN16, pin 71 (O).
	Is the resistance less than 5 ohms? **Yes** GO to N2. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
N2: CHECK CONTINUITY OF THE IAT SENSOR CIRCUIT	
	1 Measure the resistance between the MAF sensor electrical connector EN6 pin 5 (BG) and the ECM electrical connector EN16, pin 19 (BG).
	Is the resistance less than 5 ohms? **Yes** GO to N4. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
N3: CHECK THE IAT SENSOR CIRCUIT FOR SHORT TO BATTERY	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the MAF sensor electrical connector EN6.
	3 Check for a voltage between EN6 pin 5 (BG) and GROUND.
	Is the voltage greater than 1 volt? **Yes** GO to N1. **No** INSTALL a new MAF sensor. REFER to: Mass Air Flow (MAF) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.
N4: CHECK THE IAT SENSOR POWER SUPPLY CIRCUIT FOR SHORT TO GROUND	
	1 Measure the resistance between the MAF sensor electrical connector EN6 pin 4 (O) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to N5.
N5: CHECK THE IAT SENSOR GROUND CIRCUIT FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector, EN16.
	2 Turn the ignition switch to the ON position.
	3 Check for voltage at EN6 pin 5 (BG)

	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new MAF sensor. REFER to: Mass Air Flow (MAF) Sensor (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST O : DTC P0051, P0052. LEFT-HAND BANK H02S HEATER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
O1: CHECK THE POWER SUPPLY CIRCUIT TO THE LEFT-HAND BANK HO2S HEATER	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the HO2S electrical connector EN32 pin 2 (WR) and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to O4. **No** GO to O2.
O2: CHECK THE GROUND CIRCUIT TO THE LEFT-HAND BANK HO2S HEATER	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between the HO2S electrical connector EN32 pin 1 (GO) and the ECM electrical connector EN16 pins 55 and 56 (GO).
	Is the resistance of each wire less than 5 ohms? **Yes** GO to O3. **No** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation.
O3: CHECK THE LEFT-HAND BANK HO2S CIRCUIT FOR SHORT TO GROUND	
	1 Measure the resistance between the HO2S electrical connector EN32 pin 1 (GO) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to ground. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new left-hand bank HO2S. For additional information, REFER to: Heated Oxygen Sensor (HO2S) LH (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR DTCs. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support.
O4: CHECK FUSE 42 OF THE ENGINE COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to O6. **No** GO to O5.
O5: CHECK FUSE 42 OF THE ENGINE COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB34 pin 105 of the engine compartment fuse box and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the engine compartment fuse box and the left-hand bank HO2S. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. Check the circuit for cause of fuse failure. CLEAR the DTC. TEST the system for normal operation.
O6: CHECK THE POWER SUPPLY TO FUSE 42 IN THE ENGINE COMPARTMENT FUSE BOX	
	1 Measure the voltage between fuse 42, electrical connector JB34 pin 105 and GROUND.
	Is the voltage less than 10 volts? **Yes** Repair the circuit from the ECM control relay to the engine compartment fuse box. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Repair the circuit between the engine compartment fuse box and the HO2S. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST P : DTC P1606. ECM RELAY.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
P1: CHECK THE ECM CONTROL RELAY	
	1 Turn the ignition switch to the ON position.
	Does the ECM relay make an audible click? **Yes** GO to P2. **No** GO to P6.
P2: CHECK FOR POWER SUPPLY FROM THE ECM CONTROL RELAY	
	1 Measure the voltage between the ECM control relay JB34 pin 131 and GROUND.

	Is the voltage less than 10 volts? **Yes** GO to P3. **No** REPAIR the circuit from the ECM control relay to the ECM. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
P3: CHECK FUSE 9 IN THE ENGINE COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to P4. **No** INSTALL a new fuse. Check the circuit for cause of fuse failure. CLEAR the DTC. TEST the system for normal operation.
P4: CHECK THE POWER SUPPLY TO FUSE 9 IN THE ENGINE COMPARTMENT FUSE BOX	
	1 Measure the voltage between Fuse 9 electrical connector JB34 pin 75 and GROUND.
	Is the voltage less than 10 volts? **Yes** Repair the circuit from the battery positive to the engine compartment fuse box. CLEAR the DTC. TEST the system for normal operation. **No** GO to P5.
P5: CHECK THE POWER SUPPLY FROM FUSE 9 IN THE ENGINE COMPARTMENT FUSE BOX TO THE ECM CONTROL RELAY	
	1 Measure the voltage between the ECM control relay electrical connector JB34 pin 132 and GROUND.
	Is the voltage less than 10 volts? **Yes** Repair the circuit from the engine compartment fuse box to the ECM control relay. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new ECM control relay. For additional information, refer to the electrical guide. CLEAR the DTC. TEST the system for normal operation.
P6: CHECK FUSE 31 OF THE ENGINE COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to P7. **No** GO to P10.
P7: CHECK POWER SUPPLY TO THE ECM CONTROL RELAY FROM FUSE 31 OF THE ENGINE COMPARTMENT FUSE BOX	
	1 Measure the voltage between ECM relay electrical connector JB34 pin 133 and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to P8. **No** GO to P12.
P8: CHECK CONTINUITY OF THE ECM CONTROL RELAY GROUND CIRCUIT	
	1 Disconnect the ECM electrical connector EN16. 2 Remove the ECM control relay from the engine compartment fuse box. 3 Measure the resistance between the ECM electrical connector EN16 pin 40 and JB34 pin 134 of the engine compartment fuse box.
	Is the resistance less than 5 ohms? **Yes** GO to P9. **No** REPAIR the circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the power distribution fuse box and the EMS relay and diode.)
P9: CHECK CONTINUITY OF THE ECM CONTROL RELAY WINDING	
	1 Measure the resistance of the ECM control relay winding between pins 1 and 2 of the ECM control relay.
	Is the resistance less than 60 ohms? **Yes** INSTALL a new ECM control relay. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support. CLEAR the DTC. TEST the system for normal operation.
P10: CHECK FUSE 31 OF THE ENGINE COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB34 pin 83 of the engine compartment fuse box and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to GROUND between the engine compartment fuse box and the ECM control relay. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. CLEAR the DTC. TEST the system for normal operation.
P11: CHECK FUSE 9 OF THE ENGINE COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB34 pin 132 of the engine compartment fuse box and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the engine compartment fuse box and the ECM control relay. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. CLEAR the DTC. TEST the system for normal operation.
P12: CHECK THE ECM CONTROL RELAY DIODE	
	1 Remove the ECM control relay diode from the engine compartment fuse box. 2 Measure the continuity of ECM control relay diode.

	Is the resistance less than 5 ohms? **Yes** Possible intermittent fault. Recheck DTCs. **No** INSTALL a new ECM control relay diode. Make sure that the ECM control relay diode is installed correctly. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST Q : P0106, P0107, P0108. MAP SENSOR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Q1: CHECK THE GROUND CIRCUIT TO THE MAP SENSOR	
	1 Disconnect the MAP sensor electrical connecter EN8.
	2 Measure the resistance between the MAP sensor electrical connecter EN8 pin 4 (BG) and GROUND. ● Reconnect electrical connectors following test.
	Is the resistance less than 5 ohms? **Yes** GO to Q2. **No** REPAIR the circuit between the MAP sensor and GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
Q2: CHECK THE POWER SUPPLY CIRCUIT TO THE MAP SENSOR FOR SHORT TO BATTERY	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the MAP sensor electrical connector EN8 pin 2 (OY) and GROUND.
	Is the voltage greater than 6 volts? **Yes** REPAIR the short to battery. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to Q3.
Q3: CHECK THE POWER SUPPLY CIRCUIT TO THE MAP SENSOR FOR SHORT TO GROUND	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between the MAP sensor electrical connector EN8 pin 2 (OY) and GROUND.
	Is the voltage less than 4 volts? **Yes** REPAIR the short to GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to Q4.
Q4: CHECK CONTINUITY OF THE MAP SENSOR SIGNAL WIRE	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the MAP sensor electrical connector EN8.
	3 Disconnect the ECM electrical connector EN16.
	4 Measure the resistance of the circuit between MAP sensor electrical connector EN8 pin 1 (BW) and ECM electrical connector EN16 pin 127 (BW).
	Is the resistance less than 5 ohms? **Yes** GO to Q5. **No** REPAIR the circuit between the MAP sensor electrical connector EN8 pin 1 (BW) and ECM electrical connector EN16 pin 127 (BW). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
Q5: CHECK THE MAP SENSOR SIGNAL WIRE FOR SHORT TO GROUND	
	1 Disconnect the ECM electrical connector EN16.
	2 Disconnect the MAP sensor electrical connector EN8.
	3 Measure the resistance between EN8 pin 1 (BW) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (The fault could be in any of the components or sensors in the 5 volt supply circuit, or the ECM.) **No** GO to Q6.
Q6: CHECK THE MAP SENSOR SIGNAL WIRE FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Check for a voltage at EN8 pin 1 (BW).
	Is the voltage greater than 10 volts? **Yes** Repair the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (The fault could be in any of the components or sensors in the 5 volt supply circuit, or the ECM.) **No** INSTALL a new MAP sensor. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST R : P0010, P1384. VVT RIGHT-HAND BANK	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
R1: CHECK THE GROUND CIRCUIT TO THE RIGHT-HAND BANK VVT SOLENOID	
	1 Disconnect the VVT solenoid electrical connector EN61.
	2 Measure the resistance between the VVT solenoid electrical connector EN61 pin 2 (BG) and GROUND.

	Is the resistance less than 5 ohms? **Yes** GO to R2. **No** REPAIR the circuit between VVT solenoid electrical connector EN61 pin 2 (BG) and GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
R2: CHECK CONTINUITY OF THE RIGHT-HAND BANK VVT SOLENOID SIGNAL WIRE	
	1 Measure the resistance between VVT solenoid electrical connector EN61 pin 1 (RW) and ECM electrical connector EN16 pin 109 (RW).
	Is the resistance less than 5 ohms? **Yes** GO to R3. **No** REPAIR the circuit between VVT solenoid electrical connector EN61 pin 1 (RW) and ECM electrical connector EN16 pin 109 (RW). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
R3: CHECK FOR SHORT TO GROUND AT THE RIGHT-HAND BANK VVT SOLENOID SIGNAL WIRE	
	1 Disconnect the ECM electrical connector EN16.
	2 Measure the resistance between EN61 pin 1 (RW) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to R4.
R4: CHECK FOR SHORT TO BATTERY AT THE RIGHT-HAND BANK VVT SOLENOID SIGNAL WIRE	
	1 TURN the ignition switch to the ON position.
	2 Check for a voltage at EN61 pin 1 (RW).
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new right-hand bank VVT solenoid. REFER to: Variable Camshaft Timing (VCT) Oil Control Solenoid (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST S : P0020, P1396. VVT LEFT-HAND BANK	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
S1: CHECK GROUND CIRCUIT TO THE LEFT-HAND BANK VVT SOLENOID	
	1 Disconnect the VVT solenoid electrical connector, EN42.
	2 Measure the resistance between the VVT solenoid electrical connector EN42 pin 2 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to S2. **No** REPAIR the circuit between VVT solenoid electrical connector EN42 pin 2 (BG) and GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
S2: CHECK CONTINUITY OF THE LEFT-HAND BANK VVT SOLENOID SIGNAL WIRE.	
	1 Measure the resistance between VVT solenoid electrical connector EN42 pin 1 (G) and ECM electrical connector EN16 pin 110 (G).
	Is the resistance less than 5 ohms? **Yes** GO to S3. **No** REPAIR the circuit between VVT solenoid electrical connector EN42 pin 1 (G) and ECM electrical connector EN16 pin 110 (G). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
S3: CHECK FOR SHORT TO GROUND AT THE LEFT-HAND BANK VVT SOLENOID SIGNAL WIRE	
	1 Disconnect the ECM electrical connector EN16.
	2 Measure the resistance between EN61 pin 1 (RW) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to S4.
S4: CHECK FOR SHORT TO BATTERY AT THE LEFT-HAND BANK VVT SOLENOID SIGNAL WIRE	
	1 TURN the ignition switch to the ON position.
	2 Check for a voltage at EN61 pin 1 (RW).
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new left-hand bank VVT solenoid. REFER to: Variable Camshaft Timing (VCT) Oil Control Solenoid (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST T : P1251, P1631, P1657, P1658. THROTTLE MOTOR RELAY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
T1: CHECK THE POWER SUPPLY CIRCUIT TO THE THROTTLE MOTOR RELAY	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between pin 1 of the throttle motor relay base and GROUND.

	Is the voltage greater than 10 volts? **Yes** GO to T2. **No** REPAIR the circuit between pin 1 of the throttle motor relay base and the EMS control relay. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
T2: CHECK CONTINUITY OF THE THROTTLE MOTOR RELAY SIGNAL WIRE	
	1 Turn the ignition switch to the OFF position.
	2 Measure the resistance between the throttle motor relay base, pin 2 and the ECM electrical connector EN16 pin 52 (GR).
	Is the resistance less than 5 ohms? **Yes** GO to T3. **No** REPAIR the circuit between the throttle motor relay base pin 2 and the ECM electrical connector EN16 pin 52 (GR). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
T3: CHECK THE THROTTLE MOTOR RELAY SIGNAL WIRE FOR SHORT TO BATTERY	
	1 Turn the ignition switch to the OFF position.
	2 Remove the throttle motor relay.
	3 Disconnect the ECM electrical connector EN16.
	4 Check for a voltage between the throttle motor relay base pin 2 and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to T4.
T4: CHECK THE THROTTLE MOTOR RELAY SIGNAL WIRE FOR SHORT TO GROUND	
	1 Measure the resistance between the throttle motor relay base pin 2 and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to T5.
T5: CHECK CONTINUITY OF THE THROTTLE MOTOR RELAY OUTPUT WIRE	
	1 Test for continuity between throttle motor relay base pin 5 and ECM electrical connector EN16 pin 134 (RW).
	Is the circuit continuous? **Yes** INSTALL a new throttle motor relay. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing a ECM, contact Dealer technical support. **No** REPAIR the circuit between throttle motor relay base pin 2 and ECM electrical connector EN16 pin 134 (RW). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
T6: CHECK THE THROTTLE MOTOR RELAY OUTPUT WIRE FOR SHORT TO BATTERY	
	1 Check for a voltage between the throttle motor relay base pin 5 and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short to battery. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to T7.
T7: CHECK THE THROTTLE MOTOR RELAY OUTPUT WIRE FOR SHORT TO GROUND	
	1 Measure the resistance between the throttle motor relay base pin 5 and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new throttle motor relay. For additional information, refer to the electrical guide. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST U : P1549. IMT VALVE 1	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
U1: CHECK THE POWER SUPPLY CIRCUIT TO THE IMT VALVE 1	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between IMT valve 1 electrical connector EN999 pin 1 (NG) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to U2. **No** REPAIR the circuit between the IMT valve 1 electrical connector EN999 pin 1 (NG) and the Battery power bus 2. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the power distribution fuse box and the EMS control relay. For additional information, refer to wiring diagrams.)
U2: CHECK CONTINUITY OF THE IMT VALVE 1 SIGNAL WIRE.	
	1 Disconnect the ECM electrical connector EN16.
	2 Measure the resistance between the IMT valve 1 electrical connector EN999 pin 2 (OY) and the ECM electrical connector EN16 pin 38 (OY).

	Is the resistance less than 5 ohms? **Yes** GO to U3. **No** REPAIR the circuit between the IMT valve 1 electrical connector EN999 pin 2 (OY) and the ECM electrical connector EN16 pin 38 (OY). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
U3: CHECK IMT VALVE SIGNAL WIRE FOR SHORT TO GROUND	
	1 Measure the resistance between EN999 pin 2 (OY) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to U4.
U4: CHECK IMT VALVE SIGNAL WIRE FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Check for a voltage at EN999 pin 2 (OY).
	Is the voltage greater than 10 volts? **Yes** REPAIR the short to battery. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new IMT valve. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST V : P1532. IMT VALVE 2	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
V1: CHECK THE POWER SUPPLY CIRCUIT TO THE IMT VALVE 2	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between IMT valve 2 electrical connector EN998 pin 1 (NG) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to V2. **No** REPAIR the circuit between the IMT valve 2 electrical connector EN998 pin 1 (NG) and the Battery power bus 2. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the power distribution fuse box and the EMS control relay. For additional information, refer to wiring diagrams.)
V2: CHECK CONTINUITY OF THE IMT VALVE 2 SIGNAL WIRE	
	1 Disconnect the ECM electrical connector EN16.
	2 Measure the resistance between the IMT valve 2 electrical connector EN998 pin 2 (OY) and the ECM electrical connector EN16 pin 39 (OY).
	Is the resistance less than 5 ohms? **Yes** GO to V3. **No** REPAIR the circuit between the IMT valve 2 electrical connector EN998 pin 2 (OY)and the ECM electrical connector EN16 pin 39 (OY). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
V3: CHECK IMT VALVE SIGNAL WIRE FOR SHORT TO GROUND	
	1 Measure the resistance between EN998 pin 2 (OY) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short to GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to V4.
V4: CHECK IMT VALVE SIGNAL WIRE FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Check for a voltage at EN998 pin 2 (OY).
	Is the voltage greater than 10 volts? **Yes** REPAIR the short to battery. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new IMT valve. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST W : P1582. FLIGHT RECORDER DATA STORED	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
W1: EXTRACT THE FLIGHT RECORDER DATA	
	• NOTE: Flight recorder data can only be extracted using the Jaguar approved diagnostic system, where available. 1 Connect the Jaguar approved diagnostic system, or code reader.
	Is DTC P1582 stored? **Yes** Refer to dealer technical support for information on extracting data. **No**

	Test not applicable.

PINPOINT TEST X : P1243. SENSOR GROUND CIRCUITS.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
X1: CHECK THE GROUND CIRCUIT TO THE ECT SENSOR	
	1 Measure the resistance between ECT sensor electrical connector EN18 pin 1 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to X2. **No** REPAIR the circuit between the ECT sensor electrical connector EN18 pin 1 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams.)
X2: CHECK THE GROUND CIRCUIT TO THE EOT SENSOR	
	1 Measure the resistance between EOT sensor electrical connector EN25 pin 2 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to X3. **No** REPAIR the circuit between the EOT sensor electrical connector EN25 pin 2 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams.)
X3: CHECK THE GROUND CIRCUIT TO THE IP SENSOR	
	1 Measure the resistance between IP sensor electrical connector IJ7 pin 2 (WG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to X4. **No** REPAIR the circuit between the IP sensor electrical connector IJ7 pin 2 (WG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams.)
X4: CHECK THE GROUND CIRCUIT TO THE EFT SENSOR	
	1 Measure the resistance between EFT sensor electrical connector IJ8 pin 1 (NU) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to X5. **No** REPAIR the circuit between the EFT sensor electrical connector IJ8 pin 1 (NU) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams.)
X5: CHECK THE GROUND CIRCUIT TO THE MAP SENSOR	
	1 Measure the resistance between MAP sensor electrical connector EN8 pin 4 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to X6. **No** REPAIR the circuit between the MAP sensor electrical connector EN8 pin 4 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams.)
X6: CHECK THE GROUND CIRCUIT TO THE FTP SENSOR	
• NOTE: Access to the FTP sensor involves the removal of the fuel tank. To reduce the amount of work necessary, a slave harness could be used. This can be connected at the access port beneath the rear seat. Tests can then be carried out via the slave harness and sensor. If system operation is normal with the slave harness and sensor, the fault lies in the vehicle's harness or sensor.	
	1 Measure the resistance between FTP sensor electrical connector FT1 pin 3 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to X7. **No** REPAIR the circuit between the FTP Sensor electrical connector FT1 pin 3 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams.)
X7: CHECK THE GROUND CIRCUIT TO THE APP SENSOR (TRACK 1)	
	1 Measure the resistance between APP sensor electrical connector PA1 pin 3 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to X8. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 3 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams.)
X8: CHECK THE GROUND CIRCUIT TO THE TP SENSOR	
	1 Measure the resistance between TP sensor electrical connector EN13 pin 1 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to X9. **No** REPAIR the circuit between the TP sensor electrical connector EN13 pin 1 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams.)
X9: CHECK THE GROUND CIRCUIT TO THE APP SENSOR (TRACK 3)	
	1 Measure the resistance between APP sensor electrical connector PA1 pin 6 (BG) and GROUND.

	Is the resistance less than 5 ohms? **Yes** GO to X10. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 6 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams.)
X10: CHECK THE GROUND CIRCUIT TO THE AIR CONDITIONING PRESSURE SENSOR	
	1 Measure the resistance between ACP sensor electrical connector JB106 pin 1 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** No electrical fault in ground circuit. Recheck DTCs. **No** REPAIR the circuit between the ACP sensor electrical connector JB106 pin 1 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams.)

PINPOINT TEST Y : P0480. RADIATOR COOLING FAN MODULE DRIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Y1: CHECK THE PULSE WIDTH MODULATED SIGNAL TO THE COOLING FAN MODULE	
	1 Disconnect the radiator cooling fan module electrical connector PWM1.
	2 RUN the engine to a temperature at which the cooling fans would operate.
	3 Using a suitable meter, test for a pulse width modulated signal at PWM1 pin 3 (WU).
	Is a PWM signal present? **Yes** INSTALL a new cooling fan module. CLEAR the DTC. TEST the system for normal operation. **No** GO to Y2.
Y2: CHECK CONTINUITY OF THE RADIATOR COOLING FAN MODULE SIGNAL WIRE	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16.
	3 Measure the resistance between the radiator cooling fan module electrical connector PWM1 pin 3 (WU) and the ECM electrical connector EN16 pin 51 (WU).
	Is the resistance less than 5 ohms? **Yes** INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support. **No** REPAIR the circuit between the radiator cooling fan module electrical connector PWM1 pin 3 (WU) and the ECM electrical connector EN16 pin 51 (WU). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST Z : P0226, P0227, P0228. APP SENSOR (TRACK 1)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Z1: CHECK THE POWER SUPPLY CIRCUIT TO THE APP SENSOR. TRACK 1	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between APP sensor electrical connector PA1 pin 2 (Y) and GROUND.
	Is the voltage greater than 4volts? **Yes** GO to Z2. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 2 (Y) and the sensor 5 volt supply 2. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM, EMS control relay, and power distribution fuse box. For additional information, refer to wiring diagrams.)
Z2: CHECK THE GROUND CIRCUIT TO THE APP SENSOR	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect APP Sensor electrical connector PA1.
	3 Measure the resistance between APP sensor electrical connector PA1 pin 6 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to Z5. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 6 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams.)
Z3: CHECK THE GROUND CIRCUIT TO THE APP SENSOR. FOR CONTINUITY	
	1 Disconnect the ECM electrical connector EN16.
	2 Disconnect the APP sensor electrical connector PA1.
	3 Measure the resistance between EN16 pin 20 (BG) and PA1 pin 6 (BG).
	Is the resistance less than 5 ohms? **Yes** GO to Z4. **No** REPAIR the circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
Z4: CHECK THE GROUND CIRCUIT TO THE APP SENSOR. FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Check for a voltage at PA1 pin 6 (BG).

	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to Z5.
Z5: CHECK CONTINUITY OF THE APP SENSOR SIGNAL WIRE	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the APP sensor electrical connector PA1.
	3 Measure the resistance between APP sensor electrical connector PA1 pin 4 (R) and the ECM electrical connector EN16 pin 102 (R).
	Is the resistance less than 5 ohms? **Yes** GO to Z6. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 4 (R) and the ECM electrical connector EN16 pin 102 (R). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
Z6: CHECK CONTINUITY OF THE APP SENSOR POTENTIOMETER	
	1 Measure the resistance between APP sensor electrical connector PA1 pins 4 and 6.
	2 Operate the accelerator pedal through it's full range while observing the resistance reading.
	Does the resistance vary as the pedal is operated? **Yes** INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support. **No** INSTALL a new accelerator pedal position sensor, REFER to: Accelerator Pedal (310-02 Acceleration Control, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST AA : P2122, P2123. APP SENSOR (TRACK 3)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AA1: CHECK THE POWER SUPPLY CIRCUIT TO THE APP SENSOR. TRACK 3	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between APP sensor electrical connector PA1 pin 1 (Y) and GROUND.
	Is the voltage greater than 4 volts? **Yes** GO to AA2. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 1 (Y) and the sensor 5 volt supply. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM, EMS control relay, and power distribution fuse box. For additional information, refer to wiring diagrams. This supply is also linked to other sensors. The fault could be in any of these or their wiring.)
AA2: CHECK THE GROUND CIRCUIT TO THE APP SENSOR	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the APP sensor electrical connector PA1.
	3 Measure the resistance between APP sensor electrical connector PA1 pin 3 (BG) and GROUND.
	Is the resistance less than 5 ohms? **Yes** GO to AA5. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 3 (BG) and GROUND. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ECM. For additional information, refer to wiring diagrams.)
AA3: CHECK THE GROUND CIRCUIT TO THE APP SENSOR FOR CONTINUITY	
	1 Disconnect the ECM electrical connector EN16.
	2 Disconnect the APP sensor electrical connector PA1.
	3 Measure the resistance between EN16 pin 19 (BG) and PA1 pin 3 (BG).
	Is the resistance less than 5 ohms? **Yes** GO to AA4. **No** REPAIR the circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
AA4: CHECK THE GROUND CIRCUIT TO THE APP SENSOR FOR SHORT TO BATTERY	
	1 Connect the ECM electrical connector EN16.
	2 Turn the ignition switch to the ON position.
	3 Check for a voltage at PA1 pin 3 (BG).
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AA5.
AA5: CHECK CONTINUITY OF THE APP SENSOR SIGNAL WIRE	
	1 Measure the resistance between APP sensor electrical connector PA1 pin 1 (Y) and the ECM electrical connector EN16 pin 103 (Y).
	Is the resistance less than 5 ohms? **Yes** GO to AA6. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 1 (Y) and the ECM electrical connector EN16 pin 103 (Y). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

AA6: CHECK CONTINUITY OF THE APP SENSOR POTENTIOMETER	
	1 Measure the resistance between APP sensor electrical connector PA1 pins 1 and 3. 2 Operate the accelerator pedal through it's full range while observing the resistance reading.
	Does the resistance vary as the pedal is operated? **Yes** INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing a ECM, contact Dealer technical support. **No** INSTALL a new accelerator pedal position sensor, REFER to: Accelerator Pedal (310-02 Acceleration Control, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST AB : P0512, P1245. IGNITION SWITCH CRANK SIGNAL	
WARNING: Make sure the starter motor does not engage in the course of these tests. Failure to follow these instructions may result in personal injury.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AB1: CHECK THE START INPUT TO THE ECM	
	1 Move the gear selector to the N position. 2 Disconnect the ECM electrical connector EN16. 3 Remove the starter relay from the power distribution fuse box. 4 Turn the ignition switch to the CRANK position. 5 Measure the voltage between EN16 pin 6 (Y) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to AB2. **No** REPAIR the circuit between the ECM and the battery. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ignition switch and the power distribution fuse box. [Fuse 28].)
AB2: CHECK THE START INPUT TO THE STARTER RELAY	
	1 Turn the ignition switch to the START position and hold. 2 Measure the voltage between the starter relay base (R10) pin 1 and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to AB3. **No** REPAIR the circuit between the starter relay base and the battery. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ignition switch and the power distribution fuse box.)
AB3: CHECK THE START INPUT WIRE FOR SHORT TO BATTERY AT ECM	
	1 Turn the ignition switch to the ON position. 2 Measure the voltage between EN16 pin 6 (Y) and GROUND.
	Is the voltage greater than 10 volts? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AB4.
AB4: CHECK THE START INPUT WIRE FOR SHORT TO BATTERY AT RELAY	
	1 Turn the ignition switch to the ON position. 2 Measure the voltage between the starter relay base pin 1 and GROUND.
	Is the voltage greater than 10 volts? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AB5.
AB5: CHECK THE STARTER RELAY INPUT FROM THE ECM FOR CONTINUITY	
	1 Measure the resistance between EN16 pin 41 (GO) and relay base pin 2.
	Is the resistance less than 5 ohms? **Yes** GO to AB6. **No** REPAIR the open circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
AB6: CHECK THE STARTER RELAY INPUT FROM THE ECM FOR SHORT TO GROUND	
	1 Disconnect ignition switch electrical connector IP18. 2 Measure the resistance between EN16 pin 41 (GO) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AB7.
AB7: CHECK THE STARTER RELAY INPUT FROM THE ECM FOR SHORT TO BATTERY	
	1 Measure the voltage between the starter relay base pin 2 and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new starter relay. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system

	for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Before replacing an ECM, contact dealer technical support.

PINPOINT TEST AC : P0561, P0562, P0563. SENSOR POWER SUPPLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AC1: CHECK THE POWER SUPPLY CIRCUIT TO THE IP SENSOR	
	1 Disconnect the IP sensor electrical connector, IJ7.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between IP sensor electrical connector IJ7 pin 1 (YG) and GROUND.
	Is the voltage greater than 4 volts? **Yes** GO to AC2. **No** REPAIR the circuit between the IP sensor electrical connector IJ7 pin 1 (YG) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The fault could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams.)
AC2: CHECK THE POWER SUPPLY CIRCUIT TO THE IP SENSOR FOR SHORT TO BATTERY	
	1 Measure the voltage between IP sensor electrical connector IJ7 pin 1 (YG) and GROUND.
	Is the voltage greater than 6 volts? **Yes** REPAIR the circuit between the IP sensor electrical connector IJ7 pin 1 (YG) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The short could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams.) **No** GO to AC3.
AC3: CHECK THE POWER SUPPLY CIRCUIT TO THE MAP SENSOR	
	1 Disconnect the MAP sensor electrical connector EN8.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between MAP sensor electrical connector EN8 pin 2 (OY) and GROUND.
	Is the voltage greater than 4 volts? **Yes** GO to AC4. **No** REPAIR the circuit between the MAP sensor electrical connector EN8 pin 2 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The fault could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams.)
AC4: CHECK THE POWER SUPPLY CIRCUIT TO THE MAP SENSOR FOR SHORT TO BATTERY	
	1 Measure the voltage between MAP sensor electrical connector EN8 pin 2 (OY) and GROUND.
	Is the voltage greater than 6 volts? **Yes** REPAIR the circuit between the MAP sensor electrical connector EN8 pin 2 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The short could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams.) **No** GO to AC5.
AC5: CHECK THE POWER SUPPLY CIRCUIT TO THE FTP SENSOR	
• NOTE: Access to the FTP sensor involves the removal of the fuel tank. To reduce the amount of work necessary, a slave harness could be used. This can be connected at the access port beneath the rear seat. Tests can then be carried out via the slave harness and sensor. If system operation is normal with the slave harness and sensor, the fault lies in the vehicle's harness or sensor.	
	1 Disconnect the FTP sensor electrical connector FT1. (See note above).
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between FTP sensor electrical connector FT1 pin 1 (OY) and GROUND.
	Is the voltage greater than 4 volts? **Yes** GO to AC6. **No** REPAIR the circuit between the FTP sensor electrical connector FT1 pin 1 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The fault could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams.)
AC6: CHECK THE POWER SUPPLY CIRCUIT TO THE FTP SENSOR FOR SHORT TO BATTERY	
	1 Measure the voltage between FTP sensor electrical connector FT1 pin 1 (OY) and GROUND.
	Is the voltage greater than 6 volts? **Yes** REPAIR the circuit between the FTP sensor electrical connector FT1 pin 1 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The short could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams.) **No** GO to AC7.
AC7: CHECK THE POWER SUPPLY CIRCUIT TO THE APP SENSOR	
	1 Disconnect the APP sensor electrical connector.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between APP sensor electrical connector PA1 pin 5 (OY) and GROUND.
	Is the voltage greater than 4 volts? **Yes** GO to AC8. **No** REPAIR the circuit between the APP sensor electrical connector PA1 pin 5 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The fault could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams.)
AC8: CHECK THE POWER SUPPLY CIRCUIT TO THE APP SENSOR FOR SHORT TO BATTERY	

	1 Measure the voltage between APP sensor electrical connector PA1 pin 5 (OY) and GROUND.
	Is the voltage greater than 6 volts? **Yes** REPAIR the circuit between the APP sensor electrical connector PA1 pin 5 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The short could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams.) **No** GO to AC9.
AC9: CHECK THE POWER SUPPLY CIRCUIT TO THE TP SENSOR	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between TP sensor electrical connector EN13 pin 2 (OY) and GROUND.
	Is the voltage greater than 4 volts? **Yes** GO to AC10. **No** REPAIR the circuit between the TP sensor electrical connector EN13 pin 2 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The fault could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams.)
AC10: CHECK THE POWER SUPPLY CIRCUIT TO THE TP SENSOR FOR SHORT TO BATTERY	
	1 Measure the voltage between TP sensor electrical connector EN13 pin 2 (OY) and GROUND.
	Is the voltage greater than 6 volts? **Yes** REPAIR the circuit between the TP sensor electrical connector EN13 pin 2 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The short could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams.) **No** GO to AC11.
AC11: CHECK THE POWER SUPPLY CIRCUIT TO THE AIR CONDITIONING PRESSURE (ACP) SENSOR	
	1 Turn the ignition switch to the ON position.
	2 Measure the voltage between ACP sensor electrical connector JB106 pin 2 (OY) and GROUND.
	Is the voltage greater than 4 volts? **Yes** GO to AC12. **No** REPAIR the circuit between the ACP sensor electrical connector JB106 pin 2 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The fault could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams.)
AC12: CHECK THE POWER SUPPLY CIRCUIT TO THE AIR CONDITIONING PRESSURE SENSOR FOR SHORT TO BATTERY	
	1 Measure the voltage between ACP sensor electrical connector JB106 pin 2 (OY) and GROUND.
	Is the voltage greater than 6 volts? **Yes** REPAIR the circuit between the ACP sensor electrical connector JB106 pin 2 (OY) and the sensor 5 volt supply bus. CLEAR the DTC. TEST the system for normal operation. (The short could be in any of the other sensors in this circuit, or in any of the spurs in this circuit. For additional information, refer to wiring diagrams.) **No** No electrical fault in power supply circuit. Recheck DTCs using the Jaguar approved diagnostic system, or code reader. (This fault could also be a PSV failure within the ECM.)

PINPOINT TEST AD : P0851, P0852. P/N SWITCH STARTING/DRIVING MALFUNCTIONS.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AD1: CHECK THE P/N INPUT TO THE ECM.	
	1 Select PARK.
	2 Set the ignition switch to the ON position.
	3 Measure the voltage at the ECM electrical connector EN16 pin 31 (B).
	Is the voltage greater than 10 volts? **Yes** INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing a ECM, contact Dealer technical support. **No** REPAIR the circuit between the ECM electrical connector EN16 pin 31 (B) and the ignition switch. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (On automatic transmission vehicles, this circuit includes the TR sensor, central junction fuse box, ignition relay, and inertia switch. On NAS manual transmission vehicles, this circuit also includes the clutch safety switch.)

PINPOINT TEST AE : P0646, P0647. AIR CONDITIONING CLUTCH RELAY DRIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AE1: CHECK THE GROUND SUPPLY TO THE AIR CONDITIONING CLUTCH	
WARNING: This test involves working in proximity to rotating parts. Make sure due care is exercised.	
	1 Turn the ignition switch to the ON position.
	2 Disconnect the ECM electrical connector EN16.
	3 Disconnect the air conditioning clutch electrical connector EN30.
	4 Measure the resistance between EN30 pin 2 (B) and GROUND.

	Is the resistance less than 5 ohms? **Yes** REPAIR the circuit between EN30 pin 2 (B) and GROUND. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AE2.
AE2: CHECK THE CIRCUIT INTEGRITY BETWEEN THE ECM AND THE AIR CONDITIONING CLUTCH	
	1 Apply a GROUND to the disconnected ECM electrical connector EN16 pin 34 (BG).
	2 Measure the voltage at air conditioning clutch electrical connector EN30 pin 1 (RG).
	Is the voltage greater than 10 volts? **Yes** GO to AE3. **No** GO to AE4.
AE3: CHECK THE AIR CONDITIONING CLUTCH RELAY TO ECM CIRCUIT FOR SHORT TO GROUND	
	1 Measure the resistance between EN16 pin 34 (BG) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** GO to AE4. **No** INSTALL a new air conditioning compressor clutch relay. For additional information, refer to the electrical guide. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. REFER to: Engine Control Module (ECM) (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation). Before replacing an ECM, contact dealer technical support.
AE4: CHECK THE CIRCUIT BETWEEN THE AIR CONDITIONING COMPRESSOR CLUTCH AND THE RELAY FOR SHORT TO BATTERY	
	1 Measure the voltage between EN30 pin 1 (RG) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AE5.
AE5: CHECK THE CIRCUIT BETWEEN THE AIR CONDITIONING COMPRESSOR CLUTCH AND THE ACCC RELAY FOR SHORT TO GROUND	
	1 Measure the resistance between EN30 pin 1 (RG) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AE6.
AE6: CHECK THE CIRCUIT BETWEEN FUSE 23 OF THE POWER DISTRIBUTION FUSE BOX AND THE ACCC RELAY FOR SHORT TO GROUND	
	1 Remove Fuse 23. 2 Measure the resistance between fuse box electrical connector JB34 pin 79 and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AE7.
AE7: CHECK THE ACCC RELAY BASE FOR BATTERY VOLTAGE AT PIN 3	
	1 Refit Fuse 23. 2 Measure the voltage between the ACCC relay base pin 3 and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to AE8. **No** Check/replace fuses. REPAIR the circuit between the relay base and the battery power bus 1. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
AE8: CHECK THE CIRCUIT BETWEEN PIN 1 OF THE ACCC RELAY BASE AND THE POWER DISTRIBUTION FUSE BOX FOR SHORT TO GROUND	
	1 Remove Fuse 36. 2 Measure the resistance between the ACCC relay base pin 1 and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AE9.
AE9: CHECK THE ACCC RELAY BASE FOR BATTERY VOLTAGE AT PIN 1	
	1 Refit Fuse 36. 2 Turn the ignition switch to the ON position. 3 Measure the voltage between ACCC relay base pin 1 and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to AE10. **No** Check/replace fuses. REPAIR the circuit between the relay base and the battery power bus 2. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the EMS relay, and Fuses 9 and 31)
AE10: CHECK THE CIRCUIT BETWEEN THE ECM AND THE ACCC RELAY BASE FOR CONTINUITY	
	1 Remove the ACCC relay. 2 Measure the resistance between the ECM electrical connector EN16 pin 34 (BG) and ACCC relay base pin 2.

	Is the resistance less than 5 ohms? **Yes** GO to AE11. **No** REPAIR the circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
AE11: CHECK THE CIRCUIT BETWEEN THE ECM AND THE ACCC RELAY BASE FOR SHORT TO BATTERY	
	1 Check for a voltage between the ECM electrical connector EN16 pin 34 (BG) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to AE12.
AE12: CHECK THE CIRCUIT BETWEEN THE ECM AND THE ACCC RELAY BASE FOR SHORT TO GROUND	
	1 Measure the resistance between the ECM electrical connector EN16 pin 34 (BG) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new ACCC relay. For additional information, refer to the electrical guide. CLEAR the DTC. TEST the system for normal operation.

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Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - 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 ºC (140 ºF).

   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.

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Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - 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.

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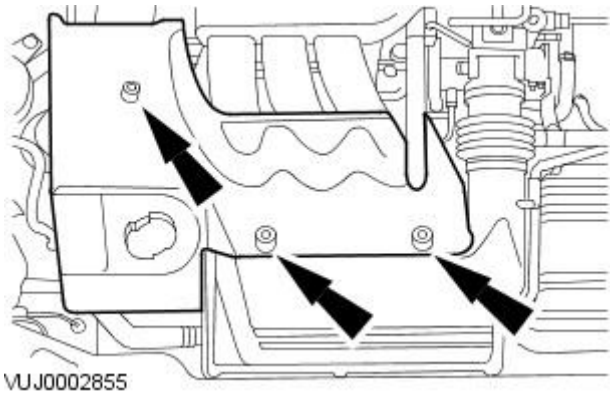
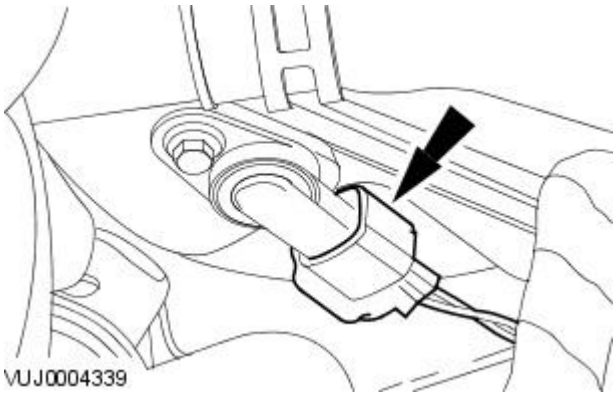
Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Camshaft Position (CMP) Sensor

Removal and Installation

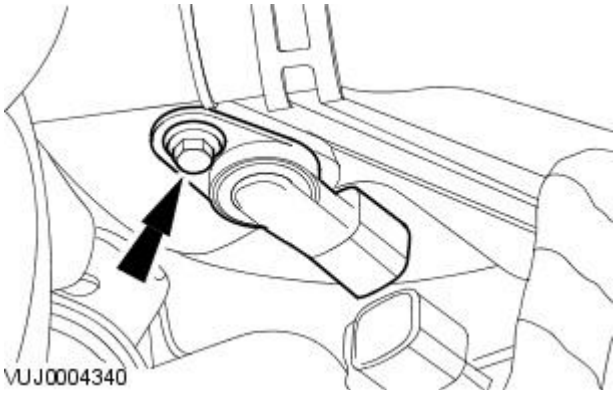
Removal



1. Remove the engine cover.



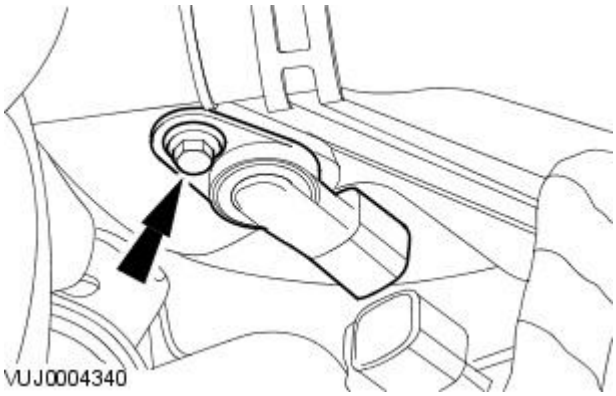
2. Disconnect the CMP sensor electrical connector.



3. Remove the CMP sensor.

- Remove and discard the O-ring seal.

Installation



1. NOTE: Install a new O-ring seal.

To install, reverse the removal procedure.

- Tighten to 7 Nm.

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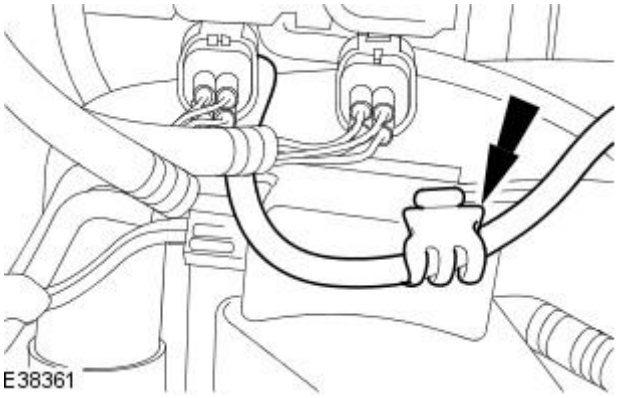
Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Catalyst Monitor Sensor LH

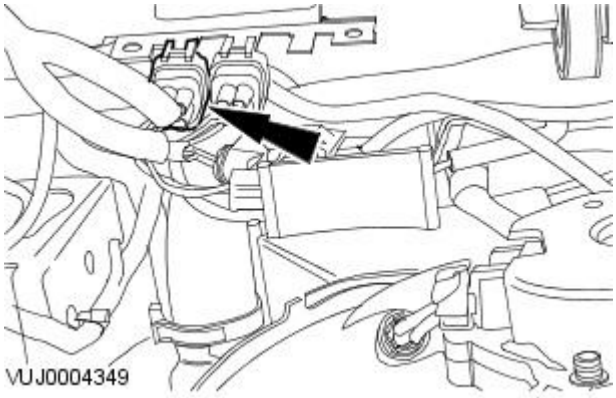
Removal and Installation

Removal

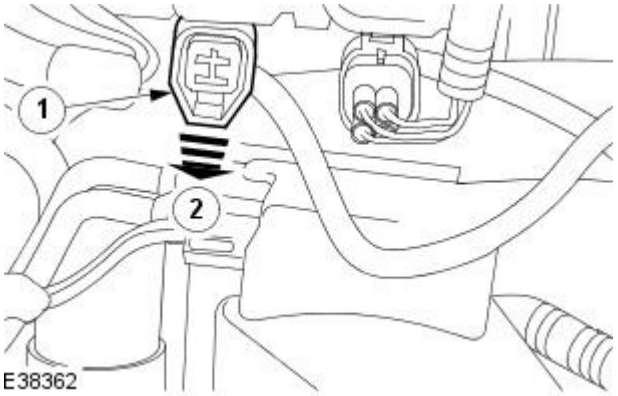
1. Disconnect the battery ground cable.
   For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Raise and support the vehicle. For additional information, refer to
   For additional information, refer to: Jacking (100-02 Jacking and Lifting, Description and Operation).
   .
3. Detach the catalyst monitor sensor harness from the securing clip.



4. Disconnect the catalyst monitor sensor electrical connector.



5. Detach the catalyst monitor sensor electrical connector from the securing bracket.
   1. Release the retaining tang.
   2. Detach the catalyst monitor sensor electrical connector from the securing bracket.

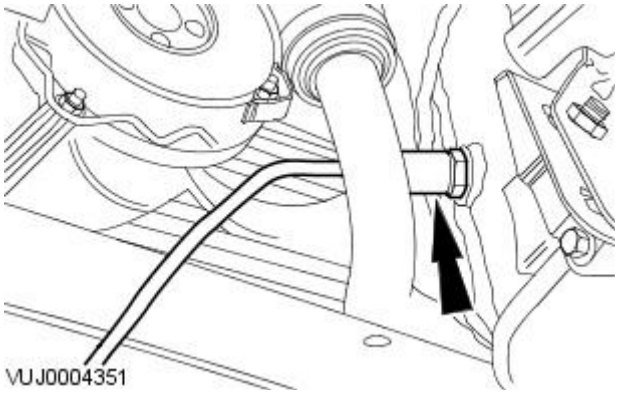


6. CAUTIONS:

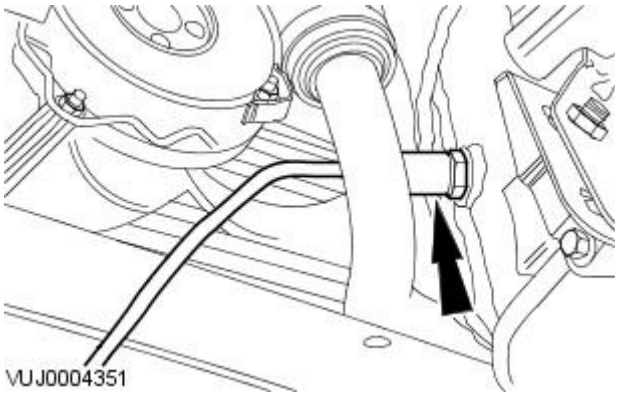
Do not cut the HO2S harness.

Make sure that the catalyst monitor sensor casing and harness is not damaged.

Using Snap-on socket S6176 remove the catalyst monitor sensor.



Installation



1. CAUTION: Make sure that the catalyst monitor sensor casing and cable are not damaged.

To install, reverse the removal procedure.

- Tighten to 40 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 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).

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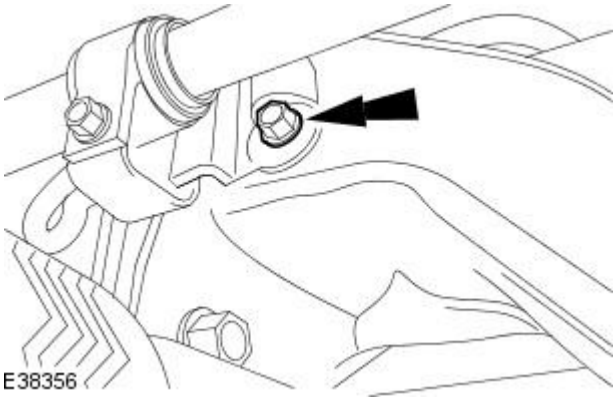
Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Catalyst Monitor Sensor RH

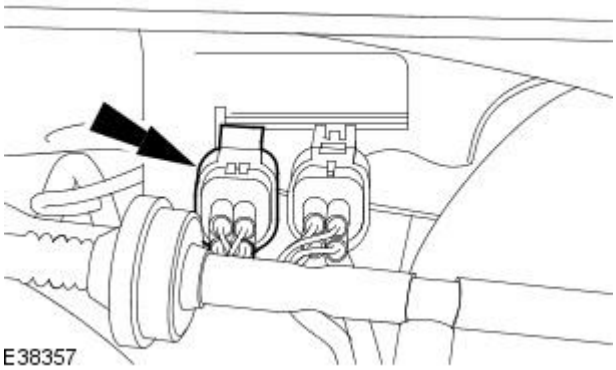
Removal and Installation

Removal

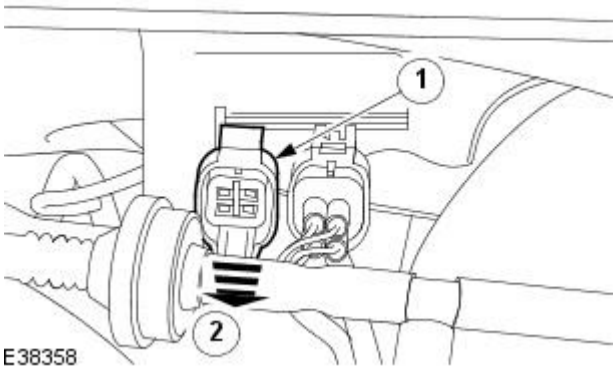
1. Disconnect the battery ground cable.
   For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the intake manifold.
   For additional information, refer to: Intake Manifold (303-01B Engine - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, In-vehicle Repair).
3. Raise and support the vehicle. For additional information, refer to
   For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
   .
4. Undo and remove the exhaust shield securing bolt to allow access to the catalyst monitor sensor.

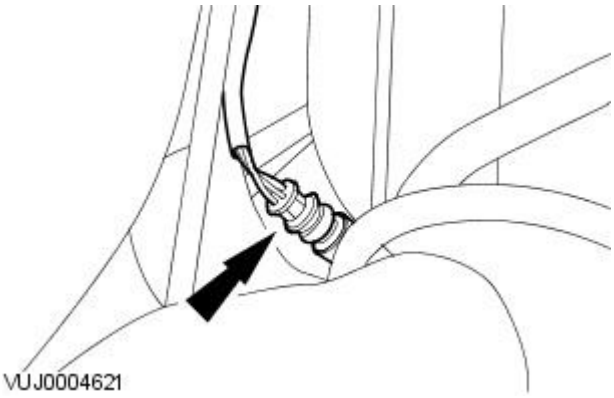


5. Lower the vehicle.
6. Disconnect the catalyst monitor sensor electrical connector.



7. Detach the catalyst monitor sensor electrical connector from the securing bracket.
   1. Release the retaining tang.
   2. Detach the catalyst monitor sensor electrical connector from the securing bracket.





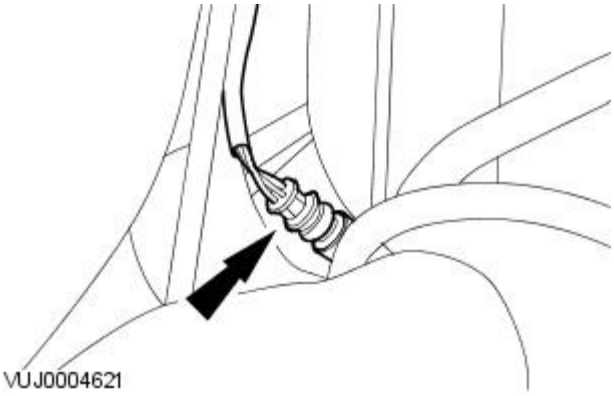
8. CAUTIONS:

Do not cut the HO2S harness.

Make sure that the catalyst monitor sensor casing and cable are not damaged.

Using Snap-on socket YA8875 remove the catalyst monitor sensor.

Installation



1. CAUTION: Make sure that the catalyst monitor sensor casing and cable are not damaged.

To install, reverse the removal procedure.

- Tighten to 40 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 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).

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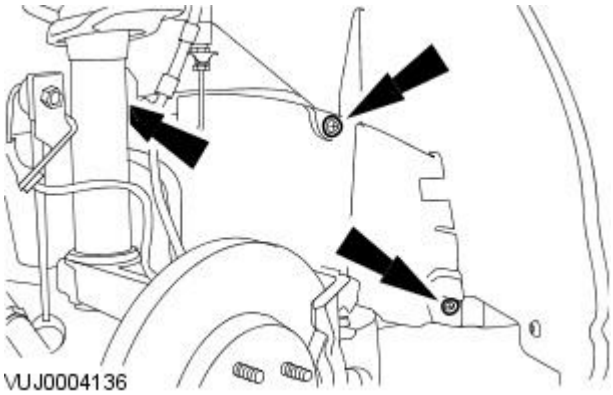
Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Crankshaft Position (CKP) Sensor

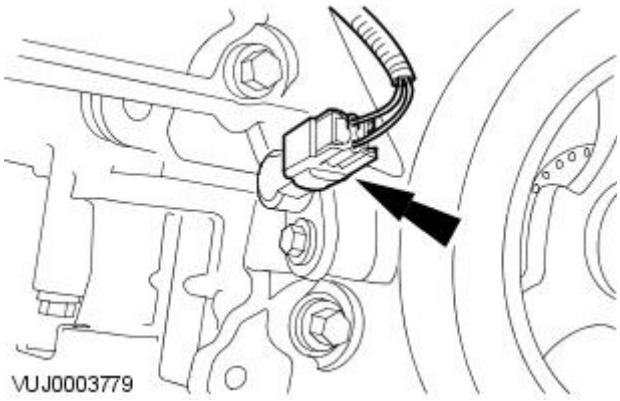
Removal and Installation

Removal

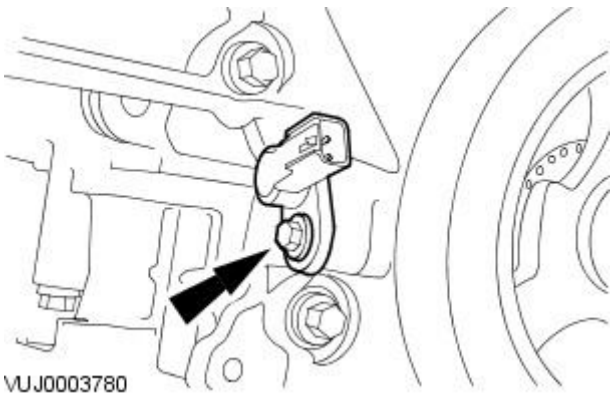
1. Remove the right-hand front road wheel. For additional information, refer to Section 204-04 Wheels and Tires.
2. Remove the wheel arch liner access cover.



3. Disconnect the CKP sensor electrical connector.



4. Remove the CKP sensor.
   - Remove and discard the O-ring seal.

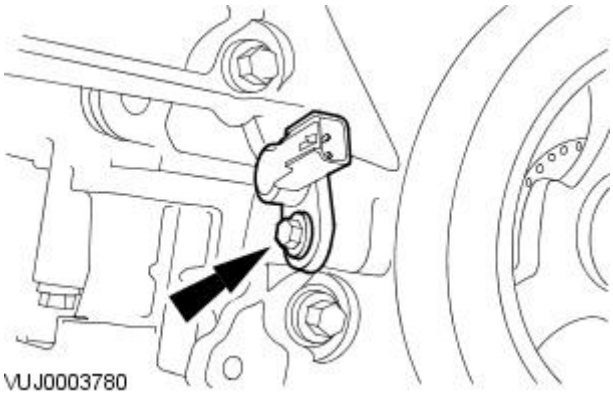


Installation

1. NOTE: Install a new O-ring seal.

To install, reverse the removal procedure.

- Tighten to 10 Nm.



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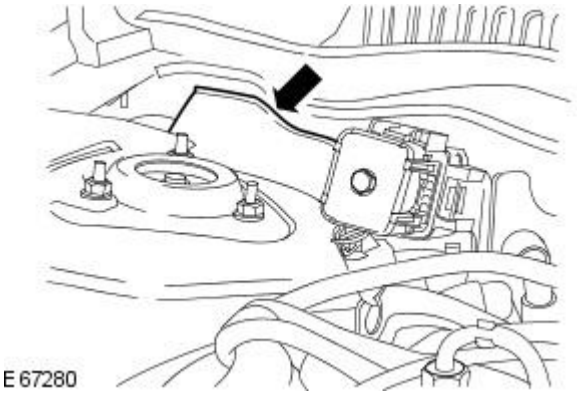
Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Engine Control Module (ECM)

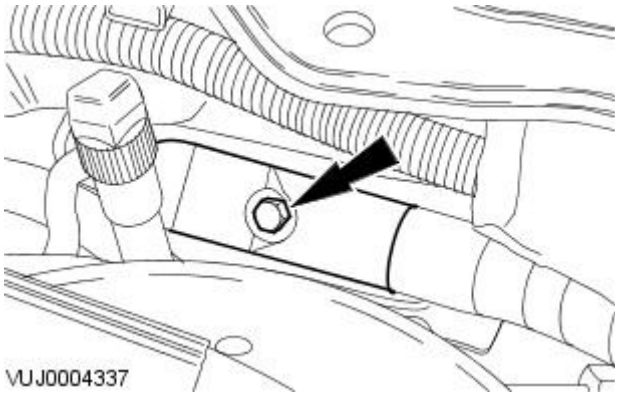
Removal and Installation

Removal

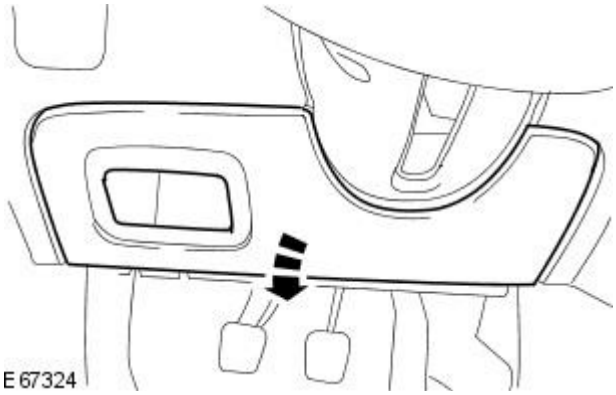
1. Disconnect the battery ground cable. For additional information, refer to For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the engine wiring harness trim panel.



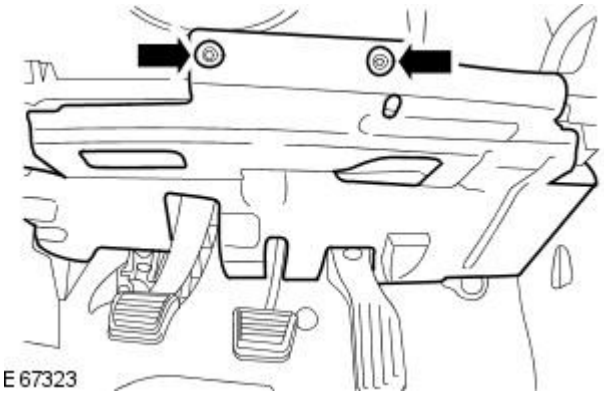
3. Disconnect the engine control module (ECM) electrical connector.

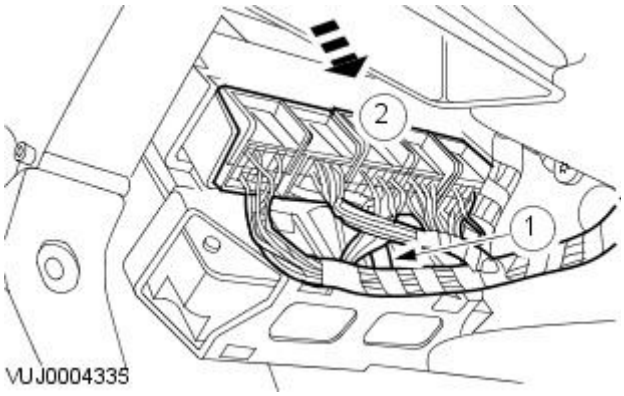


4. Remove the instrument cluster lower trim panel.



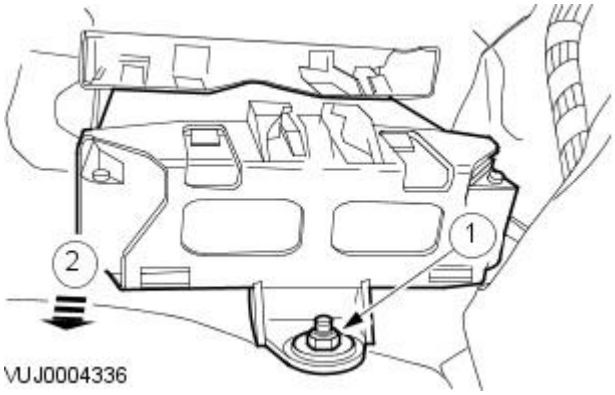
5. Remove the trim panel.





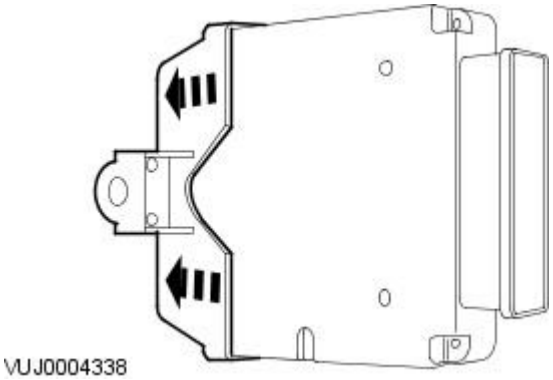
6. Detach the generic electronic module (GEM) from the ECM.

1. Release the GEM locking tang.
2. Detach the GEM from the ECM.



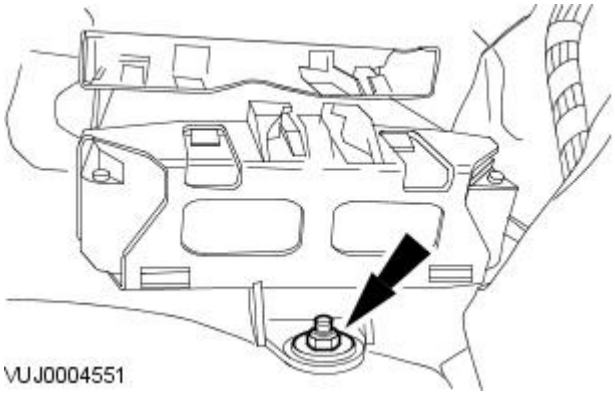
7. Remove the ECM.

1. Remove the ECM retaining nut.
2. Remove the ECM.



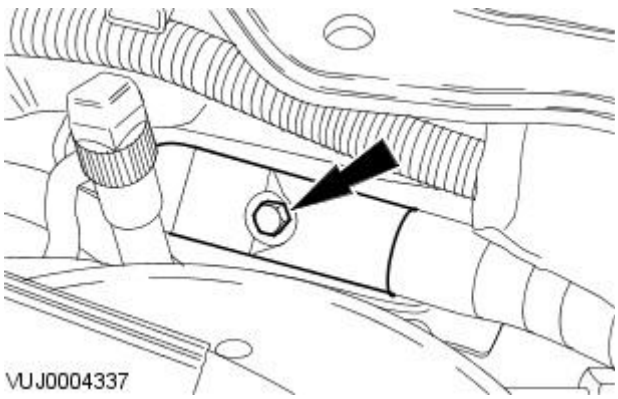
8. Remove the ECM from the ECM retaining bracket.

Installation



1. To install, reverse the removal procedure.

- Tighten to 10 Nm.



2. CAUTION: Make sure that the electrical connector locates correctly in the ECM. Do not force or overtighten the electrical connector.

Tighten to 10 Nm.

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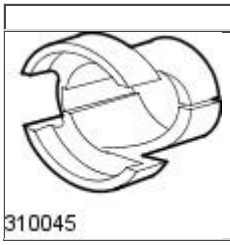
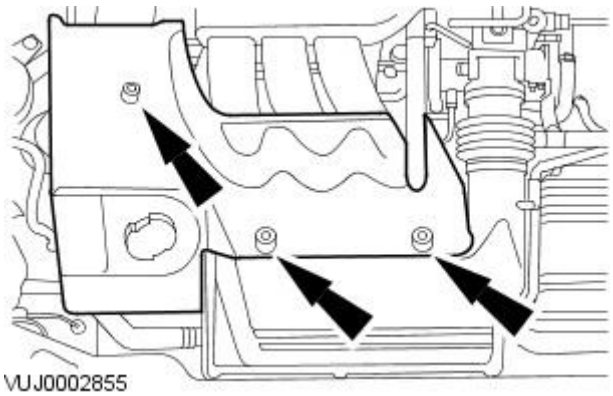
Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Fuel Temperature Sensor2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

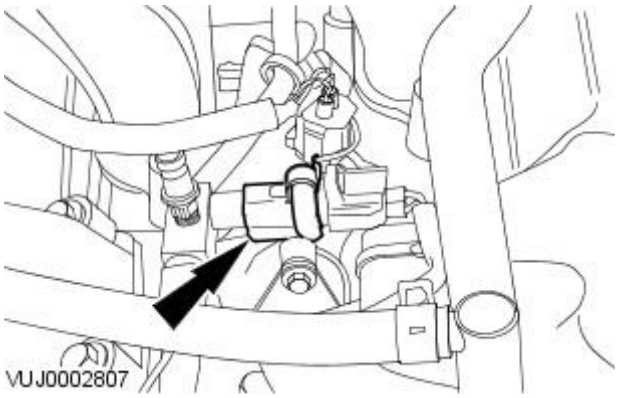
Removal and Installation

Special Tool(s)	
 310045	Quick fit connector releasing tool 310-045

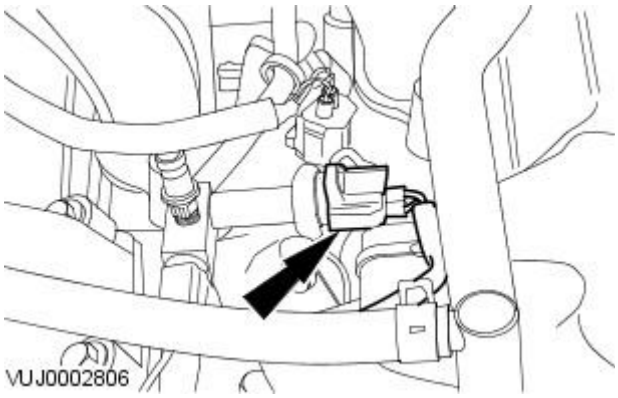
Removal


VUJ0002855

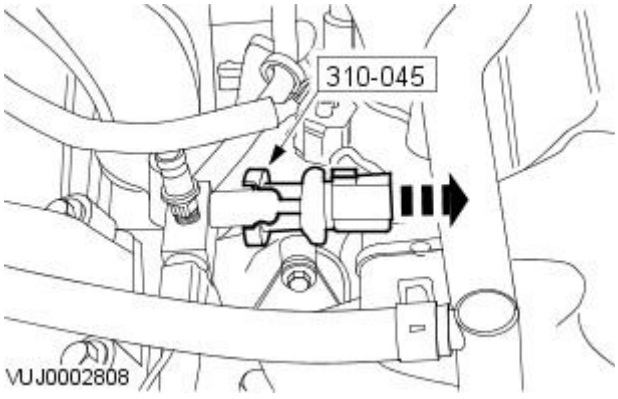
1. Remove the engine cover.


VUJ0002807

2. Remove the retaining clip from the spring lock coupling.


VUJ0002806

3. Disconnect the fuel temperature sensor electrical connector.

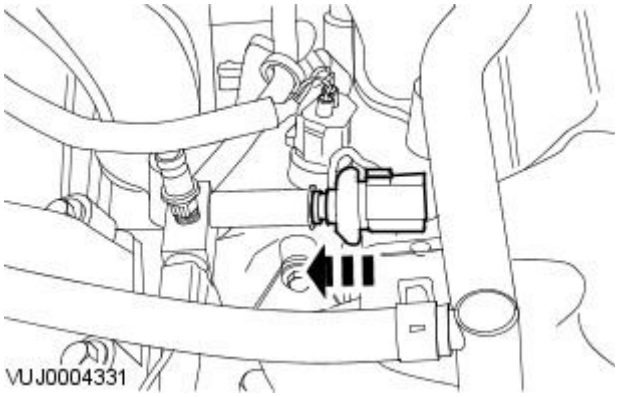


VUJ0002808

4. Using the special tool, remove the fuel temperature sensor.

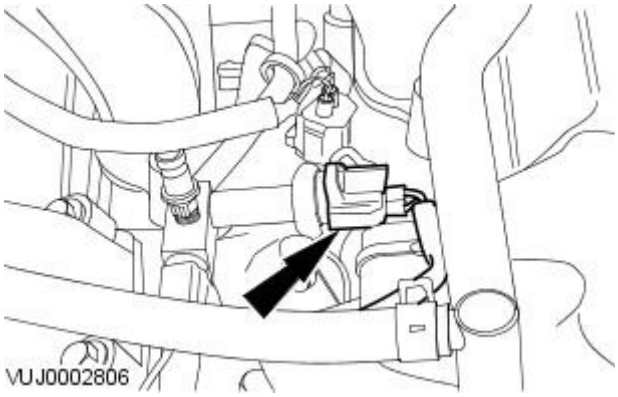
- Remove and discard the O-ring seal.

Installation

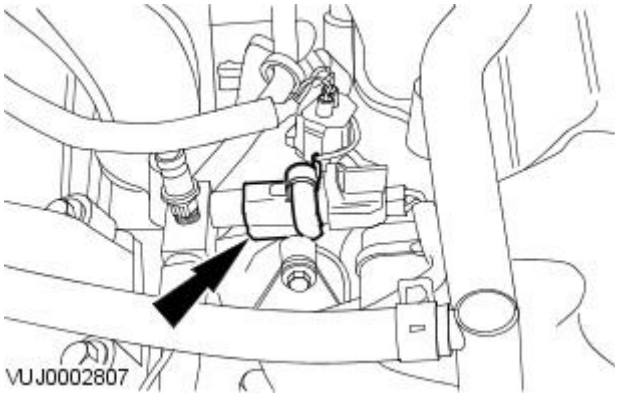


1. NOTE: Install a new O-ring seal.

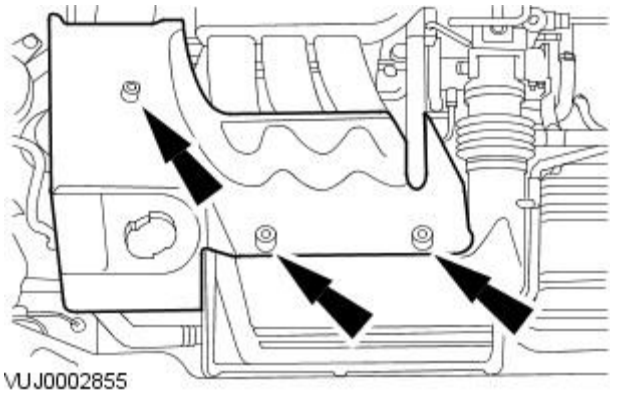
Install the fuel temperature sensor.



2. Connect the fuel temperature sensor electrical connector.



3. Install the retaining clip to the spring lock coupling.



4. Install the engine cover.

Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Heated Oxygen Sensor (HO2S) LH

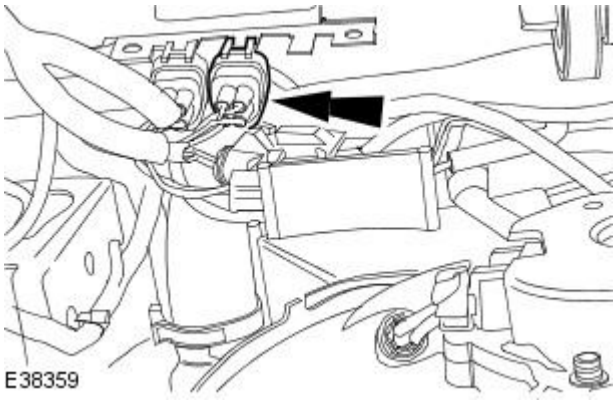
Removal and Installation

Removal

1. Disconnect the battery ground cable.
For additional information, refer to Section 414-01 Battery, Mounting and Cables.

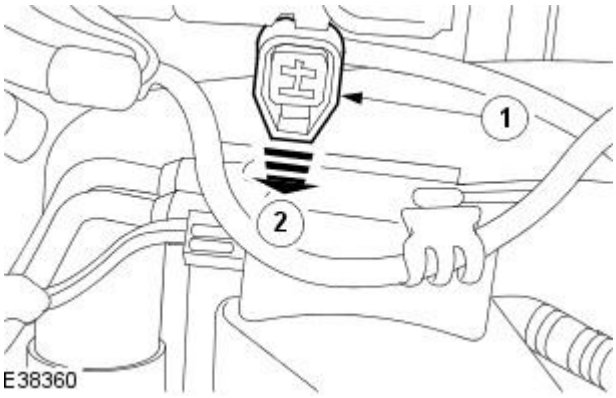
2. Raise and support the vehicle.
For additional information, refer to Section 100-02 Jacking and Lifting.

3. Disconnect the heated oxygen sensor (HO2S) electrical connector.



4. Detach HO2S electrical connector from the securing bracket.

1. Release the retaining tang.
2. Detach HO2S electrical connector from the securing bracket.

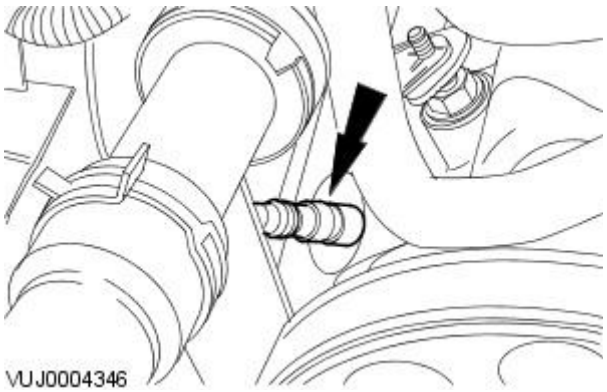


5. CAUTIONS:

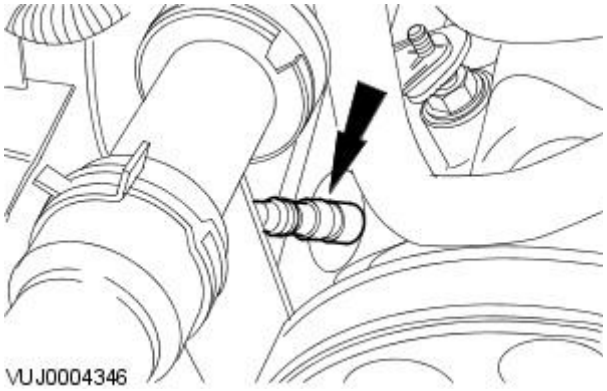
Do not cut the HO2S harness.

Make sure that the HO2S casing and harness is not damaged.

Using Snap-on socket S6176 remove the HO2S.



Installation



1. CAUTION: Make sure that the HO2S casing and cable are not damaged.

To install, reverse the removal procedure.

- Tighten to 40 Nm.

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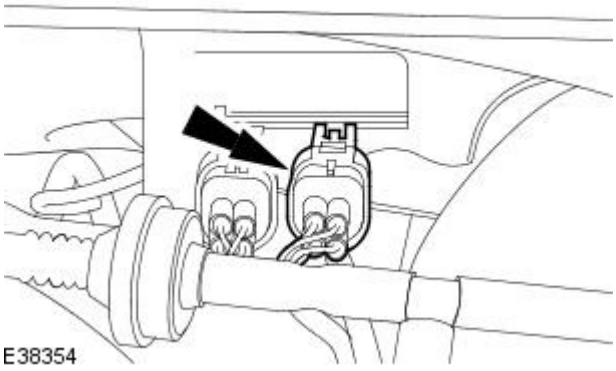
Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Heated Oxygen Sensor (HO2S) RH

Removal and Installation

Removal

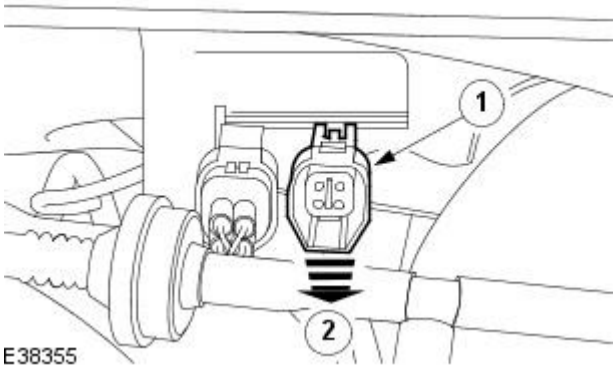
1. Disconnect the battery ground cable.
For additional information, refer to Section 414-01 Battery, Mounting and Cables.

2. Disconnect the heated oxygen sensor (HO2S) electrical connector.



3. Detach HO2S electrical connector from the securing bracket.

1. Release the retaining tang.
2. Detach HO2S electrical connector from the securing bracket.



4. Turn the steering onto full right-hand lock.

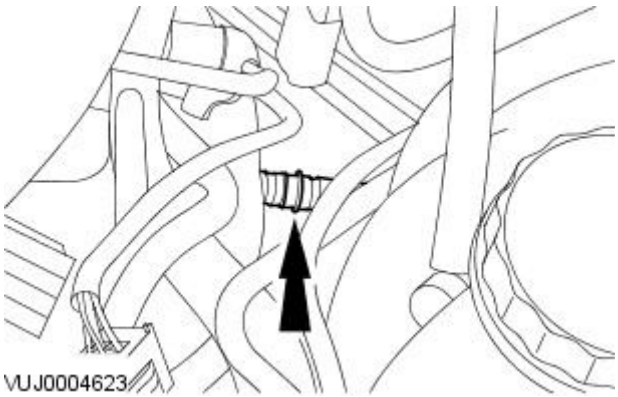
5. Raise and support the vehicle.
For additional information, refer to Section 100-02 Jacking and Lifting.

6. CAUTIONS:

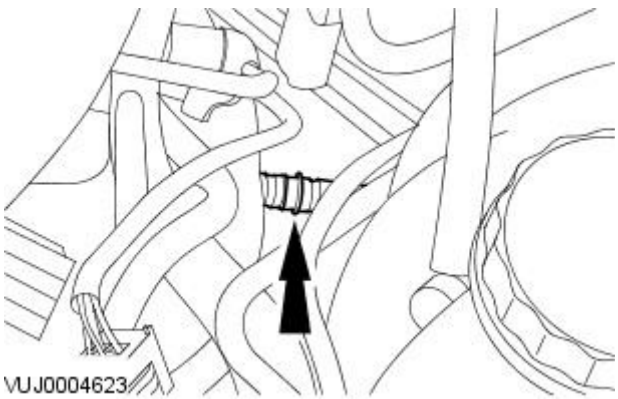
Do not cut the HO2S harness.

Make sure that the HO2S casing and harness is not damaged.

Using Snap-on socket S6176 remove the HO2S.



Installation



1. CAUTION: Make sure that the HO2S casing and harness is not damaged.

To install, reverse the removal procedure.

- Tighten to 40 Nm.

Published: 11-May-2011

Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Knock Sensor (KS)

Removal and Installation

Removal

All vehicles

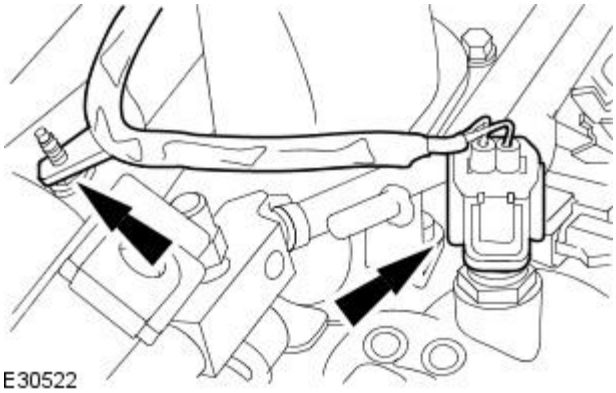
1. Disconnect the battery ground cable.
   For additional information, refer to Section 414-01 Battery, Mounting and Cables.
2. Disconnect the spring lock coupling.
   For additional information, refer to Section 310-00 Fuel System - General Information.

Vehicles with 2.5L or 3.0L engine

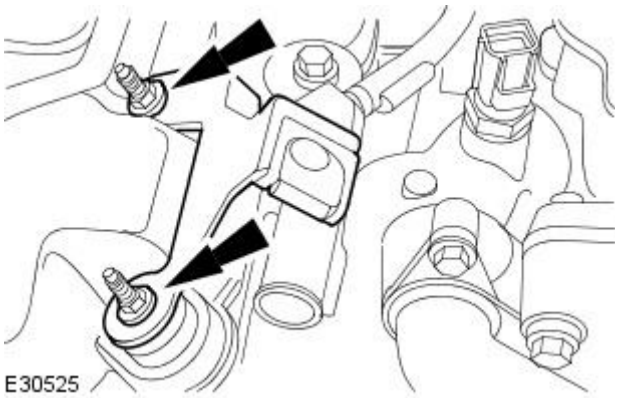
3. Remove the fuel charging wiring harness. For additional information, refer to Section 303-04A Fuel Charging and ControlsSection 303-04B Fuel Charging and ControlsSection 303-04C Fuel Charging and Controls - Turbocharger.

Vehicles with 2.0L engine

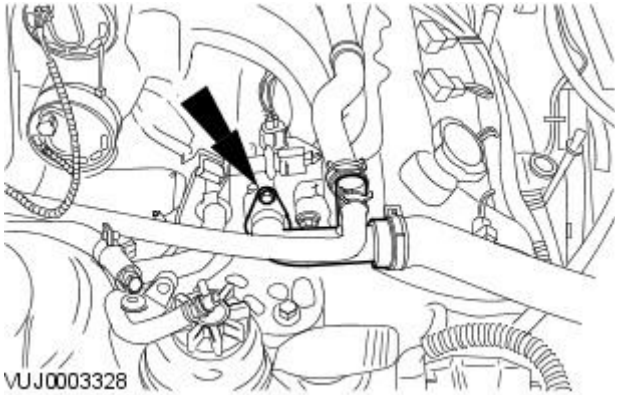
4. Drain the cooling system. For additional information, refer to Section 303-03A Engine Cooling / 303-03B Engine Cooling.
5. Disconnect the electrical connector.
   - Detach the harness.



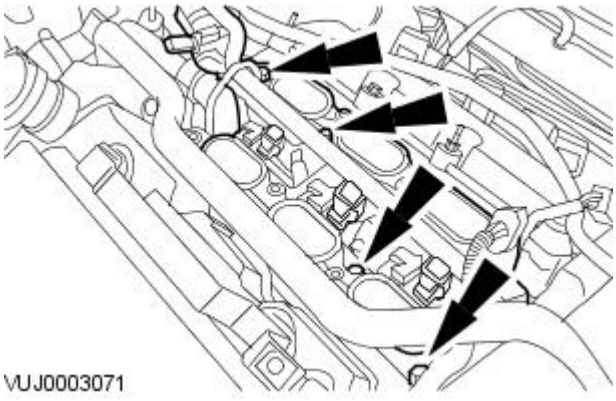
6. Remove the engine trim retaining bracket.



7. Detach the coolant pipe.
   - Remove and discard the seal.

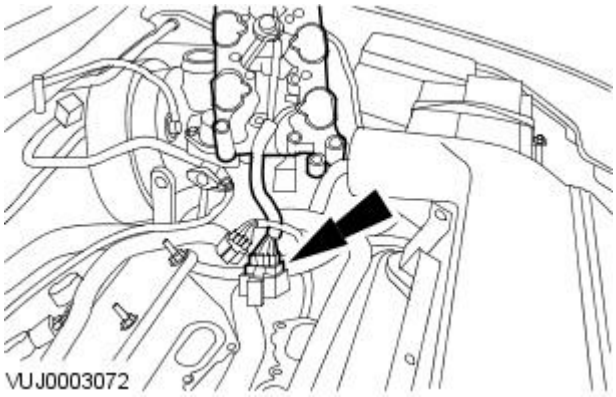


All vehicles


VUJ0003071

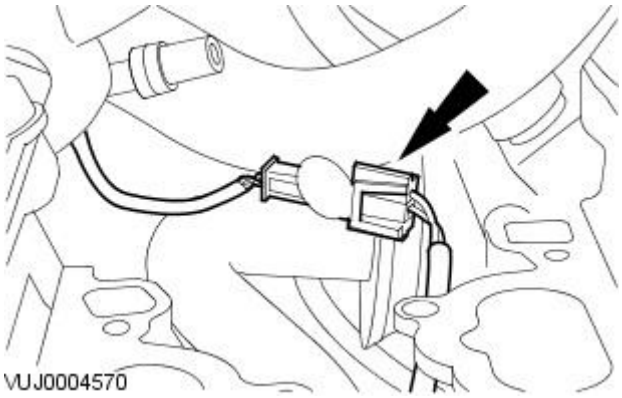
8. NOTE: Fuel may still be present in the fuel supply manifold.

Detach the fuel injection supply manifold and lower intake manifold and place to one side.

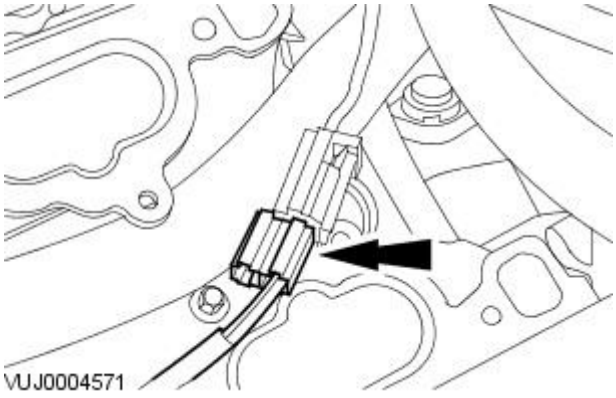

VUJ0003072

9. Remove the fuel injection supply manifold and lower intake manifold.

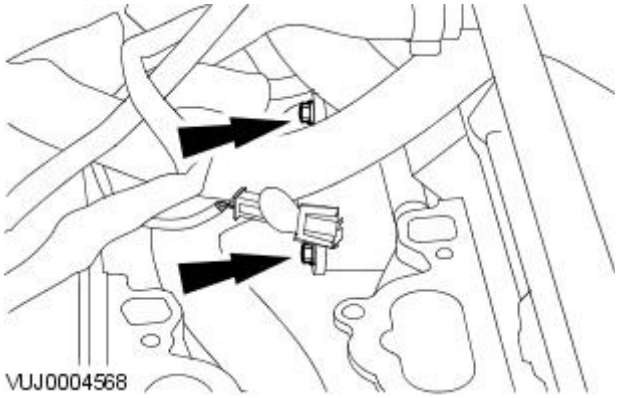
- Disconnect the electrical connector.
- Remove and discard the lower intake manifold O-ring seals.


VUJ0004570

10. Detach the KS electrical connector from the retaining bracket.

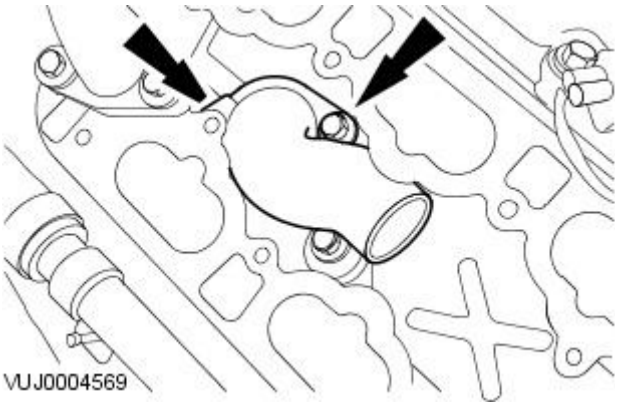

VUJ0004571

11. Disconnect the KS electrical connector.


VUJ0004568

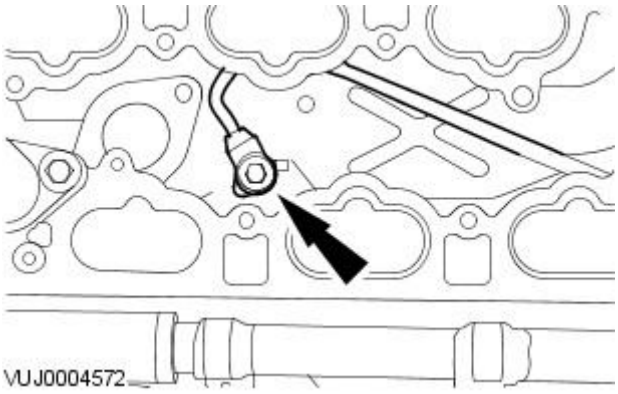
12. Remove the water pump outlet coolant pipe.

- Remove and discard the seal.



13. Remove the engine coolant inlet pipe.

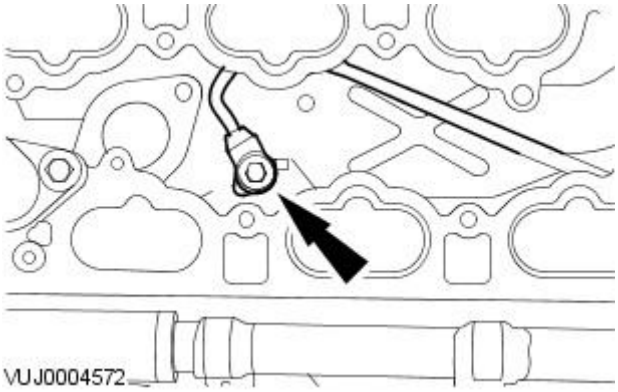
- Remove and discard the seal.



14. Remove the KS.

Installation

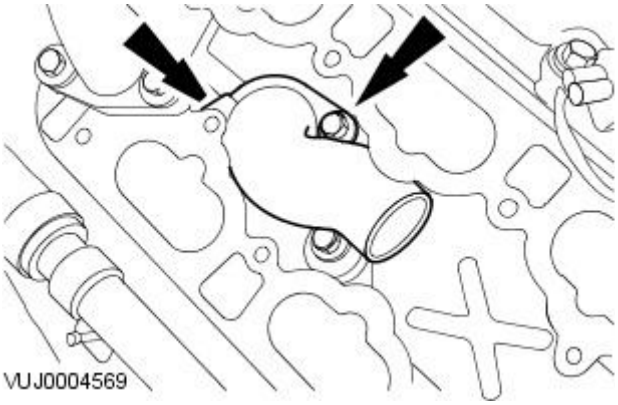
All vehicles



1. NOTE: Prior to installing the KS, clean the engine block and KS mating surfaces with metal surface cleaner (WSW-M5B392-A).

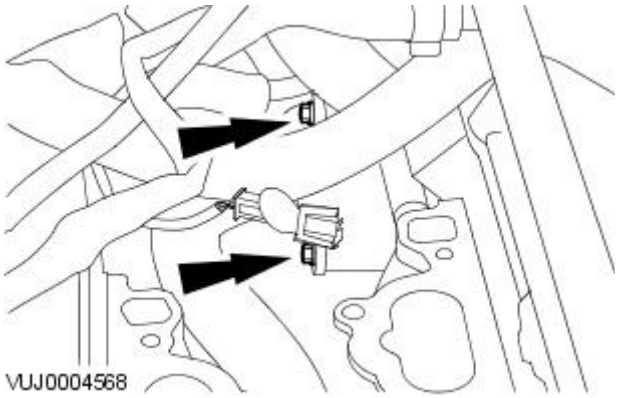
To install, reverse the removal procedure.

- Tighten to 19 Nm.



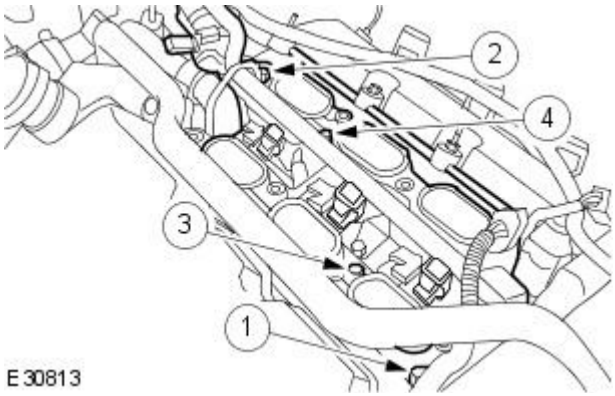
2. Install a new seal.

- Tighten to 25 Nm.



3. Install a new seal.

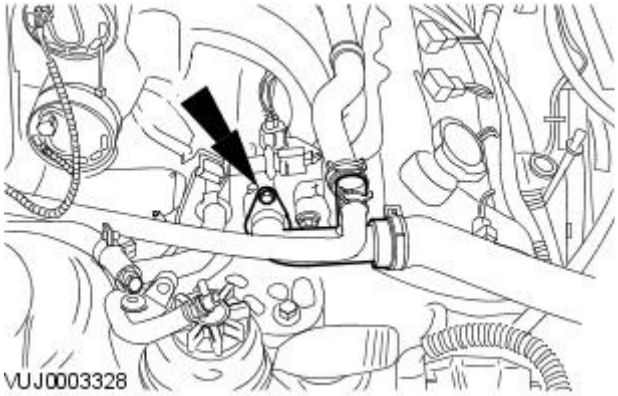
- Tighten to 10 Nm.



4. Tighten in the sequence shown.

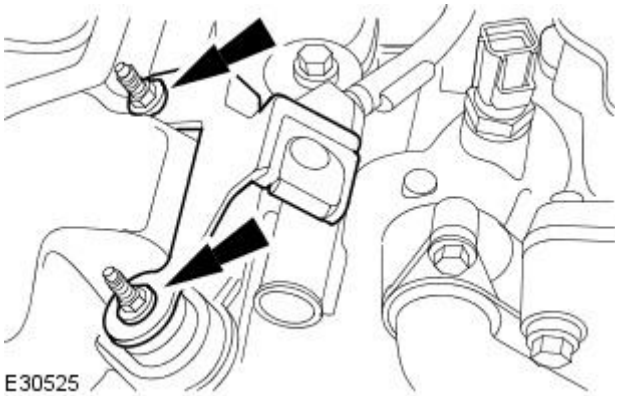
- Tighten to 10 Nm.

Vehicles with 2.0L engine



5. Install a new seal.

- Tighten to 9 Nm.



6. Tighten to 6 Nm.

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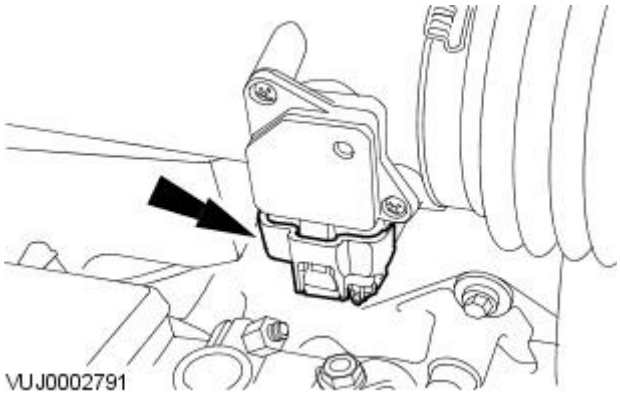
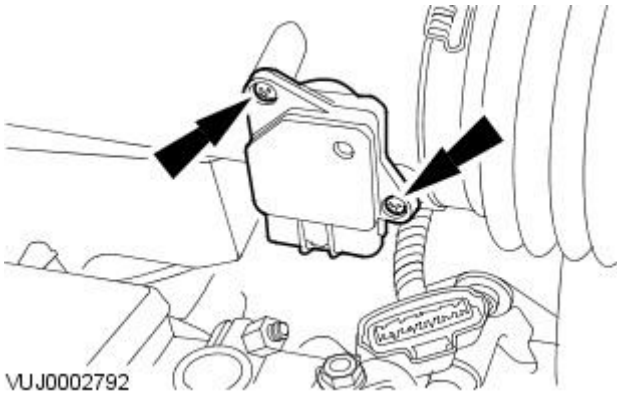
Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Mass Air Flow (MAF) Sensor

Removal and Installation

Removal



1. Remove the battery cover.
2. Disconnect the MAF sensor electrical connector.



3. Remove the MAF sensor.

Installation

1. To install, reverse the removal procedure.
2. NOTE: For NAS vehicles only.

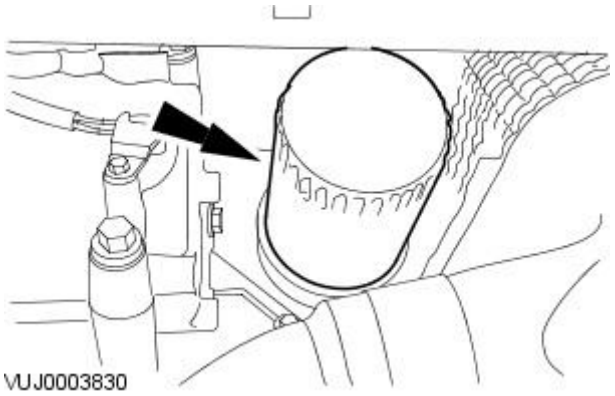
   If required, carry out a short drive cycle.
   For additional information, refer to: Powertrain Control Module (PCM) Short Drive Cycle Self-Test (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).

Published: 11-May-2011

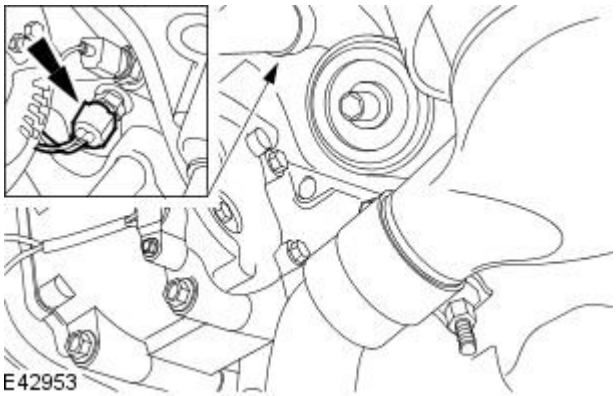
Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Oil Temperature Sensor

Removal and Installation

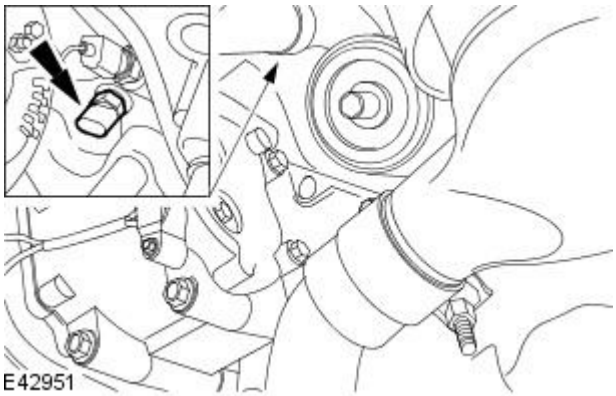
Removal



1. Raise and support the vehicle.
   For additional information, refer to Section 100-02 Jacking and Lifting.
2. Remove and discard the oil filter.

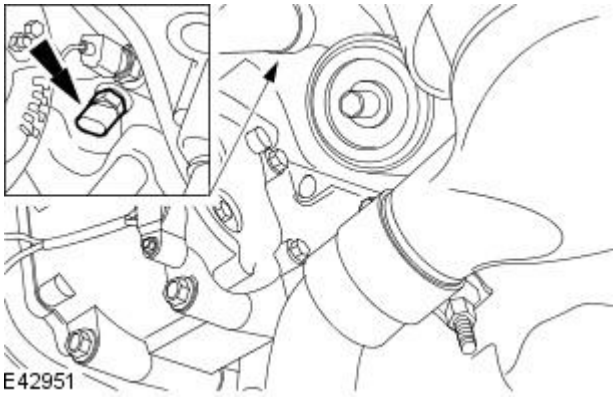


3. Disconnect the oil temperature sensor electrical connector.



4. Remove the oil temperature sensor.

Installation



1. NOTE: Apply a small bead of sealant WSK-M4G328-A3 or equivalent sealant meeting Jaguar specification on the first three threads of the oil temperature sensor.

To install, reverse the removal procedure.

- Tighten to 15 Nm.

2. Install a new oil filter.
3. NOTE: Use oil WSE-M2C908-A or equivalent meeting Jaguar specification.

Check and top up the engine with oil.

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Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Throttle Position (TP) Sensor

Removal and Installation

Removal

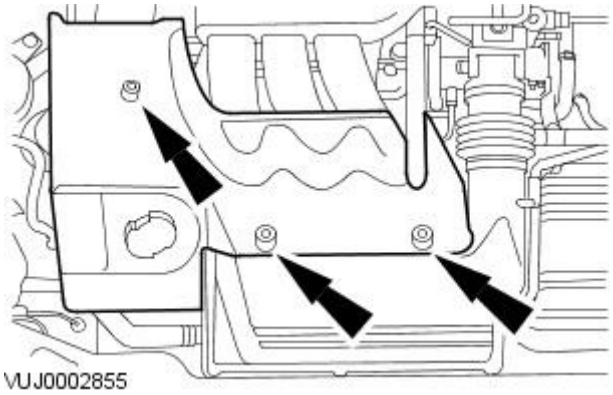
Vehicles with 2.5L or 3.0L engine

1. For additional information, refer to Section 303-04A Fuel Charging and ControlsSection 303-04B Fuel Charging and ControlsSection 303-04C Fuel Charging and Controls - Turbocharger .

Vehicles with 2.0L engine

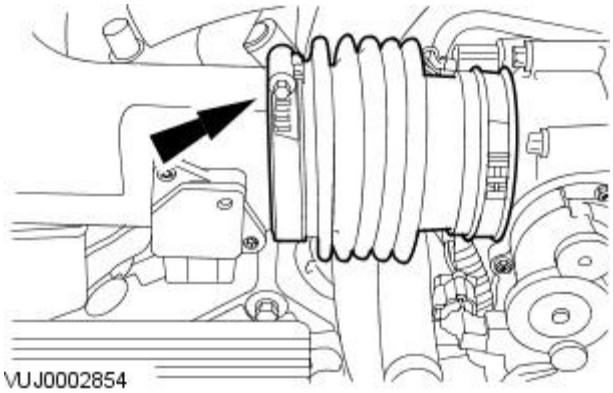
2. Disconnect the battery
   For additional information, refer to Section 414-01 Battery, Mounting and Cables.
3. NOTE: 2.5L and 3.0L shown, 2.0L similar.

   Remove the engine cover.

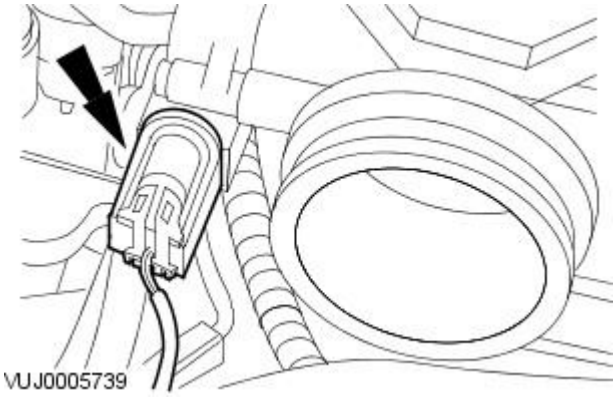


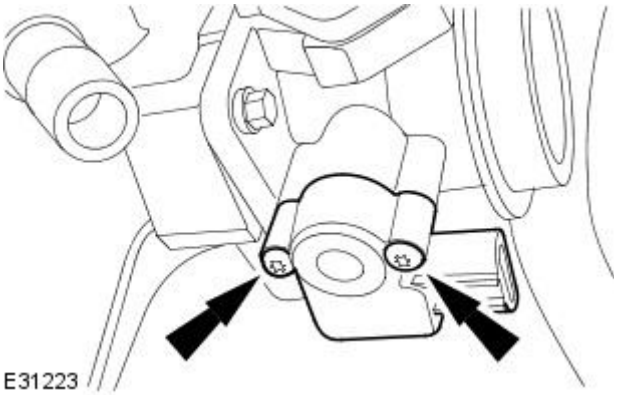
4. NOTE: 2.5L and 3.0L shown, 2.0L similar.

   Disconnect the air cleaner outlet pipe.



5. Disconnect the electrical connector.



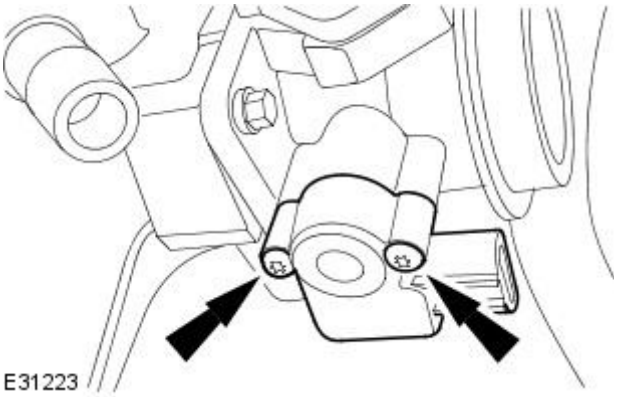


6. Remove the the throttle position (TP) sensor.

Installation

1. To install, reverse the removal procedure.

2. Tighten to 7 Nm.



Published: 11-May-2011

Electronic Engine Controls - 2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27 - Variable Camshaft Timing (VCT) Oil Control Solenoid

Removal and Installation

Removal

Right-Hand Bank

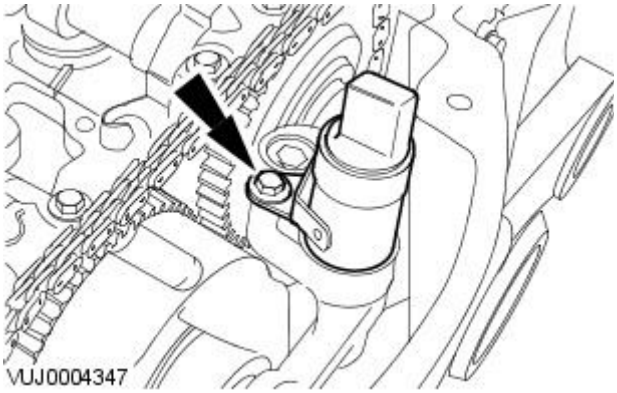
1. Remove the right-hand valve cover. For additional information, refer to For additional information, refer to: Valve Cover RH (303-01A Engine - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, In-vehicle Repair).
.

Left-Hand Bank

2. Remove the left-hand valve cover. For additional information, refer to For additional information, refer to: Valve Cover RH (303-01A Engine - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, In-vehicle Repair).
.

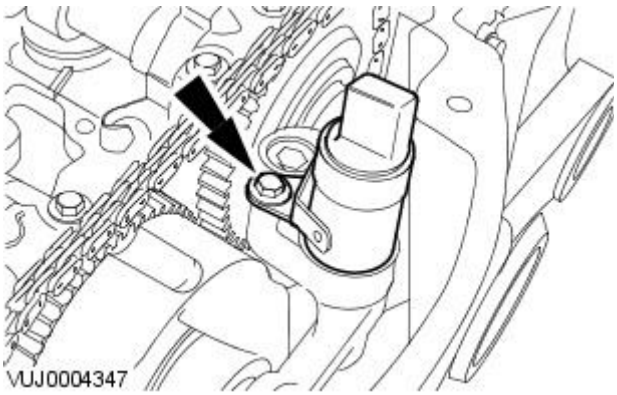
Right-Hand and Left-Hand Banks

3. Remove the variable camshaft timing 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 long drive cycle.
   For additional information, refer to: Powertrain Control Module (PCM) Long Drive Cycle Self-Test (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).

Published: 11-May-2011

Electronic Engine Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma -

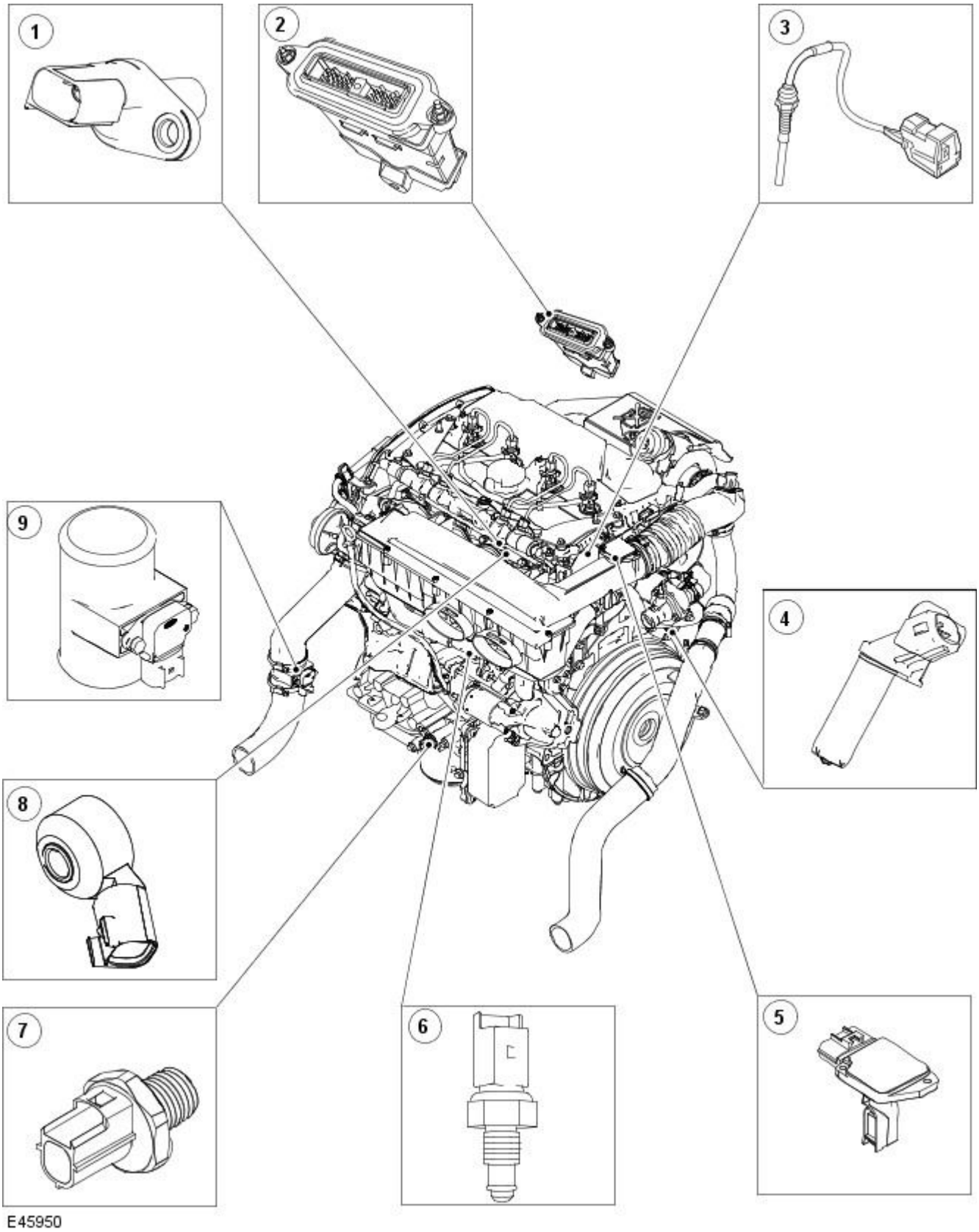
Torque Specifications

Description	Nm	lb-ft	lb-in
Camshaft position sensor retaining bolt	9	–	80
Crankshaft position sensor retaining bolt	7	–	62
Cylinder head temperature sensor	10	–	89
Power steering pump belt cover retaining nut	10	–	89
Engine oil pressure sensor	15	11	–
Fuel temperature sensor	15	11	–
Knock sensor	20	15	–
Fuel injection supply manifold high-pressure pipe retaining nut	10	–	89
Manifold absolute pressure and temperature sensor retaining clips	4	–	35
Radiator support bar retaining bolts	25	18	–
Charge air cooler upper hose retaining clip	4	–	35
Charge air cooler lower hose retaining clip	4	–	35
Catalytic converter temperature sensor	35	26	–
Diesel particulate filter temperature sensor	35	26	–
Manifold absolute pressure sensor retaining bolt	4	–	35

Published: 11-May-2011

Electronic Engine Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Electronic Engine Controls

Description and Operation



Item	Part Number	Description
1	—	Camshaft position (CMP) sensor
2	—	Engine control module (ECM)
3	—	Cylinder head temperature (CHT) sensor
4	—	Crankshaft position (CKP) sensor
5	—	Mass airflow (MAF) sensor
6	—	Fuel temperature sensor
7	—	Engine oil pressure (EOP) sensor
8	—	Knock (KS) sensor
9	—	Manifold absolute pressure and temperature (MAP-T) sensor

Camshaft Position (CMP) Sensor

The camshaft position (CMP) sensor is located on the front of the cylinder head and it is a hall effect type sensor. The CMP sensor takes its signal from the inlet camshaft lobe. The signal is used to identify cylinder number three and thus allowing the individual cylinders to be

identified. Should the CMP sensor fail the engine will not start.

Engine Control Module (ECM)

The engine control module (ECM) is located in the same position as the petrol version. The engine management system (EMS) uses signals from the various sensors as inputs to the ECM which contains a series of maps for the engine parameters. Based on the inputs from the sensors regarding current engine conditions and loads, the ECM determines the optimum settings to use for the EMS, and so gives the best performance and/or economy for a given set of conditions. The ECM also manages the speed control system, again based on information from the vehicle sensors to provide the optimum settings.

Cylinder Head Temperature (CHT) Sensor

The cylinder head temperature (CHT) sensor is located at the rear of the engine behind the rear end accessory drive camshaft pulley. The CHT sensor measures the temperature of the cylinder head and then provides the ECM and the instrument cluster with the engine temperature.

Crankshaft Position (CKP) Sensor

The crankshaft position (CKP) sensor is located at the rear of the engine mounted to the cylinder block. It is used to detect the engine position and speed of the crankshaft. It is a permanent inductive type sensor. Should the CKP sensor fail, the engine will not start.

Mass Airflow (MAF) Sensor

The mass airflow (MAF) sensor is mounted on the clean air side of the air filter and upstream of the turbocharger air compressor. The function of the MAF sensor is to measure the amount of air flow drawn into the engine. This airflow is used by the ECM to control the exhaust gas recirculation (EGR) operation.

Engine Oil Pressure (EOP) Sensor

The engine oil pressure (EOP) sensor is located on the left-hand side of the engine in the oil filter housing. The EOP is connected to the instrument cluster and is not directly part of the electronic engine control system.

Knock Sensor (KS)

The knock sensor (KS) is located on the left-hand side of the engine mounted on the cylinder head between cylinders two and three. The KS allows the ECM to analyze the quality of combustion by measuring the increase in vibration. The ECM will use this signal to calculate the quantity of fuel to be injected during phased injection. The correction to the fueling for the phased injection minimizes the combustion noise. Should the KS fail the result would be no phased injection and thus an increase in diesel knock when idling and accelerating.

Manifold Absolute Pressure and Temperature (MAP-T) Sensor

The manifold absolute pressure and temperature (MAP-T) sensor combines the manifold pressure sensor and inlet air temperature sensor in one component. It is located in the inlet boost pressure pipe, right side front after the charge air cooler. Its function and operation is to measure the positive charge pressure developed by the turbocharger and its temperature, and to inform the ECM.

Fuel Temperature Sensor

The fuel temperature sensor can be identified by a blue connector located in the low pressure fuel supply circuit on the back of the high pressure pump. The fuel temperature sensor is a negative thermal coefficient type sensor which measures the fuel temperature in the low pressure circuit. Should the fuel temperature sensor fail the cold running characteristic will be affected.

Published: 12-Jul-2011

Electronic Engine Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Electronic Engine Controls

Diagnosis and Testing

Overview

This section covers the components of the engine management system.

The changes to the engine management for this model year include the addition of a diesel particulate filter system, and this section includes information on the diagnosis and testing of this system and links to sections dealing specifically with particulate filter checks.

For additional information on the description and operation of the engine management system:
REFER to: Electronic Engine Controls (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Description and Operation).

For additional information on the description and operation of the diesel particulate filter system:
REFER to: Exhaust System (309-00 Exhaust System, Description and Operation).

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious mechanical or electrical faults.

Visual inspection

Mechanical	Electrical
• Engine oil level • Cooling system coolant level • Fuel level/contamination • Fuel leaks • Fuel pumps • Intake air system • Accessory drive belt • Sensor fitment/condition • Diesel particulate filter (DPF)	• Fuses • Wiring harness • Electrical connector(s) • Injectors • Glow plugs • 5 volt sensor supply • Sensor(s) • Engine control module (ECM)

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.** Use the approved diagnostic system or a scan tool to retrieve any diagnostic trouble codes (DTCs) before moving onto the symptom chart or DTC index.
    - Make sure that all DTCs are cleared following rectification.

Symptom Chart

Symptom (general)	Symptom (specific)	Possible source	Action
Non-Start	Engine does not crank	• Security system /Immobilizer engaged • Battery condition/charge • Starter relay fault • Starting system fault • Engine control module (ECM) relay fault • **Park/Neutral** switch fault • Engine seized	Make sure that the immobilizer system is disarmed. Check the battery condition and state of charge. Check that the engine turns by hand. Check the starting system and circuits. Refer to the electrical guides. Check for DTCs indicating an ECM relay or park/neutral switch fault. Rectify as necessary.
	Engine cranks, but does not start	• Security system /Immobilizer engaged • Low/Contaminated fuel • Air ingress • Blocked air cleaner • Blocked fuel filter • Low-pressure circuit fault • Fuel metering valve blocked/contaminated • Injector(s) fault/programming • Intake air temperature (IAT) sensor fault • Glow plug(s)/circuit fault • Fuel pressure sensor fault • Camshaft position (CMP) sensor fault • Crankshaft position (CKP) sensor fault • Cylinder head temperature (CHT) sensor fault • Fuel pump fault • Low compression • Valve train fault • Blocked catalyst	Make sure that the immobilizer system is disarmed. 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 low-pressure fuel system for leaks/damage, check for air ingress. Check the air cleaner element. Check that fuel flows through the fuel filter. Check for DTCs indicating a fuel metering valve or injector fault. Check for DTCs indicating an engine management sensor fault. Check the valve train, check the compressions, REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing). Check the catalytic converter condition, etc. Check for diesel particulate filter (DPF)DTCs. Refer to the warranty policy and procedures manual if an ECM is suspect.

Symptom (general)	Symptom (specific)	Possible source	Action
		• Engine control module (ECM) fault	
Difficult to start	Difficult to start cold	• Glow plug(s)/circuit fault • Contaminated fuel • Air ingress • Blocked air cleaner • Blocked fuel filter • Low-pressure circuit fault • Fuel metering valve blocked/contaminated • Fuel pressure sensor fault • Intake air temperature (IAT) sensor fault • Cylinder head temperature (CHT) sensor fault • Camshaft position (CMP) sensor fault • Crankshaft position (CKP) sensor fault • Injector(s) fault/programming • Pump fault • Blocked catalyst • Valve train fault • Low compression	Check the glow plugs and circuits. Refer to the electrical guides. 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 low-pressure fuel system for leaks/damage, check for air ingress. Check the air cleaner element. Check that fuel flows through the fuel filter. Check for DTCs indicating a fuel metering valve or injector fault. Check for DTCs indicating an engine management sensor fault. Check the valve train, check the compressions, REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing). Check the catalytic converter condition, etc. Check for diesel particulate filter DTCs.
	Difficult to start hot	• Contaminated fuel • Air ingress • Blocked air cleaner • Blocked fuel filter • Low-pressure circuit fault • Fuel metering valve blocked/contaminated • Exhaust gas recirculation (EGR) valve fault • Fuel pressure sensor fault • Intake air temperature (IAT) sensor fault • Camshaft position (CMP) sensor fault • Crankshaft position (CKP) sensor fault • Injector(s) fault/programming • Pump fault • Blocked catalyst • Valve train fault • Low compression	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 low-pressure fuel system for leaks/damage, check for air ingress. Check the air cleaner element. Check that fuel flows through the fuel filter. Check for DTCs indicating a fuel metering valve or injector fault. Check for DTCs indicating an engine management sensor fault. Check the valve train, check the compressions, REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing). Check the catalytic converter condition, etc. Check for diesel particulate filter DTCs.
	Engine cranks too fast/slow	• Battery condition/charge • Starting system fault • Low compression	Check the battery condition and state of charge. Check the starting system circuits. Refer to the electrical guides. Rectify as necessary. Check the compressions, REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).
Driveability	Rough idle	• Low/Contaminated fuel • Air ingress • Injector(s) fault/programming • Fuel metering valve blocked/contaminated • Exhaust gas recirculation (EGR) valve fault • Blocked air cleaner • Blocked fuel filter • Pump fault • Crankshaft position (CKP) sensor fault • Intake air temperature (IAT) sensor fault • Manifold absolute pressure (MAP) sensor fault • Knock sensor fault • Dual-mass flywheel fault	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 low-pressure fuel system for leaks/damage, check for air ingress. Check for DTCs indicating an injector programming or EGR fault. Check the air cleaner element. Check that fuel flows through the fuel filter. Check for DTCs indicating a fuel metering valve fault. Check for DTCs indicating an engine management sensor fault. Check the dual-mass flywheel.
	Idle speed high or low	• Accelerator pedal position (APP) sensor fault • Intake air temperature (IAT) sensor fault	Check for DTCs indicating an APP or IAT sensor fault. Rectify as necessary.

Symptom (general)	Symptom (specific)	Possible source	Action
	Engine speed out of control	• Engine oil level too high • Excessive blow-by • Accelerator pedal position (APP) sensor fault • Turbocharger bearing/seal failure	Check/correct the engine oil level. Check the engine condition. Check for DTCs indicating an APP sensor fault. Rectify as necessary. Check the turbocharger bearing/seal condition by assessing the movement in the turbocharger shaft and the amount of oil in the turbocharger body. Note that a small amount of oil is normal.
	Lack of power when accelerating	• Contaminated fuel • Air intake circuit fault • Low fuel pressure • Exhaust gas recirculation (EGR) valve fault • Fuel filter blocked • Fuel lines kinked/restricted • Pump fault • Injector(s) fault/programming • Vehicle speed sensor fault • Cylinder head temperature (CHT) sensor fault • Intake air temperature (IAT) sensor fault • Manifold absolute pressure (MAP) sensor fault • Accelerator pedal position (APP) sensor fault • Fuel rail temperature (FRT) sensor fault • Fuel rail pressure (FRP) sensor fault • Fuel metering valve fault • Turbocharger fault • Catalyst blocked • Valve timing fault • Low compression	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 air intake system and low-pressure fuel circuit. Rectify as necessary. Check for DTCs indicating an EGR fault. Check for DTCs indicating an engine management sensor or injector programming fault. Check the turbocharger condition and operation. Check the catalytic converter condition. Rectify as necessary. For valve timing and compression information, REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).
	Engine stops/stalls	• Low/Contaminated fuel • Air cleaner element blocked • Fuel metering valve blocked/contaminated • Pump fault • High-pressure leak • Low-pressure circuit fault (air ingress) • Relay fault • Crankshaft position (CKP) sensor fault • Camshaft position (CMP) sensor fault • Cylinder head temperature (CHT) sensor fault • Fuel rail pressure (FRP) sensor fault • Dual-mass flywheel fault • Engine control module (ECM) fault	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 air intake system and low-pressure fuel circuit. Rectify as necessary. Check for DTCs indicating a relay, engine management sensor or ECM fault. Check the dual-mass flywheel. Refer to the warranty policy and procedures manual if an ECM is suspect.
	Engine judders	• Low/Contaminated fuel • Fuel metering valve blocked/contaminated • High-pressure leak • Air intake circuit fault • Low-pressure circuit fault (air ingress) • Pump fault • Exhaust gas recirculation (EGR) valve fault • Accelerator pedal position (APP) sensor fault • Cylinder head temperature (CHT) sensor fault • Camshaft position (CMP) sensor fault • Crankshaft position (CKP) sensor fault • Intake air temperature (IAT) sensor fault	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 air intake system and low-pressure fuel circuit. Rectify as necessary. Check for DTCs indicating an engine management sensor or injector programming fault. Check the catalytic converter and turbocharger condition. Rectify as necessary. Check the dual-mass flywheel. For cylinder head, compression and camshaft information, REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).

Symptom (general)	Symptom (specific)	Possible source	Action
		• Manifold absolute pressure (MAP) sensor fault • Knock sensor fault • Fuel rail pressure (FRP) sensor fault • Injector(s) fault/programming • Catalyst blocked • Turbocharger fault • Dual-mass flywheel fault • Cylinder head gasket fault • Camshafts/Valve clearances • Low compression	
	Engine will not stop	• Engine oil level too high • Turbocharger fault • Engine control module (ECM) fault	Check/correct the engine oil level. Check the turbocharger condition and operation. Check for DTCs indicating an ECM fault. Refer to the warranty policy and procedures manual if an ECM is suspect.
General	Excessive fuel consumption	• Incorrect engine oil • Air intake circuit fault • Low-pressure circuit fault (air ingress/leaks) • Fuel metering valve/circuit • High-pressure leak • Exhaust gas recirculation (EGR) valve fault • Injector(s) fault/programming • Cylinder head temperature (CHT) sensor fault • Intake air temperature (IAT) sensor fault • Manifold absolute pressure (MAP) sensor fault • Turbocharger fault • Dual-mass flywheel fault • Valve timing fault • Low compression	Make sure that the correct grade of oil is used in the engine. Check the air intake and low-pressure circuits. Check for DTCs indicating an EGR, injector programming or engine management sensor fault. Check the turbocharger condition and operation. Check the dual-mass flywheel. For valve timing and compression information, REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).
	Excessive black smoke	• Air intake circuit fault • Exhaust gas recirculation (EGR) valve fault • Injector(s) fault/programming • Accelerator pedal position (APP) sensor fault • Crankshaft position (CKP) sensor fault • Knock sensor fault • Fuel rail pressure (FRP) sensor fault • Turbocharger bearings/seals fault • Valve timing fault	Check the air intake circuit. Check for DTCs indicating an EGR, injector programming or engine management sensor fault. Check the turbocharger bearing/seal condition by assessing the movement in the turbocharger shaft and the amount of oil in the turbocharger body. Note that a small amount of oil is normal. For valve timing information, REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).

DTC index

DTC	Condition	Possible source	Action
B1864	Battery power supply	• Engine control module (ECM) power supply circuit fault	Check the ECM power and ground circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs and check for normal operation.
B2139	Engine control module (ECM) ID does not match	• Data mismatch between ECM and passive anti-theft system (PATS)	Check the configuration of the ECM and anti-theft system. Reconfigure as necessary using the approved diagnostic system.
C1137	Anti-lock brake system (ABS) control module fault	• ABS control module internal fault, random access memory, read only memory	Refer to the warranty policy and procedures manual if a module is suspect.
C1145	Right-hand front wheel speed sensor input circuit fault	• Wheel speed sensor input circuit: high resistance • Wheel speed sensor input circuit: short circuit to ground	Check the wheel speed sensor and circuits. Refer to the electrical guides. If no fault is found in the circuits, install a new sensor.

DTC	Condition	Possible source	Action
		• Wheel speed sensor input circuit: short circuit to power	
C1155	Left-hand front wheel speed sensor input circuit fault	• Wheel speed sensor input circuit: high resistance • Wheel speed sensor input circuit: short circuit to ground • Wheel speed sensor input circuit: short circuit to power	
C1165	Right-hand rear wheel speed sensor input circuit fault	• Wheel speed sensor input circuit: high resistance • Wheel speed sensor input circuit: short circuit to ground • Wheel speed sensor input circuit: short circuit to power	
C1175	Left-hand rear wheel speed sensor input circuit fault	• Wheel speed sensor input circuit: high resistance • Wheel speed sensor input circuit: short circuit to ground • Wheel speed sensor input circuit: short circuit to power	
P0070	Ambient air temperature (AAT) sensor circuit malfunction	• AAT sensor circuit: high resistance • AAT sensor circuit: short circuit to ground • AAT sensor circuit: short circuit to power • AAT sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the ambient air temperature sensor and circuits. Refer to the electrical guides. If no fault is found in the circuits, install a new sensor. Clear the DTCs, test for normal operation.
P0100	Mass air flow (MAF) sensor circuit malfunction	• MAF sensor circuit: high resistance • MAF sensor circuit: short circuit to ground • MAF sensor circuit: short circuit to signal return • MAF sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the MAF sensor and circuits. Refer to the electrical guides. If no fault is found in the circuits, install a new sensor. REFER to: Mass Air Flow (MAF) Sensor (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Clear the DTCs, test for normal operation.
P0105	Manifold absolute pressure temperature (MAPT) sensor circuit malfunction	• MAPT sensor circuit: high resistance • MAPT sensor circuit: short circuit to ground • MAPT sensor circuit: short circuit to power • MAPT sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. This DTC can be set as a result of other codes. If P1665 is also set, investigate this first. Check the MAPT sensor and circuits. Refer to the electrical guides. If no fault is found in the circuits, install a new sensor. Clear the DTCs, test for normal operation.
P0110	Intake air temperature (IAT) sensor circuit malfunction (the intake air temperature sensor is part of the manifold absolute pressure and temperature (MAPT) sensor)	• IAT sensor circuit: high resistance • IAT sensor circuit: short circuit to ground • IAT sensor circuit: short circuit to signal return • MAPT sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the MAPT sensor and circuits. Refer to the electrical guides. If no fault is found in the circuits, install a new sensor. REFER to: Manifold Absolute Pressure and Temperature (MAPT) Sensor (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Clear the DTCs, test for normal operation.
P0121	Accelerator pedal position (APP) sensor circuit A range/performance	• APP sensor circuit A: high resistance • APP sensor circuit A: short circuit to ground • APP sensor circuit A: short circuit to signal return • APP sensor fault	Check the APP sensor and circuits. Refer to the electrical guides. If no fault is found in the circuits, install a new sensor. REFER to: Accelerator Pedal (310-02 Acceleration Control, Removal and Installation). Clear the DTCs, test for normal operation.
P0180	Fuel temperature sensor A range malfunction	• Fuel temperature sensor circuit: high resistance • Fuel temperature sensor: faulty connection • Fuel temperature sensor fault	Check the fuel temperature sensor and circuits. Refer to the electrical guides. If no fault is found in the circuits, install a new sensor. REFER to: Fuel Temperature Sensor (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Clear the DTCs, test for normal operation.
P0190	Fuel pressure sensor A circuit	• Fuel pressure sensor circuit: high resistance • Fuel pressure sensor: faulty connection • Fuel pressure sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the fuel pressure sensor and circuits. Refer to the electrical guides. If no fault is found in the circuits, install a new fuel injection supply manifold (the pressure sensor cannot be serviced separately). REFER to: Fuel Injection Supply Manifold (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Clear the DTCs, test for normal operation.

DTC	Condition	Possible source	Action
P0191	Fuel pressure sensor A circuit range/performance	• Pump deterioration - Contaminated fuel • Leaking fuel rail • Fuel pressure sensor circuit fault • Fuel pressure sensor fault	Check for contaminated fuel. Draw off approximately 1 litre (2.11 pints) of fuel into a clear container and allow to settle for 1 minute. Examine the fuel for separation indicating contamination. Check the fuel rail for leaks, etc. Check the fuel pressure sensor and circuits. Refer to the electrical guides. If no fault is found in the circuits, install a new fuel injection supply manifold (the pressure sensor cannot be serviced separately). REFER to: Fuel Injection Supply Manifold (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Clear the DTCs, test for normal operation.
P0200	Injector circuit fault	• Blocked, kinked or crushed fuel return lines • Injector supply circuit: short circuit to ground • Injector supply circuit: short circuit to power • Injector resistance correction invalid • Engine control module (ECM) fault	Check the fuel return lines for damage, etc. Check the injector circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation. Refer to the warranty policy and procedures manual if an ECM is suspect.
P0201	Injector circuit open, cylinder 1	• Injector 1 circuit: short circuit to ground • Injector 1 circuit: short circuit to power • Injector 1 circuit: high resistance • Injector failure	Check the injector circuits. Refer to the electrical guides. Rectify as necessary. If no fault is found in the circuits, install a new injector. REFER to: Fuel Injector (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Clear the DTCs, test for normal operation.
P0202	Injector 4 (cylinder 2) circuit malfunction	• Injector 4 circuit: short circuit to ground • Injector 4 circuit: short circuit to power • Injector 4 circuit: high resistance • Injector failure	
P0203	Injector 2 (cylinder 3) circuit malfunction	• Injector 2 circuit: short circuit to ground • Injector 2 circuit: short circuit to power • Injector 2 circuit: high resistance • Injector failure	
P0204	Injector 3 (cylinder 4) circuit malfunction	• Injector 3 circuit: short circuit to ground • Injector 3 circuit: short circuit to power • Injector 3 circuit: high resistance • Injector failure	
P0221	Accelerator pedal position (APP) sensor circuit B range/performance	• APP sensor circuit B: high resistance • APP sensor circuit B: short circuit to ground • APP sensor circuit B: short circuit to signal return • APP sensor fault	Check the APP sensor and circuits. Refer to the electrical guides. If no fault is found in the circuits, install a new sensor. REFER to: Accelerator Pedal (310-02 Acceleration Control, Removal and Installation). Clear the DTCs, test for normal operation.
P0226	Accelerator pedal position (APP) sensor circuit C range/performance	• APP sensor circuit C: high resistance • APP sensor circuit C: short circuit to ground • APP sensor circuit C: short circuit to signal return • APP sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the APP sensor and circuits. Refer to the electrical guides. If no fault is found in the circuits, install a new sensor. REFER to: Accelerator Pedal (310-02 Acceleration Control, Removal and Installation). Clear the DTCs, test for normal operation.
P0234	Turbocharger over boost condition	• Excessive boost, detected by manifold absolute pressure and temperature (MAPT) sensor	Check the turbocharger operation, check for sticking turbocharger vanes, etc. Clear the DTCs, test for normal operation.
P0235	Turbocharger boost sensor A circuit	• Manifold absolute pressure and temperature (MAPT) sensor vacuum hose fault • MAPT sensor circuit: open circuit • MAPT sensor circuit: high resistance • MAPT sensor circuit: short circuit to ground • MAPT sensor circuit: short circuit to power • MAPT sensor circuit: short circuit to another	Using the manufacturer approved diagnostic system perform the **(Turbo, exhaust gas recirculation and air path dynamic test)** routine. Refer to the electrical circuit diagrams and check manifold absolute pressure and temperature sensor circuit - DL1-108 - for short circuit to ground, short circuit to power, open circuit, high resistance, short circuit to another circuit. For further diagnostic information REFER to: Turbocharger (303-04C Fuel Charging and Controls - Turbocharger, Diagnosis and Testing).

DTC	Condition	Possible source	Action
		circuit (signal return) • MAPT sensor fault	
P0243	Turbocharger actuator A circuit	• Turbocharger actuator circuit: high resistance • Turbocharger actuator fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the turbocharger actuator and circuits. Refer to the electrical guides. If no fault is found in the circuits, install a new turbocharger. REFER to: Turbocharger (303-04C Fuel Charging and Controls - Turbocharger, Removal and Installation). Clear the DTCs, test for normal operation.
P0251	Injection pump fuel metering control valve	• Contaminated fuel • Air ingress • Pump fault • Excessive injector leakage • Swarf in system • Inlet metering valve fault	Check for contaminated fuel. Draw off approximately 1 litre (2.11 pints) of fuel into a clear container and allow to settle for 1 minute. Examine the fuel for separation indicating contamination. Check the low-pressure fuel system for air ingress, check the fuel pump for evidence of swarf, etc. Check for injector leakage and DTCs indicating an inlet metering valve fault.
P0263	Injector 1 (cylinder 1) contribution/balance	• Injector fault	Carry out the injector leakage procedure. Rectify as necessary. Clear the DTCs, test for normal operation.
P0266	Injector 4 (cylinder 2) contribution/balance	• Injector fault	
P0269	Injector 2 (cylinder 3) contribution/balance	• Injector fault	
P0272	Injector 3 (cylinder 4) contribution/balance	• Injector fault	
P0325	Knock sensor (KS) signal invalid	• KS circuit fault	Check the KS and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P0335	Crankshaft position (CKP) sensor	• Teeth missing from the crank input, indicating poor output from the crankshaft reference sensor • Extra crank teeth seen, indicating the presence of noise • No crank events have been detected within a calibratable time (when events have previously been detected) • The gap in the flywheel tooth pattern has not been seen where expected, indicating the presence of noise • CKP sensor circuit fault	Check the CKP sensor fitment and condition. Check the CKP sensor and circuits. Refer to the electrical guides. Clear the DTCs, test for normal operation.
P0340	Camshaft position (CMP) sensor	• CMP sensor circuit: high resistance • CMP sensor circuit: short circuit to ground • CMP sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the CMP sensor and circuits. Refer to the electrical guides. Clear the DTCs, test for normal operation.
P0380	Glow plug control circuit	• Glow plug control circuit: high resistance • Glow plug control circuit: short circuit to ground • Glow plug control circuit: short circuit to power • Glow plug relay fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the glow plug circuits. Refer to the electrical guides. Activate the glow plug relay and listen for an audible "click". Install a new relay as necessary. Clear the DTCs, test for normal operation.
P0401	Exhaust gas recirculation (EGR) insufficient flow detected	• Damaged, blocked or leaking pipes • Disconnected hose between the air intake (after the mass air flow sensor) and the turbocharger inlet • EGR valve stuck closed - If P0405 is also set	Using the manufacturer approved diagnostic system perform the **(Turbo, exhaust gas recirculation and air path dynamic test)** routine. Check the intake air path hoses and pipework. Rectify as necessary. If P0405 is also set, check the EGR valve and rectify as necessary.
P0402	Exhaust gas recirculation (EGR) excessive flow detected	• EGR valve stuck open	Using the manufacturer approved diagnostic system perform the **(Turbo, exhaust gas recirculation and air path dynamic test)** routine
P0403	Exhaust gas recirculation (EGR) valve control circuit malfunction	• EGR valve connector fault • EGR valve to engine control module (ECM) circuit: high resistance • EGR valve to ECM circuit: short circuit to ground • EGR valve to ECM circuit: short circuit to power • EGR valve to ECM circuit: open circuit	Using the manufacturer approved diagnostic system perform the **(Turbo, exhaust gas recirculation and air path dynamic test)** routine. Note that this code does not indicate a fault in the EGR valve nor the engine control module (ECM), but possibly in the connectors to these components. Check the connectors and circuits. Refer to the electrical guides. Also note that the EGR system will often set groups of codes rather than a single code. Check out P0403 first. Refer to the electrical circuit diagrams and check exhaust gas recirculation (EGR) valve control circuit - DL1-116 - and - DL1-119 - for short circuit to ground, short circuit to power, open circuit, high resistance
P0404	Exhaust gas recirculation (EGR) valve control circuit range/performance	• Excessive soot build-up on the EGR valve seat	Using the manufacturer approved diagnostic system perform the **(Turbo, exhaust gas recirculation and air path dynamic test)** routine. Refer to the electrical circuit diagrams and check exhaust gas recirculation (EGR) valve control circuit - DL1-008 - , - DL1-116 - and - DL1-119 - for short circuit to ground, short circuit to power,

DTC	Condition	Possible source	Action
			open circuit, high resistance. For further diagnostic information REFER to: Turbocharger (303-04C Fuel Charging and Controls - Turbocharger, Diagnosis and Testing).
P0405	Exhaust gas recirculation (EGR) sensor A circuit low	• EGR valve connector fault • EGR valve stuck closed	Check for P0401 if this code is logged suspect an exhaust gas recirculation (EGR) valve internal fault. Using the manufacturer approved diagnostic system perform the **(Turbo, exhaust gas recirculation and air path dynamic test)** routine. Refer to the electrical circuit diagrams and check exhaust gas recirculation (EGR) valve sensor circuit - DL1-008 - for short circuit to ground
P0406	Exhaust gas recirculation (EGR) sensor A circuit high	• EGR valve connector fault • EGR valve stuck open	Check for P0402 if this code is logged suspect an exhaust gas recirculation (EGR) valve internal fault. Using the manufacturer approved diagnostic system perform the **(Turbo, exhaust gas recirculation and air path dynamic test)** routine. Refer to the electrical circuit diagrams and check exhaust gas recirculation (EGR) valve sensor circuit - DL1-008 - for short circuit to power
P0409	Exhaust gas recirculation (EGR) sensor A circuit	• EGR valve connector fault • ECM internal fault • EGR valve to engine control module (ECM) circuit: high resistance • EGR valve to ECM circuit: short circuit to ground • EGR valve to ECM circuit: short circuit to power • EGR valve to ECM circuit: open circuit	Check the EGR valve connections and circuits first. Rectify as necessary. Using the manufacturer approved diagnostic system perform the **(Turbo, exhaust gas recirculation and air path dynamic test)** routine. Refer to the electrical circuit diagrams and check exhaust gas recirculation (EGR) valve sensor circuit - DL1-008 - for short circuit to ground, short circuit to power, open circuit, high resistance
P0480	Fan 1 control circuit	• Fan control module circuit: high resistance • Fan control module circuit: short circuit to ground • Fan control module circuit: short circuit to power • Fan motor circuit: high resistance • Fan motor circuit: short circuit to ground • Fan motor circuit: short circuit to power	Refer to the approved diagnostic system for a guided diagnostic routine. Check the fan circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P0481	Fan 2 control circuit	• High fan control primary circuit	Refer to the approved diagnostic system for a guided diagnostic routine. Check the fan circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P0485	Fan power/ground circuit	• Fan control module circuit: high resistance • Fan control module circuit: short circuit to ground • Fan control module circuit: short circuit to power	Check the fan circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P0486	Exhaust gas recirculation (EGR) sensor B circuit	• EGR valve connector fault • EGR valve to engine control module (ECM) circuit: high resistance • EGR valve to ECM circuit: short circuit to ground • EGR valve to ECM circuit: short circuit to power • EGR valve to ECM circuit: open circuit	Check the EGR valve connections and circuits first. Rectify as necessary. Using the manufacturer approved diagnostic system perform the **(Turbo, exhaust gas recirculation and air path dynamic test)** routine. Refer to the electrical circuit diagrams and check exhaust gas recirculation throttle position sensor circuit - DL1-036 - for short circuit to ground, short circuit to power, open circuit, high resistance
P0487	Exhaust gas recirculation (EGR) throttle position control circuit	• EGR circuit: high resistance • EGR circuit: short circuit to ground	Refer to the approved diagnostic system for a guided diagnostic routine. Check the EGR valve connections and circuits first. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P0488	Exhaust gas recirculation (EGR) throttle position control range/performance	• EGR valve connector fault • EGR valve to engine control module (ECM) circuit: high resistance • EGR valve to ECM circuit: short circuit to ground • EGR valve to ECM circuit: short circuit to power • EGR valve to ECM circuit: open circuit	Check the EGR valve connections and circuits first. Rectify as necessary. Using the manufacturer approved diagnostic system perform the **(Turbo, exhaust gas recirculation and air path dynamic test)** routine. Refer to the electrical circuit diagrams and check exhaust gas recirculation (EGR) valve sensor circuit - DL1-096 - for short circuit to ground, short circuit to power, open circuit, high resistance
P0500	Vehicle speed sensor A	• The engine control module (ECM) cannot determine the vehicle speed from the anti-lock brake system (ABS) or transmission	Check for DTCs indicating a fault in the ABS or transmission. Rectify as necessary. Clear the DTCs, test for normal operation.

DTC	Condition	Possible source	Action
P0530	Air conditioning refrigerant pressure sensor circuit	• Air conditioning pressure sensor circuit: high resistance • Air conditioning pressure sensor circuit: short circuit to ground • Air conditioning pressure sensor circuit: short circuit short circuit to power • Air conditioning pressure sensor fault	Check the air conditioning refrigerant pressure sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P0544	Exhaust gas temperature sensor circuit, right-hand bank, upstream sensor	• Exhaust gas temperature sensor circuit: short circuit to ground • Exhaust gas temperature sensor circuit: open circuit • Exhaust gas temperature sensor circuit: short circuit to power • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P0545	Exhaust gas temperature sensor circuit low, right-hand bank, upstream sensor	• Exhaust gas temperature sensor circuit: short circuit to ground • Exhaust gas temperature sensor circuit: open circuit • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P0546	Exhaust gas temperature sensor circuit high, right-hand bank, upstream sensor	• Exhaust gas temperature sensor circuit: short circuit to power • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P0560	System voltage - range failure of the battery voltage input	• Battery voltage high or low	Check the battery condition and state of charge. Check the charging system. Rectify as necessary. Clear the DTCs, test for normal operation.
P0571	Speed control brake switch circuit failure	• Speed control brake switch circuit: high resistance • Speed control brake switch circuit: short circuit to ground • Speed control brake switch circuit: short circuit to power • Speed control brake switch failure	Check the speed control brake switch and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P0575	Speed control input circuit	• Speed control steering wheel switch circuit: high resistance • Speed control steering wheel switch circuit: short circuit to ground • Speed control steering wheel switch circuit: short circuit to power • Clockspring failure	Check the speed control steering wheel switch and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P0603	Engine control module (ECM) keep-alive memory error	• ECM power supply circuit fault • ECM fault	Check the power supplies to the ECM. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P0605	Engine control module (ECM) read-only-memory (ROM) error	• ECM flash memory error - Internal ECM fault	Refer to the warranty policy and procedures manual if an ECM is suspect
P060B	Internal control module analogue to digital processing performance	• Failure of the analogue to digital converter - Internal ECM fault	Refer to the warranty policy and procedures manual if an ECM is suspect
P0611	Fuel injector control module performance	• Fuel injectors have not been programmed • Fuel injector programming is corrupt and the injectors have reset to their default values	Programme the injectors using the approved diagnostic system. Clear the DTCs, test for normal operation.
P0622	Generator field terminal circuit	• Generator monitor circuit: high resistance • Generator monitor circuit: short circuit to ground • Generator monitor circuit: short circuit to power • Generator regulator fault	Check the generator and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.

DTC	Condition	Possible source	Action
		• Engine control module (ECM) fault	
P0623	Generator warning lamp circuit	• Warning lamp failure • Warning lamp circuit: high resistance • Warning lamp circuit: short circuit to ground • Warning lamp circuit: short circuit to power	Check the generator and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P0641	Sensor reference voltage A circuit	• This code indicates an internal engine control module (ECM) fault	Refer to the warranty policy and procedures manual if an ECM is suspect
P0645	Air conditioning (A/C) clutch relay control circuit	• A/C clutch relay control circuit: high resistance • A/C clutch relay control circuit: short circuit to ground • A/C clutch relay control circuit: short circuit to power • A/C clutch relay	Check the A/C clutch and circuits. Refer to the electrical guides. Check the operation of the air conditioning clutch relay. Rectify as necessary. Clear the DTCs, test for normal operation.
P0648	Immobilizer lamp control circuit	• Immobilizer lamp control circuit: high resistance • Immobilizer lamp control circuit: short circuit to ground • Immobilizer lamp control circuit: short circuit to power • Lamp failure	Check the immobilizer lamp and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P0685	Engine control module (ECM) main relay control circuit open	• Poor battery connections at the battery or engine block • ECM relay control circuit: high resistance • ECM relay control circuit: short circuit to ground • ECM relay control circuit: short circuit to power • ECM relay fault	Check the connections at the battery and engine block. Check the relay and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P0700	Transmission control system (MIL Request)	• TCM reports unspecified error to ECM and requests MIL illumination	Check the TCM for DTCs. Clear the DTCs, test for normal operation.
P1000	Not all diagnostic monitors have run	• One or more on-board diagnostic routines have not completed	This code does not indicate a fault, just that additional drive cycles are required.
P1200	Injector Range/Performance	• Injector fault	This DTC would be accompanied by the code P2336, P2337, P2338 or P2339 indicating which injector is faulty. Install a new injector(s) as necessary. REFER to: Fuel Injector (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). Clear the DTCs, test for normal operation.
P1211	Injector control pressure higher/lower than desired with the engine running/fuel system contamination	• Contaminated fuel • Air ingress • High-pressure injector leak • Fuel pressure sensor/circuit fault • Fuel metering valve/circuit fault • Fuel pump fault	Check for contaminated fuel. Draw off approximately 1 litre (2.11 pints) of fuel into a clear container and allow to settle for 1 minute. Examine the fuel for separation indicating contamination. Check the low-pressure fuel system for air ingress. Check for evidence of a high-pressure fuel leak. Rectify as necessary. Check the fuel pressure sensor, metering valve and circuits. Refer to the electrical guides. Check for DTCs indicating a pump fault.
P1288	Cylinder head temperature (CHT) sensor out of selftest range	• Coolant low/contaminated • Poor thermostat operation • CHT sensor circuit fault • CHT sensor fault	Check the coolant level and condition, check the thermostat operation. Rectify as necessary. Check the CHT sensor and circuits. Refer to the electrical guides. Clear the DTCs, test for normal operation.
P132A	Turbocharger boost system performance	• Turbocharger actuator fault	Carry out visual inspection of the rotary electronic actuator arm during ignition state on/off. Ignition **on** actuator will retract under smooth operation to a set position. Ignition **off** actuator will retract to the fully open position. If this is not observed inspect the turbo charger rotary electronic actuator arm for corrosion and check for ease of vane movement. Using the manufacturer approved diagnostic system perform the **(Turbo, exhaust gas recirculation and air path dynamic test)** routine. For further diagnostic information REFER to: Turbocharger (303-04C Fuel Charging and Controls - Turbocharger, Diagnosis and Testing).

DTC	Condition	Possible source	Action
P132B	Turbocharger boost system performance	• Memory check failure during initialization • Turbocharger vanes sticking • Turbocharger rotary electronic actuator internal failure	Carry out visual inspection of the rotary electronic actuator arm during ignition state on/off. Ignition **on** actuator will retract under smooth operation to a set position. Ignition **off** actuator will retract to the fully open position. If this is not observed inspect the turbo charger rotary electronic actuator arm for corrosion and check for ease of vane movement. Clear the DTCs cycle the ignition and recheck. If the DTCs are still present after 3 attempts, check the turbocharger vanes for deposit build-up, a foreign body or damage to the compressor/turbine wheels/housing as mechanism may be sticking. For further diagnostic information REFER to: Turbocharger (303-04C Fuel Charging and Controls - Turbocharger, Diagnosis and Testing).
P132C	Turbocharger boost system voltage	• Battery voltage out of range	Refer to the approved diagnostic system for a guided diagnostic routine. Check the battery condition and state of charge. Check the turbocharger circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P138D	Turbocharger boost system temperature too high	• Engine overheating as a result of exhaust gas leakage • Carbon deposits on the exhaust manifold • Turbocharger actuator fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust manifold for leakage/carbon deposits. Clear the DTCs, test for normal operation. If the fault persists, install a new turbocharger. REFER to: Turbocharger (303-04C Fuel Charging and Controls - Turbocharger, Removal and Installation). Clear the DTCs, test for normal operation.
P1403	Differential pressure feedback sensor hoses reversed	• DPF pressure sensor (delta pressure sensor) crossed hose fault	Check the correct connection of the hoses to the DPF pressure sensor. Rectify as necessary. Clear the DTCs, test for normal operation.
P1543	Engine coolant heater A control circuit	• Engine coolant heater A control circuit: high resistance	Refer to the approved diagnostic system for a guided diagnostic routine. Check the coolant heater and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P1544	Engine coolant heater B control circuit	• Engine coolant heater B control circuit: high resistance	Refer to the approved diagnostic system for a guided diagnostic routine. Check the coolant heater and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P1576	Pedal position not available (accelerator pedal position (APP) sensor failed on more than one track)	• APP sensor circuit fault • APP sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the APP sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P1582	Electronic throttle monitor data available	• Inertia switch tripped	Check the inertia switch status and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P1630	Engine control module (ECM) internal voltage reference	• Internal ECM fault	Refer to the approved diagnostic system for a guided diagnostic routine. Refer to the warranty policy and procedures manual if an ECM is suspect.
P1632	Smart generator output circuit	• Generator circuit: high resistance • Generator circuit: short circuit to ground • Generator circuit: short circuit to power • Generator regulator fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the generator and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P1635	Tire/Axle ratio out of acceptable range	• The tire size stored in the vehicle identification (VID) block is out of range	Check that the tires fitted to the vehicle are of the correct specification. Rectify as necessary.
P1643	CAN link engine control module/transmission control module circuit/network	• CAN H open circuit failure between ECM and TCM • CAN L open circuit failure between ECM and TCM	Check the CAN circuits between the engine control module (ECM) and the TCM. Rectify as necessary. Clear the DTCs, test for normal operation.
P1676	Injector Data Incompatible	• Injector corrections download failed	Re-enter the injector codes using the approved diagnostic system. Clear the DTCs, test for normal operation.
P1700	Transmission indeterminate failure (failed to neutral)	• TCM has identified a failure, the ECM is required to record this failure	Check the TCM for DTCs. Clear the DTCs, test for normal operation.
P179A	Controller area network (CAN) link, turbocharger boost control system	• CAN feedback messages not received	Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Carry out visual inspection of the rotary electronic actuator arm during ignition state on/off. Ignition **on** actuator will retract under smooth operation to a set position. Ignition **off** actuator will retract to the fully open position. If this is not observed inspect the turbo charger rotary electronic actuator arm for corrosion and check for ease of vane movement. Using the manufacturer approved diagnostic system perform the **(Turbo, exhaust gas recirculation and air path dynamic test)** routine. For further diagnostic information REFER to: Turbocharger (303-04C Fuel Charging and Controls - Turbocharger, Diagnosis and Testing).
P1816	Transmission Neutral Safety Switch Circuit Failure	• Start lock switch plausibility failure • Start lock STLK circuit: open circuit • Start lock STLK circuit: short to ground • Start lock STLK circuit:	Check the Start lock switch and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation. Refer to the warranty policy and procedures manual if an ECM / TCM is suspect

DTC	Condition	Possible source	Action
		short to power • Failure of ECM • Failure of TCM	
P1937	Fuel fired heater (FFH) control circuit	• FFH supply or ground circuit fault • FFH control circuit: high resistance • FFH control circuit: short circuit to ground • FFH control circuit: short circuit to power • FFH control module fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the FFH and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P2031	Right-hand bank exhaust gas temperature sensor circuit, sensor 2	• Exhaust gas temperature sensor circuit: short circuit to ground • Exhaust gas temperature sensor circuit: open circuit • Exhaust gas temperature sensor circuit: short circuit to power • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P2032	Right-hand bank exhaust gas temperature sensor circuit low, sensor 2	• Exhaust gas temperature sensor circuit: short circuit to ground • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P2033	Right-hand bank exhaust gas temperature sensor circuit high, sensor 2	• Exhaust gas temperature sensor circuit: short circuit to power • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P2080	Right-hand bank exhaust gas temperature sensor circuit range/performance, sensor 1	• Exhaust gas temperature sensor circuit: short circuit to ground • Exhaust gas temperature sensor circuit: open circuit • Exhaust gas temperature sensor circuit: short circuit to power • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P2081	Right-hand bank exhaust gas temperature sensor circuit intermittent, sensor 1	• Exhaust gas temperature sensor circuit: intermittent high resistance • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P2085	Right-hand bank exhaust gas temperature sensor circuit intermittent, sensor 2	• Exhaust gas temperature sensor circuit: intermittent high resistance • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P2288	Injector control pressure too high	• Fuel contaminated • Fuel pressure sensor circuit: high resistance • Fuel pressure sensor circuit: short circuit to ground • Fuel pressure sensor circuit: short circuit to power	Check for contaminated fuel. Draw off approximately 1 litre (2.11 pints) of fuel into a clear container and allow to settle for 1 minute. Examine the fuel for separation indicating contamination. Rectify as necessary. Check the fuel pressure sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P2291	Injector control pressure too low - engine cranking	• Low fuel level • Blocked, kinked or crushed fuel lines • Fuel pressure sensor circuit fault • Inlet metering valve fault • Injector leaking • Fuel pump fault • Engine control module (ECM) fault	Check the fuel level. Check the fuel lines for damage, etc. Rectify as necessary. Check the fuel pressure sensor and circuits. Refer to the electrical guides. Check for DTCs indicating an inlet metering valve, injector or pump fault. Rectify as necessary. Clear the DTCs, test for normal operation. Refer to the warranty policy and procedures manual if an ECM is suspect.
P2336	Cylinder 1 above knock threshold - knock sensor trim for cylinder 1 invalid	• Natural wear of the injector • Fuel contaminated • Blocked or dirty fuel injector(s) • Injector circuit fault • Injector fault	Re-enter the injector codes using the approved diagnostic system. If after reprogramming and clearing the DTCs the DTC reoccurs, check for contaminated fuel. Draw off approximately 1 litre (2.11 pints) of fuel into a clear container and allow to settle for 1 minute. Examine the fuel for separation indicating contamination. Rectify as necessary. Carry out the cylinder balance check. Check the injector circuits. Refer to the electrical guides. Rectify as necessary. Clear

DTC	Condition	Possible source	Action
P2337	Cylinder 2 above knock threshold - knock sensor trim for cylinder 2 (injector 4) invalid	• Natural wear of the injector • Fuel contaminated • Blocked or dirty fuel injector(s) • Injector circuit fault • Injector fault	the DTCs, test for normal operation.
P2338	Cylinder 3 above knock threshold - knock sensor trim for cylinder 3 (injector 2) invalid	• Natural wear of the injector • Fuel contaminated • Blocked or dirty fuel injector(s) • Injector circuit fault • Injector fault	
P2339	Cylinder 4 above knock threshold - knock sensor trim for cylinder 4 (injector 3) invalid	• Natural wear of the injector • Fuel contaminated • Blocked or dirty fuel injector(s) • Injector circuit fault • Injector fault	
P242F	Diesel particulate filter (DPF) restriction - ash accumulation	• DPF blocked	Install a new DPF as necessary. REFER to: Diesel Particulate Filter (DPF) (309-00 Exhaust System, Removal and Installation). Clear the DTCs, test for normal operation.
P244A	Diesel particulate filter (DPF) differential pressure too low	• DPF leaking	Install a new DPF as necessary. REFER to: Diesel Particulate Filter (DPF) (309-00 Exhaust System, Removal and Installation). Clear the DTCs, test for normal operation.
P244B	Diesel particulate filter (DPF) differential pressure too high	• DPF overloaded	Carry out the regeneration procedure. Clear the DTCs, test for normal operation.
P244C	Exhaust temperature too low for particulate filter regeneration	• Insufficient mileage/speed for regeneration	Carry out the regeneration procedure. Clear the DTCs, test for normal operation.
P2452	Diesel particulate filter (DPF) pressure sensor A circuit	• DPF pressure sensor (delta pressure sensor) circuit fault • DPF pressure sensor (delta pressure sensor)fault	Check the DPF pressure sensor (delta pressure sensor)and circuits. Refer to the electrical guides. Rectify as necessary.
P2453	Diesel particulate filter (DPF) pressure sensor A circuit range/performance	• DPF pressure sensor (delta pressure sensor) hose fault • DPF pressure sensor (delta pressure sensor)fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the condition and fitment of the DPF pressure sensor (delta pressure sensor) and hoses. Rectify as necessary.
P2623	Injector control pressure regulator open	• Inlet metering valve fault • Inlet metering valve circuit fault	Check the inlet metering valve and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.

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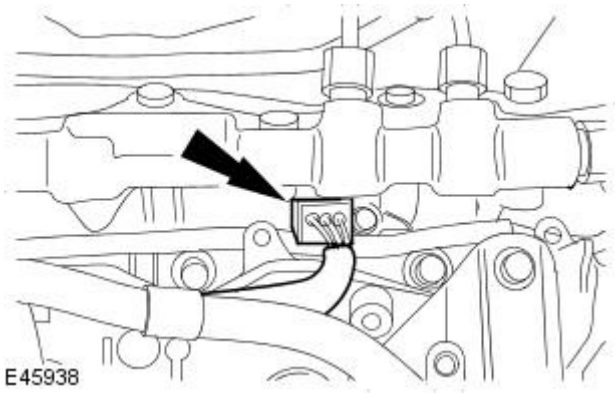
Electronic Engine Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Camshaft Position (CMP) Sensor

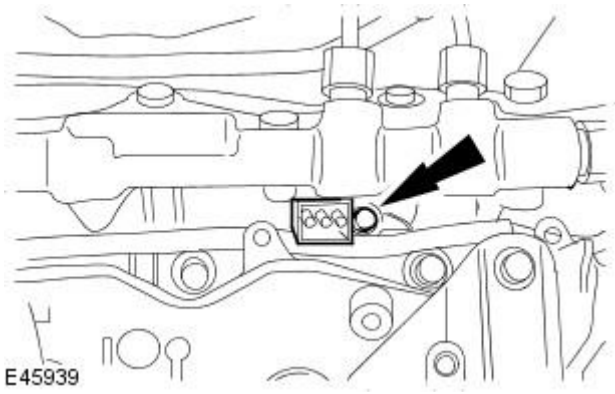
Removal and Installation

Removal

1. Remove the air cleaner.
   For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
2. Disconnect the electrical connector.

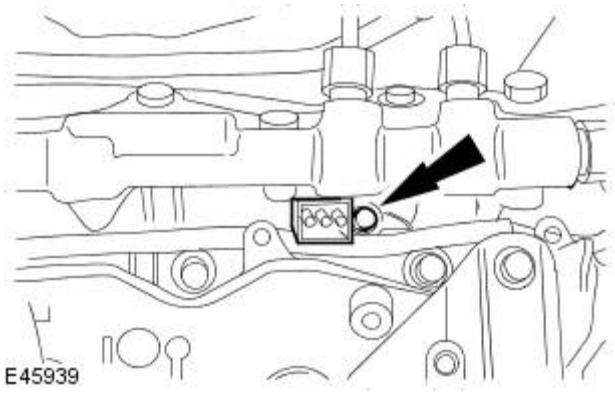


3. Remove the camshaft position (CMP) sensor.



Installation

1. To install, reverse the removal procedure.
   - Tighten to 9 Nm.



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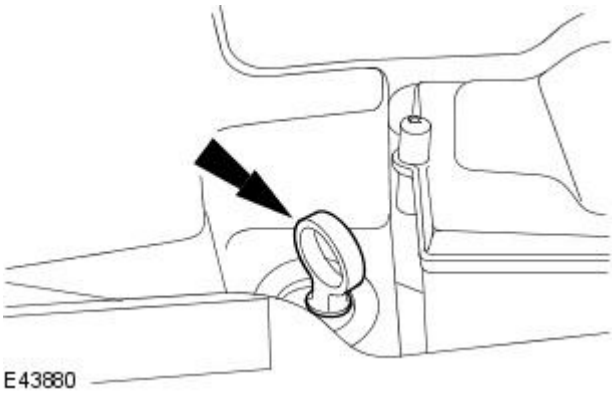
Electronic Engine Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Catalytic Converter Temperature Sensor

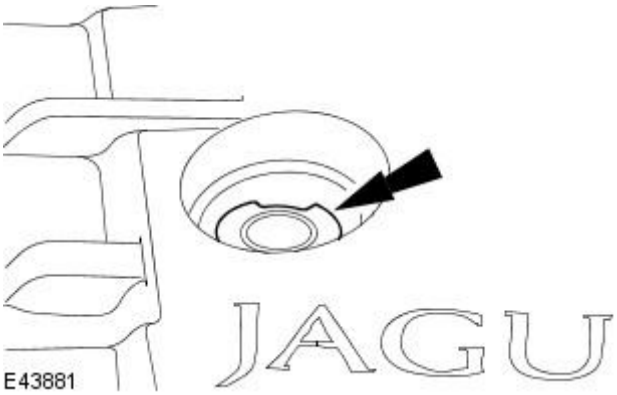
Removal and Installation

Special Tool(s)	
303-1184  E67739	Exhaust gas temperature sensor wrench 303-1184

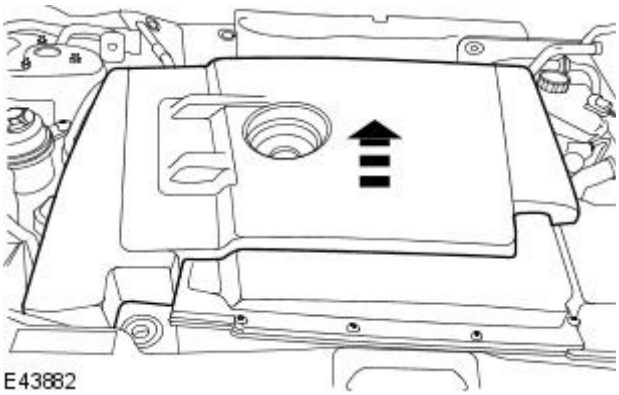
Removal



1. Remove the oil level indicator.

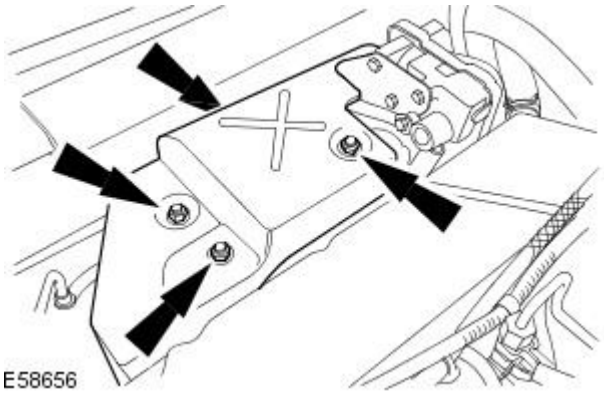


2. Remove the oil filler cap.

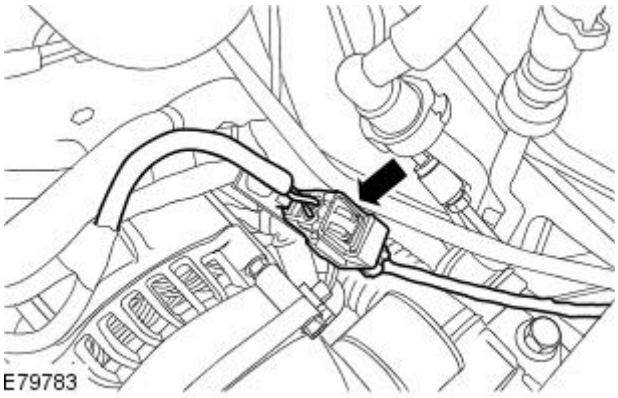


3. NOTE: Install the oil filler cap and oil level indicator to prevent foreign material entering the valve cover.

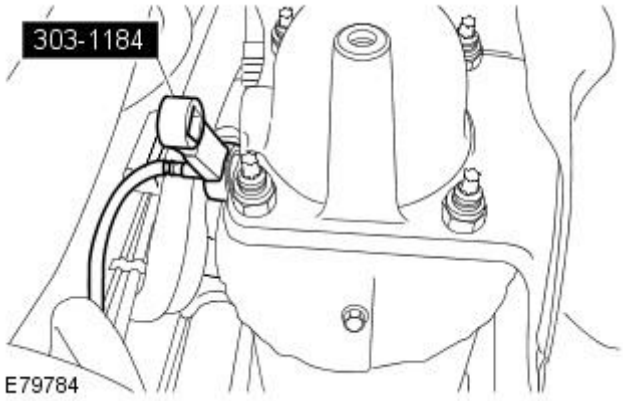
Remove the engine cover.



4. Remove the turbocharger heatshield.

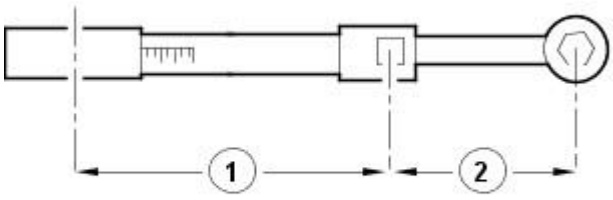


5. Disconnect the catalytic converter temperature sensor electrical connector.



6. Remove the catalytic converter temperature sensor.

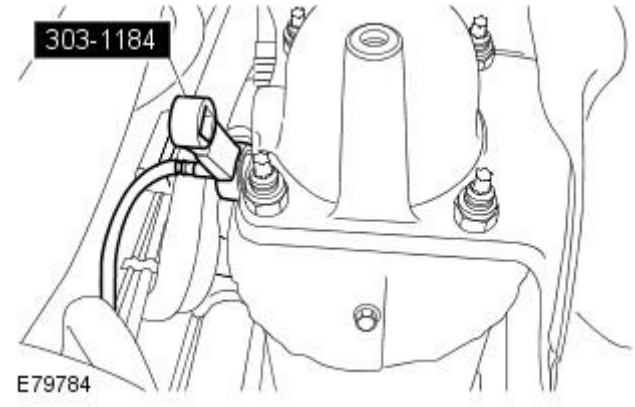
Installation



1. CAUTION: Make sure the torque wrench setting procedure is followed correctly. Failure to follow this instruction may result in damage to the vehicle.

Calculate the setting for the torque wrench.

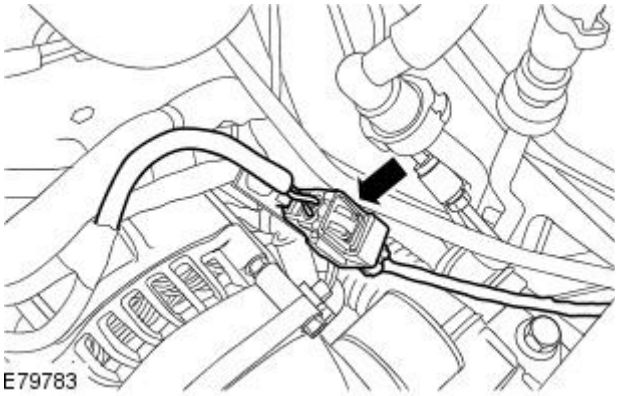
- Stage 1: Multiply the required torque by the effective length of the torque wrench (1).
- Stage 2: Add the effective length of the special tool (2) to the effective length of the torque wrench.
- Stage 3: Divide the total of stage 1 by the total of stage 2.
- Stage 4: Set the torque wrench to the figure arrived at in stage 3.



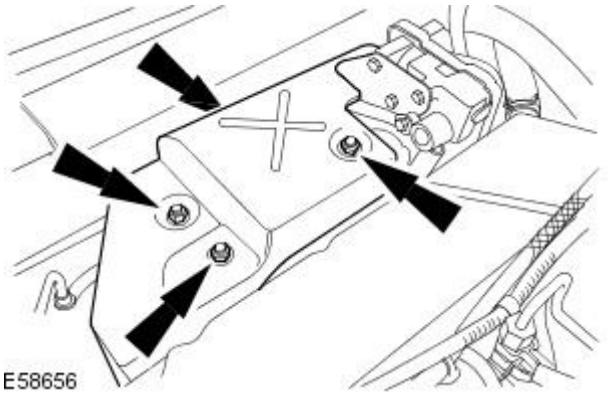
2. CAUTION: Make sure the torque wrench setting procedure is followed correctly. Failure to follow this instruction may result in damage to the vehicle.

Install the catalytic converter temperature sensor.

- Tighten to 35 Nm.

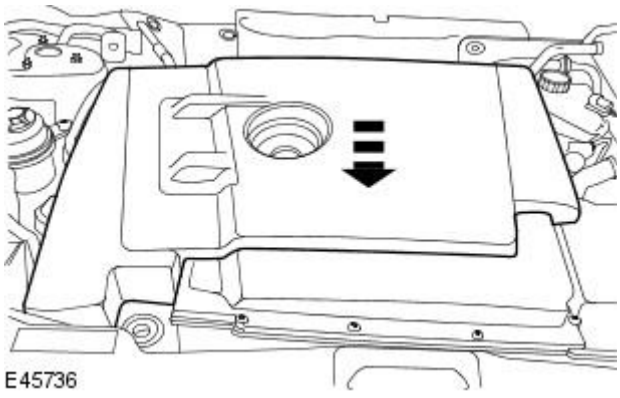


3. Connect the catalytic converter temperature sensor electrical connector.



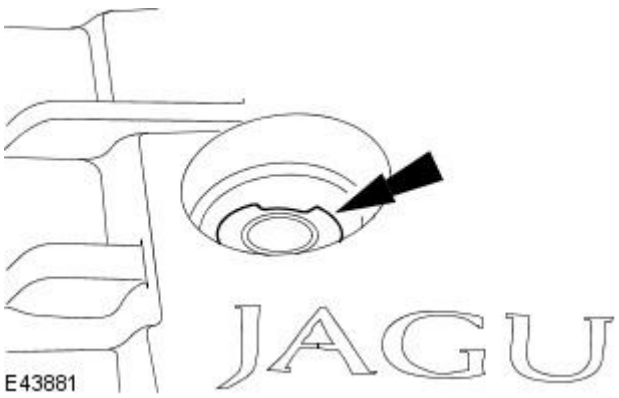
4. Install the turbocharger heatshield.

- Tighten to 9 Nm.

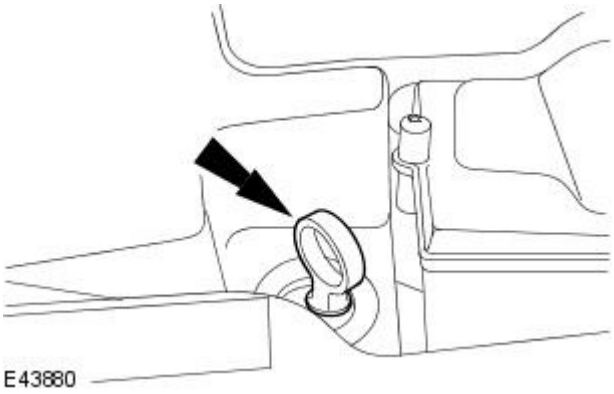


5. NOTE: Remove the oil filler cap and oil level indicator.

Install the engine cover.



6. Install the oil filler cap.



7. Install the oil level indicator.

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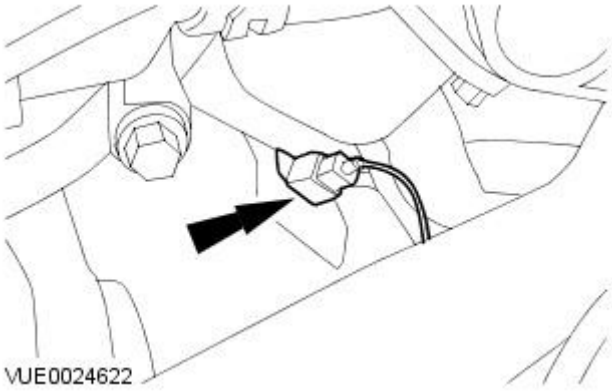
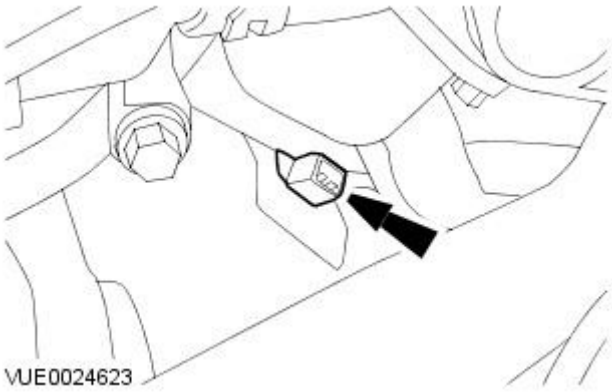
Electronic Engine Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Crankshaft Position (CKP) Sensor

Removal and Installation

Removal

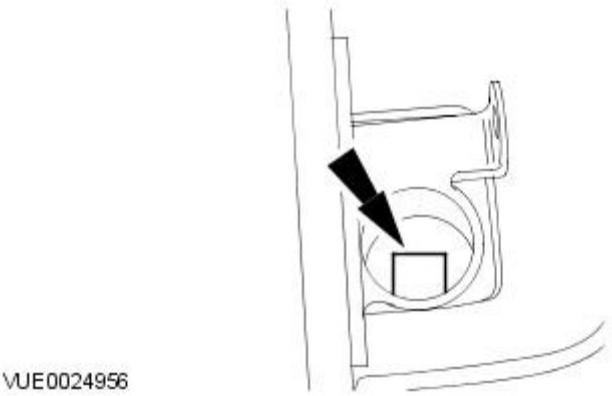


1. Disconnect the electrical connector.



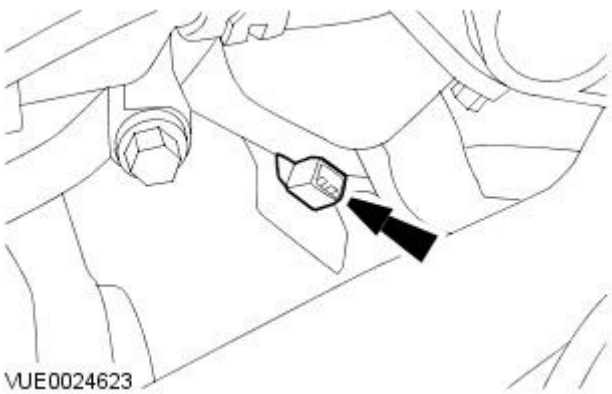
2. Remove and discard the crankshaft position (CKP) sensor.

Installation



1. NOTE: Only turn the engine in the normal direction of rotation

Turn the engine until a flywheel trigger tooth is visible through the CKP sensor housing.

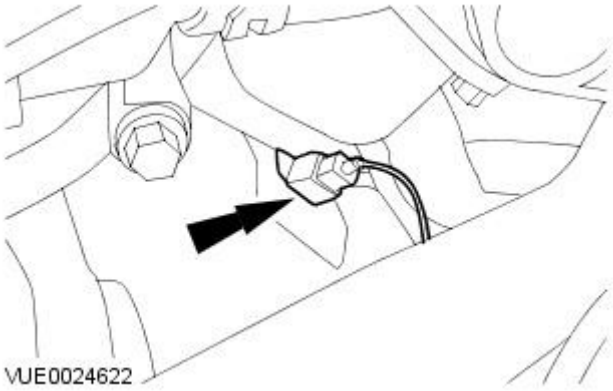


2. CAUTION: The CKP sensor tip must rest on a flywheel trigger tooth. Incorrect installation may result in the CKP sensor being damaged.

• NOTE: Make sure that the CKP sensor housing is clean and free from foreign material.

Install the CKP sensor.

- Tighten to 7 Nm.



3. Connect the CKP sensor electrical connector.

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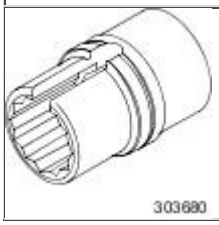
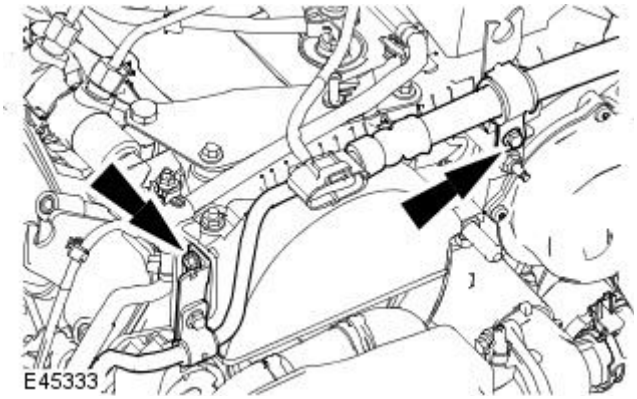
Electronic Engine Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Cylinder Head Temperature (CHT) Sensor

Removal and Installation

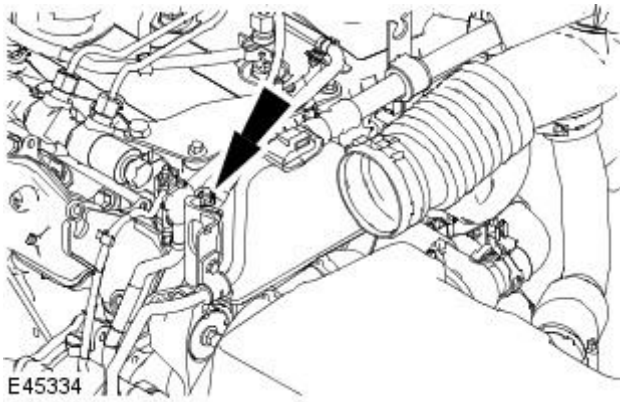
Special Tool(s)	
 303680	Socket, CHT Sensor 303-680 (21-239)

Removal

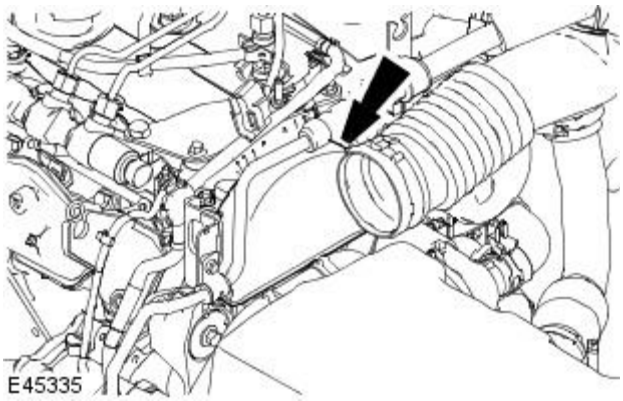
1. Remove the air cleaner.
   For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
2. Detach the power assisted steering fluid pipe.

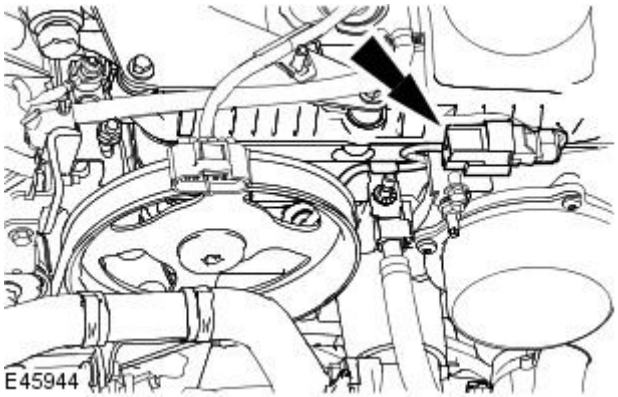

E45333

3. Remove the power steering pump belt cover retaining nut.

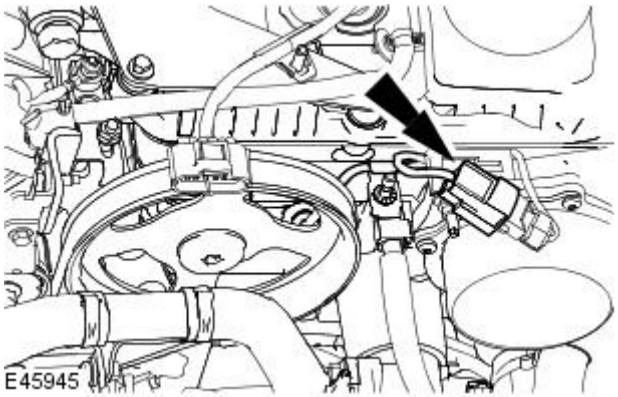

E45334

4. Remove the power steering pump belt cover.

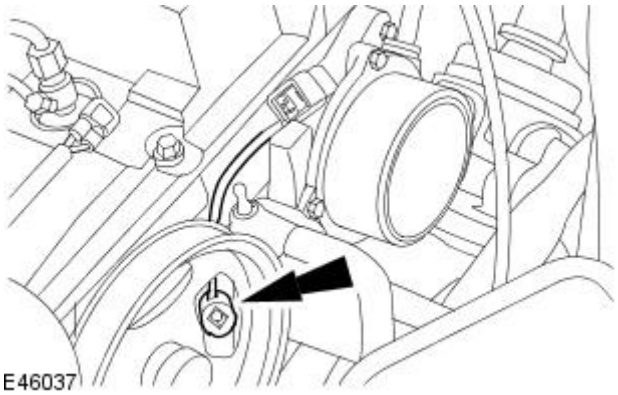

E45335



5. Detach the cyclinder head temperature (CHT) sensor electrical connector.

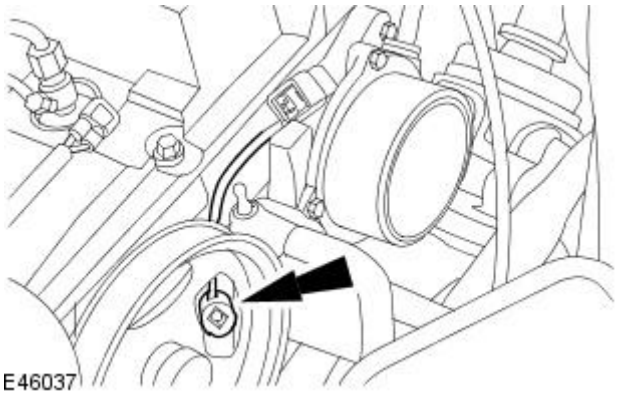


6. Disconnect the CHT sensor electrical connector.



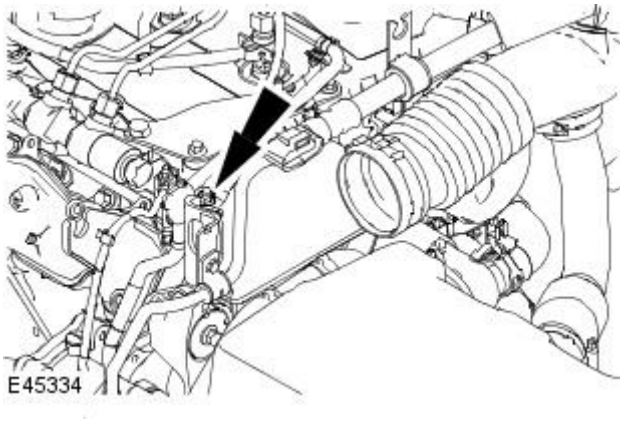
7. Using the special tool 303-680, remove the CHT sensor.

Installation



1. To install, reverse the removal procedure.

- Tighten to 10 Nm.



2. Tighten to 10 Nm.

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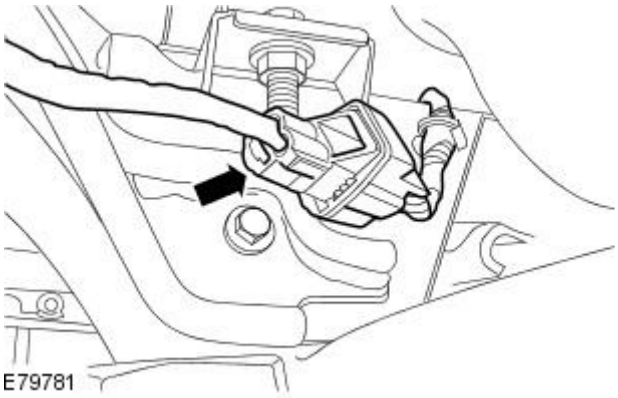
Electronic Engine Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Diesel Particulate Filter (DPF) Temperature Sensor

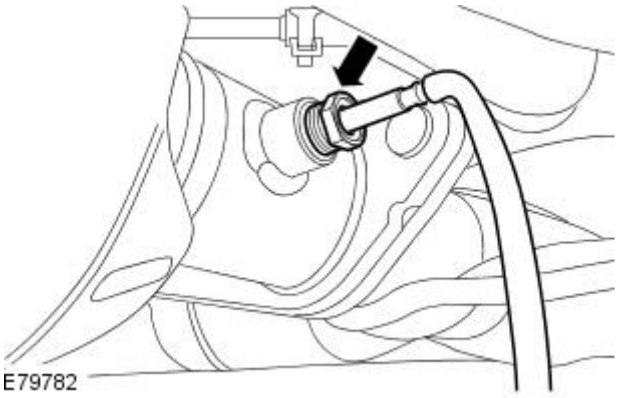
Removal and Installation

Removal

1. Remove the air deflector.
   For additional information, refer to: Air Deflector - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (501-02 Front End Body Panels, Removal and Installation).
2. Disconnect the diesel particulate filter (DPF) temperature sensor electrical connector.

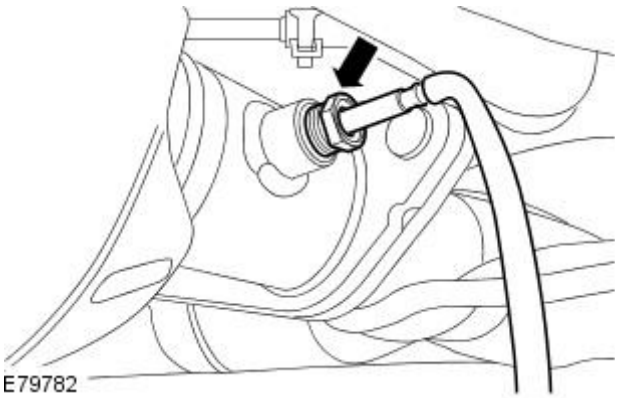


3. Remove the DPF temperature sensor.



Installation

1. To install, reverse the removal procedure.
   - Tighten to 35 Nm.



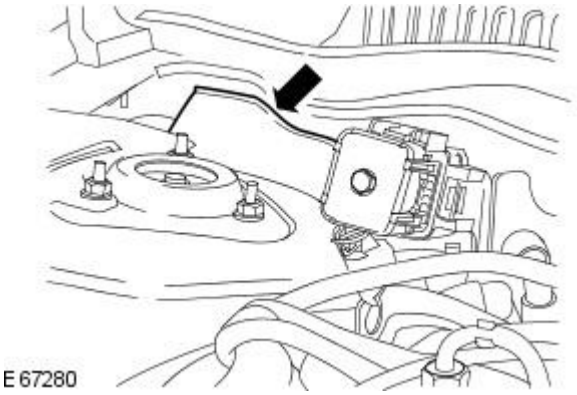
Published: 11-May-2011

Electronic Engine Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Engine Control Module (ECM)

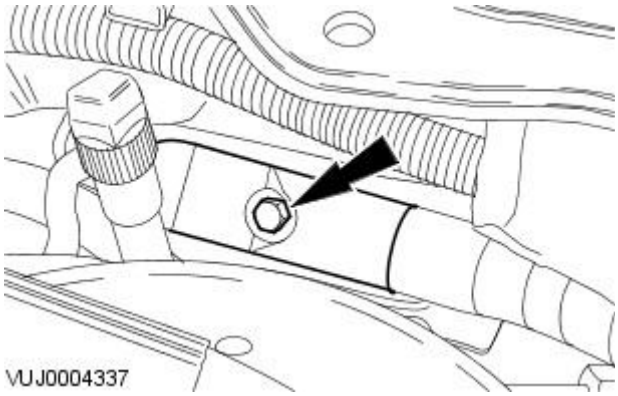
Removal and Installation

Removal

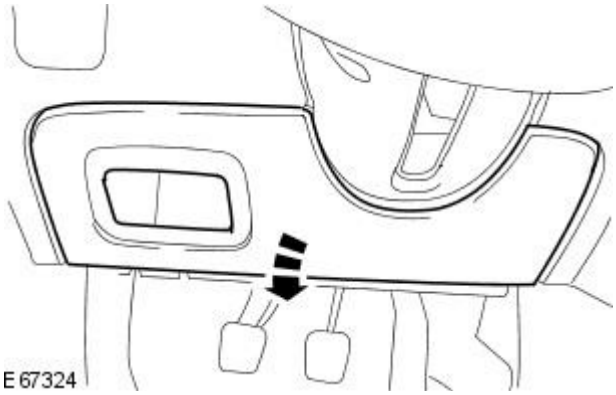
1. Disconnect the battery ground cable. For additional information, refer to For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the engine wiring harness trim panel.



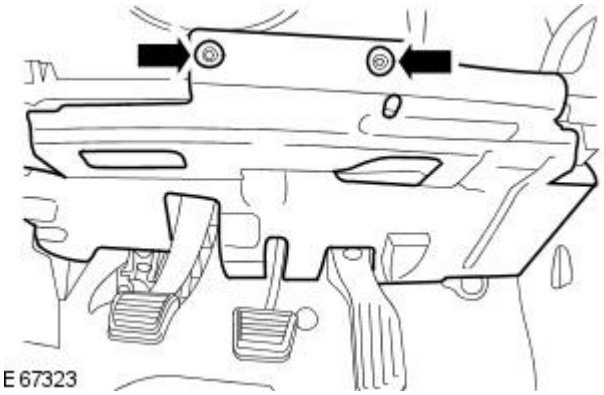
3. Disconnect the engine control module (ECM) electrical connector.

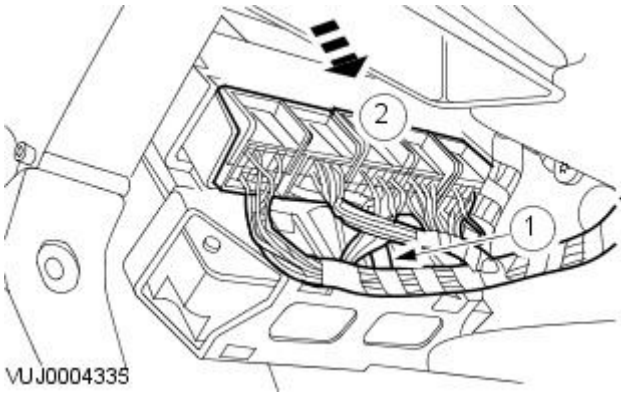


4. Remove the instrument cluster lower trim panel.



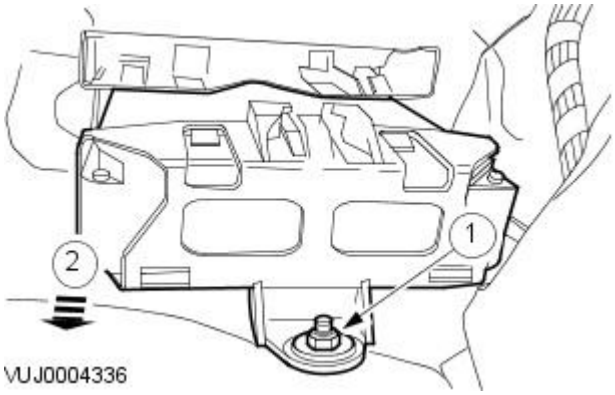
5. Remove the trim panel.





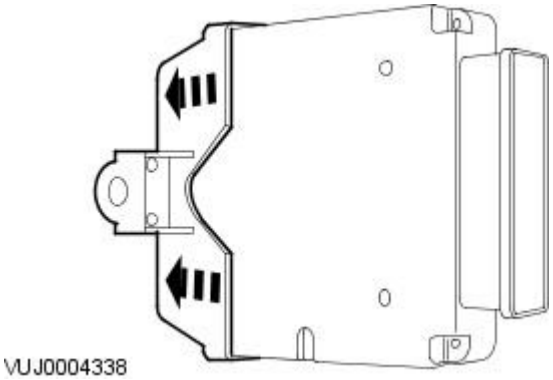
6. Detach the generic electronic module (GEM) from the ECM.

1. Release the GEM locking tang.
2. Detach the GEM from the ECM.



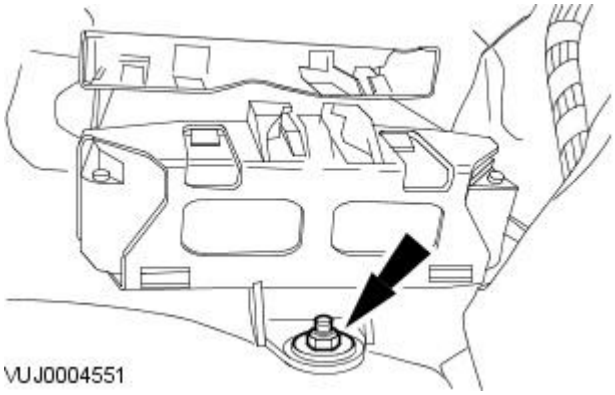
7. Remove the ECM.

1. Remove the ECM retaining nut.
2. Remove the ECM.



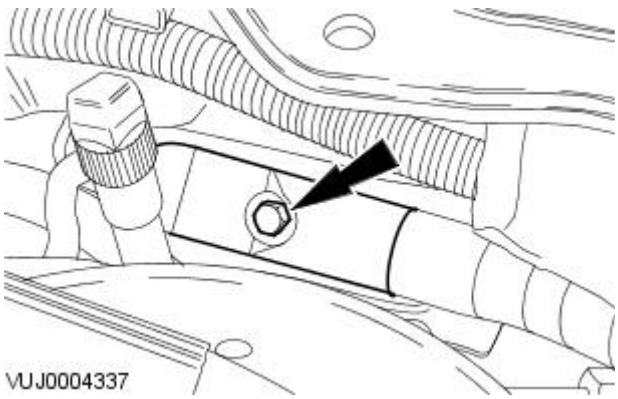
8. Remove the ECM from the ECM retaining bracket.

Installation



1. To install, reverse the removal procedure.

- Tighten to 10 Nm.



2. CAUTION: Make sure that the electrical connector locates correctly in the ECM. Do not force or overtighten the electrical connector.

Tighten to 10 Nm.

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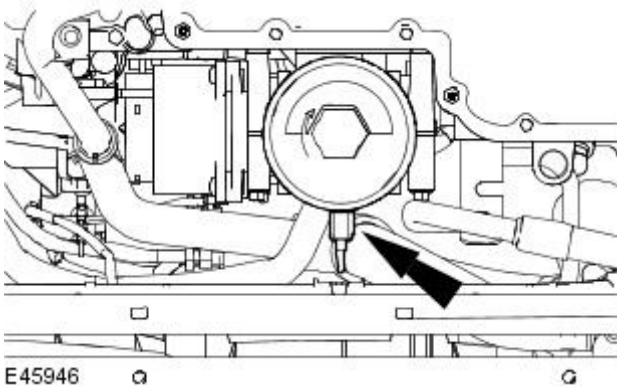
Electronic Engine Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Engine Oil Pressure (EOP) Sensor

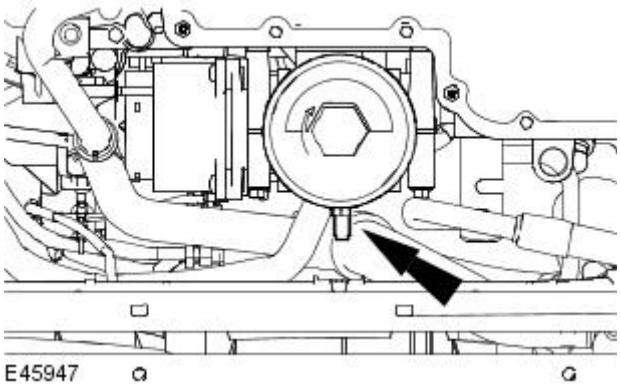
Removal and Installation

Removal

1. Raise and support the vehicle.
   For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. Remove the engine undertray.
   For additional information, refer to: Air Deflector - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (501-02 Front End Body Panels, Removal and Installation).
3. Disconnect the engine oil pressure (EOP) sensor electrical connector.

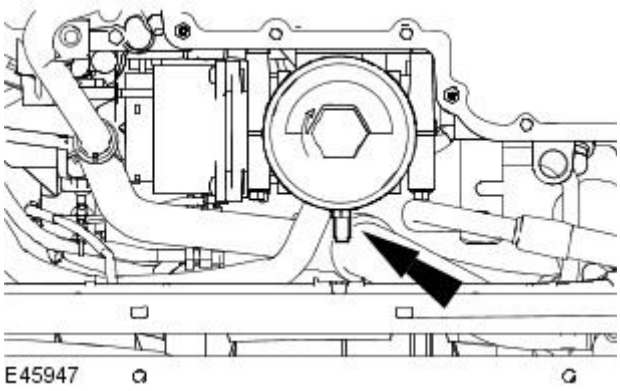


4. Remove the EOP sensor.



Installation

1. To install, reverse the removal procedure.
   - Tighten to 15 Nm.



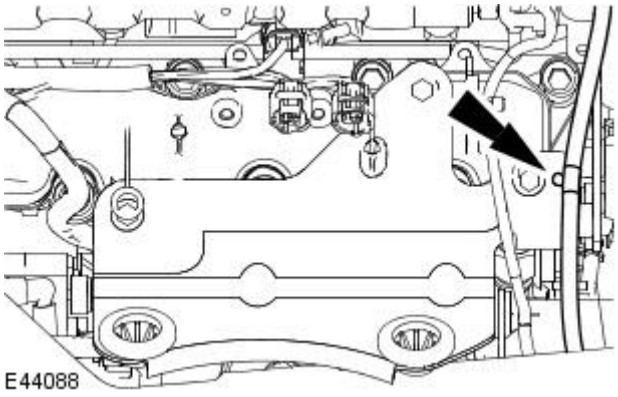
Published: 11-May-2011

Electronic Engine Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Fuel Temperature Sensor

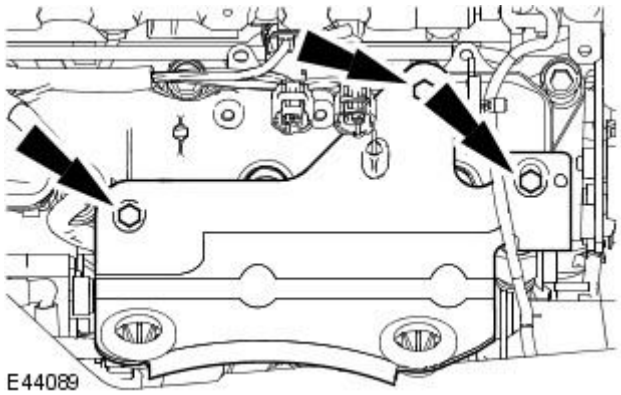
Removal and Installation

Removal

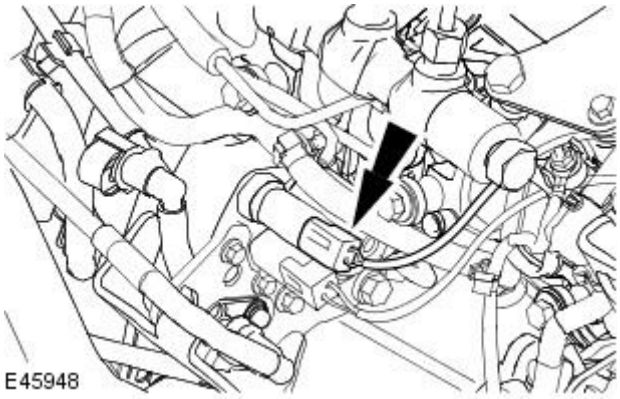
1. Remove the air cleaner.
   For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
2. Detach the wiring harness.



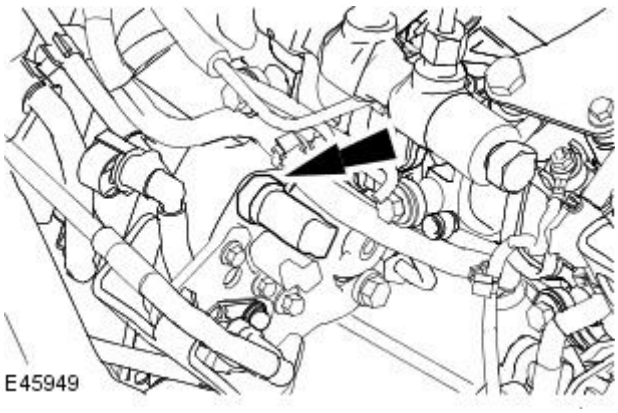
3. Remove the air cleaner mount bracket.



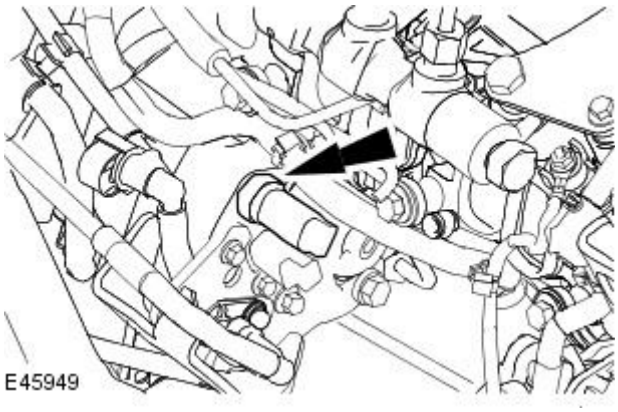
4. Disconnect the electrical connector.



5. Remove the fuel temperature sensor.



Installation



1. To install, reverse the removal procedure.

- Tighten to 15 Nm.

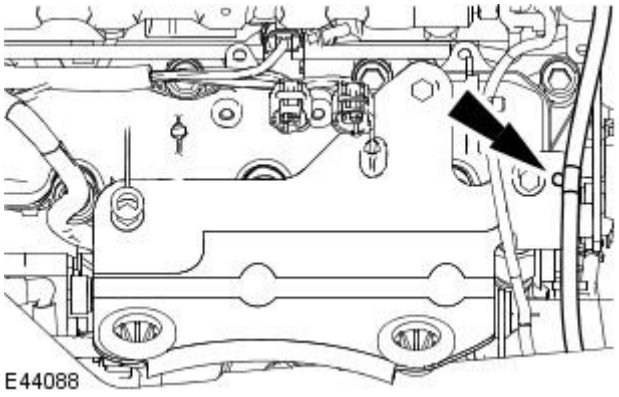
Published: 11-May-2011

Electronic Engine Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Knock Sensor (KS)

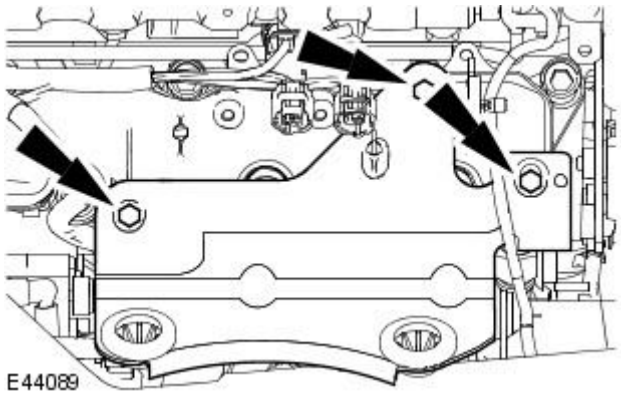
Removal and Installation

Removal

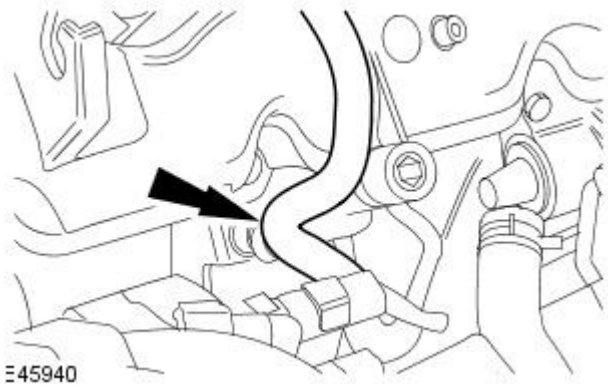
1. Remove the air cleaner.
   For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
2. Detach the wiring harness.



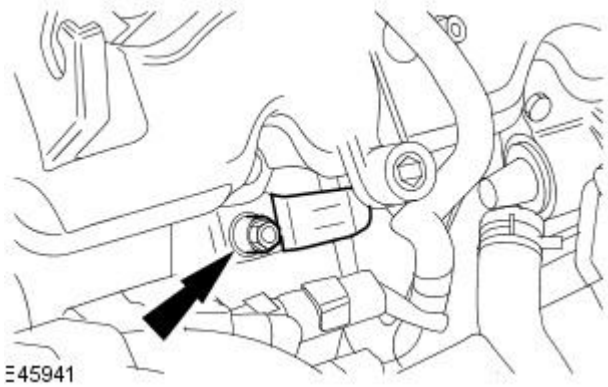
3. Remove the air cleaner mount bracket.



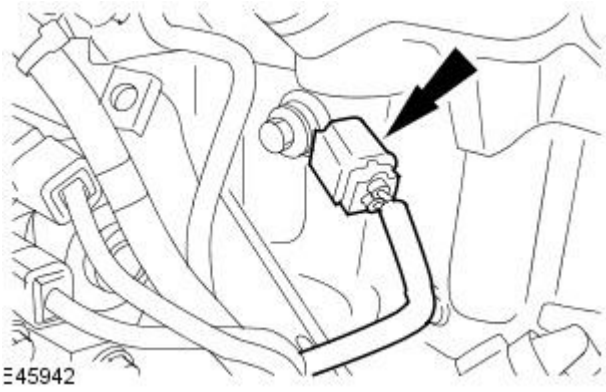
4. Detach the wiring harness.



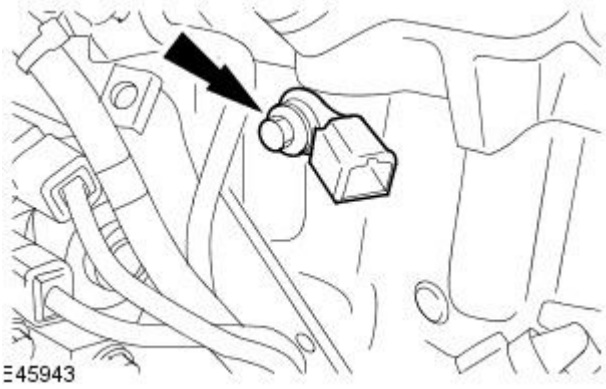
5. Remove the fuel pump to fuel injection supply manifold high pressure pipe retaining bracket.



6. Disconnect the electrical connector.



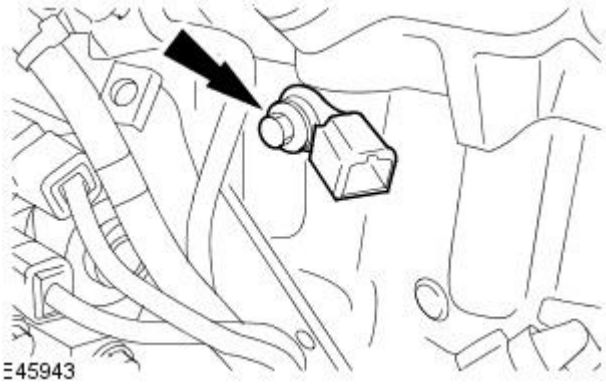
7. Remove the knock sensor (KS).



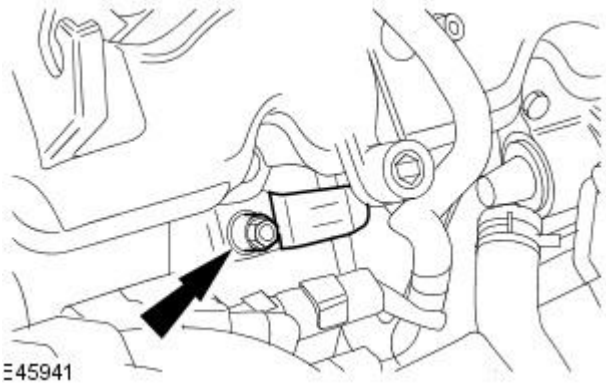
Installation

1. To install, reverse the removal procedure.

- Tighten to 20 Nm.



2. Tighten to 10 Nm.



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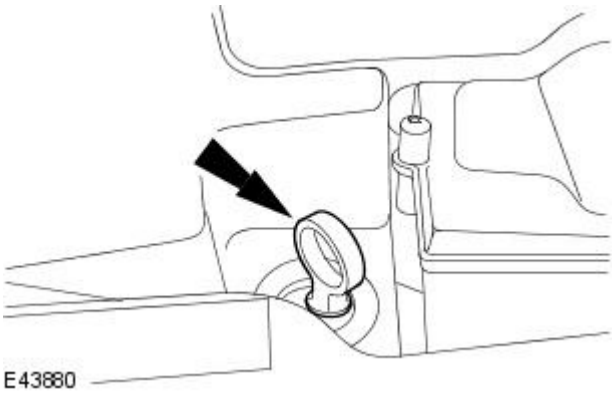
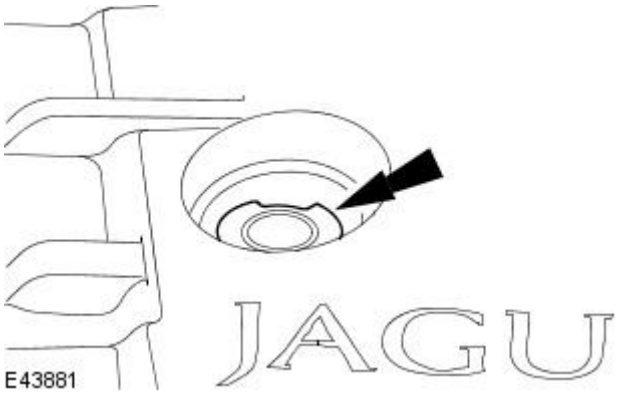
Electronic Engine Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Manifold Absolute Pressure and Temperature (MAPT) Sensor

Removal and Installation

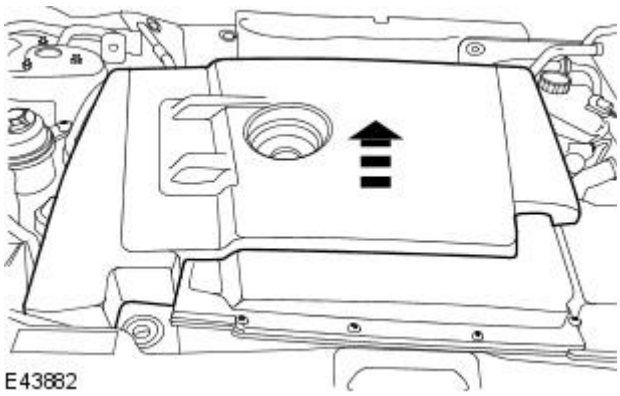
Removal



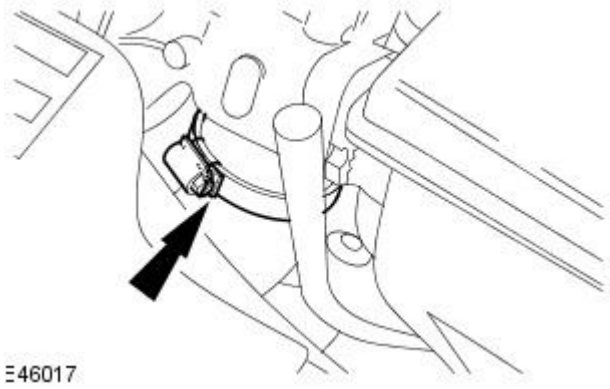
1. Remove the oil level indicator.



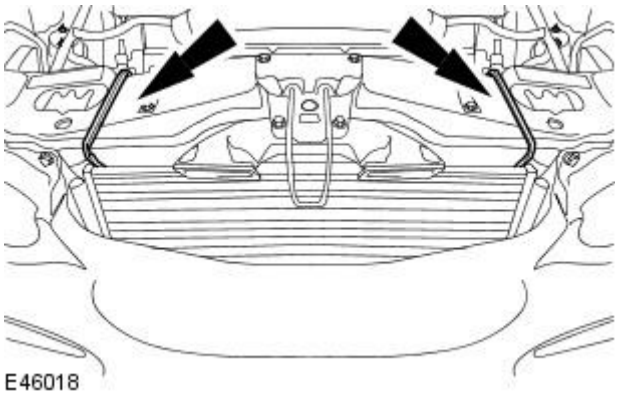
2. Remove the oil filler cap.



3. Remove the engine cover.



4. Detach the charge air cooler hose.


E46018

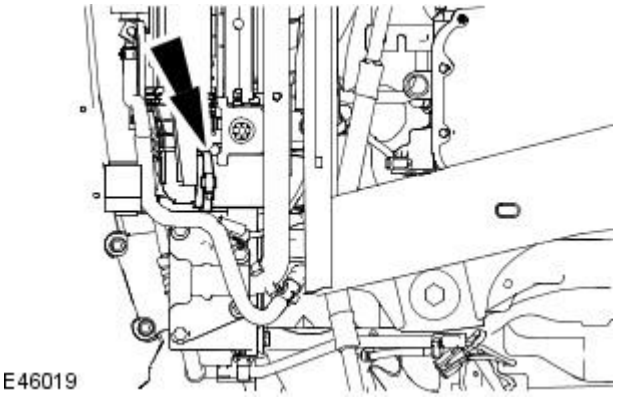
5. CAUTION: Make sure that the radiator is not damaged when installing the retaining straps.

Fit suitable retaining straps to the radiator.

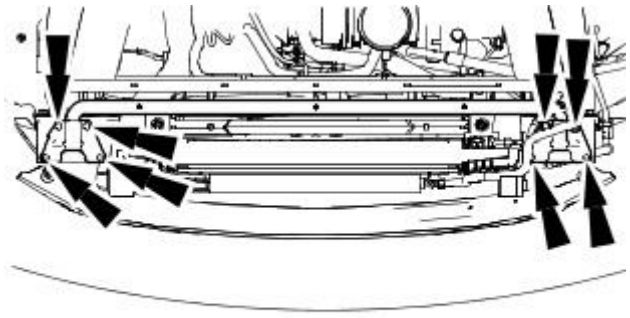
6. Raise and support the vehicle.
For additional information, refer to: Jacking (100-02 Jacking and Lifting, Description and Operation).

7. Remove the radiator splash shield.
For additional information, refer to: Radiator Splash Shield (501-02 Front End Body Panels, Removal and Installation).

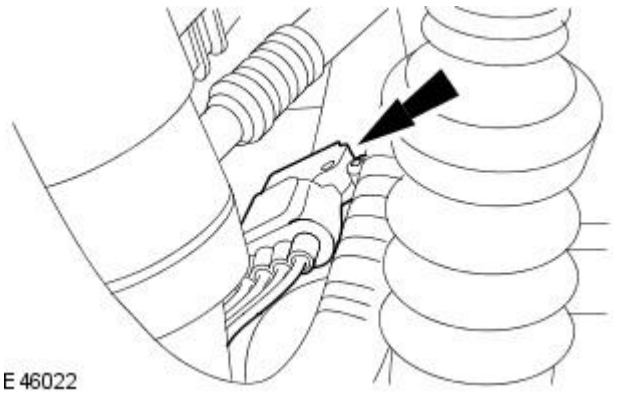
8. Detach the charge air cooler hose.

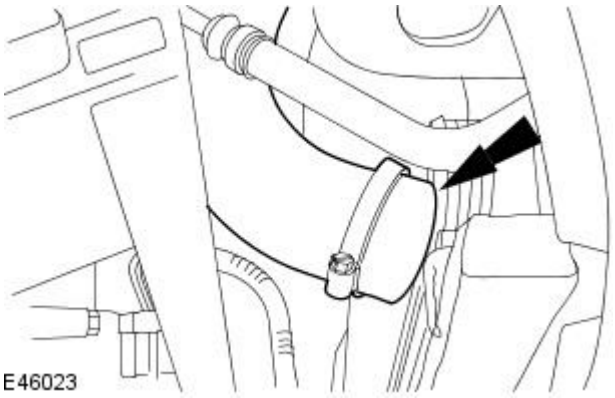

E46019

9. Remove the radiator support bar.


E46021

10. Disconnect the electrical connector.

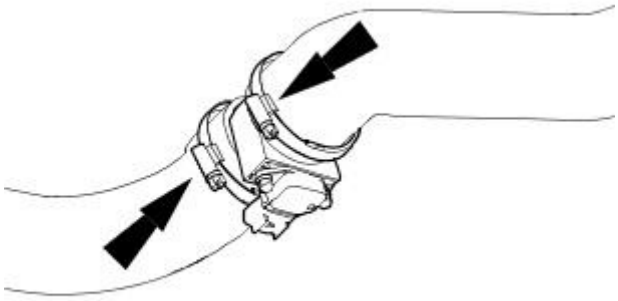

E46022



E46023

11. Remove the charge air cooler hoses and manifold absolute pressure and temperature (MAPT) sensor assembly.

12. Remove the MAPT sensor.

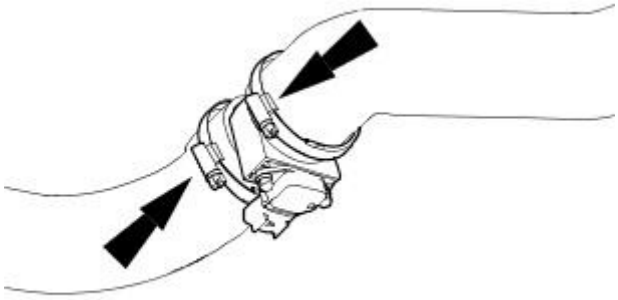


E46024

Installation

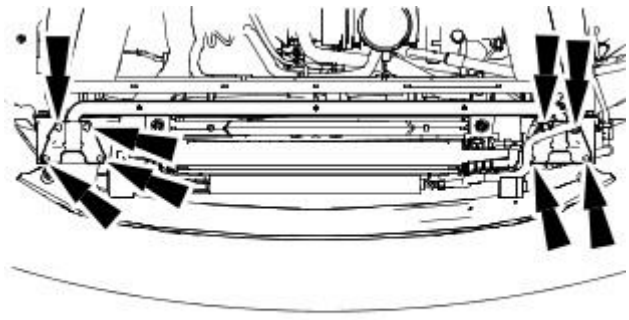
1. To install, reverse the removal procedure.

- Tighten to 4 Nm.

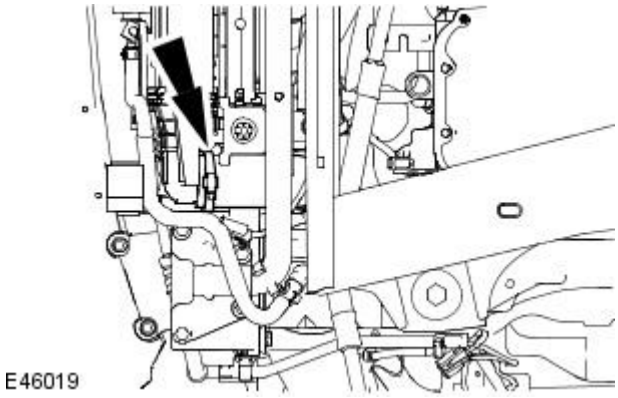


E46024

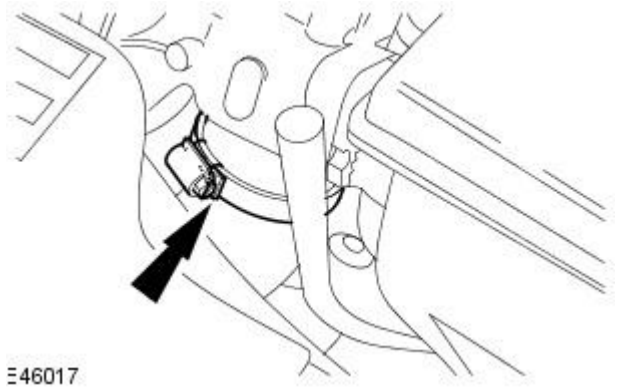
2. Tighten to 25 Nm.



E46021



3. Tighten to 4 Nm.



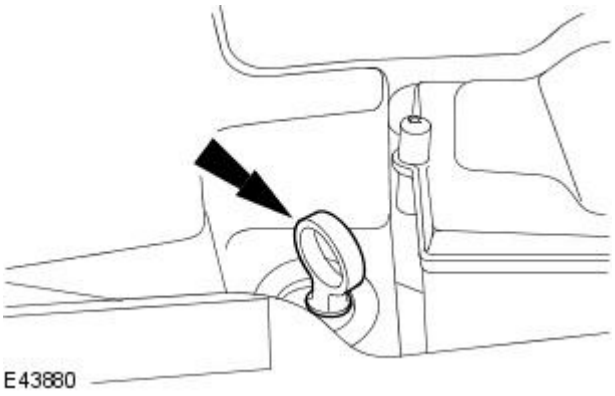
4. Tighten to 4 Nm.

Published: 11-May-2011

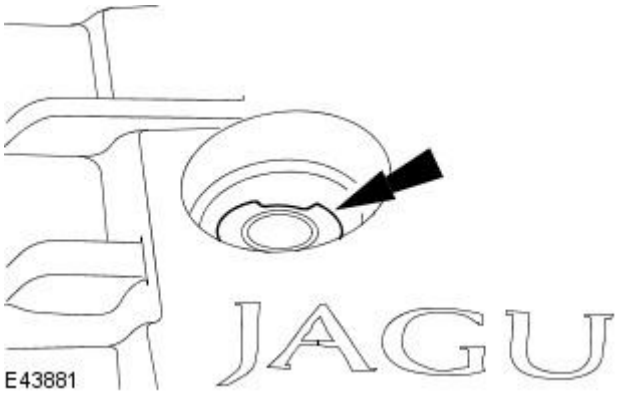
Electronic Engine Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Manifold Absolute Pressure (MAP) Sensor

Removal and Installation

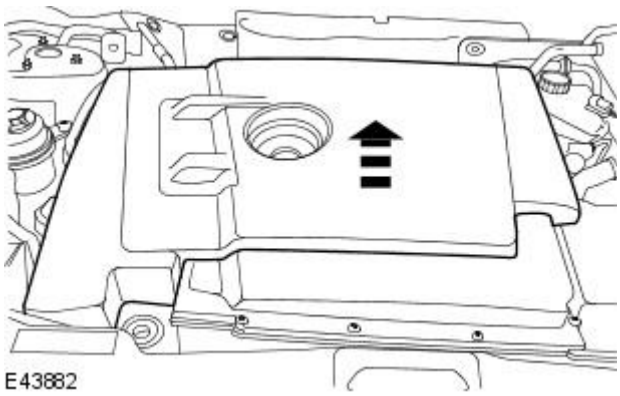
Removal



1. Remove the oil level indicator.

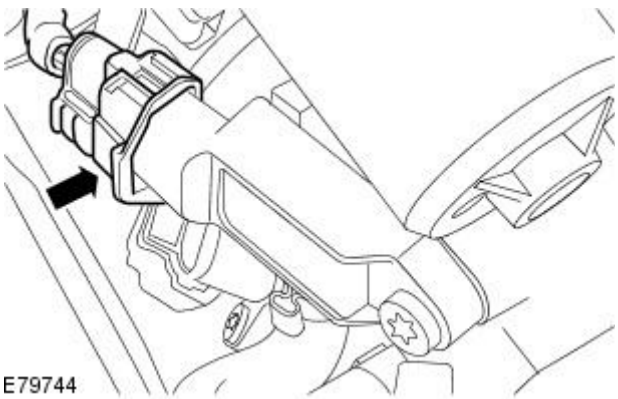


2. Remove the oil filler cap.

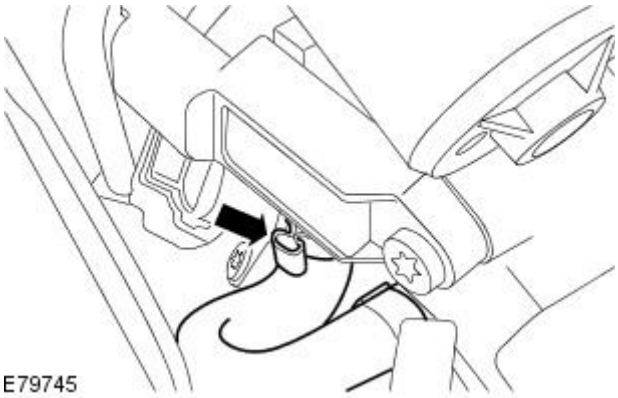


3. NOTE: Install the oil filler cap and oil level indicator to prevent foreign material entering the valve cover.

Remove the engine cover.

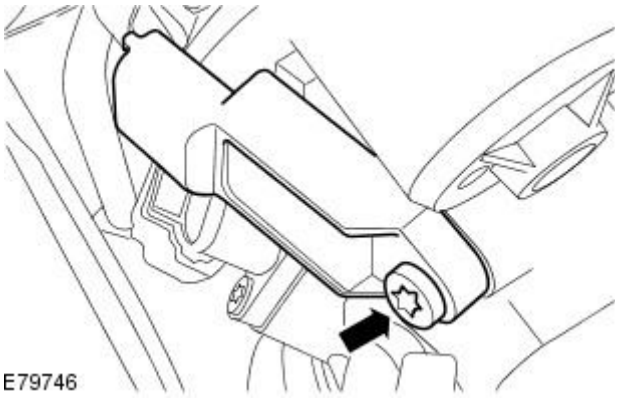


4. Disconnect the manifold absolute pressure (MAP) Sensor electrical connector.



5. Disconnect the hose.

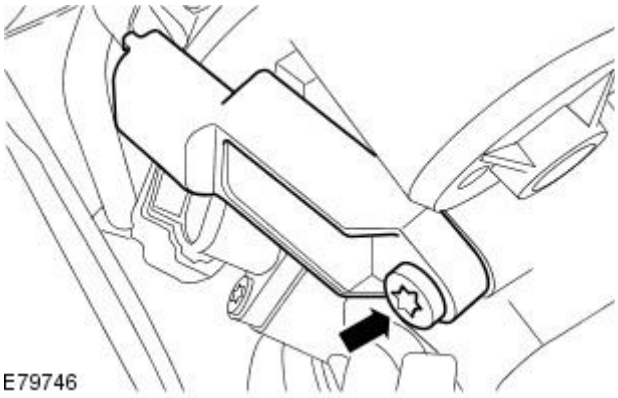
- Detach the retaining clip.



6. Remove the MAP sensor.

- Remove the retaining bolt.

Installation



1. To install, reverse the removal procedure.

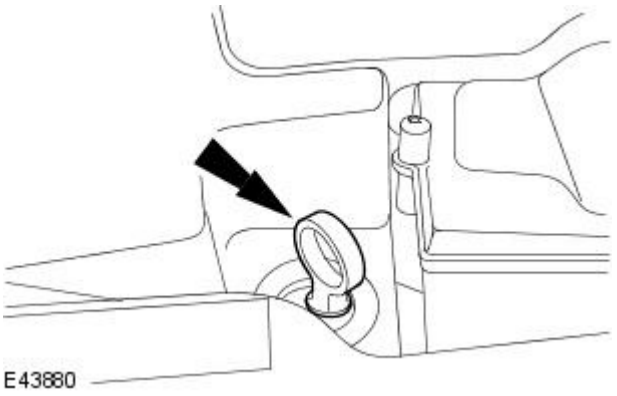
- Tighten to 4 Nm.

Published: 11-May-2011

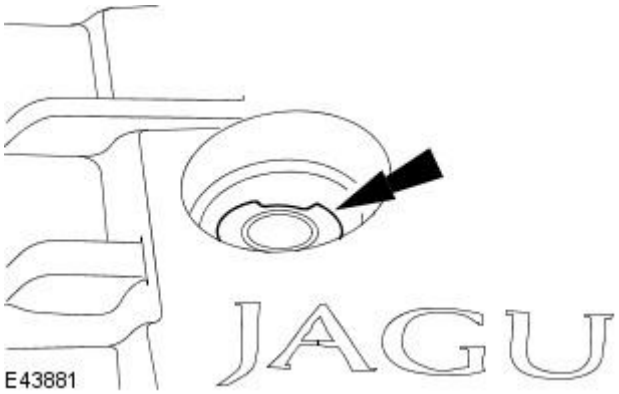
Electronic Engine Controls - 2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma - Mass Air Flow (MAF) Sensor

Removal and Installation

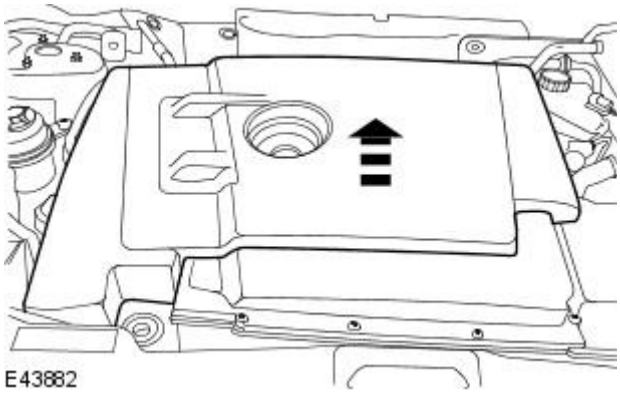
Removal



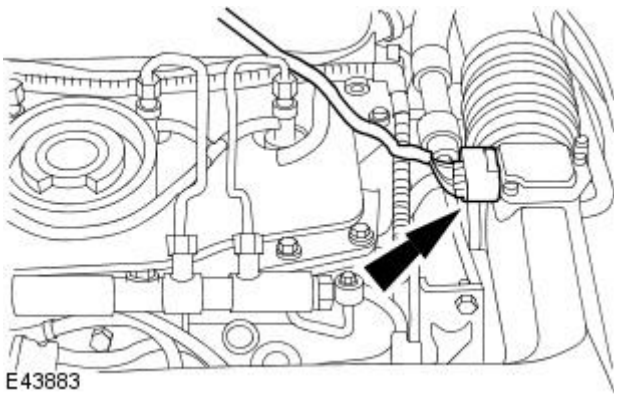
1. Remove the oil level indicator.



2. Remove the oil filler cap.

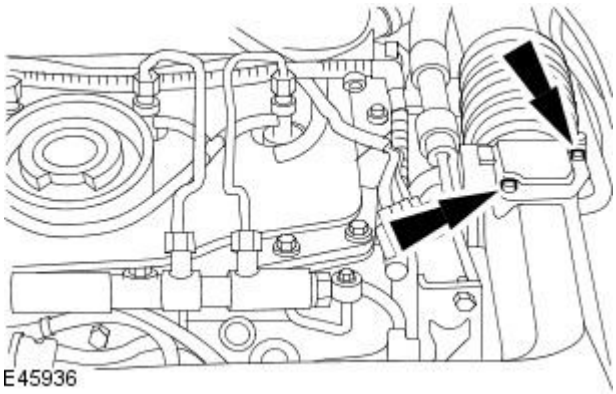


3. Remove the engine cover.



4. Disconnect the mass air flow sensor electrical connector.

5. Remove the mass air flow (MAF) sensor.



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Automatic Transmission / Transaxle - Vehicles With: 5-Speed Automatic Transaxle - JATCO -

Lubricant, Sealers and Solvents

Description	Specification
High-temperature grease	ESD-M1C220-A
Metal surface cleaner	WSW-M5B392-A
Sealant	WSS-M4G323-A6

Fluid Maintenance

 CAUTION: Use only WSS-M2C922-A1 automatic transmission fluid. Use of any other fluids may result in a transmission malfunction or failure.

Intervals	
Normal Maintenance	Not necessary. Filled for life.
Severe Duty Maintenance	Change the fluid at 48,000 km (30,000 miles) intervals.

General Specifications

Engine	Approximate Liters	Refill Capacity [1] U.S. Quarts	Fluid Type
2.0l, 2.5L and 3.0L	8.8	8.32	WSS-M2C9 22-A1

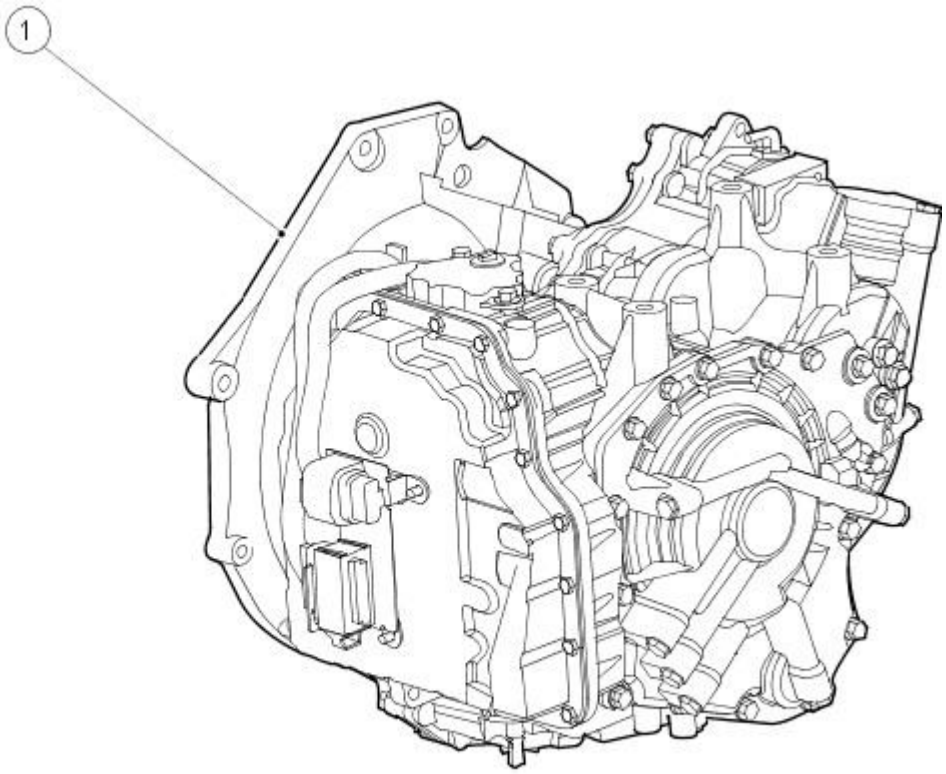
1 Approximate dry capacity, includes cooler and tubes. Check the level at normal operating temperature. DO NOT OVERFILL. If it is necessary to add or change fluid, use only fluid which has been certified by the supplier as meeting the Jaguar Cars Ltd specification shown.

Description	Nm	lb-ft	lb-in
Main control valve body screws	8	-	71
Torque converter access cover retaining bolts	10	-	89
Torque converter retaining bolts	55	41	-
Transaxle retaining bolts	48	35	-
Transaxle dust cover retaining bolt	10	-	89
Solenoid retaining bolt	8	-	71
Transaxle support insulator retaining nut	133	98	-
Transaxle mount bracket retaining bolts	80	59	-
Transmission control module retaining nuts	10	-	89
Transmission fluid drain plug	45	33	-
Transmission fluid level plug	15	11	-
Transmission mount to body retaining bolts	80	59	-
Transmission range sensor retaining bolts	10	-	89
Valve body cover retaining bolts	8	-	71
Starter motor retaining bolts	35	26	-
Starter motor solenoid electrical connector retaining nut	6	-	53
Starter motor electrical connector retaining nut	12	9	-
Wiring harness to camshaft cover retaining stud, retaining nut	6	-	53
Intake manifold support bracket retaining bolts	10	-	89
Air cleaner mount bracket retaining nuts and bolt	6	-	53
Left-hand driveshaft retaining nuts - vehicles with 2.0L and 2.0L diesel engine	25	18	-
Shock absorber and spring assembly securing nuts	25	18	-
Transaxle ground lead	25	18	-
Support bar retaining bolts	25	18	-

Published: 11-May-2011

Automatic Transmission / Transaxle - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Transmission DescriptionVehicles With: 5-Speed Automatic Transaxle - JATCO

Description and Operation



VUJ0004671

Automatic transmission JF506E - Up To 2009MY

The newly developed JF506E automatic transmission has been developed for use by Jaguar. The JF506E is built in Japan by JATCO (Japan Automatic Transmission Company). The JF506E has 5-speed lock-up which provides smooth and fast operation and employs a Transmission Control Module (TCM), three speed sensors and nine gear change solenoids to realize finer gear change control which provides excellent response to changing driving conditions.

Automatic transmission JF506E

JF506E:

- J = Japan automatic transmission company
- F = front wheel drive
- 5 = 5 Forward gears
- 06 = Version number
- E = Electronic control

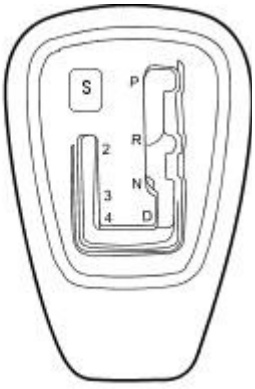
The transmission ID is stamped on the transmission, E.G.: PL002 = 2.0 litre, PL 001 = 2.5 litre and PL 000 = 3.0 litre. This is followed by the production year and month and a 5 digit serial number – 08 XXXXX.

Range Selection

Depending on the vehicle options selected the automatic transmission range selector may have different range positions.

The standard range selector has seven positions: P, R, N, D, 4, 3 and 2.

J-Gate Range Selection



VUJ0004672

"P"

In the PARK position:

- there is no power flow through the automatic transmission.
- the parking pawl locks the output shaft to the case.
- the engine may be started.
- the ignition key may be removed.

"R"

In the REVERSE position:

- the vehicle may be operated in a rearward direction, at a reduced gear ratio.
- backup lamps are illuminated.

"N"

In the NEUTRAL position:

- there is no power flow through the automatic transmission.
- the output shaft is not held and is free to turn.
- the engine may be started.

"D"

Drive is the normal position for most forward driving.

The D position provides:

- automatic shift 1-5 and 5-1.
- apply and release of the torque converter clutch.
- maximum fuel economy during normal operation.
- engine braking in 5th gear.

"4"

The 4 position provides:

- automatic shift 1-4 and 4-1.
- apply and release of the torque converter clutch.
- engine braking in 4th gear.

"3"

The 3 position provides:

- third gear start and hold.
- the torque converter clutch may apply and release.
- improved traction on slippery roads.
- engine braking.

"2"

The 2 position provides:

- second gear start and hold.
- the torque converter clutch may apply and release.
- improved traction on slippery roads.
- engine braking.

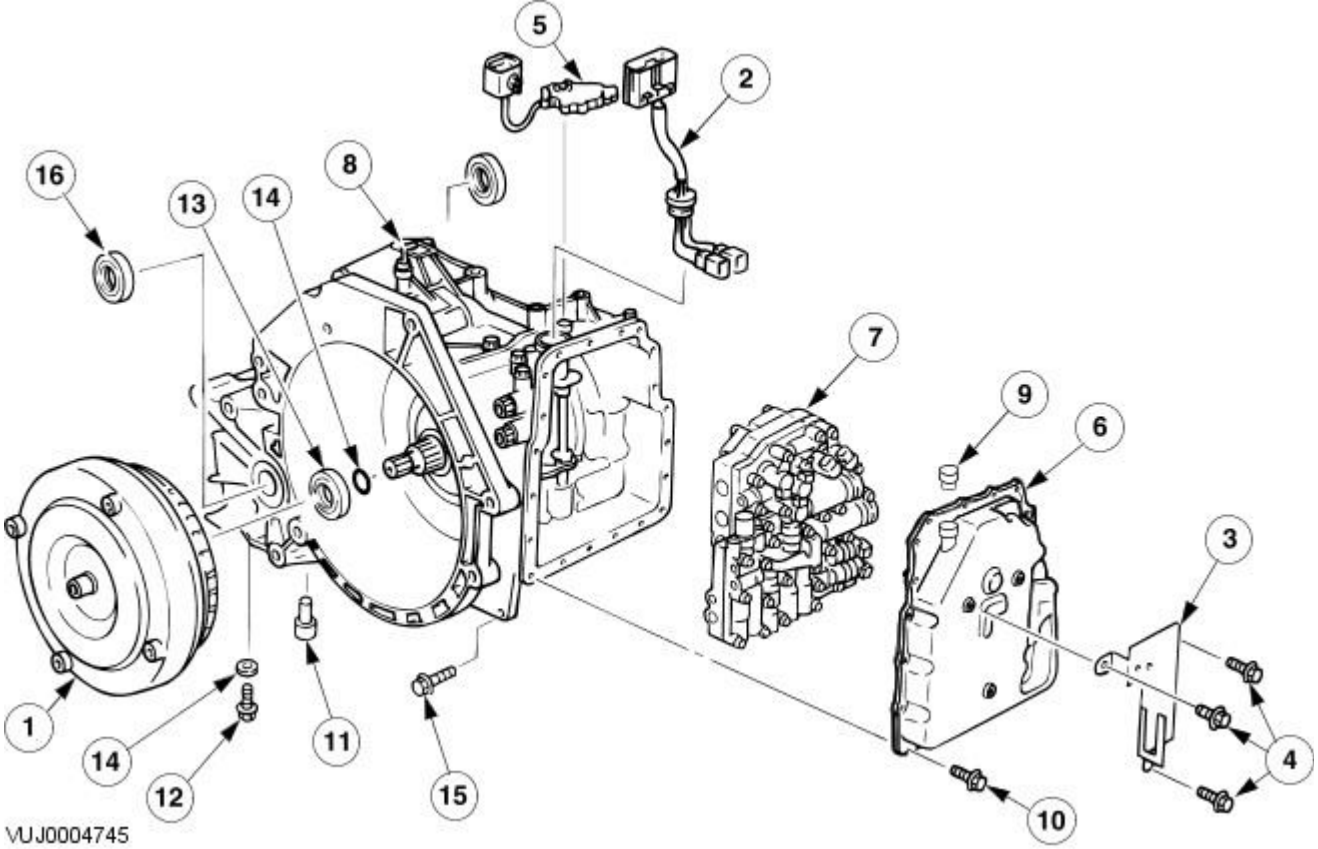
"S"

The Sport mode switch allows:

- the driver to select or de-select the automatic transmission sport mode.
- the automatic transmission to operate normally when the sport mode is selected, but under acceleration the gear shift points are extended to make full use of the engine's power reserves.
- the driver to drive the vehicle in the "D" position with full automatic transmission shift or manually shift gears in the "2, 3 and 4" positions.

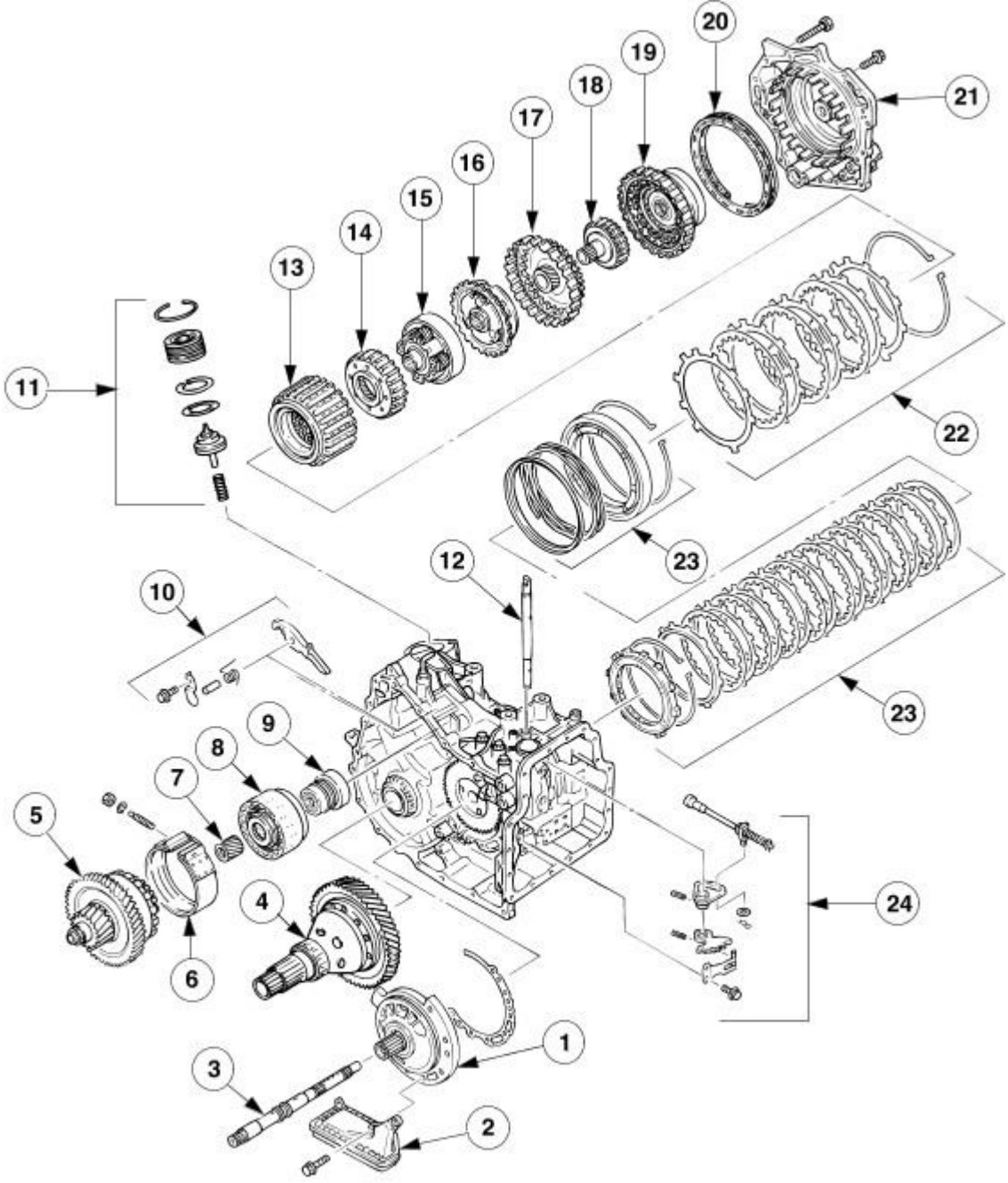
Disassembled Views

Transmission disassembled Views



Item	Part Number	Description
1	—	Torque converter
2	—	Terminal assembly
3	—	Plate
4	—	Retaining bolt
5	—	Inhibitor switch
6	—	Main control valve body cover
7	—	Main control valve body
8	—	Air breather
9	—	Automatic transmission fluid charging pipe cap.
10	—	Main control valve body cover retaining bolt
11	—	Automatic transmission fluid level tube
12	—	Magnet plug
13	—	Oil seal
14	—	O-ring
15	—	Transmission retaining bolts
16	—	Differential oil seal

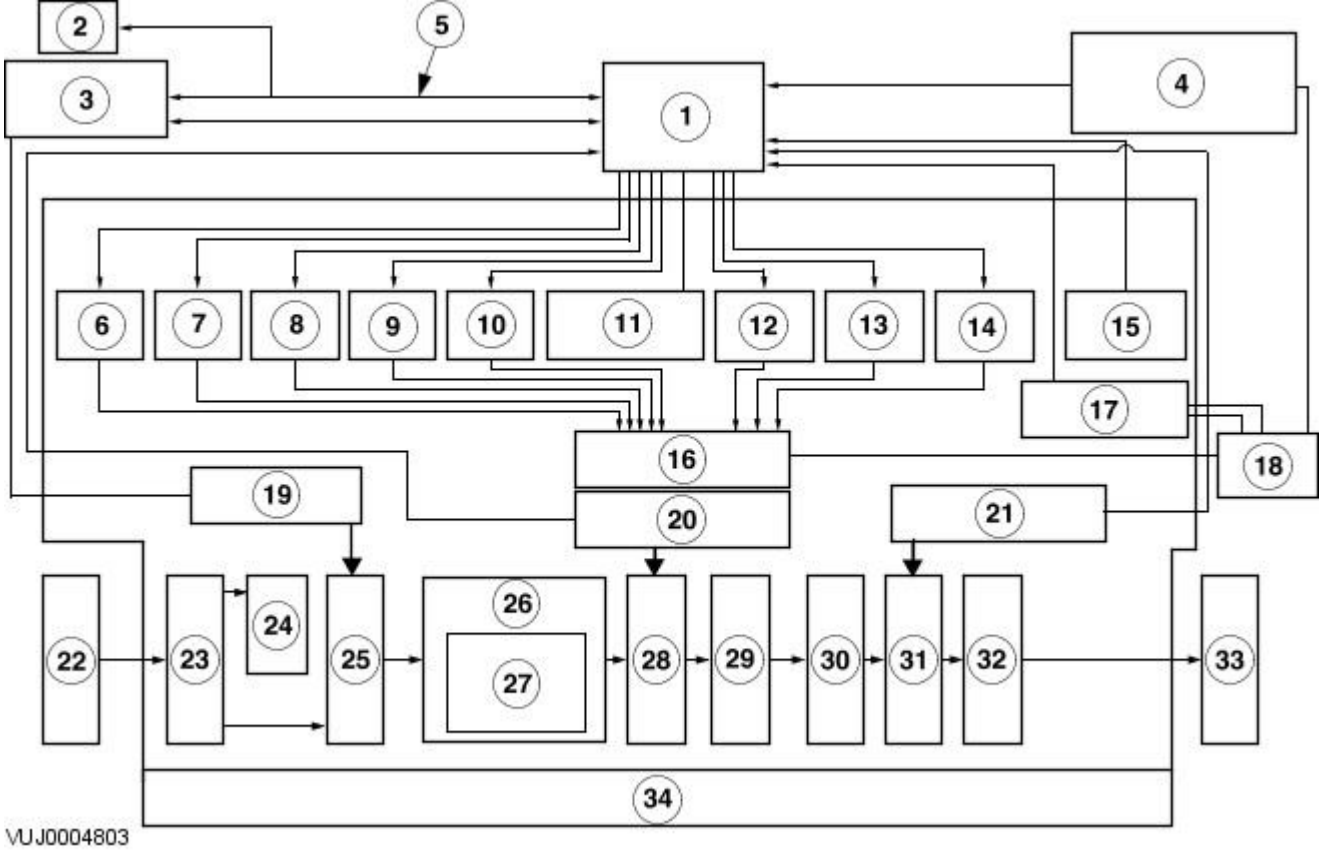
Transmission disassembled Views (continued)



VUJ0004746

Item	Part Number	Description
1	—	Oil pump
2	—	Oil strainer
3	—	Input shaft
4	—	Differential gear
5	—	Reduction gear
6	—	Reduction brake band
7	—	Sun gear
8	—	Direct clutch
9	—	One-way clutch inner race
10	—	Parking mechanism
11	—	Band servo
12	—	Manual shaft
13	—	Low clutch
14	—	Internal gear
15	—	Rear planetary carrier
16	—	Front planetary carrier
17	—	Low clutch hub
18	—	High clutch hub
19	—	Reverse and high clutch assembly
20	—	Return spring
21	—	Side cover
22	—	2-4 brake
23	—	Low and reverse brake
24	—	Parking component

Overview



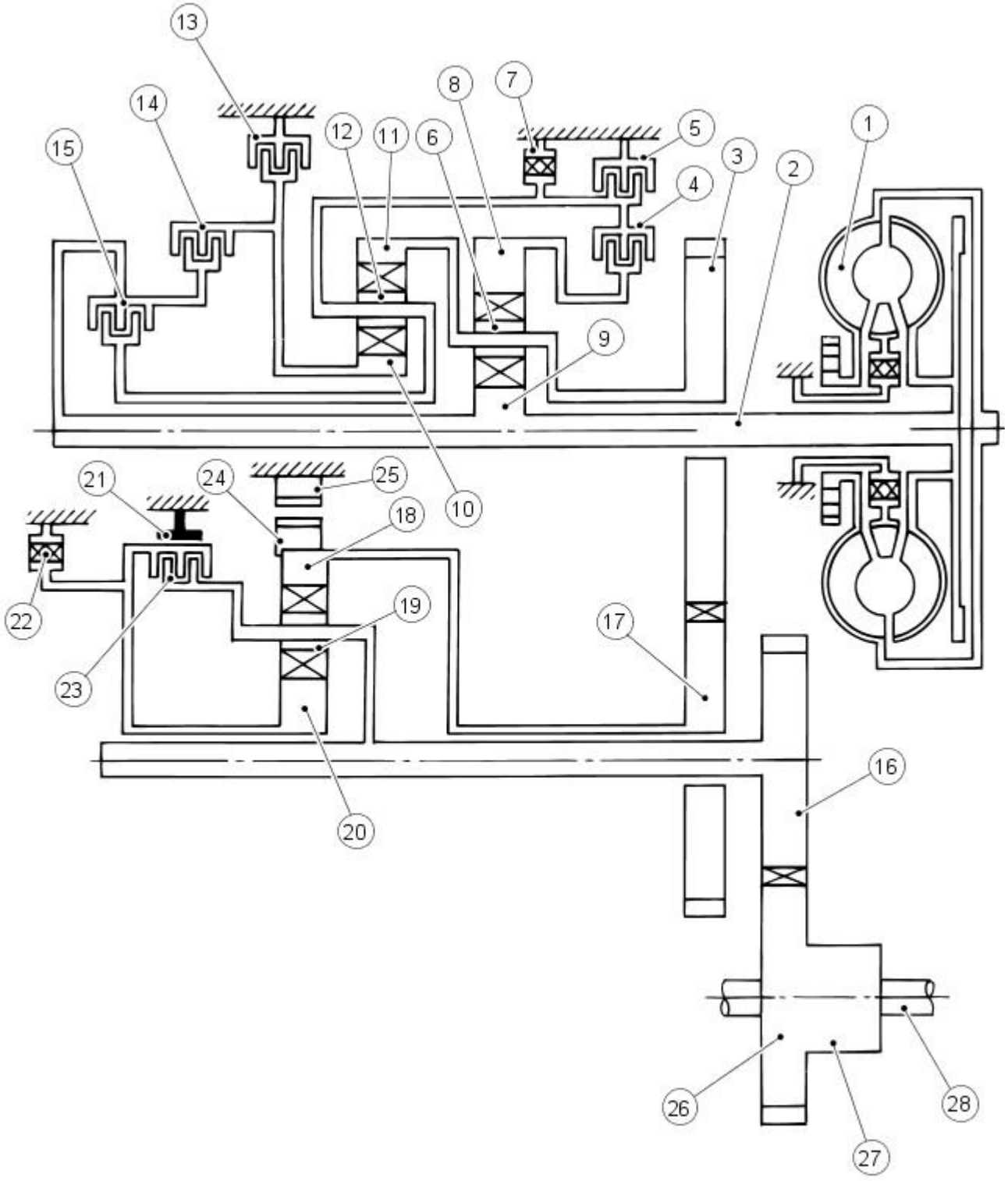
Item	Part Number	Description
1	—	TCM
2	—	Anti-lock Braking System (ABS)
3	—	Engine Control Module (ECM)
4	—	D/4 switch, (test switch), sports mode switch
5	—	CAN (including torque down switch)
6	—	Line pressure solenoid
7	—	Lock-up solenoid
8	—	Shift solenoid A
9	—	Shift solenoid B
10	—	Shift solenoid C
11	—	Low clutch timing solenoid
12	—	Reduction timing solenoid
13	—	2-4 brake timing solenoid
14	—	2-4 brake duty solenoid
15	—	Transmission Fluid Temperature (TFT) sensor
16	—	Control valve
17	—	Inhibitor switch
18	—	Select lever
19	—	Turbine Shaft Speed (TSS) sensor
20	—	Intermediate Shaft Speed (ISS) sensor
21	—	Vehicle Speed (VSS) sensor
22	—	Engine
23	—	Torque converter
24	—	Fluid pump
25	—	Input shaft
26	—	Four-speed geartrain
27	—	Clutch, brake, planetary gear etc
28	—	Output gear
29	—	Idler gear
30	—	Reduction geartrain
31	—	Parking gear
32	—	Final gear and differential
33	—	Transfer case
34	—	Automatic transmission assembly

The transmission gear changes, oil pressure and lock-up operation are all electronically controlled. The TCM located in the left hand A-pillar receives electrical signals from sensors indicating vehicle speed and throttle opening. In response to these signals the TCM selects the appropriate gear and regulates other related conditions.

Actual transmission control changes are made by actuators (solenoids) that respond to input signals received from the TCM. These solenoids operate in response to electrical signals they regulate the control valve operation. The control valves cause changes in the fluid flow passages. This results in pressure changes within the transmission.

Transmission Construction

A cross-sectional view of the automatic transmission.

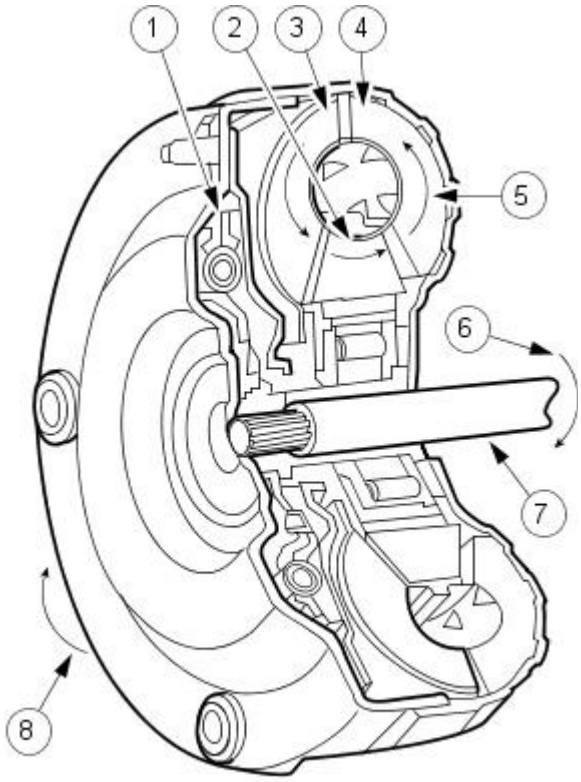


VUJ0004751

Item	Part Number	Description
1	—	Torque converter
2	—	Input shaft
3	—	Output gear
4	—	Low clutch
5	—	Low and reverse brake
6	—	Rear planetary pinion gear
7	—	Low one-way clutch
8	—	Rear internal gear
9	—	Rear sun gear
10	—	Front sun gear
11	—	Front internal gear
12	—	Front planetary pinion gear
13	—	2-4 brake
14	—	Reverse clutch
15	—	High clutch
16	—	Reduction gear
17	—	Idler gear
18	—	Reduction internal gear
19	—	Reduction planetary pinion gear
20	—	Reduction sun gear
21	—	Reduction brake band
22	—	Reduction one-way clutch

23	—	Direct clutch
24	—	Parking gear
25	—	Parking pawl
26	—	Final gear
27	—	Differential gear
28	—	Driveshaft

Torque Converter



VUJ0004819

Item	Part Number	Description
1	—	Converter clutch and damper
2	—	Reactor
3	—	Turbine damper
4	—	Impeller
5	—	Fluid motion
6	—	Transmission input rotation
7	—	Input shaft
8	—	Engine rotation

Torque Converter

The torque converter delivers the engine drive power to the transmission. When the lock-up clutch is released, the power delivery is depended on automatic transmission fluid (ATF). When the lock-up clutch is engaged the engine power is delivered to the transmission through the lock-up clutch.

The lock-up clutch is controlled electronically and operates in 4th and 5th gears.

A symmetrical element 1-step 2-phase torque converter is used with JF506E automatic transmission. The term "1-step" refers to the single turbine and runner assembly and "2-step" refers to the turbine runner speed relative to the pump impeller speed. When the turbine runner speed is lower than the pump impeller speed, the mechanism operates as a simple torque converter. When the turbine runner speed is higher than pump impeller speed, the mechanism acts as a fluid coupling.

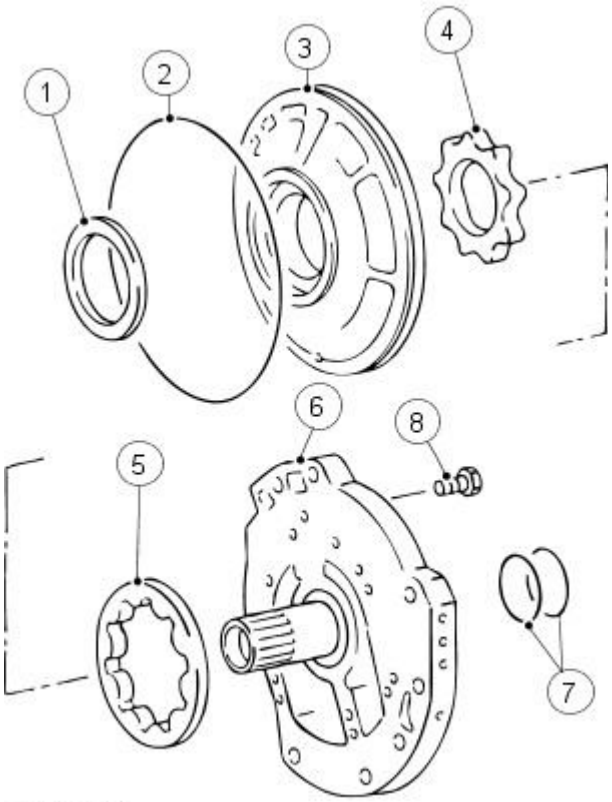
The torque converter transmits and multiplies torque. The torque converter is a four-element device:

- impeller assembly
- turbine and damper assembly
- reactor assembly
- clutch

The standard torque converter components operate as follows:

- Rotation of the converter housing and impeller set the fluid in motion.
- The turbine reacts to the fluid motion from the impeller, transferring rotation to the geartrain through the input shaft.
- The reactor redirects fluid going back into the impeller, allowing for torque multiplication.
- The clutch and damper assembly dampens powertrain torsional vibration and provides a direct mechanical connection for improved efficiency.
- Power is transmitted from the torque converter to the planetary gearsets and other components through the input shaft.

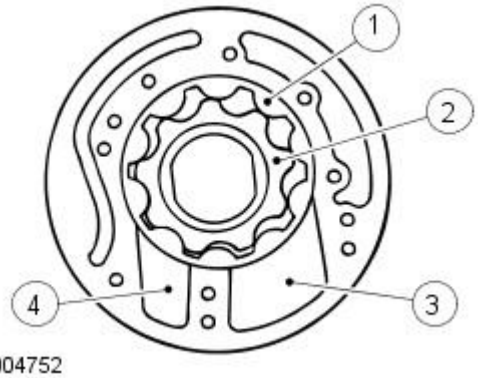
Oil Pump



VUJ0004765

Item	Part Number	Description
1	—	Oil seal
2	—	O-ring
3	—	Oil pump housing
4	—	Inner rotor
5	—	Outer rotor
6	—	Oil pump cover
7	—	Seal ring
8	—	Bolts

A trochoid oil pump is used with JF506E automatic transmission. The trochoid oil pump has the advantage of very low power loss.



VUJ0004752

Item	Part Number	Description
1	—	Outer rotor
2	—	Inner rotor
3	—	Suction port
4	—	Discharge port

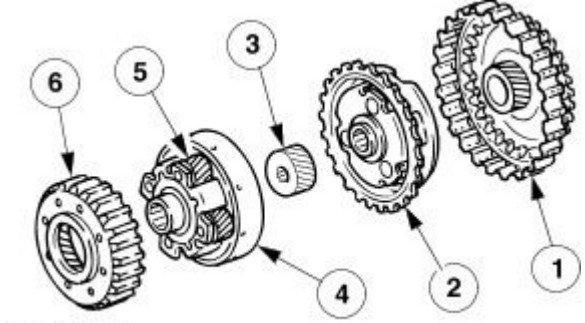
The oil pump is driven by the engine. The inner rotor connects to the torque converter sleeve.

Geartrain

Power is transmitted from the torque converter to the planetary gearsets through the input shaft. Bands and clutches are used to hold and drive certain combinations of gearsets. This results in five forward ratios and one reverse ratio, which are transmitted to the output shaft and differential.

Gear Ratio	
1st	3.801 to 1
2nd	2.131 to 1
3rd	1.364 to 1
4th	0.935 to 1
5th	0.685 to 1
Reverse	2.970 to 1

Planetary Gears



VUJ0004754

Item	Part Number	Description
1	—	Front sun gear
2	—	Front pinion gear
3	—	Rear sun gear
4	—	Front internal gear
5	—	Rear pinion gear
6	—	Rear internal gear

There are 3 planetary gear sets. Front, rear and reduction.

Clutches

There are 4 wet type multi disc clutches (low clutch, high clutch, reverse clutch and direct clutch).

Each clutch has two primary rotating parts (the clutch drum and the clutch hub). Power transmission is effected and controlled by these two parts.

The clutch drum and hub are connected to a clutch plate. Pressure applied to the clutch plate results in power transfer. When this pressure is released from the clutch plate, power does not transfer.

The clutch plates at the clutch drum side function as the driven plates. The clutch plates at the clutch hub side function as the drive plates. The drive plates have friction materials on the faces.

Clutch engagement occurs when oil pressure is applied to the piston in the clutch drum. The dish plate acts as a cushion to prevent sudden and violent force applied to the clutch plates which may causes a rough clutch engagement.

The retaining plate is attached to the driven plate. The retaining plate also serves as a spacer when the clutch is disengaged. It ensures specified clutch clearance.

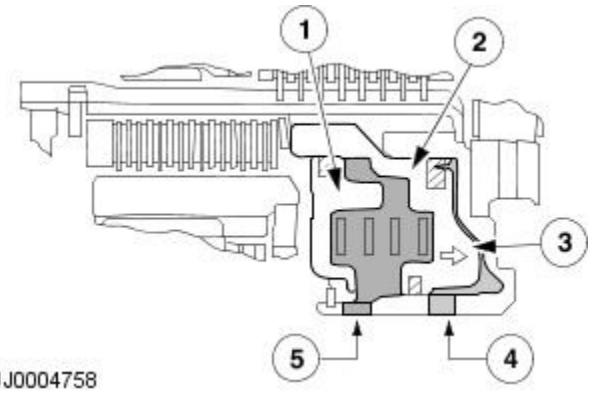
The piston is returned by return spring forces to ordinal position when the oil pressure is removed through the drain hole. As a result the clutch is disengaged.

The check ball is forced to seal the oil circuit by oil pressure against the oil input hole when the clutch is engaged. When the clutch is released the check ball moves back from the input hole to open the circuit and air is led into the oil chamber. This prevents residual oil pressure build-up in the clutch drum.

The clutch drum and the clutch hub are connected to the planetary gears respectively. Planetary gear rotation acts as the controlling element of the clutch.

Cancel Force Cover

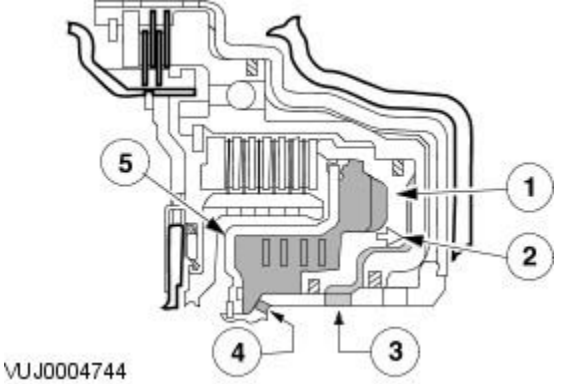
Low Clutch



VUJ0004758

Item	Part Number	Description
1	—	Cancel force cover
2	—	Low clutch piston
3	—	Cancel force
4	—	Low clutch pressure
5	—	Lubricating pressure

High Clutch



Item	Part Number	Description
1	—	High clutch piston
2	—	Cancel force
3	—	High clutch pressure
4	—	Lubricating pressure
5	—	Cancel force cover

The JF506E automatic transmission is equipped with the centrifugal oil pressure cancel room in low clutch and high clutch.

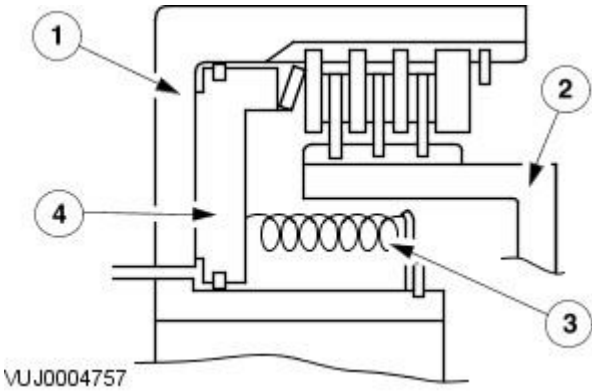
The centrifugal oil pressure cancel room improves clutch release time by applying force to the low clutch and the high clutch.

This system improves operating performance of the piston compared with the check ball system.

The piston returns to the original position by centrifugal force that is kept at the pressure room located at the other side of the piston cylinder.

Therefore, the response of the clutch release operation is improved and quick gear change is obtained.

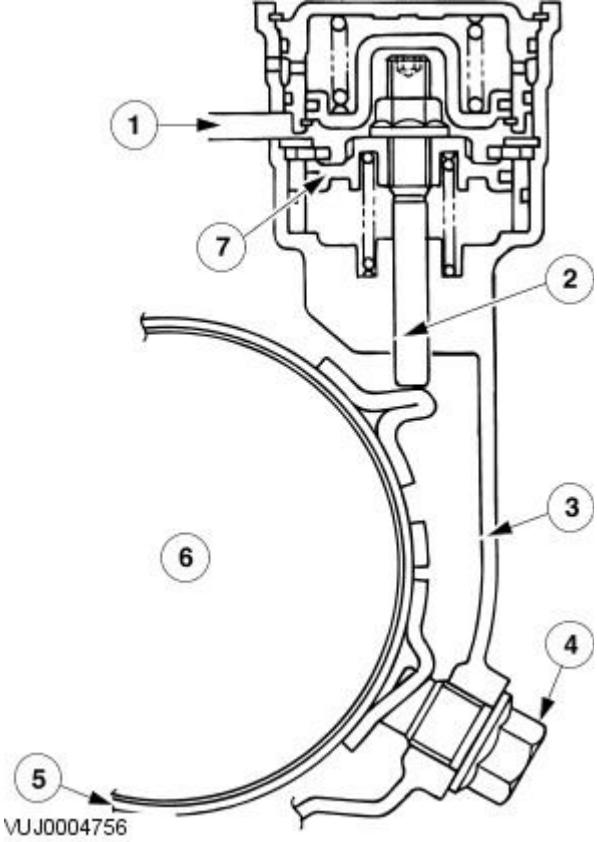
Low and Reverse Brake, 2-4 Brake



Item	Part Number	Description
1	—	Transmission case
2	—	Brake hub
3	—	Return spring
4	—	Piston

The low & reverse brake and the 2-4 brake are multi-disc type brakes. Basic brake operation is similar to the clutch. The clutch drum is mounted to an appropriate position on the transmission case. The low & reverse brake and the 2-4 brake act to stop the clutch hub rotation when the clutch plate is engaged.

Reduction Brake Band and Band Servo



VUJ0004756

Item	Part Number	Description
1	—	Brake band engagement pressure
2	—	Piston stem
3	—	Transmission case
4	—	Anchor end bolt
5	—	Brake band
6	—	Direct clutch drum
7	—	Brake piston

The brake band acts in response to the servo to stop the direct clutch drum rotation.

The servo has a piston that operates in response to changes in oil pressure. The piston expands in P and N ranges, 1st, 2nd, 3rd, 4th, and reverse gears to stop the direct clutch drum rotation.

When the line pressure reaches to the band servo the servo piston works. The downward piston stroke causes the piston stem to tighten the brake band. The direct clutch drum rotation stops.

The anchor end bolt is used to maintain appropriate clearance between the brake band and the direct clutch drum when the brake band is released. This clearance can be adjusted with the adjusting nut on the anchor end bolt.

One Way Clutches

The transmission uses two one way clutches.

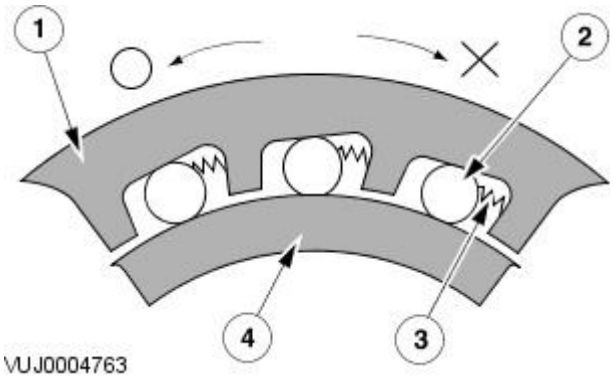
Low One Way Clutch

The front planetary carrier is fixed by the inner race which runs free during 1st gear operation.

Reduction One Way Clutch

The reduction sun gear is fixed by the inner race which runs free during 1st, 2nd, 3rd and 4th gear operations.

Roller-Type One-Way Clutch



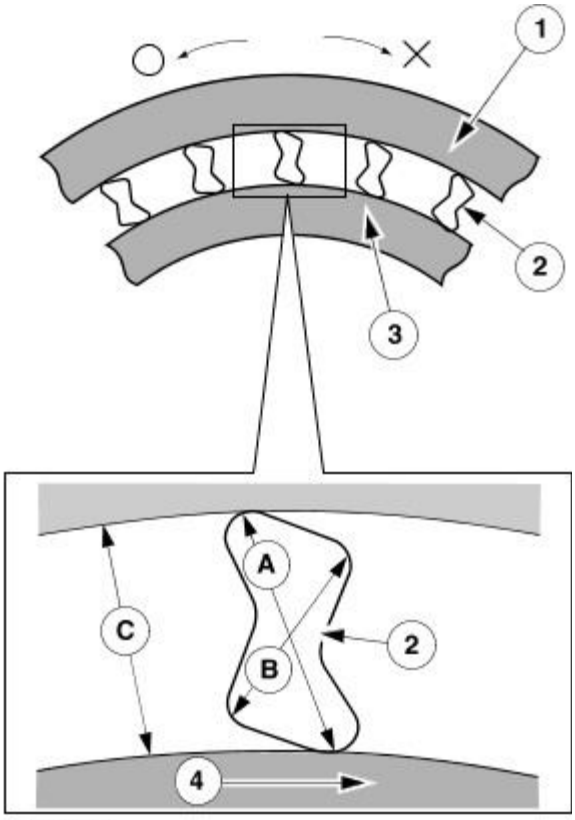
VUJ0004763

Item	Part Number	Description
1	—	Outer race
2	—	Roller
3	—	Spring
4	—	Inner race

Normally, rollers are energized to the narrower section via a spring. Therefore, in the direction where the rollers are engaged between the

cam and inner race they are united to transmit torque. In the reverse direction, because the rollers move in the direction where the clearance is larger, clearances occur between races and the inner and outer races can rotate to each other.

Sprag-Type One-Way Clutch

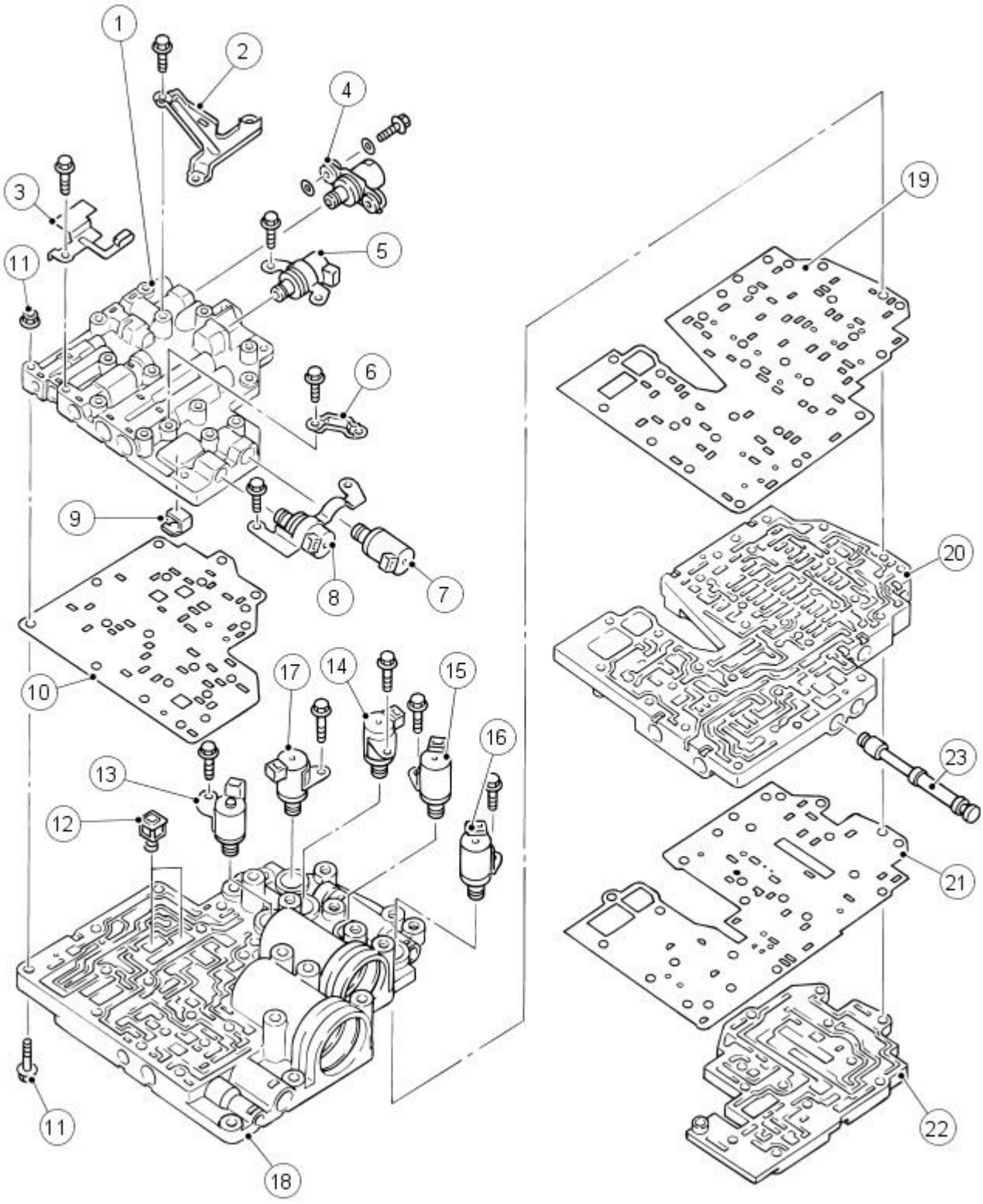


VUJ0004764

Item	Part Number	Description
1	—	Outer race
2	—	Sprag
3	—	Inner race
4	—	Rotation direction

Note the difference between sprag diameters "A" and "B" If the inner race tries to turn toward the left, radius "B" (longer than gap "C") firmly locks the sprag to prevent the sprag from moving to the left.

Solenoids



VUJ0004747

Item	Part Number	Description
1	—	Sub lower body
2	—	Bracket
3	—	Clip
4	—	Line pressure duty solenoid
5	—	Low clutch timing solenoid
6	—	Bracket
7	—	2-4 brake duty timing solenoid
8	—	2-4 brake timing solenoid
9	—	Pilot filter
10	—	Separate plate A
11	—	Locating bolt
12	—	Filter
13	—	Lock-up solenoid
14	—	Reduction timing solenoid
15	—	Shift solenoid B
16	—	Shift solenoid C
17	—	Shift solenoid A
18	—	Lower body
19	—	Separate plate B
20	—	Internal body

21	—	Separate plate C
22	—	Upper body
23	—	Manual valve

There are 9 solenoids which can be classified as two types by the way in which they operate. Three of them are duty solenoids, the other six are on/off types. The solenoids are actuated by the TCM output signals.

On/Off Solenoids

Shift solenoids A, B, C, low clutch solenoid, reduction timing solenoid and the 2/4 brake timing solenoid

The on/off solenoids close the pressure circuit in response to current flow.

Each solenoid has a internal coil. Current passes through coil and actuates the needle valve. The needle valve then opens and closes the fluid pressure circuits.

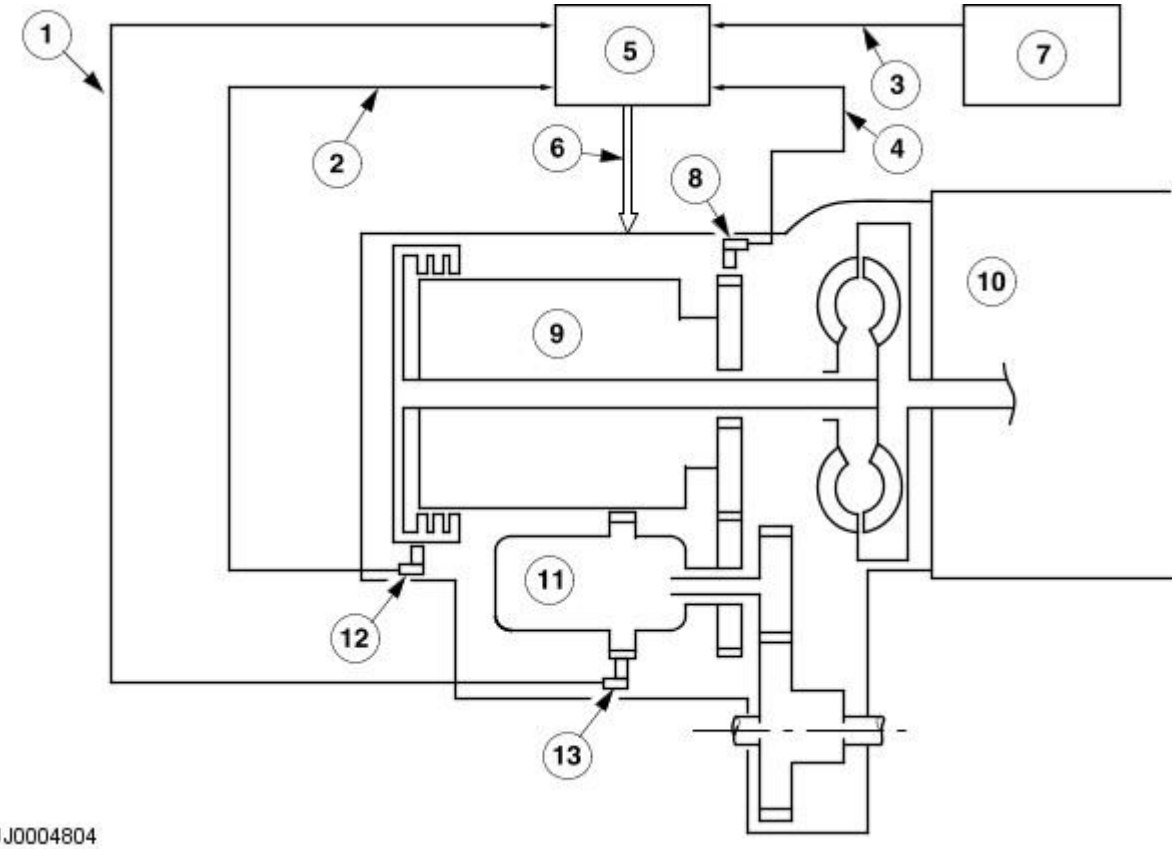
Duty Solenoids

Line pressure solenoid, lock-up solenoid and the 2/4 brake duty solenoid.

The duty solenoids repeatedly turn on/off in 50Hz cycles, this opens and closes the fluid pressure circuits.

Sensors

Sensor Schematic



VUJ0004804

Item	Part Number	Description
1	—	Output shaft rotational speed sensor
2	—	Input shaft rotational speed sensor
3	—	Engine speed signal
4	—	Output gear rotational signal
5	—	TCM
6	—	Transmission control
7	—	Engine Control Module (ECM)
8	—	Intermediate sensor
9	—	Geartrain
10	—	Engine
11	—	Reduction geartrain
12	—	Turbine sensor
13	—	Vehicle Speed Sensor (VSS)

Transmission Fluid Temperature (TFT) Sensor

The TFT sensor is installed in the transmission case, it constantly monitors the fluid temperature resistance varies with fluid temperature.

Automatic transmission internal operational resistance varies with automatic transmission fluid temperature change. The TCM detects the automatic transmission fluid temperature according to the voltage produced by the TFT sensor.

Speed Sensors

There are 3 sensors installed in the transmission casing. They are all of the inductive type.

Turbine Shaft Speed Sensor

The Turbine Shaft Speed Sensor (TSS) detects the reverse clutch drum revolution speed. The reverse clutch drum is connected to the input shaft and rotates at the same speed. The TCM calculates the input shaft speed to determine the turbine speed.

The TSS uses a magnetic coil. As the input shaft rotates, the sensor detects a pulse signal according to the gear teeth on the outside of the reverse clutch drum and sends it to the TCM.

Vehicle Speed Sensor

The vehicle speed sensor (VSS) detects the parking gear rotation speed. The TCM calculates the vehicle speed based on the parking gear rotation speed.

The VSS uses a magnetic coil. As the parking gear rotates the sensor detects a pulse signal according to the gear teeth rotation speed and then sends it to the TCM.

Intermediate Shaft Speed Sensor

The Intermediate Shaft Speed Sensor (ISS) detects the output gear rotation speed which is calculated by the TCM.

The ISS uses a magnetic coil. As the output gear rotates the sensor detects a pulse signal according to the gear teeth rotation and sends it to the TCM.

Automatic Transmission / Transaxle - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Diagnostic StrategyVehicles With: 5-Speed Automatic Transaxle - JATCO

Diagnosis and Testing

The complexity of the electronics involved with the automatic transmission/transaxle preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the Jaguar approved diagnostic system for detailed instructions on testing the automatic transmission/transaxle.

Where a fault involving the automatic transmission/transaxle is indicated by the Jaguar approved diagnostic system, some basic diagnostic methods may be necessary to confirm that connections are good and that the wiring is not damaged, before installing new components.

1. **1.** Verify the customer concern by operating the vehicle. Refer to the automatic transmission diagnostic drive cycle in the DTC summary section.
2. **2.** Check the fluid levels and condition of the fluid.
3. **3.** Check for non-factory fitted items.
4. **4.** Check the shift linkages for correct adjustment. REFER to Section 307-05A Automatic Transmission/Transaxle External Controls / 307-05B Automatic Transmission/Transaxle External Controls.
5. **5.** Visually inspect for obvious signs of mechanical, electrical or hydraulic damage.

Visual Inspection Chart

Mechanical	Electrical	Hydraulic
○ Damaged shift mechanism/linkages ○ Damaged automatic transmission/transaxle casing	○ Blown fuse ○ Wiring harness ○ Damaged transmission control module (TCM) ○ Damaged rotary switch ○ Damaged, loose or corroded connectors	○ Fluid level too high/low ○ Poor condition of fluid ○ Fluid leak

Basic diagnosis

Check Fluid Level and Condition

CAUTION: The vehicle should not be driven if the fluid level is low as internal failure can result.

• NOTE: The transmission oil temperature must not be allowed to exceed 40°C whilst checking level. Should the temperature rise above this figure, abort the check and allow the transmission oil to cool to below 30°C.

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 in this section.

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 reading is indicated,
REFER to Transmission Fluid Drain and Refill in this section.

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 in this section.

Adding Fluid

CAUTION: The use of any other type of transmission fluid than 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 General Specification chart in this section.
REFER to Transmission Fluid Level Check in this section.

Fluid Condition Check

1. **1.** Check the fluid level. For additional information,
   REFER to Transmission Fluid Drain and Refill in this section.
2. **2.** Observe the color and the odor. The color under normal circumstances should be reddish, not 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: Being thermostatically controlled, the lubrication system cannot be completely flushed. In the event of a transmission unit replacement for internal failure, the oil cooler and pipes must also be replaced.

Shift Linkage Check

Hydraulic leakage at the manual control valve can cause delay in engagements and/or slipping while operating if the linkage is not correctly adjusted; REFER to Section 307-05A Automatic Transmission/Transaxle External Controls / 307-05B Automatic Transmission/Transaxle External Controls. for shift linkage adjustment.

Diagnostic Trouble Code (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: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: When performing electrical 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.

DTC	Component	Description	Condition	Action
P0731, P0732, P0733, P0734, P0735	Input, intermediate, and output sensors	Gear ratio errors	Gear ratio out of range. Mechanical failure	REFER to pinpoint tests for individual sensors and shift solenoids.
P1573	This DTC does not indicate a component failure	Sympathetic DTCs from modules in CAN network	CAN throttle angle signal fail	REFER to Section 418-00 Module Communications Network.
P1601	Transmission control module (TCM)	Incorrect configuration	Incorrect configuration	Reconfigure module.
P1603	Transmission control module (TCM)	TCM EEPROM failure	TCM has lost it's adaptive values	REFER to Section 418-00 Module Communications Network.
P1796	CAN network	Wire or connection in the CAN network malfunction	The module does not respond to the Jaguar approved diagnostic system — No modules function	REFER to Section 418-00 Module Communications Network.
P1745	Low clutch timing solenoid	Solenoid or circuit malfunction	Harsh gear shifts	GO to Pinpoint Test A.
P1746	Reduction timing solenoid	Solenoid or circuit malfunction	Erratic engine braking	GO to Pinpoint Test B.
P1747	2/4 Brake timing solenoid	Solenoid or circuit malfunction	Erratic 2 and 4 ratios	GO to Pinpoint Test C.
P0706	Transmission range (TR) sensor	TR sensor or circuit malfunction	TR sensor out of range	GO to Pinpoint Test D.
P1777	This DTC does not indicate a component failure	Sympathetic DTCs from modules in CAN network	CAN torque reduction fail	REFER to Section 418-00 Module Communications Network.
P1780 (To VIN D15361)	D-4 switch malfunction	Switch or circuit malfunction	D-4 switch inoperative or out of range	GO to Pinpoint Test E.
P1793	TCM Ignition switched power malfunction	TCM, relay, power distribution fuse box	TCM inoperative	GO to Pinpoint Test F.
P1797	Engine control module (ECM)	Wire or connection in the CAN network	The module does not respond to the Jaguar approved diagnostic system — engine control module (ECM). No TCM communication to the ECM	REFER to Section 418-00 Module Communications Network.
P1799	Anti-Lock Brake Control Module or DSC	Wire or connection in the CAN network	The module does not respond to the Jaguar approved diagnostic system — Anti-Lock Brake Control Module or DSC. No TCM communication to Anti-Lock Brake System (ABS)	REFER to Section 418-00 Module Communications Network.
P0791 (To VIN C79328)	Intermediate speed sensor	ISS or circuit	Erratic gear shifts	GO to Pinpoint Test G.
P0791 (From VIN C79329)	Intermediate speed sensor (ISS)	ISS or circuit	Erratic gear shifts	GO to Pinpoint Test S.
P0720 (To VIN C79328)	Output speed sensor (OSS)	OSS or circuit	Erratic gear shifts	GO to Pinpoint Test H.
P0720 (From VIN C79328)	Output speed sensor (OSS)	OSS or circuit	Erratic gear shifts	GO to Pinpoint Test T.
P0715 (To VIN C79328)	Turbine speed sensor (TSS)	TSS or circuit	Erratic gear shifts	GO to Pinpoint Test I.
P0715 (From VIN C79329)	Turbine speed sensor (TSS)	TSS or circuit	Erratic gear shifts	GO to Pinpoint Test U.
P0710	Oil temperature sensor (OTS)	OTS or circuit	Erratic gear shifts, temperature malfunction	GO to Pinpoint Test J.
P0753	Shift solenoid **A** (SSA)	SSA Solenoid or circuit malfunction	Erratic gear shifts, 4th gear engaged	GO to Pinpoint Test K.
P0758	Shift solenoid **B** (SSB)	SSB Solenoid or circuit malfunction	Erratic gear shifts, 3rd/5th gear engaged	GO to Pinpoint Test L.
P0763	Shift solenoid **C** (SSC)	SSC Solenoid or circuit malfunction	Erratic gear shifts, 4th gear engaged	GO to Pinpoint Test M.
P0743	Torque converter clutch (TCC) solenoid	TCC Solenoid or circuit malfunction	No lock-up	GO to Pinpoint Test N.
P0740	Torque converter clutch	Torque converter clutch failure	No lock-up/permanent lock-up	INSTALL a new torque convertor.
P0748	Line pressure control (LPC) solenoid	LPC solenoid or circuit malfunction	Erratic transmission operation	GO to Pinpoint Test O.
P0778	2/4 Brake pressure control (BPC) circuit	2/4 BPC solenoid or circuit malfunction	Erratic gear shifts	GO to Pinpoint Test P.
P1710	Control valve solenoid GROUND	GROUND circuit	Erratic gear shifts	GO to Pinpoint Test Q.
P0915	J-Gate input	J-Gate or circuit malfunction	Left-hand side of the J-Gate inoperative	GO to Pinpoint Test R.

PINPOINT TEST A : P1745. LOW CLUTCH TIMING SOLENOID MALFUNCTION

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE LOW CLUTCH TIMING SOLENOID GROUND CIRCUIT.	
	1 Disconnect transmission electrical connector JB155.
	2 Measure the resistance between JB155, pin 18 (B) and GROUND.

	Is the resistance greater than 5 ohms? **Yes** GO to A3. **No** GO to A2.
A2: CHECK THE LOW CLUTCH TIMING SOLENOID RESISTANCE.	
	1 Measure the resistance between transmission electrical connector JB155 pin 18 and pin 12 at the transmission.
	Is the resistance 16 ohms? **Yes** GO to A3. **No** INSTALL a new timing solenoid. CLEAR the DTC. TEST the system for normal operation.
A3: CHECK THE LOW CLUTCH TIMING SOLENOID GROUND WIRE FOR CONTINUITY.	
	1 Disconnect TCM electrical connector JB131.
	2 Measure the resistance between JB155, pin 18 (B) and JB131, pin 17 (B).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.
A4: CHECK THE LOW CLUTCH TIMING SOLENOID SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB155, pin 12 (Y) and JB131, pin 53 (Y).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.

PINPOINT TEST B : P1746. REDUCTION TIMING SOLENOID MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE REDUCTION TIMING SOLENOID GROUND CIRCUIT.	
	1 Disconnect transmission electrical connector JB155.
	2 Measure the resistance between JB155, pin 18 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to B3. **No** GO to B2.
B2: CHECK THE REDUCTION TIMING SOLENOID RESISTANCE.	
	1 Measure the resistance between JB155, pin 18 and pin 14 at the transmission.
	Is the resistance 16 ohms? **Yes** GO to B3. **No** INSTALL a new timing solenoid. CLEAR the DTC. TEST the system for normal operation.
B3: CHECK THE REDUCTION TIMING SOLENOID GROUND WIRE FOR CONTINUITY.	
	1 Disconnect TCM electrical connector JB131.
	2 Measure the resistance between JB155, pin 18 (B) and JB131, pin 17 (B).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.
B4: CHECK THE REDUCTION TIMING SOLENOID SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB155, pin 14 (W) and JB131, pin 10 (W).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.

PINPOINT TEST C : P1747. 2/4 BRAKE TIMING SOLENOID MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE 2/4 BRAKE TIMING SOLENOID GROUND CIRCUIT.	
	1 Disconnect transmission electrical connector JB155.
	2 Measure the resistance between JB155, pin 18 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to C3. **No** GO to C2.
C2: CHECK THE 2/4 BRAKE TIMING SOLENOID RESISTANCE.	
	1 Measure the resistance between JB155 pin 18 and pin 13 at the transmission.
	Is the resistance 16 ohms? **Yes** GO to C3. **No** INSTALL a new timing solenoid. CLEAR the DTC. TEST the system for normal operation.
C3: CHECK THE 2/4 BRAKE TIMING SOLENOID GROUND WIRE FOR CONTINUITY.	
	1 Disconnect TCM electrical connector JB131.

	2 Measure the resistance between JB155, pin 18 (B) and JB131, pin 17 (B).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.
C4: CHECK THE 2/4 BRAKE TIMING SOLENOID SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB155, pin 13 (U) and JB131, pin 04 (U).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.

PINPOINT TEST D : P0706. TRANSMISSION RANGE SENSOR MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK TRANSMISSION RANGE SENSOR CONTINUITY IN PARK.	
	1 Disconnect TR sensor electrical connector JB156.
	2 Select **PARK**.
	3 Check for continuity between pins 08 and 09 of the sensor.
	Is the circuit continuous? **Yes** GO to D2. **No** Carry out the adjustment procedure for the transmission range sensor. REFER to Transmission Range (TR) Sensor Adjustment in this section. Recheck the circuit. If still open circuit, INSTALL a new transmission range sensor. REFER to Transmission Range (TR) Sensor in this section. CLEAR the DTC. TEST the system for normal operation.
D2: CHECK TRANSMISSION RANGE SENSOR CONTINUITY IN REVERSE.	
	1 Select **REVERSE**.
	2 Check for continuity between pins 08 and 07 of the sensor.
	Is the circuit continuous? **Yes** GO to D3. **No** Carry out the adjustment procedure for the transmission range sensor. REFER to Transmission Range (TR) Sensor Adjustment in this section. Recheck the circuit. If still open circuit, INSTALL a new transmission range sensor. REFER to Transmission Range (TR) Sensor in this section. CLEAR the DTC. TEST the system for normal operation.
D3: CHECK TRANSMISSION RANGE SENSOR CONTINUITY IN NEUTRAL.	
	1 Select **NEUTRAL**.
	2 Check for continuity between pins 08 and 02 of the sensor.
	Is the circuit continuous? **Yes** GO to D4. **No** Carry out the adjustment procedure for the transmission range sensor. REFER to Transmission Range (TR) Sensor Adjustment in this section. Recheck the circuit. If still open circuit, INSTALL a new transmission range sensor. REFER to Transmission Range (TR) Sensor in this section. CLEAR the DTC. TEST the system for normal operation.
D4: CHECK TRANSMISSION RANGE SENSOR CONTINUITY IN D.	
	1 Select **D**.
	2 Check for continuity between pins 08 and 01 of the sensor.
	Is the circuit continuous? **Yes** GO to D5. **No** Carry out the adjustment procedure for the transmission range sensor. REFER to Transmission Range (TR) Sensor Adjustment in this section. Recheck the circuit. If still open circuit, INSTALL a new transmission range sensor. REFER to Transmission Range (TR) Sensor in this section. CLEAR the DTC. TEST the system for normal operation.
D5: CHECK TRANSMISSION RANGE SENSOR CONTINUITY IN 2 (TO VIN D15361).	
	1 Select **2**.
	2 Check for continuity between pins 08 and 03 of the sensor.
	Is the circuit continuous? **Yes** GO to D6. **No** Carry out the adjustment procedure for the transmission range sensor. REFER to Transmission Range (TR) Sensor Adjustment in this section. Recheck the circuit. If still open circuit, INSTALL a new transmission range sensor. REFER to Transmission Range (TR) Sensor in this section. CLEAR the DTC. TEST the system for normal operation.
D6: CHECK TRANSMISSION RANGE SENSOR CONTINUITY IN 3 (TO VIN D15361).	
	1 Select **3**.
	2 Check for continuity between pins 08 and 04 of the sensor.
	Is the circuit continuous? **Yes** GO to D7. **No**

	Carry out the adjustment procedure for the transmission range sensor. REFER to Transmission Range (TR) Sensor Adjustment in this section. Recheck the circuit. If still open circuit, INSTALL a new transmission range sensor. REFER to Transmission Range (TR) Sensor in this section. CLEAR the DTC. TEST the system for normal operation.
D7: CHECK TRANSMISSION RANGE SENSOR GROUND CIRCUIT.	
	1 Measure the resistance between JB156, pin 08 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to D8.
D8: CHECK TRANSMISSION RANGE SENSOR PARK SIGNAL WIRE FOR CONTINUITY.	
	1 Disconnect the TCM electrical connector JB131.
	2 Measure the resistance between JB131, pin 30 (U) and the TR sensor electrical connector JB156, pin 09 (U).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to D9.
D9: CHECK TRANSMISSION RANGE SENSOR REVERSE SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB131, pin 26 (G) and JB156, pin 07 (G).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to D10.
D10: CHECK TRANSMISSION RANGE SENSOR NEUTRAL SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB131, pin 25 (W) and JB156, pin 02 (W).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to D11.
D11: CHECK TRANSMISSION RANGE SENSOR DRIVE SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB131, pin 27 (Y) and JB156, pin 01 (Y).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to D12.
D12: CHECK TRANSMISSION RANGE SENSOR 2 SIGNAL WIRE FOR CONTINUITY (TO VIN D15361).	
	1 Measure the resistance between JB131, pin 08 (R) and JB156, pin 03 (R).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to D13.
D13: CHECK TRANSMISSION RANGE SENSOR 3 SIGNAL WIRE FOR CONTINUITY (TO VIN D15361).	
	1 Measure the resistance between JB131, pin 07 (O) and JB156, pin 04 (O).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new TCM. REFER to Transmission Control Module (TCM) - in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST E : P1780. D-4 SWITCH MALFUNCTION (TO VIN D15361)	
• NOTE: Incorrect adjustment of the selector cable could result in this DTC being set with no electrical fault being present. REFER to Section 307-05A Automatic Transmission/Transaxle External Controls / 307-05B Automatic Transmission/Transaxle External Controls.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK POWER SUPPLY TO THE J-GATE.	
	1 Disconnect the J-Gate electrical connector, IP14.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between IP14, pin 01 (WR) and GROUND.
	Is the voltage less than 10 volts? **Yes** REPAIR the circuit between IP14, pin 01 (WR) and the ignition switch (this circuit includes the central junction fuse box, ignition relay, and inertia switch). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to E2.
E2: CHECK GROUND SUPPLY TO THE J-GATE.	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between IP14, pin 02 (B) and GROUND.

	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to E3.
E3: CHECK D-4 SWITCH SIGNAL WIRE FOR HIGH RESISTANCE.	
	1 Measure the resistance between IP14, pin 05 (BW) and JB131, pin 45 (BW).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new J-Gate. REFER to Section 307-05A Automatic Transmission/Transaxle External Controls / 307-05B Automatic Transmission/Transaxle External Controls.

PINPOINT TEST F : P1793. TCM IGNITION SWITCHED POWER MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK TRANSMISSION CONTROL MODULE IGNITION SWITCHED POWER SUPPLY CIRCUIT.	
	1 Disconnect TCM electrical connector, JB131.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between JB131, pin 36 (WU) and GROUND.
	Is the voltage less than 10 volts? **Yes** REPAIR the circuit between TCM electrical connector JB131, pin 36 (WU) and the battery power bus 1 (this circuit includes the TCM relay and power distribution fuse box). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to F2.
F2: CHECK TRANSMISSION CONTROL MODULE IGNITION SWITCHED POWER SUPPLY CIRCUIT.	
	1 Measure the voltage between JB131, pin 54 (WU) and GROUND.
	Is the voltage less than 10 volts? **Yes** REPAIR the circuit between JB131, pin 54 (WU) and the battery power bus 1 (this circuit includes the TCM relay and power distribution fuse box). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.

PINPOINT TEST G : P0791. INTERMEDIATE SPEED SENSOR MALFUNCTION (ONLY UP TO VIN C79328)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: CHECK THE INTERMEDIATE SPEED SENSOR GROUND CIRCUIT.	
	1 Disconnect the transmission electrical connector, JB155.
	2 Measure the resistance between JB155, pin 03 (B) and GROUND (shielded cable).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to G3.
G2: CHECK THE INTERMEDIATE SPEED SENSOR GROUND CIRCUIT FOR CONTINUITY.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between transmission electrical connector JB155, pin 03 (B) and TCM electrical connector JB131, pin 20 (B).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to G3.
G3: CHECK THE INTERMEDIATE SPEED SENSOR SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB155, pin 04 (N) and JB131, pin 21 (N).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit . For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to G4.
G4: CHECK THE RESISTANCE OF THE INTERMEDIATE SPEED SENSOR.	
	1 Measure the resistance between JB155, pin 03 and pin 04 at the transmission.
	Is the resistance 550 ohms? **Yes** Contact dealer technical support for advice on possible module failure. **No** INSTALL a new transaxle. REFER to Transaxle - in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST H : P0720. OUTPUT SPEED SENSOR MALFUNCTION (TO VIN C79328)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: CHECK THE OUTPUT SPEED SENSOR GROUND CIRCUIT.	
	1 Disconnect the transmission electrical connector, JB155.
	2 Measure the resistance between JB155, pin 05 (B) and GROUND (shielded cable).

	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to H3.
H2: CHECK THE OUTPUT SPEED SENSOR GROUND CIRCUIT FOR CONTINUITY.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between JB155, pin 05 (B) and JB131, pin 20 (B).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to H3.
H3: CHECK THE OUTPUT SPEED SENSOR SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB155, pin 06 (N) and JB131, pin 05 (N).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to H4.
H4: CHECK THE RESISTANCE OF THE OUTPUT SPEED SENSOR.	
	1 Measure the resistance between JB155, pin 05 and pin 06 at the transmission.
	Is the resistance 550 ohms? **Yes** Contact dealer technical support for advice on possible module failure. **No** INSTALL a new transaxle. REFER to Transaxle - in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST I : P0715. TURBINE SPEED SENSOR MALFUNCTION (TO VIN C79328)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: CHECK THE TURBINE SPEED SENSOR GROUND CIRCUIT.	
	1 Disconnect the transmission electrical connector, JB155.
	2 Measure the resistance between JB155, pin 01 (B) and GROUND (shielded cable).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to I3.
I2: CHECK THE TURBINE SPEED SENSOR GROUND CIRCUIT FOR CONTINUITY.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between JB155, pin 01 (B) and JB131, pin 20 (B).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to I3.
I3: CHECK THE TURBINE SPEED SENSOR SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB155, pin 02 (N) and TCM electrical connector, JB131, pin 24 (N).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to I4.
I4: CHECK THE RESISTANCE OF THE OUTPUT SPEED SENSOR.	
	1 Measure the resistance between JB155, pin 01 and pin 02 at the transmission.
	Is the resistance 550 ohms? **Yes** Contact dealer technical support for advice on possible module failure. **No** INSTALL a new transaxle. REFER to Transaxle - in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST J : P0710. OIL TEMPERATURE SENSOR MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
J1: CHECK THE OIL TEMPERATURE SENSOR GROUND CIRCUIT.	
	1 Disconnect the transmission electrical connector, JB155.
	2 Measure the resistance between JB155, pin 08 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to J3.
J2: CHECK THE OIL TEMPERATURE SENSOR GROUND CIRCUIT FOR CONTINUITY.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between JB155, pin 08 (B) and JB131 pin 20 (B).

	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to J3.
J3: CHECK THE OIL TEMPERATURE SENSOR SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB155, pin 07 (W) and JB131, pin 39 (W).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to J4.
J4: CHECK THE OIL TEMPERATURE SENSOR RESISTANCE.	
	1 Measure the resistance between JB155, pin 07 and pin 08 at the transmission.
	Is the resistance 2,000-5,000 ohms at room temperature? **Yes** Contact dealer technical support for advice on possible module failure. **No** INSTALL a new transaxle. REFER to Transaxle - in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST K : P0753. SHIFT SOLENOID A MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
K1: CHECK THE SHIFT SOLENOID A GROUND CIRCUIT.	
	1 Disconnect the transmission electrical connector, JB155.
	2 Measure the resistance between JB155, pin 18 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to K3. **No** GO to K2.
K2: CHECK THE SHIFT SOLENOID A RESISTANCE.	
	1 Measure the resistance between JB155, pin 09 and pin 18 at the transmission.
	Is the resistance 16 ohms? **Yes** GO to K3. **No** INSTALL a new shift solenoid. REFER to Shift Solenoids (SS) - in this section. CLEAR the DTC. TEST the system for normal operation.
K3: CHECK THE SHIFT SOLENOID A GROUND WIRE FOR CONTINUITY.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between JB155, pin 18 (B) and JB131, pin 17 (B).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.
K4: CHECK THE SHIFT SOLENOID A SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB155, pin 09 (B) and TCM electrical connector JB131, pin 15 (B).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.

PINPOINT TEST L : P0758. SHIFT SOLENOID B MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
L1: CHECK THE SHIFT SOLENOID B GROUND CIRCUIT.	
	1 Disconnect the transmission electrical connector, JB155.
	2 Measure the resistance between JB155, pin 18 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to L3. **No** GO to L2.
L2: CHECK THE SHIFT SOLENOID B RESISTANCE.	
	1 Measure the resistance between JB155, pin 10 and pin 18 at the transmission.
	Is the resistance 16 ohms? **Yes** GO to L4. **No** INSTALL a new shift solenoid. REFER to Shift Solenoids (SS) - in this section. CLEAR the DTC. TEST the system for normal operation.
L3: CHECK THE SHIFT SOLENOID B GROUND WIRE FOR CONTINUITY.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between JB155, pin 18 (B) and JB131, pin 17 (B).

	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.
L4: CHECK THE SHIFT SOLENOID B SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB155, pin 10 (N) and JB131, pin 14 (N).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.

PINPOINT TEST M : P0763. SHIFT SOLENOID C MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
M1: CHECK THE SHIFT SOLENOID C GROUND CIRCUIT.	
	1 Disconnect the transmission electrical connector, JB155.
	2 Measure the resistance between JB155, pin 18 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to M3. **No** GO to M2.
M2: CHECK THE SHIFT SOLENOID C RESISTANCE.	
	1 Measure the resistance between JB155, pins 11 and 18 at the transmission.
	Is the resistance 16 ohms? **Yes** GO to M4. **No** INSTALL a new shift solenoid. REFER to Shift Solenoids (SS) - in this section. CLEAR the DTC. TEST the system for normal operation.
M3: CHECK THE SHIFT SOLENOID C GROUND WIRE FOR CONTINUITY.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between JB155, pin 18 (B) and JB131, pin 17 (B).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.
M4: CHECK THE SHIFT SOLENOID C SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB155, pin 11 (G) and JB131, pin 52 (G).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.

PINPOINT TEST N : P0743. TORQUE CONVERTER CLUTCH SOLENOID MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
N1: CHECK THE TORQUE CONVERTER CLUTCH SOLENOID GROUND CIRCUIT.	
	1 Disconnect the transmission electrical connector, JB155.
	2 Measure the resistance between JB155, pin 18 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to N3. **No** GO to N2.
N2: CHECK THE TORQUE CONVERTER CLUTCH SOLENOID RESISTANCE.	
	1 Measure the resistance between JB155, pin 17 and pin 18 at the transmission.
	Is the resistance 12.6 ohms? **Yes** GO to N4. **No** INSTALL a new TCC solenoid. CLEAR the DTC. TEST the system for normal operation.
N3: CHECK THE TORQUE CONVERTER CLUTCH SOLENOID GROUND WIRE FOR CONTINUITY.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between JB155, pin 18 (B) and JB131, pin 17 (B).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.
N4: CHECK THE TORQUE CONVERTER CLUTCH SOLENOID SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB155, pin 17 (O) and JB131, pin 16 (O).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No**

	Contact dealer technical support for advice on possible module failure.

PINPOINT TEST O : P0748. LINE PRESSURE CONTROL SOLENOID MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
O1: CHECK THE LINE PRESSURE CONTROL SOLENOID GROUND CIRCUIT.	
	1 Disconnect the transmission electrical connector, JB155.
	2 Measure the resistance between JB155, pin 18 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to O3. **No** GO to O2.
O2: CHECK THE LINE PRESSURE CONTROL SOLENOID RESISTANCE.	
	1 Measure the resistance between JB155, pin 15 and pin 18 at the transmission.
	Is the resistance 2.9 ohms? **Yes** GO to O4. **No** INSTALL a new LPC solenoid. CLEAR the DTC. TEST the system for normal operation.
O3: CHECK THE LINE PRESSURE CONTROL SOLENOID GROUND WIRE FOR CONTINUITY.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between JB155, pin 18 (B) and JB131, pin 17 (B).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.
O4: CHECK THE LINE PRESSURE CONTROL SOLENOID SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB155, pin 15 (R) and JB131, pin 18 (R).
	Is the resistance greater than 5 ohms? **Yes** For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.

PINPOINT TEST P : P0778. 2/4 BRAKE DUTY PRESSURE CONTROL SOLENOID MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
P1: CHECK THE 2/4 BRAKE DUTY PRESSURE CONTROL SOLENOID GROUND CIRCUIT.	
	1 Disconnect the transmission electrical connector, JB155.
	2 Measure the resistance between JB155, pin 18 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to P3. **No** GO to P2.
P2: CHECK THE 2/4 BRAKE DUTY PRESSURE CONTROL SOLENOID RESISTANCE.	
	1 Measure the resistance between JB155, pin 16 and pin 18 at the transmission.
	Is the resistance 2.9 ohms? **Yes** INSTALL a new 2/4 brake duty pressure control solenoid. CLEAR the DTC. TEST the system for normal operation. **No** GO to P4.
P3: CHECK THE 2/4 BRAKE DUTY PRESSURE CONTROL SOLENOID GROUND WIRE FOR CONTINUITY.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between JB155, pin 18 (B) and JB131, pin 17 (B).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.
P4: CHECK THE 2/4 BRAKE DUTY PRESSURE CONTROL SOLENOID SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB155, pin 16 (G) and JB131, pin 03 (G).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.

PINPOINT TEST Q : P1710. CONTROL VALVE SOLENOID GROUND.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Q1: CHECK CONTROL VALVE SOLENOID GROUND CIRCUIT.	
	1 Disconnect transmission electrical connector, JB155.
	2 Measure the resistance between JB155, pin 18 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to Q2. **No** No electrical fault in GROUND circuit. Possible internal fault. Recheck DTCs.
Q2: CHECK CONTROL VALVE SOLENOID GROUND WIRE FOR CONTINUITY.	
	1 Disconnect TCM electrical connector, JB131.

	2 Measure the resistance between JB155, pin 18 (B) and JB131, pin 17 (B).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible module failure.

PINPOINT TEST R : P0915 J-GATE SIGNAL INPUTS TO THE TCM.	
• NOTE: Incorrect adjustment of the selector cable could result in this DTC being set with no electrical fault being present. REFER to Section 307-05A Automatic Transmission/Transaxle External Controls / 307-05B Automatic Transmission/Transaxle External Controls.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
R1: CHECK TRANSMISSION RANGE SENSOR CONTINUITY IN D.	
	1 Disconnect TR sensor electrical connector JB156.
	2 Select **D**.
	3 Check for continuity between JB156, pin 08 and pin 01 at the sensor.
	Is the circuit continuous? **Yes** GO to R2. **No** Carry out the adjustment procedure for the transmission range sensor. REFER to Transmission Range (TR) Sensor Adjustment in this section. Recheck the circuit. If still open circuit, INSTALL a new transmission range sensor. REFER to Transmission Range (TR) Sensor in this section. CLEAR the DTC. TEST the system for normal operation.
R2: CHECK TRANSMISSION RANGE SENSOR DRIVE SIGNAL WIRE FOR HIGH RESISTANCE.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between JB131, pin 27 (Y) and JB156, pin 01 (Y).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to R3.
R3: CHECK POWER SUPPLY TO THE J-GATE.	
	1 Disconnect the J-Gate electrical connector, IP14.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between IP14, pin 01 (WR) and GROUND.
	Is the voltage less than 10 volts? **Yes** REPAIR the circuit between IP14, pin 01 (WR) and the ignition switch (this circuit includes the central junction fuse box, ignition relay, and inertia switch). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to R4.
R4: CHECK GROUND SUPPLY TO THE J-GATE.	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between J-Gate electrical connector IP14, pin 02 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to R5.
R5: CHECK J-GATE SIGNAL INPUT WIRES FOR CONTINUITY (4 RANGE).	
	1 Disconnect the TCM electrical connector JB131.
	2 Measure the resistance between IP14 pin 05 (BW) and JB131 pin 45 (BW).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to R6.
R6: CHECK THE J-GATE SIGNAL INPUT WIRES FOR CONTINUITY (3 RANGE).	
	1 Measure the resistance between IP14 pin 15 (O) and JB131 pin 07 (O).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to R7.
R7: CHECK THE J-GATE SIGNAL INPUT WIRES FOR CONTINUITY (2 RANGE).	
	1 Measure the resistance between IP14 pin 14 (R) and JB131 pin 08 (R).
	Is the resistance less than 5 ohms? **Yes** GO to R8. **No** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
R8: J-GATE SIGNALS FUNCTIONALITY	
	1 If tests between R1 and R7 have been successfully completed and the fault is still present, INSTALL a new J-Gate.
	2 CLEAR the DTC.
	3 TEST the system for normal operation.

	Does the system function correctly? **Yes** No further action required. **No** Contact dealer technical support for advice on possible module failure.

PINPOINT TEST S : P0791. INTERMEDIATE SPEED SENSOR MALFUNCTION (FROM VIN C79329)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
S1: CHECK THE INTERMEDIATE SPEED SENSOR GROUND CIRCUIT.	
	1 Disconnect the transmission electrical connector, JB155.
	2 Measure the resistance between JB155, pin 03 (B) and GROUND (shielded cable).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to S2.
S2: CHECK THE INTERMEDIATE SPEED SENSOR GROUND CIRCUIT FOR CONTINUITY.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between JB155, pin 03 (B) and JB131, pin 46 (B).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to S3.
S3: CHECK THE INTERMEDIATE SPEED SENSOR SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB155, pin 4 (N) and JB131, pin 21 (N).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to G4.
S4: CHECK THE RESISTANCE OF THE INTERMEDIATE SPEED SENSOR.	
	1 Measure the resistance between JB155, pin 13 and pin 04 at the transmission.
	Is the resistance 550 ohms? **Yes** Contact dealer technical support for advice on possible module failure. **No** INSTALL a new transaxle. REFER to Transaxle - in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST T : P0720. OUTPUT SPEED SENSOR MALFUNCTION (FROM VIN C79329)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
T1: CHECK THE OUTPUT SPEED SENSOR GROUND CIRCUIT.	
	1 Disconnect the transmission electrical connector, JB155.
	2 Measure the resistance between JB155, pin 05 (B) and GROUND (shielded cable).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to T2.
T2: CHECK THE OUTPUT SPEED SENSOR GROUND CIRCUIT FOR CONTINUITY.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between JB155, pin 05 (B) and JB131, pin 42 (B).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to T3.
T3: CHECK THE OUTPUT SPEED SENSOR SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB155, pin 06 (N) and JB131, pin 05 (N).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to T4.
T4: CHECK THE RESISTANCE OF THE OUTPUT SPEED SENSOR.	
	1 Measure the resistance between JB155, pin 05 and pin 06 at the transmission.
	Is the resistance 550 ohms? **Yes** Contact dealer technical support for advice on possible module failure. **No** INSTALL a new transaxle. REFER to Transaxle - in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST U : P0715. TURBINE SPEED SENSOR MALFUNCTION (FROM VIN C79329)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**

U1: CHECK THE TURBINE SPEED SENSOR GROUND CIRCUIT.	
	1 Disconnect the transmission electrical connector, JB155.
	2 Measure the resistance between JB155, pin 01 (B) and GROUND (shielded cable).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to U2.
U2: CHECK THE TURBINE SPEED SENSOR GROUND CIRCUIT FOR CONTINUITY.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between JB155, pin 01 (B) and JB131, pin 44 (B).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to U3.
U3: CHECK THE TURBINE SPEED SENSOR SIGNAL WIRE FOR CONTINUITY.	
	1 Measure the resistance between JB155, pin 2 (N) and JB131, pin 24 (N).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to U4.
U4: CHECK THE RESISTANCE OF THE OUTPUT SPEED SENSOR.	
	1 Measure the resistance between JB155, pin 01 and pin 02 at the transmission.
	Is the resistance 550 ohms? **Yes** Contact dealer technical support for advice on possible module failure. **No** INSTALL a new transaxle. REFER to Transaxle - in this section. CLEAR the DTC. TEST the system for normal operation.

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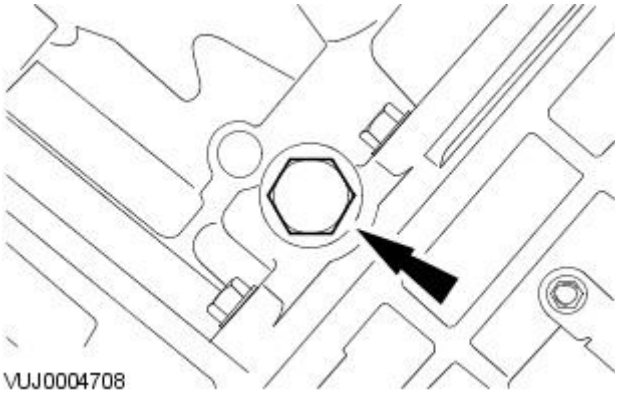
Automatic Transmission / Transaxle - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Transmission Fluid Drain and Refill

General Procedures

Drain

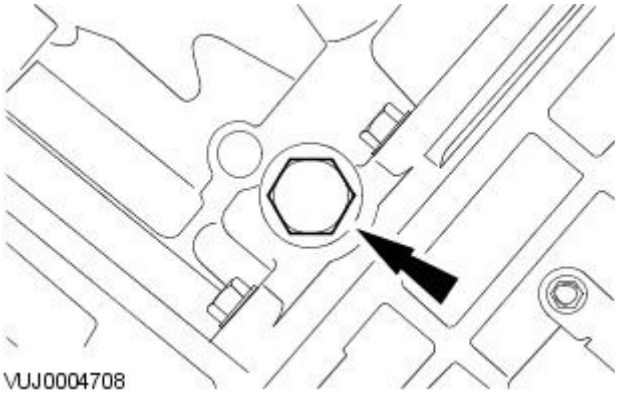
1. Raise and support the vehicle. For additional information, refer to For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
.

2. Place a suitable container under the transmission drain plug.



3. CAUTION: If the automatic transmission fluid is very dirty or it contains metallic particles, then along with a new transmission, install a new automatic transmission fluid cooler and lines.

Remove the transmission drain plug.



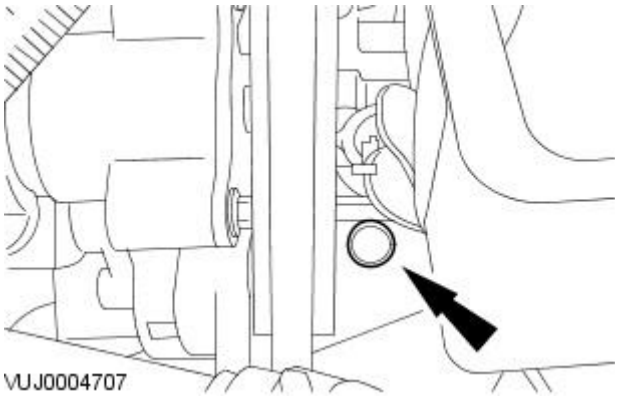
4. Install the transmission drain plug.

- Tighten to 45 Nm.

Refill

5. Lower the vehicle.

6. Remove the automatic transmission fluid charging pipe cap.



7. NOTE: Use automatic transmission fluid WSS-M2C922-A1 or equivalent meeting Jaguar specification.

Fill the automatic transmission with 8 litres of automatic transmission fluid through the automatic transmission fluid charging pipe.

8. Carry out a fluid level check and adjustment. For additional information, refer to
For additional information, refer to: Transmission Fluid Level Check (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

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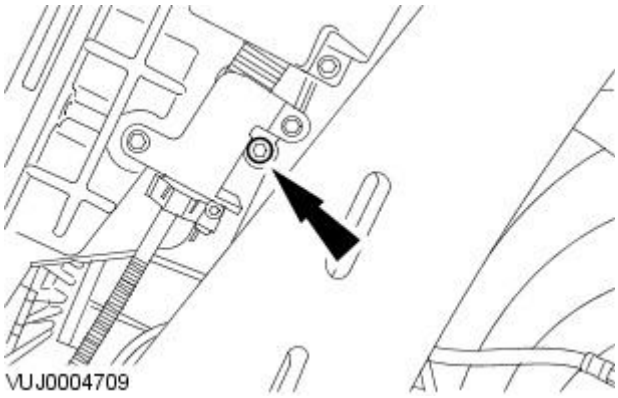
Automatic Transmission / Transaxle - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Transmission Fluid Level Check

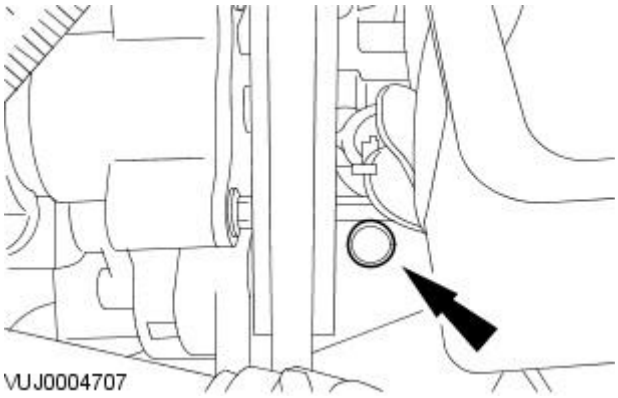
General Procedures

1. Raise and support the vehicle. For additional information, refer to Section 100-02 Jacking and Lifting.
2. Connect the Jaguar Approved Diagnostic System.
3. Make sure J-Gate shift selector is in the Park position (P).
4. With the engine running and the foot brake applied, move the J-Gate shift selector through "P-R-N-D-4-3-2" and back to the "P" position to circulate the automatic transmission fluid until the temperature reaches 30 to 40°C (86 to 104°F) on the Jaguar Approved Diagnostic System.
5. When the automatic transmission fluid temperature reaches 35°C (95°F) check that the selector lever is in the "P" position raise the vehicle.
6. With the engine running, remove the automatic transmission fluid level tube plug.
   - Remove and discard the level plug and sealing washer.



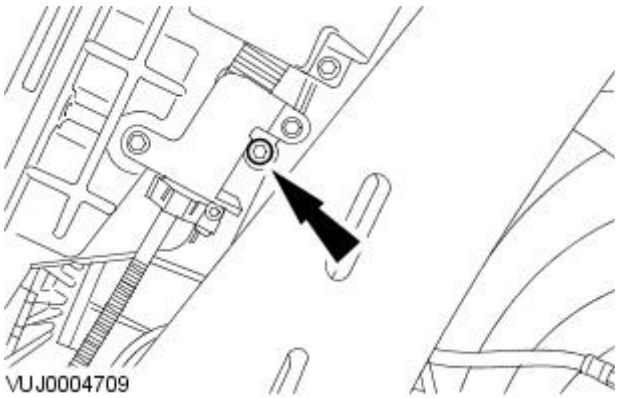
7. NOTE: Use automatic transmission fluid WSS-M2C922-A1 or equivalent meeting Jaguar specification.

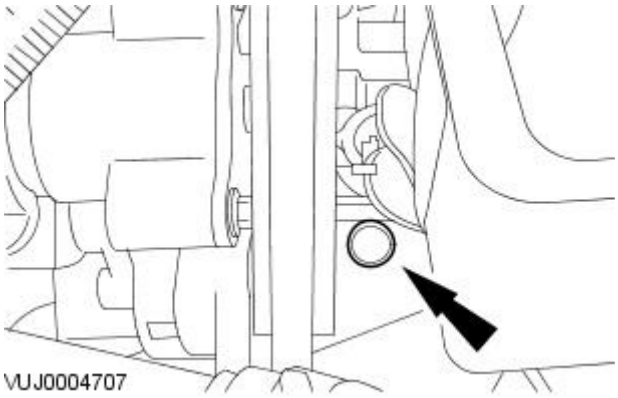
   If the automatic transmission fluid does not come out of the transmission fluid level tube the automatic transmission fluid level is insufficient. If this is the case add the automatic transmission fluid in 0.5 litre units into the automatic transmission fluid charging pipe until the automatic transmission fluid comes out of the automatic transmission fluid level tube.
   - Remove the automatic transmission fluid charging pipe cap.



8. NOTE: Make sure the automatic transmission fluid temperature does not exceed 40°C (104°F). If the automatic transmission fluid temperature does exceed 40°C (104°F) stop the automatic transmission fluid level check and allow the automatic transmission fluid to cool until the temperature reaches 30 to 40°C (86 to 104°F).

   Allow the automatic transmission fluid to come out of the automatic transmission fluid level tube until the overflow stops at a temperature of no more than 40°C (104°F).
9. If when the automatic transmission fluid level plug is first removed and automatic transmission fluid comes out of the automatic transmission fluid level tube, allow the automatic transmission fluid to come out of the automatic transmission fluid level tube until the overflow stops at a temperature of no more than 40°C (104°F).
10. Install the transmission fluid level plug.
    - Install a new level plug and sealing washer.
    - Tighten to 15 Nm.





11. Install the automatic transmission fluid charging pipe cap.

12. Lower the vehicle.

13. Disconnect the Jaguar Approved Diagnostic System.

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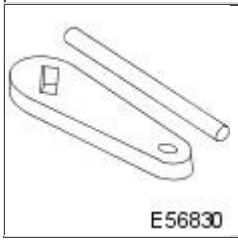
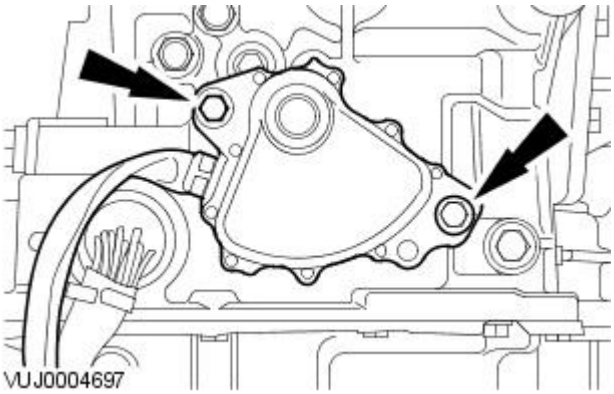
Automatic Transmission / Transaxle - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Transmission Range (TR) Sensor Adjustment

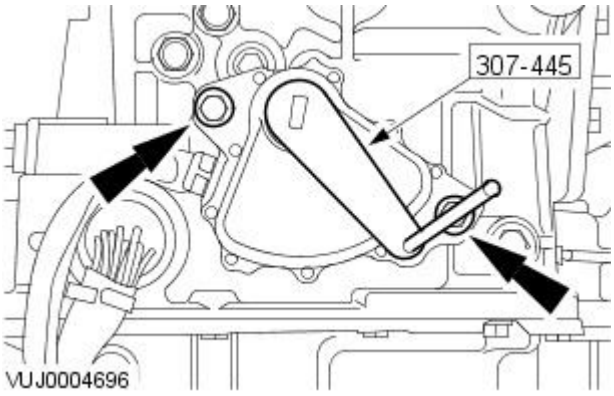
General Procedures

Special Tool(s)	
 E56830	Setting plate rotary switch 307-445

1. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
2. Loosen the Transmission Range (TR) sensor.


VUJ0004697

3. Make sure the J-Gate shift selector is in the "N" position.
4. Using the special tool adjust the TR sensor.
   - Tighten to 10 Nm.



VUJ0004696

5. Remove the special tool.
6. Install the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
7. NOTE: If the J-Gate shift selector does not illuminate in all positions repeat the complete procedure.

   Make sure the vehicle starts in the "P" and "N" positions and that it does not start in the R, D, 4, 3 and 2 positions, and that the J-Gate shift selector illuminates in all positions.

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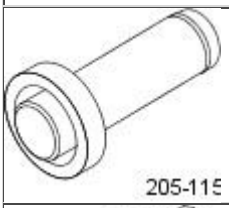
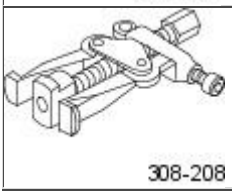
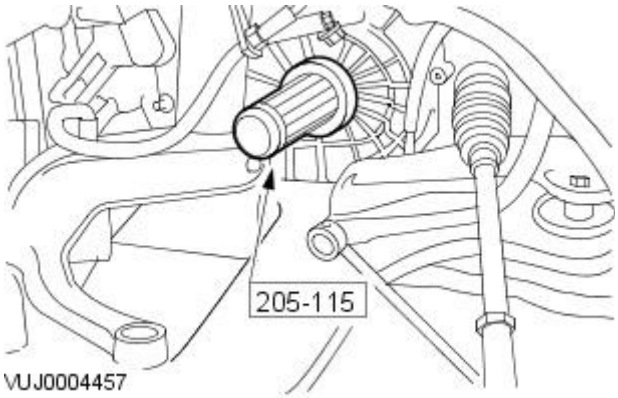
Automatic Transmission / Transaxle - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Halfshaft Seal LH

In-vehicle Repair

Special Tool(s)	
	Link shaft oil seal installer 205-115
	Pinion oil seal remover 308-208

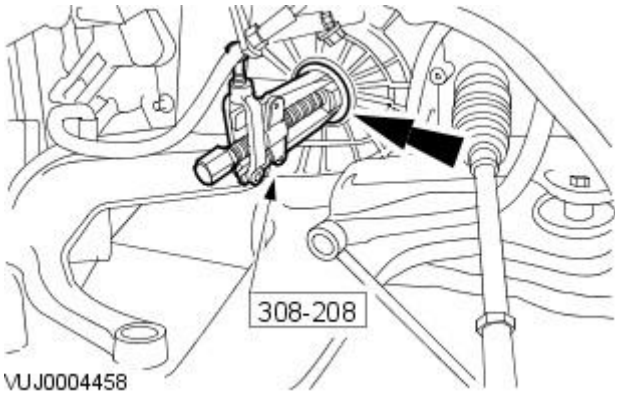
Removal

1. Drain the transmission. For additional information, refer to Transmission Fluid Drain and Refill.
2. Remove the left-hand drive halfshaft. For additional information, refer to Section 205-04 Front Drive Halfshafts.
3. Using the special tool, remove the drive halfshaft oil seal.



Installation

1. Using the special tool, install the drive halfshaft oil seal.



2. Install the left-hand drive halfshaft. For additional information, refer to Section 205-04 Front Drive Halfshafts.
3. Fill the transmission. For additional information, refer to Transmission Fluid Drain and Refill

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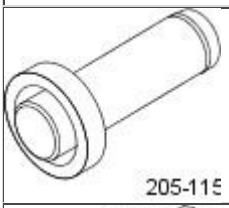
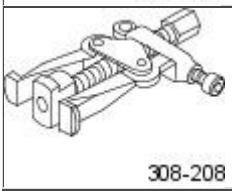
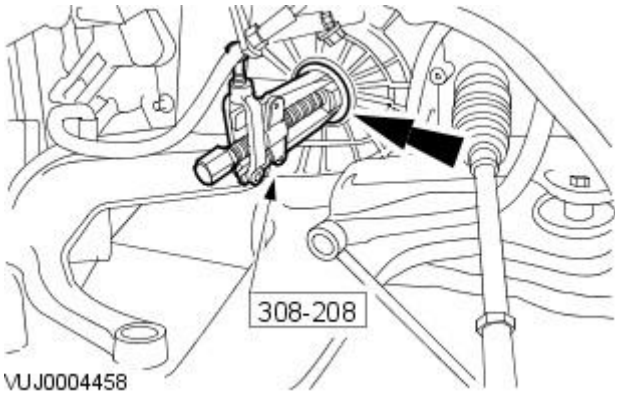
Automatic Transmission / Transaxle - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Halfshaft Seal RH

In-vehicle Repair

Special Tool(s)	
	Linkshaft oil seal installer 205-115
	Pinion oil seal remover 308-208

1. Drain the transmission.
   For additional information, refer to Transmission Fluid Drain and Refill in this section.
2. Remove the intermediate shaft.
   For additional information, refer to Section 205-04 Front Drive Halfshafts.

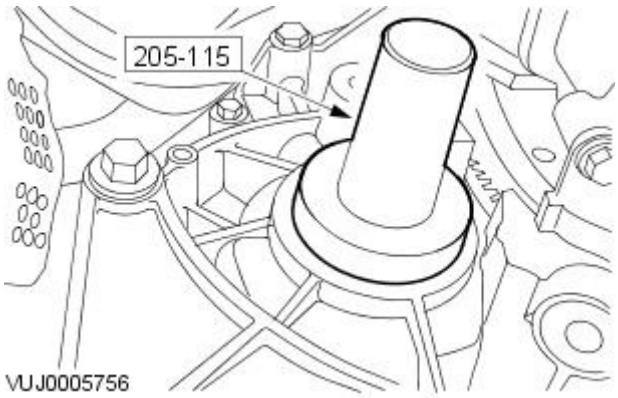
Removal



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

   Using the special tool, remove the halfshaft oil seal.

Installation



1. Using the special tool install, the halfshaft oil seal.
2. Install the intermediate shaft.
   For additional information, refer to Section 205-04 Front Drive Halfshafts.
3. Refill the transmission.
   For additional information, refer to Transmission Fluid Drain and Refill in this section.

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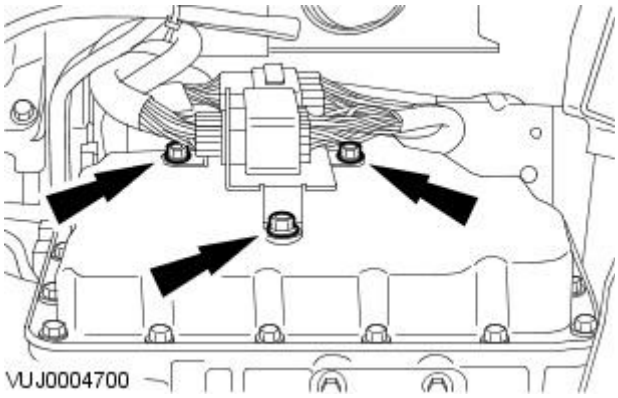
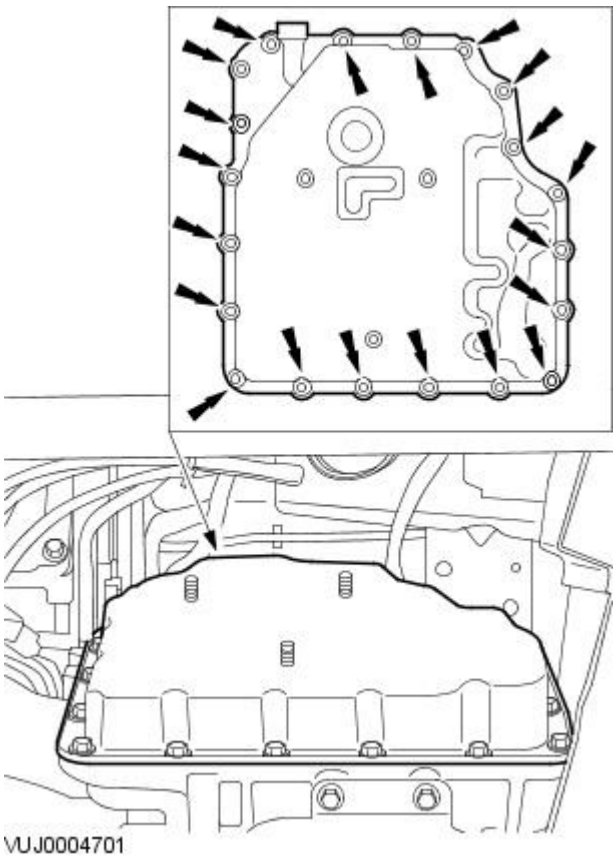
Automatic Transmission / Transaxle - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Main Control Valve Body

In-vehicle Repair

Removal

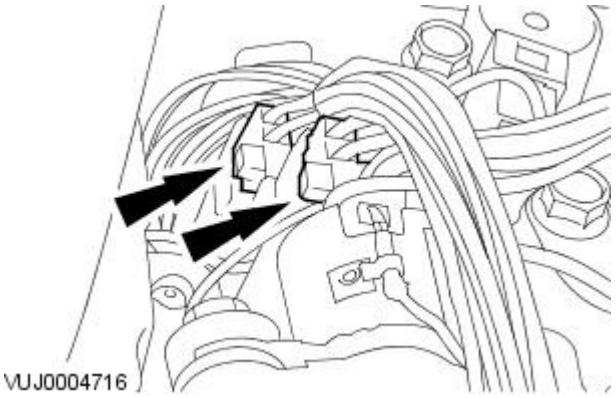


1. Detach the wiring harness.

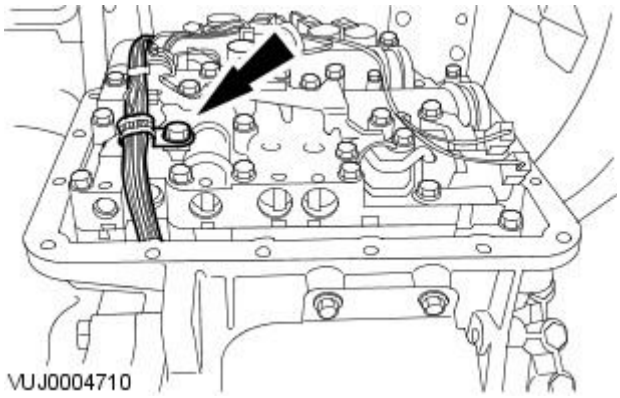


2. Remove the main valve body cover.

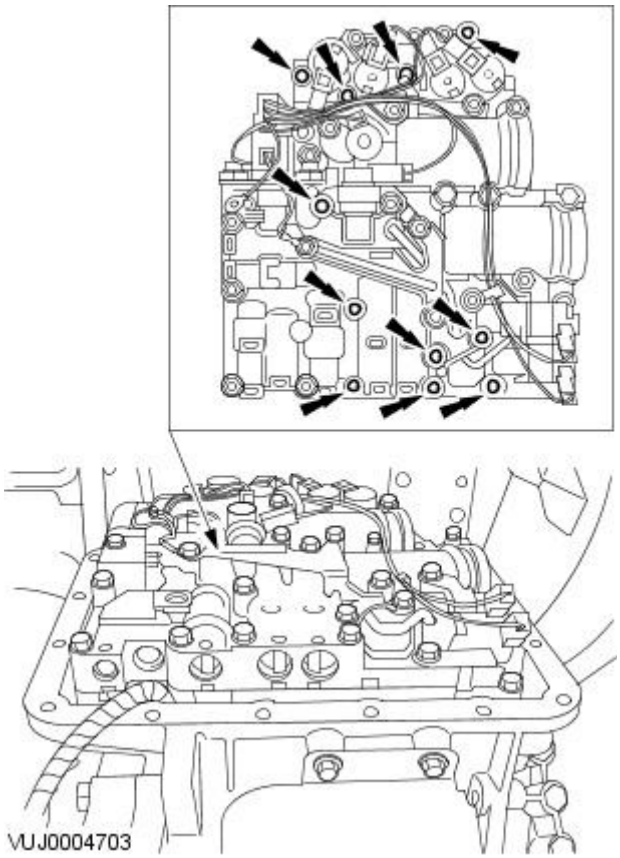
- Drain the transmission fluid into a suitable container.
- Clean and inspect the main valve body cover and transmission sealing surfaces using Metal surface cleaner WSE-M5B392-A or equivalent meeting Jaguar specification.



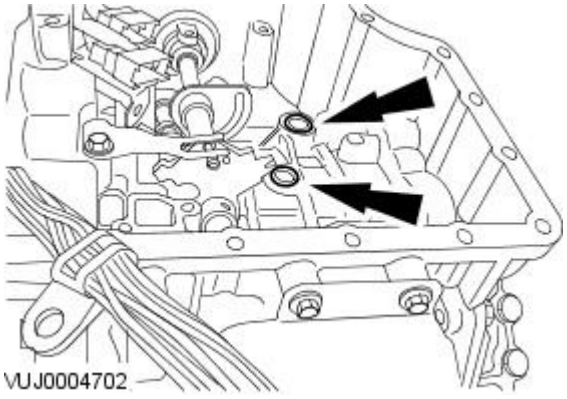
3. Disconnect the electrical connectors.



4. Detach the wiring harness.

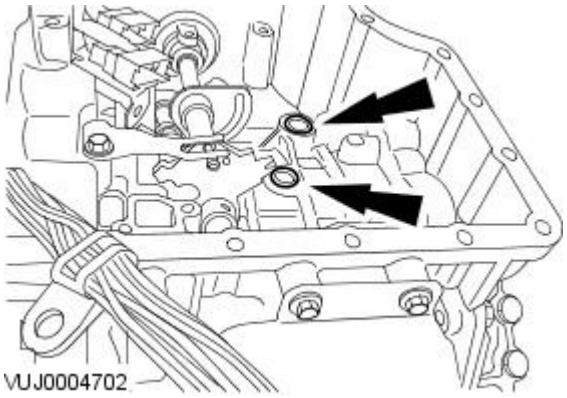


5. Remove the main control valve body.



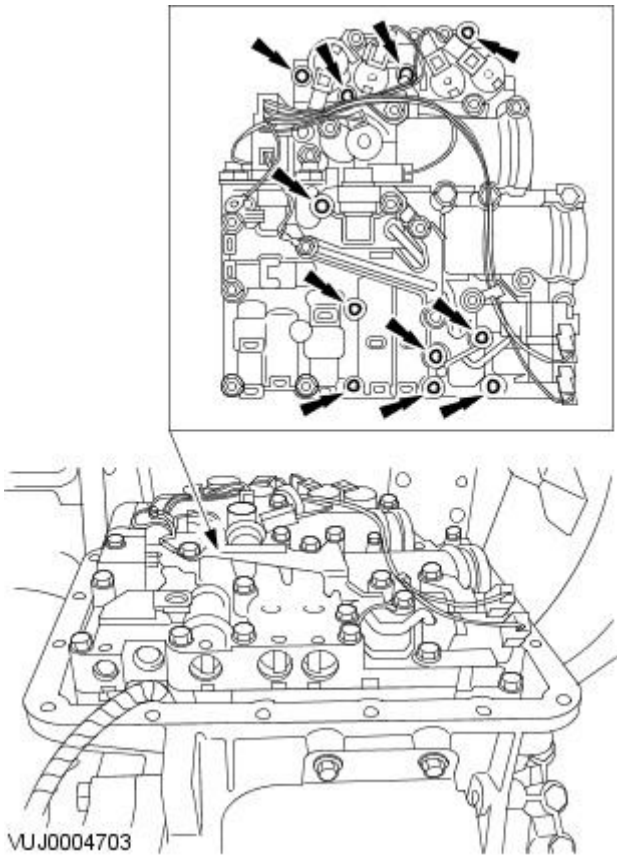
6. Remove and discard the O-ring seals.

Installation



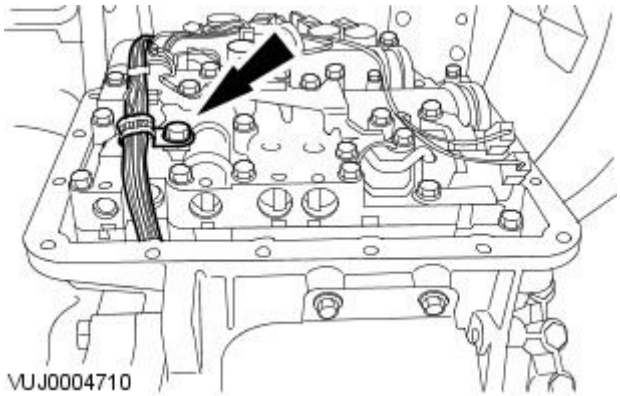
1. To install, reverse the removal procedure.

- Install the new O-ring seals.

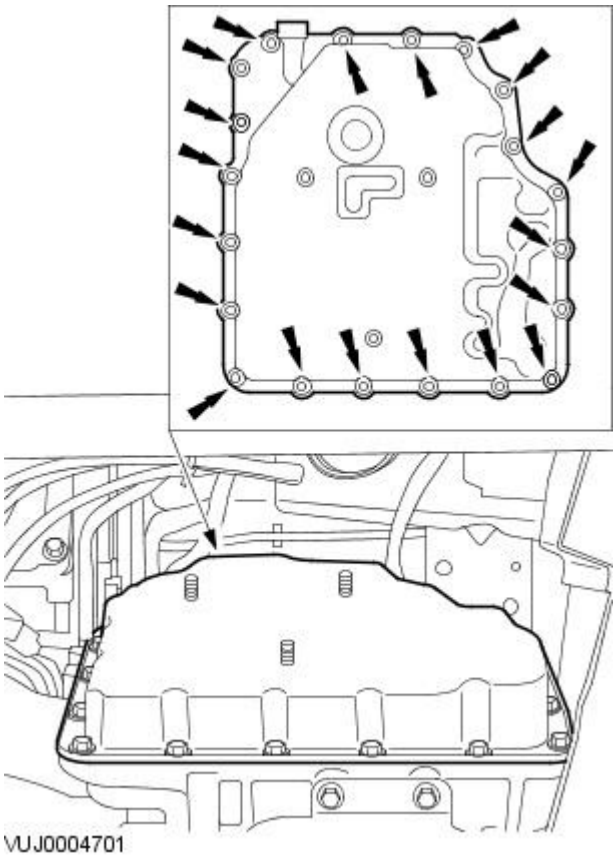


2. To install, reverse the removal procedure.

- Tighten to 8 Nm.



3. Tighten to 8 Nm.



4. NOTE: Apply an even bead of silicone gasket sealant WSE-M4G323-A6 or equivalent meeting Jaguar specification to the main valve body cover sealing surface.

Tighten to 8 Nm.

5. Check and adjust the transmission fluid level. For additional information, refer to Adjustment—Fluid Level Check.

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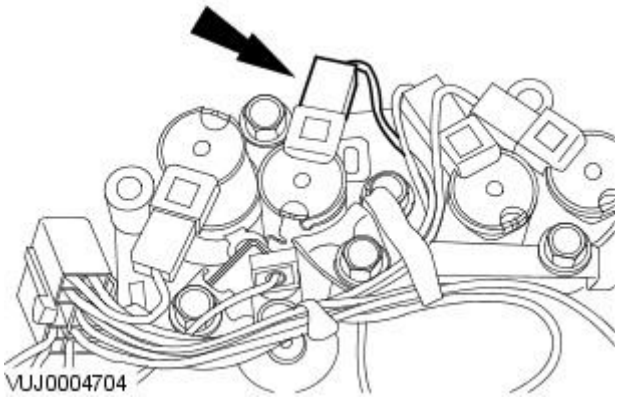
Automatic Transmission / Transaxle - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Shift Solenoids (SS)

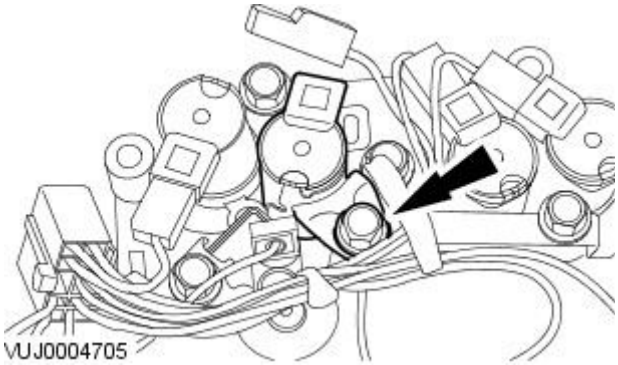
In-vehicle Repair

Removal

1. Remove the main control valve body. For additional information, refer to Main Control Valve Body.
2. Disconnect the electrical connector.



3. Remove the shift solenoid.

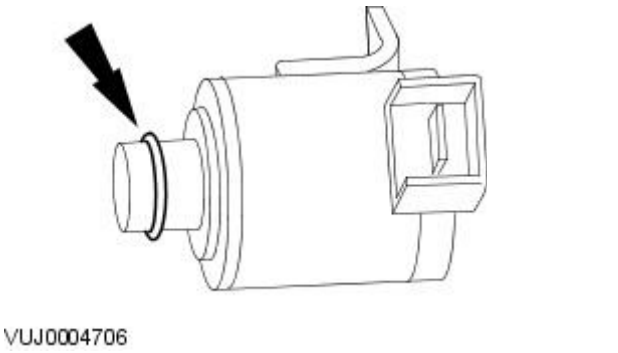


Installation

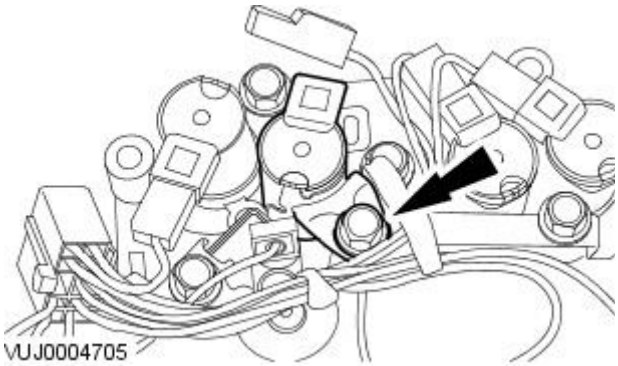
1. NOTE: Lubricate the shift solenoid O-ring seal with automatic transmission fluid WSS-M2C922-A1 or equivalent meeting Jaguar specification.

To install, reverse the removal procedure.

- Lubricate the shift solenoid O-ring seal.



2. Tighten to 8 Nm.



3. Install the main control valve body. For additional information, refer to Main Control Valve Body.

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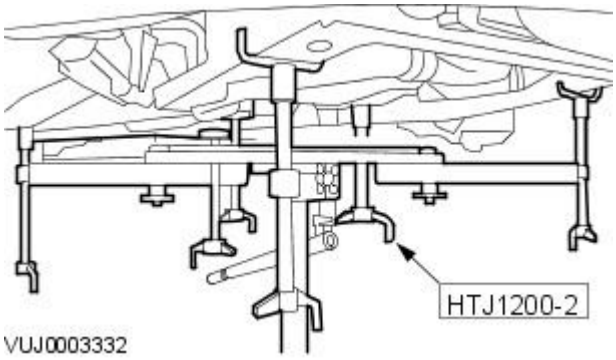
Automatic Transmission / Transaxle - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Transaxle Support Insulator

In-vehicle Repair

Special Tool(s)	
 HTJ12002	Powertrain assembly jack HTJ1200-2

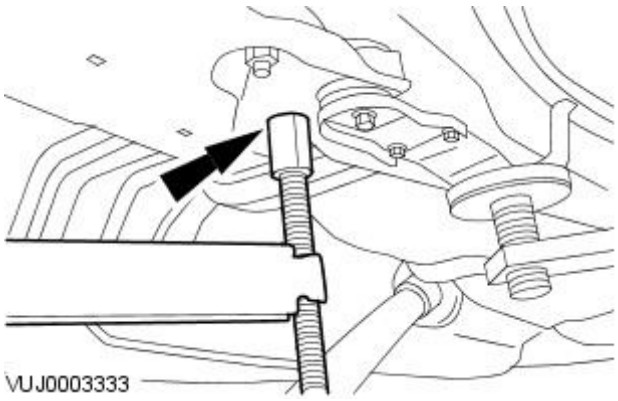
Removal

1. Raise and support the vehicle. For additional information, refer to Section 100-02 Jacking and Lifting.
2. Install the special tool.



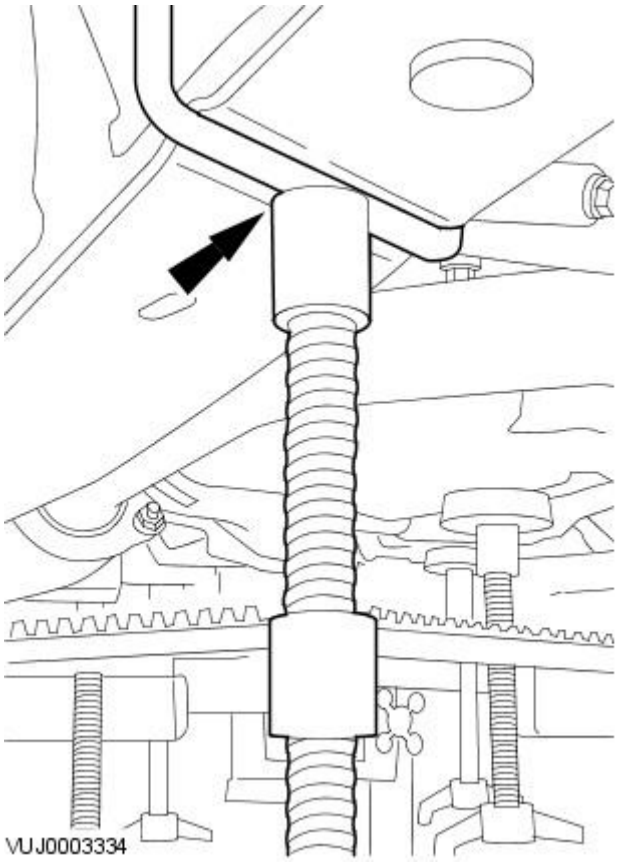
3. NOTE: Left-hand shown, right-hand similar.

   Position and adjust the special tool rear height adjuster.

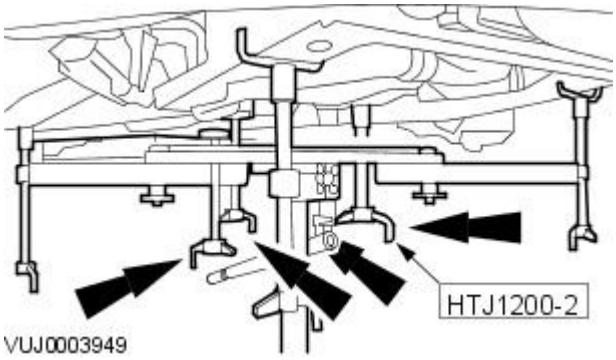


4. NOTE: Right-hand shown, left-hand similar.

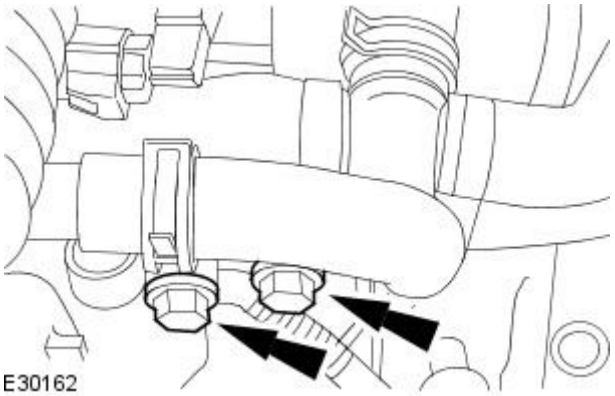
Position and adjust the special tool front height adjuster.



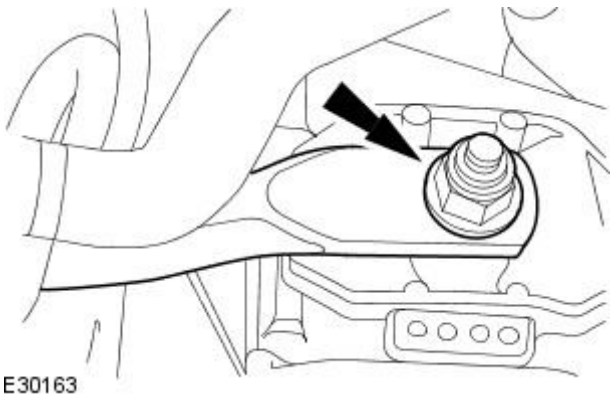
5. Position and adjust the special tool engine height adjusters.

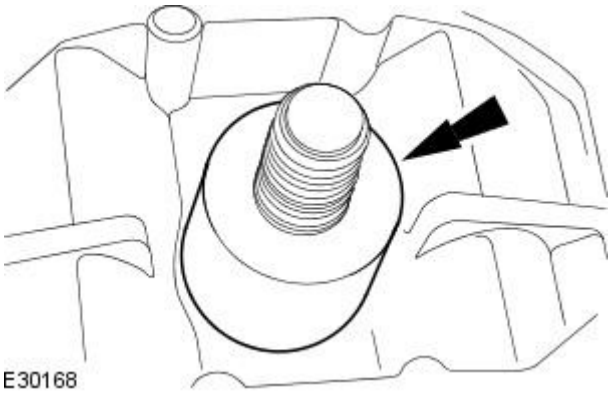


6. Detach the support bar.

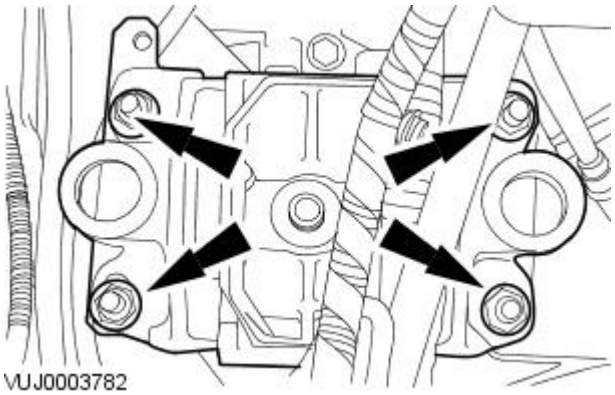


7. Remove the support bar.





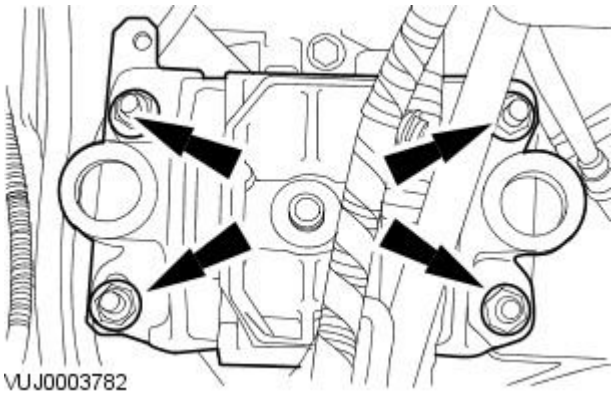
8. Remove the spacer.



9. Remove the transaxle support insulator.

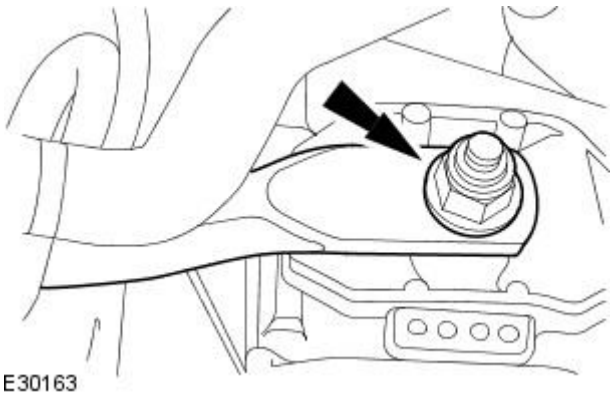
- Remove the transaxle support insulator retaining nuts.

Installation

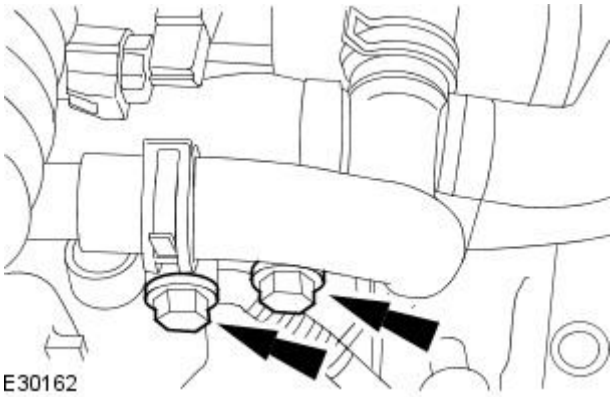


1. To install, reverse the removal procedure.

- Tighten to 47 Nm.



2. Tighten to 133 Nm.



3. Tighten to 25 Nm.

Published: 11-May-2011

Automatic Transmission / Transaxle - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Transmission Control Module (TCM)

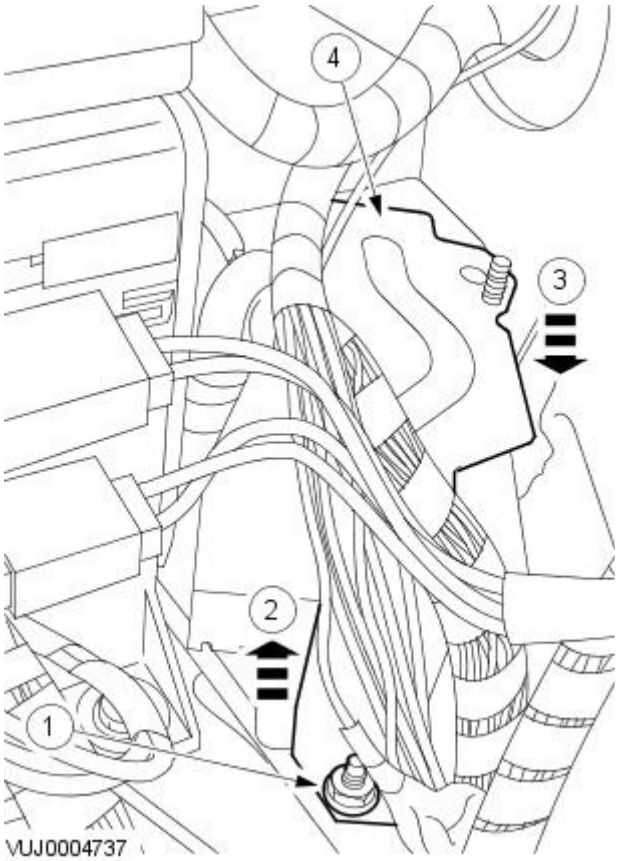
In-vehicle Repair

Removal

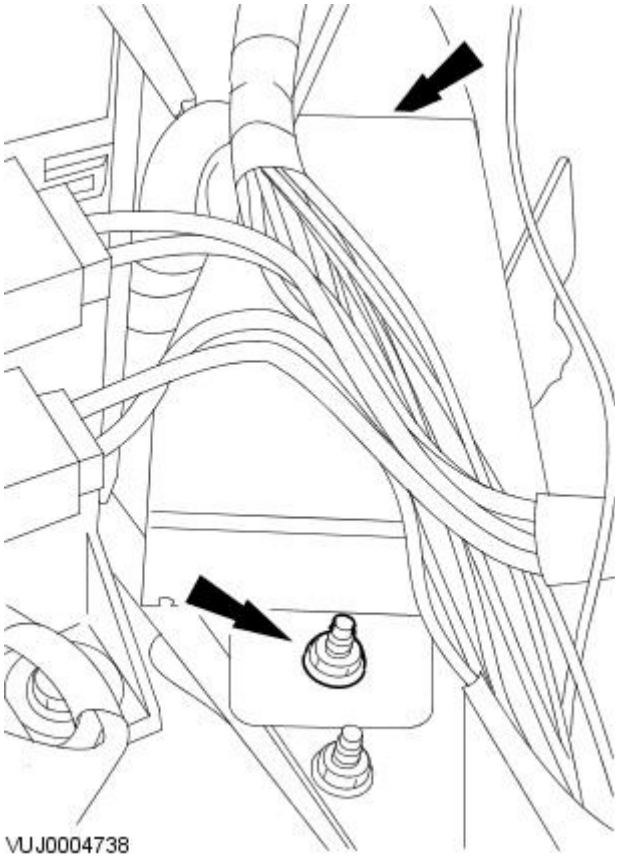
1. Remove the rain sensor module. For additional information, refer to Section 501-16 Wipers and Washers.

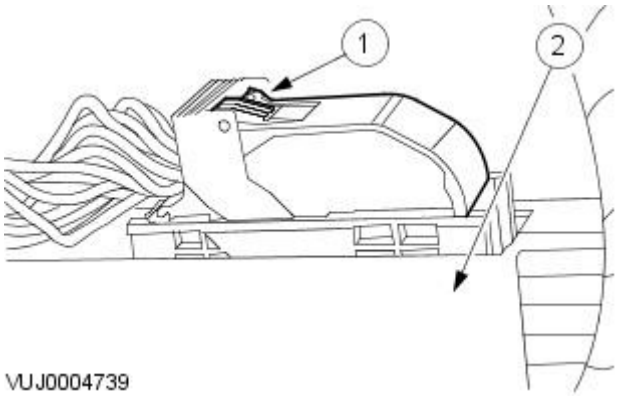
2. Remove the mounting plate.

1. Remove the retaining nut.
2. Reposition the mounting plate.
3. Detach the mounting plate.
4. Remove the mounting plate.



3. Detach the Transmission Control Module (TCM).



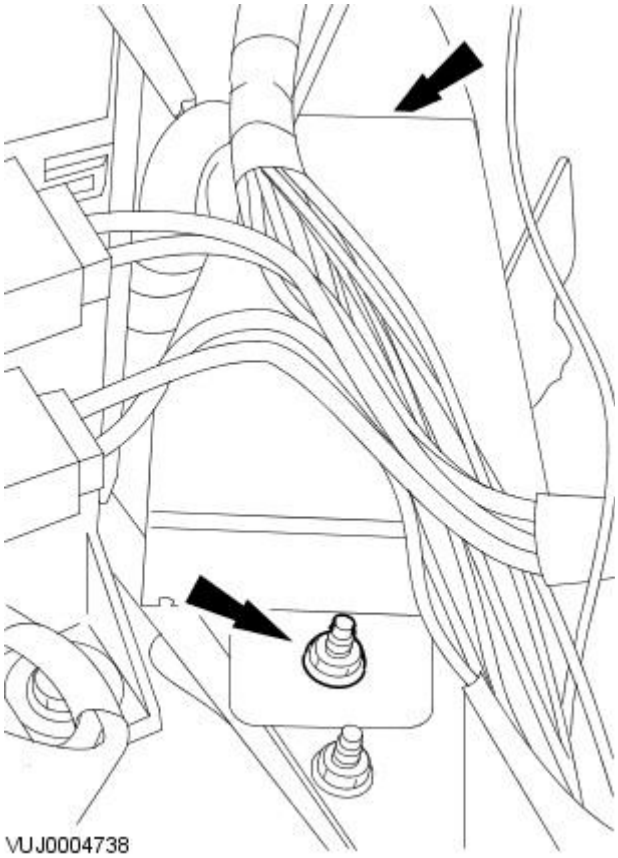


VUJ0004739

4. Remove the TCM.

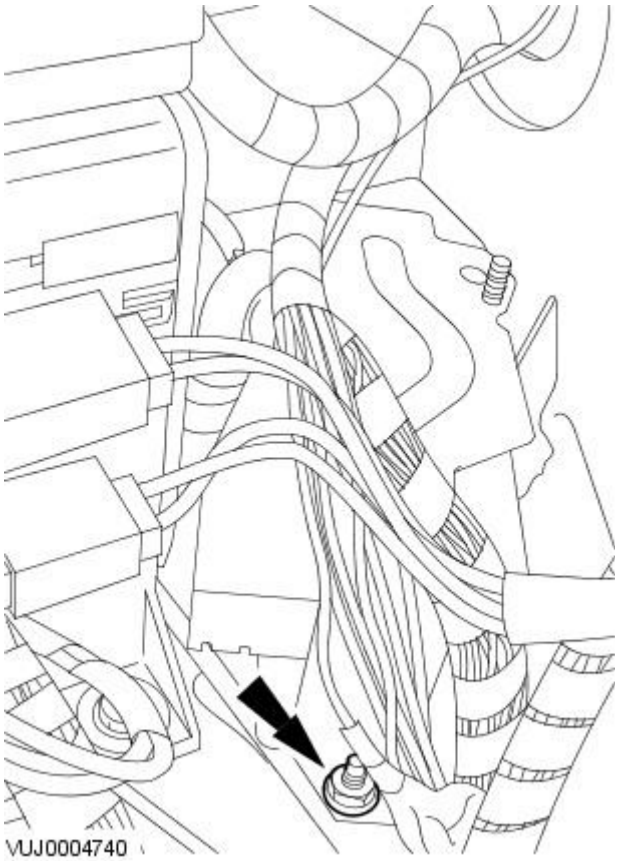
1. Disconnect the electrical connector.
2. Remove the TCM.

Installation


VUJ0004738

1. To install, reverse the removal procedure.

- Tighten to 10 Nm.



2. Tighten to 10 Nm.

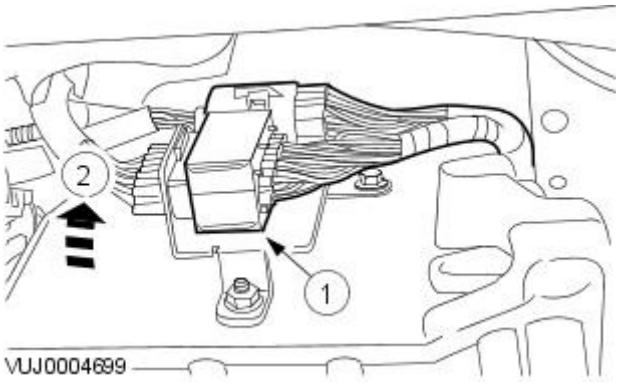
Published: 11-May-2011

Automatic Transmission / Transaxle - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Transmission Range (TR) Sensor

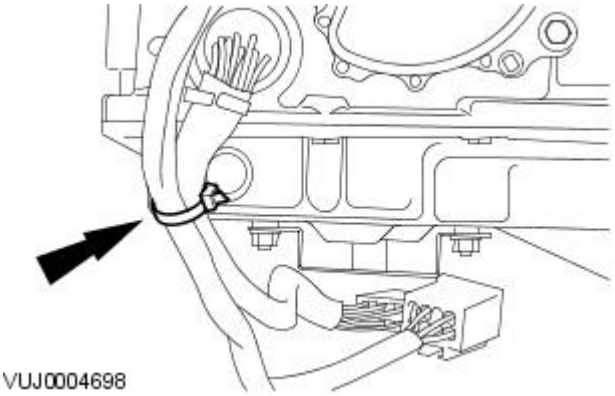
In-vehicle Repair

Removal

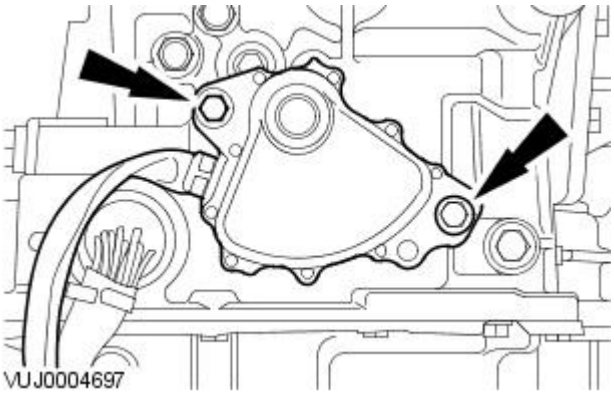
1. Remove the battery tray. For additional information, refer to Section 414-01 Battery, Mounting and Cables.
2. Disconnect the electrical connector.
    1. Detach the electrical connector.
    2. Disconnect the electrical connector.



3. Remove the tie strap.

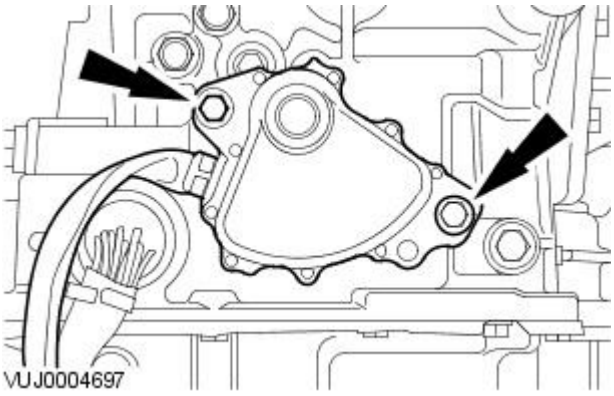


4. Remove the Transmission Range (TR) sensor.



Installation

1. Install the TR sensor.



2. Adjust the TR sensor. For additional information, refer to Adjustment —Transmission Range (TR) Sensor.

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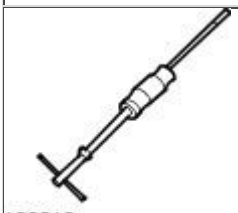
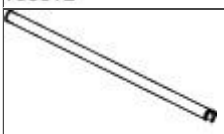
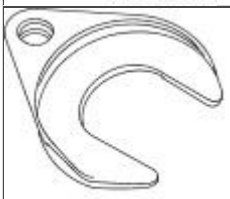
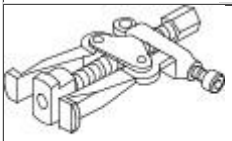
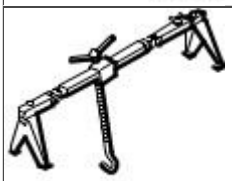
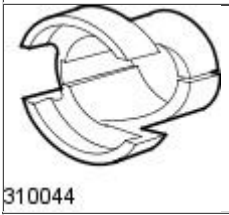
Automatic Transmission / Transaxle - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Transaxle

Removal

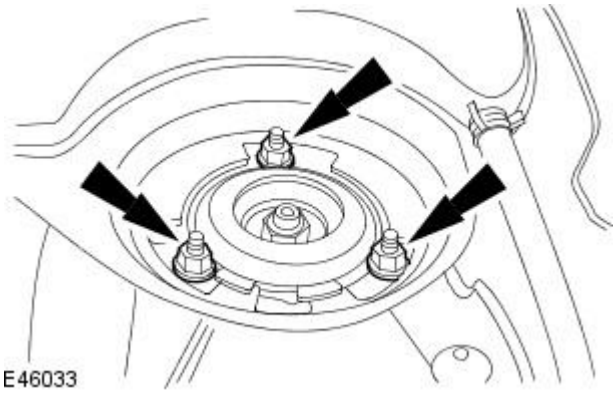
Special Tool(s)	
 100012	Slide hammer 100-012
 100-012-02	100-012-02 Slide hammer shaft
 204-226	Halfshaft remover fork 204-226
 HTJ12002	Powertrain assembly jack HTJ1200-2
 308-208	Pinion oil seal remover 308-208
 303-021	Engine support bracket 303-021
 E46047	Engine support brackets 303-1068
 310044	Disconnect tool, fuel line 310-044

Removal

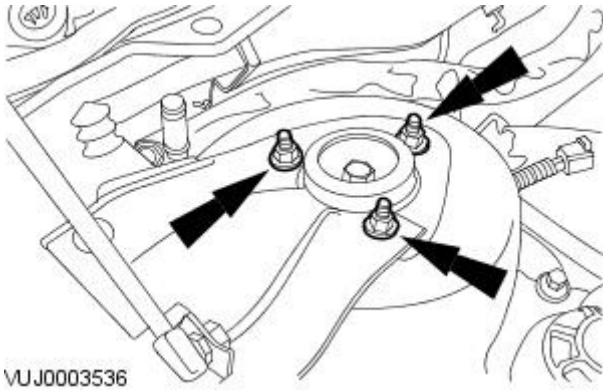
All vehicles

1. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
2. Remove the air cleaner.
   For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

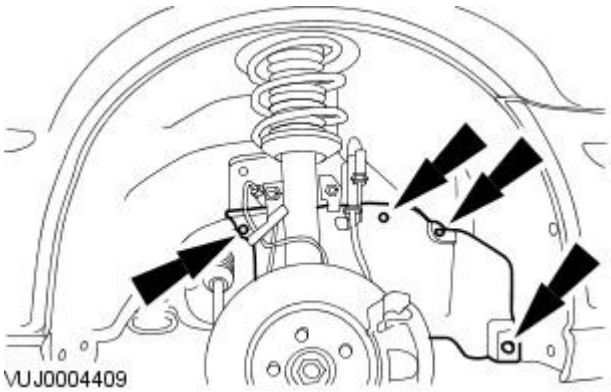
3. Loosen the left-hand shock absorber and spring assembly securing nuts.



4. Loosen the right-hand shock absorber and spring assembly securing nuts.

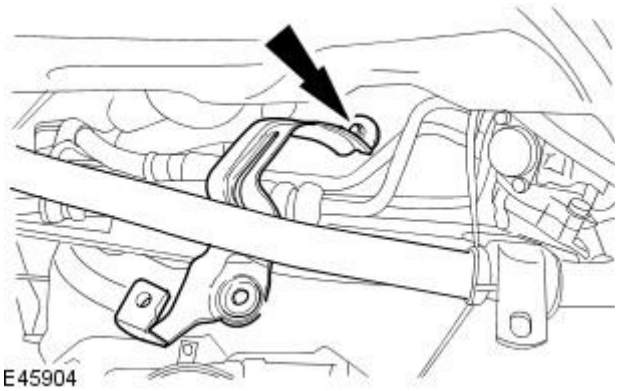


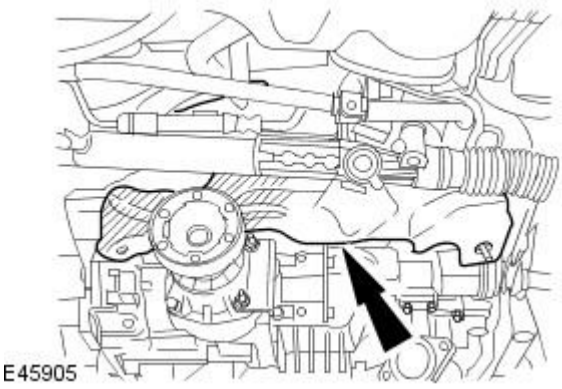
5. Remove the front subframe.
   For additional information, refer to: Front Subframe - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
6. Remove the fender splash shield access panel.



Vehicles with 2.5L or 3.0L engine

7. Remove the steering gear heat shield bracket.

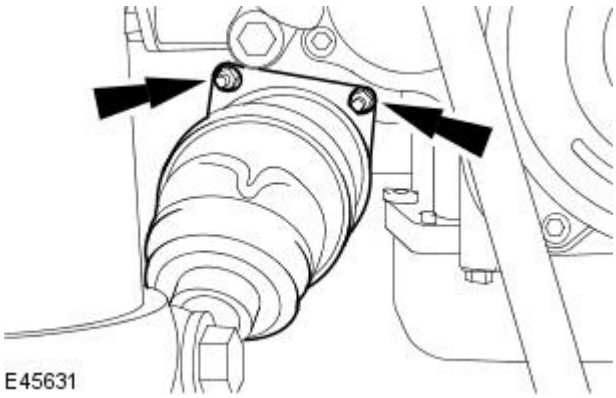




8. Remove the steering gear heat shield.

9. Remove the transfer case.
For additional information, refer to: Transfer Case (308-07 Transfer Case, Removal).

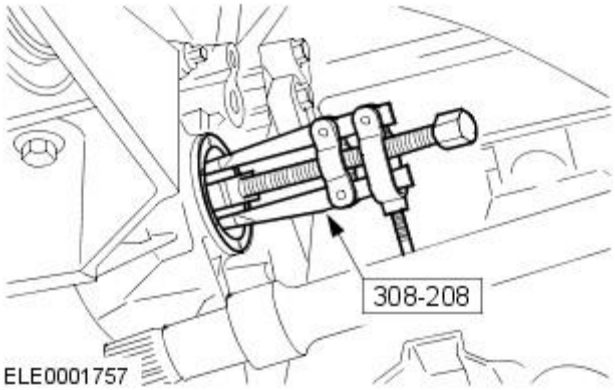
Vehicles with 2.0L engine



10. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

Detach the right-hand halfshaft.

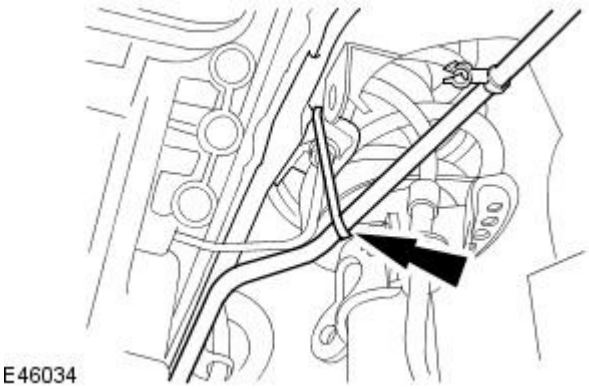
- Disengage the right-hand halfshaft from the transaxle.
- Secure the right-hand halfshaft to one side.



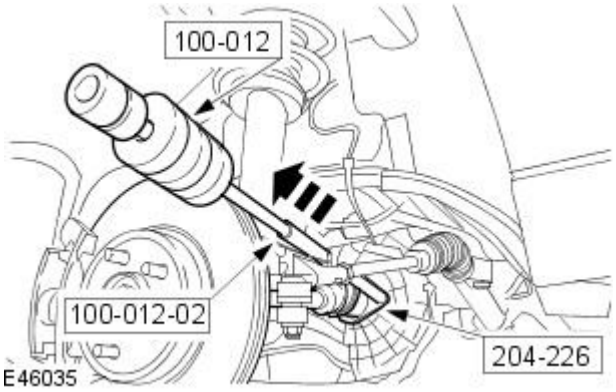
11. NOTE: Plug the transaxle to prevent fluid loss or dirt ingress.

Using the special tool, remove the right-hand halfshaft seal.

All vehicles

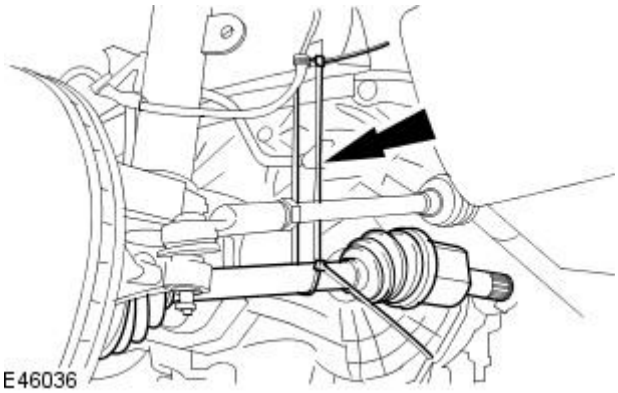


12. Support the power steering fluid pipe.



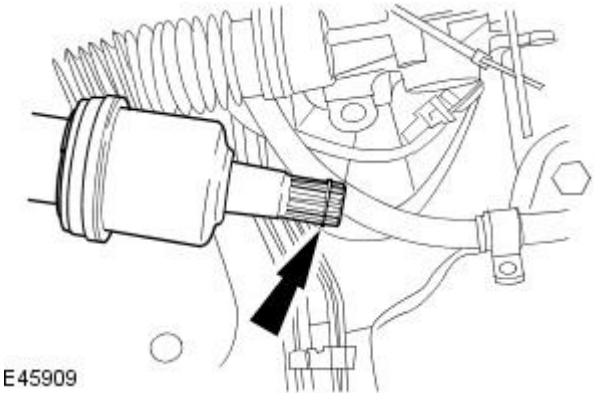
13. NOTE: Plug the transaxle to prevent fluid loss or dirt ingress.

Using the special tools, detach the left-hand halfshaft.

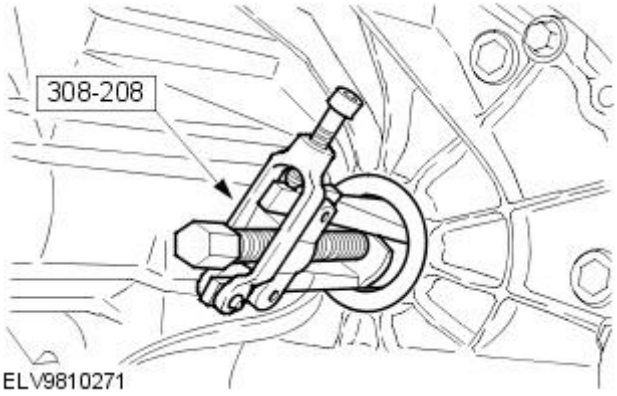


14. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

Support the left-hand halfshaft.

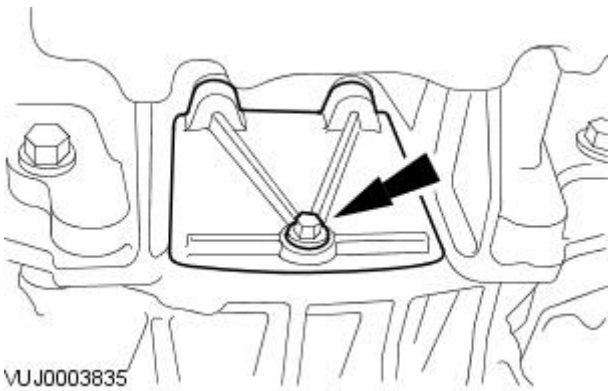


15. Remove and discard the halfshaft snap ring.

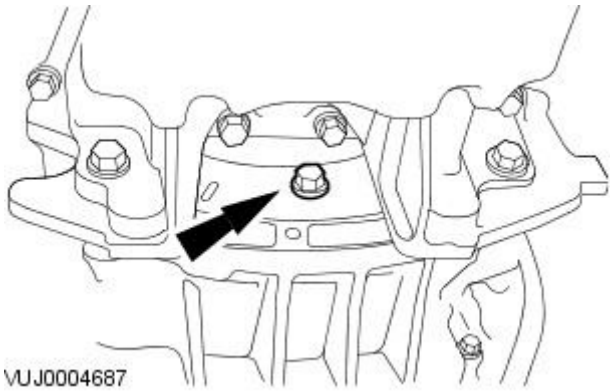


16. NOTE: Plug the transaxle to prevent fluid loss or dirt ingress.

Using the special tool, remove the halfshaft seal.

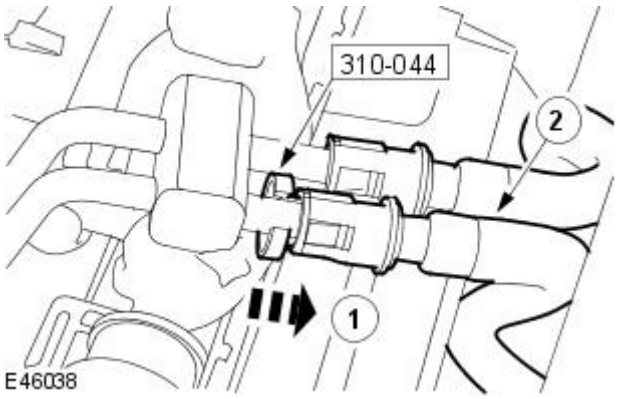


17. Remove the torque converter retaining bolts access cover.



18. NOTE: Rotate the torque converter to gain access for the remaining retaining bolts.

Remove the torque converter retaining bolts.

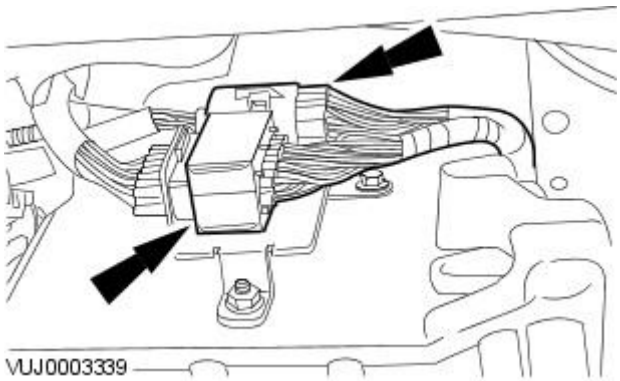


19. NOTE: Lower transaxle fluid cooler tube shown, upper transaxle fluid cooler tube similar.

• NOTE: Plug the transaxle fluid cooler and transaxle fluid cooler tubes to prevent fluid loss or dirt ingress.

Using the special tool, detach the transaxle fluid cooler tubes.

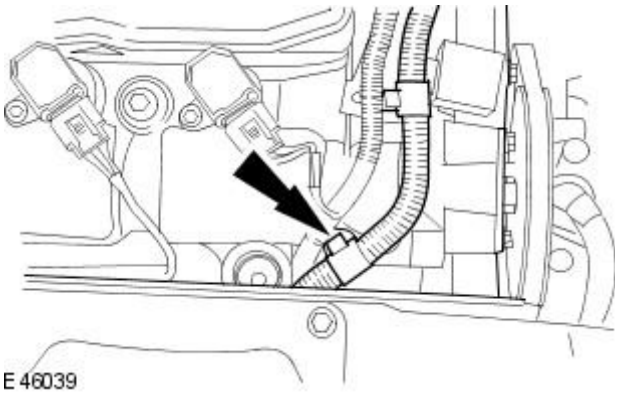
1. Install the special tool to the transaxle fluid cooler tube.
2. Using the special tool, detach the transaxle fluid cooler tube.



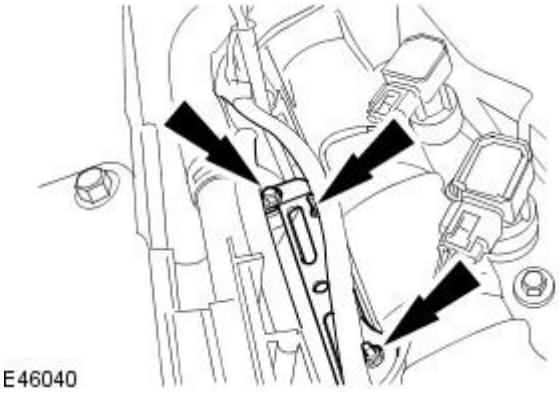
20. Disconnect the transaxle electrical connectors.

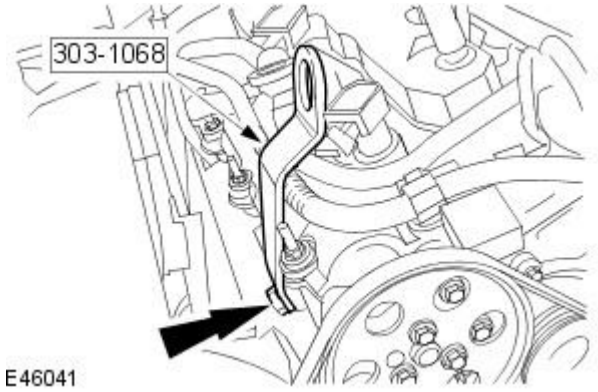
21. Lower the vehicle.

22. Detach the generator wiring harness retaining clip from the camshaft cover retaining clip.



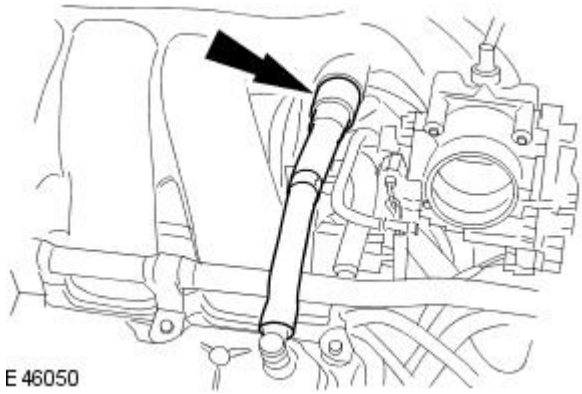
23. Remove the air cleaner mount bracket.



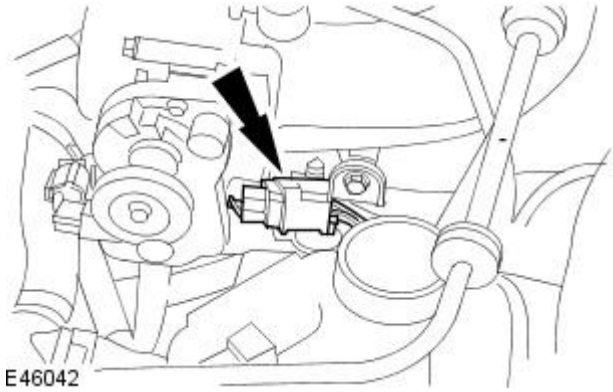


E46041

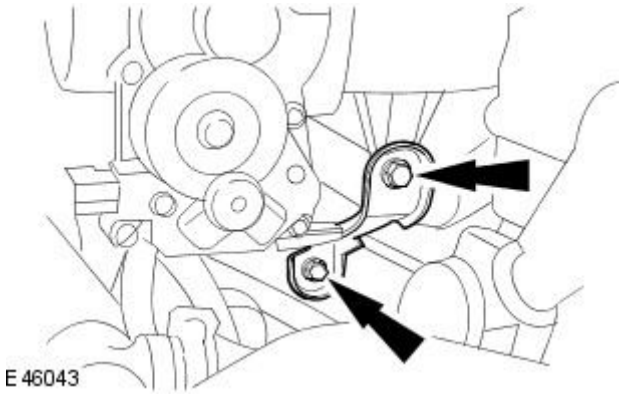
24. Install the engine support bracket.


E46050

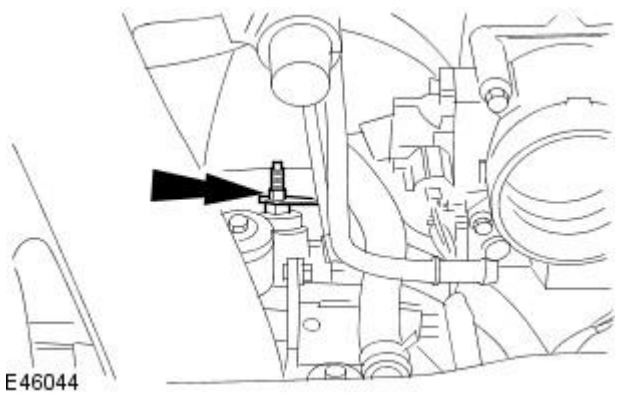
25. Detach the positive crankcase ventilation (PCV) hose from the intake manifold.


E46042

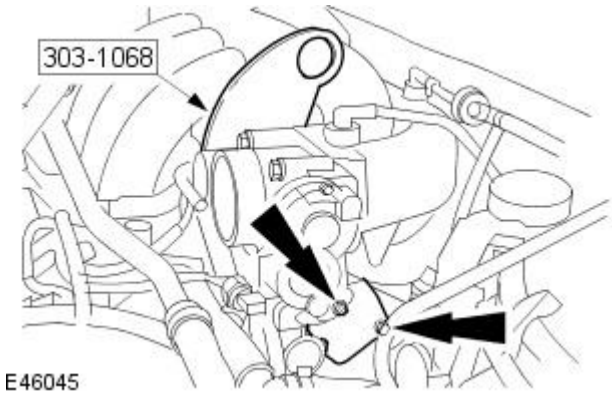
26. Detach the electrical connector from the intake manifold support bracket.


E46043

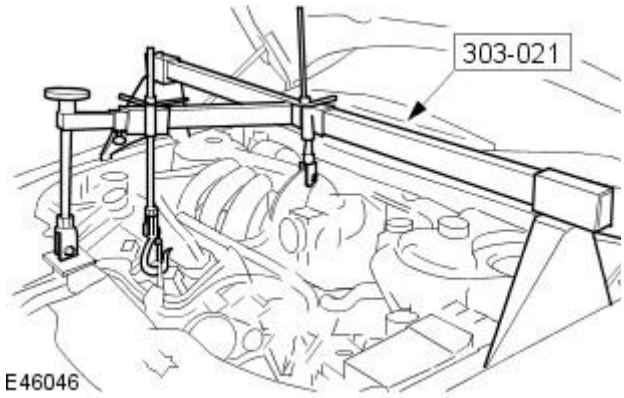
27. Remove the intake manifold support bracket.


E46044

28. Detach the wiring harness from the camshaft cover retaining stud.

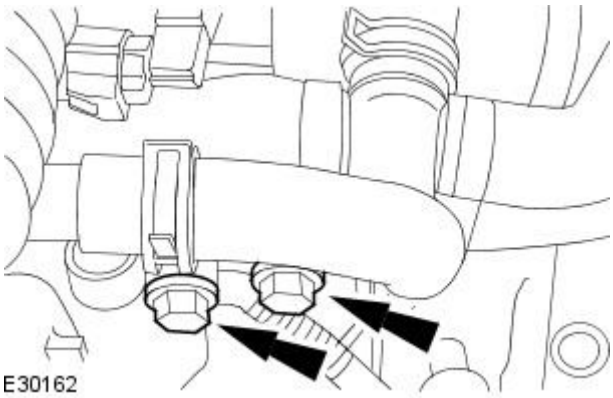


29. Install the engine support bracket.

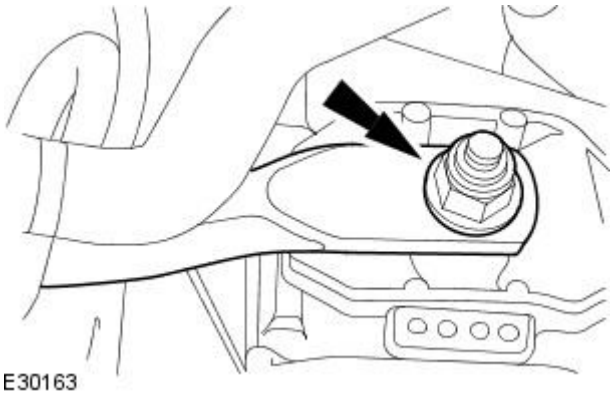


30. Install the engine support bracket.

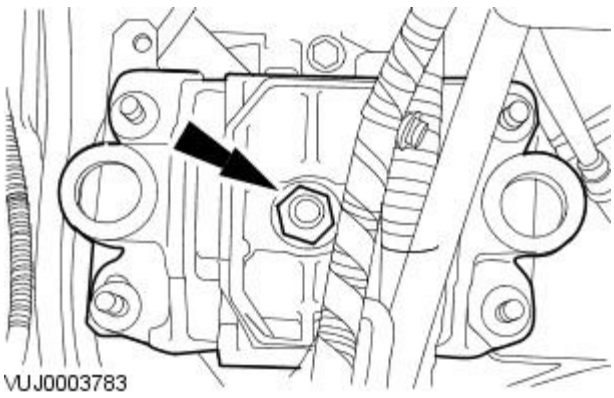
- Adjust the engine support bracket to support the weight of the powertrain assembly.



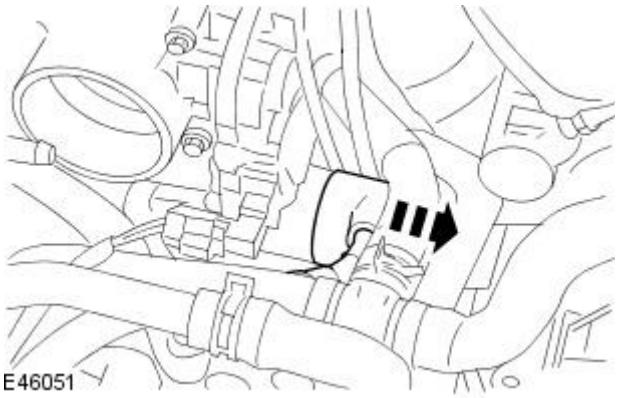
31. Remove the support bar retaining bolts.



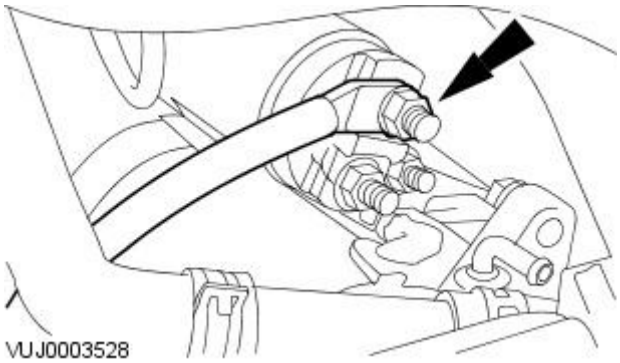
32. Remove the support insulator bar.



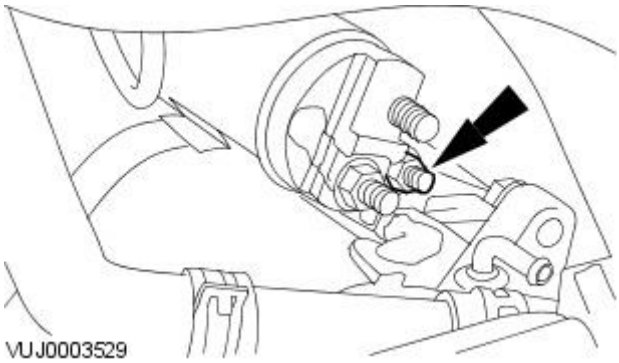
33. Install the support insulator retaining nut.



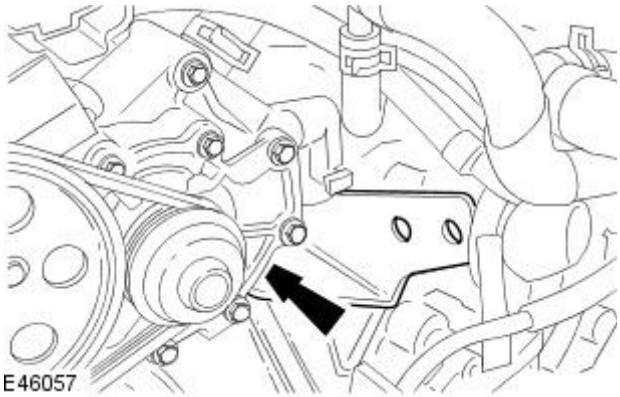
34. Detach the starter motor solenoid cover.



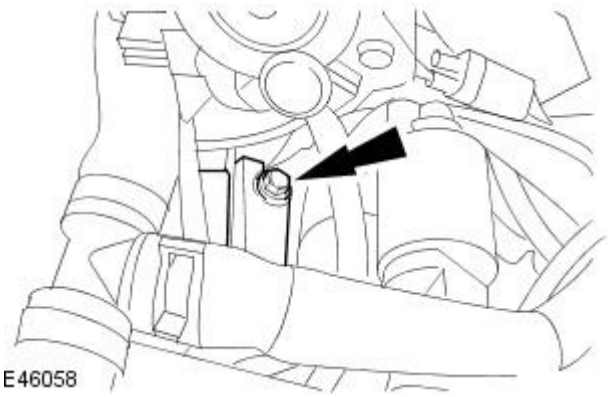
35. Detach the starter motor electrical connector.



36. Detach the starter motor solenoid electrical connector.

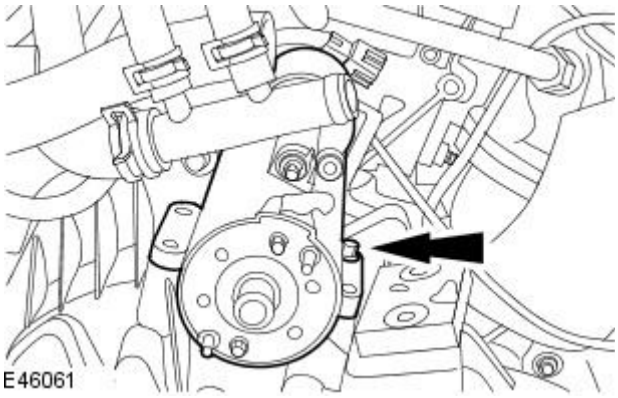


37. Remove the support bar mount bracket/transaxle upper retaining bolt.

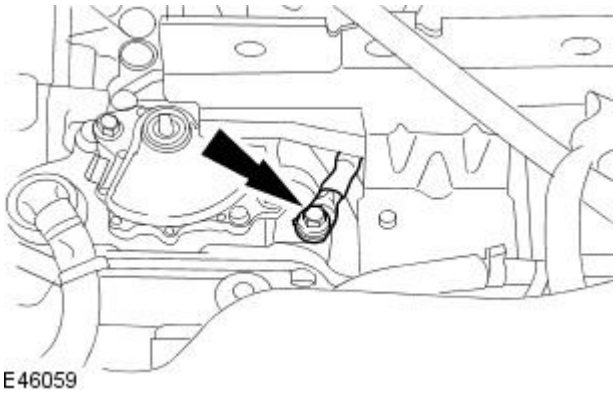


38. Remove the support bar mount bracket.

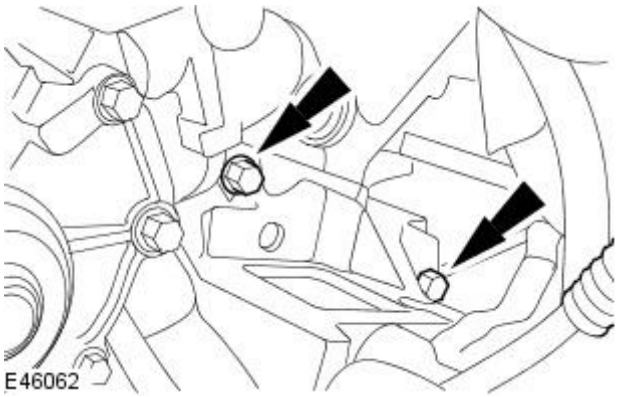
- Remove the stater motor front retaining bolt.



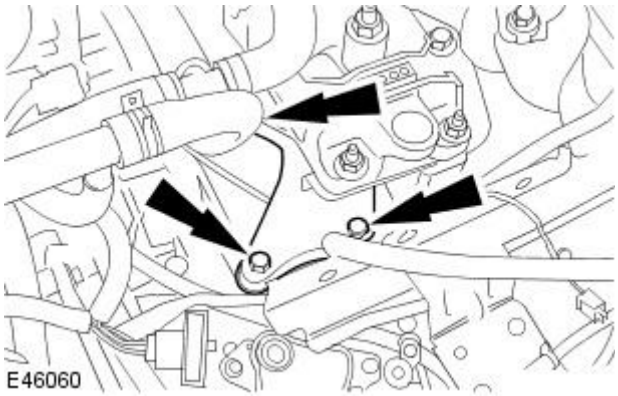
39. Remove the starter motor.



40. Detach the transaxle ground lead.



41. Remove the transaxle retaining bolts.

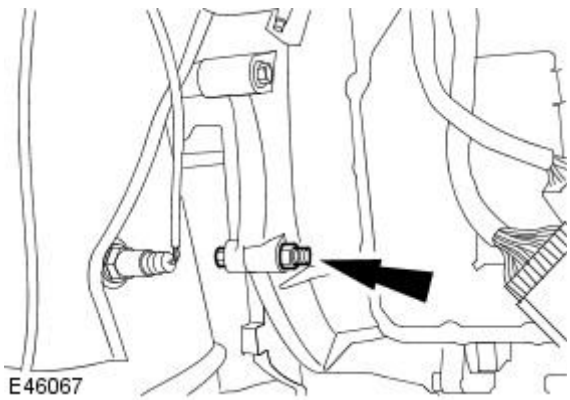


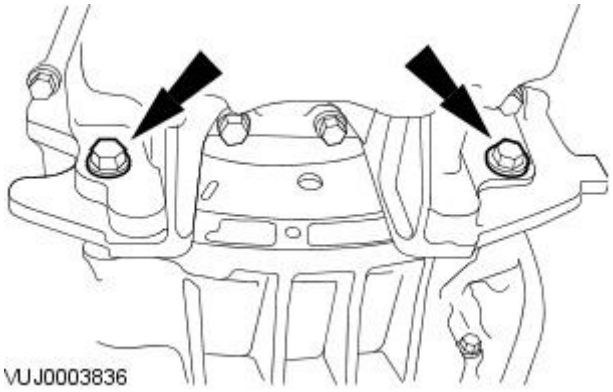
42. Remove the transaxle mount bracket securing bolts.

43. Raise the vehicle.

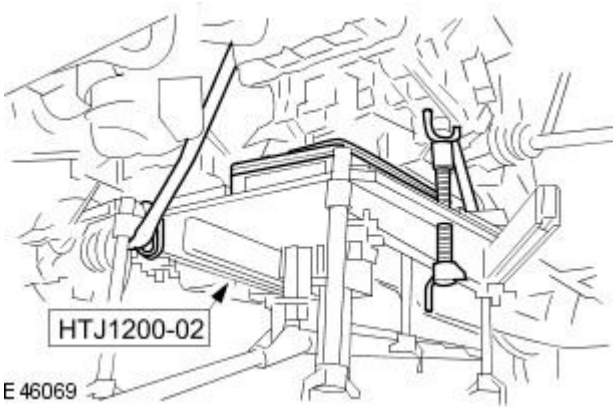
44. NOTE: The transaxle retaining bolt remains captive to the cylinder block flange.

Remove the transaxle retaining nut.



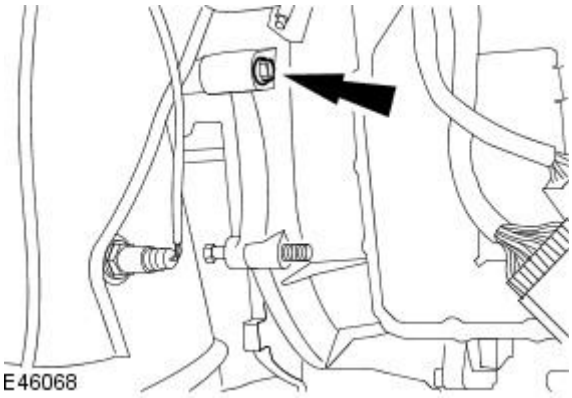


45. Remove the transaxle retaining bolts.

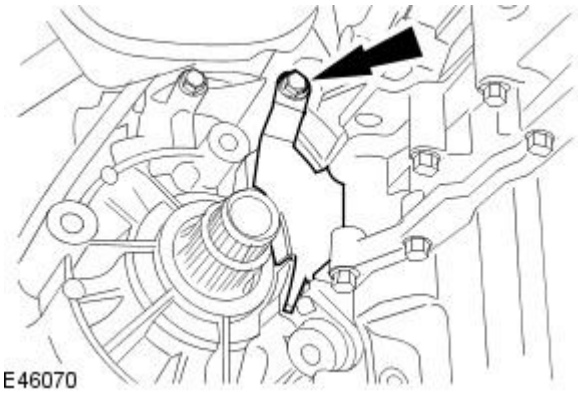


46. Align the powertrain assembly jack to the transaxle.

- Secure the transaxle to the powertrain assembly jack.



47. Remove the transaxle retaining bolt.

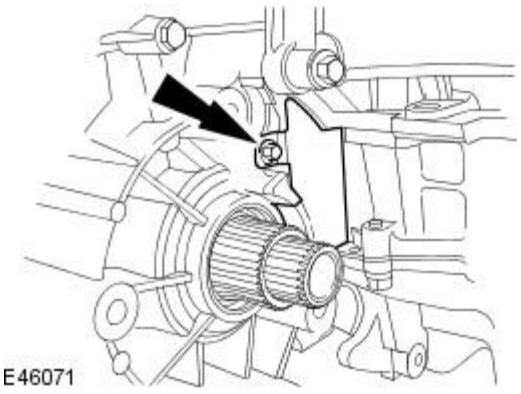


48. NOTE: Carry this step if an early condition transaxle is being removed.

• NOTE: Vehicles with 2.5L and 3.0L engines shown, vehicles with 2.0L engine similar.

Remove the transaxle retaining bolt

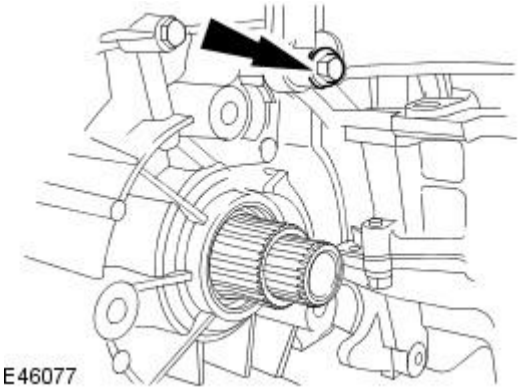
- Remove the transaxle dust cover.



49. NOTE: Carry this step if a later condition transaxle is being removed.

• NOTE: Vehicles with 2.5L and 3.0L engines shown, vehicles with 2.0L engine similar.

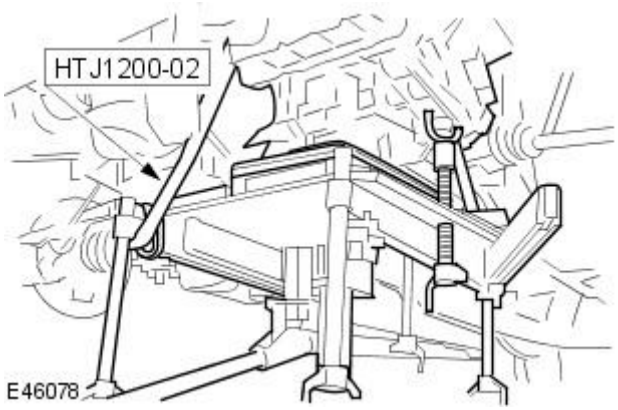
Remove the transaxle dust cover.



50. NOTE: Carry this step if a later condition transaxle is being removed.

• NOTE: Vehicles with 2.5L and 3.0L engines shown, vehicles with 2.0L engine similar.

Remove the transaxle retaining bolt.



51. WARNING: Do not let the torque converter drop out of the transaxle. Failure to follow this instruction may result in personal injury.

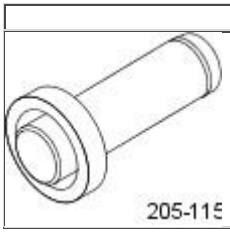
Remove the transaxle.

- Detach the transaxle from the drive plate.
- Lower the powertrain assembly jack and transaxle assembly.

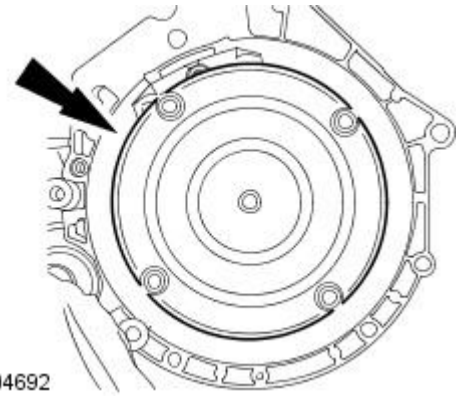
Published: 11-May-2011

Automatic Transmission / Transaxle - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Input Shaft Seal

Disassembly and Assembly of Subassemblies

Special Tool(s)	
 205-115	Link shaft oil seal installer 205-115

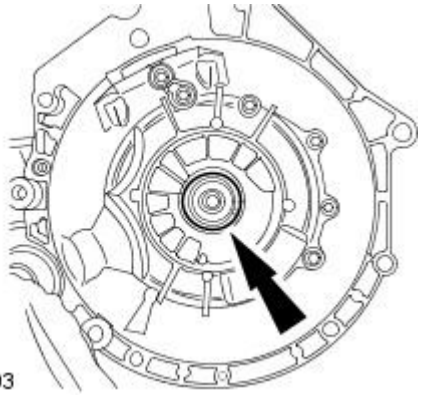
1. Remove the transmission assembly. For additional information, refer to Transmission.


VUJ0004692

2. CAUTION: Do not let the torque converter drop out of the transmission. Failure to follow this instruction may result in personal injury.

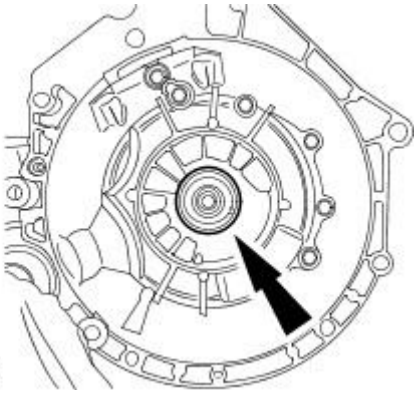
Remove the torque converter.

- Drain any remaining fluid into a suitable container.


VUJ0004693

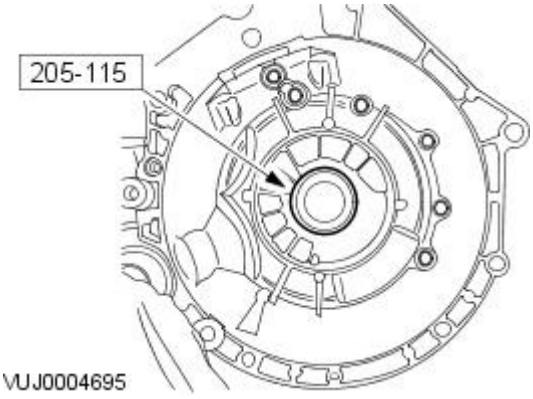
3. NOTE: Make sure the transmission housing seal face is not damaged when removing the torque converter seal.

Using a suitable tool, remove the torque converter seal.


VUJ0004694

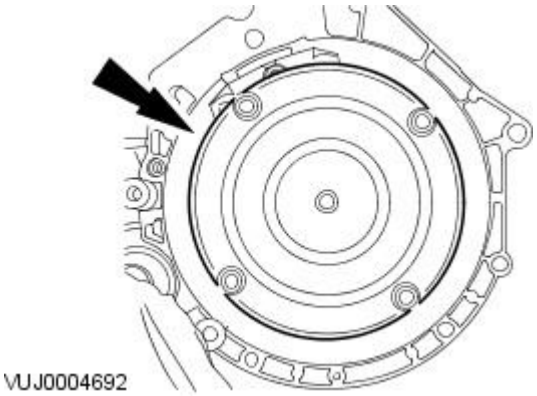
4. NOTE: Using a suitable Metal surface cleaner WSE-M5B392-A or equivalent meeting Jaguar specification. clean the seal face on the housing before fitting the new seal.

Clean and inspect the transmission housing seal face.



VUJ0004695

5. Using the special tool, install a new torque converter seal.


VUJ0004692

6. CAUTION: Do not let the torque converter drop out of the transmission. Failure to follow this instruction may result in personal injury.

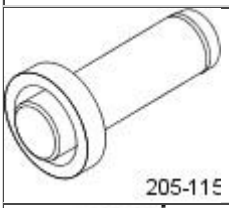
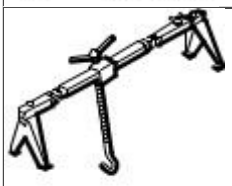
• NOTE: The torque converter hub must engage fully in the oil pump drive gear.

Install the torque converter.

7. Install the transmission assembly. For additional information, refer to Transmission.

Automatic Transmission / Transaxle - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Transaxle

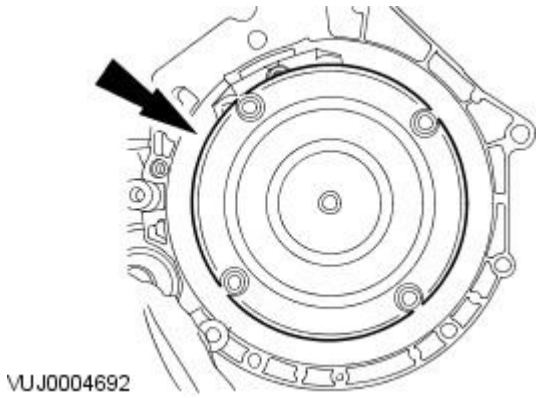
Installation

Special Tool(s)	
 205-115	Halfshaft oil seal installer 205-115
 HTJ12002	Powertrain assembly jack HTJ1200-2
 303-021	Engine support bracket 303-021
 E46047	Engine support brackets 303-1068

Installation

All vehicles

CAUTION: When replacing or installing a new automatic transaxle. The transaxle control module (TCM) adaptation procedure must be carried out using the Jaguar approved diagnostic system using software issue 19 or higher, where available. If the Jaguar approved diagnostic system is not available the TCM must be replaced. Failure to follow this instruction will result in damage to the automatic transaxle.


VUJ0004692

1. CAUTION: If the automatic transmission fluid is very dirty or it contains metallic particles, then along with a new transmission, install a new automatic transmission fluid cooler and lines.

Flush the transaxle fluid cooler and fluid tubes.

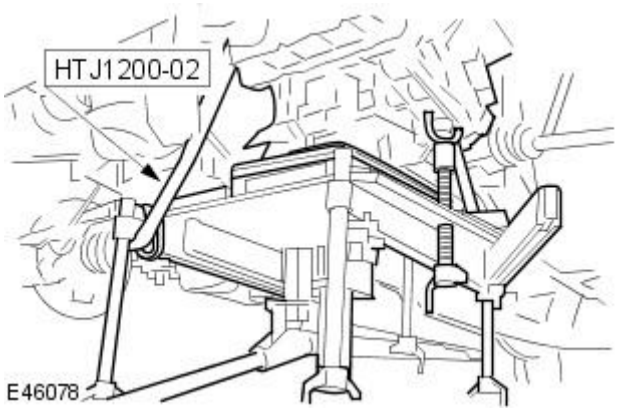
2. NOTE: Use high-temperature grease ESD-M1C220-A or equivalent meeting Jaguar specification.

Apply a thin layer of grease to the centering spigot bore on the torque converter.

3. CAUTION: The torque converter must remain at the correct installation depth throughout the whole installation procedure.

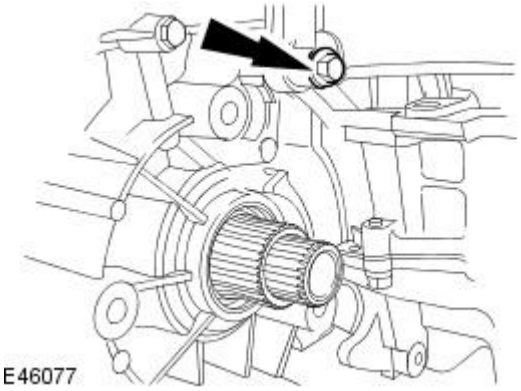
• NOTE: The torque converter hub must engage fully in the fluid pump drive gear.

Check the installation depth between the transaxle flange and the torque converter is at least 0.04 mm (0.015 in).



4. WARNING: Do not let the torque converter drop out of the transaxle. Failure to follow this instruction may result in personal injury.

Install the transaxle.

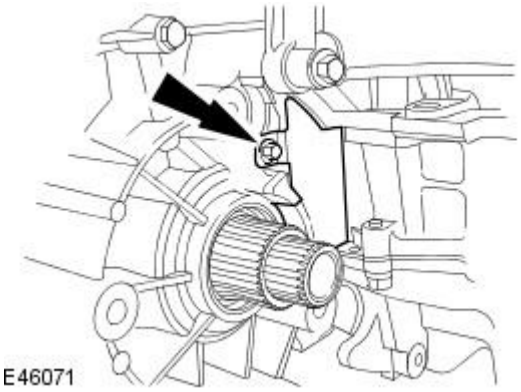


5. NOTE: Carry out this step if a later condition transaxle is being installed.

• NOTE: Vehicles with 2.5L and 3.0L engines shown, vehicles with 2.0L engine similar.

Install the transaxle retaining bolt.

- Tighten to 48 Nm.

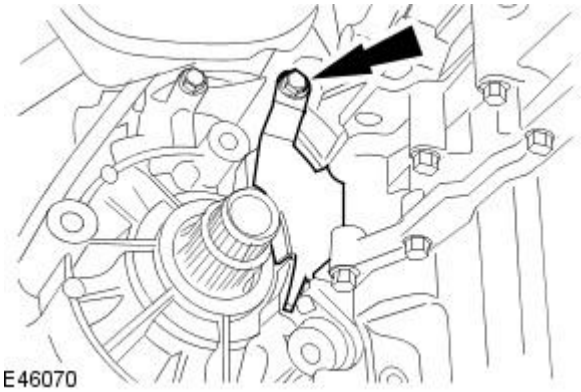


6. NOTE: Carry out this step if a later condition transaxle is being installed.

• NOTE: Vehicles with 2.5L and 3.0L engines shown, vehicles with 2.0L engine similar.

Install the transaxle dust cover.

- Tighten to 10 Nm.

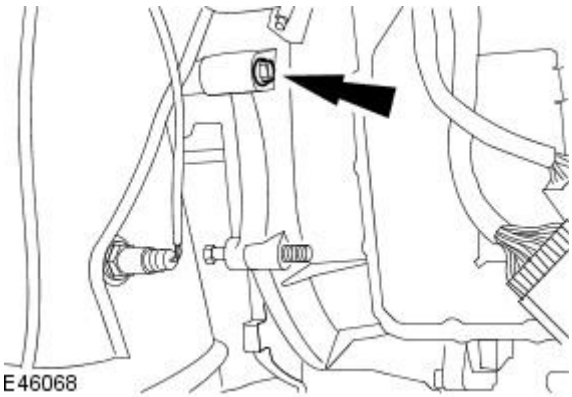


7. NOTE: Carry out this step if an early condition transaxle is being installed.

• NOTE: Vehicles with 2.5L and 3.0L engines shown, vehicles with 2.0L engine similar.

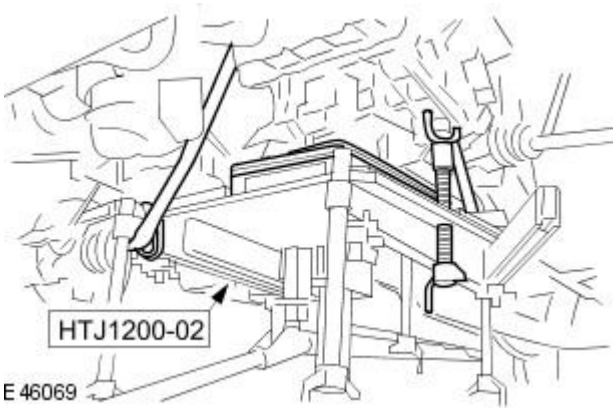
Install the transaxle retaining bolt

- Install the transaxle dust cover.
- Tighten to 48 Nm.



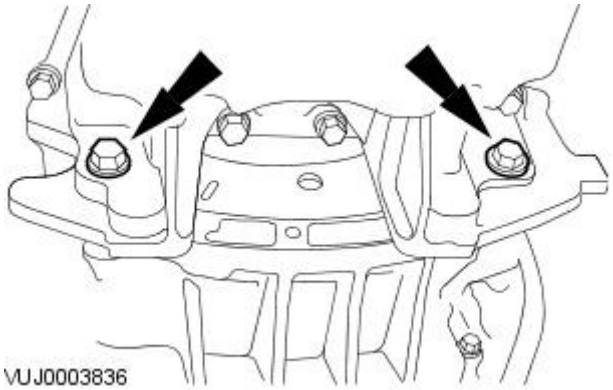
8. Install the transaxle retaining bolt.

- Tighten to 48 Nm.



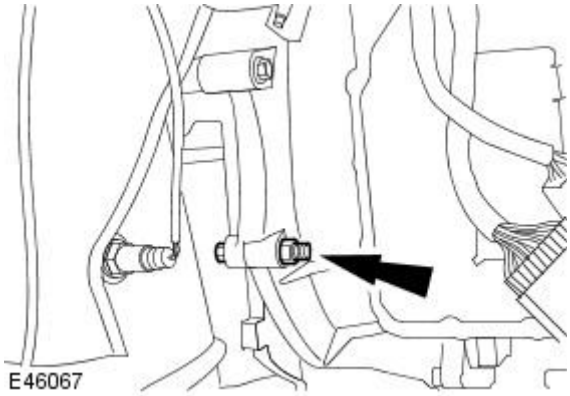
9. Remove the powertrain assembly jack.

- Remove the transaxle to the powertrain assembly jack securing strap.



10. Install the transaxle retaining bolts.

- Tighten to 48 Nm.

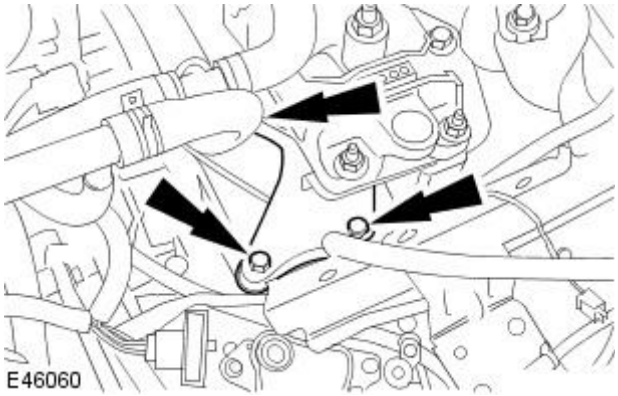


11. Install the transaxle retaining nut.

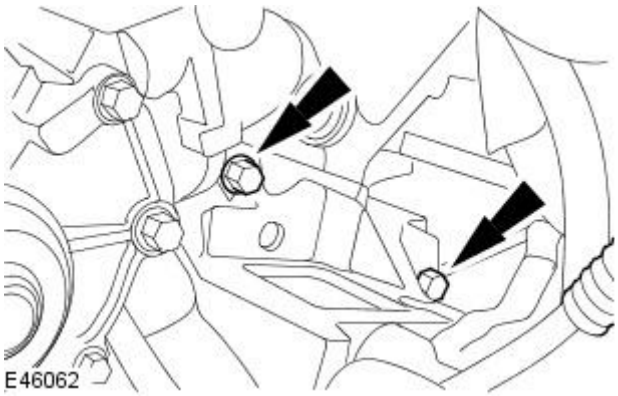
- Tighten to 48 Nm.

12. Lower the vehicle.

13. Install the transaxle mount bracket securing bolts.

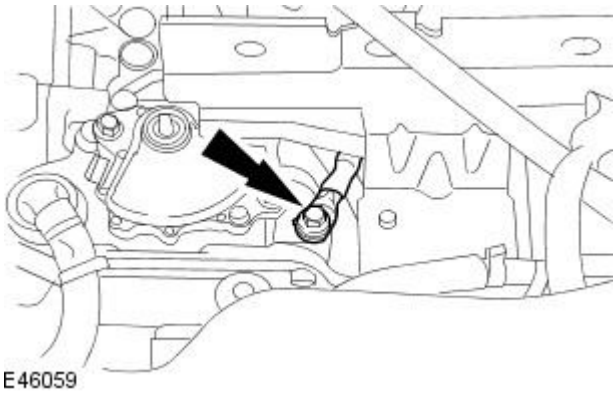


- Tighten to 48 Nm.



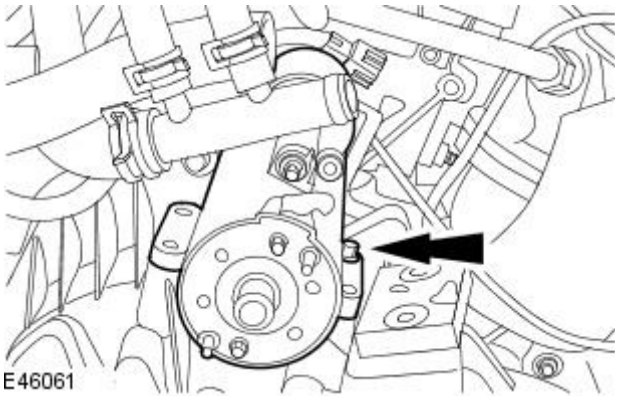
14. Install the transaxle retaining bolts.

- Tighten to 48 Nm.



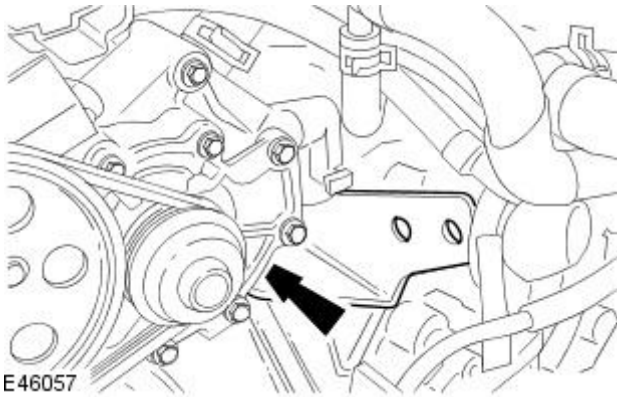
15. Attach the transaxle ground lead.

- Tighten to 25 Nm.



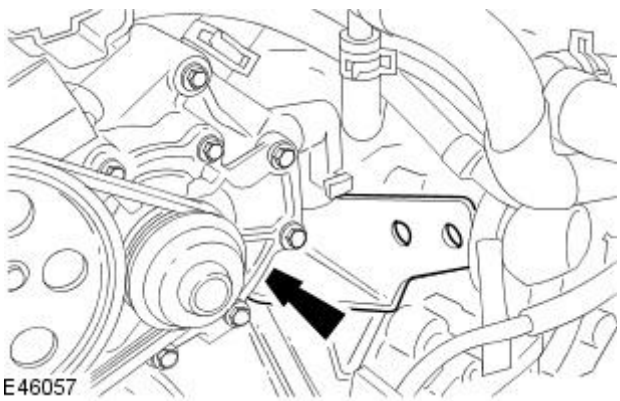
16. Install the starter motor.

- Tighten to 35 Nm.



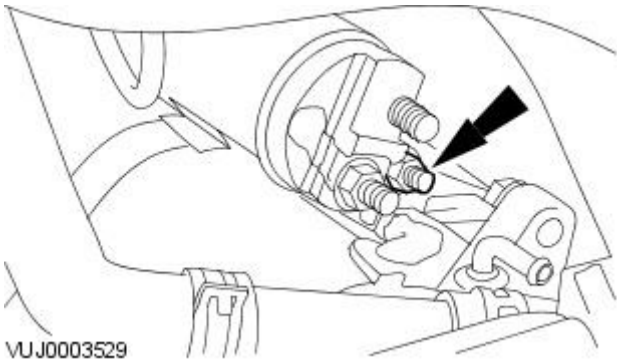
17. Install the support bar mount bracket.

- Install the starter motor front retaining bolt.
- Tighten to 35 Nm.



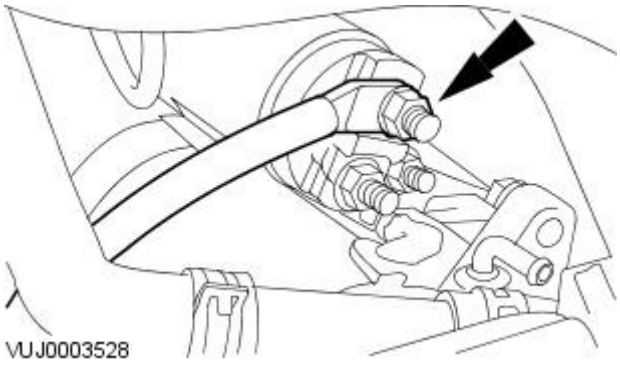
18. Install support bar mount bracket/transaxle upper retaining bolt.

- Tighten to 48 Nm.



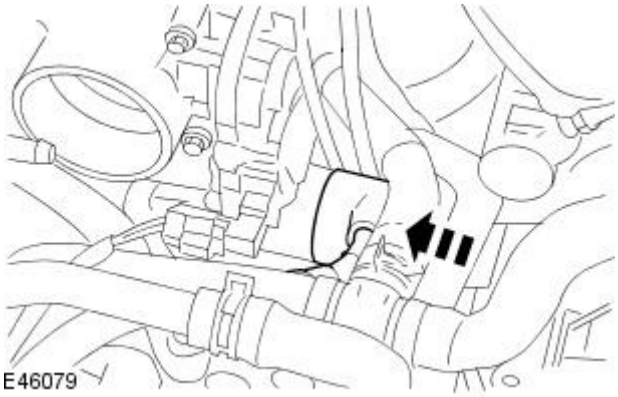
19. Attach the starter motor solenoid electrical connector.

- Tighten to 6 Nm.

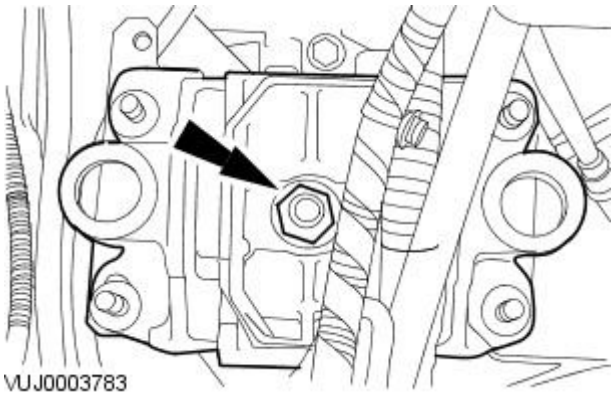


20. Attach the starter motor electrical connector.

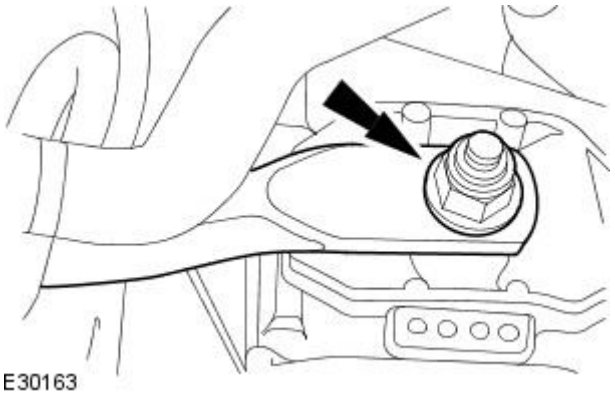
- Tighten to 12 Nm.



21. Attach the starter motor solenoid cover.

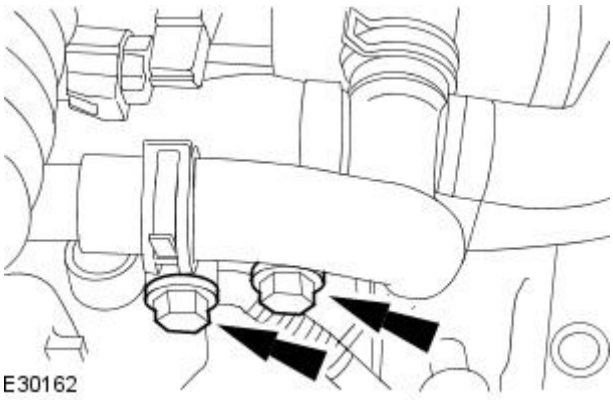


22. Remove the support insulator retaining nut.



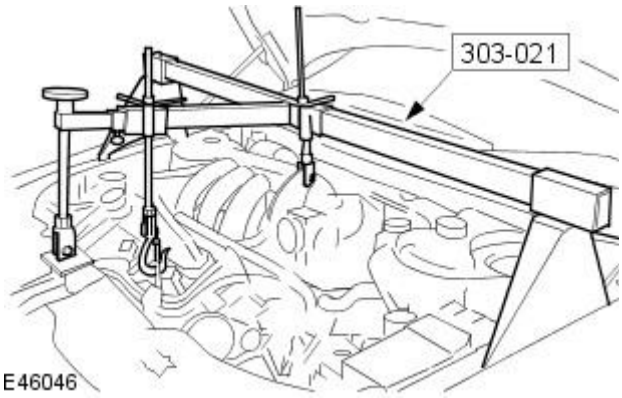
23. Install the support insulator bar.

- Tighten to 133 Nm.

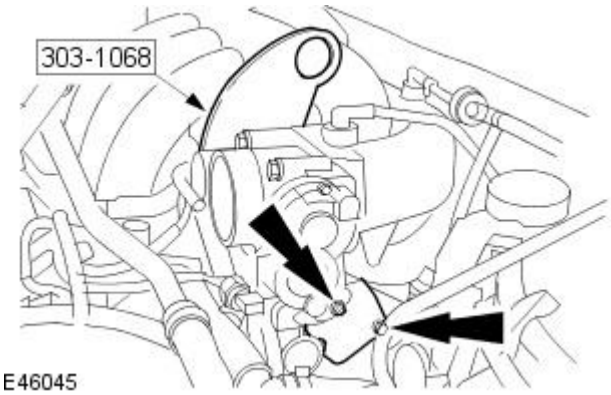


24. Install the support bar retaining bolts.

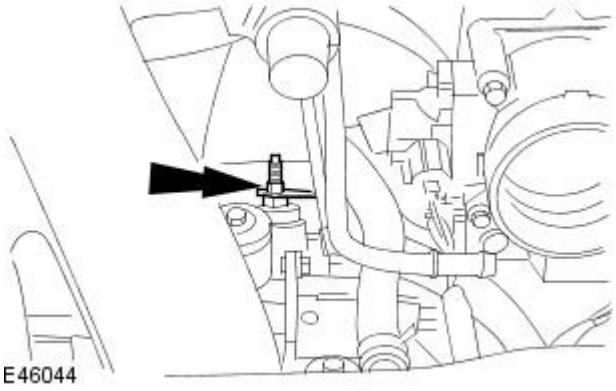
- Tighten to 25 Nm.



25. Remove the engine support bracket.

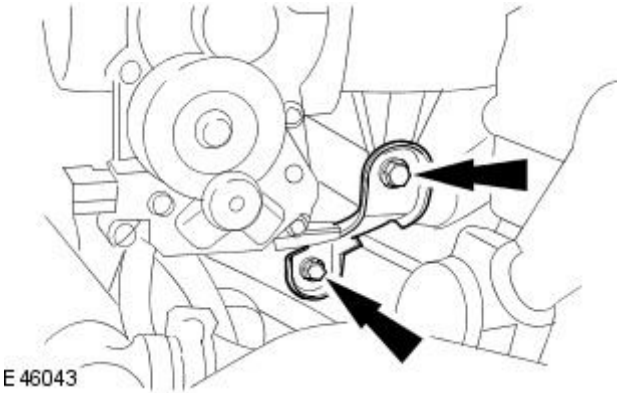


26. Remove the engine support bracket.



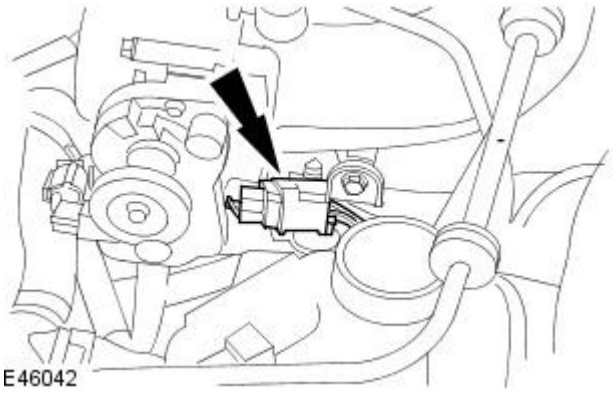
27. Attach the wiring harness from the camshaft cover retaining stud.

- Tighten to 6 Nm.

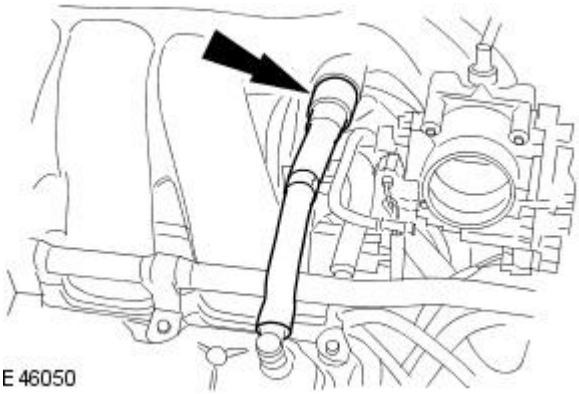


28. Install the intake manifold support bracket.

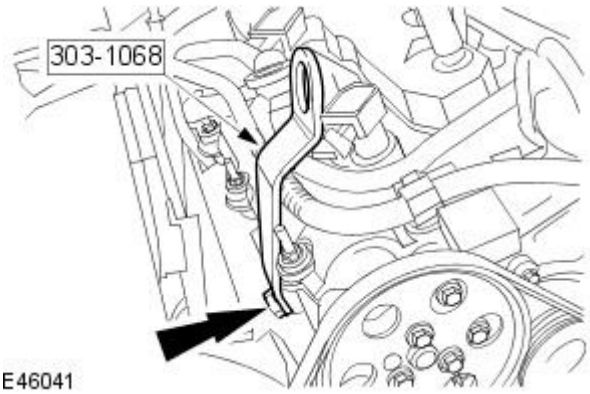
- Tighten to 10 Nm.


E46042

29. Attach the electrical connector to the intake manifold support bracket.

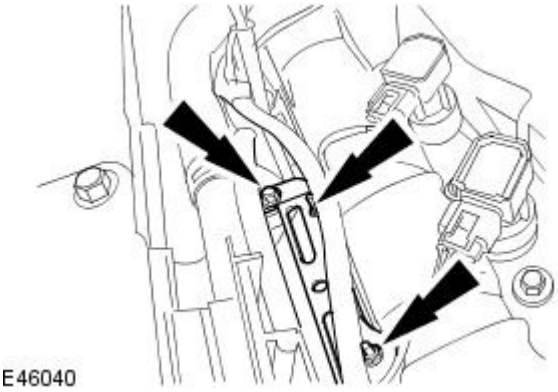

E46050

30. Attach the positive crankcase ventilation (PCV) hose to the intake manifold.



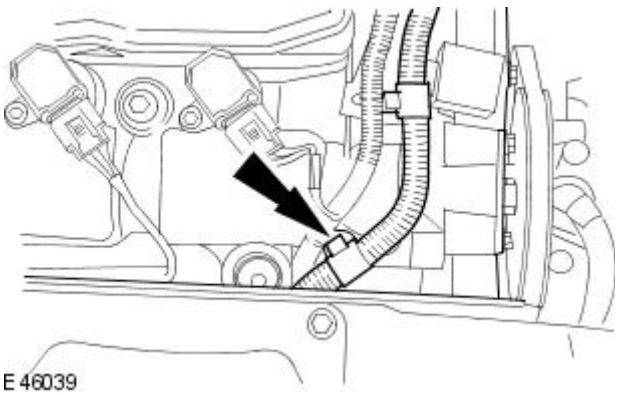
E46041

31. Remove the engine support bracket.


E46040

32. Install the air cleaner mount bracket.

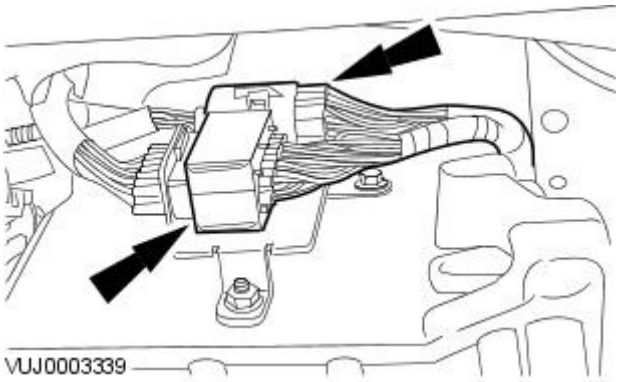
- Tighten to 6 Nm.


E46039

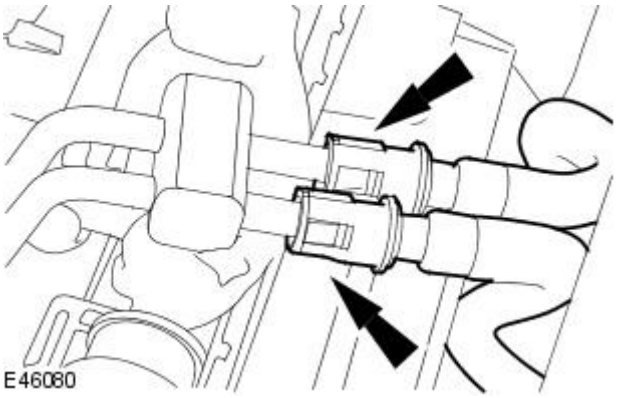
33. Attach the generator wiring harness retaining clip to the camshaft cover retaining clip.

34. Raise the vehicle.

35. Connect the transaxle electrical connectors.



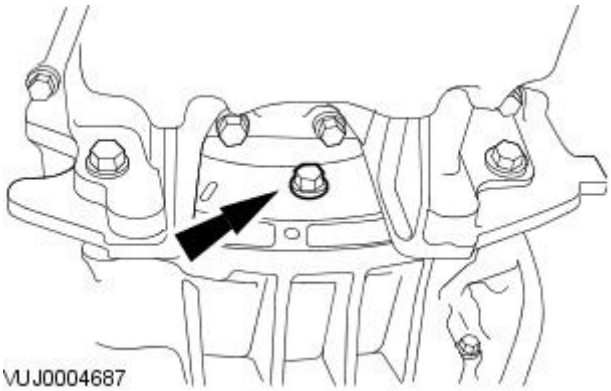
36. Connect the transaxle fluid cooler tubes.



37. NOTE: Rotate the torque converter to gain access for the remaining retaining bolts.

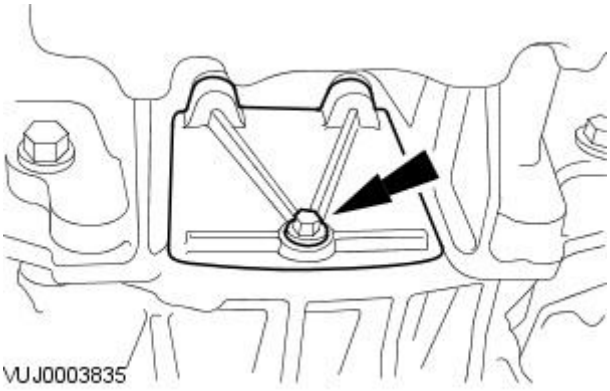
Install the torque converter retaining bolts.

- Tighten to 55 Nm.



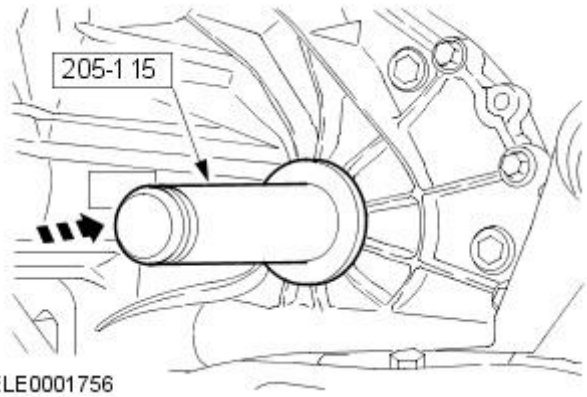
38. Install the torque converter retaining bolts access cover.

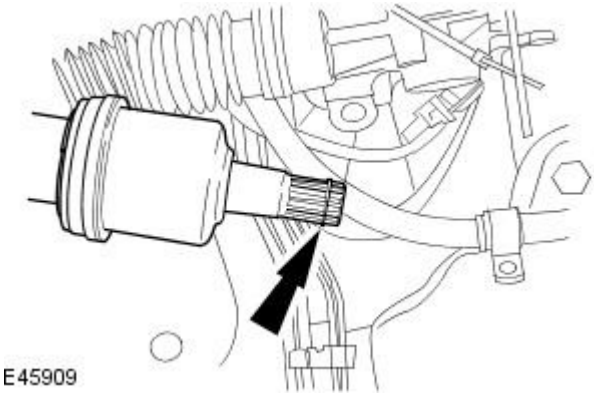
- Tighten to 10 Nm.



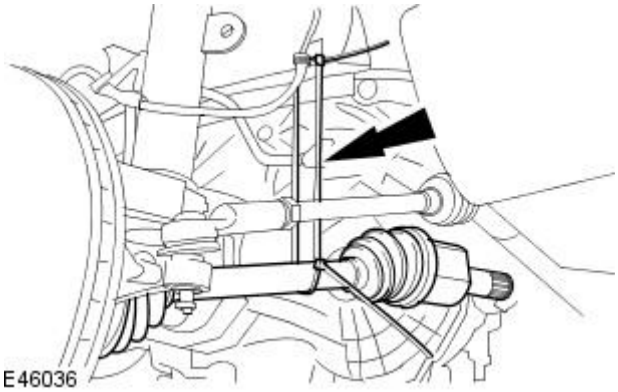
39. NOTE: Remove the transaxle plug.

Using the special tool, install a new halfshaft seal.



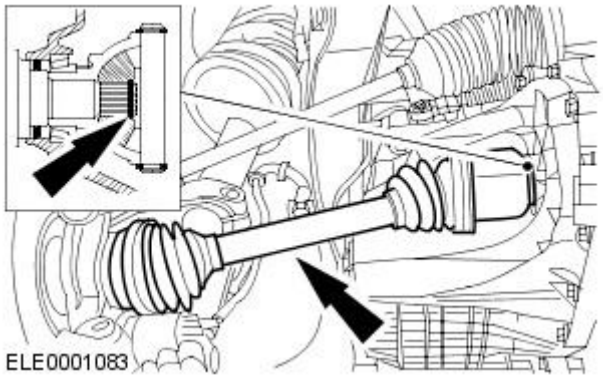


40. Install a new halfshaft snap ring.



41. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

Detach the halfshaft.



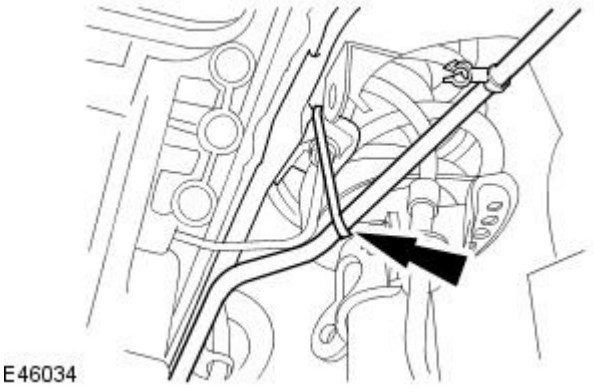
42. CAUTIONS:

Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

Make sure the halfshaft seal is not damaged. Failure to follow this instruction may result in an transaxle fluid leak.

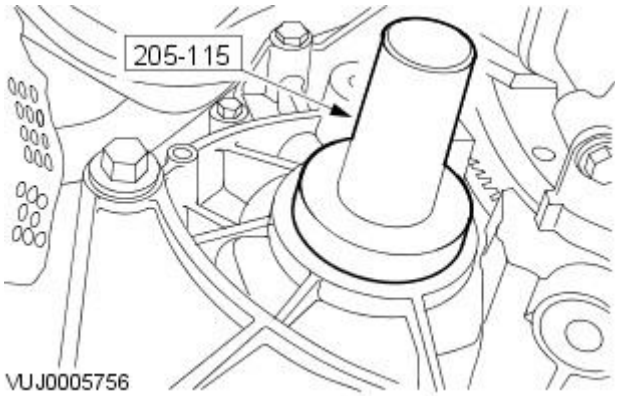
Attach the right-hand halfshaft to the transaxle.

- Make sure the halfshaft snap ring is correctly seated.



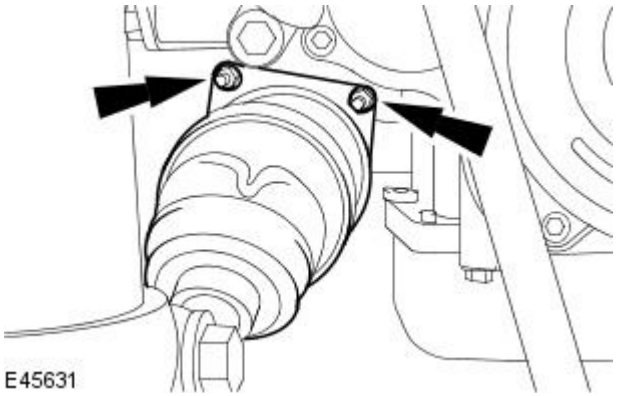
43. Detach the power steering fluid pipe.

Vehicles with 2.0L engine



44. NOTE: Remove the transaxle plug.

Using the special tool, install a new halfshaft seal.



45. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

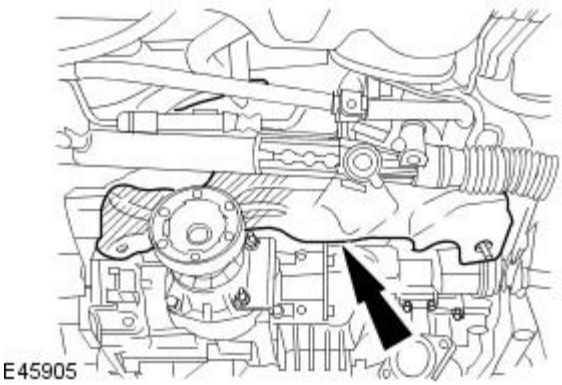
Attach the right-hand halfshaft.

- Engage the right-hand halfshaft to the transaxle.
- Tighten to 25 Nm.

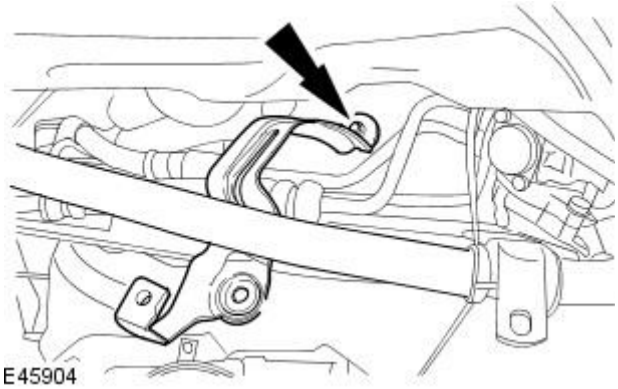
Vehicles with 2.5L or 3.0L engine

46. Install the transfer case.
For additional information, refer to: Transfer Case (308-07 Transfer Case, Installation).

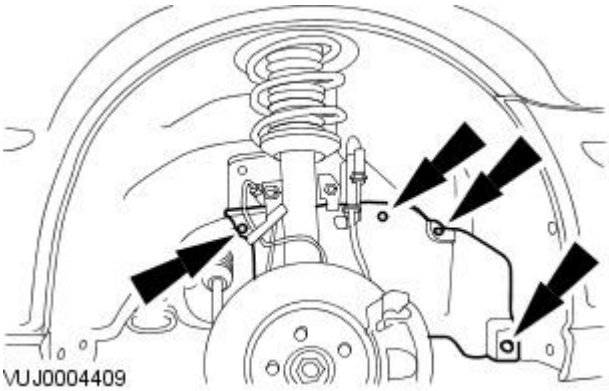
47. Install the steering gear heat shield.



48. Install the steering gear heat shield bracket.



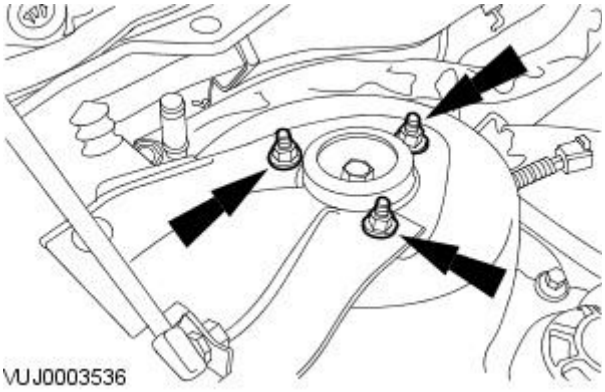
All vehicles



49. NOTE: Right-hand shown, left-hand similar.

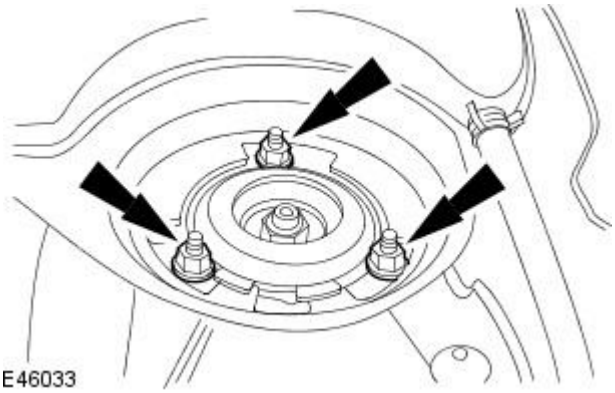
Install the fender splash shield access panel.

50. Install the front subframe.
For additional information, refer to: Front Subframe - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



51. Tighten the right-hand shock absorber and spring assembly securing nuts.

- Tighten to 25 Nm.



52. Tighten the left-hand shock absorber and spring assembly securing nuts.

- Tighten to 25 Nm.

53. Install the air cleaner.
For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

54. Install the battery tray.
For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

55. Check the transaxle fluid level.
For additional information, refer to: Transmission Fluid Level Check (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

56. 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 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).

Published: 11-May-2011

Automatic Transmission / Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 -

Lubricant, Sealers, Solvents and Adhesives

Description	Specification
High-temperature grease	ESD-M1C220-A
Metal surface cleaner	WSW-M5B392-A
Sealant	WSK-M4G320-A
Adhesives	Loctite 243

Fluid Maintenance

CAUTION: Use only C2S-51628 automatic transmission fluid. Use of any other fluids may result in a transmission malfunction or failure.

Intervals	
Normal Maintenance	Not necessary. Filled for life.

General Specifications

Engine	Dry Fill - Approximate Liters	Refil - Approximate Liters	Fluid Type
2.2L	6.6	5.6	C2S-51628

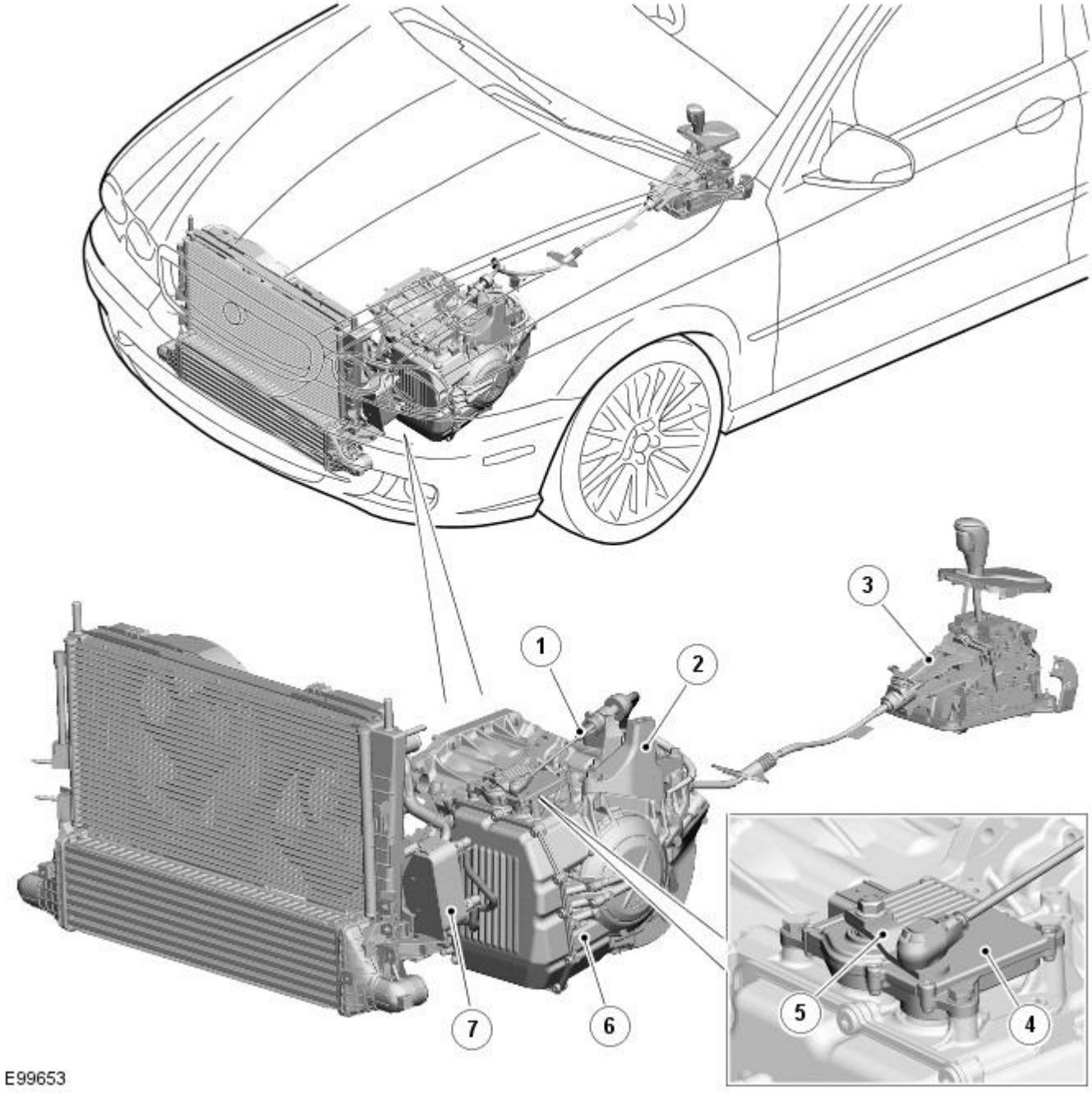
Description	Nm	lb-ft
Main control valve body screws	10	7
Torque converter retaining bolts	60	44
Transaxle retaining bolts	48	35
Emission control valve retaining bolts	30	22
Transaxle support insulator retaining nut	130	96
Transmission control module retaining nuts	24	18
Transmission fluid drain plug	47	35
Transmission fluid filler plug	40	30
Transmission fluid level plug	7	5
Transmission turbine shaft speed (TSS) sensor	6	4
Transmission fluid pan retaining bolts	13	10
Starter motor retaining bolts	35	26
Starter motor solenoid electrical connector retaining nut	6	4
Starter motor electrical connector retaining nut	12	9
Wiring harness to camshaft cover retaining stud, retaining nut	6	4
Intake manifold support bracket retaining bolts	10	7
Air cleaner mount bracket retaining nuts and bolt	6	4
Left-hand driveshaft retaining nuts	25	18
Shock absorber and spring assembly securing nuts	25	18
Transaxle ground lead	25	18
Support bar retaining bolts	25	18

Published: 11-May-2011

Automatic Transmission / Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Transmission DescriptionVehicles With: 6-Speed Automatic Transaxle - AWF21

Description and Operation

COMPONENT LOCATION - AW F21 6 SPEED AUTOMATIC TRANSMISSION 2009MY



Item	Part Number	Description
1	-	Selector cable
2	-	Cable bracket
3	-	Transmission selector lever assembly
4	-	Transmission Control Module (TCM)
5	-	Lever arm
6	-	Automatic transmission
7	-	Transmission fluid cooler

OVERVIEW

The AW F21 automatic transmission is a 6 speed, electronically controlled unit manufactured by Aisin AW in Japan. The transmission represents the latest in automatic transmission technology for a transverse unit. The transmission features lock-up slip control, 'Jaguar Sequential Shift' functions and automatic and driver selectable modes to give the optimum performance.

The transmission is controlled by a TCM (transmission control module) which 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 selector lever. Movement of the selector lever across the gate to the 'M/S' position puts the transmission into electronic 'Sport' mode. Further movement of the lever in a longitudinal direction to the + or – position puts the transmission into electronic manual 'Jaguar Sequential Shift' mode.
For additional information, refer to: External Controls - Vehicles With: 6-Speed Automatic Transaxle - AWF21 (307-05B Automatic Transmission/Transaxle External Controls - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Description and Operation).

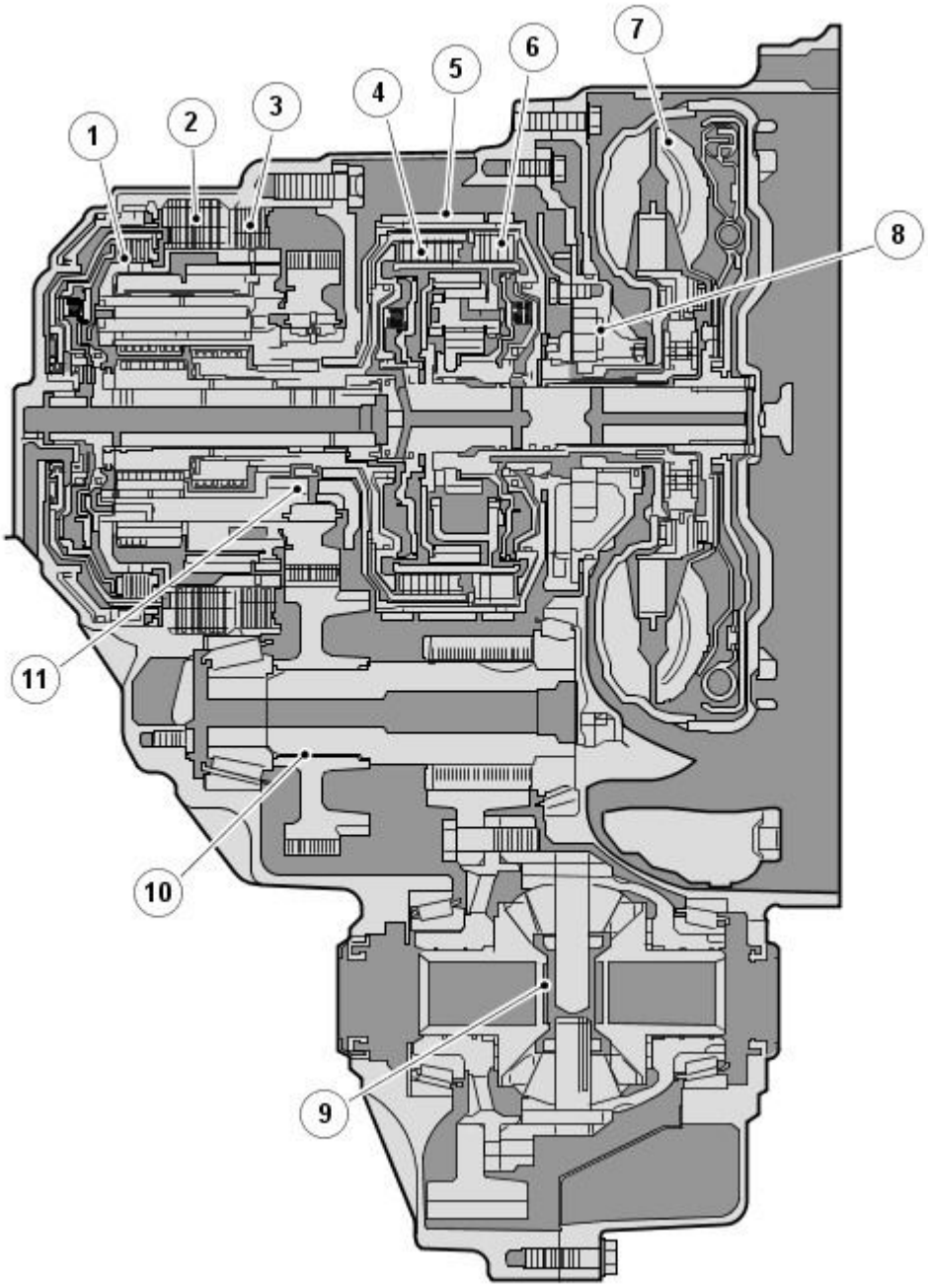
The AW F21 transmission has the following features:

- Designed to be maintenance free
- Torque capacity of 450 Nm
- Transmission fluid is fill for life
- The torque converter features a controlled slip feature with electronically regulated lock-up control on gears 2 to 6
- Shift programs controlled by the TCM
- TCM has an adaptive capability to ensure efficient gear shift quality throughout the service life of the transmission
- Diagnostics available from the TCM via the high speed CAN (controller area network) bus.

TRANSMISSION

The transmission comprises the main casing which houses all of the transmission components. The torque converter is located in a separate converter housing.

AW F21 Automatic Transmission - Sectional View



E83814

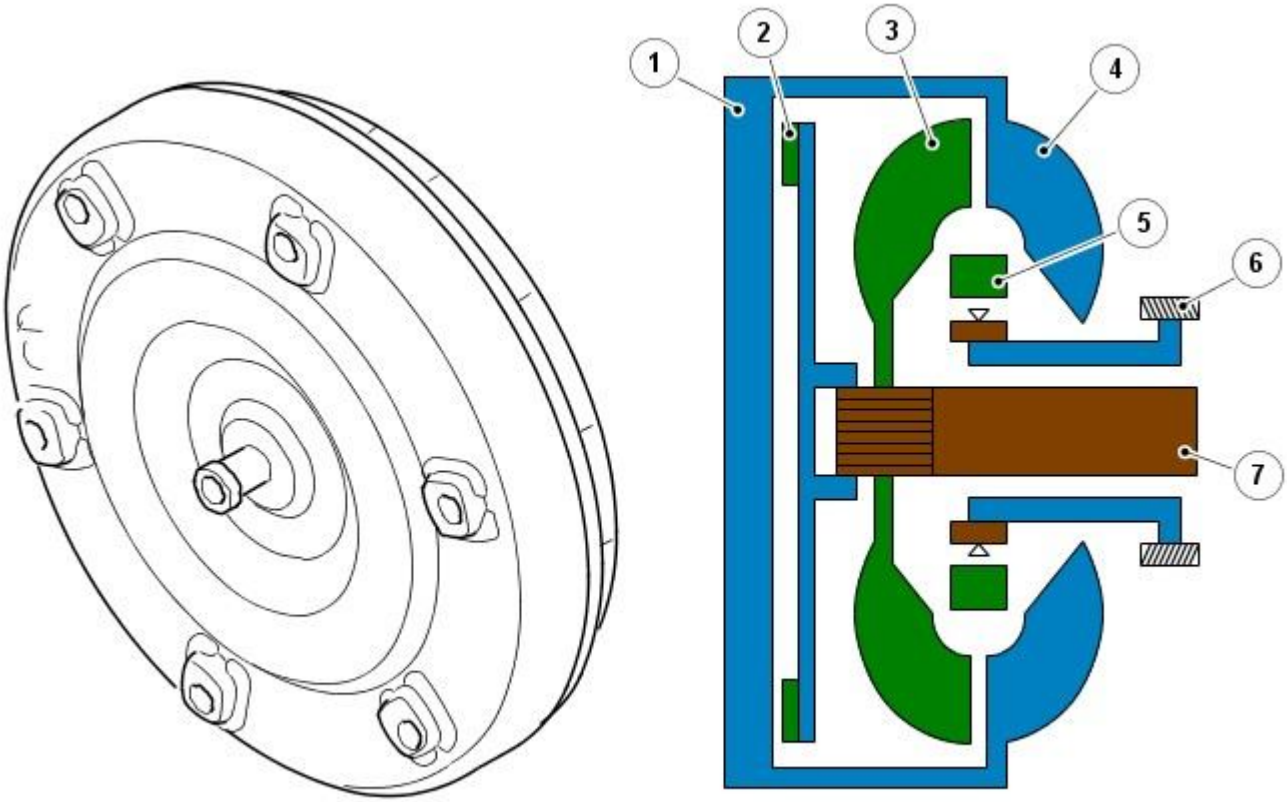
Item	Part Number	Description
1	-	Clutch - C2
2	-	Brake - B2
3	-	One-way clutch - F1
4	-	Clutch - C1
5	-	Brake - B1
6	-	Clutch - C3
7	-	Torque converter
8	-	Fluid pump
9	-	Differential assembly
10	-	Counter driven gear
11	-	Counter drive gear

The main casing retains the fluid at the bottom. A combined drain/filler plug is located in the bottom of the casing. The oil level is checked by removing the inner fill plug when the transmission fluid is at a temperature of between 50 to 60°C (122 to 140°F). When the oil flow becomes a drip from the plug hole, the level is correct.

The transmission has a fluid cooler which is located on the LH (left-hand) end of the engine cooling radiator. The cooler is connected to the transmission converter housing by 2 pipes. The fluid cooler is connected into the engine cooling system and cools the transmission fluid by heat transfer through the cooler to the engine coolant.

For additional information, refer to: Transmission Cooling - Vehicles With: 6-Speed Automatic Transaxle - AWF21 (307-02B Transmission/Transaxle Cooling - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Description and Operation).

TORQUE CONVERTER



E83815

Item	Part Number	Description
1	-	Torque converter housing
2	-	Lock-up clutch
3	-	Turbine
4	-	Impeller
5	-	Stator
6	-	Fluid pump
7	-	Input shaft

The torque converter is the coupling element between the engine and the transmission and is located in the transmission 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.

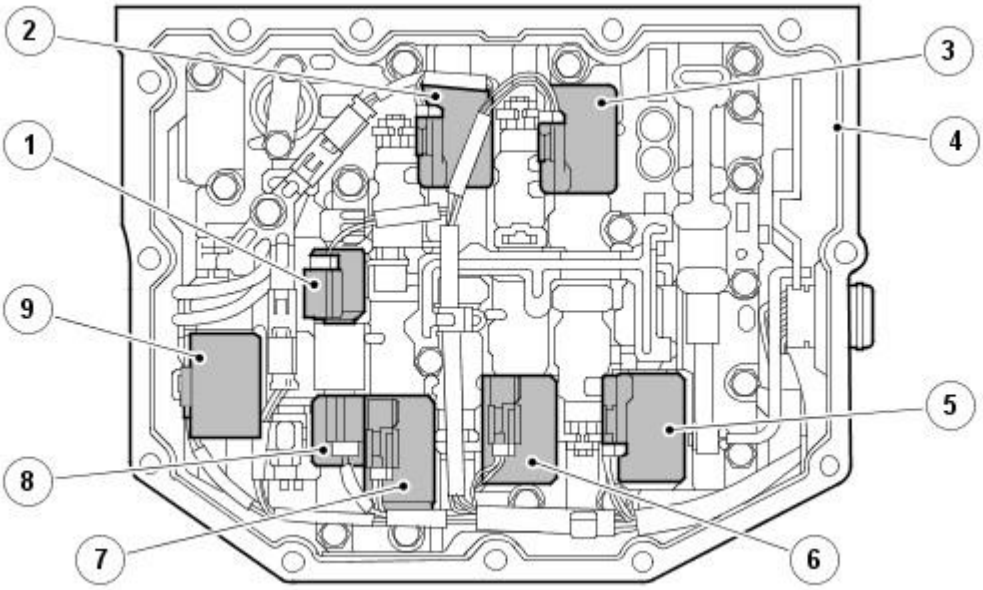
The torque converter comprises an impeller, a stator and a turbine. The torque converter is a sealed unit with all components located between the converter housing cover and the impeller. The two components are welded together to form a sealed, fluid filled housing. With the impeller welded to the converter housing cover, the impeller is therefore driven at engine crankshaft speed.

The torque converter contains a hydraulically operated lock-up clutch which is controlled by the TCM via a solenoid in the valve block which actuates spool valves to control the hydraulic pressure applied to the clutch. This allows the TCM to provide 3 modes of converter operation; unlocked, partially locked and fully locked.

VALVE BLOCK

The valve block is located in a vertical position at the front of the transmission main casing, behind a sealed cover. The valve block contains a number of solenoids, dampers and spool valves to control the transmission operation. The solenoids are controlled by the TCM to provide gear changes and smooth transition between ratio changes.

Solenoids



Item	Part Number	Description
1	-	3-Way solenoid - S2
2	-	Shift control solenoid - SLC2
3	-	Shift control solenoid - SLC1
4	-	Valve block
5	-	Lock-up control solenoid - SLU
6	-	Shift control solenoid - SLC3
7	-	Shift control solenoid - SLB1
8	-	3-Way solenoid - S1
9	-	Line pressure control solenoid - SLT

Shift Control Solenoids - SLC1, SLC2, SLC3, SLB1

The shift control solenoids (SLC1, SLC2, SLC3 and SLB1) are installed on the front valve body. The solenoids respond to inputs from the TCM and control the hydraulic pressure applied to the clutches (C1, C2 and C3) and to the brake B1 to provide smooth shifting. The TCM uses a single or a combination of these solenoids to provide shifts from 1st to 6th gear.

If a solenoid fails, the TCM will remove the current to the shift control solenoids and the transmission will use limp home mode, to prevent damage to the transmission.

Line Pressure Control Solenoid - SLT

The line pressure control solenoid (SLT) is installed on the front valve body. The solenoid is controlled in a linear manner by the TCM which uses throttle opening degree signals and engine torque information from the ECM (engine control module) to determine the solenoid operation. The solenoid controls the line pressure applied to the clutches and brakes to provide smooth shifting.

If the solenoid fails, the TCM will remove the current supplied to the solenoid. Maximum line pressure will be applied to the clutches and brakes unless the failure is due to the solenoid valve sticking, which may result in low line pressure.

Lock-Up Control Solenoid - SLU

The lock-up control solenoid is installed on the front valve body. The solenoid is controlled in a linear manner by the TCM which uses engine speed, throttle opening degree signals and transmission speed sensor signals to determine the solenoid operation. The solenoid controls the amount of lock-up or slip required for the torque converter lock-up clutch.

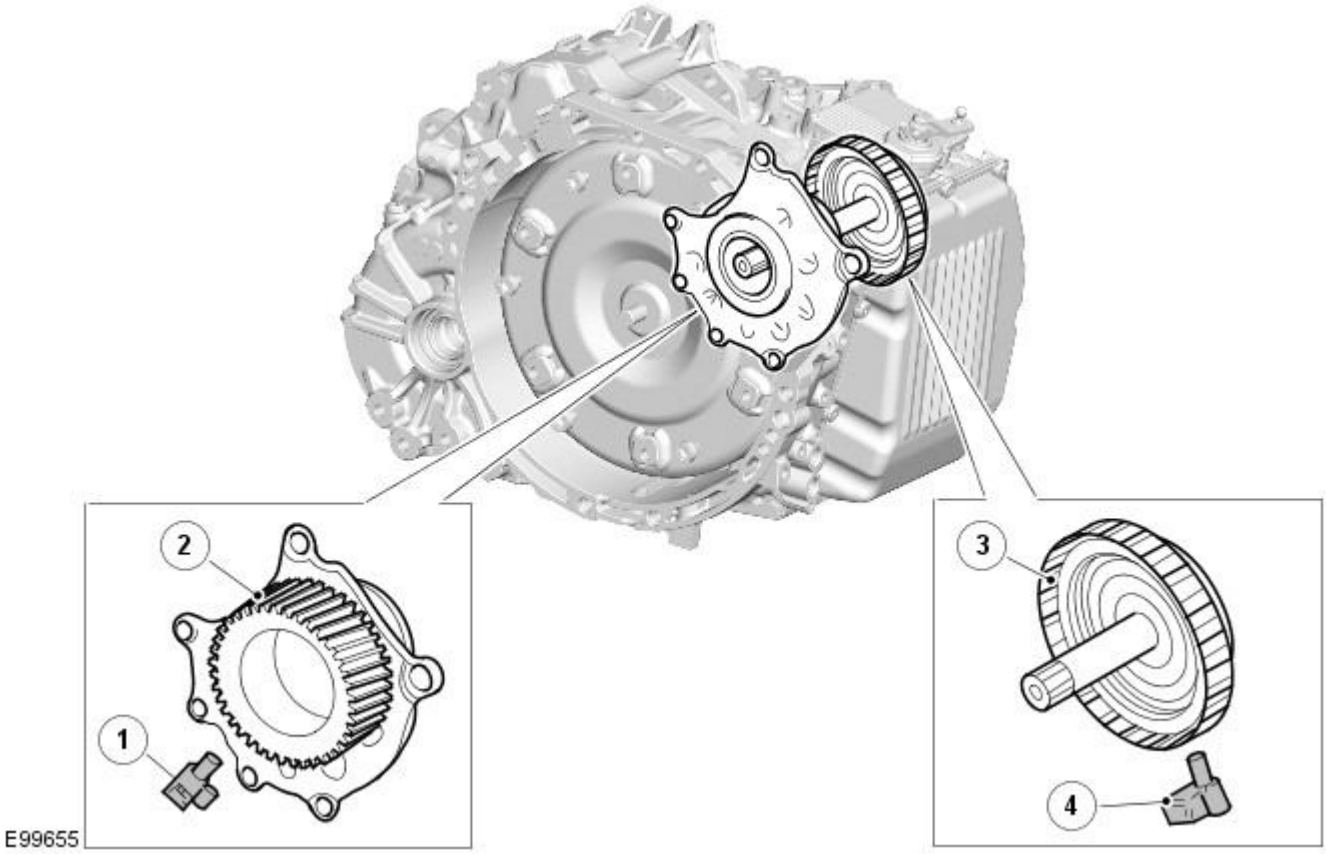
If the solenoid fails, the TCM removes the current supplied to the solenoid which results in no torque converter lock-up being applied.

3-Way Solenoid - S1, S2

The 3-way solenoid (S1) is located on the center valve body and solenoid (S2) is located on the front valve body. The solenoids are on/off solenoids controlled by the TCM. A combination of the 2 solenoids is used to operate either the 1st gear engine braking or enable gear shifts.

If a solenoid fails, the TCM will remove the current supplied to both solenoids.

Speed Sensors



Item	Part Number	Description
1	-	Speed Sensor (SP) - Output shaft speed
2	-	Counter drive gear
3	-	C2 clutch drum
4	-	Speed sensor (NIN)

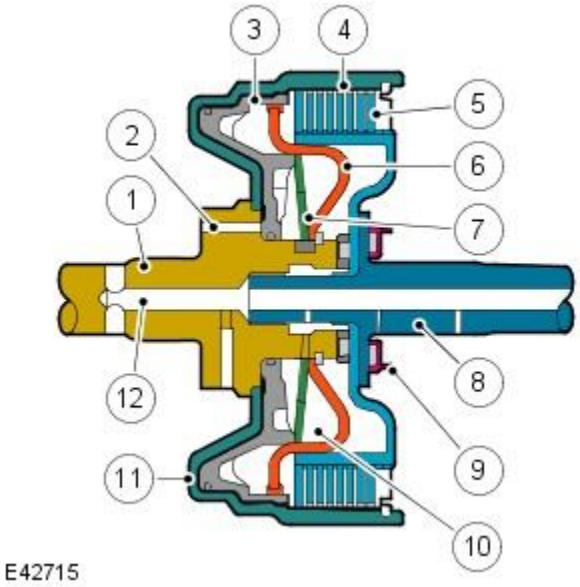
Two speed sensors (NIN and SP) are used in the transmission and are located within the transmission housing. Speed sensor (SP) is located adjacent to the counter drive gear and reads from the gear teeth to provide an output shaft speed signal. Speed sensor (NIN) is located adjacent to the clutch C" drum and reads off teeth on the outer circumference of the drum to provide an input shaft speed. Both speed signals are received by the TCM which uses the 2 signals to calculate engine torque output, shift timing and torque converter lock-up.

Fluid Temperature Sensor

The fluid temperature sensor is integrated into the internal wiring harness within the transmission. It detects the fluid temperature in the hydraulic pressure control circuit and transmits a signal corresponding to the temperature to the TCM. The TCM monitors the temperature and provides smooth gear shifts across a wide range of temperatures.

DRIVE CLUTCHES

Multiplate Drive or Brake Clutch – Typical



Item	Part Number	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 three drive clutches and two brake clutches (B2 is a multiplate brake clutch & B1 is a double wrap brake band) used in the AW F21 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.

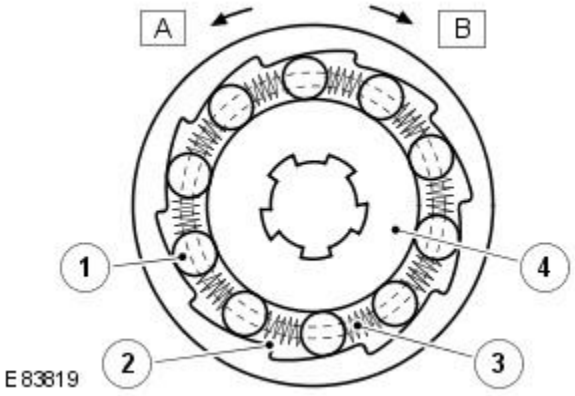
Clutch / Brake	Operation
C1 Clutch	Connects the front planetary carrier to the rear planetary rear sun gear
C2 Clutch	Connects the intermediate shaft to the rear planetary carrier
C3 Clutch	Connects the front planetary carrier to the rear planetary middle sun gear
B1 Brake	Locks the rear planetary middle sun gear
B2 Brake	Locks the rear planetary carrier

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 equalization 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 equalization 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.

One-Way Clutch

One-Way clutch - Typical

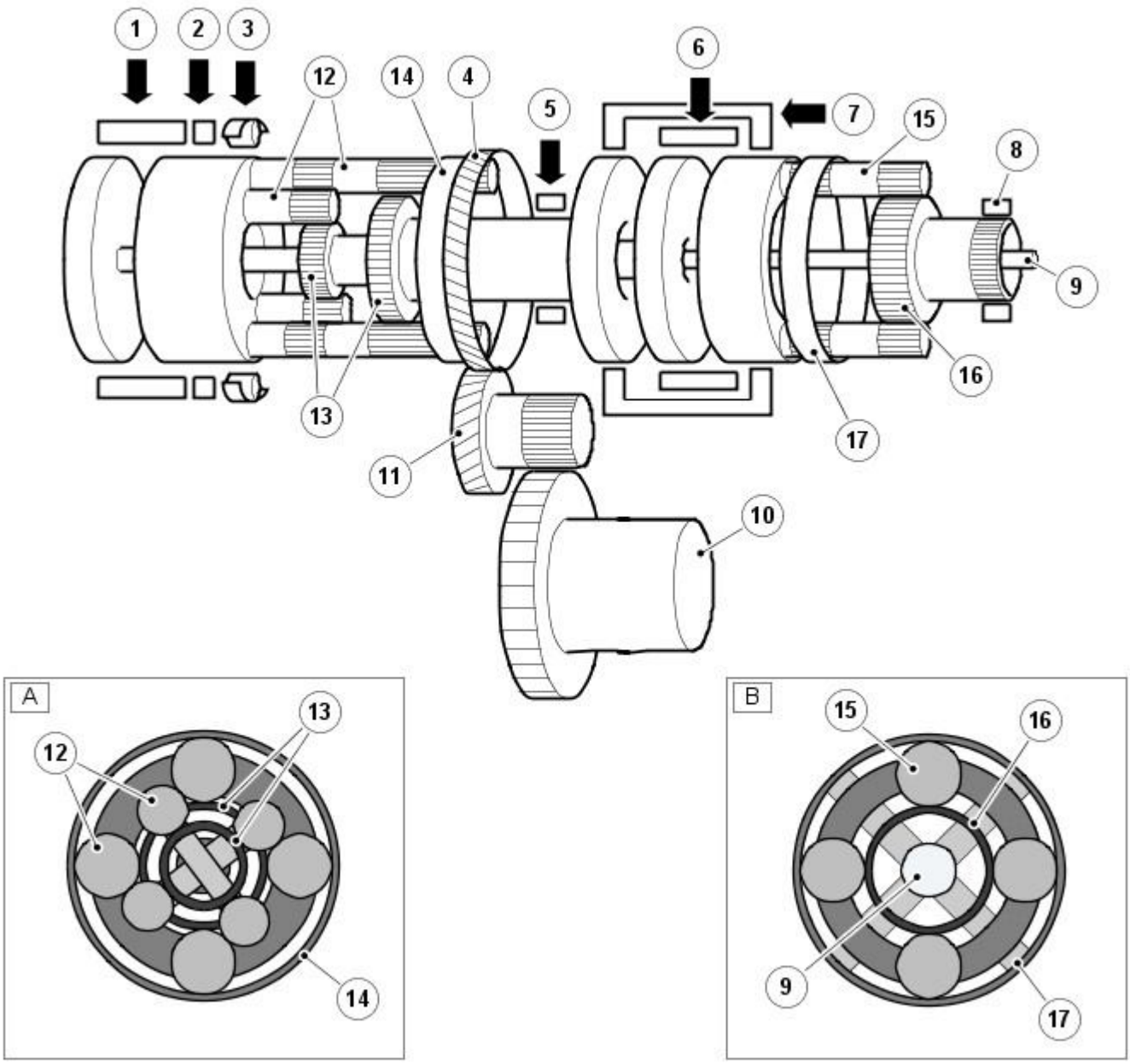


Item	Part Number	Description
1	-	Roller
2	-	Cage
3	-	Spring
4	-	Inner race

The roller clutch used on the one-way clutch uses parallel rollers, located between the smooth, cylindrical inner race and the inclined cam faces of the clutch body. Springs are used to hold the rollers in position between the two contact faces.

When the clutch is rotated in a clockwise direction, the rollers become trapped between the inner race and the inclined cam faces of the clutch body, providing positive (locked) rotation of the inner race, locking the counter-clockwise rotation of the rear planetary carrier. When the clutch is rotated in a clockwise direction, the rollers are moved away from the inclined cam faces and can rotate freely (unlocked) with the clutch body, providing no drive from the clutch to the rear planetary carrier. In this condition the clutch can rotate freely on the inner race.

PLANETARY GEAR TRAIN



E83818

Item	Part Number	Description
1	-	Clutch C2
2	-	Brake B2
3	-	One way clutch F1
4	-	Counter drive gear
5	-	Brake B1
6	-	Clutch C1
7	-	Clutch C3
8	-	Fluid pump
9	-	Input shaft
10	-	Differential gear assembly
11	-	Counter gear assembly
12	-	Pinion gears
13	-	Sun gears
14	-	Ring gear
15	-	Pinion gear
16	-	Sun gears
17	-	Ring gear

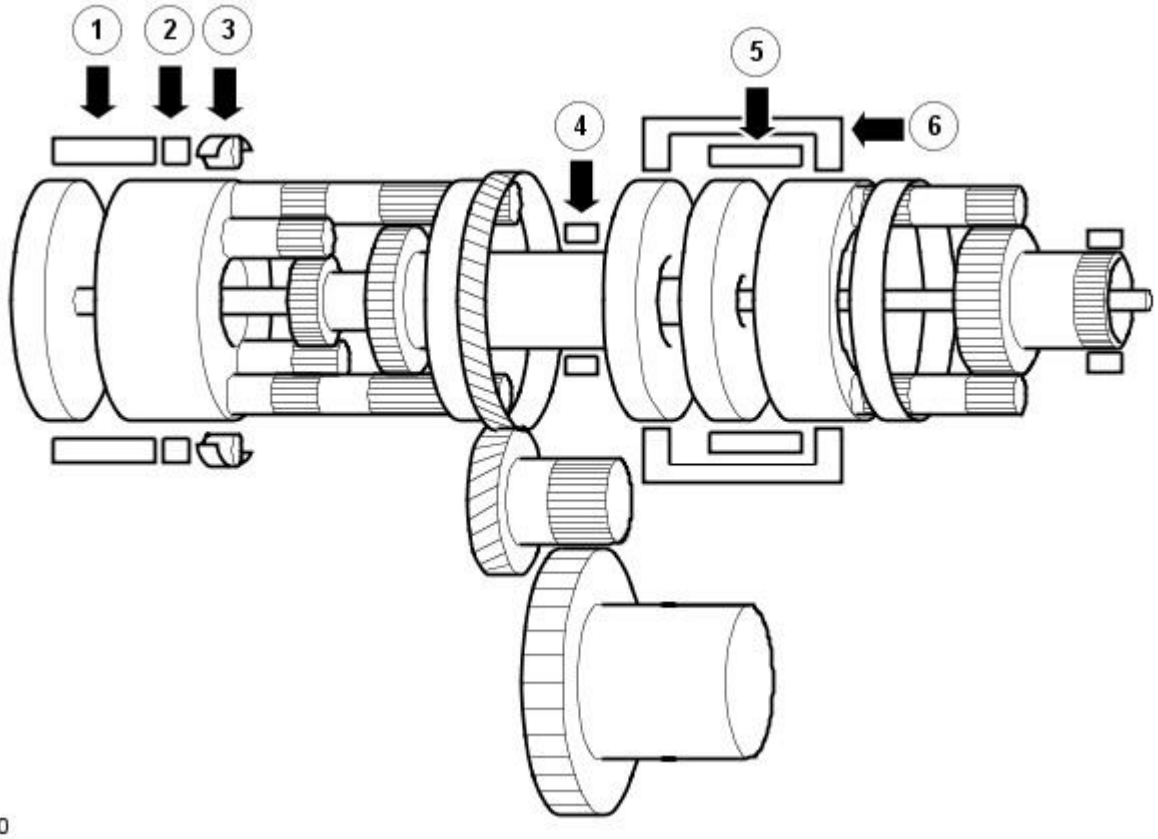
The planetary gear trains used on the AW F21 transmission comprise a single web planetary gear train and a double web planetary gear train. These gear trains are known as Ravignaux type gear trains and together produce the six forward gears and the one reverse gear.

Engine torque is transferred, via operation of single or combinations of clutches to the two planetary gear trains. Both gear trains are controlled by reactionary inputs from brake clutches to produce the six forward gears and one reverse gear. The ratios are as follows:

Gear	1st	2nd	3rd	4th	5th	6th	Reverse
Ratio	4.148	2.370	1.556	1.155	0.859	0.686	3.394

POWER FLOWS

Operation of the transmission is controlled by the TCM which electrically activates various solenoids to control the transmission gear selection. The sequence of solenoid activation is based on programmed information in the module memory and physical transmission operating conditions such as vehicle speed, throttle position, engine load and selector lever position.



Item	Part Number	Description
1	-	Clutch - C2
2	-	Brake - B2
3	-	One-way clutch - F1
4	-	Brake - B1
5	-	Clutch - C1
6	-	Clutch - C3

Power Flow - 1st Gear Engine Braking

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
D	Engine Brake	-	X	X	X	X	X

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
D	Engine Brake	X	-	-	-	X	X

X = Operating

When the engine brake is active, driving force is transmitted to the transmission from the road wheels, via the power transfer unit. The rear planetary carrier is locked from clockwise rotation by the one-way clutch (F1) and brake (B2). This results in torque from the wheels being transmitted directly to the engine, providing engine braking.

Power Flow - 1st Gear

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
D	1st Gear	-	X	X	X	-	-

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
D	1st Gear	X	-	-	-	-	X

X = Operating

The planetary gear trains are in the following conditions:

- Front planetary gear train
  - Input: Ring gear
  - Locked: Sun gear
  - Output: Carrier
- Rear planetary gear train
  - Input: Rear sun gear
  - Locked: Carrier
  - Output: Ring gear

Front Planetary Gear Train

The input shaft rotates in a clockwise direction, driven by the torque converter. The planetary ring gear rotates in a clockwise direction along with the planetary pinion gear which also rotates clockwise on its axis and orbit. The planetary sun gear is locked by the fluid pump which causes it to press against the planetary ring gear and orbit the sun gear, rotating on its axis.

The front planetary carrier rotates clockwise in the same direction as the planetary pinion gear. The clutch (C1) is activated and locks the planetary carrier to the rear planetary sun gear.

Rear Planetary Gear Train

The planetary sun gear rotates in a clockwise direction. The planetary short pinion gear rotates in a counter-clockwise direction. The planetary carrier attempts to rotate in the same direction but is restrained by the one-way clutch (F1).

The long pinion gear rotates clockwise on its axis and the middle sun gear rotates counter-clockwise while idling. The ring gear is rotated by the long pinion gear and drives the counter drive gear in a clockwise direction.

The counter driven gear is driven in a counter-clockwise direction which in turn drives the differential ring gear in a clockwise direction.

Power Flow - 2nd Gear

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
D	2nd Gear	-	X	X	-	-	-

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
D	2nd Gear	X	-	-	X	-	-

X = Operating

The planetary gear trains are in the following conditions:

- Front planetary gear train
  - Input: Ring gear
  - Locked: Sun gear
  - Output: Carrier
- Rear planetary gear train
  - Input: Rear sun gear
  - Locked: Middle sun gear
  - Output: Ring gear

Front Planetary Gear Train

The input shaft rotates in a clockwise direction, driven by the torque converter. The planetary ring gear rotates in a clockwise direction along with the planetary pinion gear which also rotates clockwise on its axis and orbit. The planetary sun gear is locked by the fluid pump which causes it to press against the planetary ring gear and orbit the sun gear, rotating on its axis.

The front planetary carrier rotates clockwise in the same direction as the planetary pinion gear. The clutch (C1) is activated and locks the planetary carrier to the rear planetary sun gear.

Rear Planetary Gear Train

The planetary sun gear and the carrier rotate in a clockwise direction. The middle sun gear is locked by the brake (B1). The short pinion gears rotate counter-clockwise on its axis and orbits in a clockwise direction. The long pinion gears rotates clockwise on its axis and its orbit.

The ring gear is rotated in a clockwise direction by the long pinion gear. The ring gear and the counter drive gear both rotate in a clockwise direction.

The counter driven gear is driven in a counter-clockwise direction which in turn drives the differential ring gear in a clockwise direction.

• NOTE: Engine braking is available when this gear is selected.

Power Flow - 3rd Gear

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
D	3rd Gear	-	X	-	X	-	-

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
D	3rd Gear	X	-	-	X	-	-

X = Operating

The planetary gear trains are in the following conditions:

- Front planetary gear train
  - Input: Ring gear
  - Locked: Sun gear
  - Output: Carrier
- Rear planetary gear train
  - Input: Middle sun gear
  - Locked: -
  - Output: Ring gear

Front Planetary Gear Train

The input shaft rotates in a clockwise direction, driven by the torque converter. The planetary ring gear rotates in a clockwise direction along

with the planetary pinion gear which also rotates clockwise on its axis and orbit. The planetary sun gear is locked by the fluid pump which causes it to press against the planetary ring gear and orbit the sun gear, rotating on its axis.

The front planetary carrier rotates clockwise in the same direction as the planetary pinion gear. The clutch (C1) is activated and locks the planetary carrier to the rear planetary sun gear. Clutch (C3) is also activated and locks the carrier to the middle sun gear.

Rear Planetary Gear Train

The planetary short pinion gear and the long pinion gear are engaged which causes both pinion gears to lock due to the different rotational directions. Torque from the sun gear and middle sun gear is transmitted to the planetary ring gear which rotates clockwise in the same direction as the planetary carrier.

The counter drive gear rotates in a clockwise direction with the ring gear.

The counter driven gear is rotated in a counter-clockwise direction which in turn drives the differential ring gear in a clockwise direction.

• NOTE: Engine braking is available when this gear is selected.

Power Flow - 4th Gear

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
D	4th Gear	-	-	X	X	-	-

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
D	4th Gear	X	X	-	-	-	-

X = Operating

The planetary gear trains are in the following conditions:

- Front planetary gear train
  - Input: Ring gear
  - Locked: Sun gear
  - Output: Carrier
- Rear planetary gear train
  - Input: Rear sun gear, Carrier
  - Locked: -
  - Output: Ring gear

Front Planetary Gear Train

The input shaft rotates in a clockwise direction, driven by the torque converter. The planetary ring gear rotates in a clockwise direction along with the planetary pinion gear which also rotates clockwise on its axis and orbit. The planetary sun gear is locked by the fluid pump which causes it to press against the planetary ring gear and orbit the sun gear, rotating on its axis.

The front planetary carrier rotates clockwise in the same direction as the planetary pinion gear. The clutch (C1) is activated and locks the planetary carrier to the rear planetary sun gear. The intermediate shaft rotates in the same direction as the input shaft. Clutch (C2) is also activated rotates in the same direction as the intermediate shaft.

Rear Planetary Gear Train

The planetary carrier rotates in a clockwise direction with the intermediate shaft. The short pinion gear rotates clockwise on its axis and orbits at a faster speed than the sun gear. The long pinion gear rotates counter-clockwise on its axis and orbit. The rotation of the ring gear is in a clockwise direction and is slower than the rotation of the carrier due to the long pinion gear's rotation is counteracted by the planetary carrier.

The counter drive gear rotates in a clockwise direction with the ring gear.

The counter driven gear is rotated in a counter-clockwise direction which in turn drives the differential ring gear in a clockwise direction.

• NOTE: Engine braking is available when this gear is selected.

Power Flow - 5th Gear

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
D	5th Gear	X	-	-	X	-	-

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
D	5th Gear	-	X	X	-	-	-

X = Operating

The planetary gear trains are in the following conditions:

- Front planetary gear train
  - Input: Ring gear
  - Locked: Sun gear
  - Output: Carrier
- Rear planetary gear train
  - Input: Middle sun gear
  - Locked: -
  - Output: Ring gear

Front Planetary Gear Train

The input shaft rotates in a clockwise direction, driven by the torque converter. The planetary ring gear rotates in a clockwise direction along with the planetary pinion gear which also rotates clockwise on its axis and orbit. The planetary sun gear is locked by the fluid pump which causes it to press against the planetary ring gear and orbit the sun gear, rotating on its axis.

The front planetary carrier rotates clockwise in the same direction as the planetary pinion gear. The clutch (C3) is activated and locks the planetary carrier to the rear planetary middle sun gear. The intermediate shaft rotates in the same direction as the input shaft. Clutch (C2) is also activated and rotates in the same direction as the intermediate shaft.

Rear Planetary Gear Train

The middle sun gear rotates clockwise in the same direction as clutch (C3). The deceleration of the front planetary gear slows the speed of the input shaft. The intermediate shaft rotates clockwise in the same direction as the input shaft. The planetary carrier also rotates clockwise in the same direction as the intermediate shaft.

The long pinion gear rotates clockwise on its axis and orbit. The carrier rotates faster than the middle sun gear which causes the middle pinion gear to be cancelled out by the speed difference. The middle pinion gear orbits and rotates on its axis in a clockwise direction.

The planetary ring gear rotates in a clockwise direction. The speed of the ring gear is faster than the planetary carrier because the long pinion gear's rotation is combined with the planetary carrier's speed. The counter drive gear rotates in a clockwise direction with the ring gear.

The counter driven gear is rotated in a counter-clockwise direction which in turn drives the differential ring gear in a clockwise direction.

• NOTE: Engine braking is available when this gear is selected.

Power Flow - 6th Gear

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
D	6th Gear	X	-	X	-	-	-

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
D	6th Gear	-	X	-	X	-	-

X = Operating

The planetary gear trains are in the following conditions:

- Front planetary gear train
  - Input: -
  - Locked: -
  - Output: -
- Rear planetary gear train
  - Input: Carrier
  - Locked: Middle sun gear
  - Output: Ring gear

Front Planetary Gear Train

The input shaft rotates in a clockwise direction, driven by the torque converter. The intermediate shaft rotates clockwise in the same direction as the torque converter. Clutch (C2) locks the intermediate shaft to the rear planetary carrier.

Rear Planetary Gear Train

The planetary carrier rotates clockwise in the same direction as the intermediate shaft. The planetary long pinion gear rotates clockwise on its axis and orbit. The rotational speed of the middle sun gear increases with input shaft speed because it is locked.

The planetary ring gear rotates in a clockwise direction. The speed of the ring gear is faster than the planetary carrier because the long pinion gear's rotation is combined with the planetary carrier's speed. The counter drive gear rotates in a clockwise direction with the ring gear.

The counter driven gear is rotated in a counter-clockwise direction which in turn drives the differential ring gear in a clockwise direction.

• NOTE: Engine braking is available when this gear is selected.

Power Flow - Reverse Gear

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
R	Reverse Gear - Less than 11 volts	X	X	-	X	-	-
R	Reverse Gear - More than 11 volts	X	X	X	X	X	X

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
R	Reverse Gear - Less than 11 volts	-	X	-	X	-	-
R	Reverse Gear - More than 11 volts	-	-	-	-	X	-

X = Operating

The planetary gear trains are in the following conditions:

- Front planetary gear train
  - Input: Ring gear
  - Locked: Sun gear
  - Output: Carrier
- Rear planetary gear train

- Input: Middle sun gear
- Locked: Carrier
- Output: Ring gear

Front Planetary Gear Train

The input shaft rotates in a clockwise direction, driven by the torque converter. The planetary ring gear rotates clockwise with the input shaft.

The pinion gear rotates clockwise on its axis and orbit. The planetary sun gear is locked by the fluid pump which causes it to press against the planetary ring gear and orbit the sun gear, rotating on its axis. The planetary carrier rotates clockwise with the pinion gear orbit.

Clutch (C3) is activated and rotates clockwise and locks the planetary carrier to the rear planetary middle sun gear.

Rear Planetary Gear Train

The middle sun gear rotates clockwise with the clutch (C3), but at a lower speed than the input shaft. Brake (B2) is activated and locks the planetary carrier. The long pinion gear rotates counter-clockwise which in turn rotates the ring gear counter-clockwise.

The counter drive gear rotates in a counter-clockwise direction with the ring gear at the same speed.

The counter driven gear is rotated in a clockwise direction which in turn drives the differential ring gear in a counter-clockwise direction.

• NOTE: Engine braking is available when this gear is selected.

Power Flow Neutral

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
N	Neutral	X	X	X	X	-	-

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
N	Neutral	-	-	-	-	-	-

X = Operating

In neutral, all the solenoids, except the 3 way solenoids, are energised and the clutches and brakes are all disengaged. This allows rotation from the input shaft to rotate the front planetary gear train without transferring any drive to the differential ring gear.

TOWING FOR RECOVERY

 WARNING: If the engine cannot be run whilst the vehicle is being towed, there will be no power assistance for the steering or brakes. This will result in greater effort being required to steer or slow the vehicle, and greatly increased stopping distances.

 CAUTION: The vehicle should only be towed for a maximum of 80 km (50 miles), at a maximum speed of 80 km/h (50 mph). Towing for a greater distance, or at a higher speed may result in serious damage to the transmission.

• NOTE: The recommended recovery method is by trailer or recovery vehicle.

Secure the towing attachment from the recovery vehicle to the front towing eye.

Switch on the ignition to ensure that the steering lock is dis-engaged.

• NOTE: Leaving the ignition switched on for extended periods will cause the battery to drain.

Apply the foot brake, and move the selector lever to the neutral 'N' position. With the footbrake still applied, release the park brake. If electrical power to the selector is not available, the emergency release lever on the selector lever can be used to release the interlock solenoid.

The vehicle can be towed a maximum of 80 km (50 miles) at a maximum speed of 80 km/h (50 mph).

Park the vehicle on firm, level ground. Apply the park brake and move the selector lever to the park 'P' position.

Switch off the ignition.

 CAUTION: The vehicle cannot be towed in a reverse direction.

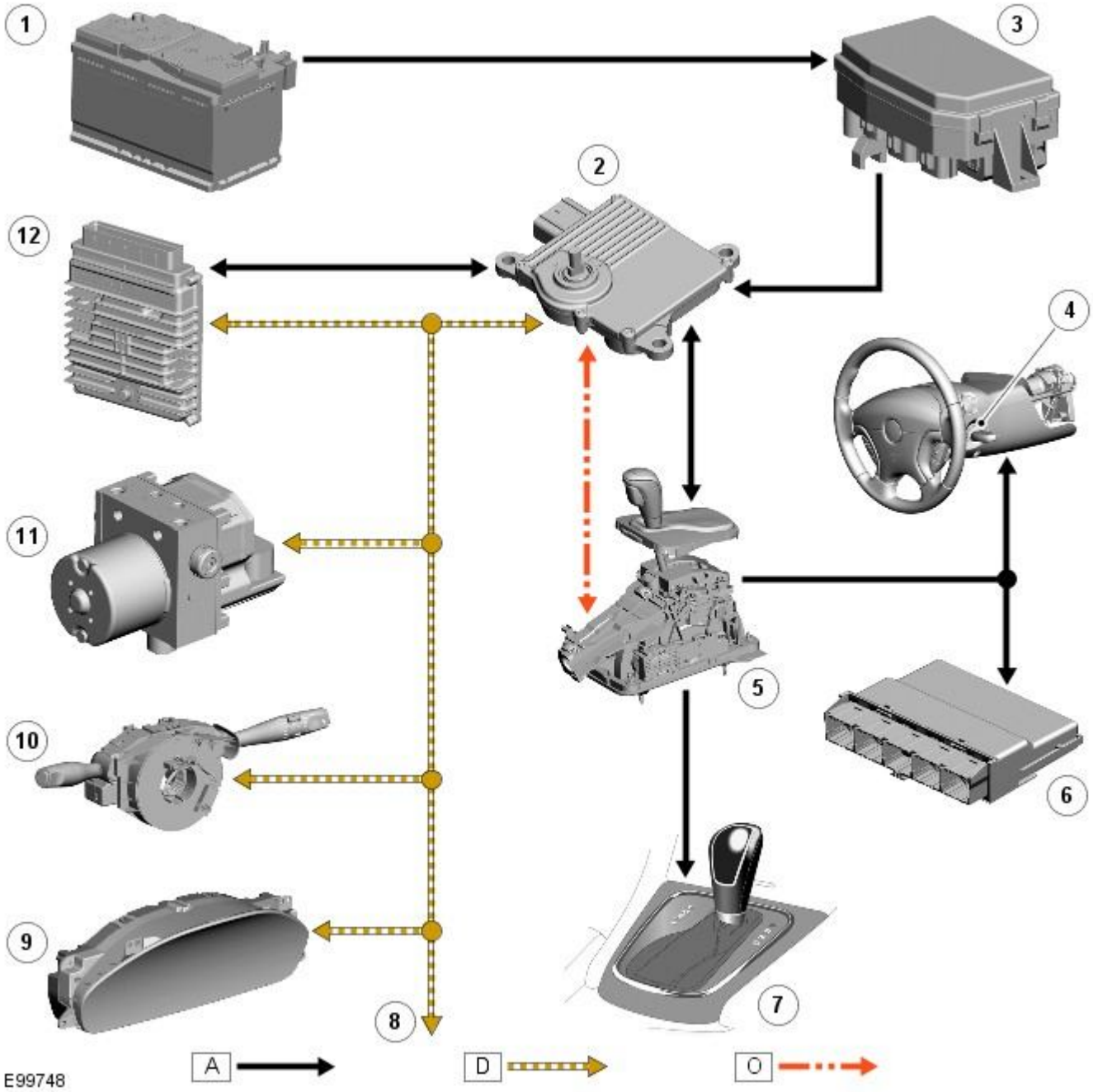
Published: 11-May-2011

Automatic Transmission / Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Transmission Electronic Control SystemVehicles With: 6-Speed Automatic Transaxle - AWF21

Description and Operation

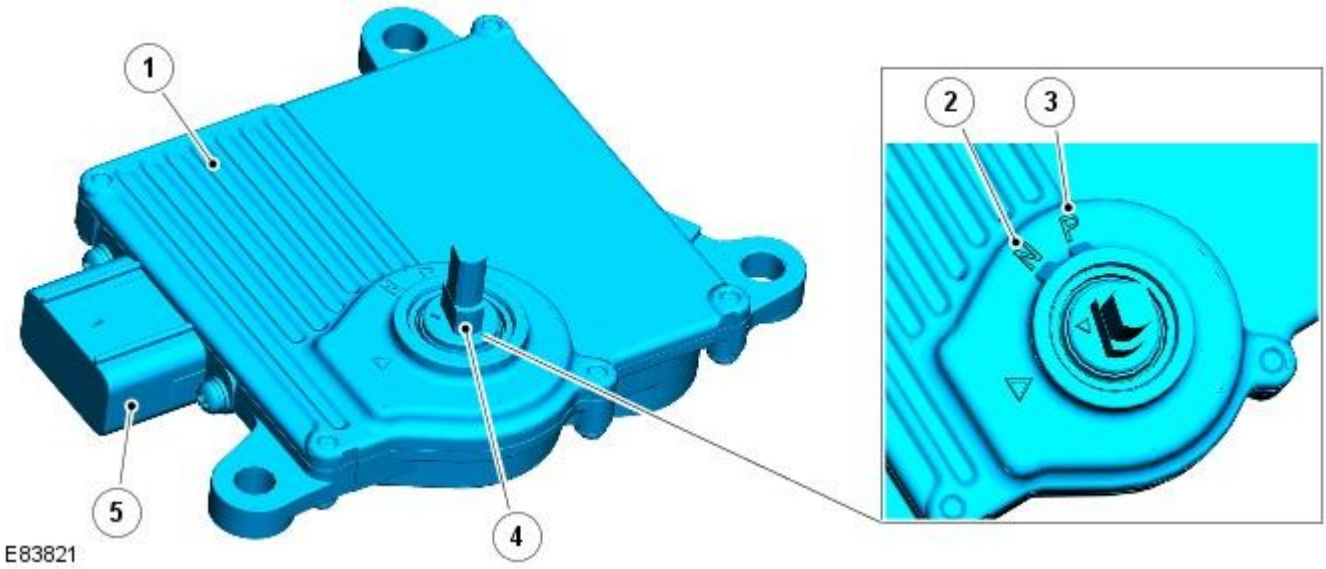
CONTROL DIAGRAM - AW F21 6 SPEED AUTOMATIC TRANSMISSION 2009MY

• NOTE: **A** = Hardwired; **D** = High speed CAN bus; **O** = LIN bus



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box (BJB)
3	-	Central Junction Box (CJB)
4	-	Transmission Control Module (TCM)
5	-	Selector lever
6	-	Selector lever PRND and M/S Light Emitting Diode (LED) displays
7	-	High speed Controller Area Network (CAN) bus to other vehicle systems
8	-	Instrument cluster
9	-	Steering angle sensor
10	-	Anti-lock Brake System (ABS) module
11	-	Engine Control Module (ECM)

TRANSMISSION CONTROL MODULE (TCM)



Item	Part Number	Description
1	-	TCM
2	-	'Neutral 'N' position
3	-	Park 'P' position
4	-	Position sensor/manual shaft
5	-	Electrical connector

The TCM (transmission control module) is located on the top of the transmission casing and is connected on the high speed CAN (controller area network) bus to send and receive information to and from other system modules.

The TCM outputs signals to operate the transmission solenoid valves to control the hydraulic operation of the transmission.

The ECM (engine control module) supplies the engine management data on the high speed CAN bus system. The TCM requires engine data to efficiently control the transmission operation, using for example; crankshaft torque, engine speed, accelerator pedal angle, engine temperature etc.

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 module calculates the correct gear, torque converter clutch setting and optimum pressure settings for gear shift and lock-up clutch control.

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 TCM is positioned over the manual shaft which protrudes through an oil seal on the top face of the main casing. The shaft locates in a rotary position sensor and turns the sensor in the appropriate direction when a selection is made using the selector lever. The rotary position sensor is a Hall effect sensor which outputs a specified voltage relating to the selected selector lever position.

The selector lever is connected to the automatic transmission and the rotary position sensor in the transmission by a Bowden cable. Movement of the selector lever moves the position switch via the Bowden cable and the switch position informs the TCM of the selected position; P, R, N or D. The sport and manual +/- 'Jaguar Sequential Shift' switch passes sport or manual selections to the TCM on a LIN (local interconnect network) bus. 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.

If the TCM or transmission requires replacement, a setting procedure must be performed using a Jaguar approved diagnostic system to allow the TCM to learn the neutral position of the transmission. The TCM uses the neutral position as a reference point for each of the gear positions P, R, N and D.

INSTRUMENT CLUSTER

The instrument cluster is connected to the TCM via the CAN.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

Message Center Display

The message center is located in the speedometer. The message center is a LCD (liquid crystal display) to relay vehicle status information to the driver. The message center will display 'SPORT' when sport mode is selected.
For additional information, refer to: Information and Message Center (413-08 Information and Message Center, Description and Operation).

CONTROLLER AREA NETWORK (CAN)

The high speed CAN broadcast bus network is used to connect the powertrain modules. The CAN bus is connected between the following electronic units:

High Speed CAN Bus

- TCM
- Instrument cluster
- Steering angle sensor
- Restraints control module
- ECM
- ABS module.
- Diagnostic socket.

The CAN bus allows a fast exchange of data between modules. The CAN bus comprises two wires which are identified as CAN high (H) and CAN low (L). The two wires are colored green and yellow and are twisted together to minimise electromagnetic interference (noise) produced by the CAN bus messages.

For additional information, 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 mode
- Torque converter lock-up clutch control is disabled.

DRIVING MODES

A number of different driving modes are available. Some can be selected by the driver and some are automatically initiated by the TCM to adapt to different driving conditions.

- Normal
- Sports
- Manual 'Jaguar Sequential Shift'
- Cooling
- Cruise
- Limp home
- Coast
- Fast off recognition
- Uphill and Trailer
- Downhill
- Wide Throttle
- Reverse lock-out

Normal

Normal mode is automatically selected by the TCM when the ignition is switched on. In this mode all automatic and adaptive modes are active. Normal mode uses gear shift and lock-up maps which provides the optimum of fuel consumption, emissions and driveability, depending on the driving style.

If the transmission is operated in sport mode or 'Jaguar Sequential Shift' mode and the selector lever is moved back to the drive 'D' position, then normal mode operation is resumed.

Sports

Sports mode provides enhanced acceleration and responsiveness by the use of sports shift maps. This mode allows the transmission to down shift more readily and hold gears for longer at higher engine speeds.

Manual 'Jaguar Sequential Shift'

Manual 'Jaguar Sequential Shift' mode allows the transmission to operate as a semi-automatic transmission. The driver can change up and down the six forward gears with the freedom of a manual transmission.

Shift maps are provided to protect the engine at high 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 laboring and stalling.

When kick-down is requested the TCM shifts down to the lowest available gear. When the vehicle is stationary, the driver can select 1st, 2nd or 3rd to start off.

When moving from a standstill, upshifts can be pre-selected by making '+' selections with the selector lever for the number of upshifts required. The TCM then performs the requested number of upshifts when appropriate shift points are reached. For example; when moving off in 1st gear, if 3 '+' selections are made in quick succession, the TCM will automatically upshift through the gears to 4th gear as the vehicle accelerates, without any further selections being made.

Cooling

Cooling mode is activated when the TCM detects excessively high transmission fluid or engine coolant temperatures. When this mode is active torque converter lock-up is activated earlier to minimize a further rise in fluid and/or engine coolant temperature and assist fluid cooling.

Cruise

When speed control is activated, the TCM receives a speed control active message on the high speed CAN bus. The TCM activates a speed control map which minimizes up and down shifts.

Cruise mode is active when speed control is selected on and the transmission is in drive 'D' or sport 'S'. Unique cruise maps override the current mode to provide a smooth driving feel and mode reselection.

Limp home

If a transmission fault is detected by the TCM, the TCM adopts a limp home strategy and a message 'TRANSMISSION FAULT LIMITED GEARS AVAILABLE' is displayed in the message center. If the fault has an effect on engine emissions, the MIL (malfunction indicator lamp) in the instrument cluster will also be illuminated.

In limp home mode, P, R and N functions operate normally (if the fault allows these selections) and the TCM locks the transmission in 3rd gear to allow the driver to take the vehicle to a Jaguar dealer or approved repairer. Torque converter lock-up is disabled and reverse-lock-out will not function.

If the vehicle is stopped and subsequently restarted in the limp home mode condition, the TCM operates normally until the fault which caused the condition is detected again.

Coast

Coast mode provides earlier downshifts during coasting dependant on output shaft deceleration rate to improve driveability and refinement by avoiding negative to positive driveline torque reversals transmission during the downshifts.

Fast Off Recognition

Fast off recognition is activated when the TCM detects that the driver has released the accelerator pedal quickly. This is detected by the TCM monitoring for a high level of negative pedal angle from ECM signals on the high speed CAN bus. If this condition is detected, the TCM holds the current gear ratio to allow the driver to complete the manoeuvre without the need for a downshift. The mode can remain active for a predetermined length of time or if the driving style remains passive.

Fast off recognition mode assists vehicle stability and is used in conjunction with a lateral acceleration input during cornering to maintain the current gear until the corner is negotiated.

Uphill and Trailer

Uphill and trailer mode can be active when the transmission is operating in normal or sport `modes. When the vehicle is pulling a trailer or driving up an incline, the TCM detects the increased resistance by monitoring engine torque and speed signals received from the ECM on the high speed CAN bus and also transmission output shaft speed sensor signals. Uphill and trailer mode will provide downshifts to prevent a drop in transmission torque output and maintain driving force.

Downhill

Downhill mode can be active when the transmission is operating in normal or sport modes. When the vehicle is descending an incline the TCM detects a reduction in resistance by monitoring engine torque and speed signals received from the ECM on the high speed CAN bus and also transmission output shaft speed sensor signals. Downhill mode assists engine braking by selecting an appropriate gear reducing the load required on the brakes.

Wide Throttle

Wide open throttle mode operates for part throttle upshifts and kick-down upshifts. It provides consistent wide open throttle upshift performance under all driving conditions. The full engine speed range is used in all driving modes; normal, sport, hill modes and Jaguar Sequential Shift. Compensation is used for delays (hydraulic and electronic) in gear change request to gear change start to provide smooth changes and correct shift point correction.

Reverse Lock-Out

If the selector lever is moved from N to R and the vehicle is travelling forwards, reverse selection is prevented if the vehicle speed is 11 km/h (6.8 mph) or more. When reverse lock-out is activated, the clutch (C3) is released without energizing solenoid (SLC3), preventing the transmission from selecting reverse gear.

TRANSMISSION FAULT STATUS

If the TCM detects a fault with the transmission system, it will enter a default (limp home) mode to prevent further damage to the transmission and allow the vehicle to be driven. If possible reverse gear will be available and also 3rd gear only.

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 required) and displays an applicable message in the message center.
For additional information, refer to: Information and Message Center (413-08 Information and Message Center, Description and Operation).

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 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.

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Automatic Transmission / Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Diagnostic StrategyVehicles With: 6-Speed Automatic Transaxle - AWF21

Diagnosis and Testing

Principles 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: Transmission Description (307-01, Description and Operation).

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Mechanical	Electrical	Hydraulic
• Damaged/stuck shift mechanism • Damaged automatic transmission casing	• Blown fuse(s) • Damaged, loose or corroded connectors • Wiring harness • Transmission Control Module (TCM) • Gear Selection Module (GSM) • Engine Control Module (ECM)	• Fluid level too high/low • Poor condition of fluid • Fluid leak

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.

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.

Service Routines

Carry out the service routines listed below when instructed to do so by the repair 'action' of the DTC Index

1. **1. Vehicle Configuration Main Menu, Configure New Modules, Transmission Control Module:** This routine is used to install software into a new TCM. The routine must be performed if a new TCM has been installed.
2. **2. Vehicle Configuration Main Menu, Configure New Modules, On Demand Self Test:** This routine is used to check that the TCM is installed without any electrical errors. When the routine is activated the TCM will test all outputs for electrical errors. The routine must be performed if the TCM has been separated from the transmission.
3. **3. Vehicle Configuration Main Menu, Configure Existing Modules, Transmission Control Module:** This routine is used to install software into an existing TCM. The routine must be performed if an existing TCM is having its software updated.
4. **4. Vehicle Configuration Main Menu, Special Applications, Transmission Control Module Neutral Learn::** This routine is used to re-calibrate the neutral position. The routine must be performed if the TCM has been separated from the transmission, TCM software is updated or TCM hardware is updated.
5. **5. Vehicle Configuration Main Menu, Special Applications, Clear Self Learning Data:** This routine is used to clear the solenoid adaptation in the TCM. The routine must be performed if the transmission is replaced and TCM is reused.
6. **6. Vehicle Configuration Main Menu, Special Applications, Set Adaption Mode:** This routine is used when the transmission is replaced. When this is done the transmission must be pre adapted before the customer drives the car, otherwise bad shifts might occur.
7. **7. Vehicle Configuration Main Menu, Special Applications, Oil Change Reset:** This routine is used to clear the counter that counts the oil degradation. The data needs to be erased if the oil is exchanged or if the transmission is replaced and the TCM is reused.
8. **8. Vehicle Configuration Main Menu, Special Applications, TCM Adaption Clear:** This routine is used to rest the self learning data in the TCM. The routine must be performed after a software update, if the TCM has been installed to another vehicle or if any mechanical components have been replaced in the transmission.

DTC	Description	Possible Cause	Action
P021868	Transmission Fluid Over temperature Condition	• Event information. System event not caused by the TCM, but requiring the TCM to record this DTC	Check the transmission fluid level and condition. Check the transmission fluid cooler/hoses for signs of obstruction, damage, blockage. Replace as required. Check the engine cooling system and engine cooling fans operation. Suspect the TCM/transmission, check

DTC	Description	Possible Cause	Action
		• Transmission fluid level low • Transmission fluid cooler/hoses are obstructed, damaged, blocked • Mechanical fault in the transmission • Engine cooling system failure	and install a new TCM/transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P050000	Vehicle Speed Sensor A	• Vehicle speed sensor circuit SP+ or SP- open circuit • Vehicle speed sensor failure • Vehicle speed sensor circuit SP+ short to ground • Internal failure in TCM	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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P056100	System Voltage Unstable	• Battery voltage too low • Battery voltage too high • High contact resistance or oxidation in the connector on the TCM or the transmission • Battery charger with incorrect voltage has been used • Charging system failure • Internal failure in TCM	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical guides and check BAT+ circuit for correct battery voltage, open circuit, oxidation in connector terminals. Check the vehicle charging 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P056200	System Voltage Low	• Battery voltage too low • High contact resistance or oxidation in the connector on the TCM or the transmission • Battery charger with incorrect voltage has been used • Charging system failure • Internal failure in TCM	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical guides and check BAT+ circuit for correct battery voltage, open circuit, oxidation in connector terminals. Check the vehicle charging 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P060100	Internal Control Module Memory Check Sum Error	• Internal failure in TCM	Using the manufacturer approved diagnostic system select the vehicle configuration main menu, select configure existing modules menu and programme the transmission control module. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P060300	Internal Control Module Keep Alive Memory (KAM) Error	• Internal failure in TCM	Using the manufacturer approved diagnostic system select the vehicle configuration main menu, select configure existing modules menu and programme the transmission control module. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P060400	Internal Control Module Random Access Memory (RAM) Error	• Internal failure in TCM	Using the manufacturer approved diagnostic system select the vehicle configuration main menu, select configure existing modules menu and programme the transmission control module. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P060500	Internal Control Module Read Only Memory (ROM) Error	• Internal failure in TCM	Using the manufacturer approved diagnostic system select the vehicle configuration main menu, select configure existing modules menu and programme the transmission control module. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P062F00	Internal Control Module EEPROM Error	• Internal failure in TCM	Using the manufacturer approved diagnostic system select the vehicle configuration main menu, select configure existing modules menu and programme the transmission control module. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P070500	Transmission Range Sensor A Circuit (PRNDL Input)	• Incorrect adjustment of gear selector lever cable • Incorrect adjustment of gear position sensor • Internal failure in TCM	Check the adjustment of the gear selector lever cable. Carry out neutral learn service routine. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P070900	Transmission Range Sensor A Circuit Intermittent	• Incorrect adjustment of gear selector lever cable • Incorrect adjustment of gear position sensor • Internal failure in TCM	Check the adjustment of the gear selector lever cable. Carry out neutral learn service routine. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P071100	Transmission Fluid Temperature Sensor A Circuit Range/Performance	• High contact resistance in the connector terminals • Failure of oil temperature sensor • Internal failure in TCM	Check for high contact resistance in the connector terminals between the TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new

DTC	Description	Possible Cause	Action
			module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P071200	Transmission Fluid Temperature Sensor A Circuit Low	• Short to ground on the OT circuit of the oil temperature sensor • Failure of oil temperature sensor • Internal failure in TCM	Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P071300	Transmission Fluid Temperature Sensor A Circuit High	• High contact resistance in the connector terminals • Short to power on the OT circuit of the oil temperature sensor • Open circuit on the OT circuit of the oil temperature sensor • Failure of oil temperature sensor • Internal failure in TCM	Check for high contact resistance in the connector terminals between the TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P071500	Turbine/Input Shaft Speed Sensor A Circuit	• Short to power on the NIN+ circuit of the input speed sensor • Failure of input speed sensor • Internal failure in TCM	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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P071600	Turbine/Input Shaft Speed Sensor A Circuit Range/Performance	• High contact resistance in the connector terminals • Input speed sensor not correctly installed • Failure of input speed sensor • Internal failure in TCM	Check for high contact resistance in the connector terminals between the TCM and transmission. Check input speed sensor installed correctly. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P071800	Turbine/Input Shaft Speed Sensor A Circuit Intermittent	• High contact resistance in the connector terminals • Input speed sensor not correctly installed • Failure of input speed sensor • Internal failure in TCM	Check for high contact resistance in the connector terminals between the TCM and transmission. Check input speed sensor installed correctly. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P072000	Output Shaft Speed Sensor Circuit	• Short to power SP+ circuit of vehicle speed sensor • Failure of vehicle speed sensor • Internal failure in TCM	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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P072100	Output Shaft Speed Sensor Circuit Range/Performance	• High contact resistance in the connector terminals • Vehicle speed sensor not correctly installed • Failure of vehicle speed sensor • The wheel radius does not agree with the wheel radius programmed in the vehicle's configuration file • Internal failure in TCM	Check the correct wheels and tires are installed. Using the manufacturer approved diagnostic system go to vehicle setup and configuration tab, add/remove accessories and carry out, tire size rolling circumference test. Check for high contact resistance in the connector terminals between the TCM and transmission. Check vehicle speed sensor installed correctly. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P072200	Output Shaft Speed Sensor Circuit No Signal	• High contact resistance in the connector terminals • Failure of vehicle speed sensor • Internal failure in TCM	Check for high contact resistance in the connector terminals between the TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P072300	Output Shaft Speed Sensor Circuit Intermittent	• High contact resistance in the connector terminals • Vehicle speed sensor not correctly installed • Failure of vehicle speed sensor • Internal failure in TCM	Check for high contact resistance in the connector terminals between the TCM and transmission. Check vehicle speed sensor installed correctly. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P072500	Engine Speed Input Circuit	• Open circuit on CAN circuit between ECM and TCM • Engine speed signal has not been updated • Engine speed signal quality factor has a failure value	Refer to the electrical guides and check CAN circuit for open circuit, short to ground between ECM and TCM. Check ECM for DTCs and refer to relevant DTC Index

DTC	Description	Possible Cause	Action
		• Short to ground on CAN circuit between ECM and TCM	
P072900	Gear 6 Incorrect Ratio	• Incorrectly regulating solenoid • Mechanical failure in transmission • Transmission components worn causing low system fluid pressure and slip	Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P073000	Incorrect Gear Ratio	• Internal malfunction in the transmission	Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P073095	Incorrect Gear Ratio	• Incorrect final drive installed • Incorrect assembly. The TCM has detected that the transmission has the incorrect gear ratio	Suspect the final drive unit, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P073100	Gear 1 Incorrect Ratio	• Incorrectly regulating solenoid • Mechanical failure in transmission • Transmission components worn causing low system fluid pressure and slip	Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P073200	Gear 2 Incorrect Ratio	• Incorrectly regulating solenoid • Mechanical failure in transmission • Transmission components worn causing low system fluid pressure and slip	Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P073300	Gear 3 Incorrect Ratio	• Incorrectly regulating solenoid • Mechanical failure in transmission • Transmission components worn causing low system fluid pressure and slip	Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P073400	Gear 4 Incorrect Ratio	• Incorrectly regulating solenoid • Mechanical failure in transmission • Transmission components worn causing low system fluid pressure and slip	Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P073500	Gear 5 Incorrect Ratio	• Incorrectly regulating solenoid • Mechanical failure in transmission • Transmission components worn causing low system fluid pressure and slip	Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P073600	Reverse Incorrect Ratio	• Mechanical failure in transmission • Transmission components worn causing low system fluid pressure and slip • Internal failure in TCM	Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P073E64	Unable to Engage Reverse	• Signal plausibility failure. The TCM has detected a plausibility failure • High contact resistance in the connector terminals • C3 pressure control SLC3 not operating when reverse gear is selected • Mechanical failure in transmission	Check for high contact resistance in the connector terminals between the TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P073F00	Unable to Engage Gear 1	• High contact resistance in the connector terminals • B1 pressure control SLB1 solenoid has stuck in off or on position • C2 pressure control SLC2 solenoid has stuck in off or on position • C3 pressure control SLC3 solenoid has stuck in off or on position • Mechanical failure in transmission	Check for high contact resistance in the connector terminals between the TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
P074100	Torque Converter Clutch Solenoid Circuit Performance/Stuck Off	• High contact resistance in the connector terminals • Open circuit of SLU circuit of lock up control solenoid • Failure of SLU lock up solenoid • SLU lock up solenoid stuck in closed position • Internal failure in TCM	Check for high contact resistance in the connector terminals between the TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P074200	Torque Converter Clutch Solenoid Circuit Stuck On	• High contact resistance in the connector terminals • Open circuit of SLU circuit of lock up control solenoid • Failure of SLU lock up solenoid • Internal failure in TCM	Check for high contact resistance in the connector terminals between the TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P074468	Torque Converter Clutch Solenoid Circuit Intermittent	• Event information. System event not caused by the TCM, but requiring the TCM to record this DTC • Engine stall condition detected • Mechanical fault in engine	Check for engine related DTCs. Rectify as required
P074A00	Unable to Engage Gear 2	• High contact resistance in the connector terminals • B1 pressure control SLB1 solenoid has stuck in off position • C1 pressure control SLC1 solenoid has stuck in off position • C1 pressure control SLC1 solenoid has stuck in on position • C2 pressure control SLC2 solenoid has stuck in on position • C3 pressure control SLC3 solenoid has stuck in on position • Mechanical failure in transmission	Check for high contact resistance in the connector terminals between the TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P074B00	Unable to Engage Gear 3	• High contact resistance in the connector terminals • C1 pressure control SLC1 solenoid has stuck in off position • C3 pressure control SLC3 solenoid has stuck in off position • C2 pressure control SLC2 solenoid has stuck in on position • Mechanical failure in transmission	Check for high contact resistance in the connector terminals between the TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P074C00	Unable to Engage Gear 4	• High contact resistance in the connector terminals • C1 pressure control SLC1 solenoid has stuck in off position • C2 pressure control SLC2 solenoid has stuck in off position • C3 pressure control SLC3 solenoid has stuck in on position • B1 pressure control SLB1 solenoid has stuck in on position • Mechanical failure in transmission	Check for high contact resistance in the connector terminals between the TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P074D00	Unable to Engage Gear 5	• High contact resistance in the connector terminals • C2 pressure control SLC2 solenoid has stuck in off position • C3 pressure control SLC3 solenoid has stuck in off position • C1 pressure control SLC1 solenoid has stuck in on position • B1 pressure control SLB1 solenoid has stuck in on position	Check for high contact resistance in the connector terminals between the TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
		• Mechanical failure in transmission	
P074E00	Unable to Engage Gear 6	• High contact resistance in the connector terminals • C2 pressure control SLC2 solenoid has stuck in off position • B1 pressure control SLB1 solenoid has stuck in off position • C1 pressure control SLC1 solenoid has stuck in on position • C3 pressure control SLC3 solenoid has stuck in on position • Mechanical failure in transmission	Check for high contact resistance in the connector terminals between the TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P077700	Pressure Control Solenoid B Stuck On	• S2 shift solenoid has jammed in the on position • Hydraulic fault in the transmission	Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P081442	Transmission Range Display Circuit	• General memory failure • Internal fault in GSM	Suspect the GSM, check and install a new GSM as required, refer to the new module/component installation note at the top of the DTC Index
P081449	Transmission Range Display Circuit	• Internal electronic failure. The TCM has detected an internal circuit failure • Internal fault in GSM	Suspect the GSM, check and install a new GSM as required, refer to the new module/component installation note at the top of the DTC Index
P081711	Starter Disable Circuit / Open	• Circuit short to ground. The TCM has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • High contact resistance in the connector terminals • Start lock STLK circuit short to ground • Internal failure in TCM • Internal failure in ECM	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical guides and check Start lock STLK circuit for high resistance in connector terminals, short to ground. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P081712	Starter Disable Circuit / Open	• Circuit short to power. The TCM has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Start lock STLK circuit short to power • Internal failure in TCM • Internal failure in ECM	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical guides and check Start lock STLK circuit for short to power. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P081C49	Park Input Circuit	• Internal electronic failure. The GSM has detected an internal circuit failure • Internal fault in GSM	Suspect the GSM, check and install a new GSM as required, refer to the new module/component installation note at the top of the DTC Index
P082601	Up and Down Switch Circuit	• General electrical failure • GSM not working (tiptronic mode)	Suspect the GSM, check and install a new GSM as required, refer to the new module/component installation note at the top of the DTC Index
P085A00	Gear Shift Module B Communication Circuit	• LIN communication line failure • Internal fault in GSM	Refer to the electrical guides and check LIN circuit for open circuit, short to ground, short to power. Suspect the GSM, check and install a new GSM as required, refer to the new module/component installation note at the top of the DTC Index
P086011	Gear Shift Module A Communication Circuit	• Circuit short to ground. The TCM has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Short to ground on the LIN communication circuit between the TCM and GSM • Internal failure in GSM • Internal failure in TCM	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical guides and check LIN circuit between TCM and GSM for high resistance in connector terminals, short to ground. Suspect the GSM, check and install a new GSM as required, refer to the new module/component installation note at the top of the DTC Index. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P086012	Gear Shift Module A Communication Circuit	• Circuit short to power. The TCM has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical guides and check LIN circuit between TCM and GSM for short to power. Suspect the GSM, check and install a new GSM as required, refer to the new module/component installation note at the top of the DTC Index. Suspect the TCM, check and install a new TCM as required,

DTC	Description	Possible Cause	Action
		value was expected • Short to power on the LIN communication circuit between the TCM and GSM • Internal failure in GSM • Internal failure in TCM	refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P086013	Gear Shift Module A Communication Circuit	• Circuit open. The TCM has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • High contact resistance in the connector terminals • Oxidation in the connector terminals • Open circuit on the power supply to the GSM • Open circuit on the ground supply to the GSM • Open circuit on the LIN communication circuit between the TCM and GSM • Internal failure in GSM • Internal failure in TCM	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical guides and check LIN circuit between TCM and GSM for open circuit. Check for high contact resistance in the connector terminals. Check for oxidation in the connector terminals. Check for open circuit on the power supply to the GSM. Check for open circuit on the ground supply to the GSM. Suspect the GSM, check and install a new GSM as required, refer to the new module/component installation note at the top of the DTC Index. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P086087	Gear Shift Module A Communication Circuit	• Missing message. The TCM has not received one or more expected messages from the GSM. • Internal failure in GSM • Internal failure in TCM	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical guides and check LIN circuit between TCM and GSM for open circuit. Suspect the GSM, check and install a new GSM as required, refer to the new module/component installation note at the top of the DTC Index. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P088513	TCM Power Relay Control Circuit /Open	• Circuit open. The TCM has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Open circuit on the VSUP power circuit between the TCM and GSM • Internal failure in GSM • Internal failure in TCM	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical guides and check VSUP power circuit between TCM and GSM for open circuit. Suspect the GSM, check and install a new GSM as required, refer to the new module/component installation note at the top of the DTC Index. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P088611	TCM Power Relay Control Circuit Low	• Circuit short to ground. The TCM has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • High contact resistance in the connector terminals • Short to ground on the VSUP power circuit between the TCM and GSM • Internal failure in GSM • Internal failure in TCM	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical guides and check VSUP power circuit between TCM and GSM for high resistance in connector terminals, short to ground. Suspect the GSM, check and install a new GSM as required, refer to the new module/component installation note at the top of the DTC Index. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P089500	Shift Time Too Short	• Mechanical fault in transmission • Hydraulic fault in transmission • Internal failure in TCM	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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P089600	Shift Time Too Long	• Mechanical fault in transmission • Hydraulic fault in transmission • Internal failure in TCM	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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P089709	Transmission Fluid Deteriorated	• Transmission fluid is degraded, exerted to very hard strain and high ambient temperatures and is no longer serviceable	Replace the transmission fluid. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P092813	Gear Shift Lock Solenoid/Actuator Circuit A / Open	• Circuit open. The TCM has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • High contact resistance in the	Refer to the electrical guides and check the SFL shiftlock circuit for open circuit, high resistance, corrosion, oxidation of connector terminals. Refer to the electrical guides and check the ground circuit between the GSM and ground stud. Suspect the GSM, check and install a new GSM as required, refer to the new module/component installation note at the top of the DTC Index

DTC	Description	Possible Cause	Action
		connector terminals • Open circuit on the SFL shiftlock circuit between the TCM and GSM • Open circuit on the ground circuit between the GSM and ground stud • Internal failure in GSM	
P093011	Gear Shift Lock Solenoid/Actuator Circuit A Low	• Circuit short to ground. The TCM has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Short to ground on the SFL shiftlock circuit between the TCM and GSM • Failure of the shiftlock solenoid • Internal failure in GSM	Refer to the electrical guides and check the SFL shiftlock circuit for short to ground. Suspect the GSM, check and install a new GSM as required, refer to the new module/component installation note at the top of the DTC Index
P093112	Gear Shift Lock Solenoid/Actuator Circuit A High	• Circuit short to power. The TCM has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Short to power on the SFL shiftlock circuit between the TCM and GSM • Internal failure in GSM	Refer to the electrical guides and check the SFL shiftlock circuit for short to power. Suspect the GSM, check and install a new GSM as required, refer to the new module/component installation note at the top of the DTC Index
P096000	Pressure Control Solenoid A Control Circuit / Open	• High contact resistance in the connector terminals between TCM and transmission • open circuit of internal wiring for SLT control signal circuit • open circuit of internal wiring for SLT ground signal circuit • SLT line pressure control solenoid no operation	Check the terminals for corrosion, oxidation between TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P096100	Pressure Control Solenoid A Control Circuit Range/Performance	• High contact resistance in the connector terminals between TCM and transmission • open circuit of internal wiring for SLT control signal circuit • open circuit of internal wiring for SLT ground signal circuit • SLT line pressure control solenoid no operation • SLT line pressure control solenoid stuck	Check the terminals for corrosion, oxidation between TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P096300	Pressure Control Solenoid A Control Circuit High	• Short to power of internal wiring for SLT line pressure solenoid control signal circuit • SLT line pressure control solenoid no operation • Internal failure in TCM	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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P096400	Pressure Control Solenoid B Control Circuit / Open	• High contact resistance in the connector terminals between TCM and transmission • open circuit of internal wiring for SLU control signal circuit • SLU lock up control solenoid no operation • Internal failure in TCM	Check the terminals for corrosion, oxidation between TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P096500	Pressure Control Solenoid B Control Circuit Range/Performance	• High contact resistance in the connector terminals between TCM and transmission • open circuit of internal wiring for SLU control signal circuit • SLU lock up control solenoid no operation • SLU lock up control solenoid stuck • Internal failure in TCM	Check the terminals for corrosion, oxidation between TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P096700	Pressure Control Solenoid B Control Circuit High	• Short to power of internal wiring for SLU lock up control solenoid signal circuit • SLU lock up control solenoid no operation • Internal failure in TCM	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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
P096900	Pressure Control Solenoid C Control Circuit Range/Performance	• High contact resistance in the connector terminals between TCM and transmission • open circuit of internal wiring for SLC2 control signal circuit • open circuit of internal wiring for SLC2 ground control signal circuit • SLC2 pressure control solenoid no operation • SLC2 pressure control solenoid stuck • Internal failure in TCM	Check the terminals for corrosion, oxidation between TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P097000	Pressure Control Solenoid C Control Circuit Low	• Short to ground of internal wiring for SLC2 control signal circuit • Open circuit of internal wiring for SLC2 control signal circuit • SLC2 pressure control solenoid no operation • Internal failure in TCM	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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P097100	Pressure Control Solenoid C Control Circuit High	• Short to power of internal wiring for SLC2 control signal circuit • SLC2 pressure control solenoid no operation • Internal failure in TCM	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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P097300	Shift Solenoid A Control Circuit Low	• Short to ground of internal wiring for S1 shift solenoid 1 • S1 shift solenoid 1 not working • Internal failure in TCM	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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P097400	Shift Solenoid A Control Circuit High	• High contact resistance in the connector terminals between TCM and transmission • Open circuit of internal wiring for S1 shift solenoid 1 • S1 shift solenoid 1 not working • Short to power of internal wiring for S1 shift solenoid 1 • Internal failure in TCM	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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P097600	Shift Solenoid B Control Circuit Low	• Short to ground of internal wiring for S2 shift solenoid 2 • S2 shift solenoid 2 not working • Internal failure in TCM	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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P097700	Shift Solenoid B Control Circuit High	• High contact resistance in the connector terminals between TCM and transmission • Open circuit of internal wiring for S2 shift solenoid 2 • S2 shift solenoid 2 not working • Short to power of internal wiring for S2 shift solenoid 2 • Internal failure in TCM	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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P171900	Engine Torque Signal	• CAN message, engine torque signal has not been updated • CAN message, engine torque signal quality factor equals zero	Check for ECM DTCs. Rectify as required
P173D00	Ignition Key Lock Solenoid Circuit / Open	• Open circuit between ignition switch keylock solenoid and GSM	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical guides and check for open circuit between ignition switch keylock solenoid and GSM
P173E00	Ignition Key Lock Solenoid Circuit Low	• Short to ground between ignition switch keylock solenoid and GSM	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical guides and check for short to ground between ignition switch keylock solenoid and GSM
P173F00	Ignition Key Lock Solenoid Circuit High	• Short to power between ignition switch keylock solenoid and GSM	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical guides and check for short to power between ignition switch keylock solenoid and GSM
P178368	Transmission Overtemperature Condition	• Event information. System event not caused by the TCM, but requiring the TCM to record this DTC • Transmission fluid level low • Transmission fluid cooler/hoses are	Check the transmission fluid level and condition, correct as required. Check the transmission fluid cooler hoses for signs of obstruction/damage/blockage, correct as required. Check the engine cooling system and engine cooling fans operation. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry

DTC	Description	Possible Cause	Action
		• obstructed/damaged/blocked • Mechanical failure of transmission • Transmission has been exposed to excessive high load and high ambient temperature greater than 150 degrees C (302 degrees F)	out service routines as required using the manufacturer approved diagnostic system
P179900	CAN TCM/ABS Circuit Malfunction	• Vehicle speed message has not been updated on CAN • ABS malfunction	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check ABS for DTCs rectify as required
P215800	Vehicle Speed Sensor B	• Open circuit of internal wiring NIN+ input speed sensor circuit • Short circuit to ground of internal wiring NIN+ input speed sensor circuit • Input speed sensor failure • Internal failure in TCM	Check the terminals for corrosion, oxidation between TCM and transmission. Check NIN+ circuit for open circuit, short to ground. Replace Input speed sensor. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P271900	Pressure Control Solenoid D Control Circuit Range/Performance	• High contact resistance in the connector terminals between TCM and transmission • SLC3 pressure control solenoid stuck • open circuit of internal wiring for SLC3 control signal circuit • open circuit of internal wiring for SLC3 ground control signal circuit • SLC3 pressure control solenoid no operation • Internal failure in TCM	Check the terminals for corrosion, oxidation between TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P272000	Pressure Control Solenoid D Control Circuit Low	• High contact resistance in the connector terminals between TCM and transmission • Short to ground of internal wiring for SLC3 control signal circuit • Open circuit of internal wiring for SLC3 control signal circuit • SLC3 pressure control solenoid no operation • Internal failure in TCM	Check the terminals for corrosion, oxidation between TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P272100	Pressure Control Solenoid D Control Circuit High	• Short to power of internal wiring for SLC3 control signal circuit • SLC3 pressure control solenoid no operation • Internal failure in TCM	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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P272800	Pressure Control Solenoid E Control Circuit Range/Performance	• High contact resistance in the connector terminals between TCM and transmission • Open circuit of internal wiring for SLB1 control signal circuit • Open circuit of internal wiring for SLB1 ground control signal circuit • SLB1 pressure control solenoid no operation • SLB1 pressure control solenoid stuck • Internal failure in TCM	Check the terminals for corrosion, oxidation between TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P272900	Pressure Control Solenoid E Control Circuit Low	• High contact resistance in the connector terminals between TCM and transmission • Open circuit of internal wiring for SLB1 control signal circuit • Open circuit of internal wiring for SLB1 ground control signal circuit • SLB1 pressure control solenoid no operation • Internal failure in TCM	Check the terminals for corrosion, oxidation between TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P273000	Pressure Control Solenoid E Control Circuit High	• Short to power of internal wiring for SLB1 control signal circuit • SLB1 pressure control solenoid no operation • Internal failure in TCM	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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
P273300	Pressure Control Solenoid F Stuck On	• SLC1 pressure control not engaged in drive • Mechanical fault in the transmission	Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P273700	Pressure Control Solenoid F Control Circuit Range/Performance	• High contact resistance in the connector terminals between TCM and transmission • Open circuit of internal wiring for SLC1 control signal circuit • Open circuit of internal wiring for SLC1 ground control signal circuit • SLC1 pressure control solenoid no operation • SLC1 pressure control solenoid stuck • Internal failure in TCM	Check the terminals for corrosion, oxidation between TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P273800	Pressure Control Solenoid F Control Circuit Low	• High contact resistance in the connector terminals between TCM and transmission • Open circuit of internal wiring for SLC1 control signal circuit • Open circuit of internal wiring for SLC1 ground control signal circuit • SLC1 pressure control solenoid no operation • Internal failure in TCM	Check the terminals for corrosion, oxidation between TCM and transmission. 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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P273900	Pressure Control Solenoid F Control Circuit High	• Short to power of internal wiring for SLC1 control signal circuit • SLC1 pressure control solenoid no operation • Internal failure in TCM	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. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P278368	Torque Converter Temperature Too High	• Event information. System event not caused by the TCM, but requiring the TCM to record this DTC • Torque converter temperature greater than 170 degrees C (338 degrees F)	Check the transmission fluid level and condition. Check the transmission fluid cooler/hoses for signs of obstruction, damage, blockage. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P278768	Clutch Temperature Too High	• Event information. System event not caused by the TCM, but requiring the TCM to record this DTC • Torque converter stalled • The transmission fluid temperature is the same, or greater than 120 degrees C (248 degrees F) for longer than 5 seconds • The transmission fluid temperature is greater than 120 degrees C and lower than 150 degrees C (302 degrees F) for longer than 4 seconds • The transmission fluid temperature is greater than 150 degrees (302 degrees F) for longer than 3 seconds • Internal failure in TCM	Check the transmission fluid level and condition. Check the transmission fluid cooler/hoses for signs of obstruction, damage, blockage. Suspect the transmission, check and install a new transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P280000	Transmission Range Sensor B Circuit (PRNDL Input)	• Incorrect adjustment of gear position sensor • Internal failure in TCM	Check the gear selector lever is adjusted correctly. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P280100	Transmission Range Sensor B Circuit Range/Performance	• Undefined range when drive selected • Incorrect adjustment of gear position sensor • Internal failure in TCM	Check the gear selector lever is adjusted correctly. Suspect the TCM, GSM or transmission check and install a new TCM, GSM or transmission as required, refer to the new module/component installation note at the top of the DTC Index. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
P280500	Transmission Range Sensor A / B Correlation	• Incorrect adjustment of gear position sensor • Internal failure in TCM	Check the gear selector lever is adjusted correctly. 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. Refer to service routines at the top of the DTC Index and carry out service routines as required using the manufacturer approved diagnostic system
U000100	High Speed CAN Communication Bus	• CAN bus open circuit • CAN bus short circuit to ground • CAN bus short circuit to power • Internal fault in another control module in the same	Carry out any diagnostic pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical guides and check CAN circuit for open circuit, short to ground, short to power. 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. Refer to service routines at the top of the DTC Index and

DTC	Description	Possible Cause	Action
		• part of the CAN network • Internal failure in TCM	carry out service routines as required using the manufacturer approved diagnostic system
U210511	Switch Pack Signal "A"	• Circuit short to ground. The TCM has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Shiftlock solenoid circuit short to ground • GSM internal failure	Refer to the electrical guides and check shiftlock circuit for short to ground. Suspect the GSM, check and install a new GSM as required, refer to the new module/component installation note at the top of the DTC Index
U210512	Switch Pack Signal "A"	• Circuit short to power. The TCM has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Shiftlock solenoid circuit short to power • Open circuit shiftlock solenoid circuit • GSM internal failure	Refer to the electrical guides and check shiftlock circuit for short to power, open circuit. Suspect the GSM, check and install a new GSM as required, refer to the new module/component installation note at the top of the DTC Index

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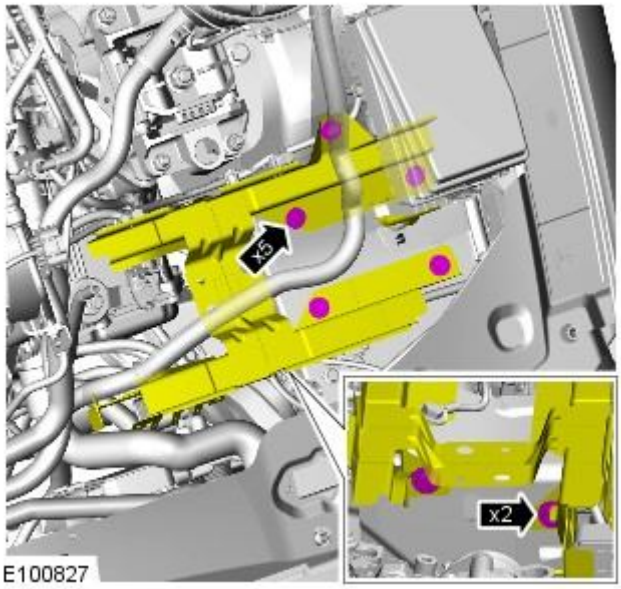
Automatic Transmission / Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Transmission Fluid Drain and Refill

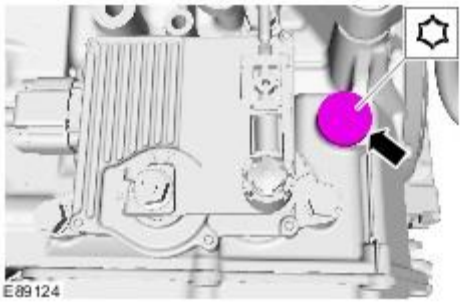
General Procedures

WARNING: Observe due care when draining, as the fluid can be very hot.

1. Ensure that the automatic transmission is in 'P' and the handbrake is fully applied.
2. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
3. Release the battery carrier bracket and position aside.



4. Clean the area around the transmission fluid filler plug.
5. Remove the transmission fluid filler plug.



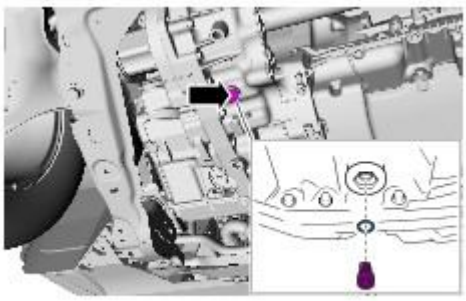
6. WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

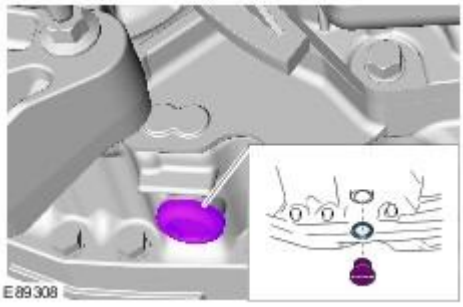
• NOTE: Make sure that the vehicle is standing on a level surface.

Raise and support the vehicle.

7. Remove the air deflector.
   For additional information, refer to: Air Deflector - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (501-02 Front End Body Panels, Removal and Installation).
8. Clean the area around the transmission fluid level and drain plugs.
9. Place a container under the transmission.
10. CAUTION: The fluid level plug and drain plug both use the same point on the transmission. The inner plug is for level indication and the outer plug is to drain the fluid.

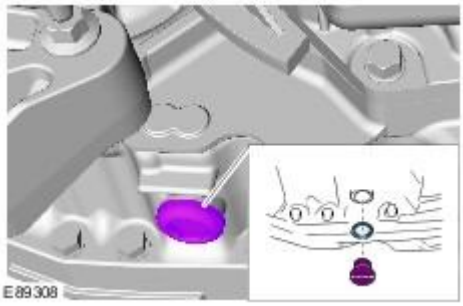
Remove the transmission fluid level plug.





11. Remove the transmission fluid drain plug.

- Allow the transmission fluid to drain.



12. NOTE: Install a new gasket.

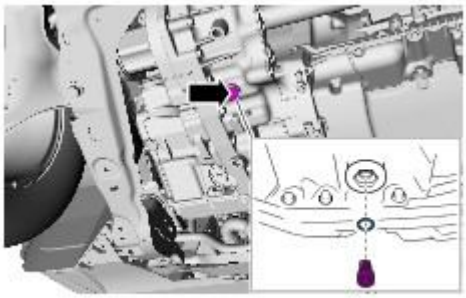
Install the transmission fluid drain plug.

- Tighten to 47 Nm.

13. Lower the vehicle.

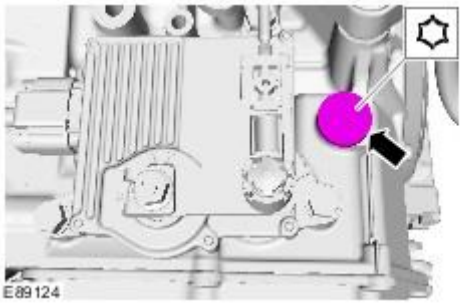
14. Fill the transmission with the correct fluid until it runs from the level plug.

15. Install the transmission fluid level plug.



- Tighten to 7 Nm.

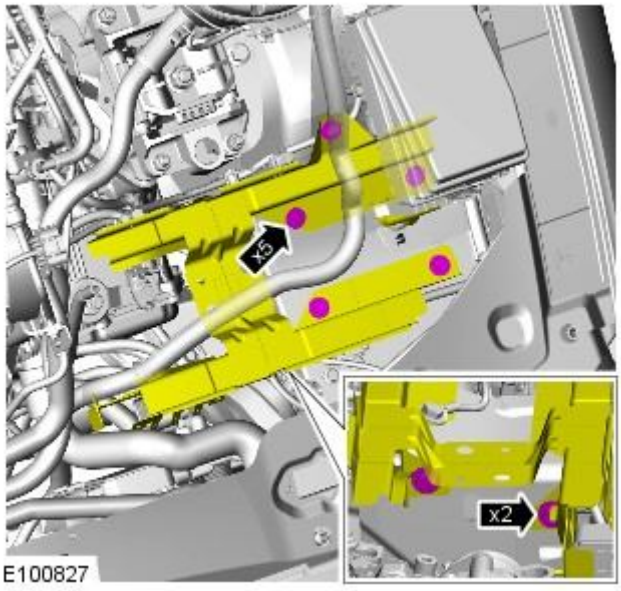
16. Add an additional 0.5 litres of transmission fluid.



17. CAUTION: A new O-ring seal is to be installed.

Install the transmission fluid filler plug.

- Tighten to 40 Nm.



18. Secure the battery carrier bracket.

- Tighten to 25 Nm.

19. Install the battery tray.
For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

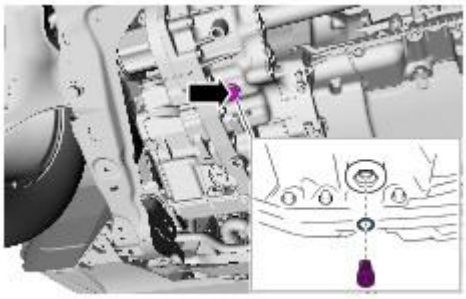
20. Connect the Jaguar approved diagnostic equipment. Start and run the engine.

21. Using the diagnostic equipment to monitor the transmission fluid temperature, allow the temperature to reach 60 degrees C.

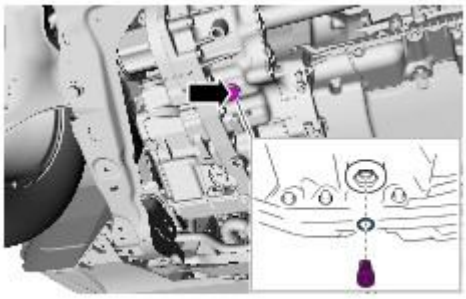
22. Move the selector lever from 'P' through all the gear positions, pausing in each gear position for 2-3 seconds and return to the 'P' position.

23. Raise the vehicle.

24. Remove the transmission fluid level plug.



25. With the engine running a small amount of fluid should drip out of the level plug.



26. CAUTION: A new O-ring seal is to be installed.

Install the transmission fluid level plug.

- Tighten to 7 Nm.

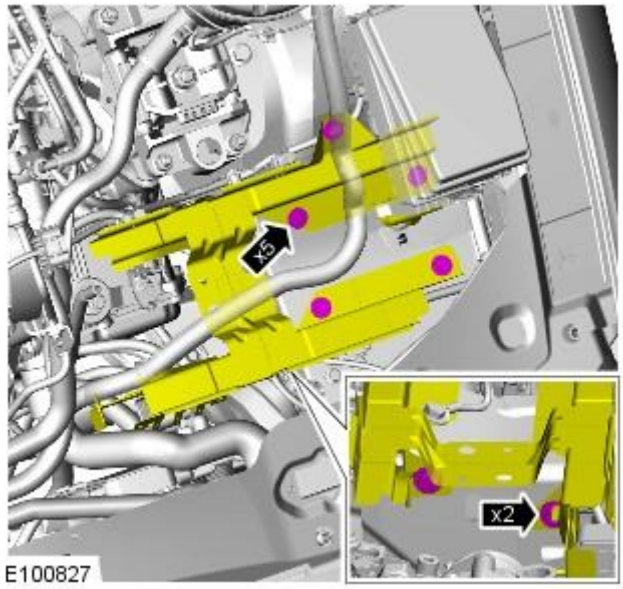
27. Install the air deflector.
For additional information, refer to: Air Deflector - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (501-02 Front End Body Panels, Removal and Installation).

Automatic Transmission / Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Transmission Fluid Level Check

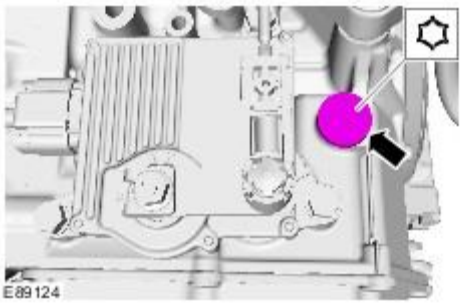
General Procedures

WARNING: Observe due care when draining, as the fluid can be very hot.

1. Ensure that the automatic transmission is in 'P' and the handbrake is fully applied.
2. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
3. Release the battery carrier bracket and position aside.



4. Clean the area around the transmission fluid filler plug.



5. CAUTION: The fluid level plug and drain plug both use the same point on the transmission. The inner plug is for level indication and the outer plug is to drain the fluid.

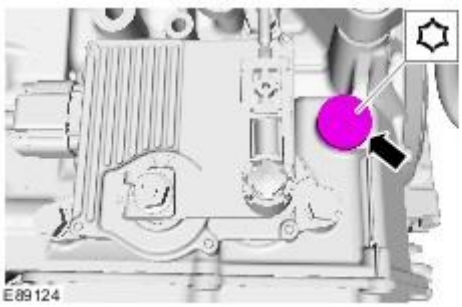
   Remove the transmission fluid filler plug.

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

• NOTE: Make sure that the vehicle is standing on a level surface.

   Raise and support the vehicle.

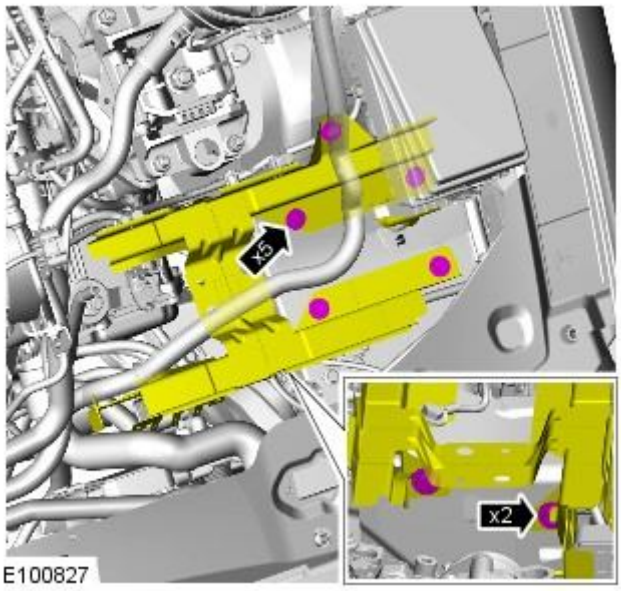
7. Remove the air deflector.
   For additional information, refer to: Air Deflector - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (501-02 Front End Body Panels, Removal and Installation).
8. Clean the area around the transmission fluid level plug.
9. Place a container under the transmission.
10. Lower the vehicle.
11. Add 0.5 litres of transmission fluid.



12. CAUTION: A new O-ring seal is to be installed.

    Install the transmission fluid filler plug.

    - Tighten to 40 Nm.



13. Secure the battery carrier bracket.

- Tighten to 25 Nm.

14. Install the battery tray.
For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

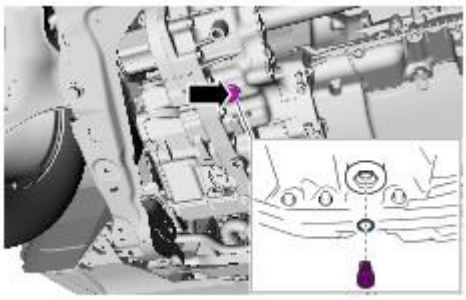
15. Connect the Jaguar approved diagnostic equipment. Start and run the engine.

16. Using the diagnostic equipment to monitor the transmission fluid temperature, allow the temperature to reach 60 degrees C.

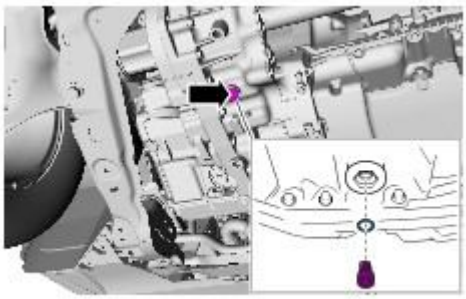
17. Move the selector lever from 'P' through all the gear positions, pausing in each gear position for 2-3 seconds and return to the 'P' position.

18. Raise the vehicle.

19. Remove the transmission fluid level plug.



20. With the engine running a small amount of fluid should drip out of the level plug.



21. CAUTION: A new O-ring seal is to be installed.

Install the transmission fluid level plug.

- Tighten to 7 Nm.

22. Install the air deflector.
For additional information, refer to: Air Deflector - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (501-02 Front End Body Panels, Removal and Installation).

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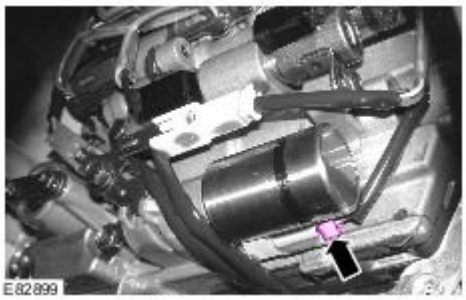
Automatic Transmission / Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Main Control Valve Body

In-vehicle Repair

Removal

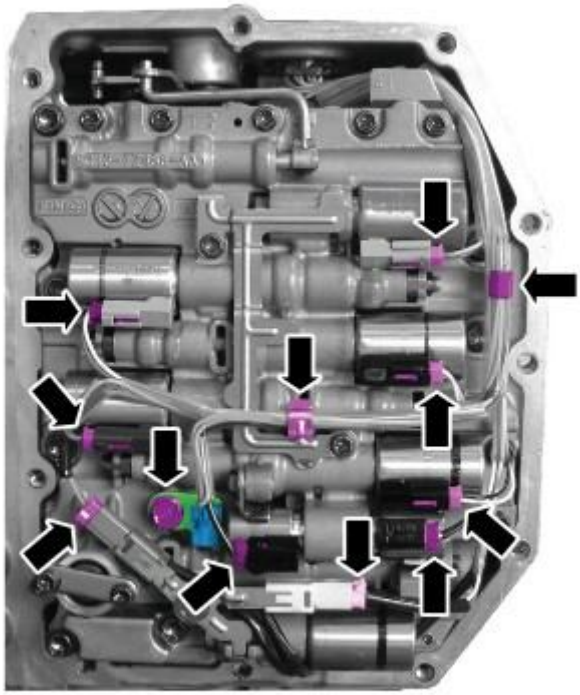
1. Raise and support the vehicle.
2. Remove the transmission fluid pan.
   For additional information, refer to: Transmission Fluid Pan (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, In-vehicle Repair).
3. Disconnect the electrical connector.



4. NOTE: Note the position of the electrical connectors.

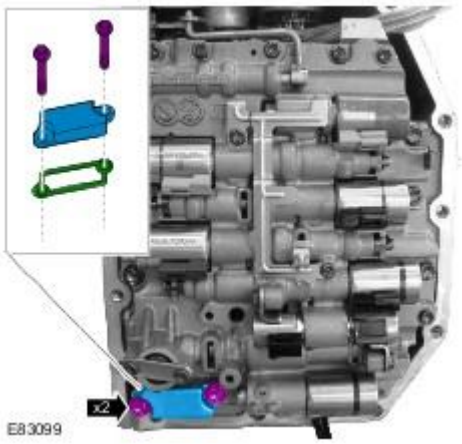
   Release the transmission internal wiring harness.

   - Remove the bolt.
   - Release from the clip.
   - Disconnect the 9 electrical connectors.



5. NOTE: Make sure that the tape has not detached from the edges of the component.

   Position the wiring harness aside.



6. CAUTION: Discard the bolts.

Remove the suction cover.

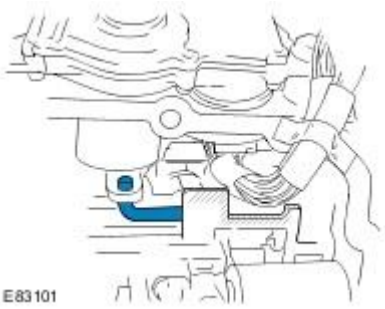
- Remove the 2 bolts.
- Remove and discard the gasket.

7. CAUTION: Discard the bolts.

• NOTE: With every pass, undo the bolts one turn at a time alternately.

Release the transmission main control valve body.

- Remove the 6 bolts.

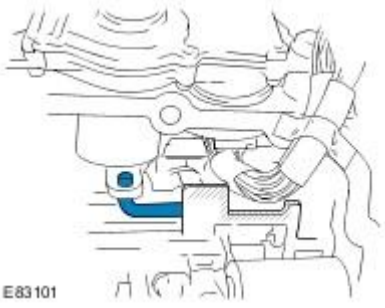


8. CAUTION: Make sure that no components fall off during removal.

Remove the transmission main control valve body.

- Release the selector selector rod.

Installation



1. Install the transmission main control valve body.

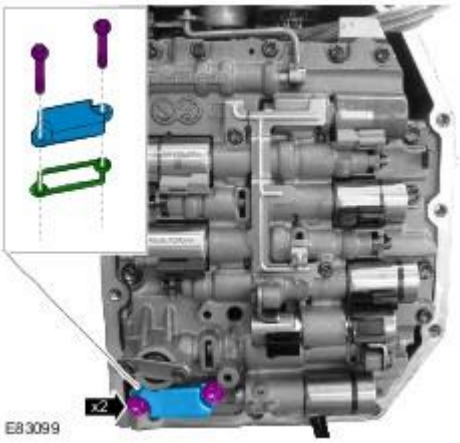
- Attach the selector rod.

2. CAUTIONS:

Make sure that new bolts are installed.

Only tighten the bolts finger-tight at this stage.

Secure the transmission main control valve body.



3. CAUTIONS:

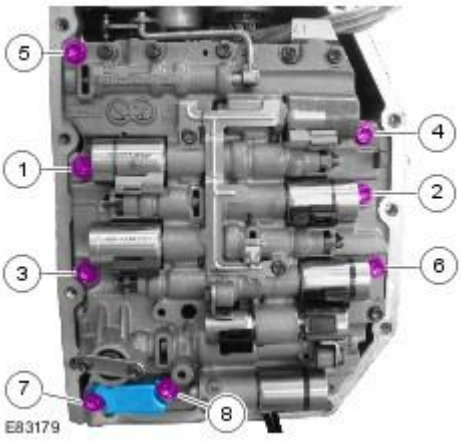
Make sure that new bolts are installed.

Only tighten the bolts finger-tight at this stage.

• NOTE: Install a new gasket.

Install the suction cover.

- Install the bolts.



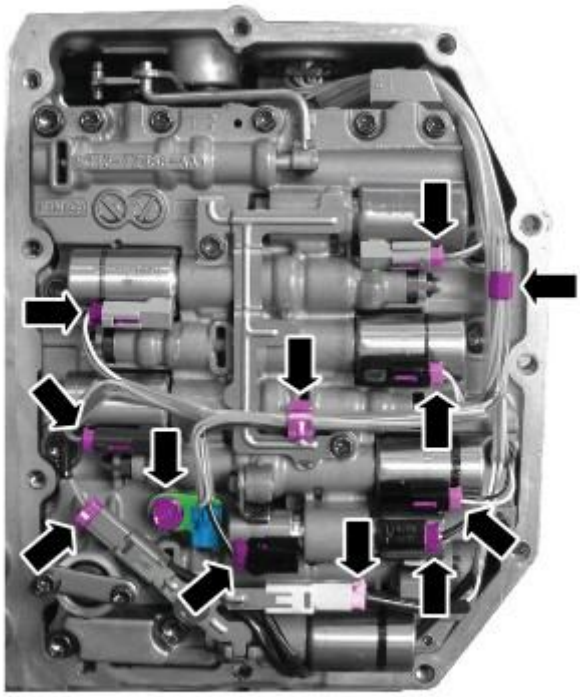
4. NOTE: Install a new gasket.

Tighten the bolts to 10 Nm.

5. CAUTION: Make sure that these components are installed to the noted removal position.

Secure the transmission internal wiring harness.

- Secure in the clips.
- Connect the electrical connectors.
- Tighten the bolt to 10 Nm.



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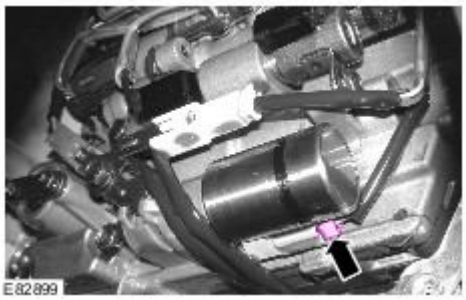
6. Connect the electrical connector.



7. Install the transmission fluid pan.
For additional information, refer to: Transmission Fluid Pan (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, In-vehicle Repair).

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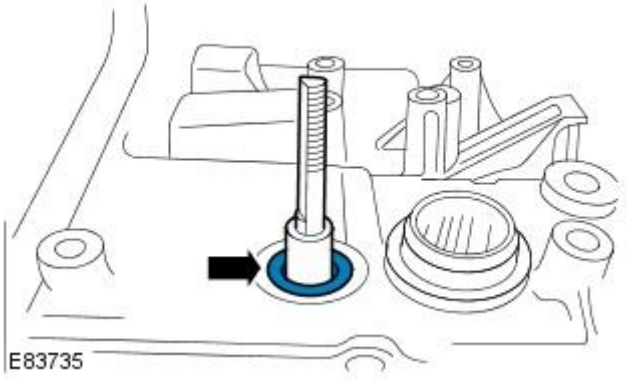
Automatic Transmission / Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Selector Shaft Seal

In-vehicle Repair

Removal

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



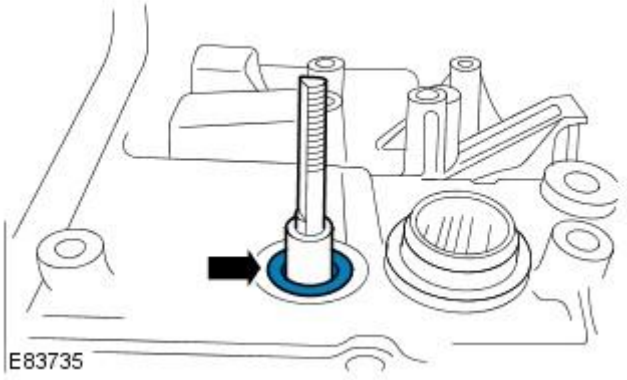
1. Disconnect the battery ground cable.
   For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the transmission control module (TCM).
   For additional information, refer to: Transmission Control Module (TCM) (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, In-vehicle Repair).
3. CAUTIONS:

   Take extra care not to damage the mating faces.

   Make sure that a new component is installed.

   Remove the transmission selector shaft seal.

Installation



1. CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Install the seal, flush with the transmission case.

   Install the transmission selector shaft seal.
2. Install the transmission control module (TCM).
   For additional information, refer to: Transmission Control Module (TCM) (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, 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).

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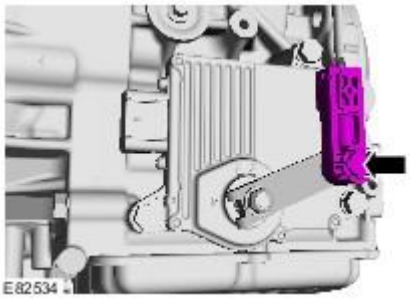
Automatic Transmission / Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Transmission Control Module (TCM)

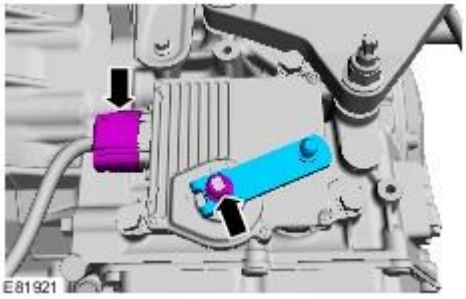
In-vehicle Repair

Removal

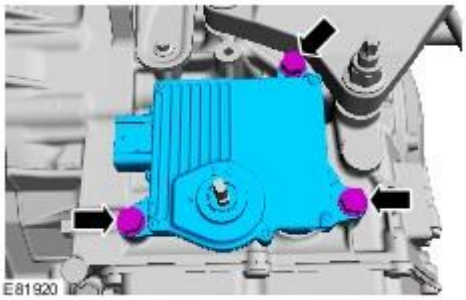
1. Remove the cover and disconnect the battery ground cable.
   For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
3. Release and disconnect the selector lever cable.



4. Remove the transmission selector lever and disconnect the electrical connector.
   - Remove the nut.



5. Remove the transmission control module (TCM).
   - Remove the 3 bolts.



Installation

1. CAUTIONS:

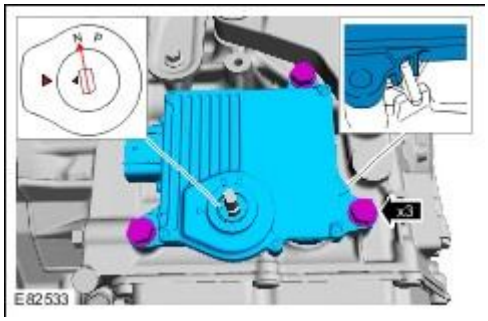
Make sure that the terminals or pins/sockets of the transmission control module (TCM) and the TCM connector are not bent or damaged.

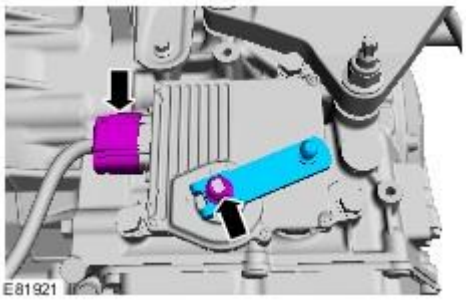
The component must be aligned with the installation markings.

• NOTE: The new transmission control module (TCM) is set in the N position at the factory.

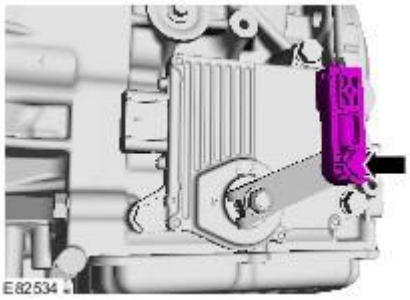
Install the transmission control module (TCM).

- Tighten the bolts to 24 Nm.





2. Install the transmission selector lever and connect the electrical connector.
   - Tighten the nut to 13 Nm.



3. Secure and connect the selector lever cable.

4. Install the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
5. 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).
6. If a new component has been installed, configure using Jaguar approved diagnostic equipment.

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Automatic Transmission / Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Transmission Internal Wiring Harness

In-vehicle Repair

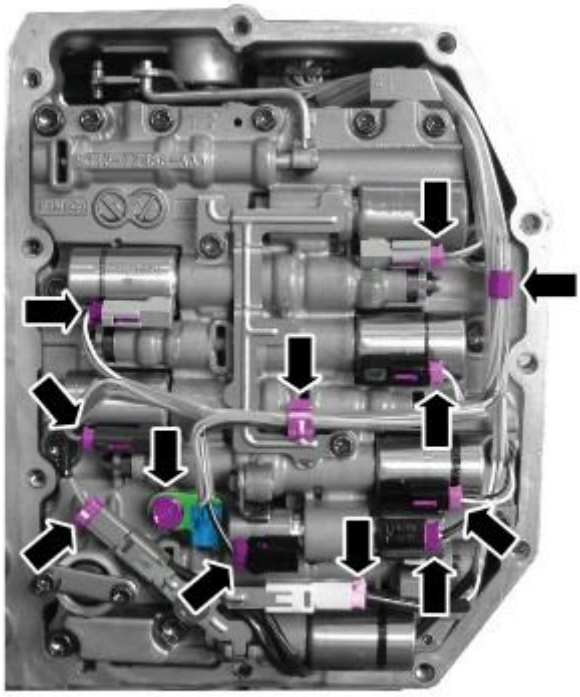
Removal

1. Raise and support the vehicle.
2. Remove the transmission control module (TCM).
   For additional information, refer to: Transmission Control Module (TCM) (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, In-vehicle Repair).
3. Remove the transmission fluid pan.
   For additional information, refer to: Transmission Fluid Pan (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, In-vehicle Repair).
4. Disconnect the electrical connector.

5. NOTE: Note the position of the electrical connectors.

   Release the transmission internal wiring harness.

   - Remove the bolt.
   - Release from the clip.
   - Disconnect the 9 electrical connectors.



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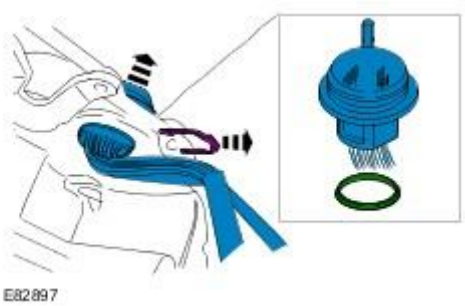
6. CAUTION: Make sure that the wiring harness does not catch.

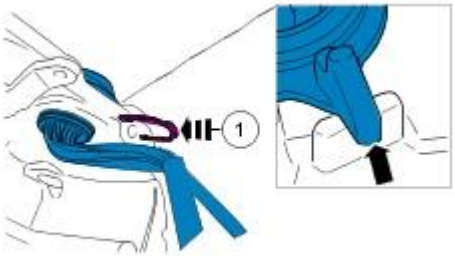
   Remove the transmission internal wiring harness.

   - Remove the clip.



E82897

Installation



E82898

1. CAUTIONS:

⚠ Make sure that the wiring harness does not catch.

⚠ The component must be aligned with the installation markings.

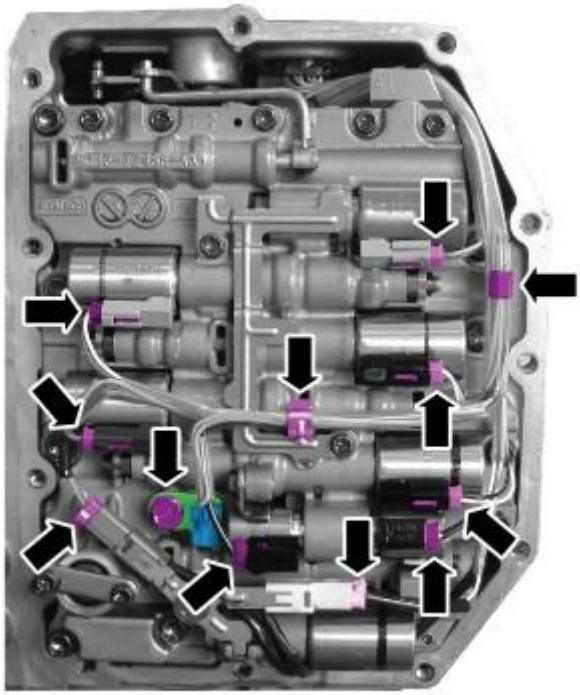
Install the transmission internal wiring harness.

- Secure with the clip.

2. ⚠ CAUTION: Make sure that these components are installed to the noted removal position.

Secure the transmission internal wiring harness.

- Connect the electrical connectors.
- Tighten the bolt to 10 Nm.
- Secure in the clip.



E101212

3. Connect the electrical connector.

E82899

4. Install the transmission fluid pan.
For additional information, refer to: Transmission Fluid Pan (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, In-vehicle Repair).

5. Install the transmission control module (TCM).
For additional information, refer to: Transmission Control Module (TCM) (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, In-vehicle Repair).

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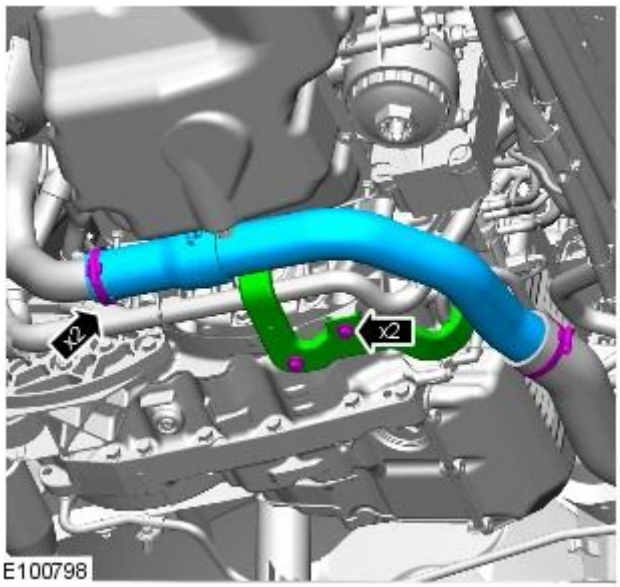
Automatic Transmission / Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Transmission Fluid Pan

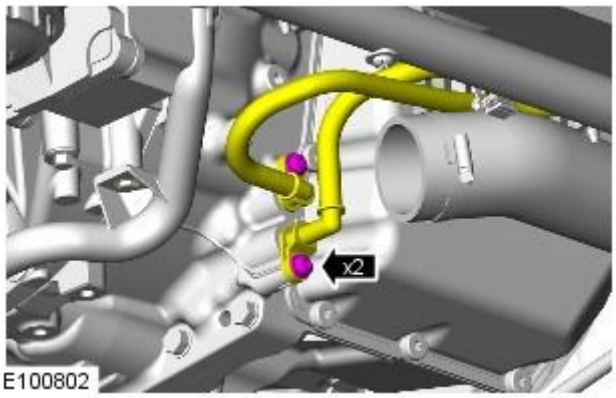
In-vehicle Repair

Removal

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



1. Raise and support the vehicle.
2. Drain the transmission fluid.
   For additional information, refer to: Transmission Fluid Drain and Refill (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).
3. Remove the charge air cooler intake pipe.
   - Release the 2 hose clips.
   - Remove the 2 bolts.

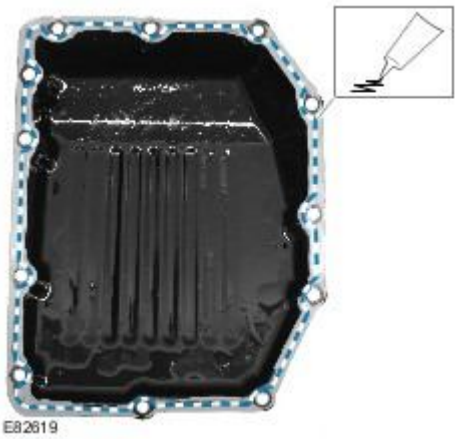


4. Position the charge air cooler intake hose aside.
5. Disconnect the 2 transmission fluid cooler tubes.
   - Remove the 2 Torx bolts.
   - Position aside.

6. CAUTION: Take extra care not to damage the mating faces.

   Remove the transmission fluid pan.
   - Remove the 12 bolts.
   - Slacken the transmission fluid pan with a plastic hammer, avoid distorting the pan.

Installation

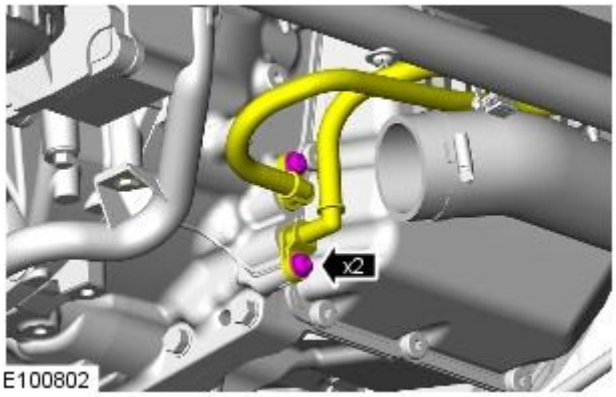


1. CAUTION: Make sure that the mating faces are clean and free of foreign material.

Apply silicone rubber sealant to the transmission fluid pan.

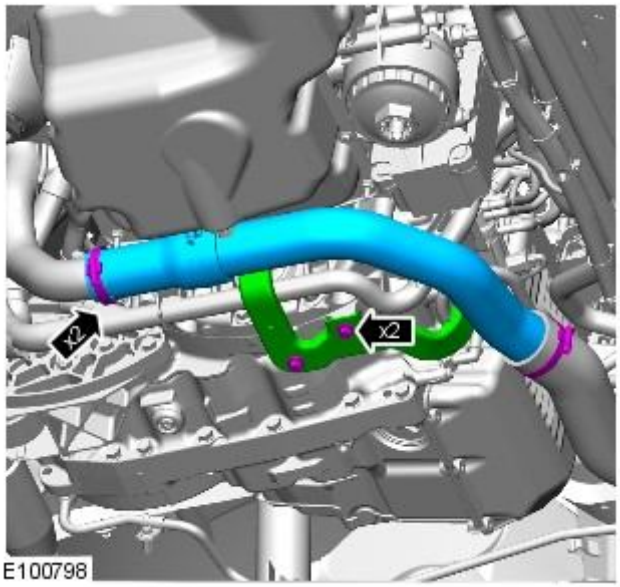
2. Install the transmission fluid pan.

- Apply Loctite 243 to the transmission fluid pan bolt threads.
- Tighten to 13 Nm.



3. Connect the transmission fluid cooler tubes.

- Tighten to 25 Nm.



4. Install the charge air cooler intake pipe.

- Tighten the hose clips.
- Tighten the bolts to 35 Nm.

5. Refill the transmission with fluid.
For additional information, refer to: Transmission Fluid Drain and Refill (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

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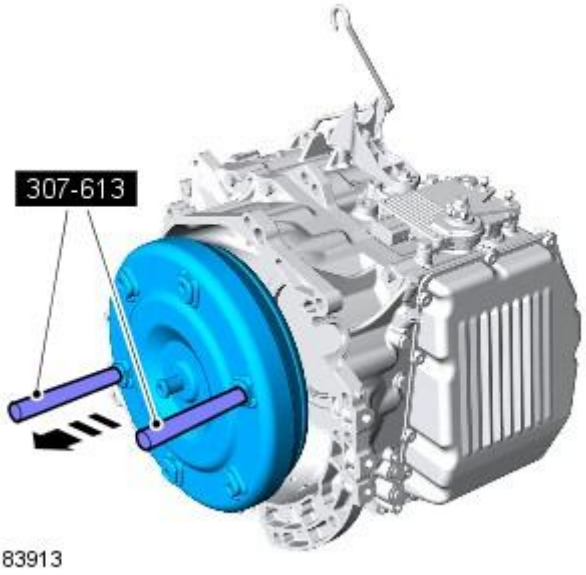
Automatic Transmission / Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Torque Converter

Removal and Installation

Removal



E83913

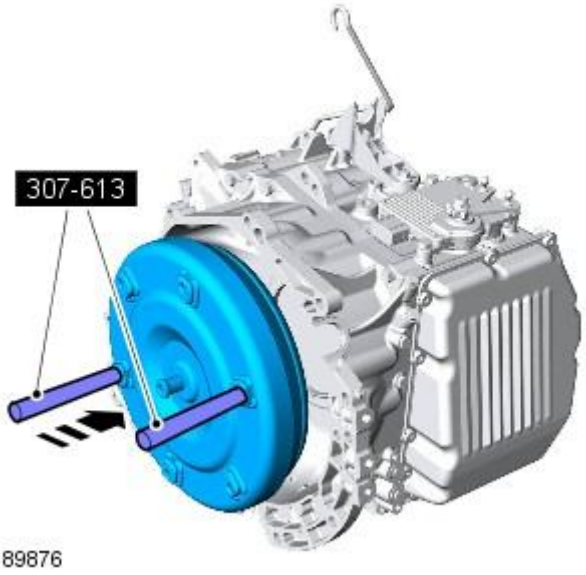
1. Raise and support the vehicle.

2. Remove the transmission.
For additional information, refer to: Transmission (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Removal).

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

Using the special tools, remove the torque converter.

Installation



E89876

1. CAUTIONS:

Align the torque converter and oil pump drive before installing the torque converter.

Make sure that the mating faces are clean and free of foreign material.

Take extra care when handling the component.

Install the torque converter.

2. Install the transmission.
For additional information, refer to: Transmission (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Removal).

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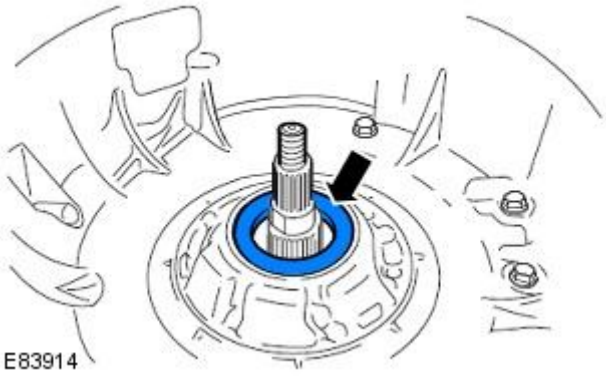
Automatic Transmission / Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Torque Converter Seal

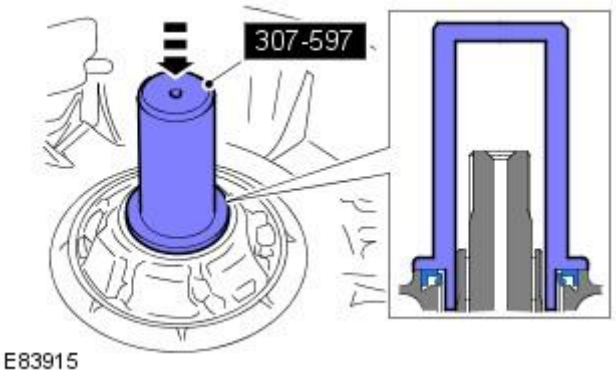
Removal and Installation

Removal


E83914

1. Raise and support the vehicle.
2. Remove the torque converter.
   For additional information, refer to: Torque Converter (307-01, Removal and Installation).
3. Carefully remove and discard the torque converter seal.

Installation



E83915

1. CAUTIONS:

   Extreme cleanliness must be exercised when handling this component.

   Make sure that the mating faces are clean and free of foreign material.

   Using the special tool, install a new torque converter seal.

2. CAUTIONS:

   Align the torque converter and oil pump drive before installing the torque converter.

   Make sure that the mating faces are clean and free of foreign material.

   Take extra care when handling the component.

   Install the torque converter.
   For additional information, refer to: Torque Converter (307-01, Removal and Installation).

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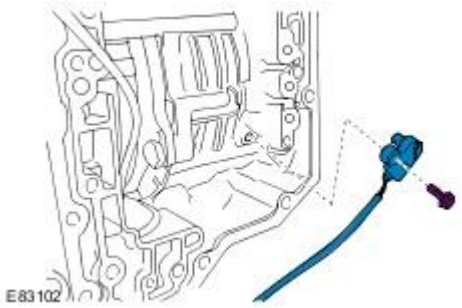
Automatic Transmission / Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Turbine Shaft Speed (TSS) Sensor

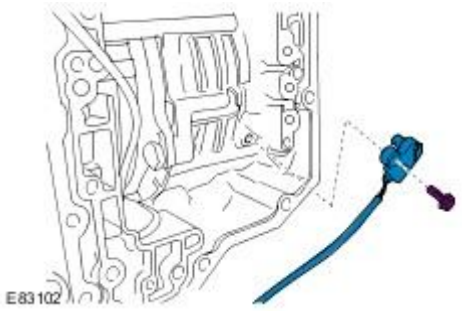
Removal and Installation

Removal



1. Remove the main control valve body.
   For additional information, refer to: Main Control Valve Body (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, In-vehicle Repair).
2. Remove the turbine shaft speed (TSS) sensor.
   - Remove the bolt.
   - Release the sensor from the transmission.

Installation



1. To install, reverse the removal procedure.
   - Tighten to 6 Nm.

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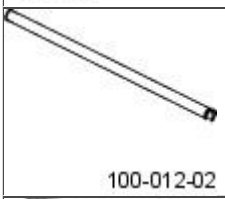
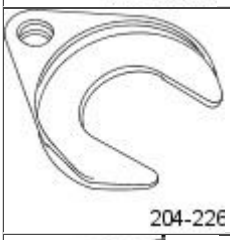
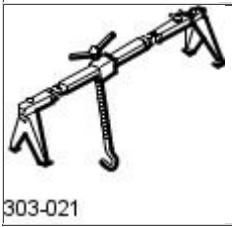
Automatic Transmission / Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Transmission

Removal

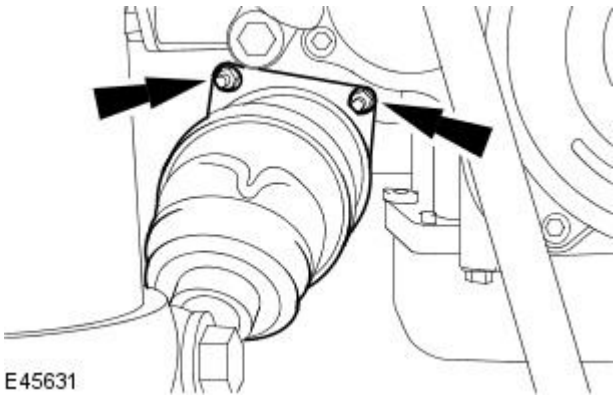
Special Tool(s)	
	Impulse extractor 100-012(LRT-99-004)
	Slide Hammer Shaft - 100-012-02
	Halfshaft Remover Fork - 204-226
	Power train assembly jack HTJ1200-2
	Engine support bracket 303-021

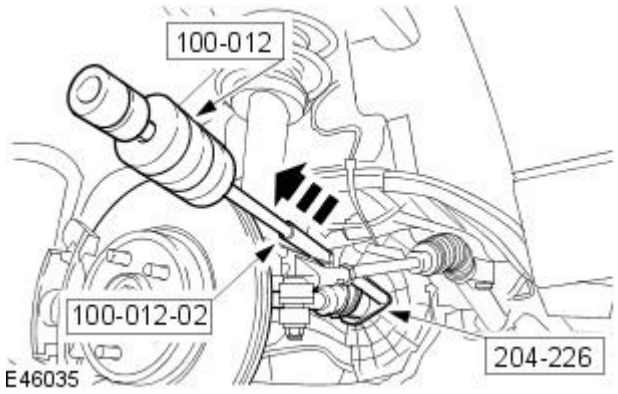
Removal

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 battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
3. Raise the vehicle.
4. Remove the front subframe.
   For additional information, refer to: Front Subframe - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
5. Drain the transmission fluid.
   For additional information, refer to: Transmission Fluid Drain and Refill (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).
6. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

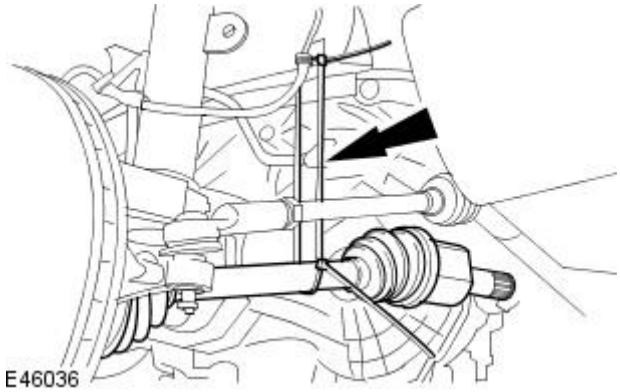
   Release the RH halfshaft.

   - Release the RH halfshaft from the transmission.
   - Secure the RH halfshaft to one side.



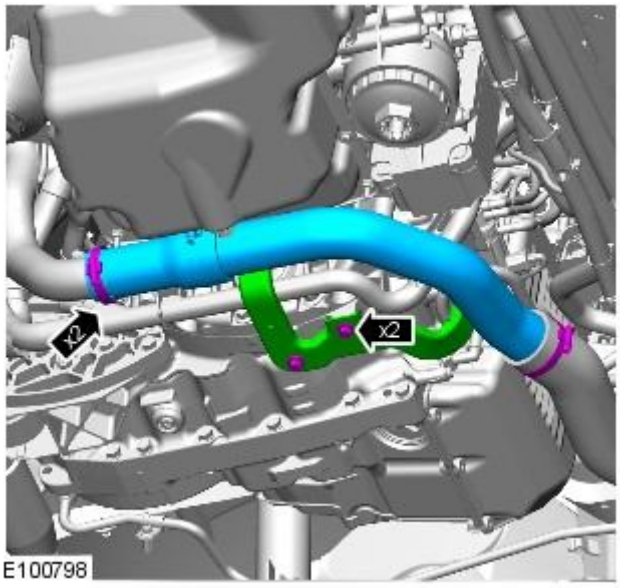


7. Using the special tools, release the LH halfshaft.



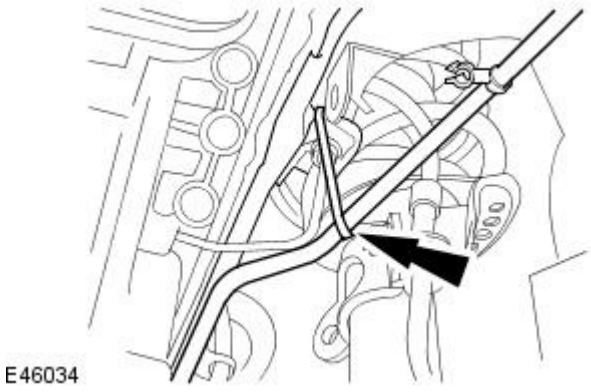
8. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

Using a suitable tie strap, support the LH halfshaft.



9. Remove the charge air cooler intake pipe.

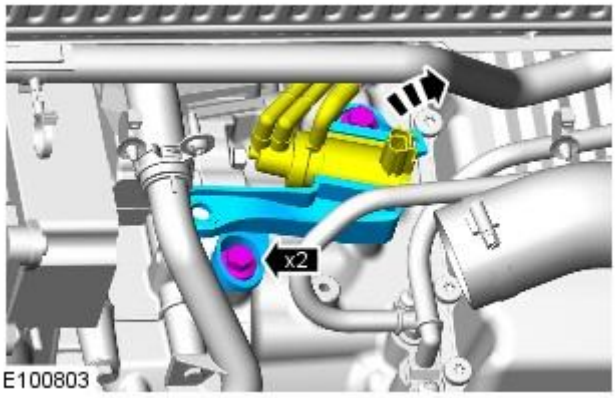
- Release the 2 hose clips.
- Remove the 2 bolts.



10. Support the power steering fluid pipe.

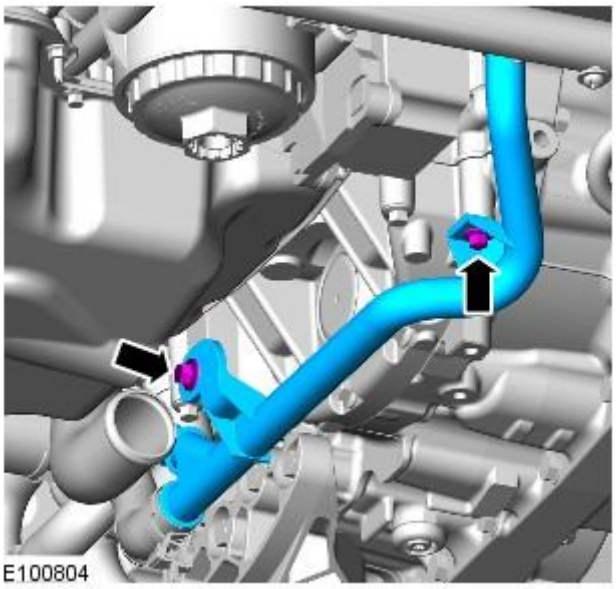
11. Release the emission control valve.

- Remove the 2 bolts.
- Position aside.

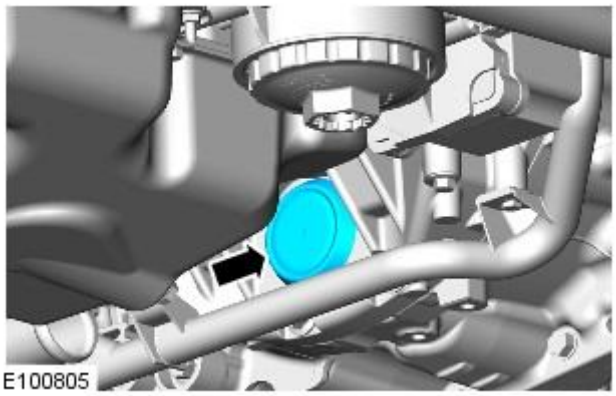


12. Release coolant pipe from the engine.

- Remove the 2 bolts.

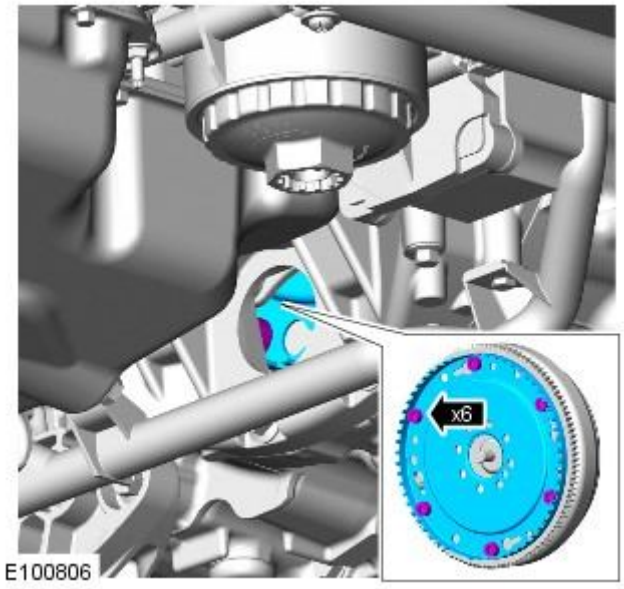


13. Remove the flexplate cover.



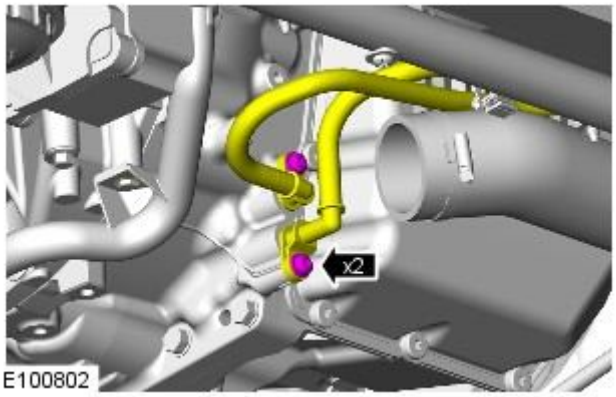
14. Release the torque convertor from the flexplate.

- Remove the 6 bolts.



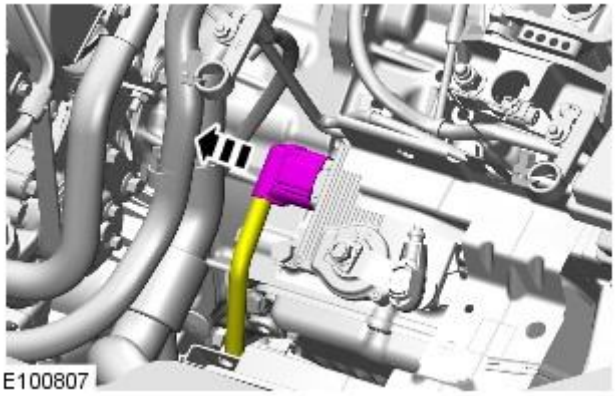
15. Disconnect the 2 transmission fluid cooler tubes.

- Remove the 2 Torx bolts.
- Position aside.



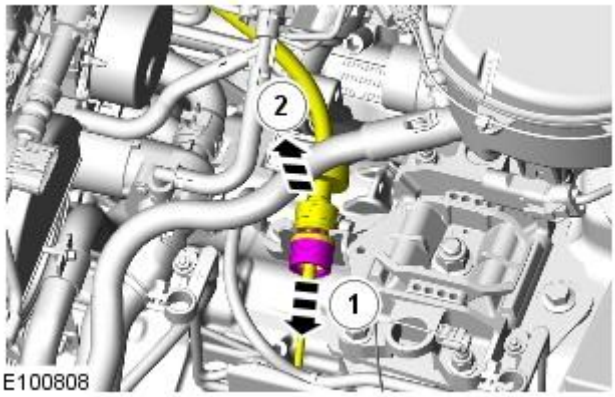
16. Lower the vehicle.

17. Disconnect the transmission control module (TCM) electrical connector.



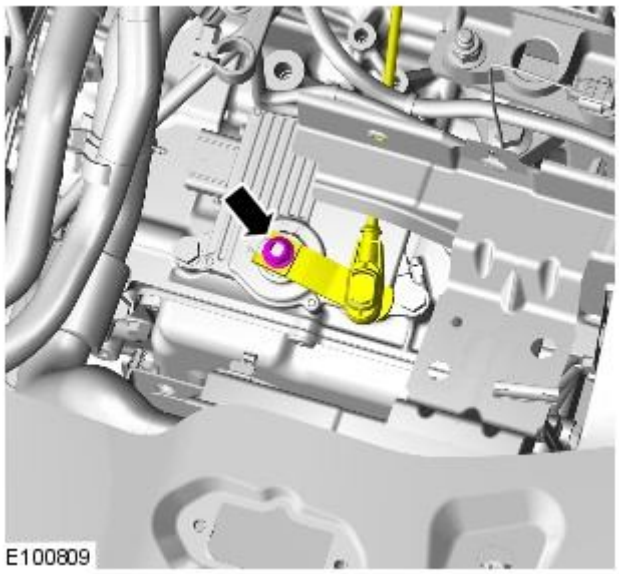
18. Release the transmission selector cable from the bracket.

- Release the locking sleeve and release from the bracket.



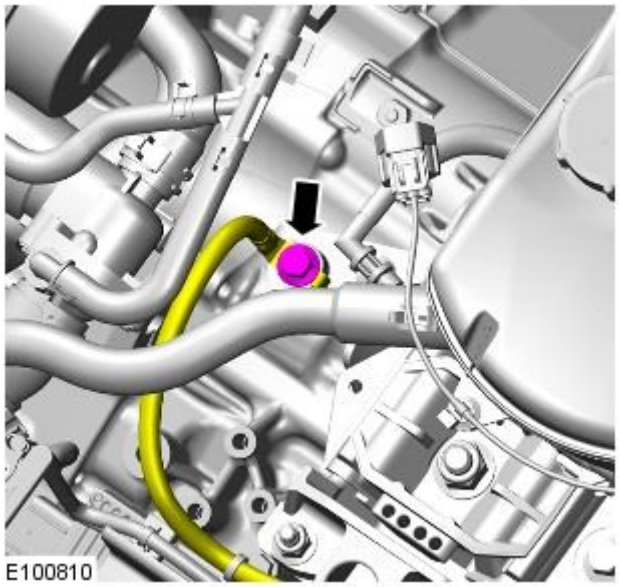
19. Release the transmission selector lever cable from the TCM.

- Remove the nut.
- Release the selector cable and lever.
- Position aside.

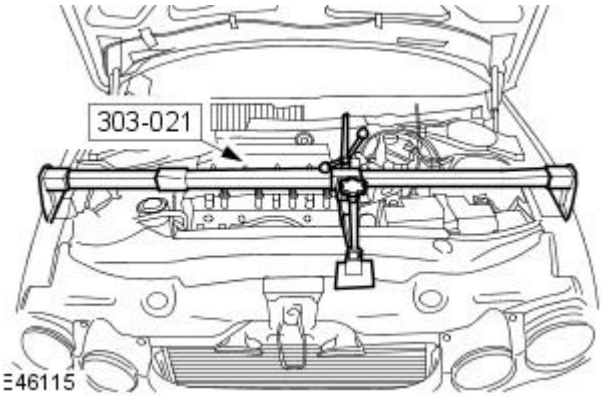


20. Disconnect the battery ground cable.

- Remove the bolt.

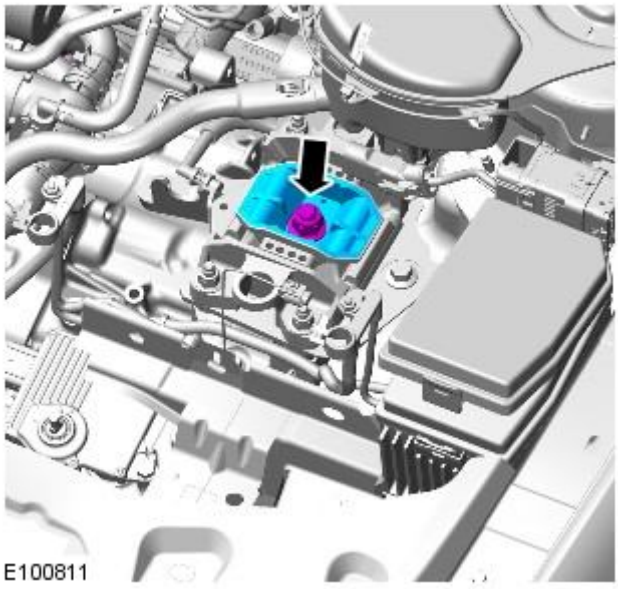


21. Using the special tool, support the engine and transmission assembly.



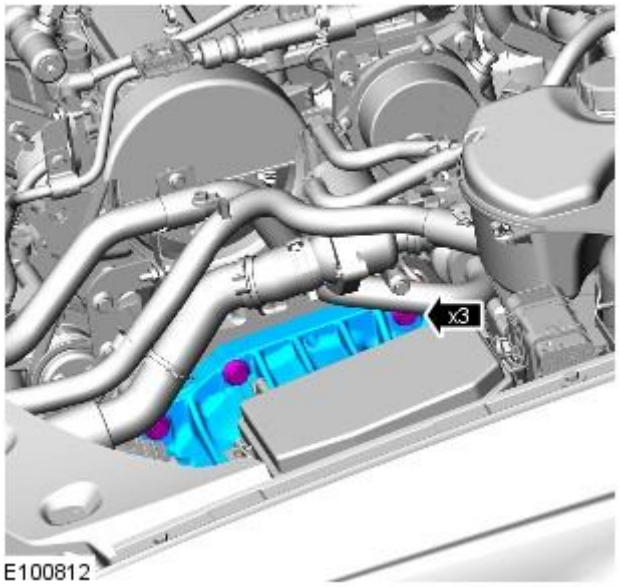
22. Release the transmission mounting.

- Remove the nut.



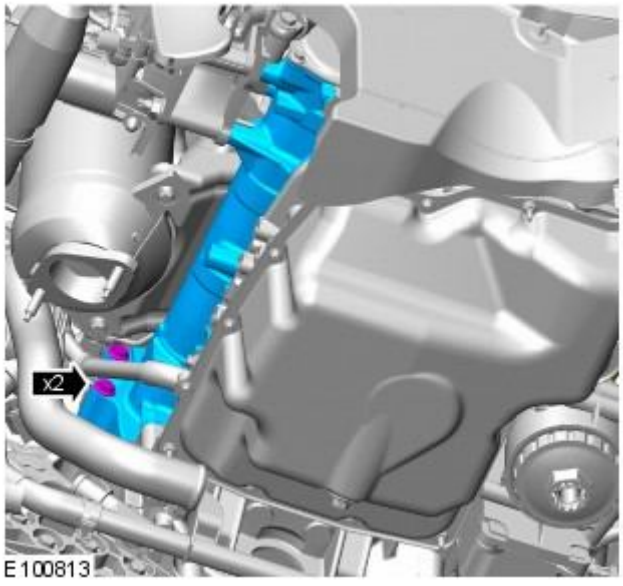
23. Lower the engine sufficiently allowing the transmission assembly to clear the mounting.

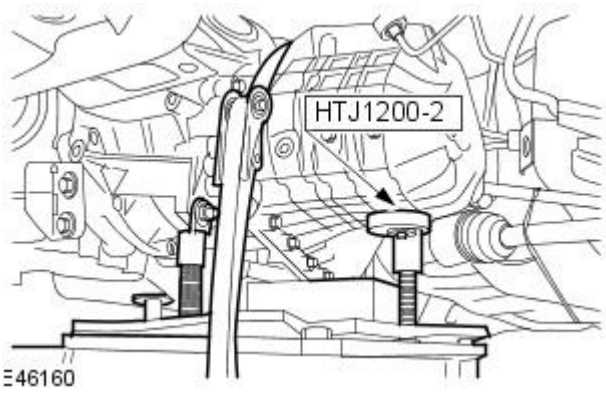
24. Remove the 3 transmission assembly upper bolts.



25. Raise the vehicle.

26. Remove the 2 transmission assembly rear bolts.

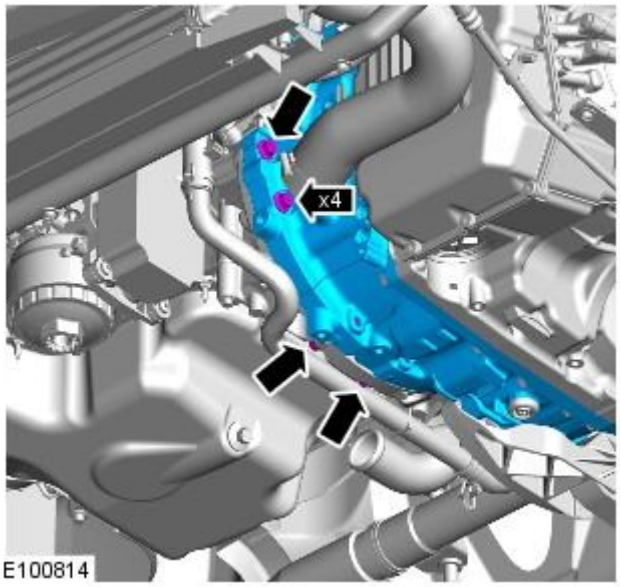




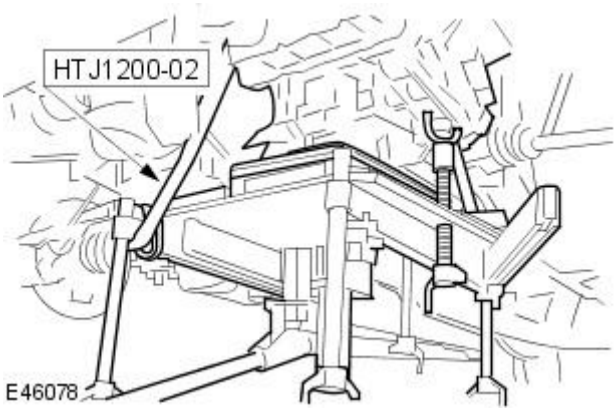
27. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Align the powertrain assembly jack to the transmission.

- Secure the transmission to the powertrain assembly jack.



28. Remove the 4 transmission assembly lower bolts.



29. Remove the transmission.

- Detach the transmission from the drive plate.
- Lower the powertrain assembly jack and transmission assembly.

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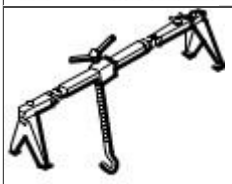
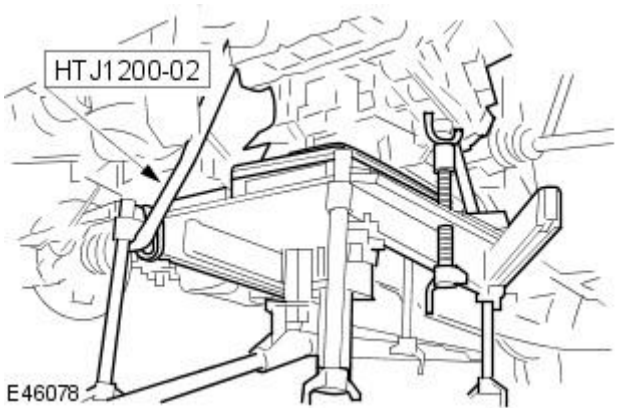
Automatic Transmission / Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Transmission

Installation

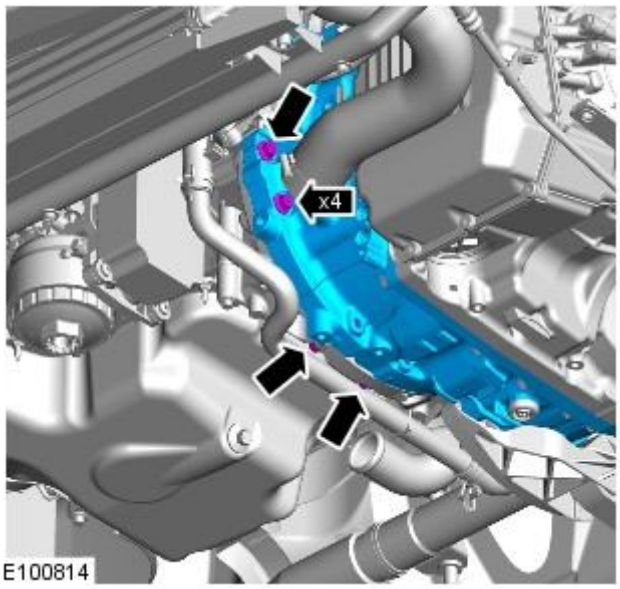
Special Tool(s)	
 HTJ12002	Power train assembly jack HTJ1200-2
 303-021	Engine support bracket 303-021

Installation



1. Install the transmission.

- Raise the powertrain assembly jack and transmission assembly.

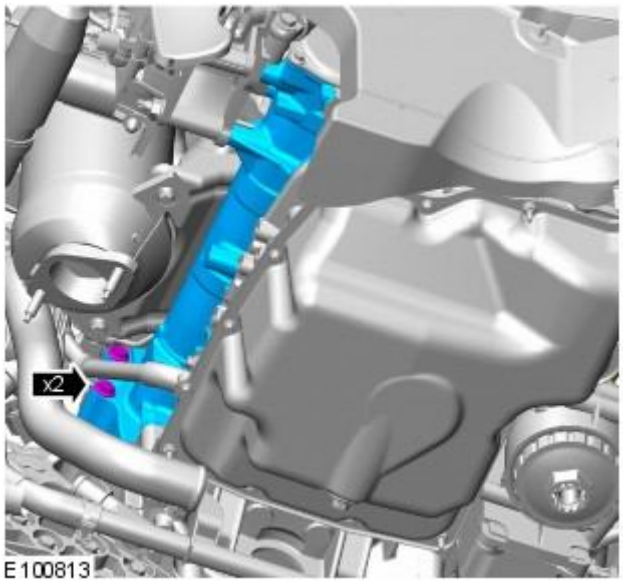


2. Install the transmission assembly lower bolts.

- Tighten the bolts to 48 Nm.

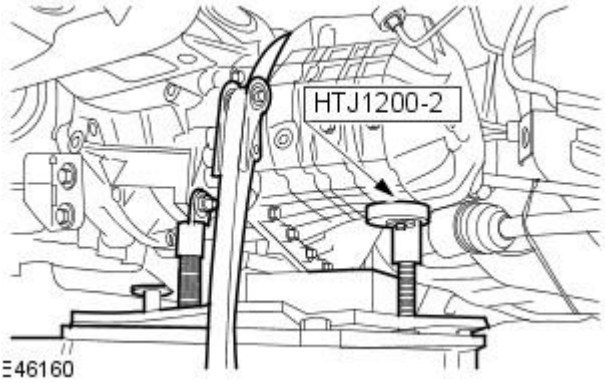
3. Install the transmission assembly rear bolts.

- Tighten the bolts to 48 Nm.



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

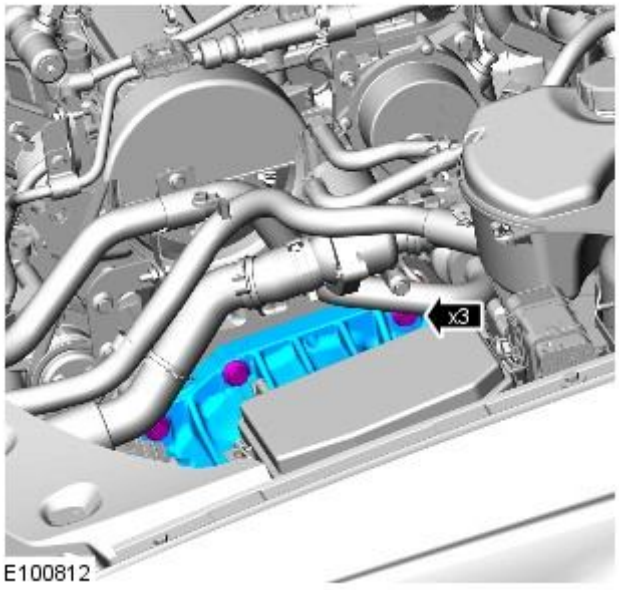
Remove the powertrain assembly jack.



5. Lower the vehicle.

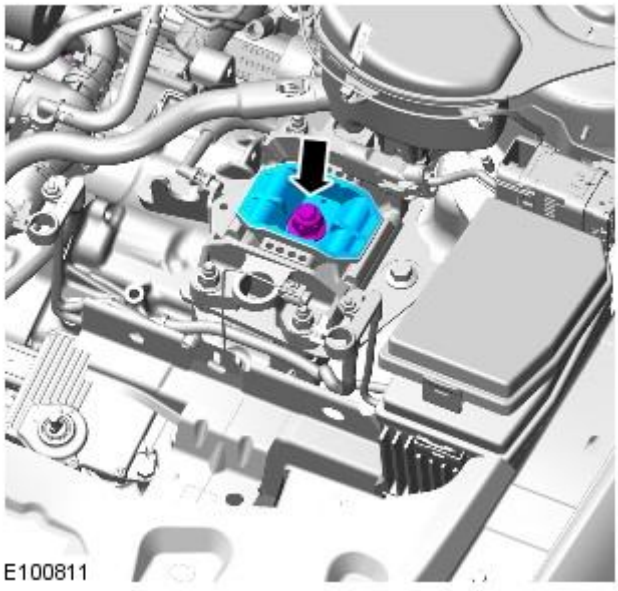
6. Install the transmission assembly upper bolts.

- Tighten the bolts to 48 Nm.

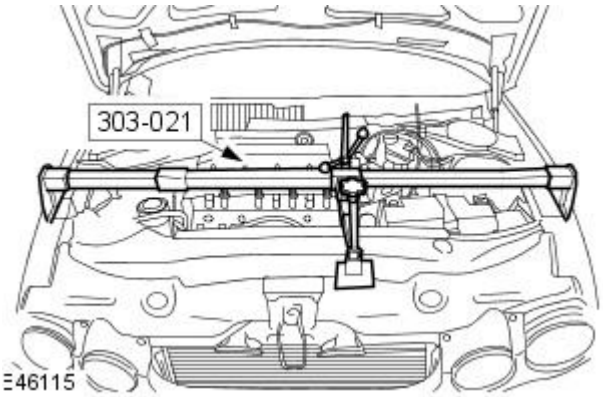


7. Raise the engine and transmission assembly onto the mounting.

- Tighten the nut to 130 Nm.

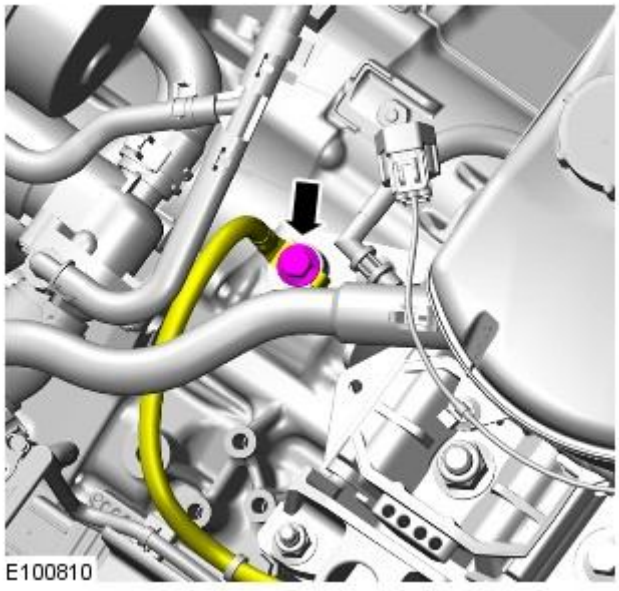


8. Remove the special tool.



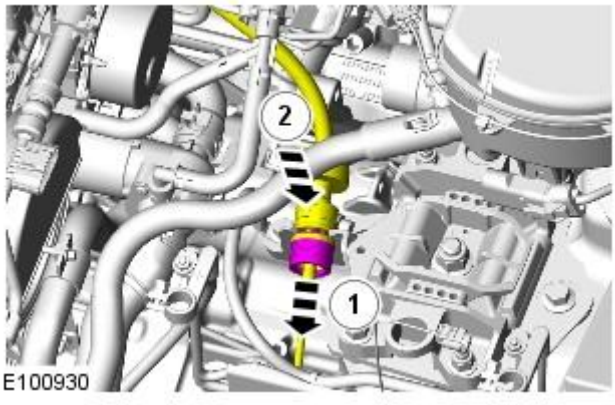
9. Attach the battery ground cable.

- Tighten the bolt to 25 Nm.



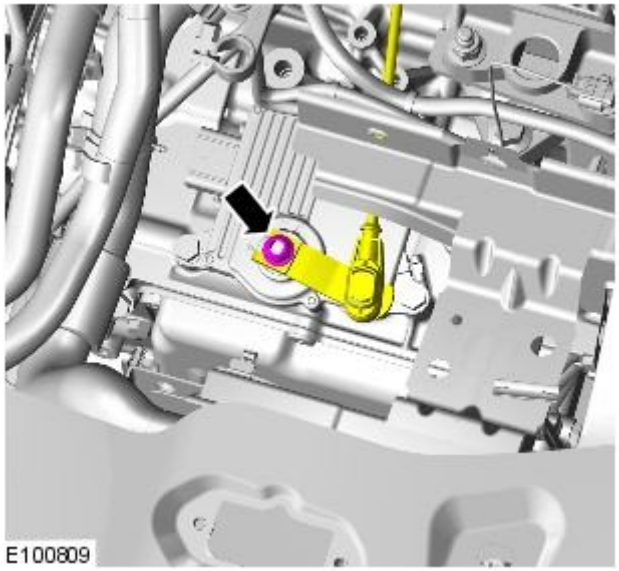
10. Attach the transmission selector cable to the bracket.

- Release the locking sleeve and attach to the bracket.

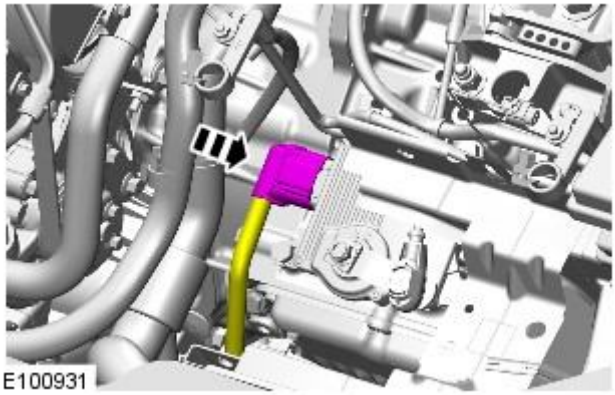


11. Attach the transmission selector cable and lever to the transmission control module (TCM).

- Tighten the nut to 13 Nm.



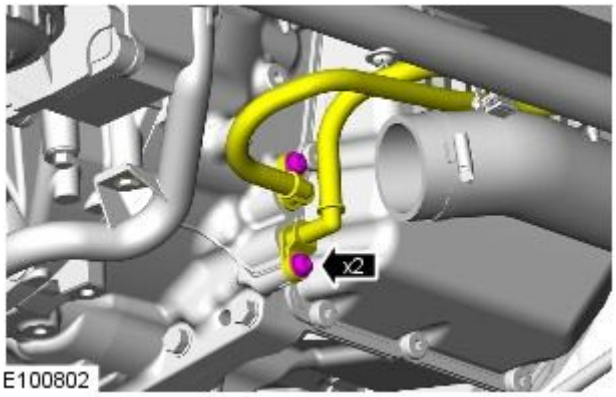
12. Connect the TCM electrical connector.



13. Raise the vehicle.

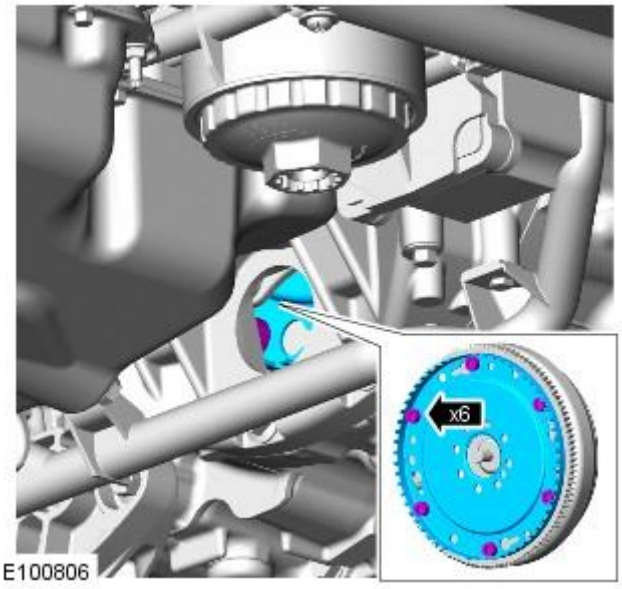
14. Connect the transmission fluid cooler tubes.

- Tighten the bolts to 10 Nm.

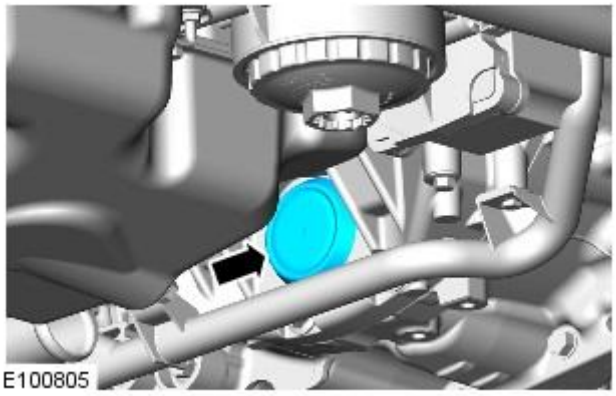


15. Secure the torque convertor to the flexplate.

- Tighten the bolts 60 Nm.

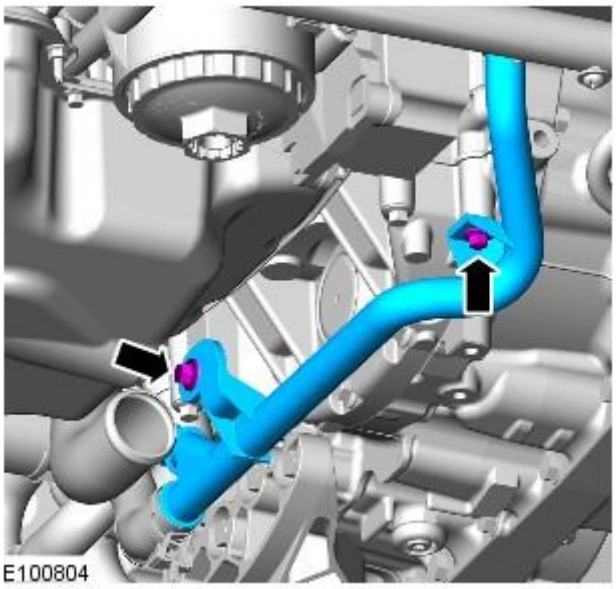


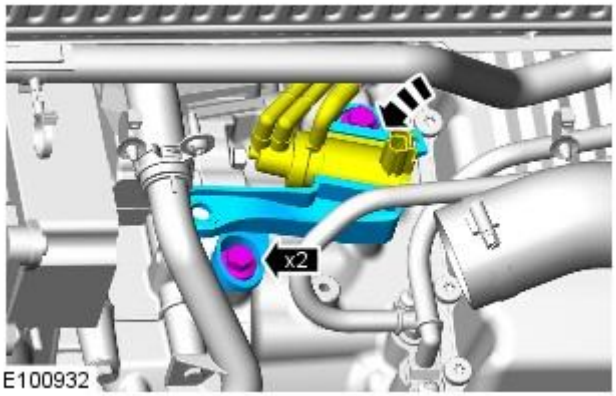
16. Install the flexplate cover.



17. Secure the coolant pipe to the engine.

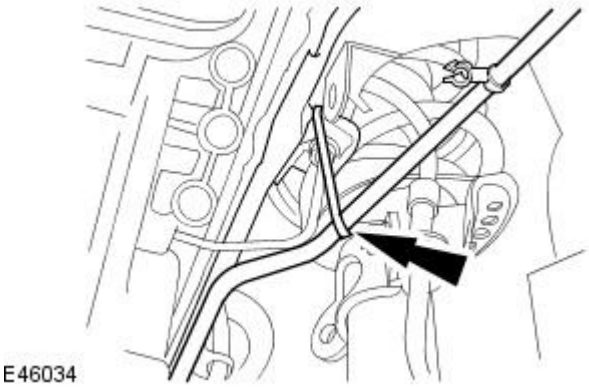
- Tighten the bolts to 10 Nm.



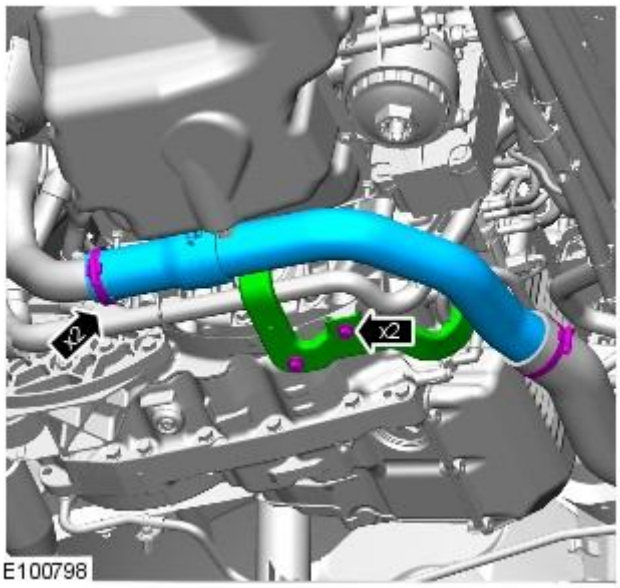


18. Secure the emission control valve.

- Tighten the bolts to 30 Nm.

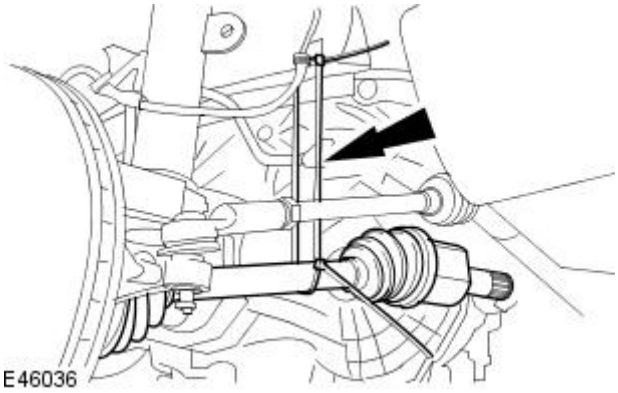


19. Release the power steering fluid pipe.



20. Install the charge air cooler intake pipe.

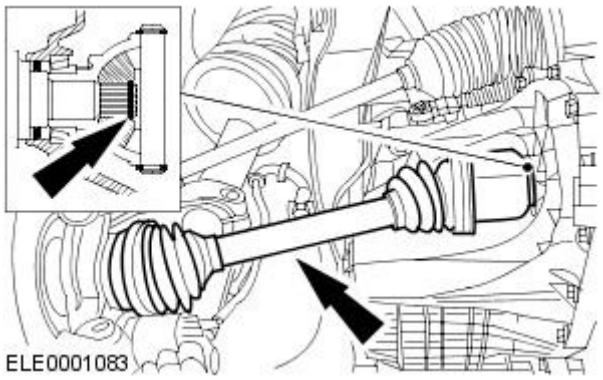
- Tighten the hose clips.
- Tighten the bolts to 35 Nm.

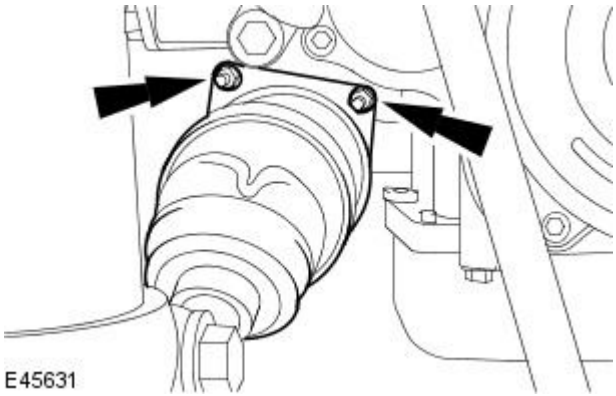


21. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

Release the LH halfshaft.

22. Attach the LH halfshaft to the transmission.





23. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

Attach the RH halfshaft to the transmission.

- Engage the RH halfshaft to the transmission.
- Tighten the bolts to 25 Nm.

24. Install the front subframe.
For additional information, refer to: Front Subframe - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

25. Lower the vehicle.

26. Install the battery tray.
For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

27. Refill the transmission with fluid.
For additional information, refer to: Transmission Fluid Drain and Refill (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

28. Connect the battery ground cable.
For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

29. 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 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).

Published: 11-May-2011

Transmission / Transaxle Cooling - Vehicles With: 5-Speed Automatic Transaxle - JATCO -

General Specifications

Item	Specification
Automatic transmission fluid	WSS-M2C922-A1

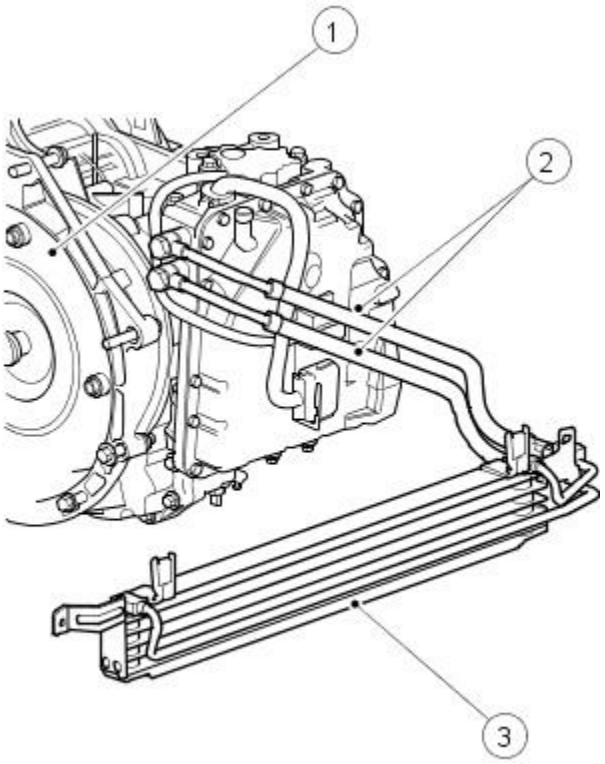
Torque Specifications

Description	Nm	lb-ft	lb-in
Automatic transmission fluid cooler tube union	35	26	-

Published: 11-May-2011

Transmission / Transaxle Cooling - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Transmission CoolingVehicles With: 5-Speed Automatic Transaxle - JATCO

Description and Operation



VUJ0004552

Item	Part Number	Description
1	—	Automatic transmission
2	—	Transmission fluid cooler tubes
3	—	Transmission fluid cooler

Transmission fluid cooler

The transmission fluid cooler is of an aluminium construction consisting of a tube and louvered fin core-type, the tubes are arranged horizontally for the crossflow of the oil.

A thermostatic control valve is incorporated in the transmission fluid cooler, this maintains the transmission fluid at the optimum temperature for use in the transmission.

When carrying out automatic transmission procedures any drained fluid should be checked thoroughly for any metal filings or particles. If metal filings or particles are evident the automatic transmission fault should be located followed by a thorough flushing of the fluid cooler and fluid cooler lines.

Published: 11-May-2011

Transmission / Transaxle Cooling - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Transmission Cooling

Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern by operating the system.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical
• Feed and return tubes • Connections to the automatic transmission and the automatic transmission fluid cooler. • Automatic transmission fluid level

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

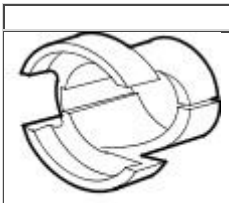
Symptom Chart

Symptom	Possible Sources	Action
Loss of automatic transmission fluid.	* Connections to the automatic transmission and the automatic transmission fluid cooler.	* Check the torque of the tubes, if correct, check the tubes and connections.
Loss of the automatic transmission fluid.	* Leak at transmission fluid cooler.	* INSTALL new transmission fluid cooler.

Published: 11-May-2011

Transmission / Transaxle Cooling - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Transmission Fluid Cooler

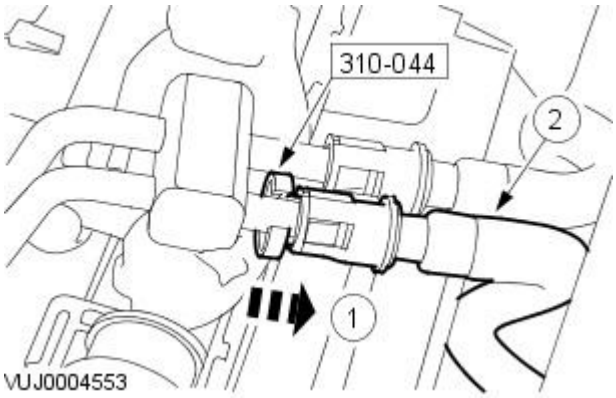
Removal and Installation

Special Tool(s)	
 310044	Quick fit connector releasing tool 310-044

Removal

WARNING: Whenever releasing the transmission cooling system fluid, take care to prevent fluid scalding. Failure to follow these instructions may result in personal injury.

1. Remove the front bumper. For additional information, refer to Section 501-19 Bumpers.
2. NOTE: Lower transmission fluid cooler tube shown, upper similar.

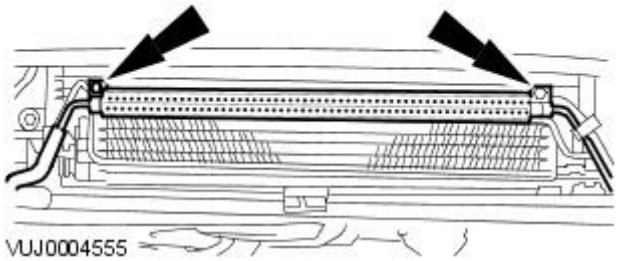


- NOTE: Allow the fluid to drain into a suitable container.

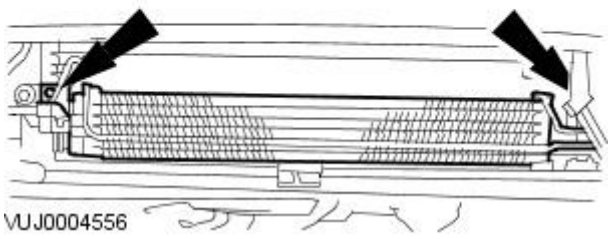
Detach the transmission cooler tube.

1. Install the special tool.
2. Detach the transmission cooler tube.

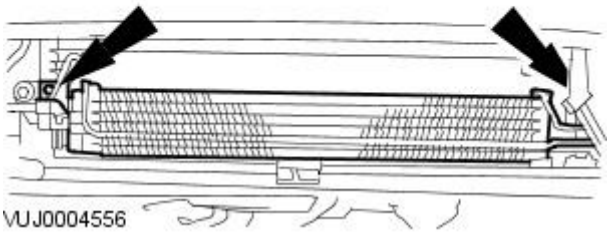
3. Detach the power assisted steering oil cooler.



4. Remove the transmission fluid cooler.



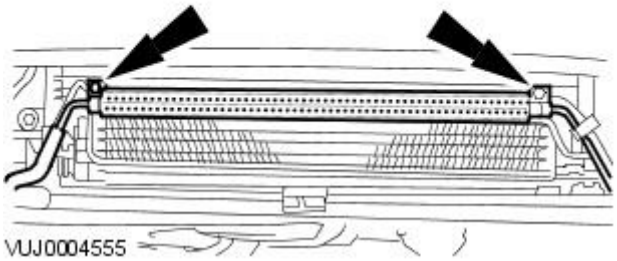
Installation



1. To install reverse the removal procedure.

1. Tighten to 7 Nm.

2. Tighten to 7 Nm.



3. CAUTION: Use of any transmission fluid other than the recommended fluid, will cause transmission damage.

Carry out a transmission fluid level check. For additional information, refer to Section 307-01A Automatic Transmission/TransaxleSection 307-01B Automatic Transmission/Transaxle.

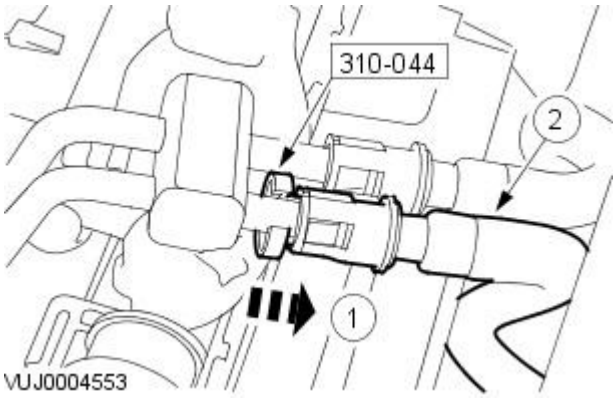
Published: 11-May-2011

Transmission / Transaxle Cooling - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Transmission Fluid Cooler Tubes

Removal and Installation

Removal

WARNING: Whenever releasing the transmission cooling system fluid, take care to prevent fluid scalding. Failure to follow these instructions may result in personal injury.

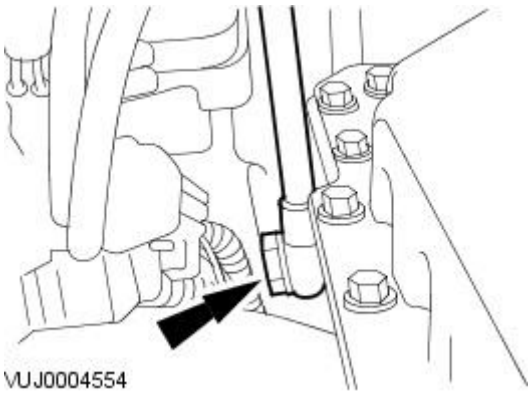


1. Remove the undertray. For additional information, refer toSection 501-02 Front End Body Panels.
2. NOTE: Lower transmission fluid cooler tube shown, upper similar.

• NOTE: Allow the fluid to drain into a suitable container.

Detach the transmission cooler tube.

1. Install the special tool.
2. Detach the transmission cooler tube.

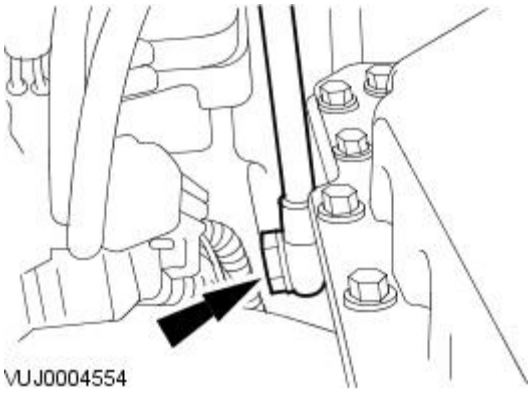


3. NOTE: Lower transmission fluid cooler tube shown, upper similar.

Remove the transmission fluid cooler tube.

- Remove and discard the sealing washers.

Installation



1. NOTE: Lower transmission fluid cooler tube shown, upper similar.

To install reverse the removal procedure.

- Install new sealing washers.
- Tighten to 35 Nm.

2. CAUTION: Use of any transmission fluid other than the recommended fluid, will cause transmission damage.

Carry out a transmission fluid level check. For additional information, refer to Section 307-01A Automatic Transmission/TransaxleSection 307-01B Automatic Transmission/Transaxle.

Published: 11-May-2011

Transmission / Transaxle Cooling - Vehicles With: 6-Speed Automatic Transaxle - AWF21 -

General Specifications

Item	Specification
Automatic transmission fluid	WSS-M2C922-A1

Torque Specifications

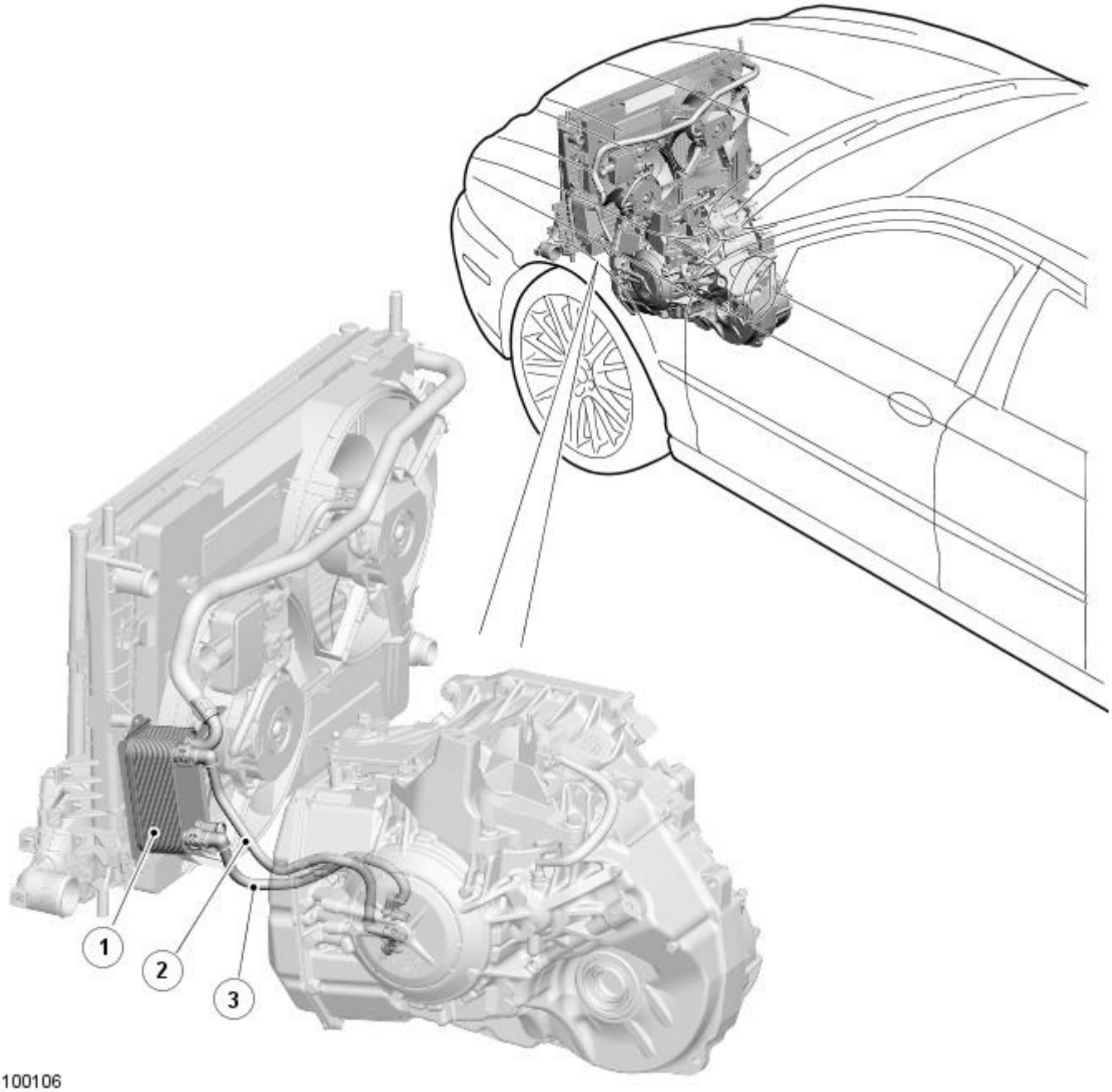
Description	Nm	lb-ft	lb-in
Automatic transmission fluid cooler tube union	35	26	-

Published: 11-May-2011

Transmission / Transaxle Cooling - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Transmission CoolingVehicles With: 6-Speed Automatic Transaxle - AWF21

Description and Operation

COMPONENT LOCATION - AW F21 6 SPEED AUTOMATIC TRANSMISSION - FROM 2009MY



E100106

Item	Part Number	Description
1	-	Transmission fluid cooler
2	-	Transmission fluid pipe - to transmission
3	-	Transmission fluid pipe - from transmission

OVERVIEW

The AW F21 transmission uses an external fluid cooler to reduce the temperature of the transmission fluid.

SYSTEM OPERATION

Fluid is supplied from the transmission fluid pump into the lower connection of the cooler. After passing through the cooler, the fluid passes out of the upper connection and is returned to the transmission fluid pan.

SYSTEM DESCRIPTION

The transmission fluid cooler is attached to the LH (left-hand) end of the radiator. The fluid cooler is an aluminum housing comprising louvred fins and plates. The plates allow a cross-flow of transmission fluid and engine coolant through the cooler. The plates are immersed in engine coolant from the 'cold' side of the radiator which provides cooling of the transmission fluid by the temperature differential between the transmission fluid and the engine coolant.

The radiator is divided so that any coolant passing through the top quarter of the radiator will also pass through the transmission oil cooler. There is a variable restrictor in the coolant bottom hose to allow the correct coolant flow through the transmission fluid cooler to optimise the transmission fluid cooling performance.

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Transmission / Transaxle Cooling - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Transmission Cooling

Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern by operating the system.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical
• Feed and return tubes • Connections to the automatic transmission and the automatic transmission fluid cooler. • Automatic transmission fluid level

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

Symptom Chart

Symptom	Possible Sources	Action
Loss of automatic transmission fluid.	* Connections to the automatic transmission and the automatic transmission fluid cooler.	* Check the torque of the tubes, if correct, check the tubes and connections.
Loss of the automatic transmission fluid.	* Leak at transmission fluid cooler.	* INSTALL new transmission fluid cooler.

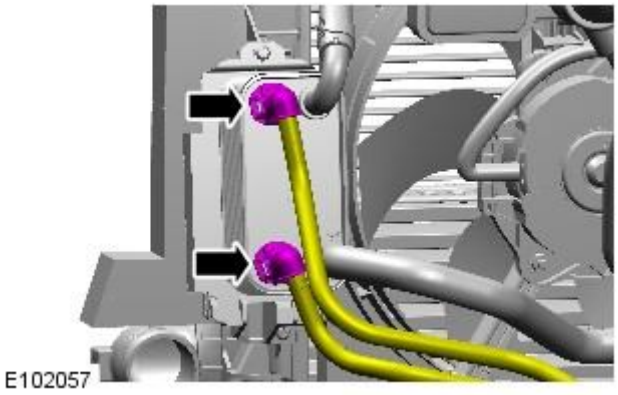
Published: 11-May-2011

Transmission / Transaxle Cooling - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Transmission Fluid Cooler

Removal and Installation

Removal

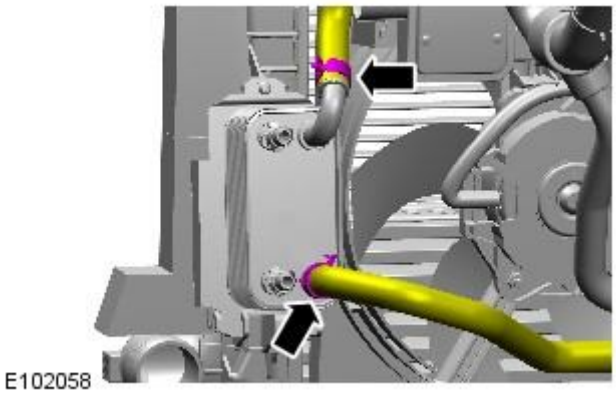
1. Drain the cooling system.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).


E102057

2. WARNING: Be prepared to catch escaping fluid.

• NOTE: Use suitable paper to absorb and escaping fluid.

Disconnect the 2 transmission fluid cooler tubes from the transmission fluid cooler.


E102058

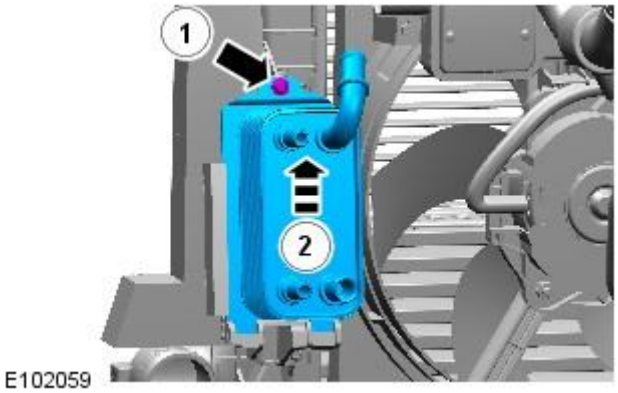
3. WARNING: Be prepared to catch escaping fluid.

Disconnect the 2 coolant hoses from the transmission fluid cooler.

- Release the 2 clips.

4. Remove the Torx screw securing the transmission fluid cooler to the cooling pack.

- Release the transmission fluid cooler from the cooling pack.



E102059

Installation

1. To install, reverse the removal procedure.

2. Check automatic transmission fluid level.
For additional information, refer to: Transmission Fluid Level Check (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

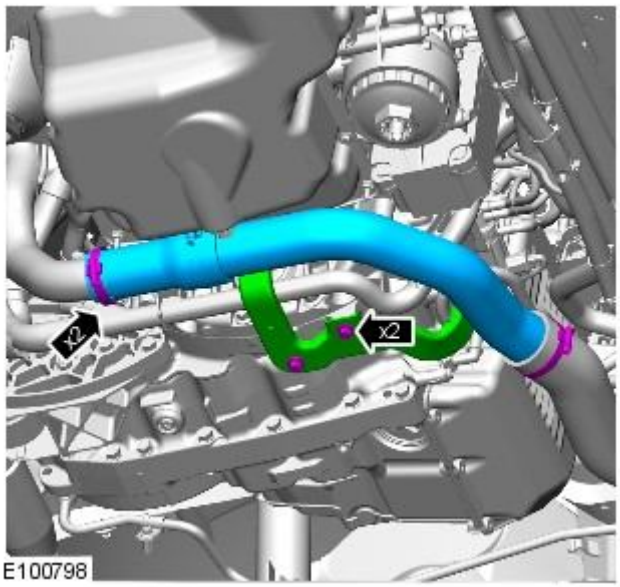
Published: 11-May-2011

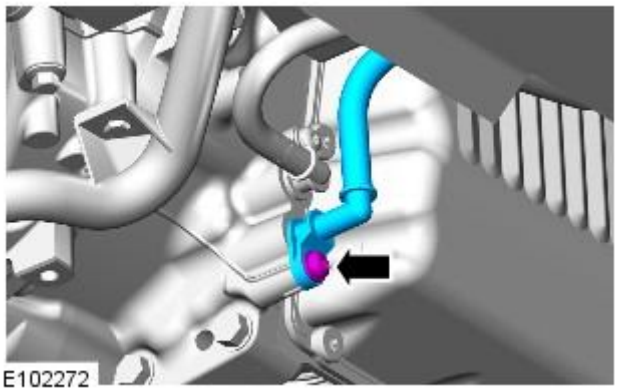
Transmission / Transaxle Cooling - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Transmission Fluid Cooler Return Tube

Removal and Installation

Removal

1. Remove the radiator splash shield.
   For additional information, refer to: Radiator Splash Shield (501-02 Front End Body Panels, Removal and Installation).
2. Remove the charge air cooler intake pipe.
   - Release the 2 hose clips.
   - Remove the 2 bolts.



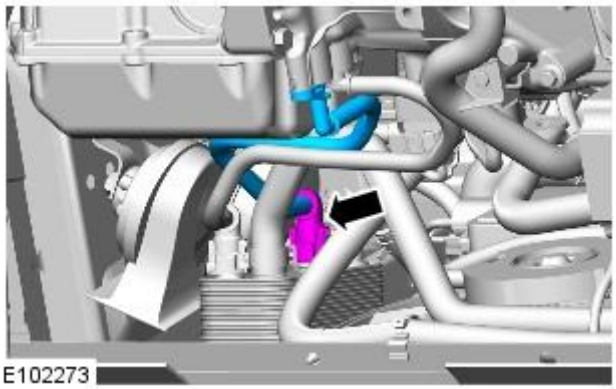


3. WARNING: Be prepared to catch escaping fluid.

• NOTE: Use suitable paper to absorb and escaping fluid.

Disconnect the transmission fluid cooler return tube from the transmission.

- Remove the Torx bolt.



4. WARNING: Be prepared to catch escaping fluid.

• NOTE: Use suitable paper to absorb and escaping fluid.

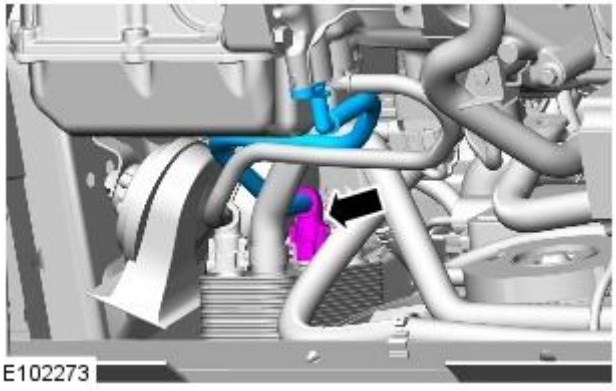
Disconnect the transmission fluid cooler return tube from the transmission fluid cooler.

5. Remove the transmission fluid cooler supply tube.

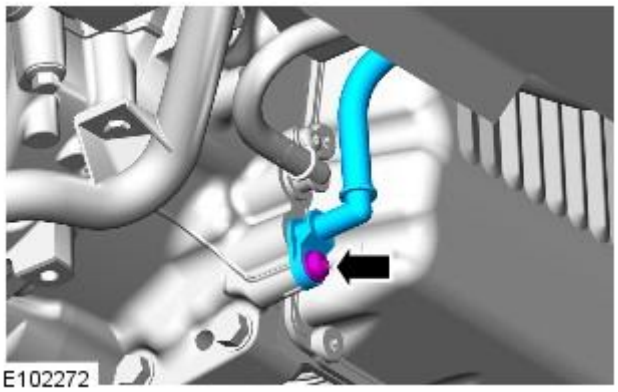
Installation

1. Install the transmission fluid cooler supply tube.

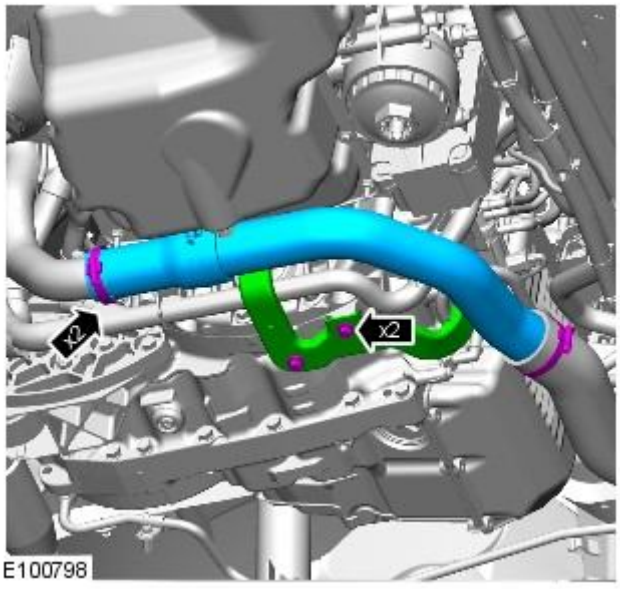
2. Connect the transmission fluid cooler return tube to the transmission fluid cooler.


E102273

3. Connect the transmission fluid cooler return tube to the transmission.
   - Tighten to 10 Nm.


E102272

4. Install the charge air cooler intake pipe.
   - Tighten the hose clips.
   - Tighten the bolts to 35 Nm.



E100798

5. Check and top-up the transmission fluid level.
   For additional information, refer to: Transmission Fluid Level Check (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).
6. Install the radiator splash shield.
   For additional information, refer to: Radiator Splash Shield (501-02 Front End Body Panels, Removal and Installation).

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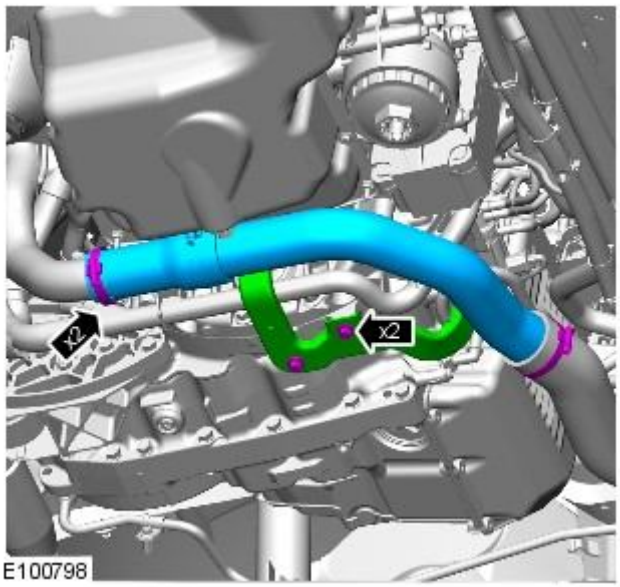
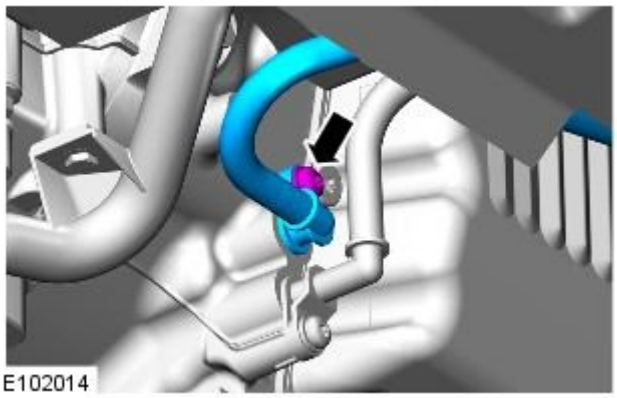
Transmission / Transaxle Cooling - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Transmission Fluid Cooler Supply Tube

Removal and Installation

Removal

1. Remove the radiator splash shield.
   For additional information, refer to: Radiator Splash Shield (501-02 Front End Body Panels, Removal and Installation).
2. Remove the charge air cooler intake pipe.
   - Release the 2 hose clips.
   - Remove the 2 bolts.



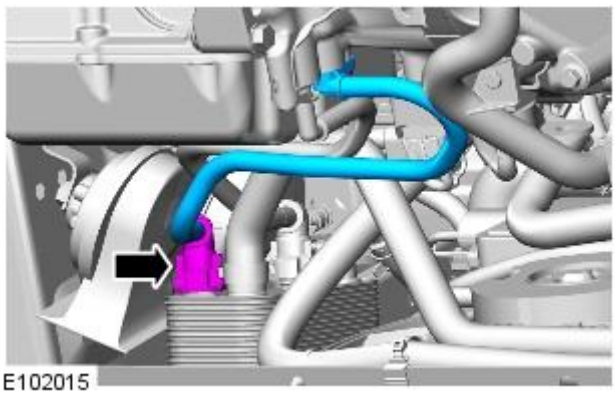


3. WARNING: Be prepared to catch escaping fluid.

• NOTE: Use suitable paper to absorb and escaping fluid.

Disconnect the transmission fluid cooler supply tube from the transmission.

- Remove the Torx bolt.



4. WARNING: Be prepared to catch escaping fluid.

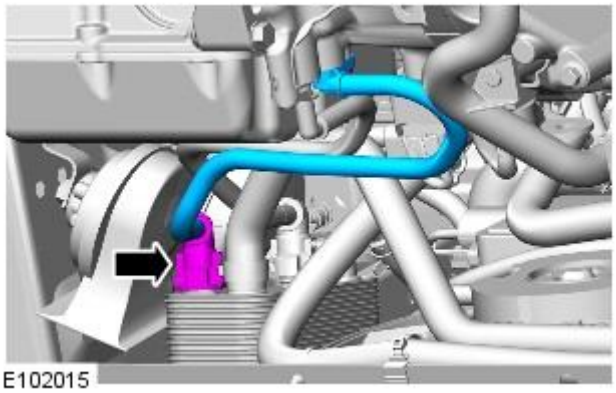
• NOTE: Use suitable paper to absorb and escaping fluid.

Disconnect the transmission fluid cooler supply tube from the transmission fluid cooler.

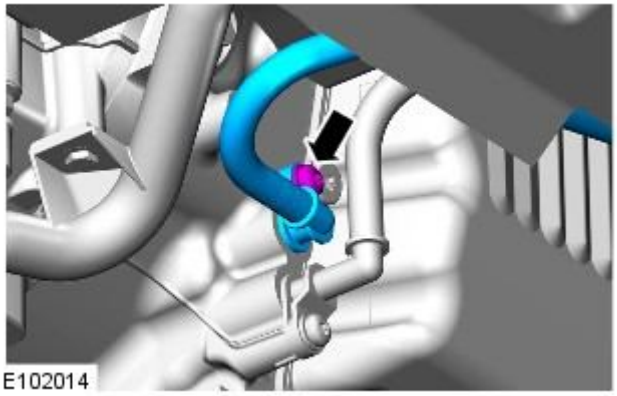
5. Remove the transmission fluid cooler supply tube.

Installation

1. Install the transmission fluid cooler supply tube.

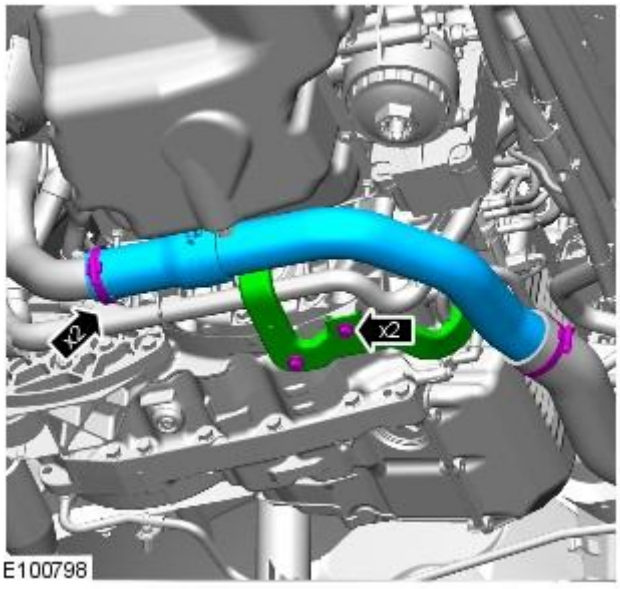

E102015

2. Connect the transmission fluid cooler supply tube to the transmission fluid cooler.


E102014

3. Connect the transmission fluid cooler supply tube to the transmission.

- Tighten to 10 Nm.



E100798

4. Install the charge air cooler intake pipe.

- Tighten the hose clips.
- Tighten the bolts to 35 Nm.

5. Check and top-up the transmission fluid level.
For additional information, refer to: Transmission Fluid Level Check (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

6. Install the radiator splash shield.
For additional information, refer to: Radiator Splash Shield (501-02 Front End Body Panels, Removal and Installation).

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Automatic Transmission / Transaxle External Controls - Vehicles With: 5-Speed Automatic Transaxle - JATCO -

Torque Specifications

Description	Nm	lb-ft	lb-in
Selector cable shield	10	7	-
Selector cable retaining bracket	10	7	-

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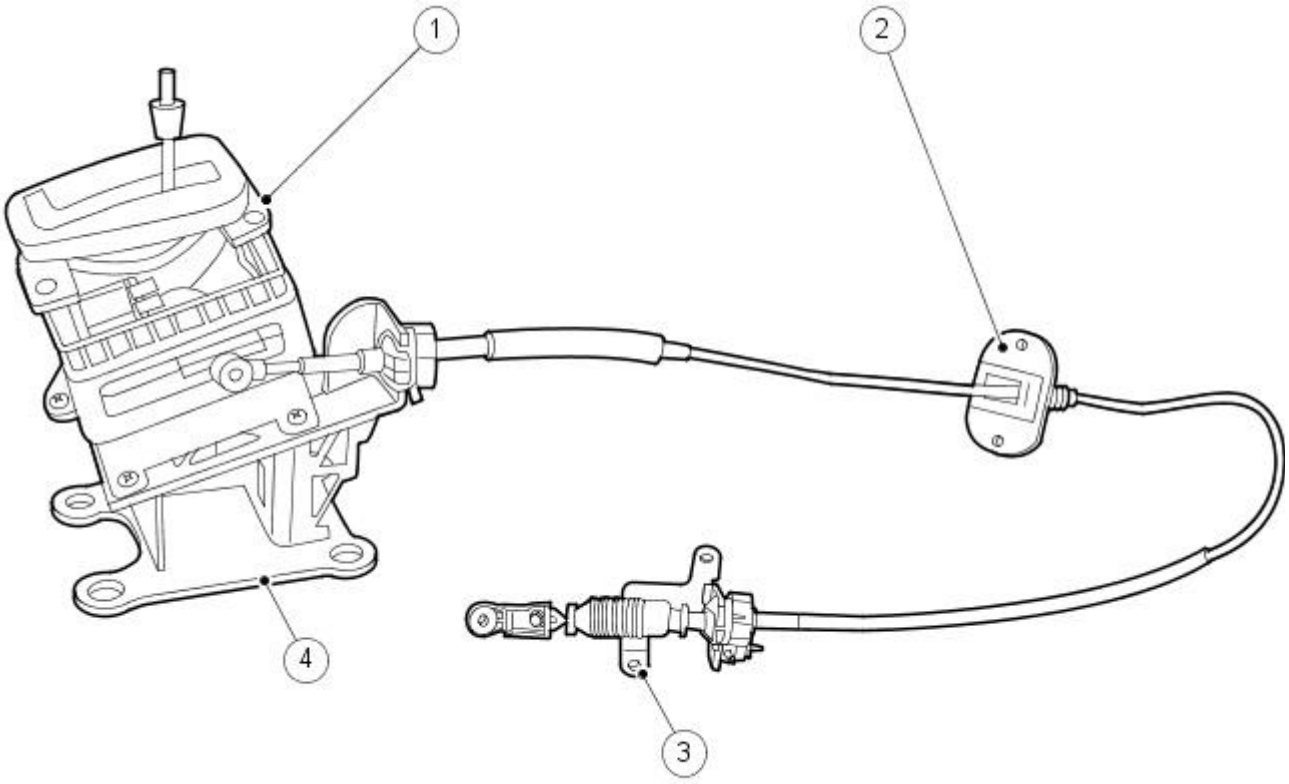
Automatic Transmission / Transaxle External Controls - Vehicles With: 5-Speed Automatic Transaxle - JATCO - External ControlsVehicles With: 5-Speed Automatic Transaxle - JATCO

Description and Operation



VUJ0003990

Item	Part Number	Description
1	—	Transmission selector lever.
2	—	Gear selector cable and bracket.
3	—	Gear selector cable retaining bracket.
4	—	Gear selector module bracket.

Transmission Selector Lever

The transmission selector lever:

- Has seven positions: PARK, REVERSE, NEUTRAL, DRIVE, FOURTH, THIRD and SECOND.
- Operates the transmission selector shaft in the PARK, REVERSE, NEUTRAL and DRIVE positions by means of a cable.
- Passes driver gearshift requests to the engine control module (ECM) via the rotary switch.
- Uses Hall effect switches and a micro controller inside the transmission selector lever to generate the electronic code.
- When moved to the left-hand side of the transmission selector lever allows manual electronic selection of FOURTH, THIRD and SECOND gears.

The NEUTRAL position switch:

- Is incorporated within the transmission rotary switch.

The transmission selector illumination module:

- Provides a red transmission lever position illumination to indicate the selected gear.
- Provides a green background for the transmission selector lever.

The transmission selector interlock solenoid:

- Prevents the transmission selector lever from being moved from the PARK position, unless the ignition switch is in **ON** position, and the brake pedal is pressed.
- Is controlled by an input from the ECM via the CAN bus.

The seven transmission selector positions are:

- P: The transmission is mechanically locked (starting enabled).
- R: Reverse gear.
- N: No power to the road wheels (starting enabled).
- D: All 5 forward gears available.
- 4: Upshift to 4th gear only.
- 3: Upshift to 3rd gear only.
- 2: Upshift to 2nd gear only.

The performance mode push button:

- is mounted on the transmission selector surround.
- selects Normal or Sport mode when pressed by the driver.
- is illuminated when Sport mode is selected.
- is hard-wired to the ECM.

The transmission selector at the transmission unit:

- is connected to the driver's selector module by a cable.
- operates the manual selector valve, which is part of the electro-hydraulic control unit.
- operates the rotary switch, which is connected to the ECM.

The transmission selector cable provides the positive link between the selector lever and the transmission. The transmission selector cable does not require adjustment.

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Automatic Transmission / Transaxle External Controls - Vehicles With: 5-Speed Automatic Transaxle - JATCO - External Controls

Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

WARNING: Danger of accident. Apply the parking brake. Shift the gear selector to **P**. Failure to follow these instructions may result in personal injury.

Visual Inspection Chart

Mechanical	Electrical
• Visibly damaged or worn parts • Gear selector interlock solenoid • Brake pedal switch	• Fuse(s) • Wiring harness for damage or corrosion • Electrical connector(s)

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 Jaguar approved diagnostic system.

Symptom Chart

CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: When performing electrical 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.

Symptom (general)	Symptom (specific)	Possible source	Action
Erratic operation of brake shift interlock	Interlock function will not operate/release	• Brake shift interlock solenoid circuit failure • Brake shift interlock solenoid failure	GO to Pinpoint Test A.

Diagnostic Trouble Code (DTC) Index

Five Digit DTC	Component	Description	Condition	Action
P1780 (To VIN D15361)	D-4 switch malfunction	Switch or circuit malfunction	D-4 switch inoperative or out of range	GO to Pinpoint Test B.
P0915 (From VIN D15362)	J-Gate input	J-Gate or circuit malfunction	Left-hand side of the J-Gate inoperative	GO to Pinpoint Test C.

PINPOINT TEST A : J-GATE SYSTEM CIRCUIT CHECKS	
TEST CONDITIONS	**DETAILS / RESULTS / ACTIONS**
A1: CHECK IGNITION SUPPLY TO THE J-GATE.	
	1 Disconnect the J-Gate electrical connector, IP14.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between IP14, pin 01 (WR) and GROUND.
	Is the voltage less than 10 Volts? **Yes** REPAIR the circuit between IP14 pin 01 (WR) and the ignition switch. For additional information, refer to the wiring diagrams. TEST the system for normal operation. **No** GO to A2.
A2: CHECK GROUND SUPPLY TO THE J-GATE.	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between IP14, pin 02 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. TEST the system for normal operation. **No** CHECK for CAN DTCs. REFER to Section 418-00 Module Communications Network.

PINPOINT TEST B : P1780. D-4 SWITCH MALFUNCTION (TO VIN D15361)	
• NOTE: Incorrect adjustment of the selector cable could result in this DTC being set with no electrical fault being present. REFER to Selector Lever Cable Adjustment - in this section.	
TEST CONDITIONS	**DETAILS / RESULTS / ACTIONS**
B1: CHECK IGNITION SUPPLY TO THE J-GATE.	
	1 Disconnect the J-Gate electrical connector, IP14.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between IP14, pin 01 (WR) and GROUND.

	Is the voltage less than 10 volts? **Yes** REPAIR the circuit between IP14, pin 01 (WR) and the ignition switch (this circuit includes the Central Junction fuse box, Ignition relay, and inertia switch). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to B2.
B2: CHECK GROUND SUPPLY TO THE J-GATE.	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between IP14, pin 02 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to B3.
B3: CHECK D-4 SWITCH SIGNAL WIRE FOR HIGH RESISTANCE.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between IP14, pin 05 (BW) and JB131, pin 45 (BW).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new J-Gate. REFER to Transmission Selector Lever - in this section.

PINPOINT TEST C : P0915 J-GATE SIGNAL INPUTS TO THE TCM (FROM VIN D15362)	
• NOTE: Incorrect adjustment of the selector cable could result in this DTC being set with no electrical fault being present. REFER to Selector Lever Cable Adjustment - in this section.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK TRANSMISSION RANGE SENSOR CONTINUITY IN D.	
	1 Disconnect TR sensor electrical connector JB156.
	2 Select **D**.
	3 Check for continuity between JB156, pin 08 and pin 01 at the sensor.
	Is the circuit continuous? **Yes** GO to C2. **No** Carry out the adjustment procedure for the Transmission Range Sensor. REFER to Transmission Range (TR) Sensor Adjustment in this section. Recheck the circuit. If still open circuit, INSTALL a new Transmission Range Sensor. REFER to Transmission Range (TR) Sensor in this section. CLEAR the DTC. TEST the system for normal operation.
C2: CHECK TRANSMISSION RANGE SENSOR DRIVE SIGNAL WIRE FOR HIGH RESISTANCE.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between JB131, pin 27 (Y) and JB156, pin 01 (Y).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to C3.
C3: CHECK IGNITION SUPPLY TO THE J-GATE.	
	1 Disconnect the J-Gate electrical connector, IP14.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between IP14, pin 01 (WR) and ground.
	Is the voltage less than 10 volts? **Yes** REPAIR the circuit between IP14, pin 01 (WR) and the ignition switch (this circuit includes the Central Junction fuse box, Ignition relay, and inertia switch). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to C4.
C4: CHECK GROUND SUPPLY TO THE J-GATE.	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between J-Gate electrical connector IP14, pin 02 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to C5.
C5: CHECK J-GATE SIGNAL INPUT WIRES FOR CONTINUITY (4 RANGE).	
	1 Disconnect the TCM electrical connector JB131.
	2 Measure the resistance between IP14 pin 05 (BW) and JB131 pin 45 (BW).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to C6.
C6: CHECK THE J-GATE SIGNAL INPUT WIRES FOR CONTINUITY (3 RANGE).	
	1 Measure the resistance between IP14 pin 15 (O) and JB131 pin 07 (O).

	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to C7.
C7: CHECK THE J-GATE SIGNAL INPUT WIRES FOR CONTINUITY (2 RANGE).	
	1 Measure the resistance between IP14 pin 14 (R) and JB131 pin 08 (R).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to C8.
C8: J-GATE SIGNALS FUNCTIONALITY	
	1 If tests between C1 and C7 have been successfully completed and the fault is still present, INSTALL a new J-Gate.
	2 CLEAR the DTC.
	3 TEST the system for normal operation.
	Does the system function correctly? **Yes** No further action required. **No** Contact dealer technical support for advice on possible module.

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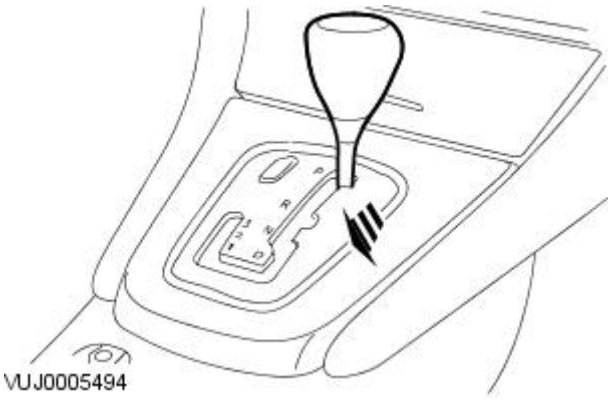
Automatic Transmission / Transaxle External Controls - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Selector Lever Cable Adjustment

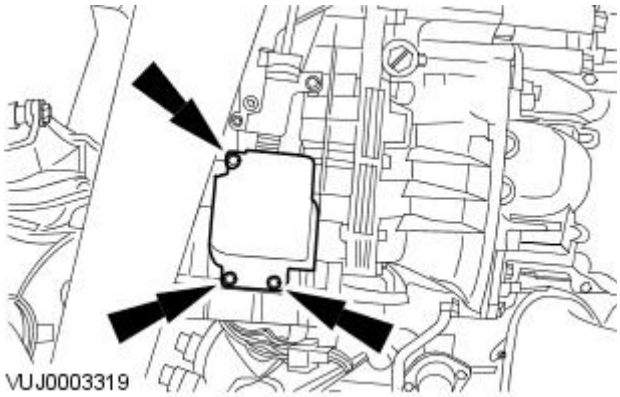
General Procedures

Setting Procedure-All Vehicles

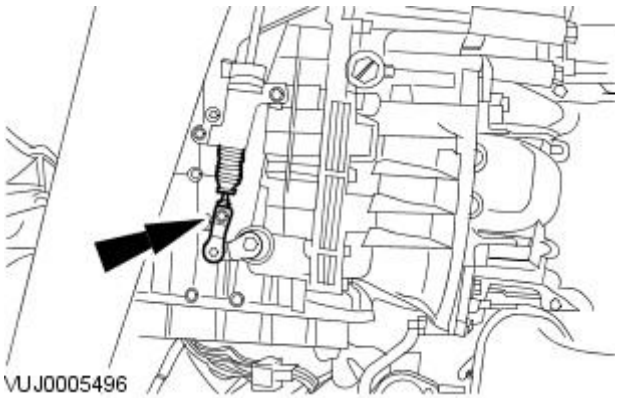

VUJ0005494

1. Apply the parking brake.
2. Apply the footbrake.
3. Turn the ignition switch to position II.
4. Move the gear selector lever to 'N'.

5. Raise and support the vehicle.
   For additional information, refer to Section 100-02 Jacking and Lifting.
6. Remove the gear selector cover plate.

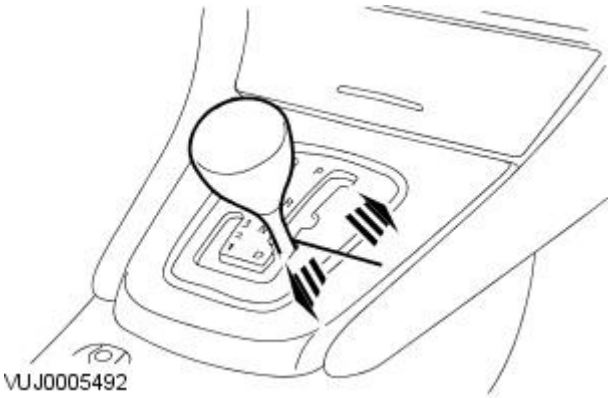

VUJ0003319

7. Loosen the gear selector cable retaining bolt.


VUJ0005496

Vehicles Built up to VIN D15360

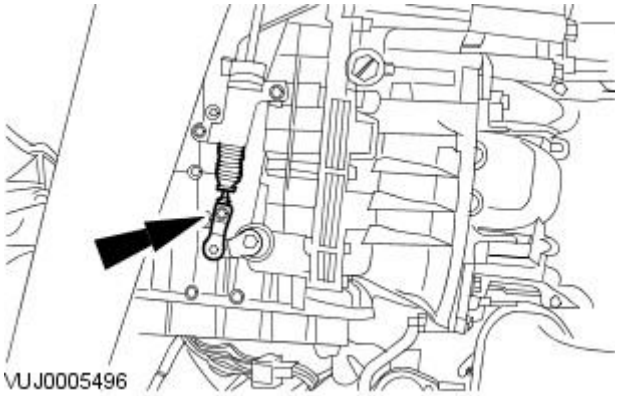
• NOTE: Before starting the 'J' gate setting procedure, make sure the vehicle is cold, or has been left to cool for at least two hours.



1. Using the corner of the grey feature line that follows the edge of the 'J' gate as a datum, use a rule and move the gear selector forwards or back two millimeters.

All Vehicles

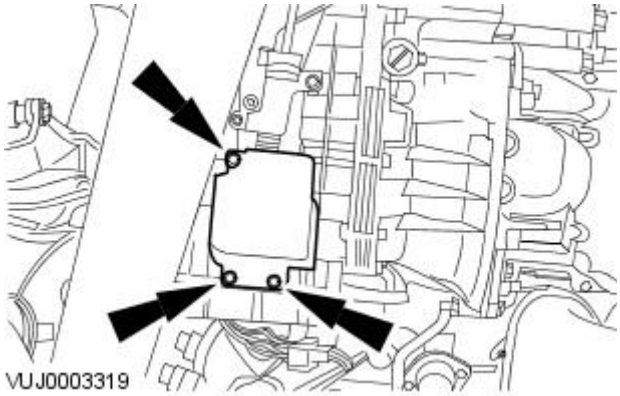
• NOTE: Before starting the 'J' gate setting procedure, make sure the vehicle is cold, or has been left to cool for at least two hours.



1. NOTE: Make sure the transmission is in neutral.

Fully tighten the cable retaining bolt

- Tighten to 5Nm.



2. Install the gear selector cover plate.

- Tighten to 10Nm.

3. Check for correct operation. If setting is incorrect, repeat the above steps until correct operation is achieved.

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Automatic Transmission / Transaxle External Controls - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Selector Lever Cable and Bracket

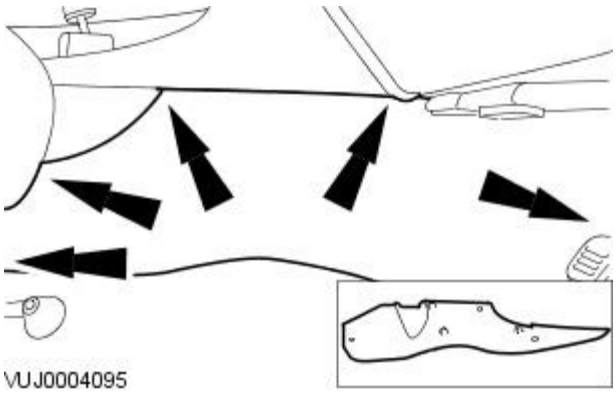
Removal and Installation

Removal

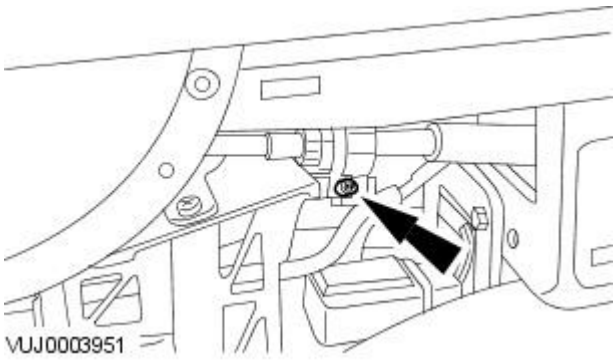
1. NOTE: To move the gear selector lever, the ignition must be in the RUN position, with the foot brake pressed.

Move the gear selector lever to "N" position.

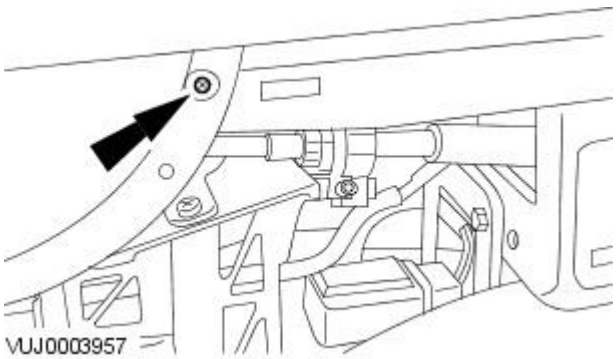
2. Remove the center console right-hand side trim panel.



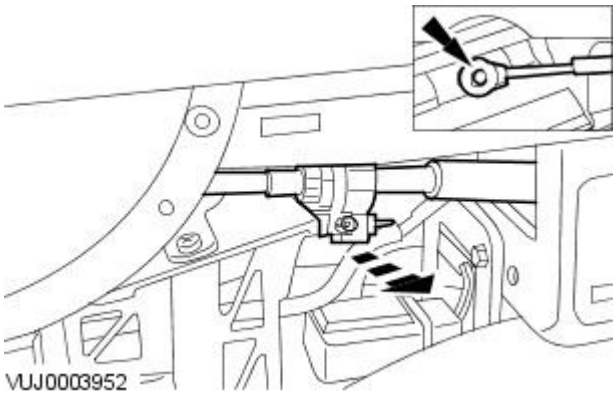
3. Release the gear selector cable locking pin.

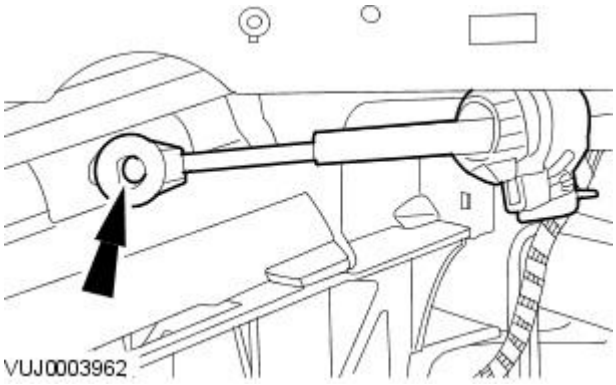


4. Remove the center console side retaining screw.

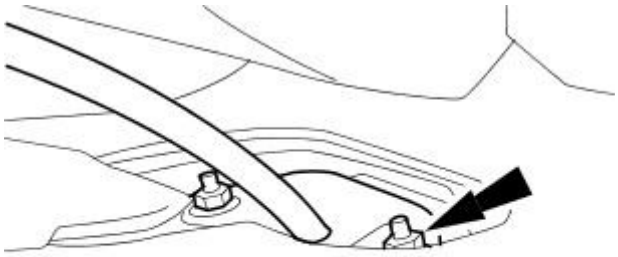


5. Detach the gear selector cable from the J-gate.




VUJ0003962

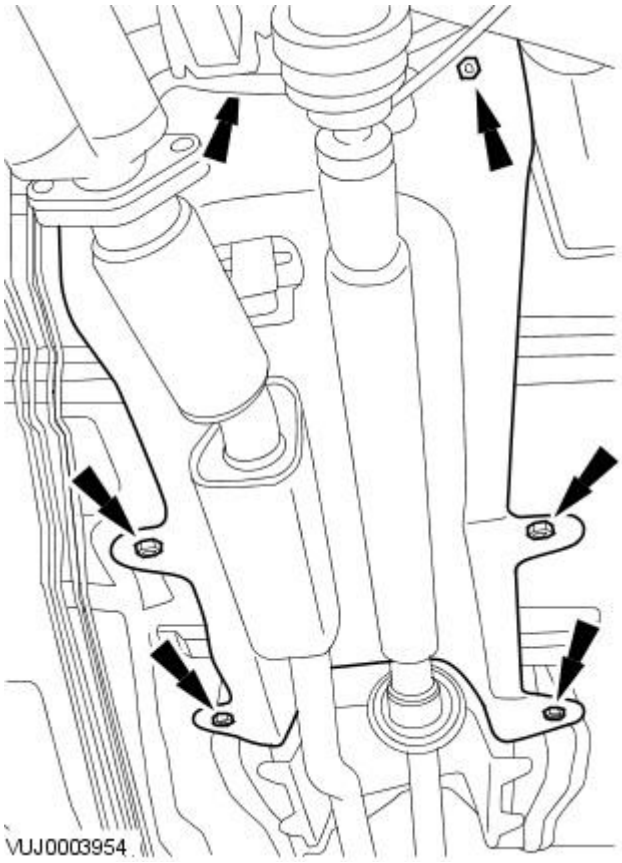
6. Disconnect the gear selector cable from the J-gate.


VUJ0003953

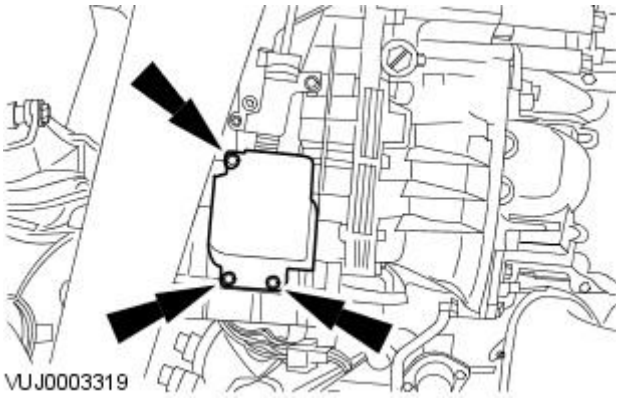
7. Detach the gear selector cable grommet.

8. Raise and support the vehicle. For additional information, refer to Section 100-02 Jacking and Lifting.

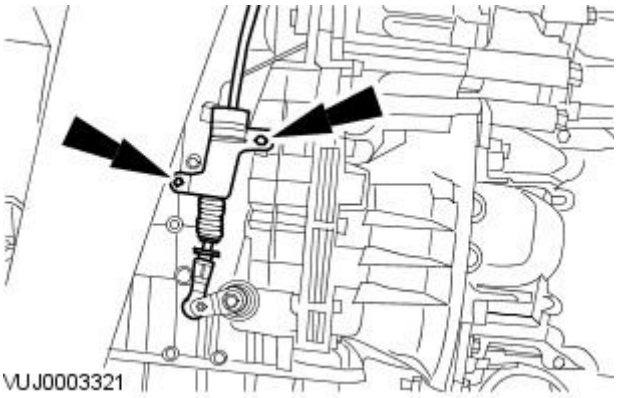
9. Detach the exhaust heat shield.


VUJ0003954

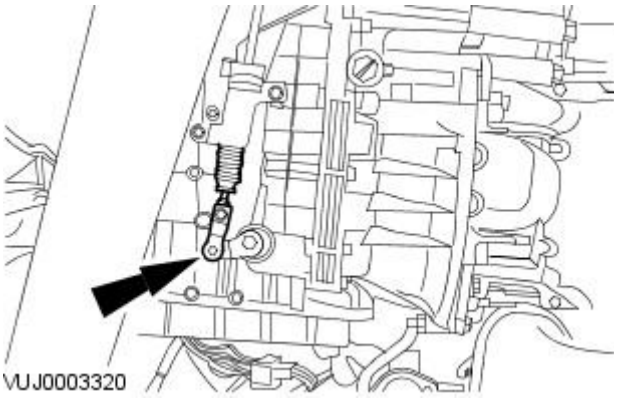
10. Remove the gear selector cable shield.



11. Detach the gear selector cable bracket.

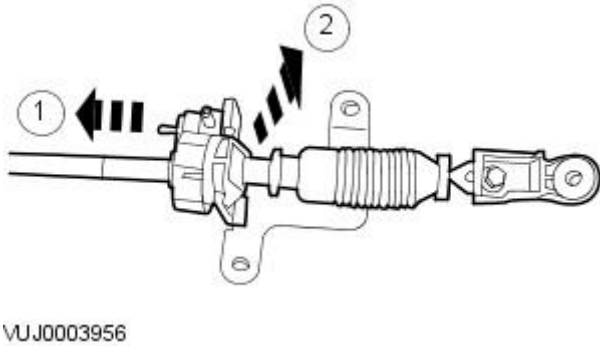


12. Disconnect the gear selector cable.



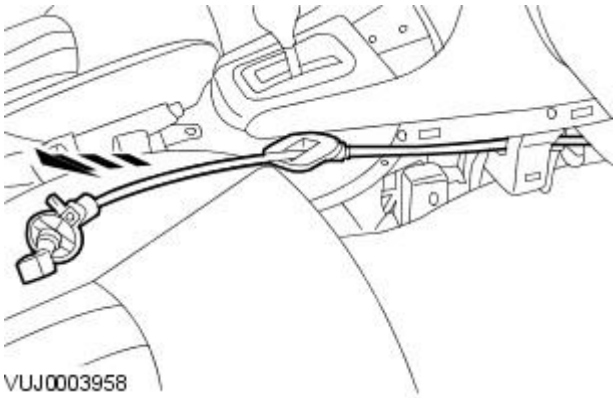
13. Remove the gear selector cable from the gearbox mounting bracket.

1. Pull out the locking pin.
2. Remove the gear selector cable from the gearbox mounting bracket.

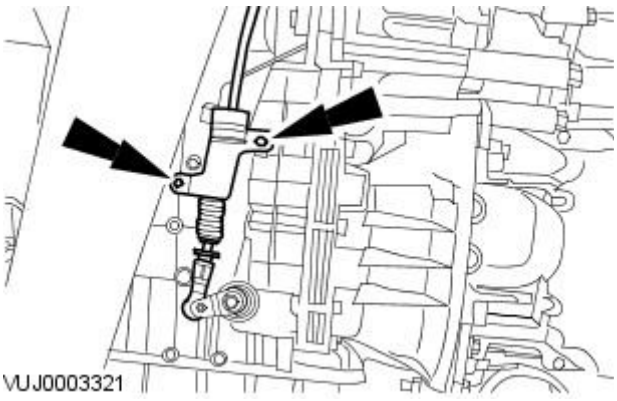


14. Lower the vehicle.

15. Remove the selector cable.

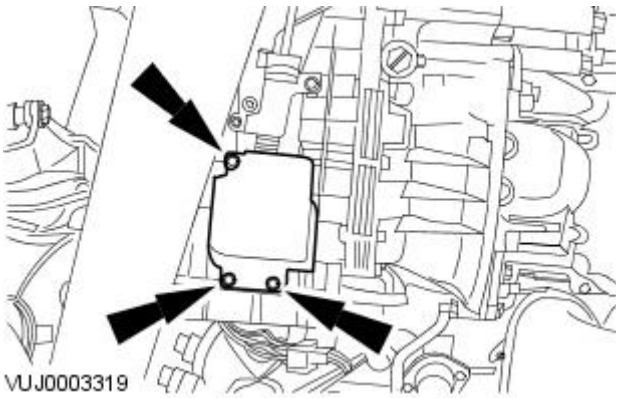


Installation



1. To install, reverse the removal procedure.

- Tighten to 10 Nm.



2. Tighten to 10 Nm.

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Automatic Transmission / Transaxle External Controls - Vehicles With: 5-Speed Automatic Transaxle - JATCO - Selector Lever Assembly

Removal and Installation

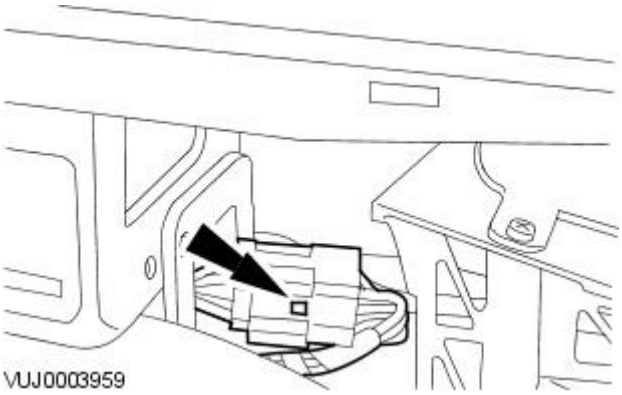
Removal

1. NOTE: To move the selector lever, the ignition must be in the RUN position, with the foot brake pressed.

Move the selector lever to the 'N' position.

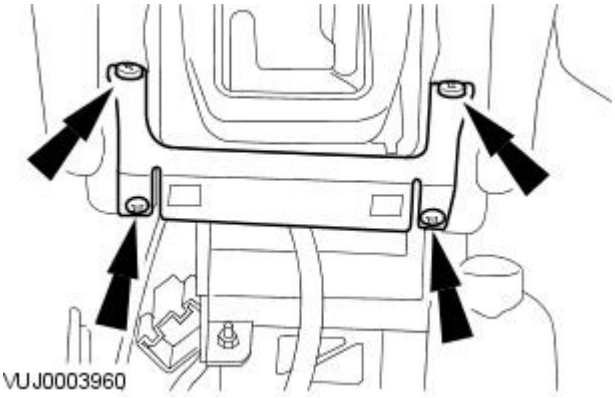
2. Remove the floor console.
For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

3. Disconnect the electrical connector.

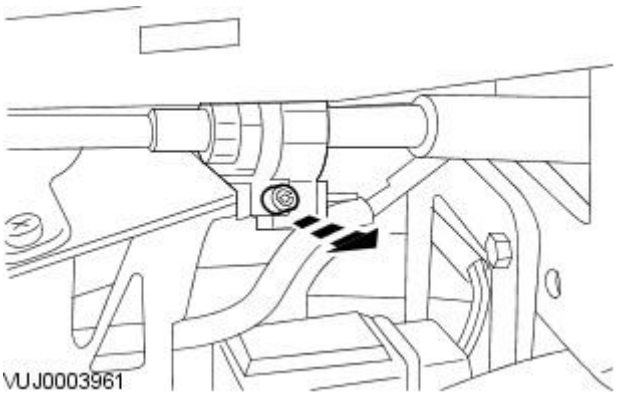


4. NOTE: The floor console bracket cannot be removed at this stage.

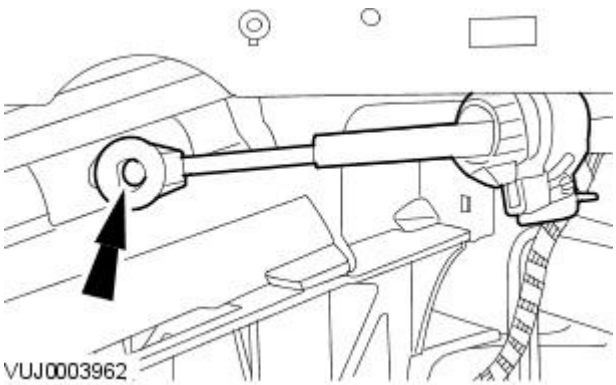
Remove the floor console bracket retaining screws.

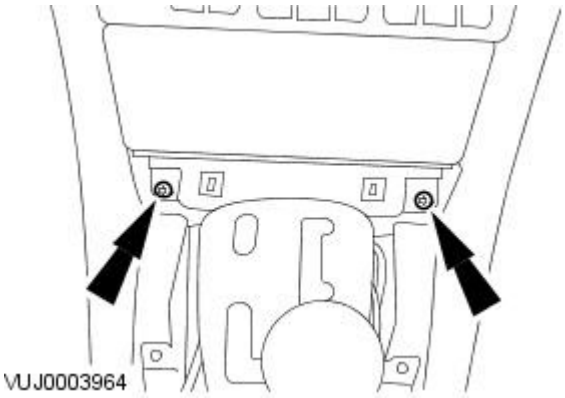


5. Release the selector lever cable locking pin.

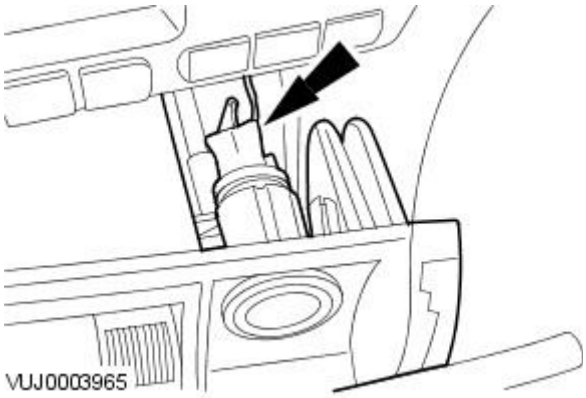


6. Disconnect the selector lever cable from the selector lever.



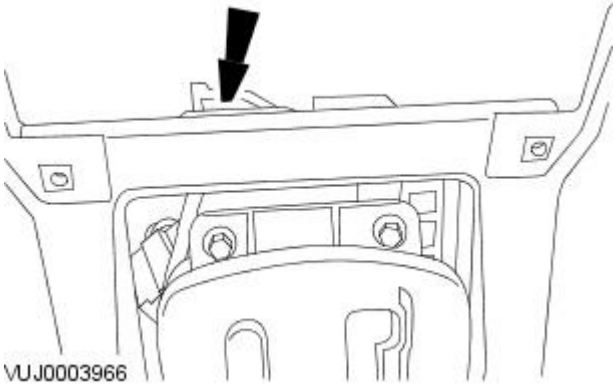


7. Remove the ashtray retaining screws.

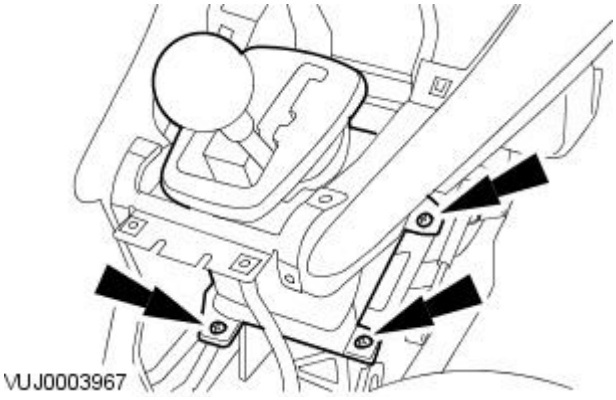


8. Remove the ashtray.

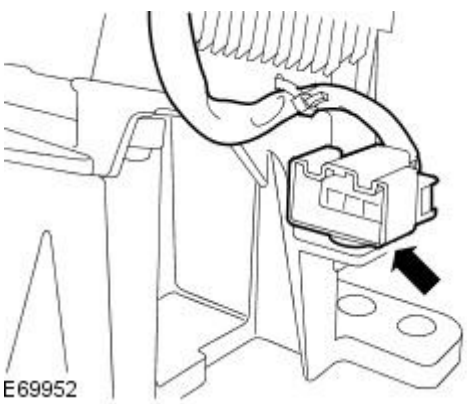
- Disconnect the cigar lighter electrical connector.



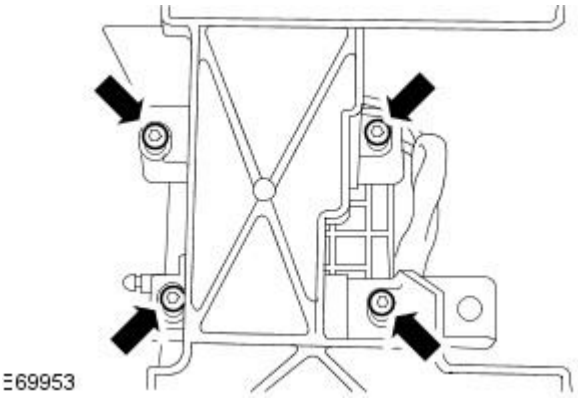
9. Remove the selector lever retaining screw.



10. Remove the selector lever.



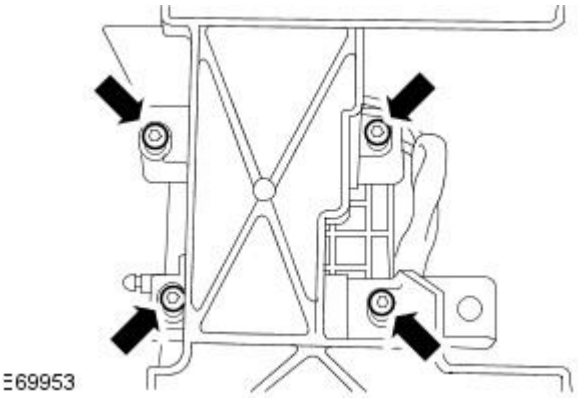
11. Detach the electrical connector from the selector lever.



12. Remove the selector lever from the selector lever bracket.

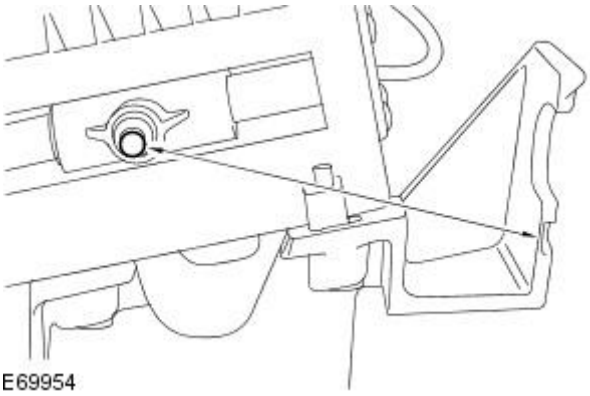
- Remove the selector lever retaining screws.

Installation



1. NOTE: Do not fully tighten the selector lever retaining screws at this stage.

Install the new selector lever to the selector lever bracket.

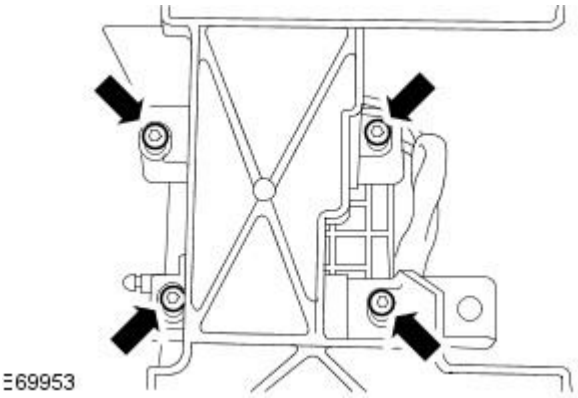


2. NOTE: The new selector lever is supplied with a setting tool installed, to hold the selector lever in the correct position for adjustment to be carried out.

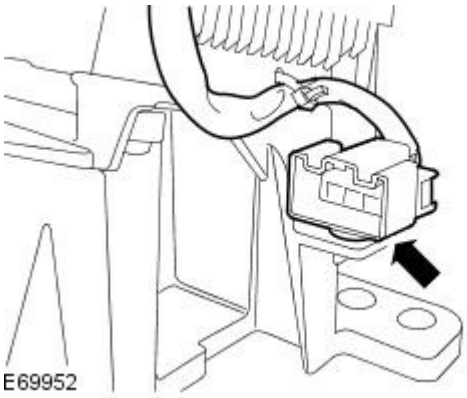
• NOTE: The setting tool must remain installed, until the selector lever cable adjustment has been carried out.

Set the distance between the selector lever pin and the selector lever bracket.

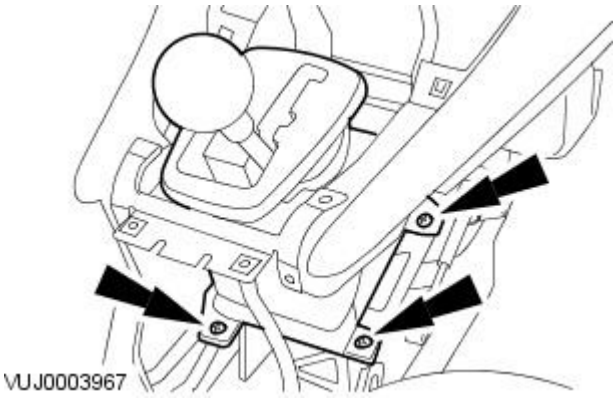
- Adjust the the distance to 97.5 mm (3.84 inches).



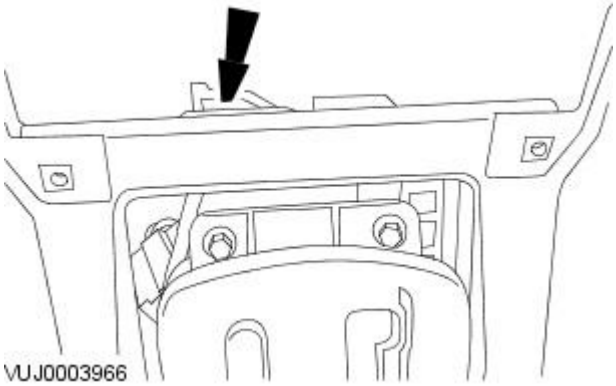
3. Tighten the selector retaining screws.



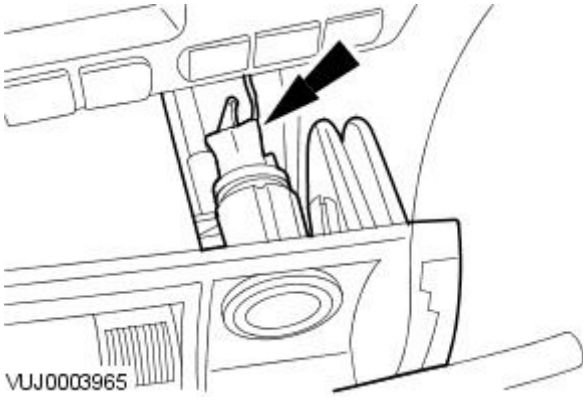
4. Attach the electrical connector to the selector lever.



5. Install the selector lever.

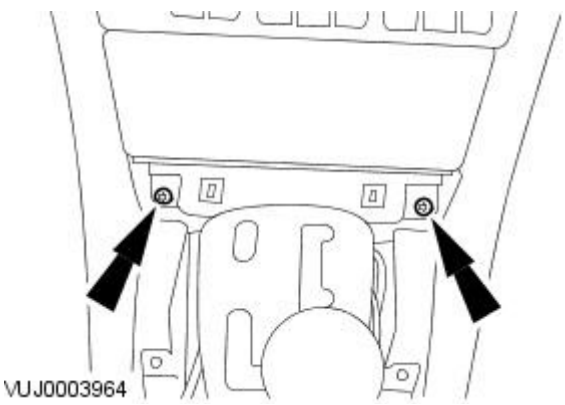


6. Install the selector lever retaining screw.

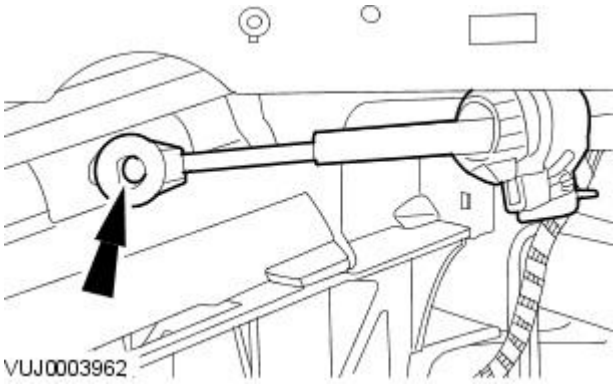


7. Install the ashtray.

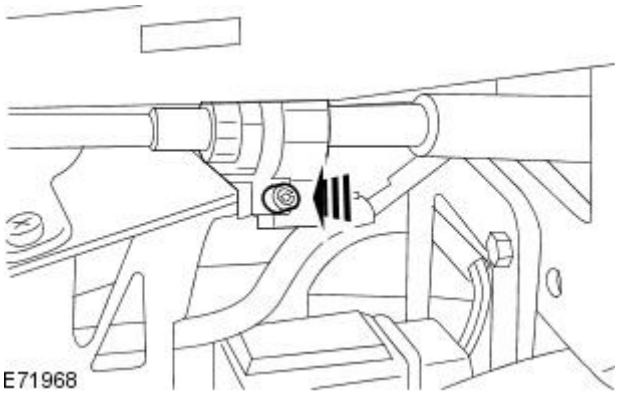
- Connect the cigar lighter electrical connector.



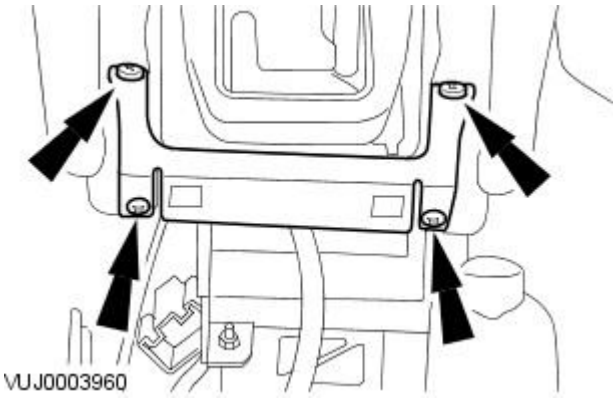
8. Install the ashtray retaining screws.



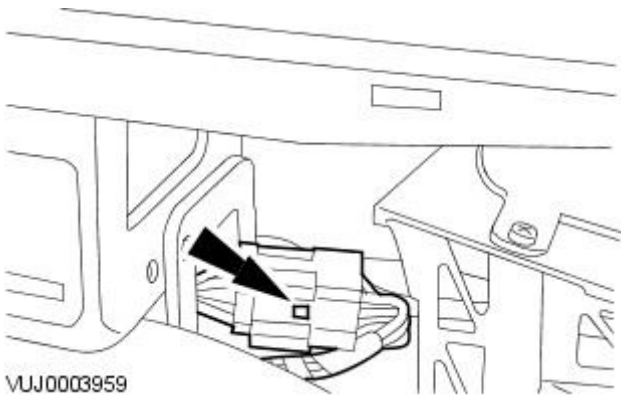
9. Connect the selector lever cable to the selector lever.



10. Install the selector lever cable locking pin.



11. Install the floor console bracket retaining screws.



12. Connect the selector lever electrical connector.

13. Set the selector lever cable adjustment.
For additional information, refer to: Selector Lever Cable Adjustment (307-05B Automatic Transmission/Transaxle External Controls - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

14. Remove the selector lever setting tool.

15. Install the floor console.
For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

16. Move the selector lever to the 'P' position.

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Automatic Transmission / Transaxle External Controls - Vehicles With: 6-Speed Automatic Transaxle - AWF21 -

Torque Specifications

Description	Nm	lb-ft	lb-in
Selector cable shield	10	7	-
Selector cable retaining bracket	10	7	-

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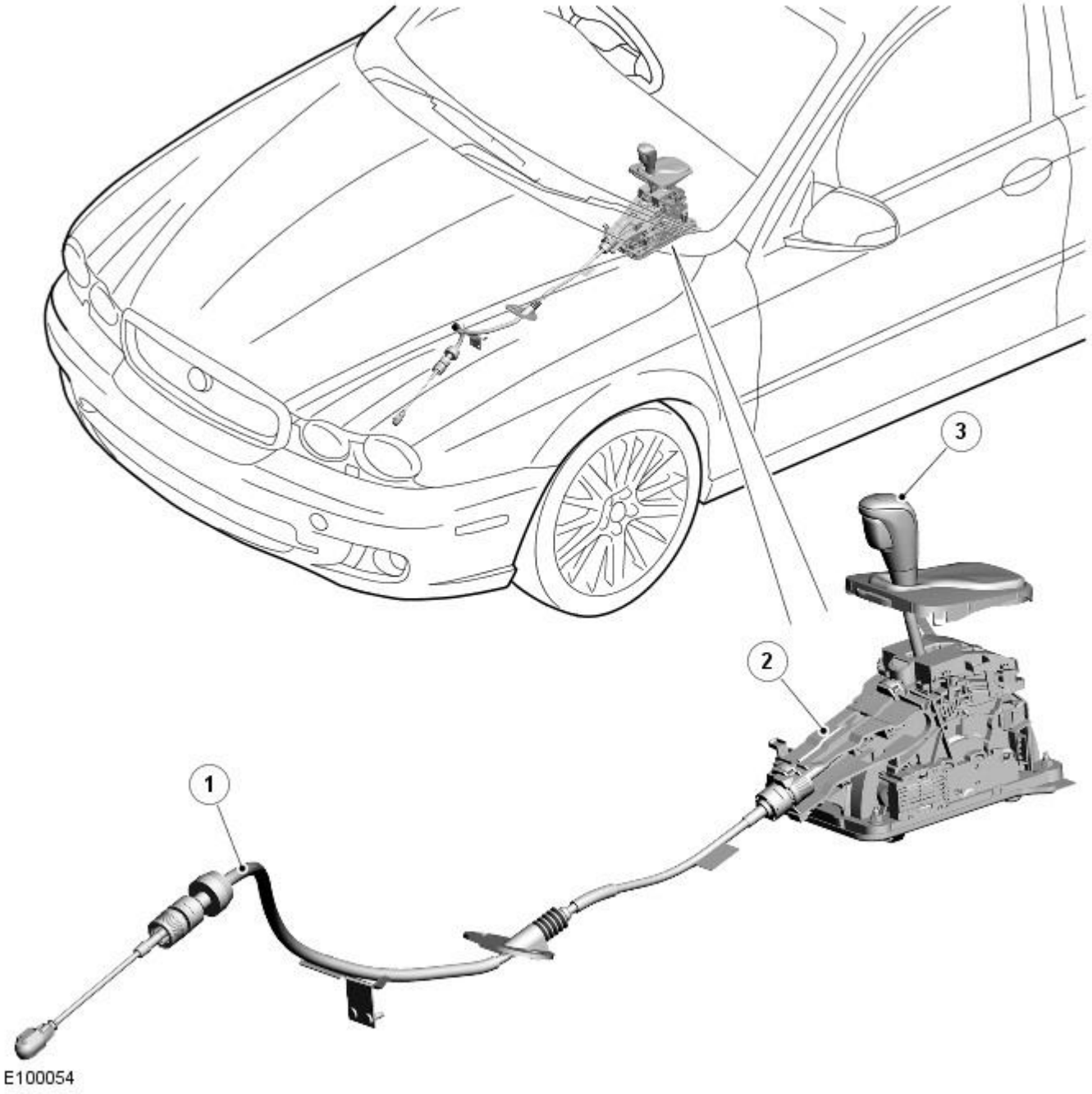
Automatic Transmission / Transaxle External Controls - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - External ControlsVehicles With: 6-Speed Automatic Transaxle - AWF21

Description and Operation

COMPONENT LOCATION - AW F21 6 SPEED AUTOMATIC TRANSMISSION FROM 2009MY



Item	Part Number	Description
1	-	Selector cable
2	-	Selector lever assembly
3	-	Selector knob, gaiter and illumination module

OVERVIEW

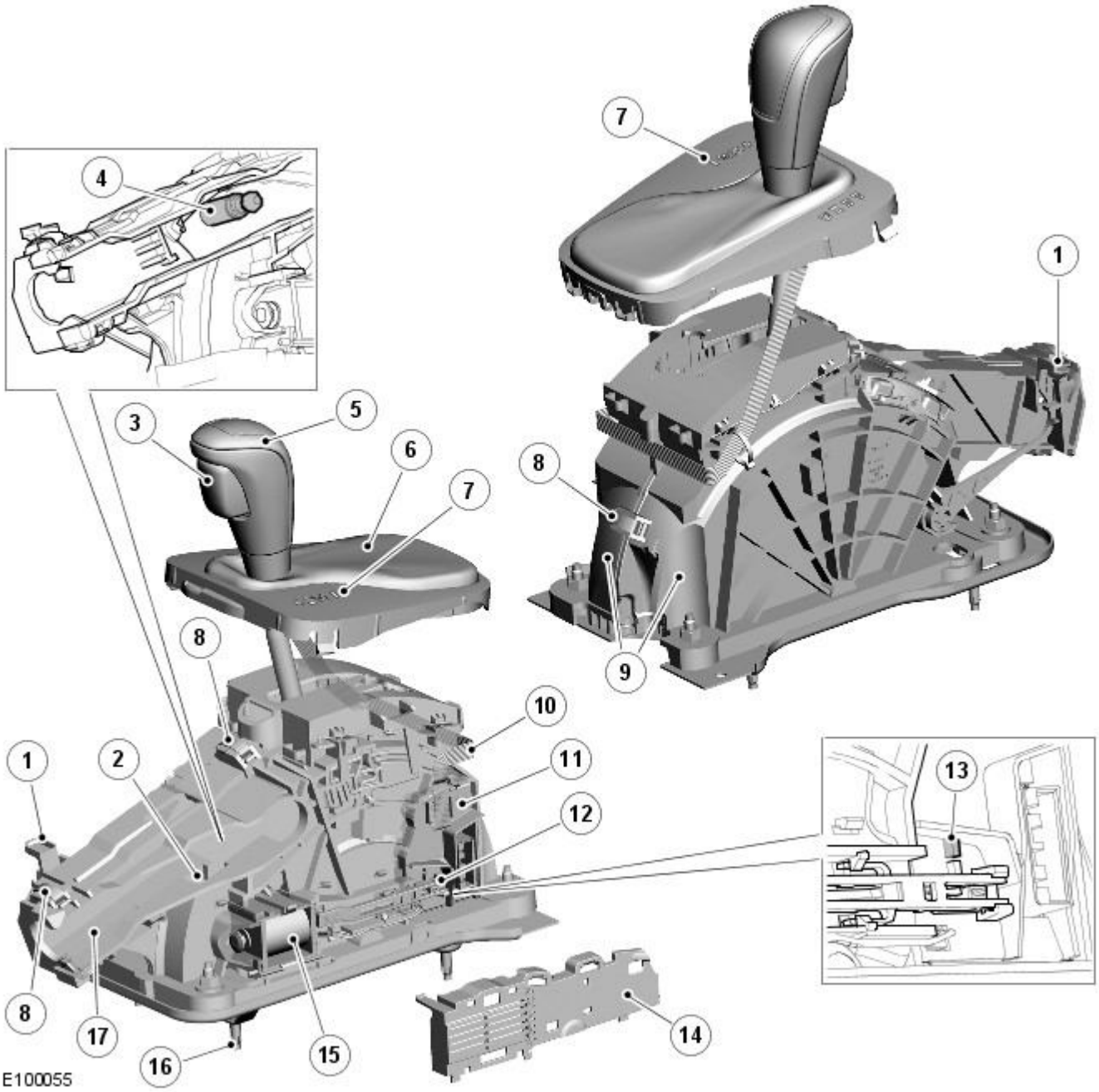
The automatic transmission external controls comprise a selector lever assembly and a transmission cable. The selector lever allows the driver to select forward or reverse gears and also to engage sport or manual 'Jaguar Sequential Shift' modes.

Movement of the selector lever is confirmed to the driver by illumination of the applicable position LED (light emitting diode) on the illumination module and by a message displayed in the instrument cluster message center.

• NOTE: PRND is not displayed in the message center. When in sport mode 'S' is displayed and when in Jaguar Sequential Shift mode the selected gear (1, 2, 3, 4, 5, or 6) is displayed.

SELECTOR LEVER

• NOTE: RHD (right-hand drive) version shown



Item	Part Number	Description
1	-	Interlock solenoid - Emergency release lever
2	-	Cable adjustment/setting aperture
3	-	Selector lever button
4	-	Cable attachment ball pin
5	-	Knob
6	-	Gaiter
7	-	Selector position LED's
8	-	Spring clip
9	-	Shift housing Left Hand (LH) and Right Hand (RH)
10	-	Printed Circuit Board (PCB) ribbon cable and connector
11	-	Gear shift module
12	-	Sensor arm
13	-	Optical sensor alignment mark
14	-	Cover
15	-	Shift interlock solenoid
16	-	Mounting bolt (4 off)
17	-	Cable abutment aperture

The selector lever assembly is located in a central position on the transmission tunnel, between the front driver and passenger seats and is secured to the transmission tunnel with 4 bolts. The selector lever assembly is an electro-mechanical assembly which is used by the driver to select the required transmission mode. Serviceable parts comprise the shifter mounting plate, the knob, the PRND LED display, gaiter and illumination module assembly and the base shifter. If other selector components require replacement then a complete shifter assembly will need to be fitted.

Selections made using the selector lever are passed to the transmission lever arm by a cable. A ball pin is attached to the lever mechanism and provides for the attachment of the cable.

There are 5 selector lever positions and 2 additional positions for manual 'Jaguar Sequential Shift' operation:

- P (Park) - Prevents the vehicle from moving by locking the transmission
- R (Reverse) - Select only when the vehicle is stationary and the engine is at idle
- N (Neutral) - No torque transmitted to drive wheels
- D (Drive) - Select only when the vehicle is stationary and the engine speed is at idle. Allows the transmission to automatically select the most appropriate of the 6 forward gears

- M/S (Manual/Sport Mode) - Initial selection of this position activates the transmission 'Sport' mode. This position has the same function as 'D' but forces the transmission to upshift at higher engine speeds to improve acceleration
- + and - (Manual 'Jaguar Sequential Shift' mode) - Movement of the selector lever in the +/- positions, when the lever is in the M/S position, will operate the transmission in manual (Jaguar Sequential Shift) mode allowing the driver to manually select all 6 forward gears.
  - To change back to Sport mode once Manual 'Jaguar Sequential Shift' mode has been engaged, the selector lever must first be moved to the 'D' position and then returned to the M/S position.

The selector lever position is shown on the PRND LED display on the selector illumination module. The illumination of the LED's is controlled by CAN (controller area network) messages from the instrument cluster.

The selector lever position when in 'Sport' or 'Jaguar Sequential Shift' mode is displayed to the driver on the selector position LED and in the instrument cluster. PRND positions are not displayed. In 'Jaguar Sequential Shift' mode, if a gear is selected but the TCM (transmission control module) logic prevents selection of that gear, the requested gear will be initially displayed. The TCM will engage the next allowed gear and then display that gear. In 'Jaguar Sequential Shift' when a gear is selected it will only be displayed in the instrument cluster message center.

Gear Shift Module

A gear shift module is located on the LH (left-hand) side of the selector lever. The gear shift module is an intelligent unit and controls the selector position LED operation and also the shift interlock solenoid operation. The module comprises a Printed Circuit Board (PCB) and Hall sensors which detect the selected position of the selector lever, when in M/S and + and - positions, via a magnet located on the lever mechanism. The signals from the Hall sensors are passed from a connector on the gear shift module to the TCM on a LIN (local interconnect network).

The gear shift module main connector uses 4 pins for LIN bus, ground, power and neutral inputs and outputs. A second connector allows for the connection of a ribbon cable from the selector position LED for background illumination and position illumination. A third connector supplies power and ground connections to the shift interlock solenoid.

Shift Interlock

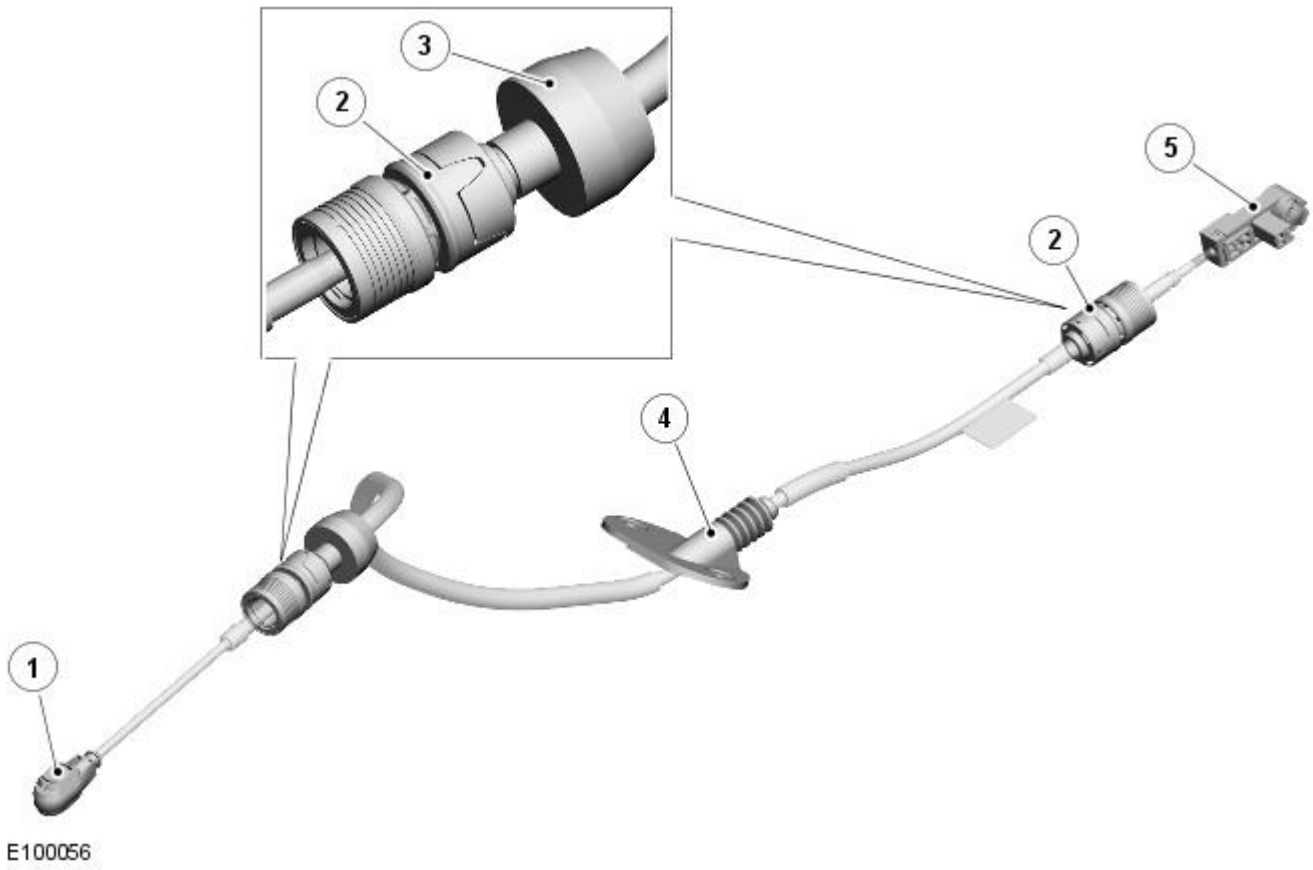
The shift interlock solenoid is located on the LH side of the selector lever assembly. The solenoid operates a locking lever which engages with the lever mechanism and locks it in the Park (P) and Neutral (N) positions. When the ignition is in power mode 6 or the engine is running, the solenoid is de-energised and prevents the lever from moving from these positions until the brake pedal is pressed.

The neutral interlock feature only operates after a period of approximately 3 seconds. This allows the driver to move the selector lever between gears ('D' to 'R') without the need to operate the brake pedal.

• NOTE: The selector lever cannot be moved from the 'Park' position if the ignition is off.

If a fault occurs with the shift interlock solenoid, the sensor module or the brake switch, an emergency release lever is provided to disconnect the interlock mechanism. The emergency release lever can be accessed by removal of the RH (right-hand) carpet panel from the floor console. The panel can be removed to gain access to the release lever which is located at the front of the selector lever assembly and is colored yellow for identification.

TRANSMISSION CABLE



Item	Part Number	Description
1	-	Transmission eye end
2	-	Abutment
3	-	Damper weight
4	-	Bulkhead grommet
5	-	Selector lever arm eye end and adjuster

The transmission cable assembly is a one-piece, push/pull cable connected between the transmission and the selector lever.

The selector lever end of the cable has an adjustable eye end which locates on a ball pin on the selector lever. An abutment on the cable outer sheath locates in an aperture in the selector lever shift housing. The transmission end of the cable also has an eye end which locates on a ball pin on the end of the transmission lever arm. An abutment on the outer sheath locates in a bracket attached to the top of the transmission. A damper weight is attached to the cable outer sheath to reduce noise and vibration being transmitted to the selector lever.

The purpose of the manual adjuster on the selector lever arm eye end is to accommodate vehicle to vehicle build tolerances. This ensures that the selector lever movements are correctly aligned with the movements of the transmission selector lever. This is essential to ensure the correct function of the selector mechanism.

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Automatic Transmission / Transaxle External Controls - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - External Controls

Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

WARNING: Danger of accident. Apply the parking brake. Shift the gear selector to **P**. Failure to follow these instructions may result in personal injury.

Visual Inspection Chart

Mechanical	Electrical
• Visibly damaged or worn parts • Gear selector interlock solenoid • Brake pedal switch	• Fuse(s) • Wiring harness for damage or corrosion • Electrical connector(s)

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 Jaguar approved diagnostic system.

Symptom Chart

CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: When performing electrical 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.

Symptom (general)	Symptom (specific)	Possible source	Action
Erratic operation of brake shift interlock	Interlock function will not operate/release	• Brake shift interlock solenoid circuit failure • Brake shift interlock solenoid failure	GO to Pinpoint Test A.

Diagnostic Trouble Code (DTC) Index

Five Digit DTC	Component	Description	Condition	Action
P1780 (To VIN D15361)	D-4 switch malfunction	Switch or circuit malfunction	D-4 switch inoperative or out of range	GO to Pinpoint Test B.
P0915 (From VIN D15362)	J-Gate input	J-Gate or circuit malfunction	Left-hand side of the J-Gate inoperative	GO to Pinpoint Test C.

PINPOINT TEST A : J-GATE SYSTEM CIRCUIT CHECKS	
TEST CONDITIONS	**DETAILS / RESULTS / ACTIONS**
A1: CHECK IGNITION SUPPLY TO THE J-GATE.	
	1 Disconnect the J-Gate electrical connector, IP14.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between IP14, pin 01 (WR) and GROUND.
	Is the voltage less than 10 Volts? **Yes** REPAIR the circuit between IP14 pin 01 (WR) and the ignition switch. For additional information, refer to the wiring diagrams. TEST the system for normal operation. **No** GO to A2.
A2: CHECK GROUND SUPPLY TO THE J-GATE.	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between IP14, pin 02 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. TEST the system for normal operation. **No** CHECK for CAN DTCs. REFER to Section 418-00 Module Communications Network.

PINPOINT TEST B : P1780. D-4 SWITCH MALFUNCTION (TO VIN D15361)	
• NOTE: Incorrect adjustment of the selector cable could result in this DTC being set with no electrical fault being present. REFER to Selector Lever Cable Adjustment - in this section.	
TEST CONDITIONS	**DETAILS / RESULTS / ACTIONS**
B1: CHECK IGNITION SUPPLY TO THE J-GATE.	
	1 Disconnect the J-Gate electrical connector, IP14.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between IP14, pin 01 (WR) and GROUND.

	Is the voltage less than 10 volts? **Yes** REPAIR the circuit between IP14, pin 01 (WR) and the ignition switch (this circuit includes the Central Junction fuse box, Ignition relay, and inertia switch). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to B2.
B2: CHECK GROUND SUPPLY TO THE J-GATE.	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between IP14, pin 02 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to B3.
B3: CHECK D-4 SWITCH SIGNAL WIRE FOR HIGH RESISTANCE.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between IP14, pin 05 (BW) and JB131, pin 45 (BW).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new J-Gate. REFER to Transmission Selector Lever - in this section.

PINPOINT TEST C : P0915 J-GATE SIGNAL INPUTS TO THE TCM (FROM VIN D15362)	
• NOTE: Incorrect adjustment of the selector cable could result in this DTC being set with no electrical fault being present. REFER to Selector Lever Cable Adjustment - in this section.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK TRANSMISSION RANGE SENSOR CONTINUITY IN D.	
	1 Disconnect TR sensor electrical connector JB156.
	2 Select **D**.
	3 Check for continuity between JB156, pin 08 and pin 01 at the sensor.
	Is the circuit continuous? **Yes** GO to C2. **No** Carry out the adjustment procedure for the Transmission Range Sensor. REFER to Transmission Range (TR) Sensor Adjustment in this section. Recheck the circuit. If still open circuit, INSTALL a new Transmission Range Sensor. REFER to Transmission Range (TR) Sensor in this section. CLEAR the DTC. TEST the system for normal operation.
C2: CHECK TRANSMISSION RANGE SENSOR DRIVE SIGNAL WIRE FOR HIGH RESISTANCE.	
	1 Disconnect the TCM electrical connector, JB131.
	2 Measure the resistance between JB131, pin 27 (Y) and JB156, pin 01 (Y).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to C3.
C3: CHECK IGNITION SUPPLY TO THE J-GATE.	
	1 Disconnect the J-Gate electrical connector, IP14.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between IP14, pin 01 (WR) and ground.
	Is the voltage less than 10 volts? **Yes** REPAIR the circuit between IP14, pin 01 (WR) and the ignition switch (this circuit includes the Central Junction fuse box, Ignition relay, and inertia switch). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to C4.
C4: CHECK GROUND SUPPLY TO THE J-GATE.	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between J-Gate electrical connector IP14, pin 02 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to C5.
C5: CHECK J-GATE SIGNAL INPUT WIRES FOR CONTINUITY (4 RANGE).	
	1 Disconnect the TCM electrical connector JB131.
	2 Measure the resistance between IP14 pin 05 (BW) and JB131 pin 45 (BW).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to C6.
C6: CHECK THE J-GATE SIGNAL INPUT WIRES FOR CONTINUITY (3 RANGE).	
	1 Measure the resistance between IP14 pin 15 (O) and JB131 pin 07 (O).

	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to C7.
C7: CHECK THE J-GATE SIGNAL INPUT WIRES FOR CONTINUITY (2 RANGE).	
	1 Measure the resistance between IP14 pin 14 (R) and JB131 pin 08 (R).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to C8.
C8: J-GATE SIGNALS FUNCTIONALITY	
	1 If tests between C1 and C7 have been successfully completed and the fault is still present, INSTALL a new J-Gate.
	2 CLEAR the DTC.
	3 TEST the system for normal operation.
	Does the system function correctly? **Yes** No further action required. **No** Contact dealer technical support for advice on possible module.

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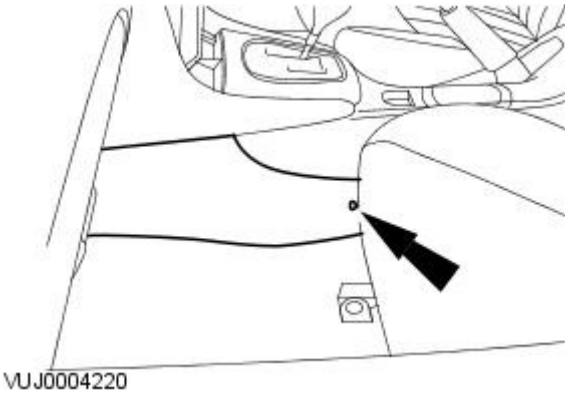
Automatic Transmission / Transaxle External Controls - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Selector Lever Cable Adjustment

General Procedures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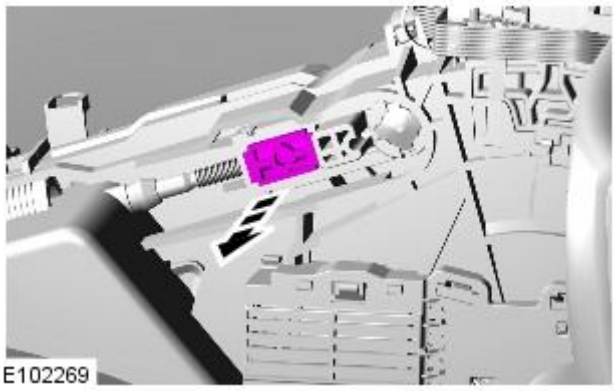
1. Check the operation of the transmission selector lever.
2. Remove the center console LH side finisher trim panel.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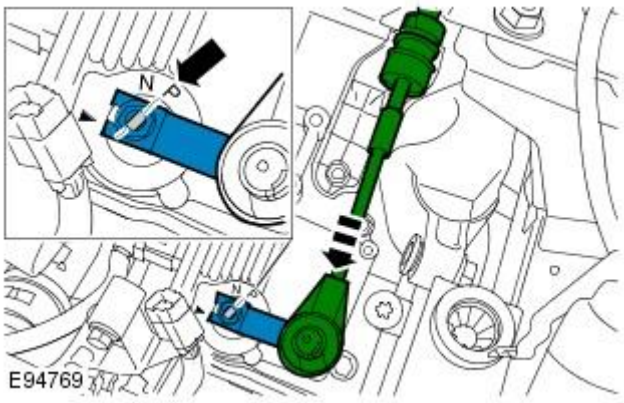
3. CAUTION: Make sure that the selector lever and the gearshift mechanism are in the park (P) position.

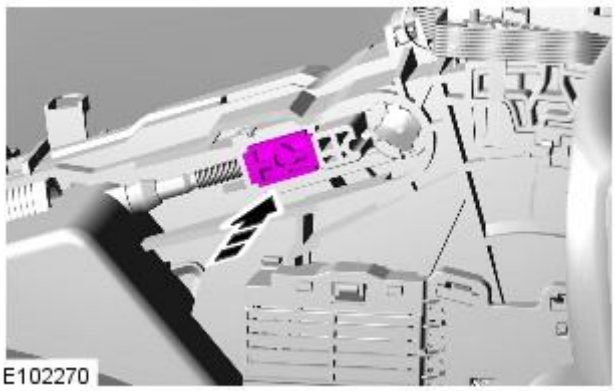
   Release the transmission selector cable adjuster.

4. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).



5. CAUTION: Make sure that the selector lever and the gearshift mechanism are in the park (P) position.

   Adjust the transmission selector cable.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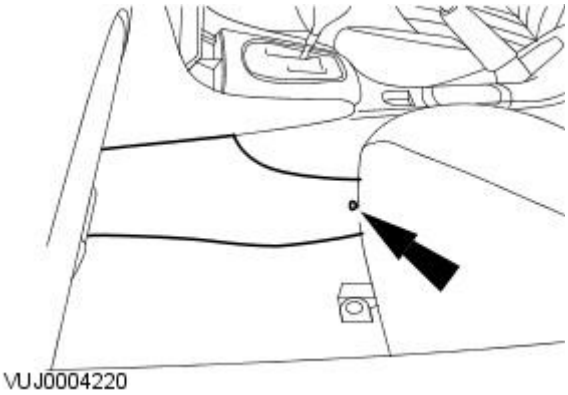
6. Lock the transmission selector cable adjuster.

7. Install the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).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8. Install the center console LH side finisher trim panel.

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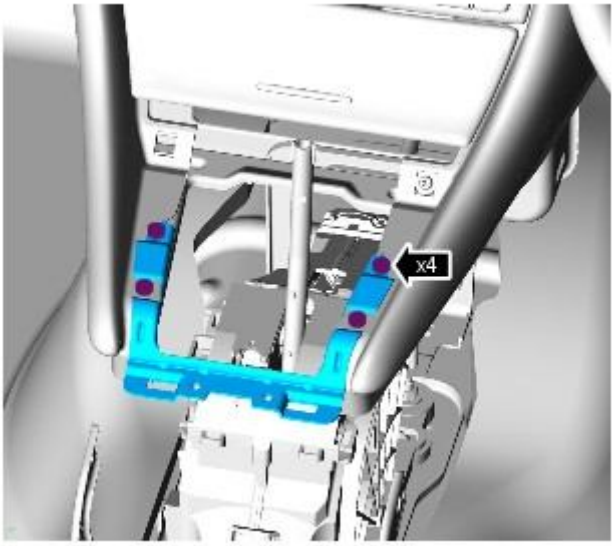
Automatic Transmission / Transaxle External Controls - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Selector Lever Assembly

Removal and Installation

Removal

1. Remove the floor console.
   For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).
2. Remove the floor console reinforcement bracket.
   - Remove the 4 Torx bolts.



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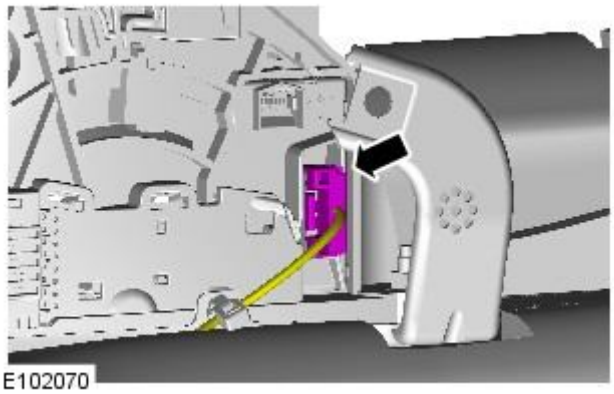
3. Disconnect the selector lever assembly electrical connector.



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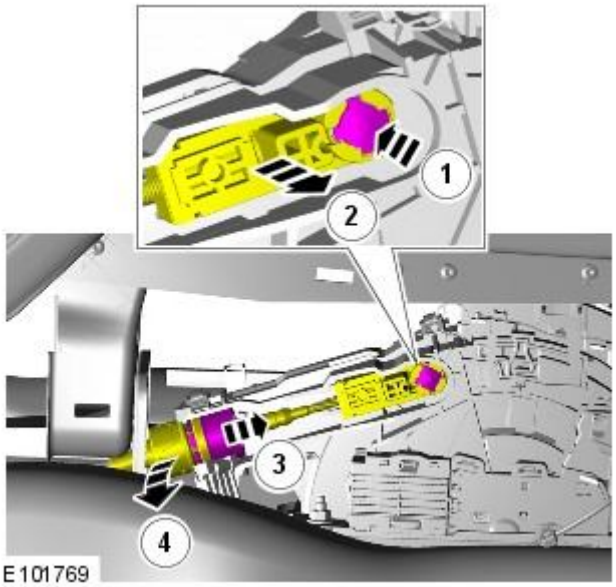
4. Release the transmission selector cable.
   - Release from the selector lever assembly.



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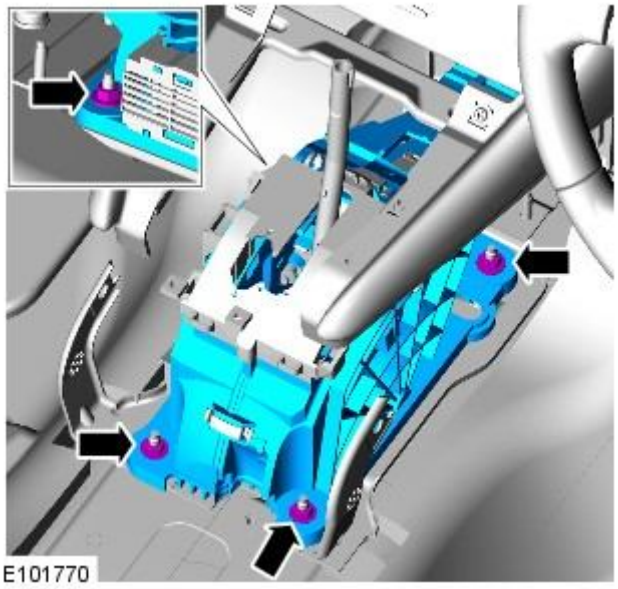
5. Remove the selector lever assembly.

- Remove the 4 nuts.

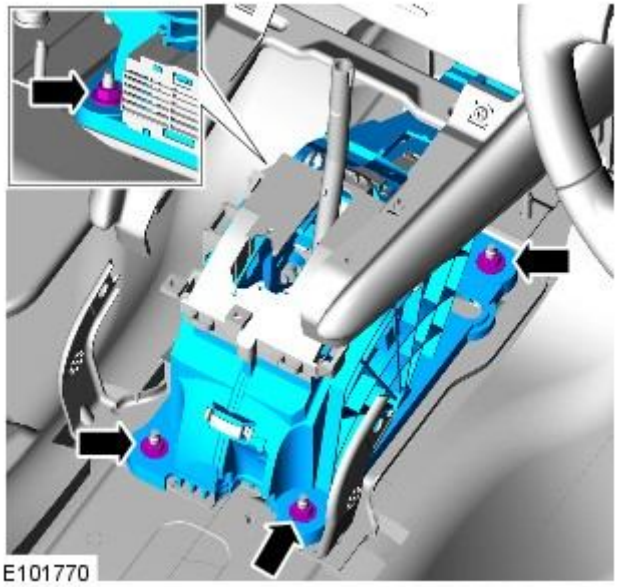


Installation

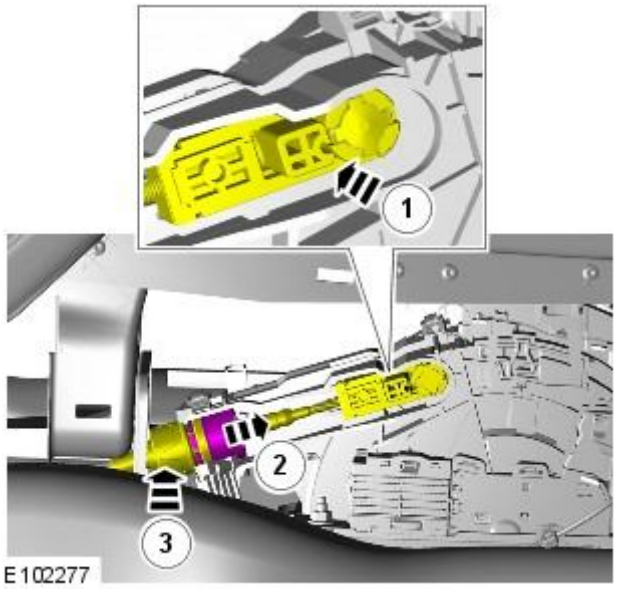
1. NOTE: Tighten the front 2 bolts first.

Install the selector lever assembly.

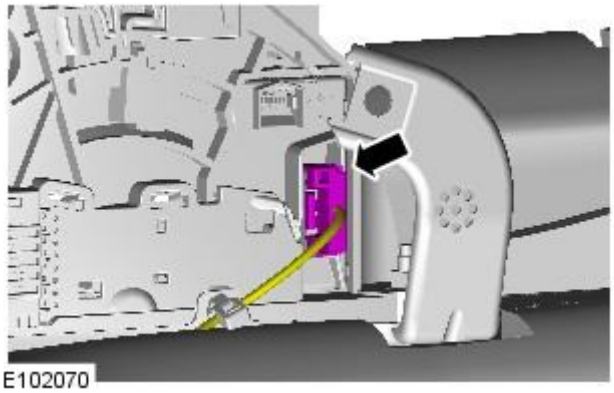
- Tighten to 10 Nm.



2. Attach the transmission selector lever cable.



3. Connect the selector lever assembly electrical connector.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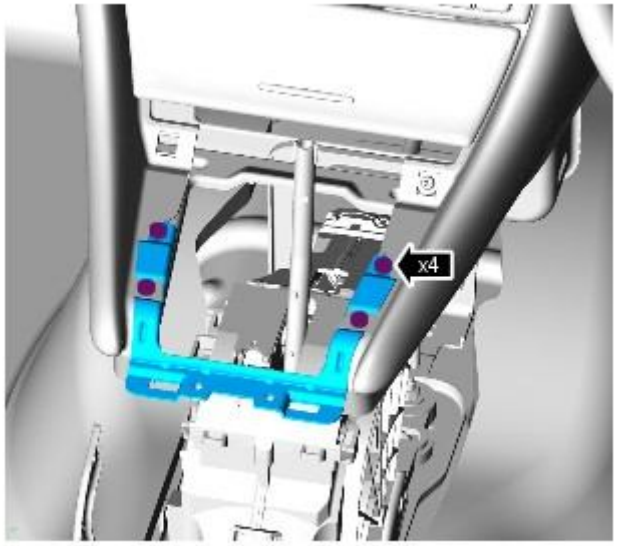
4. Install the floor console reinforcement bracket.

- Tighten to 3 Nm.



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5. Install the floor console.
For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

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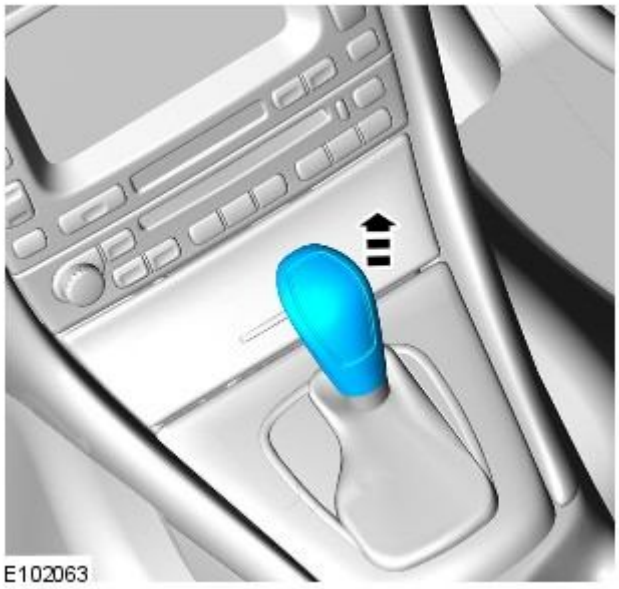
Automatic Transmission / Transaxle External Controls - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Selector Lever Knob

Removal and Installation

Removal

1. Release the selector lever gaiter from the selector lever knob.

- Rotate the chrome finisher clockwise and push downwards.



2. WARNING: The selector lever knob will be released suddenly, keep face clear during removal.

Remove the selector lever knob.

- Pull the selector lever knob upwards.

Installation

1. To install, reverse the removal procedure.

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Manual Transmission / Transaxle and Clutch - General Information -

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Brake fluid	ITT Super Dot 4

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Manual Transmission / Transaxle and Clutch - General Information - Manual Transmission and Clutch

Description and Operation

The clutch system consists of the following components:

- A flywheel
- A clutch disc
- A clutch pressure plate
- A clutch master cylinder
- A clutch slave cylinder
- A clutch release hub and bearing

The clutch master cylinder transmits fluid pressure to the slave cylinder, which in turn moves the clutch release hub and bearing.

The clutch master cylinder uses brake fluid and shares a common reservoir with the brake master cylinder.

The clutch is a single plate, dry-friction disc with a diaphragm-style spring clutch pressure plate. The clutch disc has a hub which is splined to the input shaft. The clutch disc has friction material where it contacts the flywheel and the pressure plate. The clutch pressure plate applies pressure to the clutch disc, holding it tightly against the surface of the flywheel.

In the engaged position, the diaphragm spring holds the clutch pressure plate against the clutch disc, so that engine torque is transmitted to the input shaft. When the clutch pedal is depressed, the clutch release hub and bearing pushes the diaphragm spring center toward the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted to the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission and enabling the gears to be changed.

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Manual Transmission / Transaxle and Clutch - General Information - Manual Transmission and Clutch

Diagnosis and Testing

Inspection and Verification -Clutch

As fault diagnosis starts when repairs are taken on, the following procedure is recommended:

1. **1.** Verify the customer concern by operating the system.
2. **2.** Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical	Electrical
• Transmission oil leak • Missing screws or nuts	• •

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.

Inspection and Verification - Manual Transmission

The following checks should be carried out before repairing or installing a new transmission:

Transmission Noise

If transmission noises are reported, check the transmission fluid level. If damage has occurred due to a lack of fluid, install a new transmission.

Oil Leakage

- Check that the leaking fluid is actually transmission fluid and not hydraulic fluid (from the hydraulically operated clutch) or engine oil.
- Check the transmission fluid level and, as necessary, drain off any excess fluid.
- Clean the transmission and the adjacent areas carefully before the road test.

Symptom Chart - Poor gear shifting

Symptom Chart

Symptom	Possible Sources	Action
Significant effort required when downshifting or synchronizer crashing	* Gear synchronization is inadequate.	* Check oil level. * Check gear linkage. * INSTALL a new transmission.
Gear jumps out of engagement while driving	* Worn or broken synchronizer components. * Manufacturing error (incorrect gear wheel toothing or synchronizer ring).	* INSTALL a new transmission.
Gearshift problems in different gears (stiff or partially seized)	* Gear linkage.	* Check oil level. * Check gear linkage. * INSTALL a new transmission.
Brief scratching noise during gear shifting	* Inadequate gear synchronization.	* Check oil level. * Check gear linkage. * INSTALL a new transmission.

Symptom Chart - Oil leakage

Symptom Chart

Symptom	Possible Sources	Action
Leak from transmission housing	* Leak from breather.	* CHECK oil level.
	* Leak from fill plug.	* TIGHTEN fill plug.
	* Leak from drain plug.	* TIGHTEN drain plug.
	* Sealing lip of the output shaft oil seal damaged.	* INSTALL a new output shaft seal and drive flange if seal is damaged.
	* Oil leaking from the selector shaft oil seal.	* INSTALL a new selector shaft seal.
	* Leak from crankshaft rear seal.	* INSTALL a new crankshaft seal.
	* Leak from clutch hydraulics.	* For additional information, refer to Pinpoint Test H.
	* Sealing lip on input shaft damaged.	* INSTALL a new input shaft seal.

Symptom Chart - General Concerns

Symptom Chart

Symptom	Possible Sources	Action
Clicking noises in reverse gear	* Gear wheels.	* RUN the vehicle on wheel free ramp to establish that the noise is coming from the transmission. If the noise is coming from the transmission INSTALL a new transmission.
Gear wheels banging when shifting	* Damaged clutch.	* CHECK the clutch is clearing correctly. - No-For additional information, refer to Pinpoint Test A. - Yes-CHECK transmission oil level. If transmission level is okay INSTALL a new transmission.
	* Selector forks or synchronizer rings.	* INSTALL a new transmission.
Noises in the forward	* Transmission fluid level low	* FILL the transmission with correct amount of fluid.

gears	* The engine/transmission assembly is in contact with the chassis/body.	* INSPECT for points of contact or damaged engine/transmission isolator, support insulator.
	* Engine/transmission flange bolts.	* TIGHTEN the transmission flange bolts. For additional information, refer to 308-03.
	* Input and output shaft bearings.	* INSTALL a new transmission.
Gears jump out of engagement	* Engine/transmission support insulator. * Internal components.	* REPAIR or INSTALL new components as necessary. * INSTALL a new transmission.
One of the gears cannot be selected	* Gearshift linkage malfunction.	* CHECK gearshift linkage correctly attached to transmission case, sector arm and the rear mounted to body. - CHECK gearshift linkage functions correctly.
	* Transmission internal selection problem.	* INSTALL a new transmission.
Gears jumps out of engagement	* Gearshift linkage fault. * Internal selector mechanism loose. * Synchronizer fault.	* CHECK gearshift linkage for correct function. * INSTALL a new transmission. * INSTALL a new transmission.
Clattering, or rattling noises	* Gearshift mechanism foul to body.	* Make sure that the gearshift mechanism is correctly located onto the gearbox. - Make sure that there are no components fouling the gearshift linkage.
	* Gearshift lever joint.	* CHECK free play in bearing between the lever and support housing, and between the lever and shift arm.
	* Gearshift lever knob loose.	* TIGHTEN the gearshift lever knob or, INSTALL a new knob as necessary.
Gearshift linkage has excessive play	* Gear lever bearing worn. * Gearshift selector rod assembly damaged or worn	* CHECK free play in bearing. INSTALL a new if necessary. * INSTALL a new gearshift selector rod assembly
Gearshift linkage does not operate freely	* Excessive friction in lever bearing. * Gearshift selector rod assembly damaged or worn * Possible fault in transmission	* INSTALL a new lever bearing. * INSTALL new gearshift selector rod assembly * INSTALL new transmission.

Symptom Chart - Clutch

Symptom Chart

Symptom	Possible Sources	Action
Clutch slippage	* Clutch pedal free play. * Sticking clutch pedal. * Diaphragm springs. * Clutch pressure plate. * Clutch disc facing. * Hardened or oiled clutch disc facing surface. * Flywheel.	* GO to Pinpoint Test A.
	* Excessive temperature.	* ALLOW the clutch to fully cool.
	* Slave cylinder sticking.	* CHECK slave cylinder travels freely over its complete travel.
	* Adjuster ring at fully worn position.	* INSTALL a new clutch drive plate.
Clutch chatter or shudder	* Engine mounts. * Oil on clutch disc facing. * Diaphragm springs. * Clutch pressure plate. * Clutch disc facing. * Flywheel.	* GO to Pinpoint Test B.
Clutch drag	* Insufficient brake fluid. * Air in hydraulic system. * Clutch pedal free play. * Diaphragm springs. * Clutch disc. * Clutch disc splines. * Oil on clutch disc facing.	* GO to Pinpoint Test C.
	* Insufficient clutch pedal travel.	* Make sure the clutch pedal has its full range of travel. * Make sure the clutch pedal returns to the fully released position and the reservoir is full.
Clutch pedal pulsation	* Clutch and brake pedal pivot shaft not correctly lubricated. * Flywheel. * Damaged springs in pressure plate.	* GO to Pinpoint Test E.
	* Release bearing noisy or worn.	* INSTALL a new release bearing.
	* Cover assembly.	* CHECK run out of clutch cover. INSTALL a new clutch cover.
Clutch pedal related vibrations	* Engine component grounding against frame. * Accessory drive belt. * Flywheel bolts. * Flywheel. * Imbalanced clutch pressure plate.	* GO to Pinpoint Test E.
Hard shifting	* Insufficient brake fluid. * Clutch pedal free play. * Manual transmission concern.	* GO to Pinpoint Test F.
Excessive noise	* Clutch pedal free play. * Clutch release bearing. * Poor lubrication of clutch release bearing. * Pilot bearing. * Excessive crankshaft end play.	* GO to Pinpoint Test G.
	* If the noise is heard from the transmission when the engine is started and switched off with the clutch engaged, and the noise disappears if the clutch pedal is depressed.	* INSTALL a new flywheel.
Fluid leakage	* Clutch master cylinder. * Clutch slave cylinder. * Clutch hydraulic tubes.	* GO to Pinpoint Test H.

PINPOINT TEST A : CLUTCH SLIPPAGE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: TEST CLUTCH SLIPPAGE	
	1 Lock wheels and put parking brake on .
	2 Start the engine and engage 4th gear.
	3 Run the engine at approximately 2000 rpm.
	4 Release clutch pedal slowly.
	Does the engine stall when the clutch pedal is fully released? **Yes** Clutch OK. **No** GO to A2.
A2: TEST CLUTCH FOR CLEARING	
	1 Start engine, fully depress the clutch pedal, partially engage reverse gear, slowly engage clutch until a grating noise is heard, depress the clutch slowly until grating stops.
	2 Measure pedal travel from the pedal to the floor.
	Is the measurement between 25mm and 45mm? **Yes** GO to A3. **No** GO to B3.
A3: TEST FULL PEDAL TRAVEL	
	1 Measure the clutch pedal travel from fully up to fully compressed.
	Is the measurement between 140mm and 150mm? **Yes** GO to A4. **No** CHECK clutch pedal for obstructions. TEST the system for normal operation.
A4: TEST CLUTCH PEDAL	
	1 Check lubrication.
	Is the clutch pedal shaft sufficiently lubricated? **Yes** GO to B3. **No** Lubricate clutch pedal shaft.

PINPOINT TEST B : CLUTCH CHATTER OR SHUDDER

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: TEST CLUTCH CHATTER OR SHUDDER	
	1 Start the engine and engage 1st gear.
	2 Run the engine between 1200 rpm and 1500 rpm.
	3 Release clutch pedal slowly.
	Does the vehicle jerk when it starts off? **Yes** GO to B2. **No** Clutch OK.
B2: TEST ENGINE/TRANSMISSION SUPPORT INSULATOR	
	1 Check engine/transmission mountings, support insulators for damage or loose bolts.
	Are the engine/transmission mountings, support insulators loose or damaged? **Yes** TIGHTEN the bolts or INSTALL new engine/transmission mountings as necessary. TEST the system for normal operation. **No** GO to B3.
B3: TEST CLUTCH PRESSURE PLATE	
	1 Remove clutch pressure plate.
	Does the clutch pressure plate have signs of wear or damage? **Yes** INSTALL a new clutch pressure plate. **No** GO to B4.
B4: TEST CLUTCH FRICTION DISC	
	1 Visually check the clutch friction disc.
	Is the clutch friction disc oil-fouled or does it have burn marks? **Yes** INSTALL a new clutch friction disc. TEST the system for normal operation. **No** CHECK the flywheel.

PINPOINT TEST C : CLUTCH DRAG

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK BRAKE FLUID LEVEL	
• NOTE: The hydraulic clutch fluid is supplied from the brake master cylinder.	
	1 Check the brake fluid level.
	Is the brake fluid level between the MAX and MIN marks on the brake fluid reservoir? **Yes** GO to C2. **No** FILL brake fluid, the brake and clutch system for leaks. Test system for normal operation.
C2: TEST CLUTCH PEDAL FREE TRAVEL	
	1 Operate clutch pedal manually to the point of resistance and release.
	2 Measure pedal travel.

	Is the measured dimension within 15 mm? **Yes** INSTALL a new clutch pressure plate. TEST the system for normal operation. **No** GO to B3.

PINPOINT TEST D : CLUTCH PEDAL PULSATION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: TEST CLUTCH PEDAL	
	1 Check lubrication.
	Is the clutch pedal shaft sufficiently lubricated? **Yes** CHECK the flywheel. **No** LUBRICATE the clutch pedal shaft. TEST the system for normal operation.

PINPOINT TEST E : CLUTCH RELATED VIBRATIONS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK FOR ENGINE COMPONENT GROUNDING	
	1 Raise and support the vehicle. REFER to: Jacking (100-02 Jacking and Lifting, Description and Operation).
	2 Check the engine mountings for grounding on the body frame.
	3 Check the exhaust manifold or other engine component grounding on the body or frame.
	Is there evidence of grounding on body or frame? **Yes** REPAIR or INSTALL a new as necessary. TEST the system for normal operation. **No** GO to E2.
E2: CHECK FOR ACCESSORY DRIVE VIBRATIONS	
	1 Feel accessory vibration at clutch engage/disengage when engine torque changes.
	2 Disconnect the accessory drive belt and check for vibration.
	Does the vibration stop when the drive belt is removed from the engine? **Yes** REPAIR or INSTALL new accessory drive belt components. REFER to: Accessory Drive - 4.2L/2.5L/3.0L (303-05 Accessory Drive, Diagnosis and Testing), Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing). **No** GO to E3.
E3: CHECK FOR RELEASE BEARING NOISE	
	1 Start the engine.
	2 Depress and hold clutch pedal.
	Is a whirring, grating or grinding noise present? **Yes** INSTALL a new clutch slave cylinder. . TEST the system for normal operation. **No** GO to E4.
E4: INSPECT FLYWHEEL	
	1 Remove the transmission. • Five speed transmission - REFER to: Manual Transmission (308-03 Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transmission, Diagnosis and Testing). • Six speed transmission - REFER to: Manual Transmission (308-03 Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transmission, Diagnosis and Testing).
	2 Inspect for loose flywheel bolts.
	3 Carry out flywheel runout check.
	Is the flywheel OK? **Yes** DIAGNOSE engine vibration concern. REFER to: Engine - 4.2L/2.5L/3.0L (303-00 Engine System - General Information, Diagnosis and Testing). or REFER to: Engine - 2.7L Diesel (303-00 Engine System - General Information, Diagnosis and Testing). **No** TIGHTEN flywheel bolts or INSTALL a new flywheel. Test the system for normal operation.

PINPOINT TEST F : HARD SHIFTING	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK FLUID LEVEL	
• NOTE: The hydraulic clutch fluid is supplied from the brake master cylinder.	
	1 Inspect the fluid level in the brake master cylinder reservoir.
	Is the fluid within the MAX and MIN level marks? **Yes** GO to C2. **No** FILL brake fluid, CHECK for leaks in the clutch and brake system. TEST the system for leaks.

PINPOINT TEST G : EXCESSIVE NOISE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: CHECK TRANSMISSION NEUTRAL POSITION	
	1 Start the engine and run it in neutral.
	2 Depress clutch pedal fully.

	Are there noises when the clutch is operated? **Yes** GO to G2. **No** System OK.
G2: TEST CLUTCH PEDAL FREE TRAVEL	
	1 Press the clutch down manually until resistance is felt, then release it again.
	2 Measure pedal travel.
	Is the measured dimension within 15 mm? **Yes** GO to G3. **No** INSTALL a new clutch master cylinder.
G3: TEST CLUTCH SLAVE CYLINDER WITH RELEASE BEARING	
	1 Remove the transmission. ● Five speed transmission - REFER to: Manual Transmission (308-03 Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transmission, Diagnosis and Testing). ● Six speed transmission - REFER to: Manual Transmission (308-03 Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transmission, Diagnosis and Testing).
	2 Check the clutch slave cylinder bolts.
	3 Check the release bearing for wear and rust.
	Are the bolts loose or are there signs of wear or rust? **Yes** TIGHTEN the bolts or INSTALL a new clutch slave cylinder with the release bearing. TEST the system for normal operation. **No** GO to G4.
G4: CHECK CLUTCH FRICTION DISC TORSION SPRINGS	
	1 Check torsion springs for wear.
	Do the torsion springs have signs of wear? **Yes** INSTALL a new clutch friction disc. TEST the system for normal operation. **No** Check crankshaft end play. REFER to: Camshaft End Play (303-00 Engine System - General Information, General Procedures).

PINPOINT TEST H : FLUID LEAKAGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: INSPECT CLUTCH MASTER CYLINDER	
	1 Inspect the clutch master cylinder for leakage.
	Is the clutch master cylinder OK? **Yes** GO to H2. **No** INSTALL a new clutch master cylinder as necessary. REFER to: Clutch Master Cylinder (308-02 Clutch Controls, Removal and Installation).
H2: INSPECT CLUTCH SLAVE CYLINDER	
	1 Inspect the clutch slave cylinder for leaks.
	Is the clutch slave cylinder OK? **Yes** GO to H3. **No** INSTALL a new clutch slave cylinder as necessary.
H3: INSPECT SYSTEM HYDRAULIC TUBES	
	1 Inspect the clutch hydraulic tubes for loose or damaged fittings causing leakage.
	Are the clutch hydraulic tubes OK? **Yes** CARRY OUT road test to verify customer complaint. **No** INSTALL new components as necessary. Carry out road test.

Manual Transmission / Transaxle and Clutch - General Information - Clutch System BleedingVehicles With: 5-Speed Manual Transmission - MT75

General Procedures

1. WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with the eyes. Wash hands thoroughly after handling. If brake fluid contacts the eyes, flush the eyes for 15 minutes with cold water. Get medical attention immediately if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately. Failure to follow these instructions may result in personal injury.

CAUTION: If brake fluid comes into contact with the paintwork, it should be washed down immediately with cold water.

• NOTE: Make sure of absolute cleanliness when filling brake fluid.

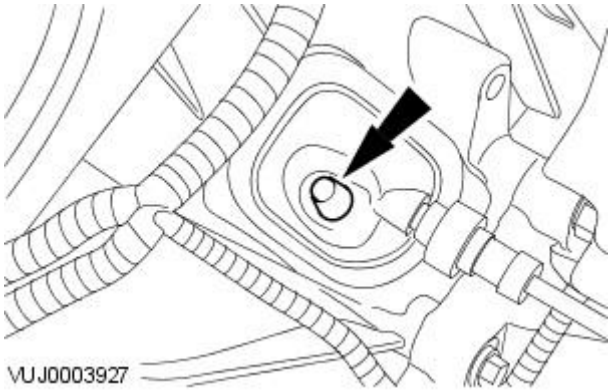
• NOTE: Do not re-use brake fluid.

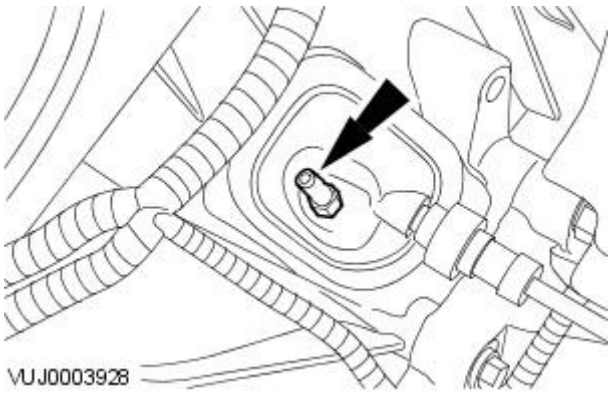
Bleed the clutch system.

2. Fill the brake fluid reservoir with brake fluid.

3. Raise and support the vehicle. For additional information, refer toSection 100-02 Jacking and Lifting

4. Remove the bleed nipple cover.





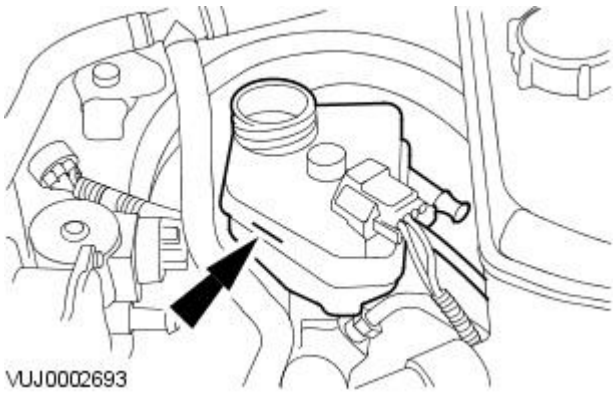
5. Bleed the clutch system.

- Attach a proprietary bleed jar to the bleed nipple and open the bleed nipple one turn.
- Depress the clutch pedal repeatedly until the emerging fluid is free of bubbles; always make sure that there is sufficient fluid (5 mm above the MAX) in the reservoir.
- After bleeding, tighten the bleed nipple.
- Install the bleed nipple cover.
- Install the dust cover.
- After bleeding, depress the clutch ten times and check that it is functioning correctly.

6. NOTE: Make sure of absolute cleanliness when filling brake fluid.

Check the brake fluid level.

- The fluid level should be between the MIN and MAX marks. If the level drops below the MIN mark, the brake warning indicator will light up.
- As necessary, fill the brake fluid reservoir with brake fluid.



Manual Transmission / Transaxle and Clutch - General Information - Clutch System BleedingVehicles With: 6-Speed Manual Transaxle - MMT6

General Procedures

1. WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with the eyes. Wash hands thoroughly after handling. If brake fluid contacts the eyes, flush the eyes for 15 minutes with cold water. Get medical attention immediately if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately. Failure to follow these instructions may result in personal injury.

CAUTION: If brake fluid comes into contact with the paintwork, it should be washed down immediately with cold water.

• NOTE: Make sure of absolute cleanliness when filling brake fluid.

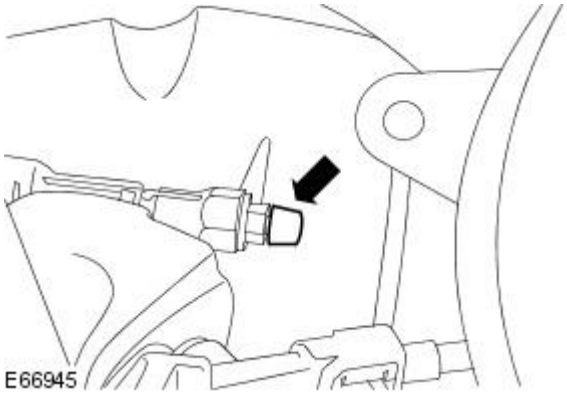
• NOTE: Do not re-use brake fluid.

Bleed the clutch system.

2. Fill the brake fluid reservoir with brake fluid.

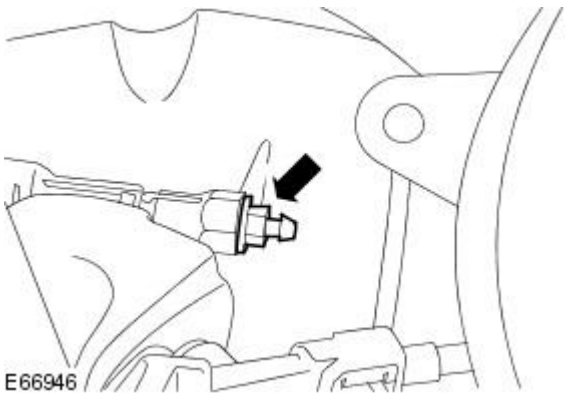
3. Raise and support the vehicle. For additional information, refer to For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

4. Remove the bleed nipple cover.



5. Bleed the clutch system.

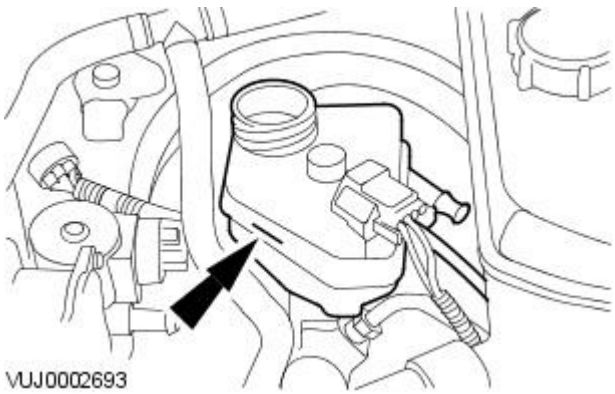
- Attach a proprietary bleed jar to the bleed nipple and open the bleed nipple one turn.
- Depress the clutch pedal repeatedly until the emerging fluid is free of bubbles; always make sure that there is sufficient fluid (5 mm above the MAX) in the reservoir.
- After bleeding, tighten the bleed nipple.
- Install the bleed nipple cover.
- Install the dust cover.
- After bleeding, depress the clutch ten times and check that it is functioning correctly.



6. NOTE: Make sure of absolute cleanliness when filling brake fluid.

Check the brake fluid level.

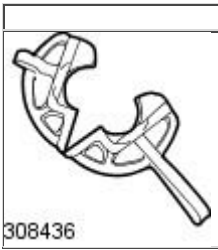
- The fluid level should be between the MIN and MAX marks. If the level drops below the MIN mark, the brake warning indicator will light up.
- As necessary, fill the brake fluid reservoir with brake fluid.



Published: 11-May-2011

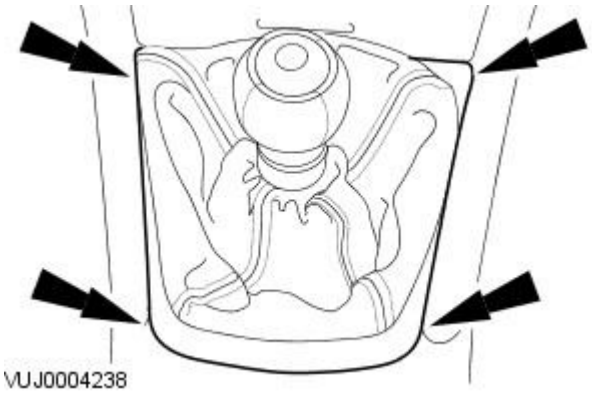
Manual Transmission / Transaxle and Clutch - General Information - Gearshift Cable Adjustment

General Procedures

Special Tool(s)	
 308436	Gearshift selector setting tool 308-436

1. Remove the wheel and tire. For additional information, refer to Section 204-04 Wheels and Tires

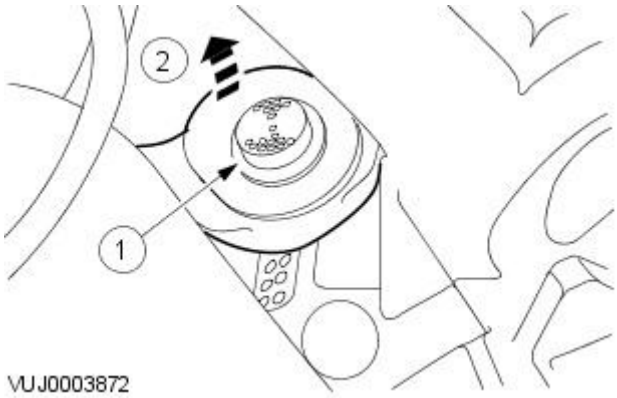
2. Detach the gearshift lever surround.


VUJ0004238

3. NOTE: Upper selector cable shown, lower shift cable similar.

Detach the shift and selector cables.

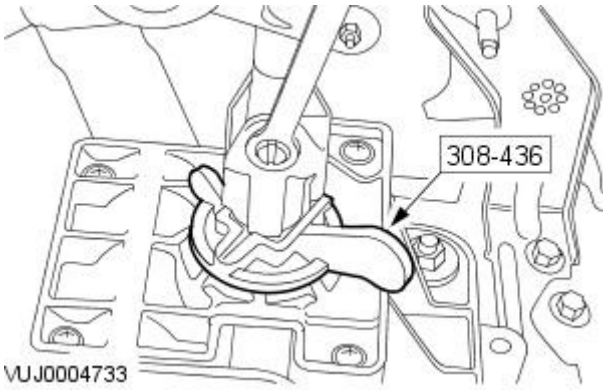
1. Press the button.
2. Detach the selector cable.



VUJ0003872

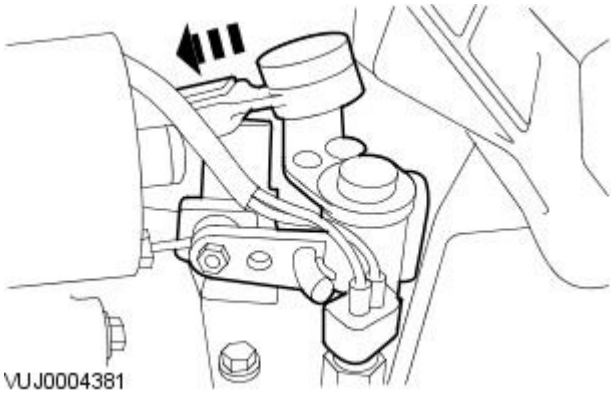
4. NOTE: Lift the reverse gear selector to fit special tool.

Using the special tool, make sure the gearshift lever is in the neutral position.

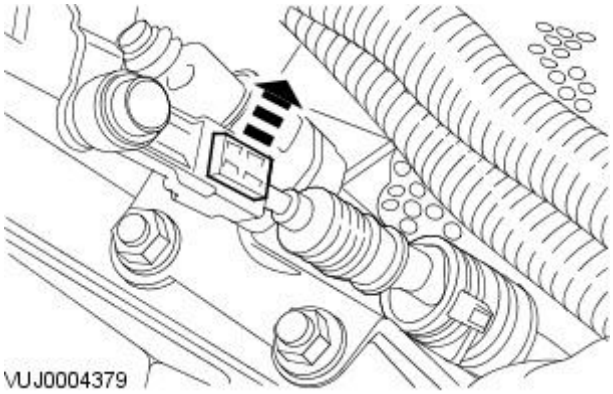


VUJ0004733

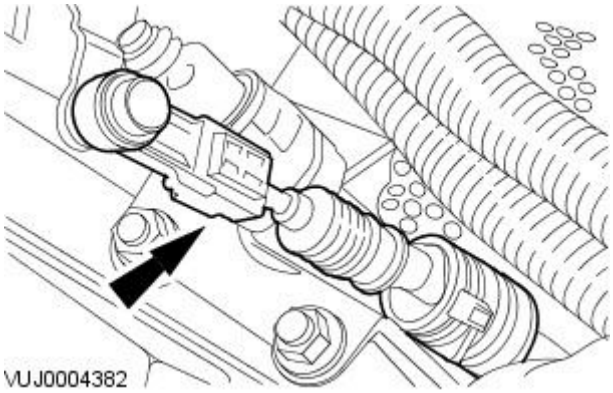
5. Make sure the transmission selector is in the fourth gear position.


VUJ0004381

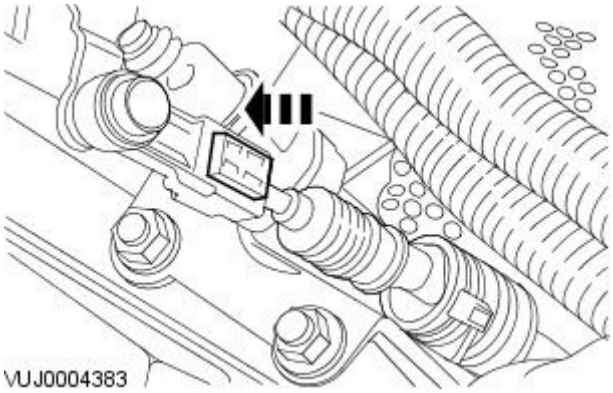
• NOTE: Shift cable has a black cover to cable end and the selector cable has a white cover to cable end.



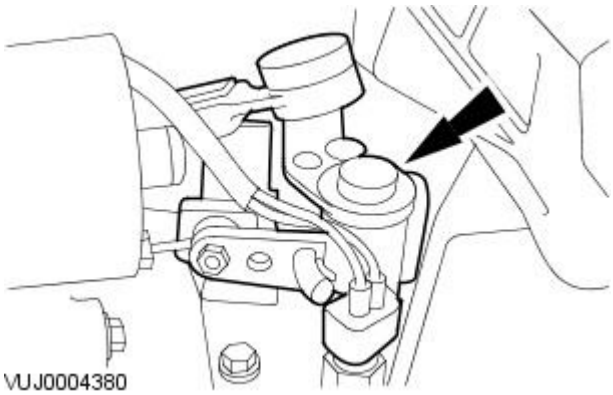
6. Detach the red locking tab on the shift cable.



7. Attach the shift cable to the ball pin on the transmission selector.

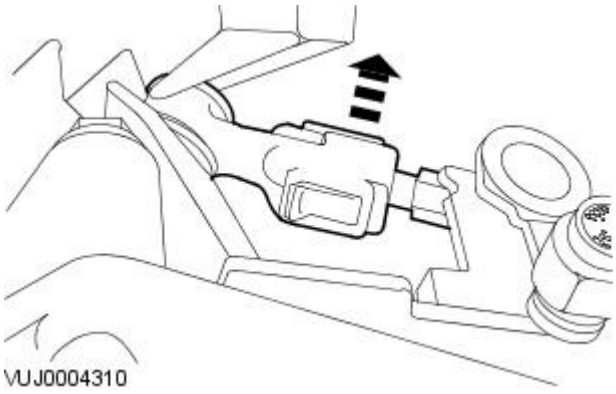


8. Press the red locking tab to secure the position of the shift cable.

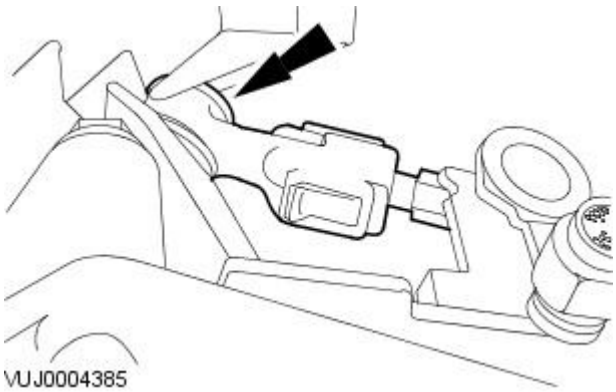


9. Place the transmission selector into the neutral position.

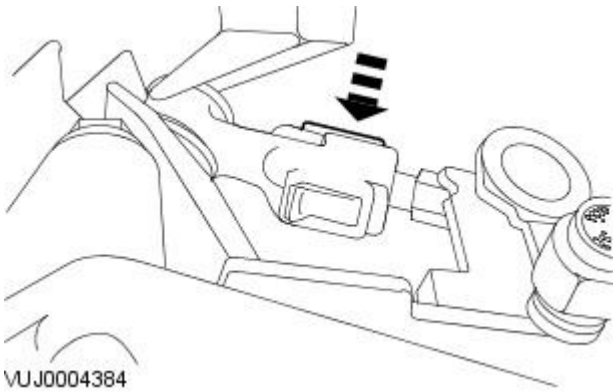
10. Detach the red locking tab on the selector cable.



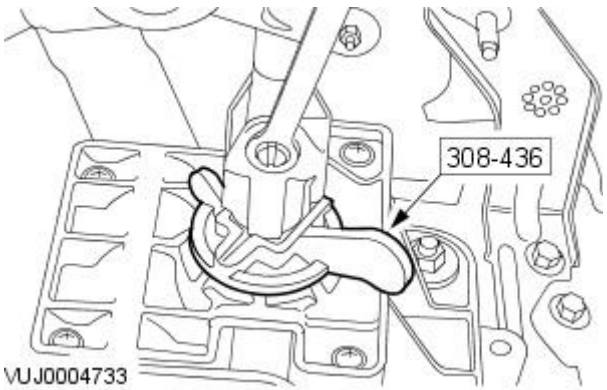
11. Attach the selector cable to the ball pin on the gearbox mass damper.



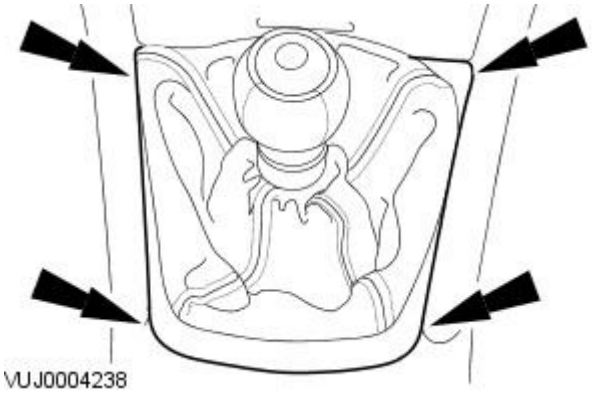
12. Press the red locking tab to secure the position of the selector cable.



13. Remove the gearshift selector setting tool.



14. Install the gearshift lever surround.



15. Check for correct operation of gear controls.

16. Install the wheel and tire. For additional information, refer to Section 204-04 Wheels and Tires

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Manual Transmission / Transaxle and Clutch - General Information - Release Hub and Bearing Check

General Procedures

1. Turn the clutch release hub and bearing in both directions and check for any binding or abnormal noise.
2.  CAUTION: The clutch release hub and bearing is sealed and must not be immersed in any type of cleaning fluid.

   Check for worn or damaged clutch release hub and bearing contact surfaces.
3. Install the clutch release hub and bearing on the input shaft and check for a smooth sliding condition.

Published: 11-May-2011

Clutch -

Torque Specifications

Description	Nm	lb-ft	lb-in
Pressure plate retaining bolts	25	18	-

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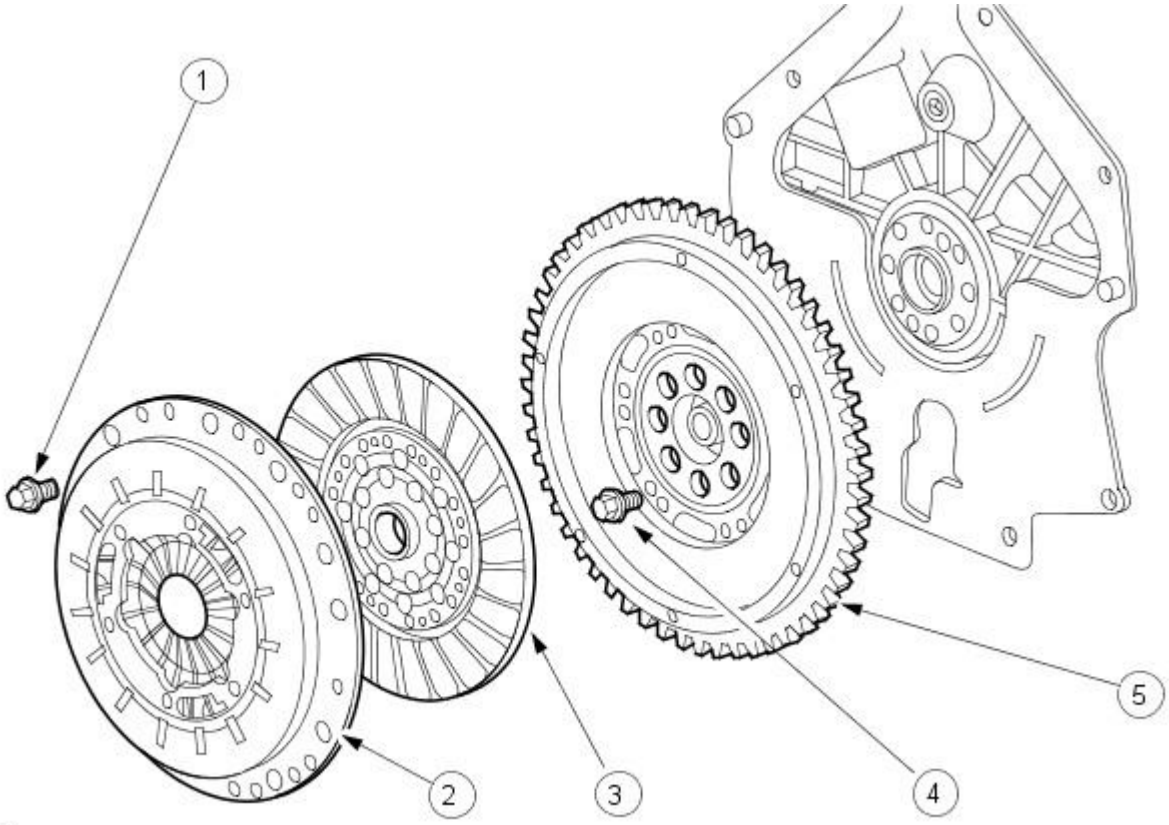
Clutch - Clutch

Description and Operation



VUJ0004131

Item	Part Number	Description
1	—	Pressure plate retaining bolt
2	—	Pressure plate
3	—	Clutch disc
4	—	Flywheel retaining bolt
5	—	Flywheel

The clutch transfers the engine torque to the transmission.

The clutch consists of a disc and a pressure plate with a diaphragm spring, bolted to the flywheel.

When the clutch pedal is operated the power transmission from the engine to the transmission is interrupted. The clutch is therefore engaged when the pedal is not depressed. Pressing down the pedal disengages the clutch.

Published: 11-May-2011

Clutch - Clutch

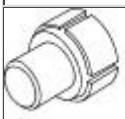
Diagnosis and Testing

For additional information, refer to Section 308-00 Manual Transmission/Transaxle and Clutch - General Information.

Published: 11-May-2011

Clutch - Clutch Disc and Pressure Plate

Removal and Installation

Special Tool(s)	
 308-441	Clutch alignment tool 308-441

Removal

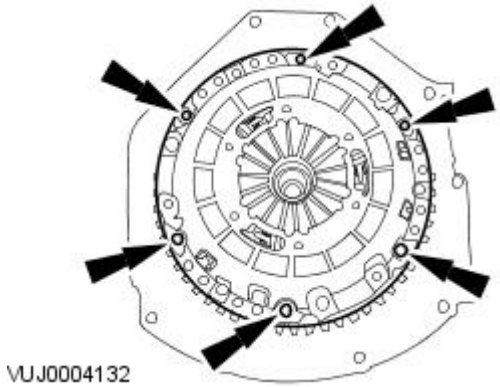
All except vehicles with diesel engine

1. Remove the manual transmission.
   For additional information, refer to: Transaxle - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (308-03 Manual Transmission/Transaxle, Removal).

Vehicles with diesel engine

2. Remove the manual transmission.
   For additional information, refer to: Transaxle - 2.0L Duratorq-TDCi (308-03 Manual Transmission/Transaxle, Removal) / Transaxle - 2.2L Duratorq-TDCi (110kW/150PS) - Puma (308-03 Manual Transmission/Transaxle, Removal).

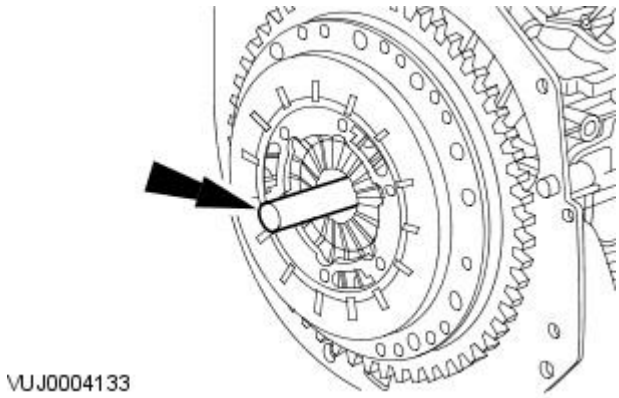
All vehicles


VUJ0004132

3. Remove the clutch disc and pressure plate.
   - Remove the pressure plate bolts in a uniform sequence.

Installation

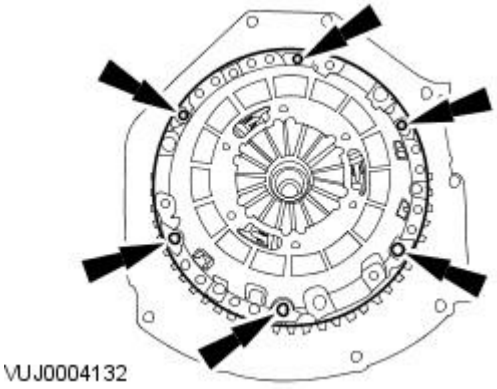
All except vehicles with diesel engine


VUJ0004133

1. NOTE: The clutch disc is marked "Transmission side" for correct installation.

   Using the special tool, align the clutch assembly.

All vehicles


VUJ0004132

2. NOTE: The clutch disc is marked "Transmission side" for correct installation.

Locate the clutch pressure plate on the flywheel dowels and tighten the bolts progressively in a diagonal sequence.

- Tighten to 25 Nm.

Vehicles with diesel engine

3. NOTE: Make sure that the input shaft of the transmission is moved squarely into the hub of the clutch disc. Do not bend in any direction.

Install the manual transmission.
For additional information, refer to: Transaxle - 2.0L Duratorq-TDCi (308-03 Manual Transmission/Transaxle, Installation) / Transaxle - 2.2L Duratorq-TDCi (110kW/150PS) - Puma (308-03 Manual Transmission/Transaxle, Installation).

All except vehicles with diesel engine

4. Remove the special tool.

5. NOTE: Make sure that the input shaft of the transmission is moved squarely into the hub of the clutch disc. Do not bend in any direction.

Install the manual transmission.
For additional information, refer to: Transaxle - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (308-03 Manual Transmission/Transaxle, Installation).

Published: 11-May-2011

Clutch Controls -

General Specifications

Item	Specification
Brake fluid	ITT super dot 4

Torque Specifications

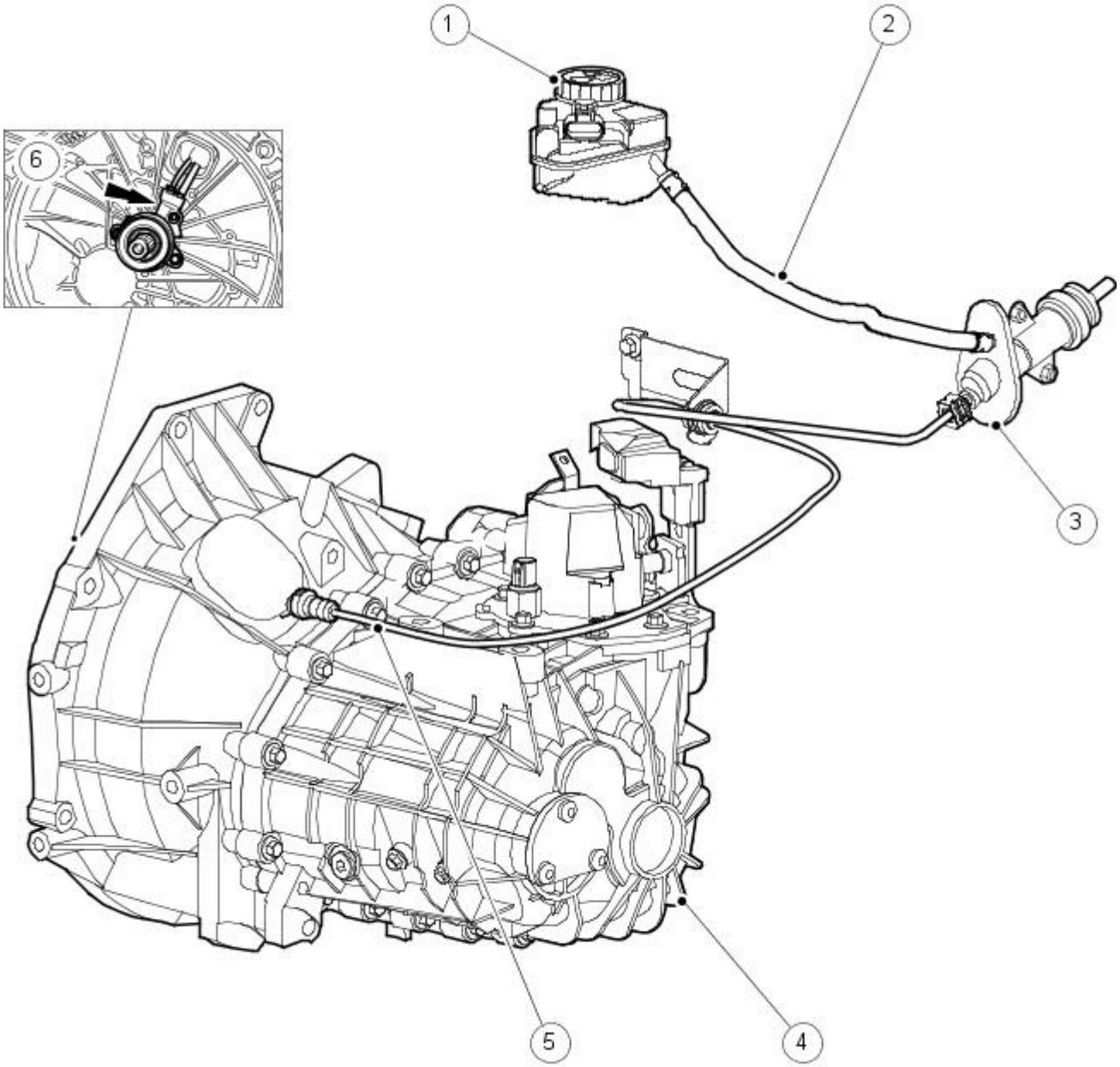
Description	Nm	lb-ft	lb-in
Clutch slave cylinder retaining bolts	10	7	-
Clutch master cylinder retaining nuts and bolts	10	7	-
Clutch pedal retaining nut	23	17	-
Engine wiring harness bracket retaining bolts	10	7	-

Published: 11-May-2011

Clutch Controls - Clutch Controls

Description and Operation

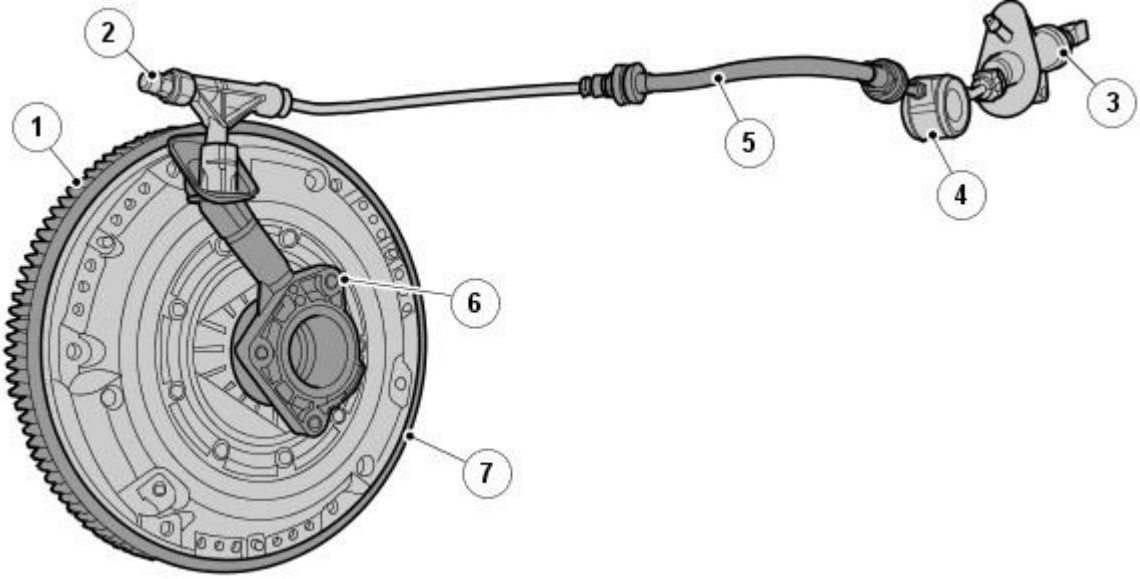
Vehicles with 5-speed manual transmission



VUJ0004195

Item	Part Number	Description
1	—	Brake fluid reservoir
2	—	Clutch master cylinder supply line
3	—	Clutch master cylinder
4	—	Transmission
5	—	Clutch slave cylinder supply line
6	—	Clutch slave cylinder

Vehicles with 6-speed manual transmission



E67496

Item	Part Number	Description
1	-	Flywheel
2	-	Bleed nipple
3	-	Clutch master cylinder
4	-	Vibration damper
5	-	Hydraulic line
6	-	Clutch slave cylinder
7	-	Self-adjusting clutch

This vehicle has a hydraulically operated clutch. The brake master cylinder reservoir has a separate chamber and is used to supply the hydraulic clutch system with fluid.

Depressing the clutch pedal builds up pressure in the clutch master cylinder and operates the release bearing integrated in the clutch slave cylinder.

The hydraulic clutch system has the following advantages:

- Automatic adjustment.
- Low operating effort.
- Minimal wear.

Reservoir

The brake fluid reservoir supplies both the hydraulic clutch system and the brake system with brake fluid.

The hydraulic clutch system and the brake system are separate inside the brake fluid reservoir. In the event of any leaks in the hydraulic clutch system the brake system remains fully operative.

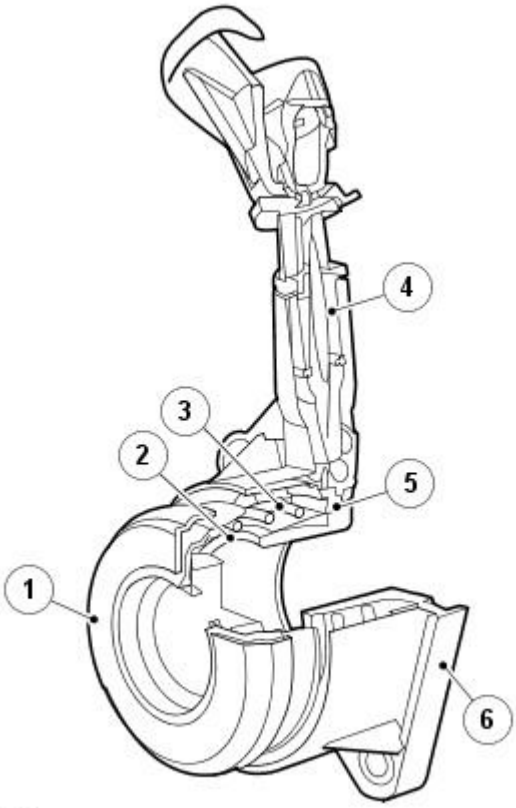
Clutch Master Cylinder

The pressure required to operate the clutch system is produced in the clutch master cylinder.

When the clutch pedal is depressed the piston rod moves the piston in the clutch master cylinder. This displaces the hydraulic fluid in the clutch master cylinder, which in turn displaces the hydraulic fluid in the clutch slave cylinder via the high - pressure line.

Clutch Slave Cylinder

Vehicles with 6-speed manual transmission



E67497

Item	Part Number	Description
1	-	Release bearing
2	-	Protective cap
3	-	Pressure spring
4	-	Hydraulic channel
5	-	Oil seal
6	-	Plastic housing

The central slave cylinder is fixed to the clutch housing with three bolts, together with an integrated release bearing. The release bearing is a press - fit on the clutch slave cylinder.

The hydraulic fluid which is displaced by the master cylinder piston moves the piston in the clutch slave cylinder, which in turn moves the release bearing in an axial direction. The release bearing presses against the tongues of the diaphragm spring with the inner bearing ring. This breaks the friction contact between the clutch disc and the flywheel.

When the clutch pedal is released the diaphragm spring returns the piston in the clutch slave cylinder to its original position. This restores the friction contact between the clutch disc and the flywheel.

Published: 11-May-2011

Clutch Controls - Clutch Controls

Diagnosis and Testing

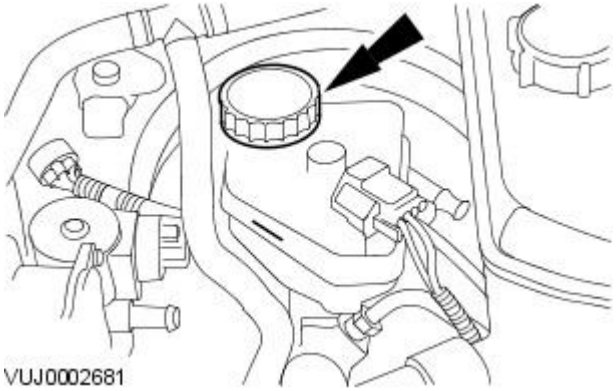
For additional information, refer to Section 308-00 Manual Transmission/Transaxle and Clutch - General Information

Clutch Controls - Clutch Master Cylinder

Removal and Installation

Removal

All vehicles

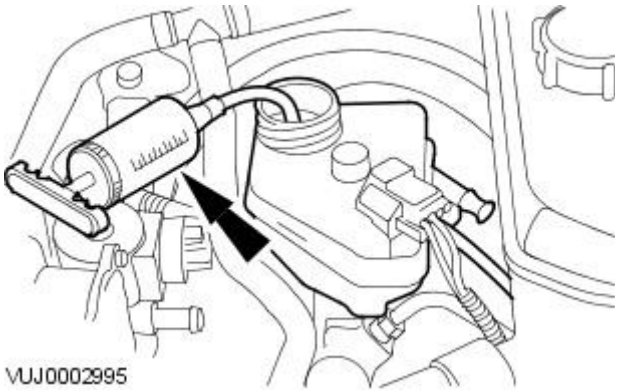


1. WARNING: Do not allow brake fluid to contact the skin or eyes. If brake fluid comes into contact with the skin or eyes, rinse the affected places immediately with water. Failure to follow this instructions can result in personal injury.

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

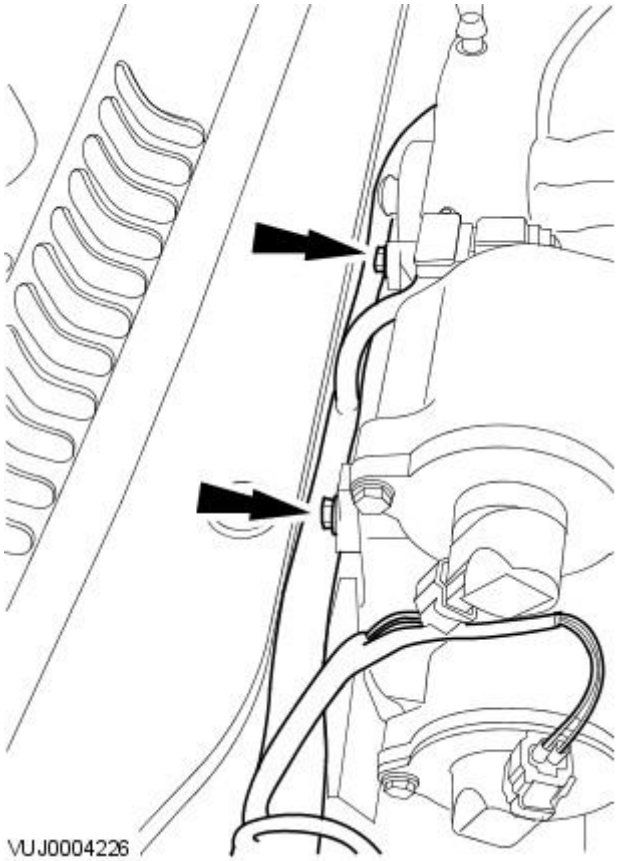
• NOTE: Make sure the filler cap does not become contaminated.

Remove the brake fluid reservoir filler cap.



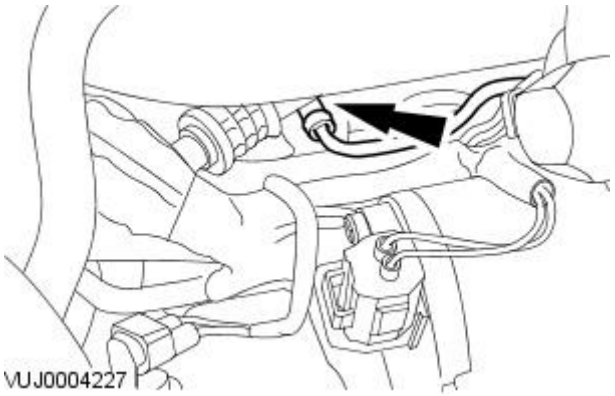
2. Using a suitable suction device drain the brake fluid reservoir.

All except vehicles with diesel engine

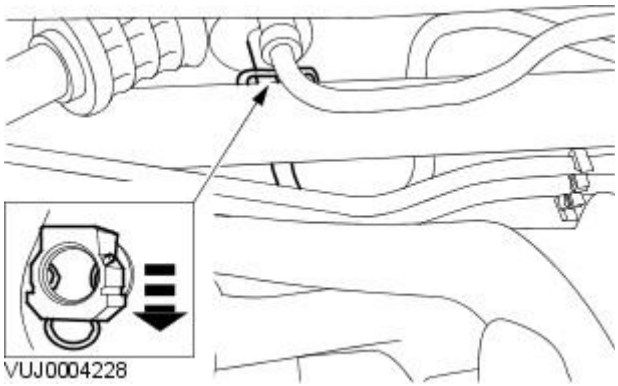


3. Detach the engine wiring harness from the intake manifold.

All vehicles

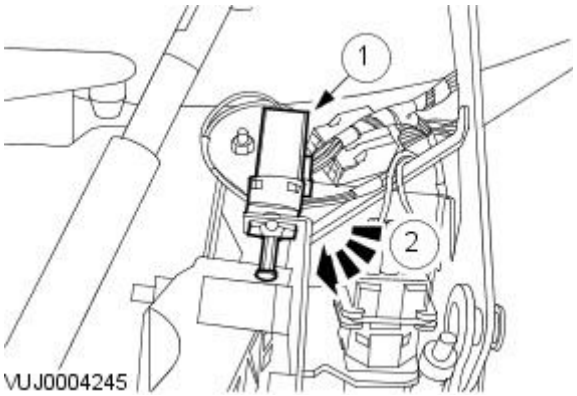


4. Disconnect the clutch master cylinder supply line.



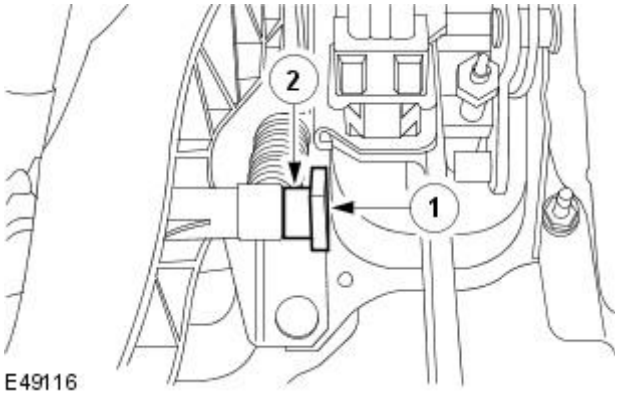
5. Disconnect the clutch slave cylinder supply line from the clutch master cylinder.

- Release the retaining clip to disconnect the line.



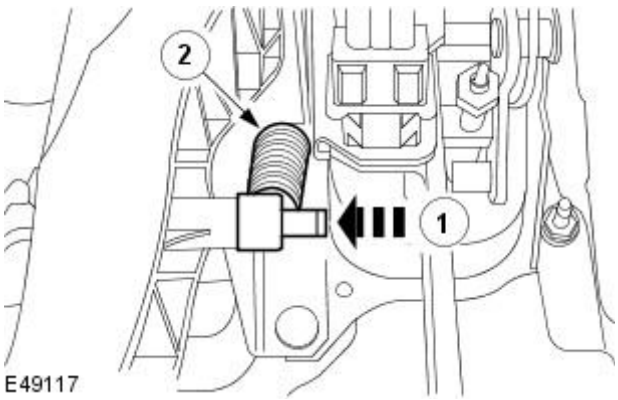
6. Remove the clutch pedal position switch.

1. Disconnect the electrical connector.
2. Remove the clutch pedal position switch.



7. Remove the clutch pedal return spring pin retaining clip and spacer.

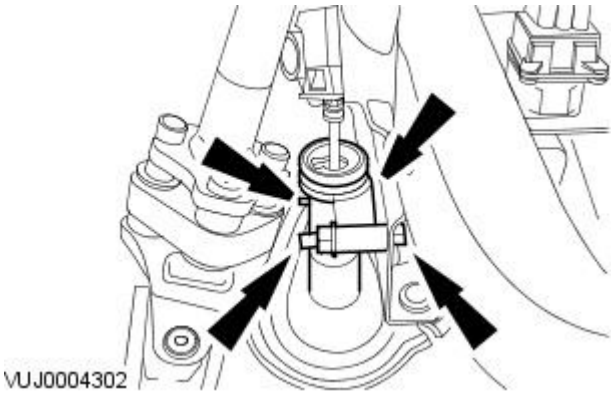
1. Remove the clutch pedal return spring pin retaining clip.
2. Remove the clutch pedal return spring pin spacer.



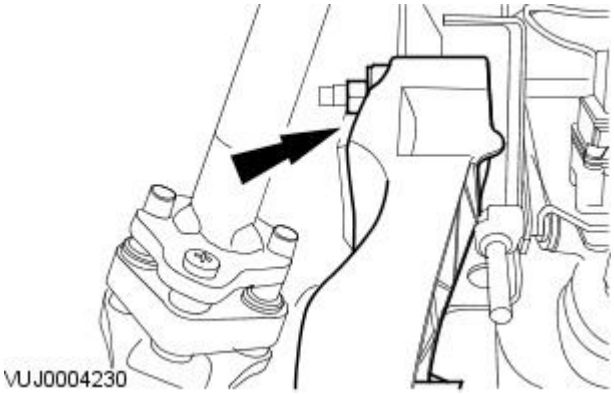
8. Remove the clutch pedal return spring.

1. Remove the clutch pedal return spring pin.
2. Remove the clutch pedal return spring.

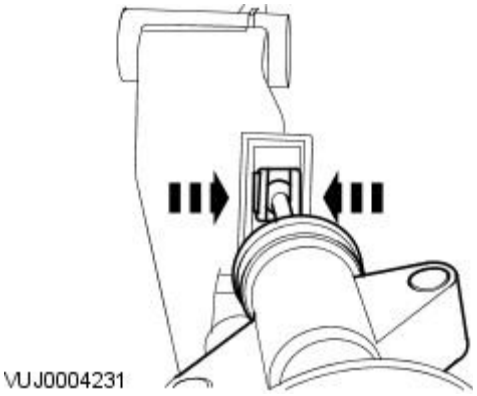
9. Remove the clutch master cylinder retaining nuts and bolts.



10. Remove the clutch master cylinder and clutch pedal.



11. Remove the clutch master cylinder from the clutch pedal.

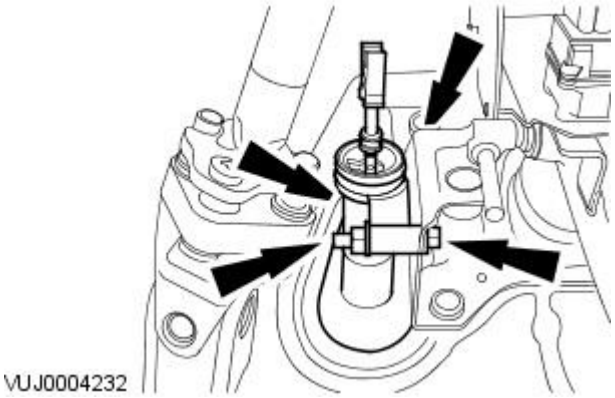


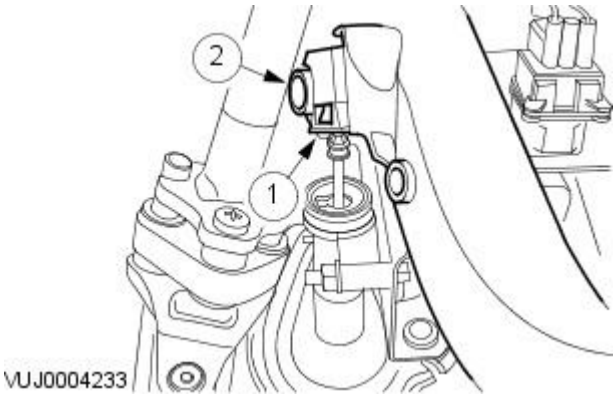
Installation

All vehicles

1. Install the clutch master cylinder.

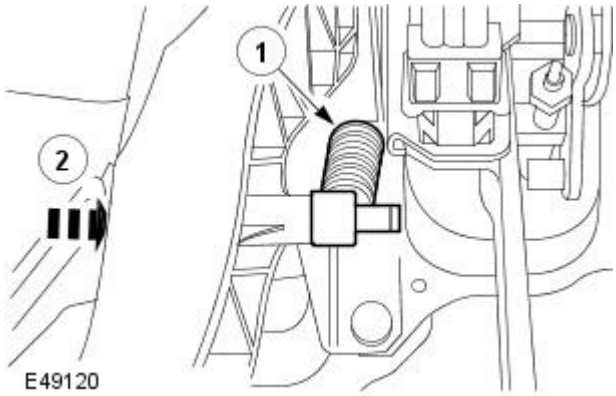
- Tighten to 10 Nm.





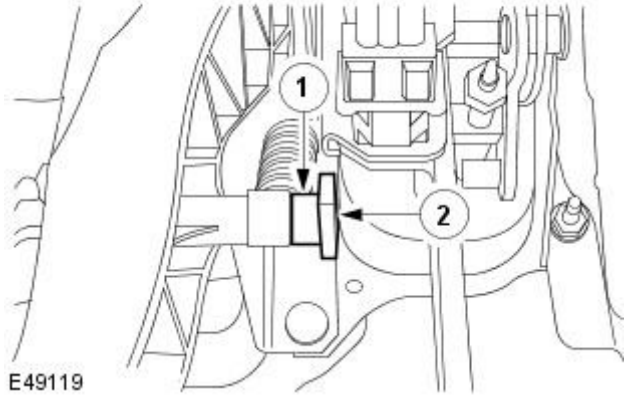
2. Install the clutch pedal.

1. Attach the clutch pedal to the clutch master cylinder.
2. Attach the clutch pedal to the support bracket.
    1. Tighten to 23 Nm.



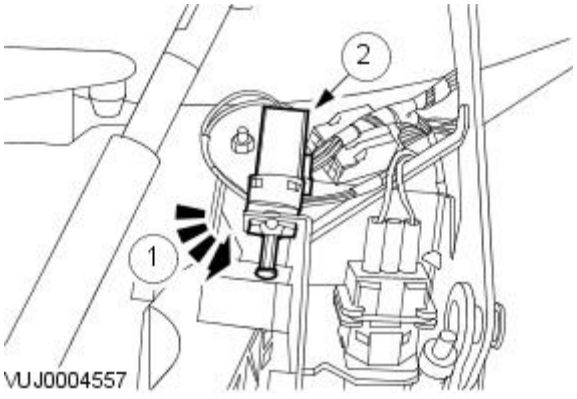
3. Install the clutch pedal return spring pin.

1. Install the clutch pedal return spring.
2. Install the clutch pedal return spring pin.



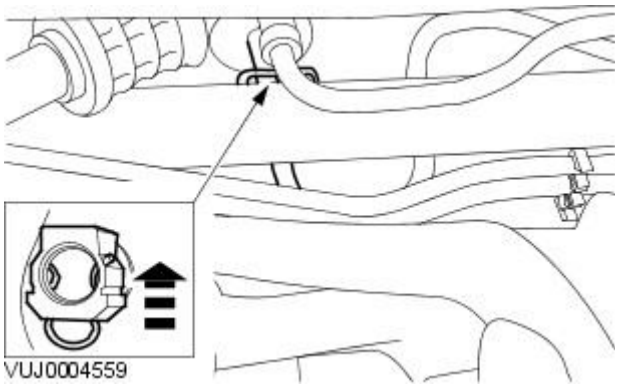
4. Install the clutch pedal return spring pin spacer and retaining clip.

1. Install the clutch pedal return spring pin spacer.
2. Install the clutch pedal return spring pin retaining clip.



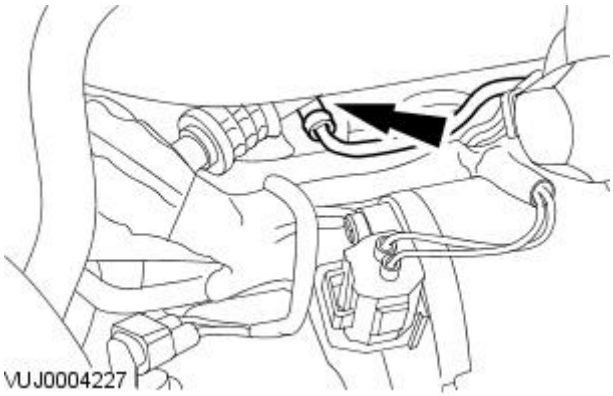
5. Install the clutch pedal position switch.

1. Install the clutch pedal position switch.
2. Connect the electrical connector.



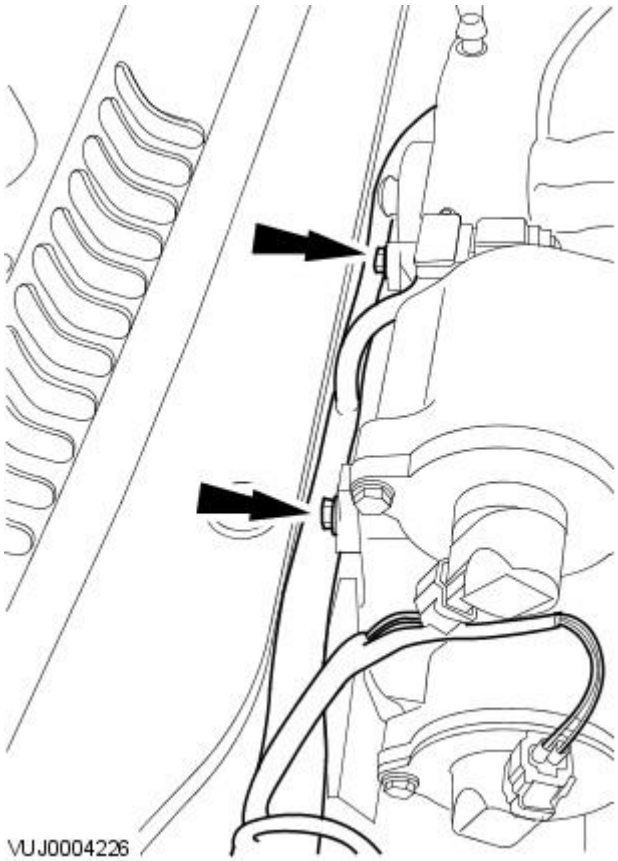
6. NOTE: Reposition the retaining clip.

Connect the clutch slave cylinder supply line to the clutch master cylinder.



7. Connect the clutch master cylinder supply line.

All except vehicles with diesel engine



8. Attach the engine wiring harness to the intake manifold.

- Tighten to 10 Nm.

All vehicles

9. Bleed the hydraulic clutch system.
For additional information, refer to: Clutch System Bleeding - Vehicles With: 6-Speed Manual Transaxle - MMT6 (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

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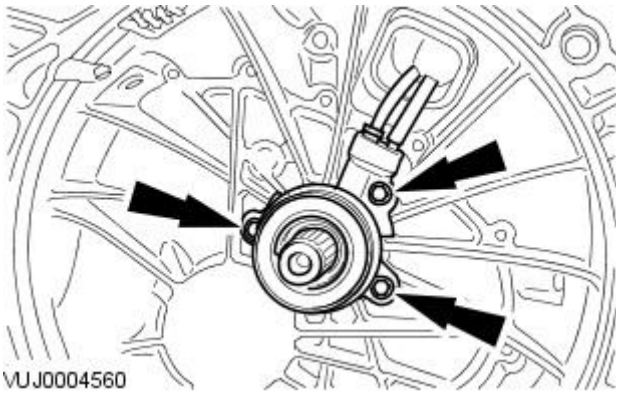
Clutch Controls - Clutch Slave CylinderVehicles With: 5-Speed Manual Transmission - MT75

Removal and Installation

Removal


VUJ0004560

1. NOTE: The clutch slave cylinder assembly must be replaced whenever it is removed.

Remove the manual transmission.
For additional information, refer to: Transaxle - 2.0L Duratorq-TDCi (308-03 Manual Transmission/Transaxle, Removal) / Transaxle - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (308-03 Manual Transmission/Transaxle, Removal).

2. WARNING: Do not allow brake fluid to contact the skin or eyes. If brake fluid comes into contact with the skin or eyes, rinse the affected areas immediately with water. Failure to follow this instructions can result in personal injury.

CAUTION: Brake fluid will escape when the lines are disconnected.

Remove the clutch slave cylinder.

- Detach the rubber grommet.
- Remove the clutch slave cylinder.

Installation

1. NOTE: Apply suitable tape to the input shaft to protect the slave cylinder seal from damage. Remove the tape when the slave cylinder is installed.

• NOTE: Apply sealer to the mating faces of the clutch slave cylinder and the transmission housing.

Install the clutch slave cylinder.

- Attach the rubber grommet.
- Tighten to 10 Nm.

2. Install the manual transmission.
For additional information, refer to: Transaxle - 2.0L Duratorq-TDCi (308-03 Manual Transmission/Transaxle, Installation) / Transaxle - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (308-03 Manual Transmission/Transaxle, Installation).

3. Bleed the hydraulic clutch system.
For additional information, refer to: Clutch System Bleeding - Vehicles With: 5-Speed Manual Transmission - MT75 (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

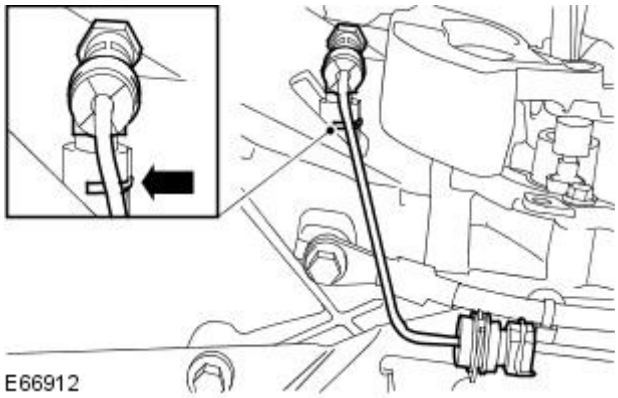
Clutch Controls - Clutch Slave CylinderVehicles With: 6-Speed Manual Transaxle - MMT6

Removal and Installation

Removal

1. NOTE: The clutch slave cylinder assembly must be replaced whenever it is removed.

Remove the manual transmission.
For additional information, refer to: Transaxle - 2.2L Duratorq-TDCi (110kW/150PS) - Puma (308-03 Manual Transmission/Transaxle, Removal).

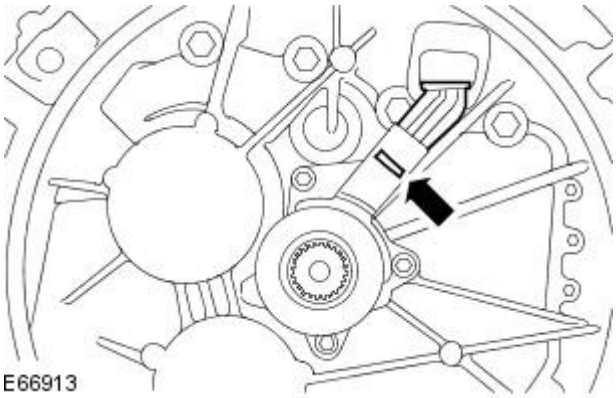

E66912

2. WARNING: Do not allow brake fluid to contact the skin or eyes. If brake fluid comes into contact with the skin or eyes, rinse the affected areas immediately with water. Failure to follow this instructions can result in personal injury.

CAUTION: Brake fluid will escape when the lines are disconnected.

Remove the clutch slave cylinder high pressure pipe from the retaining bracket and clutch slave cylinder bleed union.

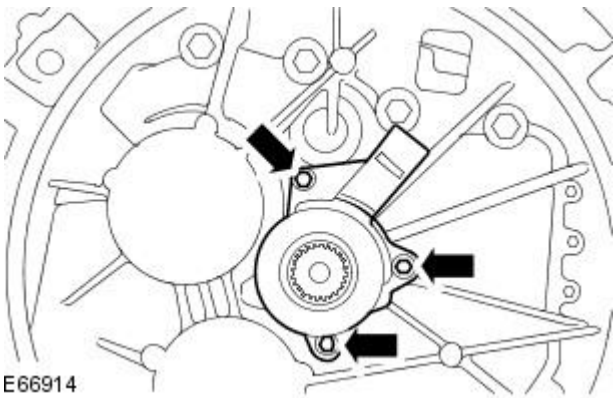
- Release the retaining clip.


E66913

3. CAUTION: Brake fluid will escape when the lines are disconnected.

Remove the clutch slave cylinder bleed union.

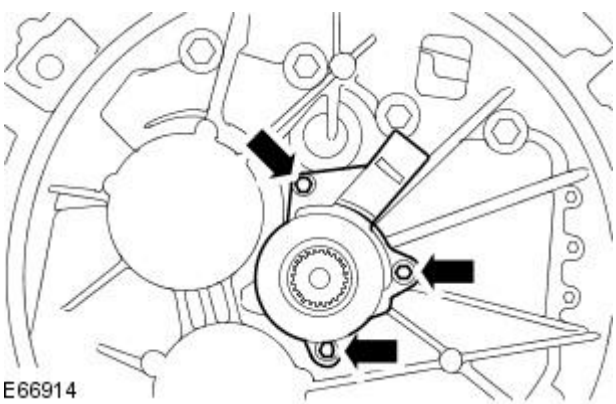
- Release the retaining clip.


E66914

4. CAUTION: Brake fluid will escape when the lines are disconnected.

Remove the clutch slave cylinder.

Installation

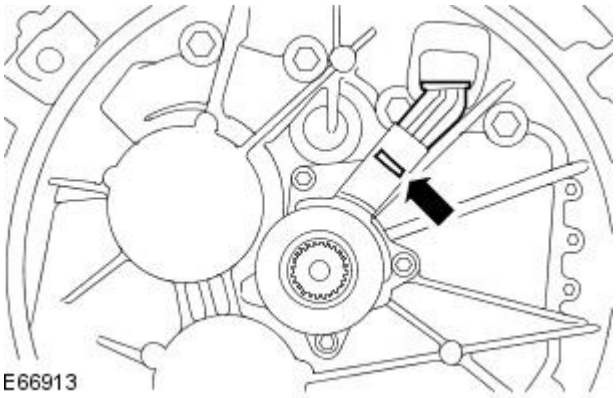

E66914

1. NOTE: Apply suitable tape to the input shaft to protect the slave cylinder seal from damage. Remove the tape when the slave cylinder is installed.

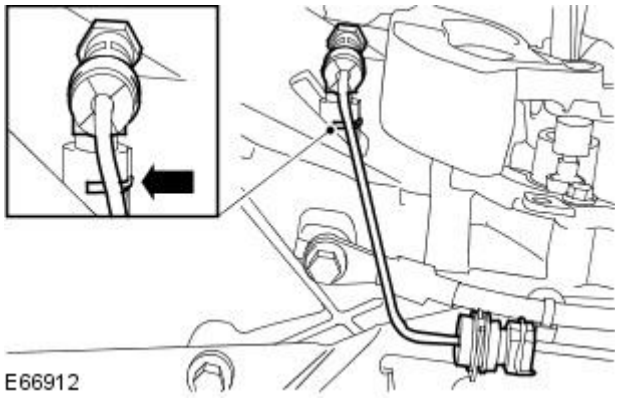
• NOTE: Apply sealer to the mating faces of the clutch slave cylinder and the transmission housing.

Install the clutch slave cylinder.

- Tighten to 10 Nm.



2. Install the clutch slave cylinder bleed union.
   - Fully seat the retaining clip.



3. Install the clutch slave cylinder high pressure pipe to the retaining bracket and clutch slave cylinder bleed union.
   - Fully seat the retaining clip.

4. Install the manual transmission.
   For additional information, refer to: Transaxle - 2.2L Duratorq-TDCi (110kW/150PS) - Puma (308-03 Manual Transmission/Transaxle, Installation).
5. Bleed the hydraulic clutch system.
   For additional information, refer to: Clutch System Bleeding - Vehicles With: 6-Speed Manual Transaxle - MMT6 (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

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Manual Transmission / Transaxle -

Lubricants, Fluids, Sealers and Adhesives

Description	Specification
Manual transaxle fluid	WSD-M2C200-C

Capacities

Description	Quantity
Manual transmission fluid	1.75 Liters or 0 - 5 mm (0 - 0.20 in) below the lower edge of the fill plug bore

Torque Specifications

Description	Nm	lb-ft	lb-in
Transaxle retaining bolts	48	35	-
Reversing lamp switch	20	15	-
Starter motor retaining bolts - vehicles with 2.0L, 2.5L and 3.0L engine	35	26	-
Transaxle mount retaining bolt and studs	80	59	-
Transaxle mount retaining nut	133	98	-
Transaxle drain plug	45	33	-
Transaxle fill plug	45	33	-
Starter motor retaining bolts - vehicles with diesel engine	25	18	-
Starter motor electrical connector retaining nut	12	9	-
Starter motor solenoid electrical connector retaining nut	6	-	53
Intake manifold support bracket retaining bolts	10	-	89
Gearshift cable support bracket retaining nuts	25	18	-
Air cleaner mount bracket retaining nuts and bolt - vehicles with 2.0L, 2.5L and 3.0L engine	6	-	53
Left-hand driveshaft retaining nuts - vehicles with 2.0L or diesel engine	25	18	-
Vacuum solenoids and vacuum reservoir mount bracket retaining bolts - vehicles with diesel engine	23	17	-
Shock absorber and spring assembly securing nuts	25	18	-
Wiring harness to camshaft cover retaining stud, retaining nut	6	-	53
Engine cover rear mount bracket retaining bolts - vehicles with diesel engine	23	17	-
Charge air cooler pipe	4	-	35

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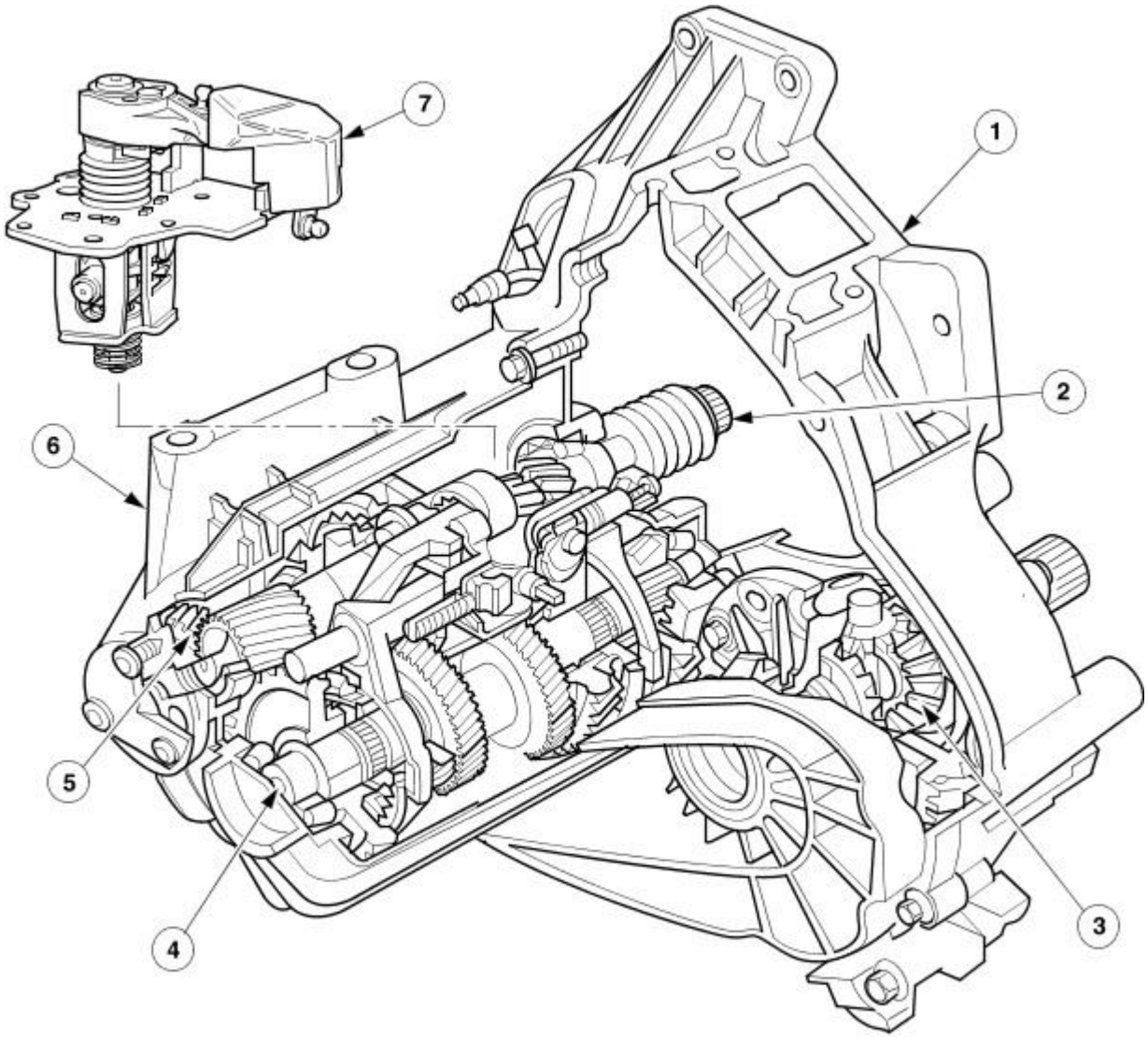
Manual Transmission / Transaxle - Manual TransaxleVehicles With: 5-Speed Manual Transmission - MT75

Description and Operation



VUJ0004405

Item	Part Number	Description
1	—	Transaxle housing - clutch side
2	—	Input shaft
3	—	Differential
4	—	Output shaft
5	—	Reverse gear idler
6	—	Transaxle housing
7	—	Selector mechanism

The MTX 75 manual transaxle is a 2-shaft transaxle.

MTX 75 means:

- M = Manual
- T = Transmission
- X = Transaxle (front wheel drive)
- 75 = The distance from the input and output shafts in mm

The aluminium housing consists of two closed sections. The reinforced ribs on the transaxle housing are to reduce the noise and vibration. With the '2-shaft transaxle' all the gear wheels are in permanent mesh. In each gear the required ratio is achieved by means of a pair of geared wheels. When reverse is selected, an idler gear changes the direction of rotation of the output. The input and output shafts run taper roller bearings. To further improve stability and gear shifting, a maintenance free cable operating mechanism is used. all gear wheels, including reverse gear, are beveled cut, synchronized and run on needle roller bearings 1st, 2nd, 3rd, gear have doubled synchronization.

The engine rotational torque is transmitted from the crankshaft through the clutch to the transaxle input shaft, which then transmits drive to the output shaft by utilizing an arrangement of gears. When reverse gear is selected, the direction of the output shaft is changed by an idler gear assembly.

In neutral, none of the gears are connected to the input or output shaft through the relevant synchronizer unit. No torque is transmitted to the differential.

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Manual Transmission / Transaxle - Manual TransaxleVehicles With: 6-Speed Manual Transaxle - MMT6

Description and Operation

This vehicle is equipped with a transversely mounted manual transaxle, which combines both the transmission and differential in one unit.

The transaxle is a 6-speed, 3-shaft design with all pairs of gears in continuous mesh.

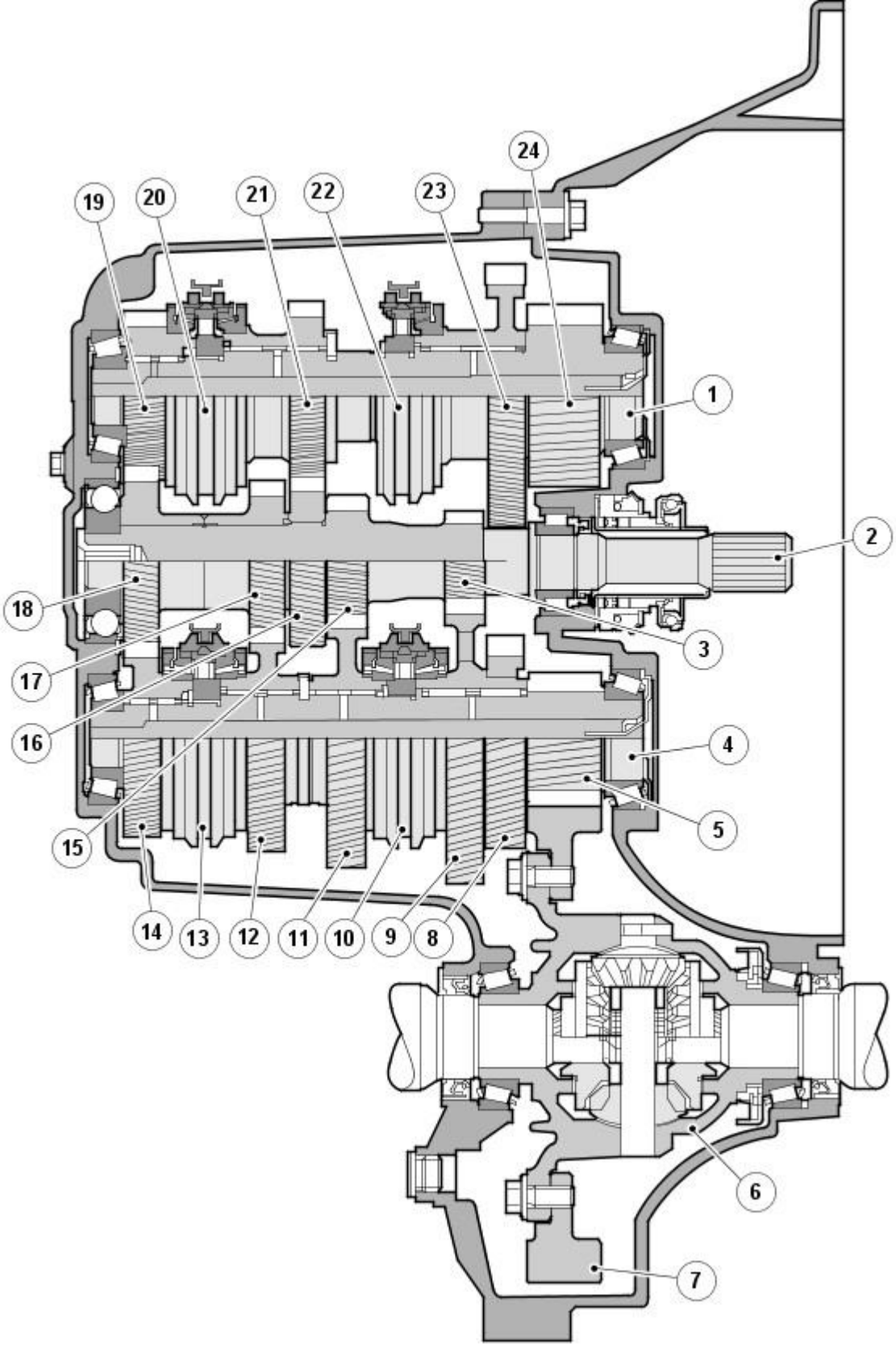
Each forward gear ratio is produced through a pair of dedicated gears, with the exception of 4th and 6th gears which share the same input shaft gear.

All gear wheels rotate on needle-roller bearings, and are helical-cut, this type of gearing enables a higher gear contact ratio, which mesh with minimum rolling noise; resulting in a quiet transaxle operation.

Torque is transmitted from the selected output shaft to the differential, which transmits the torque to the halfshafts to drive the front wheels. With neutral selected, the gears are not connected via the synchronizers to the output shafts, therefore no torque is transmitted to the differential.

The aluminum transaxle housing consists of two sections, reinforced by a web of strengthening ribs. The ribs also serve to reduce noise and vibration, and aid the cooling of the transaxle.

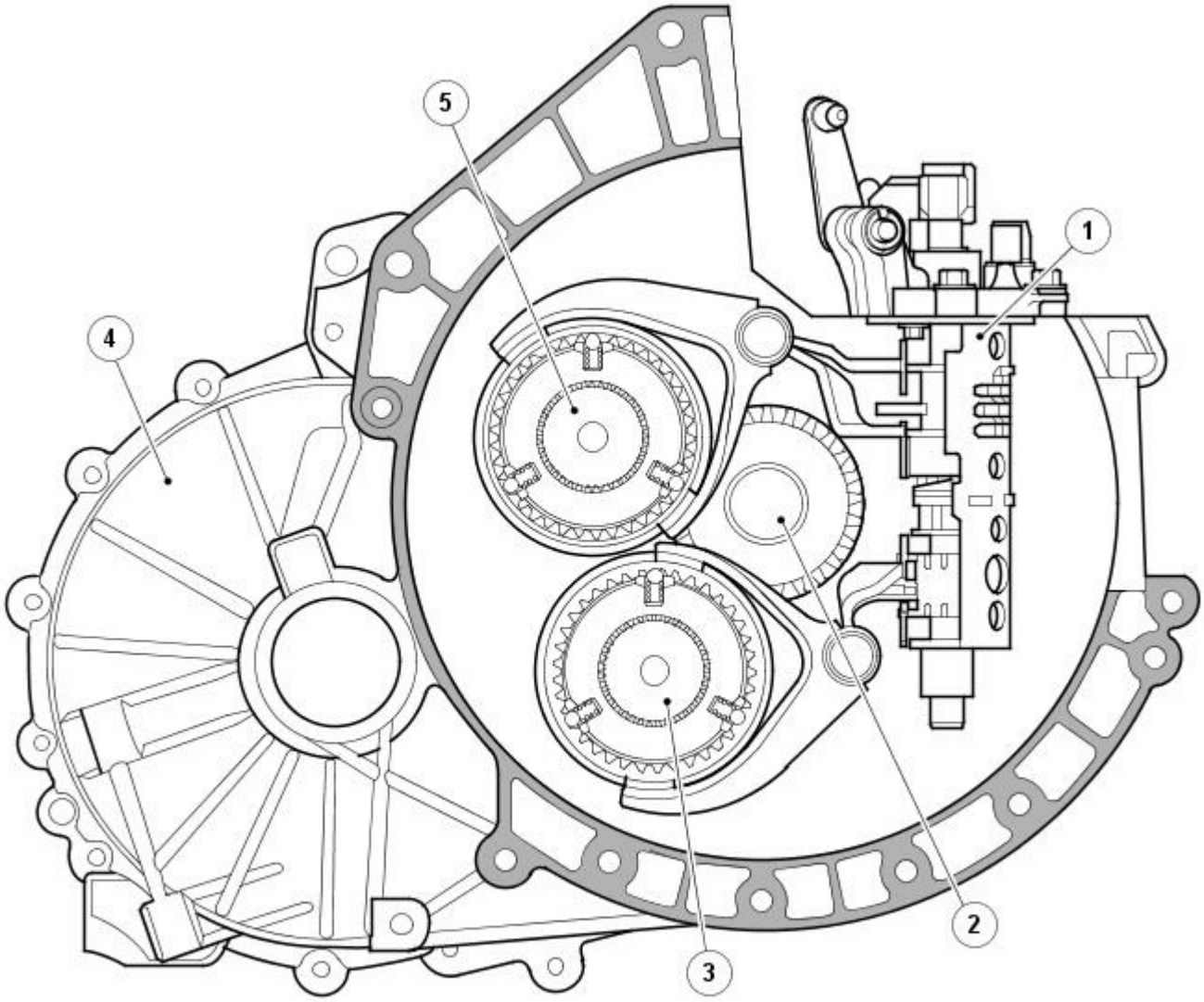
Gear Train



E67473

Item	Description	Item	Description
1	Output shaft — 5th/6th and reverse gears	13	Synchronizer assembly – 3rd/4th gear
2	Input shaft	14	4th gear wheel
3	1st gear wheel	15	2nd gear wheel
4	Output shaft — 1st to 4th gears	16	5th gear wheel
5	Pinion	17	3rd gear wheel
6	Differential assembly	18	4th/6th gear wheel
7	Crown wheel	19	6th gear wheel
8	Reverse idler gear	20	Synchronizer assembly – 5th/6th gear
9	1st gear wheel	21	5th gear wheel
10	Synchronizer assembly – 1st/2nd gear	22	Synchronizer assembly — reverse gear
11	2nd gear wheel	23	Reverse gear wheel
12	3rd gear wheel	24	Pinion

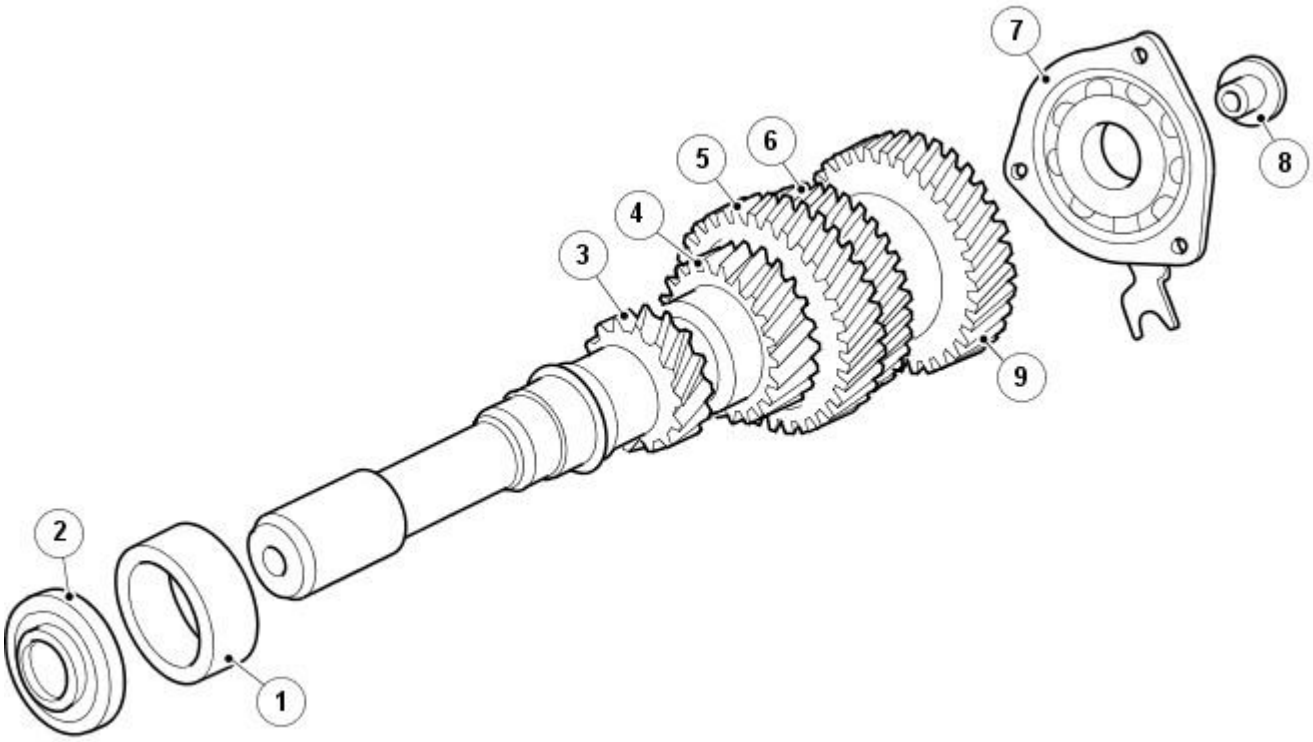
Shafts and Selector Mechanism



E67474

Item	Description
1	Selector mechanism
2	Input shaft
3	Output shaft — 1st to 4th gears
4	Differential housing
5	Output shaft — 5th/6th and reverse gears

Input Shaft



E67475

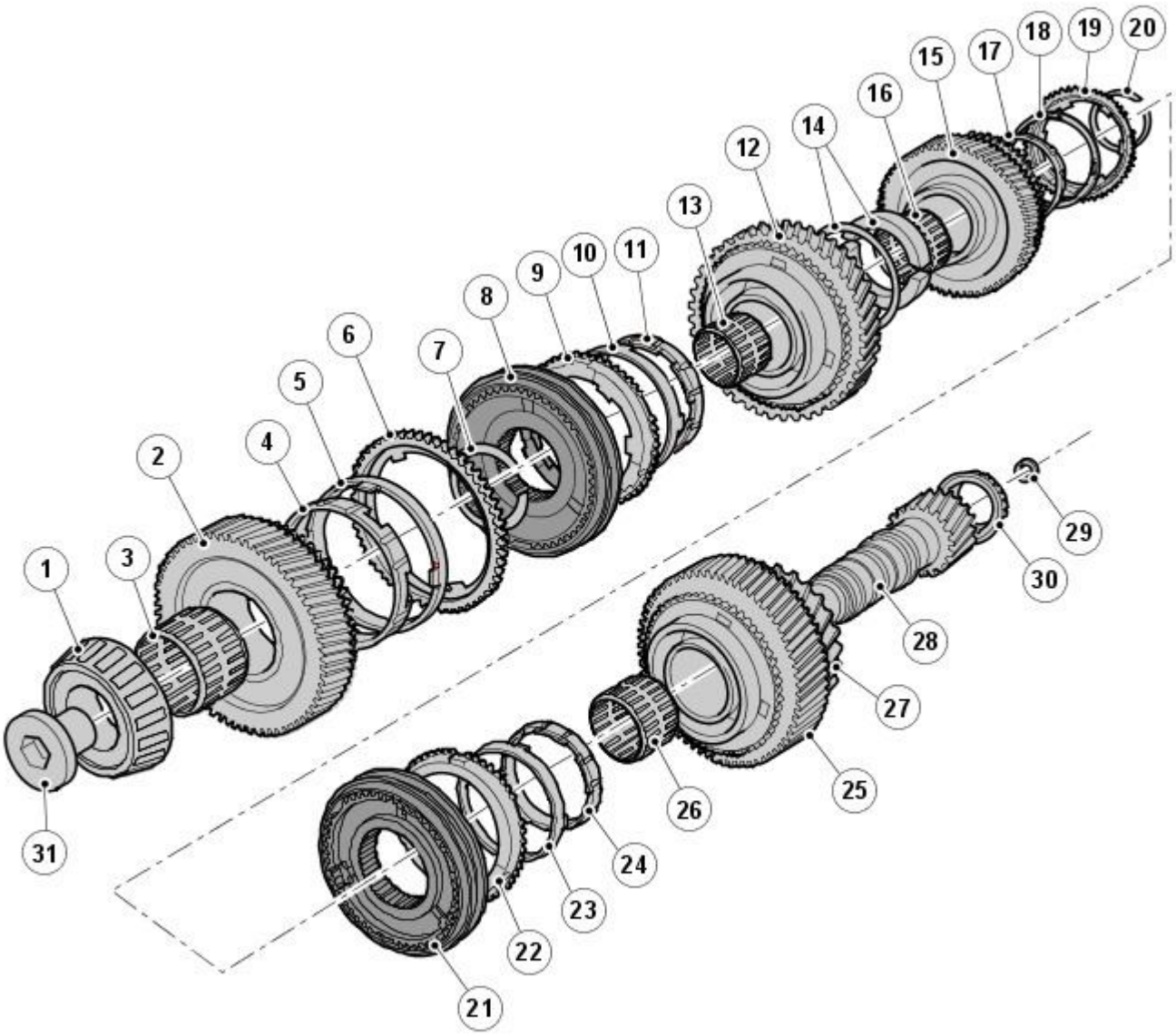
Item	Description	Item	Description
1	Clutch housing roller bearing	6	3rd gear wheel
2	Oil seal	7	Bearing retainer
3	1st gear wheel	8	Bearing retaining screw
4	2nd gear wheel	9	4th/6th gear wheel
5	5th gear wheel		

The input-shaft is a solid unit, which rotates:

- in a ball-bearing at the clutch-housing-end of the transaxle, and
- a roller bearing at the rear of the transaxle,
- due to this mounting arrangement, the bearings do not require preload adjustment on assembly.

- 1st and 2nd gear wheels are an integral part of the input shaft.
- 3rd and 5th gear wheels and 4th/6th gear wheel are pressed onto the input shaft.

Output Shaft 1st to 4th Gears



E67476

Item	Description	Item	Description
1	Taper roller bearing, transmission housing	17	Inner synchronizer ring
2	4th gear wheel	18	2nd gear synchronizer cone
3	Needle bearing	19	Outer synchronizer ring - 2nd gear
4	Inner synchronizer ring	20	Snap ring
5	4th gear synchronizer cone	21	Synchronizer assembly - 1st/2nd gear
6	Outer synchronizer ring - 4th gear	22	Outer synchronizer ring - 1st gear
7	Snap ring	23	1st gear synchronizer cone
8	Synchronizer assembly - 3rd/4th gear	24	Inner synchronizer ring
9	Outer synchronizer ring - 3rd gear	25	1st gear wheel
10	3rd gear synchronizer cone	26	Needle bearing
11	Inner synchronizer ring	27	Reverse idler gear
12	3rd gear wheel	28	Output shaft 1st/4th gear
13	Needle bearing	29	Oil collector ring
14	Thrust washers	30	Taper roller bearing, clutch housing
15	2nd gear wheel	31	Bearing retaining bolt (left-hand thread)
16	Needle bearing		

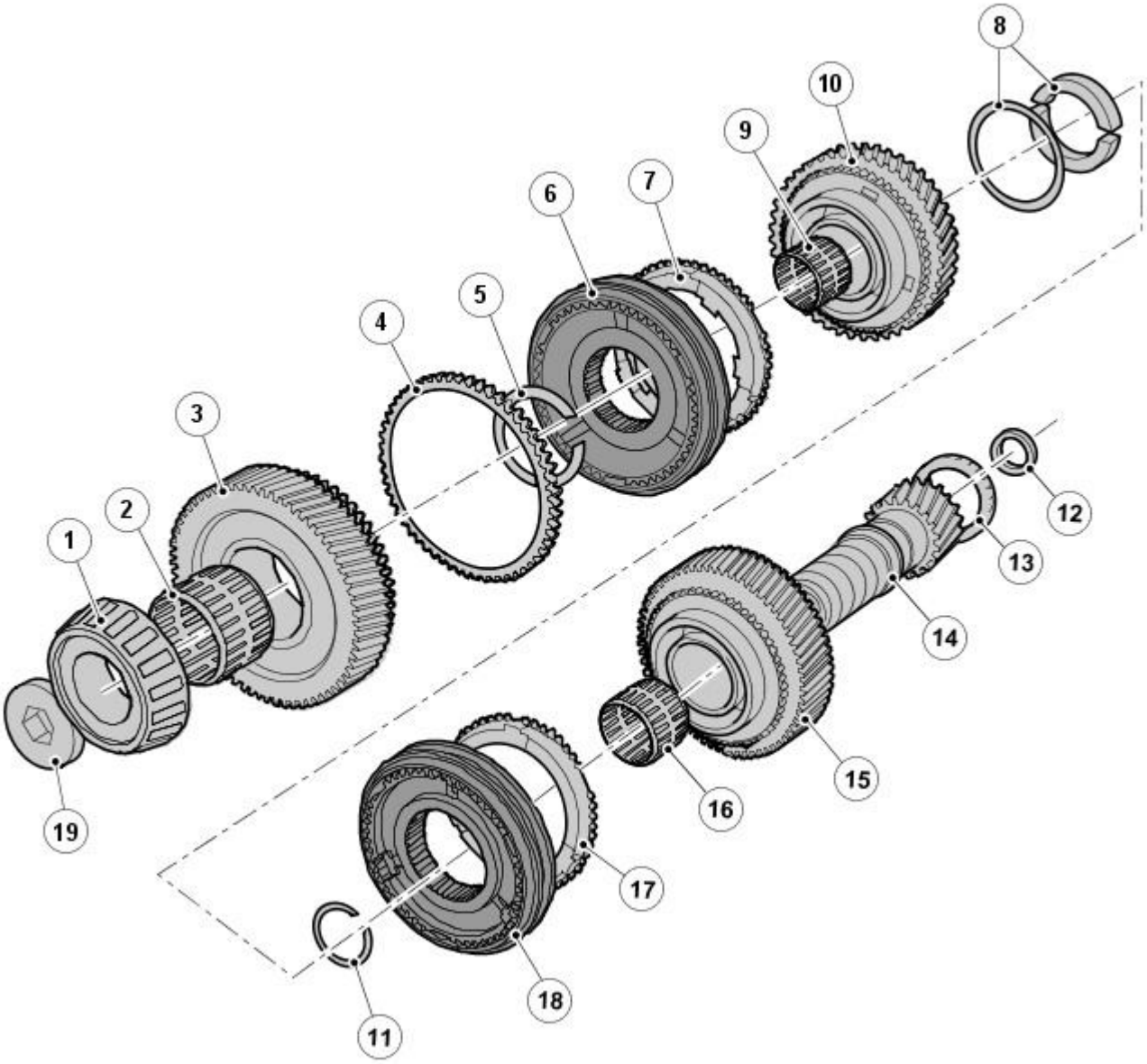
The 1st to 4th gear output shaft is a hollow unit, which rotates in tapered roller-bearings; this arrangement requires adjustment of the bearing's preload on assembly.

The output pinion is an integral part of the output shaft. The synchronizer assemblies of the 1st, 2nd, and 3rd, 4th gears are located on the output shaft.

Internal oil-ways in the output shaft provide lubrication to the gear wheel's needle-roller bearings and synchronizer assemblies.

An integrated oil-collector ring and oil-thrower, located on the clutch-housing-end of the output shaft, guides the transmission oil into the oilway of the output shaft.

Output Shaft — 5th / 6th and Reverse Gears



E67477

Item	Description	Item	Description
1	Transmission housing taper roller bearing	11	Snap ring
2	Needle bearing	12	Oil collector ring
3	6th gear wheel	13	Taper roller bearing, clutch housing
4	6th gear synchronizer ring	14	Output shaft 5th/6th/reverse gear
5	Snap ring	15	Reverse gear wheel
6	Synchronizer assembly - 5th/6th gear	16	Needle bearing
7	5th gear synchronizer ring	17	Reverse gear synchronizer ring
8	Thrust washers	18	Synchronizer assembly — reverse gear
9	Needle bearing	19	Bearing retaining bolt (left-hand thread)
10	5th gear wheel		

The 5th/6th and reverse gear output shaft is a hollow unit, which rotates in tapered roller-bearings; this arrangement requires adjustment of the bearing's preload on assembly.

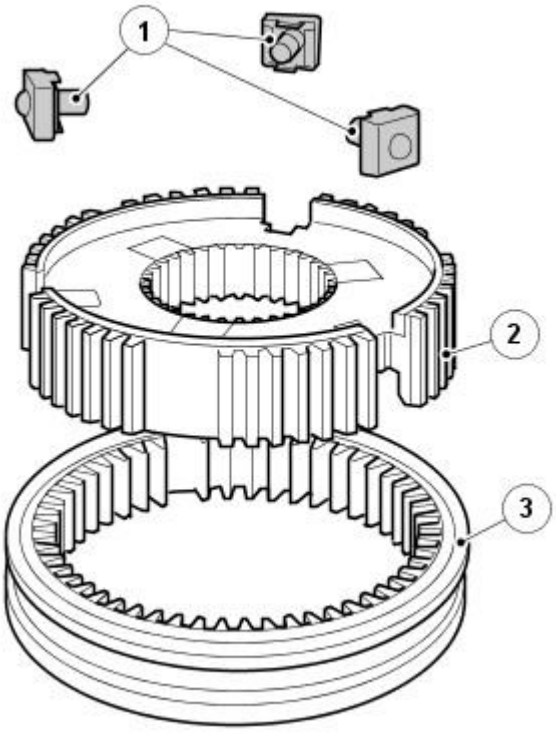
The output pinion is an integral part of the output shaft.

The synchronizer assemblies of the 5th/6th and reverse gears are located on the output shaft.

Internal oil-ways in the output shaft provide lubrication to the gear wheel's needle-roller bearings and synchronizer assemblies.

An integrated oil-collector ring and oil-thrower, located on the clutch-housing-end of the output shaft, guides the transmission oil into the oilway of the output shaft.

Synchronizer Assemblies



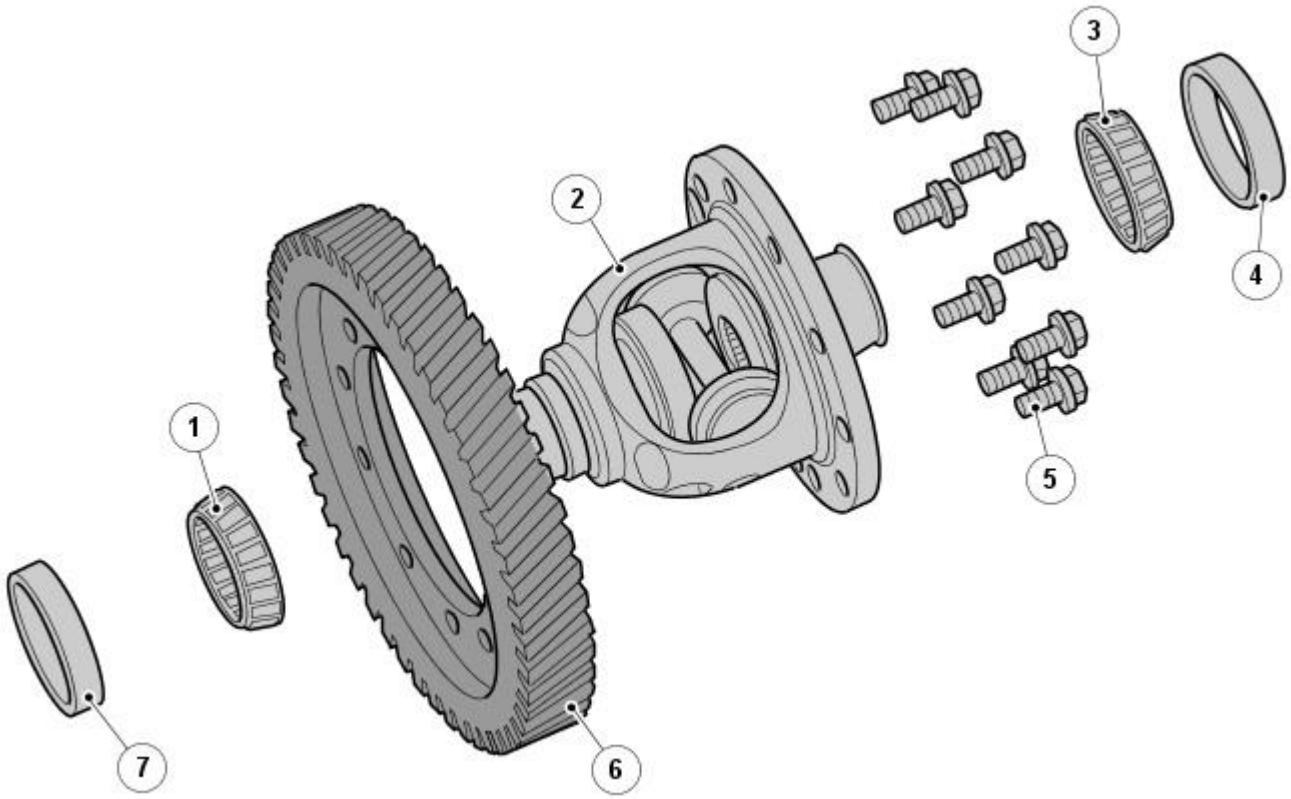
E67478

Item	Description
1	Sliding block assembly
2	Synchronizer hub
3	Sliding collar

The gears 1st, 2nd, 3rd and 4th have double cone synchronizers, 5th, 6th and reverse gears have single cone synchronizers.

The detent balls, springs and sliding blocks form one unit, this arrangement aids an easier assembly of the synchronizer.

Differential Assembly



E67481

Item	Description	Item	Description
1	Taper roller bearing, transmission housing	5	Crown wheel bolts
2	Differential assembly	6	Crown wheel
3	Taper roller bearing, clutch housing	7	Bearing shell, taper roller bearing
4	Bearing shell, taper roller bearing		

The differential is identical to that used in the 5 speed transmission, with the exception of the vehicle speed sensor, which has been deleted along with the sender wheel. Vehicle speed sensing is provided by the wheel-speed sensors.

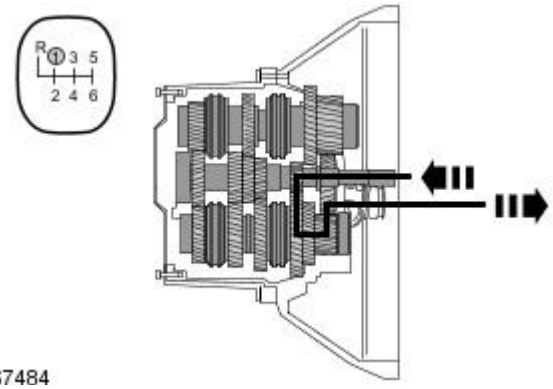
The differential is mounted on taper-roller bearings, this arrangement requires adjustment of the bearing's preload on assembly.

Gear Selection Power Flow

• NOTE: The position of the transaxle shafts has been altered for clarity.

The following diagrams show a schematic representation of the power-flow through transaxle for each gear selection. The power flow is transmitted through the positively engaged pair of gears onto the output pinion of the relevant output shaft and then to the crown wheel of the differential.

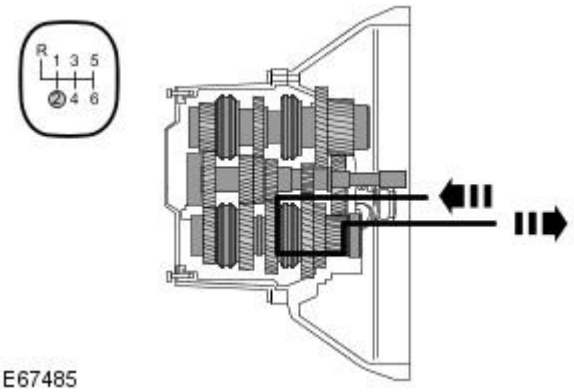
First Gear



E67484

The 1st gear-wheel on the input shaft is positively connected to the 1st gear-wheel on the output shaft by the 1st/2nd gear synchronizer.

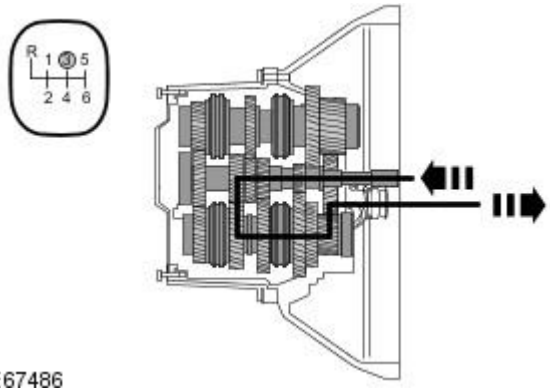
Second Gear



E67485

The 2nd gear-wheel on the input shaft is positively connected to the 2nd gear-wheel on the output shaft by the 1st/2nd gear synchronizer.

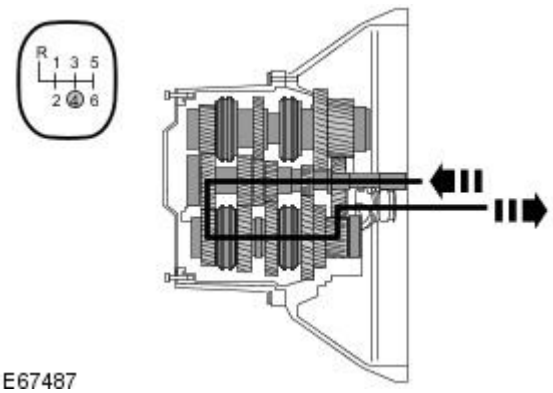
Third Gear



E67486

The 3rd gear-wheel on the input shaft is positively connected to the 3rd gear-wheel on the output shaft by the 3rd/4th gear synchronizer.

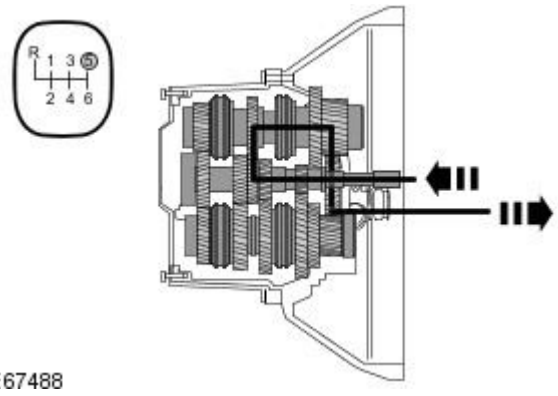
Fourth Gear



E67487

The 4th/6th gear-wheel on the input shaft is positively connected to the 4th gear-wheel on the output shaft by the 3rd/4th gear synchronizer.

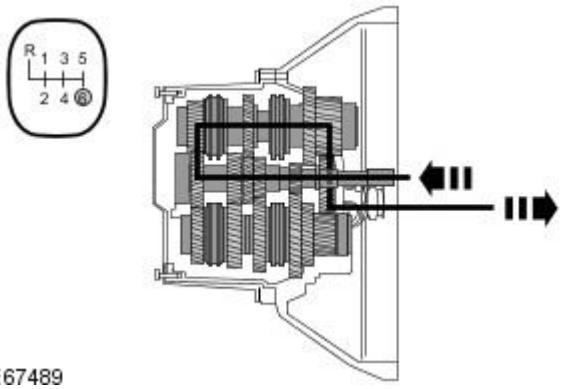
Fifth Gear



E67488

The 5th gear-wheel on the input shaft is positively connected to the 5th gear-wheel on the output shaft by the 5th/6th gear synchronizer.

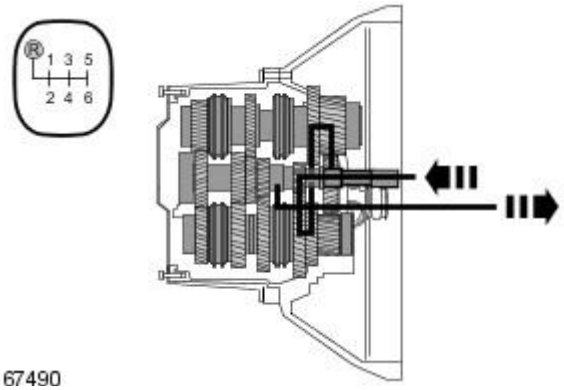
Sixth Gear



E67489

The 4th/6th gear-wheel on the input shaft is positively connected to the 6th gear-wheel on the output shaft by the 5th/6th gear synchronizer.

Reverse Gear

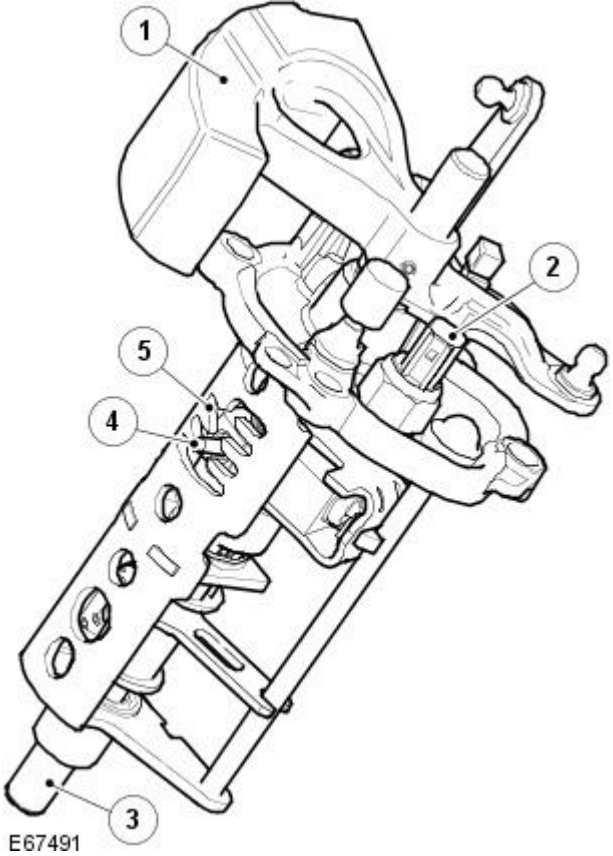


E67490

• NOTE: The reverse idler-gear in turn transmits the drive to the reverse gear on the opposite output shaft.

The reverse gear synchronizer, transfers drive from the 1st gear-wheel on the input shaft, to the 1st gear-wheel on the output shaft, which is fixed to the reverse idler-gear.

Internal Selector Mechanism



Item	Description
1	Counterbalance
2	Reverse gear switch
3	Selector shaft
4	Selector finger
5	Selector gate

The selector interlock mechanism and selector finger are mounted on a sleeve in the selector mechanism housing. A spring-loaded ball maintains the engagement of the selected gear. A counterbalance weight dampens the synchronized shift resistance of gear selection to provide a smooth gear change operation.

The reverse lamp switch is mounted on the housing's cover.

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Manual Transmission / Transaxle - Manual Transaxle

Diagnosis and Testing

For additional information, refer to Section 308-00 Manual Transmission/Transaxle and Clutch - General Information

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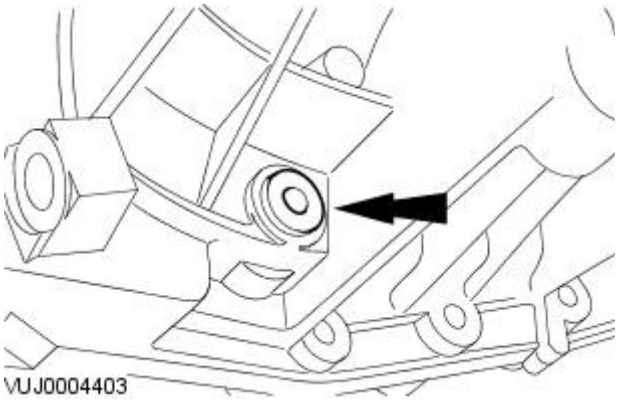
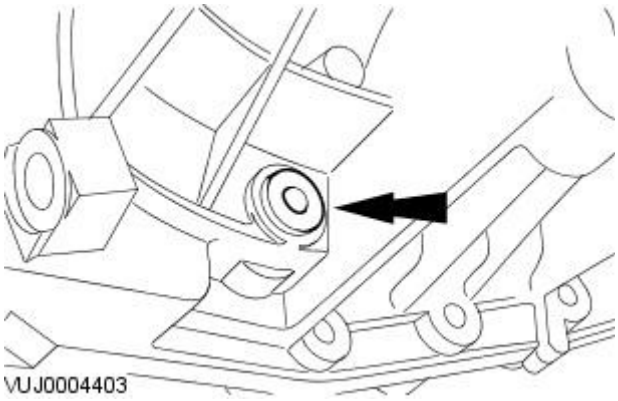
Manual Transmission / Transaxle - Transaxle Draining and FillingVehicles With: 5-Speed Manual Transmission - MT75

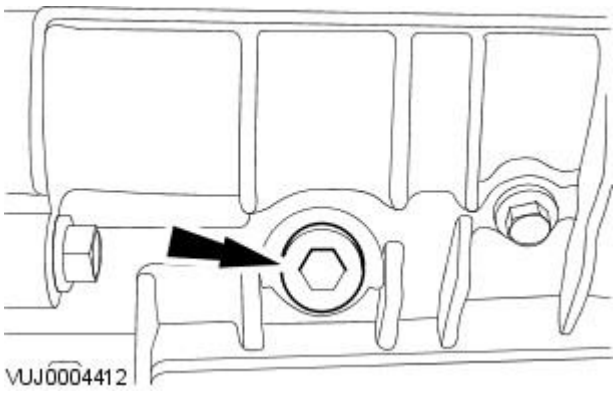
General Procedures



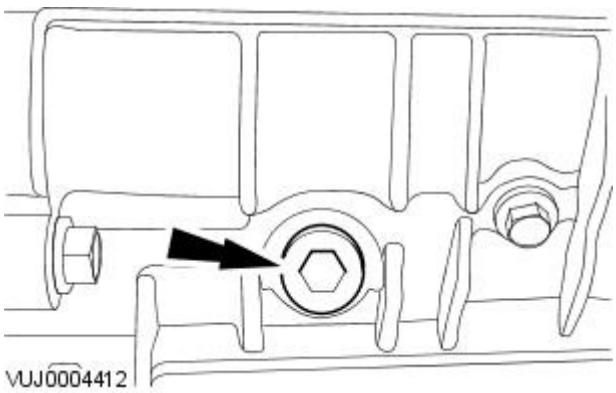
1. Raise and support the vehicle. For additional information, refer toSection 100-02 Jacking and Lifting
2. Remove the drain plug.



3. Install the drain plug.



4. Remove the fill plug.



5. Fill the transaxle to 0.5 mm (0.02 in) below the lower edge of the fill plug bore.
6. Install the fill plug.
   - Tighten to 45 Nm.
7. Lower the vehicle.

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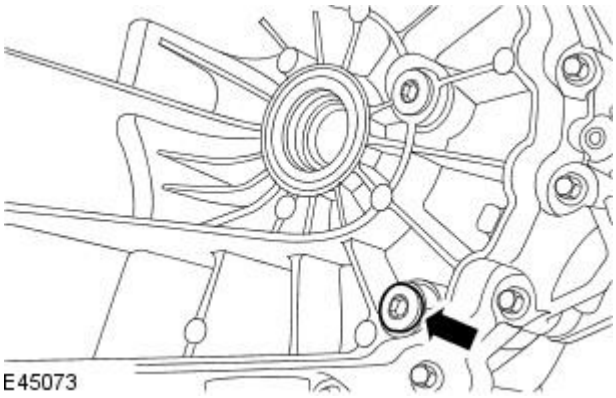
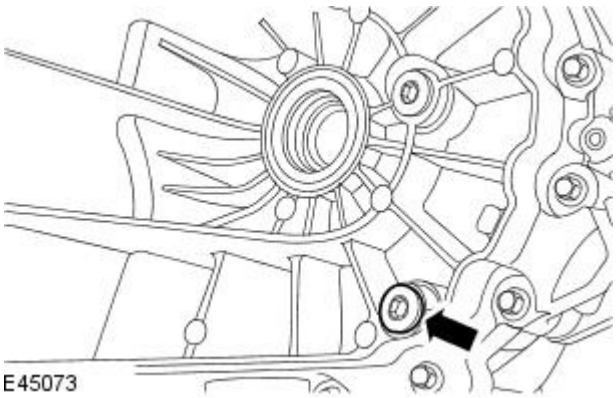
Manual Transmission / Transaxle - Transaxle Draining and FillingVehicles With: 6-Speed Manual Transaxle - MMT6

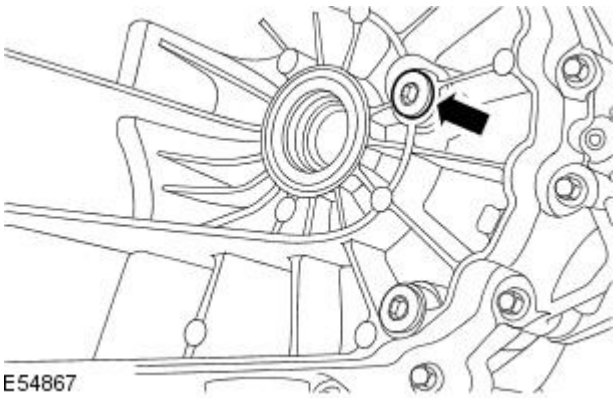
General Procedures



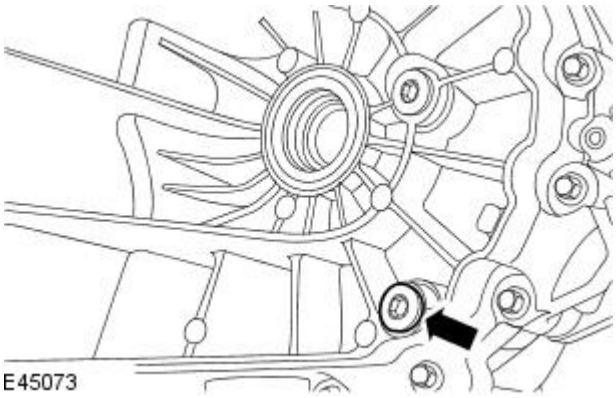
1. Raise and support the vehicle.
   For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. Remove the drain plug and drain the fluid into a suitable container



3. Install the drain plug.
   - Tighten to 35 Nm.



4. Remove the fill plug.

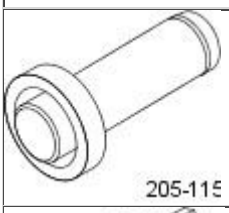
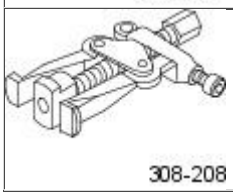


5. Fill the transaxle to 0 - 5 mm (0 - 0.20 in) below the lower edge of the fill plug bore.
6. Install the fill plug.
   - Tighten to 35 Nm.
7. Lower the vehicle.

Published: 11-May-2011

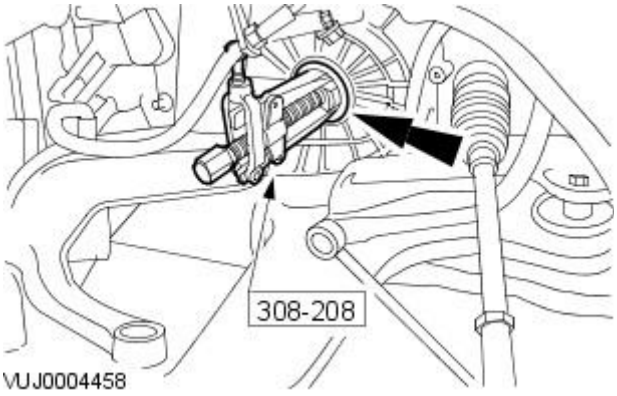
Manual Transmission / Transaxle - Halfshaft Seal LH

In-vehicle Repair

Special Tool(s)	
	Link shaft oil seal installer 205-115
	Pinion oil seal remover 308-208

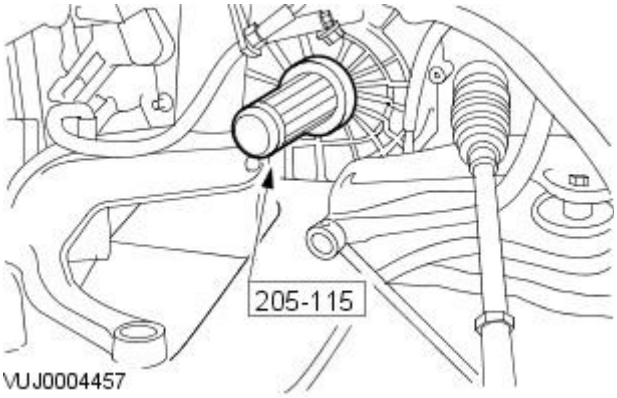
Removal

1. Drain the transmission.
   For additional information, refer to: Transaxle Draining and Filling - Vehicles With: 5-Speed Manual Transmission - MT75 (308-03 Manual Transmission/Transaxle, General Procedures) / Transaxle Draining and Filling - Vehicles With: 6-Speed Manual Transaxle - MMT6 (308-03 Manual Transmission/Transaxle, General Procedures).
2. Remove the left-hand halfshaft.
   For additional information, refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
3. Using the special tool, remove the halfshaft oil seal.



Installation

1. Using the special tool, install the halfshaft oil seal.

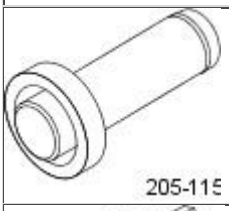
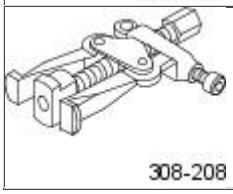


2. Install the left-hand halfshaft.
   For additional information, refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
3. Refill the transmission.
   For additional information, refer to: Transaxle Draining and Filling - Vehicles With: 5-Speed Manual Transmission - MT75 (308-03 Manual Transmission/Transaxle, General Procedures) / Transaxle Draining and Filling - Vehicles With: 6-Speed Manual Transaxle - MMT6 (308-03 Manual Transmission/Transaxle, General Procedures).

Published: 11-May-2011

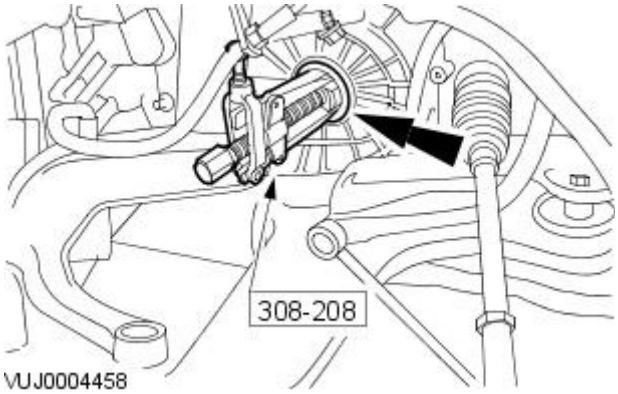
Manual Transmission / Transaxle - Halfshaft Seal RH

In-vehicle Repair

Special Tool(s)	
	Link shaft oil seal installer 205-115
	Pinion oil seal remover 308-208

1. Drain the transmission.
   For additional information, refer to: Transaxle Draining and Filling - Vehicles With: 5-Speed Manual Transmission - MT75 (308-03 Manual Transmission/Transaxle, General Procedures) / Transaxle Draining and Filling - Vehicles With: 6-Speed Manual Transaxle - MMT6 (308-03 Manual Transmission/Transaxle, General Procedures).
2. Remove the right-hand halfshaft.
   For additional information, refer to: Front Halfshaft RH - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (205-04 Front Drive Halfshafts, Removal and Installation) / Front Halfshaft RH - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (205-04 Front Drive Halfshafts, Removal and Installation).

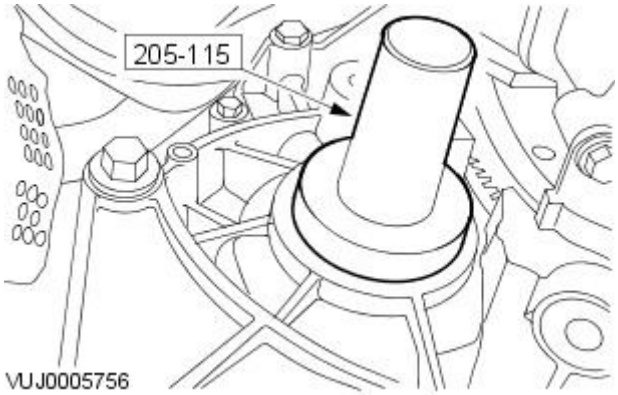
Removal



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

   Using the special tool, remove the halfshaft oil seal.

Installation



1. Using the special tool, install the halfshaft oil seal.
2. Install the right-hand halfshaft.
   For additional information, refer to: Front Halfshaft RH - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (205-04 Front Drive Halfshafts, Removal and Installation) / Front Halfshaft RH - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (205-04 Front Drive Halfshafts, Removal and Installation).
3. Refill the transmission.
   For additional information, refer to: Transaxle Draining and Filling - Vehicles With: 5-Speed Manual Transmission - MT75 (308-03 Manual Transmission/Transaxle, General Procedures) / Transaxle Draining and Filling - Vehicles With: 6-Speed Manual Transaxle - MMT6 (308-03 Manual Transmission/Transaxle, General Procedures).

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Manual Transmission / Transaxle - Input Shaft Seal

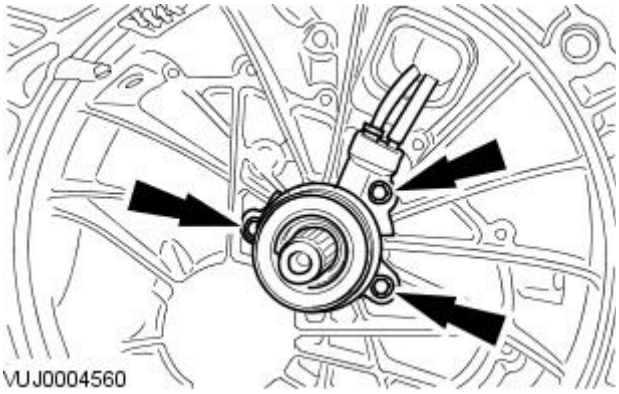
In-vehicle Repair

Removal

1. Remove the clutch slave cylinder.
   For additional information, refer to: Clutch Slave Cylinder - Vehicles With: 5-Speed Manual Transmission - MT75 (308-02 Clutch Controls, Removal and Installation) / Clutch Slave Cylinder - Vehicles With: 6-Speed Manual Transaxle - MMT6 (308-02 Clutch Controls, Removal and Installation).
   .

Installation

Vehicles with 5-speed manual transaxle



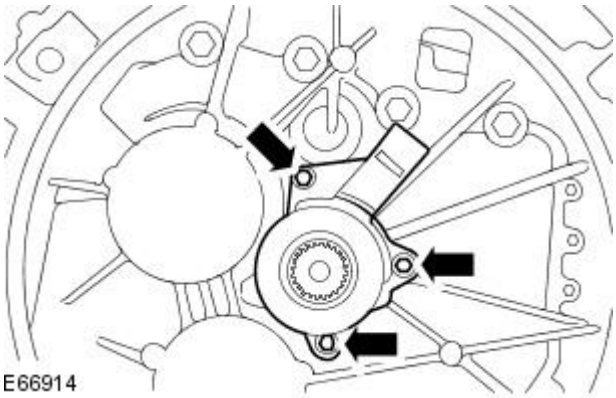
1. NOTE: Apply suitable tape to the input shaft to protect the slave cylinder seal from damage. Remove the tape when the slave cylinder is installed.

• NOTE: Apply sealer to the mating faces of the clutch slave cylinder and the transmission housing.

To install, reverse the removal procedure.

- Tighten to 10 Nm.

Vehicles with 6-speed manual transaxle



2. NOTE: Apply suitable tape to the input shaft to protect the slave cylinder seal from damage. Remove the tape when the slave cylinder is installed.

• NOTE: Apply sealer to the mating faces of the clutch slave cylinder and the transmission housing.

Tighten to 10 Nm.

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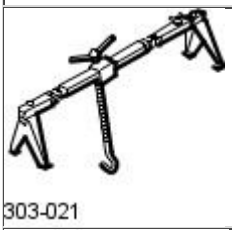
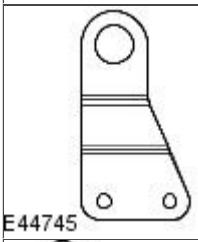
Manual Transmission / Transaxle - Selector MechanismVehicles With: 5-Speed Manual Transmission - MT75

In-vehicle Repair

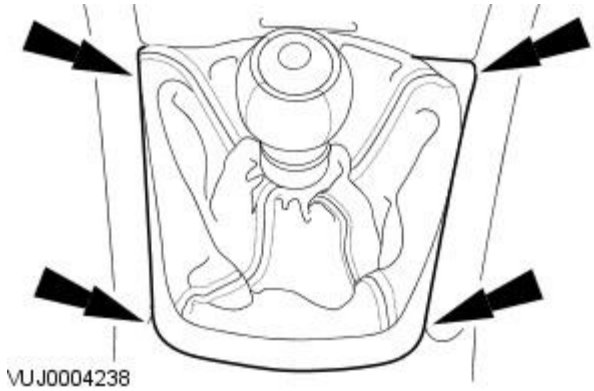
Special Tool(s)	
 303-021	Engine Support Beam 303-021
 E46047	Engine Support Brackets 303-1068
 E44745	Engine lifting eye 303-1067
 308436	Gearshift selector setting tool 308-436

Materials

Name	Specification
Gasket Eliminator Sealant	WSK-M2G348-A5

Removal

All vehicles

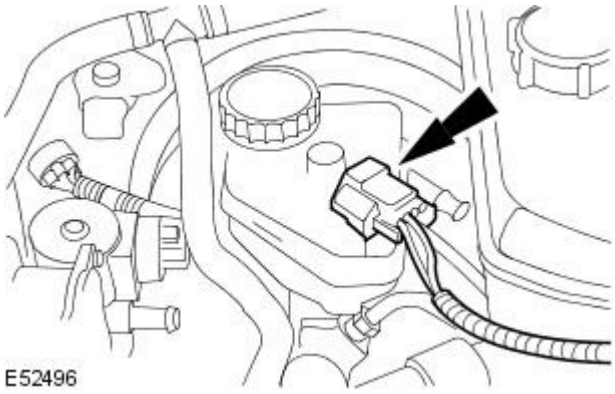

VUJ0004238

1. Detach the gearshift lever surround.

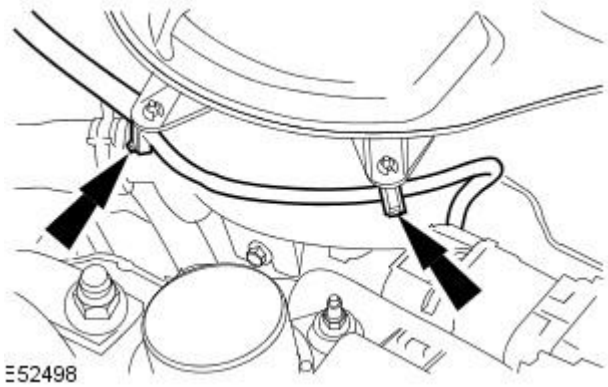
2. Remove the air cleaner. For additional information, refer to:

   Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation),
   Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

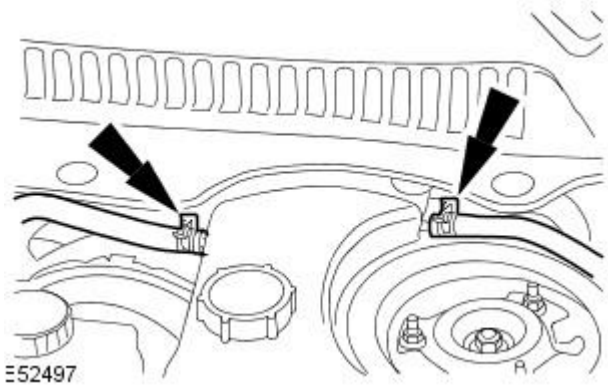
3. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).



4. Disconnect the brake fluid low level warning indicator electrical connector.

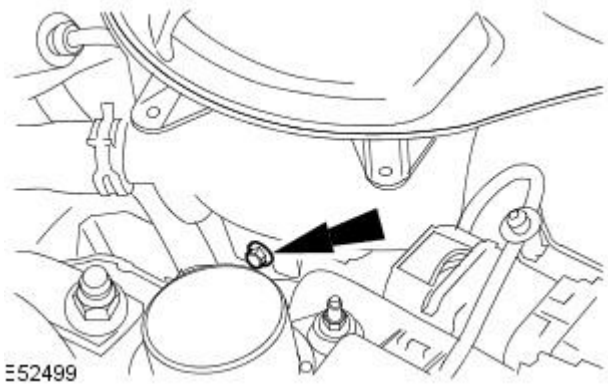


5. Detach the brake fluid low level warning indicator wiring harness from the coolant expansion tank.

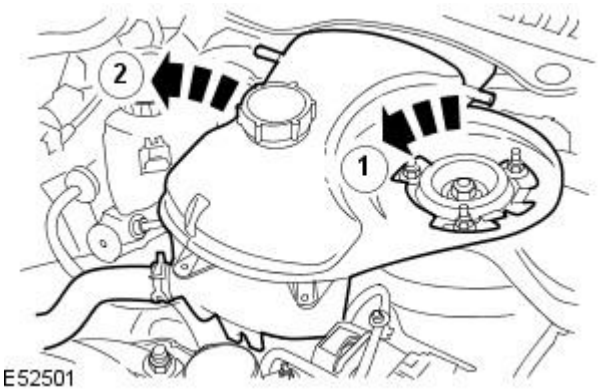


6. NOTE: Install blanking plugs to the cooling system vent hoses and the coolant expansion tank.

Detach the cooling system vent hoses from the coolant expansion tank.



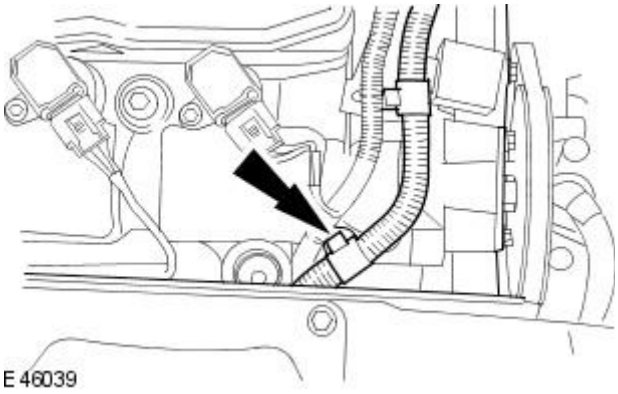
7. Remove the coolant expansion tank retaining bolt.



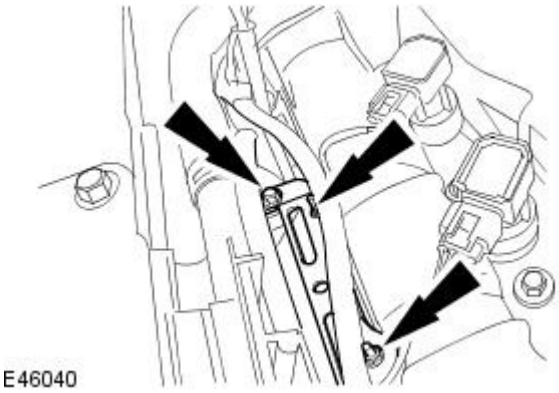
8. Reposition the coolant expansion tank.

1. Detach the coolant expansion tank.
2. Reposition the coolant expansion tank.

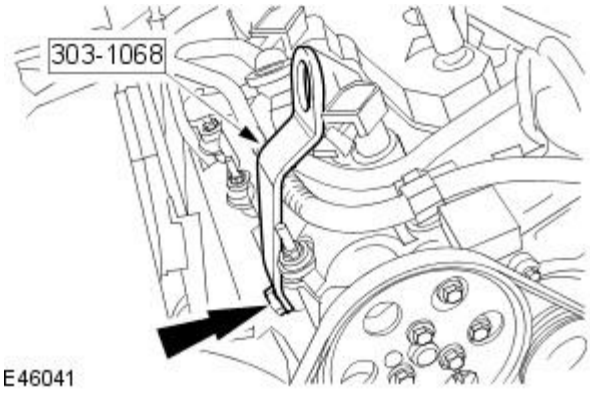
All except vehicles with diesel engine


E46039

9. Detach the generator wiring harness retaining clip from the camshaft cover retaining clip.

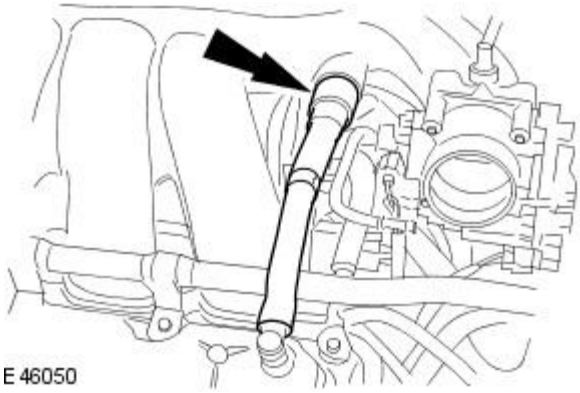

E46040

10. Remove the air cleaner mount bracket.

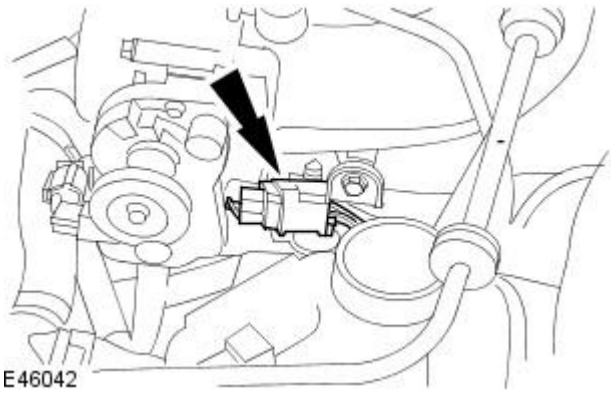


E46041

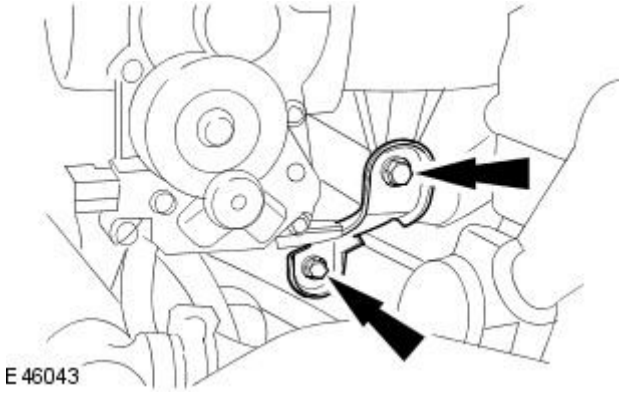
11. Install the special tool.


E46050

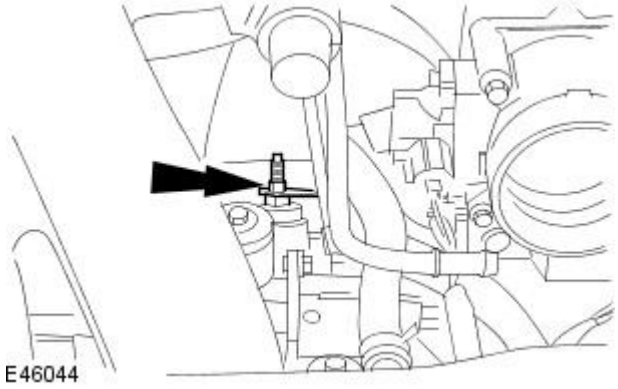
12. Detach the positive crankcase ventilation (PCV) hose from the intake manifold.


E46042

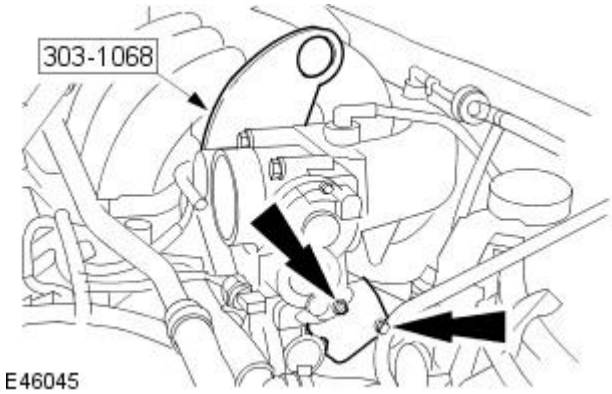
13. Detach the electrical connector from the intake manifold support bracket.


E46043

14. Remove the intake manifold support bracket.

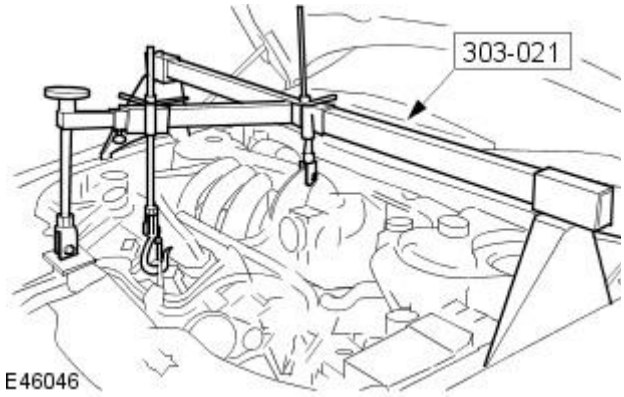

E46044

15. Detach the wiring harness from the camshaft cover retaining stud.



E46045

16. Install the special tool.



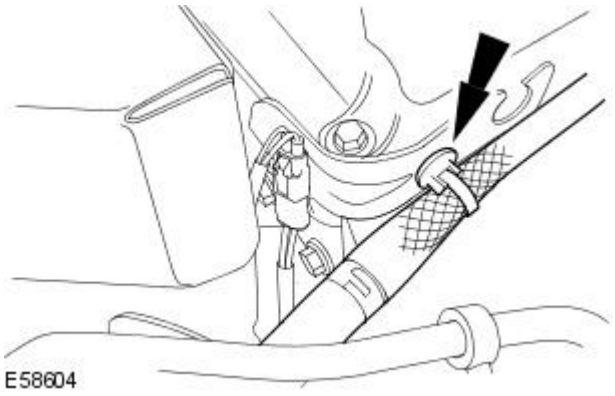
E46046

17. Install the special tool.

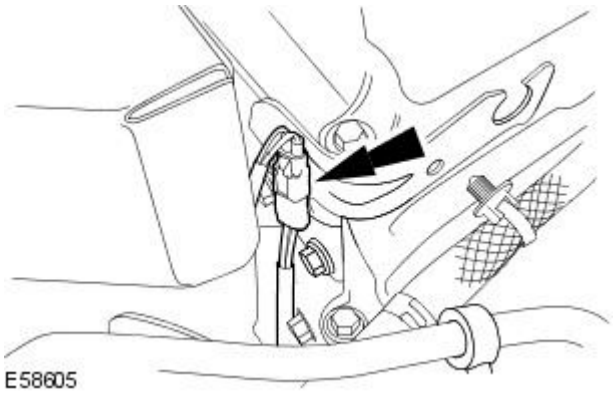
- Adjust the engine support bracket to support the weight of the powertrain assembly.

Vehicles with diesel engine

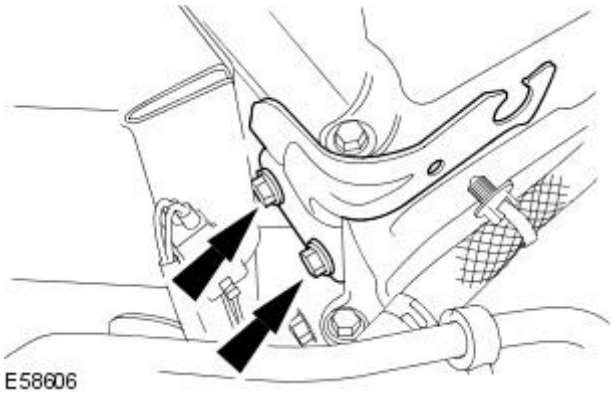
18. Detach the engine harness.



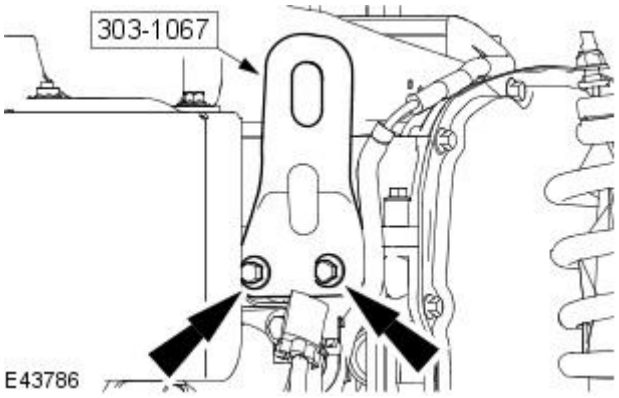
19. Detach the electrical connector.



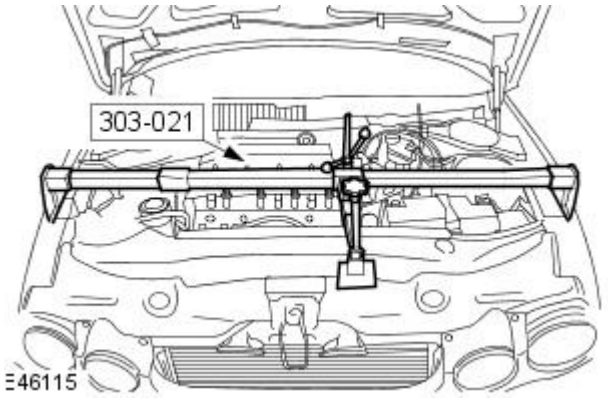
20. Remove the engine cover rear mount bracket.



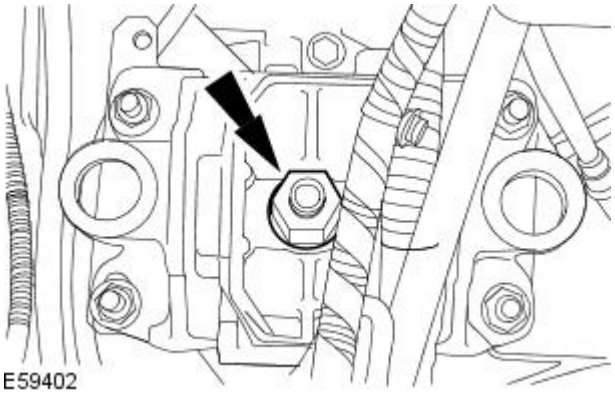
21. Install the special tool.



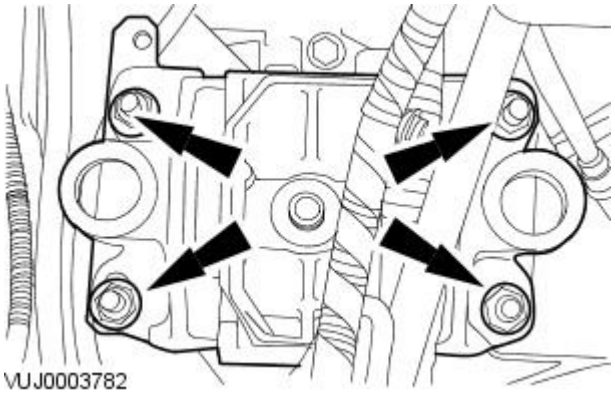
22. Using the special tool, support the engine and transmission assembly.



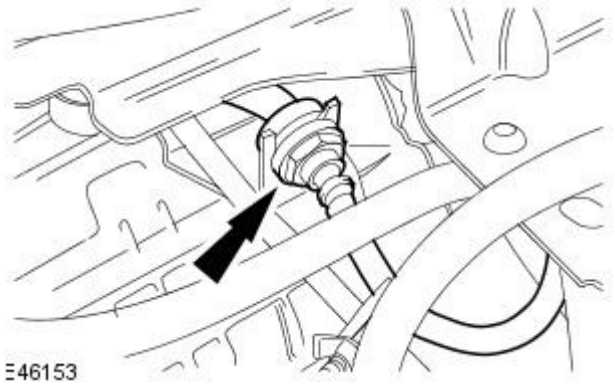
All vehicles



23. Remove the transaxle mount bracket securing nut.

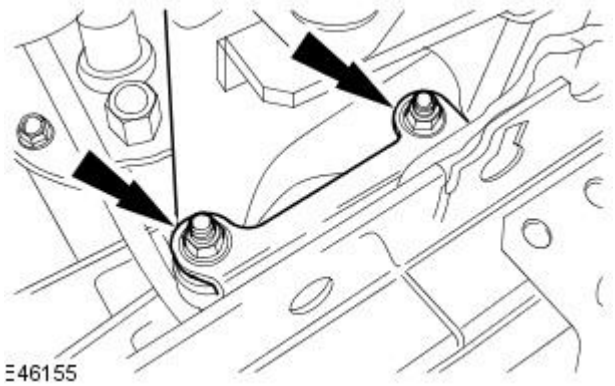


24. Remove the transaxle support insulator.



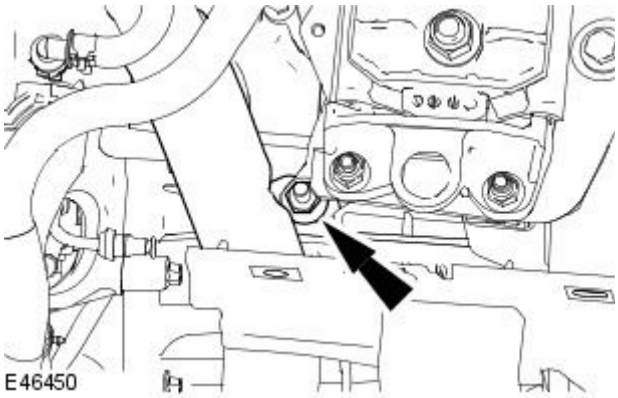
25. Detach the clutch master cylinder to clutch slave cylinder high pressure pipe from the support bracket.

All except vehicles with diesel engine

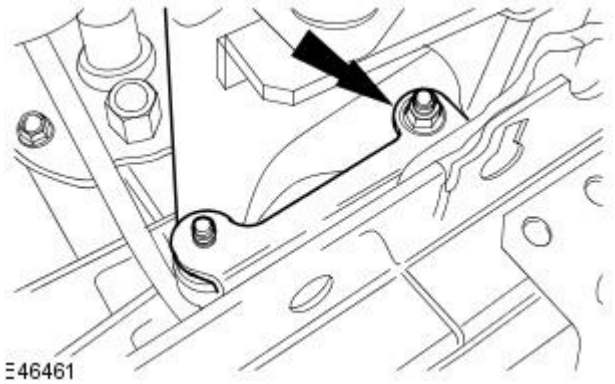


26. Remove the clutch master cylinder to clutch slave cylinder high pressure pipe support bracket.

Vehicles with diesel engine

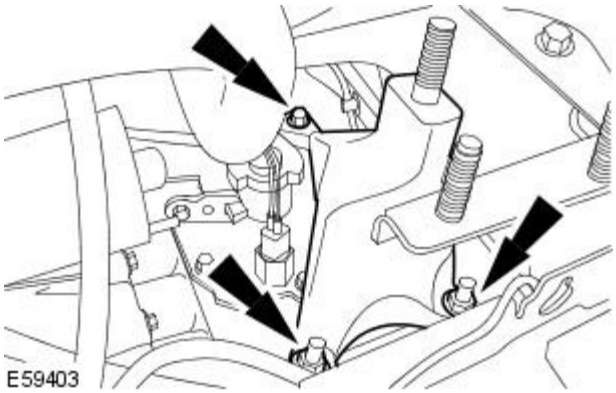


27. Remove the charge air cooler pipe retaining nut.

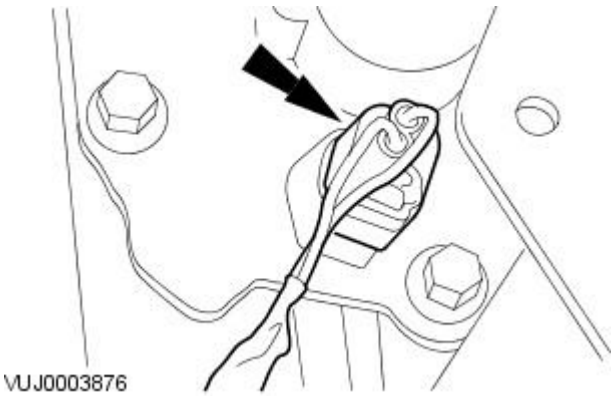


28. Remove the clutch master cylinder to clutch slave cylinder high pressure pipe support bracket.

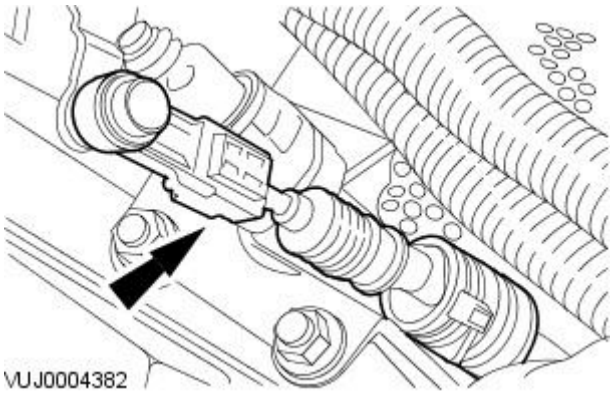
All vehicles



29. Remove the transaxle mount bracket.



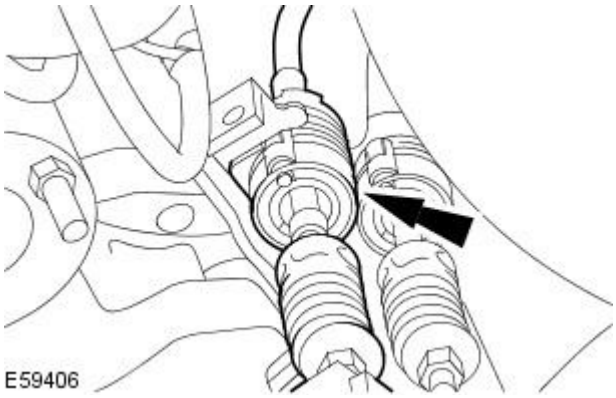
30. Disconnect the reverse lamp switch electrical connector.



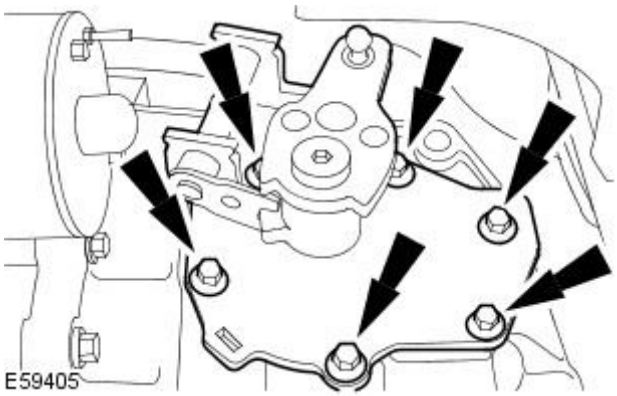
31. NOTE: Shown from the under side of the vehicle for clarity.

• NOTE: Lower shift cable shown, upper shift cable similar.

Disconnect the shift cables from the transaxle selectors.



32. Detach the upper shift cable from the retaining bracket.

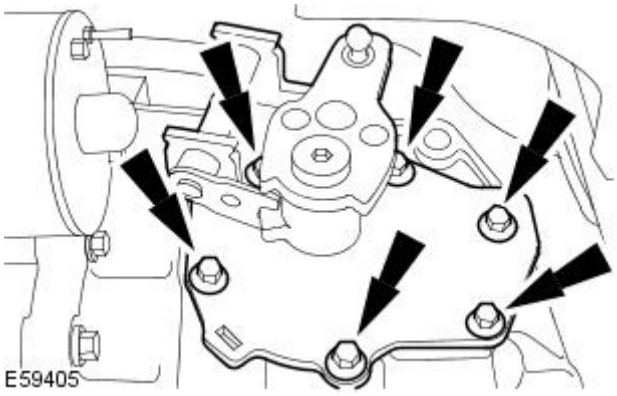


33. NOTE: Clean the selector mechanism mating surfaces and make sure all the sealant is removed.

Remove the selector mechanism.

Installation

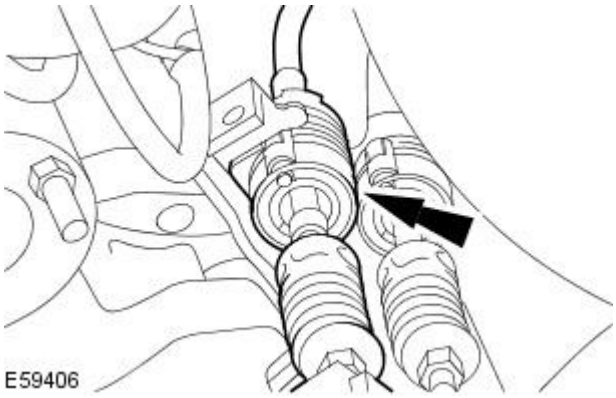
All vehicles



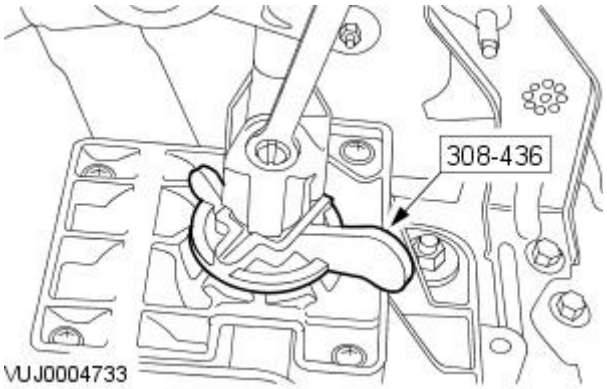
1. Apply sealant to the selector mechanism mating surfaces (bead diameter: 2 mm).

2. Install the selector mechanism.

- Tighten to 20 Nm.

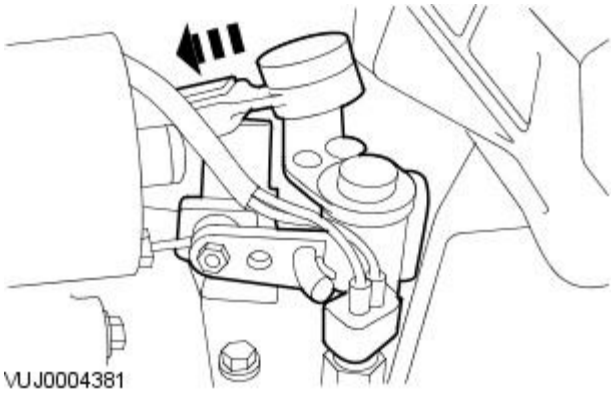


3. Attach the upper shift cable to the retaining bracket.

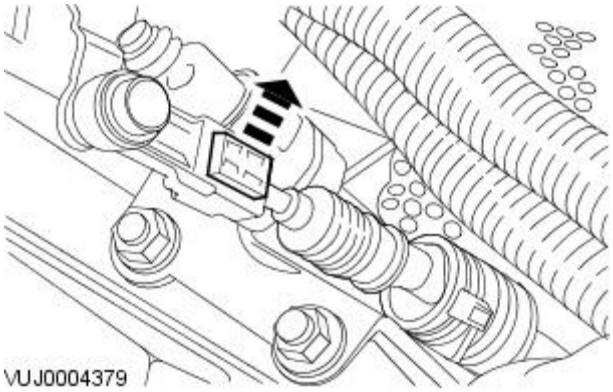


4. NOTE: Lift the reverse gear selector to fit special tool.

Using the special tool, make sure the gearshift lever is in the neutral position.

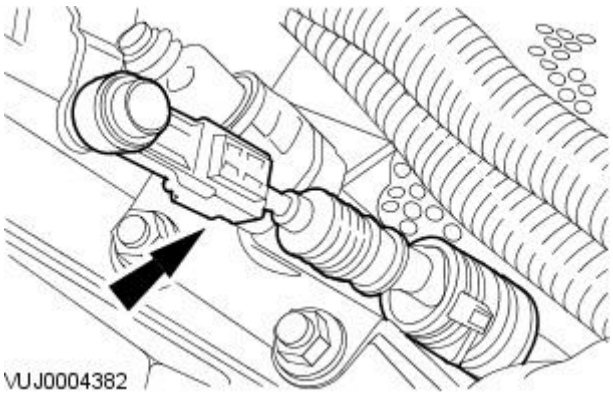


5. Make sure the transmission selector is in the fourth gear position.



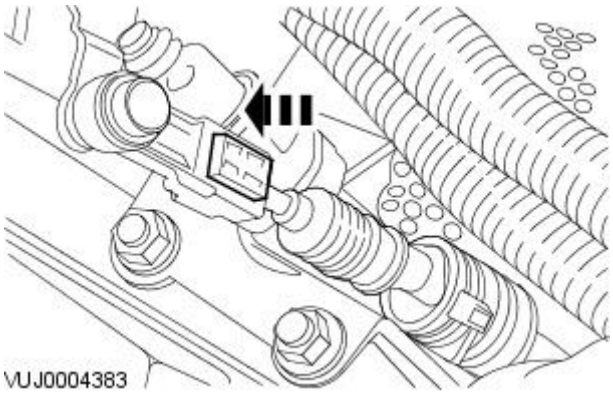
6. NOTE: Shown from the under side of the vehicle for clarity.

Detach the red locking tab on the shift cable.



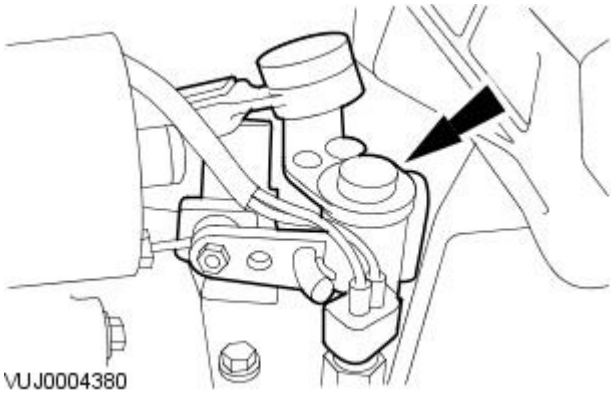
7. NOTE: Shown from the under side of the vehicle for clarity.

Attach the shift cable to the ball pin on the transmission selector.

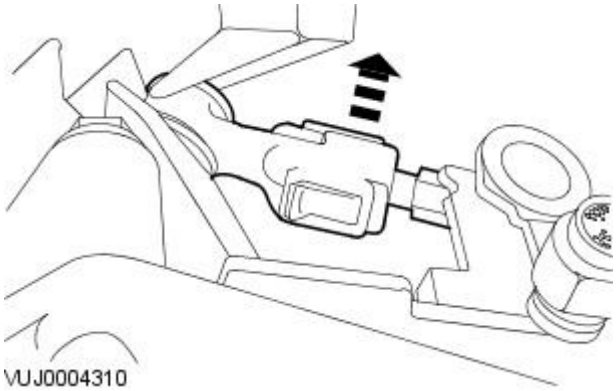


8. NOTE: Shown from the under side of the vehicle for clarity.

Press the red locking tab to secure the position of the shift cable.

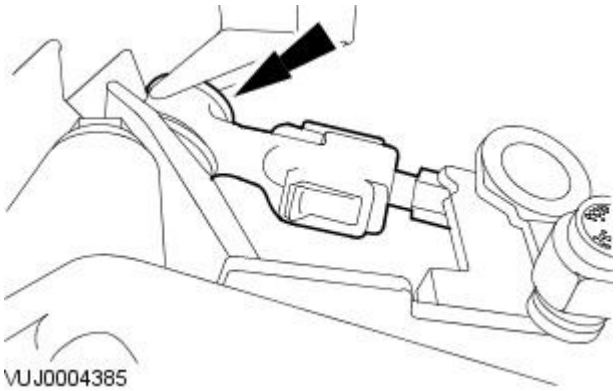


9. Place the transmission selector into the neutral position.



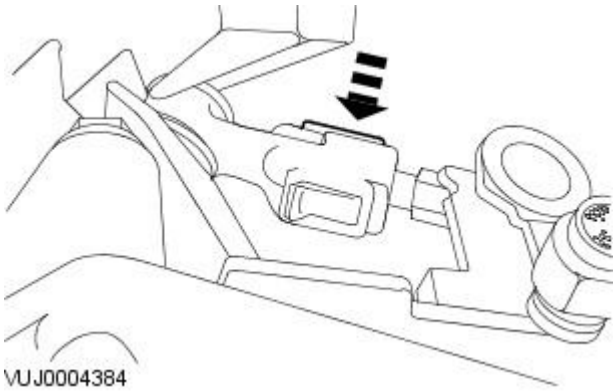
10. NOTE: Shown from the under side of the vehicle for clarity.

Detach the red locking tab on the selector cable.



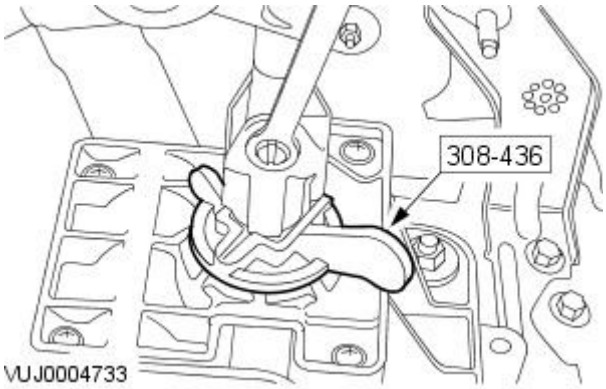
11. NOTE: Shown from the under side of the vehicle for clarity.

Attach the selector cable to the ball pin on the gearbox mass damper.

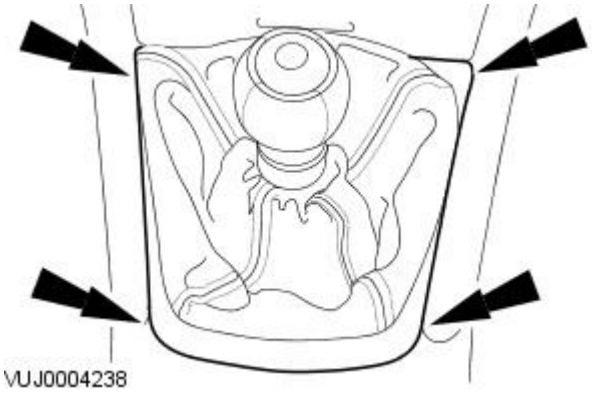


12. NOTE: Shown from the under side of the vehicle for clarity.

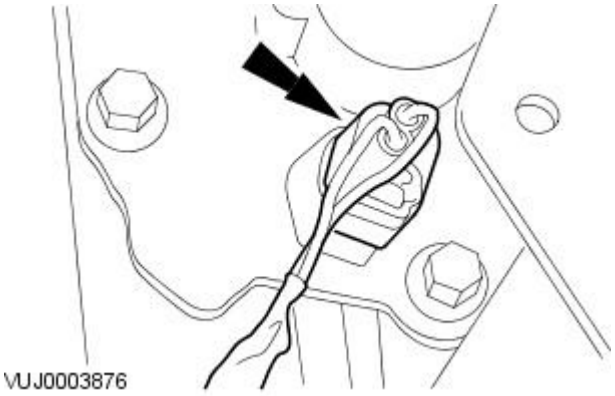
Press the red locking tab to secure the position of the selector cable.



13. Remove the special tool.

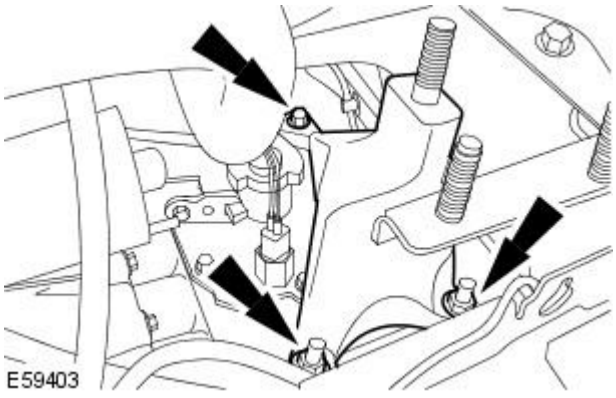


14. Attach the gearshift lever surround.



15. Check for correct operation of gear controls.

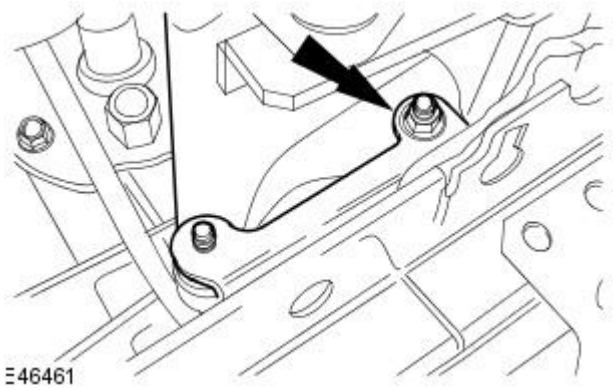
16. Connect the reverse lamp switch electrical connector.



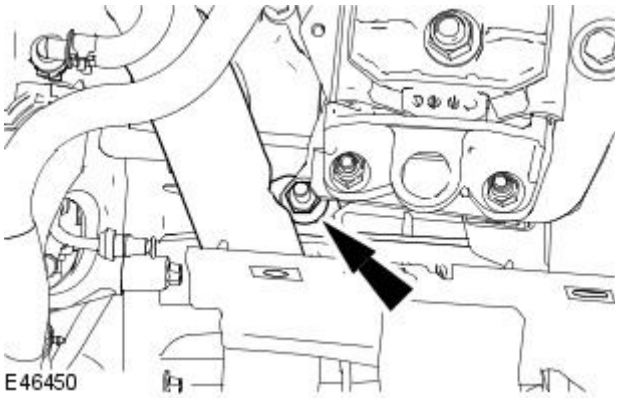
17. Install the transaxle mount bracket.

- Tighten to 80 Nm.

Vehicles with diesel engine

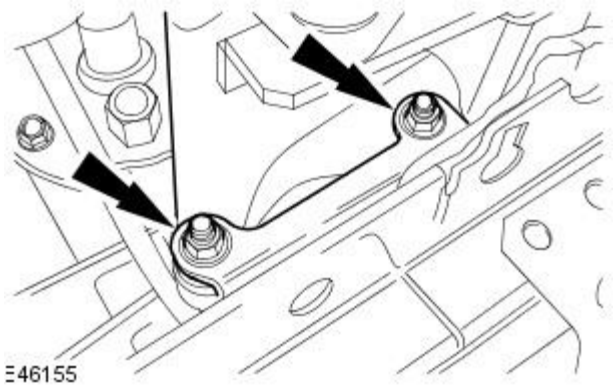


18. Install the clutch master cylinder to clutch slave cylinder high pressure pipe support.



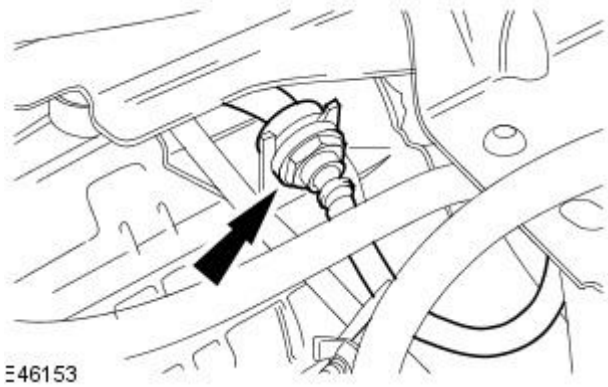
19. Install the charge air cooler pipe retaining nut.

All except vehicles with diesel engine

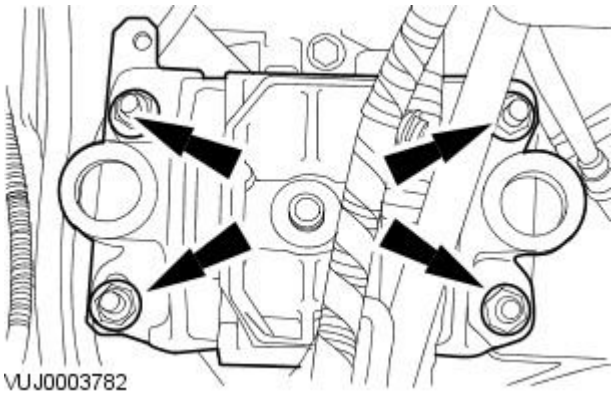


20. Install the clutch master cylinder to clutch slave cylinder high pressure pipe support bracket.

All vehicles

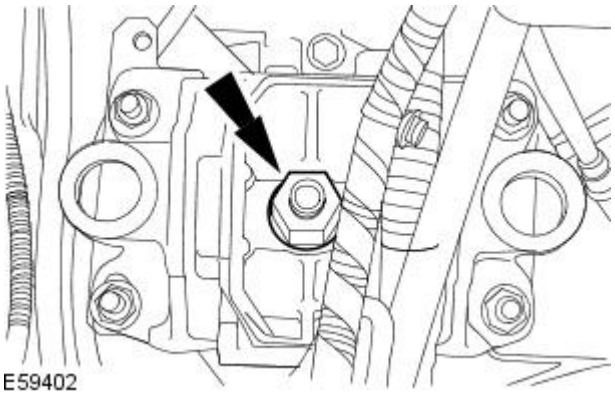


21. Attach the clutch master cylinder to clutch slave cylinder high pressure pipe to the support bracket.



22. Install the transaxle support insulator.

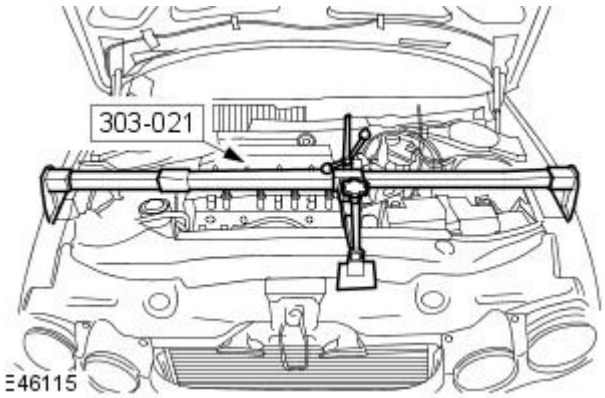
- Tighten to 47 Nm.



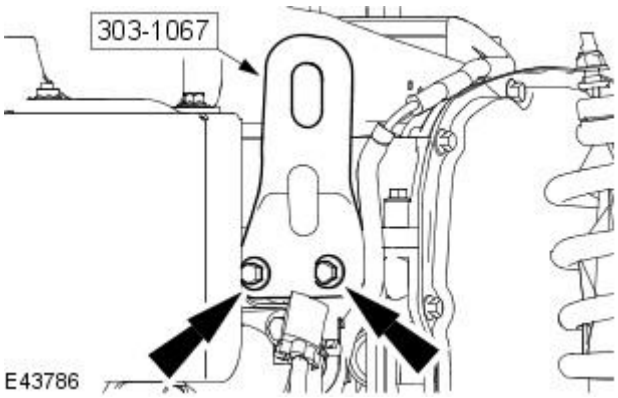
23. Install the transaxle mount bracket securing nut.

- Tighten to 133 Nm.

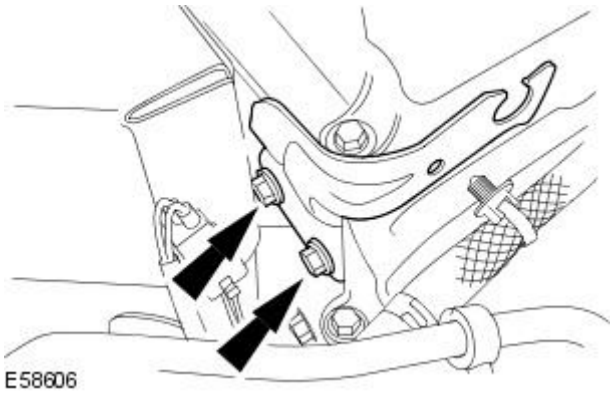
Vehicles with diesel engine



24. Remove the special tool.

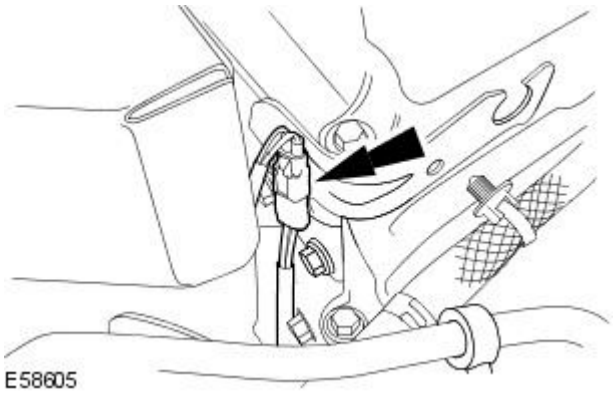


25. Remove the special tool.

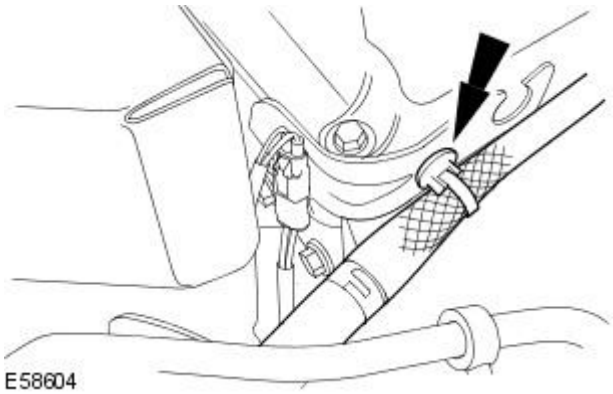


26. Install the engine cover rear mount bracket.

- Tighten to 23 Nm.

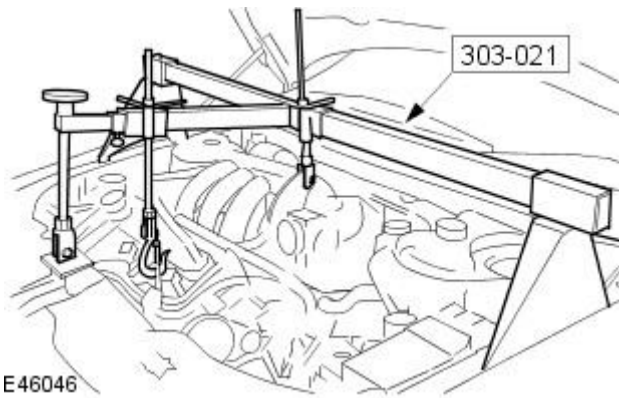


27. Attach the electrical connector.

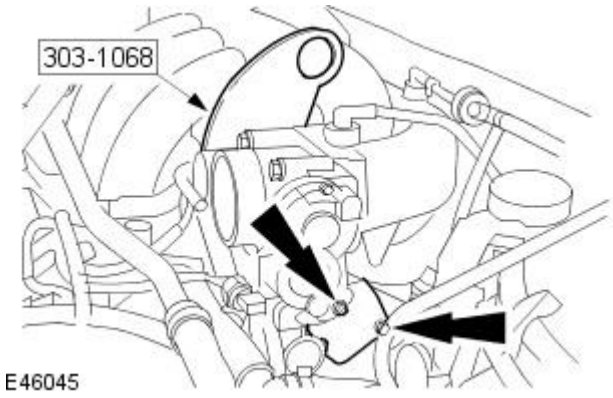


28. Attach the engine harness.

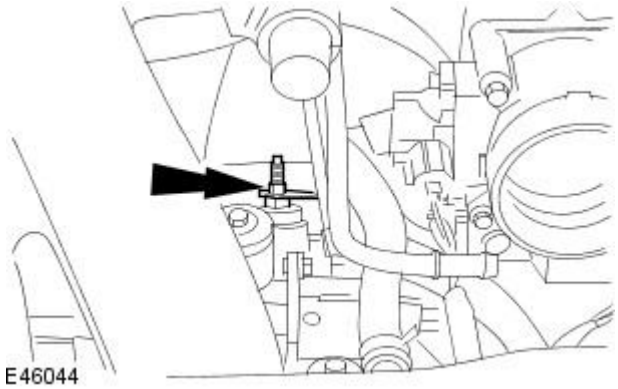
All vehicles



29. Remove the special tool.

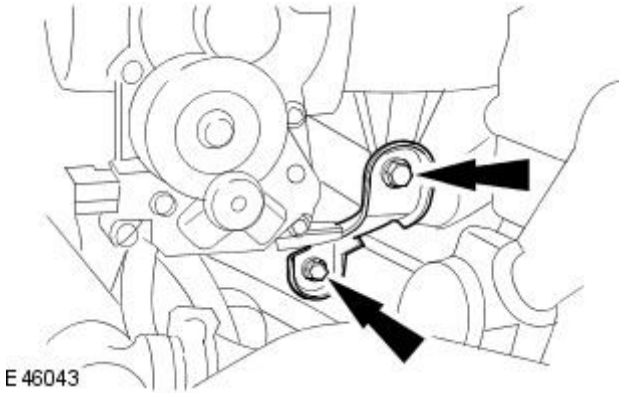


30. Remove the special tool.



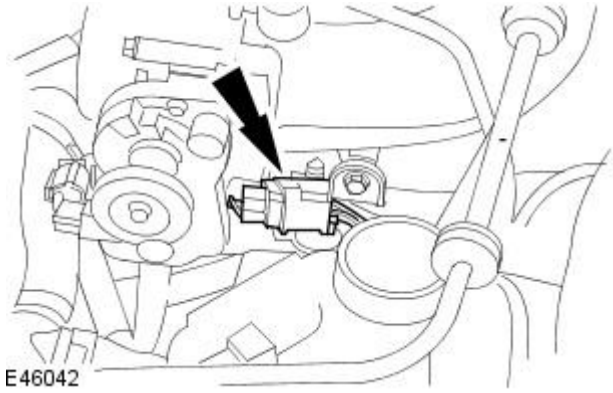
31. Attach the wiring harness to the camshaft cover retaining stud.

- Tighten to 6 Nm.

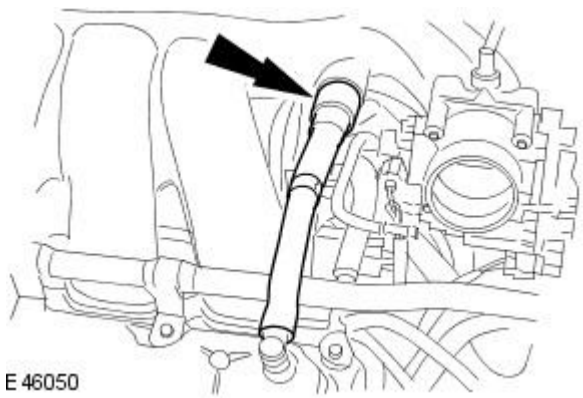


32. Install the intake manifold support bracket.

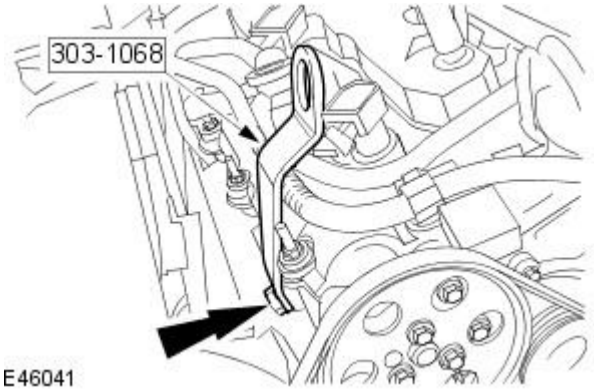
- Tighten to 10 Nm.



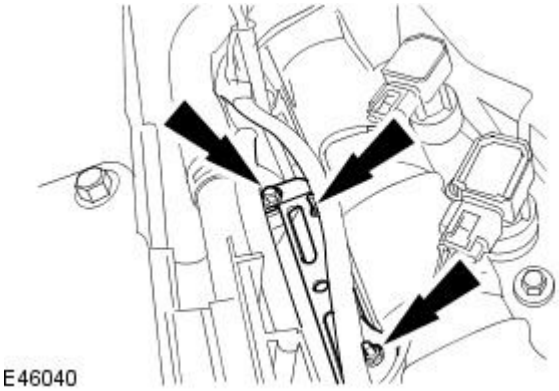
33. Attach the electrical connector to the intake manifold support bracket.



34. Attach the PCV hose to the intake manifold.

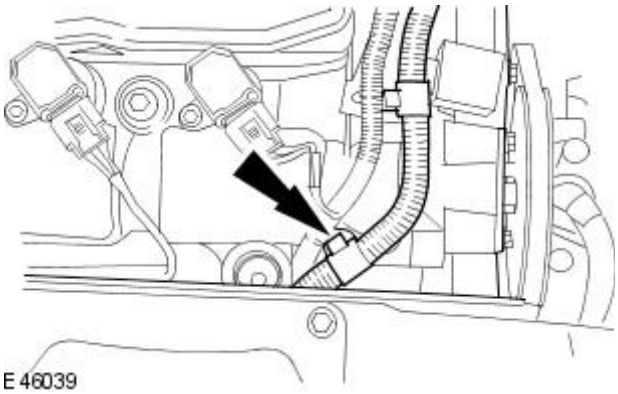


35. Remove the special tool.

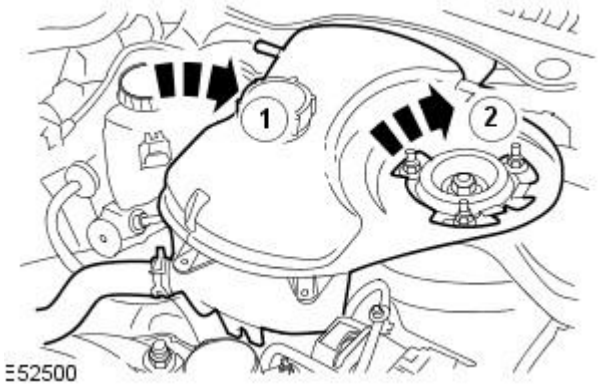


36. Install the air cleaner mount bracket.

- Tighten to 6 Nm.

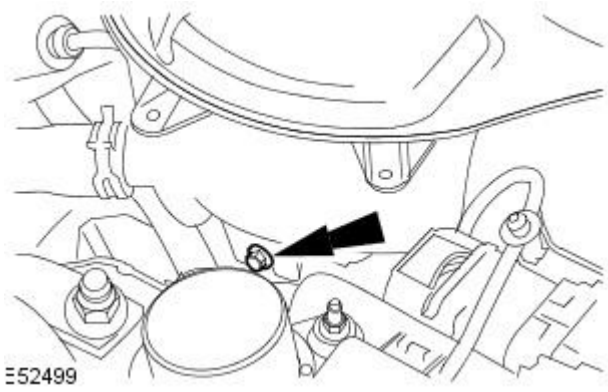


37. Attach the generator wiring harness retaining clip to the camshaft cover retaining clip.



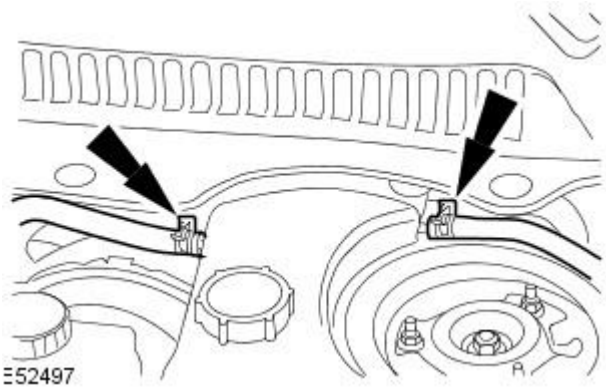
38. Attach the coolant expansion tank.

1. Reposition the coolant expansion tank.
2. Attach the coolant expansion tank.



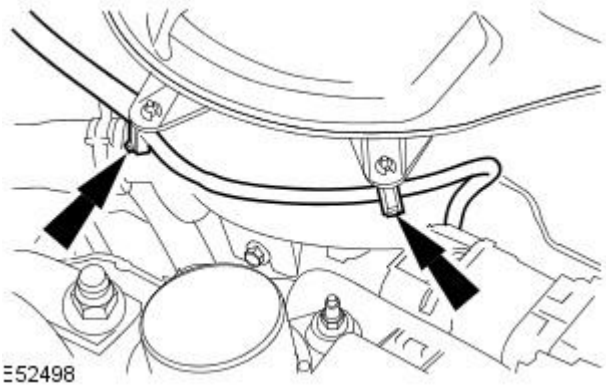
39. Install the coolant expansion tank retaining bolt.

- Tighten to 3 Nm.

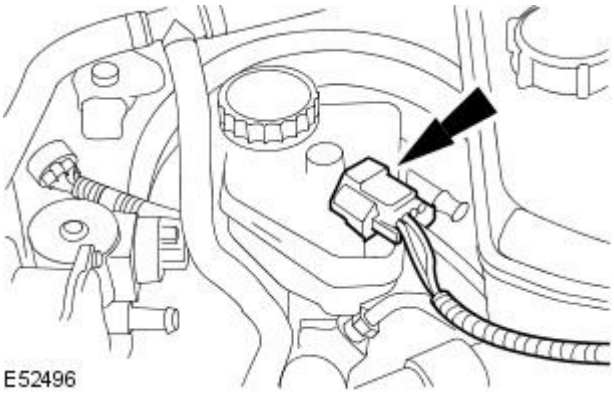


40. NOTE: Remove the blanking plugs from the cooling system vent hoses and the coolant expansion tank.

Attach the cooling system vent hoses to the coolant expansion tank.



41. Attach the brake fluid low level warning indicator wiring harness to the coolant expansion tank.



42. Connect the brake fluid low level warning indicator electrical connector.

43. Install the battery tray.
For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

44. Install the air cleaner. For additional information, refer to:

Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation),
Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

Published: 11-May-2011

Manual Transmission / Transaxle - Selector MechanismVehicles With: 6-Speed Manual Transaxle - MMT6

In-vehicle Repair

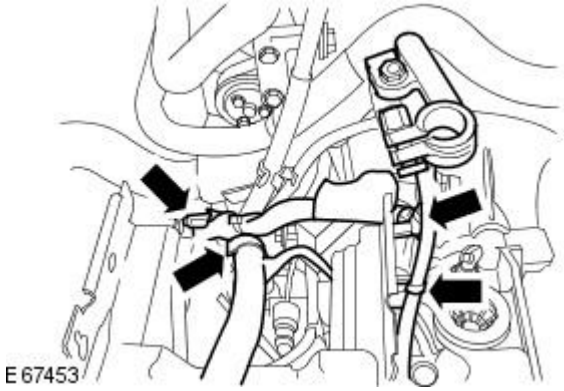
Materials

Name	Specification
Gasket Eliminator Sealant	WSK-M2G348-A5

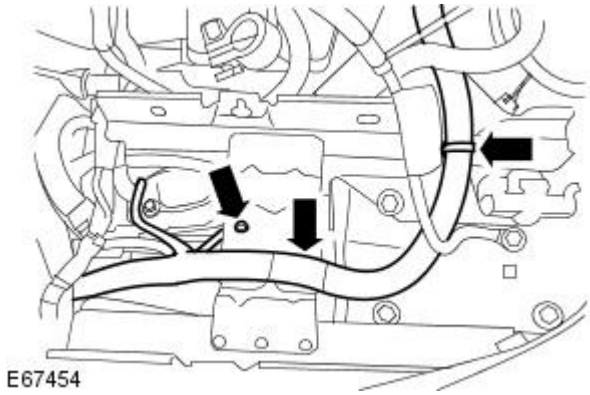
Removal

1. Remove the battery tray.
For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

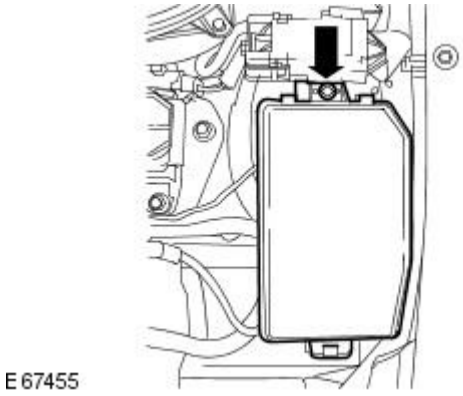
2. Detach the wiring harnesses.



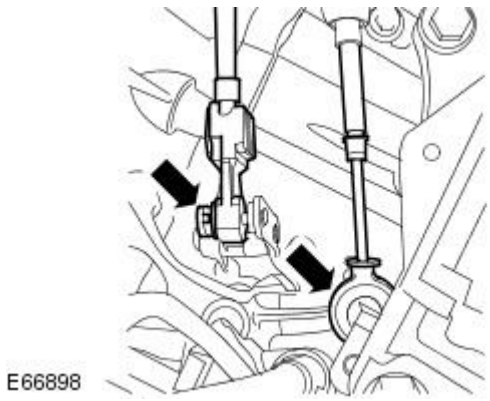
3. Detach the wiring harnesses.

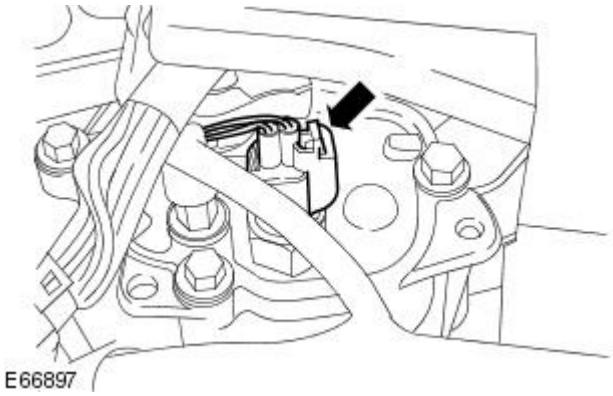


4. Detach the fuse box.

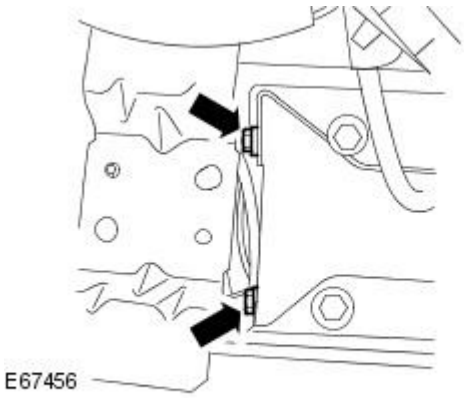


5. Detach the selector cables.

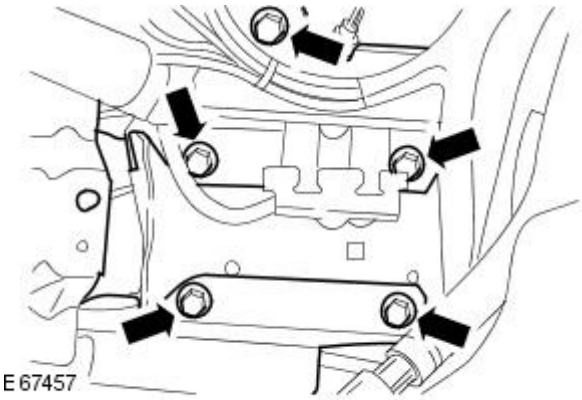



E66897

6. Disconnect the reverse lamp switch electrical connector.

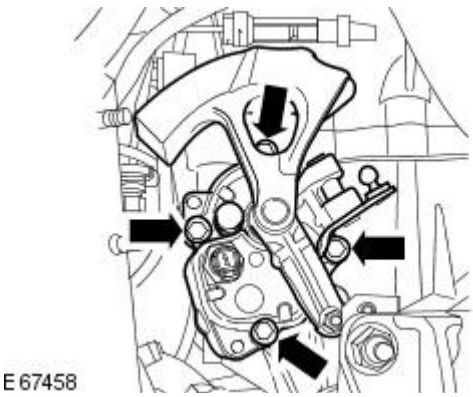

E67456

7. Remove the battery tray retaining bracket retaining bolts.


E67457

8. Remove the battery tray retaining bracket retaining bolts.

- Reposition the battery tray

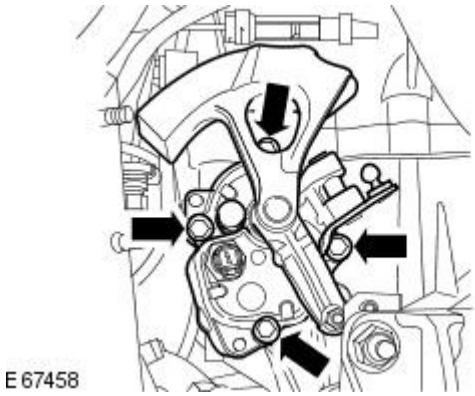

E67458

9. NOTE: Clean the selector mechanism mating surfaces and make sure all the sealant is removed.

Remove the selector mechanism.

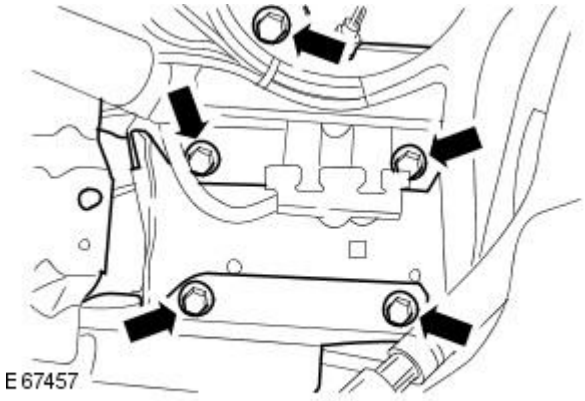
Installation

1. Apply sealant to the selector mechanism mating surfaces (bead diameter: 2 mm).



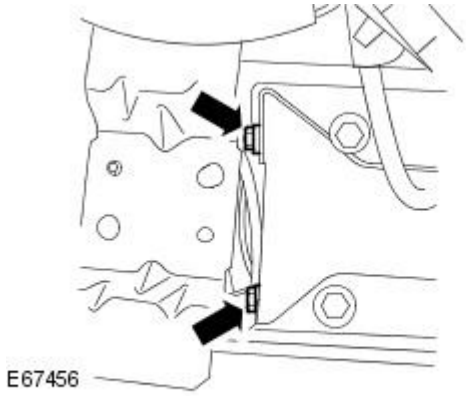
2. Install the selector mechanism.

- Tighten to 20 Nm.

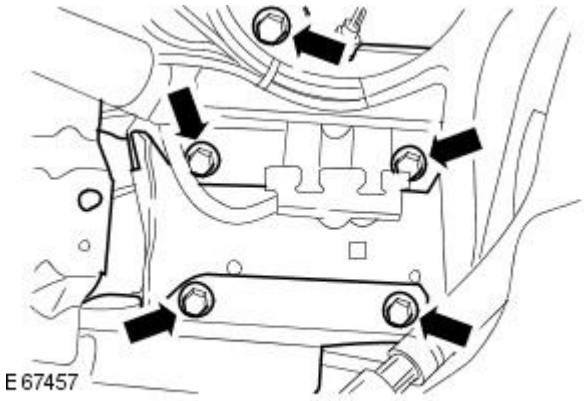


3. Loosly install the battery tray retaining bracket retaining bolts.

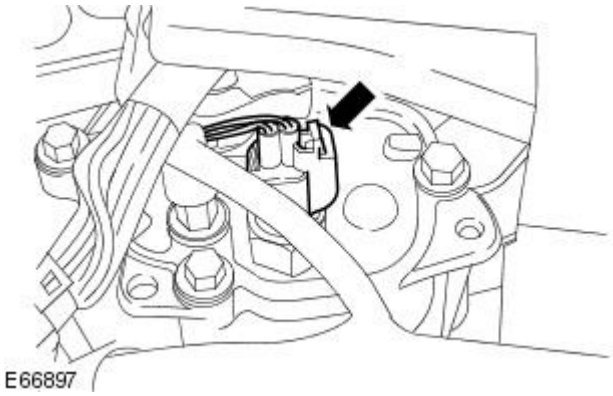
- Reposition the battery tray.



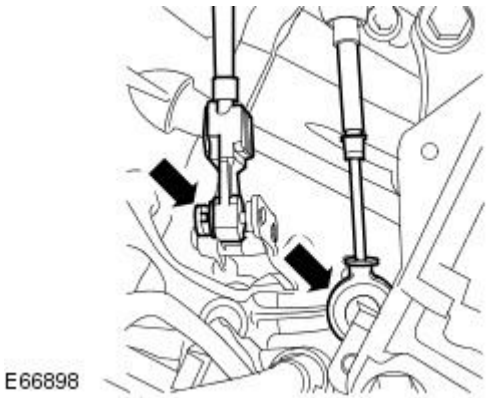
4. Install the battery tray retaining bracket retaining bolts.



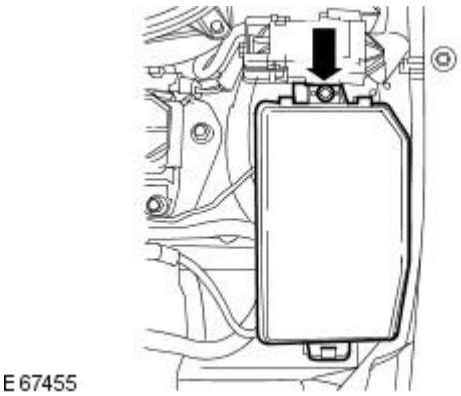
5. Fully tighten the battery tray retaining bracket retaining bolts.


E66897

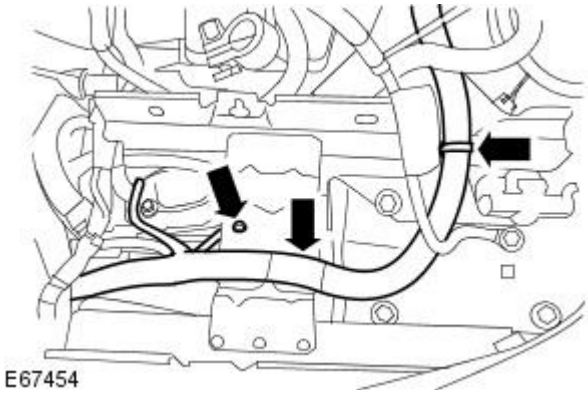
6. Connect the reverse lamp switch electrical connector.


E66898

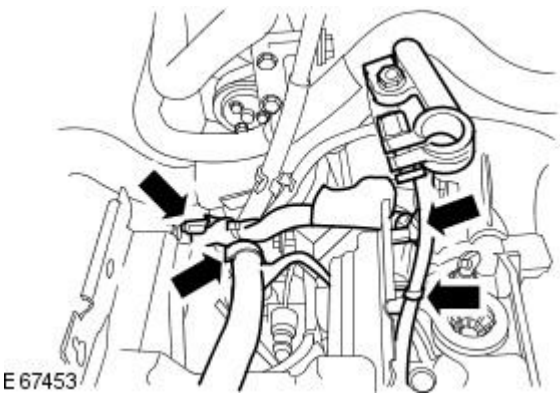
7. Attach the selector cables.


E67455

8. Attach the fuse box.


E67454

9. Attach the wiring harnesses.


E67453

10. Attach the wiring harnesses.

11. Install the battery tray.
For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

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Manual Transmission / Transaxle - Support Insulator

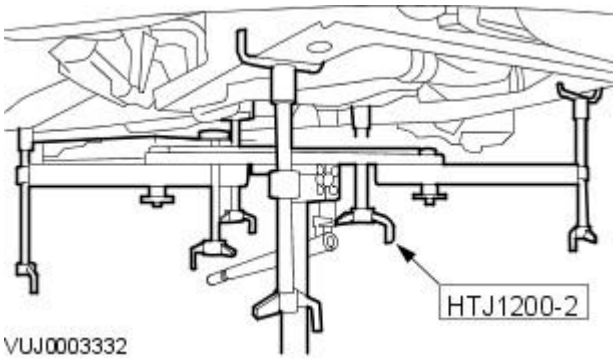
In-vehicle Repair

Special Tool(s)	
 HTJ12002	Powertrain assembly jack HTJ1200-2

Removal

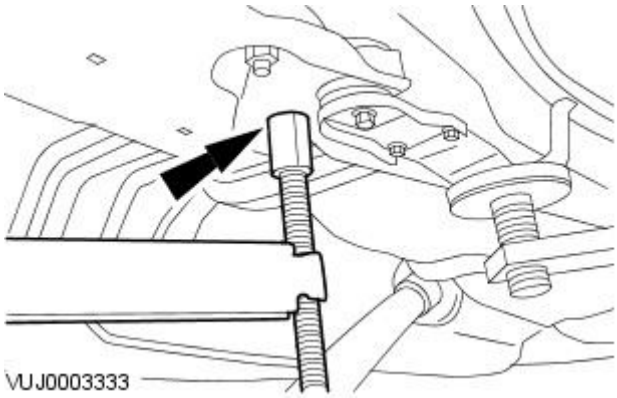
All vehicles

1. Raise and support the vehicle.
   For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. Install the special tool.



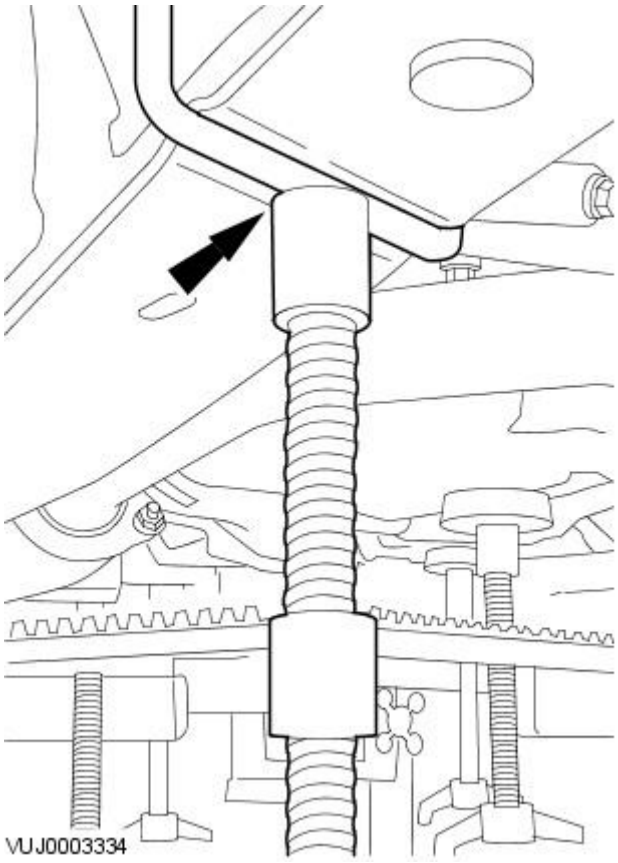
3. NOTE: Left-hand shown, right-hand similar.

   Position and adjust the special tool height rear adjuster.

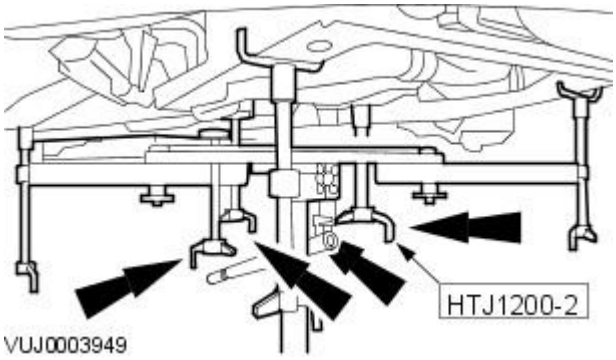


4. NOTE: Right-hand shown, left-hand similar.

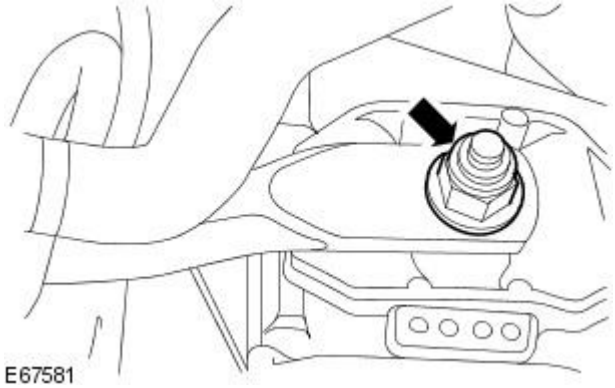
Position and adjust the special tool front height adjuster.



5. Position and adjust the special tool engine height adjusters.

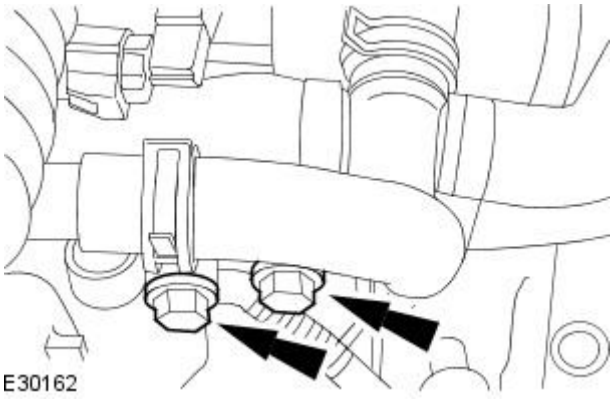


6. Remove the retaining nut.

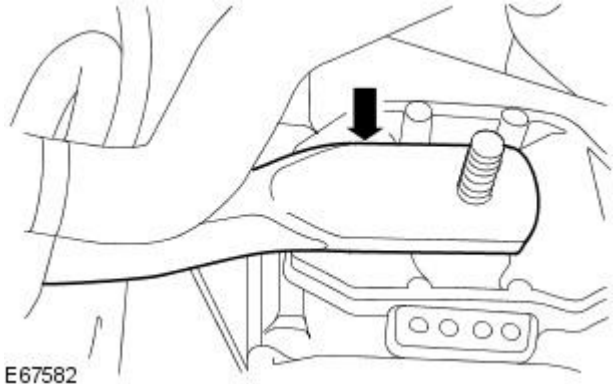


Vehicles with 5-speed manual transaxle

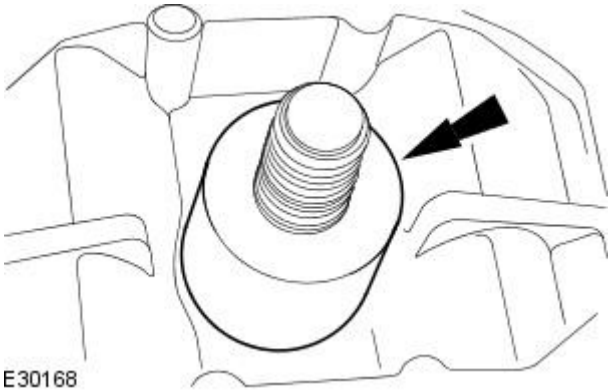
7. Detach the support bar.



8. Remove the support bar.



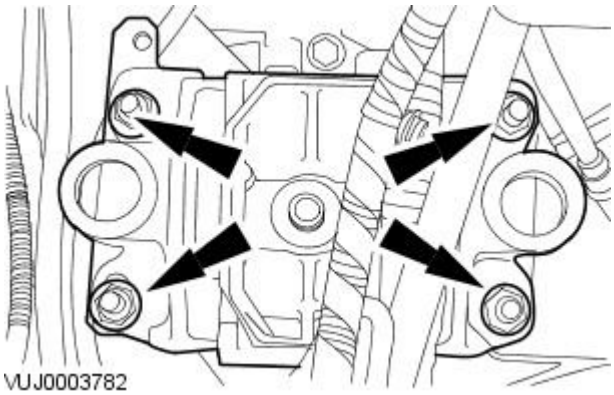
9. Remove the spacer.



All vehicles

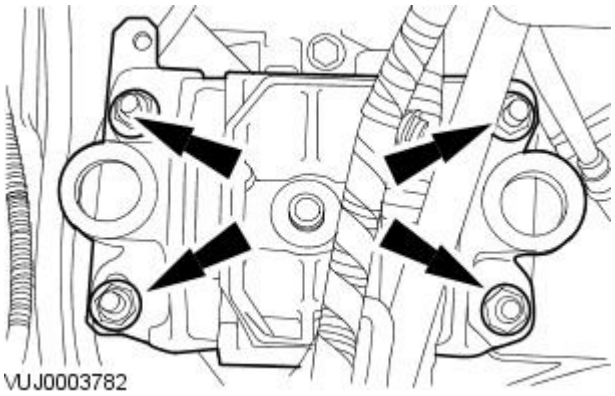
10. Remove the transmission mount.

- Remove the transmission mount retaining nuts.



Installation

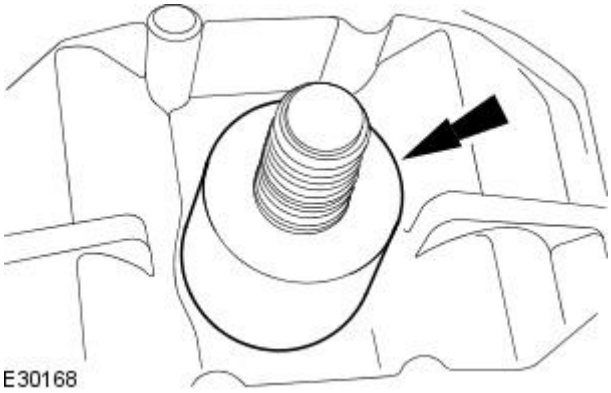
All vehicles


VUJ0003782

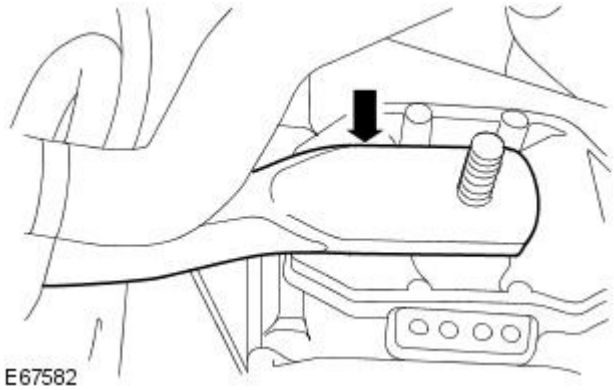
1. Install the transmission mount.

- Tighten to 47 Nm.

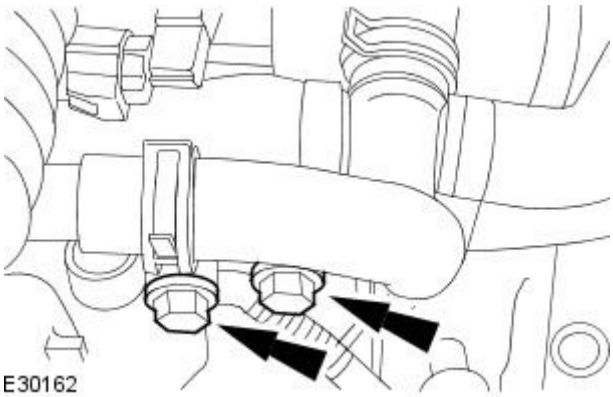
Vehicles with 5-speed manual transaxle


E30168

2. Install the spacer.

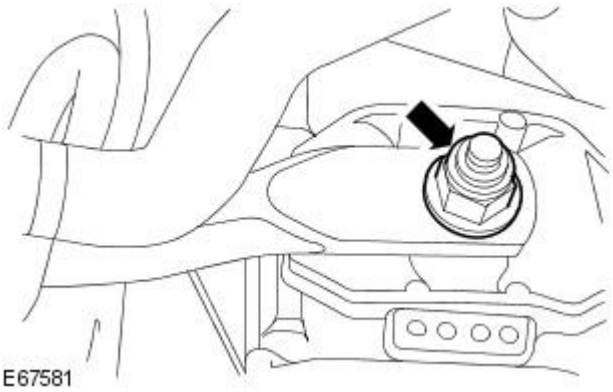

E67582

3. Install the support bar.

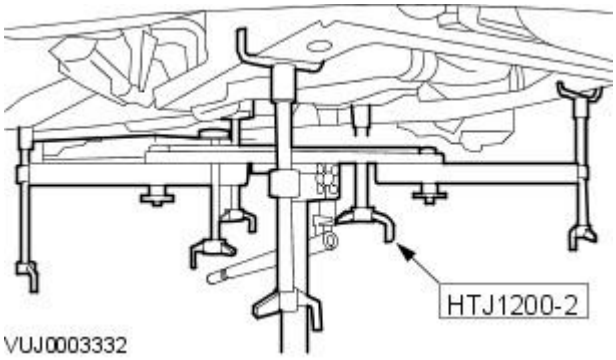

E30162

4. Tighten to 25 Nm.

All vehicles



5. Tighten to 133 Nm.



6. Remove the special tool.

7. Lower the vehicle.

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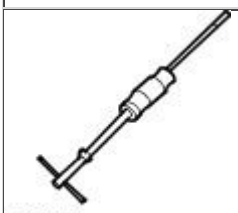
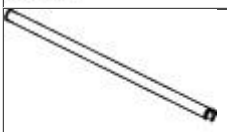
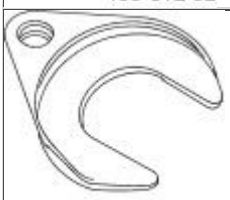
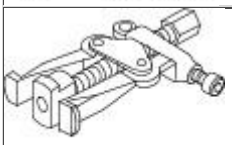
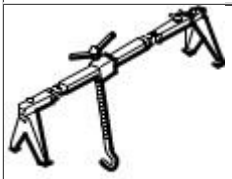
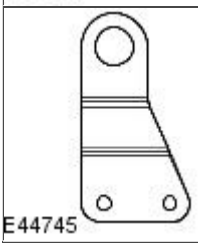
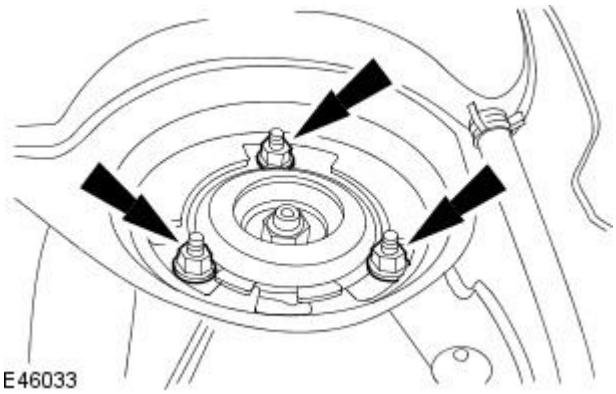
Manual Transmission / Transaxle - Transaxle2.0L Duratorq-TDCi

Removal

Special Tool(s)	
 100012	Slide hammer 100-012
 100-012-02	100-012-02 Slide hammer shaft
 204-226	Halfshaft remover fork 204-226
 HTJ12002	Powertrain assembly jack HTJ1200-2
 308-208	Pinion oil seal remover 308-208
 303-021	Engine support bracket 303-021
 E44745	Engine lifting eye 303-1067

Removal

1. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
2. Remove the air cleaner.
   For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

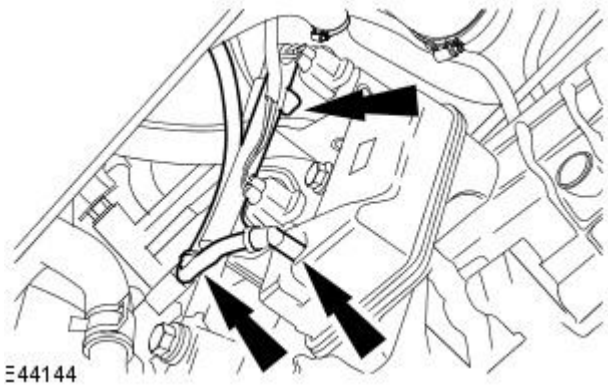


3. NOTE: Left-hand shown, right-hand similar.

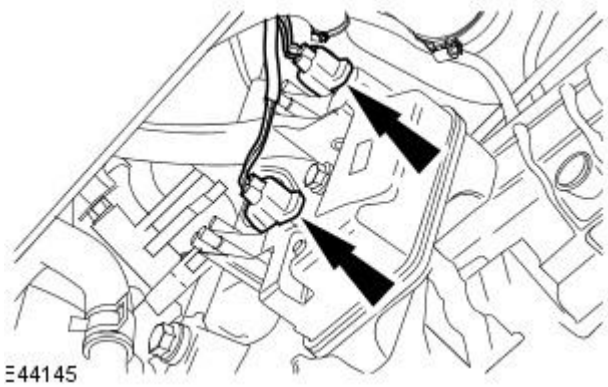
Loosen the shock absorber and spring assembly securing nuts.

4. Remove the front subframe.
For additional information, refer to: Front Subframe - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

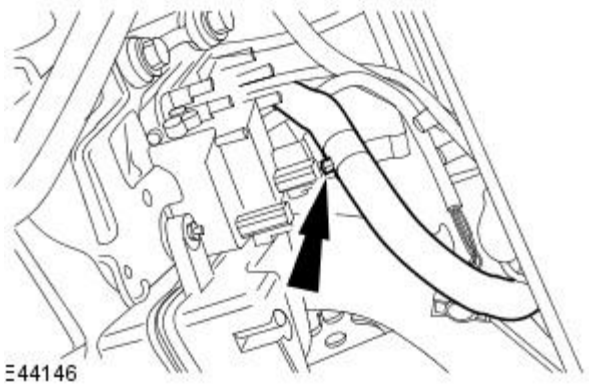
5. Disconnect the vacuum pipes from the vacuum solenoid valves and the vacuum reservoir.

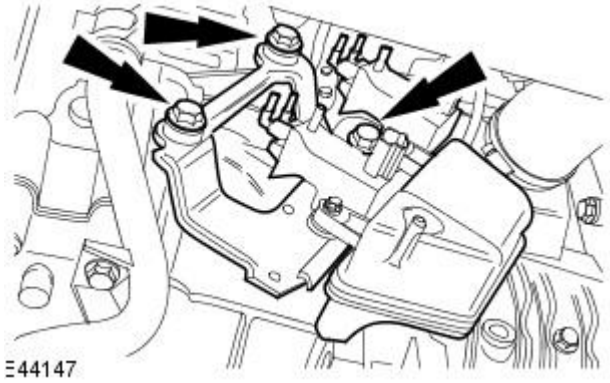


6. Disconnect the vacuum solenoid valves electrical connectors.

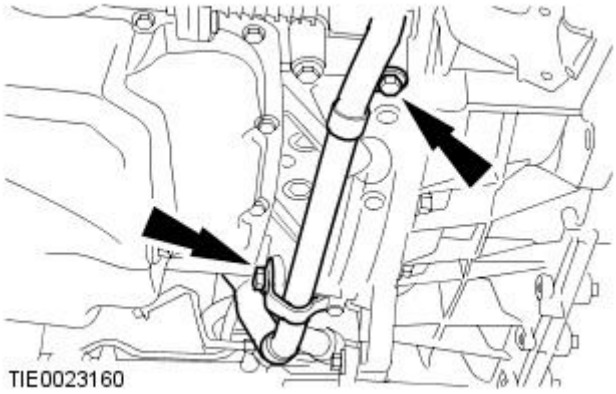


7. Detach the wiring harness from the vacuum solenoids and vacuum reservoir mount bracket.

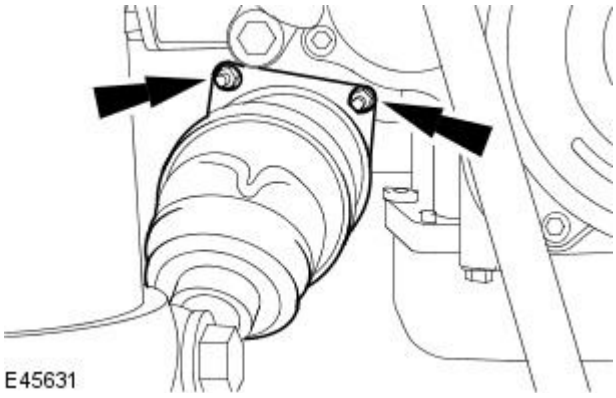




8. Remove the vacuum solenoids and vacuum reservoir mount bracket assembly.



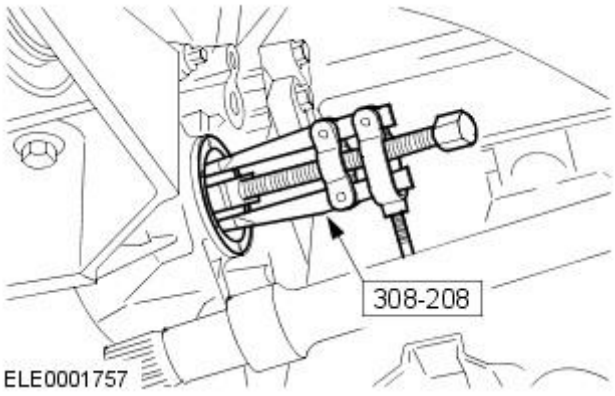
9. Detach the coolant pipe from the engine.



10. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

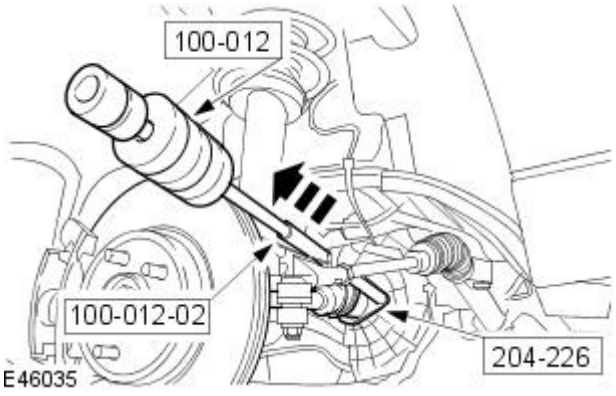
Detach the right-hand halfshaft.

- Disengage the right-hand halfshaft from the transaxle.
- Secure the right-hand halfshaft to one side.

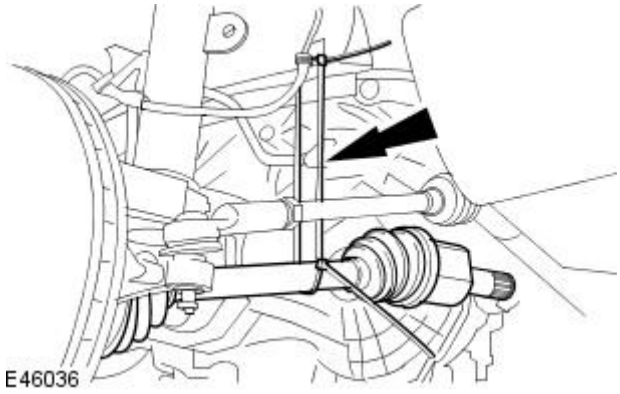


11. NOTE: Plug the transaxle to prevent fluid loss or dirt ingress.

Using the special tool, remove the right-hand halfshaft seal.

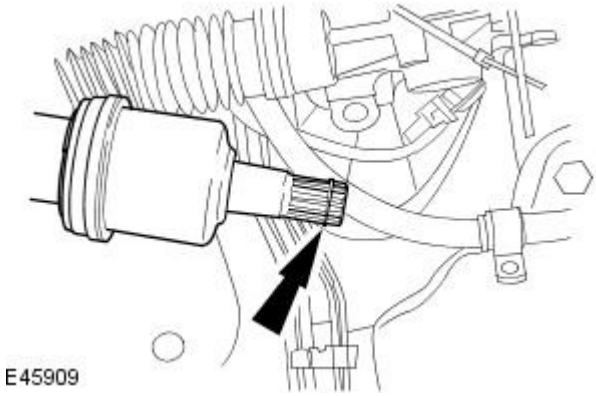


12. Using the special tools, detach the left-hand halfshaft.

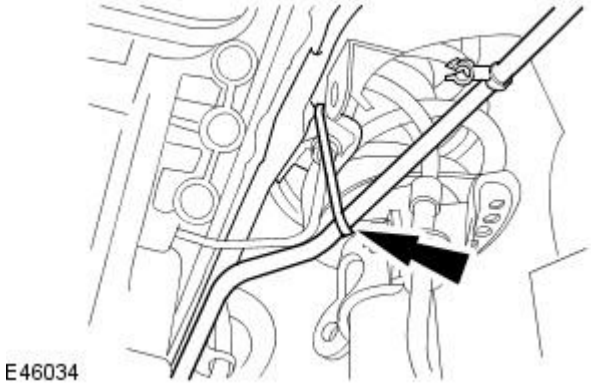


13. CAUTION: Make sure the halfshaft CV joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

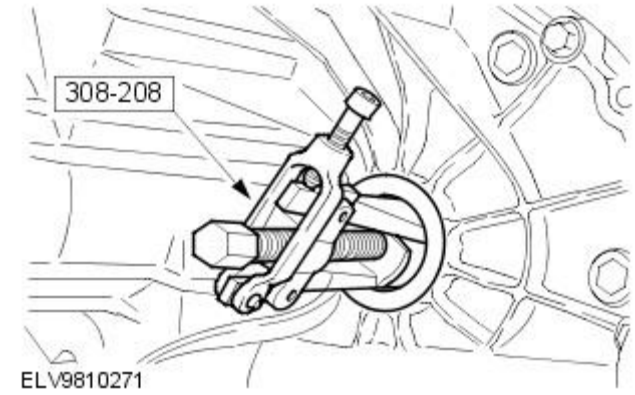
Support the left-hand halfshaft.



14. Remove and discard the left-hand halfshaft snap ring.

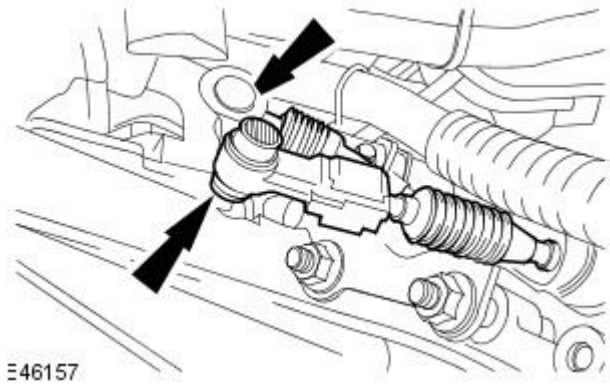


15. Support the power steering fluid pipe.



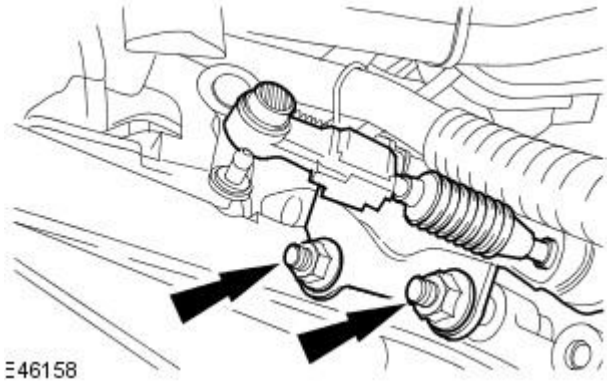
16. NOTE: Plug the transaxle to prevent fluid loss or dirt ingress.

Using the special tool, remove the left-hand halfshaft seal.

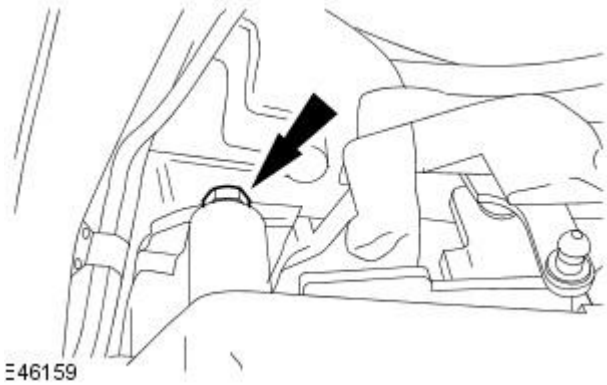


17. Detach the gearshift cables from the transaxle.

18. Detach the gearshift cable support bracket from the transaxle.

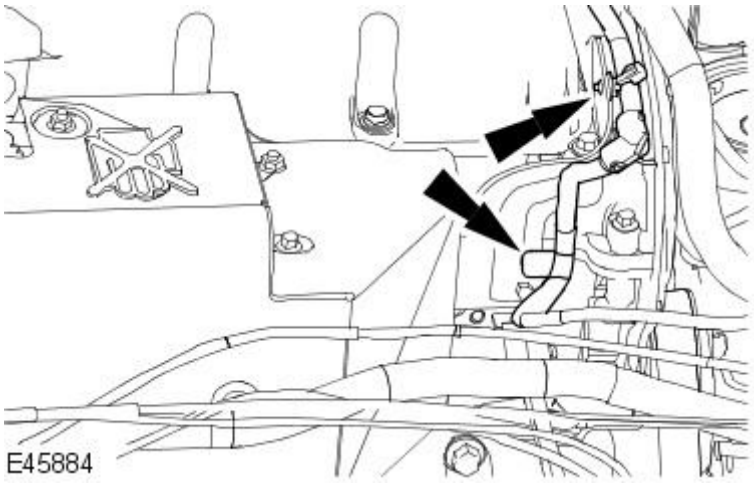


19. Remove the transaxle mount bracket retaining bolt.

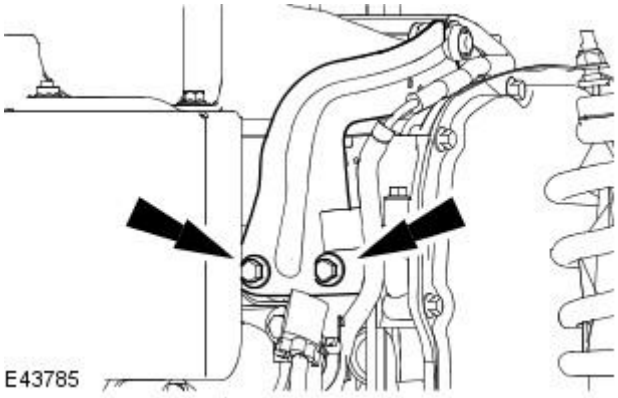


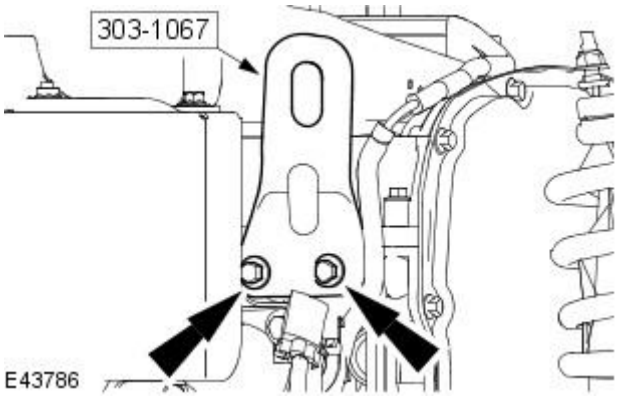
20. Lower the vehicle.

21. Detach the generator and starter motor positive cable from the engine cover mounting bracket.

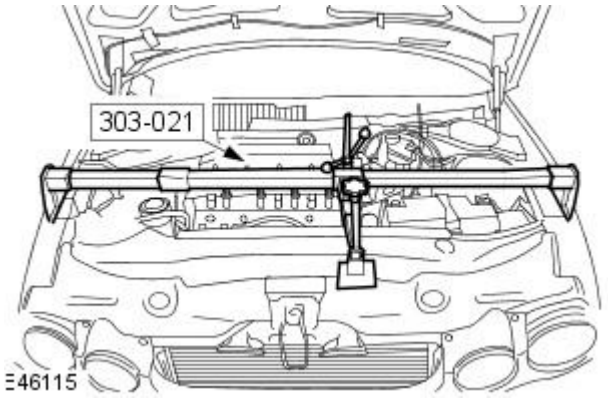


22. Remove the engine cover rear mount bracket.

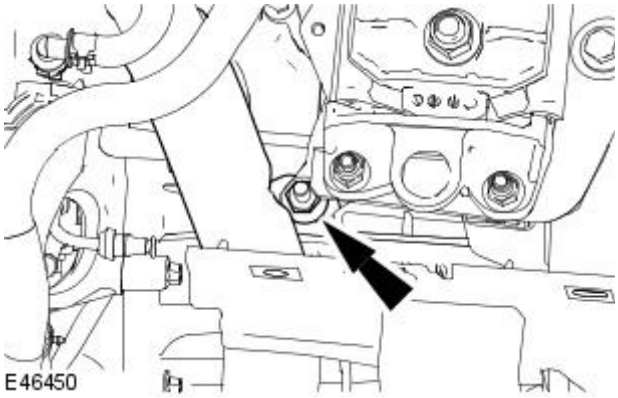




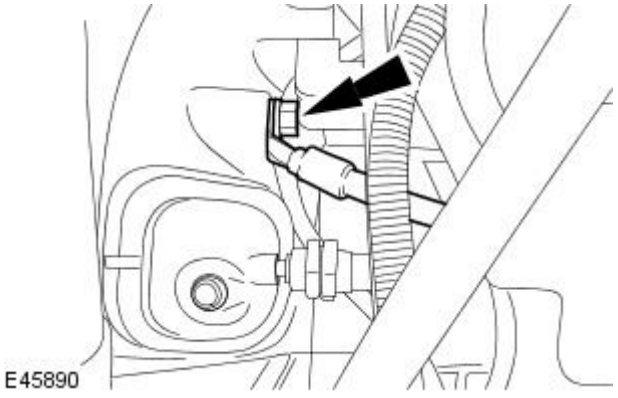
23. Install the special tool.



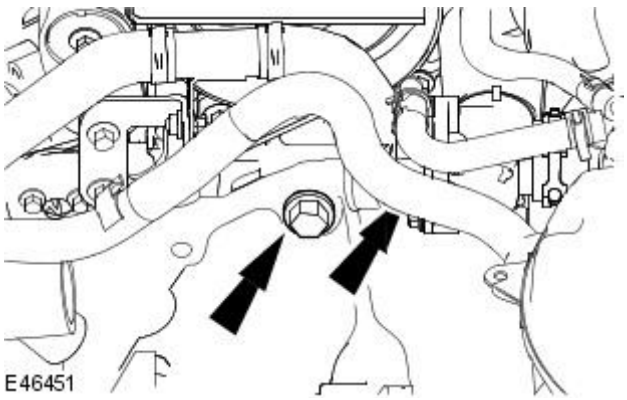
24. Using the special tool, support the engine and transmission assembly.



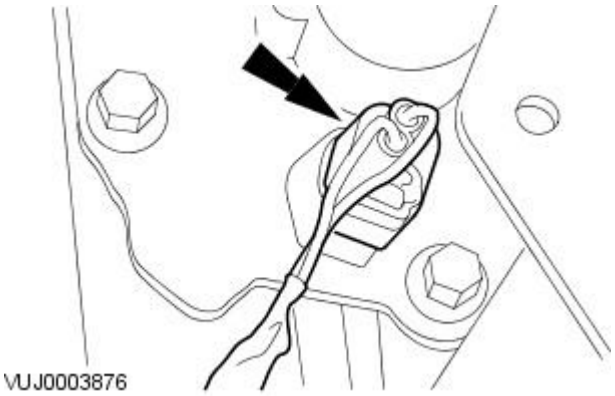
25. Detach the charge air cooler pipe.



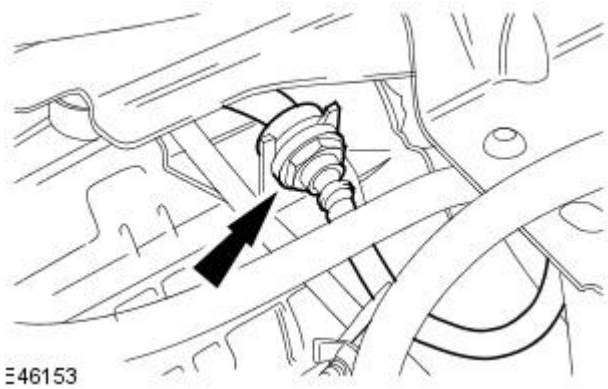
26. Detach the transaxle ground cable.



27. Remove the transaxle upper retaining bolts.



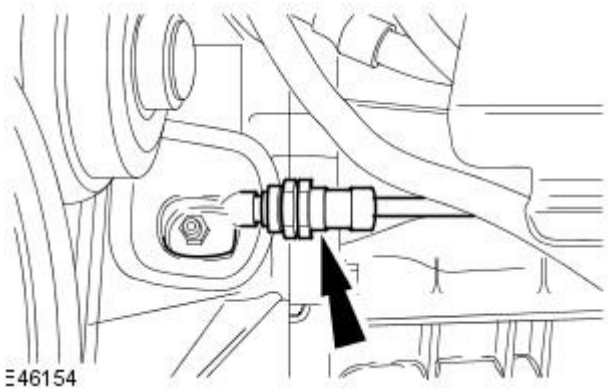
28. Disconnect the reverse lamp switch electrical connector.



29. CAUTION: If brake fluid is split on the paintwork, the affected area must be washed down immediately with cold water. Failure to follow this instruction may result in damage to the vehicle.

Detach the clutch master cylinder to clutch slave cylinder high pressure pipe from the support bracket.

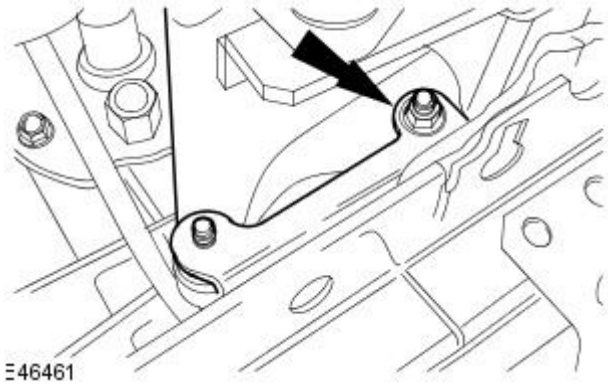
- Install a suitable pipe clamp to the clutch master cylinder to clutch slave cylinder high pressure pipe.



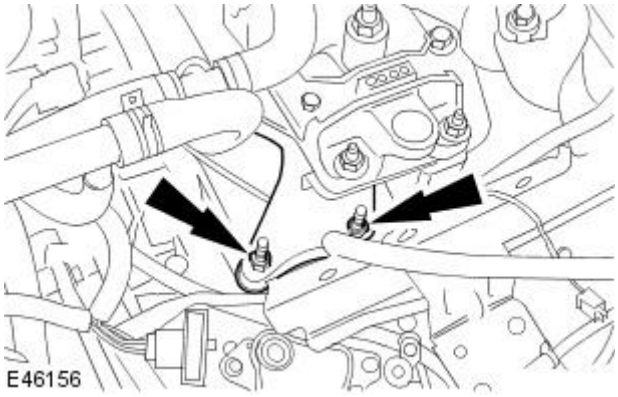
30. CAUTION: If brake fluid is split on the paintwork, the affected area must be washed down immediately with cold water. Failure to follow this instruction may result in damage to the vehicle.

Detach the clutch master cylinder to clutch slave cylinder high pressure pipe from the clutch slave cylinder.

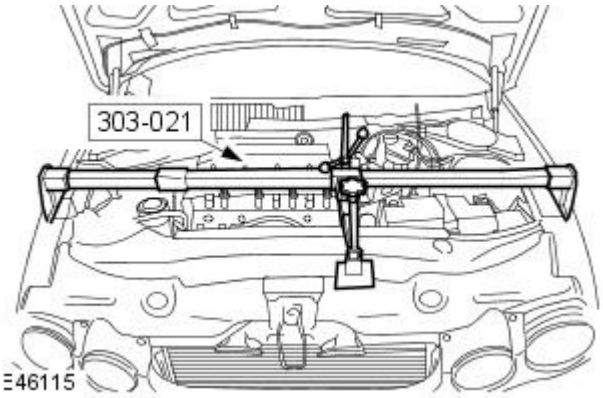
- Remove the clutch master cylinder to clutch slave cylinder high pressure pipe retaining clip.



31. Remove the clutch master cylinder to clutch slave cylinder high pressure pipe support bracket.



32. Remove the transaxle mount bracket retaining studs.

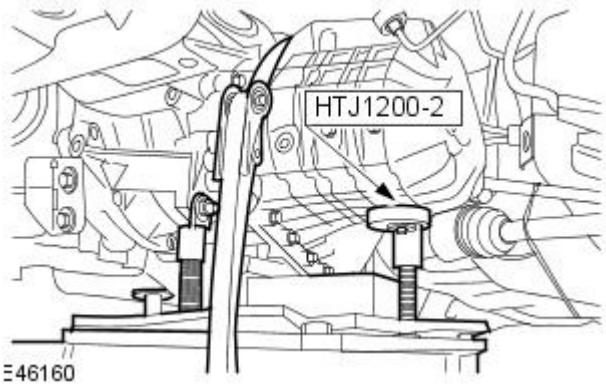


33. Using the engine support bracket lower the powertrain assembly approximately 60 mm (2.36 inches) between the transaxle and transaxle mount bracket.

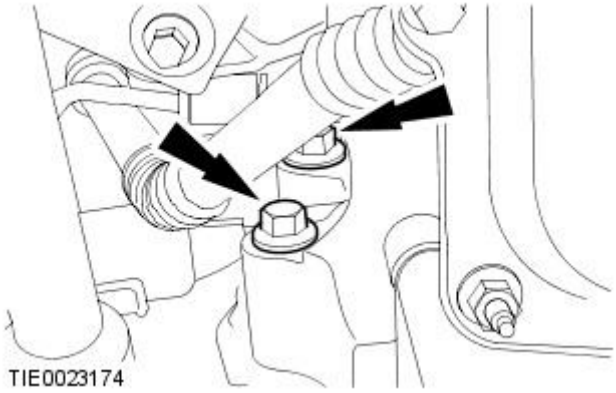
34. Raise the vehicle.

35. Align the powertrain assembly jack to the transaxle.

- Secure the transaxle to the powertrain assembly jack.

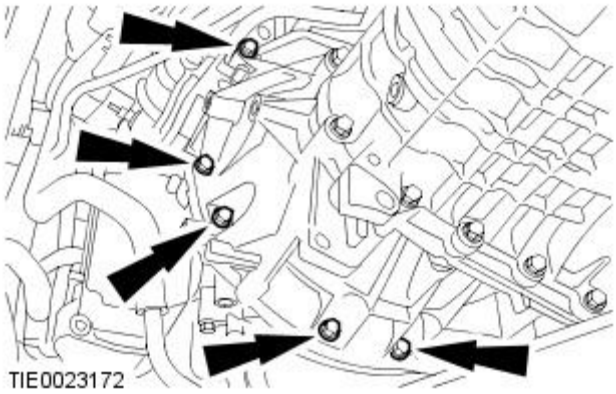


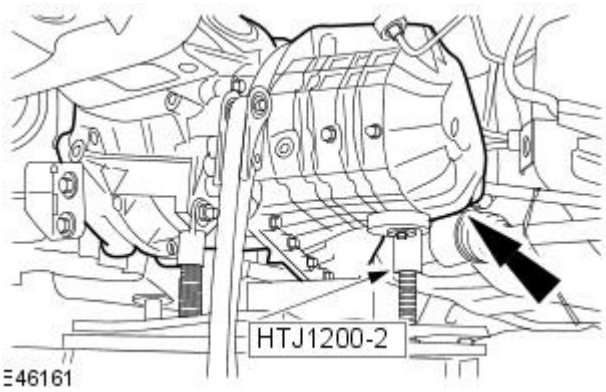
36. Remove the transaxle retaining bolts.



37. NOTE: Shown with the powertrain assembly jack removed for clarity.

Remove the transaxle retaining bolts.





38. Remove the transaxle.

- Detach the transaxle from the clutch plate.
- Lower the powertrain assembly jack and transaxle assembly.

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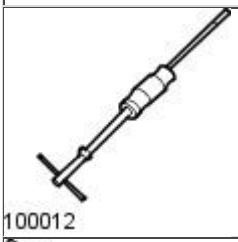
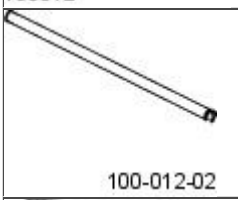
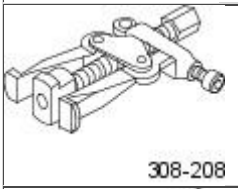
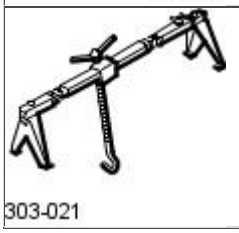
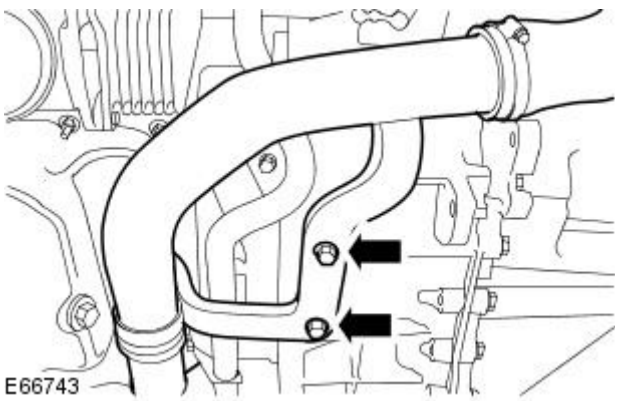
Manual Transmission / Transaxle - Transaxle2.2L Duratorq-TDCi (110kW / 150PS) - Puma

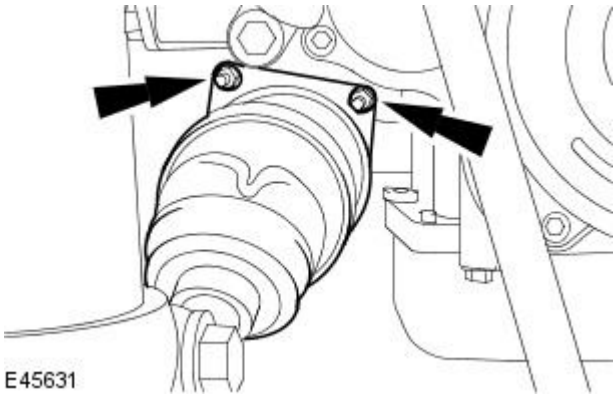
Removal

Special Tool(s)	
 100012	Slide hammer 100-012
 100-012-02	100-012-02 Slide hammer shaft
 204-226	Halfshaft remover fork 204-226
 HTJ12002	Powertrain assembly jack HTJ1200-2
 308-208	Pinion oil seal remover 308-208
 303-021	Engine support bracket 303-021

Removal

1. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
2. Remove the front subframe.
   For additional information, refer to: Front Subframe - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
3. Remove the charge air cooler intake pipe retaining bolts.

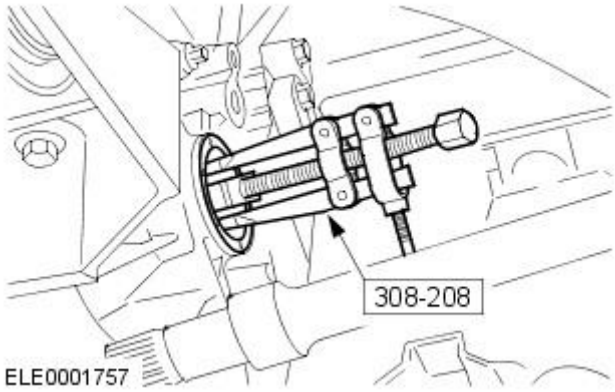




4. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

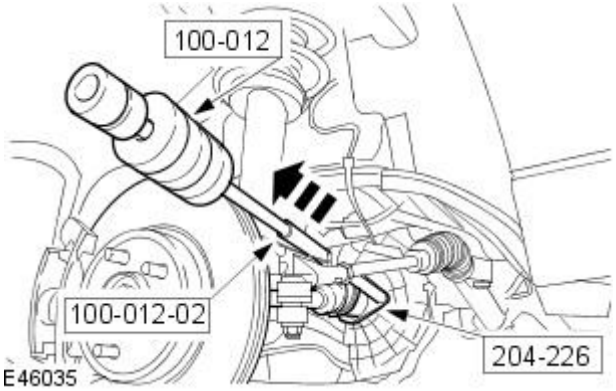
Detach the right-hand halfshaft.

- Disengage the right-hand halfshaft from the transaxle.
- Secure the right-hand halfshaft to one side.

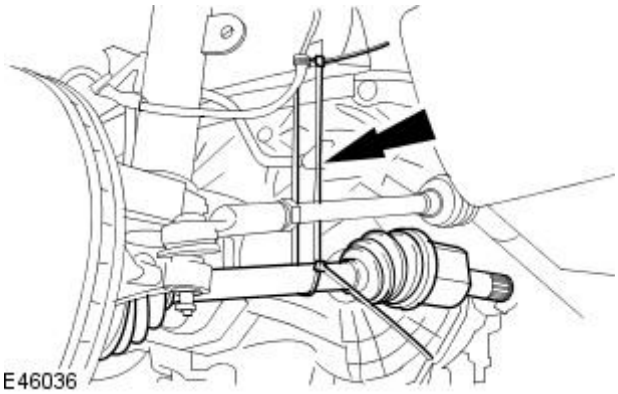


5. NOTE: Plug the transaxle to prevent fluid loss or dirt ingress.

Using the special tool, remove the right-hand halfshaft seal.



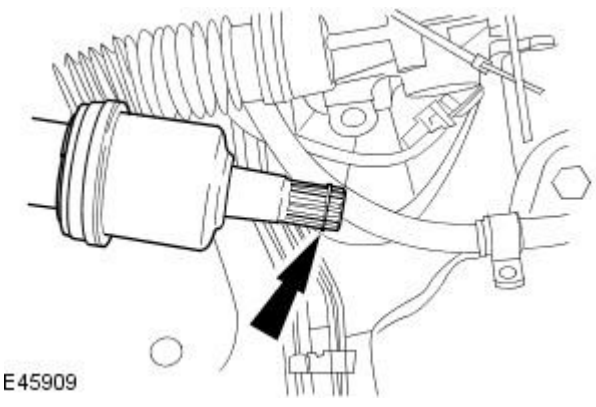
6. Using the special tools, detach the left-hand halfshaft.



7. CAUTION: Make sure the halfshaft CV joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

• NOTE: Secure the right-hand halfshaft using tie strap.

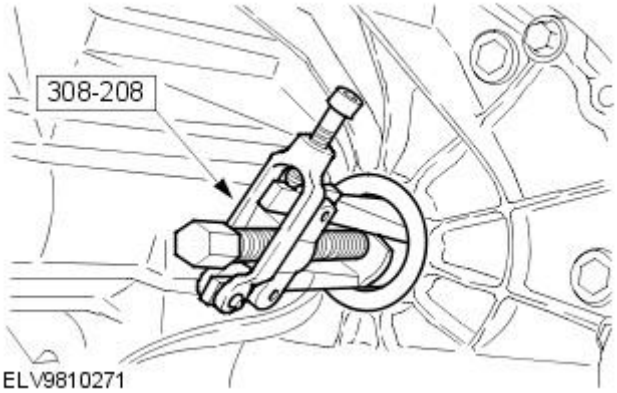
Support the left-hand halfshaft.



8. Remove and discard the left-hand halfshaft snap ring.

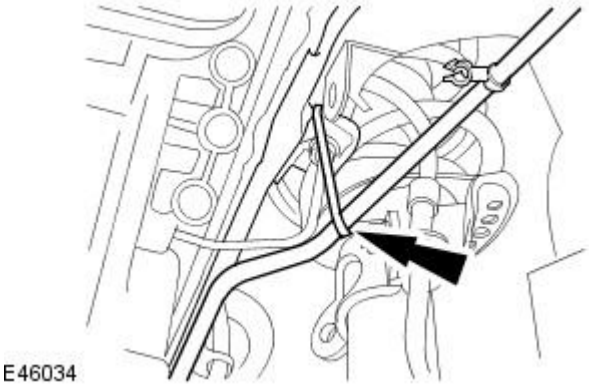
9. NOTE: Plug the transaxle to prevent fluid loss or dirt ingress.

Using the special tool, remove the left-hand halfshaft seal.



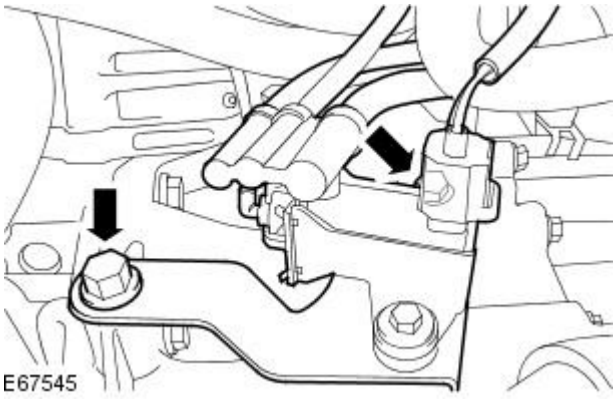
10. NOTE: Secure the power steering fluid pipe using tie straps.

Support the power steering fluid pipe.



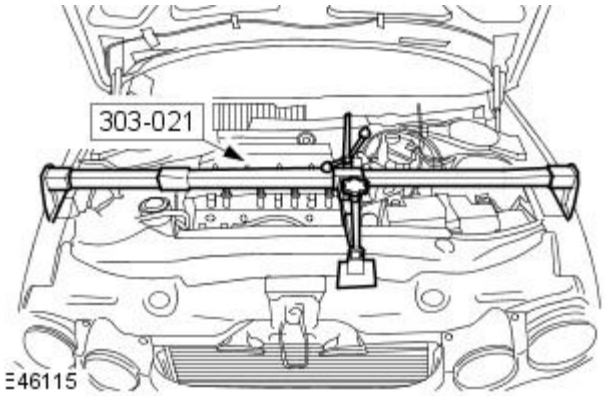
11. Detach the vacuum solenoid valve assembly.

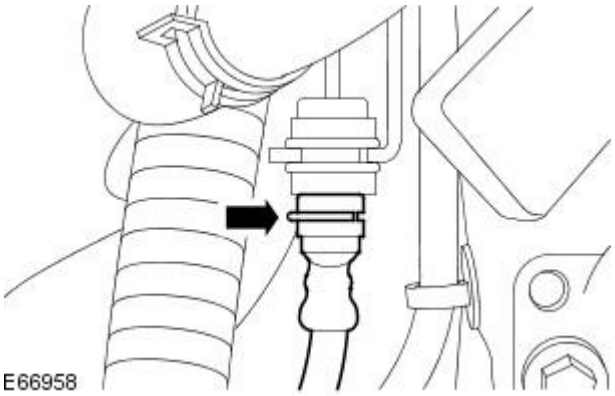
- Remove the retaining bolts.
- Secure the vacuum solenoid valve assembly to one side.



12. Lower the vehicle.

13. Using the special tool, support the engine and transmission assembly.

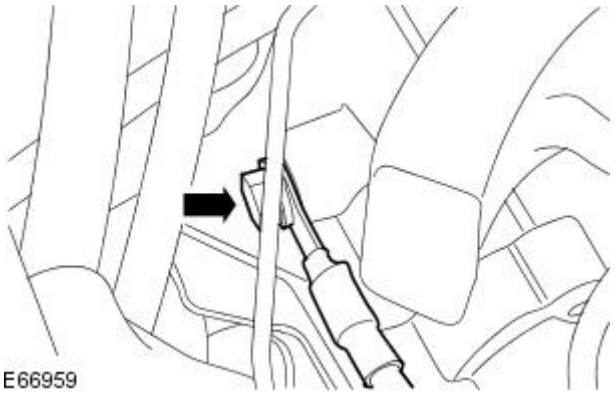




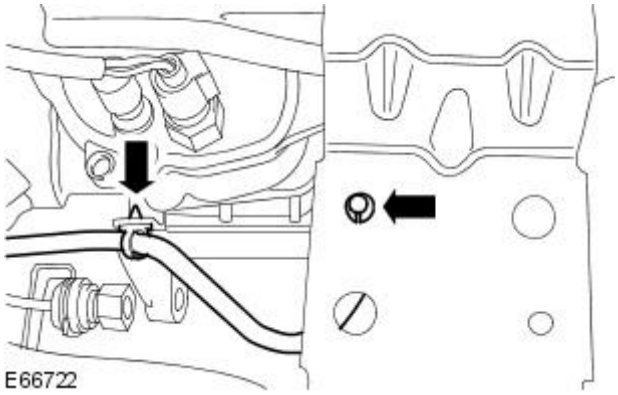
14. CAUTION: If brake fluid is split on the paintwork, the affected area must be washed down immediately with cold water. Failure to follow this instruction may result in damage to the vehicle.

Disconnect the clutch master cylinder to clutch slave cylinder high pressure hose from the clutch slave cylinder high pressure pipe.

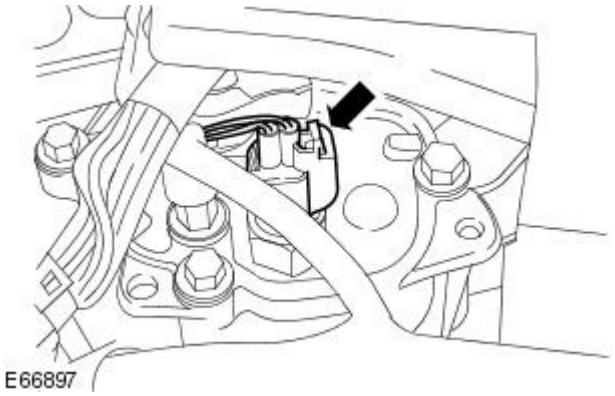
- Install a suitable pipe clamp to the clutch master cylinder to clutch slave cylinder high pressure hose.



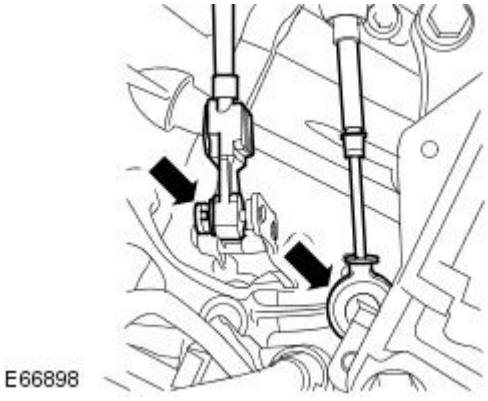
15. Detach the battery ground cable.



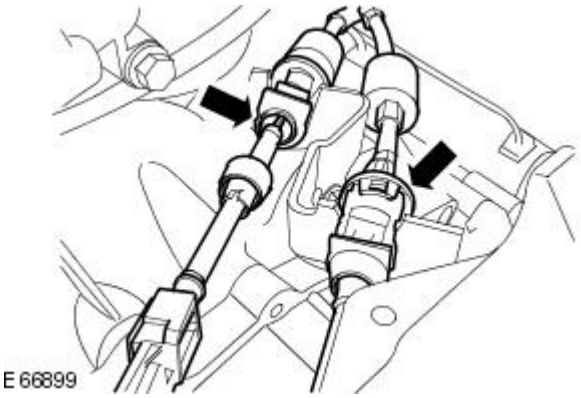
16. Detach the battery ground cable.



17. Disconnect the reverse lamp switch electrical connector.

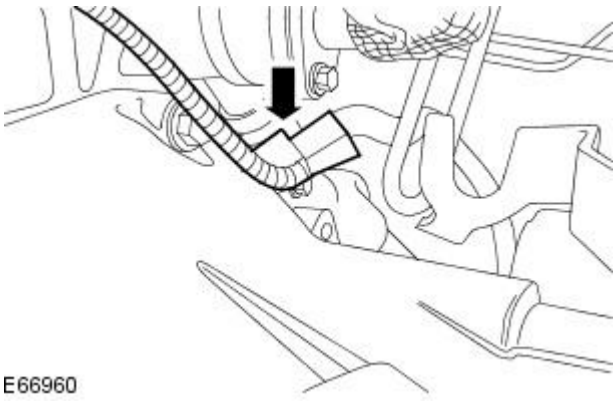


18. Detach the selector cables.

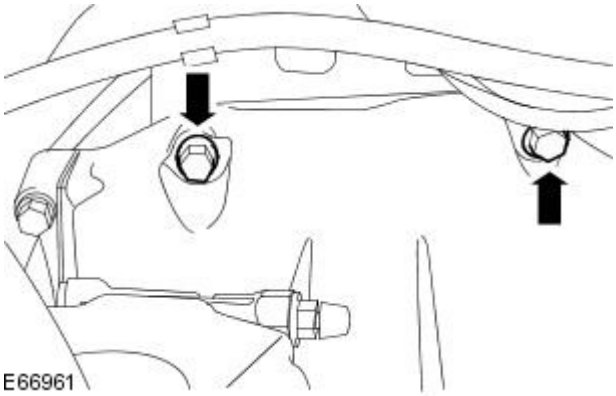


19. NOTE: Secure the selector cables using tie straps.

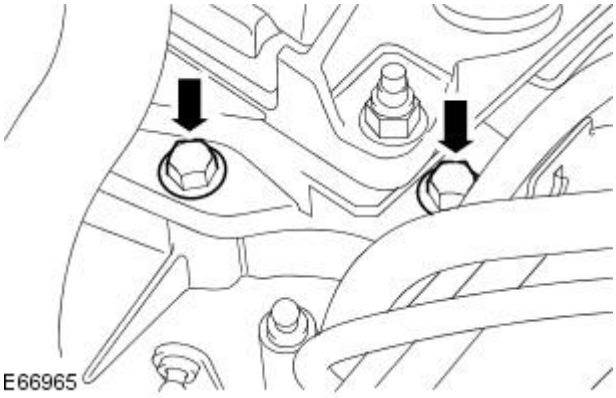
Detach the selector cables.



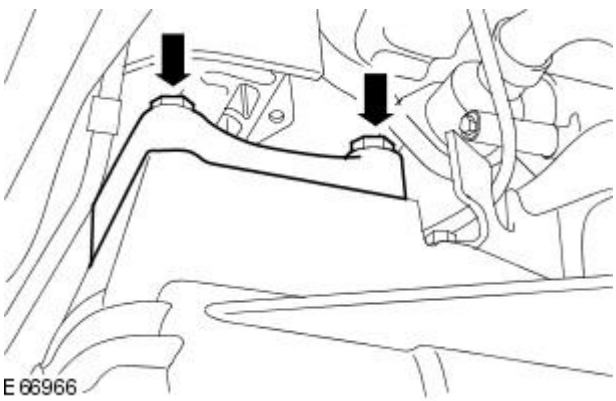
20. Disconnect the crankshaft position (CKP) sensor electrical connector.



21. Remove the transaxle upper retaining bolts.

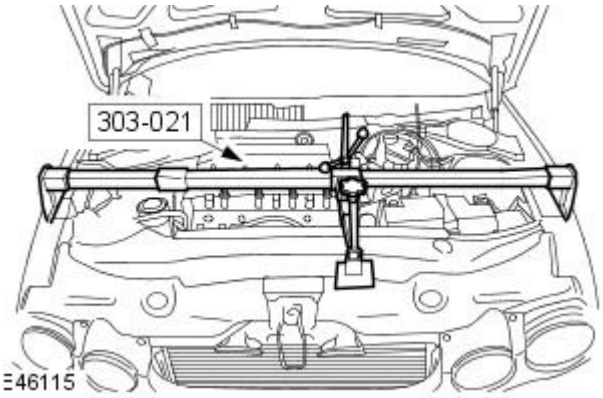


22. Remove the transaxle mount bracket retaining bolts.



23. Detach the transaxle mount.

- Remove the transaxle mount bracket retaining bolts.

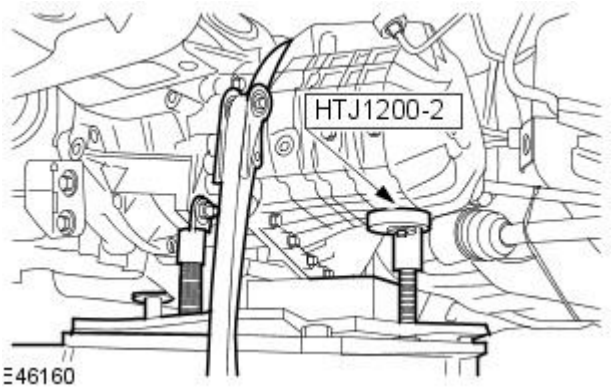


24. Using the special tool, lower the powertrain assembly approximately 60 mm (2.36 inches) between the transaxle and transaxle mount bracket.

25. Raise the vehicle.

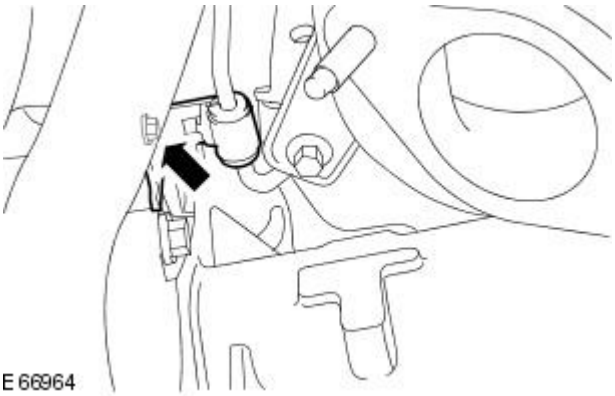
26. Align the special tool to the transaxle.

- Secure the transaxle to the powertrain assembly jack.

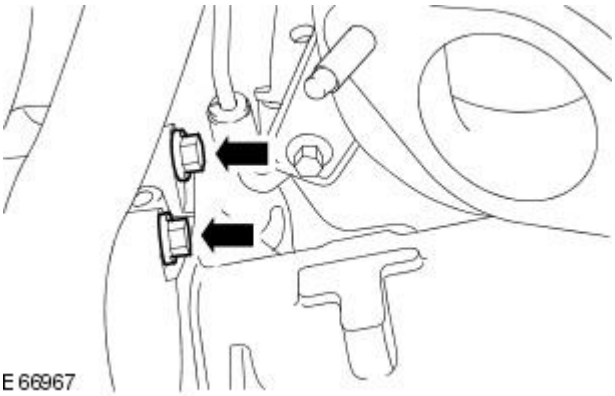


27. Detach the turbocharger oil feed pipe retaining bracket.

- Reposition the retaining bracket.

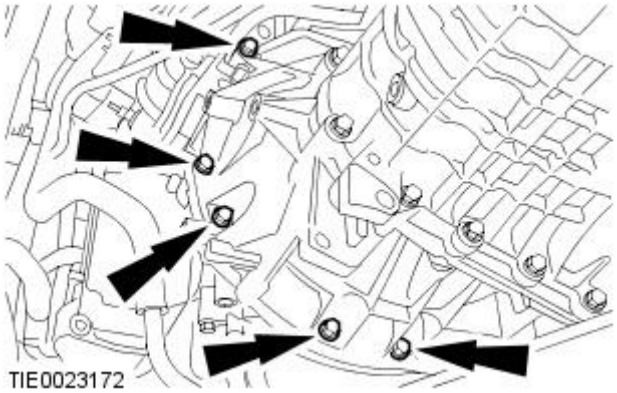


28. Remove the transaxle retaining bolts.



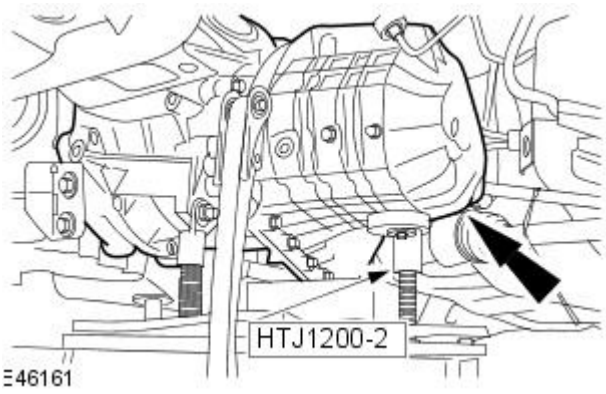
29. NOTE: Shown with the special tool removed for clarity.

Remove the transaxle retaining bolts.



30. Using the special tool, remove the transaxle.

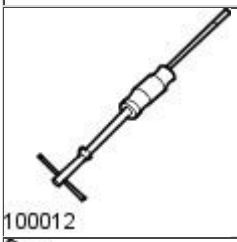
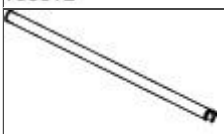
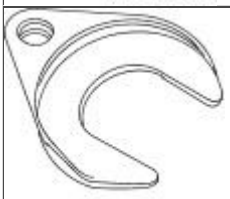
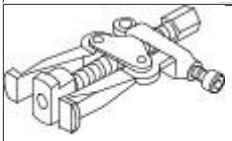
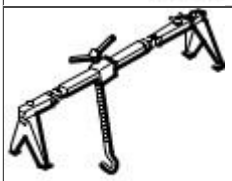
- Detach the transaxle from the clutch plate.
- Lower the powertrain assembly jack and transaxle assembly.



Published: 11-May-2011

Manual Transmission / Transaxle - Transaxle2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Removal

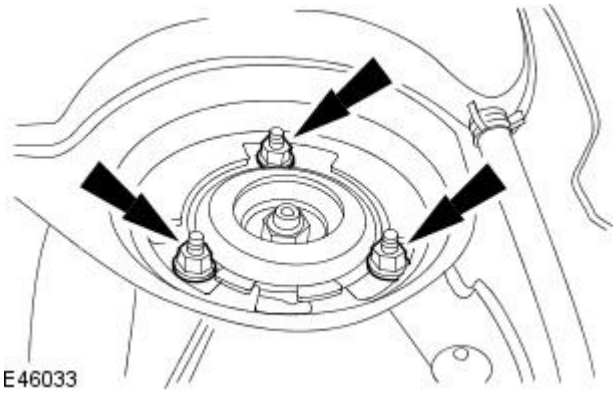
Special Tool(s)	
 100012	Slide hammer 100-012
 100-012-02	100-012-02 Slide hammer shaft
 204-226	Halfshaft remover fork 204-226
 HTJ12002	Powertrain assembly jack HTJ1200-2
 308-208	Pinion oil seal remover 308-208
 303-021	Engine support bracket 303-021
 E46047	Engine support brackets 303-1068

Removal

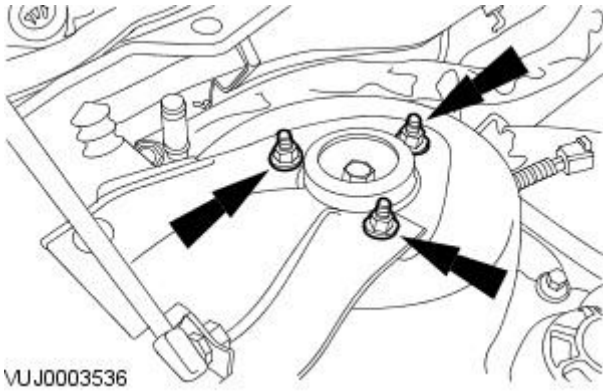
All vehicles

1. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
2. Remove the air cleaner.
   For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

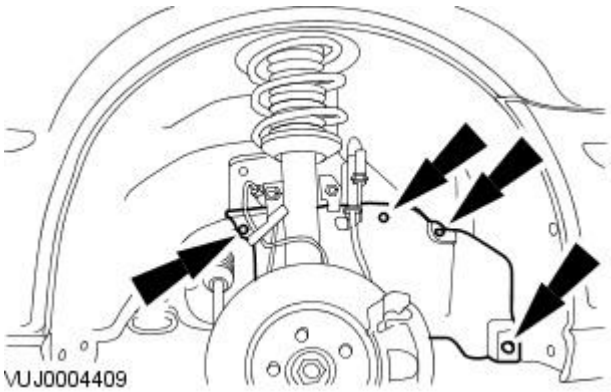
3. Loosen the left-hand shock absorber and spring assembly securing nuts.



4. Loosen the right-hand shock absorber and spring assembly securing nuts.

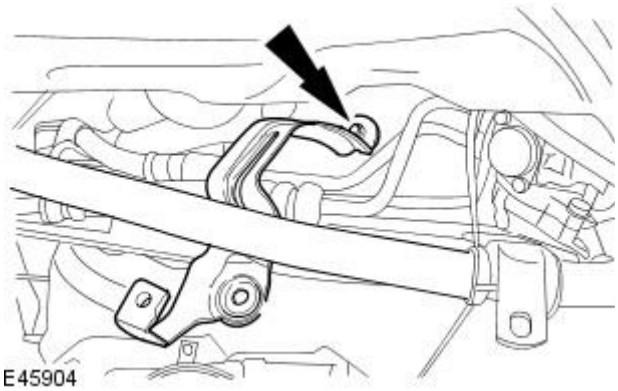


5. Remove the front subframe.
   For additional information, refer to: Front Subframe - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
6. Remove the fender splash shield access panel.

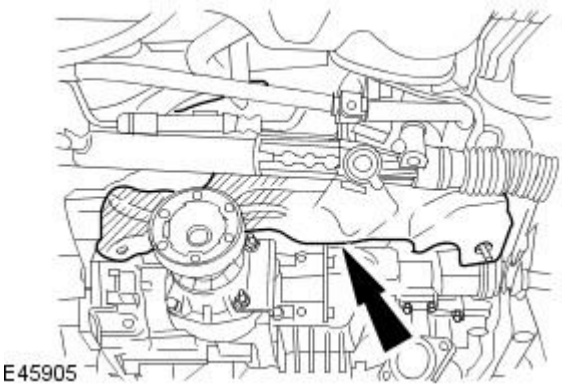


Vehicles with 2.5L or 3.0L engine

7. Remove the steering gear heat shield bracket.

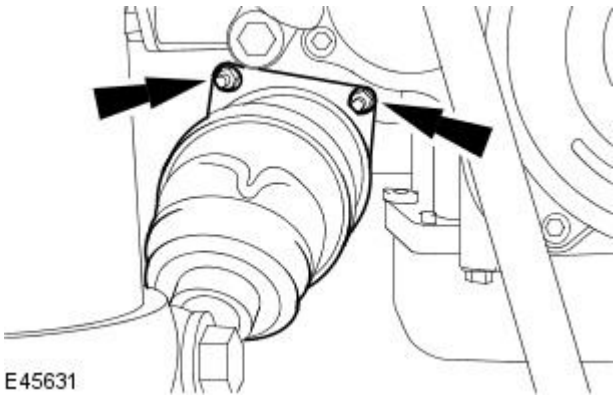


8. Remove the steering gear heat shield.



9. Remove the transfer case.
For additional information, refer to: Transfer Case (308-07 Transfer Case, Removal).

Vehicles with 2.0L engine



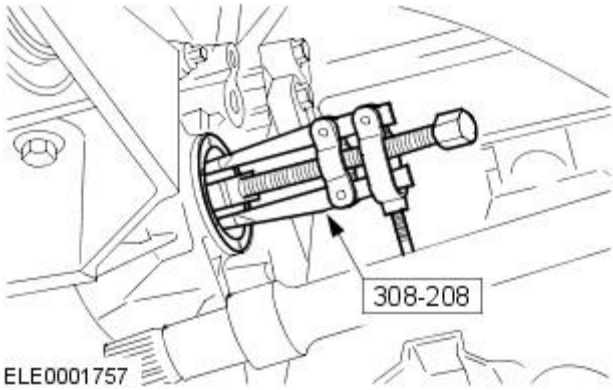
10. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

Detach the right-hand halfshaft.

- Disengage the right-hand halfshaft from the transaxle.
- Secure the right-hand halfshaft to one side.

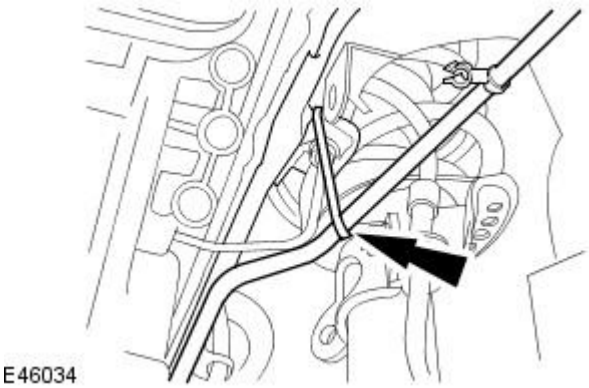
11. NOTE: Plug the transaxle to prevent fluid loss or dirt ingress.

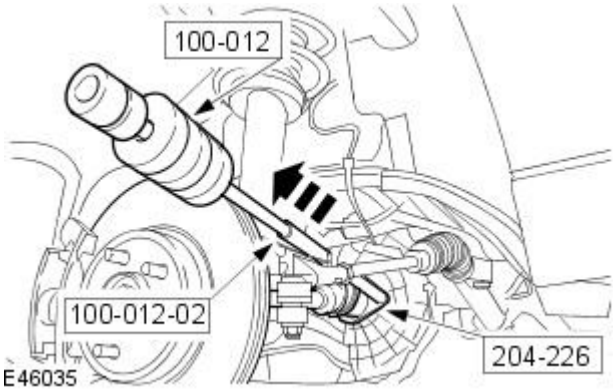
Using the special tool, remove the halfshaft seal.



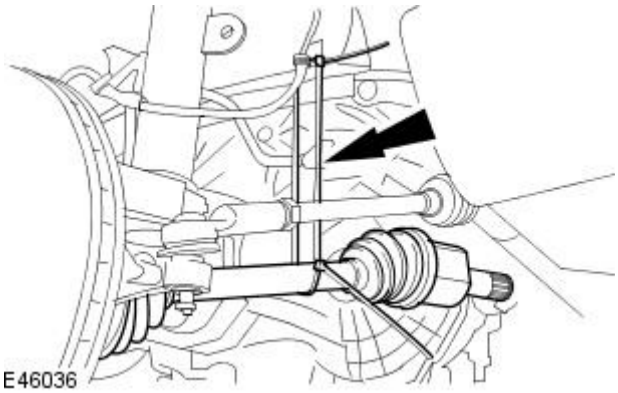
All vehicles

12. Support the power steering fluid pipe.



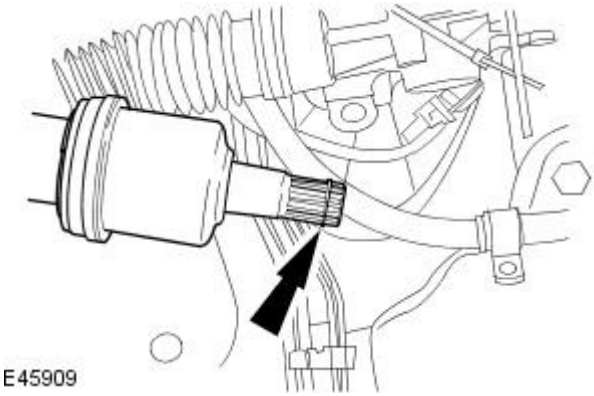


13. Using the special tools, detach the left-hand halfshaft.

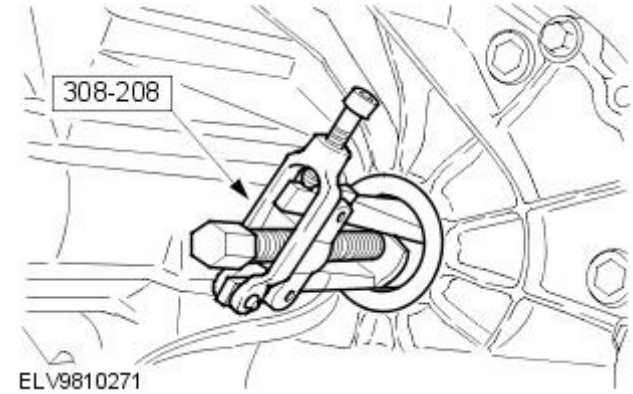


14. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

Support the halfshaft.

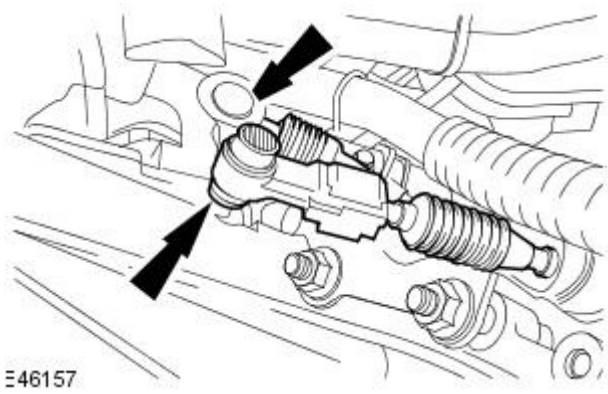


15. Remove and discard the halfshaft snap ring.



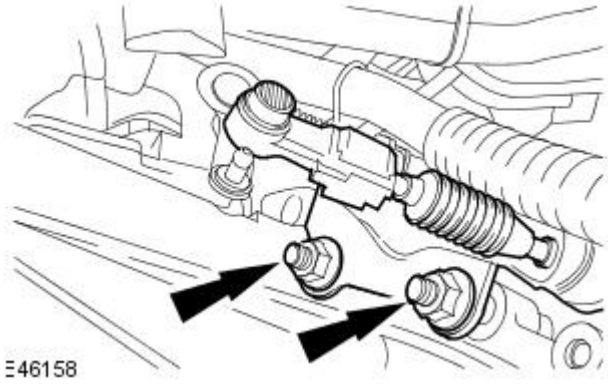
16. NOTE: Plug the transaxle to prevent fluid loss or dirt ingress.

Using the special tool, remove the halfshaft seal.

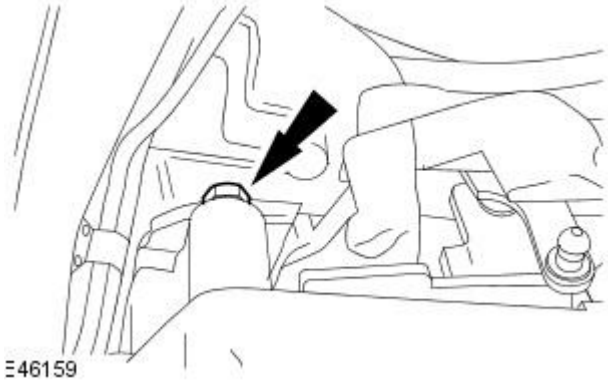


17. Detach the gearshift cables from the transaxle.

18. Detach the gearshift cable support bracket from the transaxle.

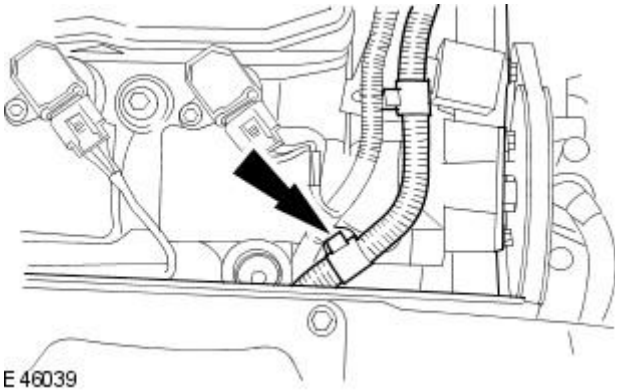


19. Remove the transaxle mount bracket retaining bolt.

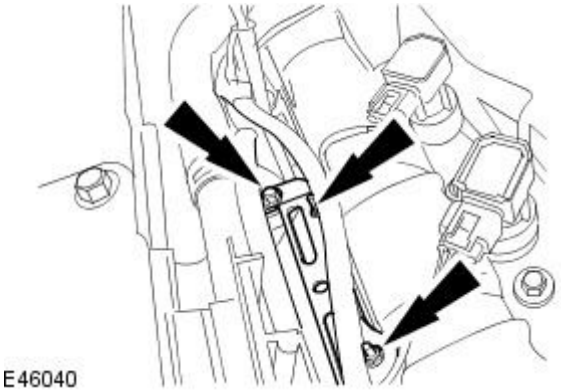


20. Lower the vehicle.

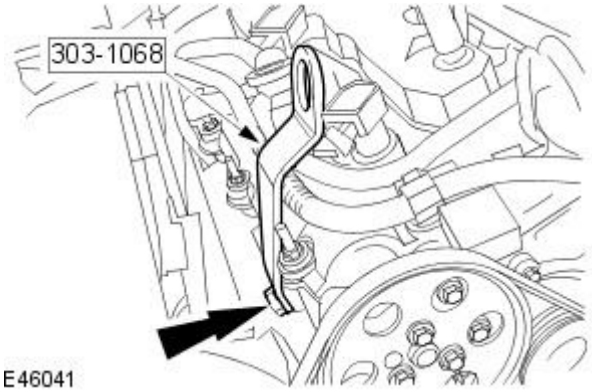
21. Detach the generator wiring harness retaining clip from the camshaft cover retaining clip.

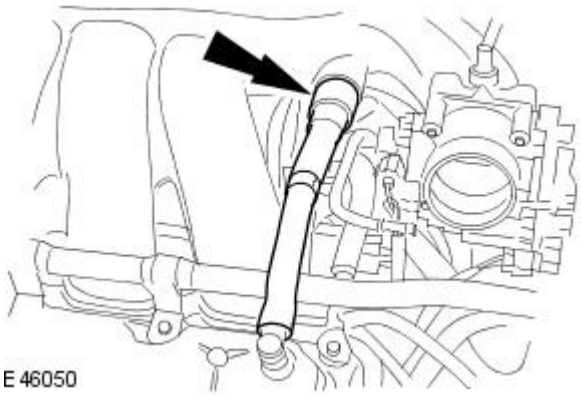


22. Remove the air cleaner mount bracket.

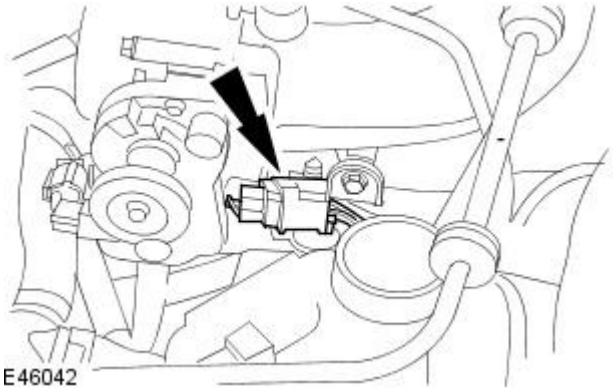


23. Install the engine support bracket.

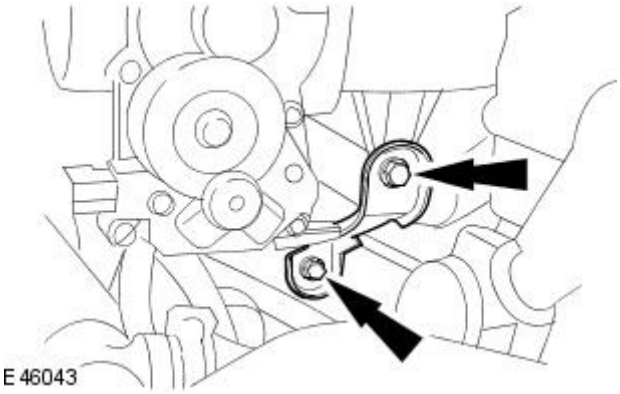




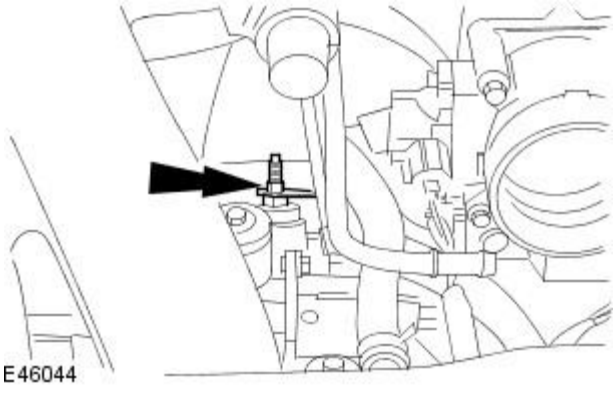
24. Detach the positive crankcase ventilation (PCV) hose from the intake manifold.



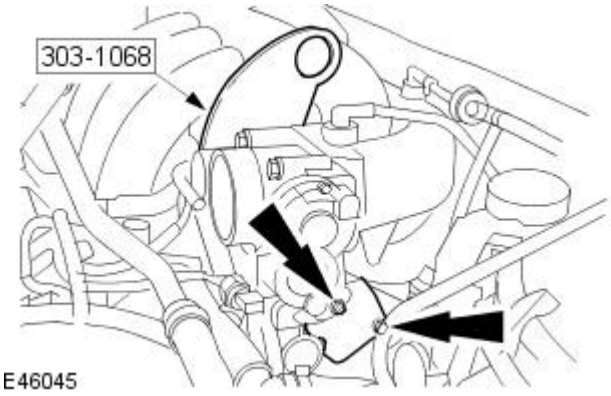
25. Detach the electrical connector from the intake manifold support bracket.



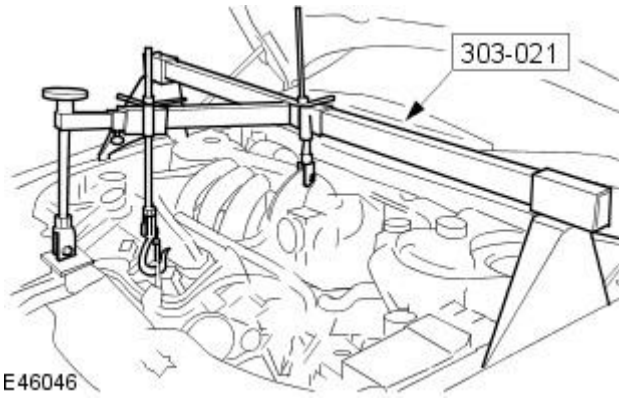
26. Remove the intake manifold support bracket.



27. Detach the wiring harness from the camshaft cover retaining stud.

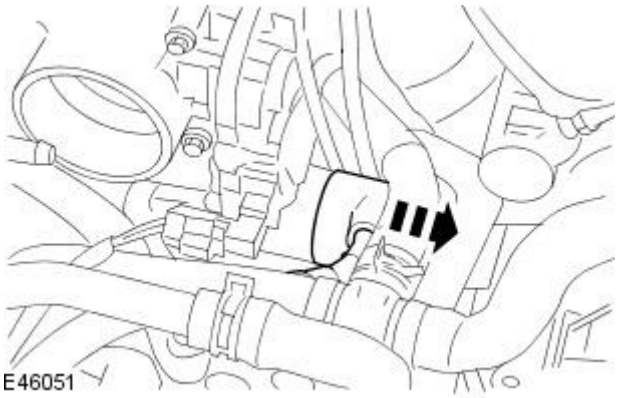


28. Install the engine support bracket.

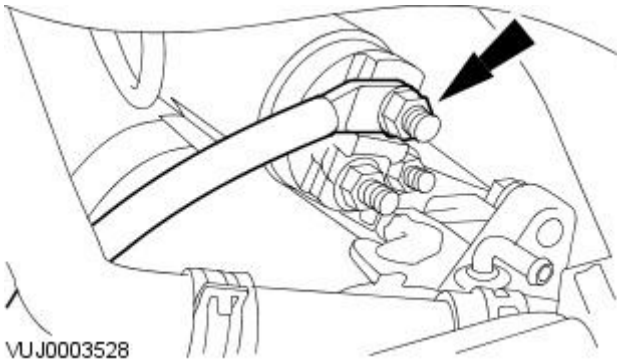


29. Install the engine support bracket.

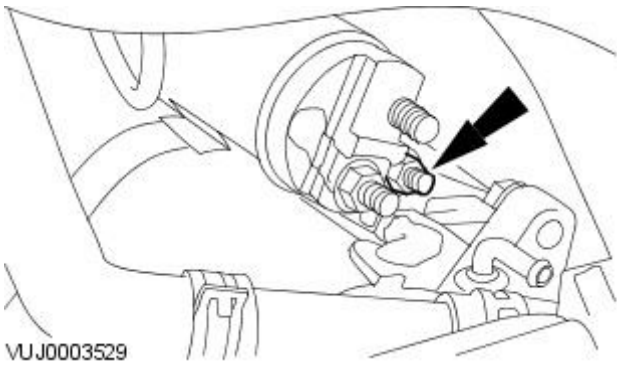
- Adjust the engine support bracket to support the weight of the powertrain assembly.



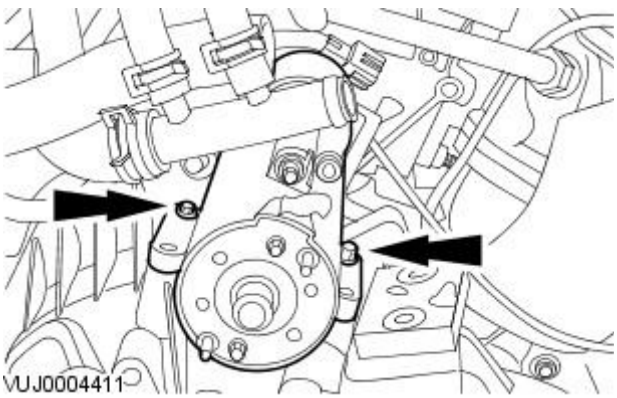
30. Detach the starter motor solenoid cover.



31. Detach the starter motor electrical connector.

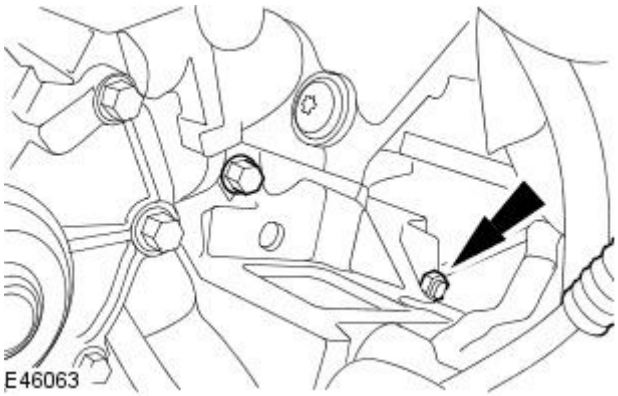


32. Detach the starter motor solenoid electrical connector.

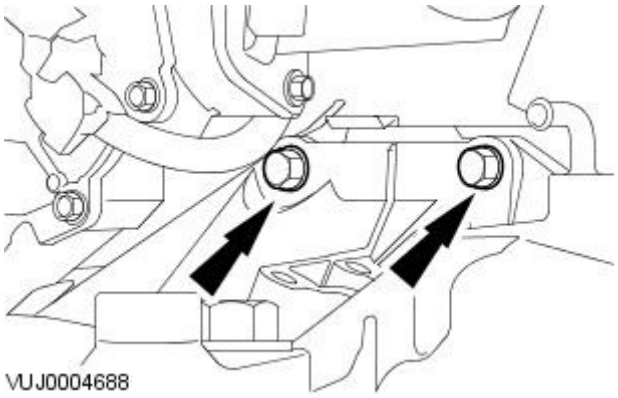


33. Remove the starter motor.

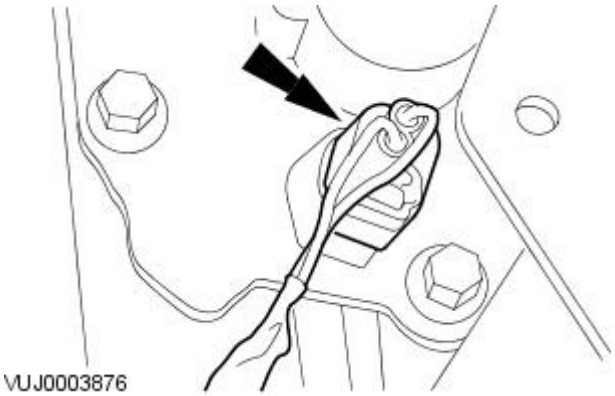
34. Remove the transaxle retaining bolt.



35. Remove the transaxle retaining bolts.



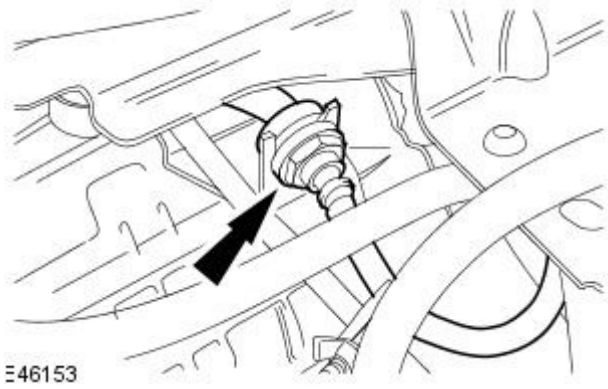
36. Disconnect the reverse lamp switch electrical connector.



37. CAUTION: If brake fluid is split on the paintwork, the affected area must be washed down immediately with cold water. Failure to follow this instruction may result in damage to the vehicle.

Detach the clutch master cylinder to clutch slave cylinder high pressure pipe from the support bracket.

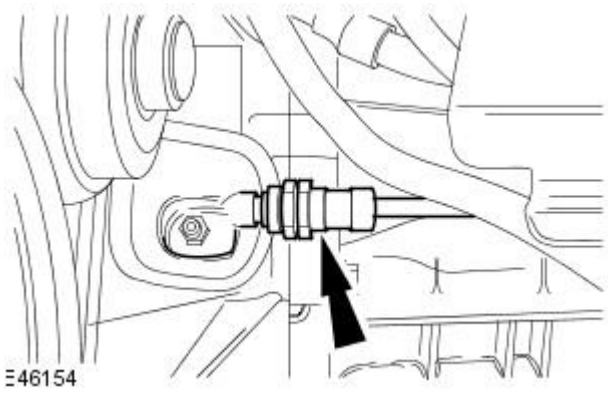
- Install a suitable pipe clamp to the clutch master cylinder to clutch slave cylinder high pressure pipe

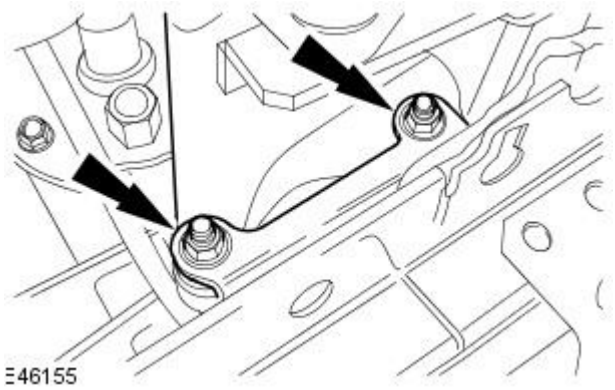


38. CAUTION: If brake fluid is split on the paintwork, the affected area must be washed down immediately with cold water. Failure to follow this instruction may result in damage to the vehicle.

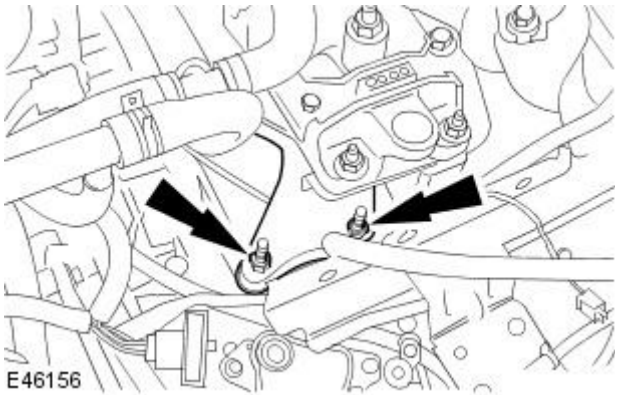
Detach the clutch master cylinder to clutch slave cylinder high pressure pipe from the clutch slave cylinder.

- Remove the clutch master cylinder to clutch slave cylinder high pressure pipe retaining clip.

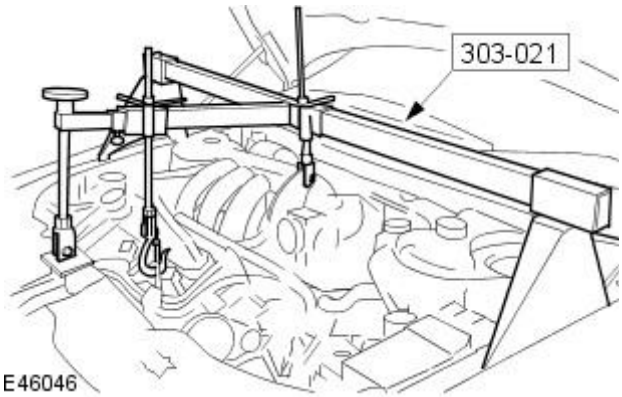




39. Remove the clutch master cylinder to clutch slave cylinder high pressure pipe support.



40. Remove the transaxle mount bracket securing studs.

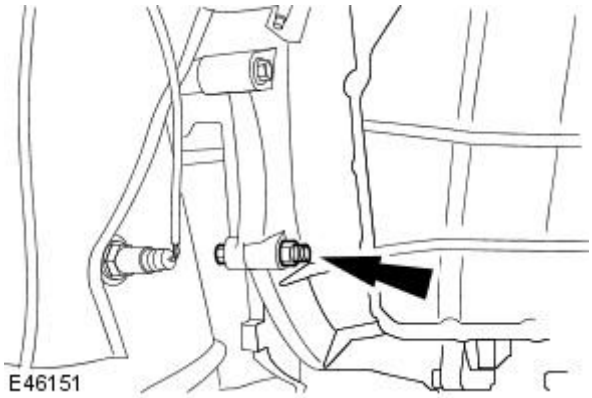


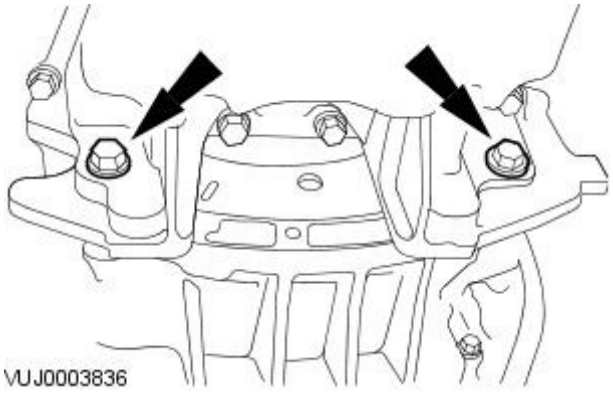
41. Using the engine support bracket lower the powertrain assembly approximately 60 mm between the transaxle and transaxle mount bracket.

42. Raise the vehicle.

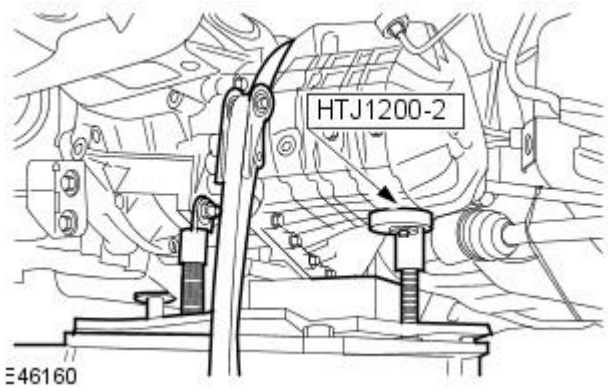
43. NOTE: The transaxle retaining bolt remains captive to the cylinder block flange.

Remove the transaxle retaining nut.



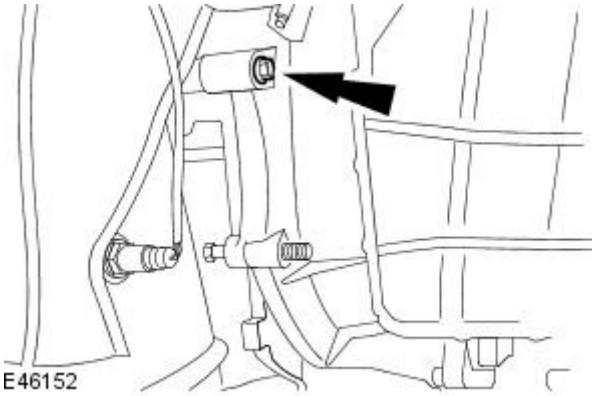


44. Remove the transaxle retaining bolts.

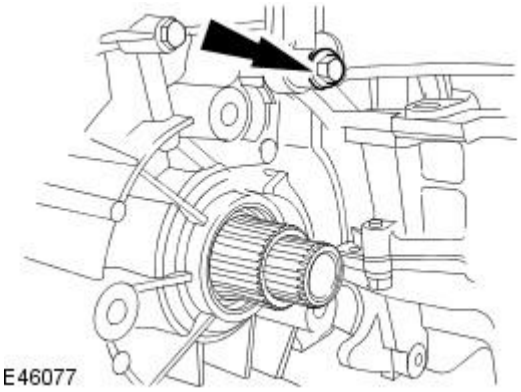


45. Align the powertrain assembly jack to the transaxle.

- Secure the transaxle to the powertrain assembly jack.

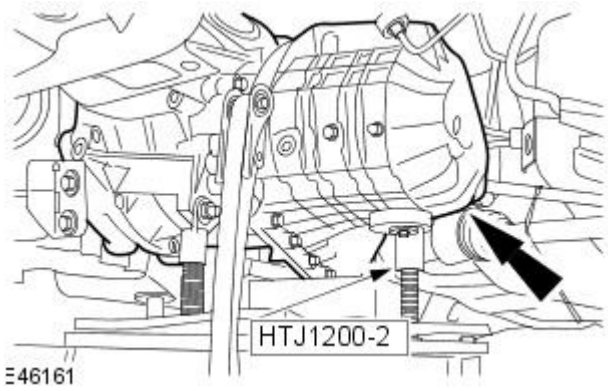


46. Remove the transaxle retaining bolt.



47. NOTE: Vehicles with 2.5L and 3.0L engines shown, vehicles with 2.0L engine similar.

Remove the transaxle retaining bolt.

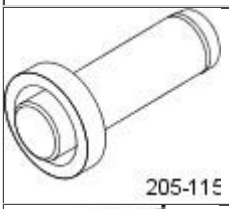
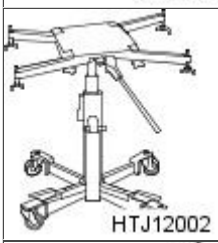
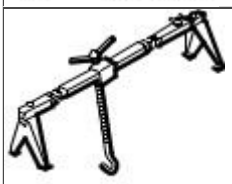
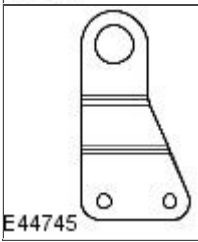


48. Remove the transaxle.

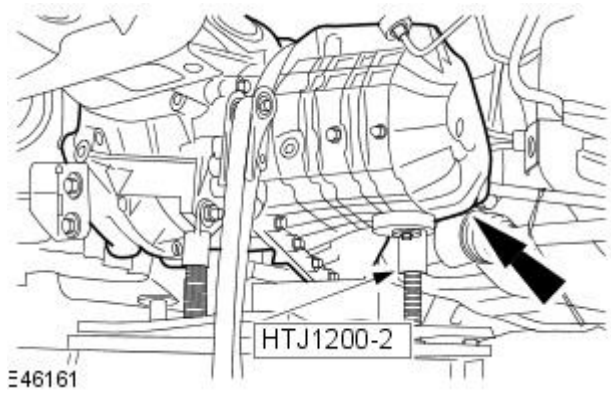
- Detach the transaxle from the clutch plate.
- Lower the powertrain assembly jack and transaxle assembly.

Manual Transmission / Transaxle - Transaxle2.0L Duratorq-TDCi

Installation

Special Tool(s)	
 205-115	Halfshaft oil seal installer 205-115
 HTJ12002	Powertrain assembly jack HTJ1200-2
 303-021	Engine support bracket 303-021
 E44745	Engine lifting eye 303-1067

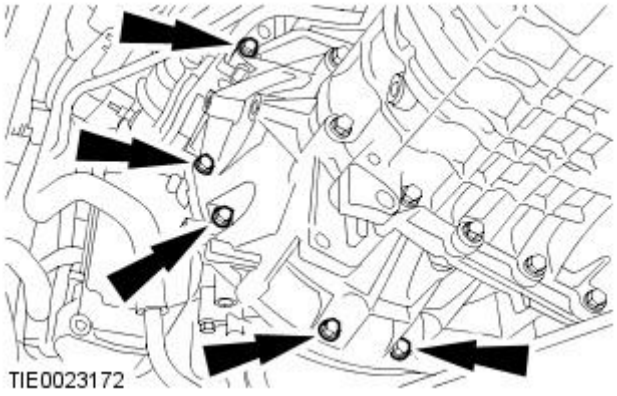
Installation



E46161

1. Install the transaxle.

- Raise the powertrain assembly jack and transaxle assembly.
- Align the transaxle to the clutch plate.


TIE0023172

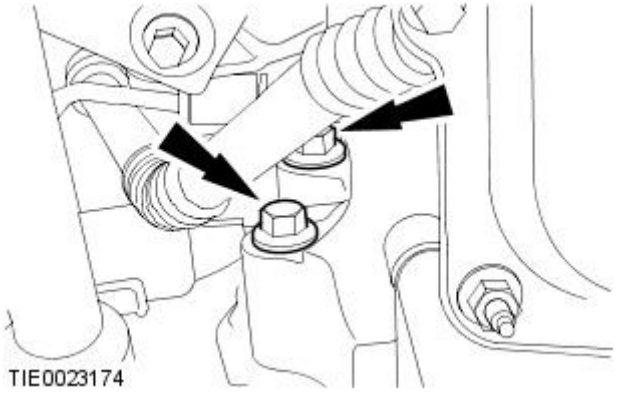
2. NOTE: Shown with the powertrain assembly jack removed for clarity.

Install the transaxle retaining bolts.

- Tighten to 48 Nm.

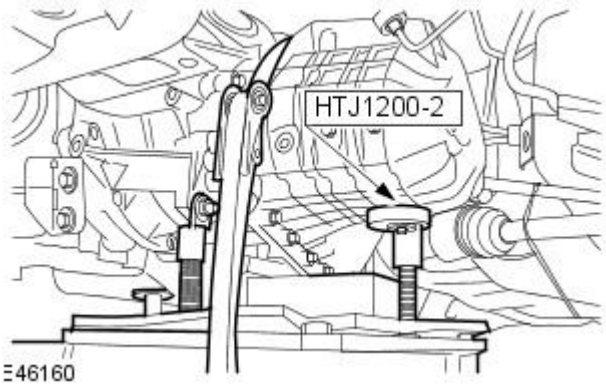
3. Install the transaxle retaining bolts.

- Tighten to 48 Nm.



4. Remove the powertrain assembly jack.

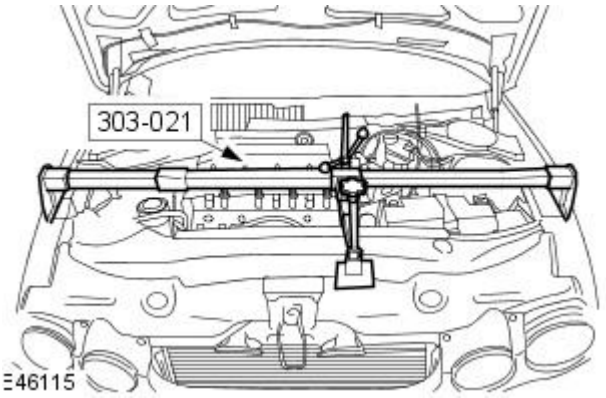
- Remove the transaxle to the powertrain assembly jack securing strap.



5. Lower the vehicle.

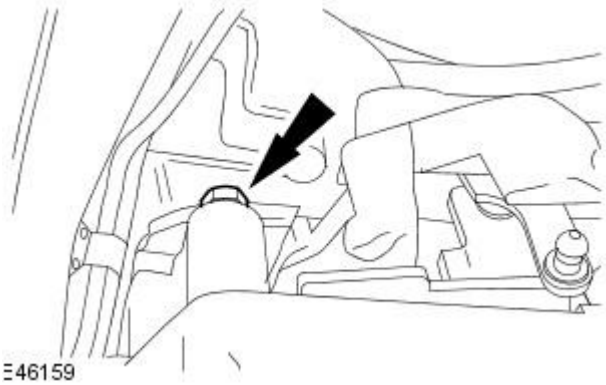
6. Using the engine support bracket raise the powertrain assembly.

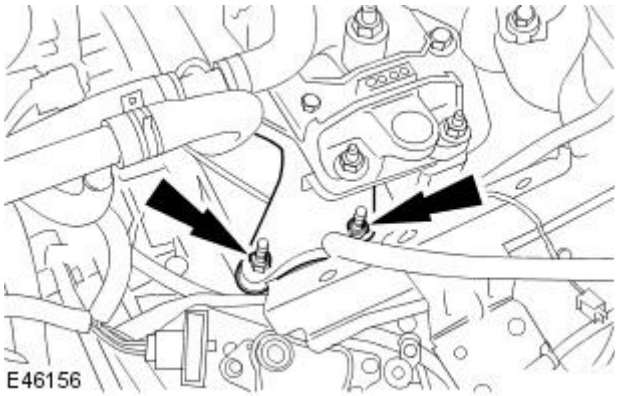
- Adjust the engine support bracket to align the transaxle to the transaxle mount bracket.



7. NOTE: Shown from under the vehicle for clarity.

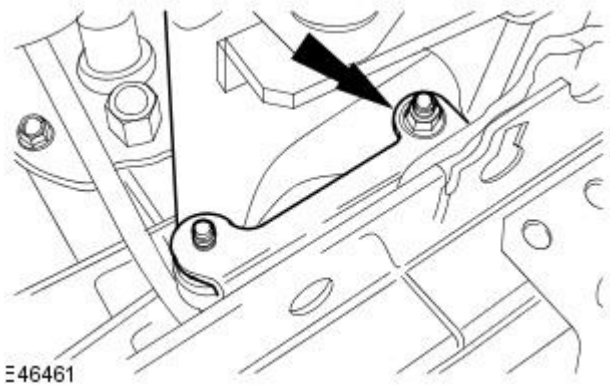
Loosely install the transaxle mount bracket retaining bolt.



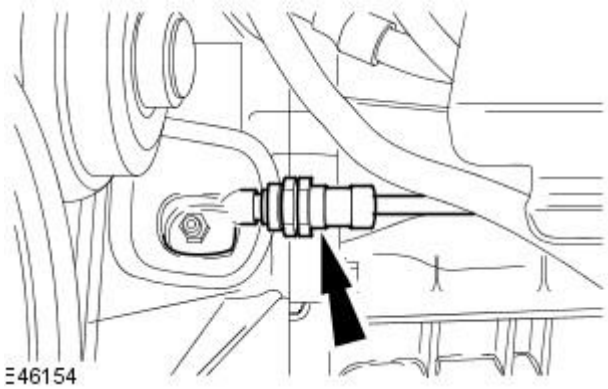


8. Install the transaxle mount bracket retaining studs.

- Tighten to 80 Nm.



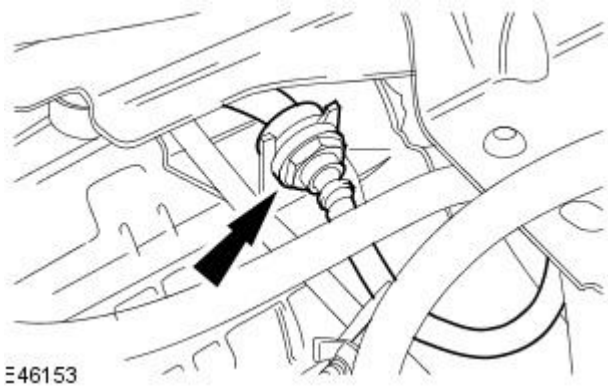
9. Install the clutch master cylinder to clutch slave cylinder high pressure pipe support bracket.



10. CAUTION: If brake fluid is split on the paintwork, the affected area must be washed down immediately with cold water. Failure to follow this instruction may result in damage to the vehicle.

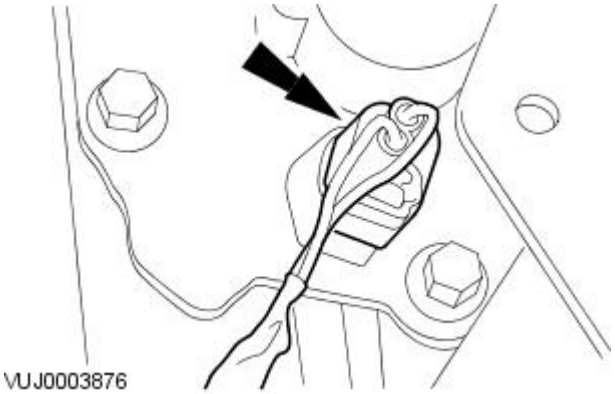
Attach the clutch master cylinder to clutch slave cylinder high pressure pipe to the clutch slave cylinder.

- Install the clutch master cylinder to clutch slave cylinder high pressure pipe retaining clip.

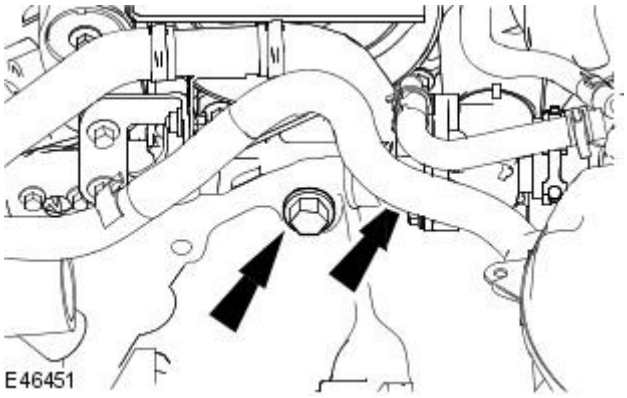


11. Attach the clutch master cylinder to clutch slave cylinder high pressure pipe to the support bracket.

- Remove the pipe clamp from the clutch master cylinder to clutch slave cylinder high pressure pipe.

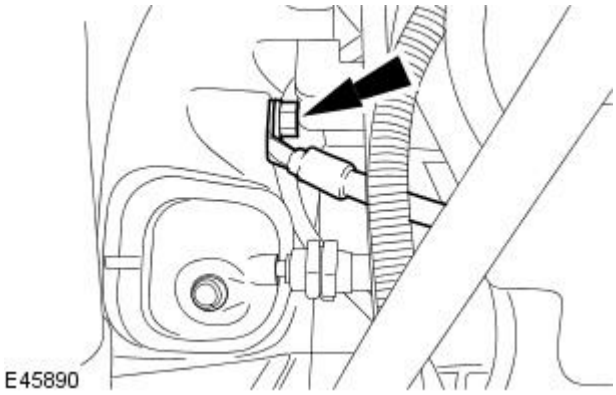


12. Connect the reverse lamp switch electrical connector.

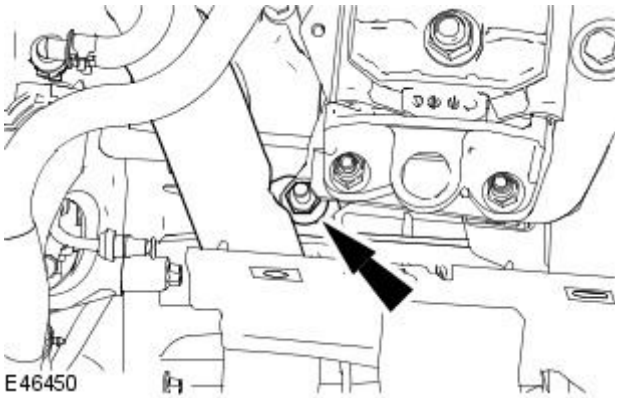


13. Install the transaxle upper retaining bolts.

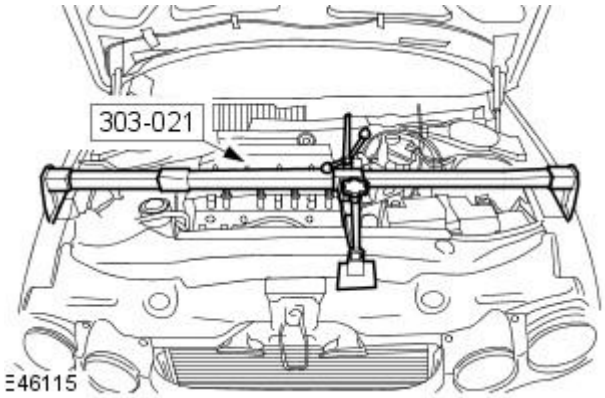
- Tighten to 48 Nm.



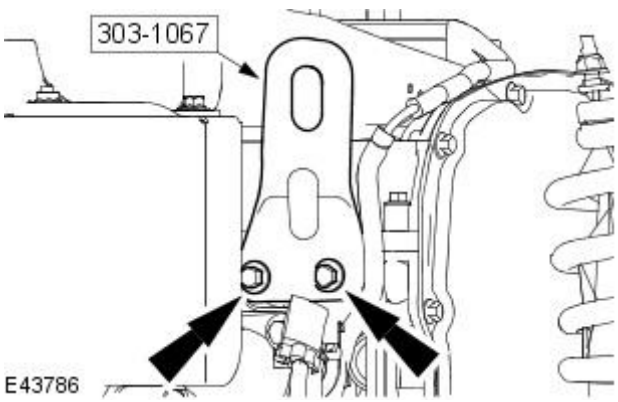
14. Attach the transaxle ground cable.



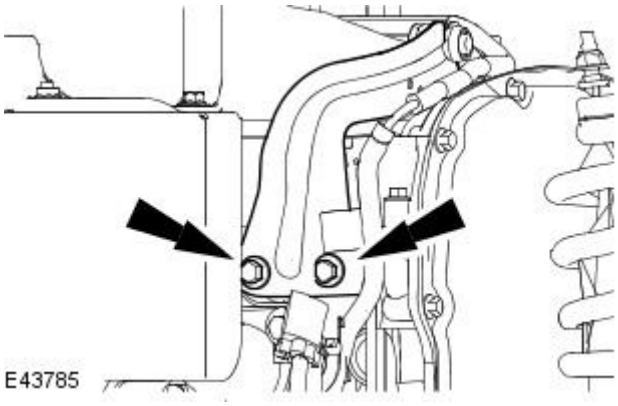
15. Attach the charge air cooler pipe retaining nut.



16. Remove the engine support bracket.

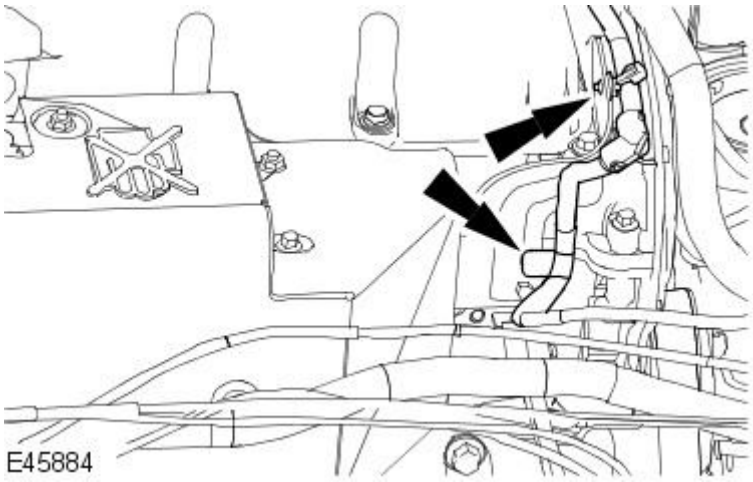


17. Remove the special tool.



18. Install the engine cover rear mount bracket.

- Tighten to 23 Nm.

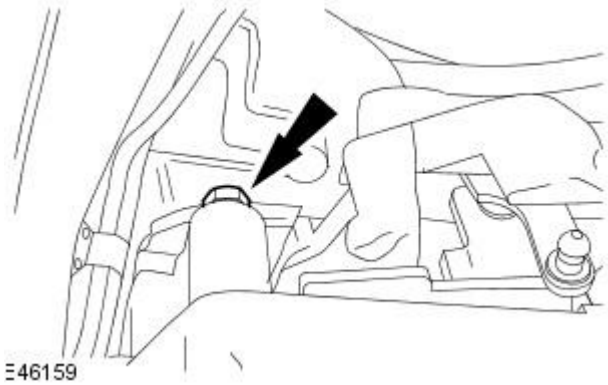


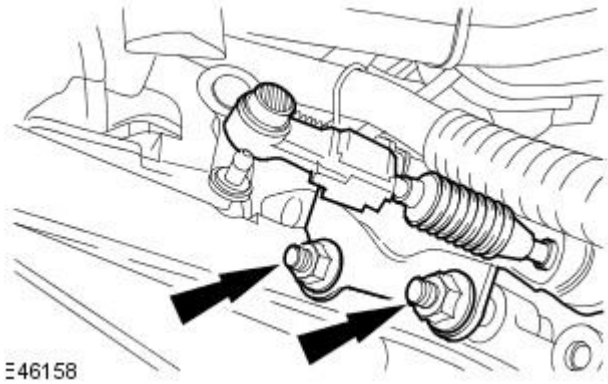
19. Attach the generator and starter motor positive cable from the engine cover mounting bracket.

20. Raise the vehicle.

21. Tighten the transaxle mount bracket retaining bolt.

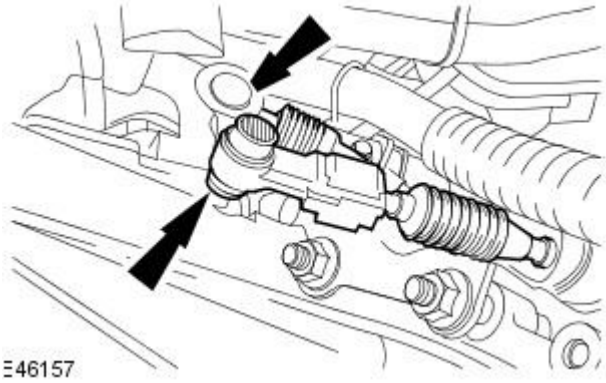
- Tighten to 80 Nm.



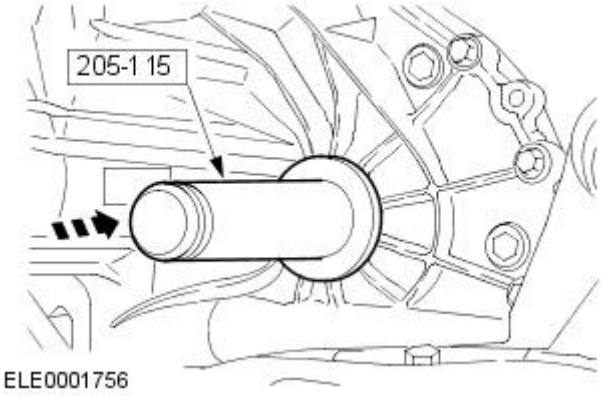


22. Attach the gearshift cable support bracket to the transaxle.

- Tighten to 25 Nm.

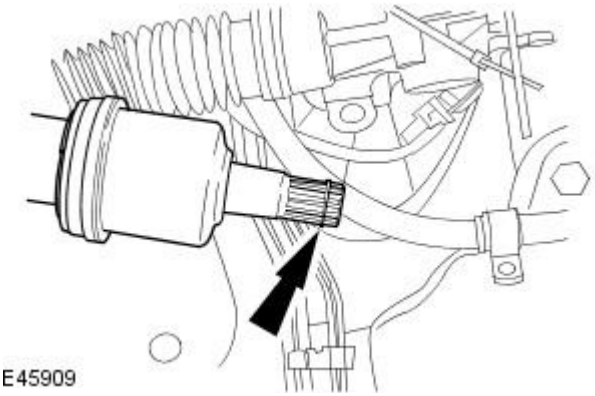


23. Attach the gearshift cables to the transaxle.

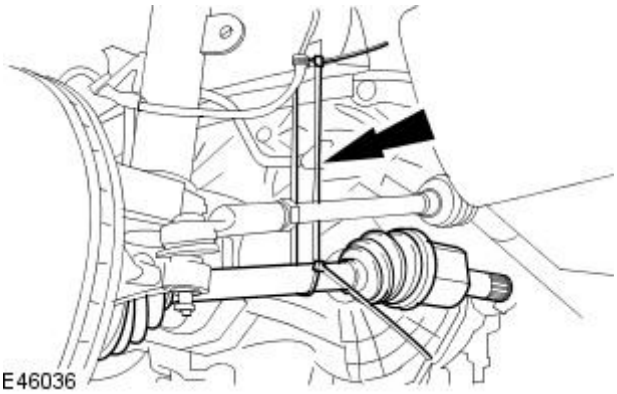


24. NOTE: Remove the transaxle plug.

Using the special tool, install a new right-hand halfshaft seal.

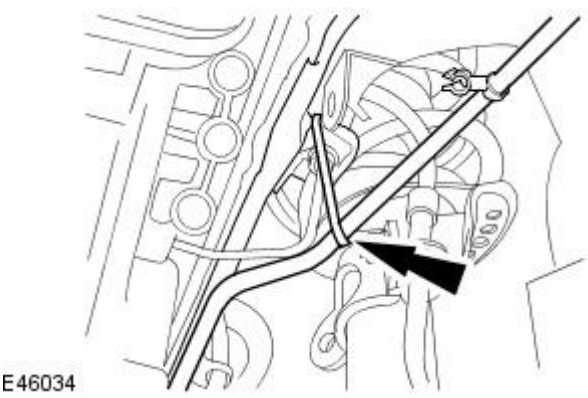


25. Install a new right-hand halfshaft snap ring.



26. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

Detach the right-hand halfshaft.



27. Detach the power steering fluid pipe.

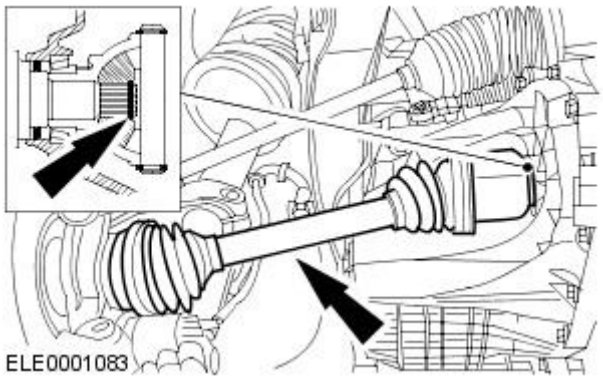
28. CAUTIONS:

⚠ Make sure the halfshaft CV joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

⚠ Make sure the halfshaft seal is not damaged. Failure to follow this instruction may result in an transaxle fluid leak.

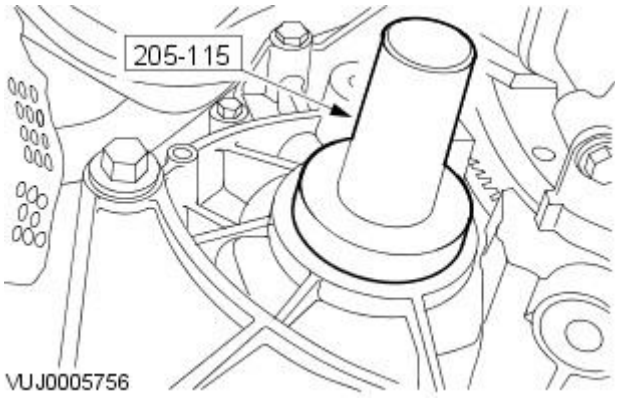
Attach the right-hand halfshaft to the transaxle.

- Make sure the halfshaft snap ring is correctly seated.



29. NOTE: Remove the transaxle plug.

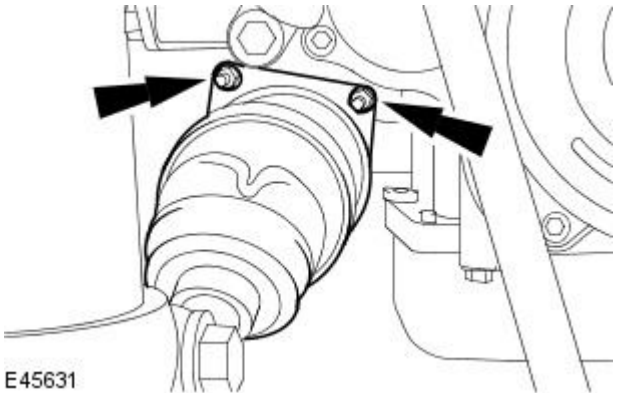
Using the special tool, install a new left-hand halfshaft seal.



30. ⚠ CAUTION: Make sure the halfshaft CV joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

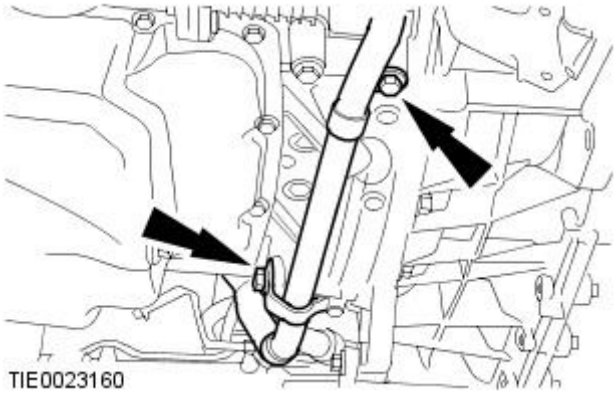
Attach the left-hand halfshaft.

- Engage the left-hand halfshaft to the transaxle.
- Tighten to 25 Nm.



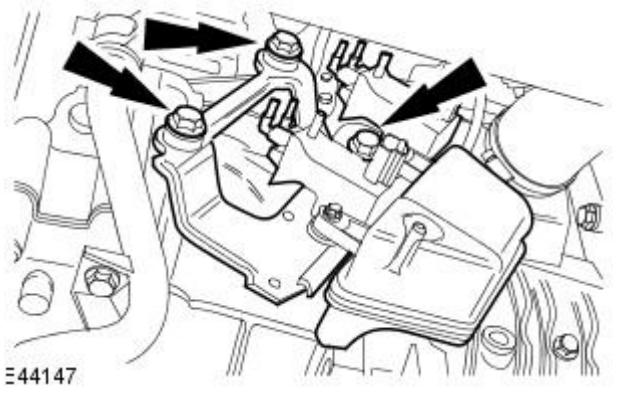
31. Attach the coolant pipe to the engine.

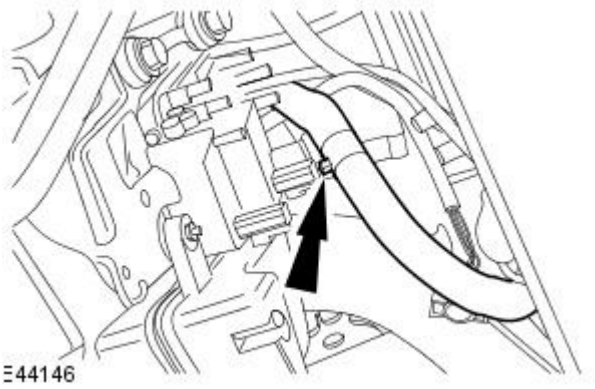
- Tighten to 40 Nm.



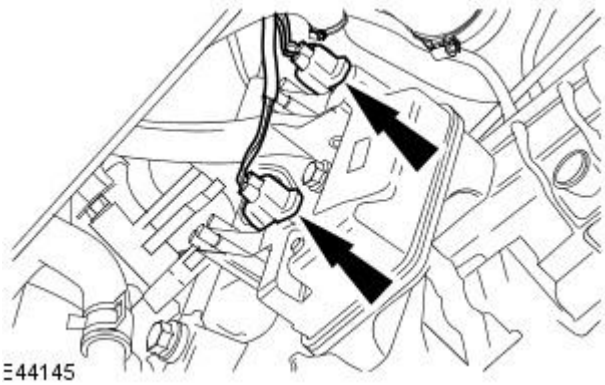
32. Install the vacuum solenoids and vacuum reservoir mount bracket assembly.

- Tighten to 23 Nm.

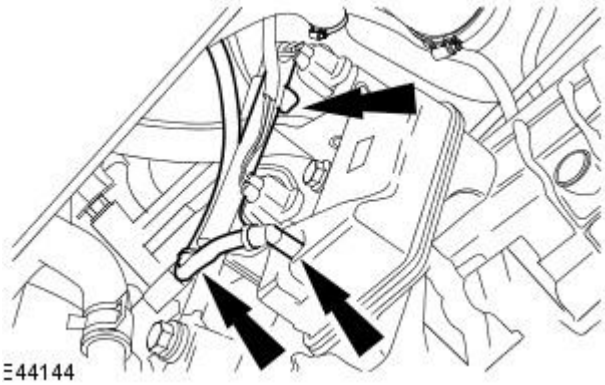




33. Attach the wiring harness to the vacuum solenoids and vacuum reservoir mount bracket.



34. Connect the vacuum solenoid valves electrical connectors.



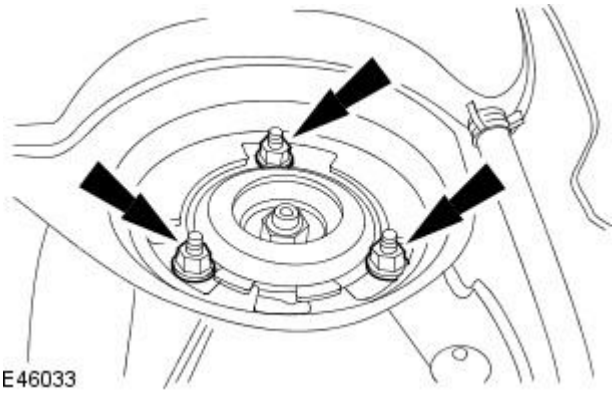
35. Connect the vacuum pipes to the vacuum solenoid valves and the vacuum reservoir.

36. Install the front subframe.
For additional information, refer to: Front Subframe - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

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

Tighten the shock absorber and spring assembly securing nuts.

- Tighten to 25 Nm.



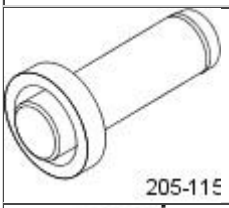
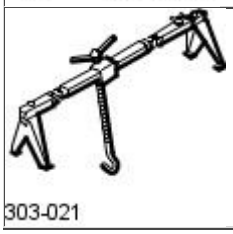
38. Install the air cleaner.
For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

39. Install the battery tray.
For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

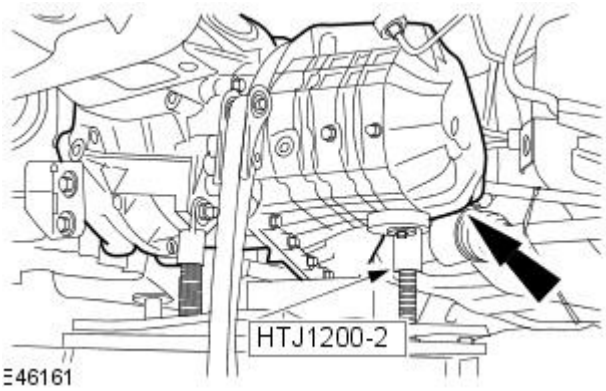
40. Fill the manual transaxle to the correct oil level.
For additional information, refer to: Transaxle Draining and Filling - Vehicles With: 6-Speed Manual Transaxle - MMT6 (308-03 Manual Transmission/Transaxle, General Procedures).

Manual Transmission / Transaxle - Transaxle2.2L Duratorq-TDCi (110kW / 150PS) - Puma

Installation

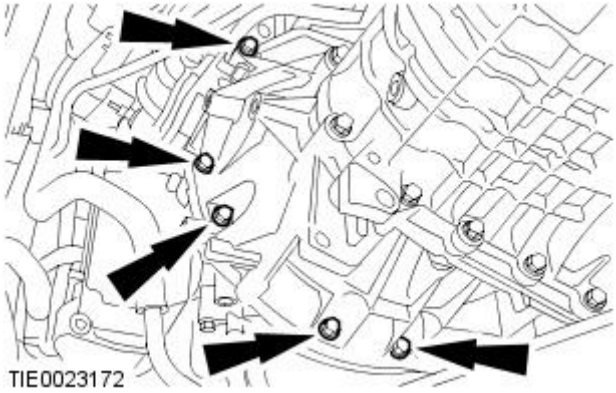
Special Tool(s)	
	Halfshaft oil seal installer 205-115
	Powertrain assembly jack HTJ1200-2
	Engine support bracket 303-021

Installation



1. Using the special tool, install the transaxle.

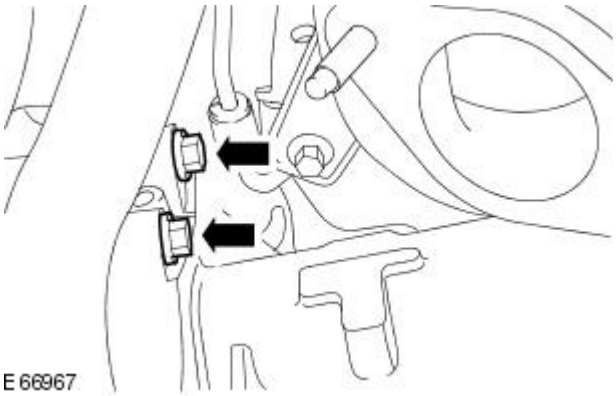
- Using the special tool raise the transaxle assembly.
- Align the transaxle to the clutch plate.



2. NOTE: Shown with the special tool removed for clarity.

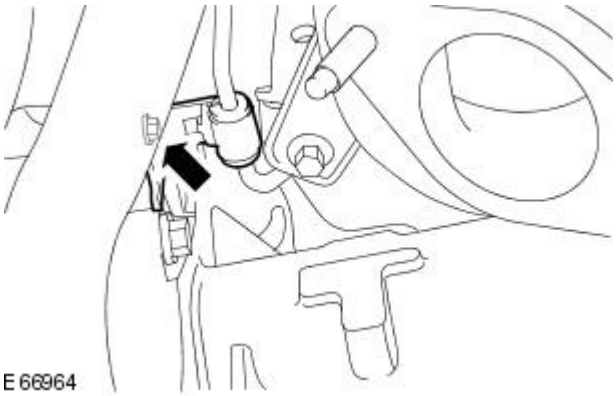
Install the transaxle retaining bolts.

- Tighten to 48 Nm.



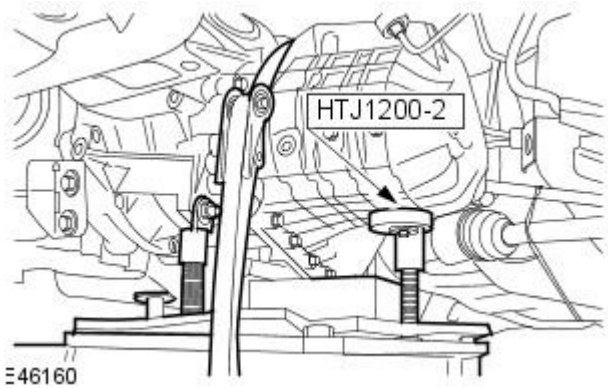
3. Install the transaxle retaining bolts.

- Tighten to 48 Nm.



4. Attach the turbocharger oil feed pipe retaining bracket.

- Tighten to 22 Nm.



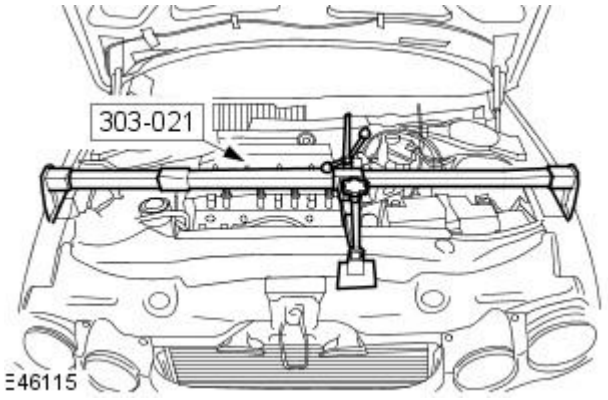
5. Remove the special tool.

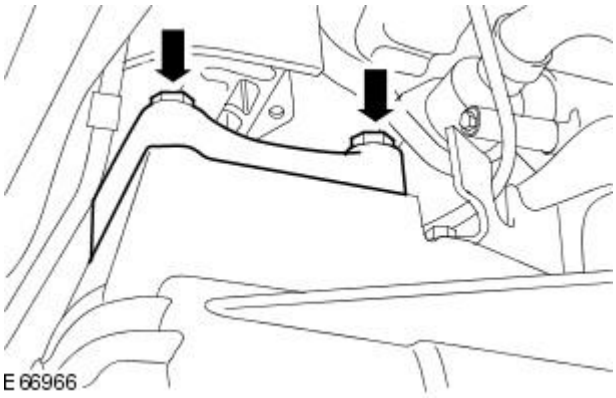
- Remove the special tool securing strap.

6. Lower the vehicle.

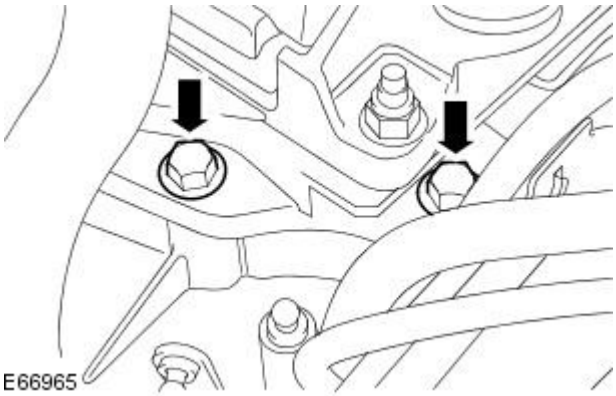
7. Using the special tool raise the powertrain assembly.

- Adjust the engine support bracket to align the transaxle to the transaxle mount bracket.



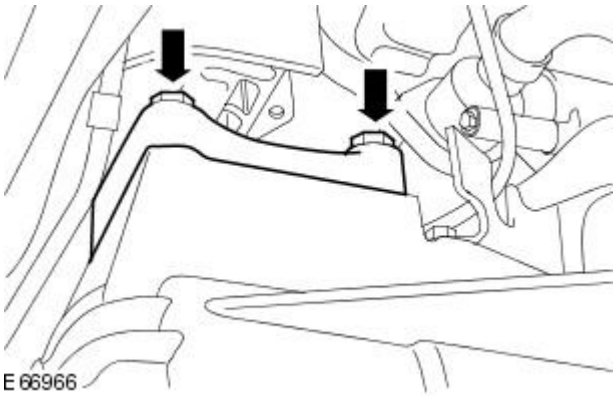


8. Loosely install the transaxle mount bracket retaining bolts.

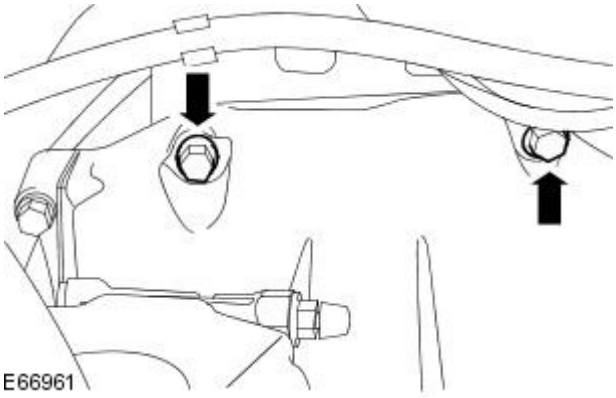


9. Install the transaxle mount bracket retaining bolts.

- Tighten to 80 Nm.

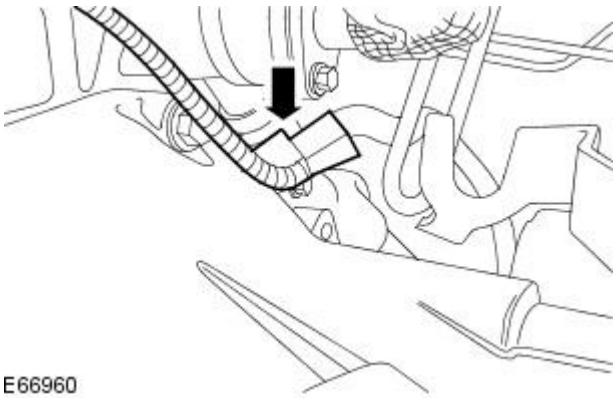


10. Tighten to 80 Nm.

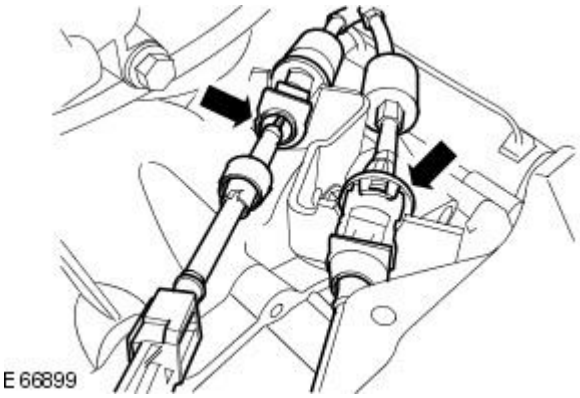


11. Install the transaxle upper retaining bolts.

- Tighten to 48 Nm.

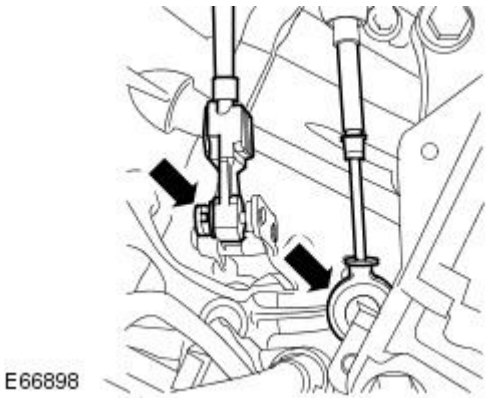


12. Connect the crankshaft position (CKP) sensor electrical connector.

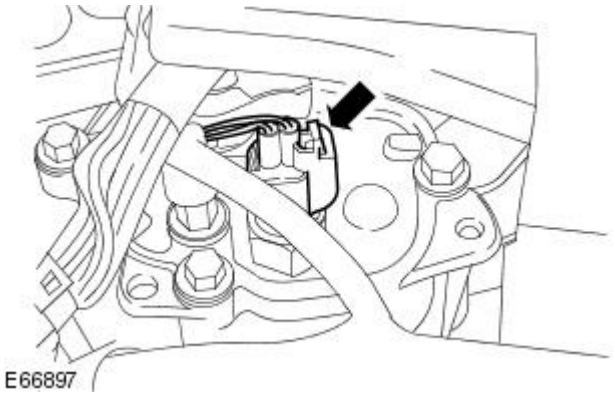


13. NOTE: Remove the selector cable tie straps.

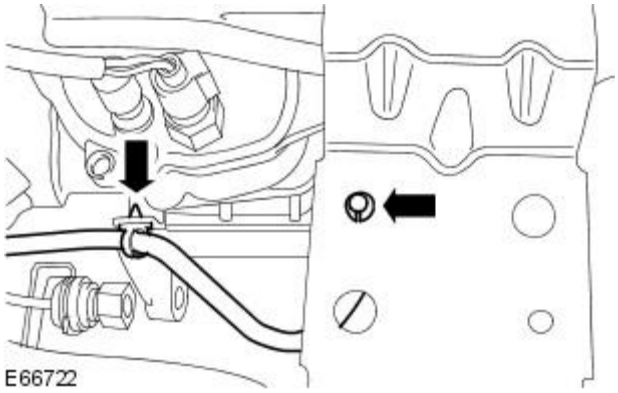
Attach the selector cables.



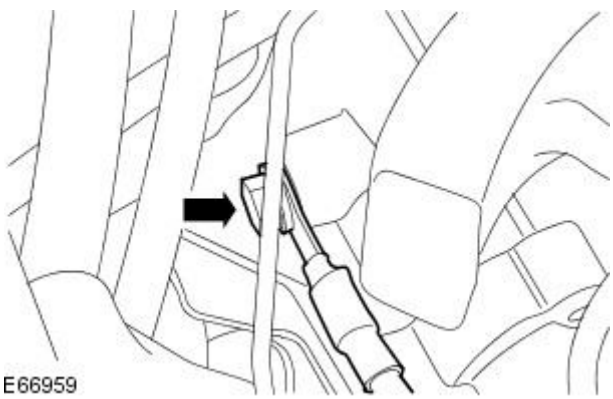
14. Attach the selector cables.



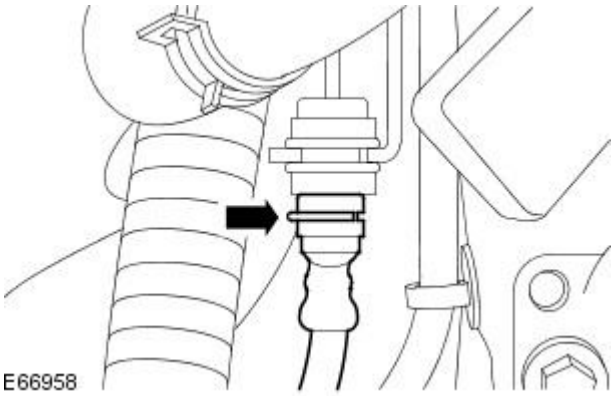
15. Connect the reverse lamp switch electrical connector.



16. Attach the battery ground cable.



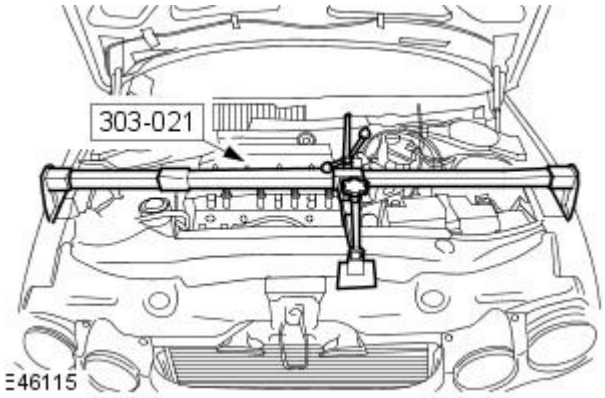
17. Attach the battery ground cable.



18. CAUTION: If brake fluid is split on the paintwork, the affected area must be washed down immediately with cold water. Failure to follow this instruction may result in damage to the vehicle.

Connect the clutch master cylinder to clutch slave cylinder high pressure hose.

- Remove the pipe clamp from the clutch master cylinder to clutch slave cylinder high pressure hose.

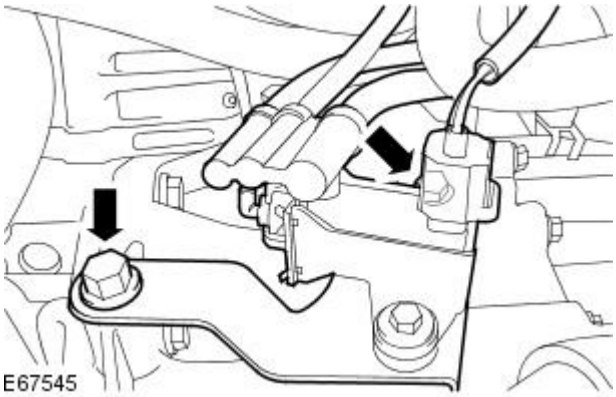


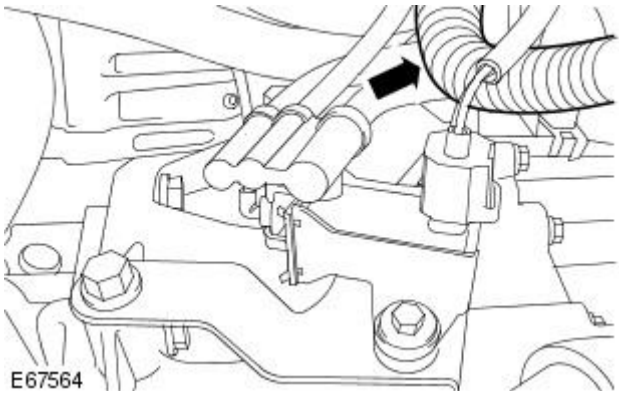
19. Remove the special tool.

20. Raise the vehicle.

21. Attach the vacuum solenoid valve assembly.

- Install the retaining bolts.

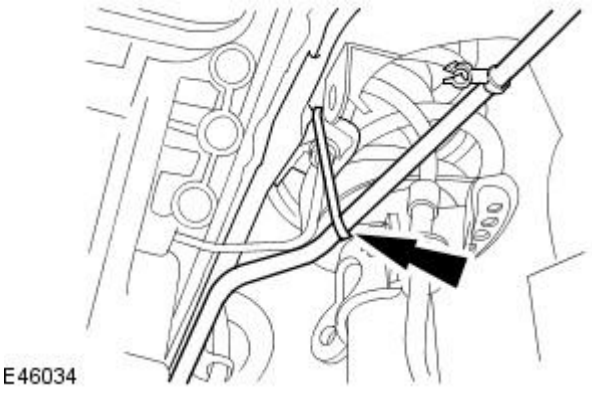


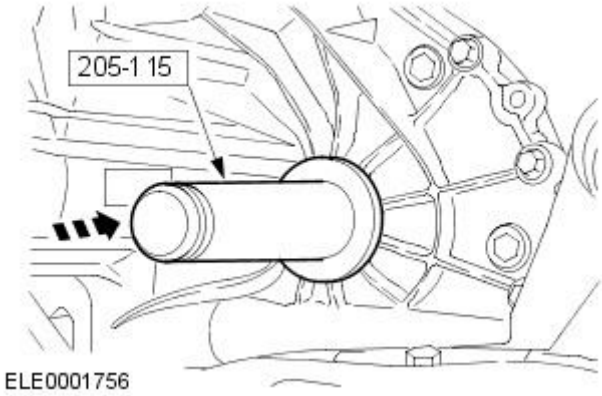


22. Attach the engine wiring harness.

23. NOTE: Remove the power steering fluid pipe tie strap.

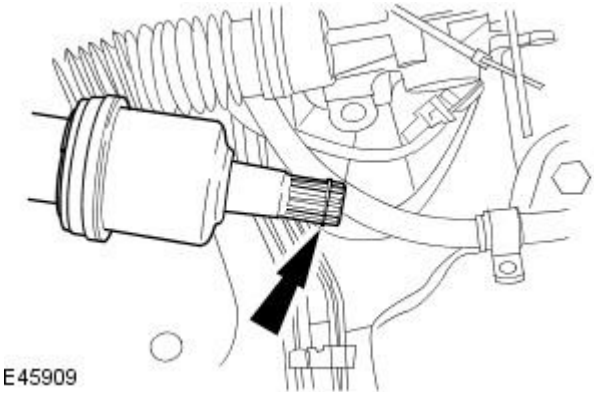
Detach the power steering fluid pipe.



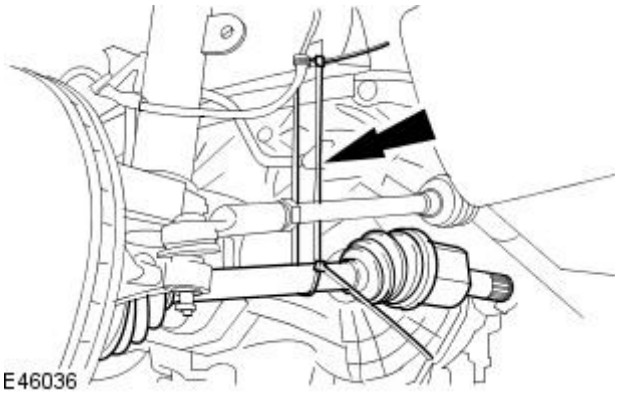


24. NOTE: Remove the transaxle plug.

Using the special tool, install a new right-hand halfshaft seal.



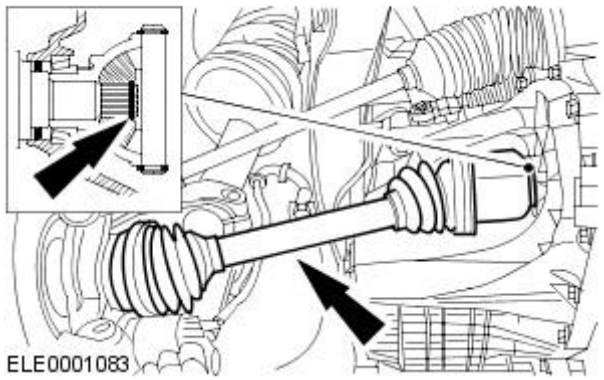
25. Install a new right-hand halfshaft snap ring.



26. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

• NOTE: Remove the right-hand halfshaft tie strap.

Detach the right-hand halfshaft.



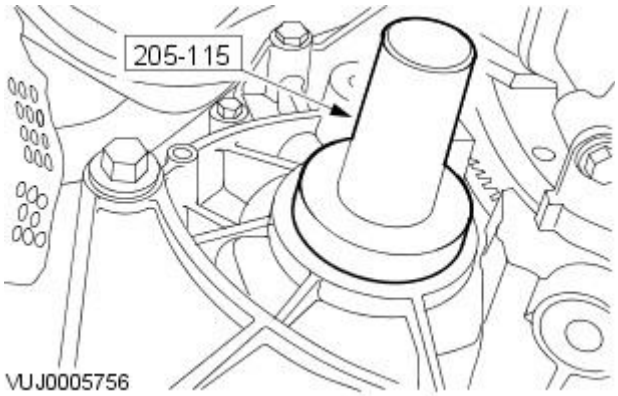
27. CAUTIONS:

Make sure the halfshaft CV joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

Make sure the halfshaft seal is not damaged. Failure to follow this instruction may result in an transaxle fluid leak.

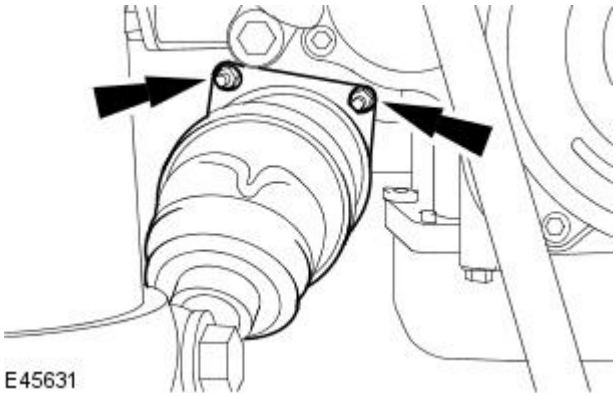
Attach the right-hand halfshaft to the transaxle.

- Make sure the halfshaft snap ring is correctly seated.



28. NOTE: Remove the transaxle plug.

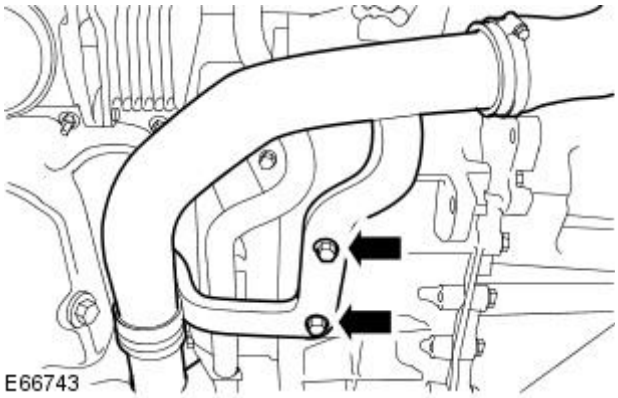
Using the special tool, install a new left-hand halfshaft seal.



29. CAUTION: Make sure the halfshaft CV joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

Attach the left-hand halfshaft.

- Engage the left-hand halfshaft to the transaxle.
- Tighten to 25 Nm.



30. Install the charge air cooler intake pipe retaining bolts.

- Tighten to 35 Nm.

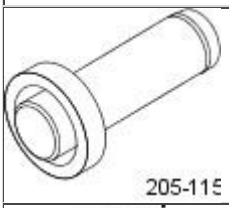
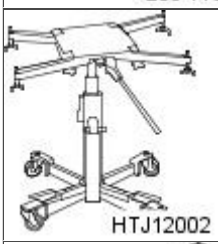
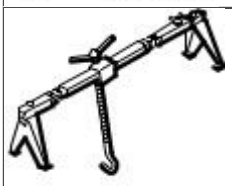
31. Install the front subframe.
For additional information, refer to: Front Subframe - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

32. Install the battery tray.
For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

33. Fill the manual transaxle to the correct oil level.
For additional information, refer to: Transaxle Draining and Filling - Vehicles With: 6-Speed Manual Transaxle - MMT6 (308-03 Manual Transmission/Transaxle, General Procedures).

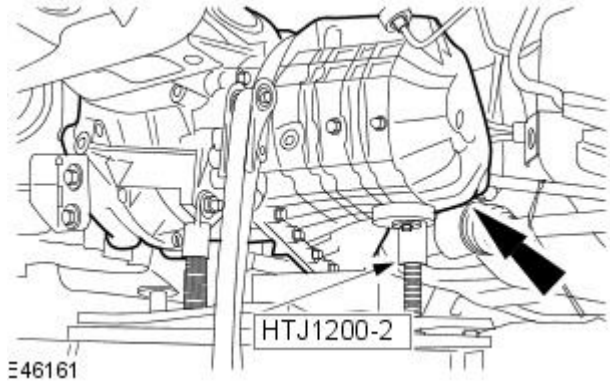
Manual Transmission / Transaxle - Transaxle2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Installation

Special Tool(s)	
 205-115	Halfshaft oil seal installer 205-115
 HTJ12002	Powertrain assembly jack HTJ1200-2
 303-021	Engine support bracket 303-021
 E46047	Engine support brackets 303-1068

Installation

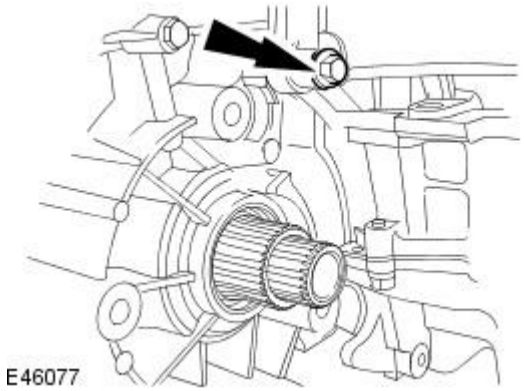
All vehicles



E46161

1. Install the transaxle.

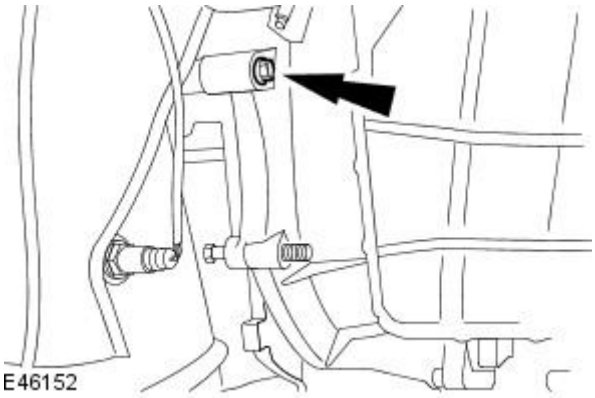
- Raise the powertrain assembly jack and transaxle assembly.
- Align the transaxle to the clutch plate.


E46077

2. NOTE: Vehicles with 2.5L and 3.0L engines shown, vehicles with 2.0L engine similar.

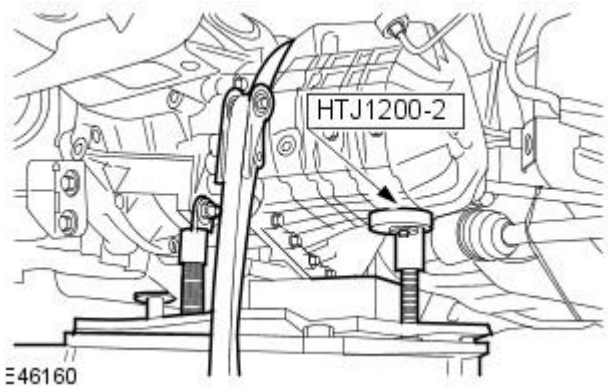
Install the transaxle retaining bolt.

- Tighten to 48 Nm.



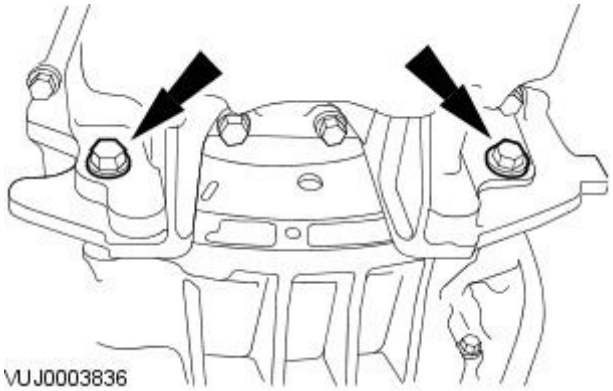
3. Install the transaxle retaining bolt.

- Tighten to 48 Nm.



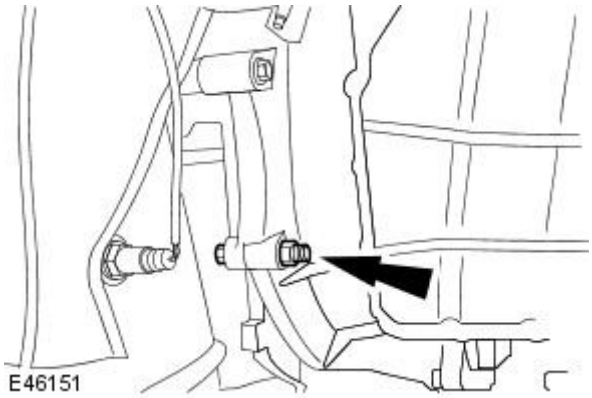
4. Remove the powertrain assembly jack.

- Remove the transaxle to the powertrain assembly jack securing strap.



5. Install the transaxle retaining bolts.

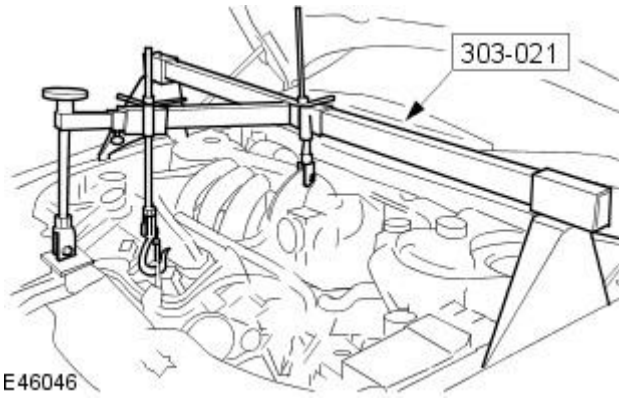
- Tighten to 48 Nm.



6. Install the transaxle retaining nut.

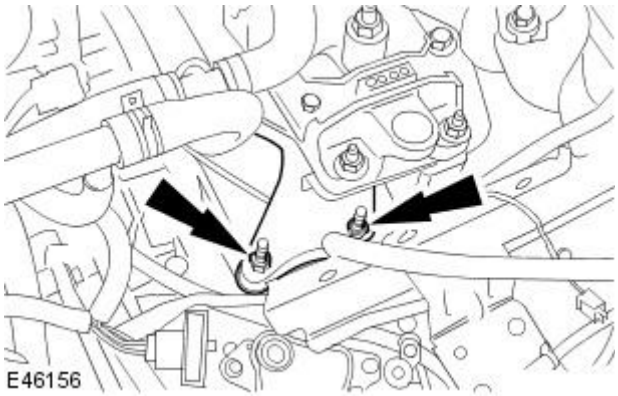
- Tighten to 48 Nm.

7. Lower the vehicle.
For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



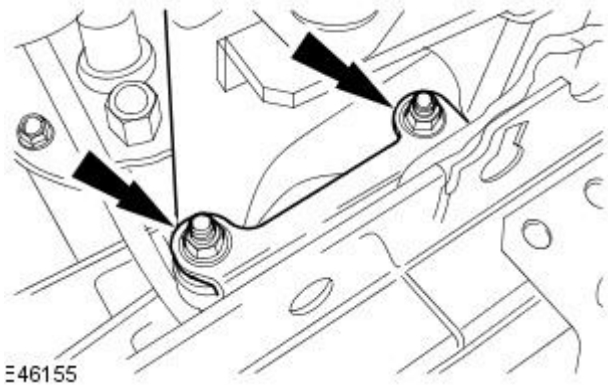
8. Using the engine support bracket raise the powertrain assembly.

- Adjust the engine support bracket to align the transaxle to the transaxle mount bracket.

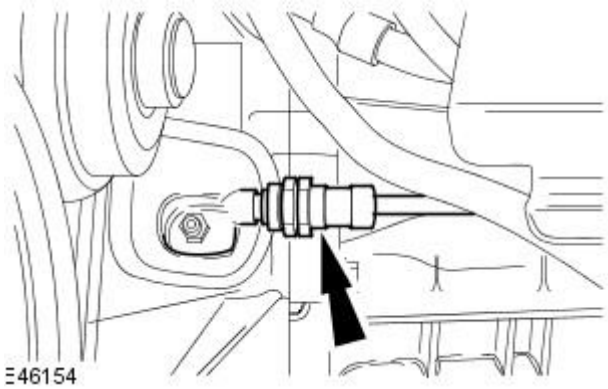


9. Install the transaxle mount bracket securing studs.

- Tighten to 80 Nm.



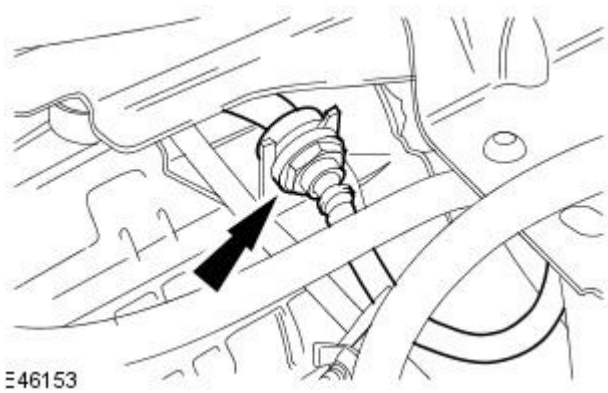
10. Install the clutch master cylinder to clutch slave cylinder high pressure pipe support bracket.



11. CAUTION: If brake fluid is split on the paintwork, the affected area must be washed down immediately with cold water. Failure to follow this instruction may result in damage to the vehicle.

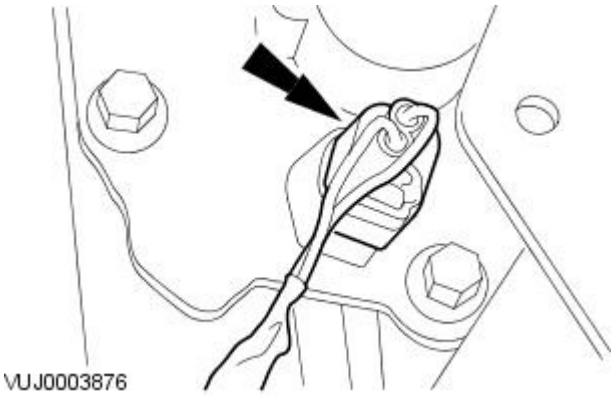
Attach the clutch master cylinder to clutch slave cylinder high pressure pipe to the clutch slave cylinder.

- Install the clutch master cylinder to clutch slave cylinder high pressure pipe retaining clip.

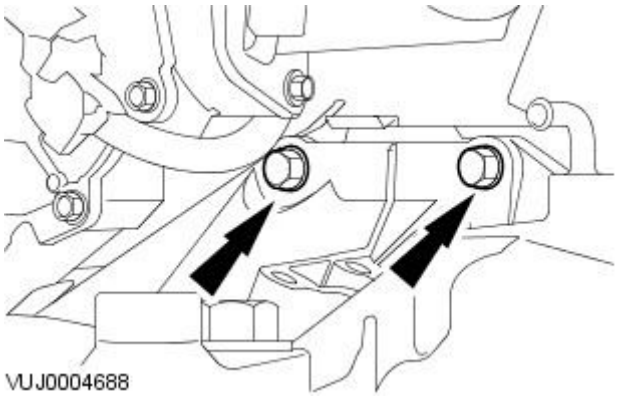


12. Attach the clutch master cylinder to clutch slave cylinder high pressure pipe to the support bracket.

- Remove the pipe clamp from the clutch master cylinder to clutch slave cylinder high pressure pipe.

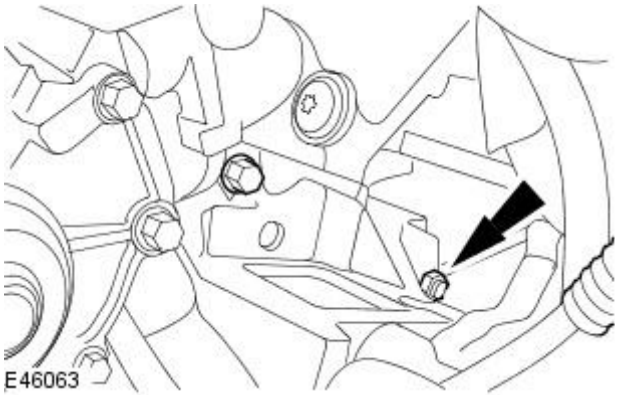


13. Connect the reverse lamp switch electrical connector.



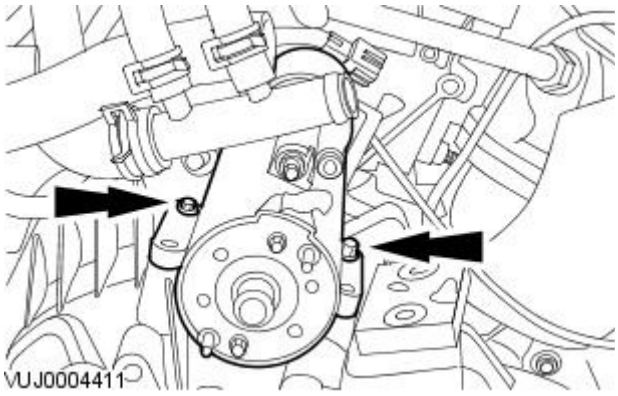
14. Install the transaxle retaining bolts.

- Tighten to 48 Nm.



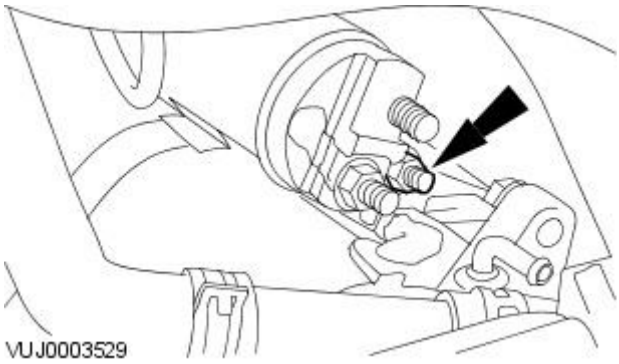
15. Install the transaxle retaining bolt.

- Tighten to 48 Nm.



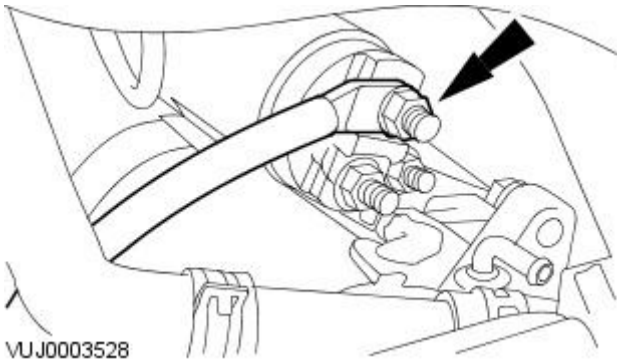
16. Install the starter motor.

- Tighten to 35 Nm.



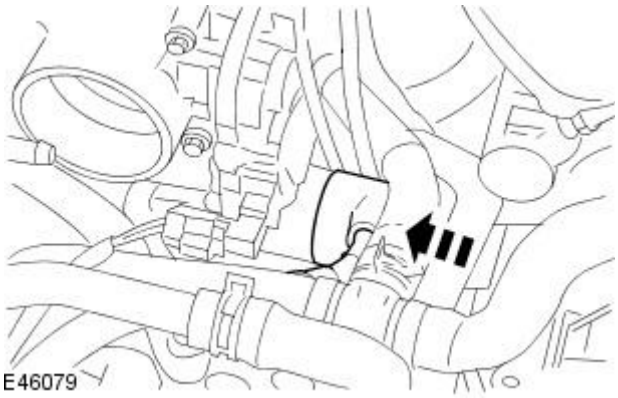
17. Attach the starter motor solenoid electrical connector.

- Tighten to 6 Nm.

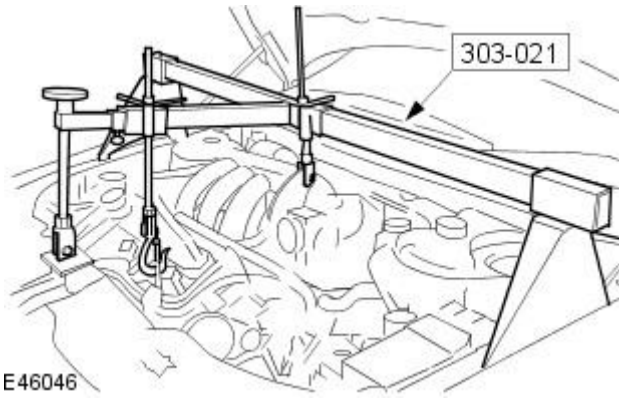


18. Attach the starter motor electrical connector.

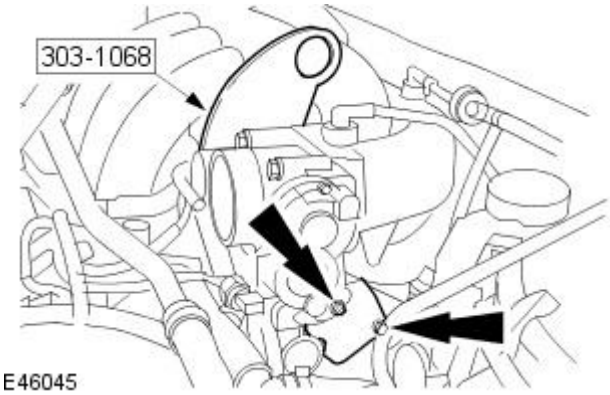
- Tighten to 12 Nm.



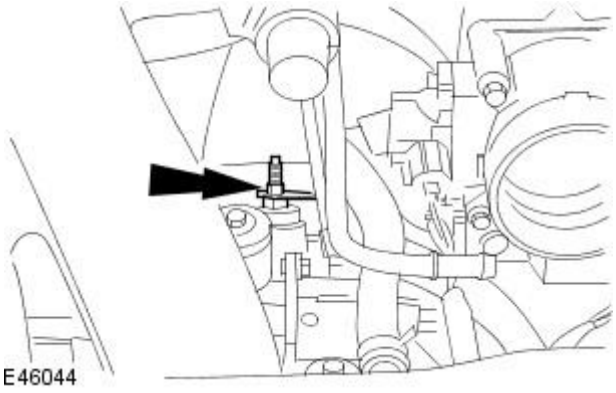
19. Attach the starter motor solenoid cover.



20. Remove the engine support bracket.

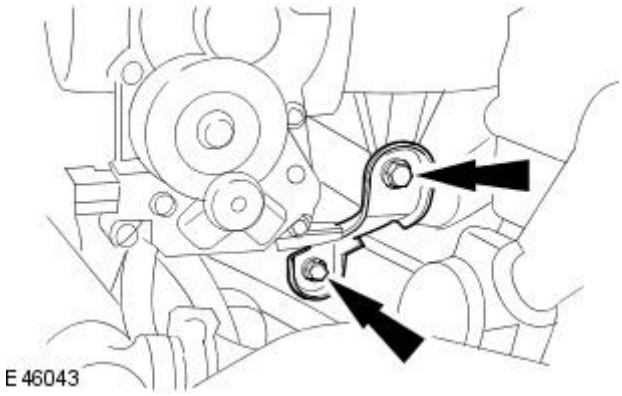


21. Remove the engine support bracket.



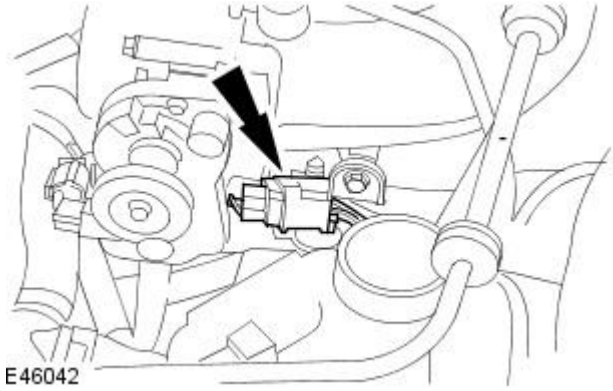
22. Attach the wiring harness to the camshaft cover retaining stud.

- Tighten to 6 Nm.

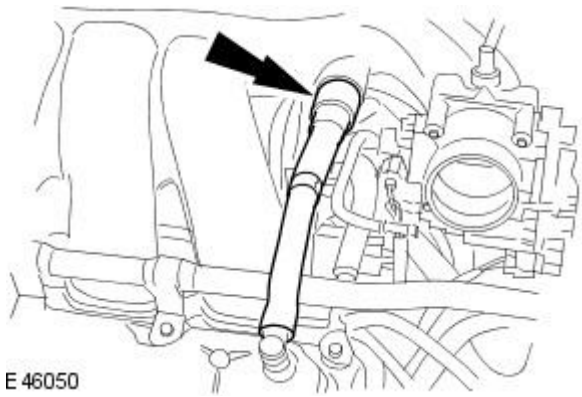

E46043

23. Install the intake manifold support bracket.

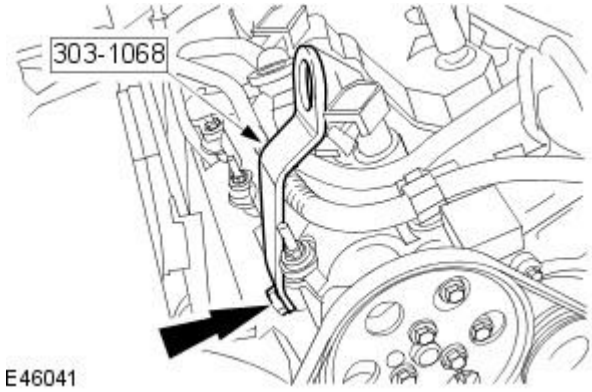
- Tighten to 10 Nm.


E46042

24. Attach the electrical connector to the intake manifold support bracket.

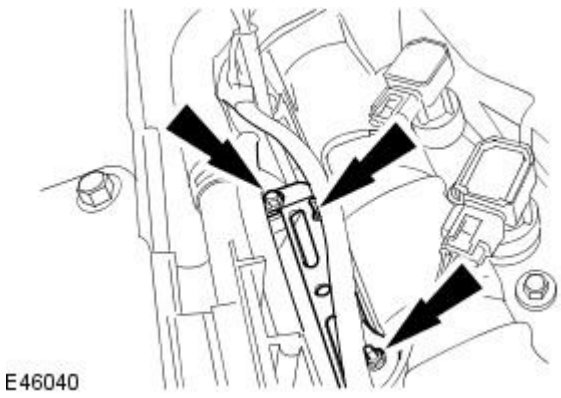

E46050

25. Attach the positive crankcase ventilation (PCV) hose to the intake manifold.



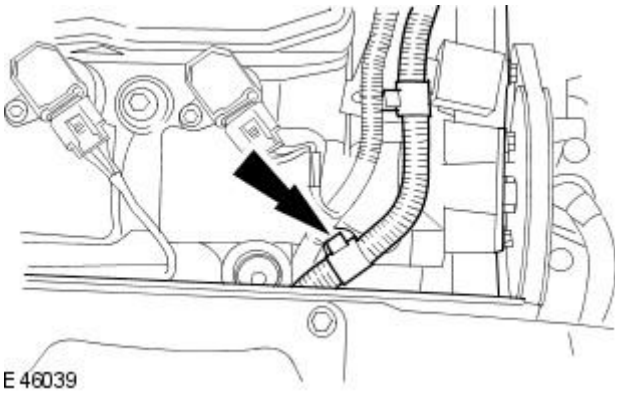
E46041

26. Remove the engine support bracket.


E46040

27. Install the air cleaner mount bracket.

- Tighten to 6 Nm.

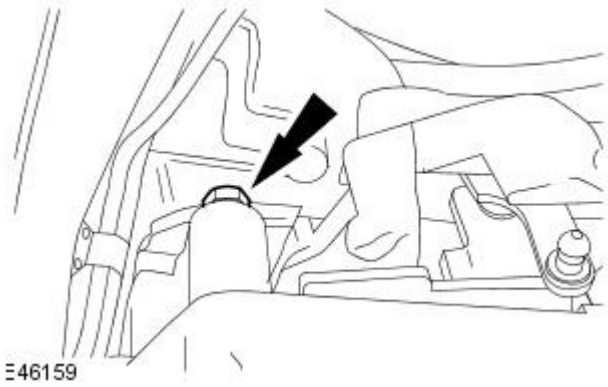

E46039

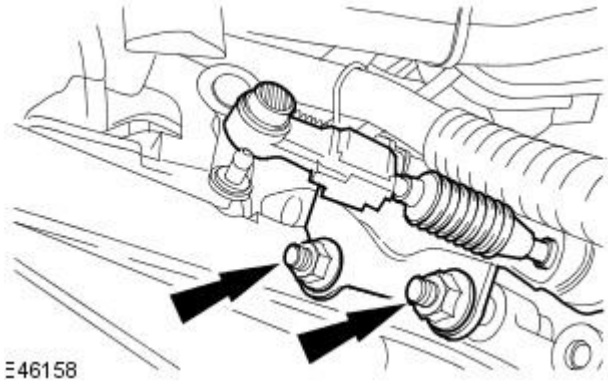
28. Attach the generator wiring harness retaining clip to the camshaft cover retaining clip.

29. Raise the vehicle.
For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

30. Install the transaxle mount bracket retaining bolt.

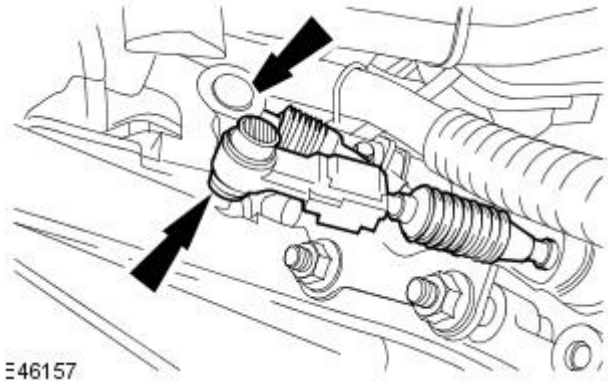
- Tighten to 80 Nm.


E46159

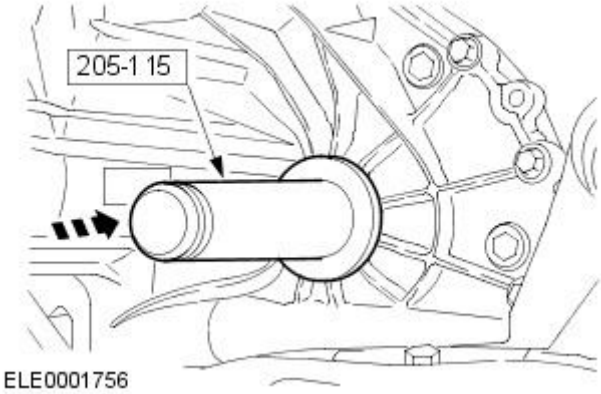

E46158

31. Attach the gearshift cable support bracket to the transaxle.

- Tighten to 25 Nm.

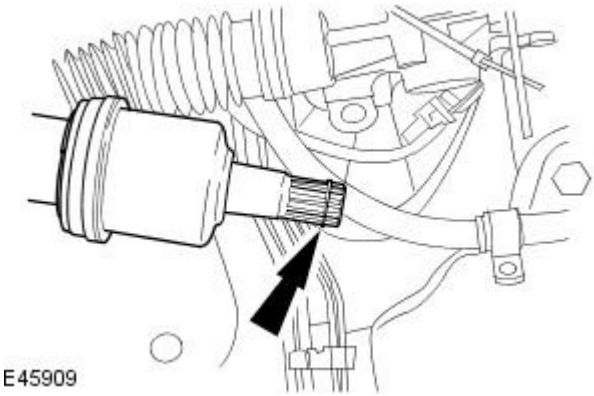

E46157

32. Attach the gearshift cables to the transaxle.

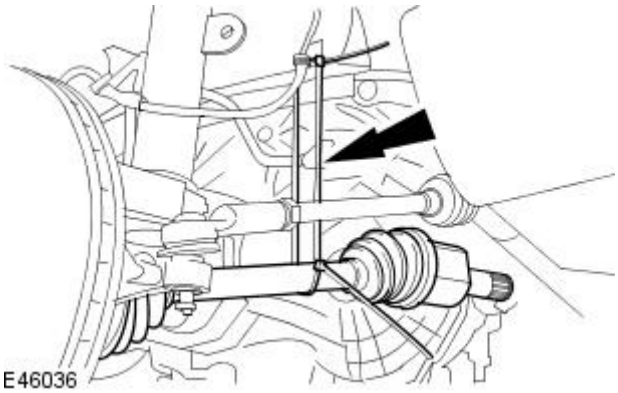


33. NOTE: Remove the transaxle plug.

Using the special tool, install a new halfshaft seal.

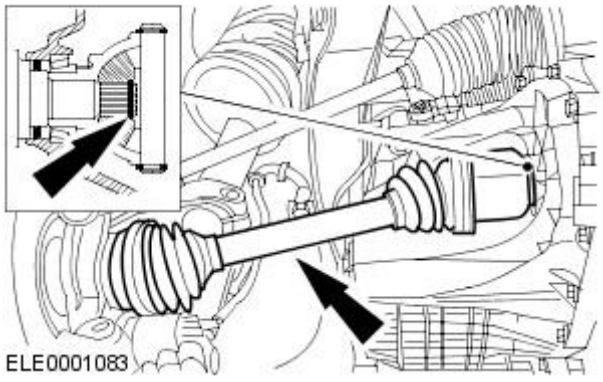


34. Install a new halfshaft snap ring.



35. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

Detach the left-hand halfshaft.



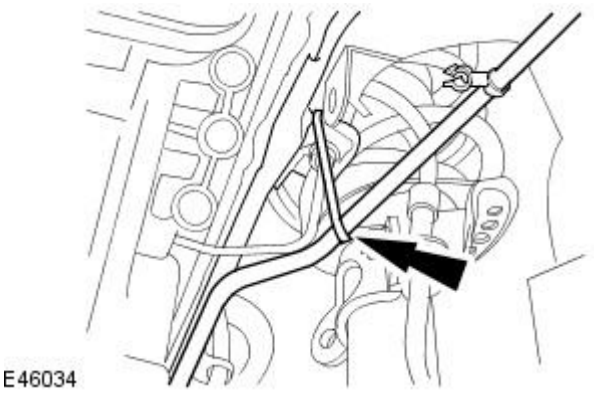
36. CAUTIONS:

Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

Make sure the halfshaft seal is not damaged. Failure to follow this instruction may result in an transaxle fluid leak.

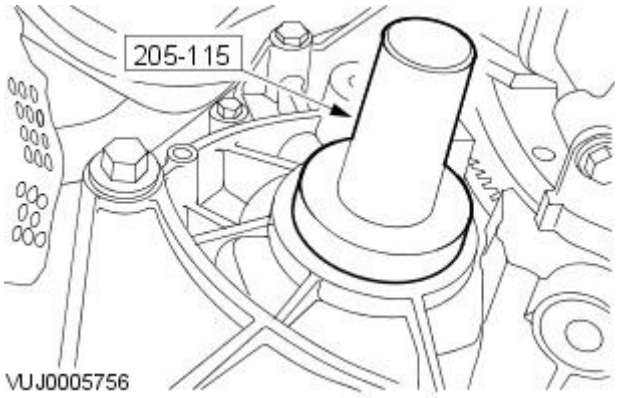
Attach the left-hand halfshaft to the transaxle.

- Make sure the halfshaft snap ring is correctly seated.



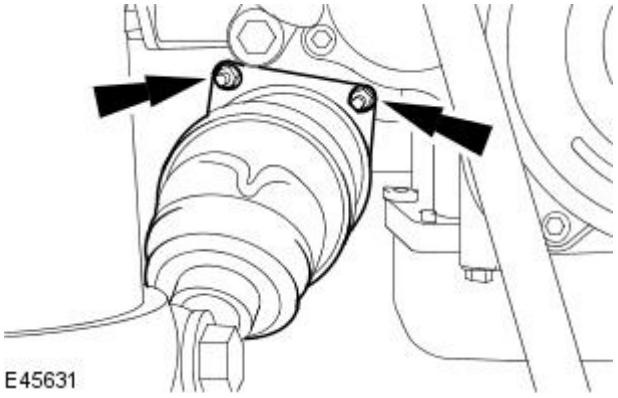
37. Detach the power steering fluid pipe.

Vehicles with 2.0L engine



38. NOTE: Remove the transaxle plug.

Using the special tool, install a new halfshaft seal.



39. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

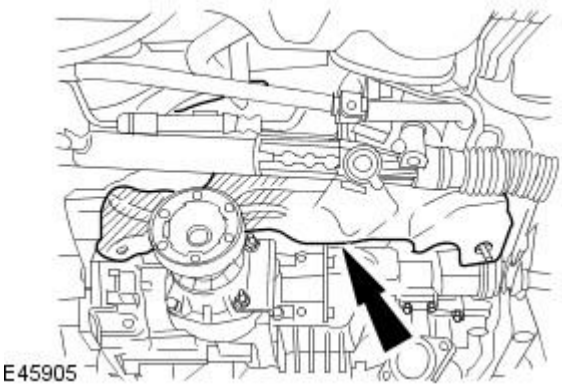
Attach the right hand halfshaft.

- Engage the right-hand halfshaft from the transaxle.
- Tighten to 25 Nm.

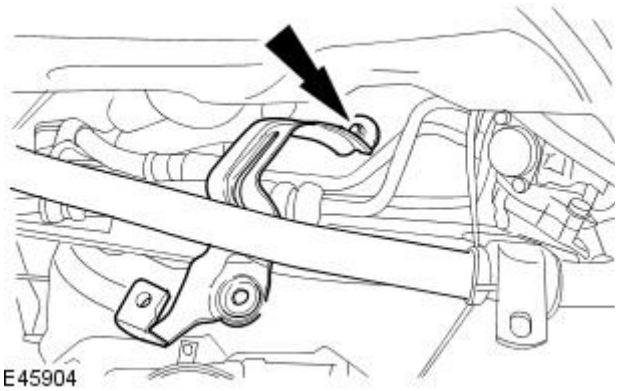
Vehicles with 2.5L or 3.0L engine

40. Install the transfer case.
For additional information, refer to: Transfer Case (308-07 Transfer Case, Installation).

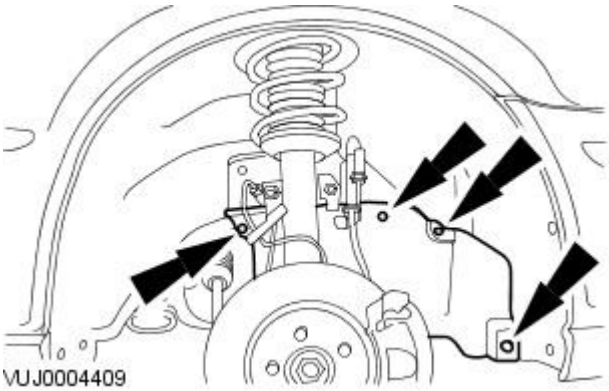
41. Install the steering gear heat shield.



42. Install the steering gear heat shield bracket.

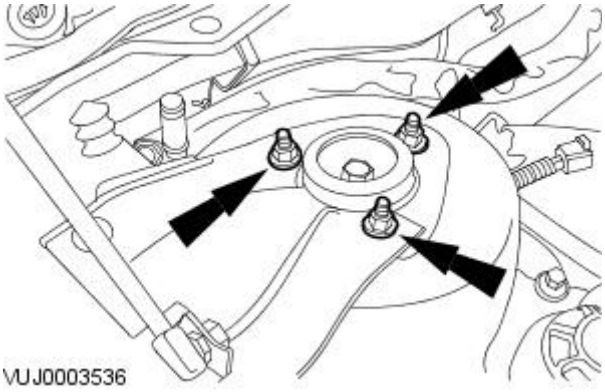


All vehicles



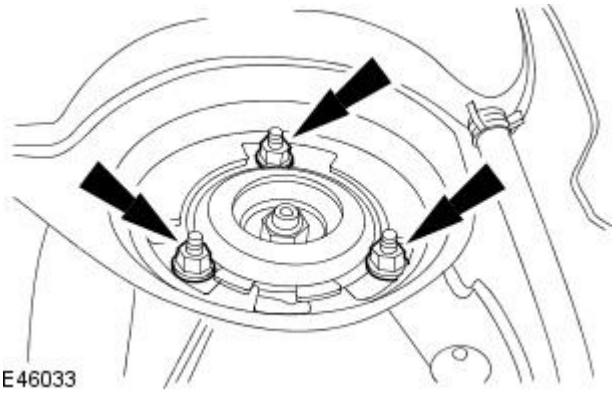
43. Install the fender splash shield access panel.

44. Install the front subframe.
For additional information, refer to: Front Subframe - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



45. Tighten the right-hand shock absorber and spring assembly securing nuts.

- Tighten to 25 Nm.



46. Tighten the left-hand shock absorber and spring assembly securing nuts.

- Tighten to 25 Nm.

47. Install the air cleaner.
For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).

48. Install the battery tray.
For additional information, refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

49. Fill the manual transaxle to the correct oil level.
For additional information, refer to: Transaxle Draining and Filling - Vehicles With: 5-Speed Manual Transmission - MT75 (308-03 Manual Transmission/Transaxle, General Procedures).

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Manual Transmission / Transaxle External Controls -

Torque Specifications

Description	Nm	lb-ft	lb-in
Selector cable grommet	-	-	60 lb-in
Gearshift lever mount retaining nuts	-	-	80 lb-in

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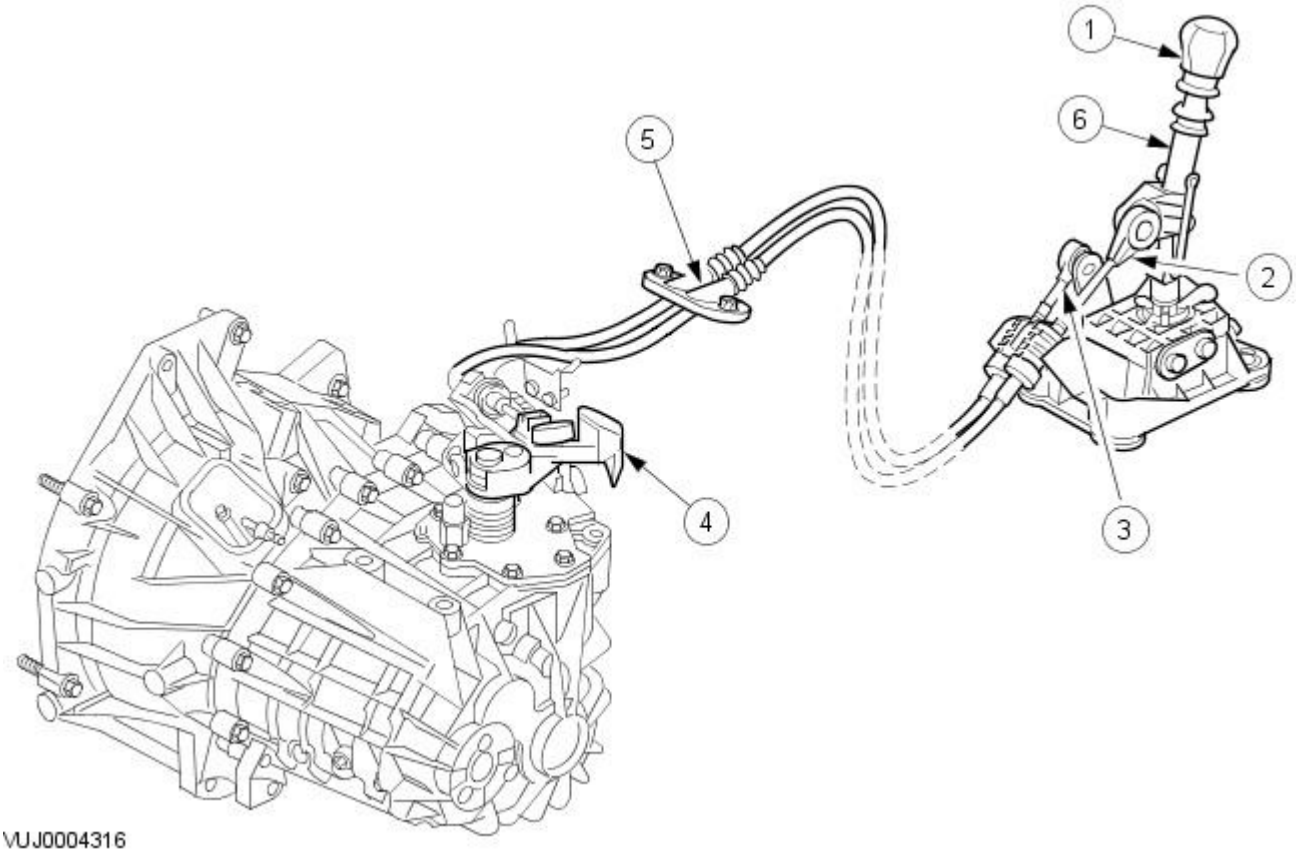
Manual Transmission / Transaxle External Controls - External Controls

Description and Operation

Vehicles with 5-speed manual transmission

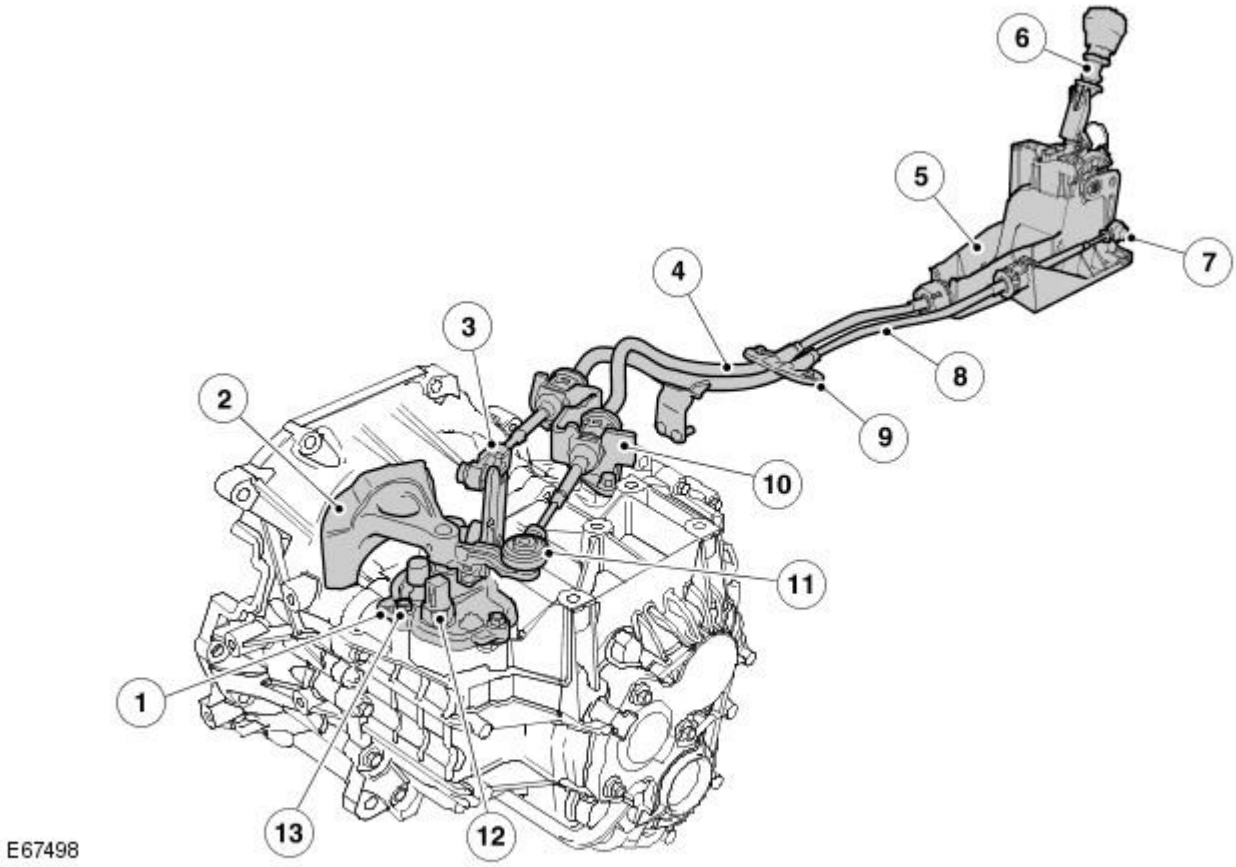


VUJ0004316

Item	Part Number	Description
1	—	Gearshift lever knob
2	—	Shift cable
3	—	Selector cable
4	—	Selector lever on the transmission
5	—	Shift and selector cable grommet
6	—	Gearshift lever

The shift is white and the selector cable is black. In order to detach the cables from there abutment brackets on the transmission and at the gear lever, twist the locking tab of each abutment clockwise. As the shift and selector cable have a common grommet where they pass through the floor, they can only be changed as a pair.

Vehicles with 6-speed manual transmission



Item	Description	Item	Description
1	Internal shift mechanism	8	Selector cable
2	Counterbalance	9	Body seal
3	Selector cable adjustment mechanism	10	Shift cable mounting
4	Shift cable	11	Shift cable mounting point on the gearshift lever
5	Gear lever housing	12	Reverse gear switch
6	Shift lever	13	Transmission vent
7	Selector cable mounting point on the gearshift lever		

The transaxle uses a cable-shift mechanism designed to provide a smooth and positive gearshift action, while also isolating the lever from any powertrain vibration. Cable adjustment is provided at the transaxle end of the cables at the abutment brackets. Damper weights incorporated behind the cable adjusters suppress cable vibration.

There are no adjustment capabilities within the gear selector mechanism.

The cables are color coded and attached at both ends with ball connections incorporating a button release.

Reverse gear is selected by pulling-up the ring below the gear knob and then moving the lever to the reverse position.

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Manual Transmission / Transaxle External Controls - External Controls

Diagnosis and Testing

1. **1.** Verify the customer concern by operating the system.
2. **2.** Visually inspect for obvious signs of mechanical damage.

Mechanical
● Visibly damaged or worn ● Loose or missing screws or nuts

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 REFER to: Manual Transmission and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Diagnosis and Testing).

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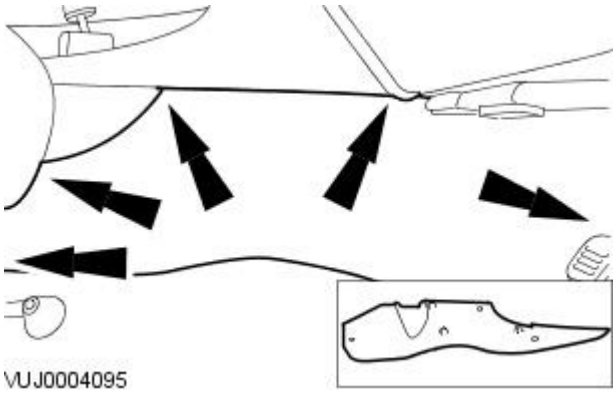
Manual Transmission / Transaxle External Controls - Gearshift CablesVehicles With: 5-Speed Manual Transmission - MT75

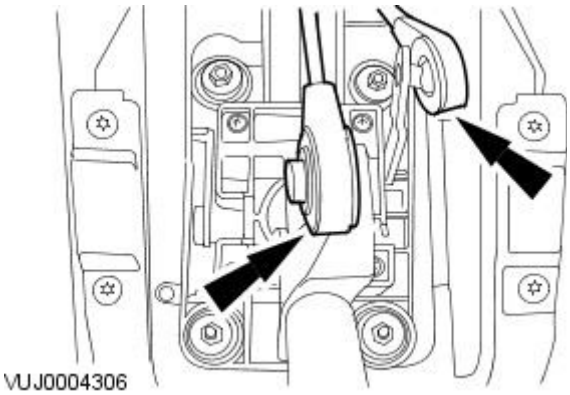
Removal and Installation

Special Tool(s)	
 HTJ12002	Powertrain assembly jack HTJ1200-2

Removal

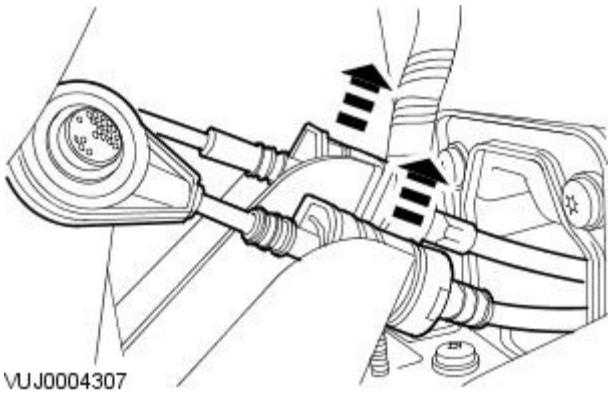

VUJ0004095

1. Remove the center console right-hand side panel.

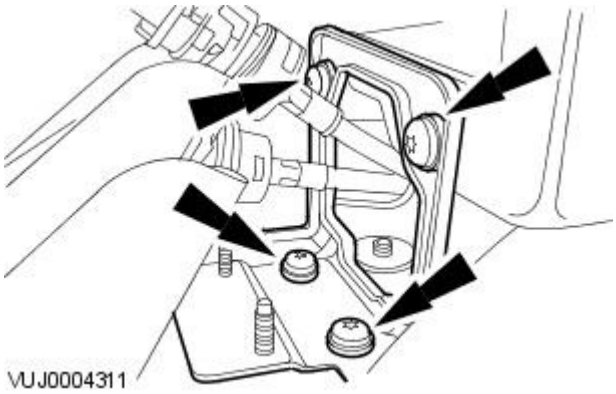

VUJ0004306

2. NOTE: Press the button to release the cable fitting before disconnecting the cable.

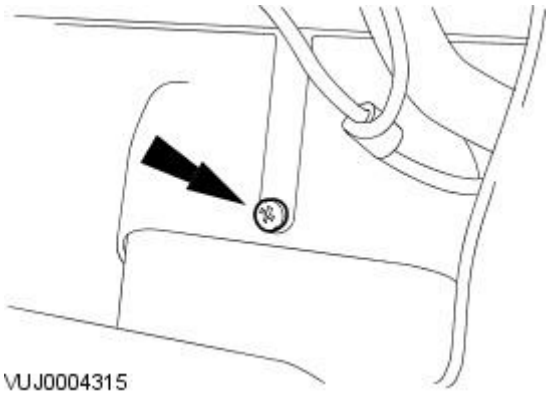
Disconnect the gearshift selector cables.


VUJ0004307

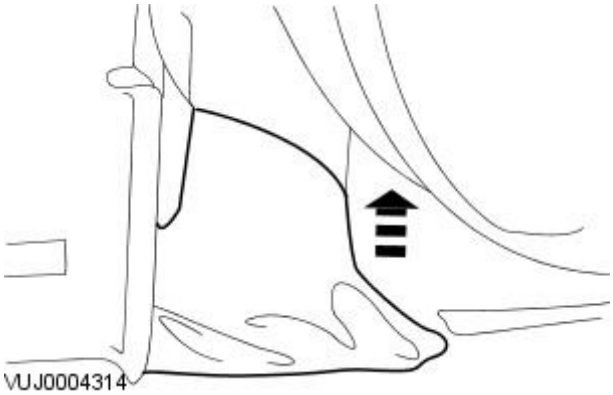
3. Disconnect the gearshift selector cables.



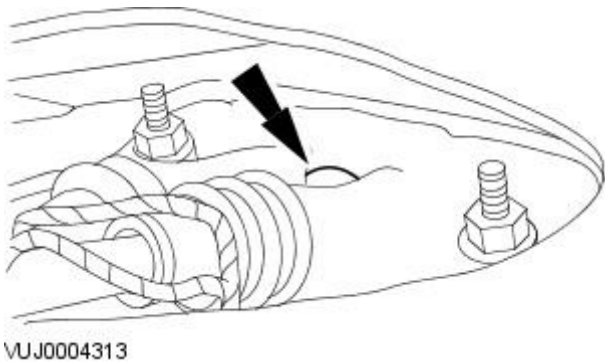
4. Remove the instrument panel center mount bracket.



5. Remove the center air duct retaining screw.



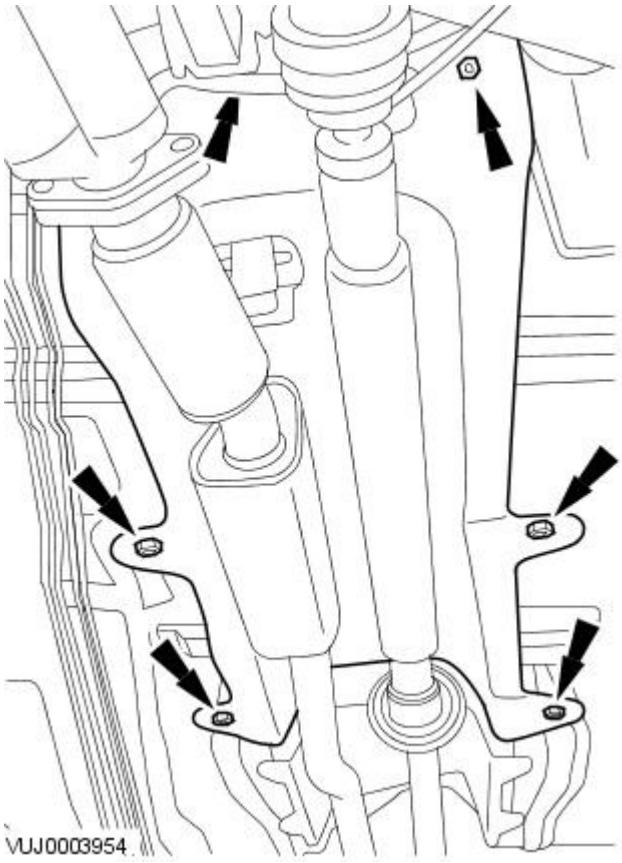
6. Reposition the center air duct upwards.



7. Detach the gearshift selector cable grommet.

8. Raise and support the vehicle. For additional information, refer toSection 100-02 Jacking and Lifting.

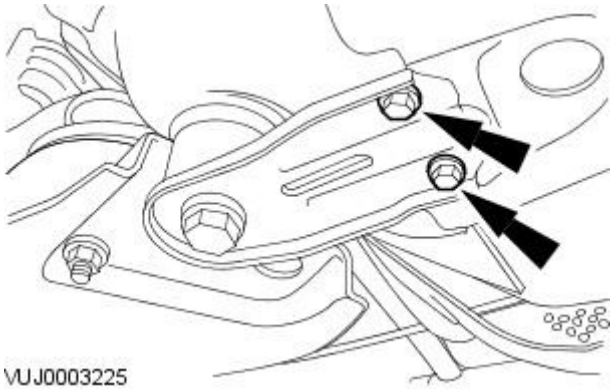
9. Detach the exhaust heat shield.



10. CAUTION: Using the powertrain assembly jack, support the rear of the subframe.

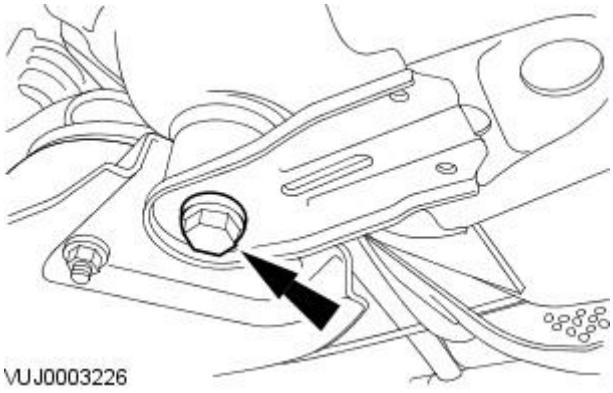
• NOTE: Left-hand shown, right-hand similar.

Remove the subframe reinforcement plate retaining bolts.



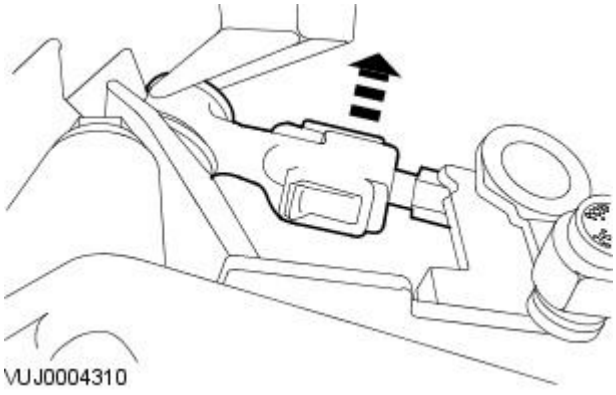
11. NOTE: Left-hand shown, right-hand similar.

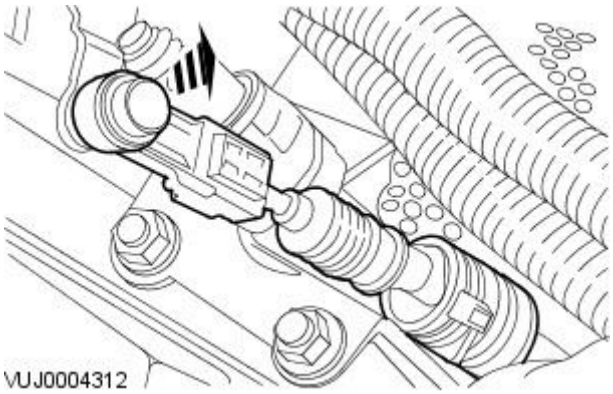
Loosen the subframe rear mount retaining bolt.



12. NOTE: Press the button to release the cable fitting before disconnecting the cable.

Detach the gearshift selector cables.




VUJ0004312

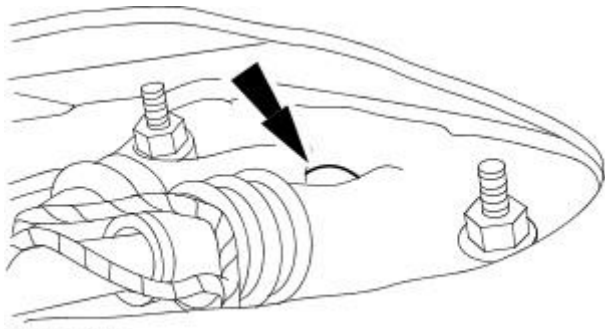
13. NOTE: Press the button to release the cable fitting before disconnecting the cable.

Remove the gearshift selector cable.

Installation

1. To install, reverse the removal procedure.

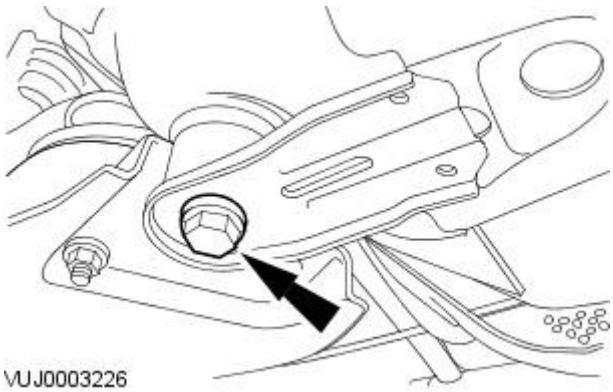
2. Tighten to 60 lb/in.


VUJ0004313

3. Check and adjust the gearshift cables. For additional information, refer toSection 308-00 Manual Transmission/Transaxle and Clutch - General Information.

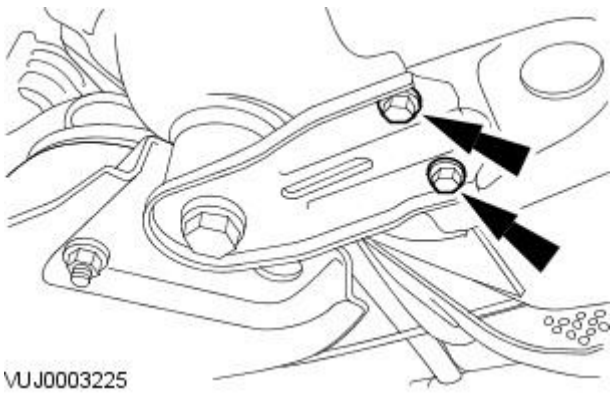
4. Tighten the subframe rear mount retaining bolt.

- Tighten to 142 Nm.


VUJ0003226

5. Tighten the front subframe reinforcement plate retaining bolts.

- Tighten to 35 Nm.


VUJ0003225

6. Carry out front subframe alignment procedure. For additional information, refer toSection 502-00 Uni-Body, Subframe and Mounting System.

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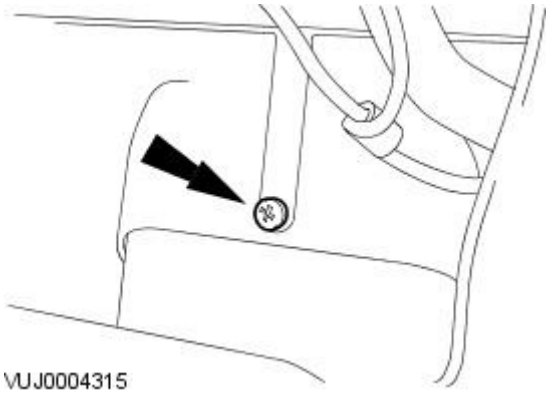
Manual Transmission / Transaxle External Controls - Gearshift CablesVehicles With: 6-Speed Manual Transaxle - MMT6

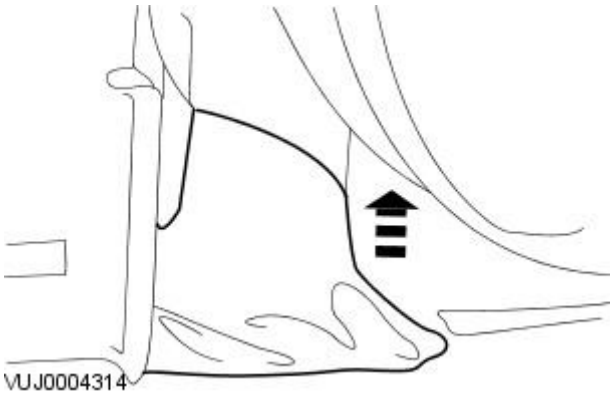
Removal and Installation

Removal

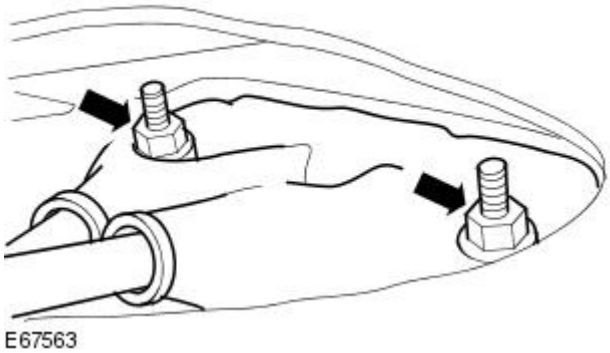
1. Remove the gearshift lever.
   For additional information, refer to: Gearshift Lever - Vehicles With: 6-Speed Manual Transaxle - MMT6 (308-06 Manual Transmission/Transaxle External Controls, Removal and Installation).
2. Remove the center air duct retaining screw.



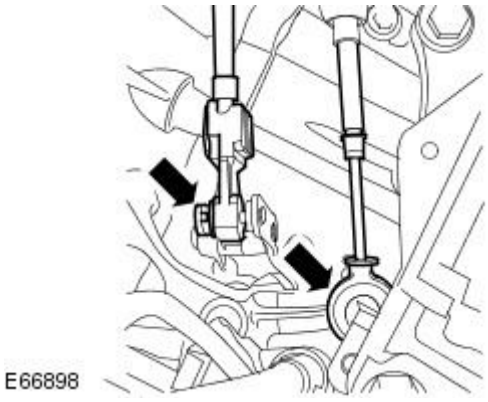
3. Reposition the center air duct upwards.

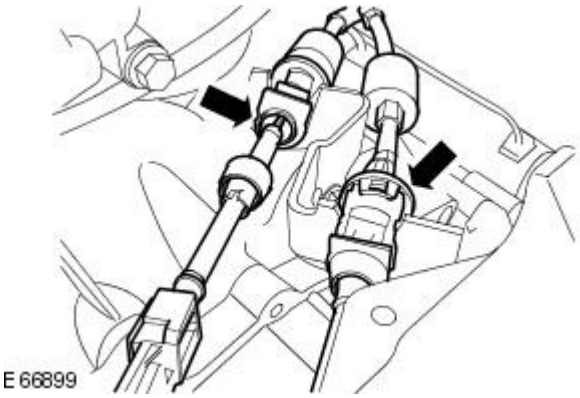


4. Detach the gearshift cable grommet.



5. Detach the gearshift cables from the transmission selector mechanism.



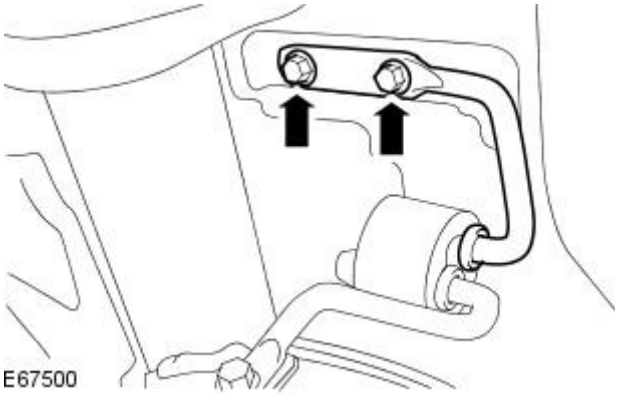


6. Detach the gearshift cables from the transmission retaining bracket.

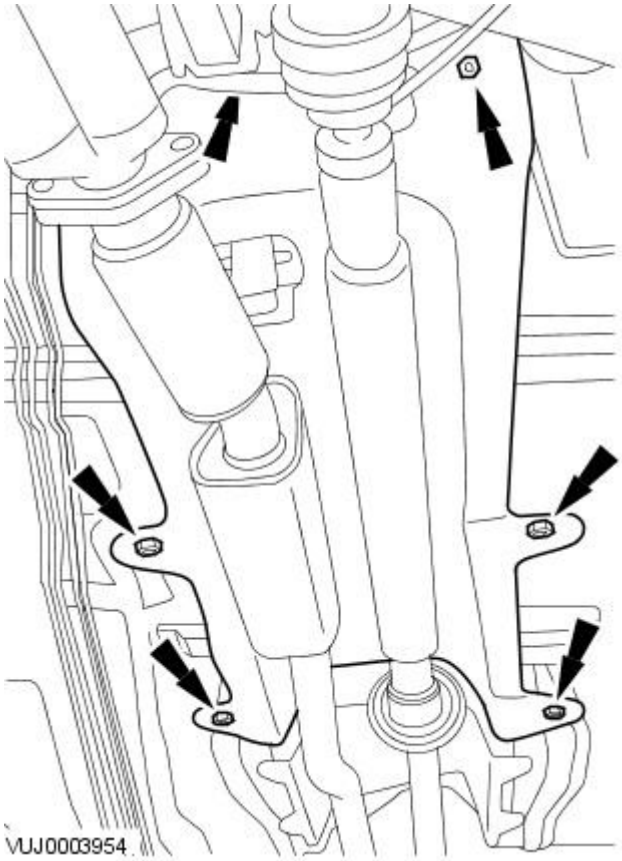
7. Raise and support the vehicle.
For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

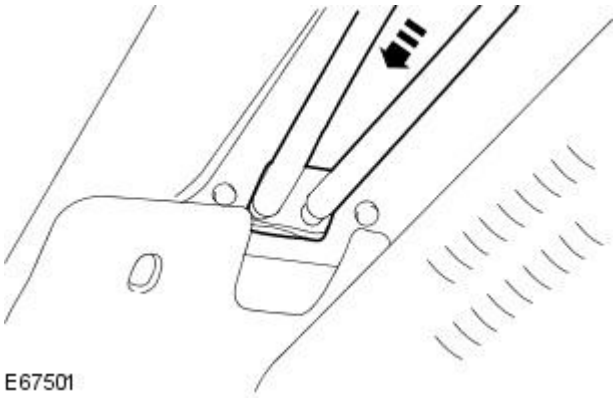
8. Reposition the exhaust mounting for access to the exhaust heat shield.

- Remove the retaining bolts.

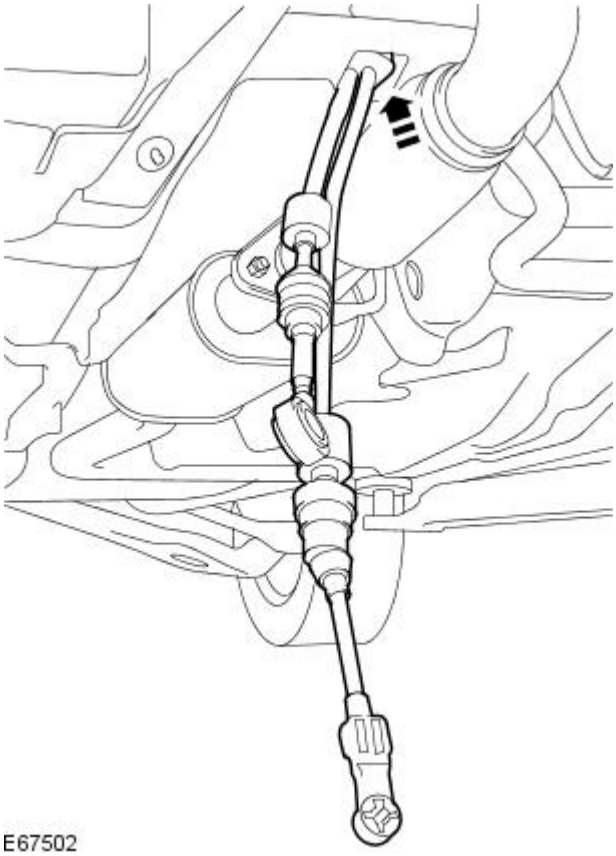


9. Reposition the exhaust heat shield for access to the gearshift cables.




E67501

10. Reposition the gearshift cables from the subframe.


E67502

11. CAUTION: Make sure the gearshift cables are fed through the vehicle floor pan individually. Failure to follow this instruction may result in damage to the vehicle.

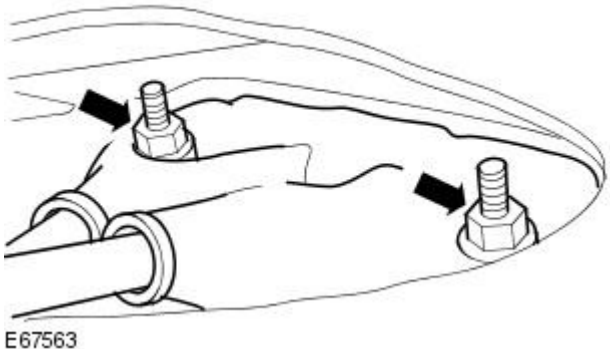
• NOTE: Remove the gearshift cables from inside the vehicle.

Remove the gearshift cables.

Installation

1. To install, reverse the removal procedure.

- Tighten to 10 Nm.


E67563

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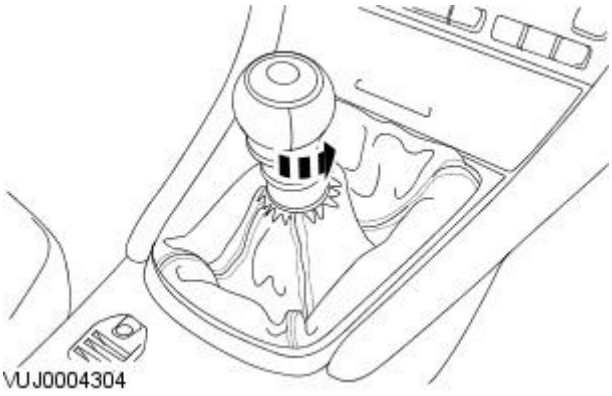
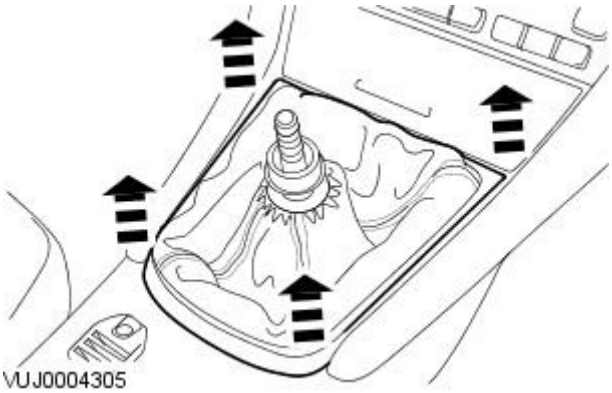
Manual Transmission / Transaxle External Controls - Gearshift LeverVehicles With: 5-Speed Manual Transmission - MT75

Removal and Installation

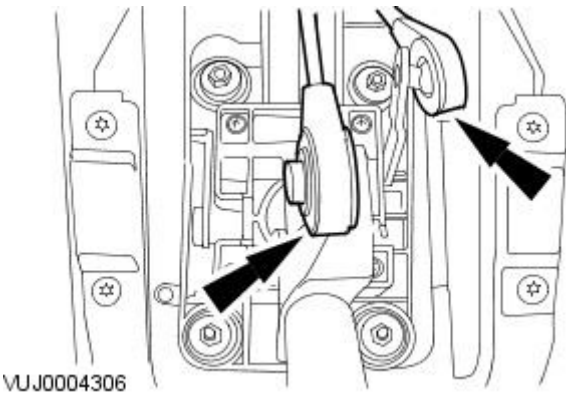
Removal



1. Remove the gearshift lever knob.

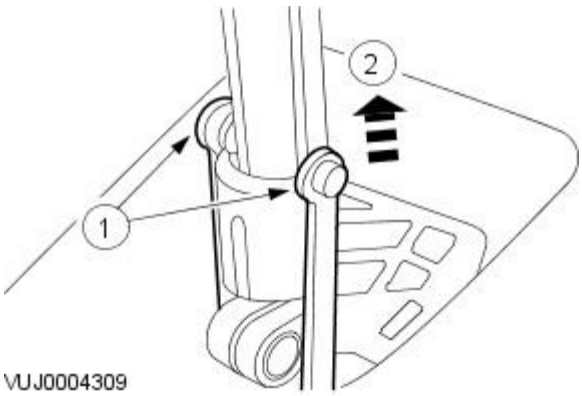


2. Detach the gearshift lever surround.



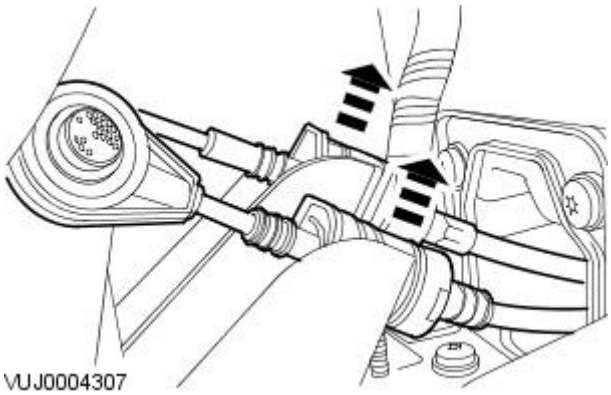
3. NOTE: Press the button to release the cable fitting before disconnecting the cable.

Disconnect the gearshift selector cables.

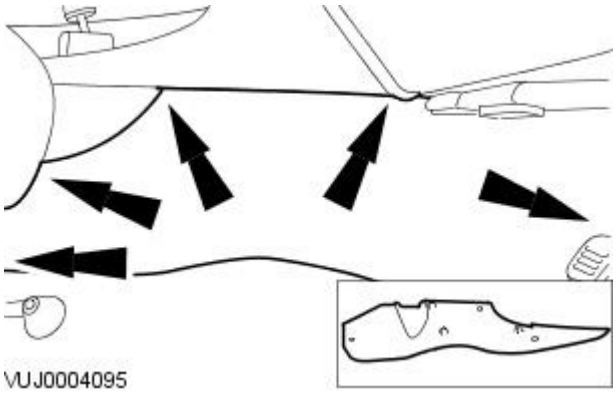


4. Remove the gearshift lever surround.

1. Detach the reverse gear selector rods.
2. Remove the gearshift lever surround.

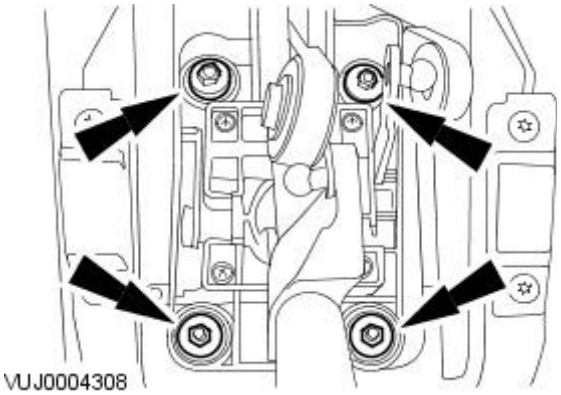


5. Disconnect the gearshift selector cables.



6. NOTE: Right-hand shown, left hand similar.

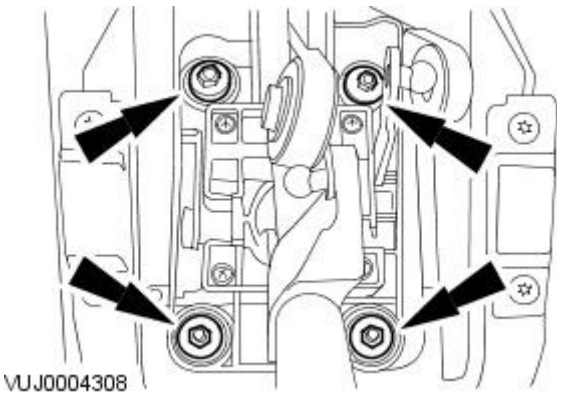
Remove the center console right-hand side trim panel.



7. Remove the gearshift lever.

1. Remove the gearshift lever mounting retaining nuts.
2. Remove the gearshift lever.

Installation



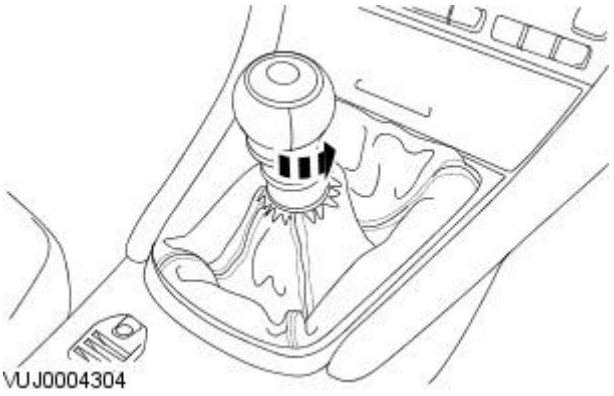
1. Tighten to 60 lb-ft.

Published: 11-May-2011

Manual Transmission / Transaxle External Controls - Gearshift LeverVehicles With: 6-Speed Manual Transaxle - MMT6

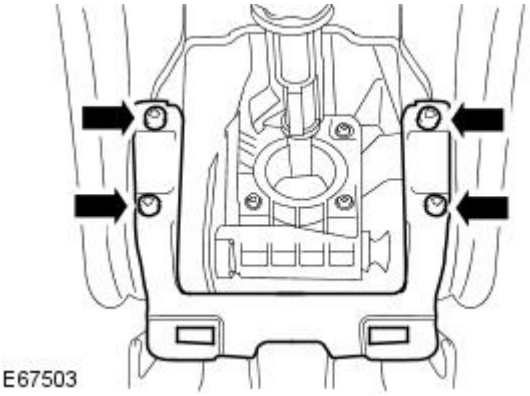
Removal and Installation

Removal



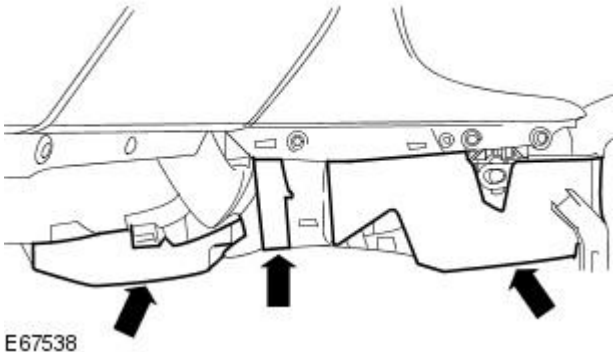
1. Remove the gearshift lever knob.
   - Remove the gearshift lever spring.

2. Remove the restraints control module (RCM).
   For additional information, refer to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
3. Remove the floor console mounting bracket.

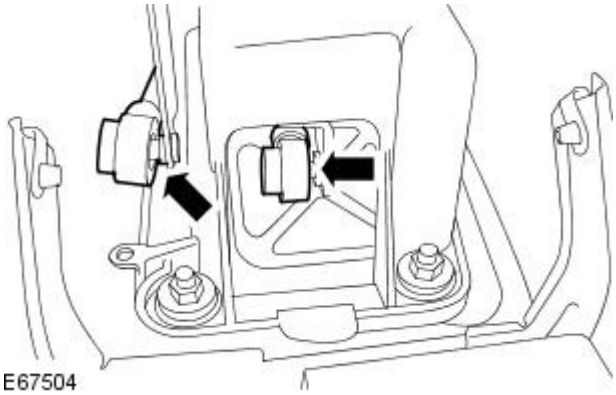


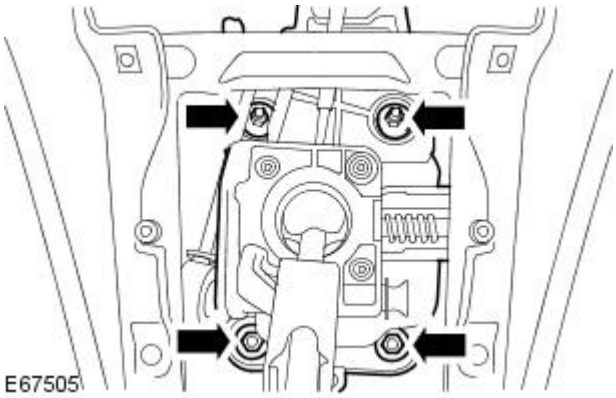
4. NOTE: Left -hand shown, right-hand similar.

   Remove the floor console sound absorbing foam.



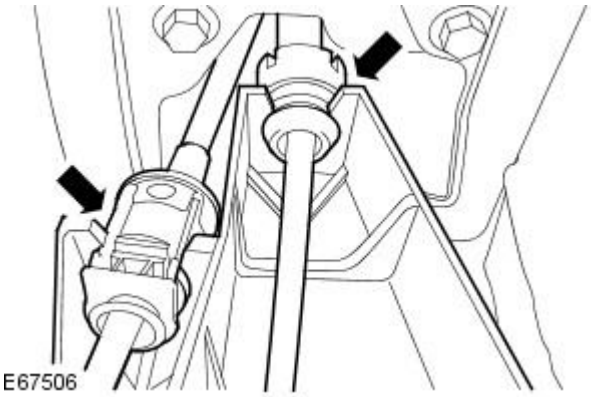
5. Disconnect the gearshift selector cables.





6. Detach the gearshift lever assembly to allow access to the gearshift cables.

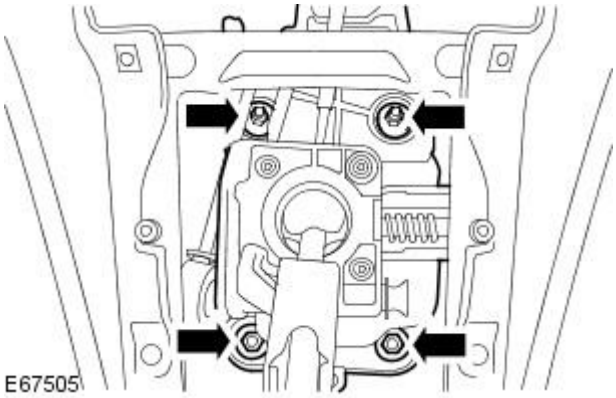
- Remove the retaining nuts.



7. Disconnect the gearshift cables.

- Remove the gearshift lever assembly.

Installation



1. Tighten to 10 Nm.

Published: 11-May-2011

Transfer Case -

Capacities

Description	Liters
Transfer case lubricant, drain and refill	0.50

Torque specifications

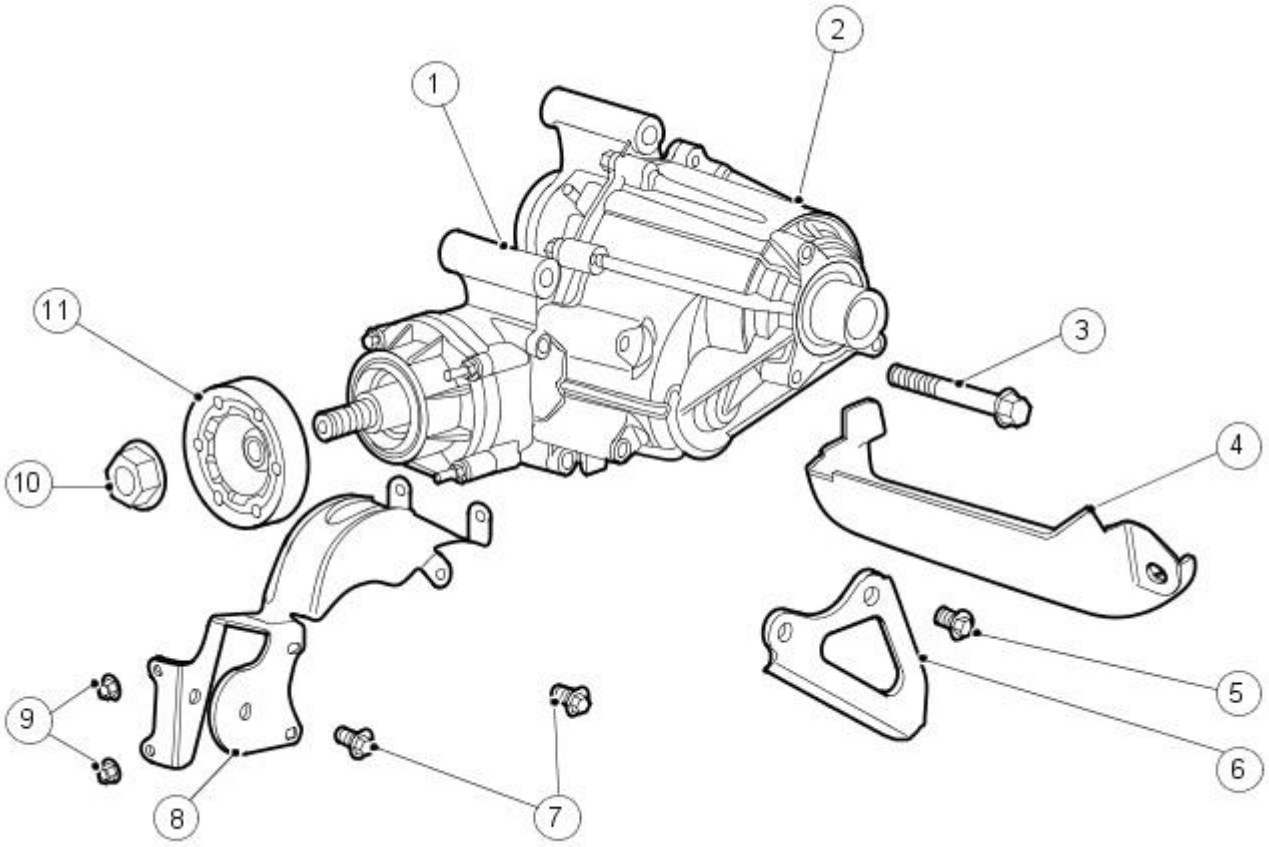
Description	Nm	Lb - ft	Lb - in
M8 pinion housing studs	35	26	-
M8 pinion housing bolts	35	26	-
Engine anti-roll restrictor mounting bracket top retaining bolts	55	41	-
Engine anti-roll restrictor mounting bracket side retaining bolts	35	26	-
Engine anti-roll restrictor mounting bracket bottom retaining nuts	35	26	-
Engine anti-roll restrictor mount retaining bolt	55	41	-
Transfer case support bracket top retaining bolts	25	18	-
Transfer case support bracket bottom retaining bolt	47	35	-
Transfer case retaining bolts*	80	59	-
Transfer case fill plug	20	15	-
Exhaust front pipe retaining clamp	55	41	-
Catalytic converter to catalytic converter mount bracket retaining bolts	25	18	-
Shock absorber and spring assembly securing nuts	25	18	-

*On vehicles prior to VIN J25640, if you are re-using fixings, tighten to 90 Nm.

Published: 11-May-2011

Transfer Case - Transfer Case

Description and Operation



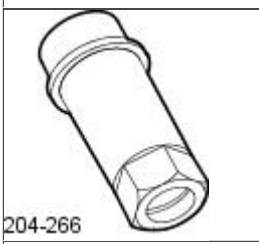
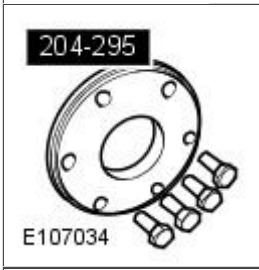
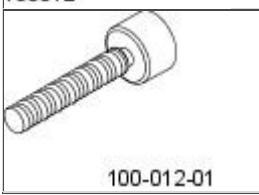
E30054

Item	Part Number	Description
1	—	Transfer case
2	—	Transfer case fill plug
3	—	Transfer case retaining bolt
4	—	Transfer case air cooling duct
5	—	Transfer case Y bracket retaining bolt
6	—	Transfer case Y bracket
7	—	Engine anti-roll restrictor mounting bracket retaining bolts
8	—	Engine anti-roll restrictor mounting bracket
9	—	Engine anti-roll restrictor mounting bracket retaining nuts
10	—	Companion flange retaining nut
11	—	Companion flange

The transfer case system consists of a power transfer unit, rear driveshaft, coupling device and rear axle. The power transfer unit is a gearbox that attaches to the transaxle. The right hand halfshaft engages to the transfer case link shaft which engages to the differential side gears as in a normal 4x2 application. The transfer case provides power to the driveshaft through a helical gear spline coupled to the transaxle differential case, a helical gear drop (idler gear) and hypoid/helical ring gear assembly and pinion set. Repair of the transfer case is limited to seals and gaskets. If any of the geared components, tappered roller bearings, case cover or internal shafts fail, a new transfer case must be installed. The transfer case is sealed from the transaxle and has its own sump. The transfer case uses SAE 75W140 synthetic gear lubricant. The fill plug is located on the top of the transfer case, under the engine anti roll restrictor mounting bracket.

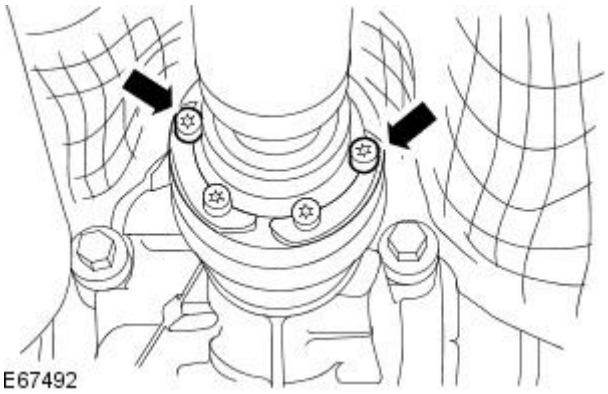
Transfer Case - Transfer Case Draining and Filling

General Procedures

Special Tool(s)	
	Flange holding tool 205-053
	Flange remover/installer 204-068A
	Flange remover/installer boss 204-266
	Flange remover/installer 204-295
	Seal extractor 308-375
	Slide hammer 100-012
	Slide hammer adapter 100-012-01

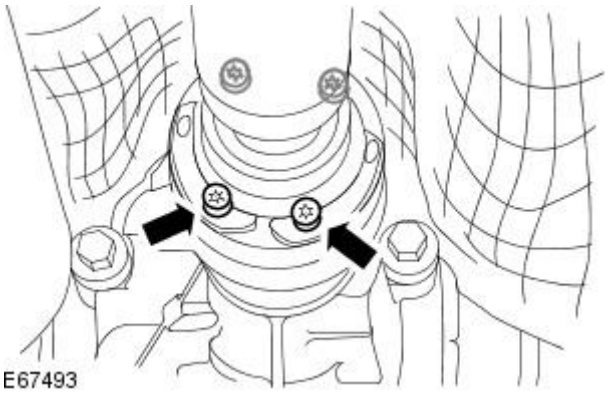
1. WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.



2. NOTE: Mark the position of the driveshaft in relation to the drive pinion flange.

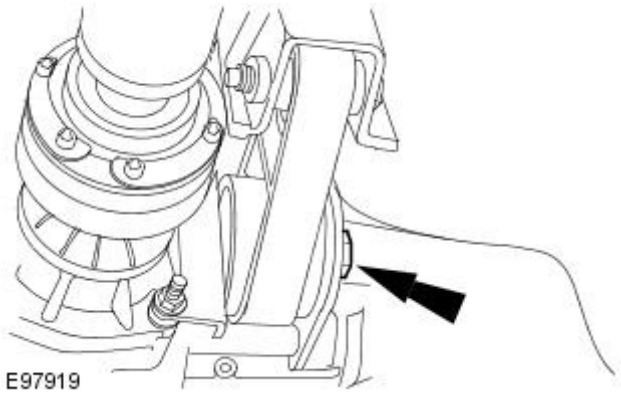
Remove two opposing driveshaft universal joint retaining bolts.



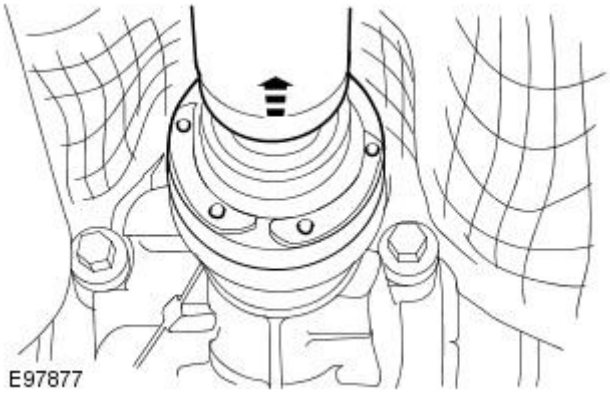
3. Loosen the remaining driveshaft universal joint retaining bolts.

4. Detach the engine roll restrictor.

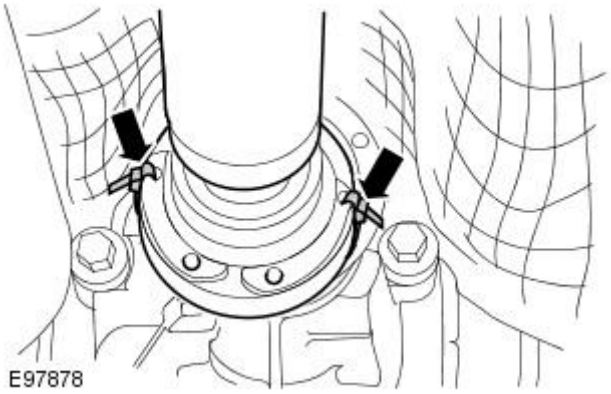
- Remove the engine roll restrictor retaining bolt.



5. Detach the driveshaft from drive pinion flange.

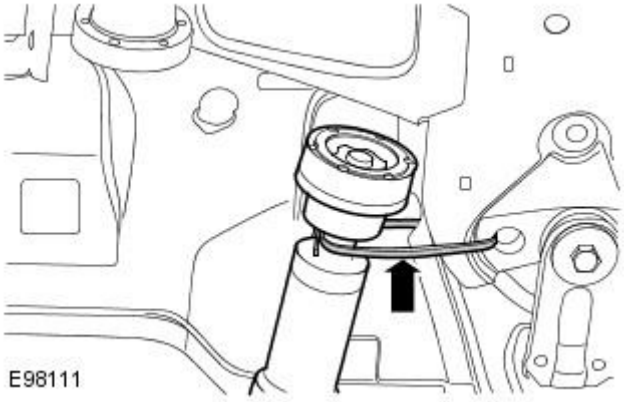


6. Using suitable tie straps, secure the outer casing of the driveshaft universal joint.

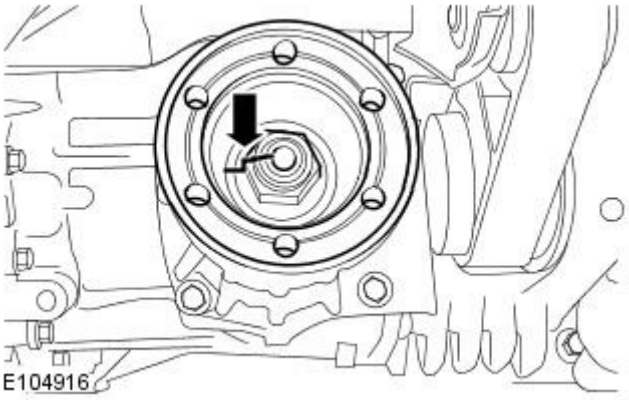


7. CAUTION: Make sure that the driveshaft does not hang on the center universal joint. Failure to follow this instruction may result in damage to the driveshaft.

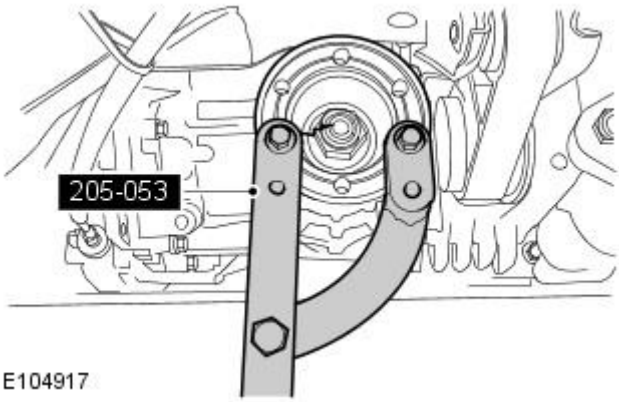
Using suitable tie straps, secure the driveshaft to the subframe.

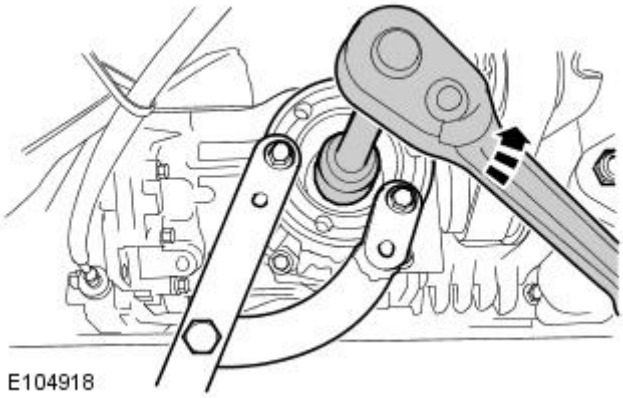


8. Mark the position of the retaining nut in relation to the companion flange and the companion flange in relation to the output shaft.



9. Install the special tool to the companion flange.





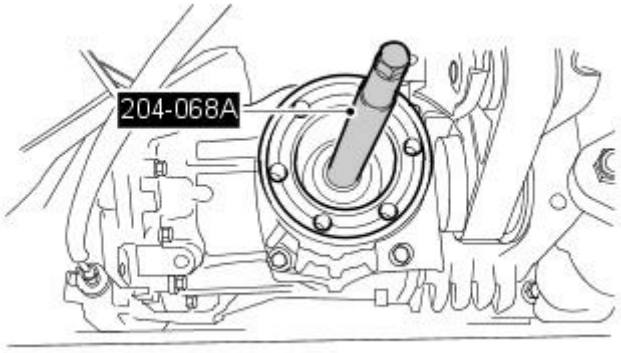
E104918

10. NOTE: Make a note of the complete number of turns required to remove the companion flange retaining nut.

• NOTE: Make a note of the number of degrees past the last complete rotation required to remove the companion flange retaining nut.

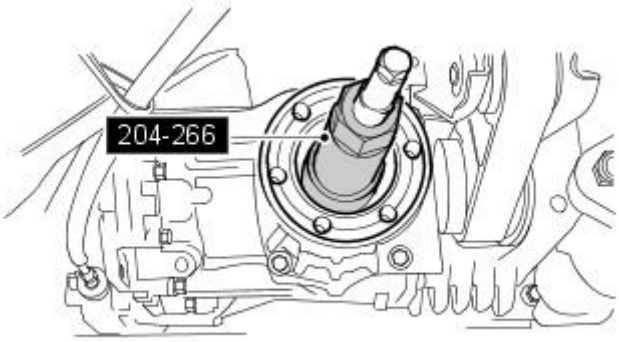
Remove the companion flange retaining nut.

11. Install the special tool to the output shaft.



E104919

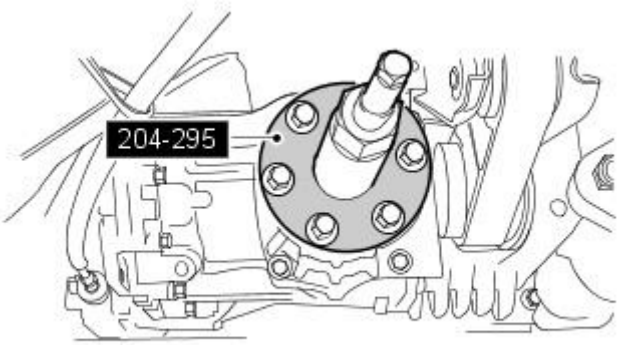
12. Install special tool 204-266 to special tool 204-068A.



E104920

13. Install the special tool to the companion flange.

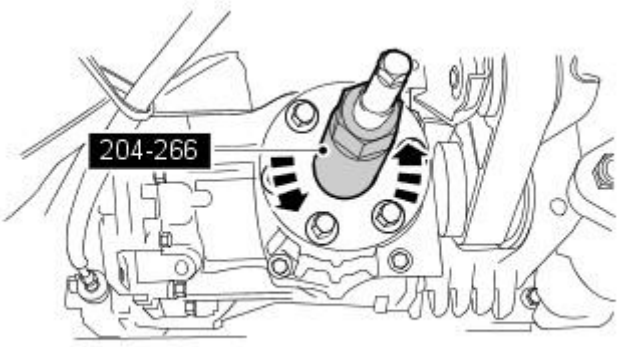
- Install the six retaining bolts.



E104921

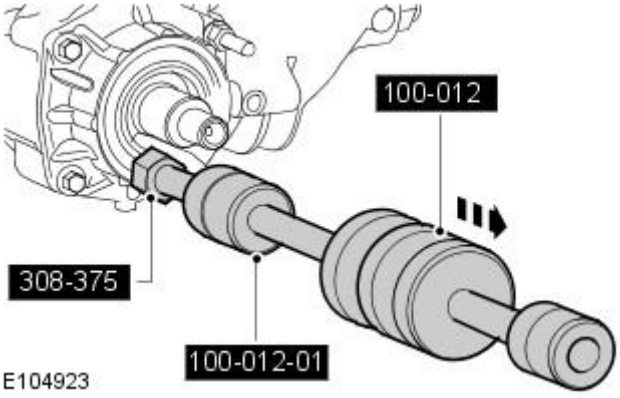
14. Remove the companion flange.

- Rotate the special tool counter-clockwise.



E104922

15. Using the special tools remove the pinion oil seal.

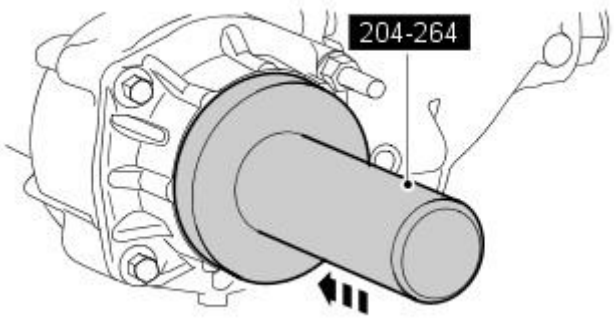


E104923

16. NOTE: Make sure the vehicle is completely level when draining the transfer case.

Allow the oil to fully drain into a suitable container.

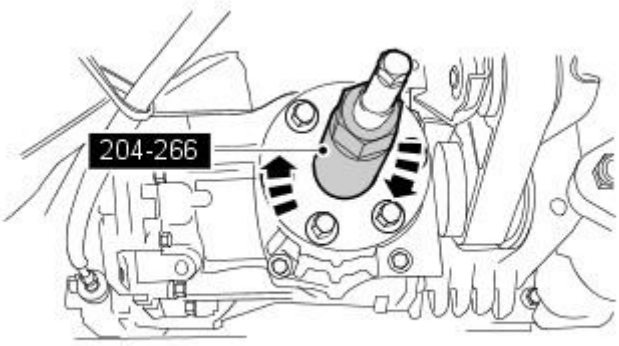
17. Using the special tool 204-264 fully seat the new oil seal.



E104924

18. Install the companion flange to the output shaft.

- Lubricate the companion flange splines with SAE 75W140 lubricant.
- Install the companion flange making sure that the flange and output shaft marks are aligned.
- Install special tool 204-295 to the companion flange.
- Install special tool 204-266.
- Using the special tools install the companion flange to the output shaft by 10mm.

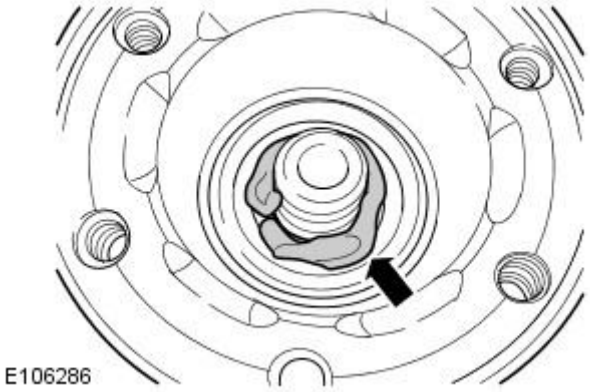


E104926

19. Remove the special tools.

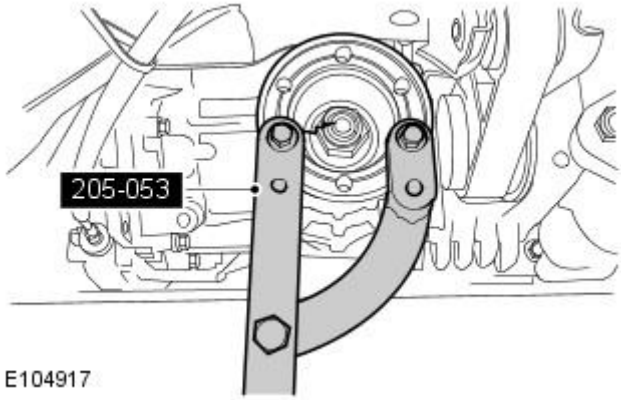
20. Using a suitable solvent/cleaner, remove all traces of oil from the transfer case rear output flange and exposed threads of the output shaft.

21. Apply sealant (C2S 12099) to the area of transfer case rear output flange where securing nut seats.



E106286

22. Install the special tool to the companion flange.



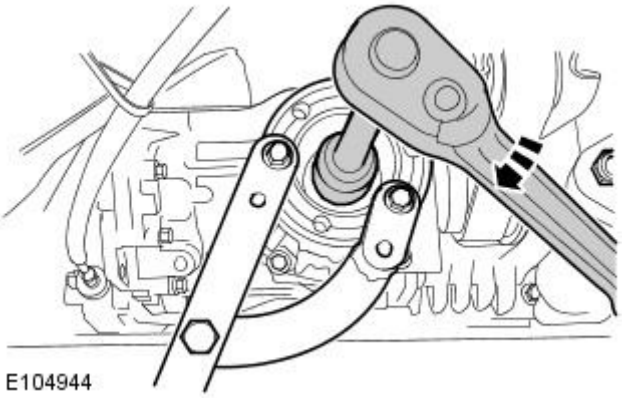
E104917

23. Apply sealant (C2S 12099) to the mating face of the transfer case rear output flange securing nut.

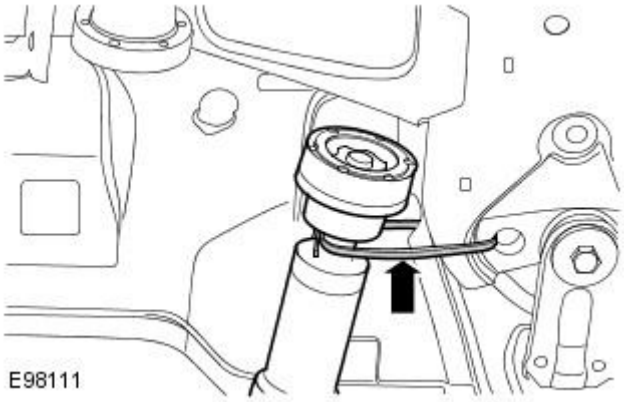
E106287

24. Install the companion flange securing nut.

- Start the nut at the noted number of degrees before the start of the first full rotation.
- Tighten to the noted full number of rotations.
- Make sure that the original marks between the companion flange, securing nut and output shaft are aligned.

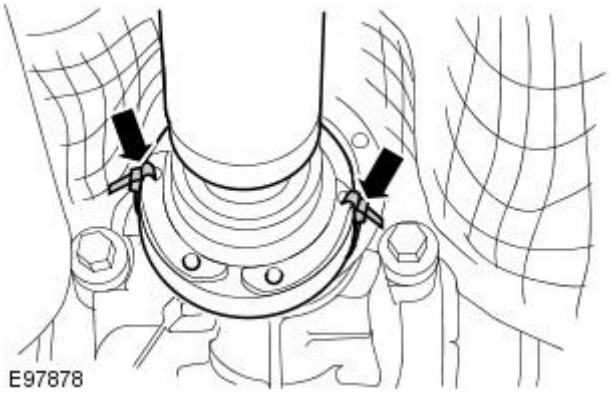


E104944

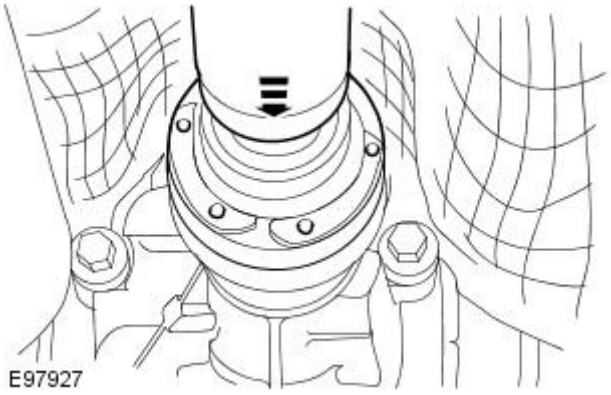


25. CAUTION: Make sure that the driveshaft does not hang on the center universal joint. Failure to follow this instruction may result in damage to the driveshaft.

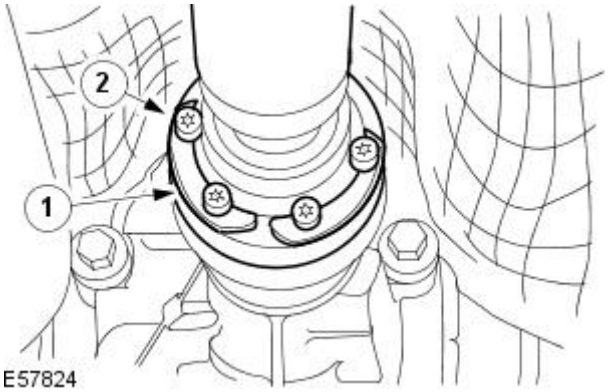
Cut and remove the tie straps securing the outer casing of the driveshaft universal joint.



26. Cut and remove the tie straps securing the outer casing of the driveshaft universal joint.



27. Connect the driveshaft to the transfer case.



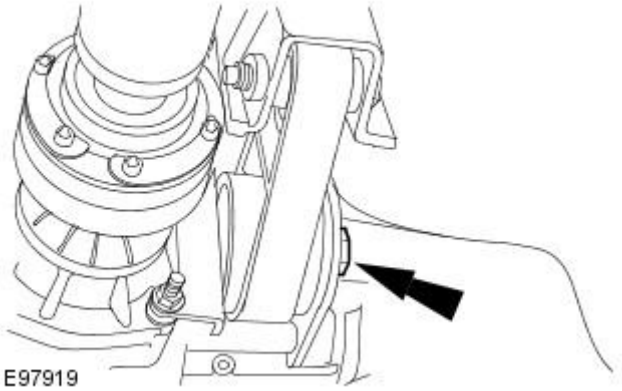
28. Attach the driveshaft universal joint.

1. Attach the driveshaft universal joint.
2. Install new driveshaft retaining bolts.

- Tighten to 44 Nm.

29. Attach the engine roll restrictor.

- Tighten to 80 Nm.


E97919

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

• NOTE: The lower lip of the sill must be 540mm from the floor.

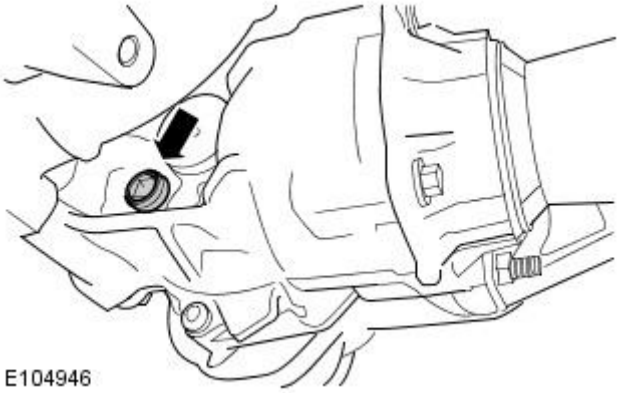
Raise and support the left hand side of the vehicle.

- Remove the vehicle from the lift.
- Raise the vehicle using two jacks.


E104945

31. Fill the transfer case with 400ml of oil.

- Tighten the filler plug to 20Nm.


E104946

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Transfer Case - Halfshaft Seal RH

In-vehicle Repair

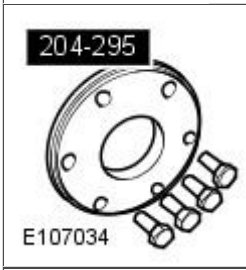
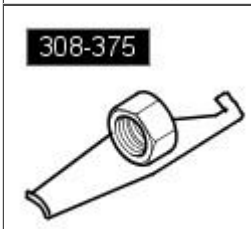
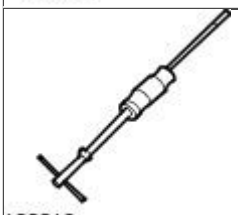
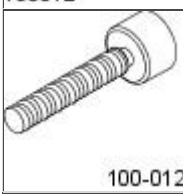
Removal

1. Remove the right-hand halfshaft seal.
   For additional information, refer to Transfer Case in this section.

Published: 11-May-2011

Transfer Case - Transfer Case Rear Output Shaft Seal

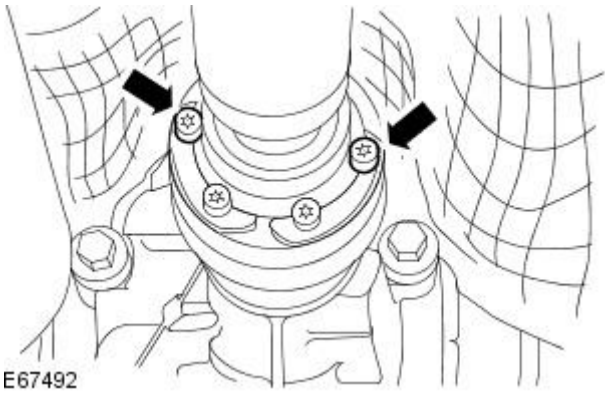
In-vehicle Repair

Special Tool(s)	
	Flange holding tool 205-053
	Flange remover/installer 204-068A
	Flange remover/installer boss 204-266
	Flange remover/installer 204-295
	Seal extractor 308-375
	Slide hammer 100-012
	Slide hammer adapter 100-012-01

Removal

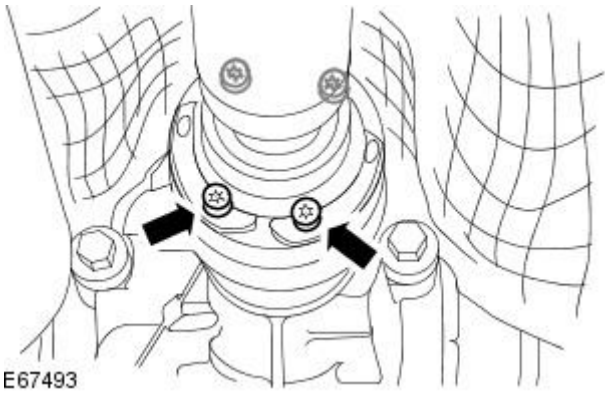
1. WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.



2. NOTE: Mark the position of the driveshaft in relation to the drive pinion flange.

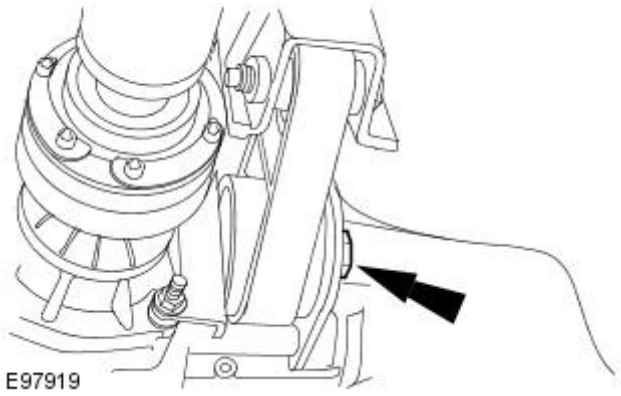
Remove two opposing driveshaft universal joint retaining bolts.



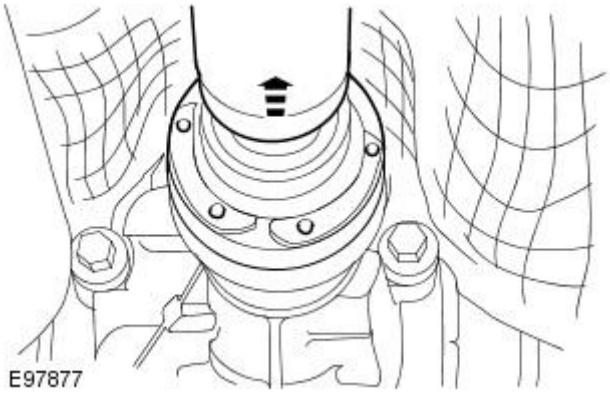
3. Loosen the remaining driveshaft universal joint retaining bolts.

4. Detach the engine roll restrictor.

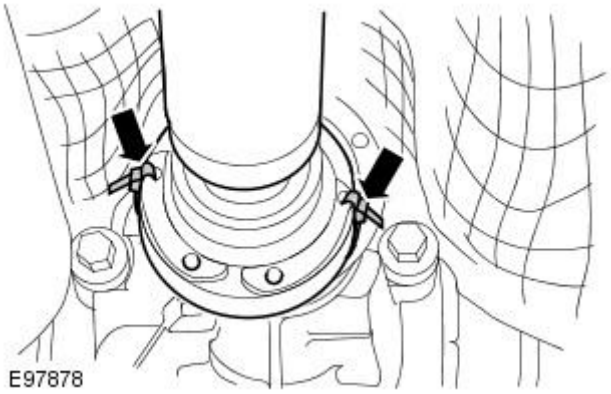
- Remove the engine roll restrictor retaining bolt.



5. Detach the driveshaft from drive pinion flange.

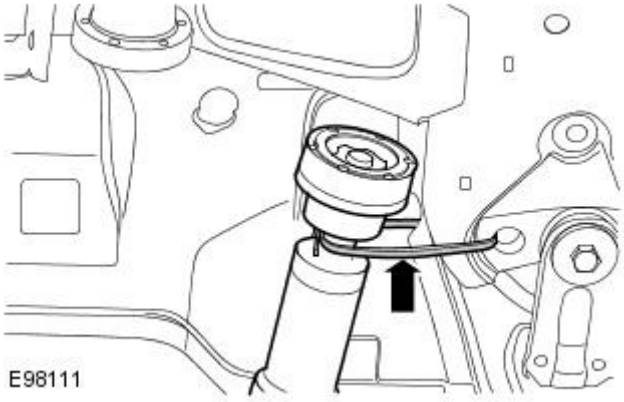


6. Using suitable tie straps, secure the outer casing of the driveshaft universal joint.

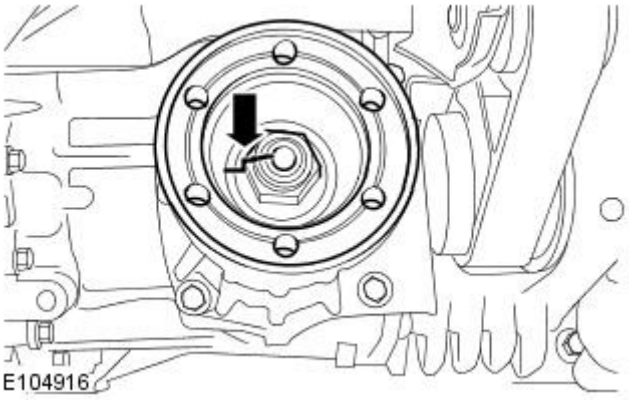


7. CAUTION: Make sure that the driveshaft does not hang on the center universal joint. Failure to follow this instruction may result in damage to the driveshaft.

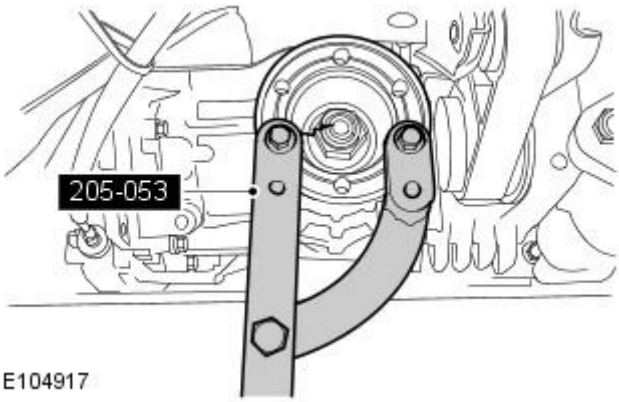
Using suitable tie straps, secure the driveshaft to the subframe.



8. Mark the position of the retaining nut in relation to the companion flange and the companion flange in relation to the output shaft.



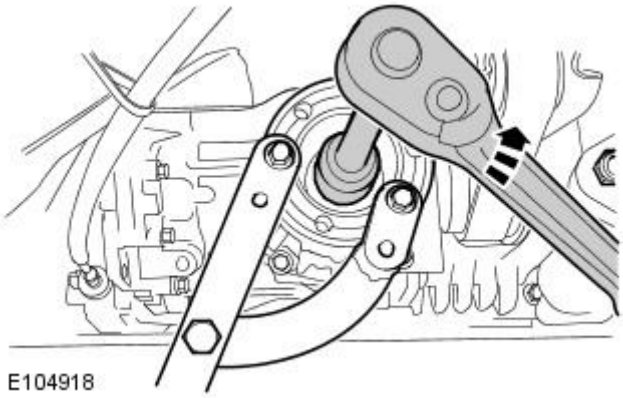
9. Install the special tool to the companion flange.



10. NOTE: Make a note of the complete number of turns required to remove the companion flange retaining nut.

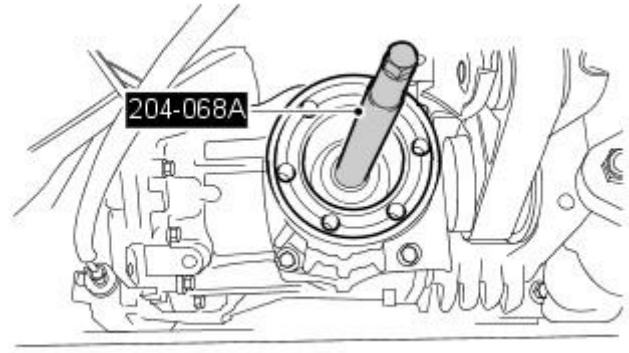
• NOTE: Make a note of the number of degrees past the last complete rotation required to remove the companion flange retaining nut.

Remove the companion flange retaining nut.



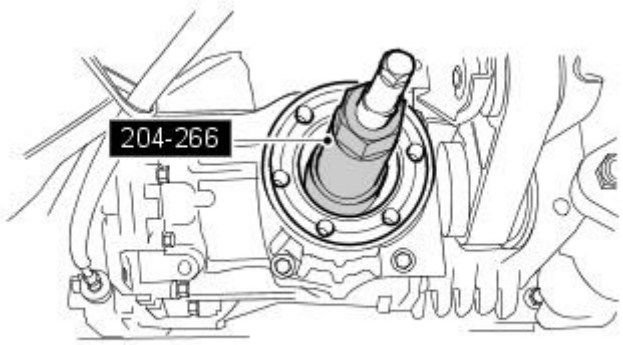
E104918

11. Install the special tool to the output shaft.



E104919

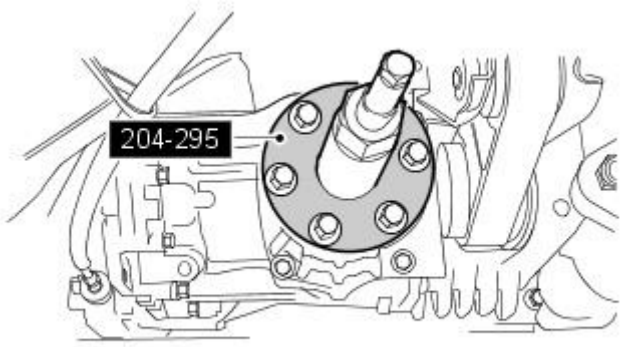
12. Install special tool 204-266 to special tool 204-268A.



E104920

13. Install the special tool to the companion flange.

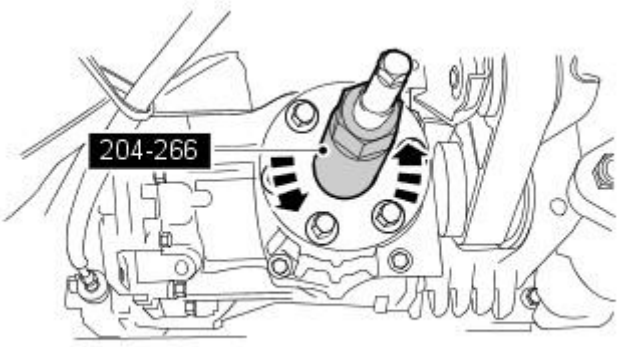
- Install the six retaining bolts.



E104921

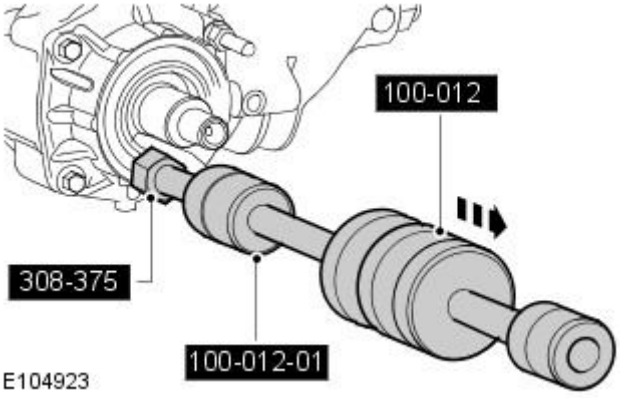
14. Remove the companion flange.

- Rotate the special tool anti-clockwise.



E104922

15. Using the special tools remove the pinion oil seal.



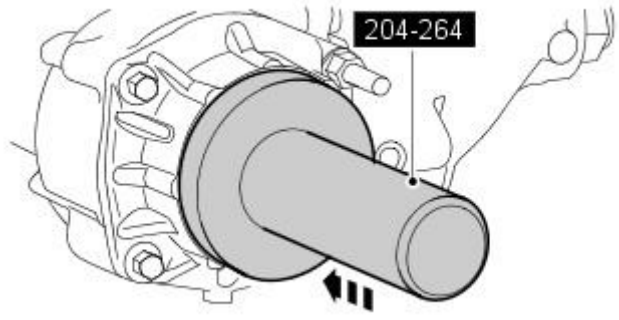
E104923

16. NOTE: Make sure the vehicle is completely level when draining the transfer case.

Allow the oil to fully drain into a suitable container.

Installation

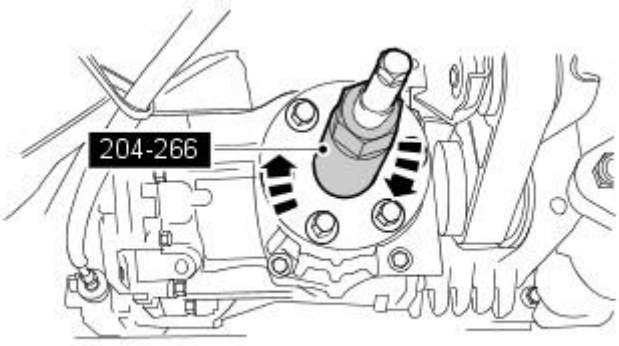
1. Using the special tool 204-268 fully seat the new oil seal.



E104924

2. Install the companion flange to the output shaft.

- Lubricate the companion flange splines with SAE 75W140 lubricant.
- Install the companion flange making sure that the flange and output shaft marks are aligned.
- Install special tool 204-295 to the companion flange.
- Install special tool 204-266.
- Using the special tools install the companion flange to the output shaft by 10mm.

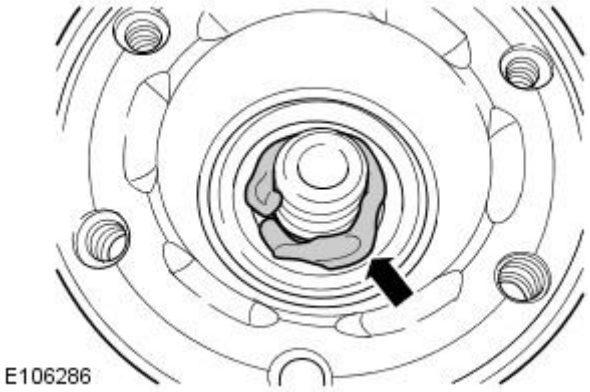


E104926

3. Remove the special tools.

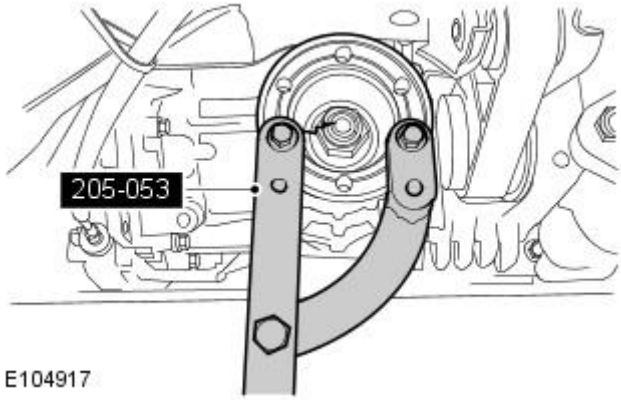
4. Using a suitable solvent/cleaner, remove all traces of oil from the transfer case rear output flange and exposed threads of the output shaft.

5. Apply sealant (C2S 12099) to the area of transfer case rear output flange where securing nut seats.



E106286

6. Install the special tool to the companion flange.



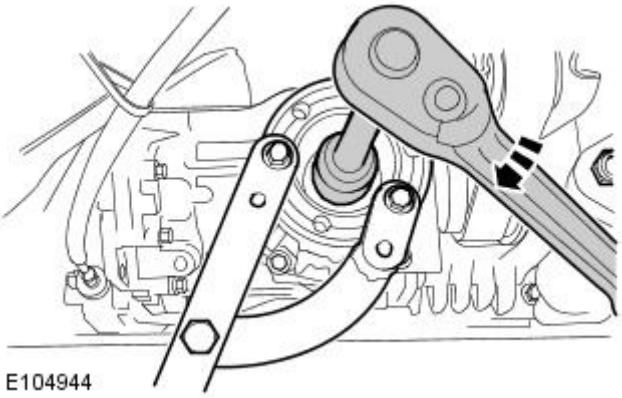
E104917

7. Apply sealant (C2S 12099) to the mating face of the transfer case rear output flange securing nut.

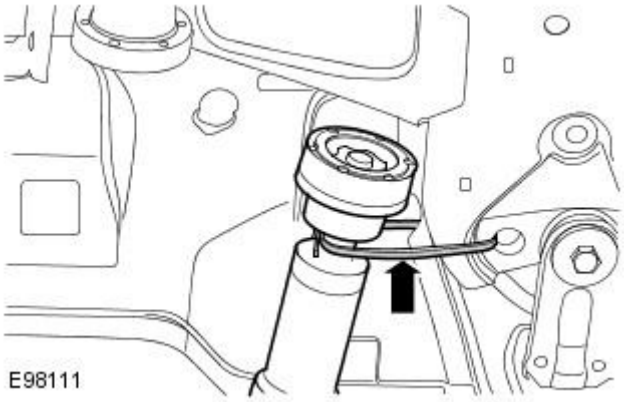
E106287

8. Install the companion flange securing nut.

- Start the nut at the noted number of degrees before the start of the first full rotation.
- Tighten to the noted full number of rotations.
- Make sure that the original marks between the companion flange, securing nut and output shaft are aligned.

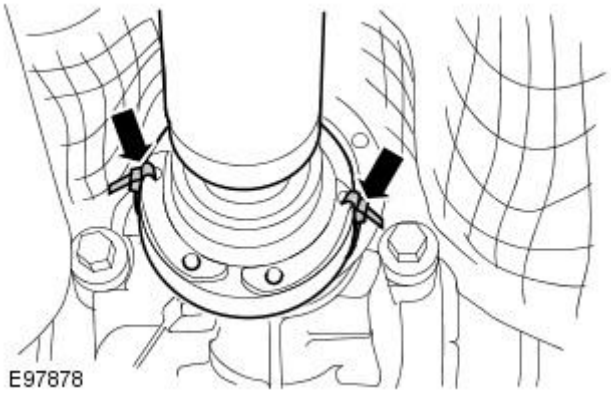


E104944

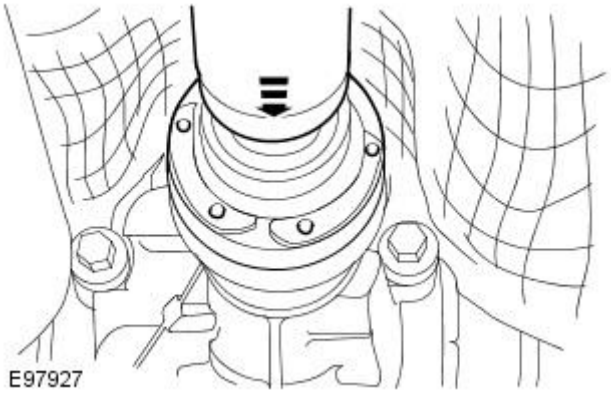


9. CAUTION: Make sure that the driveshaft does not hang on the center universal joint. Failure to follow this instruction may result in damage to the driveshaft.

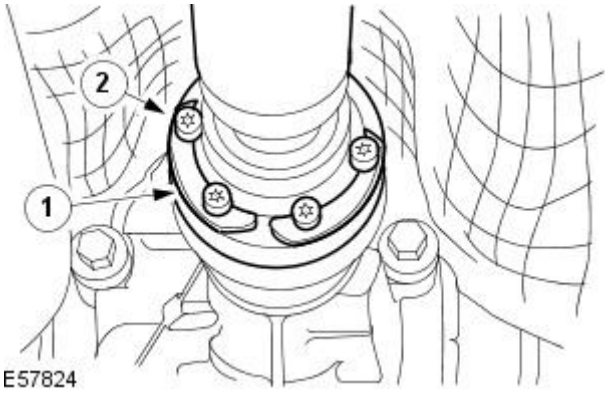
Cut and remove the tie straps securing the outer casing of the driveshaft universal joint.



10. Cut and remove the tie straps securing the outer casing of the driveshaft universal joint.



11. Connect the driveshaft to the transfer case.



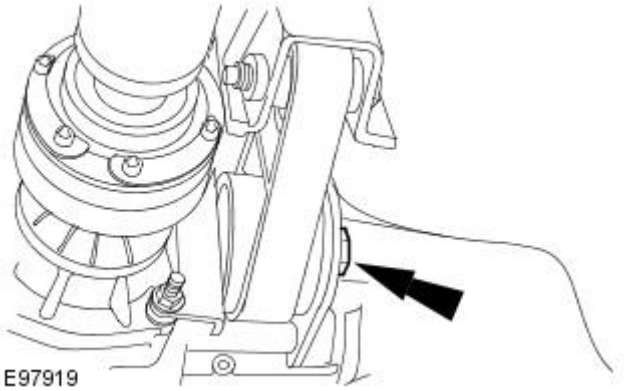
12. Attach the driveshaft universal joint.

1. Attach the driveshaft universal joint.
2. Install new driveshaft retaining bolts.

- Tighten to 44 Nm.

13. Attach the engine roll restrictor.

- Tighten to 80 Nm.


E97919

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

• NOTE: The lower lip of the sill must be 540mm from the floor.

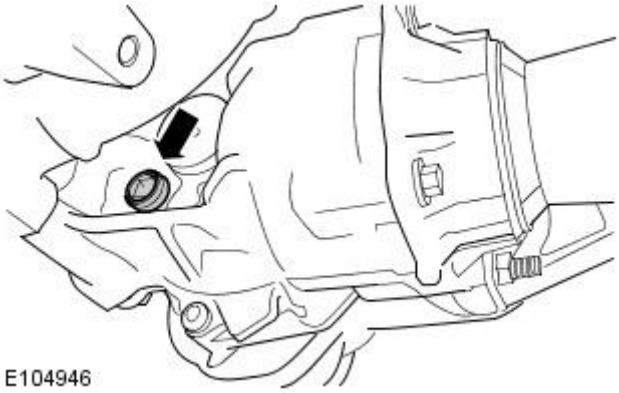
Raise and support the left hand side of the vehicle.

- Remove the vehicle from the lift.
- Raise the vehicle using two jacks.


E104945

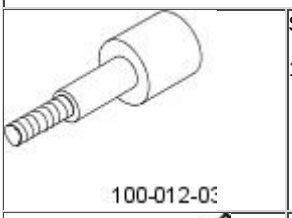
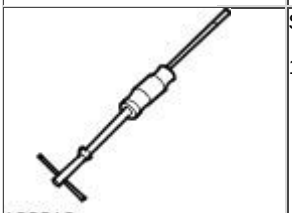
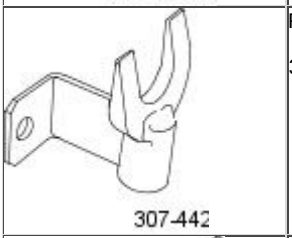
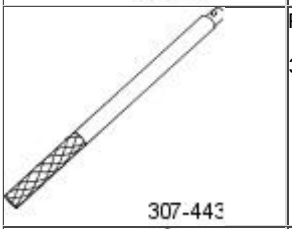
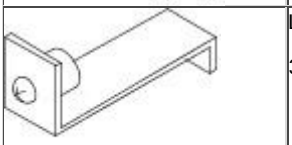
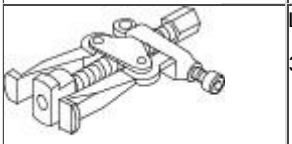
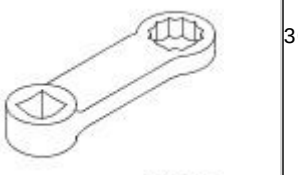
15. Fill the transfer case with 400ml of oil.

- Tighten the filler plug to 20Nm.


E104946

Transfer Case - Transfer Case

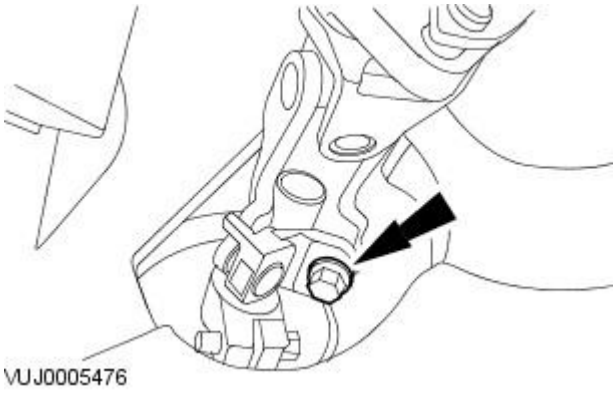
Removal

Special Tool(s)	
 100-012-03	Slide hammer adapter 100-012-03
 100012	Slide hammer 100-012
 100-012-02	100-012-02 Slide hammer shaft
 307-442	Right-hand halfshaft splitter 307-442
 307-443	Right-hand halfshaft splitter handle 307-443
 307-446	Link shaft limiter bracket 307-446
 308-208	Link shaft oil seal remover 308-208
 E46430	Torque adaptor 303-1069

Removal

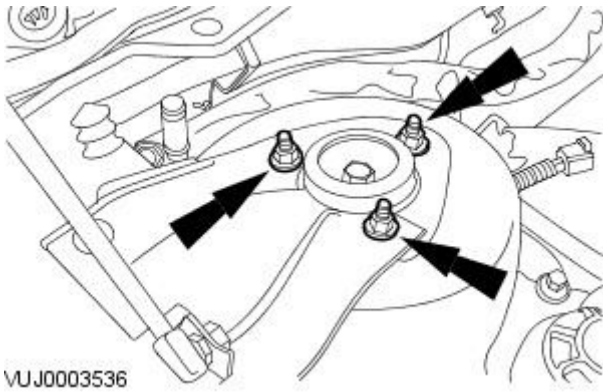
All vehicles

1. Position the front wheels in a straight ahead position and centralize the steering wheel.
   - Lock in position and remove the ignition key.


VUJ0005476

2. Detach the steering column.

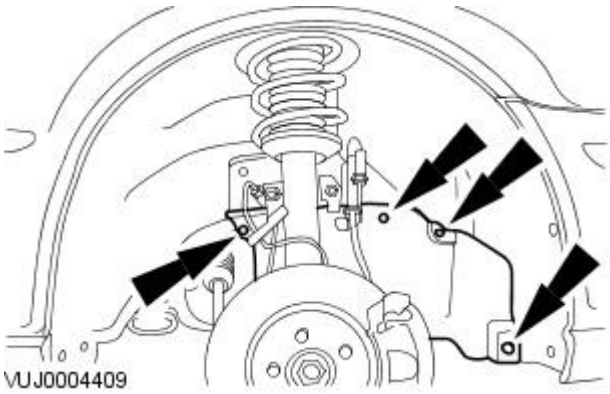
- Remove and discard the steering column lower retaining bolt.


VUJ0003536

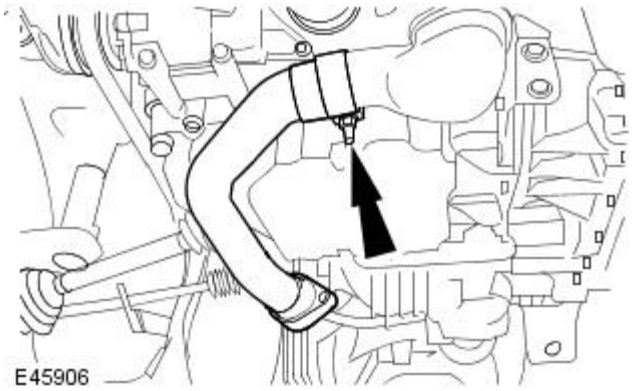
3. Loosen the shock absorber and spring assembly securing nuts.

4. Remove the right-hand front wheel and tire.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

5. Remove the fender splash shield access panel.

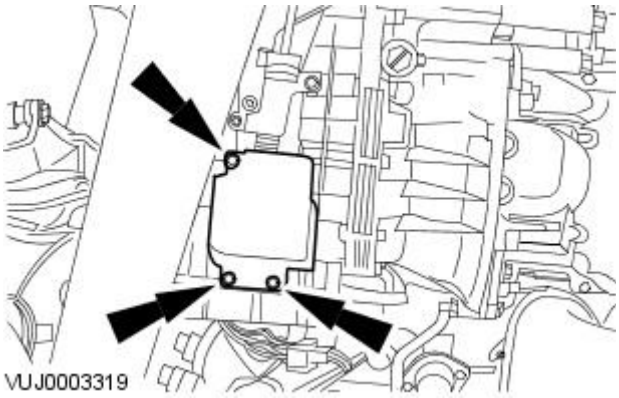

VUJ0004409

6. Remove the front pipe.

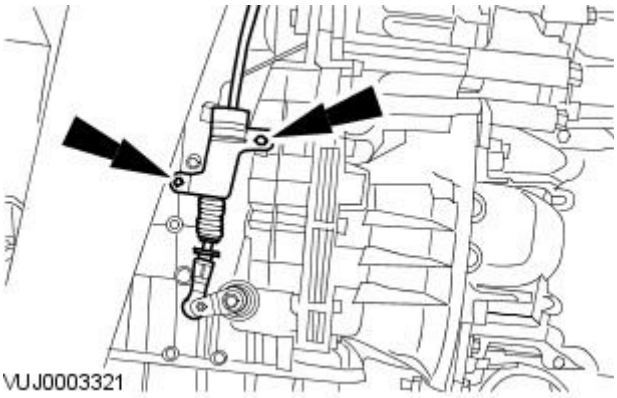

E45906

7. Remove the muffler inlet pipe.
For additional information, refer to: Muffler Inlet Pipe - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (309-00 Exhaust System, Removal and Installation).

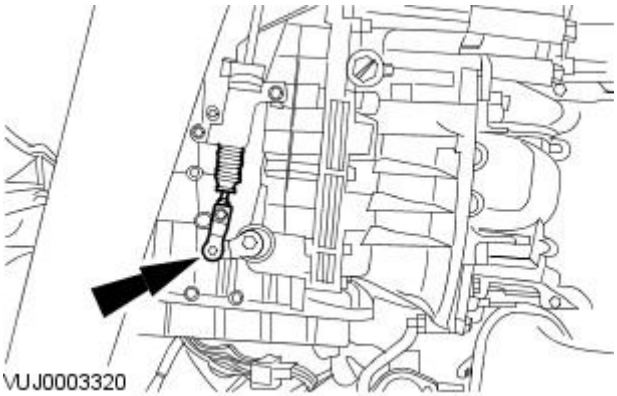
Vehicles with automatic transmission



8. Remove the selector lever cable shield.



9. Detach the selector lever cable bracket.



10. Disconnect the selector lever cable.

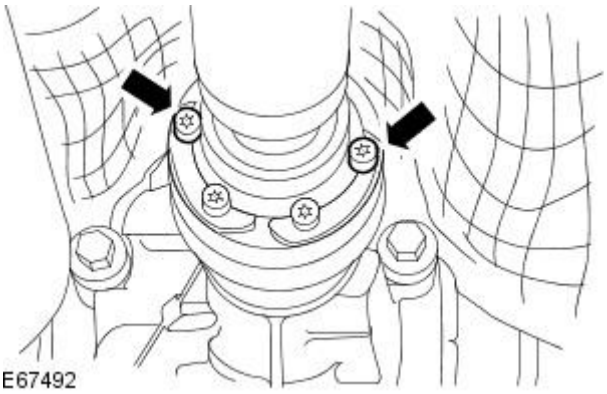
11. Drain the transmission fluid.
For additional information, refer to: Transmission Fluid Drain and Refill (307-01B Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

Vehicles with manual transmission

12. Drain the transmission fluid. For additional information, refer to: (308-03 Manual Transmission/Transaxle)

Transaxle Draining and Filling - Vehicles With: 5-Speed Manual Transmission - MT75 (General Procedures),
Transaxle Draining and Filling - Vehicles With: 5-Speed Manual Transmission - MT75 (General Procedures).

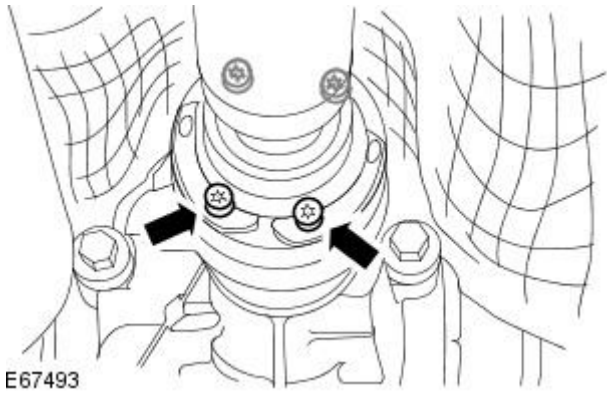
All vehicles



13. NOTE: Mark the position of the driveshaft in relation to the drive pinion flange.

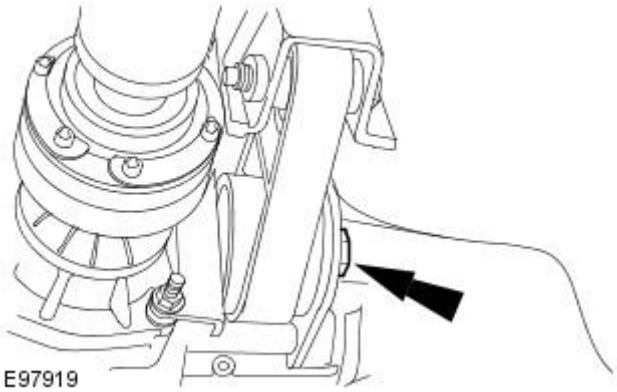
Remove two opposing driveshaft universal joint retaining bolts.

14. Loosen the remaining driveshaft universal joint retaining bolts.



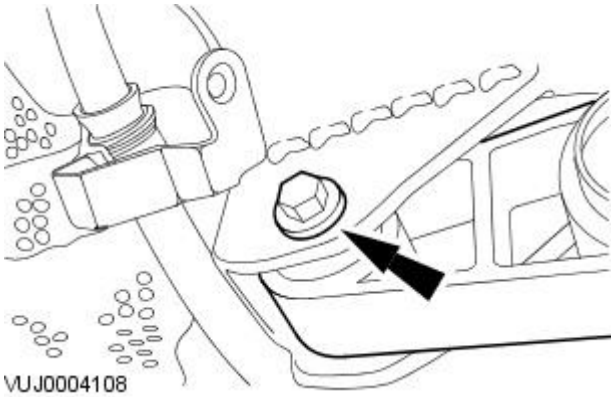
15. Detach the engine roll restrictor.

- Remove the engine roll restrictor retaining bolt.

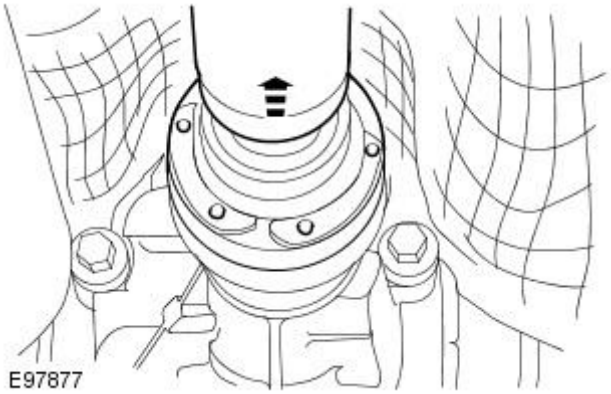


16. Remove the engine roll restrictor.

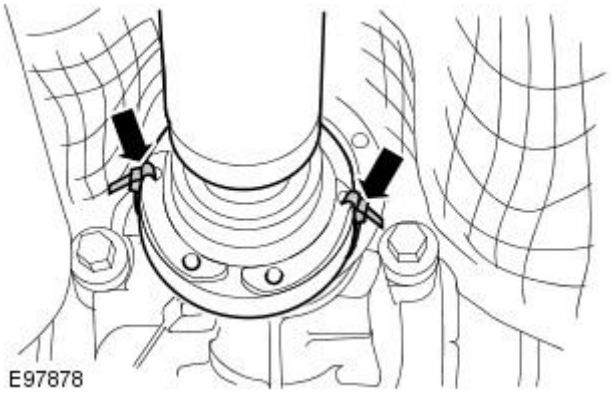
- Remove the engine roll restrictor retaining bolt.



17. Detach the driveshaft from drive pinion flange.

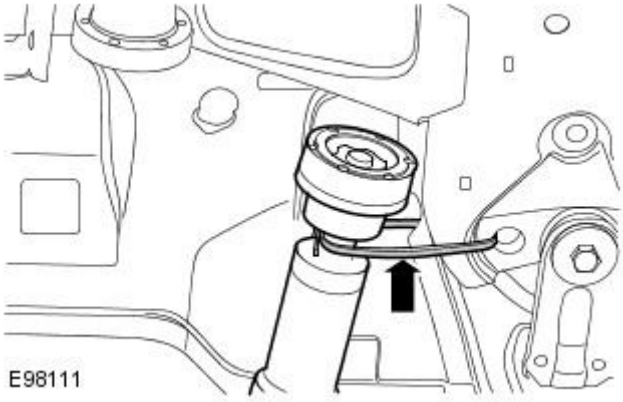


18. Using suitable tie straps, secure the outer casing of the driveshaft universal joint.



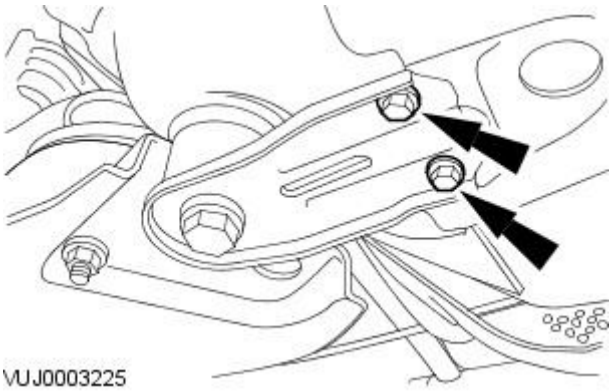
19. CAUTION: Make sure that the driveshaft does not hang on the center universal joint. Failure to follow this instruction may result in damage to the driveshaft.

Using suitable tie straps, secure the driveshaft to the subframe

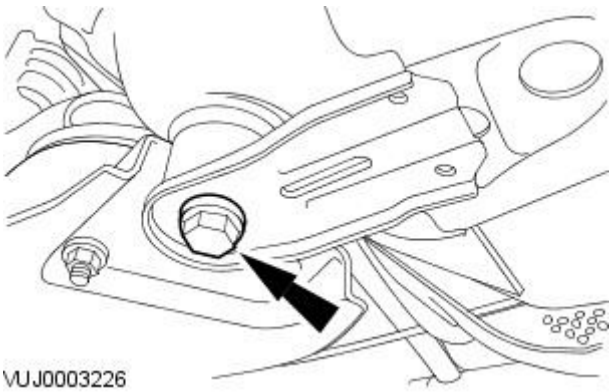


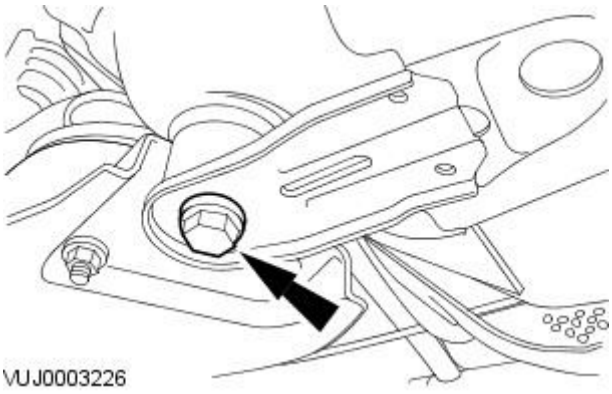
20. NOTE: Left-hand shown, right-hand similar.

Remove the front subframe reinforcement plate retaining bolts.

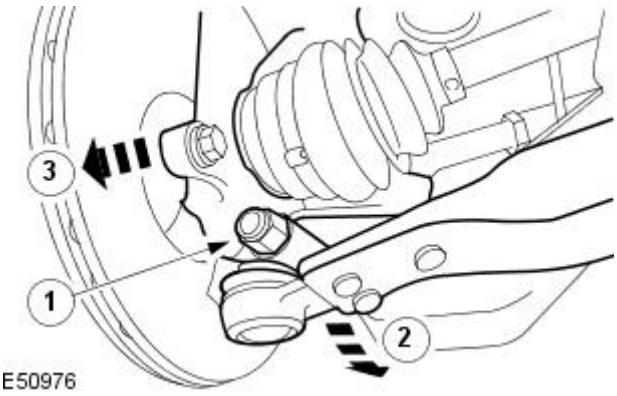


21. Remove the right-hand front subframe rear mount retaining bolt.





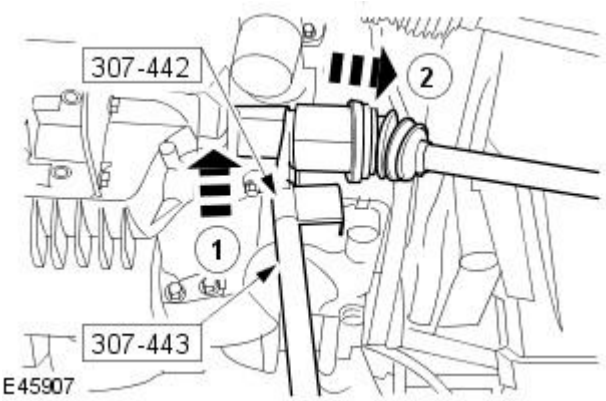
22. Loosen the left-hand front subframe rear mount retaining bolt.



23. CAUTION: Make sure the constant velocity (CV) joint boot is protected. Failure to follow this instruction may result in damage to the CV joint boot.

Detach the lower arm from the wheel knuckle.

1. Remove the lower arm ball joint retaining nut and bolt.
2. Reposition the lower arm.
3. Reposition the wheel knuckle.



24. CAUTIONS:

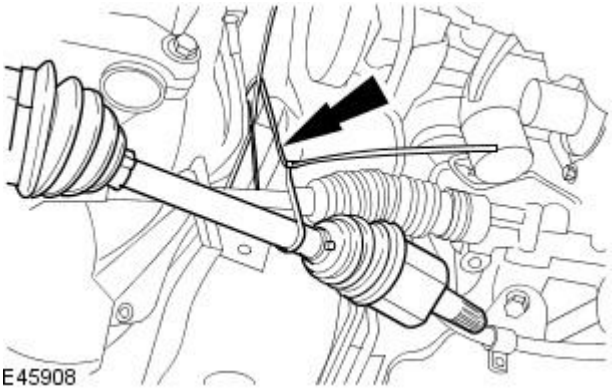
To prevent damage to the transfer box internal seal, make sure that the link shaft is not retracted further than 200 mm (7.87 inches) from the transfer case.

Make sure the halfshaft CV joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

Using the special tools, detach the halfshaft.

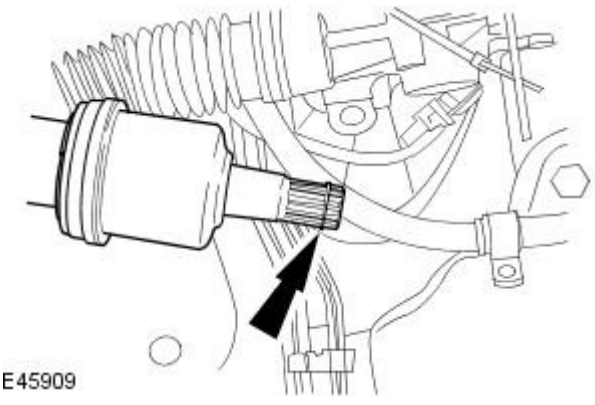
1. Align the special tools to the halfshaft.
2. Detach the halfshaft.

- Remove and discard the halfshaft seal.

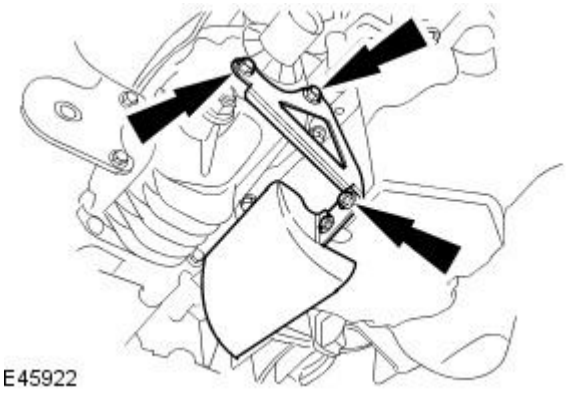


25. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

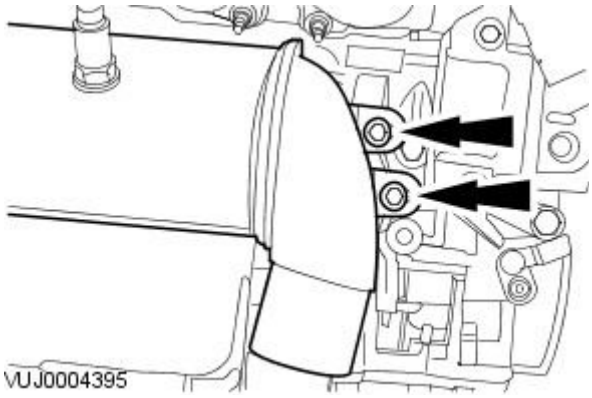
Support the halfshaft.



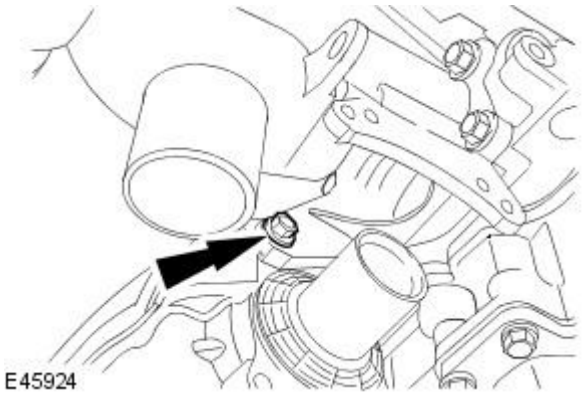
26. Remove and discard the halfshaft snap ring.


E45922

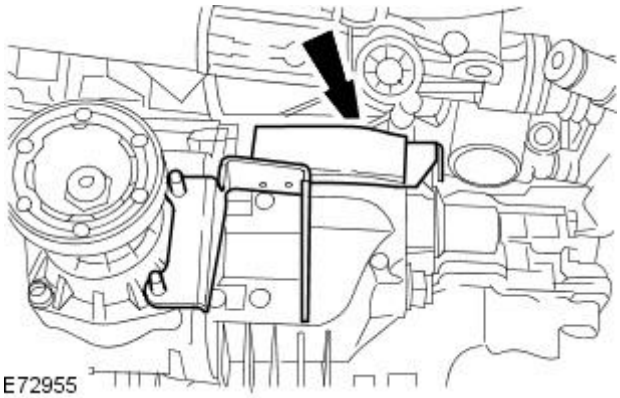
27. Remove the transfer case support bracket.


VUJ0004395

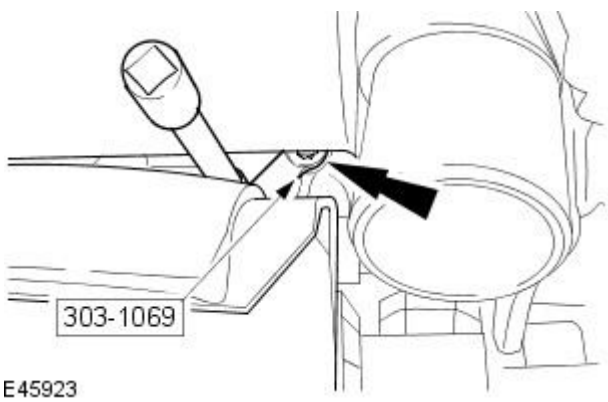
28. Remove the catalytic converter mount bracket retaining bolts.


E45924

29. Remove the catalytic converter mount bracket to transfer case retaining bolt.


E72955

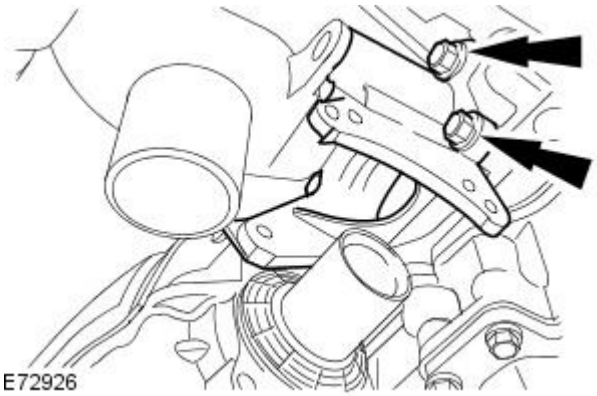
30. Remove the catalytic converter mount bracket retaining bolt.



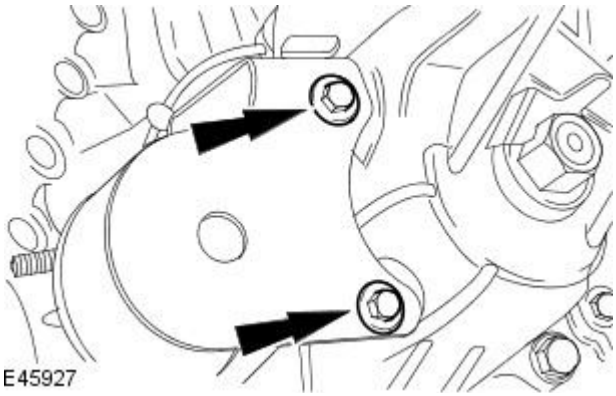
E45923

31. Using the special tool, loosen the catalytic converter mount bracket, top left-hand retaining bolt.

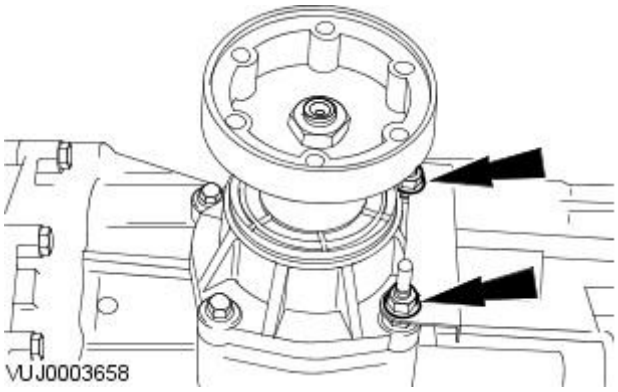
32. Remove the catalytic converter mount bracket.



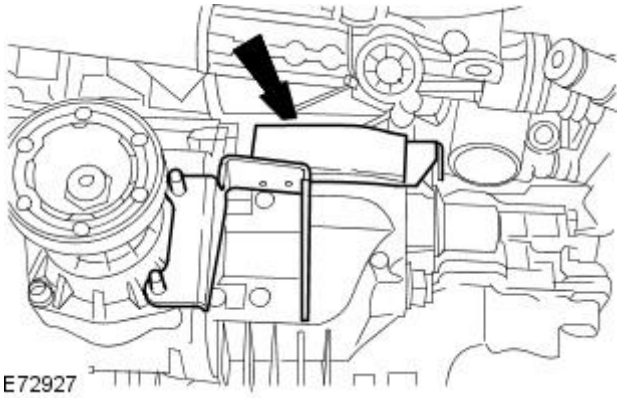
33. Remove the engine anti-roll restrictor bracket retaining bolts.



34. Remove the engine anti-roll restrictor bracket retaining nuts.

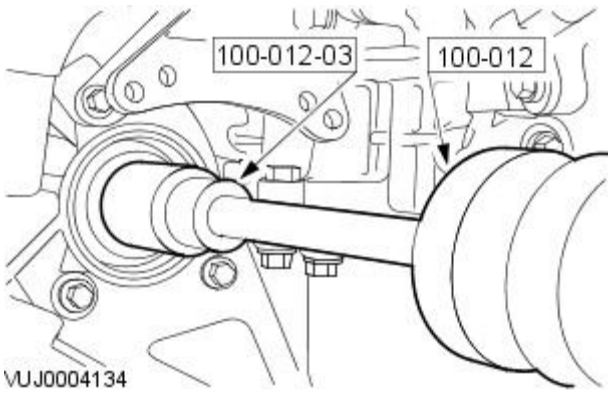


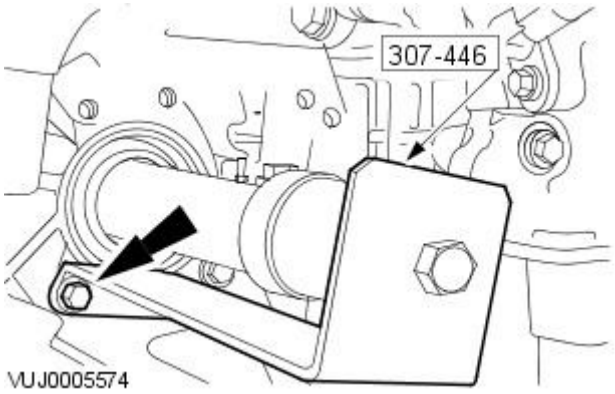
35. Remove the engine anti-roll restrictor bracket.



36. CAUTION: To prevent damage to the transfer box internal seal, make sure that the link shaft is not retracted further than 200 mm (7.87 inches) from the transfer case.

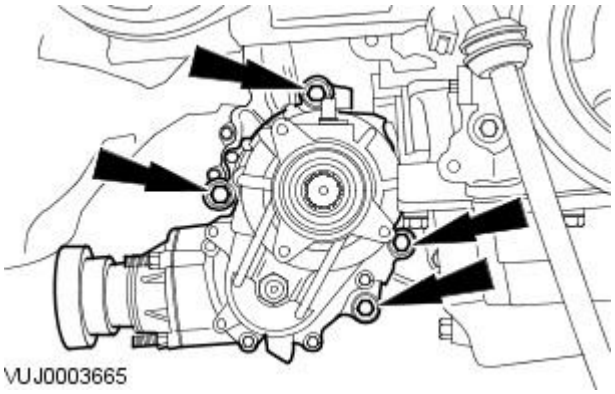
Using the special tools, detach the transfer case link shaft from the transfer case.





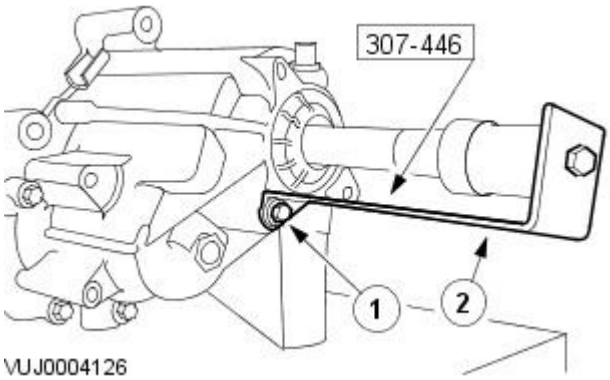
37. CAUTION: To prevent damage to the transfer box internal seal, make sure that the link shaft is not retracted further than 200 mm (7.87 inches) from the transfer case.

Using the special tool, retract the transfer case link shaft.



38. CAUTION: Make sure there is no loss of fluid from the transfer case. Failure to follow this instruction may result in damage to the transfer case.

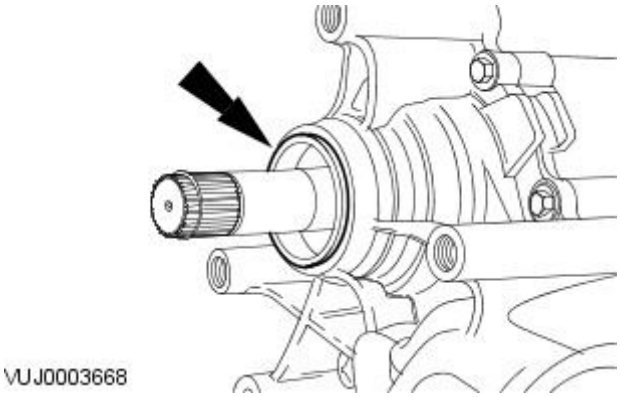
With the aid of an assistant remove the transfer case.



39. CAUTION: Make sure there is no loss of fluid from the transfer case. Failure to follow this instruction may result in damage to the transfer case.

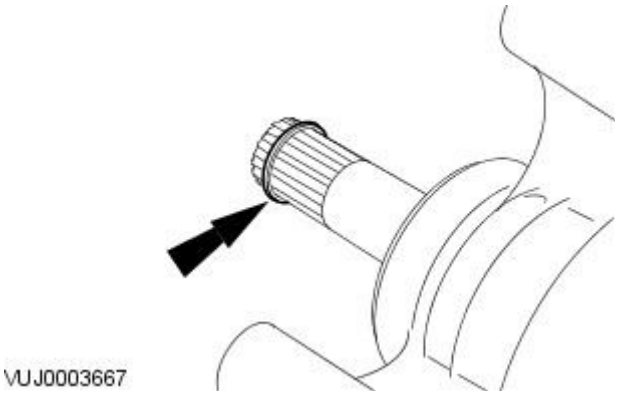
Remove the special tool.

1. Remove the retaining bolt.
2. Remove the special tool.



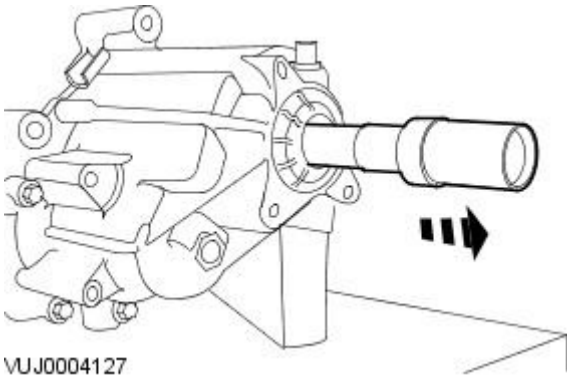
40. CAUTION: Make sure there is no loss of fluid from the transfer case. Failure to follow this instruction may result in damage to the transfer case.

Remove and discard O-ring seal.



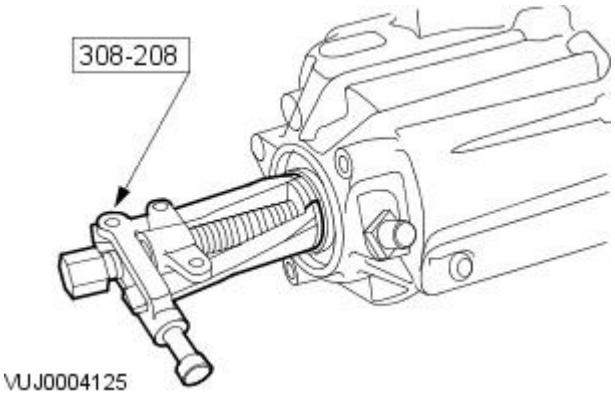
41. CAUTION: Make sure there is no loss of fluid from the transfer case. Failure to follow this instruction may result in damage to the transfer case.

Remove and discard the link shaft snap ring.



42. CAUTION: Make sure there is no loss of fluid from the transfer case. Failure to follow this instruction may result in damage to the transfer case.

Remove the link shaft from the transfer case.

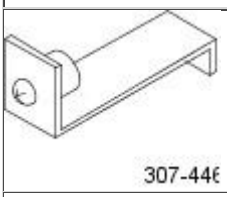
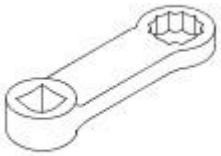
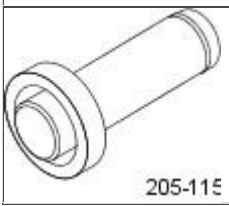


43. CAUTION: Make sure there is no loss of fluid from the transfer case. Failure to follow this instruction may result in damage to the transfer case.

Using the special tool, remove the link shaft seal.

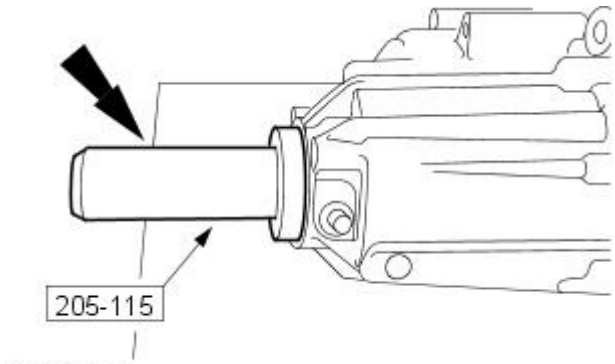
Transfer Case - Transfer Case

Installation

Special Tool(s)	
 307-44	Link shaft limiter bracket 307-446
 E46430	Torque adapter 303-1069
 205-11	Link shaft oil seal installer 205-115

Installation

All vehicles



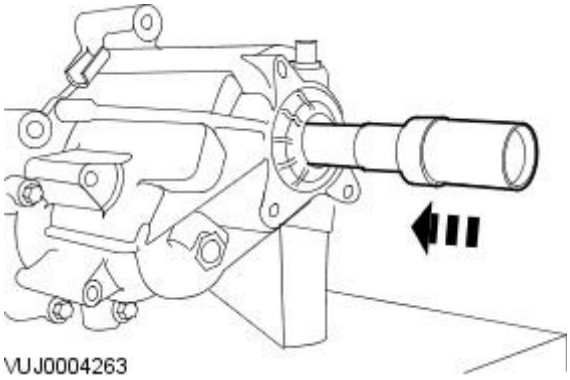
VUJ0004124

1. CAUTION: Make sure there is no loss of fluid from the transfer case. Failure to follow this instruction may result in damage to the transfer case.

• NOTE: Using a suitable solvent clean the seal face on the housing before fitting a new seal.

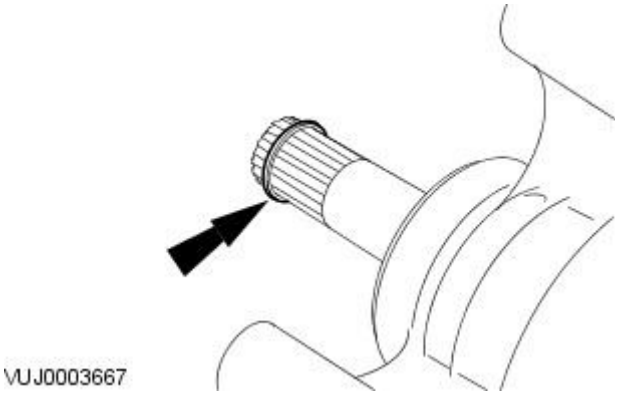
Using the special tool, install the link shaft oil seal.

- If any transfer case fluid is lost during installation carry out drain and refill.
  For additional information, refer to: Transfer Case Draining and Filling (308-07 Transfer Case, General Procedures).


VUJ0004263

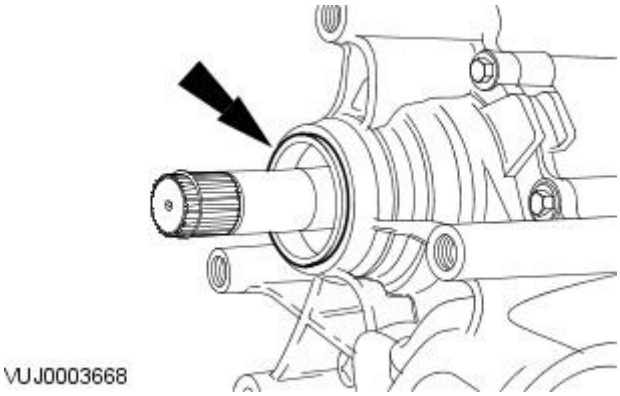
2. CAUTION: Make sure there is no loss of fluid from the transfer case. Failure to follow this instruction may result in damage to the transfer case.

Install the link shaft into the transfer case.


VUJ0003667

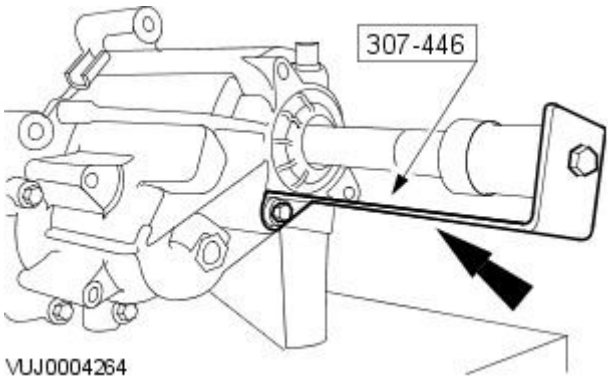
3. CAUTION: Make sure there is no loss of fluid from the transfer case. Failure to follow this instruction may result in damage to the transfer case.

Install a new link shaft snap ring.



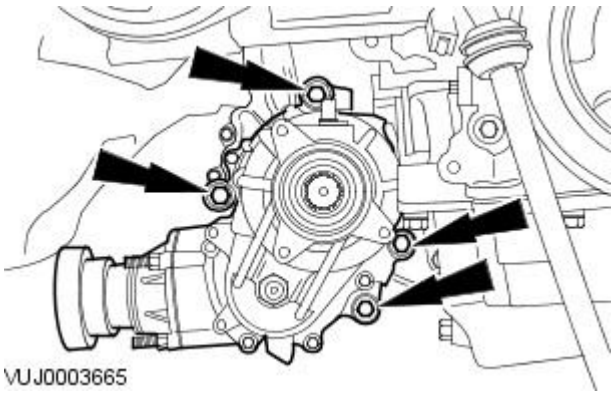
4. CAUTION: Make sure there is no loss of fluid from the transfer case. Failure to follow this instruction may result in damage to the transfer case.

Install a new O-ring seal.



5. CAUTION: Make sure there is no loss of fluid from the transfer case. Failure to follow this instruction may result in damage to the transfer case.

Install the special tool.

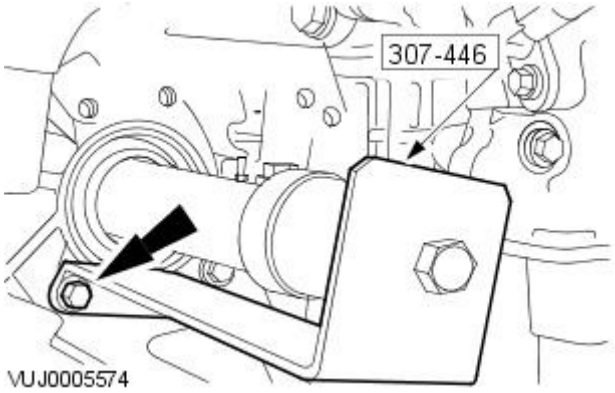


6. CAUTION: Make sure there is no loss of fluid from the transfer case. Failure to follow this instruction may result in damage to the transfer case.

With the aid of an assistant install the transfer case.

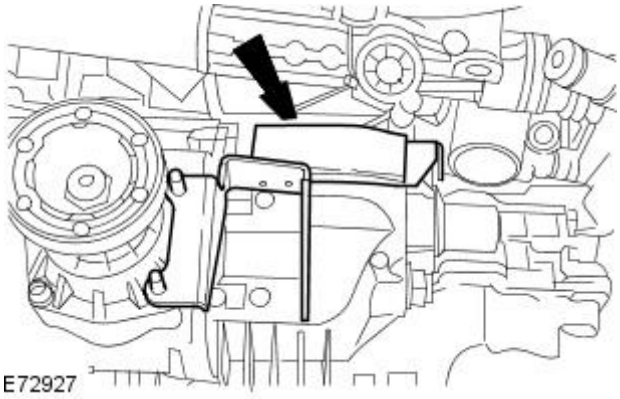
- Tighten to 80 Nm.
- If any transfer case fluid is lost during installation carry out drain and refill.
  For additional information, refer to: Transfer Case Draining and Filling (308-07 Transfer Case, General Procedures).

• NOTE: On vehicles prior to VIN J25640, if you are re-using transfer case fixings, tighten to 90 Nm.



7. Remove the special tool.

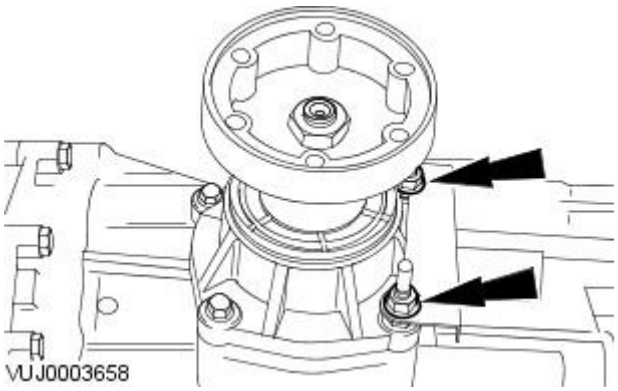
- Engage the link shaft into the transfer case.



8. NOTE: Do not tighten the engine anti-roll restrictor bracket top retaining bolt at this stage.

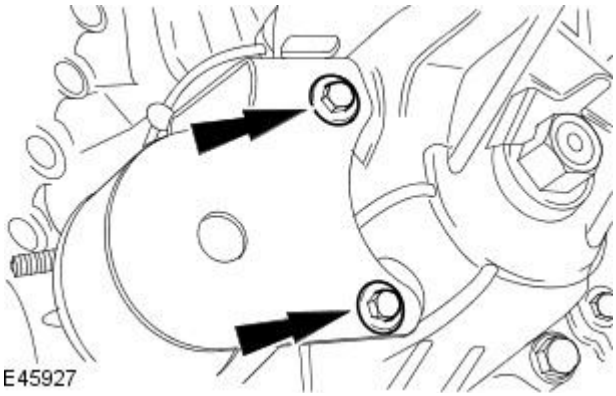
Install the engine anti-roll restrictor bracket.

- Install the engine anti-roll restrictor bracket top retaining bolt.



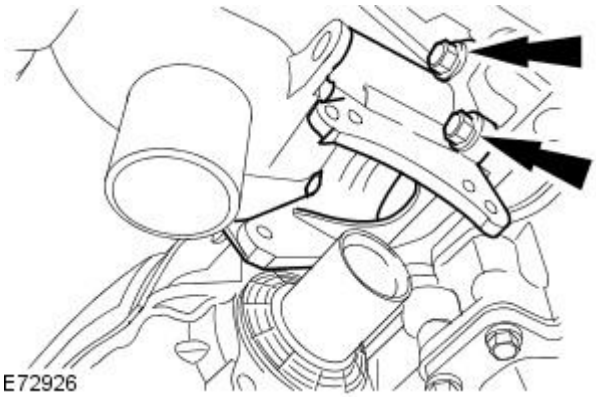
9. NOTE: Do not tighten the engine anti-roll restrictor bracket retaining nuts at this stage.

Install the engine anti-roll restrictor bracket retaining nuts.



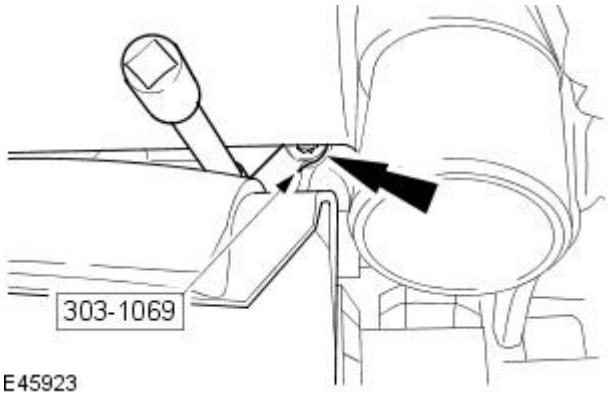
10. NOTE: Do not tighten the engine anti-roll restrictor bracket retaining bolts at this stage.

Install the engine anti-roll restrictor bracket side retaining bolts.



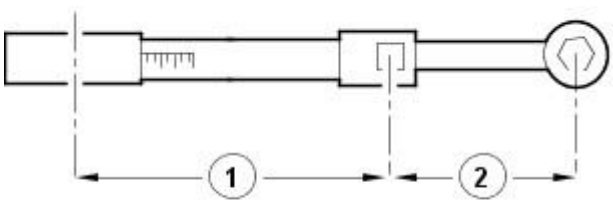
11. NOTE: Do not tighten the catalytic converter mount bracket retaining bolts at this stage.

Install the catalytic converter mount bracket.



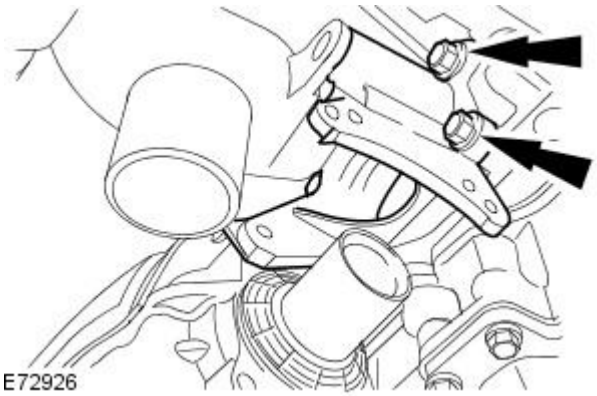
12. Using the special tool, tighten the catalytic converter mount bracket, top left-hand retaining bolt.

- Use the calculation in step 13 to produce the correct torque to apply to the retaining bolt.



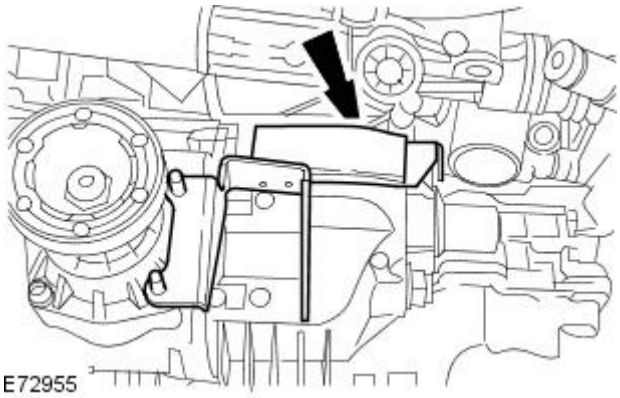
13. Using the special tool and a torque wrench, tighten the catalytic converter mount bracket, top left-hand retaining bolt.

- To make sure the catalytic converter mount bracket, top left-hand retaining bolt is torqued to the correct specification the following calculation steps must be used.
    1. Step 1. Multiply 55 Nm by the effective length of the torque wrench (1).
    2. Step 2. Add the effective length of the special tool (2) to the effective length of the torque wrench (1).
    3. Step 3. Divide the total of step 1 by the total of step 2.
    4. Step 4. Set the torque wrench to the figure arrived at in step 3.
- Tighten the catalytic converter mount bracket, top left-hand retaining bolt to the torque given by the calculation.



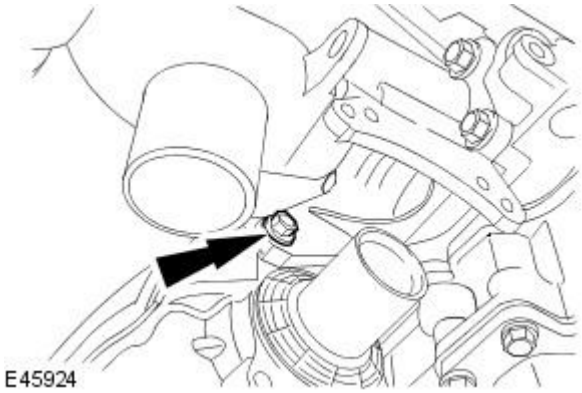
14. Tighten the catalytic converter mount bracket retaining bolts.

- Tighten to 55 Nm.



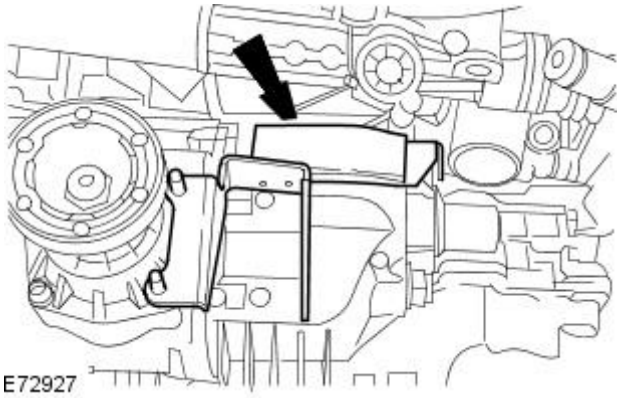
15. Tighten the catalytic converter mount bracket retaining bolt.

- Tighten to 55 Nm.



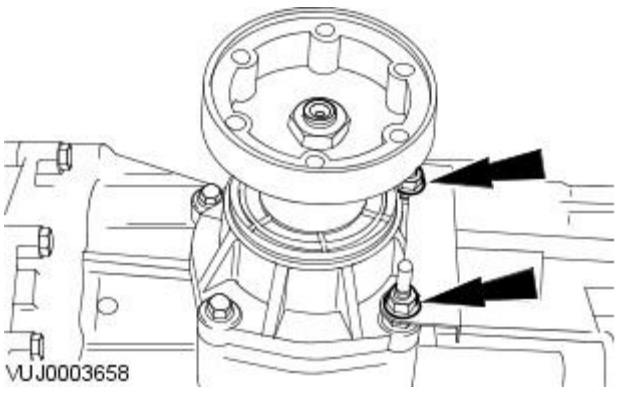
16. Install the catalytic converter mount bracket to transfer case retaining bolt.

- Tighten to 25 Nm.



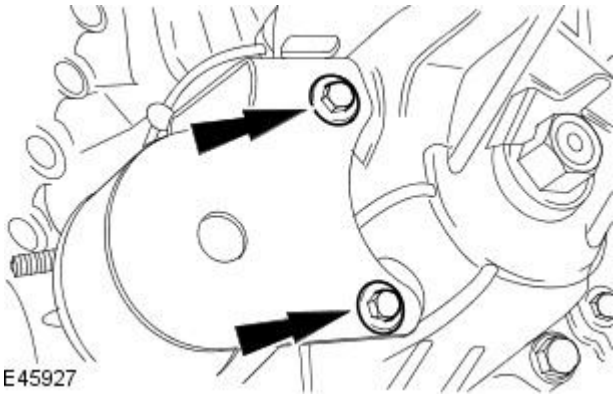
17. Tighten the engine anti-roll restrictor bracket top retaining bolt.

- Tighten to 55 Nm.



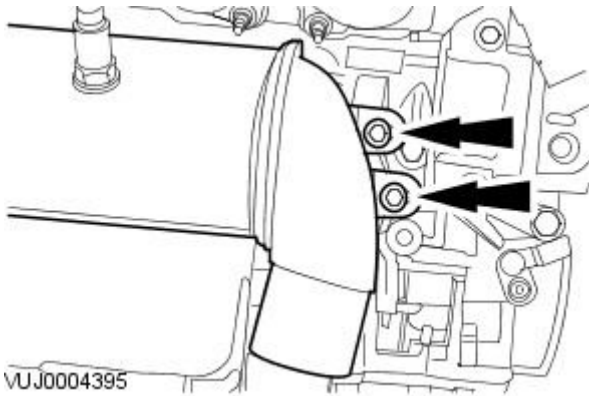
18. Tighten the engine anti-roll restrictor bracket retaining nuts.

- Tighten to 35 Nm.



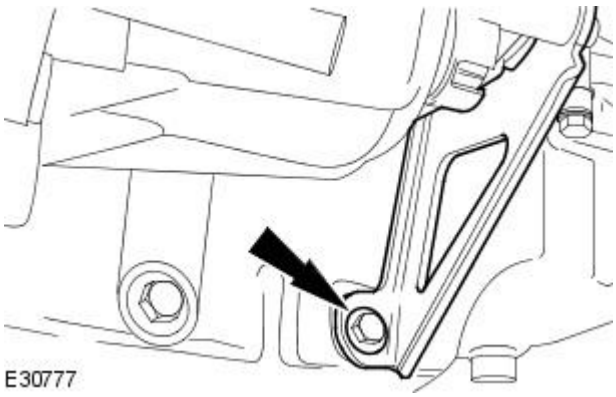
19. Tighten the engine anti-roll restrictor bracket side retaining bolts.

- Tighten to 35 Nm.



20. Install the catalytic converter to catalytic converter mount bracket retaining bolts.

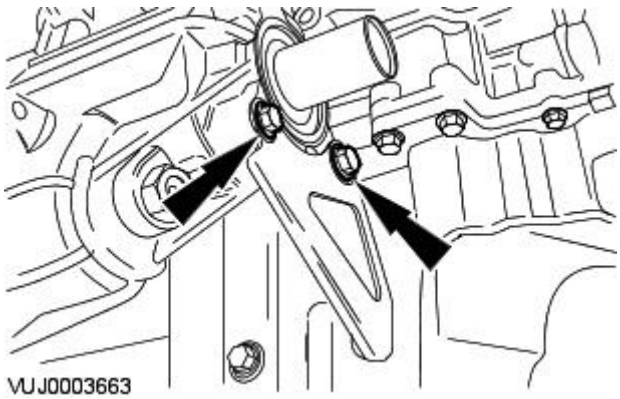
- Tighten to 25 Nm.



21. NOTE: Alternator cooling duct shown removed for clarity.

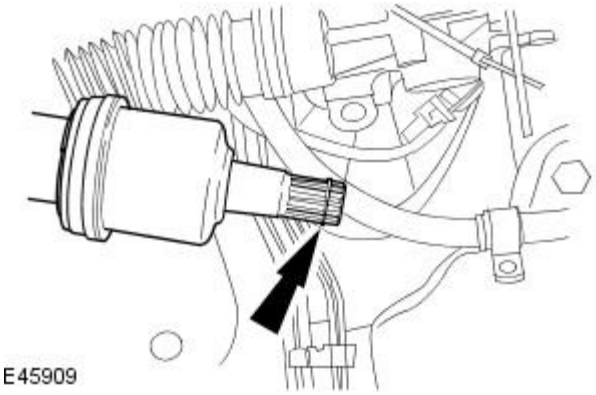
Install transfer case support bracket.

- Tighten to 47 Nm.

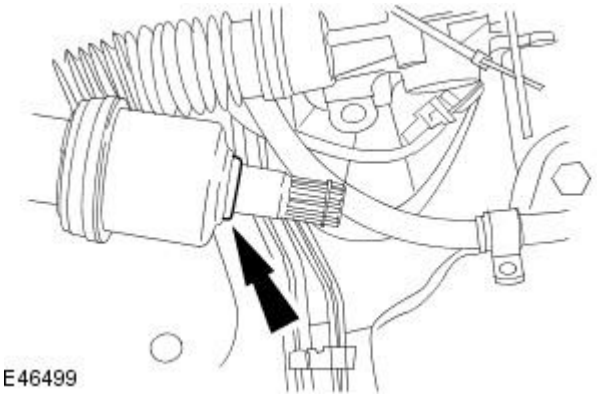


22. Install transfer case support bracket top retaining bolts.

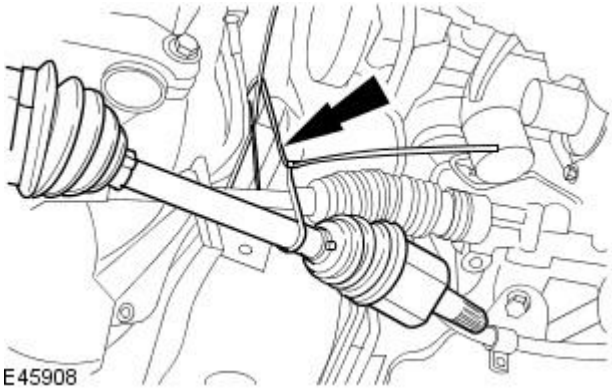
- Tighten to 25 Nm.



23. Install a new snap ring to the halfshaft.

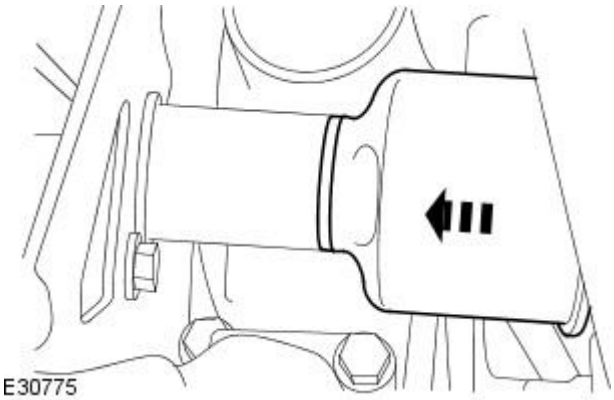


24. Install a new halfshaft seal.



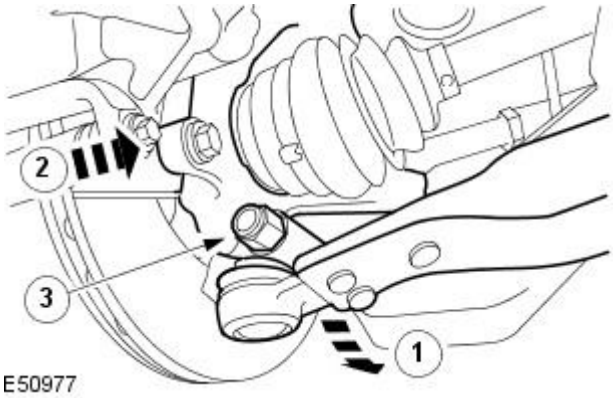
25. CAUTION: Make sure the halfshaft constant velocity (CV) joints do not over articulate. Failure to follow this instruction may result in damage to the CV joints.

Remove the halfshaft support strap.



26. CAUTION: Make sure the CV joint splines are located fully. Do not use excessive force when engaging the CV joint into the link shaft.

Install the halfshaft.

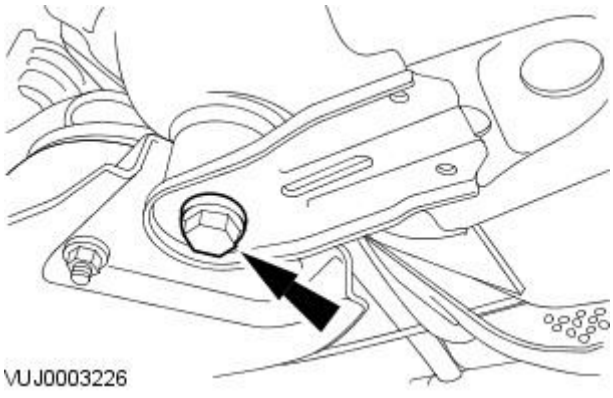


27. NOTE: Install a new retaining nut.

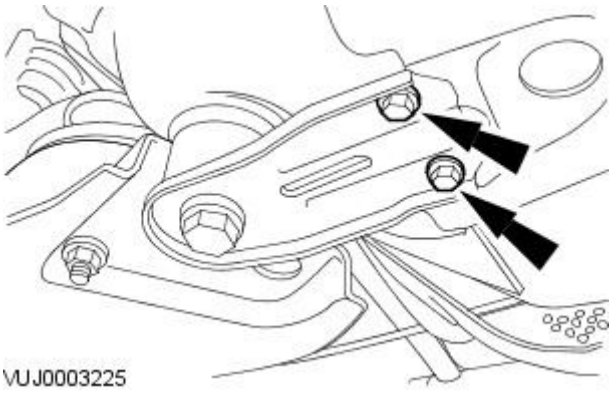
Attach the wheel knuckle.

1. Reposition the lower arm.
2. Attach the wheel knuckle.
3. Install the lower arm ball joint retaining nut and bolt.

- Tighten to 83 Nm.

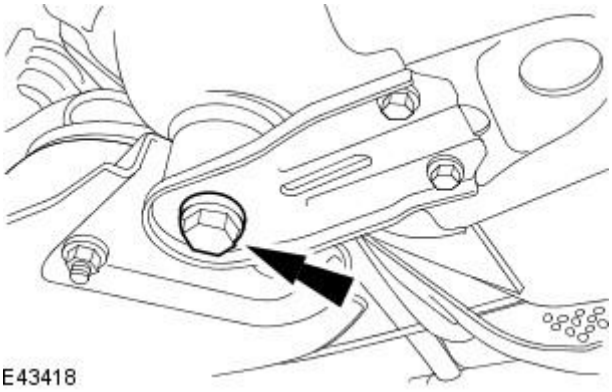


28. Loosley install the right-hand front subframe rear mount retaining bolt.



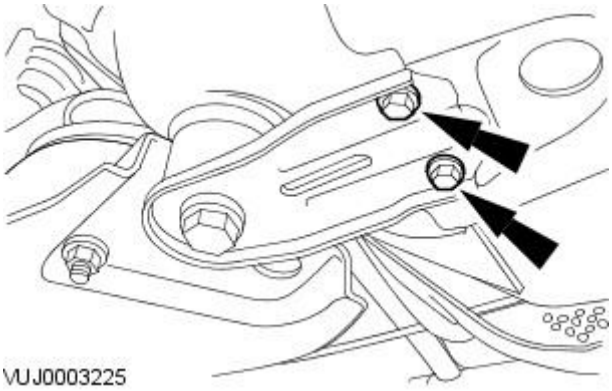
29. NOTE: Left-hand shown, right-hand similar.

Loosely install the front subframe reinforcement plate retaining bolts.



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

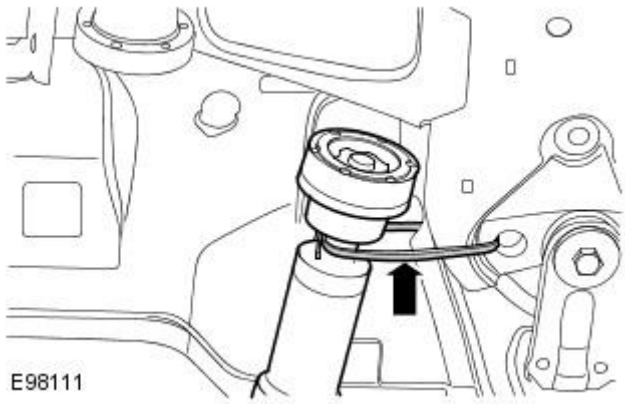
Tighten to 142 Nm.



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

Tighten the front subframe reinforcement bolts.

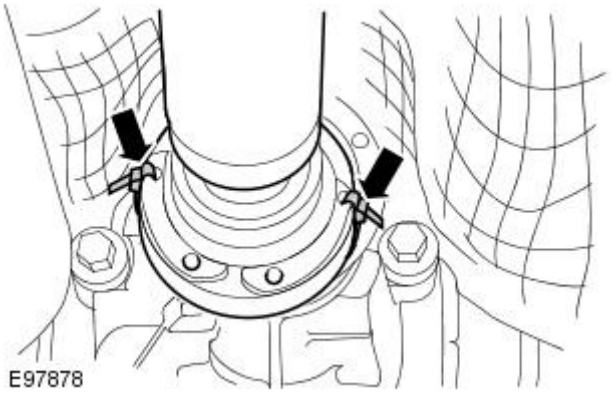
- M8 to 35 Nm.
- M10 to 70 Nm.



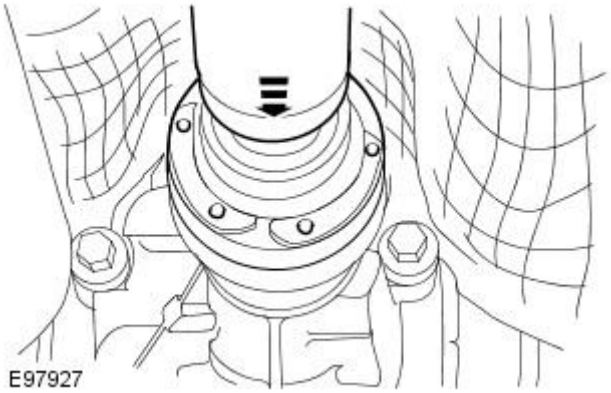
32. CAUTION: Make sure that the driveshaft does not hang on the center universal joint. Failure to follow this instruction may result in damage to the driveshaft.

Cut and remove the tie straps securing the outer casing of the driveshaft universal joint.

33. Cut and remove the tie straps securing the outer casing of the driveshaft universal joint.



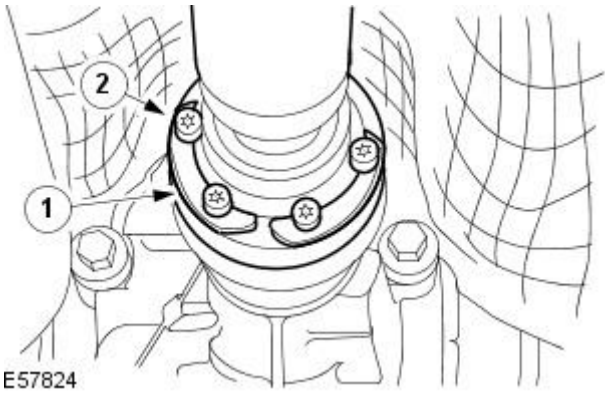
34. Connect the driveshaft to the transfer case.



35. Attach the driveshaft universal joint.

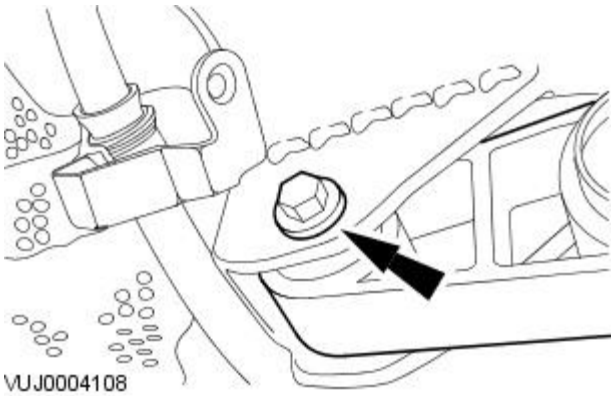
1. Attach the driveshaft universal joint.
2. Install new driveshaft retaining bolts

- Tighten to 44 Nm.



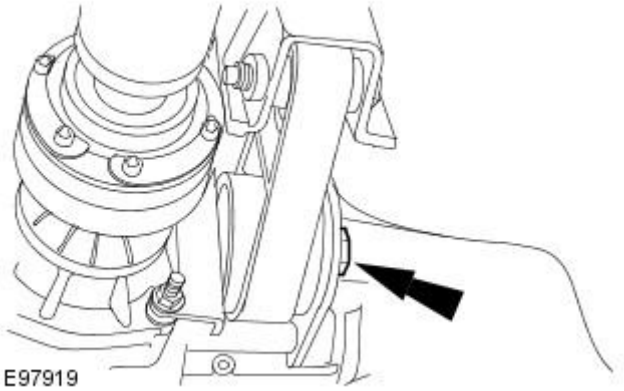
36. Install the engine roll restrictor.

- Install the engine roll restrictor retaining bolt.

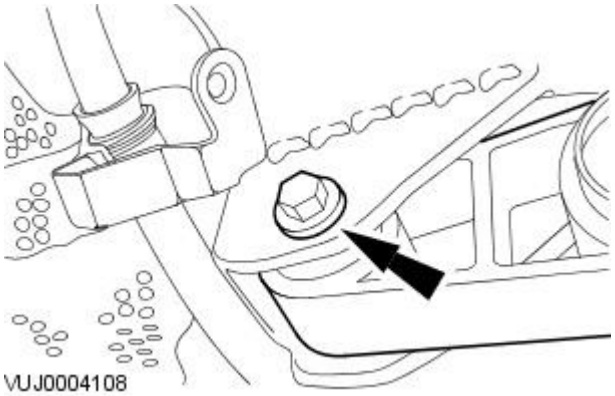


37. Attach the engine roll restrictor.

- Tighten to 80 Nm



38. Tighten to 80 Nm.



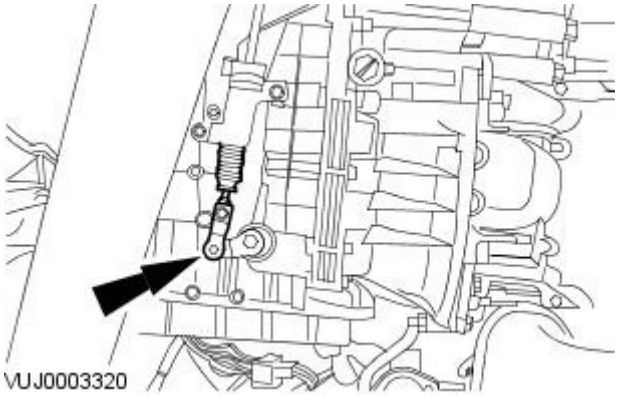
Vehicles with manual transmission

39. Fill the manual transmission to the correct oil level. For additional information, refer to: (308-03 Manual Transmission/Transaxle)

Transaxle Draining and Filling - Vehicles With: 5-Speed Manual Transmission - MT75 (General Procedures),
Transaxle Draining and Filling - Vehicles With: 5-Speed Manual Transmission - MT75 (General Procedures).

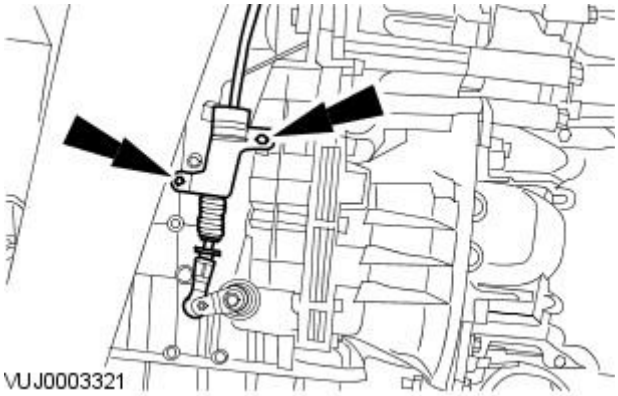
Vehicles with automatic transmission

40. Connect the selector lever cable.



41. Attach the selector lever cable bracket.

- Tighten to 10 Nm.

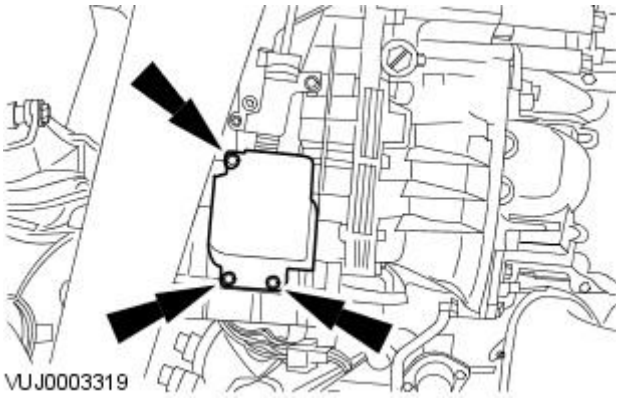


42. Fill the automatic transmission to the correct oil level.
For additional information, refer to: Transmission Fluid Drain and Refill (307-01A Automatic Transmission/Transaxle - Vehicles With: 5-Speed

Automatic Transaxle - JATCO, General Procedures).

43. Install the selector lever cable shield.

- Tighten to 10 Nm.

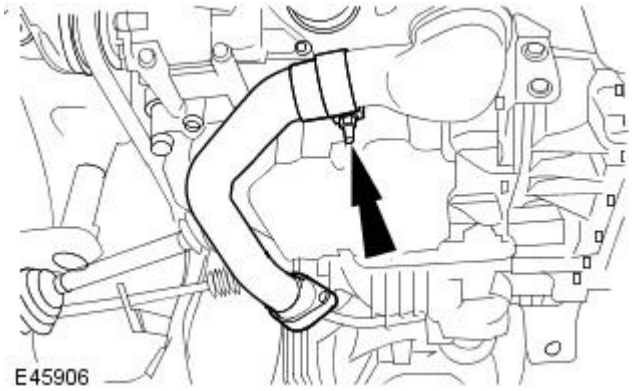


All vehicles

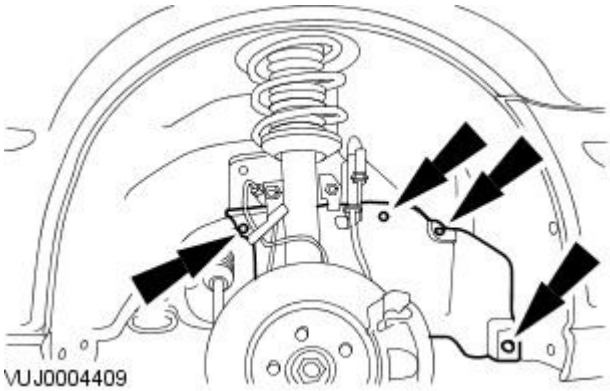
44. Install the muffler inlet pipe.
For additional information, refer to: Muffler Inlet Pipe - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (309-00 Exhaust System, Removal and Installation).

45. Install the front pipe.

- Tighten to 55 Nm.



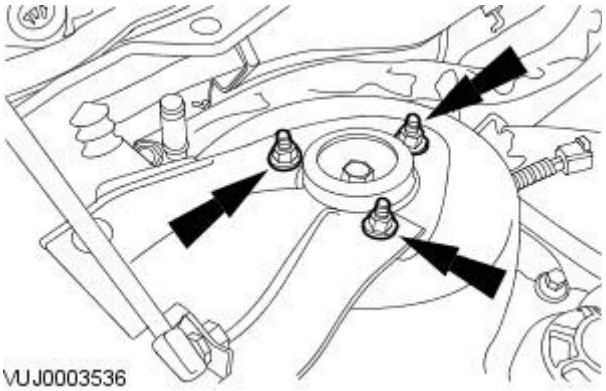
46. Install the fender splash shield access panel.

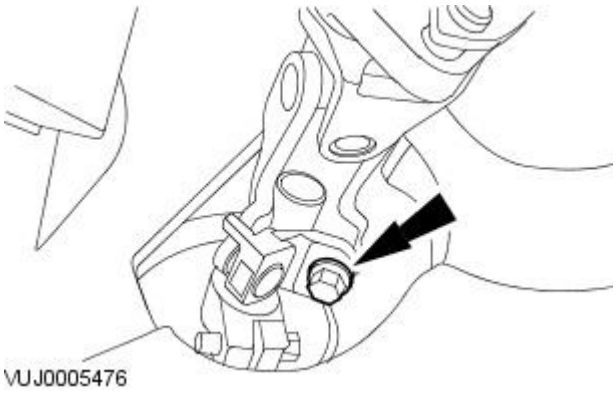


47. Install the right-hand front wheel and tire.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

48. Tighten the shock absorber and spring assembly securing nuts.

- Tighten to 25 Nm.




VUJ0005476

49. NOTE: Install a new steering column lower retaining bolt.

Attach the steering column.

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Exhaust System -

Torque Specifications

Description	Nm	lb-ft	lb-in
Catalytic converter retaining studs - vehicles without diesel engines	9	-	80
Catalytic converter to exhaust manifold retaining nuts - vehicles without diesel engines	A	-	-
Catalytic converter - right-hand - to transfer case mounting bracket retaining bolts - vehicles without diesel engines	25	18	-
Catalytic converter - left-hand - to support bracket retaining bolts - vehicles without diesel engines	25	18	-
Muffler and tailpipe clamp retaining nut - all vehicles	48	35	-
Front muffler to muffler inlet pipe retaining nuts - vehicles without diesel engines	48	35	-
Muffler inlet pipe to front pipe retaining nut and bolt - vehicles without diesel engines	48	35	-
Exhaust hanger to front muffler retaining bolt - all vehicles	25	18	-
Heated oxygen sensor (HO2S) - vehicles without diesel engines	40	30	-
Catalyst monitor sensor - vehicles without diesel engines	40	30	-
Exhaust hanger to body retaining bolts - all vehicles	25	18	
Exhaust heat shield retaining bolts - vehicles without diesel engines	10	-	89
Catalytic converter heat shield retaining bolts - vehicles without diesel engines	10	-	89
Air cleaner bracket retaining nuts - vehicles without diesel engines	6	-	53
Catalytic converter to turbocharger retaining nuts - vehicles with diesel engines	48	35	-
Catalytic converter retaining bolts - vehicles with diesel engines	48	35	-
Turbocharger heat shield retaining nuts - vehicles with diesel engines	8	-	71
Turbocharger heat shield retaining bolts - vehicles with diesel engines	8	-	71
Exhaust flexible pipe to catalytic converter retaining nuts - vehicles with diesel engines	48	35	-
Front muffler to exhaust flexible pipe retaining nuts - vehicles with diesel engines	48	35	-
Exhaust flexible pipe to diesel particulate filter retaining nuts - vehicles with diesel engines	48	35	-
Diesel particulate filter to muffler inlet pipe retaining nuts - vehicles with diesel engines	48	35	-
Diesel particulate filter pressure sensor mounting bracket retaining nuts - vehicles with diesel engines	5	-	44
Catalytic converter temperature sensor - vehicles with diesel engines	35	26	-
Diesel particulate filter temperature sensor - vehicles with diesel engines	35	26	-

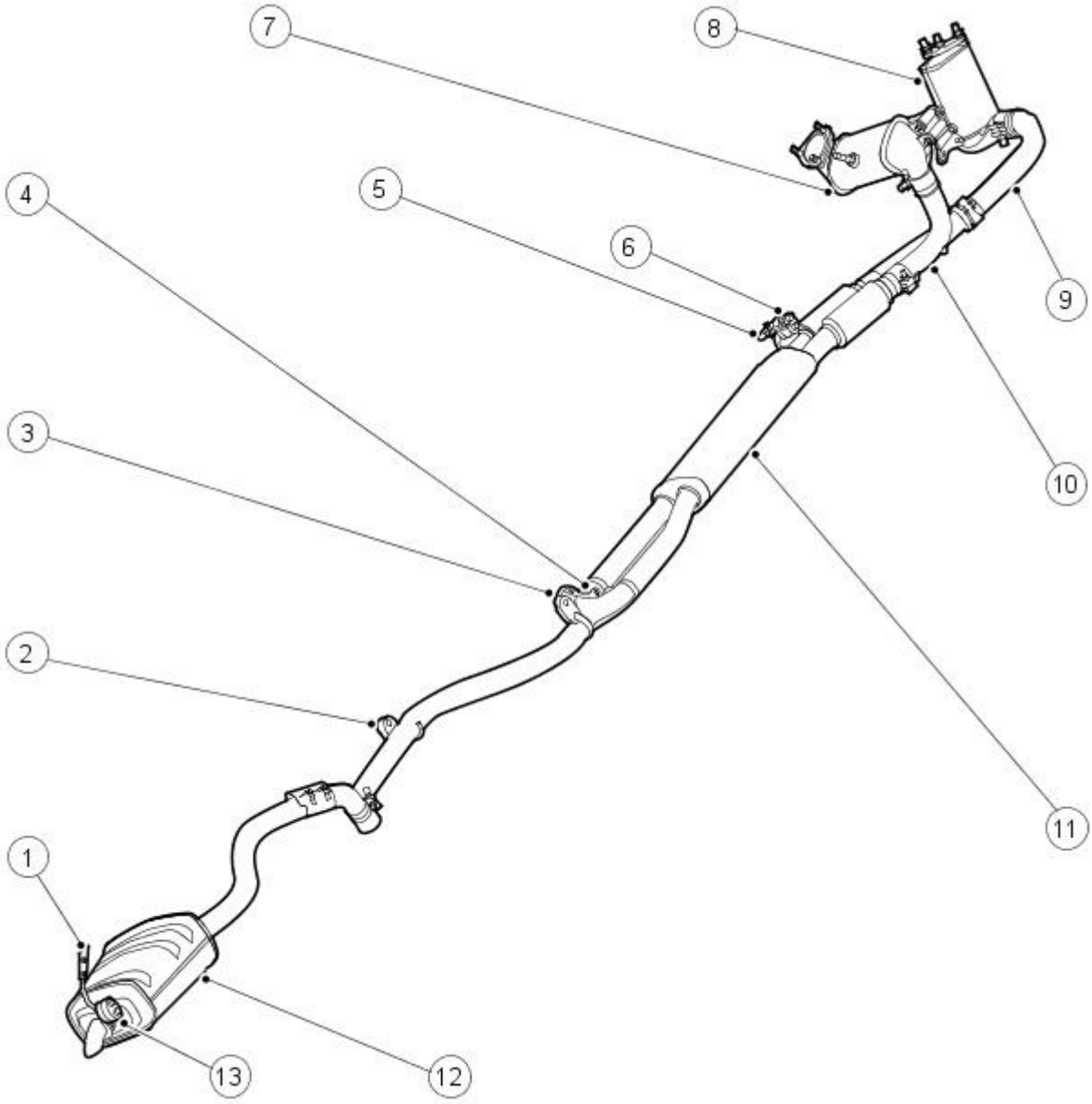
A = refer to the procedure for the correct torque sequence

Published: 11-May-2011

Exhaust System - Exhaust System

Description and Operation

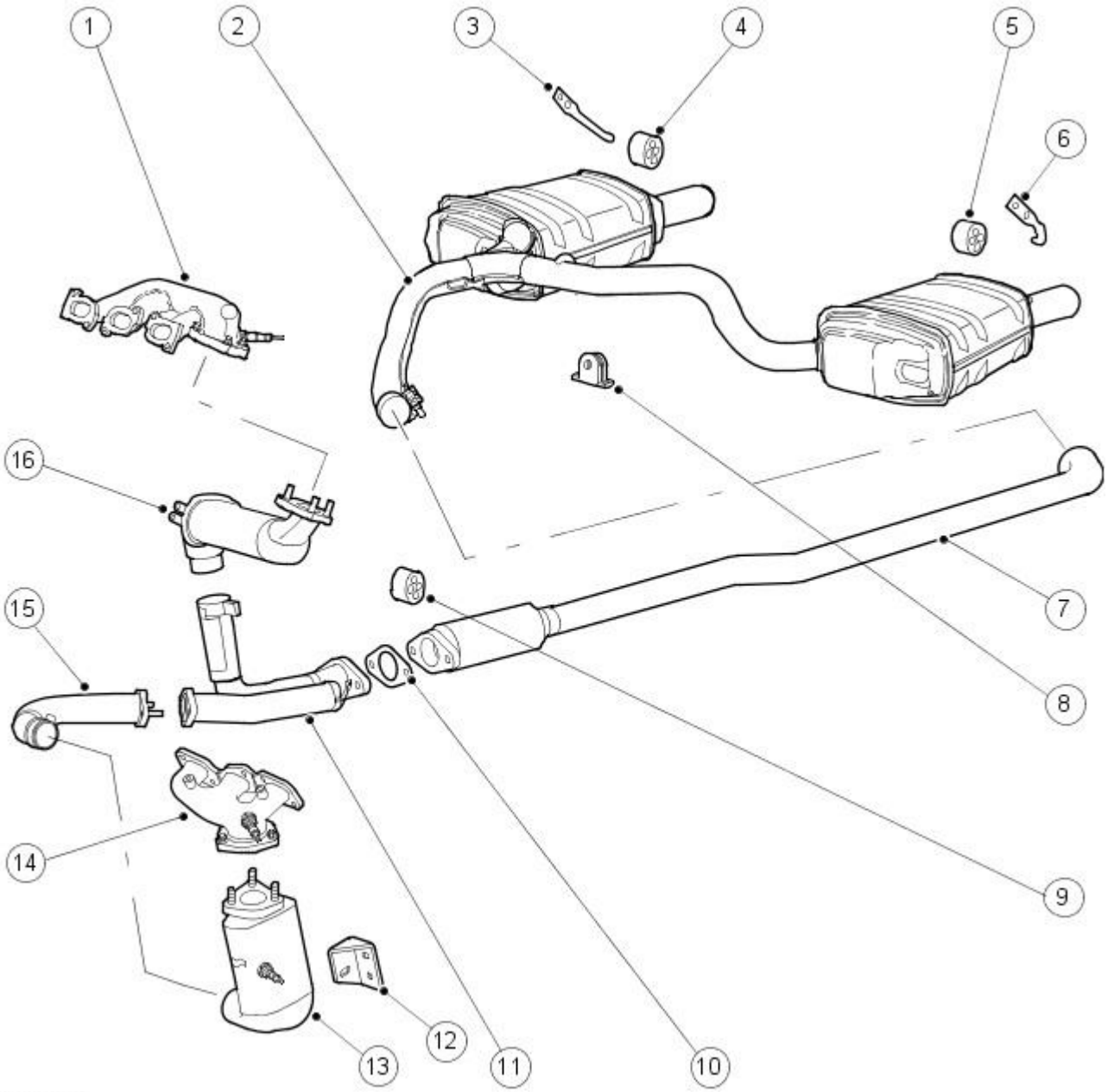
Vehicles with 2.0L petrol engine



VUJ0005785

Item	Part Number	Description
1	-	Exhaust hanger
2	-	Exhaust hanger isolator
3	-	Exhaust hanger isolator
4	-	Exhaust hanger
5	-	Exhaust hanger
6	-	Exhaust hanger isolator
7	-	Catalytic converter - R/H
8	-	Catalytic converter - L/H
9	-	Front pipe
10	-	Muffler inlet pipe
11	-	Front muffler
12	-	Muffler and tailpipe
13	-	Exhaust hanger

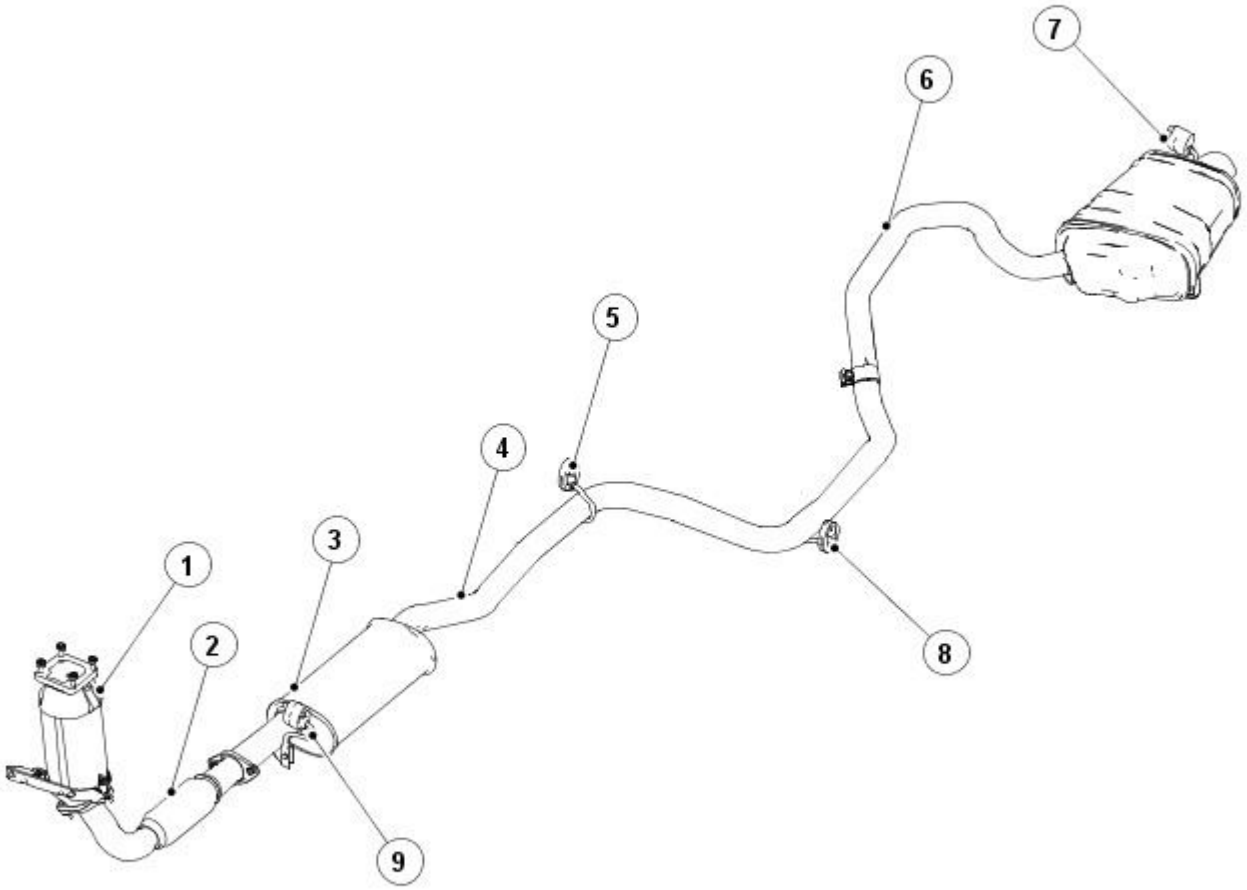
Vehicles with 2.5L or 3.0L engine



VUJ0003737

Item	Part Number	Description
1	—	Exhaust manifold - R/H
2	—	Muffler and tailpipe assembly
3	—	Exhaust hanger
4	—	Exhaust hanger isolator
5	—	Exhaust hanger isolator
6	—	Exhaust hanger
7	—	Front muffler
8	—	Exhaust hanger isolator
9	—	Exhaust hanger isolator
10	—	Front muffler to muffler inlet pipe gasket
11	—	Muffler inlet pipe
12	—	Catalytic converter - L/H, support bracket
13	—	Catalytic converter - L/H
14	—	Exhaust manifold - L/H
15	—	Front pipe
16	—	Catalytic converter - R/H

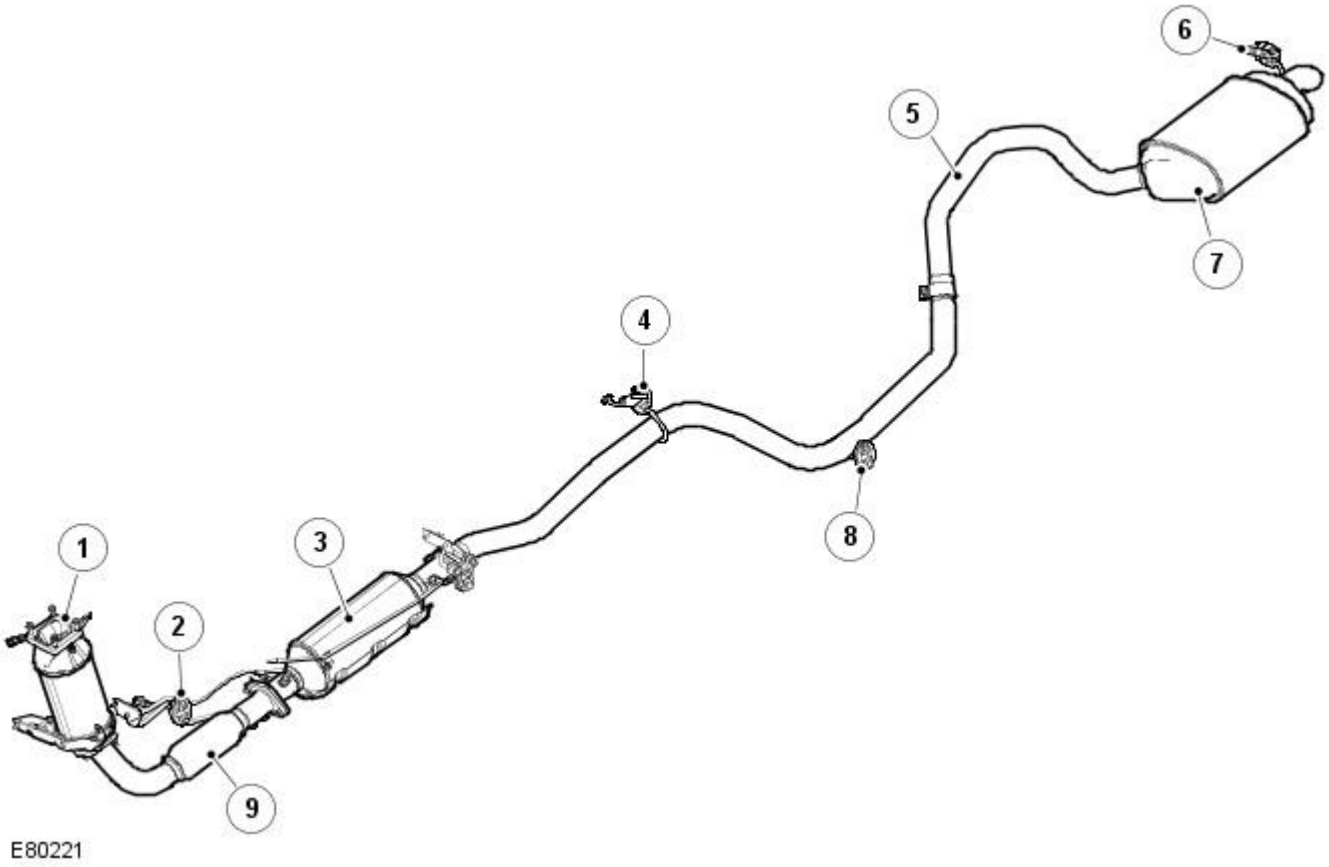
Vehicles with Diesel Engine



E43778

Item	Part Number	Description
1	—	Catalytic converter
2	—	Exhaust flexible pipe
3	—	Exhaust hanger isolator
4	—	Front muffler
5	—	Exhaust hanger isolator
6	—	Muffler and tailpipe
7	—	Exhaust hanger isolator
8	—	Exhaust hanger isolator
9	—	Exhaust hanger

Vehicles with Diesel Particulate Filter (DPF)



Item	Part Number	Description
1	—	Catalytic converter
2	—	Exhaust hanger
3	—	DPF
4	—	Exhaust hanger isolator
5	—	Rear pipe
6	—	Exhaust hanger isolator
7	—	Muffler
8	—	Exhaust hanger isolator
9	—	Exhaust flexible pipe

All petrol vehicles are fitted with a stainless steel exhaust system consisting of:

- catalytic converter(s)
- front pipe
- muffler inlet pipe
- front muffler assembly
- muffler and tailpipe assembly

The exhaust system is designed to meet the rising standards of vehicle emissions, complying with LEV (USA) and stage three (Europe) emission legislation; effective from January 2001.

The exhaust system is supported at the front by the two catalytic converters which are retained directly to the exhaust manifolds by studs and nuts. The remainder of the exhaust system is supported by four rubber hanger isolators. On 2.0L and diesel vehicles there are three attached to the front muffler assembly and one attached to the rear muffler. On 2.5L and 3.0L vehicles there is one attached to the front muffler and three attached to the rear muffler and tail pipe assembly.

A flexible coupling, which is part of the front muffler, is fitted to isolate the exhaust system from engine movement and vibration.

For 2.5L and 3.0L vehicles the rear exhaust muffler and tail pipe assembly is manufactured in one section which consists of a 'Y' pipe joined to the two rear muffler and tail pipes. A service fix is provided for replacement of the rear mufflers and tail pipes. For 2.0L and diesel vehicles there is a single rear muffler assembly which is attached to the left-hand side of the vehicle.

Three Way Catalytic Converters

The catalytic converters each contain two bricks coated with palladium/rhodium. These elements are utilized to control the emissions of hydrocarbons (HC), carbon monoxide (CO) and oxides of nitrogen (NOx) from the engine.

Oxidation Catalytic Converter

The catalytic converter contains a brick coated with platinum. This element is utilized to control the emissions of hydrocarbons (HC), carbon monoxide (CO) and particles of matter from the engine.

Diesel Particulate Filter

The Diesel Particulate Filter (DPF) system reduces diesel particulate emissions to negligible levels (0.005 g/km) to meet current local European City clear air requirements.

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 micro-spheres on which hydrocarbons from the engine's fuel and lubricant condense.

The DPF filter system consists of the following components:

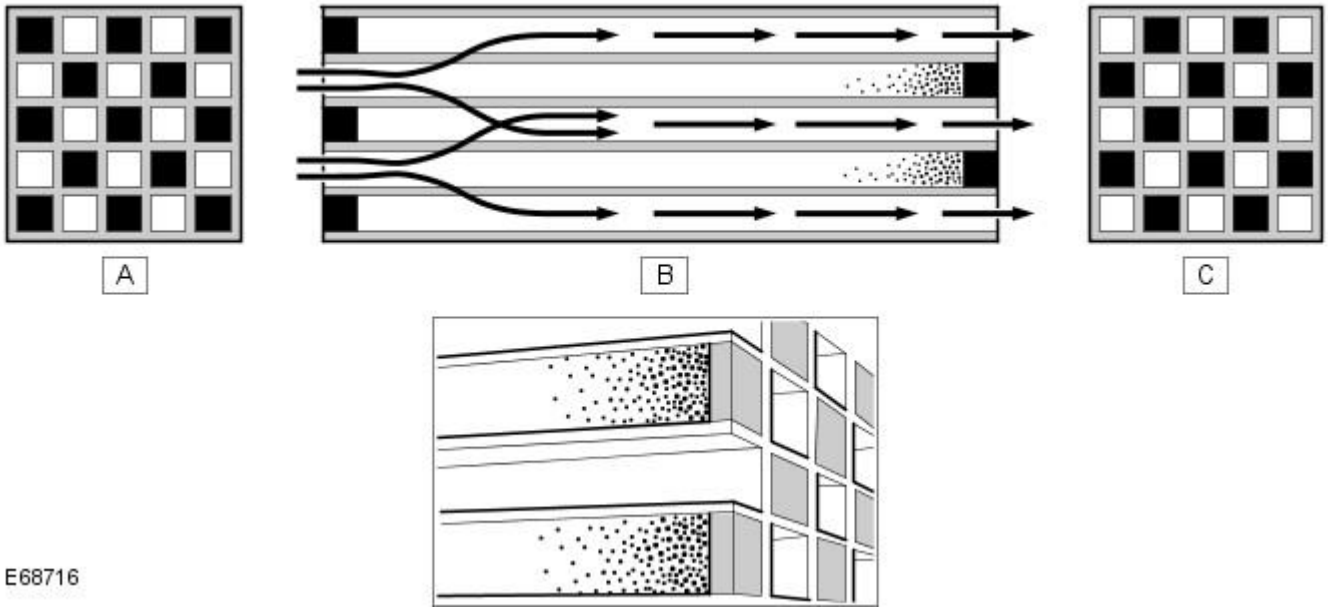
- DPF

- DPF control software incorporated into the engine control module (ECM)
- Differential pressure sensor

The DPF reduces the pollution generated by diesel vehicles by filtering soot particles out of the exhaust gases.

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 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 its self be damaged or destroyed. The material trapped in the filter is in the most part carbon particles with some absorbed hydrocarbons.



Item	Part Number	Description
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 hundreds 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 incinerates the particles.

Two processes are used to regenerate the DPF, passive and active.

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 traveled and back-pressure signals from the differential pressure sensor.

Active regeneration generally occurs every 370 to 1250 miles (600 to 2000km) although this is 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 an additional trigger, which is used as backup 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 estimated cumulative particulate emissions since the last active regeneration event.

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:

- Retarding the main injection timing
- Reducing intake boost pressure levels
- Activation of the inlet throttle
- Introducing post-injection of fuel after the pilot and main fuel injections have occurred.

Control of the post-injection 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 1 or 2 post-injections of fuel:

- The first post-injection of fuel burns 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 un-burnt 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 200°C (392°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 760°C (1400°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 re-circulation (EGR) valve is closed. The use of EGR decreases the exhaust gas temperature and therefore prevents the optimum DPF temperature being achieved
- The glow plugs are occasionally activated to provide additional heat to assist in raising the DPF temperature

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 the Jaguar approved diagnostic system to the vehicle, which will perform an automated static 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 3 separate control software modules; a DPF supervisor module, a DPF fuel management module and a DPF air management module.

These 3 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 4 split injections per stroke (pilot, main and 2 post injections)
- Injection pressure and the transition between the 3 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 4-split injections, for each of the 3 calibration levels for injection pressure, and also manages the transition between the levels.

The 2 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 un-burnt 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
- Exhaust Air Fuel Ratio (AFR) 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. 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 exhaust AFR by actuating the EGR throttle.

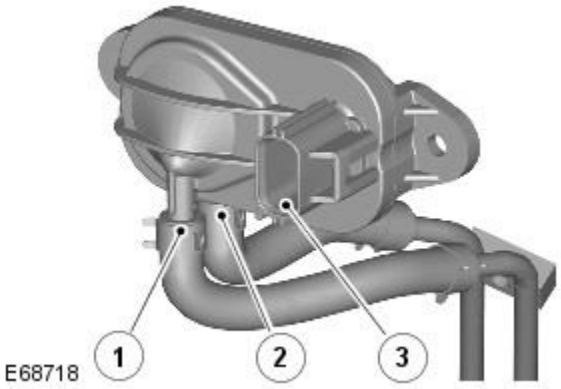
DPF Co-ordinator Module

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 in the intake manifold
- Fuel injection control

When the supervisor module issues a regeneration request, the co-ordinator module manages the change over to the regeneration specific settings. The change over occurs during an accelerator pedal release manoeuver from the driver or after a calibrated waiting time.

Pressure Differential Sensor



Item	Part Number	Description
1	-	High pressure connection
2	-	Low pressure connection
3	-	Electrical connector

The differential pressure sensor is located in the engine compartment, on the lower RH side of the bulkhead. The sensor is located on 2 studs and secured with nuts.

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 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

Two temperature sensors are used in the DPF system. One is located in the catalyst inlet and the second sensor is located in the DPF inlet.

The sensors measure the temperature of exhaust gas exiting the turbocharger 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

When the engine is at it's normal operating temperature and the vehicle is driven at moderate speeds, 30 mph (48 km/h), or more, a regeneration of the DPF takes place automatically. This means that the exhaust particles collected in the filter are burned away and the filter is emptied.

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 by displaying a warning message 'DPF FULL' in the message center, plus either a RED or AMBER warning lamp.

CAUTION: If the warning message with the RED warning lamp is displayed, a Jaguar dealer/authorized repairer must be contacted as soon as possible before damage to the DPF occurs.

When the message is displayed with an AMBER priority warning lamp, regeneration is required.

CAUTION: If the vehicle continues to be driven with the AMBER warning lamp illuminated without regenerating the DPF, the RED warning lamp will illuminate.

• NOTE: Once triggered, the warning lamp and message will remain on until the ignition is switched to the 'OFF' position. Even though regeneration is still required, the warning lamp and message will only re-appear after 255 seconds of driving and sufficient pressure has built up in the DPF.

For more information, refer to the Owners Handbook.

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 a 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. When active regeneration is operating, there will be a 100% increase in fuel consumption.

Published: 11-May-2011

Exhaust System - Exhaust System

Diagnosis and Testing

Overview

For information on the description and operation of the diesel particulate filter (DPF) and catalytic converter systems:
REFER to: Exhaust System (309-00 Exhaust System, Description and Operation).

Inspection and verification

1. **1.** Verify the customer concern.
   - Confirm the illumination of any DPF warning lamps (red or amber) and any message center information.
   - Once the ignition is turned off, the warnings will disappear, but will reappear after 255 seconds of driving, or once sufficient pressure has built up in the DPF.
2. **2.** Visually inspect for obvious mechanical or electrical faults.

Visual inspection

Mechanical	Electrical
• Mufflers and pipes • Catalytic converter • Diesel particulate filter (DPF) • Exhaust gas recirculation (EGR) valve • Turbocharger	• Exhaust gas temperature sensors • Injectors • Differential pressure sensor and circuits • Exhaust gas recirculation (EGR) valve and circuits • Turbocharger and circuits • Glow plugs • Engine control module (ECM)

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.** Use the approved diagnostic system or a scan tool to retrieve any diagnostic trouble codes (DTCs) before moving onto the symptom chart or DTC index.
   - Make sure that all DTCs are cleared following rectification.

Symptom chart

Condition	Possible source	Action
Engine oil dilution	• Fuel entering the crankcase during post-injection	Note that depending on driving style and use, some vehicles may require engine oil changes at less than usual service intervals. Check the message center and service history. Change the engine oil and reset the counter as necessary.
Excessive fuel consumption/poor performance	• Damaged/blocked exhaust pipe and/or muffler(s) • Blocked catalytic converter(s)	Inspect the exhaust system for damage. Disconnect the exhaust system from the catalytic converter(s) and check for restricted flow. Remove the catalytic converter(s) and inspect internally for damage. Install new components as necessary. REFER to: Exhaust System (309-00 Exhaust System, Description and Operation). Note that the fuel consumption increases while active regeneration is in operation, but as this happens infrequently there is only a slight increase in overall consumption.
Knocks/rattles from underside	• Exhaust system components insecure/damaged • Catalytic converter(s) damaged	Inspect the exhaust system for damage. Check the security of the system fittings. Tap the sides of the catalytic converter(s) with a soft-faced hammer and listen for movement inside the converter. Install new components as necessary. REFER to: Exhaust System (309-00 Exhaust System, Description and Operation).
Noise/fumes in vehicle	• Exhaust system components insecure/damaged • Leakage from joints	Inspect the exhaust system for damage. Check the security of the system fittings. In a well-ventilated area, close off the tailpipe(s) and check for evidence of leakage. Seal any leaks as necessary. REFER to: Exhaust System (309-00 Exhaust System, Description and Operation).

DTC index

• NOTE: For a full list of Engine Control Module (ECM) DTCs:
REFER to: Electronic Engine Controls (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Description and Operation).

DTC	Description	Possible cause	Action
P0544	Exhaust gas temperature sensor circuit, right-hand bank, upstream sensor	• Exhaust gas temperature sensor circuit: short circuit to ground • Exhaust gas temperature sensor circuit: open circuit • Exhaust gas temperature sensor circuit: short circuit to power • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P0545	Exhaust gas temperature sensor circuit low, right-hand bank, upstream sensor	• Exhaust gas temperature sensor circuit: short circuit to ground • Exhaust gas temperature sensor circuit: open circuit • Exhaust gas temperature	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.

DTC	Description	Possible cause	Action
		sensor fault	
P0546	Exhaust gas temperature sensor circuit high, right-hand bank, upstream sensor	• Exhaust gas temperature sensor circuit: short circuit to power • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P1403	Differential pressure feedback sensor hoses reversed	• Diesel Particulate Filter (DPF) delta pressure sensor crossed hose fault	Check the correct connection of the hoses to the pressure sensor. Rectify as necessary. Clear the DTCs, test for normal operation.
P2031	Right-hand bank exhaust gas temperature sensor circuit, sensor 2	• Exhaust gas temperature sensor circuit: short circuit to ground • Exhaust gas temperature sensor circuit: open circuit • Exhaust gas temperature sensor circuit: short circuit to power • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P2032	Right-hand bank exhaust gas temperature sensor circuit low, sensor 2	• Exhaust gas temperature sensor circuit: short circuit to ground • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P2033	Right-hand bank exhaust gas temperature sensor circuit high, sensor 2	• Exhaust gas temperature sensor circuit: short circuit to power • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P2080	Right-hand bank exhaust gas temperature sensor circuit range/performance, sensor 1	• Exhaust gas temperature sensor circuit: short circuit to ground • Exhaust gas temperature sensor circuit: open circuit • Exhaust gas temperature sensor circuit: short circuit to power • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P2081	Right-hand bank exhaust gas temperature sensor circuit intermittent, sensor 1	• Exhaust gas temperature sensor circuit: intermittent high resistance • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P2085	Right-hand bank exhaust gas temperature sensor circuit intermittent, sensor 2	• Exhaust gas temperature sensor circuit: intermittent high resistance • Exhaust gas temperature sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the exhaust gas temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs, test for normal operation.
P242F	Diesel particulate filter (DPF)restriction - ash accumulation	• DPF blocked	Install a new DPF as necessary. REFER to: Diesel Particulate Filter (DPF) (309-00 Exhaust System, Removal and Installation). Clear the DTCs, test for normal operation.
P244A	Diesel particulate filter (DPF)differential pressure too low	• DPF leaking	Install a new DPF as necessary. REFER to: Diesel Particulate Filter (DPF) (309-00 Exhaust System, Removal and Installation). Clear the DTCs, test for normal operation.
P244B	Diesel particulate filter (DPF)differential pressure too high	• DPF overloaded	Carry out the regeneration procedure. Clear the DTCs, test for normal operation.
P244C	Exhaust temperature too low for particulate filter regeneration	• Insufficient mileage/speed for regeneration	Carry out the regeneration procedure. Clear the DTCs, test for normal operation.
P2452	Diesel particulate filter (DPF)pressure sensor A circuit	• DPF delta pressure sensor circuit fault • DPF delta pressure sensor fault	Check the DPF delta pressure sensor and circuits. Refer to the electrical guides. Rectify as necessary.
P2453	Diesel particulate filter (DPF)pressure sensor A circuit range/performance	• DPF delta pressure sensor hose fault • DPF delta pressure sensor fault	Refer to the approved diagnostic system for a guided diagnostic routine. Check the condition and fitment of the DPF delta pressure sensor and hoses. Rectify as necessary.

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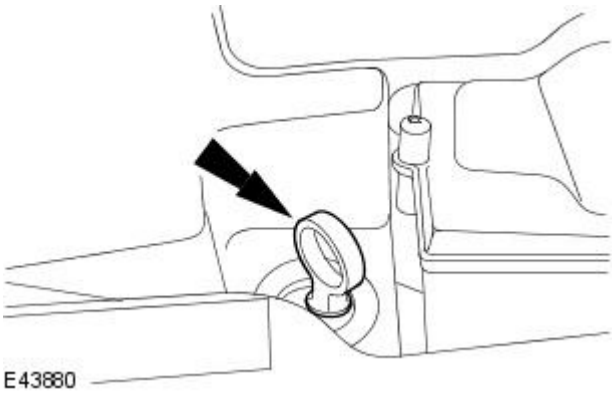
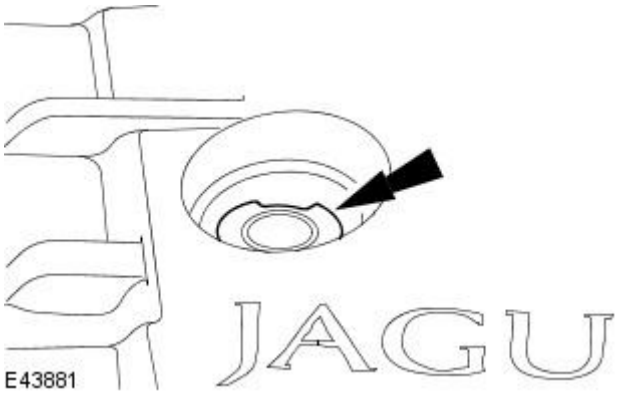
Exhaust System - Catalytic Converter2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma

Removal and Installation

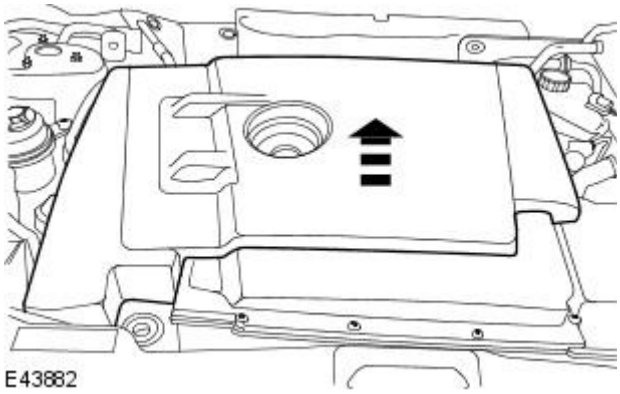
Removal



1. Remove the oil level indicator.

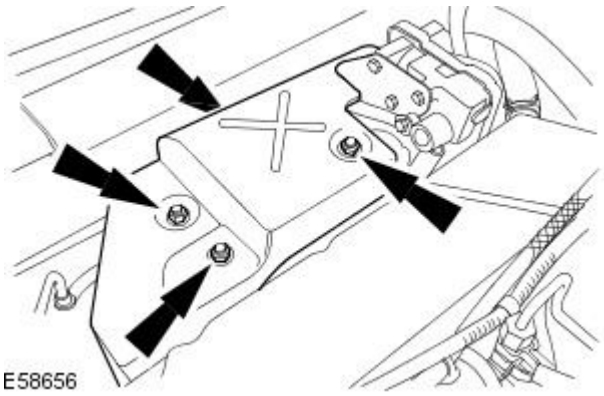


2. Remove the oil filler cap.

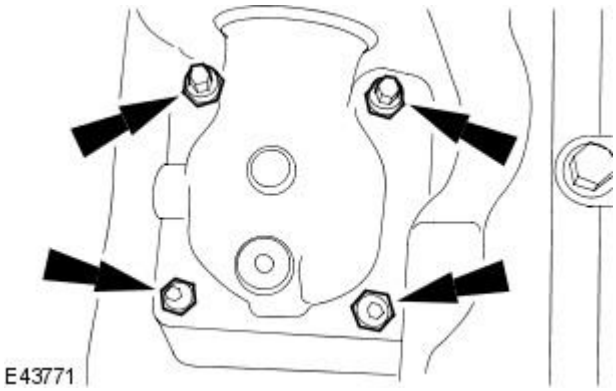


3. NOTE: Install the oil filler cap and oil level indicator to prevent foreign material entering the valve cover.

Remove the engine cover.

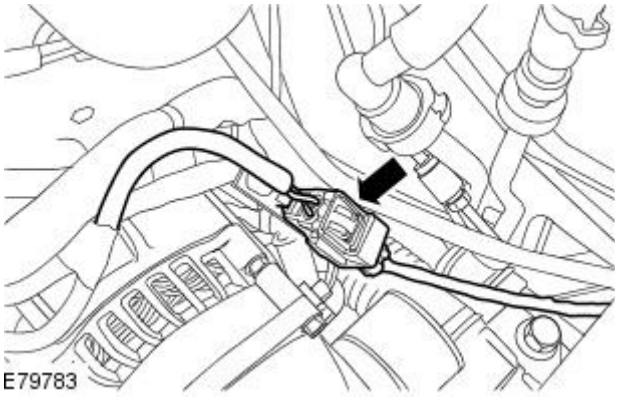


4. Remove the turbocharger heatshield.



5. Remove the catalytic converter to turbocharger retaining nuts.

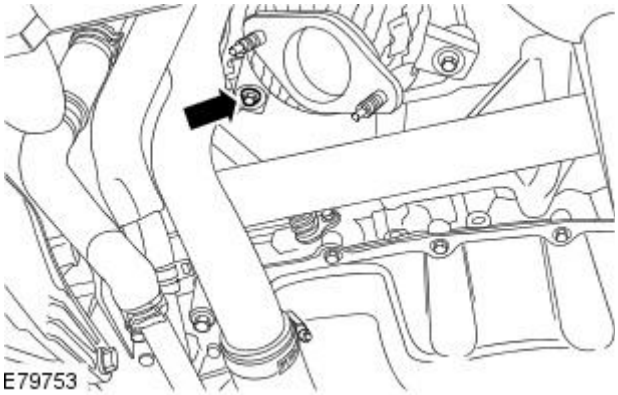
- Remove and discard the retaining nuts.

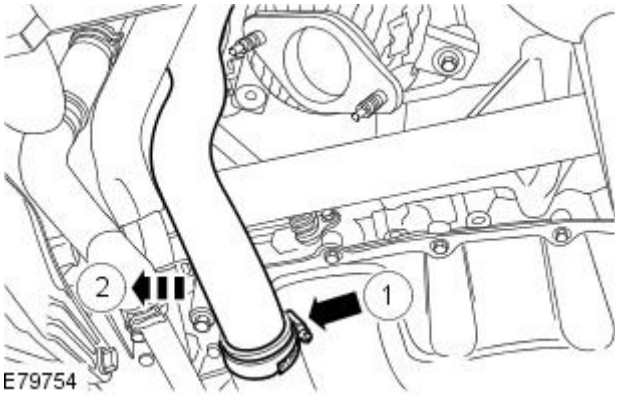


6. Disconnect the catalytic converter temperature sensor electrical connector.

7. Remove the exhaust flexible pipe.
For additional information, refer to: Exhaust Flexible Pipe - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (309-00 Exhaust System, Removal and Installation).

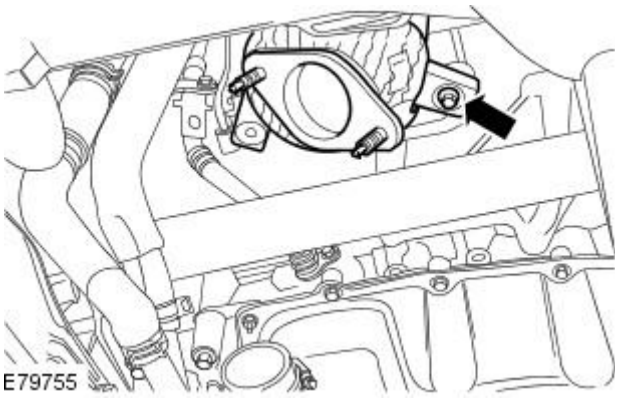
8. Remove the turbocharger outlet pipe retaining bolt.





9. Detach the turbocharger outlet pipe.

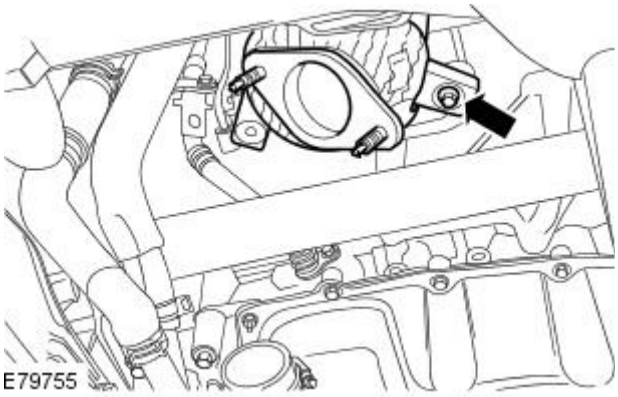
1. Loosen the retaining clip.
2. Reposition the pipe.



10. Remove the catalytic converter.

- Remove the securing bolt.
- Remove and discard the gasket.

Installation



1. CAUTION: Never use jointing compound forward of the catalytic converter.

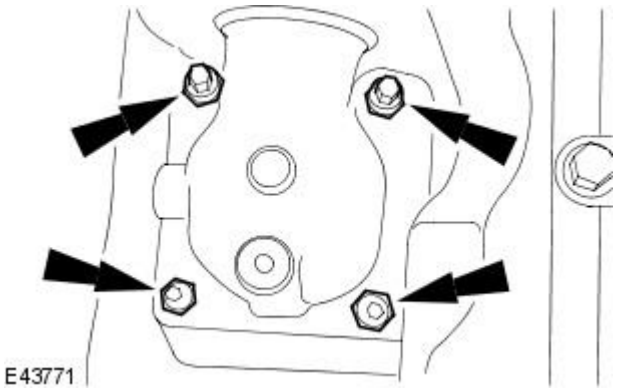
• NOTE: Coat the catalytic converter studs with anti-seize grease.

Install the catalytic converter.

- Loosely install the catalytic converter retaining bolt.
- Install a new gasket.

2. Lower the vehicle.

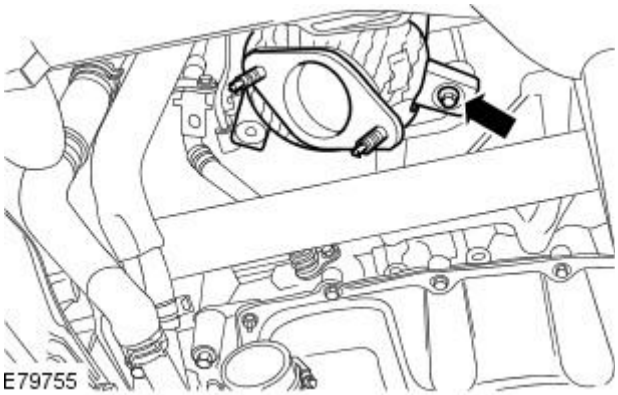
3. Install the catalytic converter to turbocharger retaining nuts.



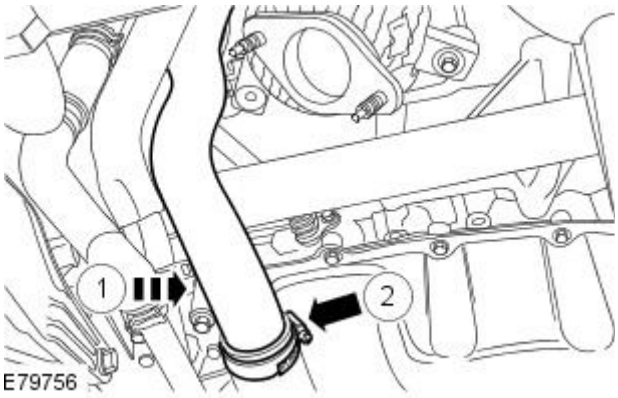
- Tighten to 46 Nm.
- Install new retaining nuts.

4. Raise the vehicle.

5. Tighten the catalytic converter retaining bolt.



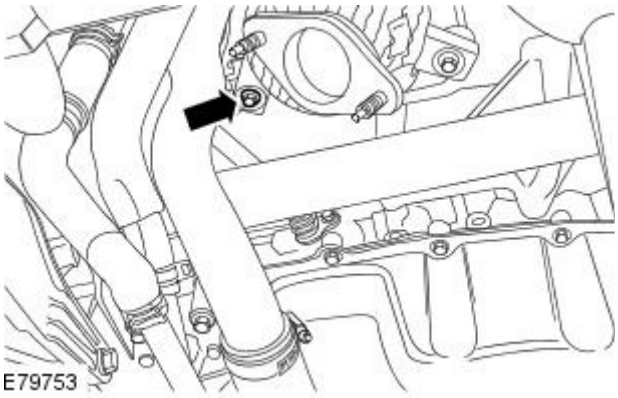
- Tighten to 46 Nm.



6. Attach the turbocharger outlet pipe.

1. Reposition the pipe.
2. Tighten the retaining clip.

- Tighten to 4 Nm.

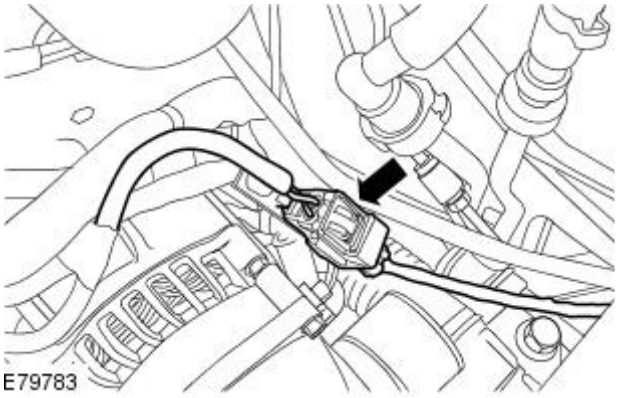


7. Install the turbocharger outlet pipe retaining bolt.

- Tighten to 46 Nm.

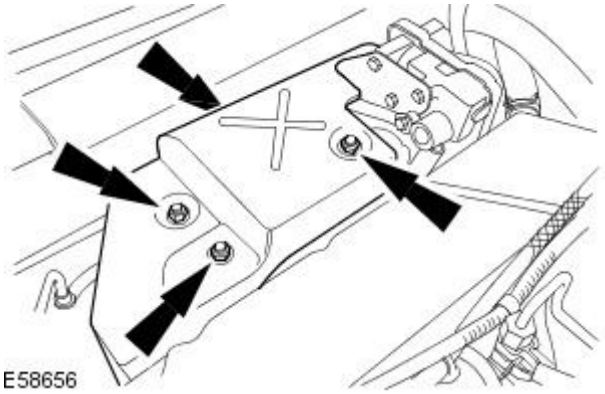
8. Install the exhaust flexible pipe.
For additional information, refer to: Exhaust Flexible Pipe - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (309-00 Exhaust System, Removal and Installation).

9. Connect the catalytic converter temperature sensor electrical connector.



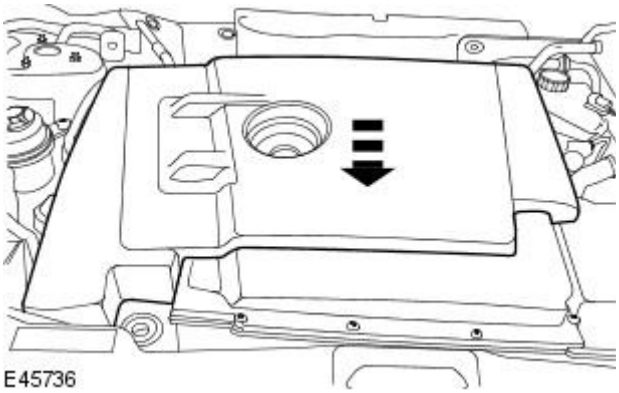
10. Install the turbocharger heatshield.

- Tighten to 8 Nm.

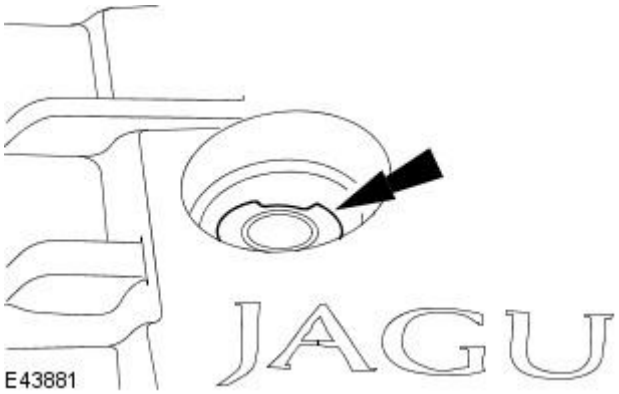


11. NOTE: Remove the oil filler cap and oil level indicator.

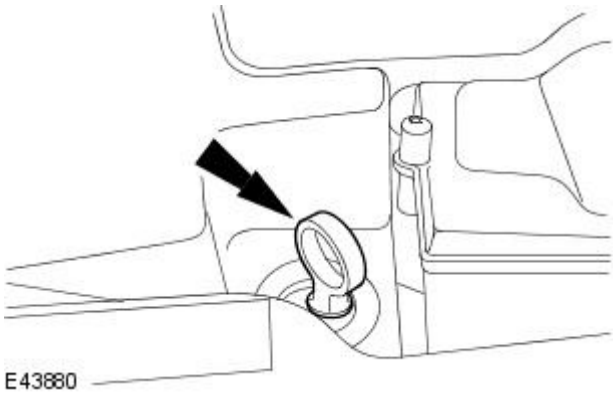
Install the engine cover.


E45736

12. Install the oil filler cap.


E43881

13. Install the oil level indicator.


E43880

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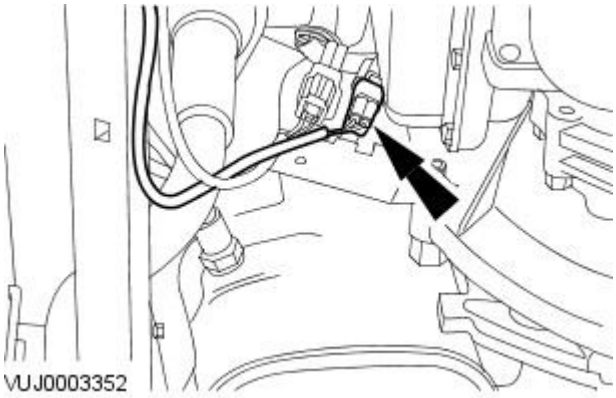
Exhaust System - Catalytic Converter LH2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

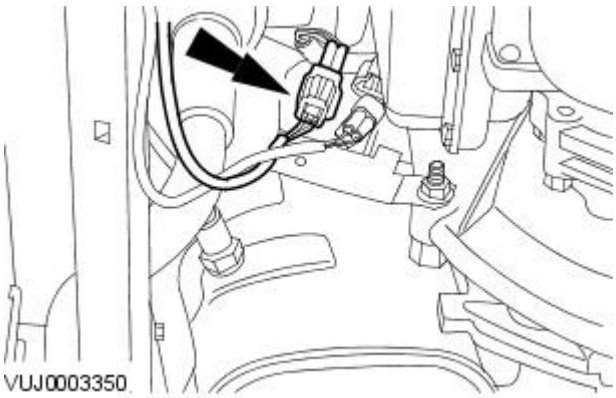
Removal and Installation

Removal

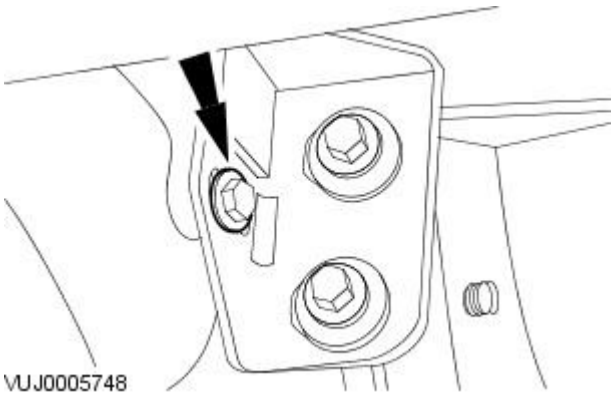
1. Disconnect the battery ground cable. For additional information, refer to For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
.
2. Remove the cooling fan motor and shroud. For additional information, refer to
For additional information, refer to: Cooling Fan Motor and Shroud (303-03A Engine Cooling - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).
.
3. Disconnect the heated oxygen sensor (HO2S) electrical connector.



4. Disconnect the catalyst monitor sensor electrical connector.

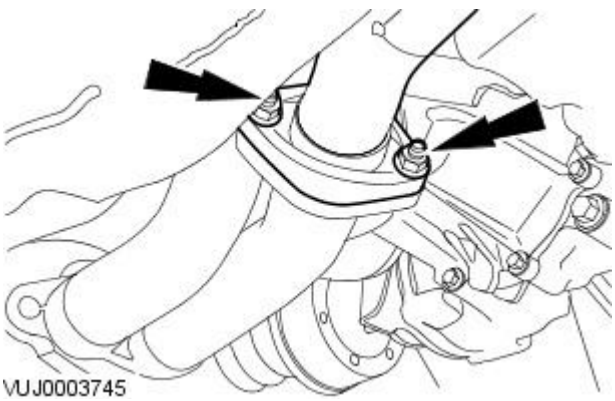


5. Remove the catalyst to support bracket retaining bolt.

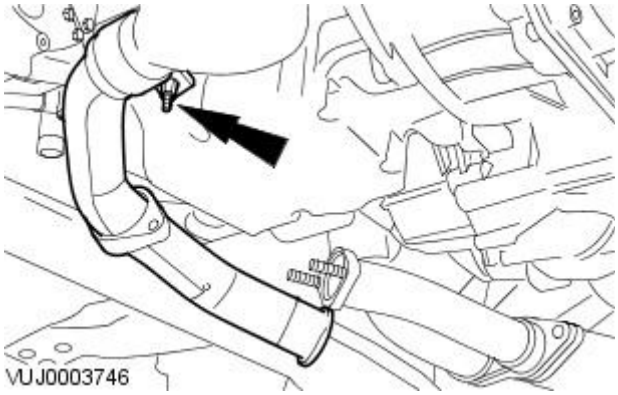


6. NOTE: 2.5L and 3.0L shown, 2.0L similar.

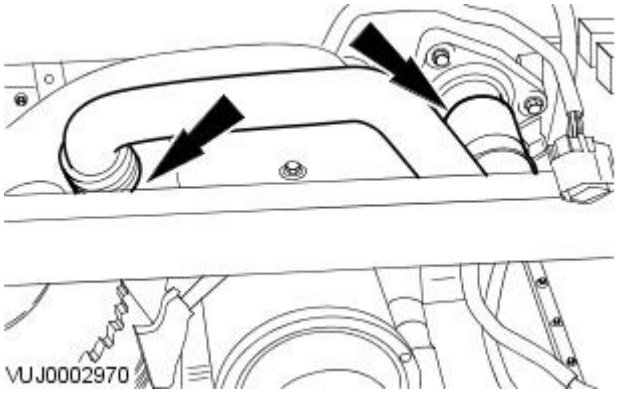
Detach the muffler inlet pipe.



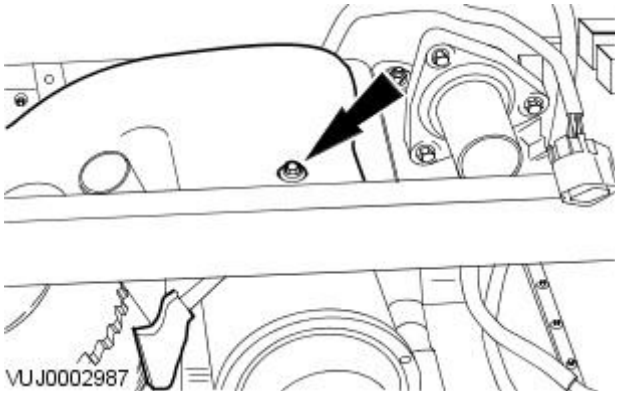
7. Remove the front pipe.



8. Remove the thermostat housing to oil cooler coolant pipe.

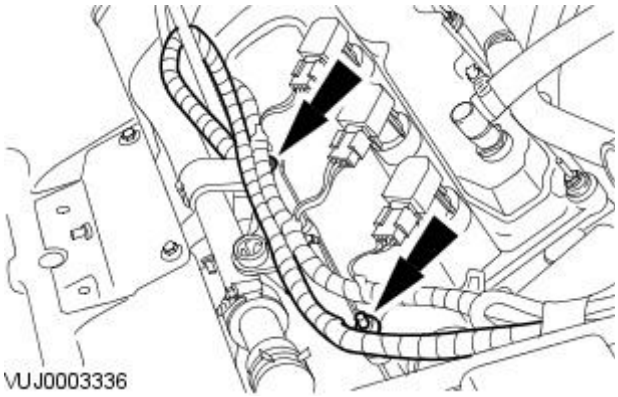


9. Remove the catalytic converter heat shield lower retaining bolt.

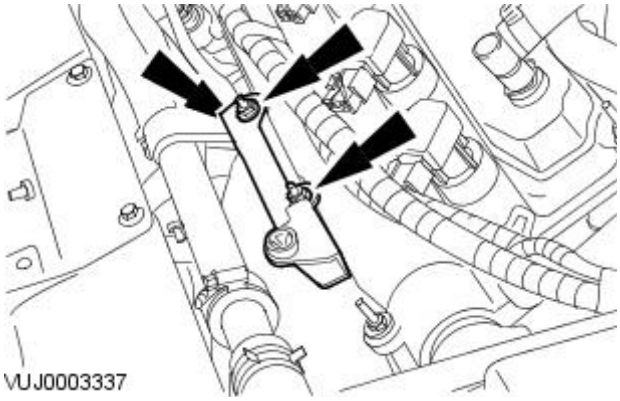


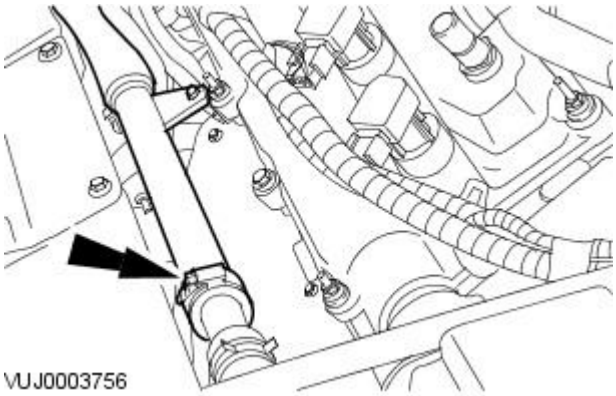
10. Lower the vehicle.

11. Detach and reposition the wiring harnesses.

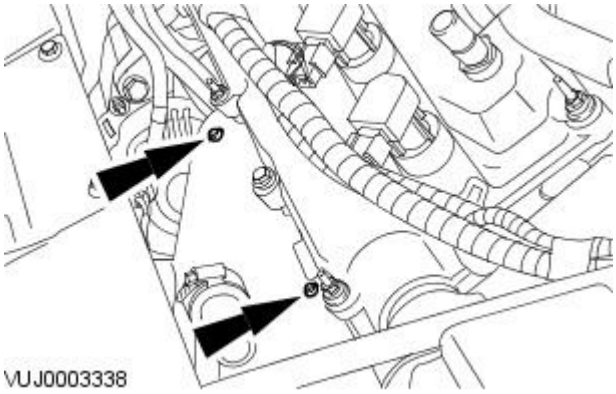


12. Remove the air cleaner retaining bracket.

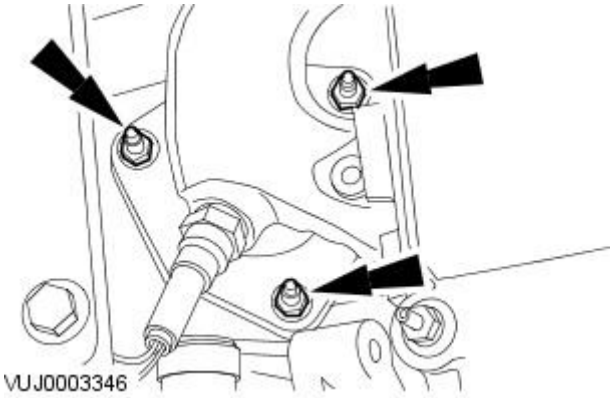




13. Detach and reposition the radiator inlet coolant pipe.

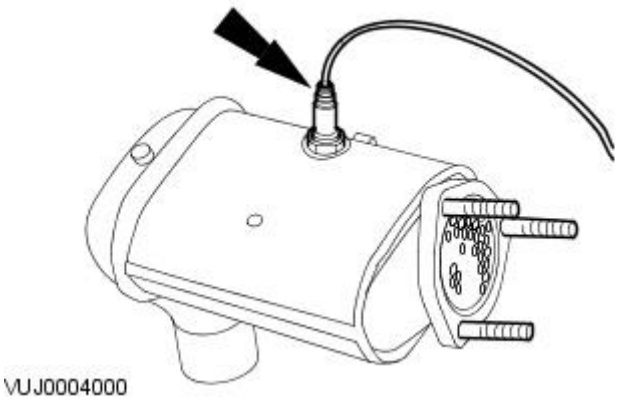


14. Remove the catalytic converter heat shield.

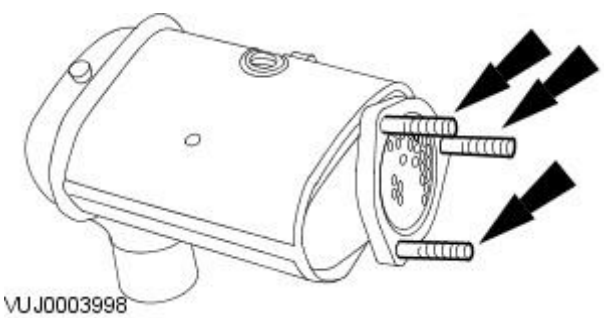


15. Remove the catalytic converter.

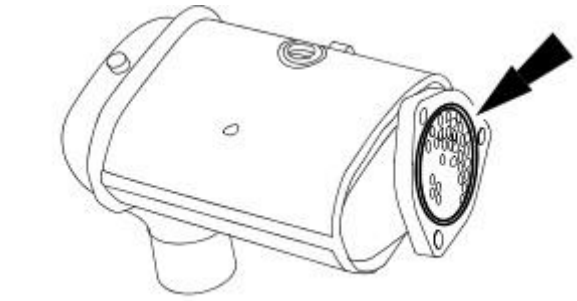
- Discard the retaining nuts.



16. Remove the HO2S.



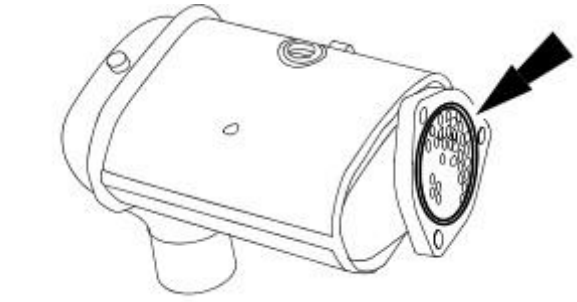
17. Remove and discard the catalytic converter retaining studs.



VUJ0003999

18. Remove and discard the sealing ring.

Installation

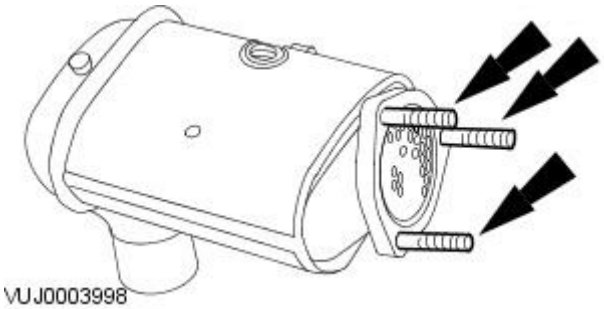


VUJ0003999

1. CAUTION: Never use jointing compound forward of the catalytic converter.

To install, reverse the removal procedure.

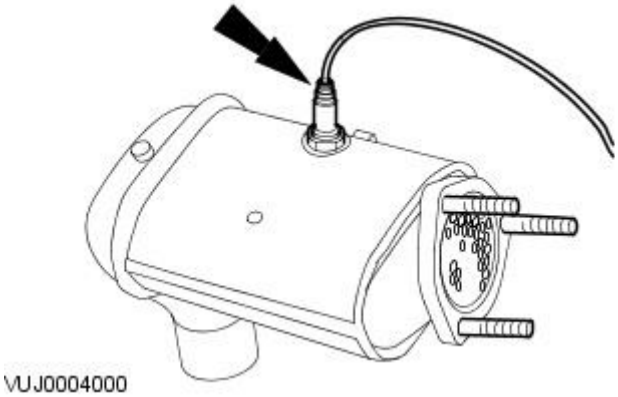
- Install a new sealing ring.



VUJ0003998

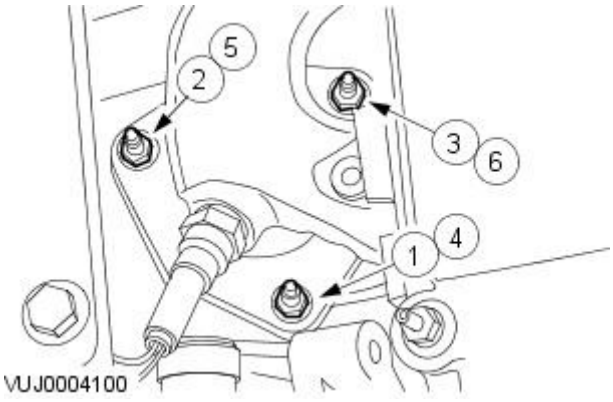
2. Install new catalytic converter retaining studs.

- Tighten to 9 Nm.



VUJ0004000

3. Tighten to 40 Nm.

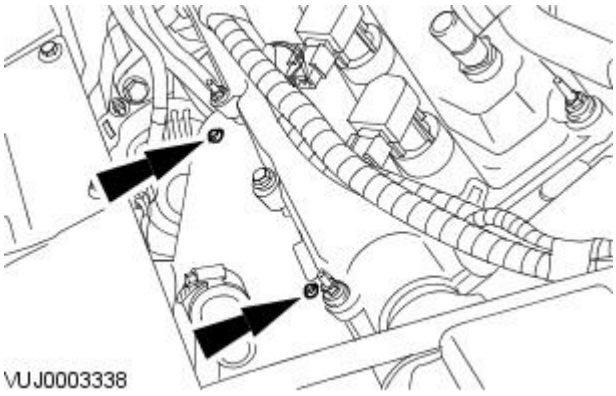


VUJ0004100

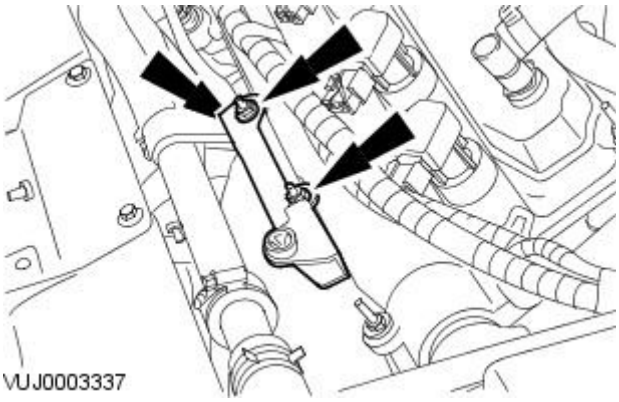
4. NOTE: Make sure that the retaining nuts are tightened twice in the sequence shown.

Tighten in the sequence shown to 25 Nm.

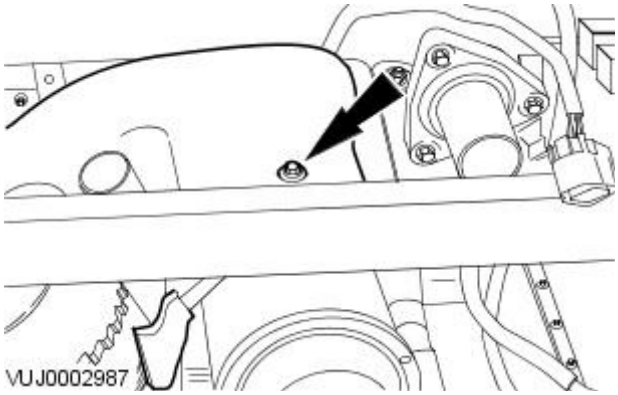
5. Tighten to 10 Nm.



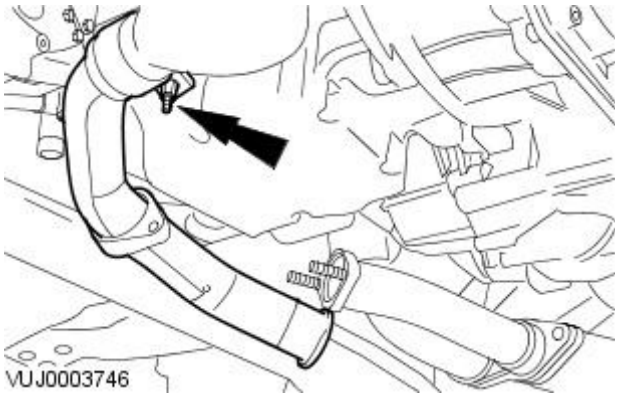
6. Tighten to 6 Nm.



7. Tighten to 10 Nm.

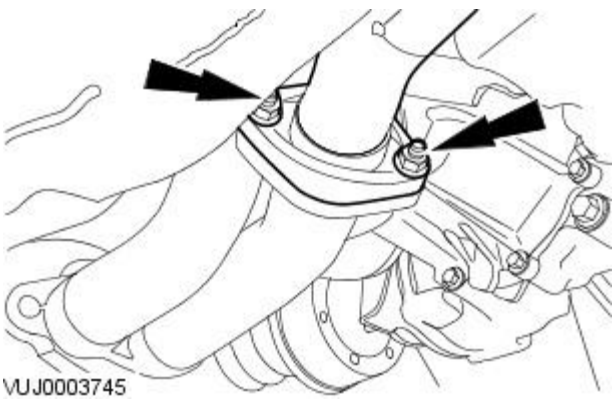


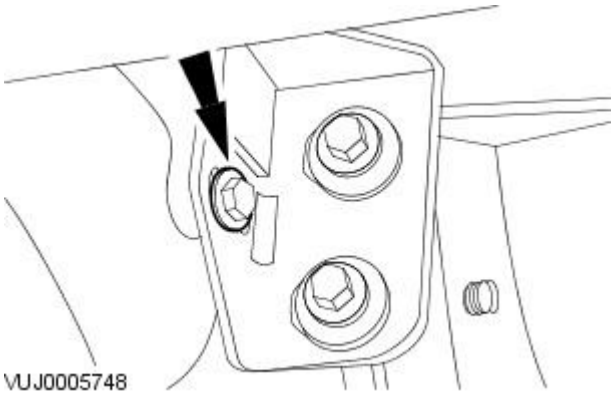
8. Tighten to 55 Nm.



9. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Tighten to 55 Nm.





10. Tighten to 25 Nm.

11. 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 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).

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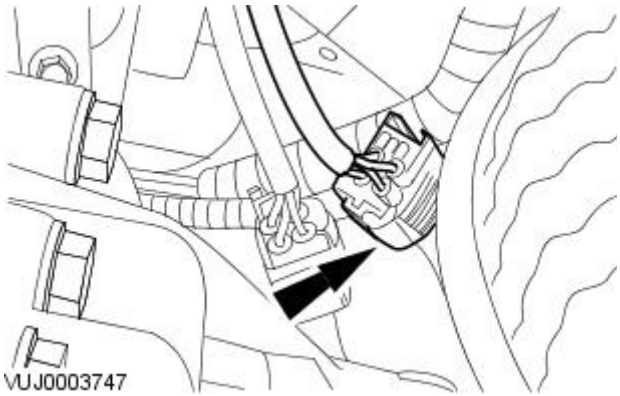
Exhaust System - Catalytic Converter RH2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Removal and Installation

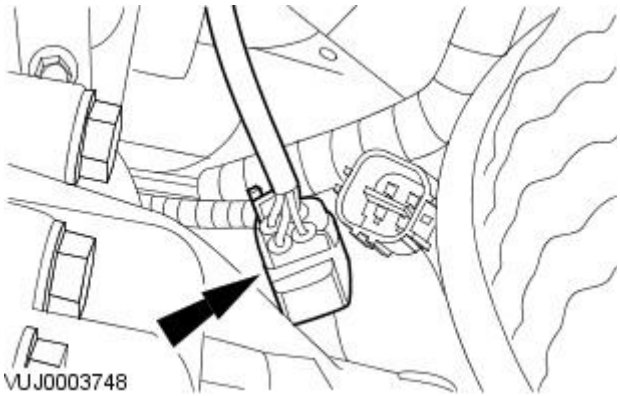
Removal

1. Remove the front subframe. For additional information, refer to For additional information, refer to: Front Subframe - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
.



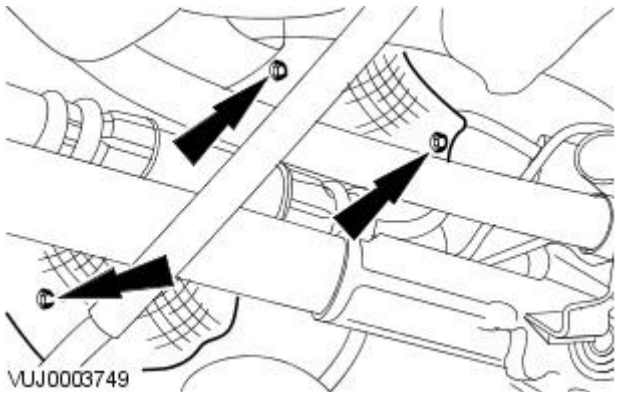
2. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Disconnect the catalyst monitor sensor electrical connector.



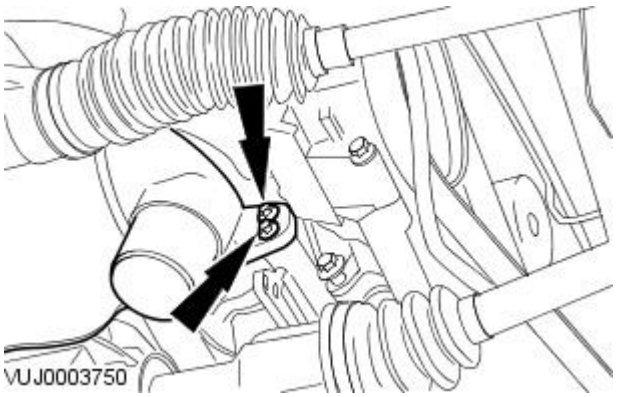
3. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Disconnect the heated oxygen sensor (HO2S) electrical connector.



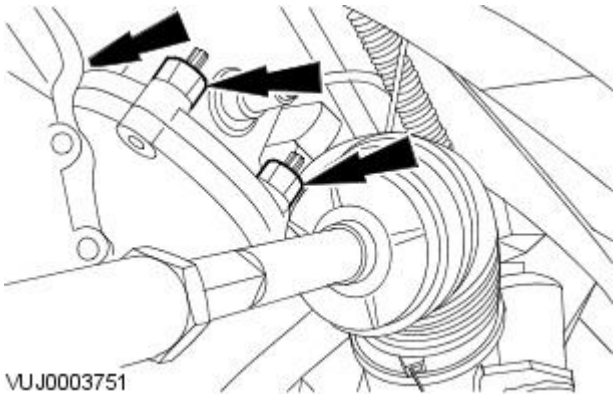
4. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Remove the exhaust heat shield.



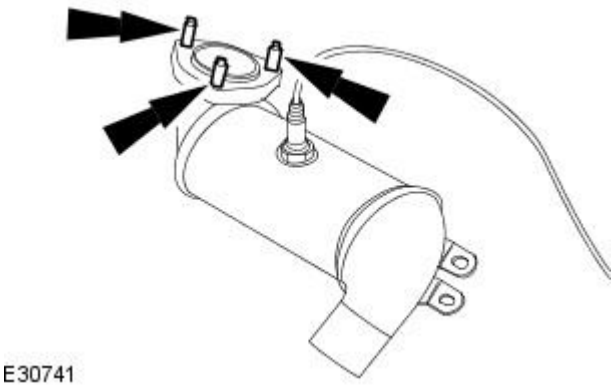
5. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Remove the catalytic converter retaining bolts.

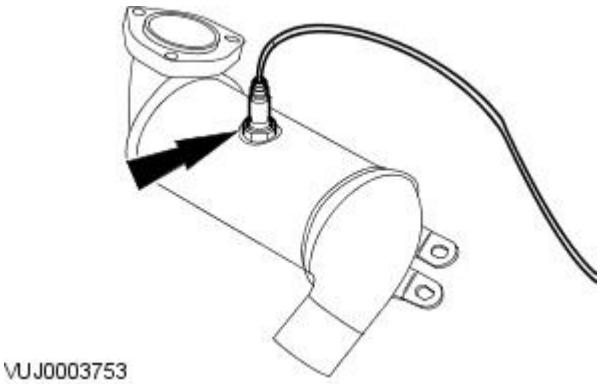

VUJ0003751

6. NOTE: 2.5L and 3.0L shown, 2.0L similar.

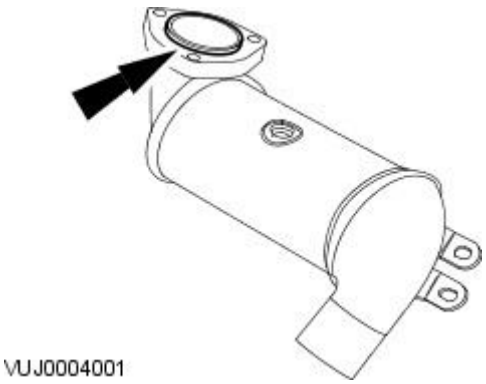
Remove and discard the retaining nuts.


E30741

7. Remove and discard the retaining studs.

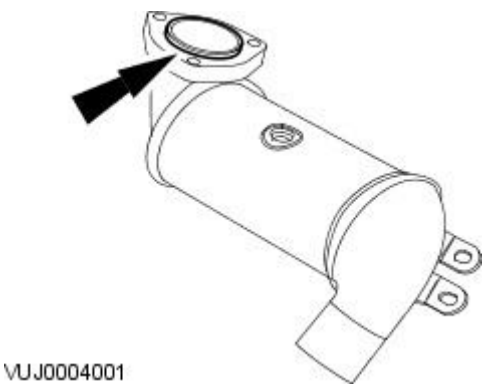

VUJ0003753

8. Remove the HO2S.


VUJ0004001

9. Remove and discard the sealing ring.

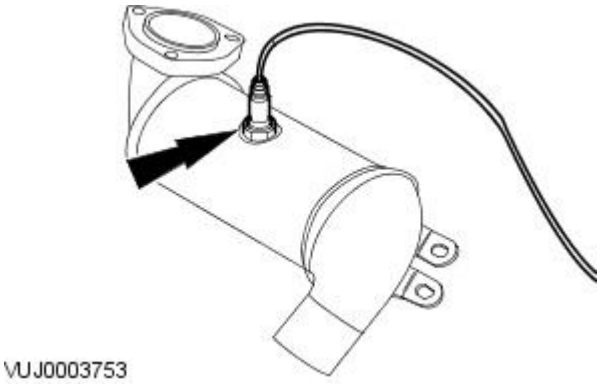
Installation


VUJ0004001

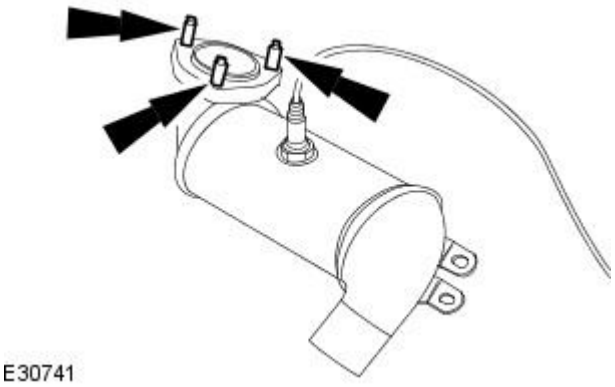
1. CAUTION: Never use jointing compound forward of the catalytic converter.

To install, reverse the removal procedure.

- Install a new sealing ring.

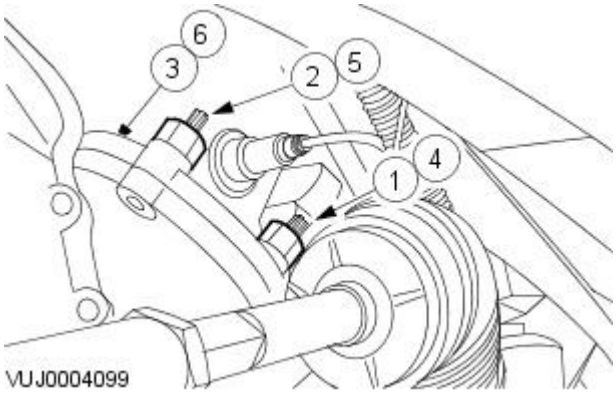


2. Tighten to 40 Nm.



3. Install new retaining studs.

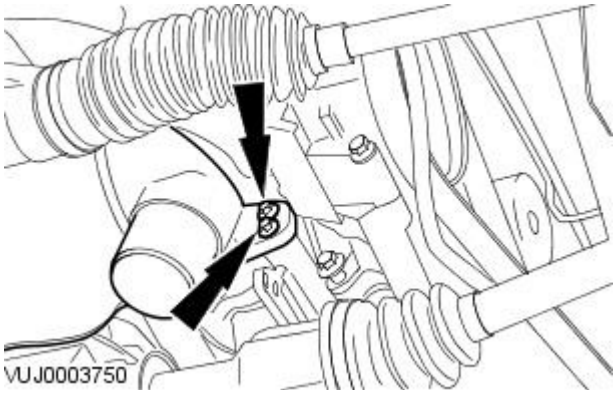
- Tighten to 9 Nm.



4. NOTE: 2.5L and 3.0L shown, 2.0L similar.

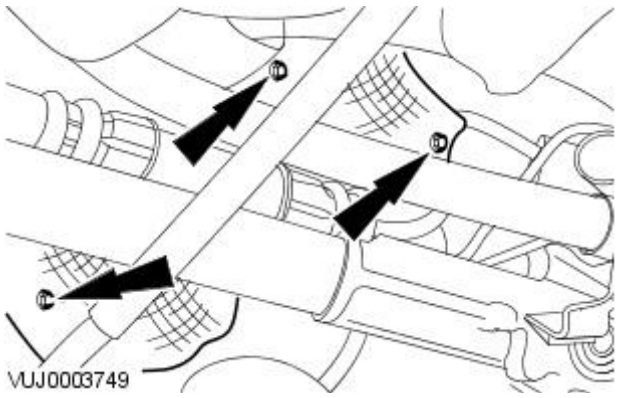
• NOTE: Make sure that the retaining nuts are tightened twice in the sequence shown.

Tighten in the sequence shown to 25 Nm.



5. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Tighten to 25 Nm.



6. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Tighten to 10 Nm.

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 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, General Procedures).

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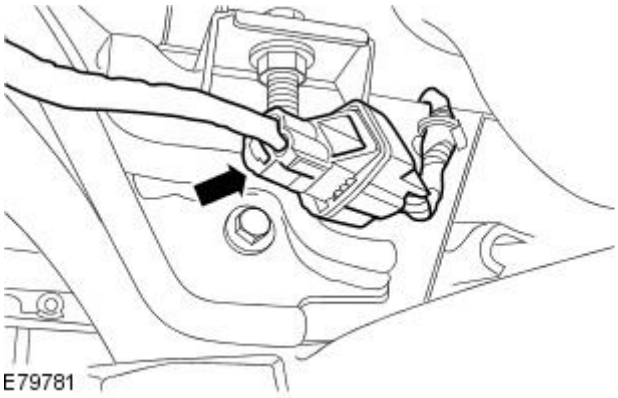
Exhaust System - Diesel Particulate Filter (DPF)

Removal and Installation

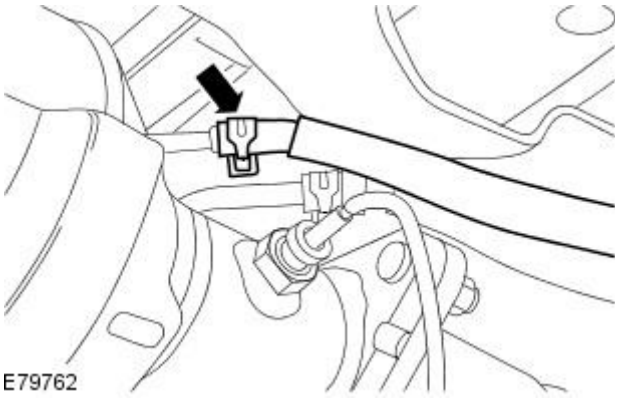
Removal

1. Raise and support the vehicle.
   For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. Disconnect the diesel particulate filter temperature sensor electrical connector.



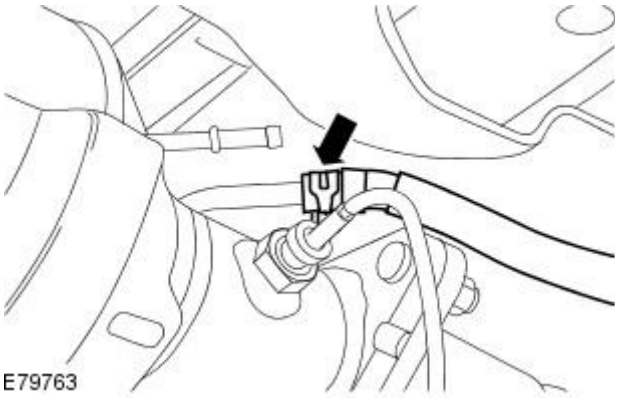
3. NOTE: Note the orientation of the diesel particulate filter high-pressure and low-pressure hoses and make sure they are installed in the same position.

   Detach the diesel particulate filter low-pressure hose.

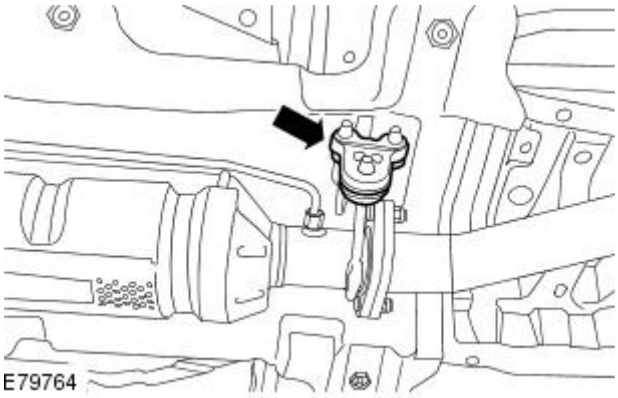


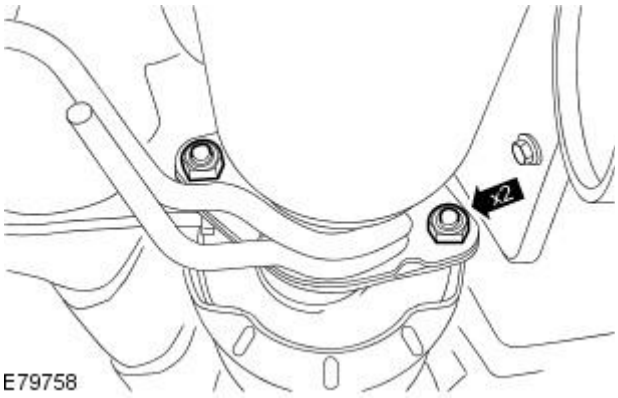
4. NOTE: Note the orientation of the diesel particulate filter high-pressure and low-pressure hoses and make sure they are installed in the same position.

   Detach the diesel particulate filter high-pressure hose.



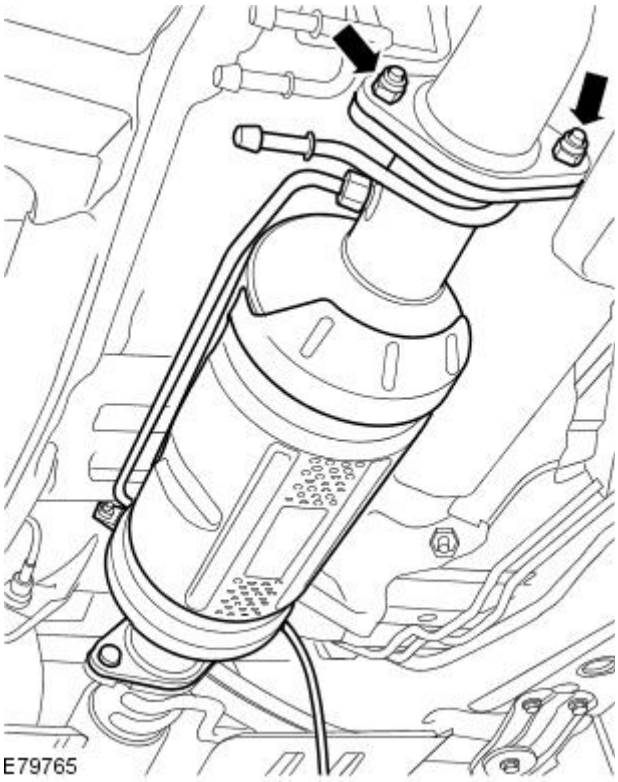
5. Detach the diesel particulate filter support isolator.





6. Remove the diesel particulate filter to flexible pipe retaining nuts.

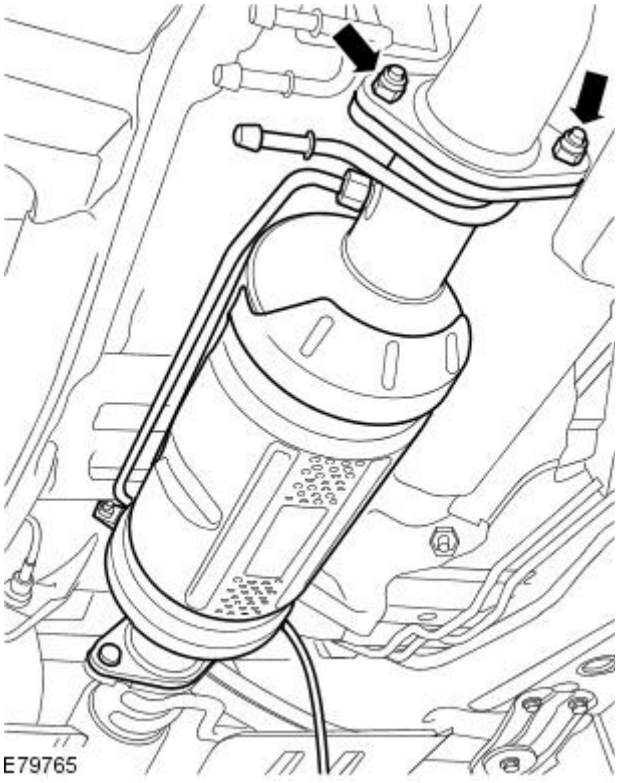
- Remove and discard the gasket and nuts.



7. Remove the diesel particulate filter.

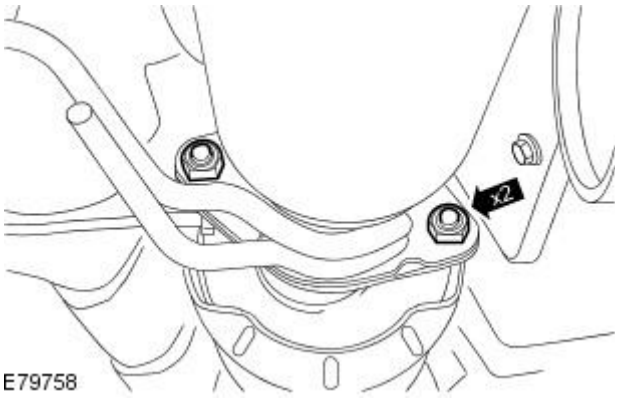
- Remove and discard the gasket and nuts.

Installation



1. To install, reverse the removal procedure.

- Tighten to 46 Nm.
- Install a new gasket and nuts.



2. Tighten to 46 Nm.

- Install a new gasket and nuts.

Published: 11-May-2011

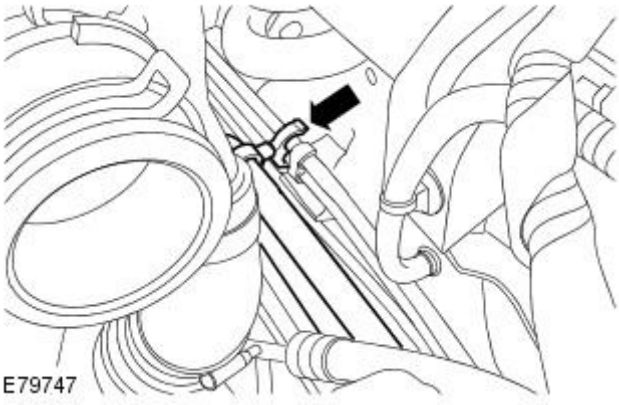
Exhaust System - Diesel Particulate Filter (DPF) Differential Pressure Sensor

Removal and Installation

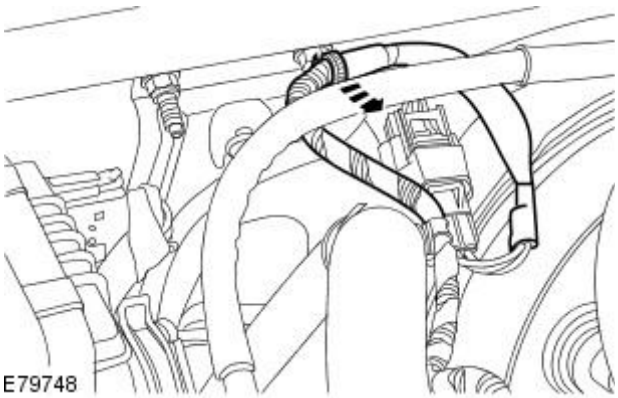
Removal

1. Remove the air cleaner outlet pipe.
   For additional information, refer to: Air Cleaner Outlet Pipe (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
2. NOTE: Note the orientation of the retaining clip.

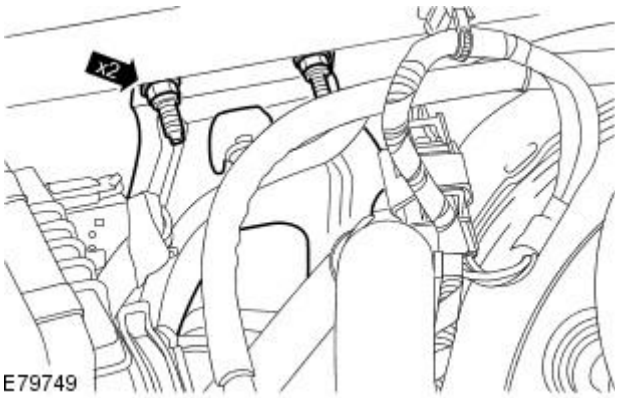
   Detach the diesel particulate filter (DPF) high-pressure and low-pressure hoses.



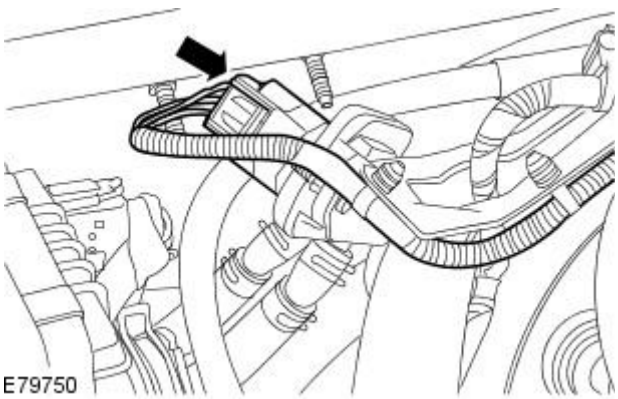
3. Detach the wiring harness.

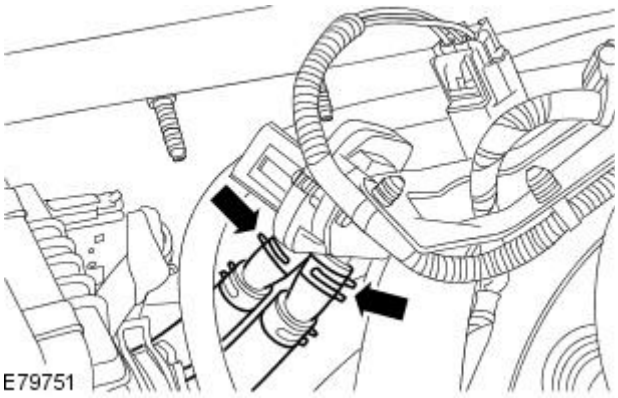


4. Detach the DPF differential pressure sensor retaining bracket.
   - Remove the retaining nuts.



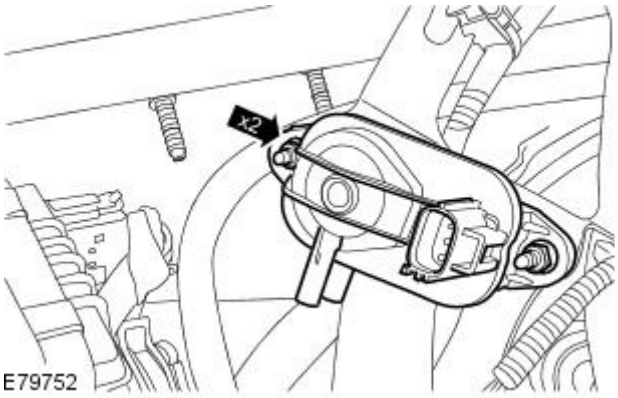
5. Disconnect the DPF differential pressure sensor electrical connector.





6. NOTE: Note the orientation of the DPF differential pressure high-pressure and low-pressure hoses and make sure they are installed in the same position.

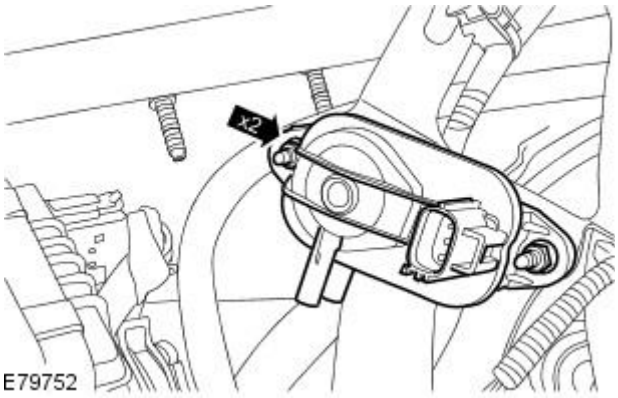
Disconnect the DPF differential pressure sensor high-pressure and low-pressure hoses.



7. Remove the DPF differential pressure sensor.

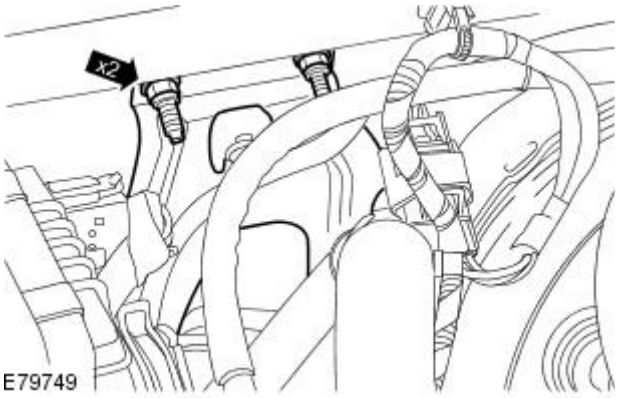
- Remove the retaining nuts.

Installation



1. To install, reverse the removal procedure.

- Tighten to 5 Nm.



2. Tighten to 4 Nm.

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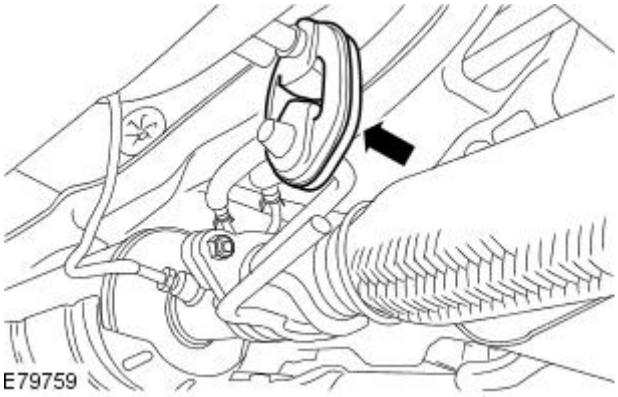
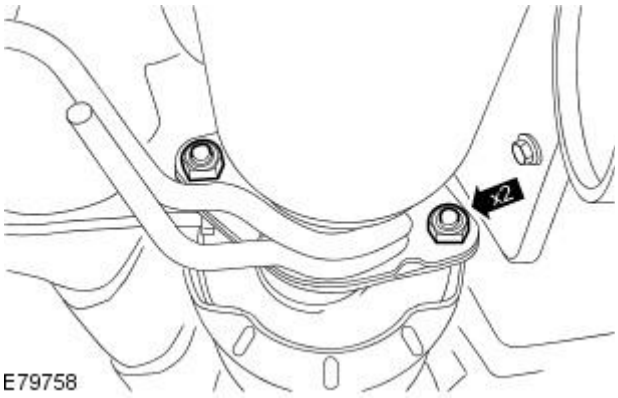
Exhaust System - Exhaust Flexible Pipe2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma

Removal and Installation

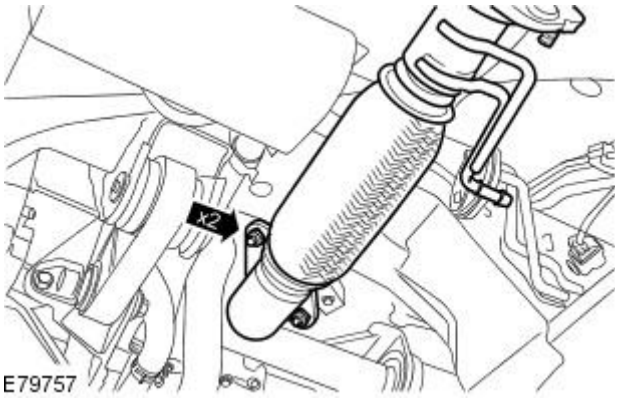
Removal



1. Remove the air deflector.
   For additional information, refer to: Air Deflector - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (501-02 Front End Body Panels, Removal and Installation).
2. Detach the exhaust flexible pipe support isolator.



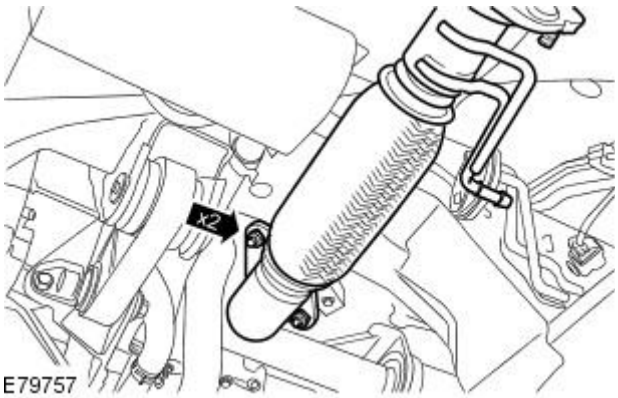
3. Remove the exhaust flexible pipe retaining nuts.
   - Remove and discard the gasket and nuts.



4. CAUTION: Over bending of the exhaust flexible pipe may result in damage to the component.

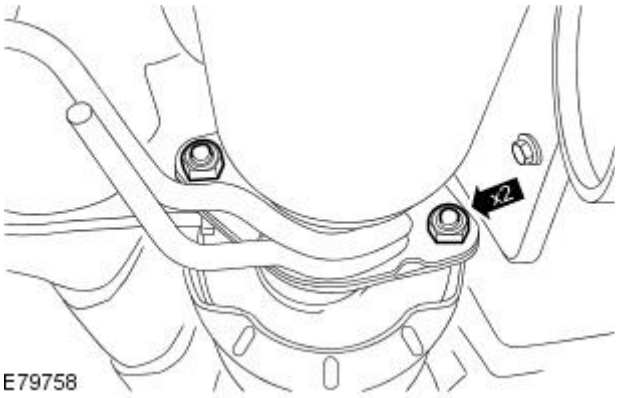
   Remove the exhaust flexible pipe.
   - Remove and discard the gasket and nuts.

Installation



1. CAUTION: Over bending of the exhaust flexible pipe may result in damage to the component.

   To install, reverse the removal procedure.
   - Install a new exhaust flexible pipe gasket and nuts.
   - Tighten to 46 Nm.



2. Tighten to 46 Nm.

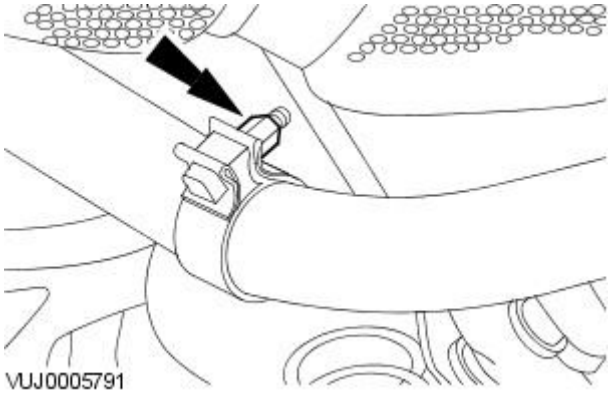
- Install a new exhaust flexible pipe gasket and nuts.

Exhaust System - Front Muffler2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma

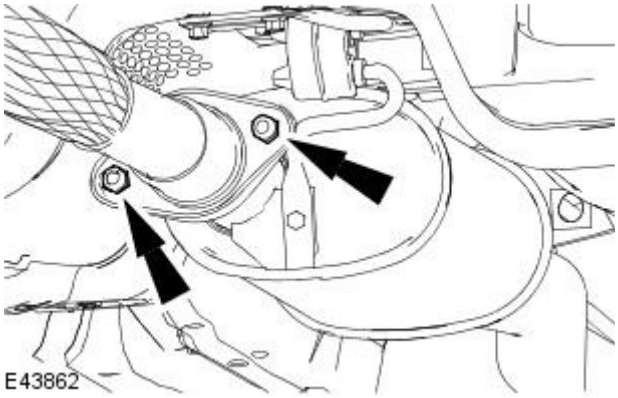
Removal and Installation

Removal

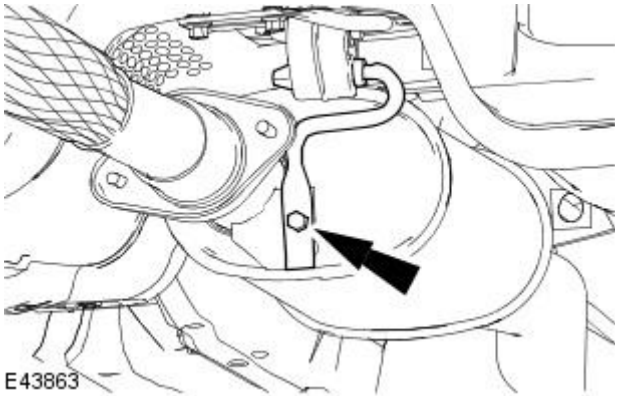
1. Raise and support the vehicle.
   For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. Loosen the rear muffler exhaust clamp nut.



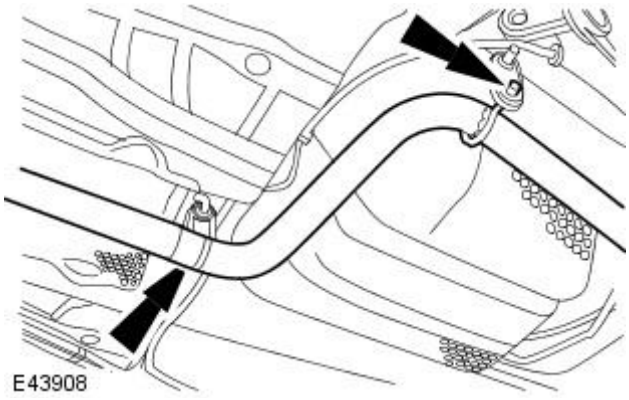
3. Remove the front muffler retaining nuts.



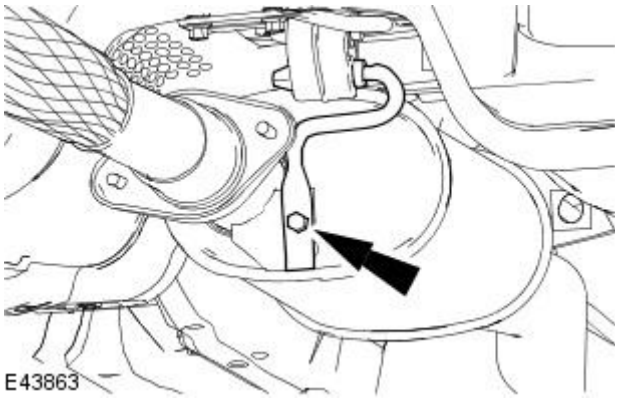
4. Detach the front muffler exhaust hanger isolator bracket.



5. Remove the front muffler.
   - Detach the front muffler hanger isolators.
   - Discard the gasket.



Installation



1. CAUTION: The exhaust hanger isolators are constructed of a special material. Use only the correct specification exhaust hanger isolators.

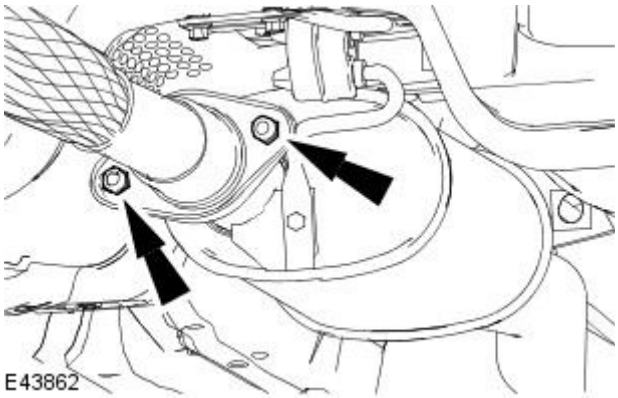
• NOTE: Check the exhaust hanger isolators for damage or fatigue. Install new exhaust hanger isolators if required.

• NOTE: Make sure the front muffler does not foul the underside of the vehicle.

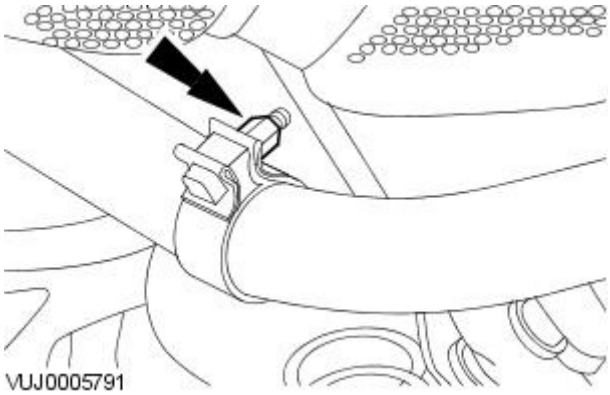
• NOTE: Install a new gasket.

To install, reverse the removal procedure.

- Tighten to 25 Nm.



2. Tighten to 46 Nm.



3. Tighten to 55 Nm.

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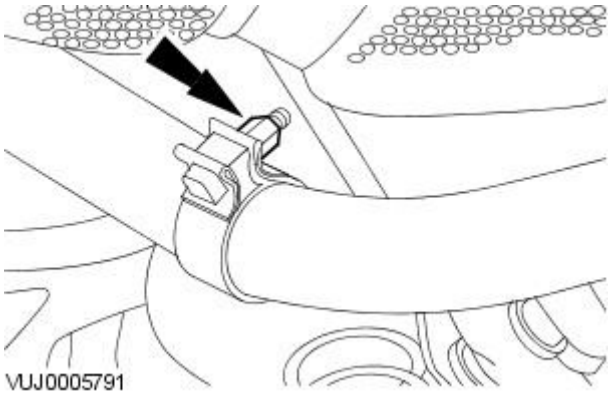
Exhaust System - Front Muffler2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Removal and Installation

Removal

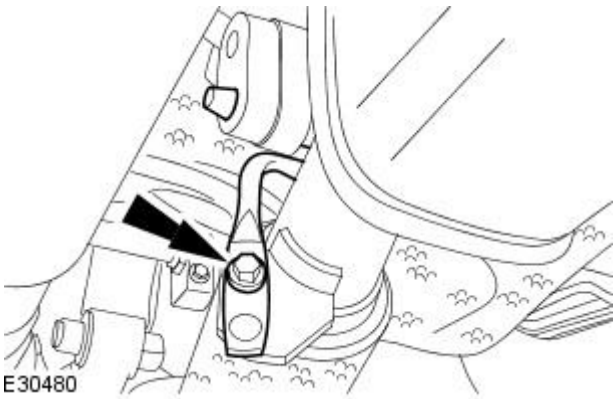
All vehicles

1. Raise and support the vehicle.
   For additional information, refer to Section 100-01 Identification Codes.
2. Loosen the rear muffler exhaust clamp nut.

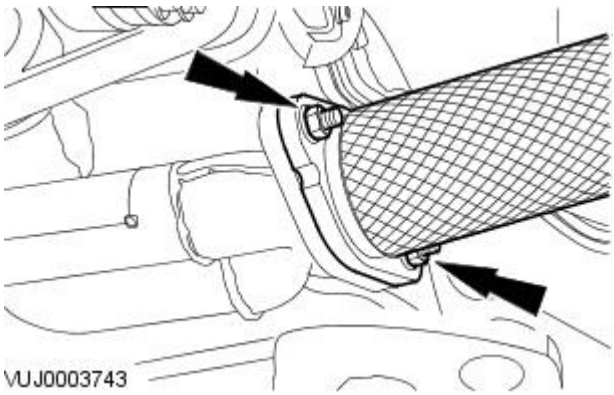


Vehicles with 2.5L or 3.0L engine

3. Detach the front muffler exhaust hanger isolator bracket.

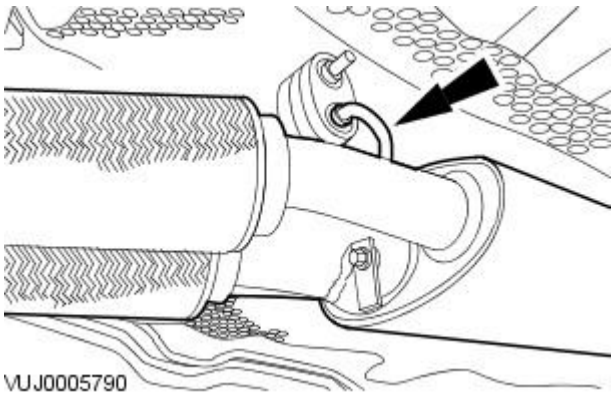


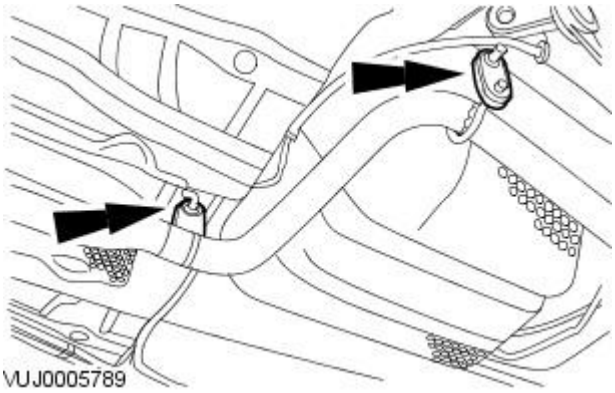
4. Remove the front muffler.
   - Remove and discard the gasket.



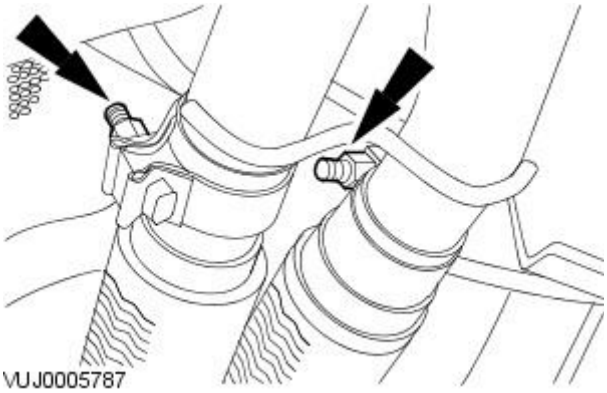
Vehicles with 2.0L engine

5. Detach the front muffler exhaust hanger isolator.





6. Detach the front muffler hanger isolators.

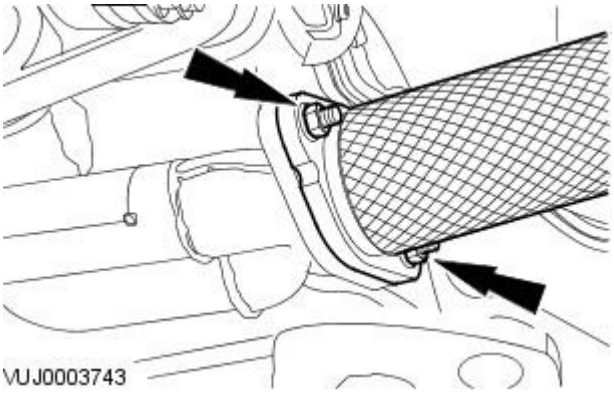


7. Remove the front muffler.

- Loosen the front muffler clamp retaining nuts.

Installation

Vehicles with 2.5L or 3.0L engine



1. CAUTION: The exhaust hanger isolators are constructed of a special material. Use only the correct specification exhaust hanger isolators.

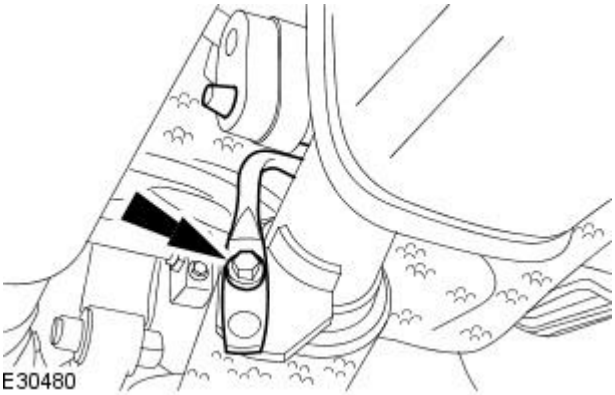
• NOTE: Check the exhaust hanger isolators for damage or fatigue. Install new exhaust hanger isolators if required.

• NOTE: Make sure the front muffler does not foul the underside of the vehicle.

• NOTE: Install a new gasket.

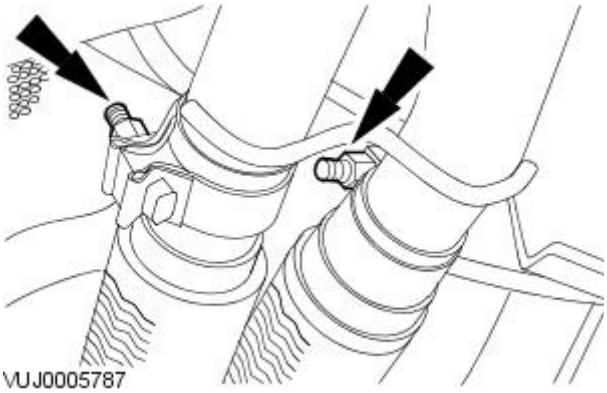
To install, reverse the removal procedure.

- Tighten to 55 Nm.



2. Tighten bolt to 25 Nm.

Vehicles with 2.0L engine



3. CAUTION: The exhaust hanger isolators are constructed of a special material. Use only the correct specification exhaust hanger isolators.

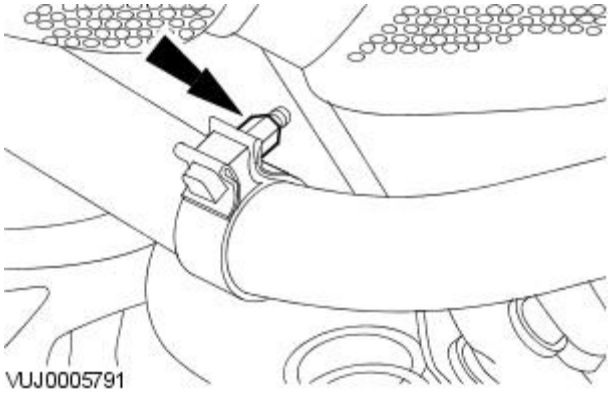
• NOTE: Check the exhaust hanger isolators for damage or fatigue. Install new exhaust hanger isolators if required.

• NOTE: Make sure the front muffler does not foul the underside of the vehicle.

To install, reverse the removal procedure.

- Tighten to 55 Nm.

All vehicles



4. Tighten to 55 Nm.

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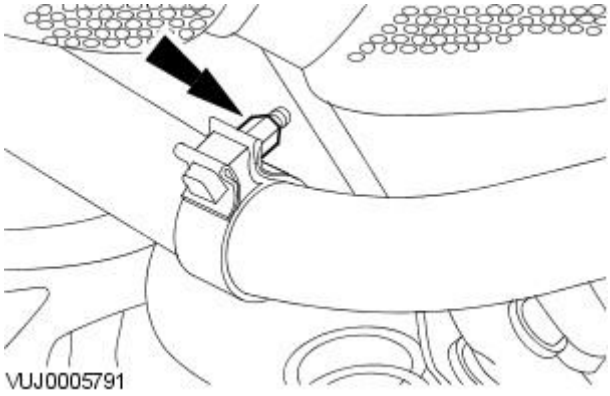
Exhaust System - Muffler and Tailpipe2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma, 2.0L

Removal and Installation

Removal



1. Raise and support the vehicle.
For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

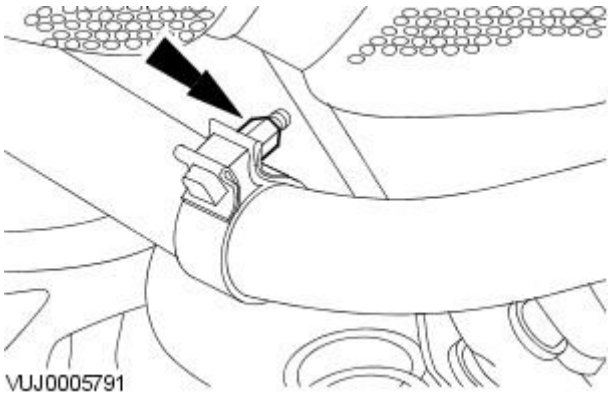
2. CAUTION: Before removing the rear muffler assembly, make a note of the location between the rear muffler and the rear muffler inlet pipe. Failure to install the rear muffler in the correct position could cause an acoustic vibration inside the vehicle.

Loosen the muffler and tailpipe clamp retaining nut.

3. Remove the rear muffler assembly.

- Detach the muffler and tailpipe support isolator.

Installation



1. CAUTION: The exhaust hanger isolators are constructed of a special material. Use only the correct specification exhaust hanger isolators. Failure to follow this instruction may result in damage to the component.

• NOTE: Check the exhaust hanger isolators for damage or fatigue. Install new exhaust hanger isolators if required.

• NOTE: Install the muffler and tailpipe in the same position that was noted in the removal procedure. If installing a new rear muffler make sure that there is no torsional stress in the exhaust system, and that the exhaust system is free of the underbody of the vehicle.

To install, reverse the removal procedure.

- Tighten to 55 Nm.

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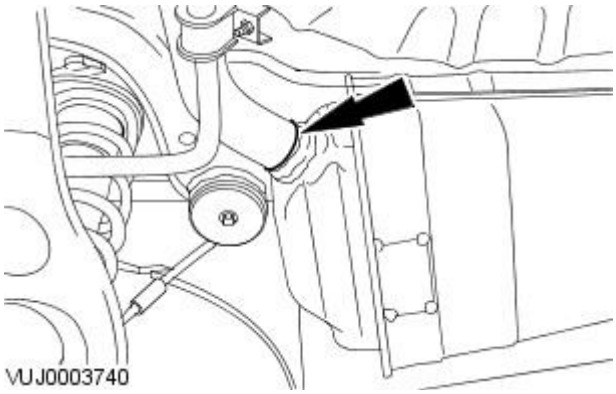
Exhaust System - Muffler and Tailpipe2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

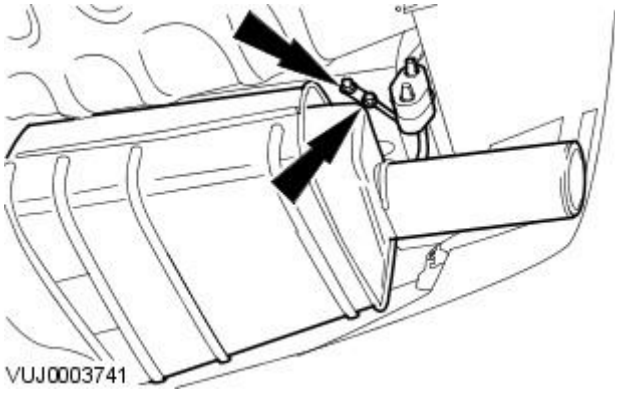
Removal and Installation

Removal



1. Raise and support the vehicle.
   For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. NOTE: Right-hand shown, left-hand similar.

   Cut the rear muffler 'Y' pipe in front of the welded joint.

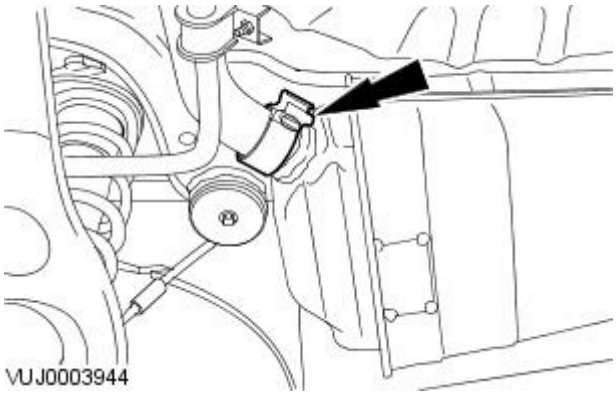


3. NOTE: Right-hand shown, left-hand similar.

   Remove the muffler and tailpipe.

   - Remove the exhaust hanger and isolator.

Installation



1. CAUTION: The exhaust hanger isolators are constructed of a special material. Use only the correct specification exhaust hanger isolators. Failure to follow this instruction may result in damage to the component.

   • NOTE: Check the exhaust hanger isolators for damage or fatigue. Install new exhaust hanger isolators if required.

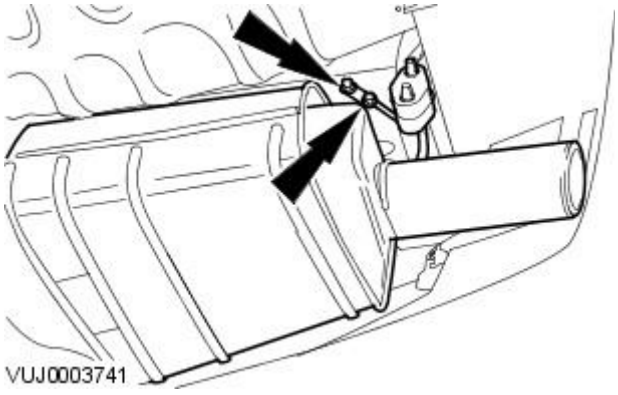
   • NOTE: Make sure the rear muffler 'Y' pipe does not have any burrs.

   • NOTE: Make sure the muffler and tailpipe is central to the bumper aperture.

   • NOTE: Right-hand shown, left-hand similar.

   Install the muffler and tailpipe.

   - Tighten to 55 Nm.



2. NOTE: Right-hand shown, left-hand similar.

   Tighten to 25 Nm.

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Exhaust System - Muffler Inlet Pipe2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Removal and Installation

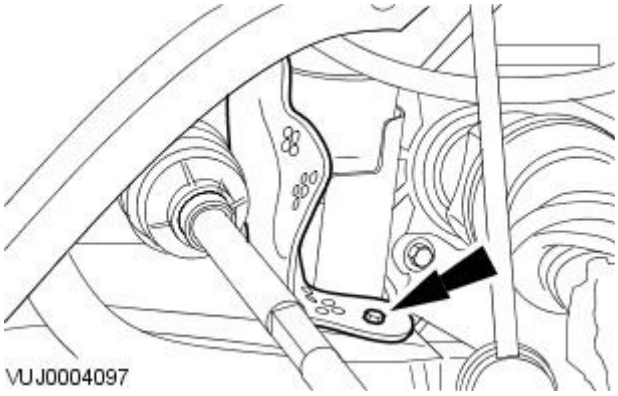
Removal

All vehicles

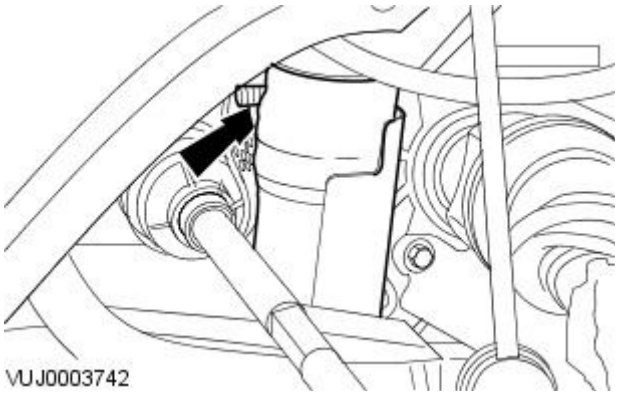
1. Remove the front wheel and tire. For additional information, refer to Section 204-04 Wheels and Tires.

Vehicles with 2.5L or 3.0L engine

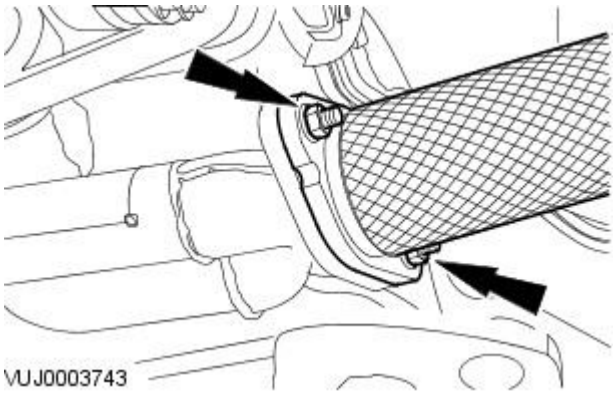
2. Detach and reposition the heat shield.



3. Loosen the muffler inlet pipe exhaust clamp nut.

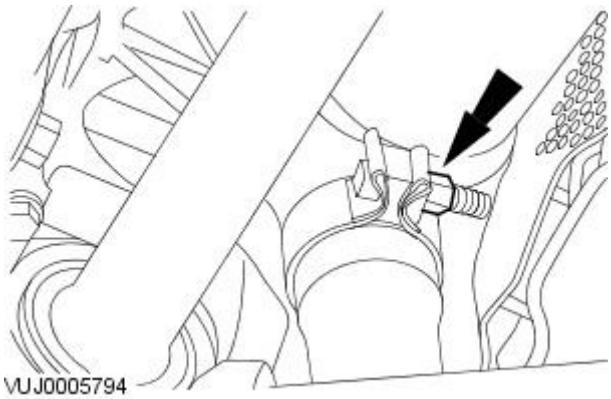


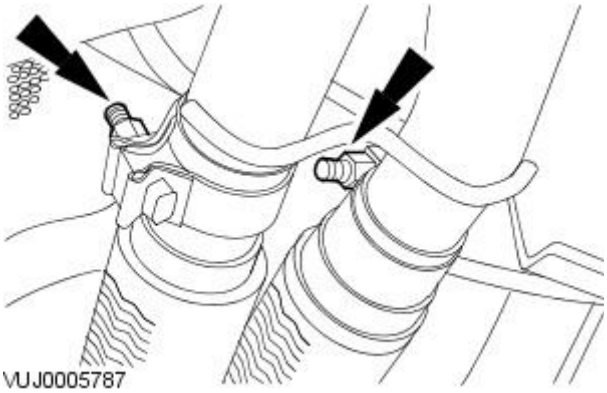
4. Detach the front muffler.
   - Remove and discard the gasket.



Vehicles with 2.0L engine

5. Loosen the muffler inlet pipe exhaust clamp nut.

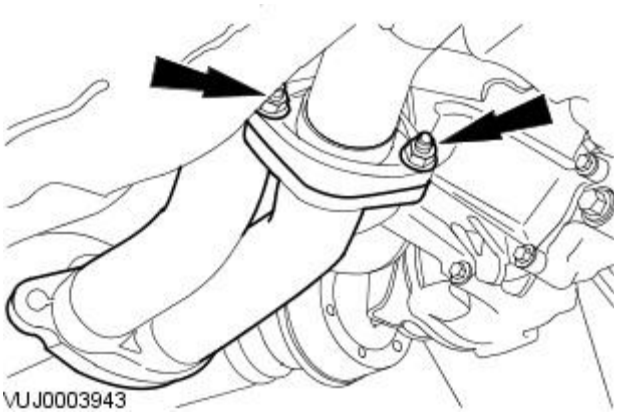



VUJ0005787

6. Detach the muffler.

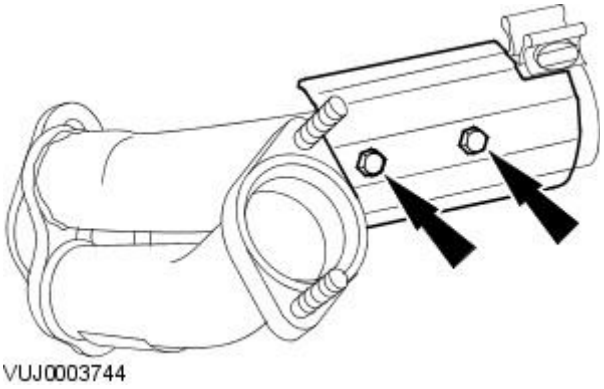
- Slacken the muffler retaining clamp nuts.

All vehicles


VUJ0003943

7. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Remove the muffler inlet pipe.

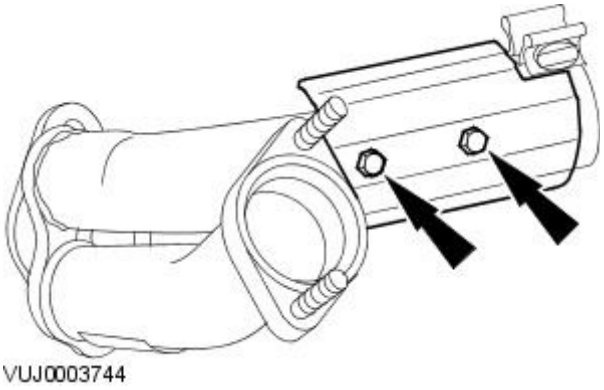

VUJ0003744

8. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Remove the exhaust heat shield.

Installation

All vehicles


VUJ0003744

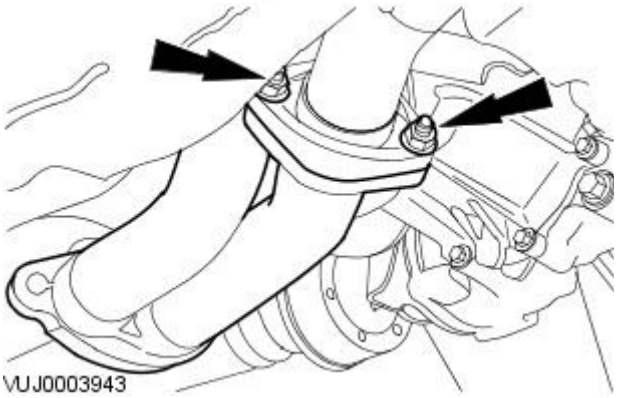
1. NOTE: 2.5L and 3.0L shown, 2.0L similar.

To install, reverse the removal procedure.

- Tighten to 10 Nm.

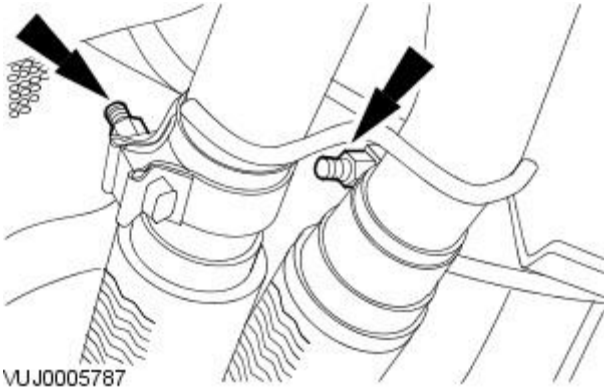
2. NOTE: 2.5L and 3.0L shown, 2.0L similar.

Tighten to 55 Nm.

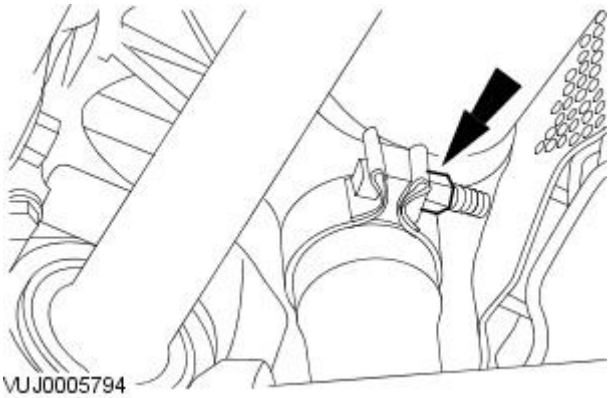


Vehicles with 2.0L engine

3. Tighten to 55 Nm.



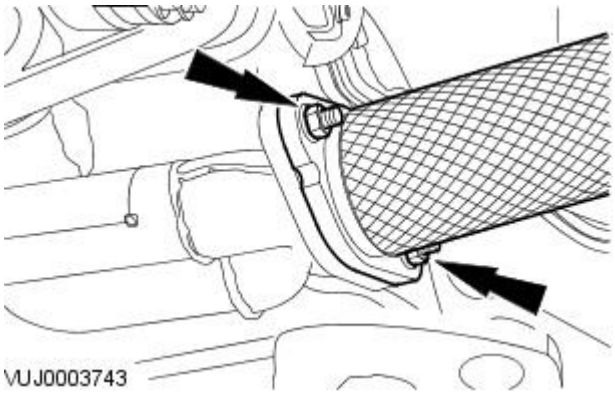
4. Tighten to 55 Nm.

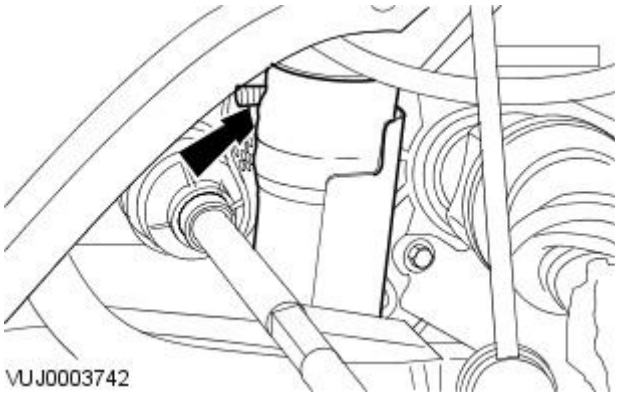


Vehicles with 2.5L or 3.0L engine

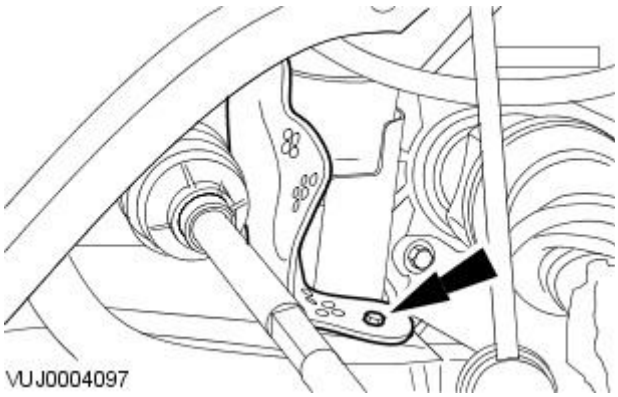
5. NOTE: Install a new gasket.

Tighten to 55 Nm.





6. Tighten to 55 Nm.



7. Tighten to 10 Nm.

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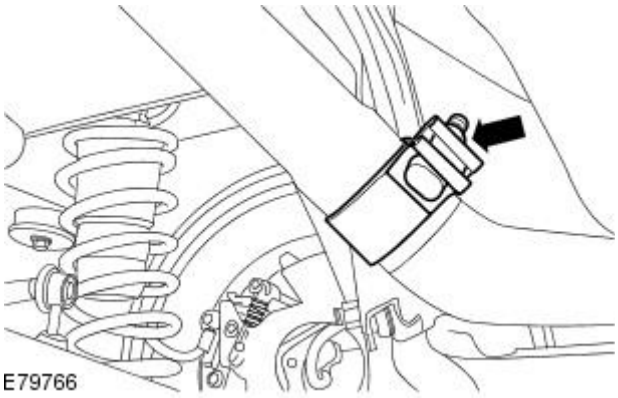
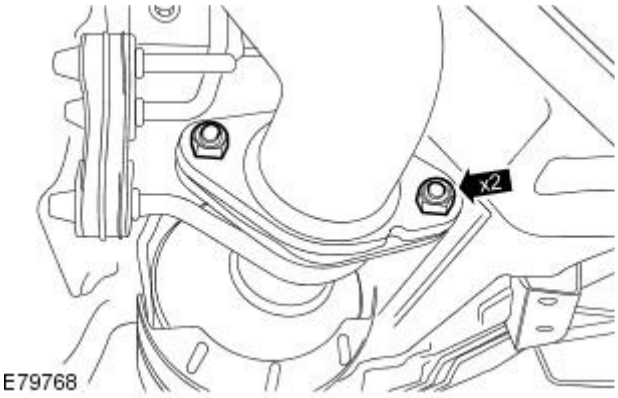
Exhaust System - Muffler Inlet PipeVehicles With: Diesel Particulate Filter (DPF)

Removal and Installation

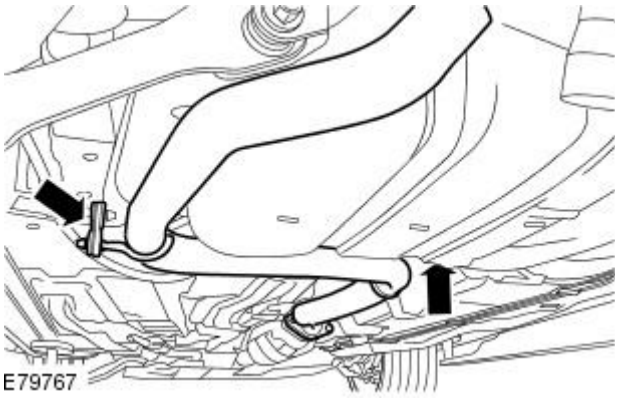
Removal



1. Raise and support the vehicle.
   For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. Loosen the rear muffler exhaust clamp nut.

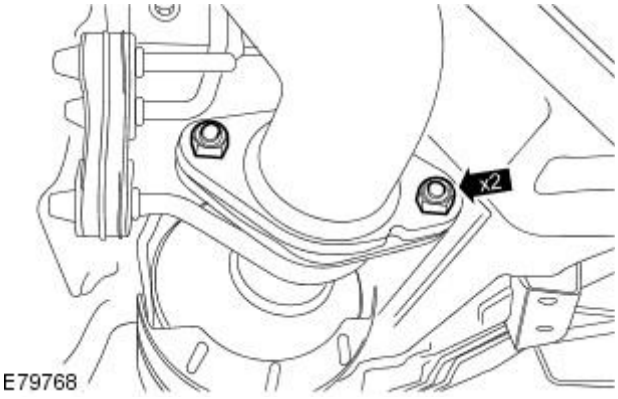


3. Remove the muffler inlet pipe to diesel particulate filter retaining nuts.



4. Remove the muffler inlet pipe.
   - Detach the muffler inlet pipe support isolators.
   - Remove and discard the gasket.

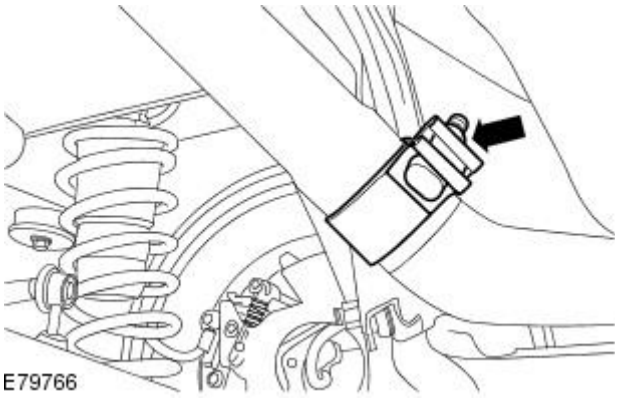
Installation



1. NOTE: Check the exhaust support isolators for damage or fatigue. Install new exhaust support isolators if required.

To install, reverse the removal procedure.

- Tighten to 46 Nm.
- Install a new gasket.



2. Tighten to 55 Nm.

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Fuel System - General Information -

General Specifications

Item	Specification
Fuel tank capacity	61.5 ltrs

Torque Specifications

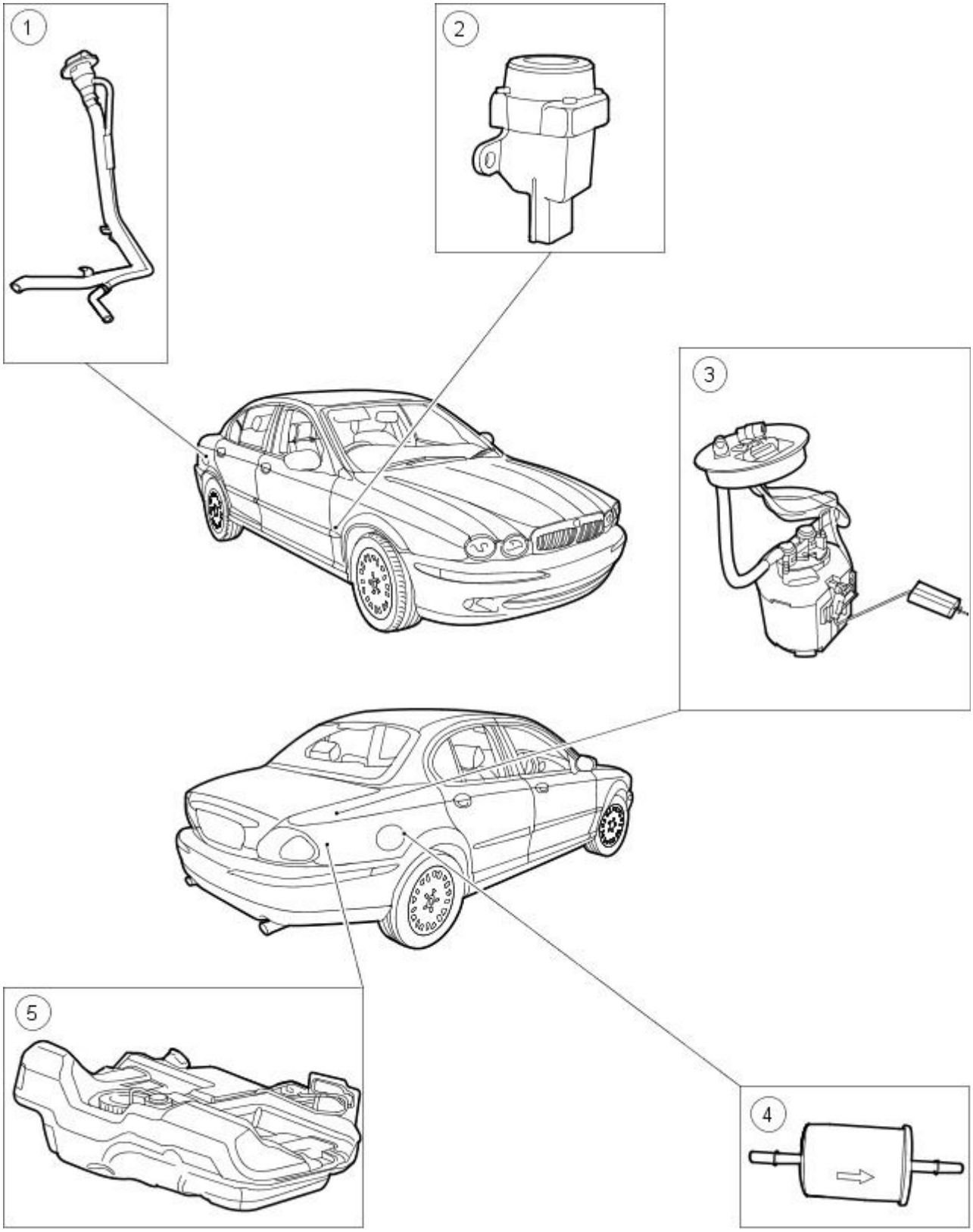
Description	Nm	lb-ft	lb-in
Fuel tank sender unit lock rings	70	52	-

Published: 11-May-2011

Fuel System - General Information - Fuel System

Description and Operation

Vehicles with 2.0L engine



E31338

Item	Part Number	Description
1	—	Fuel tank filler pipe
2	—	Inertia fuel shutoff (IFS) switch
3	—	Fuel pump
4	—	Fuel filter
5	—	Fuel tank

The mechanical returnless fuel system utilized has the following advantages:

- Reduces the build up of fuel pressure on starting the engine
- Holds the pressure in the fuel lines to aid engine hot starts
- Smooths out pulsations and reduces fuel pump noise

The fuel tank is constructed of high density polythylene and is located underneath the vehicle below the rear passenger seat. The tank is retained by two support straps fixed to the vehicle's underbody, with the underside of the tank being protected by a fitted heatshield.

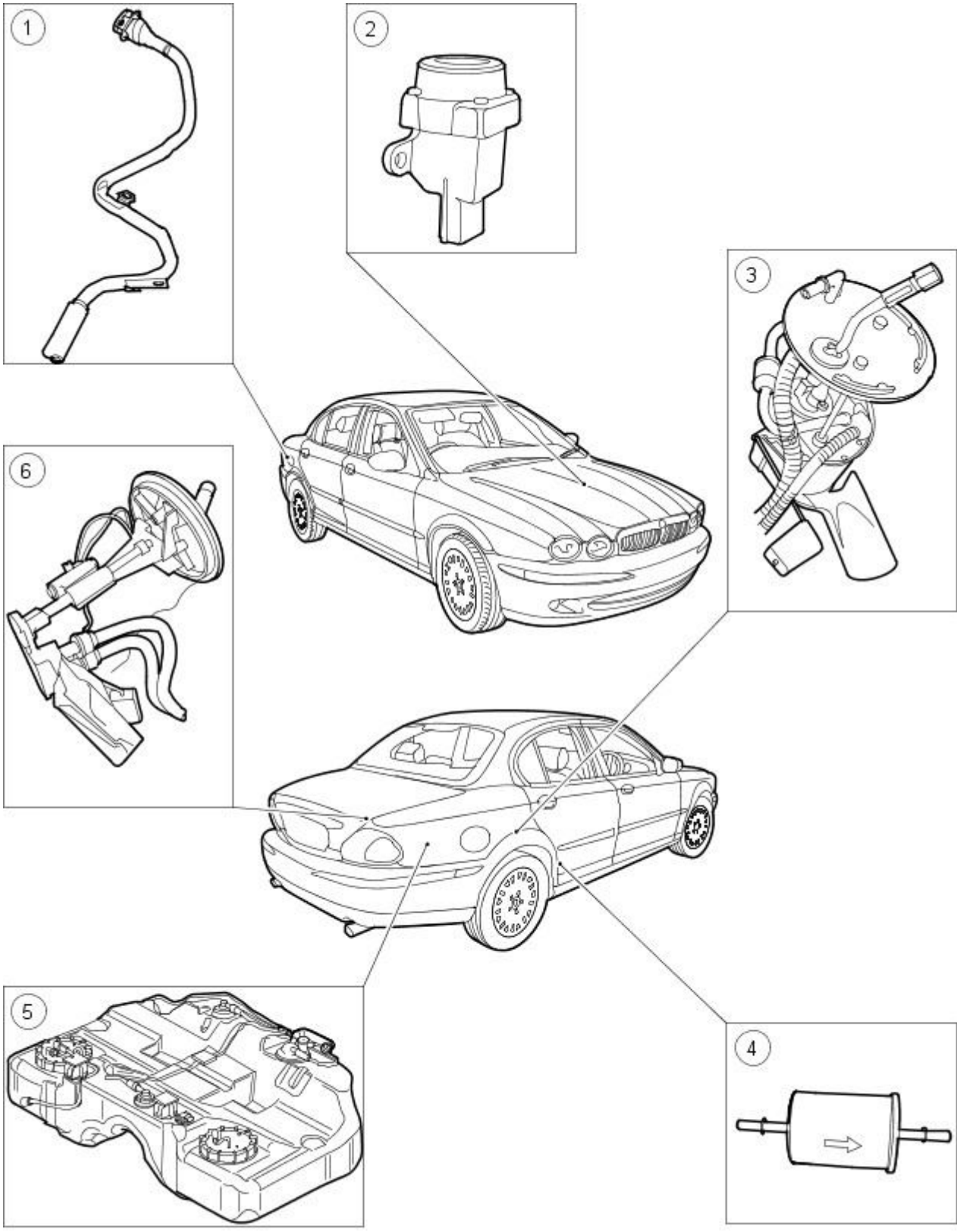
The electric turbine fuel pump, which operates in a fuel reservoir, has an integral top plate for the external pipe work and electrical connectors. The pump is secured to the fuel tank by a screw-on plastic closure ring.

Two roll over valves are connected by a hose which allows air to circulate in the tank which prevents the build up of high pressure vapor areas which may be created during fuel tank filling on gradients or when the vehicle is in motion.

CAUTION: The use of supplementary oil or fuel additives is not approved unless specified by Jaguar Cars in the form of a service communication or directive.

Fuel is pumped from the tank to the fuel rail at a constant pressure of 4.5 bar, regardless of the amount of fuel being injected into the engine. Fuel pressure is constantly maintained by the fuel pump's integral mechanical pressure regulator which returns excess fuel to the fuel tank via a T-piece positioned directly after the fuel filter.

Vehicles with 2.5L or 3.0L engine



VUJ0003469

Item	Part Number	Description
1	—	Fuel tank filler pipe
2	—	Inertia fuel shutoff (IFS) switch
3	—	Fuel pump module
4	—	Fuel filter
5	—	Fuel tank

6	—	Fuel transfer pump (jet pump) module

The electronic returnless fuel system utilized has the following advantages:

- reduced fuel tank vapor.
- requires less electrical power.
- does not require a fuel return line.

The intelligence of this system is contained within the engine control module (ECM).

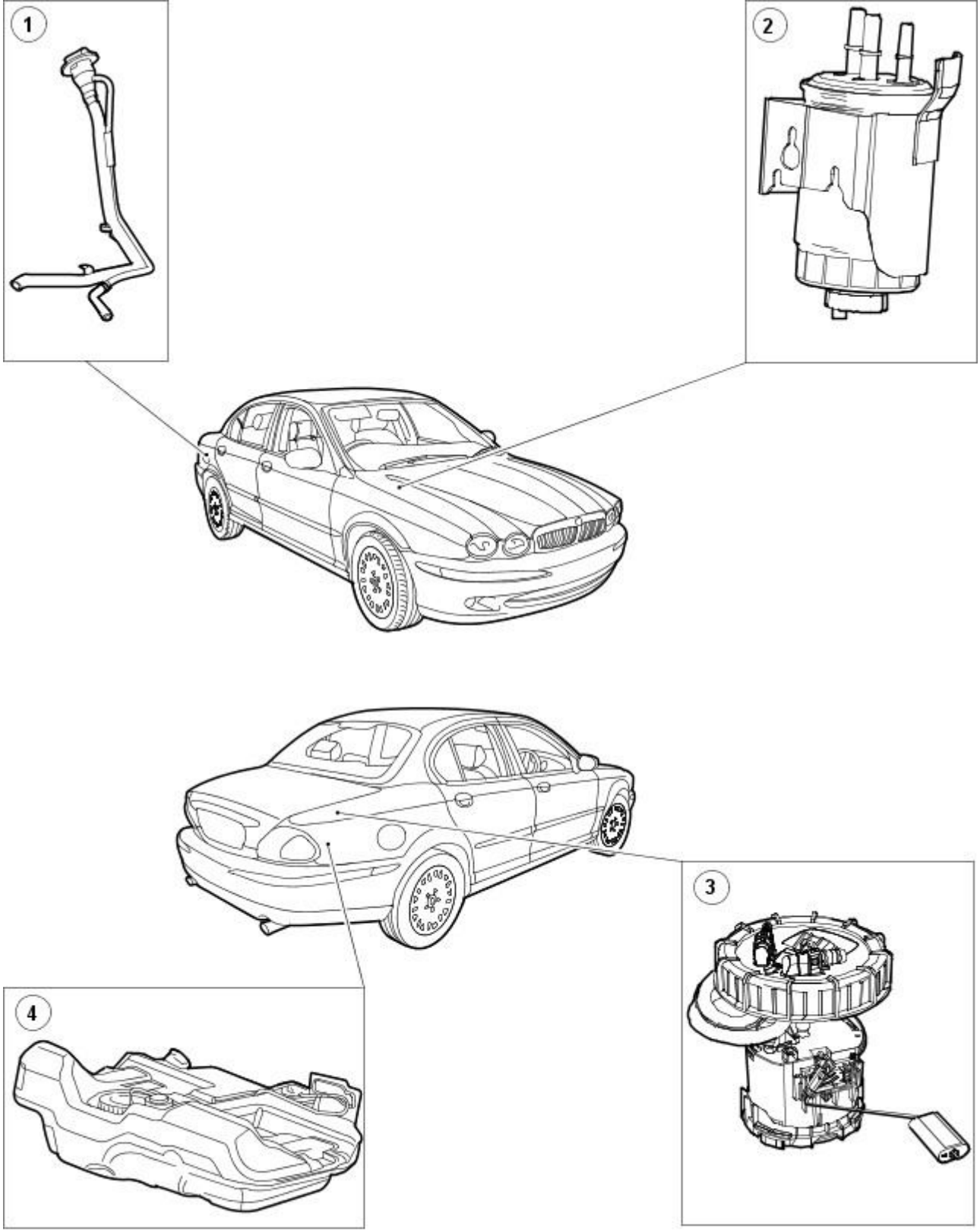
The ECM determines the required fuel flow and communicates this information to the fuel pump controller. The fuel pump controller has the fuel pump driver functions fully integrated into the microprocessor. The ECM calculates the frequency and determines the current required by the fuel pump to maintain the correct fuel pressure at the fuel injectors.

The fuel tank is of a saddle design which incorporates two sender units. The right-hand side houses the fuel pump module. The left-hand side houses the transfer pump (jet pump) module.

 CAUTION: The use of supplementary oil or fuel additives is not approved unless specified by Jaguar Cars in the form of a service communication or directive.

Fuel is supplied at high pressure to the injectors via a fuel rail which incorporates a fuel pressure and a fuel temperature sensor. The ECM increases the fuel pressure to minimize fuel vapor formation to maintain fuel flow across the injectors. An inertia type fuel cut-off switch will cut power to the fuel pump module in the event of an accident.

Vehicles with diesel engine



E49004

Item	Part Number	Description
1	-	Fuel tank filler pipe
2	-	Fuel filter
3	-	Sender unit
4	-	Fuel tank

The fuel tank is constructed of high density polythylene and is located underneath the vehicle below the rear passenger seat. The tank is retained by two support straps fixed to the vehicle's underbody, with the underside of the tank being protected by a fitted heatshield.

The fuel sender unit uses a resistor tile and float rod system to supply information to the instrument cluster of the fuel level. The fuel system has a run dry strategy which leaves four litres of unusable fuel in the tank. If fuel runout occurs no system priming/bleeding is required.

CAUTION: The use of supplementary oil or fuel additives is not approved unless specified by Jaguar Cars in the form of a service communication or directive.

The fuel filter is located at the top of the bulkhead on the right-hand side of the vehicle. The fuel filter incorporates a fuel pre heat function, which utilizes a ball valve operated by a bimetallic strip. When the temperature is less than 15° C (59° F), the ball valve allows the warm fuel in the fuel return system to pass back through the fuel filter to the fuel pump to improve cold running. Once the temperature exceeds 31° C (88° F) a bimetallic strip closes the ball valve in the fuel filter and all of the fuel in the fuel return system is directed back to the fuel tank.

Published: 11-May-2011

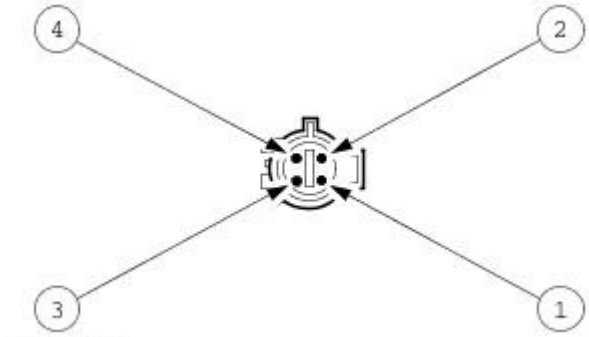
Fuel System - General Information - Fuel System

Diagnosis and Testing

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.
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, refer to the Symptom Chart.

Symptom Chart

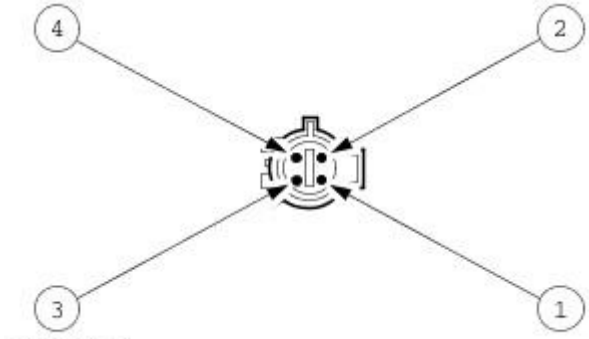
Symptom	Possible Sources	Action
P1233, P1235, —Fuel Pump Primary Circuit Failure	* Damaged harness. * Connector loose or corroded. * Connector pin(s) bent or tracking between connections. * Damaged GROUND. * 'Popped' inertia switch.	* GO to Pinpoint Test A.
B1201, P0460, —Fuel Sender Circuit Failure	* Worn or damaged sensor tracks. * Damaged Harness. * Connector loose or corroded. * Connector pin(s) bent or tracking between connections. * Fuel level sensor to instrument cluster circuits intermittent short or open circuit or high resistance. * Fuel level sensor failure. * Instrument cluster fault (incorrect fuel level data).	* GO to Pinpoint Test B.



VUJ0002070

Fuel Pump Harness Connector

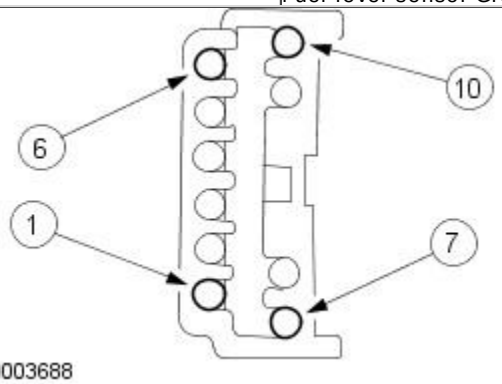
Pin Number	Circuit Function	Circuit Color
1	Fuel level sensor signal supply	Yellow/white
2	Fuel pump voltage supply	Pink/black
3	Fuel level sensor GROUND supply	Pink/orange
4	Fuel pump GROUND supply	Black



VUJ0002070

Transfer Pump Fuel Level Sensor Harness Connector

Pin Number	Circuit Function	Circuit Color
1	Fuel level sensor signal supply	Yellow/white
3	Fuel level sensor GROUND supply	Pink/orange



VUJ0003688

Fuel Pump Controller Harness Connector

Pin Number	Circuit Function	Circuit Color
1	engine control module (ECM) control input	Brown

Pin Number	Circuit Function	Circuit Color
2	Ground	Black
3	Fuel pump ground	Yellow
4	Throttle screen	Black/green
5	Fuel pump screen	White
7	ECM monitor output	White
9	Battery positive	Brown/green
10	Fuel pump positive	Red

PINPOINT TEST A : P1233, P1235—FUEL PUMP PRIMARY CIRCUIT FAILURE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE POSITIVE SUPPLY TO THE FUEL PUMP	
	1 Switch the ignition to the OFF position.
	2 Disconnect the fuel pump electrical connector FT002.
	3 Switch the ignition to the RUN position.
	4 Measure the pulse width modulation voltage between the fuel pump electrical connector FT002 pin 2, (KB) and GROUND.
	Is there a 1 second, 12 volts voltage signal after the ignition is switched on? **Yes** GO to A2. **No** GO to A5.
A2: CHECK THE GROUND SUPPLY TO THE FUEL PUMP	
	1 Switch the ignition to the OFF position.
	2 Measure the resistance between the fuel pump electrical connector FT002 pin 4, (B) and GROUND.
	Is the resistance less than 0.5 Ohm? **Yes** INSTALL a new fuel pump. CLEAR DTC. TEST the system for normal operation. **No** GO to A7.
A3: CHECK THE POSITIVE SUPPLY TO THE FUEL PUMP CONTROLLER	
	1 Switch the ignition to the RUN position.
	2 Measure the voltage at the fuel pump controller CA105 pin 9.
	Is the voltage less than 10.5 Volts? **Yes** GO to A4. **No** GO to A10.
A4: CHECK THE FUEL PUMP CONTROLLER VOLTAGE SUPPLY FUSE	
	1 Measure the voltage at the fuel pump controller supply fuse.
	Is the voltage less than 10.5 Volts? **Yes** GO to A12. **No** REPAIR the circuit between the central electrical junction box (CEJB) and the fuel pump controller. CLEAR DTC. TEST the system for normal operation.
A5: CHECK THE VOLTAGE OUTPUT AT THE FUEL PUMP CONTROLLER	
	1 Switch the ignition to the OFF position.
	2 Disconnect the fuel pump controller electrical connector CA105.
	3 Switch the ignition to the RUN position.
	4 Measure the pulse width modulation voltage between the fuel pump controller electrical connector CA105 pin 10 and GROUND.
	Is there a 1 second 12 volts voltage signal after the ignition is switched on? **Yes** GO to A6. . **No** GO to A3. .
A6: CHECK THE CONTINUITY BETWEEN THE FUEL PUMP CONTROLLER AND THE FUEL PUMP	
	1 Measure the resistance between the fuel pump controller connector CA105 pin 10, (R) and fuel pump electrical connector FT002 pin 2, (KB).
	Is the resistance less than 0.5 Ohm? **Yes** INSTALL a new fuel pump controller. CLEAR DTC. TEST the system for normal operation. **No** REPAIR the circuit between the fuel pump controller CA105 pin 10, (R) and the fuel pump electrical connector FT002 pin 2, (KB). CLEAR DTC. TEST the system for normal operation.
A7: CHECK THE GROUND SUPPLY AT THE FUEL PUMP CONTROLLER	
	1 Switch the ignition to the OFF position.
	2 Measure the resistance between the fuel pump controller electrical connector CA105 pin 3, (Y) and GROUND.
	Is the resistance less than 0.5 Ohm? **Yes** GO to A8. . **No** GO to A9. .
A8: CHECK THE CONTINUITY BETWEEN THE FUEL PUMP AND THE FUEL PUMP CONTROLLER	
	1 Measure the resistance between the fuel pump connector FT002 pin 4, (B) and the fuel pump controller connector CA105 pin 3 (Y).
	Is the resistance less than 0.5 Ohms? **Yes** GO to A9. **No** REPAIR the circuit between the fuel pump FT002 pin 4, (B) and the fuel pump controller CA105 pin 3, (Y). CLEAR DTC. TEST the system for normal operation.
A9: CHECK THE GROUND SUPPLY TO THE FUEL PUMP CONTROLLER	
	1 Switch the ignition to the OFF position.

	2 Measure the resistance between the fuel pump controller CA105 pin 2, and GROUND.
	Is the resistance less than 0.5 Ohm? **Yes** REPAIR the circuit between the fuel pump controller CA105 pin 2, (B) and GROUND. CLEAR DTC. TEST the system for normal operation. **No** INSTALL a new fuel pump controller. CLEAR DTC. TEST the system for normal operation.
A10: CHECK THE SWITCHABLE SUPPLY TO THE FUEL PUMP CONTROLLER	
	1 Switch the ignition to the OFF position.
	2 Disconnect the fuel pump controller electrical connector CA105.
	3 Switch the ignition to the RUN position.
	4 Measure the pulse width modulation frequency between the fuel pump controller electrical connector CA105 pin 1, (N) and GROUND.
	Is the frequency 250 Hz, 1-50% duty? **Yes** INSTALL a new fuel pump controller. CLEAR DTC. TEST the system for normal operation. **No** GO to A11.
A11: CHECK THE CONTINUITY BETWEEN THE FUEL PUMP CONTROLLER AND THE ECM	
	1 Switch the ignition to the OFF position.
	2 Disconnect the ECM electrical connector EN016.
	3 Measure the resistance between the fuel pump controller electrical connector CA105 pin 1, (N) and the ECM electrical connector EN106 pin 27, (N).
	Is the resistance less than 0.5 Ohm? **Yes** INSTALL a new ECM. CLEAR DTC. TEST the system for normal operation. **No** REPAIR the circuit between the fuel pump controller electrical connector CA105 pin 1, (N) and the ECM electrical connector EN106 pin 27, (N). CLEAR DTC. TEST the system for normal operation.
A12: CHECK THE POSITIVE SUPPLY TO THE IGNITION RELAY	
	1 Switch the ignition to the OFF position.
	2 Disconnect the central electrical junction box (CEJB) electrical connector IP003.
	3 Switch the ignition to the RUN position.
	4 Measure the voltage between the CEJB electrical connector IP003 pin 1, (GU) and GROUND.
	Is the voltage less than 10.5 Volts? **Yes** GO to A13. **No** INSTALL a new ignition relay R18. CLEAR DTC. TEST the system for normal operation.
A13: CHECK THE POSITIVE SUPPLY TO THE INERTIA SWITCH	
	1 Switch the ignition to the OFF position.
	2 Disconnect the inertia switch electrical connector IP132.
	3 Switch the ignition to the RUN position.
	4 Measure the voltage between the inertia switch electrical connector IP132 pin 3, (GO) and GROUND.
	Is the voltage less than 10.5 Volts? **Yes** GO to A14. **No** GO to A15.
A14: CHECK THE INERTIA SWITCH VOLTAGE SUPPLY AT THE IGNITION SWITCH	
	1 Switch the ignition to the OFF position.
	2 Remove the ignition switch electrical connector IP018.
	3 Switch the ignition to the RUN position.
	4 Measure the voltage between the ignition switch electrical connector IP018 pin 1 and GROUND.
	Is the voltage less than 10.5 Volts? **Yes** INSTALL a new ignition switch. CLEAR DTC. TEST the system for normal operation. **No** REPAIR the circuit between the ignition switch and the inertia switch. CLEAR DTC. TEST system for normal operation.
A15: CHECK THE CONTINUITY BETWEEN THE CEJB AND THE INERTIA SWITCH	
	1 Switch the ignition switch to the OFF position.
	2 Measure the resistance between the CEJB electrical connector IP003 pin 1, (GU) and the inertia switch electrical connector IP132 pin 1, (GU).
	Is the resistance less than 0.5 Ohm? **Yes** INSTALL a new inertia switch. CLEAR DTC. TEST the system for normal operation. **No** REPAIR the circuit between the CEJB electrical connector IP003 pin 1, (GU) and the inertia switch electrical connector IP132 pin 1, (GU). CLEAR DTC. TEST the system for normal operation.

PINPOINT TEST B : B1201, P0460—FUEL SENDER CIRCUIT FAILURE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE VOLTAGE SUPPLY TO THE FUEL TANK ELECTRICAL CONNECTOR	
	1 Switch the ignition to the OFF position.
	2 Disconnect the fuel tank electrical connector CA005.
	3 Switch the ignition to the RUN position.
	4 Measure the voltage at the fuel tank electrical connector between: • CA005 pin 1, (WU) and GROUND • CA005 pin 2, (WB) and GROUND

	Is the voltage greater than 10.5 Volts? **Yes** GO to B2. **No** GO to B3.
B2: CHECK THE GROUND SUPPLY TO THE FUEL TANK ELECTRICAL CONNECTOR	
	1 Switch the ignition to the OFF position.
	2 Measure the resistance at the fuel tank electrical connector between CA005 pin 3, (B) and GROUND.
	Is the resistance less than 0.5 Ohms? **Yes** GO to B4. **No** GO to B5.
B3: CHECK THE VOLTAGE SUPPLY FROM THE INSTRUMENT CLUSTER	
	1 Switch the ignition to the OFF position.
	2 Disconnect the instrument cluster electrical connector IP010.
	3 Switch the ignition switch to the RUN position.
	4 Measure the voltage at the instrument cluster connector between: • IP010 pin 8 and GROUND • IP010 pin 7 and GROUND
	Is the voltage greater than 10.5 Volts? **Yes** REPAIR the relevant circuit. CLEAR DTC. TEST the system for normal operation. **No** INSTALL a new instrument cluster. CLEAR DTC. TEST the system for normal operation.
B4: CHECK THE RESISTANCE AT THE FUEL LEVEL SENSORS	
	1 Remove the fuel tank. For additional information, refer to Section 310-01 Fuel Tank and Lines.
	2 Disconnect the fuel sensor electrical connectors: • FT002 • FT003
	3 Measure the resistance between the sensor electrical connectors: • FT002 pin 1 and FT002 pin 3 • FT003 pin 1 and FT003 pin 3
	Is the resistance between 16 and 160 Ohms? **Yes** REPAIR the relevant circuit. CLEAR DTC. TEST the system for normal operation. **No** INSTALL the relevant new fuel level sensor. CLEAR DTC. TEST the system for normal operation.
B5: CHECK THE GROUND SUPPLY FROM THE INSTRUMENT CLUSTER	
	1 Disconnect the instrument cluster electrical connector IP010.
	2 Measure the resistance at the instrument cluster between IP010 pin 9 and GROUND.
	Is the resistance less than 0.5 Ohm? **Yes** REPAIR the circuit between the instrument cluster IP010 pin 9, (B) and the fuel tank electrical connector CA005 pin 3, (B). CLEAR DTC. TEST the system for normal operation. **No** INSTALL a new instrument cluster. CLEAR DTC. TEST the system for normal operation.

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Fuel System - General Information - Fuel System Pressure Check

General Procedures

• 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.

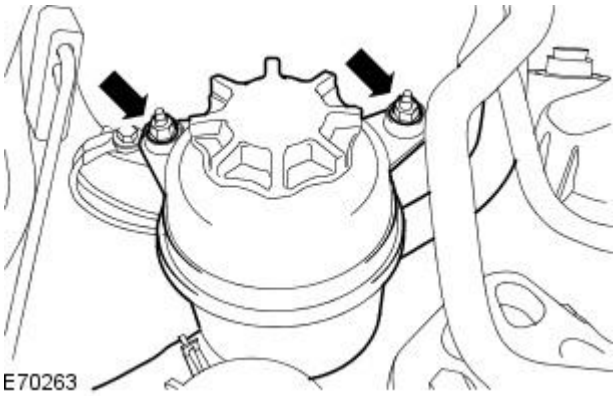
This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

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 and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. Remove the engine cover.

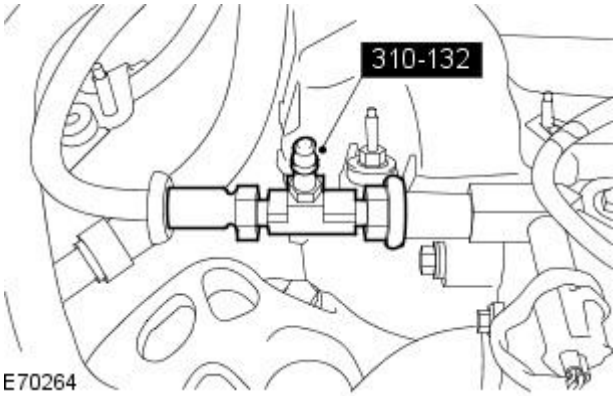
3. Detach the power steering fluid reservoir and reposition.

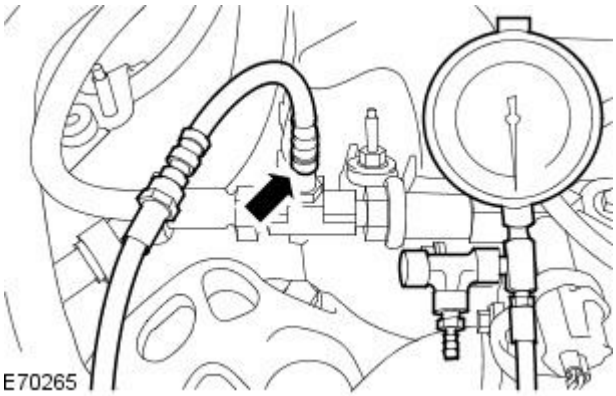


4. Disconnect the fuel rail feed pipe.
For additional information, refer to: Spring Lock Couplings (310-00 Fuel System - General Information, General Procedures).

5. NOTE: Make sure the special tool is fully seated to the fuel pipe connections.

Install the special tool.





6. Install the fuel pressure gauge.

7. Connect the battery ground cable.
   For additional information, refer to: Battery Connect (414-01 Battery, Mounting and Cables, General Procedures).

8. Carry out the fuel system pressure check.
   For additional information, refer to: Fuel Charging and Controls - 2.0L NA V6 - AJV6 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).

Published: 11-May-2011

Fuel System - General Information - Fuel System Pressure Release

General Procedures

Release

1. WARNINGS:

 Do not smoke, carry lighted tobacco or an 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 released before attempting any repairs. Failure to follow this instruction may result in personal injury.

Remove the fuel pump fuse.

2. Start the engine and allow to idle until the engine stalls.

3. Crank the engine for approximately five seconds to make sure the fuel injection supply manifold pressure has been released.

4. Install the fuel pump fuse.

Published: 11-May-2011

Fuel System - General Information - Fuel Tank Draining2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma

General Procedures

Special Tool(s)	
 E46545	Fuel supply line adaptor 310-131

1. WARNINGS:

Place the vehicle in a quarantined area and arrange **No Smoking** 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.

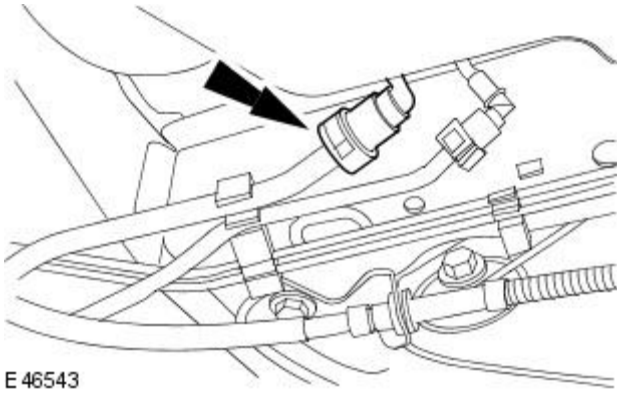
This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.

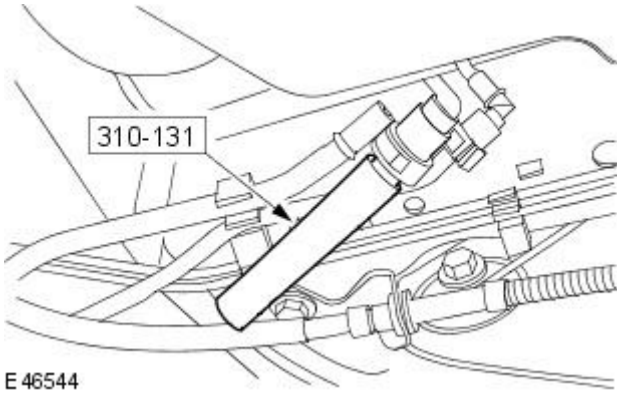
Disconnect the battery ground cable.
For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. Raise and support the vehicle.
For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

3. Disconnect the supply line.


E46543

4. Install the special tool to the fuel supply line.



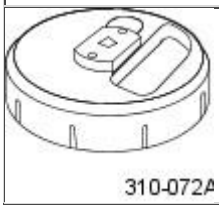
E46544

5. Using suitable draining equipment, connect the draining equipment to the special tool and drain the fuel tank. Follow the manufactures operating instructions.

Published: 11-May-2011

Fuel System - General Information - Fuel Tank Draining2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

General Procedures

Special Tool(s)	
	Remove/Refit fuel pump/sender locking nut 310-072A

2.0L vehicle

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.

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 Section 414-01 Battery, Mounting and Cables.

2. Remove the fuel filler cap.

3. Using suitable draining equipment, drain the fuel tank. Follow the manufactures operating instructions.

2.5L and 3.0L vehicles

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.

The fuel tank on the 2.5L and 3.0L vehicles can not be drained in vehicle. Due to the heavy weight, make sure that the fuel tank is securely attached to the lowering equipment when removing.

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.

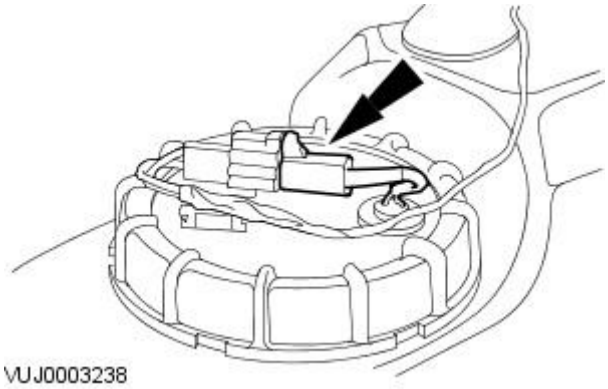
Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

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.

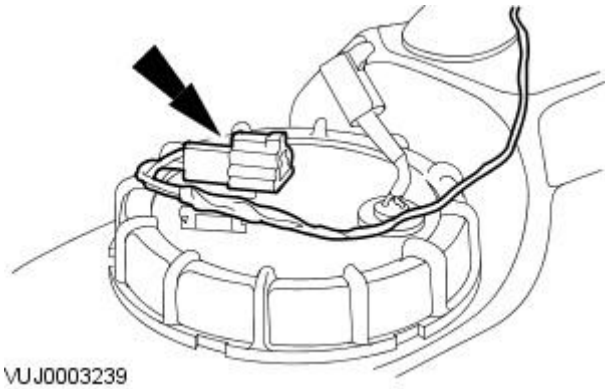
After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.

Disconnect the battery ground cable. For additional information, refer to Section 414-01 Battery, Mounting and Cables.

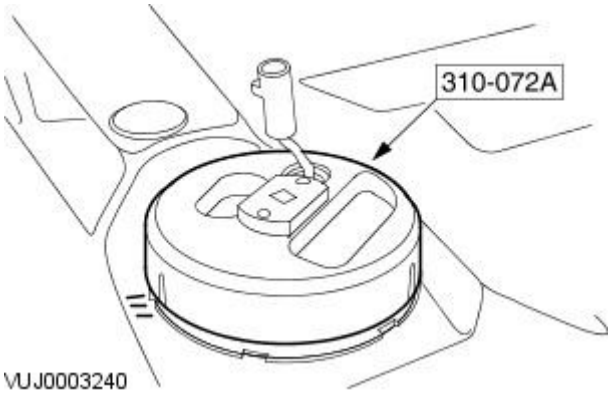
2. Remove the fuel tank. For additional information, refer to Section 310-01 Fuel Tank and Lines.
3. Disconnect the electrical connector.


VUJ0003238

4. Detach the electrical connector.


VUJ0003239

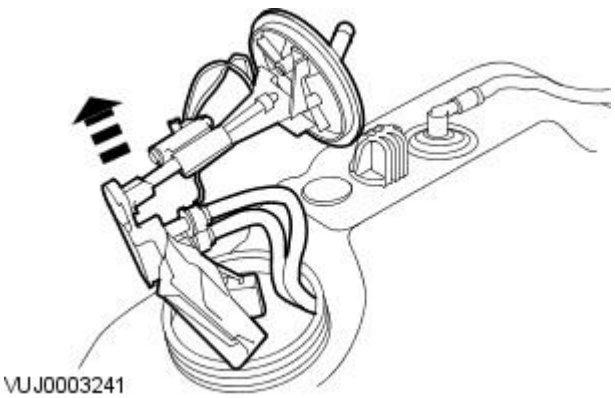
5. Using the special tool, remove the locking ring.

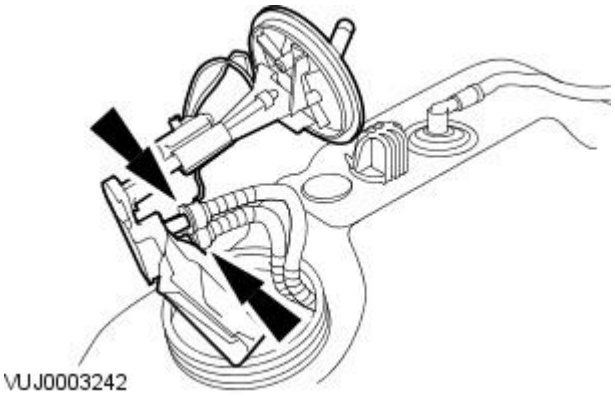


VUJ0003240

6. CAUTION: Make sure the float or arm are not damaged while removing the fuel transfer pump.

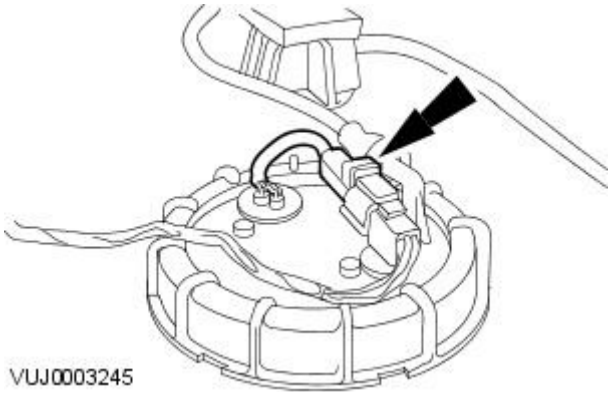
Detach the fuel transfer pump.


VUJ0003241

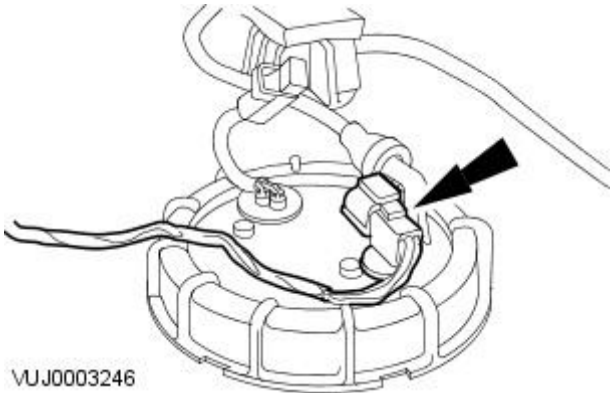

VUJ0003242

7. Remove the fuel transfer pump.

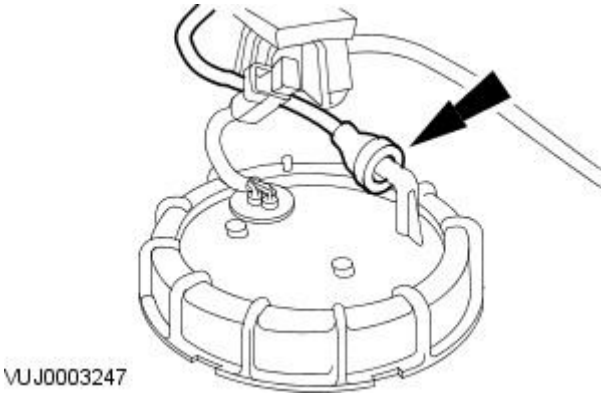
- Disconnect the cross over pipes
- Remove and discard the O-ring seal.


VUJ0003245

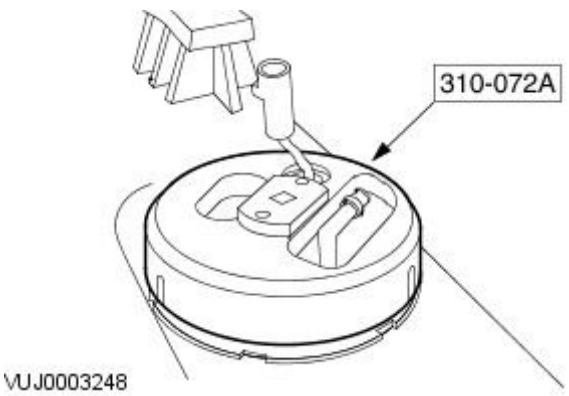
8. Disconnect the electrical connector.


VUJ0003246

9. Detach the electrical connector.

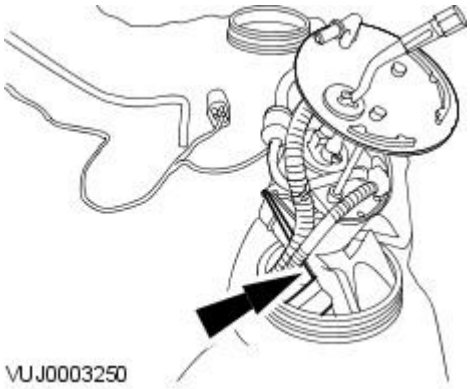

VUJ0003247

10. Disconnect the fuel supply pipe.



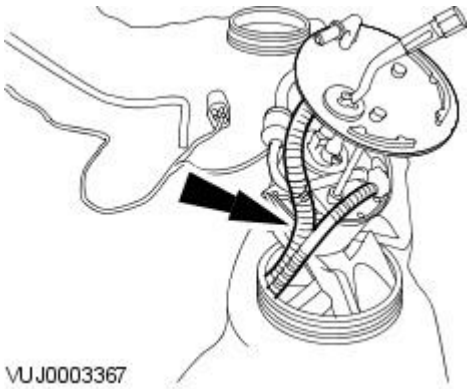
VUJ0003248

11. Using the special tool, remove the locking ring.



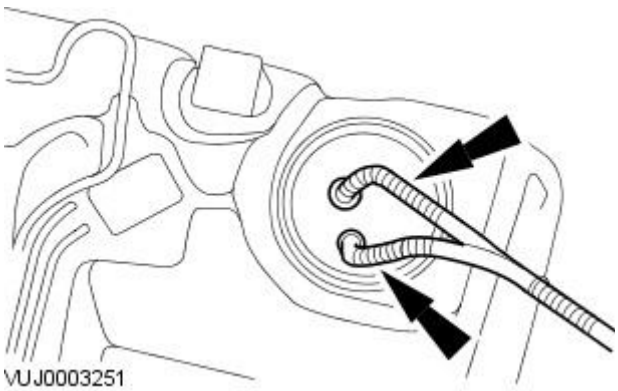
12. CAUTION: Make sure the float or arm are not damaged while removing the fuel pump module.

Guide the fuel pump module through the aperture.



13. CAUTION: Make sure damage to the fuel cross over pipes does not occur.

Guide the cross over pipes through the aperture.



14. Remove the fuel pump module and cross over pipes.

- Remove and discard the O-ring seal.

15. Using the fuel pump access holes to gain access to the fuel, remove the fuel from the fuel tank using suitable fuel tank draining equipment. Follow the manufactures operating instructions.

Published: 11-May-2011

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/Fuel Vapors" 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.

After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.

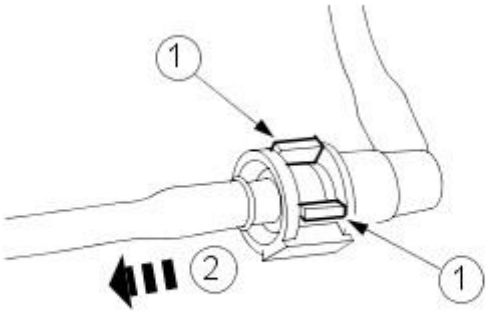
This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

Disconnect the battery ground cable.
For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. Relieve the fuel pressure.
For additional information, refer to: Fuel System Pressure Release.

3. Disconnect the fuel line quick release coupling.

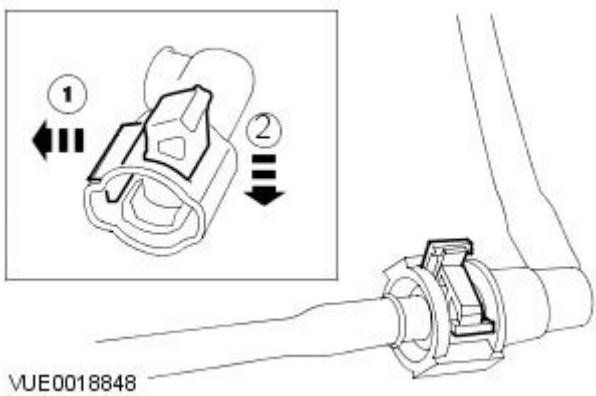
1. Press the fuel line quick release coupling locking tangs.
2. Disconnect the fuel line quick release coupling.



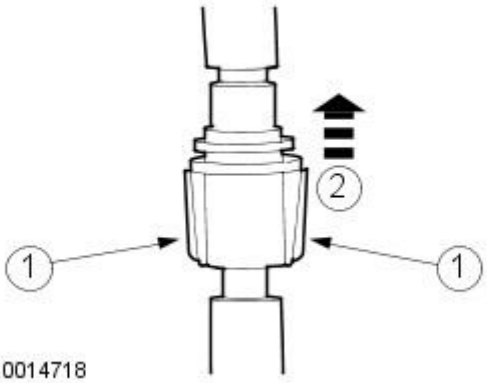
VUE0004022

4. Disconnect the fuel line quick release coupling.

1. Pull the fuel line quick release coupling locking tang.
2. Push the clip through the fuel line quick release coupling to release the fuel line.



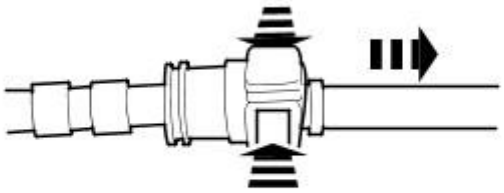
VUE0018848



VUE0014718

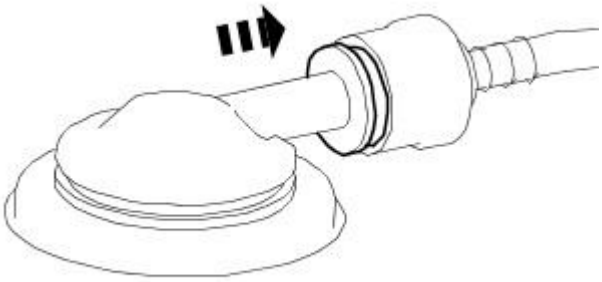
5. Disconnect the fuel line quick release coupling.

1. Press the fuel line quick release coupling locking tangs.
2. Disconnect the fuel line quick release coupling.


VUE0032292

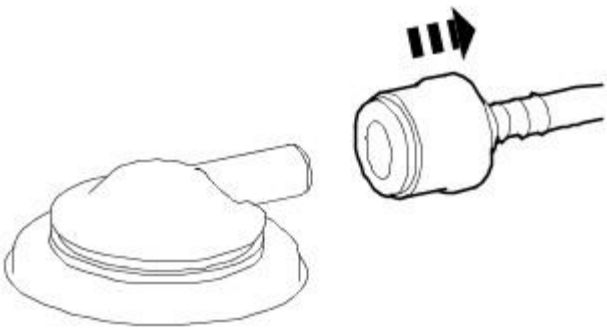
6. Disconnect the fuel line quick release coupling.

- Press the fuel line quick release coupling buttons and pull the fuel line to disconnect.

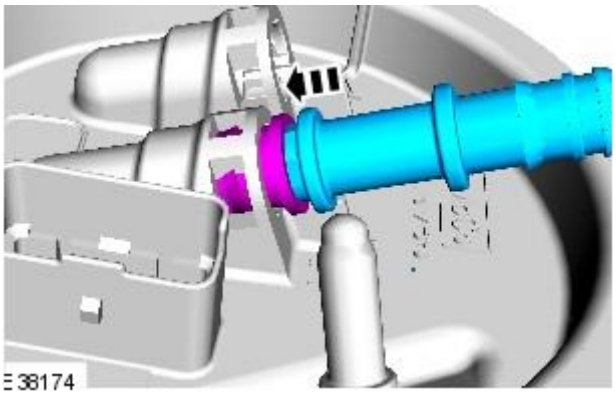

E38210

7. Release the fuel tank vent line quick release coupling.

- Press the fuel tank vent line quick release coupling locking release collar.

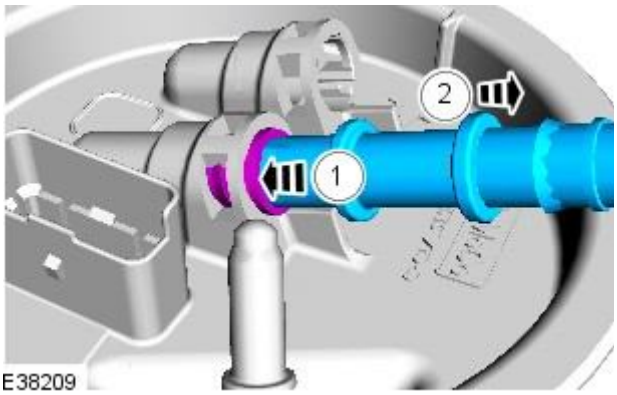

E38211

8. Disconnect the fuel tank vent line quick release coupling.

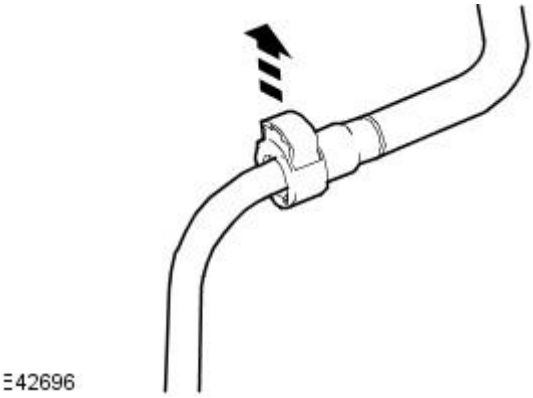


9. Release the fuel line quick release coupling.

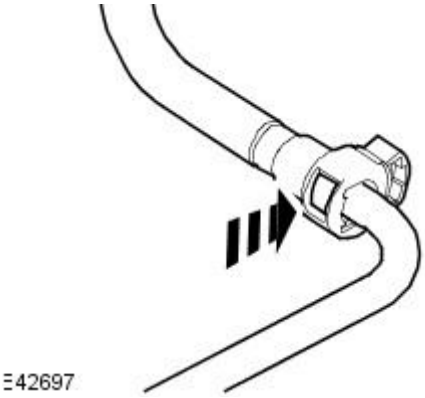
- Press the fuel line quick release coupling locking release collar.



10. Disconnect the fuel line quick release coupling.

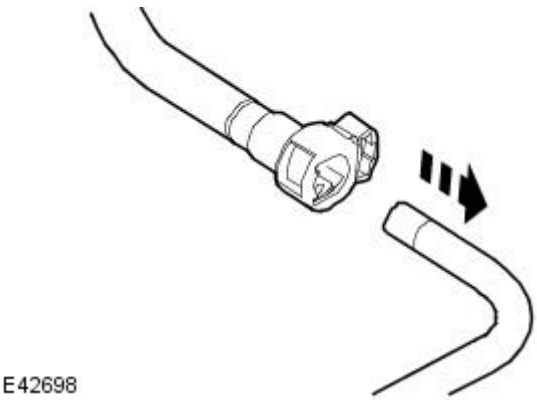


11. Using a suitable Flat-bladed screwdriver release the fuel line quick release coupling secondary locking tang.



12. Operate the fuel line quick release coupling primary locking tang.

- Push the fuel line quick release coupling primary locking tang into from the fuel line quick release coupling.



13. Disconnect the fuel line from the fuel line quick release coupling.

Connect

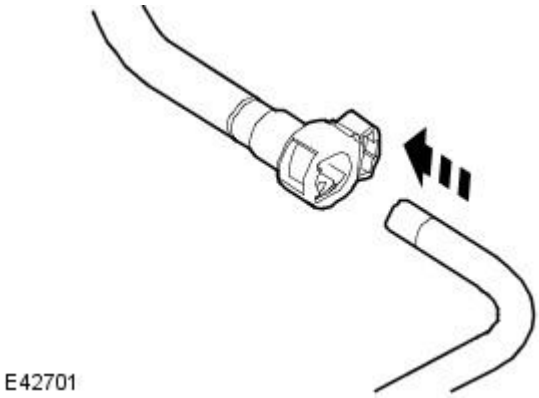
• WARNINGS:

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.

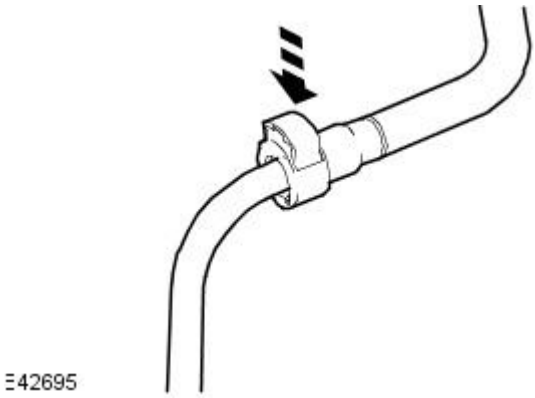
Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

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.

After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.

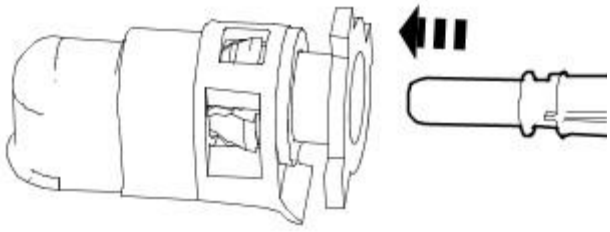

E42701

1. Install the fuel line to the fuel line quick release coupling.


E42695

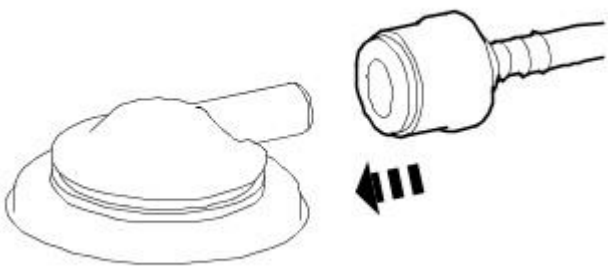
2. CAUTION: Make sure the quick release coupling primary locking tang clicks into place when installing.

Insert the fuel line quick release coupling secondary locking tang into the fuel line quick release coupling.


E38272

3. CAUTION: After installation, to make sure that the fuel line is fully seated, pull on the line.

Install the fuel line quick release coupling.

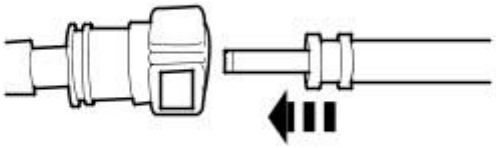

E38273

4. CAUTION: After installation, to make sure that the vent line is fully seated, pull on the line.

Install the fuel tank vent line quick release coupling.

5. CAUTION: Make sure the fuel line clicks into place when installing the line. To make sure that the fuel line is fully seated, pull on the line.

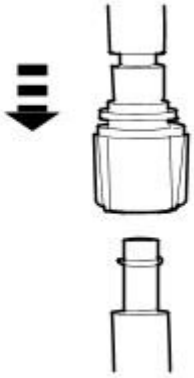
Install the fuel line quick release coupling.



VUE0032293

6. NOTE: Make sure the collar on the fuel line is inserted fully into the fuel line quick release coupling.

Install the fuel line quick release coupling.

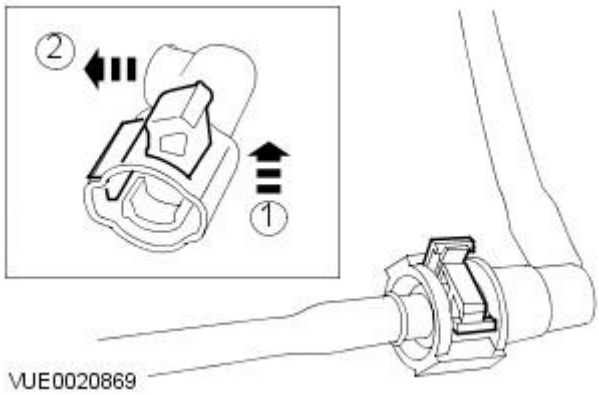


VUE0014720

7. NOTE: Make sure the collar on the fuel line is inserted fully into the fuel line quick release coupling before the locking tang is locked.

Install the fuel line quick release coupling.

1. Install the fuel line quick release coupling locking tang.
2. Rotate the fuel line quick release coupling locking tang into position.

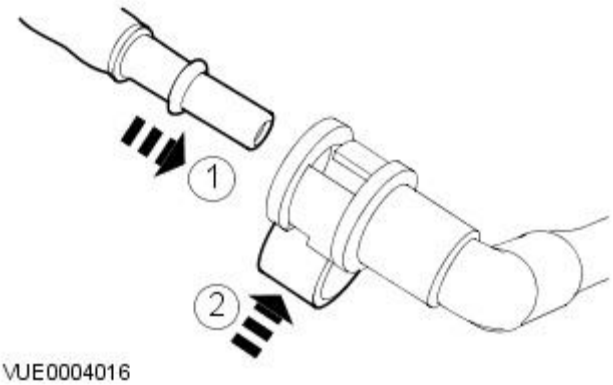


VUE0020869

8. NOTE: Make sure the collar on the fuel line is inserted fully into the fuel line quick release coupling before the locking tang is locked.

Install the fuel line quick release coupling.

1. Install the fuel line quick release coupling.
2. Press the fuel line quick release coupling locking tang into position.



VUE0004016

Published: 11-May-2011

Fuel System - General Information - Spring Lock Couplings

General Procedures

Special Tool(s)	
	Spring Lock Coupler Tool or Equivalent 23-040

Disconnection

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 vapours 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 and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. Relieve the fuel pressure.
For additional information, refer to: Fuel System Pressure Release (310-00 Fuel System - General Information, General Procedures).
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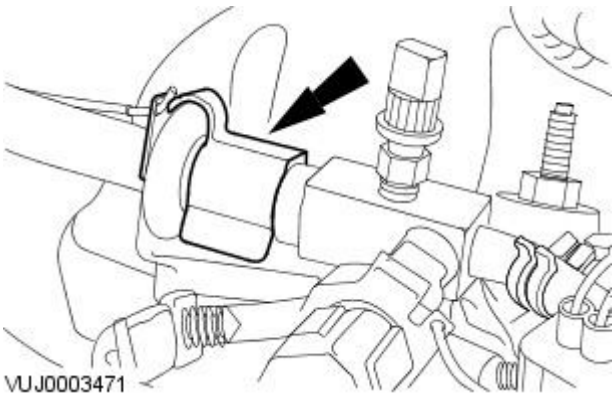
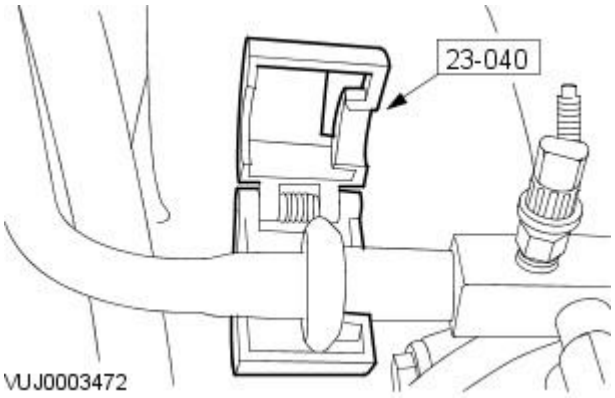
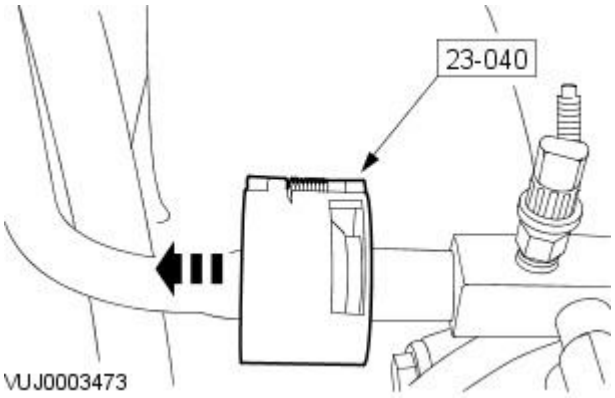
3. Remove the safety clip from the spring lock coupling.



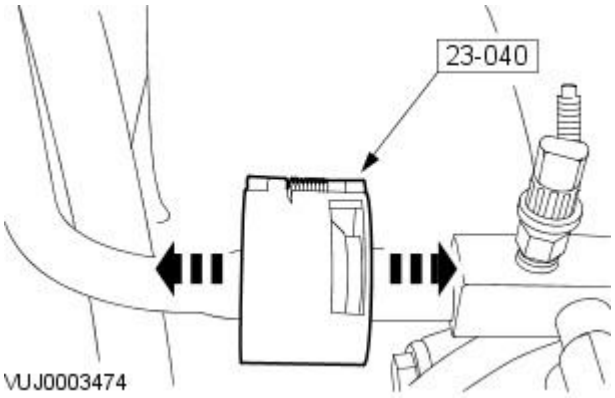


4. Install the spring lock coupling tool.

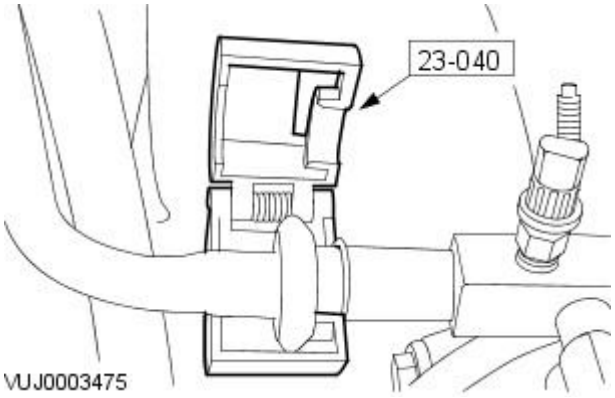
- Place suitable absorbent material below the pipe to collect fuel spillage



5. Close and push the spring lock coupling tool into the open side of the cage.

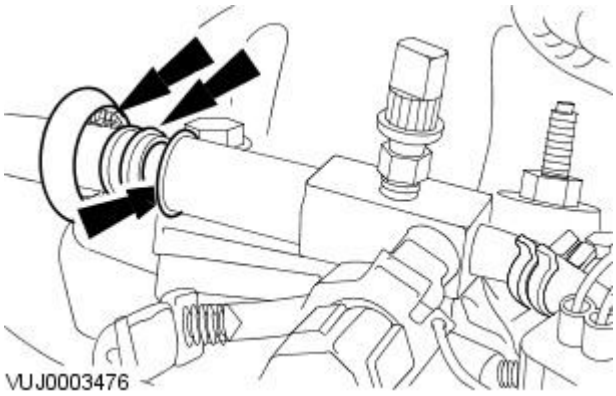


6. Separate the fitting.

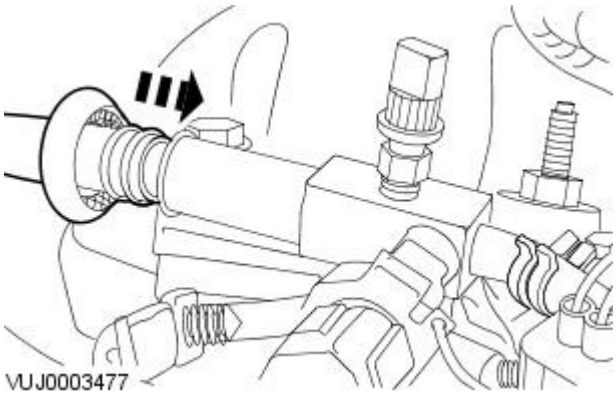


7. Remove the spring lock coupling tool.

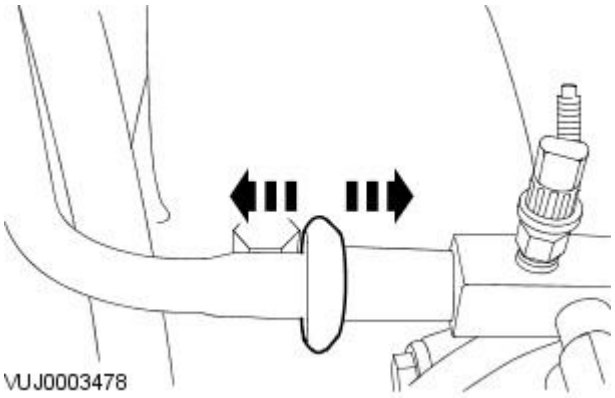
Connection



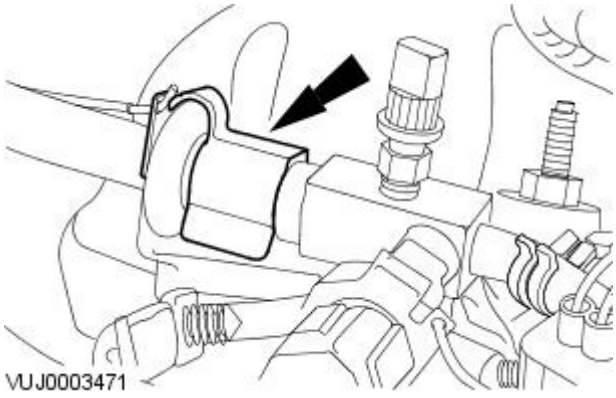
1. Inspect and clean both coupling ends. Install new O-rings and garter springs if necessary.



2. Fit the male fitting into the female end and push until the garter spring snaps over the flared end of the male fitting.



3. Make sure the coupling is engaged by pulling on the lines.



4. Install the safety clip.

- Remove the absorbent material below the pipe

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Fuel Tank and Lines -

Torque Specifications

Description	Nm	lb-ft	lb-in
Fuel tank support strap retaining bolts	25	18	-
Fuel pump module locking ring - vehicles with 2.5L or 3.0L engine (non federal market vehicles)	70	52	-
Fuel pump module locking ring - vehicles with 2.5L or 3.0L engine (federal market vehicles)	120	89	-
Fuel pump module locking ring - vehicles with 2.0L or diesel engine	85	63	-
Transfer pump locking ring (non federal market vehicles)	70	52	-
Transfer pump locking ring (federal market vehicles)	120	89	-
Fuel tank filler pipe to fuel tank hose retaining clip	3	-	27
Fuel tank filler pipe retaining nuts	4	-	35
Fuel filter bracket retaining nuts - vehicles with 2.0L, 2.5L or 3.0L engine	4	-	35
Axle assembly rear retaining bolt	110	81	-
Axle assembly front retaining bolts	90	66	-

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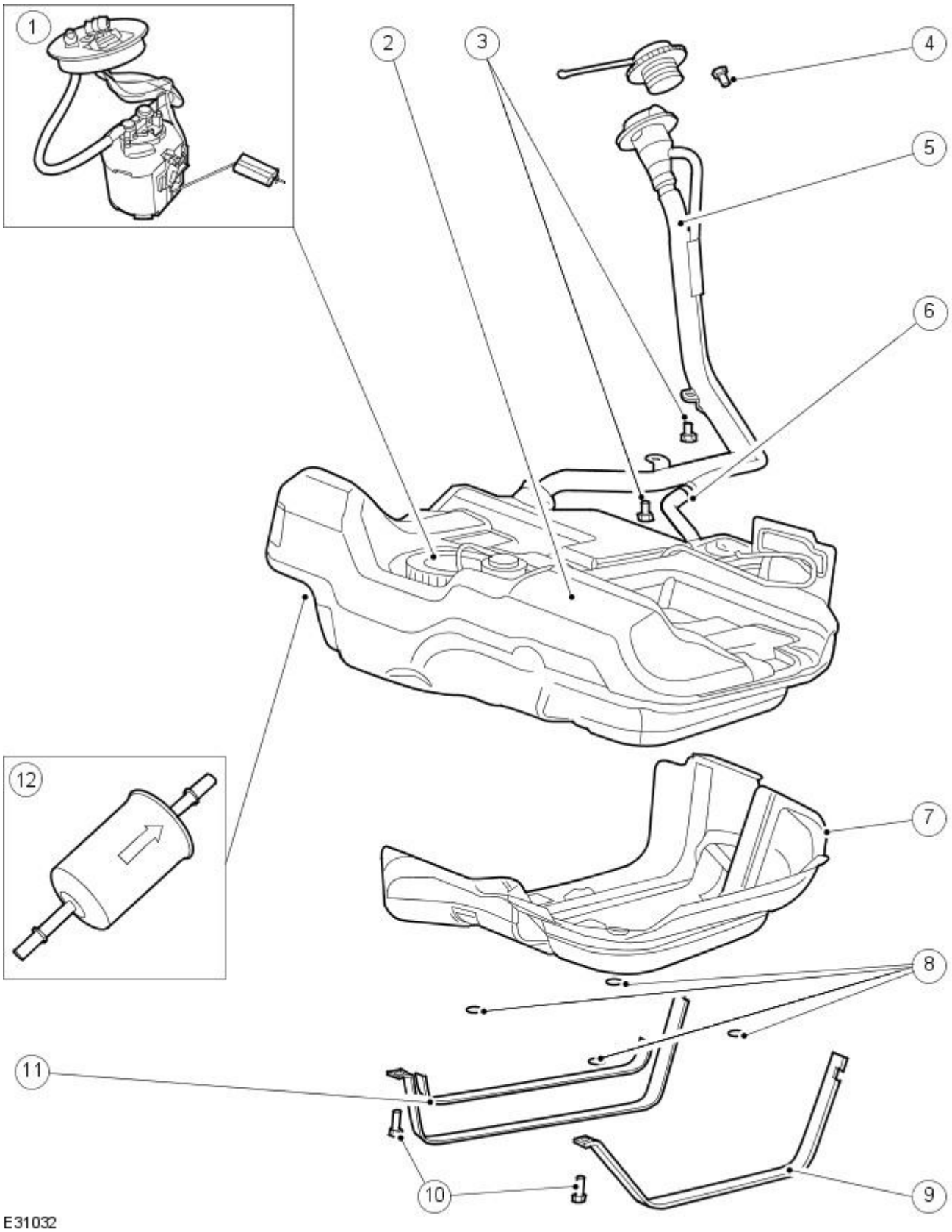
Fuel Tank and Lines - Fuel Tank and Lines

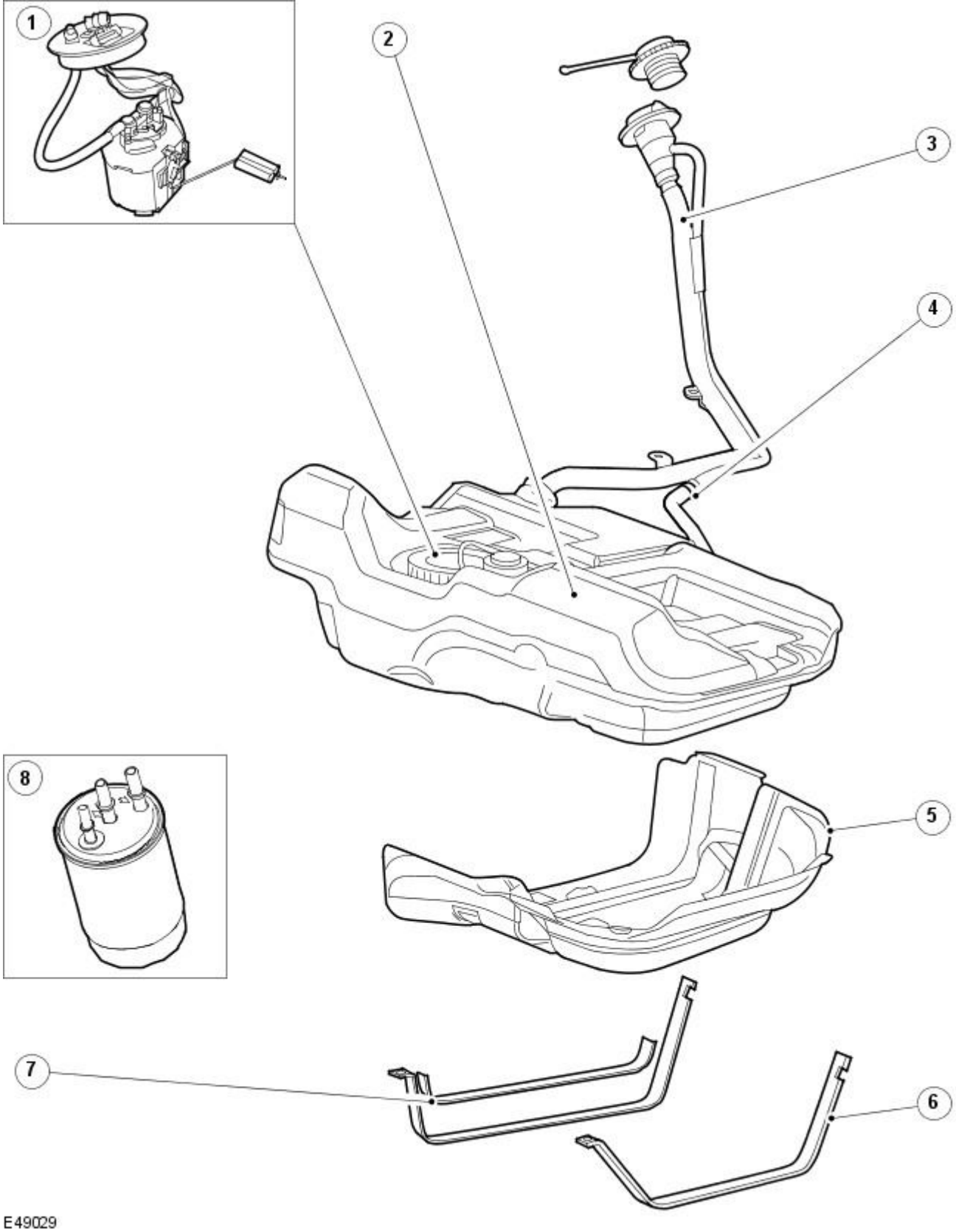
Description and Operation

Vehicles with 2.0L engine



Item	Part Number	Description
1	-	Fuel pump module
2	-	Fuel tank
3	-	Lower fuel tank filler pipe retaining nut
4	-	Upper fuel tank filler pipe retaining nut
5	-	Fuel tank filler pipe
6	-	Fuel tank filler pipe breather hose
7	-	Fuel tank heat shield
8	-	Fuel tank heat shield retaining clips
9	-	Fuel tank support straps
10	-	Fuel tank support straps retaining bolts
11	-	Fuel tank support strap insulator
12	-	Fuel filter

Vehicles with diesel engine

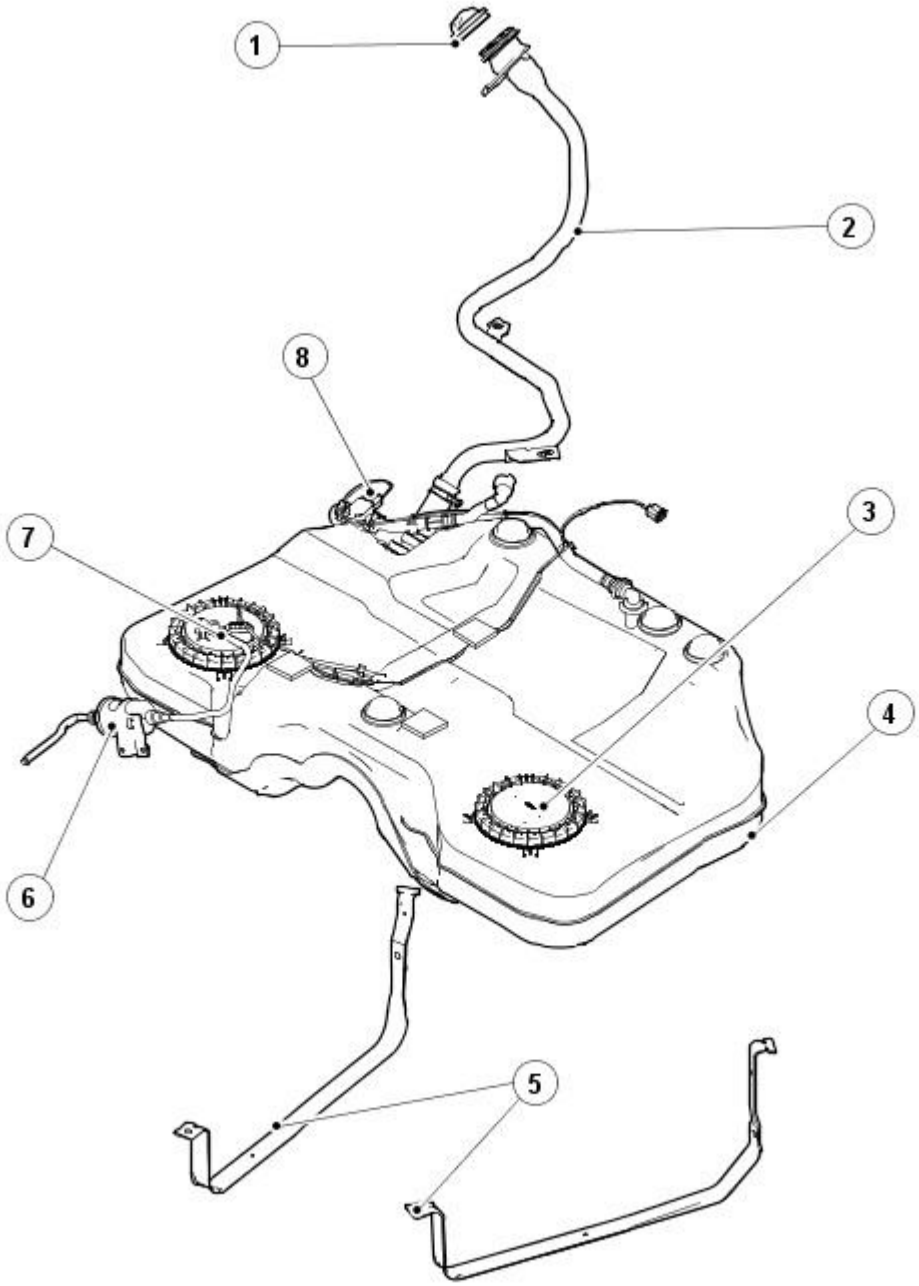


E49029

Item	Part Number	Description
1	-	Fuel level sensor
2	-	Fuel tank
3	-	Fuel tank filler pipe
4	-	Fuel tank filler pipe breather hose
5	-	Fuel tank heat shield
6	-	Fuel tank support straps
7	-	Fuel tank support strap insulator
8	-	Fuel filter

Vehicles with 2.5L or 3.0L engine

• NOTE: Federal market vehicle shown, non federal market vehicle similar.



E49051

Item	Part Number	Description
1	—	Fuel filler cap
2	—	Fuel tank filler pipe
3	—	Fuel transfer pump
4	—	Fuel tank
5	—	Fuel tank support straps
6	—	Fuel filter
7	—	Fuel pump module
8	—	Fuel tank pressure sensor (Federal market vehicles only)

Fuel Tank

The fuel tank is of a plastic construction and is retained to the vehicle by two steel support straps. The fuel tank support straps are mounted onto the underside of the vehicle chassis towards the rear of the fuel tank and retained by bolts to the vehicle towards the front of the fuel tank. Fuel tank ventilation is achieved through two fuel tank roll-over valves into an evaporative emission canister which absorbs fuel tank vapor. The fuel tank roll-over valves are integral to the fuel tank and will prevent fuel loss from the fuel tank if the vehicle becomes inverted. A fuel level valve is also incorporated into the fuel tank to prevent fuel overfilling, this allows the fuel tank to maintain adequate space for expansion of the fuel.
For additional information, refer to: Evaporative Emissions (303-13 Evaporative Emissions, Description and Operation).
Federal market vehicles only are fitted with leak check diagnostics which detect leaks in the fuel vapor system using signals from a vapor pressure sensor mounted in the evaporative emission canister purge vapor line.

Fuel Filter - Vehicles with 2.0L, 2.5L or 3.0L engine

The fuel filter is of a conventional construction being that of a paper element sealed within a steel canister. The fuel filter is located in front of the fuel tank, on the right-hand side of the floor pan.

Fuel Filter - Vehicles with diesel engine

The fuel filter is located at the top of the bulkhead on the right-hand side of the vehicle. The fuel filter incorporates a fuel pre heat function, which utilizes a ball valve operated by a bimetallic strip. When the temperature is less than 15°C (59°F), the ball valve allows the warm fuel in the fuel return system to pass back through the fuel filter to the fuel pump to improve cold running. Once the temperature exceeds 31°C (88°F) a bimetallic strip closes the ball valve in the fuel filter and all of the fuel in the fuel return system is directed back to the fuel tank.

Fuel Tank Filler Pipe

The fuel tank filler pipe is of a steel construction and is retained to the vehicle by means of three retaining nuts, one retaining the filler neck to the body and two nuts retaining the filler pipe to the vehicle chassis. The fuel tank filler pipe is fitted with a screw turn filler cap, which seals the system.

Inertia Fuel Shutoff (IFS) Switch

The inertia fuel shutoff (IFS) switch is designed to cut power to the fuel pump in the event of an accident. The shutoff switch is located behind the right-hand cowl side trim panel.

Fuel pump - Vehicles with 2.0L, 2.5L or 3.0L engine

On all wheel drive vehicles, the fuel is pumped by a transfer pump and an electric turbine pump. Both pumps are fitted with fuel level sender units which are serviced separately. On two wheel drive vehicles, the fuel is pumped by a single electric turbine pump which is fitted with a separately serviced fuel level sender. The fuel pumps are fixed to the fuel tank by means of a locking ring and seal, which can only be accessed by removing the fuel tank.

On 2.0L vehicles the fuel tank is of a conventional design, a fuel pump module with mechanical pressure regulator and a local returnless circuit through the fuel filter is incorporated.

On 2.5L and 3.0L vehicles the fuel tank is of a saddle design, incorporating a fuel pump module and a transfer pump module. The transfer pump module (jet pump), located in the left-hand saddle, transfers low pressure fuel (high flow) to the right-hand saddle of the tank. The fuel pump module located in the right-hand saddle, supplies high pressure fuel (low flow) to the fuel pump on the engine.

Fuel Pump - Vehicles with diesel engine

For additional information, refer to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Description and Operation).

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Fuel Tank and Lines - Fuel Tank and Lines

Diagnosis and Testing

Inspection and verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual inspection, vehicles with petrol engines

Mechanical	Electrical
• Fuel line(s) • Push connect fittings • Fuel leak(s) • Fuel filler cap • Fuel tank filler pipe • Fuel filter • Fuel tank • Fuel tank roll-over valve	• Inertia fuel shutoff (IFS) switch • Electrical connector(s) • Damaged or corroded wiring harness • Fuel pump module • Fuel transfer pump • Fuse(s)

Visual inspection, vehicles with diesel engines

Mechanical	Electrical
• Fuel line(s) • Fuel leak(s) • Fuel filler cap • Fuel tank filler pipe • Fuel filter • Fuel tank • Fuel tank roll-over valve	• Inertia fuel shutoff (IFS) switch

• WARNINGS:

Vehicles with diesel engine only. Do **NOT** carry out any work on the fuel system with the engine running. The fuel pressure within the system can be as high as 1600 bar (23,206 lb/in²). 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.

Vehicles with diesel engine only. The fuel system remains pressurized after the ignition is switched off. If communications with a suitable tester (able to read fuel rail pressure and temperature) can be established, wait until the tester indicates pressure of less than 20 bar (290 lb/in²), and temperature of less than 35° C (95° F) before working on the system. If communications with a suitable tester cannot be established, the fuel system must **NOT** be worked on for a period of fifteen minutes following the ignition being switched off. 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 this instruction may result in personal injury.

Vehicles with diesel engine only. After carrying out repairs, the fuel system must be checked visually for leaks. This should be done after the engine has been run, but with the engine switched **OFF**. Failure to follow this instruction may result in personal injury.

If fuel is taken internally, **DO NOT** induce vomiting. Seek immediate medical attention. Failure to follow this instruction may result in personal injury.

If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek medical attention. Failure to follow this instruction may result in personal injury.

Wash hands thoroughly after handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention. Failure to follow this instruction may result in personal injury.

• CAUTIONS:

Vehicles with diesel engine only. Before disconnecting any part of the system, it is imperative that all dust, dirt and debris is removed from around components to prevent ingress of foreign matter into the fuel system. Failure to follow this instruction may result in damage to the vehicle.

Vehicles with diesel engine only. The fuel pipes between the injectors and the rail must be discarded after each use, and new pipes installed. Failure to follow this instruction may result in damage to the vehicle.

Vehicles with diesel engine only. It is 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 damage to the vehicle.

Vehicles with diesel engine only. 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. Failure to follow this instruction may result in damage to the vehicle.

Vehicles with diesel engine only. Do not interchange fuel injectors. Improper injector installation can cause misfires, poor running and severe engine damage.

Make sure that any protective clothing worn is clean and made from lint-free non-flocking material. Failure to follow this instruction may result in damage to the vehicle.

Make sure that any protective gloves worn are new and are of the non-powdered latex type. Failure to follow this instruction may result in damage to the vehicle.

Vehicles with diesel engine only. Make sure that clean, non-plated tools are used. Clean tools using a new brush that will not lose it's bristles and fresh cleaning fluid prior to starting work on the vehicle. Failure to follow this instruction may result in damage to the vehicle.

Use a steel-topped work bench and cover it with clean, lint-free, non-flocking material. Failure to follow this instruction may result in damage to the vehicle.

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: This section contains references to Parameter Identifiers (PIDs). Where the Jaguar approved diagnostic system is not available, a scantool may be used to access these PIDs, all of which give information, and some of which can be used to both read information and to activate components. The format of the information may vary, depending on the tool used.

• NOTE: **Vehicles with diesel engine only.** As well as carrying out its normal function the glow plug indicator also acts as an engine check lamp which will flash continuously when a hard diagnostic trouble code (DTC) is detected by the ECM. Soft DTCs are also stored by the ECM but will only be identified if the system is checked for DTCs using the Jaguar approved diagnostic system.

• NOTE: If a DTC is detected, all DTCs must be cleared after the concern is repaired. Failure to clear all DTCs may cause driveability concerns.

• NOTE: **Vehicles with diesel engine only.** If the fuel level in the fuel tank drops below approximately four liters, rough running will occur. This is to signal to the driver that the vehicle requires refuelling in order to prevent the fuel system from running dry.

• 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 the symptom is not present when performing the pinpoint tests, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

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.

Symptom chart (vehicles with petrol engine only)

Symptom	Possible source	Action
Engine cranks, but does not start	• IFS switch • Low/contaminated fuel • ECM malfunction	Check that the IFS switch is in the 'down' position, check the fuel level and condition, GO to Pinpoint Test F. Check for DTCs indicating fuel pump inactive. For ECM tests, REFER to: Electronic Engine Controls - 2.0L NA V6 - AJV6 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing) / Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
Difficult to start	• Low/contaminated fuel • Purge valve • Fuel pump • Engine coolant temperature (ECT) sensor • Ignition system • Battery/charging system	Check the fuel level and condition, GO to Pinpoint Test F. For evaporative emission system tests, REFER to: Evaporative Emissions - 2.0L NA V6 - AJV6 (303-13 Evaporative Emissions, Diagnosis and Testing). and/or REFER to: Evaporative Emissions - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-13 Evaporative Emissions, Diagnosis and Testing). Check for fuel pump DTCs, refer to DTC table. For engine coolant temperature sensor tests, REFER to: Electronic Engine Controls - 2.0L NA V6 - AJV6 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). and/or REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). For ignition system tests, REFER to: Engine Ignition - 2.0L NA V6 - AJV6 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). and/or REFER to: Engine Ignition - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). For charging system tests, REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing). and/or REFER to: Generator (414-02 Generator and Regulator, Diagnosis and Testing).

Symptom	Possible source	Action
Difficult to start hot	• Injector leak • Fuel temperature sensor • IAT sensor • MAF sensor • Engine coolant temperature (ECT) sensor • Purge valve • Fuel pump • Ignition system • EGR valve stuck open	For fuel injector tests, REFER to: Fuel Charging and Controls - 2.0L NA V6 - AJV6 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). and/or REFER to: Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). For sensor tests, REFER to: Electronic Engine Controls - 2.0L NA V6 - AJV6 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). and/or REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). For evaporative emission system tests, REFER to: Evaporative Emissions - 2.0L NA V6 - AJV6 (303-13 Evaporative Emissions, Diagnosis and Testing). and/or REFER to: Evaporative Emissions - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-13 Evaporative Emissions, Diagnosis and Testing). Check for fuel pump DTCs, refer to DTC table. For ignition system tests, REFER to: Engine Ignition - 2.0L NA V6 - AJV6 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). and/or REFER to: Engine Ignition - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). For EGR system tests, REFER to: Engine Emission Control (303-08 Engine Emission Control - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
Engine stalls soon after start	• Low/contaminated fuel • Breather system disconnected/restricted • ECM relay • MAF sensor • Engine coolant temperature (ECT) sensor • Ignition system • Fuel rail pressure sensor • Air filter restricted • Air leakage	Check the fuel level and condition, GO to Pinpoint Test F. For breather system tests, REFER to: Engine Emission Control (303-08 Engine Emission Control - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). For ECM relaly and sensor tests, REFER to: Electronic Engine Controls - 2.0L NA V6 - AJV6 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). and/or REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). For ignition system tests, REFER to: Engine Ignition - 2.0L NA V6 - AJV6 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). and/or REFER to: Engine Ignition - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). For fuel rail pressure sensor tests, REFER to: Fuel Charging and Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-04A Fuel Charging and Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). Check the air filter element and intake system.
Engine hesitates/poor acceleration/pre-detonation at high engine speeds	• Low/contaminated fuel • Restricted pedal travel (carpet, etc) • Fuel pump • No fuel pump commands • Throttle sensors • APP sensor • HO2 sensors • Engine control module (ECM) • Ignition system • EGR valve stuck open • Air leakage • Fuel starvation	Check the fuel level and condition, GO to Pinpoint Test F. Check the accelerator pedal for full travel. Check for fuel pump and related DTCs. For sensor and ECM tests, REFER to: Electronic Engine Controls - 2.0L NA V6 - AJV6 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). and/or REFER to: Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). For ignition system tests, REFER to: Engine Ignition - 2.0L NA V6 - AJV6 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). and/or REFER to: Engine Ignition - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-07A Engine Ignition - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing). For EGR system tests, REFER to: Engine Emission Control (303-08 Engine Emission Control - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). Check the air intake system for leakage. For fuel starvation tests, GO to Pinpoint Test E.
Difficulty in fuelling vehicle	• Customer using incorrect filling procedure • Service station equipment • Obstructions in/damage to filler neck/pipe • Blockage in vent system • Canister close valve blockage • Purge valve malfunction • Water ingress into carbon	Refer to owner's handbook. Check if filling difficulty is consistent, or intermittent. Check for obstructions/damage at filler neck. Check the vent system (this will vary dependent on market). Check for DTCs indicating an evaporative emissions system valve malfunction. For evaporative emissions system tests, REFER to: Evaporative Emissions - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-13 Evaporative Emissions, Diagnosis and Testing). Check the condition of the carbon canister.

Symptom	Possible source	Action
	canister ● Snow or ice pack around the canister outlet or filter	
Fuel smells in/around the vehicle	● Filler cap incorrectly fitted ● Leaks from joints ● Leaks from module seals ● Leak from inlet/outlet pipes at purge valve ● Inoperative purge valve	Check that the filler cap is correctly fitted and secure (the filler cap must be tightened to at least three 'clicks'). Inspect the pipes and joints for evidence of leakage, using an HC detector. Inspect the fuel tank for evidence indicating a leak from the module seals. If such evidence is found, the fuel tank should be removed to check the seals. Check for DTCs indicating an evaporative emissions system purge valve malfunction. For evaporative emissions system tests, REFER to: Evaporative Emissions - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-13 Evaporative Emissions, Diagnosis and Testing).
Engine stops with fuel indicated on the gauge	● Fuel transfer malfunction (2.5/3.0 L only) ● Level sensor malfunction ● Transfer pipes split/kinked (2.5/3.0 L only) ● Blocked transfer pump module jet (2.5/3.0 L only) ● Non fuel-related fault	Check for DTCs indicating a failure to transfer fuel, refer to the DTC index. For fuel transfer test, GO to Pinpoint Test C. Check the internal transfer pipes for damage/kinking. Check the 2mm hole as detailed in bulletin A310-01. Check for DTCs indicating a non fuel-related fault. For a full list of DTCs, REFER to: Electronic Engine Controls - 2.0L NA V6 - AJV6 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing) / Electronic Engine Controls - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, VIN Range: E96603->J28492 (303-14A Electronic Engine Controls - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Diagnosis and Testing).
Fuel pump noise	● Fuel pump module malfunction	For a basic noise test, GO to Pinpoint Test D.

Symptom chart (vehicles with diesel engine only)

Symptom	Possible source	Action
Engine cranks, but does not start	● IFS switch ● Low/contaminated fuel ● Blocked fuel filter ● Low pressure circuit fault ● Fuel metering valve blocked/contaminated ● Pump failure	Check that the inertia switch has not tripped. Check fuel level/condition. For fuel system tests, REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
Difficult to start	● Low/contaminated fuel ● Blocked fuel filter ● Low pressure circuit fault ● Fuel metering valve blocked/contaminated ● Injector(s) failure/programming	Check fuel level/condition. For fuel system tests, REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). Check the injector programming using the Jaguar approved diagnostic system.
Rough idle	● Low/contaminated fuel ● Blocked fuel filter ● Fuel metering valve blocked/contaminated ● Low pressure circuit fault ● Injector(s) failure/programming	Check fuel level/condition. For fuel system tests, REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). Check the injector programming using the Jaguar approved diagnostic system.
Lack of power when accelerating	● Air intake circuit fault ● Catalyst blocked ● Low fuel pressure ● EGR valve fault ● Turbocharger fault	For fuel system tests, REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). For exhaust system tests, REFER to: Exhaust System (309-00 Exhaust System, Diagnosis and Testing). For EGR tests, REFER to: Engine Emission Control (303-08 Engine Emission Control - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). For turbocharger tests, REFER to: Turbocharger (303-04C Fuel Charging and Controls - Turbocharger, Diagnosis and Testing).
Engine stops/stalls	● Low/contaminated fuel ● Low pressure circuit fault ● Fuel metering valve blocked/contaminated ● Fuel metering valve leak ● High pressure leak	Check fuel level/condition. For fuel system tests, REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
Engine judders	● Low/contaminated fuel ● Low pressure circuit fault ● Fuel metering valve blocked/contaminated ● Fuel metering valve leak ● High pressure leak ● Pump fault	Check fuel level/condition. For fuel system tests, REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
Excessive fuel consumption	● Low pressure circuit fault ● Fuel metering valve leak ● Fuel temperature sensor leak ● High pressure leak ● Injector(s) failure/programming	Check fuel level/condition. For fuel system tests, REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).

DTC index (for a full list of DTCs for both petrol and diesel engines, refer to sections 303.14 A or B)

DTC	Condition	Possible source	Action
P0441	Evaporative emissions system, incorrect purge flow	• Canister purge pipe; restricted, leaking or disconnected • Canister vent restricted • Canister purge pipes to engine; restricted, leaking or disconnected • Canister purge valve failure	For evaporative emissions system tests, REFER to: Evaporative Emissions - 2.0L NA V6 - AJV6 (303-13 Evaporative Emissions, Diagnosis and Testing) / Evaporative Emissions - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-13 Evaporative Emissions, Diagnosis and Testing).
P0444	Evaporative emissions system canister purge valve circuit; open circuit	• Canister purge valve disconnected • Canister purge valve to ECM drive circuit; open circuit, high resistance • Canister purge valve failure	For evaporative emissions system tests, REFER to: Evaporative Emissions - 2.0L NA V6 - AJV6 (303-13 Evaporative Emissions, Diagnosis and Testing) / Evaporative Emissions - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-13 Evaporative Emissions, Diagnosis and Testing).
P0445	Evaporative emissions system canister purge valve circuit; short circuit	• Canister purge valve to ECM drive circuit; short circuit to ground • Canister purge valve failure	For evaporative emissions system tests, REFER to: Evaporative Emissions - 2.0L NA V6 - AJV6 (303-13 Evaporative Emissions, Diagnosis and Testing) / Evaporative Emissions - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-13 Evaporative Emissions, Diagnosis and Testing).
P0460	Fuel level sensor range/performance	• ECM software level • Fuel level sensor • Fuel level sensor circuit • Instrument cluster	Refer to technical bulletin A310-02. For fuel level sensor circuit tests, GO to Pinpoint Test A.
P1234	No fuel pump commands received by ECM	• ECM to fuel pump control module and/or feedback circuits: open circuit, short circuit, high resistance • Fuel pump control module failure	For fuel pump module circuit tests, GO to Pinpoint Test B.
P1236	Fuel pump not activated when requested by the ECM	• ECM to fuel pump control module and/or feedback circuits: open circuit, short circuit, high resistance • Fuel pump control module failure	For fuel pump module circuit tests, GO to Pinpoint Test B.
P1338	Fuel pump feedback circuit high/low voltage	• ECM to fuel pump control module and/or feedback circuits: open circuit, short circuit, high resistance • Fuel pump control module failure	For fuel pump module circuit tests, GO to Pinpoint Test B.
B1202	Fuel level sensor 1 circuit fault	• Fuel level sensor 1 circuit; open circuit	For fuel level sensor circuit tests, GO to Pinpoint Test A.
B1204	Fuel level sensor 1 circuit fault	• Fuel level sensor 1 circuit; short circuit to ground	For fuel level sensor circuit tests, GO to Pinpoint Test A.
B2627	Fuel level sensor 2 circuit fault	• Fuel level sensor 1 circuit; open circuit	For fuel level sensor circuit tests, GO to Pinpoint Test A.
B2628	Fuel level sensor 2 circuit fault	• Fuel level sensor 1 circuit; short circuit to ground	For fuel level sensor circuit tests, GO to Pinpoint Test A.
B2879	Failure to transfer fuel	• Transfer pump malfunction • Internal transfer system	Carry out fuel transfer test, GO to Pinpoint Test C. Refer to bulletin A310-01.

Pinpoint tests

PINPOINT TEST A : P0460, B1202, B1204, B2627, B2628: FUEL LEVEL SENSORS

• NOTE: In the event of a fault with the level sensors, only the relevant module should be replaced. There is no requirement to replace the fuel tank.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE FUEL LEVEL SENSOR GROUND CIRCUITS	
	1 Disconnect the fuel level sensor connector(s): Vehicles with 2.5/3.0 L engine, ROW; • FT02 and FT03. Vehicles with 2.5/3.0 L engine, USA; • FT06. Vehicles with 2.0 L petrol engine; • CA415. Vehicles with 2.0/2.2 L diesel engines; • CA415.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the resistance between: Vehicles with 2.5/3.0 L engine, ROW; • FT02, pin 03 (B) and GROUND. • FT03, pin 03 (B) and GROUND. Vehicles with 2.5/3.0 L engine, USA;

- FT06, pin 02 (B) and GROUND.
- FT06, pin 04 (B) and GROUND.

Vehicles with 2.0 L petrol;

- CA415, pin 04 (B) and GROUND.

Vehicles with 2.0 /2.2 L diesel engines;

- CA415, pin 04 (B) and GROUND.

Is the resistance greater than 5 ohms?

Yes

REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

No

GO to A2.

A2: CHECK THE FUEL LEVEL SENSOR SIGNAL CIRCUIT FOR HIGH RESISTANCE

1 Disconnect the Instrument cluster connector, IP10.

2 Measure the resistance between IP10, pin 07 (WU) and:

Vehicles with 2.5/3.0 L engine, ROW;

- FT02, pin 01 (WU).

Vehicles with 2.5/3.0 L engine, USA;

- FT06, pin 03 (WU).

Vehicles with 2.0 L petrol;

- CA415, pin 02 (WB).

Vehicles with 2.0/2.2 L diesel engines;

- CA415, pin 02 (WB).

Is the resistance greater than 5 ohms?

Yes

REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

No

GO to A3.

A3: CHECK THE FUEL LEVEL SENSOR SIGNAL CIRCUIT FOR SHORT CIRCUIT TO GROUND

1 Measure the resistance between;

Vehicles with 2.5/3.0 L engine, ROW;

- FT02, pin 01 (WU) and GROUND.

Vehicles with 2.5/3.0 L engine, USA;

- FT06, pin 03 (WU) and GROUND.

Vehicles with 2.0 L petrol engine;

- CA415, pin 02 (WB) and GROUND.

Vehicles with 2.0/2.2 L diesel engines;

- CA415, pin 02 (WB) and GROUND.

Is the resistance less than 10,000 ohms?

Yes

REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

No

GO to A4.

A4: CHECK THE FUEL LEVEL SENSOR (2) SIGNAL CIRCUIT FOR HIGH RESISTANCE

• NOTE: Vehicles with 2.0 L petrol or 2.0/2.2 L diesel engines are only fitted with one sensor.

1 Measure the resistance between IP10 pin 08 (WB) and:

Vehicles with 2.5/3.0 L engine, ROW;

- FT03, pin 01 (WB).

Vehicles with 2.5/3.0 L engine, USA;

- F06, pin 05 (WB).

Is the resistance greater than 5 ohms?

Yes

REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

No

GO to A6.

A5: CHECK THE FUEL LEVEL SENSOR (2) SIGNAL CIRCUIT FOR SHORT CIRCUIT TO GROUND

1 Measure the resistance between;

Vehicles with 2.5/3.0 L engine, ROW;

- FT03, pin 01 (WB) and GROUND.

Vehicles with 2.5/3.0 L engine, USA;

	• F06, pin 05 (WB) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation. **No** GO to A6.
A6: CHECK THE FUEL LEVEL SENSOR RANGE	
	1 Measure the resistance between: Vehicles with 2.5/3.0 L engine, ROW; • Pins 01 and 03 of the fuel pump module at FT02. Vehicles with 2.5/3.0 L engine, USA; • Pins 03 and 04 of the fuel pump module. Vehicles with 2.0 L petrol engine; • Pins 02 and 04 of the fuel pump module/level sensor. Vehicles with 2.0/2.2 L diesel engine; • Pins 02 and 04 of the fuel pump module/level sensor.
	Is the resistance between 11 ohms and 165 ohms? **Yes** **Vehicles with 2.0 L petrol or 2.0/2.2 L diesel engines**, Reflash the engine control module using the Jaguar approved diagnostic system, **Vehicles with 2.5/3.0 L engine**GO to A7. **No** INSTALL a new fuel level sensor. REFER to: Fuel Level Sensor - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (310-01 Fuel Tank and Lines, Removal and Installation). INSTALL a new fuel pump module, REFER to: Fuel Pump Module - 2.0L NA V6 - AJV6 (310-01 Fuel Tank and Lines, Removal and Installation) / Fuel Pump Module - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation) / Fuel Pump Module - 2.0L NA V6 - AJV6 (310-01 Fuel Tank and Lines, Removal and Installation). CLEAR the DTC, test the system for normal operation.
A7: CHECK THE FUEL LEVEL SENSOR (2) RANGE	
• NOTE: Vehicles with 2.0 L petrol or 2.0/2.2 L diesel engines are only fitted with one sensor.	
	1 Measure the resistance between: Vehicles with 2.5/3.0 L engine, ROW; • Pins 01 and 03 of the fuel level sensor at FT03. Vehicles with 2.5/3.0 L engine, USA; • Pins 02 and 05 of the fuel level sensor.
	Is the resistance between 11 ohms and 165 ohms? **Yes** Reflash the engine control module using the Jaguar approved diagnostic system. **No** INSTALL a new fuel transfer pump module, REFER to: Fuel Transfer Pump (310-01 Fuel Tank and Lines, Removal and Installation). CLEAR the DTC, test the system for normal operation.

PINPOINT TEST B : P1234, P1236, P1338: FUEL PUMP CONTROL MODULE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE POWER SUPPLY TO THE FUEL PUMP MODULE	
	1 Disconnect the fuel pump module connector, CA105.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between CA105, pin 09 (NG) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to B2. **No** REPAIR the circuit between CA105 pin 09 (NG) and the ignition switch. This circuit includes the passenger junction box (fuse 17), ignition relay, and the inertia switch. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.
B2: CHECK THE GROUND CIRCUIT TO THE FUEL PUMP MODULE	
	1 Measure the resistance between CA105, pin 02 (B) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation. **No** GO to B3.
B3: CHECK THE SIGNAL GROUND CIRCUIT TO THE FUEL PUMP MODULE	
• NOTE: This test would be necessary if there were an EMC (Electro Magnetic Compatibility) issue with the vehicle.	
	1 Turn the ignition switch to the **CRANK** position.
	2 Measure the resistance between CA105, pin 04 (BG) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. This circuit includes the ECM. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation. ()

	No GO to B4.
B4: CHECK THE POWER SUPPLY CIRCUIT TO THE FUEL PUMP	
	1 Reconnect the fuel pump module connector, CA105.
	2 Disconnect the fuel pump connector: Vehicles with 2.5/3.0 L engine, ROW; • FT02. Vehicles with 2.5/3.0 L engine, USA; • FT06.
	3 Turn the ignition switch to the **ON** position.
	4 Measure the voltage between: Vehicles with 2.5/3.0 L engine, ROW; • FT02, pin 02 (R) and GROUND. Vehicles with 2.5/3.0 L engine, USA; • FT06, pin 06 (R) and GROUND.
	Is the voltage less than 10 volts? **Yes** INSTALL a new fuel pump module. REFER to: Fuel Pump Module - 2.0L NA V6 - AJV6 (310-01 Fuel Tank and Lines, Removal and Installation) / Fuel Pump Module - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation). CLEAR the DTC, test the system for normal operation. **No** GO to B5.
B5: CHECK THE SIGNAL GROUND CIRCUIT FOR CONTINUITY	
	1 Disconnect the fuel pump module connector, CA105.
	2 Measure the resistance between CA105, pin 03 (Y) and: Vehicles with 2.5/3.0 L engine, ROW; • FT02, pin 04 (Y). Vehicles with 2.5/3.0 L engine, USA; • FT06, pin 01 (Y).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation. **No** INSTALL a new fuel pump module. REFER to: Fuel Pump Module - 2.0L NA V6 - AJV6 (310-01 Fuel Tank and Lines, Removal and Installation) / Fuel Pump Module - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation). CLEAR the DTC, test the system for normal operation.

PINPOINT TEST C : FUEL TRANSFER TEST

WARNING: Use extreme care when carrying out the fuel transfer test not to endanger other road users or infringe any road traffic regulations. Ideally, this should be carried out away from public roads.

• NOTE: Make sure the fuel tank is between one quarter and half full as indicated by the fuel gauge before beginning this test.

• NOTE: If the **'F2****'** value in step 6 of this test is **'255'**, suspect an open or short circuit through the level sensor.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK THE 'F2**' VALUES**	
	1 Turn the ignition switch to the **OFF** position.
	2 Depress the trip button on the indicator stalk and turn the ignition switch to the **ON** position.
	3 Continue to hold the trip button in until **'TEST'** appears on the instrument cluster display.
	4 Release the trip button.
	5 Press the trip button repeatedly until **'F2****'** is displayed (this is the sender value of the transfer fuel pump module).
	6 Start the engine and drive the vehicle in a tight right-hand circle to transfer fuel from the fuel pump module side of the fuel tank to the transfer pump module side.
	7 Monitor the **'F2****'** value (with assistance, if necessary), and once the value is greater than 60, bring the vehicle to rest.
	8 Monitor the **'F2****'** value over approximately 3 minutes.
	Does the **'F2****'** value decrease steadily? **Yes** If the **'F2****'** value decreases steadily, this indicates that fuel is transferring. **No** If the **'F2****'** value does not decrease, or increases, return to the symptom chart and follow the actions listed for 'engine stops with fuel indicated on the gauge'.

PINPOINT TEST D : FUEL PUMP NOISE (VEHICLES WITH 2.5/3.0L ENGINES ONLY)

• NOTE: A certain amount of 'swishing' from the fuel tank is normal as fuel is transferred around the fuel modules.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: VERIFY THAT THE FUEL PUMP IS THE SOURCE OF THE NOISE	
	1 Apply the parking brake.

	2 Make sure the gear selector is in the **NEUTRAL** position for vehicles fitted with manual transmission, **PARK** position for vehicles fitted with automatic transmission. 3 Start the engine and allow to idle. 4 While the engine is idling, disconnect the main tank harness and monitor the noise (the engine will continue to run briefly to allow this test to be performed).
	Does the noise continue? **Yes** The noise is not caused by the fuel pumps. Clear any DTCs, recheck the system. **No** INSTALL a new fuel pump module, REFER to: Fuel Pump Module - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation). CLEAR any DTCs, test the system for normal operation.

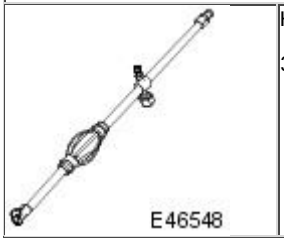
PINPOINT TEST E : FUEL STARVATION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK FUEL PRESSURE	
• NOTE: **Petrol vehicles only.**	
	WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury. • NOTE: **Vehicles built to Vin: D86654.** The fuel pressure can be tested using the Jaguar approved diagnostic system datalogger facility, or by the use of a suitable gauge from the schraeder connector on the fuel rail. • NOTE: **Vehicles built from Vin: D86655.** The fuel pressure can be tested using the Jaguar approved diagnostic system datalogger facility, or by the use of a suitable gauge from the schraeder connector on the special tool fitted to the fuel rail. REFER to: Fuel System Pressure Check (310-00 Fuel System - General Information, General Procedures). • NOTE: The fuel pressure should rise to nominal pressure (320 - 380 Kpa [46 - 55 lb/in²]) within 2 seconds of starting. 1 Install the fuel pressure gauge to the fuel Schraeder valve. 2 Apply the parking brake. 3 Make sure the gear selector is in the **NEUTRAL** position for vehicles fitted with manual transmission, **PARK** position for vehicles fitted with automatic transmission. 4 Start the engine. ● Make sure there are no leaks from the gauge connections 5 Hold the engine at a steady light throttle and monitor the fuel pressure.
	Does the fuel pressure decrease as the throttle is held steady? **Yes** CHECK the following; Visual inspections from this sectionSender function, GO to Pinpoint Test A. If this fails to resolve the issue, install a new fuel pump module, REFER to: Fuel Pump Module - 2.0L NA V6 - AJV6 (310-01 Fuel Tank and Lines, Removal and Installation) / Fuel Pump Module - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation). and transfer pump, REFER to: Fuel Transfer Pump (310-01 Fuel Tank and Lines, Removal and Installation). Clean and flush any heavy contamination from the fuel tank. Clear any DTCs, test the system for normal operation. **No** CHECK the ECM for DTCs indicating another cause for the problem.

PINPOINT TEST F : FUEL CONTAMINATION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK FOR THE PRESENCE OF CONTAMINANTS IN THE FUEL	
	1 Extract approximately 1 liter of fuel from the rail into a suitable clear container. 2 Allow to settle for 2 minutes and check for separation of the fuel into layers.
	Is there visible separation of the fuel? **Yes** REMOVE the fuel tank. Drain off the fuel. Clean and flush the fuel tank and lines. Refill with fresh fuel. Clear any DTCs, test the system for normal operation. **No** CHECK the ECM for DTCs indicating another cause for the problem.

Published: 11-May-2011

Fuel Tank and Lines - Fuel Filter2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma

Removal and Installation

Special Tool(s)	
 E46548	Hand Pressure Pump with Adapter Kit 310-110

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 mixtures are always present and can 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.

• CAUTIONS:

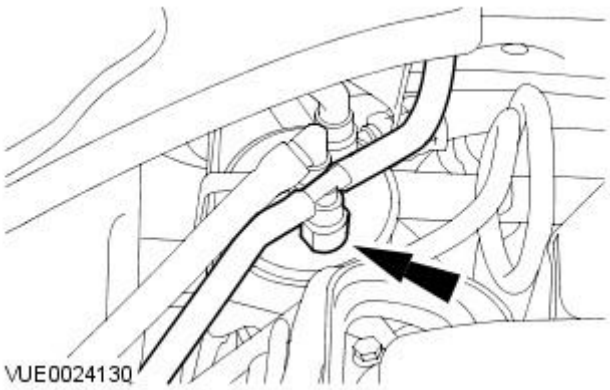
Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always fit blanking plugs to any open orifices or lines.

Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow these instructions may result in foreign matter ingress to the fuel injection system.

1. CAUTION: The generator must be protected from contamination. Failure to follow this instruction may cause premature failure of the generator.

Protect the generator with lint-free material to prevent contamination.

2. Disconnect the fuel pump to fuel filter fuel return line from the fuel filter.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).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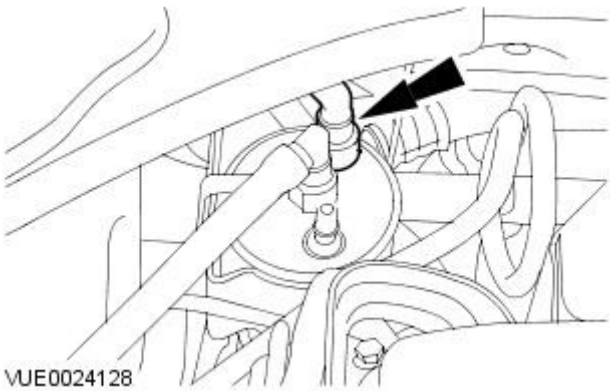
3. Disconnect the fuel tank to fuel filter fuel supply line from the fuel filter.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).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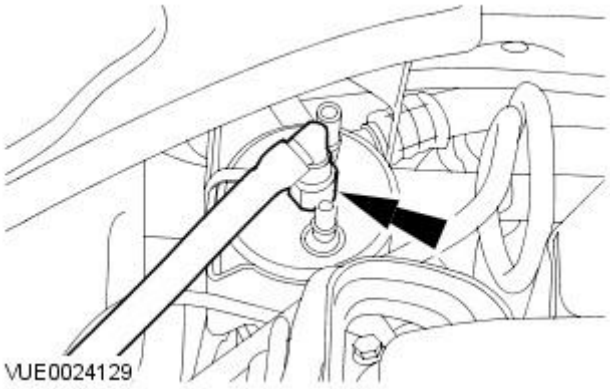
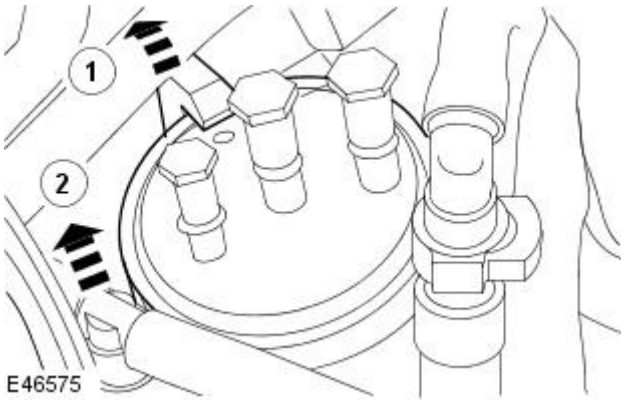


4. Disconnect the fuel filter to fuel pump fuel supply line from the fuel filter.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

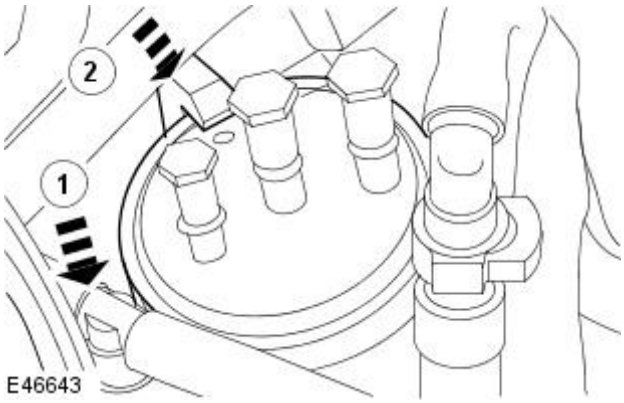
- Install a blanking plug to the fuel pump fuel supply line.



5. Remove the fuel filter

1. Detach the fuel filter retaining clip.
2. Remove the fuel filter.

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 mixtures are always present and can 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.

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 fit blanking plugs to any open orifices or lines.

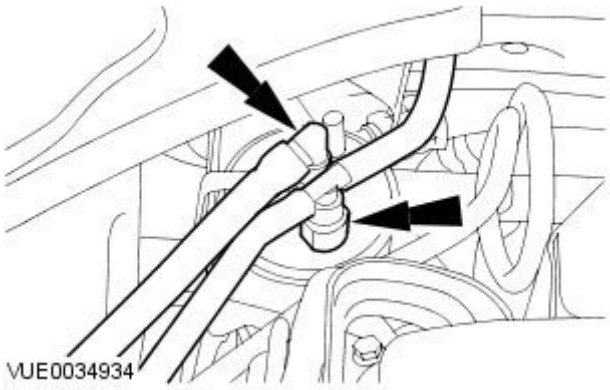
• NOTE: Make sure that the fuel filter is fully installed into the fuel filter retaining bracket.

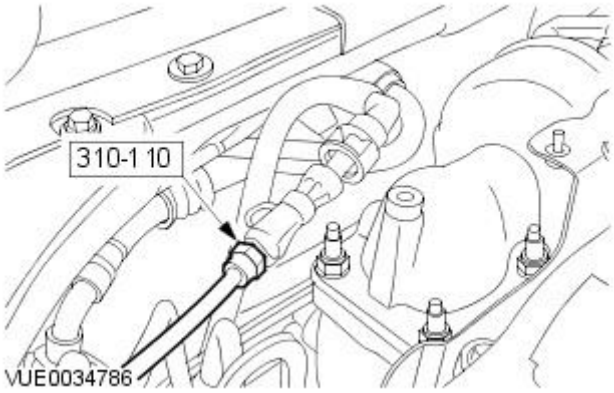
Install the fuel filter.

1. Install the fuel filter.
2. Attach the fuel filter retaining clip.

2. Connect the fuel pump to fuel filter fuel supply and fuel return lines to the fuel filter.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

- Remove the blanking plugs.





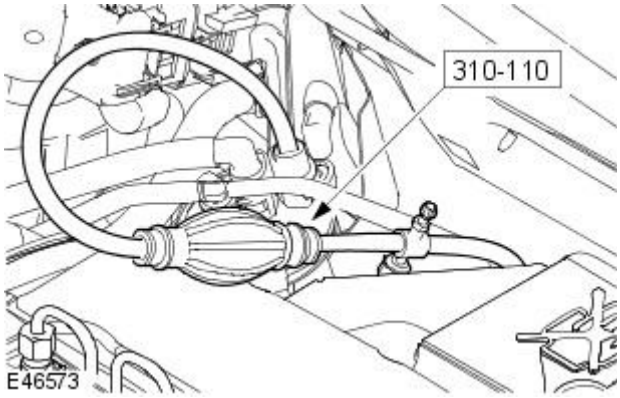
3. NOTE: Make sure that the hand primer arrow indicating the fuel flow is pointing towards the fuel filter.

Install the hand pressure pump special tool between the fuel filter and the fuel filter fuel supply line.

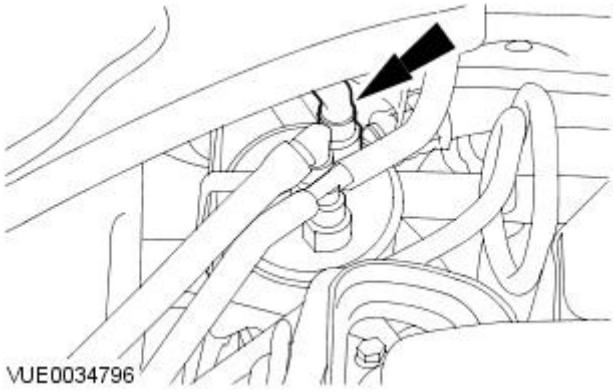
4. NOTE: Once the hand pressure pump special tool bellow has become firm hold the pressure for five minutes.

Operate the hand pressure pump special tool until fuel starts to flow through the fuel filter and the special tool becomes firm.

5. Remove the hand pressure pump special tool.



6. Connect the fuel tank to fuel filter fuel supply line to the fuel filter. For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).



7. Remove the lint-free material from the generator.

Published: 11-May-2011

Fuel Tank and Lines - Fuel Filter2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Removal and Installation

Removal

1. WARNINGS:

Place the vehicle in a quarantined area and arrange "No Smoking/Petrol Fumes" signs about the vehicle.

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.

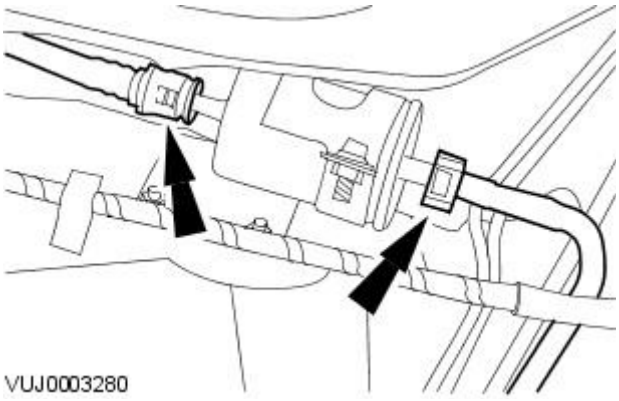
This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

Disconnect the battery ground cable. For additional information, refer to Section 414-01 Battery, Mounting and Cables.

2. De-pressurize the fuel system. For additional information, refer to Section 310-00 Fuel System - General Information.

3. Raise and support the vehicle. For additional information, refer to Section 100-02 Jacking and Lifting.

4. Disconnect the fuel line quick release couplings. For additional information, refer to Section 310-00 Fuel System - General Information.



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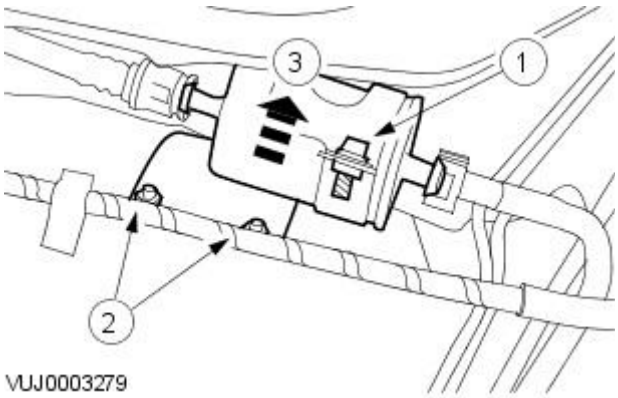
5. Remove the fuel filter and bracket assembly.

1. Loosen the fuel filter bracket retaining bolt.
2. Remove the retaining bracket nuts.
3. Remove the fuel filter and bracket assembly.



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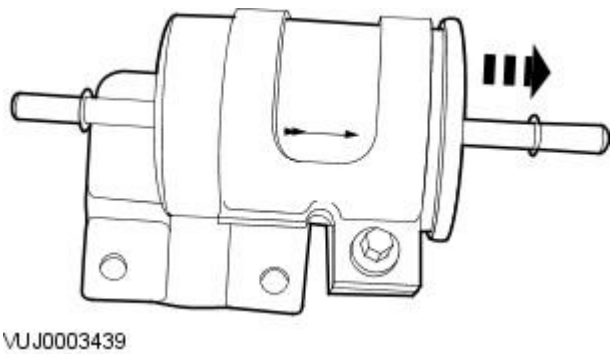
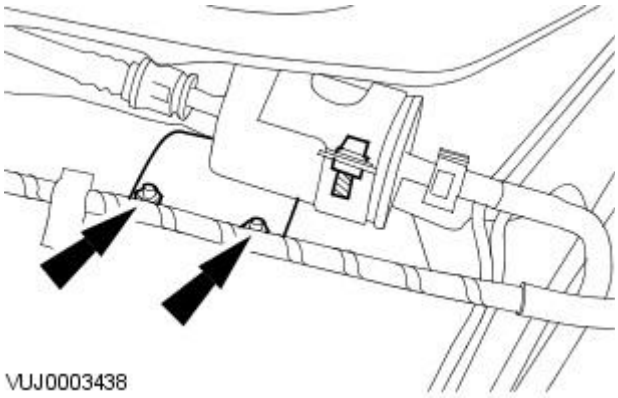
6. Remove the fuel filter.



VUJ0003439

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 vapours 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.

• NOTE: Observe the direction of the flow arrow.

To install, reverse the removal procedure.

- Tighten to 4 Nm.

Published: 11-May-2011

Fuel Tank and Lines - Fuel Level Sender2.0L NA V6 - AJV6

Removal and Installation

Removal

• WARNINGS:

Do not smoke or carry lighted tobacco or an 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.

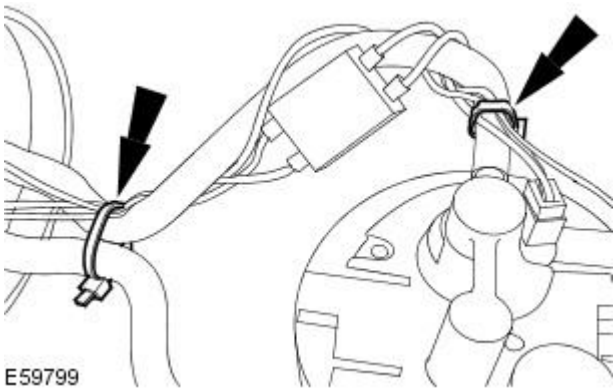
Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

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 - 2.0L NA V6 - AJV6 (310-01 Fuel Tank and Lines, Removal and Installation).

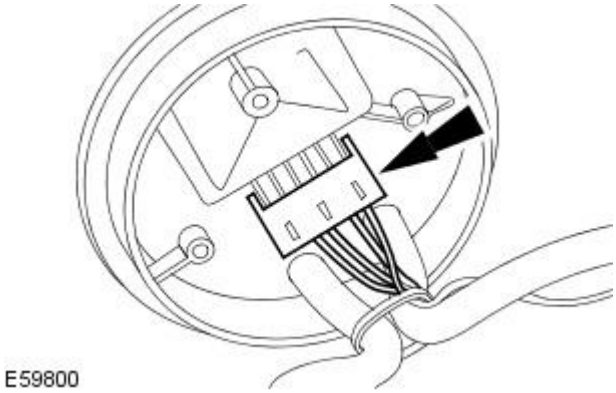
2. NOTE: Note the position of the tie straps securing the harness to the fuel pipes.

Remove the tie straps.

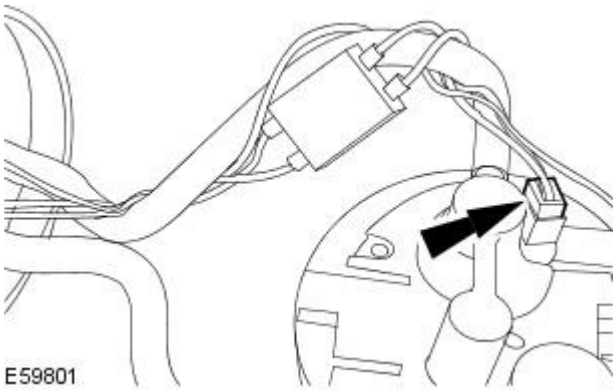


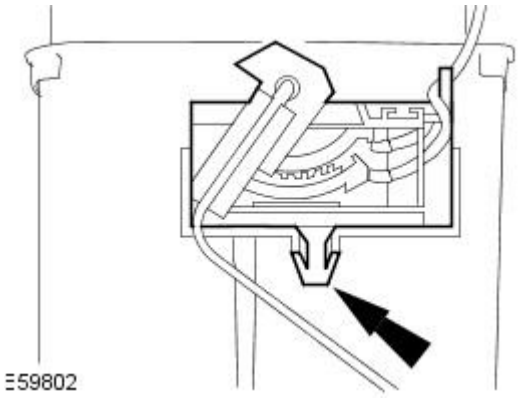
3. NOTE: Vehicle with single electrical connector shown, vehicles with multiple electrical connectors similar.

Disconnect the electrical connector from the fuel pump module flange.



4. Disconnect the electrical connector from the fuel pump.





5. Remove the fuel level sender.

Installation

• WARNINGS:

Do not smoke or carry lighted tobacco or an 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.

CAUTION: Make sure the float or arm are not damaged while installing the fuel pump module.

1. To install, reverse the removal procedure.

Fuel Tank and Lines - Fuel Level Sender2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma

Removal and Installation

Removal

• WARNINGS:

Do not smoke or carry lighted tobacco or an 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.

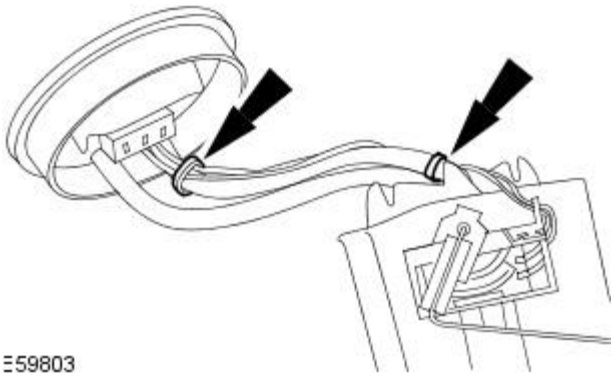
Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

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 level sensor.
For additional information, refer to: Fuel Level Sensor - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (310-01 Fuel Tank and Lines, Removal and Installation).

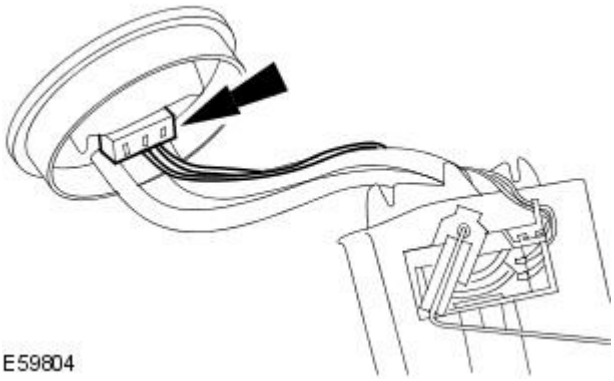
2. NOTE: Note the position of the tie straps securing the harness to the fuel pipes.

Remove the tie straps.

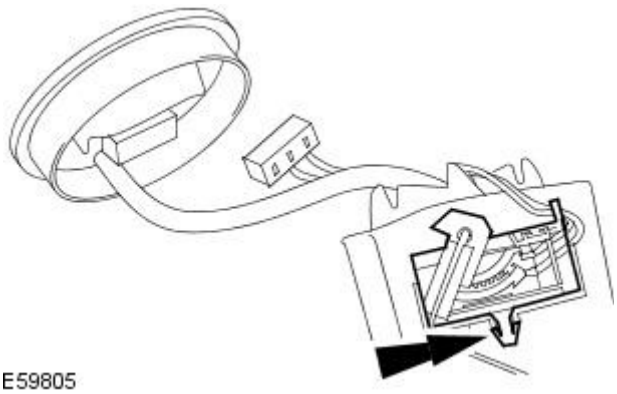


3. NOTE: Vehicle with single electrical connector shown, vehicles with multiple electrical connectors similar.

Disconnect the electrical connector from the fuel level sensor flange.



4. Remove the fuel level sender.



Installation

• WARNINGS:

Do not smoke or carry lighted tobacco or an 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. To install, reverse the removal procedure.

Published: 11-May-2011

Fuel Tank and Lines - Fuel Level Sender LH2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Removal and Installation

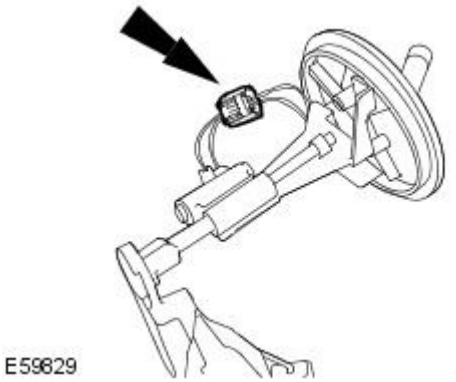
Removal

• WARNINGS:

Do not smoke or carry lighted tobacco or an 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.

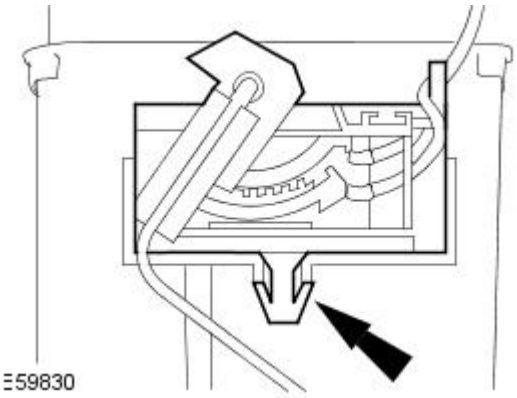


1. NOTE: All vehicles.

Remove the transfer pump.
For additional information, refer to: Fuel Transfer Pump (310-01 Fuel Tank and Lines, Removal and Installation).

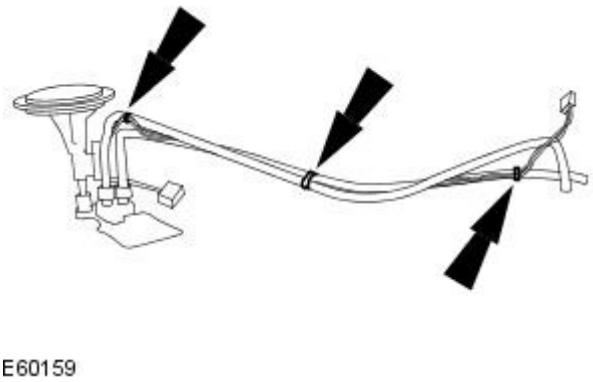
2. NOTE: Non federal market vehicles only.

Disconnect the fuel level sender electrical connector.



3. NOTE: Non federal market vehicles only.

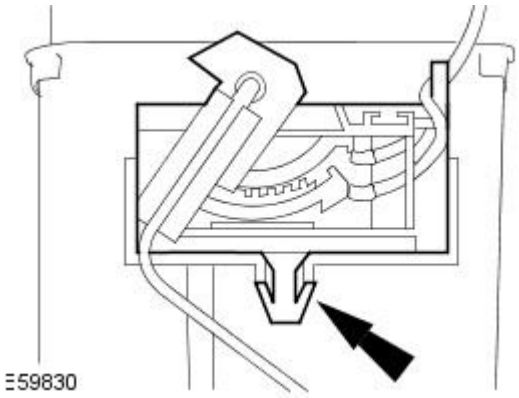
Remove the fuel level sender.



4. NOTE: Federal market vehicles only.

• NOTE: Note the position of the tie straps securing the harness to the fuel pipes.

Remove the tie straps.



5. NOTE: Federal market vehicles only.

Remove the fuel level sender and harness.

Installation

• WARNINGS:

Do not smoke or carry lighted tobacco or an 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. To install, reverse the removal procedure.

Published: 11-May-2011

Fuel Tank and Lines - Fuel Level Sender RH2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Removal and Installation

Removal

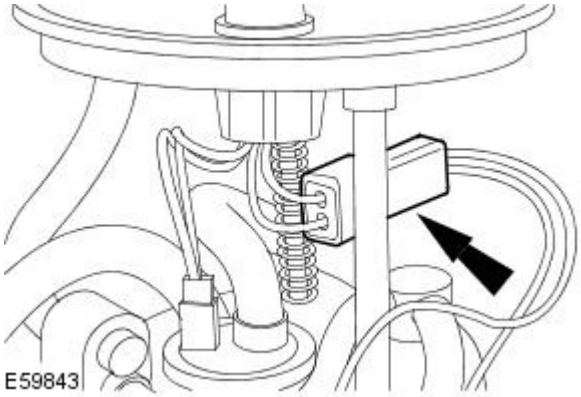
• WARNINGS:

Do not smoke or carry lighted tobacco or an 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.

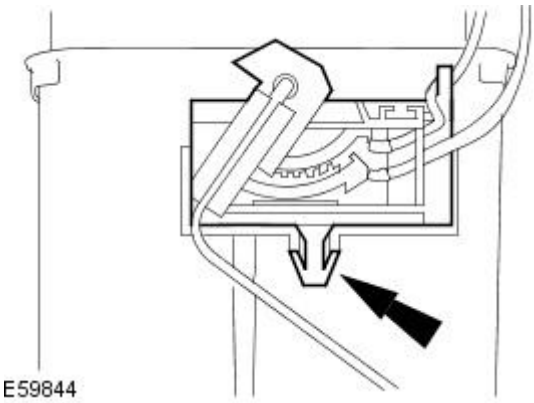
Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

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 - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation).
2. Disconnect the fuel level sender electrical connector.



3. Remove the fuel level sender.



Installation

• WARNINGS:

Do not smoke or carry lighted tobacco or an 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. To install, reverse the removal procedure.

Published: 11-May-2011

Fuel Tank and Lines - Fuel Level Sensor2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma

Removal and Installation

Special Tool(s)	
 E49162	Remove/Install fuel pump/transfer pump locking ring 310-127

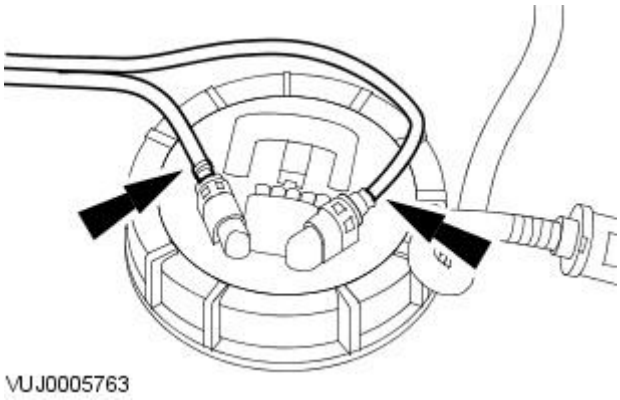
Removal

• WARNINGS:

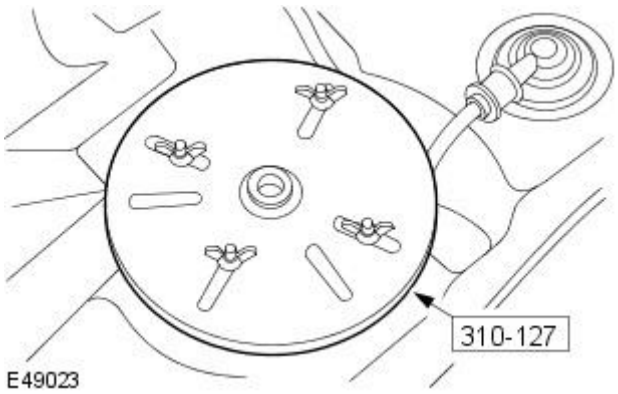
Do not smoke or carry lighted tobacco or an open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

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.


VUJ0005763

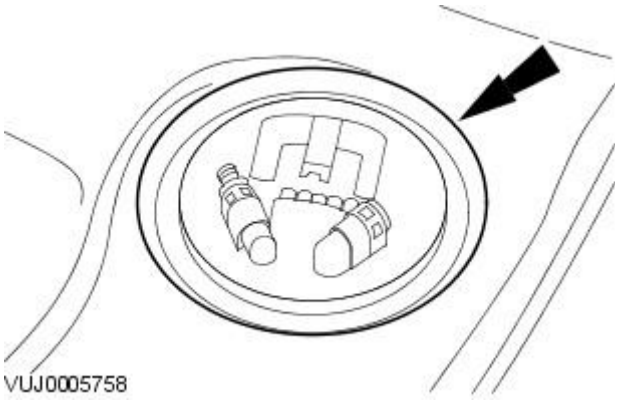
1. Remove the fuel tank.
   For additional information, refer to: Fuel Tank - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (310-01 Fuel Tank and Lines, Removal and Installation).
2. Disconnect the fuel lines.
   For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).



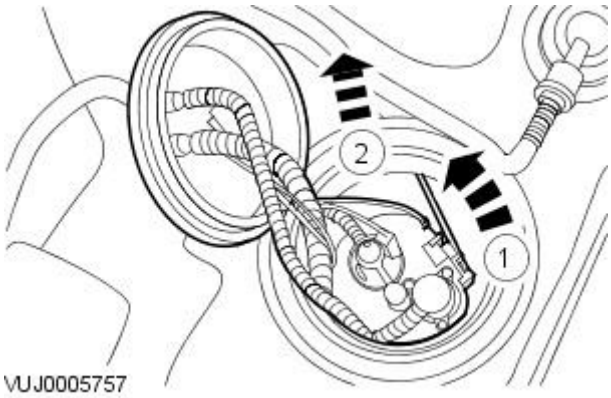
E49023

3. NOTE: Note the orientation of the fuel level sensor before removal.

   Using the special tool, remove the locking ring.



4. Detach the top of the fuel level sensor.



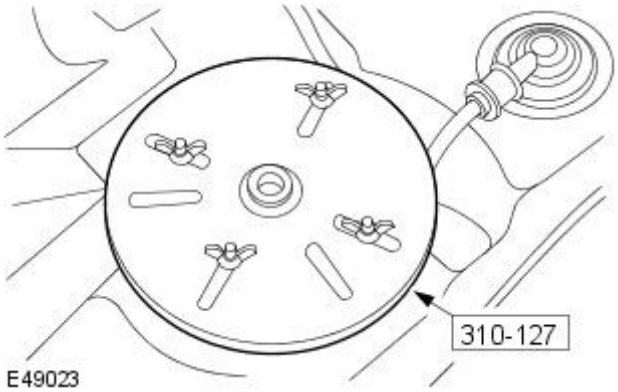
5. CAUTION: Make sure the float or arm are not damaged while removing the fuel level sensor.

Remove the fuel level sensor.

1. Rotate the lower part of the fuel level sensor.
2. Remove the fuel level sensor.

- Remove and discard the seal.

Installation



1. WARNINGS:

Do not smoke or carry lighted tobacco or an 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.

CAUTION: Make sure the float or arm are not damaged while installing the fuel level sensor.

• NOTE: Install a new seal.

• NOTE: Make sure the fuel level sensor is correctly orientated.

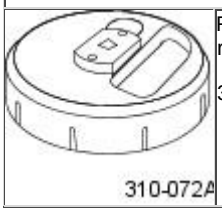
To install, reverse the removal procedure.

- Tighten to 85 Nm.

Published: 11-May-2011

Fuel Tank and Lines - Fuel Pump Module2.0L NA V6 - AJV6

Removal and Installation

Special Tool(s)	
	Remove/Install fuel pump/transfer pump locking ring 310-072A

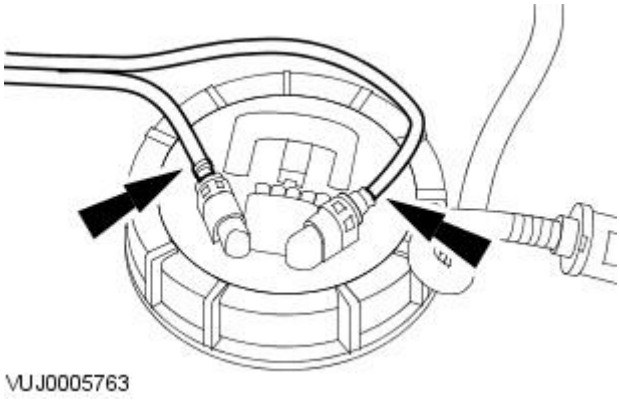
Removal

• WARNINGS:

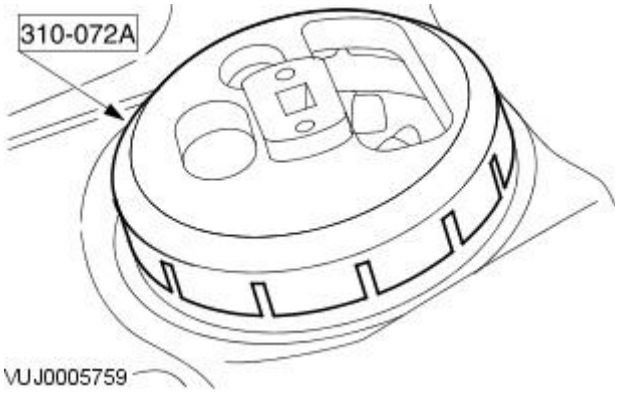
Do not smoke or carry lighted tobacco or an open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

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.

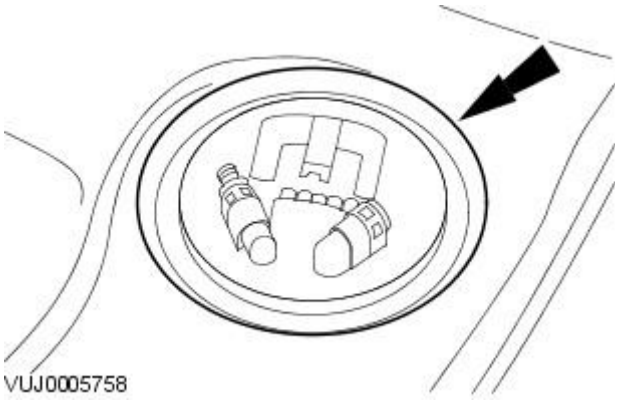


1. Remove the fuel tank.
   For additional information, refer to: Fuel Tank - 2.0L NA V6 - AJV6 (310-01 Fuel Tank and Lines, Removal and Installation).
2. Disconnect the fuel lines.
   For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

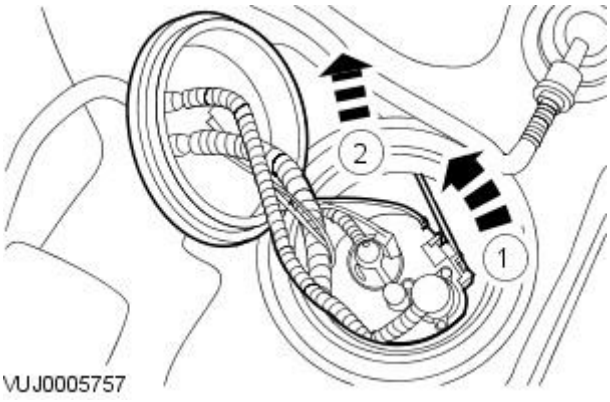


3. NOTE: Note the orientation of the fuel pump module before removal.

   Using the special tool, remove the locking ring.



4. Detach the top of the fuel pump module.



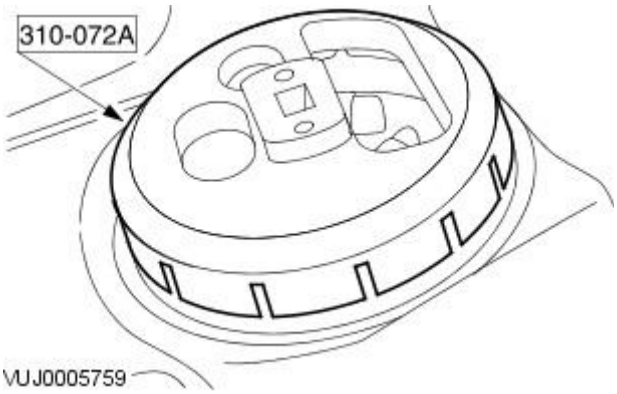
5. CAUTION: Make sure the float or arm are not damaged while removing the fuel pump module.

Remove the fuel pump module.

1. Rotate the lower part of the fuel pump module.
2. Remove the fuel pump module.

- Remove and discard the seal.

Installation



1. WARNINGS:

Do not smoke or carry lighted tobacco or an 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.

CAUTION: Make sure the float or arm are not damaged while installing the fuel pump module.

• NOTE: Make sure the fuel pump module is correctly orientated.

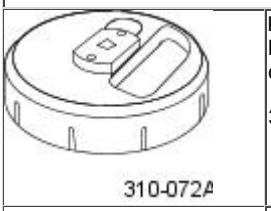
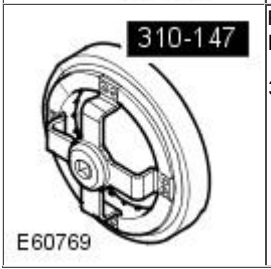
To install, reverse the removal procedure.

- Install a new seal.
- Tighten to 85 Nm.

Published: 11-May-2011

Fuel Tank and Lines - Fuel Pump Module2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Removal and Installation

Special Tool(s)	
 310-072A	Remove/Install fuel pump/transfer pump locking ring (Non federal market vehicles only) 310-072A
 310-147 E60769	Remove/Install fuel pump/transfer pump locking ring (Federal market vehicles only) 310-147

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.

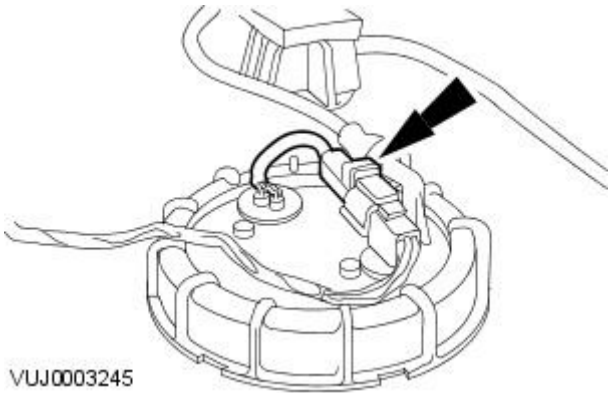
If taken internally do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.

If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek medical attention.

Wash hands thoroughly after handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

• NOTE: Non federal market vehicles, refer to steps 1 to 8.

• NOTE: Federal market vehicles, refer to steps 9 to 19.

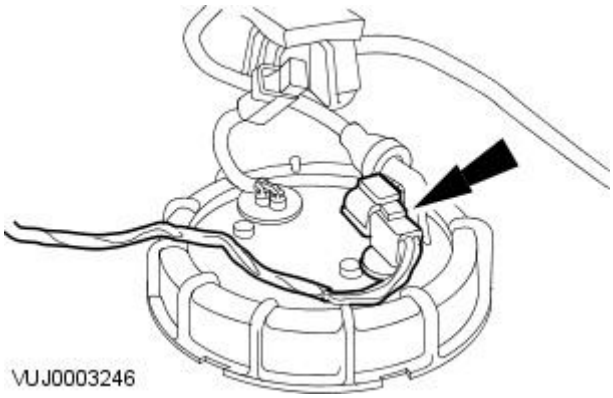

VUJ0003245

1. NOTE: Non federal market vehicles only.

Remove the fuel transfer pump.
For additional information, refer to: Fuel Transfer Pump (310-01 Fuel Tank and Lines, Removal and Installation).

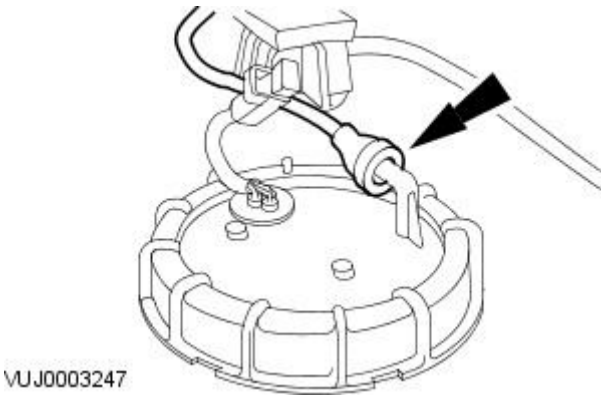
2. NOTE: Non federal market vehicles only.

Disconnect the electrical connector.


VUJ0003246

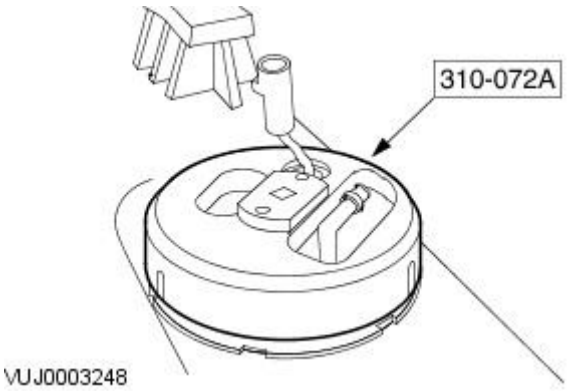
3. NOTE: Non federal market vehicles only.

Detach the electrical connector.


VUJ0003247

4. NOTE: Non federal market vehicles only.

Disconnect the fuel supply pipe.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

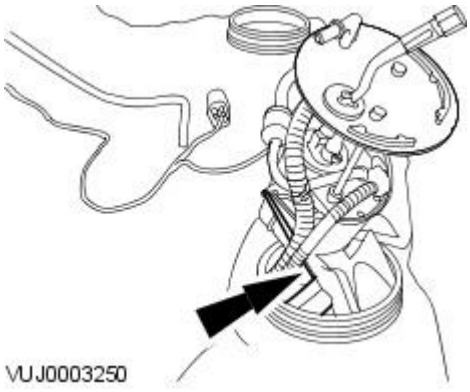


VUJ0003248

5. NOTE: Non federal market vehicles only.

• NOTE: Note the orientation of the fuel pump module before removal.

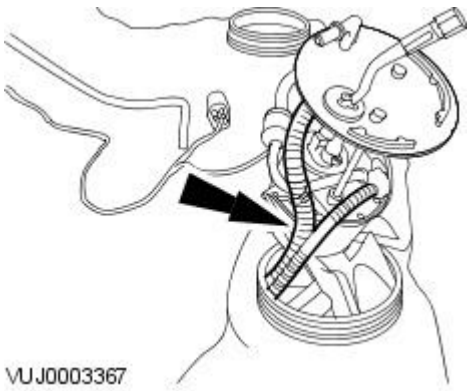
Using the special tool, remove the locking ring.


VUJ0003250

6. CAUTION: Make sure the float or arm are not damaged while removing the fuel pump module.

• NOTE: Non federal market vehicles only.

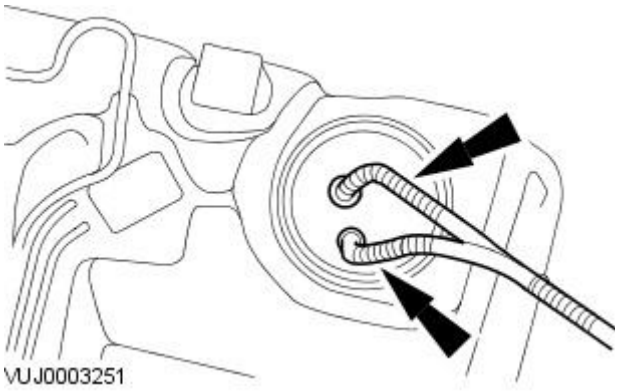
Guide the fuel pump module through the aperture.


VUJ0003367

7. CAUTION: Make sure damage to the fuel crossover pipes does not occur.

• NOTE: Non federal market vehicles only.

Guide the crossover pipes through the aperture.



8. NOTE: Non federal market vehicles only.

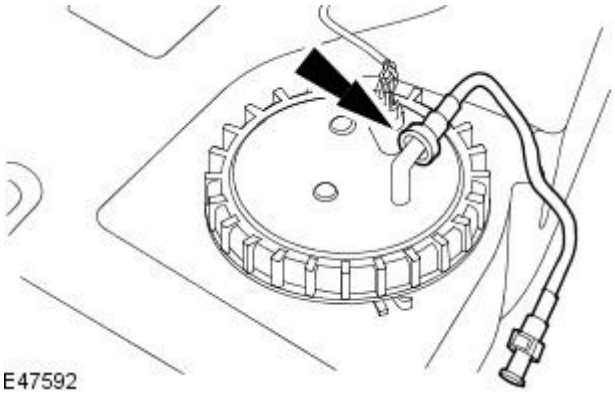
Remove the fuel pump module and crossover pipes.

- Remove and discard the O-ring seal.

9. NOTE: Federal market vehicles only.

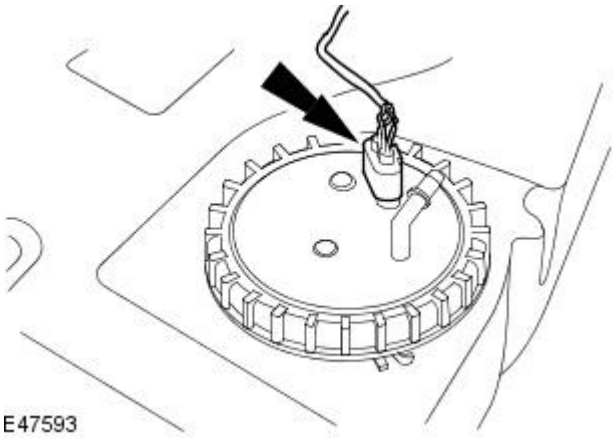
Remove the fuel tank.
For additional information, refer to: Fuel Tank - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation).

10. NOTE: Federal market vehicles only.



Remove the fuel supply pipe.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

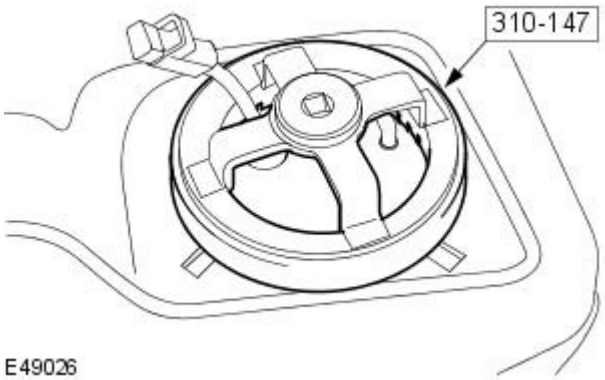
11. NOTE: Federal market vehicles only.



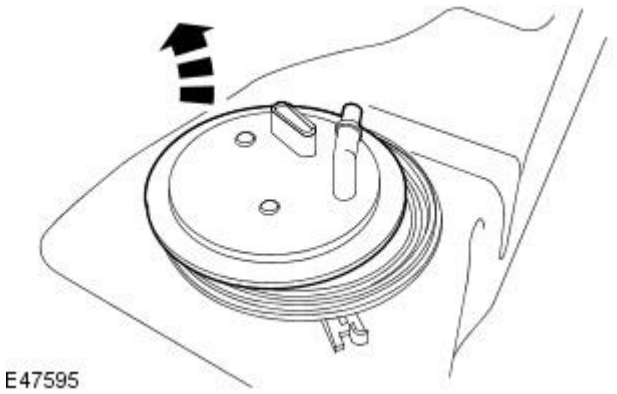
Disconnect the electrical connector.

12. NOTE: Federal market vehicles only.

• NOTE: Note the orientation of the fuel pump module before removal.

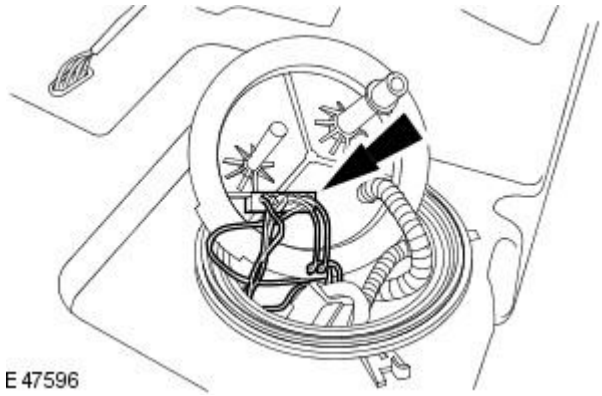


Using the special tool, remove the locking ring.


E47595

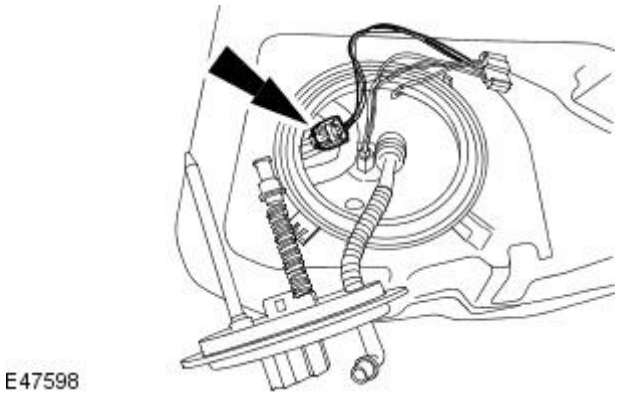
13. NOTE: Federal market vehicles only.

Detach the fuel pump module flange from the fuel pump module base.


E47596

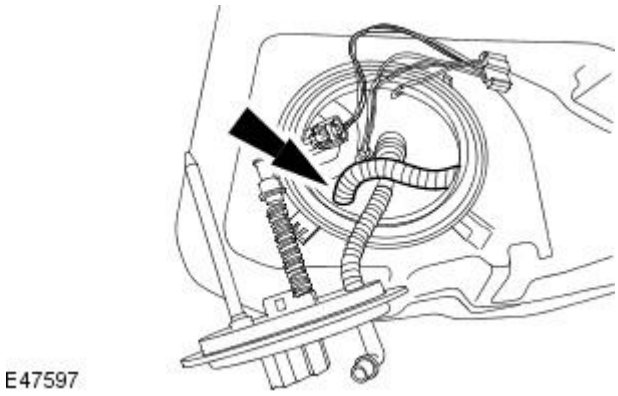
14. NOTE: Federal market vehicles only.

Disconnect the electrical connector.

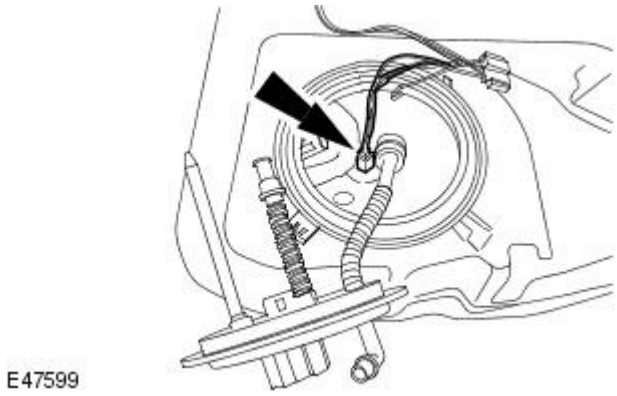

E47598

15. NOTE: Federal market vehicles only.

Disconnect the electrical connector.

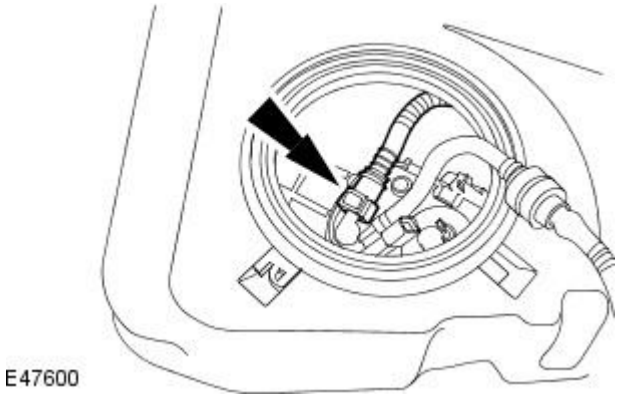

E47597

16. Detach the fuel crossover pipe from the fuel pump module base.


E47599

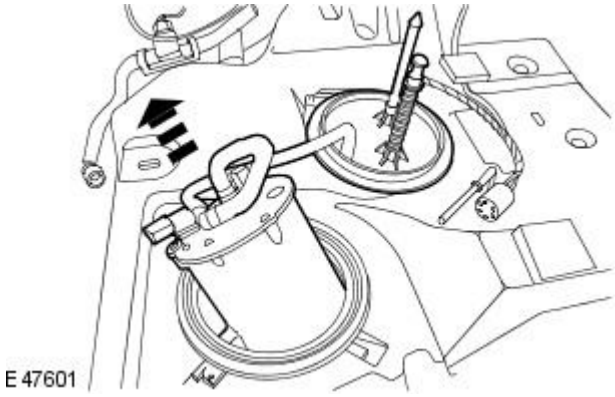
17. NOTE: Federal market vehicles only.

Disconnect the electrical connector.


E47600

18. NOTE: Federal market vehicles only.

Disconnect the fuel crossover pipe from the fuel pump module base.


E47601

19. CAUTION: Make sure the float or arm are not damaged while removing the fuel pump module.

• NOTE: Federal market vehicles only.

Remove the fuel pump module.

- Remove the fuel pump module base from the fuel tank.

Installation

• 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.

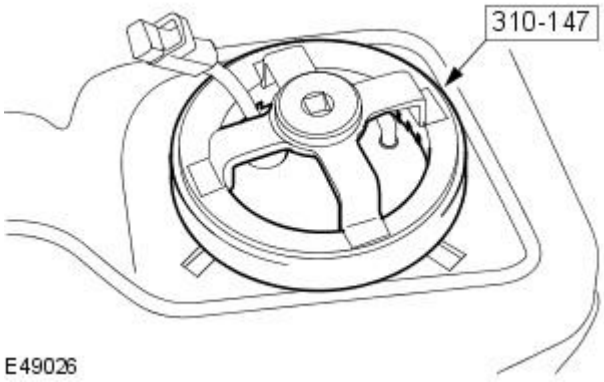
If taken internally do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.

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.

• NOTE: Federal market vehicles, refer to step 1.

• NOTE: Non federal market vehicles, refer to step 2.



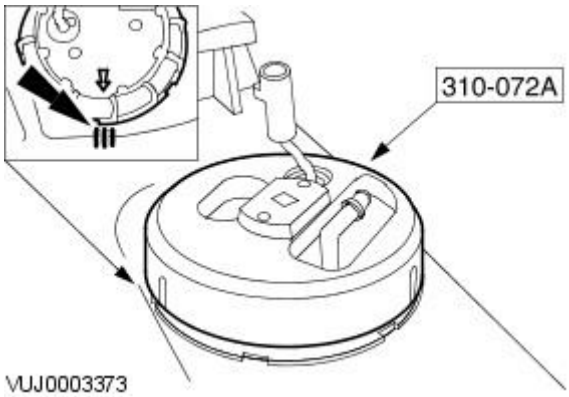
1. CAUTION: Make sure the float or arm are not damaged while installing the fuel pump module.

• NOTE: Federal market vehicles only.

• NOTE: Make sure the fuel pump module is correctly orientated.

To install, reverse the removal procedure.

- Install a new O-ring seal.
- Tighten to 120 Nm.



2. CAUTIONS:

Make sure the float or arm are not damaged while installing the fuel pump module.

Make sure the fuel cross over pipes are not damaged while installing the fuel pump module.

• NOTE: Non federal market vehicles only.

• NOTE: Make sure the fuel pump module is correctly orientated.

To install, reverse the removal procedure.

- Install a new O-ring seal.
- Tighten to 70 Nm.

Published: 11-May-2011

Fuel Tank and Lines - Fuel Tank2.0L NA V6 - AJV6

Removal and Installation

Removal

• WARNINGS:

Place the vehicle in a well ventilated, quarantined area and arrange **No Smoking / Petrol Fumes** signs about the vehicle.

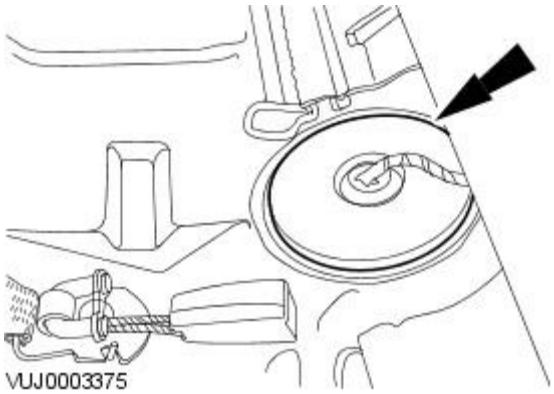
Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.

Do not smoke or carry lighted tobacco or an 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.

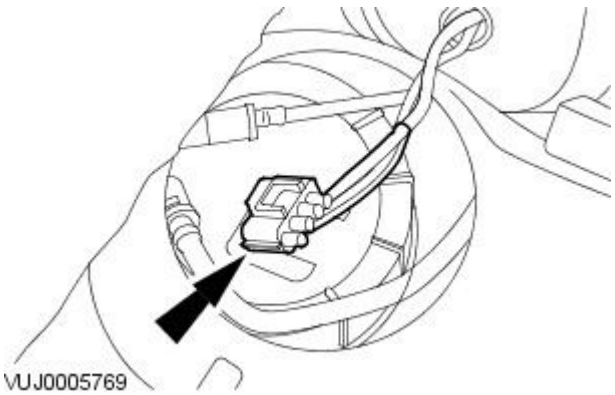
Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

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.

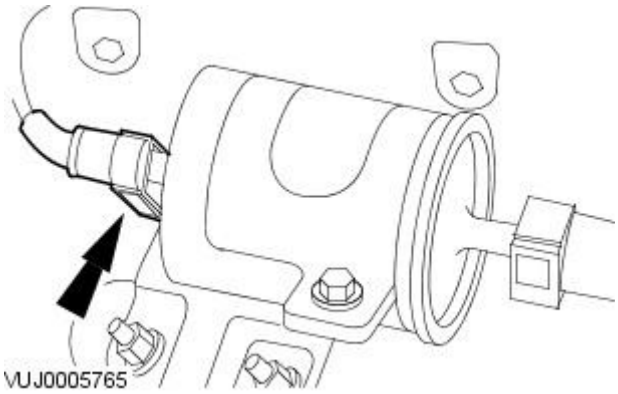
1. De-pressurize the fuel system.
   For additional information, refer to: Fuel System Pressure Release (310-00 Fuel System - General Information, General Procedures).
2. Remove the rear seat cushion.
   For additional information, refer to: Rear Seat Cushion (501-10 Seating, Removal and Installation).
3. Detach the wiring harness grommet.



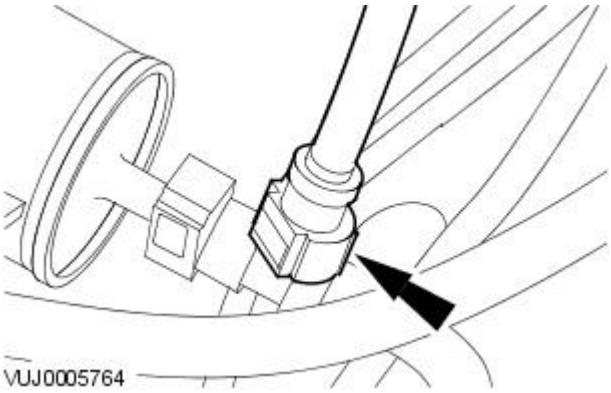
4. Disconnect the electrical connector.



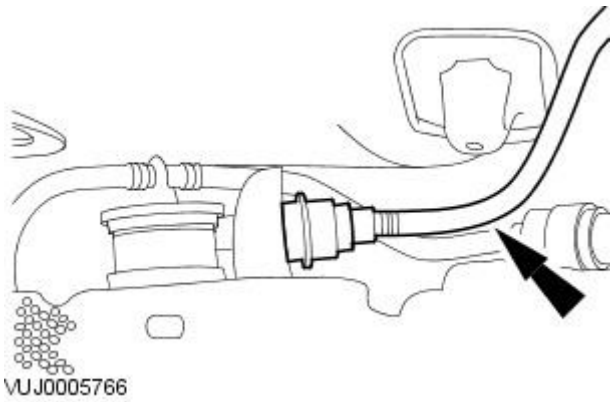
5. Drain the fuel tank.
   For additional information, refer to: Fuel Tank Draining - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-00 Fuel System - General Information, General Procedures).
6. Raise and support the vehicle.
   For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



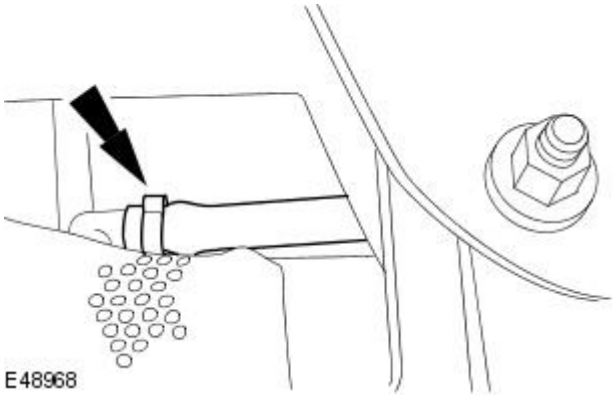
7. Disconnect the fuel filter line quick release coupling.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).



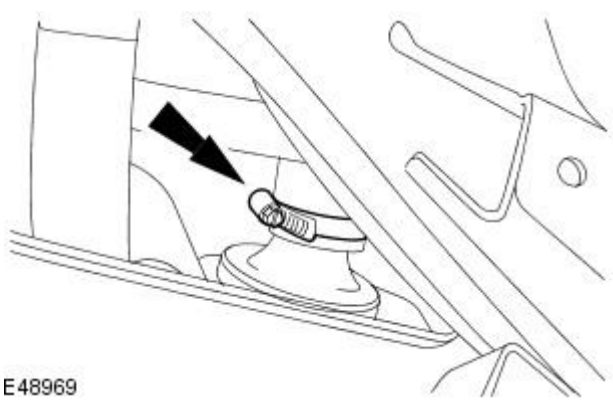
8. Disconnect the fuel filter line quick release coupling.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).



9. Disconnect the evaporative emission canister hose.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

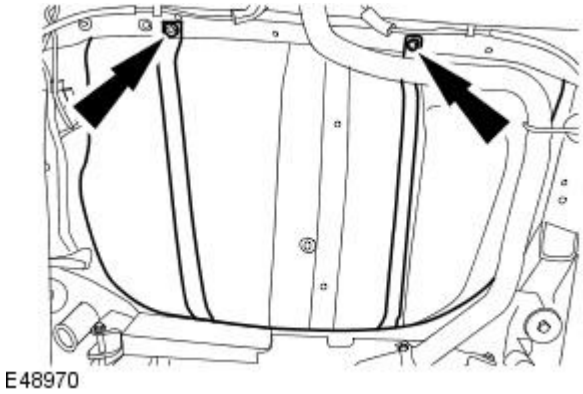


10. Detach the breather hose from the fuel tank.



11. NOTE: Note the orientation of the fuel tank filler pipe to fuel tank hose retaining clip before loosening.

Loosen the fuel tank filler pipe to fuel tank hose retaining clip.


E48970

12. NOTE: An assistant will be required to remove the fuel tank.

Remove the fuel tank.

- Remove the fuel tank support straps.

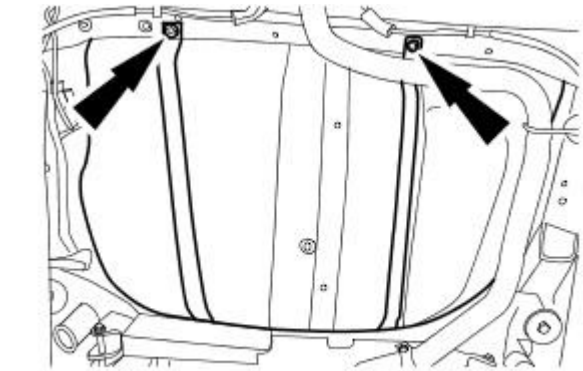
Installation

• WARNINGS:

Do not smoke or carry lighted tobacco or an 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.

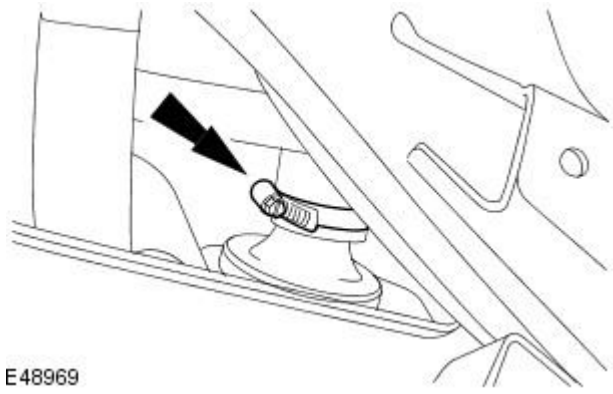

E48970

1. NOTE: An assistant will be required to install the fuel tank.

• NOTE: Make sure the fuel filler pipe hose is connected to the fuel tank as it is installed.

Install the fuel tank.

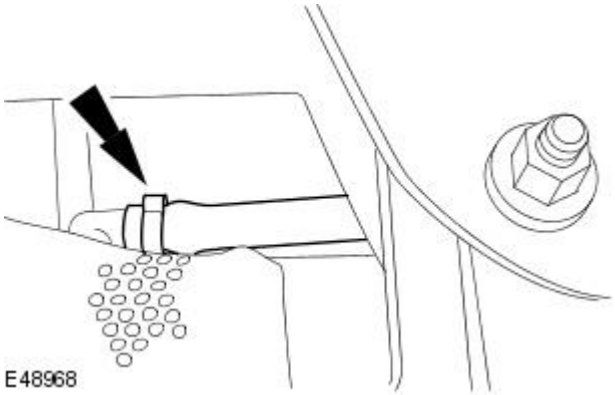
- Install the fuel tank support straps.
- Tighten to 25 Nm.


E48969

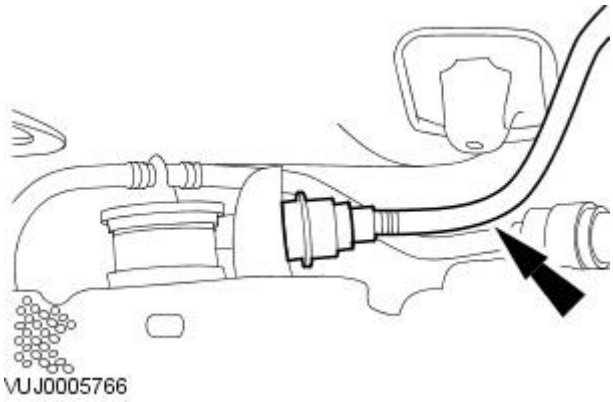
2. NOTE: Make sure the fuel tank filler pipe to fuel tank hose retaining clip is correctly orientated.

Tighten the fuel tank filler pipe to fuel tank hose retaining clip.

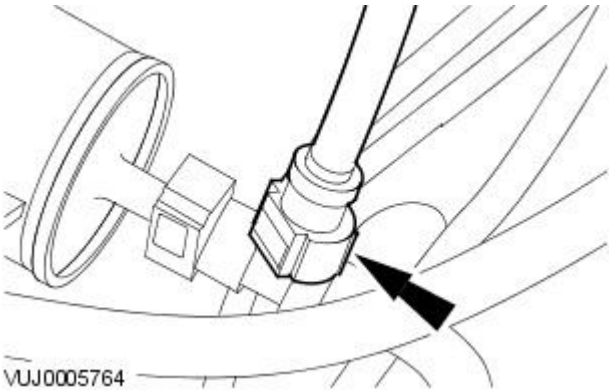
- Tighten to 3 Nm.


E48968

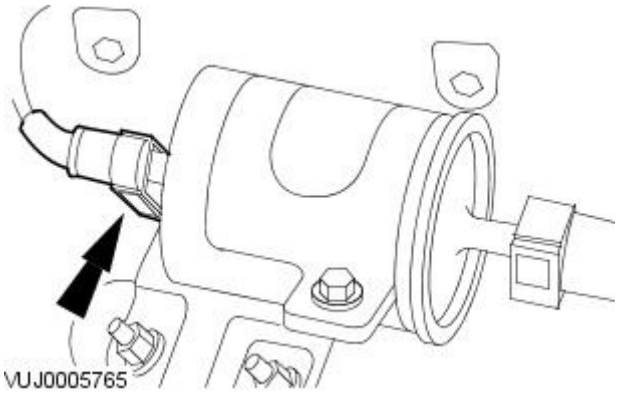
3. Attach the breather hose from the fuel tank.



4. Connect the evaporative emission canister hose.
   For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

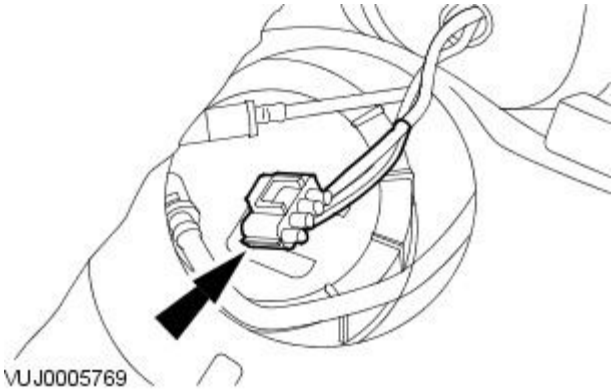


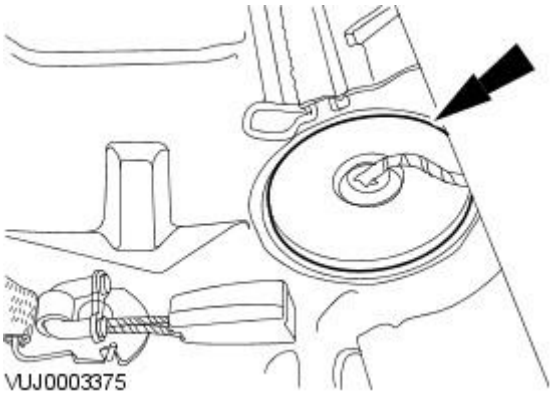
5. Connect the fuel filter line quick release coupling.
   For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).



6. Connect the fuel filter line quick release coupling.
   For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

7. Lower the vehicle.
8. Fill the fuel tank with fuel.
9. Connect the electrical connector.




VUJ0003375

10. Attach the wiring harness grommet.

11. Install the rear seat cushion.
For additional information, refer to: Rear Seat Cushion (501-10 Seating, Removal and Installation).

12. Connect the battery ground cable.
For additional information, refer to: Battery Connect (414-01 Battery, Mounting and Cables, General Procedures).

Published: 11-May-2011

Fuel Tank and Lines - Fuel Tank2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma

Removal and Installation

Removal

• WARNINGS:

Place the vehicle in a well ventilated, quarantined area and arrange **No Smoking** signs about the vehicle.

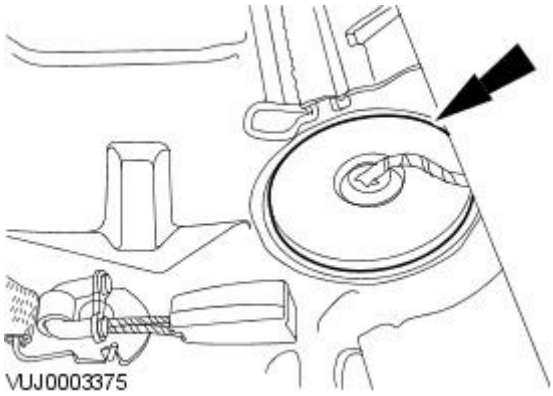
Do not smoke or carry lighted tobacco or an open flame of any type when working on or near any fuel related components. Failure to follow these instructions may result in personal injury.

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. Failure to follow this instruction may result in personal injury.

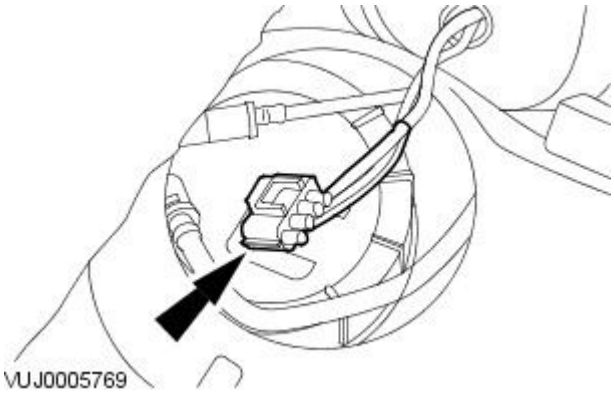
This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

After carrying out repairs, the fuel system must be checked for leaks. Failure to follow this instruction may result in personal injury.

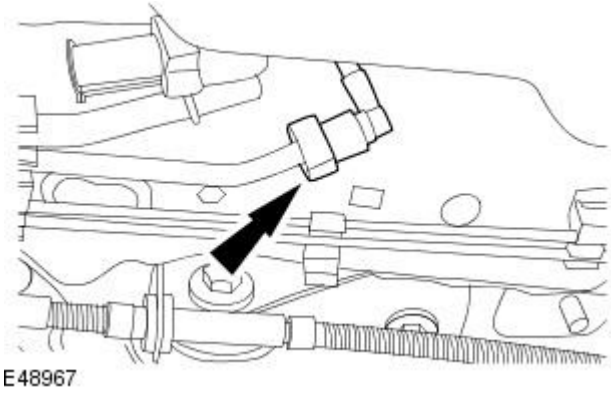
1. Remove the rear seat cushion.
   For additional information, refer to: Rear Seat Cushion (501-10 Seating, Disassembly and Assembly).
2. Detach the wiring harness grommet.



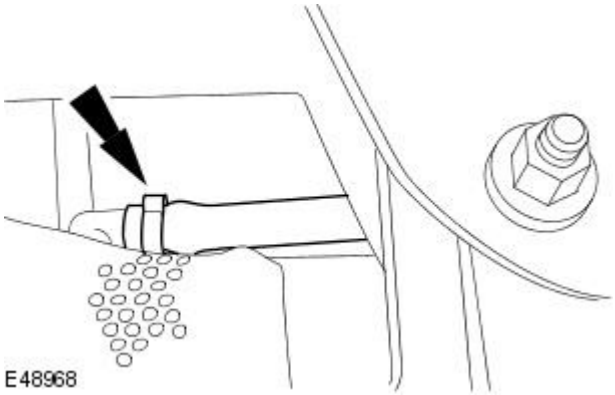
3. Disconnect the electrical connector.



4. Drain the fuel tank.
   For additional information, refer to: Fuel Tank Draining - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (310-00 Fuel System - General Information, General Procedures).
5. Disconnect the fuel return line.

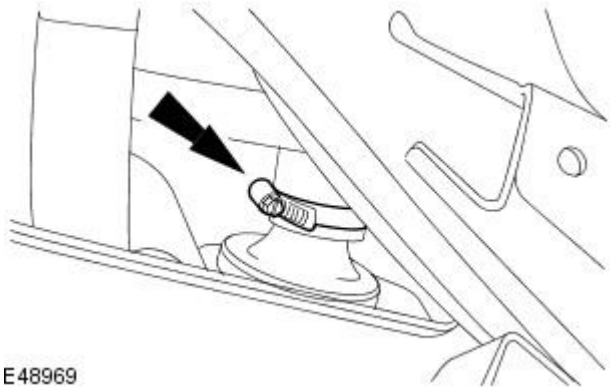


6. Detach the breather hose from the fuel tank.



7. NOTE: Note the orientation of the fuel tank filler pipe to fuel tank hose retaining clip before loosening.

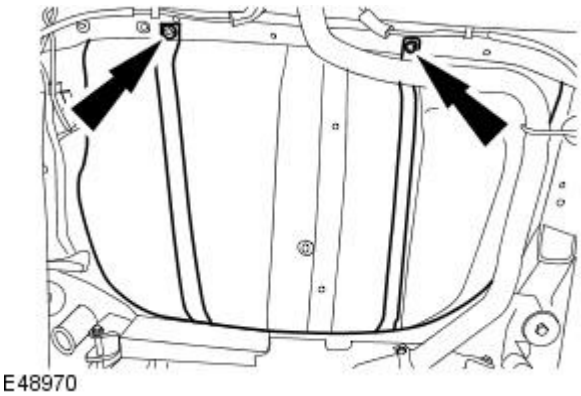
Loosen the fuel tank filler pipe to fuel tank hose retaining clip.



8. NOTE: An assistant will be required to remove the fuel tank.

Remove the fuel tank.

- Remove the fuel tank support straps.



Installation

• WARNINGS:

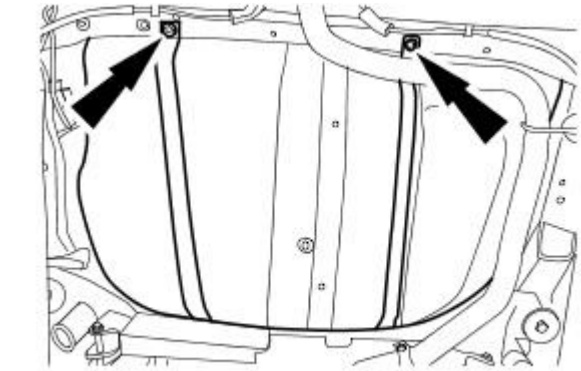
Place the vehicle in a well ventilated, quarantined area and arrange **No Smoking** signs about the vehicle.

Do not smoke or carry lighted tobacco or an open flame of any type when working on or near any fuel related components. Failure to follow these instructions 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.

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 for leaks. Failure to follow this instruction may result in personal injury.

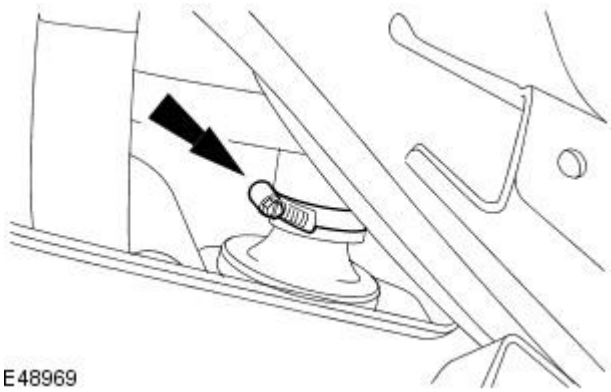

E48970

1. NOTE: An assistant will be required to install the fuel tank.

• NOTE: Make sure the fuel filler pipe hose is connected to the fuel tank as it is installed.

Install the fuel tank.

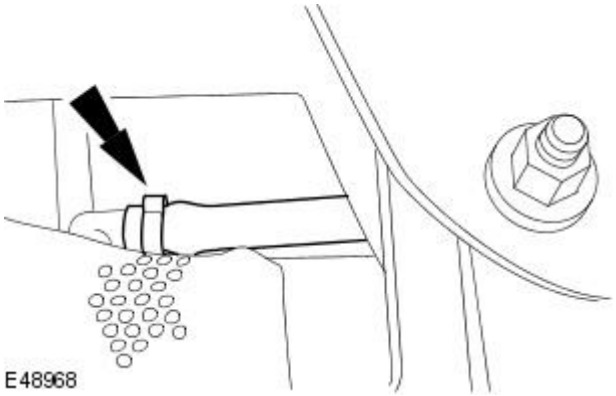
- Install the fuel tank support straps.
- Tighten to 25 Nm.


E48969

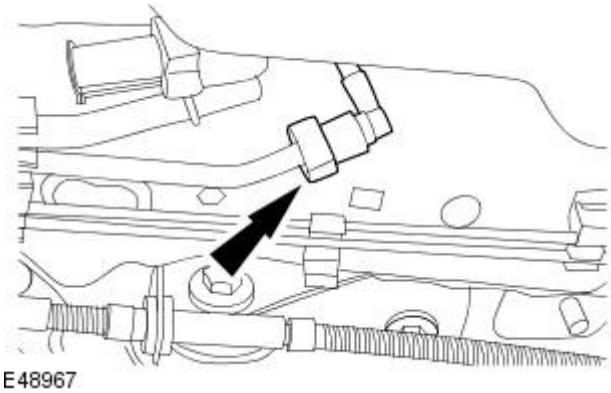
2. NOTE: Make sure the fuel tank filler pipe to fuel tank hose retaining clip is correctly orientated.

Tighten the fuel tank filler pipe to fuel tank hose retaining clip.

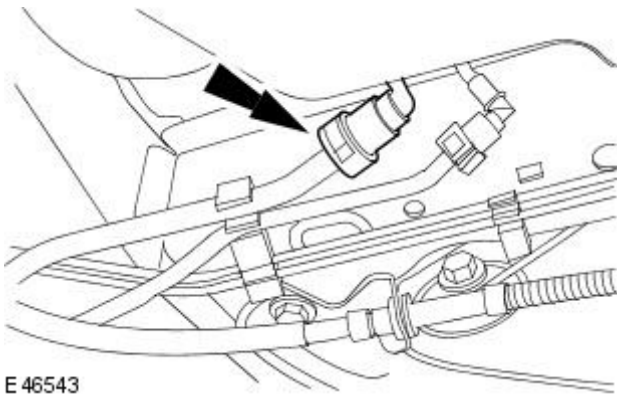
- Tightyen to 3 Nm.


E48968

3. Attach the breather hose to the fuel tank.

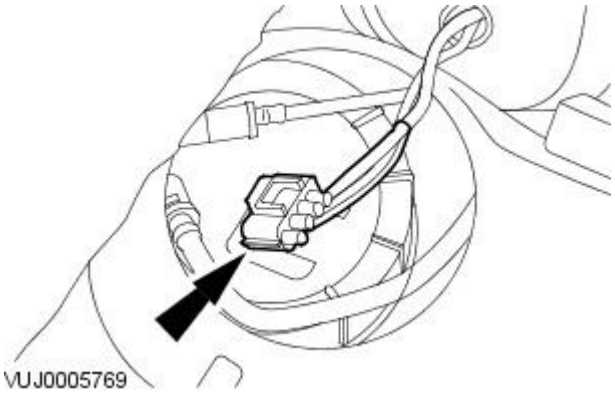

E48967

4. Connect the fuel return line.

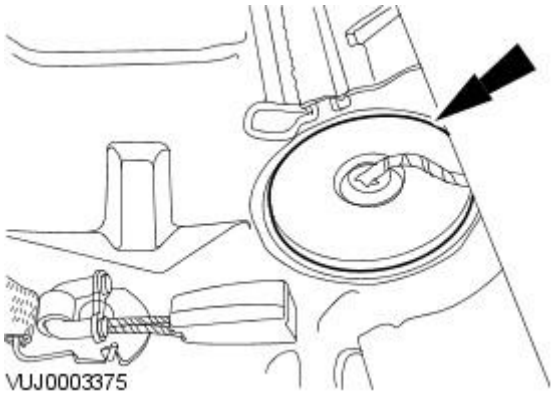

E46543

5. Connect the fuel supply line.

6. Lower the vehicle.
7. Fill the fuel tank with fuel.
8. Connect the electrical connector.



9. Attach the wiring harness grommet.



10. Install the rear seat cushion.
    For additional information, refer to: Rear Seat Cushion (501-10 Seating, Disassembly and Assembly).
11. Connect the battery ground cable.
    For additional information, refer to: Battery Connect (414-01 Battery, Mounting and Cables, General Procedures).

Published: 11-May-2011

Fuel Tank and Lines - Fuel Tank2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Removal and Installation

Special Tool(s)	
 HTJ12002	Powertrain Assembly Jack HTJ1200-2

Removal

• WARNINGS:

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.

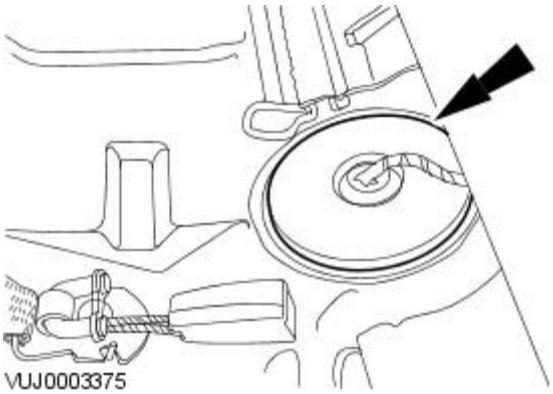
Do not smoke or carry lighted tobacco or an open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

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.

• NOTE: Non federal market vehicles, refer to steps 29 and 32.

• NOTE: Federal market vehicles, refer to steps 23, 24, 28 and 31.


VUJ0003375

1. NOTE: All vehicles

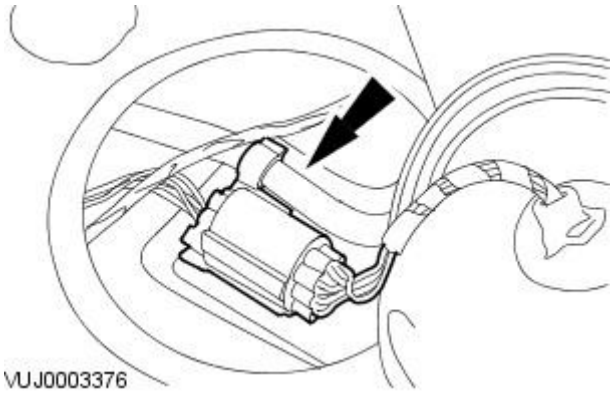
Disconnect the battery ground cable.
For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. Remove the fuel filler cap.

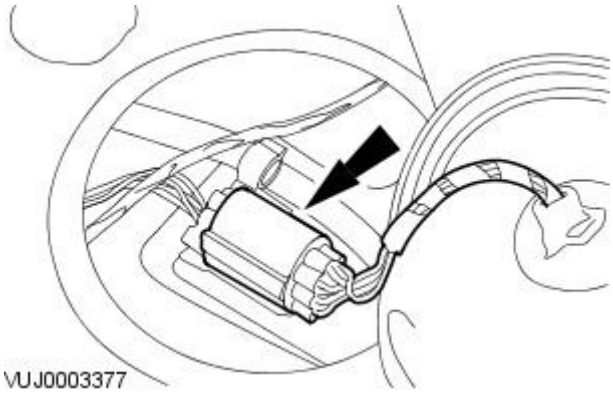
3. De-pressurize the fuel system.
For additional information, refer to: Fuel System Pressure Release (310-00 Fuel System - General Information, General Procedures).

4. Remove the rear seat cushion.
For additional information, refer to: Rear Seat Cushion (501-10 Seating, Removal and Installation).

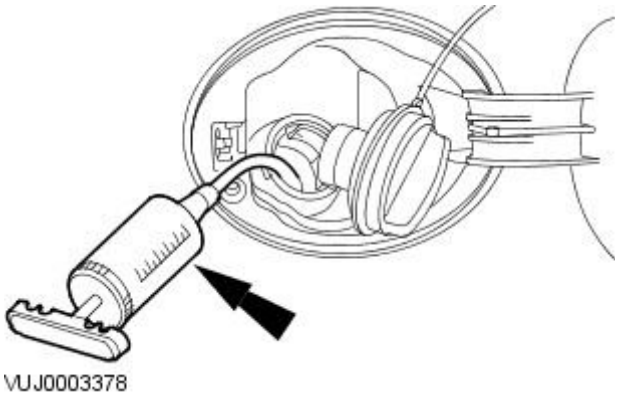
5. Detach the wiring harness grommet.


VUJ0003376

6. Detach the electrical connector.


VUJ0003377

7. Disconnect the electrical connector.


VUJ0003378

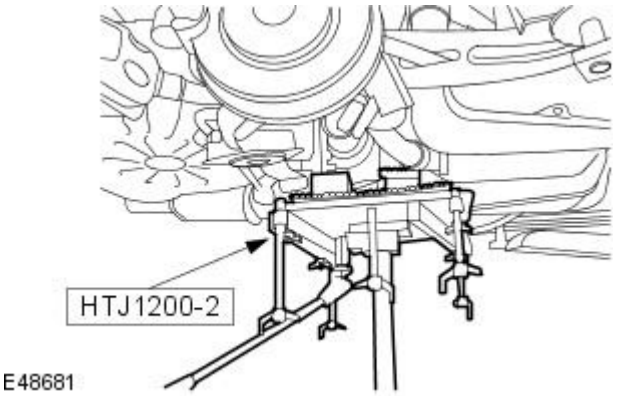
8. Using a suitable suction device drain the fuel tank filler pipe.

9. NOTE: To prevent the vehicle becoming unstable when the fuel tank has been removed, install the vehicle tie down straps.

Raise and support the vehicle.
For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

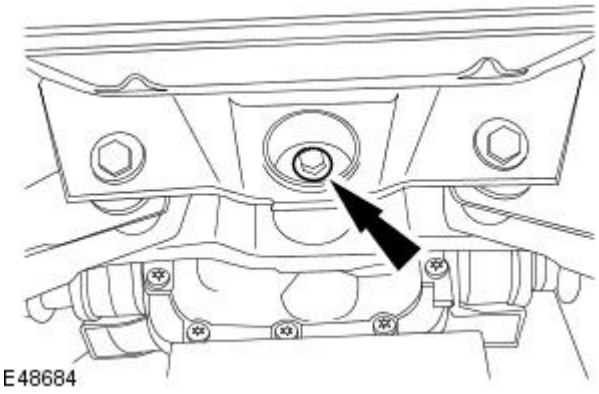
10. Remove the driveshaft.
For additional information, refer to: Driveshaft (205-01 Driveshaft, Removal and Installation).

11. Remove the front muffler.
For additional information, refer to: Front Muffler - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (309-00 Exhaust System, Removal and Installation).

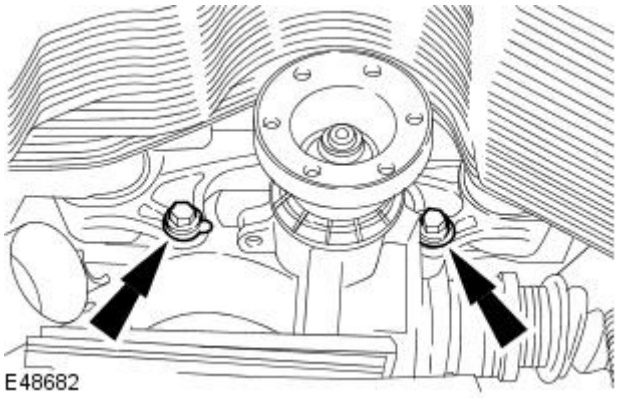


E48681

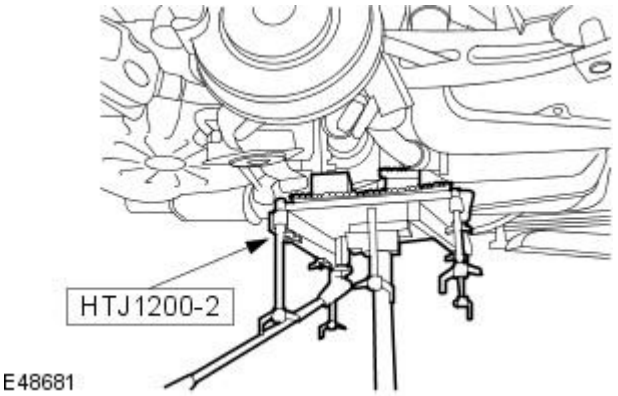
12. Using the special tool, support the axle assembly.



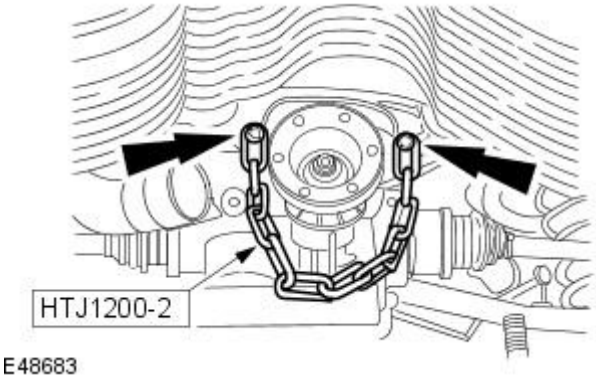
13. Remove the axle assembly rear retaining bolt.



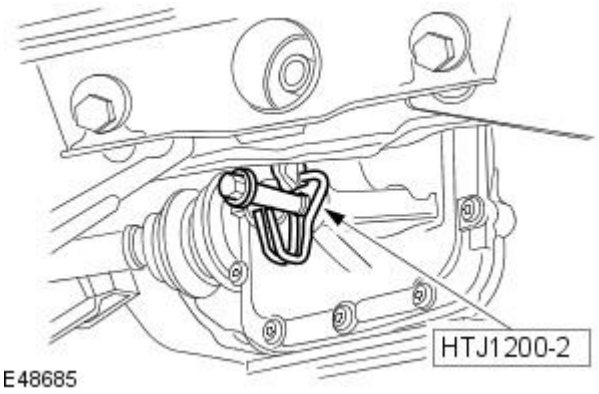
14. Remove the axle assembly front retaining bolts.



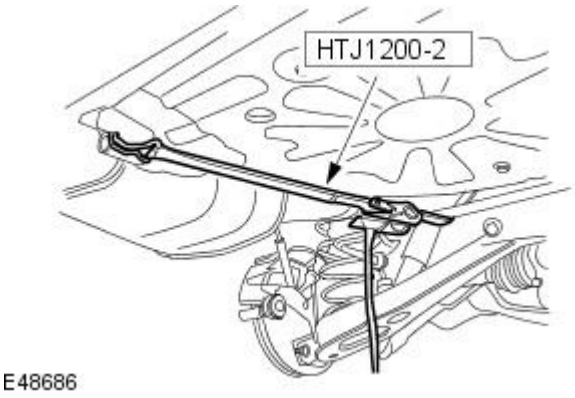
15. Using the special tool, lower the axle assembly approximately 75 mm (2.95 inches).



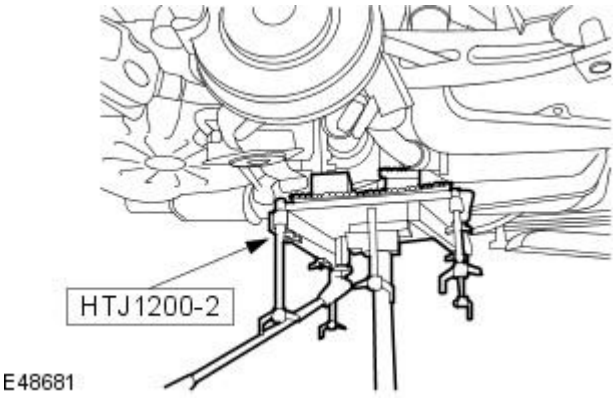
16. Install the chain supplied with the special tool HTJ1200-2 to the axle assembly front support bracket.



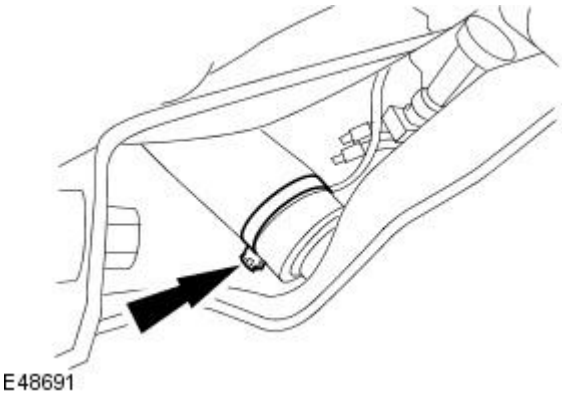
17. Install the securing strap supplied with the special tool HTJ1200-2 to the axle assembly.



18. Attach the securing strap supplied with the special tool HTJ1200-2 to the rear towing eye thread and support the rear of the axle assembly.

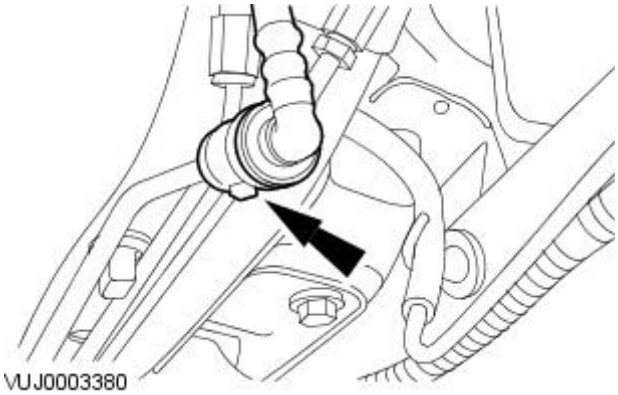


19. Remove the special tool.

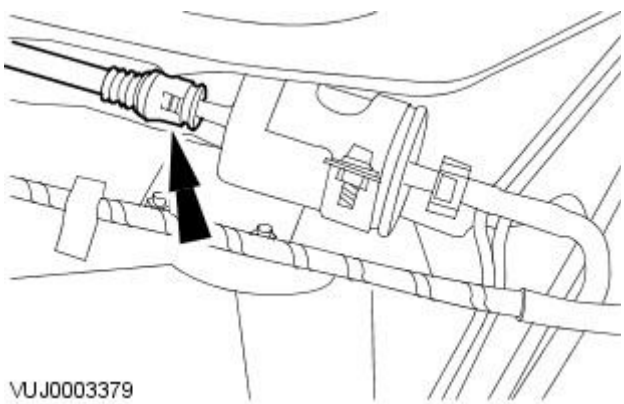


20. NOTE: Note the orientation of the fuel tank filler pipe to fuel tank hose retaining clip before loosening.

Loosen the fuel tank filler pipe to fuel tank hose retaining clip.

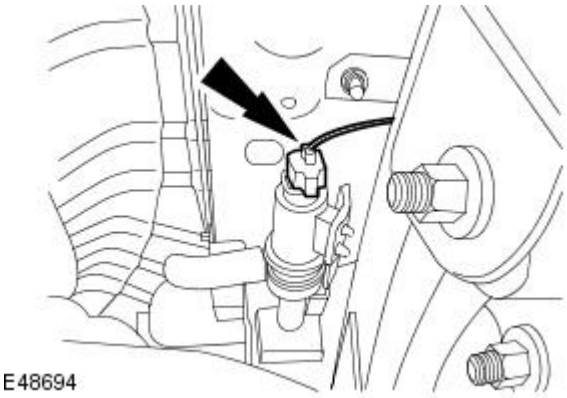


21. Disconnect the evaporative emission canister purge hose quick release coupling.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).



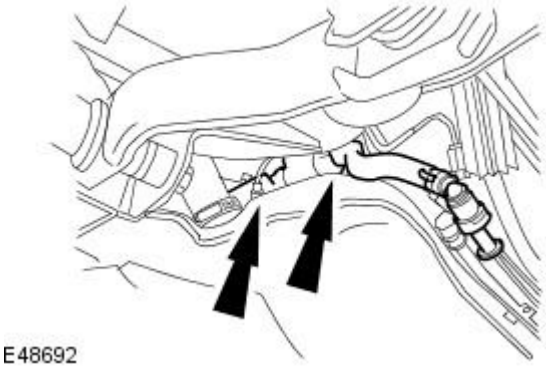
22. Disconnect the fuel filter line quick release coupling.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).

- Install blanking plugs to the male and female connectors.


E48694

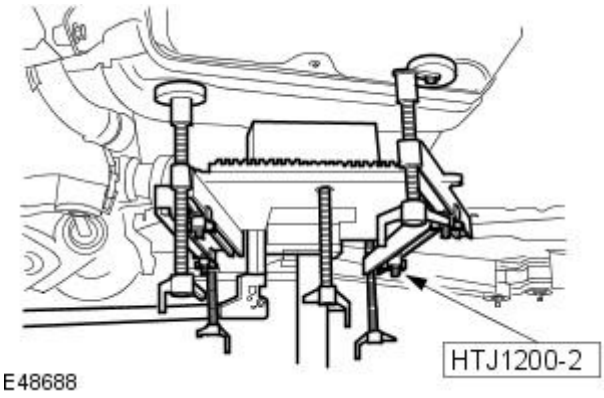
23. NOTE: Federal market vehicles only.

Disconnect the evaporative emission canister close valve electrical connector.


E48692

24. NOTE: Federal market vehicles only.

Detach the evaporative emission canister purge hose from the fuel tank retaining clips.



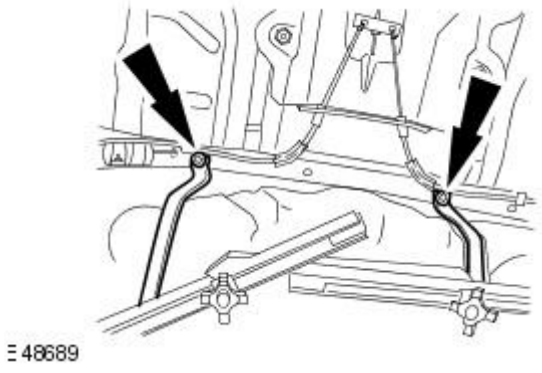
E48688

25. CAUTION: Use packing blocks supplied with the special tool HTJ1200-2 to prevent damage to the underside of the fuel tank. Failure to follow this instruction may result in damage to the fuel tank.

• NOTE: All vehicles

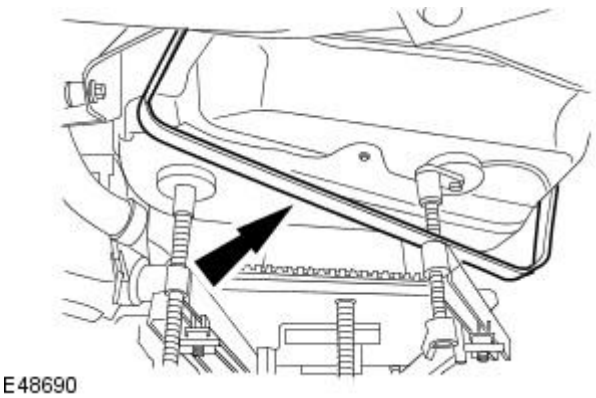
Using the special tool, support the fuel tank.

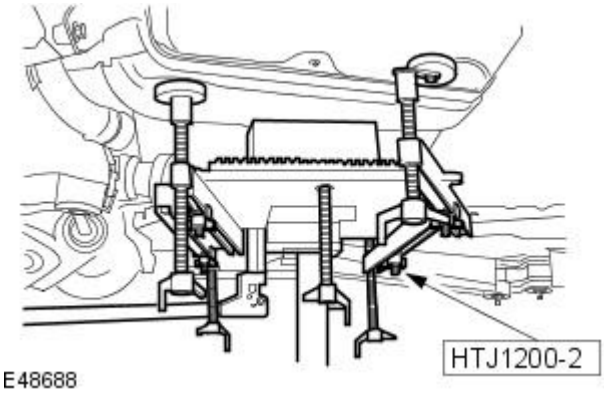
26. Remove the fuel tank support straps retaining bolts.


E48689

27. NOTE: Right-hand shown, left-hand similar.

Remove the fuel tank support straps.


E48690

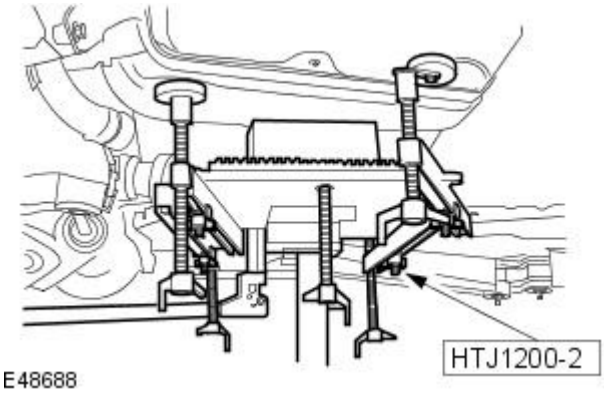


E48688

28. NOTE: Federal market vehicles only.

Using the special tool, lower the fuel tank approximately 100 mm (3.94 inches).

- Detach the fuel filler pipe hose from the fuel tank.
- Install blanking plugs to the fuel tank and fuel filler pipe hose.

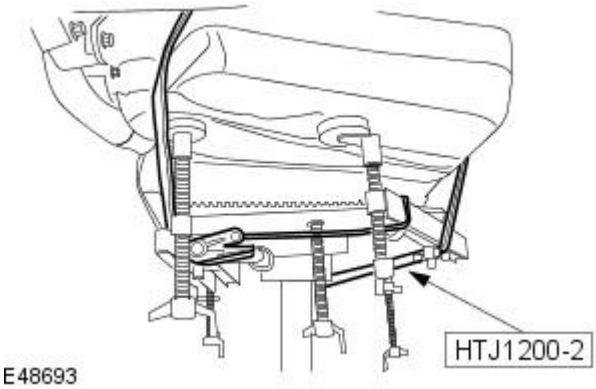


E48688

29. NOTE: Non federal market vehicles only.

Using the special tool, lower the fuel tank approximately 75 mm (2.95 inches).

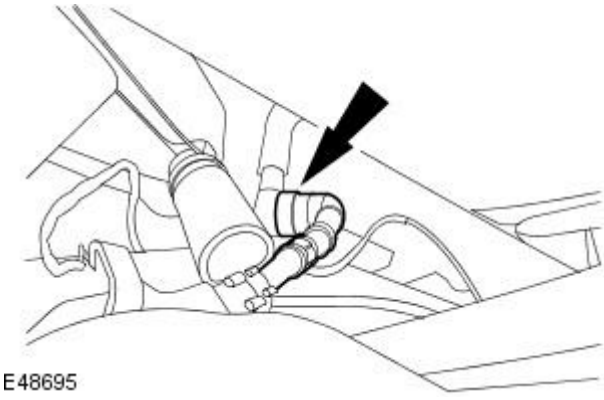
- Detach the fuel filler pipe hose from the fuel tank.
- Install blanking plugs to the fuel tank and fuel filler pipe hose.



E48693

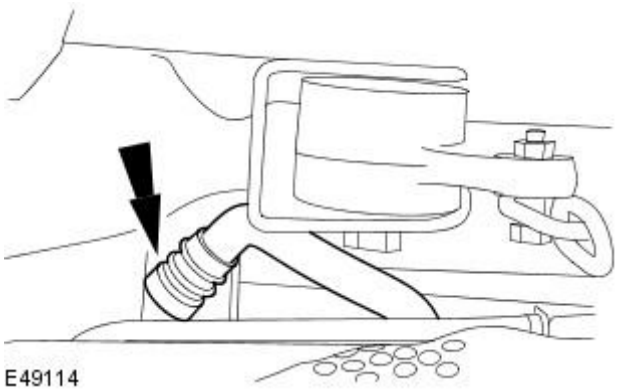
30. NOTE: All vehicles

Install the securing strap supplied with the special tool HTJ1200-2 to secure the fuel tank to the special tool.


E48695

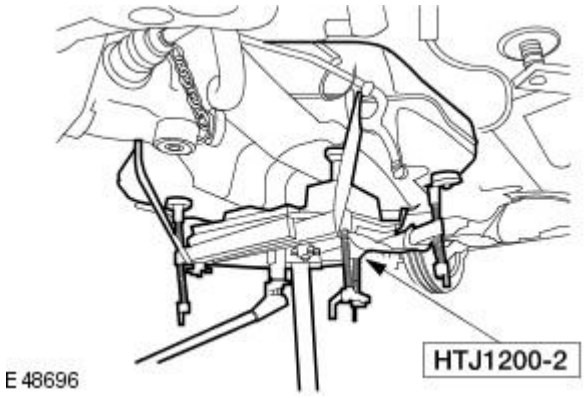
31. NOTE: Federal market vehicles only.

Disconnect the evaporative emission canister hose from the evaporative emission canister.


E49114

32. NOTE: Non federal market vehicles only.

Disconnect the evaporative emission canister hose from the evaporative emission canister.



33. WARNING: The fuel tank cannot be drained in vehicle. Due to the heavy weight, make sure that the fuel tank is securely attached to the powertrain assembly jack when removing. Failure to follow this instruction may result in personal injury.

• NOTE: All vehicles

Using the special tool, remove the fuel tank.

Installation

• WARNINGS:

Do not smoke or carry lighted tobacco or an 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.

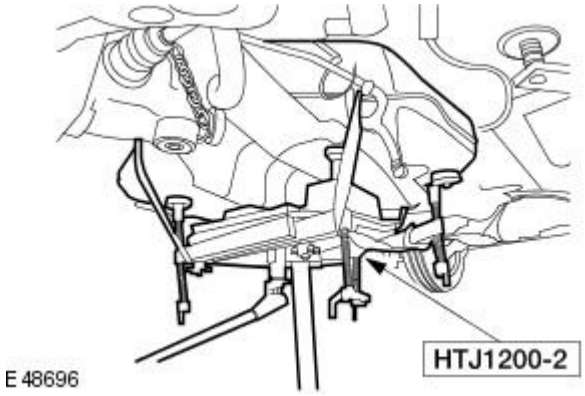
Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

Due to the heavy weight, make sure that the fuel tank is securely attached to the powertrain assembly jack when installing.

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.

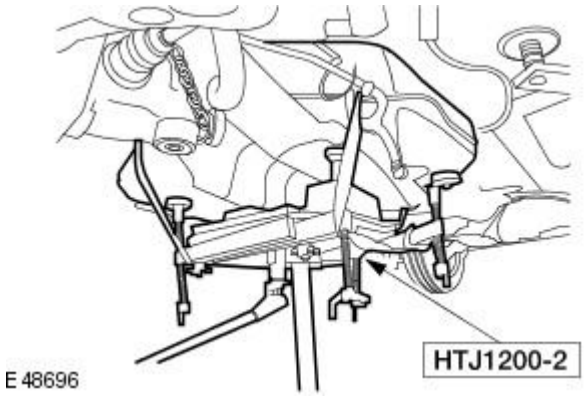
• NOTE: Non federal vehicles, refer to steps 2 and 3.

• NOTE: Federal vehicles, refer to steps 1, 4, 10 and 11.



1. NOTE: Federal market vehicles only.

Using the special tool, position the fuel tank approximately 100 mm (3.94 inches) lower than the fully installed position.



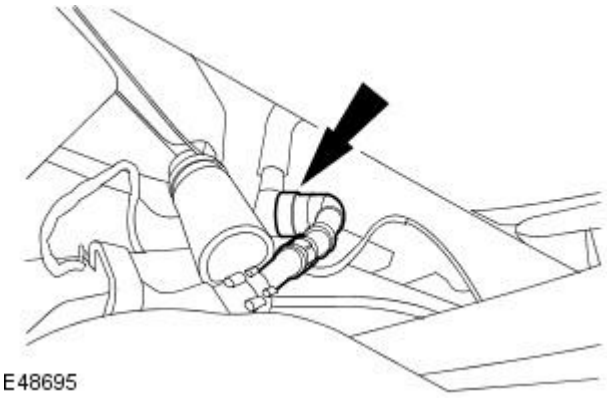
2. NOTE: Non federal market vehicles only.

Using the special tool, position the fuel tank approximately 75 mm (2.95 inches) lower than the fully installed position.


E49114

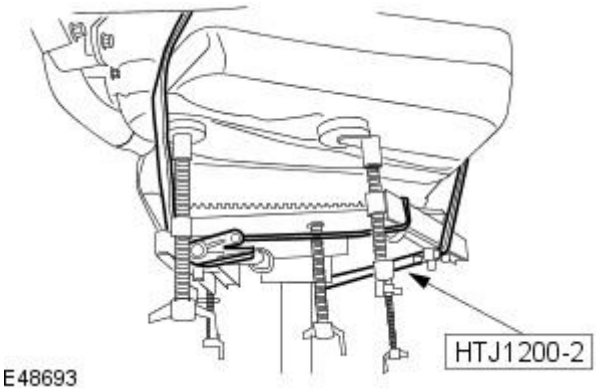
3. NOTE: Non federal market vehicles only.

Connect the evaporative emission canister hose to the evaporative emission canister.


E48695

4. NOTE: Federal market vehicles only.

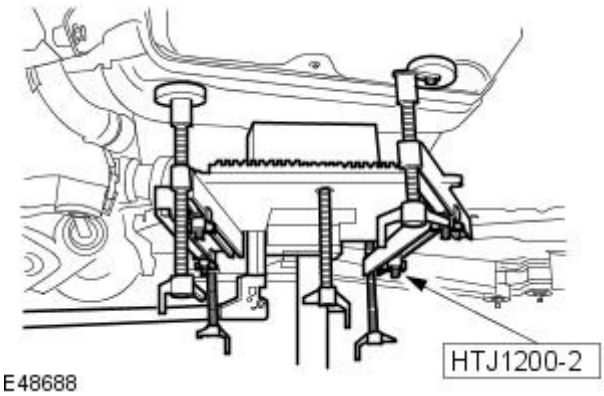
Connect the evaporative emission canister hose to the evaporative emission canister.



E48693

5. NOTE: All vehicles

Remove the securing strap from the fuel tank and the special tool.

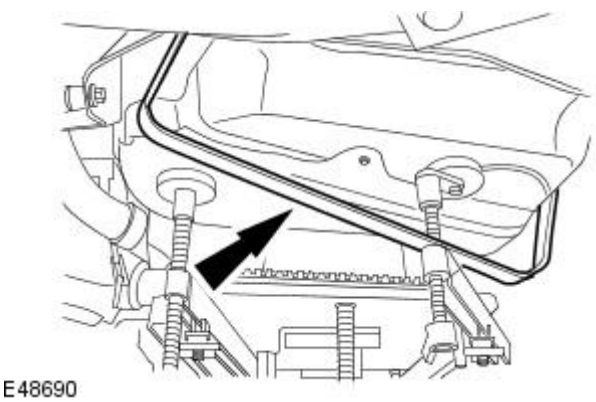


E48688

6. NOTE: Remove the blanking plugs from the fuel tank and fuel filler pipe hose.

• NOTE: Make sure the fuel filler pipe hose is connected to the fuel tank as it is installed.

Using the special tool, install the fuel tank.

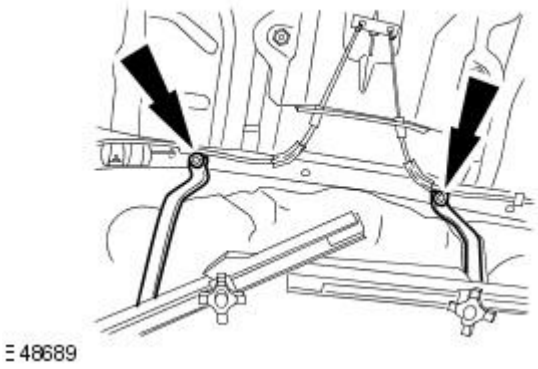

E48690

7. NOTE: Right-hand shown, left-hand similar.

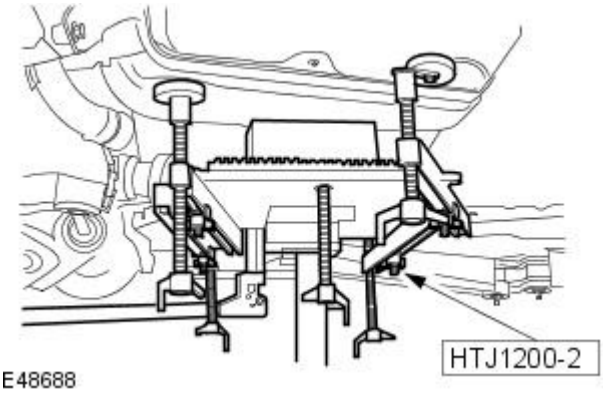
Install the fuel tank support straps.

8. Install the fuel tank support straps retaining bolts.

- Tighten to 25 Nm.

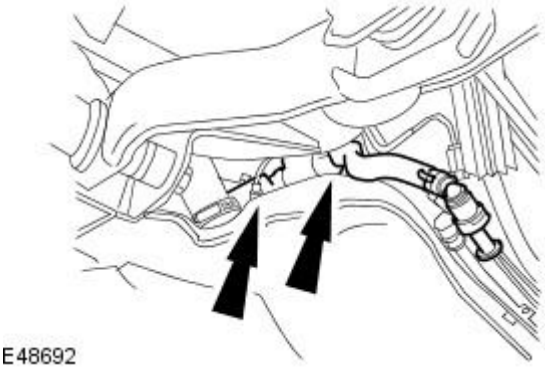


9. Remove the special tool.



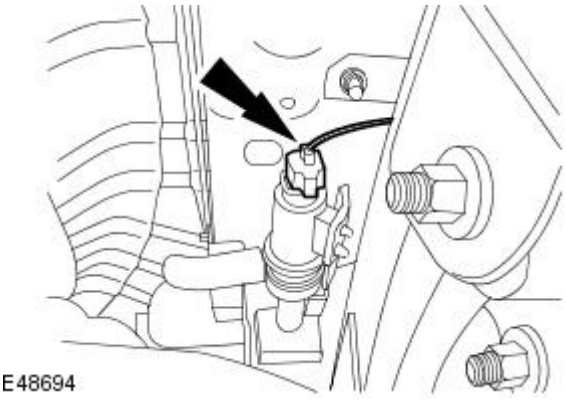
10. NOTE: Federal market vehicles only.

Attach the evaporative emission canister purge hose to the fuel tank retaining clips.



11. NOTE: Federal market vehicles only.

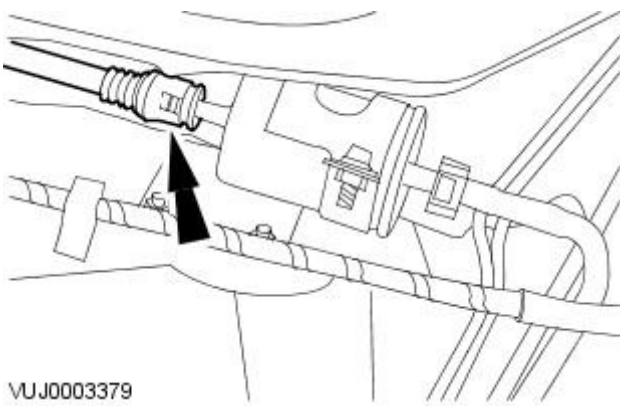
Connect the evaporative emission canister close valve electrical connector.

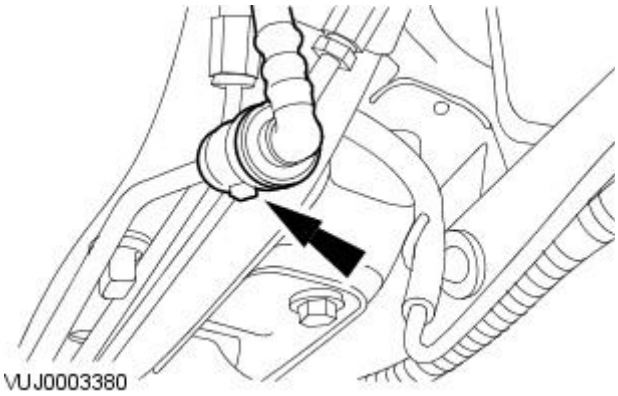


12. NOTE: All vehicles

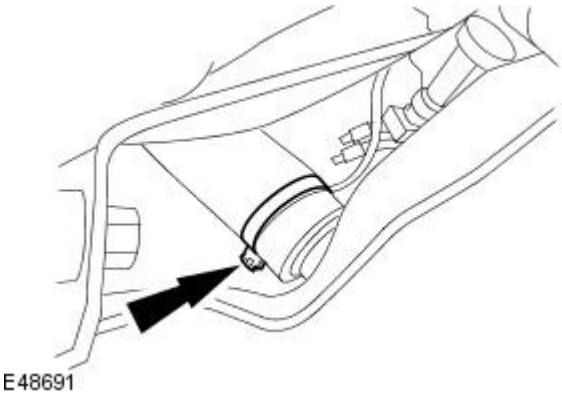
• NOTE: Remove the blanking plugs.

Connect the fuel filter line quick release coupling.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).





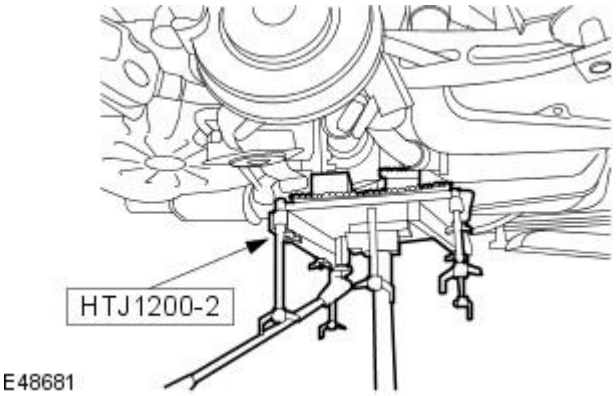
13. Connect the evaporative emission canister purge hose quick release coupling.
For additional information, refer to: Quick Release Coupling - Push Connect (310-00 Fuel System - General Information, General Procedures).



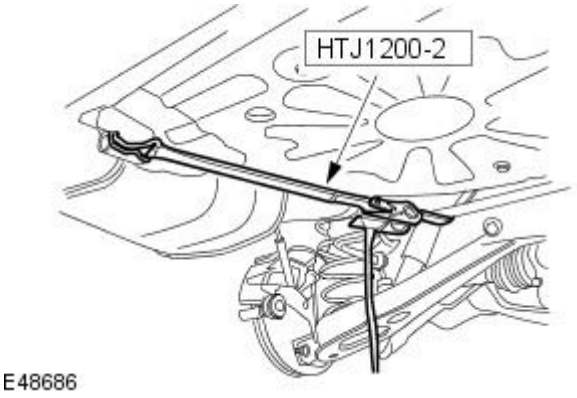
14. NOTE: Make sure the fuel tank filler pipe to fuel tank hose retaining clip is correctly orientated.

Tighten the fuel tank filler pipe to fuel tank hose retaining clip.

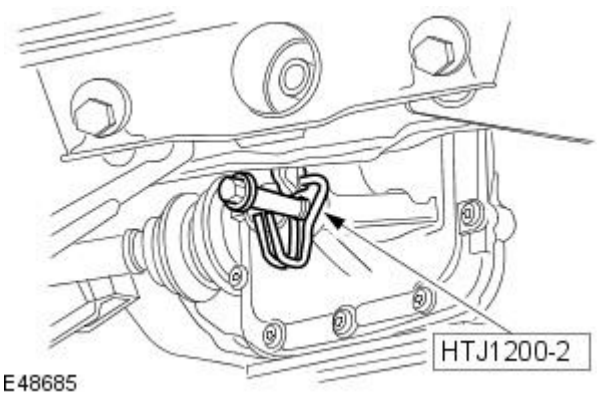
- Tighten to 3 Nm.



15. Using the special tool, support the axle assembly.



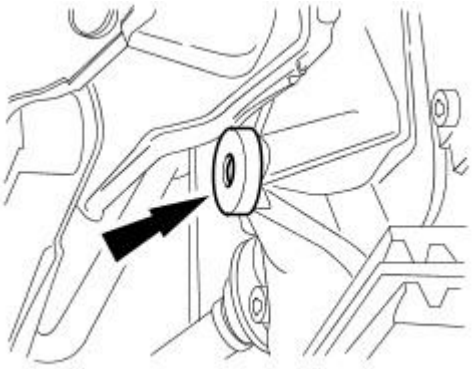
16. Detach the securing strap from the rear towing eye thread.



17. Remove the securing strap from the axle assembly.

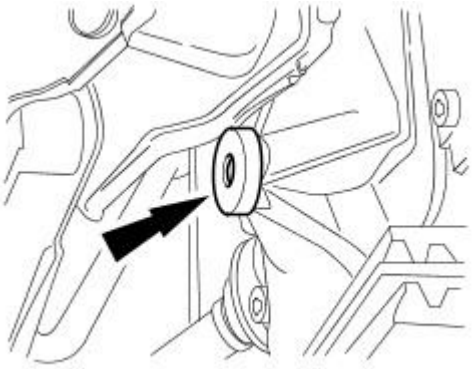
- Discard the axle assembly rear retaining bolt.

18. Remove and discard the axle assembly washer.



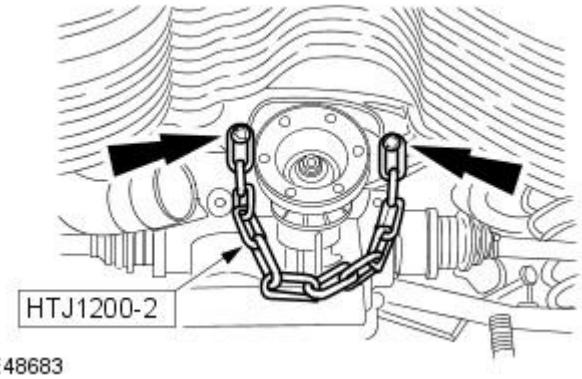
E48687

19. Install a new axle assembly washer.



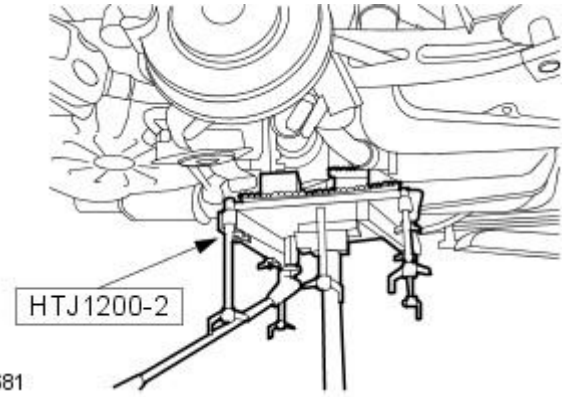
E48687

20. Remove the chain from the axle assembly front support bracket.



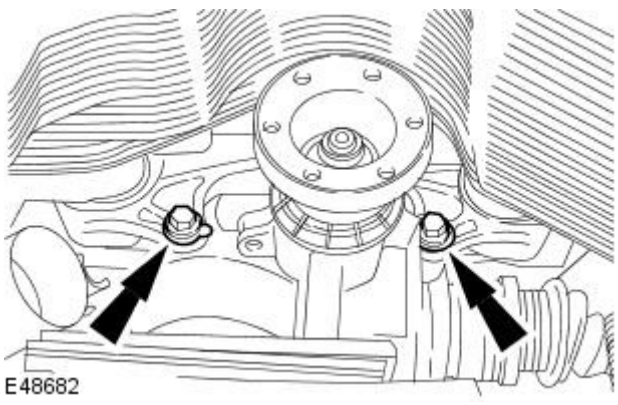
E48683

21. Using the special tool, install the axle assembly.



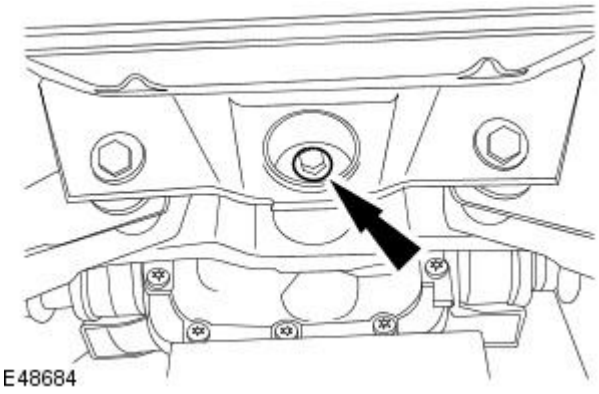
E48681

22. Loosely install the axle assembly front retaining bolts.

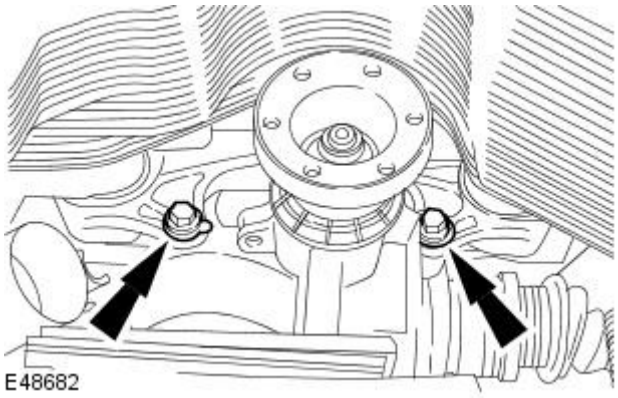


E48682

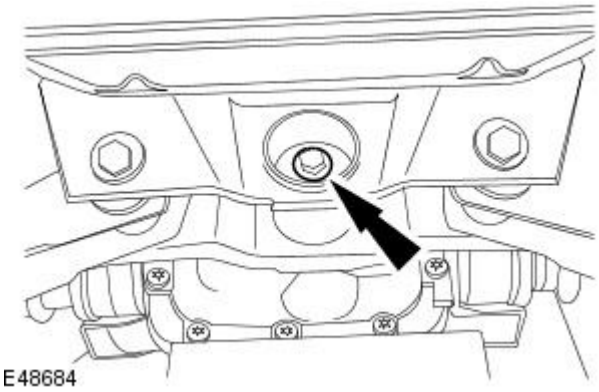
23. Loosely install a new axle assembly rear retaining bolt.



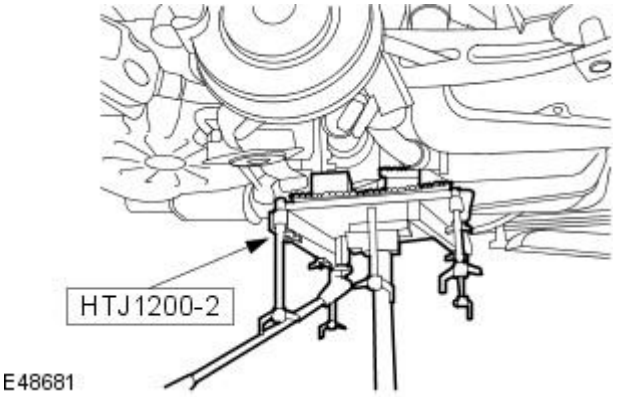
24. Tighten to 90 Nm.



25. Tighten to 110 Nm.



26. Remove the special tool.

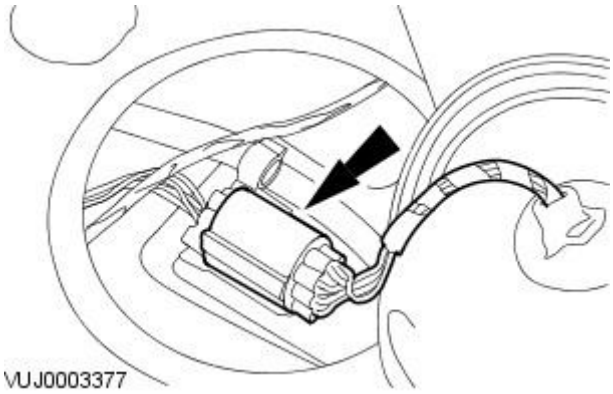


27. Install the front muffler.
For additional information, refer to: Front Muffler - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (309-00 Exhaust System, Removal and Installation).

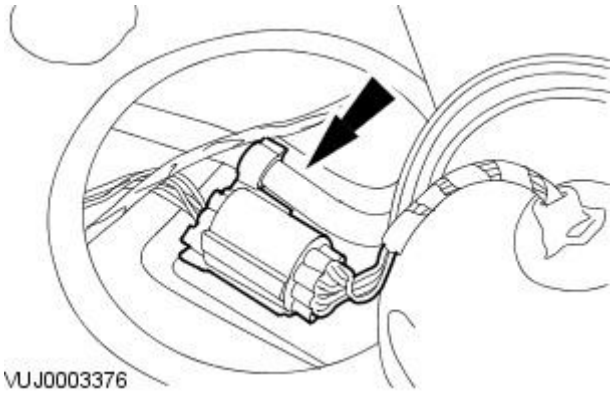
28. Install the driveshaft.
For additional information, refer to: Driveshaft (205-01 Driveshaft, Removal and Installation).

29. NOTE: Remove the the vehicle tie down straps.

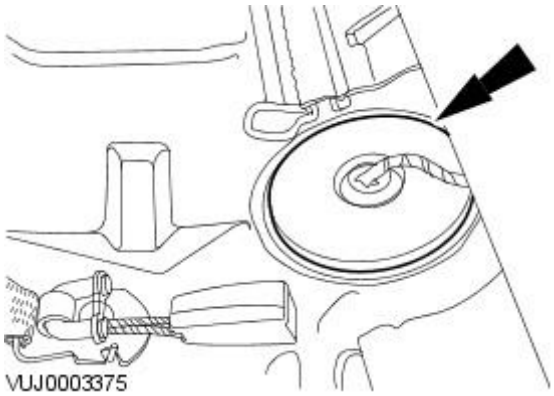
Lower the vehicle.


VUJ0003377

30. Connect the electrical connector.


VUJ0003376

31. Attach the electrical connector.


VUJ0003375

32. Attach the wiring harness grommet.

33. Install the rear seat cushion.
For additional information, refer to: Rear Seat Cushion (501-10 Seating, Removal and Installation).

34. Fill the fuel tank with the fuel drained from the fuel filler pipe.

35. Install the fuel filler cap.

36. Connect the battery ground cable.
For additional information, refer to: Battery Connect (414-01 Battery, Mounting and Cables, General Procedures).

Fuel Tank and Lines - Fuel Tank Filler Pipe

Removal and Installation

Removal

1. WARNINGS:

Place the vehicle in a quarantined area and arrange "No Smoking/Petrol Fumes" signs about the vehicle.

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.

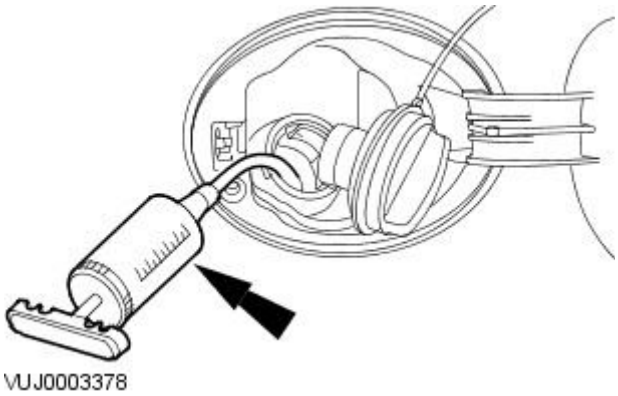
Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapours are always present and may ignite. Failure to follow these instructions may result in personal injury.

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.

Disconnect the battery ground cable. For additional information, refer to Section 414-01 Battery, Mounting and Cables.

2. Remove the fuel filler cap.

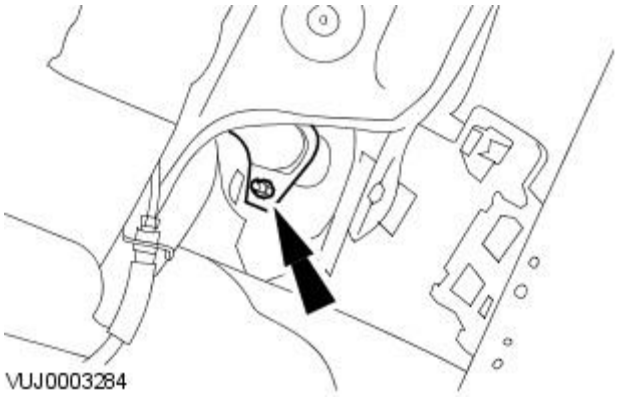
3. Using a suitable suction device drain the fuel tank filler pipe.



VUJ0003378

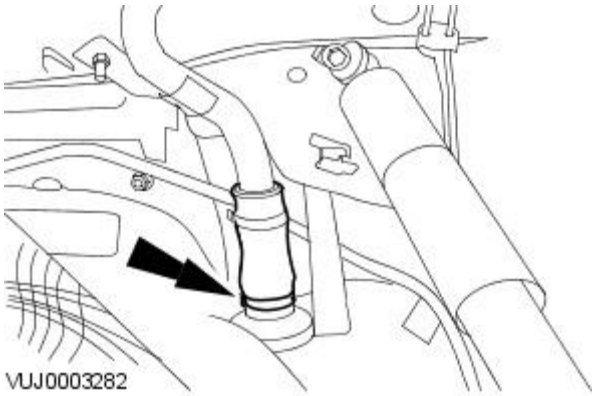
4. Remove the rear subframe. For additional information, refer to Section 502-00 Uni-Body, Subframe and Mounting System.

5. Detach the fuel tank filler pipe.

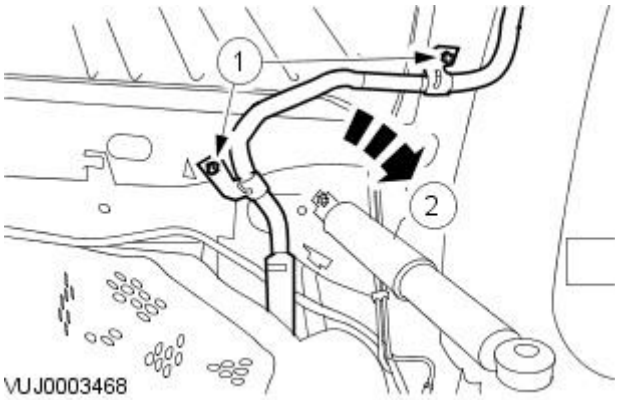


VUJ0003284

6. Detach the fuel tank filler pipe hose from the fuel tank.



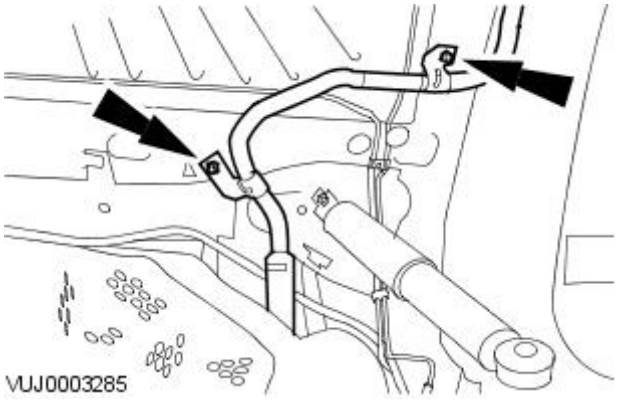
VUJ0003282



7. Remove the fuel tank filler pipe and hose.

1. Remove the retaining nuts.
2. Remove the fuel tank filler pipe and hose.

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.

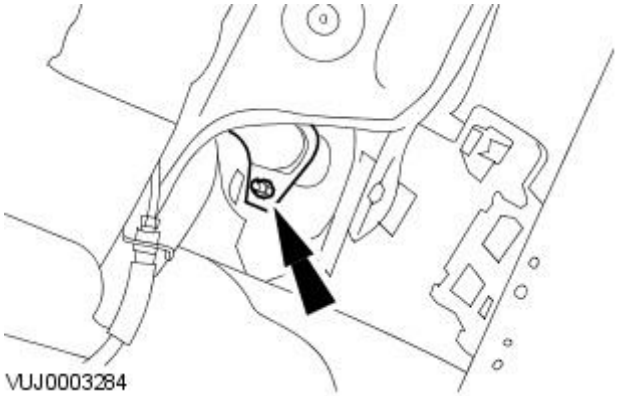
Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapours are always present and may ignite. Failure to follow these instructions may result in personal injury.

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.

- Tighten to 4 Nm.

2. Tighten to 4 Nm.



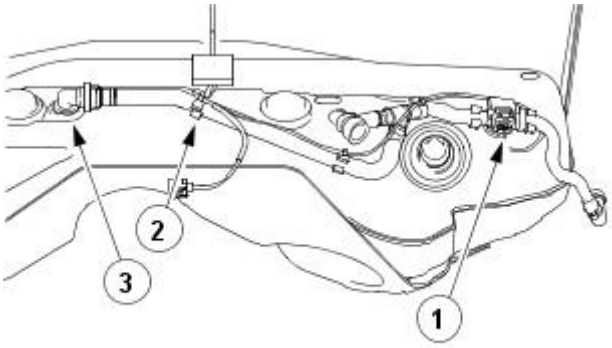
Published: 11-May-2011

Fuel Tank and Lines - Gas Fuel Tank Pressure Sensor

Removal and Installation

Removal

• NOTE: The fuel tank pressure sensor is fitted to federal market vehicles only.



E49044

1. WARNINGS:

Do not smoke or carry lighted tobacco or an 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 can 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.

Remove the fuel tank.
For additional information, refer to: Fuel Tank - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation).

2. NOTE: The fuel tank pressure sensor is supplied as an assembly with the evaporative emission hoses.

Remove the fuel tank pressure sensor assembly.

1. Disconnect the electrical connector.
2. Detach the wiring harness.
3. Remove the fuel tank pressure sensor assembly.

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 can 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.

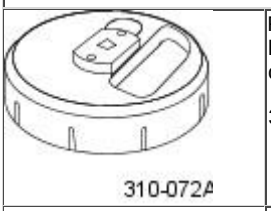
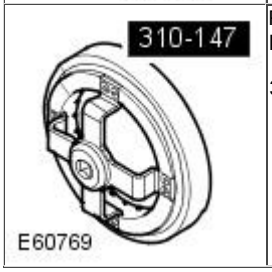
This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

To install, reverse the removal procedure.

Published: 11-May-2011

Fuel Tank and Lines - Fuel Transfer Pump

Removal and Installation

Special Tool(s)	
	Remove/Install fuel pump/transfer pump locking ring (Non federal market vehicles only) 310-072A
	Remove/Install fuel pump/transfer pump locking ring (Federal market vehicles only) 310-147

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 medical attention.

Wash hands thoroughly after handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

• NOTE: Non federal market vehicles, refer to steps 1 to 6.

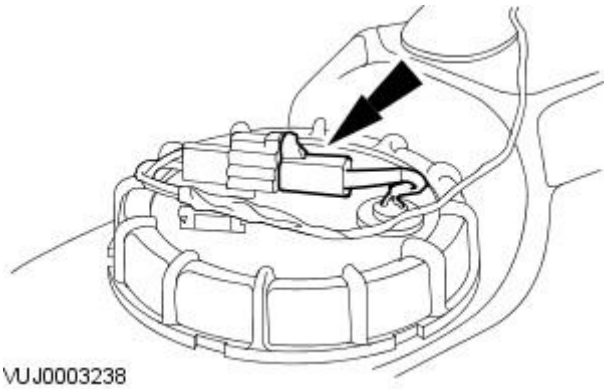
• NOTE: Federal market vehicles, refer to steps 7 to 10.

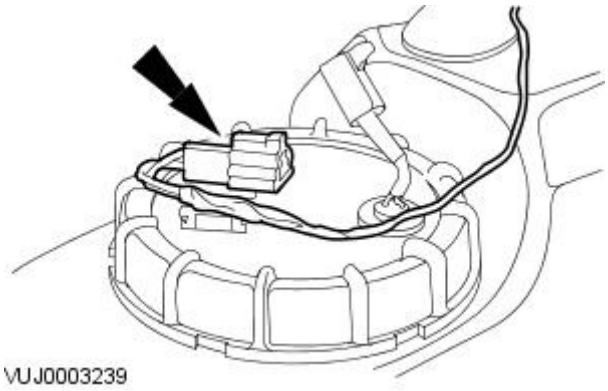
1. NOTE: Non federal market vehicles only.

Remove the fuel tank.
For additional information, refer to: Fuel Tank - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation).

2. NOTE: Non federal market vehicles only.

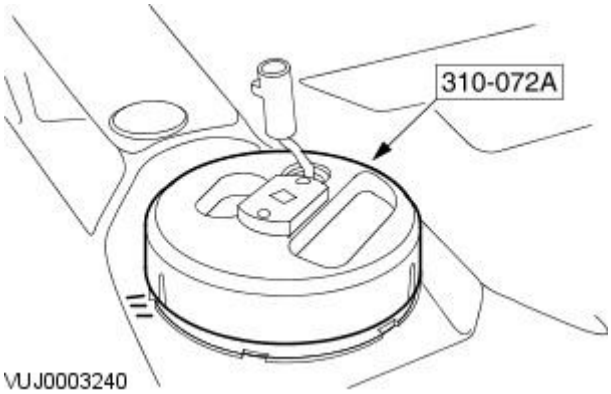
Disconnect the electrical connector.




VUJ0003239

3. NOTE: Non federal market vehicles only.

Detach the electrical connector.

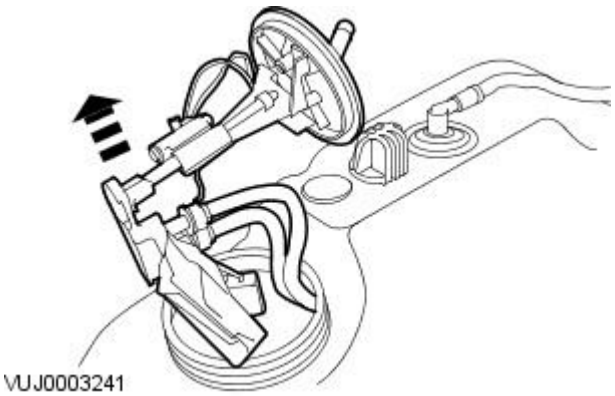


VUJ0003240

4. NOTE: Non federal market vehicles only.

• NOTE: Note the orientation of the fuel transfer pump before removal.

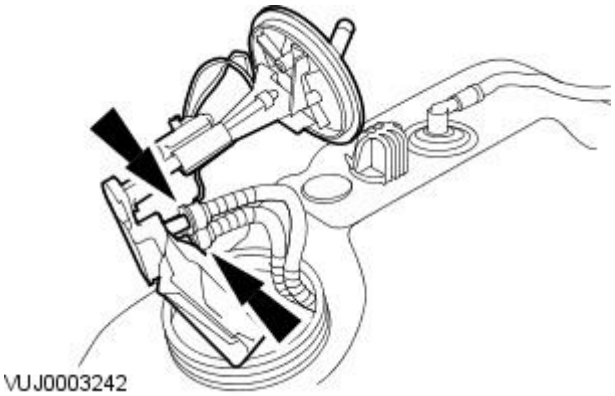
Using the special tool, remove the locking ring.


VUJ0003241

5. CAUTION: Make sure the float or arm are not damaged while removing the fuel transfer pump.

• NOTE: Non federal market vehicles only.

Detach the fuel transfer pump from the fuel tank.


VUJ0003242

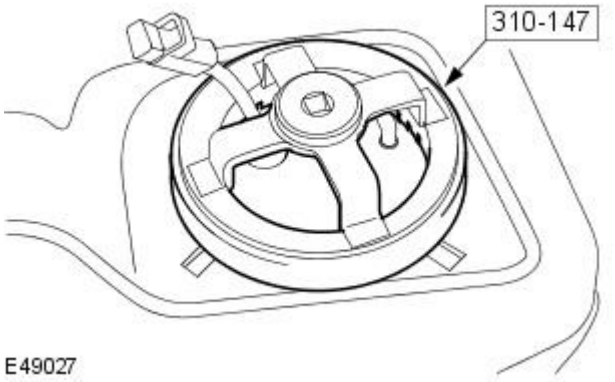
6. NOTE: Non federal market vehicles only.

Remove the fuel transfer pump.

- Disconnect the fuel crossover pipes.
- Remove and discard the O-ring seal.

7. NOTE: Federal market vehicles only.

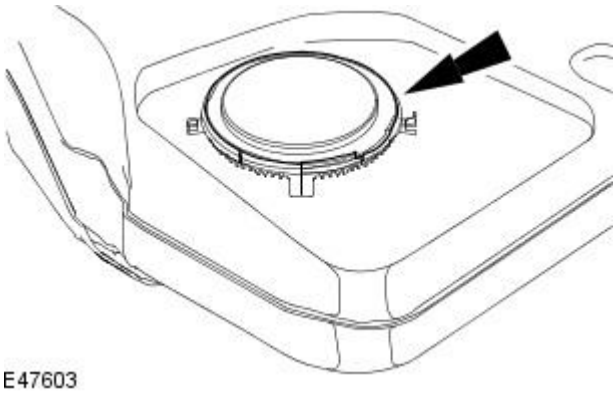
Remove the fuel pump module.
For additional information, refer to: Fuel Pump Module - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (310-01 Fuel Tank and Lines, Removal and Installation).



8. NOTE: Federal market vehicles only.

• NOTE: Note the orientation of the fuel transfer pump before removal.

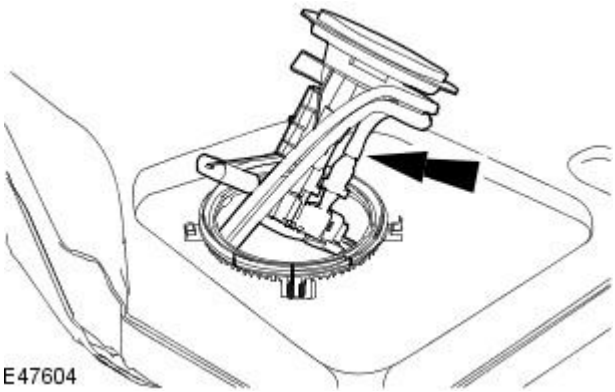
Using the special tool, remove the locking ring.



9. CAUTION: Make sure the float or arm are not damaged while removing the fuel transfer pump.

• NOTE: Federal market vehicles only.

Detach the fuel transfer pump from the fuel tank.



10. NOTE: Federal market vehicles only.

Remove the fuel transfer pump and fuel crossover pipes.

- Remove and discard the O-ring seal.

Installation

• 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.

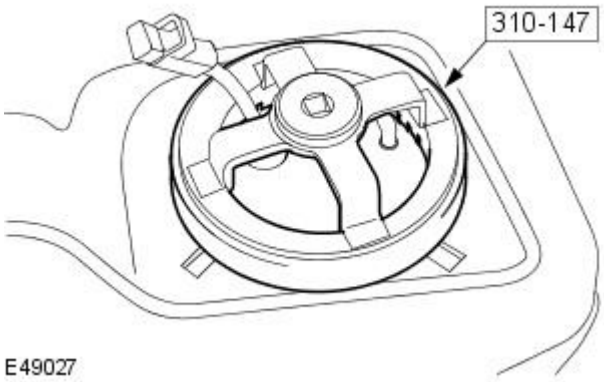
If taken internally do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.

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.

• NOTE: Federal market vehicles, refer to step 1.

• NOTE: Non federal market vehicles, refer to step 2.



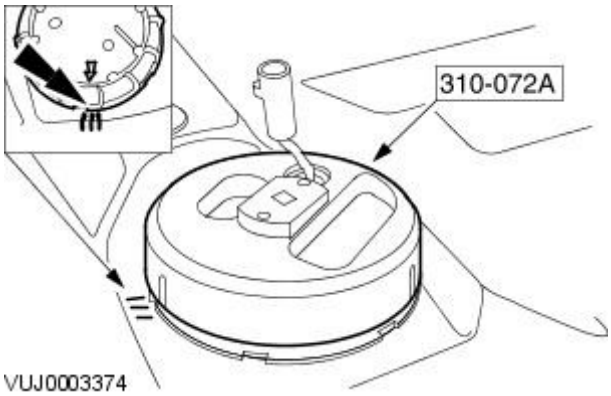
1. CAUTION: Make sure the float or arm are not damaged while installing the fuel pump module.

• NOTE: Federal market vehicles only.

• NOTE: Make sure the fuel transfer pump is correctly orientated.

To install, reverse the removal procedure.

- Install a new O-ring seal.
- Tighten to 120 Nm.



2. CAUTIONS:

Make sure the float or arm are not damaged while installing the fuel pump module.

Make sure the fuel crossover pipes are not damaged while installing the fuel pump module.

• NOTE: Non federal market vehicles only.

• NOTE: Make sure the fuel transfer pump is correctly orientated.

To install, reverse the removal procedure.

- Install a new O-ring seal.
- Tighten to 70 Nm.

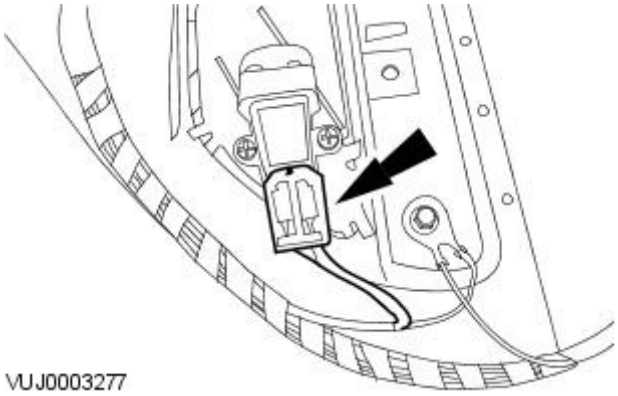
Published: 11-May-2011

Fuel Tank and Lines - Inertia Fuel Shutoff (IFS) Switch

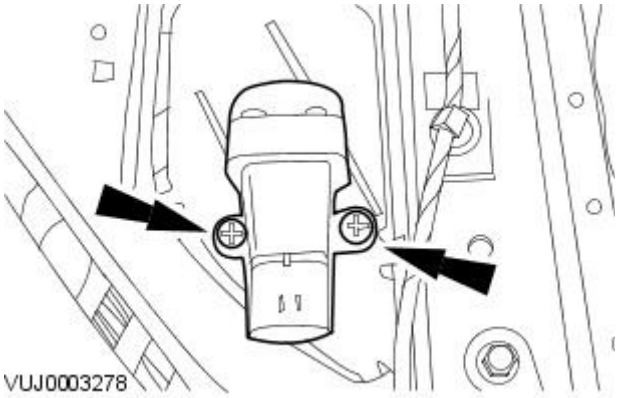
Removal and Installation

Removal

1. Remove the cowl side trim panel. For additional information, refer to Section 501-05 Interior Trim and Ornamentation.
2. Disconnect the electrical connector.



3. Remove the inertia fuel shutoff (IFS) switch.



Installation

1. To install, reverse the removal procedure.

Published: 24-Mar-2011

Fuel Tank and Lines - Fuel Tank Filler Pipe Hose

Removal and Installation

Removal

1. WARNINGS:

Place the vehicle in a quarantined area and arrange "No Smoking/Petrol Fumes" signs about the vehicle.

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.

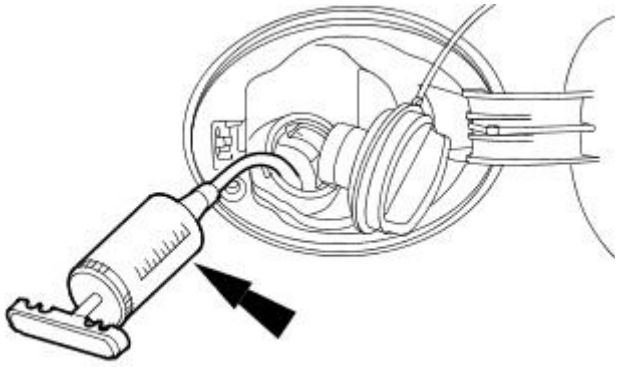
Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapours are always present and may ignite. Failure to follow these instructions may result in personal injury.

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.

Disconnect the battery ground cable. For additional information, refer to For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
.

2. Remove the fuel filler cap.

3. Using a suitable suction device drain the fuel tank filler pipe.



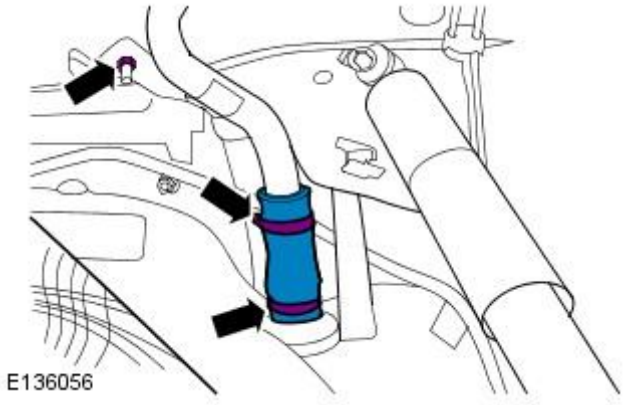
VUJ0003378

4. Raise and support the vehicle.
For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

5. NOTE: Subframe shown removed for clarity.

Remove the fuel filler neck link hose.

- Release the two band clamps.
- Remove the fuel filler neck nut.



E136056

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 vapours 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.

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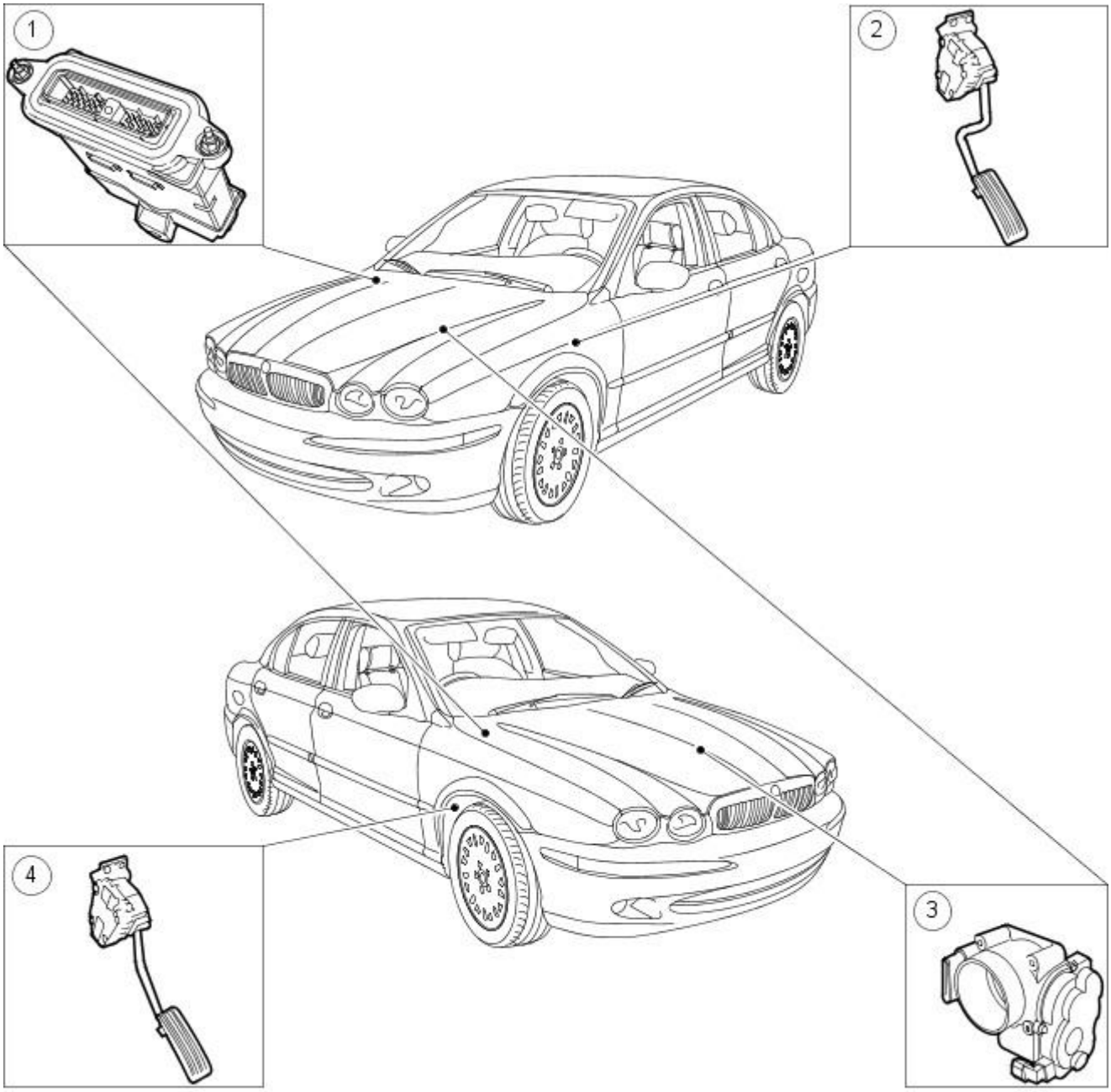
Acceleration Control -

Torque Specifications

Description	Nm	lb-ft	lb-in
Accelerator pedal	9	-	80

Acceleration Control - Acceleration Control

Description and Operation



VUJ0004039

Item	Part Number	Description
1	—	Engine control module (ECM)
2	—	Accelerator pedal (left-hand drive vehicles)
3	—	Throttle body
4	—	Accelerator pedal (right-hand drive vehicles)

Vehicles with 2.0L engine

The acceleration control consists of the pedal and shaft assembly, accelerator cable and accelerator cable bracket.

WARNING: Make sure surrounding components such as wiring, hoses, sound insulation and floor carpeting are not contacting the sliding inner cable or the accelerator pedal and shaft. Failure to follow these instructions may result in personal injury.

The throttle is controlled by an accelerator cable attached to the accelerator pedal and shaft. The accelerator pedal and shaft should travel smoothly from the idle to the wide-open throttle positions. Hesitation on return or prevention of return to the idle position must not occur.

Vehicles with 2.5L, 3.0L or diesel engine

The accelerator pedal demand sensor provides an analogue voltage to the ECM which is proportional to the accelerator pedal position. A throttle position sensor provides a signal to the ECM which monitors throttle plate position.

After receiving these signals and monitoring the wheel speed signal output, coolant temperature, rotary switch status (automatic transmission) and inertia switch confirmation, the ECM then issues a throttle request signal. A motor within the throttle body rotates the throttle plate to a position which is relative to the position demanded.

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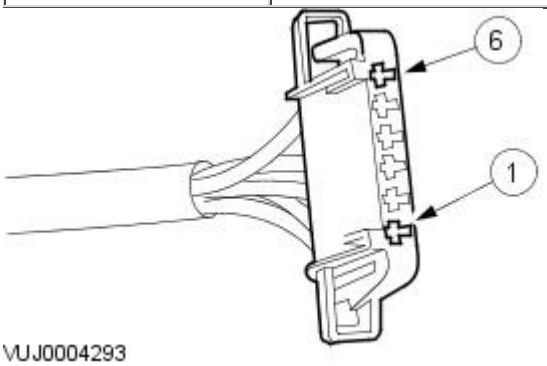
Acceleration Control - Acceleration Control

Diagnosis and Testing

1. **1.** Verify the customer concern by operating the system.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.
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, use a fault code reader to retrieve the fault codes before proceeding to the Symptom Chart.

Symptom Chart

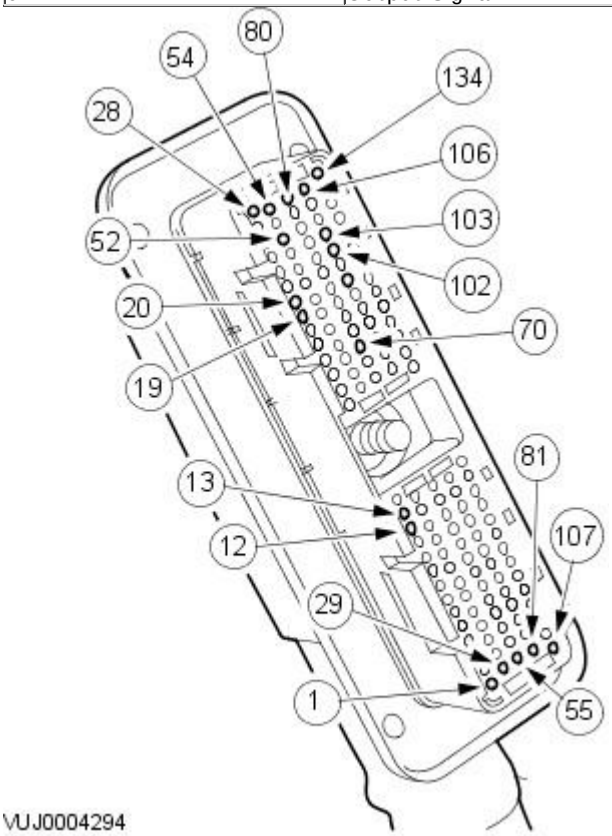
Symptom	Possible Sources	Action
DTC P1240, P1241, P1242	* Accelerator pedal power supply circuit out of range	* GO to Pinpoint Test A.
DTC P1122, P1123, P1215, P1216, P1344	* Accelerator pedal demand sensor output circuit out of range	* GO to Pinpoint Test B.
DTC P0121, P0122, P0123	* Throttle position sensor circuit out of range	* GO to Pinpoint Test C.
DTC P1251, P1658, P1631, P1657	* Throttle motor relay failure	* GO to Pinpoint Test D.
DTC P1243	* Accelerator pedal demand sensor ground; open circuit	* GO to Pinpoint Test E.
DTC P1506, P1507, P1611, P1633	* Engine control module (ECM) failure	* INSTALL a new ECM. For additional information, refer toSection 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls.
DTC P1254, P1250	* Throttle limp home spring malfunction.	* INSTALL a new throttle motor. For additional information refer toSection 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls.



VUJ0004293

Accelerator Pedal Demand Sensor Electrical Connector (PA1, Harness Side)

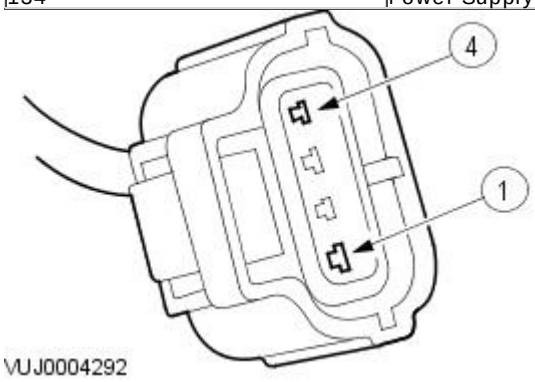
Pin Number	Circuit Function	Circuit Color
1	Sensor Ground	Black/Green
2	Sensor Ground	Black/Green
3	Output Signal	Red
4	Sensor Power Supply (5 volts)	Orange/Yellow
5	Sensor Power Supply (5 volts)	Yellow
6	Output Signal	Yellow



VUJ0004294

Engine Control Module (ECM) Electrical Connector (EN16, Harness Side)

Pin Number	Circuit Function	Circuit Color
12	Output (5 volts)	Orange/Yellow
13	Output (5 volts)	Yellow
19	Ground	Black/Green
20	Ground	Black/Green
52	Throttle Relay Ground	Green/Red
75	Input	Purple
76	Input	Yellow
80	Throttle motor	Green
102	Input	Red
103	Input	Yellow
106	Throttle motor	Red
134	Power Supply (12 volts)	Red/White



VUJ0004292

Throttle Position Sensor Electrical Connector (EN13, Harness Side)

Pin Number	Circuit Function	Circuit Color
1	Sensor Ground	Black/Green
2	Output Signal	Yellow
3	Output Signal	Purple
4	Sensor Power Supply (5 volts)	Orange/Yellow

VUJ0004291

Throttle Motor Electrical Connector (EN10, Harness Side)

Pin Number	Circuit Function	Circuit Color
80	Throttle motor	Green
106	Throttle motor	Red

PINPOINT TEST A : DTC P1240, P1241, P1242	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE POWER SUPPLY TO THE ACCELERATOR PEDAL DEMAND SENSOR	
	1 TURN the ignition switch to the RUN position.
	2 Measure the voltage between electrical connector PA1-5 and ground.
	3 Measure the voltage between electrical connector PA1-4 and ground.
	Is the voltage less than 4.5 volts? **Yes** GO to A2. . **No** DIAGNOSE the electronic engine control system. For additional information, refer toSection 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls.
A2: CHECK CONTINUITY OF THE ACCELERATOR PEDAL DEMAND SENSOR POWER SUPPLY CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16 and the accelerator pedal electrical connector PA1.
	3 Measure the resistance between EN16-13 and PA1-5.
	4 Measure the resistance between EN16-12 and PA1-4.
	Is the resistance less than 5 ohms? **Yes** GO to A3. . **No** REPAIR the power supply circuit from the ECM to the accelerator pedal. CLEAR the DTC. TEST the system for normal operation.
A3: CHECK THE ACCELERATOR PEDAL DEMAND SENSOR POWER SUPPLY FOR A SHORT CIRCUIT TO GROUND	
	1 Measure the resistance between PA1-5 and ground.
	2 Measure the resistance between PA1-4 and ground.

	Is the resistance greater than 10,000 ohms? **Yes** DIAGNOSE the electronic engine control system. For additional information, refer toSection 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls. **No** REPAIR the power supply circuit from the ECM to the accelerator pedal. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST B : DTC P1122, P1123, P1215, P1216, P1344	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE ACCELERATOR PEDAL DEMAND SENSOR OUTPUT	
	1 Turn the ignition switch to the RUN position.
	2 Measure the voltage between electrical connector PA1-6 and ground with the accelerator pedal released and with the accelerator pedal at full throttle.
	3 Measure the voltage between electrical connector PA1-3 and ground with the accelerator pedal released and with the accelerator pedal at full throttle.
	Does the voltage vary between 0.3 volts and 5 volts? **Yes** GO to B4. . **No** GO to B2. .
B2: CARRY OUT AN ACCELERATOR PEDAL POSITION SENSOR COMPONENT CHECK	
	1 Remove the accelerator pedal. For additional information, refer to Pedal.
	2 Measure the resistance between pin 1 and pin 6 of the accelerator pedal.
	3 Measure the resistance between pin 2 and pin 3 of the accelerator pedal.
	Is the resistance between pin 1 and pin 6 between 546 and 1134 ohms, and between pin 2 and pin 3 between 975 and 2025 ohms? **Yes** GO to B3. . **No** INSTALL a new accelerator pedal. For additional information, refer to Pedal. CLEAR the DTC. TEST the system for normal operation.
B3: CHECK THE ACCELERATOR PEDAL DEMAND SENSOR CIRCUIT FOR A SHORT TO GROUND	
	1 Disconnect the ECM electrical connector EN16.
	2 Measure the resistance between electrical connector PA1-6 and ground.
	3 Measure the resistance between electrical connector PA1-3 and ground.
	Is the resistance greater than 10,000 ohms? **Yes** GO to B4. . **No** REPAIR the accelerator pedal demand sensor circuit from the ECM to the accelerator pedal. CLEAR the DTC. TEST the system for normal operation.
B4: CHECK THE ACCELERATOR PEDAL DEMAND SENSOR CIRCUIT FOR OPEN CIRCUIT	
	1 Disconnect the ECM electrical connector EN16 and the accelerator pedal electrical connector PA1.
	2 Measure the resistance between EN16-103 and PA1-6.
	3 Measure the resistance between EN16-102 and PA1-3.
	Is the resistance less than 5 ohms? **Yes** DIAGNOSE the electronic engine control system. For additional information, refer toSection 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls. **No** REPAIR the accelerator pedal demand sensor circuit from the ECM to the accelerator pedal. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST C : DTC P0121, P0122, P0123	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE POWER SUPPLY TO THE THROTTLE POSITION SENSOR	
	1 Turn the ignition switch the to the RUN position.
	2 Measure the voltage between the throttle position sensor electrical connector EN13-4 and ground.
	Is the voltage less than 4.5 volts? **Yes** GO to C2. . **No** GO to C4. .
C2: CHECK THE THROTTLE POSITION SENSOR POWER SUPPLY CIRCUIT FOR OPEN CIRCUIT	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16 and the throttle position sensor electrical connector EN13.
	3 Measure the resistance between EN16-12 and EN13-4.
	Is the resistance less than 5 ohms? **Yes** GO to C3. . **No** REPAIR the throttle position sensor power supply circuit from the ECM to the throttle position sensor. CLEAR the DTC. TEST the system for normal operation.
C3: CHECK THE THROTTLE POSITION SENSOR POWER SUPPLY CIRCUIT FOR A SHORT TO GROUND	
	1 Measure the resistance between EN13-4 and ground.
	Is the resistance greater than 10,000 ohms? **Yes** DIAGNOSE the electronic engine control system. For additional information, refer toSection 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls. **No** REPAIR the throttle position sensor power supply circuit from the ECM to the throttle position sensor. CLEAR the DTC. TEST the system for normal operation.
C4: CHECK THE THROTTLE POSITION SENSOR GROUND CIRCUIT	

	1 Turn the ignition switch to the OFF position.
	2 Disconnect the throttle position sensor electrical connector EN13.
	3 Measure the resistance between EN13-1 and ground.
	Is the resistance less than 5 ohms? **Yes** GO to C6. . **No** GO to C5. .
C5: CHECK THE THROTTLE POSITION SENSOR GROUND WIRE FOR OPEN CIRCUIT	
	1 Disconnect the ECM electrical connector EN16 and the throttle position sensor electrical connector EN13.
	2 Measure the resistance between EN16-13 and EN13-1.
	Is the resistance less than 5 ohms? **Yes** GO to C6. . **No** REPAIR the throttle position sensor ground circuit from the ECM to the throttle position sensor. CLEAR the DTC. TEST the system for normal operation.
C6: CHECK THE THROTTLE POSITION SENSOR	
	1 Measure the resistance between EN13-2 and EN13-4.
	2 Measure the resistance between EN13-3 and EN13-4.
	Are the resistor values the same? **Yes** GO to C7. . **No** INSTALL a new throttle position sensor. For additional information refer toSection 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls.
C7: CHECK CONTINUITY OF THE THROTTLE POSITION SENSOR OUTPUT CIRCUIT	
	1 Measure the resistance between EN16-75 and EN13-3.
	2 Measure the resistance between EN16-76 and EN13-2.
	Is the resistance less than 5 ohms? **Yes** GO to C8. . **No** REPAIR the circuit from the ECM to the throttle position sensor. CLEAR the DTC. TEST the system for normal operation.
C8: CHECK THE THROTTLE POSITION SENSOR OUTPUT CIRCUIT FOR A SHORT TO GROUND	
	1 Measure the resistance between EN13-3 and ground.
	2 Measure the resistance between EN13-2 and ground.
	Is the resistance greater than 10,000 ohms? **Yes** DIAGNOSE the electronic engine control system. For additional information, refer toSection 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls. **No** REPAIR the circuit from the ECM to the throttle position sensor. CLEAR the DTC. TEST the system for normal operation.

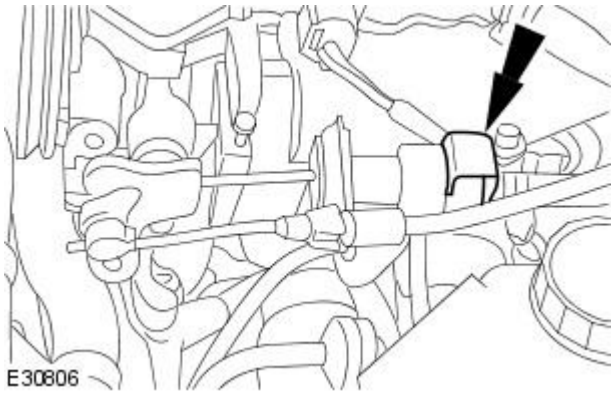
PINPOINT TEST D : DTC P1251, P1658, P1631, P1657	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE THROTTLE MOTOR RELAY	
	1 Turn the ignition switch to the RUN position.
	Does the throttle relay make an audible click? **Yes** GO to D2. . **No** GO to D8. .
D2: CHECK THE ECM POWER SUPPLY FROM THE THROTTLE MOTOR RELAY	
	1 Measure the voltage between the throttle motor relay connector JB34-138 and ground.
	Is the voltage greater than 10 volts? **Yes** GO to D3. . **No** GO to D4. .
D3: CHECK CONTINUITY OF THE ECM POWER SUPPLY WIRE FROM THE THROTTLE MOTOR RELAY	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the ECM electrical connector EN16 and remove the throttle motor relay.
	3 Measure the resistance between the throttle motor relay electrical connector JB34-138 and the ECM electrical connector EN16-134.
	Is the resistance less than 5 ohms? **Yes** DIAGNOSE the electronic engine control system. For additional information, refer toSection 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls. **No** REPAIR the ECM power supply wire from the throttle motor relay. CLEAR the DTC. TEST the system for normal operation.
D4: CHECK FUSE 33 IN THE ENGINE COMPARTMENT FUSE BOX.	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to D5. . **No** GO to D6. .
D5: CHECK THE THROTTLE MOTOR RELAY POWER SUPPLY CIRCUIT	
	1 Remove the throttle motor relay.
	2 Measure the voltage between the throttle motor relay connector JB34-139 and ground.

	Is the voltage less than 10 volts? **Yes** REPAIR the throttle motor relay power supply circuit. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new throttle motor relay. CLEAR the DTC. TEST the system for normal operation.
D6: CHECK FUSE 33 FOR A SHORT TO GROUND	
	1 Measure the resistance between fuse 33 and ground.
	Is the resistance greater than 10,000 ohms? **Yes** INSTALL a new fuse. CLEAR the DTC. TEST the system for normal operation. **No** REPAIR short to ground between engine compartment fuse box and the throttle motor relay. INSTALL a new fuse. CLEAR the DTC. TEST the system for normal operation.
D7: CHECK FUSE 36 IN THE ENGINE COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to D7. . **No** GO to D10. .
D8: CHECK THE POWER SUPPLY CIRCUIT TO THE THROTTLE MOTOR RELAY COIL	
	1 Turn the ignition switch to the RUN position.
	2 Measure the voltage between the throttle motor relay connector JB34-137 and ground.
	Is the voltage greater than 10 volts? **Yes** GO to D11. . **No** GO to D9. .
D9: CHECK CONTINUITY OF THE POWER SUPPLY CIRCUIT TO THE THROTTLE MOTOR RELAY COIL	
	1 Disconnect the ECM electrical connector EN16 and remove the throttle motor relay.
	2 Measure the resistance between the throttle motor relay electrical connector JB34-137 and the ECM electrical connector EN16-52.
	Is the resistance less than 5 ohms? **Yes** GO to D11. . **No** REPAIR the throttle motor relay coil power supply circuit from the engine compartment fuse box. CLEAR the DTC. TEST the system for normal operation.
D10: CHECK FUSE 36 OF THE PASSENGER COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between fuse 36 of the passenger compartment fuse box and ground.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the engine compartment fuse box and the throttle motor relay coil. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new fuse. CLEAR the DTC. TEST the system for normal operation.
D11: CHECK CONTINUITY OF THE THROTTLE MOTOR RELAY COIL	
	1 Remove the throttle motor relay (if not already removed).
	2 Measure the resistance between terminal 1 and terminal 2 of the throttle motor relay.
	Is the resistance between 70 and 90 ohms? **Yes** GO to D12. . **No** INSTALL a new throttle motor relay. CLEAR the DTC. TEST the system for normal operation.
D12: CHECK CONTINUITY OF THE THROTTLE MOTOR RELAY GROUND CIRCUIT	
	1 Disconnect the ECM electrical connector EN16.
	2 Measure the resistance between the throttle motor relay electrical connector JB34-135 and the ECM electrical connector EN16-52.
	Is the resistance less than 5 ohms? **Yes** DIAGNOSE the electronic engine control system. For additional information, refer toSection 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls. **No** REPAIR the throttle motor relay ground circuit from the ECM to the engine compartment fuse box. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST E : DTC P1254, P1250	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK THE ACCELERATOR PEDAL DEMAND SENSOR GROUND CIRCUIT	
	1 Disconnect the ECM electrical connector EN16 and the accelerator pedal electrical connector PA1.
	2 Measure the resistance between EN16-19 and PA1-1.
	3 Measure the resistance between EN16-20 and PA1-2.
	Is the resistance less than 5 ohms? **Yes** DIAGNOSE the electronic engine control system. For additional information, refer toSection 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls. **No** REPAIR the accelerator pedal demand sensor ground circuit from the accelerator pedal to the ECM. CLEAR the DTC. TEST the system for normal operation.

Acceleration Control - Accelerator Cable Adjustment2.0L NA V6 - AJV6

General Procedures



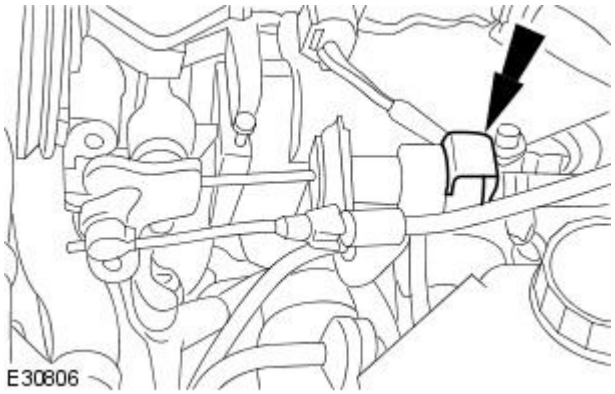
1. Remove the primary cable retaining clip.

2. NOTE: Make sure the accelerator cable is seated fully in the retaining bracket.

   Fully depress the accelerator pedal and hold down.

3. NOTE: Make sure the throttle actuator is in the fully open position.

   Install the retaining clip.



4. Release the accelerator pedal.
5. Fully depress the accelerator pedal and hold down.
6. If the accelerator actuator is not in the fully open position, repeat the above procedure.

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Acceleration Control - Accelerator Cable2.0L NA V6 - AJV6

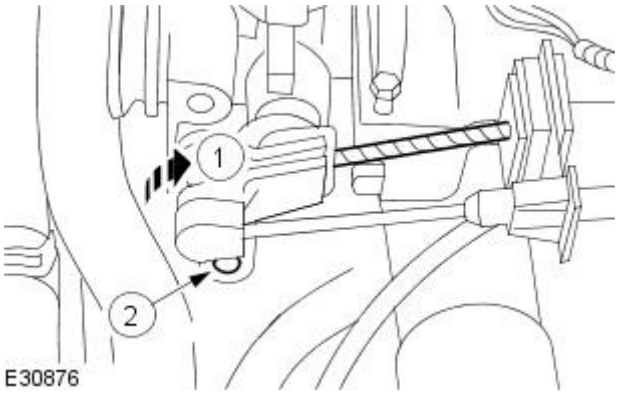
Removal and Installation

Removal

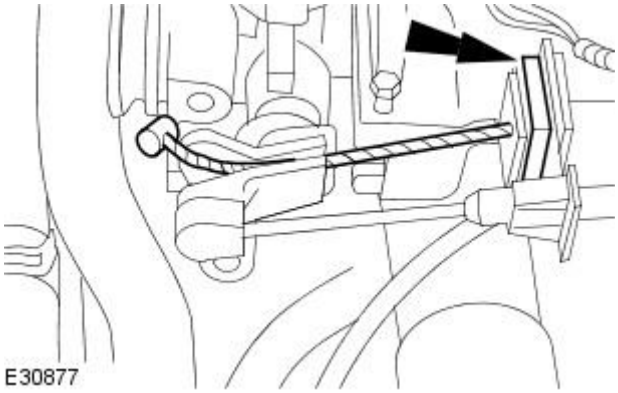
1. Disconnect the battery ground cable.
For additional information, refer to Section 414-01 Battery, Mounting and Cables.

2. Detach the accelerator cable.

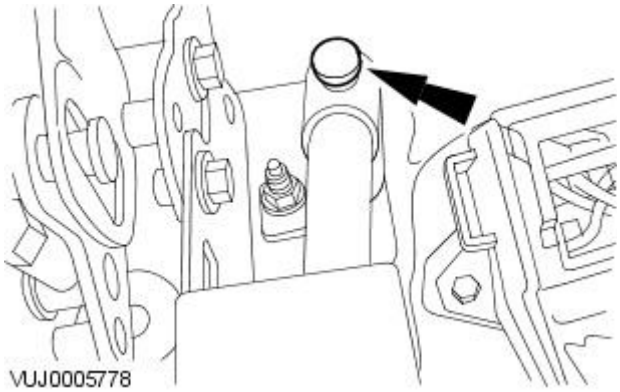
1. Position the accelerator actuator to the fully open position.
2. Detach the accelerator cable.



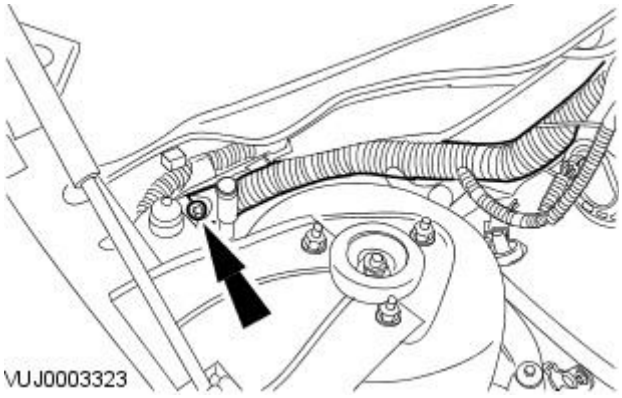
3. Detach the outer accelerator cable.

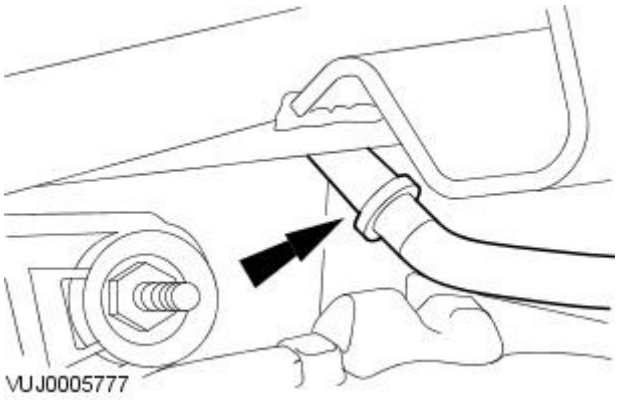


4. Detach the accelerator cable from the accelerator pedal.



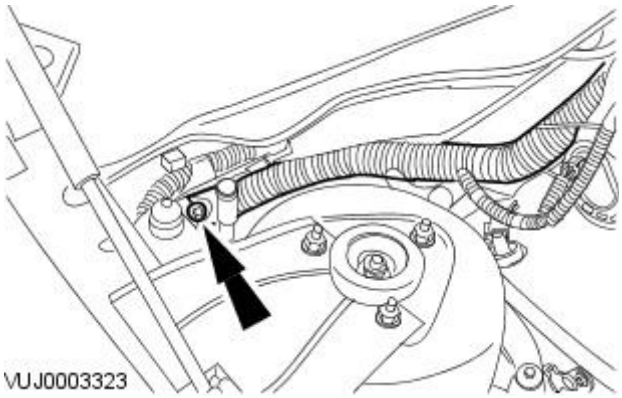
5. Disconnect the engine control module (ECM) electrical connector.





6. Remove the accelerator cable.
   - Detach the accelerator cable grommet.

Installation



1. To install, reverse the removal procedure.
2. Tighten to 5 Nm.
3. Adjust the accelerator cable.
   For additional information, refer to Accelerator Cable Adjustment-2.0L in this section.

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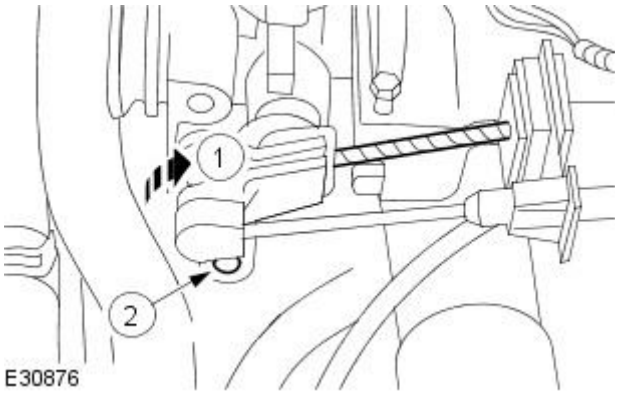
Acceleration Control - Accelerator Pedal

Removal and Installation

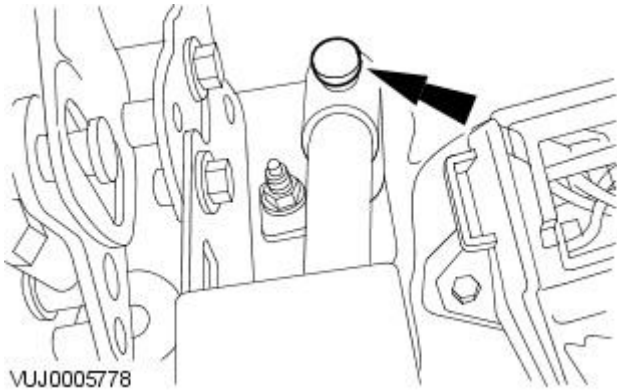
Removal

Vehicles with 2.0L engine



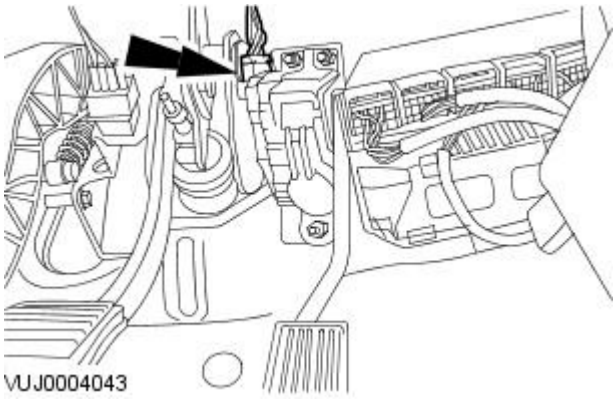
1. Detach the accelerator cable.

1. Position the accelerator actuator to the fully open position.
2. Detach the accelerator cable.



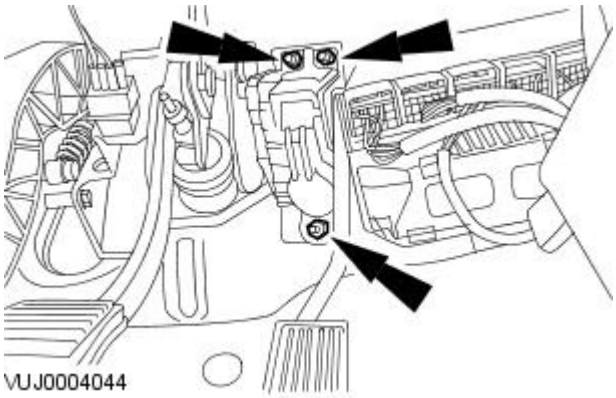
2. Detach the accelerator cable.

Vehicles with 2.5L, 3.0L or diesel engine



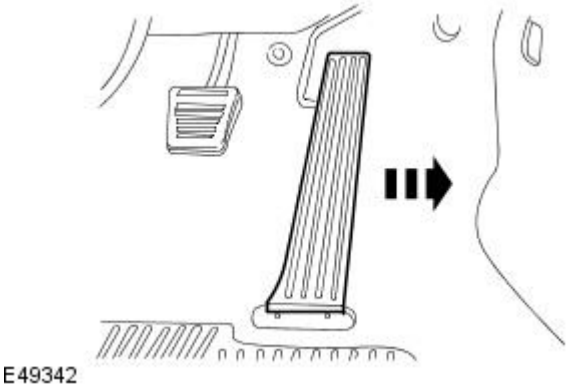
3. Disconnect the accelerator pedal electrical connector.

All vehicles



4. NOTE: Vehicles with 2.5L, 3.0L or diesel engine shown, 2.0L similar.

Remove the accelerator pedal retaining nuts.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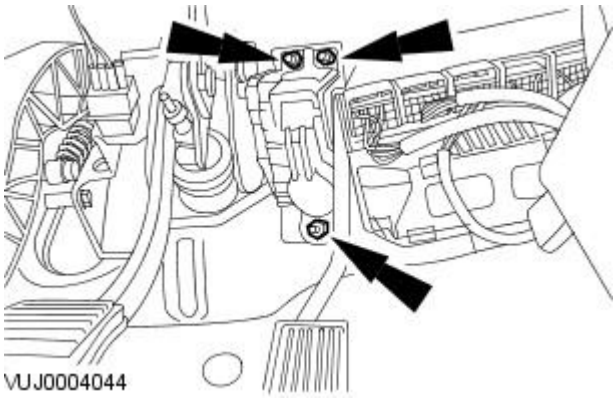
5. Remove the accelerator pedal.

Installation


VUJ0004044

1. NOTE: Vehicles with 2.5L, 3.0L or diesel engine shown, 2.0L similar.

To install, reverse the removal procedure.

- Tighten to 9 Nm.

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Speed Control -

Torque Specifications

Description	Nm	lb-ft	lb-in
Cruise control switch retaining screws	3	-	27

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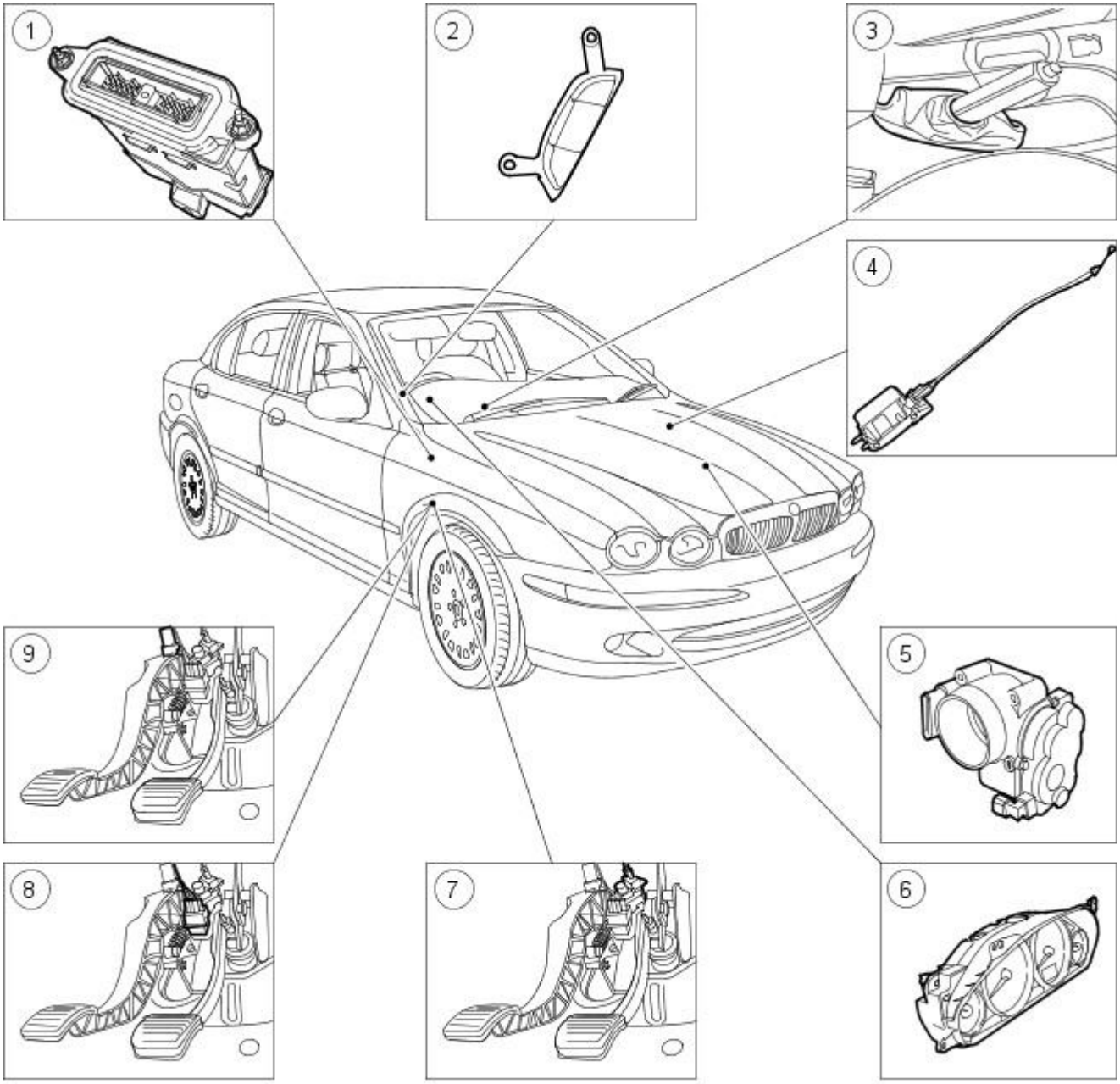
Speed Control - Speed Control

Description and Operation

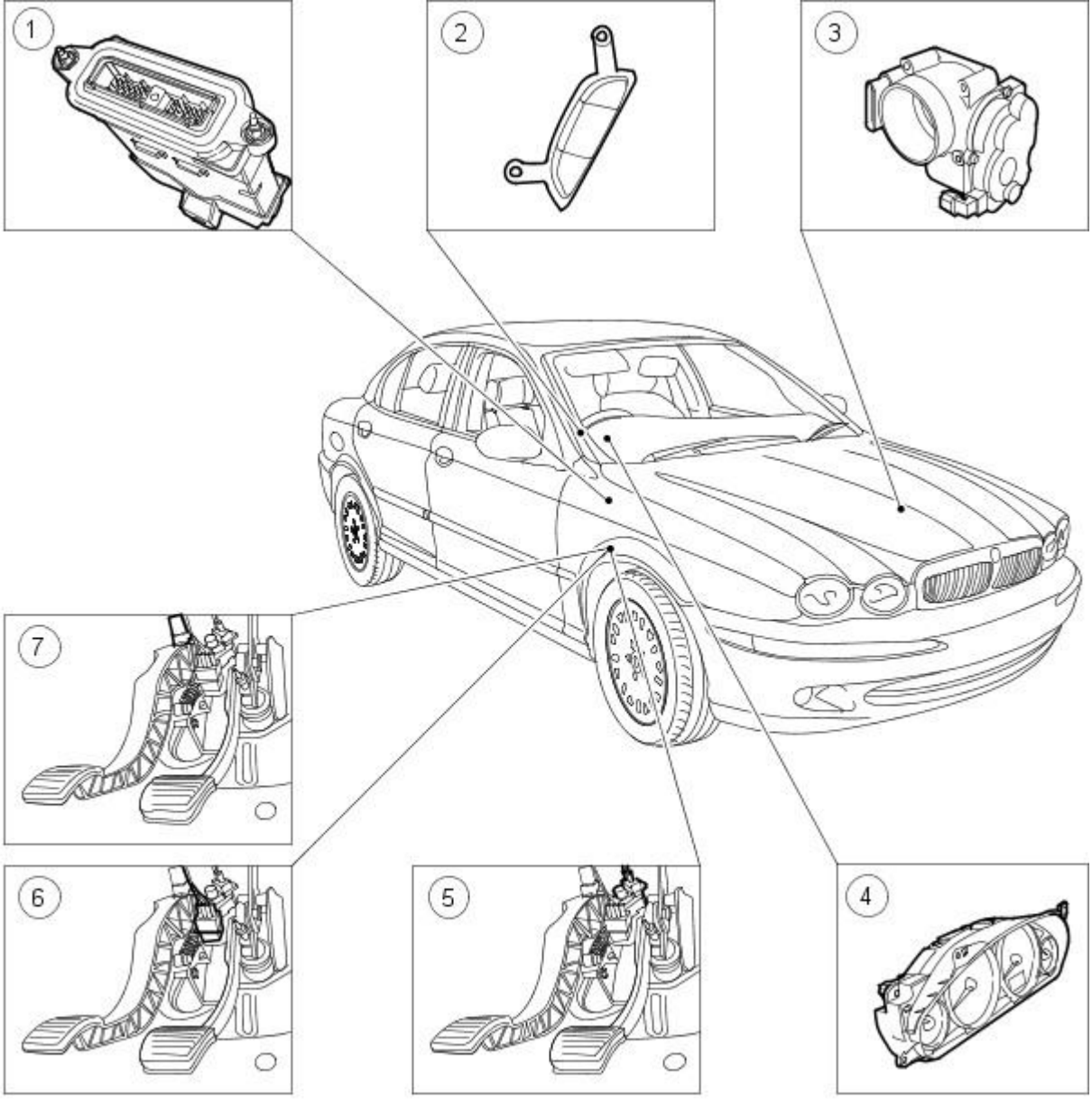
2.0L vehicles



E31059

Item	Part Number	Description
1	—	Engine control module (ECM)
2	—	Cruise control switch
3	—	Handbrake switch
4	—	Cruise control module
5	—	Throttle body
6	—	Instrument cluster (IC)
7	-	Speed control deactivator switch (brake pedal position primary switch, black)
8	-	Speed control deactivator switch (brake pedal position secondary switch)
9	-	Speed control deactivator switch (clutch pedal position switch, red, vehicles fitted with manual transmission)

Vehicles with 2.5L, 3.0L or diesel engine



VUJ0004372

Item	Part Number	Description
1	—	Engine control module (ECM)
2	—	Cruise control switch
3	—	Throttle body
4	—	Instrument cluster (IC)
5	—	Speed control deactivator switch (brake pedal position secondary switch, green)
6	—	Speed control deactivator switch (brake pedal position primary switch, black)
7	—	Speed control deactivator switch (clutch pedal position switch, red, vehicles fitted with manual transmission)

System operation

The speed control system operates between the following speeds:

- On vehicles with 2.0L engine the speed range is 40km/h (25mile/h) and 192km/h (120mile/h). On vehicles with 2.5L, 3.0L or diesel engine the speed range is 40km/h (25mile/h) and 180km/h (112mile/h).

The speed control system is designed to maintain a selected vehicle speed between these two parameters.

Vehicles with 2.0L engine

Any of the deactivator switches operated by the handbrake, footbrake or clutch pedal (vehicles fitted with manual transmission) or by information sent by the engine control module (ECM) to the cruise control module will interrupt the speed control operation. This will allow the system to go into STANDBY mode. Operating the RESUME switch with the system in STANDBY mode will allow the vehicle to accelerate until the last set speed is resumed, providing the vehicle speed remains between the upper and lower operating limits of the speed control system.

Vehicles with 2.5L, 3.0L or diesel engine

Any of the deactivator switches operated by the brake or clutch pedal (vehicles fitted with manual transmission) will interrupt the speed control operation by switching the signal to the ECM. This will allow the system to go into STANDBY mode. Operating the RESUME switch with the system in STANDBY mode will allow the vehicle to accelerate until the last set speed is resumed, providing the vehicle speed remains between the upper and lower operating limits of the speed control system.

Vehicle Speed Signal

The vehicle speed signal for the speed control system comes from the anti-lock control system (ABS) through the control area network (CAN) via the (EMS).

Actuator Switches

ON Switch

When the ON switch is operated the speed control system is activated and providing the vehicle is travelling at a speed greater than 40km/h (25mile/h), the speed control system will accept the speed inputs. The instrument cluster (IC) will inform the driver that the speed control has been activated.

OFF Switch

When the OFF switch is operated the speed control system is deactivated and the speed setting stored in the ECM memory will be erased. The speed control warning in the IC will be extinguished.

RESUME Switch

When the RESUME switch is operated with the system in STANDBY mode, providing the vehicle speed is above, 40km/h (25mile/h) the vehicle will accelerate until the last set speed is reached.

The RESUME switch will not function if:

- The OFF switch has been operated.
- The ignition switch has been turned to the OFF position.
- The vehicle speed is below 40km/h (25mile/h).
- There is a loss of drive between the driveline system and the road wheels.
- The diagnostic system has detected a fault with the speed control system.

CANCEL Switch

When the CANCEL switch is operated with the vehicle speed control system active, the system will enter STANDBY mode.

SET Switch

When the SET switch is operated, providing the vehicle is travelling above 40km/h (25mile/h) the system allows the vehicle speed to be maintained to ± 2km/h (1 mile/h). When the vehicle speed control system is active, operating the SET switch will increase or decrease the vehicle speed respectively until the switch is released. If the SET switch is operated momentarily, the vehicle speed will increase or decrease in 2km/h (1 mile/h) increments.

Handbrake switch (vehicles with 2.0L engine only)

If the handbrake is operated when the speed control system is active, the cruise control module will receive a signal from the handbrake position switch via the (EMS). This will put the system into STANDBY mode and allow the vehicle to return to a speed demanded by the throttle pedal position.

Brake Pedal Position Switches

Vehicles with 2.0L engine

If the brake pedal is operated when the speed control system is active, the cruise control module will receive a signal from the brake pedal position primary and secondary switches. This will put the system into STANDBY mode and allow the vehicle to return to a speed demanded by the throttle pedal position.

Vehicles with 2.5L, 3.0L or diesel engine

If the brake pedal is operated when the speed control system is active, the ECM will receive a signal from the brake pedal position primary and secondary switches. This will put the system into STANDBY mode and allow the vehicle to return to a speed demanded by the throttle pedal position.

The brake pedal position primary switch is also used to operate the stop lamps.

Clutch Pedal Position Switch (vehicles fitted with manual transmission)

Vehicles with 2.0L or diesel engine

If the clutch pedal is operated when the speed control system is active, the cruise control module will receive a signal from the clutch pedal position (CPP) switch. This will put the system into STANDBY mode and allow the vehicle to return to a speed demanded by the throttle pedal.

Vehicles with 2.5L, 3.0L or diesel engine

If the clutch pedal is operated when the speed control system is active, the ECM will receive a signal from the clutch pedal position (CPP) switch. This will put the system into STANDBY mode and allow the vehicle to return to a speed demanded by the throttle pedal.

Throttle Body

The throttle body moves the throttle plate to a position demanded by the throttle pedal or the speed control system.

Cruise control module (vehicles with 2.0L engine only)

The cruise control module receives information from the sensors and the ECM, which enables it to hold the throttle lever in a set position, this is achieved via a cable which is attached to the throttle lever. The cruise control actuator cable is permanently attached to the cruise control module and cannot be replaced or adjusted.

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Speed Control - Speed Control2.0L NA V6 - AJV6

Diagnosis and Testing

The complexity of the electronics involved with the vehicle speed control system and the communication network which is connected to the system, preclude the use of workshop general electrical test equipment. For diagnosis and testing of the vehicle speed control system, refer to the Jaguar approved diagnostic system.

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Throttle body mechanism	• Module • Switch(es) • Instrument cluster

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 Jaguar approved diagnostic system.
5. **5.** The DTC summaries are generated to support the Jaguar approved diagnostic system, but also provide the basis for diagnosis of OBD related concerns using a suitable generic scan tool, in conjunction with the electrical guides. Until the DTC summaries and electrical guides are available, the speed control system can only be accurately diagnosed using the Jaguar approved diagnostic system. For additional information, refer to Dealer technical support.

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Speed Control - Speed Control2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Diagnosis and Testing

The complexity of the electronics involved with the vehicle speed control system and the communication network which is connected to the system, preclude the use of workshop general electrical test equipment. For diagnosis and testing of the vehicle speed control system, refer to the Jaguar approved diagnostic system.

The Jaguar approved diagnostic system tests and analyses all functions of the vehicle speed control system. The following DTCs may be tested using a suitable meter.

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Throttle body mechanism	• Throttle body actuator • Module • Switch(es) • Instrument cluster

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 Jaguar approved diagnostic system.

Diagnostic Trouble Code (DTC) Index

DTC	Description	Possible Source	Action
P0568	Speed control input signal low/high resistance, open circuit.	• Speed control switches internal steering wheel circuit, open circuit, high resistance. • Cassette reel open circuit, high resistance. • Cassette reel to engine control module (ECM) circuit, open circuit, high resistance	GO to Pinpoint Test A.
P0565	Speed control ON/OFF switch fault.	• Speed control switches internal steering wheel circuit, short to ground. • Cassette reel short to ground. • Cassette reel to ECM circuit short to ground. • ON/OFF switch failure. (Stuck on)	GO to Pinpoint Test B.
P0566	Speed control CANCEL switch fault.	• Speed control switches internal steering wheel circuit, short to ground. • Cassette reel short to ground. • Cassette reel to ECM circuit short to ground • CANCEL switch failure. (Stuck on).	GO to Pinpoint Test C.
P0567	Speed control RESUME switch fault.	• Speed control switches internal steering wheel circuit, short to ground. • Cassette reel short to ground. • Cassette reel to ECM circuit short to ground. • RESUME switch failure. (Stuck on)	GO to Pinpoint Test D.
P0569	Speed control SET/- switch fault.	• Speed control switches internal steering wheel circuit, short to ground. • Cassette reel short to ground. • Cassette reel to ECM circuit short to ground. • SET/- switch failure.	GO to Pinpoint Test E.
P0570	Speed control SET/+ switch fault.	• Speed control switches internal steering wheel circuit, short to ground. • Cassette reel short to ground. • Cassette reel to ECM circuit short to ground. • SET/+ switch failure.	GO to Pinpoint Test F.
P0831	Clutch cancel switch, low voltage. (Switch normally closed).	• Switch supply open circuit. • Switch to ECM circuit open circuit or high resistance. • Switch failure.	GO to Pinpoint Test G.
P0832	Clutch cancel switch, high voltage. (Switch normally closed).	• Switch short circuit to battery. • Switch failure.	GO to Pinpoint Test G.
P0834	Clutch pedal safety switch, low voltage. (Switch normally open).	• Clutch pedal safety switch supply circuit open circuit. • Clutch pedal safety switch to ECM circuit open circuit/high resistance. • Switch failure.	GO to Pinpoint Test H.
P0835	Clutch pedal safety switch, high voltage. (Switch normally open).	• Clutch pedal safety switch to ECM circuit short circuit to battery. • Switch failure.	GO to Pinpoint Test H.
P1571	Brake ON/OFF switch, brake cancel switch malfunction.	• Brake ON/OFF switch to ECM circuit open circuit, short circuit to ground, high resistance. • Brake ON/OFF switch power supply circuit open circuit. • Brake ON/OFF switch failure. • Brake cancel switch to ECM circuit open circuit, short circuit	GO to Pinpoint Test I.

DTC	Description	Possible Source	Action
		to ground, high resistance. ● Brake cancel switch power supply circuit open circuit. ● Brake cancel switch failure.	

Pinpoint Tests

PINPOINT TEST A : P0568. CHECK SPEED CONTROL INPUT WIRE FOR OPEN CIRCUIT/HIGH RESISTANCE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK INTERNAL STEERING WHEEL CIRCUIT FOR OPEN CIRCUIT/HIGH RESISTANCE (INPUT)	
	1 Disconnect steering wheel internal connector, SW5.
	2 Disconnect steering wheel connector, SW4.
	3 Measure the resistance between SW5, pin 4 (YR) and SW4, pin 1 (YR).
	Is the resistance less than 5 ohms? **Yes** GO to A3. **No** INSTALL a new steering wheel assembly. REFER to Section 211-04 Steering Column. CLEAR the DTC. TEST the system for normal operation.
A2: CHECK INTERNAL STEERING WHEEL CIRCUIT FOR OPEN CIRCUIT/HIGH RESISTANCE (SIGNAL)	
	1 Measure the resistance between SW5, pin 2 (B) and SW4, pin 3.
	Is the resistance less than 5 ohms? **Yes** GO to A3. **No** INSTALL a new steering wheel assembly. REFER to Section 211-04 Steering Column. CLEAR the DTC. TEST the system for normal operation.
A3: CHECK STEERING WHEEL CASSETTE FOR OPEN CIRCUIT/HIGH RESISTANCE (INPUT)	
	1 Disconnect steering wheel Cassette connector, IP34.
	2 Reconnect steering wheel internal connector, SW5.
	3 Measure the resistance between SW5, pin 4 (YR) and IP34, pin 8 (YR).
	Is the resistance less than 5 ohms? **Yes** GO to A4. **No** INSTALL a new steering wheel Cassette assembly. REFER to Section 211-04 Steering Column. CLEAR the DTC. TEST the system for normal operation.
A4: CHECK STEERING WHEEL CASSETTE FOR OPEN CIRCUIT/HIGH RESISTANCE (SIGNAL)	
	1 Disconnect steering wheel cassette connector, IP34.
	2 Measure the resistance between SW5, pin 2 (B) and IP34, pin 6 (YG).
	Is the resistance less than 5 ohms? **Yes** GO to A5. **No** INSTALL a new steering wheel cassette assembly. REFER to Section 211-04 Steering Column. CLEAR the DTC. TEST the system for normal operation.
A5: CHECK INPUT LEAD FROM ECM TO STEERING WHEEL CASSETTE FOR OPEN CIRCUIT/HIGH RESISTANCE	
	1 Disconnect ECM electrical connector, EN16.
	2 Measure the resistance between IP34, pin 8 (YR) and EN16, pin 47 (YR).
	Is the resistance less than 5 ohms? **Yes** GO to A6. **No** Repair the circuit between EN16, pin 47 and IP34, pin 8. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
A6: CHECK SIGNAL LEAD FROM ECM TO STEERING WHEEL CASSETTE FOR OPEN CIRCUIT/HIGH RESISTANCE	
	1 Measure the resistance between IP34, pin 6 (YG) and EN16, pin 48 (YG).
	Is the resistance less than 5 ohms? **Yes** GO to B1. **No** Repair the circuit between EN16, pin 48 and IP34, pin 6. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST B : P0565. SPEED CONTROL ON/OFF SWITCH MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK SWITCH FUNCTION OF ON/OFF SWITCH	
	1 Connect an Ohmmeter between pins 1 and 3 of the Speed Control switchpack.
	2 Set the switch to the ON position.
	Does the resistance vary by 2200 ohms? **Yes** GO to B2. **No** INSTALL a new switchpack. REFER to Speed Control Switch in this section. CLEAR the DTC. TEST the system for normal operation.
B2: CHECK SWITCH FUNCTION OF ON/OFF SWITCH	
	1 Set the switch to the OFF position.

	Is the resistance 0 ohms? **Yes** No electrical fault in switchpack. RECHECK DTCs. **No** INSTALL a new switchpack. REFER to Speed Control Switch in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST C : P0566. SPEED CONTROL CANCEL SWITCH MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK SWITCH FUNCTION OF CANCEL SWITCH	
	1 Connect an Ohmmeter between pins 1 and 3 of the Speed Control switchpack.
	2 Operate the Cancel switch.
	Does the resistance vary by 4200 ohms? **Yes** No electrical fault in switchpack. RECHECK DTCs. **No** INSTALL a new switchpack. REFER to Speed Control Switch in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST D : P0567. SPEED CONTROL RESUME SWITCH MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK SWITCH FUNCTION OF RESUME SWITCH	
	1 Connect an Ohmmeter between pins 1 and 3 of the Speed Control switchpack.
	2 Operate the Resume switch.
	Does the resistance vary by 3200 ohms? **Yes** No electrical fault in switchpack. RECHECK DTCs. **No** INSTALL a new switchpack. REFER to Speed Control Switch in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST E : P0569. SPEED CONTROL SET/- SWITCH MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK SWITCH FUNCTION OF SET/- SWITCH	
	1 Connect an Ohmmeter between pins 1 and 3 of the Speed Control switchpack.
	2 Operate the Set /- switch.
	Does the resistance vary by 4000 ohms? **Yes** No electrical fault in switchpack. RECHECK DTCs. **No** INSTALL a new switchpack. REFER to Speed Control Switch in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST F : P0570. SPEED CONTROL SET/+ SWITCH MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK SWITCH FUNCTION OF SET/+ SWITCH	
	1 Connect an Ohmmeter between pins 1 and 3 of the Speed Control switchpack.
	2 Operate the Set /+ switch.
	Does the resistance vary by 3700 ohms? **Yes** No electrical fault in switchpack. RECHECK DTCs. **No** INSTALL a new switchpack. REFER to Speed Control Switch in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST G : P0831, P0832. CLUTCH CANCEL SWITCH, HIGH/LOW VOLTAGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: CHECK THE POWER SUPPLY CIRCUIT TO THE CLUTCH CANCEL SWITCH	
	1 Disconnect the clutch cancel switch electrical connector, PA4.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between PA4, pin 1 (RW) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to G2. **No** REPAIR the circuit between the clutch cancel switch electrical connector, PA4, pin 1 (RW) and the ignition switch. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the ignition relay and the inertia switch)
G2: CHECK THE POWER SUPPLY CIRCUIT TO THE CLUTCH CANCEL SWITCH FOR SHORT CIRCUIT TO BATTERY	
	1 Disconnect the clutch cancel switch electrical connector, PA4.
	2 Turn the ignition switch to the OFF position.
	3 Measure the voltage between PA4, pin 1 (RW) and GROUND.
	Is the voltage greater than 1 volt? **Yes** Repair the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to G3.
G3: CHECK THE SWITCH ACTION OF THE CLUTCH CANCEL SWITCH	

	1 Connect an ohmmeter between pins 1 and 3 of the clutch cancel switch.
	2 Operate the clutch pedal up and down, while observing the resistance reading.
	Does the resistance switch between open and closed circuit as the pedal is operated? **Yes** GO to G4. **No** INSTALL a new clutch cancel switch. CLEAR the DTC. TEST the system for normal operation.
G4: CHECK THE SWITCH ACTION OF THE CLUTCH CANCEL SWITCH	
	1 Disconnect the ECM electrical connector, EN16.
	2 Reconnect the clutch cancel switch electrical connector, PA4.
	3 Connect a voltmeter between ECM electrical connector EN16, pin 33 (WG) and GROUND.
	4 Turn the ignition switch to the ON position.
	5 Operate the clutch pedal up and down, while observing the voltage reading.
	Does the voltage switch between 0 volts and battery voltage as the pedal is operated? **Yes** INSTALL a new ECM. REFER to Section 303-14A Electronic Engine Controls / 303-14B Electronic Engine Controls. Before replacing a ECM, contact Dealer technical support. CLEAR the DTC. TEST the system for normal operation. **No** GO to G5.
G5: CHECK THE CLUTCH CANCEL SWITCH SIGNAL WIRE FOR CONTINUITY	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect clutch cancel switch electrical connector, PA4.
	3 Measure the resistance between clutch cancel switch electrical connector PA4, pin 3 (W) and ECM electrical connector EN16, pin 33 (WG).
	Is the resistance less than 5 ohms? **Yes** No electrical fault in circuit. RECHECK DTCs. **No** REPAIR the circuit between clutch cancel switch electrical connector PA4, pin 3 (W) and ECM electrical connector EN16, pin 33 (WG). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST H : P0834, P0835. CLUTCH PEDAL SAFETY SWITCH, HIGH/LOW VOLTAGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: CHECK THE POWER SUPPLY CIRCUIT TO THE CLUTCH PEDAL SAFETY SWITCH	
	1 Disconnect the clutch pedal safety switch electrical connector, PA5.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between PA5, pin 1 (RW) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to H3. **No** REPAIR the circuit between the clutch pedal safety switch electrical connector, PA5, pin 1 (RW) and the ignition switch. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
H2: CHECK THE POWER SUPPLY CIRCUIT TO THE CLUTCH PEDAL SAFETY SWITCH FOR SHORT CIRCUIT TO BATTERY	
	1 Disconnect the clutch pedal safety switch electrical connector, PA5.
	2 Turn the ignition switch to the OFF position.
	3 Measure the voltage between PA5, pin 1 (RW) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to H3.
H3: CHECK THE SWITCH ACTION OF THE CLUTCH PEDAL SAFETY SWITCH	
	1 Connect an ohmmeter between pins 1 and 2 of the clutch pedal safety switch.
	2 Operate the clutch pedal up and down, while observing the resistance reading.
	Does the resistance switch between open and closed circuit as the pedal is operated? **Yes** GO to H4. **No** INSTALL a new clutch pedal safety switch. CLEAR the DTC. TEST the system for normal operation.
H4: CHECK THE SWITCH ACTION OF THE CLUTCH PEDAL SAFETY SWITCH	
	1 Disconnect the ECM electrical connector, EN16.
	2 Reconnect the clutch pedal safety switch electrical connector, PA5.
	3 Connect a voltmeter between ECM electrical connector EN16, pin 31 (B) and GROUND.
	4 Turn the ignition switch to the ON position.
	5 Operate the clutch pedal up and down, while observing the voltage reading.
	Does the voltage switch between 0 volts and battery voltage as the pedal is operated? **Yes** INSTALL a new ECM. REFER to Section 303-14A Electronic Engine Controls / 303-14B Electronic Engine Controls. Before replacing a ECM, contact Dealer technical support. CLEAR the DTC. TEST the system for normal operation. **No** GO to H5.
H5: CHECK THE CLUTCH PEDAL SAFETY SWITCH SIGNAL WIRE FOR CONTINUITY	
	1 Turn the ignition switch to the OFF position.
	2 Disconnect the clutch pedal safety switch electrical connector, PA5.
	3 Measure the resistance between clutch pedal safety switch electrical connector PA5, pin 2 (W) and ECM electrical connector EN16, pin 31 (B).
	Is the resistance less than 5 ohms? **Yes** No electrical fault in circuit. RECHECK DTCs. **No** REPAIR the circuit between clutch pedal safety switch electrical connector PA5, pin 2 (W) and ECM electrical connector

	EN16, pin 31 (B). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST I : P1571. BRAKE ON/OFF SWITCH / BRAKE CANCEL SWITCH MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: CHECK THE POWER SUPPLY CIRCUIT TO THE BRAKE ON/OFF SWITCH	
	1 Disconnect the brake ON/OFF switch electrical connector, PA3.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between PA3, pin 3 (NR) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to I2. **No** REPAIR the circuit between the brake ON/OFF switch electrical connector, PA3, pin 3 (NR) and the ignition switch. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit icludes the inertia switch, ignition relay, and the central junction fuse box)
I2: CHECK THE POWER SUPPLY CIRCUIT TO THE BRAKE ON/OFF SWITCH FOR SHORT CIRCUIT TO BATTERY	
	1 Turn the ignition switch to the OFF position.
	2 Measure the voltage between PA3, pin 3 (NR) and GROUND.
	Is the voltage greater than 1 volt? **Yes** Repair the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to I3.
I3: CHECK THE BRAKE ON/OFF SWITCH SIGNAL WIRE FOR CONTINUITY	
	1 Disconnect the ECM electrical connector, EN16.
	2 Measure the resistance between the ECM electrical connector, EN16, pin 8 (GO) and brake ON/OFF switch electrical connector PA3, pin 1 (GW).
	Is the resistance less than 5 ohms? **Yes** GO to I4. **No** REPAIR the circuit between the ECM electrical connector, EN16, pin 8 (GO) and brake ON/OFF switch electrical connector PA3, pin 1 (GW). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
I4: CHECK THE SWITCH ACTION OF THE BRAKE ON/OFF SWITCH	
	1 Measure the resistance between pins 1 and 3 of the brake ON/OFF switch, with the brake pedal at rest.
	Is the switch open circuit? **Yes** GO to I5. **No** INSTALL a new brake ON/OFF Switch. CLEAR the DTC. TEST the system for normal operation.
I5: CHECK THE SWITCH ACTION OF THE BRAKE ON/OFF SWITCH	
	1 Measure the resistance between pins 1 and 3 of the brake ON/OFF switch, with the brake pedal depressed.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new ECM. REFER to Section 303-14A Electronic Engine Controls / 303-14B Electronic Engine Controls. Before replacing a ECM, contact Dealer technical support. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new brake ON/OFF switch. CLEAR the DTC. TEST the system for normal operation.
I6: CHECK THE POWER SUPPLY CIRCUIT TO THE BRAKE CANCEL SWITCH	
	1 Disconnect the brake cancel switch electrical connector, PA2.
	2 Turn the ignition switch to the ON position.
	3 Measure the voltage between PA2, pin 2 (NR) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to I7. **No** REPAIR the circuit between the brake cancel switch electrical connector, PA2, pin 2 (NR) and the Ignition Switch. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. (This circuit includes the inertia switch, ignition relay, and the central junction fuse box)
I7: CHECK THE POWER SUPPLY CIRCUIT TO THE BRAKE CANCEL SWITCH FOR SHORT CIRCUIT TO BATTERY	
	1 Disconnect the brake cancel switch electrical connector, PA2.
	2 Turn the ignition switch to the OFF position.
	3 Measure the voltage between PA2, pin 2 (NR) and GROUND.
	Is the voltage greater than 1 volt? **Yes** Repair the short circuit. For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to I8.
I8: CHECK THE BRAKE CANCEL SWITCH SIGNAL WIRE FOR CONTINUITY	
	1 Disconnect the ECM electrical connector, EN16.
	2 Measure the resistance between the ECM electrical connector, EN16, pin 9 (U) and brake cancel switch electrical connector PA2, pin 1 (U).
	Is the resistance less than 5 ohms? **Yes** GO to I9. **No** REPAIR the circuit between the ECM electrical connector, EN16, pin 9 (U) and brake cancel switch electrical connector PA2, pin 1 (U). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
I9: CHECK THE SWITCH ACTION OF THE BRAKE CANCEL SWITCH	
	1 Measure the resistance between pins 1 and 2 of the brake cancel switch, with the brake pedal at rest.

	Is the switch open circuit? **Yes** GO to I10. **No** INSTALL a new brake cancel switch. CLEAR the DTC. TEST the system for normal operation.
I10: CHECK THE SWITCH ACTION OF THE BRAKE CANCEL SWITCH	
	1 Measure the resistance between pins 1 and 2 of the brake cancel switch, with the brake pedal depressed.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new ECM. REFER to Section 303-14A Electronic Engine Controls / 303-14B Electronic Engine Controls. Before replacing a ECM, contact Dealer technical support. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new brake cancel switch. CLEAR the DTC. TEST the system for normal operation.

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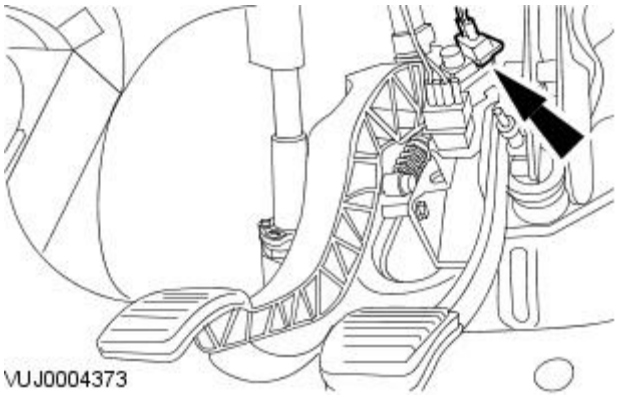
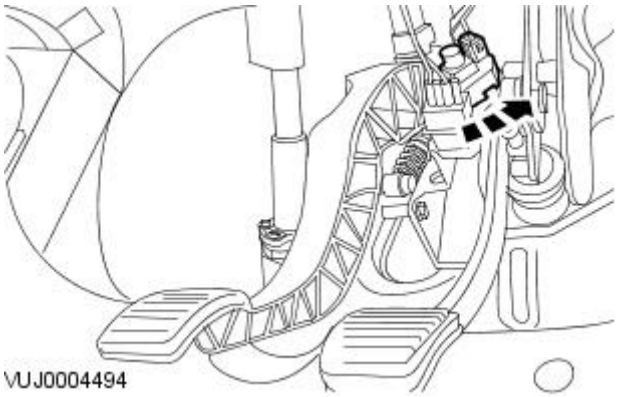
Speed Control - Speed Control Deactivator Switch

Removal and Installation

Removal



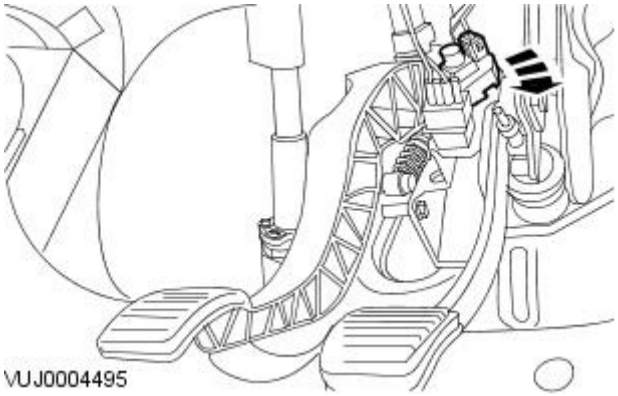
1. Disconnect the speed control deactivator switch electrical connector.



2. Remove the speed control deactivator switch.

- Turn the speed control deactivator switch 45 degrees counter clockwise.

Installation

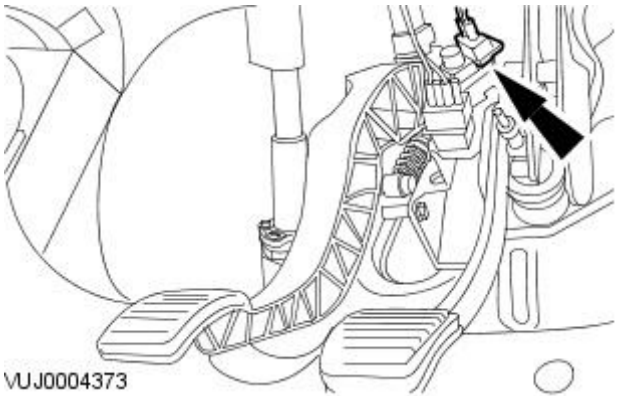


1. NOTE: Operate the brake pedal to allow the speed control deactivator switch plunger to remain in the fully extended position during installation.

• NOTE: Releasing and then pulling back on the brake pedal until the pedal reaches the stop in the brake booster, will adjust the speed control de-activator switch plunger to the required setting.

Install the speed control deactivator switch.

- Turn the speed control deactivator switch 45 degrees clockwise.



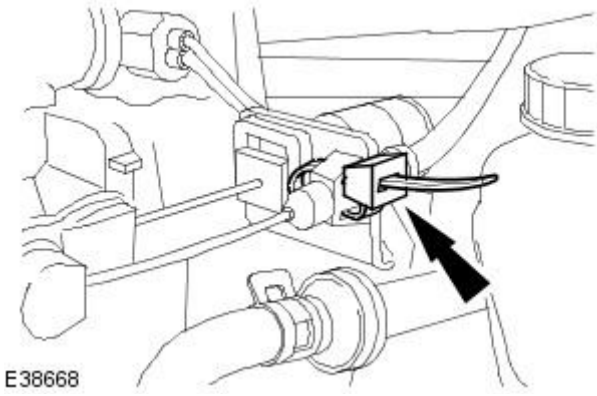
2. Connect the speed control deactivator switch electrical connector.

Published: 11-May-2011

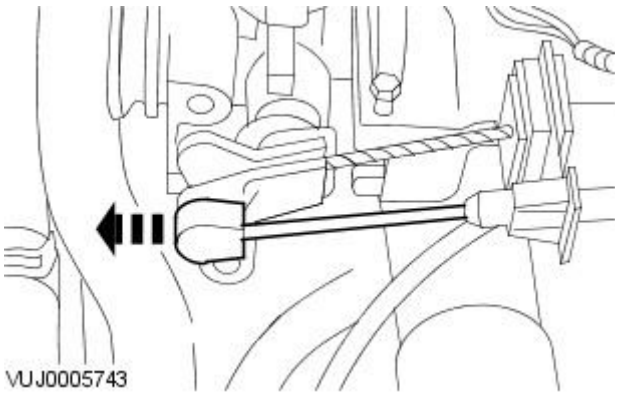
Speed Control - Speed Control Module

Removal and Installation

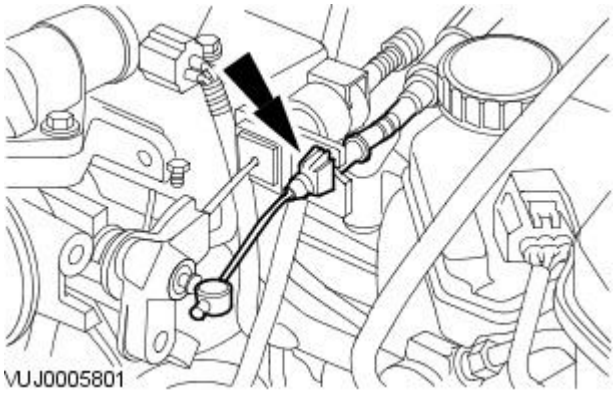
Removal



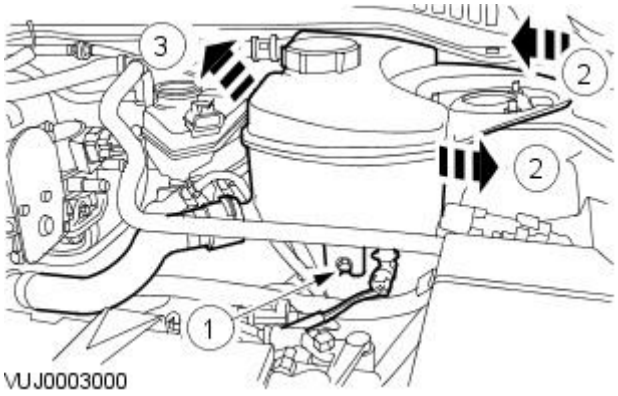
1. Remove the speed control module cable retaining tie strap.



2. Detach the inner cable.



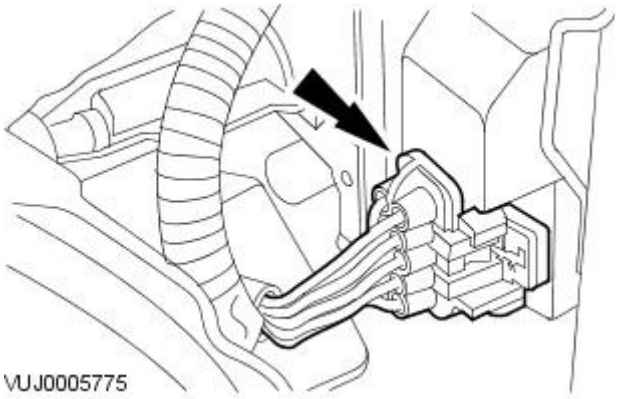
3. Detach the outer cable.



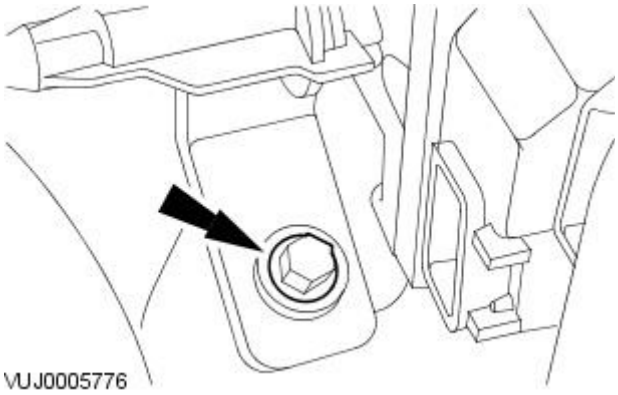
4. Detach the coolant expansion tank.

1. Remove the coolant expansion tank retaining bolt.
2. Turn the coolant expansion tank counter clockwise.
3. Detach the coolant expansion tank.

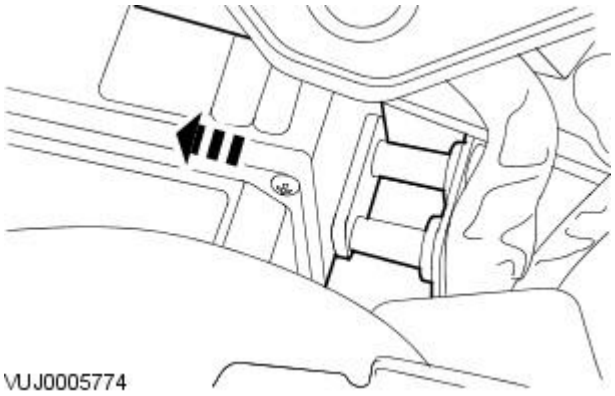
5. Disconnect the electrical connector.



6. Remove the module retaining bolt.



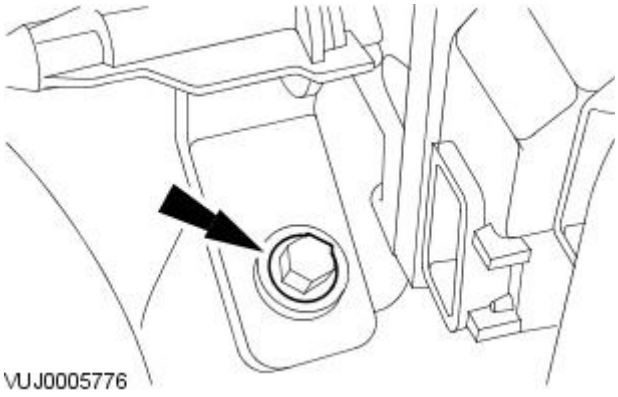
7. Remove the module.

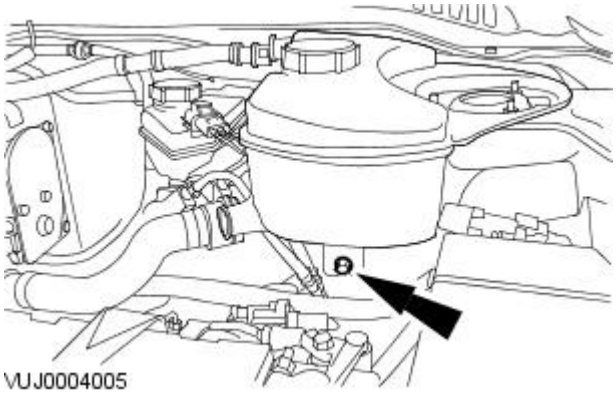


Installation

1. To install, reverse the removal procedure.

2. Tighten to 4 Nm.





3. Tighten to 3 Nm.

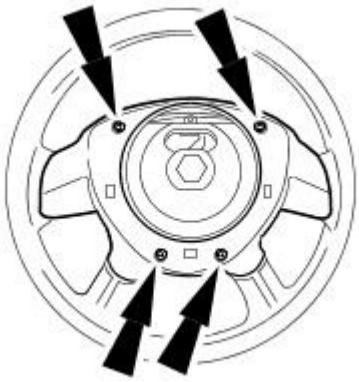
Published: 11-May-2011

Speed Control - Speed Control Switch

Removal and Installation

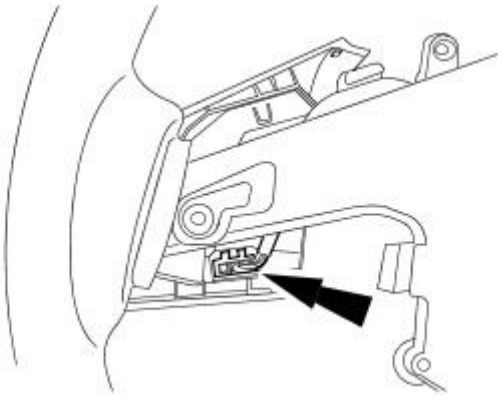
Removal

1. Remove the steering wheel.
   For additional information, refer to: Steering Wheel (211-04 Steering Column, Removal and Installation).
2. Remove the steering wheel finisher trim panel.



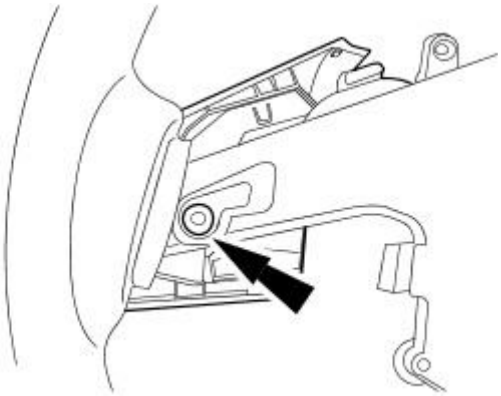
E49217

3. Disconnect the speed control switch electrical connector.



E49218

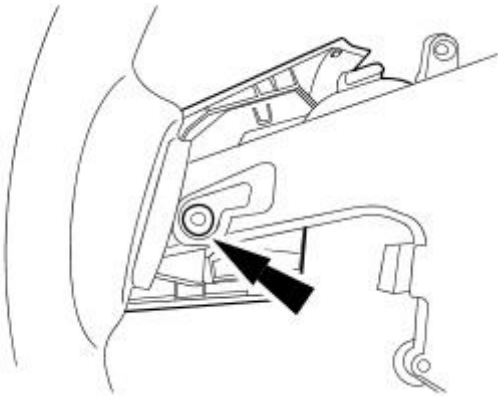
4. Remove the speed control switch.



E49219

Installation

1. To install, reverse the removal procedure.
   - Tighten to 4 Nm.



E49219

Published: 11-May-2011

Battery and Charging System - General Information - Charging System

Description and Operation

Vehicles with 2.0L, 2.5L or 3.0L engines

The charging system consists of a 120 amp output generator and regulator assembly which generates current to supply the vehicle electrical system with electricity when the engine is running and maintain the battery in a charged condition.

The generator is belt driven by the accessory drive belt.
For additional information, refer to: Accessory Drive (303-05 Accessory Drive, Description and Operation).
When the engine is started, the generator begins to generate alternating current (AC) which is converted to direct current (DC) internally. The DC current and voltage 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 solidly mounted to the engine timing cover and is driven at 2.8 times the engine speed.

Vehicles fitted with manual transmission have a one way clutch fitted to the drive pulley, which prevents torsional vibrations from the engine being transmitted to the generator.

The engine control module (ECM) can switch the voltage regulator between two voltages to optimize the charging of the battery.

The low voltage regulator setting is 13.6 volts and the high voltage regulator setting is 15.3 volts, measured with the generator at 25°C (77°F) and charging at a rate of 5 amps. These values decrease with a rise in temperature or current flow.

The ECM determines the voltage setting of the voltage regulator. The high voltage setting is always selected by the ECM once the vehicle has started. The ECM determines the period of time that the high voltage setting is selected for.

There are three different time periods selected by the ECM which is dependent upon the vehicle conditions when the vehicle is started:

- The longest time period is selected if the ECM determines that the vehicle has been 'soaking' for sufficient time to allow the engine coolant temperature (ECT) and the intake air temperature (IAT) to fall within 3°C (37°F) of each other.
- The intermediate time period is selected when the ECT and the IAT is below 5°C (41°F).
- The shortest time period is the default time and is used to provide a short period of boost charge.

At the end of these time periods the voltage is always set to the low voltage setting to prevent the battery from being overcharged.

The time periods are variable depending upon the temperature and the battery voltage. The target voltage of the battery varies between 14 volts and 15 volts depending upon the ambient temperature and the vehicle operating conditions. Once this target voltage has been achieved, providing the vehicle has been operating for at least the shortest time period, the ECM will reduce the voltage regulator to the minimum setting of 13.6 volts.

There are three wires connected to the generator from the ECM by connector EN16:

- EN49-1; RG wire, is the voltage regulator request setting from the ECM to the generator.
- EN49-3; OG wire, is a pulse width modulated signal (PWM) from the generator to the ECM which enables the ECM to monitor the generator load on the engine.
- EN49-4; U wire, is the charge warning lamp signal wire from the generator to the ECM.

If the voltage request signal wire (EN 49-1) is open circuit or short to battery positive, the generator will charge the battery at a setting of 15.3 volts. If the wire is short circuit to ground, the generator will charge the battery at a setting of 13.6 volts.

A fault in the wiring or the connections from the generator to the ECM, will cause a fault code to be generated and stored in the ECM and the charge warning indicator lamp to be displayed in the instrument cluster (IC) after a short time.

The charge warning indicator lamp is operated by the IC after receiving a signal from the ECM through the control area network (CAN).

With the ignition switch in the RUN position the charge warning indicator lamp will be displayed in the IC when the generator is not generating power.

If a fault is detected with the generator a fault code will be generated and stored by the ECM. The charge warning indicator lamp will also be displayed in the IC.

Units should be repaired as an assembly and not dismantled for repair.
For additional information, refer to: Generator - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (414-02 Generator and Regulator, Removal and Installation).

Vehicles with 2.0L and 2.2L diesel engine

The diesel charging system differs from that used in petrol-engined variants in that it incorporates a **'smartcharge'** function.

This function is capable of supplying infinitely variable voltages to the battery, depending on the temperature and on the current requirements of the battery.

The system continuously monitors the battery voltage and temperature (via the ambient air temperature sensor), and uses a map of both to deliver the optimum charge to the battery.

Another feature of this system is that it uses a 'wake-up' and 'sleep' strategy, initiated by the ignition switch position and ECM, rather than being constantly active, to avoid current drain.

Published: 14-Jul-2011

Battery and Charging System - General Information - Battery Care

Description and Operation

12V LEAD ACID BATTERY CARE MANUAL FOR DEALER / RETAILER USE

1. INTRODUCTION

This publication sets out, for the benefit of dealers / retailers worldwide, requirements for the care and maintenance of batteries, from the vehicles hand-over to the dealer / retailer to the handover to the customer or in the case of a spare part battery from is delivery to the dealer / retailer to its fitment to a customer vehicle.

It applies to all types of 12 volt Lead Acid Batteries used, whether they are conventional flooded technology or Absorbed Glass Mat (AGM) technology and also applies to both Primary and Secondary or Auxiliary Batteries.

The clearly laid out and illustrated sections guide dealers / retailers through each stage of the vehicles or spare parts receipt, storage, pre-delivery and customer hand-over. This publication can be used as a guide to the handling and care of batteries in service. It is vital to appreciate that unless each process is rigorously applied on all vehicles, the customer will receive a vehicle with a battery or a spare part battery which will not provide a satisfactory service life.

It is very important that all tests quoted throughout this publication are adhered to. If they are applied incorrectly batteries could be scrapped unnecessarily. Refer to the battery testing section for detailed information.

It is equally important therefore to note the following key points:

- Most new vehicles leave the factory with either a transit relay installed and/or have a transit mode programmed into the vehicle control modules. The transit relay must be removed and the transit mode disabled (where applicable) using an approved diagnostic system, **NOT MORE THAN 24 HOURS** before the customer takes delivery.
- 12 Volt Lead Acid Batteries rely on internal chemical processes to create a voltage and deliver current. These processes and the internal chemical structure of the battery can be damaged if the battery is allowed to discharge over a number of weeks / months, or is left in a discharged state for a lengthy time period. For this reason the battery must be tested / re-charged if necessary every month, and **MUST BE** re-charged after every three month period of storage. Refer to the vehicle storage manual and update the vehicle history sheet.
- Under no circumstances should the battery be disconnected with the engine running because under these conditions the alternator can give a very high output voltage. This high transient voltage will damage the electronic components in the vehicle. Loose or incomplete battery connections may also cause high transient voltage.
- On vehicles with conventional ignition keys, these must not be left in the ignition lock barrel when the transit relay has been removed, otherwise quiescent current will increase and the battery will discharge more rapidly.
- Two types of Lead acid batteries are used; standard Flooded type and AGM (Absorbed Glass Mat) or VRLA (Valve regulated Lead Acid) types. AGM batteries offer improved resistance to cycling as seen in stop start applications. AGM Batteries are fully sealed and cannot have the electrolyte level topped up.

Dealers and retailers involved in the storage, handling of vehicles and spare parts batteries have a responsibility to ensure that only vehicles and spare parts having a fully satisfactory battery may be processed further through the distribution selling chain.

• NOTE: It is very important that test processes quoted throughout this publication are adhered to.

If they are not adhered to correctly batteries could be scrapped unnecessarily or a battery with an issue remains in use. Refer to the battery testing section for detailed information.

2. GENERAL RULES FOR BATTERY CARE

Frequency of Battery Condition Checks.

Any battery in storage whether it is in a vehicle or in spare parts inventory must have its charge status checked every 30 days as described in Appendix A, and must be recharged every 90 days as described in the "Battery Charging and Maintenance" section of this manual.

Dealer Demonstration Vehicles

Due to the high depth of discharge a dealer demonstration vehicle battery may experience, batteries that are fitted to vehicles used as dealer demonstration vehicles must be connected to a power supply / charger capable of delivering 50 Amps or more whilst the vehicle is being demonstrated and the engine is not running. This will prevent the battery from being damaged from "energy throughput " wear out during a demonstration.

Software Reflash, SDD work or Ignition On related Workshop Activities.

Due to the high electrical current demand and high depth of Discharge that can occur during vehicle software re-flash activities, SDD work or ignition on related work in the workshop, vehicles that are undergoing such activities MUST have the electrical system on the vehicle

supported with a power supply / charger / vehicle maintainer capable of delivering 50 Amps or more.

Jump Starting New vehicles Before They Have Been Delivered to the Customer.

- It is the dealer / retailers responsibility to ensure the battery is not allowed to go flat by following the instructions and processes defined in this manual.
- However if circumstances dictate that a new vehicle must be jump started due to a flat battery whilst the vehicle is in the dealer / retailers care, the battery on this vehicle must be replaced with a new one prior to delivery to the customer at the dealer / retailers liability.
- The vehicle should also undergo investigation as to why the battery went flat.
- Do not connect the jump starting cable to the negative (-) terminal of the battery. Always connect to the recommended earthing point. As defined in the owners handbook or service documentation for that vehicle.

Jump Starting or Boost Charging Vehicles in Service

Do not connect the jump starting cable to the negative (-) terminal of the battery. Always connect to the recommended earthing point. As defined in the owners handbook or service documentation for that vehicle.

Charging AGM Batteries

AGM batteries must not be charged with voltages above 14.8 Volts. Doing so will damage them.

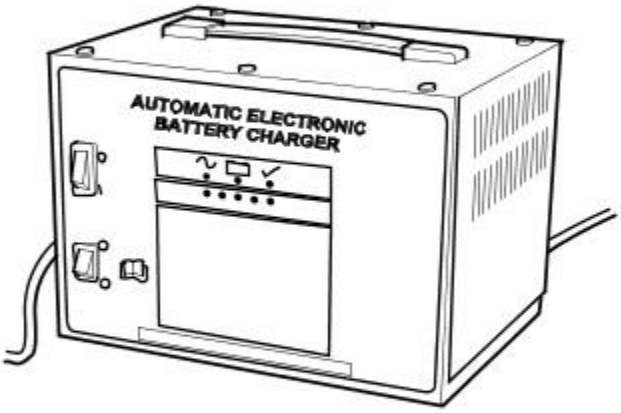
Testing AGM Batteries

Midtronics 393, 394, 493 and 494 testers are not capable of testing AGM batteries. Doing so can give an incorrect result.

When it is necessary to test an AGM battery use the Midtronics EXP1080 tester or the GR1 Diagnostics Charger.

3. EQUIPMENT (MINIMUM STANDARD) (pictures are for illustration only)

Traction Battery Charger (or similar stand-alone charger)



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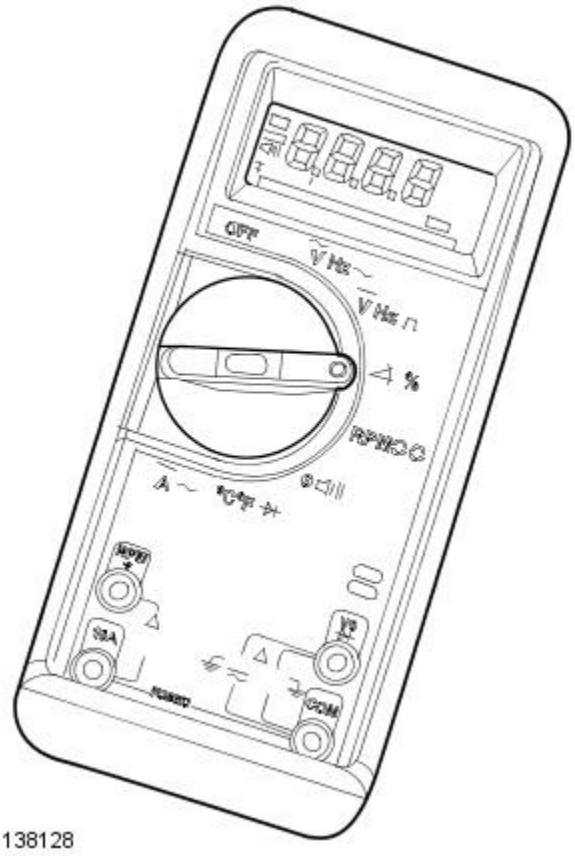
Midtronics EXP1080 Hand-Held Tester

Digital Multi-Meter or Digital Volt-Ohm Meter (DVOM)



Midtronics GR-1 Diagnostic Charger

E138129

4. HEALTH AND SAFETY PRECAUTIONS

• WARNINGS:

BATTERY CELLS CONTAIN SULPHURIC ACID AND EXPLOSIVE MIXTURES OF HYDROGEN AND OXYGEN GASES. IT IS THEREFORE ESSENTIAL THAT THE FOLLOWING SAFETY PRECAUTIONS ARE OBSERVED.

Batteries emit highly explosive hydrogen at all times, particularly during charging. To prevent any potential form of ignition occurring when working in the vicinity of a battery:

- Do not smoke when working near batteries.
- Avoid sparks, short circuits or other sources of ignition in the battery vicinity.
- Switch off current before making or breaking electrical connections.
- Ensure battery charging area is well ventilated.
- Ensure the charger is switched off when: a) connecting to a battery; b) disconnecting from the battery.
- Always disconnect the ground cable from the battery terminal first and reconnect it last.

Batteries contain poisonous and highly corrosive acid. To prevent personal injury, or damage to clothing or the vehicle, the following working practices should be followed when topping up, checking electrolyte specific gravity, removal, refitting or carrying batteries:

- Always wear suitable protective clothing (an apron or similar), safety glasses, a face mask and suitable gloves.
- If acid is spilled or splashed onto clothing or the body, it must be neutralized immediately and then rinsed with clean water. A solution of baking soda or household ammonia and water may be used as a neutralizer.
- In the event of contact with the skin, drench the affected area with water. In the case of contact with the eyes, bathe the affected area with cool clean water for approximately 15 minutes and seek urgent medical attention.
- If battery acid is spilled or splashed on any surface of a vehicle, it should be neutralized and rinsed with clean water.
- Heat is generated when acid is mixed with water. If it becomes necessary to prepare electrolyte of a desired specific gravity, SLOWLY pour the concentrated acid into water (not water into acid), adding small amounts of acid while stirring. Allow the electrolyte to cool if noticeable heat develops. With the exception of lead or lead-lined containers, always use non-metallic receptacles or funnels. Do not store acid in excessively warm locations or in direct sunlight.

Due to their hazardous contents, the disposal of batteries is strictly controlled. When a battery is scrapped, ensure it is disposed of safely, complying with local environmental regulations. If in doubt, contact your local authority for advice on disposal facilities.

5. DETERMINING BATTERY CONDITION

The tools used for determining the condition of the battery will depend upon whether it is installed in a vehicle or in spare parts inventory. Concerning an installed battery, procedures will vary if the vehicle is new, or already in service with a customer.

• NOTE: The term `New Vehicle' refers to a vehicle at any part of the delivery process from leaving the factory to arriving at a port of entry, dealership, retailer, including any storage facilities en route or a vehicle being stored prior to sale at dealership / retailer.

• NOTE: Midtronics 393, 394. 493 and 494 testers must not be used to test AGM batteries as these testers are not capable of correctly testing AGM batteries and can give an incorrect result. For AGM battery testing use the EXP1080 tester or the GR1 Diagnostics charger.

NEW VEHICLES

A Midtronics tester should be used to assess the condition of the battery for new vehicles. The test results should be recorded on the Storage History Sheet (see Vehicle Storage manual).

Scenario 1 - Dealership / Retailer (Responsibility: Dealer / Retailer)

1. Within 24 hours of arrival at the dealer / retailer proceed as follows:

- Perform a Midtronics battery test (See Appendix A.)
- Carry out the recommended actions accordingly.

2. If the Midtronics result is "Good Battery" the vehicle may be stored.

- For all new vehicles in storage the transit relay MUST be fitted, or the Transit Mode enabled where used. For vehicles without a transit relay or a Transit Mode, the battery negative cable MUST BE DISCONNECTED from the battery.

3. The battery must be tested and/or re-charged every month and MUST be re-charged after every three month period.

4. Record your test results on the Storage History Sheet (see Vehicle Storage Manual) to indicate when a re-charge will be necessary.

Scenario 2 - Delivery to the Customer (Responsibility: Dealer / Retailer)

• NOTE: It is essential that the following actions are conducted in the 24 hours prior to the agreed hand over time:

1. Perform a Midtronics Battery test (See Appendix A).

2. Carry out the recommended actions accordingly.

3. The vehicle should only be released to the customer if Midtronics has tested the battery as "Good Battery"

Spare Part Batteries

Lead acid batteries will, as a result of natural chemical processes, slowly self discharge themselves over a period of time (even when open circuit and no electrical load applied).

In the case of spare parts batteries, a Midtronics tester should be used to assess the condition of new spare parts batteries.

The batteries must be stored such that they cannot get wet and are not in direct sunlight.

Any batteries which are dropped must be scrapped. This applies even if no external damage is apparent.

Scenario 1 - Spare Part Batteries Within Dealer Stock But Not Yet Fitted To A Vehicle (Responsibility: Dealer / Retailer)

1. For a battery in the Dealer parts or in ready to use stock but not yet fitted to a vehicle the following rules must be followed:

- Check the battery condition on receipt by performing a Midtronics battery test (See Appendix A).
- Batteries should only be returned to storage if the Midtronics tester indicates "Good Battery".
- The battery condition should be rechecked every 30 days by performing a Midtronics battery test (See Appendix A).
- If required batteries should be recharged as described in the "Battery Charging and Maintenance" section of this manual.

2. 2 All batteries must be controlled via a FIFO (First In First Out) process to ensure aged batteries are not held and the batteries are not allowed to age unnecessarily.

VEHICLES IN SERVICE

The Midtronics hand-held tester or the Midtronics Diagnostic Charger are the preferred tools to assess battery condition for vehicles in service. The test results should be recorded on the In-Service Battery Report Form (See Appendix B).

Midtronics Testing - In-Service Testing Only

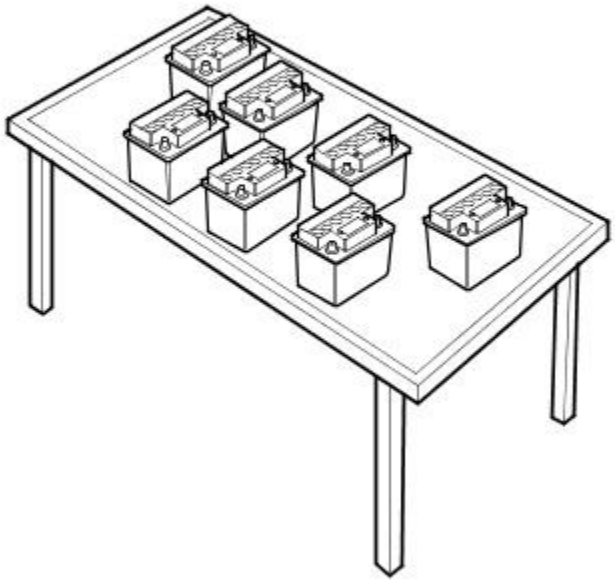
• NOTE: The battery surface charge must be removed before this test in accordance with the procedure in Appendix A. Ensure that the battery terminal connectors are clean. When connecting the Midtronics testing equipment, connect the RED clip to the positive (+) battery terminal first, and then connect the BLACK clip to the negative (-) battery terminal. Rock the clips backward and forward to ensure a good connection to the battery.

1. Perform a Midtronics battery test (See Appendix A).

2. Carry out the recommended actions accordingly.

6. BATTERY CHARGING AND MAINTENANCE

BATTERY CHARGING



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It is essential that a suitably ventilated defined area exists in each dealership / retailer for battery charging. Likewise, an area should be allotted for scrap batteries, and clearly indicated as such. It is recommended that dealers / retailers always have fully charged batteries ready for use. However the battery MUST BE tested and charged if necessary every month, and charged after three months irrespective of any test.

• CAUTIONS:

Batteries must be re-charged after a maximum of 3 months storage (see Storage History sheet in the New Vehicle Storage Manual).

It is very important that when charging batteries using the traction charger or other stand-alone chargers that the charger is set for the correct type of battery before charging commences. If the wrong switch is selected the result would be a battery that is not charged fully and / or overheating can occur. Follow the manufacturers operating instructions.

Do not charge AGM batteries with voltages over 14.8 volts as this will damage the battery.

To bring a serviceable but discharged battery back to a fully charged condition proceed as follows:

- Check and if necessary top-up the battery electrolyte level.
- Charge the battery using the Midtronics Diagnostic Charger (USA) or Traction Charger (all other markets) following the manufacturers operating instructions.

• NOTE: When using the Midtronics Diagnostic Charger, automatic mode must always be used. After charging and analysis, the charger may display 'Top-Off Charging', press STOP to end. Do not stop charging until the current falls to 5A or less, otherwise the battery will not be fully charged.

POST-CHARGE TEST METHODS

New Batteries, Batteries in Storage and In-Service Batteries

The purpose of this test is to ensure that the charging process has fully charged the battery.

• NOTE: IT IS RECOMMENDED THAT THIS TEST IS CONDUCTED AT LEAST 24 HOURS AFTER THE CHARGE CYCLE IS COMPLETED.

CAUTION: DO NOT connect the tester to any other circuit or chassis point.

1. Attach the Midtronics Tester to the battery.

2. Follow the instructions on the tester to test the battery. Ensure the correct battery type and size is selected.

3. Perform the action based on the tester results (see the tester results chart in the Vehicles in Service sub -section of Determining Battery Condition Section).

4. Enter the readings and test code obtained on the In Service Battery Report Form.

• NOTE: Midtronics 393, 394. 493 and 494 testers must not be used to test AGM batteries as these testers are not capable of correctly testing AGM batteries and can give an incorrect result. For AGM battery testing use the EXP1080 tester or the GR1 Diagnostics charger.

BATTERY REPLACEMENT

If it is determined that a battery requires replacement, always refer to the appropriate section of the workshop manual for instructions on removing and installing the battery from the vehicle.

On in service vehicles fitted with a Battery Monitoring System (BMS), the BMS module must be reset following the installation of a new battery. The BMS module reset procedure must be performed using an approved diagnostic system.

CHECK / TOP-UP BATTERY ELECTROLYTE – Only Applicable to certain Flooded Types of Battery.

• WARNINGS:

AGM TECHNOLOGY BATTERIES ARE FULLY SEALED FOR LIFE AND NO ATTEMPT SHOULD BE MADE TO CHECK OR TOP UP THE ELECTROLYTE LEVEL.

BEFORE CHECKING AND TOPPING-UP THE BATTERY ELECTROLYTE, REFER TO THE HEALTH AND SAFETY PRECAUTIONS SECTION.

Check to ensure the battery is of a type suitable for topping up. These types of batteries will have cell plugs visible on the top face of the battery or a removable access panel to allow access to the cells.

On batteries with a clear or opaque case and level marks, check the electrolyte level by visual inspection of the maximum level indicator mark on the battery casing indicating adequate level above the battery separators.

On batteries with black cases, remove the cell plugs or access panel and ensure the electrolyte level is level with the indicator in the cell hole. A flashlight may be required to see the electrolyte level on this type of battery.

CAUTION: **DO NOT** overfill.

If the electrolyte level is low, top-up using distilled water.

Maintenance free and Valve Regulated (AGM) batteries are sealed and therefore cannot be topped up.

CHARGING SYSTEM TEST AND DIAGNOSIS

For all vehicles, refer to the Charging System - Diagnosis and Testing in section 414-00 of the Workshop Manual.

VEHICLE QUIESCENT CURRENT TESTING

• NOTE: On vehicles fitted with a Battery Monitoring System (BMS), the diagnostic routine for quiescent drain testing in the approved diagnostic system should be utilized.

• NOTE: If a customer complains of a vehicle battery that discharges continuously or when left for a prolonged period of time, it is recommended that a quiescent drain test is performed as described below.

• NOTE: The battery drain should be measured using an approved diagnostic system or a Digital Multi-Meter (DVOM).

The vehicle should be in the locked/armed state (for example vehicle alarm fully armed), all doors, engine and luggage compartment lids are open and latched (so as to appear closed from an electrical point of view). The test should take place after the vehicle has entered shutdown mode. The time taken for this to occur after the ignition is switched off varies according to model - Refer to Quiescent Drain in section 414-00 of the Workshop Manual.

• NOTE: When the vehicle is armed, the effect of the security system Light Emitting Diode (LED) flashing is to cause a pulsation in the measured current drain. In this case, either the average current should be taken (using a Digital Multi- Meter (DVOM) with an averaging system) or the current reading taken, ignoring the brief high current peaks.

EQUIPMENT

Approved diagnostic system with current probe or Digital Multi-Meter (DVOM) with current probe.

METHOD OF MEASUREMENT

Using an Approved Diagnostic System

1. Switch off all electrical loads and ensure that the ignition is off.

2. Connect the current probe to the approved diagnostic system.

3. Calibrate the probe.

4. Install a clamp around the battery lead/junction box lead.

5. Go to the Quiescent Current Testing section.

Using a Digital Multi-Meter (DVOM)

• NOTE: Do not use an in-line DVOM to measure the quiescent drain on vehicles fitted with an electronic throttle. The current exceeds the maximum amount the fuse in the DVOM is capable of handling.

1. Switch off all electrical loads and ensure that the ignition is off.

2. Connect the current probe to the DVOM.

3. Calibrate the probe.

4. Install a clamp around the battery lead/junction box lead.

5. Go to the following Quiescent Current Testing section.

QUIESCENT CURRENT TESTING

1. Switch ignition to ‘on’ or select ignition mode in keyless vehicles and switch to ‘off’ (do not crank).

2. Remove key from ignition switch (where applicable).

3. Open and latch all doors, hood and luggage compartment lid.

4. Lock the vehicle using the remote function on the remote handset. (Single lock only to avoid volumetric alarm arming).

5. Remove any other potential electrical drains such as accessories plugged into accessory sockets.

6. Record the amperage readings after the shutdown period. The model specific Amperage readings for quiescent drain are referenced in Quiescent Drain in section 414-00 of the Workshop Manual

7. Record the final reading on the battery report form Appendix B.

• NOTE: The preferred method of testing following an excessive current consumption figure is to use a current probe around individual junction box leads to the various suspected circuits to identify a potential cause. This is in preference to the old method of removing fuses for the following reasons:

- Many modules take a considerable time to power down. Each time a fuse is removed and re-fitted, the quiescent drain current may take an extended period of time to return to normal (typically up to 45 minutes).
- The drain may be caused by a module remaining active and preventing the quiescent drain from reducing to normal levels.
- The drain may be caused by a relay winding that is activated. Pulling the fuse can allow this to ‘reset’ and the drain will be lost and go un-diagnosed.

APPENDIX A BATTERY TEST PROCESS

It is recommended that this test is conducted at least 24 hours after the vehicle engine has been run or the battery charged to avoid the need of surface charge removal or if this time constraint is unacceptable due to circumstances, then conduct the charge strip removal process.

Part 1 - Surface Charge Removal

• NOTE: Before carrying out a battery test you must ensure that there is no battery surface charge present.

• NOTE: The battery may be tested either on a bench or on the vehicle.

- In the case of on-vehicle testing, the battery must be isolated from the vehicle by removal of the battery negative (-) cable from the battery terminal before the measurement is taken unless the vehicle has a transit relay fitted or is in transit mode.

A vehicle which has had its battery charged or been driven in a 24 hour period before the test, must have its surface charge removed using one of the following methods:

1. If 24 hours have passed since the last time the engine was run or the battery charged, proceed to `Part 2 - Battery Test'.

2. Turn on the ignition. Switch on the headlamps on high beam for a minimum 3 minutes.

3. Switch off the headlamps. For vehicles tested after the transit relay has been removed, disconnect the battery by removal of the negative (-) cable. Vehicles with a transit relay fitted or with a low current transport mode enabled do not need to have the battery disconnected.

4. Wait a maximum of 5 minutes before recording test results for any battery measurements.

Part 2 - Battery Test

• NOTE: The battery surface charge must be removed before this test in accordance with the procedure in Part 1 above. Ensure that the battery terminal connectors are clean. When connecting the Midtronics testing equipment, connect the RED clip to the positive (+) battery terminal first, and then connect the BLACK clip to the negative (-) battery terminal. Rock the clips backward and forward to ensure a good connection to the battery.

• NOTE: Midtronics 393, 394. 493 and 494 testers must not be used to test AGM batteries as these testers are not capable of correctly testing AGM batteries and can give an incorrect result. For AGM battery testing use the EXP1080 tester or the GR1 Diagnostics charger.

 CAUTION: **DO NOT** connect the tester to any other circuit or chassis point other than the battery negative terminal.

1. Attach the Midtronics tester to the battery.

2. Follow the instructions on the tester to test the battery. Ensure the correct battery type and size is selected.

3. Perform the action based on the tester results (see table below).

4. Enter the readings and test code obtained on the Battery Report Form (Appendix B) or equivalent which records as a minimum the technician's name, Vehicle Identification Number (VIN), Date of check, Midtronics code and Battery Voltage from the Midtronics tester.

At the end of the test, the battery negative (-) cable should be re-attached to the battery terminal.

TESTER RESULTS	ACTION
GOOD BATTERY	Return to service.
GOOD RE-CHARGE	Fully charge battery and return to service.
CHARGE AND RE-TEST	Fully charge battery. Remove surface charge. Re-test battery. If same result replace battery.
REPLACE BATTERY OR BAD CELL BATTERY	Verify surface charge removed. Disconnect battery from vehicle and re-test. If result repeats after surface charge removal, replace battery. **DO NOT RECHARGE**.
UNABLE TO DO TEST	Disconnect battery from vehicle and re-test.

APPENDIX B : BATTERY REPORT FORM - IN SERVICE BATTERIES ONLY

• NOTE: Fields marked with * are mandatory and must be completed.

General Information	YES / NO		YES / NO	
Customer Name:		Dealer/Retailer Code:	*	
Repair Order Number:	*	Battery Date Code:	*	
Repair Order Date:	*	Number of Times Battery Charged:	*	
Repair Order Date:		Technicians Name:	*	
Vehicle Identification Number (VIN):	*	Technicians Signature:	*	
Give a detailed description of the symptoms experienced by the customer (attach a separate sheet if necessary)				
-				
-				
-				
-				
-				
-				
Diagnostics (Battery Testing)				
1: Loose battery clamps	Yes	*	No	*
2: Loose hold down clamps	Yes		No	
3: Corroded terminal posts	Yes	*	No	*
4: Physical damage/leaks	Yes		No	
5: Low electrolyte	Yes	*	No	*
6: FEAD belt tension	OK	*	Not OK	*
7: Surface charge removed	Yes	*	No	*
8: Voltage (appendix A)	Yes	*	No	*
9: Quiescent Drain	mA	*		
10: Vent tube correctly installed	Yes		No	
11: Midtronics test				
Code before charging	*			
If Midtronics indicates that the battery needs re-charging, charge the battery for 24 hours				
Code after charge	*			
Result after charge	*			
If "good and re-charge" charge the battery for an additional 24 hours.				
If "charge and re-test" for both before and after 24 hours charge renew the battery				
Only renew the battery if "renew battery", "bad cell" or charge and re-test has been displayed twice.				
Comments				
-				
-				
-				
-				
-				

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Battery and Charging System - General Information - Quiescent Drain

Description and Operation

QUIESCENT DRAIN - TYPICAL VALUES

• NOTE: The quiescent drain after the initial shutdown period should not exceed the value shown in the table.

Jaguar Quiescent Drain Values

MODEL	SHUT DOWN PERIOD (minutes)	TYPICAL VALUES BATTERY DRAIN (mA)
XJS 3.2	60	< 30
Sovereign 3.2	60	< 37.3
XJ6 4.0	60	< 38.6
XJS	60	< 43.9
XJ6 (X300) (1995MY)	60	< 43
XJ8 (X300)	60	< 30
XK8 (X100)	60	< 30
S-Type (X200)	60	< 30
X-Type (X400)	30	< 30
XJ6 (X350)	40	< 30
XJ8 (X350)	40	< 30
XK (X150)	3 (after lock/arm condition) [2]	< 30
	33 (unlocked)	< 30
XF (X250)	3 (after lock/arm condition) [2]	< 30
	33 (unlocked)	< 30
XJ (X351)	3 (afterlock/arm condition) [2]	< 30
	33 (unlocked)	< 30

• NOTE:

1. The total current drain will be higher if certain approved accessories are fitted (for example: tracker, trailer module, etc.)

2. Applies to vehicles without Tire Pressure Monitoring System (TPMS). Vehicle shut-down period with TPMS is approximately 15 minutes.

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Battery and Charging System - General Information - Charging System2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27

Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern by operating the system.
2. **2.** Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

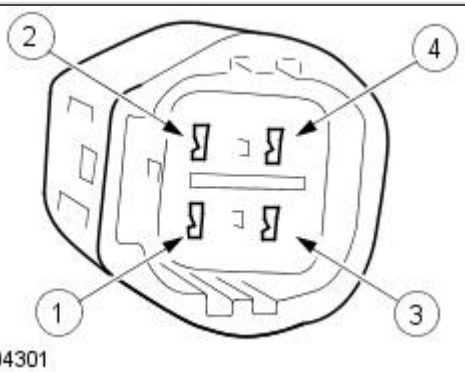
Mechanical	Electrical
• Drive belt • Drive belt tensioner • Generator • Generator pulley (vehicles fitted with manual transmission)	• Battery • Generator • Fuse • Circuit • Wiring harness for damage or corrosion • Electrical connectors • Warning lamp operation

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 Jaguar Approved Diagnostic System.

Symptom chart

Charging system faults/codes and related causes

Symptom	Possible Sources	Action
DTC P1146 Low input from the Engine control module (ECM) on the voltage regulator request signal wire	* Circuit. * Generator. * ECM.	* GO to Pinpoint Test B.
DTC P1244 Generator overcharging	* Generator. * Circuit. * Battery.	* GO to Pinpoint Test C.
DTC P1629 Generator load monitoring signal failure	* Circuit. * Generator. * ECM.	* GO to Pinpoint Test D.
DTC P1632 Charging system failure	* Fuse 82 (20A). * Circuit. * Generator. * Battery. * ECM.	* GO to Pinpoint Test A.
The charging system warning indicator is on, intermittent or flickers with the engine running	* Accessory drive belt. * Fuse 82 (20A). * Circuit. * Generator. * Generator pulley (vehicles fitted with manual transmission). * Battery. * ECM. * Instrument cluster (IC). * Control area network (CAN).	* CHECK the accessory drive belt tension. For additional information, refer to Section 303-05 Accessory Drive . * GO to Pinpoint Test A.
Generator not charging, battery keeps going flat	* Accessory drive belt. * Fuse 82 (20A). * Circuit. * Generator. * Generator pulley (vehicles fitted with manual transmission). * Battery.	* CHECK drive belt tension. For additional information, refer to Section 303-05 Accessory Drive . * GO to Pinpoint Test A.
Generator noisy	* Accessory drive belt. * Accessory drive belt tensioner. * Generator pulley (vehicles fitted with manual transmission).	* CHECK the accessory drive belt and tensioner. For additional information, refer to Section 303-05 Accessory Drive . * GO to Pinpoint Test G.
Radio interference	* Circuit. * Generator.	* GO to Pinpoint Test H.

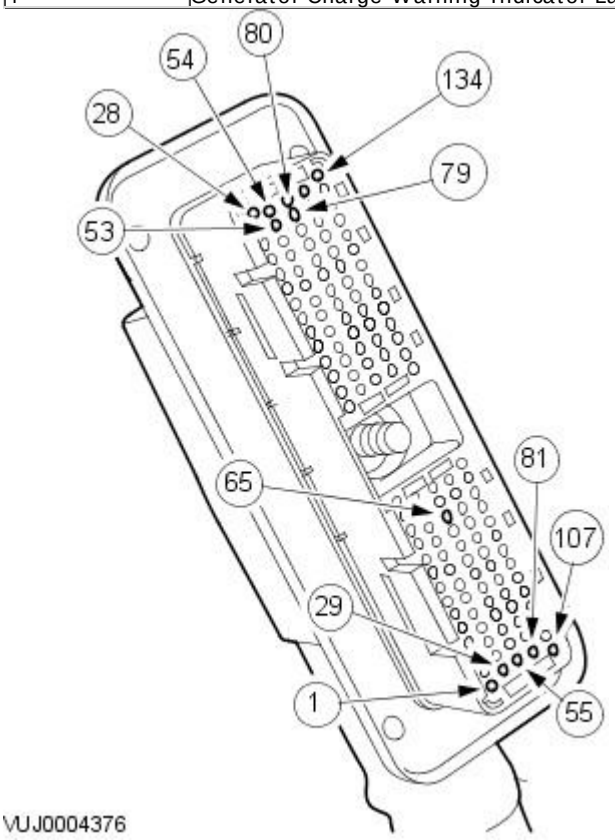


VUJ0004301

Generator Electrical Connector (EN49, Harness Side)

Pin Number	Circuit Function	Circuit Color
1	Voltage Request Input Signal from ECM	Red/Green
2	Power Supply (12 volts) from Fuse 82 of the Passenger Compartment Fuse Box	Green/Red
3	PWM Output Signal to ECM	Orange/Green

Pin Number	Circuit Function	Circuit Color
4	Generator Charge Warning Indicator Lamp Output Signal to ECM	Blue



Engine Control Module (ECM) Electrical Connector (EN16, Harness Side)

Pin Number	Circuit Function	Circuit Color
53	Voltage Request Output Signal to Generator	Red/Green
65	PWM Input Signal from Generator	Orange/Green
79	Generator Charge Warning Indicator Lamp Input Signal from Generator	Blue

PINPOINT TEST A : LOW INPUT ON THE VOLTAGE REGULATOR REQUEST SIGNAL WIRE FROM THE ECM (P1146)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE VOLTAGE REGULATOR REQUEST SIGNAL WIRE FOR A SHORT TO GROUND	
	1 Disconnect the ECM electrical connector EN16 and the generator electrical connector EN49.
	2 Measure the resistance between electrical connector EN49-1 and ground.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the generator and the ECM. CLEAR the DTC. TEST the system for normal operation. **No** GO to A2. .
A2: CHECK THE VOLTAGE REGULATOR REQUEST SIGNAL WIRE FOR OPEN CIRCUIT	
	1 Measure the resistance between electrical connector EN49-1 and the ECM electrical connector EN16-53.
	Is the resistance less than 5 ohms? **Yes** REPAIR the circuit from the ECM to the generator. CLEAR the DTC. TEST the system for normal operation. **No** GO to A3. .
A3: CHECK THE OPERATION OF THE GENERATOR CHARGE WARNING INDICATOR LAMP	
	1 Connect the ECM electrical connector EN16 and the generator electrical connector EN49.
	2 Clear the DTC. START and RUN the engine at 1500 RPM with no electrical load applied.
	Does the generator charge warning indicator lamp illuminate within 30 seconds of the engine being started? **Yes** INSTALL a new generator. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, refer to Section 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls . **No** GO to A4. .
A4: CHECK THE OPERATION OF THE GENERATOR CHARGE WARNING INDICATOR LAMP AFTER 15 MINUTES	
	1 RUN the engine at idle for 15 minutes and then increase the engine speed to 1500 RPM for one minute with no electrical load applied.
	Does the generator charge warning indicator lamp illuminate or is the DTC repeated? **Yes** INSTALL a new generator. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, refer to Section 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls . **No** DIAGNOSE the ECM. For additional information, refer to Section 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls .

PINPOINT TEST B : GENERATOR OVERCHARGING (P1244)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE VOLTAGE REGULATOR REQUEST SIGNAL WIRE FOR A SHORT TO BATTERY POSITIVE	
	1 Disconnect the ECM electrical connector EN16 and the generator electrical connector EN49.

	2 Measure the resistance between electrical connector EN49-1 and the generator battery positive cable.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to the generator battery positive cable. CLEAR the DTC. TEST the system for normal operation. **No** GO to B2. .
B2: CHECK THE VOLTAGE REGULATOR REQUEST SIGNAL WIRE FOR OPEN CIRCUIT	
	1 Measure the resistance between electrical connector EN49-1 and the ECM electrical connector EN16-53.
	Is the resistance less than 5 ohms? **Yes** REPAIR the circuit from the ECM to the generator. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new generator. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, refer to Section 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls .

PINPOINT TEST C : CHARGING SYSTEM FAILURE (P1632)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE BATTERY VOLTAGE WITH THE ENGINE RUNNING AND NO ELECTRICAL LOADS APPLIED	
	1 START and RUN the engine at 1500 RPM with no electrical load applied.
	2 Measure the battery voltage.
	Is the voltage less than 14.5 volts? **Yes** GO to C2. . **No** INSTALL a fully charged battery.GO to C4. .
C2: CHECK CONTINUITY OF THE VOLTAGE REGULATOR REQUEST SIGNAL WIRE	
	1 Disconnect the ECM electrical connector EN16 and the generator electrical connector EN49.
	2 Measure the resistance between electrical connector EN49-1 and the ECM electrical connector EN16-53.
	Is the resistance less than 5 ohms? **Yes** REPAIR the circuit from the ECM to the generator. Clear the DTC. TEST the system for normal operation. **No** GO to C3. .
C3: CHECK THE VOLTAGE REGULATOR REQUEST SIGNAL WIRE FOR A SHORT GROUND	
	1 Measure the resistance between electrical connector EN49-1 and the ECM electrical connector EN16-53.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the circuit from the ECM to the generator. Clear the DTC. TEST the system for normal operation. **No** INSTALL a new generator. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, refer to Section 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls .
C4: CHECK THE GENERATOR CHARGE WARNING INDICATOR LAMP AND COOLING FAN OPERATION WITH THE ENGINE RUNNING AT IDLE SPEED	
	1 START and RUN the engine at idle speed for 15 minutes with no electrical load applied.
	Is the generator charge warning indicator lamp illuminated and the cooling fans operating at maximum speed? **Yes** GO to C6. . **No** GO to C5. .
C5: CHECK THE GENERATOR CHARGE WARNING INDICATOR LAMP AND COOLING FAN OPERATION WITH THE ENGINE RUNNING FOR A FURTHER MINUTE AT 1500 RPM.	
	1 Increase the engine speed to 1500 RPM for one minute with no electrical load applied.
	Is the generator charge warning indicator lamp illuminated? **Yes** INSTALL a new generator. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, refer to Section 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls . **No** INSTALL a fully charged slave battery. CLEAR the DTC. TEST the system for normal operation.
C6: CHECK FOR A SHORT TO BATTERY POSITIVE CABLE	
	1 Disconnect the ECM electrical connector EN16 and the generator electrical connector EN49.
	2 Measure the resistance between electrical connector EN49-1 and the generator battery positive cable.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the circuit from the ECM to the generator. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new generator. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, refer to Section 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls .

PINPOINT TEST D : GENERATOR LOAD MONITORING SIGNAL FAILURE (P1629)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE SIGNAL WIRE FOR OPEN CIRCUIT	
	1 Disconnect the ECM electrical connector EN16 and the generator electrical connector EN49.
	2 Measure the resistance between electrical connector EN49-3 and the ECM electrical connector EN16-65.
	Is the resistance less than 5 ohms? **Yes** GO to D2. . **No** REPAIR the circuit from the ECM to the generator. CLEAR the DTC. TEST the system for normal operation.
D2: CHECK THE SIGNAL WIRE FOR A SHORT TO BATTERY POSITIVE	
	1 Measure the resistance between electrical connector EN49-3 and the generator battery positive cable.

	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to the generator battery positive cable. CLEAR the DTC. TEST the system for normal operation. **No** GO to D3. .
D3: CHECK THE SIGNAL WIRE FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector EN49-3 and ground.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the circuit from the ECM to the generator. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new generator. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, refer to Section 303-14A Electronic Engine ControlsSection 303-14B Electronic Engine Controls .

PINPOINT TEST E : THE GENERATOR CHARGE WARNING INDICATOR LAMP IS ON WITH THE ENGINE RUNNING	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK THE BATTERY VOLTAGE	
	1 Measure the battery voltage.
	Is the voltage less than 12 volts? **Yes** Charge the battery.GO to E2. . **No** GO to E3. .
E2: CHECK THE BATTERY	
	1 Carry out a Battery Condition Test.
	Is the battery OK? **Yes** GO to E3. . **No** INSTALL a new battery. TEST the system for normal operation.
E3: CHECK THE BATTERY VOLTAGE WITH THE ENGINE RUNNING AND NO ELECTRICAL LOADS APPLIED	
	1 START and RUN the engine at 1500 RPM. Measure the battery voltage.
	Is the voltage less than 13 volts? **Yes** For vehicles fitted with manual transmissionGO to E4. . For vehicles fitted with automatic transmissionGO to E5. . **No** GO to E11. .
E4: CHECK THE GENERATOR DRIVE PULLEY (VEHICLES FITTED WITH MANUAL TRANSMISSION)	
	1 REMOVE the accessory drive belt. For additional information, refer to Section 303-05 Accessory Drive . 2 ROTATE the generator pulley by hand.
	Does the alternator rotor shaft rotate with the pulley? **Yes** GO to E5. . **No** INSTALL a new generator. TEST the system for normal operation.
E5: CHECK THE GENERATOR OUTPUT VOLTAGE AT THE GENERATOR BATTERY POSITIVE CABLE TERMINAL, WITH THE ENGINE RUNNING AND NO ELECTRICAL LOADS APPLIED	
	1 START and RUN the engine at 1500 RPM. Measure the voltage between the generator battery positive cable electrical connector; ST4 and ground.
	Is the voltage less than 13 volts? **Yes** GO to E6. . **No** REPAIR the permanent live supply circuit from the battery to the generator. TEST the system for normal operation.
E6: CHECK THE GENERATOR GROUND CIRCUIT	
	1 Measure the resistance between the generator casing and the battery ground terminal.
	Is the resistance less than 5 ohms? **Yes** GO to E7. . **No** REPAIR the ground circuit between the generator and the battery ground terminal. TEST the system for normal operation.
E7: CHECK IGNITION SUPPLY VOLTAGE TO THE GENERATOR	
	1 Turn the ignition switch to the RUN position. Measure the voltage between the generator ignition supply terminal, EN49-2 and ground.
	Is the voltage less than 10 volts? **Yes** GO to E8. . **No** INSTALL a new generator. TEST the system for normal operation.
E8: CHECK FUSE 82 IN THE PASSENGER COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to E9. . **No** GO to E10. .
E9: CHECK FOR IGNITION SUPPLY VOLTAGE AT FUSE 82 OF THE PASSENGER COMPARTMENT FUSE BOX	
	1 Turn the ignition switch to the RUN position. Measure the voltage between the passenger compartment fuse box; JB51-14 and ground.
	Is the voltage less than 10 volts? **Yes** REPAIR the circuit between the passenger compartment fuse box and the ignition relay. TEST the system for normal operation. **No** REPAIR the circuit between the passenger compartment fuse box and the generator. TEST the system for normal

	operation.
E10: CHECK FUSE 82 OF THE PASSENGER COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB51-14 of the passenger compartment fuse box and ground.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the passenger compartment fuse box and the generator. INSTALL a new fuse. TEST the system for normal operation. **No** INSTALL a new fuse. TEST the system for normal operation.
E11: CHECK THE CONTINUITY OF THE GENERATOR CHARGE WARNING INDICATOR LAMP SIGNAL WIRE	
	1 Disconnect the ECM electrical connector; EN16 and the generator electrical connector; EN49.
	2 Measure the resistance between EN49-4 and EN1-79.
	Is the resistance less than 5 ohms? **Yes** Refer to the approved Jaguar diagnostic system. **No** REPAIR the circuit from the ECM to the generator. TEST the system for normal operation.

PINPOINT TEST F : GENERATOR NOT CHARGING — BATTERY KEEPS GOING FLAT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK THE CHARGE WARNING LAMP IS ILLUMINATED WITH THE ENGINE RUNNING	
	1 START and RUN the engine at 1500 RPM. INSPECT the generator charge warning indicator lamp.
	Is the warning lamp illuminated? **Yes** GO to F2. . **No** GO to F4. .
F2: CHECK THE BATTERY VOLTAGE WITH IGNITION OFF AND NO ELECTRICAL LOADS APPLIED	
	1 Measure the battery voltage.
	Is the voltage less than 12 volts? **Yes** Charge the battery.GO to F3. . **No** GO to F4. .
F3: CHECK THE BATTERY	
	1 Carry out a Battery Condition Test.
	Is the battery OK? **Yes** GO to F4. . **No** INSTALL a new battery. TEST the system for normal operation.
F4: CHECK THE BATTERY VOLTAGE WITH THE ENGINE RUNNING AND NO ELECTRICAL LOADS APPLIED	
	1 START and RUN the engine at 1500 RPM. Measure the battery voltage.
	Is the voltage less than 13 volts? **Yes** For vehicles fitted with manual transmissionGO to F5. . For vehicles fitted with automatic transmissionGO to F6. . **No** GO to F10. .
F5: CHECK THE GENERATOR DRIVE PULLEY (VEHICLES FITTED WITH MANUAL TRANSMISSION)	
	1 REMOVE the accessory drive belt. For additional information, refer to Section 303-05 Accessory Drive .
	2 ROTATE the generator pulley by hand.
	Does the alternator rotor shaft rotate with the pulley? **Yes** GO to F6. . **No** INSTALL a new generator. TEST the system for normal operation.
F6: CHECK THE GENERATOR OUTPUT VOLTAGE AT THE GENERATOR MAIN TERMINAL WITH THE ENGINE RUNNING AND NO ELECTRICAL LOADS APPLIED	
	1 START and RUN the engine at 1500 RPM. Measure the voltage between the generator main output electrical connector; ST4 and ground.
	Is the voltage less than 13 volts? **Yes** GO to F7. . **No** REPAIR the permanent live supply circuit from the battery to the generator. TEST the system for normal operation.
F7: CHECK FUSE 82 IN THE PASSENGER COMPARTMENT FUSE BOX	
	1 Check the fuse.
	Is the fuse OK? **Yes** GO to F9. . **No** GO to F8. .
F8: CHECK FUSE 82 OF THE PASSENGER COMPARTMENT FUSE BOX FOR A SHORT TO GROUND	
	1 Measure the resistance between electrical connector JB51-14 of the passenger compartment fuse box and ground.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR short to ground between the passenger compartment fuse box and the generator. INSTALL a new fuse. TEST the system for normal operation. **No** INSTALL a new fuse. TEST the system for normal operation.
F9: CHECK FOR IGNITION SUPPLY VOLTAGE AT FUSE 82 OF THE PASSENGER COMPARTMENT FUSE BOX	
	1 Turn the ignition switch to the RUN position. Measure the voltage between the passenger compartment fuse box; JB51-14 and ground.

	Is the voltage less than 10 volts? **Yes** REPAIR the circuit between the passenger compartment fuse box and the ignition relay. TEST the system for normal operation. **No** REPAIR the circuit between the passenger compartment fuse box and the generator. TEST the system for normal operation.
F10: CHECK THE CONTINUITY OF THE GENERATOR CHARGE WARNING INDICATOR LAMP SIGNAL WIRE	
	1 Disconnect the ECM electrical connector EN16 and the generator electrical connector EN49.
	2 Measure the resistance between EN49-4 and EN1-79.
	Is the resistance less than 5 ohms? **Yes** Refer to the approved Jaguar diagnostic system. **No** REPAIR the circuit from the ECM to the generator. TEST the system for normal operation.

PINPOINT TEST G : GENERATOR NOISY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: CHECK GENERATOR FOR SECURITY	
	1 INSPECT the generator fixings.
	Is the generator loose? **Yes** TIGHTEN generator fixings. TEST the system for normal operation. **No** GO to G2. .
G2: CHECK THE ACCESSORY DRIVE BELT	
	1 REMOVE and INSPECT the accessory drive belt. For additional information, refer to Section 303-05 Accessory Drive .
	Is the accessory drive belt OK? **Yes** GO to G3. . **No** INSTALL a new accessory drive belt. TEST the system for normal operation.
G3: CHECK THE ACCESSORY DRIVE BELT TENSIONER	
	1 REMOVE and INSPECT the accessory drive belt tensioner. For additional information, refer to Section 303-05 Accessory Drive .
	Is the accessory drive belt tensioner OK? **Yes** GO to G4. . **No** INSTALL a new accessory drive belt tensioner. For additional information, refer to Section 303-05 Accessory Drive . TEST the system for normal operation.
G4: CHECK GENERATOR FOR MECHANICAL NOISE	
	1 ROTATE the generator pulley by hand.
	Does the generator rotor shaft rotate smoothly? **Yes** For vehicles fitted with manual transmissionGO to G5. . For vehicles fitted with automatic transmissionGO to G6. . **No** INSTALL a new generator. TEST the system for normal operation.
G5: CHECK GENERATOR DRIVE PULLEY (VEHICLES FITTED WITH MANUAL TRANSMISSION)	
	1 ROTATE the generator pulley quickly by hand.
	2 Stop the generator pulley from spinning by holding the pulley.
	Does the generator rotor shaft continue to rotate? **Yes** GO to G6. . **No** INSTALL a new generator. TEST the system for normal operation.
G6: CHECK THE ACCESSORY DRIVE BELT IDLER PULLEYS	
	1 ROTATE the accessory drive belt idler pulleys by hand.
	Do the accessory drive belt idler pulleys rotate smoothly? **Yes** GO to G7. . **No** INSTALL new accessory drive belt pulleys as necessary. TEST the system for normal operation.
G7: CHECK GENERATOR FOR ELECTRICAL NOISE	
	1 INSTALL the accessory drive belt. For additional information, refer to Section 303-05 Accessory Drive .
	2 START and RUN the engine at 1500 RPM. APPLY a high electrical load to the battery.
	Is the noise only heard with the high electrical load applied? **Yes** GO to G8. . **No** CHECK the air conditioning compressor. For additional information, refer to Section 412-03 Air Conditioning . CHECK the power steering pump. For additional information, refer to Section 211-02 Power Steering . TEST the system for normal operation.
G8: ELIMINATE THE GENERATOR AS THE CAUSE OF ELECTRICAL NOISE	
	1 REMOVE fuse 82 from the passenger compartment fuse box.
	2 START and RUN the engine at 1500 RPM.
	Is the noise still present? **Yes** CHECK the air conditioning compressor. For additional information, refer to Section 412-03 Air Conditioning . CHECK the power steering pump. For additional information, refer to Section 211-02 Power Steering . TEST the system for normal operation. **No** INSTALL a new generator. TEST the system for normal operation.

PINPOINT TEST H : RADIO INTERFERENCE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
H1: CHECK THE GENERATOR FOR THE CAUSE OF RADIO INTERFERENCE	
	1 START and RUN the engine at 1500 RPM.
	2 TURN the radio switch to the ON position.
	Is radio interference present? **Yes** GO to H3. . **No** GO to H2. .
H2: CHECK THE GENERATOR FOR THE CAUSE OF RADIO INTERFERENCE WITH A HIGH ELECTRICAL LOAD APPLIED TO THE BATTERY	
	1 START and RUN the engine at 1500 RPM
	2 APPLY a high electrical load to the battery.
	3 TURN the radio switch to the ON position.
	Is radio interference present? **Yes** GO to H3. . **No** DIAGNOSE the entertainment system. For additional information, refer to Section 415-00 Information and Entertainment System - General Information .
H3: ELIMINATE THE GENERATOR AS THE CAUSE OF RADIO INTERFERENCE	
	1 REMOVE fuse 82 from the passenger compartment fuse box.
	2 START and RUN the engine at 1500 RPM.
	3 TURN the radio switch to the ON position.
	Is radio interference still present? **Yes** Diagnose the Entertainment System. For additional information, refer to Section 415-00 Information and Entertainment System - General Information . **No** CLEAN and TIGHTEN all mounting points, positive and ground cable connections. INSTALL fuse 82 in the passenger compartment fuse box. TEST the system for normal operation. If interference is still present, INSTALL a new generator.

Base Voltage Test

• NOTE: Prior to running this test, turn the headlamps on for 30 seconds to remove any surface charge from the battery. Wait until the voltage stabilizes before carrying out the base voltage test.

1. **1.** With the ignition switch in the OFF position and no electrical loads applied to the battery, connect the negative lead of a digital multimeter to the battery ground cable clamp.
2. **2.** Connect the positive lead of the digital multimeter to the battery positive terminal cable clamp.
3. **3.** Read and record the battery voltage shown on the digital multimeter. This is called base voltage and will be used in later tests.

No-Load Test

1. **1.** Connect the digital multimeter leads across the battery terminals.
2. **2.** Read the voltage (base voltage). If the battery voltage is less than 12 volts. Charge the battery before test.
3. **3.** Start the engine.
4. **4.** Run the engine to 1500 RPM with no electrical load applied to the battery.
5. **5.** Read the voltage. If the voltage increase is less than 0.5 volts above the base voltage, carry out the Battery Condition Test. If there is no voltage increase, diagnose the charging system. For additional information refer to the symptom chart.

Battery Condition Test

• WARNINGS:

Batteries contain sulphuric acid and explosive mixtures of Hydrogen and Oxygen gasses; protective clothing should be worn to avoid the risk of personal injury.

Avoid sparks and all sources of ignition when working on the battery.

• CAUTIONS:

Do not carry out this test if the battery voltage is below 12.5 volts.

Do not carry out this test for longer than 15 seconds or damage to the battery may occur.

• NOTE: Make sure that the high rate discharge tester is capable of applying a load of 300 Amps to the battery.

1. **1.** Connect the high rate discharge tester to the battery.
2. **2.** Observe and record the voltage reading of the battery.
3. **3.** Turn the switch to the ON position for 15 seconds.
4. **4.** Observe and record the minimum voltage reading of the battery.
5. **5.** Turn the switch to the OFF position.
6. **6.** Observe the voltage reading of the battery.

The battery voltage should not fall below 9.6 volts at a temperature of 21°C (70°F) when carrying out the test.
The battery should recover to the original voltage when the test is complete.

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Battery and Charging System - General Information - Charging System2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma

Diagnosis and Testing

Principle of operation

The diesel charging system differs from that used in petrol-engined variants in that it incorporates a **'smartcharge'** function.

This function is capable of supplying infinitely variable voltages to the battery, depending on the temperature and on the current requirements of the battery.

The system continuously monitors the battery voltage and temperature (via the ambient air temperature sensor), and uses a map of both to deliver the optimum charge to the battery.

Another feature of this system is that it uses a 'wake-up' and 'sleep' strategy, initiated by the ignition switch position and engine control module (ECM) to avoid current drain.

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.
3. **3.** Check the vehicle battery condition and state of charge before condemning any of the charging system components. For additional information, refer to the battery care manual.

Visual Inspection Chart

Mechanical	Electrical
● Generator ● Drive belt ● Drive belt tensioner ● Generator pulley ● Check the security of the generator fittings	● Generator ● Battery ● Charging system warning light function (ignition **ON**, engine **OFF**) ● Fuse 36 (7.5A) front power distribution box (battery voltage sense) ● Engine/Generator ground connection ● Circuit(s) ● Electrical connector(s) ● Engine control module (ECM)

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 and the Jaguar approved diagnostic system is not available, use a scan tool to retrieve the fault codes before proceeding to the symptom chart.

CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: When performing electrical 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.

Symptom Chart

• NOTE: For a full list of DTCs,
REFER to: Electronic Engine Controls (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).

DTC	Condition	Possible Source	Action
P0622	Generator monitor circuit fault	● Generator monitor circuit: open circuit, high resistance, short circuit to B+, short circuit to ground ● Generator regulator failure ● ECM fault	For generator monitor circuit tests, GO to Pinpoint Test C.
P0623	Generator warning light circuit fault	● Generator warning light circuit: open circuit, short circuit	For generator warning light circuit tests, REFER to: Electronic Engine Controls (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
P1632	Generator communications circuit fault	● Generator communications circuit: open circuit, high resistance, short circuit to B+, short circuit to ground ● Generator regulator failure ● ECM fault	For generator communications circuit tests, GO to Pinpoint Test D.
None	The battery warning light is on, intermittent, or flickers with the engine running	● Battery, low voltage ● Accessory drive belt tension ● Generator failure ● ECM ● Instrument cluster (IC) fault	Check the battery condition and state of charge. Refer to the battery care manual. Check the accessory drive belt tension, REFER to: Accessory Drive Belt Tensioner - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-05 Accessory Drive, Removal and Installation). Check the generator output, GO to Pinpoint Test B. and GO to Pinpoint Test A.. For CAN circuit tests, REFER to: Communications Network - VIN Range: E96603->J28492 (418-00 Module Communications Network, Diagnosis and Testing).

DTC	Condition	Possible Source	Action
None	The battery keeps discharging	• Battery fault • Battery cables • Battery quiescent drain • Accessory drive belt tension • Generator failure • Generator pulley fault	Check the battery condition and state of charge. Refer to the battery care manual. Check the volt drop across the charging circuit, GO to Pinpoint Test G. Check the accessory drive belt tension, REFER to: Accessory Drive Belt Tensioner - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-05 Accessory Drive, Removal and Installation). Check the generator output, GO to Pinpoint Test B. and GO to Pinpoint Test A. Check that the generator pulley does not turn independently of the generator.
None	Generator noisy	• Generator failure • Accessory drive belt tension • Accessory drive belt • Accessory drive belt tensioner	For generator mechanical tests, GO to Pinpoint Test E. Check the accessory drive belt and tensioners, REFER to: Accessory Drive Belt Tensioner - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-05 Accessory Drive, Removal and Installation).
None	Radio interference	• Generator • Wiring harness	For interference tests, GO to Pinpoint Test F.

Pinpoint tests

PINPOINT TEST A : CHECK THE GENERATOR OUTPUT UNDER LOAD AT IDLE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE GENERATOR OUTPUT AT IDLE	
	1 Start the engine and allow to idle.
	2 Turn the headlights **ON**.
	3 With the engine idling, measure the voltage between the battery positive terminal and GROUND over ten seconds.
	Was the average voltage greater than 12.85 volts? **Yes** GO to A2. **No** Check the volt drop across the charging circuit, GO to Pinpoint Test G. . If the volt drop is within limits, install a new generator. REFER to: Generator.
A2: CHECK THE GENERATOR OUTPUT AT IDLE FOR OVERCHARGE	
	1 With the engine idling and headlights still **ON**, measure the voltage between the battery positive terminal and GROUND over ten seconds.
	Was the average voltage greater than 15.25 volts? **Yes** The generator is overcharging. INSTALL a new generator. REFER to: Generator. **No** Charging system is within limits.

PINPOINT TEST B : CHECK THE GENERATOR OUTPUT UNDER LOAD	
• NOTE: Before beginning this test, make sure the warning light function is normal without the engine running (see visual inspection table).	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE FUNCTION OF THE CHARGING SYSTEM WARNING LIGHT	
	1 Start the engine and allow to idle.
	Is the charging system warning light illuminated? **Yes** Check for DTC P0623. REFER to: Electronic Engine Controls (303-14B Electronic Engine Controls - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). **No** GO to B2.
B2: CHECK THE CHARGING SYSTEM OUTPUT UNDER LOAD (LOW VOLTAGE)	
	1 Turn the headlights and heated rear window to the **ON** position.
	2 Raise the engine speed to between 2,800 rpm and 3,200 rpm and hold for ten seconds.
	3 Whilst holding the engine rpm in the above range, measure the voltage between the battery positive terminal and GROUND.
	4 Allow the engine to idle.
	Was the average battery voltage less than 12.85 volts? **Yes** GO to B4. **No** GO to B3.
B3: CHECK THE CHARGING SYSTEM OUTPUT UNDER LOAD (HIGH VOLTAGE)	
	1 Raise the engine speed to between 2,800 rpm and 3,200 rpm and hold for ten seconds.
	2 Whilst holding the engine rpm in the above range, measure the voltage between the battery positive terminal and GROUND.
	3 Allow the engine to idle.
	Was the average battery voltage greater than 15.25 volts? **Yes** INSTALL a new generator. REFER to: Generator. CLEAR the DTC. TEST the system for normal operation. **No** Charging system output is within limits.
B4: CHECK THE CHARGING SYSTEM VOLTAGE AT THE GENERATOR CONNECTOR, PIN 01	
WARNING: The following test may involve working in close proximity to hot components. Observe caution when working in this area. Failure to follow this instruction may result in personal injury.	
	1 Turn the headlights and heated rear window to the **OFF** position.

	2 Turn the ignition switch to the **OFF** position.
	3 Disconnect the generator three-way connector.
	4 Connect a voltmeter between the generator, pin 01 and GROUND.
	5 Start the engine.
	6 Turn the headlights and heated rear window to the **ON** position.
	7 Raise the engine speed to between 2,800 rpm and 3,200 rpm and hold for ten seconds.
	8 Whilst holding the engine rpm in the above range, measure the voltage between the generator connector, pin 01 and GROUND.
	9 Allow the engine to idle.
	Was the voltage between 11 and 16 volts? **Yes** Generator is within limits, suspect generator cables. GO to Pinpoint Test G. **No** INSTALL a new generator. REFER to: Generator. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST C : P0622: GENERATOR MONITOR CONTROL CIRCUIT FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE GENERATOR MONITOR CIRCUIT FOR HIGH RESISTANCE	
	1 Turn the ignition switch to the **OFF** position.
	2 Disconnect the battery negative terminal.
	3 Disconnect the generator three-way connector.
	4 Disconnect the ECM connector, DL01.
	5 Measure the resistance between the three-way connector, pin 01 (W) and DL01, pin 47 (W).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to C2.
C2: CHECK THE GENERATOR MONITOR CIRCUIT FOR SHORT TO B+	
	1 Reconnect the battery negative terminal.
	2 Measure the voltage between DL01, pin 47 (W) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to C3.
C3: CHECK THE GENERATOR MONITOR CIRCUIT FOR SHORT TO GROUND	
	1 Measure the resistance between DL01, pin 47 (W) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** RECHECK DTCs.

PINPOINT TEST D : P1632: GENERATOR COMMUNICATIONS CIRCUIT FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE GENERATOR COMMUNICATIONS CIRCUIT FOR HIGH RESISTANCE	
	1 Turn the ignition switch to the **OFF** position.
	2 Disconnect the battery negative terminal.
	3 Disconnect the generator three-way connector.
	4 Disconnect the ECM connector, DL01.
	5 Measure the resistance between the three-way connector, pin 02 (N) and DL01, pin 112 (N).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to D2.
D2: CHECK THE GENERATOR COMMUNICATIONS CIRCUIT FOR SHORT TO B+	
	1 Reconnect the battery negative terminal.
	2 Measure the voltage between DL01, pin 112 (N) and GROUND.
	Is the voltage greater than 1 volt? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to D3.
D3: CHECK THE GENERATOR COMMUNICATIONS CIRCUIT FOR SHORT TO GROUND	
	1 Measure the resistance between DL01, pin 112 (N) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** RECHECK DTCs.

PINPOINT TEST E : GENERATOR NOISY

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: CHECK THE GENERATOR FOR SECURITY	
	1 Inspect the generator fixings.
	Is the generator secure? **Yes** GO to E2. **No** SECURE the generator. REFER to: Generator. TEST the system for normal operation.
E2: CHECK THE ACCESSORY DRIVE BELT	
	1 Remove and inspect the accessory drive belt. For additional information REFER to: Accessory Drive Belt - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-05 Accessory Drive, Removal and Installation).
	Is the accessory drive belt in good condition? **Yes** GO to E3. **No** INSTALL a new accessory drive belt. REFER to: Accessory Drive Belt - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-05 Accessory Drive, Removal and Installation). TEST the system for normal operation.
E3: CHECK THE ACCESSORY DRIVE BELT TENSIONER	
	1 Remove and inspect the accessory drive belt tensioner. REFER to: Accessory Drive Belt - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-05 Accessory Drive, Removal and Installation).
	Is the accessory drive belt tensioner in good condition? **Yes** GO to E4. **No** INSTALL a new accessory drive belt tensioner. REFER to: Accessory Drive Belt Tensioner - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-05 Accessory Drive, Removal and Installation). TEST the system for normal operation.
E4: CHECK THE GENERATOR FOR MECHANICAL NOISE	
	1 Rotate the generator pulley by hand.
	Does the generator rotor shaft rotate smoothly and quietly? **Yes** GO to E5. **No** INSTALL a new generator. REFER to: Generator. TEST the system for normal operation.
E5: CHECK THE ACCESSORY DRIVE BELT IDLER PULLEYS	
	1 Rotate the accessory drive belt idler pulleys by hand.
	Do the accessory drive belt idler pulleys rotate smoothly and quietly? **Yes** GO to E6. **No** INSTALL new accessory drive belt pulleys as necessary. REFER to: Accessory Drive Belt Tensioner - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-05 Accessory Drive, Removal and Installation). TEST the system for normal operation.
E6: CHECK THE GENERATOR FOR ELECTRICAL NOISE	
	1 Install the accessory drive belt. REFER to: Accessory Drive Belt - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-05 Accessory Drive, Removal and Installation).
	2 Start and run the engine at 1500 rpm. Apply a high electrical load to the battery.
	Is the noise only heard with the high electrical load applied? **Yes** GO to E7. **No** CHECK the air conditioning compressor. For additional information REFER to: Air Conditioning (A/C) Compressor - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (412-03 Air Conditioning, Removal and Installation). CHECK the power steering pump. For additional information REFER to: Power Steering Pump - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (211-02 Power Steering, Removal and Installation). TEST the system for normal operation.
E7: ELIMINATE THE GENERATOR AS THE CAUSE OF ELECTRICAL NOISE	
	1 Remove fuse 15 from the primary junction fuse box.
	2 Start and run the engine at 1500 rpm.
	Is the noise still present? **Yes** CHECK the air conditioning compressor. For additional information REFER to: Air Conditioning (A/C) Compressor - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (412-03 Air Conditioning, Removal and Installation). CHECK the power steering pump. For additional information REFER to: Power Steering Pump - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (211-02 Power Steering, Removal and Installation). TEST the system for normal operation. **No** INSTALL a new generator. REFER to: Generator. TEST the system for normal operation.

PINPOINT TEST F : RADIO INTERFERENCE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: CHECK IF THE GENERATOR IS THE CAUSE OF THE RADIO INTERFERENCE	
	1 Start and run the engine at 1500 rpm.
	2 Turn the radio to the **ON** position, and select the affected station.
	Is the radio interference present? **Yes** GO to F3. **No** GO to F2.
F2: CHECK IF THE GENERATOR IS THE CAUSE OF THE RADIO INTERFERENCE WITH A HIGH ELECTRICAL LOAD APPLIED TO THE BATTERY	
	1 Start and run the engine at 1500 rpm.
	2 Apply a high electrical load to the battery.
	3 Turn the radio to the **ON** position, and select the affected station.
	Is the radio interference present? **Yes** GO to F3. **No** DIAGNOSE the entertainment system. For additional information REFER to: Audio System (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).
F3: ELIMINATE THE GENERATOR AS THE CAUSE OF RADIO INTERFERENCE	
	1 Remove fuse 33 from the primary junction fuse box.
	2 Start and run the engine at 1500 rpm.
	3 Turn the radio to the **ON** position, and select the affected station.
	Is the radio interference present? **Yes** DIAGNOSE the entertainment system. For additional information REFER to: Audio System (415-00 Information and Entertainment System - General Information, Diagnosis and Testing). **No** CLEAN and tighten all mounting points, positive and negative cable connections (including the bonnet, boot and engine GROUND straps). INSTALL fuse 15 from the primary junction fuse box. TEST the system for normal operation. If interference is still present, INSTALL a new generator. REFER to: Generator.

PINPOINT TEST G : CHECK THE VOLT DROP ACROSS THE BATTERY CABLES	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: CHECK THE VOLT DROP BETWEEN THE BATTERY AND THE GENERATOR	
	1 Measure the voltage between the battery terminals.
	2 With the negative probe still on the battery negative terminal, connect the positive probe to the generator output terminal.
	3 Compare the voltages.
	Is the voltage difference greater than 1 volt? **Yes** INSTALL a new battery cable. REFER to: Battery Cables - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (414-01 Battery, Mounting and Cables, Removal and Installation). **No** CHECK for DTCs. Check the generator output.

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Battery and Charging System - General Information - Battery Charging

General Procedures

1. For additional information, refer to the battery care manual (BCM).

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Battery, Mounting and Cables -

General Specifications

Item	Specification
Battery Capacity Vehicles With Petrol Engines	80 Ah
Battery Capacity Vehicles With Diesel Engines	80 Ah
Battery Cold Cranking Vehicles With Petrol Engines	680 Amps
Battery Cold Cranking Vehicles With Diesel Engines	640 Amps

Torque Specifications

Description	Nm	lb-ft	lb-in
Battery to starter motor solenoid cable retaining nut - vehicles with 2.0L, 2.5L or 3.0L engines	12	9	-
Battery ground cable to body retaining bolt	25	18	-
Battery ground cable to transmision retaining bolt	25	18	-
Battery ground cable to starter motor retaining bolt - vehicles with manual transmission and 2.0L, 2.5L or 3.0L engines	35	26	-
Generator positive cable retaining nut - vehicles with 2.0L diesel engine	8	-	71

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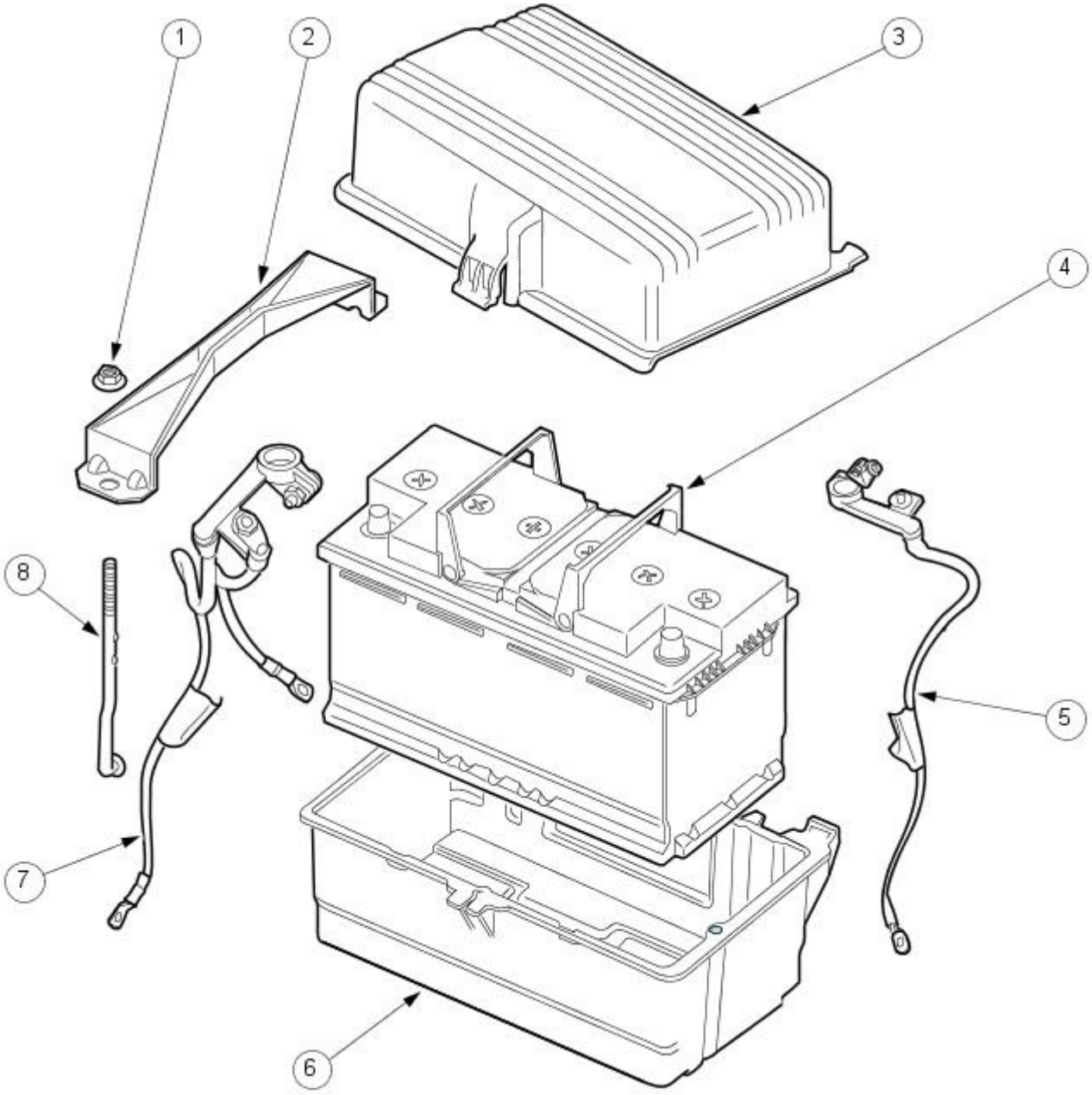
Battery, Mounting and Cables - Battery and Cables

Description and Operation

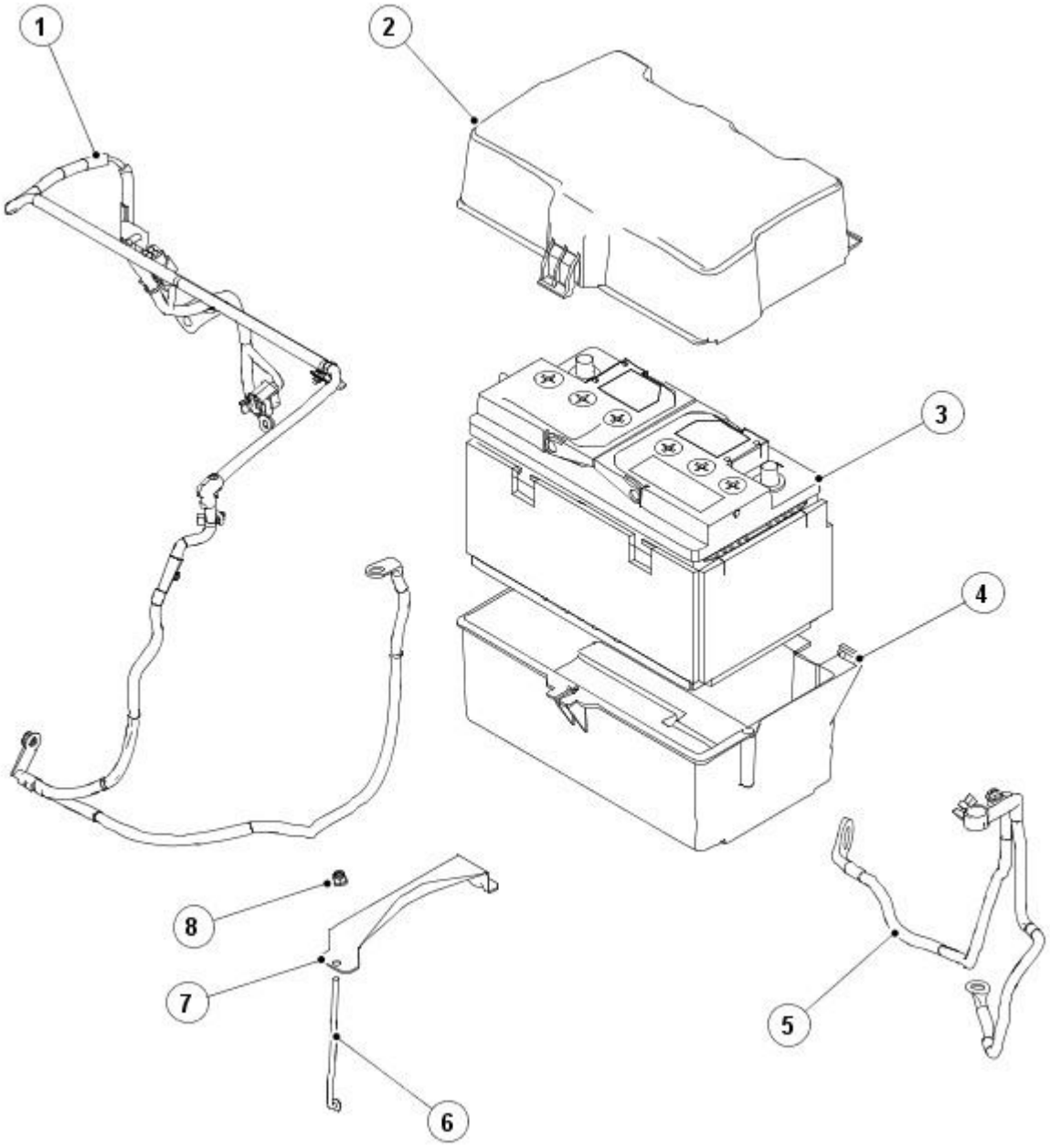
Vehicles fitted with 2.0L, 2.5L and 3.0L engines



VUJ0003823

Item	Part Number	Description
1	—	Battery clamp retaining nut
2	—	Battery clamp
3	—	Battery cover
4	—	Battery
5	—	Battery to starter motor solenoid cable
6	—	Battery tray
7	—	Battery ground cable
8	—	Battery clamp retaining bolt

Vehicles fitted with 2.0L diesel engines



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Item	Part Number	Description
1	—	Battery to generator and starter motor positive cable
2	—	Battery cover
3	—	Battery
4	—	Battery tray
5	—	Battery ground cable
6	—	Battery clamp retaining bolt
7	—	Battery clamp
8	—	Battery clamp retaining nut

The battery fitted is a 12 volts (DC) 80 ampere hour.

The battery ground cable consists of two heavy duty cables which are connected between the battery ground distributor pole and both the vehicle body and transmission.

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Battery, Mounting and Cables - Battery

Diagnosis and Testing

For additional information, refer to the battery care manual.

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Battery, Mounting and Cables - Battery Connect

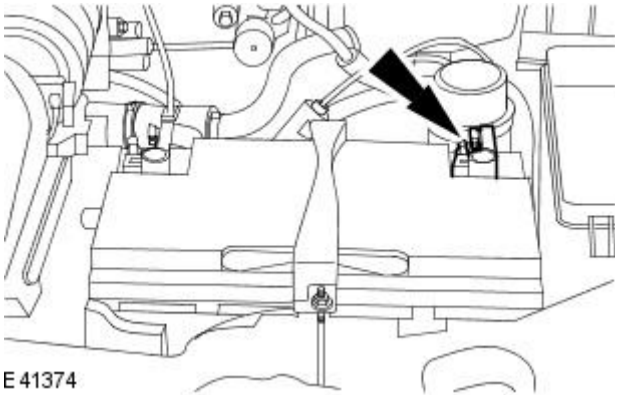
General Procedures

• WARNINGS:

Batteries normally produce explosive gases which may cause personal injury, therefore do not allow lighted substances to come near the battery. When charging or working near the battery always shield your face and protect your eyes. Always provide adequate ventilation. Failure to follow these instructions may result in personal injury.

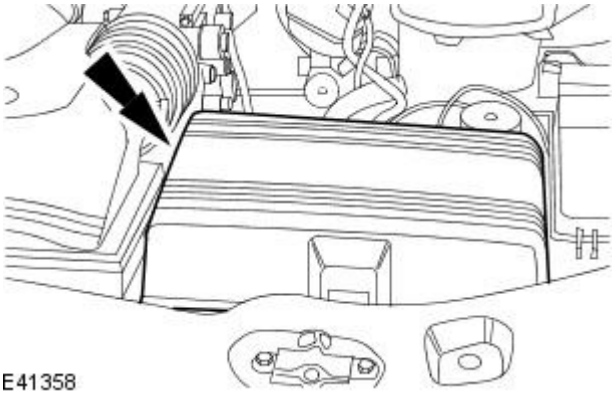
Batteries contain sulphuric acid, avoid contact with skin, eyes or clothing. Shield your face and protect your eyes when working near the battery to guard against possible splashing of the acid solution. In case of acid contact with the skin or eyes, flush immediately for a minimum of 15 minutes and seek prompt medical attention. If swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

CAUTION: Make sure all electrical systems are OFF before connecting the battery ground cable. Failure to follow this instruction may result in damage to the vehicles electrical system.



1. NOTE: Petrol engine shown, diesel engine similar.

Connect the battery ground cable.



2. NOTE: Petrol engine shown, diesel engine similar.

Install the battery cover.

3. Enter the audio unit keycode and preset radio frequencies.

4. Reset the clock to the correct time.

5. NOTE: When the battery has been disconnected and connected the settings for the windows one touch facility and the anti-trap facility will have been erased.

Initialize the door window motors.
For additional information, refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

6. NOTE: When the battery has been disconnected and connected, the stored idle and drive values contained within the engine control module (ECM) will have been erased. The ECM must relearn the idle and drive values.

Relearn the ECM fueling adaptations.
For additional information, refer to: Evaporative Emissions - 2.0L NA V6 - AJV6 (303-13 Evaporative Emissions, Diagnosis and Testing) / Evaporative Emissions - 2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (303-13 Evaporative Emissions, Diagnosis and Testing).

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Battery, Mounting and Cables - Battery Disconnect and Connect

General Procedures

Disconnect

• WARNINGS:

Batteries normally produce explosive gases which may cause personal injury, therefore do not allow lighted substances to come near the battery. When charging or working near the battery always shield your face and protect your eyes. Always provide adequate ventilation. Failure to follow these instructions may result in personal injury.

Batteries contain sulphuric acid, avoid contact with skin, eyes or clothing. Shield your face and protect your eyes when working near the battery to guard against possible splashing of the acid solution. In case of acid contact with the skin or eyes, flush immediately for a minimum of 15 minutes and seek prompt medical attention. If swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

Audio unit key code saving devices must not be used when working on supplemental restraint or fuel systems. When using these devices the vehicle electrical system is still live but with a reduced current flow. Failure to follow this instruction may result in personal injury.

CAUTION: Make sure the engine is not running before disconnecting the battery ground cable. Failure to follow this instruction may result in damage to the vehicles electrical system.

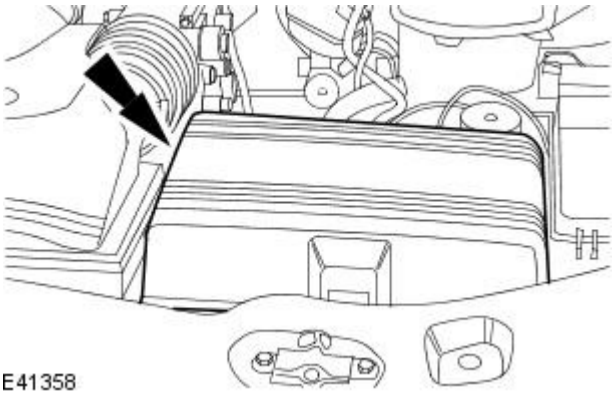
• NOTE: Before disconnecting the battery make sure that no data is required from the engine control module (ECM), as battery cable disconnection will erase any fault codes and idle/drive values held in the keep alive memory (KAM). It is not necessary to disconnect or remove electronic control modules.

• NOTE: This procedure should be used to disconnect the battery while carrying out repairs that refer to the battery being disconnected.

1. Obtain and record the audio unit keycode and preset radio frequencies.

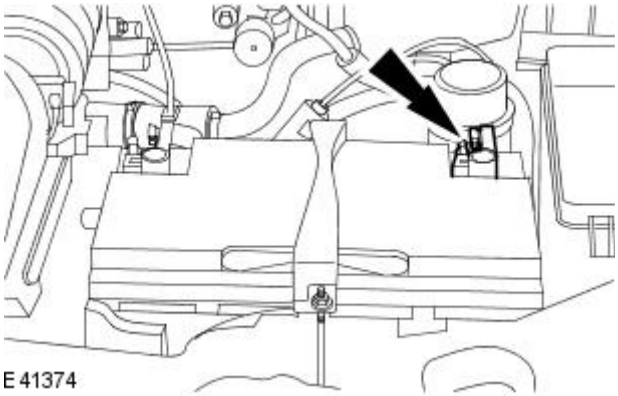
2. NOTE: Petrol engine shown, diesel engine similar.

Remove the battery cover.



3. NOTE: Petrol engine shown, diesel engine similar.

Disconnect the battery ground cable.



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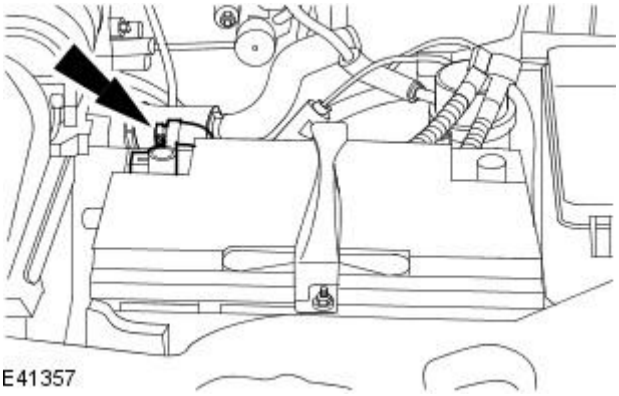
Battery, Mounting and Cables - Battery

Removal and Installation

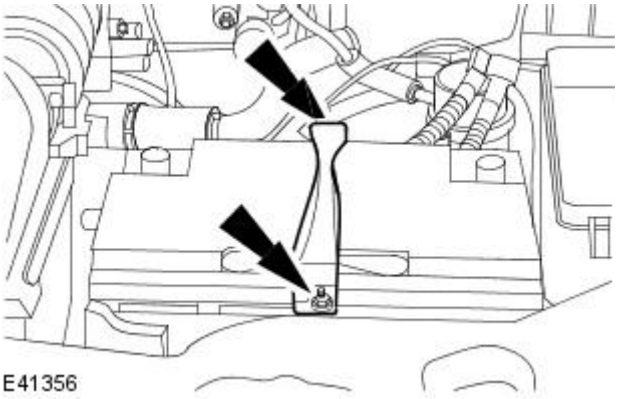
Removal

1. Disconnect the battery ground cable.
   For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).



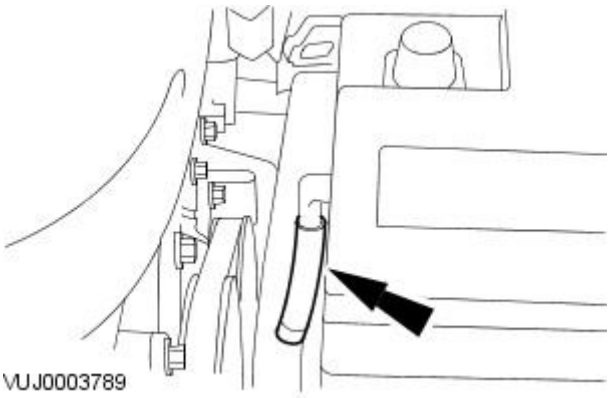
2. NOTE: Petrol engine shown, diesel engine similar.

   Disconnect the battery positive cable.



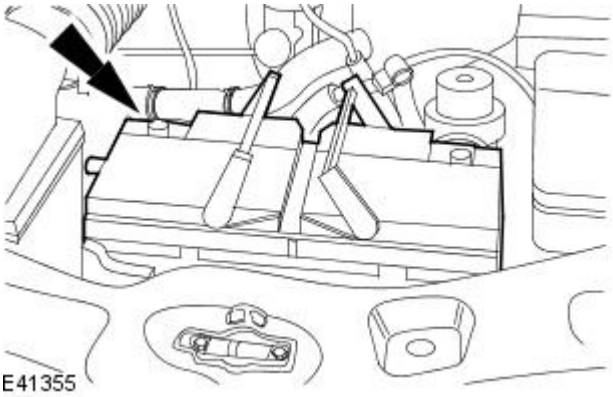
3. NOTE: Petrol engine shown, diesel engine similar.

   Remove the battery clamp.



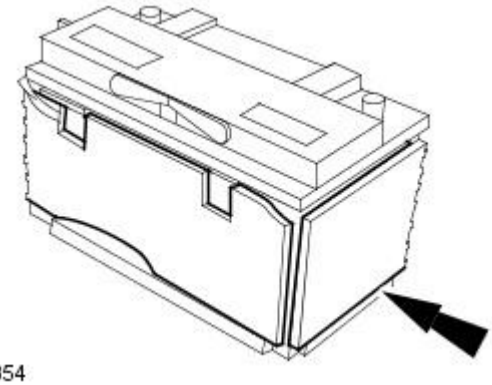
4. NOTE: Petrol engine shown, diesel engine similar.

   Disconnect the battery vent tube.



5. NOTE: Petrol engine shown, diesel engine similar.

   Remove the battery.


E41354

6. NOTE: Petrol engine shown, diesel engine similar.

Remove the battery heat shield.

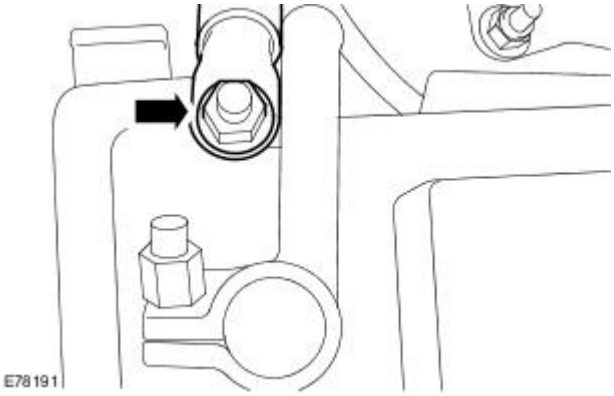
Installation

1. To install, reverse the removal procedure.

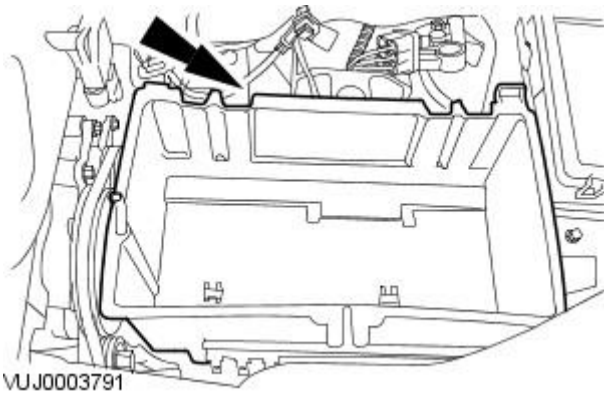
Battery, Mounting and Cables - Battery Cables2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

Removal and Installation

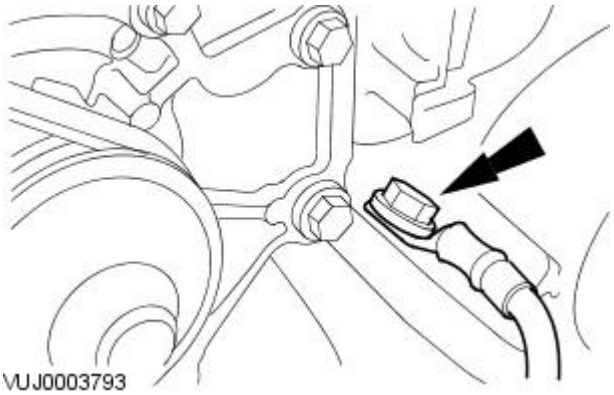
Removal



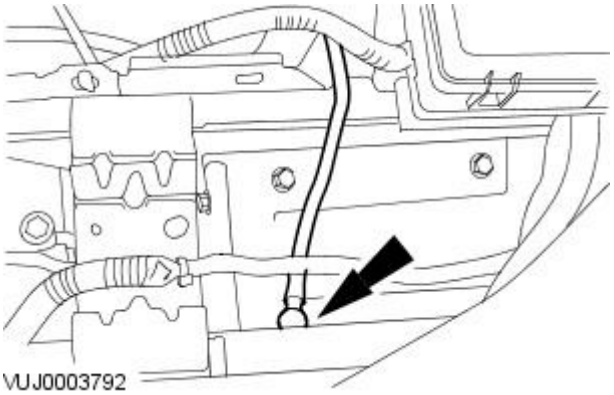
1. Disconnect the battery.
   For additional information, refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Detach the battery junction box positive cable.
   - Remove the retaining nut.



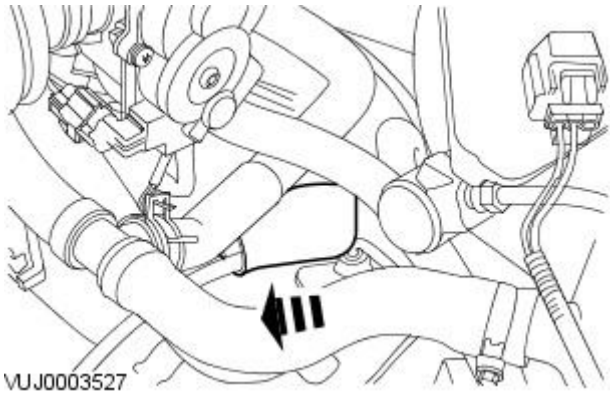
3. Remove the battery.
   For additional information, refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
4. Remove the battery tray.



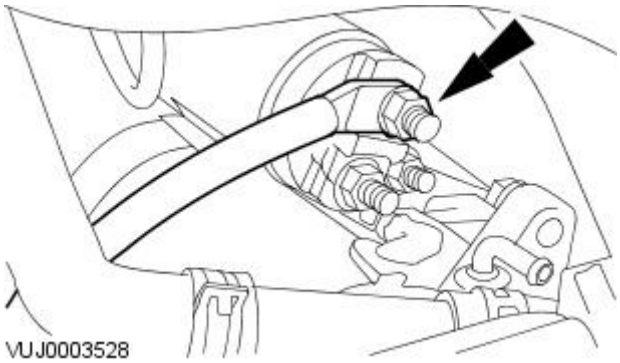
5. Detach the battery ground cable.
   - Remove the retaining bolt.



6. Remove the battery ground cable.
   - Remove the retaining bolt.



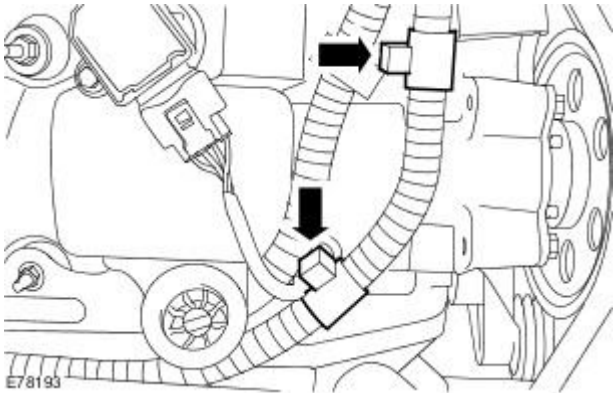
7. Detach the battery to starter motor solenoid cable cover.



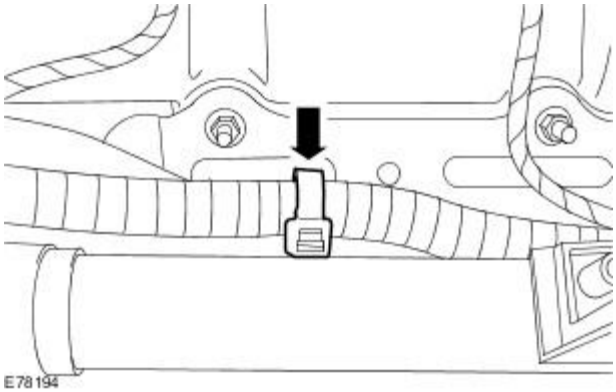
8. Remove the battery to starter motor solenoid cable.

- Remove the retaining nut.

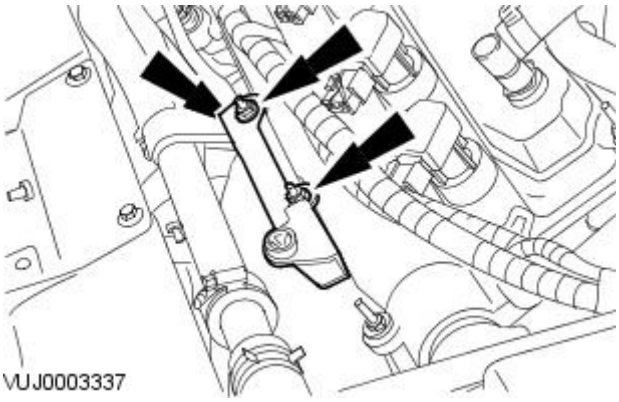
9. Remove the air cleaner assembly.
For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27, Removal and Installation).



10. Detach the wiring harness.

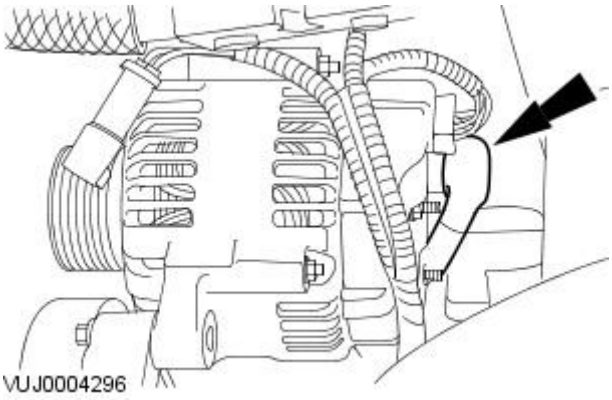


11. Detach the wiring harness.

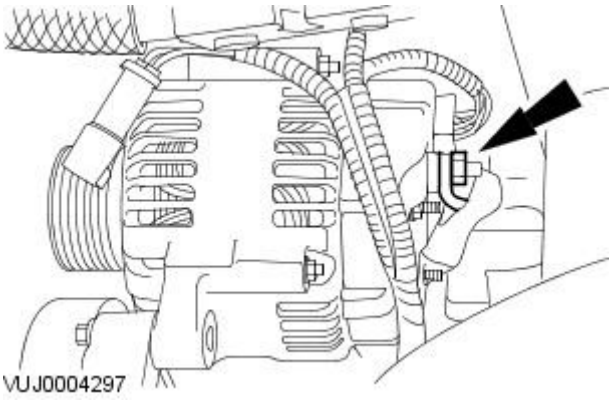


12. Remove the air filter retaining bracket.

- Remove the retaining nuts.



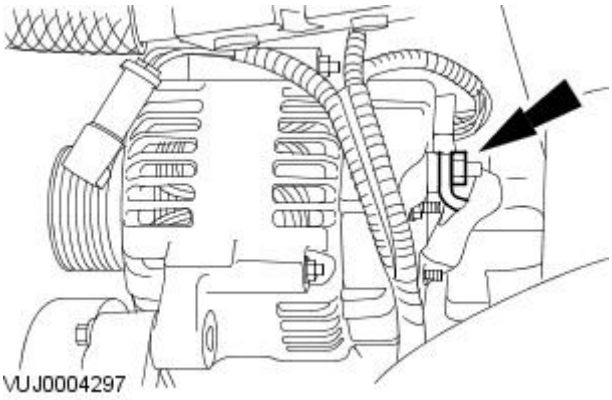
13. Detach the generator battery positive cable protective cover.



14. Remove the battery positive cable.

- Detach the generator battery positive cable electrical connector.
- Remove the retaining nut.

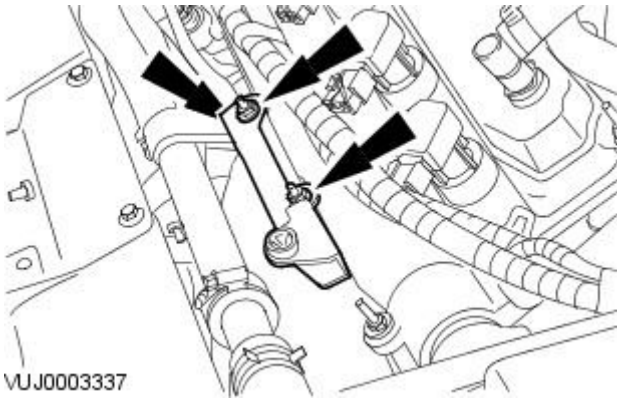
Installation



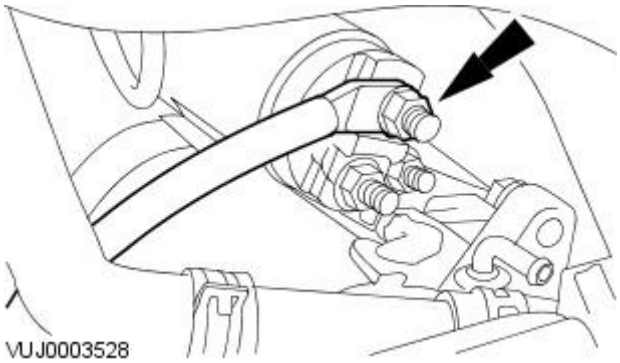
1. To install, reverse the removal procedure.

- Tighten to 12 Nm.

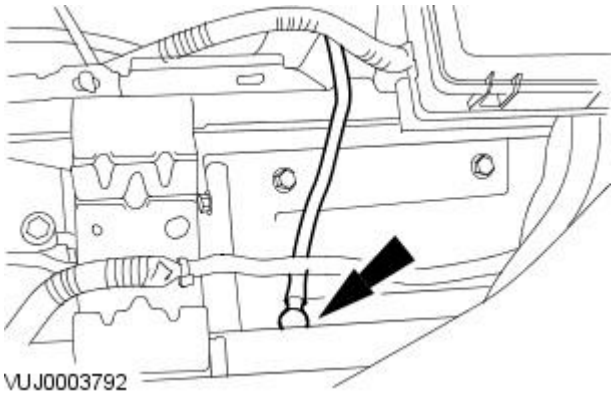
2. Tighten to 6 Nm.



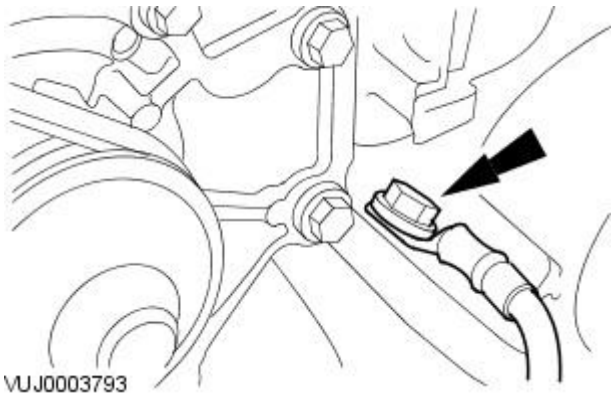
3. Tighten to 12 Nm.



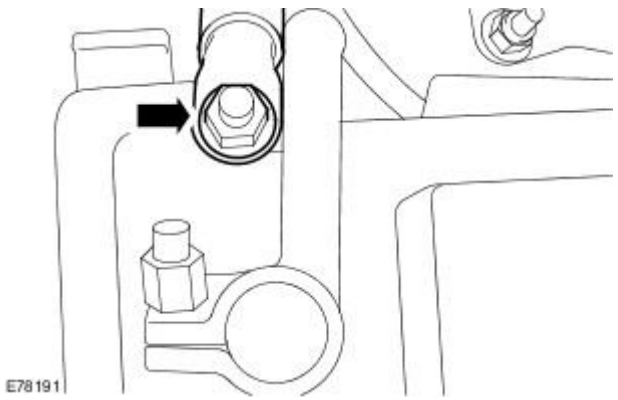
4. Tighten to 25 Nm.



5. Tighten to 25 Nm.



6. Tighten to 4 Nm.



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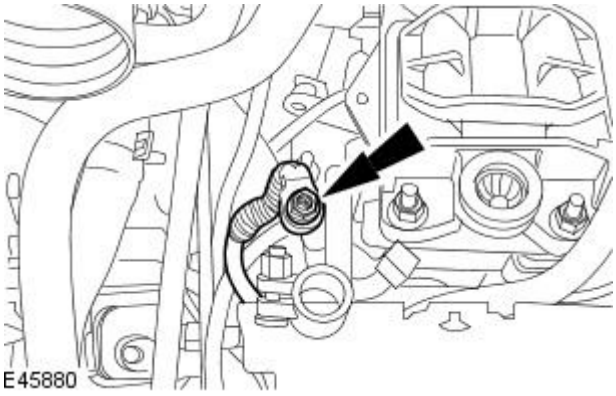
Battery, Mounting and Cables - Battery Cables2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma

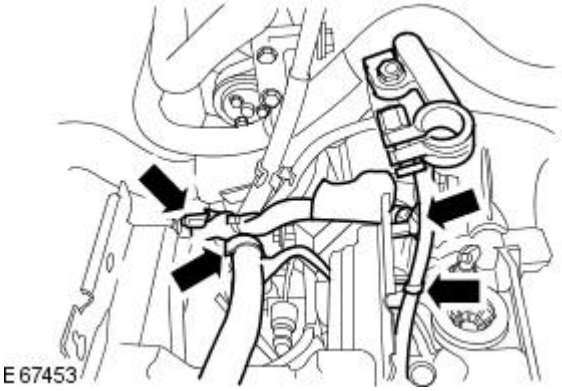
Removal and Installation

Removal

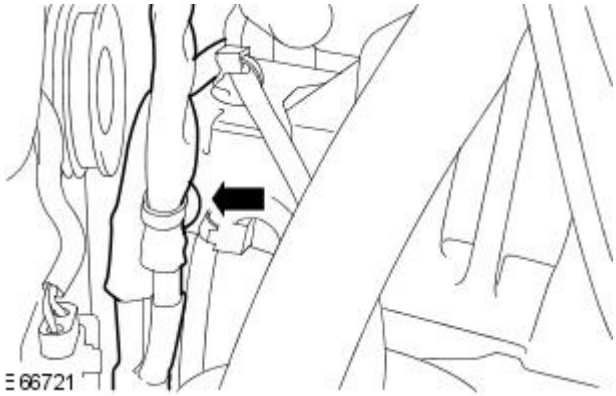
1. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
2. Remove the air cleaner.
   For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
3. Detach the generator and starter motor positive cable away from the battery positive terminal.



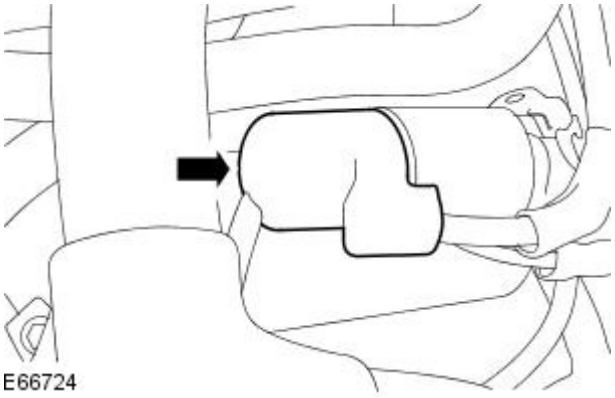
4. Detach the generator and starter motor positive cable from the battery bracket and the wiring harness.

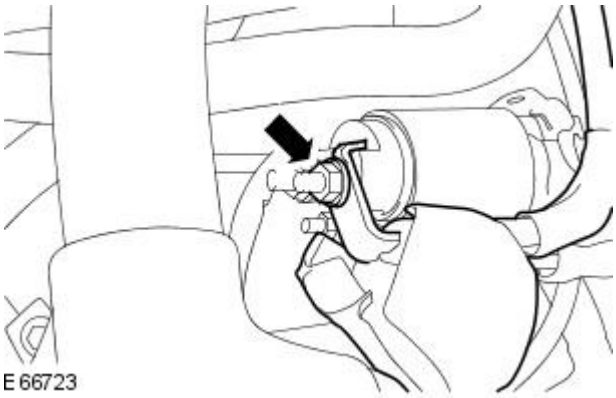


5. Detach the generator and starter motor positive cable from the starter motor wiring harness support bracket.

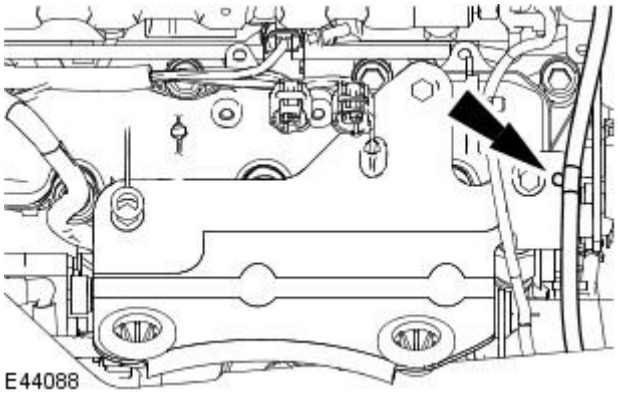


6. Reposition the starter motor solenoid protective cover.

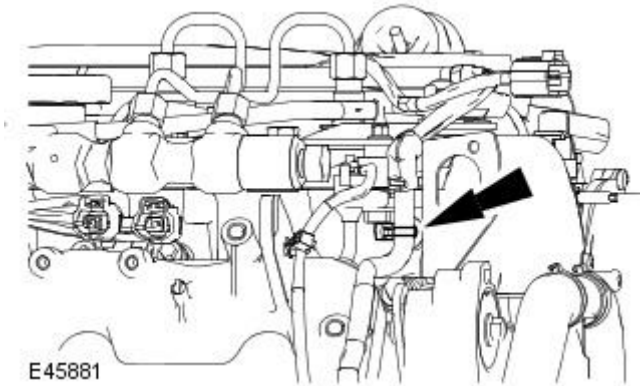




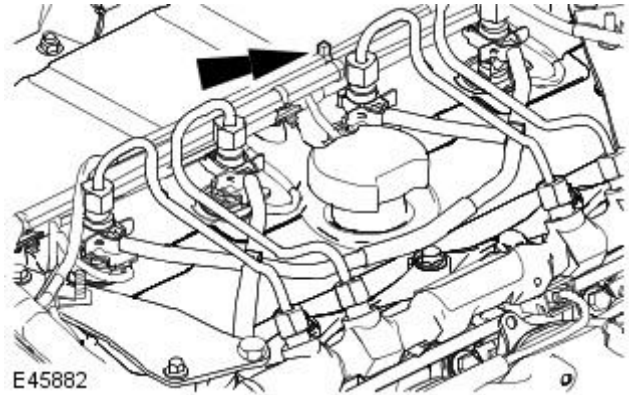
7. Detach the generator and starter motor positive cable from the starter motor.



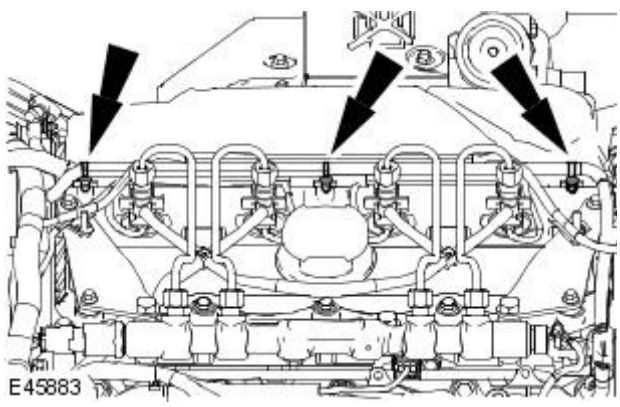
8. Detach the generator and starter motor positive cable from the air cleaner mounting bracket.



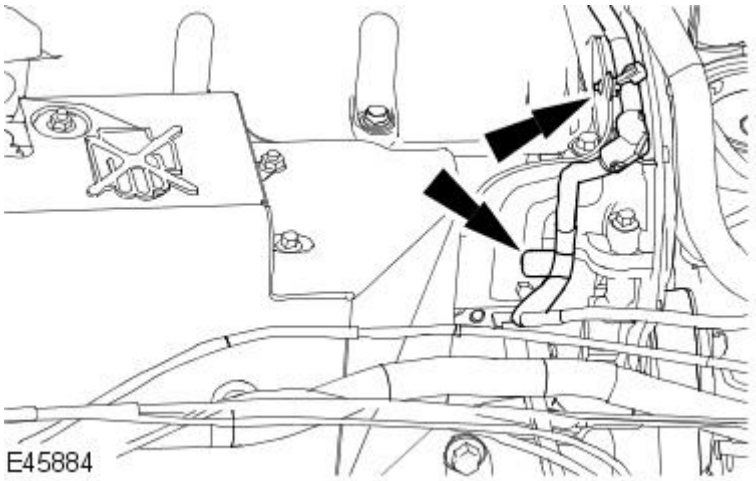
9. Detach the generator and starter motor positive cable from the power steering pump belt cover mounting bracket.



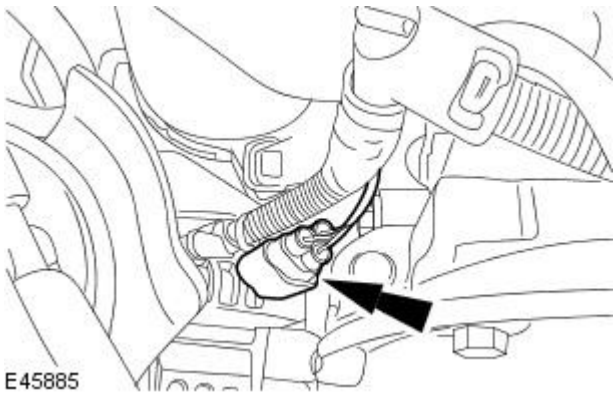
10. Remove the retaining strap.



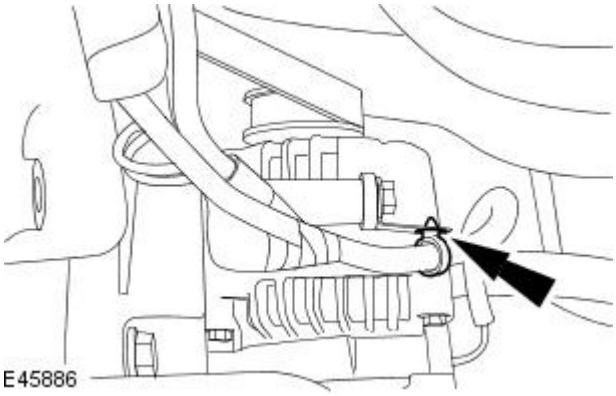
11. Detach the generator and starter motor positive cable from the engine harness.



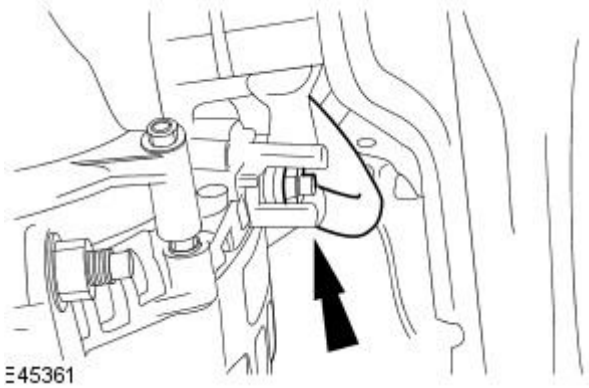
12. Detach the generator and starter motor positive cable from the engine cover mounting bracket.



13. Disconnect the generator wiring harness electrical connector.



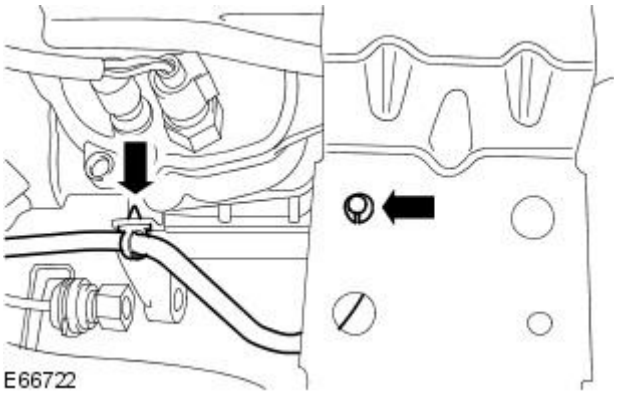
14. Detach the generator and starter motor positive cable from the generator cable mounting bracket.



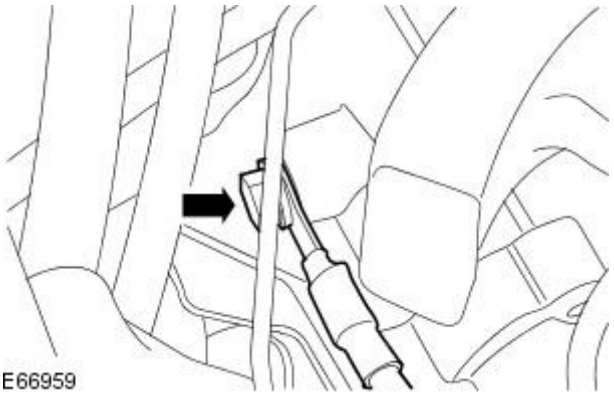
15. Detach the generator positive cable.

16. Disconnect the generator electrical connector.

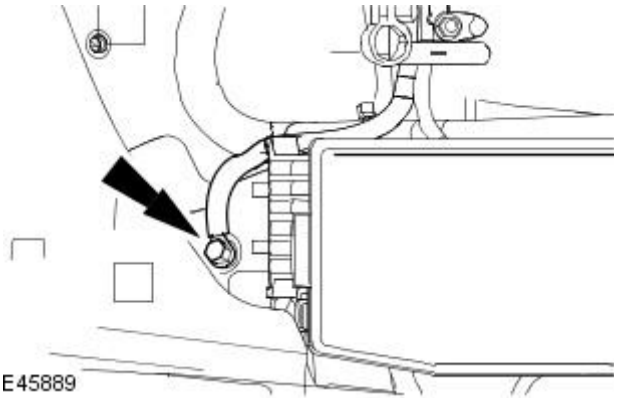
17. Detach the battery ground cable from the transmission retaining bracket and battery bracket.



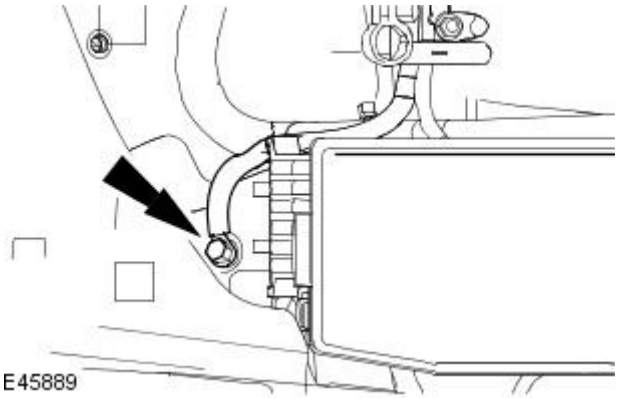
18. Detach the battery ground cable from the transmission.



19. Remove the battery ground cable.

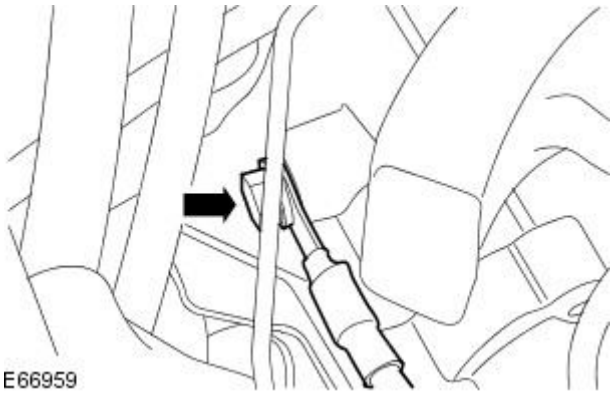


Installation

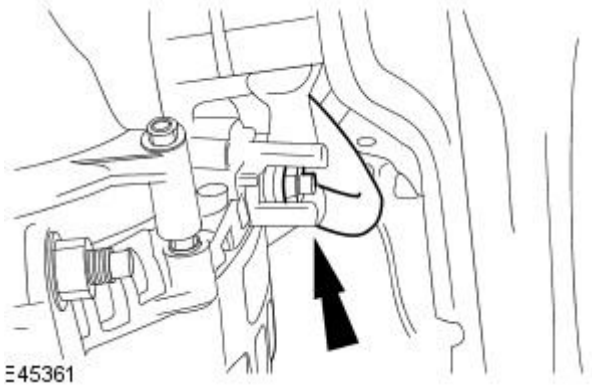


1. To install, reverse the removal procedure.

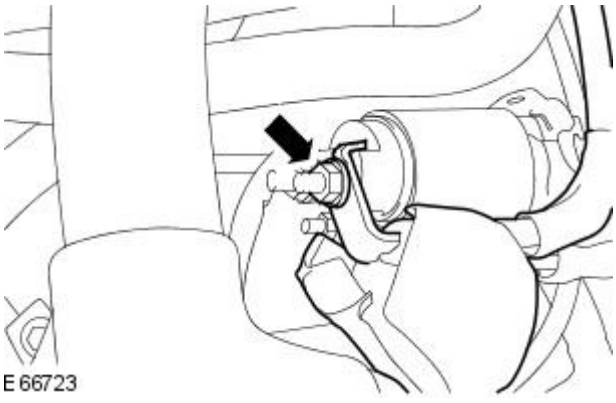
- Tighten to 25 Nm.



2. Tighten to 25 Nm.



3. Tighten to 8 Nm.



4. Tighten to 8 Nm.

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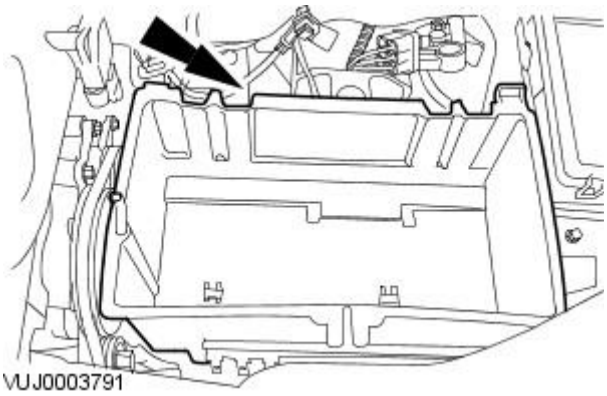
Battery, Mounting and Cables - Battery Tray

Removal and Installation

Removal



1. Remove the battery.
   For additional information, refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
2. NOTE: Petrol engine shown, diesel engine similar.

   Remove the battery tray.

Installation

1. To install, reverse the removal procedure.

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Generator and Regulator -

Torque Specifications

Description	Nm	lb-ft	lb-in
Generator upper retaining bolt	47	35	-
Generator lower retaining bolts - vehicles with 2.0L, 2.5L or 3.0L engine	25	18	-
Generator lower mounting studs - vehicles with 2.0L diesel engine	15	11	-
Generator lower retaining nuts - vehicles with 2.0L diesel engine	47	35	-
Generator battery positive cable retaining nut	12	9	-
Generator cooling duct retaining nuts - vehicles with 2.0L diesel engine	4	-	35

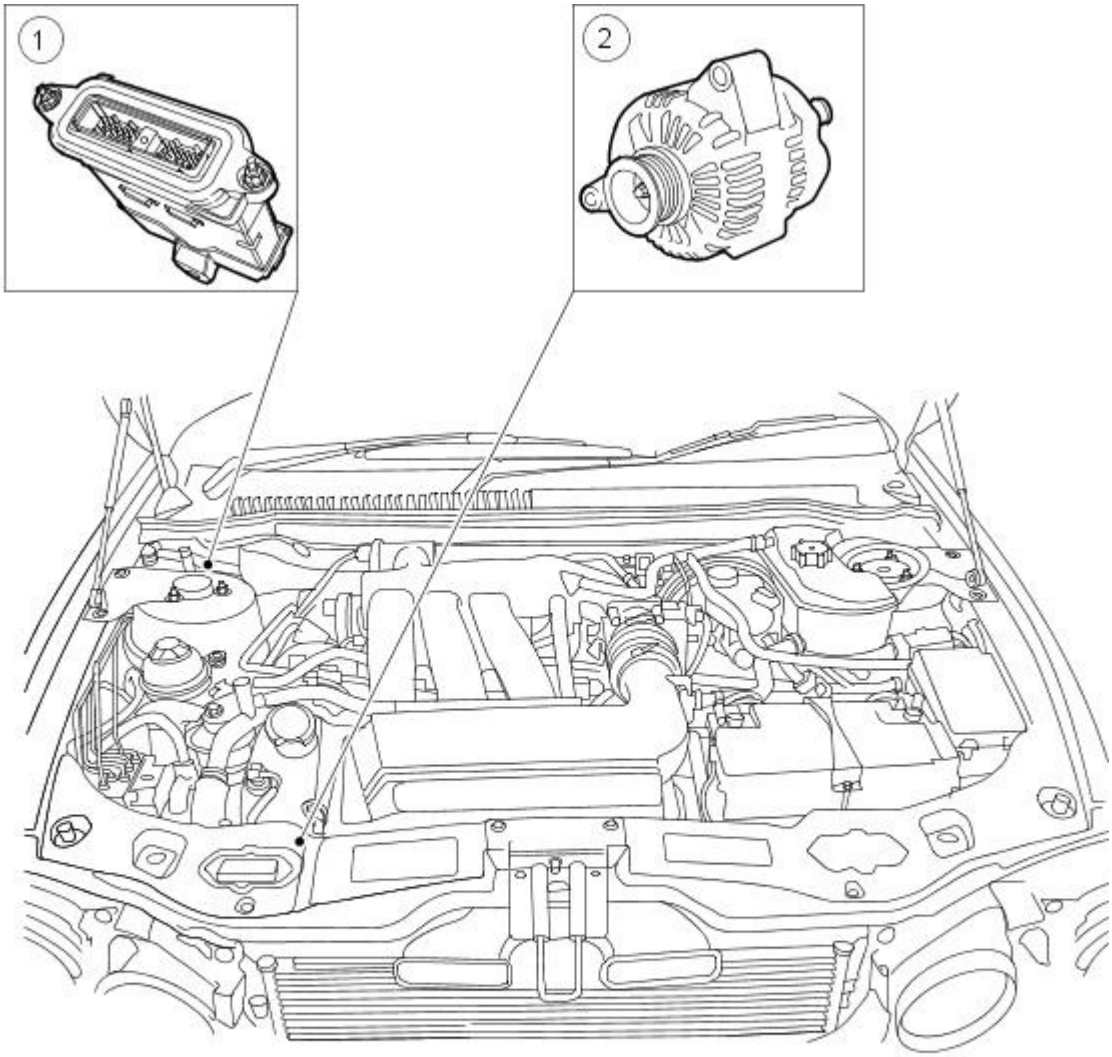
Published: 11-May-2011

Generator and Regulator - Generator

Description and Operation

Charging system components

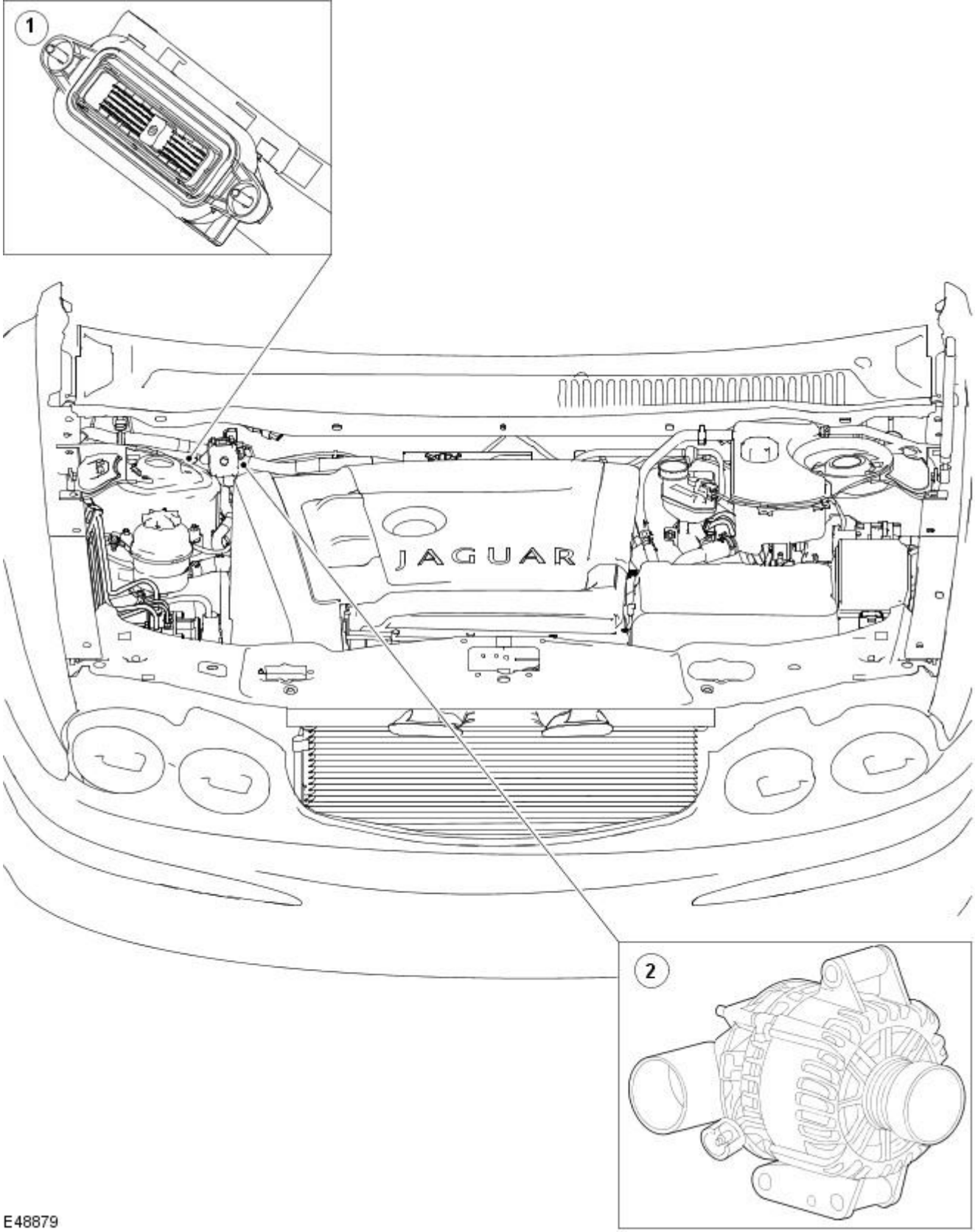
Vehicles with 2.0L, 2.5L or 3.0L engine



VUJ0004295

Item	Part Number	Description
1	—	Engine Control Module (ECM)
2	—	Generator

Vehicles with 2.0L diesel engine



E48879

Item	Part Number	Description
1	—	Engine Control Module (ECM)
2	—	Generator

• NOTE: Generators should be serviced as a unit and not dismantled for overhaul.

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Generator and Regulator - Generator

Diagnosis and Testing

2.0L/2.5L/3.0L Vehicles

REFER to: Charging System - 2.0L NA V6 - AJV6/2.5L NA V6 - AJV6/3.0L NA V6 - AJ27 (414-00 Battery and Charging System - General Information, Diagnosis and Testing).

2.0L Diesel Vehicle

REFER to: Charging System - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (414-00 Battery and Charging System - General Information, Diagnosis and Testing).

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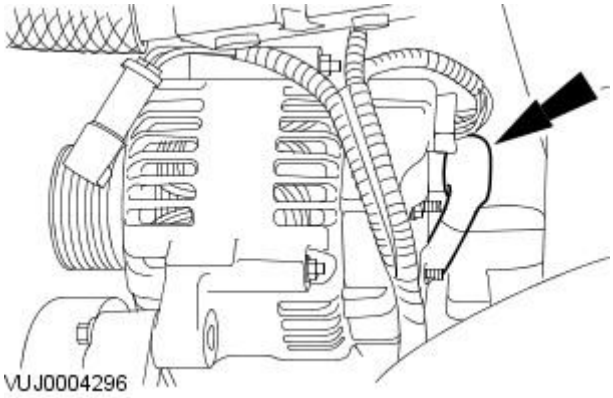
Generator and Regulator - Generator2.0L NA V6 - AJV6 / 2.5L NA V6 - AJV6 / 3.0L NA V6 - AJ27

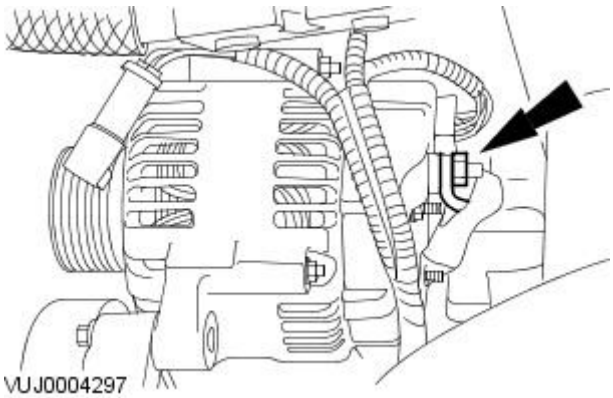
Removal and Installation

Removal

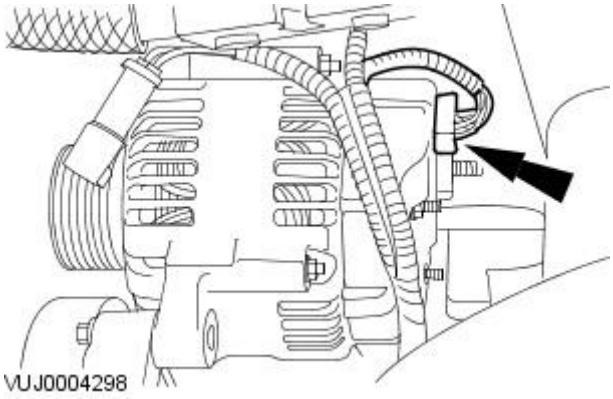
1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 Battery, Mounting and Cables.
2. Remove air conditioning compressor. For additional information, refer to Section 412-03 Air Conditioning.
3. Detach the generator battery positive cable protective cover.



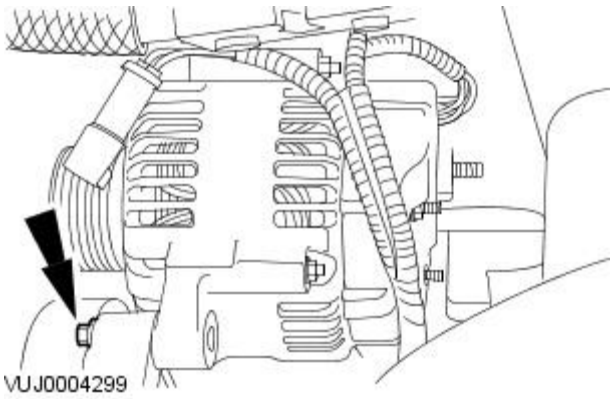
4. Disconnect the generator battery positive cable electrical connector.

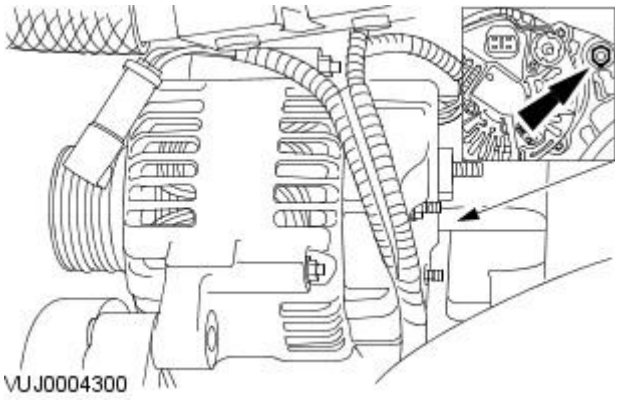


5. Disconnect the generator electrical connector.



6. Remove the generator lower retaining bolt.

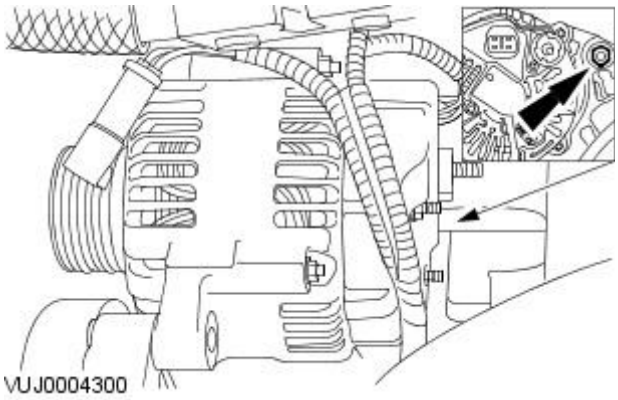




7. Remove the generator.

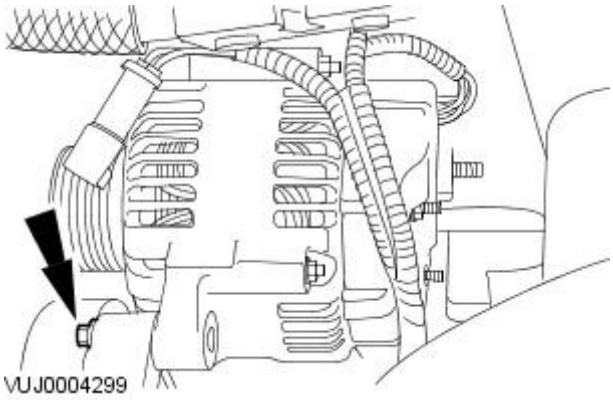
- Remove the generator upper retaining bolts.

Installation

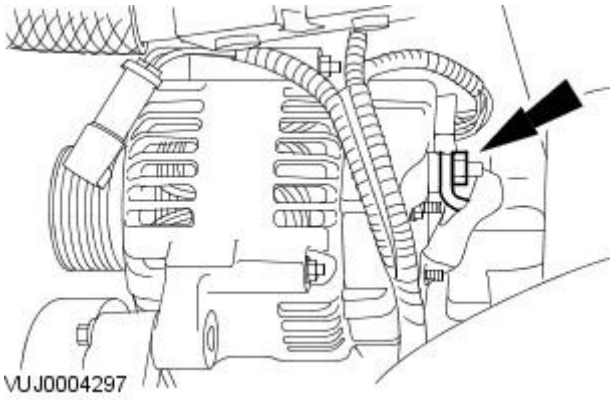


1. To install, reverse the removal procedure.

- Tighten to 47 Nm.



2. Tighten to 25 Nm.



3. Tighten to 12 Nm.

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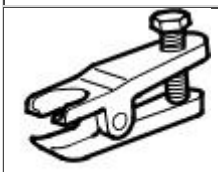
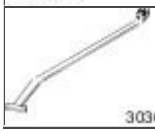
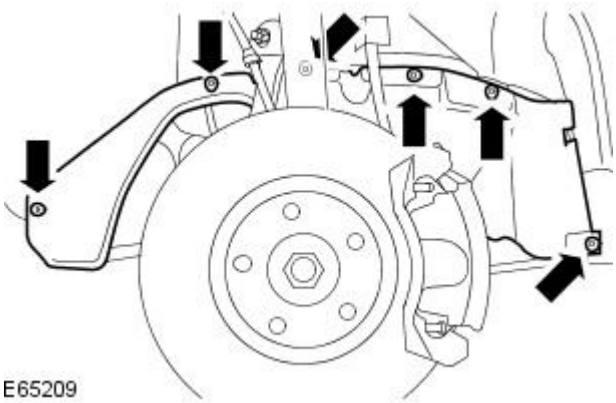
Generator and Regulator - Generator2.0L Duratorq-TDCi / 2.2L Duratorq-TDCi (110kW / 150PS) - Puma

Removal and Installation

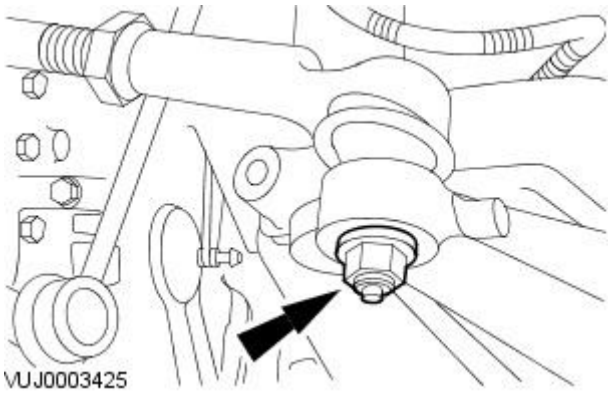
Special Tool(s)	
	Separator, ball joint 204-192
	Release tool, belt tensioner 303-676

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 - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (501-02 Front End Body Panels, Removal and Installation).
3. Remove the front, right-hand wheel and tire.
   For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
4. Remove the right-hand wheel arch liner access cover.

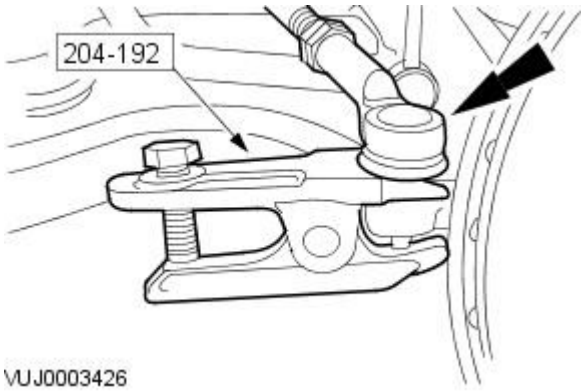


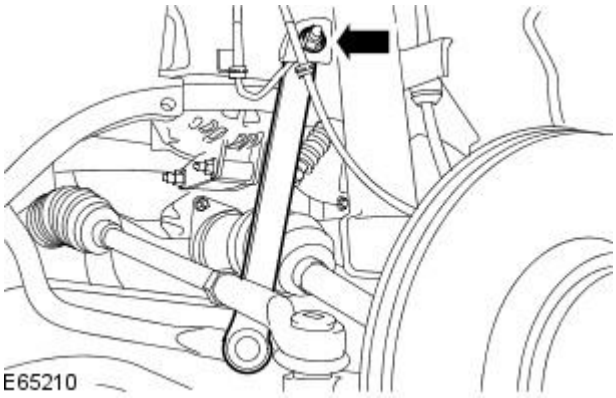
5. Remove the tie-rod end retaining nut.



6. NOTE: When the tie-rod end is separated from the wheel hub assembly, the ball joint seal should be protected to prevent damage.

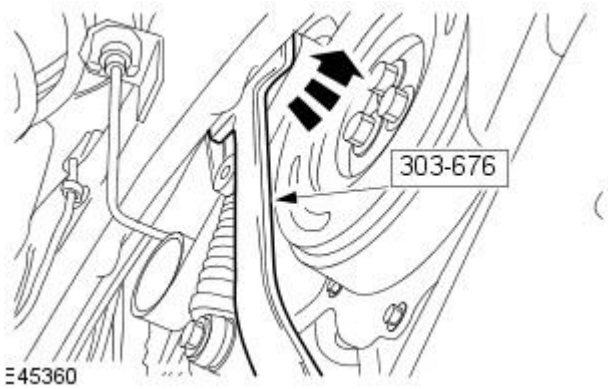
   Using the special tool, detach the tie-rod end.



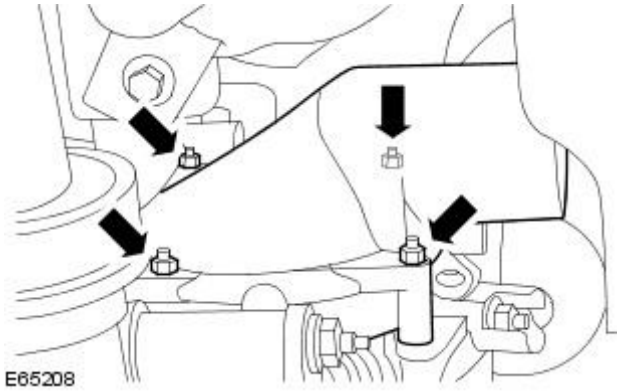


7. Detach the right-hand stabilizer bar link.

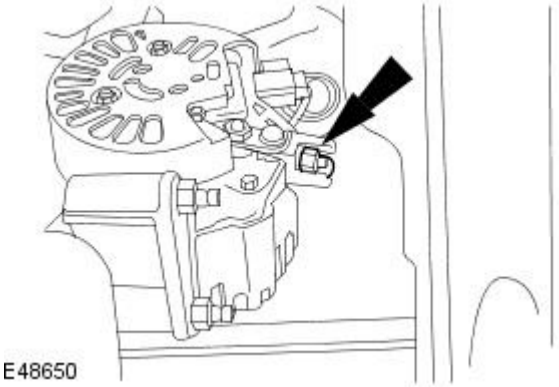
- Reposition the anti-lock brake system (ABS) wiring harness mounting bracket.



8. Using the special tool, detach the accessory drive belt.



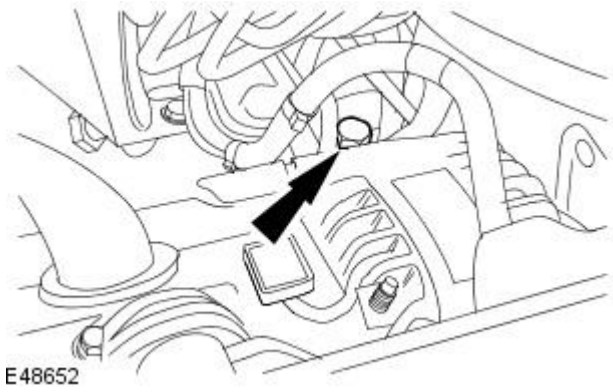
9. Remove the generator cooling duct from the generator.



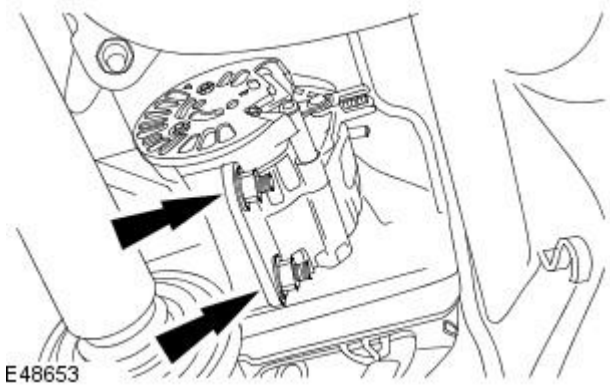
10. Detach the generator positive cable.

11. Disconnect the generator electrical connector.

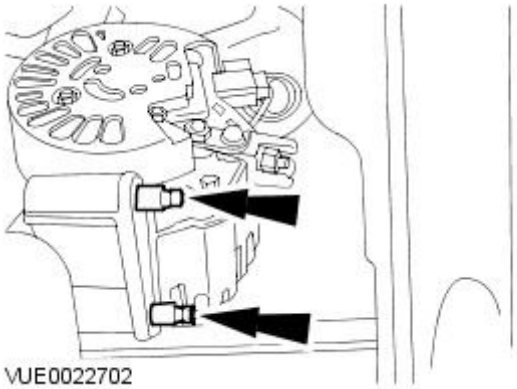
12. Remove the generator upper retaining bolt.



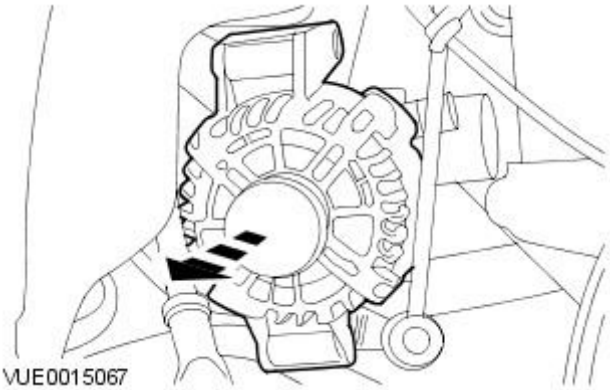
13. Remove the generator retaining nuts.



14. Remove the generator mounting studs.

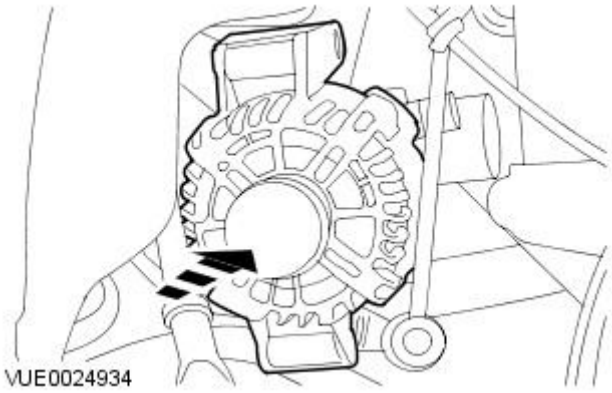


15. Remove the generator.



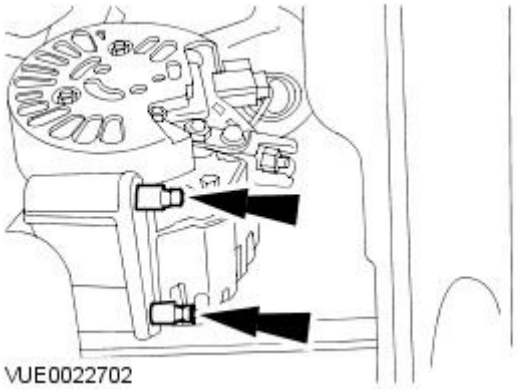
Installation

1. Install the generator.

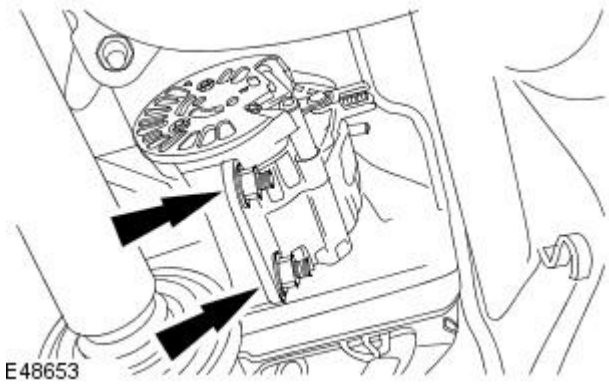


2. Install the generator mounting studs.

- Tighten to 15 Nm.

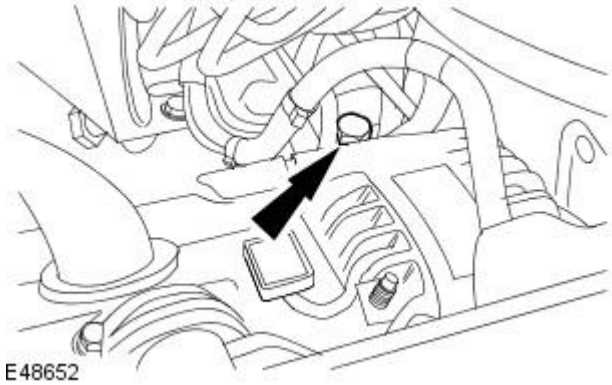


3. Loosely install the generator retaining nuts.

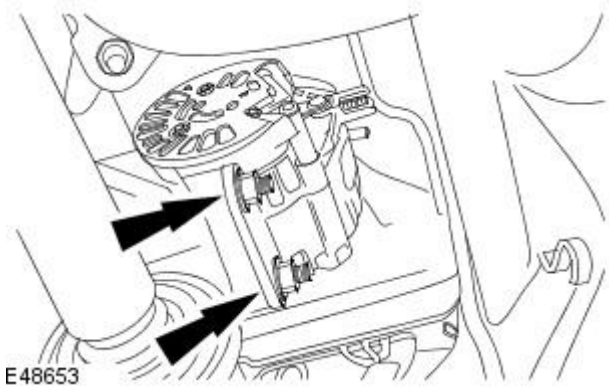


4. Install the generator upper retaining bolt.

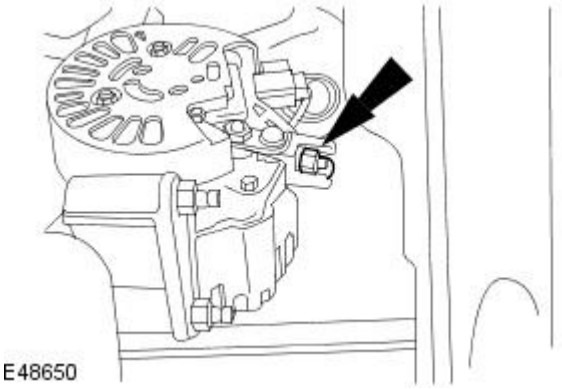
1. Tighten to 47 Nm.



5. Tighten to 47 Nm.

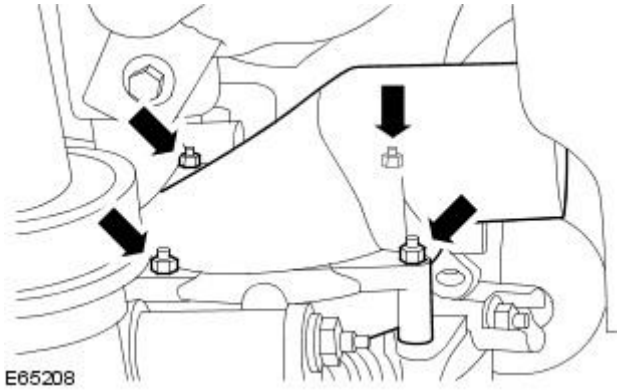


6. Connect the generator electrical connector.



7. Attach the generator positive cable.

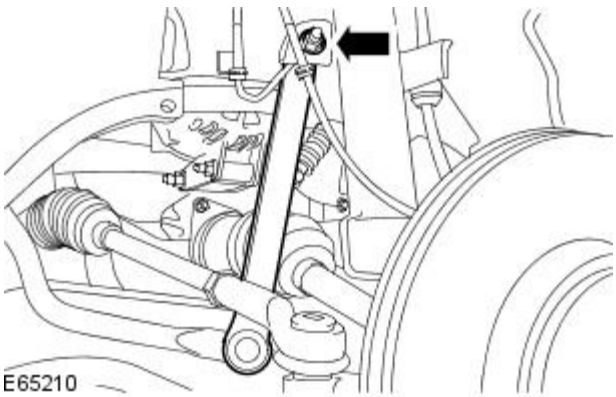
- Tighten to 12 Nm.



8. Install the generator cooling duct to the generator.

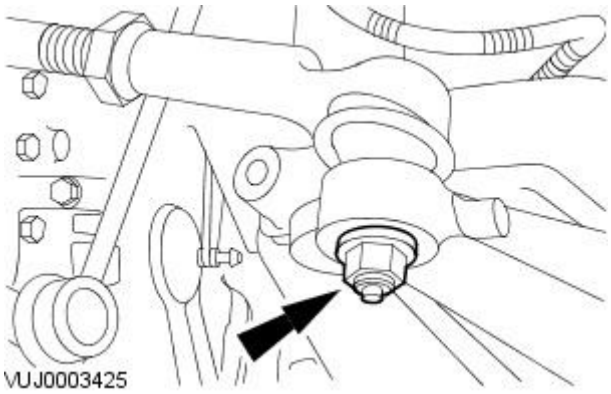
- Tighten to 4 Nm.

9. Using the special tool, attach the accessory drive belt.



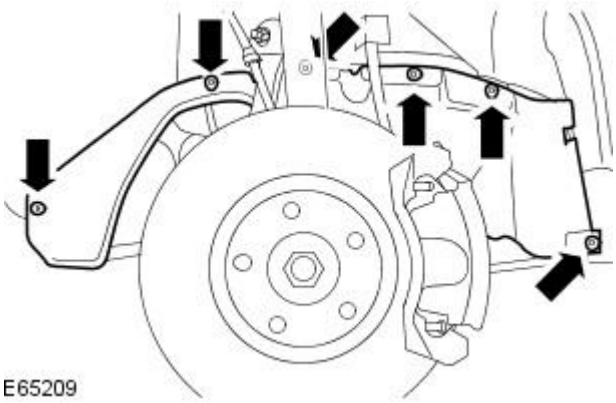
10. Attach the right-hand stabilizer bar link.

- Attach the ABS wiring harness mounting bracket.
- Tighten to 48 Nm.



11. Install the tie-rod end and the tie-rod end retaining nut.

- Tighten to 35 Nm.



12. Install the right-hand wheel arch liner access cover.

13. Install the front, right-hand wheel and tire.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

14. Install the air deflector.
For additional information, refer to: Air Deflector - 2.0L Duratorq-TDCi/2.2L Duratorq-TDCi (110kW/150PS) - Puma (501-02 Front End Body Panels, Removal and Installation).

15. Connect the battery ground cable.
For additional information, refer to: Battery Connect (414-01 Battery, Mounting and Cables, General Procedures).