Engine Data

Model/Engine	Engine Capacity	Engine Description	Max. Engine Power (SAE)	Max. Engine Torque (SAE)	Max. Engine Power (EEC)	Max. Engine Torque (EEC)	Comp. Ratio	Bore	Stroke
X-TYPE: 2001 MY	onwards – St	art VIN C0034	4						
2.0 liter Gasoline	2099 cm ³ (128 in ³)	60° 'V' 6 Cylinder 24 Valves	154 BHP at 6800 RPM	145 lbf.ft at 4100 RPM	114.6 kW at 6800 RPM	196 Nm at 4100 RPM	10.75 : 1 ± 0.5 : 1	81.65 mm (3.214 in)	66.84 mm (2.631 in)
2.0 liter Diesel	1998 cm³ (122 in³)	In-line 4 Cylinder 16 Valves	Not applicable	Not applicable	96 kW at 3800 RPM	330 Nm at 1800 RPM	18.2 : 1 ± 0.5 : 1	86 mm (3.385 in)	86 mm (3.385 in)
2.2 liter Diesel	2198 cm ³ (134 in ³)	In-line 4 Cylinder 16 Valves	Not applicable	Not applicable	114 kW at 3500 RPM	360 Nm at 1800 RPM	17.5 : 1 ± 0.5 : 1	86 mm (3.385 in)	94.6 mm (3.724 in)
2.5 liter Gasoline	2497 cm ³ (152 in ³)	60° 'V' 6 Cylinder 24 Valves	192 BHP at 6800 RPM	178 lbf.ft at 3000 RPM	143.5 kW at 6800 RPM	241 Nm at 3000 RPM	10.30 : 1 ± 0.35 : 1	81.65 mm (3.214 in)	79.5 mm (3.130 in)
3.0 liter Gasoline	2967 cm ³ (181 in ³)	60° 'V' 6 Cylinder 24 Valves	227 BHP at 6800 RPM	206 lbf.ft at 3000 RPM	169.4 kW at 6800 RPM	279.3 Nm at 3000 RPM	10.5 : 1 ± 0.5 : 1	89.0 mm (3.504 in)	79.5 mm (3.130 in)

Engine Valve Clearances

Engine	Valve Clearances (cold)			
	Intake	Exhaust		
V6 Gasoline	0.175 – 0.225 mm	0.325 – 0.375 mm		
In-line 4 Cylinder Diesel	No adjustment necessary			

Engine Oil – Specification and Capacity

Model/Engine	Market	Oil Specification	Engine Oil Capacity service oil fill and filter change Liters (US Quarts)		Start VIN	
			oil cooler	non oil cooler		
X-TYPE: 2001 MY onwar	ds					
	NAS	API SL and ILSAC GF–3				
2.0 liter Gasoline	ROW	API SJ / EC and ACEA A1 or A3 Jaguar WSS–M2C913–B preferred	5.8 (6.1)	_		
2.0 liter Diesel	iesel EUR 5W–30 meeting Jaguar WSS–M2C913–B		6.0 (6.4)	_		
2.2 liter Diesel	Diesel EUR 5W-30 meeting Jaguar WSS-M2C913-B		6.0 (6.4)	_		
	NAS	API SL and ILSAC GF-3			C00344	
2.5 liter Gasoline	ROW	API SJ / EC and ACEA A1 or A3 Jaguar WSS–M2C913–B preferred	5.8 (6.1			
	NAS	API SL and ILSAC GF-3				
3.0 liter Gasoline	ROW	API SJ / EC and ACEA A1 or A3 Jaguar WSS–M2C913–B preferred	5.8 (6.1)			

Note: 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.



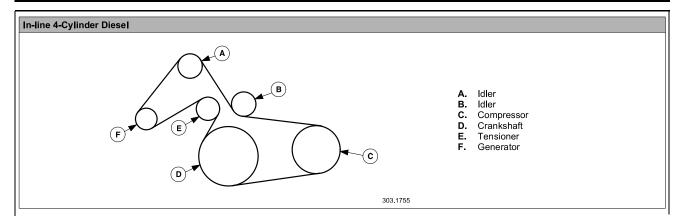
Engine Coolant – Specification and Capacity

Model/Engine	Start VIN	Market	Coolant Specification	Part Number	Total Coolant Capacities 50% water + 50% coolant Liters (US Quarts)
X-TYPE: 2001 MY onwards					
2.0 liter Gasoline	C00344	All	WSS M97B44-D	JLM 20972/*	10.0 (10.6) approx.
2.0 liter Diesel	C00344	EUR	WSS M97B44-D	JLM 20972/*	10.1 (10.7) approx.
2.2 liter Diesel	C00344	EUR	WSS M97B44-D	JLM 20972/*	10.1 (10.7) approx.
2.5 liter	C00344	All	WSS M97B44-D	JLM 20972/*	10.0 (10.6) approx.
3.0 liter	C00344	All	WSS M97B44-D	JLM 20972/*	10.0 (10.6) approx.

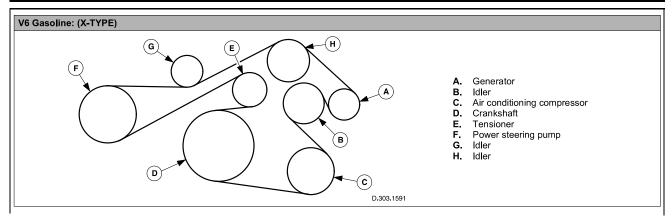
Note: * denotes container quantity when substituted with a number.

Note: Coolant JLM 20972 is of the Organic Acid Technology (OAT) type and must not be mixed with other types of coolant.

Accessory Drive Belt Installation



Accessory Drive Belt Installation



Spark Plug Specification

Start VIN	Engine Type	Engine	Market Spark Plug Part Number		Spark Plug Gap – mm (inches)		
X-TYPE: 2001 MY onwards							
C00344	V6	2.0 liter	All	XR8 42795 or	1.32 – 1.42 (0.051 – 0.056)		
		2.5 liter			1.32 - 1.42 (0.031 - 0.036)		
		3.0 liter		C2S 46895	1.2 - 1.3 (0.047 - 0.051)		

Engine

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
 helt
- a variable vain turbocharger.

Engine

Inspection and Verification

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

- 1. Verify the customer concern by operating the system.
- 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.

Mechanical

- Coolant leaks
- Oil leaks
- · Leaks in the fuel system
- Vis bly damaged or worn parts
- · Loose or missing nuts or bolts
- 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Difficult to start during hot or cold start

Possible Source(s):

• Piston ring(s) worn, damaged, sticking or worn piston/cylinder.

Action(s) to take:

• INSTALL a new engine.

Possible Source(s):

• Head gasket damaged.

Action(s) to take:

• INSPECT the head gasket.

Possible Source(s):

• Fuel system damaged or inoperative.

Action(s) to take:

• For additional information, refer to <<303-04>>.

Possible Source(s):

• Ignition system inoperative.

Action(s) to take:

• For additional information, refer to <<303-04>>.

Poor Idling

Possible Source(s):

Restricted exhaust system.

Action(s) to take:

• INSPECT the exhaust system. For additional information, refer to <<309-00>>.

Possible Source(s):

Vacuum leak.

Action(s) to take:

• CARRY out the Intake Manifold Vacuum Test in this section. REPAIR and INSTALL new components as necessary.

Possible Source(s):

Burned valve(s).

Action(s) to take:

• INSPECT the valve(s).

Possible Source(s):

• Incorrect valve to valve seat contact.

Action(s) to take:

• INSPECT the valve and valve seat.

Possible Source(s):

• Head gasket damaged.

Action(s) to take:

• INSPECT the head gasket.

Possible Source(s):

• Fuel system damaged or inoperative.

Action(s) to take:

• For additional information, refer to <<303-04>>.

Insufficient power

Possible Source(s):

• Compression leakage from valve seat.

Action(s) to take:

• INSPECT the valve or valve seat.

Possible Source(s):

· Valve sticking.

Action(s) to take:

• INSPECT valve stem to valve guide clearance or carbon accumulation.

Possible Source(s):

Valve spring weak or broken.

Action(s) to take:

• INSPECT the valve spring.

Possible Source(s):

• Head gasket damaged.

Action(s) to take:

• INSPECT the head gasket.

Possible Source(s):

• Cylinder head cracked or distorted.

Action(s) to take:

• INSPECT the cylinder head.

Possible Source(s):

Piston ring(s) worn, damaged or sticking.

Action(s) to take:

• INSTALL a new engine.

Possible Source(s):

• Fuel system damaged or inoperative.

Action(s) to take:

• For additional information, refer to <<303-04>>.

Possible Source(s):

Brakes dragging.

Action(s) to take:

• For additional information, refer to <<206-00>>.

Possible Source(s):

• Restricted exhaust system.

Action(s) to take:

• INSPECT the exhaust system. For additional information, refer to <<309-00>>.

Possible Source(s):

• Valve(s) burnt or sticking.

Action(s) to take:

• INSPECT the valve(s).

Possible Source(s):

• Valve spring(s) weak or broken.

Action(s) to take:

• INSPECT the valve spring(s).

Possible Source(s):

• Piston ring(s) worn, damaged, sticking or worn piston/cylinder.

Action(s) to take:

• INSTALL a new engine.

Possible Source(s):

Head gasket damaged.

Action(s) to take:

• INSPECT the head gasket.

Possible Source(s):

• Carbon accumulation in combustion chamber.

Action(s) to take:

• ELIMINATE carbon build up.

Possible Source(s):

• Fuel system damaged or inoperative.

Action(s) to take:

• For additional information, refer to <<303-04>>.

Excessive oil consumption

Possible Source(s):

• Piston ring(s) worn, damaged, sticking or worn piston/cylinder.

Action(s) to take:

• INSTALL a new engine.

Possible Source(s):

• Valve stem seal worn or missing.

Action(s) to take:

• INSPECT the valve or valve stem seal.

Possible Source(s):

· Oil leakage.

Action(s) to take:

• REPAIR oil leakage.

Possible Source(s):

• Valve stem or valve guide worn.

Action(s) to take:

• INSPECT the valve stem or valve guide.

Possible Source(s):

Incorrect oil viscosity.

Action(s) to take:

• DRAIN and FILL with new oil.

Possible Source(s):

• Diluted oil.

Action(s) to take:

• CHECK oil dilution. DRAIN and FILL as necessary.

Possible Source(s):

• Crankcase overfilled.

Action(s) to take:

· CHECK and adjust the oil level.

Possible Source(s):

• Incorrect oil pressure.

Action(s) to take:

• CHECK the oil pressure. REPAIR as necessary.

Engine noise

Possible Source(s):

• Excessive crankshaft main bearing clearance.

Action(s) to take:

• INSTALL a new engine.

Possible Source(s):

Excessive crankshaft end play.

Action(s) to take:

• INSTALL a new engine.

Possible Source(s):

• Excessive connecting rod bearing oil clearance.

Action(s) to take:

• INSTALL a new engine.

Possible Source(s):

• Piston/cylinder worn.

Action(s) to take:

• INSTALL a new engine.

Possible Source(s):

• Piston ring damaged.

Action(s) to take:

• INSTALL a new engine.

Possible Source(s):

· Connecting rod bent.

Action(s) to take:

• INSTALL a new engine.

Possible Source(s):

• Valve spring(s) broken.

Action(s) to take:

• INSPECT the valve spring(s).

Possible Source(s):

• Excessive valve guide clearance.

Action(s) to take:

• INSPECT the valve guide or valve.

Possible Source(s):

• Cooling system inoperative (water pump, vibration of radiator).

Action(s) to take:

• For additional information, refer to <<303-03>>.

Possible Source(s):

• Fuel system inoperative.

Action(s) to take:

• For additional information, refer to <<303-04>>.

Possible Source(s):

• Excessive carbon buildup.

Action(s) to take:

ELIMINATE carbon buildup.

Possible Source(s):

Exhaust gas leakage.

Action(s) to take:

• REPAIR leakage. For additional information, refer to <<309-00>>.

Possible Source(s):

Incorrect drive belt tension.

Action(s) to take:

• INSPECT the drive belt tension. For additional information, refer to <<303-05>>.

Possible Source(s):

· Generator front bearing worn.

Action(s) to take:

• For additional information, refer to <<414-02>>.

Tappet noise, engine running

Possible Source(s):

• Incorrect tappet clearance.

Action(s) to take:

• 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. Clean the engine with a suitable cleaning fluid (brake cleaner).
- 2 . Drain the engine oil and refill with recommended oil, premixed with Diesel Engine Oil Dye or equivalent. Use a minimum 14.8 ml (0.5 ounce) to a maximum 29.6 ml (1 ounce) of fluorescent additive to all engines. If oil is not premixed, fluorescent additive must first be added to the crankcase.
- 3 . Run engine for 15 minutes. Stop the engine and inspect all seal and gasket areas for leaks using a 12 Volt Master UV Diagnostic Inspection Kit or equivalent. A clear bright yellow or orange area will identify leak. For extremely small leaks, several hours may be required for the leak to appear.
- 4 . As necessary, pressurize the main oil gallery system to locate leaks due to incorrectly sealed, loose or cocked plugs.
- 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. Remove the fuel pump relay.
- 2. Start the engine the engine will start, run for a few seconds then stall.
- 3. Remove the spark plugs.
- 4 . Install the compression tester.
- 5 . Install an auxiliary starter switch in the starting circuit. With the ignition switch OFF, using the auxiliary starter switch, crank the engine a minimum of five compression strokes and record the highest reading. Note the approximate number of compression strokes required to obtain the highest reading.
- 6 . Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.
- 7. Install the components in reverse order, observing the specified tightening torques.
- 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 . 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. Verify that the engine has no external oil leaks as descr bed under Engine Oil Leaks.
- 3. Verify that the engine has the correct oil level.
- 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. Carry out an oil consumption test:
- Drain engine oil and fill with one liter less than the recommended amount.
- 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.
- 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.)
- 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.
- Record the vehicles mileage.
- Instruct the customer to drive the vehicle as usual and:
- Check the oil level regularly at intervals of 160-240 km (100-150 miles).
- Return to the service point when the oil level drops below the lower (ADD) mark on the oil level indicator.
- Add only full liters of the same oil in an emergency. Note the mileage at which the oil is added.
- Check the oil level under the same conditions and at the same location as in steps 3 and 4.

- Measure the distance from the oil level to the UPPER mark on the oil level indicator and record.

 Measure the distance between the two scribe marks and record.
- Divide the first measurement by the second.
- 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.
- If the oil consumption rate is unacceptable go to Step 6.
- 6. Check the positive crankcase ventilation (PCV) system. Make sure the system is not plugged.
- 7. Check for plugged oil drain-back holes in the cylinder head and cylinder block.
- 8. If the condition still exists after carrying out the above tests go to step 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 . Check valve guides for excessive guide clearance. Install new valve stem seals after verifying valve guide clearance.
- 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.

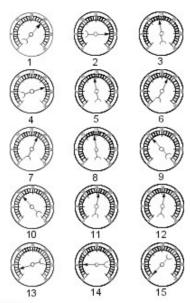
The reading should be steady. As necessary, adjust the gauge damper control (where used) if the needle is fluttering rapidly. Adjust the damper until the needle moves easily without excessive flutter.

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.



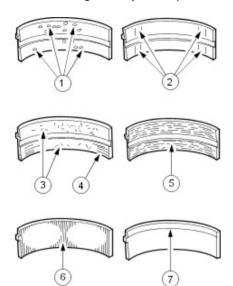
VUJ0001694

- 1 . NORMAL READING: Needle between 51-74 kPa (15-22 in-Hg) and holding steady.
- 2 . NORMAL READING DURING RAPID ACCELERATION : When the engine is rapidly accelerated (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 . NORMAL FOR HIGH-LIFT CAMSHAFT WITH LARGE OVERLAP: The needle will register as low as 51 kPa (15 in-Hg) but will be relatively steady. Some oscillation is normal.
- 4. WORN RINGS OR DILUTED OIL: When the engine is accelerated (dotted needle), the needle drops to 0 kPa (0 in-Hg). Upon deceleration, the needle runs slightly above 74 kPa (22 in-Hg).
- 5 . STICKING VALVES: When the needle (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 . BURNED OR BENT VALVES: A regular, evenly-spaced, downscale flicking of the needle indicates one or more burned or damaged valves. Insufficient hydraulic valve tappet or hydraulic lash adjuster clearance will also cause this reaction.
- 7. POOR VALVE SEATING: A small but regular downscale flicking can mean one or more valves are not seating correctly.
- 8 . 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 . 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 . LATE VALVE TIMING: A steady but low reading could be caused by late valve timing.
- 11 . IGNITION TIMING RETARDING: Retarded ignition timing will produce a steady but somewhat low reading.
- 12 . INSUFFICIENT SPARK PLUG GAP: When spark plugs are gapped too close, a regular, small pulsation of the needle can occur.
- 13 . INTAKE LEAK: A low, steady reading can be caused by an intake manifold or throttle body gasket leak.
- 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 . 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.

Bearing Inspection

- 1. Inspect bearings for the following defects.
 - 1. Cratering fatigue failure
 - 2. Spot polishing incorrect seating.
 - 3. Imbedded dirt engine oil.
 - 4. Scratching dirty engine oil.
 - 5. Base exposed poor lubrication.
 - 6. Both edges worn journal damaged.
 - 7. One edge worn journal tapered or bearing not seated.



VUJ0002219

Camshaft Bearing Journal Clearance

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.

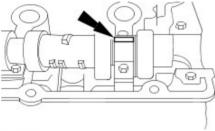
NOTE:

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.



VUJ0001696

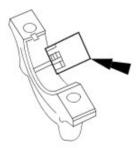
2. Install the camshaft bearing caps. For additional information, refer to <<303-01>>.

3. **NOTE:**

Do not str ke the bearing caps.

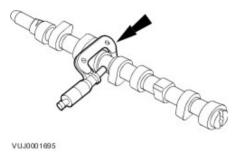
Remove the camshaft bearing caps. For additional information, refer to <<303-01>>.

- 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.



Camshaft Bearing Journal Diameter

- 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.



Camshaft End Play

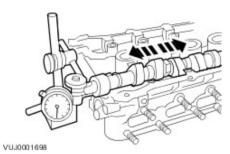
1. NOTE:

Make sure that the camshaft is to specification.

Using the special tool, measure the end play.

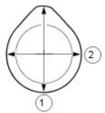
Slide the camshaft in both directions. Read and note the maximum and minimum values on the dial indicator gauge. End play = maximum value minus minimum value.

If the measurement is out of specification, install new components.



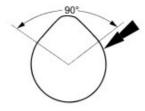
Camshaft Lobe Lift

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



Camshaft Surface Inspection

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



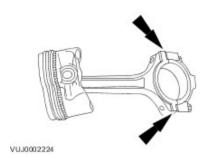
Connecting Rod Cleaning

1.



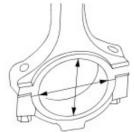
CAUTION: Do not use a caustic cleaning solution or damage to connecting rods may occur.

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



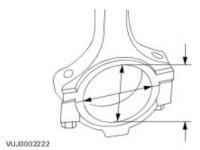
Connecting Rod Large End Bore

1. Measure the bearing bore in two directions. The difference is the connecting rod bore out-of-round. Verify the out-of-round is within specification.



VUJ0002223

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



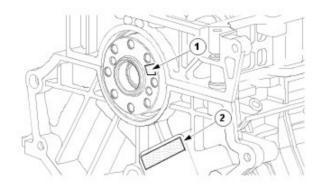
Crankshaft End Play

- 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.



Crankshaft Main Bearing Journal Clearance

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



E53234

2. NOTE:

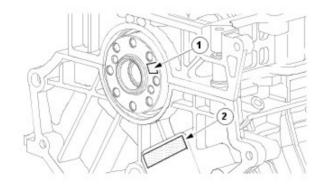
Main bearing number 1 relates to the front of the engine.

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

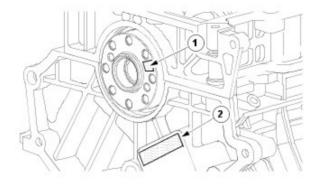
3. **NOTE:**

Main bearing number 1 relates to the front of the engine.

Read the identification numbers on the cylinder block (2).

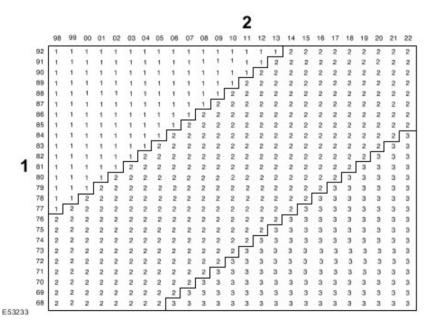
•

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.

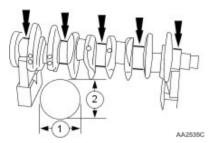


- 5. E.g. if the crankshaft code is *8580*8082* and the Block code is *0609*0711*, main bearing 1 should be assembled with a grade 1 bearing, as determined by the intersection of the number 06 block column (2) and the number 85 crankshaft row (1).
 - Main bearing 2, 3 and 4 would all be assemble with a grade 2.

Crankshaft Main Bearing Journal Diameter

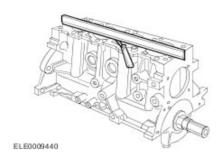
Micrometer 1. Measure the diameter of the main bearing journals and the big-end bearing journals.

- Repeat the measurement with the 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.



Cylinder Block Distortion

- 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).



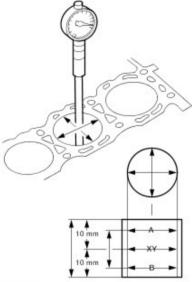
Cylinder Bore Out-of-Round

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.

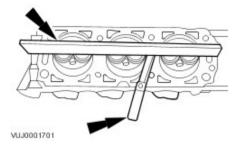
Measure the cylinder bore with an internal micrometer.

- 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.



Cylinder Head Distortion

- 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).



Exhaust Manifold Cleaning and Inspection

- 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.

Flywheel Inspection

1.



CAUTION: Do not rework the flywheel if it is distorted.

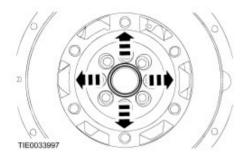


CAUTION: Do not clean the dual mass flywheel with any kind of fluid. Clean the flywheel with a dry cloth only.

CAUTION: 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.



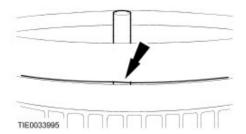
3.



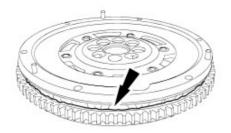
CAUTION: Make sure that the three locating dowels are installed.

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.



- 4. Inspect for grease along the welding.
 - If grease is evident, install a new flywheel.



TIE0033996

Piston Diameter

Micrometer 1. NOTE:

Mark the piston to make sure the piston is installed correctly.

Using a measure the piston diameter.



IAV2102103

Piston Inspection

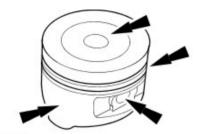
1.



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.



Piston Pin Diameter

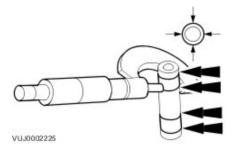
1. NOTE:

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.



Piston Pin to Bore Diameter

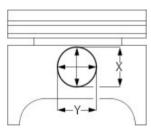
1. NOTE:

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.



VUJ0002232

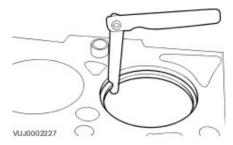
Piston Ring End Gap

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.

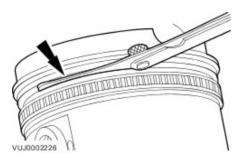


Piston Ring-to-Groove Clearance

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.



Valve Seat Inspection

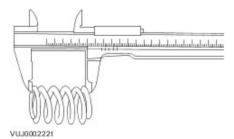
Valve seat width scale 1. Measure the width of the valve seat.

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



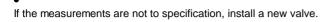
Valve Spring Free Length

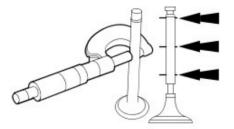
1. Using a vernier gauge, measure the free length of each valve spring. Verify the length is within specification.



Valve Stem Diameter

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





VUJ0002220

Specifications

Lubricants, Fluids, Sealers and Adhesives

Description	Specification
Engine oil (EUROPE), SAE 5W-30	WSS-M2C-913A
Engine oil (US), SAE 5W-30	ILSAC GF3, API SJ
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	Α	-	-
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	А	-	-
Oil cooler retaining bolt	57	42	-
Oil level indicator tube retaining bolt with stud head	10	7	-
Oil pan retaining bolts	Α	-	-
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	А	-	-
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
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	-	-	-

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 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 2011-11-23
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
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, 2.5 and 3.0 litre.

Item	Liters
Oil capacity with filter	6.5

Valve Clearance Adjustment (12.29.48)

- 1. Remove the camshafts. For additional information, refer to Ôæ(@ecŠP OFGÈHÈJD Q) X^@B(\ Ü^) æ Û\&æ() à^[, È
- 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 to Oa(@ecŠP OFOEHÈJD Q) X^@8\^Ü^] all U^&a[] à^[] È

Valve Clearance Check (12.29.47)

3.

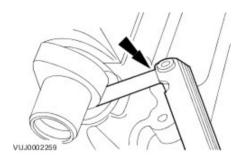
- 1. Remove the left hand valve cover. Refer to Valve Cover LH-In Vehicle Repair Section below
- 2. Remove the right hand valve cover. For additional information, refer to Valve Cover RH In Vehicle Repair Section below

CAUTION: 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.

CAUTION: Camshaft lobes must be 180 degrees away from each valve shim or valve clearance measurement will be incorrect.

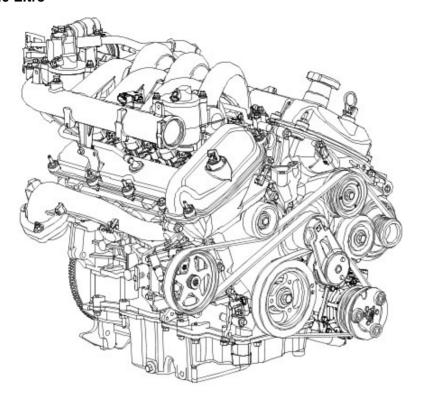
Rotate the engine clockwise to position the camshaft lobe away from the shim surface.

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 <<303-00>>. Adjust the clearances as necessary. For additional information, refer to



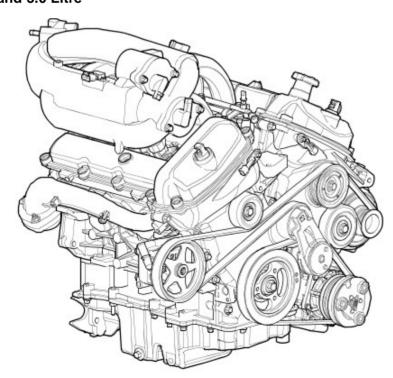
Engine

2.0 Litre



E30691

2.5 and 3.0 Litre



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 distr butorless 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.

Engine

For additional information, refer to <<303-00>>.

Engine - Vehicles With: Automatic Transaxle (12.41.01)

Special Service Tools



Powertrain Assembly Jack HTJ1200-2



5 Point Security Torx Bit 418-535



204-192

Ball joint splitter 204-192



Wheel hub puller 205-491



20549101

Adaptor nuts 205-491-01



Forcing screw 204-269



Slide hammer 100-012



100-012-02

Slide hammer shaft 100-012-02



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

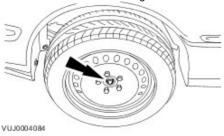
Removal

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 <u>Transmission Fluid Drain and Refill (44.24.02)</u>

3. Remove the steering column lower retaining bolt.



4 . Remove the battery tray.

For additional information, refer to Battery Tray (86.15.11)

5 . Recover the air conditioning (A/C) refrigerant.

For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging (82.30.30)

6 . Remove the front wheels and tires.

For additional information, refer to Wheel and Tire (74.20.05)

 $\boldsymbol{7}$. Drain the cooling system.

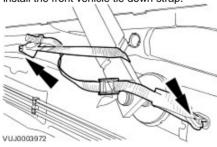
For additional information, refer to Cooling System Draining, Filling and Bleeding

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.

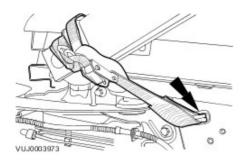


CAUTION: To prevent the vehicle becoming unstable when the engine and transmission assembly are removed, install the vehicle tie down straps.

NOTE:

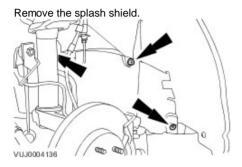
Right-hand shown, left-hand similar.

Install the rear vehicle tie down strap.



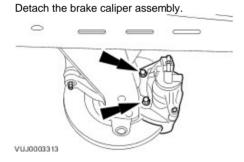
10 . **NOTE:**

Right-hand shown, left-hand similar.



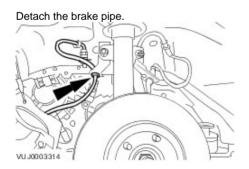
11 . **NOTE**:

Left-hand shown, right-hand similar.



12 . **NOTE:**

Left-hand shown, right-hand similar.



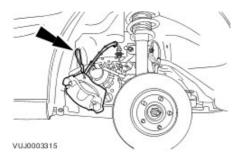
13 . **NOTE**:

Support the brake caliper assembly using tie straps.

NOTE:

Left-hand shown, right-hand similar.

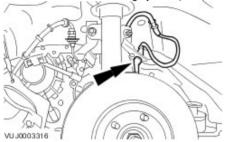
Reposition and secure the brake caliper assembly.



14 . **NOTE**:

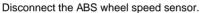
Left-hand shown, right-hand similar.

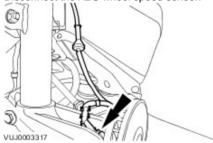
Detach the anti-lock braking system (ABS) wheel speed sensor.



15 . **NOTE:**

Left-hand shown, right-hand similar.





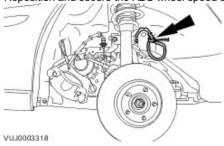
16 . **NOTE**:

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 (26.25.25)

Vehicles with 2.5L or 3.0L engine

All vehicles

19 . Remove the front muffler.

For additional information, refer to Front Muffler - 2.0L/2.5L/3.0L (30.10.18)

20 . **NOTE**:

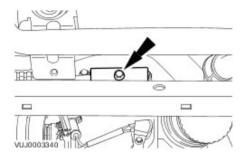
Using a suitable blanking plug, seal the tube and the A/C compressor.

NOTE:

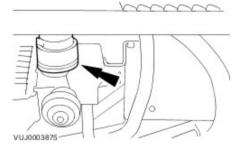
Secure the A/C compressor supply and return tubes using tie straps.

Detach the A/C compressor supply and return tubes.

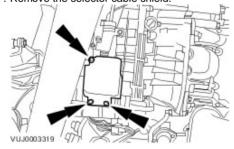
Remove and discard the O-ring seals.



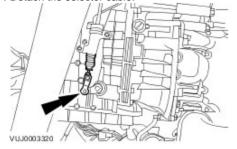
21 . Detach the coolant hose.



22 . Remove the selector cable shield.



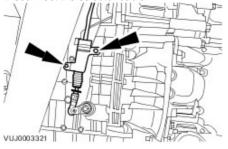
23 . Detach the selector cable.



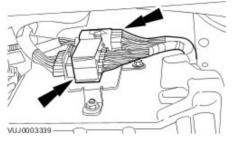
24 . **NOTE:**

Secure the selector cable using tie straps

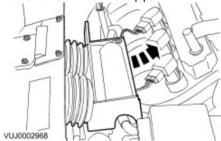
Disconnect the selector cable.



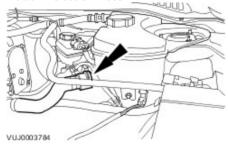
25 . Disconnect the automatic transaxle electrical connectors.



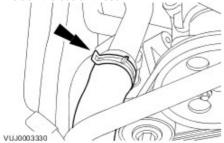
- 26 . Lower the vehicle.
- 27 . Remove the air cleaner.
 For additional information, refer to Air Cleaner (19.10.05)
- 28 . Remove the air filter intake pipe.



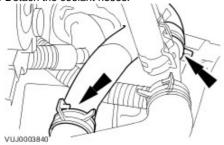
29 . Detach the coolant hose.



30 . Detach the coolant hose.

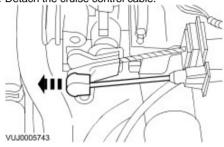


31 . Detach the coolant hoses.

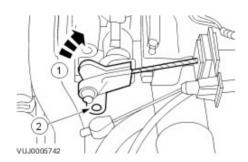


Vehicles with 2.0L engine

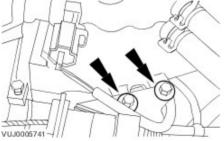
32 . Detach the cruise control cable.



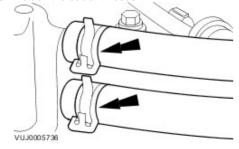
- 33 . Detach the accelerator cable.
 - 1) Reposition the accelerator lever to the fully open position.
 - 2) Detach the accelerator cable.



34 . Detach the accelerator cable retaining bracket.

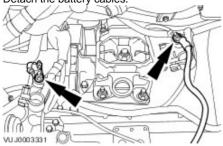


35 . Detach the coolant hoses.

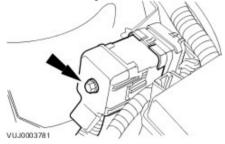


All vehicles

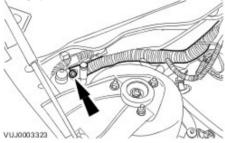
36 . Detach the battery cables.



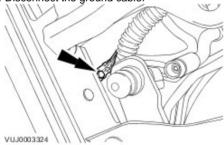
37 . Disconnect the engine harness electrical connector.



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



39 . Disconnect the ground cable.



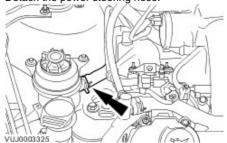
40 . **NOTE:**

Drain the fluid into a suitable container.

NOTE:

Use a suitable blanking plug to seal the hose.

Detach the power steering hose.



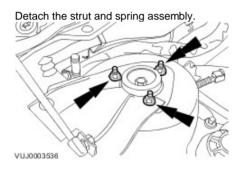
41 . Disconnect the spring lock coupling.
For additional information, refer to Spring Lock Couplings

42 . Detach the coolant pipe.



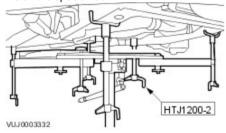
43 . **NOTE**:

Right-hand shown, left-hand similar.



44 . Raise the vehicle.

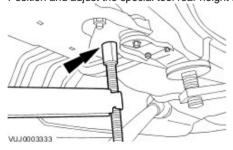
45 . Install the special tool.



46 . **NOTE**:

Left-hand shown, right-hand similar.

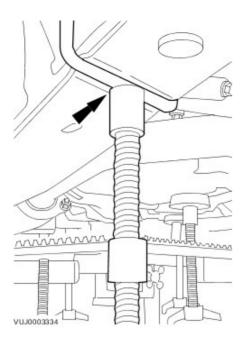
Position and adjust the special tool rear height adjuster.



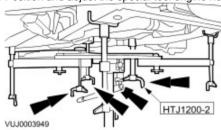
47 . **NOTE**:

Right-hand shown, left-hand similar.

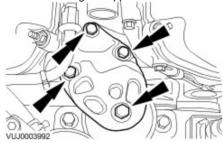
Position and adjust the special tool front height adjuster.



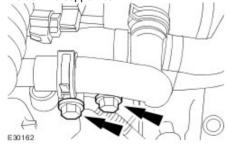
48 . Position and adjust the special tool engine height adjusters.



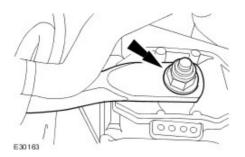
49 . Remove the engine support bracket.



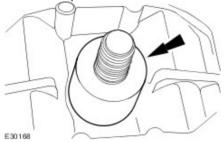
50 . Detach the support bar.



51 . Remove the support bar.



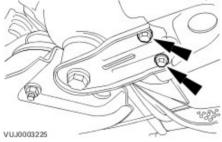
52 . Remove the spacer.



53 . **NOTE:**

Left-hand shown, right-hand similar.

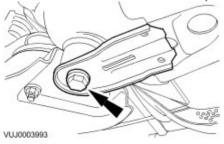
Remove the front subframe reinforcement plate retaining bolts.



54 . **NOTE:**

Left-hand shown, right-hand similar.

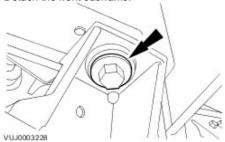
Remove the front subframe reinforcement plate.



55 . **NOTE:**

Left-hand shown, right-hand similar.

Detach the front subframe.

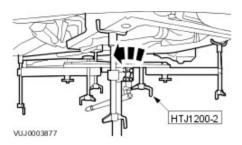


56

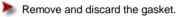
WARNING: Rotate the special tool height adjustment valve slowly. Failure to follow this instruction may result in personal injury.

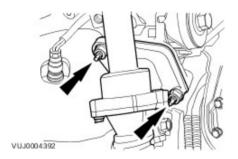
Remove the engine and transaxle assembly.

Rotate the special tool height adjustment valve counter clockwise.

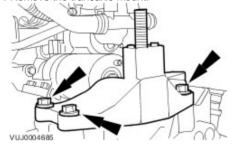


57 . Remove the coolant system top hose.

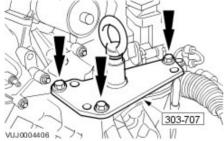




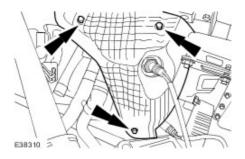
58 . Remove the transaxle mount.



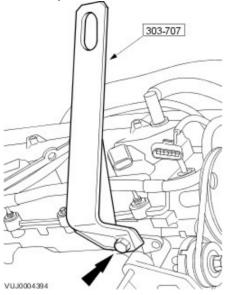
59 . Install the special tool.



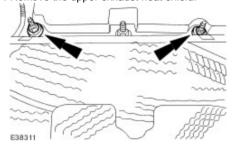
60 . Remove the left-hand exhaust manifold heat shield.



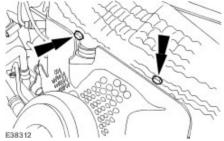
61 . Install the special tool.



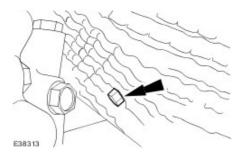
62 . Remove the upper exhaust heat shield.



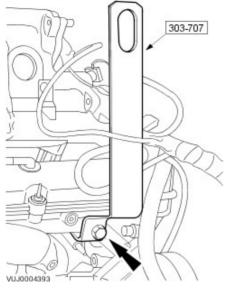
63 . Remove the center exhaust heat shield retaining bolts.



64 . Remove the center exhaust heat shield.

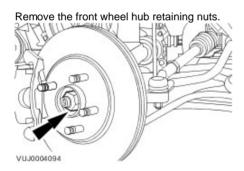


65 . Install the special tool.



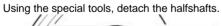
66 . **NOTE**:

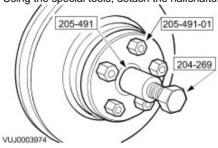
Left-hand shown, right-hand similar.



67 . **NOTE:**

Left-hand shown, right-hand similar.

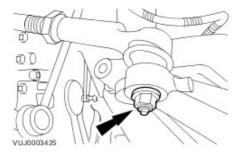




68 . **NOTE:**

Left-hand shown, right-hand similar.

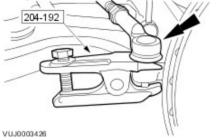
Remove the tie rod end retaining nuts.



69 . **NOTE**:

Right-hand shown, left-hand similar.

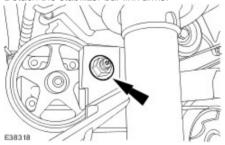
Using the special tool, detach the tie rod ends.



70 . **NOTE:**

Right-hand shown, left-hand similar.



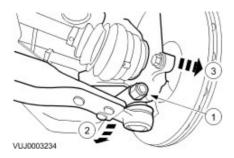


71 . **NOTE:**

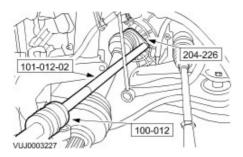
Left-hand shown, right-hand similar.

Detach the wheel knuckles.

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



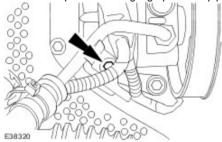
72 . Using the special tools, remove the left-hand halfshaft.



73 . Remove and discard the halfshaft snap ring.

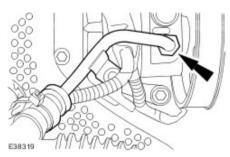


74 . Remove the power steering high-pressure pipe retaining bolt.

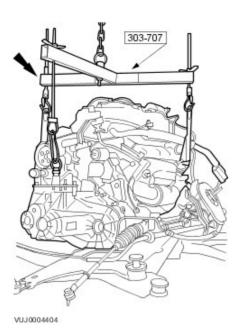


 ${\bf 75}$. Disconnect the power steering high-pressure pipe.

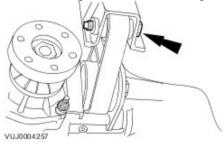




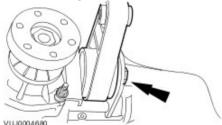
76 . Install the special tool.



77 . Remove the engine roll restrictor retaining bolt.

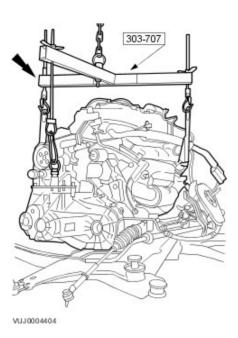


78 . Remove the engine roll restrictor.



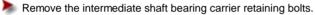
CAUTION: Make sure the right-hand drive halfshaft is supported, failure to follow this instruction may result in damage to the component.

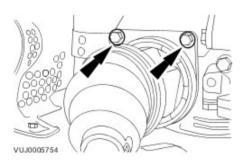
Using the special tool, remove the engine and transaxle from the subframe.



Vehicles with 2.0L engine

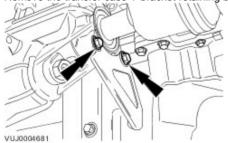
80 . Remove the halfshaft and intermediate shaft assembly.



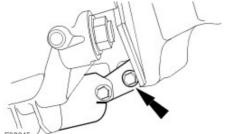


Vehicles with 2.5L or 3.0L engine

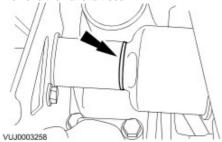
81 . Remove the transfer case Y bracket retaining bolts.



82 . Remove the transfer case Y bracket.



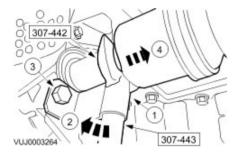
83 . Remove the halfshaft seal.



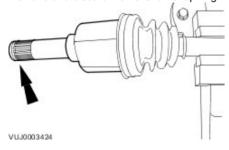
CAUTION: To prevent damage to the transfer case internal seal, make sure the link shaft is not retracted further that 200 mm (7.87 inches) from the transfer case.

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.



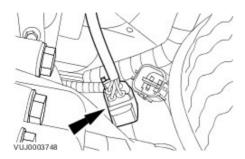
85 . Remove and discard the halfshaft snap ring.



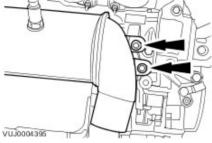
86 . Disconnect the right-hand catalyst monitor sensor electrical connector.



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

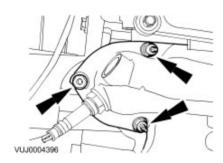


88 . Remove the right-hand catalytic converter retaining bolts.

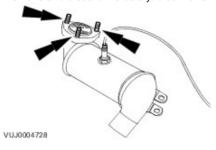


89 . Remove the right-hand catalytic converter.





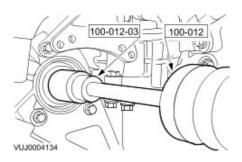
90 . Remove and discard the catalytic converter retaining studs.



91 . Remove and discard the catalytic converter sealing ring.



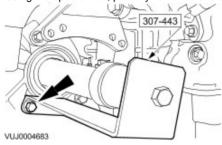
92 . Using the special tool, detach the transfer case link shaft.



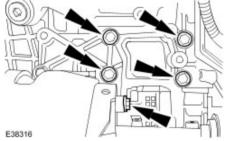
93

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.

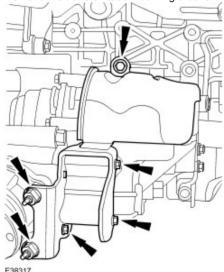
Using the special tool, partially remove transfer case link shaft.



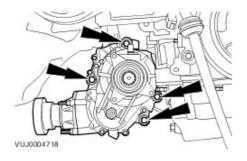
94 . Remove the catalytic converter mounting bracket.



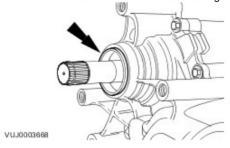
95 . Remove the transfer case mounting bracket.



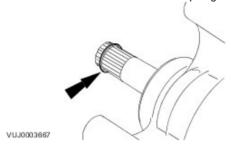
96 . Remove the transfer case.



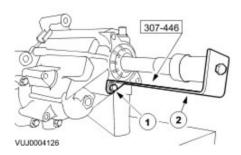
97 . Remove and discard the transfer case O-ring seal.



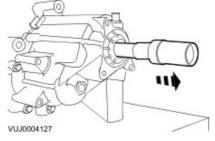
98 . Remove and discard the link shaft snap ring.



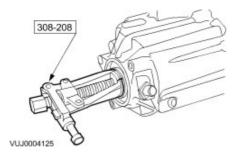
- 99 . Remove the link shaft limiting tool.
 - 1) Remove the retaining bolt.
 - 2) Remove the link shaft limiting tool.



100 . Remove the link shaft.

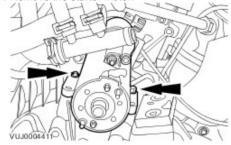


101 . Using the special tool, remove and discard the link shaft oil seal.



All vehicles

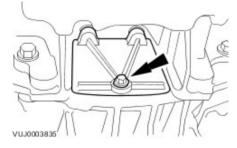
102 . Remove the starter motor.



103 . Remove the dust cover.



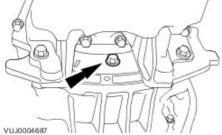
104 . Remove the access cover.

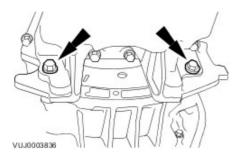


105 . **NOTE:**

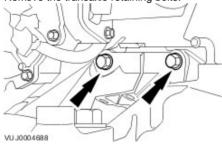
Rotate the torque converter to gain access to the remaining retaining bolts.

Remove the torque converter retaining bolts.

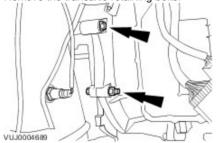




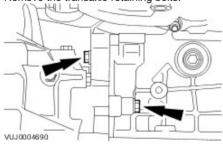
107 . Remove the transaxle retaining bolts.



108 . Remove the transaxle retaining bolts.

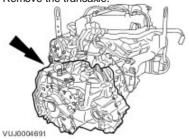


109 . Remove the transaxle retaining bolts.



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 - Vehicles With: Manual Transaxle (12.41.01)

Special Service Tools



Powertrain Assembly Jack HTJ1200-2



5 Point Security Torx Bit 418-535



204-192

Ball joint splitter 204-192



Wheel hub puller 205-491



20549101

Adaptor nuts 205-491-01



Forcing screw 204-269



Slide hammer 100-012



Slide hammer shaft 100-012-02



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



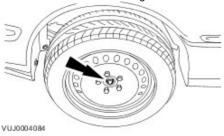
Engine lifting kit 303-707

Removal

All vehicles

1 . **NOTE**:

Loosen the front hub retaining nuts.



2. Drain the transaxle.

For additional information, refer to Transaxle Draining and Filling - Vehicles With: 5-Speed Manual Transmission (44.24.02)

3. Remove the steering column lower retaining bolt.



4 . Remove the battery tray.

For additional information, refer to <u>Battery Tray (86.15.11)</u>

5 . Recover the air conditioning (A/C) refrigerant.

For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging (82.30.30)

6 . Remove the front wheels and tires.

For additional information, refer to Wheel and Tire (74.20.05)

 $\boldsymbol{7}$. Drain the cooling system.

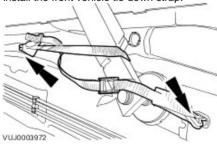
For additional information, refer to Cooling System Draining, Filling and Bleeding

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.



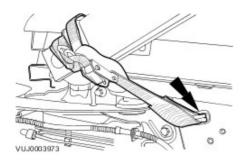


CAUTION: To prevent the vehicle becoming unstable when the engine and transmission assembly are removed, install the vehicle tie down straps.

NOTE:

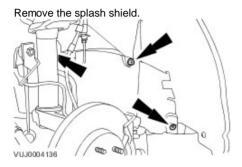
Right-hand shown, left-hand similar.

Install the rear vehicle tie down strap.



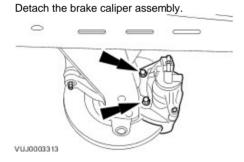
10 . **NOTE:**

Right-hand shown, left-hand similar.



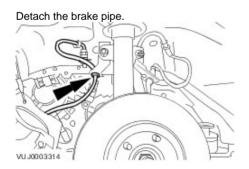
11 . **NOTE**:

Left-hand shown, right-hand similar.



12 . **NOTE:**

Left-hand shown, right-hand similar.



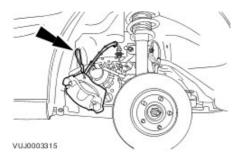
13 . **NOTE**:

Support the brake caliper assembly using tie straps.

NOTE:

Left-hand shown, right-hand similar.

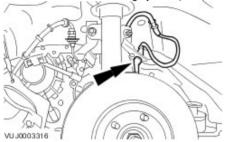
Reposition and secure the brake caliper assembly.



14 . **NOTE**:

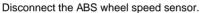
Left-hand shown, right-hand similar.

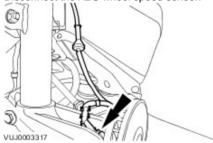
Detach the anti-lock braking system (ABS) wheel speed sensor.



15 . **NOTE:**

Left-hand shown, right-hand similar.





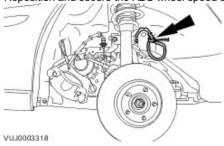
16 . **NOTE**:

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 (26.25.25)

Vehicles with 2.5L or 3.0L engine

All vehicles

19 . Remove the front muffler.

For additional information, refer to Front Muffler - 2.0L/2.5L/3.0L (30.10.18)

20 . **NOTE**:

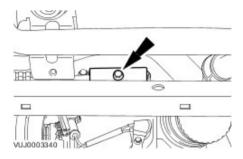
Using a suitable blanking plug, seal the tube and the A/C compressor.

NOTE:

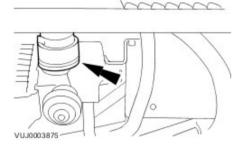
Secure the A/C compressor supply and return tubes using tie straps.

Detach the A/C compressor supply and return tubes.

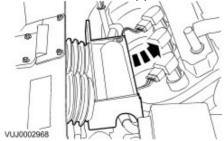
Remove and discard the O-ring seals.



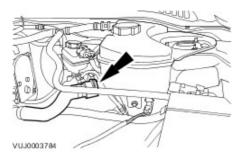
21 . Detach the coolant hose.



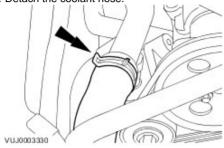
- 22 . Lower the vehicle.
- 23 . Remove the air cleaner.
 For additional information, refer to Air Cleaner (19.10.05)
- 24 . Remove the air filter intake pipe.



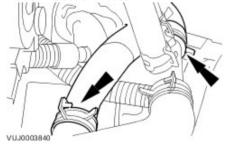
25 . Detach the coolant hose.



26 . Detach the coolant hose.

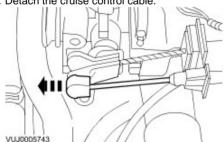


27 . Detach the coolant hoses.

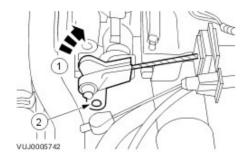


Vehicles with 2.0L engine

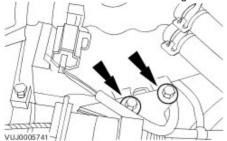
28 . Detach the cruise control cable.



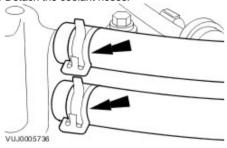
- 29 . Detach the accelerator cable.
 - 1) Reposition the accelerator lever to the fully open position.
 - 2) Detach the accelerator cable.



30 . Detach the accelerator cable retaining bracket.

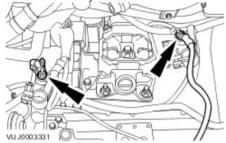


31 . Detach the coolant hoses.



All vehicles

32 . Detach the battery cables.

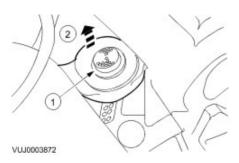


33 . **NOTE**:

Upper selector cable shown, lower selector cable similar.

Detach the selector cables.

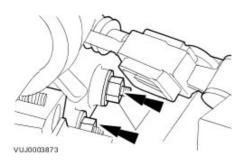
- 1) Press the button.
- 2) Detach the selector cables.



34 . **NOTE**:

Secure the selector cables using tie straps.

Detach the selector cables.



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:

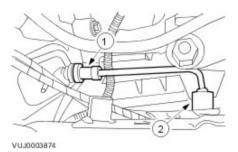
Using a suitable blanking plug, seal the pipe and the slave cylinder.

NOTE:

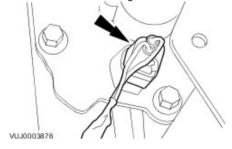
Secure the clutch slave cylinder pipe using tie straps.

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

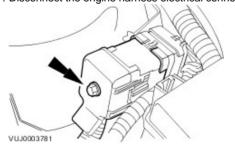
- 1) Detach the clutch slave cylinder pipe from the slave cylinder.
- 2) Detach the clutch cylinder from the retaining bracket.

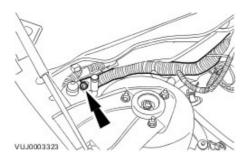


36 . Disconnect the reverse light switch electrical connector.

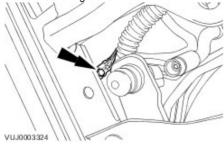


37 . Disconnect the engine harness electrical connector.





39 . Disconnect the ground cable.



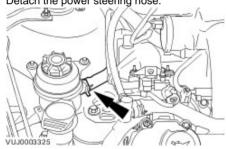
40 . **NOTE**:

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

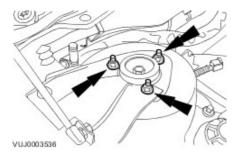
42 . Detach the coolant pipe.



43 . **NOTE:**

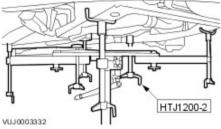
Right-hand shown, left-hand similar.

Detach the strut and spring assembly.



44 . Raise the vehicle.

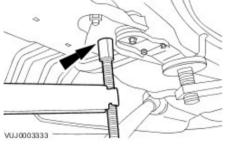
45 . Install the special tool.



46 . **NOTE**:

Left-hand shown, right-hand similar.

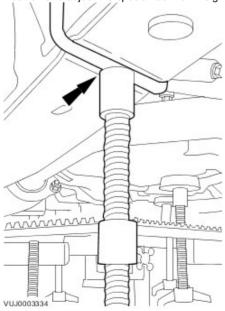
Position and adjust the special tool rear height adjuster.

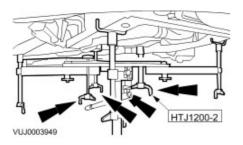


47 . **NOTE:**

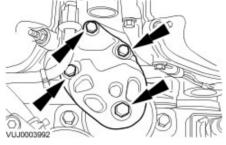
Right-hand shown, left-hand similar.

Position and adjust the special tool front height adjuster.

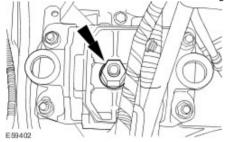




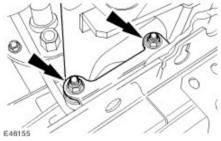
49 . Remove the engine support bracket.



50 . Remove the transaxle mount bracket securing nut.



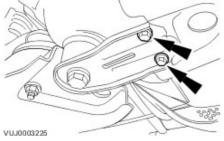
51 . Remove the clutch master cylinder to clutch slave cylinder high-pressure pipe support bracket.



52 . **NOTE:**

Left-hand shown, right-hand similar.

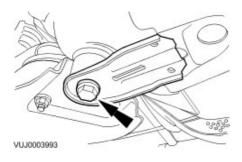
Remove the front subframe reinforcement plate retaining bolts.



53 . **NOTE:**

Left-hand shown, right-hand similar.

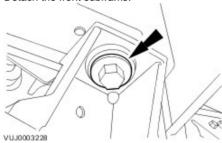
Remove the front subframe reinforcement plate.



54 . **NOTE:**

Left-hand shown, right-hand similar.

Detach the front subframe.

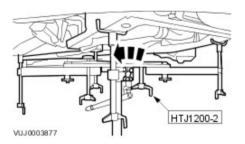


55

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

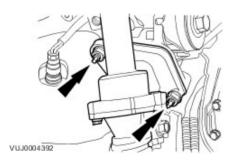
Remove the engine and transaxle assembly.

Rotate the special tool height adjustment valve counter clockwise.

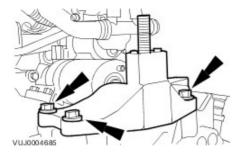


 ${\bf 56}$. Remove the coolant system top hose.

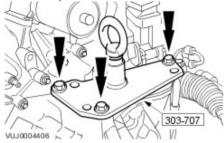
Remove and discard the gasket.



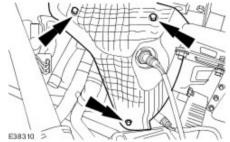
57 . Remove the transaxle mount.



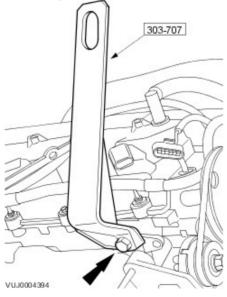
58 . Install the special tool.



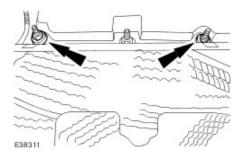
59 . Remove the left-hand exhaust manifold heat shield.



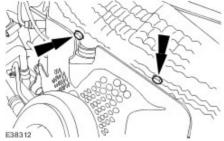
60 . Install the special tool.



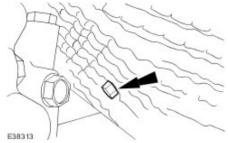
61 . Remove the upper exhaust heat shield.



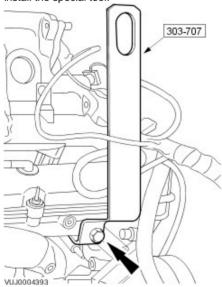
62 . Remove the center exhaust heat shield retaining bolts.



63 . Remove the center exhaust heat shield.



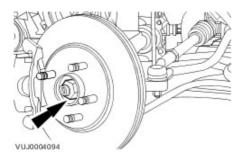
64 . Install the special tool.



65 . **NOTE**:

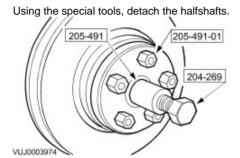
Left-hand shown, right-hand similar.

Remove the front wheel hub retaining nuts.



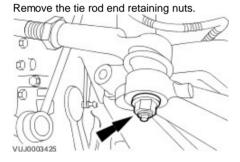
66 . **NOTE**:

Left-hand shown, right-hand similar.



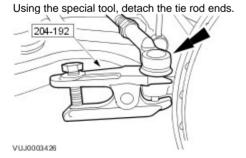
67 . **NOTE**:

Left-hand shown, right-hand similar.



68 . **NOTE:**

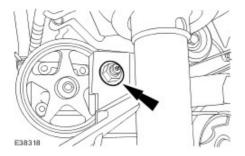
Right-hand shown, left-hand similar.



69 . **NOTE**:

Right-hand shown, left-hand similar.

Detach the stabilizer bar link arms.

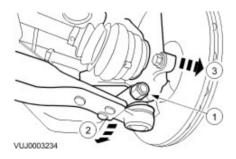


70 . **NOTE**:

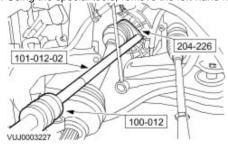
Left-hand shown, right-hand similar.

Detach the wheel knuckles.

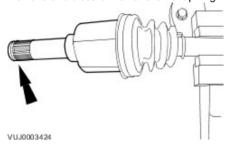
- 1) Remove the lower arm ball joint retaining bolt.
- 2) Reposition the lower arm.
- 3) Detach the wheel knuckles.



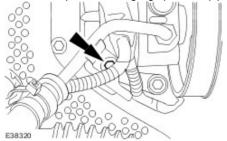
71 . Using the special tools, remove the left-hand halfshaft.



72 . Remove and discard the halfshaft snap ring.

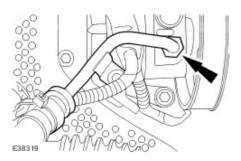


73 . Remove the power steering high-pressure pipe retaining bolt.

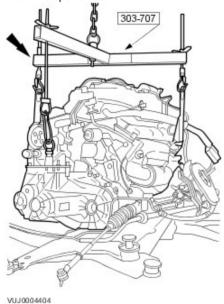


74 . Disconnect the power steering high-pressure pipe.

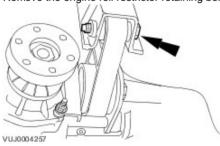
Remove and discard the O-ring seal.



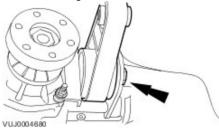
75 . Install the special tool.



76 . Remove the engine roll restrictor retaining bolt.



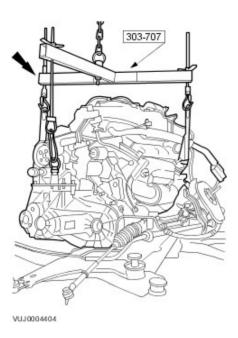
77 . Remove the engine roll restrictor.



78

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

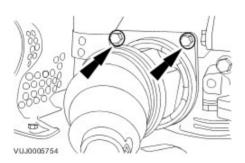
Using the special tool, remove the engine and transaxle from the subframe.



Vehicles with 2.0L engine

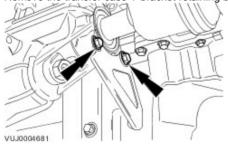
79 . Remove the halfshaft and intermediate shaft assembly.



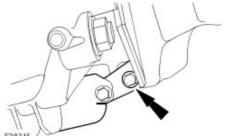


Vehicles with 2.5L or 3.0L engine

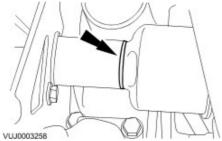
80 . Remove the transfer case Y bracket retaining bolts.



81 . Remove the transfer case Y bracket.



82 . Remove the halfshaft seal.

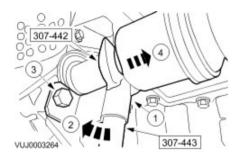


83

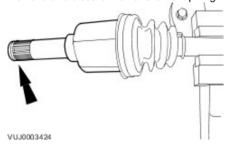
CAUTION: To prevent damage to the transfer case internal seal, make sure the link shaft is not retracted further that 200 mm (7.87 inches) from the transfer case.

Using the special tools, remove the halfshaft.

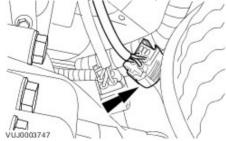
- 1) Attach the special tools to the halfshaft.
- 2) Lever the special tools, to detach the halfshaft.
- 3) Install the transfer case Y bracket retaining bolt.
- 4) Remove the halfshaft.



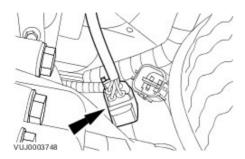
84 . Remove and discard the halfshaft snap ring.



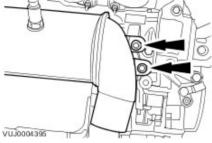
85 . Disconnect the right-hand catalyst monitor sensor electrical connector.



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

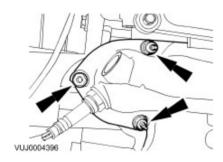


87 . Remove the right-hand catalytic converter retaining bolts.

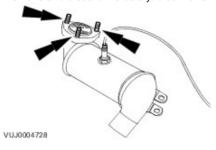


88 . Remove the right-hand catalytic converter.





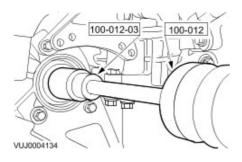
89 . Remove and discard the catalytic converter retaining studs.



90 . Remove and discard the catalytic converter sealing ring.



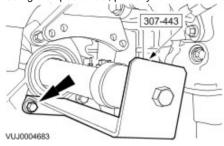
91 . Using the special tool, detach the transfer case link shaft.



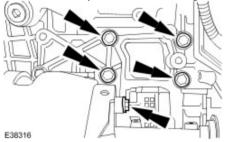
92

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.

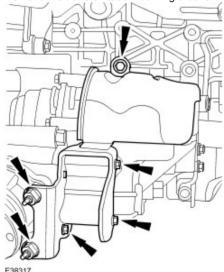
Using the special tool, partially remove transfer case link shaft.



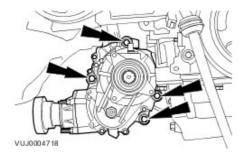
93 . Remove the catalytic converter mounting bracket.



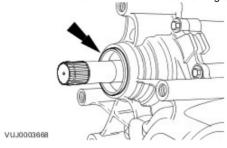
94 . Remove the transfer case mounting bracket.



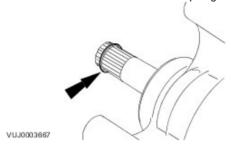
95 . Remove the transfer case.



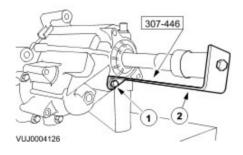
96 . Remove and discard the transfer case O-ring seal.



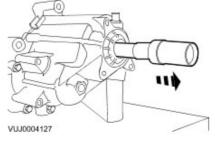
97 . Remove and discard the link shaft snap ring.



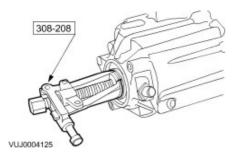
- 98 . Remove the link shaft limiting tool.
 - 1) Remove the retaining bolt.
 - 2) Remove the link shaft limiting tool.



99 . Remove the link shaft.

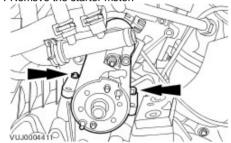


100 . Using the special tool, remove and discard the link shaft oil seal.



All vehicles

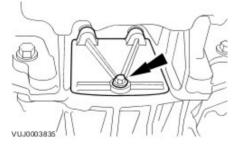
101 . Remove the starter motor.



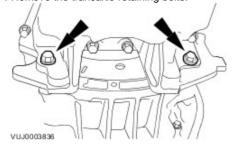
102 . Remove the dust cover.



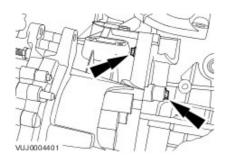
103 . Remove the access cover.

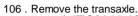


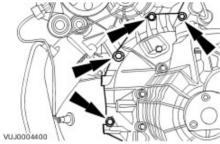
104 . Remove the transaxle retaining bolts.



105 . Remove the transaxle retaining bolts.







Engine - Vehicles With: Automatic Transaxle (12.41.01)

Special Service Tools



Halfshaft oil seal installer 205-115



Link shaft limiting tool 307-446



Engine lifting kit 303-707



Powertrain Assembly Jack HTJ12000-2



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.

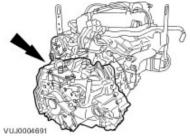
CAUTION: The torque converter must remain at the correct installation depth throughout the whole installation procedure.

NOTE:

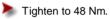
The torque converter must engage fully in the oil pump drive gear.

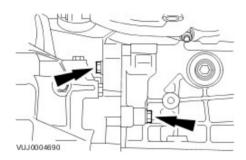
WARNING: Do not let the torque converter drop out of the transaxle. Failure to follow this instruction may result in personal injury.

Install the transaxle.

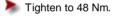


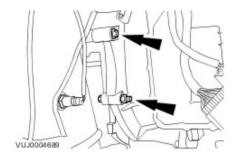
4 . Install the transaxle retaining bolts.



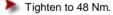


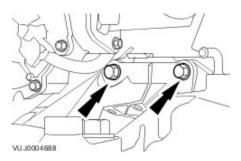
 ${\bf 5}$. Install the transaxle retaining bolts.





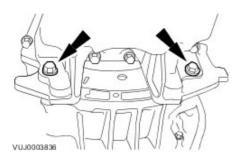
6 . Install the transaxle retaining bolts.





7 . Install the transaxle retaining bolts.

Tighten to 48 Nm.

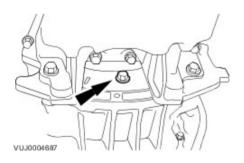


8 . **NOTE:**

Rotate the torque converter to gain access to the remaining retaining bolts.

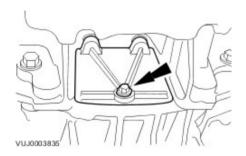
Install the torque converter retaining bolts.

Tighten to 55 Nm.



9 . Install the access cover.

Tighten to 10 Nm.



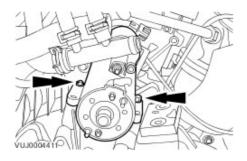
10 . Install the dust cover.

Tighten to 10 Nm.



11 . Install the starter motor.

Tighten to 35 Nm.

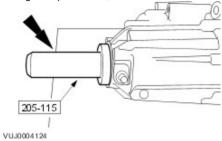


Vehicles with 2.5L or 3.0L engine

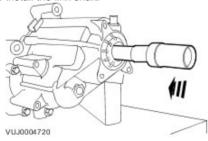
12 **NOTE**:

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.

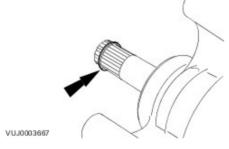
Using the special tool, install a new link shaft oil seal.



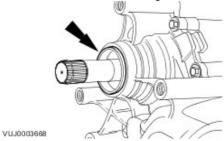
13 . Install the link shaft.



14 . Install a new link shaft snap ring.



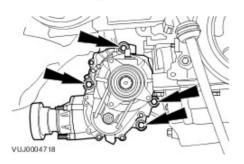
15 . Install a new transfer case O-ring seal.



Engage the link shaft into the transaxle.

Install the transfer case.

Tighten to 90 Nm.

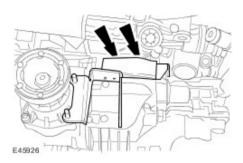


17 . **NOTE:**

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

Install the engine roll restrictor bracket.

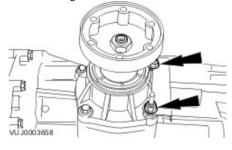
Install the engine roll restrictor bracket top retaining bolts.



18 . **NOTE:**

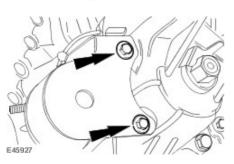
Do not tighten the engine roll restrictor bracket retaining nuts at this stage.

Install the engine roll restrictor bracket.



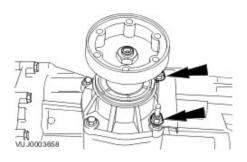
19 . Install the engine roll restrictor bracket side retaining bolts.





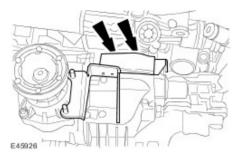
20 . Tighten the engine roll restrictor bracket retaining nuts.





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

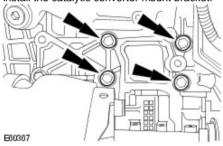




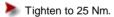
22 . **NOTE:**

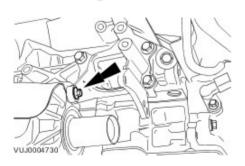
Do not tighten the catalytic converter retaining bolts at this stage.





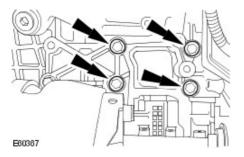
23 . Install the catalytic converter mount bracket retaining bolt.





24 . Tighten the catalytic converter mount bracket retaining bolts.



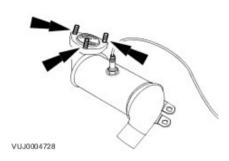


25 . Install a new catalytic converter sealing ring.



26 . Install new catalytic converter retaining studs.





27

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

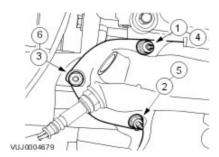
NOTE:

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

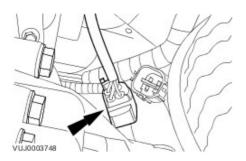
Install the right-hand catalytic converter.

Install new retaining nuts.

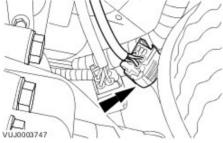
Tighten in the sequence shown to 25 Nm.



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



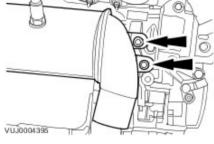
29 . Connect the right-hand catalyst monitor sensor electrical connector.



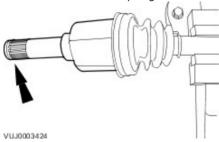
30 . Install the right-hand catalytic converter retaining bolts.



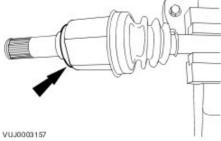
Tighten to 25 Nm.



31 . Install a new halfshaft snap ring.



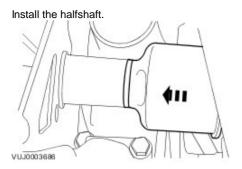
32 . Install a new halfshaft seal.



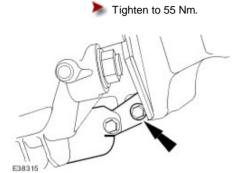
CAUTION: Do not use excessive force when engaging the halfshaft to the link shaft. Failure to follow this instruction may result in damage to the component.

33

Make sure the halfshaft is fully located to the link shaft.

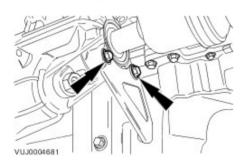


34 . Install the transfer case Y bracket.



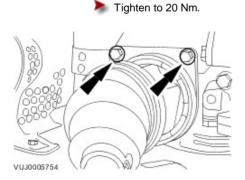
35 . Install the transfer case Y bracket retaining bolts.

Tighten to 25 Nm.



Vehicles with 2.0L engine

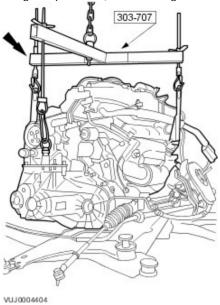
 ${\bf 36}$. Install the halfshaft and intermediate shaft assembly.



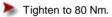
All vehicles

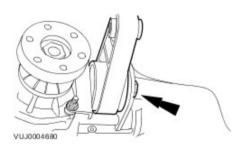
in damage to the component.

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



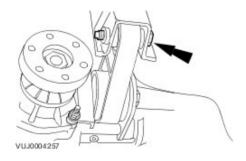
38 . Install the engine roll restrictor.



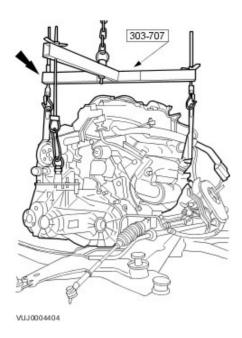


39 . Install the engine roll restrictor retaining bolt.





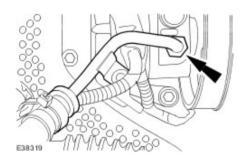
40 . Remove the special tool.



41 . Connect the power steering high-pressure pipe.

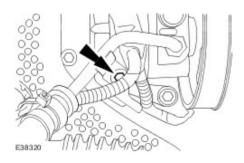
Install a new O-ring seal.

Tighten to 30 Nm.

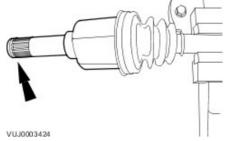


42 . Install the power steering high-pressure pipe retaining bolt.

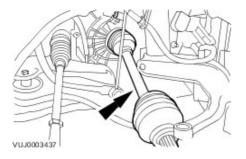
Tighten to 25 Nm.



43 . Install a new halfshaft snap ring.



44 . Install the left-hand halfshaft.



45 . **NOTE**:

Left-hand shown, right-hand similar.

NOTE:

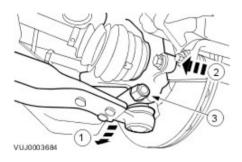
Make sure the halfshaft is aligned to the front wheel hub.

Attach the wheel knuckles.

- 1) Reposition the lower arm.
- 2) Attach the wheel knuckles.
- 3) Install the lower arm ball joint retaining bolt.



Tighten to 83 Nm.



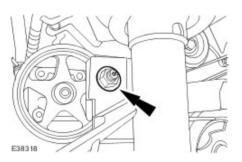
46 . **NOTE**:

Right-hand shown, left-hand similar.

Attach the stabilizer bar link arms.



Tighten to 48 Nm.



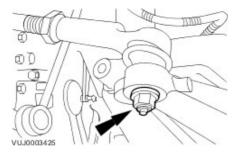
47 . **NOTE**:

Left-hand shown, right-hand similar.

Attach the tie rod ends.



Tighten to 35 Nm.

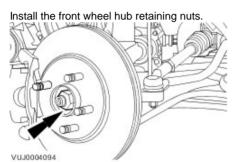


48 . **NOTE**:

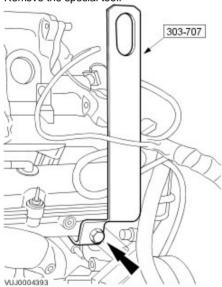
Left-hand shown, right-hand similar.

NOTE:

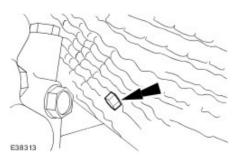
Do not tighten the front wheel hub retaining nuts at this stage.



49 . Remove the special tool.

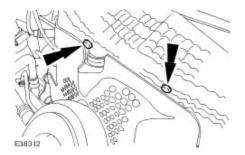


50 . Install the center exhaust heat shield.

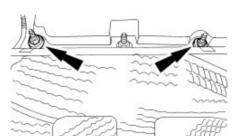


Tighten to 10 Nm.

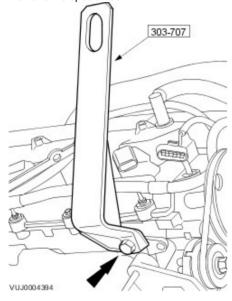
Tighten to 10 Nm.



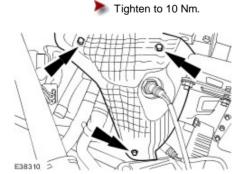
52 . Install the upper exhaust heat shield. Tighten to 6 Nm.

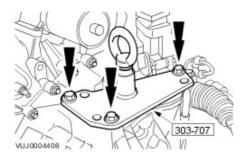


53 . Remove the special tool.



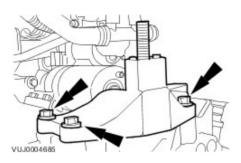
${\bf 54}$. Install the left-hand exhaust manifold heat shield.





56 . Install the transaxle mount.

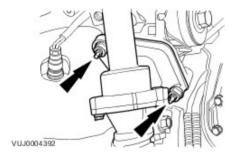
Tighten to 80 Nm.



57 . Install the coolant system top hose.

Install a new gasket.





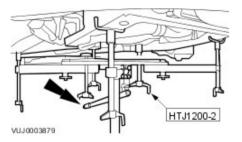
58



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

Install the engine and transaxle assembly.

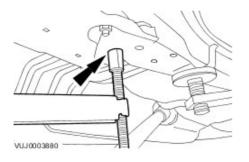
Raise the special tool platform.



59 . **NOTE:**

Left-hand shown, right-hand similar.

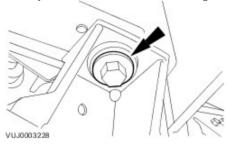
Make sure the special tool rear height adjuster aligns into the locating hole in the vehicle floor pan.



60 . **NOTE:**

Left-hand shown, right-hand similar.

Loosely install the front subframe retaining bolt.

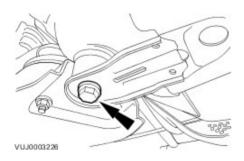


61 . **NOTE**:

Left-hand shown, right-hand similar.

Install the front subframe reinforcement plate.

Loosely install the front subframe rear retaining bolt.



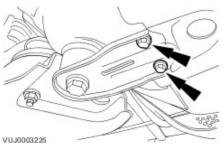
62 . **NOTE**:

Left-hand shown, right-hand similar.

Tighten the front subframe reinforcement bolts.





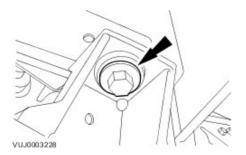


63 . **NOTE:**

Left-hand shown, right-hand similar.

Tighten the front subframe retaining bolt.

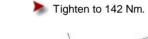
Tighten to 142 Nm.

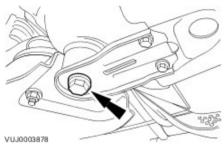


64 . **NOTE**:

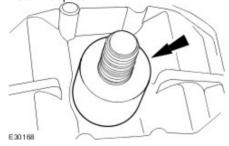
Left-hand shown, right-hand similar.

Tighten the front subframe rear retaining bolt.

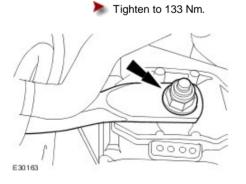




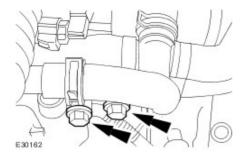
65 . Install the spacer.



66 . Install the support bar.

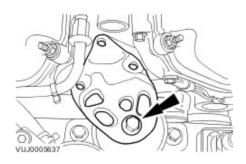


67 . Tighten to the support bar retaining bolts. Tighten to 25 Nm.



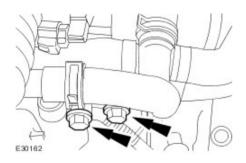
68 . Install the engine support bracket.

Tighten to 80 Nm.

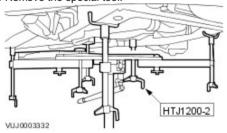


69 . Tighten the support bar retaining bolts.

Tighten to 25 Nm.



70 . Remove the special tool.



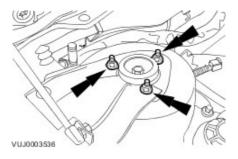
71 . Lower the vehicle.

72 . **NOTE:**

Right-hand shown, left-hand similar.

Attach the strut and spring assembly.

Tighten to 30 Nm.



73 . Attach the coolant pipe.



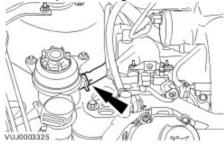


74 . Connect the spring lock coupling.
For additional information, refer to Spring Lock Couplings

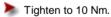
75 . **NOTE**:

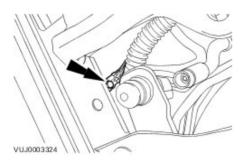
Remove the blanking plug from the hose.





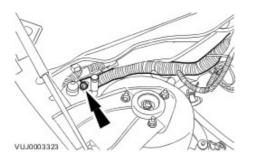
76 . Connect the ground cable.





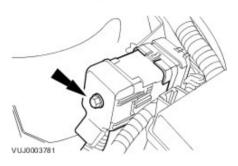
77 . Connect the engine control module (ECM) electrical connector.

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



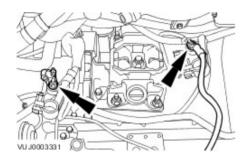
78 . Connect the engine harness electrical connector.





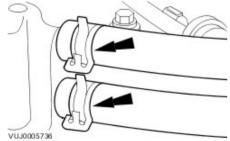
79 . Attach the battery cables.

Tighten to 10 Nm.



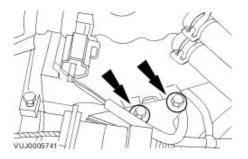
Vehicles with 2.0L engine

80 . Attach the coolant hoses.

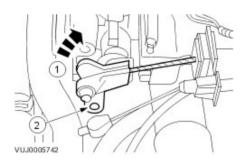


81 . Attach the accelerator cable retaining bracket.

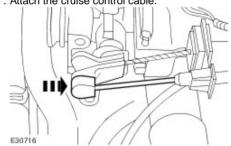
Tighten to 9 Nm.



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

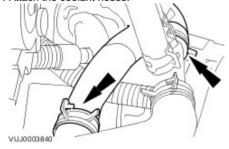


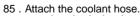
83 . Attach the cruise control cable.

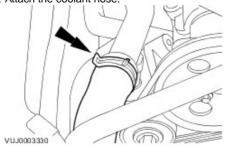


All vehicles

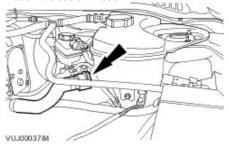
84 . Attach the coolant hoses.



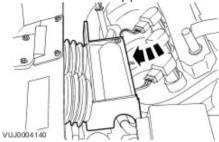




86 . Attach the coolant hose.



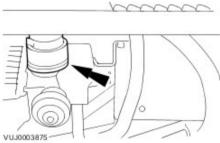
87 . Install the air filter intake pipe.



- 88 . Install the air cleaner.

 For additional information, refer to Air Cleaner (19.10.05)
- 89 . Raise the vehicle.

90 . Attach the coolant hose.



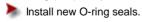
91 . **NOTE**:

Remove the tie straps.

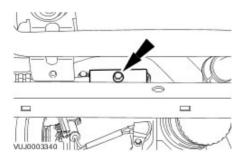
NOTE:

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.







92 . Install the front muffler.

For additional information, refer to Front Muffler - 2.0L/2.5L/3.0L (30.10.18)

Vehicles with 2.5L or 3.0L engine

93 . Install the driveshaft.

For additional information, refer to Driveshaft (47.15.01)

All vehicles

94 . Install the cooling fan motor and shroud.

For additional information, refer to Cooling Fan Motor and Shroud (26.25.25)

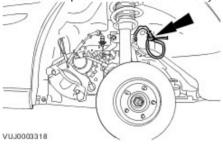
95 . **NOTE:**

Remove the tie straps.

NOTE:

Left-hand shown, right-hand similar.

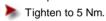
Detach and reposition the anti-lock brake system (ABS) wheel speed sensor.

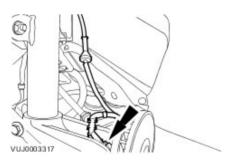


96 . **NOTE:**

Left-hand shown, right-hand similar.

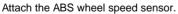
Connect the ABS wheel speed sensor.

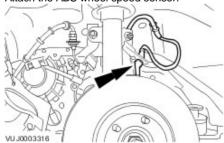




97 . **NOTE**:

Left-hand shown, right-hand similar.





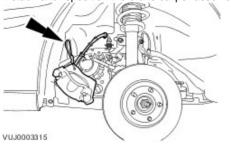
98 . **NOTE**:

Remove the tie straps.

NOTE:

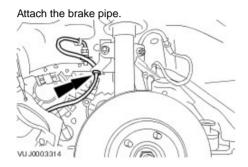
Left-hand shown, right-hand similar.

Detach and reposition the brake caliper assembly.



99 . **NOTE:**

Left-hand shown, right-hand similar.



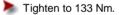
100 . **NOTE:**

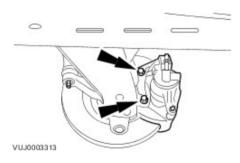
Left-hand shown, right-hand similar.

NOTE:

Install new brake caliper anchor plate retaining bolts.

Attach the brake caliper assembly.





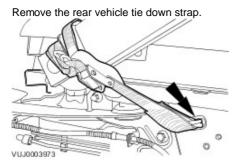
101 . **NOTE:**

Right-hand shown, left-hand similar.



102 . **NOTE**:

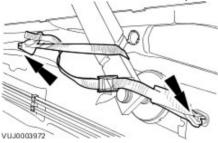
Right-hand shown, left-hand similar.



103 . **NOTE:**

Right-hand shown, left-hand similar.





104 . Install the front wheels and tires.

For additional information, refer to Wheel and Tire (74.20.05)

105 . Install the battery tray.

For additional information, refer to Battery Tray (86.15.11)

106 . Fill and bleed the cooling system.

For additional information, refer to Cooling System Draining, Filling and Bleeding

107 . Bleed the power steering system.

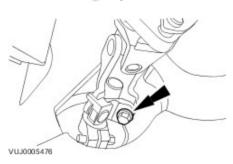
For additional information, refer to Power Steering System Filling

108 . Recharge the A/C refrigerant.

For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging (82.30.30)

109 . Install the steering column lower retaining bolt.





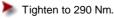
110 . Fill the transaxle.

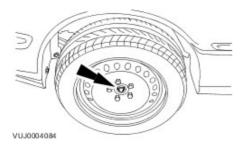
For additional information, refer to Transmission Fluid Drain and Refill (44.24.02)

111 . **NOTE**:

Left-hand shown, right-hand similar.

Tighten the front hub retaining nuts.





- 112 . Carry out the underbody misalignment check.
 For additional information, refer to <u>Underbody Misalignment Check (57.65.20)</u>
- 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).

Engine - Vehicles With: Manual Transaxle (12.41.01)

Special Service Tools



Halfshaft oil seal installer 205-115



Link shaft limiting tool 307-446



Engine lifting kit 303-707



Powertrain Assembly Jack HTJ12000-2

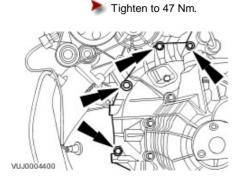


5 Point Security Torx Bit 418-535

Installation

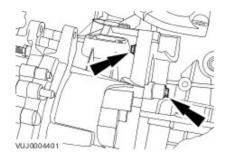
All vehicles

1 . Install the transaxle.



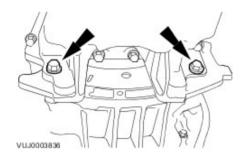
2 . Install the transaxle retaining bolts.

Tighten to 47 Nm.



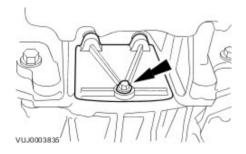
3 . Install the transaxle retaining bolts.

Tighten to 47 Nm.



4 . Install the access cover.

Tighten to 10 Nm.



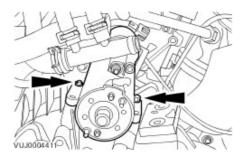
5 . Install the dust cover.

Tighten to 10 Nm.



6 . Install the starter motor.

Tighten to 35 Nm.

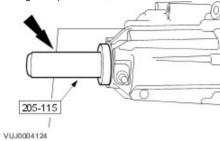


Vehicles with 2.5L or 3.0L engine

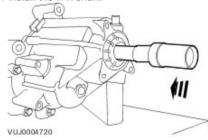
7 NOTE:

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.

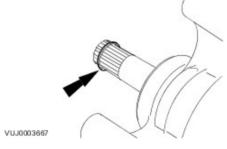
Using the special tool, install a new link shaft oil seal.



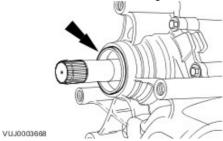
8 . Install the link shaft.



9 . Install a new link shaft snap ring.

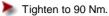


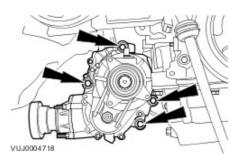
10 . Install a new transfer case O-ring seal.



Engage the link shaft into the transaxle.

Install the transfer case.



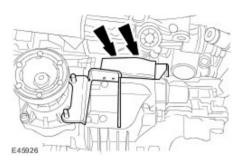


12 . **NOTE:**

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

Install the engine roll restrictor bracket.

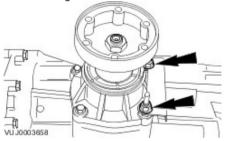
Install the engine roll restrictor bracket top retaining bolts.



13 . **NOTE:**

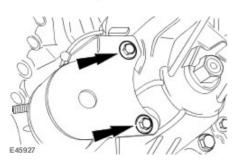
Do not tighten the engine roll restrictor bracket retaining nuts at this stage.

Install the engine roll restrictor bracket.

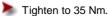


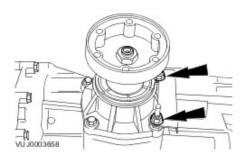
14 . Install the engine roll restrictor bracket side retaining bolts.



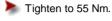


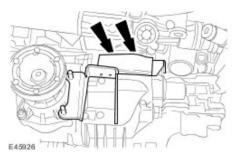
15 . Tighten the engine roll restrictor bracket retaining nuts.





 ${\bf 16}$. Tighten the engine roll restrictor bracket top retaining bolts.

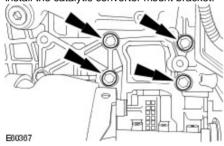




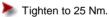
17 . **NOTE:**

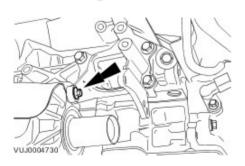
Do not tighten the catalytic converter retaining bolts at this stage.



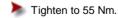


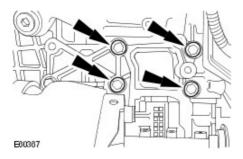
18 . Install the catalytic converter mount bracket retaining bolt.





19 . Tighten the catalytic converter mount bracket retaining bolts.



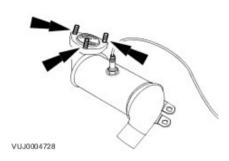


20 . Install a new catalytic converter sealing ring.



21 . Install new catalytic converter retaining studs.





22

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

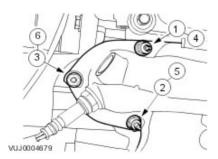
NOTE:

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

Install the right-hand catalytic converter.

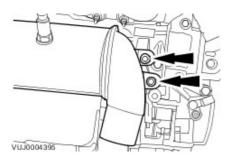
Install new retaining nuts.

Tighten in the sequence shown to 25 Nm.

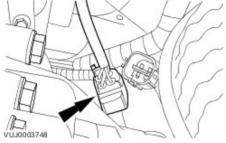


23 . Install the right-hand catalytic converter retaining bolts.

Tighten to 25 Nm.



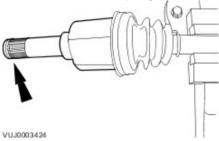
24 . Connect the right-hand heated oxygen sensor (HO2S) electrical connector.



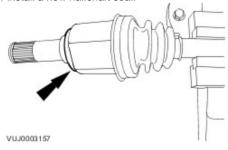
25 . Connect the right-hand heated catalyst monitor sensor electrical connector.



26 . Install a new halfshaft snap ring.

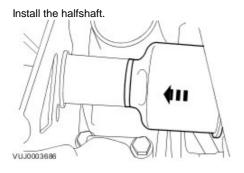


27 . Install a new halfshaft seal.

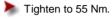


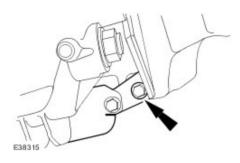
CAUTION: Do not use excessive force when engaging the halfshaft to the link shaft. Failure to follow this instruction may result in damage to the component.

NOTE:

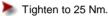


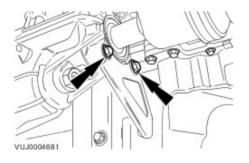
29 . Install the transfer case Y bracket.





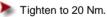
30 . Install the transfer case Y bracket retaining bolts.

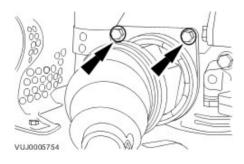




Vehicles with 2.0L engine

 ${\bf 31}$. Install the halfshaft and intermediate shaft assembly.

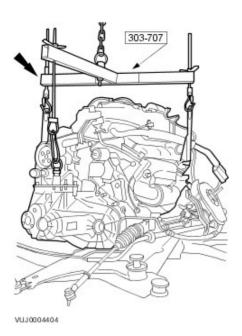




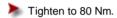
All vehicles

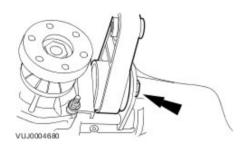
32

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



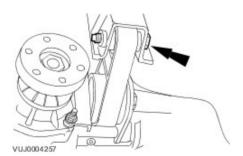
33 . Install the engine roll restrictor.



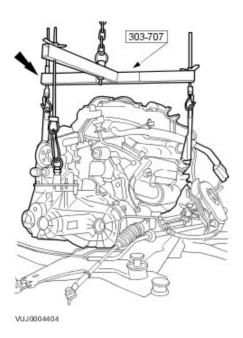


34 . Install the engine roll restrictor retaining bolt.

Tighten to 80 Nm.



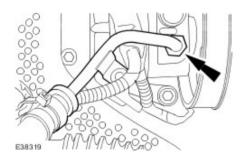
35 . Remove the special tool.



 $36\ .$ Connect the power steering high-pressure pipe.

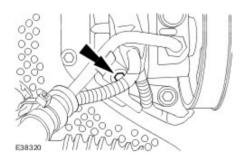
Install a new O-ring seal.

Tighten to 30 Nm.

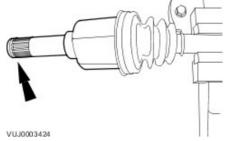


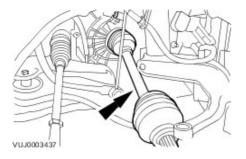
 ${\bf 37}$. Install the power steering high-pressure pipe retaining bolt.

Tighten to 25 Nm.



38 . Install a new halfshaft snap ring.





40 . **NOTE**:

Left-hand shown, right-hand similar.

NOTE:

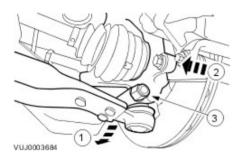
Make sure the halfshaft is aligned to the front wheel hub.

Attach the wheel knuckles.

- 1) Reposition the lower arm.
- 2) Attach the wheel knuckles.
- 3) Install the lower arm ball joint retaining bolt.



Tighten to 83 Nm.



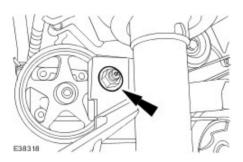
41 . **NOTE**:

Right-hand shown, left-hand similar.

Attach the stabilizer bar link arms.



Tighten to 48 Nm.



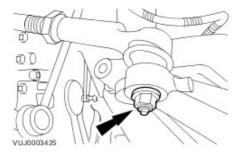
42 . **NOTE**:

Left-hand shown, right-hand similar.

Attach the tie rod ends.



Tighten to 35 Nm.

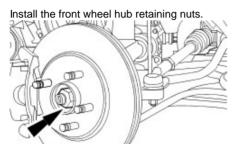


43 . **NOTE**:

Left-hand shown, right-hand similar.

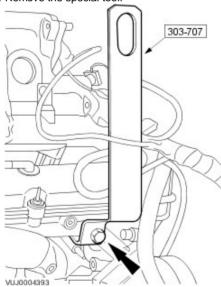
NOTE:

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

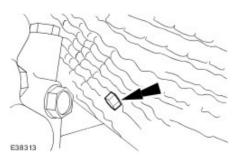


44 . Remove the special tool.

VUJ0004094



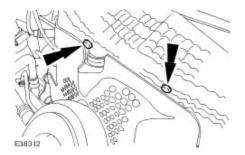
45 . Install the center exhaust heat shield.



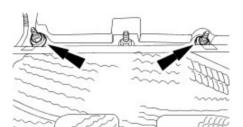
Tighten to 10 Nm.

46 . Install the center exhaust heat shield retaining bolts.

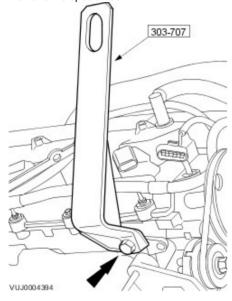
Tighten to 10 Nm.



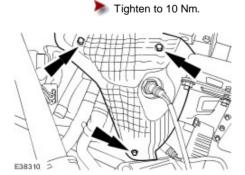
47 . Install the upper exhaust heat shield. Tighten to 6 Nm.



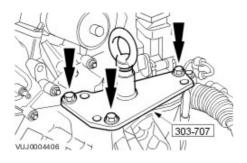
48 . Remove the special tool.



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

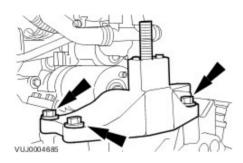


50 . Remove the special tool.



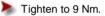
51 . Install the transaxle mount.

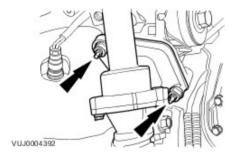
Tighten to 80 Nm.



52 . Install the coolant system top hose.

Install a new gasket.





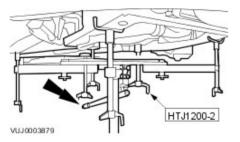
53



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

Install the engine and transaxle assembly.

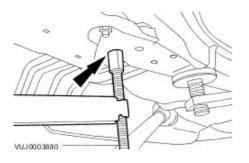
Raise the special tool platform.



54 . **NOTE:**

Left-hand shown, right-hand similar.

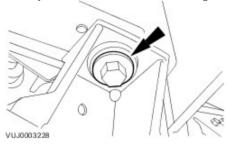
Make sure the special tool rear height adjuster aligns into the locating hole in the vehicle floor pan.



55 . **NOTE:**

Left-hand shown, right-hand similar.

Loosely install the front subframe retaining bolt.

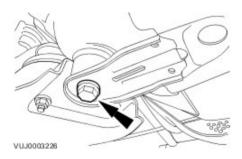


56 . **NOTE**:

Left-hand shown, right-hand similar.

Install the front subframe reinforcement plate.

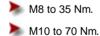
Loosely install the front subframe rear retaining bolt.

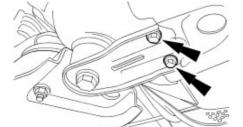


57 . **NOTE:**

Left-hand shown, right-hand similar.

Tighten the front subframe reinforcement bolts.





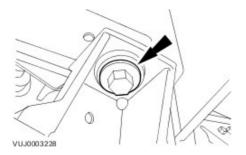
58 . **NOTE:**

VUJ0003225

Left-hand shown, right-hand similar.

Tighten the front subframe retaining bolt.

Tighten to 142 Nm.

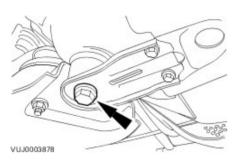


59 . **NOTE:**

Left-hand shown, right-hand similar.

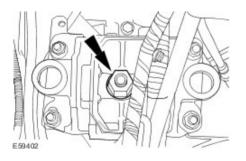
Tighten the front subframe rear retaining bolt.

Tighten to 142 Nm.

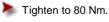


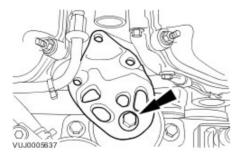
60 . Install the transaxle mount bracket securing nut.

Tighten to 133 Nm.



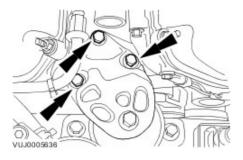
61 . Install the engine support bracket.





 $\ensuremath{\mathsf{62}}$. Tighten the engine support bracket retaining bolts.

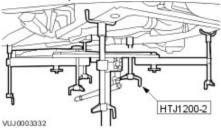
Tighten to 40 Nm.



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.

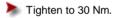


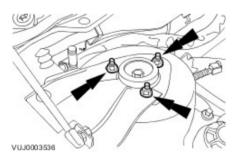
64. Lower the vehicle.

65 . **NOTE**:

Right-hand shown, left-hand similar.

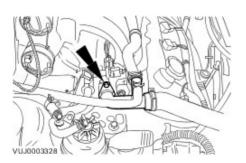
Attach the strut and spring assembly.





66 . Attach the coolant pipe.

Tighten to 9 Nm.

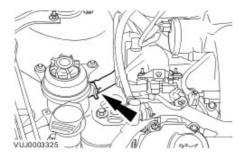


67 . Connect the spring lock coupling.
For additional information, refer to Spring Lock Couplings

68 . **NOTE**:

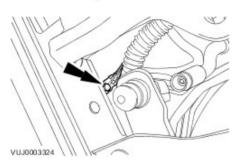
Remove the blanking plug from the hose.

Attach the power steering hose.



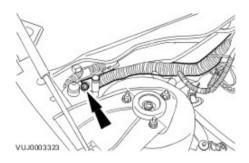
69 . Connect the ground cable.





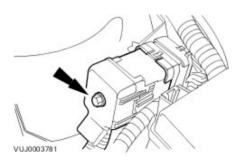
70 . Connect the engine control module (ECM) electrical connector.

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



71 . Connect the electrical connector.

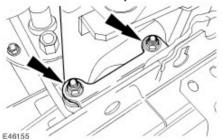
Tighten to 10 Nm.



72 . Connect the reverse light switch electrical connector.



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



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

NOTE:

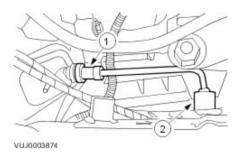
Remove the tie straps.

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.



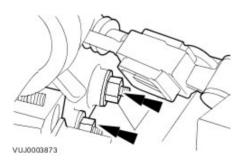
75 . **NOTE:**

Remove the tie straps.

Attach the selector cables.



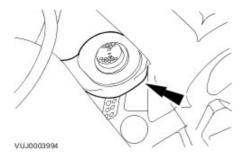
Tighten to 25 Nm.



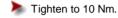
76 . **NOTE:**

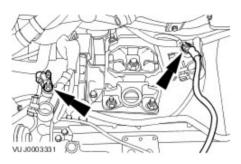
Upper selector cable shown, lower selector cable similar.

Attach the selector cables.



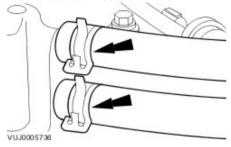
77 . Attach the battery cables.



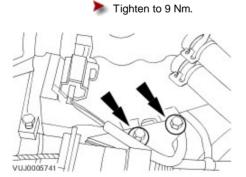


Vehicles with 2.0L engine

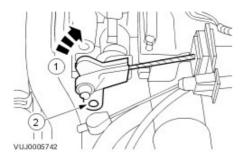
78 . Attach the coolant hoses.



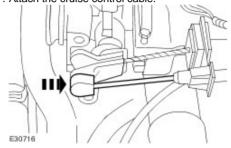
 $\ensuremath{\mathbf{79}}$. Attach the accelerator cable retaining bracket.



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

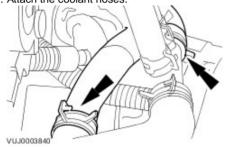


81 . Attach the cruise control cable.

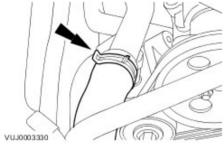


All vehicles

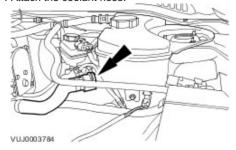
82 . Attach the coolant hoses.



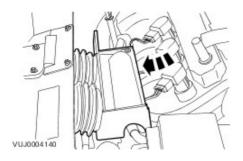
83 . Attach the coolant hose.



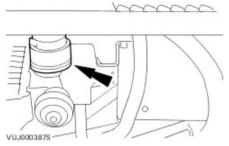
84 . Attach the coolant hose.



85 . Install the air filter intake pipe.



- 86 . Install the air cleaner.
 For additional information, refer to Air Cleaner (19.10.05)
- 87 . Raise the vehicle.
- 88. Attach the coolant hose.



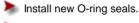
89 . **NOTE:**

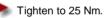
Remove the tie straps.

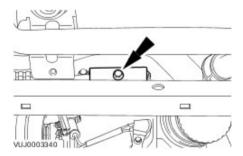
NOTE:

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

Attach the A/C compressor supply and return tubes.







90 . Install the front muffler.

For additional information, refer to Front Muffler - 2.0L/2.5L/3.0L (30.10.18)

Vehicles with 2.5L or 3.0L engine

91 . Install the driveshaft.

For additional information, refer to <u>Driveshaft (47.15.01)</u>

All vehicles

92 . Install the cooling fan motor and shroud.

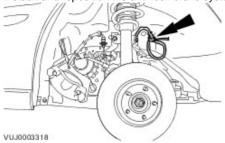
For additional information, refer to Cooling Fan Motor and Shroud (26.25.25)

Remove the tie straps.

NOTE:

Left-hand shown, right-hand similar.

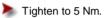
Detach and reposition the anti-lock brake system (ABS) wheel speed sensor.

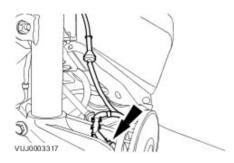


94 . **NOTE:**

Left-hand shown, right-hand similar.

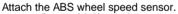
Connect the ABS wheel speed sensor.

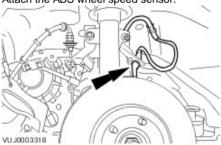




95 . **NOTE:**

Left-hand shown, right-hand similar.





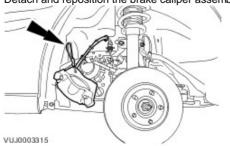
96 . **NOTE:**

Remove the tie straps.

NOTE:

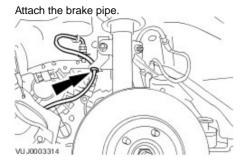
Left-hand shown, right-hand similar.

Detach and reposition the brake caliper assembly.



97 . **NOTE:**

Left-hand shown, right-hand similar.



98 . **NOTE:**

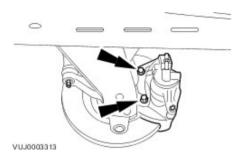
Left-hand shown, right-hand similar.

NOTE:

Install new brake caliper anchor plate retaining bolts.

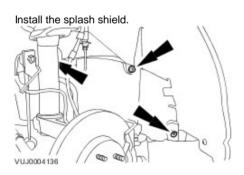
Attach the brake caliper assembly.





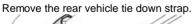
99 . **NOTE:**

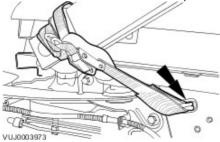
Right-hand shown, left-hand similar.



100 . **NOTE:**

Right-hand shown, left-hand similar.

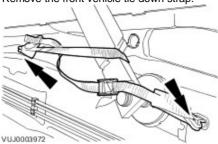




101 . **NOTE:**

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 (74.20.05)

103 . Install the battery tray.

For additional information, refer to <u>Battery Tray (86.15.11)</u>

104 . Fill and bleed the cooling system.

For additional information, refer to Cooling System Draining, Filling and Bleeding

105 . Bleed the power steering system.

For additional information, refer to Power Steering System Filling

106 . Recharge the A/C refrigerant.

For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging (82.30.30)

107 . Install the steering column lower retaining bolt.



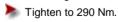
108 . Fill the transaxle.

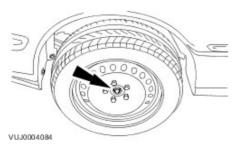
For additional information, refer to Transaxle Draining and Filling - Vehicles With: 6-Speed Manual Transmission (44.24.02)

109 . **NOTE:**

Left-hand shown, right-hand similar.

Tighten the front hub retaining nuts.





110. Carry out the underbody misalignment check.

For additional information, refer to <u>Underbody Misalignment Check (57.65.20)</u>

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.

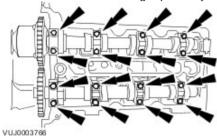
Finishing operations.

- 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).

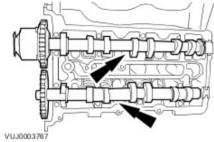
Camshafts LH (12.13.19)

Removal

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



3. Remove the camshafts.

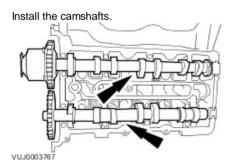


Installation

2

1 NOTE:

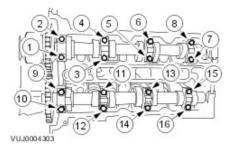
Lubricate the camshafts and the camshaft bearing caps with oil WSE-M2C908-A or equivalent meeting Jaguar specification prior to installation.



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.



- $\bf 3$. Carry out a valve clearance check. For additional information, refer to For additional information, refer to .
- $\bf 4$. Install the timing chains. For additional information, refer to For additional information, refer to .

Crankshaft Front Seal (12.21.14)

Special Service Tools



Crankshaft Front Seal Remover 303-700



303-542

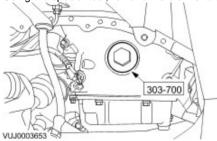
Crankshaft Front Seal Installer 303-542



Crankshaft Damper Installer 303-102

Removal

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



Installation

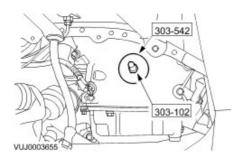


CAUTION: Make sure the seal and the tool are approximately parallel to the front of the engine.

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.



 ${\bf 2}$. Install the crankshaft vibration damper. For additional information, refer to For additional information, refer to .

Crankshaft Pulley (12.21.09)

Special Service Tools



303D055

Wrench strap-universal 303-D055



Crankshaft Damper Remover 303-D121



Thrust Pad 303-D121-01



Crankshaft Damper Installer Draw Bolt 303-102



303-335%

Crankshaft Damper Installer 303-335/2

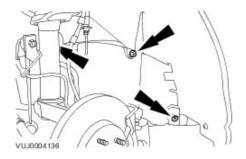


303-703

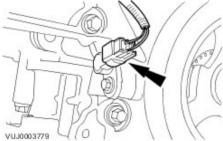
Accessory Belt Detensioner 303-703

Removal

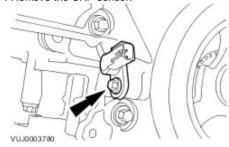
- 1 . Remove the wheel and tire. For additional information, refer to <<204-04>>.
- 2 . Remove the splash shield.



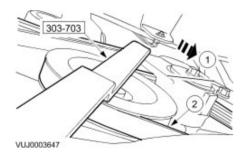
3 . Disconnect the crankshaft position sensor (CKP) electrical connector.



4 . Remove the CKP sensor.

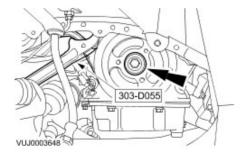


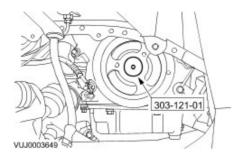
- 5 . Detach the accessory drivebelt.
 - 1) Using the special tool, rotate the belt tensioner counter clockwise.
 - 2) Detach the accessory drivebelt.



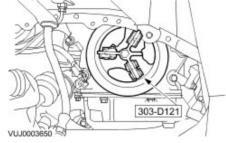
6. Using the special tool, remove the crankshaft v bration damper retaining bolt.







8 . Using the special tools, remove the crankshaft v bration damper.

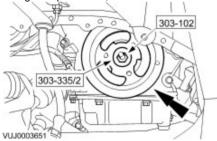


Installation

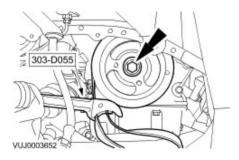
1 NOTE:

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

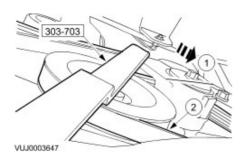
Using the special tool, install the crankshaft v bration damper.



- $\boldsymbol{2}$. Using the special tool, tighten the crankshaft vibration damper retaining bolt.
 - Install a new crankshaft v bration damper 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°.

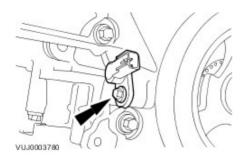


- ${\bf 3}$. Attach the accessory drivebelt.
 - 1) Using the special tool, rotate the belt tensioner counter-clockwise.
 - 2) Attach the accessory drivebelt.

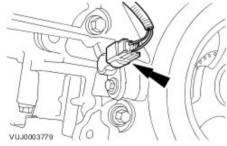


4 . Install the CKP.

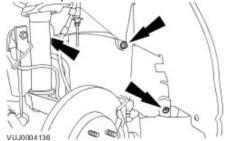




5 . Connect the CKP electrical connector.



6 . Install the splash shield.



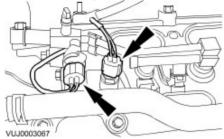
7 . Install the wheel and tire. For additional information, refer to <<204-04>>.

Cylinder Head LH (12.29.02)

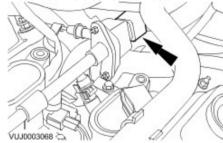
Removal

Vehicles with 2.5L or 3.0L engine

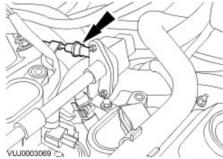
1 . Disconnect the engine coolant temperature (ECT) and fuel temperature sensor (FTS) electrical connectors.



2 . Disconnect the electrical connector.

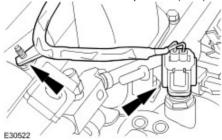


3. Detach fuel sensor vacuum line.



Vehicles with 2.0L engine

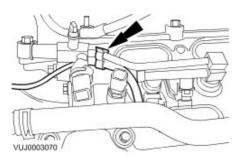
4 . Disconnect the coolant temperature (ECT) electrical connector.



All vehicles

5. Detach the fuel charging wiring harness.

2.5 and 3.0L shown, 2.0L similar.

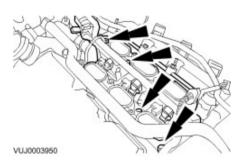


WARNING: Fuel may still be present in the fuel injection supply manifold, extreme care must be taken as this could cause personal injury.

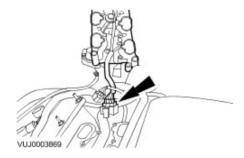
Detach the fuel injection supply manifold, lower intake manifold and place to one side.

Remove and discard the lower intake manifold seals.

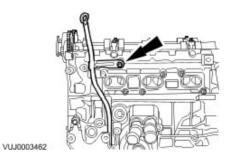
2.5 and 3.0L shown, 2.0L similar.



- 7 . Remove the fuel injection supply manifold and lower intake manifold.
 - Disconnect the electrical connector.

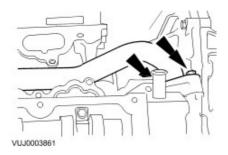


- 8 . Remove the oil level indicator tube.
 - Remove and discard the oil level indicator tube O-ring seal.

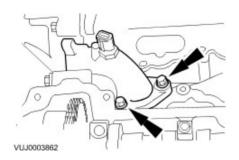


9 . Remove the water pump outlet pipe.

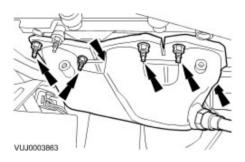
Remove and discard the water pump outlet pipe O-ring seals.



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



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

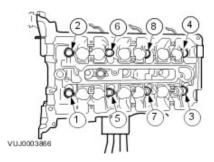


- 12 . Remove the left-hand camshafts. For additional information, refer to For additional information, refer to .
- 13 . **NOTE**:

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 <<303-00>>.

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:

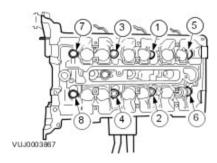
Make sure the cylinder head is installed in its original position.

NOTE:

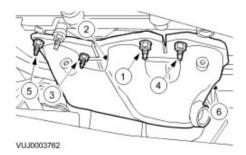
Tighten the bolts in the indicated sequence in six stages.

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

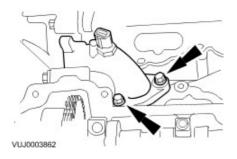
- Stage 1: Tighten to 30 Nm.
- Stage 2: Tighten 90 degrees.
- Stage 3: Loosen 360 degrees (one full turn) in reverse order.
- Stage 4: Tighten to 30 Nm.
- Stage 5: Tighten 90 degrees.
- Stage 6: Tighten 90 degrees.



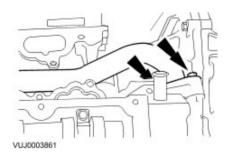
- 3 . Install the left-hand camshafts. For additional information, refer to For additional information, refer to .
- 4 . Install the exhaust manifold.
 - Install the new exhaust manifold gasket.
 - Complete the tightening sequence.
 - Tighten to 20 Nm.



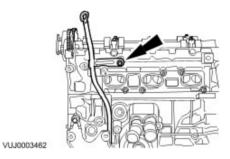
- 5 . Install the coolant bypass tube.
 - Install the new coolant bypass tube O-ring seals.
 - Tighten to 10 Nm.



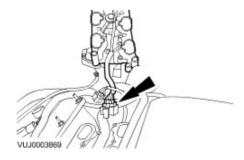
- 6 . Install the water pump outlet pipe.
 - Install the new water pump outlet pipe O-ring seals.
 - Tighten to 10 Nm.



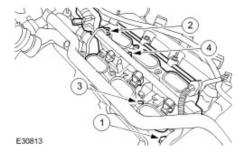
- 7. Install the oil level indicator tube.
 - Install a new O-ring seal.
 - Tighten to 10 Nm.



- 8 . Attach the fuel injection supply manifold and lower intake manifold.
 - Connect the electrical connector.

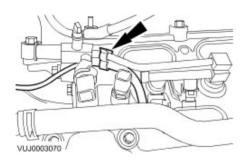


- 9 . Install the fuel injection supply manifold, lower intake manifold.
 - Install new lower intake manifold O-ring seals.
 - Tighten in the sequence shown.
 - Tighten to 10 Nm.



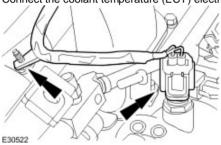
10 . Attach the fuel charging wiring harness.

2.5 and 3.0L shown, 2.0L similar.



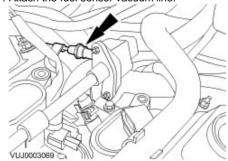
Vehicles with 2.0L engine

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

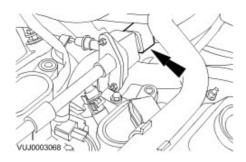


Vehicles with 2.5L or 3.0L engine

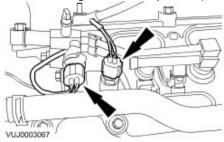
12 . Attach the fuel sensor vacuum line.



13 . Connect the electrical connector.



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



Engine Front Cover (12.65.01)

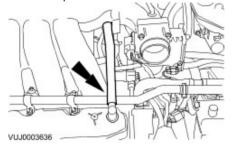
Removal

All vehicles

- 1. Using a suitable container drain the engine oil.
- 2 . Remove the automatic or manual transmission. For additional information, refer to <<307-01>> or <<308-03>>.

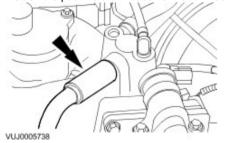
Vehicles with 2.5L or 3.0L engine

3. Detach the positive crank case ventilation hose.

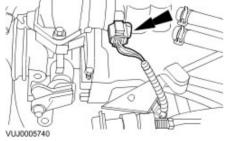


Vehicles with 2.0L engine

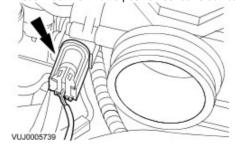
4. Detach the positive crank case ventilation hose.



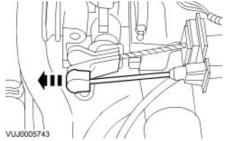
 ${\bf 5}$. Disconnect the idle actuator control valve electrical connector.



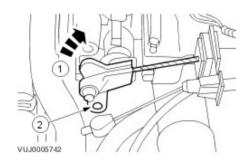
6 . Disconnect the throttle position sensor electrical connector.



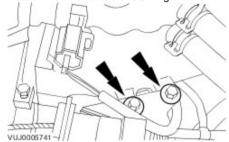




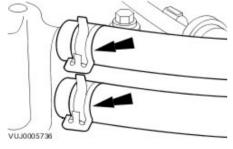
- 8 . Detach the throttle cable.
 - 1) Reposition the throttle lever to the fully open position.
 - 2) Detach the throttle cable.



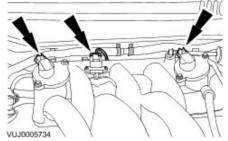
9 . Detach the throttle cable retaining bracket.

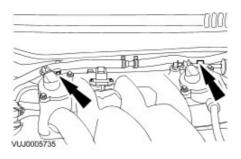


10 . Detach the coolant hoses.



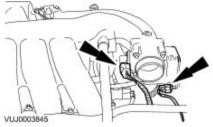
11 . Disconnect the electrical connectors.



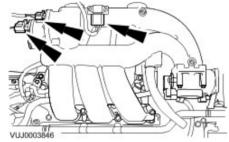


Vehicles with 2.5L or 3.0L engine

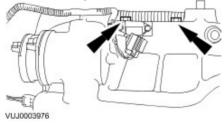
13 . Disconnect the electrical connectors.



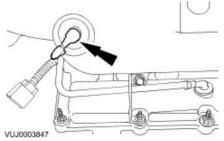
14 . Disconnect the electrical connectors.



15 . Detach the wiring harness.



16 . Detach the vacuum hose.

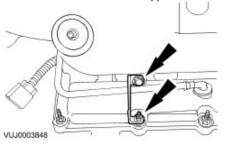


All vehicles

17 . **NOTE**:

2.5L and 3.0L shown, 2.0L similar.

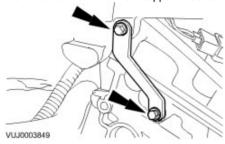
Remove the intake manifold support bracket.



18 . **NOTE**:

2.5L and 3.0L shown, 2.0L similar.

Remove the intake manifold support bracket.

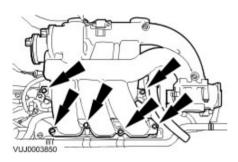


19 . **NOTE**:

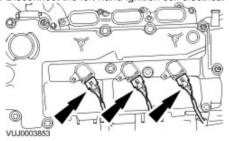
2.5L and 3.0L shown, 2.0L similar.

Remove the intake manifold.

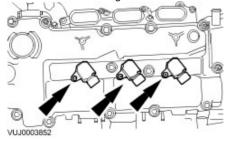
Remove and discard the intake manifold gaskets.



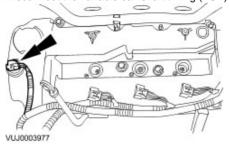
20 . Disconnect the left-hand ignition coil electrical connectors.



21 . Remove the left-hand ignition coils.



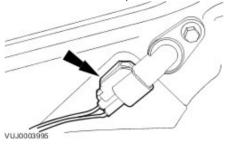
22 . Disconnect the variable camshaft timing (VCT) solenoid electrical connector.



23 . **NOTE:**

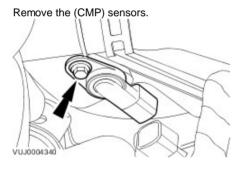
Right-hand shown, left-hand similar.

Disconnect the camshaft position sensor electrical connectors.



24 . **NOTE**:

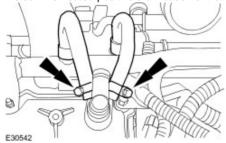
Right-hand shown, left-hand similar.



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

Vehicles with 2.0L engine

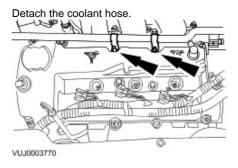
26 . Detach the heated positive crankcase ventilation valve coolant hoses.



All vehicles

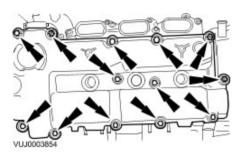
27 . **NOTE**

2.5L and 3.0L shown, 2.0L similar.

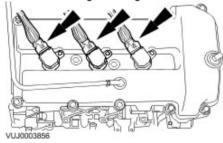


28 . Remove the left-hand valve cover.

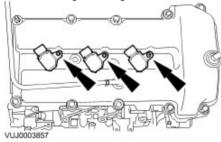
Remove and discard the valve cover gaskets.



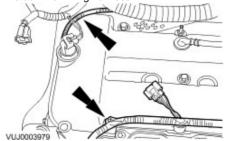
29 . Disconnect the right-hand ignition coil electrical connectors.



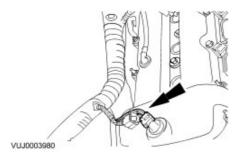
30 . Remove the right-hand ignition coils.



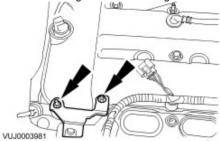
31 . Detach the wiring harness.



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

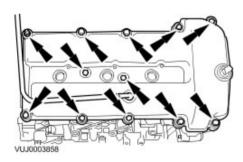


33 . Remove the engine cover retaining bracket.

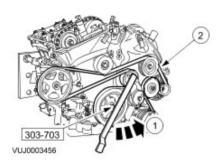


- 34 . Reposition the right-hand wiring harness for access to the valve cover.
- 35 . Remove the right-hand valve cover.

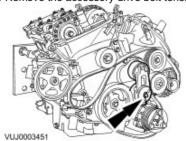
Remove and discard the valve cover gaskets.



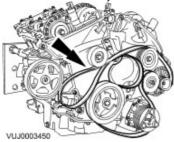
- 36 . Detach the accessory drivebelt.
 - 1) Using the special tool, rotate the belt tensioner counter-clockwise.
 - 2) Detach the accessory drivebelt.



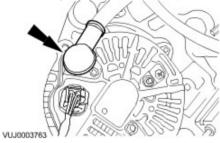
37 . Remove the accessory drive belt tensioner.



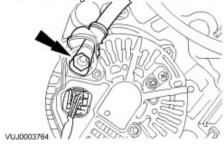
38 . Remove the accessory drive belt.



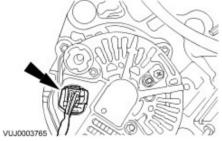
39 . Detach the generator positive cable protective cover.



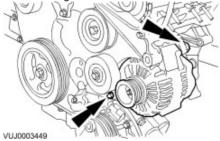
40 . Disconnect the generator positive cable electrical connector.



41 . Disconnect the generator electrical connector.

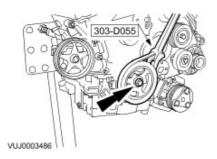


42 . Remove the generator.

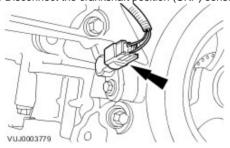


43 . Using the special tool, remove the crankshaft vibration damper retaining bolt.

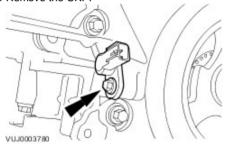
Remove and discard the crankshaft vibration damper retaining bolt.



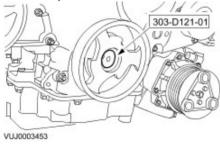
44 . Disconnect the crankshaft position (CKP) sensor electrical connector.



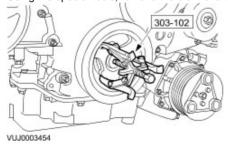
45 . Remove the CKP.



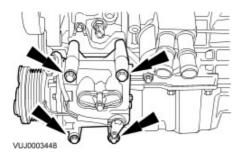
46 . Install the special tool.



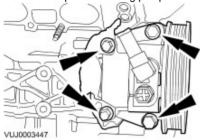
47 . Using the special tools, remove the crankshaft vibration damper.



48 . Remove the air conditioning compressor.

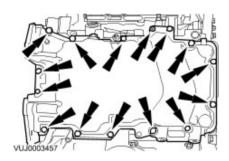


49 . Remove the power steering pump.

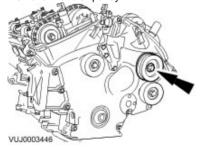


50 . Remove the oil pan.

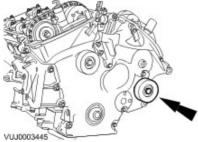
Remove and discard the oil pan gasket.



51 . Remove the idler pulley.

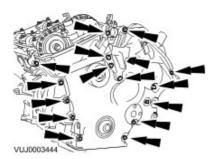


52 . Remove the idler pulley.



53 . Remove the engine front cover.

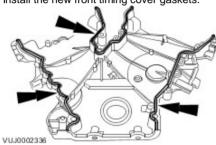
Remove and discard the engine front cover gaskets.



Installation

All vehicles

1 . Install the new front timing cover gaskets.



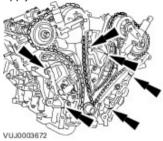
2 **NOTE**:

 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.



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°.

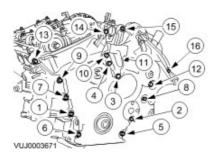
Stage 3: Bolts 5 through 9, 25 Nm.

Stage 4: Bolts 10 and 11, 30 Nm + 45°.

Stage 5: Bolts 12 and 13, 25 Nm.

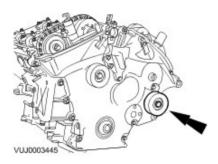
Stage 6: Bolt 14, 25 Nm.

Stage 7: Bolts 15 and 16, 25 Nm.



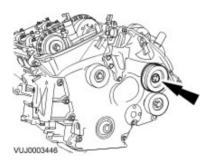
4 . Install the idler pulley.

Tighten to 47 Nm.



5 . Install the idler pulley.

Tighten to 25 Nm.



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:

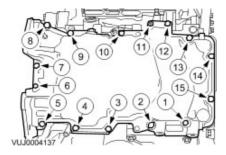
Tighten the oil pan bolts within six minutes of applying sealer.

Install the oil pan.

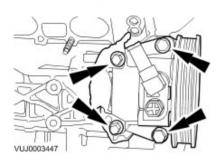
Install the new oil pan gasket.

Complete the tightening sequence.

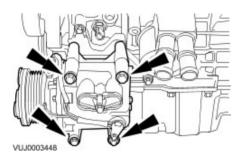
Tighten to 25 Nm.



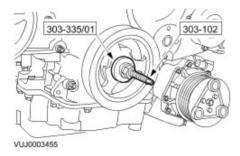
- 7 . Install the power steering pump.
 - Tighten to 25 Nm.



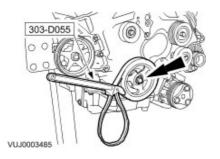
- 8 . Install the air conditioning compressor.
 - Tighten to 25 Nm.



- 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.

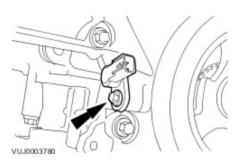


- 10 . Using the special tool, tighten the crankshaft vibration damper retaining bolt.
 - Install a new crankshaft vibration retaining bolt.
 - Complete the tightening sequence.
 - Stage 1: Torque to 120 Nm.
 - Stage 2: Loosen the bolt (minimum 1 turn).
 - Stage 3: Torque to 50 Nm.
 - Stage 4: Angle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

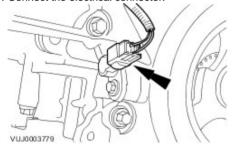


11 . Install the CKP sensor.

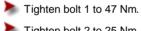
Tighten to 10 Nm.



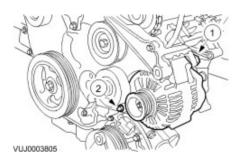
12 . Connect the electrical connector.



13 . Install the generator retaining bolts.

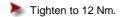


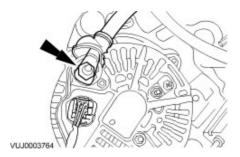




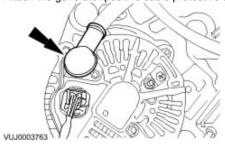
14 . Connect the generator electrical connector.



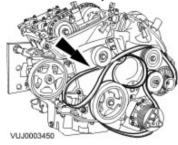




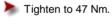
16 . Attach the generator positive cable protective cover.

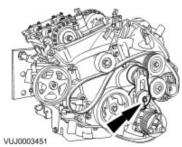


17. Attach the accessory drive belt.

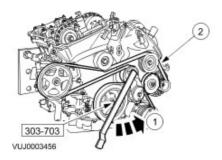


18 . Install the accessory drive belt tensioner.





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



20 **NOTE**:

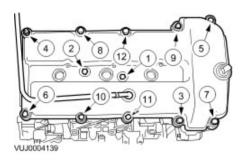
 Apply a 5 mm diameter bead of silicone gasket sealant WSE-M4G323-A6 or equivalent meeting Jaguar specification on the half round gaskets and apply an 8 mm diameter bead of silicone gasket sealant on the two places where the cylinder head and front timing cover join.

NOTE:

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

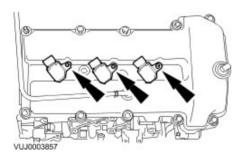
Install the new valve cover gaskets.

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

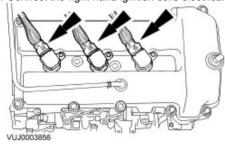


21 . Install the right-hand ignition coils.





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



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.

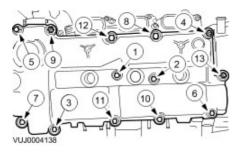
NOTE:

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

Install the new valve cover gaskets.

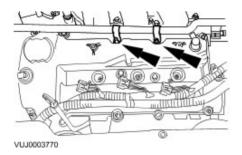
Complete the tightening sequence.

Tighten to 10 Nm.



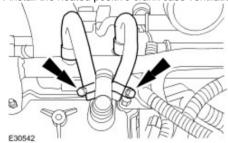
24 . Install the coolant hose.





Vehicles with 2.0L engine

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



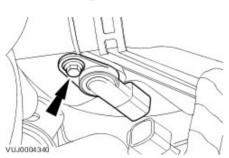
All vehicles

26 . **NOTE**:

Right-hand shown, left-hand similar.

Install the (CMP) semsors.

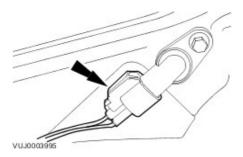




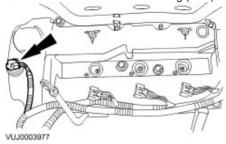
27 . **NOTE**:

Right-hand shown, left hand similar.

Connect the camshaft position sensor electrical connector.

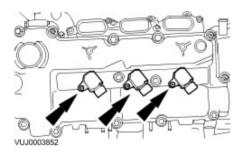


28 . Connect the variable camshaft timing (VCT) solenoid electrical connector.

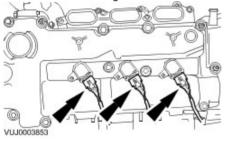


29 . Install the left-hand ignition coils.





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



31 . **NOTE:**

2.5L and 3.0L shown, 2.0L similar.

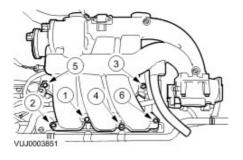
NOTE:

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.

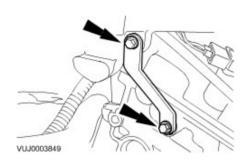
Tighten to 10 Nm.



2.5L and 3.0L shown, 2.0L similar.

Install the intake manifold support bracket.

Tighten to 10 Nm.

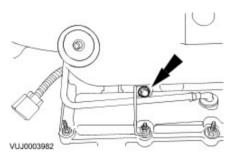


33 . **NOTE:**

2.5L and 3.0L shown, 2.0L similar.

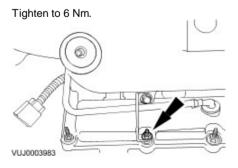
Install the intake manifold support bracket.

Tighten to 10 Nm.



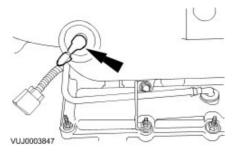
34 . **NOTE**:

2.5L and 3.0L shown, 2.0L similar.



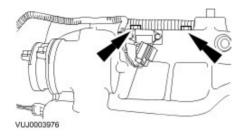
Vehicles with 2.5L or 3.0L engine

35 . Connect the vacuum hose.

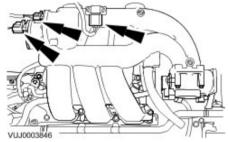


36 . Attach the wiring harness.

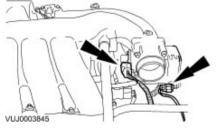




37 . Connect the electrical connectors.

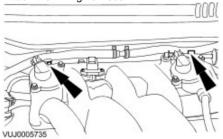


38 . Connect the electrical connectors.

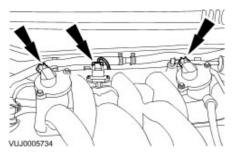


Vehicles with 2.0L engine

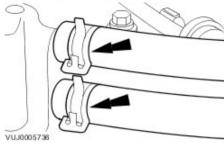
39 . Attach the wiring harness.



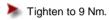
40 . Connect the electrical connectors.

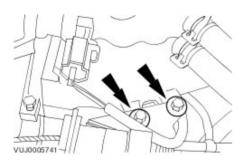


41 . Install the coolant hoses.

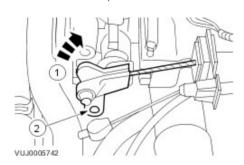


42 . Attach the throttle cable bracket.

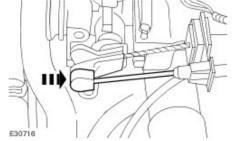


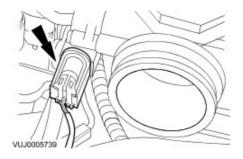


- 43 . Attach the throttle cable.
 - 1) Reposition the throttle lever to the fully open position.
 - 2) Attach the throttle cable.

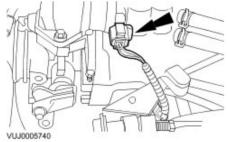


44 . Attach the cruise control cable.

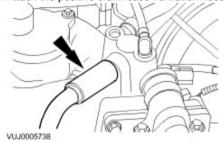




46 . Connect the idle actuator control valve electrical connector.

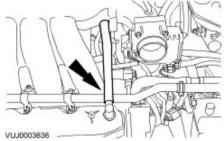


47 . Attach the positive crank case venilation hose.



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 <<307-01>> or <<308-03>>.

50 . **NOTE**:

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

Refill the engine with oil.

Engine Front Mount (12.45.01)

Special Service Tools

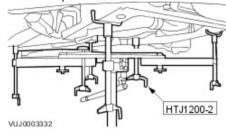


Powertrain Assembly Jack HTJ1200-02

Removal

1 . Drain the cooling system. For additional information, refer to . For additional information, refer to <u>Cooling System Draining</u>, <u>Filling and Bleeding</u>

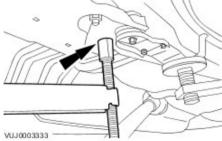
2 . Install the special tool



3 . **NOTE:**

Left-hand shown, right-hand similar.

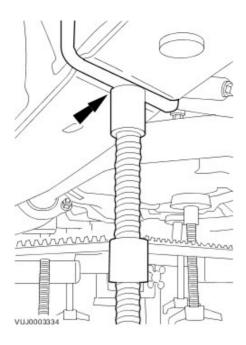
Position and adjust the special tool rear height adjuster.



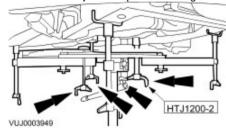
4 . **NOTE**:

Right-hand shown, left-hand similar.

Position and adjust the special tool front height adjuster.



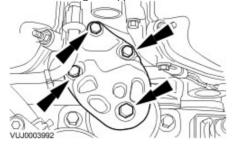
5 . Position and adjust the special tool engine height adjusters.



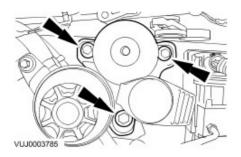
6 . Detach the coolant pipe.



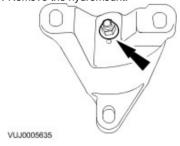
7 . Remove the engine support bracket.



8 . Remove the engine mount.



9 . Remove the hydromount.



Installation

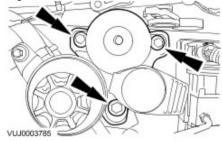
1 . To install, reverse the removal procedure.

Tighten to 83 Nm.

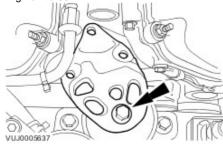


VUJ0005635

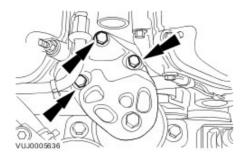
2 . Tighten to 80 Nm.



3 . Tighten to 80 Nm.



 ${\bf 4}$. 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.



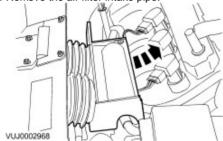


6 . Fill and bleed the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding

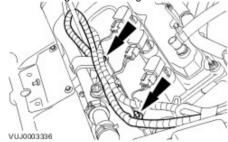
Exhaust Manifold LH (30.15.55)

Removal

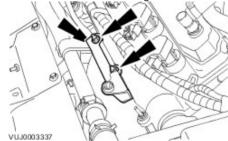
- 1 . Drain the cooling system. For additional information, refer to <<303-03>>.
- 2 . Remove the cooling fan motor and shroud. For additional information, refer to <<<303-03>>.
- 3. Lower the vehicle.
- 4 . Remove the air filter intake pipe.



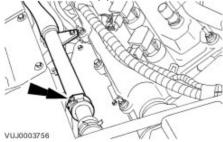
5 . Detach the generator wiring harness.



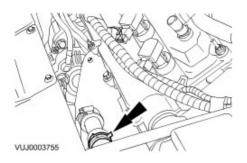
6 . Remove the air filter retaining bracket.



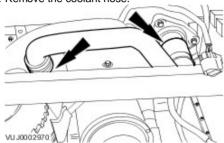
7. Detach the coolant pipe.



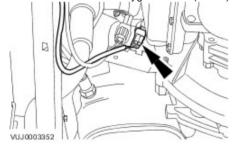
8. Detach the coolant hose.



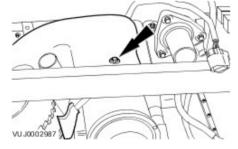
- 9 . Raise the vehicle.
- 10 . Remove the coolant hose.



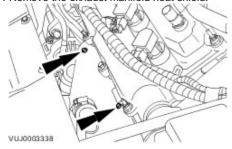
11 . Disconnect the heated oxygen sensor (HO2S) electrical connector.



12 . Remove the exhaust manifold heat shield retaining bolt.



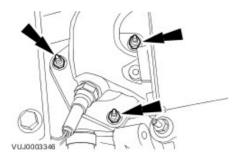
- 13 . Lower the vehicle.
- 14 . Remove the exhaust manifold heat shield.



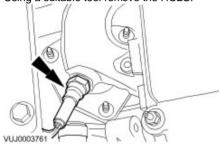
15 . Detach the catalytic converter.

Discard the retaining nuts.

Remove and discard the retaining studs.

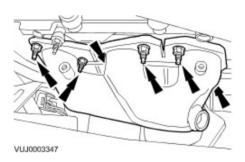


16 . Using a suitable tool remove the HO2S.



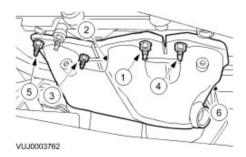
17 . Remove the exhaust manifold.

Remove and discard the exhaust manifold gasket.



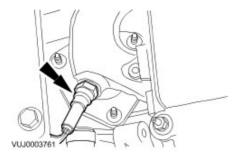
Installation

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



2 . Install the H02S.

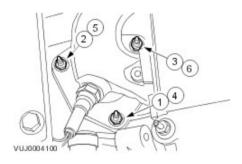
Tighten to 40 Nm.



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

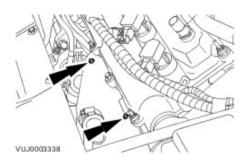
Attach the catalytic converter.

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

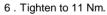


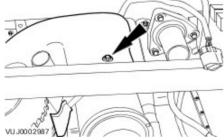
4 . Install the exhaust manifold heat shield.



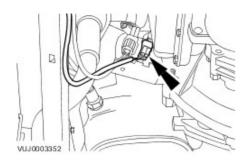


5 . Raise the vehicle.

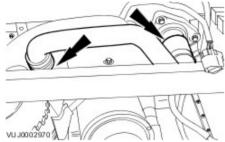




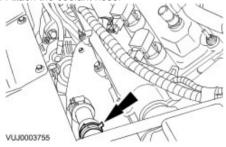
7 . Connect the heated oxygen sensor (HO2S) electrical connector.



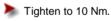
8 . Install the coolant hose.

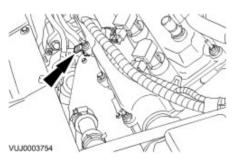


- 9. Lower the vehicle.
- 10 . Attach the coolant hose.

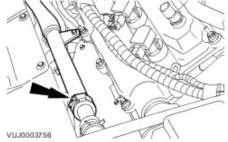


11 . Install the coolant pipe retaining bracket.

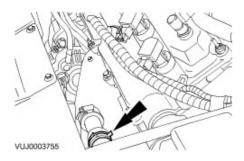




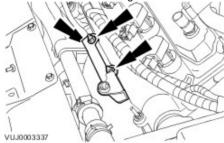
12 . Attach the coolant pipe.



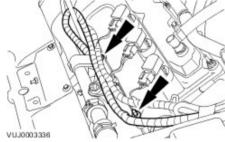
13 . Attach the coolant hose.



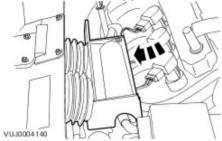
14 . Install the air filter retaining bracket.



15 . Attach the generator wiring harness.



16 . Install the air filter intake pipe.

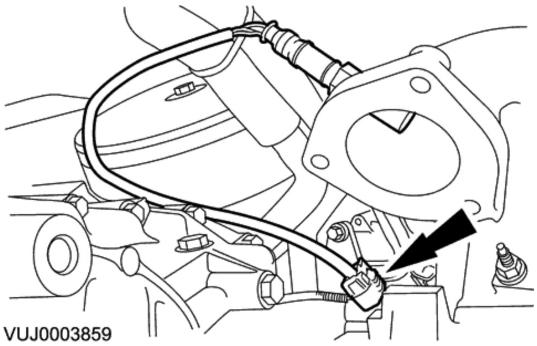


- 17 . Install the cooling fan motor and shroud. For additional information, refer to <<303-03>>.
- 18 . Fill and bleed the cooling system. For additional information, refer to $\leq <303-03>>$.

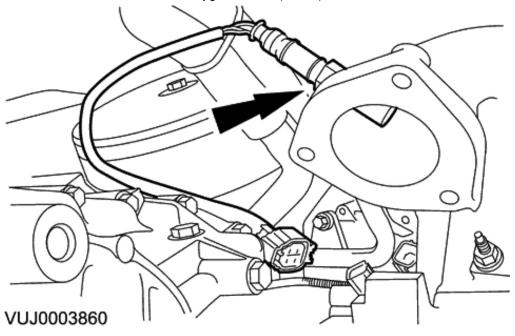
Exhaust Manifold RH 30.15.56

Removal

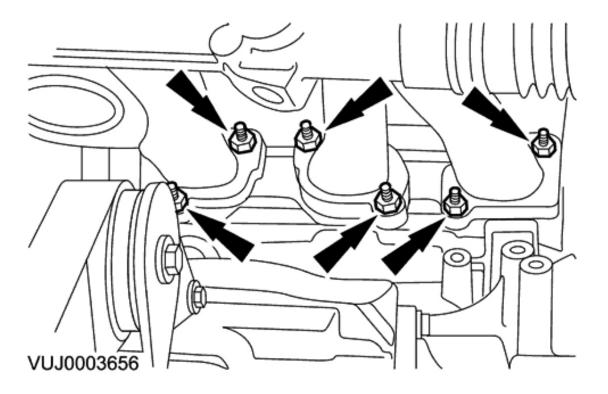
1. Remove the three way catalytic converter (TWC). For additional information, refer to <<309-00>>.



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

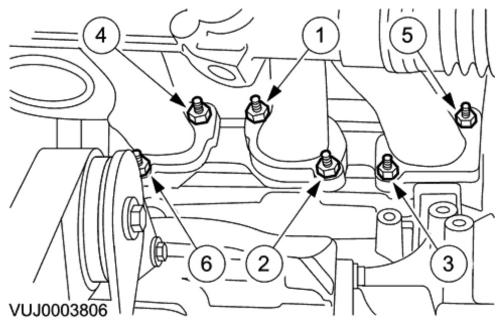


3. Using a suitable tool remove the HO2S.

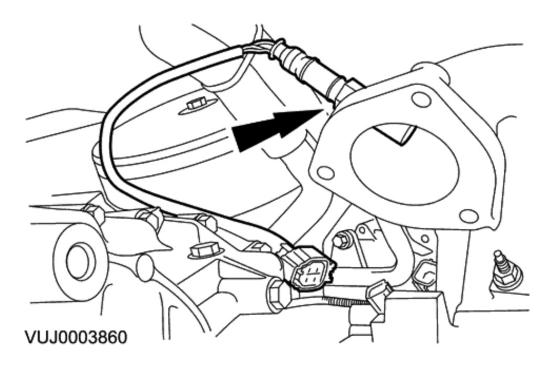


- 4. Remove the exhaust manifold.
 - Remove and discard the exhaust manifold gasket.

Installation



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

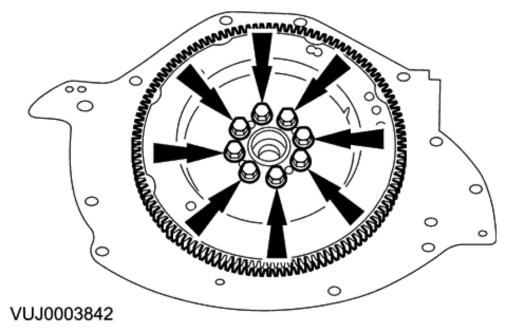


- 2. Tighten to 40 Nm.
- 3. Install the three way catalytic converter (TWC). For additional information, refer to <<309-00>>.

Flexplate 12.53.13

Removal

1. Remove the automatic transmission. For additional information, refer to << 307-01>>.

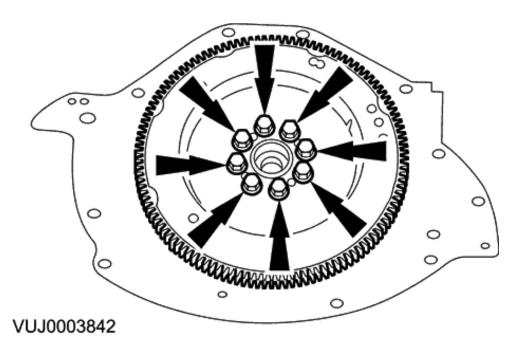


2. **NOTE:**

Prevent the flexplate from rotating.

Remove the flexplate.

Installation



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.

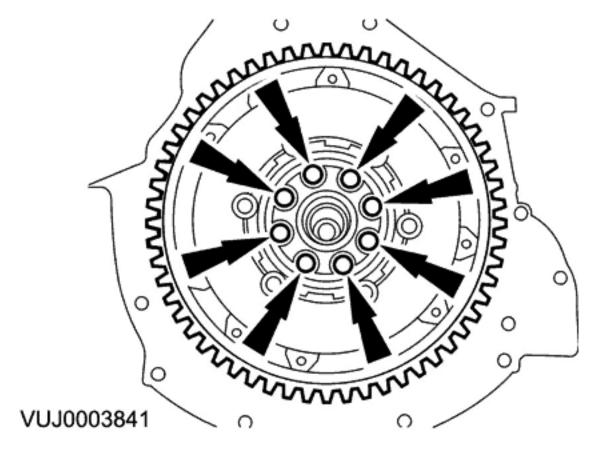
Install the flexplate.

- Prevent the flexplate from rotating.
- Tighten to 80 Nm.
- 2. Install the automatic transmission. For additional information, refer to <<307-01>>.

Flywheel 12.53.07

Removal

1. Remove the clutch disc and pressure plate. For additional information, refer to <<308-01>>.

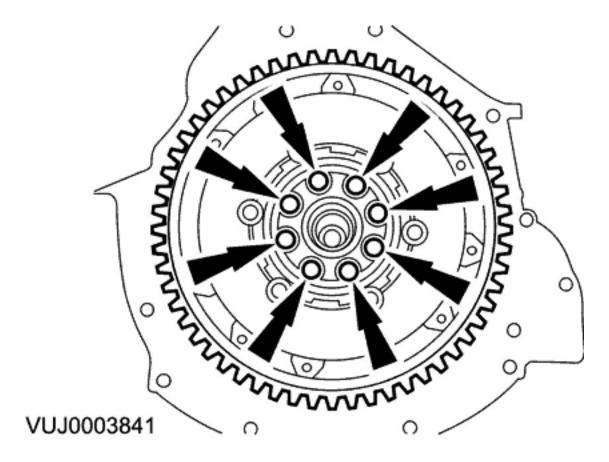


2. **NOTE:**

Prevent the flywheel from rotating.

Remove the flywheel.

Installation



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

NOTE:

The flywheel will only locate in one position.

NOTF:

Tighten the retaining bolts working diagonally.

Install the flywheel.

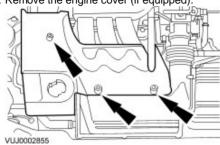
- Prevent the flywheel from rotating.
- Tighten to 80 Nm.
- 2. Install the clutch disc and pressure plate. For additional information, refer to <<308-01>>.

Intake Manifold (30.15.01)

Removal

All vehicles

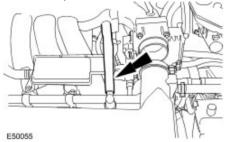
1 . Remove the engine cover (if equipped).



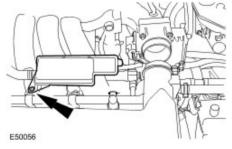
2 . Remove the air filter outlet pipe.
For additional information, refer to <u>Air Cleaner Outlet Pipe (19.10.31)</u>

Vehicles with 2.5L or 3.0L engine

3 . Remove the positive crankcase ventilation hose.

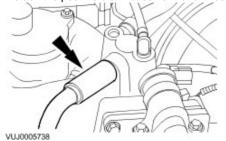


4 . Remove the air cleaner resonator.

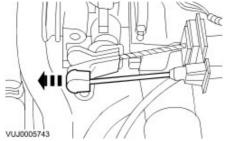


Vehicles with 2.0L engine

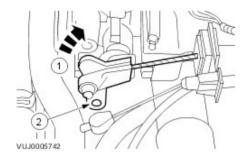
5. Detach the positive crank case ventilation hose.



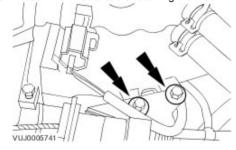
6 . Detach the cruise control cable.



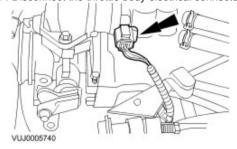
- 7. Detach the throttle cable.
 - 1) Reposition the throttle lever to the fully open position.
 - 2) Detach the throttle cable.



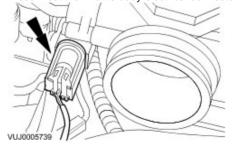
8 . Detach the throttle cable retaining bracket.



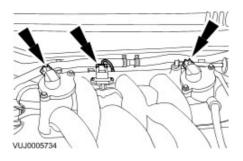
9 . Disconnect the throttle body electrical connector.



10 . Disconnect the throttle body electrical connector.

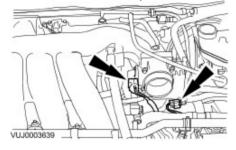


11 . Disconnect the electrical connectors.

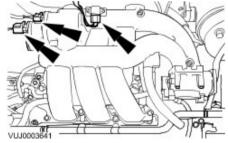


Vehicles with 2.5L or 3.0L engine

12 . Disconnect the throttle body electrical connectors.



13 . Disconnect the electrical connectors.



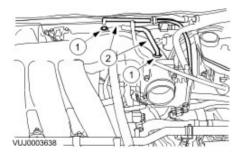
All vehicles

14 . **NOTE**:

2.5 L and 3.0 L shown, 2.0 L similar.

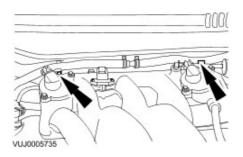
Detach the vacuum hoses.

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



Vehicles with 2.0L engine

15 . Detach the coolant hose from the retaining clips.



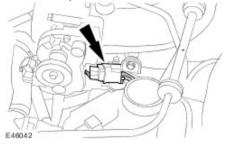
Vehicles with 2.5L or 3.0L engine

16 . Disconnect the vacuum hose.



All vehicles

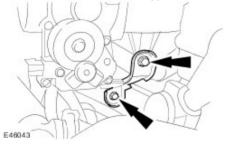
17 . Detach the injector harness electrical connector from the intake manifold support bracket.



18 . **NOTE:**

2.5L and 3.0L shown, 2.0L similar.

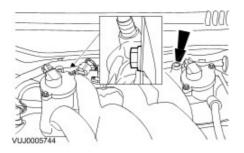
Remove the intake manifold support bracket.



19 . **NOTE**:

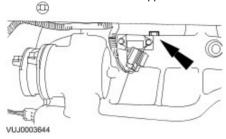
2.0L shown, 2.5L and 3.0L similar.

Detach the engine wiring harness bracket.



2.5L and 3.0L shown, 2.0L similar.

Detach the intake manifold support bracket.



Vehicles with 2.0L engine

21

WARNING: 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.

WARNING: 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.

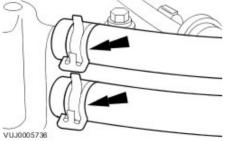
Release the cooling system pressure.

Remove the coolant expansion tank pressure cap.

22 . **NOTE**:

Cap the coolant hoses to minimize coolant loss.

Detach the intake manifold coolant hoses.



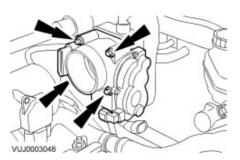
Vehicles with 2.5L or 3.0L engine

23 . **NOTE:**

Remove and discard the O-ring seal.

Detach the throttle body.

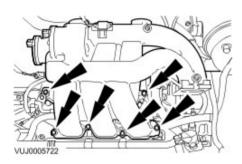
Remove the retaining bolts.



All vehicles

24 . Remove the intake manifold.

Remove and discard the intake manifold gaskets.



Installation

All vehicles

1 . **NOTE**:

Install new intake manifold gaskets.

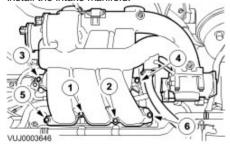
NOTE:

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.



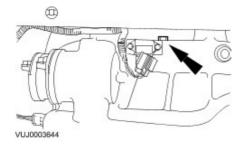
2 . **NOTE**:

2.5L and 3.0L shown, 2.0L similar.

NOTE:

Do not fully tighten the retaining bolts.

Attach the intake manifold support bracket.

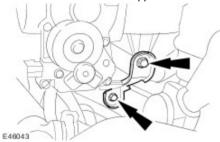


2.5L and 3.0L shown, 2.0L similar.

NOTE:

Do not fully tighten the retaining bolts.

Install the intake manifold support bracket.



4 . **NOTE**:

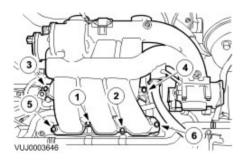
The intake manifold retaining bolts in position 1, 4 and 5 are longer than the retaining bolts in position 2, 3 and 6.

NOTE:

2.5L and 3.0L shown, 2.0L similar.

Tighten to 10 Nm.

Complete the tightening sequence.



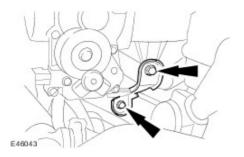
5 . Tighten to 10 Nm.



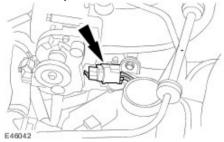
6 . **NOTE**:

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.

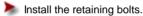


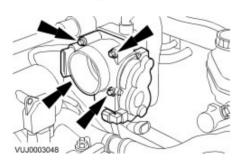
Vehicles with 2.5L or 3.0L engine

8 . **NOTE:**

Install a new O-ring seal.

Attach the throttle body.



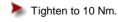


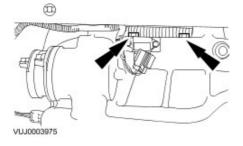
9 . Connect the vacuum hose.



All vehicles

10 . Attach the wiring harness.

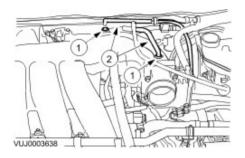




2.5L and 3.0L shown, 2.0L similar.

Attach the vacuum hoses.

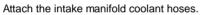
- 1) Press the retaining ring.
- 2) Attach the vacuum hose.

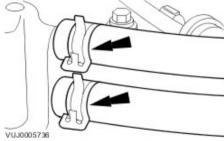


Vehicles with 2.0L engine

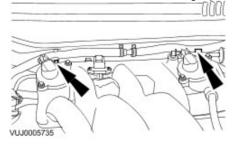
12 . **NOTE:**

Remove the coolant hose caps.

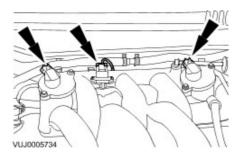




13 . Attach the coolant hose to the retaining clips.

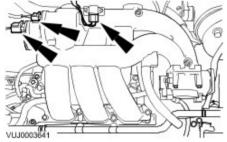


14 . Connect the electrical connectors.

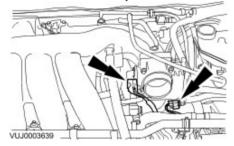


Vehicles with 2.5L or 3.0L engine

15 . Connect the electrical connectors.

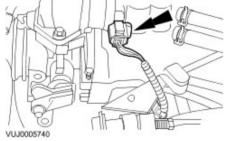


16 . Connect the throttle body electrical connectors.

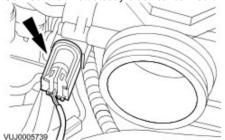


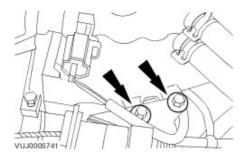
Vehicles with 2.0L engine

17 . Connect the throttle body electrical connector.

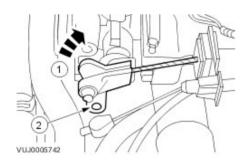


18 . Connect the throttle body electrical connector.

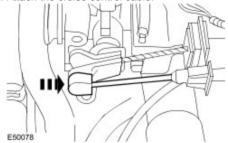




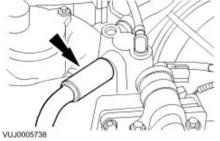
- 20 . Attach the throttle cable.
 - 1) Reposition the throttle lever to the fully open position.
 - 2) Attach the throttle cable.



21 . Attach the cruise control cable.



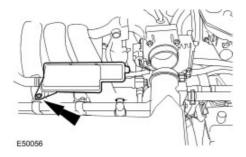
22 . Attach the positive crank case ventilation hose.



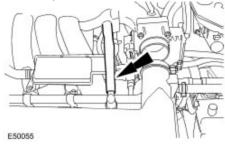
23 Fill the cooling system up to the MAX mark on the coolant expansion tank using a fifty percent mixture of Jaguar Premium Cooling . System Fluid or equivalent, meeting Jaguar specification WSS M97B44-D and fifty percent water.

Vehicles with 2.5L or 3.0L engine

24 . Install the air cleaner resonator.

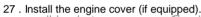


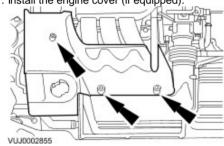
25 . Install the positive crankcase ventilation hose.



All vehicles

26 . Install the air filter outlet pipe. For additional information, refer to <u>Air Cleaner Outlet Pipe (19.10.31)</u>





Lower Intake Manifold (30.15.61)

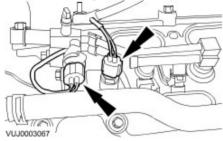
Removal

All vehicles

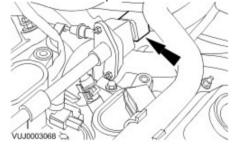
- 1 . Remove the intake manifold. For additional information, refer to Intake Manifold (30.15.01)
- 2 . Disconnect the spring lock coupling.
 For additional information, refer to Spring Lock Couplings

Vehicles with 2.5L or 3.0L engine

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

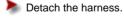


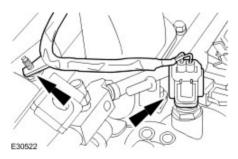
4. Disconnect the fuel pressure sensor electrical connector.



Vehicles with 2.0L engine

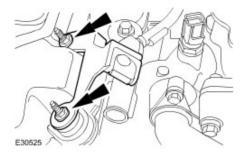
 ${\bf 5}$. Disconnect the engine coolant temperature (ECT) electrical connector.



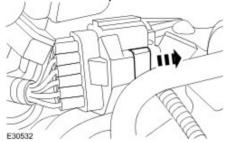


All vehicles

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



7 . Disconnect the fuel injector harness electrical connector.

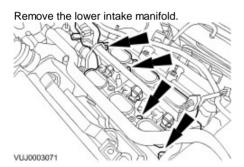




WARNING: Fuel may still be present in the fuel injection supply manifold.

NOTE:

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



Installation

All vehicles

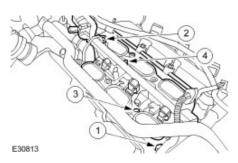
1 . **NOTE**:

Install new O-ring seals.

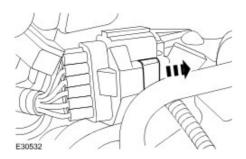
Install the lower intake manifold.

Tighten the retaining bolts in the sequence shown.

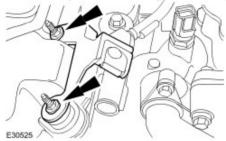
Tighten to 10 Nm.



 ${\bf 2}$. Connect the fuel injector harness electrical connector.



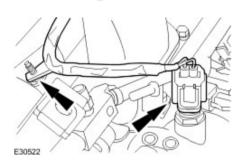
3 . Install the engine cover retaining bracket (if equipped).



Vehicles with 2.0L engine

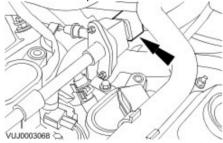
 ${\bf 4}$. Connect the engine coolant temperature (ECT) electrical connector.

Attach the harness.

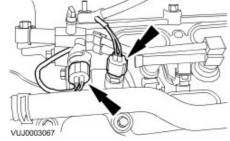


Vehicles with 2.5L or 3.0L engine

5. Connect the fuel pressure sensor electrical connector.



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



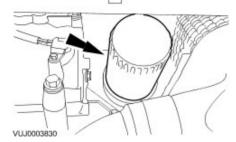
- 7 . Connect the spring lock coupling.
 For additional information, refer to Spring Lock Couplings
- 8 . Install the intake manifold.

 For additional information, refer to Intake Manifold (30.15.01)

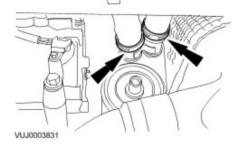
Oil Cooler (12.60.68)

Removal

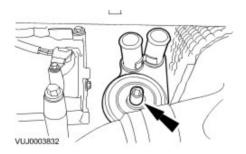
- 1. Drain the cooling system. For additional information, refer to <<303-03>>.
- 2 . Drain the engine oil.
- 3 . Remove and discard the engine oil filter.



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.



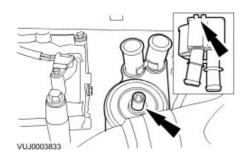
Installation

- 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.



Oil Pan (12.60.44)

Special Service Tools



Accessory Belt Detensioner 303-703

Removal

All vehicles

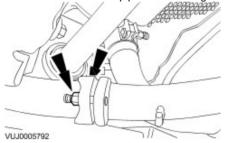
1. Drain the engine oil.

Vehicles with 2.5L or 3.0L engine

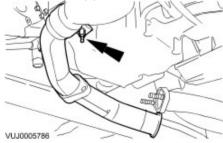
2 . Remove the transfer case. For additional information, refer to <<308-07>>.

Vehicles with 2.0L engine

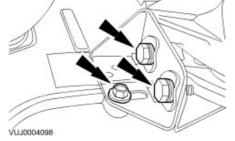
3 . Detach the exhaust link pipe rear retaining clamp.



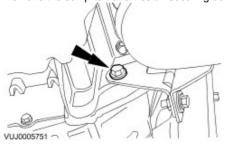
4 . Remove the link pipe.



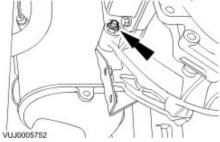
 ${\bf 5}$. Remove the catalytic converter retaining bracket.



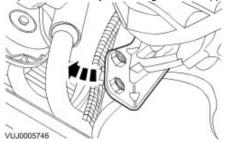
6. Remove the sump to transmission securing bolt.



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

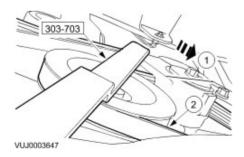


8 . Reposition the catalyst retaining bracket support.



All vehicles

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

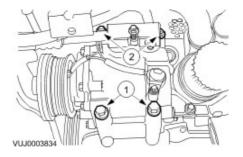


10 . **NOTE**:

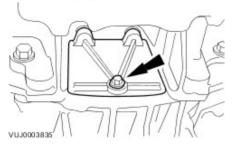
Do not remove the A/C compressor upper retaining bolts.

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.

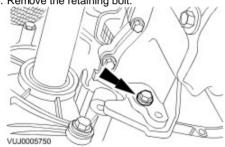


11 . Remove the access cover.



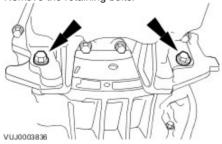
Vehicles with 2.0L engine

12 . Remove the retaining bolt.



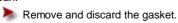
Vehicles with 2.5L or 3.0L engine

13 . Remove the retaining bolts.

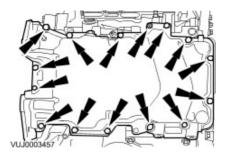


All vehicles

14 Remove the oil pan.



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:

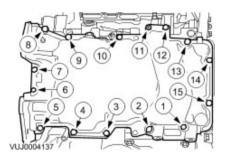
Tighten the oil pan bolts within six minutes of applying sealer.

To install, reverse the removal procedure.

Install the new oil pan gasket.

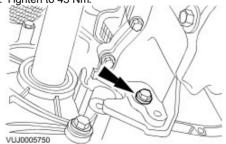
Complete the tightening sequence.

Tighten to 25 Nm.



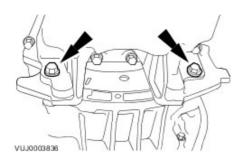
Vehicles with 2.0L engine



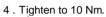


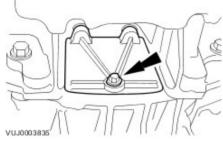
Vehicles with 2.5L or 3.0L engine

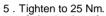
3 . Tighten to 45 Nm.

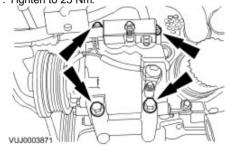


All vehicles

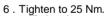


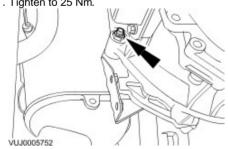




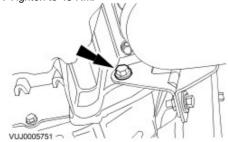


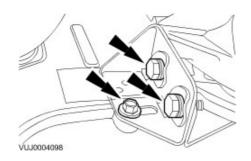
Vehicles with 2.0L engine

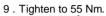


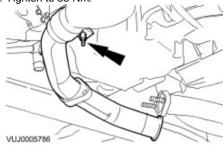


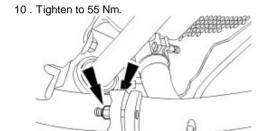
7. Tighten to 45 Nm.











Vehicles with 2.5L or 3.0L engine

11 . Install the transfer case. For additional information, refer to <<308-07>>.

All vehicles

12 . **NOTE:**

VUJ0005792

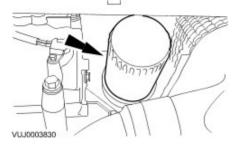
Use oil WSE-M2C908-A or equivalent meeting Jaguar specification.

Refill the engine with oil.

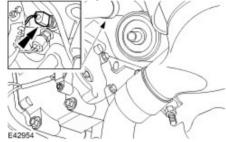
Oil Pressure Sender

Removal

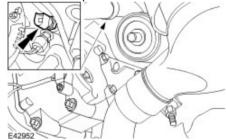
- 1 . Raise and support the vehicle. <<100-02>>
- 2 . Remove and discard the oil filter.



3 . Disconnect the oil pressure sender electrical connector.



4 . Remove the oil pressure sender.



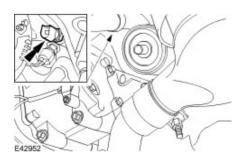
Installation

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.





2 . Install a new oil filter.

3 . **NOTE:**

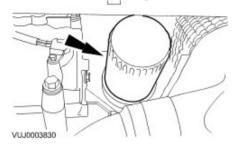
Use oil WSE-M2C908-A or equivalent meeting Jaguar specification.

Check and top up the engine with oil.

Oil Pump (12.60.26)

Removal

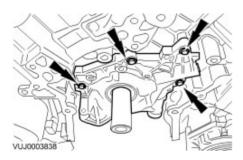
- 1 . Remove the timing chains. For additional information, refer to For additional information, refer to .
- 2 . Remove and discard the engine oil filter.



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

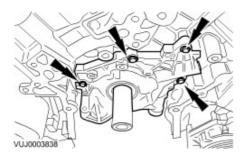
CAUTION: Install the oil pump flush to the cylinder block for correct sealing.



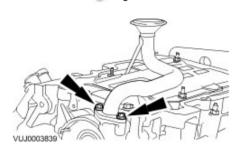
CAUTION: Rotate the inner rotor of the oil pump to align with the flats on the crankshaft before installation.

Install the oil pump.

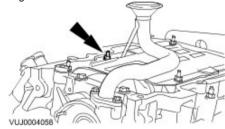
Tighten to 10 Nm.



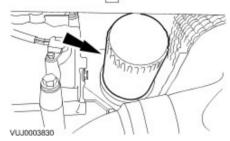
- 2 . Install the oil pump tube.
 - Install a new O-ring seal.
 - Tighten to 10 Nm.



3 . Tighten to 5 Nm + 45°.



4 . Install a new engine oil filter.



 ${\bf 5}$. Install the timing chains. For additional information, refer to For additional information, refer to .

Timing Drive Components (12.65.13)

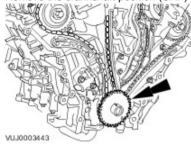
Removal

- 1 . Remove the engine front cover.
 For additional information, refer to Engine Front Cover (12.65.01)
- 2. Remove the spark plugs.

3 NOTE:

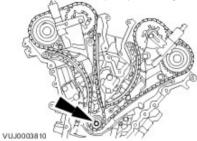
Note the position of the crankshaft position (CKP) sensor pulse wheel during removal. It must be returned to its original position during installation.

Remove the crankshaft position (CKP) sensor pulse wheel.



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

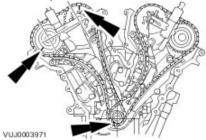
Install the crankshaft pulley retaining bolt and washer.



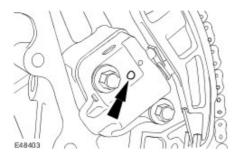
5

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.



 $\ensuremath{\mathbf{6}}$. Release the timing chain tensioner ratchet.



7 . **NOTE:**

Keep the timing chain tensioner ratchet released.

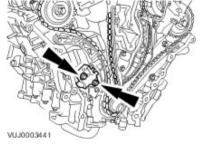
Reposition the timing chain tensioner plunger.



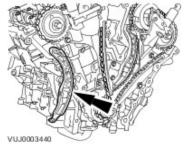
8 . Retain the timing chain tensioner plunger.



9 . Remove the right-hand timing chain tensioner.



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



11 . Remove the right-hand timing chain.



12.

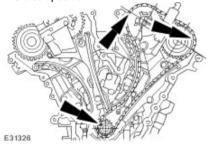
CAUTION: Inspect and replace the O-ring seal if necessary.

Remove the right-hand timing chain inner guide.



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.



14 . **NOTE**:

Right-hand bank shown, left-hand bank similar.

Release the timing chain tensioner ratchet.



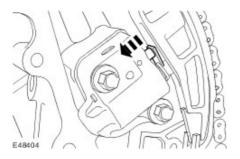
15 . **NOTE:**

Right-hand bank shown, left-hand bank similar.

NOTE:

Keep the timing chain tensioner ratchet released.

Reposition the timing chain tensioner plunger.



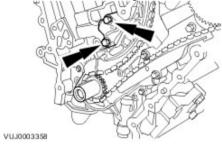
16 . **NOTE:**

Right-hand bank shown, left-hand bank similar.

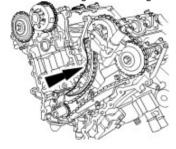




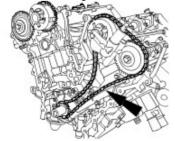
17 . Remove the left-hand timing chain tensioner.



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



19 . Remove the left-hand timing chain.



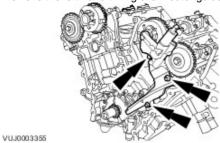
20 .



VUJ0003356

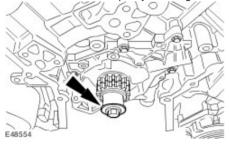
VUJ0003357

Remove the left-hand timing chain outer guide.

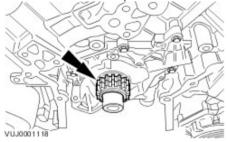


CAUTION: Make sure the crankshaft keyway is at the 9 O'clock position before any further engine repairs are carried out.

Remove the crankshaft pulley retaining bolt and washer.



22 . Remove the crankshaft sprocket.

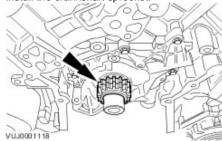


Installation

1. NOTE:

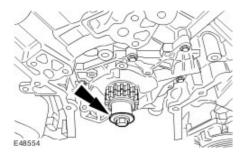
Make sure the crankshaft sprocket timing marks are facing outwards.



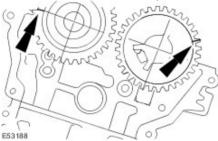


CAUTION: Make sure the crankshaft keyway is at the 9 O'clock position before the camshaft positions are

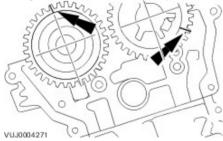
Install the crankshaft pulley retaining bolt and washer.



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



4 Rotate the right-hand intake camshaft clockwise until the camshaft sprocket alignment mark is at the 5 O'clock position and rotate . the right-hand exhaust camshaft 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.



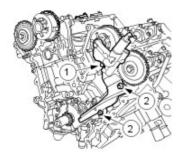
CAUTION: Inspect and replace the O-ring seal if necessary.



CAUTION: 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.



VUJ0003807

7

CAUTION: 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.

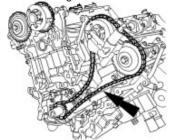
CAUTION: Make sure the timing chain alignment marks are correctly positioned to the crankshaft sprocket and camshaft sprocket alignment marks.



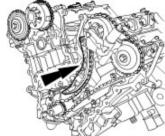
VUJ0003356

CAUTION: 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.



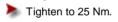
9.

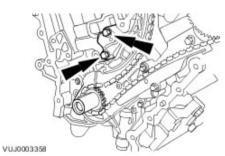


VUJ0003357

CAUTION: Do not manually adjust the timing chain tensioner.

Install the left-hand timing chain tensioner.



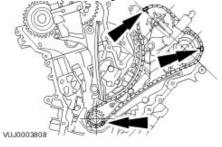


10



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.





CAUTION: Do not manually adjust the timing chain tensioner.

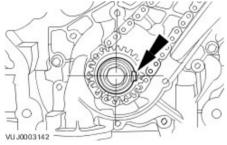
Remove the timing chain tensioner retaining pin.



12

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

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





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



CAUTION: 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.



14

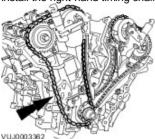
CAUTION: Make sure the crankshaft keyway is at the 3 O'clock position, the alignment mark on the right-hand intake camshaft sprocket is at the 5 O'clock position and the alignment mark on the right-hand exhaust camshaft sprocket is at the 12 O'clock position.

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



CAUTION: 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.

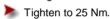


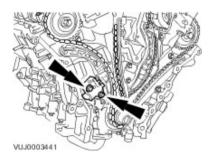
16.



CAUTION: Do not manually adjust the timing chain tensioner.

Install the right-hand timing chain tensioner.





17



CAUTION: Do not manually adjust the timing chain tensioner.

Remove the timing chain tensioner retaining pin.



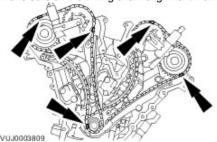
18

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



CAUTION: 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:

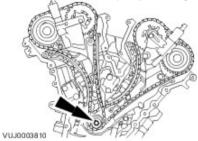
Rotate the crankshaft using hand tools only

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

20

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

Remove the crankshaft pulley retaining bolt and washer.



21

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



CAUTION: 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.

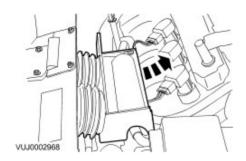
23 . Install the engine front cover.

Valve Cover LH (12.29.43)

Removal

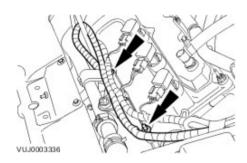
All vehicles

- 1 . Remove the ignition coils. For additional information, refer to <<303-07>>.
- 2 . Remove the air filter intake pipe.
 - 2.5 and 3.0L shown, 2.0L similar.



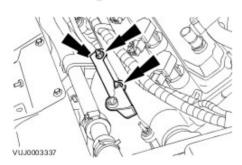
3 . Detach the wiring harness.

2.5 and 3.0L shown, 2.0L similar.



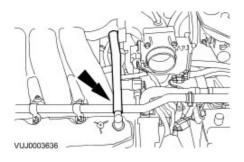
4 . Remove the air filter retaining bracket.

2.5 and 3.0L shown, 2.0L similar.



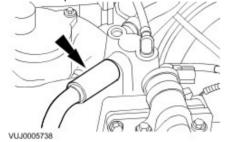
5 . Detach the positive crank case ventilation hose.

2.5 and 3.0L shown, 2.0L similar.

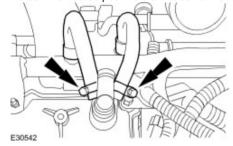


Vehicles with 2.0L engine

6. Detach the positive crank case ventilation hose.



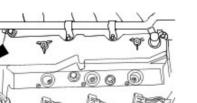
7 . Detach the heated positive crankcase ventilation valve coolant pipes.



All vehicles

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

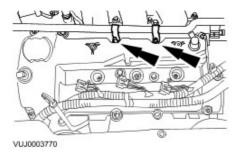
2.5 and 3.0L shown, 2.0L similar.



9 . Detach the coolant hose.

VUJ0003769

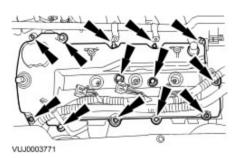
2.5 and 3.0L shown, 2.0L similar.



10 . Remove the valve cover.

Remove and discard the valve cover gaskets.

2.5 and 3.0L shown, 2.0L similar.



Installation

1 NOTE:

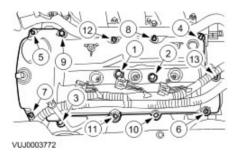
Apply a 5 mm diameter bead of silicone gasket sealant WSE-M4G323-A6 or equivalent meeting Jaguar specification on the half round gaskets, apply an 8 mm diameter bead of silicone gasket sealant on the two places where the cylinder head and front timing cover join and the twe places wherethe cylindar head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

NOTE:

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

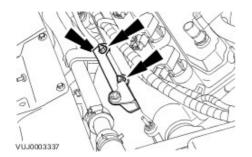
To install, reverse the removal procedure.

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



2. Tighten to 6 Nm.

2.5 and 3.0L shown, 2.0L similar.

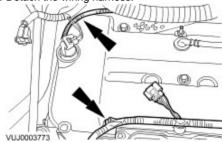


Valve Cover RH (12.29.44)

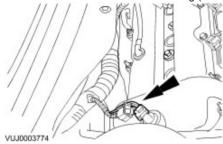
Removal

1. Remove the ignition coils. For additional information, refer to << 303-07>>.

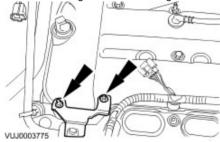
2 . Detach the wiring harness.



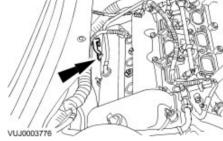
3 . Disconnect the variable camshaft timing (VCT) solenoid electrical connector.



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:

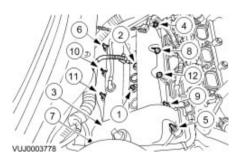
Apply a 5 mm diameter bead of silicone gasket sealant WSE-M4G323-A6 or equivalent meeting Jaguar specification on the half round gaskets and apply an 8 mm diameter bead of silicone gasket sealant on the two places where the cylinder head and front timing cover join.

NOTE:

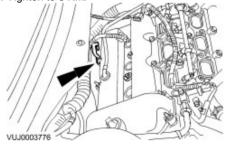
Make sure that the valve cover isolator mounts are correctly installed to the new valve cover gaskets.

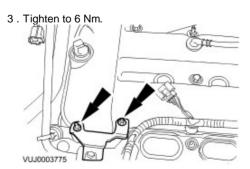
To install, reverse the removal procedure.

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



2 . Tighten to 6 Nm.





Engine

Special Service Tools



303D055

Wrench strap-universal 303-D055



Crankshaft Pulley Remover 303-D121



Crankshaft Pulley Installer 303-102



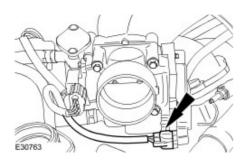
Trust Pad 303-D121-01



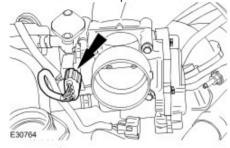
Crankshaft pulley installer 303-335/2

Disassembly

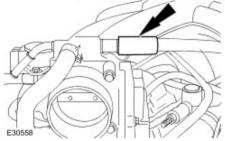
1 . Disconnect the throttle motor electrical connector.



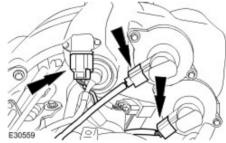
2 . Disconnect the throttle position sensor.



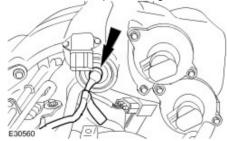
 ${\bf 3}$. Disconnect the positive crankcase ventilation (PCV) hose.



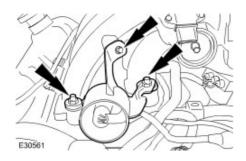
4 . Disconnect the electrical connectors.



 ${\bf 5}$. Disconnect the fuel pressure regulator vacuum hose.



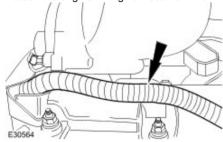
6 . Remove the fuel pressure regulator bracket.



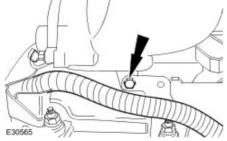
7 . Detach the intake manifold front retaining bracket.



 $\boldsymbol{8}$. Detach the engine wiring harness from the intake manifold rear retaining bracket.



9 . Detach the intake manifold rear retaining bracket.



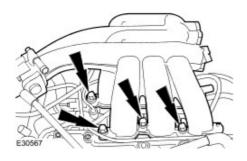
10 **NOTE**:

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

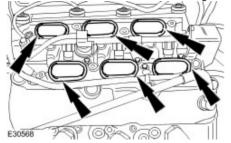
Disconnect the evaporative emission canister purge valve transfer pipe.



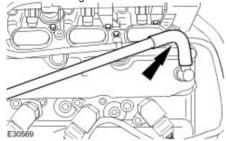
11 . Remove the intake manifold.



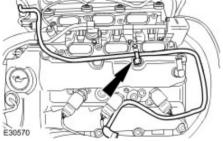
12 . Remove and discard the intake manifold gaskets.



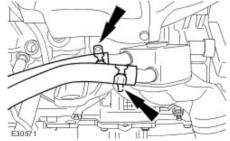
13 . Remove the engine breather hose.



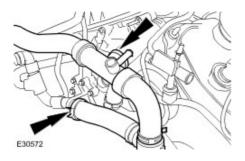
14 . Remove the evaporative emission purge valve hose.



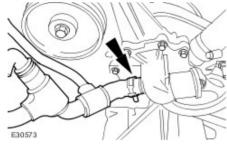
15 . Disconnect the oil cooler coolant hoses.



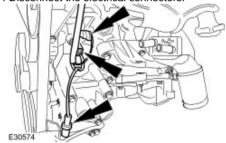
16 . Remove the coolant hose.



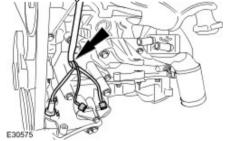
17 . Remove the coolant hose.

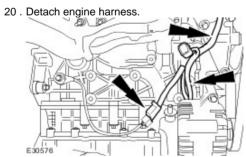


18. Disconnect the electrical connectors.

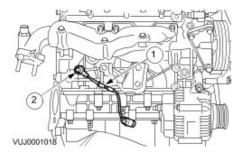


19 . Detach the engine harness.

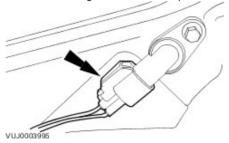




- 21 . Remove the rear knock sensor.
 - 1. Detach the knock sensor wiring harness.
 - 2. Remove the rear knock sensor.



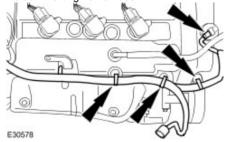
22 . Disconnect the right-hand camshaft position sensor.



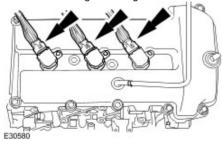
23 . Detach the engine harness retaining bracket.



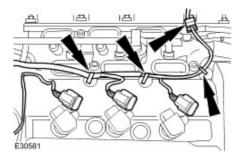
24 . Detach the engine harness.



25 . Disconnect the right-hand ignition coils.

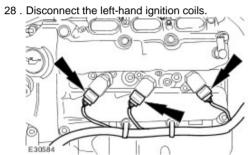


26 . Detach the engine harness.



27 . Disconnect the left-hand camshaft position sensor.

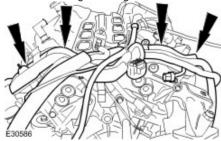




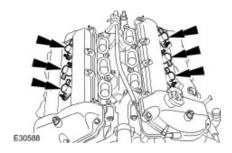
29 . Disconnect the engine wiring harness electrical connectors.



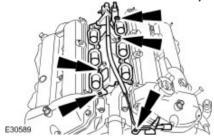
30 . Remove the engine wiring harness.



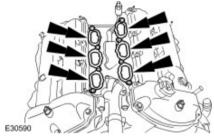
31 . Remove the ignition coils.



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



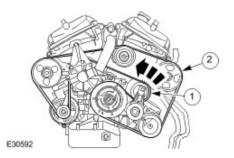
33 . Remove and discard the lower intake manifold gaskets.



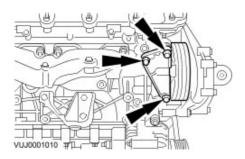
34 . Remove the left-hand knock sensor.



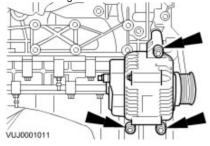
- 35 . Remove the accessory drive belt.
 - Use a 3/8 inch drive bar to release the accessory drive belt tensioner.
 - Remove the accessory drive belt.



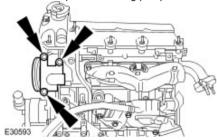
36 . Remove the right-hand idler pulley.



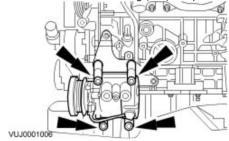
37 . Remove the generator.



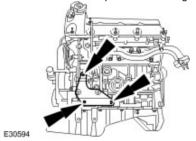
38 . Remove the power steering pump.



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

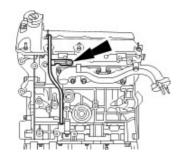


40 . Remove the A/C compressor mounting bracket.



41 . Remove the oil level indicator tube.

Remove and discard the O-ring seal.

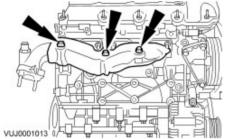


E30595

42 . **NOTE:**

Right-hand shown, Left-hand similar.

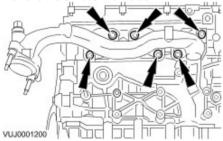
Remove the exhaust manifold heat shields.



43 . **NOTE:**

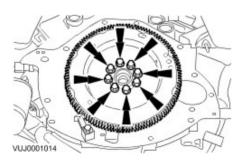
Right-hand shown, Left-hand similar.

Remove the exhaust manifolds.

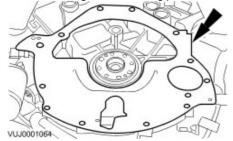


44 . Remove the flywheel.

• Prevent the engine from rotating.

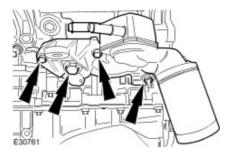


45 . Remove the engine rear backing plate.

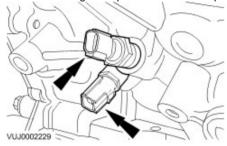


46 . Remove the oil filter housing assembly.

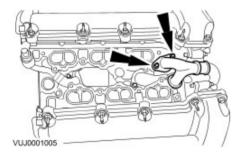
Remove and discard the O-ring seal.



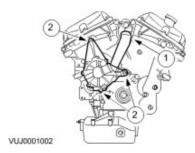
47 . Remove the engine oil pressure and oil temperature sensors.



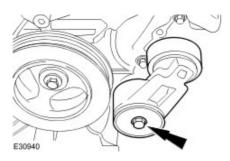
- 48 . Remove the coolant crossover tube.
 - Remove and discard the O-ring seals.



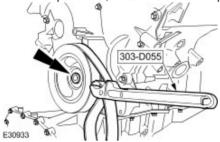
- 49 . Remove the water pump and coolant hose assembly.
 - 3. Detach the hose.
 - 4. Remove the water pump and coolant hose assembly.



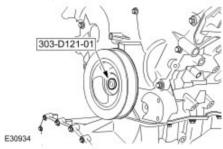
50 . Remove the accessory drive belt tensioner.



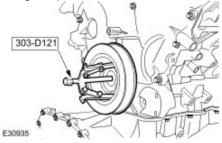
51 . Install the special tool, loosen the crankshaft pulley retaining bolt.



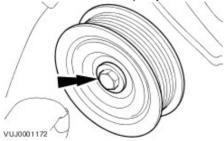
52 . Install the special tool.



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



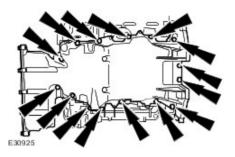
54 . Remove the left-hand idler pulley.



55 Remove the oil pan.

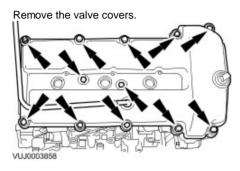
Remove and discard the oil pan gasket.

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.

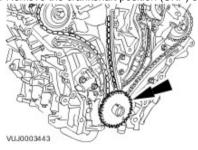


57 . Remove the engine front cover

Remove and discard the engine front cover gaskets.



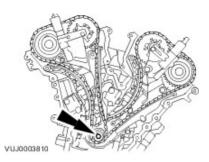
58 . Remove the crankshaft position (CKP) sensor pulse wheel.



59

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

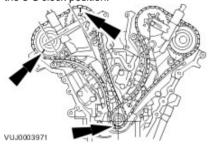
Install the crankshaft pulley retaining bolt and washer.



60

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

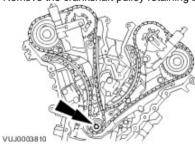
Rotate the crankshaft clockwise until the crankshaft keyway is at the 7 O'clock position, the alignment mark on the right-hand intake camshaft sprocket is at the 1 O'clock position and the alignment mark on the right-hand exhaust camshaft sprocket is at the 8 O'clock position.



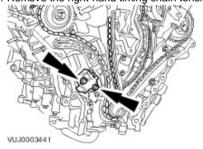
61

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

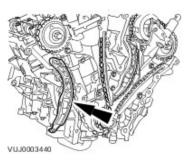
Remove the crankshaft pulley retaining bolt and washer.



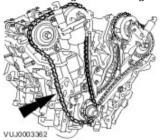
62 . Remove the right-hand timing chain tensioner.



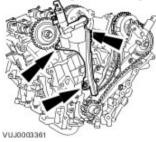
63 . Remove the right-hand timing chain outer guide.



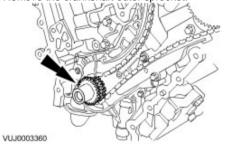
64 . Remove the right-hand timing chain.



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



66 . Remove the crankshaft outer sprocket.



67

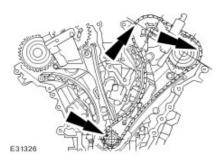
CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Install the crankshaft pulley retaining bolt and washer.

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.

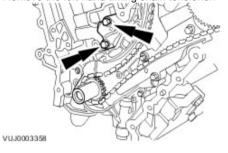


69

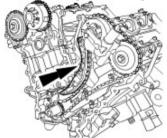
CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Remove the crankshaft pulley retaining bolt and washer.

70 . Remove the left-hand timing chain tensioner.

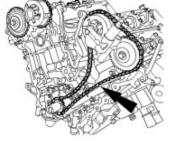


71 . Remove the left-hand timing chain inner guide.



VUJ0003357

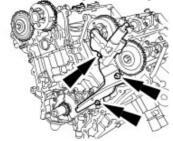
72 . Remove the left-hand timing chain.



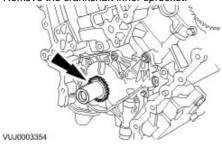
VUJ0003356

VUJ0003355

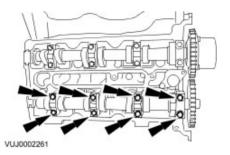
73 . Remove the left-hand timing chain outer guide.



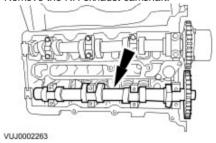
74 . Remove the crankshaft inner sprocket.



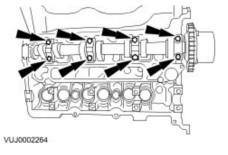
- 75 . Remove the RH exhaust camshaft bearing cap bolts evenly.
 - Remove the exhaust camshaft bearing caps.



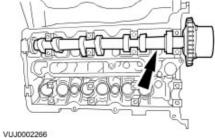
76 . Remove the RH exhaust camshaft.



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

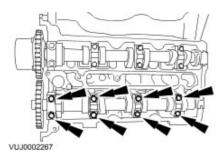


78 . Remove the RH inlet camshaft.

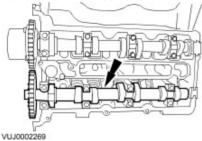


79 . Remove the LH exhaust camshaft bearing cap bolts evenly.

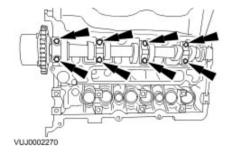
Remove the exhaust camshaft bearing caps.



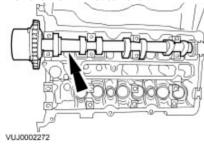
80 . Remove the LH exhaust camshaft.



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



82 . Remove the LH inlet camshaft.

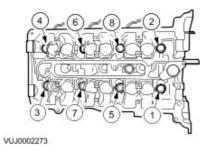


83 . **NOTE:**

Remove the bolts in the indicated sequence.

Remove the RH cylinder head.

• Discard the gasket.

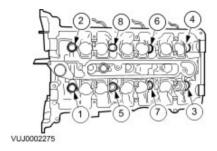


84 . **NOTE:**

Remove the bolts in the indicated sequence.

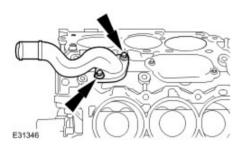
Remove the LH cylinder head.

Discard the gasket.



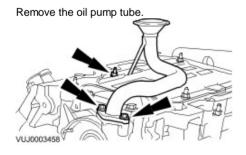
85 . Remove the engine coolant housing.

Discard the 'O' ring seals.

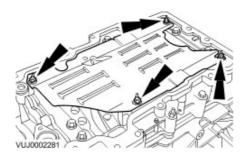


86 . **NOTE**:

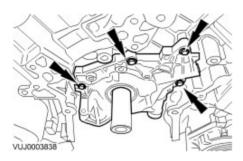
Engine inverted for clarity.



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.

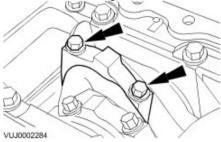
NOTE:

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.

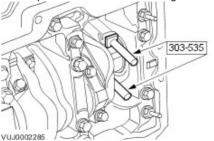


90 . Inspect the tops of the cylinder bores. As necessary remove ridge and carbon build up from each cylinder.

91

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

Install special tools to the connecting rods.



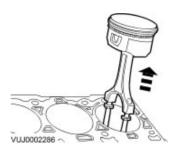
CAUTION: Care should be taken not to damage the connecting rod and cap joint face surfaces or possible engine damage may occur. Avoid contaminating the fracture joint surfaces with dirt or grease.

NOTE:

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

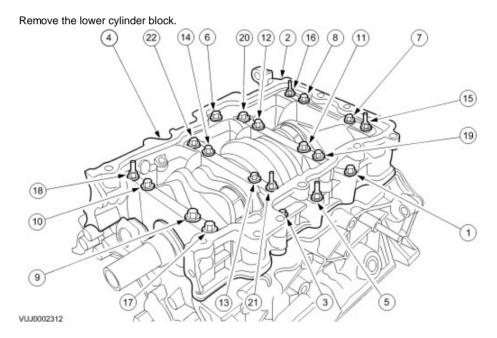
Remove the pistons.

- 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.

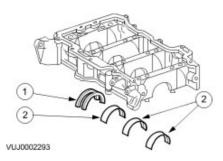


94 . **NOTE:**

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

Remove the lower crankshaft bearings.

- 5. Remove the lower crankshaft thrust main bearing.
- 6. Remove the lower crankshaft main bearings.



95 .



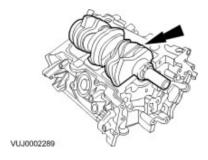
CAUTION: Avoid damage to any crankshaft bearing surfaces.

NOTE:

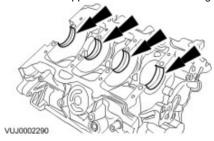
Never remove any pipe plugs or dowels unless they are to be newly installed or the cylinder block is to be washed.

Remove the crankshaft.

Discard the crankshaft rear main oil seal.

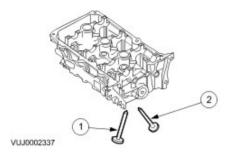


96 . Remove the upper crankshaft main bearings.



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

- 4 . Remove the valves from the cylinder heads.
 - 4. Remove the intake valves.
 - 5. Remove the exhaust valves.



- 5 . Inspect the cylinder heads and the related components. <<303-00>>
- 6. Remove the pipe plugs and alignment dowels as necessary to clean the cylinder heads.

Assembly

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.

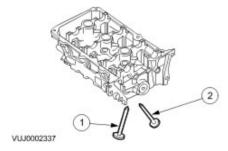
- 2 . Install the pipe plugs and alignment dowels to cylinder heads.
 - Apply pipe sealant to plugs prior to installation.

3 . **NOTE:**

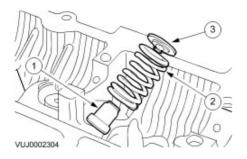
Lubricate the valve stems before assembly.

Install the valves into the cylinder heads.

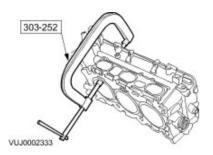
- 6. Install the intake valves.
- 7. Install the exhaust valves.



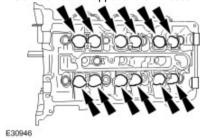
- 4. Install the valve spring retainers and valve springs.
 - 8. Install the valve stem oil seals.
 - 9. Install the valve springs.
 - 10. Install the valve spring retainers.



- 5 . Using the special tool, compress the valve springs.
 - Install the valve collets.



6 . Install the bucket tappet and shim assemblies.



Cylinder Head (12.29.22)

Special Service Tools

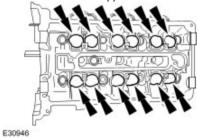


Valve Spring Compressor 303-252

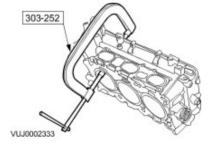
Disassembly

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.

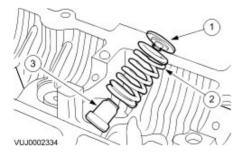
Remove the bucket tappet and shim assemblies.



- 2. Using the special tool, compress the valve springs.
 - Remove the valve collets.



- 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.



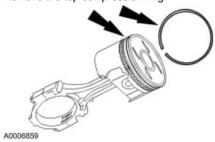
Piston (12.17.02)

Disassembly

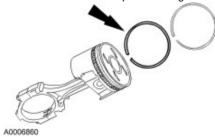
1 NOTE:

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

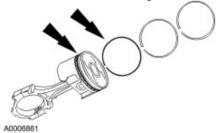
Remove the top compression ring.



2 . Remove the second compression ring.



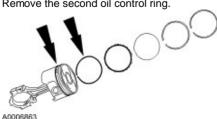
3 . Remove the first oil control ring.



4. Remove the oil control spacer ring.

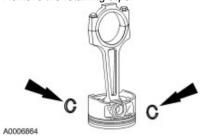


5 . Remove the second oil control ring.

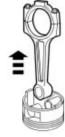


WARNING: The retaining rings have a tendency to spring out during removal. Cover the end of the pin bore with a hand or a rag when removing the retaining ring. Eye protection should be worn. Failure to follow these instructions may result in personal injury.

Remove the retaining clips.



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 <<303-00>>.

Assembly

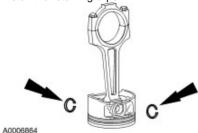
A0006865

1 . Install the piston pin.

Lubricate the piston pin and piston bore.

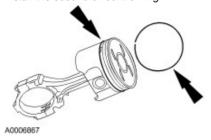


2 . Install the retaining clips.

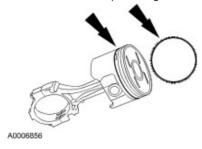


- 3 . Check the piston ring end gap. For additional information, refer to <<303-00>>.
- 4. Lubricate the piston and piston rings.

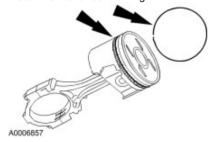
5. Install the second oil control ring.



6 . Install the oil control spacer ring.

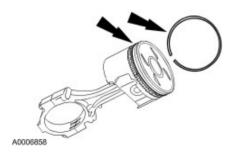


7. Install the first oil control ring.



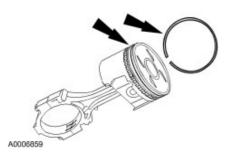
8 . Install the second compression ring.

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.



9 . Install the top compression ring.

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



Engine

Special Service Tools



303D055

Wrench Strap-Universal 303-D055



Crankshaft Rear Seal Installer 303-178





Crankshaft Rear Seal Installer Adapter Bolts 303-384



Piston Ring Compressor 303-372



Cylinder Bore Protector 303-535

Assembly



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.

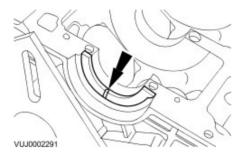
Reseal oil passage blanking plugs, as necessary.

3 . **NOTE**:

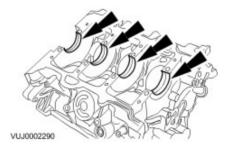
The main bearings are precision selective fit. For additional information, refer to <<303-00>>.

Install the upper crankshaft thrust washer.

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



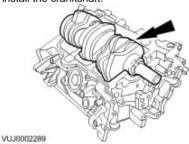
- 4 . Install the upper crankshaft main bearings.
 - Lubricate the bearings and thrust washer.



5.

CAUTION: Avoid damage to any crankshaft journal bearing surfaces.

Install the crankshaft.



6 . **NOTE:**

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

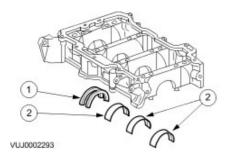
NOTE:

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.



7 . **NOTE:**

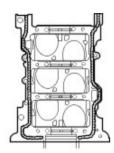
Sealant application must stop 6 mm from the rear crankshaft bore on each side.

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.



VUJ0002294

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:

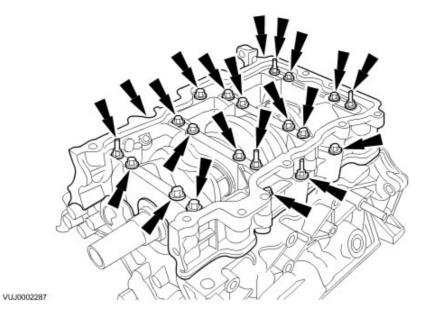
Do not rotate crankshaft until all bolts are tightened to specification.

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.



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

•

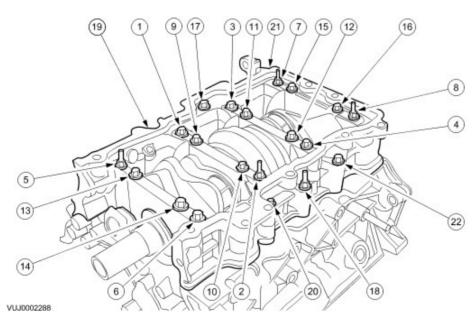
Stage 2: Bolts 9-16, 40 Nm

Stage 3: Bolts 1-16, 90°

Stage 4: Bolts 17-22, 25 Nm

•

Verify the crankshaft rotates freely.

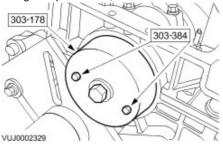


10 . Remove excess sealant which may squeeze out at the front cover sealing surface.

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**:

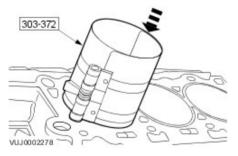
Make sure the piston ring gaps are positioned at different locations opposite the thrust side of the piston before installation.

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.



CAUTION: 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.



14

CAUTION: 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.

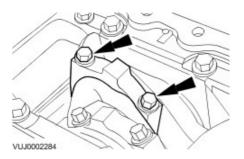
Stage 1: 23 Nm

•

Stage 2: 43 Nm

•

Stage 3: 105°



15 . Rotate the crankshaft to check correct operation.

16.



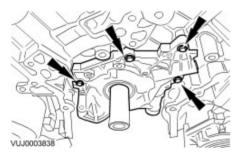
CAUTION: Install the oil pump flush to the cylinder block for correct sealing.



CAUTION: 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.

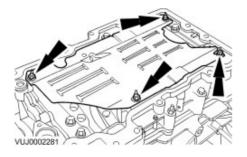
NOTE:

Tighten the bolts in the indicated sequence in two stages.

Install the oil pan baffle.

Stage 1: 5 Nm





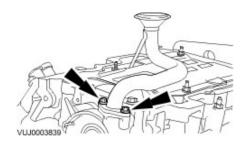
18 . **NOTE**:

Engine inverted for clarity.

Install the oil pump tube.

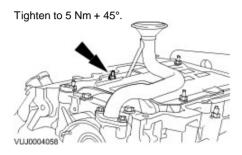
Install a new O-ring seal.

Tighten to 10 Nm.

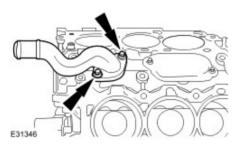


19 . **NOTE:**

Engine inverted for clarity.

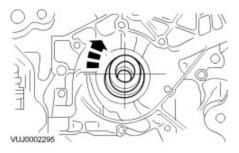


- 20 . Install the engine coolant housing.
 - Install new 'O' ring seals.
 - Tighten to 25 Nm.

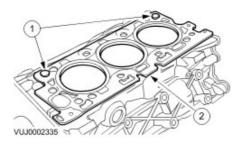


21 . Position the crankshaft.

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



- 22 . Install a new cylinder head gasket (LH shown RH similar).
 - 3. Make sure the cylinder head dowels are correctly located.
 - 4. Install a new cylinder head gasket.



23 . **NOTE:**

Install the bolts in the indicated sequence.

Install the LH cylinder head.

•

Tighten to 30 Nm.

•

Tighten 90°.

•

Loosen 360°.

•

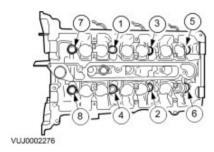
Tighten to 30 Nm.

•

Tighten 90°.

•

Tighten 90°.



24 . **NOTE**:

Install the bolts in the indicated sequence.

Install the RH cylinder head.

Tighten to 30 Nm.

Tighten 90°.

•

Loosen 360°.

•

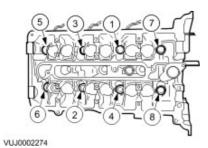
Tighten to 30 Nm.

•

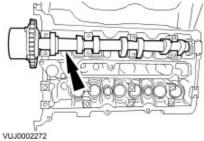
Tighten 90°.

•

Tighten 90°.



25 . Install the LH inlet camshaft.



26

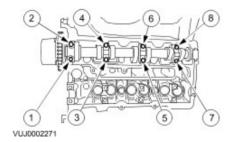
CAUTION: Do not install the cylinder head camshaft journal thrust caps until the camshaft journal caps are installed or damage to the thrust caps may occur.

NOTE:

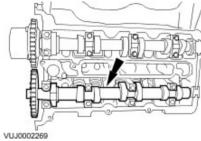
Lubricate the camshafts and the camshaft bearing caps with oil WSE-M2C908-A or equivalent meeting Jaguar specification prior to installation.

Install the LH inlet camshaft bearing cap bolts evenly.

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



27 . Install the LH exhaust camshaft.



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.

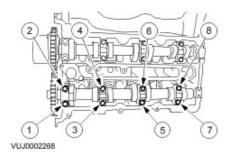
NOTE:

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

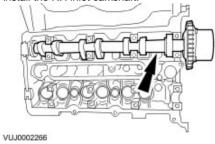
Install the LH exhaust camshaft bearing cap bolts evenly.

•

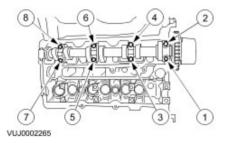
Install the exhaust camshaft bearing caps.



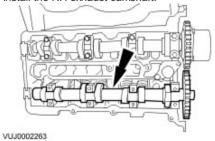
29 . Install the RH inlet camshaft.



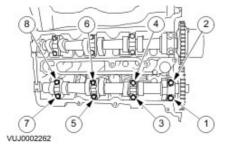
- 30 . Install the RH inlet camshaft bearing cap bolts evenly.
 - Install the inlet camshaft bearing caps.



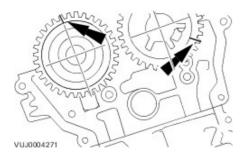
31 . Install the RH exhaust camshaft.



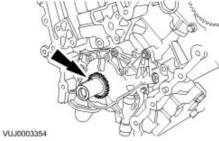
- 32 . Install the RH exhaust camshaft bearing cap bolts evenly.
 - Install the exhaust camshaft bearing caps.



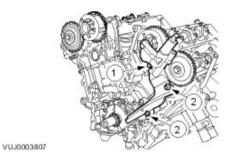
33 Rotate the right-hand intake camshaft clockwise until the camshaft sprocket alignment mark is at the 5 O'clock position and rotate . the right-hand exhaust camshaft sprocket clockwise until the camshaft sprocket alignment mark is at the 12 O'clock position.



34 . Install the crankshaft inner sprocket.



- 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.



CAUTION: 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.

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

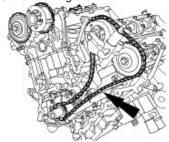


VUJ0003356

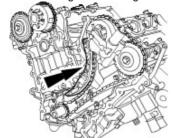
36

CAUTION: 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.

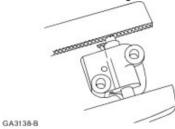


VUJ0003357

38 .

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

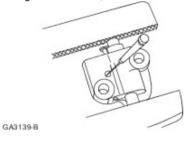
Secure the left-hand timing chain tensioner in the vice jaws.



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.



40 **NOTE**:

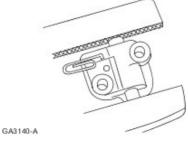
· The timing chain tensioner piston should retract with minimal force. If binding occurs, reposition the timing chain tensioner to eliminate side loading.

Slowly compress the left-hand timing chain tensioner.

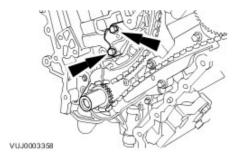
41 **NOTE**:

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.

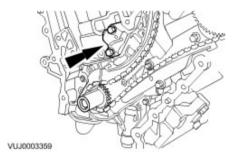


Tighten to 25 Nm.

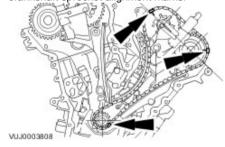


43 . Release the tension in the left-hand timing chain tensioner.

Remove the retaining tool.



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



45

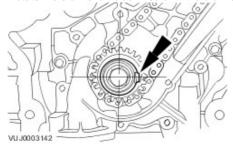
CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Install the crankshaft pulley retaining bolt and washer.

46

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

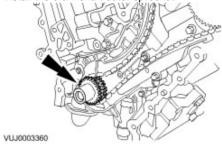
Rotate the crankshaft clockwise until the crankshaft keyway is at the 3 O'clock position.



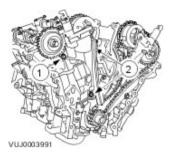
CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

Remove the crankshaft pulley retaining bolt and washer.

48 . Install the crankshaft outer sprocket.



- 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.



CAUTION: 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.

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

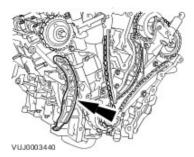


CAUTION: Make sure the timing chain slack is on the tensioned side of the timing chain.

Install the right-hand timing chain.



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

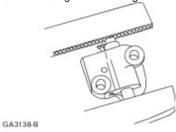


52 .



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

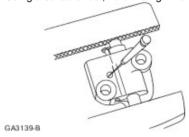
Secure the right-hand timing chain tensioner in the vice jaws.



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**:

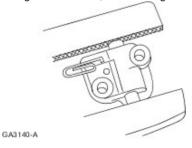
The timing chain tensioner piston should retract with minimal force. If binding occurs, reposition the timing chain tensioner to eliminate side loading.

Slowly compress the right-hand timing chain tensioner.

55 **NOTE**:

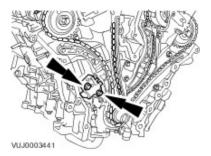
 The retaining tool must remain in the timing chain tensioner until the timing chain tensioner is installed to the engine with the piston bottomed in the bore.

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



56 . Install the right-hand timing chain tensioner.

Tighten to 25 Nm.



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

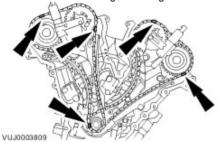
Remove the retaining tool.



58

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

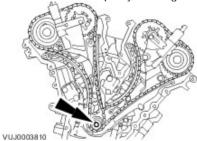
Make sure all the timing chain alignment marks are in the positions shown.



59

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

Install the crankshaft pulley retaining bolt and washer.



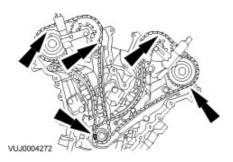
60

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

Check the engine valve timing is correctly set.

•

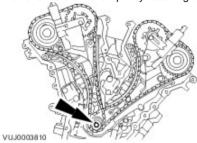
Rotate the crankshaft two complete turns clockwise. Make sure the alignment marks on the camshaft sprockets are in the positions shown when the crankshaft keyway is at the 11 O'clock position.



61

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

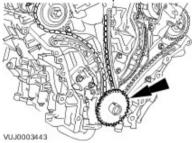
Remove the crankshaft pulley retaining bolt and washer.



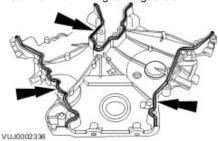
62 . **NOTE:**

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





- 63 . Carry out a valve clearance check. For additional information, refer to
- 64 . Install new front timing cover gaskets.



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.

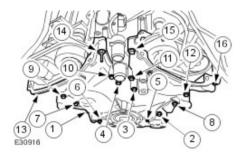


66 **NOTE**:

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.



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:

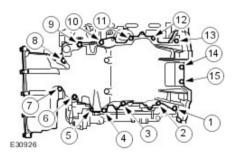
Loosely install the oil pan to transmission housing bolts.

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.

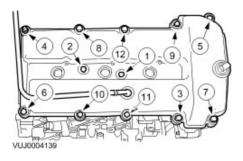


68 . **NOTE**:

Right-hand shown, left-hand similar.

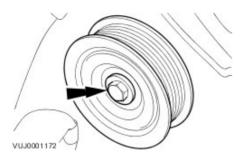
Install the valve covers.

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

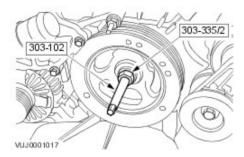


69 . Install the left-hand idler pulley.

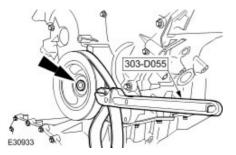
Tighten to 25 Nm.



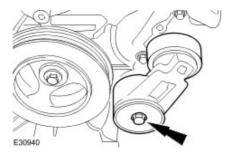
- 70. Using the special tools, install the crankshaft pulley.
 - Coat the crankshaft pulley keyway with silicone gasket sealant meeting Jaguar specification.
 - Coat the sealing surfaces of the crankshaft pulley with silicone gasket sealant meeting Jaguar specification.



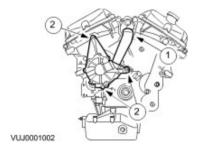
- 71 . Install the crankshaft pulley retaining bolt.
 - Torque to 120 Nm.
 - •
 - Loosen the bolt (minimum 1 turn).
 - Torque to 50 Nm.
 - Angle Torque to 90°.



Tighten 45 Nm.



- 73 . Install the water pump and coolant hose assembly.
 - 5. Attach the hose.
 - 6. Install the water pump and coolant hose assembly.
 - Tighten to 25 Nm.

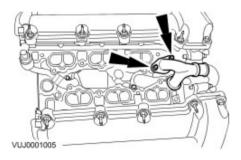


74 . **NOTE**:

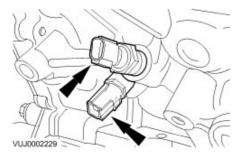
Install new coolant crossover O-ring seals.

Install the coolant crossover tube.

• Tighten to 10 Nm,



- 75 . Install the engine oil pressure and oil temperature sensors.
 - Tighten to 14Nm.

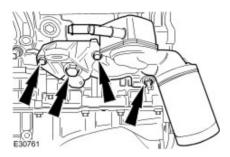


76 . **NOTE:**

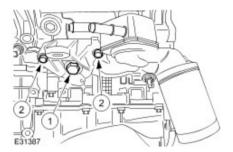
Install new O-ring seals.

Install the oil filter housing assembly.

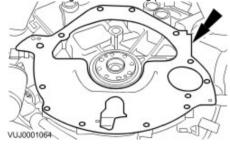
Tighten all oil filter housing retaining bolts to 25 Nm.



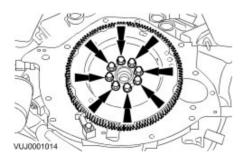
- $\ensuremath{\mathsf{77}}$. Tighten the oil filter housing assembly retaining bolts in sequence.
 - Tighten to 150 Nm.
 - Tighten to 40 Nm + 90 degrees.



78 . Install the engine rear backing plate.



- 79 . Install the flywheel.
 - Prevent the engine from rotating.
 - Tighten to 80 Nm.



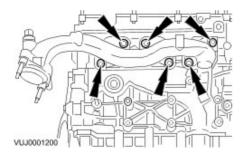
80 . **NOTE:**

Right-hand shown, Left-hand similar.

Install the exhaust manifolds.

•

Tighten to 25 Nm.

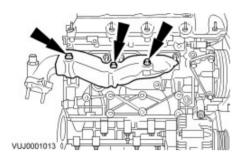


81 . **NOTE:**

Right-hand shown, Left-hand similar.

Install the exhaust manifold heat shields.

Tighten to 10 Nm.

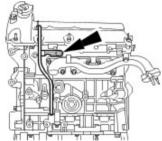


82 . **NOTE:**

E30595

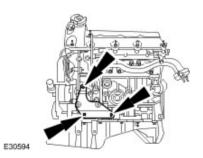
Install a new O-ring seal.

Install the oil level indicator tube.



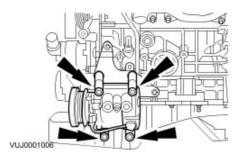
83 . Install the A/C compressor mounting bracket.

• Tighten to 25 Nm.

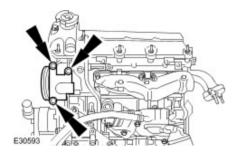


84 . Install the air conditioning (A/C) compressor.

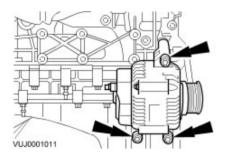
Tighten to 25 Nm.



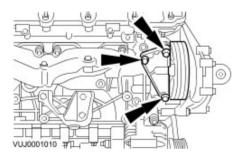
- 85 . Install the power steering pump.
 - Tighten to 25 Nm.



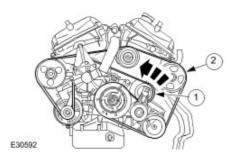
- 86 . Install the generator.
 - Tighten to 48 Nm.



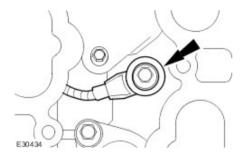
- 87 . Install the right-hand idler pulley.
 - Tighten to 25 Nm.



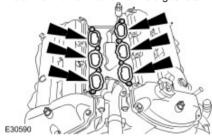
- 88 . Install the accessory drive belt.
 - Use a 3/8 inch drive bar to release the accessory drive belt tensioner.
 - Install the accessory drive belt.



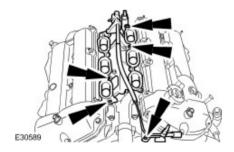
- 89 . Install the left-hand knock sensor.
 - Tighten to 25 Nm.



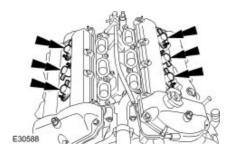
90 . Install new lower intake manifold gaskets.



- 91 . Install the lower intake manifold and injector supply manifold.
 - Tighten to 10 Nm.

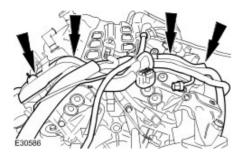


- 92 . Install the ignition coils.
 - Tighten to 10 Nm.



93 . Install the engine wiring harness.

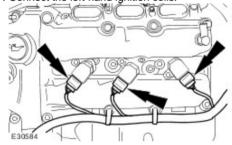
Tighten to 10 Nm.



94 . Connect the engine wiring harness electrical connectors.



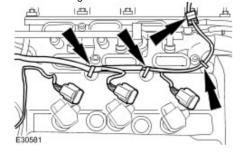
95 . Connect the left-hand ignition coils.



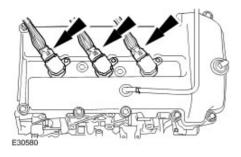
96 . Connect the left-hand camshaft position sensor.



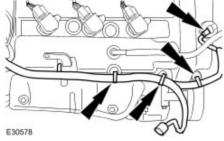
97 . Attach the engine harness.



98 . Connect the right-hand ignition coils.



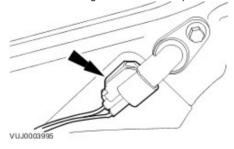
99 . Attach the engine harness.



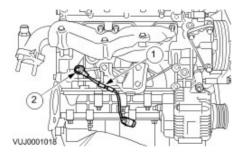
100 . Attach the engine harness retaining bracket.



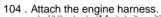
101 . Disconnect the right-hand camshaft position sensor.

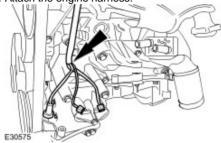


- 102 . Install the rear knock sensor.
 - 7. Attach the knock sensor wiring harness.
 - 8. Install the rear knock sensor.
 - Tighten to 25 Nm.

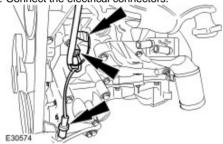




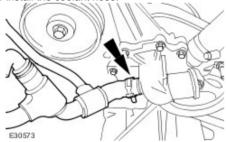




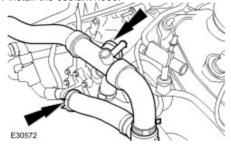
105 . Connect the electrical connectors.



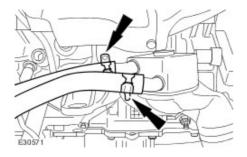
106 . Install the coolant hose.



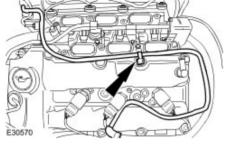
107 . Install the coolant hose.



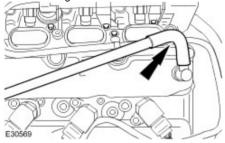
108. Connect the oil cooler coolant hoses.



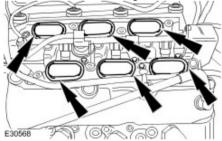
109 . Install the evaporative emission purge valve hose.



110 . Install the engine breather hose.



111 . Install new intake manifold gaskets.

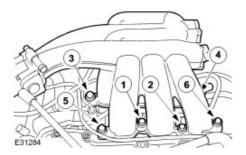


112 . **NOTE**:

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.

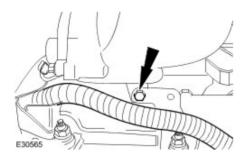


113. Connect the evaporative emission canister purge valve transfer pipe.

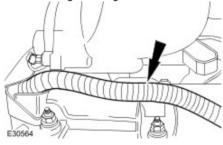


114 . Attach the intake manifold rear retaining bracket.

Tighten to 10 Nm.



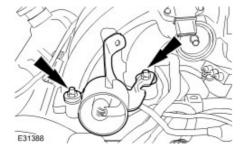
115 . Attach the engine wiring harness from the intake manifold rear retaining bracket.



- 116 . Attach the intake manifold front retaining bracket.
 - Tighten to 10 Nm.

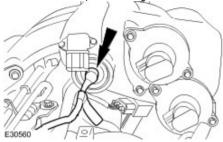


- 117 . Install the fuel pressure regulator bracket.
 - Tighten to 10 Nm.

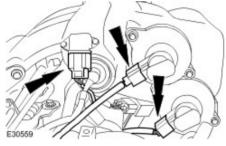




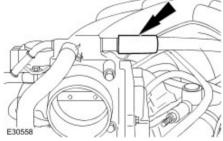
119 . Connect the fuel pressure regulator vacuum hose.



120 . Connect the electrical connectors.



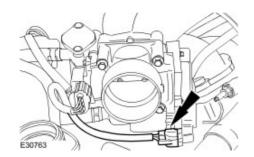
121 . Connect the positive crankcase ventilation (PCV) hose.



122 . Connect the throttle position sensor.



123 . Connect the throttle motor electrical connector.



Specifications

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	а	-	-
Crankshaft rear oil seal carrier	10	-	89
Flywheel	а	-	-
Crankshaft bearing caps	а	-	-
Big-end bearing caps	а	-	-
Fuel injectors	47	35	-
Injection pump sprocket	33	24	-
Injector tubes	38	28	-
Lower crankcase	а	-	-
Camshaft carrier (M8)	а	-	-
Camshaft carrier (M6)	а	-	-
Rocker shafts	а	-	-
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	<u> -</u>	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	а	-	-
Cylinder head bolts (M10 x 160)	а	-	-
Cylinder head bolts (M8 x 120)	а	-	-
Engine front cover	а	-	-
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.

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

Cylinder Block Dimensions 2.0 litre diesel.

Description 1	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 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 diesel.

Description Upper compression ring	mm 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 rielements. Position the ring gaps offset at 120 degrees to one another.

Piston Pin Dimensions 2.0 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 diesel.

Description	mm
Main bearing journal – diameter	69.9520 - 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 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)	56-004 - 56-032
Big-end bearing – radial clearance	0.034 - 0.100
Big-end bearing – end float	0.100 - 0.320

Camshaft Dimensions 2.0 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 diesel.

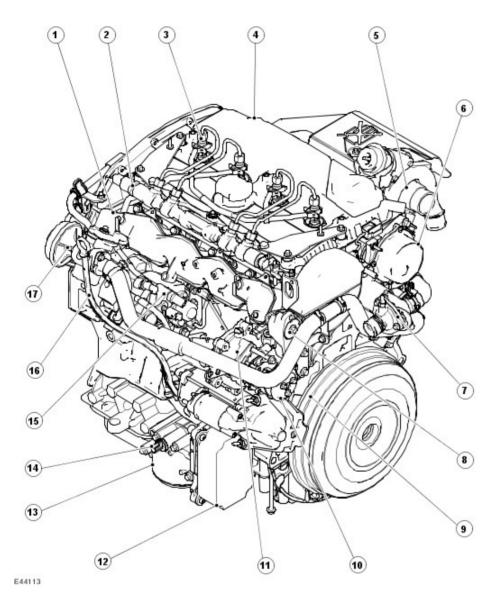
Description	mm
Valve stem to valve guide clearance – intake valve	0.045
Valve stem to valve guide clearance – exhaust valve	0.055

Cylinder Head 2.0 litre 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

Engine

General View



Item Part Number Description Intake manifold 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

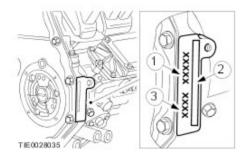
16	Oil level indicator and tube
17	Exhaust gas recirculation (EGR) valve

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 CO2.

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.

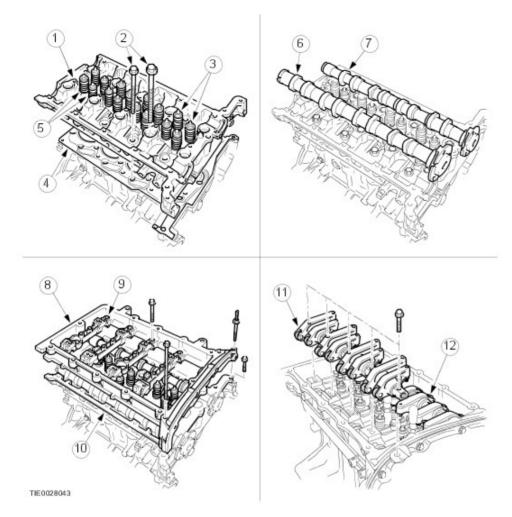
European Stage 4 Diesel Emissions - Vehicles built from VIN:E25782

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 <u>Turbocharger</u> (303-04C)
- An electronically controlled EGR system.

These changes have therefore been utilized on the 2.2L diesel engine.

Cylinder Head

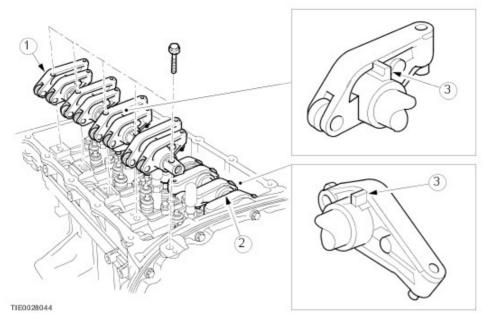


Item	Part Number	Description
1		Cylinder head
2		Cylinder head bolts
3		Intake valves
4		Cylinder head gasket
5		Exhaust valves
6		Exhaust camshaft
7		Intake camshaft
8		Camshaft carrier
9		Camshaft carrier bearing brackets (5 off)
10		Sealing surface
11		Rocker shaft with rocker arms (exhaust)
12		Rocker 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

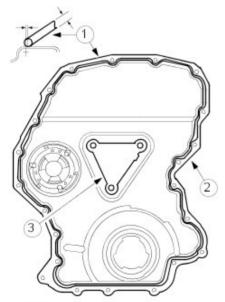


Item	Part Number	Description
1		Rocker shaft, exhaust rocker arm
2		Rocker shaft, intake rocker arm
3		Stud on rocker arm

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



TIE0028045

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.

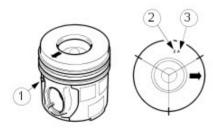


Item	Part Number	Description
1		Piston pin
2		Length category

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.

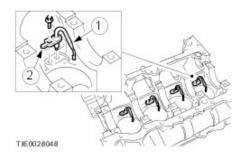
When installing the pistons, it must be ensured that the arrow on the piston points to the timing chain side.



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.

Engine - 2.0L Diesel (12.41.01)

Special Service Tools



Remover/Installer, Cooling Hose Clamp 303-397 (24-003)



204-192

Ball joint splitter 204-192



Wheel hub puller 205-491



20549101

Adaptor nuts 205-491-01



Forcing screw 204-269



Slide hammer 100-012



Slide hammer shaft 100-012-02



Halfshaft remover fork 204-226



Powertrain assembly jack HTJ1200-02

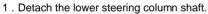


Engine lifting eye 303-1067



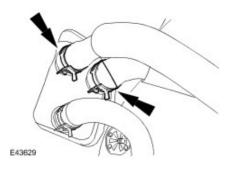
5 Point Security Torx Bit 418-535

Removal

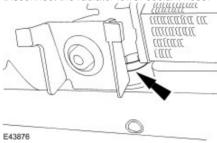




- 2 . Remove the battery tray. For additional information, refer to Battery Tray (86.15.11)
- 3 . Recover the air conditioning refrigerant. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging (82.30.30)
- 4 . Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding
- 5 . Remove the exhaust flexible pipe. For additional information, refer to
- 6. Disconnect the heater hoses from the heater core.



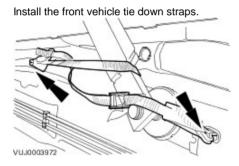
7 . Disconnect the radiator lower coolant hose.



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:

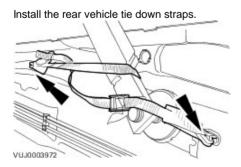
Right-hand shown, left-hand similar.



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.



- 10 . Lower the vehicle to a suitable working height.
- 11 . Remove the front wheels and tires.
 For additional information, refer to Wheel and Tire (74.20.05)

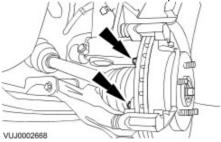
12. Remove the front brake pads.

For additional information, refer to Brake Pads (70.40.02)

13 . **NOTE:**

Left-hand shown, right-hand similar.

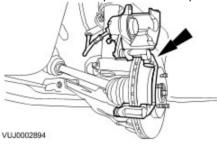
Remove and discard the brake caliper anchor plate retaining bolts.



14 . **NOTE**:

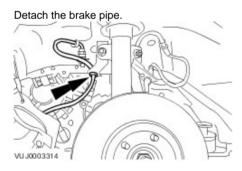
Left-hand shown, right-hand similar.

Detach the brake caliper and brake caliper anchor plate assembly.



15 . **NOTE:**

Left-hand shown, right-hand similar.



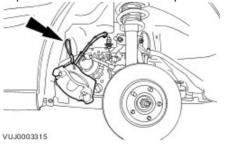
16

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.

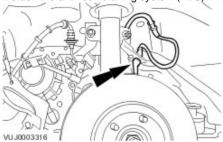
Reposition and attach the brake caliper assembly.



17 . **NOTE**:

Left-hand shown, right-hand similar.

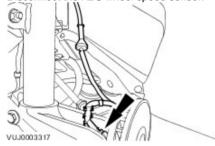
Detach the anti-lock braking system (ABS) wheel speed sensor.



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.



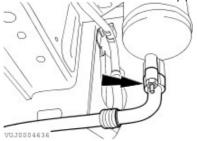
20 . **NOTE:**

Remove and discard the O-ring seal.

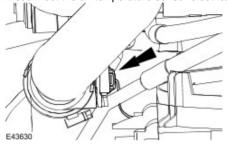
NOTE:

Cap the exposed ports.

Disconnect the suction accumulator pipe.



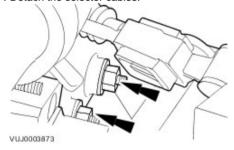
21 . Disconnect the air temperature sensor electrical connector.



22 . Disconnect the high intensity discharge (H.I.D) sensor drop arm.



23 . Detach the selector cables.

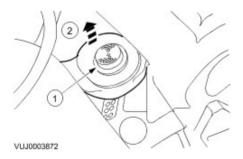


24 . **NOTE:**

Secure the selector cables using tie straps.

Detach the selector cables.

- 1) Press the retaining clip.
- 2) Detach the selector cables.

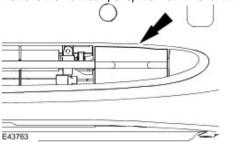


25 . Remove the front bumper splitter vain.



Left-hand shown, right-hand similar.

Remove the front bumper splitter vain finisher trims.



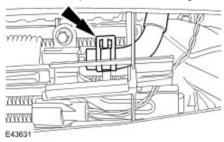
27 . **NOTE**:

Drain the fluid into a suitable container.

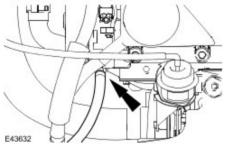
NOTE:

Cap the exposed ports.

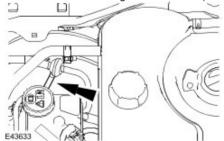
Disconnect the power assisted steering hose.



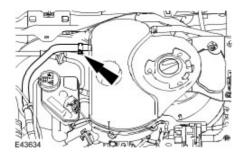
- 28 . Lower the vehicle to a suitable working height.
- 29 . Disconnect the brake vacuum pump vacuum hose.



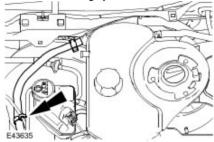
30 . Disconnect the exhaust gas recirculation (E.G.R) valve module vacuum hose.



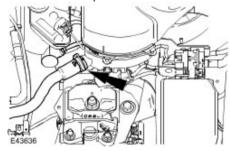
31 . Disconnect the expansion tank vent hose.



32 . Detach the cooling system hose.



33 . Disconnect the expansion tank outlet hose.



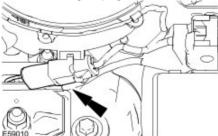
34 . **NOTE:**

The retaining bolt remains captive in the electrical connector.

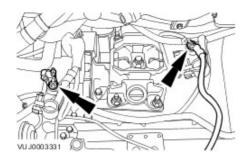
Disconnect the engine harness electrical connector.



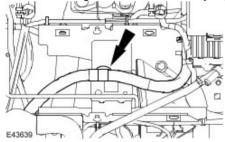
 ${\bf 35}$. Disconnect the glow plug harness electrical connector.



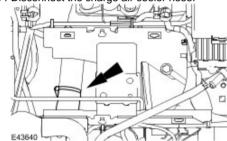
36 . Disconnect the battery cables.



37 . Detach the wiring harness from the battery tray mount.



38 . Disconnect the charge air cooler hose.



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:

39

Drain the fluid into a suitable container.

NOTE:

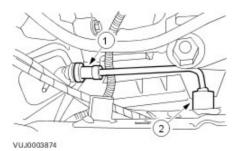
Cap the exposed ports.

NOTE:

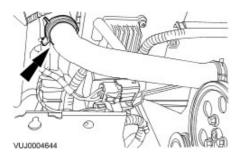
Secure the clutch slave cylinder pipe using tie strap.

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.



40 . Disconnect the radiator upper coolant hose.



41 . Disconnect the charge air cooler hose.



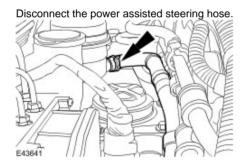
42 . Remove the exhaust manifold to E.G.R valve tube. For additional information, refer to

43 . **NOTE**:

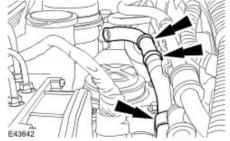
Place suitable absorbent material below the fluid reservoir to absorb fluid spillage.

NOTE:

Cap the exposed ports.



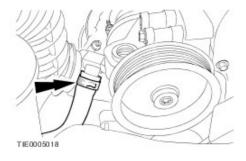
44 . Detach the power assisted steering hose.



45 . **NOTE:**

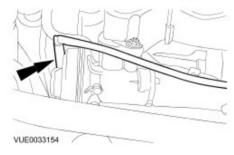
Cap the exposed ports.

Disconnect the power assisted steering hose.

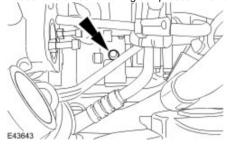


Cap the exposed ports.

Disconnect the E.G.R valve vacuum pipe.



47 . Loosen the air conditioning compressor line retaining bolt.



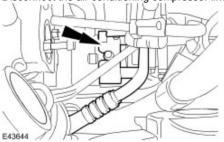
48 . **NOTE**:

Remove and discard the O-ring seals.

NOTE:

Cap the exposed ports.

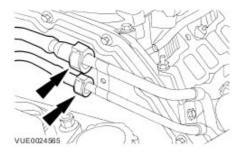
Disconnect the air conditioning compressor lines.



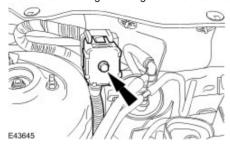
49 . Disconnect the fuel lines.

For additional information, refer to Quick Release Coupling - Push Connect

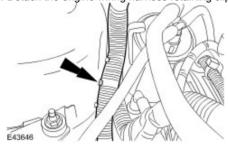
lnstall blanking plugs to the fuel pump fuel supply and fuel return line male and female connectors.



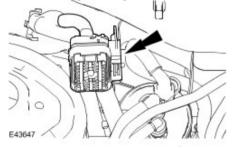
50 . Disconnect the engine wiring harness electrical connector.



51 . Detach the engine wiring harness retaining clip.



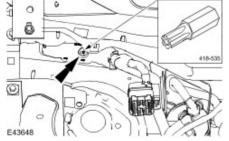
52 . Detach the engine wiring harness electrical connector.



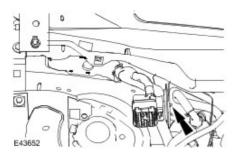
53 . **NOTE:**

Bolt remains captive in the engine control module (ECM) electrical connector.

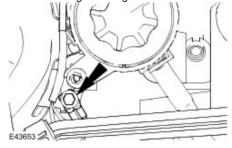
Using the special tool, disconnect the ECM harness electrical connector.



54. Detach the engine wiring harness retaining clip.

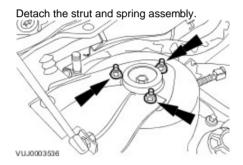


55 . Detach the engine wiring harness earth lead.



56 . **NOTE**:

Right-hand shown, left-hand similar.

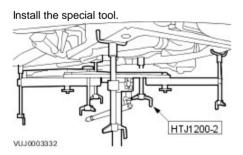


57 . Raise the vehicle.

58 .



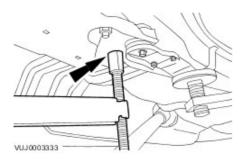
CAUTION: Do not support the engine and transaxle assembly directly on the oil pan.



59 . **NOTE:**

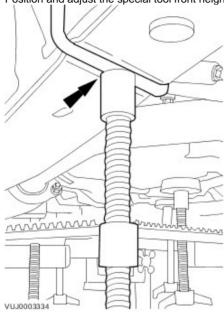
Left-hand shown, right-hand similar.

Position and adjust the special tool rear height adjuster.

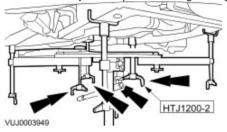


Right-hand shown, left-hand similar.

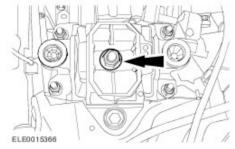
Position and adjust the special tool front height adjuster.



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



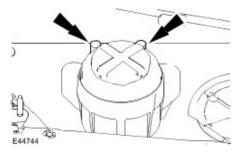
 $\ensuremath{\text{62}}$. Remove the engine rear mount retaining nut.



63 . **NOTE:**

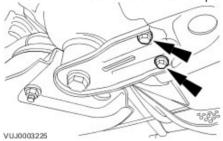
Discard the retaining nuts.

Remove the engine front mount retaining nuts.



Left-hand shown, right-hand similar.

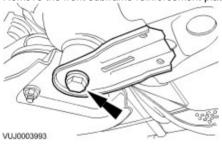
Remove the front subframe reinforcement plate retaining bolts.



65 . **NOTE**:

Left-hand shown, right-hand similar.

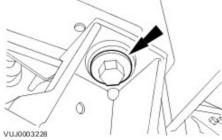
Remove the front subframe reinforcement plate.



66 . **NOTE**:

Left-hand shown, right-hand similar.



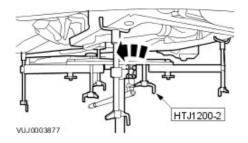


67

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.

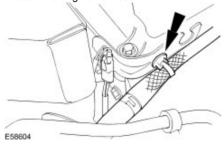


68

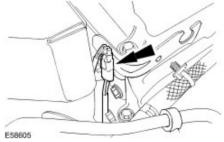
CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

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.

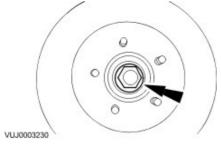


72 . Install the engine rear lifting eye.



Left-hand shown, right-hand similar.

Remove and discard the wheel hub nuts.



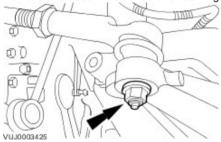
74

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.

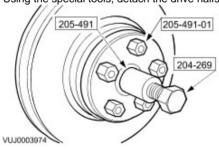
Remove and discard the tie rod-end retaining nuts.



75 . **NOTE:**

Left-hand shown, right-hand similar.

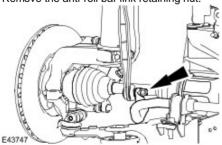
Using the special tools, detach the drive halfshaft.



76 . **NOTE:**

Left-hand shown, right-hand similar.

Remove the anti-roll bar link retaining nut.

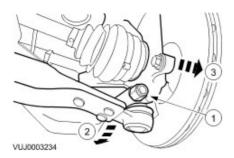


77 . **NOTE**:

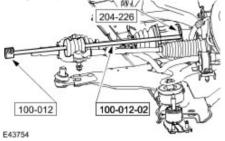
Left-hand shown, right-hand similar.

Remove the wheel knuckle and strut.

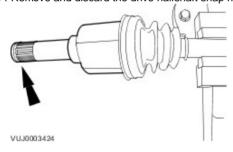
- 1) Remove and discard the lower arm ball joint retaining nut and bolt.
- 2) Reposition the lower arms.
- 3) Remove the wheel knuckle and strut.



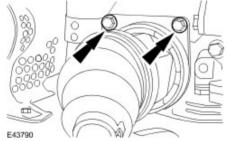
78 . Using the special tools, remove the drive halfshaft.



79 . Remove and discard the drive halfshaft snap ring.



80 . Remove the drive halfshaft.



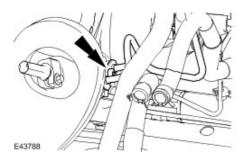
81 . **NOTE**:

Discard the O-ring seals.

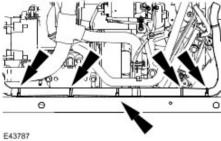
NOTE:

Cap the exposed ports.

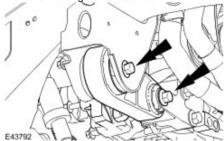
Disconnect the power steering lines.



82 . Detach the wiring harness.



83 . Remove the engine roll restrictor.



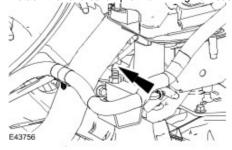
CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

Using a suitable hydraulic lift, remove the engine and transmission from the subframe and place to a suitable working area.

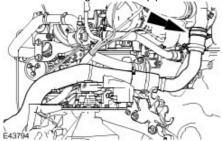
85 . Remove the charge air cooler pipe retaining nut.



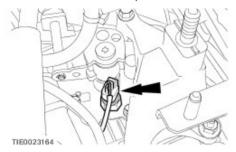
86 . Detach the reverse lamp switch wiring harness retaining clip.



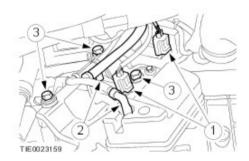
87 . Remove the charge air cooler pipe.



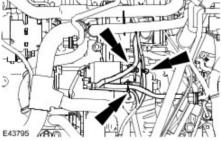
88 . Disconnect the reverse lamp switch electrical connector.



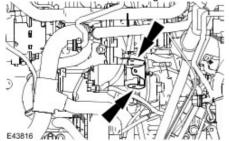
- 89 . Remove the vacuum regulator solenoid valve.
 - 1) Disconnect the electrical connectors.
 - 2) Detach the vacuum hoses.
 - 3) Remove the vacuum regulator solenoid valve.

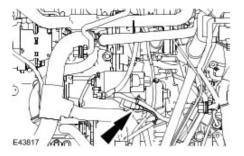


90 . Detach the starter motor wiring harness.

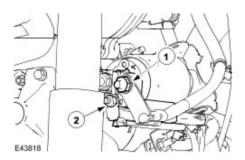


91 . Remove the starter motor wiring harness retaining bracket.

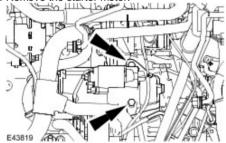




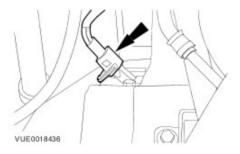
- 93 . Detach the starter motor wiring harness.
 - 1) Disconnect the starter motor electrical connector.
 - 2) Disconnect the starter motor solenoid electrical connector.



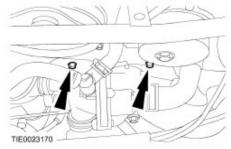
94 . Remove the starter motor.



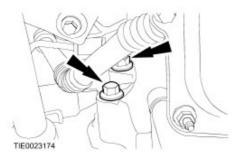
95 . Disconnect the crankshaft sensor electrical connector.



96 . Remove the transmission upper retaining bolts.



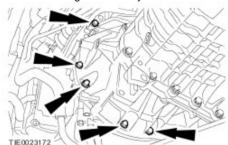
97 . Remove the transmission right-hand retaining bolts.



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.



Engine - 2.2L Diesel (12.41.01)

Special Service Tools



Remover/Installer, Cooling Hose Clamp 303-397 (24-003)



204-192

Ball joint splitter 204-192



Wheel hub puller 205-491



20549101

Adaptor nuts 205-491-01



Forcing screw 204-269



Powertrain assembly jack HTJ1200-02



Engine lifting eye 303-1067

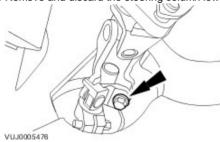


5 Point Security Torx Bit 418-535

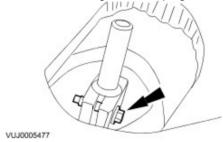
Removal

All vehicles

1 . Remove and discard the steering column lower retaining bolt.



2 . Remove the steering column coupling.

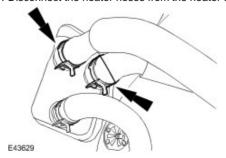


- 3 . Remove the battery tray.
 For additional information, refer to Battery Tray (86.15.11)
- 4 . Recover the air conditioning refrigerant.
 For additional information, refer to <u>Air Conditioning (A/C) System Recovery, Evacuation and Charging (82.30.30)</u>
- 5 . Drain the cooling system.

 For additional information, refer to Cooling System Draining, Filling and Bleeding
- 6 . Remove the exhaust flexible pipe. For additional information, refer to

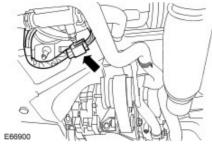
Vehicles without auxiliary heating

7. Disconnect the heater hoses from the heater core.

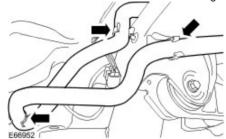


Vehicles with electric booster heater

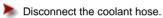
8 . Detach the electric booster heater electrical connector from the subframe retaining tang.

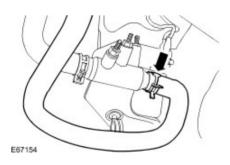


9. Detach the coolant hoses from the retaining clips.



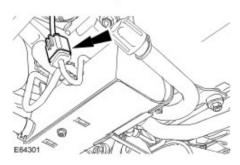
10. Detach the coolant hose.





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.

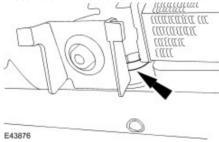


13. Disconnect the coolant hose.



All vehicles

14. Disconnect the radiator lower coolant hose.

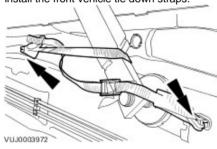


15 CAUTION: To prevent the vehicle becoming unstable when the engine and transmission assembly are removed, install the vehicle tie-down straps. Failure to follow this instruction may result in damage to the vehicle.

NOTE:

Right-hand shown, left-hand similar.





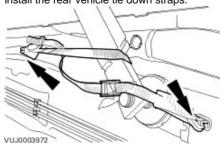
CAUTION: To prevent the vehicle becoming unstable when the engine and transmission assembly are removed, install the vehicle tie-down straps. Failure to follow this instruction may result in damage to the vehicle.

NOTE:

16

Right-hand shown, left-hand similar.

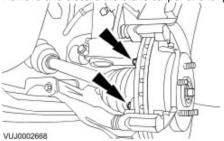
Install the rear vehicle tie down straps.



- 17. Lower the vehicle to a suitable working height.
- 18 . Remove the front brake pads.
 For additional information, refer to Brake Pads (70.40.02)

Left-hand shown, right-hand similar.

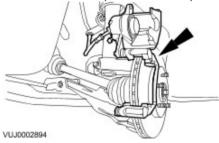
Remove and discard the brake caliper anchor plate retaining bolts.



20 . **NOTE:**

Left-hand shown, right-hand similar.

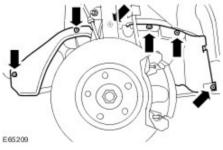
Detach the brake caliper and brake caliper anchor plate assembly.



21 . **NOTE:**

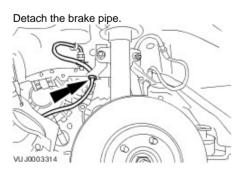
Right-hand shown, left-hand similar.

Remove the wheel arch liner access cover.



22 . **NOTE:**

Left-hand shown, right-hand similar.

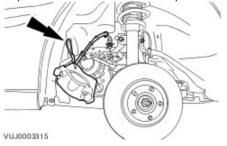


CAUTION: Support the brake caliper assembly using tie straps. Failure to follow this instruction may result in damage to the vehicle.

NOTE:

Left-hand shown, right-hand similar.

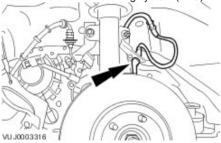
Reposition and attach the brake caliper assembly.



24 . **NOTE**:

Left-hand shown, right-hand similar.

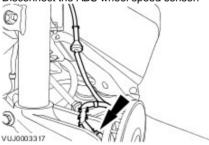
Detach the anti-lock braking system (ABS) wheel speed sensor.



25 . **NOTE:**

Left-hand shown, right-hand similar.

Disconnect the ABS wheel speed sensor.



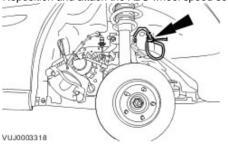
26

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.



Remove and discard the O-ring seal.

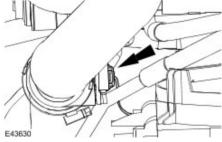
NOTE:

Cap the exposed ports.

Disconnect the suction accumulator pipe.



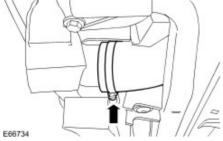
28 . Disconnect the air temperature sensor electrical connector.



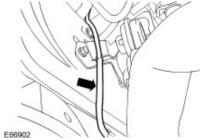
29 . Disconnect the high intensity discharge (H.I.D) sensor drop arm.



30 . Detach the charge air cooler outlet hose from the charge air cooler.



31 . Detach the battery breather hose.



Drain the fluid into a suitable container.

NOTE:

Cap the exposed ports.

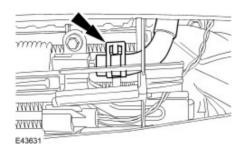
NOTE:

Use care when repositioning power assisted steering hose.

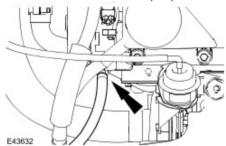
Disconnect the power assisted steering hose.

Remove the power assisted steering hose retaining clip.

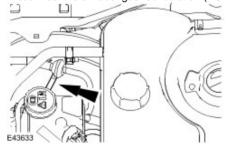
Reposition the power assisted hose through the radiator side seal.



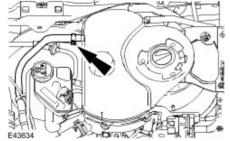
- 33 . Lower the vehicle to a suitable working height.
- 34. Disconnect the brake vacuum pump vacuum hose.

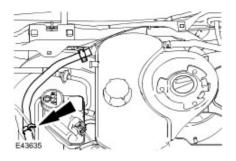


35 . Disconnect the exhaust gas recirculation (EGR) valve module vacuum hose.

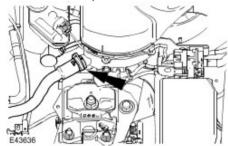


36 . Disconnect the expansion tank vent hose.





38 . Disconnect the expansion tank outlet hose.



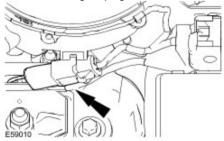
39 . **NOTE:**

The retaining bolt remains captive in the electrical connector.

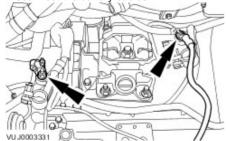
Disconnect the engine harness electrical connector.



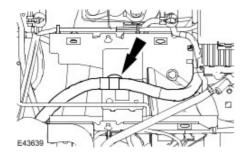
40 . Disconnect the glow plug harness electrical connector.



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.

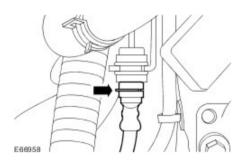
NOTE:

Secure the clutch slave cylinder hose using a tie strap.

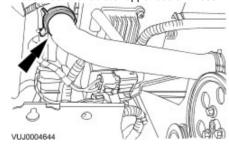
Detach the clutch slave cylinder hose from the clutch slave cylinder pipe.

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.

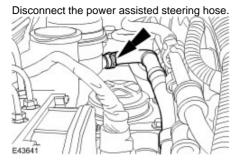


46 . **NOTE:**

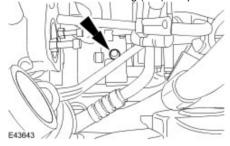
Place suitable absorbent material below the fluid reservoir to absorb fluid spillage.

NOTE:

Cap the exposed ports.



47 . Loosen the air conditioning (A/C) compressor line retaining bolt.



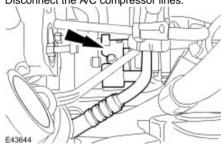
48 . **NOTE**:

Remove and discard the O-ring seals.

NOTE:

Cap the exposed ports.

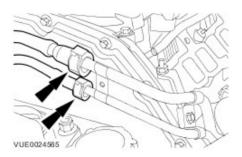




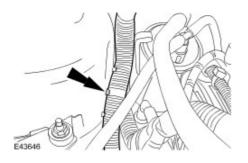
49 . Disconnect the fuel lines.

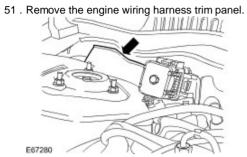
For additional information, refer to Quick Release Coupling - Push Connect

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.





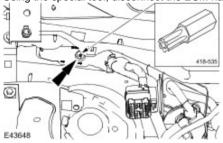
52 . Detach the engine wiring harness electrical connector.



53 . **NOTE:**

Bolt remains captive in the engine control module (ECM) electrical connector.

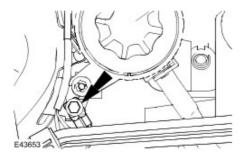
Using the special tool, disconnect the ECM harness electrical connector.



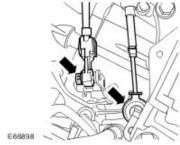
 ${\bf 54}$. Detach the engine wiring harness retaining clip.



55 . Detach the engine wiring harness earth lead.



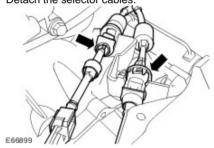
56 . Detach the selector cables.



57 . **NOTE:**

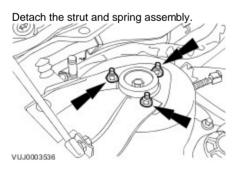
Secure the selector cables using tie straps.





58 . **NOTE:**

Right-hand shown, left-hand similar.



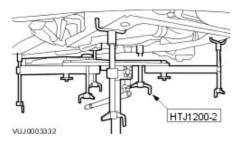
59 . Raise the vehicle.

60 .



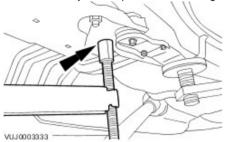
CAUTION: Do not support the engine and transaxle assembly directly on the oil pan.

Install the special tool.



Left-hand shown, right-hand similar.

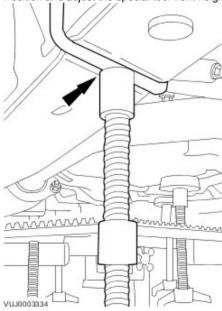
Position and adjust the special tool rear height adjuster.



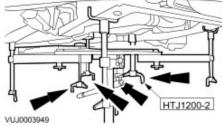
62 . **NOTE**:

Right-hand shown, left-hand similar.

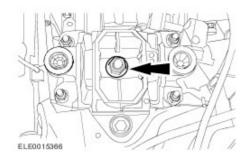
Position and adjust the special tool front height adjuster.



 $\ensuremath{\mathsf{63}}$. Position and adjust the special tool engine height adjusters.

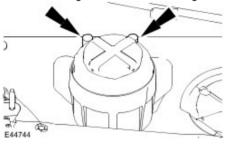


64 . Remove the engine rear mount retaining nut.



Discard the retaining nuts.

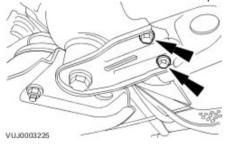
Remove the engine front mount retaining nuts.



66 . **NOTE**:

Left-hand shown, right-hand similar.

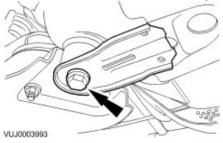
Remove the front subframe reinforcement plate retaining bolts.



67 . **NOTE**:

Left-hand shown, right-hand similar.

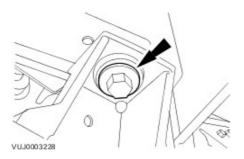
Remove the front subframe reinforcement plate.



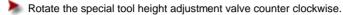
68 . **NOTE:**

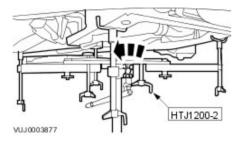
Left-hand shown, right-hand similar.

Detach the front subframe.



69. Lower the engine, suspension and transmission assembly to gain access to the A/C pipe.

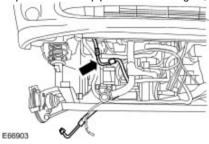




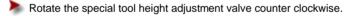
70 . **NOTE:**

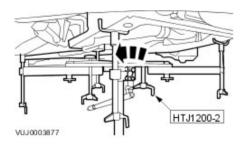
Secure the A/C pipe using tie straps.

Reposition the AC pipe clear of the engine, suspension and transmission assembly.



71 . Remove the engine, suspension and transmission assembly.

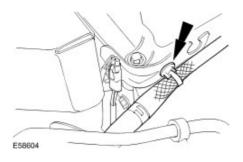




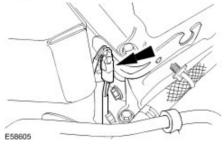
CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

Place the engine, suspension and transmission assembly to a suitable working area.

73 . Detach the engine harness.



74 . Detach the electrical connector.



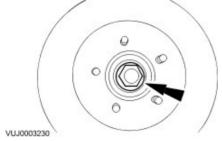
75 . Remove the engine cover rear mount bracket.



76 . Install the engine rear lifting eye.



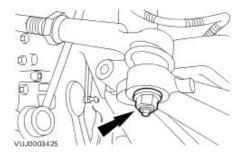
77 . Remove and discard the right-hand wheel hub nut.



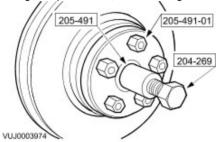
78

CAUTION: When the tie-rod end is separated from the wheel hub assembly, the ball joint seal should be protected to prevent damage.

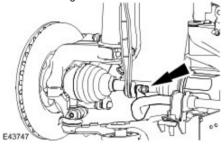
Remove and discard the right-hand tie rod-end retaining nut.



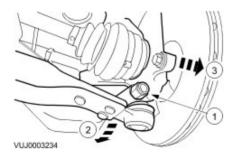
79 . Using the special tools, detach the right-hand drive halfshaft.



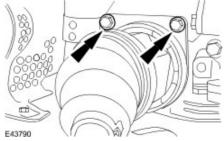
80 . Remove the right-hand anti-roll bar link retaining nut.



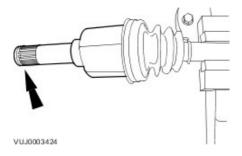
- 81 . Remove the right-hand wheel knuckle and strut.
 - 1) Remove and discard the lower arm ball joint retaining nut and bolt.
 - 2) Reposition the lower arms.
 - 3) Remove the wheel knuckle and strut.



82 . Remove the right-hand drive halfshaft.



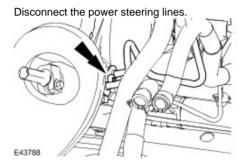
83 . Remove and discard the drive halfshaft snap ring.



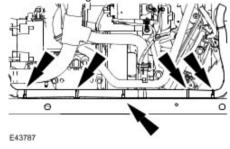
Discard the O-ring seals.

NOTE:

Cap the exposed ports.

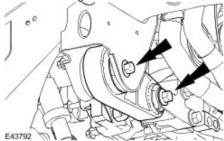


85 . Detach the wiring harness.



86 . Remove the engine roll restrictor.

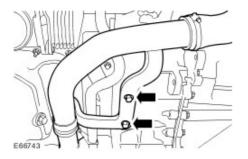
87



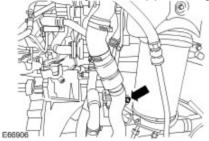
CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

Using a suitable hydraulic lift, raise the engine and transmission from the subframe.

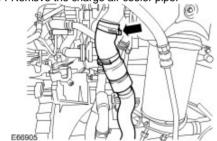
88 . Remove the charge air cooler intake pipe retaining bolts.



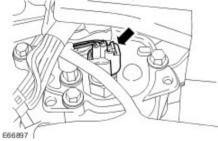
89 . Remove the charge air cooler pipe retaining bolt.



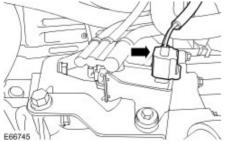
90 . Remove the charge air cooler pipe.



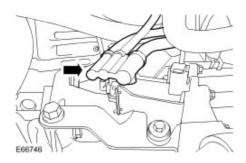
91 . Disconnect the reverse lamp switch electrical connector.



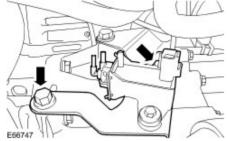
92 . Disconnect the emission control solenoid electrical connector.

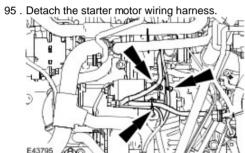


93 . Disconnect the emission control solenoid hose.

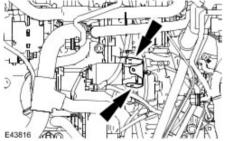


94 . Remove the emission control solenoid assembly.

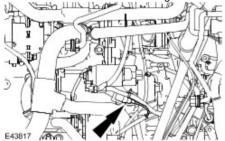




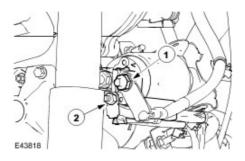
96 . Remove the starter motor wiring harness retaining bracket.



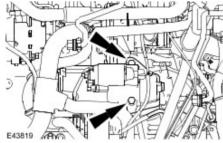
97 . Disconnect the starter motor wiring harness electrical connector.



- 98 . Detach the starter motor wiring harness.
 - 1) Disconnect the starter motor electrical connector.
 - 2) Disconnect the starter motor solenoid electrical connector.



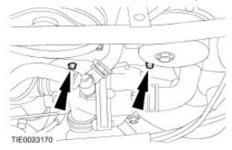
99 . Remove the starter motor.



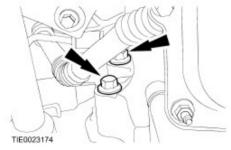
100 . Disconnect the crankshaft position (CKP) sensor electrical connector.



101 . Remove the transmission upper retaining bolts.

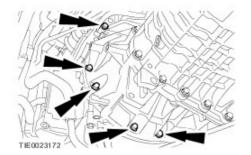


102 . Remove the transmission right-hand retaining bolts.



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.



Engine - 2.0L Diesel (12.41.01)

Special Service Tools



Remover/Installer, Cooling Hose Clamp 303-397 (24-003)



Powertrain assembly jack HTJ1200-02



Engine lifting eye 303-1067



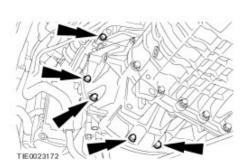
5 Point Security Torx Bit 418-535

Installation

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.

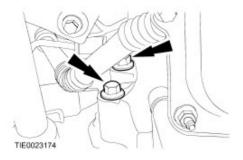
Install the engine assembly to the transmission assembly.





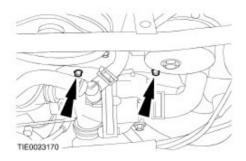
2 . Install the transmission right-hand retaining bolts.



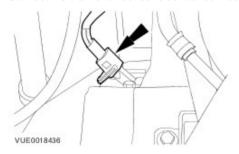


3 . Install the transmission upper retaining bolts.



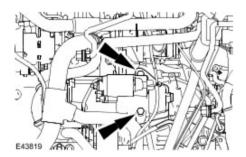


4 . Connect the crankshaft sensor electrical connector.

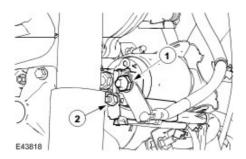


5 . Install the starter motor.

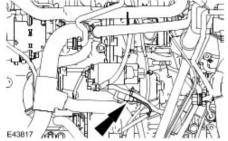
Tighten to 25 Nm.



- 6 . Attach the starter motor wiring harness.
 - 1) Tighten to 12 Nm.
 - 2) Tighten to 6 Nm.

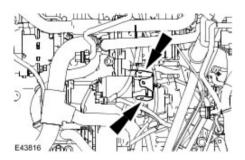


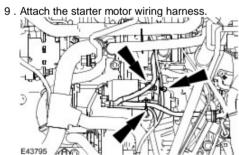
7 . Connect the starter motor wiring harness electrical connector.



8 . Install the starter motor wiring harness retaining bracket.



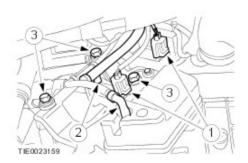




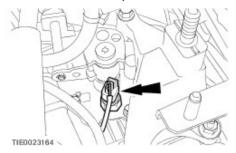
- 10 . Install the vacuum regulator solenoid valve.
 - 1) Connect the electrical connectors.
 - 2) Attach the vacuum hoses.
 - 3) Install the vacuum regulator solenoid valve.



Tighten to 23 Nm.

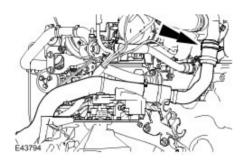


11 . Connect the reverse lamp switch electrical connector.

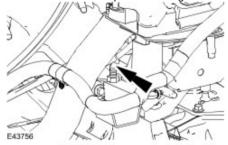


12 . Install the charge air cooler pipe.

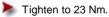


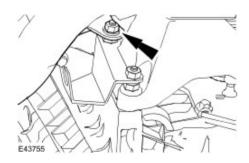


13 . Attach the reverse lamp switch wiring harness retaining clip.



14 . Install the charge air cooler pipe retaining nut.





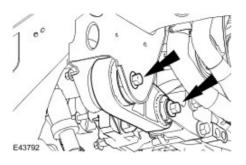
CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

Using a suitable hydraulic lift install the engine and transmission to the subframe.

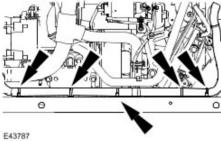
16 . Install the engine roll restrictor.

15





17 . Attach the wiring harness.



18 . **NOTE:**

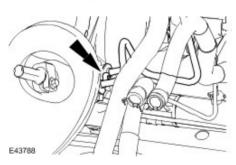
Un-Cap the exposed ports.

NOTE:

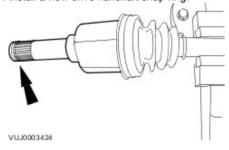
Install new O-ring seals.

Connect the the power steering lines.





19 . Install a new drive halfshaft snap ring.



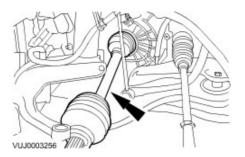
20

CAUTION: Make sure the CV joint splines are located fully. Do not use excessive force when engaging the CV joint into the transmission.



CAUTION: Do not damage the oil seal.

Install the drive halfshaft.

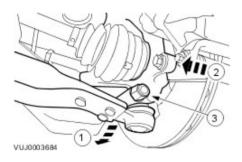


Left-hand shown, right-hand similar.

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.

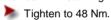


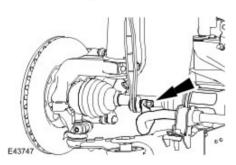


22 . **NOTE:**

Left-hand shown, right-hand similar.

Install a new anti-roll bar link retaining nut.

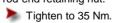


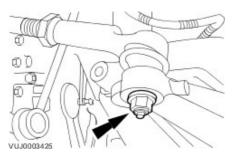


23 . **NOTE:**

Left-hand shown, right-hand similar.

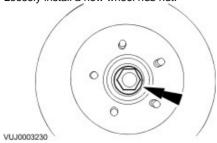
Install a new tie rod-end retaining nut.





Left-hand shown, right-hand similar.

Loosely install a new wheel hub nut.

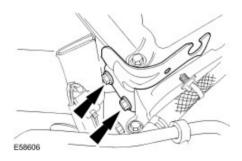


25 . Remove the engine rear lifting eye.

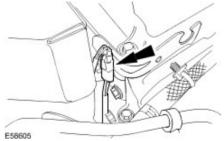


26 . Install the engine cover rear mount bracket.

Tighten to 23 Nm.



27 . Attach the electrical connector.



28 . Attach the engine harness.



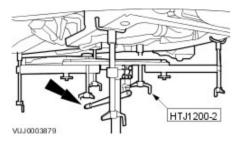
injury.

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

Install the engine.



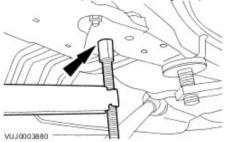
Raise the special tool.



30 . **NOTE:**

Left-hand shown, right-hand similar.

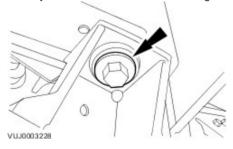
Make sure the special tool rear height adjuster aligns into the locating hole in the vehicle floor pan.



31 . **NOTE**:

Left-hand shown, right-hand similar.

Loosely install the front subframe retaining bolts.

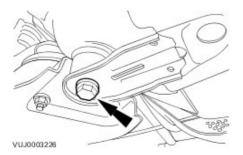


32 . **NOTE**:

Left-hand shown, right-hand similar.

Install the front subframe reinforcement plate.

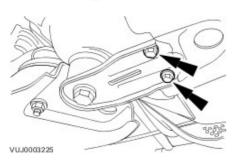
Loosely install the front subframe rear retaining bolts.



Left-hand shown, right-hand similar.

Install the front subframe reinforcement plate retaining bolts.

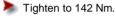
Tighten to 70 Nm.

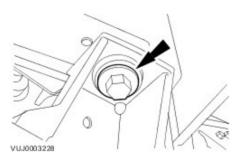


34 . **NOTE**:

Left-hand shown, right-hand similar.

Fully tighten the front subframe retaining bolts.

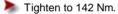


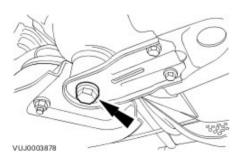


35 . **NOTE:**

Left-hand shown, right-hand similar.

Fully tighten the front subframe retaining bolts.



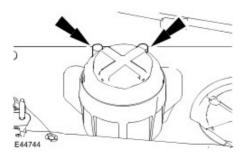


36 . **NOTE:**

Install new retaining nuts.

Install the engine front mount retaining nuts.

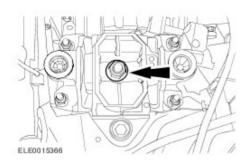




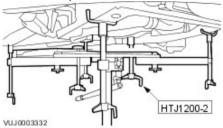
Install a new retaining nut.

Install the engine rear mount retaining nut.

Tighten to 133 Nm.



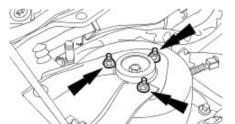
38 . Remove the special tool.



39 . Lower the vehicle.

VUJ0003536

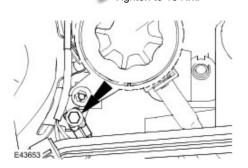
40 . Attach the strut and spring assembly.



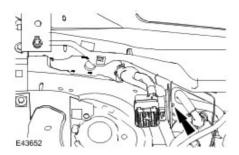
Tighten to 30 Nm.

41 . Attach the engine wiring harness earth lead.

Tighten to 10 Nm.



42 . Attach the engine wiring harness retaining clip.



43

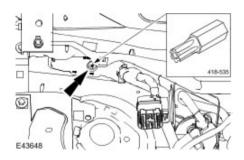
CAUTION: Make sure that the electrical connector locates correctly in the ECM. Do not force or overtighten the electrical connector. Failure to follow this instruction may result in damage to the components.

NOTE:

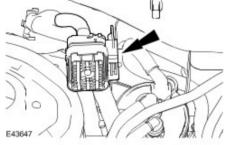
Bolt remains captive in the ECM electrical connector.

Using the special tool, connect the ECM harness electrical connector.

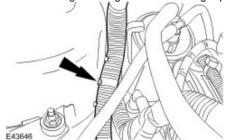
Tighten to 10 Nm.



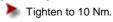
44 . Attach the engine wiring harness electrical connector.

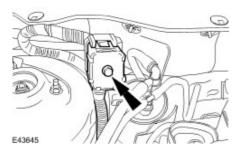


45 . Attach the engine wiring harness retaining clip.



46 . Connect the engine wiring harness electrical connector.

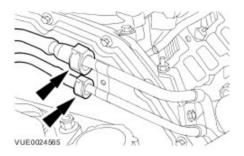




47. Connect the fuel lines.

For additional information, refer to Quick Release Coupling - Push Connect

Remove the blanking plugs.



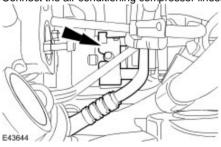
48 . **NOTE**:

Install new O-ring seals.

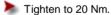
NOTE:

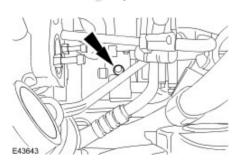
Un-cap the exposed ports.

Connect the air conditioning compressor lines.



49 . Fully tighten the air conditioning compressor line retaining bolt.

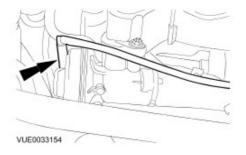




50 . **NOTE**:

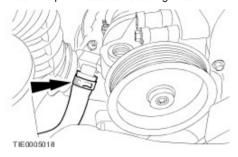
Un-cap the exposed ports.

Connect the exhaust gas recirculation (EGR) valve vacuum pipe.



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.

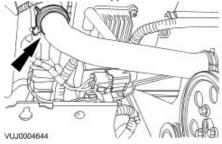


- 54 . Install the exhaust manifold to EGR valve tube. For additional information, refer to
- 55 . Connect the charge air cooler hose.





56 . Connect the radiator upper coolant hose.



57

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

NOTE:

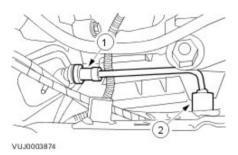
Un-cap the exposed ports.

NOTE:

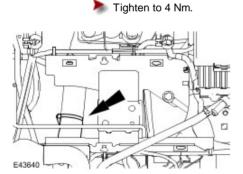
Remove the tie strap.

Attach the clutch slave cylinder pipe.

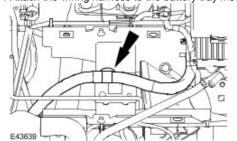
- 1) Connect and fully seat the clutch slave cylinder pipe and retaining clip.
- 2) Attach the clutch slave cylinder pipe.

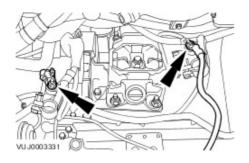


58 . Connect the charge air cooler hose.

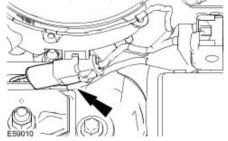


59 . Attach the wiring harness to the battery tray mount.

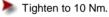


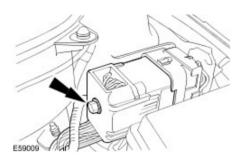


61 . Connect the glow plug harness electrical connector.



 $\ensuremath{\mathsf{62}}$. Connect the engine harness electrical connector.

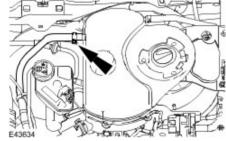




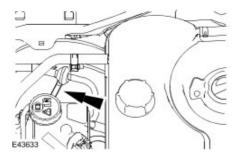
63 . Attach the the expansion tank outlet hose.



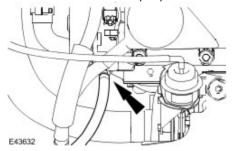
64 . Connect the expansion tank outlet hose.



65 . Connect the exhaust gas recirculation (EGR) valve module vacuum hose.



66 . Connect the brake vacuum pump vacuum hose.

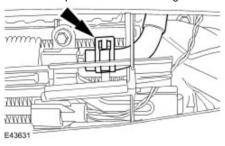


67 . Raise the vehicle.

68 . **NOTE**:

Un-cap the exposed ports.

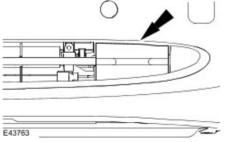
Connect the power assisted steering hose.



69 . **NOTE:**

Left-hand shown, right-hand similar.

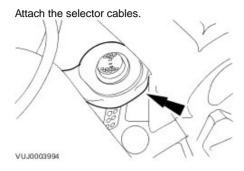
Install the front bumper splitter vain finisher trims.



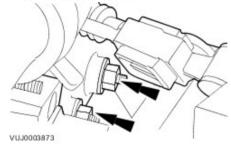
70 . Install the front bumper splitter vain.



Remove the selector cables tie straps.



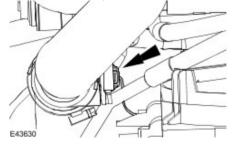
72 . Attach the selector cables.



73 . Connect the high intensity discharge (HID) sensor drop arm.



74 . Connect the air temperature sensor electrical connector.



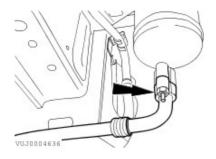
75 . **NOTE**:

Install a new O-ring seal.

NOTE:

Un-cap the exposed ports.

Connect the suction accumulator pipe.



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.



77 . **NOTE:**

Left-hand shown, right-hand similar.

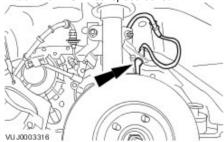
Connect the ABS wheel speed sensor.



78 . **NOTE**:

Left-hand shown, right-hand similar.

Attach the ABS wheel speed sensor.



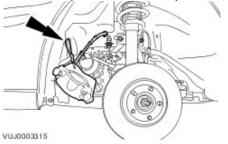
79 . **NOTE**:

Remove the brake caliper assembly tie straps.

NOTE:

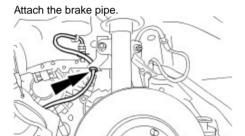
Left-hand shown, right-hand similar.

Detach and reposition the brake caliper assembly.



80 . **NOTE:**

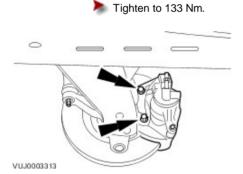
Left-hand shown, right-hand similar.



81 . **NOTE**:

Install new brake caliper anchor plate retaining bolts.

Attach the brake caliper and brake caliper anchor plate assembly.

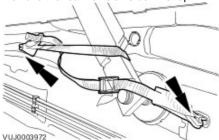


- 82 . Install the front brake pads.
 For additional information, refer to Brake Pads (70.40.02)
- 83 . Install the front wheels and tires.
 For additional information, refer to Wheel and Tire (74.20.05)

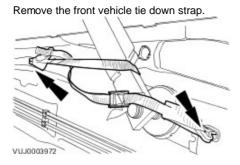
84 . **NOTE**:

Right-hand shown, left-hand similar.

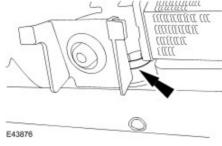
Remove the rear vehicle tie down strap.



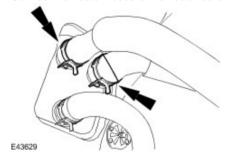
Right-hand shown, left-hand similar.



86. Connect the radiator lower coolant hose.

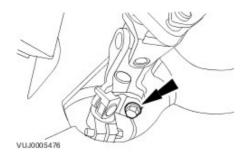


87 . Connect the heater hoses to the heater core.



- 88 . Install the exhaust flexible pipe. For additional information, refer to
- 89 . Install the battery tray.
 For additional information, refer to Battery Tray (86.15.11)
- 90 . Check and top up the transmission fluid level.
 For additional information, refer to Transaxle Draining and Filling Vehicles With: 6-Speed Manual Transmission (44.24.02)
- 91 . Carry out the clutch bleeding system procedure.
 For additional information, refer to <u>Clutch System Bleeding Vehicles With: 6-Speed Manual Transmission (33.15.01)</u>
- 92 . Fill and bleed the cooling system.
 For additional information, refer to Cooling System Draining, Filling and Bleeding
- 93 . Recharge the air conditioning refrigerant.

 For additional information, refer to <u>Air Conditioning (A/C) System Recovery, Evacuation and Charging (82.30.30)</u>
- 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
- 96 . Carry out the gear shift cable adjustment procedure.
 For additional information, refer to Gearshift Cable Adjustment (37.16.47)
- 97 . Carry out the underbody misalignment check.
 For additional information, refer to <u>Underbody Misalignment Check (57.65.20)</u>

Engine - 2.2L Diesel (12.41.01)

Special Service Tools



Remover/Installer, Cooling Hose Clamp 303-397 (24-003)



Powertrain assembly jack HTJ1200-02



Engine lifting eye 303-1067



418-535

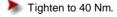
5 Point Security Torx Bit 418-535

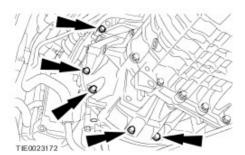
Installation

All vehicles

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.

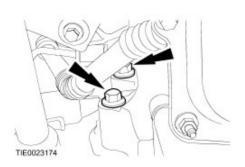
Using a suitable hydraulic lift, install the engine assembly to the transmission assembly.





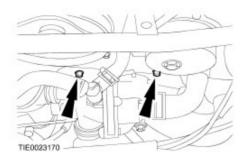
2 . Install the transmission right-hand retaining bolts.

Tighten to 40 Nm.

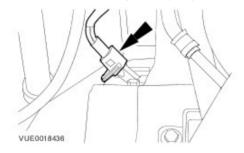


3 . Install the transmission upper retaining bolts.

Tighten to 40 Nm.

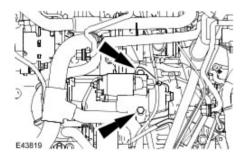


4 . Connect the crankshaft position (CKP) sensor electrical connector.

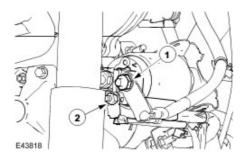


5 . Install the starter motor.

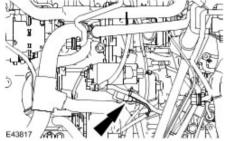
Tighten to 25 Nm.



- 6 . Attach the starter motor wiring harness.
 - 1) Tighten to 12 Nm.
 - 2) Tighten to 6 Nm.

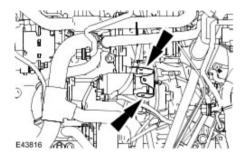


7 . Connect the starter motor wiring harness electrical connector.

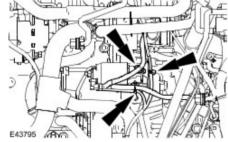


8 . Install the starter motor wiring harness retaining bracket.



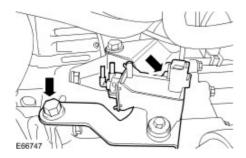


9 . Attach the starter motor wiring harness.

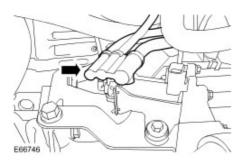


10 . Install the emission control solenoid assembly.

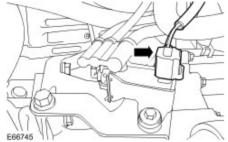
Tighten to 23 Nm.



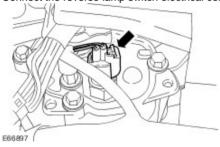
11 . Connect the emission control solenoid hose.



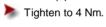
12 . Connect the emission control solenoid electrical connector.

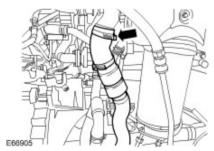


13 . Connect the reverse lamp switch electrical connector.



14 . Install the charge air cooler pipe.





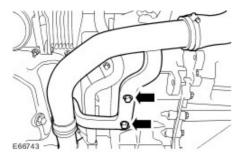
15 . Install the charge air cooler pipe retaining bolt.



Tighten to 10 Nm.

16 . Install the charge air cooler intake pipe retaining bolts.

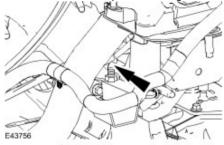




CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

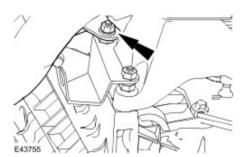
Using a suitable hydraulic lift, lower the engine and transmission from the subframe.

18 . Attach the reverse lamp switch wiring harness retaining clip.



19 . Install the charge air cooler pipe retaining nut.

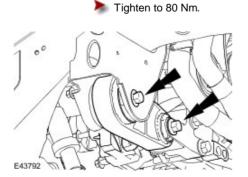
Tighten to 23 Nm.



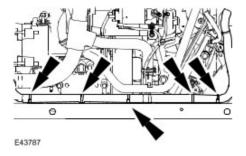
CAUTION: Do not support the engine and transaxle assembly directly on the oil pan. Failure to follow this instruction may cause damage to the component.

Using a suitable hydraulic lift install the engine and transmission to the subframe.

21 . Install the engine roll restrictor.



22 . Attach the wiring harness.



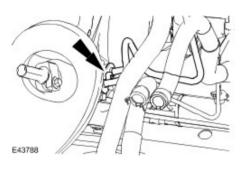
Un-Cap the exposed ports.

NOTE:

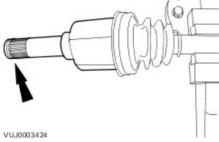
Install new O-ring seals.

Connect the the power steering lines.





24 . Install a new drive halfshaft snap ring.



25

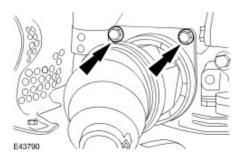
CAUTION: Make sure the CV joint splines are located fully. Do not use excessive force when engaging the CV joint into the transmission.



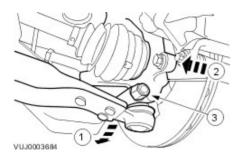
CAUTION: Do not damage the oil seal.

Install the right-hand drive halfshaft.

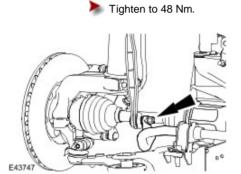




- 1) Reposition the lower arm.
- 2) Attach the wheel knuckle.
- 3) Install a new lower arm ball joint retaining nut and bolt.
- Tighten to 83 Nm.

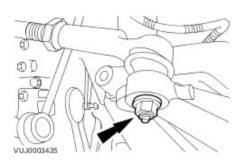


27 . Install a new right-hand anti-roll bar link retaining nut.

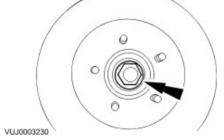


28 . Install a new right-hand tie rod-end retaining nut.

Tighten to 35 Nm.



29 . Loosely install a new wheel right-hand hub nut.

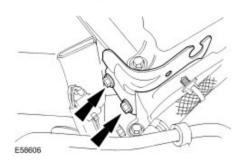


30 . Remove the engine rear lifting eye.

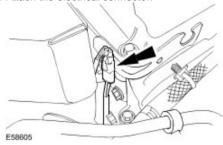


31 . Install the engine cover rear mount bracket.

Tighten to 23 Nm.



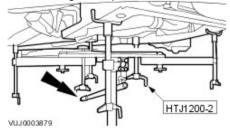
32 . Attach the electrical connector.



33 . Attach the engine harness.



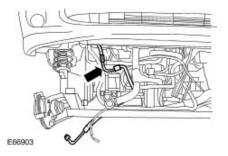
34 . Raise the engine, suspension and transmission assembly to a suitable height.



35 . **NOTE:**

Remove the tie straps.

Reposition the air conditioning (A/C) pipe to the engine, suspension and transmission assembly.

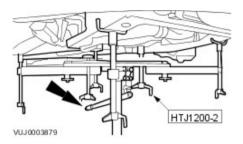


36

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

Install the engine.

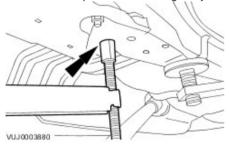
Raise the special tool.



37 . **NOTE:**

Left-hand shown, right-hand similar.

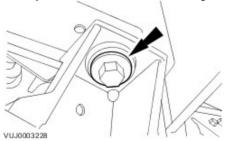
Make sure the special tool rear height adjuster aligns into the locating hole in the vehicle floor pan.



38 . **NOTE**:

Left-hand shown, right-hand similar.

Loosely install the front subframe retaining bolts.



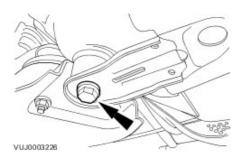
39 . **NOTE**:

Left-hand shown, right-hand similar.

Install the front subframe reinforcement plate.



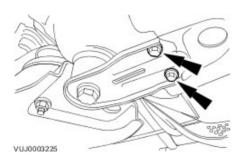
Loosely install the front subframe rear retaining bolts.



Left-hand shown, right-hand similar.

Install the front subframe reinforcement plate retaining bolts.

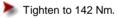
Tighten to 70 Nm.

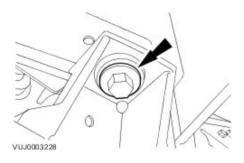


41 . **NOTE**:

Left-hand shown, right-hand similar.

Fully tighten the front subframe retaining bolts.

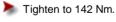


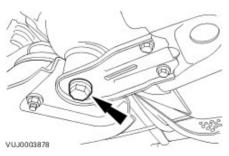


42 . **NOTE**:

Left-hand shown, right-hand similar.

Fully tighten the front subframe retaining bolts.



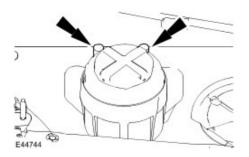


43 . **NOTE:**

Install new retaining nuts.

Install the engine front mount retaining nuts.

Tighten to 80 Nm.

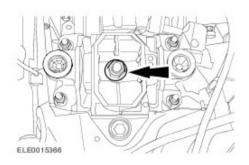


44 . **NOTE**:

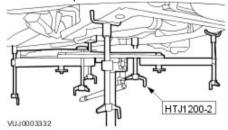
Install a new retaining nut.

Install the engine rear mount retaining nut.

Tighten to 133 Nm.

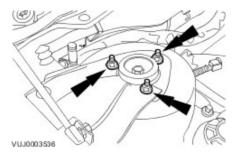


45 . Remove the special tool.



- 46 . Lower the vehicle.
- 47 . Attach the strut and spring assembly.

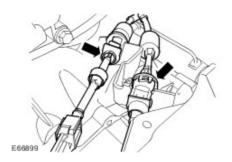
 Tighten to 30 Nm.



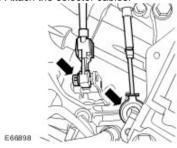
48 . **NOTE**:

Remove the tie straps.

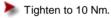
Attach the selector cables.

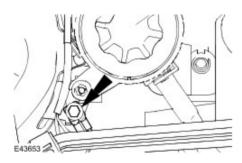


49 . Attach the selector cables.

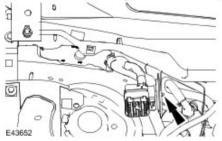


 $50\ .$ Attach the engine wiring harness earth lead.





51 . Attach the engine wiring harness retaining clip.



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.

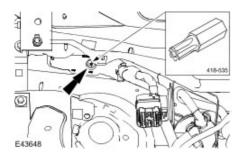
NOTE:

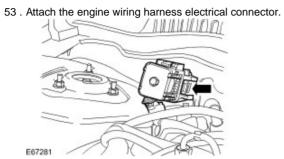
52

Bolt remains captive in the ECM electrical connector.

Using the special tool, connect the ECM harness electrical connector.

Tighten to 10 Nm.

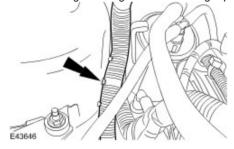




54 . Install the engine wiring harness trim panel.

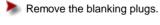


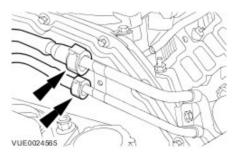
 ${\bf 55}$. Attach the engine wiring harness retaining clip.



56. Connect the fuel lines.

For additional information, refer to Quick Release Coupling - Push Connect





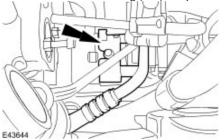
57 . **NOTE:**

Install new O-ring seals.

NOTE:

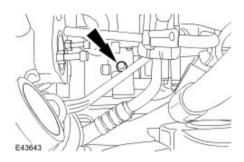
Un-cap the exposed ports.

Connect the air conditioning (A/C) compressor lines.



58 . Fully tighten the A/C compressor line retaining bolt.



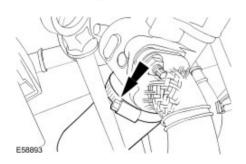


59 . Connect the power assisted steering hose.

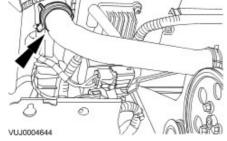


60 . Connect the charge air cooler hose.

Tighten to 4 Nm.



61 . Connect the radiator upper coolant hose.



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

NOTE:

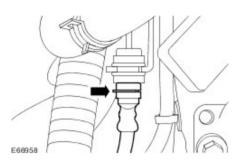
Un-cap the exposed ports.

NOTE:

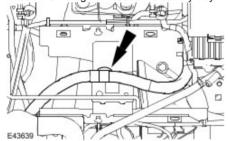
Remove the tie strap.

Attach the clutch slave cylinder pipe.

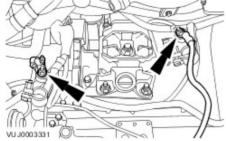
Connect and fully seat the clutch slave cylinder pipe and retaining clip.



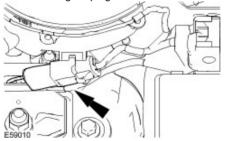
63 . Attach the wiring harness to the battery tray mount.



64 . Connect the battery cables.

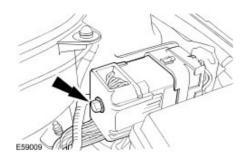


65. Connect the glow plug harness electrical connector.

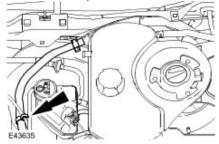


66 . Connect the engine harness electrical connector.

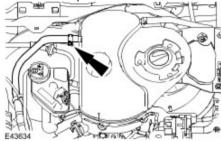




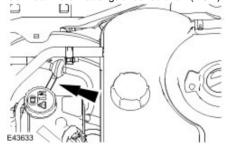
67 . Attach the the expansion tank outlet hose.



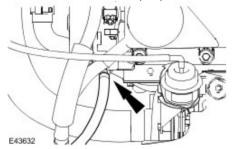
68 . Connect the expansion tank outlet hose.



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.

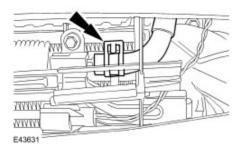
NOTE:

Use care when repositioning power assisted steering hose.

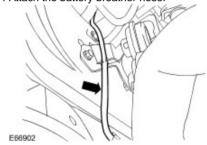
Connect the power assisted steering hose.

Reposition the power assisted hose through the radiator side seal.

Install the power assisted steering hose retaining clip.



73 . Attach the battery breather hose.



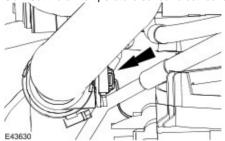
74 . Attach the charge air cooler outlet hose to the charge air cooler.



75 . Connect the high intensity discharge (HID) sensor drop arm.



76 . Connect the air temperature sensor electrical connector.



Install a new O-ring seal.

NOTE:

Un-cap the exposed ports.





78 . **NOTE**:

Remove the anti-lock braking system (ABS) wheel speed sensor tie straps.

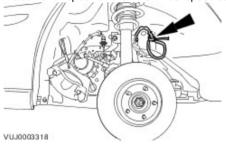
NOTE:

Left-hand shown, right-hand similar.

NOTE:

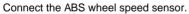
Remove the tie strap.

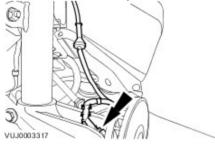
Detach and reposition the ABS wheel speed sensor.



79 . **NOTE:**

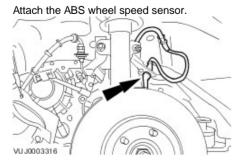
Left-hand shown, right-hand similar.





80 . **NOTE:**

Left-hand shown, right-hand similar.



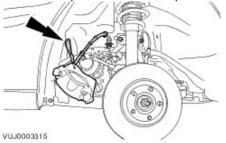
81 . **NOTE**:

Remove the brake caliper assembly tie straps.

NOTE:

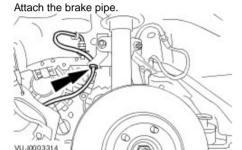
Left-hand shown, right-hand similar.

Detach and reposition the brake caliper assembly.



82 . **NOTE**:

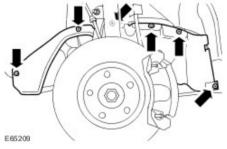
Left-hand shown, right-hand similar.



83 . **NOTE:**

Right-hand shown, left-hand similar.

Install the wheel arch liner access cover.



84 . **NOTE**:

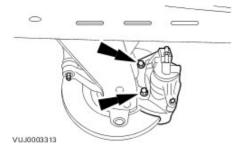
Left-hand shown, right-hand similar.

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 (70.40.02)

86 . **NOTE:**

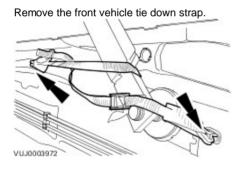
Right-hand shown, left-hand similar.



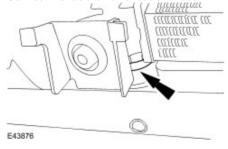
87 . **NOTE:**

VUJ0003972

Right-hand shown, left-hand similar.

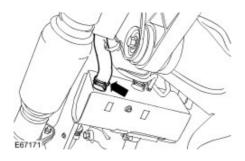


88 . Connect the radiator lower coolant hose.

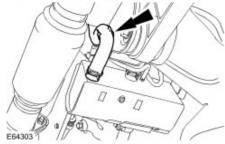


Vehicles with fuel fired booster heater

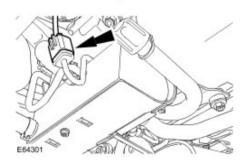
89 . Connect the coolant hose.



90 . Attach the coolant hose.



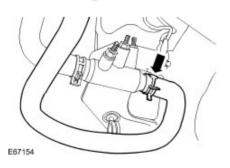
91 . Connect the fuel fired booster heater electrical connector to the subframe retaining tang.



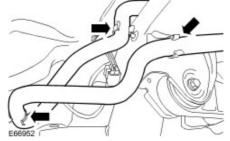
Vehicles without electric booster heater

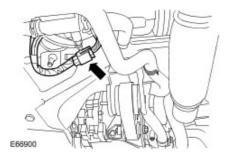
92 . Attach the coolant hose.





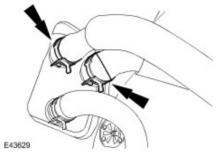
93 . Attach the coolant hoses to the retaining clips.





Vehicles without auxiliary heating

95 . Connect the heater hoses to the heater core.



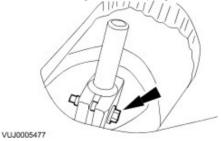
All vehicles

- 96 . Install the exhaust flexible pipe. For additional information, refer to
- 97 . Install the battery tray.
 For additional information, refer to Battery Tray (86.15.11)
- 98 . Check and top up the transmission fluid level.

 For additional information, refer to Transaxle Draining and Filling Vehicles With: 5-Speed Manual Transmission (44.24.02)
- 99 . Carry out the clutch bleeding system procedure.
 For additional information, refer to <u>Clutch System Bleeding Vehicles With: 5-Speed Manual Transmission (33.15.01)</u>
- 100 . Fill and bleed the cooling system.

 For additional information, refer to Cooling System Draining, Filling and Bleeding
- 101 . Recharge the air conditioning refrigerant.

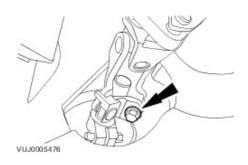
 For additional information, refer to <u>Air Conditioning (A/C) System Recovery, Evacuation and Charging (82.30.30)</u>
- 102 . Install the steering column coupling.



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

105 . Carry out the gear shift cable adjustment procedure.
For additional information, refer to Gearshift Cable Adjustment (37.16.47)

106 . Carry out the underbody misalignment check.
For additional information, refer to <u>Underbody Misalignment Check (57.65.20)</u>

Crankshaft Front Seal (12.21.14)

Special Service Tools



Release tool, belttensioner 303-676



303D055

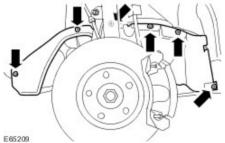
Wrenchstrap-universal 303-D055



Remover/Installer, Front OilSeal 303-679(21-238)

Removal

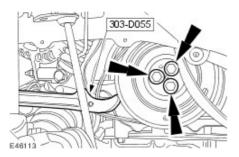
- Remove the front road wheel and tire.
 For additional information, refer to Wheel and Tire (74.20.05)
- $\boldsymbol{2}$. Remove the right-hand wheel arch liner access panel.



3. Using the special tool, detach the accessory drive belt.

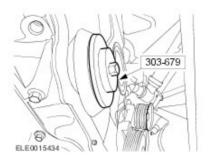


- 4. Using the special tool, remove the crankshaft pulley.
 - Remove and discard the crankshaft pulley bolts.



5. Using the special tool, remove the crankshaft front oil seal.

Discard the oil seal.



Installation

1. NOTE:

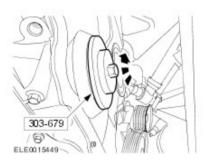
Install a new crankshaft front oil seal.

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.



CAUTION: Install new crankshaft pulley retaining bolts. Failure to follow this instruction many result in damage to the vehicle.

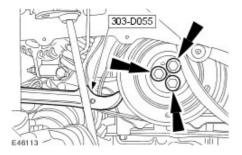
CAUTION: Tighten the new crankshaft pulley bolts in 2 stages. Failure to follow this instruction many result in damage to the vehicle.

Install the crankshaft pulley.

Using the special tool, retain the crankshaft pulley.

Stage 1: 45 Nm.

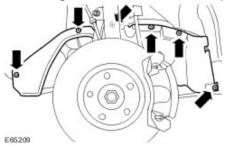
Stage 2: 120 degrees.



3. Using the special tool, install the accessory drive belt.



4 . Install the right-hand wheel arch liner access panel.



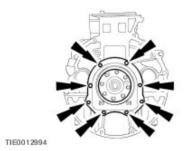
5 . Install the front road wheel and tire. For additional information, refer to Wheel and Tire (74.20.05)

Crankshaft Rear Seal (12.21.20)

Removal

- 1 . Remove the flywheel. For additional information, refer to Flywheel (12.53.07)
- 2. Remove the crankshaft rear seal.





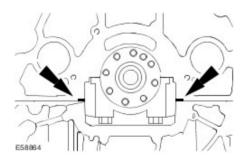
Installation

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.

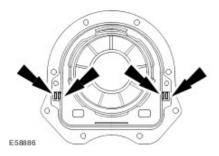
- 1 Check the two foam pads are located as shown on the ladder frame gasket.
 - If the ladder frame gasket tabs are present, trim using a suitable tool flush to the engine block and ladder frame.
 - Apply a thin layer of sealant to the areas shown.



CAUTION: 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.

CAUTION: 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 <u>Specifications</u>

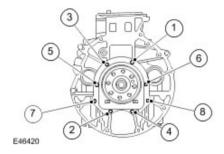


3 . **NOTE**:

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.



- ${\bf 5}$. Remove the crankshaft rear oil seal alignment sleeve.
- 6 . Install the flywheel. For additional information, refer to Flywheel (12.53.07)

Engine Front Cover (12.65.01)

Special Service Tools

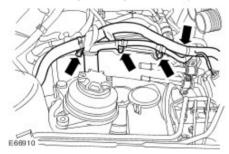


Aligner, Front Cover 303-682 (21-241)

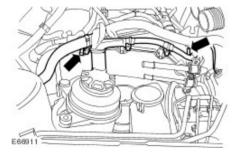
Removal

1 . Remove the engine front mount. For additional information, refer to Engine Front Mount (12.45.01)

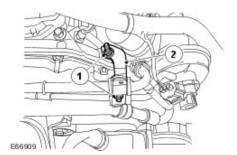
2 . Detach the engine wiring harness.



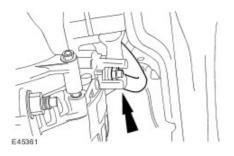
 ${\bf 3}$. Detach the engine wiring harness.



- 4. Remove the retaining bracket.
 - 1) Remove the retaining nuts.
 - 2) Remove the retaining bracket.



- Remove the crankshaft front seal.
 For additional information, refer to <u>Crankshaft Front Seal (12.21.14)</u>
- 6 . Detach the generator positive cable.



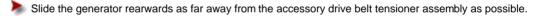
 $\ensuremath{\mathbf{7}}$. Disconnect the generator electrical connector.

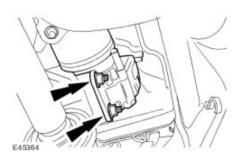


8 . Remove the generator upper retaining bolt.

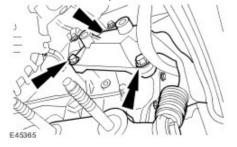


9 . Detach the generator.

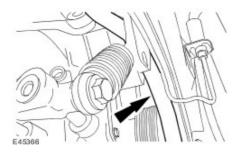




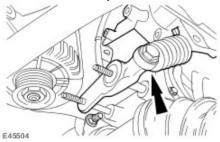
10 . Detach the accessory drive belt tensioner assembly.



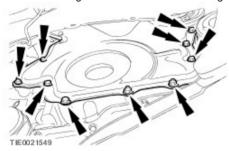
11 . Detach the accessory drive belt.



12 . Remove the accessory drive belt tensioner.



13 . Remove the engine front cover lower retaining nuts and bolts.



14 . Lower the vehicle.

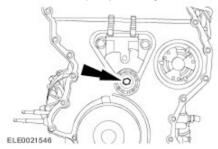
15 . **NOTE:**

Engine shown removed for clarity.

NOTE:

The idler pulley can not be removed until the engine mount bracket is removed.

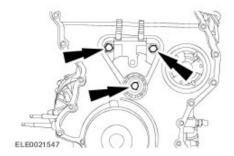
Remove the idler pulley retaining nut.



16 . **NOTE**:

Engine shown removed for clarity.

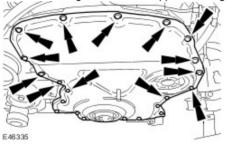
Remove the front engine mount bracket and idler pulley.



17 . **NOTE:**

Engine shown removed for clarity.

Remove the engine front cover upper retaining bolts.



18

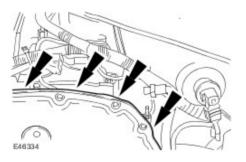
CAUTION: Avoid damage to the engine front cover mating face on the engine. Failure to follow this instruction may result in damage to the vehicle.

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

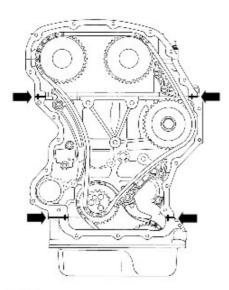
1. Clean the engine front cover mating faces.

2 🛕

CAUTION: A new engine front cover must be installed. Failure to follow this instruction may result in damage to the vehicle.

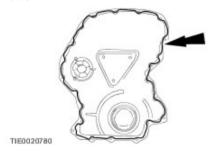
CAUTION: Install the engine front cover within five minutes of applying the sealer. Failure to follow this instruction may result in damage to the vehicle.

Apply a 3 mm (0.118 inch) bead of sealer to the four T-joints.



E100334

3. Apply a 3 mm (0.118 inch) bead of selaer to the engine front cover.



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.

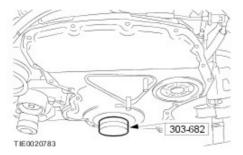
5 . Raise the vehicle.

6 . **NOTE**:

Engine shown removed for clarity.

Using the special tool, align the engine front cover.

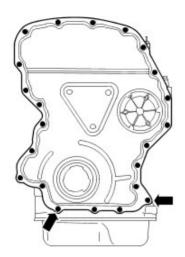
- Intall and tighten 2 engine front cover bolts to 6 Nm.
- Install and tighten the remaining 16 engine front cover bolts and 2 nuts to 6 Nm.
- Slacken the engine front cover bolts and nuts 360 degrees.
- Install the special tool.



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.

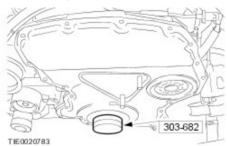


E100335

8 . **NOTE:**

Engine shown removed for clarity.

Remove the special tool.



9 . **NOTE**:

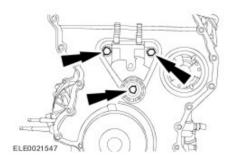
Engine shown removed for clarity.

NOTE:

Install the engine front mount bracket, the idler pulley and bolts as one item.

Install the front engine mount bracket and idler pulley.

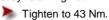
Tighten to 80 Nm.

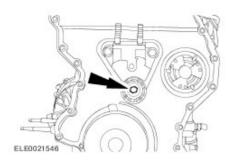


10 . **NOTE:**

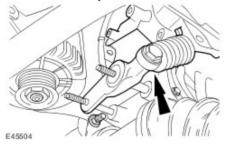
Engine shown removed for clarity.

Install the idler pulley retaining nut.

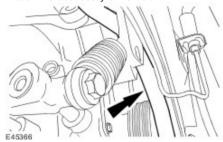




11 . Install the accessory drive belt tensioner.



12. Attach the accessory drive belt.



13 . Attach the accessory drive belt tensioner assembly.

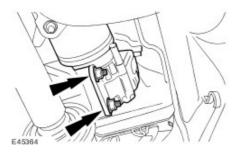
Tighten to 47 Nm.



14 . **NOTE:**

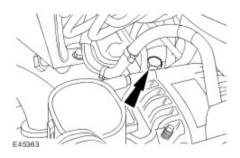
Do not tighten the generator retaining nuts at this stage.

Attach the generator.

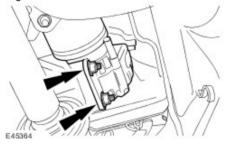


15 . Install the generator upper retaining bolt.

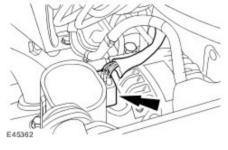




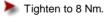
16 . Tighten to 47 Nm.

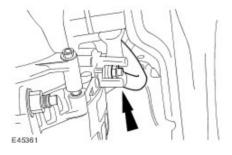


17 . Connect the generator electrical connector.



18 . Attach the generator positive cable.



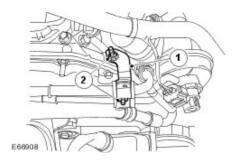


19 . Install the crankshaft front seal.

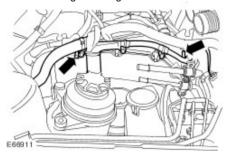
For additional information, refer to Crankshaft Front Seal (12.21.14)

20 . Install the retaining nuts.

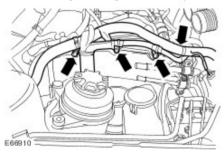
- 1) Install the retaining bracket.
- 2) Install the retaining nuts.



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 (12.45.01)

Engine Front Mount (12.45.01)

Special Service Tools



303-021

Engine support bracket 303-021



Engine lifting eye 303-1067

Removal

All vehicles

1 . Remove the oil level indicator.



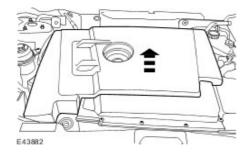
2 . Remove the oil filler cap.



3 . **NOTE**:

Install the oil filler cap and oil level indicator to prevent foreign material entering the valve cover.

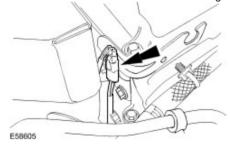
Remove the engine cover.



 ${\bf 4}$. Detach the wiring harness from the engine cover mounting bracket.



 ${\bf 5}$. Detach the electrical connector from the engine cover mounting bracket.



6 . Remove the engine cover mounting bracket.



7 . Install the special tool.





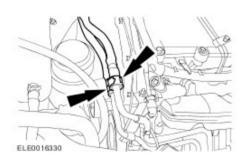
 $\boldsymbol{8}$. Using the special tool, support the engine and transmission assembly.



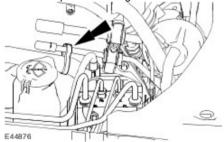
Vehicles built up to VIN:E43868

9 . Disconnect the fuel pump fuel supply and return lines.
For additional information, refer to Quick Release Coupling - Push Connect

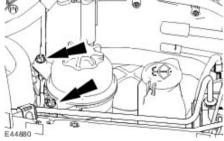




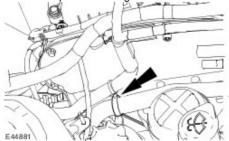
10 . Detach the power steering fluid hose from the fuel return line.



11 . Remove the power steering fluid reservoir retaining nuts.



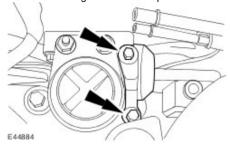
12 . Detach the power steering fluid reservoir.



13 . Secure the power steering fluid reservoir to one side.



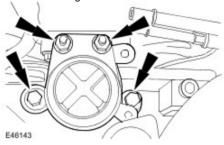
14 . Remove the engine mount damper.



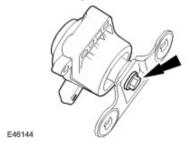
15 . **NOTE:**

Mark the position of the engine mount before removal.

Remove the engine mount and bracket assembly.



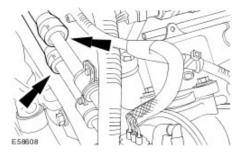
16 . Remove the engine mount.



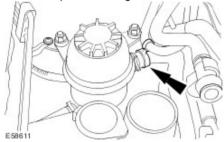
Vehicles built from VIN:E43869

17 . Disconnect the fuel pump fuel supply and return lines.
For additional information, refer to Quick Release Coupling - Push Connect

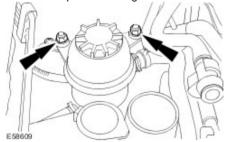
Install blanking plugs to the fuel pump fuel supply and return line male and female connectors.



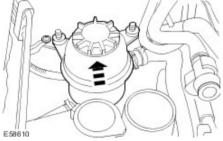
18 . Detach the power steering fluid hose from the fuel return line.



19 . Remove the power steering fluid reservoir retaining nuts.



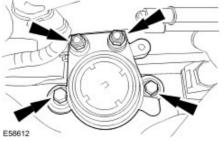
20 . Detach the power steering reservoir away from the power steering reservoir retaining bracket.



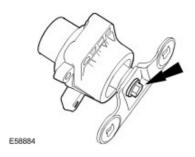
21 . **NOTE**:

Mark the position of the engine mount before removal.

Remove the engine mount and bracket assembly.



22 . Remove the engine mount.



Installation

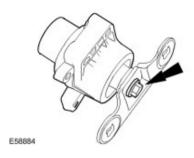
Vehicles built from VIN:E43869

1 . **NOTE**:

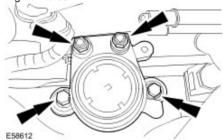
Clean the front engine mount mating faces.

To install, reverse the removal procedure.

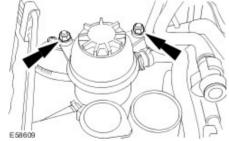




2 . Tighten to 80 Nm.



3 . Tighten to 10 Nm.

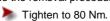


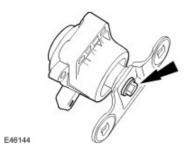
Vehicles built up to VIN:E43868

4 . **NOTE**:

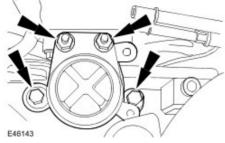
Clean the front engine mount mating faces.

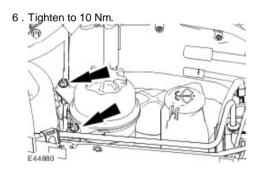
To install, reverse the removal procedure.



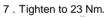


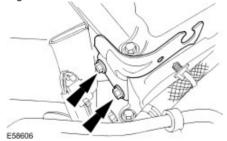
5 . Tighten to 80 Nm.





All vehicles





Flexplate (12.53.13)

Removal

- Disconnect the battery ground cable.
 For additional information, refer to Battery Disconnect and Connect
- 2. Raise and support the vehicle.
- 3 . Remove the transmission.
 For additional information, refer to <u>Transmission (44.20.01)</u>

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

1.

CAUTION: Make sure that new bolts are installed.

NOTE:

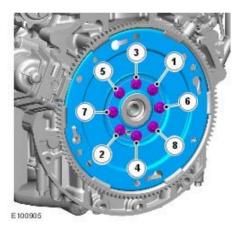
Some variation in the illustrations may occur, but the essential information is always correct.

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 <u>Transmission (44.20.01)</u>
- 3 . Connect the battery ground cable. For additional information, refer to Battery Disconnect and Connect

Flywheel (12.53.07)

Removal

- Remove the clutch disc and pressure plate.
 For additional information, refer to <u>Clutch Disc and Pressure Plate (12.53.13)</u>
- 2 . Remove the flywheel.
 - Discard the bolts.



TIE0012992

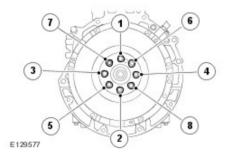
Installation

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 (12.53.13)

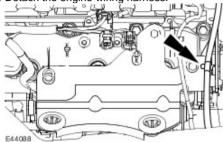
Intake Manifold (30.15.01)

Removal

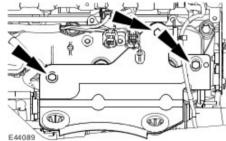
Remove the air cleaner assembly.

For additional information, refer to <u>Air Cleaner (19.10.05)</u>

2 . Detach the engine wiring harness

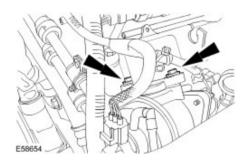


3 . Remove the air cleaner mount bracket.

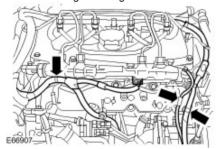


4. Detach the exhaust gas recirculation (EGR) valve from the intake manifold.



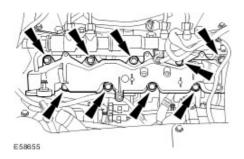


5 . Detach the engine wiring harness from the intake manifold.



6. Remove the intake manifold.

Remove and discard the intake manifold gaskets.



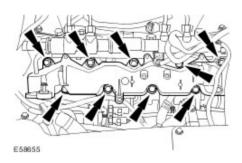
Installation

1 . **NOTE**:

Install new intake manifold gaskets.

To install, reverse the removal procedure.

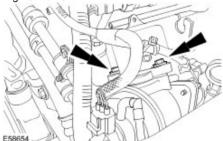




2 . **NOTE:**

Install a new EGR valve gasket.





Oil Pan (12.60.44)

Removal

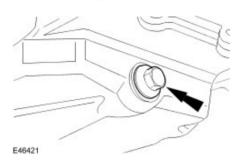
All vehicles

- 1 . Remove the air deflector.
 For additional information, refer to <u>Air Deflector 2.0L Diesel/2.2L Diesel (76.11.41)</u>
- 2 . Drain the engine oil.
- 3 . **NOTE**:

Install a new drain plug seal.

Install the drain plug.

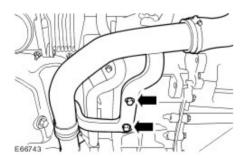




Vehicles with 2.2L diesel engine

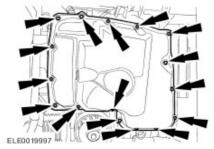
4 . Remove the charge air cooler intake pipe retaining bolts.





All vehicles

5 . Remove the oil pan retaining bolts.



CAUTION: A new oil pan must be installed. Failure to follow this instruction may cause damage to the vehicle.

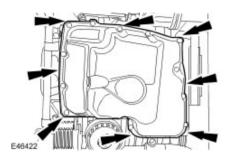
CAUTION: Avoid damage to the oil pan mating face of the engine. Failure to follow this instruction may cause damage to the vehicle.

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

CAUTION: Avoid damage to the oil pan mating face of the cylinder block. Failure to follow this instruction may cause damage to the vehicle.

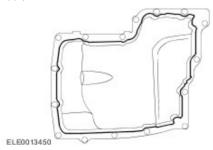
Clean the cylinder block mating faces.

2

CAUTION: A new oil pan must be installed. Failure to follow this instruction may cause damage to the vehicle.

CAUTION: Install the oil pan within five minutes of applying the sealer. Failure to follow this instruction may cause damage to the vehicle.

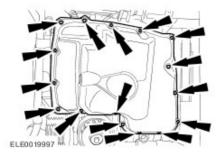
Apply a 3 mm bead of sealer WSE-M4G323-A4 to the oil pan.



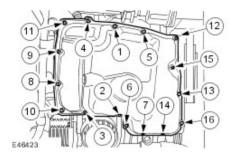
3 . **NOTE:**

Do not fully tighten the oil pan retaining bolts at this stage.

Install the oil pan.

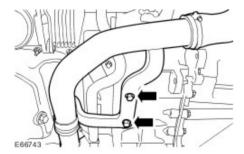


- 4 . Tighten the oil pan retaining bolts.
 - Tighten the bolts in the sequence shown in two stages.
 - Stage 1: Tighten bolts 1 through 16 to 7 Nm.
 - Stage 2: Tighten bolts 1 through 16 to 14 Nm.



Vehicles with 2.2L diesel engine

- 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 <u>Air Deflector 2.0L Diesel/2.2L Diesel (76.11.41)</u>
- 7. Lower the vehicle.
- 8 . Fill the engine with engine oil.

Timing Chain

Special Service Tools



Timing Tool, Crankshaft 303-698 (21-251)

Removal

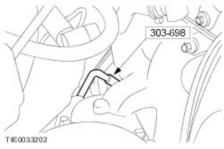
4

- 1 . Remove the engine front cover.
 For additional information, refer to Engine Front Cover (12.65.01)
- Remove the air cleaner outlet pipe.
 For additional information, refer to <u>Air Cleaner Outlet Pipe (19.10.31)</u>
- 3 . Remove the crankshaft position (CKP) sensor.
 For additional information, refer to Crankshaft Position (CKP) Sensor (18.30.12)
 - 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.

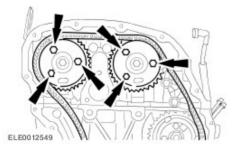
NOTE:

Make sure the crankshaft is only rotated in the normal direction of rotation.

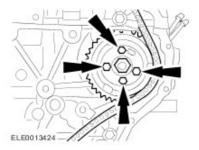
Turn the crankshaft to 50 degrees before top dead center (BTDC) and insert the special tool through the CKP sensor hole.



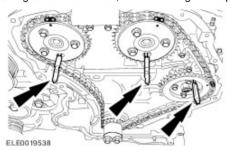
5. Loosen the camshaft sprocket retaining bolts.



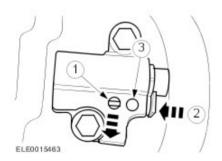
6. Loosen the fuel injection pump sprocket retaining bolts.



 $\boldsymbol{7}$. Using suitable 6 mm bar, lock the timing drive sprockets.



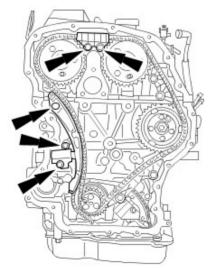
- 8 . Detension and lock the timing chain tensioner.
 - 1) Retract the pawl.
 - 2) Push the lock in.
 - 3) Insert a pin.



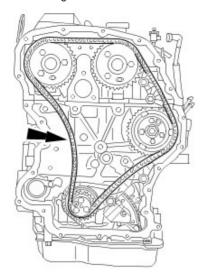
9 . **NOTE:**

Engine removed for clarity.

Remove the timing chain tensioner and guides.



10 . Remove the timing chain.

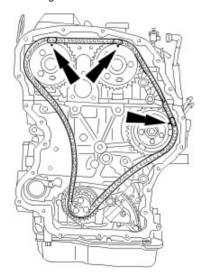


E46626

Installation

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.



E46627

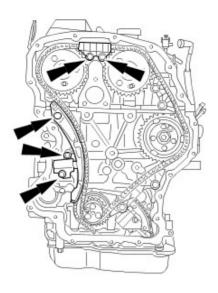
2
. CAUTION: Make sure the timing chain tensioner is fully retracted before installation. Failure to follow this instruction may result in damage to the vehicle.

NOTE:

Engine removed for clarity.

Install the timing chain tensioner and guides.

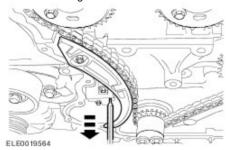
Tighten to 15 Nm.



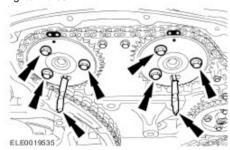
3 . **NOTE:**

Make sure the timing chain tensioner is completely released.

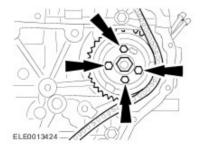
Unlock the timing chain tensioner.



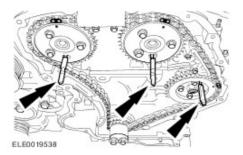
4 . Tighten to 35 Nm.



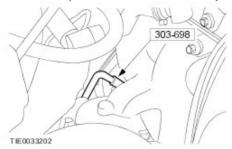
5 . Tighten to 33 Nm.



${\bf 6}$. Remove the suitable ${\bf 6}$ mm bar.



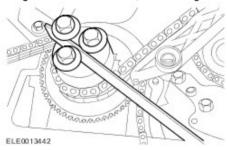
 ${\bf 7}$. Remove the special tool from the crankshaft position (CKP) sensor hole.



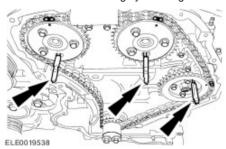
8 . **NOTE:**

Only turn the engine in the normal direction of rotation.

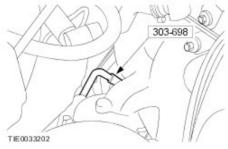
Using a suitable screwdriver, turn the engine clockwise two revolutions.



9. Check the camshaft timing by inserting a suitable 6 mm bar through the holes in the camshaft and fuel injection pump sprockets.



10 . Check the timing by inserting the special tool in the $\ensuremath{\mathsf{CKP}}$ sensor hole.



11 . Remove the special tool and the suitable 6 mm bar.

12 . Install the CKP sensor.
For additional information, refer to <u>Crankshaft Position (CKP) Sensor (18.30.12)</u>

13 . Install the air intake pipe.
For additional information, refer to Air Cleaner (19.10.05)

14 . Install the engine front cover.
For additional information, refer to Engine Front Cover (12.65.01)

Valve Cover

Special Service Tools



Aligner, Fuel Injector 303-711 (21-258)

Removal

WARNING: 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.

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

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.

WARNING: 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.

CAUTION: Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

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.

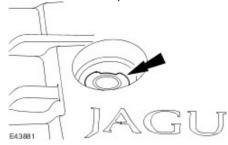
CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

CAUTION: 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.



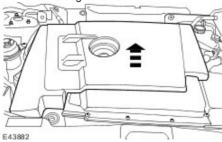
2. Remove the oil filler cap.



3 . **NOTE**:

Install the engine oil filler cap to prevent foreign material entering the valve cover.

Remove the engine cover.



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 <u>Fuel Injection Component Cleaning</u>

5 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.

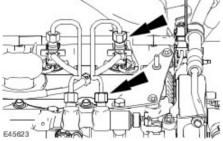
CAUTION: Make sure the tool used to loosen the high-pressure fuel supply line unions is used at the top of the unions as this is where there is most material. Failure to follow this instruction may result in damage to the unions.

CAUTION: 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.



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

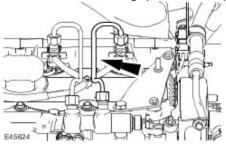
may result in foreign matter ingress to the fuel injection system.

Using the , 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 , 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.

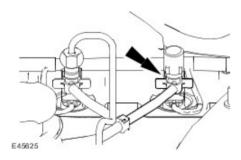
10 . **NOTE:**

One fuel return line shown other fuel return lines are similar.

Disconnect the fuel return line from the fuel injector.



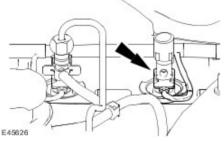
Discard the fuel return line O-ring seal.



11 . **NOTE**:

One fuel injector electrical connector shown other fuel injector electrical connectors are similar.

Disconnect the fuel injector electrical connector.

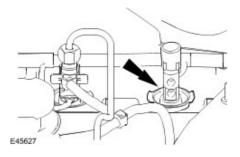


12 . **NOTE**:

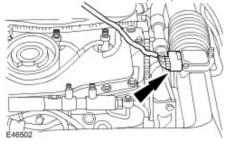
One fuel injector shown other fuel injectors are similar.

Remove the valve cover fuel injector seal.

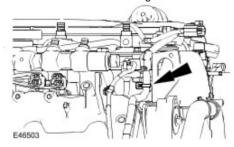
Discard the valve cover fuel injector seal.



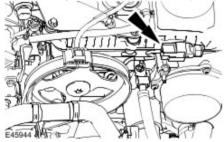
13 . Disconnect the mass air flow (MAF) sensor electrical connector.



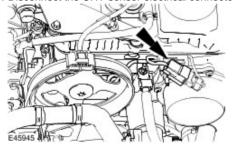
14 . Detach the starter motor wiring harness.



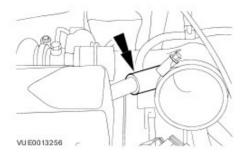
 ${\bf 15}$. Detach the cylinder head temperature (CHT) sensor electrical connector.



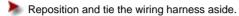
16 . Disconnect the CHT sensor electrical connector.

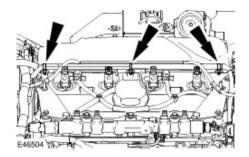


17 . Disconnect the positive crankcase ventilation (PCV) hose from the valve cover.



18 . Detach the starter motor and injector wiring harness.

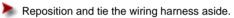


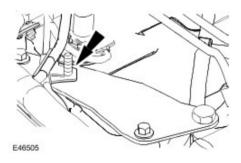


19 . **NOTE**:

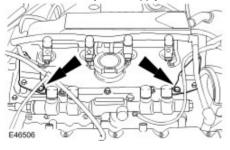
Right-hand shown left-hand similar.

Detach the mass air flow (MAF) sensor wiring harness.

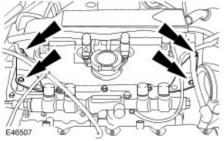




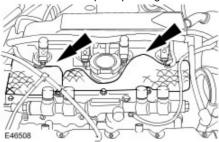
20 . Remove the fuel injection supply manifold retaining bolts.



21 . Remove the fuel injection supply manifold support brackets.

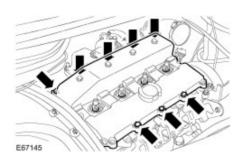


22. Remove the sound proof padding.



23. Remove the valve cover.

Remove and discard the valve cover gasket.



Installation

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

CAUTION: 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.

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.

CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

CAUTION: 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:

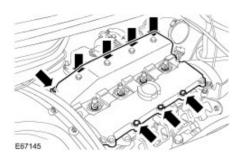
Install new fuel return line O-ring seals.

1 . **NOTE**:

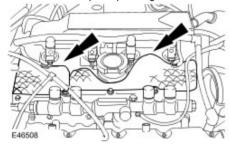
Install a new valve cover gasket.

Install the valve cover.



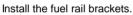


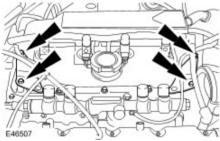
2 . Install the sound proof padding.



3 . **NOTE:**

Do not tighten the retaining bolts at this stage.

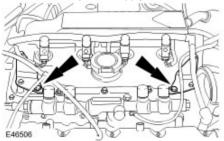




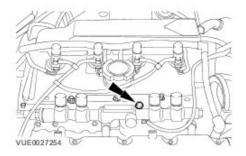
4 . **NOTE**:

Do not tighten the retaining bolts at this stage.

Install the fuel injection supply manifold retaining bolts.

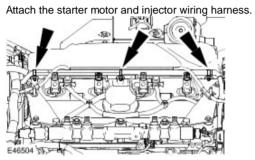


 ${\bf 5}$. Loosen the fuel injection supply manifold retaining bolt.



6 . **NOTE:**

Remove the tie strap.



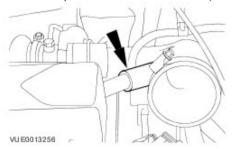
7 . **NOTE:**

Right-hand shown left-hand similar.

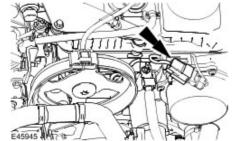
Attach the MAF sensor wiring harness.



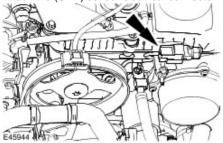
 $\boldsymbol{8}$. Connect the positive crankcase ventilation (PCV) hose to the valve cover.



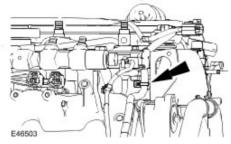
9 . Connect the CHT sensor electrical connector.



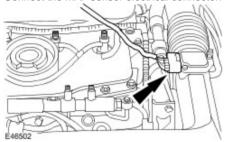
10 . Attach the (CHT) sensor electrical connector.



11 . Attach the starter motor wiring harness.



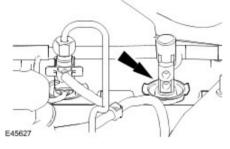
12 . Connect the MAF sensor electrical connector.



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 .



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.

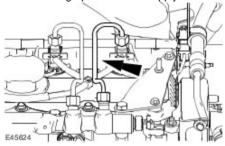
NOTE:

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.

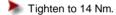
Install new high-pressure fuel supply lines

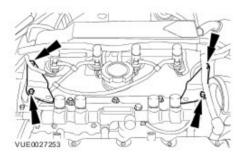


18 . **NOTE:**

High pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold support brackets retaining bolts.



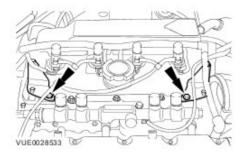


19 . **NOTE:**

High pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold retaining bolts.

Tighten to 23 Nm.

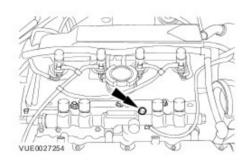


20 . **NOTE:**

High pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold retaining bolt.

Tighten to 23 Nm.



CAUTION: Make sure the special tool is clamped around the fuel injector which is being tightened and is resting up against the adjacent fuel injector.

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.

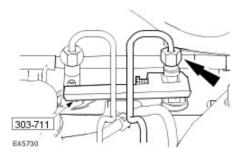
CAUTION: Make sure that the fuel injector does not move when tightening the high-pressure fuel supply lines. Failure to follow this instruction will result in damage to the fuel injector and the fuel injector sealing washer.

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.

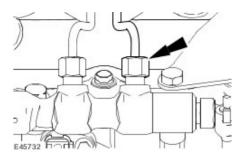
Tighten to 40 Nm.



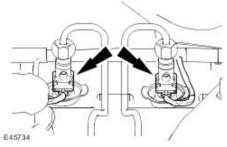
22 . Remove the special tool.

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.

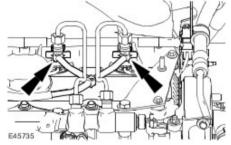
Tighten to 40 Nm.



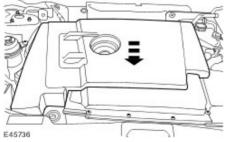
24 . Connect the fuel injector electrical connectors.



25 . Connect the fuel return lines to the fuel injectors.



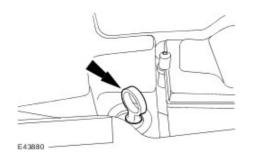
26 . Install the engine cover.



27 . Install the oil filler cap.



28 . Install the oil level indicator.



Engine

Special Service Tools



Engine stand 303-011



Universal Flange Holding Wrench 205-053



Adapter for 205-053-02 205-053-02



Timing Tool, Crankshaft 303-698



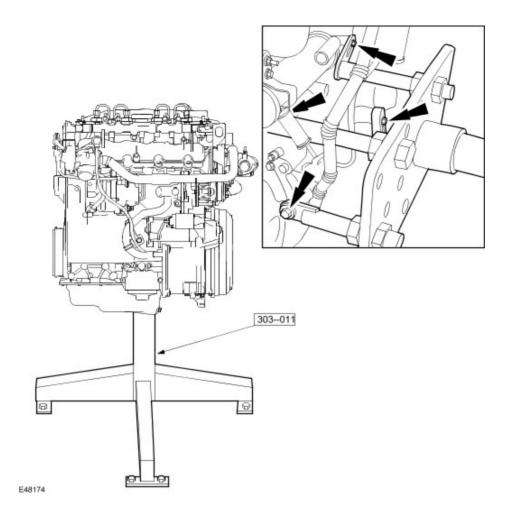
Remover, Fuel Injector 303-711



Remover/Installer, Cooling Hose Clamp 303-397

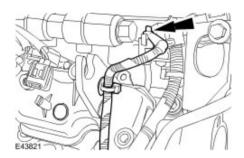
Disassembly

1 . Using the special tool, mount the engine to the engine stand.

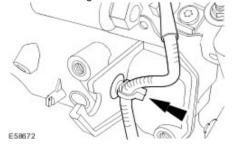


2 . Detach the glow plug wiring harness.

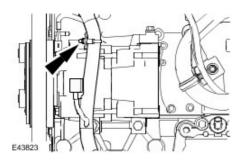
Remove the glow plug wiring harness securing nut.



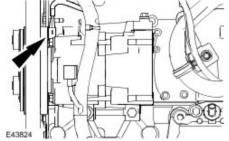
 ${\bf 3}$. Detach the wiring harness from the intake manifold.



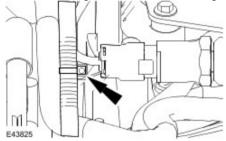
 ${\bf 4}$. Detach the wiring harness from the air conditioning (AC) compressor.



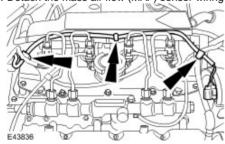
5 . Disconnect the AC compressor electrical connector.



6 . Detach the wiring harness from the retaining stud.



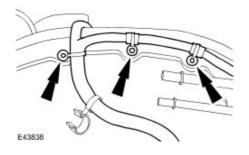
7. Detach the mass air flow (MAF) sensor wiring harness.



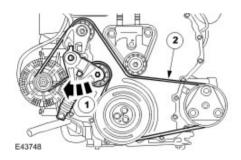
8 . Detach the generator wiring harness electrical connector.



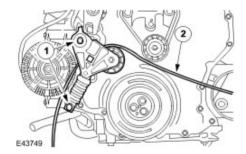
9 . Remove the wiring harness.



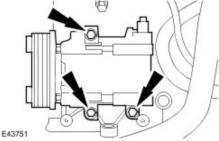
- 10 . Detach the accessory drive belt.
 - Reposition the accessory drive belt tensioner.
 - Detach the accessory drive belt.



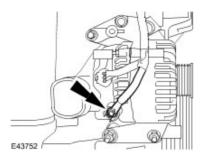
- 11 . Remove the accessory drive belt.
 - Remove the accessory drive belt tensioner.
 - Remove the accessory drive belt.



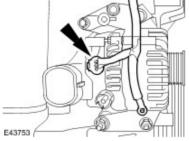
12 . Remove the AC compressor.



- 13 . Detach the generator electrical connector.
 - Remove the generator electrical connector securing nut.

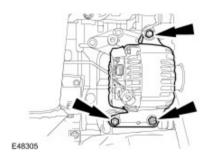


14 . Disconnect the generator electrical connector.

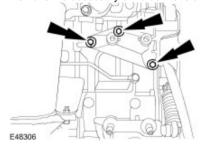


15 . Remove the generator.

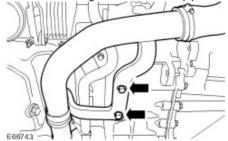
Remove the wiring harness support bracket from the generator upper retaining bolt.



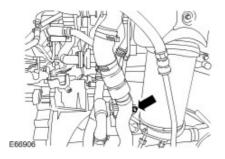
16 . Remove the accessory drive belt tensioner bracket.



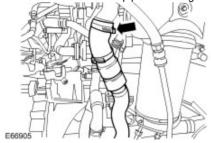
17 . Remove the charge air cooler intake pipe retaining bolts.



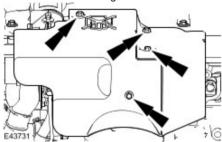
18 . Remove the turbo outlet pipe retaining bolt.



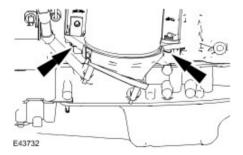
19 . Remove the turbo outlet pipe and charge air cooler intake pipe assembly.



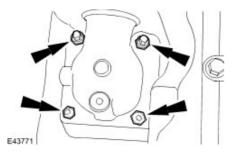
20 . Remove the turbocharger heat shield.



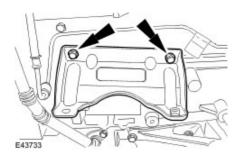
- 21 . Remove the catalytic converter retaining bolts.
 - Remove the catalytic converter securing bracket.



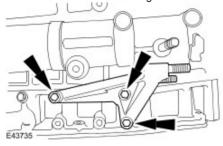
- 22 . Remove the catalytic converter.
 - Remove and discard the retaining nuts.



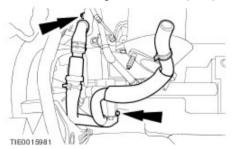
23 . Remove the catalytic converter retaining bracket.



24 . Remove the halfshaft retaining bracket.



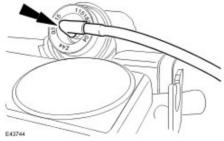
25 . Remove the exhaust gas recirculation (EGR) cooler coolant hose.



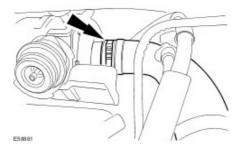
26 . Using the special tool, remove the water pump hoses.



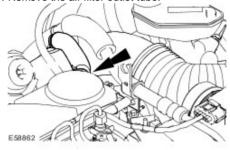
 $\ensuremath{\mathbf{27}}$. Disconnect the turbocharger vacuum hose.



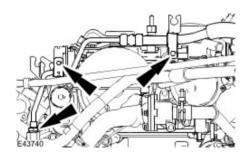
28 . Remove the air filter outlet tube retaining clip.



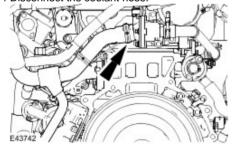
29 . Remove the air filter outlet tube.



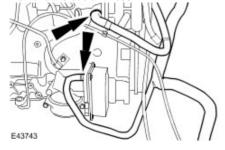
- 30 . Remove the power assisted steering high-pressure pipe.
 - Discard the O-ring seal.



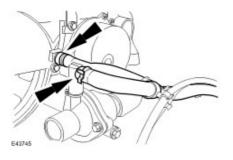
31 . Disconnect the coolant hose.



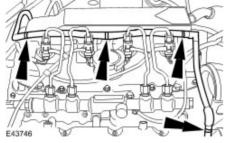
32 . Remove the coolant hose.



33 . Remove the coolant hose.

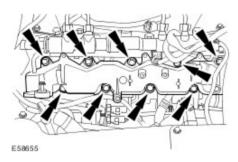


34 . Remove the starter motor to generator wiring harness.

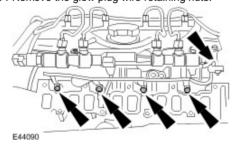


35 . Remove the intake manifold.

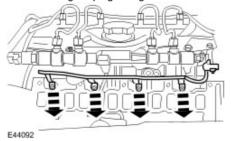
Remove and discard the intake manifold gaskets.



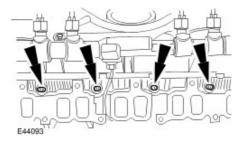
 $36\ .$ Remove the glow plug wire retaining nuts.



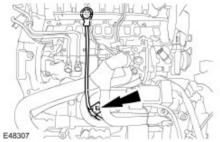
37 . Remove the glow plug wiring harness.



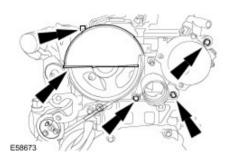
38 . Remove the glow plugs.



39 . Remove the oil level indicator and tube.



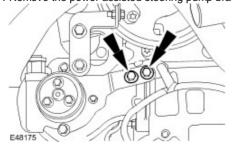
- 40 . Remove the brake vacuum pump retaining bolts.
 - Remove the power steering pump belt cover.



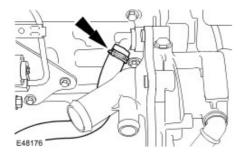
- 41 . Remove the power steering pump belt.
 - Rotate the power steering pump belt tensioner clockwise.



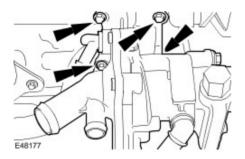
42 . Remove the power assisted steering pump bracket retaining bolts.



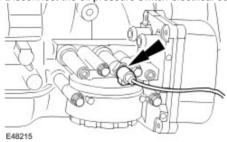
43 . Disconnect the coolant hose from the water pump.



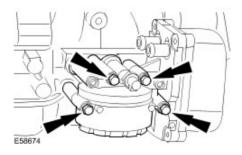
- 44 . Remove the water pump and power assisted steering pump assembly.
 - Remove and discard the gasket.



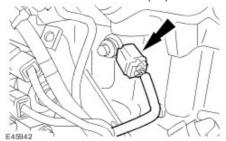
45 . Disconnect the oil pressure switch electrical connector.



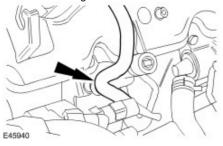
- 46 . Remove the oil filter housing.
 - Remove and discard the oil filter.
 - Remove and discard the O-ring seals.



47 . Disconnect the knock sensor (KS) electrical connector.



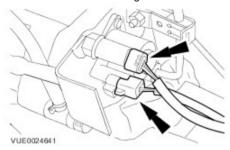
48 . Detach the wiring harness.



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.



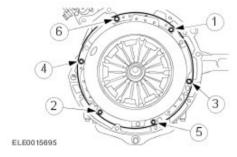
50 .

 Λ

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.

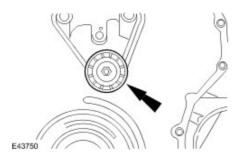


51 . Remove the flywheel.

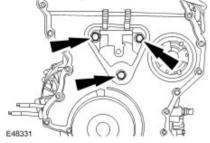
Remove and discard the retaining bolts.



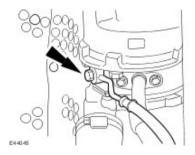
TIE0012992



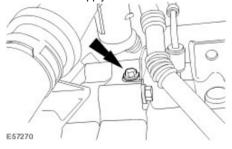
53 . Remove the engine front mount bracket.



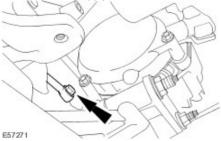
- 54 . Disconnect the oil supply tube from the turbocharger.
 - Remove and discard the sealing washers.



55 . Detach the oil supply tube.

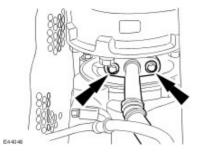


56 . Remove the oil supply tube.



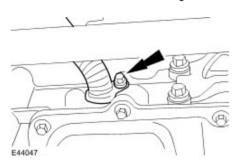
 $\ensuremath{\mathsf{57}}$. Disconnect the oil return tube from the turbocharger.

• Remove and discard the gasket.

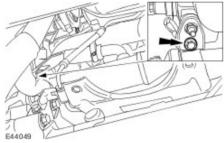


58 . Remove the oil return tube.

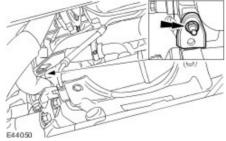
Remove and discard the O-ring seal.



59 . Remove the EGR cooler mount bracket retaining bolt.



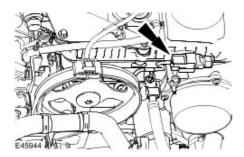
60 . Remove the EGR cooler mount bracket.



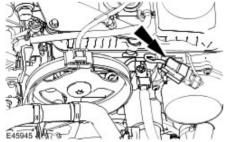
61 . Remove the exhaust manifold.

Remove and discard the retaining bolts and nuts.

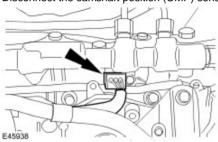




63 . Disconnect the CHT sensor electrical connector.



64 . Disconnect the camshaft position (CMP) sensor electrical connector.



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.

CAUTION: 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.

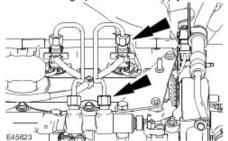
CAUTION: Make sure that the fuel injector does not move when loosening the high-pressure fuel supply lines. Failure to follow this instruction will result in damage to the fuel injector and the fuel injector sealing washer.

NOTE:

65

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

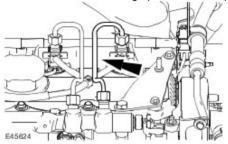
CAUTION: Make sure that the high-pressure fuel supply line remains in contact with both the fuel injector and the fuel injection supply manifold until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

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.



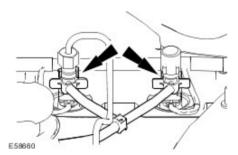
- 68. Using the pneumatic vacuum gun, vacuum foreign material from the fuel injector and the fuel injection supply manifold.
- 69 . Install blanking caps to the open threaded ports on the fuel injector and the fuel injection supply manifold.

70 . **NOTE**:

Injector number 4 shown, injector numbers 1, 2 and 3 similar.

Disconnect the fuel return lines from the fuel injectors.

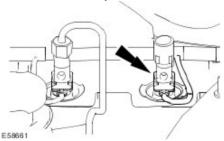
Discard the fuel return line O-ring seals.



71 . **NOTE**:

Injector number 4 shown, injector numbers 1, 2 and 3 similar.

Disconnect the fuel injector electrical connector.

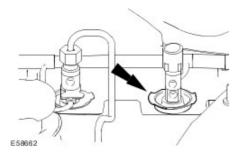


72 . **NOTE**:

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.



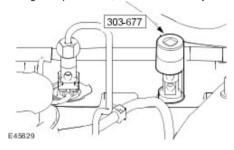
73

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.

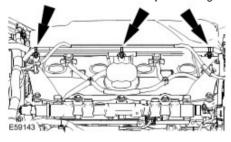
NOTE:

Injector number 4 shown, injector numbers 1, 2 and 3 similar.

Using the special tool, remove the fuel injector.

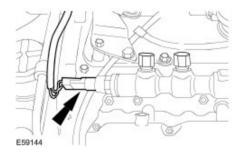


74. Detach the starter motor and injector wiring harness.



75 . Remove the wiring harness.

Disconnect the fuel pressure sensor electrical connector.



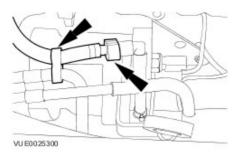
76

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

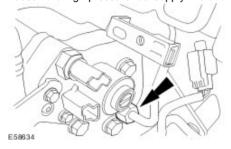
CAUTION: Make sure that the high-pressure fuel supply line remains in contact with both the fuel injector and the fuel injection supply manifold until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Using the pneumatic vacuum gun, vacuum foreign material from the high-pressure fuel supply line, the fuel injector and the fuel injection supply manifold.

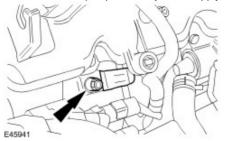
CAUTION: Make sure the tool used to loosen the high-pressure fuel supply line union is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

CAUTION: 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

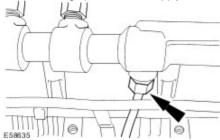
CAUTION: Make sure the tool used to loosen the high-pressure fuel supply line union is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

CAUTION: 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

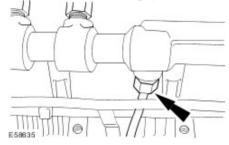
matter ingress to the fuel injection system.

CAUTION: While maintaining the pressure on the high-pressure fuel supply line, clean and vacuum foreign material from the line and union.

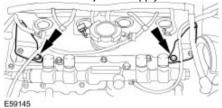
Loosen the high-pressure fuel supply line at the fuel injection supply manifold.



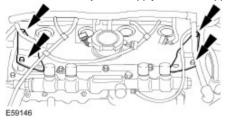
83 . Remove and discard the high pressure fuel supply line.



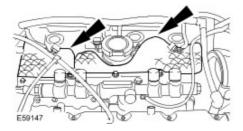
- 84 . Install blanking caps to the open threaded ports on the fuel pump and the fuel injection supply manifold.
- 85 . Clean the fuel injection supply manifold and surrounding areas. For additional information, refer to Fuel Injection Component Cleaning
- 86 . Remove the fuel injection supply manifold retaining bolts.



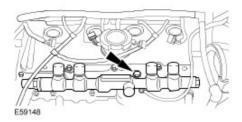
87 . Loosen the fuel injection supply manifold support brackets.



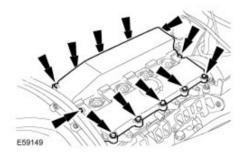
88 . Remove the sound proof padding.



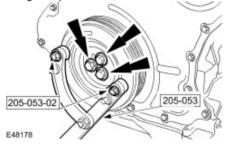
89 . Remove the fuel injection supply manifold.



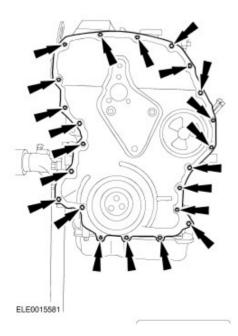
- 90 . Remove the valve cover.
 - Remove and discard the valve cover gasket.



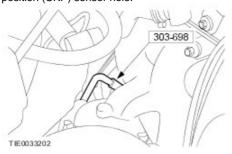
91 . Using the special tools, remove the crankshaft damper.



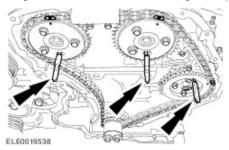
- 92 . Remove and discard the engine front cover.
 - Remove the engine front cover retaining nuts and bolts.



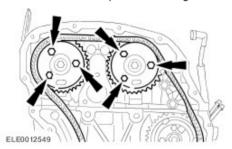
93 Turn the crankshaft to 50 degrees before top dead center (BTDC) and insert the special tool 303-698, through the crankshaft . position (CKP) sensor hole.



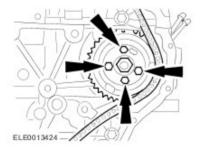
94 . Using suitable 6 mm bar, lock the timing drive sprockets.



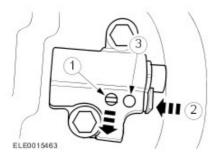
95 . Loosen the camshaft sprocket retaining bolts.



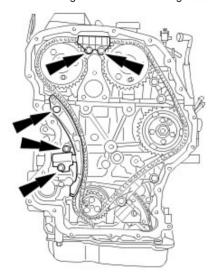
 $96\ .$ Loosen the fuel injection pump sprocket retaining bolts.



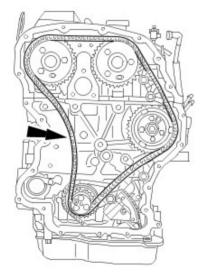
- 97 . Using a suitable tool, retain the timing chain tensioner piston.
 - 1. Retract the pawl.
 - 2. Push the lock in.
 - 3. Insert a pin.



 $98\ .$ Remove the timing chain tensioner and guides.

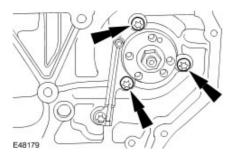


99 . Remove the timing chain.

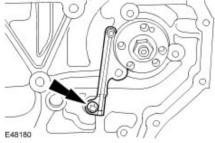


E46626

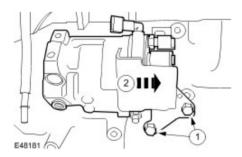
100 . Remove the high-pressure fuel pump retaining bolts.



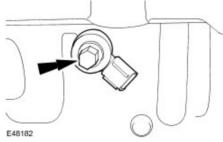
101 . Remove the timing chain oil feed pipe.



- 102 . Remove the high-pressure fuel pump.
 - Remove the retaining bolts.
 - Remove the high-pressure fuel pump.

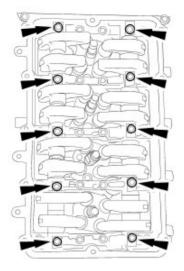


103 . Remove the KS.



104 . Remove the rocker shafts.

Remove and discard the retaining bolts.



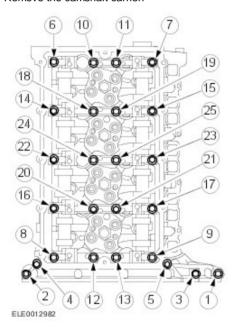
ELE0015429

105 .



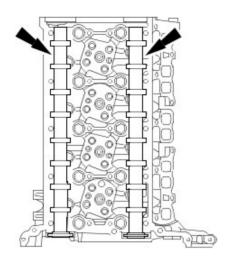
CAUTION: Remove the camshaft carrier bolts in the sequence shown.

Remove the camshaft carrier.



106 . Remove the camshafts.

Remove and discard the intake camshaft rear oil seal.



E48216

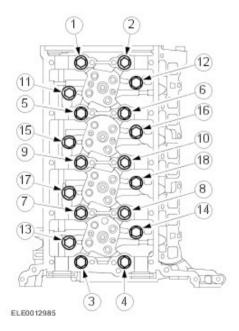
107.



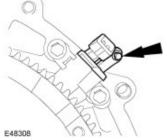
CAUTION: Remove the cylinder head bolts in the sequence shown.

Remove the cylinder head.

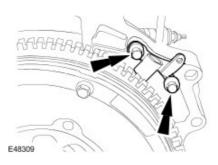
Remove and discard the cylinder head gasket and the bolts.



108 . Remove the CKP sensor.

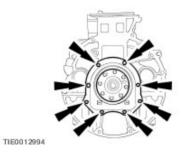


109 . Remove the CKP sensor bracket.



Do not discard the crankshaft rear oil seal carrier.

Remove the crankshaft rear oil seal carrier.



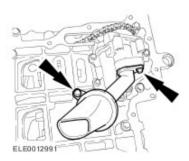
111 . Remove and discard the oil pan.

Remove the oil pan retaining nuts and bolts.



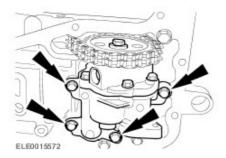
112 . Remove the oil pump pickup tube.

Remove and discard the O-ring seal.



113 . Remove the oil pump.

Remove the chain from the crankshaft sprocket.



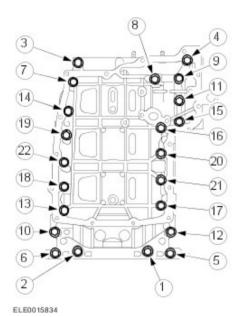
114.



CAUTION: Remove the ladder frame bolts in the sequence shown.

Remove the ladder frame.

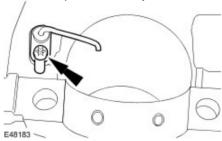
Remove and discard the ladder frame gasket.



115 . **NOTE:**

One piston oil cooler jet shown, other piston oil cooler jets similar.

Remove the piston oil cooler jets.

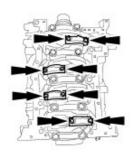


116.



CAUTION: Keep the connecting rod bearing caps in order for installation.

Remove the connecting rod bearing caps.



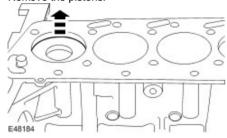
ELE0012996

117.



CAUTION: Match the piston and connecting rods to the connecting rod caps.

Remove the pistons.

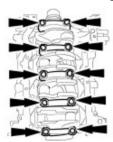


118 .



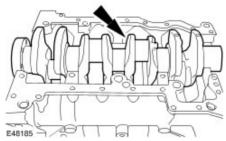
CAUTION: Keep the crankshaft main bearing caps in order for installation.

Remove the crankshaft main bearing caps.



ELE0013006

119 . Remove the crankshaft.



Engine

Special Service Tools



Piston ring compressor 303-372



Universal Flange Holding Wrench 205-053



Adapter for 205-053 205-053-02



Bedplate alignment plate 303-1095



Remover/Installer Crankshaft Front Oil Seal 303-679



Aligner, Engine Front Cover 303-682



Timing Tool, Crankshaft 303-698



Aligner, Fuel Injector 303-711



Oil seal installer 308-417



Pointer, top dead center (TDC) 303-1094



Remover/Installer, Cooling Hose Clamp 303-397



Engine stand 303-011

Assembly

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

CAUTION: 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.

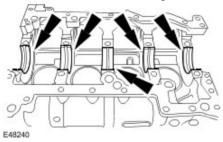
CAUTION: Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

1. Clean the mating faces of the cylinder head and cylinder block with suitable metal surface cleaner.

2 . **NOTE**:

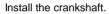
Lubricate the crankshaft main bearing shells with clean engine oil.

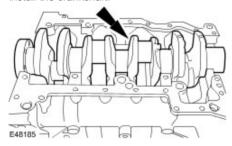
Install the crankshaft main bearing shells.



3 . **NOTE:**

Lubricate the crankshaft and the crankshaft main bearing shells with clean engine oil.





4.

CAUTION: Assemble caps with arrows pointing forward. Caps are identified from front to rear, F, 2, 3, 4, R.



CAUTION: Crankshaft main bearing cap bolts must only be used four times.



CAUTION: 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.

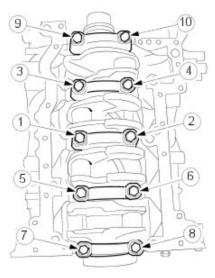
Stage 1: 45 Nm.

•

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.

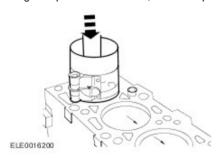
NOTE:

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.



7 . Lubricate the connecting rod bearing shells with clean engine oil.

3.



CAUTION: Connecting rod bearing cap bolts must only be used four times.



CAUTION: 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.

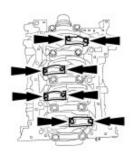
Install the connecting rod bearing caps.

Tighten the bolts in two stages.

•

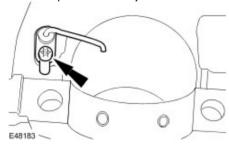
•

Stage 2: 80 degrees.



ELE0012996

9 . Install the piston oil cooler jets.



10.



CAUTION: Do not trim or damage protruding foam pads.

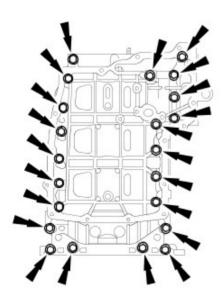
NOTE:

Install new ladder frame gaskets.

NOTE:

Do not fully tighten the ladder frame retaining nuts and bolts at this stage.

Install the ladder frame.

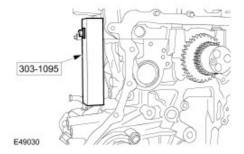


ELE0018513

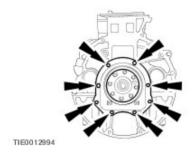
11

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.

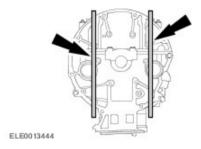


12 . Install the old crankshaft rear seal and carrier.



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.

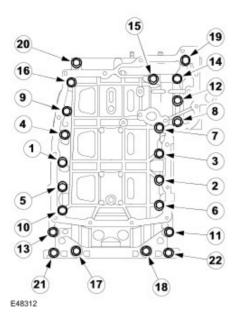


14 . **NOTE**:

Tighten the nuts and bolts in the sequence shown.

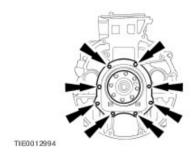
Tighten the ladder frame nuts and bolts.

• Tighten to 23 Nm.



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:

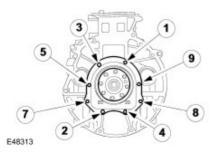
A new crankshaft rear oil seal carrier is supplied with an alignment sleeve that must be removed following installation.

NOTE:

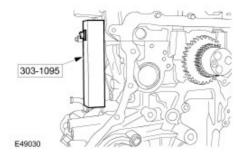
Tighten the nuts and bolts in the sequence shown.

Install the crankshaft rear oil seal carrier.

Tighten to 10 Nm.

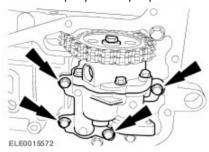


17 . Remove the special tool.

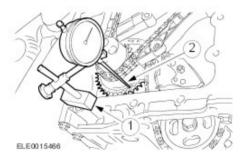


Do not fully tighten the oil pump retaining bolts at this stage.

Install the oil pump and oil pump chain.



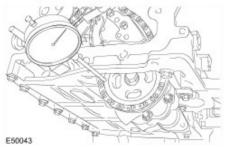
- 19 . Using a suitable dial indicator gauge take a reference measurement from the front face of the crankshaft sprocket.
 - Position the dial gauge holding fixture on the cylinder block.
 - Position the dial indicator gauge plunger on the crankshaft sprocket and set the dial to zero.



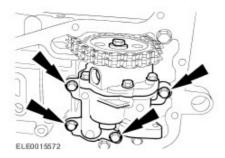
20 . **NOTE:**

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.

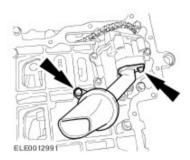


- 23 . Check the alignment of the oil pump sprocket with the crankshaft sprocket. Repeat the alignment procedure if necessary.
- 24 . Install the oil pump tensioner.

Install a new O-ring seal.

Install the oil pump pickup tube.

Tighten to 10 Nm.



26 .



CAUTION: A new oil pan must be installed



CAUTION: 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.

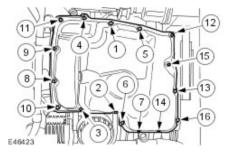


Tighten the bolts in the sequence shown in two stages.

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.

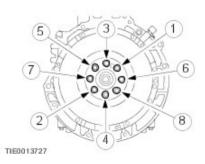
Install the flywheel.

Stage 1: 25 Nm.

• Stage 2: 40 Nm.

Olago Z. 40

Stage 3: 48 degrees.

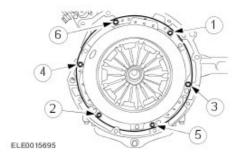


30 . **NOTE:**

Tighten the retaining bolts in the sequence shown.

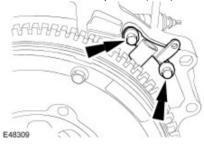
Install the clutch disc and pressure plate.

Tighten to 29 Nm.



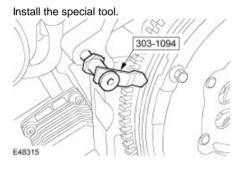
Do not fully tighten the crankshaft position sensor bracket retaining bolts at this stage.

Install the crankshaft position (CKP) sensor bracket.

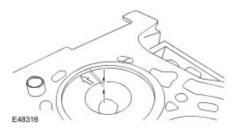


32 . **NOTE:**

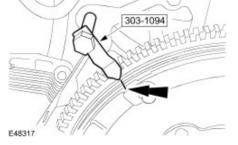
After installation do not move the special tool.



33 . Rotate the crankshaft until piston number one is approximately 10 mm before top dead center (TDC).



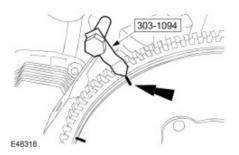
- 34 . Zero the dial indicator gauge.
- 35 . Mark the position on the flywheel primary mass.



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.

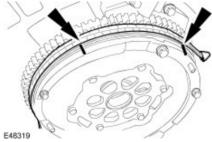


37 . Repeat the previous steps to make sure that the marking is correct.

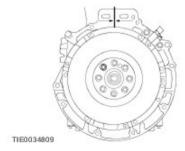
38 . **NOTE:**

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.

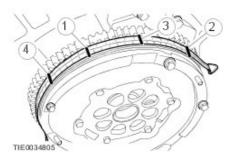
Multiply the circumference by 0.1388.

First mark.

Second mark.

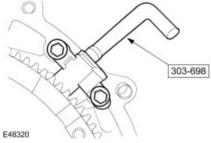
Determined TDC.

Determined 50 degrees before top dead center (BTDC).



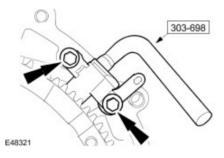
Rotate the crankshaft in the normal direction of rotation to the mark of the calculated 50 degrees BTDC.

Install the special tool 303-698.



43 . Tighten the CKP sensor bracket retaining bolts.

Tighten to 23 Nm.

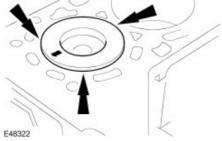


44 . Clean the cylinder block mating face and the piston.

45 . **NOTE:**

Measure the piston protrusion of each cylinder at top dead center (TDC).

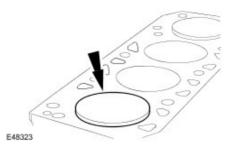
Measure the distance between the piston crown and the cylinder block at the points indicated.



46 . **NOTE**:

The largest measurement determines the choice of the cylinder head gasket.

Using a suitable tool, measure the piston protrusion.

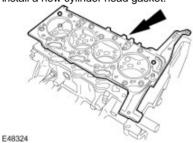


47 . Determine the cylinder head gasket thickness. For additional information, refer to **Specifications**

48

CAUTION: The thickness of the new cylinder head gasket depends on the piston protrusion (hole/tooth marked).

Install a new cylinder head gasket.





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.

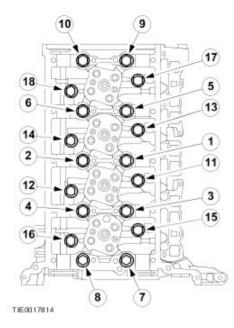
Stage 2: Tighten bolts 11 through 18 to 10 Nm.

Stage 3: Tighten bolts 1 through 10 to 40 Nm.

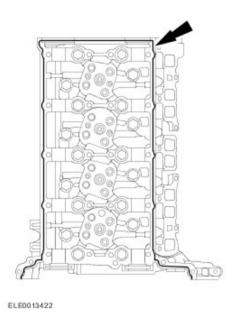
Stage 4: Tighten bolts 11 through 18 to 20 Nm.

Stage 5: Tighten bolts 1 through 10 to 180 degrees.

Stage 6: Tighten bolts 11 through 18 to 180 degrees.

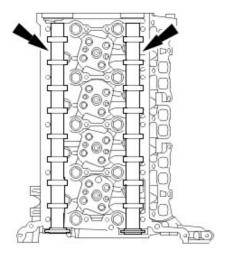


50 . Apply a 2.5 mm diameter bead of sealer WSE-M4G323-A4 to the mating face of the cylinder head.



51 . Remove the camshafts.

Remove and discard the intake camshaft rear oil seal.



E48216

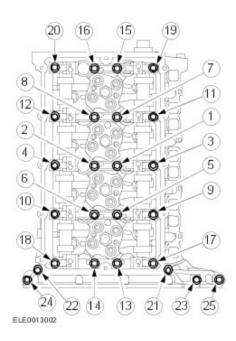
52 . **NOTE:**

Tighten the bolts in the sequence shown in two stages.

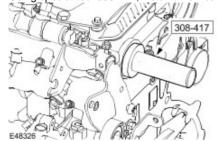
Install the camshaft carrier.

Stage 1: Tighten bolts 1 through 22 to 23 Nm.

• Stage 2: Tighten bolts 23 through 25 to 10 Nm.

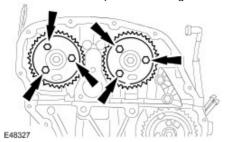


53 . Using special tool 308-417, install a new camshaft rear seal.



Do not fully tighten at this stage.

Install the camshaft sprocket retaining bolts.



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:

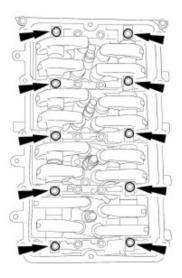
Tighten the bolts in two stages.

Install the rocker shafts.

Stage 1: 13 Nm.

•

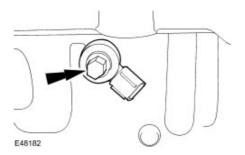
Stage 2: 45 degrees.



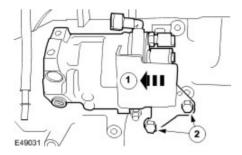
ELE0015429

56 . Install the knock sensor (KS).

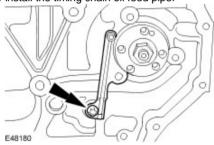
• Tighten to 20 Nm.



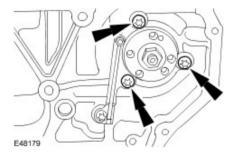
- 57 . Install the high-pressure fuel pump.
 - Install the high-pressure fuel pump.
 - Tighten to 33 Nm..



58 . Install the timing chain oil feed pipe.



- 59 . Install the high-pressure fuel pump retaining bolts.
 - Tighten to 22 Nm.



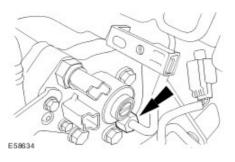
60



CAUTION: Do not tighten the high-pressure fuel supply line union at this stage.

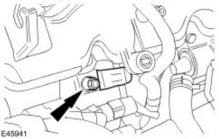
CAUTION: Maintain pressure on the high-pressure fuel supply line to keep the olive in contact with the fuel pump cone while hand installing the union. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Install a new high-pressure fuel supply line to the fuel pump.



Do not tighten the retaining nut at this stage.

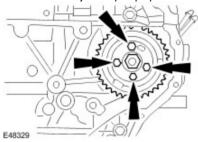
Install the high-pressure fuel pump pipe retaining bracket.



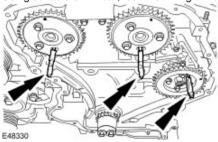
62 . **NOTE:**

Do not tighten the retaining bolts at this stage.

Install the fuel injection pump sprocket.



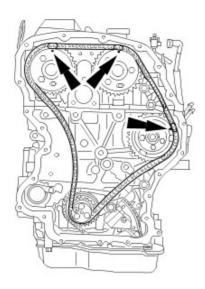
63 . Using suitable 6 mm bar, lock the timing drive sprockets.



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.



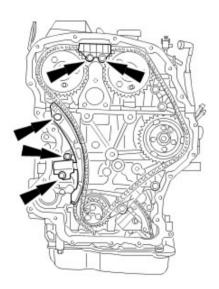
E46627

65

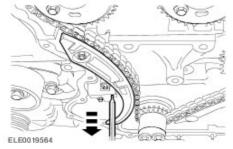
CAUTION: Make sure the timing chain tensioner is fully retracted before installation. Failure to follow this instruction may result in damage to the vehicle.

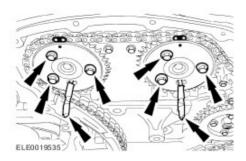
Install the timing chain tensioner and guides.

Tighten to 14 Nm.

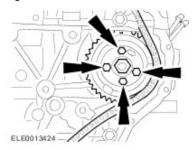


 ${\bf 66}$. Unlock the timing chain tensioner.

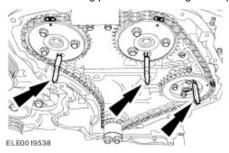




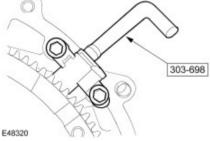
68 . Tighten to 33 Nm.



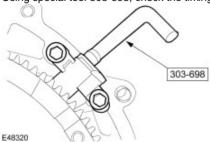
69 . Remove the locking pins from the timing drive sprockets.



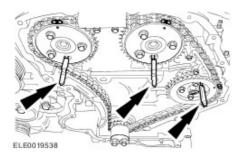
70 . Remove the special tool 303-698.



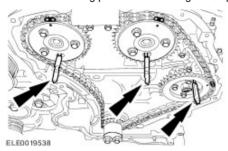
- 71 . Rotate the crankshaft two revolutions.
- 72 . Using special tool 303-698, check the timing by inserting the special tool in the CKP sensor hole.



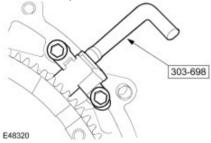
73 . Check the camshaft timing by inserting a suitable 6 mm bar through the holes in the camshaft and fuel injection pump sprockets.



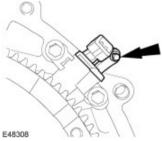
74 . Remove the locking pins from the timing drive sprockets.



75 . Remove the special tool.



76 . Install the CKP sensor.



77 .



CAUTION: Install the engine front cover within five minutes of applying the sealer.

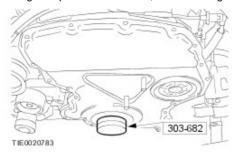
NOTE:

Install a new engine front cover.

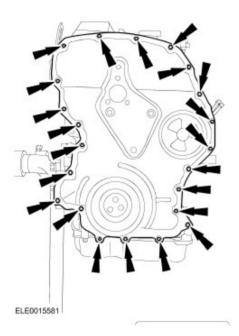
Apply a 3 mm diameter bead of sealer WSE-M4G323-A4 to the engine front cover.



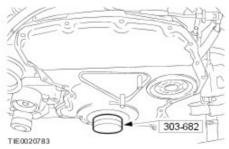
78 . Using the special tool 303-682, install the engine front cover.



- 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.



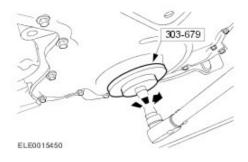
81 . **NOTE:**

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.

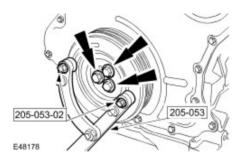


New crankshaft pulley bolts must be installed.

Using the special tools 205-053 and 205-053-02, install the crankshaft damper.

Stage 1: 45 Nm.

Stage 2: 120 degrees.

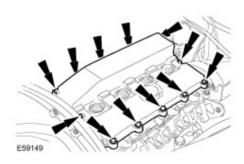


83 . **NOTE**:

Install a new valve cover gasket.

Install the valve cover.

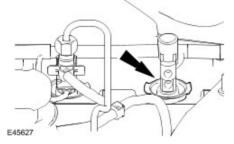
Tighten to 10 Nm.



84 . **NOTE**:

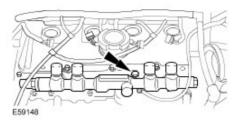
One valve cover fuel injector seal shown, other valve cover fuel injector seals similar.

Install new valve cover fuel injector seals.

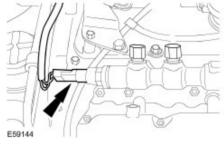


Do not fully tighten the fuel injection supply manifold retaining bolt at this stage.

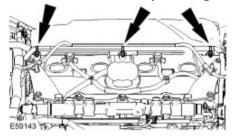
Install the fuel injection supply manifold.



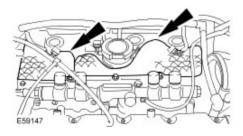
86 . Connector the fuel pressure sensor electrical connector.



87 . Attach the starter motor and injector wiring harness.



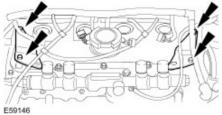
88 . Install the sound proof padding.



89 . **NOTE:**

Do not fully tighten the fuel injection supply manifold support bracket bolts at this stage.

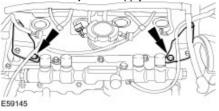
Install the fuel injection supply manifold support brackets.



90 . **NOTE**:

Do not fully tighten the fuel injection supply manifold retaining bolts at this stage.

Install the fuel injection supply manifold retaining bolts.



91. Using a suitable multipurpose lubricant spray, lubricate the new high-pressure fuel supply line union threads.



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:

92

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.

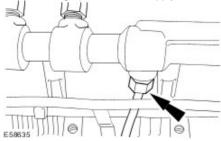
94



CAUTION: Do not tighten the high-pressure fuel supply line union at this stage.

CAUTION: 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.

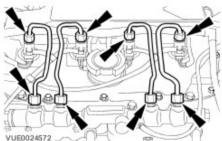
NOTE:

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.

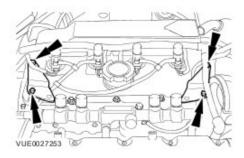


99 . **NOTE:**

High-pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold support brackets.

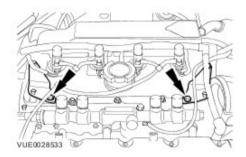
Tighten to 14 Nm.



High-pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold retaining bolts.

Tighten to 23 Nm.



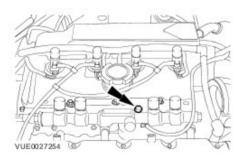
101 . **NOTE:**

102

High-pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold retaining bolt.

Tighten to 23 Nm.



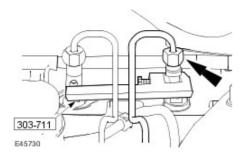
CAUTION: Make sure the special tool is clamped around the fuel injector which is being tightened and is resting up against the adjacent fuel injector.

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.

CAUTION: 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.



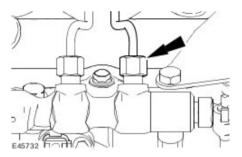
103 . Remove the special tool.

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**:

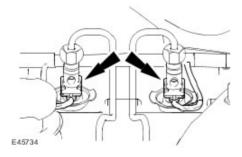
Cylinders three and four fuel injectors shown, cylinders one and two fuel injectors similar.

NOTE:

Install new O-ring seals.

Install the wiring harness.

Connect the fuel injector electrical connectors.



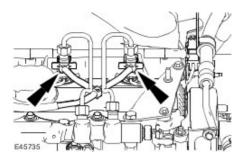
107 . **NOTE**:

Cylinders three and four fuel injectors shown, cylinders one and two fuel injectors similar.

NOTE:

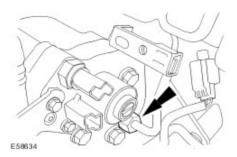
Install new O-ring seals.

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.

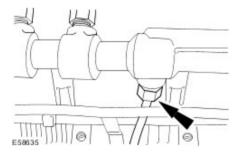


CAUTION: Make sure the tool used to tighten the high pressure fuel supply line union is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

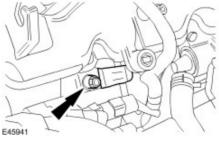
Tighten the high pressure fuel supply line union at the fuel injection supply manifold.

Tighten to 40 Nm.

109



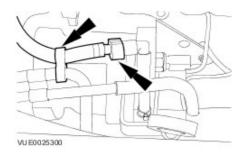
110 . Tighten to 8 Nm.



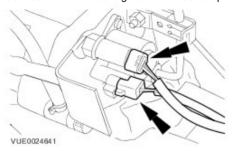
111 . **NOTE**:

Remove the blanking plugs from the fuel injector to fuel pump fuel return line male and female connectors.

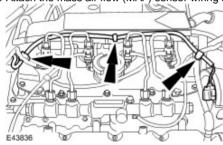
Connect the fuel injector to fuel pump fuel return line and attach the line to the retaining clip.



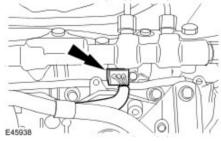
112 . Connect the fuel metering valve and fuel temperature sensor electrical connectors.



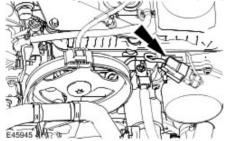
113 . Attach the mass air flow (MAF) sensor wiring harness.



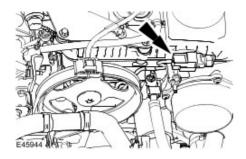
114 . Connect the camshaft position (CMP) sensor electrical connector.



115 . Connect the cylinder head temperature (CHT) sensor electrical connector.



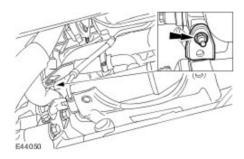
116 . Attach the CHT sensor electrical connector.



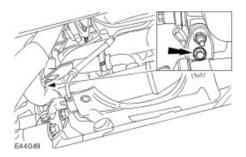
- 117 . Install the exhaust manifold.
 - Tighten to 40 Nm.



- 118 . Install the exhaust gas recirculation (EGR) cooler mount bracket.
 - Tighten to 10 Nm.



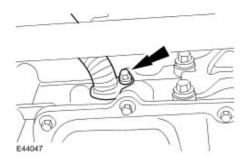
- 119 . Install the EGR cooler mount bracket retaining bolt.
 - Tighten to 10 Nm.



Install a new O-ring seal.

Install the oil return tube.

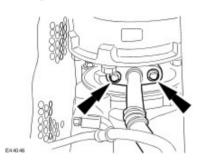
Tighten to 10 Nm.



Install a new gasket.

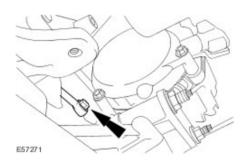
Connect the oil return tube to the turbocharger.

Tighten to 10 Nm.



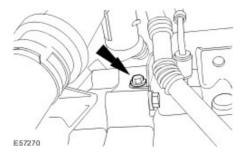
122 . Install the oil supply tube.

Tighten to 14 Nm.



123 . Attach the oil supply tube.

• Tighten to 23 Nm.

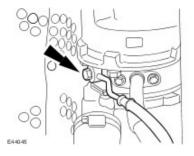


124 . **NOTE:**

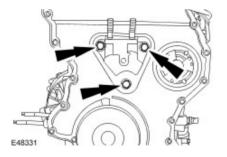
Install new sealing washers.

Connect the oil supply tube to the turbocharger.

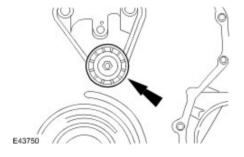
Tighten to 14 Nm.



- 125 . Install the engine front mount bracket.
 - Tighten to 80 Nm.



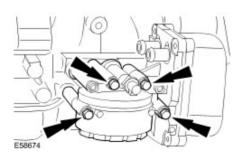
- 126 . Install the idler pulley.
 - Tighten to 43 Nm.



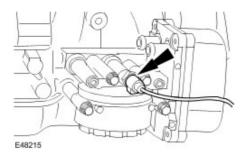
Install new O-ring seals.

Install the oil filter housing.

• Tighten to 22 Nm.



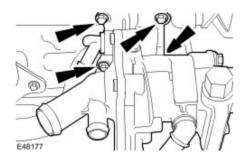
128 . Connect the oil pressure switch electrical connector.



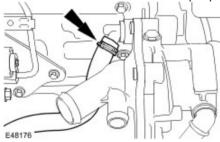
Install a new water pump gasket.

Install the water pump and power assisted steering pump assembly.

Tighten to 22 Nm.

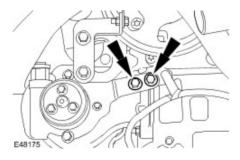


130 . Connect the coolant hose to the water pump.



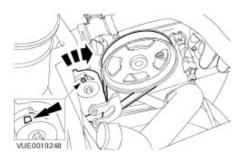
131 . Install the power assisted steering pump bracket retaining bolts.

• Tighten to 22 Nm.

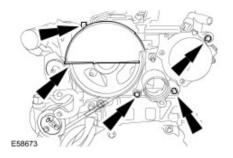


132 . Install the power assisted steering pump belt.

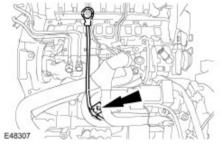
Rotate the tensioner clockwise.



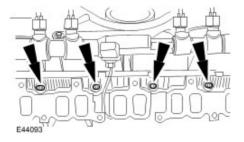
- 133 . Install the brake vacuum pump retaining bolts.
 - Tighten to 10 Nm.



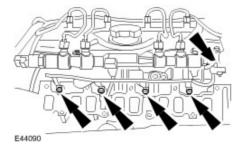
134 . Install the oil level indicator and tube.



- 135 . Install the glow plugs.
 - Tighten to 13 Nm.



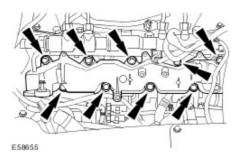
- 136 . Install the glow plug wire.
 - Tighten to 2 Nm.



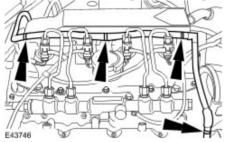
Install new manifold gaskets.

Install the intake manifold.

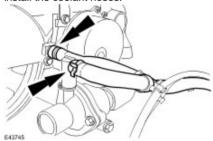
Tighten to 15 Nm.



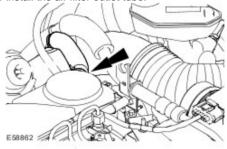
138 . Install the starter motor to generator wiring harness.



139 . Install the coolant hoses.



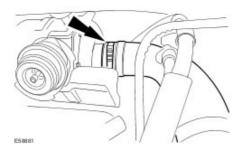
140 . Install the air filter outlet tube.



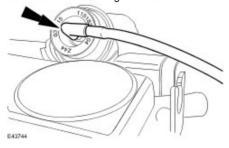
141 . **NOTE**:

Install a new air filter outlet tube retaining clip.

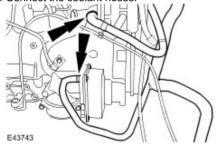
Install the air filter outlet tube.



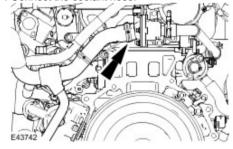
142 . Connect the turbocharger vacuum hose.



143 . Connect the coolant hoses.



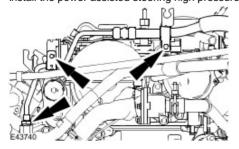
144 . Connect the coolant hose.



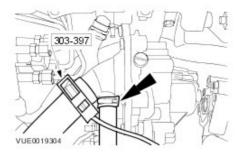
145 . **NOTE:**

Install a new power assisted steering high-pressure O-ring seal.

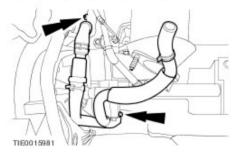
Install the power assisted steering high pressure pipe.



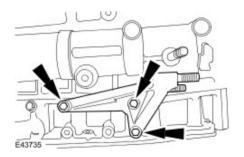
146 . Using the special tool, install the water pump hoses.



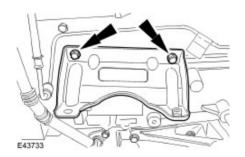
147 . Install the EGR cooler coolant hose.



- 148 . Install the halfshaft bracket.
 - Tighten to 25 Nm.



- 149 . Install the catalytic converter bracket.
 - Tighten to 46 Nm.

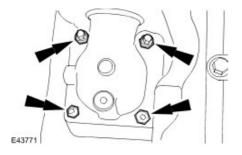


150 . **NOTE:**

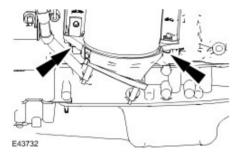
Install new retaining nuts.

Install the catalytic converter.

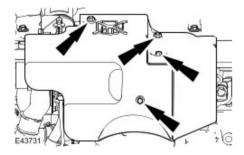
Tighten to 46 Nm.



- 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.

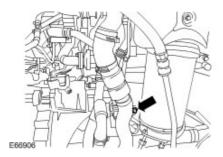


Do not tighten the retaining clip.

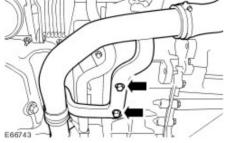
Align the turbo outlet pipe and charge air cooler intake pipe assembly.



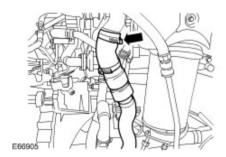
154 . Install the turbo outlet pipe retaining bolt.



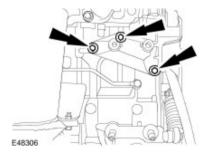
155 . Install the charge air cooler intake pipe retaining bolts.



- 156. Tighten the retaining clip.
 - Tighten to 4 Nm.



- 157 . Install the accessory drive belt tensioner bracket.
 - Tighten to 25 Nm.

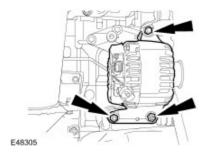


158 . **NOTE:**

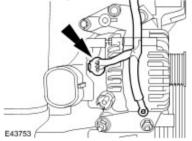
Install the wiring harness support bracket to the generator upper retaining bolt.

Install the generator.

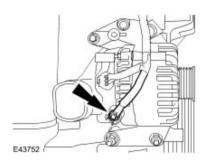
• Tighten to 47 Nm.



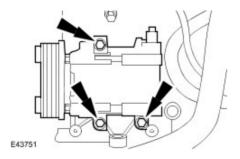
159 . Connect the generator electrical connector.



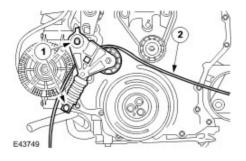
- 160 . Attach the generator electrical connector.
 - Tighten to 8 Nm.



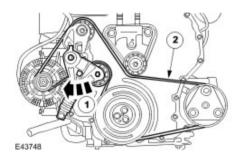
- 161 . Install the air conditioning (AC) compressor.
 - Tighten to 25 Nm.



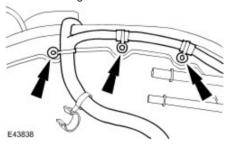
- 162 . Install the accessory drive belt tensioner.
 - Install the accessory drive belt.
 - Install the accessory drive belt tensioner.



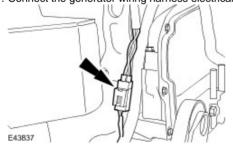
- 163. Attach the accessory drive belt.
 - Reposition the accessory drive belt tensioner.
 - Attach the accessory drive belt.



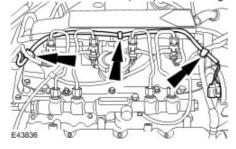
164 . Install the wiring harness.



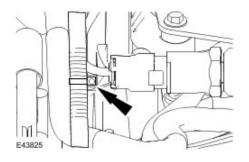
165 . Connect the generator wiring harness electrical connector.



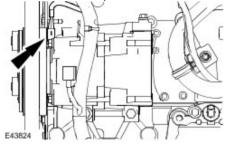
166 . Attach the mass air flow (MAF) sensor wiring harness.



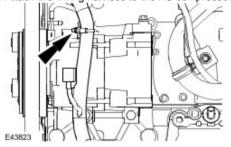
167 . Attach the wiring harness to the retaining stud.



168 . Connect the AC compressor electrical connector.

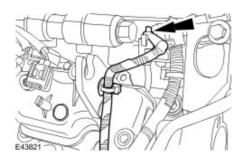


169 . Attach the wiring harness to the AC compressor.

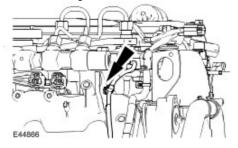


170 . Attach the glow plug wiring harness.

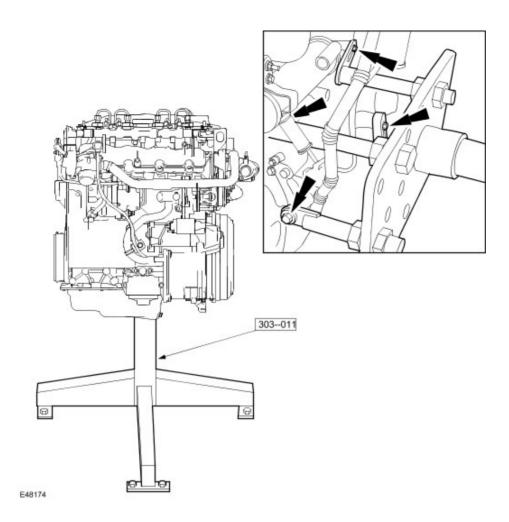




171 . Attach the wiring harness to the intake manifold.



172 . Remove the engine from the engine stand.



Specifications

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		-	62
Block heater		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		-	9
Radiator support beam retaining bolts		18	-
Thermostat housing retaining bolts		-	89
Water pump housing retaining bolts		-	89
Water pump to water pump housing retaining bolts		-	89
Water pump drive pulley retaining bolts		8	-
Water pump housing inlet pipe retaining nuts		-	80
Water pump housing inlet pipe retaining studs		9	-
Water pump housing outlet pipe retaining bolts	10	-	89

Cooling System Backflushing

CAUTION: 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.

CAUTION: 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 .
- 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 .

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.

Cooling System Draining, Filling and Bleeding

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.

WARNING: 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.

CAUTION: 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.

CAUTION: The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage.

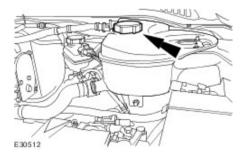
CAUTION: Do not RUN the engine with the coolant pressure cap removed. Failure to follow this instruction may cause damage to the engine.

CAUTION: Do not RUN the engine without the correct level of coolant. Failure to follow this instruction may cause damage to the engine.

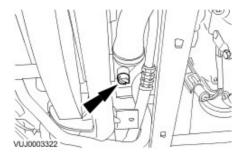
1.

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 <<501-02>>.
- 3. Remove the coolant drain plug.
 - Drain the coolant into a suitable container.



4.

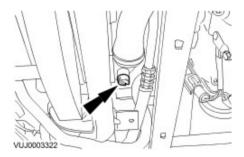


CAUTION: Do not over tighten the drain plug. Failure to follow this instruction may cause damage to the vehicle.

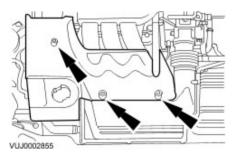
Install the drain plug when all coolant has drained.

• Tighten to 1 Nm.

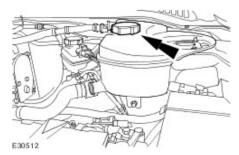
Remove the drain tray.



- 5. Install the undertray. For additional information, refer to <<501-02>>.
- 6. Lower the vehicle.
- 7. Remove the engine cover.



- 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.

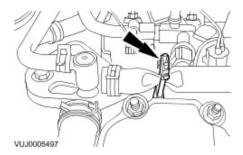


10. **NOTE**:

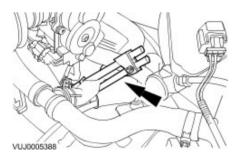
During this procedure the thermostat should open.

START and RUN the engine at 2000 rpm until the cooling fan operates.

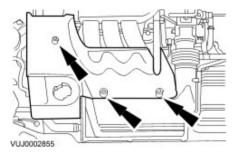
- 11. Stop the engine and allow to cool for two minutes.
- 12. Loosely install a pipe clamp to the heater inlet hose.



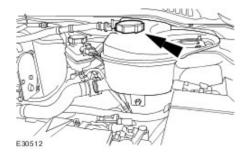
13. Loosely install a pipe clamp to the heater return hose.



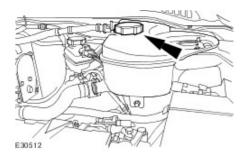
- 14. START and RUN the engine at 2000 rpm.
- 15. With the engine at 2000 rpm, fully clamp the heater outlet hose and then fully clamp the heater inlet hose.
- 16. Continue to run the engine for a further two minutes.
- 17. Switch the engine off.
- 18. Remove the heater hose clamps.
- 19. Fit the engine cover.



- 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.



22. Install the coolant expansion tank pressure cap.



Cooling System Flushing

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.

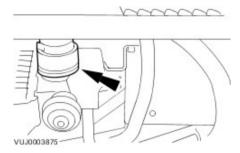
NOTE:

A pulsating or reversed direction of flushing water will loosen sediment more quickly than a steady flow in the normal coolant flow direction

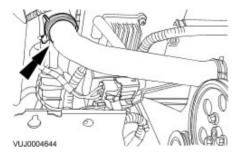
NOTE:

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 <<303-12>>.
- 2. Remove the thermostat. For additional information, refer to .
- 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.



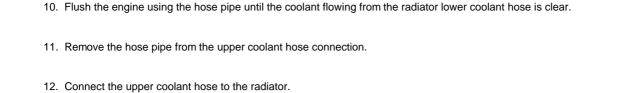
6. Connect a hose pipe to the radiator upper coolant hose connection using a suitable connector.

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.

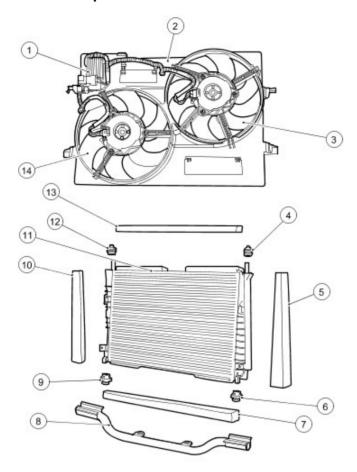
- 8. Remove the hose pipe from the radiator upper coolant hose connection.
- 9. Connect a hose pipe to the upper coolant hose using a suitable connector.



- 13. Install the thermostat. For additional information, refer to .
- 14. Fill the cooling system. For additional information, refer to .
- 15. Install the undertray. For additional information, refer to <<501-02>>.
- 16. Install the air cleaner. For additional information, refer to <<303-12>>.

Engine Cooling

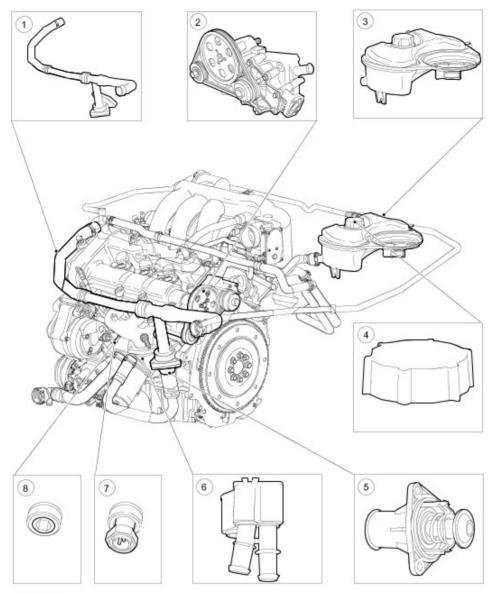
Cooling Module Components



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

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.

WARNING: 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.



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.

CAUTION: 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 <<303-05>>.

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.

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:

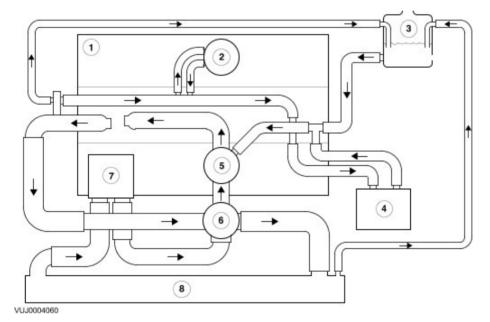
- Service fill.
- Coolant expansion during warm-up.
- Air separation during operation.
- System pressurization by the coolant pressure cap.
- The coolant expansion tank is designed to have approximately 0.5 to 1 liter of air when cold to allow for coolant expansion.

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)



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.

Engine Cooling

- 1. Verify the customer concern.
- 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. Visually inspect for obvious signs of mechanical or electrical damage.
- 4 . If the concern is not an electrical fault and is not visually evident, verify the concern and refer to the symptom chart.
- 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	

DTC P0480; High/low signal from the cooling fan motor control module to the engine control module (ECM)

Possible Source(s):

- Fuse 8 (80A), engine compartment fuse box.
- Circuit.
- · Cooling fan motor.
- Cooling fan motor control module.
- ECM.

Action(s) to take:

• GO to Pinpoint Test A.

Loss of coolant

Possible Source(s):

- Hoses.
- Hose connections.
- Radiator.
- Water pump.
- Heater core.
- · Gaskets.
- · Coolant expansion tank.
- Coolant pressure cap.
- Engine casting cracks.
- Engine core plugs.

Action(s) to take:

• Go to Pinpoint Test B.

Engine overheats

Possible Source(s):

- Engine coolant.
- Thermostat.
- Fuse 8 (80A), engine compartment fuse box.
- Circuit.
- Cooling fan motor(s).
- · Radiator.
- · Water pump.

- Water pump drive belt.
- Engine coolant temperature (ECT) sensor.
- Cooling fan motor control module.

Action(s) to take:

• Go to Pinpoint Test C.

Engine block heater does not operate properly

Possible Source(s):

- Block heater power cable.
- Block heater.

Action(s) to take:

• Go to Pinpoint Test D.

The engine does not reach normal operating temperature

Possible Source(s):

Thermostat.

Action(s) to take:

INSTALL a new thermostat.

PINPOINT TEST G92380p1: DTC P0480; HIGH/LOW SIGNAL FROM THE COOLING FAN MOTOR CONTROL MODULE TO THE ECM

G92380t1: 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 Pinpoint Test G92380t2.

-> No

GO to Pinpoint Test G92380t7.

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 Pinpoint Test G92380t4.

G92380t2: CHECK THE OPERATION OF THE TWO COOLING FANS

-> No

GO to Pinpoint Test G92380t3.

G92380t3: 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. 2. Remove the PWM signal wire from the cooling fan control module electrical connector JB187-1 (WU). 3. Connect the cooling fan control module electrical connector JB187 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. 5. Install the PWM signal wire to the cooling fan control module electrical connector JB187-1 (WU). 6. Connect the cooling fan control module electrical connector JB187 to the cooling fan control module. 7. Turn the ignition switch to the RUN position.
 - · Are both the cooling fans operating?

Connect the engine coolant temperature sensor electrical connector.GO to Pinpoint Test G92380t4.

-> No

G92380t4: 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. 3. Measure the resistance between electrical connectors JB187-1 and EN16-51.
 - Is the resistance less than 5 ohms?

-> Yes

GO to Pinpoint Test G92380t5.

-> No

REPAIR the circuit from the ECM to the cooling fan motor control module. CLEAR the DTC. TEST the system for normal operation.

G92380t5 : CHECK THE COOLING FAN MOTOR CONTROL MODULE SIGNAL WIRE FROM THE ECM FOR A SHORT TO GROUND

- 1. Measure the resistance between JB187-1 and ground.
 - Is the resistance less than 10.000 ohms?

-> Yes

GO to Pinpoint Test G92380t6.

-> No

REPAIR the circuit from the ECM to the cooling fan motor control module. CLEAR the DTC. TEST the system for normal operation.

G92380t6 : 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.
 - Is the resistance less than 10,000 ohms?

Yes

INSTALL a new cooling fan motor control module. For additional information, refer to

. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, refer to <<303-14>>.

-> No

REPAIR the circuit from the ECM to the cooling fan motor control module. CLEAR the DTC. TEST the system for normal operation.

G92380t7 : CHECK FUSE 8 IN THE ENGINE COMPARTMENT FUSE BOX

- 1. Check the fuse.
 - Is the fuse OK?

-> Yes

GO to Pinpoint Test G92380t9.

-> No

GO to Pinpoint Test G92380t8.

.

G92380t8 : CHECK FUSE 8 OF THE ENGINE COMPARTMENT FUSE BOX FOR A SHORT TO GROUND

- 1. Measure the resistance between electrical connector JB34-73 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 cooling fan motor control module. INSTALL a new fuse. CLEAR the DTC. TEST the system for normal operation.

INSTALL a new fuse. CLEAR the DTC. TEST the system for normal operation.

G92380t9: CHECK THE POWER SUPPLY TO THE COOLING FAN MOTOR CONTROL MODULE

- 1. Measure the voltage between the cooling fan motor control module electrical connector JB188-1 and ground.
 - Is the voltage less than 10 volts?

-> Yes

GO to Pinpoint Test G92380t10.

-> No

GO to Pinpoint Test G92380t11.

G92380t10: CHECK FOR BATTERY VOLTAGE AT FUSE 8 OF THE ENGINE COMPARTMENT **FUSE BOX**

- 1. Measure the voltage between the engine compartment fuse box electrical connector JB34-73 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.

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.

G92380t11: 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 and ground.
 - Is the voltage less than 10 volts?

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 Pinpoint Test G92380t12

G92380t12: CHECK THE COOLING FAN MOTOR CONTROL MODULE GROUND CIRCUIT

- 1. Measure the resistance between the cooling fan motor control module electrical connector JB188-2 and ground.
 - Is the resistance less than 5 ohms?

INSTALL a new cooling fan motor control module. For additional information, refer to

. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. For additional information, refer to <<303-14>>.

REPAIR the ground circuit to the cooling fan motor control module. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST G92380p2 : LOSS OF COOLANT

G92380t13: 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.

Carry out the Cooling System Pressure TEST. For additional information, refer to the component test in this section.

PINPOINT TEST G92380p3: THE ENGINE OVERHEATS

G92380t14: CHECK COOLANT

- 1. Inspect the coolant level.
 - Is the coolant level OK?

-> Yes

GO to Pinpoint Test G92380t15.

-> No

DIAGNOSE and REPAIR the coolant leaks. REFILL the cooling system. For additional information, refer to . TEST the cooling system for normal operation.

G92380t15: CHECK THE CONDITION OF THE WATER PUMP DRIVE BELT

- 1. Inspect the water pump drive belt. For additional information, refer to <<303-05>>.
 - Is the water pump drive belt OK?

-> Yes

GO to Pinpoint Test G92380t16.

-> No

INSTALL a new water pump drive belt. For additional information, refer to <<303-05>>. TEST the cooling system for normal operation.

G92380t16: CHECK THE WATER PUMP DRIVE

- 1. Remove the water pump drive belt. For additional information, refer to <<303-05>>. 2. Attempt to turn the water pump drive pulley by hand
 - Does the water pump drive pulley turn?

GO to Pinpoint Test G92380t17.

-> No

GO to Pinpoint Test G92380t18.

G92380t17: CHECK THE LEFT HAND EXHAUST CAMSHAFT

- 1. Remove the water pump. For additional information, refer to
- . 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

. TEST the system for normal operation.

INSTALL a new camshaft. For additional information, refer to <<303-01>>. Install a new water pump. For additional information, refer to . TEST the system for normal operation.

G92380t18: 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 Pinpoint Test G92380t20.

-> No

Turn the ignition switch to the OFF position. Connect the ECT sensor. GO to Pinpoint Test G92380t1.

G92380t19: 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 Pinpoint Test G92380t21.

.

G92380t20 : 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 Pinpoint Test G92380t21.

-> No

DIAGNOSE the electronic engine controls. For additional information, refer to <<303-14>>.

G92380t21: CHECK THE TEMPERATURE OF THE RADIATOR

- 1. Check the radiator core temperature.
 - Is the radiator core hot?

-> Yes

GO to Pinpoint Test G92380t22.

. .

-> No

GO to Pinpoint Test <u>G92380t23</u>.

G92380t22: 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

. TEST the system for normal operation. If the fault is still present, INSTALL a new radiator. For additional information, refer to

•

-> No

GO to Pinpoint Test G92380t23.

. ____

G92380t23: 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 Pinpoint Test G92380t24.

-> No

INSTALL a new thermostat. For additional information, refer to

. TEST the system for normal operation.

G92380t24: CHECK THE ENGINE OIL COOLER FOR A BLOCKAGE

- 1. Remove the engine oil cooler. For additional information, refer to <<303-01>>. 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 <<303-01>>. TEST the system for normal operation.

-> No

INSTALL a new water pump. For additional information, refer to

. TEST the system for normal operation.

PINPOINT TEST G92380p4: THE ENGINE BLOCK HEATER DOES NOT OPERATE

G92380t25 : 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 Pinpoint Test G92380t26

.

G92380t26: 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 Pinpoint Test G92380t27.

-> No

-> NO

INSTALL a new block heater. For additional information, refer to

. TEST the system for normal operation.

G92380t27: 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

. TEST the system for normal operation.

-> No

GO to Pinpoint Test G92380t28.

.

G92380t28: 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 Pinpoint Test G92380t29

. .

> No

Install a new block heater power supply cable. TEST the system for normal operation.

G92380t29: 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 . Switch the engine OFF.
- 2. Open the hood and install protective fender covers.
- 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 . Install the cooling system Pressure Tester adaptor tightly to the coolant expansion tank.
- 5 . Attach the pressure pump and gauge to the adapter fitting and pressurize the cooling system to 100 kPa (14.5 psi).
- 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 . 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. 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. Remove the coolant pressure cap from the coolant expansion tank.
- $\boldsymbol{2}$. Install the coolant pressure cap to the coolant system Pressure Tester.
- 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.

Compare the gauge reading with the maximum opening pressure of the coolant pressure cap: 100 KPa (14.5 psi).

- 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. If the pressure test gauge readings are not within acceptable gauge reading limits, install a new coolant pressure cap.
- 6 . Pressurize the coolant pressure cap until the pressure is just below the opening pressure of the coolant pressure cap.
- 7. Observe the reading of the pressure gauge for one minute. The pressure should not fall within this time.
- 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 . Remove the thermostat. For additional information, refer to
- 2. Immerse the thermostat in water.
- 3. Increase the temperature of the water.
- 4 . Observe the state of the thermostat and the temperature of the water.
- 5. The thermostat should begin to open at 82°C (179°F) and is fully open at 93°C (199°F).
- 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.

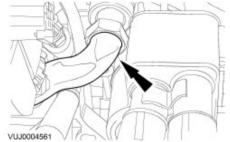
Clean the radiator before leak testing to prevent contamination of the test tank. Leak test the radiator in clean water with 138 kPa (20 psi) air pressure.

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.

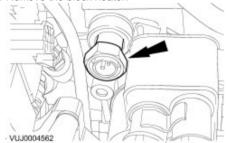
Block Heater (86.62.18)

Removal

- ${\bf 1}$. Drain the cooling system. For additional information, refer to For additional information, refer to .
- 2 . Disconnect the block heater electrical connector.

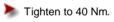


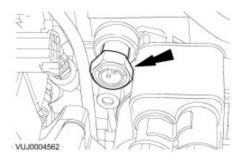
3 . Remove the block heater.



Installation

1 . To install, reverse the removal procedure.





2 . Fill the cooling system. For additional information, refer to For additional information, refer to .

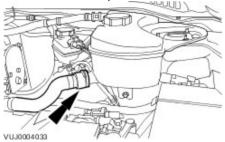
Coolant Expansion Tank (26.15.01)

Removal

1. NOTE:

Clamp the hose to minimize coolant loss.

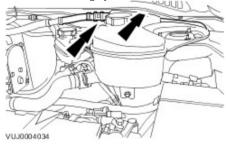
Detach the coolant expansion tank outlet hose from the coolant expansion tank.



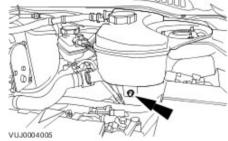
2 . **NOTE:**

Clamp the hoses to minimize coolant loss.

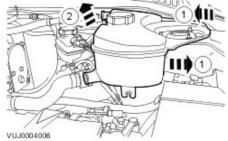
Detach the cooling system vent hoses from the coolant expansion tank.



3 . Remove the coolant expansion tank retaining bolt.



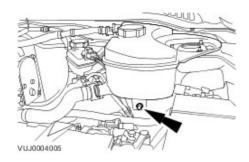
4 . Remove the coolant expansion tank



Installation

1 . To install, reverse the removal procedure.





2 . Check and top up the cooling system.

Cooling Fan Module (26.25.38)

Removal

1. Remove the air cleaner.

For additional information, refer to <u>Air Cleaner (19.10.05)</u> For additional information, refer to <u>Air Cleaner (19.10.05)</u>

2 . Remove the battery tray.

For additional information, refer to <u>Battery Disconnect and Connect</u>

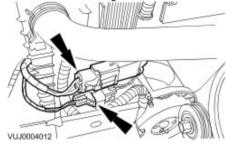
3 . **NOTE**:

Left hand shown, right hand similar.

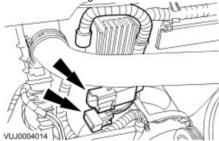
Disconnect the cooling fan motor electrical connectors.



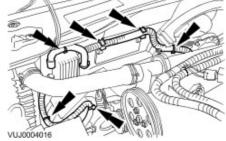
4 . Disconnect the cooling fan module electrical connectors.



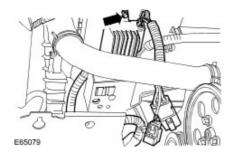
5 . Detach the cooling fan module electrical connectors from the cooling fan shroud.



6 . Detach the cooling fan module wiring harness from the cooling fan shroud.

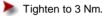


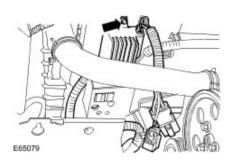
7 . Remove the cooling fan module.



Installation

1 . To install reverse the removal procedure.

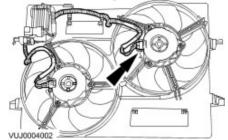




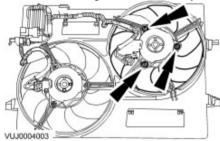
Cooling Fan Motor (26.25.24)

Removal

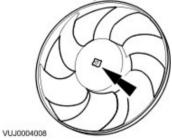
- ${\bf 1}$. Remove the cooling fan motor and shroud. For additional information, refer to For additional information, refer to .
- 2 . Disconnect the cooling fan motor electrical connector.



3 . Remove the cooling fan motor assembly.

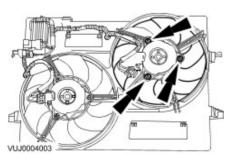


4 . Remove the cooling fan from the cooling fan motor.



Installation

 $\boldsymbol{1}$. To install, reverse the removal procedure.



Tighten to 6 Nm.

Cooling Fan Motor and Shroud (26.25.25)

Removal

All vehicles

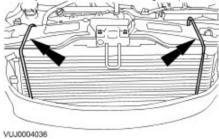
1. Remove the air cleaner. For additional information, refer to Air Cleaner (19.10.05)

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.

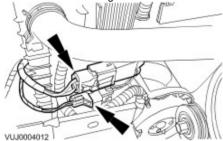
Loosely attach suitable retaining straps to the radiator.



- 3. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding
- 4. Lower the vehicle.

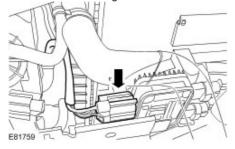
Vehicles built up to VIN:E71956

5. Disconnect the cooling fan motor control module electrical connectors.



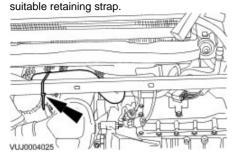
Vehicles built from VIN:E71957

6 . Disconnect the cooling fan motor control module electrical connector.

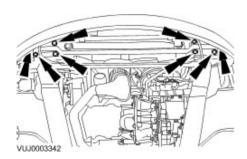


All vehicles

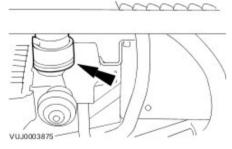
- 7. Raise the vehicle.
- 8 Reposition the coolant hose from the engine oil cooler to the thermostat housing and secure it to the front cross member using a



- 9 . Remove the radiator support beam.
 - Allow the cooling module to be partially lowered and supported by the retaining straps.



 $10\ .$ Detach the lower coolant hose from the radiator and position to one side.

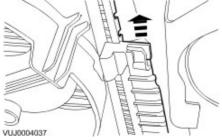


CAUTION: Make sure that the retaining lugs of the radiator are not damaged when displacing the cooling fan motor and shroud. Failure to follow this instruction may result in damage to the vehicle.

NOTE:

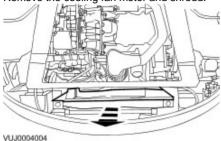
Right-hand shown, left-hand similar.

Displace the cooling fan motor and shroud from the retaining lugs of the radiator.



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.



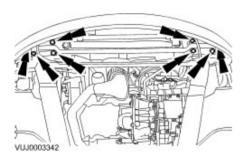
Installation

CAUTION: 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.

CAUTION: 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.





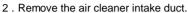
2 . Fill the cooling system.
For additional information, refer to Cooling System Draining, Filling and Bleeding

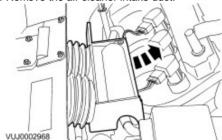
Cooling Module (26.40.16)

Removal

All Vehicles

1 . Remove the air cleaner. For additional information, refer to Air Cleaner (19.10.05)





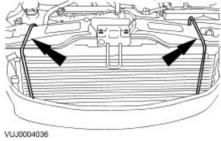
CAUTION: Make sure that the air conditioning (A/C) condenser is not damaged when installing the retaining straps. Failure to follow this instruction may result in damage to the vehicle.

NOTE:

3

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.

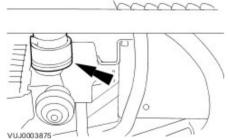
Loosely attach suitable retaining straps to the A/C condenser.



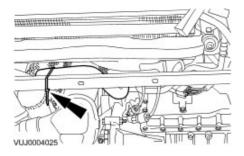
4 . Drain the cooling system.

For additional information, refer to Cooling System Draining, Filling and Bleeding





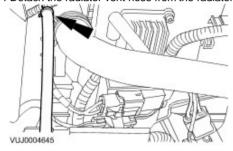
6 Reposition the coolant hose from the engine oil cooler to the thermostat housing and secure it to the front cross member using a suitable retaining strap.



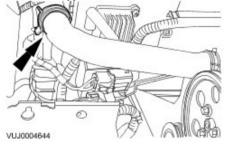
7. Lower the vehicle.

Vehicles built up to VIN:E71956

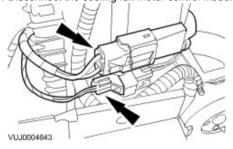
8 . Detach the radiator vent hose from the radiator.



9 . Detach the upper coolant hose from the radiator.

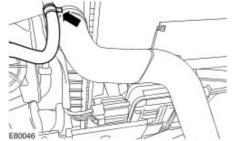


10 . Disconnect the cooling fan motor control module electrical connectors.

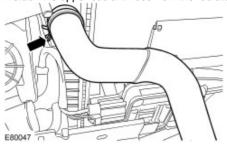


Vehicles built from VIN:E71957

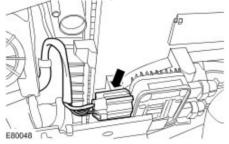
11 . Detach the radiator vent hose from the radiator.



12. Detach the upper coolant hose from the radiator.



13 . Disconnect the cooling fan motor control module electrical connector.



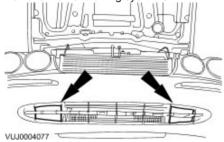
All vehicles

14 . Raise the vehicle.

VUJ0004076



16 . Remove the front towing eye trims.



Vehicles With Automatic Transmission

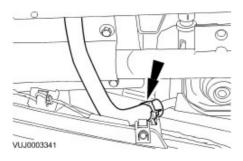
17 . **NOTE**:

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.

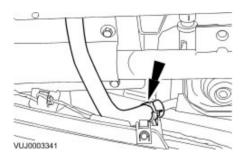


Vehicles With Manual Transmission

18 . Detach the power assisted steering oil cooler inlet pipe.

Allow the power assisted steering fluid to drain into a suitable container.

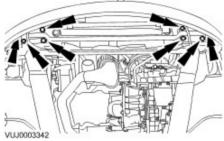
Using suitable blanking plugs, blank the exposed ports.



All Vehicles

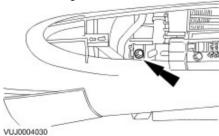
20

19 . Remove the radiator support beam.

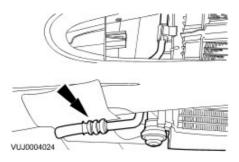


CAUTION: Apply suitable tape to the right-hand side lower section of the front bumper to prevent damage to the paintwork from the A/C pipe when the cooling module is lowered. Failure to follow this procedure may cause damage to the vehicle.

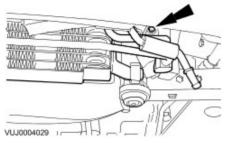
Remove the right-hand side A/C condenser retaining bolt from the radiator.



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

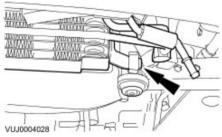
23 . **NOTE**:

Left-hand side shown, right-hand side similar.

NOTE:

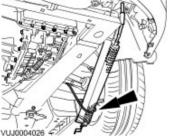
The power assisted steering oil cooler remains captive to the automatic transmission oil cooler.

Detach the automatic transmission oil cooler from the radiator.



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.

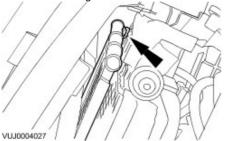


All vehicles

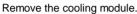
25 . **NOTE**:

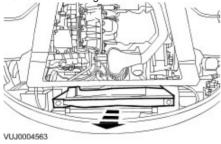
Left-hand side shown, right-hand side similar.

Detach the cooling module from the A/C condenser.



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.

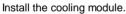


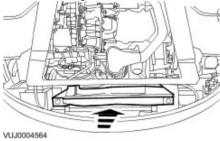


Installation

All vehicles

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.

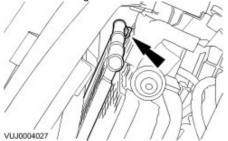




2 . **NOTE:**

Left-hand side shown, right-hand side similar.

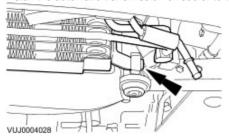
Attach the cooling module to the A/C condenser.



3 . **NOTE:**

Left-hand side shown, right-hand side similar.

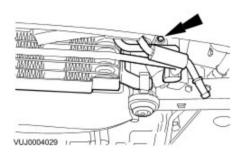
Install the automatic transmission oil cooler to the radiator.



All Vehicles

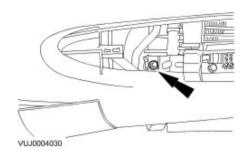
4 . Install the left-hand side A/C condenser retaining bolt.





5 . Install the right-hand side A/C condenser retaining bolt.





6. Lower the vehicle.

7

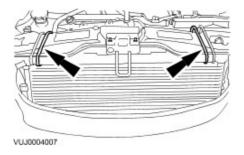
CAUTION: Do not over tighten the retaining straps. Failure to follow this instruction may cause damage to the vehicle.

NOTE:

To allow installation of the radiator support beam, install retaining straps to the radiator to hold the cooling module in position.

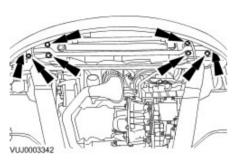
Install suitable retaining straps to the radiator. Align the cooling module to the upper isolator mounting points.

Carefully tension the retaining straps to hold the cooling module in position.



- 8 . Raise the vehicle.
- 9 . Install the radiator support beam.



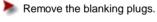


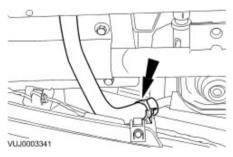
Vehicles With Automatic Transmission

10 . **NOTE:**

Left-hand side shown, right-hand side similar.

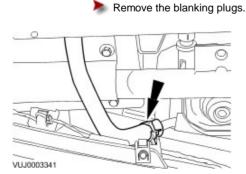
Connect the power assisted steering oil cooler inlet and return pipes.





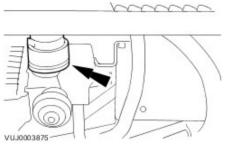
Vehicles With Manual Transmission

11 . Connect the power assisted steering oil cooler inlet pipe.

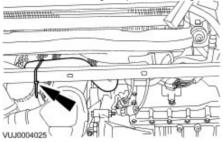


All Vehicles

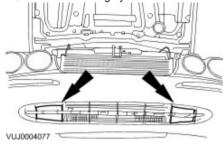
12 . Connect the lower coolant hose to the radiator.



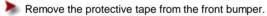
13 . Remove the retaining strap from the engine oil cooler coolant hose.

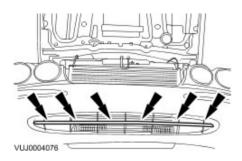


14 . Install the front towing eye trims

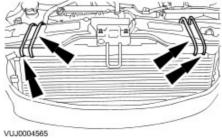


15 . Install the air splitter grille.



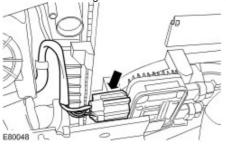


- 16 . Lower the vehicle.
- $\ensuremath{\mathsf{17}}$. Remove the retaining straps from the A/C condenser and radiator.

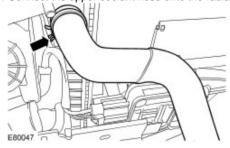


Vehicles built from VIN:E71957

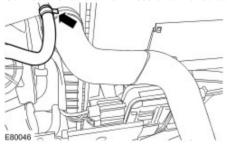
18 . Connect the cooling fan motor control module electrical connector.



19 . Connect the upper coolant hose onto the radiator.

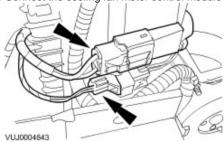


20 . Connect the radiator vent hose onto the radiator.

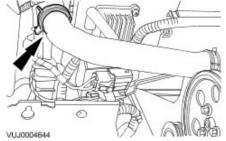


Vehicles built up to VIN:E71956

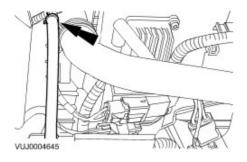
21 . Connect the cooling fan motor control module electrical connectors.



22 . Connect the upper coolant hose onto the radiator.

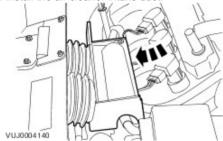


23 . Connect the radiator vent hose onto the radiator.



All vehicles

24 . Install the air cleaner intake duct.



25 . Install the air cleaner.
For additional information, refer to Air Cleaner (19.10.05)

26 . Fill the cooling system.

For additional information, refer to Cooling System Draining, Filling and Bleeding

27 . Check and adjust the power assisted steering fluid level.

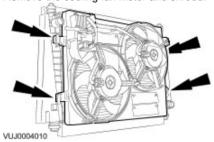
Radiator (26.40.01)

Removal

1 . Remove the cooling module. For additional information, refer to For additional information, refer to .

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

CAUTION: Make sure that the retaining lugs of the radiator are not damaged when installing the cooling fan motor and shroud to the radiator.

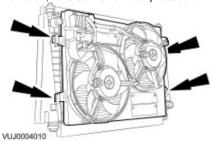
CAUTION: The radiator isolator mountings are constructed from a special material. Use only the correct specification radiator isolator mountings.

CAUTION: Inspect the radiator isolator mountings for damage and fatigue. Install new radiator isolator mountings if required.



CAUTION: Inspect the radiator seals for damage and security. Install new radiator seals if required.

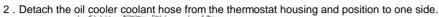
To install, reverse the removal procedure.

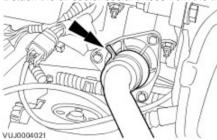


Thermostat (26.45.07)

Removal

1 . Drain the cooling system. For additional information, refer to For additional information, refer to Cooling System Draining, Filling and Bleeding.

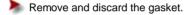


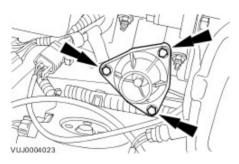


3 . **NOTE:**

The thermostat remains captive in the thermostat housing.

Remove the thermostat.





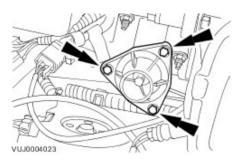
Installation

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.

3 . **NOTE:**

For NAS vehicles only.

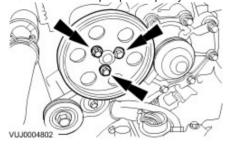
If required, carry out a long drive cycle.

For additional information, refer to Powertrain Control Module (PCM) Long Drive Cycle Self-Test

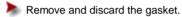
Water Pump (26.50.01)

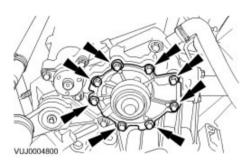
Removal

- ${\bf 1}$. Drain the cooling system. For additional information, refer to For additional information, refer to .
- 2. Lower the vehicle.
- 3 . Remove the water pump belt. For additional information, refer to <<303-05>>.
- 4 . Remove the water pump drive pulley.



5 . Remove the water pump.





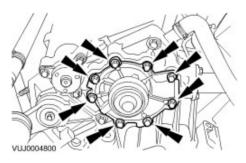
Installation

1 . **NOTE**:

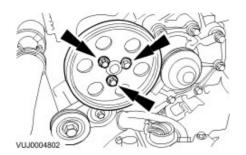
Install a new gasket.

To install, reverse the removal procedure.





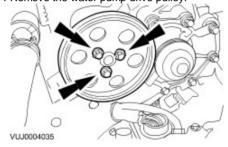
2 . Tighten to 11 Nm.



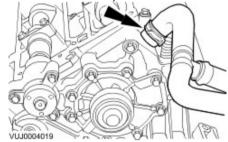
Water Pump Housing (26.50.07)

Removal

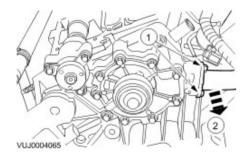
- 1 . Drain the cooling system. For additional information, refer to For additional information, refer to .
- 2 . Lower the vehicle.
- 3 . Remove the water pump belt tensioner. For additional information, refer to <<303-05>>.
- 4 . Remove the left-hand valve cover. For additional information, refer to <<303-01>>.
- 5. Remove the water pump drive pulley.



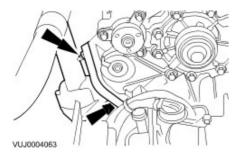
6. Detach the coolant expansion tank outlet hose from the water pump housing.



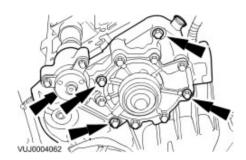
- 7 . Remove the water pump coolant outlet pipe.
 - Remove and discard the seals.



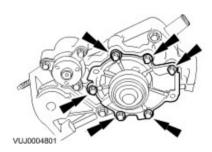
- 8. Detach the coolant inlet pipe from the water pump housing.
 - Remove and discard the gasket.



- 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.

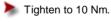


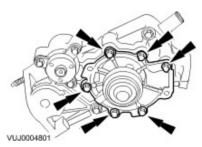
Installation

1 . **NOTE**:

Install a new gasket.

To install, reverse the removal procedure.



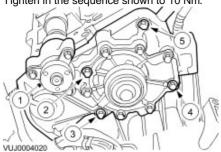


CAUTION: Make sure that the water pump housing is tightened in the sequence shown. Failure to follow this instruction may result in damage to the water pump drive pulley bearings.

NOTE:

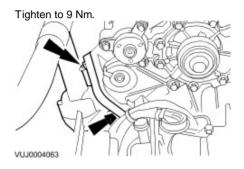
Install a new gasket.

Tighten in the sequence shown to 10 Nm.



3 . **NOTE**:

Install a new gasket.



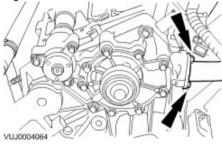
4 NOTE:

· Install new O-ring seals to the water pump coolant outlet pipe.

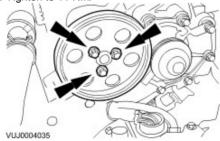
NOTE:

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.





5 . Tighten to 11 Nm.



6 . Fill the cooling system. For additional information, refer to For additional information, refer to .

Specifications

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%	1_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

Cooling System Draining and Vacuum Filling

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.

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 vehicle.

CAUTION: Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.

CAUTION: 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.

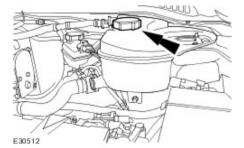
1. Set the heater controls to maximum HOT.

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.



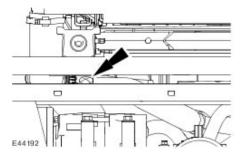
3. Remove the radiator splash shield. Radiator Splash Shield (76.22.90)

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.



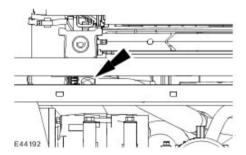
CAUTION: Do not over tighten the drain plug. Failure to follow this instruction may result in damage to the vehicle.

NOTE:

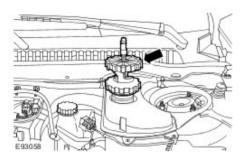
Install a new O-ring seal.

Install the coolant drain plug.

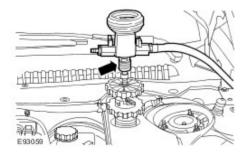
- Tighten to 1 Nm.
- Remove the drain tray.



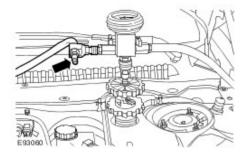
- 6. Lower the vehicle.
- 7. Install the cooling system vacuum refill adaptor to the expansion tank.



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.

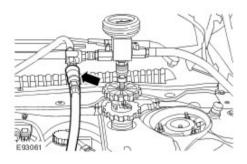
NOTE:

The coolant vacuum fill tool needs an air pressure of 6 to 8 bar (87 to 116 psi) to operate correctly.

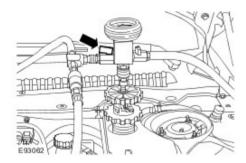
NOTE:

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.



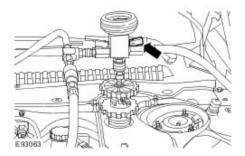
11. Open the air supply valve.



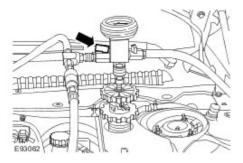
12. **NOTE**:

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.

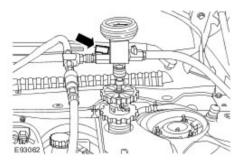
Open the coolant supply valve for 2 seconds to prime the coolant supply hose.



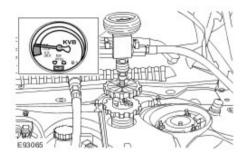
13. Apply air pressure progressively until the arrow on the vacuum filler gauge reaches the green segment.



14. Close the air supply valve.



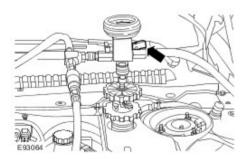
- 15. Allow one minute to check the vacuum is held.
 - Disconnect the air supply.



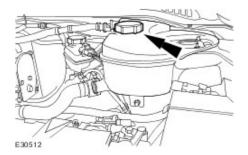
16. **NOTE:**

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. Radiator Splash Shield (76.22.90)

Cooling System Draining, Filling and Bleeding

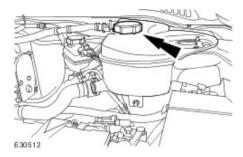
1.

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:

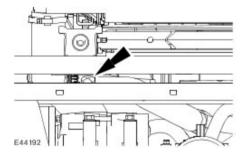
Release the cooling system pressure by slowly turning the coolant expansion tank cap a quarter of a turn.

Remove the coolant expansion tank cap.

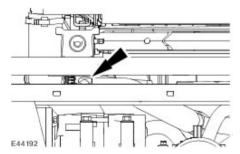


2. Remove the radiator splash shield. Radiator Splash Shield (76.22.90)

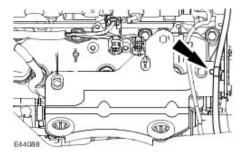
- 3. Drain the cooling system.
 - Allow the coolant to drain into a suitable container.



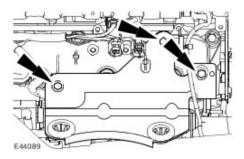
4. Install the radiator drain plug.



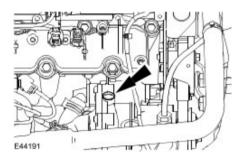
- 5. Install the radiator splash shield. Radiator Splash Shield (76.22.90)
- 6. Remove the air cleaner assembly. Air Cleaner (19.10.05)
- 7. Detach the wiring harness.



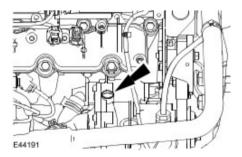
8. Remove the air cleaner mount bracket.



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.

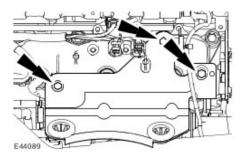


12.

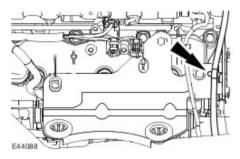
CAUTION: The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage.

Fill the coolant expansion tank to the Max mark.

- 13. Install the air cleaner mount bracket.
 - Tighten the retaining bolts.

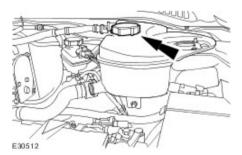


14. Attach the wiring harness.



15. Install the air cleaner assembly. Air Cleaner (19.10.05)

- 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.

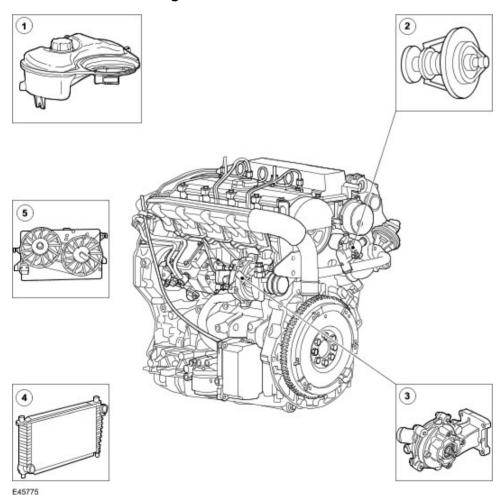
Engine Cooling

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.

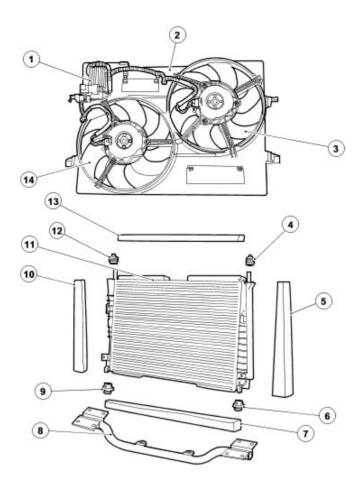
WARNING: Remove fuses 40 and 16 from the engine compartment fuse box prior to performing any under hood service in the area of the cooling fans when the engine is hot, since the cooling fan motors could operate if the engine has been switched off. Failure to follow this instruction may result in personal 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



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.

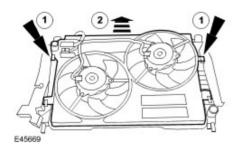
Engine oil cooler thermostat

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).

Cooling Fan Motor and Shroud (26.25.25)

Removal

- 1 . Remove the cooling module. For additional information, refer to
- 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.

Cooling Module (26.40.16)

Special Service Tools



Remover/installer, cooling hose clamp. 303-397

Removal

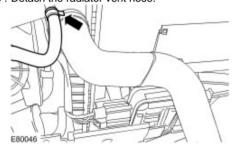
1 . Remove the battery tray.
For additional information, refer to Battery Tray (86.15.11)

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 (82.30.30)

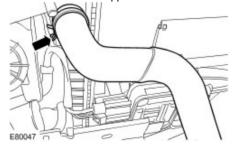
3 . Carry out the cooling system drain procedure.
For additional information, refer to Cooling System Draining, Filling and Bleeding

4 . Lower the vehicle.

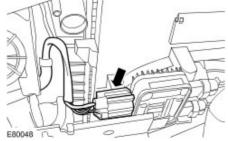
5. Detach the radiator vent hose.



6. Detach the radiator upper coolant hose.

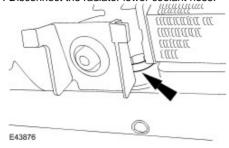


7 . Disconnect the electrical connector.



8 . Remove the charge air cooler.

9. Disconnect the radiator lower coolant hose.



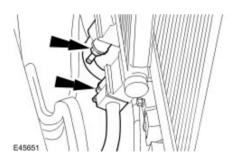
10 . **NOTE**:

Install blanking plugs to the exposed ports.

Disconnect the A/C lines.



Remove and discard the O-ring seals.

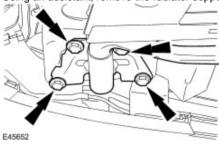


11 WARNING: Using an assistant support the cooling module. Failure to follow this instruction may result in personal injury.

NOTE:

Left-hand shown, right-hand similar.

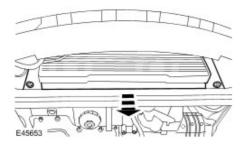
Using an assistant, remove the radiator support beam.



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.

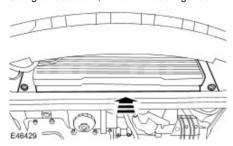


Installation

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.



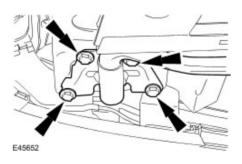
WARNING: Using an assistant support the cooling module. Failure to follow this instruction may result in personal injury.

NOTE:

Left-hand shown, right-hand similar.

Using an assistant, install the radiator support beam.





3 . **NOTE:**

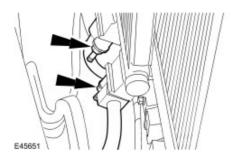
NOTE:

Remove the blanking plugs.

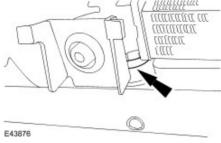
Connect the A/C lines.

Install new O-ring seals.

Tighten to 25 Nm.



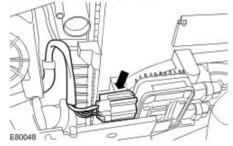
4 . Connect the radiator lower coolant hose.



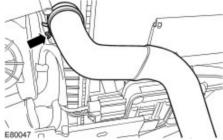
5 . Install the charge air cooler.

For additional information, refer to Charge Air Cooler - 2.0L Diesel
For additional information, refer to Charge Air Cooler - 2.2L Diesel

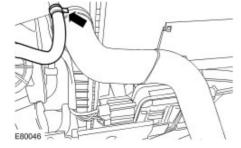
6. Connect the electrical connector.



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 (86.15.11)

- 10 . Carry out the cooling system filling and bleeding procedure.

 For additional information, refer to Cooling System Draining, Filling and Bleeding
- 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 (82.30.30)

Radiator (26.40.01)

Removal

- 1 . Remove the cooling fan motor and shroud. For additional information, refer to <u>Cooling Fan Motor and Shroud (26.25.25)</u>
- 2 . Remove the radiator.



Installation

1 . To install, reverse the removal procedure.

Water Pump (26.50.01)

Special Service Tools



Remover/Installer, Cooling Hose Clamp 303-397 (24-003)

Removal

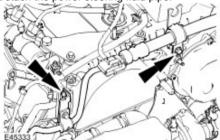
Vehicles with 2.2L diesel engine

Remove the exhaust gas recirculation (EGR) tube.
 For additional information, refer to

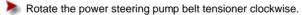
All vehicles

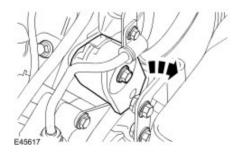
2 . Drain the cooling system.
For additional information, refer to Cooling System Draining, Filling and Bleeding

3. Detach the power steering fluid pipe.



4. Detach the power steering pump belt.

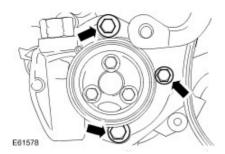




5 . **NOTE:**

Shown with the exhaust gas recirculation (EGR) cooler to EGR valve tube removed for clarity.

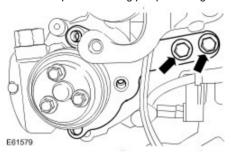
Remove the power steering pump retaining bolts.



6 . **NOTE:**

Shown with the EGR cooler to EGR valve tube removed for clarity.

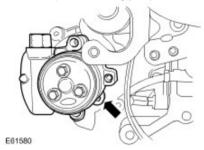
Remove the power steering pump securing bracket.



7 . **NOTE**:

Shown with the EGR cooler to EGR valve tube removed for clarity.

Detach the power steering pump from the water pump.



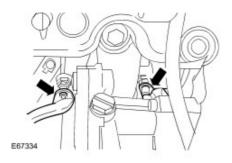
 $\boldsymbol{8}$. Using the special tool, disconnect the coolant hoses from the water pump.



9 . **NOTE:**

Shown with the EGR cooler to EGR valve tube removed for clarity.

Detach the wiring harness.

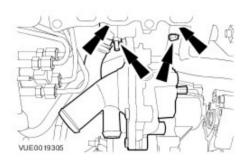


10 . **NOTE:**

Shown with the EGR cooler to EGR valve tube removed for clarity.

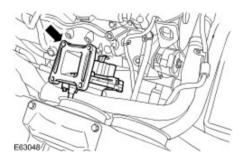
Detach the water pump.

Detach the wiring harness from the water pump lower retaining bolts.

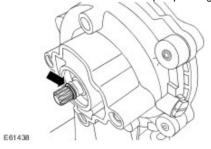


11 . Remove the water pump.

Remove and discard the gasket.

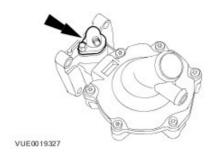


12 . Remove and discard the water pump O-ring seal.



 ${\bf 13}$. Remove the engine oil temperature control thermostat.

Remove and discard the O-ring seal.



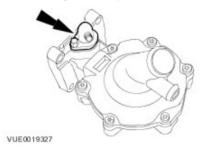
Installation

All vehicles

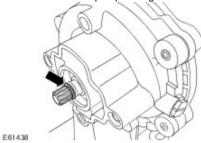
1 . **NOTE**:

Install a new engine oil temperature control thermostat O-ring seal.

Install the engine oil temperature control thermostat.



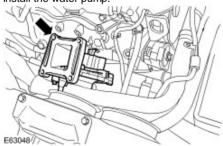
2 . Install a new water pump O-ring seal.



3 . **NOTE**:

Install a new water pump gasket.





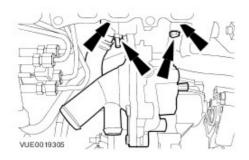
4 . **NOTE**:

Shown with the EGR cooler to EGR valve tube removed for clarity.

Attach the water pump.

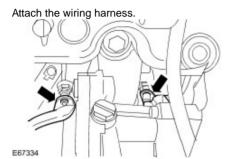
Tighten the water pump retaining bolts to 24 Nm.

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.



6. Using the special tool, connect the coolant hoses to the water pump.



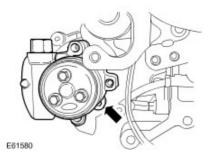
7. Coat the power steering pump drive shaft splines with .



8 . **NOTE:**

Shown with the EGR cooler to EGR valve tube removed for clarity.

Attach the power steering pump to the water pump.

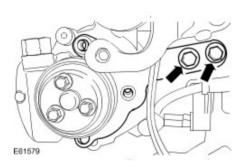


9 . **NOTE:**

Shown with the EGR cooler to EGR valve tube removed for clarity.

Install the power steering pump securing bracket.

Tighten to 25 Nm.

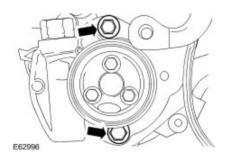


10 . **NOTE**:

Shown with the EGR cooler to EGR valve tube removed for clarity.

Install the power steering pump retaining bolts.



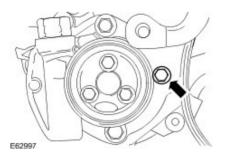


11 . **NOTE**:

Shown with the EGR cooler to EGR valve tube removed for clarity.

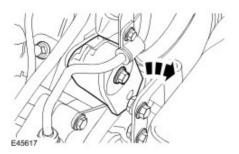
Install the power steering pump retaining bolts.



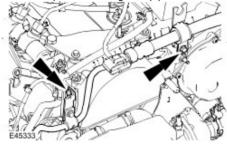


12 . Attach the power steering pump belt.

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

Vehicles with 2.2L diesel engine

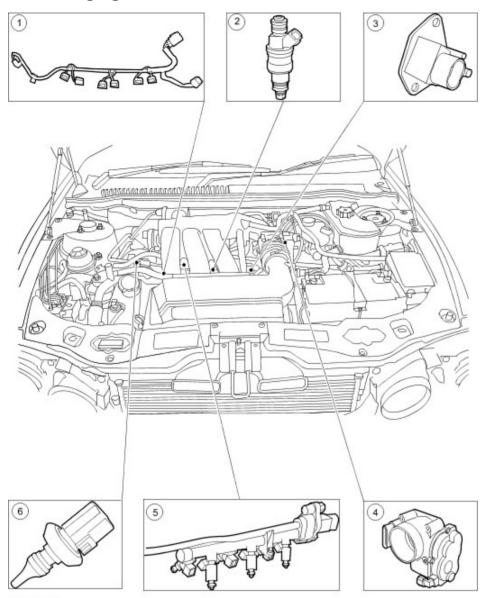
15 . Install the exhaust gas recirculation (EGR) tube. For additional information, refer to

Specifications

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

Fuel Charging and Controls



VUJ0003183

ltem	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.

Fuel Charging and Controls - 2.0L

- 1. Verify the customer concern by operating the system.
- 2 . Visually inspect for obvious signs of mechanical or electrical damage.
- 3. Make sure there is sufficient fuel in the vehicle.
- 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 . 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.

Fuel Charging and Controls - 2.5L/3.0L, VIN Range: E96603->J28492

- 1. Verify the customer concern by operating the system.
- 2. Visually inspect for obvious signs of mechanical or electrical damage.
- 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4. If the concern is not visually evident, use a fault code reader to retrieve fault codes before proceeding to the 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 gressure 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 	<<303-07>> <<303-01>> Fuel Charging and Controls - 2.5L/3.0L, VIN Range: E96603->J28492 <<309-00>> <<303-14>>
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	<<303-12>> <<303-14>>
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 	<<303-07>> <<303-01>> Fuel Charging and Controls - 2.5L/3.0L, VIN Range: E96603->J28492 <<309-00>> <<303-14>>
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	<<303-12>> <<303-14>>
P1251, P1631, P1657, P1658	Concern with throttle motor relay	Throttle motor relay Throttle motor relay circuit	<<303-14>>

P0112, P0113	Concern with IAT sensor	 Engine faulty leading to overheating Intake air temperature (IAT) sensor fault Harness fault ECM failure 	<<310-02>> <<303-14>>
P0121, P0122, P0123, P0222, P0223	Concern with throttle position (TP) sensor	TP sensor faultHarness faultECM failure	<<303-14>>
P0116, P0117, P0118, P0125	Concern with engine coolant temperature	Engine coolant temperature sensorHarness faultECM failure	<<303-14>>
P0201, P0202, P0203, P0204, P0205, P0206	Concern with fuel injectors	Faulty injector(s)Harness faultECM failure	<<303-14>>
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 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 <u>G92396p3</u> .
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 G92396p3.
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 <u>G92396p3</u> .
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 G92396p4.
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 G92396p5.
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 G92396p6.

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 G92396p1.
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	<<303-14>> 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. CLEAR the DTC, TEST the system for normal operation.
P1656	Concern with TP sensor amplifier circuit	ECM	<<303-14>>

PINPOINT TEST G92396p2 : Fuel Injectors, P0201, P0202, P0203, P0204, P0205, P0206.

G92396t3: 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 Pinpoint Test G92396t4.

-> No

INSTALL a new injector.

CLEAR the DTC. TEST the system for normal operation.

G92396t4: 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 Pinpoint Test G92396t5.

-> No

INSTALL a new injector.

CLEAR the DTC. TEST the system for normal operation.

G92396t5: 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 Pinpoint Test G92396t6.

-> 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.

G92396t6: 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 Pinpoint Test G92396t32.

-> 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.

G92396t32: CHECK THE INJECTOR GROUND CIRCUIT FOR SHORT CIRCUIT TO BATTERY

- 1. Measure the voltage between the relevant injector harness electrical connector (JJ 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 Pinpoint Test G92396t33.

G92396t33: 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. <<303-14>> Before replacing a ECM, contact Dealer technical support.

PINPOINT TEST G92396p3 : FUEL RAIL PRESSURE SENSOR. P0190, P0192, P0193 G92396t7 : 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 Pinpoint Test G92396t8.

-> 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. <<303-14>> 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

G92396t8: 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 Pinpoint Test G92396t9.

G92396t9: 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 Pinpoint Test G92396t10.

G92396t10 : 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 Pinpoint Test G92396t11.

G92396t11: 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 Pinpoint Test G92396t12.

-> No

Install a new fuel rail pressure sensor.

<u>Fuel Pulse Damper - 2.5L/3.0L (18.30.98)</u> CLEAR the DTC. TEST the system for normal operation.

G92396t12: 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 Pinpoint Test G92396t13.

-> No

Install a new fuel rail pressure sensor.

Fuel Pulse Damper - 2.5L/3.0L (18.30.98) CLEAR the DTC. TEST the system for normal operation.

G92396t13: 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. <<303-14>> Before replacing a ECM, contact Dealer technical support.

-> No

Install a new fuel rail pressure sensor.

Fuel Pulse Damper - 2.5L/3.0L (18.30.98) CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST G92396p4: FUEL LEVEL SENSORS. P0460

G92396t14: 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 Pinpoint Test G92396t15.

-> 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.

G92396t15: 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 Pinpoint Test G92396t16.

-> 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.

G92396t16: 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 Pinpoint Test G92396t17.

-> No

INSTALL a new fuel level sensor. <<310-01>> CLEAR the DTC. TEST the system for normal operation.

G92396t17: 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. <<413-01>> CLEAR the DTC. TEST the system for normal operation.

-> No

INSTALL a new fuel level sensor. <<310-01>> CLEAR the DTC. TEST the system for normal operation.

G92396t18: 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 Pinpoint Test G92396t19.

-> 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.

G92396t19: 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 Pinpoint Test G92396t20.

-> 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.

G92396t20: 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 Pinpoint Test G92396t21

-> No

INSTALL a new fuel level sensor. <<310-01>> CLEAR the DTC. TEST the system for normal operation.

G92396t21: 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. <<413-01>> CLEAR the DTC. TEST the system for normal operation.

-> No

INSTALL a new fuel level sensor. <<310-01>> CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST G92396p5: FUEL PUMP CONTROL MODULE. P1234, P1236

G92396t22: 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 Pinpoint Test G92396t23

-> 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

G92396t23: 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 Pinpoint Test G92396t24.

-> 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.

G92396t24: CHECK THE SIGNAL GROUND CIRCUIT TO THE FUEL PUMP MODULE

- 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 Pinpoint Test G92396t25.

-> 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

G92396t25: 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 Pinpoint Test G92396t27.

-> No

INSTALL a new fuel pump module. <<310-01>> CLEAR the DTC. TEST the system for normal operation.

G92396t27: 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. <<310-01>> If the DTC is repeated, INSTALL a new fuel pump. <<310-01>> 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 G92396p6: FUEL PUMP FEEDBACK CIRCUITS. P1338

G92396t28: 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 Pinpoint Test G92396t29.

-> No

GO to Pinpoint Test G92396t31.

G92396t29: 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 Pinpoint Test G92396t30.

G92396t30: 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 Pinpoint Test G92396t31.

-> 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.

G92396t31: 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. <<310-01>> CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM. <<303-14>> 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 G92396p7: THROTTLE CONTROL POSITION ERROR. P1224.

G92396t1: 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 Pinpoint Test G92396t2.

-> 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.

G92396t2: 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. <<303-14>> 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.

Fuel Charging and Controls - 2.5L/3.0L, VIN Range: J28493->V99999

- 1. Verify the customer concern by operating the system.
- 2 . Visually inspect for obvious signs of mechanical or electrical damage.
- 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4. If the concern is not visually evident, use a fault code reader to retrieve fault codes before proceeding to the 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 	Engine Ignition - 2.5L/3.0L Engine Exhaust System Electronic Engine Controls - 2.5L/3.0L, VIN Range: J28493->V99999
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	Intake Air Distribution and Filtering Electronic Engine Controls - 2.5L/3.0L, VIN Range: J28493->V99999
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	Engine Ignition - 2.5L/3.0L Engine Exhaust System Electronic Engine Controls - 2.5L/3.0L, VIN Range: J28493->V99999
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 	
P1251, P1631, P1657, P1658	Concern with throttle motor relay	Throttle motor relay Throttle motor relay circuit	Electronic Engine Controls - 2.5L/3.0L, VIN Range: J28493->V99999
P0112, P0113	Concern with IAT sensor	 Engine faulty leading to overheating Intake air temperature (IAT) sensor fault Harness fault ECM failure Acceleration Control Electronic Engine Controls - 2.5L/3.0L, VIN Range: J28493->V99999	

P0121, P0122, P0123, P0222, P0223	Concern with throttle position (TP) sensor	TP sensor faultHarness faultECM failure	Electronic Engine Controls - 2.5L/3.0L, VIN Range: J28493->V99999	
P0116, P0117, P0118, P0125	Concern with engine coolant temperature	Engine coolant temperature sensor Harness fault ECM failure	Electronic Engine Controls - 2.5L/3.0L, VIN Range: J28493->V99999	
P0201, P0202, P0203, P0204, P0205, P0206	Concern with fuel injectors	Faulty injector(s) Harness fault ECM failure	Electronic Engine Controls - 2.5L/3.0L, VIN Range: J28493->V99999	
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 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 <u>G1007750p2</u> .	
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 G1007750p2.	
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 G1007750p2.	
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 G1007750p3.	
	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 G1007750p4.	
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 G1007750p5.	
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. Throttle Body (19.70.04) CLEAR the DTC, TEST the system for normal operation.	

P2107	Concern with throttle "watchdog circuit" circuit	ЕСМ	Electronic Engine Controls - 2.5L/3.0L, VIN Range: J28493->V99999
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 G1007750p6.
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; open circuit, short circuit, high resistance Throttle motor failure Throttle body failure	Electronic Engine Controls - 2.5L/3.0L, VIN Range: J28493->V99999 Individual Pinpoint tests for components and circuits listed
P1656	Concern with TP sensor amplifier circuit	ECM	Electronic Engine Controls - 2.5L/3.0L, VIN Range: J28493->V99999

PINPOINT TEST G1007750p1 : Fuel Injectors, P0201, P0202, P0203, P0204, P0205, P0206.

G1007750t1: 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 Pinpoint Test G1007750t2.

-> No

INSTALL a new injector.

Fuel Injectors (18.10.02) CLEAR the DTC. TEST the system for normal operation.

G1007750t2: 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 Pinpoint Test G1007750t3.

-> No

INSTALL a new injector.

Fuel Injectors (18.10.02) CLEAR the DTC. TEST the system for normal operation.

G1007750t3: 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 Pinpoint Test G1007750t4.

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.

G1007750t4: 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 Pinpoint Test G1007750t5.

-> 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.

G1007750t5: 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 Pinpoint Test G1007750t6

G1007750t6: 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.

Engine Control Module (ECM) (18.30.01) Before replacing a ECM, contact Dealer technical support.

PINPOINT TEST G1007750p2 : fuel pulse damper SENSOR. P0190, P0192, P0193 G1007750t7 : 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 Pinpoint Test G1007750t8.

-> 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.

Engine Control Module (ECM) (18.30.01) 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

G1007750t8: 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 Pinpoint Test G1007750t9.

G1007750t9: 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 Pinpoint Test G1007750t10.

G1007750t10 : 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 Pinpoint Test G1007750t11.

G1007750t11: 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 Pinpoint Test G1007750t12.

-> No

Install a new fuel pulse damper sensor.

<u>Fuel Pulse Damper - 2.5L/3.0L (18.30.98)</u> CLEAR the DTC. TEST the system for normal operation.

G1007750t12: 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 Pinpoint Test G1007750t13.

-> No

Install a new fuel pulse damper sensor.

Fuel Pulse Damper - 2.5L/3.0L (18.30.98) CLEAR the DTC. TEST the system for normal operation.

G1007750t13: 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.

Electronic Engine Controls - 2.5L/3.0L, VIN Range: J28493->V99999 Before replacing a ECM, contact Dealer technical support.

> No

Install a new fuel pulse damper sensor.

Fuel Pulse Damper - 2.5L/3.0L (18.30.98) CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST G1007750p3: FUEL LEVEL SENSORS. P0460

G1007750t14: 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 Pinpoint Test G1007750t15.

-> 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.

G1007750t15: 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 Pinpoint Test G1007750t16.

-> 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.

G1007750t16: 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 Pinpoint Test G1007750t17.

-> No

INSTALL a new fuel level sensor.

Fuel Level Sender LH - 2.5L/3.0L

Fuel Level Sender RH - 2.5L/3.0L CLEAR the DTC. TEST the system for normal operation.

G1007750t17: 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.

<u>Instrument Cluster (88.20.01)</u> CLEAR the DTC. TEST the system for normal operation.

-> No

INSTALL a new fuel level sensor.

Fuel Level Sender LH - 2.5L/3.0L

G1007750t18: 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 Pinpoint Test G1007750t19.

-> 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.

G1007750t19: 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 Pinpoint Test G1007750t20.

-> 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.

G1007750t20: 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 Pinpoint Test G1007750t21.

-> No

INSTALL a new fuel level sensor.

Fuel Level Sender LH - 2.5L/3.0L

Fuel Level Sender RH - 2.5L/3.0L CLEAR the DTC. TEST the system for normal operation.

G1007750t21: 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.

Instrument Cluster (88.20.01) CLEAR the DTC. TEST the system for normal operation.

-> No

INSTALL a new fuel level sensor.

Fuel Level Sender LH - 2.5L/3.0L

<u>Fuel Level Sender RH - 2.5L/3.0L</u> CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST G1007750p4: FUEL PUMP CONTROL MODULE. P0627, P0628, P0629

G1007750t22: 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 Pinpoint Test G1007750t23.

-> No

GO to Pinpoint Test G1007750t25.

G1007750t23: 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 Pinpoint Test G1007750t24.

G1007750t24: 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 Pinpoint Test G1007750t25.

-> 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.

G1007750t25: 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.

<u>Fuel Pump Module - 2.5L/3.0L (19.45.08)</u> CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, INSTALL a new ECM.

Engine Control Module (ECM) (18.30.01) 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 G1007750p5: FUEL PUMP CONTROL MODULE. P2635

G1007750t26: 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 Pinpoint Test G1007750t27.

-> 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

G1007750t27: 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?

SAY es

GO to Pinpoint Test G1007750t28.

-> 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.

G1007750t28: CHECK THE SIGNAL GROUND CIRCUIT TO THE FUEL PUMP MODULE

- 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 Pinpoint Test G1007750t29.

-> 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

G1007750t29: 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 Pinpoint Test G1007750t30.

-> No

INSTALL a new fuel pump module.

Fuel Pump Module - 2.5L/3.0L (19.45.08) CLEAR the DTC. TEST the system for normal operation.

G1007750t30: 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.

Fuel Pump Module - 2.5L/3.0L (19.45.08) If the DTC is repeated, INSTALL a new fuel level sender.

Fuel Level Sender LH - 2.5L/3.0L

Fuel Level Sender RH - 2.5L/3.0L 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 G1007750p6: THROTTLE CONTROL CIRCUIT P2118.

G1007750t31: 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 Pinpoint Test G1007750t32.

-> 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.

G1007750t32: 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.

Engine Control Module (ECM) (18.30.01) CLEAR the DTC. TEST the system for normal operation.

-> No

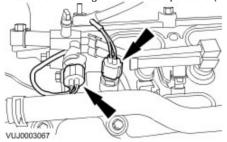
REPAIR the circuit between ECM electrical connector EN16 pin 106 (R) and throttle motor electrical connector EN95 pin 1 (R). For additional information, refer to wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

Fuel Charging Wiring Harness (86.70.22)

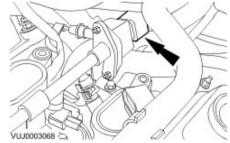
Removal

Vehicles with 2.5L or 3.0L engine

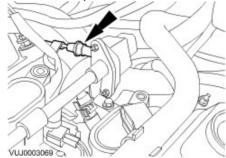
- 1 . Remove the intake manifold. For additional information, refer to <<303-01>>.
- 2 . Disconnect the spring lock coupling. For additional information, refer to $\underline{<<\!310\text{-}00>>}.$
- 3 . Disconnect the engine coolant temperature (ECT) and fuel temperature sensor electrical connectors.



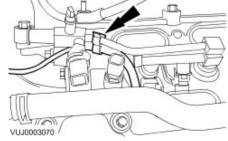
4 . Disconnect the electrical connector.



5. Detach the fuel pressure sensor vacuum line.



6 . Detach the fuel charging wiring harness.

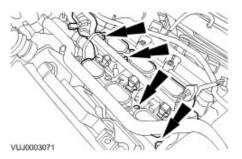


7 . **NOTE:**

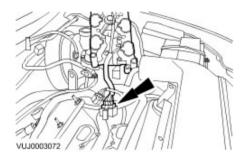
Fuel may still be present in the fuel injection supply manifold.

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

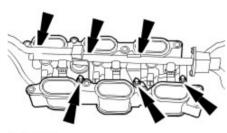
Remove and discard the lower intake manifold O-ring seals.



- 8 . Remove the fuel injection supply manifold and lower intake manifold.
 - Disconnect the electrical connector.

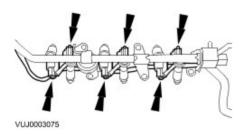


- 9 . Remove the lower intake manifolds.
 - Remove and discard the fuel injector O-ring seals.



VUJ0003074

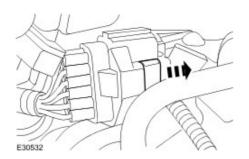
- 10 . Remove the fuel charging wiring harness.
 - Disconnect the electrical connectors.



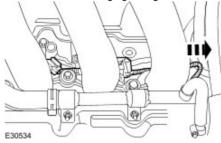
Vehicles with 2.0L engine

- 11 . Remove the fuel rail.

 For additional information, refer to Fuel Injection Supply Manifold (19.60.13)
- 12 . Disconnect the electrical connector.



13 . Remove the fuel charging wiring harness.



Installation

Vehicles with 2.0L engine

1 . To install, reverse the removal procedure.

Vehicles with 2.5L or 3.0L engine

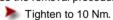
2 . **NOTE:**

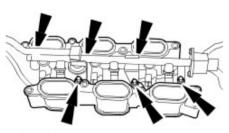
Install new fuel injector O-ring seals.

NOTE:

Install new lower intake manifold O-ring seals.

To install, reverse the removal procedure.

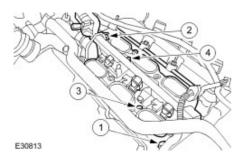




VUJ0003074

3 . Tighten in the sequence shown.





Fuel Injection Supply Manifold (19.60.13)

Removal

All vehicles

- 1 . Disconnect the battery ground cable. <<414-01>>
- 2 . Disconnect the spring lock coupling. <<310-00>>

Vehicles with 2.5L or 3.0L engine

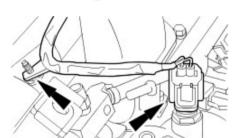
3 . Remove the fuel injectors. For additional information, refer to For additional information, refer to .

Detach the harness.

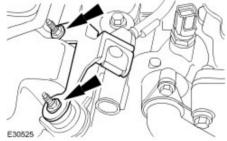
Vehicles with 2.0L engine

E30522

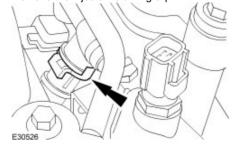
4 . Disconnect the electrical connector.



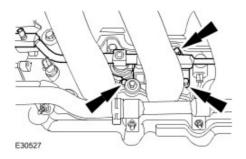
 ${\bf 5}$. Remove the engine trim retaining bracket.



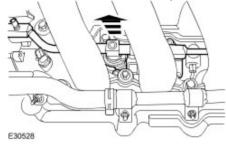
6 . Remove the injector retaining clip.



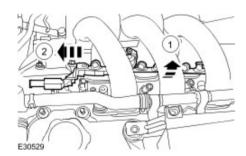
7 . Remove the fuel rail retaining bolts.



8 . Disconnect the fuel rail from the injectors.

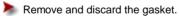


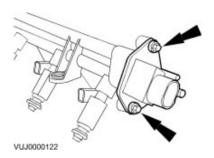
- 9 . Remove the fuel injection rail.
 - 1) Rotate the fuel injection rail through 180°.
 - 2) Remove the fuel injection rail.



Vehicles with 2.5L or 3.0L engine

 $10\ .$ Remove the fuel pressure sensor.





Installation

All vehicles

1 . **NOTE**:

Install new fuel injector O-ring seals.

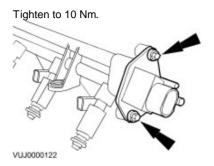
To install, reverse the removal procedure.

Lubricate the fuel injector O-ring seals with clean engine oil.

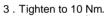
Vehicles with 2.5L or 3.0L engine

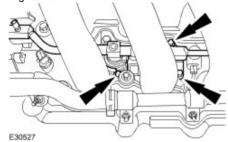
2 . **NOTE**:

Install a new gasket.

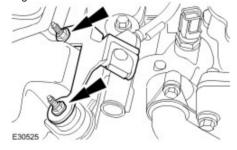


Vehicles with 2.0L engine





4 . Tighten to 6 Nm.

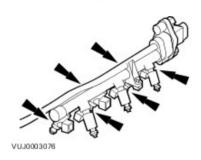


Fuel Injectors (18.10.02)

Removal

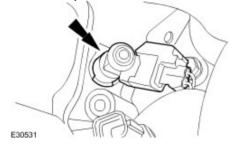
Vehicles with 2.5L or 3.0L engine

- Remove the fuel charging wiring harness.
 For additional information, refer to <u>Fuel Charging Wiring Harness</u> (86.70.22)
- 2 . Remove the fuel injectors.
 - Remove the fuel injector retaining clips.

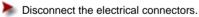


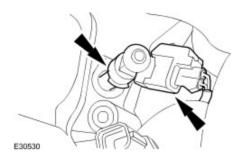
Vehicles with 2.0L engine

- 3 . Remove the fuel injection supply manifold.
 For additional information, refer to Fuel Injection Supply Manifold (19.60.13)
- 4. Detach the injectors from the lower intake manifold.



5 . Remove the injectors.





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.

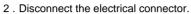


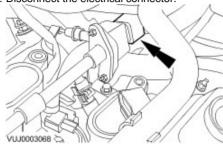
VUJ0000564

Fuel Pulse Damper - 2.5L/3.0L (18.30.98)

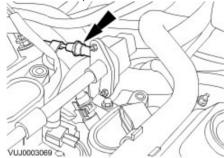
Removal

 ${\bf 1}$. Remove the throttle body. For additional information, refer to For additional information, refer to .

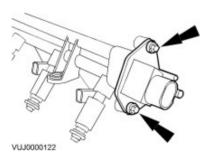




3 . Detach the fuel pressure sensor vacuum line.



- 4 . Remove the fuel pressure sensor.
 - Remove and discard the gasket.



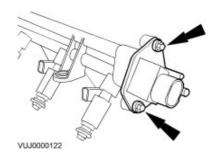
Installation

1 . **NOTE**:

Install a new gasket.

To install, reverse the removal procedure.

Tighten to 10 Nm.



Throttle Body (19.70.04)

Removal

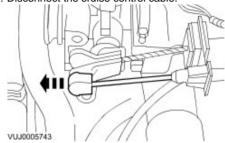
All vehicles

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.

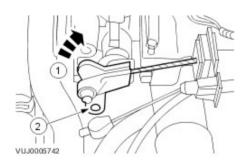
1 . Remove the air cleaner outlet pipe. For additional information, refer to <<303-12>>.

Vehicles with 2.0L engine

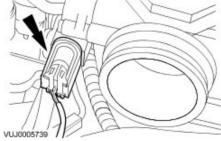
2 . Disconnect the cruise control cable.



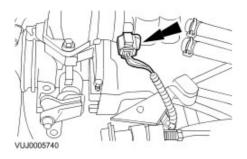
- 3 . Disconnect the accelerator cable.
 - 1) Position the accelerator actuator to the open position.
 - 2) Disconnect the accelerator cable.



4 . Disconnect the electrical connector.

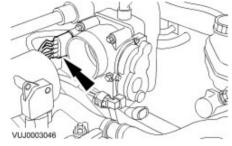


5 . Disconnect the electrical connector.

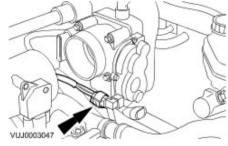


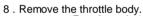
Vehicles with 2.5L or 3.0L engine

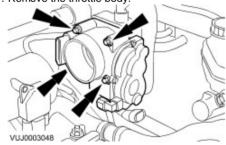
6 . Disconnect the electrical connector.



7 . Disconnect the electrical connector.

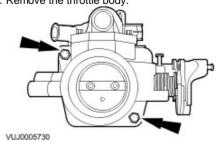






Vehicles with 2.0L engine

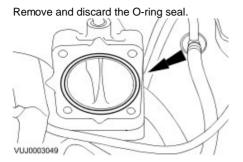
9 . Remove the throttle body.



All vehicles

10 . **NOTE:**

2.5L and 3.0L shown, 2.0L similar.



Installation

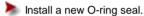
All vehicles

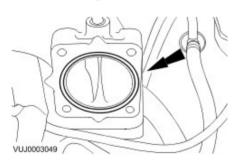
CAUTION: Do not attempt to clean the throttle body. The bore and the throttle plate has a special coating applied during manufacture which should not be removed.

1 . **NOTE**:

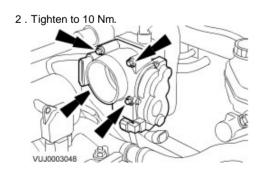
2.5L and 3.0L shown, 2.0L similar.

To install, reverse the removal procedure.



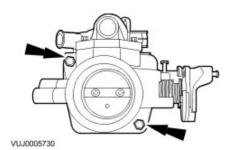


Vehicles with 2.5L or 3.0L engine



Vehicles with 2.0L engine

3 . Tighten to 10 Nm.



Specifications

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

Fuel Injection Component Cleaning

Pneumatic vacuum gun Cleaning Fluid W-M5B411-A

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: 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.

WARNING: 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.

CAUTION: 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.

CAUTION: 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.



CAUTION: Use a steel topped workbench and cover it with clean, lint-free non-flocking material.



CAUTION: Make sure that all parts removed from the vehicle are placed on the lint-free non-flocking material.



CAUTION: Make sure that any protective clothing worn is clean and made from lint-free non-flocking material.



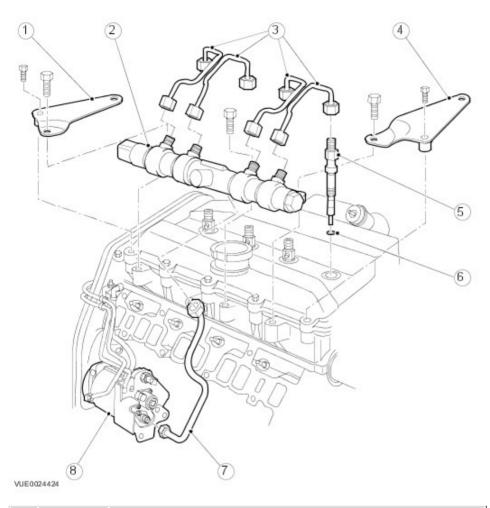
CAUTION: Make sure that any protective gloves worn are new and are of the non-powdered latex type.

CAUTION: 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 onto the components being removed and onto the surrounding area.
- 2. Using a, remove all traces of and foreign material.
- 3. Dispose of any used and the brush after completing the repair.

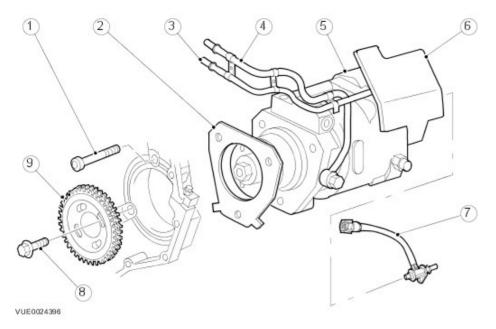
Fuel Charging and Controls

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 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 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.



VUE0024576

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.

Fuel Charging and Controls

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: Fuel Charging and Controls

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.

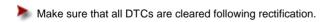
Important Safety Instructions

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. Verify the customer concern.
- 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 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. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 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.



Symptom Chart

Symptom (general)	Symptom (specific)	Possible source	Action
Non-Start	Engine does not crank	Starter relay rault Starting system fault Engine control module	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.

		 Security system /lmmobilizer engaged Low/Contaminated fuel 	
	Engine cranks, but does not start	 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 	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, Engine 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.
Difficult to start	Difficult to start cold	fault Intake air temperature (IAT) sensor fault Cylinder head	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, Engine Check the catalytic converter condition, etc. Check for diesel particulate filter DTCs.
	Difficult to start hot	blocked/contaminated Exhaust gas recirculation (EGR) valve 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 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, Engine Check the catalytic converter condition, etc. Check for diesel particulate filter DTCs.

		(CMP) sensor fault Crankshaft position (CKP) sensor fault Injector(s) fault/programming Pump fault Blocked catalyst Valve train fault Low compression	
	Engine cranks too fast/slow	Battery condition/chargeStarting system faultLow 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, Engine
	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 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.
Driveability	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	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, Engine

	 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 	
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 Crankshaft position (CMP) sensor fault Crankshaft position (CKP) sensor fault Intake air temperature (IAT) 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	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, Engine

		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, Engine
	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, Engine

DTC index

NOTE:

For a full list of ECM DTCs: Electronic Engine Controls

DTC	Condition	Possible source	Action
PUTKU	Fuel temperature sensor 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. Fuel Temperature Sensor (18.30.99) Clear the DTCs, test for normal operation.
IP0190	Fuel pressure sensor A circuit	Fuel pressure sensor circuit: high	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

		resistance • Fuel pressure sensor: faulty connection • Fuel pressure sensor fault	injection supply manifold (the pressure sensor cannot be serviced separately). Fuel Injection Supply Manifold (19.60.13) Clear the DTCs, test for normal operation.
	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 liter (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). Fuel Injection Supply Manifold (19.60.13) 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 	
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 	Check the injector circuits. Refer to the electrical guides. Rectify as
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 	necessary. If no fault is found in the circuits, install a new injector. Fuel Injector (18.10.01) Clear the DTCs, test for normal operation.
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 	
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 liter (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) leak detected	Injector fault	
P0266	Injector 4 (cylinder 2) leak detected	Injector fault	Carry out the injector leakage procedure. Rectify as necessary. Clear
P0269	Injector 2 (cylinder 3) leak detected	Injector fault the DTCs, test for normal operation.	
P0272	Injector 3 (cylinder 4) leak detected	Injector fault	
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.
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. Fuel Injector (18.10.01) Clear the DTCs, test for normal operation.
D1211	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 liter (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.
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.
	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 liter (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.
IIP 7741	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 Jaguar approved diagnostic system. If after reprogramming and clearing the DTCs the DTC reoccurs, check for contaminated fuel. Draw off approximately 1 liter (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 the DTCs, test for normal operation.

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 	
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 	
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.

Fuel Injection Pump

Special Service Tools



Adapter for 303-681-01 303-681-01



Remover/Installer, Crankshaft Oil Seal 303-679



Locking Tool, Fuel Injection Pump Sprocket 303-681



Locking Tool, Fuel Injection Pump Sprocket 303-1151



Socket, Fuel Injection Pump 303-083A (23-057)

Removal

All vehicles

WARNING: 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.

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

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.

WARNING: 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.

CAUTION: Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

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.

CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

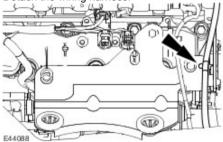
CAUTION: Do not disassemble or clean inside the fuel injection pump, even with an ultrasonic cleaner. Always install a new fuel injection pump when required.

NOTE:

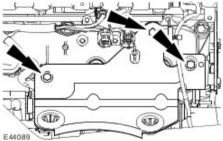
If the fuel injection pump has suffered a major mechanical failure, new fuel injectors should also be installed.

Remove the exhaust gas recirculation (EGR) cooler to EGR valve tube.
 For additional information, refer to

2. Detach the wiring harness

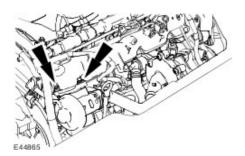


3. Remove the air cleaner mount bracket.

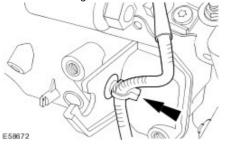


4 . Detach the EGR valve from the intake manifold.

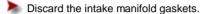


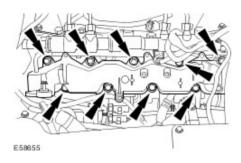


5 . Detach the wiring harness from the intake manifold.

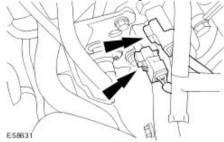


6 . Remove the intake manifold.

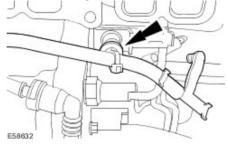




7 . Disconnect the fuel metering valve and fuel temperature sensor electrical connectors.



8. Detach the wiring harness.



 $\boldsymbol{9}$. 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

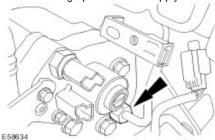
12

14

CAUTION: 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.

CAUTION: 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.



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.

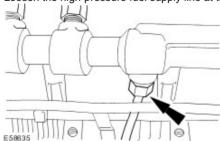
Using the pneumatic vacuum gun, vacuum foreign material from the high-pressure fuel supply line and the fuel injection pump.

CAUTION: 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.

CAUTION: 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.

CAUTION: While maintaining the pressure on the high pressure fuel supply line, clean and vacuum foreign material from the line and union.

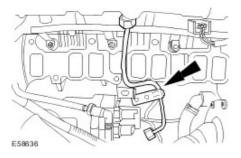
Loosen the high-pressure fuel supply line at the fuel injection supply manifold.



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.



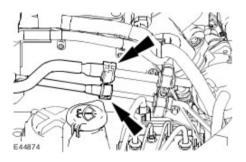
- 16. Using the pneumatic vacuum gun, vacuum foreign material from the fuel injection pump and the fuel injection supply manifold.
- 17 . Install blanking caps to the open threaded ports on the fuel injection pump and the fuel injection supply manifold.

Vehicles built up to VIN:E43868

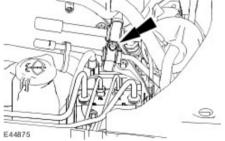
18 . Disconnect the fuel injection pump fuel supply and return lines.

For additional information, refer to Quick Release Coupling - Push Connect

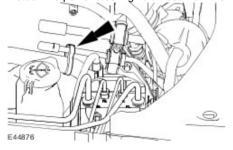
≽ Install blanking plugs to the fuel injection pump fuel supply and return line male and female connectors.



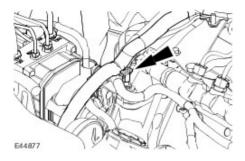
19 . Loosen the fuel supply and return line support bracket retaining nut.



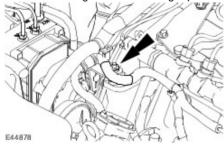
20 . Detach the power steering fluid hose from the fuel return line.



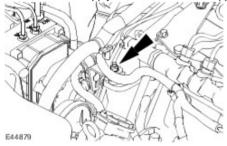
21 . Detach the wiring harness retaining clip.



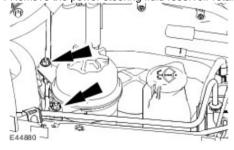
22 . Detach the wiring harness retaining clip.



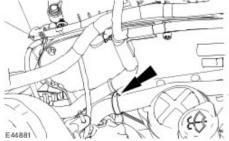
23 . Detach the fuel supply and fuel return line support bracket.



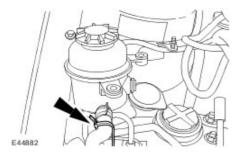
 $24\ .$ Remove the power steering fluid reservoir retaining nuts.



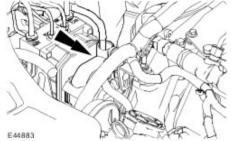
25 . Detach the power steering fluid reservoir.



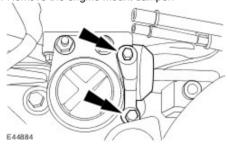
26 . Secure the power steering fluid reservoir to one side.



27 . Disconnect the hydraulic control unit electrical (HCU) connector.



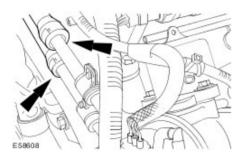
28 . Remove the engine mount damper.



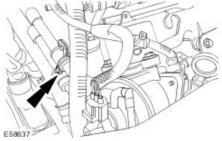
Vehicles built from VIN:E43869

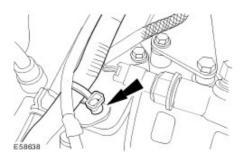
29 . Disconnect the fuel injection pump fuel supply and return lines. For additional information, refer to Quick Release Coupling - Push Connect



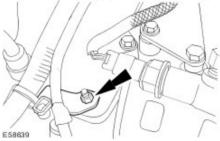


30 . Remove the fuel supply and return line support bracket retaining nut.





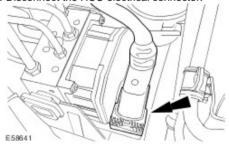
32 . Remove the fuel supply and return line support bracket retaining nut.



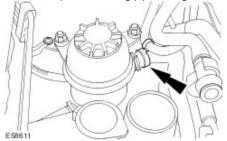
33 . Detach the fuel supply and return lines.



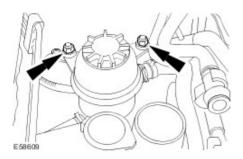
34 . Disconnect the HCU electrical connector.



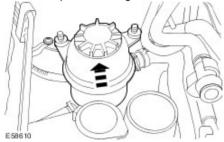
35 . Detach the power steering pipe to engine wiring harness retaining clip.



36 . Remove the power steering fluid reservoir retaining nuts.

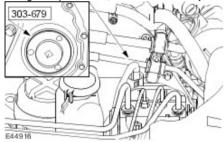


37 . Detach the power steering fluid reservoir.



All vehicles

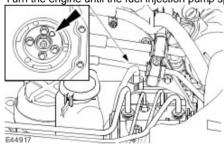
38. Using the special tool, remove the fuel injection pump sprocket access cover.



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:**

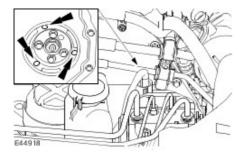
The fuel injection pump retaining bolts remain captive behind the fuel injection pump sprocket after removal.

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.



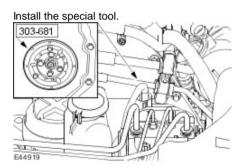
- 41 From 2006 MY special tool numbers 303-681 and 303-681-01 have now been superseded by special tool numbers 303-1151 and 303-083A.
 - To carry out the procedure using special tool numbers 303-681 and 303-681-01 see steps 43 46.
 - To carry out the procedure using special tool numbers 303-1151 and 303-083A see steps 47 49.

42 **NOTE**:

For additional information, see step 41.

NOTE:

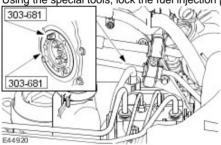
The special tool locking pin holes are offset. During installation of the special tool, check that the offset pin hole is located at the top.



43 . **NOTE**:

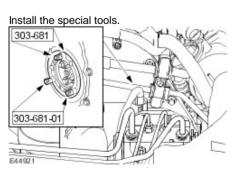
For additional information, see step 41.

Using the special tools, lock the fuel injection pump sprocket.



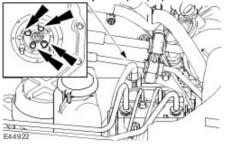
44 . **NOTE:**

For additional information, see step 41.



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.



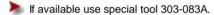
47 **NOTE**:

· 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.

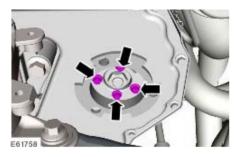




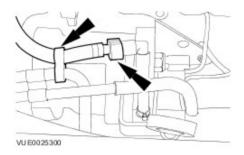
48 . **NOTE:**

For additional information, see step 41.

Remove the fuel injection pump sprocket retaining bolts.



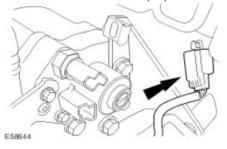
- 49 . Disconnect the fuel injector to fuel injection pump fuel return line.
 - Detach the fuel injector to fuel injection pump return line retaining clip (if equipped).
 - Install blanking plugs to the fuel injector to fuel injection pump fuel return line male and female connectors.



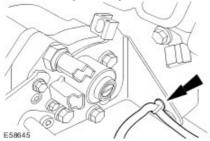
50 . Disconnect the fuel pipe.



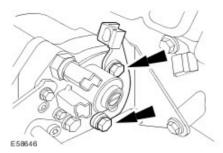
51 . Disconnect the knock sensor (KS) electrical connector.



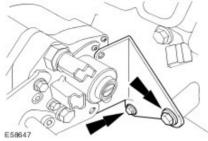
52 . Detach the engine wiring harness.



 ${\bf 53}$. Remove the fuel injection pump support bracket.



54 . Remove the fuel injection pump support bracket to engine cylinder block retaining bolts.

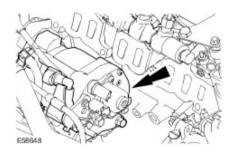


55 **NOTE**:

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.

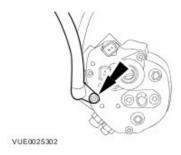
Remove the fuel injection pump.

Discard the fuel injection pump gasket.

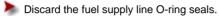


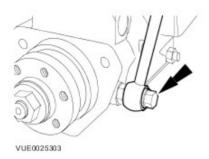
56 . Remove the fuel injection pump shield from the fuel injection pump.





58 . Remove the fuel injection pump fuel supply line and fuel return line assembly from the fuel injection pump.





Installation

All vehicles

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

CAUTION: 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.

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.

CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

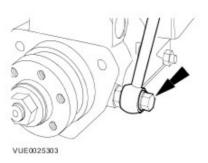
CAUTION: Do not disassemble or clean inside the fuel injection pump, even with an ultrasonic cleaner. Always install a new fuel injection pump when required.

CAUTION: Install a new high-pressure fuel supply line. Failure to follow this instruction may result in damage to the vehicle.

1. NOTE:

Install the fuel injection pump fuel supply line and fuel return line assembly to the fuel injection pump.

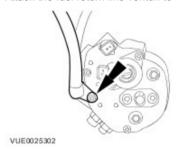




2 . **NOTE**:

Install a new O-ring seal to the fuel return line venturi.

Attach the fuel return line venturi to the fuel injection pump.



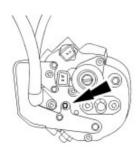
3 . Install the fuel injection pump shield to the fuel injection pump.





4 . Install the fuel injection pump shield retaining bolt.





E45131

E45130

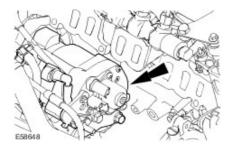
5 . **NOTE:**

Install a new fuel injection pump gasket.

NOTE:

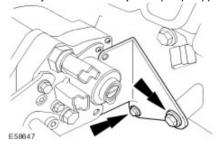
Apply a small bead of loctite 572 on the fuel injection pump retaining bolts.

Install the fuel injection pump.



Install the fuel injection pump retaining bolts evenly in order to pull the fuel injection pump squarely into position.

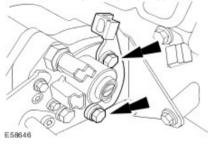
Loosely install the fuel injection pump support bracket to engine cylinder block retaining bolts.



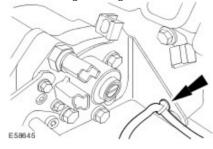
7 . **NOTE:**

Do not fully tighten the fuel injection pump support bracket bolts at this stage.

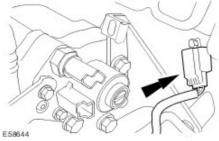
Install the fuel injection pump support bracket to the fuel injection pump.



8 . Attach the engine wiring harness.

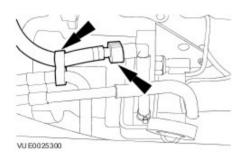


9 . Connect the KS electrical connector.





- 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.



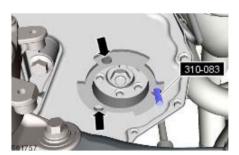
- 12 From 2006 MY special tool numbers 303-681 and 303-681-01 have now been superseded by special tool numbers 303-1151 and 303-083A.
 - To carry out the procedure using special tool numbers 303-1151 and 303-083A see steps 13 15.
 - To carry out the procedure using special tool numbers 303-681 and 303-681-01 see steps 16 18.

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.

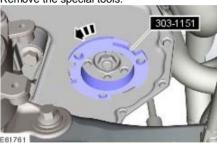
Install the fuel injection pump sprocket retaining bolts.

Tighten to 32 Nm.



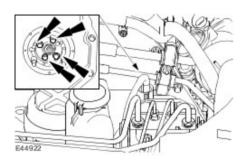
For additional information, see step 12.

Remove the special tools.

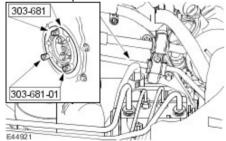


16 . Install the fuel injection pump sprocket retaining bolts.





17 . Remove the special tools.



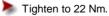
18 . **NOTE:**

Install the fuel injection pump retaining bolts evenly in order to pull the fuel injection pump squarely into position.

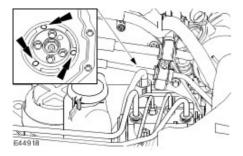
NOTE:

Use a torx 45 drive socket with a minimum shaft length of 43 mm (1.69 in).

Tighten the fuel injection pump retaining bolts.

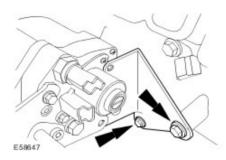


If available use special tool 303-083A.

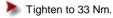


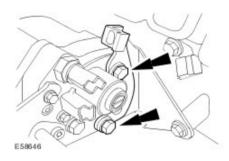
19 . Tighten the fuel injection pump support bracket to cylinder block retaining bolts.



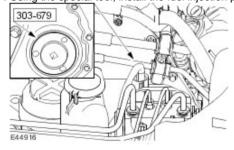


20 . Tighten the fuel injection pump support bracket retaining bolts.





21 . Using the special tool, install the fuel injection pump sprocket access cover.

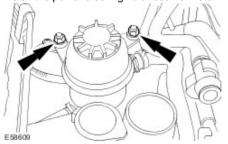


Vehicles built from VIN:E43869

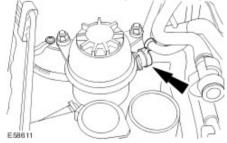
22 . Attach the power steering fluid reservoir.



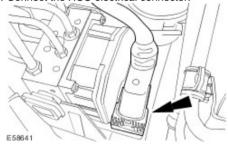
23 . Install the power steering fluid reservoir retaining nuts.



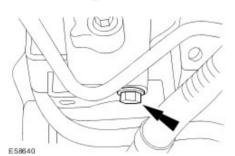
24 . Attach the power steering pipe to the engine wiring harness securing clip.



25 . Connect the HCU electrical connector.

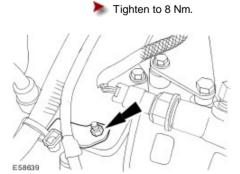


26 . Attach the fuel supply and return lines.

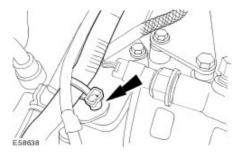


Tighten to 23 Nm.

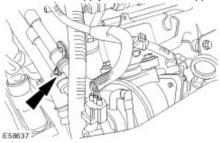
 $\ensuremath{\mathbf{27}}$. Install the fuel supply and return lines support bracket retaining nut.



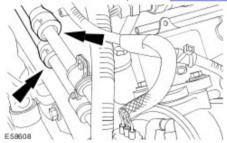
28 . Attach the wiring harness retaining clip.



29 . Install the fuel supply and return lines support bracket retaining nut.

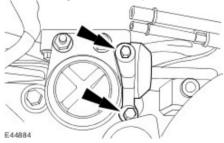


30 . Connect the fuel injection pump fuel supply and return lines. For additional information, refer to Quick Release Coupling - Push Connect

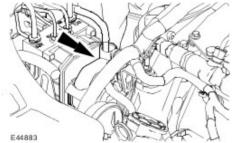


Vehicles built up to VIN:E43868

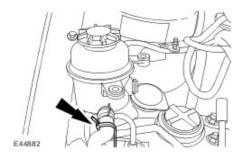
31 . Install the engine mount damper.



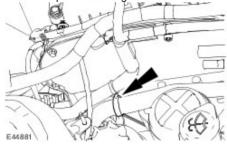
32 . Connect the HCU electrical connector.



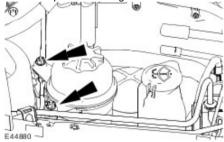
33 . Detach the power steering fluid reservoir.



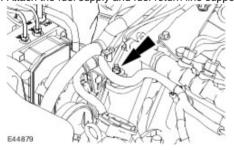
34 . Attach the power steering fluid reservoir.



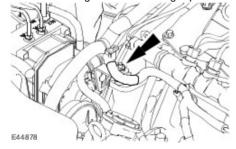
35 . Install the power steering fluid reservoir retaining nuts.



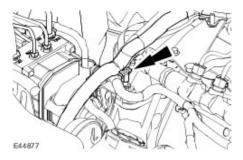
36 . Attach the fuel supply and fuel return line support bracket.



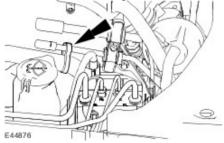
 $\ensuremath{\mathsf{37}}$. Attach the wiring harness retaining clip.



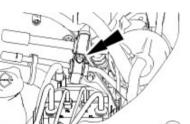
38 . Attach the wiring harness retaining clip.



39 . Attach the power steering fluid hose to the fuel return line.

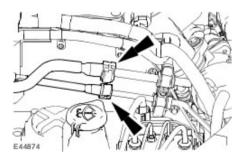


40 . Tighten the fuel supply and return lines support bracket retaining nut.



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
 - Remove the blanking plugs from the fuel injection pump fuel supply and return line male and female connectors.



All vehicles

E44875

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.

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.

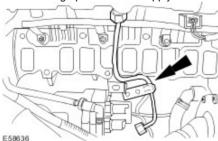
NOTE:

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.



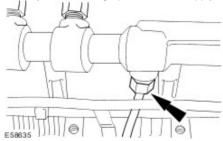
45



CAUTION: Do not tighten the high-pressure fuel supply line union at this stage.

CAUTION: 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.



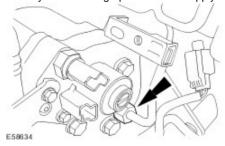
46



CAUTION: Do not tighten the high-pressure fuel supply line union at this stage.

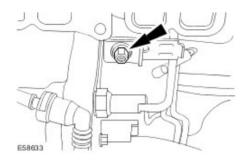
CAUTION: Maintain pressure on the high-pressure fuel supply line to keep the olive in contact with the fuel injection pump cone while installing the union. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Loosely install the high-pressure fuel supply line to the fuel injection pump.



47 . Attach the high-pressure fuel supply line support bracket.





48

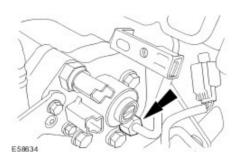
49

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 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.

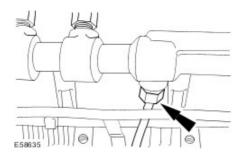




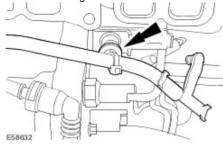
CAUTION: Make sure the tool used to tighten the high-pressure fuel supply line union is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Tighten the high-pressure fuel supply line union at the fuel injection supply manifold.

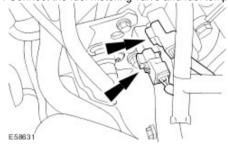




50 . Attach the wiring harness.



 ${\bf 51}$. Connect the fuel metering valve and fuel temperature sensor electrical connectors.

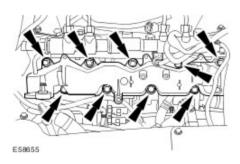


52 . **NOTE**:

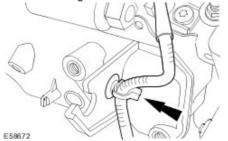
Install new intake manifold gaskets.

Install the intake manifold.

Tighten to 15 Nm.



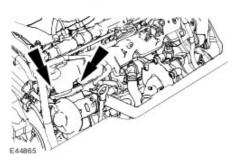
53 . Attach the wiring harness onto the intake manifold.



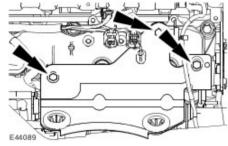
Install a new EGR valve gasket.

Attach the EGR valve to the intake manifold.

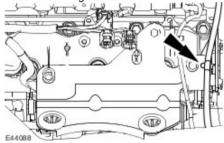




55 . Install the air cleaner mount bracket.



56 . Attach the wiring harness.



- 57 . Install the EGR cooler to EGR valve tube. For additional information, refer to
- 58 . Install a new fuel filter.
 For additional information, refer to Fuel Filter 2.0L Diesel/2.2L Diesel (19.25.02)

Fuel Injection Supply Manifold (19.60.13)

Special Service Tools



Aligner, Fuel Injector 303-711 (21-258)

Removal

WARNING: 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.

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

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.

WARNING: 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.

CAUTION: Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

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.

CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

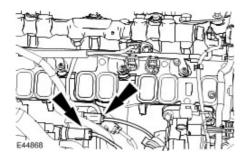
CAUTION: Do not disassemble or clean inside the fuel injection supply manifold, even with an ultrasonic cleaner. Always install a new fuel injection supply manifold when required.

1 . Remove the intake manifold. For additional information, refer to Intake Manifold (30.15.01)

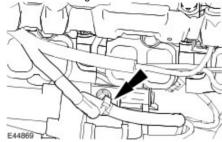
2 . **NOTE**:

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.

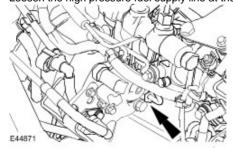


5 . Clean the fuel pump, high pressure fuel supply line and surrounding areas. For additional information, refer to Fuel Injection Component Cleaning

CAUTION: 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.

CAUTION: 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.



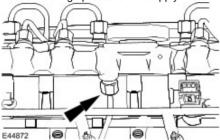
CAUTION: Make sure that the high pressure fuel supply line remains in contact with both the fuel pump and the fuel injection supply manifold until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

CAUTION: 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.

CAUTION: 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.

CAUTION: While maintaining the pressure on the high pressure fuel supply line, clean and vacuum foreign material from the line and union.

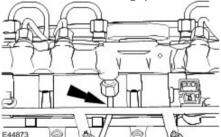
Loosen the high pressure fuel supply line at the fuel injection supply manifold.



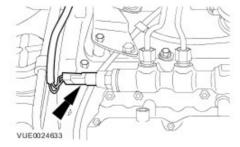
CAUTION: Make sure that the high pressure fuel supply line remains in contact with both the fuel pump and the fuel injection supply manifold until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Using the , 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 , 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
- ${\bf 14}$. Disconnect the fuel pressure sensor electrical connector.

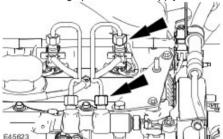


CAUTION: Make sure that the high pressure fuel supply line remains in contact with both the fuel injector and the fuel injection supply manifold until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

CAUTION: 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.

CAUTION: 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.

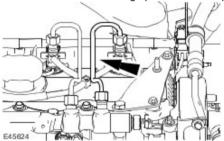
Loosen the high pressure fuel supply line from the fuel injector and the fuel injection supply manifold.



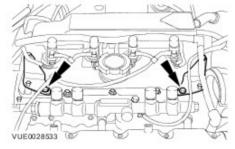
CAUTION: Make sure that the high pressure fuel supply line remains in contact with both the fuel injector and the fuel injection supply manifold until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

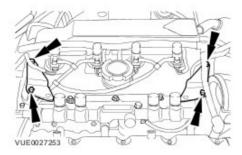
Using the , vacuum foreign material from the fuel injector and the fuel injection supply manifold.

17 . Remove and discard the high pressure fuel supply line.

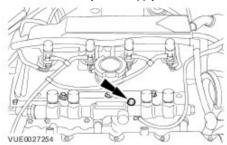


- 18 . Repeat steps 14 and ,15 to remove the 3 remaining high pressure fuel supply lines.
- 19. Using the , vacuum foreign material from the fuel injector and the fuel injection supply manifold.
- 20 . Install blanking caps to the open threaded ports on the fuel injectors and the fuel injection supply manifold.
- 21 . Remove the fuel injection supply manifold retaining bolts.





23 . Remove the fuel injection supply manifold.



Installation

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

CAUTION: 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.

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.

CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

CAUTION: 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.

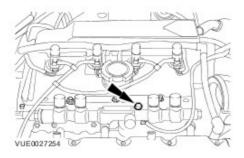
NOTE:

Install new high pressure fuel supply lines.

1 . **NOTE**:

Do not tighten the fuel injection supply manifold retaining bolt at this stage.

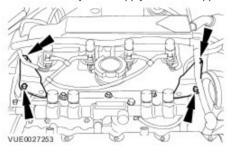
Install the fuel injection supply manifold.



2 . **NOTE:**

Do not tighten the fuel injection supply manifold support bracket bolts at this stage.

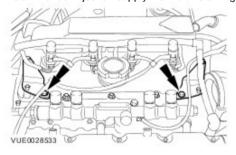
Install the fuel injection supply manifold support brackets.



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 .



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:

5

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.

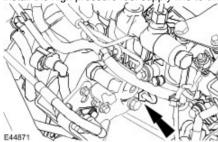
6. Remove the blanking plugs from the fuel pump and the fuel injection supply manifold threaded ports.

⁷ .

CAUTION: Do not tighten the high pressure fuel supply line union at this stage.

CAUTION: 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.

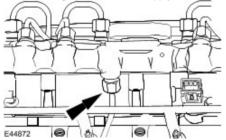


8

CAUTION: Do not tighten the high pressure fuel supply line union at this stage.

CAUTION: 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 .



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:

10

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.

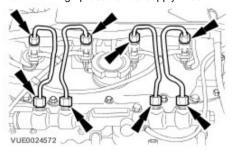
NOTE:

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.

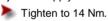
Install new high pressure fuel supply lines.

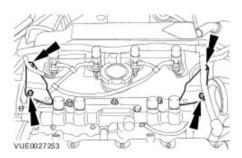


13 . **NOTE:**

High pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold support brackets.

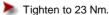


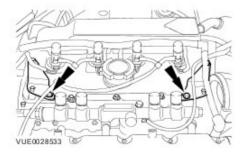


14 . **NOTE:**

High pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold retaining bolts.



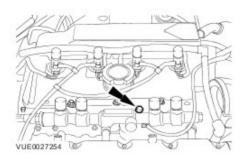


15 . **NOTE**:

High pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold retaining bolt.

Tighten to 23 Nm.

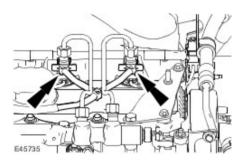


16 . **NOTE:**

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.

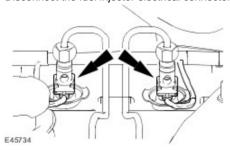


17 . **NOTE**:

18

Two fuel injector shown, other fuel injectors similar.

Disconnect the fuel injector electrical connectors.



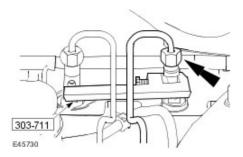
CAUTION: Make sure the special tool is clamped around the fuel injector which is being tightened and is resting up against the adjacent fuel injector.

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.

CAUTION: 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.





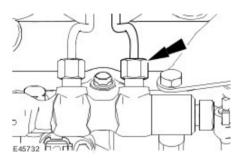
19 . Remove the special tool.

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.



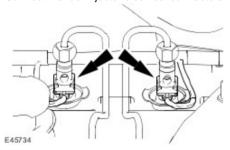


21 . Repeat steps 16, 17 and 18 for tightening the 3 remaining high pressure fuel supply line unions.

22 . **NOTE:**

Cylinders three and four fuel injectors shown, cylinders one and two fuel injectors similar.

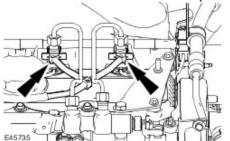
Connect the fuel injector electrical connectors.



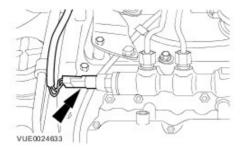
23 . **NOTE:**

Cylinders three and four fuel injectors shown, cylinders one and two fuel injectors similar.

Connect the fuel return lines to the fuel injectors.

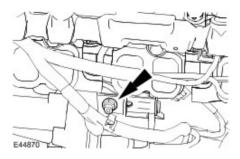


24 . Connect the fuel pressure sensor electrical connector.



25 . Attach the high pressure fuel supply line support bracket.





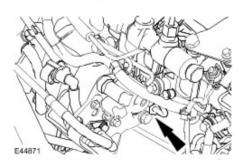
26

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 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.

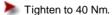
Tighten the high pressure fuel supply line union at the fuel pump.

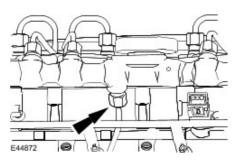




CAUTION: Make sure the tool used to tighten the high pressure fuel supply line union is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Tighten the high pressure fuel supply line union at the fuel injection supply manifold.

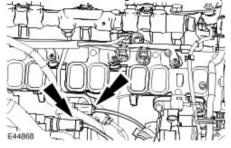




28 . Attach the wiring harness.

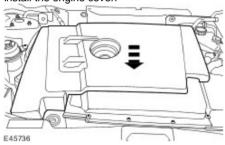


29 . Connect the fuel metering valve and fuel temperature sensor electrical connectors.



30 . Install the intake manifold. For additional information, refer to Intake Manifold (30.15.01)

31 . Install the engine cover.



32 . Install the oil filler cap.



33 . Install the oil level indicator.



Fuel Injector (18.10.01)

Special Service Tools



Socket, Fuel Injector Remover/Installer 303-677



Aligner, Fuel Injector 303-711

Removal

WARNING: 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.

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

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.

WARNING: 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.

CAUTION: Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

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.

CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

CAUTION: 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.



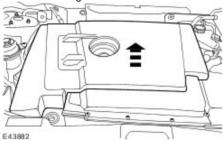
2. Remove the oil filler cap.



3 . **NOTE**:

Install the oil filler cap and oil level indicator to prevent foreign material entering the valve cover.

Remove the engine cover.



CAUTION: Protect the fuel injector electrical connectors with lint-free material to prevent contamination from the cleaning fluid.

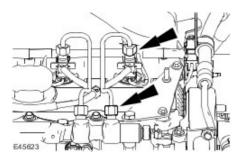
Clean the fuel injector, high-pressure fuel supply line and surrounding areas. For additional information, refer to Fuel Injection Component Cleaning

5 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.

CAUTION: 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.

CAUTION: 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.

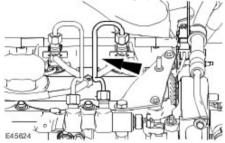
Loosen the high-pressure fuel supply line from the fuel injector and fuel injection supply manifold.



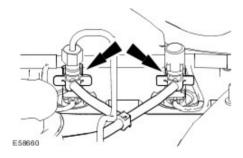
CAUTION: Make sure that the high-pressure fuel supply line remains in contact with both the fuel injector and the fuel injection supply manifold until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

Using the pneumatic vacuum gun, vacuum foreign material from the high-pressure fuel supply line, the fuel injector and the fuel injection supply manifold.

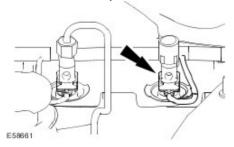
7 . Remove and discard the high-pressure fuel supply line.



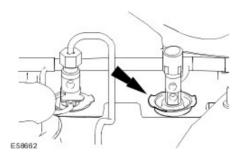
- 8. Using the pneumatic vacuum gun, vacuum foreign material from the fuel injector and the fuel injection supply manifold.
- 9 . Install blanking caps to the open threaded ports on the fuel injector and the fuel injection supply manifold.
- $10\ .$ Disconnect the fuel return lines from the fuel injectors.
 - Discard the fuel return line O-ring seals.



11 . Disconnect the fuel injector electrical connector.

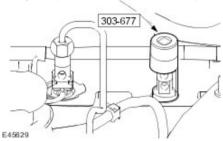


- 12 . Remove the valve cover fuel injector seal.
 - Discard the valve cover fuel injector seal.



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

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

CAUTION: 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.

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.

CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

CAUTION: 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).

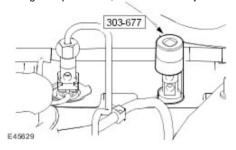


VUE0024576

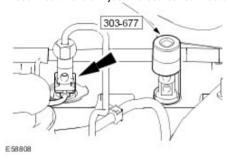
2 . **NOTE**:

Do not tighten the fuel injector locking collar at this stage.

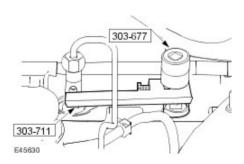
Using the special tool, install the fuel injector.



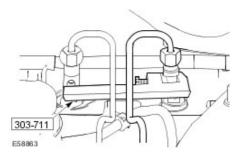
3 . Disconnect the fuel injector electrical connector.



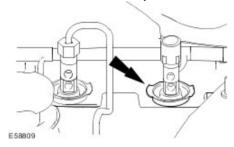
 ${\bf 4}$. Using the special tools, tighten the fuel injector locking collar. Tighten to 47 Nm.



5 . Remove the special tool.



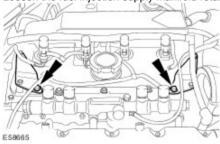
6 . Install the valve cover fuel injector seal.



7 . **NOTE:**

High-pressure fuel supply lines shown removed for clarity.

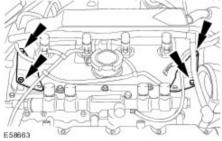
Loosen the fuel injection supply manifold retaining bolts.



8 . **NOTE:**

High-pressure fuel supply lines shown removed for clarity.

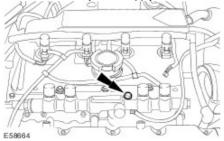
Loosen the fuel injection supply manifold support brackets.



9 . **NOTE:**

High-pressure fuel supply lines shown removed for clarity.

Loosen the fuel injection supply manifold retaining bolt.



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.

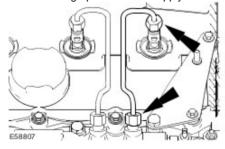
NOTE:

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.

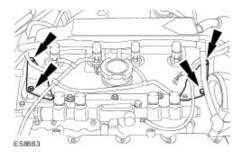


14 . **NOTE**:

High-pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold support brackets retaining bolts.

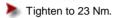
Tighten to 14 Nm.

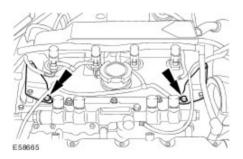


15 . **NOTE:**

High-pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold retaining bolts.



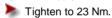


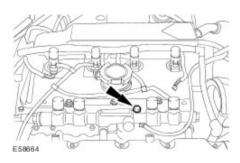
16 . **NOTE:**

17

High-pressure fuel supply lines shown removed for clarity.

Tighten the fuel injection supply manifold retaining bolt.





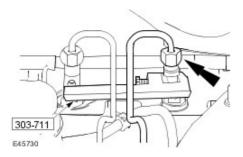
CAUTION: Make sure the special tool is clamped around the fuel injector which is being tightened and is resting up against the adjacent fuel injector.

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.

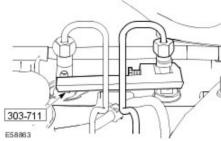
CAUTION: Make sure that the fuel injector does not move when tightening the high-pressure fuel supply lines. Failure to follow this instruction will result in damage to the fuel injector and the fuel injector sealing washer.

Install the special tool and tighten the high-pressure fuel supply line union at the fuel injector.



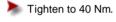


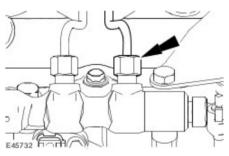
18 . Remove the special tool.



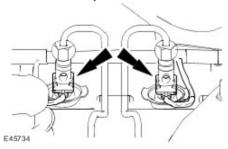
CAUTION: Make sure the tool used to tighten the high-pressure fuel supply line unions is used at the top of the union as this is where there is most material. Failure to follow this instruction may result in damage to the union.

Tighten the high-pressure fuel supply line union at the fuel injection supply manifold.

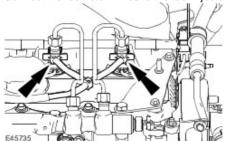




20 . Connect the fuel injector electrical connectors.



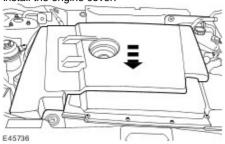
21 . Connect the fuel return lines to the fuel injectors.



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.



 $25 \; . \; \text{Using the Jaguar approved diagnostic system, configure the new fuel injector to the engine control module (ECM)}.$

Fuel Metering Valve

Removal

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

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.

WARNING: 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.

WARNING: If taken internally, DO NOT induce vomiting. Seek medical attention. Failure to follow this instruction may result in personal injury.

WARNING: 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.

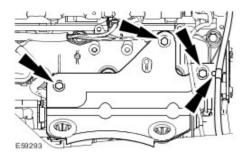
WARNING: Wash hands thoroughly afer handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention. Failure to follow this instruction may result in personal injury.

CAUTION: Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

CAUTION: 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.

CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

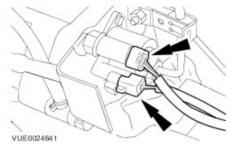
- Remove the air cleaner assembly.
 For additional information, refer to <u>Air Cleaner (19.10.05)</u>
- 2 . Remove the air cleaner mount bracket.
 - Detach the wiring harness.
 - Remove the air cleaner bracket retaining bolts.



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

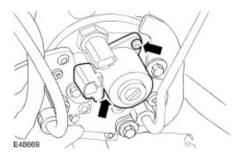
4 . Disconnect the fuel metering valve and fuel temperature sensor electrical connectors.



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

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling, Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

CAUTION: 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.

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.

CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

NOTE:

Install a new fuel metering valve and O-ring seal.

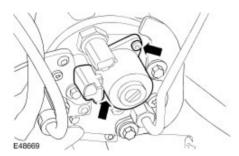
- 1. Remove and discard the blanking plug from the fuel pump.
- 2. Using a suitable multipurpose lubricant spray, lubricate the O-ring seal.

CAUTION: 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.

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.

Install the fuel metering valve and O-ring seal.

Install the fuel metering valve retaining bolts finger tight.

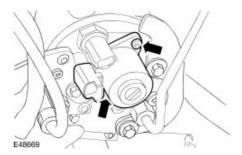


CAUTION: The fuel metering valve retaining bolts must be tightened in the following stages. Failure to follow this instruction may result in damage to the fuel metering valve.

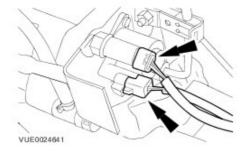
Tighten the fuel metering valve retaining bolts in two stages.

Stage 1: 2.5 Nm

Stage 2: 5.5 Nm



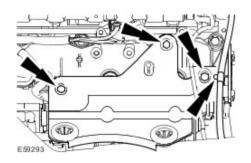
5. Connect the fuel metering valve and fuel temperature sensor electrical connectors.



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 (19.10.05)

Fuel Return Line Venturi

Removal

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

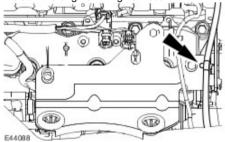
CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

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.

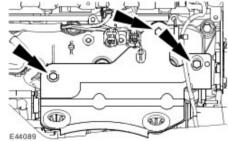
Remove the air cleaner.

For additional information, refer to Air Cleaner (19.10.05)

2 . Detach the engine wiring harness



3. Remove the air cleaner mount bracket.



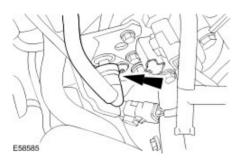
4 . **NOTE**:

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.

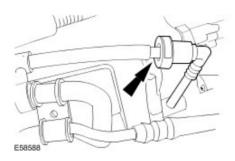


- 5 . Clean the fuel pump, fuel return lines and surrounding area. For additional information, refer to Fuel Injection Component Cleaning
- 6 . Disconnect the fuel filter return line from the fuel pump.
 For additional information, refer to Quick Release Coupling Push Connect
 - Install blanking plugs to the open orifices.

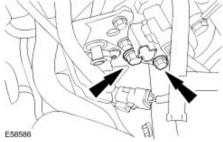


7 . Disconnect the fuel injector to fuel pump return line. For additional information, refer to Quick Release Coupling - Push Connect

Install blanking plugs to the open orifices.



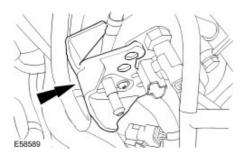
8 . Remove the fuel pump shield lower retaining bolts.



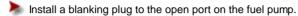
9 . Remove the fuel pump shield upper retaining bolts.

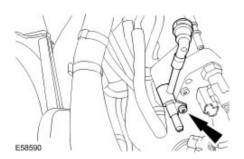


- 10 Using the pneumatic vacuum gun, vacuum foreign material from the fuel pump, fuel return line venturi and the fuel pump fuel . return lines.
- ${\bf 11}$. Remove the fuel pump shield.



12 . Remove the fuel return line venturi.





Installation

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

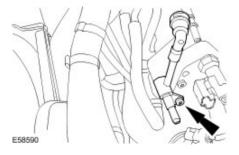
WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

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.

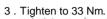
To install, reverse the removal procedure.

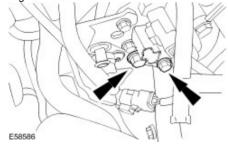




2. Tighten to 8 Nm.







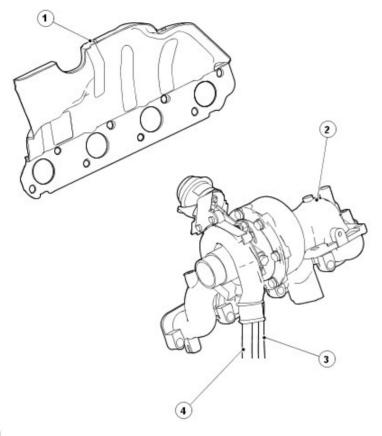
Specifications

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

Turbocharger

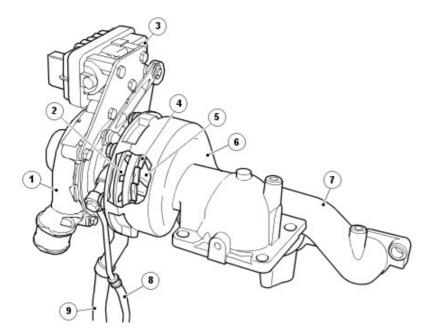
Variable vane turbocharger - Vehicles built up to VIN:E25781



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



F67499

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.

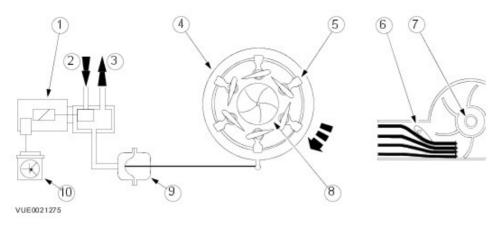
The turbocharger does not have a wastegate control valve. Instead, it has variable turbocharger vanes which are located in the turbocharger turbine housing and directs the air flow into the turbocharger turbine. The turbocharger vanes act as the control for the turbocharger boost pressure.

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.

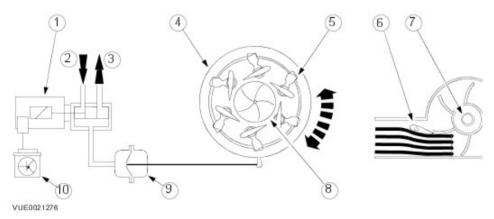
Regulation at Low Engine Speed



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.

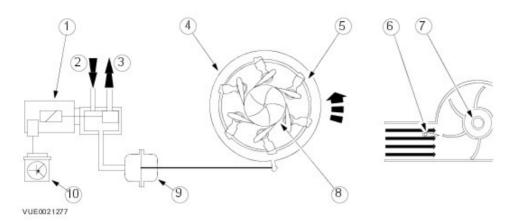
Regulation at Moderate Engine Speed



ltem	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

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.

Turbocharger

Overview

For information on the operation of the turbocharger: <u>Turbocharger</u>

Inspection and Verification

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.

WARNING: 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 . Verify the customer concern.
- 2. Visually inspect for obvious mechanical or electrical faults.

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.

NOTE:

For a full list of DTCs:
Electronic Engine Controls

DTC	Condition	Possible source	Action
P0234	Turbocharger overboost condition	 Excessive boost, detected by the 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: high resistance MAPT sensor circuit: short circuit to ground MAPT sensor circuit: short circuit to signal return MAPT sensor fault 	Check the MAPT sensor and circuits. Refer to the electrical guides. If no fault is found in the circuits, install a new sensor. Manifold Absolute Pressure and Temperature (MAPT) Sensor Clear the DTCs, test for normal operation.
P0243	Turbocharger actuator A circuit	Turbocharger actuator circuit: high resistanceTurbocharger 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. Turbocharger Clear the DTCs, test for normal operation.
P132A	Turbocharger boost system performance	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. Turbocharger Clear the DTCs, test for normal operation.
P132B	Turbocharger boost system performance	Memory check failure during initializationTurbocharger vanes sticking	Refer to the approved diagnostic system for a guided diagnostic routine. Clear the DTCs. Cycle the ignition and recheck the DTCs. If the DTCs are still present after 3 attempts, check the turbocharger vanes for deposit build-up. If there is no build-up, install a new turbocharger. <u>Turbocharger</u> Clear the DTCs, test for normal operation.
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 and 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. Turbocharger Clear the DTCs, test for normal operation.

Turbocharger

Removal

All vehicles

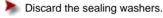
1 . Remove the catalytic converter. For additional information, refer to

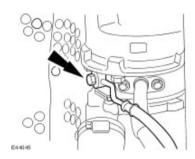
Vehicles with 2.2L diesel engine

2 . Remove the right-hand halfshaft. For additional information, refer to Front Halfshaft RH - 2.0L Diesel/2.2L Diesel (47.10.16)

Vehicles built up to VIN:E25781

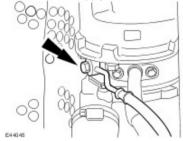
 $\boldsymbol{3}$. Detach the oil supply tube from the turbocharger.



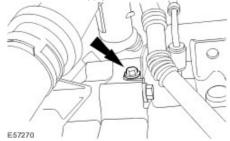


Vehicles built from VIN:E25782

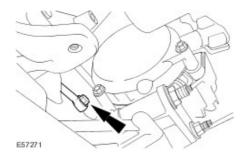
4 . Detach the oil supply tube from the turbocharger.



5. Detach the oil supply tube.

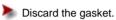


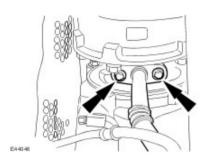
 ${\bf 6}$. Remove the oil supply tube.



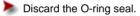
All vehicles

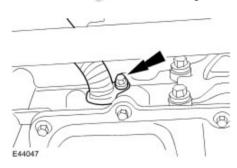
7 . Detach the oil return tube from the turbocharger.



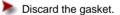


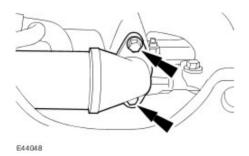
8 . Remove the oil return tube.



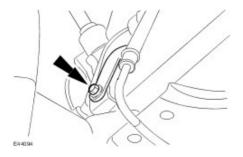


9 . Detach the exhaust gas recirculation (EGR) cooler from the exhaust manifold.

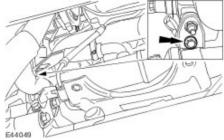




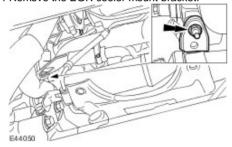
10 . Detach the coolant pipe from the EGR cooler.



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.

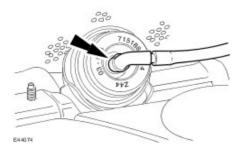
Discard the bolts and nuts.



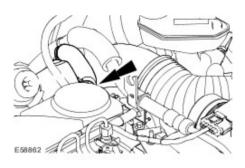
- 14 . Lower the vehicle.
- 15 . Remove the cowl vent screen.
 For additional information, refer to Cowl Vent Screen (76.10.01)

Vehicles built up to VIN:E43868

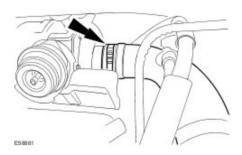
16 . Disconnect the vacuum hose.



- 17 . Detach the positive crankcase ventilation hose from the valve cover.
 - Discard the positive crankcase ventilation hose retaining clip.

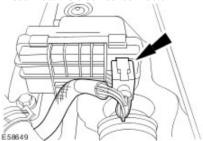


- 18 . Detach the air cleaner outlet pipe from the turbocharger.
 - Discard the air cleaner outlet pipe retaining clip.

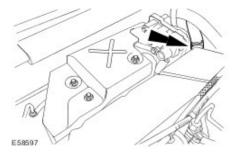


Vehicles built from VIN:E43869

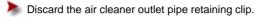
19 . Disconnect the electrical connector.

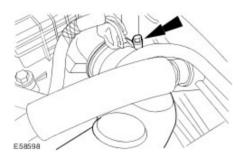


- 20 . Detach the positive crankcase ventilation hose from the valve cover.
 - Discard the positive crankcase ventilation hose retaining clip.



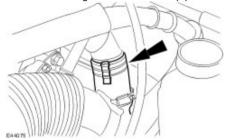
21 . Detach the air cleaner outlet pipe from the turbocharger.



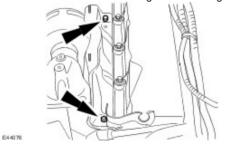


All vehicles

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.

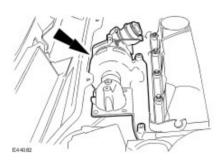


25 . Remove and discard the exhaust manifold gasket.



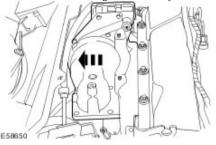
26 . Remove the turbocharger.

Remove and discard the turbocharger retaining studs.

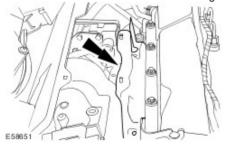


Vehicles built from VIN:E43869

27 . Detach the turbocharger from the cylinder head.

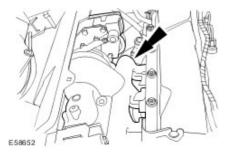


28 . Remove and discard the exhaust manifold gasket.



29 . Remove the turbocharger.

Remove and discard the turbocharger retaining studs.

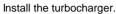


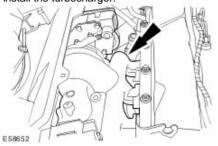
Installation

Vehicles built from VIN:E43869

1 . **NOTE**:

Install new turbocharger retaining studs.





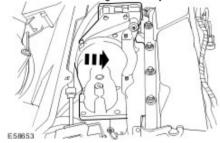
2 . **NOTE:**

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.



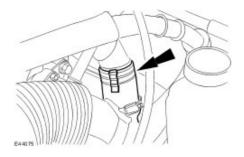
8 . Install the exhaust manifold gasket retaining studs.



Tighten to 10 Nm.

E44076

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.

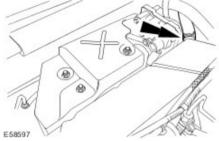
Attach the air cleaner outlet pipe to the turbocharger.



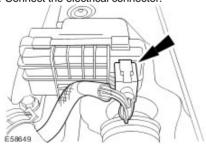
11 . **NOTE**:

Install a new positive crankcase ventilation hose retaining clip.

Attach the positive crankcase ventilation hose to the valve cover.



12 . Connect the electrical connector.

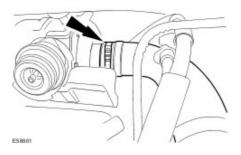


Vehicles built up to VIN:E43868

13 . **NOTE:**

Install a new air cleaner outlet pipe retaining clip.

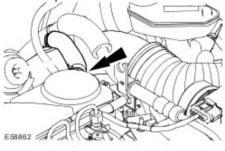
Attach the air cleaner outlet pipe to the turbocharger.



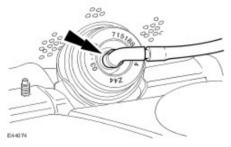
14 . **NOTE**:

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.

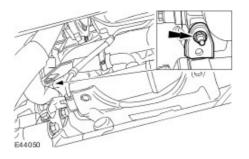
 For additional information, refer to Cowl Vent Screen (76.10.01)
- 17 . Raise the vehicle.
- 18 . Tighten the exhaust manifold retaining nuts and bolts.





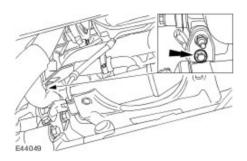
19 . Install the EGR cooler mount bracket.

Tighten to 10 Nm.

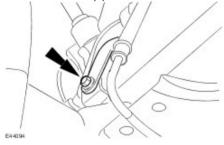


20 . Install the EGR cooler mount bracket retaining bolt.





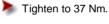
21 . Attach the coolant pipe to the EGR cooler.

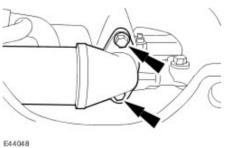


22 . **NOTE:**

Install a new gasket.

Attach the EGR cooler to the exhaust manifold.



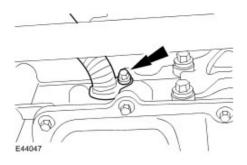


23 . **NOTE:**

Install a new O-ring seal.

Install the oil return tube.

Tighten to 10 Nm.

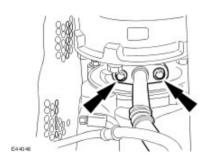


24 . **NOTE**:

Install a new gasket.

Attach the oil return tube to the turbocharger.

Tighten to 10 Nm.



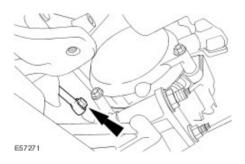
Vehicles built from VIN:E25782

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.

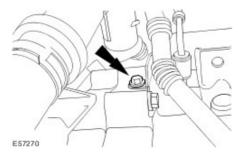
Install the oil supply tube.

Tighten to 14 Nm.



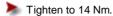
26 . Attach the oil supply tube.

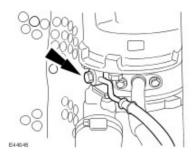
Tighten to 23 Nm.



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.





Vehicles built up to VIN:E25781

28

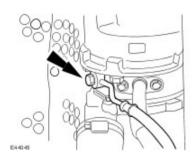
CAUTION: When installing the oil supply tube union to the turbocharger, check the routing of the oil supply tube and make sure it is not touching the turbocharger.

NOTE:

Install new sealing washers.

Attach the oil supply tube to the turbocharger.





Vehicles with 2.2L diesel engine

29 . Install the right-hand halfshaft.
For additional information, refer to Front Halfshaft RH - 2.0L Diesel/2.2L Diesel (47.10.16)

All vehicles

30 . Install the catalytic converter. For additional information, refer to

31 . **NOTE**:

Use oil WSS-M2C913-B or equivalent meeting Jaguar specification.

Check and top up the engine with oil if necessary.

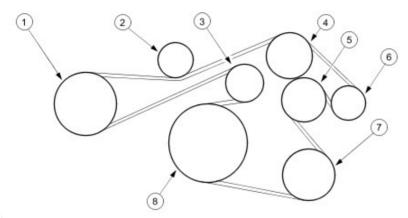
Specifications

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	-
nerator retaining bolt - vehicles with 2.0L or 2.2L diesel engine		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	-

Accessory Drive

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 r bbed 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.

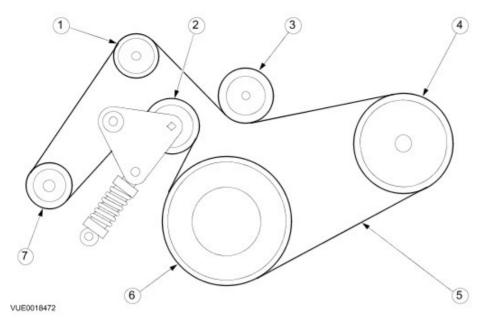
Generator Drive

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.

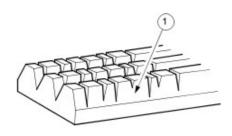
Generator Drive

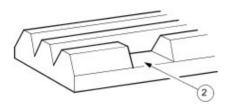
The generator is fitted on the lower right accessory mounting.

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

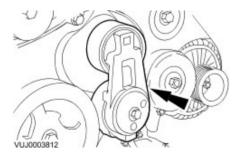
Item	Description
1	Acceptable Drive Belt Cracking
2	Unacceptable Drive Belt Damage

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.

Accessory Drive

Inspection and Verification

- 1. Verify the customer concern.
- 2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
Damaged or contaminated belt
Belt tension
Belt tensioner
Pulleys
Loose hardware

- 1 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 2. If the concern is not visually evident, verify the symptom and refer to the symptom chart.

Symptom Chart

Belt noise or squeal

Possible Source(s):

- Pulley(s)
- Lubricant or other contamination
- Belt

Action(s) to take:

- 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/2.5L/3.0L (12.10.40) or Accessory Drive Belt - 2.0L Diesel/2.2L Diesel (12.10.40)
- CHECK belt for correct application.

Belt does not hold tension

Possible Source(s):

- Belt cracking or damaged
- Tensioner worn or damaged

Action(s) to take:

- INSPECT belt for cracking or damage. INSTALL a new belt if required. For additional information refer to Accessory Drive Belt - 2.0L/2.5L/3.0L (12.10.40) or Accessory Drive Belt - 2.0L Diesel/2.2L Diesel (12.10.40)
- 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/2.5L/3.0L (12.10.41) or Accessory Drive Belt Tensioner - 2.0L Diesel/2.2L Diesel (12.10.41)
```

Component Tests

Belt Tensioner-Mechanical

The only mechanical check that needs to be made is a check for tensioner "stick, grab or bind".

- 1. Remove the belt in the area of the tensioner.
- 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 . 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 Diesel/2.2L Diesel (12.10.41) or Accessory Drive Belt Tensioner - 2.0L/2.5L/3.0L (12.10.41)

Belt Tensioner-Dynamic

The automatic belt tensioner can be checked dynamically as follows:

- 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. With the engine off, check routing of the belt. For additional information, refer to the illustrations under Description and Operation.
- 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/2.5L/3.0L (12.10.40) or Accessory Drive Belt 2.0L Diesel/2.2L Diesel (12.10.40)

Accessory Drive Belt - 2.0L Diesel/2.2L Diesel (12.10.40)

Special Service Tools



Release tool, belt tensioner 303-676

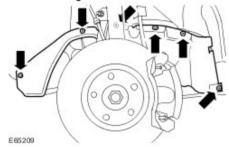
Removal

Disconnect the battery ground cable.
 For additional information, refer to Battery Disconnect and Connect

2 . Remove the air deflector.
For additional information, refer to <u>Air Deflector - 2.0L Diesel/2.2L Diesel (76.11.41)</u>

3 . Remove the right-hand road wheel. For additional information, refer to Wheel and Tire (74.20.05)

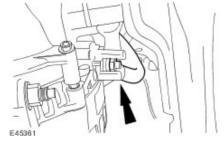
4 . Remove the right-hand wheel arch liner access panel.



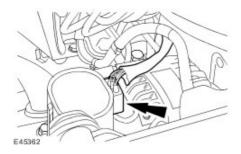
5. Using the special tool, detach the accessory drive belt.



6 . Detach the generator positive cable.



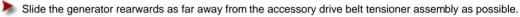
7 . Disconnect the generator electrical connector.

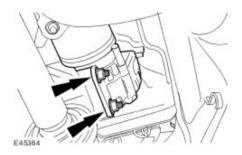


8 . Remove the generator upper retaining bolt.

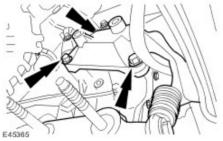


9 . Detach the generator.

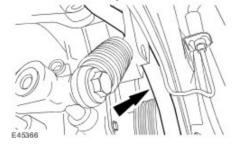




10 . Detach the accessory drive belt tensioner assembly.

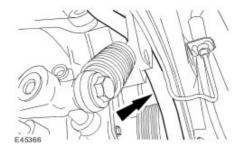


11 . Remove the accessory drive belt.



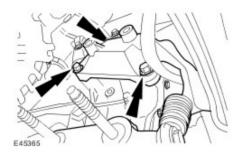
Installation

1 . Install the accessory drive belt.



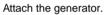
2 . Attach the accessory drive belt tensioner assembly.

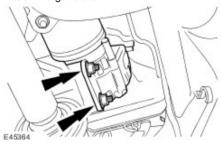




3 . **NOTE:**

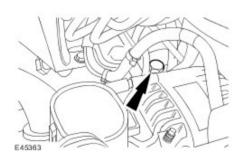
Loosely install the generator retaining nuts.



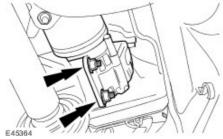


4 . Install the generator retaining bolt.

Tighten to 47 Nm.



5 . Tighten to 47 Nm.

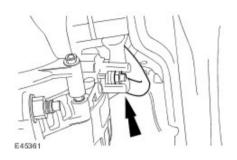


6 . Connect the generator electrical connector.



7 . Attach the generator positive cable.

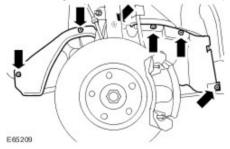




8 . Using the special tool, install the accessory drive belt.



9. Install the right-hand wheel arch liner access panel.



Install the right-hand road wheel.
 For additional information, refer to Wheel and Tire (74.20.05)

11 . Install the air deflector.
For additional information, refer to Air Deflector - 2.0L Diesel/2.2L Diesel (76.11.41)

12 . Connect the battery ground cable.
For additional information, refer to Battery Connect (86.15.15)

Accessory Drive Belt Tensioner - 2.0L Diesel/2.2L Diesel (12.10.41)

Special Service Tools



Release tool, belt tensioner 303-676

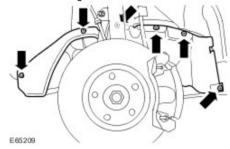
Removal

Disconnect the battery ground cable.
 For additional information, refer to Battery Disconnect and Connect

2 . Remove the air deflector.
For additional information, refer to <u>Air Deflector - 2.0L Diesel/2.2L Diesel (76.11.41)</u>

3 . Remove the right-hand road wheel. For additional information, refer to Wheel and Tire (74.20.05)

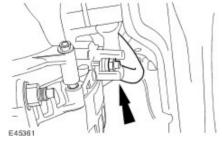
4 . Remove the right-hand wheel arch liner access panel.



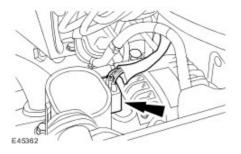
5. Using the special tool, detach the accessory drive belt.



6 . Detach the generator positive cable.



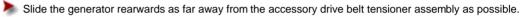
7 . Disconnect the generator electrical connector.

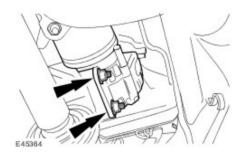


8 . Remove the generator upper retaining bolt.

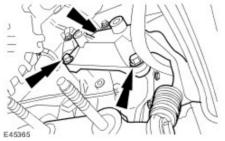


9 . Detach the generator.

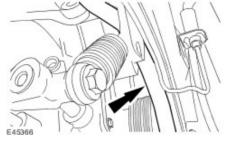




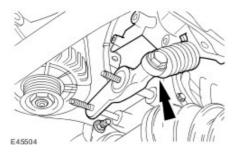
10 . Detach the accessory drive belt tensioner assembly.



11 . Detach the accessory drive belt.

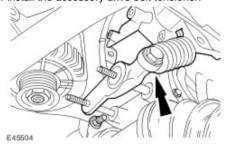


12 . Remove the accessory drive belt tensioner.

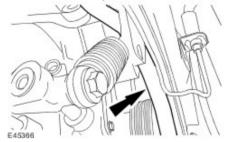


Installation

1 . Install the accessory drive belt tensioner.

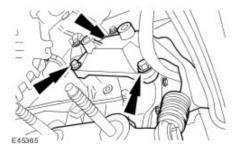


2 . Attach the accessory drive belt.



3 . Attach the accessory drive belt tensioner assembly.

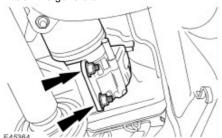
Tighten to 47 Nm.



4 . **NOTE:**

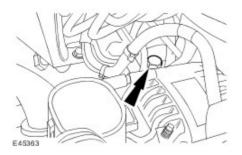
Loosely install the generator retaining nuts.

Attach the generator.

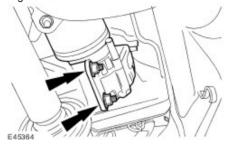


5 . Install the generator retaining bolt.

Tighten to 47 Nm.



6 . Tighten to 47 Nm.

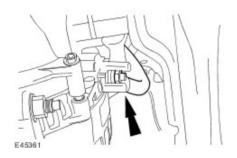


7 . Connect the generator electrical connector.



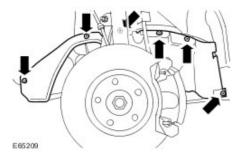
8 . Attach the generator positive cable.

Tighten to 8 Nm.



 $\boldsymbol{9}$. Using the special tool, install the accessory drive belt.





11 . Install the right-hand road wheel.
For additional information, refer to Wheel and Tire (74.20.05)

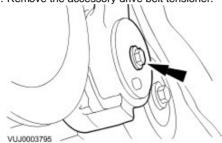
12 . Install the air deflector.
For additional information, refer to <u>Air Deflector - 2.0L Diesel/2.2L Diesel (76.11.41)</u>

13 . Connect the battery ground cable.
For additional information, refer to Battery Connect (86.15.15)

Accessory Drive Belt Tensioner - 2.0L/2.5L/3.0L (12.10.41)

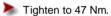
Removal

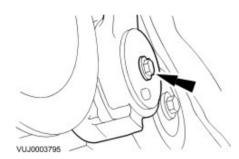
- ${\bf 1}$. Remove the accessory drive belt. For additional information, refer to the For additional information, refer to .
- 2 . Remove the accessory drive belt tensioner.



Installation

1 . To install, reverse the removal procedure.





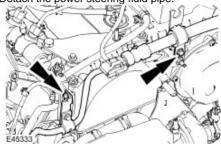
Power Steering Pump Belt - 2.0L Diesel/2.2L Diesel

Removal

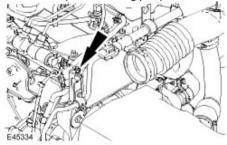
Remove the air cleaner assembly.

For additional information, refer to <u>Air Cleaner (19.10.05)</u>

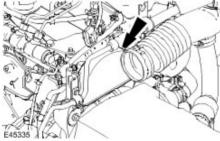
2 . Detach the power steering fluid pipe.



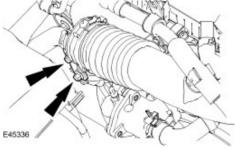
3 . Remove the power steering pump belt cover retaining nut.



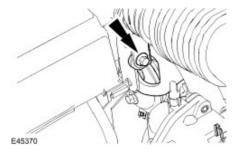
4 . Remove the power steering pump belt cover.



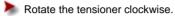
5 . Remove the exhaust gas recirculation (EGR) cooler to EGR valve tube support bracket lower retaining bolts.

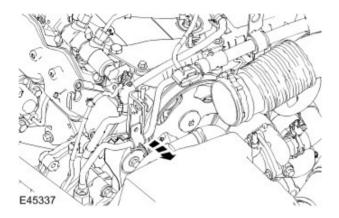


6 . Remove the EGR cooler to EGR valve tube support bracket.



7 . Remove the power steering pump belt.

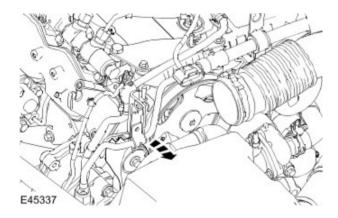




Installation

1 . Install the power steering pump belt.





2 . **NOTE**:

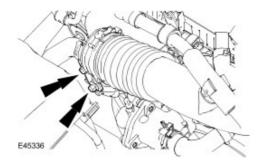
Do not tighten the EGR cooler to EGR valve tube support bracket upper retaining bolt at this stage.

Install the EGR cooler to EGR valve tube support bracket.

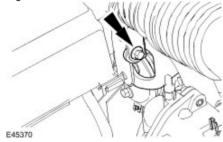


3 . Install the EGR cooler to EGR valve tube support bracket lower retaining bolts.

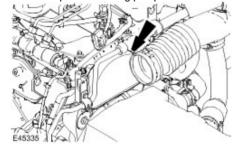
Tighten to 23 Nm.



4 . Tighten to 10 Nm.

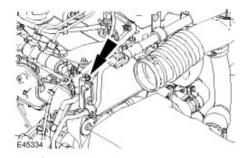


 ${\bf 5}$. Install the power steering pump belt cover.

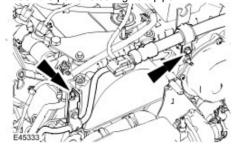


6 . Install the power steering pump belt cover retaining nut.

Tighten to 10 Nm.



7 . Attach the power steering fluid pipe.

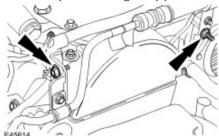


For additional information, refer to Air Cleaner (19.10.05)

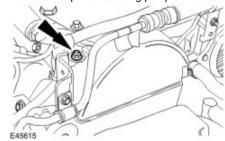
Power Steering Pump Belt Tensioner - 2.0L Diesel/2.2L Diesel

Removal

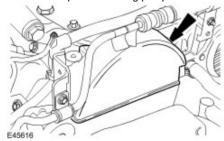
- Remove the exhaust gas recirculation (EGR) cooler to EGR valve tube.
 For additional information, refer to
- 2 . Detach the power steering fluid pipe.



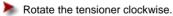
3 . Remove the power steering pump belt cover retaining nut.

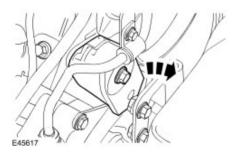


4. Remove the power steering pump belt cover.

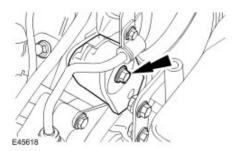


5 . Detach the power steering pump belt.





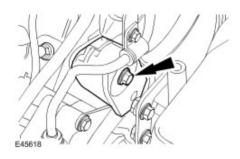
6 . Remove the power steering pump belt tensioner.



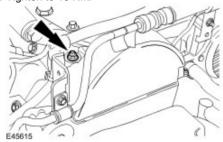
Installation

1 . To install, reverse the removal procedure.





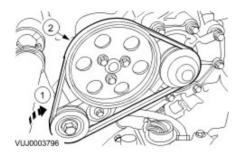
2 . Tighten to 10 Nm.



Water Pump Belt - 2.0L/2.5L/3.0L (12.10.44)

Removal

- 1 . Remove the battery tray. For additional information, refer to <<414-01>>.
- 2 . Remove the water pump belt.
 - 1) De-tension the water pump belt.
 - 2) Remove the water pump belt.



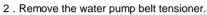
Installation

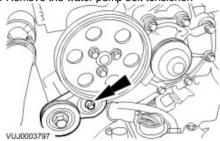
1 . To install, reverse the removal procedure.

Water Pump Belt Tensioner - 2.0L/2.5L/3.0L (12.10.45)

Removal

1 . Remove the water pump belt. For additional information, refer to the For additional information, refer to .

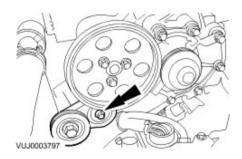




Installation

1 . To install, reverse the removal procedure.





Specifications

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	-

Starting System

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:

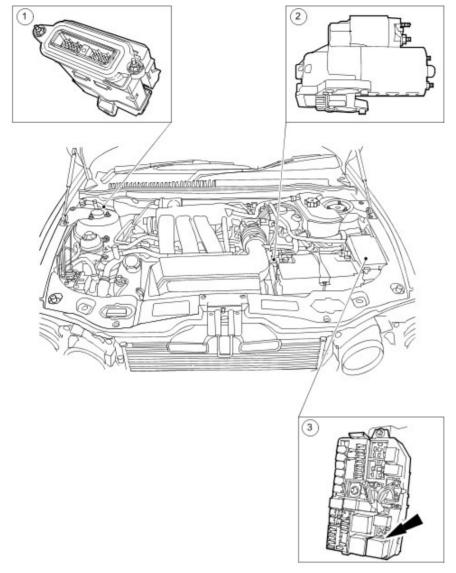
- The maximum cranking time is exceeded
- The ECM detects an engine running signal
- The ignition switch is no longer in the start position
- The transmission range switch is no longer in the NEUTRAL or PARK position (vehicles fitted with automatic transmission)
- The clutch pedal is released (USA vehicles 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

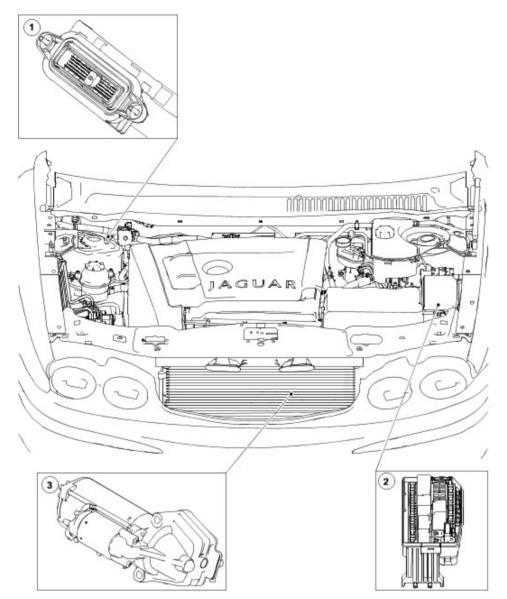
Vehicles with 2.0L, 2.5L or 3.0L engines



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



E44289

Item Part Number		Description
1	_	Engine control module (ECM)
2	_	Starter motor relay
3	_	Starter motor

Starting System - 2.0L



WARNING: Beware of rotating parts. Failure to follow these instructions may result in personal injury.

- 1. Visually inspect for obvious signs of mechanical and electrical damage.
- 2. Verify the customer concern by operating the system.
- 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. If an obvious cause for an observed or reported concern is found, correct the cause, (if poss ble) before proceeding to the next step.
- 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 - 2.5L/3.0L

- 1 . Verify the customer concern by operating the system.
- 2. Visually inspect for obvious signs of mechanical or electrical damage.
- 3 . Make sure the vehicle is in NEUTRAL or PARK for automatic vehicles, NEUTRAL for manual vehicles.
- 4. Make sure the clutch pedal is fully depressed for Federal manual vehicles.

Visual Inspection Chart

Mechanical	Electrical
Starter MotorFlywheel Ring GearEngine 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)

- 1 . If an obvious cause for an observed or reported concern is found, correct the cause, (if poss ble) before proceeding to the next step.
- 2. If the concern is not visually evident, verify the symptom and refer to the 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 G92411p1.
None.	The engine cranks slowly.	Battery. Circuit. Starter motor.	GO to Pinpoint Test G92411p2.
None.	Unusual starter motor noise.	Starter motor. Flywheel ring gear.	INSPECT flywheel ring gear. For additional information, <<303-00>> 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. <<303-00>> INSPECT starter motor pinion gear for missing teeth. CHECK starter motor for correct mounting. If concern persists, INSTALL a new starter motor.

PINPOINT TEST G92411p1: P0616, P0617. THE ENGINE DOES NOT CRANK

G92411t1: CHECK THE BATTERY

- 1. Check the battery. For additional information. $\leq <414-00>>$
 - Is the battery OK?

-> Yes

-> No

INSTALL a new battery. <<414-01>> CLEAR the DTC. TEST the system for normal operation.

G92411t2: CHECK THE STARTER RELAY

- 1. Turn the ignition switch to the CRANK position.
 - Does the starter relay make an audible click?

-> Yes

GO to Pinpoint Test G92411t5.

-> No

GO to Pinpoint Test G92411t7.

G92411t7: 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 Pinpoint Test G92411t3.

-> No

GO to Pinpoint Test G92411t20.

G92411t20: 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 Pinpoint Test G92411t8.

-> No

GO to Pinpoint Test G92411t10.

G92411t10: CHECK FUSE 28 IN THE ENGINE COMPARTMENT FUSE BOX.

- 1. Check the fuse
 - Is the fuse OK?

-> Vac

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 Pinpoint Test G92411t8.

G92411t8: 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.

GO to Pinpoint Test G92411t9.

G92411t9: 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 Pinpoint Test G92411t12.

Manual transmission vehicles. GO to Pinpoint Test G92411t21.

Federal spec. manual transmission vehicles. GO to Pinpoint Test G92411t14.

-> 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.

G92411t12: 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 Pinpoint Test G92411t13.

-> No

GO to Pinpoint Test G92411t16.

G92411t16: 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.

G92411t22 : 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 Pinpoint Test G92411t13.

-> 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.

G92411t13: 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. <<303-14>> Before replacing a ECM, contact Dealer technical support.

-> No

INSTALL a new transmission range sensor. <<307-01>> CLEAR the DTC. TEST the system for normal operation.

G92411t21: 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. <<303-14>> 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)

G92411t14: 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 Pinpoint Test G92411t15.

-> 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)

G92411t6: 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 Pinpoint Test G92411t15.

-> 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.

G92411t15: 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. <<303-14>> Before replacing a ECM, contact Dealer technical support.

-> No

INSTALL a new clutch switch. CLEAR the DTC. TEST the system for normal operation.

G92411t5: CHECK THE STARTER SOLENOID INPUT

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 Pinpoint Test G92411t3.

-> No

GO to Pinpoint Test G92411t23.

G92411t23: 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 Pinpoint Test G92411t11.

-> 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.

G92411t11: 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 Pinpoint Test G92411t3.

-> No

GO to Pinpoint Test G92411t17.

G92411t17: 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.

G92411t3: 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 Pinpoint Test G92411t4.

-> 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.

G92411t4: CHECK THE STARTER GROUND

- 1. Measure the resistance between starter outer casing and GROUND.
 - Is the resistance less than 2 Ohms?

INSTALL a new starter motor. <<303-06>> 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 G92411p2: THE ENGINE CRANKS SLOWLY

G92411t18: CHECK FOR VOLTAGE DROP

- 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 Pinpoint Test G92411t19.

-> 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. <<414-01>>

G92411t19: 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. <<303-06>> 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. <<414-01>>

Starter Motor - 2.0L Diesel (86.60.01)

Removal

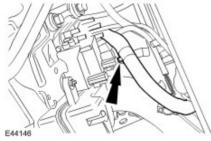
- Disconnect the battery.
 For additional information, refer to Battery Disconnect and Connect
- 2 . Remove the air deflector.
 For additional information, refer to Air Deflector 2.0L Diesel/2.2L Diesel (76.11.41)
- ${\bf 3}$. Disconnect the vacuum pipes from the vacuum solenoid valves and the vacuum reservoir.



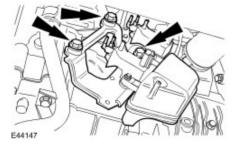
4 . Disconnect the vacuum solenoid valves electrical connectors.



 ${\bf 5}$. Detach the wiring harness from the vacuum solenoids and vacuum reservoir mount bracket.



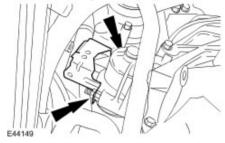
6. Remove the vacuum solenoids and vacuum reservoir mount bracket assembly.



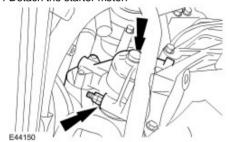
 $\boldsymbol{7}$. Detach the wiring harness retaining clips from the wiring harness support bracket.



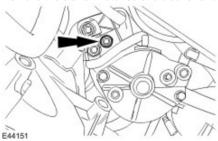
8 . Remove the wiring harness support bracket.



9 . Detach the starter motor.

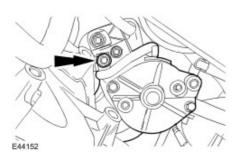


- 10 . Position the starter motor to provide access to the starter motor cables.
- 11 . Remove the starter motor solenoid cover and electrical connector retaining nut.



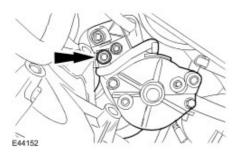
12 . Remove the starter motor.

Remove the starter motor electrical connector retaining nut.

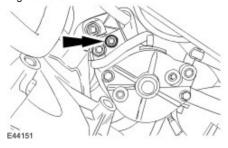


1 . To install, reverse the removal procedure.

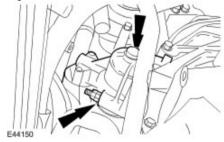
Tighten to 12 Nm.



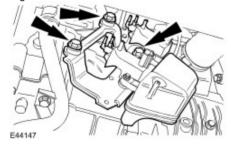
2 . Tighten to 6 Nm.



3 . Tighten to 25 Nm.



4 . Tighten to 23 Nm.



Starter Motor - 2.0L/2.5L/3.0L (86.60.01)

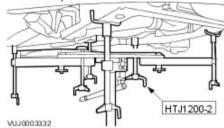
Special Service Tools



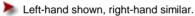
Powertrain assembly jack HTJ1200-2

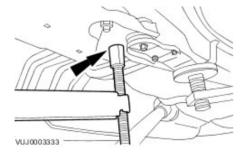
Removal

- 1 . Disconnect the battery ground cable. For additional information, refer to <<414-01>>.
- 2 . Raise and support the vehicle. <<100-02>>
- 3. Install the special tool.



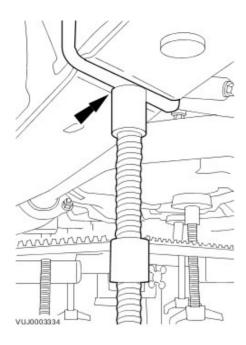
4 . Position and adjust the special tool rear height adjuster.



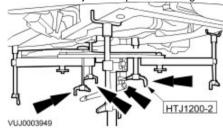


 ${\bf 5}$. Position and adjust the special tool front height adjuster.

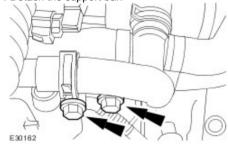
Right-hand shown, left-hand similar.



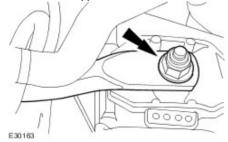
6 . Position and adjust the special tool engine height adjusters.



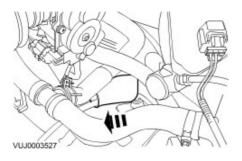
7 . Detach the support bar.



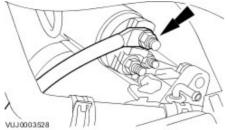
8 . Remove the support bar.



9 . Detach the starter motor solenoid cover.



10 . Disconnect the starter motor electrical connector.



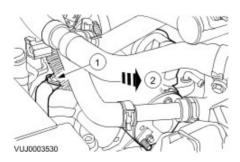
11 . Disconnect the starter motor solenoid electrical connector.



12 . Remove the starter motor rear retaining bolt.



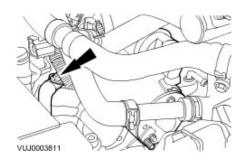
- 13 . Remove the starter motor.
 - 1) Remove the starter motor front retaining bolt.
 - 2) Remove the starter motor.



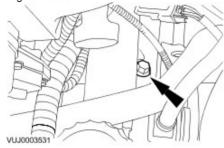
Installation

1 . To install, reverse the removal procedure.



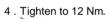


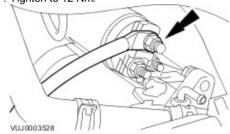
2 . Tighten to 35 Nm.



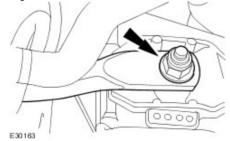
3 . Tighten to 6 Nm.



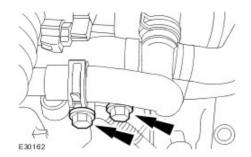




5 . Tighten to 133 Nm.



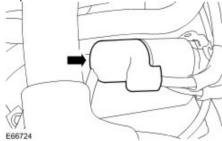
6 . Tighten to 25 Nm.



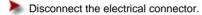
Starter Motor - 2.2L Diesel (86.60.01)

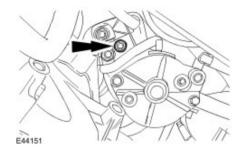
Removal

- Disconnect the battery.
 For additional information, refer to Battery Disconnect and Connect
- 2 . Remove the air deflector.
 For additional information, refer to Air Deflector 2.0L Diesel/2.2L Diesel (76.11.41)
- 3 . Reposition the starter motor solenoid cover.



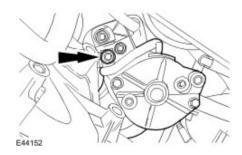
4 . Remove the starter motor electrical connector retaining nut.



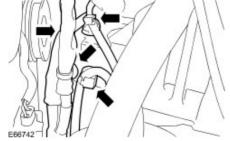


 ${\bf 5}$. Remove the starter motor electrical connector retaining nut.

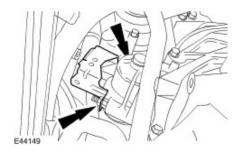




6 . Detach the wiring harness retaining clips from the wiring harness support bracket.

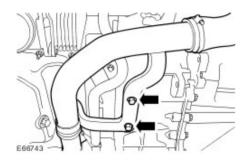


7 . Remove the wiring harness support bracket.

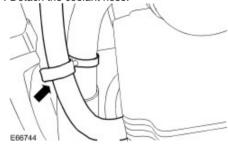


8 . Remove the charge air cooler intake pipe retaining bolts.

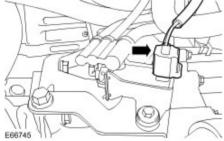
Reposition the charge air cooler intake pipe for access.



9. Detach the coolant hose.



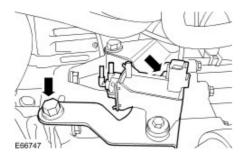
10 . Disconnect the vacuum solenoid valve electrical connector.



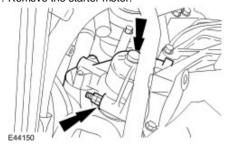
11 . Disconnect the vacuum pipes from the vacuum solenoid valve.



12 . Remove the vacuum solenoid mount bracket assembly.

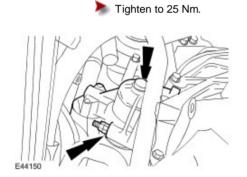


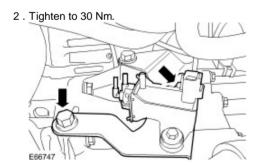
13 . Remove the starter motor.

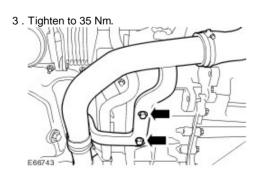


Installation

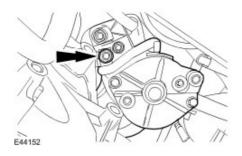
1 . To install reverse the removal procedure.







4 . Tighten to 12 Nm.



5 . Tighten to 6 Nm.

